

ATTACHMENT “D”

PIPING SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this section.

1.02 PRINCIPLE WORK IN THIS SECTION

- A. The Work under this Section shall include labor, materials, accessories, services, and equipment necessary to furnish and install piping specialties and accessories, complete, as specified herein.
- B. Without limiting the generality thereof, the Work in this Section shall include the following items:
 - 1. Insulating flanges and unions.
 - 2. Strainers
 - 3. Anchors, sleeves, inserts, hangers, and supports.
 - 4. Pipe expansion loops, compensators, anchors, and guides for Glycol/Water service.
 - 5. Reduced pressure backflow prevented.
 - 6. Air separator and trim.
 - 7. Pipeline flexible connectors.
 - 8. Thermometers and gauges
 - 9. Pressure relief valves

1.03 SUBMITTALS

- A. Catalog cut sheets including specifications, installation instructions, and general recommendations for each item listed in 1.02.B

PART 2- PRODUCTS

2.01 INSULATING FLANGES AND UNIONS

- A. Insulating flanges: Maloney Econoset flanged insulating set, Advance Products, PSI, Inc. or approved equal, consisting of Type “E” neoprene laminated phenol gaskets, integral sleeves, washers and flat washers.
- B. Unions: Insulating type, nylon or Teflon bushing, May Products Company, EPCO, PSI, Inc. or approved equal, installed in Permute and in a position to take pipeline expansion as an axial thrust.

2.02 STRAINERS- WATER AND GLYCOL/WATER SERVICE

- A. Description: Full WYE pattern type with stainless steel strainer and gasketed machined strainer cap either bolted or screwed. Provide strainers with valve blowout piping same size as blowout plug. Provide globe valve blowout for Glycol/water service and ball valve for water service. For each blow down valve used for Glycol/water service provide a 2" long nipple with ¾" threaded male hose connection.
1. 2" and smaller 200-psi (WOG) cast bronze with screwed ends, 20 mesh screen figure # 351M as manufactured by Mueller or approved equal.
 2. 2 1/2 " and larger 200 psi (WOG) cast iron with flanged connections, 1/16 perforated mesh screen, figure # 751 as manufactured by Mueller or approved equal.
 3. Acceptable manufacturers: Mueller, Armstrong, Sarco, Hoffman, or approved equal.

2.03 ANCHORS, SLEEVES, INSERTS, HANGERS, AND SUPPORTS

A. General

1. Anchors, sleeves, inserts, hangers, and supports shall be provided by the Proposer.
2. Horizontal pipe runs, within the PCA equipment room, shall be isolated from building structure and hung with specified piping hanger spacing. In addition, piping in building connected to a pump shall be isolated from the building. Minimum deflections 0.5 inches unless otherwise indicated. See latest SMACNA Seismic Guide and OSHPD Requirements for related hangers with seismic restraints.
3. Vertical risers, within the PCA equipment room, shall be supported on spring isolators at a distance not to exceed 10' apart. Brace pipes between supports with neoprene type isolator guides.
4. Provide spring isolated pipe supports at equipment and tank connections to prevent overloading.
5. Provide flexible connectors at equipment and piping hook-ups.

B. Pipe Hanger and Supports:

1. Hangers to be used for outdoors piping, in damp corrosive environments shall be galvanized, primed and finish painting.
2. Support single pipe runs for pipe sizes up thru 3" with adjustable clevis type hangers Elcen Fig 12, rinnell Fig 260, B- line No. B3100 or as pre-approved by OSHPD. For insulated lines, hanger shall be sized to permit continuous run of insulation. Provide insulation protection shields on the outside of the specified pipe coverings and high density inserts to support weight of pipe. Vapor barriers shall be continuous without interruption or penetrations.
3. For pipe sizes 4" and above for ethylene glycol water service; support single pipe runs with adjustable steel yoke pipe roll Grinnel Figure 181, B-line No. B3111 or as pre-approved by OSHPD. For insulated lines. Hanger shall be sized to permit continuous run of insulation. Provide pipe insulation protection shields on the outside of the pipe covering and high density inserts to support the weight of the pipe. Vapor barriers shall be continuous without interruption or penetrations.
4. For condenser water piping, sizes, support single pipe runs with adjustable clevis type hangers Elcen figure 12, Grinnel figure 260, B-line No. 3100 or as

pre-approved by OSHPD. For insulated lines, hanger shall be sized to permit continuous run of insulation. Provide pipe insulation protection shields on the outside of the pipe covering and high density inserts to support weight of pipe. Vapor barriers shall be continuous without interruptions or penetrations.

