	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: HVAC Standards	Section: 23 21 13 Piping: Hydronic, Steam, Condensate and Welding Requirements
		Date: 6/15/16
		Author: Office of Facilities
CC: Project Folder		

Date	Description of Change	Pages / Sections Modified	ID
6/15/16	Entire document	-	mg144

PART 1 - INTRODUCTION

- A. This standard refers to piping and welding requirements for both Building and Utility Systems. Refer to the Service Index matrix for other Standards applicable to pipe, and valve requirements.

PART 2 - PIPING SYSTEMS


2.1 PIPING CODE COMPLIANCE

- A. All piping systems (steam, condensate return, and chilled water) in all locations within the utility and building distribution system scope shall be designed, fabricated, erected, and tested in accordance with ASME B31.1. Building systems may be in accordance with ASME B31.9 as that code allows.

2.2 DESIGN PARAMETER

A. General

1. All piping systems and all components within the piping systems shall be designed for the "Maximum Design Pressure and Temperature" conditions listed below. These conditions are the maximum pressure and temperature that will be experienced in the piping system (exclusive of any type of water hammer). This includes thermal stress analyses and anchors for expansion joints where a pressure thrust force can be experienced. This is the "Design Pressure" per ASME B31.1. The steam maximum conditions are determined by safety relief valves in the steam generating equipment or pressure regulating valves in the CPP. The trap return maximum conditions are determined from the same values since isolation valves in the system can keep these pressures to the corresponding steam conditions. The pumped return maximum condition is an estimate of the highest conceivable dead head pressure of a condensate return pump. The chilled water maximum pressure is the dead head point for the chilled water distribution pumps in the CPP and the cumulative static head pressure on the system.

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2. "Normal Operating" conditions are the system conditions where the utilities leave the CPP or downstream of distribution pressure regulating stations. Actual available steam or chilled water pressure at buildings will be lower due to the pressure drop through the distribution system. For the normal and minimum available pressures available at each building, request this data from Yale Utilities. Do not look at a pressure gage at a building and assume that pressure will always be available - pressures can drop significantly seasonally when demand peaks.


B. Steam

1. General
2. Steam is distributed at various pressures. For new projects, discuss available pressures with Yale Utilities.
3. For thermal stress analyses, consider the install temperature to be no higher than 50 deg F. If work is to be installed outdoors, unprotected from the elements during the winter period, consider lowering the install temperature to something more appropriate.

C. High Pressure Steam: Designate this system as "HPS"

1. HPS - 250 PSIG (Primarily in Science Hill distribution from CPP)
 - a. Maximum Design Pressure and Temperature: 300 PSIG at 410 deg. F
 - b. Normal Operating Pressure and Temperature: 250 PSIG at 406 deg F (saturated)
2. HPS - 125 PSIG (Primarily in Central Campus distribution from CPP and all HPS of SPP)
 - a. Maximum Design Pressure and Temperature: 150 PSIG at 366 deg F (saturated)
 - b. Normal Operating Pressure and Temperature: 125 PSIG at 353 deg F (saturated)

- D. Medium Pressure Steam: Designate this system as "MPS". For each project, refer to Yale Utilities for possibly using "Maximum Design Pressure and Temperature" conditions for HPS system so that in the future, the piping system can be converted to HPS with no modifications except for replacing steam traps and re-insulating. This way, the new piping system will be designed for thermal expansion and pressure and temperature for the higher

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conditions.

1. MPS - 70 PSIG (Primarily in Science Hill distribution from CPP)
 - a. Maximum Design Pressure and Temperature: 80 PSIG at 324 deg F (saturated)
 - b. Normal Operating Pressure and Temperature: 70 PSIG at 316 deg F (saturated)
 2. MPS - 30 PSIG (Primarily in Central Campus distribution from CPP)
 - a. Maximum Design Pressure and Temperature: 40 PSIG at 287 deg F (saturated)
 - b. Normal Operating Pressure and Temperature: 30 PSIG at 274 deg F (saturated)
- E. Low Pressure Steam: Designate this system as "LPS" (Primarily in Central Campus distribution from CPP and all LPS of SPP). For each project, refer to Yale Utilities for possibly using "Maximum Design Pressure and Temperature" conditions for HPS or MPS system so that in the future, the piping system can be converted to HPS or MPS with no modifications except for replacing steam traps and re-insulating. This way, the new piping system will be designed for thermal expansion and pressure and temperature for the higher conditions.
1. Maximum Design Pressure and Temperature: 20 PSIG at 259 deg F (saturated)
 2. Normal Operating Pressures and Temperature: 10 PSIG at 239 deg F (saturated)


