

1 PART 1 GENERAL**2 DESCRIPTION**

3 The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the
4 HVAC work specified in this Division.

5
6 The requirements of this Section apply to the HVAC systems specified in these Specifications and in other
7 Division 23 sections.

8
9 Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or
10 scheduled on the Drawings and/or in these Specifications, including all labor, supervision, services, permits,
11 fees, and incidentals necessary and required to provide a complete and operable facility with complete
12 systems as shown, specified, and required by applicable codes.

13
14 The work shall include, but not be limited to, the following systems:
15 Fuel supply system.
16 Complete piping systems including insulation, valves, supports, etc.
17 Air handling equipment including packaged equipment and exhaust fans.
18 Air distribution systems including ductwork, terminal units, dampers, insulation, and air inlets and
19 outlets.
20 HVAC control system.
21 Assist Commissioning Agent as required by Commissioning specification.

22
23 Advise subcontractor, suppliers, and vendors involved in the work specified in this Section of the applicable
24 requirements.

25
26 **QUALITY ASSURANCE**
27 All work and materials shall conform to all applicable local and state codes and all federal, state and other
28 applicable laws and regulations. All clarifications and modifications which have been cleared with appropriate
29 authorities are listed under the applicable sections. All electrical products shall bear the label of a recognized
30 testing laboratory such as UL or CSA.

31
32 Whenever the requirements of the Specifications or Drawings exceed those of the applicable code or
33 standard, the requirements of the Specifications and Drawings shall govern.

34
35 Codes and Standards: Comply with the provisions of the following referenced codes, standards and
36 specifications:

37 Federal Specifications (FS)
38 American National Standards Institute (ANSI)
39 National Electrical Manufacturer's Association (NEMA)
40 National Fire Protection Association (NFPA)
41 Underwriters Laboratories, Inc. (UL)
42 Factory Mutual (FM)
43 International Building Code (IBC) with State and Local Amendments
44 International Mechanical Code (IMC) with State and Local Amendments
45 Uniform Plumbing Code (UPC) with State and Local Amendments
46 American Society for Testing and Materials (ASTM)
47 Americans with Disabilities Act (ADA)
48 International Fire Code (IFC) with State and Local Amendments
49 Energy Policy Act (EPAct)
50 Manufacturers Standardization Society (MSS)
51 American Gas Association (AGA)

52

1 Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications
2 and shall be suitable for the installation shown. Equipment not meeting all requirements will not be
3 acceptable, even though specified by name. Where two or more units of the same class of equipment are
4 furnished, use product of the same manufacturer; component parts of the entire system need not be products
5 of same manufacturer. Furnish all materials and equipment, new and free from defect and of size, make, type
6 and quality herein specified or approved by the Architect. All materials shall be installed in a neat and
7 professional manner.

8
9 All apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was
10 designed.

11
12 The Drawings and Specifications are complementary. What is called for by one shall be as though called for
13 by both.

14
15 Drawings: Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field
16 measurements and prepare shop drawings. Coordinate work with shop drawings of other specification
17 divisions. See Part 3 for more information and requirements.

18
19 Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to
20 all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit
21 ampacity and number of connections provided. Provide all necessary field wiring and devices from the point
22 of connection indicated on the electrical drawings. All equipment shall be installed in compliance with the
23 Electrical Code and the equipment's UL listing. Bring to the attention of the Architect in writing, all conflicts,
24 incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

25 26 WORK OF OTHER CONTRACTS

27 Work under this contract shall be conducted in a manner to allow for the future installations of such equipment
28 or items listed in other sections of this Specification.

29 30 WORK OF OTHER DIVISIONS

31 Work under this Division shall be conducted in a manner to cooperate with the installation of such equipment
32 or items as specified in other Divisions.

33
34 Plumbing piping systems and fixtures and fire suppression piping systems are specified under other Divisions
35 of these Specifications except for provisions or items specifically noted on the Drawings or specified herein.

