

*Appendix
XII*

Mechanical and HVAC Hydronic Piping
Requirements

Revision 05
Date: 06/12/2014

Outline Mechanical and HVAC Hydronic Piping requirements

No	Abbreviation	Service	Location	Pipe Material	Class / Compliance	Type	Joint	Failure	Valves	Insulation Material	Insulation Size	Backdrop Color / Letter Color	Remarks	Special Handling	Pressure Testing / Chemical Cleaning and Passivation	Red Size / Hazard / Storage
H1	CHWS and CHWR	Chilled Water Supply and Return	Direct Buried, Below Grade	Pipe 4" and above: Domestic (US Made) seamless steel pipe (No ERW, longitudinal seam and lap jointing are allowed.) Pipe 4" and above: ASTM A53, S, Grade A or Grade B Type K, cold drawn	Welded AWS D1.1 Standard weight carbon steel, butt weld ASTM B 16.3.	Pipes up to 2": NIBCO T-Apollo series 77-140, pipes 3"-5": NIBCO LD3122.3 Pipes 6" and above: NIBCO LD3122.5 lug style butterfly valves.	Field or Factory applied insulation: Polyisocyanurate Rigid Foam, Min Service Temp: -297F; Max Service Temp: 300F; Max Moisture Absorption: 0.2% by volume; Tymer 2000XP by Dow Plastics. 2" thick "PIVWRAP" is acceptable insulation material.	Pipe 4" and above: 2.5" thick foam	Green / White with arrows in the direction of flow	Provide stem extensions on all pipes to accommodate operation of the valve handle.	Design engineer or contractor shall analyze the pipe work and make any necessary provisions for thermal expansion and contraction.	N/A				
H2	CHWS and CHWR	Chilled Water Supply and Return	Direct Buried, Below Grade	Pipe up to 3": Hard drawn seamless copper tubing Type K, cold drawn	Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.18	Pipes up to 2": NIBCO T-Apollo series 77-140, pipes 3"-5": NIBCO LD3122.3 Pipes 6" and above: NIBCO LD3122.5 lug style butterfly valves.	Polyisocyanurate Rigid Foam, ASTM C591, K = 0.19 at 75F; Min Service Temp: -297F; Max Service Temp: 300F; Max Moisture Absorption: 0.2% by volume; Tymer 2000XP by Dow Plastics. 2" thick "PIVWRAP" is acceptable insulation material.	Pipe up to 2": 2" thick foam	Green / White with arrows in the direction of flow	No soft solder allowed except within 6" of threaded fittings and couplings. Design engineer or contractor shall analyze the pipe work and make any necessary provisions for thermal expansion and contraction.	N/A					
H3	CHWS and CHWR	Chilled Water Supply and Return	Above Ground	Pipe up to 3": Domestic (US Made) seamless steel pipe (No ERW, longitudinal seam and lap jointing are allowed.) Type L, hard drawn	ANSI / ASME B16.22 Standard weight copper	Pipes up to 2": NIBCO T-Apollo series 77-140, pipes 3"-5": NIBCO LD3122.3 Pipes 6" and above: NIBCO LD3122.5 lug style butterfly valves.	Polyisocyanurate Rigid Foam, ASTM C591, K = 0.19 at 75F; Min Service Temp: -297F; Max Service Temp: 300F; Max Moisture Absorption: 0.2% by volume; Tymer 2000XP by Dow Plastics.	Pipe up to 1.5" thick foam, Pipe 1.5" and above: 2" thick foam	Green / White with arrows in the direction of flow	No soft solder allowed except within 6" of threaded fittings and couplings. Design engineer or contractor shall analyze the pipe work and make any necessary provisions for thermal expansion and contraction.	N/A					