5. Miscellaneous piping support requirements shall be as follows:
 - A. No strap or perforated straphangers will be permitted in piping work.
 - B. Additional hangers must be provided at changes in pipe direction valve assemblies, automatic valves, bypasses, or elsewhere, where required to properly support additional pipe loadings.
 - C. Nuts in pipe hanger assemblies shall be new and unused hexagonal, semi-finishes American Standard, Coarse Series. Hangers shall be secured to rod pendants with two (2) nuts and they shall be jammed locked after hanger adjustment.
 - D. No item of equipment shall support the pipe loading, nor shall a fixture or item of equipment be supported by the piping.
 - E. Copper plated hangers, clamps, etc, shall be provided where same are in direct contact with copper piping. On insulated copper piping, copper plated hangers may be omitted. Hangers for copper piping shall be Grinnel figure CT-69, ELCEN, B-line or equal.
6. Maximum center spacing of individual pipe hangers, except as otherwise specified, shall be in accordance with the following:

MAX. C TO CO	STEEL PIPE SIZE	COPPER TUBING SIZE
6'-0" ½"	½"	
8'-0"	¾" to 1"	¾" to 1"
10'-0"	1-1/4" to 2"	1-1/4" to 2"
12'-0"	2-1/2" to 3"	2-1/2" & Larger
14'-0"	4"	
15'-0"	5" to 6"	
17'-0"	8"	
20'-0"	10"	
23'-0"	12"	

7. Regardless of the above listed hanger spacings, provide a hanger not more than 12" from each change in direction of piping and at each drop, riser, pump suction and pump discharge.
8. Hanger rods shall be of hot drawn cadmium or electro galvanized plated solid or threaded carbon steel, of the following sizes:

PIPE SIZE	ROD DIAMETER
½"-2"	3/8"
2-1/2" TO 3"	½"
4"-5"	5/8"
6"	¾"
8"-12"	7/8"

B. Pipe Sleeves:

1. Manufactured, pre-engineering fire rated sleeve kits shall be installed at penetrations of fire and smoke rated partitions and decks. Fire-rated sleeve kit assemblies will display a Listing Label or stamp by the UL, FM, Or Warnock Hersey documenting passage of test and code requirements as stipulated in ASTM E814, and/or UBC 43-6 and documenting participation in Q/A Manufacturing Audit program conducted by the listing organization – UL, FM or Warnock Hersey.
2. Installed kits shall have the same “F” rating as the (partition or deck) fire separation in which they are installed.
3. Openings with sleeves cast in place in masonry do not require fasteners into the surface plate. Openings should be in pre-poured concrete or cut in dry wall with 3M intumescent on the sleeve diameter.
4. Kits shall be installed in the fire separation (wall or deck) to conform to the design in the listing or as otherwise modified or approved by the local authority having jurisdiction. (AHJ)
5. Bare Pipe Metal Only
 - A. Annular spacing shall first be packed with ceramic fiber batting and then sealed with 3-M CP25 WB Intumescent caulking, BIO Fire, General Electric Corporation, Hilti, Rector Seal, USG or other listed sealant materials as per installation instructions, and as specified in the design listing.
 - B. Provide Pipe shields, Inc. Models F3000, F3200, F3400, F3600, F6000, F6200, F9000, and/or F9200, Rilco Manufacturing, or approved equal.
6. Insulated Pipe (metal or plastic)
 - A. Same as five above, but with addition of a 360 degree cylinder of waterproof calcium silicate insulation encasing the pipe and covered with galvanized sheet metal shielding, sized to extend to beyond wall or deck specified in the listing.
 - B. Provide Pipe Shields, Inc. Models F100 through F2800, F4000 through F5200, and/or F7000 through F8200, Rilco Manufacturing or approved equal.
7. Sleeves may be omitted for piping less than 1 ¼” size that pass through interior partitions. Where sleeves are omitted, uninsulated piping shall be wrapped with fiberglass insulation at the point where partitions occur.