36
37 Consult all Drawings and Specifications in this project and become familiar with all equipment to be installed.
38 Coordinate all aspects of the construction with the other trades on the job to ensure that all work and
39 materials required to provide a complete and operational facility are included in the bid.

40
41 All sections of Division 23 are interrelated and shall be considered in their entirety when interpreting any
42 material, method, or direction listed in any section of Division 23. Individual sections are not written for
43 specific subcontractors or suppliers but for the General Contractor.

44 45 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES (SUBMITTALS)

46 Submit in accordance with Division 1 full technical and descriptive shop drawing data on proposed materials
47 and equipment as detailed in each section.

48
49 The Contractor shall verify that all equipment submitted can be delivered and installed within the time
50 constraints of the construction period.

51
52 Include the manufacturer, type, style, catalog number, complete specification, certified dimensions, and
53 description of physical appearance for each item and option submitted. Reproduction of catalog data sheets
54 shall be clean and legible to show all details, including gauge of metal used.

55
56 Include only information on exact equipment to be installed, not general catalogs of the manufacturer. Where
57 sheets show proposed equipment as well as other equipment, identify proposed equipment with rubber stamp
58 arrow or similar concise method.

1 Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully
2 considered for quality, dimensions, function, and have been coordinated with the Drawings and
3 Specifications. Guarantee that proposed materials will meet or exceed the quality and function of those
4 specified.

5
6 Include field wiring diagrams and connection diagrams for all control and/or low voltage systems, including
7 floor plans.

8
9 Submittal Review: The submittal review process is a means to provide quality control. The action noted to be
10 taken (or where conflicts with the contract documents are not noted) shall not be interpreted by the Contractor
11 as automatic "change orders." Approval of the data for substitution and shop Drawings shall not eliminate the
12 Contractor's responsibility for compliance with Drawings or Specifications, nor shall it eliminate the
13 responsibility for freedom from errors of any sort in the data discovered prior to or after the review process.
14 Deviations, discrepancies, and conflicts between the submittals and the Contract Documents shall be called
15 to the Architect's attention in writing at the time of transmittal of the data.

16
17 Submittals shall be in the form of PDF documents. Arrange submittals numerically with specification sections
18 identified in tabs. All required sections shall be submitted at one time. **Partial submittals will be rejected**
19 **without review.**

20
21 For adhesives and sealants used on the interior of the building (inside the waterproofing system), include
22 printed statement of volatile organic compound (VOC) content.

23 24 PRODUCT SUBSTITUTION

25 Materials other than those specified may be approved for this project providing a written request is submitted
26 to the Architect prior to bid in accordance with Instructions to Bidders. Requests shall include complete
27 specifications, dimensions, manufacturer and catalog number for each item for which approval is desired. If,
28 in the opinion of the Architect, the material is not complete or if it is not an acceptable substitute, he may
29 reject it. The Architect's evaluation will be based solely on the material submitted.

30 31 CHANGE ORDERS

32 All supplemental cost proposals by the Contractor shall be accompanied by a complete itemized breakdown
33 of labor and materials without exception. At the Architect's request, the Contractor's estimating sheets for the
34 supplemental cost proposals shall be made available to the Architect. Labor must be separated and allocated
35 for each item of work.

36 37 RECORD DOCUMENTS

38 Project Record (As-Installed) Drawings:

39 Maintain a set of record Drawings on the job site as directed in Division 1.

40 Keep Drawings clean, undamaged, and up to date.

41 Record and accurately indicate the following:

42 Depths, sizes, and locations of all buried and concealed piping dimensioned from permanent
43 building features.

44 Locations of all valves with assigned tag numbers.

45 Locations of all fire dampers and other airflow control devices.

46 Changes, additions, and revisions due to change orders, obstructions, etc. Eradicate
47 extraneous information.

48 Model numbers of installed equipment.

49 Make Drawings available when requested by Architect for review.

50 Submit as part of the required Project Closeout documents. Final submittal will be in the form of
51 reproducible drawings.