H4	CHWS and CHWR	Chilled Water Supply and Return	Above Ground	Pipe 4" and above: Domestic (US Made) Seamless Steel Pipe (No ERW, longitudinal seam and lap jointing are allowed.) ASTM A53, S, Grade A or B	Standard weight carbon steel, butt weld ASTM B 16.3.	Pipes up to 2": NIBCO T-Apollo series 77-140, pipes 3"-5": NIBCO LD3122.3 Pipes 6" and above: NIBCO LD3122.5 lug style butterfly valves.	Polyisocyanurate Rigid Foam, ASTM C591, K = 0.19 at 75F; Min Service Temp: -297F; Max Service Temp: 300F; Max Moisture Absorption: 0.2% by volume; Tymer 2000XP by Dow Plastics.	Pipe 4" and above: 2.5" thick insulation	Yellow / Black with arrows in the direction of flow	Design engineer or contractor shall analyze the pipe work and make any necessary provisions for thermal expansion and contraction.	N/A					
H5	HHWS and HHWR	Heating Hot Water Supply and Return	Direct Buried, Below Grade	Pipe 4" and above: Domestic (US Made) Seamless steel pipe (No ERW, longitudinal seam and lap jointing are allowed.) ASTM A53, S, Grade A or B	Standard weight carbon steel, butt weld ASTM B 16.3.	Pipes up to 2": NIBCO T-Apollo series 77-140, pipes 3"-5": NIBCO LD3122.3 Pipes 6" and above: NIBCO LD3122.5 lug style butterfly valves.	Polyisocyanurate Rigid Foam, ASTM C591, K = 0.19 at 75F; Min Service Temp: -297F; Max Service Temp: 300F; Max Moisture Absorption: 0.2% by volume; Tymer 2000XP by Dow Plastics. As an alternative 2.0" thick "PIVWRAP" is also acceptable insulation material.	Pipe 4" and above: 2.0" thick insulation, Pipe 2.5" to 3": 3" thick insulation	Yellow / Black with arrows in the direction of flow	No soft solder allowed except within 6" of threaded couplings. Provide provisions for thermal expansion and contraction as necessary to compensate for long pipe runs and high temperatures fluctuations.	N/A					
H6	HHWS and HHWR	Heating Hot Water Supply and Return	Direct Buried, Below Grade	Pipe up to 3": Hard drawn seamless copper tubing Type K, cold drawn	Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.18	Pipes up to 2": NIBCO T-Apollo series 77-140, pipes 3"-5": NIBCO LD3122.3 Pipes 6" and above: NIBCO LD3122.5 lug style butterfly valves.	Polyisocyanurate Rigid Foam, ASTM C591, K = 0.19 at 75F; Min Service Temp: -297F; Max Service Temp: 300F; Max Moisture Absorption: 0.2% by volume; Tymer 2000XP by Dow Plastics. As an alternative 2.0" thick "PIVWRAP" is also acceptable insulation material.	Pipe 4" and above: 2.0" thick insulation, Pipe 2.5" to 3": 3" thick insulation	Yellow / Black with arrows in the direction of flow	No soft solder allowed except within 6" of threaded couplings. Provide provisions for thermal expansion and contraction as necessary to compensate for long pipe runs and high temperatures fluctuations.	N/A					