2.3 Condensate Return

A. General

1. Condensate return consists of trap returns from the distribution system and pumped returns from the buildings and distribution steam condensate return packages. In some cases, trap condensate from the distribution system is connected directly to the pumped return line. This is no longer allowed and all existing connections of this type are being retrofitted. If you discover this condition in an area where you are performing design, please ask Yale Utilities if it should be retrofitted. All high pressure and medium pressure distribution trap returns shall be flashed in tunnels to low pressure steam systems (complete with relief valve) and all low pressure traps shall be gravity returned.
2. For thermal stress analyses, consider the install temperature to be no higher than 50 deg F.

2.4 Trap Returns

- A. All trap returns design and operating pressures and temperatures shall match the steam

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conditions, i.e., trap returns from an "HPS" steam trap shall have maximum design pressure and temperature of 300 PSIG at 410 deg. F.

1. Trap return piping shall be labeled as follows:
 - a. From "HPS" traps: "HPC" for high pressure condensate or "HPR" for high pressure return.
 - b. From "MPS" traps: "MPC" or "MPR".
 - c. From "LPS" traps: "LPC" or "LPR".

B. Where trap returns from different pressure systems join together upstream of a flash tank to atmosphere where they can be valved off, all of the trap return piping shall be designed for the higher pressure system.

2.5 Pumped Returns: Shall be labeled as "PC". Refer to "Condensate Return Units" for design of pumps.

A. Maximum Design Pressure and Temperature: 75 PSIG at 212 deg F. Note that in cases where trap returns discharge into the pumped return line, consideration should be made to increase the maximum design pressure to the trap system conditions.

B. Normal Operating Pressure and Temperature: Determine from Yale Utilities per the "Condensate Return Units" paragraph.

2.6 VELOCITY AND PRESSURE DROP LIMITS

A. General

1. Pipes shall be sized to satisfy the more restrictive condition of velocity or pressure drop. In areas where noise may be an issue (basements or mechanical rooms), size lines for slower velocities.


2. Steam

a. HPS and MPS Systems

1) For 4" piping and lower: Maximum velocity shall be 8,000 FT/MIN. Maximum pressure drop shall be 0.5 PSID / 100 FT.

2) For piping larger than 4": Maximum velocity shall be 12,000 FT/MIN. Maximum pressure drop shall be 0.5 PSID / 100 FT.

b. LPS System

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- 1) For 4" piping and lower: Maximum velocity shall be 4,000 FT/MIN. Maximum pressure drop shall be 0.5 PSID / 100 FT.
- 2) For piping larger than 4": Maximum velocity shall be 8,000 FT/MIN. Maximum pressure drop shall be 0.5 PSID / 100 FT.

c. Condensate Return

- 1) Trap Returns: Maximum velocity shall be 4,000 FT/MIN in consideration of two phase flow. Maximum pressure drop shall be 1 PSID / 100 FT.
- 2) Pumped Returns: Maximum velocity shall be 10 FT/SEC. Maximum pressure drop shall be 1 PSID / 100 FT.

d. Chilled, Hot, and Glycol Fluid

- 1) For 2" piping and lower: Maximum velocity shall be 4 FT/SEC.
- 2) For 2-1/2" piping and larger: Maximum velocity shall be 8 FT/SEC.
- 3) Maximum pressure drop shall be 4 FT HD / 100 FT.


B. Country of Fabrication / ISO Registration

1. All piping, fittings, and specialties including expansion joints, strainers, etc. shall be manufactured, fabricated, and assembled in the United States or Canada, or they shall be by an ISO 9001 registered corporation. No piping, fittings, or specialties manufactured, fabricated, and/or assembled in China, Taiwan, or India are permitted on any project including those companies registered with ISO 9001.