52 Quality of entire set of project record drawings to match the quality of the contract documents; quality
53 to be judged by Architect. Computer-aided design drafting (CADD) shall be used to complete project
54 record drawings. Use standards set in contract documents. Note field modifications, all addenda,
55 and change order items on project record drawings. If deficiencies are found in either the quality or
56 the accuracy of the drawings, they will be returned unapproved. Additional review of subsequent
57 submissions shall be at the Contractor's expense.
58

1 Operating and Maintenance Manuals: Submit Operating and Maintenance Instructions, including
2 manufacturer's service data, wiring diagrams, and parts lists and vendors for all serviceable items of
3 equipment, valve charts, balancing data, final control diagrams showing final set points, duct and piping
4 pressure test reports, equipment startup records, and any additional equipment added by change order.
5 Provide any performance curves, data, and model numbers from submittals. Comply with provisions of
6 Division one where applicable to the mechanical work. Submittal shall be in the form of a PDF file per
7 specification section. Arrange submittals numerically with equipment type or classification identified in tabs.
8 Manufactures O&M manuals shall be provided as a single PDF file that can be hyper-linked by Owner for
9 reference. O&M manuals that are a series of PDF files will not be accepted.

10 WARRANTY

11 Furnish, prior to application for final payment, three copies of written and signed guarantee effective a period
12 of one year from date of completion and acceptance of entire project; agree to correct, repair and/or replace
13 defective materials and/or equipment or the results of defective workmanship without additional expense to
14 the Owner. Where no response satisfactory to the Owner has occurred within three working days from the
15 written report of a warranty covered defect, the Contractor shall agree to pay for the cost of repair of the
16 reported defect by a Contractor of the Owner's choice.

17
18
19 Where the manufacturer's guarantee exceeds one year, the longer guarantee shall govern and include the
20 Contractor's labor.

21 PART 2 PRODUCTS

22 GENERAL

23 General: Provide all new materials and equipment, identical to apparatus or equipment in successful
24 operation for a minimum of two years. Provide materials of comparable quality omitted here but necessary to
25 complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved
26 in each case.

27
28 Compatibility: Provide products which are compatible with other portions of the work and provide products
29 with the proper or correct power and fuel-burning characteristics, and similar adaptations for the project.

30
31 Efficiency: Heating and cooling equipment shall comply with ASHRAE Standard 90.1-2010 and the State
32 Energy Code. Where equipment efficiencies are indicated, the use of alternate or substitute manufacturer's
33 equipment with lower efficiencies is not permitted.

34 Storage and Handling:

35 Delivery: Deliver to project site with manufacturer's labels intact and legible.

36 Handling: Avoid damage.

37 Storage: Inside protected from weather, dirt and construction dust. Where necessary to store
38 outside, elevate well above grade and enclose with durable, waterproof wrapping.

39 ACCESS PANELS

40
41 Manufacturers: Inryco/Milcor, Bilco, Elmdor, Karp, Potter-Roemer or accepted substitute. Inryco/Milcor Style
42 DW, K, or M panels as required by construction.

43
44
45 Construction: Flush style, fire rated in fire rated partitions and ceilings. Provide flush key cylinder locks on all
46 access panels less than 8' above the floor in public spaces. Turn keys over to Owner at project completion.
47 Screwdriver latches on all others.

48 METERS AND GAUGES

49 General: Install meters and gauges where shown on the plans or specified elsewhere in these specifications.

50 Pressure-Temperature Test Plugs:

51
52
53 $\frac{1}{4}$ " or $\frac{1}{2}$ " NPT fitting of solid brass capable of receiving either an $\frac{1}{8}$ " OD pressure or temperature
54 probe and rated for zero leakage from vacuum to 1000 psig. Neoprene valve core for temperatures to
55 200 deg. F., Nordel to 350 deg. F.