Appendix XII HVAC_Spec_Table_09-12-2014_rev05.xlsx

No	Abbreviation	Service	Location	Pipe Material	Class (Constraint)	Type	Joint	Fittings	Valves	Insulation Material	Insulation Status	Jacket	Background Color / Letter	Remarks	Special Handling	Pressure Testing (Chemistry, Cleanout, and Passivation)	Rod Size / Hangers / Spacers
H16	SCR	Steam Condensate Piping	Above Ground	Pipe up to 2" Domestic (US Make), seamless pipe, black welded ends (No ERW, longitudinal seam and imported piping are allowed.)	ASTM A53, S, Grade B	Schedule 80	Threaded or AWS D11.1 Welded	ANSI / ASTM B16.3, Maleable iron, 300 lb.	Higher than 10' above finished floor shall have chain operated hand wheel	Rigid Fiberglass, ASTM C335, K = 0.24 at 75°F; Min Service Temp: -20°F; Max Moisture Absorption: 0.2% by volume; Owens Corning, Certihard or John Manville. In areas where physical damage, insulate with Calcium Silicate, ASTM C533, ASTM C335, K = 0.38 at 75°F; Min Service Temp: -20°F; Max Moisture Absorption: 0.2% by volume; Cabotite Manufacturing Corp. only.	Title 24 compliant. Refer to 2013 nonresidential CEC manual, Table 4-15 Standards table 120.3-A Pipe Insulation Thickness	Exposed + 0.015" + 0.016" Aluminum	Yellow / Black with arrows in the direction of flow	Isolate valves and associated trim components with fiberglass insulation. Provide preformed demethyl for fittings and valves, or approved equal. Design engineer or contractor shall analyze the pipe work and make any necessary provisions for thermal expansion and contraction.	For pipe work installed below 8' or 4'F where insulation is subject to damage, provide Calcium Fiberglass. Provide provisions for expansion and contraction as necessary to compensate for long pipe runs and high temperatures fluctuations	Pressure Test (Chemistry, Cleanout, and Passivation) Representative and signed off in writing. Neutralize the chemicals and flush the system. Complete and discharge the chemicals in a code-approved manner in compliance with CT design guide. Refer to campus design guide document for the details of cleaning and passivation procedures and chemicals. Supports shall be designed for seismic zone 4.	As per latest applicable CMC, NFPA, FM global and fire marshal requirements. Supports shall be designed for seismic zone 4.
H17	SCR	Steam Condensate Piping	Above Ground	Pipe 2.5" and above Domestic (US Make), seamless pipe, black welded longitudinal seam and imported piping are allowed.)	ASTM A53, S, Grade B	Schedule 80	Butt welded AWS D11.1 Welded. For larger pipe fittings, use raised face flanges and metal wound Mechanical joint couplings required at final connections to coupling and maintenance.	Standard weight, carbon steel butt weld, ASTM A234, Class 300.		Rigid Fiberglass, ASTM C335, K = 0.24 at 75°F; Min Service Temp: -20°F; Max Moisture Absorption: 0.2% by volume; Owens Corning, Certihard or John Manville. In areas where physical damage, insulate with Calcium Silicate, ASTM C533, ASTM C335, K = 0.38 at 75°F; Min Service Temp: -20°F; Max Moisture Absorption: 0.2% by volume; Cabotite Manufacturing Corp. only.	Title 24 compliant. Refer to 2013 nonresidential CEC manual, Table 4-15 Standards table 120.3-A Pipe Insulation Thickness	Exposed + 0.015" + 0.016" Aluminum	Yellow / Black with arrows in the direction of flow	Isolate valves and associated trim components with fiberglass insulation. Provide preformed demethyl, blanket or boxed insulation for fittings and valves, or approved equal. Design engineer or contractor shall analyze the pipe work and make any necessary provisions for thermal expansion and contraction.	For pipe work installed below 8' or 4'F where insulation is subject to damage, provide Calcium Fiberglass. Provide provisions for expansion and contraction as necessary to compensate for long pipe runs and high temperatures fluctuations	Pressure Test (Chemistry, Cleanout, and Passivation) Representative and signed off in writing. Neutralize the chemicals and flush the system. Complete and discharge the chemicals in a code-approved manner in compliance with CT design guide. Refer to campus design guide document for the details of cleaning and passivation procedures and chemicals. Supports shall be designed for seismic zone 4.	As per latest applicable CMC, NFPA, FM global and fire marshal requirements. Supports shall be designed for seismic zone 4.
