

Project Manual

for

Southern Utah University Steam/Condensate Safety Line Repair DFCM Project No.: 09117730 2 of 2



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State of Utah—Department of Administrative Services

DIVISION OF FACILITIES CONSTRUCTION
AND MANAGEMENT

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DFCM Project No.: 09117730
Steam/Condensate Safety Line Repair

Division of Facilities Construction and Management
Southern Utah University
Cedar City, Utah

Resp. Charge	Section	Title	Page
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SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP – See Drawing GG2

FACILITY SERVICES SUBGROUP

DIVISION 20	FACILITY SERVICES		
20 05 00	Common Work Results for Facility Services Pipe Class Specifications		1 thru 4
20 05 13	ACS1 – ASME Class 150 Seamless Carbon Steel Welding Requirements for Facility Services Systems		1 thru 7
20 05 23	General Duty Valves for Facility Services Piping		1 thru 2
20 05 26	Piping Specialties for Facility Services Systems		1 thru 2
20 07 00	Facility Services Systems Insulation		1 thru 4
DRAWING LIST			1 thru 1
DRAWINGS			Bound Herein

Drawing No.	Title	Rev. No.
GG1	Title Sheet & Sheet Index	0
GG2	General Notes	0
MP1	Existing and New Steam Trap Locations – North Campus	0
MP2	Existing and New Steam Trap Locations – South Campus	0
MD1	Mechanical Details	0

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe materials.
- B. Fittings, unions, flanges, and couplings.
- C. Welding fittings.
- D. Piping identification.
- E. Pipe joining methods.
- F. Cleaning and protection.
- G. Leakage tests.
- H. Piping schedules.

1.02 SUBMITTALS

- A. Quality assurance data: Certified records, indicating that procedures used and welding operators employed are in compliance with codes referenced in article "Quality Assurance."

1.03 QUALITY ASSURANCE

- A. Regulatory requirements:
 - 1. Piping construction criteria shall conform to requirements of ANSI B31.1 as applicable. Work shall also comply with applicable state and local codes.
 - 2. Qualification of welding procedures to be used and welding operators shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX.
- B. Certifications: New materials and equipment shall bear manufacturer's name, model number, or other identification marking.
- C. Standard product shall be of latest design with published properties of manufacturer regularly engaged in production of specified material or equipment for minimum 5 years (unless exempted by Engineer).
- D. Unless otherwise indicated, equipment of same type in same room shall match color, finish, and design.
- E. Standardization: Unless otherwise submitted to and accepted by Engineer, equipment and its devices shall be of same manufacturer; or devices must be approved and warranted by equipment manufacturer.
- F. All piping and fittings shall be manufactured in the United States (domestic).

1.04 COORDINATION

- A. Coordinate with all trades regarding location and size of pipes, equipment, ducts, openings, light fixtures, and other similar items mutually located in same or adjacent spaces.
- B. Make minor modifications in Work required by interferences (structural, work of other trades) following notification to Engineer.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

- A. Pipe materials shall be as specified herein and in Mechanical Standards bound at end of Project Manual. No asbestos shall be used. If pipe wall thickness specified is not available, use next heavier wall.

2.02 FITTINGS - GENERAL

- A. Material, wall thickness, and pressure class: As specified in article "Pipe Materials," unless otherwise noted.
- B. Use long radius fittings, except where space limitations require short radius.

2.03 UNIONS, FLANGES, AND COUPLINGS

- A. Pressure class, material, and facing: As specified in article "Pipe Materials."
- B. Pipe size 2" and smaller: Malleable iron unions for threaded ferrous piping
- C. Pipe size 2-1/2" and larger: Forged steel welding neck or slip-on flanges for ferrous piping.

2.04 WELDING FITTINGS

- A. Material and wall thickness: As specified in article "Pipe Materials."
- B. Use welding tees for socket-welded piping for field-fabricated branch tees in butt-weld end piping.
- C. Nozzle-welded branches or "Weldolets" and "Threadolets" only.
- D. Mitering of pipe to form elbows, notching straight pipe to form tees, and similar construction will not be acceptable for pressure piping except where specifically permitted in Mechanical Standards.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Equipment shall be installed in accordance with manufacturers' recommendations.
- B. Install piping as shown on Drawing and as specified.
- C. Provide sufficient unions and flanges to permit removal of equipment.
- D. Spacing of piping shall be adequate to permit servicing valves and specialties and replacing sections of pipe.
- E. Slope pipe as indicated on drawings.
- F. Provide nuts, bolts, gaskets, and washers for complete and proper installation.
- G. Provide dirt legs and main drips as indicated on drawings.

3.02 PIPE JOINING METHODS

- A. Comply with Mechanical Standards listed under article "Pipe Materials" and with requirements of ANSI B31, unless otherwise indicated.
- B. Threaded joints:
 - 1. Clean-cut threads, ream pipe ends, and remove burrs.
 - 2. Apply suitable lubricating, noncorrosive, flexible pipe joint compound to male threads only.
- C. Flanged joints:
 - 1. Clean mating surfaces of flanges.
 - 2. Install gasket and tighten bolts evenly.
- D. Weld joints:
 - 1. Cut pipe square, and prepare pipe ends for welding as required by ANSI B31.
 - 2. Workmanship shall conform to details and requirements of ANSI B31.
- E. Other joints and jointing methods: In accordance with Pipe Material Schedule and Mechanical Standards.