56 Provide for each test plug a pressure gauge adapter with $\frac{1}{16}$ " or $\frac{1}{8}$ " OD pressure probe.

1 Furnish a test kit containing one 2-1/2" dial pressure test gauge of suitable range, one gauge adapter
2 with 1/16" or 1/8" OD probe and two 5" stem pocket test thermometers – one 0 to 220 degrees F and
3 one 50 to 550 degrees F. Turn the kit over to the Architect.
4 Cisco "P/T Plugs," Peterson "Pete's Plug" or approved substitute.
5

6 VALVES

7 General: Provide factory fabricated valves of the type, body material, temperature and pressure class, and
8 service indicated. Bronze gate, globe and check valves shall comply with MSS-SP-80. Ball valves shall
9 comply with MSS-SP-110. Iron gate and globe valves shall comply with MSS-SP-70. Iron check valves shall
10 comply with MSS-SP-71. Butterfly valves shall comply with MSS-SP-67. Valve size same as connecting pipe
11 size.
12

13 Acceptable Manufacturers: Milwaukee, Crane, Grinnell, Nibco, Hammond, Stockham, Legend, Watts, and
14 Walworth. Grooved end valves Victaulic, Gruvlock, or accepted substitute. NIBCO numbers are given except
15 as noted. Where possible, provide valves from a single manufacturer.
16

17 Valve Styles: See individual Division 23 sections for valve styles.
18

19 Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper
20 manner to receive insulation.
21

22 Selection of Valve Ends (Pipe Connections): Select and install valves with ends matching the types of
23 pipe/tube connections.
24

25 HANGERS AND SUPPORTS

26 General: Provide factory-fabricated horizontal piping hangers, clamps, hanger rod, inserts, supports, etc., of
27 the indicated MSS type and size. The Manufacturers Standardization Society (MSS) of the Valve and Fittings
28 Industry Practice SP-58 and SP-69 are referenced in this section.
29

30 Manufacturers: B-Line, Carpenter & Paterson, Grinnell, Michigan, Superstrut, Tolco, Erico, or accepted
31 substitute. Grinnell figure numbers in parentheses where applicable (or other manufacturers as noted).
32

33 Corrosion Protection: Provide materials which are zinc plated or factory painted to prevent corrosion.
34 Prevent electrolysis in the support of copper tubing by the use of hangers and supports which are copper
35 plated, plastic coated, or by other recognized industry methods.
36

37 Seismic Requirements: Provide seismic restraints in accordance with OSSC Section 1613. Design restraint
38 systems in accordance with "Seismic Restraint Manual: Guidelines for Mechanical Systems," Second Edition,
39 1998, SMACNA, or "A Practical Guide to Seismic Restraint" ASHRAE RP-812, 1999.
40

41 Horizontal Piping Hangers and Supports:

42 Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).

43 Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.

44 Adjustable Swivel-Band Hanger: MSS Type 10 (Fig. 70).

45 Clamp: MSS Type 4 (Fig. 212, 216).

46 Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.

47 Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle,
48 pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-
49 steel plate.

50 Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or
51 double channel as indicated on the Drawings or as required by piping and equipment weights.

52 Grinnell "Power Strut" channel. Acceptable Manufacturers: Super Strut, Globestrut, Bee, Kindorf or
53 Unistrut.
54

55 Vertical Pipe Clamps:

56 Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).

57 Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.
58

59 Hanger Attachment:

- 1 Hanger Rod: Rolled threads, zinc plated. Right hand threaded.
2 Turnbuckles: MSS Type 13 (Fig. 230).
3 Weldless Eye-Nut: MSS Type 17 (Fig. 290).
4 Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
5 Clevises: MSS Type 14 (Fig. 299).
6

7 Building Attachments:

- 8 Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel.
9 Acceptable Manufacturers: Michigan Hanger, Globestrut, Unistrut, Super Strut.
10 Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87, 88),
11 Type 25 (Fig. 227), Type 27 through 30 where applicable.
12

13 IDENTIFICATION MARKERS

14 Pipe Markers:

- 15 Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
16 Acceptable Manufacturers: Brady B946 with arrow banding tape or similar Seaton, Zeston, MSI.
17

18 Duct Markers:

- 19 Adhesive duct markers 2¼"x14" with black text indicating contents on white background with
20 directional flow arrow.
21 Acceptable Manufacturers: Brady B946 or similar Seaton, Zeston, MSI.
22

