

BID DOCUMENTS COVER SHEET

CONTRACT DOCUMENTS

FOR

L-1177 INDUSTRIAL TRADES LABS RENOVATION

AT

Los Medanos College
2700 East Leland Road, Pittsburg, CA 94565

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

Consists of the following:

VOLUME 1
SPECIFICATIONS

DSA Appl. #01-118866

ARCHITECT:

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April 15, 2021

PROJECT MANUAL
L-1177 INDUSTRIAL TRADES LABS
RENOVATION

LOS MEDANOS COLLEGE
CONTRA COSTA COMMUNITY COLLEGE DISTRICT
IBI Group Project No. 121030

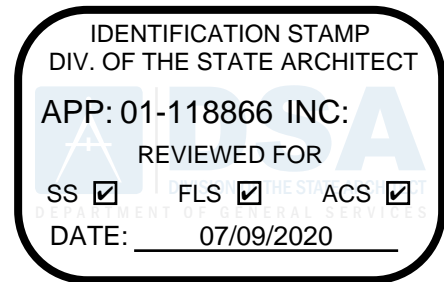
Owner: Contra Costa Community College District
500 Court Street
Martinez, CA 94553

Deferred Approvals:

None

ARCHITECT

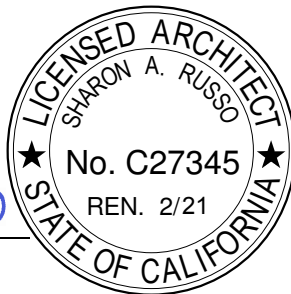
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By:

Sharon A. Russo

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DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number: 7-C1

Increment Number:

Date Submitted: 4/2/2020

IMPORTANT: This form is only a summary list of structural tests and some of the special inspections required for the project. Generally, the structural tests and special inspections noted on this form are those that will be performed by the Geotechnical Engineer of Record, Laboratory of Record, or Special Inspector. The actual complete test and inspection program must be performed as detailed on the DSA approved documents. The appendix at the bottom of this form identifies work NOT subject to DSA requirements for special inspection or structural testing. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of non-structural components, etc., per Title 24, Part 2, Chapter 17A.

KEY TO COLUMNS

1. TYPE	2. PERFORMED BY
Continuous – Indicates that a continuous special inspection is required	GE – Indicates that the special inspection shall be performed by a registered geotechnical engineer or his or her authorized representative.
Periodic – Indicates that a periodic special inspection is required	LOR – Indicates that the test or special inspection shall be performed by a testing laboratory accepted in the DSA Laboratory Evaluation and Acceptance (LEA) Program. See CAC Section 4-335.
Test – Indicates that a test is required	PI – Indicates that the special inspection may be performed by a project inspector when specifically approved by DSA.
	SI – Indicates that the special inspection shall be performed by an appropriately qualified/approved special inspector.

****NOTE:** Undefined section and table references found in this document are from the CBC, or California Building Code.

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Concrete)

Table 1705A.3; ACI 318-14 Sections 26.12 & 26.13

Application Number: 01-118866

School Name: Los Medanos

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DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

7. CAST-IN-PLACE CONCRETE				
Material Verification and Testing:				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Verify use of required design mix.	Periodic	SI	Table 1705A.3 Item 5, 1910A.1.
<input type="checkbox"/>	b. Identify, sample, and test reinforcing steel.	Test	LOR	1910A.2; ACI 318-14 Section 26.6.1.2; DSA IR 17-10. (See Appendix for exemptions.)
<input type="checkbox"/>	c. During concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	Test	LOR	Table 1705A.3 Item 6; ACI 318-14 Sections 26.5 & 26.12.
<input type="checkbox"/>	d. Test concrete (f'_c).	Test	LOR	1905A.1.15; ACI 318-14 Section 26.12.
Inspection:				
<input type="checkbox"/>	e. Batch plant inspection:	See Notes	SI	Default of 'Continuous' per 1705A.3.3. If approved by DSA, batch plant inspection may be reduced to 'Periodic' subject to requirements in Section 1705A.3.3.1, or eliminated per 1705A.3.3.2. (See Appendix for exemptions.)
<input type="checkbox"/>	f. Welding of reinforcing steel.	Provide special inspection per STEEL, Category 19.1(d) & (e) and/or 19.2(g) & (h) below.		

8. PRESTRESSED / POST-TENSIONED CONCRETE (in addition to Cast-in-Place Concrete tests and inspections):				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Sample and test prestressing tendons and anchorages.	Test	LOR	1705A.3.4, 1910A.3
<input type="checkbox"/>	b. Inspect placement of prestressing tendons.	Periodic	SI	1705A.3.4, Table 1705A.3 Items 1 & 9.

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Concrete)

Table 1705A.3; ACI 318-14 Sections 26.12 & 26.13

Application Number: 01-118866	School Name: Los Medanos	School District: Contra Costa Community College District
DSA File Number:	Increment Number:	Date Submitted: 4/2/2020

<input type="checkbox"/>	c. Verify in-situ concrete strength prior to stressing of post-tensioning tendons.	Periodic	SI	Table 1705A.3 Item 11. Special inspector to verify specified concrete strength test prior to stressing.
<input type="checkbox"/>	d. Inspect application of post-tensioning or prestressing forces and grouting of bonded prestressing tendons.	Continuous	SI	1705A.3.4, Table 1705A.3 Item 9; ACI 318-14 Section 26.13

9. PRECAST CONCRETE (in addition to Cast-in-Place Concrete tests and inspections):				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Inspect fabrication of precast concrete members.	Continuous	SI	ACI 318-14 Section 26.13.
<input type="checkbox"/>	b. Inspect erection of precast concrete members.	Periodic	SI*	Table 1705A.3 Item 10. * May be performed by PI when specifically approved by DSA.

10. SHOTCRETE (in addition to Cast-in-Place Concrete tests and inspections):				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Inspect shotcrete placement for proper application techniques.	Continuous	SI	1705A.19, Table 1705A.3 Item 7, 1908A.6, 1908A.7, 1908A.8, 1908A.9, 1908A.11, 1908A.12. See ACI 506.2-13 Section 3.4, ACI 506R-16.
<input type="checkbox"/>	b. Sample and test shotcrete (f'_c).	Test	LOR	1908A.5, 1908A.10.

11. POST-INSTALLED ANCHORS:				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input checked="" type="checkbox"/>	a. Inspect installation of post-installed anchors	See Notes	SI*	1617A.1.19, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic), 1705A.3.8 (See Appendix for exemptions). ACI 318-14

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Concrete)

Table 1705A.3; ACI 318-14 Sections 26.12 & 26.13

Application Number: 01-118866	School Name: Los Medanos	School District: Contra Costa Community College District
DSA File Number:	Increment Number:	Date Submitted: 4/2/2020

				Sections 17.8 & 26.13. * May be performed by the project inspector when specifically approved by DSA.
<input checked="" type="checkbox"/>	b. Test post-installed anchors.	Test	LOR	1910A.5. (See Appendix for exemptions.)

	12. OTHER CONCRETE:			
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>				

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Steel and Aluminum)

1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

17. STRUCTURAL STEEL, COLD-FORMED STEEL AND ALUMINUM USED FOR STRUCTURAL PURPOSES				
Material Verification and Testing:				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input checked="" type="checkbox"/>	a. Verify identification of all materials and: <ul style="list-style-type: none">• Mill certificates indicate material properties that comply with requirements.• Material sizes, types and grades comply with requirements.	Periodic	*	Table 1705A.2.1 Item 3a–3c. 2202A.1; AISI S100-16 Section A3.1 & A3.2, AISI S240-15 Section A3 & A5, AISI S220-15 Sections A4 & A6. * By special inspector or qualified technician when performed off-site.
<input checked="" type="checkbox"/>	b. Test unidentified materials	Test	LOR	2202A.1.
<input type="checkbox"/>	c. Examine seam welds of HSS shapes	Periodic	SI	DSA IR 17-3.
Inspection:				
<input checked="" type="checkbox"/>	d. Verify and document steel fabrication per DSA-approved construction documents.	Periodic	SI	Not applicable to cold-formed steel light-frame construction, except for trusses (1705A.2.4).

18. HIGH-STRENGTH BOLTS: RCSC 2014				
Material Verification and Testing of High-Strength Bolts, Nuts and Washers:				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Verify identification markings and manufacturer's certificates of compliance conform to ASTM standards specified in the DSA-approved documents.	Periodic	SI	Table 1705A.2.1 Items 1a & 1b, 2202A.1; AISC 360-16 Section A3.3, J3.1, and N3.2; RCSC 2014 Section 1.5 & 2.1; DSA IR 17-8 & DSA IR 17-9.
<input type="checkbox"/>	b. Test high-strength bolts, nuts and washers.	Test	LOR	Table 1705A.2.1 Item 1c, 2213A.1; RCSC 2014 Section 7.2; DSA IR 17-8.
Inspection of High-Strength Bolt Installation:				

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Steel and Aluminum)

1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

<input type="checkbox"/>	c. Bearing-type ("snug tight") connections.	Periodic	SI	Table 1705A.2.1 Item 2a, 1705A.2.6, 2204A.2; AISC 360-16 J3.1, J3.2, M2.5 & N5.6; RCSC 2014 Section 9.1; DSA IR 17-9.
<input type="checkbox"/>	d. Pretensioned and slip-critical connections.	*	SI	Table 1705A.2.1 Items 2b & 2c, 1705A.2.6, 2204A.2; AISC 360-16 J3.1, J3.2, M2.5 & N5.6; RCSC 2014 Sections 9.2 & 9.3; DSA IR 17-9. * "Continuous" or "Periodic" depends on the tightening method used.

19. WELDING:	1705A.2.5, Table 1705A.2.1 Items 4 & 5; AWS D1.1 and AWS D1.8 for structural steel; AWS D1.2 for Aluminum; AWS D1.3 for cold-formed steel; AWS D1.4 for reinforcing steel; DSA IR 17-3 (See Appendix for exemptions.)
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Verification of Materials, Equipment, Welders, etc.:

	Test or Special Inspection	Type	Performed By	Code References and Notes
<input checked="" type="checkbox"/>	a. Verify weld filler material identification markings per AWS designation listed on the DSA-approved documents and the WPS.	Periodic	SI	DSA IR 17-3.
<input checked="" type="checkbox"/>	b. Verify weld filler material manufacturer's certificate of compliance.	Periodic	SI	DSA IR 17-3.
<input checked="" type="checkbox"/>	c. Verify WPS, welder qualifications and equipment.	Periodic	SI	DSA IR 17-3.

19.1 SHOP WELDING:				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	Continuous	SI	Table 1705A.2.1 Items 5a.1–4; AISC 360-16 (and AISC 341-16 as applicable); DSA IR 17-3.
<input checked="" type="checkbox"/>	b. Inspect single-pass fillet welds ≤ 5/16", floor and roof deck welds.	Periodic	SI	1705A.2.2, Table 1705A.2.1 Items 5a.5 & 5a.6; AISC 360-16 (and AISC 341-16 as applicable); DSA IR 17-3.
<input type="checkbox"/>	c. Inspect welding of stairs and railing systems.	Periodic	SI	1705A.2.1; AISC 360-16 (and AISC 341-16 as applicable); AWS D1.1 & D1.3; DSA IR 17-3.

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Steel and Aluminum)

1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

<input type="checkbox"/>	d. Verification of reinforcing steel weldability other than ASTM A706.	Periodic	SI	1705A.3.1 ; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
<input type="checkbox"/>	e. Inspect welding of reinforcing steel.	Continuous	SI	Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8 ; AWS D1.4; DSA IR 17-3.
19.2 FIELD WELDING:				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	Continuous	SI	Table 1705A.2.1 Items 5a.1–4 ; AISC 360-16 (AISC 341-16 as applicable); DSA IR 17-3.
<input type="checkbox"/>	b. Inspect single-pass fillet welds ≤ 5/16".	Periodic	SI	Table 1705A.2.1 Item 5a.5 ; AISC 360-16 (AISC 341-16 as applicable); DSA IR 17-3.
<input type="checkbox"/>	c. Inspect end-welded studs (ASTM A-108) installation (including bend test).	Periodic	SI	2213A.2 ; AISC 360-16 (AISC 341-16 as applicable); AWS D1.1; DSA IR 17-3.
<input type="checkbox"/>	d. Inspect floor and roof deck welds.	Periodic	SI	1705A.2.2, Table 1705A.2.1 Item 5a.6 ; AISC 360-16 (AISC 341-16 as applicable); AWS D1.3; DSA IR 17-3.
<input type="checkbox"/>	e. Inspect welding of structural cold-formed steel.	Periodic	SI*	1705A.2.5; AWS D1.3; DSA IR 17-3. The quality control provisions of AISI S240-15 Chapter D shall also apply. * May be performed by the project inspector when specifically approved by DSA.
<input type="checkbox"/>	f. Inspect welding of stairs and railing systems.	Periodic	SI*	1705A.2.1 ; AISC 360-16 (AISC 341-16 as applicable); AWS D1.1 & D1.3; DSA IR 17-3. * May be performed by the project inspector when specifically approved by DSA.
<input type="checkbox"/>	g. Verification of reinforcing steel weldability.	Periodic	SI	1705A.3.1 ; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
<input type="checkbox"/>	h. Inspect welding of reinforcing steel.	Continuous	SI	Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8 ; AWS D1.4; DSA IR 17-3.

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Steel and Aluminum)

1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

20. NONDESTRUCTIVE TESTING: 1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Ultrasonic	Test	LOR	1705A.2.1, 1705A.2.5; AISC 341-16 J6.2, AISC 360-16 N5.5; ANSI/ASNT CP-189, SNT-TC-1A; AWS D1.1, AWS D1.8; DSA IR 17-2.
<input type="checkbox"/>	b. Magnetic Particle	Test	LOR	1705A.2.1, 1705A.2.5; AISC 341-16 J6.2, AISC 360-16 N5.5; ANSI/ASNT CP-189, SNT-TC-1A; AWS D1.1, AWS D1.8; DSA IR 17-2.
<input type="checkbox"/>				

21. STEEL JOISTS AND TRUSSES: 1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>	a. Verify size, type and grade for all chord and web members as well as connectors and weld filler material; verify joist profile, dimensions and camber (if applicable); verify all weld locations, lengths and profiles; mark or tag each joist.	Continuous	SI	1705A.2.3, Table 1705A.2.3; AWS D1.1; DSA IR 22-3 for steel joists only. 1705A.2.4; AWS D1.3 for cold-formed steel trusses.

22. SPRAY APPLIED FIRE-PROOFING: 1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16				
	Test or Special Inspection	Type	Performed By	Code References and Notes

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Steel and Aluminum)

1705A.2.1, Table 1705A.2.1; AISC 303-16, AISC 341-16, AISC 358-16, AISC 360-16; AISI S100-16

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
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DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

<input type="checkbox"/>	a. Examine structural steel surface conditions, inspect application, take samples, measure thickness and verify compliance of all aspects of application with DSA-approved documents.	Periodic	SI	1705A.14.
<input type="checkbox"/>	b. Test bond strength.	Test	LOR	1705A.14.6.
<input type="checkbox"/>	c. Test density.	Test	LOR	1705A.14.5.

	23. ANCHOR BOLTS AND ANCHOR RODS:			
<input checked="" type="checkbox"/>	a. Anchor Bolts and Anchor Rods	Test	LOR	Sample and test anchor bolts and anchor rods not readily identifiable per procedures noted in DSA IR 17-11.
<input type="checkbox"/>	b. Threaded rod not used for foundation anchorage.	Test	LOR	Sample and test threaded rods not readily identifiable per procedures noted in DSA IR 17-11.

	23.1 OTHER STEEL:			
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input type="checkbox"/>				

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (Other)

Application Number: 01-118866

School Name: Los Medanos

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DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

27. OTHER:				
	Test or Special Inspection	Type	Performed By	Code References and Notes
<input checked="" type="checkbox"/>	a. Load test for identified product(s): Continuous	Test	LOR	1709A.2, 1709A.3. Testing is not required for: 1) a product with a valid evaluation service report per DSA IR A-5, or 2) a product that can be justified by structural calculation.
<input type="checkbox"/>	b. Installation torque for non-HS bolts	Continuous	SI*	Applicable to communication towers identified as Essential Service Facility Projects (ESFP). Calibrated wrench use required, verified by SI during installation. DSA Policy PL 18-01: Communication Towers, Poles and Buildings Utilized by State Agencies for Essential Services Communications.*EXCEPTION: Non-ESFP may use PI without need for notification to DSA.
<input type="checkbox"/>	c.			

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number:

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Exempt items given in DSA IR A-22 or the 2019 CBC (including DSA amendments) and those items identified below with an "X" by the design professional are NOT subject to DSA requirements for the structural tests / special inspections noted. **Items marked as exempt shall be identified on the approved construction documents.** The project inspector shall verify all construction complies with the approved construction documents.

	SOILS:
<input type="checkbox"/>	1. Deep foundations acting as a cantilever footing designed based on minimum allowable pressures per CBC Table 1806A.2 and having no geotechnical report for the following cases: A) free standing sign or scoreboard, B) cell or antenna towers and poles less than 35'-0" tall (e.g., lighting poles, flag poles, poles supporting open mesh fences, etc.), C) single-story structure with dead load less than 5 psf (e.g., open fabric shade structure), or D) covered walkway structure with an apex height less than 10'-0" above adjacent grade.
<input type="checkbox"/>	2. Shallow foundations, etc. are exempt from special inspections and testing by a Geotechnical Engineer for the following cases: A) buildings without a geotechnical report and meeting the exception Item #1 criteria in CBC Section 1803A.2 supported by native soil (any excavation depth) or fill soil (not exceeding 12" depth per CBC, Section 1804A.6), B) soil scarification/recompaction not exceeding 12" depth, C) native or fill soil supporting exterior non-structural flatwork (e.g., sidewalks, site concrete ramps, site stairs, parking lots, driveways, etc.), D) unpaved landscaping and playground areas, or E) utility trench backfill.

	CONCRETE/MASONRY:
<input type="checkbox"/>	1. Post-installed anchors for the following: A) exempt non-structural components (e.g., mechanical, electrical, plumbing equipment - see Item 7 for "Welding") given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) or B) interior nonstructural wall partitions meeting criteria listed in exempt Item 3 for "Welding."
<input type="checkbox"/>	2. Concrete batch plant inspection is not required for items given in CBC Section 1705A.3.3.2 subject to the requirements and limitations in that section.
<input type="checkbox"/>	3. Non-bearing non-shear masonry walls may be exempt from certain DSA masonry testing and special inspection items as allowed per DSA IR 21-1. Refer to construction documents for specific exemptions accordingly for each applicable wall condition.
<input type="checkbox"/>	4. Epoxy shear dowels in site flatwork and/or other non-structural concrete.
<input type="checkbox"/>	5. Testing of reinforcing bars is not required for items given in CBC Section 1910A.2 subject to the requirements and limitations in that section.

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

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Increment Number:

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	Welding:
<input type="checkbox"/>	1. Solid-clad and open-mesh gates with maximum leaf span or rolling section for rolling gates of 10' and apex height less than 8'-0" above lowest adjacent grade. When located above circulation or occupied space below, these gates are not located within 1.5x gate/fence height (max 8'-0") to the edge of floor or roof.
<input type="checkbox"/>	2. Handrails, guardrails and modular or relocatable ramps associated with walking surfaces less than 30" above adjacent grade (excluding post base connections per the 'Exception' language in Section 1705A.2.1); fillet welds shall not be ground flush.
<input type="checkbox"/>	3. Non-structural interior cold-formed steel framing spanning less than 15'-0", such as in interior partitions, interior soffits, etc. supporting only self weight and light-weight finishes or adhered tile, masonry, stone, or terra cotta veneer no more than 5/8" thickness and apex less than 20'-0" in height and not over an exit way. Maximum tributary load to a member shall not exceed the equivalent of that occurring from a 10'x10' opening in a 15' tall wall for a header or king stud.
<input type="checkbox"/>	4. Manufactured support frames and curbs using hot rolled or cold-formed steel (i.e., light gauge) for mechanical, electrical, or plumbing equipment weighing less than 2000# (equipment only) (connections of such frames to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections 19, 19.1 and/or 19.2 of listing above).
<input type="checkbox"/>	5. Manufactured components (e.g., Tolco, B-Line, Afcon, etc.) for mechanical, electrical, or plumbing hanger support and bracing (connections of such components to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections 19, 19.1 and/or 19.2 of listing above).
<input type="checkbox"/>	6. TV Brackets, projector mounts with a valid listing (see DSA IR A-5) and recreational equipment (e.g., playground structures, basketball backstops, etc.) (connections of such elements to superstructure elements using welding will require special inspection as noted in selected item(s) for section 19, 19.1 and/or 19.2 located in the Steel/Aluminum category).
<input type="checkbox"/>	7. Any support for exempt non-structural components given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) meeting the following: A) when supported on a floor/roof, <400# and resulting composite center of mass (including component's center of mass) $\leq 4'$ above supporting floor/roof, B) when hung from a wall or roof/floor, <20# for discrete units or <5 plf for distributed systems.

DSA 103: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS (SIGNATURE)

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

Name of Architect or Engineer in general responsible charge:

JOSH REYNOLDS, S.E.

Name of Structural Engineer (When structural design has been delegated):

Signature of Architect or Structural Engineer:

Date:

04/02/2020

Note: Do not use secured electronic or digital signatures preventing DSA mark-ups.

DSA STAMP

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 01-118866 INC:
REVIEWED FOR
SS ☒ FLS ☐ ACS ☐
DATE: 07/09/2020

DSA 103: LIST OF REQUIRED VERIFIED REPORTS

Application Number: 01-118866

School Name: Los Medanos

School District: Contra Costa Community
College District

DSA File Number:

Increment Number:

Date Submitted: 4/2/2020

1. Structural Testing and Inspection: Laboratory Verified Report Form DSA 291
2. Post-installed Anchors: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292
3. Shop Welding Inspection: Laboratory Verified Report Form DSA 291, or, for independently contracting SI, Special Inspection Verified Report Form DSA 292

SECTION 00010
TABLE OF CONTENTS

SPECIFICATIONS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

SECTION 00001	TITLE PAGE
SECTION 00007	SEALS PAGE and DSA TESTS
SECTION 00010	TABLE OF CONTENTS
SECTION 00016	LMC CAMPUS MAP
SECTION 00100	NOTICE INVITING BIDS
SECTION 00110	PROJECT STABILIZATION AGREEMENT PROJECT STABILIZATION AGREEMENT and AMENDMENT ONE
SECTION 00210	INFORMATION AVAILABLE TO BIDDERS
SECTION 00300	BID PROPOSAL FORM
SECTION 00450	CERTIFICATION OF SITE VISIT
SECTION 00500	PAYMENT AND PERFORMANCE BOND FORMS
SECTION 00510	NOTICE OF AWARD
SECTION 00600	CONSTRUCTION AGREEMENT Appendix B-1 – Contra Costa County Health Officer Order May 18, 2020
SECTION 00650	NOTICE TO PROCEED
SECTION 00800	SUPPLEMENTARY GENERAL CONDITIONS

DIVISION 01 – GENERAL REQUIREMENTS

See SECTION 00800 SUPPLEMENTARY GENERAL CONDITIONS, above
SECTION 01318 DOCUMENT MANAGEMENT SYSTEM

TECHNICAL SPECIFICATIONS

DIVISION 2 – EXISTING CONDITIONS

02 41 19 Selective Demolition

DIVISION 3 - CONCRETE

03 53 00 Concrete Topping

DIVISION 4 – Not Used

DIVISION 5 - METALS

05 12 00 Structural Steel Framing

05 40 00	Cold-Formed Structural Metal Framing
05 50 00	Metal Fabrications

DIVISION 6 – WOODS, PLASTICS, AND COMPOSITES

06 41 00	Architectural Wood Cabinets
06 83 16	Fiberglass-Reinforced Plastic Paneling

DIVISION 7 – Not Used

DIVISION 8 - OPENINGS

08 11 13	Hollow-Metal Doors and Frames
08 33 23	Overhead Coiling Service Door
08 71 00	Door Hardware
08 81 00	Glass Glazing
08 88 13	Fire-Rated Glazing

DIVISION 9 - FINISHES

09 29 00	Gypsum Board
09 91 00	Painting

DIVISION 10 - SPECIALTIES

10 14 00	Signage
10 44 16	Fire Extinguishers
10 51 13	Metal Lockers

DIVISION 11 - EQUIPMENT

11 52 13	Projection Screen
11 52 23	Audio-Visual Equipment Support

DIVISIONS 12 thru 21 – Not Used

DIVISION 22 – PLUMBING

22 00 50	Basic Plumbing Materials and Methods
22 10 00	Plumbing Piping Systems
22 40 00	Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 00 50	Basic HVAC Materials and Methods
23 05 93	Testing, Adjusting and Balancing for HVAC

23 80 00 Heating, Ventilating and Air Conditioning

DIVISIONS 24 & 25 – Not used

DIVISION 26 – ELECTRICAL

26 05 00 General Electrical Requirements
 26 05 19 Line Voltage Wire and Cable
 26 05 26 Grounding
 26 05 33 Outlet, Junction, and Pull Boxes
 26 05 42 Conduits, Raceways, and Fittings
 26 22 00 Transformers
 26 24 13 Switchboards, 600 Volts and Below
 26 24 16 Panelboards and Distribution Panels
 26 27 26 Devices Wiring
 26 28 16 Circuit Breakers
 26 51 00 Lighting

DIVISION 27 – COMMUNICATIONS

27 00 00 Telecommunications Cabling System

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 31 00 Fire Alarm System

DIVISIONS 29 thru 31 – Not Used

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 17 13 Wheelstops
 32 17 26 Tactile Warning Surfaces

DIVISIONS 33 thru 49 – Not Used

DRAWINGS

SHEET INDEX

G0001 COVER SHEET

ARCHITECTURAL

A1100 OVERALL SITE PLAN
 A1101 ACCESSIBLE ELEMENTS
 A2010 DEMOLITION PLAN
 A2310 FLOOR PLAN AND CODE ANALYSIS PLAN

A2710	REFLECTED CEILING PLAN
A6010	INTERIOR ELEVATIONS
A8001	DETAILS
A8002	DETAILS
A9101	ROOM FINISH SCHEDULE

MECHANICAL

M0001	MECHANICAL LEGENDS & NOTES
M2010	MECHANICAL DEMOLITION PLAN
M2310	MECHANICAL FLOOR PLAN
M5001	MECHANICAL DETAILS

PLUMBING

P0001	PLUMBING LEGENDS, SCHEDULES, NOTES & DETAILS
P0002	PLUMBING FIXTURE SCHEDULES
P2010	PLUMBING DEMOLITION PLAN
P2310	PLUMBING FLOOR PLAN

ELECTRICAL

E0.1	SYMBOLS, ABBREVIATIONS, CODES, STANDARDS, NOTES & SHEET INDEX
E0.2	CALIFORNIA ENERGY COMPLIANCE TITLE 24 – INDOOR
E1.1	ELECTRICAL SINGLE LINE DIAGRAM & PANELBOARD SCHEDULES
E2.1	ELECTRICAL SITE PLAN
E3.1	ELECTRICAL DEMOLITION PLAN
E4.1	POWER PLAN
E5.1	LIGHTING PLAN & LIGHT FIXTURE SCHEDULE
E6.1	ELECTRICAL DETAILS
E6.2	ELECTRICAL DETAILS

FIRE ALARM

FA0.1	FIRE ALARM SYMBOLS, ABBREVIATIONS, EQUIPMENT LIST, OPERATIONAL MATRIX, DETAILS & NOTES
FA1.1	FIRE ALARM RISER DIAGRAM, BATTERY & VOLTAGE DROP, CALCULATIONS
FA2.1	ELECTRICAL SITE PLAN
FA4.1	FIRE ALARM PLAN

END OF SECTION

Campus Overview

LOS MEDANOS COLLEGE

2700 East Leland Road
Pittsburg, CA 94565
(925) 439 – 2181
www.losmedanos.edu

Building Legend

- CC** College Complex
- CO** CORE
 - Business Services
 - Center for Academic Support
 - Equity & Inclusion
- CS** Child Study Center
- CS** Campus Safety
 - Police Services
- EL** ETEC Lab
- F** Cafeteria
- KAC** Kinesiology & Athletics Complex
- L** Library
 - Community Room
- MA** Math
- MU** Music
 - Recital Hall
- PS** Classrooms
- SC** Science
 - MESA Center
- SS** Student Services
 - Admissions/Cashier
 - Assessment Services
 - Counseling Services
 - DSPS
 - EOPS, CARE, CalWORKs
 - Financial Aid/Scholarships
 - Information/Welcome Center
 - LMC Foundation
 - Office of Instruction
 - President's Office
 - Transfer & Career Services
- SU** Student Union
 - Bookstore
 - Conference Center
 - Food Pantry
 - Honors Program
 - International Students Program
 - Latinx Empowerment Center
 - Reflection Room
 - Student Life
 - Student Lounge
 - Unity Center
 - Umoja Scholars Program
- V** Veterans Resource Center



Smoking restricted to parking lot areas.

E-Charging Stations

All Gender Restrooms

Accessible Parking

Accessible Entrance

Bus Stop

Elevator



**SECTION 00100
NOTICE INVITING BIDS**

L-1177 INDUSTRIAL TRADES LABS RENOVATION

LOS MEDANOS COLLEGE

2700 E Leland Rd.
Pittsburg, CA 94565

SCOPE OF WORK: Modernization of two (2) existing vocational labs, including, but not limited to the following: New interior partition and overhead coiling door; updated lighting, mechanical, plumbing, and electrical distribution for the two rooms.

IMPORTANT INFORMATION:

Pre-Bid Meeting & Job Walk: **April 22, 2021 @ 11:00 AM, Non-Mandatory**
Location: Los Medanos College, College Complex Building, Main Entrance
2700 E Leland Rd.
Pittsburg, CA 94565

PLEASE NOTE: A Site Visit will be held immediately following the Pre-Bid meeting. Please sign in on the attendance Log. Attendees are required to wear face masks, as required by CCC Health Services.

Cost Estimate (Range): **\$1,100,000. to \$1,300,000.**

CA License Required: **B-General Building Contractor**

Last Date / Time for Bidder's Requests for Information: **April 29, 2021, prior to 5:00 PM**

BID OPENING: **May 13, 2021 @ 2:00 PM**

This project is a public works project and is subject to prevailing wage rate laws. A copy of the prevailing rates of wages is on file with the Contracts & Purchasing Office of the Contra Costa Community College District. Said rates of wages will be included in the contract for the work.

Attention is directed to Section 4100 through 4113 of the Public Contract Code concerning Subcontractors, with emphasis on Section 4104, known as the "Subletting and Subcontracting Fair Practices Act, effective July 1, 2014.

Attention is directed to Labor Code Section 1725.5 regarding Department of Industrial Relations (DIR) contractor registration process including registration criteria and implementation of DIR registration requirements. Labor Code Section 1771.7 establishes contractor's obligation to submit Certified Pay Roll (CPR) to the Department of Labor and Standards Enforcement (DLSE) and public works monitoring and enforcement. Labor Code Section 1773.3 requires the District to submit a PWC-100 to DIR for all public works contract awarded effective January 1, 2015.

~~Site Visit Certification (Section 00450) shall be authorized by the representative of the District and shall be submitted with the bid. Failure to submit all of the above may cause your bid to be non-responsive and disqualified for contract award.~~

For information directly from the District, you may log in to the District Website:

<https://webapps.4cd.edu/apps/purchasingviewbids/default.aspx>. Project documents available include, but are not limited to, plans, specifications, addenda, bidders' lists, bid results, etc., and can be viewed on this District webpage.

The District does not provide hardcopies of bid documents or reimburse cost of printing, delivery, or any expenses related to the bidding process.

All questions related to this project must be submitted electronically, *no later than April 29, 2021* for any addenda to be issued by **Ben M. Cayabyab, Contracts Manager** (Interim), Contra Costa Community College District, **Email:** bcayabyab@4cd.edu.

Each bid shall be made on the Bid Proposal Form, which is included in the Bid Documents. The successful bidder will be required to furnish a payment bond in an amount equal to one hundred percent (100%) of the contract price and a faithful performance bond in an amount equal to one hundred percent (100%) of the contract price, said bonds to be secured from a surety company acceptable to the Contra Costa Community College District and authorized to execute such surety in the State of California.

Certificates of Liability Insurance with proper endorsements shall be required for the successful bidder.

The contract time is **120 Calendar Days** between the Notice to Proceed date and the contract Substantial Completion date. Liquidated Damages shall be set for **Five Hundred Dollars (\$500.00)** for each Calendar Day the Work is delayed beyond the contract Substantial Completion date; and **One Hundred Dollars (\$100.00)** for each Calendar Day Remaining Work is delayed beyond the Contract Final Completion Date. The Contra Costa Community College District reserves the right to reject any and all bids and/or waive any informality or irregularity in any bid received. No bidder may withdraw their Bid for a period of fifteen (15) Calendar Days after the date set for opening thereof.

END OF SECTION

SECTION 00110
PROJECT STABILIZATION AGREEMENT

This project is subject to the terms and conditions of a Project Stabilization Agreement (PSA) executed between the Contra Costa Community College District and the Contra Costa County Building & Construction Trades Council ("Council") and its affiliated local signatory unions.

END OF DOCUMENT

FIRST AMENDMENT TO THE
PROJECT STABILIZATION AGREEMENT
for the
CONTRA COSTA COMMUNITY COLLEGE DISTRICT

Preamble

This is the First Amendment (this "Amendment") to the Project Stabilization Agreement ("Agreement") for the Contra Costa Community College District entered into as of the 22nd day of October, 2012, by and between the Contra Costa Community College District ("District") together with contractors and/or subcontractors who became or will become signatory to the Agreement by signing the Agreement Exhibit A, the "Agreement to be Bound", and the Contra Costa Building & Construction Trades Council ("Council") and its affiliated local unions that have executed the Agreement (all of whom are referred to collectively as "Unions").

Recitals

WHEREAS the District, the Council, and the Unions desire to amend the Agreement to reflect certain agreed upon changes as set forth below, with the understanding that all other terms, conditions and Recitals in the Agreement remain valid and in effect; and

WHEREAS Article 2, Section 2.4.10 of the Agreement provides that the District and the Contra Costa Building and Construction Trades Council may mutually agree in writing to amend and extend this Agreement at any time.

NOW THEREFORE, in consideration of the mutual promises and covenants herein contained, the District and the Contra Costa Building and Construction Trades Council, and its affiliated local unions that become signatory to this Amendment, together with the contractors and/or subcontractors who became or will become signatory to the Agreement, do mutually agree to amend the Agreement as noted below with all other terms and conditions to remain unchanged and in effect.

Amendment

Article 1 Section 1.6 is hereby amended and revised to state as follows:

"Project" means any District construction project that has a total minimum estimated construction cost of one million dollars (\$1,000,000) or more. The District may, at its discretion, designate other project(s) or contract(s) with a total estimated construction cost of less than one million dollars (\$1,000,000) to be covered by this Agreement if the District believes it is in the best interest of the District to do so. Routine maintenance of District properties are not covered by the scope of this Agreement.

Article 2 is hereby amended to include Section 2.4.11 which states as follows:

2.4.11 Pursuant to Section 2.4.10, this Agreement has been reviewed and considered for extension or renewal, and the District and the Contra Costa Building and Construction Trades Council have agreed that the Agreement shall be extended for a term of five (5) years from the original expiration date of the Agreement which is the 22nd day of October 2017. At the close of the extension term, the Agreement shall be reviewed and considered for further extension or renewal, with modifications, if appropriate. Except as amended herein, the Agreement shall continue in full force and effect in accordance with its terms.

Contra Costa Community College District

BY: 
Fred E. Wood
Chancellor

DATE: 11/2/17


Contra Costa Building and Construction
Trades Council, AFL-CIO

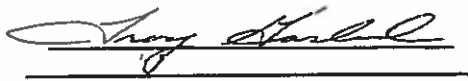
BY: 
Bill Whitney, Chief Executive Officer


DATE: 10/16/2017

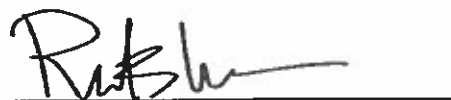
SIGNATURE PAGE
UNIONS


Asbestos Workers Local #16



Boilermakers Local #549


Bricklayers Local #3


Northern California Regional Council of
Carpenters for itself and on behalf of its
affiliated local unions


Sheet Metal Workers Local #104

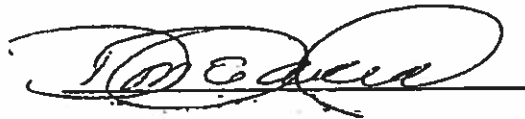

Operating Engineers Local #3

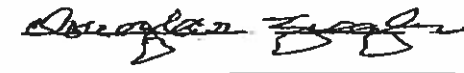

District Council #16, Painters and
Allied Trades for itself and on behalf of
its affiliated local unions



Sprinkler Fitters Local #483

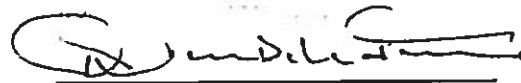

United Association Local #342



Elevator Constructors Local #8

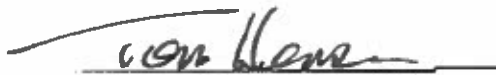

Teamsters Local #315


Roofers Local #81


Iron Workers Local #378


Northern California District Council of
Laborers for itself and on behalf of its
affiliated local unions


Cement Masons Local #300


Electrical Workers Local #302


Plasterers Local #66


United Association Local #159


United Association Local #355

PROJECT STABILIZATION AGREEMENT

for the

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

PREAMBLE

This Project Stabilization Agreement is entered into this 22 day of OCTOBER, 2012 by and between the Contra Costa Community College District (hereinafter, the "District"), together with contractors and/or subcontractors, who shall become signatory to this Agreement by signing the "Agreement To Be Bound" (Exhibit A) (all of whom are referred to herein as "Contractors/Employers"), and the Contra Costa County Building & Construction Trades Council ("Council") and its affiliated local unions that have executed this Agreement (all of whom are referred to collectively as "Unions").

Recitals

WHEREAS, the purpose of this Agreement is to promote efficiency of construction operations during the construction of District Projects and provide for peaceful settlement of labor disputes and grievances without strikes or lockouts, thereby promoting the District's interest and the public's interest in assuring the timely and economical completion of the District's construction Projects; and

WHEREAS, the successful and efficient completion of the District's construction Projects is of the utmost importance to the District and its educational programs and mission; and

WHEREAS, large numbers of workers of various skills will be required in the performance of the construction work, including those to be represented by the Unions affiliated with the Council; and

WHEREAS, it is recognized that District construction Projects require multiple contractors and bargaining units on the job site at the same time over an extended period of time, and that the potential for work disruption is substantial in the absence of a binding commitment to maintain continuity of work; and

WHEREAS, the interests of the general public, the District, the Unions and Contractors/Employers would be best served if the construction work proceeded in an orderly manner without disruption because of strikes, sympathy strikes, work stoppages, picketing, lockouts, slowdowns or other interferences with work; and

WHEREAS, the Contractors/Employers and the Unions desire to mutually establish and stabilize wages, hours and working conditions for the workers employed on District Projects by

the Contractors/Employers and the Unions to the end that a satisfactory, continuous and harmonious relationship will exist among the parties to this Agreement; and

WHEREAS, this Agreement is not intended to replace, interfere, abrogate, diminish or modify existing local or national collective bargaining agreements in effect during the duration of the Program, insofar as a legally binding agreement exists between the Contractor(s)/Employer(s) and the affected Union(s) except to the extent that the provisions of this Agreement are inconsistent with said collective bargaining agreements, in which event, the provisions of this Agreement shall prevail; and

WHEREAS, the contracts for the construction of District Projects will be awarded in accordance with the applicable provisions of the California Public Contract Code; and

WHEREAS, the parties signatory to this Agreement pledge their full good faith and trust to work towards mutually satisfactory completion of all District construction Projects subject to the Agreement.

NOW, THEREFORE, the parties, in consideration of the mutual promises and covenants herein contained, do mutually agree as follows:

ARTICLE 1

DEFINITIONS

1.1 "Agreement" means this Project Stabilization Agreement, plus Exhibit A and Exhibit B.

1.2 "District" means the Contra Costa Community College District and the administrative staff under its Chancellor.

1.3 "Contractor(s)/Employer(s)" means any individual, firm, partnership, corporation or other entity, or any combination thereof, including joint ventures, which is an independent business enterprise and has entered into a contract with the District or any of its contractors or subcontractors of any tier, with respect to construction work on any District Project covered by this Agreement.

1.4 "Master Agreement" means the Master Collective Bargaining Agreement of each craft union signatory hereto, copies of which have been made available by the Council to the District and are on file with the Council and which are incorporated herein by reference and designated the "Schedule A(s)," and are listed in Exhibit B.

1.5 "Project Manager" or "Construction Manager" means any employee or business entity(ies) designated by the District to oversee District Projects subject to this Agreement.

1.6 "Project" means any District construction project that has a total minimum estimated construction cost of two million dollars (\$2,000,000) or more. The District may, at its discretion,

designate other project(s) or contract(s) with a total estimated construction cost of less than two million dollars (\$2,000,000) to be covered by this Agreement if the District believes it is in the best interest of the District to do so. Routine maintenance of District properties are not covered by the scope of this Agreement.

1.7. "Union" or "Unions" means the Contra Costa Building and Construction Trades Council, AFL-CIO and its affiliated local unions that have executed this Agreement.

ARTICLE 2

SCOPE OF AGREEMENT AND TERM

2.1. This Agreement shall apply to all on-site demolition, construction, alteration, painting or repair of buildings, structures and other works and related activities on any Project covered by this Agreement that is within the craft jurisdiction of one of the Unions and that is directly or indirectly part of the Project, including, without limitation, pipelines (including those in linear corridors built to serve the Project), pumps, pump stations, start-up, site preparation, on-site survey work, soils and material inspection and testing, including x-ray technicians, and all on-site fabrication work provided such work is within the fabrication provision of a local Master Agreement or national agreement of one of the Unions. On-site fabrication work includes work done for the Project in temporary yards or areas near the Project, and at the site of any batch plant constructed solely to supply materials to the Project. This Agreement also covers all off site work, including fabrication, that is traditionally performed by any of the Unions that are directly or indirectly part of the Project, provided such work is covered by a provision of a local Master Agreement or a local addendum to a national agreement of the applicable Union(s) including delivery and off-haul work to the full extent of the law.

2.2. This Agreement shall govern the award of all construction contracts on all District Projects covered by this Agreement. The District has the absolute right to combine, consolidate, add, or cancel covered Project(s) or portions of covered Project(s). Once a construction Project is completed, it is no longer covered by this Agreement. For the purposes of this Agreement, a construction Project shall be considered completed upon filing of a Notice of Completion.

2.3. All labor disputes involving the application or interpretation of the collective bargaining agreement to which a signatory Contractor/Employer and a signatory Union are parties shall be resolved pursuant to the resolution procedures of the collective bargaining agreement. All disputes relating to the interpretation or application of this Agreement shall be subject to resolution pursuant to the grievance arbitration procedure set forth herein.

2.4. Exclusions:

2.4.1. This Agreement shall be limited to construction work on covered Projects and is not intended to, and shall not, govern any construction work performed at the District at any time prior to the effective date, or after the expiration or termination, of this Agreement.

2.4.2. This Agreement is not intended to, and shall not affect or govern the award of public works contracts by the District which are outside the approved scope of the Projects.

2.4.3. This Agreement is not intended to, and shall not affect the operation or maintenance of the District.

2.4.4. This Agreement shall not apply to a Contractor's/Employer's executives, managerial employees, engineering employees, supervisors (except those covered by existing building and construction trades collective bargaining agreements), and office and clerical employees.

2.4.5. This Agreement shall not apply to employees of the District.

2.4.6. This Agreement shall not apply to contracts awarded pursuant to any emergency public works project(s).

2.4.7 The District shall retain the right at all times to perform and/or subcontract small, incidental portions of related work on the Project site not contracted by the construction contract documents to the signatory Contractor(s) bound to this Agreement.

2.4.8. No provisions negotiated in any Master Agreement solely to apply to work covered by this Project Stabilization Agreement shall apply if such provisions are less favorable to the Contractor for work covered by this Project Stabilization Agreement than those provisions uniformly required of contractors for construction work normally covered by those Master Labor Agreements.

2.4.9 It is the legal obligation of the District to obtain the most competitive bids while maintaining the conditions of the Agreement. To ensure that a competitive bid is received from a range of general contractors, the Contra Costa Building and Construction Trades Council shall assist the District in soliciting interested parties in bidding on the Project(s). Additionally, the District recognizes that multiple subcontractor quotations of bids ensure the most competitive overall bid. The Contra Costa Building and Construction Trades Council shall assist the District in encouraging and soliciting local and other subcontractors in bidding to interested general contractors. In the event the Project bids over the estimated construction cost of the Project, the District reserves the right to request a list of all subcontractors which bid to the two lowest general contractors to verify that adequate competitive bidding was conducted. Additionally, if the project bids are over the estimated construction cost and fewer than three (3) general contractors bid on the Project(s), the District reserves the right, without reservation, to reject all bids and re-bid the Project.

2.4.10 This Agreement shall become effective on the day it is signed by the District, the Contra Costa Building and Construction Trades Council, AFL-CIO, and its affiliated local Unions and shall continue in full force and effect for a period of five (5) years, at which time this Agreement will be reviewed and considered for extension or renewal, with modifications, if appropriate. The terms of this Agreement shall continue to apply to

those Projects subject to this Agreement until construction is completed. The District and the Contra Costa Building and Construction Trades Council may mutually agree in writing to amend, extend or terminate this Agreement at any time. Should either the District or the Contra Costa Building and Construction Trades Council, AFL-CIO, wish to unilaterally terminate this Agreement prior to its expiration, that party must provide written notice to the other party and, if a mutually acceptable resolution cannot be reached, shall submit the request to a neutral arbitrator selected from the following list of arbitrators, through a striking procedure, with a coin toss determining the order of striking, for a final and binding determination whether just cause exists for early termination of the Agreement because it is no longer serving the Purposes, as set forth in the Recitals, herein:

Thomas Angelo
William Riker
Barry Winograd
Jerilou Cossack
William Engler

ARTICLE 3

EFFECT OF AGREEMENT

3.1. By executing this Agreement, the Unions and the District agree to be bound by each and all of the provisions of the Agreement.

3.2. By accepting the award of a construction contract for a Project, whether as contractor or subcontractor, the Contractor/Employer agrees to be bound by each and every provision of the Agreement and agrees that it will evidence its acceptance prior to the commencement of work by executing the Agreement to be Bound in the form attached hereto as Exhibit A.

3.3. At the time that any Contractor/Employer enters into a subcontract with any subcontractor providing for the performance of a Construction Contract, the Contractor/Employer shall provide a copy of this Agreement to said subcontractor and shall require the subcontractor as a part of accepting an award of a construction subcontract to agree in writing to be bound by each and every provision of this Agreement prior to the commencement of work. If a Contractor/Employer requires a subcontractor to agree in writing to comply with the terms of this Agreement as a condition of awarding work to the subcontractor, the Contractor/Employer shall not be liable in any way for the subcontractor's failure to pay the wages and benefits required by this Agreement except as required by the provisions of the California Labor Code.

3.4. Except as enumerated in this Agreement, all other terms and conditions of employment described in the Master Agreement of the Union having traditional and customary jurisdiction over the work shall apply. The provisions of this Agreement shall take precedence over conflicting provisions of any applicable Master Agreement, or any other national, area or local collective bargaining agreement, except that all work performed under the NTL Articles of

Agreement, the National Stack/Chimney Agreement and the National Cooling Tower Agreement; all instrument calibration work and loop checking Covered Work shall be performed under the terms of the UA/IBEW Joint National Agreement for Instrument and Control Systems Technicians, and work within the craft jurisdiction of the Elevator Constructors will be performed under the terms of the National Agreements of the International Union of Elevator Constructors; provided that Articles 4 and 13 of this Agreement shall apply to all Covered Work. In the absence of a conflict, the provisions of the applicable Master Agreements shall govern.

3.5. This Agreement shall only be binding on the signatory parties hereto and shall not apply to the parents, affiliates, subsidiaries or other ventures of any such party.

3.6. This Agreement shall not be effective unless and until the District, the Contra Costa Building and Construction Trades Council AFL-CIO and all the Unions listed on the signature page have signed and dated this Agreement.

ARTICLE 4

WORK STOPPAGES, STRIKES, SYMPATHY STRIKES AND LOCKOUTS

4.1. The Unions, District and Contractor(s)/Employer(s) agree that for the duration of the Program:

4.1.1. There shall be no strikes, sympathy strikes, work stoppages, picketing, handbilling or otherwise advising the public that a labor dispute exists, or slowdowns of any kind, for any reason, by the Unions or employees employed on a covered Project, at the job site of the Project or at any other facility of the District because of a dispute on a covered Project or with a Contractor/Employer on the Project. It shall not be considered a violation of this provision for a Union to withhold labor (but not picket) from any Contractor/Employer who fails to make its timely payment of Trust Fund contributions or fails to meet its weekly payroll. The affected Union shall give 72-hour written notice to the District prior to withholding labor due to a Contractor's failure to make timely payment of Trust Fund contributions or payroll. Although disputes arising between the Unions and Contractor(s)/Employer(s) on other projects are not governed by this Agreement, a Union may not take any action against Contractor(s)/Employer(s) on District property and/or on a District Project because of a dispute between the Unions and Contractor(s)/Employer(s) on other projects.

4.1.1.1 If the arbitrator determines, in accordance with this Article, a work stoppage has occurred, the respondent Union(s) shall, within eight (8) hours of receipt of the decision, direct all of the employees they represent on the Project to immediately return to work. If the craft(s) involved do not return to work by the beginning of the next regularly scheduled shift following such eight (8) hour period after receipt of the arbitrator's decision, and the respondent Union(s) have not complied with their obligations to immediately instruct, order and use their best efforts to cause a cessation of the violation and return the employees they

represent to work, then the non-complying respondent Union(s) shall each pay a sum as liquidated damages to the District, and each will pay an additional sum per shift, as set forth in 4.1.1.3 below, for each shift thereafter on which the craft(s) have not returned to work.

4.1.1.2 If the arbitrator determines in accordance with this Article that a lock-out has occurred, the respondent Contractor(s) shall, within eight (8) hours after receipt of the decision, return all the affected employees to work on the Project, or otherwise correct the violation found by the arbitrator. If the respondent Contractor(s) do not take such action by the beginning of the next regularly scheduled shift following the eight (8) hour period, each non-complying respondent Contractor shall pay or give as liquidated damages, to the affected Union(s) (to be apportioned among the affected employees and the benefit funds to which contributions are made on their behalf, as designated by the arbitrator) and each shall pay an additional sum per shift, as set forth in 4.1.1.3 below, for each shift thereafter in which compliance by the respondent Contractor(s) have not been completed.

4.1.1.3 The arbitrator shall retain jurisdiction to determine compliance with this Section and to establish the appropriate sum of liquidated damages, which shall be not less than One Thousand Dollars (\$1,000.00), nor more than Five Thousand Dollars (\$5,000.00) per shift for each non-complying entity.

4.1.2. As to employees employed on a covered Project, there shall be no lockout of any kind by a Contactor/Employer subject to the Agreement.

4.1.3. If a Master Agreement between a Contractor/Employer and the Union expires before the Contractor/Employer completes the performance of a Construction Contract and the Union or Contractor/Employer gives notice of demands for a new or modified Master Agreement, the Union agrees that it will not strike the Contractor/Employer on said contract for work covered under this Agreement, and the Union and the Contractor/Employer agree that the expired Master Agreement shall continue in full force and effect for work covered under this Agreement until a new or modified Master Agreement is reached between the Union and Contractor/Employer.

4.2. When a remedy is sought for an alleged breach of this Article, any party to this Agreement shall institute the following procedure, prior to any other action at law or equity.

4.2.1. A party invoking this procedure shall notify Thomas Angelo, as the permanent arbitrator, or Robert Hirsch, as the alternate, under this procedure. In the event that the permanent arbitrator is unavailable at any time, the alternate will be contacted. If neither is available, then a selection shall be made from the list of arbitrators in Article 12, Section 12.2. Notice to the arbitrator shall be by the most expeditious means available, with notices by facsimile or telephone to the party alleged to be in violation and to the Contra Costa Building and Construction Trades Council and involved Union if a Union is alleged to be in violation.

4.2.2. Upon receipt of said notice, the District will contact the designated arbitrator named above or his alternate who will attempt to convene a hearing within twenty-four (24) hours if it is contended that the violation still exists.

4.2.3. The arbitrator shall notify the parties by facsimile or telephone of the place and time for the hearing. Said hearing shall be completed in one session, which, with appropriate recesses at the arbitrator's discretion, shall not exceed twenty-four (24) hours unless otherwise agreed upon by all parties. A failure of any party to attend said hearings shall not delay the hearing of evidence or the issuance of any award by the arbitrator.

Thomas Angelo's postal address, phone number, fax number and e-mail address are:

Thomas Angelo
PO Box 1937
Mill Valley CA 94943
Phone: (415) 381-1701
Fax: (415) 380-9792
tangelomv@gmail.com

Robert Hirsch postal address, phone number, and e-mail address are:

Robert Hirsch
PO Box 170428
San Francisco, CA 94117
Phone: 415-362-9999
Rmhirsch@gmail.com

4.2.4. The sole issue at the hearing shall be whether or not a violation of Article 4, Section 4.1 of the Agreement has occurred. The arbitrator shall have no authority to consider any matter of justification, explanation or mitigation of such violation or to award damages, which issue is reserved for court proceedings, if any. The award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without a written opinion. If any party desires a written opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the award. The arbitrator may order cessation of the violation of this Article and other appropriate relief and such award shall be served on all parties by hand or registered mail upon issuance.

4.2.5. Such award may be enforced by any Court of competent jurisdiction upon the filing of this Agreement and all other relevant documents referred to above in the following manner. Written notice of the filing of such enforcement proceedings shall be given to the other party. In the proceeding to obtain a temporary order enforcing the arbitrator's award as issued under Section 4.2.4 of this Article, all parties waive the right

to a hearing and agree that such proceedings may be ex parte. Such agreement does not waive any party's right to participate in a hearing for a final order or enforcement. The Court's order or orders enforcing the arbitrator's award shall be served on all parties by hand or delivered by certified mail.

4.2.6. Any rights created by statute or law governing arbitration proceedings inconsistent with the above procedure or which interfere with compliance are waived by the parties.

4.2.7. The fees and expenses of the arbitrator shall be divided equally between the parties to the arbitration.

4.2.8. The parties to this Agreement agree that the labor organizations have not waived their legal rights to undertake otherwise lawful activity with regard to any dispute or disputes which they may have regarding non-Project construction work and operations; provided, however, that any such activities by the signatory Unions shall not disrupt or interfere in any way with any work done at any District site. Recognizing the above and, in order to carry out the principles of this Agreement, the parties agree that should a signatory Union have a dispute with regard to non-covered work on or adjacent to any District site, the signatory Union will notify the Contra Costa Building and Construction Trades Council and shall not undertake on or adjacent to the property, any public activity regarding the dispute. Representatives of the involved Union and the Council shall meet with the representatives of the District to discuss and review the valid, legal manner and means by which the signatory Union may undertake its activities with regard to this dispute (giving due consideration in such discussions and review to the traditional concerns for the ongoing operations of the Project and to the importance of the continuity of the work covered by the Master Agreement), and develop a program which allows the signatory Union to exercise its legal rights but at the same time eliminates any possible disruptive effect on the ongoing Project construction work.

4.2.9. Should any Union or the District (or its Project Manager/Project Contractors/Employers) become aware of a possible or actual labor dispute involving non-Project construction work or operations and involving non-signatory unions which may result in public activity on or about any District site by such non-signatory unions, the representative of each will jointly meet to discuss such activity and to work together, using their best efforts, to avoid having such activity adversely impact or otherwise delay or interfere with ongoing Project construction work.

4.2.10. To the extent any provision in this Article 4 conflicts with the dispute resolution provisions of Public Contract Code section 20104, et seq, this Article 4 shall be null and void.

ARTICLE 5

PRECONSTRUCTION CONFERENCE

5.1. A preconstruction conference shall be held prior to the commencement of each construction Project. Such conference shall be attended by a representative each from the participating Contractor(s)/Employer(s) and Union(s) and the Project Manager.

ARTICLE 6

NO DISCRIMINATION

6.1. The Contractor(s)/Employer(s) and Unions agree not to engage in any form of discrimination on the ground or because of; race, color, creed, national origin, ancestry, age, sex, sexual orientation, disability or Acquired Immune Deficiency Syndrome or AIDS Related Condition (AIDS/ARC), or union status against any employee, or applicant for employment, on the Program.

ARTICLE 7

UNION SECURITY

7.1. The Contractor(s)/Employer(s) recognize the Union(s) as the sole bargaining representative of all craft employees working within the scope of this Agreement.

7.2. No employee covered by this Agreement is required to join any Union as a condition of being first employed on the Project.

7.3. All employees working on the Project shall be governed by the applicable Union security clause of the applicable craft's "Schedule A" Agreement. Employees hired by the Contractor(s)/Employer(s) shall, as a condition of employment, be responsible for the payment of the applicable monthly working dues and any associated fees uniformly required for union membership in the local Union which is signatory to this Agreement. Further, there is nothing in this Agreement that would prevent non-union employees from joining the local Union.

7.4. Authorized representatives of the Unions shall have access to the Projects whenever work covered by this Agreement is being, has been, or will be performed on the Projects, provided it is not disruptive to the work on the Projects or the operation of the District.

ARTICLE 8

REFERRAL

8.1. Contractor(s)/Employer(s) performing construction work on covered Projects shall, in filling craft job requirements be bound by and utilize the registration facilities and referral systems established or authorized by the signatory Unions when such procedures are not in violation of Federal law. The Contractor(s)/Employer(s) shall have the right to reject any applicant referred by the Union(s), in accordance with the applicable Master Agreement.

8.2. The Contractor(s)/Employer(s) shall have the unqualified right to select and hire directly all supervisors above the level of General Foreman it considers necessary and desirable, without such persons being referred by the Union(s). The selection of craft foremen and general foremen shall be entirely the responsibility of the Contractor(s). Foremen and general foremen shall take orders from the designated Contractor(s) representatives.

8.3. In the event that referral facilities maintained by the Unions are unable to fill the requisition of a Contractor/Employer for employees within a forty-eight (48) hour period (Saturday, Sundays and holidays excluded) after such requisition is made by the Contractor/Employer, the Contractor/Employer shall be free to obtain work persons from any source.

8.4. Unions will exert their utmost efforts to recruit sufficient numbers of skilled craft persons to fulfill the requirements of the Contractor(s)/Employer(s). The parties to this Agreement support the development of increased numbers of skilled construction workers from graduates of District schools and residents of Contra Costa County and the surrounding East Bay Area to meet the needs of District Projects and the requirements of the industry generally. Toward that end, the Unions agree to encourage the referral and utilization, to the extent permitted by law and the hiring hall procedures, of qualified graduates of District schools, Contra Costa residents and residents of the East Bay Area as journeymen and apprentices to covered Projects and entrance into such apprenticeship and training programs as may be operated by the Unions.

8.5. Recognizing the special needs of District Projects, the Unions shall consider a Contractor(s)/Employer(s) request to transfer key employees to work on a covered Project in a manner consistent with the Union's referral procedures.

ARTICLE 9

BENEFITS

9.1. All Contractor/Employers agree to pay contributions to the vacation, pension and other form of deferred compensation plan, apprenticeship, and health benefit funds established in the applicable Schedule A for each hour worked on the Project in amounts no less than those designated in the Department of Industrial Relations Wage Determination of the applicable craft.

9.2. The Contractor(s)/Employer(s) shall not be required to pay contributions to any other trust funds that are not contained in the published prevailing wage determination to satisfy their obligation under this Article except those Contractor(s)/Employer(s) who are signatory to the Master Agreements with the respective trades shall continue to pay all trust fund contributions as outlined in such Master Agreements.

9.3. By signing this Agreement, the Contractor(s)/Employer(s) adopt and agree to be bound by the written terms of the legally established Trust Agreements as described in Section 9.1 above specifying the detailed basis on which payments are to be made into, and benefits paid out of, such Trust Funds.

9.4. Wages, Hours, Terms and Conditions of Employment: The wages, hours and other terms and conditions of employment on a Project shall be governed by the Master Agreement of the respective crafts, copies of which shall be on file with the District, to the extent such Master Agreement is not inconsistent with the applicable Department of Industrial Relations Prevailing Wage Determinations which shall establish minimum wages. Where a subject is covered by the Master Agreement and not covered by a Wage Determination or this Agreement, the Master Agreement will prevail. When a subject is covered by both the Master Agreement and this Agreement, to the extent there is any inconsistency, this Agreement will prevail.

ARTICLE 10

LOCAL HIRE

10.1. It is an objective of the parties that not less than 25 percent (25%) of all hours worked by journeyman and apprentices on the Project, on a craft by craft basis, be worked by residents of the area served by the Contra Costa Community College District. The Unions will exert their utmost efforts to recruit sufficient numbers of skilled craft persons to fulfill the requirements of the Contractor(s)/Employer(s). The parties to this Agreement support the development of increased numbers of skilled construction workers from the area served by the District. To the extent allowed by law, and consistent with the local Union's hiring hall provisions, and as long as they possess the requisite skills and qualifications, residents of the area served by the District, including journeyman and apprentices, shall be referred for Project work covered by this Agreement.

ARTICLE 11

COMPLIANCE

11.1. It shall be the responsibility of the Contractor(s)/Employer(s) and Unions to investigate and monitor compliance with the provisions of the Agreement contained in Article 9. Nothing in this agreement shall be construed to interfere with or supersede the usual and customary legal remedies available to the Unions and/or employee benefit Trust Funds to collect delinquent Trust Fund contributions from Employers on the Project. The District shall monitor and enforce compliance with the prevailing wage requirements of the State and Contractor'(s)/Employer'(s) compliance with this Agreement if the District operates a labor compliance program ("LCP") on the Covered Project and if that LCP requires the District to monitor and enforce this compliance.

ARTICLE 12

GRIEVANCE ARBITRATION PROCEDURE

12.1. The parties understand and agree that questions between or among parties signatory to a Master Agreement arising out of or involving the interpretation of a Master Agreement shall be resolved under the grievance procedure provided in that Master Agreement. The parties further understand and agree that in the event any dispute arises out of the meaning, interpretation or application of the provisions of this Agreement, such dispute shall be settled by means of the procedures set out herein. No grievance filed under this Grievance Arbitration Procedure shall be recognized unless the grieving party (Union on its own behalf, or on behalf of an employee whom it represents, or a Contractor/Employer on its own behalf) provides notice in writing to the signatory party with whom it has a dispute within five (5) days after becoming aware of the dispute but in no event more than thirty (30) days after it reasonably should have become aware of the event giving rise to the dispute. The time limits in this Section 12.1 may be extended by mutual written agreement of the parties.

12.2. Grievances shall be settled according to the following procedures:

Step 1: Within five (5) business days after the receipt of the written notice of the grievance, the Business Representative of the involved local Union or his/her designee, or the representative of the employee, and the representative of the involved Contractor/Employer shall confer and attempt to resolve the grievance.

Step 2: In the event that the representatives are unable to resolve the dispute within the five (5) business days after its referral to Step 1, the International Union Representative and the Contractor involved shall meet within seven (7) working days of the referral of the dispute to this second step to arrive at a satisfactory settlement thereof. Meeting minutes shall be kept by the Contractor. In the event that these representatives are unable to resolve the dispute after its referral to Step 2, either involved party may submit it within three (3) business days to the Grievance Committee, which shall meet within five (5) business days after such referral (or such longer time as is mutually agreed upon by all representatives on the Grievance Committee), to confer in an attempt to resolve the grievance. The Grievance Committee shall be comprised of

- two (2) representatives of the District; and
- two (2) representatives of the Contra Costa Building & Construction Trades Council.

If the dispute is not resolved within such time (five (5) business days after its referral or such longer time as mutually agreed upon) it may be referred within five (5) business days by either party to Step 3.

Step 3: Within five (5) business days after referral of a dispute to Step 3, the representatives shall choose a mutually agreed upon arbitrator for final and binding

arbitration. The parties agree that if the permanent arbitrator or his alternate is not available, an arbitrator shall be selected by the alternate striking method from the list of five (5) below:

1. Barry Winograd
2. Thomas Angelo
3. Robert Hirsch
4. William Riker
5. Joseph Grodin

The decision of the Arbitrator shall be binding on all parties. The Arbitrator shall have no authority to change, amend, add to, or detract from, any of the provisions of the Agreement. The expense of the Arbitrator shall be divided equally between the parties to the arbitration.

The Arbitrator shall arrange for a hearing on the earliest available date from the date of his/her selection. A decision shall be given to the parties within five (5) calendar days after completion of the hearing unless such time is extended by mutual agreement. A written opinion may be requested by a party from the presiding Arbitrator.

The time limits specified in any step of the Grievance Procedure set forth in Section 12.2 may be extended by mutual agreement of the parties initiated by the written request of one party to the other, at the appropriate step of the Grievance Procedure. However, failure to process a grievance, or failure to respond in writing within the time limits provided above, without an agreed upon extension of time, shall be deemed a waiver of such grievance without prejudice, or without precedent to the processing of and/or resolution of like or similar grievances or disputes.

In order to encourage the resolution of disputes and grievances at Steps 1 and 2 of this Grievance Procedure, the parties agree that such settlements shall not be precedent setting.

ARTICLE 13

JURISDICTIONAL DISPUTES

13.1. The assignment of Covered Work will be solely the responsibility of the Employer performing the work involved; and such work assignments will be in accordance with the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (the "Plan") or any successor Plan.

13.2. All jurisdictional disputes on this Project between or among the Building and Construction Trades Unions and their employers, parties to this Agreement, shall be settled and

adjusted according to the present Plan established by the Building and Construction Trades Department or any other plan or method of procedure that may be adopted in the future by the Building and Construction Trades Department. Decisions rendered shall be final, binding and conclusive on the Employers and Unions parties to this Agreement.

13.2.1. For the convenience of the parties, and in recognition of the expense of travel between Northern California and Washington, DC, at the request of any party to a jurisdictional dispute under this Agreement an Arbitrator shall be chosen by the procedures specified in Article V, Section 5, of the Plan from a list composed of John Kagel, Thomas Angelo, Robert Hirsch, and Thomas Pagan, and the Arbitrator's hearing on the dispute shall be held at the offices of the applicable Building and Construction Trades Council. All other procedures shall be as specified in the Plan.

13.3. All jurisdictional disputes shall be resolved without the occurrence of any strike, work stoppage, or slow-down of any nature, and the Employer's assignment shall be adhered to until the dispute is resolved. Individuals violating this Section shall be subject to immediate discharge.

13.4. Each Employer will conduct a pre-job conference with the Local Council prior to commencing work. Primary Employer will be advised in advance of all such conferences and may participate if they wish. Pre-job conferences for different Employers may be held together.

ARTICLE 14

APPRENTICES

14.1. Recognizing the need to maintain continuing support of programs designed to develop adequate numbers of competent workers in the construction industry, the Contractor(s)/Employer(s) shall employ apprentices of a State-approved Apprenticeship Program in the respective crafts to perform such work as is within their capabilities and which is customarily performed by the craft in which they are indentured.

14.2. The apprentice ratios will be in compliance with the applicable provisions of the California Labor Code and Prevailing Wage Rate Determination.

14.3. There shall be no restrictions on the utilization of apprentices in performing the work of their craft provided they are properly supervised.

ARTICLE 15

HELMETS TO HARDHATS

15.1. The Contractors/Employers and Unions recognize a desire to facilitate the entry into the building and construction trades of veterans and members of the National Guard and Reserves who are interested in careers in the building and construction industry. The

Contractors/Employers and Unions agree to utilize the services of the Center for Military Recruitment, Assessment and Veterans Employment (hereinafter "Center"), a joint Labor-Management Cooperation Trust Fund, established under the authority of Section 6(b) of the Labor-Management Cooperation Act of 1978, 29 U.S.C. Section 175(a), and Section 302(c)(9) of the Labor-Management Relations Act, 29 U.S.C. Section 186(c)(9), and a charitable tax exempt organization under Section 501(c)(3) of the Internal Revenue Code, and the Center's "Helmets to Hardhats" program to serve as a resource for preliminary orientation, assessment of construction aptitude, referral to apprenticeship programs or hiring halls, counseling and mentoring, support network, employment opportunities and other needs as identified by the parties.

15.2. The Unions and Contractors/Employers agree to coordinate with the Center to create and maintain an integrated database of veterans and members of the National Guard and Reserves interested in working on this Project and of apprenticeship and employment opportunities for this Project. To the extent permitted by law, the Contractors/Employers and Unions will give credit to such veterans and members of the National Guard and Reserves for bona fide, provable past experience.

15.3. In recognition of the work of the Center and the value it offers to the Project, Contractors/Employers performing work on the Project, on a voluntary basis, may elect to contribute to the Center the amount of one cent (\$0.01) per hour for each hour worked by each individual employee covered by this Agreement. Any such payments shall be forwarded monthly to the Center in a form and manner to be determined by the Center's Trustees.

15.4. The Center shall function in accordance with, and as provided in the Agreement and Declaration of Trust creating the fund, and any amendments thereto, and any other of its governing documents. Each Contractor(s)/Employer(s) electing to contribute to the Center approves and consents to the appointment of the Trustees designated pursuant to the Trust Agreement establishing the Center and hereby adopts and agrees to be bound by the terms and provisions of the Trust Agreement.

ARTICLE 16

MANAGEMENT RIGHTS

16.1. The Contractor(s)/Employer(s) shall retain full and exclusive authority for the management of their operations, including the right to direct their work force in their sole discretion. No rules, customs or practices shall be permitted or observed which limit or restrict production, or limit or restrict the working efforts of employees except that lawful manning provisions in the Master Agreement shall be recognized.

16.2. Except as provided in Section 2.1, there shall be no limitation or restriction upon the choice of materials or upon the full use and installation of equipment, machinery, package units, factory pre-cast prefabricated or preassembled materials, tools or other labor saving devices. The on-site installation or application of all items shall be performed by the craft having jurisdiction over such work; provided, however, it is recognized that installation of specialty items which may be furnished by the owner of the Project or a Contractor shall be performed by

construction persons employed under this Agreement who may be directed by other personnel in a supervisory role, provided, however, in limited circumstances requiring special knowledge of the particular item(s), may be performed by construction persons of the vendor or other companies where necessary to protect a manufacturer's warranty. In such instances all provisions of this Agreement shall apply. The issue of whether it is necessary to use construction persons of the vendor or other companies to protect the manufacturer's warranty shall be subject to the grievance and arbitration clause of this Agreement.

ARTICLE 17

SAVINGS CLAUSE

17.1 The parties agree that in the event any article, provision, clause, sentence or word of the Agreement is determined to be illegal or void as being in contravention of any applicable law, by a court of competent jurisdiction such as the Department of Industrial Relations, the Division of Apprenticeship Standards, and other applicable labor related governmental agencies the remainder of the Agreement shall remain in full force and effect. The parties further agree that if any article, provision, clause, sentence or word of the Agreement is determined to be illegal or void, by a court of competent jurisdiction or other labor related governmental authorities, the parties shall substitute, by mutual agreement, in its place and stead, an article, provision, clause, sentence or word which will meet the objections to its validity and which will be in accordance with the intent and purpose of the article, provision, clause, sentence or word in question.

ARTICLE 18

MISCELLANEOUS PROVISIONS

18.1 Counterparts: This Agreement may be executed in counterparts, such that original signatures may appear on separate pages, and when bound together all necessary signatures shall constitute an original. Facsimile signature pages transmitted to other parties to this Agreement shall be deemed equivalent to original signature.

18.2 Warranty of Authority: Each of the persons signing this Agreement represents and warrants that such person has been duly authorized to sign this Agreement on behalf of the party indicated, and each of the parties by signing this Agreement warrants and represents that such party is legally authorized and entitled to enter into this Agreement.

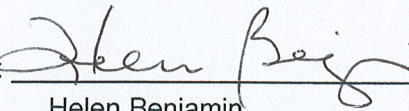
18.3 Ratification by Governing Board: This Agreement shall not be binding on the District until it is approved by the Contra Costa Community College District Governing Board.

18.4 The Agreement shall be included as a condition of the award of all Construction Contracts that are a part of the PSA Program.

18.5 The parties shall establish and implement reasonable substance abuse testing procedures and regulations, which may include prehire, reasonable cause, random and post-

accident testing, to the extent permitted and/or required by Federal and State Law. Should the District administrator for the PSA approve an established program to which signatory Unions are currently a party, such program may become the Project-wide substance abuse testing program, after consultation with the Unions. Until there is such a Project-site substance abuse testing procedure negotiated by the District administrator and the Unions for the PSA, such substance abuse testing procedures as are contained in the Schedule A's shall be applicable to work on the Project, pursuant to their terms.

Contra Costa Community College District

BY:  DATE: 10-22-12
Helen Benjamin
Chancellor

Contra Costa Building & Construction Trades
Council AFL-CIO (Council)

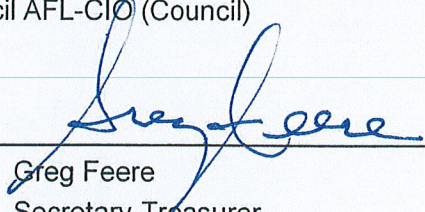
BY:  DATE: Oct. 22, 2012.
Greg Feere
Secretary-Treasurer
Business Manager

Exhibit A
Agreement to Be Bound

Project Stabilization Agreement

The undersigned, as a Contractor on the Contra Costa Community College Project Stabilization Agreement "Project", subject to the Project Stabilization Agreement "Agreement", for and in consideration of the award to it of a contract to perform work on said Project, and in further consideration of the promises made in the Agreement and all attachments, a copy of which was received and is acknowledged, hereby:

1. Accepts and agrees to be bound by the terms and conditions of the Agreement together with any and all amendments and supplements now existing or which are later made thereto only for the duration and scope of the Contractor's work on the Project.
2. The Contractor agrees to be bound by the legally established trust agreements designated in local master collective bargaining agreements. The Contractor authorizes the parties to such local trust agreements to appoint trustees and successor trustee to administer the trust funds and hereby ratifies and accepts the trustees so appointed as if made by the Contractor.
3. Certifies that it has no commitments or agreements which would preclude its full and complete compliance with the terms and conditions of said Agreement.
4. Agrees to secure from any Contractor(s) (as defined in said Agreement) which are or become a subcontractor (of any tier) to it a duly executed Agreement to be Bound in a form identical to this document.

Signature of (Sub)Contractor

Date

(Authorized Officer & Title)

Contractor's State License #

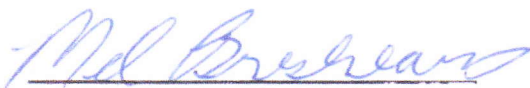
Exhibit B

List of "Schedule A" Agreements:

Collective Bargaining Agreements of each craft signatory to this Project Stabilization Agreement

1. Asbestos Workers Local 16
2. Boilermakers Local 549
3. Bricklayers Local 3
4. Northern California Regional Council of Carpenters for and on Behalf of Their Affiliated Crafts
5. Sheet Metal Workers Local 104
6. Operating Engineers Local 3
7. Painters District Council 16
8. Sprinkler Fitters Local 483
9. United Association Local 342
10. Teamsters Local 315
11. Hod Carriers Local 166
12. Roofers Local 81
13. Iron Workers Local 378
14. Laborers Local Union 324
15. Laborers Local Union 67
16. Cement Masons Local 300
17. Electrical Workers Local 302
18. Plasterers Local 66
19. United Association Local 159
20. United Association Local 355
21. Elevator Constructors Local 8

SIGNATURE PAGE
UNIONS



Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

Laborers Local Union 324

Laborers Local Union 67

Sheet Metal Workers Local 104

Cement Masons Local 300

Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

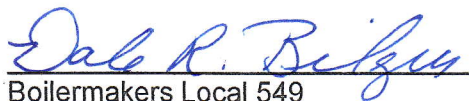
United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

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UNIONS**

Asbestos Workers Local 16


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**SIGNATURE PAGE
UNIONS**

Asbestos Workers Local 16

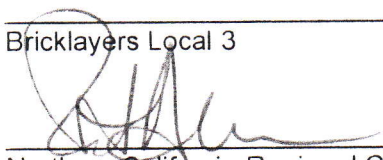
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Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

Laborers Local Union 324

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Elevator Constructors Local 8

**SIGNATURE PAGE
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SIGNATURE PAGE
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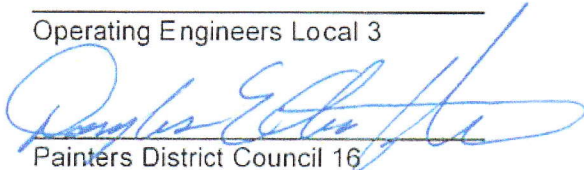
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Plasterers Local 66


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SIGNATURE PAGE
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Northern California Regional Council
of Carpenters for and on Behalf of
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Sprinkler Fitters Local 483

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Teamsters Local 315

Elevator Constructors Local 8

**SIGNATURE PAGE
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Asbestos Workers Local 16

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Boilermakers Local 549

Roofers Local 81

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Northern California Regional Council
of Carpenters for and on Behalf of
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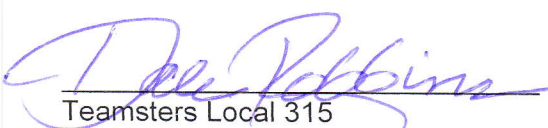
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United Association Local 342

United Association Local 355


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Elevator Constructors Local 8



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UNIONS**

Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

Laborers Local Union 324

Laborers Local Union 67

Sheet Metal Workers Local 104

Cement Masons Local 300

Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Plasterers Local 86

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

**SIGNATURE PAGE
UNIONS**

Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549


Roofers Local 81

Bricklayers Local 3

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Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

Laborers Local Union 324

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Sheet Metal Workers Local 104

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Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

**SIGNATURE PAGE
UNIONS**

Asbestos Workers Local 18

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

Laborers Local Union 324

Laborers Local Union 67

Sheet Metal Workers Local 104

Cement Masons Local 300

Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

SIGNATURE PAGE
UNIONS

Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts


Laborers Local Union 324

Laborers Local Union 67

Sheet Metal Workers Local 104

Cement Masons Local 300

Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

**SIGNATURE PAGE
UNIONS**

Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

Laborers Local Union 324


Laborers Local Union 67

Sheet Metal Workers Local 104

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Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

**SIGNATURE PAGE
UNIONS**

Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

Laborers Local Union 324

Laborers Local Union 67

Sheet Metal Workers Local 104

Carmen Costa Comm. College - Martinez
Cement Masons Local 300

Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

**SIGNATURE PAGE
UNIONS**

Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts


Laborers Local Union 324

Laborers Local Union 67

Sheet Metal Workers Local 104

Cement Masons Local 300

Operating Engineers Local 3


Electrical Workers Local 302

Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

SIGNATURE PAGE
UNIONS

Asbestos Workers Local 18

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

Iron Workers Local 378

Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

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Sheet Metal Workers Local 104

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Operating Engineers Local 3

Electrical Workers Local 302

Painters District Council 16

Chest
Plasterers Local 66

Sprinkler Fitters Local 483

United Association Local 159

United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

SIGNATURE PAGE
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Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

Bricklayers Local 3

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Northern California Regional Council
of Carpenters for and on Behalf of
Their Affiliated Crafts

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Painters District Council 16

Plasterers Local 66

Sprinkler Fitters Local 483



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United Association Local 342

United Association Local 355

Teamsters Local 315

Elevator Constructors Local 8

**SIGNATURE PAGE
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Asbestos Workers Local 16

Hod Carriers Local 166

Boilermakers Local 549

Roofers Local 81

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Northern California Regional Council
of Carpenters for and on Behalf of
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Painters District Council 16

Plasterers Local 66

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**SIGNATURE PAGE
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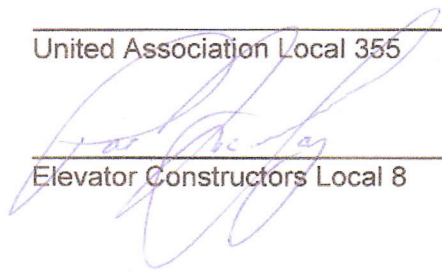
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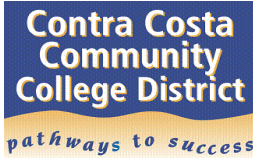


SECTION 00210
INFORMATION AVAILABLE TO BIDDERS

PART 1 - REPORT AND INFORMATION

- 1.1** Existence of reports, record drawings, and utility surveys: Contra Costa Community College District, its consultants, and prior contractors may have collected documents providing a general description of the site and conditions of the work. These documents may consist of geotechnical reports for and around the site, record drawings, utility drawings, and information regarding underground utilities. These reports, documents and other information are not part of the Contract Documents and do not show new work to be constructed, rather, they show existing conditions that Contractor may have to address as part of its construction planning.
- 1.2** Available Documentation: The following existing documentation has been made available for downloading via the District's web site:
<https://webapps.4cd.edu/apps/purchasingviewbids/default.aspx>
 - A.** Limited Pre-Renovation Hazardous Materials Survey Report, dated March 22, 2021, prepared by Terracon Consultants, Inc.
 - B.** Project As-Built Drawings titled:
 1. "Vocational Technology Addition", "Issued for Permit, 5/4/99"
 2. "East Campus - College Complex", "Issued for Permit, 5/4/99"
- 1.3** Contractor shall acknowledge and accept that the documents are not a part of the Contract Documents and are made available to bidders for reference only. The District and its representatives are not responsible for any and all discrepancies between the documents and the existing and actual as-built conditions, and do not guarantee the accuracy of the documents.
- 1.4** The District and Design Consultants assume no responsibility for the completeness or accuracy of the documents or the records compiled there from and the interpretations made from the documents. There is no express or implied guarantee that the conditions indicated in the documents are representative of those existing throughout the building and/or site Conditions differing substantially from those indicated may be encountered.