3.03 LEAKAGE TESTS

- A. Notify Engineer and Owner of intent to test piping at least 1 week prior to test. Test in presence of Engineer and Owner, unless notified otherwise.
- B. Vents and gravity drainage piping: Cap discharge, fill with water, and check for leaks.
- C. Other piping: Test hydrostatically, in accordance with ANSI B31.
- D. Provide pumps, compressors, meters, gages, piping, fittings, accessories, and labor required to conduct tests.
- E. Isolate equipment that may be damaged by test pressure.
- F. Refit joints indicating leakage, replace defective pipe, fittings, and accessories.

3.04 CLEANING AND PROTECTION

- A. Remove foreign material from pipes before erection.
- B. Close ends of partially erected systems.
- C. Remove temporary preservative coatings from valves and accessories.
- D. Flush or otherwise clean systems after erection.
- E. Prior to conducting final performance test Contractor shall verify that strainers are clean.
- F. Contractor shall be responsible for malfunctioning of pumps, valves, controls, or other equipment due to presence of foreign material. Contractor shall clean, repair or replace malfunctioning equipment at no cost to Owner.

3.05 EXTERIOR AND BURIED INTERIOR PIPING SCHEDULE

Service	Pipe	Mechanical Standard No.
Steam		

Service	Pipe	Mechanical Standard No.
3/4" and larger	ASTM A53 GR B, Type S	ACS1
Condensate	ASTM-A53 GR B, Type S	ACS1

END OF SECTION

- 1) C.H. Kim
- 2) D. Scanlon



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PIPE CLASS SPECIFICATION - ACS1

MAWP	TEMP, °F	100	200	300	400	500	600	650	700	750	775	
	PRESS, PSIG	285	260	230	200	170	140	125	110	95	87	
PIPE	MATERIAL, ASTM	A53 GR B, TYPE S OR A106 GR B										
	NOMINAL PIPE SIZES AND SCHEDULE	3/4" - 2"						XS				
		2-1/2" - 24"						STD				
JOINT	TYPE	THREADED		SOCKET WELD		BUTT WELD		FLANGED				
	USE FOR PIPE SIZES	NONE		3/4" - 2"		2-1/2" - 24"		NONE				
FITTINGS	MATERIAL, ASTM			A105		A234 WPB						
	PRESS CL, ASME B16.11			3000								
	MINIMUM WALL THICKNESS					MATCH PIPE						
	WELDING END					ASME B16.25						
	UNIONS			GROUND JOINT		NONE						
FLANGES	MATERIAL, ASTM	A105										
	PRESS CL, ASME B16.5	150										
	FACING	1/16" RF SERRATED										
	GASKETS ASME B16.20	304 SS SPIRAL WOUND FLEXITALLIC FLEXICARB STYLE CG OR EQUAL, UNLESS SPECIFIED OTHERWISE.										
	BOLTS & NUTS	A193 GR B7 STUD BOLTS & A194 GR 2H HEAVY HEX NUTS										
GENERAL NOTES & COMMENTS:												
1. THREADED JOINTS NOT ALLOWED UNLESS SPECIFIED OTHERWISE.												
2. THREADED JOINTS ALLOWED FOR INSERTION TYPE TEMPERATURE WELLS. WELLS SHALL BE SEAL WELDED. USE CLASS 2000 A105 FITTINGS.												
3. BACKING RINGS NOT PERMITTED.												
4. BUTT WELD END PREPARATIONS 1. NOMINAL PIPE WALL THICKNESSES 0.375" AND LESS: CONFORM TO ASME B16.25, FIGURE 2, DETAIL (A).												
5. FURNISH FLAT FACED FLANGES AND USE FULL-FACED GASKETS WHERE REQUIRED FOR CONNECTION TO CAST IRON FLANGES.												
6. FLANGES SHALL BE WELD NECK.												
7. FITTINGS SHALL BE SEAMLESS.												
										ASME CLASS 150		
										SEAMLESS CARBON STEEL		
										NO.		
0	REVISION 0			9-Dec-04	JSM	JC	MAE	ACS1				
NO.	REVISION			DATE	DESIGN	CHECK	APVD					

M-1802, M-2000

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applicable Welding Codes and Standards.
- B. Metallic welding requirements.
- C. Procedure and performance qualifications.
- D. Filler materials.
- E. Weld joint preparation.
- F. Thermal Treatment
- G. Filler metal control.
- H. Nondestructive examinations.
- I. Weld repairs.
- J. Submittals.

1.02 APPLICABLE WELDING CODES AND STANDARDS

- A. All welding, welding procedures and qualifications, welder qualifications and fabrication shall be in accordance with the requirements of the applicable fabrication codes invoked by the specification and the additional requirements herein, and the requirements of the Authority Having Jurisdiction (AHJ). The requirements of this section supplement the requirements of the applicable fabrication code.
- B. Chilled water, condenser water, cooling water, and compressed air piping shall be designed and installed per ASME B31.9, "Building Services Piping."
- C. Welding of piping within the jurisdictional limits of ASME Boiler and Pressure Vessel Codes (either Section I, Section IV or Section VIII) shall conform to the specific requirements of that code.
- D. Reference Specification Section 20 05 00, "Common Work Results for Facility Services Systems", for specific design conditions of piping services.