H18	SCD	Steam drain from humidifiers	Above Ground	Pipes up to 2" Domestic (US Make), seamless copper tubing (No ERW, longitudinal seam and imported piping are allowed.)	ASTM B88	Type L, Hard drawn	Brace with 15% eye brazing allow. Provide threaded connections at unions and valves	ANSI / ASME B16.22, Pipes up to 2" NIBCO T-585-70-66	Pipes up to 2" NIBCO T-585-70-66	Rigid Fiberglass, ASTM C335, K = 0.24 at 75°F; Min Service Temp: -20°F; Max Moisture Absorption: 0.2% by volume; Owens Corning, Certihard or John Manville	Title 24 compliant. Refer to 2013 nonresidential CEC manual, Table 4-15 Standards table 120.3-A Pipe Insulation Thickness	Exposed + 0.015" + 0.016" Aluminum	Yellow / Black with arrows in the direction of flow	Isolate valves and associated trim components with fiberglass insulation. Provide preformed demethyl for fittings and valves, or Approved Equal. Provide stem insulation on all ball valves serving insulated pipes to prevent formation of ice. Provide provisions for expansion and contraction as necessary for long pipe runs and high temperatures fluctuations.	Brace copper pipe joints and non-threaded fittings with 15% Si-Fee. Threaded fittings shall be insulated. Insulation should be taken not to smear the threads. Purge with nitrogen gas during installation to prevent oxidation. Provide provisions for expansion and contraction as necessary for long pipe runs and high temperatures fluctuations.	Pressure Test (Chemistry, Cleanout, and Passivation) Representative and signed off in writing. Neutralize the chemicals and flush the system. Complete and discharge the chemicals in a code-approved manner in compliance with CT design guide. Refer to campus design guide document for the details of cleaning and passivation procedures and chemicals. Supports shall be designed for seismic zone 4.	As per latest applicable CMC, NFPA, FM global and fire marshal requirements. Supports shall be designed for seismic zone 4.
H19	CS and CSCK	Clean Steam and Steam Condensate return Piping	Above Ground	Seamless stainless steel pipe/hubing, Grade 304L, ERW, seamless pipe, seamless pipes are unacceptable.	ASTM A312 / ASME SA312	Schedule 10S	Options 1, Gas Tungsten arc (GTAW) gas welding (TIG) for tungsten metal. Options 2, SWAGELOK tube and fittings are also acceptable.	Seamless stainless, Grade 304L, ASTM A312, ASME SA312	Option 1, 800R class steel gate valve with threaded union. Option 2, SWAGELOK ball valve. SWAGELOK ball valve need for steam application. SWAGELOK ball valve isolation valves installed higher than 10' above finished floor shall have chain operated hand wheel	Rigid Fiberglass, ASTM C335, K = 0.24 at 75°F; Min Service Temp: -20°F; Max Moisture Absorption: 0.2% by volume; Owens Corning, Certihard or John Manville. In areas where physical damage, insulate with Calcium Silicate, ASTM C533, ASTM C335, K = 0.38 at 75°F; Min Service Temp: -20°F; Max Moisture Absorption: 0.2% by volume; Cabotite Manufacturing Corp. only.	Title 24 compliant. Refer to 2013 nonresidential CEC manual, Table 4-15 Standards table 120.3-A Pipe Insulation Thickness	Exposed + 0.015" + 0.016" Aluminum	Yellow / Black with arrows in the direction of flow	Isolate valves and associated trim components with fiberglass insulation. Provide preformed demethyl for fittings and valves, or Approved Equal. Provide stem insulation on all ball valves serving insulated pipes to prevent formation of ice. Provide provisions for expansion and contraction as necessary for long pipe runs and high temperatures fluctuations.	Pressure Test (Chemistry, Cleanout, and Passivation) Representative and signed off in writing. Neutralize the chemicals and flush the system. Complete and discharge the chemicals in a code-approved manner in compliance with CT design guide. Refer to campus design guide document for the details of cleaning and passivation procedures and chemicals. Supports shall be designed for seismic zone 4.	As per latest applicable CMC, NFPA, FM global and fire marshal requirements. Supports shall be designed for seismic zone 4.	