END OF SECTION 00210



**SECTION 00300
BID PROPOSAL FORM**

Bidder's Name _____

L-1177 INDUSTRIAL TRADES LABS RENOVATION

LOS MEDANOS COLLEGE
2700 E Leland Rd.
Pittsburg, CA 94565

BID DATE: May 26, 2021, 2:00 PM

=====

INSTRUCTIONS TO BIDDERS:

- *Submit your BID Proposal via mail/overnight mail or deliver, in person, to:
Contra Costa Community College District
500 Court Street
Martinez, CA 94553
Attn: Ben M. Cayabyab, Contracts Manager*
 - *Don't forget to include a Bid Bond for 10% of the Bid amount; (copy attached to Bid Proposal is accepted, original by mail to follow); ~~and signed Certification of Site Visit;~~*
 - *Bid results shall be sent to you via email message and posted at the District Website;
For clarification, please email: **Ben M. Cayabyab, Contracts Manager**, bcayabyab@4cd.edu*
- =====

Attention is directed to Labor Code Section 1725.5 regarding Department of Industrial Relations (DIR) contractor registration process; registration criteria and implementation of DIR registration requirements. Labor Code Section 1771.7 establishes contractor's obligation to submit Certified Payroll (CPR) to the Department of Labor and Standards Enforcement (DLSE) and public works monitoring and enforcement. Labor Code Section 1773.3 requires the District to submit a PWC-100 to DIR for all public works contract awarded effective January 1, 2015.

1. INTRODUCTION

- A. The Bidder proposes to perform the Work for the Contract Sum and within the proposed time, based upon an examination of the Job Site and Specifications.
- B. The Bidder certifies this proposal is submitted in good faith.
- ~~C. The signed copy of the Certification of Visit to the Site shall be attached to the Bid Proposal Form.~~
- D. The Bidder shall attach a Bid Security for ten percent (10%) of the Bid Amount in the form of Bid Bond, or Certified Check payable to the District.
- E. The District shall award the contract to the lowest responsive and responsible Bidder. The evaluation of the low bid shall be based on the total of Base Bid.**

Please Note: PCC 20651 (b); In the event, the successful bidder fails to provide the required Payment and Performance bonds, the Bid Security shall be forfeited in favor of the District and Contractor shall not be entitled for contract award.

2. BID AMOUNT

For labor, materials, insurances, bonds, fixtures, equipment, tools, transportation, services, sales taxes and other costs necessary to complete the public project in accordance with Contract Drawings and Specifications, for a stipulated Contract Sum in the amount of:

Quote for the BASE BID Scope of Work:

_____ \$ _____
(Write amount of Base Bid)

3. ADDENDUM (if applicable): #1 Received Date: _____; #2 Received Date: _____;

4. SUBCONTRACTORS LIST (If Any)

Attention is directed to Section 4100 through 4113 of the Public Contract Code concerning Subcontractors, with emphasis on Section 4104, known as the "Subletting and Subcontracting Fair Practices Act, effective July 1, 2014.

	Type of Work	Subcontractor's Name	Address/Phone	Business License # & DIR Registration #
(1)		_____	_____	_____
(2)		_____	_____	_____
(3)		_____	_____	_____

4. COMPLETION TIME

- A. For establishing the Date of Substantial Completion, the contract time shall be **120 calendar days** after date of Notice to Proceed.
- B. Final Completion shall be **45 calendar days** after the date of Substantial Completion.
- C. Prior to the Notice to Proceed issued by the District, the Contractor shall provide a CPM construction schedule, prepared in Microsoft Project format, utilizing the entire time allowed to complete the project. Schedule shall be subject to District's approval.

5. ACCEPTANCE AND AWARD

The District reserves the right to waive minor irregularities or reject all bids; or negotiate changes before or after execution of the Contract. This Bid shall remain open and shall not be withdrawn for a period of 10 days after Bid Opening date.

If written notice of acceptance of this Bid is mailed or delivered to the Bidder within 10 days after the date set for the receipt of this Bid, or other time before it is withdrawn, the Bidder shall execute and deliver to

the District a Contract prepared by District with the required Surety Bonds and Certificates of Insurance, within 10 days after personal delivery or deposit in the mail of the notification of acceptance.

Notice of acceptance or request for additional information may be addressed to the Bidder at the address provided.

The undersigned hereby certifies under penalty of perjury under the laws of the State of California that all the information submitted by the bidder in connection with this proposal and all the representations herein made are true and correct.

Firm Name

CSLB License No.: _____ Exp: _____

Address

DIR Registration No.: _____

Phone: _____

Email: _____

Authorized Signature Print Name Date

SECTION 00500
PAYMENT BOND
(CALIFORNIA PUBLIC WORK)

KNOW ALL MEN BY THESE PRESENTS:

THAT WHEREAS, the Contra Costa Community College District (sometimes referred to hereinafter as "Obligee") has awarded to _____ (hereinafter designated as the "Principal" or "Contractor"), an agreement for the work described as follows: _____ (hereinafter referred to as the "Public Work"); and

WHEREAS, said Contractor is required to furnish a bond in connection with said Contract, and pursuant to California Civil Code Section 9550;

NOW, THEREFORE, We, _____, the undersigned Contractor, as Principal; and _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the Contra Costa Community College District and to any and all persons, companies, or corporations entitled by law to file stop notices under California Civil Code Section 9100, or any person, company, or corporation entitled to make a claim on this bond, in the sum of _____ Dollars (\$ _____), said sum being not less than one hundred percent (100%) of the total amount payable by said Obligee under the terms of said Contract, for which payment will and truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal, its heirs, executors, administrators, successors, or assigns, or subcontractor, shall fail to pay any person or persons named in Civil Code Section 9100; or fail to pay for any materials, provisions, or other supplies, used in, upon, for, or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or for amounts due under the Unemployment Insurance Code, with respect to work or labor thereon of any kind; or shall fail to deduct, withhold, and pay over to the Employment Development Department, any amounts required to be deducted, withheld, and paid over by Unemployment Insurance Code Section 13020 with respect to work and labor thereon of any kind, then said Surety will pay for the same, in an amount not exceeding the amount herein above set forth, and in the event suit is brought upon this bond, also will pay such reasonable attorneys' fees as shall be fixed by the court, awarded and taxed as provided in California Civil Code Sections 9550 et seq.

This bond shall inure to the benefit of any person named in Civil Code Section 9100 giving such person or his/her assigns a right of action in any suit brought upon this bond.

It is further stipulated and agreed that the Surety of this bond shall not be exonerated or released from the obligation of the bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, or specifications, or agreement pertaining or relating to any scheme or work of improvement herein above described; or

pertaining or relating to the furnishing of labor, materials, or equipment therefor; nor by any change or modification of any terms of payment or extension of time for payment pertaining or relating to any scheme or work of improvement herein above described; nor by any rescission or attempted rescission of the contract, agreement or bond; nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond; nor by any fraud practiced by any person other than the claimant seeking to recover on the bond; and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given; and under no circumstances shall the Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the Obligee and the Contractor or on the part of any obligee named in such bond; that the sole condition of recovery shall be that the claimant is a person described in California Civil Code Sections 9100, and who has not been paid the full amount of his or her claim; and that the Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20____.

PRINCIPAL/CONTRACTOR:

By: _____

SURETY:

By: _____

Attorney-in-Fact

**CONTRACT PERFORMANCE BOND
(CALIFORNIA PUBLIC WORK)**

KNOW ALL MEN BY THESE PRESENTS:

THAT WHEREAS, Contra Costa Community College District (sometimes referred to hereinafter as "Obligee") has awarded to _____ (hereinafter designated as the "Principal" or "Contractor"), an agreement for the work described as follows: _____ (hereinafter referred to as the "Public Work"); and

WHEREAS, the work to be performed by the Contractor is more particularly set forth in that certain contract for said Public Work dated _____, (hereinafter referred to as the "Contract"), which Contract is incorporated herein by this reference; and

WHEREAS, the Contractor is required by said Contract to perform the terms thereof and to provide a bond both for the performance and guaranty thereof.

NOW, THEREFORE, we, _____, the undersigned Contractor, as Principal, and _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the Contra Costa Community College District in the sum of _____ Dollars (\$ _____), said sum being not less than one hundred percent (100%) of the total amount payable by said Obligee under the terms of said Contract, for which amount well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if the bounded Contractor, his or her heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions, and agreements in said Contract and any alteration thereof made as therein provided, on his or her part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their intent and meaning; and shall faithfully fulfill guarantees of all materials and workmanship; and indemnify, defend and save harmless the Obligee, its officers and agents, as stipulated in said Contract, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

The Surety, for value received, hereby stipulates and agrees that it shall not be exonerated or released from the obligation of this bond (either by total exoneration or pro tanto) by any change, extension of time, alteration in or addition to the terms of the contract or to the work to be performed there under or the specifications accompanying the same, nor by any change or modification to any terms of payment or extension of time for any payment pertaining or relating to any scheme of work of improvement under the contract. Surety also stipulates and agrees that it shall not be exonerated or released from the obligation of this bond (either by total exoneration or pro tanto) by any overpayment or underpayment by the Obligee that is based upon estimates approved by the Architect. The Surety stipulates and agrees that none of the aforementioned

changes, modifications, alterations, additions, extension of time or actions shall in any way affect its obligation on this bond, and it does hereby waive notice of any such changes, modifications, alterations, additions or extension of time to the terms of the contract, or to the work, or the specifications as well notice of any other actions that result in the foregoing.

Whenever Principal shall be, and is declared by the Obligor to be, in default under the Contract, the Surety shall promptly either remedy the default, or shall promptly complete the Contract through its agents or independent contractors, subject to acceptance and approval of such agents or independent contractors by Obligor as hereinafter set forth, in accordance with its terms and conditions and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees and the payment of liquidated damages; or, at Obligor's sole discretion and election, Surety shall obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Obligor of the lowest responsible bidder, arrange for a contract between such bidder and the Obligor and make available as Work progresses (even though there should be a default or succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the "balance of the Contract price" (as hereinafter defined), and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees and the payment of liquidated damages. The term "balance of the Contract price," as used in this paragraph, shall mean the total amount payable to Principal by the Obligor under the Contract and any modifications thereto, less the amount previously paid by the Obligor to the Principal, less any withholdings by the Obligor allowed under the Contract.

Surety expressly agrees that the Obligor may reject any agent or contractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Principal. Unless otherwise agreed by Obligor, in its sole discretion, Surety shall not utilize Principal in completing the Contract nor shall Surety accept a bid from Principal for completion of the work in the event of default by the Principal.

No final settlement between the Obligor and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

The Contractor and Surety shall remain responsible and liable for all patent and latent defects that arise out of or are related to the Contractor's failure and/or inability to properly complete the Public Work as required by the Contract and the Contract Documents. The obligation of the Surety hereunder shall continue so long as any obligation of the Contractor remains.

Contractor and Surety agree that if the Obligor is required to engage the services of an attorney in connection with enforcement of the bond, Contractor and Surety shall pay Obligor's reasonable attorneys' fees incurred, with or without suit, in addition to the above sum.

In the event suit is brought upon this bond by the Obligor and judgment is recovered, the Surety shall pay all costs incurred by the Obligor in such suit, including reasonable attorneys' fees to be fixed by the Court.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20____.

PRINCIPAL/CONTRACTOR:

By: _____

SURETY:

By: _____

Attorney-in-Fact

The rate of premium on this bond is _____ per thousand.

The total amount of premium charged: \$_____ (This must be filled in by a corporate surety).

IMPORTANT: THIS IS A REQUIRED FORM.

Surety companies executing bonds must possess a certificate of authority from the California Insurance Commissioner authorizing them to write surety insurance defined in California Insurance Code Section 105, and if the work or project is financed, in whole or in part, with federal, grant or loan funds, Surety's name must also appear on the Treasury Department's most current list (Circular 570 as amended).

Any claims under this bond may be addressed to:

(Name and Address of Surety)

(Name and Address of agent or representative
for service for service of process in California)

Telephone: _____

Telephone: _____

Section 00500 – Page 7 of 7
Payment and Performance Bond Forms

SECTION 00510
NOTICE OF AWARD

DATE: _____

TO: _____

ADDRESS: _____

PROJECT: _____

The Contract Sum of your contract is _____ Dollars,
(\$_____).

You must comply with the following conditions within **ten (10)** calendar days of the date of this Notice of Award, that is, by _____.

1. You must deliver to the District two fully executed counterparts of Section 00600, "Construction Agreement."
2. You must deliver to the District the "Contract Performance Bond," and "Payment Bond," executed by you and your surety, which are included in Section 00500.
3. You must deliver to the District the Contractor's CPM Schedule, prepared in Microsoft Project format, including both PDF and electronic file for the District's review.

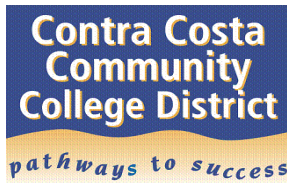
Failure to comply with these conditions within the time specified will entitle District to consider your bid abandoned, to annul this Notice of Award, and to declare your Bid Security forfeited. Within **ten (10)** calendar days after you comply with these conditions, the District will return to you one fully signed counterpart of the Construction Agreement.

Contra Costa Community College District

By: _____

Title: _____

END OF DOCUMENT



CONTRACT NO. _____
(Construction Agreement)

=====

1. **SPECIAL TERMS.** These special terms are incorporated below by reference.

- (§1.1) Parties: (Public Agency) CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court St, Martinez, CA 94553
- (Contractor) _____
Address: _____
- (§1.2) Effective Date: See Section (§1.4) Completion Time, below
- (§1.3) The Work: _____
- (§1.4) Completion Time: **120 Calendar Days** from the Notice to Proceed to Substantial Completion, and **45 Calendar Days** from Substantial Completion to Final Completion (Remaining Work).
- (§1.5.1) Liquidated Damages, Substantial Completion: **\$500** per Calendar Day beyond the Contract Substantial Completion Date.
- (§1.5.2) Liquidated Damages, Remaining Work/Final Completion: **\$100/** per Calendar Day Remaining Work is delayed beyond the Contract Final Completion Date.
- (§1.6) Public Agency's Agent: CONTRA COSTA COMMUNITY COLLEGE DISTRICT (The District)
- (§1.7) Contract Price: _____

2. **SCOPE OF WORK**

3. **WORK CONTRACT, CHANGES**

- (a) By their signatures below, effective on the above date, these parties promise and agree as set forth in this Agreement, incorporating by these references labor and materials contained in Section 2, Scope of Work.
- (b) Contractor shall, at Contractor's own cost and expense, and in a workmanlike manner, fully and faithfully perform and complete the work; and will furnish all materials, labor, services, equipment, and transportation necessary, convenient and proper in order fairly to perform the requirements of this contract, all strictly in accordance with the Scope of Work in Section 2 above, and the Public Agency's plans, drawings and specifications, and with Supplementary General Conditions, if any.
- (c) The work can be changed only with Public Agency's prior written order specifying such change and its cost agreed to by the parties; and the Public Agency shall never have to pay more than specified in Section 7 without such an order.

4. TIME: NOTICE TO PROCEED

Contractor shall start this work as directed in Section 1.4 Completion Time above or as directed by the Notice to Proceed, if any, and shall complete it as specified in Section 1.4, Completion Time.

5. LIQUIDATED DAMAGES

If the Contractor fails to complete this contract and this work within the time fixed therefore, allowance being made for contingencies as provided herein, he becomes liable to the Public Agency for all its loss and damage there from; and because, from the nature of the case, it is and will be impracticable and extremely difficult to ascertain and fix the Public Agency's actual damage from any delay in performance hereof, it is agreed that Contractor will pay as liquidated damages to the Public Agency the reasonable sum specified in Section 1, the result of the parties' reasonable endeavor to estimate fair average compensation therefore, for each calendar day's delay in finishing said work; and if the same be not paid, Public Agency may, in addition to its other remedies, deduct the same from any money due or to become due Contractor under this contract. If the Public Agency for any cause authorizes or contributes to a delay, suspension of work or extension of time, its duration shall be added to the time allowed for completion, but it shall not be deemed a waiver nor be used to defeat any right of the Agency to damages for non-completion or delay hereunder. Pursuant to Government Code Section 4215, the Contractor shall not be assessed liquidated damages for delay in completion of the work, when such delay was caused by the failure of the Public Agency or the owner of a utility to provide for removal or relocation of existing utility facilities.

6. INTEGRATED DOCUMENTS

The plans, drawings and specifications or special provisions of the Public Agency's call for bids, and Contractor's accepted bid for this work are hereby incorporated into this contract; and they are intended to cooperate, so that anything exhibited in the plans or drawings and not mentioned in the specifications or special provisions, or vice versa, is to be executed as if exhibited, mentioned and set forth in both, to the true intent and meaning thereof when taken all together; and differences of opinion concerning these shall be finally determined by the Public Agency.

7. PAYMENT

- (a) For strict and literal fulfillment of these promises and conditions, and full compensation for all this work, the Public Agency shall pay the Contractor the sum specified in Section 1, except that in unit price contracts the payment shall be for finished quantities at unit bid prices.
- (b) On or about the first day of each calendar month, the Contractor shall submit to the Public Agency a verified application for payment, supported by a statement showing all materials actually installed during the preceding month, the labor expended thereon, and the cost thereof; whereupon, after checking, the Public Agency shall issue to Contractor a certificate for the amount determined to be due, minus five (5%) percent thereof, but not until defective work and materials have been removed, replaced and made good. Payment of the approved amount will be made to the Contractor within 30 calendar days from the date the Public Agency approves in writing the Contractor's application for payment.

8. PAYMENTS WITHHELD

- (a) The Public Agency or its agent may withhold any payment, or because of later discovered evidence nullify all or any certificate for payment, to such extent and period of time only as may be necessary to protect the Public Agency from loss because of:
 - (1) Defective work not remedied, or work not completed, or
 - (2) Claims filed or reasonable evidence indicating probable filing, or
 - (3) Failure to properly pay subcontractors or for material or labor, or

- (4) Reasonable doubt that the work can be completed for the balance then unpaid, or
 - (5) Damage to another contractor, or
 - (6) Damage to the Public Agency, other than damage due to delays.
- (b) The Public Agency shall use reasonable diligence to discover and report to the Contractor, as the work progresses, the materials and labor which are not satisfactory to it, so as to avoid unnecessary trouble or cost to the Contractor in making good any defective work or parts.
- (c) Thirty-five (35) calendar days after Public Agency files its notice of completion of the entire work, it shall issue a certificate to the Contractor and pay the balance of the contract price after deducting all amounts withheld under this contract, provided the Contractor shows that all claims for labor and materials have been paid, no claims have been presented to the Public Agency based on acts or omissions of the Contractor, and no liens or withhold notices have been filed against the work or site, and provided there are not reasonable indications of defective or missing work or of late-recorded notices of liens or claims against Contractor.

9. **INSURANCE**

Before the commencement of the Work, the Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in California as admitted carriers, or a District approved equal, with a financial rating of at least A status as rated in the most recent edition of Best's Insurance Reports or as amended by the Supplementary General Conditions, such insurance as will protect the Public Agency from claims set forth below, which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations are by the Contractor, by a Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

- (a) Claims for damages because of bodily injury, sickness, disease, or death of any person District would require indemnification and coverage for employee claim;
- (b) Claims for damages insured by usual personal injury liability coverage, which are sustained by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor or by another person;
- (c) Claims for damages because of injury or destruction of tangible property, including loss of use resulting therefrom, arising from operations under the Contract Documents;
- (d) Claims for damages because of bodily injury, death of a person, or property damage arising out of the ownership, maintenance, or use of a motor vehicle, all mobile equipment, and vehicles moving under their own power and engaged in the Work;
- (e) Claims involving contractual liability applicable to the Contractor's obligations under the Contract Documents, including liability assumed by and the indemnity and defense obligations of the Contractor and the Subcontractors; and
- (f) Claims involving Completed Operations, Independent Contractors' coverage, and Broad Form property damage, without any exclusions for collapse, explosion, demolition, underground coverage, and excavating. (XCU)
- (g) Claims involving sudden or accidental discharge of contaminants or pollutants.

Additional Insured Endorsement Requirement: The Contractor shall name, on any policy of insurance, the District, Architect, Inspector, the State of California, their officers, employees, agents and independent contractors as Additional Insured. Subcontractors shall name the Contractor, the District, Architect, Inspector, the State of California, their officers, employees, agents and independent contractors as Additional Insured. The Additional Insured Endorsement included on all such insurance policies shall state that coverage is afforded the additional insured with respect to claims arising out of operations performed by or on behalf of the insured. If the Additional Insured, have other insurance which is applicable to the loss, such other insurance shall be on an excess or contingent basis. The insurance provided by the Contractor must be designated in the policy as

primary to any insurance obtained by the Public Agency. The amount of the insurer's liability shall not be reduced by the existence of such other insurance.

Specific Insurance Requirement: Contractor shall take out and maintain and shall require all subcontractors, if any, whether primary or secondary, to take out and maintain:

- (a) Comprehensive General Liability Insurance with an aggregate of not less than \$2,000,000.00; Per occurrence, \$1,000,000.00
- (b) Automotive (any auto) where operated in amounts \$1,000,000.00
- (c) Workers' Compensation Insurance: \$1,000,000.00; Contractor is aware of and complies with Labor Code Section 3700 and the Worker's Compensation Law.

10. BONDS

(Not Required for Public Projects below \$25,000; Civil Code 9550; Public Contract Code 7103.)

Bond Requirements: Prior to commencing any portion of the Work, the Contractor shall furnish separate payment and performance bonds for its portion of the Work which shall cover 100% faithful performance of and payment of all obligations arising under the Contract Documents and/or guaranteeing the payment in full of all claims for labor performed and materials supplied for the Work. All bonds shall be provided by a corporate surety authorized and admitted to transact business in California as sureties.

To the extent, if any, that the Contract Price is increased in accordance with the Contract Documents, the Contractor shall, upon request of the Public Agency, cause the amount of the bonds to be increased accordingly and shall promptly deliver satisfactory evidence of such increase to the Public Agency. To the extent available, the bonds shall further provide that no change or alteration of the Contract Documents (including, without limitation, an increase in the Contract Price, as referred to above), extensions of time, or modifications of the time, terms, or conditions of payment to the Contractor will release the surety. If the Contractor fails to furnish the required bonds, the Public Agency may terminate the Contract for cause.

On signing this contract, Contractor shall deliver to Public Agency for approval good and sufficient bonds with sureties, in amount(s), specified in the specifications or special provisions, guaranteeing faithful performance of this contract and payment for all labor and materials hereunder.

11. FAILURE TO PERFORM

If the Contractor at any time refuses or neglects, without fault of the Public Agency or its agent(s), to supply sufficient materials or workers to complete this agreement and work as provided herein, for a period of ten days or more after written notice thereof by the Public Agency, the Public Agency may furnish same and deduct the reasonable expenses thereof from the contract price.

12. LAWS APPLY: General

Both parties recognize the applicability of various federal, state and local laws and regulations, especially Chapter 1 of Part 7 of the California Labor Code (beginning with Section 1720, and including Sections 1735, 1777.5, 1777.6, forbidding discrimination) and intend that this agreement complies therewith. The parties specifically stipulate that the relevant penalties and forfeitures provided in the Labor Code, especially in Sections 1775, 1777.6, and 1813, concerning prevailing wages and hours, shall apply to this agreement as though fully stipulated herein.

13. REGISTRATION WITH DEPARTMENT OF INDUSTRIAL RELATIONS

Contractor shall be registered pursuant to Section 1725.5 of the California Labor Code to be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any public work contract that is subject to the requirements of Section 1725.5. For the purposes of this requirement, "contractor" includes a subcontractor as defined by Labor Code Section 1722.1.

The requirement to list only registered contractors and subcontractors on bids becomes effective on March 1, 2015. The requirement to only use registered contractors and subcontractors on public works projects applies to all projects awarded on or after April 1, 2015.

14. SUBCONTRACTORS

Public Contract Code Sections 4100-4113 are incorporated herein.

15. WAGE RATES

- (a) Pursuant to Labor Code Section 1773, the Director of the Department of Industrial Relations has ascertained the general prevailing rates of wages per diem, and for holiday and overtime work, in the locality in which this work is to be performed, for each craft, specified in the call for bids for this work and are on file with the Public Agency, and are hereby incorporated herein.
- (b) This schedule of wages is based on a working day of eight (8) hours unless otherwise specified; and the daily rate is the hourly rate multiplied by the number of hours constituting the working day. When less than that number of hours are worked, the daily wage rate is proportionately reduced, but the hourly rate remains as stated.
- (c) The Contractor, and all subcontractors, must pay at least these rates to all persons on this work, including all travel, subsistence, and fringe benefit payments provided for by applicable collective bargaining agreements. All skilled labor not listed above must be paid at least the wage scale established by collective bargaining agreement for such labor in the locality where such work is being performed. If it becomes necessary for the Contractor or any subcontractor to employ any person in a craft, classification or type of work (except executive, supervisory, administrative, clerical or other non-manual workers as such) for which no minimum wage rate is specified, the contractor shall immediately notify the Public Agency which shall promptly determine the prevailing wage rate therefore and furnish the Contractor with the minimum rate based thereon, which shall apply from the time of the initial employment of the person affected and during the continuance of such employment.

16. HOURS OF LABOR

Eight hours of labor in one calendar day constitutes a legal day's work, and no worker employed at any time on this work by the Contractor or by any subcontractor shall be required or permitted to work longer thereon except as provided in Labor Code Sections 1810-1815.

17. APPRENTICES

Properly indentured apprentices may be employed on this work in accordance with Labor Code Sections 1777.5 and 1777.6, forbidding discrimination.

18. SUBMISSION OF CERTIFIED PAYROLL RECORDS

Contractors and subcontractors on all public works projects will be required to submit certified payroll records (CPRs) to the Labor Commissioner unless excused from this requirement. This requirement will be phased in as follows:

- (a) Applies immediately to public works projects that have already been under CMU monitoring, i.e. contractors on ongoing projects that have been submitting CPRs to the CMU will continue doing so.
- (b) Will apply to any new projects awarded on or after April 1, 2015.
- (c) May apply to other projects as determined by Labor Commissioner.
- (d) Will apply to all public works projects, new or ongoing, on and after January 1, 2016.

19. PREFERENCE FOR MATERIALS

The Public Agency desires to promote the industries and economy of Contra Costa County, and the Contractor therefore promises to use the products, workers, laborers and mechanics of this County in every case where the price, fitness and quality are equal.

20. ASSIGNMENT

This agreement binds the heirs, successors, assigns, and representatives of the Contractor; but Contractor cannot assign it in whole or in part, nor any monies due or to become due under it, without the prior written consent of the Public Agency and the Contractor's surety or sureties, unless they have waived notice of assignment.

21. NO WAIVER BY PUBLIC AGENCY

Inspection of the work and/or materials, or approval of work and/or materials inspected, or statement by any officer, agent or employee of the Public Agency indicating the work or any part thereof complies with the requirements of this contract, or acceptance of the whole or any part of said work and/or materials, or payments therefore, or any combination of these acts, shall not relieve the Contractor of Contractor's obligation to fulfill this contract as prescribed; nor shall the Public Agency be thereby stopped from bringing any action for damages or enforcement arising from the failure to comply with any of the terms and conditions hereof.

22. HOLD HARMLESS AND INDEMNITY

- (a) Contractor promises to and shall hold harmless and indemnify from the liabilities as defined in this section.
- (b) The indemnities benefited and protected by this promise are the Public Agency and its elective and appointive boards, commissions, officers, agents and employees.
- (c) The liabilities protected against are any liability or claim for damage of any kind allegedly suffered, incurred or threatened because of actions defined below, including personal injury, death, property damage, inverse condemnation, or any combination of these, regardless of whether or not such liability, claim or damage was unforeseeable at any time before the Public Agency approved the improvement plan or accepted the improvements as completed, and including the defense of any suit(s) or action(s) at law or equity concerning these.
- (d) The actions causing liability are any act or omission (negligent or non-negligent) in connection with the matters covered by this contract and attributable to the contractor, subcontractor(s), or any officer(s), agent(s), or employee(s) of one or more of them.
- (e) Non-conditions: The promise and agreement in this section is not conditioned or dependent on whether or not any Indemnities has prepared, supplied, or approved any plan(s), drawing(s), specifications(s) or special provision(s) in connection with this work, has insurance or other indemnification covering any of these matters, or that the alleged damage resulted partly from any negligent or willful misconduct of any Indemnities.

23. EXCAVATION

Contractor shall comply with the provisions of Labor Code Section 6705, if applicable, by submitting to Public Agency a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during trench excavation.

24. GOVERNMENT CODE SECTION 10532

Contractor shall be subject to the examination and audit of the Auditor General for a period of three years after final payment under the contract.

25. WARRANTY

The Contractor warrants to the Public Agency that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contractor Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work shall conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage.

26. CONSEQUENTIAL DAMAGES

The Contractor and Public Agency waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

- (a) Damages incurred by the Public Agency for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- (b) Damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.
- (c) This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination. Nothing contained in this subparagraph shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

27. HAZARDOUS MATERIALS

- (a) If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos, lead or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Public Agency in writing.
- (b) The Public Agency shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. The Public Agency shall furnish in writing to the Contractor the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written notification from the Public Agency and Contractor. The Contract Time shall be extended appropriately.

28. SAFETY:

- (a) **Safety Programs.** The Contractor shall be solely responsible for initiating, maintaining and supervising all safety programs required by applicable law, ordinance, regulation or governmental orders in connection with the performance of the Contract, or otherwise required by the type or nature of the Work. The Contractor's safety program shall include all actions and programs necessary for compliance with California or federally statutorily mandated workplace safety programs, including without limitation, compliance with the California Drug Free Workplace Act of 1990 (California Government Code §§8350 et seq.). Without

limiting or relieving the Contractor of its obligations hereunder, the Contractor shall require that its Subcontractors similarly initiate and maintain all appropriate or required safety programs. Prior to commencement of Work, the Contractor shall meet with the campus Buildings and Grounds Manager, Project Manager, and Construction Manager to review Contractor's safety precautions and implementation of safety programs during the Work.

- (b) **Safety Precautions.** The Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (i) employees on the Work and other persons who may be affected thereby; (ii) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and (iii) other property or items at the site of the Work, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall take adequate precautions and measures to protect existing roads, sidewalks, curbs, pavement, utilities, adjoining property and improvements thereon (including without limitation, protection from settlement or loss of lateral support) and to avoid damage thereto. Without adjustment of the Contract Price or the Contract Time, the Contractor shall repair, replace or restore any damage or destruction of the foregoing items as a result of performance or installation of the Work.
- (c) **Safety Signs, Barricades.** The Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Districts and users of adjacent sites and utilities.
- (d) **Safety Notices.** The Contractor shall give or post all notices required by applicable law and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.
- (e) **Safety Coordinator.** The Contractor shall designate a responsible member of the Contractor's organization at the Site whose duty shall be the prevention of accidents and the implementation and maintenance safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Project Inspector and the Architect.

29. SIGNATURES AND ACKNOWLEDGEMENT

Public Agency:

By: _____
Assistant Secretary, Governing Board
GENE HUFF, Acting Director of Purchasing

Note to Contractor: (1) Execute acknowledgement form below, and (2) if a corporation, affix Corporate Seal.

Contractor hereby also acknowledging awareness of and compliance with Labor Code S1861 concerning Worker's Compensation Law.

Contractor:

By: _____ (CORPORATE SEAL)
(Designate Official Capacity – **NAME**)

Print NAME and TITLE

License Number

Federal ID Number

NOTARY PUBLIC

=====

STATE OF CALIFORNIA)
) ss.
COUNTY OF CONTRA COSTA)

On _____, before me, _____, Notary Public,

personally appeared _____, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing is true and correct.

Witness my hand and official seal.

Notary Public

[SEAL]

Appendix B-1

Small Construction Project Safety Protocol

1. Any construction project meeting any of the following specifications is subject to this Small Construction Project Safety Protocol (“SCP Protocol”), including public works projects unless otherwise specified by the Health Officer:
 - a. For residential projects, any single-family, multi-family, senior, student, or other residential construction, renovation, or remodel project consisting of 10 units or less. This SCP Protocol does not apply to construction projects where a person is performing construction on their current residence either alone or solely with members of their own household.
 - b. For commercial projects, any construction, renovation, or tenant improvement project consisting of 20,000 square feet of floor area or less.
 - c. For mixed-use projects, any project that meets both of the specifications in subsection 1.a and 1.b.
 - d. All other construction projects not subject to the Large Construction Project Safety Protocol set forth in Appendix B-2.
2. The following restrictions and requirements must be in place at all construction job sites subject to this SCP Protocol:
 - a. Comply with all applicable and current laws and regulations including but not limited to OSHA and Cal-OSHA. If there is any conflict, difference, or discrepancy between or among applicable laws and regulations and/or this SCP Protocol, the stricter standard shall apply.
 - b. Designate a site-specific COVID-19 supervisor or supervisors to enforce this guidance. A designated COVID-19 supervisor must be present on the construction site at all times during construction activities. A COVID-19 supervisor may be an on-site worker who is designated to serve in this role.
 - c. The COVID-19 supervisor must review this SCP Protocol with all workers and visitors to the construction site.
 - d. Establish a daily screening protocol for arriving staff to ensure that potentially infected staff do not enter the construction site. If workers leave the jobsite and return the same day, establish a cleaning and decontamination protocol prior to entry and exit of the jobsite. Post the daily screening protocol at all entrances and exits to the jobsite. More information on screening can be found online at: <https://www.cdc.gov/coronavirus/2019-ncov/community/index.html>.
 - e. Practice social distancing by maintaining a minimum six-foot distance between workers at all times, except as strictly necessary to carry out a task associated with the construction project.



Appendix B-1

- f. Where construction work occurs within an occupied residential unit, separate work areas must be sealed off from the remainder of the unit with physical barriers such as plastic sheeting or closed doors sealed with tape to the extent feasible. If possible, workers must access the work area from an alternative entry/exit door to the entry/exit door used by residents. Available windows and exhaust fans must be used to ventilate the work area. If residents have access to the work area between workdays, the work area must be cleaned and sanitized at the beginning and at the end of workdays. Every effort must be taken to minimize contact between workers and residents, including maintaining a minimum of six feet of social distancing at all times.
- g. Where construction work occurs within common areas of an occupied residential or commercial building or a mixed-use building in use by on-site employees or residents, separate work areas must be sealed off from the rest of the common areas with physical barriers such as plastic sheeting or closed doors sealed with tape to the extent feasible. If possible, workers must access the work area from an alternative building entry/exit door to the building entry/exit door used by residents or other users of the building. Every effort must be taken to minimize contact between worker and building residents and users, including maintaining a minimum of six feet of social distancing at all times.
- h. Prohibit gatherings of any size on the jobsite, including gatherings for breaks or eating, except for meetings regarding compliance with this protocol or as strictly necessary to carry out a task associated with the construction project.
- i. Cal-OSHA requires employers to provide water, which should be provided in single-serve containers. Sharing of any of any food or beverage is strictly prohibited and if sharing is observed, the worker must be sent home for the day.
- j. Provide personal protective equipment (PPE) specifically for use in construction, including gloves, goggles, face shields, and face coverings as appropriate for the activity being performed. At no time may a contractor secure or use medical-grade PPE unless required due to the medical nature of a jobsite. Face coverings must be worn in compliance with Section 5 of the Health Officer's Order No. HO-COVID19-08, dated April 17, 2020, or any subsequently issued or amended order.
- k. Strictly control "choke points" and "high-risk areas" where workers are unable to maintain six-foot social distancing and prohibit or limit use to ensure that six-foot distance can easily be maintained between individuals.
- l. Minimize interactions and maintain social distancing with all site visitors, including delivery workers, design professional and other project consultants, government agency representatives, including building and fire inspectors, and residents at residential construction sites.



Appendix B-1

- m. Stagger trades as necessary to reduce density and allow for easy maintenance of minimum six-foot separation.
- n. Discourage workers from using others' desks, work tools, and equipment. If more than one worker uses these items, the items must be cleaned and disinfected with disinfectants that are effective against COVID-19 in between use by each new worker. Prohibit sharing of PPE.
- o. If hand washing facilities are not available at the jobsite, place portable wash stations or hand sanitizers that are effective against COVID-19 at entrances to the jobsite and in multiple locations dispersed throughout the jobsite as warranted.
- p. Clean and sanitize any hand washing facilities, portable wash stations, jobsite restroom areas, or other enclosed spaces daily with disinfectants that are effective against COVID-19. Frequently clean and disinfect all high touch areas, including entry and exit areas, high traffic areas, rest rooms, hand washing areas, high touch surfaces, tools, and equipment
- q. Maintain a daily attendance log of all workers and visitors that includes contact information, including name, phone number, address, and email.
- r. Post a notice in an area visible to all workers and visitors instructing workers and visitors to do the following:
 - i. Do not touch your face with unwashed hands or with gloves.
 - ii. Frequently wash your hands with soap and water for at least 20 seconds or use hand sanitizer with at least 60% alcohol.
 - iii. Clean and disinfect frequently touched objects and surfaces such as work stations, keyboards, telephones, handrails, machines, shared tools, elevator control buttons, and doorknobs.
 - iv. Cover your mouth and nose when coughing or sneezing, or cough or sneeze into the crook of your arm at your elbow/sleeve.
 - v. Do not enter the jobsite if you have a fever, cough, or other COVID-19 symptoms. If you feel sick, or have been exposed to anyone who is sick, stay at home.
 - vi. Constantly observe your work distances in relation to other staff. Maintain the recommended minimum six feet at all times when not wearing the necessary PPE for working in close proximity to another person.
 - vii. Do not carpool to and from the jobsite with anyone except members of your own household unit, or as necessary for workers who have no alternative means of transportation.
 - viii. Do not share phones or PPE.



SECTION 00650

NOTICE TO PROCEED

DATE: _____

TO: _____

ADDRESS: _____

PROJECT: _____

You are notified that the Contract Time under the above contract will commence to run on _____. By that date, you are to start performing your obligations under the Contract Documents. In accordance with Section 00600, Construction Agreement, the date of Substantial Completion is _____, and the date for Final Completion is _____.

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

By : _____
Ines Zildzic
Vice Chancellor, Facilities Planning and Construction

END OF SECTION 00650

SECTION 00800

SUPPLEMENTARY GENERAL CONDITIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Refer to Scope of Work in Section 00600 Construction Agreement.

1.2 REFERENCES

- A. The publications listed below form a part of this specification by reference.
1. Current California Occupational Safety and Health Act Regulations
 2. Current California Occupational Safety and Health Construction Safety Orders
 3. This work will be contracted using the District's Short Form Construction Agreement; See Section 00600.

1.3 SUBMITTALS

- A. Provide submittals in the format, and as described below:
1. **Submittals shall be submitted to the District, electronically in PDF format, within seven (7) Calendar Days from the Notice to Proceed, except as otherwise noted.**
 2. ~~Submit three (3) original (not less than 8 1/2" x 11", nor more than 30" x 42") wet signed, and one (1) color PDF file for submittals that require shop drawings, unless otherwise directed by District and accepted by the Electrical Engineer.~~
 3. Submittals that require local and State agency approval, shall conform to this Specification and the requirements of the local or State agency.
 4. **District will review and provide a response to submittals within fourteen (14) calendar days (excluding holidays).** Submittals that include design documents prepared by a licensed California Engineer will be submitted for the District's records. Any District review and response to the Contractor's design documents by a licensed California Engineer will be for format and general compliance only. Contractor and Contractor's licensed California Engineer are responsible for compliance with all applicable State of California codes, laws and regulations applicable to this project.
- B. Provide submittals for all equipment, if any, listed on the Drawings or in the Specifications.
- C. The Schedule of Values shall be submitted to the District within seven (7) calendar days after the Notice of Award. The Schedule of Values shall be broken down by the following minimum categories:
5. Demolition
 6. Concrete Topping
 7. Structural Steel Framing

8. Cold-formed Structural Metal Framing
9. Metal Fabrications
10. Architectural Wood Cabinets
11. Fiberglass-Reinforced Plastic Paneling
12. Hollow Metal Doors & Frames
13. Overhead Coiler Door
14. Door Hardware
15. Glazing
16. Framing & Gypsum Board
17. Painting
18. Signage
19. Fire Extinguishers
20. Metal Lockers
21. Audio-Visual Equipment
22. Testing and Training on Audio-Visual Equipment
23. Plumbing & Fixtures
24. HVAC Ducting & Equipment
25. HVAC Testing & Adjusting
26. Electrical raceways, fittings, and wiring
27. Panel boards, switchboards, and distribution panels
28. Circuit Breaker and Device Wiring
29. Light Fixtures
30. Wheel stops
31. Tactile Warning Surfaces
32. Owner and Maintenance Manuals and Warranties
33. As-Built Drawings
34. Any other subcontractor work not listed above

The District will only pay for Work installed at the Site.

- D.** CPM construction schedule shall be submitted within **seven (7) calendar days** from the Contract Award date. District and Contractor shall meet and review the schedule. The Notice to Proceed will not be issued until the District accepts the schedule or accepts it with conditional changes. Below are the minimum activity types that shall be included in the schedule:

1. Contractor Submittals
2. Submittal Reviews by District / Architect of Record
3. Procurement and Fabrication of Equipment and Materials

4. Construction activities corresponding to the Schedule of Values, including installation activities. Separate rough-in from finish activities.
 5. Substantial Completion Milestone
 6. Project Closeout Activities
 7. Final Completion Milestone
- E. Submittals are for review of conformance with the requirements of the Contract.

1.4 SUBSTITUTIONS.

A. *One Product Specified.* Unless the Specifications state that no substitution is permitted, whenever the Contract Documents indicate any specific material, product, thing or service, or any specific name, make, trade name, or catalog number, with or without the words “or equal,” such specification shall be deemed to be used for the purpose of facilitating description of the material, product, thing or service desired and shall be deemed to be followed by the words “or equal” unless the Contract Documents specify “no substitution allowed”, “no equal”, “no equivalent”, or other language with similar meaning, in which case no substitutions will be allowed. Pursuant to Paragraph 1.3.F.3, the Contractor may, unless otherwise stated, within three (3) work days after the bid opening, submit a substitution request for any material, product, thing or service, which shall be materially equal or better in every respect to that so indicated or specified (“Specified Item”) and will completely accomplish the purpose of the Contract Documents.

1. ***Products Specified which are Commercially Unavailable.*** If the Contractor fails to make a request for substitutions for products, within three (3) work days after bid opening, and such products subsequently become commercially unavailable, the Contractor may request a substitution for such commercially unavailable item. The decision to grant this request is solely at the District’s discretion. The written approval of the District, consistent with the procedure for Change Orders, shall be required for the use of a proposed substitute material. The District may condition its approval of the substitution upon the delivery to District of an extended warranty or guaranty or other assurances of adequate performance of the substitution as well as an equitable deduction in the contract sum should the substituted item cost less than the Specified Item. All risks of delay due the approval of a requested substitution by the District, DSA, or any other governmental agency having jurisdiction, shall be on the requesting party. All additional costs, all procurement and construction delays, and all costs for review by the Architect or its consultants shall be the responsibility of the Contractor and will be deducted from Contractor’s pay request.

B. *Substitution Request Form.* Requests for substitutions of materials, products, things or services in place of a Specified Item must be submitted to the District in writing on the District’s Substitution Request Form (“Request Form”) within three (3) work days after bid opening, except as provided for in Paragraph 1.3.F.1.

1. The Substitution Request Form must be accompanied by evidence as to whether the proposed substitution:

- (a) Is equal in quality/service/ability to the Specified Item;
 - (b) Will entail no changes in detail, construction, and scheduling of related work;
 - (c) Will be acceptable in consideration of the required design and artistic effect;
 - (d) Will provide no cost disadvantage to the District;
 - (e) Will require no excessive or more expensive maintenance, including adequacy and availability of replacement parts; and
 - (f) Will required no change of the construction schedule.
 - 2. In completing the Substitution Request Form, the bidder shall state, with respect to each requested substitution, that the bidder will agree to provide the Specified Item in the event that the District denies the bidder's request for such requested substitution. In the event the District denies the bidder's requested substitution for a Specified Item, the bidder shall provide the Specified Item without any additional cost or charge to the District and waives all rights to submit a claim.
- C. After Bid Opening.** After bids are opened, the apparent lowest bidder shall provide, within three (3) days of opening such bids, any and all Drawing, Specifications, samples, performance data, calculations, and other information, as may be required to assist the Design Consultant and the District in determining whether the proposed substitution is acceptable. The burden of establishing these facts shall be upon the bidder.
- 1. After the District's receipt of such evidence by the bidder, the District will make its final decision as to whether the bidder's request for substitution for any Specified Items will be granted. The decision as to whether a proposed request for substitution is equal to a Specified Item shall be at the sole discretion of the District. Any request for substitution that is granted by the District shall be documented and processed through a Change Order. The District may condition its approval of any substitution upon delivery to the District of an extended warranty or guaranty or other assurances of adequate performance of the substitution. Any and all risks of delay due to approval by the District, DSA or any other governmental agency having jurisdiction shall be on the bidder.
 - 2. If the Design Consultant and District accept a proposed substitution, the Contractor agrees to pay for all District expenses, including but not limited to Division of the State Architect fees, engineering and design services, compensation to the Design Consultant for their required time to process such substitution through the Division of the State Architect, if required, and to make all changes and adjustments in materials or the work of all trades directly or indirectly affected by the substituted item or items at no cost to the District

PART 2 - PRODUCTS

2.1 MATERIALS

- A.** Contractor Provided Materials: The Contractor provided materials shall include any associated equipment and appurtenances required for performing the contract properly and in accordance with the equipment manufacturer's literature.
- B.** All materials shall be new, unless otherwise authorized or specified in the scope of work of this specification.

PART 3 - EXECUTION AND RELATED REQUIREMENTS

3.1 GENERAL

- A. Work Restrictions:** Contractor shall maintain a safe path of travel for all pedestrians and vehicles during construction. Contractor is required to provide safety barricades and alternative routes of travel for pedestrians and vehicles at all times, unless otherwise approved by the District. Anytime the Contractor anticipates it will block and divert existing paths of travel for pedestrians or vehicles, it shall provide a hard copy plan along with proposed wayfinding signage for review by the District at least 3 work days prior to such blockage and diversion. Said plan shall be reviewed and approved by the District prior to commencement of this work by the Contractor.
- B.** Contractor shall provide barricades, wayfinding signage, safety signage, and COVID-19 signage around the construction site through Substantial Completion to deter access by students, faculty, and the public to areas under the control of the Contractor.
- C.** Contractor will be allowed to have access and use Campus utilities for temporary water and electricity, but Contractor shall be responsible to investigate prior to bid, and for all work necessary to connect to existing utilities for temporary use.
- D.** Contractor shall control all construction-generated dust during construction, and clean-up said dust and debris daily to prevent migration to other areas or rooms.
- E. Scheduling and Coordination:** Before commencing work on a specific area, the Contractor shall confirm that all requirements have been met pertaining to scheduling of the work. The Contractor shall further determine that all required written notices have been given to the District.
- F. Scheduling and Sequence of Work:** The work shall be prosecuted in such a manner as to cause the least interference with the normal functions of the campus activity in the adjacent areas. Prior to beginning any work, the Contractor shall meet with the District and the Contractor's schedule shall be approved as noted in Article 1.3D above.
- G. Interruption of Utilities Services:** Interruptions shall be kept to a minimum and shall be at such times and duration as approved ahead of time by the District. No interruption shall occur unless scheduled with the District and approved in advance in writing as to time and duration of such interruption. No utility interruptions that impact building operation during classes will be allowed, and these types of interruptions, if any, shall be scheduled for after normal hours when classes are not in session.
- H. Material, equipment, tools and workmen** shall be scheduled and delivered to the Site in a timely manner to avoid delay in the work. Materials provided shall be inspected by the

Contractor to make certain they follow the specifications and are free from defects and damage.

- I. Measurements: Before fabrication, obtain necessary field measurements and verify all measurements.
- J. **Bathroom Facilities: The Contractor will NOT be allowed to use College bathroom facilities and the Contractor shall provide porta-potties and cleaning stations to wash hands for construction personnel located at the Site. The location shall be approved in writing by the District before locating the porta-potties.**
- K. Workmanship: Skilled personnel shall execute in a careful, neat, and proficient manner and in compliance with accepted trade practices for all work. All work shall be executed in accordance with Cal/OSHA standards and safety orders. And all work on this contract shall comply with all Local, State, and Federal Environmental Laws.
- L. Incidental Work: Minor incidental materials and work not specifically mentioned herein, but necessary for the proper completion of the specified work, shall be provided without additional cost to the District
- M. Administrative Forms: District shall provide its standard forms for use by Contractor. (See Section 01318 – Document Management System)

3.2 EXISTING CONDITIONS & DRAWINGS

- A. See Section 00210, Information Available to Bidders for documents available for review by the Contractor and its subcontractors prior to and after bid.

3.3 WORK BY CALIFORNIA LICENSED ENGINEER

- A. Note that modifications to existing building structures, fire systems, or ADA changes, if any are discovered during construction, will require DSA approval. Contractor will be granted a non-compensable time extension for the duration it takes to obtain DSA approval. A change order will be negotiated for added direct labor field construction costs, if any.

3.4 NOISE CONTROL

- A. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to building occupants.
 - 1. Notify District's Representative not less than two days in advance of proposed disruptive operations.
 - 2. Obtain District's Representative's written permission before proceeding with disruptive operations.

3.5 SITE WORK-Not Used

3.6 PROJECT CLOSEOUT REQUIREMENTS (After Substantial Completion & Before Final Completion)

- A. Refer to the Drawings listed in Section 00010, Table of Contents for requirements, and these Supplementary General Conditions.
- B. Provide final clean-up of Site prior to Final Completion.
- C. Warranty
 - 1. The Contractor warrants to the District that material and equipment furnished under the Contract will be of the highest quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor's warranty and guaranty to District includes, but is not limited to the following representations:
 - a. In addition to any other warranties and guaranties provided elsewhere, Contractor shall, and hereby does, warrant all Work after the Certificate of Substantial Completion date issued by District and shall repair or replace any or all such work, together with any other work, which may be displaced in so doing that may prove defective in workmanship or materials within a one (1) year period from date of completion as defined in Public Contract Code Section 7107(c) without expense whatsoever to District, ordinary wear and tear, unusual abuse or neglect excepted. District will give notice of observed defects with reasonable promptness. Contractor shall notify District upon completion of repairs.
 - b. In the event of failure of Contractor to comply with above mentioned conditions within one week after being notified in writing, District is hereby authorized to proceed to have defects repaired and made good at expense of Contractor who hereby agrees to pay costs and charges therefore immediately on demand.
 - c. If, in the opinion of the District, defective Work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the District, the District will attempt to give the notice required by this Article. If the Contractor cannot be contacted or does not comply with the District's requirements for correction within a reasonable time as determined by the District, the District may, notwithstanding the provisions of this article, proceed to make such correction or attention which shall be charged against Contractor. Such action by the District will not relieve the Contractor of the guarantee provided in this Article or elsewhere in this Contract.
 - d. This Article does not in any way limit the guarantee on any items for which a longer warranty or guaranty is specified or on any items for which a manufacturer gives a guarantee for a longer period. Contractor shall furnish District all appropriate guaranty or warranty certificates upon completion of the project.
 - 2. Format - All Warranties/Guaranties and shall include:
 - a. Contractor, subcontractor, and equipment supplier shall provide Warranties and Guaranties on their original company letterhead with original signature.

- b. Contractor shall provide original Warranties and Guaranties. Photocopies, fax and e-mail copies are not acceptable.
- 3. Preparation
 - a. Contractor shall obtain warranties and guaranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within fifteen (15) days after Certificate of Substantial Completion date of the applicable Work. Except for items put into use with District's permission, Contractor shall leave date of beginning of time of warranty or guaranty blank until the date of completion is determined by District.
 - b. Contractor's Response to Construction Warranty and Guaranty Service Requirements: Following oral or written notification by the District, respond to construction warranty and guaranty service requirements within 24 hours, or earlier in case of emergency.
- 4. Warranty and/or Guaranty Tags
 - a. At the time of installation of mechanical equipment or other major system elements, tag each warranted or guaranteed item with a durable, oil and water-resistant tag approved by the District. Attached each tag with a copper wire and spray with a silicone waterproof coating. The date of Substantial Completion and the Contractor Authorized signature must remain blank until the date the District makes a determination of Substantial Completion. Show the following information on the tag:

WARRANTY/GUARANTY INFORMATION – [insert project number and name on actual tag]

- a. Type of product/material_____.
- b. Model number_____.
- c. Serial number_____.
- d. Contract number_____.
- e. Warranty/Guaranty period _____ (months) from_____ to_____.
- f. Inspector's signature_____.
- g. Construction Contractor_____.
- Address_____.
- Telephone number_____.
- h. Warranty or Guaranty contact_____.
- Address_____.
- Telephone number_____.
- i. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

3.7 Project As-Built

- A. Contractor shall dedicate one complete full-size set of the Contract Drawings and one complete Project Manual for use in documenting as-built conditions, including but not limited to; RFIs, ASI, PCOs and Change Order.
- B. Contractor shall submit to District in hard copy one original and two copies of all Project As-Built Documents. In addition, one electronic copy shall be submitted to District. District reserves the right to require resubmittal in accordance with these Supplementary General

Conditions if the documents are inaccurate or incomplete, or otherwise fail to meet the requirements of these Contract Documents.

- C. **Electronic Media Format:** Electronic media format for all Project As-Built Documents shall be Adobe PDF, with chapter markers and/or bookmarks inserted in place of the equivalent hard copy section tabs. Electronic copy shall include all tables, charts, drawings, codes and all other matters reflected in hard copies. Electronic media files shall be delivered on a unique CD-ROM or flash drive.

3.8 TIME OF COMPLETION

- A. See Section 00300, Bid Proposal Form for specific requirements to complete the Work. Time requirements are also included in Section 00600, Construction Agreement.
- B. **Substantial Completion:** The date on which the Work or designated portion thereof, as certified by the District and Architect, is sufficiently complete, in accordance with the Contract Documents, so the District may occupy or utilize the Work or designated portion thereof for the use for which it is intended.
- C. **Remaining Work after Substantial Completion:** If the Architect or District determines that the work required by the Contract is Substantially Complete during any inspection conducted pursuant to this Agreement, the Contractor shall be notified of that determination and the District shall determine if there is Remaining Work. A list of Remaining Work shall be issued only by the District or the Architect and only after the District has certified Substantial Completion. The District or Architect shall give the Contractor the necessary instructions for correction or completion of the Remaining Work, and the Contractor shall immediately comply with and execute such instructions within the Contract Time. Upon completion of the Remaining Work, another inspection shall be made that shall constitute the Final Inspection, provided the Remaining Work has been completed to the satisfaction of the District. If the remaining work has been completed to the satisfaction of the District, the District shall make the final acceptance and notify the Contractor in writing of this acceptance as of the date of Final Inspection.
- D. **Final Completion:** The date when all Work for the total project has been completed in accordance with the terms of the Contract Documents and has been inspected following completion of Work identified in the Punch List Inspection and accepted by the Architect and the District. Final Completion is also sometimes referred to as Final Acceptance.

3.9 ADDITIONAL REQUIREMENTS FOR DSA-APPROVED PROJECTS

- A. All substitutions affecting DSA regulated items shall be considered as a Construction Change Document or Addenda and shall be approved by DSA prior to fabrication and installation, as required by IR A-6 and Section 4-338(c), Part 1. Substitutions shall be for any material, system or product that would otherwise be regulated by DSA.
- B. All Addenda must be signed by **Architect/Engineer of Record** and approved by DSA (Section 4-338, Part 1).
- C. The Construction Change Documents (Section 4-338(c), Part 1) must be signed by all the following:
 1. A/E of Record

2. Structural Engineer (when applicable)
3. Delegated Professional Engineer (when applicable)
4. DSA



CONTRA COSTA COMMUNITY COLLEGE DISTRICT

500 Court Street, Martinez, CA 94553

SUBSTITUTION REQUEST FORM

Contractor Name: _____
Contract #: _____

RFS # _____ Date: _____

DSA Application #: _____

Campus: Contra Costa College

Project No., Name: _____

Contractor pursuant to General Conditions submits the proposed items. If the District accepts such items so described, the undersigned may furnish such item with all necessary labor, materials, equipment and incidentals to perform and complete the Work.

Item No.	SPECIFIED ITEM OR DRAWING	SPECIFICATION SECTION	PROPOSED SUBSTITUTION (and name of Subcontractor if different)

CERTIFICATION

Under penalty of perjury under the Laws of California, I certify that the proposed substitution will be readily available, perform adequately the functions and achieve the results called for by the design concept, be similar in substance to that specified, and be suited to the same use as that specified in Contract Documents.

Contractor: _____

(Please print name of company) Name and Title (print/type) Contractor Authorized Representative Date

A. Does the substitution affect dimensions shown on Drawings?
B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?
C. What effect does the substitution have on other trades?
D. Will substitution cause change to Project Schedule, or to critical delivery dates? Add ? Shorten ?
E. Differences between proposed substitution and specified item?
F. What is the Cost Differential including all mark-ups?
G. Are Manufacturer's guarantees for the proposed item the same as for item specified? Explain differences.
H. The undersigned accepts full responsibility for delays caused by redesign of other items of the Work necessitated by substitution.
I. The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

<p>A/E Response:</p> <p><input type="radio"/> Accepted</p> <p><input type="radio"/> Not Accepted</p> <p><input type="radio"/> Accepted As Noted</p> <p><input type="radio"/> Received Too Late</p> <p>BY: _____ Date: _____</p>	<p>District Representative Response:</p> <p><input type="radio"/> Accepted</p> <p><input type="radio"/> Not Accepted</p> <p><input type="radio"/> Accepted As Noted</p> <p><input type="radio"/> Received Too Late</p> <p>By: _____ Date: _____</p>
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END OF SECTION 00800

SECTION 01318

DOCUMENT MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- 1.1.1 This Section is in addition to the requirements in the Contract General Conditions and General Specifications.
- 1.1.2 The District is utilizing the **Bentley Systems, Incorporated (Bentley)** web-based system to aid in the document control, management and communications between the District, Architect, and Contractor. Therefore, the District and Contractor shall utilize **Bentley's** system for electronic submittal of all data and documents (unless otherwise specified or allowed by the District) throughout the duration of the Contract. **Bentley** is a web-based electronic media site that is hosted by **Bentley** utilizing their **Bentley** web solution. **Bentley** will be made available to the Contractor's project personnel, subcontractor personnel, suppliers, consultants and the Architect and their sub-consultants. The joint use of this system is to facilitate: electronic exchange of information, automation of key processes, and overall management of the Contract. **Bentley** shall be the primary means of project information submission and management. When required by the District elsewhere in these Specifications, paper documents will also be provided. In the event of discrepancy between the electronic version and paper documents, the paper documents will govern. **Bentley** is a registered trademark of **Bentley Systems, Incorporated**.
- 1.1.3 Preconstruction Meeting/Contractor Information: At the Preconstruction Meeting, the Contractor shall provide to the District the email addresses of all Contractor personnel that will be using the **Bentley** web based system. At a minimum, this will include the Contractor's Project Manager, General Site Superintendent and Project Engineer. These personnel shall have sufficient computer skills required to access, and process documents over the Internet.

1.2 USER ACCESS LIMITATIONS

The District will control the Contractor's access to **Bentley** by allowing access and assigning user profiles to accepted Contractor personnel. User profiles will define levels of access into the system; determine assigned function-based authorizations (determines what can be seen) and user privileges (determines what they can do). Sub-contractors and suppliers will be given access to **Bentley** through the Contractor. Entry of information exchanged and transferred between the Contractor and its sub-contractors and suppliers on **Bentley** shall be the responsibility of the Contractor.

1.3 AUTOMATED SYSTEM NOTIFICATION AND AUDIT LOG TRACKING

Review comments made (or lack thereof) by the District on Contractor submitted documentation shall not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. District acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the Contractor's submitted information.

1.4 SUBMITTALS

See Section 01330, Submittals for general submittal requirements.

1.5 COMPUTER REQUIREMENTS

The Contractor shall use computer hardware and software that meets the requirements of the **Bentley** system as recommended by **Bentley** to access and utilize **Bentley**. As recommendations are modified by **Bentley**, the Contractor will upgrade their system(s) to meet the recommendations or better. Upgrading of the Contractor's computer systems will not be justification for a cost or time modification to the Contract. The Contractor will ensure that connectivity to the **Bentley** system (whether at the home office or job site) is accomplished through DSL, cable, T-1 or wireless communications systems. The minimum bandwidth requirements for using the system are 128kb/s. It is recommended the Contractor use a faster connection when uploading pictures and files into the system. **Bentley** currently supports Mozilla's Firefox v3.0-3.6, Apple's Safari V3.0-5.0, and Microsoft's Internet Explorer v7.0-8.0 web browsers for accessing the application.

1.6 CONTRACTOR RESPONSIBILITY

The Contractor shall be responsible for the validity of their information placed in **Bentley** and for the abilities of their personnel. Accepted users shall be knowledgeable in the use of computers, including Internet Browsers, email programs, cad drawing applications, and Adobe Portable Document Format (PDF) document distribution program. The Contractor shall utilize the existing forms in **Bentley** to the maximum extent possible. If a form does not exist in **Bentley**, the Contractor must include a form of their own, or use the forms provided **or required** by the District. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The Contractor is responsible for the training of their personnel in the use of **Bentley** (outside what is provided by the District), and the other programs indicated above as needed.

- 1.6.1 User Access Administration: Provide a list of Contractor's key **Bentley** personnel for the District's acceptance. Contractor is responsible for adding and removing users from the system as it pertains to their personnel or the personnel of their subcontractors and/or suppliers. The District reserves the right to perform a security check on all potential users. The Contractor will be allowed to add additional personnel and subcontractors to **Bentley**.
- 16.2 **Bentley** RFI Sketch Attachments: Faxed copies or hand delivered RFI attachments (sketches, product information, etc.) will NOT be accepted. The Contractor shall scan and convert all RFIs sketches and other documents into PDF files. To perform this task, the Contractor shall procure and use Adobe Acrobat 9.0 and Adobe Pro X.

1.7 CONNECTIVITY PROBLEMS

Bentley is a web-based environment; therefore, subject to the inherent speed and connectivity problems of the Internet. The Contractor is responsible for its own connectivity to the Internet. **Bentley** response time is dependent on the Contractor's equipment, including processor speed, Internet access speed, etc., and current traffic on the Internet. The District is not liable for any delays associated from the usage of **Bentley** including, but not limited to: slow response time, down time periods, connectivity problems, or loss of information. The Contractor will ensure that connectivity to the **Bentley** system (whether at the home office or job site) is accomplished through DSL, cable, T-1 or wireless communications systems. The Contractor's minimum bandwidth requirements for using the system are 128kb/s. It is recommended a faster connection be used when uploading pictures and files into the system. Under no circumstances shall the usage of the **Bentley** be grounds for a time extension or cost adjustment to the Contract.

1.8 EADOC TRAINING AND SUPPORT

- 1.8.1 **Bentley** Training: The District has arranged for the following training that will be provided to the Contractor at no additional cost to the Contractor: Project Team Training, which includes one, 3-hour session on line. All other **Bentley** training or services desired by the Contractor, or its subcontractors, shall be at the expense of

the Contractor. All District provided **Bentley** training for the Contractor will occur between the Notice of Award and the Notice to Proceed.

- 1.8.2 **Bentley** Support: **Bentley** will provide limited web support to the Contractor between the hours of 6:00 am and 6:00 pm, Pacific Standard Time. If requested by the Contractor, **Bentley** phone support or special support by **Bentley** shall be at the Contractor's expense.

PART 2 PRODUCTS

2.1 Description

Bentley project management application (no equal) provided by **Bentley**, www.EADOCsoftware.com

PART 3 EXECUTION

3.1 BENTLEY UTILIZATION

Bentley will be used for, but not limited to, all of the following documents. At the direction of the District, the Contractor may be required to post other documents that are not listed below over the course of the Project.

1. Submittals/Shop Drawings/Samples (by Contractor; response by District)
2. Submittal substitution requests (by Contractor; response by District)
3. Requests for Information (by Contractor; response by District)
4. Non-Compliance Reports (by District; response by Contractor)
5. Schedules (by Contractor; response by District)
6. Project Photographs (by Contractor)
7. Posting Weekly Project Meeting Minutes (by District)
8. Change Order Request (by Contractor; response by District)
9. Field Instructions (by District; response by Contractor)
10. Payment Requests (by Contractor; response by District)
11. Daily Reports (by Contractor)
12. Inspection and Special Inspection & Testing Requests (by Contractor)
13. Punch lists (By Contractor)
14. Architectural Supplemental Instructions (by District)
15. Memos (General and notices to District or Contractor)
16. Conformed Drawings and Specifications (Contract Documents may be posted by the District)

3.2. Additional Information Regarding Submittals, Shop Drawings, Samples, Etc.

All submittals, shop drawings, samples, etc. shall be submitted as PDF attachments to the **Bentley** submittal work flow process and form. See Section 01330 for specific submittal requirements, including paper submittals and copies.

- 3.2.1 Shop Drawings: Contractor shop drawing and design data documents shall be submitted as PDF attachments (in addition to the hard copies requested) to the **Bentley** submittal work flow process and form. Examples of shop drawings include, but are not limited to:
- Standard manufacturer installation drawings.
 - Drawings prepared to illustrate portions of the work designed or developed by the Contractor.
 - Steel fabrication, piece, and erection drawings.
- 3.2.2 Product Data: Product catalog data and manufacturer's instructions shall be submitted as PDF attachments (in addition to the hard copies requested) to the **Bentley** submittal work flow process and form. Examples of product data include, but are not limited to:
- Manufacturer's printed literature.
 - Preprinted product specification data and installation instructions.
- 3.2.3 Samples: Sample submittals shall be physically submitted as specified in Section 01330. Contractor shall enter submittal data information into **Bentley** with a copy of the submittal form(s) attached to the sample. Examples of samples include, but are not limited to:
- Product finishes and color selection samples.
 - Product finishes and color verification samples.
 - Finish/color boards.
 - Physical samples of materials.
- 3.2.4 Administrative Submittals: All correspondence and pre-construction submittals shall be submitted using **Bentley**. Examples of administrative submittals include, but are not limited to:
- Digging permits and notices for excavation.
 - SWPPP reports.
 - List of product substitutions
 - List of contact personnel.
 - Notices for roadway interruption, work outside regular hours, and utility cutovers.
 - Schedules and associated reports and updates. Each schedule submittal specified in Specification Section 01320 shall be submitted as a native backed-up file (.PRX or .STX) of the scheduling program being used. The schedule will also be posted as a PDF file in the format specified in Specification Section 01320.
 - Plans for safety, demolition, environmental protection, and similar activities.
 - Quality Control Plan(s), Testing Plan and Log, Quality Control Reports, Production Reports, Quality Control Specialist Reports, Preparatory Phase Checklist, Initial Phase Checklist, Field Test reports, Summary reports, Rework Items List, etc.
 - Meeting minutes for quality control meetings, progress meetings, pre-installation meetings, etc.
 - Any general correspondence submitted.
- 3.2.5 Compliance Submittals: Test reports, certificates, and manufacturer field report submittals shall be submitted on **Bentley** as PDF attachments. Examples of compliance submittals include, but are not limited to:
- Field test reports.
 - Quality Control certifications.
 - Manufacturer's documentation and certifications for quality of products and materials provided.
- 3.2.6 Record and Closeout Submittals
- Operation and maintenance data and closeout submittals shall be submitted on **Bentley** as PDF documents during the approval and review stage as specified, with actual set of documents submitted for final. Examples of record submittals include, but are not limited to:
- Operation and Maintenance Manuals: Final documents shall be submitted as specified.

- b. As-Built Drawings: Final documents shall be submitted as PDF and hard copy.
 - c. Extra Materials, Spare Stock, etc.: Submittal forms shall indicate when actual materials are submitted.
- 3.2.7 Financial Submittals: Schedule of Values, Progress Payment Requests and Change Order Requests shall be submitted on **Bentley**. Supporting material for Pay Requests and Change Order Requests shall be submitted on **Bentley** as PDF attachments. Examples of compliance submittals include, but are not limited to:
- a. Contractor's Schedule of Values
 - b. Contractors Monthly Progress Payment Requests
 - c. Contractor Change Order Requests requested by the District.

3.3.0 District Prepared Logs

- 3.3.1 The District will prepare the following logs that will be distributed at the weekly progress meetings: Open Request for Information Log; Open Submittal and Re-Submittal Log; Open Field Instruction Log; Open Notice of Non-Compliance Log. No other versions of these logs will be distributed, or used during the weekly meetings, or posted with the meeting minutes. However, the Contractor can provide comments as described in Section 01312, Project Meetings.

END OF SECTION 01318

L-1177 INDUSTRIAL TRADES LABS RENOVATION

Los Medanos College
Contra Costa Community College District

PROJECT MANUAL
Construction Documents

IBI Group - Project No. 121030



IBI GROUP

333 West San Carlos Street, 3rd Floor
San Jose, CA 95110
Tel (408) 924-0811

PROJECT MANUAL
L-1177 INDUSTRIAL TRADES LABS
RENOVATION

LOS MEDANOS COLLEGE
CONTRA COSTA COMMUNITY COLLEGE DISTRICT
IBI Group Project No. 121030

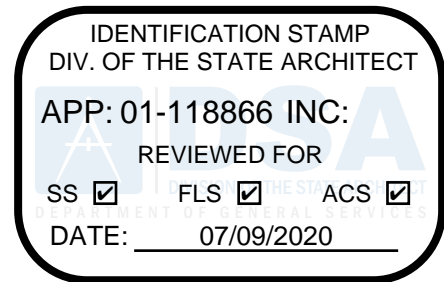
Owner: Contra Costa Community College District
500 Court Street
Martinez, CA 94553

Deferred Approvals:

None

ARCHITECT

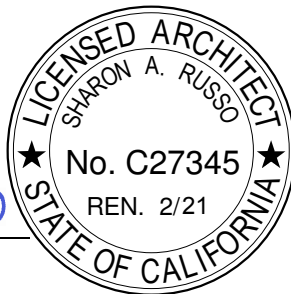
IBI Group
333 West San Carlos Street, 6th Floor
San Jose, CA 95110



By:

Sharon A. Russo

Sharon A. Russo (C27345)



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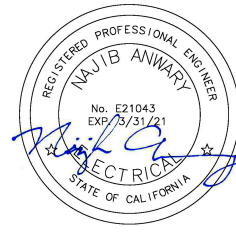


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TABLE OF CONTENTS TO PROJECT MANUAL

TITLE/SIGNATURE PAGE

TABLE OF CONTENTS

BIDDING REQUIREMENTS

CONTRACTING REQUIREMENTS

SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

DIVISION 2 – EXISTING CONDITIONS

02 41 19 Selective Demolition

DIVISION 3 - CONCRETE

03 53 00 Concrete Topping

DIVISION 4 – Not Used

DIVISION 5 - METALS

05 12 00 Structural Steel Framing
05 40 00 Cold-Formed Structural Metal Framing
05 50 00 Metal Fabrications

DIVISION 6 – WOODS, PLASTICS, AND COMPOSITES

06 41 00 Architectural Wood Cabinets
06 83 16 Fiberglass-Reinforced Plastic Paneling

DIVISION 7 – Not Used

DIVISION 8 - OPENINGS

08 11 13	Hollow-Metal Doors and Frames
08 33 23	Overhead Coiling Service Door
08 71 00	Door Hardware
08 81 00	Glass Glazing
08 88 13	Fire-Rated Glazing

DIVISION 9 - FINISHES

09 29 00	Gypsum Board
09 91 00	Painting

DIVISION 10 - SPECIALTIES

10 14 00	Signage
10 44 16	Fire Extinguishers
10 51 13	Metal Lockers

DIVISION 11 - EQUIPMENT

11 52 13	Projection Screen
11 52 23	Audio-Visual Equipment Support

DIVISIONS 12 thru 21 – Not Used

DIVISION 22 – PLUMBING

22 00 50	Basic Plumbing Materials and Methods
22 10 00	Plumbing Piping Systems
22 40 00	Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 00 50	Basic HVAC Materials and Methods
23 05 93	Testing, Adjusting and Balancing for HVAC
23 80 00	Heating, Ventilating and Air Conditioning

DIVISIONS 24 & 25 – Not used

DIVISION 26 – ELECTRICAL

26 05 00	General Electrical Requirements
26 05 19	Line Voltage Wire and Cable
26 05 26	Grounding
26 05 33	Outlet, Junction, and Pull Boxes
26 05 42	Conduits, Raceways, and Fittings
26 22 00	Transformers
26 24 13	Switchboards, 600 Volts and Below
26 24 16	Panelboards and Distribution Panels
26 27 26	Devices Wiring
26 28 16	Circuit Breakers
26 51 00	Lighting

DIVISION 27 – COMMUNICATIONS

27 00 00	Telecommunications Cabling System
----------	-----------------------------------

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 31 00	Fire Alarm System
----------	-------------------

DIVISIONS 29 thru 31 – Not Used

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 17 13	Wheelstops
32 17 26	Tactile Warning Surfaces

DIVISIONS 33 thru 49 – Not Used

End of Table of Contents

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Demolition and removal of selected portions of existing buildings or structures.
 - 2. Salvaging existing items for reinstallation or delivery to Owner.
- B. Related Sections include:
 - 1. Division 1 Section for temporary construction, protection facilities, and environmental-protection measures for selective demolition operations.
 - 2. Division 1 Section for cutting and patching procedures.
 - 3. Division 1 Section for construction waste management and administrative and procedural requirements for salvaging and recycling of demolition waste.
 - 4. Division 1 Section for photographic documentation of existing buildings and sitework prior to selective demolition.
 - 5. Division 22 Sections for demolishing or relocating plumbing items.
 - 6. Division 23 Sections for demolishing or relocating mechanical items.
 - 7. Division 26 Sections for demolishing or relocating electrical items.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)/American Society of Safety Engineers (ASSE):
 - 1. ANSI/ASSE A10.6: Safety Requirements for Demolition Operations.
- B. Cal/OSHA Standards - California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety.
- C. Code of Federal Regulations (CFR):
 - 1. 40 CFR, Part 82: Protection of Stratospheric Ozone.
- D. EPA: United States Environmental Protection Agency.

- E. National Fire Protection Association (NFPA):
 - 1. NFPA 51B: Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.
 - 2. NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations.
- F. Resilient Floor Covering Institute (RFCI):
 - 1. Recommended Work Practices for Removal of Resilient Floor Coverings.

1.4 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are to be undisturbed and left in place.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.5 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.6 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

1.7 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review and finalize protection requirements for areas of existing construction to remain.
 - 6. Review procedures for noise control and dust control.

7. Review procedures for protection of adjacent buildings.
8. Review items to be salvaged and returned to Owner.

1.8 INFORMATIONAL SUBMITTALS

- A. Engineering Survey: Submit engineering survey of condition of building.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Coordinate to avoid interruptions to Owner's on-site operations.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Shutoff and capping, and continuation of utility services.
 4. Locations of temporary protection of means of egress, including for other tenants affected by selective demolition operations, if applicable.
 5. Coordination of Owner's continuing occupancy of portions of existing buildings and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations.. Submit prior to beginning Work.
- E. Record drawings of removed, relocated, or abandoned utilities in accordance Division 1 Section for project closeout requirements.
 1. Locate and dimension work with reference to permanent landmarks. Indicate materials and sizes of all components.
- F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.9 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.10 FIELD CONDITIONS

- A. Owner will occupy portions of the building immediately adjacent to selective demolition areas. Conduct selective demolition so Owner's operations will not be disrupted.
 1. Provide not less than 10 working days notice to Owner of activities that will affect Owner's operations.

2. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.
- B. Owner assumes no responsibility for buildings and structures to be demolished.
 1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as practical. Minor variations may occur as a result of Owner's salvaging operations prior to start of selective demolition work.
 - a. Before start of demolition, Owner will remove the following items:
 - i) ***[insert items to be removed by Owner]***
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous materials will be removed by Owner before start of Work.
- E. On-site storage or sale of removed items or materials is not permitted.
- F. Utility Service: Maintain existing utilities serving building and protect them against damage during selective demolition operations, unless indicated otherwise.
 1. Do not interrupt fire-protection service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are the same as those indicated in Project Record Documents.
- C. Determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations. If required, engage a professional engineer to perform an engineering survey of condition of building.
 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record by use of preconstruction photographs or video, existing conditions that might be misconstrued as damage caused by demolition operations.
 - 1. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Utilities to be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Protect site improvements and landscaping to remain.
 6. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate fumes and noise from selective demolition areas from occupied adjacent portions of building. Comply with Division 1 requirements for temporary facilities.
- B. Temporary Shoring: Design, provide and maintain shoring, bracing, or structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Do not damage portions of existing construction indicated to remain. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. If using cutting torches, comply with applicable requirements of Cal/OSHA Standards (California Code of Regulations, Title 8), Chapter 4 - Division of Industrial Safety, Subchapter 7 – General Industry Safety Orders, Article 88 Fire Prevention in Welding and Cutting Operations, and NFPA 51B.
 - a. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - b. Maintain fire watch during and for at least 1 hour after flame-cutting operations.
 - c. Maintain adequate ventilation when using cutting torch
 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 6. Equipment: Disconnect equipment indicated to be removed at nearest fitting connection to services, complete with service valves. Remove as whole units, complete with controls.
 7. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - a. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Concrete and Asphalt Paving: Cleanly saw-cut in straight lines, perimeter of area to be removed, then break up and remove portion indicated.
 - a. At utility trenches occurring in existing paved areas to remain, remove portion occurring over width of trench.
 - b. At concrete paving, use existing joints to define area of removal, unless indicated otherwise.
 10. Dispose of demolished items and materials promptly. Comply with applicable waste management regulations for recycling of demolition waste.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of container.
 3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."
- E. Structural Steel: Dismantle field connections without bending or damaging steel members.
- F. Roofing: Remove not more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 7 Section for new roofing requirements.
 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 2. Remove existing roof system down to substrate.

3.7 REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- C. Restore landscaping plants to condition matching existing appearance prior to start of selective demolition work.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove from Project site, and legally dispose of, all demolished materials. Comply with all applicable regulations for salvaging and recycling of demolition waste materials. Materials to be disposed of in landfill, are to be disposed of in EPA-approved landfill acceptable to authorities having jurisdiction. Comply with applicable construction waste management regulations for salvaging and recycling demolition waste materials.
 1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 53 00
CONCRETE TOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Concrete topping.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 1-in. or 50-mm Cube Specimens).
 - 2. ASTM C150: Standard Specification for Portland Cement.
 - 3. ASTM C219: Standard Terminology Relating to Hydraulic Cement.
- B. California Department of Public Health (CDPH):
 - 1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010.
- C. European Standards (EN):
 - 1. EN 15804: Sustainability of Construction Works – Environmental Product Declarations – Core Rules for the Product Category of Construction Products.
- D. International Organization for Standardization (ISO):
 - 1. ISO 14021: Environmental Labels and Declarations – Self-Declared Environmental Claims (Type II Environmental Labeling).
 - 2. ISO 14025: Environmental Labels and Declarations – Type III Environmental Declarations – Principals and Procedures.
 - 3. ISO 14040: Environmental Management – Life Cycle Assessment – Principals and Framework.
 - 4. ISO 14044: Environmental Management – Life Cycle Assessment – Requirements and Guidelines.
 - 5. ISO 21930: Sustainability in Building Construction – Environmental Declaration of Building Products.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to review pertinent issues related to concrete topping.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans indicating substrates, locations, and average depths of concrete topping based on survey of substrate conditions.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of concrete topping products required for this Project.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature and humidity, ventilation, and other conditions affecting concrete topping performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain hydraulic cement underlayment and all accessory materials, including finishing underlayment, from a single manufacturer.

2.2 CONCRETE TOPPING

- A. Concrete Topping: Self-leveling, concrete topping product that can applied in minimum uniform thickness of 1/2 inch.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ardex Americas; TRM.
 - b. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Cement Binder: ASTM C150, Portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
 - 3. Compressive Strength: Not less than 10,000 psi at 28 days when tested according to ASTM C109.

- B. Aggregate: Coarse sand as recommended in writing by hydraulic cement underlayment manufacturer.
 - 1. Provide well-graded, washed gravel aggregate when recommended in writing by hydraulic cement underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Primer: Product of concrete topping manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat in-plane nonmoving substrate cracks less than 1/4 inch wide according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
 - 3. Cracks with vertical separation (out-of-plane), or cracks wider than 1/4 inch should not be repaired with underlayment systems.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture and Alkalinity Testing: Perform tests recommended by resilient flooring manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform concrete moisture testing, using the relative humidity in-situ probe test method, in accordance with ASTM F 2170.
 - i) Proceed with installation only after substrates show a moisture level of 75 percent relative humidity or less, or as recommended in writing by manufacturer of resilient flooring to be installed.
 - b. Perform alkalinity testing in accordance with ASTM F 710.
 - i) Proceed with installation only after substrates show a pH level of not less than 7 and not greater than 9, or as recommended in writing by manufacturer of resilient flooring to be installed.

- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with topping according to manufacturer's written instructions.

3.3 APPLICATION

- A. General: Mix and apply hydraulic concrete topping components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 - 2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply hydraulic concrete topping to produce uniform level surface.
- D. Cure concrete topping according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over concrete topping until after time period recommended in writing by topping manufacturer.
- F. Remove and replace concrete topping areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

- A. Protect concrete topping from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 53 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide structural framing members, complete with required bracing, weld washers, nuts, shims, anchor bolts, and baseplates.
- B. Related Requirements: The General Provisions of the Contract Documents.

1.2 CODES AND STANDARDS

- A. Refer to the following for information regarding materials and installation methods necessary:
 - 1. American Society for Testing and Materials - Specifications A36, A53-B, A153, A570, A307, A370 and A500, A501 (also listed on Structural Drawings) A446, A611, A572 and A992.
 - 2. American Institute of Steel Construction, Steel Construction Manual, 14th Edition.
 - 3. American Welding Society - AWS D1.1 – 2015 and AWS D1.8 Seismic Supplement, latest edition.
 - 4. Steel Structures Painting Council.
 - 5. Title 24, Part 2, C.C.R., 2019 C.B.C.

1.3 SUBMITTALS

- A. Shop drawings and product data shall be submitted in compliance with the pertinent provisions of the General Conditions.
- B. Submit shop and erection drawings prior to fabrication. Show welded connections, lengths of welds, profiles, sizes, spacing and locations of all members, attachments, anchorages, framed openings size and type of fasteners, cambers and land loads. Contractor is responsible for dimensions on shop drawings.
 - 1. Splices and deviations: Splices will be permitted only where and as shown on drawings. Deviations from design drawings are to be handled by Construction Change Document (CCD) and require approval of the structural engineer.
- C. Erection and bracing plan and procedure: Refer to Section 1710A, Title 8, CCR. Employ a state licensed civil engineer to prepare erection and bracing plan and erection procedure for structural steel including columns, beams, and girders, who

will be responsible for compliance. Follow plan and procedure exactly. Keep a copy at project site.

1.4 TESTS AND INSPECTIONS

- A. If structural steel can be identified by heat or melt numbers and is accompanied by mill analysis and test reports per Section 2203A.1, testing shall be in accordance with Section 2213A, Title 24. Identified stock shall be tested also.
- B. If structural steel cannot be identified or its source is questionable, all steel must be tested for tension and bending for each shape and size.
- C. Furnish test specimens from steel fabricator and take them under the direction of the Testing Agency. Machine each test specimen by Testing Agency to dimensions required by ASTM A370.
- D. Have Testing Agency pick up test specimens and make required tests.
- E. Costs of tests of identified stock will be paid for by Owner, unless tests fail to comply with the specifications, in which case Owner will back-charge the contractor.
- G. After fabrication and inspection, costs associated with re-inspection of defective or replaced materials will not be the responsibility of the Owner.
- H. Provide all labor, equipment and facilities necessary for moving and handling materials to be inspected.
- I. Cost for supervision by a registered inspector of all welding operations, including inspection for quality, penetration, and conformity of drawings, and a report verifying that welding is adequate and was done in conformity of all project requirements will be paid for by Owner. Sections 1701.5 and 1705.2.2, Title 24, CBC.
 - 1. Visually inspect all welds and inspect grouting of column base plates.
- J. Comply with Sections 2213.1 and 2213.2, Title 24.
- K. Shop fabrication inspections per Section 1704A.2.5.

1.5 PROJECT CONDITIONS

- A. Verify measurements, lines, grades, locations and details at project site. Conform to existing actual field conditions.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

- A. Structural Steel Members: Type for general construction, weldable steel, conforming to requirements of ASTM A36, A36/A572, or A992 as per plans, and as required, shop primed or galvanized where left exposed to elements of weather. Title 24, 2203.2 and 2205.
- B. Structural Pipe: Provide ASTM A53, (Type E or S) or A501.
- C. Tube Steel: Provide ASTM A500 Grade C Type or ASTM A1085
- D. Cast Steel: Provide in accordance with A27.
- E. Machine Bolts: ASTM A307
- F. High strength bolts: ASTM A325 or ASTM A490.
- G. Comply with Title 24, Section 2205A.
- H. Anchor Rods: As specified on drawings.

2.2 LIGHT STRUCTURAL STEEL

- A. Standard Specifications for Flat-Rolled Carbon Steel Sheets of Structural Quality, ASTM A570 or A611, A446
- B. Standard Specifications for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing, ASTM A36 and A501, or Cold Formed Tubing, ASTM A500, Grade C or ASTM A1085

2.3 WELDING ELECTRODES

- A. Conform to AWS D1.1-10 & Section 2204A.1, Title 24, Classification E70 series as required for rigid frames the electrodes shall meet Charpy V-notch 20 ft.-lbs. at minus 20 degrees F.

2.4 GALVANIZING

- A. Provide hot-dip galvanizing in accordance with ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. Cold galvanizing: See Section 09 97 13 Steel Coatings.

2.5 PRIMER

- A. Provide Themec 10-99, zinc chromate, or other approved.
- B. Clean, prepare and shop prime members in accordance with SSPC. Do not prime specific surfaces to be welded or which will be embedded in concrete or other cementitious materials.
- C. Do not apply primer to structural steel framing members to be encased in cementitious spray-on fireproofing.

2.6 OTHER MATERIALS

- A. Provide other materials, not specifically described or indicated but required for a complete and proper installation, as selected by Contractor subject to acceptance by Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Prior to commencing work of this section, inspect the work of others and verify that such work has been properly completed and installed to allow for proper installation of all materials and methods required of this section.

3.2 FABRICATION AND ERECTION

- A. Fabricate and assemble work with skilled personnel using sizes and weights shown. Connections are to be as detailed, unless approved otherwise beforehand. Allow no splices except where shown.
 - 1. Ultrasonic material inspection - ultrasonically test column materials thicker than 1-1/2 inch for laminations within 1 foot (6 inches either side) of a direct groove weld from girder flange connections and column splices.
 - 2. Rigid frames: Fabrication welding and erection of rigid frames.
 - a) The fabricator shall provide fabrication/erection inspector to oversee the fabrication, welding and erection of the rigid frames. This inspector is in addition to the District's verification inspector.
 - b) A welding procedure specification, prepared in accordance with AWS requirements, shall be submitted to the project structural engineer and project inspector.
- B. Drilling, Punching and Reaming: Hole burning to make or enlarge previous holes is not allowed. Prepare required holes in structural steel members for attachment or passage or work of other trades. Where allowed, steel may be punched 1/16 inch larger than the nominal diameter of the bolt when thickness of the steel is equal to or less than the diameter of the bolt plus 1/8 inch. Where the steel is thicker than the diameter of the bolt plus 1/8 inch, the holes must be drilled or sub-punched and reamed. Diameter of the sub-punched holes, and the drill for sub-drilled holes, is to be 1/16 inch smaller than the nominal diameter of bolt to be installed. Precisely locate finished holes to ensure passage of all bolts through steel assemblies without drifting. Enlarge holes only by reaming. Poor matching of holes is cause for rejection of work.
- C. Welding: Perform welding by the electric shielded arc process. Cut out defective welds with a chisel. Clamp or hold materials securely in position for welding. Upon completion, remove slag and clean welds for inspections and painting. All groove

and multi-pass welds are required to be continuously inspected. Welding shall conform to T-24, 2204A.1.

1. Storage and care of electrodes - Ensure that coatings of low hydrogen type electrodes are thoroughly dry when used. Use electrodes taken from hermetically sealed packages within 4 hours of the time the package is opened. Electrodes not used within this time period, and electrodes which have been exposed more than one hour to air having a relative humidity of 75 percent or greater, are to be dried for at least 2 hours at 200 to 250 degrees F. before used, or are to be reconditioned according to manufacturer's printed recommendations. Electrodes dried or reconditioned which are not used within 4 hours after drying is completed are to be re-dried before use. Electrodes of any classifications that have been wet are not to be used under any conditions.
2. Preparation - Clean surfaces to be welded, or paint, grease, scale, and foreign matter. Clean welds each time electrode is changed. Chip entire area of hand-guided and controlled flame cut edges before welds are deposited. In general, surfaces made by automatic or mechanically guided and controlled equipment need not be ground or chipped before welded.
3. Procedures - During assembling and welding, hold components of a built-up member with sufficient clamps or other adequate means to keep parts straight and in close contact. Do no welding in wind until adequate protective screening has been set up. Cut out defective welds or parts of welds with chisel or air arc and replace.
4. Characteristics of welds - After being deposited, brush welds and ensure they exhibit uniform section, smoothness of weld metal, feather edges without undercuts or overlays, and freedom from porosity and clinkers. Ensure through visual inspection at edges and ends of fillet welds there is good fusion and penetration into base metal.

D. Bolting

1. Common bolts - make connections with common or machine bolts only where indicated. (ASTM A307 Bolt.)
2. High strength steel bolting - where structural joints are made using high strength bolts, hardened washers, and nuts tightened to a high tension, the materials, method of installation and tension control, types of wrenches to be used, and inspection methods are to conform to specifications for structural jointing using ASTM A325 or A490 bolts established by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation and the following requirement:
 - a. Provide high strength bolts with a suitable identifying mark placed on top of the head before leaving factory.

- b. Do tightening of nuts with properly calibrated wrenches or turn of nut method; the minimum bolt tension for the size of bolt used is to be in accordance with tables listed in the above standards and as required by AISC in the presence of the special inspector.
 - c. Check calibrated wrenches individually for accuracy at least once daily for actual condition of application.
 - d. Mark bolts that have been completely tightened with identifying symbol.
 - e. Install hardened washers in accordance with AISC specifications.
 - f. Ensure that contact bearing surfaces and threads of bolted parts are free of scale, slag, and burrs which could prevent solid seating of parts.
 - g. Bolt lengths are to be grip plus 1-1/4 inch.
- 3. Load indicator washers - provide as manufactured/licensed by Cooper and Turner, or Bethlehem Steel. They may be used for field installation of high-strength bolts. These washers may not be substituted for any required washer, but may be used in conjunction with required washers. Tightening is to be in accordance with these specifications using high strength bolts. After sufficient bolts in a joint are snugged to draw the members into close contact, tightening should progress from the most rigid part to the free edges until the load indicators on all bolts are closed to the required gap of 0.015 inches under bolt heads or 0.005 inches under the load indicator at half of the gaps or as required per manufacturer. To prevent over tightening and damage to the bolts, do not completely close the gap.
 - 4. For alternatives to load indicator washers, see structural drawings.

E. Erection

- 1. Erect structural steel by professional riggers, using proper hoists and equipment, carefully planned and laid out so that cutting will not be necessary. Erect the work plumb, square and true to line. Provide temporary bracing and guys where necessary to provide for loads and stresses to which the structure may be subjected, including those due to erection equipment and its operation, and leave in place as long as necessary to safeguard all parts of the work.
- 2. Temporary connections - securely bolt work to maintain the steel in proper position while bolting and welding is being performed. Align, plumb and level all work prior to welding and final bolting.
- 3. Set column base plates in exact position as to alignment, level and elevation and support on steel wedges or equivalent until grout has properly set. Center of each base is to be true to the column center within

1/16 inch and adjusted to its elevation to 1/32 inch. Exactly level plates on both axis.

4. Sequence - carry out the erection of steel in the proper sequence with the work of others. Frame, bed and anchor to concrete and related work in accordance with detailed drawings and setting diagrams.
 5. Erection tolerance in accordance with AISC's "Code of Standard Practice for Steel Buildings and Bridges".
 6. Perform erection with suitable equipment, of adequate capacity and design with due regard for personnel and public safety and as not to deflect or stress members beyond reasonable limits. Maintain erection and temporary bracing plan at project site in accordance with Title 8, CAC.
 7. Damaged members - during erection, straighten or replace members which are bent, twisted or damaged as directed. If heating is required in straightening, perform heating by methods which ensure uniform temperatures throughout entire member. When directed, remove members which are not damaged to an extent impairing their appearance, strength or serviceability and replace with new members at no additional cost to Owner and must have DSA approval.
 8. Anchor bolts - provide with setting drawings and instructions. Verify position of bolts prior to delivery of steel; report errors or deviation for adjustment.
- F. Erection Bracing: Provide erection bracing immediately upon erection of members and leave in place until all members are braced by balance of building.
- G. Protection of Floors and Temporary Flooring:
1. Exercise caution to protect floor surfaces and adjacent work from damages. Do not overload floors. Provide only pneumatic tired mobile equipment for moving steel. Do not place steel members directly on concrete floors; use pads, or timbers, or other materials for cushioning.
 2. Provide necessary planking, scaffolding and temporary flooring in connection with erection of steel or support of erection machinery as part of the work. Conform use of temporary floors or steel deck to governing codes and regulations.
 3. Temporarily tack weld steel deck to supports where used as a working platform. Distribute concentrated loading from welding machines or other heavy machinery by planking or other equivalent means. Replace steel deck damaged by using as working platform at no additional cost to Owner.
- H. Shop Priming: Clean surfaces according to SSPC and AISC recommendations, and apply specified primer to minimum 1.0 dry mil thickness. Ensure that primer is worked into joints. Do not prime the following: steel to be embedded into

cementitious materials, permanently concealed steel surfaces, contact surfaces of high strength bolted connections, and surfaces to receive fireproofing.

3.3 TEST AND INSPECTION

- A. Welding – 1705A.2.5.
- B. H.S. Bolts –table 1705A.2.1 and 2213A.1.
- C. Shop Fab –1705A.2.

3.4 CLEANING

- A. Clean site after work of this section.
- B. Remove weld splatters
- C. Use galvanizing repair coating specified, then re-prime areas of materials damaged during installation and other construction activities, and leave in condition for subsequent finish painting or application of additional finish materials provided by others.

END OF SECTION 05 12 00

SECTION 05 40 00

COLD-FORMED 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes cold-formed structural metal framing, including the following:
 - 1. Wall framing.
 - 2. Metal backing plates for support of wall-mounted items on cold-formed structural metal framing.
- B. Related Sections include:
 - 1. Section 05 12 00 "Structural Steel Framing" for structural steel framing.
 - 2. Section 05 50 00 "Metal Fabrications" for miscellaneous steel shapes and connections used with cold-formed structural metal framing.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 318: Building Code Requirements for Structural Concrete.
- B. American Iron and Steel Institute (AISI):
 - 1. AISI S200: North American Standard for Cold-Formed Steel Framing - General Provisions.
 - 2. AISI S202: Code of Standard Practice for Cold-Formed Steel Structural Framing.
- C. ASTM International:
 - 1. ASTM A 36: Standard Specification for Carbon Structural Steel.
 - 2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A 153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. ASTM A 653: Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 5. ASTM A 780: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

6. ASTM A 1003: Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
 7. ASTM B 633: Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 8. ASTM C 150: Standard Specification for Portland Cement.
 9. ASTM C 404: Standard Specification for Aggregates for Masonry Grout.
 10. ASTM C 1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 11. ASTM C 1513: Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
 12. ASTM E 119: Standard Test Methods for Fire Tests of Building Construction and Materials.
 13. ASTM E 488: Standard Test Methods for Strength of Anchors in Concrete Elements.
 14. ASTM E 1190: Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members.
 15. ASTM F 593: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 16. ASTM F 594: Standard Specification for Stainless Steel Nuts.
 17. ASTM F 1554: Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 18. ASTM F 1941: Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch, and Metric.
- D. American Welding Society (AWS):
1. AWS D1.1: Structural Welding Code - Steel.
 2. AWS D1.3: Structural Welding Code - Sheet Steel.
- E. International Code Council Evaluation Service (ICC-ES):
1. ICC-ES AC58: Acceptance Criteria for Adhesive Anchors in Masonry Elements.
 2. ICC-ES AC70: Acceptance Criteria for Fasteners Power-Driven Into Concrete, Steel, and Masonry Elements.
 3. ICC-ES AC193: Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 4. ICC-ES AC261: Acceptance Criteria for Connectors Used with Cold-Formed Steel Structural Members.
 5. ICC-ES AC308: Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- F. Steel Framing Industry Association (SFIA):
1. SFIA Technical Guide for Cold-Formed Steel Framing Products.

1.4 COORDINATION

- A. Coordinate locations of cold-formed metal backing and reinforcements to ensure that surface mounted items specified in other Sections can be supported and installed as indicated. Surface mounted items include, but are not limited to, the following:
 - 1. Fire alarm devices.
 - 2. Toilet accessories.
 - 3. Door hardware.
 - 4. Fire protection specialties.
 - 5. Signage.
 - 6. Lockers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding Certificates.
- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency, indicating compliance with requirements:
 - 1. Steel sheet.
 - 2. Post-installed anchors.
 - 3. Power-actuated fasteners.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Bypass clips.
 - 7. Miscellaneous structural clips and accessories.
- D. Evaluation Reports: For non-standard cold-formed metal framing, post-installed anchors, and power-actuated fasteners, from ICC-ES.

1.7 QUALITY ASSURANCE

- A. 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.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- C. Welding Qualifications: 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."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling, in accordance with AISI S202.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation, in accordance with AISI S202.

PART 2 - PRODUCTS

2.1 COLD-FORMED STRUCTURAL METAL FRAMING, GENERAL

- A. Cold-Formed Structural Metal Framing, General: Comply with AISI S200.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed structural metal framing products that may be incorporated into the Work include, but are not limited to the following:
 - a. California Expanded Metal Products Company (CEMCO).
 - b. ClarkDietrich Building Systems.
 - c. Consolidated Fabricators Corp.; Building Products Division.
 - d. MarinoWare; a Division of Ware Industries.
 - e. SCAFCO Corporation.
 - f. Steeler, Inc.
 - g. United Metal Products, Inc.
- B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic-coated, of grade and coating weight as follows:
 - 1. Grade: ST33H (33 ksi), except, ST50H where indicated as 50 ksi.
 - 2. Coating: G60 (Z180), except where noted otherwise.

- C. Section Properties: For each indicated metal framing product, the following section properties are to be as specified in "Section Properties" portion of SFIA "Technical Guide for Cold-Formed Steel Framing Products:"
1. Section modulus.
 2. Moment of inertia.
 3. Allowable moment.

2.2 WALL FRAMING AND OTHER FRAMED ASSEMBLIES

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, web depth, width, and base-metal thickness as indicated on Drawings; punched, unless noted as unpunched, with stiffened flanges.
- B. Wall Framing Schedule: Provide products conforming with SFIA Product Designator codes as defined in of SFIA "Technical Guide for Cold-Formed Steel Framing Products," and as indicated. Indicated maximum wall heights refer to distance of unsupported vertical span.
1. 3-5/8-Inch Deep Studs:
 - a. Product Designator: 362S125-33.
 - b. Stud Web Depth: 1-5/8 inches.
 - c. Stud Flange Width: 1-1/4 inches.
 - d. Minimum Base-Metal Thickness: 0.033 inch (20 gage).
 - e. Maximum Height (at Stud Spacing of 16 inches on center): 16'-0".
- C. Jamb, Sill, and Header Framing at Wall Openings: As indicated on Drawings.
- D. Steel Track: Manufacturer's standard U-shaped steel track, of web depths matching studs, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
 2. Flange Width: As indicated.
- E. Slip-Type Head Joints: Manufacturer's standard slotted deflection track system, capable of resisting lateral loads while accommodating upward and downward displacement of primary structure through positive attachment to stud; provide width to accommodate depth of stud being fastened; tested in accordance with ICC-ES AC261.
1. Material: Steel sheet, ASTM A 653, metallic-coated, as follows:
 - a. Minimum Base-Metal Thickness: As indicated.
 - b. Grade: 50 ksi minimum yield strength.
 - c. Coating: G60 (Z180).
 2. Provide manufacturer's standard bushings for use with screws in attaching track to studs, which ensure free movement in the vertical direction between track and stud.

2.3 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
 - 1. Minimum Base-Metal Thickness: As indicated.
 - a. If not indicated, provide 0.054 inch (16 gage) thickness.
 - 2. Provide accessories of configuration indicated, to include the following:
 - a. Supplementary framing.
 - b. Bracing, bridging, and solid blocking.
 - c. Zee-shaped furring.
 - d. Web stiffeners.
 - e. Anchor clips.
 - f. End clips.
 - g. Foundation clips.
 - h. Gusset plates.
 - i. Stud kickers, knee braces, and girts.
 - j. Joist hangers and end closures.
 - k. Hole reinforcing plates.
 - l. Backer plates.
- B. Cold-Rolled Furring Channels: 0.054-inch (16 gage) minimum base-metal thickness, with minimum 1/2-inch wide flange.
 - 1. Depth: As indicated.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum base-metal thickness of 0.033 inch (20 gage).

2.4 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc-coated by hot-dip process according to ASTM A 153, Class C.
- C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing materials, manufacturer's standard elsewhere.

- D. Post-Installed Anchors: Fastener systems with working capacity calculated according to ICC-ES Acceptance Criteria indicated, and ACI 318 greater than or equal to design load, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency, and according to evaluation report acceptable to authorities having jurisdiction, based on applicable substrate type.
1. At Concrete: One of the following:
 - a. Torque-Controlled Expansion Anchors: Working capacity calculated according to ICC-ES AC193.
 - i) Product: Subject to compliance with requirements, provide one of the following:
 - a) Hilti, Inc.; Kwik-Bolt TZ (KB-TZ), sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-1917.
 - b) Simpson Strong-Tie Company; Strong-Bolt 2, sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-3037.
 - c) Equal product in accordance with Division 1 requirements for product substitutions.
 - ii) Expansion Anchor Material: As indicated in referenced Product Report, and as follows:
 - a) Exterior: Stainless-steel, Alloy Group 1 (Type 304), ASTM F 593 and ASTM F 594.
 - b) Interior: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn5, unless otherwise indicated.
 - b. Adhesive Anchors: Working capacity calculated according to ICC-ES AC308.
 - i) Product: Subject to compliance with requirements, provide one of the following:
 - a) Hilti, Inc.; HY 200, with HAS anchor rod, sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-3187.
 - b) Simpson Strong-Tie Company; ET-HP, with anchor rod sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-3372.
 - c) Equal product in accordance with Division 1 requirements for product substitutions.
 - ii) Anchor Rod and Nut Material: As indicated in referenced Product Report, and as follows:
 - a) Exterior: Stainless-steel, Alloy Group 1 (Type 304), ASTM F 593 and ASTM F 594.

- b) Interior: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn5, unless otherwise indicated.
- E. Power-Actuated Fasteners: Direct-fastening system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
 - 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. Hilti, Inc.; X-U, sizes as indicated on Drawings.
 - i) Product Report: ICC-ES Evaluation Report #ESR-2269.
 - b. Simpson Strong-Tie Company; PDPA.
 - i) Product Report: ICC-ES Evaluation Report #ESR-2138.
 - c. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Provide 0.08-inch minimum by 1.425 inches diameter steel washers under the heads of all power-actuated fasteners.
- F. Welding Electrodes: Comply with AWS standards.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

2.6 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
- 4. Fasten other materials to cold-formed metal framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Verify locations of all surface-mounted items requiring cold-formed metal backing or support framing.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- C. Install cold-formed metal framing according to AISI S200, AISI S202, and to manufacturer's written instructions unless more stringent requirements are indicated.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 21 00 "Building Insulation," in exterior framing assembly members, such as headers, sills, boxed joists, and multiple studs at opening, that are inaccessible on completion of framing work.
- I. Install metal backing as required to provide anchorage for surface-mounted items.
- J. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- K. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and to supporting structure as indicated.
- B. Squarely seat studs against bottom tracks with gap not exceeding 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to bottom tracks. Space studs as follows:
 - 1. Stud Spacing: 16 inches on center unless indicated otherwise.
- C. Install slotted sliptrack at overhead supports. Extend framing full height to structural supports or substrates. Continue framing around ducts that penetrate 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 while providing lateral support.
 - 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.
 - 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.
- D. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

- H. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 ERECTION TOLERANCES

- A. Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet, and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

END OF SECTION 05 40 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Steel framing and supports for overhead coiling doors.
 - 2. Steel framing and supports for mechanical and electrical equipment.
 - 3. Manufactured metal items:
 - a. Slotted channel framing.
- B. Related Sections include:
 - 1. Section 05 12 00 "Structural Steel" for structural steel framing.
 - 2. Section 09 91 00 "Painting" for field painting of metal fabrications.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 318: Building Code Requirements for Structural Concrete.
- B. American Society of Mechanical Engineers (ASME):
 - 1. ASME B18.2.1: Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws.
 - 2. ASME B18.6.1: Wood Screws.
 - 3. ASME B18.6.3: Machine Screws, Tapping Screws, and Metallic Drive Screws.
 - 4. ASME B18.21.1: Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.
 - 5. ASME B18.22.1: Plain Washers.
- C. American Welding Society (AWS):
 - 1. AWS D1.1: Structural Welding Code - Steel.
- D. ASTM International:
 - 1. ASTM A36: Standard Specification for Carbon Structural Steel.
 - 2. ASTM A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 4. ASTM A489: Standard Specification for Carbon Steel Eyebolts.
 5. ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 6. ASTM A563: Standard Specification for Carbon and Alloy Steel Nuts.
 7. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 8. ASTM C1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 9. ASTM D1187: Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 10. ASTM E488: Standard Test Methods for Strength of Anchors in Concrete Elements.
 11. ASTM F1554: Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 12. ASTM F 1941: Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch, and Metric.
- E. International Code Council Evaluation Service (ICC-ES):
1. ICC-ES AC193: Acceptance Criteria for Mechanical Anchors in Concrete Elements.
 2. ICC-ES AC308: Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- F. Metal Framing Manufacturers Association (MFMA):
1. MFMA-4: Metal Framing Standards Publication.
- G. Society for Protective Coatings (SSPC):
1. SSPC-PA 1: Shop, Field, and Maintenance Painting of Steel.
 2. SSPC-SP 3: Power Tool Cleaning.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each manufactured item specified, including:
 - 1. Slotted channel framing.
 - 2. Grout.
 - 3. Paint products.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide shop drawings for the following:
 - 1. Steel framing and supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding Certificates.
- B. Research Reports: For post-installed anchors.

1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel."

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Metal fabrications shall 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.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 METALS

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

- B. Steel:
 - 1. Steel Plates, Shapes, and Bars: ASTM A36.
 - 2. Steel Tubing: ASTM A500, cold-formed steel tubing.
 - 3. Steel Pipe: ASTM A53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum and stainless steel. Select fasteners for type, grade, and class required.
- B. Steel Bolts, Threaded Rods, and Nuts: Regular hexagon-head bolts and threaded rods, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Eyebolts: ASTM A489.
 - 1. Closed eye with shoulder; lag screw, where indicated.
- E. Machine Screws: ASME B18.6.3.
- F. Lag Bolts: ASME B18.2.1.
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1.
- I. Lock Washers: Helical, spring type, ASME B18.21.1.
- J. Post-Installed Anchors: Fastener systems with working capacity calculated according to ICC-ES Acceptance Criteria indicated and ACI 318, greater than or equal to design load, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency, and according to evaluation report acceptable to authorities having jurisdiction, based on applicable substrate type.
 - 1. At Concrete: One of the following:
 - a. Torque-Controlled Expansion Anchors: Working capacity calculated according to ICC-ES AC193.
 - i) Product: Subject to compliance with requirements, provide one of the following:

- a) Hilti, Inc.; Kwik-Bolt TZ (KB-TZ), sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-1917.
 - b) Simpson Strong-Tie Company; Strong-Bolt 2, sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-3037.
 - c) Equal product in accordance with Division 1 requirements for product substitutions.
 - ii) Expansion Anchor Material: As indicated in referenced Product Report, and as follows:
 - a) Exterior: Stainless-steel, Alloy Group 1 (Type 304), ASTM F 593 and ASTM F594.
 - b) Interior: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn5, unless otherwise indicated.
- b. Adhesive Anchors: Working capacity calculated according to ICC-ES AC308.
 - i) Product: Subject to compliance with requirements, provide one of the following:
 - a) Hilti, Inc.; HY 200, with HAS anchor rod, sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-3187.
 - b) Simpson Strong-Tie Company; ET-HP, with anchor rod sizes as indicated on Drawings.
-Product Report: ICC-ES Evaluation Report #ESR-3372.
 - c) Equal product in accordance with Division 1 requirements for product substitutions.
 - ii) Anchor Rod and Nut Material: As indicated in referenced Product Report, and as follows:
 - a) Exterior: Stainless-steel, Alloy Group 1 (Type 304), ASTM F593 and ASTM F594.
 - b) Interior: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For stainless-steel fabrications, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Shop Primers: As specified in Section 09 91 00 "Painting."
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187
- E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 MANUFACTURED ITEMS

- A. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Unistrut Corporation; P1000 Series.
 - b. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Size of Channels: 1-5/8 inches by 1-5/8 inches.
 - 3. Material: Galvanized steel, complying with ASTM A653, structural steel, Grade 33, 0.108-inch (12 gage) thick.
 - 4. Finish: Galvanized.
 - 5. Fittings: Manufacturer's standard line of fittings for securing mechanical, plumbing, and electrical lines and equipment to channel framing and for connecting channel framing members to each other and adjacent construction; steel, ASTM A 36.
 - a. Finish: Galvanized, per ASTM A153.
 - b. Fasteners: Temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to the greatest extent possible. 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 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.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously and cope components at connections to provide close fit. 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. 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.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel anchors as indicated on Drawings for embedding in concrete or masonry construction.

2.9 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL FINISHES

- A. Finish steel and iron items as follows:
 - 1. Shop prime all items occurring at interior locations, except those items indicated to be galvanized or left unprimed.
- B. 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 metal fabrications:
 - 1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications of steel, except those with galvanized finishes and those to be embedded in concrete or masonry, or receive sprayed-on fireproofing, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Shop prime uncoated metal railings with primer specified in Section 09 91 00 "Painting."
 - 2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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 bolts, 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 a heavy coat of bituminous paint.
- G. Install manufactured items in accordance with written instructions of manufacturer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturer's written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for securely to and rigidly brace from building structure.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting of Nongalvanized Steel and Iron Items: 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.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Check and adjust all operating hardware and moving parts for proper operation.

END OF SECTION 05 50 00

SECTION 06 41 00

ARCHITECTURAL WOOD CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Plastic-laminate-faced architectural cabinets.
 - 2. Plastic-laminate-faced countertops and splashes.
 - 3. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
- B. Related Sections include:
 - 1. Section 05 41 00 "Cold-Formed Structural Metal Framing" for concealed metal backing in load-bearing metal stud-framed walls for anchoring cabinets.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A208.1: Particleboard.
 - 2. ANSI A208.2: Medium Density Fiberboard (MDF) for Interior Applications.
- B. Architectural Woodwork Manufacturer's Association of Canada/Woodwork Institute (AWMAC/WI):
 - 1. North American Architectural Woodwork Standards 3.1.
- C. ASTM International:
 - 1. ASTM A36: Standard Specification for Carbon Structural Steel.
 - 2. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
- D. Builders Hardware Manufacturers Association (BHMA):
 - 1. BHMA A156.9: Cabinet Hardware.
 - 2. BHMA A156.18: Materials and Finishes.
- E. California Air Resources Board:
 - 1. Airborne Toxic Control Measure to Reduce Formaldehyde Emissions From Composite Wood Products.

- F. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.
- G. California Code of Regulations – Title 17 - Public Health.
- H. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.
- I. Laminating Materials Association (LMA):
 - 1. LMA EDG-1: Voluntary Product Standard and Typical Physical Properties of Edgebanding Materials.
- J. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA LD-3: High-Pressure Decorative Laminates.
- K. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1168 – Adhesive and Sealant Applications.
- L. UL Environment:
 - 1. GREENGUARD Gold certification program.
- M. Woodwork Institute (WI):
 - 1. Certified Compliance Program.

1.4 DEFINITIONS

- A. Composite Wood Product: Manufactured product using derivative wood materials such as strands, chips, particles, or fibers bonded together with a resin binder to form a rigid panel. Composite wood products include medium density fiberboard, particleboard, and hardboard.
- B. DSA: Division of the State Architect.
- C. Plastic-Laminate: High-pressure decorative laminate.
- D. PVC: Polyvinyl chloride.
- E. VOC: Volatile organic compound.

1.5 COORDINATION

- A. Coordinate sizes and locations of concealed framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural wood cabinets can support loads imposed by installed and fully loaded cabinets.
- B. Coordinate locations of utilities that will penetrate countertops or splashes.

1.6 PREINSTALLATION MEETING

- A. Preinstallation Conference: Conduct conference at Project site to review pertinent issues related to architectural wood cabinets.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including:
 - 1. Composite wood products.
 - 2. Cabinet hardware and accessories.
 - 3. High-pressure decorative laminate.
 - 4. Low-pressure decorative laminate.
 - 5. PVC edgebanding material.
 - 6. Sealant.
 - 7. Adhesives for bonding plastic-laminates and wood veneers.
- B. Shop Drawings: Submit shop drawings in conformance with AWI/AWMAC/WI Architectural Woodwork Standards 3.1, Section 1, showing location of each item, dimensioned plans and elevations, large-scale construction details, attachment devices, and other components. Shop drawings shall be reviewed by an independent WI Inspector (not the millwork contractor) and bear the WI Certified Compliance Program label, affixed to the first page of each set of the shop drawings.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking/backing and reinforcement specified in other Sections.
 - 3. Show countertop materials, finishes, edge, backsplash, and endsplash profiles, methods of joining, and cutouts for plumbing fixtures and other items occurring in countertop or splash.
 - a. Show locations and details of joints.
 - b. Show directional pattern, if any.
 - 4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, appliances, electrical switches and receptacles, and other items installed in architectural wood cabinets.
 - 5. Include keying schedule with schematic keying diagram indexing each key set to cabinet doors and drawers.
- C. Samples for Initial Selection: Manufacturer's full range of colors and patterns for the following, for selection by Architect:
 - 1. High-pressure decorative laminate.
 - a. Minimum Number of Colors for Selection: 230.
 - 2. PVC edgebanding.
 - a. Minimum Number of Colors for Selection: As required to match color of adjacent plastic-laminate facing.

3. Low-pressure decorative laminate.
 - a. Minimum Number of Colors for Selection: 2.
- D. Samples for Verification:
 1. High-pressure decorative laminate-clad panel products, 4 inches by 6 inches for each type, color, pattern, and surface finish, with corresponding PVC edgebanding applied to one edge.
 2. Low-pressure decorative laminate-surfaced panel products, 4 inches by 6 inches for each type, color, pattern, and surface finish.
 3. Cabinet hardware and accessories, one unit for each type and finish.
- E. CALGreen Submittals:
 1. Manufacturer's product data for adhesives, sealants, and transparent wood finishes indicating compliance with product requirements specified in "CALGreen Requirements" Article.
 2. Manufacturer's product data for composite wood products indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator. Demonstrate capabilities and experience.
 1. Include list of completed projects with project names, addresses, and names of Owners and Architects.

1.9 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates, as specified in "Quality Assurance" Article.

1.10 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.
- C. Quality Standard: Comply with the AWMAC/WI North American Architectural Woodwork Standards 3.1, for grades of architectural wood cabinets and countertops indicated for construction, finishes, installation, and other requirements.
 1. WI Quality Marking: Mark each unit of the following types of architectural wood cabinets and countertops with WI Certified Compliance Label on an unexposed surface, indicating compliance with specified quality grade.
 - a. Cabinets.
 - b. Plastic-laminate countertops and splashes.

2. WI Certificate of Compliance: Before delivery to the jobsite, obtain from WI, a Certified Compliance Certificate for materials and workmanship certifying that cabinet products fully meet requirements of the grades specified.
 - a. Upon completion of installation, obtain from WI, a Certified Compliance Certificate, certifying that installation is in compliance with specified AWMAC/WI requirements.
3. The Contract Documents may contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.
4. If, for any reason, a reinspection is requested of Work required to be manufactured in accordance with the Architectural Woodwork Standards, and for which a fee is charged, said fee (if millwork is found to be non-conforming in any manner) shall be the responsibility of the Contractor and subsequently deducted from the contract price in form of a deductive change order.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protect cabinets and countertops during transit, delivery, storage, and handling to prevent damage.
- B. Do not deliver cabinets until painting and similar operations that could damage cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.12 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work in space is complete and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
 1. Comply with cabinet fabricator and Installer's recommendations for optimum temperature and humidity conditions for cabinets during storage and installation. Maintain recommended conditions through remainder of construction period.
- B. Field Measurements: Where cabinets and countertops 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. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
 2. Verify dimensions of countertops by field measurements after base cabinets are installed, but before countertop fabrication is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Single-Source Manufacturing and Installation Responsibility: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural wood cabinets specified in this Section, including fabrication and installation.

2.2 CALGREEN REQUIREMENTS

- A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).
- B. Provide adhesives and sealants which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethylen).
 - 1. Aerosol adhesives and similar unit sizes of adhesives, and sealants (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions of use of certain toxic compounds, of the California Code of Regulations, Title 17, commencing with Section 94507.
- C. Composite Wood Products: Provide architectural wood cabinets and, where applicable, countertops, manufactured from composite wood products which meet requirements of California Air Resources Board "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions From Composite Wood Products" for formaldehyde resin emission limits (in ppm) for composite wood products and as specified below:
 - 1. Particleboard: 0.09.
 - 2. Medium Density Fiberboard: 0.11.

2.3 PERFORMANCE REQUIREMENTS

- A. Design wall-hung and -anchored cabinets, storage shelving and connections with sufficient strength to resist stresses imposed by design loads as follows:
 - 1. Vertical Design Loads: Per 2016 California Building Code, Table 1607A.1, Item 36, Minimum Uniformly Distributed Live Loads and Minimum Concentrated Live Loads.
 - 2. Seismic Loads: Earthquake motions determined according to requirements of the California Building Code and Seismic Design Category specific to project.
 - 3. Adjustable Shelf Loading: Provide 50 lbs/sq ft load bearing capacity, as per AWMAC/WI North American Architectural Woodwork Standards – 3.1, Section 10 (maximum deflection: L/144).

2.4 PLASTIC-LAMINATE-FACED CABINETS

- A. Quality Standard: Comply with applicable requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1, Section 10, "Casework."
 - 1. Grade: Premium.
 - a. This grade requirement applies to cabinets in storage rooms and closets, janitor (custodian) rooms and closets, and utility rooms, and supersedes the exception for these locations as occurs in AWMAC/WI North American Architectural Woodwork Standards – 3.1, Section 10, Introductory Information – Advisories.
 - 2. Where Contract Documents indicate requirements beyond those of specified quality standard, comply with those requirements in addition to the quality standard.
- B. AWMAC/WI Construction Style: Frameless.
- C. AWMAC/WI Cabinet/Door Interface Style: Flush Overlay.
 - 1. At cabinet doors, exposed-knuckle hinges shall be let (notched) into door edge as required to maintain consistent gap width between adjacent cabinet door panels.
- D. Door and Drawer Front Profile: Square edge.
- E. Finish by Surface Category (as defined in AWMAC/WI standard):
 - 1. Exposed Outer Surfaces: High-pressure decorative laminate, NEMA LD 3.
 - a. Grades:
 - i) Horizontal Surfaces: Grade HGS (0.048-inch nominal thickness)
 - ii) Vertical Surfaces: Grade VGS (0.028-inch nominal thickness).
 - iii) Postformed Surfaces: Grade HGP (0.042-inch nominal thickness).
 - 2. Exposed Inner Surfaces (includes open shelving without doors, surfaces around and behind open shelving without doors, behind glass doors, backside of doors, edges of doors and drawers, and underside of exposed shelving): High-pressure decorative laminate, same material, pattern, color and thickness as exposed outer surfaces.
 - 3. Semi-Exposed Surfaces: Low-pressure decorative laminate.
 - a. Color: White.
 - 4. Concealed Backs of Panels with Exposed or Semi-Exposed Surfaces: As required by referenced quality standard.
- F. Edge Treatment:
 - 1. Cabinet Doors and Drawers: PVC edgebanding, 3 mm thickness.
 - 2. Exposed Edge of Shelving: PVC edgebanding, 1 mm thickness.

- G. Colors/Patterns:
 - 1. High-Pressure Decorative Laminate: As selected by Architect from manufacturer's full range.
 - 2. Low-Pressure Decorative Laminate: White.
 - 3. PVC Edgebanding: As selected by Architect from manufacturer's full range.

2.5 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Comply with applicable requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1, Section 11, "Countertops."
 - 1. Grade: Premium.
 - 2. Where Contract Documents indicate requirements beyond those of specified quality standard, comply with those requirements in addition to the quality standard.
- B. High-Pressure Decorative Laminate Grade for Horizontal Surfaces: NEMA LD 3, Grade HGS (0.048-inch nominal thickness), except as follows:
 - 1. Vertical Surfaces: Grade VGS (0.028-inch nominal thickness).
 - 2. Post-Formed Surfaces: Grade HGP (0.042-inch nominal thickness).
- C. Edge Treatment: Same as laminate cladding horizontal surfaces.
- D. Splash Profile: Square top and coved base, unless indicated otherwise.
 - 1. Splash Height: 6 inches.
- E. Core Material: Particleboard or medium density fiberboard.
 - 1. Core Thickness: 1-1/8 inch.
 - 2. At sink areas, core material to be moisture-resistant grade, dyed green per WI standards, with Type II water-resistant adhesive, per AWI/AWMAC/WI Architectural Woodwork Standards, Appendix, "Adhesives Guidelines."
- F. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL (0.020-inch nominal thickness), on underside of countertop substrate.
- G. Where end of countertop terminates at a wall, provide end splash.
- H. Colors/Patterns: As selected by Architect from manufacturer's full range.

2.6 CABINET AND COUNTERTOP MATERIALS

- A. General: Provide materials that comply with requirements of the AWMAC/WI quality standard for each type of cabinet and quality grade specified, unless otherwise indicated. Modifications of AWMAC/WI standards contained herein, and on the Drawings, shall govern and take precedence over AWMAC/WI grade rules.
- B. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 2. Wood Moisture Content: 5 to 10 percent.
- C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural wood cabinet and quality grade specified unless otherwise indicated.
1. Medium Density Fiberboard: ANSI A208.2, Grade 130.
 - a. Recycled Content:
 - i) Preconsumer: 92 percent minimum.
 2. Particleboard: ANSI A208.1, Grade M-2.
 - a. Recycled Content:
 - i) Preconsumer: 92 percent minimum.
 3. Formaldehyde Emissions:
 - a. Complies with requirements specified in "CALGreen Requirements" Article.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or, if not indicated, as required by AWMAC/WI quality grade.
1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminate by one of the following:
 - a. Formica Corporation.
 - b. Nevamar Company, LLC; Decorative Products Division.
 - c. Panolam Industries International Incorporated; Pionite Decorative Surfaces.
 - d. Wilsonart International; Division of Premark International, Inc.
 2. Color(s): Refer to "Plastic-Laminate-Faced Cabinets" and "Plastic-Laminate Countertops" Articles for colors.
- E. Low-Pressure Decorative Laminate: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
- F. Edgebanding: PVC, of thickness indicated; complying with LMA EDG-1.
1. Manufacturer: Subject to compliance with requirements, provide edgebanding by the following:
 - a. Doellken Woodtape.
 2. Color(s): Refer to "Plastic-Laminate-Faced Cabinets" Article for colors.

2.7 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural wood cabinets, except for items which are specified in Section 08 71 00 "Door Hardware."
 - 1. Hardware Finishes: Where BHMA finish designations are referenced, provide finish that complies with BHMA A156.18.
 - a. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - b. Satin Stainless-Steel: BHMA 630.
- B. Hinges: BHMA A156.9, Grade 1; 2-3/4-inch, 5-knuckle wrap-around type; offset for overlay doors; from .095 inch steel; hospital tips; 270 degree swing; finish: BHMA 652 (satin chromium).
 - 1. Product: Rockford Process Control, Inc.; #374.
- C. Drawer Slides for Other Than File Drawers: BHMA A156.9, Grade 1; 150 lb per pair load rating; full-extension; steel ball bearings; progressive movement; rail mount/disconnect; finish: clear zinc.
 - 1. Product: Accuride; #4032.
- D. Drawer Slides for File Drawers up to 42 inches wide: BHMA A156.9, Grade 1HD-200; 200 lb per pair load rating; 1-inch overtravel; finish: clear zinc.
 - 1. Product: Accuride; #3640.
- E. Drawer and Door Pulls: Back mounted, solid metal wire pull; 4 inches center-to-center, 7/8-inch clearance, 5/16 inch in diameter; finish: BHMA 630 (satin stainless steel).
 - 1. Trimco/Builders Brass Works; #562-4.
- F. Door Catches: Magnetic catch, adjustable; self-aligning; pull strength, 5 lbs; finish: aluminum.
 - 1. Door Catches: Ives; #325.
- G. Elbow Catches: Designed for use on inactive leaf of pair of locking cabinet doors; finish: BHMA 626.
 - 1. Product: Ives; #2.
- H. Adjustable Shelf Supports: Steel with pins for 5 mm diameter drilled holes; provide top pin for shelves occurring 5 feet or higher above floor; finish: satin nickel plated.
 - 1. Product:
 - a. Shelves less than 5 feet above floor: Hafele; #282-24-710.
 - b. Shelves 5 feet or higher above floor: Hafele; #282-24-720.
- I. Cable Grommets: Molded plastic, circular shape, 2 inch diameter; two-piece with removable cap with flip-top access slot; color: Matte black.
 - 1. Product: Doug Mockett & Company; Model #TG3.

- J. Locks: Pin tumbler type with retractable bolt; provide manufacturer's standard feature allowing replacement of cylinder without removal of lock assembly; keyed alike within each room, keyed different for each room, masterkeyed alike; finish: BHMA 626 (satin chromium).
 - 1. Product:
 - a. Doors: CompX National; #C8173.
 - b. Drawers: CompX National; #C8179.

2.8 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: As indicated on Drawings, or if not indicated, 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, floors, and elsewhere as required for corrosion-resistance. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
- C. Adhesives: Type recommended by adhesive manufacturers to suit products and substrate conditions indicated.
 - 1. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.
- D. Joint Sealant: Silicone joint sealant; ASTM C920, Type S (single-component), Grade NS (nonsag), Class 12.5.
 - 1. Color: Translucent.
 - 2. Unless precluded by use in food-handling areas, provide mildew-resistant type, where occurs in areas subject to moisture.
 - 3. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.
- E. Metal Fabrications: Steel plate, ASTM A36; thicknesses as indicated; ground all welds smooth; dimensions as indicated.
 - 1. Anchorage Clips: Bent plate.
 - 2. Connection Bracket at End of Sliding Markerboard Tracks: Welded construction.

2.9 FABRICATION

- A. Provide cabinets complying with 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 cabinets to dimensions, profiles, and details indicated.

- D. Complete fabrication, including assembly, 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. 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.
 - 1. Seal edges of cutout openings in countertop subtops and plastic-laminate-faced countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before installing architectural cabinets and countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
 - 1. Examine substrates to receive countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition cabinets and countertops to average prevailing humidity conditions in installation areas for not less than 72 hours.

3.3 INSTALLATION

- A. Quality Standard: Install cabinets and countertops to comply with requirements of AWMAC/WI North American Architectural Woodwork Standards 3.1 and quality grade specified for each type of cabinet and countertop in Part 2 of this Section.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking/backing built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

1. DSA-Approved Anchorages: Install cabinets in accordance with details shown.
- D. Install cabinets and countertops 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.
1. Scribe and cut cabinets and countertops to fit adjoining work, refinish cut surfaces and repair damaged finish at cuts.
 2. Install cabinets 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.
 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches on center with No. 12 screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips, or No. 12 sheet metal screws through metal backing or metal framing behind wall finish.
- E. Countertops and Splashes: Anchor securely to base cabinets or other supports as indicated.
1. Install countertops and splashes level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to tolerance of 1/8 inch in 96 inches.
 2. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 3. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 4. Plastic-Laminate Countertops:
 - a. Anchor plastic-laminate countertops by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - b. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - i) Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
 5. Seal junctures of tops, splashes, and walls with silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets and countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace cabinets. Adjust joinery for uniform appearance.

- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets and countertops on exposed and semiexposed surfaces.
- D. Protection: Provide kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches on center. Remove protection at Substantial Completion.

END OF SECTION 06 41 00

SECTION 06 83 16

FIBERGLASS-REINFORCED PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Fiberglass-reinforced plastic (FRP) paneling.
 - 2. Installation accessories.
 - a. Plastic trim.
 - b. Sealants.
- B. Related Sections include:
 - 1. Section 09 29 00 "Gypsum Board" for gypsum board substrate behind fiberglass-reinforced plastic paneling.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM D5319: Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
 - 2. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Code of Federal Regulations (CFR):
 - 1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards.
- C. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.
- D. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1168 – Adhesive and Sealant Applications.
- E. Underwriters Laboratory (UL):
 - 1. UL 723: Standard Test for Surface Burning Characteristics of Building Materials.
- F. USDA/FSIS: United States Department of Agriculture, Food Safety and Inspection Service.

1.4 DEFINITIONS

- A. VOC: Volatile Organic Compounds.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of fiberglass-reinforced plastic panel and accessory.
- B. Shop Drawings: Show locations of paneling, colors and patterns, attachment, trim, and other components.
 - 1. Include elevations showing panel sizes and layout of joints between panels.
 - a. Show electrical outlets and switches, thermostats, light fixtures, air outlets and inlets, speakers, access panels, and other items occurring within panels.
 - 2. Include details at panel joints, corners, edges, and terminations.
- C. Samples for Initial Selection: For each type of panel and accessory, submit manufacturer's full range of colors for selection by Architect.
 - 1. Minimum Number of Colors/Patterns for Selection: 55.
- D. Samples for Verification: For each type and color of plastic panel and accessory.
- E. CALGreen Submittals:
 - 1. Manufacturer's product data for adhesives, primers, and sealants indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for rigid-sheet wall-covering, indicating compliance with performance requirements.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fiberglass-reinforced plastic panels to include in maintenance manuals. Include manufacturer's written cleaning instructions and precautions for use of cleaning agents, which could damage panels.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing fiberglass-reinforced plastic paneling, with a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Follow manufacturer's written instructions for delivery, storage, and handling of fiberglass-reinforced plastic panels.

- B. Do not deliver fiberglass-reinforced plastic paneling until rooms in which it is to be installed are enclosed and weatherproof, and ready to receive installation
- C. Store panels flat on a clean dry surface, protected from weather and sunlight.

1.10 FIELD CONDITIONS

- A. Maintain ambient temperatures and humidity conditions within range recommended by manufacturer, but not less than 65 deg F or more than 75 deg F, in spaces to receive fiberglass-reinforced plastic paneling for at least 24 hours before installation, during, and after installation
- B. Field Measurements: 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fiberglass-reinforced plastic paneling through one source from a single manufacturer.

2.2 CALGREEN REQUIREMENTS

- A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).
- B. Provide adhesives, sealants, and primers which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethylen).

2.3 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Fiberglass-reinforced paneling shall comply with the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 76 or less.
 - b. Smoke-Developed Index: 450 or less.

2.4 FIBERGLASS-REINFORCED PLASTIC (FRP) PANELING

- A. General: Gel-coated flat panel formed from modified polyester copolymer resin, homogeneously reinforced with glass fibers; complying with ASTM D5319 and meeting USDA/FSIS requirements for use in food preparation areas.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Crane Composites, Inc.; Glasbord.
 - b. Marlite, Inc.; Standard FRP.
 - c. Nudo Products, Inc.; FiberLite.
 - d. Equal product in accordance with Division 1 requirements for product substitutions.
2. Panel Dimensions: 4 feet by 8 feet.
3. Panel Thickness: 0.09 inch.
4. Face Texture: Molded pebble texture.
5. Color: As selected by Architect from manufacturer's full range.

2.5 ACCESSORY MATERIALS

- A. Plastic Trim: Manufacturer's integral color, extruded PVC moldings designed to retain and cover panel edges and accommodate expansion and contraction of panels; provide rigid base flange with flexible exposed cap flange.
 1. Profiles: Provide the following shapes:
 - a. Division bar (typical panel joint).
 - b. Outside corner.
 - c. Inside corner.
 - d. Edge cap.
 2. Colors: Match colors of fiberglass-reinforced plastic paneling.
- B. Panel Adhesive: Adhesive recommended in writing by manufacturer of fiberglass-reinforced plastic panels for directly adhering panels to continuous substrate.
- C. Concealed Joint Sealant: Mildew-resistant single-component silicone sealant recommended in writing by manufacturer of fiberglass-reinforced plastic panels for use inside channels of joint and edge trim.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall-covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrate and panel surfaces of dirt, dust, oil, grease, and other substances that could impair bond of adhesive.
- D. Condition fiberglass-reinforced plastic panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints as indicated, or if not indicated, to provide equal panels at ends of walls not less than half the width of full panels, and so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate at trim accessories for accurate installation.
 - 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION - GENERAL

- A. Install fiberglass-reinforced plastic paneling system in accordance with manufacturer's written instructions.
- B. Cut panels to size with clean, straight edges; scribe panels abutting other components. Carefully measure and cutout for doors, windows, electrical devices, pipes, conduits, and other wall openings and penetrations. Allow for gaps at joints between panels to accommodate thermal expansion and contraction of panels in accordance with manufacturer's written instructions.
- C. Install solid-color plastic trim at panel joints, edges, and corner conditions. Apply continuous bead of silicone sealant inside channels of trim to form watertight seal between panel and trim. Set all trim level and plumb.
- D. Spread adhesive evenly over entire back surface of panel. Apply using manufacturer's recommended methods and tools.
- E. Set panels in place plumb, level, and true. Roll panel surface with sufficient pressure to make full contact between substrate and panel. Brace panels to maintain contact and position while adhesive cures.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.4 CLEANING

- A. On completion of fiberglass-reinforced plastic paneling installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition for remainder of construction.

3.5 PROTECTION

- A. Provide protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that fiberglass-reinforced plastic panels are without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 83 16

SECTION 08 11 13

HOLLOW-METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Hollow-metal steel doors.
 - 2. Hollow-metal steel frames for doors and glazed openings.
- B. Related Sections include:
 - 1. Section 08 71 00 "Door Hardware" for finish hardware installed on hollow-metal doors and frames.
 - 2. Section 08 81 00 "Glass Glazing" for glass installed in hollow-metal frames and doors.
 - 3. Section 08 88 13 "Fire-Rated Glazing" for fire-rated glass installed in fire-rated hollow-metal doors.
 - 4. Section 09 91 00 "Painting" for field painting of hollow-metal doors and frames.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM A 153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A 653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM A 780: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 4. ASTM A 879: Standard Specification for Steel Sheet, Zinc-Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
 - 5. ASTM A 1008: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy With Improved Formability, Solution Hardened, and Bake Hardenable.
 - 6. ASTM A 1011: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength.

- B. Builder's Hardware Manufacturers Association (BHMA):
 - 1. ANSI/BHMA A156.115: Standard for Hardware Preparation in Steel Doors and Steel Frames.
- C. National Association of Architectural Metal Manufacturers/Hollow Metal Manufacturers Association (NAAMM/HMMA):
 - 1. NAAMM-HMMA 803: Steel Tables.
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 80: Standard for Fire Doors and Other Opening Protectives.
 - 2. NFPA 105: Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.
 - 3. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.
 - 4. NFPA 257: Standard on Fire Test for Window and Glass Block Assemblies.
- E. Society for Protective Coatings (SSPC):
 - 1. SSPC-Paint 20: Zinc-Rich Coating, Type I – Inorganic and Type II – Organic.
 - 2. SSPC-SP1 Solvent Cleaning.
 - 3. SSPC-SP 3: Power Tool Cleaning.
 - 4. SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning.
- F. Steel Door Institute (SDI):
 - 1. ANSI/SDI A250.4: Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors.
 - 2. ANSI/SDI A250.6: Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 3. ANSI/SDI A250.8 (Formerly SDI-100): Recommended Specifications for Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10: Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11: Recommended Erection Instructions for Steel Frames.
- G. Underwriters Laboratory (UL):
 - 1. UL 9: Fire Tests of Window Assemblies.
 - 2. UL 10C: Positive Pressure Fire Tests of Door Assemblies.
 - 3. UL 1784: Air Leakage Tests of Door Assemblies.

1.4 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.5 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.6 PREINSTALLATION MEETING

- A. Preinstallation Conference: Conduct conference at Project site to review pertinent issues related to hollow-metal doors and frames.

1.7 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, fire-resistance and temperature-rise ratings, and finishes for each type of hollow-metal door and frame specified.
- B. Shop Drawings: Include the following:
 - 1. Elevation of each door type.
 - 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. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings, removable stops, and glazing.
 - 10. Existing Conditions: Where new doors are indicated to be installed in existing frames, field verify all existing conditions and dimensions. Notify Architect of any conditions that would prevent installation of scheduled door and hardware as required for proper operation and normal maintenance.
 - a. Indicate date of project site visit on submittal. Submittals prepared without project site visit for field verification will be returned as non-compliant.

- C. Samples for Verification:
 - 1. Fabrication: Prepare Samples approximately 12 inches by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.8 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame, for tests performed by a qualified testing agency.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch high wood blocking, except place on higher blocking when needed to protect hollow-metal work from moisture or other harmful conditions. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.10 FIELD CONDITIONS

- A. Existing Openings: Where new hollow-metal doors and hardware are scheduled for installation in existing frames or where modifications to existing doors and frames is required, field verify existing conditions and coordinate installation of door and hardware to suit opening conditions and to provide for proper operation and maintenance. Refer to Shop Drawing requirements in "Action Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain hollow-metal doors and frames through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
 - 1. Test Pressure: Test at positive pressure according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
 - 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.
 - 3. Smoke- and Draft-Control Assemblies: Provide assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 HOLLOW-METAL DOORS AND FRAMES, GENERAL

- A. Hollow-Metal Doors and Frames: Complying with SDI A250.8 as indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide hollow-metal doors and frames by one of the following:
 - a. Ceco Door Products; an ASSA ABLOY Group company.
 - b. Curries Company; an ASSA ABLOY Group company.
 - c. Door Components, Inc.
 - d. Steelcraft; an Allegion brand.
 - e. Stiles Custom Metal, Inc.
 - f. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.

2.4 HOLLOW-METAL DOORS

- A. Construct hollow-metal doors to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances and clearances, and as specified.
- B. Hollow-Metal Doors: Complying with SDI A250.8, Level 3 (Extra-Heavy-Duty).
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Type: Flush.
 - 3. Thickness: 1-3/4 inches.
 - 4. Faces: 0.053-inch thick (16 gage) metallic-coated steel sheet with minimum A40 (ZF120) coating.
 - 5. Edge Construction: Model 2, Seamless.
 - a. Top Edge Closure: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.

- b. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets.
 - c. Provide beveled strikeside jamb edge per referenced standards.
- 6. Core: Manufacturer's standard kraft-paper honeycomb, except as follows:
 - a. At fire-protection-rated doors, provide core as required to meet fire-protection and temperature-rise ratings indicated.
- 7. Moldings for Glazed Lites in Doors: Minimum 0.032-inch thick (20 gage), fabricated from same material as door face sheet in which they are installed.
- 8. Concealed Reinforcing: Fabricated reinforcement plates from metallic-coated steel sheet, in thickness and dimensions as required for proper reinforcing and support for hinges, locks, flush bolts, closers, holders, and other hardware items
- 9. Finish: Factory-primed.

2.5 HOLLOW-METAL FRAMES

- A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances and clearances, and as specified.
- B. Interior Hollow-Metal Frames: Complying with SDI 250.8, Level 3 (Extra-Heavy-Duty), except as noted otherwise below.
 - 1. Frame Material: 0.053-inch thick (16 gage) uncoated steel sheet.
 - 2. Construction: Full-profile welded.
 - 3. Finish: Factory-primed.
 - 4. Concealed Stiffeners and Reinforcing: Fabricated reinforcement plates from uncoated steel sheet, in thickness and dimensions as required for proper reinforcing and support for hinges, locks, flush bolts, closers, holders, and other hardware items.
 - 5. Loose Stops for Glazed Lites in Frames: Fabricated from uncoated steel sheet, minimum 0.032 inch thick (20 gage). Prepared for countersink style screws. Finish to match frame.
 - 6. Anchors: Formed from same material as frames except as noted otherwise below:
 - a. Jamb Anchors: Provide minimum size, type, and quantity required by applicable door and frame standard, and suitable for performance level indicated.
 - i) Stud-Wall Type: Designed to engage studs, welded to back of frames; not less than 0.042-inch thick (18 gage).
 - ii) Postinstalled Expansion Type for In-Place Concrete: Minimum 3/8-inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

- b. Floor Anchors: Formed from same material as frame, minimum thickness of 0.042-inch (18 gage), and as follows:
 - i) Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - ii) Separate Topping Concrete Slabs or Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of topping slab or underlayment.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879, Commercial Steel, (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips of other accessory devices for attaching hollow-metal frames of type indicated.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- H. Glazing: Comply with requirements of Section 08 81 00 "Glass Glazing" and Section 08 88 13 "Fire-Rated Glazing."

2.7 FABRICATION

- A. Fabricate hollow-metal doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Fire Door Cores: As required to provide fire-protection ratings indicated.
 - 2. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.

3. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 4. Glazed Lites: Factory cut openings in doors.
- C. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Welded Frames: Weld continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 3. At postinstalled expansion type anchors, provide countersunk screws.
 - a. Dimple holes in frames for countersinking of screws to allow filling and finishing for flush appearance after painting.
 4. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor. Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on center and as follows:
 - i) Three anchors per jamb up to 60 inches in frame height.
 - ii) Four anchors per jamb from 60 to 90 inches in frame height.
 - iii) Five anchors per jamb from 90 to 96 inches in frame height.
 - iv) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in frame height.
 - v) Two anchors per head for frames more than 42 inches wide and mounted in stud partitions.
 - b. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches on center.
 6. Door Silencers: Except on weather-stripped and gasketed frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

- E. Hardware Preparation: Factory-prepare hollow-metal doors and frames to receive templated mortised hardware and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping, according to SDI A250.6, the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 "Door Hardware."
 - 1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal doors and frames for hardware.
 - 3. Where installing doors in existing frames, field verify locations and spacing of hinges and strike.
- F. Glazed Lites: Provide fixed moldings and removable stops around glazed lites. Form corners of stops and moldings with mitered hairline joints.
 - 1. Provide fixed moldings and removable stops such that each glazed lite is capable of being removed independently.
 - 2. At hollow-metal doors, provide stops and moldings flush with face of door, and with beveled or square stops unless otherwise indicated.
 - 3. Provide fixed frame moldings on exterior side of exterior doors and frames, and secure side of interior doors and frames. Provide removable stops on interior side of exterior doors and frames, and non-secure side of interior doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with type of glazing and installation types indicated.
 - 5. Provide removable stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center, and not more than 2 inches on center from each corner.

2.8 STEEL FINISHES

- A. Metallic-Coated Steel 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 regalanizing welds in steel, complying with SSPC-Paint 20.
- B. Uncoated Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

- C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed work.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch up finishes.

- c. Install frames with removable glazing stops located on secure side of opening.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
- 2. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. In-Place Concrete Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors in dimpled openings, and fill and make smooth, flush, and invisible on exposed faces after painting.
- 4. Installation Tolerances: Adjust hollow-metal frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Hollow-Metal Doors: Comply with SDI A250.8.
 - 2. Fire-Rated Hollow-Metal Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke Control Hollow-Metal Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 08 81 00 "Glass Glazing" and Section 08 88 13 "Fire-Rated Glazing," and with hollow-metal door and frame manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center, and not more than 2 inches from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying rust-inhibitive primer.

END OF SECTION 08 11 13

SECTION 08 33 23
OVERHEAD COILING SERVICE DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following overhead coiling door types:
 - 1. Non-insulated service doors, manually-operated.
- B. Related Sections include:
 - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.
- C. National Association of Architectural Metal Manufacturers/National Ornamental & Miscellaneous Metals Association (NAAMM/NOMMA):
 - 1. NAAMM/NOMMA 500: Metal Finishes Manual for Architectural and Metal Products.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling service door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and finished accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include points of attachment and their corresponding weights, and static and dynamic loads imposed on structure.
 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 5. Show locations of controls, locking devices, and other accessories.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors available for units with factory-applied finishes, for selection by Architect.
1. Minimum Number of Colors for Selection: 188.
- D. Samples for Verification: For each type of exposed finish and color required for the following components, in manufacturer's standard sizes:
1. Curtain slats.
 2. Bottom bar.
 3. Guides.
 4. Hood.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: for Installer.
- B. Sample Warranty: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling service doors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
1. Maintenance Proximity: Not more than 2 hours' normal travel time from Installer's place of business to Project site.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of overhead coiling service doors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which powder-coat finish deteriorates or otherwise fails in materials or workmanship with specified warranty period. Deterioration includes color fading, chalking, cracking, checking, and peeling or failure of paint to adhere to metal substrate.
1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling service door assemblies through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Loads: Overhead coiling doors shall withstand the effects of the following, without evidencing permanent deformation or disengagement of door components, and as required to remain operable under loads, both inward and outward:
 - 1. Lateral Loads: 25 lbs per sq ft.
- B. Seismic Performance: Overhead coiling service door assemblies shall withstand the effects of earthquake motions calculated according to requirements of the California Building Code and Seismic Design Category specific to project.

2.3 NON-INSULATED OVERHEAD COILING SERVICE DOOR

- A. Overhead Coiling Service Door, Non-Insulated: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Clopay Building Products; Model CESD10.
 - b. CornellCookson, Inc.; Model ESD10.
 - c. Overhead Door Corporation; Model 610.
 - d. Equal product in accordance with Division 1 requirements for product substitutions.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000 cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.
- C. Weight of Non-Insulated Overhead Coiling Door Curtain: 2.8 lbs per square foot maximum.
- D. Door Curtain Material: Galvanized steel.
- E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
- F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch; fabricated from galvanized-steel and finished to match door.
- G. Curtain Jamb Guides: Galvanized-steel with exposed finish matching curtain slats.

- H. Hood: Match curtain material and finish.
 - 1. Shape: Square .
 - 2. Mounting: Face of wall.
- I. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Locking bars, operable from inside with thumbturn, and outside with cylinder.
- J. Manual Door Operator: Chain-hoist operator.
- K. Door Finish:
 - 1. Powder-Coated Finish:
 - a. Color: Color as selected by Architect from manufacturer's full range.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch (24 gage) minimum; and as required.
 - 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: Nominal 0.028-inch-thick (24 gage) minimum, hot-dip galvanized-steel sheet with G90 (Z275) zinc coating, complying with ASTM A653.

2.6 LOCKING DEVICE

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Coordinate with Owner's locksmith.

2.7 CURTAIN ACCESSORIES

- A. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

2.8 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in/ft of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 MANUAL DOOR OPERATOR

- A. General: Equip overhead coiling service door with manual door operator by door manufacturer.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's powder-coat baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application and baking finish, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling service doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling service door.

END OF SECTION 08 33 23

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Door silencers installed on hollow-metal steel frames.
- B. Related Sections include:
 - 1. Section 08 11 13 "Hollow-Metal Doors and Frames" for hollow-metal steel doors and frames to receive door hardware.

1.3 REFERENCES

- A. ASTM International (American Society for Testing and Materials):
 - 1. ASTM E 283: Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Wall, and Doors Under Specified Pressure Differences Across the Specimen.
- B. Builders Hardware Manufacturers Association (BHMA):
 - 1. BHMA A156.1: Butts and Hinges.
 - 2. BHMA A156.2: Bored and Preamsembled Locks & Latches.
 - 3. BHMA A156.3: Exit Devices.
 - 4. BHMA A156.4: Door Controls – Closers.
 - 5. BHMA A156.8: Door Controls – Overhead Stops and Holders.
 - 6. BHMA A156.13: Mortise Locks & Latches Series.
 - 7. BHMA A156.16: Auxiliary Hardware.
 - 8. BHMA A156.18: Materials and Finishes.
 - 9. BHMA A156.21: Thresholds.
 - 10. BHMA A156.22: Door Gasketing and Edge Seal Systems.
 - 11. BHMA A156.28: Recommended Practices for Keying Systems.
- C. Door and Hardware Institute (DHI):
 - 1. DHI Handbook: Sequence and Format for the Hardware Schedule.

- D. Hollow Metal Manufacturers Association (HMMA):
 - 1. HMMA 831: Recommended Hardware Locations for Custom Hollow Metal Doors and Frames.
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 80: Fire Doors and Fire Windows.
 - 2. NFPA 101: Life Safety Code.
 - 3. NFPA 105: Standard Practice for the Installation of Smoke Door Assemblies and Other Opening Protectives.
 - 4. NFPA 252: Methods of Fire Tests of Door Assemblies.
- F. Steel Door Institute (SDI):
 - 1. ANSI/SDI A250.6: Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.8 (Formerly SDI-100): Recommended Specifications for Standard Steel Doors and Frames.
- G. Underwriters Laboratory (UL):
 - 1. UL 10C: Positive Pressure Fire Tests of Door Assemblies.
 - 2. UL 305: Panic Hardware.
 - 3. UL 1784: Air Leakage Tests for Door Assemblies.
- H. United States Department of Justice:
 - 1. 2010 ADA Standards for Accessible Design.

1.4 COORDINATION

- A. Installation Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing 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.
- B. Coordinate sizes and locations of concealed framing and blocking to ensure that doorstops and other wall-mounted items have sufficient backing as required for proper performance.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Samples for Verification: Submit minimum 2-inch by 4-inch plate Samples of each type of finish required, except primed finish.
1. Submit full size Sample of exposed door hardware of each type as directed by Architect in specified finish. Tag with full description for coordination with door hardware sets. Submit Samples before, or concurrent with, submission of final door hardware sets.
 - a. Full size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- C. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Submittal Sequence: Submit final door hardware sets at earliest possible date, particularly where approval of door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
 2. Format: Comply with scheduling sequence and vertical format in DHI Handbook "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page. Use same door numbers as in Contract Documents.
 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Location of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Type, style, function, size, quantity, and finish of each door hardware item.
 - d. Complete designations, including name and manufacturer, type, style, function, size, quantity, and finish of each door hardware product.
 - e. Fastenings and other pertinent information.
 - f. Explanation of abbreviations, symbols, and codes contained in schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.
 4. Existing Conditions: Where new hardware is indicated to be installed on existing doors, frames, or openings, or existing hardware is indicated to be removed and reinstalled, field verify all existing conditions. Notify Architect of any conditions that would prevent installation of scheduled hardware as required for proper operation and normal maintenance.

- a. Indicate date of project site visit on submittal. Submittals prepared without project site visit for field verification will be returned as non-compliant.
- D. Keying Schedule: Prepared by or under supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Warranty: Special warranty specified in this Section.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Installer shall have warehousing facilities in Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer.
- D. Keying Conference: Conduct conference at Project site to comply with Division 1 requirements for project meetings. In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2. Preliminary key system schematic diagram.
 - 3. Requirements for key control system.

4. Address for delivery of keys.
- E. Preinstallation Conference: Conduct conference at Project site.
 1. Review and finalize construction schedule and verify availability of materials. Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Inspect and discuss preparatory work performed by other trades.
 3. Review required testing, inspecting, and certifying procedures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.10 FIELD CONDITIONS

- A. Existing Openings: Where new hardware components are scheduled for installation on existing construction or where modifications to existing door hardware is required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper door operation and maintenance. Refer to requirements for installation of new hardware on existing doors, frames, and openings in "Action Submittals" Article.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Periods:
 - a. Locksets (non-electrified): 3 years from date of Substantial Completion.
 - b. Surface Closers: 10 years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
- C. Means of Egress Doors: Comply with California Building Code. Locks do not require use of a key, tool, or special knowledge for operation. Latches do not require more than 15 lbf to release the latch.
- D. Accessibility Requirements:
 - 1. Comply with applicable provisions of the following:
 - a. California Building Code (Title 24, Part 2), Chapters 11A and 11B.
 - b. United States Department of Justice's 2010 ADA Standards for Accessible Design.
 - 2. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 3. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - c. Exterior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - d. Fire Doors: Minimum opening force allowable by authorities having jurisdiction, but not to exceed 15 lbf.
 - 4. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 5. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position 12 degrees from the latch.

2.2 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.

- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Manufacturer and product designation are listed for each door hardware type required. Manufacturer's names are abbreviated in Part 3 "Door Hardware Sets" Article.

2.3 HINGES

- A. Hinges: BHMA A156.1, Grade 1.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Fasteners: Comply with the following:
 - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 - 2. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors; wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As scheduled in Part 3 "Door Hardware Sets" Article.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
- C. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
- D. Bored Locks: BHMA A156.2.

2.5 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1.
- B. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- C. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- D. Outside Trim: As scheduled in Part 3 "Door Hardware Sets" Article.

2.6 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Six.
 - 2. Bored-Lock Type: Cylinders with tailpieces to suit locks.
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturer's cylinders.
- D. Construction Keying: Comply with the following:
 - 1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
 - a. Replace construction cores with permanent cores as directed by Owner.
- E. Manufacturer: Same manufacturer as for locks and latches.

2.7 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - 1. Comply with all keying requirements of Owner.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the notation "DO NOT DUPLICATE."
 - 2. Quantity: In addition to one extra key blank for each lock, provide the following (as applicable):
 - a. Cylinder Change Keys: Three.

2.8 OPERATING TRIM

- A. Operating Trim: BHMA A156.6.

2.9 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4, Grade 1; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Install surface closer on non-public side of door unless indicated otherwise.
 - a. Provide parallel arm closers when located on push-side of door.

2.10 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.11 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

2.12 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Door Sweeps: Gasket material held in place by flat metal housing or flange; surface mounted to face of door with screws.
- C. Door Shoes: Gasket material held in place by metal housing; mounted to bottom edge of door with screws.
- D. Automatic Door Bottoms: Gasket material held in place by metal housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

2.13 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.14 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch thick metal as scheduled in Hardware Sets; with manufacturer's standard machine or self-tapping screw fasteners.
- B. Kickplates: Height as scheduled in Part 3 "Door Hardware Sets" Article, by door width with allowance for frame stops.