1.03 METALLIC WELDING REQUIREMENTS

- A. All drawings which show fabrication by welding shall indicate the joints, together with the required weld joint geometry and welding procedure number. Welding and nondestructive examination symbols shall be in accordance with AWS A2.4. Welding terms and definitions shall be in accordance with AWS A3.0.
- B. Safety measures for the protection of welders and operators involved in welding and cutting shall be in accordance with AWS Z49.1.
- C. Peening shall not be used unless specific written approval is obtained from OWNER and the ENGINEER.
- D. All full penetration weld joints, except those with a root pass deposited by the gas tungsten arc welding (GTAW) process, shall have the root of the second side removed to sound metal before welding from

the second side. Full penetration welds or continuous seal welds shall be used on all joints which will be in contact with the flue gas, condensate, or water, require special cleaning or which will be internally coated or lined. Permanent backing rings or bars are not permitted without specific written authorization from the ENGINEER or OWNER. Consumable inserts are not considered backing and may be used with GTAW on pipe welds; it is an essential variable and shall be qualified separately.

- E. Inert purging gas shall be used on all GTAW root passes. The gas backing shall be maintained until a minimum of three passes or 0.1875" (5 mm) of weld metal has been deposited. All gases for purging and shielding shall be welding grade and have a dew point of -40°F (-40°C) or lower.
- F. All welding which requires the use of an external gas shielding shall not be done in a draft or wind unless the weld area is protected by a shelter. This shelter shall limit the draft or wind speed to a maximum of 5 miles per hour.
- G. Welding shall not be performed on materials that are below 50°F. Welding shall not be permitted on surfaces that are wet or covered with ice, or when rain or snow is falling on the surfaces to be welded; nor during periods of high winds, unless the welders and the work are properly protected. Temporary heating and/or shelters shall be provided to raise the material temperature and to limit the air velocity.
- H. If run-off tabs or temporary attachments are used during production, they shall be removed and the area ground smooth, blended into the surrounding surface, and as a minimum visually examined. Materials used for run-off tabs and temporary attachments shall be of the same nominal chemical composition as the base metal.
- I. Tack welds that do not become an integral part of a weld shall be removed, the surface ground smooth, and the area visually inspected in accordance with the fabrication code. Tack welding and welding of temporary attachments shall be performed using qualified welding procedures and qualified welders and welding operators.
- J. Arc strikes shall be avoided. All arc strikes shall be removed, blended and the area examined by liquid penetrant or magnetic particle inspection techniques as applicable. Whenever possible, starter pads shall be used to avoid arc strikes on the base metal.
- K. Welding may be performed using any of the following processes or combination of these processes:
 - 1. Shielded Metal Arc Welding (SMAW);
 - 2. Gas Tungsten Arc Welding (GTAW);
 - 3. Pulsed, Spray and Globular Transfer Gas Metal Arc Welding (GMAW);
 - 4. Submerged Arc Welding (SAW).
- L. All GTAW will be made with the addition of filler metal.
- M. Parts that are to be joined by welding shall be fitted, aligned, and retained in position during the welding operation by the use of bars, jacks, clamps, or other mechanical fixtures. Excluding structural steel, welded temporary attachments shall not be used without specific written approval of OWNER.

1.04 PROCEDURE AND PERFORMANCE QUALIFICATIONS

- A. CONTRACTOR, subCONTRACTOR, or fabricator performing welding under jurisdiction of referenced codes shall be responsible for obtaining and qualifying welding procedures.
 - 1. Structural welding procedures conforming to AWS D1.1 are prequalified as defined in AWS D1.1, Chapter 5 and Appendix E.
 - 2. Piping and Other Welding: All weld procedures and welders shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, API 1104, ASME B31.1, ASME B31.3, ASME B31.9, or AWS D1.1, as applicable.
- B. CONTRACTOR shall maintain records, and make available to OWNER and ENGINEER when requested, certifying successful completion of procedure qualification tests. ENGINEER reserves the

right to require any welder to retake qualification tests when, in the opinion of the ENGINEER, work of the welder creates reasonable doubt as to the welder's proficiency. ENGINEER reserves the right to witness any required retesting. CONTRACTOR shall conduct such tests at no additional expense to OWNER.

- C. CONTRACTOR, subCONTRACTOR, or fabricator performing welding under jurisdiction of referenced codes shall be responsible for testing and qualifying its welding operators in accordance with applicable procedures.
- D. Unless welding operators have been previously qualified by CONTRACTOR within last 6 months and have been continuously employed as welders by CONTRACTOR following qualification, requalification tests must be performed.
- E. Only qualified welders or welding operators shall be used for production welding, tack welding and fit up. All welding shall be done with qualified procedures.
- F. Welders and welding operators shall be pre-qualified at the job site prior to performing production welding.
- G. Qualification of field welders shall be performed at the project site.
- H. All Welding Procedures and Qualification Records for purchased items subcontracted by the CONTRACTOR shall be reviewed by the CONTRACTOR for content and contract compliance, prior to submittal.
- I. Submerged arc welding of production parts shall be performed using the same name brand of flux and the same name brand of AWS/ASME classification of wire as was used for the procedure qualification.