23 Nameplates:

- 24 Engraved nameplates, 1/16" thick, laminated 2-ply plastic, bottom ply white, outer ply black, letters
25 formed by exposing bottom ply.
26 Size: 2" by 4" nameplates with 1/4" high letters.
27

28 Valve Tags:

- 29 2" diameter, 18-gauge polished brass tags with 3/16" chain hole and 1/4" high stamped, black-filled
30 service designation.
31 Acceptable Manufacturers: Seaton, Brady, MSI.
32

- 33 Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number,
34 size, location, concealed or exposed, function, valve manufacture and model number, and normal position.
35 Provide floor plan as part of record Drawings. Use no duplicate numbers in Plumbing and Heating systems.
36 Mount glazed frames containing one set of valve charts in the building mechanical room.
37 Include floor plan of each floor level with valve tag numbers indicated at approximate valve locations.
38 Provide separate maps for plumbing valves and HVAC valves. Maps are to be 11"x17".
39 Label all ceilings directly below or access panels directly in front of plumbing or HVAC valves using
40 engraved, printed labels or hanging tags stating the valve ID as shown on the Valve Map and the
41 Valve Tag Directory.
42

43 PENETRATION FIRE STOPPING

- 44 Through-penetration fire stopping system tested and listed by Underwriters Laboratories. 3M, Metacaulk,
45 SpecSeal, or approved.
46

47 Select system for proper application based on wall construction, type of penetrating item, wall rating, etc.
48

- 49 Sealants and Primers – General: Provide only products having lower volatile organic compound (VOC)
50 content than required by South Coast Air Quality Management District Rule No. 1168.

51 **PART 3 EXECUTION**

52 LAYOUT AND COORDINATION

- 53 Site Examination: Before starting work, carefully examine site and all contract Drawings. Become thoroughly
54 familiar with conditions governing work on this project. Verify all indicated elevations, building measurements,
55 roughing-in dimensions and equipment locations before proceeding with any of the work.
56

1 Utility Locations: The location of existing utilities, wires, conduits, pipes, ducts, or other service facilities are
2 shown in a general way only on the Drawings and are taken from existing records. Ascertain whether any
3 additional facilities other than those shown on the plans may be present and determine the exact location and
4 elevations of all utilities prior to commencing installation.

5
6 Sleeves, Inserts, Cast-in-Place Work: Provide sleeves, inserts, anchoring devices, cast-in-place work, etc.
7 which must be set in concrete sequenced at the proper time for the project schedule.

8 9 Coordination:

10 The Drawings are based on equipment of a certain manufacturer and may be identified as such.

11 Where alternate manufacturers or approved substitutes are incorporated into the work, any required
12 design changes are the responsibility of the Contractor. Such changes may include changes in utility
13 or system connection sizes, location, or orientation, service clearances, structural support or acoustic
14 considerations.

15 Prepare accurate AutoCAD shop drawings showing the actual physical dimensions required for the
16 installation for duct work, piping and mechanical devices. Submit drawings prior to
17 purchase/fabrication/installation of any of the elements involved in the coordination. Provide drawing
18 files to other trades for coordination.

19 Cooperate with other trades in furnishing material and information for sleeves, bucks, chases,
20 mountings, backing, foundations and wiring required for installation of mechanical items.

21 Coordinate all work with other trades and determine in advance where interfacing of the mechanical
22 work and other work are required to be connected together. Provide all materials and equipment to
23 make those connections. Submit shop drawings showing required connections where special
24 conditions exist.

25
26 Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing
27 conditions. Do not proceed with any questionable items of work until clarification of same has been made.
28 Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible
29 for that particular portion of the work.

30 31 UTILITY COORDINATION

32 Utility Coordination: Coordinate all aspects of the incoming utility services indicated with the City Engineer,
33 serving utility, and the off-street improvements Contractor. Requirements of the utility company which exceed
34 the provisions made on the Drawings or covered by these Specifications shall take precedence. Provisions
35 made on the Drawings or Specifications in excess of the utility company's requirements shall take
36 precedence. No additional compensation will be allowed the Contractor for connection fees or additional work
37 or equipment not covered in the Drawings or Specifications which are a result of policies of the serving
38 utilities.