B. Inserts, Shields and beam Clamps

1. Where piping is suspended from existing construction or where additional pipe hangers are required, provide Philips “ Red Head” or approved equal, inserts and anchors of the size required by hanger rod size and the imposed loading.
2. For each pipe hanger supporting piping suspended from structural steel members provide Elcen Fig. 33 or 34, B-line or approved equal as required by loading. Where supports are required between building structural members, provide necessary supplementary angles, channels, plates, etc., spanning the space between structural members; properly secured by means of welding, bolting, or concrete anchors
3. Drive screws, pins, studs, etc., of the type, which are secured in place by means of explosive force, shall not be used as a means of securing loads to the overhead structure.

2.04 PIPE EXPANSION LOOPS, COMPENSATORS, ANCHORS, SEISMIC FITTINGS, AND GUIDES FOR GLYCOL/WATER SERVICE

- A. For thermal pipe expansion and contraction, provide expansion loops and/or expansion compensators.
- B. Pipe guides shall be provided with the expansion joints in accordance with the codes and standards specified.
- C. Provide for expansion and contraction of piping for operating through the following temperature range. Glycol/Water 20 degrees F to 70 degrees F.
- D. Efforts should be made to accommodate expansion and contraction by means of pipe expansion loops wherever possible. Mechanical expansion compensators shall be used only where space constraints will not permit the use of fabricated pipe loops.
- E. Where pipes pass building seismic joints, provide seismic fittings as indicated. Seismic fittings shall be Metraflex Flexible Loop or Barco Type N Ball joint assembly.
- F. Where pipes run from utility trench to ceiling space, provide ball joints as indicated. Provide Barco type N Ball Joint Assembly, Hyspan or approved equal.
- G. Pipe Guides:
 - 1. Pipe Guide, (G-1):

Pipe Guide shall be selected for site of pipe and load rating. Pipe Guide shall have overlapping, galvanized sheet metal jacket, 2-inch thick high strength urethane (16PCF) insulating inserts, and be supported from structure above. Provide Pipe Shields, Inc. Model B3000 guided insulated pipe support or approved equal.
 - 2. Pipe Guide, (G-2):

Pipe Guide shall be selected for size of pipe and load rating. Pipe Guides shall have overlapping, galvanized sheet metal jacket, 2-inch thick high strength urethane (16PCF) insulating inserts, and be supported from structural steel pipe support below as provided in International Terminal Building Documents (Contract #5500). Provide Pipe Shields, Inc. Model B3000 guided insulated pipe support, Rilco Manufacturing or approved equal.
- H. Pipe Anchors
 - 1. Pipe Anchor (A-1):

Pipe Anchors shall be selected for size of pipe and load rating. Seismic axial load and expansion/contraction loads shall be included in load. Pipe Anchor shall have overlapping, galvanized sheet metal jacket, 2-inch thick high strength urethane (16PCF) insulating inserts, and be supported from structure above. Provide Pipe Shields, Inc. Model C4000 insulated positive Pipe Anchor, Rilco Manufacturing or approved equal.
 - 2. Pipe Anchor (A-2):

Pipe Anchors shall be selected for size of pipe and load rating. Seismic axial load and expansion/contraction loads shall be included in load. Pipe anchor shall have overlapping, galvanized sheet metal jacket, 2-inch thick high strength urethane (16PCF) insulating inserts, and be supported from structural steel pipe support below as provided in International Terminal Building Documents. Provide Pipe Shields, Inc. Model C4000 insulated positive Pipe Anchor, Rilco Manufacturing or approved equal.