1.05 FILLER MATERIALS

- A. Welding filler metals shall meet the requirements of the fabrication code and the applicable ASME Section II, Part C or AWS filler metal specification.
- B. Only low hydrogen type electrodes shall be used when the SMAW process is selected for production.
- C. Filler material shall be used so that the principal elements in the deposited weld metal shall be of the same nominal composition as the base metal, except as follows:
 - 1. Submerged arc multi-pass welds in carbon steels will use essentially a neutral flux.
 - 2. Solid wires for SAW shall contain the principal elements required for the deposited weld metal. Welds deposited by SAW shall not derive any principal element from the flux. Fluxes that the flux manufacturer recommends for single pass applications only shall not be used for multiple pass welds. All welding shall require a minimum of two passes unless specifically approved by the ENGINEER.

1.06 WELD JOINT PREPARATION

- A. The method used to prepare the base metal for welding shall leave the weld joint preparation with smooth surfaces.
- B. Carbon and low alloy steels may be cut to shape and size by mechanical means, such as machining, shearing, shipping, grinding, air-arc gouging or by thermal cutting. Prior to thermal cutting, the preheat specified by the welding procedure for welding shall be applied to the material. Preheat is not required prior to thermal cutting carbon steel materials. Discoloration which may remain on the oxy-fuel cut surface is not considered to be detrimental oxidation. The cut surface shall be ground back to bright metal.

- C. Surfaces to be welded and surfaces up to one inch for ferrous material and two inches for nonferrous materials from the edge of the weld shall be clean and free from oil, rust, scale, slag, grease, paint, and other foreign material which is detrimental to welding. Approved "weld-through primers" (i.e., Carbo Weld 11 and Zinc-lock 352) need not be removed from carbon steel surfaces prior to welding, if they were applied in accordance with the coating manufacturer's instructions.
- D. The weld end preparation of the base metals for shop welded joints shall be prepared as required by the welding procedure used.
- E. Permanent backing rings are not permitted without specific written authorization from the ENGINEER. If temporary backing rings are used and then removed, the weld area shall be dressed and examined for cracks and other defects using magnetic particle or liquid penetrant examination techniques as applicable.

1.07 THERMAL TREATMENT

- A. Preheat and interpass temperatures shall be maintained in accordance with the requirements of the applicable code and the qualified weld procedure. Electric or gas heat sources which provide a uniform application of heat over the weld area shall be used.
- B. Postweld heat treatment will be performed in accordance with the requirements of the applicable code, at standard temperatures and holding times required by the fabrication code and specified on the WPS. No low temperature-longer time post weld heat treatments shall be permitted without prior approval from the OWNER.
- C. Acceptable postweld heat treatment methods are listed as follows:
 - 1. Furnace Method
 - 2. Local Resistance Method
 - 3. Local Quartz Halogen Lamp Method
- D. On pipe diameters 10" nominal O.D. and smaller, a total of two thermocouples are required. These thermocouples shall be designated as "recording" thermocouples. If individually sheathed thermocouples are used, a spare shall be attached adjacent to each recording thermal couple. The two recording thermocouples shall be placed 180 degrees apart and on opposite sides of the welds (one at 12 o'clock and the other at 6 o'clock on the opposite side of the weld). The tips of all thermocouples shall be located a minimum of one inch from the near edge of the weld face.
- E. Temperature recording charts shall be used with all recording thermocouples. The CONTRACTOR shall maintain the original strip charts in its files throughout the Warranty Period for review by the OWNER.

1.08 FILLER METAL CONTROL

- A. All welding materials shall be stored in a controlled access, clean, dry area that is weather tight and is maintained at a temperature between 40°F and 140°F, and above the ambient dew point. The materials shall not be in contact with the floor and shall be stored on wooden pallets or cribbing. The materials shall at all times be identifiable. The CONTRACTOR shall submit a filler metal control procedure to OWNER and ENGINEER for approval no later than six weeks prior to the start of production welding.
- B. Storage requirements and atmospheric exposure limits of low hydrogen steel electrodes shall comply with AWS D2.2. If the hermetic seal of the container is damaged during shipment or storage, the covered electrodes may only be baked once. All electrodes removed from a hermetically sealed container shall be immediately placed in a storage oven.
- C. Materials that are damaged shall be discarded. All covered electrodes which are oil or water soaked, dirty, have been rained on, or have flux separated from the wire shall be discarded if a bloom of rust

develops which cannot be removed by light sanding. All flux-cored electrodes shall be discarded if they become contaminated with oil or water. Bare and flux-cored wire that becomes dirty can be used if it can be cleaned prior to use and restored to a bright surface. Any filler metal wire that exhibits pitting shall be discarded.

- D. Welders shall not be issued more than one type of electrode or filler metal at any one time and shall not have more than one type of electrode or filler metal in their pouches or portable rod heaters except a welder who is assigned to make a weld involving two processes, and who is so qualified, may possess welding materials for each process.