39 40 MECHANICAL EQUIPMENT WIRING

41 Provide all mechanical equipment motors, automatic temperature, limit, float and similar control devices
42 required, with wiring complete from power source indicated on Electrical Drawings.

43
44 Provide properly rated motor overload and undervoltage protection and all manual or automatic motor
45 operating devices for all mechanical equipment.

46
47 Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific
48 manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all
49 field wiring and/or devices necessary for a complete and operable system including controls for the actual
50 selected equipment/system.

51
52 Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine
53 starter sizes. Adjust fusing/time delay on all starters once installed.

54 55 GENERAL INSTALLATION

56 Locating and Positioning Equipment: Observe all Codes, Regulations and good common practice in locating
57 and installing mechanical equipment and material so that completed installation presents the least possible
58 hazard. Maintain adequate clearances for repair and service to all equipment and comply with Code
59 requirements.

1
2 Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7'
3 overhead clearance in all areas where possible. Unless indicated otherwise, conceal all piping. Locate
4 operating and control equipment properly to provide easy access, and arrange entire mechanical work with
5 adequate access for operation and maintenance. Give right-of-way to piping which must slope for drainage.
6 Set all equipment level or as recommended by manufacturer. Under no conditions shall beams, girders,
7 footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown
8 on Drawings.

9
10 Access Panels: Provide access panels with proper backing reinforcement for all equipment, dielectric unions,
11 valves and items requiring service and installed above ceilings, behind walls, or in furring, complete with
12 correct frame for type of building construction involved. Exact size, number and location of access panels are
13 not necessarily shown on Drawings. Use no panel smaller than 12" by 12" for simple manual access or
14 smaller than 16" x 20" where personnel must pass through.

15
16 Adjusting: Adjust and calibrate all automatic mechanical equipment, temperature controls, float devices, etc.
17 Adjust flow rates at each piece of equipment or fixture.

18
19 Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by piping, hangers,
20 conduits, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the
21 penetrations.

22 23 VALVE INSTALLATION

24 General: Comply with the following requirements:

25 Install valves where required for proper operation of piping and isolation of equipment, including
26 valves in branch lines where necessary to isolate sections of piping, and where shown on the
27 drawings. Install valves at low points in piping systems that must be drained for service or freeze
28 protection.

29 Locate valves in accessible spaces (or behind access panels) and so that separate support can be
30 provided when necessary.

31 Install valves with stems pointed up, in the vertical position where possible, but in no case with stems
32 pointed downward from a horizontal plane.

33
34 Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper
35 manner to receive insulation.

36
37 Valve Access: Provide access panels to all valves installed behind walls, in furring or otherwise inaccessible.

38 39 INSTALLATION OF HANGERS AND SUPPORTS

40 General: Proceed with the installation of hangers, supports and anchors only after the required building
41 structural work has been completed in areas where the work is to be installed. Correct inadequacies
42 including (but not limited to) the proper placement of inserts, anchors and other building structural
43 attachments.

44 Install hangers, supports, clamps, and attachments to support piping and equipment properly from the
45 building structure. Use no wire or perforated metal to support piping, and no supports from other
46 piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same
47 type and style as installed for adjacent similar piping.

48 Prevent electrolysis in the support of copper tubing use of at least 2 layers of UPC listed 10 mil tape
49 at all bearing surfaces or strut clamp cushion. Copper plated hangers alone are not sufficient.

50 Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel
51 points only.

52
53 Provisions for Movement:

54 Install hangers and supports to allow controlled movement of piping systems and to permit freedom of
55 movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops,
56 expansion bends and similar units. Install specified seismic restraints to restrict excessive
57 movement.

58 Install hangers and supports so that equipment and piping live and dead loading and stresses from
59 movement will not be transmitted to connected equipment.