2.7 PIPING SYSTEM SPECIFICATIONS

A. General

1. Piping shall be as specified for each particular system. Victaulic, fiberglass, Propress, and FRP piping are not acceptable. Refer to Service matrix for applicable Pipe Class Specification, at the end of this standard.
- 2.

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PART 3 - WELDING


3.1 A. WELDING REQUIREMENTS

A. General

1. Weld pipe joints only when ambient temperature is above 0 degree F where possible.
2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
3. Use pipe clamps or tack-weld joints with 1 inch long welds; 4 welds for pipe sizes to 10 inches, 8 welds for pipe sizes 12 inches to 20 inches.
4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.
5. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
6. If piping component ends are bored, such boring shall not result in the finished wall thickness after welding less than the minimum design thickness.
7. The inside diameters of piping components to be butt-welded shall be aligned as accurately as is practicable within existing commercial tolerances on diameters, wall thickness and out of roundness. Alignment shall be preserved during welding. The internal misalignment of the ends to be joined shall not exceed 0.05 inch.

B. Welding Processes

1. All welding on metal piping systems shall be performed using qualified welding procedures and qualified welders and welding operators in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.
2. All welding shall be performed by a process that is compatible with the work being welded and the working conditions. Shielded metal-arc welding (SMAW) shall not be used on work less than 3/16 inch thick.
3. Work thicker than 3/16 inch shall have a root pass by the GTAW process with the back purged with argon and the balance of the weld may be completed by the SMAW process or other process as stated below.
4. Welding shall be performed by using only one of the following processes:
 - a. Shielded Metal Arc Welding (SMAW), also known as "Stick" Welding
 - b. Gas Turgsten Arc Welding (GTAW), also known as TIG and Heliarc Welding
 - c. Submerged Arc Welding (SAW)

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d. Metal Inert Gas Welding (MIG)

5. Spray Rustoleum on welds after welding to prevent rust.

C. Welding Grooves

1. The ends of steel pipe and fittings to be erected with butt welded joints shall be beveled to form welding grooves in accordance with ASME B16.25.
2. Welding grooves for butt welded joints in pipe of unequal wall thickness shall be beveled in accordance with ASME Code for Pressure Piping B31.1.

D. Backing Rings

1. Backing rings shall not be used.

E. Cleaning of Welding


1. All slag or flux remaining on the bead of welding shall be completely removed before laying down the next successive bead and at the completion of the weld.

F. Weld Quality

1. All welds shall have full penetration and complete fusion with a minimum of weld metal protruding on the inside of the pipe.
2. The finished weld contour shall be uniform, with the toe or edge of the weld merging smoothly into the base material. Butt welds shall have a slight reinforcement build-up gradually from the toe or edge toward the center of the weld. The limitation on butt weld reinforcement shall be in accordance with ASME B31.1, Table 127.4.2 and shall apply separately to both inside and outside surfaces of the joint. Fillet welds may be slightly concave on the furnished surface.

G. Socket Welding Joints

1. Where socket welding valves or fittings are used, the pipe shall be spaced with a minimum of 1/16 inch clearance between the end of the pipe and the socket so that no stresses will be imparted to the weld due to "bottoming" of the pipe in the socket. The fit between the socket and the pipe shall conform to applicable standards for socket weld fittings and in no case shall the inside diameter of the socket exceed the outside diameter of the pipe by more than 0.075 inches.

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3.2 WELDER QUALIFICATIONS

A. Welding Procedures


1. In the form of a submittal, the Contractor shall record in detail and shall qualify the Welding Procedure Specifications for every welding procedure that he proposes. Procedures shall be developed for all metals included in the work. The procedures for making transition welds between different materials or between plates or pipes of different wall thickness shall be qualified. Qualification for each welding procedure shall conform to the requirements of ASME B31.1, and to this specification. The method for each system shall be fully described including the number of beads, the volts, the amperes, and the welding rod for various pipe thicknesses and materials. The welding procedures shall specify end preparation for butt welds including cleaning, alignment, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by approved welding procedures, unless otherwise indicated or specified. Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. Welding procedures shall be identified individually and shall be clearly referenced to the type of welding required for this project. These procedures shall be the same as those used for all pipe welder qualification tests, all shop welds, and all field welds. The Contractor shall provide Procedure Qualification Records for all proposed Welding Procedure Specifications (WPS).