1.09 NONDESTRUCTIVE EXAMINATIONS

- A. All nondestructive examination (NDE) methods, acceptance criteria and additional general requirements shall be in accordance with the following subparagraphs.
- B. All nondestructive examinations shall be performed by personnel certified in accordance with ASNT recommended practice SNT-TC-IA or CONTRACTOR's own equivalent certification program that has been authorized by OWNER. Personnel certified to Level II or III shall perform interpretation of results.
- C. On request, the NDE procedures shall be submitted to OWNER, in which case examination shall not proceed until authorized by OWNER. In addition, all other records pertaining to inspection and certification shall be available for review by OWNER's inspector.
- D. For all types of NDE, the evaluation of indications and the acceptance criteria shall be in accordance with the applicable code and the requirements of the AHJ.
- E. At a minimum, the CONTRACTOR shall perform the following NDE:
 - 1. Welding installations per ASME B31.1:
 - a. Visually examine all welds.
 - b. Perform radiographic examination on a minimum of 2 welds per piping service (steam, condensate, boiler feed water, high temperature hot water, etc.), unless additional examination is required per the design requirements for that piping service (e.g., 100% radiographic examination is required by the ENGINEER).
 - 2. Welding installations per ASME B31.3:
 - a. Visually examine all welds.
 - b. Perform radiographic examination on a minimum of 1 weld per piping class or service (high-pressure distribution piping and building service piping would be separate services), unless additional examination is required per the design requirements for that piping service (e.g., 10% radiographic examination is required by the ENGINEER)
 - 3. Welding installations per ASME B31.9:
 - a. Visually examine all welds.
 - b. Perform radiographic examination on a minimum of 1 weld per piping service (steam, condensate, boiler feed water, high temperature hot water, etc.).
 - 4. Welding installations per API 1104:
 - a. Visually examine all welds.
 - b. Perform radiographic examination on a minimum of 2 welds per piping service high-pressure distribution piping and building service piping would be separate services), unless additional examination is required per the design requirements for that piping service (e.g., 10% radiographic examination is required by the ENGINEER).
 - 5. For piping welds within ASME Boiler and Pressure Vessel Code jurisdictional limits:
 - a. Visually examine all welds.
 - b. Perform radiographic examination on all welds, unless otherwise noted by ENGINEER or OWNER.
 - 6. Perform additional NDE as required by the AHJ, ENGINEER, or OWNER.

- F. Visual Examination: Visual examination procedures shall be in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 9.
- G. Magnetic Particle Examination:
1. Magnetic particle examination procedures shall be in accordance with the requirements and methods specified in ASME Boiler and Pressure Vessel Code, Section V, Article 7.
 2. Magnetic particle examination of welds shall include a band of base metal at least one inch wide on each side of the weld.
 3. If arc burns occur during magnetic particle examination, the arc burns shall be ground out and the area reexamined by the magnetic yoke method.
- H. Liquid Penetrant Examination:
1. Liquid penetrant examination procedures shall be in accordance with the requirements and methods specified in ASME Boiler and Pressure Vessel Code, Section V, Article 6, using solvent removable penetrant.
 2. Penetrant materials shall meet the requirements of ASME Boiler and Pressure Vessel Code, Section V, for sulfur and chloride content regardless of the type of material to be examined.
 3. Liquid penetrant examination of welds shall include a band of base metal at least 1 inch wide on each side of the weld.
- I. Ultrasonic Examination: Ultrasonic examination procedures shall be in accordance with the requirements and methods specified in ASME Boiler and Pressure Vessel Code, Section V, Article 5 or ASME B31.3, Paragraph 344.6.2, as applicable.
- J. Radiographic Examination: Radiographic examination procedures and techniques shall be in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 2.
- K. Control of Welder/Operator Quality
1. When progressive examination in accordance with ASME B31.3, Paragraph 341.3.4 is required, then the following additional requirements shall apply:
 - a. If any of the items examined in accordance with Paragraph 341.3.4 (c) reveals a defect, then the welder/bonder or welding operator shall be considered unacceptable for any further welding/bonding to that procedure with respect to OWNER work done to this specification without requalification and the agreement of OWNER.
 - b. Timing is essential for the control of welder, bonder or operator quality; therefore, the progressive examination required by Paragraph 341.3.4 shall be completed within a day of the first defect, unless otherwise agreed to by OWNER. The examination shall be performed on work performed prior to or in the same time period as rejected or unacceptable performance. For purposes of evaluation, the term "lot welds" shall include a minimum of 15 welds, and may be extended to all welds made by an individual, according to process, weld equipment, or consumables used on agreement of the OWNER.

1.10 WELD REPAIRS

- A. Unacceptable discontinuities shall be completely removed by chipping, gouging, grinding or other authorized methods (for the type of material being repaired) to clean, sound metal.
- B. Repairs to correct weld defects shall be made using the same procedure used for the original weld, or other previously authorized weld procedure.
- C. The repaired areas shall be reexamined using the same NDE and inspection procedures by which the defect was originally detected.
- D. Two repair attempts will be allowed on any one defective area. No further attempts to repair shall be carried out without the authorization of OWNER.