1 Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe
 2 deflections allowed by ANSI B31 are not exceeded. Comply with the following installation
 3 requirements:

4 Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping
 5 support. Do not exceed pipe stresses allowed by ANSI B31.

6 Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all
 7 insulated pipe and tubing.

8 Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon
 9 testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS
 10 SP-89.

11 Support Type: Manufacturer's recommendations, hanger style and load shall determine
 12 support type.

13 Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where
 14 exposed to view in finished areas is specified, install hard maple wood insulation shields
 15 (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.
 16

17 Pipe Support:

18 Vertical Spacing: Support at base, at equivalent of every floor height (maximum 10' as required by
 19 Code) and just below roof line.

20 Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	<u>Steel</u>	<u>Copper</u>
21 1-1/4" and smaller	7' span	6' span
22 1-1/2" pipe	9' span	6' span
23 2" pipe	10' span	10' span
24 2-1/2" & larger	12' span	10' span

25
 26
 27 Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain
 28 alignment and prevent sagging.

29 Support Rod: Hanger support rods sized as follows:
 30

	<u>Pipe and Tube Size</u>		<u>Rod Size</u>	
	<u>Inches</u>	<u>mm</u>	<u>Inches</u>	<u>mm</u>
31 1/2" to 4"	12.7 to 101.6	3/8"	9.5	
32 5" to 8"	127.0 to 203.2	1/2"	12.7	
33 10" to 12"	254.0 to 304.8	5/8"	15.9	

34
 35
 36 Provide manufactures approved channel continuously below all horizontal PEX or other plastic pipe
 37 where hung from structure.
 38
 39

40 Adjust hangers and supports to bring piping to proper levels and elevations.
 41

42 Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in
 43 accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other
 44 piping, equipment, metal decking, etc., are not acceptable.
 45

46 Horizontal banks of piping may be supported on common steel channel member spaced not more than the
 47 shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using
 48 clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping
 49 weights.
 50

51 Installation of drilled-in concrete anchors shall comply with the manufacturer's instructions for working load,
 52 depth of embedment, and spacing between anchors and from the edge of the slab. Use only wedge-style
 53 anchors.
 54

1 Seismic Restraints: Install restraints where recommended in SMACNA "Seismic Restraint Manual" and as
2 required by code. Show analysis of supporting structure, anchorages, and restraints in accordance with
3 OSSC Section 16 and reference ASCE standard. Seismic restraint system components shall be approved by
4 the California Office of Statewide Health Planning and Development (OSHPD). Acceptable Manufacturers:
5 Amber/Booth, Mason Industries, Tolco, or approved. Contractor shall submit calculations and shop Drawings,
6 sealed and signed by a Professional Engineer, showing seismic restraint design for all equipment, piping and
7 ductwork required to be braced. **For remodeled areas seismic importance factor is 1.0.**

8
9 Ensure all copper piping is protected from contact with non-copper supports. Provide strut cushion below
10 clamp or 2 layers of UPC listed 10 mil tape.

11 HVAC SYSTEM IDENTIFICATION

12 Piping System: Indicate each pipe system by its generic name (abbreviated) as shown/scheduled/specified.
13 Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of
14 flow and "Electric Traced" signs to identify heat cable wrapped piping. Locate pipe labels in accessible areas
15 as follows:

16 Near each valve, meter, gauge, or control device.

17 Near equipment such as pumps, heat exchangers, water heaters, etc.

18 At piping branch connections.

19 At penetrations (each side) of walls, ceilings, and floors.

20 At access panels and doors.

21 At 25 foot maximum intervals. Provide a minimum of one label above each room where lift-out ceiling
22 is installed. Reduce intervals in congested areas such as mechanical rooms.

23
24
25 Equipment: Provide engraved plastic-laminate signs at locations of major equipment such as heat
26 exchangers, pumps, etc. Identify equipment in field same as on Drawings. Permanently mount in an
27 appropriate and effective location.

28
29 Operation Tags: Where needed for proper and adequate information on operation and maintenance of
30 mechanical systems, provide tags of plasticized card stock, either pre-printed or hand printed to convey the
31 message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN THE PUMP IS OFF."