B. Welding Procedure Submittals

1. Submit the following:
 - a. Welding Procedure Specifications: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00006, QW-482 "Suggested Format for Welding Procedure Specification (WPS)".
 - b. Procedure Qualification Records: Provide for each weld type. It is highly recommended that the Contractor use ASME Form E00007, QW-483 "Suggested Format for Procedure Qualification Record (PQR)".

C. Welder Qualification

1. WPQs: Provide welder qualifications for each welder for each weld type. It is highly recommended that the Contractor use ASME Form E00008, QW-484 "Suggested Format for Manufacturer's Record of Welder or Welding Operation Qualification Tests (WPQ)." The WPQs shall be performed under the witness of an independent

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agency. The witness shall be a representative of an independent testing agency, Authorized Inspector, or consultant, any of which must be approved by the National Certified Pipe Welding Bureau. The qualifying test segment must be a 2 inch nominal pipe size with wall thickness within range of the WPS. Tests position shall be "6G" per ASME Section IX.

2. Evidence of Continuity: Welder qualifications must be current. If the qualification test is more than 6 months old, provide record of welding continuity for each welder. Record of welding continuity shall show that the welder in question has performed welding to the procedure in question without a 6 month continuous span of inactivity since the date that the welder qualification test was passed for the submitted welding procedure. Record of welding continuity shall include, at a minimum, the welder's employer name and address, the date the welder qualification test was passed, and the dates indicating welding continuity including welding procedure for each date.
3. In lieu of providing WPQs and Evidence of Continuity, the Contractor may elect to have all welders qualified on-site by an Independent Testing Agency prior to beginning work. This may be required by Yale Utilities, especially on larger projects.


3.3 WELD RECORDS

A. General

1. For all welding within the scope of ASME B31.1, the Contractor shall submit for approval an administrative procedure for recording, locating, monitoring, and maintaining the quality of all welds to be performed on the project. This quality control document record shall include but not be limited to drawings and schedules identifying location of each weld by individual number, identification of welder who performed each weld by individual welder's name, stamp number, date and WPS used.
2. After achieving qualification, but before being assigned work, each qualified person shall be assigned an identifying number by the Contractor that shall be used to identify all of his welds. A list of qualified persons with their respective numbers shall be submitted by the Contractor and shall be maintained accurately with deletions and additions reported promptly.
3. Upon completing a joint, the welder shall mark the pipe not more than 6 inches from the weld with the identifying number and the last two digits of the year in which the work was performed. Identification marks shall be made by using a rubber stamp or felt-tipped marker with permanent, weatherproof ink or other methods approved by the Engineer that do not deform the metal. For seam welds, identification marks shall

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be placed adjacent to the welds at 3-foot intervals. Identification by die stamps or electric etchers will not be allowed. The markers are to be provided by the Contractor. Substituting a map of welds with welders' names shall not be acceptable.

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PIPE CLASS SPECIFICATION SHEET

Pipe class: CT-01

Typical Services: Compressed Air, Condenser Water, CT Overflow, Diesel Generator Cooling, Domestic Hot Water Recirculation, Hot Nonpotable Water, Indirect Drain, Instrument Air, Nitrogen, Nonpotable Water, Potable Water, Process Vacuum, Sanitary Waste, Chilled Water, Heating Hot Water, and Tempered Water.

Rating: **Pressure 125 psig at 200 degrees F**

Codes: ANSI B31.3 (except systems falling under plumbing jurisdiction)

Pipe:

Above ground: Copper, seamless, Type L, hard drawn, ASTM B88

Below ground: Copper, seamless, Type K, hard drawn, ASTM B88

2 Inches and Under:

2 1/2 Inches and Above:

Fittings: Wrought copper, ANSI B16.22 socket joint, B75

Flanges: Copper, socket joint, Class 125 FF

Unions: Copper, socket joint, Brass or bronze ring nut


Solder: 95-5 tin-antimony

Brazing: Brazing, ASTM B260; melting range, 1,185 DegF to 1,300 Deg F; Aircosil 15 or Silphos

Notes:

1. For copper pipe 2 inches and below, use solder.
2. For copper pipe 2-1/2 inches and above, use brazing.
3. Piping and material for potable water systems shall be NSF 61 Annex G no-lead compliant. Solder joints shall be with approved no-lead solder.
4. "Propress" type fittings are prohibited, unless specifically approved by Engineering.