1.11 SUBMITTALS

- A. Except for procedures exempted by AWS D1.1, Section 5.1, submit 1 copy of each welding procedure to OWNER and ENGINEER with certificate demonstrating successful qualification of welding procedures for each welding process performed in the field: AWS D1.1 – Forms E-1, E-2, E-3; or ASME QW-483.
- B. Prior to execution of any field welding, submit to OWNER and ENGINEER 1 copy of welder qualification form for each individual performing field welding: AWS D1.1 – Form E-4; or ASME QW-484.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

- 1) C. Feuerstein
- 2) C. Kim

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Butterfly valves.
- B. Globe valves.
- C. Ball valves.
- D. Swing check valves.

1.02 QUALITY ASSURANCE

- A. Uniform Plumbing Code.
- B. Uniform Mechanical Code.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Valves meeting the requirements specified as manufactured by Fisher, Nibco, Clow, DeZurik, Trerice, Watts, Cash Acme, MKM Valve Co., Doves Corporation, or Bell & Gossett ITT.
- B. Wherever possible, provide valves of same manufacturer throughout.
- C. Manufacturer's name and pressure rating shall be clearly marked on outside of valve body.

2.02 STEAM/CONDENSATE BUTTERFLY VALVES

- A. Body: Carbon steel ASTM 216, lug style, extended neck.
- B. Disc: 316 stainless steel.
- C. Stem: Stainless steel.
- D. Rating: ANSI class 300 for steam at 150 psig and ANSI class 150 for condensate.
- E. Seats: Reinforced polytetrafluoroethylene, ANSI B16.104 Class VI.
- F. Operator: 6" and Below - Hand lever with multi-position, positive locking device. Gear operators on all others.
- G. Manufacturer: Dezurik, Jamesbury or approved equal.

2.03 GLOBE VALVES

- A. 2" or smaller (For steam trap assembly):
 - 1. Body: ASTM B62 threaded-bronze, union bonnet.
 - 2. Stem: Silicon bronze, rising.
 - 3. Disc: TFE.
 - 4. Packing: Aramid fibers with graphite.
 - 5. Pressure class: 150 psi.
 - 6. Manufacturer: Nibco Model T-235-Y, or equal.

2.04 BALL VALVES

- A. Body: Bronze body conforming to ASTM B584.
- B. Ball: 316 Stainless steel.
- C. Seat and seals: Reinforced TFE
- D. Working pressure: 600 psi WOG, 150 psi saturated steam
- E. Manufacturer: Nibco T-180-70-66 or approved equal.

2.05 SWING CHECK VALVES

- A. 2" and smaller:
 - 1. Body: Threaded bronze, ASTM B62.
 - 2. Bonnet: Screwed bronze, ASTM B62.
 - 3. Seat: Integral bronze.
 - 4. Disc: TFE.
 - 5. Working pressure: 125 psig.
 - 6. Manufacturer: Nibco Model T-413, or equal.
- B. 2-1/2" and larger:
 - 1. Body and bonnet: Flanged, cast iron, ASTM A395.
 - 2. Seat: Bronze, ASTM B61.
 - 3. Disc: Bronze, ASTM B61.
 - 4. Working pressure: 150 psig.
 - 5. Manufacturer: Nibco Model F-938-31, or equal.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install valves with stems upright or horizontal, not inverted.
- B. Use ball valves in heating, chilled water, and potable water systems interchangeably with gate and globe valves 2" and smaller.

END OF SECTION

- 1) C.H. Kim
- 2) D. Scanlon

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping specialty items including strainers and steam traps.

PART 2 PRODUCTS

2.01 PIPELINE STRAINERS

- A. Location: As shown on drawings.
- B. Type: "Y" type.
- C. Strainer basket: Monel; suitable for service intended.
- D. Size:
 - 1. 2" and smaller: Bronze body, 125 psi construction, screwed ends, removable plug screen retainer.
 - 2. 2-1/2" and larger: Cast iron body, 125 psi construction, flanged ends, bolted screen retainer, off-center blow down connection, piped and valved.

2.02 INVERTED BUCKET STEAM TRAPS

- A. See details on drawings.
- B. Install with union or flanged connection on both sides of steam trap.
- C. Provide gate valve and strainer at inlet, gate valve, and check valve at discharge as detailed on Drawings.
- D. Provide minimum 10 " long dirt pocket of same pipe size as apparatus return connection.
- E. Do not install thermostatic elements in traps until system has been operated and dirt pockets cleared of sediment and scale. Provide temporary covers for use prior to this time.
- F. Characteristics:
 - 1. Inverted-bucket type with semisteel body and cover, suitable for intermittent operation.
 - 2. Stainless steel bucket, seat, head, operating mechanism, and strainer.
 - 3. Provide to drain condensate from steam main headers and branch lines.
 - 4. Maximum Pressure Rating: 150 psig.
 - 5. Maximum Allowable Pressure/Temperature Rating: 250 psig @ 450F.
 - 6. Capacity: See schedule.
 - 7. Manufacturer: Spirax Sarco, Armstrong, or approved equal.

PART 3 EXECUTION

3.01 PIPELINE STRAINERS

- A. Install strainers as indicated on Drawings and as detailed.
- B. Install strainers in steam and water systems on entering side of automatic valves.
- C. Install strainers in water systems on entering side of pumps.
- D. Extend drain piping from blowoff connections to nearest floor drains.