32 EQUIPMENT CONNECTIONS

33 Provide complete connections for all items of equipment requiring such connections, including incidental
34 piping, fittings, trim and labor necessary for a finished working installation.

35
36
37 Verify the rough-in and finish requirements for all equipment provided under other Divisions of the work and
38 requiring HVAC piping or duct connections with equipment supplier and installer prior to rough-in.

39 PROTECTION

40 Protect all work and materials against loss or damage. Close all pipe openings with caps or plugs. At final
41 completion, thoroughly clean and deliver all work and equipment in an unblemished new condition. Keep all
42 motors and bearings in watertight and dustproof covers during entire course of installation.

43
44
45 Protect floors, walls, framing and sheathing where pipe cutting and threading operations are conducted with
46 plastic sheeting under plywood sheets. Extend plastic sheeting beyond the plywood. Clean-up metal
47 cuttings, oil, etc., daily or as necessary to prevent debris from being tracked beyond the protected area.
48 Damages, as determined by the Architect, due to the pipe cutting/threading operation shall be repaired by the
49 responsible trade.

50 CUTTING AND PATCHING

51 General: Comply with the requirements of Division 1 for the cutting and patching of other work to
52 accommodate the installation of mechanical work. Do all necessary cutting and patching of existing building
53 and yard surfaces required for completion of the mechanical work. Patch to match finish and color of
54 adjacent surfaces. Coordinate work in remodel and new areas to avoid cutting of new finished surfaces.

55 PIPE PENETRATION FIRE STOPPING

56
57 Install as recommended by manufacturer and in accordance with the product's UL listing. Below are the
58 minimum installation requirements.

1 Install specified penetrating item(s) with required annular spacing in proper size wall or floor opening.
2 Support penetrating item(s) adequately on both sides of construction.
3 Clean all opening and penetrating item surfaces in penetration area to remove loose debris, dirt, oil,
4 wax, grease, old caulking, etc.
5 If needed or required for gypsum or concrete block walls, install specified galvanized steel wire mesh
6 or sleeve recessed and centered inside wall around penetrating item(s) so that it is snug against
7 perimeter of opening.
8 When required, install specified type and depth of backing material in annular space, recessed to
9 required fill depth of fire stopping caulking.
10 Gun, trowel, and/or pump fire stopping sealant to specified depth in annular space around penetrating
11 item(s). Trowel sealant surfaces flush with wall or floor surfaces to a smooth, defect-free finish.
12 Where required, apply specified size caulking bead around penetrating item(s) at zero annular
13 contact areas and tool smooth.

14
15 Drawings show some, not all, of the penetration. Review architectural Drawings for all fire walls.

16
17 Sealants and Primers – General: Provide only products having lower volatile organic compound (VOC)
18 content than required by South Coast Air Quality Management District Rule No. 1168.

19 20 MECHANICAL PAINTING

21 Minimum Requirements: Comply with minimum requirements of Division 9, Painting. All mechanical
22 equipment, piping, insulation, etc., exposed in finished areas, storage rooms and other locations except
23 mechanical equipment rooms will be painted under Section 09 90 00.

24 25 HVAC WORK CLOSEOUT

26 General: Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring
27 same. Complete each system as shown or specified herein and place in operation except where only
28 roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of
29 leaks, obstructions, or contamination.

30
31 Record Drawings: Submit record set of Drawings required in Division 1 as previously specified in this
32 Section.

33
34 Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be
35 damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and
36 each system in a test run of appropriate duration with the Architect present, and with the Owner's operating
37 personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as
38 required for proper performance. Clean and lubricate each system and replace dirty filters, excessively worn
39 parts and similar expendable items of the work.

40
41 Operating Instructions: Conduct a walk-through instruction seminar for the Owner's personnel who are to be
42 involved in the continued operation and maintenance of the HVAC equipment and systems. Provide written
43 instructions outlining and explaining the identification system, operational diagrams, emergency and alarm
44 provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of
45 the systems.

46
47
48

END OF SECTION