END OF CT-01 SECTION

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PIPE CLASS SPECIFICATION SHEET

Pipe class: CS-01

Typical Services: (Refer to Service Matrix)
 Chilled Water, Condenser Water, Condenser Water Equalization, Diesel Generator Cooling, HVAC Heating.


Rating: Pressure 150 psi

Code: ASME B31.3

Pipe:

2 inches and under:	Carbon steel, black, ASTM A53, Type B, CW, Schedule 40, threaded and coupled. Schedule "STD".
2-1/2 inches through 24 inches	All pipe 2 -1/2 inches through 24 inches shall be electric resistance weld carbon steel conforming to ASTM A 53, Grade B. Pipe wall thickness shall be Schedule "STD" for all pipe sizes.
Pipe Nipples	All threaded carbon steel pipe nipples shall be Schedule "XS" conforming to ASTM A 106, Grade B.

Pipe class: CS-01 (Continued on following page)

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Pipe class: 2 Inches and Under CS-01 (Continued from previous page)

	<u>2 Inches and Under</u>	<u>2-1/2 through 24 Inches</u>	<u>Notes</u>
Joints	Joints 2 inches and smaller shall be threaded for carbon steel.	Joints 2-1/2 inches and larger shall be butt welded.	1
Flanges	Forged steel, threaded, Class 150 RF	Slip-on and weld neck, Class 150 RF, ASTM A105	
Gaskets	Gaskets shall be spirally wound, Type 316L stainless steel with non-asbestos filler material and carbon steel outer ring. Gaskets shall be 1/8 inch thick and conform to the flange face on which they are used. Acceptable products from acceptable manufacturers include: Flexitallic Style CG with Flexite Super Filler, manufactured by Flexitallic Inc., 6915 Hwy. 225, Deer Park, TX 77536; Phone Number (281) 479- 3491; or approved equal.		
Fittings	Fittings 2 inches and smaller shall be 150 pound screwed banded malleable iron threaded in accordance with ASME B16.3. Material shall conform to ASTM A 197.	Fittings 2-1/2 inches and larger shall be steel butt-welding type in accordance with ASME B16.9 and with the same wall thickness as the attached pipe. Material shall conform to ASTM A 234, Grade WPB.	2
Bolting	Bolting materials shall be continuous threaded alloy steel studs threaded in accordance with ASME B18.2.1. Material shall conform to ASTM A 193, Grade B7. Nuts shall be heat-treated, heavy, hexagonal nuts, semi-finished and in accordance with ASME B18.2.2. Material shall conform to ASTM A 194, Grade 2H. Bolting materials shall be mild steel, hexagonal head bolts with heavy hexagonal nuts conforming to ASTM A 307, Grade B.		
Unions	MI, black, 150 psi, ASTM A197, bronze to iron seats	Use flanges	
Sockolets	Forged steel, 3,000 psi, ASTM A105	None	
Weldolets	None	Standard weight, ASTM A105	

Notes:

- 1.) All sizes shall be flanged where required to connect to flanged valves, fittings, or equipment.
- 2.) Mitered branches may be used when reinforced according to ASME B31.1. Reinforcing shall consist of increased header thickness, increased outlet pipe thickness, strap or weld type reinforcement, welding type reinforcing saddles, or a combination of these methods.

Pipe class: CS-01 (End of Section)


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PIPE CLASS SPECIFICATION SHEET

Pipe class: CS-02
 Typical Services: (Refer to Service Matrix)
 LPS, MPS, and HPS
 Rating: Pressure 300 psi
 Code: ASME B31.3
 Pipe:

2 inches and under:	All pipe 2 inches and smaller shall be seamless carbon steel conforming to ASTM A 106, Grade B.
2-1/2 inches through 24 inches	All pipe 2-1/2 inches through 24 inches shall be seamless carbon steel conforming to ASTM A 106, Grade B. Pipe wall thickness shall be Schedule "XS" for 1/8" through 2" NPS pipe size and Schedule "STD" for 2-1/2" through 24".
Pipe Nipples	All threaded pipe nipples shall be Schedule "XS" conforming to ASTM A 106, Grade B.