2.05 SEISMIC RESTRAINTS

- A. Provide seismic restraints, supports and anchorage for piping, ductwork, and equipment either hung or mounted otherwise, per the requirements of 1991 California Building Code (CBC) Title-24, with amendments to date, using the Hospital Design Criteria (OSHPD STANDARDS) with an importance.
- B. Provide calculations and details for the support and bracing of pipes, ducts, and conduits per the latest SMACNA " Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" or per the latest NUSIG "National Uniform Seismic Installation Guidelines" which are OSHPD pre-approved systems. Following types of calculations shall be prepared and signed by a Structural Engineer registered in the State of California, and submitted to the Architects, the Mechanical Engineer of record, and the Structural Engineer of record for approval.
 - 1. As requested by Director, provide details on the plans substantiating calculations for the support and anchorage of fixed equipment, (equipment with the utility connections, such as electricity, water, gas, CHW, HW, etc.) mounted directly on the floor or roof or for equipment with an operating weight over 20lbs. And is suspended from the roof, floor and wall
 - 2. As requested by Director, provide calculations, details, and/or test data for vibration isolators and their anchorages, to substantiate the isolator's capacity for vertical and lateral loads or use OSHPD pre-approved isolators. Submit calculations (whether pre-approved or not) to substantiate the size, quantity, location, and connection of isolator to structure. The submitted Drawings and calculations shall be closely coordinated with the calculations and clearly specify the manufacturer, model type, model number, base plate size, quantity used, and location at each piece of equipment, and how it is attached to the structure. Submit calculations for isolators which support equipment (such as fans inside air handling units) along with the calculations for anchoring of the parent equipment (such as air handling unit)
 - 3. As requested by Director, provide calculations, details, and Drawings for piping and ductwork showing location of supports, anchorage, guide, expansion joints/loops, and flexible connections at seismic joints. The calculations shall clearly indicate the location, direction and load forces transferred to the structure. The calculations shall take into account the operating weight, thermal expansion/contraction forces, and seismic forces. The calculations shall indicate method of attachment to the structure, size of anchor bolts, depth of embedment, welding size, etc.
 - 4. In no case shall the load forces transmitted to the building structure exceed the allowable loads of the building structure. Contractor shall provide slab inserts, deck inserts, and supplementary steel members to distribute the loads safely to the structure. Supplementary steel shall be provided where required whether shown on plans or not to support equipment, pipes, and ducts. Supplementary steel where required shall be detailed with sizes, locations, and methods of attachments shown.
- C. The anchorage details and calculations must be submitted sufficiently in advance of the desired date of approval to provide time for the initial review by the Architects, Structural Engineer of Record, and Mechanical Engineer of record, and at least one (1) cycle of response and backcheck.
- D. Contractor shall provide flexible devices for pipes, ducts, and conduits which cross building separation spaces (building seismic joints) whether shown on plan or not. Such devices shall be designed and detailed to accommodate displacements calculated on the basis noted in Title 24, CCR, Sections 2312(h) 2K or as indicated on the structural documents of the parent building. The flexible devices shall be designed and selected

for the temperature and pressure of the media transported. Contractor shall submit the required details on the plans along with the substantiating calculations.

- E. For hot and chilled water insulated piping system, provide pre-engineered and pre-insulated pipe supports, guides and anchors to prevent heat transmission between the pipe and support steel and maintain continuous vapor barrier throughout the entire pipe run
- F. Building structural steel shall not be cut or modified without the written approval of the Structural Engineer of record. Patch and repair fire-proofing at the point of connection to the structure.
- G. Seismic restraints must be installed and adjusted so that equipment, piping, and ductwork vibration isolation is not degraded by utilization of restraints.
- H. Contractor shall install supports, bracing and anchoring per the approved Shop Drawings. After the completion of the installation and adjustments, the Contractor shall certify that seismic restraints have been installed to meet the maximum requirements of Code. and approved Shop Drawings, signed by a Structural Engineer registered in the State Of Texas.

2.06 AIR SEPARATOR AND TRIM

- A. Provide an inline centrifugal air separator complete with strainer, blow down connections and high capacity air vent.
- B. Unit to be constructed according to the ASME Code stamped with "U" symbol and supplied with Form U-1 certifying National Board compliance. Strainer to be of galvanized steel having 3/16" diameter perforations and a free area of not less than five times the cross sectional area of the connection pipe.
 - 1. The strainer shall be removed and cleaned after the piping system cleaning and flushing has been accepted by the HAS.
- C. The air separator shall be model R-6 Rolaritrol as manufactured by Bell and Gossett, Taco or approved equal.
- D. The high capacity air vent shall be Model 107A as manufactured by Bell and Gossett, Watts or approved equal.

2.07 PIPE LINE FLEXIBLE CONNECTORS

- A. Provide on the suction and discharge connections of each pump and piping connections to chillers (CH-1 and CH-2) a neoprene arched flexible connector as follows:
 - 1. Connectors shall be either single or double spherical type with floating 150 lb. Steel flanges.
 - 2. The Arch joint construction shall be reinforced EPDM elastomer or approved suitable for 30% by weight concentration of ethylene glycol.
 - 3. Regardless of operating pressure galvanized control cables or rods shall be provided on flexible connectors either pre-installed at the factory or by this Contractor.
 - 4. Connections shall be suitable for a minimum operating pressure of 200 psig up through 10".
 - 5. Flexible Connectors up thru 10" will hydrostatically tested to 200 psig in the field.