Appendix XII_HVAC_Spec_Table_09-12-2014_rev05.xlsx

No	Abbreviation	Service	Location	Pipe Material	Class Compliance	Type	Joint	Fittings	Valves	Insulation Material	Insulation Size	Jacket	Background Color and Code	Remarks	Social Handling	Pressure Testing / Chemical Cleanout and Preservation	Red Size / Min. Spacing
H25	HHWS and HHWR	Heating Hot Water Supply and Return mains	Inside utility tunnels and airways	Pipe up to 3": Domestic US Made seamless ERW (No seam and imported piping are allowed.)	ASTM B88	Type L, Hard drawn	Brace with 15% Fos brazing alloy. Provide threaded connections at unions and valves	ANSI / ASME B16.22, Solder wrought pipe	Calcium silicate, ASTM C336, K = 0.24 at 75F; Min Service Temp: -450F; Max Moisture Absorption: 0.2% by volume;	Pipe up to 1", 1.5" thick fibreglass, 2" to 3" 2" thick Calcium silicate	12 ounce / square yard heavy canvas and arabinol jacking + 2 coats of high glass water-proof white paint	Yellow / Black with arrows in the direction of flow	Provide stem extensions on all ball valves serving insulated pipes to accommodate operation of the valve handle. Design engineer or contractor shall make any necessary provisions for thermal expansion and contraction.	Brace copper pipe joints and non-threaded fittings with 15% Si-Fos. Soldered fittings shall be lead-free solder. Care should be taken not to anneal the threads. Purge with Nitrogen gas during installation to prevent formation of oxides. Provide provisions for expansion and contraction necessary to compensate for long pipe runs and high temperatures fluctuations.		As per latest applicable CMC, NFPA, FM global and fire marshal requirements. Supports shall be designed for seismic zone 4.	
H26	HHWS and HHWR	Heating Hot Water Supply and Return mains	Inside utility tunnels and airways	Pipe 4" and above: ASTM A53-S, Grade A or B Steel Pipe (No seam and imported piping are allowed.)	ASTM A53-S, Grade A or B	Schedule 40, Pipe and above. Standard weight	8th verified AWS D1.1 or flanged. For flanged, use raised face flanges and gaskets. Mechanical joint couplings required at flange connections to facilitate de-coupling and maintenance.	Standard weight carbon steel, butt weld ASTM B16.3	Pipe up to 2", NIBCO T-595-70-66, Pipes 2.5", Apollo series 77-140, Pipes 3"-5", NIBCO LD3122-3, LD3122-5 lug valve butterfly valves. Raised full faced B16 studs and nuts higher than 10" above finished floor shall have chain operated hand wheel.	Calcium silicate, ASTM C336, K = 0.24 at 75F; Min Service Temp: -450F; Max Moisture Absorption: 0.2% by volume;	Pipe 4" and above: 2" thick Calcium silicate	12 ounce / square yard heavy canvas and arabinol jacking + 2 coats of high glass water-proof white paint	Yellow / Black with arrows in the direction of flow	Provide stem extensions on all ball valves serving insulated pipes to accommodate operation of the valve handle. Design engineer or contractor shall analyze the pipe work and make any necessary provisions for thermal expansion and contraction.	Steel and copper piping system shall be installed in accordance with minimum of 48 hours. Pressure test piping system with compressed air for a minimum of 24 hours at 150 psig, record initial and final pressures. Repair any leaks and retest piping system. Pressure test fire marshal requirements. Pressure test shall be observed by a Certified Inspection representative and signed off in writing. Neutralize the chemicals and flush piping. Neutralize the chemicals in a code-approved manner in compliance with OIT design guide. Refer to campus design guide document for the details of cleaning and preservation procedures and chemicals.	As per latest applicable CMC, NFPA, FM global and fire marshal requirements. Supports shall be designed for seismic zone 4.	

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