Pipe class: CS-02 (Continued on following page)

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Pipe class: CS-02 (Continued from previous page)

	<u>2 Inches and Under</u>	<u>2-1/2 through 24 Inches</u>	<u>Notes</u>
Joints	Joints 2 inches and smaller shall be socket welded.	Joints 2-1/2 inches and larger shall be butt welded.	1
Flanges	Flanges 24 inches and smaller shall be Class 300 welding neck type in accordance with ASME B16.5 and raised faced or as required to match the mating flange.	Material shall conform to ASTM A 105. Welding neck flanges shall be bored to match the same ID as the attached pipe.	
Gaskets	Gaskets shall be spirally wound, Type 316L stainless steel with non-asbestos filler material and carbon steel outer ring. Gaskets shall be 1/8 inch thick and conform to the flange face on which they are used. Acceptable products from acceptable manufacturers include: Flexitallic Style CG with Flexite Super Filler, manufactured by Flexitallic Inc., 6915 Hwy. 225, Deer Park, TX 77536; Phone Number (281) 479- 3491; or approved equal.		
Fittings	Fittings 2 inches and smaller shall be 3000 pound socket-weld in accordance with ASME B16.11. Material shall conform to ASTM A 105.	Fittings 2-1/2 inches and larger shall be steel butt-welding type in accordance with ASME B16.9 and with the same wall thickness as the attached pipe. Material shall conform to ASTM A 234, Grade WPB.	2
Bolting	Bolting materials shall be continuous threaded alloy steel studs threaded in accordance with ASME B1.1, Class 2A. Material shall conform to ASTM A 193, Grade B7. Nuts shall be heat-treated, heavy, hexagonal nuts, semi-finished and in accordance with ASME B18.2.2 and B1.1, Class 2B. Material shall conform to ASTM A 914, Grade 2H.		
Unions	Unions 2 inches and smaller shall be 3000 pound forged steel socket weld with steel to steel seats. Material shall conform to ASTM A 105.	Use flanges	
Sockolets	Forged steel, 3,000 psi, ASTM A105	None	
Weldolets	None	Standard weight, ASTM A105	

Notes:

- 1.) All sizes shall be flanged where required to connect to flanged valves, fittings, or equipment.
- 2.) Mitered branches may be used when reinforced according to ASME B31.1. Reinforcing shall consist of increased header thickness, increased outlet pipe thickness, strap or weld type reinforcement, welding type reinforcing saddles, or a combination of these methods.

Pipe class: CS-02 (End of Section)

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PIPE CLASS SPECIFICATION SHEET

Pipe Class: CS-03

Typical Services: (Refer to Service Matrix)
 Condensate steam systems (Gravity, LP, MP, HP, and Pumped HPC, MPC, LPC)


Rating: Pressure 150 psi

Code: ASME B31.3

Pipe:

2 inches and under:	All pipe shall be electric resistance welded carbon steel conforming to ASTM A 53, Grade B. Pipe wall thickness shall be Schedule "XS" for 3/4" through 24".
2-1/2 inches through 24 inches	All pipe shall be electric resistance welded carbon steel conforming to ASTM A 53, Grade B. Pipe wall thickness shall be Schedule "XS" for 3/4" through 24".
Nipples (Threaded)	All threaded pipe nipples shall be Schedule "XS" conforming to ASTM A 106, Grade B.