END OF SECTION

- 1) C.H. Kim
- 2) D. Scanlon

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating and jacketing, including, but not limited to:
 - 1. Steam and condensate piping systems as necessary to facilitate steam trap and drip installation.

1.02 SUBMITTALS

- A. Product Data: Schedule for insulating materials, including adhesives, fastening methods, and fitting materials, and intended use. Include catalog sheets indicating density, thermal characteristics, jacket, installation instructions.

1.03 QUALITY ASSURANCE

- A. Products shall conform to NFPA 90A and 90B with special regard to fire hazard classification requirements of NFPA 255, including vapor barriers and adhesives.
- B. Products shall possess a flame spread rating of not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50.
- C. Materials shall be asbestos-free.

1.04 JOB CONDITIONS

- A. Perform Work at ambient and equipment temperatures as recommended by adhesive manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material to job site in original nonbroken factory packaging, labeled with manufacturer's density and thickness.
- B. Protect insulation during storage and in erected state from damage. Remove and replace all damaged insulation and jacketing.

PART 2 PRODUCTS

2.01 ADHESIVES AND COATINGS

- A. Compatible to mechanical surfaces, insulations, and jackets to which they are applied in both wet and dry state.
- B. Fire-retardant, moisture-resistant, mildew-resistant and verminproof.
- C. Suitable for temperature of systems to which they are applied.
- D. Wire mesh reinforcing: 22-gage, 1" galvanized.
- E. Glass fabric reinforcing: Childers Chilglass No. 1, or equal.
- F. Insulation bonding adhesive to metal surfaces: Foster Products Corp. No. 85-20, or equal.
- G. Insulating and finishing cement: P. K. Manufacturing "Quick Cote," Ryder "V-Cement," or equal.
- H. Coating and vapor barrier treatment: Foster Products Corp. No. 30-35, or equal.

- I. Elastomeric insulation to metal surfaces bonding adhesive: Armstrong 520, Rubatex R-373, or equal.
- J. Lap adhesives: Foster Products Corp. No. 85-20, or equal.
- K. Lagging adhesives: Foster Products Corp. No. 30-36, or equal.
- L. PVC jacket lap and seam adhesive: "Zeston" Perma-weld adhesive by Manville.

2.02 JACKETS

- A. Puncture resistance rating based on ASTM D781 test method.
- B. Permeance ratings based on ASTM E96, Procedure A.
- C. Type D-3 jacket:
 - 1. Material: 0.016" thick 303 or 302 aluminum.
 - 2. Jacket cut to size with 2" overlap. Banded 12" oc; seam calked with aluminum color silicon sealant.
 - 3. Manufacturer: Pabsco Metals Corp., or equal.
- D. Banding:
 - 1. Over aluminum jacketing with insulation less than 13" diameter: Stainless steel, 1/2" x 0.020"; A. J. Gerrard & Co., No. 305-SS with No. 202-SS seals.
 - 2. Over aluminum jacketing with insulation larger than 13", but less than 6'-0" in diameter: Stainless steel, 3/4" x 0.020"; A. J. Gerrard & Co., No. 311-SS with No. 204-SS seals.
 - 3. Over aluminum jacketing with insulation larger than 6'-0" diameter: Stainless steel, 3/4" x 0.022" Expand-R-Strap"; A. J. Gerrard & Co.
 - 4. Maximum spacing 12" oc.

2.03 INSULATION

- A. Insulating materials: Fire-retardant, moisture- and mildew-resistant, and verminproof. Insulation shall be suitable to receive jackets, adhesives, and coatings as indicated.
- B. Glass fiber insulation: Inert inorganic material, noncorrosive to mechanical surfaces, preformed into flexible or rigid board as indicated, suitable for temperatures to 450°F.
- C. Insulating cement: P. K. "Super Stick" or Ryder "G.P.," dry density 34 lb/cu ft, thermal conductivity 0.91 Btu-in/hr-sq ft°F at 400°F, or other asbestos-free equal suitable for same temperature range as adjacent pipe or insulation.
- D. Filling and finishing cement: P. K. "Quick Cote" or Ryder "MW," dry density 40 lb/cu ft, thermal conductivity 0.89 Btu-in/hr-sq ft°F at 400°F.
- E. Type BS-2 rigid fiberglass insulation:
 - 1. Temperature rating: -20 to 850°F only for pipe insulation.
 - 2. Density: 3 lb/cu ft.
 - 3. Conductivity: Not more than 0.22 Btu-in/hr-sq ft°F at 75°F.
 - 4. Manufacturer: Owens-Corning Fiberglas 25, or equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Do not install covering before piping and equipment has been tested.

- B. Verify surface is clean and dry prior to installation. Verify insulation is dry before and during application. Finish with systems at operating conditions.

3.02 INSTALLATION - GENERAL

- A. Verify insulation is continuous through*inside walls. Pack around pipes and fireproof self-supporting insulation material, fully seal.
- B. Insulate fittings, in-line specialties, and valves. Do not insulate unions, flanges necessary for maintenance of equipment, strainers, flexible connections, and expansion joints. Terminate insulation neatly with plastic material troweled on bevel.
- C. Finish insulation neatly at hangers, supports, and other protrusions.
- D. Locate insulation or cover seams in least visible locations.
- E. Insulating materials shall be installed with necessary joints and terminations, to permit easy access and removal of equipment sections where inspection or frequent service or repair is required, and to allow for expansion.
- F. Following systems shall be insulated for complete vapor barrier protection:
 - 1. Cold potable water piping.
 - 2. Chilled water piping, valves, and accessories.