2.15 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16; Grade 1.
- B. Silencers for Metal Door Frames: Neoprene or rubber; minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.16 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

Machine Screws: For the following:

 - a. Hinges mortised to doors or frames.
 - b. Strike plates to frames.
 - c. Closers to doors and frames.
 - 2. Steel Through Bolts: For the following unless door blocking is provided:
 - a. Closers to doors and frames.
 - b. Surface-mounted exit devices.
 - 3. Spacers or Sex Bolts: for through bolting of hollow-metal doors.
 - 4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.17 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before stripping.
- 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 doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Verify concealed blocking and backing has been installed for all doorstops and other wall-mounted items occurring on framed walls.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Operating Hardware: Between 34 inches and 44 inches above finish floor, per 2016 California Building Code Section 11B-404.2.7.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in Part 3 "Door Hardware Sets" Article, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Owner's locksmith will replace construction cores with permanent cores.
 - a. Construction cores to be returned to Contractor.
- E. Thresholds: Set thresholds for exterior doors in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."
- F. Stops: Provide door stops as scheduled in Part 3 "Door Hardware Sets" Article.
 - 1. Do not mount floor stops where stop will impede traffic.

- G. Perimeter Gasketing: Apply to head and jambs, forming seal between door and frame.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position 12 degrees from the latch.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 1 Section for demonstration and training.

3.7 DOOR HARDWARE SETS

- A. Items listed in the following Schedule of Door Hardware Sets conform to requirements specified in Part 2 of this Section.
- B. Manufacturer's Abbreviations:

COR	Corbin Russwin
GLY	Glynn-Johnson
HAG	Hager
IVE	Ives
LCN	LCN
PEM	Pemko
STN	Stanley
TRI	Trimco/Builder's Brass Works
VON	Von Duprin

C. Hardware Sets:

HW Set 01

Door 102A

Qty.	Item	Product	Mfr.	Finish
3	Hinges	FBB199, 4-1/2x4-1/2 x NRP	STN	630
1	Lockset	CL3300	COR	626
1	Kickplate	KOO50, 12" x 1-1/2" LDW	TRI	630
1	Closer	4111	LCN	689
1	Overhead doorstop	100 Series	GLY	630
3	Door frame silencers	1229A	TRI	Gray
1	Threshold	271A	PEM	Alum

HW Set 02

Door 103A

Qty.	Item	Product	Mfr.	Finish
3	Hinges	FBB199, 4-1/2x4-1/2 x NRP	STN	630
1	Lockset	CL3300	COR	626
1	Kickplate	KOO50, 12" x 1-1/2" LDW	TRI	630
1	Closer	4111	LCN	689
1	Doorstop	1270CX	TRI	630
3	Door frame silencers	1229A	TRI	Gray

HW Set 03

Door 101A

Qty.	Item	Product	Mfr.	Finish
6	Hinges	FBB199, 4-1/2x4-1/2 x NRP	STN	630
2	Exit device	(reinstall existing salvaged exit devices)		
1	Kickplate	KOO50, 12" x 1-1/2" LDW	TRI	630
2	Closer	4111	LCN	689
1	Overhead doorstop	100 Series	GLY	630
1	Doorstop	1270CX	TRI	630
1 set	Frame gasketing	S88BL	PEM	Black
1	Threshold	271A	PEM	Alum

Note: Existing exit devices are concealed-rod devices for existing fire-rated hollow-metal doors

HW Set 04

Door 104A

<u>Qty.</u>	<u>Item</u>	<u>Product</u>	<u>Mfr.</u>	<u>Finish</u>
6	Hinges	FBB199, 4-1/2x4-1/2 x NRP	STN	630
2	Exit device	(reinstall existing salvaged exit devices)		
1	Kickplate	KOO50, 12" x 1-1/2" LDW	TRI	630
2	Closer	4111	LCN	689
1	Overhead doorstop	100 Series	GLY	630
1	Doorstop	1214	TRI	630
1 set	Frame gasketing	S88BL	PEM	Black
1	Threshold	271A	PEM	Alum

Note: Existing exit devices are concealed-rod devices for existing fire-rated hollow-metal doors

END OF SECTION 08 71 00

SECTION 08 81 00

GLASS GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Glass for the following glazed systems:
 - a. Hollow-metal doors and frames.
 - 2. Glazing sealants, tapes, and other accessories.
- B. Related Sections include:
 - 1. Section 08 11 13 "Hollow-Metal Doors and Frames" for hollow-metal steel window frames and doors to receive glazing, and associated glazing stops and frames.
 - 2. Section 08 88 13 "Fire-Rated Glazing" for fire-protection-rated glazing for fire-rated doors.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA):
 - 1. AAMA 800: Voluntary Specifications and Test Methods for Sealants.
- B. Architectural Glass & Metal Technician (AGMT) Certification Program.
- C. ASTM International:
 - 1. ASTM C920: Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM C1021: Standard Practice for Laboratories Engaged in the Testing of Building Systems.
 - 3. ASTM C1036: Standard Specification for Flat Glass.
 - 4. ASTM C1048: Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT, Coated, and Uncoated Glass.
 - 5. ASTM C1087: Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
 - 6. ASTM C1281: Standard Specification for Preformed Tape Sealants for Glazing Applications.
 - 7. ASTM E1300: Standard Practice for Determining Load Resistance of Glass in Buildings.

8. ASTM C1330: Standard Specification for Cylindrical Sealant Backing For Use With Cold Liquid-Applied Sealants.
 9. ASTM E2190: Standard Specification for Insulating Glass Unit Performance and Evaluation.
- D. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.
 - E. Code of Federal Regulations (CFR):
 1. 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
 2. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards.
 - F. Insulating Glass Certification Council (IGCC).
 - G. Insulating Glass Manufacturer's Alliance (IGMA):
 1. SIGMA TM-3000: North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
 - H. Lawrence Berkeley National Laboratory (LBNL):
 1. WINDOW 5.2 computer program.
 - I. National Fenestration Rating Council (NFRC):
 1. NFRC 100: Procedure for Determining Fenestration Product Thermal Properties.
 2. NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
 3. NFRC 300: Procedures for Determining Solar Optical Properties of Simple Fenestration Products.
 4. NFRC CAP 1: Certification Agency Program.
 - J. National Glass Association (NGA) with GANA (Glass Association of North America):
 1. Glazing Manual.
 - K. Safety Glazing Certification Council (SGCC).
 - L. South Coast Air Quality Management District (SCAQMD):
 1. Rule 1168 – Adhesive and Sealant Applications.

1.4 DEFINITIONS

- A. Glass Manufacturers: 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 C1036.
- C. Interspace: Space between lites of an insulating-glass unit.

- D. VOC: Volatile Organic Compound.

1.5 COORDINATION

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

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Glazing Accessory Samples: For each color of exposed tapes, gaskets, and glazing sealants, in 12-inch lengths.
- C. CALGreen Submittals:
 - 1. Manufacturer's product data for glazing sealants and primers indicating compliance with product requirements specified in "CALGreen Requirements" Article.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
 - 1. Installer.
 - 2. Manufacturers of fabricated glass units.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: For tests performed by a qualified testing agency, for the following:
 - 1. Insulating glass.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.9 QUALITY ASSURANCE

- A. Insulating-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units that is approved by primary glass manufacturers.
- B. 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.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test not fewer than four Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.12 FIELD 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or are below 40 deg F.

1.13 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Source Limitations for Glass:** Obtain from single source from single manufacturer for each glass type.
 1. Obtain all tinted glass from single source from single manufacturer, unless indicated otherwise.
 2. Obtain coated glass from single source from single manufacturer.
- B. **Source Limitations for Glazing Accessories:** For each product and installation method, obtain from single source from single manufacturer for each product and installation method.

2.2 CALGREEN REQUIREMENTS

- A. **General:** Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).
- B. **Provide glazing sealants and primers which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethylen).**

2.3 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Probability of Breakage:
 - 1. Glazing Not More Than 15 Degrees From Vertical Plane: Not greater than 8 lites per 1000.
 - a. Load Duration: 3 seconds.
- C. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Maximum Lateral Deflection: Not more than that required to maintain glazing edge support, and as required to comply with California Building Code, Chapter 24.
- E. Safety Glazing: Where tempered or laminated glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing system framing members and glazing components.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- G. 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 of thickness indicated.
 - 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. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq ft x deg F.
 - 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.
 - 6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.4 GLASS PRODUCTS, GENERAL

- A. 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. NGA Publications: "Glazing Manual," and "Laminated Glazing Reference Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark safety glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction, or of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Glass Thicknesses: Glass thicknesses indicated are minimums. Provide glass that complies with specified performance requirements and is not less than thickness indicated.
- E. Strength: Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.5 GLASS PRODUCTS

- A. Fully Tempered Float Glass: ASTM C1048.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. Kind: Kind FT (fully tempered).
 - 3. Condition: Comply with requirements for uncoated and coated glass as follows:
 - a. Uncoated Vision Glass: Condition A.
 - b. Coated Vision Glass: Condition C.
 - 4. Type: Type I (transparent flat glass).
 - a. Class:
 - i) Where Clear Glazing is Indicated: Class 1 (clear).
 - ii) Where Tinted Glazing is Indicated: Class 2 (tinted).
 - Tint Color: As indicated in Glass Schedules at end of this Section.
 - 5. Quality: Q3.

- B. Monolithic Glass Types: Refer to “Monolithic Glass Schedule” at end of this Section.

2.6 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Viracon, Inc.
 2. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.
1. Sealing System: Dual seal, with manufacturer’s standard primary and secondary sealants.
 2. Perimeter Spacer: Manufacturer’s standard spacer material and construction.
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.
- C. Glass Lites: Comply with applicable requirements in “Glass Products” and “Laminated Glass” Articles.
- D. Insulating Glass Types: Refer to “Insulating Glass Schedule” at end of this Section.

2.7 GLAZING SEALANTS

- A. General:
1. Compatibility: Provide 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.
- B. Glazing Sealant: Single-component, nonsag, neutral-curing silicone glazing sealant; ASTM C920, Type S, Grade NS, Class 50 minimum, Use NT (exposure), Use G, A, O (joint substrate)
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795 Silicone Building Sealant.
 - b. Momentive Performance Materials, Inc./GE; SCS2000 SilPruf.
 - c. Pecora Corporation; 895.
 - d. Tremco Incorporated; Spectrem 2.
 - e. Equal product in accordance with Division 1 requirements for product substitutions.

2. Colors of Exposed Glazing Sealants: Translucent.
3. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below (AAMA standards referenced below are contained within AAMA 800):
 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; and complying with AAMA 800 for the following types (AAMA standards referenced below are contained within AAMA 800):
 1. AAMA 810.1, Type I, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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:
 1. Elastomeric material with Shore, Type A durometer hardness of 85, plus or minus 5.
 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 1. Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 1. Elastomeric material with Shore A durometer hardness per manufacturer's written instructions.

2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Framing System Glazing Stops and Gaskets:
 1. Hollow-Metal Steel Frames: Refer to Section 08 11 13 "Hollow-Metal Doors and Frames" for removable glazing stops.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit 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.
 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components as specified in "Performance Requirements" Article.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, 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 systems.
 3. Minimum required face and 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.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed Work.

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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 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 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.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- 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 in writing 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 right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant, where applicable.
- 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 towards centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

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

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than 4 work days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear fully tempered float glass:
 - 1. Thickness: 6.0 mm ($\pm 1/4$ inch).
 - 2. Provide safety glazing labeling.
 - 3. Optical and Thermal Properties:
 - a. Visible Light Transmittance: 89 percent.
 - b. Solar Heat Gain Coefficient: 0.82 maximum.
 - c. Shading Coefficient: 0.94.
 - d. Winter Nighttime U-Factor: 1.02 maximum.
 - e. Summer Daytime U-Factor: 0.93 maximum.

3.9 INSULATING-GLASS SCHEDULE

- A. Clear low-e insulating safety glass:
 - 1. Overall Unit Thickness: 25.0 mm (± 1 inch).
 - 2. Outdoor Lite: Fully tempered clear float glass with sputter-coated low-e coating on No. 2 surface.
 - a. Thickness: 6.00 mm ($\pm 1/4$ inch).
 - b. Low-E Coating: Viracon VNE1-53 or equal, subject to compliance with requirements.
 - 3. Interspace:
 - a. Depth: 13.00 mm ($\pm 1/2$ inch).
 - b. Content: Argon.
 - 4. Indoor Lite: Fully tempered clear float glass.
 - a. Thickness: 6.00 mm ($\pm 1/4$ inch).
 - 5. Provide safety glazing labeling.
 - 6. Optical and Thermal Properties:
 - a. Visible Light Transmittance: 49 percent minimum.
 - b. Solar Heat Gain Coefficient: 0.22 maximum.
 - c. Shading Coefficient: 0.26.
 - d. Winter Nighttime U-Factor: 0.24 maximum.
 - e. Summer Daytime U-Factor: 0.20 maximum.

END OF SECTION 08 81 00

SECTION 08 88 13
FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Fire-rated glazing for installation in fire-rated framing systems:
 - a. Fire-protection-rated.
- B. Related Sections include:
 - 1. Section 08 11 13 "Hollow-Metal Doors and Frames" for fire-rated hollow-metal doors to receive fire-rated glazing.
 - 2. Section 08 81 00 "Glass Glazing" for non-fire-rated glass.

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 800: Voluntary Specifications and Test Methods for Sealants.
 - 2. AAMA 804.3: Back-Bedding Mastic Glazing Tapes.
 - 3. AAMA 806.3: Back-Bedding Mastic Glazing Tapes.
 - 4. AAMA 810.1: Expanded Cellular Glazing Tapes.
- B. ASTM International:
 - 1. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM C 1036: Standard Specification for Flat Glass.
 - 3. ASTM C 1048: Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - 4. ASTM C 1172: Standard Specification for Laminated Architectural Flat Glass.
 - 5. ASTM C 1281: Standard Specification for Preformed Tape Sealants for Glazing Applications.
 - 6. ASTM C 1330: Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
 - 7. ASTM E 119: Standard Test Methods for Fire Tests of Building Construction and Materials.

- C. Code of Federal Regulations (CFR):
 - 1. 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
 - 2. 40 CFR, Part 59, Subpart D (EPA Method 24): National Volatile Organic Compound Emission Standards.
- D. Glass Association of North America (GANA):
 - 1. Glazing Manual.
 - 2. Laminated Glazing Reference Manual.
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 257: Standard on Fire Test for Window and Glass Block Assemblies.
- F. National Glass Association (NGA):
 - 1. Certified Glass Installer Program.
- G. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1168 – Adhesive and Sealant Applications.
- H. Underwriters Laboratories (UL):
 - 1. UL 9: Fire Tests of Window Assemblies.
 - 2. UL 10B: Fire Tests of Door Assemblies.
 - 3. UL 263: Fire Tests of Building Construction and Materials.

1.4 DEFINITIONS

- A. Fire-Protection Rating: The period of time that an opening protective will maintain the ability to confine a fire as determined by the following tests:
 - 1. Doors: NFPA 252 or UL 10B.
 - 2. Windows: NFPA 257 or UL 9.
- B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

1.5 COORDINATION

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification:
 - 1. Each type of fire-rated glass product, in the form of 12-inch square samples.
 - 2. Each color of exposed gasket and glazing sealant, in 12-inch lengths

- C. CALGreen Submittals:
 - 1. Manufacturer's product data for sealants and sealant primers indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
 - 1. Installers.
 - 2. Manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- B. Product Test Reports: For each listed product, for tests performed by a qualified testing agency, indicating compliance with requirements for fire-rated glazing.
- C. Sample Warranties: For special warranties.

1.8 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect fire-rated glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with fire-rated insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with exterior fire-rated 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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or are below 40 deg F
- B. Do not proceed with interior fire-rated glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.11 WARRANTY

- A. Manufacturer's Special Warranty on Fire-Rated Glass: Manufacturer agrees to replace fire-rated laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to 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. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Fire-Rated Glass: Obtain from single source from single manufacturer for each fire-rated glass type.
- B. Source Limitations for Fire-Rated Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 CALGREEN REQUIREMENTS

- A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).
- B. Provide sealants and sealant primers which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethylene).

2.3 PERFORMANCE REQUIREMENTS

- A. Installed fire-rated glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials; or other defects in construction.
- B. Safety Glazing: Provide fire-rated glazing that complies with 16 CFR 1201, Category II.
- C. Fire-Protection-Rated Glazing: Provide fire-protection-rated glazing listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing as indicated below:
 - 1. Doors: NFPA 252 or UL 10B, including hose stream test, except as noted below.
 - 2. Windows: NFPA 257 or UL 9, including hose stream test.

2.4 FIRE-RATED GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization 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: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Permanently mark fire-rated glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction, or of the manufacturer. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.5 GLASS PRODUCTS

- A. Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- B. Low-Iron Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.
- C. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless indicated otherwise.

2.6 FIRE-PROTECTION-RATED MONOLITHIC GLAZING

- A. Fire-Protection-Rated Glass (Glass Type FP): Laminated glass made from two plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; polished on both exposed surfaces; complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 1. Product: Subject to compliance with requirements, provide the following:
 - a. Technical Glass Products; FireLite Plus (Premium Grade).
 - b. Equal product in accordance with Division 1 requirements for product substitutions.

- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F temperature-rise limitation; and the fire-protection rating in minutes.

2.7 FIRE-RATED GLAZING ACCESSORIES

- A. General: Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with fire-rated glazing products and each other and are approved by testing agencies that listed and labeled fire-rated glazing products with which products are used for applications and fire-protection or fire-resistant ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' writing instructions for selecting glazing sealants suitable for applications indicated.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation: 795.
 - b. GE Advanced Materials – Silicones; SilPruf SCS2000.
 - c. Pecora Corporation; 895.
 - d. Tremco Incorporated; Spectrem 3.
 - e. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
 - 3. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below (AAMA standards referenced below are contained within AAMA 800):
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types (AAMA standards referenced below are contained within AAMA 800):
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of fire-rated glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- C. Perimeter Insulation for Fire-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-rated glazing product with which it is used for application and fire-rating indicated.

2.9 FABRICATION OF FIRE-RATED GLAZING UNITS

- A. Fabricate fire-rated glazing units in sizes required to fit 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- 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.
- B. Examine fire-rated glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 FIRE-RATED GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-rated glazing products.

- B. Comply with combined written instructions of manufacturers of fire-rated glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- 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 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 fire-rated glazing manufacturer for installing glass lites.
- G. Provide spacers for fire-rated glazing lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glazing. 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 minimum bite of spacers on fire-rated glass as recommended in writing by fire-rated glazing manufacturer, 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 glazing lites from moving sideways in glazing channel, as recommended in writing by glazing manufacturer and according to requirements in referenced glazing publications.
- I. Set fire-rated glazing lites with proper orientation so that coatings face fire side or protected side as required to achieve fire rating.
- 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 immediately before each glazing unit is installed.
- F. Center glazing 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.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glazing and frame or fixed stop, so it is securely in place with joints miter-cut and bonded together at corners.
- C. Installation with Drive-In Wedge Gaskets: Center glazing 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 towards centers of openings.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glazing from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace fire-rated glazing that is damaged during construction period.

- D. Wash fire-rated glazing on both exposed surfaces in each area of Project not more than 4 days before date scheduled for inspections that establish date of Substantial Completion. Wash fire-rated glazing as recommended in writing by fire-rated glazing manufacturer.

END OF SECTION 08 88 13

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Gypsum board.
 - a. Regular.
 - 2. Cutting and patching of existing gypsum board.
- B. Related Sections include:
 - 1. Section 05 40 00 "Cold-Formed Structural Metal Framing" for load-bearing cold-formed metal framing that supports gypsum board.
 - 2. Section 09 91 00 "Painting" for primers and finish coats applied to gypsum board surfaces.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM A 653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM C 475: Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 3. ASTM C 645: Standard Specification for Nonstructural Steel Framing Members.
 - 4. ASTM C 834: Standard Specification for Latex Sealants.
 - 5. ASTM C 840: Standard Specification for Application and Finishing of Gypsum Board.
 - 6. ASTM C 954: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.112 inch in Thickness.
 - 7. ASTM C 1002: Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 8. ASTM C 1047: Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - 9. ASTM C 1396: Standard Specification for Gypsum Board.

- B. Gypsum Association (GA):
 - 1. GA-214: Recommended Levels of Gypsum Board Finish.
- C. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1168 – Adhesive and Sealant Applications.
- D. UL Environment:
 - 1. GREENGUARD Gold certification program.

1.4 DEFINITIONS

- A. STC: Sound Transmission Class.
- B. VOC: Volatile Organic Compound.

1.5 ACTION SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 25 square feet in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting and wall-coverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed and integrated into adjacent surfaces at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, surface contamination, corrosion, construction traffic, and other potential causes of damage. Stack gypsum panels flat and supported on risers on a flat platform to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads or trim.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

- A. Gypsum Panel Sizes: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Gypsum Board: Type X, ASTM C 1396.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Gypsum LLC; ToughRock Fireguard X.
 - b. National Gypsum Company; Gold Bond Fire-Shield Gypsum Board.
 - c. USG Corporation; SHEETROCK Brand Firecode X Gypsum Panel.
 - d. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.
 - 4. VOC Emissions: Complying with the testing and product requirements of the California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1, February 2010," using the applicable exposure scenario.
 - a. Certification: UL Environment; GREENGUARD Gold.

2.2 TRIM ACCESSORIES

- A. Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead: Type with face flange to receive joint compound.
 - b. LC-bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.3 JOINT TREATMENT MATERIALS

- A. General: Provide materials complying with ASTM C 475 and the recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.
- B. Joint Tape:
 - 1. Paper-Faced Gypsum Board: Paper.
- C. Joint Compound for Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - 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.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. 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 inch (22 gage) to 0.112 inch (12 gage) thick.
- C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0346 inch (20 gage), unless indicated otherwise.
 - 2. Protective Coating: ASTM A 653, G60 (Z180).
 - 3. Depth: 7/8 inch, unless indicated otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 CUTTING AND PATCHING

- A. Cut, patch, replace, and repair existing gypsum board surfaces as necessary to accommodate other work, including installation of concealed conduits and backing in existing wall cavities, and to remove dents and other imperfections, and restore surface to specified finish levels.
- B. When cutting out sections of existing gypsum board areas, cut gypsum board along supporting framing members.
- C. When patching and infilling existing gypsum board areas, produce invisible joint between existing and new surfaces. Match existing gypsum board finish.

3.3 APPLYING AND FINISHING GYPSUM BOARD PANELS

- A. Comply with ASTM C 840.
- B. Where indicated, install sound attenuation blankets and thermal batt insulation in accordance with requirements of Section 07 21 00 "Building Insulation," before installing gypsum board panels, unless blankets are readily installed after panels have been installed on one side.
 - 1. Place insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions and tight to items passing through ceilings.
- C. Install Type X gypsum board panels at all locations.
- D. Install gypsum board panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.
- E. Locate panel edges and end joints over continuous 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.
 - 1. Attach gypsum board panel edges to framing provided at perimeter of openings and cutouts.
- F. Form control and expansion joints with space between edges of adjoining gypsum board panels.
- G. Cover both faces of stud partition framing with gypsum board 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 square feet in area.

- H. Attachment to Cold-Formed Metal Framing: Attach gypsum board panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges, first.
- I. Wood Framing: Install gypsum board panels over wood framing, with floating internal corner construction. Do not attach gypsum board panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float panels over these members, or provide control joints to counteract wood shrinkage.
- J. Fit gypsum board panels around ducts, pipes, and conduits.
- K. Where partitions intersect open concrete coffers, concrete joists and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum board panels to fit profile formed by coffers, joists, and other structural members; allow 1/4 to 3/8-inch wide joints to install sealant.
- L. Isolate perimeter of gypsum board panels applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
 - 1. Refer to Section 07 84 50 "Fire-Resistive Joint Systems" for head-of-wall joint systems at fire-rated partitions.
- M. Space fasteners in gypsum board panels according to referenced gypsum board application and finishing standard and manufacturer's written instructions.
- N. Single-Layer Application:
 - 1. On ceilings, apply gypsum board panels before wall/partition gypsum board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum board 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 gypsum board panels.
 - 3. On Z-furring members, apply gypsum board panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum board panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

- B. Control Joints: Install control joints at locations indicated on Drawings, or if not indicated, according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Install trim as follows:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead (J-Bead): Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to GA-214 "Recommended Levels of Gypsum Board Finish."
 - 1. Gypsum board to receive paint finish, and as indicated otherwise: Level 4. .
 - a. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

3.6 PROTECTION

- A. Protect adjacent surfaces from joint compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board installation.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet or moisture damaged, or 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 09 29 00

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and the field application of paint systems as specified in Paint Systems Schedules at the end of this Section.
- B. Related Sections include:
 - 1. Section 05 12 00 "Structural Steel" for shop priming of structural steel.
 - 2. Section 05 50 00 "Metal Fabrications" for shop priming of metal fabrication items.
 - 3. Section 08 11 13 "Hollow-Metal Doors and Frames" for shop priming of hollow-metal steel doors and frames to receive field painted finish.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
 - 2. ASTM D 523: Standard Test Method for Specular Gloss.
- B. California Air Resources Board:
 - 1. Suggested Control Measure for Architectural Coatings.
- C. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.
- D. Master Painters Institute (MPI):
 - 1. MPI Architectural Painting Specification Manual.
 - 2. MPI Maintenance Repainting Manual.
- E. Society for Protective Coatings (SSPC):
 - 1. SSPC-PA 1: Shop, Field, and Maintenance Painting of Steel.
 - 2. SSPC-SP 2: Hand Tool Cleaning.
 - 3. SSPC-SP 3: Power Tool Cleaning.
- F. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1168 – Adhesive and Sealant Applications.

1.4 DEFINITIONS

- A. VOC: Volatile Organic Compounds.
- B. Gloss Levels: As follows, according to ASTM D 523:
 - 1. Flat: Gloss Level 1 (not more than 5 units at 60 degrees and 10 units at 85 degrees).
 - 2. Low-Sheen: Gloss Level 3 (10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees).
 - 3. Semi-Gloss: Gloss Level 5 (35 to 70 units at 60 degrees).
 - 4. Gloss: Gloss Level 6 (70 to 85 units at 60 degrees), unless indicated otherwise.

1.5 COORDINATION

- A. Review other Sections of these Specifications in which prime paints are to be provided. Where requested by those trades performing Work in other Sections, provide information regarding paint products specified in this Section to ensure compatibility of overall painting system.
 - 1. Surface preparation, priming, and coats of paint specified in this Section are in addition to surface preparation and shop priming specified in other Sections of these Specifications.
 - 2. Where prime paints specified in other Sections of these Specifications are incompatible with prime or topcoats specified in this Section, provide barrier coats, or remove and reprime as required.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Indicate preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product indicated, submit manufacturer's fan deck with full range of colors for selection by Architect.
- C. Samples for Verification: For each type of paint system and each color and sheen of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches by 12 inches.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

E. CALGreen Submittals:

1. Manufacturer's product data for paints and coatings indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run (batch mix) as materials applied and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gallon of each material and color applied.

1.8 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq ft.
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F or as otherwise recommended in paint manufacturer's written instructions.

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

1.10 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F or as otherwise stated in paint manufacturer's written instructions.

- B. Do not apply paints 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by manufacturers as indicated in Paint Systems Schedules at end of this Section.
 - 1. Material Quality: Provide manufacturer's best quality (e.g. "Premium" quality) paint products for each paint system indicated.
 - 2. Source Limitations: Unless indicated otherwise, provide primer and topcoat products as manufactured by a single manufacturer for each paint system as specified for a given substrate and sheen.

2.2 CALGREEN REQUIREMENTS

- A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).
- B. Paints and Coatings: Provide paints and coatings that comply with VOC limits in Table 1 of the California Air Resources Board (ARB) Architectural Coatings Suggested Control Measure for Architectural Coatings, unless more stringent local limits apply.

2.3 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As indicated at end of this Section.

2.4 ACCESSORY MATERIALS

- A. Elastomeric Sealant: Single-component, non-sag, paintable joint sealant complying with ASTM C 920 Type S, Grade NS, Class 12.5.

2.5 SOURCE QUALITY CONTROL

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

site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.

2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with electronic moisture meter as follows:
 1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is dry and sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 1. Beginning coating application constitutes acceptance of surfaces and conditions.

3.2 PREPARATION - GENERAL

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
 1. For renovation products, comply with recommendations in "MPI Maintenance Repainting Manual."
- B. Remove hardware, covers, plates, machined surfaces, and similar items already in place that are removable and not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Unprimed Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 3.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as is used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 PREPARATION - EXISTING PAINTED SURFACES

- A. Exterior:
 - 1. General: Mechanically clean surface using high-pressure water-wash or other feasible means to remove dirt, contaminants, rust scale, and loose and peeling paint or other coatings.
 - a. Remove mildew with a solution of one part household bleach to three parts water, as required to leave an uncontaminated, clean surface. Where necessary, increase strength of solution and scrub with a soft bristle brush.
 - 2. Nongalvanized Steel (Ferrous Metal):
 - a. After initial washing, remove remaining loose and peeling paint and other coatings in accordance with SSPC-SP 2 "Hand Tool Cleaning," or SSPC-SP 3 "Power Tool Cleaning."
 - 3. Galvanized Steel, Aluminum, Copper, Bronze (Nonferrous Metal):
 - a. After initial washing, remove remaining loose and peeling paint and other coatings in accordance with SSPC-SP 2 "Hand Tool Cleaning."
- B. Interior:
 - 1. General: Mechanically clean surfaces to remove dirt, contaminants, rust scale, and loose and peeling paint or other coatings.
 - a. Dull glossy surfaces by sanding or chemical means for maximum adhesion.
 - b. Remove mildew with a solution of one part household bleach to three parts water, as required to leave an uncontaminated, clean surface. Where necessary, increase strength of solution and scrub with a soft bristle brush.

3.4 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended in writing by paint manufacturer.
 - a. In addition to paint manufacturer's recommendations, at high-impact gypsum board substrates, apply primer coat to a minimum dry film thickness of 1.8 mils.
 - 3. Paint surfaces behind movable items, including equipment and furniture, same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 4. Paint doors on tops, bottoms, side edges, and cutouts same as faces of door, unless otherwise indicated.
 - 5. Paint entire exposed surface of hollow-metal door and window frames.
 - 6. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 8. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of a subsequent coat does not cause lifting or loss of adhesion of the undercoat.
 - 9. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to ensure a topcoat with no burn-through or other defects due to insufficient sealing.
- B. Paint all exposed surfaces, regardless of whether designated in Color Schedule. The term "exposed surface" includes area visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas as required to maintain visual continuity and protection.
- C. Do not paint the following prefinished items unless indicated otherwise:
 - 1. Exterior Prefinished Items: Do not paint prefinished exterior items, including the following:
 - a. Metal roof and siding panels with factory-applied finish.
 - b. Metal wall and soffit panels with factory-applied finish.
 - c. Integral color concrete masonry units.
 - d. Cast stone copings, sills, trim and other miscellaneous shapes.
 - e. Aluminum storefront, curtainwall, and entrance systems with factory-applied finish or anodized finish.
 - f. Aluminum windows with factory-applied finish or anodized finish.

- g. Signage.
 - h. Light fixtures.
2. Interior Prefinished Items: Do not paint prefinished interior items, including the following:
 - a. Suspended acoustical ceiling panels and exposed grid.
 - b. Applied acoustical ceiling and wall panels.
 - c. Vinyl wall covering.
 - d. Finish hardware.
 - e. Plastic laminate-faced wood casework and other surfaces.
 - f. Transparent finish wood casework.
 - g. Ceramic tile.
 - h. Signage.
 - i. Operable panel partitions and accordion folding partitions.
 - j. Toilet compartments and urinal screens.
 - k. Shower compartments.
 - l. Elevator doors, frames, and car interior.
 - m. Mechanical and electrical equipment with factory-applied finish.
 - n. Light fixtures.
 3. Wood Surfaces with Transparent Finish: Do not paint surfaces of wood indicated to receive transparent finish.
 4. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas not exposed to view.
 5. Operating Parts: Do not paint moving parts of operating units, mechanical and electrical parts, such as valves, dampers, linkages, sensing devices, and motor and fan shafts.
 6. Labels: Do not paint over labels, such as those indicating fire-ratings, or equipment identification, performance rating, or nomenclature plates.
- D. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
 - E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 - F. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

- G. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Paint items exposed in occupied spaces including, but not limited to, the following:
1. Mechanical Work:
 - a. Exposed metal ductwork and supports, unless noted otherwise.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Tanks that do not have factory-applied final finishes.
 - f. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - i) Paint with a flat black, non-specular paint.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Wall and ceiling access panels.
 - i) Paint to match surrounding wall or ceiling surface, unless noted otherwise.
 - i. Air inlets and outlets.
 - i) Paint to match surrounding wall or ceiling surface, unless noted otherwise.
 - j. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 2. Electrical, Communication, and Electronic Safety and Security Work:
 - a. Switchgear without factory-applied final finish.
 - b. Panelboards.
 - c. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 - d. Exposed conduits.
 - e. Enclosures and boxes.

3.5 FIELD QUALITY CONTROL

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

3.6 CLEANING AND PROTECTION

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

3.7 INTERIOR PAINT SYSTEMS SCHEDULE – UNPAINTED SUBSTRATES

- A. General: Subject to compliance with requirements, for each of the following interior unpainted substrate types and sheens, provide one of the listed paint systems or equal products in accordance with Division 1 requirements for product substitutions.
- B. Regular Gypsum Board - Semi-Gloss Sheen:
 - 1. Dunn-Edwards Paints:
 - a. First Coat: VNPR00-1 VINYLASTIC Premium Interior Wall Sealer
 - b. Second Coat: SPMA50 SUPREMA Interior Semi-Gloss Paint
 - c. Third Coat: SPMA50 SUPREMA Interior Semi-Gloss Paint
 - 2. Kelly-Moore Paints:
 - a. First Coat: 971 AcryPlex Interior PVA Primer/Sealer
 - b. Second Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 - c. Third Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 - 3. Sherwin-Williams Company:
 - a. First Coat: B28W02600 ProMar 200 Zero VOC Interior Latex Primer
 - b. Second Coat: B31-2600 Series ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - c. Third Coat: B31-2600 Series ProMar 200 Zero VOC Interior Latex Semi-Gloss
- C. Hollow-Metal Steel Doors and Frames (Shop-Primed), and Steel Railings - Semi-Gloss Sheen:
 - 1. Dunn-Edwards Paints:
 - a. First Coat: ULDM00-0-GR ULTRASHIELD Interior/Exterior DTM Gray Primer
 - b. Second Coat: ULDM50 ULTRASHIELD Interior/Exterior DTM Semi-Gloss Paint

- c. Third Coat: ULDM50 ULTRASHIELD Interior/Exterior DTM Semi-Gloss Paint
 - 2. Kelly-Moore Paints:
 - a. First Coat: 5725 DTM Acrylic Primer/Finish
 - b. Second Coat: 5885 DTM Acrylic Semi-Gloss Enamel
 - c. Third Coat: 5885 DTM Acrylic Semi-Gloss Enamel
 - 3. Sherwin-Williams Company:
 - a. First Coat: B66W00310 Pro Industrial Pro-Cryl Universal Primer
 - b. Second Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss
 - c. Third Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss
- D. Shop-Primed and Unprimed Steel (Other Than Hollow-Metal Steel Doors and Frames, and Steel Railings) - Semi-Gloss Sheen:
 - 1. Dunn-Edwards Paints:
 - a. First Coat: BRPR00-2-WH BLOC-RUST Premium Interior/Exterior Rust Preventative Metal Primer
 - b. Second Coat: EVSH50-2 EVERSIELD Exterior/Interior Semi-Gloss Paint
 - c. Third Coat: EVSH50-2 EVERSIELD Exterior/Interior Semi-Gloss Paint
 - 2. Kelly-Moore Paints:
 - a. First Coat: 5725 DTM Acrylic Primer/Finish
 - b. Second Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 - c. Third Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 - 3. Sherwin-Williams Company:
 - a. First Coat: B66W00310 Pro Industrial Pro-Cryl Universal Primer
 - b. Second Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss
 - c. Third Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss

3.8 INTERIOR PAINT SYSTEMS SCHEDULE - EXISTING PAINTED SUBSTRATES

- A. General: Paint systems listed below are intended for application over interior substrates with existing paint coatings. Subject to compliance with requirements, for each of the following substrate types and sheens, provide one of the listed paint systems or equal products in accordance with Division 1 requirements for product substitutions.
 - 1. Where spot priming is indicated, only those unpainted areas in which bare substrate is exposed are required to be primed.

- B. Existing Painted Regular Gypsum Board - Semi-Gloss Sheen:
1. Dunn-Edwards Paints:
 - a. Spot Prime: VNPR00-1 VINYLASTIC Premium Interior Wall Sealer
 - b. First Coat: SPMA50 SUPREMA Interior Semi-Gloss Paint
 - c. Second Coat: SPMA50 SUPREMA Interior Semi-Gloss Paint
 2. Kelly-Moore Paints:
 - a. Spot Prime: 971 AcryPlex Interior PVA Primer/Sealer
 - b. First Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 - c. Second Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 3. Sherwin-Williams Company:
 - a. Spot Prime: B28W02600 ProMar 200 Zero VOC Interior Latex Primer
 - b. First Coat: B31-2600 Series ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - c. Second Coat: B31-2600 Series ProMar 200 Zero VOC Interior Latex Semi-Gloss
- C. Existing Painted Hollow-Metal Steel Doors and Frames, and Steel Railings - Semi-Gloss Sheen:
1. Dunn-Edwards Paints:
 - a. Spot Prime: ULDM00-0-GR ULTRASHIELD Interior/Exterior DTM Gray Primer
 - b. First Coat: ULDM50 ULTRASHIELD Interior/Exterior DTM Semi-Gloss Paint
 - c. Second Coat: ULDM50 ULTRASHIELD Interior/Exterior DTM Semi-Gloss Paint
 2. Kelly-Moore Paints:
 - a. Spot Prime: 5725 DTM Acrylic Primer/Finish
 - b. Second Coat: 5885 DTM Acrylic Semi-Gloss Enamel
 - c. Third Coat: 5885 DTM Acrylic Semi-Gloss Enamel
 3. Sherwin-Williams Company:
 - a. Spot Prime: B66W00310 Pro Industrial Pro-Cryl Universal Primer
 - b. First Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss
 - c. Second Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss

- D. Existing Painted Steel (Other Than Hollow-Metal Steel Doors and Frames and Steel Railings) - Semi-Gloss Sheen:
1. Dunn-Edwards Paints:
 - a. Spot Prime: UGPR00-1 ULTRA-GRIP Premium Interior/Exterior Multi-Surface Primer
 - b. First Coat: EVSH50-2 EVERSIELD Exterior/Interior Semi-Gloss Paint
 - c. Second Coat: EVSH50-2 EVERSIELD Exterior/Interior Semi-Gloss Paint
 2. Kelly-Moore Paints:
 - a. Spot Prime 5725 DTM Acrylic Primer/Finish
 - b. First Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 - c. Second Coat: 1650 AcryPlex Interior Semi-Gloss Enamel
 3. Sherwin-Williams Company:
 - a. Spot Prime: B66W00310 Pro Industrial Pro-Cryl Universal Primer
 - b. First Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss
 - c. Second Coat: B66-650 Series Pro Industrial Acrylic Semi-Gloss

END OF SECTION 09 91 00

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Polymer panel Signs.
 - a. Room identification.
 - b. Toilet rooms.
 - c. Miscellaneous informational signage.
 - d. Fire protection signage.
 - e. Tactile exit signage.
- B. Related Sections include:
 - 1. Division 22 Section for labels, tags, and nameplates for plumbing systems and equipment.
 - 2. Division 23 Section for labels, tags, and nameplates for HVAC systems and equipment.
 - 3. Division 26 Section for labels, tags, and nameplates for electrical systems and equipment.

1.3 REFERENCES

- A. California Air Resources Board:
 - 1. Suggested Control Measure for Architectural Coatings.
- B. California Building Code (CBC) - California Code of Regulations, Title 24, Part 2.
- C. California Green Building Standards Code (CALGreen) – California Code of Regulations, Title 24, Part 11.
- D. Federal Standard 595B: Colors.
- E. South Coast Air Quality Management District (SCAQMD):
 - 1. Rule 1168 – Adhesive and Sealant Applications.
- F. United States Department of Justice:
 - 1. 2010 ADA Standards for Accessible Design.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Include elevations and layout for each sign. Show sign message, typestyles, graphic elements, including tactile characters and Braille.
 - 2. Show sign mounting heights, anchorage details, locations of supplementary supports to be provided by others, and accessories.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for selection by Architect for the following:
 - 1. Polymer Signs:
 - a. Minimum Number of Available Colors: 40.
 - 2. Include representative Samples of available typeface styles and graphic symbols, if not specified in Contract Documents.
- D. Samples for Verification: For each type of sign assembly, for each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
 - 1. Panel Signs: 6 inches by 6 inches.
 - 2. Reviewed Samples will not be returned for installation in Project.
- E. Sign Schedule: Use same designations indicated on Drawings.
- F. CALGreen Submittals:
 - 1. Manufacturer's product data for adhesives and paints for signage indicating compliance with product requirements specified in "CALGreen Requirements" Article.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

- C. Inspection: Tactile signage to be field inspected after installation per California Building Code, Section 11B-703.1.1.2.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in protective wrapping or packaging to protect from damage during handling and storage.
- B. Store and handle in accordance with manufacturer's written instructions.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration, including fading, of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic images.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period:
 - a. Polymer-Based Panel Signs: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of sign through one source from a single manufacturer.

2.2 CALGREEN REQUIREMENTS

- A. General: Conform with all applicable requirements of the California Green Building Standards Code (CALGreen).
- B. Provide adhesives which comply with current VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule 1168, except as noted otherwise below. Such products shall also comply with Rule 1168 prohibition of the use of certain toxic compounds (chloroform, ethylene, dichloride, methylene chloride, perchloroethylene, and trichloroethylen).
- C. Paints and Coatings: Provide paints and coatings for panel signs that comply with VOC limits in Table 1 of the California Air Resources Board (ARB) Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.

2.3 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with requirements for signage as per the following:
 - 1. California Building Code (Title 24, Part 2), Chapter 11B.
 - 2. United States Department of Justice's 2010 ADA Standards for Accessible Design.

2.4 POLYMER PANEL SIGNS

- A. Polymer Panel Signs: Unframed, polymer-based panel sign. Applied text is not acceptable. Panel and text color achieved through applied UV-resistant polyurethane enamel paint.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - a. ASI Sign Systems, Inc.
 - b. Corporate Sign Systems.
 - c. Mohawk Sign Systems.
 - d. Nova Polymers, Inc
 - e. Manufacturer of equal products in accordance with Division 1 requirements for product substitutions.
- B. Exterior signs to be rated by manufacturer for exterior installation.
- C. Thickness: 1/4 inch.
- D. Fabricate signs with smooth uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; edges smoothly finished to comply with the following requirements:
 - 1. Edge Conditions: Square cut, with edges eased to 1/32 inch radius.
 - 2. Corner Conditions (Front Elevation View): Square, with corners eased to 1/16 inch radius.
- E. Sign Text and Graphic Content: In addition to requirements specified herein, comply with requirements indicated on Drawings for content, typeface styles, sizes, spacing, and layout. Italicized text used in this Section indicates actual text message to be fabricated on sign.
- F. Tactile and Braille Copy: Where indicated, provide tactile text characters and corresponding Braille. Fabricate by manufacturer's photopolymer (exterior grade at exterior signs), blast-etching, engraving, or other process to form raised text and Braille dots in conformance with requirements of California Building Code and United States Justice Department's 2010 ADA Standards for Accessible Design, and integral with sign panel. Produce precisely formed characters with clean square-cut edges for text and rounded edges for Braille. Applied text is not acceptable.
 - 1. Tactile Text:
 - a. Raised Text Depth: 1/32 inch above background.

- b. Text Character Type: Uppercase, sans serif. Font as indicated.
 - c. Text Character Proportions: As indicated, and conforming with the following:
 - i) Width-to-Height Ratio: For indicated font, uppercase letter "O" shall have a width which is 60 percent minimum and 110 percent maximum of the height of uppercase letter "I."
 - ii) Stroke Thickness: For indicated font, stroke thickness of uppercase letter "I" shall be 15 percent maximum of the height of the character.
 - d. Text Character Spacing: Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces.
 - i) Characters With Rectangular Cross Sections: Spacing between individual raised characters shall be a minimum of 1/8 inch, and a maximum of 4 times the raised character stroke width.
 - ii) Characters With Other Cross Sections: Spacing between individual raised characters shall be a minimum of 1/16 inch, and a maximum of 4 times the raised character stroke width at the base of the cross sections, and a minimum of 1/8 inch, and a maximum of 4 times the raised character stroke width at the top of the cross sections.
 - iii) Characters shall be separated from raised borders and decorative elements 3/8 inch minimum.
 - e. Line Spacing: Spacing between baselines of separate lines of tactile text within a message shall be a minimum of 135 percent, and maximum of 170 percent of the raised character height.
 - f. Format: Text shall be in a horizontal format.
2. Braille Dots: Grade 2 contracted California Braille; domed or rounded.
- a. Capitalization: Indication of an uppercase letter or letters shall be used only before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.
 - b. Dimensions:
 - i) Dot Base Diameter: 0.059 inch minimum, 0.063 inch maximum.
 - ii) Distance Between Two Dots in Same Cell (Measured Center-to-Center): 0.100 inch.
 - iii) Distance Between Corresponding Dots in Adjacent Cells (Measured Center-to-Center): 0.300 inch.
 - iv) Dot Height: 0.025 inch minimum, 0.037 inch maximum.
 - v) Distance Between Corresponding Dots From One Cell Directly Below (Measured Center-to-Center): 0.395 inch minimum, 0.400 inch maximum.
 - c. Position: Braille shall be positioned directly below corresponding tactile text in a horizontal format, flush left or centered. If text is multi-lined, Braille shall be placed below entire text.
 - i) Distance Between bottom of tactile characters and top of Braille: 3/8 inch minimum, 1/2 inch maximum.

- ii) Distance Between Braille and raised borders or decorative elements: 3/8 inch minimum.
- G. Pictograms: Pictograms, where indicated, shall have a field height of 6 inches minimum. Characters and Braille shall not be located in the pictogram field.
 - 1. Contrast: Pictogram shall contrast with background field.
 - 2. Finish: Both pictogram and background field shall have non-glare finish.
 - 3. Corresponding descriptive text and Braille shall be located directly below pictogram field.
- H. Colored Coatings for Polymer Sheet: For text and graphics, and background colors, provide acrylic polyurethane enamel paints recommended by polymer manufacturer for optimum adherence to polymer surface and which are UV- and water-resistant for colors and exposures indicated. Paint to fully cover all surfaces of sign.
 - 1. Product: Subject to compliance with requirements, provide the following topcoat material:
 - a. Matthews Paint Company; Matthews Satin VOC MAP.
 - 2. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.
 - 3. Primer: As recommended in writing for intended substrate material by manufacturer of topcoat material.
 - 4. Sign Finish: Sign characters and background to have non-glare (matte) finish.
 - 5. Visual Contrast: Provide minimum 70 percent contrast between sign characters and sign background.
 - 6. Sign Colors: As selected by Architect from manufacturer's full range of standard colors.
- I. Sign Mounting: Manufacturer's noncorroding anchors suitable for substrate being mounted to or as detailed on Drawings.
 - 1. Anchors to be countersunk flush with face of sign, and finished to match surrounding color of sign face.
 - 2. Adhesive: Manufacturer's silicone adhesive.
- J. Polymer Panel Sign Types:
 - 1. Room Identification Signs:
 - a. Sign Size and Layout: As indicated on Drawings.
 - b. Tactile characters and Braille are required.
 - c. Typeface: Futura Book, upper case.
 - d. Text Character Height: As indicated on Drawings, but not less than 5/8 inch and not more than 2 inches.
 - e. Sign Message Text and Graphics: As indicated on Drawings.

- f. Mounting Location: Latch side of door, as indicated on Drawings, but not less than 48 inches from finish floor or ground to baseline of lowest Braille cells, and not more than 60 inches from finish floor or ground to baseline of uppermost line of raised tactile characters.
- K. Accessories:
 - 1. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - a. Use concealed fasteners and anchors unless indicated to be exposed.
 - b. For exterior exposure, furnish nonferrous-metal, stainless-steel, or hot-dip galvanized devices unless otherwise indicated.
 - c. Fastener Heads: For nonstructural connections, use flathead countersunk screws with tamper-resistant slots unless otherwise indicated.
 - i) Finish exposed portion of fastener head to match surrounding sign color and finish.
 - d. Furnish inserts to be set by other trades into concrete or masonry work.
 - 2. Adhesive: Silicone adhesive as recommended by sign manufacturer.
 - a. VOC Content: Complies with requirements specified in "CALGreen Requirements" Article.
 - b. VOC Emissions: Complies with requirements specified in "LEED v4 Requirements" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify anchor inserts are sized and located to accommodate signs.
- D. Verify painting and finishing of wall substrates are complete.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and complying with manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Panel Signs: Comply with sign manufacturer's written instructions, except where more stringent requirements apply.
1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled and countersunk holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
 - a. Install silicone-adhesive at perimeter of backside of sign.

3.3 CLEANING AND PROTECTION

- A. Remove and replace damaged or deformed signage that does not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signage according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signage in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Portable fire extinguishers.
 - a. Multipurpose type.
 - 2. Wall mounting brackets for wall mounted fire extinguishers not occurring in cabinet.

1.3 REFERENCES

- A. California Code of Regulations, Title 19 - Public Safety.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 10: Portable Fire Extinguishers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguishers and mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: 6 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 REGULATORY REQUIREMENTS

- A. In addition to requirements of authorities having jurisdiction, comply with applicable requirements of the following:
 - 1. California Code of Regulations, Title 19 - Public Safety, requirements for fire extinguishers (Division 1, Chapter 3).

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS – MULTIPURPOSE TYPE

- A. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. JL Industries, Inc.; Cosmic 5E.
 - b. Larsen's Manufacturing Company; MP5.
 - c. Potter Roemer LLC; #3005.
 - d. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

2.4 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.
 - b. Larsen's Manufacturing Company.
 - c. Potter Roemer LLC.
 - d. Manufacturer of equal product in accordance with Division 1 requirements for product substitutions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Where occurring on wall-mounted bracket, fasten mounting bracket to surfaces, square and plumb.

END OF SECTION 10 44 16

SECTION 10 51 13

METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Metal lockers.
- B. Related Sections include:
 - 1. Section 05 41 00 "Cold-Formed Structural Metal Framing" for concealed metal backing in structural metal stud-framed walls for anchoring wall-mounted metal lockers.

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM A1008: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy With Improved Formability, Solution Hardened, and Bake Hardenable.
- B. California Building Code (CBC) – California Code of Regulations, Title 24, Part 2.
- C. International Organization for Standardization (ISO):
 - 1. ISO 14021: Environmental Labels and Declarations – Self-Declared Environmental Claims (Type II Environmental Labeling).
- D. United States Department of Justice:
 - 1. 2010 ADA Standards for Accessible Design.

1.4 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, backing, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.5 PREINSTALLATION MEETING

- A. Preinstallation Conference: Conduct conference at Project site to review pertinent issues related to metal lockers, including condition of substrates and preparatory work.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material and hardware descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show base, sloping tops, filler panels, trim, and accessories.
 - 2. Show locations and sizes of furring, and concealed blocking and backing required.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: For units with factory-applied color finishes; submit manufacturer's full range of available colors for selection by Architect.
 - 1. Minimum Number of Locker Colors: 24.
- D. Samples for Verification: For each color of factory-applied finish required, prepared on Samples of manufacturer's standard sizes.
- E. Product Schedule: For metal lockers.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of metal lockers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.

- b. Faulty operation of latches and other door hardware.
- 2. Damage from deliberate destruction and vandalism is excluded.
- 3. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal lockers and accessories from single source from a single locker manufacturer.
 - 1. Obtain locks from a single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For metal lockers designated as accessible, comply with applicable provisions of the following:
 - 1. California Building Code (Title 24, Part 2), Chapter 11B.
 - 2. United States Department of Justice's 2010 ADA Standards for Accessible Design.

2.3 METAL LOCKERS

- A. Metal Lockers: Manufactured metal lockers, of knocked-down construction for field assembly in configurations indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide metal lockers by one of the following:
 - a. Lyon Workspace Products.
 - b. Penco Products, Inc.
 - c. Republic Storage Systems Company.
 - d. Equal product in accordance with Division 1 requirements for product substitutions.
- B. Locker Arrangement:
 - 1. Box Lockers: As follows, at locations as indicated on Drawings:
 - a. Individual Locker Dimensions: As indicated on Drawings.
- C. Doors: One piece; fabricated from 0.075-inch (14 gage) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners where required by width of door; welded to inner face of doors.
 - 2. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (18 gage) nominal-thickness steel sheet; welded to inner face of doors.
 - 3. Door Style: Vented panel.

- D. Body: Assembled by welding and riveting or bolting body components together. Fabricated from unperforated steel sheet with thicknesses as follows:
 - 1. Tops and Bottoms: 0.060-inch (16 gage) nominal thickness, with single bend at sides.
 - 2. Backs and Sides: 0.024-inch (24 gage) nominal thickness, with full-height, double-flanged connections.
 - 3. Shelves: 0.060-inch (16 gage) nominal thickness, with double bend at front and single bend at sides and back.
- E. Frames: Channel formed; fabricated from 0.060-inch (16 gage) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
- F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge and that are completely concealed and tamper-resistant when door is closed; fabricated to swing 180 degrees.
 - 1. Knuckle Hinges: Steel, full loop, five- or seven-knuckle, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
- G. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.
- H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
 - 1. Verify numbering of individual lockers with Owner prior to preparation of Shop Drawings.
- I. Continuous Zee Base: Fabricated from 0.075-inch (14 gage) minimum nominal-thickness steel sheet.
 - 1. Height: 4 inches.
- J. Continuous Sloping Tops: Fabricated from 0.060-inch (16 gage) minimum nominal-thickness steel sheet.
 - 1. Closures: Vertical-end type.
 - 2. Sloping-top corner fillers, mitered.
- K. Recessed Trim: Fabricated from 0.048-inch (18 gage) minimum nominal-thickness steel sheet.
- L. Finished End Panels: Fabricated from 0.060-inch (16 gage) minimum nominal-thickness steel sheet.
- M. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B, suitable for exposed applications.

- N. Finish: Baked-enamel or powder-coat.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.4 LOCKS

- A. Combination Padlocks: Provided by Owner.
- B. Built-in Combination Dial Lock: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key; designed for locker doors with vertical multi-point locking bars.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Master Lock Company; No. 1630/1631.
 - i) At Accessible Lockers: Master Lock Company; No. 1636MDADA/1637MDADA.
 - b. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Bolt Operation: Vertical-lift.
 - 3. At accessible lockers with built-in combination dial lock, provide three keys with ADA-compliant key head for each accessible locker.

2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate:
- D. Lock: Combination locks provided by Owner, except as indicated otherwise for accessible lockers below.
- E. Knocked-Down Construction: Fabricate metal lockers by assembling at Project site, or preassembling at plant prior to shipping, using manufacturer's nuts, bolts, screws, or rivets.
- F. Accessible Lockers: Fabricate as follows:
 - 1. Where provided, no shelf or hook to be located higher than 48 inches above floor.
 - 2. Bottom of locker to be located no lower than 15 inches above floor.

3. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf.
 4. Where occurring within row of lockers, accessible locker(s) to be located at ends of rows.
 5. Provide combination dial lock.
- G. Continuous Zee Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long practical to enclose base and base ends of metal lockers; finished to match lockers.
- H. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations
1. At corners provide sloped top corner fillers, mitered.
 2. Provide closures at exposed ends.
 3. Slope: Approximately 1:3 rise to run.
 4. Match slope of existing locker tops.
- I. Recessed Trim: Fabricated in lengths as long as practical; finished to match lockers.
- J. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of non-recessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.7 METAL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches on center. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking, as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top of lockers using manufacturer's standard fasteners and to floor or raised curb using manufacturer's standard hold-down clips.
- B. Knocked-Down Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- C. Equipment:
 - 1. Identification Plates: Identify metal lockers with identification indicated on Drawings or Shop Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recessed trim to recessed metal lockers with concealed clips.
 - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 - 3. Attach sloping-top units to metal lockers with exposed ends.
 - 4. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION 10 51 13

SECTION 11 52 13
PROJECTION SCREEN

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Front-projection screens.
 - a. Manually operated.

1.3 DEFINITIONS

- A. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

1.4 SUBMITTALS

- A. Product Data: For each type of audio-visual equipment indicated.
- B. Shop Drawings: Show layouts and types of audio-visual equipment. Include the following:
 - 1. General:
 - a. Anchorage details.
 - b. Details of juncture of exposed surfaces with adjacent finishes.
 - c. Frame details.
 - d. Accessories.
 - 2. Projection Screens:
 - a. Location of screen centerline relative to ends of screen case.
 - b. Locations of seams in viewing surfaces, if any.
 - c. Drop length.
- C. Samples for Initial Selection: Manufacturer's full range of colors for the following exposed finishes, for selection by Architect:
 - 1. Projection screen cases.
- D. Maintenance Data: For projection screens and projector lifts to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of audio-visual equipment through one source from a single manufacturer. Obtain each item as a complete unit, including necessary mounting hardware and accessories.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver projection screen until building is enclosed and other construction within spaces where equipment will be installed is substantially complete and ready for equipment installation.

1.7 COORDINATION

- A. Coordinate layout and installation of projection screen with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, fire-suppression system, and partitions.
- B. Coordinate sizes and locations of concealed framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that projection screen can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 FRONT PROJECTION SCREENS

- A. Manually Operated Screens, General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
 - 1. Screen Mounting: Top edge securely anchored to a 3-inch diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.
 - 2. Pull-cord: Provide manufacturer's standard pull-cord, adjustable to length required to fall within reach range from floor level.
- B. Surface-Mounted, Metal Encased, Manually Operated Screens: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed steel sheet not less than 0.02-inch thick or aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide end caps and universal mounting brackets, finished to match end caps.
 - 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. Da-Lite Screen Company, Inc.; Model B with CSR (Controlled Screen Return).
 - b. Draper Inc.; Luma with AutoReturn.
 - 2. Provide manufacturer's built-in mechanism to control speed of screen retraction into case.

- C. Screen Material and Viewing Surface:
1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
 - a. Products: Subject to compliance with requirements, provide the following:
 - i) Da-Lite Screen Company, Inc.; Matte White.
 - ii) Draper Inc.; Fiberglass Matte White.
 - iii) Equal product in accordance with Division 1 requirements for product substitutions.
 2. Material: Vinyl-coated glass-fiber fabric.
 3. Mildew Resistance: Rating of 0 or 1 when tested according to ASTM G 21.
 4. Flame Resistance: Passes NFPA 701.
 5. Provide screens without seams, unless dimension exceeds maximum size of screen material produced without seams.
 - a. Where length of screen exceeds maximum length produced without seams, provide screen with horizontal seam placed at juncture between extra drop length and viewing surface.
 6. Edge Treatment: Black masking borders.
 7. Provide extra drop length of dimension indicated to comply with the following requirements for fabric color and location of drop length:
 - a. Color: same as viewing surface.
 - b. Location: At top of screen.
 8. Size of Viewing Surface:
 - a. Vertical Dimension: 40 inches, plus or minus 3 inches.
 - b. Horizontal Dimension: 64 inches, plus or minus 3 inches.
 - c. Extra Drop Length: As needed to position bottom edge of viewing surface at 3 feet above floor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install projection screen at locations and heights indicated, and to comply with manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 1. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

- A. After installation, protect projection screen from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION 11 52 00

SECTION 11 52 23

AUDIO-VISUAL EQUIPMENT SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Manufactured mounting hardware for audio-visual equipment:
 - a. Projectors.
- B. Related Sections include:
 - 1. Section 11 52 13 "Projection Screens" for projection screens.

1.3 COORDINATION

- A. Coordinate layout and installation of audio-visual equipment supports with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, partitions, and other items occurring in the same area.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for audio-visual equipment supports.
- B. Shop Drawings: For special components and installations not detailed or dimensioned on manufacturer's product data. Show layout of equipment and required clearances to adjacent construction, and locations of required electrical power connections.
- C. Samples for Verification: For each color of exposed factory-applied finish required for audio-visual equipment supports, prepared on 4-inch by 4-inch Samples.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not install audio-visual equipment supports until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are at levels to be maintained after building is occupied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain audio-visual equipment supports, including all components and related items, as complete units from a single source or manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Audio-visual equipment supports shall have current pre-approval on file with the California Office of Statewide Health Planning and Development (OSHPD), for use in hospitals and State structures.

2.3 PROJECTOR CEILING MOUNT

- A. General: Fixed projector mounting assembly consisting of mounting bracket and adapter plate, extension arm, and anchorage plate.
 - 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. Peerless Industries, Inc..
 - i) Projector Mount: Model PRS with Universal Adapter Plate.
 - ii) Extension Column: Model EXT.
 - iii) Extension Column Stabilizer Kit: Model ACC 050.
 - iv) Anchorage Plate: Model CMJ 300.
 - 2. Projector Mount: Provide the following features:
 - a. Quick-release for ease of projector removal.
 - b. Adjustment Capabilities:
 - i) Pitch: +5 deg/-20 deg.
 - ii) Roll: +/- 10 deg.
 - iii) Yaw: 360 deg.
 - c. Access opening for cord management.
 - d. Universal clamp-style adapter plate adjustable to fit any projector.
 - e. Finish: Black powder coat.
 - 3. Extension Column: Schedule 40, 1-1/2 inch steel pipe (1.90 inch O.D.), threaded and notched at both ends for safety locking.
 - a. Length: As required at each ceiling condition to achieve mounting height of projector as indicated on Drawings.
 - b. Finish: Black powder coat.
 - 4. Extension Column Stabilizer Kit: Four diagonal steel brackets designed to provide lateral stability to extension column.

5. Anchorage Plate: Cold rolled steel, designed to accept projector mount or extension column; provide 4 openings at corners for anchorage hardware.
 - a. Load Capacity: 250 lbs.
 - b. Finish: Black powder coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 1. Confirm location and adequacy of blocking and supports required for installation of audio-visual equipment supports.

3.2 INSTALLATION

- A. General: Install audio-visual equipment at locations and heights indicated, and to comply with manufacturer's written instructions.
- B. Install units level, plumb, and firmly anchored in locations and at heights indicated, using fasteners appropriate to substrate indicated and recommended by manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Adjust and lubricate operable components to operate smoothly and easily, without binding or warping. Check and readjust operating hardware.
- B. Clean exposed surfaces as recommended by manufacturer.

END OF SECTION 11 52 23

SECTION 22 00 50

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric motors.
 - 2. Motor starters.
 - 3. Strainers.
 - 4. Valve boxes.
 - 5. Gauges.
 - 6. Thermometers.
 - 7. Access Doors.
 - 8. Expansion loops.
 - 9. Flexible joints.
 - 10. Insulation.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is a part of each Division 22 Section.

1.3 ADDITIONAL REQUIREMENTS

- A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.
- B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing any service.
- C. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems.

1.4 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.
 - 1. CSA – Canadian Standards Association International.

2. ANSI - American National Standards Institute.
 3. ASTM - American Society for Testing and Materials.
 4. CCR - California Code of Regulations.
 - a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.
 5. NCPWB - National Certified Pipe Welding Bureau.
 6. CEC - California Electrical Code.
 7. NEMA - National Electrical Manufacturers' Association.
 8. NFPA - National Fire Protection Association.
 9. OSHA - Occupational Safety and Health Act.
 10. UL - Underwriters' Laboratories, Inc.
- B. Requirements of Regulatory Agencies:
1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2019.
 - b. California Electrical Code, 2019.
 - c. California Energy Code, 2019.
 - d. California Fire Code, 2019.
 - e. California Green Building Standards Code, 2019.
 - f. California Mechanical Code, 2019.
 - g. California Plumbing Code, 2019.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.
 - j. CAL-OSHA.
 - k. California State Fire Marshal, Title 19 CCR.
 - l. National Fire Protection Association.
 - m. Occupational Safety and Health Administration.
 - n. Other applicable state laws.
 2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

- A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be

followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.
 2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
 3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contractors' expense upon Architects' direction.
 4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

- A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.
- B. Arrange for utility connections and pay charges incurred, including excess service charges.
1. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.
- C. Coordination:
1. General:
 - a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.
 2. Electrical Coordination:

- a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - 2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
 - 3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.
- 3. Mechanical Coordination:
 - a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
 - b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
 - c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
 - d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

- A. Refer to Division 01 Submittals Section(s) for additional requirements.
- B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.
- C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.
 - 1. Partial or incomplete submittals will not be considered.
 - 2. Quantities are Contractor's responsibility and will not be reviewed.

3. Provide materials of the same brand or manufacturer for each class of equipment or material.
 4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
 5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 6. Organize submittals in same sequence as in Specification Sections.
 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
 - a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
 - b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
 - c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
 - d. Catalog cuts and published material may be included with supplemental scaled drawings.
- D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.
- E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.
1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.
- F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.
- B. Shop Drawings.
- C. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
 - 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
- D. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.
- E. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.
 - 1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
 - 2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
 - 3. Supports, anchorages and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.
 - b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2019 California Building Code

4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

- A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 1. Refer to Division 01 for complete instructions.
 2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.
 - a. Sets shall incorporate the following:
 - 1) Product Data.
 - 2) Shop Drawings.
 - 3) Record Drawings.
 - 4) Service telephone number, address and contact person for each category of equipment or system.
 - 5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.
 - 6) Copies of guarantees/warranties for each item of equipment and systems.
 - 7) Test data and system balancing reports.
 - 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
 - 9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
 - 10) Control diagrams and literature.
 - 11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
 - 12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.
 - 13) Commissioning and Preliminary Operation Tests required as part of the Work.

- b. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.
- B. Record Drawings:
 - 1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
 - 2. Upon completion of the work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
 - d. Provide Contractor's signature, verifying accuracy of record drawings.
 - e. Obtain the signature of the Project Inspector for all record drawings.

1.11 SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In the case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.
- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.
- C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.
- E. Substitution requests shall include the following:
 - 1. Reason for substitution request.
 - 2. Complete submittal information as described herein; see "Submittals."
 - 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 - 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 - 5. Explanation of impact on connected utilities.
 - 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is the Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without

additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.

- G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with plumbing systems work similar to that required for this Project.
- C. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.
- D. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.
- E. All materials and products shall be new and shall match existing.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

- A. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor's Standard Guarantee.
- B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.
- C. On failure to comply with the warranty requirements within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.
- C. Refer to Sections 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS AND PRODUCTS

- A. No material installed as part of this Work shall contain asbestos.
- B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.3 ELECTRIC MOTORS

- A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. U.S. Motors.
 - b. Century Electric.
 - c. General Electric.
 - d. Lincoln.
 - e. Gould.
- B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
 - 1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.
- C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated

or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.

1. Multispeed motors shall have separate windings for each speed.

D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers:
 - a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - c. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - f. Each motor shall be provided with a shaft grounding device for stray current protection.
3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:

1. Select motors with service factor of 1.15.
2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
3. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
4. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
5. Motors 1/20 HP and Smaller: Shaded-pole type.

- F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.4 MOTOR STARTERS

- A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.
- B. Provide magnetic motor starters for equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size .
 - 1. All starters shall have the following:
 - a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
 - b. Ambient compensated thermal overload.
 - c. Fused control transformer (for 120 or 24 volt service).
 - d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
 - 2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
 - 3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
 - 4. Provide OSHA label indicating the device starts automatically.

2.5 STRAINERS FOR POTABLE WATER SYSTEMS

- A. Strainers: Full line size, conforming to lead-free requirements of California Health and safety Code Section 11 68 75. "Y" pattern, 125 psi SWP minimum, with 304 stainless steel screens. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 3 inches and smaller: bronze or brass body, threaded ends, with 20 mesh screen. Watts LF777SI, Wilkins SXL.
 - b. 4 inches and larger: Cast iron body, flanged ends, 1/16 inch or 1/8 inch screen as normally supplied for each size. Watts 77F-DI-125, Mueller 758.

2.6 STRAINERS FOR NON-POTABLE WATER SYSTEMS

- A. Charles M. Bailey #100A, Armstrong, Muessco, or equal, Fig. 11 "Y" pattern, 125 psi WP minimum, with monel screens with 20 square mesh for 2 inches and smaller and 3/64 inch perforations for 2-1/2 inches and larger. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

2.7 VALVE BOXES

- A. General:

1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular "vault" type adequately sized for condition and similar in construction to those specified above.
 2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
 3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.
- B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.
- C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.
- D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.8 GAUGES

- A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.9 THERMOMETERS

- A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
1. Provide extension for insulation.
 2. Provide thermometers with steel bulb chambers and brass separable sockets.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.10 ACCESS DOORS

- A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
 - 1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.
- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.
- D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.
- E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (Masonry).
 - d. Style "Fire Rated" where required.

2.11 THERMAL AND SEISMIC EXPANSION LOOPS

- A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend. Return bend section shall have support lug and plugged FPT drain. Flexible hose shall consist of corrugated metal inner hose and braided metal outer sheath. Assemblies shall be constructed from materials compatible with the fluid or gas being conveyed and shall be suitable for the system operating pressure and temperature. Provide assembly selected for 4 inches of movement.
- B. Provide CSA certified expansion loops for use in natural or propane gas piping systems.
- C. Where used in potable water systems, provide expansion loops of certified lead-free construction.

- D. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex Inc., Metraloop series, or comparable product by one of the following, or equal:
 - 1. Flexicraft Industries.

2.12 FLEXIBLE JOINTS

- A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.
- B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.13 PIPE GUIDES

- A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.14 EQUIPMENT IDENTIFICATION

- A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.15 PIPE IDENTIFICATION

- A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.
- B. The legends and flow arrows shall conform to ASME A13.1.

2.16 INSULATION WORK

- A. General:
 - 1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
 - 2. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
 - 3. The term "piping" used herein includes pipe, valves, strainers and fittings.
 - 4. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
 - 5. Provide pre-formed PVC valve and fitting covers.

6. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
7. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
8. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
9. Repair all damage to existing pipe and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:

1. Insulate domestic hot and tempered water with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness shall be the following:
 - a. Pipe 3/4 inches and smaller: 1 inch thick.
 - b. Pipe 1 inch through 1-1/2 inches: 1-1/2 inches thick.
 - c. Pipe 2 inches and larger: 2 inches thick.
2. Insulate domestic cold water piping located within building, outside of insulation envelope in outside walls, vented attic spaces, and unheated spaces, including equipment rooms and below raised floor with 1 inch thick molded fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
3. Insulate domestic cold water piping located outside building exposed to weather with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness for all pipe sizes: 2 inches.
4. Insulate roof drain and overflow drain bodies, horizontal sections of rainwater leader piping and overflow piping, and condensate drains within the building envelope with 1 inch thick fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
5. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor's option.
6. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

- a. Fitting covers:
 - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 2) Tee covers.
 - 3) Flange and union covers.
 - 4) End caps.
 - 5) Beveled collars.
 - 6) Valve covers.
 - 7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- b. Jacket thickness:
 - 1) Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.
 - 2) Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

PART 3 - EXECUTION

3.1 FRAMING, CUTTING AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

3.2 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.
- C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.3 PIPING SYSTEM REQUIREMENTS

- A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.4 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and Painting:
 - 1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.
 - a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
 - 3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.5 EXCAVATING

- A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.
- B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch

sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such that 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

- C. Maintain all warning signs, barricades, flares, and red lanterns as required.
- D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.6 BACKFILLING

- A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.
- B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.
 - 1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.
- C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.
- D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.7 PIPING SYSTEMS INSTALLATION

- A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
10. Install horizontal valves with valve stem above horizontal.
11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
12. Verify final equipment locations for roughing-in.
13. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
14. Furnish and install anchors or thrust blocks on PVC water lines in the ground, at all changes in direction of piping, and at all connections or branches from mains 1-1/2 inch and larger. Form anchors or thrust blocks by pouring concrete between pipe and trench wall. Thrust blocks shall be of adequate size and so placed as to take thrusts created by maximum internal water pressure. Sizing and placement shall be per manufacturer's recommendations, CPC, and IAPMO installation standards. Anchor piping to building construction.
15. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.
16. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

C. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

D. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

E. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with Chapter 7, CBC requirements.
3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
5. All above Systems to be installed in strict accordance with manufacturer's instructions.

6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

G. Flashing:

1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
 - a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
 - b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Provide vandalproof top for each plumbing vent through roof. Elmdor/Stoneman Model 1540, 1550, 1570, or equal.
2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4, 1100-5, 1100-7, or equal.

H. Hangers and Supports:

1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers. Hanger and support components shall support weight of equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.
 - a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - 1) Provide copper-plated or felt-lined hangers for use on copper tubing.
2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
3. Riser clamps: B-line model B3373, or equal.

4. Pipe Hanger and Support Placement and Spacing:

- a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or Welded (Note 3)</u>	<u>Steel Gas</u>	<u>Copper Brazed or Soldered (Note 3)</u>	<u>CPVC & PVC (Note 2)</u>
1/2 - 1"	12 ft.	6 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft..	Base and Each Floor (Note 1)
2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

- 1) Note 1: Provide mid-story guides.
 - 2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
 - 3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
- b. Vertical cast iron piping support spacing: Base and each floor not to exceed 15 feet.
- c. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or</u>	<u>Steel Gas</u>	<u>Copper Brazed or</u>	<u>CPVC & PVC (Note</u>
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	<u>Welded</u> <u>(Note 2)</u>		<u>Soldered</u> <u>(Notes 2, 3)</u>	<u>1)</u>
1/2 - 1"	6 ft.	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	10 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	10 ft.	4 ft.

- 1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
 - 2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
 - 3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.
- d. Horizontal cast iron piping support spacing:
- 1) Support piping at every other joint for piping length of less than 4 feet.
 - 2) For piping longer than 4 feet, provide support on each side of the coupling, within 18 inches of each joint.
 - 3) Hanger shall not be installed on the coupling.
 - 4) Provide support at each horizontal branch connection.
 - 5) Provide sway brace at 40 foot maximum spacing for suspended pipe with no-hub joints, except where a lesser spacing is required by the seismic design criteria used in delegated design for seismic systems. Refer to Article, Submittals.
 - 6) Provide a brace on each side of a change in direction of 90 degrees or more.
5. Suspended Piping:
- a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

<u>Pipe Size</u>	<u>Rod Size Diameter</u>
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"

6"	3/4"
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- b. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturer's published load ratings. No deflection to exceed 1/180 of a span.
- c. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
- d. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.
- e. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
- f. Steel Connectors: Beam clamps with retainers.

6. Support to Structure:

- a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.
 - 1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062---MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

- 2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
 - 3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.
 - b. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.
7. Rubber Neoprene Pipe Isolators:
- a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.

- b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
 - c. Acceptable Suppliers:
 - 1) Vertical runs: Acousto-Plumb or equal.
 - 2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
- 8. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
- 9. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
- 10. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
- 11. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
- 12. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.8 UNION AND FLANGE INSTALLATION

- A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.
- B. Install unions in piping NPS 2" and smaller, and flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves. Unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.
- C. Locate the unions for easy removal of the equipment, tank, or valve.

3.9 ACCESS DOOR INSTALLATION

- A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.10 CONCRETE WORK

- A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include

reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

- B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.11 PIPE PROTECTION

- A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
 - 1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Royston Products, or equal.
 - a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Royston Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
 - 2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-10 or V-20", "Scotchwrap 50", Slipknot 100, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.
- B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.
- C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. test machine (San Gabriel, CA - 818-287-5259), Pipeline Inspection Company (Houston, TX - 713-681-5837), or equal.
- D. Cleaning: Clean all piping thoroughly before wrapping.
 - 1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.
- E. Sleeve copper piping/tubing installed below slab with "Polywrap-C" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping and orange for other piping. Install sleeve per manufacturer's recommendations and instructions.
- F. Sleeve copper piping/tubing installed outside building below grade with "Polywrap-C" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or

equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping. Install sleeve per manufacturer's recommendations and instructions.

- G. Sleeve cast iron and ductile iron pipe below grade and below slab with "Polywrap" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 8 mils thick, colored natural. Install sleeve per manufacturer's recommendations and instructions.
- H. Covering: No rocks or sharp edges shall be backfilled against the wrap or sleeve. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.12 PIPE IDENTIFICATION

- A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.
- B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.
- C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.
- D. Each valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in 1/4 inch high letters.
- E. Apply markings after painting and cleaning of piping and insulation is completed.

3.13 EXPANSION ANCHORS IN HARDENED CONCRETE

- A. Refer to Structural Drawings.

3.14 PIPING SYSTEM PRESSURE TESTING

- A. General:
 - 1. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with fixtures and other appliances connected.
 - 2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- B. Piping Systems: Test piping systems in accordance with the following requirements and applicable codes:
 - 1. Authority having jurisdiction shall witness tests of piping systems.
 - 2. Notify Architect at least seven days in advance of testing.

3. All piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
 4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
 5. Isolate from system equipment that may be damaged by test pressure.
- C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.
- D. Testing of Sanitary Sewer, Drain, Vent, and Storm Drain may be done in segments in order to limit pressure to within manufacturer's recommendations. Test to 10 feet above highest point in the system.

<u>System Tested</u>	<u>Test Pressure PSI</u>	<u>Test With</u>
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Water	125	Water
Natural Gas (PE)	60	Air & Non-corrosive Leak Test Fluid
Natural Gas (Steel)	100	Air & Non-corrosive Leak Test Fluid
Compressed Air	200 lb.	Air & Non-corrosive Leak Test Fluid
Deionized Water	50	Water

1. Flush deionized water lines with deionized water after test and approval.
2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with the type of gas conveyed by the piping system.

3.15 TRACER WIRES

- A. Provide tracer wire for non-metallic gas and water pipe in ground outside of buildings. Use AWG #14 tracer wire with low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints. Tracer wire insulation shall be colored yellow for gas piping, blue for water piping.
- B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box.

Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

- C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than 1/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.16 OPERATION OF SYSTEMS

- A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:
 - 1. Complete all requirements listed under "Check, Test and Start Requirements."
 - 2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
 - 3. Filters, strainers etc. are in place.
 - 4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
 - 5. Equipment has been run under observation, and is operating in a satisfactory manner.
- B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.17 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.
 - 1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
 - 2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 - 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 - 4. When work has been completed, provide copies of reports for review, prior to final observation of work.

- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.
- C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.18 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

- A. Prior to observation to determine final acceptance, put all mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
 - 1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.
 - 2. Correct rotation of motors and ratings of overload heaters are verified.
 - 3. Specified filters are installed and spare filters have been turned over to Owner.
 - 4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
 - 5. All equipment has been cleaned, and damaged painted finishes touched up.
 - 6. Missing or damaged parts have been replaced.
 - 7. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
 - 8. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
 - 9. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 - 10. Preliminary test and balance work is complete, and reports have been forwarded for review.
 - 11. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
 - 12. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.
- B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
 - 1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
 - 2. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and

lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.

3. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
4. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

D. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

E. Preliminary Operation:

1. The Owner reserves the right to operate portions of the plumbing system on a preliminary basis without voiding the guarantee.

3.19 CERTIFICATES OF INSTALLATION

- A. Contractor shall complete applicable "Certificates of Installation" forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.20 DEMONSTRATION AND TRAINING

- A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
 2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
 - a. Listing of Owner-designated personnel completing training, by name and title.

- b. Name and title of training instructor.
 - c. Date(s) of training.
 - d. List of topics covered in training sessions.
4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION 22 00 50

SECTION 22 10 00
PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Valves.
 - 3. Domestic water piping specialties.
 - 4. Drain and waste piping specialties.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

1.4 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

1.5 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data in Operation and Maintenance Manual.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

1.7 QUALITY ASSURANCE

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Plumbing Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.2 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BUILDINGS

- A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.
- B. Drain and Waste Pipe Above Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, vertical piping above floor from lavatories, sinks, and drinking fountains may be Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV weld pipe and fittings.
 - 1. Joints above grade: No-Hub pipe conforming to ASTM A888 and CISPI 301. Couplings conforming to ASTM 1277 and CISPI 310, with stainless steel bands. Provide products by ANACO-Husky, Tyler, Ideal or equal. Provide sway brace at 20'-0" maximum spacing for suspended pipe with No-Hub joints. Provide a brace on each side of a change in direction of 90 degrees or more. Brace riser joints at each floor and at 15 foot maximum intervals (also see Specification Section 22 00 50).
- C. Drain and Waste Pipe Below Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and CISPI 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, hub and spigot cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A-74 and so marked, may be used.

1. Joints below grade: ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540.
 2. Joints below grade (hub and spigot option): Neoprene gaskets conforming to ASTM C564, as manufactured by Ty-Seal, Dual-Tite, or equal.
- D. Vent Pipe:
1. 3 inch and larger: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe above grade.
 2. 2-1/2 inch and smaller: Cast iron soil pipe and fittings as specified for sizes 3 inch and larger, Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.
 3. Vent pipe buried in ground and to 6 inches above ground: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground.
- E. Type DWV copper tubing or No-Hub cast iron pipe and fittings may be used for concealed rainwater leaders. Where no-hub piping is used, the fittings and couplings shall match those used for waste piping.
- F. Water Pipe (Tempered Water, Tempered Water Return, Hot Water, Hot Water Return and Cold Water): ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Water piping below slab: ASTM B88, Type K copper tubing, hard temper, with wrought copper fittings. At Contractor's option, pipe runs below slab having no branches may be ASTM B88, Type K annealed copper tubing without joints. See Section 22 00 50 for pipe protection requirements for below slab copper piping.
- G. Temperature and Pressure Relief Valve Piping: ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass.
- H. Condensate Drain Piping:
1. Inside buildings provide ASTM B88, Type L copper tubing and fittings. Provide Wye fittings with capped cleanout plug for tubing up to 1 inch size. Provide wrought or cast DWV fittings for sizes 1-1/4 inch and larger.
 2. Outside buildings provide ASTM B88, Type L copper pipe and fittings, cast iron drain pipe and fittings or Schedule 40 galvanized steel pipe and cast iron drain or vent fittings.
 3. Connect condensate drains to mechanical equipment per equipment manufacturer's recommendations; provide P-trap where required. Slope piping to drain, with 1 inch in 10 foot minimum pitch. Provide di-electric couplings or unions at connections to dissimilar materials.
 4. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide threaded metal

connector at mechanical equipment, Metraflex Model SST, or equal by Unisource Mfg. Co., or Flexicraft Industries. Arrange flexible connection to ensure drainage of condensate, and support flexible connection at each end of connector, to ensure proper alignment.

5. Where condensate drain P-traps are required, install trap using Wye fitting on inlet and outlet of trap. Provide cap on top of each Wye, made removable for cleaning and inspection. Drill 1/8 inch diameter hole in cap at outlet of the trap to allow venting of the system. Minimum depth of trap should be 4 inches, or as recommended by the manufacturer in printed literature.
 6. Provide cleanout tees or "Y" at each change in direction.
- I. Condensing-Type Equipment Condensate Drain Pipe: CPVC pipe and fittings conforming to ASTM D-2846.
1. Provide CPVC condensate drain pipe for condensing water heaters, furnaces, and where shown on Drawings.
 2. Piping and fittings shall be as manufactured by Spears Manufacturing, Charlotte Pipe and foundry Co., or equal.

2.3 SITE PIPING AND FITTINGS TO 5 FEET FROM BUILDINGS

A. Buried Drain, Waste, and Vent Piping:

1. Install piping from street connection to the property line in accordance with local requirements.
2. 4 inches and larger: PVC, ASTM D3034 - SDR 35; use matching Ring Tite fittings.
3. 3 inches and smaller: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler pipe, or equal. Provide ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540. Pipe and fittings shall be the product of a single manufacturer.

B. Water Service Piping:

1. Sizes 2 inches and larger (not under building): Gasket style PVC conforming to ASTM D2241-SDR21, Class 200 with gasket type fittings or ductile iron mechanical joint couplings. Gasket fittings shall be one piece injection molded PVC fittings, equal to Flo-Seal water main fittings for PVC pressure pipe, 200 psi, ASTM D-3139.
2. Sizes less than 2 inches: Type K copper tubing, hard temper, with wrought copper fittings. See Section 22 00 50 for pipe protection requirements for below grade copper piping.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. J.M. Eagle.

- b. P.W. Pipe.
- c. Iplex Series Pipe.

C. Water Service Piping Above Grade:

- 1. Sizes 2 inches and larger: Class 150 flanged ductile cast iron water pipe conforming to AWWA/ANSI C150/A21.50 and manufactured in accordance with AWWA/ANSI C151/A21.51. Fittings shall conform to AWWA/ANSI C110/A21.10, Class 250 pattern. Pipe and fittings shall have factory applied cement-mortar lining in accordance with AWWA/ANSI C104/A21.4. Flanges shall conform to ASME/ANSI B16.1.
- 2. Piping 1-1/2 inches and smaller: Type L copper tubing, hard temper, with brazed wrought copper fittings.

2.4 PIPE JOINING MATERIALS

- A. Refer to piping Articles in this Section for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated
 - a. Full-Face Type: For flat-face, Class 125, cast iron and cast bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.
 - 2. AWWA C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.
 - 3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.
 - 4. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, 100 percent lead free alloys. Include water-flushable flux according to ASTM B813.
- D. Brazing Filler Metals: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
- E. Solvent Cements for Joining CPVC Piping: ASTM F 493.
 - 1. CPVC solvent cement shall have VOC content of 490 g/L or less.
 - 2. Adhesive primer shall have VOC content of 550 g/L or less.
 - 3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
- F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 1. PVC solvent cement shall have VOC content of 510 g/L or less.

2. Adhesive primer shall have VOC content of 550 g/L or less.
3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.5 VALVES AND FITTINGS FOR POTABLE WATER SYSTEMS

A. General:

1. Provide valves and fittings conforming to lead-free requirements of California Health and Safety Code Section 11 68 75.
 - a. Provide valves listed to NSF/ANSI 61-G or NSF/ANSI 372 for valve materials for potable-water service.
 - 1) Exception: Main distribution gate valves above 1-1/2 inches located underground outside building are not required to conform lead-free requirements of California Health and Safety Code Section 11 68 75.

B. Gate Valves:

1. General: Furnish valves in copper lines with adapters to suit valve/line requirements.
2. 1-1/2 inches and smaller: Minimum 200 psi CWP, bronze body, threaded bonnet, rising or non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Milwaukee UP148, UP149, Nibco T-113-LF, S-113-LF, or equal.
3. 2 inches through 3 inches: Minimum 200 psi CWP, bronze body, threaded bonnet, non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Nibco T-113-LF, S-113-LF, or equal.
4. Main distribution gate valves underground outside building above 1-1/2 inches:
 - a. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.
 - 1) Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
 - 2) Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, cast bronze or brass body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T-685-80-LF, Milwaukee UPBA400, Apollo 77C-LF10, Kitz 868, or equal.
2. 2-1/2 inches: Apollo 77C-LF10, or equal.

D. Swing Check Valves:

1. Minimum 200 psi CWP, bronze or brass body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Milwaukee UP509, Nibco T-413LF, Kitz 822T, or equal.

E. Butterfly Valves:

1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
2. Provide valves with the following:
 - a. Seats: suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.
 - b. Bodies: ductile iron or cast iron.
 - c. Discs: Bronze or stainless steel.
 - d. Stems or Shafts: Stainless steel. Install valves with stems horizontal.
 - e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 2 through 12 inches: Watts Regulator Co., model DBF-03.

F. Silent Check Valves (for use on pump discharge):

1. General: Provide spring loaded check valves at pump discharge of all pumps.
 - a. 2 inches and smaller: Minimum 300 psi CWP, bronze body, Apollo 61LF, Milwaukee UP548-T, or equal.
 - b. 2-1/2 inches and larger: Class 250, cast iron body, suitable for regrinding, Mueller 103MAP, or equal.

2.6 VALVES AND FITTINGS FOR NON-POTABLE WATER, COMPRESSED AIR, AND GAS SYSTEMS

A. Gate Valves:

1. 2-1/2 inches and smaller: Class 150, bronze body, union bonnet, rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Hammond IB641, IB648, Nibco T-134, S-134, Milwaukee 1151, 1169, or equal.
2. 3 inches and larger: Class 125, iron body, bronze mounted, bolted bonnet, non-rising stem, solid wedge, flanged ends, conforming to MSS SP-70. Hammond IR-1138, Nibco F619, Milwaukee F2882A, Stockham G-612, or equal.
3. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.
 - a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.

- b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.
- B. Ball Valves:
 - 1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.
 - 2. 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.
 - 3. Compressed Air Services: 600 psi CWP, 150 psi SWP, bronze body, full port, three piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco Model T-595-Y, Milwaukee BA-300, or equal.
- C. Swing Check Valves: Class 125 or 150, bronze body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Stockham B-321, Milwaukee 509, Nibco T-433, or equal.
- D. Butterfly Valves:
 - 1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
 - 2. Provide valves with the following:
 - a. Seats: Suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.
 - b. Bodies: Ductile iron or cast iron.
 - c. Discs: Bronze or stainless steel.
 - d. Stems or Shafts: Stainless steel.
 - e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.
 - 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. 2 through 12 inches: Milwaukee Valve, CL series, Nibco, Inc., Model LD2000-3, or equal.
- E. Silent Check Valves (for use on pump discharge):
 - 1. General: Provide spring loaded check valves at pump discharge of all pumps.
 - 2. 2 inches and smaller: 250 psi CWP, bronze body, Nibco Model T-480, Milwaukee 548-T, or equal.

3. 2-1/2 inches and larger: Class 250, cast iron body, wafer style, suitable for regrounding. Nibco Model F960, Milwaukee 1400, Mueller 103MAP, or equal.

2.7 DOMESTIC WATER PIPING SPECIALTIES

A. Hose Bibbs:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Acorn Engineering Co.
 - b. Woodford Manufacturing Co.
2. Hose Station: Leonard THS-25-VB-CW, Symmons, or equal.

B. Wall Hydrants:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Acorn Engineering Co.
 - b. Woodford Manufacturing Co.
 - c. Mifab, Inc.

C. Water Hammer Arrestors:

1. Provide water hammer arrestors conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, with nesting type bellows contained within a casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Water hammer arrestors shall be sized for type and number of fixtures served. Provide all stainless steel shell construction with stainless steel bellows and threaded connection to water system.
2. Water hammer arrestors shall be certified under P.D.I. Standard WH201 and by ASSE Standard 1010.
3. Select units in accordance with the requirements of Plumbing and Drainage Institute Standard P.D.I. WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.
4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Josam Company, series 75000.
 - b. Smith (Jay R.) Mfg. Co., Hydrotrol 5005-5050.
 - c. Mifab, series WHB.

D. Water Filters:

1. Provide Cuno Incorporated, Aqua Pure model AP510, or equal, point of use water filters, conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, in locations indicated on Drawings.
 - a. Provide model AP517 filter cartridge at each location, with 5 micron rating and 2,000 gallon rating, to remove sediment, rust, scale and chlorine taste and odor from incoming water. 2 gallon per minute capacity.
 - b. Provide one spare cartridge for each unit provided.
- E. Potable Water Pressure-Regulating Valve:
1. Provide pressure-regulating valves, single-seated, direct-operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003, and the lead-free requirements of California Health and Safety Code Section 11 68 75. Size for maximum flow rate and inlet and outlet pressure indicated on Drawings.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Cla-Val Company.
 - b. Watts Regulator Company.
- F. Thermostatic Water Temperature Control Valve:
1. Provide thermostatic water temperature control valve conforming to lead free requirements of California Health and Safety Code Section 11 68 75, with size as noted on Drawings, complete with union angle strainer checkstops. Valves shall be thermostatic type, with a maximum temperature setting as follows:
 2. Provide surface recessed semi-recessed mounted, white enameled or stainless steel cabinet with locking door for control valves. Including:
 - a. Control valve cabinet and valve shall be provided as a package, and include thermostatic water mixing valve, thermometer, safety checkstops, volume control valve and internal piping.
 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Leonard Valve Company.
 - b. Lawler Manufacturing Co., Inc.
 - c. Powers.
- G. Relief Valves:
1. Provide relief valves as indicated, of size and capacity as selected by Contractor for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.
 2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI A21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 degrees F, and pressure relief at 150 psi.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Watts Regulator Company.
 - b. Cash (A.W.) Valve Manufacturing Corporation.
 - c. Zurn Industries, Inc.; Wilkins-Regulator Division.

H. Trap Primers:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. MiFab, Inc.
 - b. Precision Plumbing Products.
 - c. Sioux Chief Manufacturing Company.

2.8 DRAIN AND WASTE PIPING SPECIALTIES

A. Cleanouts:

1. General: Install cleanouts of same diameter as pipe (4 inch maximum) in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. No horizontal run over 50 feet inside buildings or 100 feet outside buildings shall be without cleanout, whether shown on Drawings or not. Provide two-way cleanouts where indicated on drawings, and where required for satisfactory use.
 - a. Provide cleanouts in waste drop from each sink and urinal.
 - b. Provide one wrench for each size and type of cleanout used. Turn over to Owner at completion of the project, and obtain receipt. Place receipt in Operation and Maintenance Manuals.
2. Cleanouts in floor and in concrete sidewalks: Ducco Cast Iron with nickel bronze top, clamping collar and ABS plastic plug: Zurn ZN-1400-KC, or equal, with square or round top to suit floor construction.
3. Cleanouts in composition floors: Zurn ZN-1400-X-DX, or equal (nickel bronze top).
4. Cleanouts in concealed, aboveground cast-iron soil or waste lines: Zurn Z-1440A, or equal, with ABS plastic plug.
5. Cleanouts in walls: Zurn Z-1441 or Z-1443, or equal, with stainless steel cover. Provide long sweep elbow or combination wye at connection to riser and install with surface of cleanout within ½ inch of front face of finished wall.
 - a. Where space does not permit the above installation, provide Zurn Z-1446, or equal, with stainless steel access cover, and vandal resistant screw.
 - b. Install face of cleanout plug within 1/2 inch of front face of finished wall.
6. Cleanouts exterior to building in landscaped areas: Zurn Z-1449-BP, or equal, cleanout ferrule with tapered bronze plug. Where located at grade, provide 18

by 18 by 6 inch concrete pad; Trowel concrete smooth and edge; set flush with finished grade.

7. Cleanouts in drive areas: Zurn -1400-HD-KC, or equal, with heavy-duty top and ABS plastic plug.

B. Floor Drains:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. J.R. Smith.
 - b. MIFAB.
 - c. Watts.
 - d. Zurn.

C. Floor Sinks:

1. Floor Sinks: Provide anchoring flange (seepage pan) at all floor sinks, and provide flashing clamp in locations where floor membrane is used. Provide cast iron "P" trap and trap primer connection at P-Trap.
2. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. J.R. Smith.
 - b. MIFAB.
 - c. Watts.
 - d. Zurn.

D. Hopper Drains:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Zurn.
 - b. J.R. Smith.

E. Area Drain:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Brooks.
 - b. J.R. Smith.
 - c. Old Castle Precast.
 - d. Watts.
 - e. Zurn.

F. Roof Drains and Overflow Drains:

1. See Architectural Drawings for drain style to be used.
2. Provide offset downspout boots where required for connection of exposed sheet metal downspouts to underground cast iron or PVC piping.
3. Provide rainwater leader nozzles on overflow piping. Nozzle body shall be bronze with threaded inlet and bronze wall flange with mounting holes. Size nozzle to match connected rainwater leader.
4. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. J.R. Smith.
 - b. Mifab.
 - c. Zurn.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.
- B. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work. Connect to site utilities. Verify the location of all services. No extra cost will be allowed if services are not as shown.
- C. Determine sanitary sewer and storm drain location and elevation at all points of connection before installing any piping. Notify Architect immediately if indicated grades cannot be maintained.
- D. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

3.2 INSTALLATION OF WATER PIPING

- A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.
- B. Provide manufactured water hammer arrestors, sized and installed in accordance with Plumbing and Drainage Institute Standard PDI WH201.
 1. Locate water hammer arrestors at every plumbing fixture, or, where fixtures are located in groups, at every group of fixtures, and as indicated on Drawings.

2. Install water hammer arresters above accessible ceilings, or install access doors for service.
- C. In freezing locations arrange water piping to drain as shown.
- D. Install piping on room side of building insulation.
- E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connection to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.

3.3 INSTALLATION OF SANITARY AND STORM DRAINAGE SYSTEMS

- A. Make joints in PVC sewer pipe with PVC-type couplings and rubber rings.
- B. Check final location of rubber rings within the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.
 1. Ring-Tite cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the pipe with PVC couplings.
- C. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot unless otherwise noted or later approved. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- D. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- E. Install rainwater leader nozzles at exposed bottom of leaders where they spill onto grade.
- F. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.
- G. Grade all vent piping so as to free itself quickly of any water condensation.
- H. Where possible, join groups of vent risers together with one enlarged outlet through roof. Maintain minimum of 10 foot horizontal or 3 foot vertical clearance from air intakes.
- I. Install drip pan under storm drain piping, sanitary drain piping, and vent piping that must be run over kitchen areas.
- J. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

3.4 PIPE JOINTS AND CONNECTIONS

- A. General:
 - 1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
 - 3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.
- B. Threaded Pipe: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- E. Copper Pipe and Tubing (Except pneumatic control piping): All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except domestic water piping 1-1/4 inches and smaller when not buried in the ground or concrete and type DWV plumbing piping may be soldered.
 - 1. Soldered joints: Apply water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828.
- F. Cast Iron Soil Pipe:
 - 1. No-Hub fittings shall be made with a torque wrench.
 - 2. Hub joints shall be with Ty-Seal couplings.
 - 3. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end if caulked into a joint.
 - 4. Connect cast iron sewer piping to outside service pipe with cast iron or vitrified LOP reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted.

- G. PVC Sewer and Drainage Pipe (outside building as allowed only): Four inches and larger shall be bell and spigot, assembled in accordance with manufacturer's recommendations. Joint shall be tested in accordance with ASTM D3212. Solvent weld joints below 4 inches in size, schedule 40 PVC with matching fittings, assembled per manufacturer's instructions.
- H. Make joints in PVC water pipe with PVC couplings and rubber rings, Manville Ring-Tite, PW Pipe, or equal. Check final location of rubber rings with the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron or PVC adapter fittings, installed as recommended by the manufacturer. Ring-Tite PVC or cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the water pipe with PVC couplings.
- I. Flexible Connections:
 - 1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
 - 2. Anchor piping securely on the system side of each flexible connection.

3.5 INSTALLATION OF VALVES

- A. Install valves as indicated on Drawings and in the following locations:
 - 1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
 - 2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.
 - 3. Provide gate or globe valves on inlet and outlet of each water heater or pump.
- B. General:
 - 1. Valves shall be full line size unless indicated otherwise on Drawings.
 - 2. Install horizontal valves with valve stem above horizontal, except butterfly valves.
 - 3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
 - 4. Locate valves for easy access and provide separate support where necessary.
 - 5. Install valves in position to allow full stem movement.
 - 6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.
 - 7. Butterfly valves conforming to the paragraph "Butterfly Valves" may be used in lieu of gate or globe valves for locations above grade.
 - 8. Ball valves conforming to the paragraph "Ball Valves" may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.

9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.
 10. Rigidly fasten hose bibbs, hydrants, fixture stops, compressed air outlets, and similar items to the building construction.
- C. Gate Valves:
1. Furnish valves in copper lines with adapters to suit valve / line requirements.
 2. Underground gate valves:
 - a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
 - b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.
- D. Swing Check Valves: Install in horizontal position with hinge pin level.
- E. Butterfly Valves: Install with stems horizontal.
- F. Silent Check Valves: Install in horizontal or vertical position between flanges.
- G. Valve Adjustment: Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.6 INSTALLATION OF CLEANOUTS

- A. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees. Install at maximum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping inside buildings, and at base of each conductor.
- B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through water resistant membrane.

3.7 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

- A. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains with lip of drain slightly below finished floor to ensure drainage. Install floor sinks flush with finished floor. Coordinate with other trades to ensure that floor slopes to drain. Provide flashing flange and clamping device with each drain passing through water resistant membrane.
- B. Install vented P-trap below each drain. Where trap primers are indicated, install trap primer connection in the P-trap.

3.8 INSTALLATION OF ROOF DRAINS AND OVERFLOW DRAINS

- A. Install roof drains and overflow roof drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Coordinate with roofing as necessary to interface roof drains with roofing work.

3.9 INSTALLATION OF HOPPER DRAINS

- A. Install hopper drain in wall, in sheet metal box, with access door.
 - 1. Size access door and box to suit the size required for hopper drain and trap primer, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door in occupied spaces.
- B. Grind top and sides of funnel, if required, to suit wall thickness.

3.10 TRAP PRIMER INSTALLATION

- A. Install as indicated in manufacturers printed literature, with 1/2 inch, Type L, hard copper piping to trap primer connection on floor drains and floor sinks where indicated on Drawings. At Contractor's option, Type K annealed copper tubing without joints may be used below slab only. See Section 22 00 50 for pipe protection requirements for below slab copper piping/tubing.
- B. Install trap primer piping with 1/4 inch per foot slope, to insure that the line will drain fully to the floor drain or floor sink.
 - 1. Provide ball valve to the inlet at each trap primer location.
- C. Install trap primer and distribution unit exactly as called for in manufacturers printed installation instructions. Connect to domestic water piping from the top of the water line, in order to prevent foreign material from entering directly into primer assembly.
- D. Mount trap primer in wall, in sheet metal box, with Karp or equal access door. Size access door and box to suit valve operation, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door where installed in occupied spaces.
- E. Where one trap primer will be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps sized for equal pressure drop to each trap.

3.11 INSTALLATION OF GAS PRESSURE REGULATING VALVES

- A. Install as indicated; comply with utility requirements. In locations where regulators are installed in confined spaces, pipe atmospheric vent to outdoors, full size of outlet. Install gas shutoff valve upstream and downstream of each pressure-regulating valve.

3.12 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated.
- B. Mechanical Equipment Connections: Connect hot and cold water piping system and gas piping system to mechanical equipment as indicated, and provide with shutoff valve and union for each connection.

3.13 DOMESTIC WATER SYSTEM STERILIZATION

- A. Clean and disinfect new or altered hot and cold water piping connected to domestic water systems using methods prescribed by the Health Authority. If the Health Authority does not prescribe methods, clean and disinfect new or altered hot and cold water piping using methods given in the California Plumbing Code.
 - 1. A water treatment company that has a current state EPA license to apply disinfectant chlorine in potable water shall perform the procedure.

3.14 CARE AND CLEANING

- A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Remove labels from stainless steel sinks, except 316 stainless steel sink labels should be retained to confirm that the correct material has been provided. Leave systems and equipment in satisfactory operating condition.

3.15 OPERATIONAL TESTS

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.16 TESTING AND BALANCING

- A. See Section 23 05 93 of Specifications for testing and balancing requirements.

3.17 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 22 10 00

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water supplies and stops.
 - 2. Plumbing fixture hangers and supports.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

1.4 INFORMATIONAL SUBMITTALS

- A. Refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.5 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this Section:
 - 1. California Building Code – CBC

2. California Plumbing Code – CPC
 3. California Health and Safety Code
 4. American National Standards Institute - ANSI
 5. Federal Standards - F.S.
 6. National Sanitary Foundation – NSF International
- C. ANSI Standards: Comply with ANSI/NSF 61, “Drinking Water System Components – Health Effects.”
- D. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.
- E. UL Labels: Provide water coolers that have been listed and labeled by Underwriters' Laboratories.
- F. ARI Labels: Provide water coolers that are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.
- G. Americans with Disabilities Act (ADA).
- H. California Green Building Standards Code Requirements.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. General: Provide factory fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete, installation. Where more than one type is dedicated, selection is Contractor's option; but, all fixtures of same type must be furnished by single manufacturer.
1. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.
 2. Take location and mounting heights for roughing-in from Architectural Drawings.
 3. Follow schedule on Plumbing Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.
 4. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

2.2 MATERIALS

- A. Provide materials that have been selected for their surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
- B. Where fittings, trim and accessories are exposed or semi-exposed, provide, chromium plated 17 gauge seamless brass and match faucets and fittings. Provide 17 gauge seamless copper or brass where not exposed.
- C. Handles on all faucets and stops shall be all metal chromium plated.
- D. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated.
 - 1. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
- B. P-Traps: Include IAPMO approved removable P-traps where drains are indicated for direct connection to drainage system. P-Traps shall be less trap screw cleanout, and incorporate a chrome plated cast brass body, brass connection nuts, 17 gauge seamless brass wall return and chrome plated wall escutcheon to match trap finish.
- C. Carriers: Provide cast iron supports for fixtures of graphitic gray iron, ductile iron, or malleable iron as indicated. Where the carrier for wall mounted water closets are installed more than 6 inches behind the finished wall, provide water closet support for wide pipe chase.
- D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed location, provide chrome-plated cast brass escutcheons with setscrews.
- F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction. Delete aerators where not allowed by CPC for health care occupancies.
- G. Comply with additional fixture requirements contained in Fixture Schedule shown on the drawings.

2.4 MANUFACTURERS

- A. In accordance with California Plumbing Code, provide indelibly marked or embossed manufacturers name or logo, arranged so as to be visible after installation.

- B. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following:
1. Vitrified China Plumbing Fixtures:
 - a. American Standard, U.S. Plumbing Products.
 - b. Eljer Plumbingware Div., Wallace-Murray Corp.
 - c. Kohler Co.
 - d. Vitra.
 2. Plumbing Trim:
 - a. McGuire Manufacturing Co., Inc.
 - b. Delta Commercial.
 - c. Chicago Faucet Co.
 - d. T&S Brass and Bronze Works, Inc.
 3. Flush Valves:
 - a. Sloan Valve Co.
 - b. Zurn Industries, Hydromechanics Div.
 - c. Toto USA, Inc.
 4. Faucets:
 - a. Chicago Faucet Co.
 - b. Symmons Scott.
 - c. T&S Brass and Bronze Works, Inc.
 - d. Delta Commercial.
 5. Fixture Seats:
 - a. Church Seat Co.
 - b. Bemis Mfg. Co.
 - c. Beneke Corp.
 6. Water Coolers and Drinking Fountains:
 - a. Haws Corporation.
 - b. Halsey Taylor Mfg. Co.
 - c. Elkay Mfg. Co.
 - d. Acorn Aqua.
 7. Service Sinks:
 - a. American Standard.
 - b. Kohler Co.
 - c. Williams Serviceceptor.
 - d. Florestone.
 - e. Acorn.
 8. Stainless Steel Sinks:

- a. Elkay Mfg. Co.
 - b. Just Mfg. Co.
 - c. Haws Corporation.
9. Fixture Carriers:
- a. Josam Mfg. Co.
 - b. J. R. Smith.
 - c. Tyler Pipe; Wade Div.
 - d. Zurn Industries; Hydromechanics Div.
 - e. Mifab, Inc.

2.5 FLUSH VALVE REQUIREMENTS

- A. Metering flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered bypass and be chloramine resistant synthetic rubber with internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable.
- B. Electronic flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered by pass and be chloramine and resistant synthetic rubber with rubber and internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable. All flush valve solenoids and sensors shall be UL listed.

2.6 FIXTURE CONNECTIONS

- A. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.
- B. Provide fixtures not having integral traps with P-traps of chromium-plated 17 gauge cast brass, with 17 gauge seamless brass wall return, connected to concealed waste in wall and sanitary fittings. Provide IAPMO approval for trap, and provide less trap screw cleanout.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Dearborn Brass, Commercial series with brass nuts.
 - b. Delta Commercial.
 - c. McGuire Manufacturing Co., Inc.
- C. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85 percent red brass pipe.

- D. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets. Traps shall rough in full size to waste and vent connection, using deep escutcheon plate to cover wall penetration. Compression adaptor extensions or sweat adaptors are not acceptable.

2.7 WATER SUPPLIES AND STOPS

- A. Provide 85 percent IPS threaded red brass nipple, conforming to the lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have stop valves installed on water supply lines.
- B. Provide water supplies to fixtures with compression shut-off stops with threaded inlets and lock shield-loose key handles. Provide combination fixtures with compression stop and threaded inlet on each water supply fitting. Provide lock shield-loose key handle for each stop.
- C. Provide 1/2 inch riser tubes with reducing coupling for fixtures, unless otherwise noted.
- D. Provide cast brass escutcheon.
- E. Furnish shut-off valves on hose bibbs where directly connected to mains with no intervening valves.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1. McGuire Manufacturing Company, Inc., model LFH2167LK.
 - 2. T & S Brass and Bronze Works, Inc., model B-1305.

2.8 PLUMBING FIXTURE HANGERS AND SUPPORTS

- A. Floor-affixed supports for off-the-floor plumbing fixtures shall comply with ASME A112.6.1M.
- B. Residential type fixture supports are not acceptable.
- C. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.
- D. Install floor mounted water closets with J.R. Smith, Zurn, or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with Spackle.
- E. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.
 - 1. Wall hung lavatories.

2. Wall mounted urinals.
3. Drinking fountains.
4. Electric water coolers.

2.9 PLUMBING FIXTURES

- A. Install all plumbing fixtures at height indicated on Architectural Drawings. Where mounting height is not indicated, install at height required by Code.
- B. Special Requirements For Accessible Fixtures:
 1. Operating handle or valve for accessible water closets, urinals, lavatories, and sinks shall operate with less than 5 pounds force. Metering faucets shall be adjusted to operate between 10 and 15 seconds.
 2. Insulate exposed waste piping and domestic water supplies below accessible fixtures with CBC access code compliant molded "closed-cell" vinyl covers. Covers shall be installed using vandal resistant fasteners and must be removable. Covers shall meet flame spread rating not to exceed 25 and smoke density not to exceed 50 when tested in accordance with ASTM E-84, and shall comply with the requirements of California Code of Regulations, Title 24. Plumberex – Handy Shield, Johns Manville – Zeston 2000, or equal.
- C. Refrigerator Ice Maker Outlet Boxes:
 1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Guy Gray.
 - b. Water-Tite.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING AND PROTECTION

- A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.2 PREPARATORY PROVISIONS

- A. The Contractor is responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section. Do not proceed until all unsatisfactory conditions have been corrected. Commencing work will be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.3 INSPECTION AND PREPARATION

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the National Standard Plumbing Code pertaining to installation of plumbing fixtures.
- C. Fasten plumbing fixtures securely to supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies to blocking behind or within wall construction so as to be rigid, and not subject to pull or push movement.
- D. Install CBC accessible fixtures in accordance with Chapter 4 California Plumbing Code, and Chapters 11A and 11B California Building Code.
- E. Refer to Division 26 for wiring for electronic flush valves.

3.4 FAUCET INSTALLATION

- A. Provide 85 percent IPS red brass pipe, conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to faucets, stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.
- B. Adjust metering faucets to run for 10 to 15 seconds.

3.5 CLEAN AND PROTECT

- A. Clean plumbing fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during the remainder of the construction period.
- C. Grout voids between all fixtures and adjacent surfaces with white Dow Silicone Sealant, arranged to shed water.

3.6 FIELD QUALITY CONTROL

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.7 EXTRA STOCK

- A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten units.

END OF SECTION 22 40 00

SECTION 23 00 50

BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric motors.
 - 2. Motor starters.
 - 3. Strainers.
 - 4. Gauges.
 - 5. Thermometers.
 - 6. Access Doors.
 - 7. Flexible joints.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is a part of each Division 23 Section.
- C. Refer to Section 23 08 00.13, T-24 Commissioning of HVAC for Title 24 commissioning requirements.

1.3 ADDITIONAL REQUIREMENTS

- A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.
- B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.
- C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.4 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.
 - 1. AABC - Associated Air Balance Council

2. AFBMA - Anti Friction Bearing Manufacturer's Association
3. AMCA - Air Moving and Control Association Inc.
 - a. Standard 210 - Laboratory Methods of Testing Fans
4. ANSI - American National Standards Institute
5. ARI - Air-Conditioning and Refrigeration Institute
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society for Testing and Materials
9. CCR - California Code of Regulations
 - a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36
10. CSA – Canadian Standards Association International
11. CSFM - California State Fire Marshal
12. NCPWB - National Certified Pipe Welding Bureau
13. NIST - National Institute of Standards and Technology
14. NEMA - National Electrical Manufacturers' Association
15. NFPA - National Fire Protection Association
16. OSHA - Occupational Safety and Health Act
17. SMACNA - Duct Manuals
18. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2019.
 - b. California Electrical Code, 2019.
 - c. California Energy Code, 2019.
 - d. California Fire Code, 2019.
 - e. California Green Building Standards Code, 2019.
 - f. California Mechanical Code, 2019.
 - g. California Plumbing Code, 2019.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.
 - j. CAL-OSHA.
 - k. California State Fire Marshal, Title 19 CCR.
 - l. National Fire Protection Association.
 - m. Occupational Safety and Health Administration.

- n. Other applicable state laws.
- 2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

- A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
 - 2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
 - 3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contractors' expense upon Architects' direction.
 - 4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

- A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.
- B. Arrange for utility connections and pay charges incurred, including excess service charges.

C. Coordination:

1. General:

- a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Have fire damper and fire smoke damper installation instructions available at Project site during construction for use by Project Inspector.

3. Electrical Coordination:

- a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - 2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
 - 3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

4. Mechanical Coordination:

- a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
- b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
- c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

- A. Refer to Division 01 Submittals Section(s) for additional requirements.

- B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

- C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.
1. Partial or incomplete submittals will not be considered.
 2. Quantities are Contractor's responsibility and will not be reviewed.
 3. Provide materials of the same brand or manufacturer for each class of equipment or material.
 4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
 5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 6. Organize submittals in same sequence as in Specification Sections.
 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
 - a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
 - b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
 - c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
 - d. Catalog cuts and published material may be included with supplemental scaled drawings.
- D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.
- E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.
1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize

submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

- F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.
- B. Shop Drawings.
- C. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
 - 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
- D. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.
 - 1. Calculations performed for use in selection of seismic supports, anchorages, restraints, and vibration isolators shall utilize criteria indicated in Structural Contract Documents.
 - 2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
 - 3. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping, Ductwork, and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping and ductwork, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.

- b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2019 California Building Code
- 4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

- A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.
- B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.
- C. Check, Test, and Start forms, from equipment manufacturers.
- D. Check, Test and Start reports.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.
 - a. Sets shall incorporate the following:
 - 1) Product Data.
 - 2) Shop Drawings.
 - 3) Record Drawings.
 - 4) Service telephone number, address and contact person for each category of equipment or system.
 - 5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.
 - 6) Copies of guarantees/warranties for each item of equipment or systems.
 - 7) Test data and system balancing reports.
 - 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.

- 9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
 - 10) Temperature control diagrams and literature.
 - 11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
 - 12) Check test and start reports for each piece of mechanical equipment provided as part of the Work.
 - 13) Commissioning and Preliminary Operation Tests required as part of the Work.
2. Post service telephone numbers and addresses in an appropriate place designated by Architect.
- B. Record Drawings:
1. Refer to Division 01 for additional requirements.
 2. Upon completion of the Work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
 - d. Provide Contractor's signature, verifying accuracy of record drawings.
 - e. Obtain the signature of the Inspector of Record for Record Drawings.

1.11 SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.
- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.
- C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.
- E. Substitution requests shall include the following:
 1. Reason for substitution request.

2. Complete submittal information as described herein; see "Submittals."
 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 5. Explanation of impact on connected utilities.
 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.
- G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.
- C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.
- D. All materials and products shall be new.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

- A. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor's Standard Guarantee.
- B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.
- C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.
- C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS

- A. No material installed as part of this Work shall contain asbestos.
- B. California Green Building Code Compliance:
 - 1. HVAC and refrigeration equipment shall not contain CFCs.
 - 2. HVAC and refrigeration equipment shall not contain Halons.

2.3 ELECTRIC MOTORS

- A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. U.S. Motors.
 - b. Century Electric.
 - c. General Electric.
 - d. Lincoln.
 - e. Gould.
- B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be

sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.
- C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.
1. Multispeed motors shall have separate windings for each speed.
- D. Polyphase Motors with Additional Requirements:
1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
 2. Motors Used with Variable Frequency Controllers:
 - a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - f. Each motor shall be provided with a shaft grounding device for stray current protection.
 3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
- E. Single-Phase Motors:
1. Select motors with service factor of 1.15.
 2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.

3. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:
 - a. Electronically Commutated motor (EC type): Motor shall be electronically commutated type specifically designed for applications, with heavy duty ball bearings. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.
 - 1) Exceptions:
 - a) Motors in fan-coils and terminal units that operate only when providing heating to the space served.
 - b) Motors installed in space conditioning equipment certified under California Energy Code Section 110.1 or 110.2.
4. Contractor's Option: Motors scheduled on Drawings as single-phase, and larger than 1/12 hp and smaller than 1 hp, for applications other than HVAC fans, may be EC type.
5. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
6. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
7. Motors 1/20 HP and Smaller: Shaded-pole type.
8. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.4 MOTOR STARTERS

- A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.
- B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
 1. All starters shall have the following:
 - a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
 - b. Ambient compensated thermal overload.
 - c. Fused control transformer (for 120 or 24 volt service).
 - d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
 2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.

3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIIR enclosure for starters located outdoors.
4. Provide OSHA label indicating the device starts automatically.

2.5 STRAINERS

- A. Charles M. Bailey #100A, Armstrong, Muessco, or equal, Fig. 11 "Y" pattern, 125 psi WP minimum, with monel screens with 20 square mesh for 2 inches and smaller and 3/64 inch perforations for 2-1/2 inches and larger. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

2.6 GAUGES

- A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.7 THERMOMETERS

- A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
 1. Provide extension for insulation.
 2. Provide thermometers with steel bulb chambers and brass separable sockets.
 3. Thermometers for air temperature shall have 8 inch minimum stem.
- B. Provide Ventlock, Durodyne, or equal thermometer test holes at each air conditioning unit, furnace, and make-up air unit, in mixed air and supply air, and at all locations shown or scheduled on the Drawings. Provide two portable thermometers, with sensing connection arranged to suit test connections.
- C. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.8 ACCESS DOORS

- A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
 - 1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.
- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.
- D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.
- E. Provide insulated doors where located in internally insulated ducts or casings.
- F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.
- G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.
- H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (Masonry).
 - d. Style "Fire Rated" where required.

2.9 FLEXIBLE JOINTS

- A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

2.10 PIPE GUIDES

- A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.11 EQUIPMENT IDENTIFICATION

- A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.12 PIPE IDENTIFICATION

- A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.
- B. The legend and flow arrow shall conform to ASME A13.1.

PART 3 - EXECUTION

3.1 FRAMING, CUTTING, AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

3.2 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.
- C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.3 PIPING SYSTEM REQUIREMENTS

- A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.4 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and painting:
 - 1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.
 - a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - b. Interior Ductwork: Refer to Division 09 Painting Section(s). Architect shall select paint color.
 - 2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
 - 3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.5 UNION AND FLANGE INSTALLATION

- A. Install Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.

- B. Install unions in piping NPS 2" and smaller or flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.
- C. Locate the unions for easy removal of the equipment, tank, or valve.
- D. Do not install unions or flanges in refrigerant piping systems.

3.6 ACCESS DOOR INSTALLATION

- A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.7 PIPE PROTECTION

- A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
 - 1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Royston Products, or equal.
 - a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Royston Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
 - 2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-10 or V-20", "Scotchwrap 50", Slipknot 100, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.
- B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.
- C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. holiday detector, or equal.
- D. Cleaning: Clean all piping thoroughly before wrapping.
 - 1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

- E. Covering: No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.8 PIPE IDENTIFICATION

- A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.
- B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.
- C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.
- D. Apply the markings after painting and cleaning of piping and insulation is completed.

3.9 EXPANSION ANCHORS IN HARDENED CONCRETE

- A. Refer to Structural Drawings.

3.10 PIPING SYSTEM PRESSURE TESTING

- A. General:
 - 1. Perform operational tests under simulated or actual service conditions.
 - 2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- B. Piping Systems: Test the installations in accordance with the following requirements and applicable codes:
 - 1. Notify the Architect at least seven days in advance of testing.
 - 2. Authority having jurisdiction shall witness tests of piping systems.
 - 3. Piping shall be tested at completion of roughing-in, or at other times as directed by the Architect.
 - 4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
 - 5. Isolate from system equipment that may be damaged by test pressure.
 - 6. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

<u>System Tested</u>	<u>Test Pressure PSI</u>	<u>Test With</u>
All Hot, Chilled, Combination, Condenser Water Piping	Greater of 1-1/2 x WP or 100 psi	Water

- C. Testing, Evacuating, Charging and Lubrication of Refrigeration Systems:
1. Pressurize with dry nitrogen and/or refrigerant to 300 psig and test all joints with an electronic detector or halide torch. Release the pressure and attach a high vacuum pump. Evacuate to 4 mm (4000 microns) and hold for 30 minutes. Break to 5 psig with dry nitrogen and allow to remain in the system for ten minutes. Evacuate to 2 mm (2000 microns) and hold for 30 minutes. Use a mercury manometer or electronic vacuum gauge. Do not start timing until recommended vacuum range is reached.
 2. At the end of the evacuation, if the system has been proved leak-free, charge with refrigerant and fill the crankcase to the oil level specified by the manufacturer. All refrigerant oil shall be delivered to the location in sealed containers.
 3. Replenish for a period of one year without cost to the Owner all refrigerant and oil required to maintain the proper levels.

3.11 OPERATION OF SYSTEMS

- A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:
1. Complete all requirements listed under "Check, Test and Start Requirements."
 2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
 3. Filters, strainers etc. are in place.
 4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
 5. Equipment has been run under observation, and is operating in a satisfactory manner.
- B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.
- C. Operate every fire damper, smoke damper, combination smoke and fire damper under normal operating conditions. Activate smoke detectors as required to operate the damper, stage fan, etc. Provide written confirmation that all systems operate in a satisfactory manner.

3.12 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.
 - 1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
 - 2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 - 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 - 4. When work has been completed, provide copies of reports for review, prior to final observation of work.
- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.
- C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.13 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

- A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
 - 1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
 - 2. Correct rotation of motors and ratings of overload heaters are verified.
 - 3. Specified filters are installed and spare filters have been turned over to Owner.
 - 4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
 - 5. All equipment has been cleaned, and damaged painted finishes touched up.
 - 6. Damaged fins on heat exchangers have been combed out.
 - 7. Missing or damaged parts have been replaced.

8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
 9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
 10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 11. Preliminary test and balance work is complete, and reports have been forwarded for review.
 12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
 13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.
- B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
 2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.
 3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
 4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
 5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.
- C. Before handing over the system to Owner replace all filters with complete new set of filters.
- D. Review of Contractor's Tests:
1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.
- E. Test Logs:
1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

F. Preliminary Operation:

1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

G. Operational Tests:

1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.
2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
4. Control systems shall be completely operable with settings properly calibrated and adjusted.
5. Rotating equipment shall be in dynamic balance and alignment.
6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

H. Pre-Occupancy Building Purge:

1. Prior to occupancy, ventilate the building on 100 percent outside air, 100 percent exhaust for a continuous period determined by a qualified industrial hygienist (engaged by the Contractor) to reduce V.O.C's prior to occupancy.
2. Submit report by the industrial hygienist verifying satisfactory completion of the pre-occupancy purge.

3.14 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

- a. Listing of Owner-designated personnel completing training, by name and title.
 - b. Name and title of training instructor.
 - c. Date(s) of training.
 - d. List of topics covered in training sessions.
4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION 23 00 50

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Balancing Domestic Water Piping Systems.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. Associated Air Balance Council (AABC)
 - 1. National Standards for Total System Balance, latest edition.
- B. National Environmental Balancing Bureau (NEBB)
 - 1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.4 DEFINITIONS

- A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.
- B. Similar Terms: The following table is provided for clarification only:

<u>Similar Terms</u>		
Contract Term	AABC Term	NEBB Term
TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

- C. AABC: Associated Air Balance Council.
- D. NEBB: National Environmental Balancing Bureau.
- E. TAB: Testing, adjusting, and balancing.
- F. TAB Organization: Body governing practices of TAB Specialists.
- G. TAB Specialist: An entity engaged to perform TAB Work.

1.5 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

1.6 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
 - 1. Provide list of similar projects completed by proposed TAB field supervisor.
 - 2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.
- C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
 - 1. Submit examinations report with qualifications data.

- D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.
- F. Certified TAB reports.
 - 1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.
 - a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.7 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.8 QUALITY ASSURANCE

- A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.
 - 1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.
- B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be

affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:

1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.
 - a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.
 2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.
 - a. TAB technician shall have minimum 4 years TAB field experience.
- C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.
- D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.
- E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.
 1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.
- F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.
- G. TAB Standard:
 1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:
 - a. AABC National Standards for Total System Balance, or
 - b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
 3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.
- H. TAB Conference: Meet with Architect and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide

seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at location selected by Architect.

1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow, including protocol for resolution tracking and documentation.
 2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.
- I. Certify TAB field data reports and perform the following:
1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- J. TAB Report Forms: Use standard TAB specialist's forms approved by Architect.
- K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.9 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.10 WARRANTY

- A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:
1. AABC Performance Guarantee.
 2. NEBB Quality Assurance Program.
- B. Refer to Division 01 Specifications for additional requirements.

1.11 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- C. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contract Documents Examination Report:
 - 1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:
 - a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
 - b. Proposed corrective action necessary for proper system operation.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine operating safety interlocks and controls on HVAC equipment.

- L. Report conditions requiring correction discovered before and during performance of TAB procedures.
- M. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:
 - 1. General description of each air system and sequence(s) of operation.
 - 2. Complete list of measurements to be performed.
 - 3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
 - 4. Qualifications of personnel assigned to Project.
 - 5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc).
 - 6. Air terminal correction factors for the following:
 - a. Air terminal configuration.
 - b. Flow direction (supply or return/exhaust).
 - c. Effective area of each size and type of air terminal.
 - d. Air density.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 80 00 Heating, Ventilating, and Air Conditioning.”
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.
- C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.
1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
 2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.
- D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.
- E. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- F. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- H. Verify that motor starters are equipped with properly sized thermal protection.
- I. Check dampers for proper position to achieve desired airflow path.
- J. Check for airflow blockages.

- K. Check condensate drains for proper connections and functioning.
- L. Check for proper sealing of air-handling-unit components.
- M. Verify that air duct system is sealed as specified in Section 23 80 00 "Heating, Ventilating, and Air Conditioning."
- N. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.
- O. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.
- C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.
- D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- E. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.
- F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.

2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.

G. Do not overpressurize ducts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter manufacturer's name, model number, size, type, and thermal-protection-element rating.
 - a. Starter strip heater size, type, and rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

- A. Measure pressure drop across each backflow preventer assembly at design flows.
- B. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Section 22 50 00 "Plumbing Equipment"
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data.

Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within range given in article, Tolerances.
- C. Set calibrated balancing valves, if installed, at calculated presettings.
- D. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- I. Check settings and operation of each safety valve. Record settings.

3.8 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent and minus 0 percent .
 2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent .
 3. Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for "Air Outlets and Inlets".
- B. Set plumbing systems water flow rates within plus or minus 10 percent.

3.9 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
 - 2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
 - 3. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Project Performance Guaranty
 - 6. Architect's name and address.
 - 7. Engineer's name and address.
 - 8. Contractor's name and address.

9. Report date.
 10. Signature of TAB supervisor who certifies the report.
 11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 12. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 13. Nomenclature sheets for each item of equipment.
 14. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Position of balancing devices.
- E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.
- F. Test Reports – General:
1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.
- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.

- Contra Costa Community College District 121030 Testing, Adjusting, and Balancing for HVAC
L-1177 Industrial Trades Labs Renovation 23 05 93 - 15
Los Medanos College

- e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- J. Instrument Calibration Reports:
1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.11 INSPECTIONS

- A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.

2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.
 3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
 3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.
- D. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 80 00

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fans.
 - 2. Air inlets and outlets.
 - 3. Dampers.
 - 4. Ductwork.
 - 5. Insulation.

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 23 00 50, Basic HVAC Materials and Methods.
- C. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.3 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.
 - 1. Upon approval of submittal, provide manufacturer's installation and operating instructions to the Project inspector for the following:
 - a. Fire dampers, smoke dampers, and combination smoke-fire dampers.
- C. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.4 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

- B. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.
- C. Record of pre-installation meeting.
- D. Training Certificates of Completion: Submit certificate from equipment manufacturer, indicating attendance and successful completion of manufacturer's training program for variable refrigerant flow systems installation and service. Training shall include manufacturer's preferred methods for assembling and insulating refrigerant piping and accessories.
- E. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.
- C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.
 - 2. Provide one complete set(s) of filters for each filter bank.

1.7 COORDINATED LAYOUT

- A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.
- B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.

1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
 2. Show on drawings the intended elevation of all ductwork in accordance with the following example:
 - a. B.O.D. = 9'-0"
OFFSET UP 6"
B.O.D. = 9'-6"
 3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.
- C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.
- D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.8 QUALITY ASSURANCE

- A. Design Criteria:
1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All gas-fired equipment shall be UL, ETL or CSA listed.
 2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.
 3. All items of a given type shall be products of the same manufacturer.
 4. Scheduled equipment performance is minimum capacity required.
 5. Scheduled electrical capacity shall be considered as maximum available.
 6. Scheduled gas BTU input shall be considered as maximum available.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 FANS

- A. All fans shall be Air Moving and Control Association Inc. (AMCA) labeled.
- B. Provide self-aligning, enclosed ball bearings, accessible for lubrication unless specified otherwise.
- C. Provide variable speed switch for all direct drive fans.
- D. Roof Mounted:
 - 1. Direct or V-belt Drive: Provide one-piece heavy-duty ventilator housings, one piece heavy gauge spun aluminum construction, with weatherproof assembly and integral weather shield. Mount ventilators on curbs furnished by the fan manufacturer. Install with fan assembly level.
 - 2. Fan wheels shall be centrifugal design, statically and dynamically balanced. Tip speed, rpm and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.
 - 3. Fans shall have integral factory formed base and one piece spinning without welding. Housings shall be provided with wiring channel and are to be of the direct discharge design. Motor and fan assembly shall be on vibration isolating mounts. Fans shall have capacity, speeds and motor sizes as shown.
 - 4. Provide the following accessories:
 - a. Gravity backdraft dampers.
 - b. Aluminum bird screen with a minimum of 85 percent free area.
 - c. Adjustable motor pulley.
- E. Fan Drives:
 - 1. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the nameplate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.
 - 2. Provide variable speed drives, Dayco, Browning, Woods, or equal. Allow for replacement of fan and motor drives and belts as required to suit the balance requirements of the project.
 - 3. Select variable speed drives to allow an increase or decrease of minimum of ten percent of design fan speed.
- F. Motors:
 - 1. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.

2. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.
- G. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.
- H. Belts:
1. All belts shall be furnished in matched sets.
 2. Belts shall be within 1 degree 30 minutes of true alignment in all cases.
- I. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Greenheck Fan Corporation.
 2. Loren Cook Company.
 3. PennBarry.
 4. American Coolair Corporation.
- J. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.3 AIR INLETS AND OUTLETS

- A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.
- C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.4 AIR FILTERS

- A. Temporary (Construction Period) Filters:
1. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, in accordance with manufacturer's directions, in order to provide protection for the unit prior to occupancy by the Owner.
 2. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the

permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.

B. Spare Filters:

1. Furnish two new, complete sets of filter cartridges for each filter bank on completion and acceptance of the work. Install one set of filters in units (prior to final air balance). Provide units designed to accommodate washable, permanent filters with one washable, permanent filter.

2.5 DAMPERS

A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.

B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.

1. Rectangular Ductwork:

- a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.
- b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.
- c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.

2. Round Ductwork:

- a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.
- b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches damper. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.

3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.

2.6 DUCTWORK

A. Construct and install sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.

1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.
 2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.
 3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.
 4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.
 5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.
 - a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.
 - b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide continuous metal clip at top and sides of duct, with 1 inch overhang for top side.
- B. Design and installation standards:
1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.
 2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
 3. California Mechanical Code.
- C. Duct sizes indicated are external sizes.
- D. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
1. Provide mill certification for galvanized material at request of the Project Inspector.
- E. Duct Sealants:
1. Sealant shall have a VOC content of 250 g/L or less.

2. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
 3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Design Polymerics, model DP1010.
 - 2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.
 - 3) McGill Airseal, LLC.
- F. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.
- G. Rectangular Duct Fabrication:
1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.
 - a. SMACNA HVAC Duct Construction Standards
 - b. California Mechanical Code
 2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

<u>Table A</u>		
<u>Duct Dimension</u>	<u>Minimum Gauge</u>	<u>Joint Reinforcement Per CMC</u>
Through 12"	26	Not Required
13" through 18"	24	Not Required
19" through 30"	24	C/4
31" through 42"	22	E/4
43" through 54"	22	F/2
55" through 60"	20	G/4
61" through 84"	20	I/2
85" through 96"	20	J/2

Over 96"	18	K/2
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3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.
4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph "DAMPERS" for damper requirements.
5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

H. Rectangular Internally Insulated Duct Fabrication:

1. Provide internal duct lining where indicated on the Drawings, with a minimum of 10'-0" length in each direction from the fan, fan casing, or unit casing. Line all transfer ducts.
 - a. Where ductwork is exposed to weather or outside the building insulation envelope, provide 2 inch thick, 1-1/2 pound density internal lining with matte facing, with an R-Value of 8.0 minimum.
 - b. Where ductwork is within the building insulation envelope, lining shall be 1" thick, 1-1/2 pound density, with R-value of 4.2 minimum.
 - c. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
 - d. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).
 - e. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal all raw edges of insulation inside ductwork with adhesive, including longitudinal liner edges.
 - f. Provide metal nosing at all locations where liner is preceded by unlined metal.
 - g. Provide sheet metal weld pins and washers or clinch pins and washers on all ductwork on 12 inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and within 4 inches of corners. No use of adhesive mounted pins will be considered.

- 1) Install clinched pin fasteners with properly adjusted automatic fastening equipment. Manual installation will not be considered.
 - 2) Install weld pins with properly adjusted automatic fastening equipment. Installation shall not damage the galvanized coating on the outside of the duct.
- h. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.
- i. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

<u>Manufacturer:</u>	<u>Product:</u>
Johns Manville	Linacoustic RC
CertainTeed Corporation	ToughGard
Fosters Adhesive	85-62
Swifts Adhesive	7336

I. Round and Oval Ductwork Fabrication:

1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.
 - a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.
 - 1) Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static pressure loss equivalent to rectangular duct shown on Drawings.
 - 2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.
2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.

3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

<u>Diameter</u>	<u>Minimum Gauge</u>	<u>Method of Manufacture</u>
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam
24" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.
5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

<u>Diameter</u>	<u>Minimum Gauge</u>
3" to 36"	20
38" to 50"	18
Over 50"	16

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
 7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.
- J. Round Internally Insulated Duct and Fittings: Where ductwork is exposed to weather or outside the building insulation envelope, construct with outer pressure shell, 2 inch thick (Minimum R-value = R-8) insulation layer, and perforated inner liner. Where ductwork is within the building insulation envelope, construct with outer pressure shell, 1 inch thick (minimum R-value = R4.2) insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ANSI/ASTM A 653, of spiral lockseam construction (use longitudinal seam for over 59 inches), in minimum gauges listed in table below. Where installed exposed

in the conditioned space: duct and fitting outer pressure shell shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value = R-4.2), and perforated inner liner.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner</u>
3" TO 12"	26 gauge	24 gauge
13" TO 24"	24 gauge	24 gauge
25" to 34"	22 gauge	24 gauge
35" to 48"	20 gauge	24 gauge
49" to 58"	18 gauge	24 gauge
Over 59"	16 gauge	20 gauge

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell at exposed ducts. Provide spot weld bonded seams at concealed ducts.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner</u>
3" to 34"	20 gauge	24 gauge
36" to 48"	18 gauge	24 gauge
Over 48"	16 gauge	24 gauge

2. Inner Liner: Perforate with 3/32 inch holes for 22 percent open area. Provide metal spacers welded in position to maintain spacing and concentricity.
3. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
4. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).
5. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.
6. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

- a. Sheet Metal Div., McGill AirFlow, LLC., Acousti-k27
- b. Semco Duct and Acoustical Products, Inc.
- c. Air Systems Manufacturing, Inc. - Las Vegas

K. Duct Access Doors:

- 1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access doors. Minimum size access doors shall be 6 inches by 6 inches.
- 2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.

L. Flexible Air Ducts:

- 1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.
 - 2) ThermaFlex model M KC.
- 2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with UL 181, Class 1. Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.
- 3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.
- 4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1 inch negative static pressure.
- 5. Duct Access Panels:
 - a. Provide duct access panel assembly of the same material and gauge used for the duct. Duct access panels shall conform to the following:

- 1) Fasteners: Black steel or stainless steel to match material used for the duct. Panel fasteners shall not penetrate duct wall.
- 2) Gasket: Comply with NFPA 96, grease-tight, high temperature ceramic fiber, rated for minimum 1500 °F.

M. Flexible Connectors:

1. Materials: Flame-retardant or noncombustible fabrics. Coatings and adhesives shall comply with UL 181, Class 1, with flame spread index of 25 or less, and smoke-developed index of 50 or less.
2. Metal-Edged Connectors: Factory fabricated with a fabric strip 3 inches wide attached to two strips of 3-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
3. Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - a. Minimum Weight: 26 oz./sq. yd.
 - b. Tensile Strength: Minimum 475 lbf/inch in the warp and minimum 375 lbf/inch in the filling.
 - c. Service Temperature: Minus 50 to plus 200 deg F.
4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Ductmate Industries, Inc., model Proflex.
 - b. Ventfabrics, Inc., model Ventlon.

2.7 INSULATION MATERIALS

A. General:

1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. Insulation Materials:

1. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Aeroflex USA, Inc.
 - 2) Armacell LLC.
 - 3) K-Flex USA.
 2. Mineral-Fiber, Preformed Pipe Insulation:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Johns Manville; a Berkshire Hathaway company.
 - 2) Knauf Insulation.
 - 3) Manson Insulation Inc.
 - 4) Owens Corning.
 - b. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL.
 3. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Provide 2-inch wide stapling and taping flange.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) CertainTeed Corporation.
 - 2) Johns Manville.
 - 3) Knauf Insulation.
 - 4) Owens Corning.
- C. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.

3. Service Temperature Range: 0 to plus 180 deg F.
 4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Childers Brand; H. B. Fuller Construction Products.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Childers Brand; H. B. Fuller Construction Products.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: 0 to plus 180 deg F.
 4. Color: White.
- F. Field Applied Jackets:
1. PVC Jacket and Factory Fabricated Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Johns Manville, model Zeston, with Zeston 2000 fitting covers.
 - 2) Proto Corporation, model LoSmoke.
 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Childers Brand; H. B. Fuller Construction Products.
 - 2) ITW Insulation Systems; Illinois Tool Works, Inc.
 - 3) RPR Products, Inc.
- b. Finish and thickness are indicated in field-applied jacket schedules.
- c. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
- d. Factory-Fabricated Fitting Covers:
 - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 2) Tee covers.
 - 3) Flange and union covers.
 - 4) End caps.
 - 5) Beveled collars.
 - 6) Valve covers.
 - 7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

PART 3 - EXECUTION

3.1 FAN INSTALLATION

- A. Ceiling Mounted Fans: Mount variable speed switch within fan housing. Mark final balance point on variable speed switch.
- B. Provide access doors for fans or motors mounted in ductwork.
- C. Mount all fans as detailed on Drawings and in compliance with CBC standards.
- D. Fan motors mounted in air-stream to be totally enclosed.
- E. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.
- F. Roof fans shall be mounted level.
- G. Provide heavy-duty rubber gasket between exhaust fan mounting flange and roof curb, or as required for an airtight installation.

3.2 AIR INLETS AND OUTLETS INSTALLATION

- A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.

- B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.
- C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
 - 1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
 - 2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
 - 3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.
- D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.
- E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.3 TEMPORARY FILTERS

- A. Provide temporary filters for fans that are operated during construction; after construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.
 - 1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.4 DAMPER INSTALLATION

- A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.
- B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.

- C. Install fusible link fire dampers full size of duct at points where shown or required.
- D. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.
 - 1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.5 DUCTWORK INSTALLATION

A. General:

- 1. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.
- 2. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealers shall be fire retardant. Sheet metal screws for joints shall be minimum #10 size galvanized.
- 3. Where ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
- 4. Horizontal runs of ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
- 5. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.
- 6. Paint inside of ducts, visible through grille, dull black.
- 7. Where ductwork is installed in finished areas of buildings that do not have ceilings, paint ductwork, support hangers, and air inlets and outlets to match adjacent architectural surfaces, or as directed by Architect.
- 8. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.

B. Firestopping:

1. Pack the annular space between duct openings and ducts penetrating floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
2. Firestopping systems to be installed in strict accordance with manufacturer's instructions.
3. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

C. Flashing:

1. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
2. Refer to Division 07 specifications and Drawings details as applicable.
3. Flashing for penetrations of roof for mechanical items such as flues and ducts shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
 - a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
 - b. Flues and ducts shall have 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

- D. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

- E. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

- F. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
- G. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.
- H. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct plus insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.
- I. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.
 - 1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.
 - 2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.
- J. Installation of Flexible Ductwork:
 - 1. Provide flexible ducts with supports at 30 inch centers with 2 inch wide, 26 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.
 - a. Supports shall be in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible).
 - b. Flexible duct bends shall be not less than 1-1/2 duct diameter bend radius.
 - 2. Make connections to rigid duct and units with Panduit style draw band at inner liner material, and a second draw band over the outer vapor barrier material.
 - 3. Make connection to duct with spin-in fittings, with air scoop and balance damper.

3.6 DUCTWORK SEALING AND LEAK TESTING

- A. All ductwork shall receive a Class A seal.

- B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.

- C. Leakage Classes:

<u>Pressure Class</u>	<u>Leakage Class</u>	
	<u>Round Duct</u>	<u>Rectangular Duct</u>
2"W.G. or less	8	16
4"W.G. or greater	2	4

- D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA "HVAC Air Duct Leakage Test Manual." Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 23 08 00.13, "Title 24 Commissioning of HVAC."

3.7 HANGER AND SUPPORT INSTALLATION

- A. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

- B. Duct Support to Structure:

1. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

2. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

3. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
 4. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.
- C. Duct Insulation Installation:
1. General:
 - a. Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested as a composite installation including insulation, facing materials, tapes and adhesives as normally applied. Material exposed within ducts or plenum shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50.
 - b. Duct insulation applied to the exterior surface of ducts installed outside the building insulation envelope shall meet minimum R-value of R-8 at 3 inches thickness and 3/4 pound per cubic foot density.
 - c. Duct insulation applied to the exterior surface of ducts installed within the building insulation envelope shall meet minimum R-value of R-4.2 at 1-1/2 inches thickness and 3/4 pound per cubic foot density.
 2. Mineral Fiber Blanket Installation:
 - a. Insulate all unlined concealed supply and return ducts with fiberglass duct wrap, manufactured as a blanket of glass fibers factory laminated to a reinforced foil/kraft vapor retarding facing. Provide 2 inch stapling and taping flange. Wrap insulation entirely around duct and secure with outward clinching staples on 6 inch centers. Provide mechanical fasteners at maximum 18 inch centers for all bottoms of duct which are greater than 24 inches. Lap all insulation joints 3" minimum. Insulate ducts installed tight against other work before hanging in place. Seal all seams, both longitudinal and transverse, and all staple and mechanical fastener penetrations of facing with scrim backed foil tape or recommended sealant, to provide a vapor tight installation.
 3. PVC Jacket Installation:
 - a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 - 1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 EQUIPMENT START-UP

- A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.
- B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.

- C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.
- D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.
- E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.9 TESTING AND BALANCING

- A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.10 CLEANING AND PROTECTION

- A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.
- B. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.
- C. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.11 EQUIPMENT MOUNTING

- A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

3.12 INDOOR DUCT INSULATION SCHEDULE

- A. Ducts Located Within Building Thermal Envelope:
 - 1. Minimum R-Value = R-4.2.
 - 2. Supply and Return Ducts: Mineral Fiber Blanket, 1-1/2 inches thick, 0.75 lb/cu. ft.
- B. Ducts Located Within Building Outside Thermal Envelope:
 - 1. Minimum R-Value – R-8.0.
 - 2. Supply and Return Ducts: Mineral Fiber Blanket, 3 inches thick, 0.75 lb/cu. ft.

3.13 OUTDOOR DUCT INSULATION SCHEDULE.

- A. Minimum R-Value = R-8.
- B. Refer to article, Ductwork, for internal duct lining. Provide 2 inches thick internal duct lining where indicated on Drawings.

3.14 INDOOR FIELD-APPLIED DUCT JACKET SCHEDULE

- A. Insulated ducts in concealed spaces: None.
- B. Insulated ducts in exposed unconditioned spaces: PVC, 20 mils thick.

END OF SECTION 23 80 00

SECTION 26 05 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work of this Section consists of providing all required labor, supervision, materials and equipment to satisfactorily complete all electrical installations that are shown on the Drawings, included in these specifications, or otherwise needed for a complete and fully operating facility.
- B. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated electrical systems.

1.2 RELATED WORK:

- A. This Section provides the basic Electrical Requirements which supplement the General Requirements of Division 01 and apply to all Sections of Division 26.

1.3 SUBMITTALS:

- A. As specified in Division 01. Submit to the Architect shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Information to be submitted includes manufacturer's descriptive literature of cataloged products, equipment, drawings, diagrams, performance and characteristic curves as applicable, test data and catalog cuts. Obtain written approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Furnish manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.
- B. Organize submittals for equipment and items related to each specification section together as a package.
- C. Proposed substitutions of products will not be reviewed or approved prior to awarding of the Contract.
- D. Substitutions shall be proven to the Architect or Engineer to be equal or superior to the specified product. Architect's decision is final. The Contractor shall pay all costs incurred by the Architect and Engineer in reviewing and processing any proposed substitutions whether or not a proposed substitution is accepted.

- E. If a proposed substitution is rejected, the contractor shall furnish the specified product at no increase in contract price.
- F. If a proposed substitution is accepted, the contractor shall be completely responsible for all dimensional changes, electrical changes, or changes to other work which are a result of the substitution. The accepted substitution shall be made at no additional cost to the owner or design consultants.

1.4 QUALITY ASSURANCE:

- A. Codes: All electrical equipment and materials, including installation and testing, shall conform to the latest editions following applicable codes:
 - 1. California Electrical Code (CEC).
 - 2. Occupational Safety and Health Act (OSHA) standards.
 - 3. All applicable local codes, rules and regulations.
 - 4. Electrical Contractor shall possess a C-10 license and all other licenses as may be required. Licenses shall be in effect at start of this contract and be maintained throughout the duration of this contract.
- B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.
- C. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufacturers Association (NEMA).
- D. Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Provide service entrance labels for all equipment required by the NEC to have such labels.
- E. The electrical contractor shall guarantee all work and materials installed under this contract for a period of one (1) year from date of acceptance by owner.
- F. All work and materials covered by this specification shall be subject to inspection at any and all times by representatives of the owner. Work shall not be closed in or covered before inspection and approval by the owner or his representative. Any material found not conforming with these specifications shall, within 3 days after being notified by the owner, be removed from premises; if said material has been installed, entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the contractor.

1.5 CONTRACT DOCUMENTS:

- A. Drawings and Specifications:

1. In the case of conflict between the drawings and specifications, the specifications shall take precedence.
 2. Drawings and specifications are intended to comply with all law, ordinances, rules and regulations of constituted authorities having jurisdiction, and where referred to in the Contract Documents, said laws, ordinance, rules and regulations shall be considered as a part of said Contract Documents within the limits specified. The Contractor shall bear all expenses of correcting work done contrary to said laws, ordinance, rules and regulations if the Contractor knew or should have known that the work as performed is contrary to said laws, ordinances, rules and regulations and if the Contractor performed same (1) without first consulting the Architect for further instructions regarding said work and/or (2) disregarded the Architect's instructions regarding said work.
- B. Drawings: The Electrical Drawings shall govern the general layout of the completed construction.
1. Locations of equipment, panels, pullboxes, conduits, stub-ups, ground connections are approximate unless dimensioned; verify locations with the Architect prior to installation.
 2. Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for those installations.
 3. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Architect for approval.
 4. The general arrangement and location of existing conduits, piping, apparatus, etc., is approximate. The drawings and specifications are for the assistance and guidance of the contractor, exact locations, distances and elevations are governed by actual field conditions. Accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by the Architect.
 5. All drawings and divisions of these specifications shall be considered as whole. The contractor shall report any apparent discrepancies to the Architect prior to submitting bids.
 6. The contractor shall be held responsible to have examined the site and compared it with the specifications and plans and to have satisfied himself as to the conditions under which the work is to be performed. He shall be held responsible for knowledge of all existing conditions whether or not accurately described. No subsequent allowance shall be made for any extra expense due to failure to make such examination.

1.6 CLOSEOUT SUBMITTALS:

- A. Manuals: Furnish manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 01.

1.7 COORDINATION:

- A. Coordinate the electrical work with the other trades, code authorities, utilities and the Architect.
- B. Provide and install all trenching, backfilling, conduit, pull boxes, splice boxes, etc. for all Utility Company services to the locations indicated on the Drawings. All materials and construction shall be in accordance with the requirements for all the Utility Companies. Prior to performing any work, the Electrical Contractor shall coordinate with the various Utility Companies and obtain utility company engineering drawings. Verify that all such work and materials shown on the Drawings are of sufficient sizes and correctly located to provide services on the site. The Electrical Contractor shall verify with all the Utility Companies that additional contractor furnished and installed work is not required. If additional work, materials, or changes are required by any of the Utility Companies, the Electrical Contractor shall advise the Architect of such changes and no further work shall then be performed until instructed to do so by the Architect. The Electrical Contractor shall coordinate with the various Utility Companies to schedule inspections and to obtain service connections.
- C. The Electrical Contractor shall schedule all utility work necessary for utility inspections, connections, cable installation, etc. for the new electrical service to meet the construction schedule.
- D. Utility Company charges shall be paid by the Owner.
- E. Contractor shall pay all inspection and other applicable fees and procure all permits necessary for the completion of this work.
- F. Where connections must be made to existing installations, properly schedule all the required work, including the power shutdown periods.
- G. When two trades join together in an area, make certain that no electrical work is omitted.

1.8 JOB CONDITIONS:

- A. Operations: Perform all work in compliance with Division 01
 - 1. Keep the number and duration of power shutdown periods to a minimum.
 - 2. Show all proposed shutdowns and their expected duration on the construction schedule. Schedule and carry out shutdowns so as to cause the least disruption to operation of the Owner's facilities.
 - 3. Carry out shutdown only after the schedule has been approved, in writing, by the owner. Submit power interruption schedule 15 days prior to date of interruption.

- B. Construction Power: Unless otherwise noted in Division 01 of these specifications, contractor shall make all arrangements and provide all necessary facilities for temporary construction power [from the owner's on site source. Energy costs shall be paid for by the Owner.
- C. Storage: Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from weather, dust, water, or construction operations.

1.9 DAMAGED PRODUCTS:

- A. Notify the Architect in writing in the event that any equipment or material is damaged. Obtain approval from the Architect before making repairs to damaged products.

1.10 LOCATIONS:

- A. General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located.
- B. Dry Locations: All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
- C. Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.

1.11 SAFETY AND INDEMNITY:

- A. The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continually and not be limited to normal working hours. The contractor shall provide and maintain throughout the work site proper safeguards including, but not limited to, enclosures, barriers, warning signs, lights, etc. to prevent accidental injury to people or damage to property.
- B. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
- C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants, and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the Engineer, their Consultants or their officers, agents and employees.

- D. If a work area is encountered that contains hazardous materials, the contractor is advised to coordinate with the owner and its abatement consultant for abatement of hazardous material by the Owner's Representative. "Hazardous materials" means any toxic substance regulated or controlled by OSHA, EPA, State of California or local rules, regulations and laws. Nothing herein shall be construed to create a liability for Aurum Consulting Engineers regarding hazardous materials abatement measures, or discovery of hazardous materials.

1.12 ACCESS DOORS:

- A. The contractor shall install access panels as required where floors, walls or ceilings must be penetrated for access to electrical, control, fire alarm or other specified electrical devices. The minimum size panel shall be 14" x 14" in usable opening. Where access by a service person is required, minimum usable opening shall be 18" x 24".
- B. All access doors installed lower than 7'-0" above finished floor and exposed to public access shall have keyed locks.
- C. Where specific information or details relating to access panels differ from Division 26 paragraph 1.12 of these specifications, or shown on the electrical drawings and details or under other Divisions of work, those requirements shall supersede these specifications.

1.13 ARC FLASH:

- A. The contractor shall install a clearly visible arc flash warning to the inside door of all panelboards and industrial control panels, as well as to the front of all switchboards and motor control centers that are a part of this project.
- B. The warning shall have the following wording: line 1 "WARNING" (in large letters), line 2 "Potential Arc Flash Hazard" (in medium letters), line 3 & 4 "Appropriate Personal Protective Equipment and Tools required when working on this equipment".

1.14 EMERGENCY BOXES:

- A. All boxes and enclosures for emergency circuits shall be permanently marked with a readily visible red spray painted mark.

PART 2 - PRODUCTS

2.1 STANDARD OF QUALITY:

- A. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are established to be equal to the specified product and approved by the Architect prior to installation.
- B. Material and Equipment: Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The

standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.

- C. Service Support: Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.
- D. Manufacturer's Recommendations: Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.2 NAMEPLATES:

- A. For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings, the model designation, and shop order number.
- B. Identify each piece of equipment and related controls with a rigid laminated engraved plastic nameplate. Unless otherwise noted, nameplates shall be melamine plastic 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 0.5 by 2.5 inches unless otherwise noted. Where not otherwise specified, lettering shall be a minimum of 0.25 inch high normal block style. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel or brass screws.

2.3 FASTENERS:

- A. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.4 FINISH REQUIREMENTS:

- A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Architect.
- B. Wiring System: In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

- A. Ensure that all equipment and materials fit properly in their installation.
- B. Perform any required work to correct improperly fit installation at no additional expense to the owner.
- C. All electrical equipment and materials shall be installed in a neat and workmanship manner in accordance with the "NECA-1 Standard Practices for Good Workmanship in Electrical Contracting". Workmanship of the entire job shall be first class in every respect.

3.2 EQUIPMENT INSTALLATIONS:

- A. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
- B. Do all the cutting and patching necessary for the proper installation of work and repair any damage done.
- C. Earthquake restraints: all electrical equipment, including conduits over 2 inches in diameter, shall be braced or anchored to resist a horizontal force acting in any direction as per CBC Section 1616A Title 24, part 2 and ASCE7-10, Sections 13.3 and 13.6 and Table 13.6-1.
- D. Structural work: All core drilling, bolt anchor insertion, or cutting of existing structural concrete shall be approved by a California registered structural consulting engineer prior to the execution of any construction. At all floor slabs and structural concrete walls to be drilled, cut or bolt anchors inserted, the contractor shall find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts, cores, or bolt anchor locations for approval.

3.3 FIELD TEST:

- A. Test shall be in accordance with Acceptance testing specifications issued by the National Electrical Testing Association (NETA).
- B. Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all circuits and components, and demonstrate as ready for service. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Architect prior to any test so that the tests may be witnessed.
- C. Provide instruments, other equipment and material required for the tests. These shall be of the type designed for the type of tests to be performed. Test instrument shall be calibrated by a recognized testing laboratory within three months prior to performing tests.
- D. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service.

Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions.

- E. Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Architect. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.
- F. Maintain records of each test and submit five copies to the Architect when testing is complete. All tests shall be witnessed by the Architect. These records shall include:
 - 1. Name of equipment tested.
 - 2. Date of report.
 - 3. Date of test.
 - 4. Description of test setup.
 - 5. Identification and rating of test equipment.
 - 6. Test results and data.
 - 7. Name of person performing test.
 - 8. Owner or Architect's initials.
- G. Items requiring testing shall be as noted in the additional electrical sections of these specifications.

3.4 CLEANING EQUIPMENT:

- A. Thoroughly clean all soiled surfaces of installed equipment and materials.

3.5 PAINTING OF EQUIPMENT:

- A. Factory Applied: Electrical equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section.
- B. Field Applied: Paint electrical equipment as required to match finish of adjacent surfaces.

3.6 RECORDS:

- A. Maintain one copy of the contract Drawing Sheets on the site of the work for recording the "as built" condition. After completion of the work, the Contractor shall carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:

1. Cable Size and Type: Provide the size and type of each cable installed on project.
2. Substructure: Where the location of all underground conduits, pull boxes, stub ups and etc. where are found to be different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
3. Size of all conduit runs.
4. Routes of concealed conduit runs and conduit runs below grade.
5. Homerun points of all branch circuit.
6. Location of all switchgear, panels, MCC, lighting control panels, pullcans, etc.
7. Changes made as a result of all approved change orders, addendums, or field authorized revisions.
8. As Built: At the completion of the Work the Contractor shall review, certify, correct and turn over the marked up Drawings to the Architect for his use in preparing "as built" plans.
9. As built Drawings shall be delivered to the Architect within ten (10) days of completion of construction.

3.7 CLEAN UP:

- A. Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Architect.