Pipe class: CS-03 (Continued on following page)

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Pipe class: CS-03 (Continued from previous page)

	<u>2 Inches and Under</u>	<u>2-1/2 through 24 Inches</u>	<u>Notes</u>
Joints	Joints 2 inches and smaller shall be socket welded.	Joints 2-1/2 inches and larger shall be butt welded.	1
Flanges	Flanges 24 inches and smaller shall be Class 150 welding neck type in accordance with ASME B16.5 and raised or flat faced as required to match the mating flange. Material shall conform to ASTM A 105. Welding neck flanges shall be bored to match the same ID as the attached pipe.		
Gaskets	Gaskets shall be spirally wound, Type 316L stainless steel with non-asbestos filler material and carbon steel outer ring. Gaskets shall be 1/8 inch thick and conform to the flange face on which they are used. Acceptable products from acceptable manufacturers include: Flexitallic Style CG with Flexite Super Filler, manufactured by Flexitallic Inc., 6915 Hwy. 225, Deer Park, TX 77536; Phone Number (281) 479- 3491; or approved equal.		
Fittings	Fittings 2 inches and smaller shall be 3000 pound socket-weld in accordance with ASME B16.11. Material shall conform to ASTM A 105.	Fittings 2-1/2 inches and larger shall be steel butt-welding type in accordance with ASME B16.9 and with the same wall thickness as the attached pipe. Material shall conform to ASTM A 234, Grade WPB.	2
Bolting	Bolting materials shall be continuous threaded alloy steel studs threaded in accordance with ASME B18.2.1. Material shall conform to ASTM A 193, Grade B7. Nuts shall be heat-treated, heavy, hexagonal nuts, semi-finished and in accordance with ASME B18.2.2. Material shall conform to ASTM A 194, Grade 2H.		
Unions	a. Unions 2 inches and smaller shall be 3000 pound forged steel socket weld with steel to steel seats. Material shall conform to ASTM A 105. b.	Use flanges	
Sockolets	Forged steel, 3,000 psi, ASTM A105	None	
Weldolets	None	Standard weight, ASTM A105	

Notes:

- 3.) All sizes shall be flanged where required to connect to flanged valves, fittings, or equipment.
- 4.) Mitered branches may be used when reinforced according to ASME B31.1. Reinforcing shall consist of increased header thickness, increased outlet pipe thickness, strap or weld type reinforcement, welding type reinforcing saddles, or a combination of these methods.

Pipe class: CS-03 (End of Section)

	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: HVAC Standards	Section: 23 21 13 Piping: Hydronic, Steam, Condensate and Welding Requirements
		Date: 6/15/16
		Author: Office of Facilities
CC: Project Folder		

PIPE CLASS SPECIFICATION SHEET

Pipe class: CS-04

Typical Services: (Refer to Service Index)
Pumped Sanitary Waste Above Ground, Pumped Storm Drain

Rating: Pressure 125 psi at minus 20/350 degrees F

Pipe:


4 inches and under	ASTM A53B, Type F, CW, Schedule 40, galvanized, threaded and coupled
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Nipples Schedule 40

Miscellaneous:

Fittings	Galvanized, standard, threaded
Flanges	Forged steel, Class 150, galvanized, threaded
Unions	Galvanized, bronze-to-iron seat

Pipe class: CS-04 (End of Section)

	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: HVAC Standards	Section: 23 21 13 Piping: Hydronic, Steam, Condensate and Welding Requirements
		Date: 6/15/16
		Author: Office of Facilities
CC: Project Folder		

PIPE CLASS SPECIFICATION SHEET

Pipe class: CS-05

Typical Services: (Refer to Service Index)
Condensate Drain

Rating: Pressure 125 psi at minus 20/400 degrees F

Codes: ASME B31.1

Pipe - Above Ground:

PART 1 - 2inch and under	PART 2 - ASTM A106B, seamless, Schedule 80, plain end
PART 3 - 2-1/2 inches and above	PART 4 - ASTM A53B, seamless or ERW, standard weight, plain end

Nipples: Schedule 80

	<u>2 Inches and Under</u>	<u>Over 2 Inches</u>
Fittings	Malleable iron, 300 psi, threaded, ASTM A197	Butt weld, ASTM A234
Flanges	Forged steel, socket weld, Class 150 RF, ASTM A105	Same, except weld neck
Unions	1 inch and under 3,000 psi, forged steel, steel to steel, ASTM A105, threaded	None
Threadolets	3,000 psi, ASTM A105 threaded	None
Weldolets	None	Standard weight, ASTM A105

Notes:

- a. Use flat-faced compression flanges when mating to flat-faced valves and equipment.

Pipe class: CS-05 (End of Section)