3.03 INSTALLATION - PIPING, VALVE, AND FITTING INSULATION

- A. Apply insulation to piping with bonding adhesive, with butt joints and longitudinal seams closed tightly.
- B. Laps on factory-applied jackets shall be 1-1/2" minimum width firmly cemented with lap adhesive, or be pressure sealing type lap.
- C. Cover joints with factory furnished tape (2" minimum width) to match jacket, firmly cemented with lap adhesive.
- D. Install factory-molded insulation for fittings as indicated for valve insulation.
- E. Taper terminations of pipe insulation ends.
- F. Where thermal pipe shields are used at hanger locations, insulation shall extend to thermal shield. Where vapor barrier is required, Contractor shall be responsible for continuity of vapor barrier at thermal shield.
- G. Where thermal pipe shields are not used at hangers for piping with vapor barrier, insulation shall be Type BS-3 to eliminate compression. Type BS-3 insulation shall extend for twice length of metal shield.
- H. Insulation at anchors, secured directly to pipe surface, shall extend up anchor for distance of 4 times insulation thickness. Assure vapor seal at termination of vapor barrier.

3.04 INSULATION THICKNESS SCHEDULE

- A. Furnish and install insulation and jackets on piping, valves, and piping accessories where required. Thickness shall be in accordance with Mechanical Standard M-1008, or as noted below.
- B. Piping insulation application schedule: On steam and condensate where insulation shields are installed use BS-3 insulation.

Service	Insulation	Jacket	Thickness
Steam (360°F)	BS-2	D-3	
Condensate (210°F)	BS-2	D-3	

END OF SECTION

- 1) C. Kim
- 2) D. Scanlon

MINIMUM NOMINAL INSULATION THICKNESS (INCHES) (NOTE 2)								
FLUID TEMPERATURE RANGES	39°F & BELOW	40°F TO 60°F	61°F TO 104°F	105°F TO 140°F	141°F TO 200°F	201°F TO 250°F	251°F TO 350°F	351°F TO 400°F
NOMINAL PIPE SIZE								
LESS THAN 1	0.5	0.5	0.5	0.5	1.0	1.5	1.5	2.5
1 - 1.25	1.0	0.5	0.5	0.5	1.0	1.5	2.5	3.0
1.5 - 3	1.0	1.0	1.0	1.0	1.0	2.0	3.0	3.0
4 - 6	1.0	1.0	1.0	1.0	1.5	2.0	3.0	4.0
8 & LARGER	1.5	1.0	1.0	1.0	1.5	2.0	3.0	4.0

NOTES:

1. INSULATION THICKNESSES ARE BASED ON ANSI/ASHRAE/IESNA STANDARD 90.1.
2. ON OUTDOOR EQUIPMENT AND PIPING, THE INSULATING THICKNESS SHOWN ABOVE SHALL BE INCREASED 0.5".
3. INSULATION THICKNESSES SHOWN ARE MINIMUM THICKNESSES AND DO NOT INCLUDE FINISHING OR SEALING COATS.
4. THE MINIMUM INSULATION THICKNESSES ARE BASED ON INSULATION WITHIN THE FOLLOWING CONDUCTIVITY RANGES.

CONDUCTIVITY MEAN RATING TEMPERATURE	100°F	125°F	150°F	200°F	250°F
CONDUCTIVITY (BTU-IN/HR FT-°F)	0.22 - 0.28	0.25 - 0.29	0.27 - 0.30	0.29 - 0.32	0.32 - 0.34

FOR INSULATION WITH CONDUCTIVITY VALUES OUTSIDE THE GIVEN RANGES, THE MINIMUM INSULATION THICKNESS SHALL BE ADJUSTED BASED ON THE FOLLOWING FORMULA.

$$T = r \cdot \left[\left(1 + \frac{t}{r} \right)^{\frac{K}{k}} - 1 \right]$$

WHERE:

- T = MINIMUM INSULATION THICKNESS IN INCHES.
- r = ACTUAL OUTSIDE PIPE RADIUS IN INCHES
- t = MINIMUM THICKNESS FROM ABOVE TABLE.
- K= CONDUCTIVITY OF ALTERNATE MATERIAL AT MEAN RATING TEMPERATURE INDICATED FOR THE APPLICABLE FLUID TEMPERATURE IN BTU-IN/HR FT-°F
- k = THE UPPER VALUE OF THE CONDUCTIVITY RANGE LISTED IN THE ABOVE TABLE FOR THE APPLICABLE FLUID TEMPERATURE.

3- GENERAL	TJL	JJB	MAE	7/13/2007
2- REV HEADING	JBP	SJS	SJS	10/6/1995
1- REVS & CADD	TRK	SJS	SJS	9/16/1994
REVISIONS	DES	CHK	APP	DATE



**MECHANICAL STANDARD
INSULATION**

**PIPING AND EQUIPMENT
INSULATION THICKNESS**

SCALE: NONE

NO.	REV
M-1008	3