3.8 MECHANICAL AND PLUMBING ELECTRICAL WORK:

- A. The requirements for electrical power and/or devices for all mechanical and plumbing equipment supplied and/or installed under this Contract shall be coordinated and verified with the following:
 1. Mechanical and Plumbing Drawings.
 2. Mechanical and Plumbing sections of these Specifications.
 3. Manufacturers of the Mechanical and Plumbing equipment supplied.
- B. The coordination and verification shall include the voltage, ampacity, phase, location and type of disconnect, control, and connection required. Any changes that are required as a result of this coordination and verification shall be a part of this Contract.
- C. The Electrical Contractor shall furnish and install the following for all mechanical and plumbing equipment:
 1. Line voltage conduit and wiring.
 2. Disconnect switches.
 3. Manual line motor starters.

- D. Automatic line voltage controls and magnetic starters shall be furnished by the Mechanical and/or Plumbing Contractor and installed and connected by the Electrical Contractor. When subcontracted for by the Mechanical and/or Plumbing Contractor, all line voltage control wiring installed by the Electrical Contractor shall be done per directions from the Mechanical and/or Plumbing Contractor.
- E. All low voltage control wiring for Mechanical and Plumbing equipment shall be installed in conduit. Furnishing, installation and connection of all low voltage conduit, boxes, wiring and controls shall be by the Mechanical and/or Plumbing Contractor.
- F. Disconnects (Motor And Circuit)
 - 1. Disconnect switches shall be as manufactured by ITE- Siemens, General Electric or Square D.
- G. Disconnects (Motor: Fused):
 - 1. Disconnect switches shall be provided and located at all motors.
 - 2. Switches for three-phase motors shall be heavy-duty, horsepower rated three-pole, and surface mounted except as noted on drawings.
 - 3. Switches containing more than three poles shall be as specified on the drawings.
 - 4. Switches for single-phase, fractional horsepower motors shall be heavy-duty, horsepower rated.
 - 5. Switches shall be horsepower rated.
- H. Manual motor starters, where required, shall have toggle type operators with pilot light and melting alloy type overload relays, SQUARE D COMPANY, Class 2510, Type FG-1P (surface) or Type FS-1P (flush) or ITE, WESTINGHOUSE or GENERAL ELECTRIC equal.

END OF SECTION 26 05 00

SECTION 26 05 19

LINE VOLTAGE WIRE AND CABLE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work of this Section consists of providing all wire and cable rated 600 volts or less, including splices and terminations, as shown on the Drawings and as described herein.

1.2 RELATED WORK:

- A. See the following Specification Section for work related to the work in this Section:

- 1. 260542 Conduits, Raceways and Fittings.
- 2. 260533 Junction and Pull Boxes.

1.3 QUALITY ASSURANCE:

- A. Field tests shall be performed as specified in paragraph 3.04 of this Section.

PART 2 - PRODUCTS

2.1 CONDUCTORS:

- A. Conductors shall be copper, type THHN/THWN/MTW oil and gasoline resistant, 600 volt rated insulation.
- B. Conductors shall be stranded copper.
- C. Minimum power and control wire size shall be No. 12 AWG unless otherwise noted.
- D. All conductors used on this Project shall be of the same type and conductor material.

2.2 CABLES:

- A. All individual conductors shall be copper with type THHN/THWN, 600 volt rated insulation with 90 degree rating.
- B. Insulation Marking - All insulated conductors shall be identified with printing colored to contrast with the insulation color.
- C. Color Coding - As specified in paragraph 3.03.

- D. Special Wiring - Where special wiring is proposed by an equipment manufacturer, submit the special wiring requirements to the Owner's Representative and, if approved, provide same. Special wire shall be the type required by the equipment manufacturer.
- E. Other Wiring - Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and as approved by the Owner's Representative.
- F. Manufacturer - Acceptable manufacturers including Cablec, Southwire, or equal.

2.3 TERMINATIONS:

- A. Manufacturer - Terminals as manufactured by T&B, Burndy or equal.
- B. Wire Terminations – Stranded conductors shall be terminated in clamping type terminations which serve to contain all the strands of the conductor. Curling of a stranded conductor around a screw type terminal is not allowed. For screw type terminations, use a fork type stake-on termination on the stranded conductor. Use only a stake-on tool approved for the fork terminals selected.
- C. End Seals - Heat shrink plastic caps of proper size for the wire on which used.

2.4 TAPE:

- A. Tape used for terminations and cable marking shall be compatible with the insulation and jacket of the cable and shall be of plastic material.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION:

- A. Clean Raceways - Clean all raceways prior to installation of cables as specified in Section 260542 - Conduits Raceway and Fittings.
- B. All line voltage wiring shall be installed in conduit.
- C. All feeder conductors shall be continuous from equipment to equipment. Splices in feeders are not permitted unless specifically noted or approved by the Electrical Engineer.
- D. All branch circuit wiring shall be run concealed in ceiling spaces, walls, below floors or in crawl spaces unless noted otherwise.
- E. Cable Pulling - Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and

protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

- F. Bending Radius - Cable bending radius shall be per applicable code. Install feeder cables in one continuous length.
- G. Equipment Grounding Conductors - Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in all conduits or all raceways.
- H. Panelboard Wiring - In panels, bundle incoming wire and cables which are No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

3.2 CABLE TERMINATIONS AND SPLICES:

- A. Splices - UL Listed wirenuts.
- B. Terminations - Shall comply with the following:
 - 1. Make up and form cable and orient terminals to minimize cable strain and stress on device being terminated on.
 - 2. Burnish oxide from conductor prior to inserting in oxide breaking compound filled terminal.

3.3 CIRCUIT AND CONDUCTOR IDENTIFICATION:

- A. Color Coding - Provide color coding for all circuit conductors. Insulation color shall be white for neutrals and green for grounding conductors. Conductor colors shall be as follows:

<u>VOLTAGE</u>	<u>208/120V</u>	<u>480/277V</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Grey
Ground	Green	Green

- B. Color coding shall be in the conductor insulation for all conductors #10 AWG and smaller; for larger conductors, color shall be either in the insulation or in colored plastic tape applied at every location where the conductor is readily accessible.
- C. Circuit Identification - All underground distribution and service circuits shall be provided with plastic identification tags in each secondary box and at each termination.

Tags shall identify the source transformer of the circuit and the building number(s) serviced by the circuit.

3.4 FIELD TESTS:

- A. All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show an insulation resistance between phase conductors and ground of not less than the requirements of the CEC. All circuits shall be tested for proper neutral connections.
- B. Insulation Resistance Tests: Perform insulation resistance tests on circuits with #2 AWG and larger conductors to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests before all equipment has been connected. Test the insulation with a 500Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 2 megohms or more. Submit results for review.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Conduits, wires, ground rods and other materials for the electrical grounding system.

1.2 RELATED SECTIONS:

- A. Section 260500 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 GROUND ROD:

- A. "Copperweld" ground rod conforming to or exceeding requirements of U.L. Specification No. 467 (ANSI C-33.8). Rod shall be 3/4" diameter and 10' in length, unless otherwise noted on the Drawings.

2.2 BELOW GRADE CONNECTIONS:

- A. Compression fittings, Thomas & Betts, Series 52000, 53000 or 54000 or approved equal.

2.3 HARDWARE:

- A. Bolts, nuts and washers shall be bronze, cadmium plated steel or other non-corrosive materials, approved for the purpose.

2.4 WATERPROOF SEALANT:

- A. Use Kearney "Aqua Seal" mastic sealant on all below grade clamp or compression type connections.

PART 3 - EXECUTION

3.1 GROUNDING AND BONDING:

- A. Grounding and bonding shall be as required by codes and local authorities.
- B. All electrical equipment shall be grounded, including, but not limited to, panel boards, terminal cabinets and outlet boxes.
- C. The ground pole of receptacles shall be connected to their outlet boxes by means of a copper ground wire connecting to a screw in the back of the box.

- D. A green insulated copper ground wire, sized to comply with codes, shall be installed in all conduit runs.
- E. All metal parts of pull boxes shall be grounded per code requirements.
- F. All ground conductors shall be green insulated copper.
- G. The ground system electrodes shall be tested for resistance before the equipment ground conductors are connected. Maximum ground system resistance shall be 25 ohms. Install up to two additional ground rods to meet the 25 ohm requirement. Multiple ground rods shall not be less than 10 feet apart.
- H. Grounding of the panels and buildings shall be completed as indicated on the Drawings.

END OF SECTION 26 05 26

SECTION 26 05 33

OUTLET, JUNCTION AND PULL BOXES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work of this Section consists of providing all required labor, supervision, materials and equipment to satisfactorily complete all electrical installations shown on the drawings, included in these Specification, or otherwise needed for a complete and fully operating facility. The work shall include but not be limited to the following:
- B. Furnish and install all required material, supports and miscellaneous material for the satisfactory interconnection of all associated electrical systems.

1.2 RELATED WORK:

- A. See the following specification sections for work related to the work of this section.
 - 1. 260500 General Electrical Requirements.
 - 2. 260542 Conduits, Raceway and Fittings.
 - 3. 260519 Line Voltage Wire and Cable.

PART 2 - PRODUCTS

2.1 OUTLET BOXES, JUNCTION AND PULL BOXES

- A. Standard Outlet Boxes: Galvanized, steel, knock-out type of size and configuration best suited to the application indicated on the Drawings. Minimum box size shall be 4 inches square (octagon for most light fixtures) by 1-1/2 inches deep with mud rings as required.
- B. Switch boxes: Minimum box size shall be 4 inches square by 1-1/2 inches deep with mud rings as required. Install multiple switches in standard gang boxes with raised device covers suitable for the application indicated.
- C. Conduit bodies: Cadmium plated, cast iron alloy. Conduit bodies with threaded conduit hubs and neoprene gasketed, cast iron covers. Bodies shall be used to facilitate pulling of conductors or to make changes in conduit direction only. Splices are not permitted in conduit bodies. Crouse-Hinds Form 8 Condulets, Appleton Form 35 Unilets or equal.
- D. Sheet Metal Boxes: Use standard outlet or concrete ring boxes wherever possible; otherwise use a minimum 16 gauge galvanized sheet metal, NEMA I box sized to Code requirements with covers secured by cadmium plated machine screws located six inches on centers. Circle AW Products, Hoffman Engineering Company or equal.

- E. Flush Mounted Pull boxes and Junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

PART 3 - EXECUTION

3.1 OUTLET BOXES

A. General:

1. All outlet boxes shall finish flush with building walls, ceilings and floors except in mechanical and electrical rooms above accessible ceiling or where exposed work is called for on the Drawings.
2. Install raised device covers (plaster rings) on all switch and receptacle outlet boxes installed in masonry or stud walls or in furred, suspended or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
3. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

B. Box Layout:

1. Outlet boxes shall be installed at the locations and elevations shown on the drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
2. Locate switch outlet boxes on the latch side of doorways.
3. Outlet boxes shall not be installed back to back nor shall through-wall boxes be permitted. Outlet boxes on opposite sides of a common wall shall be separated horizontally by at least one stud or vertical structural member.
4. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.
5. On fire rated walls, the total face area of the outlet boxes shall not exceed 100 square inches per 100 square feet of wall area.

C. Supports:

1. Outlet Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on specified box supports.
2. Fixture outlet boxes installed in suspended ceiling of gypsum board or lath and plaster construction shall be mounted to 16 gauge metal channel bars attached to main ceiling runners.

3. Fixture outlet boxes installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structure above where pendant mounted lighting fixture are to be installed on the box.
4. Fixture Boxes above tile ceilings having exposed suspension systems shall be supported directly from the structure above.
5. Outlet and / or junction boxes shall not be supported by grid or fixture hanger wires at any locations.

3.2 JUNCTION AND PULL BOXES

A. General:

1. Install junction or pull boxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not shown on the Drawings.
2. Locate pull boxes and junction boxes in concealed locations above accessible ceilings or exposed in electrical rooms, utility rooms or storage areas.
3. Install raised covers (plaster rings) on boxes in stud walls or in furred, suspended or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
4. Leave no unused openings in any box. Install close-up plugs as required to seal openings.
5. Identify circuit numbers and panel on cover of junction box with black marker pen.

B. Box Layouts:

1. Boxes above hung ceilings having concealed suspension systems shall be located adjacent to openings for removable recessed lighting fixtures.

C. Supports:

1. Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on specified box supports.
2. Boxes installed in suspended ceilings of gypsum board or lath and plaster construction shall be mounted to 16 gauge metal channel bars attached to main ceiling runners.
3. Boxes installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structure above.
4. Boxes mounted above suspended acoustical tile ceilings having exposed suspension systems shall be supported directly from the structure above.

END OF SECTION 26 05 33

SECTION 26 05 42

CONDUITS, RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work of this section consists of furnishing and installing conduits, raceways and fittings as shown on the Drawings and as described herein.

1.2 RELATED WORK:

- A. See the following specification sections for work related to the work in this section:
 - 1. 260543 Underground Ducts
 - 2. 260544 In Grade Pull Boxes
 - 3. 260519 Line Voltage Wire and Cable
 - 4. 260533 Junction and Pull Boxes

PART 2 - PRODUCTS

2.1 CONDUITS, RACEWAYS:

- A. Electrical Metallic Tubing (EMT) shall be hot-dip galvanized after fabrication. Couplings shall be compression or set-screw type.
- B. Flexible Conduit: Flexible metal conduit shall be galvanized steel.
- C. Galvanized Rigid Steel Conduit (GRS) shall be hot-dip galvanized after fabrication. Couplings shall be threaded type.
- D. Rigid Non-metallic Conduit: Rigid non-metallic conduit shall be PVC Schedule 40 (PVC-40 or NEMA Type EPC-40) conduit approved for underground use and for use with 90° C wires.

2.2 CONDUIT SUPPORTS:

- A. Supports for individual conduits shall be galvanized malleable iron one-hole type with conduit back spacer.
- B. Supports for multiple conduits shall be hot-dipped galvanized Unistrut or Superstrut channels, or approved equal. All associated hardware shall be hot-dip galvanized.
- C. Supports for EMT conduits shall be galvanized pressed steel single hole straps.

D. Clamp fasteners shall be by wedge anchors. Shot in anchors shall not be allowed.

2.3 FITTINGS:

A. Provide threaded-type couplings and connectors for rigid steel conduits; provide steel compression (watertight), or steel set-screw type for EMT, (die-cast zinc or malleable iron type fittings are not allowed). Provide threaded couplings and Meyers hubs for rigid steel conduit exposed to weather.

B. Fittings for flexible conduit shall be Appleton, Chicago, IL, Type ST, O-Z Gedney Series 4Q by General Signal Corp., Terryville, CT, T & B 5300 series, or approved equal.

C. Fittings for use with rigid steel shall be galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse Hinds Condulets, Syracuse, NY, Appleton Unilets, Chicago, IL, or approved equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.

D. Fittings for use with rigid non-metallic conduit shall be PVC and have solvent-weld-type conduit connections.

E. Union couplings for conduits shall be the Erickson type and shall be Appleton, Chicago, IL, Type EC, O-Z Gedney 3-piece Series 4 by General Signal Corp., Terryville, CT, or approved equal. Threadless coupling shall not be used.

F. Bushings:

1. Bushings shall be the insulated type.

2. Bushings for rigid steel shall be insulated grounding type, O-Z Gedney Type HBLG, Appleton Type GIB, or approved equal.

G. Conduit Sealants:

1. Fire Retardant Types: Fire stop material shall be reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL Classification 35L4 or as specified on the Drawings.

PART 3 - EXECUTION

3.1 CONDUIT, RACEWAY AND FITTING INSTALLATION:

A. For conduit runs exposed to weather provide rigid metal (GRS).

B. For conduit run underground, in concrete or masonry block wall and under concrete slabs, install minimum $\frac{3}{4}$ " size nonmetallic (PVC) with PVC elbows. Where conduits transition from underground or under slab to above grade install wrapped rigid metal (GRS) elbows and risers.

- C. For conduit runs concealed in steel or wood framed walls or in ceiling spaces or exposed in interior spaces above six feet over the finished floor, install EMT.
- D. Flexible metal conduit shall be used only for the connection of recessed lighting fixtures and motor connections unless otherwise noted on the Drawings. Liquid-tight steel flexible conduit shall be used for motor connections.
- E. The minimum size raceway shall be 1/2-inch unless indicated otherwise on the Drawings.
- F. Installation shall comply with the CEC.
- G. From pull point to pull point, the sum of the angles of all of the bends and offset shall not exceed 360 degrees.
- H. Conduit Supports: Properly support all conduits as required by the NEC. Run all conduits concealed except where otherwise shown on the drawings.
 - 1. Exposed Conduits: Support exposed conduits within three feet of any equipment or device and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one-hole clamps.
 - a. Conduits attached to walls or columns shall be as unobtrusive as possible and shall avoid windows. Run all exposed conduits parallel or at right angles to building lines.
 - b. Group exposed conduits together. Arrange such conduits uniformly and neatly.
 - 2. Support all conduits within three feet of any junction box, coupling, bend or fixture.
 - 3. Support conduit risers in shafts with Unistrut Superstrut, or approved equal, channels and straps.
- I. Moisture Seals: Provide in accordance with NEC paragraphs 230-8 and 300-5(g).
- J. Where PVC conduit transitions from underground to above grade, provide rigid steel 90's with risers. Rigid steel shall be half-lap wrapped with 20 mil tape and extend minimum 12" above grade.
- K. Provide a nylon pull cord in each empty raceway.
- L. Provide galvanized rigid steel factory fittings for galvanized rigid steel conduit.
- M. Slope all underground raceways to provide drainage; for example, slope conduit from equipment located inside a building to the pull box or manhole located outside the building.

- N. Conduits shall be blown out and swabbed prior to pulling wires, or installation of pull cord in empty conduits.

END OF SECTION 26 05 42

SECTION 26 22 00

TRANSFORMERS

PART 1 - GENERAL

1.01 Description of Work:

- A. The work of this section consists of providing dry type transformers as shown on Drawings and as described in this section.

1.02 Related Work:

- A. See the following specification sections for work related to the work in this section.
 - 1. 260519 Line Voltage Wire and Cable.
 - 2. 260526 Grounding.

1.03 Submittals: In accordance with Division 01.

- A. Shop Drawings: Submit manufacturer's name and nameplate data as follows:
 - 1. KVA rating.
 - 2. Nominal primary voltage.
 - 3. Tap voltages.
 - 4. Nominal secondary voltage.
 - 5. Percent impedance.
 - 6. Weight.
 - 7. Physical dimensions and mounting requirements.
- B. Submit manufacturer's no-load loss value for transformer.
- C. Operation and Maintenance Data: Submit the manufacturer's operation and maintenance data in accordance with Division 01. Copies of the factory and field test reports shall be included in this submittal.

1.04 Factory Testing:

- A. Tests on transformers shall include the manufacturer's standard tests, including winding resistance, ratio, polarity, phase relation, no-load loss, impedance, full load losses, and dielectric tests. Certified copies shall show compliance with all referenced standards.

PART 2 - PRODUCTS:

2.01 Dry Type Transformer:

- A. Unless otherwise noted on the Drawings, general purpose transformers for supplying lighting and small power loads shall be dry type, two winding, 60 Hertz, aluminum windings,

temperature rise not exceeding 150°C under full load in an ambient of 40°C, with Class H 220° C insulation. Capacity rating, number of phases and voltages shall be as shown on the Drawings. Transformer shall comply with all applicable provisions of NEMA Standard ST20 and shall have NEMA Standard taps. Transformers rated below 15 KVA shall have two (2) 5% full capacity taps below rated primary volts and transformers rated 15 KVA and above shall have six (6) 2-1/2% full capacity taps, two above the four below nominal voltage Terminal compartment shall have a temperature rise not to exceed 35°C. Provide unit UL listed for indoor/outdoor mounting. Provide dry-type transformer as manufactured by Square D, Siemens, General Electric Company or approved equal.

- B. Transformers shall be low loss type with minimum efficiencies per NEMA TP-1 when operated at 35% of full load capacity. Efficiency shall be tested in accordance with NEMA TP-2.
- C. Transformers installed outdoors shall be NEMA 3R, Unless otherwise noted on the Drawings.
- D. Transformer sound levels shall not exceed the following values;
 - 1. 0-9 KVA 40 decibels
 - 2. 10-50 KVA 45 decibels
 - 3. 51-150KVA 50 decibels
 - 4. 151-300KVA 55 decibels
 - 5. 301-500KVA 60 decibels

PART 3 - EXECUTION

3.01 Transformer Installation:

- A. Transformer shall be where indicated on the Drawings. Indoor transformers shall have code and manufacturers recommended clearances from adjacent walls. In no case should this clearance be less than six inches.
- B. Transformer shall be connected with flexible liquid tight metallic conduit to prevent the transmission of sound through the conduit system. All transformers shall be installed on resilient vibration-isolating mounting pads.
- C. Transformer neutral grounding shall be sized in accordance with requirements for separately derived systems and shall be connected to the nearest cold water pipe with supplementary driven ground. Ground rod and connections shall be as detailed in Section 16060 [26 05 26].

3.02 Field Tests:

- A. Insulation-Resistance Tests: 480 volt windings shall be tested with a 1000 volt megohm meter; 208 or 240 shall be tested with a 500 volt megohm meter. All tests shall be applied for not less than 5 minutes and until three consecutive readings, one minute part, are obtain. Readings shall be recorded every 30 seconds for the first two minutes and every minute thereafter.
- B. Acceptance: Acceptance with be based on satisfactory completion of the insulation resistance tests.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS, 600 VOLTS AND BELOW

PART 1 GENERAL

1.01 Description of Work: The work of this Section consists of providing switchboards, as shown on the Drawings and as described herein.

1.02 Related Work:

A. See the following Specification Sections for work related to the work in this Section.

1. 260519 Line Voltage Wire and Cable
2. 262200 Transformers
3. 262816 Circuit Breakers

1.03 Submittals:

A. Shop Drawings - As specified in Section 26 05 00 and Division 0]. For each switchboard furnished under this Contract, submit manufacturer's name, catalog data, and the following information:

1. Switchboard type.
2. Main bus and terminal connection sizes.
3. Location of line connections.
4. Section dimensions.
5. Gutter space.
6. Gauge of boxes and fronts.
7. Finish data.
8. Voltage rating.
9. Breaker manufacturer, types, trip ratings, and interrupting ratings.

B. Before construction of the main (service) switchboard, the contractor shall deliver two or more copies of the switchboard submittal to P.G.&E. for their approval. The contractor shall deliver one P.G.&E. approved copy of the submittal to the Electrical Engineer for record.

C. Submit operation and maintenance data for switchboards, and circuit breakers including nameplate data, parts lists, manufacturer's circuit breaker time current coordination curves, factory and field test reports, recommended maintenance procedures and typewritten as-built panel and switchboard schedules. Submit in accordance with Division 01.

1.04 Warranty

- A. Manufacturer shall warrant equipment to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase

PART 2 – PRODUCTS

2.01 Switchboards:

- A. General: Switchboards shall be designed, built and tested in accordance with applicable portions of the latest NEMA, EUSERC, and Underwriter Laboratories standards and the latest requirements of the California Electrical Code. All sections and devices shall be UL listed and labeled.
 - 1. Switchboards shall be dead front, completely self-supporting structure of the required number of vertical sections bolted together to form one metal, totally enclosed, switchboard. Sides, top, and rear covers shall be code gauge steel, bolted to the switchboard structure.
 - 2. The switchboard shall be furnished with phase and neutral busses of the amps, volts and phase shown on the Drawings. The bus shall extend the full length of the switchboard. Tapered bus is not acceptable. The switchboard sections, when called for on the plans, shall be as follows:
 - a. Metering Section and landing lugs; Fully Pacific Gas & Electric Company compatible.
 - b. All sections shall include full capacity busing between sections.
 - c. All sections shall be front aligned and shall have front-connected devices.
 - 3. All buses shall be silver plated copper, supported with high impact, non-tracking insulating material, braced to withstand the mechanical forces exerted during short circuit conditions. The current density of the bus shall not exceed 1000 amperes per square inch of cross section area or the switchboard bussing shall be of sufficient cross-sectional area to meet UL standard 891 for temperature rise. Provisions shall be provided for future splicing of additional sections from either end. The neutral bus shall be 100% rated.
 - 4. A ground bus shall be furnished secured to each vertical section structure, and shall extend the entire length of the switchboard. The ground bus shall be sized per UL standard 891 and be of the same material as the through bus.
 - 5. The neutral bus in the feeder sections shall be not further than 20 inches from the front of the switchboard.
 - 6. Vertical main bus bars shall be furnished full height to accommodate future branch devices.
 - 7. The switchboard shall be furnished and installed complete with all underground pull sections, utility sections, main device and feeder sections as indicated on the Drawings. Underground pull sections, utility cable termination, transformer and metering sections shall be in accordance with Pacific Gas and Electric Company requirements.
 - 8. The main device, where indicated to be individually mounted, shall be completely isolated from the utility and the feeder sections of the switchboard, both in the device section and

the cable section of the switchboard cubicle. The cable section shall also be isolated from the main horizontal bus. The main device cubicle shall have UL service equipment label.

9. Feeder devices shall be group-mounted and be front accessible, furnished with vertical wiring gutter on the front of the distribution sections. Wiring gutters shall be furnished with hinged, code gauge steel formed covers. Unused device space shall be covered with blank code gauge steel covers.
10. All vertical sections comprising the switchboard shall be aligned front and rear.
11. Switchboards for outdoor installation shall be furnished in [stainless steel] NEMA 3R non-walk-in enclosures provided with thermostatically controlled space heaters in each vertical section. Space heaters shall be powered from a circuit breaker protected circuit originating within the switchboard and shall be sized adequately to prevent the formation of condensation. Space heater shall be suitable for operation at 120V AC.
12. All steel surfaces are to be chemically cleaned and treated, providing a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint finish. Switchboard exterior shall be furnished with a grey enamel finish color over a rust inhibiting primer, unless otherwise noted.

B. Circuit Breakers

1. Circuit breakers, unless otherwise indicated, shall be the molded case type with ratings as indicated on the Drawings. Circuit breakers shall meet the requirements specified under Section 16475 [262816]- Circuit Breaker.
2. Main circuit breakers, where indicated to be Molded case type, shall be 80 [100] percent rated, with the frame size and trip plug ratings shown.

C. Customer Metering

1. Instrument Transformers

- a. Current transformers shall be window type conforming to, one per phase, Square D Company Class 4210, General Electric JAG-O or equal.
- b. Potential transformers shall be fixed mounted, type Square D Company Class 4210, General Electric JVM, or equal.

2. Power Monitors and Meters

- a. The Customer Metering equipment shall be manufactured by Square D Company, General Electric or equal.
- b. Substitutions: substitutions shall be made only after proper verification
- c. The switchboard shall be metered using:
 - i. [Square D Type PM 650] [Square D Type CM 2350]
 - ii. [Square D Type PM 650]

(A). Digital Power Meter with 0.25% accuracy with the following features:

- (B). A, V, kW, kVAR, kVA, PF, F, kWh, kVARh, kVAh, KYZ, RS-485 communications, THD, Demand, kWd, kVARd, kVAd, date/time stamping,
- (C). predicted power demand, onboard alarms, min/max. readings, data log, event log

iii. [Square D Type CM 2350]

- (A). Digital Circuit Monitor with 0.2% accuracy with the following features:
- (B). A, V, kW, kVAR, kVA, PF, F, THD, K-Factor, kWh, kVARd, kVAd, kVARh, kVAh, KYZ output, RS-485 communication port, kWd, kVARd, kVAd, date/time stamping, predicted power demand, onboard alarms, min/max. readings, data log, event log, extend memory (100k), wave form capture, and disturbance monitoring

D. Manufacturer

- a. The switchboard shall be Square D, Siemens, [I.E.M], [General Electric], [or] [Eaton Cutler Hammer].

PART 3 – EXECUTION

3.01 Installation:

- A. Switchboards shall be installed where indicated on the Drawings, and in accordance with the manufacturer's instructions.
- B. A 1" conduit shall be installed for new PG& E services from the PG& E Metering Section to the Main Telephone Terminal Board.
- C. At switchboards located indoors, a 2" conduit and pull tape shall be installed from outside the switchboard meter cabinet to a location on the exterior of the building. The installation shall meet PG&E Green Book requirements.

3.02 Mounting:

- A. Switchboards shall be mounted on a concrete pad, as indicated on the drawings. Reinforcing shall be as shown on the Drawings. The top surface of the pad shall be 2 inches above the surrounding surface.
- B. The switchboard shall be bolted to the pad with ½ inch diameter bolts minimum at each corner of each section unless otherwise noted.
- C. The switchboard shall be seismically qualified to withstand potential seismic forces up to UBC Seismic Zone 4.

3.03 Padlocks:

- A. Exterior switchboard shall be provided with padlocks keyed as directed by the Owner's Representative. Padlocks shall be supplied by the contractor.

3.04 Field Tests:

- A. Insulation resistance Tests: Perform insulation resistance tests on circuits to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall not be connected. Test the insulation with 500V dc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 2 megohm or more. Submit results for review.
- B. Grounding: Grounding shall conform to Section 26 05 26.
- C. Continuity: Switchboard circuits shall be tested for continuity prior to energizing. continuity tests shall be conducted using a dc device with a bell or buzzer.

END OF SECTION

SECTION 26 24 16

PANELBOARDS AND DISTRIBUTION PANELS

PART 1 – GENERAL

1.01 Description of Work:

- A. The work of this Section consists of providing panelboards and circuit breakers as shown on the Drawings and as described herein.

1.02 Related Work:

- A. See the following specification sections for work related to the work in this Section.
 - 1. 26 05 19 Line Voltage Wire and Cable
 - 2. 26 05 26 Grounding
 - 3. 26 28 16 Circuit Breakers

1.03 Submittals:

- A. Shop Drawings - As specified in Division 01 and Section 26 05 00. For each panelboard and distribution panel furnished under this Contract, submit manufacturer's name, catalog data, and the following information:
 - 1. Panelboard / distribution panel type.
 - 2. Main bus and terminal connection sizes.
 - 3. Location of line connections.
 - 4. Cabinet dimension.
 - 5. Gutter space.
 - 6. Gauge of boxes and fronts.
 - 7. Finish data.
 - 8. Voltage rating.
 - 9. Breaker manufacturer, types, trip rating, and interrupting ratings.
 - 10. When information is available on the Drawings, show breaker circuit numbers and locations along with trip ratings on a panelboard layout.
- B. Single Submittal - A single complete submittal is required for all products covered by this Section.
- C. Closeout Submittals: Submit operation and maintenance data for panelboards and circuit breakers including nameplate data, parts lists, factory and field test reports, recommended maintenance procedures and typewritten as-built panel schedules. Submit in accordance with Division 01.

PART 2 – PRODUCTS

2.01 Panelboards:

- A. General: Lighting and Receptacle Panelboards shall be the automatic circuit breaker type. The number and arrangement of circuits, trip ratings, spares and blank spaces for future circuit breakers shall be as shown on the Drawings or, if not shown, 42 circuits. All circuit breakers shall be quick-make, quick-break, thermal-magnetic, bolt-on type (unless otherwise noted on drawings), with 1, 2 or 3 poles as shown, each with a single operating handle. Tandem or piggy-back breakers shall not be used.
- B. Nameplates:
 - 1. Each panelboard shall have a field mounted identifying, rigid, plastic nameplate giving the panel identification as shown on the Drawings.
 - 2. Each panelboard shall have a manufacturer's nameplate showing the voltage, bus rating, number of phases, frequency and number of wires.
- C. Construction:
 - 1. Door and trim shall be finished to match finish type and color of surrounding wall. Box shall be hot-dip galvanized, and field finished to match the front.
 - 2. Panelboards and enclosures shall conform to requirements of all relevant codes. Panelboards shall be suitable for use as service equipment.
 - 3. Panelboards shall be furnished with hinged trim fronts with key latch and a typed directory card and holder. Panelboard circuits shall be arranged with odd numbers on the left and even numbers on the right. Provide weatherproof, NEMA type 3R enclosures for outdoor installation.
- D. Busbars: Panelboard busbars shall be phase sequence type suitable for bolt-on circuit breakers. All busbars shall be copper.
- E. Circuit Breakers: Circuit breakers shall be the molded case type with trip and interrupting ratings as shown on the Drawings.
- F. Manufacturer:
 - 1. Panelboards shall be of the same manufacturer as the switchboard.

2.02 Distribution Panels:

- A. General: Distribution panels shall be the automatic circuit breaker type. The number and arrangement of circuits, trip ratings, spares and blank spaces for future circuit breakers shall be as shown on the Drawings. All circuit breakers shall be quick-make, quick-break, thermal-magnetic bolt-on type, with 1, 2 or 3 poles as shown, each with a single operating handle. Tandem or piggy-back breakers shall not be used.
- B. Nameplates:
 - 1. Each distribution panel shall have a field mounted, identifying, rigid, plastic nameplate giving the panel identification as shown on the Drawings.

2. Each distribution panel shall have a manufacturer's nameplate showing the voltage, bus rating, number of phases, frequency and number of wires.

C. Construction:

1. Door and trim shall be finished to match color of surrounding wall. Box shall be hot-dip galvanized, field finished to match the front.
2. Distribution panels and enclosures shall conform to requirements of all relevant codes. Distribution panels shall be suitable for use as service.
3. Distribution panels shall have a front door with key latch and a typed directory card and permanently attached holder. Adhesive backed holders are not acceptable. Distribution panels circuits shall be arranged with odd numbers on the left and even numbers on the right. Provide weatherproof, NEMA type 3R enclosures for outdoor installation.

- D. Busbars: Distribution panels busbars shall be phase sequence type suitable for bolt-on circuit breakers. All busbars shall be copper, sized for a maximum current density of 1000A psi.

E. Circuit Breakers:

1. Circuit breakers shall be the molded case type with trip and interrupting ratings as shown on the Drawings.
2. Circuit breakers equipped with Ground-Fault Equipment Protection shall be capable of the following types of ground-fault protection: residual, source ground return, and modified differential.
 - a. Ground-fault settings for circuit breaker sensor sizes 1200 A or below shall be adjustable from 0.2 to 1.0 times I_n in 0.1 I_n increments. The ground-fault settings for circuit breakers above 1200 A shall be adjustable from 500 to 1200 A.
3. Circuit breakers with an arc Energy-Reducing Maintenance Switch (ERMS) setting shall be equipped with a separate trip curve to reduce incident energy.
 - a. The ERMS trip curve shall be selected through physical selector. Trip unit [remote indicator light] shall indicate when trip unit is operating in ERMS mode.
 - b. Trip unit shall operate in Fast Instantaneous trip mode, 25 to 30 mS, when ERMS trip curve is active.
 - c. Engaging/disengaging the ERMS mode or making settings changes to the ERMS settings shall be restricted to authorized personnel by limiting access to such features by padlocks or passwords to ensure safety of the personnel working with the equipment.

F. Manufacturer:

4. Distribution panels shall be of the same manufacturer as the switchboard.

PART 3 – EXECUTION

- 3.01 Installation: Panelboards and Distribution Panels shall be installed where indicated on the Drawings, and in accordance with the manufacturer's instructions.

3.02 Installation:

- A. Panelboards and Distribution Panels shall be installed where indicated on the Drawings, and in accordance with the manufacturer's instructions.
- B. Circuit breakers for solidly grounded Wye Electrical Systems of more than 150V to Ground and 1000A or larger shall be equipped with Ground-Fault Equipment Protection.
- C. Circuit breakers 1200A and larger shall be equipped with a separate trip curve for an arc Energy-Reducing Maintenance Switch (ERMS) setting to reduce incident energy.

3.03 Mounting:

- D. Panelboards and Distribution Panels shall be mounted with the top of the box 6'-6" above the floor. Panelboards and Distribution Panels shall be plumb within 1/8-inch. The highest breaker operating handle shall not be higher than 72 inches above the floor.

3.04 Field Tests:

- A. Insulation Resistance Tests: Perform insulation resistance tests on circuits with #2 AWG and larger conductors to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall not be connected. Test the insulation with a 500Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 2 megohms or more. Submit results for review.
- B. Grounding: Grounding shall conform to Section 26 05 26.
- C. Continuity: Panelboard and Distribution Panel circuits shall be tested for continuity prior to energizing. Continuity tests shall be conducted using a dc device with a bell or buzzer.

END OF SECTION

SECTION 26 27 26

DEVICES WIRING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

A. The work of this section consists of:

1. Furnishing, installing, and connecting all duplex receptacles complete with wall plates and/or covers, as shown on the Drawings.
2. Furnishing, installing and connecting all light switches complete with wall plates and or handle operators, as shown on the Drawings.

1.2 RELATED WORK:

A. See the following specification sections for work related to the work of this section:

1. 260542 Conduits, Raceways and Fittings.
2. 260519 Line Voltage Wire and Cable.
3. 250533 Junction and Pull Boxes.

1.3 SUBMITTALS: As specified in Section 260500 and Division 0.

A. Submit manufacturers published descriptive literature properly marked to identify the items to be supplied.

B. A single complete submittal is required for all products covered by this Section.

PART 2 – PRODUCTS

2.1 RECEPTACLES:

A. General - Receptacles shall be heavy duty, high abuse, grounding type.

B. Duplex Receptacles:

1. Receptacles shall be specification grade, rated 20 ampere, two-pole, 3-wire, 125 volt, NEMA 5-20 configuration, self-grounding with screw terminals. Color shall be as selected by the Architect.
2. Devices shall have a nylon face, back and side wired.
3. Manufacturer: Hubbell #DR20 Series [Hubbell #DR20_ _ TR], Leviton #16352 Series [Leviton # 16352-TRE _ _ Series].

C. GFCI Receptacles:

1. Device shall be rated 20 ampere, 2-pole, 3-wire, 120 volt, conforming to NEMA 5-20 configuration. Face shall be nylon composition. Unit shall have an LED type red indicator light, test and reset push buttons. Color shall be as selected by the Architect.
2. GFCI component shall meet UL 943 Class A standards with a tripping time of 1/40 second at 5 milliamperes current unbalance. Operating range shall extend from -31°F to 158°F. Unit shall have transient voltage protection and shall be ceramic encapsulated for protection against moisture.
3. Manufacturer: Hubbell #GF20 __ __ LA Series [Hubbell # GFTR20 __ __ Series], Leviton #7899 Series [Leviton # X7899-TRE Series].

D. Automatically Controlled Receptacles

1. Receptacles shall be specification grade, rated 20 amperes, two pole, 3-wire, 125V, NEMA 5-20 configuration, self-grounding with screw terminals. Color shall be selected by the Architect.
2. Devices shall have a nylon face, back and side wired. Marking permanently printed, molded, or stamped on the face of the receptacle and in compliance with controlled receptacle marking requirements stated in California Building Energy Efficiency Standards Section 130.5(d)(3).
3. Manufacturer: Pass & Seymour 26352CD (Dual Controlled Receptacle), 26352CH (Half Controlled Receptacle)

E. Weather Resistant GFCI Receptacles:

1. Device shall be rated 20 ampere, 2-pole, 3-wire, 120 volt, conforming to NEMA 5-20 configuration, Face shall be nylon composition. Unit shall have a LED type red indicator light, test and reset push buttons. Color shall be as selected by the architect.
2. GFCI component shall meet UL 943 Class A standards with a tripping time of 1/40 second at 5 milliamperes current unbalance. Operating range shall extend from -31°F to 158°F. Unit shall have transient voltage protection and shall be ceramic encapsulated for protection against moisture.
3. Manufacturer: Hubbell #GFTR20 __ __ Series, Leviton # W7899-TR Series.

2.2 SWITCHES:

- A. Switches shall be rated 20 amperes to 120/277 volts ac. Units shall be flush mounted, self-grounding, quiet operating rocker devices. Rocker color shall be as selected by the Architect.

1. Manufacturer: Hubbell #DS_20_ _ Series, Leviton #5621 Series. See plans for single pole, three way and four way requirements.
- B. Timed switches: Shall be as designed by Paragon Electric Company # ET2000f or Watt Stopper TS-200 rated for the voltage specified on drawings. Time-out shall be adjustable from 5 minutes up to 12 hours. Unit shall be provided with warning alarm.
- C. Dimmer switches: Switch shall be as specified on drawings, color per architect. Heat fins shall not be removed, where dimmer switches are ganged together, care shall be taken to install correct size backbox to accommodate switches without removing fins.

2.3 PLATES:

- A. General - Plates shall be of the style and color to match the wiring devices, and of the required number of gangs. Plates shall conform with NEMA WD 1, UL 514 and FS W-P-455A. Plates on finished walls shall be non-metallic or stainless steel. Plates on unfinished walls and on fittings shall be of zinc plated steel or case metal and shall have rounded corners and beveled edges.
- B. Non-Metallic: Plates shall be plain with beveled edges and shall be nylon or reinforced fiberglass.
- C. Stainless Steel: Plates shall be .040 inches thick with beveled edges and shall be manufactured from No. 430 alloy having a brushed or satin finish.
- D. Cast Metal: Plates shall be cast or malleable iron covers with gaskets so as to be moisture resistant or weatherproof.
- E. Blank Plates: Cover plates for future telephone outlets shall match adjacent device wall plates in appearance and construction.
- F. Weatherproof Plate: Cover plates in wet and damp locations shall have recessed in-use covers, Taymac or equal. Back box shall be suitable for the wall material where it is installed.
- G. Labeling: All switch and receptacle plates shall be labeled on the top portion of the plate with the panelboard and circuit number serving that device. Lettering shall be 3/16" minimum high, black color, on clear Mylar 3/8" tape. Manufactured by P-touch or equal.

PART 3 – EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

- A. Interior Locations: In finished walls, install each device in a flush mounted box with washers as required to bring the device mounting strap level with the surface of the finished wall. On unfinished walls, surface mount boxes level and plumb.

B. Mounting Heights: Adjust boxes so that the front edge of the box shall not be farther back from the finished wall plane than 1/4-inch. Adjust boxes so that they do not project beyond the finished wall. Height of device shall be as follows unless otherwise noted on the drawings:

1. Receptacles 15 Inches from finished floor to bottom of box.
2. Toggle Switches 48 Inches from finished floor to top of box.

C. Receptacles:

1. Ground each receptacle using a grounding conductor, not a yoke or screw contact.
2. Install receptacles with connections spliced to the branch circuit wiring in such a way that removal of the receptacle will not disrupt neutral continuity and branch circuit power will not be lost to other receptacles in the same circuit.

3.2 INSTALLATION OF WALL PLATES:

- A. General - Plates shall match the style of the device and shall be plumb within 1/16-inch of the vertical or horizontal.
- B. Interior Locations, Finished Walls: Install non-metallic plates so that all four edges are in continuous contact with the finished wall surfaces. Plaster filling will not be permitted. Do not use oversized plates or sectional plates.
- C. Interior (not wet) Locations, Unfinished Walls: Install stainless steel or cast metal cover plates.
- D. Wet Locations: Install cast metal plates with gaskets on wiring devices in such a manner as to provide a rain tight weatherproof installation. Cover shall be [lockable] outdoor "in use" type.
- E. Future Locations: Install blanking cover plates on all unused outlets.

3.3 TESTS:

A. Receptacles:

1. After installation of receptacles, energize circuits and test each receptacle to detect lack of ground continuity, reversed polarity, and open neutral condition.

END OF SECTION 26 27 26

SECTION 26 28 16
CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. The work of this Section consists of providing circuit breakers as shown on the Drawings and as described herein.

1.2 RELATED WORK: See the following Specification Sections for work related to the work in this Section.

- A. 26 05 00 General Electrical Requirements
- B. 26 24 13 Switchboards
- C. 26 24 16 Panelboards and Distribution Panels

1.3 SUBMITTALS:

- A. Shop Drawings - Submittals shall be in accordance with Section 26 05 00 and Division 01. For each circuit breaker furnished under this Contract, submit manufacturer's name, catalog data, and the following information:
 - 1. Terminal connection sizes.
 - 2. Voltage rating.
 - 3. Breaker manufacturer, types, trip ratings and interrupting ratings.
- B. Single Submittal - A single complete submittal is required for all products covered by this Section.
- C. Closeout Submittals: Submit in accordance with and Section 16000 [260500], operation and maintenance data for circuit breakers including nameplate data, parts lists, manufacturer's circuit breaker timer, current, coordination curves, factory and field test reports and recommended maintenance procedures.

PART 2 - PRODUCTS

2.1. CIRCUIT BREAKER: Each circuit breaker shall consist of the following:

- A. A molded case breaker with an over center toggle-type mechanism, providing quick-make, quick-break action. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Multipole circuit breakers shall have variable magnetic trip elements which are set by a single adjustment to assure uniform tripping characteristics in each pole. Circuit breakers shall be of the bolt-on type unless otherwise noted.

- B. Breaker shall be calibrated for operation in an ambient temperature of 40°C.
- C. Each circuit breaker shall have trip indication by handle position and shall be trip-free.
- D. Three pole breakers shall be common trip.
- E. The circuit breakers shall be constructed to accommodate the supply connection at either end of the circuit breaker. Circuit breaker shall be suitable for mounting and operation in any position.
- F. Breakers shall be rated as shown on Drawings.
- G. Circuit breaker and/or Fuse/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations for use in the end use equipment in which it is installed. Any series rated combination used shall be marked on the end use equipment per CEC section 110-22.
- H. Breakers shall be UL listed. Circuit breakers shall have removable lugs.
- I. Lugs shall be UL listed for copper and aluminum conductors.
- J. Breakers shall be UL listed for installation of mechanical screw type lugs.
- K. Circuit breakers serving HACR rated loads shall be HACR type. Circuit breakers serving other motor loads shall be motor rated.

PART 3 - EXECUTION

3.1 MOUNTING:

- A. The highest breaker operating handle shall not be higher than 72 inches above the floor.

END OF SECTION 26 28 16

SECTION 26 51 00

LIGHTING

PART 1 – GENERAL

1.01 Description of Work:

- A. The work of this section consists of providing and installing a complete lighting system, including fixtures, LED light module, hangers, reflectors, glassware, lenses, auxiliary equipment, heat management components, LED driver (integral or remote), and housing.

1.02 Related Work:

- A. See the following specification sections for work related to the work of this section:

- 1. 26 05 00 General Electrical Requirements.
- 2. 26 05 42 Conduit, Raceway and Fittings.
- 3. 26 05 19 Line Voltage Wire and Cable.
- 4. 26 05 33 Junction and Pull Boxes.

1.03 Submittals: In accordance with Division 01.

- A. Submit descriptive data, photometric curves for each fixture configuration proposed.
- B. Submit shop drawings showing proposed methods for mounting lighting fixtures.
- C. Seismic Requirements: Submit:
 - 1. Sketch or description of the anchorage system if not provided on construction documents.
- D. Submit Operation and Maintenance Data per Division 01.

1.04 Warranty:

- A. LED light module, LED driver, batteries or other luminaire components which fail within the first year after final acceptance shall be replaced by the Contractor with the warranty clause of the General Provisions.
- B. Replacement components provided under warranty to be provided by contractor, not taken from project spare stock.

PART 2 – PRODUCTS

2.1 General

- A. Fixtures shall be of the types, wattages and voltages shown on the Drawings and be UL or equivalent classified and labeled for the intended use.
- B. Substitutions will not be considered unless the photometric distribution curve indicates the proposed fixture is equal to or exceeds the specified luminaire and the substitution is consistent with the design intent.

- C. Luminaire (factory or field installed) wire, and the current carrying capacity thereof shall be in accordance with the CEC.
- D. Luminaires and lighting equipment shall be delivered to the project site complete, with suspension accessories, aircraft cable, stems, hangers canopies, hickey, castings, sockets, holders, LED light engine, [lamps], [ballasts], diffusers, frames, and related items, including support and braces.

2.2 Light Emitting Diode (LED) Light Sources and Luminaires:

A. General (Non-Emergency):

1. Provide identical power supply and driver within each luminaire type. Provide power supplies and drivers that are suitable and UL-listed for the electrical characteristics of the supply circuits to which they are to be connected and which are suitable for operating LED or relevant light sources.
2. Unless otherwise specified, provide power supplies of same type and same manufacturer for ease of stocking and replacement.
3. Components shall be configured and installed in luminaire by the luminaire manufacturer.
4. Luminaire housing shall be constructed of painted metal with no sharp edges unless otherwise noted.
5. Provide only luminaires whose design, fabrication and assembly prevent overheating or cycling of light engines or drivers/power supplies under any condition of use.
6. Electronic ballasts shall meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, Part C (RF Lighting Devices) Non-consumer equipment, regarding radio frequency interference (RFI) (radiated) and electromagnetic interference (EMI) (power line conducted).
7. Submit light fixture details with luminaire shop drawings.

B. Emergency Lighting: Battery-backed emergency lighting luminaires shall consist of a normal LED luminaire with some or all of the LEDs connected to a battery and charger.

1. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of luminaire operation unless otherwise noted.
2. The charger shall be solid-state and include overload, short circuit, brownout and low battery voltage protection.
3. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months.
4. The luminaire shall include a test/monitor module with status indicating lights mounted so as to be visible to the public.
5. The luminaire shall not contain an audible alarm.

6. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

C: LED Performance and component manufacturer requirements.

1. All color characteristics, SPD (Special Power Distribution) CCT, CRI, CIE Chromaticity Coordinates shall be consistent across the entire dimming range.
2. LEDs shall comply with ANSI/NEMA/ANSI C78.377-2008 – Specifications for the Chromaticity of Solid State Lighting Products. Color shall remain stable throughout the life of the source. The chromaticity of the installed product shall match IES LM-80 data showing that the LED's do not shift more than .005 DuV from submitted documentation.
3. White LEDs shall have a minimum rated source life of 50,000 hours or as specified: Luminaire Schedule. Multicolor LEDs shall have a minimum rated source life of 100,000 hours. LED "rated source life" shall be determined per IES TM-21 - Projecting Long Term Lumen Maintenance of LED Light Sources based on LM-80 test data. Calculated lifetimes exceeding testing hours per TM-21 are not accepted.
4. Luminaire assembly shall include a method of dissipating heat so as to not degrade life of source, electronic equipment, or lenses. LED luminaire housing shall be designed to transfer heat from the LED board to the outside environment. Luminaire housing shall have no negative impact on life of components. Manufacturer shall provide Luminaire Efficacy (lm/W), total luminous flux (lumens), luminous intensity (candelas), chromaticity coordinates, CCT, CRI, optical performance, polar diagrams, and relevant luminance and illuminance photometric data. Provide data in IES file format in accordance with testing standards IES LM-79-08 and IES LM-82-12, based on test results from an independent Nationally Recognized Testing Laboratory or National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.
5. Manufacturer will keep record of original chromaticity coordinates for each LED module and have replacement modules or luminaires from within three (3) MacAdam Ellipses/ steps of the same coordinates available for the duration of the warranty period.
6. Manufacturer's LED light engine or equivalent system will be available for ten (10) years: Manufacturer will provide exact replacement parts, complete replacement luminaires, or provide upgraded parts that are designed to fit into the original luminaire and provide equivalent distribution and lumen output to the original, without any negative consequences.
7. All LED sources used in the LED luminaire shall be of proven quality from established and reputable LED manufacturers and shall have been fabricated within 12 months before installation per the date code on the module. Acceptable LED component or module manufacturers unless otherwise noted are:
 - a. Cree, Inc.
 - b. Lumileds
 - c. Nichia Corporation
 - d. Norlux
 - e. Lextar

- f. Osram Optron Semiconductor
- g. Xicato
- h. Bridgelux
- i. Epistar
- j. San'an
- k. Citizen Electronics
- l. General Electric Company
- m. Sora
- n. Samsung
- o. Seoul Semiconductor
- p. Lumenetix
- q. Ledengin

2.3 LED Power Supplies/ Drivers:

1. LED driver shall have a minimum 50,000 hour published life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
2. Driver shall be Sound Rated A+.
3. Driver shall be > 80% efficient at full load across all input voltages.
4. Driver shall include ability to turn off at low control input rather than holding at a minimum dimming level, and shall consume 0.5 Watts or less in standby/off mode. Control deadband at low control input shall be included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.
5. Drivers shall track evenly across multiple luminaires at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
6. Control Input:
 - a. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
 - (i) Must meet IEC 60929 Annex E for General White Lighting LED drivers.
 - (ii) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V.
 - (iii) Must meet ESTA E1.3 for RGBW LED drivers.
 - b. Digital (DALI Low Voltage Controlled) Dimming Drivers
 - (i) Must meet IEC 62386.

- c. Digital Multiplex (DMX Love Voltage Controlled) Dimming Drivers
 - (i) Must meet DMX / RDM: USITT DMX512A and ANSI E1.20 (Explore & Address).
 - (ii) Must be capable of signal interpolation and smoothing of color and intensity transitions.
- 7. Power Factor: The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.
- 8. THD: Total harmonic distortion (current and voltage) induced into an AC power line by luminaire shall not exceed 10 percent at any standard input voltage and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
- 9. In Rush Current: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps 2 – seconds.
- 10. RF Interference: The luminaire and associated on-board circuitry must meet Class A emissions limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-Consumer requirements for EMI/RFI emissions.
- 11. Light engines shall be 3500°K 80 CRI minimum, U.O.N. on drawings.
- 12. Drivers shall be accessible for maintenance or replacement without removal of recessed light fixture and without destruction of the ceiling.

PART 3 – EXECUTION

3.01 Installation:

A. General:

- 1. All fixtures and luminaires shall be clean and lamps shall be operable at the time of acceptance.
- 2. Install luminaires in accordance with manufacturer's instructions, complete with lamps, ready for operation as indicated.
- 3. Align, mount, and level the luminaires uniformly.
- 4. Avoid interference with and provide clearance for equipment. Where an indicated position conflicts with equipment locations, change the location of the luminaire by the minimum distance necessary.
- 5. Recessed light fixtures in fire rated assemblies shall be installed per an approved UL rated fire rated penetration detail.

B. Mounting and Supports:

- 1. Mounting heights shall be as shown on the Architectural and Electrical Drawings. Unless otherwise shown, mounting height shall be measured to the centerline of the outlet box for

wall mounted fixtures and to the bottom of the fixture for suspended fixtures and to the bottom of the fixture for all other types.

2. Luminaire supports shall be anchored to structural members.
3. Pendant stem mounted luminaires shall be provided with ball aligners to assure a plumb installation and shall have a minimum 45 degree clean swing from horizontal in all directions. Sway bracing shall be installed as required to limit the movement of the fixture. Fixtures shall be allowed to sway a maximum of 45° without striking any object.
4. Fixture supports shall be designed to resist earthquake forces of seismic zone 4.
5. Refer to fixture mounting details on drawings for installation requirements.
6. Pendant cable mounted luminaires shall be provided with fully adjustable stainless steel aircraft cable hangers unless otherwise noted on the Drawings.

END OF SECTION

SECTION 27 00 00

TELECOMMUNICATIONS CABLING SYSTEM

Table of Contents

- 1 Purpose
- 2 Scope
 - 2.1 Exclusions
- 3 Responsibilities
 - 3.1 Implementation
- 4 Safety
- 5 Environmental Statement
- 6 Regulatory Compliance
 - 6.1 General
 - 6.2 Applicable Regulatory References
 - 6.2.1 ANSI/TIA:
 - 6.2.2 ISO/IEC7
 - 6.2.3 National Electric Codes
 - 6.2.4 OSHA Standards and Regulations – all applicable
 - 6.2.5 Local Codes and Standards – all applicable
 - 6.2.6 BICSI
- 7 General Guidelines
 - 7.1 Maintenance of Patch Fields
 - 7.2 Cable Pulling and Termination
- 8 Work Area
 - 8.1 General
 - 8.2 Classroom Facility
 - 8.3 Administration Facility
 - 8.4 Multi-purpose Facility
 - 8.5 Other Facility
 - 8.6 Outlets and Surface Mount Boxes
 - 8.7 Configuration of Work Areas
 - 8.8 Outlet Port Assignments

8.9	Outlet Example Diagrams	
9	Copper Horizontal Cable	
9.1	GenSpeed UTP Category 6E / 6A 4 Pair Cable	
9.2	Cat.6 / 6A UTP Jack Module	
10	Wireless Access Points	
11	Fiber Backbone Cabling	18
11.1	General	
11.2	Fiber Cable Types	
11.3	Backbone Cabling - Intrabuilding	
11.4	Backbone Cabling - Inter-building	
11.5	FiberTerminations	
11.5.1	LC OptiCam OM3 and Singlemode Fiber Connectors	
12	Telecommunications Rooms	
12.1	General	
12.2	Entrance Facilities	
12.3	Equipment Rooms	
12.4	Horizontal Telecommunications Rooms	
13	Racks, Cabinets and Cable Managers	25
13.1	General	
13.1.1	Normal or non-space restricted horizontal TRs	
13.1.2	Typical Rack Configuration For Edge Switches	
27		
13.2	Cable Manager	
13.2.1	General	
13.2.2	Horizontal Cable Managers	
13.2.3	Vertical Cable Management	

13.3	Equipment Cabinets
13.3.1	General
13.3.2	Switch Cabinets
13.3.3	Server Cabinets
14	Copper Patch Panels and Cords
14.1	General
14.2	Single Data Cable Patch Panel Example
14.3	Two Data Cable Patch Panel Example
14.4	Patch Cord Details
14.4.1	Patch Cord Color Standards33
15	Fiber Patching and Fiber Jumpers
15.1	Fiber Enclosures
15.1.1	Multi-mode Fiber Adapter Panels
15.1.2	Singlemode Fiber Adapter Panels
15.1.3	Fiber Patch Cords
16	Cable Pathways
16.1	Overhead Metallic Pathways
16.2	Overhead Fiber Pathways
17	Substitution Policy
17.1	General
18	Communications Structured Grounding36
18.1	General
18.2	Details
19	Communications Labeling40
19.1	General
19.2	Universal Guidelines

- 20 Testing and Documentation
 - 20.1 General
 - 20.1.1 Copper Testing
 - 20.1.2 Fiber Testing
 - 20.2 Documentation
 - 20.3 Final Inspection and Acceptance
- 21 PanGen System Performance Warranty
 - Error! Bookmark not defined.**
 - 21.1 General
 - 21.2 Contractor Warranty Commitments
- 22 Contractor Qualifications
 - 22.1 General
- 23 SCHOOL DISTRICT / PanGen / Plus Certificated Contractors
 - 23.1 Greater Bay Area Panduit Certificated contractors
- 24 Bid Guidelines
 - 24.1 General
 - 24.2 Labor
 - 24.3 Prevailing Wage
 - 24.4 Material
- 25 References/websites
- 26 Authorizing Signature(s)
- Appendix A. Materials Lists

Appendix B. Bill of Materials

Appendix C. Definitions of Terms

Appendix D. Legacy Voice Systems

Appendix E. Labeling a Patch Panel for Analog Gateway Wiring

Appendix F. Labeling a Copper Backbone Cable

- Appendix G. Labeling a Patch Panel for Copper Backbone Cabling
- Appendix H. Labeling a Horizontal Cable
- Appendix I. Labeling a Patch Panel for Horizontal Cabling
- Appendix J. Labeling a Copper Patch Cord
- Appendix K. Labeling a Fiber Optic Patch Cord
- Appendix L. Labeling a GDN, WAP or Analog Telecommunications Outlet
- Appendix M. Labeling a UDN Telecommunications Outlet
- Appendix N. Labeling an ODN Telecommunications Outlet
- Appendix O. Document Change Record

1 Purpose

The purpose of this document is to provide a standard defining the structured communications cabling systems to be installed within SCHOOL DISTRICT telecommunications facilities. It is geared toward leveraging our legacy cable infrastructure while upgrading to more recent technologies in all new installations. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards and industry best practices.

Such standardization will maximize system reliability by ensuring that critical operational and legal requirements are met, while enhancing safety to personnel and the public.

Note that while many portions of this document are addressed to "The Contractor", the contents herein apply equally to anyone doing the work. Whether employees internal to SCHOOL DISTRICT, or outside contractors employed on specific projects the expectation of SCHOOL DISTRICT is that all work be carried out and executed as prescribed in this document.

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 or 26, Basic Materials and Methods sections apply to work specified in this section.

2 Scope

This specification addresses the requirements and materials in the following structured cabling subsystems:

- Work Area (Equipment Outlets)
- Copper Horizontal Cabling
- Wireless Access Points
- Fiber Backbone Cabling
- Telecommunications and Equipment Rooms
- Pathways
- Cable Bundling and Dressing Accessories
- Communications Structured Grounding
- Communications Labeling

Information regarding Legacy Voice Cabling is contained in Appendix D at the end of this document.

2.1 Exclusions

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be

used with their own discretion and risk. This document is not to be used to negate good engineering principles, design practices or common sense.

This specification is meant to be a part of the overall IT standards suite and provide a background of consistency to project-specific requirements. There may be application specific standards released after the writing of this document that may provide more detailed information on some of the areas covered. Wherever requirements of this document are in conflict with existing cabling standards or state or local codes, the most stringent will apply.

Dimensions contained herein are for reference purposes only. For specific dimensional requirements of a cabling component, consult the manufacturer or distributor of that component, or the document specific to that project. For questions of architectural or structural dimensions, consult the project documentation or submit the question to IT for resolution.

This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supersedes and voids all previous literature, etc.

3 Responsibilities

The Sr. Director of IT

- Responsible for approving, revising and distributing this standard.

IT I&O Managers

- Responsible for ensuring that IT employees are aware of, and accountable for, consistent and uniform compliance with the area specific requirements of this standard when involved with the installation, maintenance, repairing, removal, or restoration of equipment.

IT Managers and Supervisors

- Responsible for the safe, efficient and timely performance of the necessary work to ensure compliance with this standard.
- Responsible for ensuring that IT employees that will be involved with installing, maintaining, repairing, removing and replacing equipment are trained, knowledgeable and qualified to perform the assigned tasks.

All Employees

- Employees assigned the task of installing, maintaining, repairing, removing, or replacing equipment are responsible for safely, effectively, and efficiently performing their assignments.
- Responsible for their own safety and that of the general public.
- Responsible for only performing tasks for which they are trained, knowledgeable and qualified.
- Responsible to notify their supervisors of whenever additional training, equipment, or resources needed to safely, effectively, and efficiently perform their assigned tasks.

3.1 Implementation

In implementation, this document applies particularly to the following:

- IT Field Engineers
 - IT Design Engineers
 - Network Specialists
 - Network Architects/Planners- Enterprise Architecture Network Services
 - Project Managers
 - Cabling Contractors and Vendors
-

4 Safety

The following are general safety requirements that should be followed:

- Always perform a pre-task safety assessment of the planned work activities to ensure proper resources have been assembled.
 - Confined spaces safety procedures must be followed if applicable.
 - IT personnel must coordinate their work with the appropriate departments, must be trained as appropriate, and must be accompanied by a qualified worker as appropriate. Contractors must always be accompanied by a qualified SCHOOL DISTRICT employee while working inside SCHOOL DISTRICT facilities, where deemed applicable. Often contractors are able to work unescorted.
-

5 Environmental Statement

This standard supports SCHOOL DISTRICT's values of protecting the environment and reducing environmental impacts by:

- Reducing the amount of materials required for infrastructure by utilizing new products that optimize rack and equipment space, investing in new technologies that reduce the need for traditional cabling schemes, and limiting the amount of un-utilized copper cables being installed in work spaces.
- Seeking vendors that have an established environmental policy and minimize environmental impacts by deploying manufacturing strategies and processes including Restriction of the use of Hazardous Substances (RoHS), Waste Electrical and Electronic Equipment (WEEE), and ISO 14001, reducing packaging materials, and promoting product and process efficiencies and energy conservation.
- Removing all old, unused cables as required by TIA and NEC Article 800.
- Implementing proper cable management strategies that improve air flow and air conditioning/cooling efficiencies.
- Recycling obsolete and unused copper cables as areas are re-stacked or upgraded.

6 Regulatory Compliance

6.1 General

- All installations should be in compliance with the requirements of the National Electric Code, UBC, the local Building Code, local OSHA rules, the FCC as well as the recommendations and guidelines of BICSI and the TIA Standards.
- In cases where listed Standards and Codes have been updated, the most recent revisions, including all relevant changes or addenda at the time of installation should be used.
- Anywhere cabling Standards conflict with electrical or safety Codes, installer should defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- Contractors are required to be familiar with all applicable codes and standards. Knowledge and execution of applicable codes is the sole responsibility of the installer.
- All active equipment installed should comply with the minimum requirements of NEMA, IEEE, ASTM, ANSI and Underwriters' Laboratories, as applicable.
- Should any change in plans or specifications be required to comply with governmental regulations, the Contractor is to notify the General Contractor/Engineer at the time of submittal.

6.2 Applicable Regulatory References

6.2.1 ANSI:

- a. ANSI/TIA-526-7-A (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- b. TIA-526.2-A (July 2015) Effective Transmitter Output Power Coupled into Single-Mode Fiber Optic Cable - Adoption of IEC 61280-1-1 ed. 2 Part 1-1: Test Procedures for General Communication Subsystems – Transmitter Output Optical Power Measurement for Single-Mode Optical Fibre Cable
- c. ANSI/TIA-4994 (March 2015) Standard for Sustainable Information Communications Technology
- d. ANSI/TIA-526-14-C (April 2015) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- e. ANSI/TIA-568.0-D (September 2015) Generic Telecommunications Cabling for Customer Premises (supersedes TIA-568-C.0 and TIA-568-C-1)
- f. ANSI/TIA-568-C.2 (August 2009) Balance Twisted Pair Communications and Components Standards
- g. TIA-568-C.2-1 (July 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 1: Specifications for 100 Next Generation Cabling
- h. TIA-568-C.2-2 (November 2014) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 2: Additional Considerations for Category 6A Patch Cord Testing

- i. TIA-568-C.3 (June 2008) Optical Fiber Cabling Components Standard (will be superseded by ANSI/TIA-568.3-D after default ballot)
- j. TIA-568-C.3-1 (October 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors (will be superseded by ANSI/TIA-568.3-D after default ballot)
- k. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
- l. ANSI/TIA-568.1-D (September 2015) Commercial Building Telecommunications Infrastructure Standard (supersedes ANSI/TIA-C.1)
- m. ANSI/TIA-569-D (April 2015) Telecommunications Pathways and Spaces
- n. ANSI/TIA-598-D (July 2014) Optical Fiber Cable Color Coding
- o. ANSI/TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- p. ANSI/TIA-606-C (June 2017) Administration Standard for Telecommunications Infrastructure
- q. ANSI/TIA-606-B-1 (December 2015) Administration Standard for Telecommunications Infrastructure Addendum 1 - Automated Infrastructure Management Systems - Addendum to ANSI/TIA-606-B
- r. ANSI/TIA-607-C (November 2015) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- s. ANSI/TIA-758-B (March 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- t. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems
- u. ANSI/TIA-942-B (Juy 2017) Telecommunications Infrastructure Standard for Data Centers (will be superseded by ANSI/TIA-942-B after balloting)
- v. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics (will be superseded by ANSI/TIA-942-B after balloting)
- w. ANSI/TIA-1005-A (May 2012) Telecommunications Infrastructure Standard For Industrial Premises
- x. ANSI/TIA-1005-A-1 (January 2015) Telecommunications Infrastructure Standard For Industrial Premises, Addendum 1- M12-8 X-Coding Connector - Addendum to TIA-1005-A
- y. ANSI/TIA-1183 (August 2012) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
- z. ANSI/TIA-1183-1 (January 2016) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183
- aa. ANSI/TIA-1152 (September 2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- bb. ANSI/TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard
- cc. ANSI/TIA-4966 (May 2014) Telecommunications Infrastructure Standard for Educational Facilities

- dd. TIA-455-104-B (February 2016) FOTP 104- Fiber Optic Cable Cyclic Flexing Test (supersedes TIA-455-104-A)
- ee. TIA/EIA-455-25-D (February 2016) FOTP-25 Impact Testing of Optical Fiber Cables
- ff. TIA-604-18 (November 2015) FOCIS 18 Fiber Optic Connector Intermateability Standard – Type MPO-16
- gg. TIA-604-5-E (November 2015) FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO
- hh. TIA-5017 (March 2016) Telecommunications Physical Network Security Standard
- ii. TIA-TSB-155-A (Reaffirmed 10-6-2014) Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T
- jj. TSB-184-A (March 2017) Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
- kk. TSB-4979 (August 2013) Practical Considerations for Implementation of Multimode Launch Conditions in the Field
- ll. TSB-190 (June 2011) Guidelines on Shared Pathways and Shared Sheaths
- mm. TIA-TSB-162-A (November 2013) Telecommunications Cabling Guidelines for Wireless Access Points
- nn. TSB-5018 (July 2016) Structured Cabling Infrastructure Guidelines to support Distributed Antenna Systems
- oo. TIA-492AAAE (June 2016) Detail Specification for 50-µm Core Diameter/125-µm Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers with Laser-Optimized Bandwidth Characteristics Specified for Wavelength Division Multiplexing
- pp. TIA-492AAAB-A (November 2009) Detail specification for 50-µm core diameter/125-µm cladding diameter class 1a graded-index multimode optical fibers
- qq. TIA-455-243 (March 2010) FOTP-243 Polarization-mode Dispersion Measurement for Installed Single-mode Optical Fibers by Wavelength-scanning OTDR and States-of-Polarization Analysis
- rr. TSB-172-A (February 2013) Higher Data Rate Multimode Fiber Transmission Techniques

6.2.2

- ANSI/TIA-569 (April 2012)
- ANSI/TIA-568-C.0 (September 2010) Generic Telecommunications Cabling for Customer Premises
- TIA-568-C.0-1 (September 2010) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
- ANSI/TIA-568-C.1 (February 2009) Commercial Building Telecommunications Cabling Standards
- TIA-568-C.1-2 (November 2011) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates

- ANSI/TIA-568-C.2 (August 2009) Balance Twisted Pair Communications and Components Standards
- ANSI/TIA-568-C.3 (June 2008) Optical Fiber Cabling Components Standard
- ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard-Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
- ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
- ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
- TIA-569-C (May 2012) Telecommunications Pathways and Spaces
- ANSI/TIA-606-B (June 2012) Administration Standard for Telecommunications Infrastructure
- TIA-607-B (September 2011) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- TIA-758-A (August 2004) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- TIA-1152 (September 2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- ANSI/TIA-862-A (April 2011) Building Automation Systems Cabling Standard
- ANSI/TIA-1005A (May 2012) Telecommunications Infrastructure Standard for Industrial Premises
- TIA-1005-1 (March 2010) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
- TIA-TSB-190 (June 2011) Guidelines on Shared Pathways and Shared Sheaths

6.2.3 ISO/IEC

- ss. ISO/IEC TR 11801-99-01 Information technology – Generic cabling for customer premises: Guidance for balanced cabling in support of at least 40 GBit/s data transmission: Parts 1 and 2
- tt. ISO/IEC TR 29106 AMD 1 Information technology -- Generic cabling -- Introduction to the MICE environmental classification
- uu. ISO/IEC 14763-3 Ed 2.0 Information technology -- Implementation and operation of customer premises cabling -- Part 3: Testing of optical fibre cabling
- vv. ISO/IEC 24764 AMD 1 Information technology – Generic cabling for data centres
- ww. ISO/IEC 11801 AMD 1 AMD 2 Information technology – Generic cabling for customer premises
- xx. ISO/IEC 15018 AMD 1 Information technology – Generic cabling for homes
- yy. ISO/IEC 24702 AMD 1 Information technology – Generic cabling – Industrial premises
- zz. ISO/IEC 14763-1 AMD 1 Information technology – Implementation and operation of customer premises

cabling – Part 1: Administration

aaa.ISO/IEC 14763-2 Information technology – Implementation and operation of customer premises cabling
– Part 2: Planning and installation

bbb.ISO/IEC 14763-2-1 Information technology – Implementation and operation of customer premises cabling
– Part 2-1: Planning and installation – Identifiers within administration systems

ccc. ISO/IEC TR 24704 Information technology – Customer premises cabling for wireless access points

ddd.ISO/IEC TR 24750 Information technology – Assessment and mitigation of installed balanced cabling
channels in order to support 10GBASE-T

eee.ISO/IEC TR 29125 IT Telecommunications cabling requirements for remote powering of terminal
equipment

- ISO 11801 - Generic Cabling for Customer Premises

6.2.4 NATIONAL ELECTRIC CODES

fff. National Electrical Safety Code (NESC) (IEEE C2-2012)

ggg.NFPA 70-2016, National Electrical Code® (NEC®)

hhh.ANSI/IEEE C2-207, National Electrical Safety Code®

iii. National Electrical Code (NEC) (NFPA 70)

jjj. NFPA 72 National Fire Alarm and Signaling Code

- National Electrical Safety Code (NESC) (IEEE C2-2012)
- National Electrical Code (NEC) (NFPA 70)

6.2.5 OSHA STANDARDS AND REGULATIONS – ALL APPLICABLE

6.2.6 LOCAL CODES AND STANDARDS – ALL APPLICABLE

6.2.7 BICSI

1. BICSI – Building Industry Consultative Services International – Published Standards

kkk. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions

III. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices

mmm. ANSI/BICSI-003-2014 Building Information Modeling (BIM) Practices for Information Technology
Systems

nnn.BICSI 004-2012, Information Technology Division Systems Design and Implementation Best Practices
for Healthcare Institutions and Facilities

ooo.ANSI/BICSI 005-2016, Electronic Safety and Security (ESS) System Design and Implementation Best
Practices

ppp.BICSI 006-2015 Distributed Antenna System (DAS) Design and Implementation Best Practices

qqq. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling

rrr. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

- Telecommunications Distribution Methods Manual, 13th Edition

2. BICSI – Building Industry Consultative Services International – Manuals

sss. Telecommunications Distribution Methods Manual, 13th Edition

ttt. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition

uuu. Outside Plant Design Reference Manual, 5th Edition

vvv. BICSI's ICT Terminology Handbook, Version 1.0

www. Telecommunications Project Management Manual (TPMM), 1st edition

xxx. Telecommunications Project Management Reference Document (TPMRD), 2nd Edition

yyy. BICSI's Special ICT Design Considerations, Version 1.0

zzz. Essentials of Bonding and Grounding, Version 1.0

-
- Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition
- ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
- ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
- NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
- AV Design Reference Manual, 1st Edition
- Network Design Reference Manual, 7th Edition
- Outside Plant Design Reference Manual, 5th Edition
- Wireless Design Reference Manual, 3rd Edition

7 General Guidelines

7.1 Maintenance of Patch Fields

Any persons with Contractor or SCHOOL DISTRICT adding or moving copper or fiber optic patch (equipment) cords should do so in a neat, workmanlike fashion in keeping with the original system concept and according to all industry best practices as outlined in cabling standards and applicable BICSI publications referenced in this document.

Persons performing such moves, adds, or changes (MACs), should further adhere to the

following:

- Contactor should use existing cabling management pathways and take care to place cable like with like, maintaining original segregation strategies for separating fiber and copper cables as well as any separation necessary between

different types of copper cables.

- Cables should be dressed neatly within patch management pathways with care taken to maintain minimum bend radius of not less than 1 times the cord outer diameter for copper and not less than a 1" bend radius for fiber jumpers as per ANSI/TIA 568-C.0.
- All patch cords used should be of same copper Category or fiber OM/OS designation or higher than the media used in the permanent links.
- Patch cords shall not be run across fan blades such that it will prohibit the maintenance of the switch.
- Patching in all cases should be done using factory terminated cords manufactured for that purpose. Hand terminated patch cords will not be accepted.
- All patch cords or jumpers must be completely contained within supplied cable management paths. Cables draped across the front cabinets or racks will not be accepted.
- Any persons moving fiber optic patch cords for any reason will clean the connector with lint-free wipes and 99% or higher isopropyl alcohol before replacing the connector in a port.
- Any persons with SCHOOL DISTRICT or Installing Contractors performing moves, adds or changes within patch field will label additions to the system according to the labeling guidelines outlined in this document.
- Any persons with SCHOOL DISTRICT or Installing Contractors performing moves, adds or changes within patch field will record the move according to documentation guidelines outlined in this document.

7.2 Cable Pulling and Termination

- The cable should be restricted to a single four-pair cable construction to support a broad range of applications.
- Keep all permanent cable runs to a maximum of 295 feet / 90 meters for each run. CAT 6 & 6A Channel has a max distance of 328 feet / 100 meters with patch cords, and CAT 6 Permanent Link has a max distance of 295' or 90 meters.
- Be conscious of conduit fill guidelines. No pathway, including conduits should have greater than a 35% fill per TIA and BICSI fill charts. Contractor is responsible for bringing to the attention of School District's project manager any insufficiently sized conduit in project documentation.
- Keep CAT 6 & 6A cables as far away from potential sources of EMI (electrical cables, transformers, light fixtures, etc.) as required in cited TIA Standards.

- Use low to moderate force when pulling cable. Maximum tensile load may not 25' lbs. maximum pulling force per 4 pair cable.
- Always use grommets to protect the cable when passing through metal studs or anything that can possibly cause damage to the cable.
- Do not deform the jacket of the cable. The jacket should be continuous, free from pinholes, splits, blisters, burn holes or other imperfections.
- Install proper cable supports, spaced less than 5 feet apart and no more than 49 cables and/or 25 lbs. max per support.
- Leave a pull string to the end of each conduit run. Replace pull string if it was used for a cable pull.
- All copper horizontal cabling should have slack service loops no less than 12" at the work area (equipment outlet) and not less than 3 feet in the telecommunications room. Slack at the work area may be stored in the ceiling and in the telecommunications room may be wall mounted or contained in pathways or racking systems if done in a neat, workmanlike fashion.
- Note service loops may not touch the ceiling assembly and if so must be remedied at the Contractor expense.
- Always label every termination point within 6 in. of the end. Use a unique number for each cable segment as required by the documentation for that project.
- Dress the cables neatly with hook and loop cable ties ("Velcro"), not plastic cable ties. Use low to moderate pressure.
- Maintain the twists of the pairs all the way to the point of termination, or no more than 0.5" (one half inch) untwisted.
- All UTP patching should be accomplished using CAT 6 & 6A rated modular patch panels as indicated elsewhere in this document.
- Contractor must remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards. This is mandatory; Contractors must consider this when placing bids.
- All removed copper cable is to be disposed of in a SCHOOL DISTRICT recycling bin designated for "copper."

8 Work Area

8.1 General

A model of one computer and one IP phone per cable has been established with wireless networking available as a secondary option for connectivity as the technology matures and the resources are deployed. Case-by-case exceptions can be made depending upon business justifications or type of work area where network cable is to be installed such as a classroom, administration room, conference room, etc.

The Work Area should consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. Both copper and fiber media should be supported. The connectivity equipment should include the following options:

- UTP Cable
- Outlets and surface mount boxes
- Surface raceway and outlet poles
- Patch Cords and Modular Connectors

The use of “mini-hubs” is not allowed since they cannot be seen or managed when connected to SCHOOL DISTRICT network.

The PANDUIT Mini-Com Network Cabling System or SCHOOL DISTRICT approved equivalent should be used for the Work Area subsystem, including all modular connectors. The network cabling system should be comprised of modular connectors in support of high-speed networks and applications designed for implementation on copper cabling. All outlets should utilize fully interchangeable and individual connector modules that mount side-by-side to facilitate quick and easy moves, adds, and changes.