6. Connections shall be Metraflex Cablesphere Model MSRC or EPDM or Mason Industries Model MFTNC or MFNC or approved equal.
- B. Provide for refrigerant pressure relief valve connections on each chiller, a flexible connector to each relief valve in accordance with ASHRAE 15 Safety Code as shown.
1. The flexible connector shall consist of corrugated inner tubing with a bronze or stainless steel wire braid outer shield. The connector shall be suitable for a minimum design working pressure of 300 psig at 70 degrees F.
 2. The connector shall be minimum 10 inches long, series SST as manufactured by Metraflex, Mercer Rubber, Mason or approved equal.
 3. The connector pipe connections shall be male thread provided on each end.

2.08 THERMOMETERS AND GAUGES

A. General:

1. Provide instruments, meters, gauges, and thermometers, complete with interconnecting tubing, piping, valves, as specified.
2. Provide stop valves in the piping for access to instruments, meters, and gauges.
3. Install stop valves both at point of takeoff and at the instruments, meters, and gauges where interconnecting pipe or tube exceeds 12'-0". Stop valves shall be of the same minimum design requirements as the lines they serve.

B. Indicating Pressure Gauges, Water and Glycol/ Water Service:

1. Manufacturers: "Duragauge", Crosby, Trerice, Weiss, Weksler or Marsh.
2. Bourdon Tube: Grade A phosphor bronze, brazed joints stress relieved.
3. Socket and tip: Brass complete with pressure impulse dampeners and gauge needle valve. Gauge valve to be brass needle valve Hammond 1B-415 or approved equal.
4. Case: Phenal, weatherproof with safety blowout discs or release back plate.
5. Ring: Boyonet locking type.
6. Movement: Stainless steel mounted on socket with milled teeth on pinion and sector.
7. Dial: 4 1/2", white laminate phenal with black markings.
8. Pointer: Aluminum with micrometer adjustment.
9. Accuracy: 1 percent over full range of scale.
10. Range: As required for the pressure range to be measured.
11. Be solid front type recalibrated from back without removing dial.

C. Thermometers, Water and Glycol/Water Service

1. Thermometers shall be red reading mercury filled with 9" scale calibrated in degrees Fahrenheit.

2. The thermometer shall be adjustable angle type of die-cast aluminum construction finished in black baked on enamel and complete with glass front. Separable well shall be stainless steel construction and have lagging extension shall be increased to permit full insulation thickness on flanged components.

- A. Accuracy to be plus/or minus 1% over the range of the scale.
- B. Manufacturers standard ranges comparable to those specified:

SYSTEM	RANGE
Condenser Water	25 degrees to 125 degrees F
Glycol/Water	0 degrees to 100 degrees F

- C. Manufacturers shall be Ashcroft, Weiss, Weksler, Trerice, Duro Instrument or approved equal.

2.09 PRESSURE RELIEF VALVES

- A. Provide pressure relief valves.
- B. Valves are to be bronze body construction with trim suitable for 30% ethylene glycol/water service.
- C. Relief valves shall be as manufactured by Cash-Acme, Bell and Gossett, Kunkle or approved equal.

PART 3 EXECUTIONS

3.01 INSTALLATION

- A. Install strainers ahead of automatic control valves; pump suction, and elsewhere as indicated.
 - 1. Remove, clean and re-install strainer screens after system flushing, after system cleaning.
 - 2. Strainer for air separator shall be removed after system flushing and thrown away.
- B. Gauges and thermometers shall be provided by one manufacturer.
 - 1. Where thermometers are mounted in small piping, furnish tee, nipples, couplings, etc., to make room for the socket without restricting flow.
 - 2. Separable sockets of wells shall be installed in pipelines before the lines are insulated and shall be plugged to prevent the entrance of foreign material.
 - 3. Install thermometers at eye level where possible.
 - 4. Wells shall extend inside the inner face of the pipe wall a minimum of 4" or to center of pipe for liquid service and shall be installed below the horizontal center point at an angle to allow drainage.
- C. Install flexible connectors in a straight line with no offsets. Piping should be anchored or hung so that the weight of the piping does not rest or stress the connector.
- D. The Contractor Shall field install ¼" NPT pressure valve extensions onto the 1 ½" and 2" flow control valves in order to be accessible once flow control valves are insulated.