The cable standards at the equipment outlet (work area) will reflect a **classroom, administration, multi-purpose, or other system** depending on the critical nature of the network traffic. These ratings are described as follows:

- Classroom locations will have two Category 6A (wifi) and six Category 6 (data, AV, clock/speaker, VOIP and future) cables to each work area. Classroom locations require high reliability and so more redundancy is built into classroom networks at all levels.
- Administration locations usually have three Category 6 (data, VOIP, and future) cables to each work area, but this may be upgraded depending on the needs of that project.
- Multi-purpose locations will have one Category 6 (clock) and four 6A (wifi) cables per work area.
- Other locations will receive three Category 6 drop and are not likely to be upgraded.

Further detail on these four work area types are provided below.

8.2 Classroom Facility

- All facilities rated classroom should have a minimum of two Category 6A and six Category 6, 4 pair station cables installed at the outset between the telecommunications room (or to the location of the serving network switch) and the work area.
- Additional cables may be installed to a work area if there is a business need for extra outlets. In cases requiring more than two drops, Contractor will use a four-hole faceplate or larger as needed by the project documentation for that job.
- Examples of this would be a classroom labs or a training room where there would be a large demand for network connections. For special cases like this, reference project-specific documentation attached to this specification.

- Cables are to be installed and tested per the Testing and Acceptance section of this document.
- The telecommunications Room end of the cables will be installed in to a patch panel per illustrations in the Telecommunications Room section of this document.

8.3 Outlets and Surface Mount Boxes

- Work area outlets will generally be one of three types.
- Modular Furniture Faceplate
- Surface Mount Box
- Wall Face Plate
 - The outlets and surface mount boxes should support the network system by providing high-density in-wall, surface mount or modular office furniture cabling applications. The outlets consist of faceplates for flush and recessed in-wall mounting as well as mounting to the modular office furniture systems. The surface mount boxes can be mounted where in-wall applications are not possible or to support applications where surface mount is the best option.
 - All outlets should utilize the interchangeable, individual Mini-Com connector modules that mount side by side to facilitate quick and easy moves, adds and changes. All outlets should be manufactured from high-impact thermoplastic material with a U.L. flammability rating of 94 HB or better.
 - The standard color for outlets and surface mount boxes is Panduit Off White (IW). Other colors may be used to match a pre-existing color scheme.
- 45° Angled Wire Caps for TX6A, TX6 PLUS and TX5e Mini-Com® UTP Jack Modules
- 45° angled wire caps, when mated with compatible UTP jack modules, shall provide improved cable routing to jacks in confined spaces. Angled wire caps shall terminate 4-pair, 22 - 26 AWG, 100 ohm unshielded twisted pair cable and shall use a forward motion termination method to optimize performance by maintaining cable pair geometry while eliminating conductor untwist.

The wire caps shall be color-coded to designate performance category and shall include a universal label coded for T568B wiring scheme.

8.4 Configuration of Work Areas

- Outlet configuration should be assembled as follows dependent upon the installed cable infrastructure for the facility. A new administration facility would only use ports 1, 2 and 3 of an outlet for the three standard data cables, filling the remaining ports with blanks or additional cables if needed. A other location with TDM voice services would use port 1 for data and port 2 for the VOIP.

8.5 Outlet Port Assignments

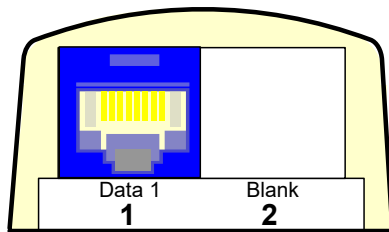
- Port #1 – Data # 1

- Port #2 – VOIP # 1 or Blank
- Port #3 – VOIP # 2, Data # 2 or Blank
- Port #4 – VOIP # 3. Data # 3 or Blank

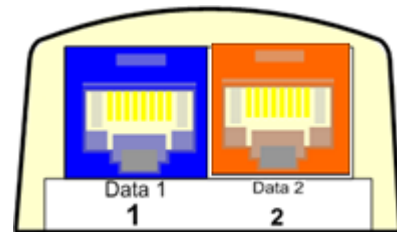
8.6 Outlet Example Diagrams

- Surface Mount Boxes.

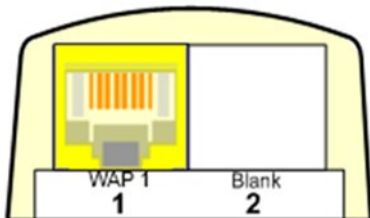
Surface box requiring one Ca 6 / 6A drop. (Good example is WAP connection).



Surface box requiring a second data drop



*Note wireless access points may use color coded jack yellow as noted below.



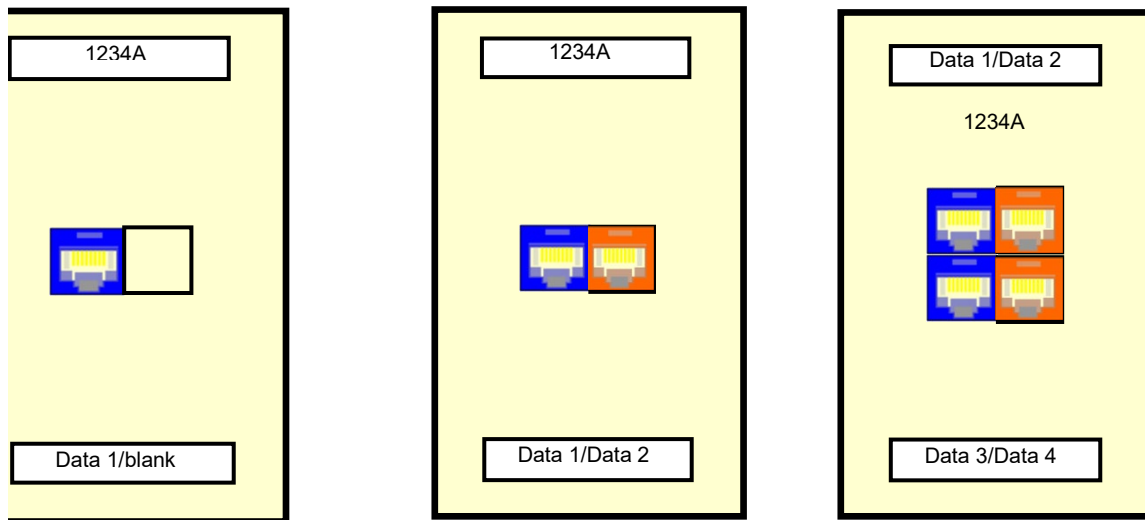
**If more drops are needed in a surface box, Contractor may need to install 4-hole surface box. Consult project documentation for details.

- Flush Mount Faceplates

Single Drop

Two Drop
Two Drop

Four Drop



9 Copper Horizontal Cable

9.1.1 COPPER CABLE CAT.6E: GEN SPEED 6000E / BLUE / PLENUM- P/N: 7131900

- Superior performance exceeds all TIA/EIA-568-B.2-1 Category 6 and ISO 11801 Edition 2.0 for Class E cable requirements
- ETL tested and verified for Category 6 component performance
- Conductors are twisted in pairs with four pairs contained in a flame retardant PVC jacket separated by a spline
- Performance tested to 650 MHz
- Plenum (CMP) and non-plenum/riser (CMR) flame rated
- Maximum installation tension of 25 lbs (110 N)
- Installation temperature range: 32°F to 140°F (0°C to 60°C)
- Operating temperature range: 14°F to 140°F (-10°C to 60°C)
- Cable diameter: Riser – 0.260"; Plenum – 0.250"
- Easy payout, reel-in-a-box and descending length markings on cable speed installation
- Supports the following applications: Ethernet 10BASE-T, 100BASE-T (Fast Ethernet) and 1000BASE-T (Gigabit Ethernet); 1.2Gb/s ATM; Token Ring 4/16; digital video; and broadband/baseband analog video

9.1.2 COPPER CABLE CAT.6A: GEN SPEED 10 / .250 O.D. / BLUE / PLENUM – P/N: 7141819

The GenSpeed 10 UTP Category 6A cable shall meet or exceed both channel and component compliant standards (ANSI/EIA/TIA-568-B.2-10, IEC/ISO 11801 Class E_A (channel) and IEC 61156-6 (component) standards). Category 6A UTP 4-pair copper cable shall be

constructed of 23 AWG conductors. The insulated conductors shall be twisted in pairs and all four pairs shall be covered by a flame retardant PVC, FEP, or PE jacket depending on cable flame rating. The copper conductors shall be twisted in pairs and separated by a crossweb. All four pairs shall be surrounded by Encapsulated Isolation Wrap and flame retardant jacket. The Encapsulated Isolation Wrap shall suppress the effects of alien crosstalk allowing 10Gb/s transmission. This innovative cable design shall provide installation flexibility as cables can be routed in tight bundles through pathways and spaces. The GenSpeed 10 UTP Copper Cable at .250 O.D. must be installed as part of a complete TX6A™ 10GIG™ Copper Cabling System in order to achieve 10GBASE-T certified performance.

All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. Cable listed to NEC Article 800-51(a) will be used for "Plenum" installations. Cable listed to NEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.

9.1.3 UTP CAT.6 & 6A JACK MODULES

MINI-COM® TX6A™ 10GIG™ UTP Jack Modules shall be Category 6A modules featuring MaTriX Technology. The eight position modules shall terminate unshielded twisted 4 pair, 22 – 26 AWG, 100 ohm cable and shall not require the use of a punchdown tool. Jack module shall use Enhanced Giga-TX™ Technology with forward motion termination to optimize performance by maintaining cable pair geometry and eliminating conductor untwist. The termination cap shall provide strain relief on the cable jacket, ensure cable twists are maintained to within 1/8" (3.18 mm) and include a wiring scheme label. The blue module base shall signify Category 6A performance and shall include a universal label representing T568A and T568B wiring schemes. The MINI-COM® TX6A™ Jack Modules include MaTriX Tape on the external portion of the jack module, which assists in suppressing alien crosstalk. The jack modules shall be universal in design, including complying with the intermateability standard IEC 60603-7 for backward compatibility. Category 6A jack modules shall be UL and CSA approved and RoHS compliant.

The jack modules shall be ETL verified to ANSI/TIA/EIA Category 6A and IEC/ISO 11801 Class EA channel performance. They shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to the outer jack contacts. The jack modules shall be able to be re-terminated a minimum of 20 times and be available in 11 standard colors for color-coding purposes. The jack module shall snap into all MINI-COM® outlets, patch panels and surface mount boxes. The MINI-COM® TX6A™ 10GIG™ Jack Module must be installed as part of a complete TX6A™ 10GIG™ Copper Cabling System with MaTriX Technology in order to achieve 10GBASE-T certified performance.

Part number	Style	Category	Colors
CJ6X88TG**	RJ-45	6A	11

**To designate a color, add suffix IW (Off White), EI (Electric Ivory), IG (Int'l Gray), WH (White), BL (Black), OR (Orange), RD (Red), BU (Blue), GR (Green), YL (Yellow) or VL

9.1.4 MINI-COM® TX-6™ TG MODULES SHALL BE CATEGORY 6 MODULES FEATURING GIGA-TX™ TECHNOLOGY. THE EIGHT POSITION MODULES SHALL BE USED IN ALL WORK AREAS AND SHALL EXCEED

THE CONNECTOR REQUIREMENTS OF THE TIA/EIA CATEGORY 6 STANDARD. TERMINATION SHALL BE ACCOMPLISHED BY USE OF A FORWARD MOTION TERMINATION CAP AND SHALL NOT REQUIRE THE USE OF A PUNCH DOWN TOOL. THE TERMINATION CAP SHALL PROVIDE STRAIN RELIEF ON THE CABLE JACKET, ENSURE CABLE TWISTS ARE MAINTAINED TO WITHIN 1/8" (3.18 MM) AND INCLUDE A WIRING SCHEME LABEL. THE WIRING SCHEME LABEL SHALL BE AVAILABLE WITH BOTH T568A AND T568B WIRING SCHEMES. ALL TERMINATIONS FOR THIS PROJECT SHALL USE THE T568B (B) WIRING SCHEME. THE MODULES SHALL TERMINATE 4 PAIR 23 100-OHM SOLID UNSHIELDED TWISTED PAIR CABLE. THE MODULES SHALL BE UNIVERSAL IN DESIGN, INCLUDING COMPLYING WITH THE INTERMATEABILITY STANDARD IEC 60603-7 FOR BACKWARD COMPATIBILITY. CATEGORY 6 MODULES SHALL HAVE UL AND CSA APPROVAL. THE MODULES SHALL HAVE ETL VERIFIED CATEGORY 6 PERFORMANCE AND ISO CLASS E PERFORMANCE (AS DEFINED IN ISO/IEC 11801) IN BOTH THE BASIC AND CHANNEL LINKS. THEY SHALL BE UNIVERSAL IN DESIGN, ACCEPTING 2, 3, OR 4 PAIR MODULAR PLUGS WITHOUT DAMAGE TO THE OUTER JACK CONTACTS. THE MODULES SHALL BE ABLE TO BE RE-TERMINATED A MINIMUM OF 10 TIMES AND BE AVAILABLE IN 11 STANDARD COLORS FOR COLOR-CODING PURPOSES. THE JACK SHALL SNAP INTO ALL MINI-COM OUTLETS AND PATCH PANELS. THE MODULE SHALL INCLUDE A BLACK BASE TO SIGNIFY CATEGORY 6 400 MHZ PERFORMANCE.

Part number	Style	Category	Colors
CJ688TG**	RJ-45	6	11

**To designate a color, add suffix IW (Off White), EI (Electric Ivory), IG (Int'l Gray), WH (White), BL (Black), OR (Orange), RD (Red), BU (Blue), GR (Green), YL (Yellow) or VL

TX6A™ Category 6A UTP Field-Term RJ45 Plug

The TX6A™ Category 6A UTP Field Terminable RJ45 Plug is a simple-to-attach plug for field termination of 4-pair unshielded twisted pair cable. Providing Category 6A performance the TX6A™ plug is also compatible with Category 6 and 5e systems. The two-piece TX6A™ plug terminates 4-pair, 22 - 26 AWG, 100 ohm unshielded twisted pair cable and uses proven TG-style forward motion termination technology to optimize performance by maintaining cable pair geometry while eliminating conductor untwist.



Part number	Style	Category	Colors
FP6X88MTG	RJ-45 Plug	6A	1 (Black)

- All copper Category 6 & 6A terminations should be the T568B pin-out.
- Refer to the "Appendix A - Materials" for specific cable part numbers.

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10 Wireless Access Points

For information regarding the design and installation of Wireless Access Points, SCHOOL DISTRICT employees should refer to the manufacturer standards.

11 Fiber Backbone Cabling

11.1 General

Installation of fiber in legacy installations must match the installed base both mechanically (core size, cable type, terminations) and in performance rating.

For new installations SCHOOL DISTRICT has standardized on General Cable brand plenum rated indoor/outdoor, tight-buffered, armored cable to be used both between telecommunications room within buildings, and in campus backbone connections between buildings.

The connections within buildings (intrabuilding) are to be OS1 - singlemode as distance requires for the transmission of 10GBase-SR 10 gigabit ethernet.

- Backbone under 300 M will use OS1.
- Distances beyond 300 M will be singlemode. The connections between buildings (inter-building) are to be various strand counts of singlemode cable in all cases unless the project documentation calls out something else.
- Confirmation of the glass type used per distance traveled is the responsibility of the Engineer.

11.2 Fiber Cable Types

SCHOOL DISTRICT made the decision to standardize on plenum rated indoor/outdoor, tight-buffered, armored cable to simplify optical distribution design and implementation. In particular this decision had the following advantages:

- Reduced part numbers and simplified design
- Outside plant fiber may skip the transition to inside type fiber since it is already inside rated.
- Using only plenum rated fiber cable allows the cable to be routed anywhere in the building, including air return spaces.
- The corrugated armor eliminates the needs to contain in conduit or innerduct within buildings.

11.3 Backbone Cabling - Intrabuilding

All fiber backbone connections within buildings should be made with General Cable OS1

singlemode, indoor/outdoor, plenum-rated, tight-buffered cable with a corrugated armor.

All fiber backbone connections within buildings should be done with General OS1 singlemode, indoor/outdoor, plenum-rated, tight-buffered cable with a corrugated armor. Contractor is responsible for bringing to the attention of the SCHOOL DISTRICT project manager any indoor fiber links that are an concern.

These intrabuilding fiber backbones should be installed in the following strand counts:

- 12, 24 and 48 strand.

See "Appendix A - Materials" for approved cable part numbers. Consult project documentation for strand counts on specific jobs.

11.4 Backbone Cabling - Inter-building

All fiber connections between buildings should be made using General Cable singlemode, plenum rated, indoor/outdoor tight-buffered cable with corrugated armor jacket unless project documentation calls out something else between buildings.

These inter-building fiber backbones should be installed in the following strand counts:

- 12, 24, 48 strand.

See "Appendix A - Materials" for approved cable part numbers. Consult project documentation for strand counts on specific jobs.

11.5 Fiber Terminations

Backbone fiber terminations should be done with Panduit duplex LC OptiCam connectors. Singlemode OS1 OptiCam factory pre-polished connectors should be used to terminate Singlemode OptiCam pre-polished for singlemode backbone terminations. These connectors must have the following properties:

Note: Pre-polished connectors should not be done in the field.

11.5.1 LC OPTICAM SINGLEMODE FIBER CONNECTORS

SCHOOL DISTRICT fiber terminations and connectors should meet the following requirements:

- TIA/EIA-604 FOCIS-10 compatible connectors.
- Exceed TIA/EIA-568-B.3 requirements.
- Connector backbone and boot colors follow TIA/EIA-568-C.3 suggested color identification scheme.
- Insertion loss: 0.3dB average (multimode and singlemode).
- Return loss: >26dB (10Gig [™]multimode), >20dB (multimode), >50dB (singlemode).
- Spring-loaded "Senior" rear pivot latch LC connector.
- Quick installation; provide field termination in less than half the time of field polish connectors.

- Patented re-termination capability provides yield rates approaching 100%.
- Factory pre-polished fiber end-face eliminates time-consuming field polishing to reduce installation costs labor, scrap and the number of tools required.
- Cam activated fiber and buffer clamp mechanisms provide superior fiber and buffer retention – less sensitivity to fiber tensile loading.
- OptiCam® Termination Tool simplifies tooling and termination, and virtually eliminates operator error by providing visual indication of proper termination after the cam step has been completed.
- Cable retention boot assemblies consistently provide higher than industry standard cable retention.
- Non-optical disconnect maintains data transmission under tensile loads for jacketed cable.
- Fiber cable size: accept 900µm tight-buffered fiber with included boot(s); accept 1.6mm – 2.0mm and 3.0mm jacketed cable with available OptiCam® Cable Retention Boot Assemblies (ten per package).

12 Telecommunications Rooms

12.1 General

All telecommunications rooms should be designed and constructed per all TIA guidelines:

- Entrance Facilities - per guidelines contained in TIA 569-C, including all additions, addenda and revisions at the time of installation.
- Equipment Rooms - per guidelines contained in TIA 569-C, including all additions, addenda and revisions at the time of installation.
- Horizontal Telecommunications Rooms - per guidelines contained in TIA 569-C, including all additions, addenda and revisions at the time of installation.

Details of mandatory attributes of telecommunications spaces (rooms) follow.

12.2 Entrance Facilities

The Entrance Facility is the location where outside communications services enter the building and are transitioned to SCHOOL DISTRICT owned cabling.

Contractor should follow all guidelines contained with TIA 569-C, Contractor should pay particular attention to the following details on all TRs and related Telecommunications Spaces:

- Locate the entrance facility in a dry area as close as practicable to the building entrance point and next to the electrical service room in order to reduce the length of bonding conductor to the electrical grounding system.
- Size the Entrance Facility according to present and expected future equipment requirements.

- Cover one wall with 3/4" A-C plywood that is 8' high, fire retardant and kiln dried to a maximum moisture content of 15%. Plywood should be painted with two coats white fire-retardant paint. Any penetrations through IDF fire-rated walls should use ETI easy path.
- Minimum ceiling height is 8' with 10' preferred.
- The floor, walls, and ceiling should be sealed to reduce dust. Finishes should be light in color to enhance room lighting. Floors should have anti-static properties.
- Lighting should be powered by separate circuits than the communications equipment and provide brightness not less than 500 lx (50 foot-candles) as measured 3 ft. above the finished floor.
- Entrance door should be lockable, not less than 36' wide and should be without a doorsill.
- Power should provide a minimum of two dedicated 120 V nominal, non-switch, ac duplex electrical receptacles, each on a separate branch circuit receptacles. Outlets should be rated at 20 A and be connected to 20 A branch circuit. Consult project documentation for specific power requirements.
- All equipment and infrastructure should be grounded according to the grounding section of this document.
- For server room design, refer to TIA 942A, section 6.4.4.4 Lighting.

12.3 Equipment Rooms

An Equipment Room may serve any or all of the functions of a telecommunications room or entrance facility, and is distinguished by the presence of active networking equipment.

An Equipment Room's contents should be restricted to only that which pertains directly to the telecommunications equipment and support features. The Equipment Room should further meet the following requirements:

- Location for an Equipment room should avoid locations restricted by building/architectural components or places holding equipment that generates large amount of electro-magnetic interference.
- Thorough-fare areas used to provide access to other part of the building should be avoided so the Equipment Room is secure and accessed only by authorized personnel.
- Locate the Equipment Room to have ready access to the main HVAC system.
- The following is a general guideline for sizing Equipment Rooms according to the number of work areas served:

Work areas	Area m ² (ft ²)
Up to 100	14 (150)
101 to 400	37 (400)
401 to 800	74 (800)
801 to 1200	111 (1200)

- Consult project documentation for details of room sizing for that project.
- Power systems up to 100 kVA may be located within the equipment room. Power systems above 100 kVA should be located in a separate room.
- Cover one wall with 3/4" A-C plywood that is 8' high, fire retardant and kiln dried to a maximum moisture content of 15%. Plywood should be painted with two coats white fire-retardant paint.
- Minimum ceiling height is 8' with 10' preferred.
- The floor, walls, and ceiling should be sealed to reduce dust. Finishes should be light in color to enhance room lighting. Floors should have anti-static properties.
- Lighting should be powered by separate circuits than the communications equipment and provide brightness not less than 500 lx (50 foot-candles) as measured 3 ft. above the finished floor.
- Doors should be lockable, not less than 36" wide 80" high, without doorsill and hinged to open outward if local codes permit. Doors could also slide side-to-side, or be removable.
- An ideal door solution is double doors with a removable center-post.
- The equipment room should be designed for a minimum distributed floor load rating of at least 4.8 kPa (100 lbf/ft²) and a minimum concentrated load rating of at least 8.8 kPa (182 lbf/ft²). If unusually heavy equipment is expected, the floor specifications should be increased to accommodate.
- HVAC should be continuously available 24/7, 365 days a year.
- HVAC should be outfitted with a standby power source.
- Temperature ranges should be 64 to 75 degrees F with a relative humidity of 30% to 55%.
- The Equipment Room should be powered by a separate circuit terminated in its own electrical panel. Required electrical provisioning is dependent upon equipment and supporting facilities. Consult project documentation for exact power needs.
- All equipment and infrastructure should be grounded according to the grounding section of this document.

12.4 Horizontal Telecommunications Rooms

Horizontal Telecommunications Rooms are located minimally one per floor and are the areas where backbone cable and horizontal cables are terminated and administered. Modern Telecommunications Rooms necessarily also contain a considerable amount of active equipment and in such cases also qualify as an "Equipment Room" and must be designed accordingly.

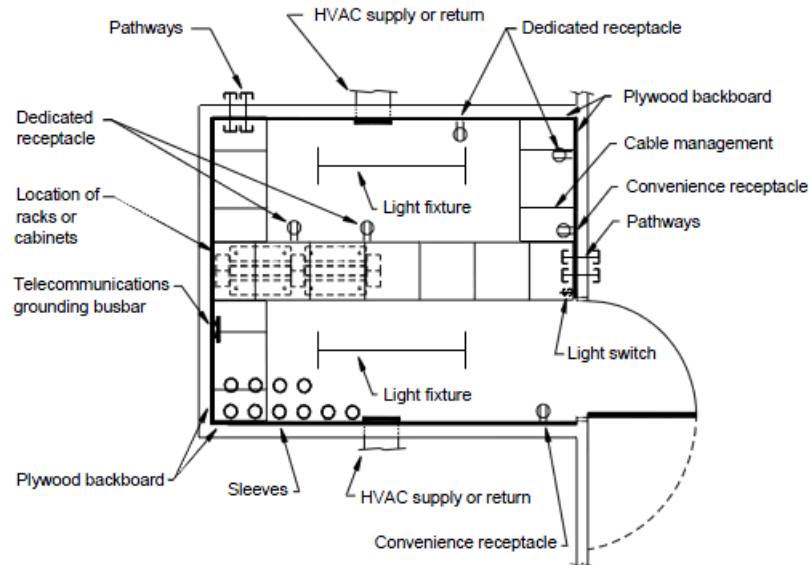
Telecommunications Rooms must meet the following requirements:

- Locate the TR (Telecommunications Room) as close as possible to the horizontal area to be served.
- Size the TR according to the following table.

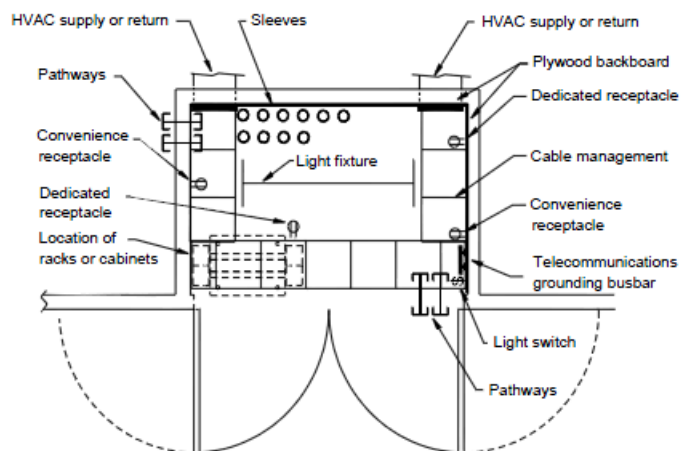
Serving area m² (ft²)	Room size mm (ft)
1000 (10 000)	3000 x 3400 (10 x 11)
800 (8000)	3000 x 2800 (10 x 9)
500 (5000)	3000 x 2200 (10 x 7)

- Cover one wall with 3/4" A-C plywood that is 8' high, fire retardant and kiln dried to a maximum moisture content of 15%. Plywood should be painted with two coats white fire-retardant paint.
- Lighting should be powered by separate circuits than the communications equipment and provide brightness not less than 500 lx (50 foot-candles) as measured 3 ft. above the finished floor.
- For maximum flexibility TRs should not have a drop ceiling.
- Minimum floor loading should be minimally 2.4 kPa (50 lbf/ft²). If unusually heavy equipment is expected, floor loading requirements may need to be increased accordingly.
- HVAC should be provided and maintain the same temperatures as adjacent office areas.
- HVAC should be provides 24/7, 365 days a year, even if this means an HVAC system exclusively provided to the TR. If there is a standby power source available, the TR HVAC will be connected to it.
- A positive pressure should be maintained with a minimum of one air change per hour, or as required by applicable code.
- A minimum of two dedicated 120 V nominal, non-switched, ac duplex electrical receptacles, each on a separate branch circuit, should be provided for equipment power.
- These receptacles should be rated at 20 A and be connected to a 20 A branch circuit.
- Identified and marked "convenience" fourdex outlets should be placed at 6' intervals around the perimeter walls, at a height of 6" above the floor.

- Specific outlets for equipment and convenience along with their locations should be coordinated with the telecommunications system designers. See project documentation for details.
- All equipment and infrastructure should be grounded according to the grounding section of this document.



TIA 569 Common Telecommunications Room – Example 1



TIA 569 Common Telecommunications Room – Example 2

13 Racks, Cabinets and Cable Managers

13.1 General

In new installations, all data and voice (VoIP) traffic should utilize Category 6 / 6A cabling and terminations.

Cables are to be terminated one cable per device. Splitting out pairs from one cable to multiple devices is not allowed and will not be accepted.

TRs where Category 6 horizontal cable is terminated fall into two types according to available space:

13.1.1 NORMAL OR NON-SPACE RESTRICTED HORIZONTAL TRs

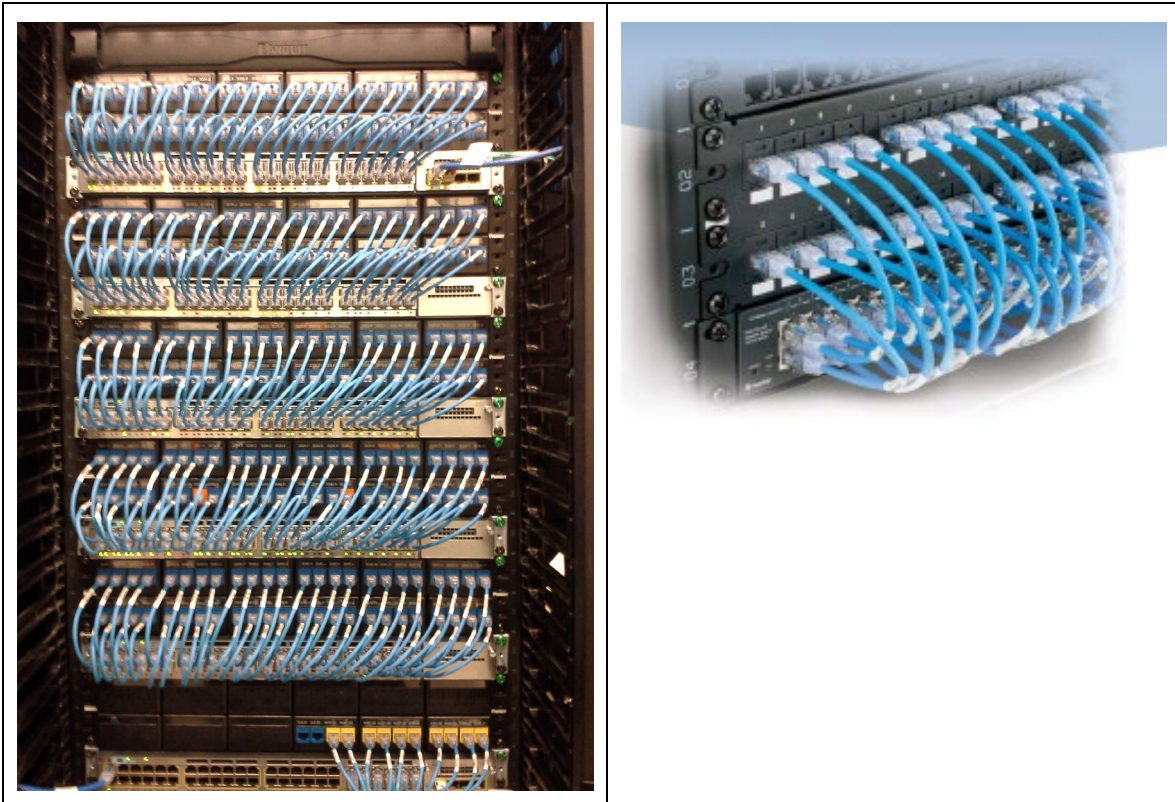
- Where space allows all modular Cat 6 / 6A panels will be angled to save space and eliminate horizontal managers.
- In such telecommunications rooms, racks should be standard 19", black aluminum with high capacity Panduit PatchRunner vertical managers on both sides. R2P
- PatchRunner high-capacity vertical managers should be sized to be no more than 35% upon installation according to manufacturer's calculations (fill charts).
- Racks should have interbay routing paths available at the top, middle and bottom of 19" racks to provide a shortest path between any two points when TR racks are ganged together.

See illustration below for properly configured 19" rack in a "normal" (non-space restricted TR:

Typical Rack Configuration

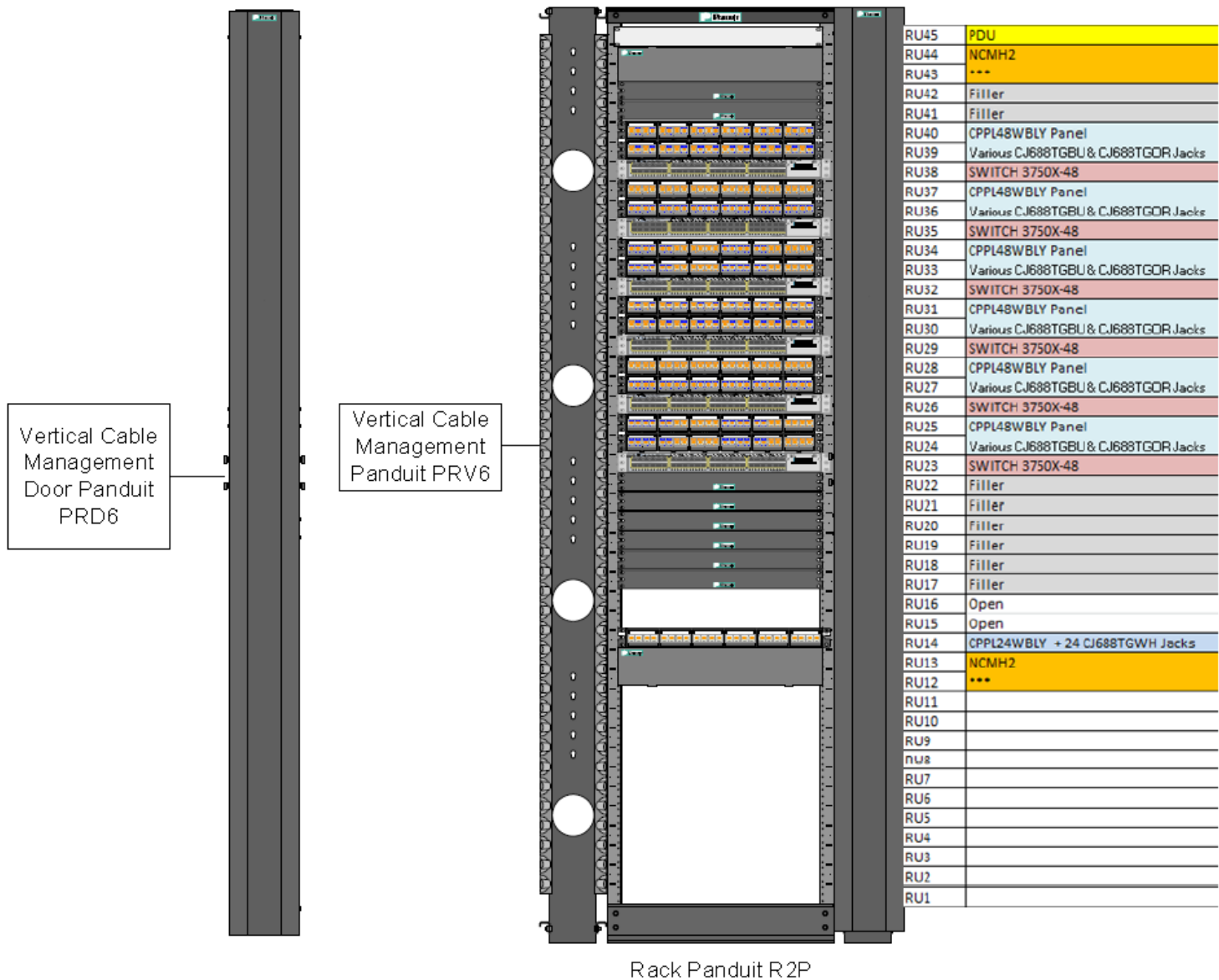
13.1.2 TYPICAL RACK CONFIGURATION FOR EDGE SWITCHES

- CAT 6 / 6A Horizontal UTP cable shall be terminated on flat Cat 6 /6A modular panels as prescribed in the elevations provided in this section.
- All patching shall be done using the “One-To-One” patching methodology demonstrated below and at: <http://www.panduit.com/heiler/ProductBulletins/D-COCB20--WW-ENG-OneToOneSwitchPatchn-W.pdf>. Horizontal cable managers are NOT used in this design.

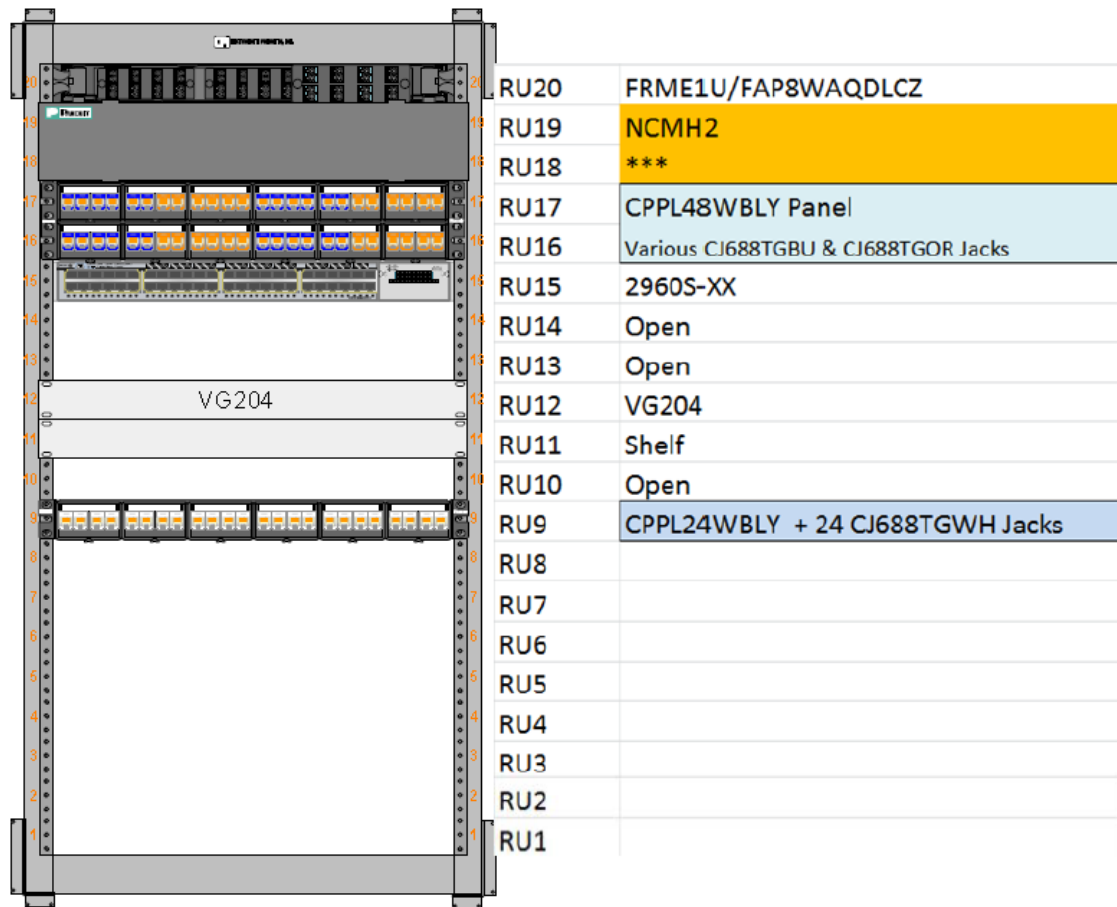


- All patch cords shall be Panduit Small Diameter Category 6 / 6A patch cords. These patch cords are 0.150 in, (3.8mm) nominal cable diameter and occupy less than half the space of traditional patch cords. <http://www.panduit.com/en/landing-pages/small-diameter-patch-cords>
- Racks in space restricted TRs shall have integrated vertical managers on one side only. See illustrations below for another comparison of rack configurations for normal-sized and space-restricted telecommunications rooms.

Typical Rack Elevation For Edge Switch Using One-To-One Patching



Wall Rack Elevation for Edge Switch Using One-To-One Patching



CPI Part #15320-724

13.2 Cable Managers

13.2.1 GENERAL

- The Cable Management System should be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures.

- The system should be a complete cable management system comprised of vertical cable managers, horizontal cable manager and cable management accessories used throughout the cabling system.
- The system should protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.
- Cable managers size should be selected according to projected port density when the rack is fully loaded and should not in any case exceed a 35% fill per manufacturers calculations (fill charts) upon installation.

13.2.2 HORIZONTAL CABLE MANAGERS

The horizontal cable managers are needed only in space restrictive TRs where there is not sufficient room to use angled patch panels. If horizontal managers are needed, they should meet the following criteria:

- Adjustable depth for pathway utilization or fan avoidance.
- Manage cables on switches with vertical cards.
- Can be used to create cable pathways for routing cable between bays.
- Have steel hinged covers to provide easy access to the pathway.
- Panduit part number PEHF2, 3 and 4 (last number corresponds with rack units).

13.2.3 VERTICAL CABLE MANAGEMENT

SCHOOL DISTRICT approved vertical cable managers are Panduit PatchRunner High Capacity type and should have the following properties:

- The Vertical cable managers should include components that aid in routing, managing and organizing cable to and from patch panels and/or equipment.
- Managers should protect network equipment by controlling cable bend radius and providing cable strain relief.
- Managers should be a universal design mounting to EIA racks. The manager should be constructed with a base that possesses pass through holes and molded cable management fingers.
- The fingers should incorporate integral bend radius control and be spaced so that the gaps between them align with the EIA rack spaces.
- The vertical manager should have a dual hinged cover that can be opened to the left or right to allow easy access to the pathway speeding moves, adds and changes.
- High density minimizes area required for network layout, freeing up valuable floor space.
- Allows mounting of many standard EIA 19" accessories, such as patch panels, vertically in the manager.
- Ventilated side walls provide maximum airflow for equipment cooling.

- Snap on finger sections can be removed to improve airflow, and break away fingers allow routing of large cable bundles.
- Large finger spacing accommodates up to 48 Cat 6 / 6A cables.
- Optional "sure close" dual hinged metal doors provide easy access to vertical pathway and provide visual and audible feedback on closure.
- Available in 7 foot version.

13.3 Equipment Cabinets

13.3.1 GENERAL

In large equipment rooms, data centers and areas requiring lockable equipment mounting, SCHOOL DISTRICT should use communications cabinets to house critical network equipment. These cabinets should be of two basic types depending on the equipment to be mounted.

13.3.2 SWITCH CABINETS

SCHOOL DISTRICT approved switch cabinets are Panduit "N-series" and should have the following properties:

- Welded and assembled steel frame construction.
- Easy maintenance powder coat finish.
- Adjustable rear equipment rails with infinite positioning
- Internal equipment space (max) 1070mm Cabinet – 995mm (39.1")
- Internal equipment space (max) 1200mm Cabinet – 1147mm (45.1")
- Doors include keyed swing handles.
- Split, hinged side panels.
- Dual hinge door for maximum accessibility between adjacent cabinets.
- Cabinet supplied with high density cable management fingers.
- Cable entry holes are equipped with plastic sealing plugs.
- Static Load of 1,364kg (3,000 lb.).
- Rolling Load of 1,136kg (2,500 lb.).
- Cabinet ships assembled, one per pallet
- Dynamic/Shock Pallet (1,250 & 2,000 lb.) ratings.
- Include hardware kit: #12-24 screws, or M6 screws and cage nuts.
- Labels minimum label 1" white on black should be placed on the outside of the door and on inside door.

13.3.3 SERVER CABINETS

SCHOOL DISTRICT approved server cabinets are Panduit "S-series" and should have the following properties:

- Welded and assembled steel frame construction.
- Easy maintenance powder coat finish.
- Adjustable front and rear equipment rails with infinite positioning.
- Doors include keyed swing handles.
- Side panels include keyed quarter-turn latches.
- Large cable entry/cable access.
- Cabinet supplied with standard density cable management fingers.
- Cable entry holes are equipped with plastic sealing plugs.
- UL Listed Static Load of 1,364kg (3,000 lb.).
- UL Listed Rolling Load of 1,136kg (2,500 lb.).
- Cabinet ships assembled, one per pallet.
- Dynamic/Shock Pallet (1,250 and 2,000 lb.) ratings.
- S-Type Cabinets include hardware kit: M6 screws, and cage nuts.
- Casters are pre-installed.

14 Copper Patch Panels and Cords

14.1 General

- Mini-Com® Modular Patch Panels should be designed with snap in four position and six position molded faceplate frames.
- The patch panels shall be modular accepting all Mini-Com® modules.
- Patch Panel Jack Color Standards:

Blue	Data 1
Orange	Data 2
White	VOIP
Yellow	WAP

Red

AV

- The faceplate frames should be releasable from the front to provide access to the modules and terminated cable. Modules should be mounted to the patch panel using Mini-Com® mounting features for added strength.
- Patch panels should be available with and without labels.
- Angled patch panels that allow cable to flow to each side of the rack eliminating the need for horizontal cable managers should be used on all SCHOOL DISTRICT telecommunications rooms having the depth to mount them.
- All patch panels should allow for a labeling scheme and port identification to be visible at all times.
- Refer to Appendix A - Materials at the end of this document for part numbers.

14.2 Single Data Cable Patch Panel Example



14.3 Two Data Cable Patch Panel Example



14.4 Patch Cord Details

- Modular patch cords should be Panduit Category 6 / 6A.
- Patch cords should be Panduit factory terminated with modular plugs featuring a tangle-free latch design and clear strain-relief boots to support easy moves, adds and changes.
- Each Panduit patch cord should be 100% performance tested at the factory to the appropriate ANSI/TIA 568 C.2 cable standard.
- The Panduit patch cords should come in standard lengths of 3', 5', 7', 10', 14', and 20'.
- Panduit patch cords should be labeled according to the labeling section in this document.

14.4.1 PANDUIT CORD COLOR STANDARDS

SCHOOL DISTRICT patch cord color coding is as follows:

- Red – Network backbone Router to Switch.
- Green – Serial connections & other telecommunications equipment.

- Blue – Patch Panel to Switch.
- Blue – Computer to work station jack.

*For patch cord part numbers see Appendix A - Materials at the end of this document.

**Check project documentation for other color conventions that may be used on that installation.

15 Fiber Patching and Fiber Jumpers

15.1 Fiber Enclosures

SCHOOL DISTRICT approved fiber enclosures are Panduit FRME type. All fiber terminations should be contained in these rack mount enclosures built to that purpose and having the following properties:

- Mount to standard 19" or 23" EIA rack or cabinet • Hold QuickNet™ or Opticom® Fiber Adapter Panels.
- Have front and rear access on all models via durable molded-hinge doors.
- Have integral bend radius control and cable management for fiber patch cords.
- Have multiple trunk cable entry locations.
- Include fiber optic cable routing kit (grommets, cable ties, saddle clips, strain relief bracket, and ID/caution labels) for various cable management solutions.

15.1.1 SINGLEMODE FIBER ADAPTER PANELS

Singlemode fiber adapter panels should be LC with 8 ports per FAP and meet the following:

- LC FAP loaded with eight LC duplex singlemode fiber optic adapters (Blue).
- Have zirconia ceramic split sleeves.
- Panduit Part number FAP8WBUDLCZ.

15.1.2 FIBER PATCH CORDS

Single-mode fiber patch cords should be manufactured by Panduit and meet the following conditions:

- Be terminated in duplex LC connections.
- Be available in both singlemode.
- Available in riser (OFNR) or plenum (OFNP) flame ratings.
- Be 100% pre-tested for insertion and return loss.
- Support speeds up to 10 Gb/s for link lengths up to 300 (OM3) meters with an 850nm source per IEEE 802.3ae 10 GbE standard.
- Pass all TIA/EIA-568-B.3 performance requirements.

- LC and SC connector housing and boot colors follow TIA/EIA-568-C.3 suggested color identification scheme.
- Typical insertion loss per connection: 0.25dB for singlemode.

See Appendix A - Materials for fiber jumper part numbers.

16 Cable Pathways

16.1 Overhead Metallic Pathways

Overhead metallic pathways should be Panduit Wyr-Grid and have the following properties:

- Be available four widths: 12" (305mm), 18" (457mm), 24" (610mm), and 30" (762mm).
- Incorporate non-integral snap-on sidewalls to minimize specification requirements and be offered in three different heights: 2" (50mm), 4" (102mm), and 6" (152mm).
- Utilize splice connectors have an integral bonding screw that creates a mechanical-electrical bond between cable tray pathway sections.
- Have bend radius control waterfalls in two different configurations that attach to all pathway sections 12" (305mm), 18" (457mm), 24" (610mm), and 30" (762mm).
- Have available a full complement of support brackets that are offered in various widths to accommodate pathways: 12" (305mm), 18" (457mm), 24" (610mm), and 30" (762mm).
- Incorporate integral quick-clip retention to accommodate 1/2" or 12 mm threaded rod.

16.2 Overhead Fiber Pathways

Overhead non-metallic fiber pathways should be Panduit FiberRunner and have the following properties:

- Be comprised of fittings, channel, couplers and brackets designed to segregate, route, and protect fiber optic and high performance copper cabling.
- Be available in sizes 24x4, 12x4, 6x4, 4x4, and 2x2.
- Have hinged channel cover and split fitting covers for 12x4, 6x4, and 4x4 systems protect cabling and provide easy access for future cabling revisions and additions.
- Feature QuikLock™ assembly features that have built-in bend radius control and that eliminates or minimizes the need for tools to assemble the system.
- QuikLock™ Couplers and Brackets require less than
- Have available multiple spillout options to provide versatility in making transitions to various equipment and rack configurations.
- Be part of an integrated system compatible with Panduit® Fiber-Duct™ 4x4 and 2x2 Routing Systems, CabRunner®, and Wyr-Grid® Overhead Routing Systems, cable management and racks.

17 Substitution Policy

17.1 General

Any Contractor wishing to offer structured cabling products or associated hardware other than those specified should submit a request for product substitution in writing no less than one week in advance of bid.

- Written requests for substitution should be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results proving equivalency in transmission performance and mechanical function.
- This written documentation should be accompanied by three (3) each samples of the substitution product being offered for evaluation by SCHOOL DISTRICT.
- Equal product acceptance must be received from SCHOOL DISTRICT in writing.
- Contractor shall be responsible for and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs should include but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.
- All requests for substitution must be submitted in writing and approved by SCHOOL DISTRICT

18 Communications Structured Grounding

18.1 General

Contractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the TIA 607-B Standard.

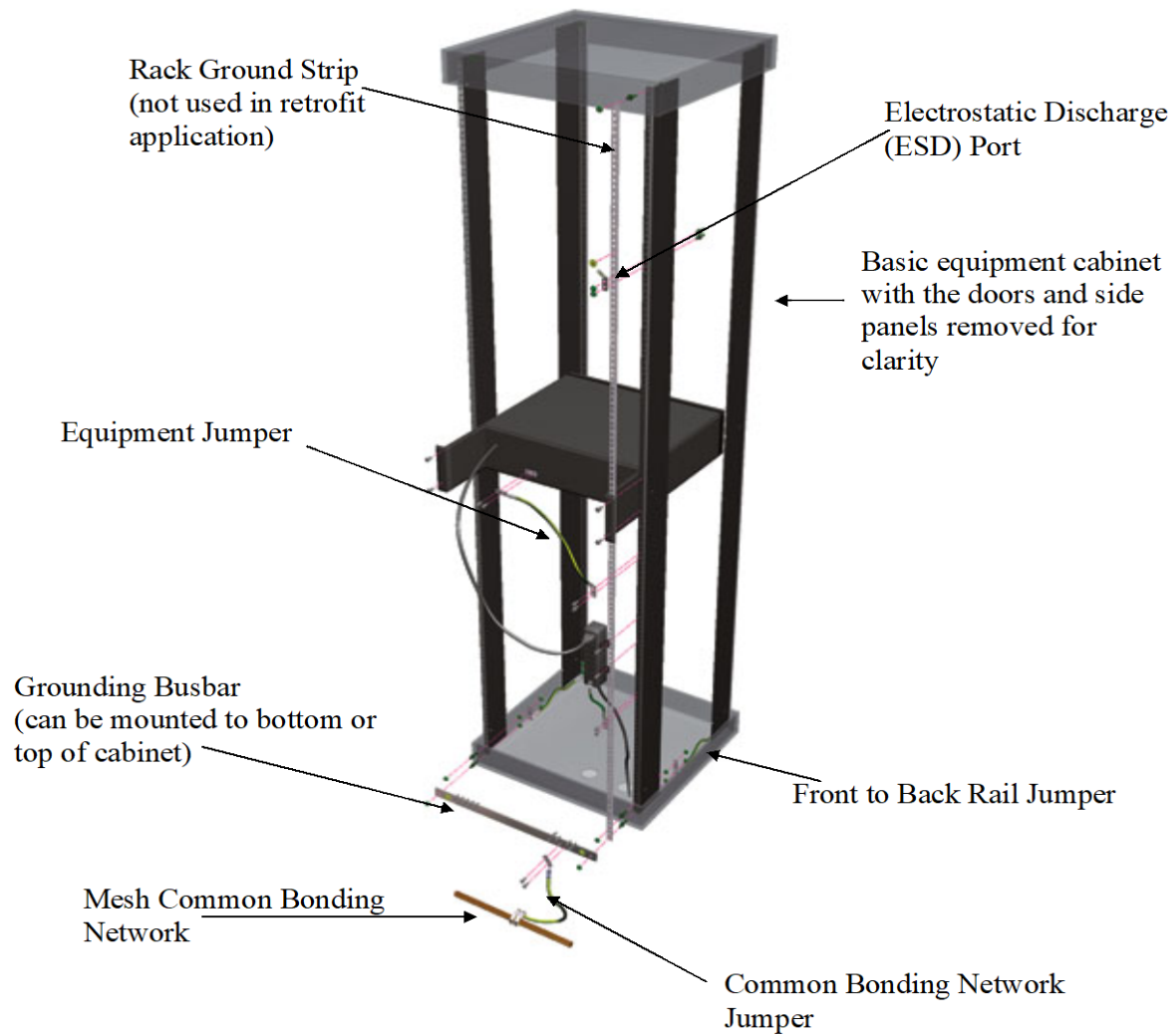
18.2 Details

- All newly installed racks and cabinets should have installed a vertical busbar mounted along one equipment rail to serve as a clean, low-resistance bonding place for any equipment not equipped with a designated grounding pad.
- Smaller equipment without an integrated grounding pad should be bonded to the vertical busbar through the use of a thread-forming grounding screw that is anodized green and includes serrations under the head to cut through oxidation or paint on the equipment flange.
- Larger equipment (chassis switches) with a designated grounding terminal should be bonded to the vertical busbar with an EBC (equipment bonding conductor) kit built to that purpose.
- Contractor should take care to clean (wire brush, scotch brite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces prior to effecting the bond.

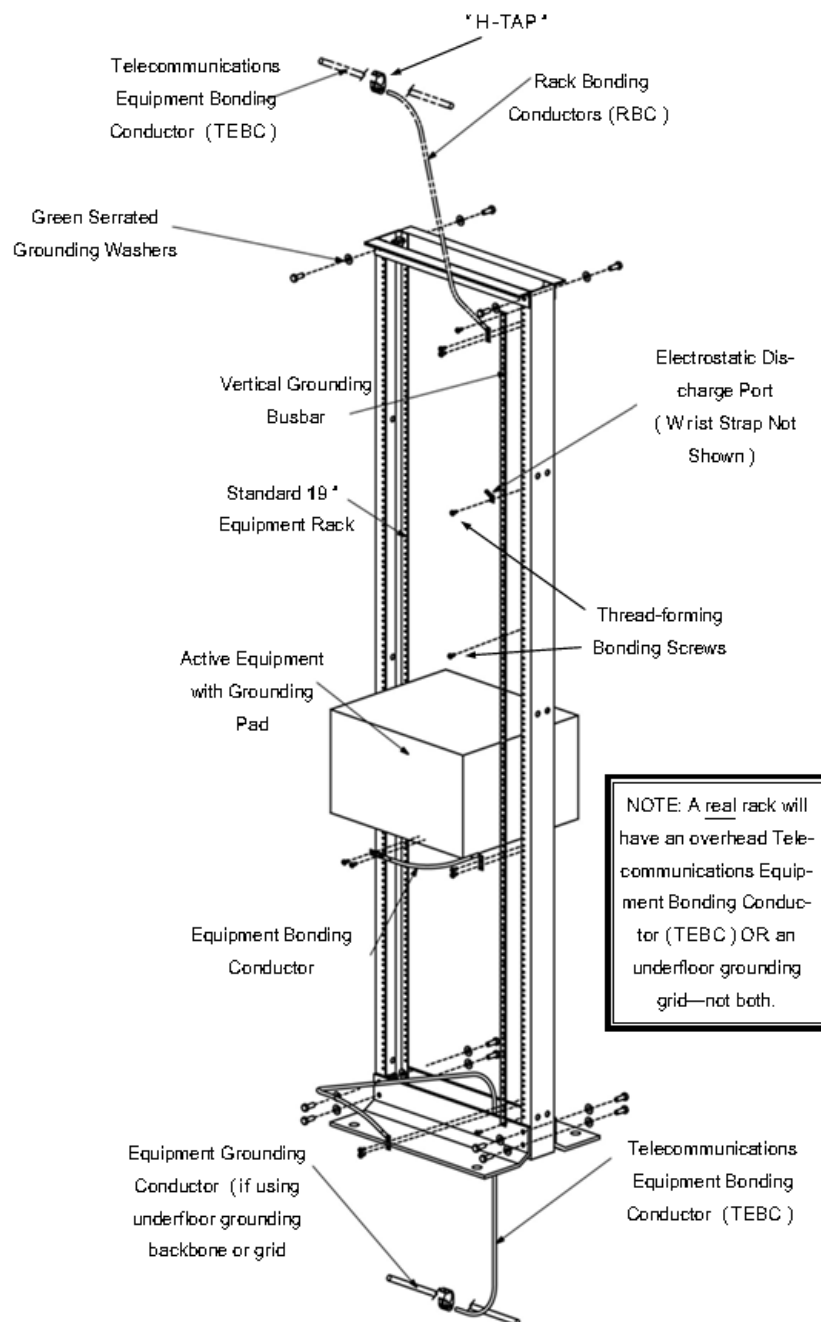
- All bonding lugs on racks and busbars should be of two-hole irreversible compression type. Mechanical lugs and single-hole lugs will not be accepted and should be removed and replaced at Contractor's expense.
- Every rack or cabinet should have an individual bonding conductor into the grounding network, serially connecting (daisy-chaining) of racks is expressly forbidden and will not be accepted.
- Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground, or may run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing 5 racks or less.
- A minimum of every other rack or cabinet should be outfitted with a properly installed and bonded ESD (electro-static discharge) port along with a wrist strap and lead to be used by any technicians servicing network equipment. On four post racks and cabinets these ESC ports and straps should be provided on front and back to be accessible and able to reach any active equipment needing servicing.
- Armored cables should be properly bonded to the earthing system with a kit built to that purpose.

For examples of rack and cabinet grounding refer to the illustrations below:

Properly Bonded Cabinet



Properly Bonded Two-post Rack



For complete list of bonding materials see "Appendix I - Materials" at the end of this document.

19 Communications Labeling

19.1 General

Within SCHOOL DISTRICT, each location has adopted local naming conventions for communications circuit designation and labeling. For exact instructions of how one project will be designated, consult the attached project specifications for that job.

19.2 Universal Guidelines

The following are general labeling guidelines that will apply to all facilities:

- When making additions to legacy systems, Contractor should adopt the circuit designation and labeling strategy of the existing systems unless instructed otherwise in project documentation.
- In new installations, Contractor should develop and submit for approval a labeling strategy based on the TIA 606-B Circuit Designation and Labeling Standard.
- This labeling scheme should, at a minimum, clearly identify all components of the system: racks, cables, panels and outlets, grounding, pathways and spaces like telecommunications rooms.
- The labeling system should designate the cable origin and destination with a unique identifier for the cable within the system.
- Racks and patch panels should be labeled to identify the location within the cable system infrastructure.
- All labeling information should be recorded on the as-built drawings and all test documents should reflect the appropriate labeling scheme.
- All label printing will be machine generated by either hand-held labeling systems or computer generated using programs and materials built specifically for communications labeling.
- Hand written labels will not be accepted and must be remedied at Contractors expense.
- Such labels should utilize materials designed to outlast the cabling elements to which they attach. Office quality labels will not be accepted.
- Cable labels should be self-laminating, appropriately sized to the outside diameter of the cable and placed within view at the termination point on each end.
- Outlet, patch panel and wiring block labels should be installed on, or in, the space provided on the device.
- Machine-generated labels should be installed behind the clear lens or cover on any device that provides such an option.
- All Bays should be labeled with Bay Designation at the end of Bay on side of cabinet.

- All cabinets should be labeled on outside door and on the inside so identification can be made when door is open.
- Labeling information will be supplied to the Communications Contractor by the SCHOOL DISTRICT Telecommunications Engineer in the project documentation.
- All labels will be permanently affixed to cables, patch panels, racks, cabinets, and enclosures.
- Labels should be legible and placed in a position that insures ease or visibility. Label type must be as listed in Appendix A - Materials.
- Conduit should be marked indicating the identification of the cable within.
- Backbone cabling should be labeled on each end designating the cable identification, FROM (origin), and TO (destination).

For a complete listing of communications labeling products see Appendix A – Materials.

20 Testing and Documentation

20.1 General

- Contractor should test all cables and termination hardware for defects in installation and to verify cabling system performance prior to system acceptance.
- Testing should be done in accordance with this document, the ANSI/TIA Standards, the Pan/Gen Certification Plus System Warranty guidelines and best industry practice.
- If any of these are in conflict, the Contractor should bring any discrepancies to the attention of SCHOOL DISTRICT Project Manager for clarification and resolution.
- Any defect in the cabling system performance or installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks should be repaired or replaced in order to ensure 100% useable conductors or fibers in all cables installed.
- Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.
- SCHOOL DISTRICT reserves the right to be present during any or all of testing.
- All cabling not tested strictly in accordance with these procedures should be re-tested at no cost to SCHOOL DISTRICT.

20.1.1 COPPER TESTING

- All twisted-pair copper cable links should be tested in compliance to the requirements in ANSI/TIA 1152 and ANSI/TIA 568-C.2 for Category 6 & 6A compliance using a test unit meeting a minimum IEC level of accuracy.

- All testers used must have been factory calibrated by the manufacturer within one year of use or according to factory calibration recommendations, whichever is the more stringent.
- Contractor should set references according to manufacturer's recommendation prior to each day's testing and reset references anytime tester is left unused for more than two hours.

20.1.2 FIBER TESTING

- All installed fiber should be tested for link-loss in accordance with ANSI/TIA 568-C.0 and should be within limits specified within ANSI/TIA 568-C.3
- For horizontal cabling system using multimode optical fiber, attenuation should be measured in one direction at either 850 nanometer (nm) or 1300 nm using a light source and power meter.
- Backbone multimode fiber cabling should be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in both directions.
- Test set-up and performance should be conducted in accordance with ANSI/568-C.0 Standard, Method B.
- Attenuation testing should be performed with a stable launch condition using two-meter reference grade fiber test leads (jumpers) to attach the test equipment to the cable plant.
- The light source should be left in place after calibration and the power meter moved to the far end to take measurements.
- Contractor should use reference grade fiber test leads built and sold specifically for fiber testing. Testing performed with standard fiber jumpers will not be accepted.
- Where links are combined to complete a circuit between devices, the Contractor should test each link from end to end to ensure the performance of the system. Only basic link loss testing is required.
- The values for calculating acceptable loss should be those defined in the ANSI/TIA 568-C.3 Standard.
- SCHOOL DISTRICT reserves the right to conduct, using Communications Contractor equipment and labor, a random re-test of up to five (5) percent of the cable plant to confirm documented results.
- Random re-testing, if performed, should be at the expense of SCHOOL DISTRICT, using standard labor rates. Any failing cabling should be re-tested and restored to a passing condition.
- In the event more than two (2) percent of the cable plant fails during a re-test, the entire cable plant should be re-tested and restored to a passing condition at no additional cost to SCHOOL DISTRICT.

20.2 Documentation

- Test reports may be submitted in hardcopy or electronic format. Hand-written test reports are not acceptable.
- Invoice will not be paid until final test results and as-built drawing(s) are received.
- Hardcopy reports are to be submitted in labeled 3 ring binders and signed off by the Communications Contractor's Project Manager, verifying passing execution of all tests. For large installations electronic reports with hardcopy summaries are preferred.
- Hardcopy summary reports should contain the following information on each row of the report: circuit ID, test specification used, length, date of test, and pass/fail result.
- Electronic documentation should be submitted in tester native format (not Excel). This is inclusive of all test results and draft as-built drawings.
- Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings should be submitted within 30 working days of the completion of each testing phase.
- At the request of SCHOOL DISTRICT, the telecommunications Contractor should provide additional copies of the original test results.
- The all report media should be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year).
- Test results should include the date of testing, a record of test frequencies (or wavelengths), cable type, conductor pair (or fiber strand if fiber) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s).
- The test equipment name, manufacturer, model number, serial number, software version and last calibration date should also be provided at the end of the document.
- Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation.
- The test document should further detail the test method used and the specific settings of the equipment during the test.
- When repairs and re-tests are performed, the problem found and corrective action taken should be noted, and both the failed and passed test data should be documented.
- The As-Built drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document should identify outlet locations.
- Numbering, icons, and drawing conventions used should be consistent throughout all documentation provided. SCHOOL DISTRICT will provide floor plans in paper and electronic (DWG, AutoCAD) formats to which as-built construction information can be added.
- The Contractor should annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD) form

20.3 Final Inspection and Acceptance

- Final project walk-through will occur within 7 working days of testing completion. The Contractor will have up to 7 days to correct any “punch item” issues identified during the walk down.
- Once all work has been completed, test documentation has been submitted, and the SCHOOL DISTRICT Project Manager is satisfied that all work is in accordance with the Scope of Work documents, SCHOOL DISTRICT should notify the Communications Contractor in writing of formal acceptance of the system.
- The Project Manager completes the [Cabling Certification Signoff form](#), obtains the signatures and uploads it to the [Cabling Test and Signoff Documents folder](#) on SharePoint.
- Following completion and/or compliance with the requirements listed above, SCHOOL DISTRICT will issue a Notice of Completion confirming that the project is complete. A 45 day Acceptance Period will begin immediately following the issuance of the Notice of Completion.
- During this Acceptance Period, the wiring system is to be up and operational. If there is a major system failure, the Acceptance Period will begin once the problem is resolved and the system is back up and running.
- The Acceptance Period is considered to be outside the warranty period. Once the Acceptance Period has passed, the Warranty will begin.
- Major system failures are defined as any event which deleteriously impacts 25% or more of the users in any one telecommunications closet.
- Failures, both major and minor, will be reported to the Communications Contractor by phone or fax, followed by written communications describing the problem, time and date of the occurrence, etc.
- Major failures should be responded to by the Communications Contractor personnel within four hours. Minor failures should be responded to at SCHOOL DISTRICT's discretion or within one business day.

20.4 [Panduit® CERTIFICATION PLUS™ System Warranty](#)

- A **CERTIFICATION PLUS** System Warranty shall provide a complete system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of 25 years.
- The Certification Plus Warranty may be applied only if the cabling channel links are comprised of Panduit connectivity and cable.

- Upon acceptance of Warranty, Panduit will mail a notification letter to the installer and a notification letter and warranty certificate to SCHOOL DISTRICT.

20.5 Contractor Warranty Commitments

- Installation firm must be a current certified Panduit ONE Partner in good standing and should include a copy of the company Panduit ONE Partner certification with the bid.
- Contractor should name a supervisor to serve on site as a liaison responsible to inspect and assure all terminations are compliant to factory methods taught in Panduit Technician Certification Training and according to all Standards cited in the Regulatory References section of this document.
- Contractor liaison should have a current, up-to-date Panduit ONE Partner Certified Technician (PCT) certificate in both copper and fiber. Copies of the copper and fiber certificates of the Panduit liaison should be submitted with the bid.
- Contractor agrees all components comprising active links should be of the same copper Category or fiber OM designation as the system being installed. Contractor should under no circumstances mix different Categories or OM classes of cable or termination devices (connectors) within the same link or system.
- Contractor should install all racking and support structures according to cited TIA Standards in such fashion as to maintain both Standards and Manufacturer recommendations for uniform support and protection, segregation of different cable types, maintenance of maximum pulling tensions, minimum bend radius, approved termination methods as well as adhering to industry accepted practices of good workmanship.
- Contractor is responsible for understanding and submitting to Panduit all documents required prior to project start to apply for this warranty. These include but are not limited to the project information form and SCS warranty agreement.
- Contractor is responsible for understanding and submitting to Panduit all documents required at project end. These include completed warranty forms, passing test reports and drawings of floor plans showing locations of links tested.
- Test results should be delivered in the tester native format (not Excel) and represent the full test report. Summaries should not be accepted. Contact Panduit for a current list of approved testers, test leads and latest operating systems.
- The Communications Contractor will correct any problems and malfunctions that are warranty-related issues without additional charge to SCHOOL DISTRICT for the entire warranty period. The warranty period should commence following the acceptance of the project by SCHOOL DISTRICT and written confirmation of Warranty from Panduit.

21 Contractor Qualifications

The following guidelines must be adhered to when work is bid to outside Contractors.

21.1 General

- Contactor should be a current Panduit Certified Installer. A copy of corporate certificate must be included with quote.
- At least 30 percent of the technicians on the job must have a current Panduit Certified Copper Technicians certificate to install Panduit Copper Distribution Systems.
- At least 30 percent of the technicians installing any Fiber Distribution Systems must have a current Panduit Certified Fiber Technicians certificate to install Fiber Distribution Systems.
- Contractor should employ at least one BICSI Registered Communication Distribution Designer (RCDD). A copy of the RCDD certificate must be attached to the proposal.
- Contractor should design and provide all materials in order to install a complete structure cabling solution supporting voice and data. Only one Contractor (no subs) should be responsible for providing a complete and functional infrastructure including the procurement of products, installation of cabling infrastructure, pathways and spaces, bonding and grounding, fire stopping, verification of performance, and documentation.
- Contractor must possess a valid C-7 California State Contractor's license. This license must have been issued 2-years prior to the date of the bid.
- Contactor must have been in telecommunications business for a period of at least 2 years. Contractor must submit at least 3 project references (of similar size and scope to this project).
- This installation must provide a 25-year extended warranty on the UTP cabling solutions by Panduit and General Cable. The extended warranty should include (but not limited to), product, performance, and application guarantees.
- Contractor should visit the work site before their proposal will be accepted. No allowances should be made to the Contractor for any extra expense, due to failure or neglect to discover unforeseen conditions affecting the work.
- Contractor employees should act in a professional manner, and be dressed appropriately for the task. No person should bring alcoholic beverages, controlled substances, firearms, or animals to the job site.
- Contractor should clear the work area every evening. If available space exists, Contractor equipment and materials may be stored at the facility with approval of SCHOOL DISTRICT. All packing material should be disposed of at the end of each day. SCHOOL DISTRICT will not be responsible for the loss, theft, or damage of any equipment or material.
- Contractor should follow the security policies and procedures defined by SCHOOL DISTRICT. This may include providing key access, creating access badges, and escorts for restricted areas.
- Contractor should take all precautions necessary to protect existing structures and furniture. Any items that are damaged during the course of the work should be repaired or replaced by the Contractor at no cost to SCHOOL DISTRICT.

- SCHOOL DISTRICT will provide the Contractor with reasonable access to the job site Monday-Friday 8-5 (Federal / State holidays excluded). SCHOOL DISTRICT must approve any work that requires access outside of these parameters.
- Contractor will provide a high-level project plan. This project plan should identify the tasks, timelines, and a completion date. Any changes to the schedule will be emailed to SCHOOL DISTRICT weekly. Attached files can be formatted in Adobe Acrobat.
- Contractor should assign a Project Manager. The Project Manager should email a weekly update status report to the project team members. A central off-hours emergency contact number should also be available for evenings and weekends.
- Contractor should take special precautions to ensure a safe work environment for the employees, contractors, and visitors.
- Contractor will make a reasonable effort to not be disruptive to other Contractors, or working staff at the job site.
- Contractor will install only material that is new and undamaged. Refurbished or used material is not acceptable.
- Contractor will dispose of all removed copper cable in a SCHOOL DISTRICT recycling bin designated for "copper" (located at most SCHOOL DISTRICT Service Centers) or recycled at a licensed recycling facility. If a non-SCHOOL DISTRICT recycling site is used then Contractor will provide SCHOOL DISTRICT with the official recycling receipt providing the recycler's name, address, phone number, weight of copper recycled and the amount paid. The money received for removed cable will either be applied as a credit to the project or refunded to SCHOOL DISTRICT in the form of a check.
- SCHOOL DISTRICT expects the workmanship to be of high quality. All equipment should be plumb and true with the structure. All materials should be firmly secured in place, adequately supported, and permanent.
- Install and coordinate this work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner accepted by the General Contractor/Engineer.
- All repairs or changes required in the work of the Contractor, caused by his/her neglect, should be made by the Contractor at his own expense.
- The locations of ladder racks and other equipment indicated on the drawings or the specification are approximately correct and are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed. Detailed information is to be discussed and agreed upon by the Contractor, or Contractor's representative, and SCHOOL DISTRICT Engineer and/or Project Manager.
- Exercise particular caution with respect to the location of cable termination frames, and have precise and definite locations accepted by SCHOOL DISTRICT/Engineer before proceeding with the installation.
- Keep all items protected before and after installation. Clean up all debris daily
- If in the event the Contractor and SCHOOL DISTRICT disagree technically during the execution of this project, both parties agree to be bound by the decision of a 3rd party. This person should be an RCDD in good standing with BICSI. He/she should be retained

by SCHOOL DISTRICT, and should not be an employee. A decision will be provided within 2-business days.

- SCHOOL DISTRICT will consider the project complete when all work has been completed when all stipulations in the Testing and Acceptance section of this document have been satisfied and signed-off on.
- Contractor agrees to replace or repair within 2 business days, any defective work or materials identified by SCHOOL DISTRICT within 12 months of final payment.

22 SCHOOL DISTRICT / PanGen Certificated Contractors

23 Bid Guidelines

23.1 General

The presentation of the cost to do the work described in this specification should be broken out with the following headings and information. The bid specification will allow for up to a +/- 10% variance to the total cable counts before a change order and/or scope revision is required.

23.2 Labor

- Labor costs to install, terminate and test all vertical and/or horizontal cabling specified by the project scope document.

23.3 Prevailing Wage

- Contractor will be performing work normally performed by IBEW represented SCHOOL DISTRICT employees. To meet SCHOOL DISTRICT contractual requirements in the IBEW Physical contract, Contractor should pay wages to the Contractor employees which meets or exceed prevailing wages. Prevailing wages should be as defined by California Labor Code Part 7, Chapter 1, Article 2 Section 1770, 1773, and 1773.1.

23.4 Material

- Contractor should provide unit cost details, including materials list, for the project including an addendum for changes or additions to the original job scope.
- Total project cost with the following cost breakdowns:
- Total material costs with detailed material list with all parts and estimated quantities identified
- Total labor costs with estimated man-hours for project completion
- Cost per additional station with one Cat6 cable pulled to the station 100 feet from the communications room.

Appendix A. Materials Lists

Part Number / GBE P/N	Description
7131900 / xxxxxxxxxxxxx	Example of Manufacture's P/N and Graybar's P/N

COPPER CONNECTIVITY

Part Number	Description
7131900/25054167	GenSpeed 6000E Enhanced Category 6E U/UTP Copper Cable, CMP, Blue
7141819/ 26029173	
CJ6X88TGxx-/ 25002033 blue 25012348 ivory 25002036 green 25002015 int'l gray 25002004 int'l white 25001979 orange 25002010 white 25002031 yellow 25012347 brown 25002061 violet 25002000 red	Mini-Com TX6A UTP Jack Module Graybar part number varies depending on color
CJ688TGxx/ 25046157 black 25042005 blue 25046152 electrical ivory 25046160 green 25046156 int'l gray 25046151 int'l white 25046158 orange 25046159 red 25046162 violet 25046161 yellow 25046153 white	Mini-Com TX6 UTP Jack Module Graybar part number varies depending on color
FP6X88MTG/ 25962349	TX6A™ Category 6A UTP Field-Term RJ45 Plug

CJUDCAPBU/ 25887410	Cat. 6A Up / Down 45° Angle Caps
CJLRCAPBU/ 25887409	Cat. 6A Left / Right 45° Angle Caps
CJUDCAPIW/26035590	Cat. 6 Up / Down 45° Angle Caps
CJLRCAPIW/ 25889262	Cat. 6 Left / Right 45° Angle Caps
DPA246X88TGY/25067749	24-port, angled, Category 6A, patch panel with 24 RJ45, 8-position, 8-wire ports
DPA486X88TGY/25067780	48-port, angled, Category 6A, patch panel with 48 RJ45, 8-position, 8-wire ports
DPA24688TGY/25067746	24-port, angled, Category 6, patch panel with 24 RJ45, 8-position, 8-wire ports
DPA48688TGY/25067778	48-port, angled, Category 6, patch panel with 48 RJ45, 8-position, 8-wire ports
DP12688TGY/ 25067727	12-port, Category 6, patch panel with twelve RJ45, 8-position, 8-wire ports. Mounts to 89D wall mount bracket.
DP246X88TGY/ 25067729	24-port, Category 6A, patch panel with 24 RJ45, 8-position, 8-wire ports
DP486X88TGY/ 25067741	48-port, Category 6A, patch panel with 48 RJ45, 8-position, 8-wire ports
DP24688TGY/ 25067598	24-port, Category 6, patch panel with 24 RJ45, 8-position, 8-wire ports
DP48688TGY/ 25067599	48-port, Category 6, patch panel with 48 RJ45, 8-position, 8-wire ports
UTP28X*xx/ COMMONLY USED BY SCHOOL DISTRICT 25704179 10 ft blue 25841472 8 in blue	Category 6A/Class E, UTP, small diameter patch cords should be constructed of 28 AWG, unshielded, twisted pair, stranded copper cable with high performance modular plugs. * = length xx = color
UTP28SP*xx/ COMMONLY USED BY SCHOOL DISTRICT 25456946 3 FT BLUE 25456950 5 FT BLUE 25460091 7 FT BLUE 25456957 10 FT BLUE 25628023 8 INCH BLUE	Category 6/Class E, UTP, small diameter patch cords should be constructed of 28 AWG, unshielded, twisted pair, stranded copper cable with high performance modular plugs. * = length xx = color
CJS6X88TGY/ 25069741	Category 6A, RJ45, 8-position, 8-wire universal shielded module with integral shield
CJS688TGY/ 25069777	Category 6, RJ45, 8-position, 8-wire universal shielded module with integral shield
UICMPPA24BLY/ 25097240	24-port angled patch panel with six UICPPL4BL Mini-Com® Ultimate ID® Faceplates
UICMPPA48BLY/ 25076107	48-port angled patch panel with six UICPPL4BL Mini-Com® Ultimate ID® Faceplates
UICMPP24BLY/	24-port patch panel with six UICPPL4BL Mini-Com® Ultimate ID® Faceplates

25093173	
UICMPP48BLY/25093174	48-port patch panel with twelve UICPPL4BL Mini-Com® Ultimate ID® Faceplates
UZPRBU*/ COMMONLY USED BY SCHOOL DISTRICT 25814457 20 FT 25814735 50 FT 25814456 100 FT	Category 6A UTP, solid, riser cable with TX6 PLUS Modular Plugs on each end for Hand Off Cables * = length
UPRBU*/COMMONLY USED BY SCHOOL DISTRICT 25925374 10 FT 25925375 15 FT 25925376 20 FT 25814775 45 FT 25809396 50 FT 25628493 70 FT 25814776 75 FT 25628494 80 FT 25809397 100 FT 25814273 120 FT 25814274 140 FT 25814275 160 FT 25814276 180 FT 25814277 200 FT	Category 6 UTP, solid, riser cable with TX6 PLUS Modular Plugs on each end for Hand Off Cables * = length
SRBWCY/25096141	Strain relief bar with integrated adjustable clips; supports, manages, and provides proper bend radius protection for up to 24 cables.
CFPL4IWxxY/ 25085862	4 Port Single gang, vertical faceplate accepts four Mini-Com® Modules
CBXJ2IW-A/96012760	Mini-Com® 2-port surface mount box accepts up to two Mini-Com® Modules. Includes built-in removable blank to add a second module.
CBXC4IW-A/ 98415468	Mini-Com® surface mount box accepts four Mini-Com® Modules
CMBxx-X/ 96045475 BL 96012780 EI 96045474 IG 96018238 IW 96018273 WH	Mini-Com® 1-port blank module, reserves space for future use xx = color
*	*For lengths 1 to 20 feet (increments of one foot), and 25, 30, 35, 40, 45, 50 feet, change the length designation in the part number to the desired length.

xx	To designate color, add suffix IW (Off White), replace IW suffix with EI (Electric Ivory), IG (International Gray), AW (Arctic White), BL (Black), BU (Blue), RD (Red), YL (Yellow), GR (Green), OR (Orange), or VL (Violet). BL (Black), BU (Blue), RD (Red), YL (Yellow), GR (Green), or OR (Orange)
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FIBER CONNECTIVITY

Part Number	Description
BE0121ANU-ILPA/25406763	General Cable Indoor / Outdoor 12 strand tight buffer Multimode 50/125um / OM3 distribution interlock armored plenum cable.
BE0241ANU-ILPA/25474185	General Cable Indoor / Outdoor 24 strand tight buffer Multimode 50/125um / OM3 distribution interlock armored plenum cable.
BE0481ANU-ILPA/26035515	General Cable Indoor / Outdoor 48 strand tight buffer Multimode 50/125um / OM3 distribution interlock armored plenum cable.
AP0121ANU-ILPA/25691598	General Cable Singlemode 9/125um Indoor / Outdoor 48 strand tight buffer Multimode 50/125um / OM3 distribution interlock armored plenum cable.
AP0241ANU-ILPA/25691598	General Cable Singlemode 9/125um Indoor / Outdoor 48 strand tight buffer Si/125um / OM3 distribution interlock armored plenum cable.
AP0481ANU-ILPA/26035516	General Cable Singlemode 9/125um Indoor / Outdoor 48 strand tight buffer Multimode 50/125um / OM3 distribution interlock armored plenum cable. DESCRIPTION
FRME1U/ 25190397	Rack Mount Enclosure 1 RU, Holds up to three FAP or FMP adapter panels or FOSM splice modules. Bidirectional sliding drawers provides front and rear access to fibers. Dimensions: 1.74"H x 17.00"W x 14.20"D (44.0mm x 432.0mm x 361.0mm)
FRME2U/25190398	Rack Mount Fiber Enclosure 2 RU, Holds up to six FAP or FMP adapter panels or FOSM splice modules. Bidirectional sliding drawers provides front and rear access to fibers. Dimensions: 3.48"H x 17.00"W x 14.20"D (88.0mm x 432.0mm x 361.0mm)
FRME4/ 22049098	Rack Mount Fiber Enclosure 4 RU, Holds up to 12 FAP or FMP adapter panels or FOSM splice modules. Provides front and rear access to fibers. Dimensions: 7"H x 17"W x 12"D
FWME4/ 22052266	Opticom Wall Mount Fiber Enclosure. Good for containing Fan-out transitions from outdoor loose-tube cable to indoor-type tight-buffered cable. Holds up to four QuickNet™ Cassettes, FAP, or FMP panels. Dimensions: 16.11"W x 12.25"H x 3.52"D. (409.2mm x 311.0mm x 89.4mm). For sizes holding 2 or 8 adapter panel, replace "4" in part number with 2 or 8.
FAPB/ 96090620	Blank fiber adapter panel for filling space in fiber enclosures for future use.
FWME4/ 22052266	Opti-com wall mount fiber enclosure. Holds up to four QuickNet™ Cassettes, FAP, or FMP panels. Dimensions: 16.11"W x 12.25"H x 3.52"D (409.2mm x 311.0mm x 89.4mm). For containing outdoor/indoor fiber fan-out transitions in entrance facilities.
FAP8WBUDLCZ/ 25117157	LC FAP loaded with eight LC duplex singlemode fiber optic adapters (Blue) with zirconia ceramic split sleeves.

F92ERQ1Q1SNMxxx 25700215 1 mtr 25700216 2 mtr 25700218 3 mtr 25700219 4 mtr 25700186 5 mtr 25700187 6 mtr 25815250 7 mtr 25815251 8 mtr 25815252 9 mtr 25815253 10 mtr 25813599 15 mtr 25813604 20 mtr 25813609 25 mtr 25813610 30 mtr	LC to LC Push-Pull singlemode duplex patch cord, 1.6mm jacketed cable (one duplex LC connector on each end) – 9/125µm. 1 meter length. Patch cords are available in 1 – 10 meter lengths in 1 meter increments, and 15, 20, 25 and 30 meter lengths. For other lengths, replace the "1" in part number with desired length.
FLCDSCBUY/ 25126957	LC OptiCam® Singlemode Duplex Fiber Optic Connector for 900µm tight-buffered fiber installation, or for use with fan-out kits when transitioning outdoor loose-tube to inside type tight buffered cable.
FCE1U/25180696	Holds up to four QuickNet™ Cassettes, FAP adapter panels, or FOSM splice modules.
FCE2U/ 25180697	Holds up to eight QuickNet™ Cassettes, FAP adapter panels, or FOSM splice modules.
FCE4U/ 25180698	Holds up to twelve QuickNet™ Cassettes, FAP adapter panels, or FOSM splice modules.
F9TRP5N5NANFxxx/COMMONLY USED BY SCHOOL DISTRICT 26006914 3 ft 25682389 4 ft 25867026 15 ft 25925514 20 ft 25638411 25 ft 25813624 30 ft 25813625 35 ft 25511489 40 ft 25511496 45 ft 25842778 50 ft	QuickNet Singlemode Female MTP* to female MTP* twelve strand fiber optic cable assembly (one female MTP* connector on each end on ribbon interconnect cable) 9/125µm. X = For lengths 1 to 20 feet (increments of one foot), and 25, 30, 35, 40, 45, 50 feet, change the length designation in the part number to the desired length.

RACKS, CABINETS AND CABLE MANAGERS

Part Number	Description
R2P/ 25367212	19" EIA rack, aluminum. Dimensions: 84.0"H x 20.3"W x 3.0"D (2134mm x 514mm x 76mm).
PRV8/ 22120406	Vertical cable manager, includes four PRSP7 slack spools. Dimensions: 83.9"H x 8.0"W x 16.4"D (2131mm x 203mm x 417mm)
PRD8/ 22120404	Vertical Dual Hinge, 8" wide Door
R2PPEVWF/ 25643482	Waterfall Trough for 2 Post Rack and PatchRunner™ High Capacity Vertical Cable Managers. Use on top each 2 post rack for high interbay pathway.
CMUT19/ 22024499	Cable Management Cable Trough. Placed at bottom of racks for lower interbay pathway. Not needed end of row.
NMF4/ 25117090	Horizontal Cable Manager High Capacity Front Only 4 Rack Units. Place in middle of racks for mid-level interbay pathway. Not needed on end of row unless shown on elevations.
NM2/ 25117084	Horizontal Cable Manager High Capacity Front and Rear 2 rack spaces.
EWMW242825/ 25231633	Hoffman 24" High AcessPlus II Double-Hinge Wall Mount Cabinet with Window Door / 12 Rack Units
EWMW362825/ 25231634	Hoffman 36" High AcessPlus II Double-Hinge Wall Mount Cabinet with Window Door / 19 Rack Units
EWMW482825/ 25231635	Hoffman 48" High AcessPlus II Double-Hinge Wall Mount Cabinet with Window Door / 29 Rack Units
E19SWM12U20/ 22078154	Hoffman 25" High Swing-Out Wall Mount Rack / 12 Rack Units
E19SWM20U20/ 22078155	Hoffman 40" High Swing-Out Wall Mount Rack / 20 Rack Units
E19SWM25U20/ 22078156	Hoffman 48" High Swing-Out Wall Mount Rack / 25 Rack Units
E19SWM32U20/ 22078157	Hoffman 60" High Swing-Out Wall Mount Rack / 32 Rack Units

PATHWAYS AND CABLE

Part Number	Description
Fiber Duct	Panduit 4X4" and 6X4" FiberRunner fiber channel. Mounts alongside ladder rack. See Panduit website or catalog for fittings and mounting hardware.
LD5EI8-A/ 96095857	LD5 Raceway - 8 foot sections - for surface mounting work area cable where concealed routing not possible only. Priced per foot
LD10EI8-A/ 97112731	LD10 Raceway - 8 foot sections - for surface mounting work area cable where concealed routing not possible only. Priced per foot
PLT2S-C702Y/ 25057008	Red (Maroon) plenum cable ties for use in ceiling spaces - 7.4"
PLT3S-C702Y/ 25057013	Red (Maroon) plenum cable ties for use in ceiling spaces - 11.6"
HLS-75R6/ 99713840	75 foot continuous roll blue hook and loop ties - to be used on cable bundles in telecom rooms
EZ Path Series 22/ 22119963	Low cable volumes

EZ Path Series 33/ 22073693	Moderate cable
EZ Path Series 44+/ 25834670	High cable volume

BONDING AND GROUNDING

Part Number	Description
LCC series	Panduit two-hole compressing lugs for code conductors in BICSI hole spacing.
HTCT series	Panduit HTAPs. Must be selected according AWG size of run and tap conductors.
CLRCVR series	Panduit clear covers for HTAPs. Must be selected according to HTAP being covered.
RGS134-1Y/ 25068985	Grounding strip (vertical busbar) for newly installed racks or cabinets with screw rails. 78.65" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
RGS134B-1/ 25097460	Grounding strip for newly installed racks or cabinets with cage nut rails: 78.70" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips.
RGCBNJ660P22/ 25106267	Jumper kit for bonding individual racks or cabinets into grounding backbone. #6 AWG (16mm ²) jumper; 60" (1.52m) length; 45° bent lug on grounding strip side; provided with .16 oz. (5cc) of antioxidant, two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread forming screws and a copper compression HTAP* for connecting to a #6 to #2 awg sized bonding backbone.
RGCBNJ660PY/ 25068971	Jumper kit for bonding individual racks or cabinets into grounding backbone. #6 AWG (16mm ²) jumper; 60" (1.52m) length; 45° bent lug on grounding strip side; provided with .16 oz. (5cc) of antioxidant, two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread forming screws and a copper compression HTAP* for connecting to a #2 awg to 250 kcmil bonding backbone.
GJ672UH/ 25439348	Rack jumper (and cabinet) kits for smaller TR (5 bays or less) to bond individual rack or cabinet directly back to wall mounted busbar. One 72" length #6 AWG green wire with yellow horizontal stripe. Jumper is pre-terminated on one end with LCC6-14JAWH-L and the other end with LCC6-14JAW-L. This rack grounding jumper is 72" long. For other lengths replace the "72" in the part number. Available lengths are 72, 96, 120, 144, 168, 192, 216, 240, 264 and 288 inches.
RGESD2-1/ 25113364	Two-hole ESD port with 5/8" hole spacing; provided with an ESD protection sticker, .16 oz. (5cc) of antioxidant, and two each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
RGESDWS/ 25180699	Adjustable fabric ESD wrist strap with 6' coil cord, banana plug, 1 megaohm resistor and 4mm snap.
RGTBSG-C	Green thread-forming bonding screws for use to mount equipment that does not have a built-in grounding pad (terminal).
CNB4K/ 25280034	Green bonding cage nut, includes 4 #12-24 bonding cage nuts (.06 – .11 thick panel) and 4 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket). Ideal for patch panel applications and

	bonding smaller equipment not equipped with a built-in grounding terminal.
CNBK/ 25308360	Green bonding cage nut, includes 50 #12-24 bonding cage nuts (.06 – .11 thick panel) and 50 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket).
RGW-100-1Y/ 25068987	100 paint piercing bonding washers for 3/8" (M8) stud size; .875" (22.2mm) O.D.; provided with .16 oz. (5cc) of antioxidant. NOTE: Panduit racks come supplied with these. This is needed to construct non-Panduit racks.
RGEJ1024PHY/ 25068973	24" long pre-terminated equipment grounding jumper#10 AWG (6mm ²) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws.
RGEJ1036PFY/ 25068974	36" long pre-terminated equipment grounding jumper#10 AWG (6mm ²) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws.
GB2B0514TPI-1/ 25236094	Wall mounted telecommunications busbar suitable for small telecom room. Pre-assembled with BICSI/TIA-607-B hole spacing. Bar is 1/4" x 2" x 24" in size.
GB4B1028TPI-1/ 25264500	Wall mounted telecommunications busbar suitable for larger telecom room. Pre-assembled with BICSI/TIA-607-B hole spacing. Bar is 1/4" x 4" x 24" in size.
ACGK/ 25237871	Armored cable grounding kit. Contains one grounding terminal for #6 AWG grounding conductor, and one #10 mechanical clamp for cable diameters in 9/16" – 1 1/16" diameter range.
ACG24K-500/ 25466854	#6 AWG (16mm ²) jumper for armored cable diameter 0.85" (21.3mm) to 1.03" (26.2mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover.
ACG24K/ 25229665	#6 AWG (16mm ²) jumper for armored cable diameter up to 0.84" (21.3mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover.
LTYK/ 25079191	Wall mounted busbar label kit. Label kit includes printed tag and one flame retardant cable tie.

LABELS & LABELING EQUIPMENT

Part Number	Description
PROG-EM2GO/ 25238993	Easy-Mark Labeling Software for PC, supplied on USB Flash Drive.
LS8EQ-KIT-ACS/ 25361785	Panduit PanTher hand-held label printing system in kit. Includes LS8EQ printer with QWERTY keypad, one cassette of S100X150VAC self-laminating labels, six AA alkaline batteries, LS8E-ACS, LS8-CASE, LS8-PCKIT, LS8-IB, LS8-WS, quick reference card and operator's manual.
C195X040Y1J/ 25027048	Faceplate label for use with Easy-Mark labeling software and laser printer.
C261X035Y1J/ 25027049	Faceplate label for use with Easy-Mark labeling software and laser printer - horizontal sloped faceplates.
C195X040Y1C/25063582	Faceplate label for use with PanTher LS8E hand-held printer
C261X035Y1J/ 25027049	Component Labels for Mini-Com® Modular Faceplate Patch Panels for use

	with Easy-Mark software and laser printer.
C261X035Y1C/ 25101088	Component Labels for Mini-Com® Modular Faceplate Patch Panels for use with PanTher LS8E hand-held printer.
S100X150YAJ/ 25025305	Self-laminating cable labels for Category 6A cable for use with Easy-Mark software and laser printer. DUPLICATE OR CORRECT PART NUMBER?
S100X150YAJ/25025305	Cable label for indoor non-armored 6 or 12 strand fiber cable. For use with Easy-Mark software and laser/inkjet printer. DUPLICATE OR CORRECT PART NUMBER?
S100X150VAC/ 25049372	Cable label for indoor non-armored 6 or 12 strand fiber cable. For use with PanTher™ LS8E Hand-Held Label Printer
S100X400YAJ/ 25115732	Cable label for 24 or 36 strand single-mode, armored inter-building fiber backbone. For use with Easy-Mark software and laser/inkjet printer.
S100X400VAC/ 25114243	Cable label for 24 or 36 strand single-mode, armored inter-building fiber backbone. For use with PanTher™ LS8E Hand-Held Label Printer
S100X150VAC/ 25049372	Self-laminating cable labels for Category 6A cable for use with PanTher LS8E hand-held printer.
S100X650YAJ/ 25115734	Label for indoor armored 12 and 24 str cable - for use with Easy-Mark software and laser printer.
S100X650VAC/ 25097651	Label for indoor armored 12 and 24 str cable - for use with PanTher LS8E handheld printer.
S100X400YAJ/ 25115732	Label for outdoor armored 24 str cable - for use with Easy-Mark software and laser printer.
S100X400VAC/ 25114243	Label for outdoor armored 24 str cable - for use with PanTher LS8E handheld printer.
S100X160YAJ / 25115710 and NWSLC-3Y/ 25061336	Laser printable fiber jumper self-laminating labels with rotating sleeve for FZE/FXE multimode and singlemode fiber jumpers
S100X160VAC/ 25114230 and NWSLC-3Y/ 25061336	Fiber jumper self-laminating labels with rotating sleeve for FZE/FXE multimode and singlemode fiber jumpers. For use with PanTher LS8E handheld printer.
S100X220YAJ/ 25115713 and NWSLC-7Y/ 25061338	Laser printable fiber jumper self-laminating labels with rotating sleeve for FZD/FXD jumpers.
S100X220VAC/ 25068362 and NWSLC-7Y/ 25061338	Fiber jumper self-laminating labels with rotating sleeve for FZD/FXD jumpers for PanTher LS8E handheld printer.
S100X150YAJ/ 25025305	Label for copper patch cords for use with laser printer.
S100X150VAC/ 25049372	Label for copper patch cords for use with PanTher hand-held labeler.
T100X000VPC-BK/ 25052263	1" high, continuous black on white, vinyl tape labels for labeling racks and cabinets with PanTher LS8E handheld labeler.
C400X100YJT/ 25080402	1" by 4" white, polyester label for labeling racks and cabinets that prints from laser printer using Easy-Mark software.

Appendix B. Bill of Materials

BoM Cabling template:

Appendix C. Definitions of Terms

Word or Phrase	Meaning
°C	degrees Celsius
°F	degrees Fahrenheit
A	Ampere
AC	Alternating Current
Access floor	A system consisting of completely removable and interchangeable floor panels that are supported on adjustable pedestals or stringers (or both) to allow access to the area beneath.
Access provider	The operator of any facility that is used to convey telecommunications signals to and from a customer premises.
ANSI	American National Standards Institute
AP	Access Provider
ASTM	American Society for Testing and Materials
ATIS	Alliance for Telecommunications Industry Solutions
AWG	American Wire Gauge
Backbone	A facility (e.g., pathway, cable or conductors) between any of the following spaces: telecommunications rooms, telecommunications enclosures, common telecommunications rooms, floor serving terminals, entrance facilities, equipment rooms, and common equipment rooms.
Backbone cable	See backbone.
BICSI	Building Industry Consulting Service International
Blended floor system	A combination of cellular floor units with raceway capability and other floor units with raceway capability, systematically arranged in a modular pattern.
BOCA	Building Officials and Code Administrators
BOMA	Building SCHOOL DISTRICTs Managers Association
Buried cable	A cable installed under the surface of the ground in such a manner that it cannot be removed without disturbing the soil.
Cabinet	A container that may enclose connection devices, terminations, apparatus, wiring, and equipment.
Campus	The buildings and grounds having legal contiguous interconnection.
CCITT	International Telegraph and Telephone Consultative Committee
Cell	A single raceway of a cellular or under floor duct system.
CER	common equipment room
Common telecommunications room	An enclosed space used for backbone interconnections for more than one tenant in a building, which may also house equipment.
Conduit	(1) A raceway of circular cross-section. (2) A structure containing one or more ducts. Editorial note - For the purposes of this Standard, the term conduit includes electrical metallic tubing (EMT) or electrical non-metallic tubing (ENT)
Consolidation point	A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
CTR	common telecommunications room
Customer premises equipment (CPE)	Telecommunications equipment located on the customer's premises.
dB	decibel
Demarcation point	A point where the operational control or ownership changes.
Direct-buried cable	A telecommunications cable designed to be installed under the

	surface of the earth, in direct contact with the soil.
Distribution duct	A raceway of rectangular cross-section placed within or just below the finished floor and used to extend the wires or cables to a specific work area.
Duct	(1) A single enclosed raceway for conductors or cables. See also conduit, raceway. (2) A single enclosed raceway for wires or cables usually used in soil or concrete. (3) An enclosure in which air is moved. Generally part of the HVAC system of a building.
EF	entrance facility
Elastomeric firestop	A firestopping material resembling rubber (See also firestopping).
Electromagnetic interference	Radiated or conducted electromagnetic energy that has an undesirable effect on electronic equipment or signal transmissions.
Embedded duct	A duct fully enclosed inside a floor or a wall.
EMT	electrical metallic tubing
Enclosure, telecommunications	A case or housing for telecommunications equipment, cable terminations, and cross-connect cabling.
End user	SCHOOL DISTRICT or user of the premises cabling system.
ENT	electrical nonmetallic tubing
Entrance facility (telecommunications)	An entrance to a building for both public and private network service cables (including wireless) including the entrance point of the building and continuing to the entrance room or space.
Entrance point (telecommunications)	The point of emergence for telecommunications cabling through an exterior wall, a floor, or from a conduit.
Entrance room or space (telecommunications)	A space in which the joining of inter or intra building telecommunications backbone facilities takes place. Editorial note - An entrance room may also serve as an equipment room.
EP	entrance point
Equipment room (telecommunications)	An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect.
False ceiling	See suspended ceiling.
FCC	Federal Communications Commission
Firestop system	A specific construction consisting of the material(s) (firestop penetration seals) that fill the opening in the wall or floor assembly and any items that penetrate the wall or floor, such as cables, cable trays, conduit, ducts, pipes, and any termination devices, such as electrical outlet boxes, along with their means of support.
Firestop	A fire-rated material, device, or assembly of parts installed in a penetration of a fire-rated barrier.
Floor slab	That part of a reinforced concrete floor which is carried on beams below.
ft.	feet, foot
Furniture cluster	A contiguous group of work areas, typically including space divisions, work surfaces, storage, and seating.
g	gram
grounding	The act of creating a ground.
Horizontal cabling	1) The cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. 2) The cabling between and including the building automation system outlet or the first mechanical termination of the horizontal connection point and the horizontal cross-connect. 3) in a data center, horizontal cabling is the

	cabling from the horizontal cross-connect (in the main distribution area or horizontal distribution area) to the outlet in the equipment distribution area or zone distribution area.
Horizontal connection point	A location for connections between horizontal cables that extend from building pathways and horizontal cables that extend to building automation systems devices and equipment.
HVAC	heating, ventilation and air conditioning
IDF	Intermediate Distribution Frame
IEEE	The Institute of Electrical and Electronics Engineers
in	inch
Infrastructure (telecommunications)	A collection of those telecommunications components, excluding equipment, which provide the basic support for the distribution of all information within a building or campus.
innerduct	A nonmetallic raceway, usually circular, placed within a larger raceway.
ISO	International Organization for Standardization
junction box	A location in the pathway system that allows transition of pathways and access to cables.
kg	kilogram
km	kilometer
m	meter
Multi-user telecommunications outlet assembly	A grouping in one location of several telecommunications outlet/connectors.
MUTOA	multi-user telecommunications outlet assembly
N	Newton
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NIST	National Institute for Standards and Technologies
Plenum cable	A cable with flammability and smoke characteristics that meets the safety requirements of the National Electrical Code® (NEC®) allowing it to be routed in a plenum area without being enclosed in a conduit.
Plenum	A designated area used for transport of environmental air as part of the air distribution system. Because it is part of the air distribution system, cables installed in this space require a higher fire rating.
Power Over Ethernet (PoE)	Power Over Ethernet. Usually referring to the IEEE 802.3af standard that provides a means to supply low voltage power to end equipment using network cable and devices.
Power Sum Attenuation-to-Crosstalk Ratio (PSACR)	The difference between attenuation and power sum crosstalk measured in dB at a given frequency. This difference is critical to ensure that the signal sent down the twisted-pair cable is stronger at the receiving end of the cable than any interference signals (crosstalk) from other cable pairs.
Power Sum Equal Level Far-End Crosstalk (PSELFEXT) Loss	A computation of the unwanted signal coupling from multiple transmitters at the near end into a pair measured at the far end and normalized to the received signal level.
Power Sum Near-End Crosstalk (PSNEXT) Loss	A computation of the unwanted signal coupling from multiple transmitters at the near end into a pair measured at the near end.
ppm	parts per million

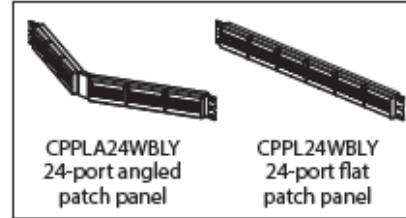
Propagation delay	The time interval required for a signal to be transmitted from one end of the circuit to the other.
pull box	A housing located in a pathway run used to facilitate the placing of wire or cables.
PVC	polyvinyl chloride
Raceway	Any enclosed channel designed for holding wires or cables.
RoHS	Restriction of Hazardous Substances. This directive was adopted by the European Union in an effort to restrict hazardous materials in the manufacture of various types of electronic and electrical equipment.
RoIP	Radio over IP
Return loss	A ratio of the power of the outgoing signal to the power of the reflected signal, expressed in dB.
RF	radio frequency
Riser	Term applied to vertical sections of cable, such as changing from underground or direct-buried plant to aerial plant. Term also applies to the space used for cable access between floors.
Service entrance	See entrance facility (telecommunications).
Service provider	The operator of any service that furnishes telecommunications content (transmissions) delivered over access provider facilities.
Signal-to-Noise Ratio (SNR)	The ratio between the detected signal power and noise in a receiver, expressed in dB. The prime determining factor in bit error rate. See Bit Error Rate.
Sleeve	An opening, usually circular, through the wall, ceiling, or floor to allow the passage of cables.
Slot	An opening through a wall, floor, or ceiling, usually rectangular, to allow the passage of cables.
SP	service provider
Splice box	A box, located in a pathway run, intended to house a cable splice.
Splice closure	A device used to protect a splice
Structural Return loss	A measure of reflected energy of a transmitted signal due to impedance variations along the length of the cable, expressed in dB.
Suspended ceiling	A ceiling that creates an area or space between the ceiling material and the structure above.
TE	telecommunications enclosure
Telecommunications room	An enclosed architectural space for housing telecommunications equipment, cable terminations, and cross-connect cabling.
TIA	Telecommunications Industry Association
TLA	Three Letter Acronym
TR	telecommunications room
TS	telecommunications space
UL	Underwriters Laboratories Inc.
Underfloor raceway	A pathway placed within the floor and from which wires and cables emerge to a specific floor area.
Uninterruptible power supply	A buffer between utility power or other power source and a load that requires continuous precise power.
UPS	uninterruptible power supply
V	volt
Vac	volts alternating current
Vdc	volts direct current
Velocity of propagation	The speed of transmission along a cable relative to the speed of light in a vacuum.
Voice over IP (VoIP)	A term used in IP telephony for voice delivered using the Internet Protocol.

YABA	Yet Another Bloody Acronym
WEEE	Waste Electrical and Electronic Equipment Directive. A European Union directive that set collection, recycling and recovery targets for all types of electrical goods.
WiFi	WiFi is the trade name for the popular wireless technology used in home networks, mobile phones, video games and other electronic devices that require some form of wireless networking capability. In particular, it covers the various IEEE 802.11 technologies (including 802.11n, 802.11b, 802.11g, and 802.11a).
Wireless	The use of radiated electromagnetic energy (e.g., radio frequency and microwave signals, light) traveling through space to convey information.
Work area	A building space where the occupants interact with telecommunications terminal equipment.
Zone box	An enclosure used to house one or more of the following; a) a consolidation point, b) a horizontal connection point, c) building automation system outlets.

Appendix D.

Appendix E. Labeling a Patch Panel for Analog Gateway Wiring

Labeling a Patch Panel for Analog Gateway Wiring



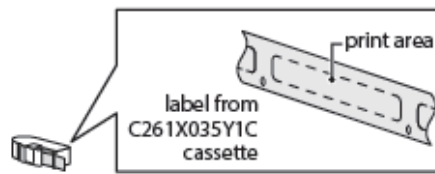
What You Will Need



LS8EQ Hand-Held
Thermal Transfer Printer

For more information, see the instructions that come with the printer.

Only black on white labels are allowed.



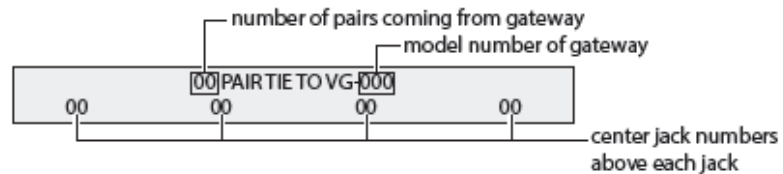
C261X035Y1C
label cassette



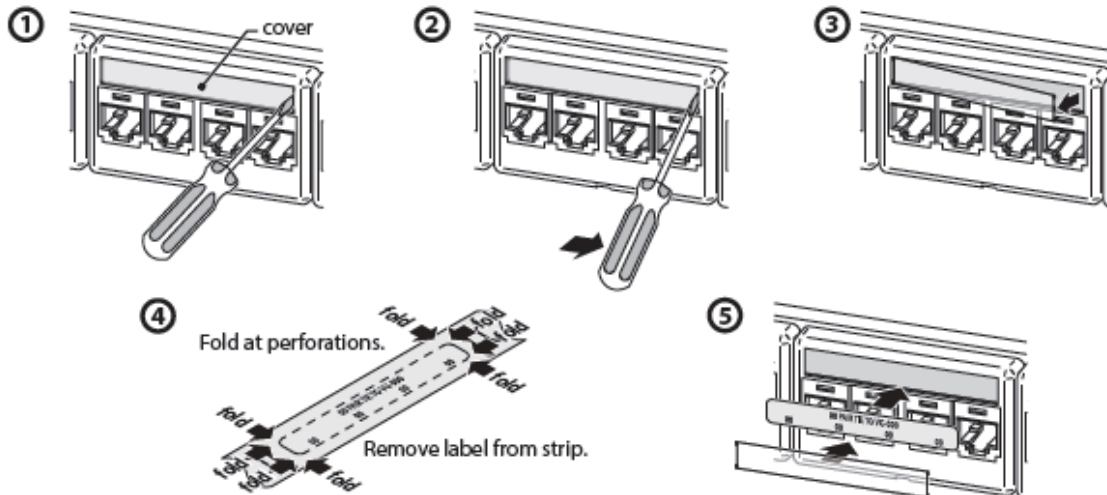
a small flathead
screwdriver

Making Labels

Use 10 pt. size text if the label information will fit. Otherwise, use 9 pt. or 8 pt., but no smaller.



Applying Labels



Revision 2014-03-19

Appendix F. Labeling a Copper Backbone Cable

Labeling a Copper Backbone Cable



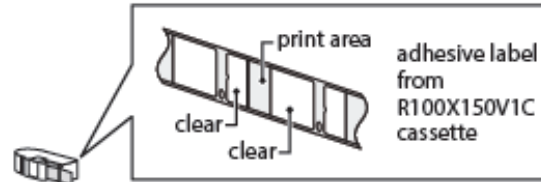
What You Will Need



LS8EQ Hand-Held
Thermal Transfer Printer

For more information, see the instructions that come with the printer.

Only black on white labels are allowed.



R100X150V1C
label cassette

Making Labels

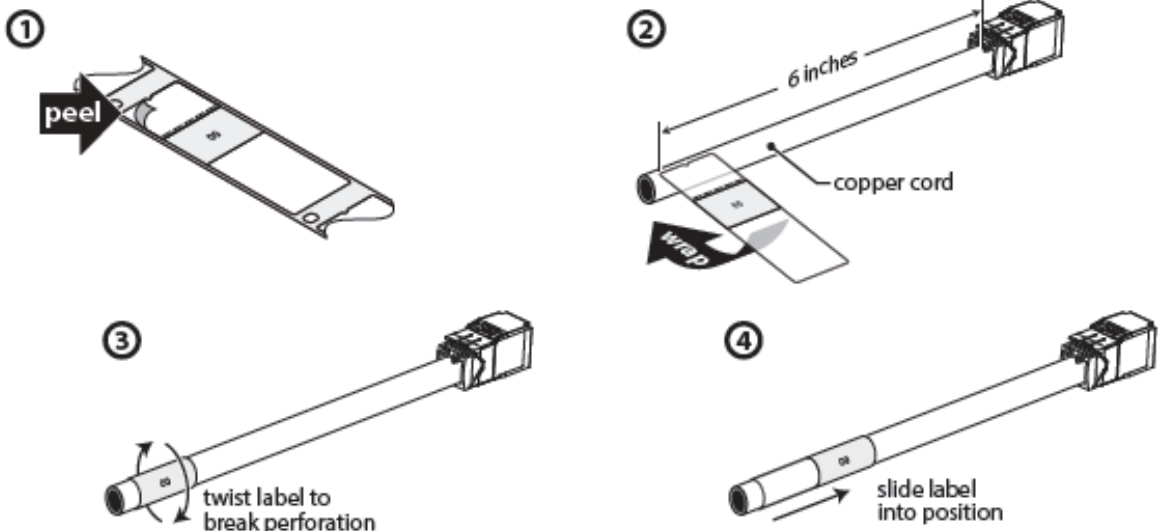
Use 10 pt. size text if the label information will fit. Otherwise, use 9 pt. or 8 pt., but no smaller.

Sequentially number each cable in the bundle.



Print a label for each end of the cable.

Applying Labels



Revision 2014-03-13

Appendix G. Labeling a Patch Panel for Copper Backbone Cabling

Labeling a Patch Panel for Copper Backbone Cabling

angled patch panels

CPPLA24WBL
24-port

CPPLA48WBL
48-port

flat patch panels

CPPL24WBL
24-port

CPPL48WBL
48-port

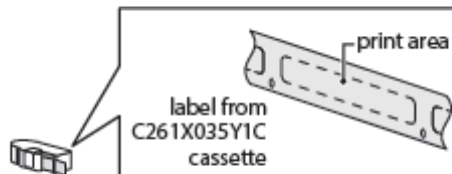
What You Will Need



LS8EQ Hand-Held
Thermal Transfer Printer

For more information, see the instructions that come with the printer.

Only black on white labels are allowed.



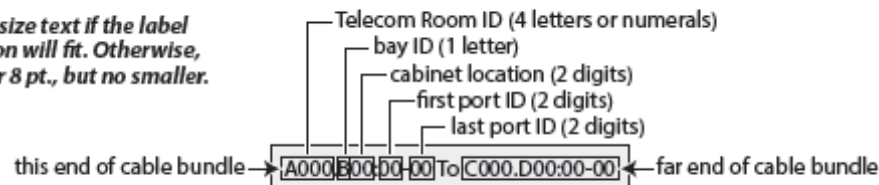
C261X035Y1C
label cassette



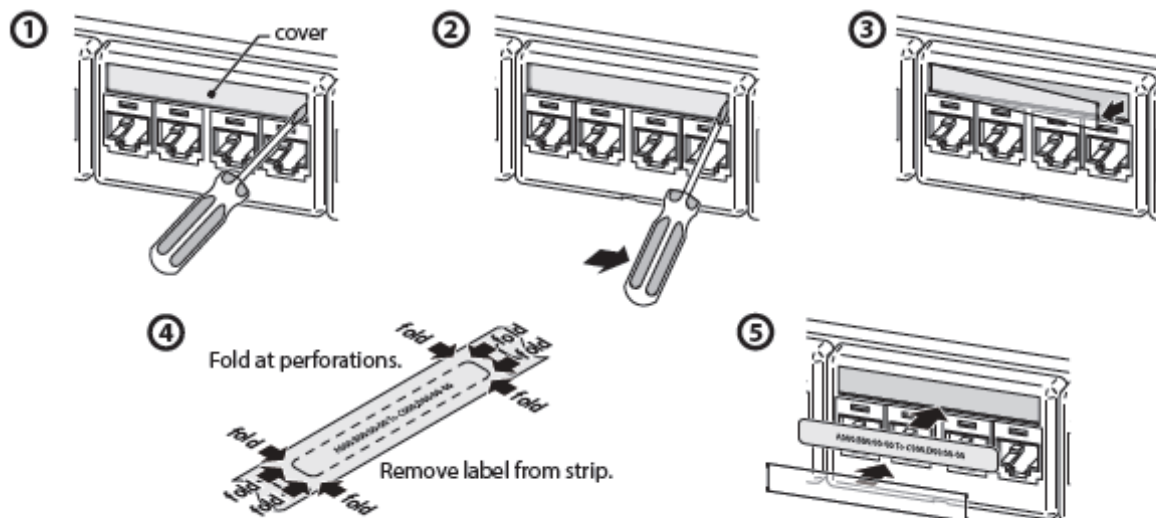
a small flathead
screwdriver

Making Labels

Use 10 pt. size text if the label information will fit. Otherwise, use 9 pt. or 8 pt., but no smaller.



Applying Labels



Revision 2014-07-29

Appendix H. Labeling a Horizontal Cable

Labeling a Horizontal Cable



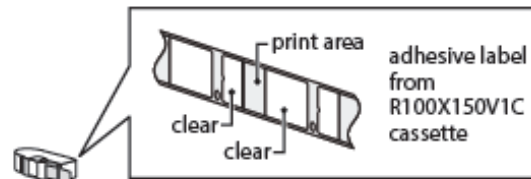
What You Will Need



LS8EQ Hand-Held
Thermal Transfer Printer

For more information, see the instructions that come with the printer.

Only black on white labels are allowed.

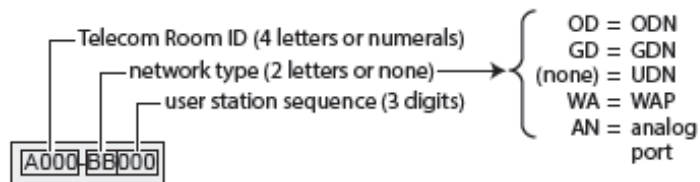


R100X150V1C
label cassette

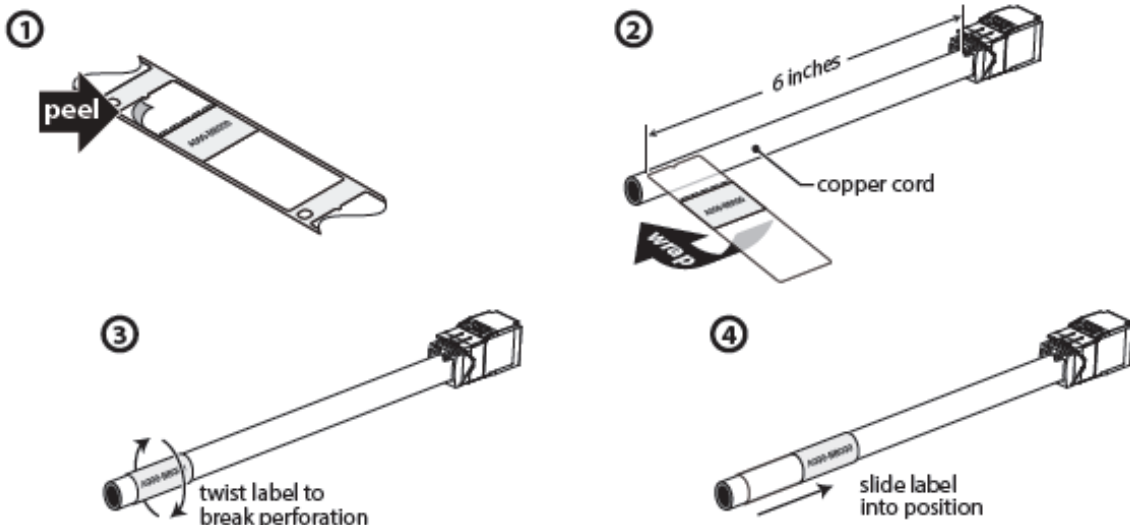
Making Labels

Use 10 pt. size text if the label information will fit. Otherwise, use 9 pt. or 8 pt., but no smaller.

Print a label for each end of the cable.



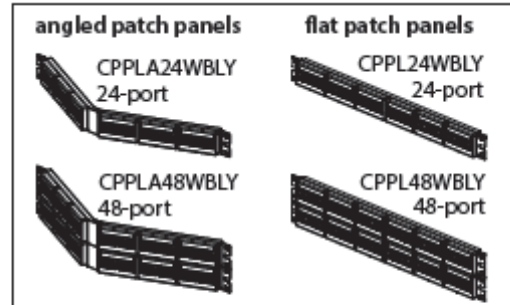
Applying Labels



Revision 2014-07-29

Appendix I. Labeling a Patch Panel for Horizontal Cabling

Labeling a Patch Panel for Horizontal Cabling



What You Will Need



LS8EQ Hand-Held
Thermal Transfer Printer

For more information, see the instructions that come with the printer.

Only black on white labels are allowed.



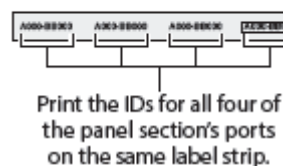
C261X035Y1C
label cassette



a small flathead
screwdriver

Making Labels

Use 10 pt. size text if the label information will fit. Otherwise, use 9 pt. or 8 pt., but no smaller.



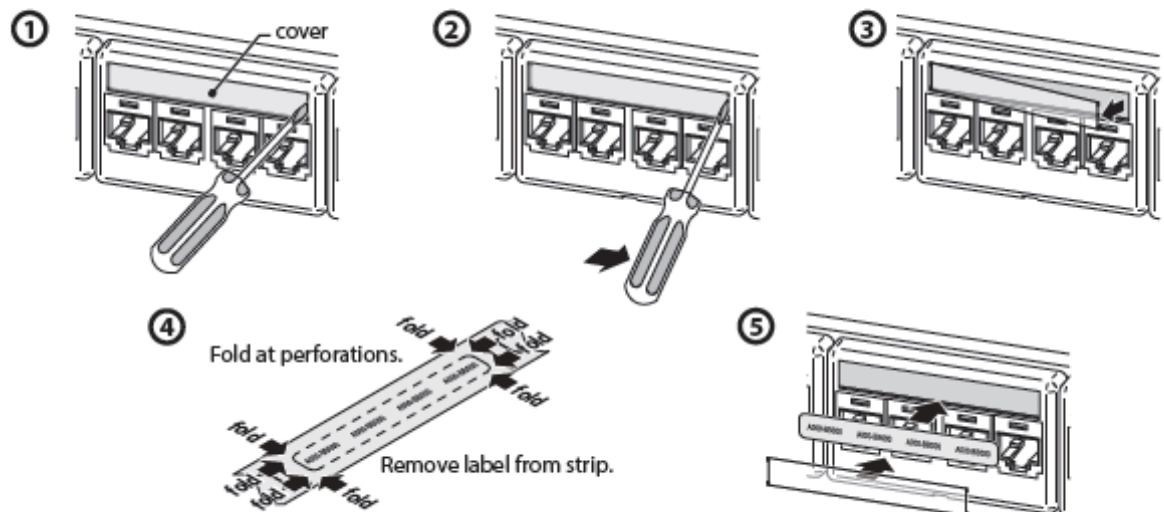
Telecom Room ID
(4 letters or numerals)

network type
(2 letters or none)

user station
sequence (3 digits)

OD = ODN
GD = GDN
(none) = UDN
WA = WAP
AN = analog
port

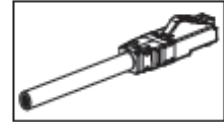
Applying Labels



Revision 2014-07-29

Appendix J. Labeling a Copper Patch Cord

Labeling a Copper Patch Cord



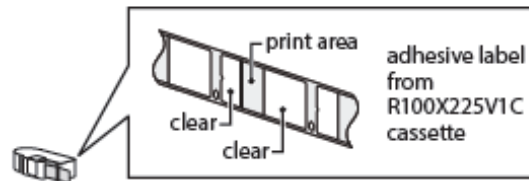
What You Will Need



LS8EQ Hand-Held Thermal Transfer Printer

For more information, see the instructions that come with the printer.

Only black on white labels are allowed.



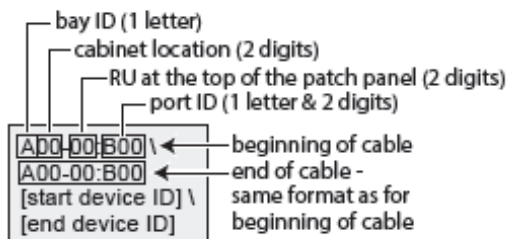
R100X225V1C label cassette

Making Labels

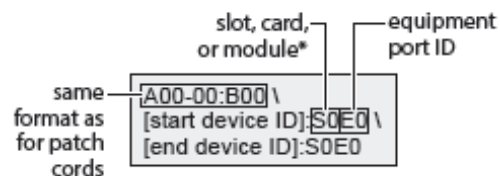
Print a label for each end of the cord.

Use 10 pt. size text if the label information will fit. Otherwise, use 9 pt. or 8 pt., but no smaller.

For a Patch Cord



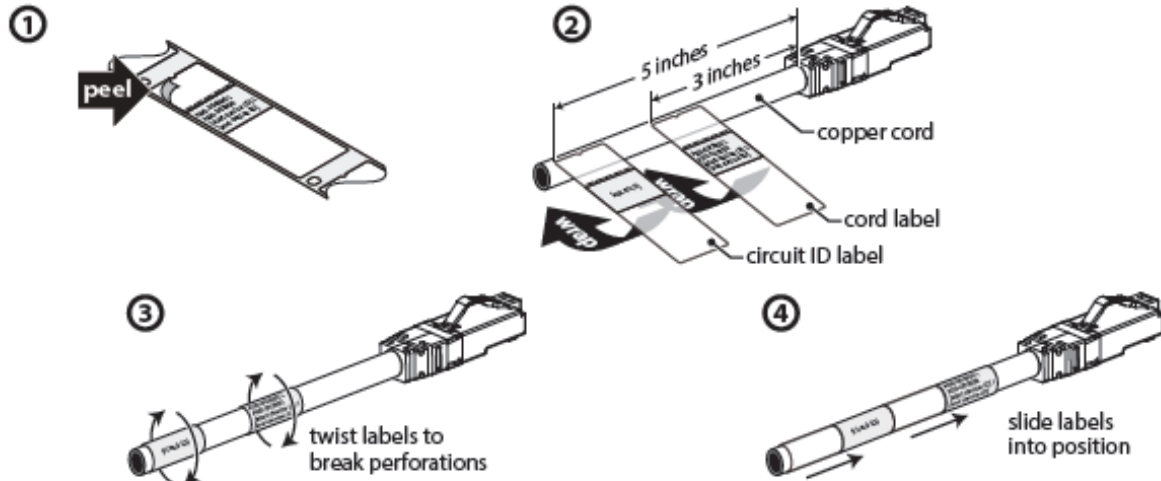
For an Equipment Cord



* Optional if not required to uniquely identify the port.

If there is a circuit ID, also print labels with the ID for each end of the cord.

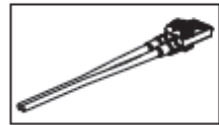
Applying Labels



Revision 2014-06-24

Appendix K. Labeling a Fiber Optic Patch Cord

Labeling a Fiber Optic Patch Cord



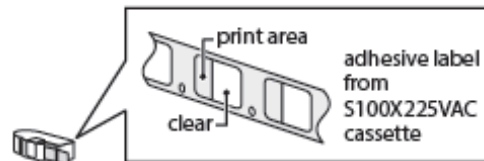
What You Will Need



LS8EQ Hand-Held Thermal Transfer Printer

For more information, see the instructions that come with the printer.

Only black on white labels are allowed.



S100X225VAC label cassette



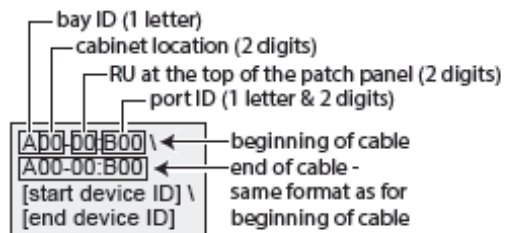
NWSLC-7 label cores

Making Labels

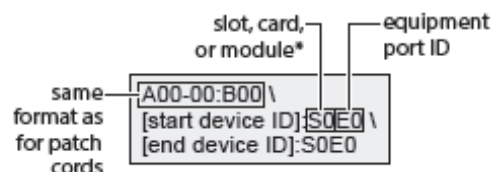
Print a label for each end of the cord.

Use 10 pt. size text if the label information will fit. Otherwise, use 9 pt. or 8 pt., but no smaller.

For a Patch Cord



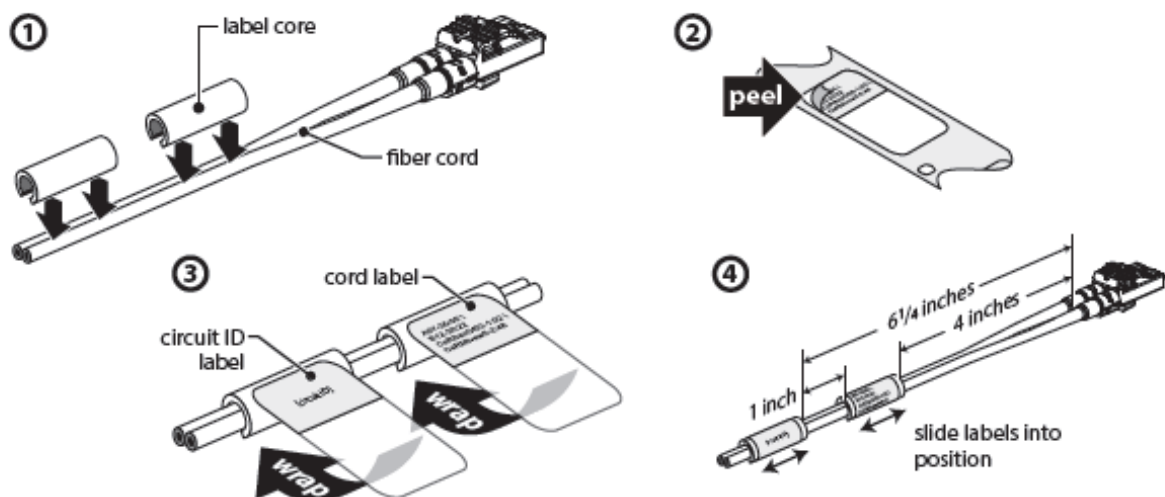
For an Equipment Cord



* Optional if not required to uniquely identify the port.

If there is a circuit ID, also print labels with the ID for each end of the cord.

Applying Labels

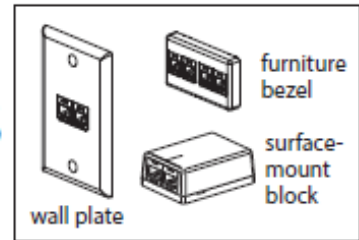


Revision 2014-06-24

Appendix L. Labeling a GDN, WAP or Analog Telecommunications Outlet

Labeling a GDN, WAP, or Analog Telecommunications Outlet

(See separate instructions for labeling ODN or UDN TOs.)



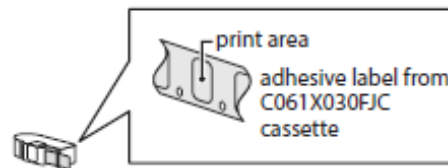
What You Will Need



LS8EQ Hand-Held Thermal Transfer Printer

For more information, see the instructions that come with the printer.

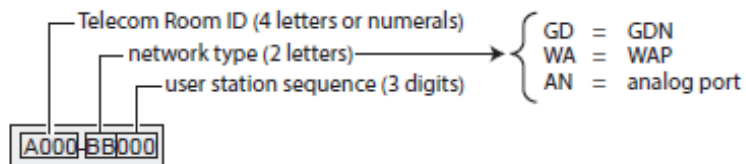
Only black on white labels are allowed.



C061X030FJC label cassette

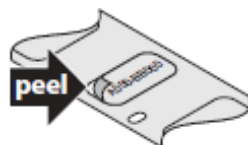
Making Labels

Use 8 pt. size text.



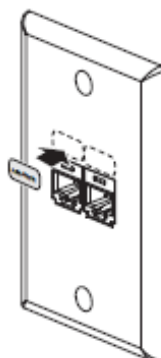
Applying Labels

①

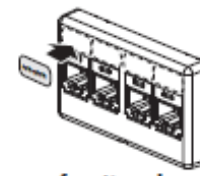


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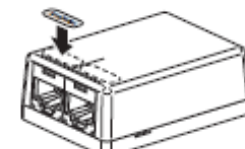
Apply the label above the appropriate jack.



on a wall plate



on a furniture bezel



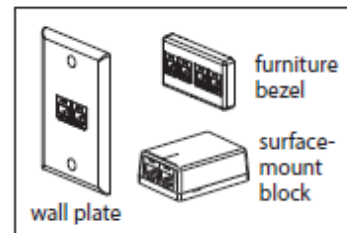
on a surface-mount block

Revision 2014-07-29

Appendix M. Labeling a UDN Telecommunications Outlet

Labeling a UDN Telecommunications Outlet

(See separate instructions for labeling ODN, GDN, WAP, or Analog TOs.)



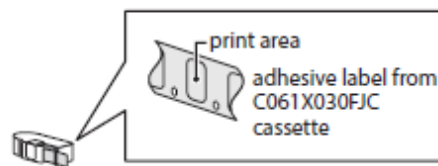
What You Will Need



LS8EQ Hand-Held Thermal Transfer Printer

For more information, see the instructions that come with the printer.

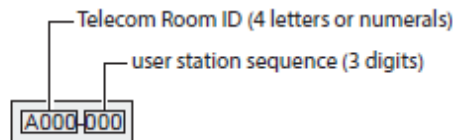
Only black on white labels are allowed.



C061X030FJC label cassette

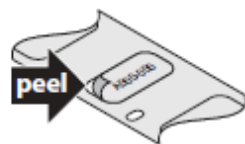
Making Labels

Use 10 pt. size text.



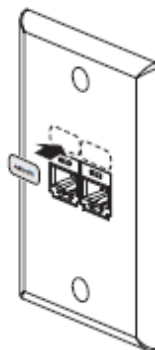
Applying Labels

①



②

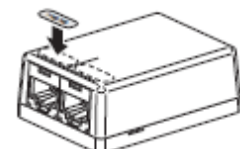
Apply the label above the appropriate jack.



on a wall plate



on a furniture bezel

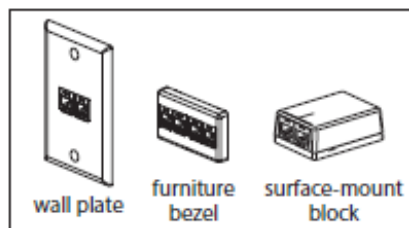


on a surface-mount block

Revision 2014-07-29

Labeling an ODN Telecommunications Outlet

(See separate instructions for labeling UDN, GDN, WAP, or Analog TOs.)



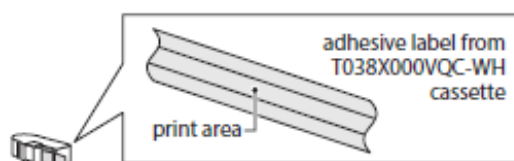
What You Will Need



LS8EQ Hand-Held Thermal Transfer Printer

For more information, see the instructions that come with the printer.

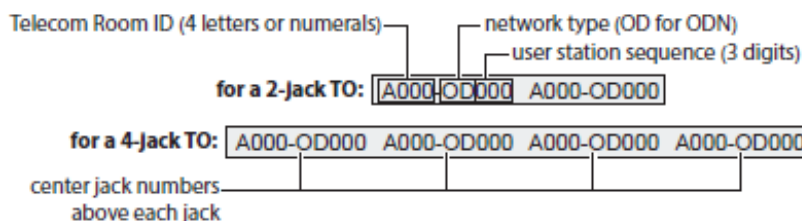
Only white on blue labels are allowed.



T038X000VQC-WH label cassette

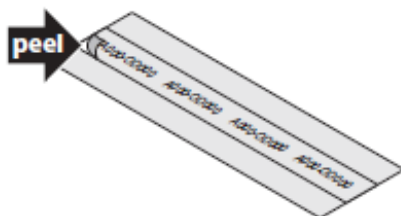
Making Labels

Use 8 pt. size text.



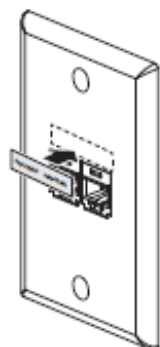
Applying Labels

①

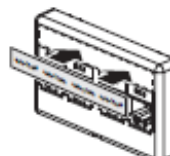


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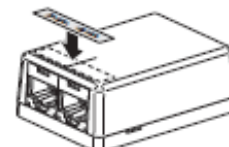
Apply the label above the appropriate jack.



on a wall plate



on a furniture bezel



on a surface-mount block

Revision 2014-07-29

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Furnish and install all materials and equipment including all required equipment, panels, raceways, conductors and connections. Provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 26 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for the extension of the existing addressable fire alarm system installation including all accessories and appurtenances required for testing the systems. It is in the intent of the drawings and specifications that all systems will be complete, and ready for operation. No extra charge will be paid for furnishing items required by regulations, but not specified herein, or on drawings.
- B. The contractor scope of work shall not degrade any function or operation of the remaining site fire alarm system.

1.2 RELATED WORK:

- A. Division 00 General Conditions, Division 01 General Requirements.
- B. See the following specification sections for work related to the work in this section.
 - 1. All other sections of Division 26.

1.3 CODES AND STANDARDS:

- A. Devices and equipment for fire alarm systems shall be U.L. listed.
- B. UL 864 Control Units, Fire Protective Signaling Systems.
- C. Devices and equipment for fire alarm system shall be listed by the California State Fire Marshal for the specific purpose the device or equipment is used.
- D. Work and material shall be in compliance with and according to the requirements of the latest version of the following standards and codes:
 - 1. California Fire Code (CFC) based on the International Fire Code (IFC) with California Amendments.

2. California Building Code (CBC) based on the International Building Code (IBC) with California Amendments.
3. California Electric Code (CEC) based on the National Electric Code (NEC) and California Amendments.
4. California Mechanical Code (CMC) based on the Uniform Mechanical Code (UMC) and California Amendments.
5. California Plumbing Code (CPC) based on the Uniform Plumbing Code (UPC) and California Amendments.
6. Title 19 C.C.R., Public Safety, State Fire Marshals Regulations.
7. NFPA 72, National Fire Alarm and Signaling Code.

1.4 SUBMITTALS:

- A. In accordance with Division 26.
- B. Submit the following items:
 1. Manufacturer's Catalog Data: Manufacturer's original catalog cuts and original description of data of all material and equipment with sufficient information provided so that the exact function of each device is known. Each item supplied shall be clearly identified including both U.L. number and a copy of the State Fire Marshal's listing.
- C. Description of conductors to be used with a statement that all wire shall be in conduit. Where accessible ceiling occurs, plenum rated wire on J-hooks are acceptable.

1.5 QUALITY ASSURANCE:

- A. Installer: The installation firm shall be an established communications and electronics contractor with at least 10 years successful installation experience of products utilizing integrated communications systems and equipment specific to that required for this project. The firm shall currently maintain and locally run and operated business. Only California Certified fire alarm technicians or California Certified electrician shall be used to install the fire alarm system. Provide proof to district that all employees are California Certified to install the fire alarm system.
- B. All materials, unless otherwise specified, shall be new, and free from any defects. All items of equipment including wire and cable shall be designed by the manufacturer unless otherwise specified, shall function as a complete system and shall be

accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

- C. The Contractor shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The contractor shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

1.6 WARRANTIES:

- A. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defect for one year (365 days) from the date of final acceptance. The contractor shall without additional expense to the owner, replace any defective materials or equipment provided by him under this contract within the warranty period.

PART 2 – PRODUCTS

2.1 FIRE ALARM CONTROL PANEL:

- A. The FACP is existing to remain.

2.2 DETECTION DEVICES:

A. Manual Pull Stations:

1. Provide non coded, addressable, semi-recessed, double-action type manual pull station with mechanical reset features. Where installed in existing buildings, boxes may be surface-mounted. Surface mounted boxes shall be the same color as the pull stations.
2. Provide separate screw terminal for each conductor connected to the manual alarm pull station. Break-glass-front pull stations will not be permitted. Provide red aluminum, housing labeled "fire". The pull stations shall not be resettable without the use of a key. [Provide Stopper II Guards for all manual stations in public areas].

B. Detectors:

1. Each photoelectric smoke detector and heat detector shall be interchangeable via twist-lock mounting base, to ensure matching the proper sensor to the potential hazards of the areas being protected. The system shall recognize when an improper sensor type has been installed in a previously programmed sensor type location.

C. Photoelectric Smoke Detector:

1. Provide white flame retardant plastic, addressable, analog, photoelectric type, smoke detectors. Detectors shall operate using an optical sensing chamber principal which complies with UL 268.
2. Each detector shall be capable of being set at two sensitivity settings.
3. Each detector shall have two LED visual indicators providing local 360 degree visibility of operating status and alarm indication.
4. Each detector shall be supported independently of wiring connections, and connected by separate screw terminals of each conductor.
5. The detector screen and cover assembly must be easily removable for field cleaning.

D. Combination Fixed Temperature, rate of Rise Heat Detectors:

1. Provide off-white flame retardant plastic, addressable, combination 140 degree F fixed temperature, rate of rise heat dual thermistor detectors. Detector shall initiate an alarm when temperature rises at a rate of over 15 degrees F per minute or above 140 degrees F.
2. Each detector shall have two LED visual indicators providing local 360 degree visibility of operating status and alarm indication.
3. Contacts shall be self-resetting after response to rate or rise principal. Locate detectors in accordance with UL FPD or FM P7825 listing and the requirements of NFPA 72. Temperature rating of detectors shall be in accordance with NFPA 72.

E. Addressable Monitor Module: provide addressable monitor module wired as style B (class "B") to provide an address for normally open contact devices.

1. Provide Addressable Monitor Module to monitor status of all Water flow Switches, Valve tamper Switches and Post Indicator Valves.

2.3 ALARM NOTIFICATION DEVICES:

- A. Color of notification appliances shall be red, unless otherwise noted by District.
- B. All alarm notification devices shall be synchronized throughout the school campus [building].

- C. Strobe Lights: Provide recessed mounted strobe light assembly suitable for use in electrically supervised circuit. Lamps shall be xenon flashtube type, powered from the fire alarm control panel alarm signaling circuit. Strobes shall provide candela ratings as indicated on the drawings and flash 60 times per minute unless otherwise noted. Strobes in toilets shall provide a minimum of 15 candelas. Lamps shall be protected by a clear polycarbonate lens. Housing shall be labeled "FIRE" in red vertical lettering.
- D. Horns/Strobes: Provide recessed mounted, grille face, vibrating diaphragm type, audio alarm devices consisting of an electro-mechanical horn suitable for use in an electrically supervised circuit. Horn/Strobes shall be provided with a red, tamper resistant grill. Horn shall have a minimum sound rating of 90 DBA at 10 feet and have field selectable sound levels. Horns shall be capable of providing a synchronized, field selectable, temporal code 3 tone. Horns shall have a separate minimum candela as shown on the drawings and flash 60 times per minute unless otherwise noted. Lamps shall be protected by a clear polycarbonate lens. Housing shall be labeled "FIRE" in red vertical lettering.
- E. Horns: Provide recessed mounted, grille face, vibrating diaphragm type, audio alarm devices consisting of an electro-mechanical horn suitable for use in an electrically supervised circuit. Horns shall be provided with a red, tamper resistant grill. Horn shall have a minimum sound rating of 90 DBA at 10 feet and have field selectable sound levels. Horns shall be capable of providing a synchronized, field selectable, temporal code 3 tone. Horns shall have a separate screw terminal for each conductor connection.
- F. Exterior Horns: Provide recessed mounted, grille face, vibrating diaphragm type, audio alarm devices consisting of an electro-mechanical horn suitable for use in an electrically supervised circuit. Horns shall be provided with a red, tamper resistant grill, and a weatherproof backbox. Horn shall have a minimum sound rating of 90 DBA at 10 feet and have field selectable sound levels. Horns shall be capable of providing a synchronized, field selectable, temporal code 3 tone. Horns shall have a separate screw terminal for each conductor connection. Horns located in areas subject to moisture or exterior atmospheric conditions, shall be approved for such locations.
- G. Field Charging Power Supply (FCPS):
1. The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
 2. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby. Upgrade batteries as shown on

drawings and include any necessary housing/mounting cabinet necessary for upsized batteries.

3. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
4. The FCPS shall include an attractive surface mount backbox.
5. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
6. The FCPS include power limited circuitry, per 1995 UL standards.

2.4 WIRING AND CONDUIT:

A. Provide wiring in accordance with NFPA 72.

B. Conductors shall be solid copper. Conductors for 120 volt circuits shall be No. 12 AWG minimum; conductors for low-voltage DC circuits shall be No. 14 AWG minimum for annunciation circuits and No. 14 AWG minimum for initiation circuits. All cables shall be rated and code compliant for their use.

1. All low voltage wiring not installed in conduits shall be plenum rated.
2. Provide color-coded conductors. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Each conductor used for the same specific function shall be distinctly color coded. Use different color codes for each interior circuit. Each circuit color code wire shall remain uniform throughout the circuit.
3. Pigtail or "T" tap connections to the evacuation alarm horns, horn/strobes and strobes are not acceptable.
4. Underground circuit or circuits in wet areas shall be gel filled cables in scheduled 40 PVC conduit. There shall be no splicing of any underground cables.

C. Conduits:

1. Identification of Conduit: New conduits containing fire alarm system conductors shall be [red], $\frac{3}{4}$ " minimum. Junction-boxes, covers, gutters, and terminal cabinets, containing fire alarm system conductors, shall be painted red or provided red in color with engraved plastic identification signs permanently attached to the equipment.

2. Do not run fire alarm circuits in the same conduit with the non-fire alarm circuits.
3. Do not run AC circuits in the same conduit with the fire alarm circuits.
4. Provide wiring in rigid metal conduit for exterior installations or where exposed to damage.
5. Conceal conduit in finished areas of new construction and wherever practical in existing construction. Conduit runs shall be straight, neatly arranged properly supported and parallel or perpendicular to walls and partitions. Identify conductors within each enclosure where a tap, splice, or termination is made.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with the NFPA publications and as modified herein.
- B. Follow manufacturer's directions in all cases for installation, testing and energizing.
- C. Accurately set, level, support, and fasten all equipment.
- D. Smoke and heat detectors:
 1. No detector shall be located closer than 12 inches to any part of any lighting fixture. Detectors, located in areas subject to moisture or exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be approved for such locations.
- E. Conduit where exposed shall be installed parallel with the walls or structural elements; vertical runs to be plumb; horizontal runs to be level or parallel with structure; conduit grouped neatly together with straight runs, all bends parallel and uniformly spaced.
- F. Earthquake Resistant installation/fastening of all electrical equipment shall conform to the general requirements of section 1614A of the California Building Code.

3.2 PRELIMINARY TESTS:

- A. Conduct the following tests during installation of wiring and system components. Correct deficiency pertaining to these requirements prior to formal functional and operational tests of the system, preliminary tests shall be performed in the presence of

the Local Fire Authority and Project inspector of Record to determine the conformance with the specified requirements.

- B. Ground Resistance: Measure the resistance of each connection to ground. Ground resistance shall not exceed 10 ohms.
- C. Dielectric Strength insulation Resistance: Test the dielectric strength and the Insulating resistance of the system interconnecting wiring by means of an instrument capable of generating 500 volts of DC and equipped to indicate leakage current 1000 megohms. For the purpose of this test, connect the instrument between each conductor on the line and between each conductor and ground at the control panel end of the line, with the other extremity open circuited and all series-connected devices in place. The system shall withstand the test without breakdown and shall indicate a resistance of not less than 1.0 minute with a DC potential of not less than 100 volts and not more than 500 volts.
- D. Standby Battery Test: prior to formal inspection and tests, place the fire alarm system on standby battery power for 24 hours; immediately thereafter, sound the building evacuation alarm signaling devices for 5 minutes. When the test is complete, the fire alarm system battery charger shall be fully recharged within 24 hours.
- E. Field Inspection and Test:
 - 1. Before final acceptance of the work, pre-test system to demonstrate compliance with the contract requirements. System shall be subjected to complete functional and operational tests, including tests in place of each detector. When tests have been completed and corrections made, submit a signed and dated NFPA Certificate of Completion along with a completed testing matrix with the request for formal inspection and tests.
 - 2. Where application of heat would destroy a heat detector, it may be manually activated.
 - 3. Verify the proper receipt of the alarm signals at the central station for the UDACT provide printout of test reports. It shall be the sole obligation of the contractor to coordinate and to provide all testing documentation from the central station.
 - 4. The communication loops and the indicating appliance circuits shall be opened in at least two locations per zone to check for the presence of correct supervisory circuitry.
 - 5. Perform the field inspection and test in the presence of the manufacturer's representative, the owner's representative, local Fire Authority and Project Inspector of Record (IOR).

6. Test equipment: It shall be the responsibility of the installing Contractor to furnish tools, instruments, and materials required for a thorough test of the system. This includes, but is not limited to, the following:
 - a. VOM meter
 - b. Manufacturer's recommended smoke detector testing device and sensitivity test equipment.
 - c. Heat source for testing heat detectors.
 - d. Keys to all control panels.
 - e. Ladders

3.3 PROJECT CLOSEOUT:

A. As Built Drawings:

1. Provide a complete set (full size scalable) of reproducible "as-built" and AutoCAD format drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment upon completion of system.

B. Operating and Instruction Manuals:

1. Operating and Instruction manuals shall be submitted prior to testing of the system. Four complete sets of operation and instructions manuals shall be delivered to the owner upon request.
2. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and troubleshooting manual explaining how to test the preliminary internal parts or each piece of equipment shall be delivered upon completion of the system.

C. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

1. Instructions on replacing any components of the system, including internal parts.
2. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions.

3. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
4. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

END OF SECTION 28 31 00

SECTION 32 17 13

WHEELSTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes
 1. Precast concrete wheelstops.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for precast concrete wheelstops.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE WHEELSTOPS

- A. Concrete Wheelstops: Precast, steel-reinforced, air-entrained concrete, 4000 psi minimum compressive strength. Provide chamfered corners and drainage slots at underside, with a minimum of two factory-formed or –drilled vertical holes through wheelstop for anchoring to substrate.
 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. Oldcastle Precast.; #36755WS.
 - b. Equal product in accordance with Division 1 requirements for product substitutions.
 2. Dimensions: 3 feet long by 7-1/2 inches wide by 5 inches high, with beveled top edges.
 3. Cross-Sectional Profile: Half octagonal.
 4. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other defects. Corners shall be uniform, straight, and sharp.
 5. Epoxy setting adhesive: As recommended by manufacturer of wheelstops.
 6. Setting Dowels: Galvanized steel, 1/2 inch diameter, 15 inch minimum length.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for proper installation and conditions affecting performance of the Work.
- B. Verify that paving surfaces are dry and fully cured.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Securely anchor wheel stops to pavement in accordance with written instructions of manufacturer.
 - 1. Install wheelstops in full bed of epoxy adhesive before anchoring.
 - 2. Securely anchor wheelstops to pavement with setting dowels in each preformed vertical hole in wheelstop. Recess head of hardware beneath top of wheelstop.

END OF SECTION 32 17 13

SECTION 32 17 26

TACTILE WARNING SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Tactile warning surface panels with truncated domes for horizontal pedestrian traffic areas.
 - a. Surface-applied.

1.3 REFERENCES

- A. ASTM International (American Society for Testing and Materials):
 - 1. ASTM B 117: Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 2. ASTM C 501: Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
 - 3. ASTM C 1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 - 4. ASTM D 570: Standard Test Method for Water Absorption of Plastics.
 - 5. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.
 - 6. ASTM D 695: Standard Test Method Compressive Properties of Rigid Plastics.
 - 7. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 8. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 9. ASTM G 26: Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
 - 10. ASTM G 155: Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
- B. California Building Code (CBC) - California Code of Regulations, Title 24, Part 2.
- C. Federal Standard 595B: Colors.

- D. United States Department of Justice:
 - 1. 2010 ADA Standards for Accessible Design.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Shop Drawings: Show layout and placement of tactile warning surface panel joints and fasteners.
- C. Samples for Verification: 6 inch by 6 inch sample, for each color and type of tactile warning surface.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For tactile warning surfaces to include in maintenance manuals. Include manufacturer's written cleaning instructions.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing tactile warning surfaces and with a record of successful in-service performance.
- B. Installer Qualifications: A qualified installer who employs workers for this Project that are trained and approved by manufacturer.
- C. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by testing and inspecting agency acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for delivery, storage, and handling of tactile warning surface panels.
- B. Store panels on flat surfaces.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when substrate temperature and ambient temperature, and existing and forecasted weather conditions permit installation of tactile warning surfaces to be performed according to manufacturer's written instructions and warranty requirements.
- B. Close area to traffic for 48 hours after tactile warning surface installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with requirements for tactile warning surfaces as per the following:
 - 1. California Building Code (Title 24, Part 2) Chapter 11B.
 - 2. United States Department of Justice's 2010 ADA Standards for Accessible Design.

2.2 TACTILE WARNING SURFACES - GENERAL

- A. General: Manufacturer's detectable warning system consisting of prefabricated panels with raised truncated dome pattern and non-slip surface field area to provide warning and directional assistance to visually impaired pedestrians.
- B. Truncated Dome Profile Dimensions:
 - 1. Base Diameter: 0.9 inch.
 - 2. Diameter at Top of Truncated Dome: 0.45 inch.
 - 3. Dome Height: 0.2 inch.
 - 4. Dome Pattern: In-line square pattern.
 - a. Dome Spacing: 1.67 inches minimum, 2.35 inches maximum, center to center, both ways.

2.3 TACTILE WARNING SURFACES - SURFACE-APPLIED PANELS

- A. General: Manufacturer's prefabricated polymer or glass and carbon-reinforced composite panels with raised truncated dome pattern; designed for installation over hardened concrete surface; homogeneous color and pattern throughout thickness of material; waterproof and nonabsorbent; ultraviolet light-stable; approved by Division of the State Architect (DSA).
 - 1. Manufacturers: Subject to compliance with requirements, provide surface-applied tactile warning panels by one of the following:
 - a. ADA Solutions, Inc.
 - b. Engineering Plastics, Inc.; Armor-Tile.
 - c. Manufacturer of equal product in accordance with Division 1 requirements for product substitutions.
- B. Panel Dimensions: 24 inches by 36 inches, 24 inches by 48 inches, 24 inches by 60 inches, 36 inches by 48 inches, and 36 inches by 60 inches, as indicated on Drawings.
- C. Panel Thickness: 1/8 inch minimum.
- D. Color: Yellow - Federal Standard No. 595C, Color No. 33538.

- E. Physical Properties:
 - 1. Slip Resistance: Not less than 0.80 static coefficient of friction for wet surfaces, per ASTM C 1028.
 - 2. Water Absorption: 0.13 percent maximum, per ASTM D 570.
 - 3. Compressive Strength: Not less than 23, 800 psi, per ASTM D 695.
 - 4. Tensile Strength: Not less than 12,100 psi, per ASTM D 638.
 - 5. Flexural Strength: Not less than 24, 600 psi, per ASTM D 790.
 - 6. Wear Resistance: Not less than 500, per ASTM C 501.
 - 7. Flame Spread: 15 or less, per ASTM E 84.
 - 8. Weathering: No change or deterioration at 3,000 hours of exposure, per ASTM G 26 or ASTM G 155.
 - 9. Salt and Spray Performance: No deterioration or other effects after 120 hours of exposure, per ASTM B 117.
- F. Accessories: As provided by manufacturer of tactile warning surface panels.
 - 1. Adhesive: As recommended by tactile warning surface manufacturer.
 - a. VOC Content: Provide adhesive that complies with local regulatory limits for VOC content when calculated according to 40 CFR, Part 59, Subpart D (EPA Method 24).
 - 2. Fasteners: Manufacturer's standard non-corrosive low-profile-head expansion anchors.
 - 3. Joint and Edge Sealant: As recommended by manufacturer for sealing joints between tactile warning surface panels and at exposed edges of panels.
 - a. VOC Content: Provide sealant that complies with local regulatory limits for VOC content when calculated according to 40 CFR, Part 59, Subpart D (EPA Method 24).

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.
- B. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of tactile warning surface panels.
- B. At areas to receive surface-applied tactile warning panels, verify that substrates are dry and free of curing compounds, sealers, loose material, dust, oils, grease, and other foreign materials that might impair adhesive bond.

- C. Prior to installation, clean backside of surface-applied tactile warning surface panels in accordance with manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

- A. General: Install tactile warning surface in accordance with manufacturer's written instructions.
- B. Lay out tactile warning surface panels in sizes and configurations as shown on Drawings.
- C. If not indicated otherwise, lay out panels from center marks established at end points, so panels at opposite ends of run are of equal width. Adjust as necessary to avoid using cut widths equal to less than one-half of a panel width at ends.
- D. Maintain correct orientation of each panel, so as to maintain correct alignment of truncated domes from panel to panel.
- E. Set panels true and square to adjacent curbs, ramps, and paving edges.
- F. Install adjacent panels in accordance with manufacturer's written instructions to maintain correct spacing and alignment of truncated domes from panel to panel.
- G. Where cut widths are necessary, cut and fit panels along a clean, straight line.
- H. Where occurring adjacent to vertical surfaces, scribe, cut, and fit panels to butt neatly and cleanly to base of vertical surface.

3.4 INSTALLATION - SURFACE-APPLIED TACTILE WARNING SURFACE PANELS

- A. Adhere surface-applied panels 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, and other surface imperfections.
- B. After panels have been set, install drilled fasteners at manufacturer's specified locations, working in a sequence to prevent buckles in the panels.
- C. Remove all concrete dust generated by drilling for fasteners.
- D. Seal joints between panels and at exposed edges of panels in accordance with manufacturer's written instructions.

3.5 PROTECTION

- A. Do not allow traffic on tactile warning panels until the following conditions have been met:
 - 1. Surface-Applied Panels: Sufficient time has been allowed for adhesive to set as per written instructions of manufacturer.
 - 2. Cast-in-Place Panels: Underlying concrete has fully cured.

- B. Once conditions have been met for allowing traffic over tactile warning panels, do not move heavy or sharp objects directly over surfaces. Place plywood or hardboard sheets over tactile warning surfaces and under objects while objects are being moved. Slide or roll objects over protective sheets without moving sheets.

3.6 CLEANING

- A. Remove adhesive and other surface blemishes using cleaner recommended by tactile surface manufacturer.
- B. Clean tactile warning surfaces in accordance with manufacturer's written instructions.

END OF SECTION 32 17 26