



RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

Shop Fabrication of Piping

ISSUED BY
RPP-WTP PDG

Content applicable to ALARA? Yes No

ADR No.
24590-WTP-ADR-PL-09-0001

Rev
0

Quality Level
Q
DOE Contract No. DE-AC27-01RV14136

NOTE: Contents of this document are Dangerous Waste Permit affecting.

0	6/3/02	B. Gavino	J. Weetch	M. Myatt		G. Warner	S. Foelber
1	6/24/02	B. Gavino	J. Weetch	M. Myatt		G. Warner	S. Foelber
2	5/14/03	B. Gavino	J. Weetch	D. Lytle		G. Warner	M. Myatt
3	8/18/03	B. Gavino	J. Weetch	D. Lytle		G. Warner	M. Myatt
4	4/22/04	B. Gavino	J. Sutton	K. Oldfather		G. Warner	S. Skiles/ MM
5	12/27/04	B. Gavino	J. Sutton	K. Oldfather		G. Warner	M. Myatt
6	8/22/05	K. Kramer	D. Lytle	K. Oldfather	D. Lord	G. Warner	J. Minichiello
7	9/5/06	D. Lytle	J. Sutton	K. Oldfather	K. D. Gibson	S. Akerman	J. Minichello
8	2/12/08	B. La Pointe	J. Sutton	J. Schuette	R. Carlstrom	M. Ehlinger/SV	C. Winkler/DJ
9	4/9/09	C. Nichols	A. Tiongson	D. Jackson	R. Carlstrom	N/A	M. Gober
10	8-25-09	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	N/A	<i>[Signature]</i> For Mark Gober
REV	DATE	BY	CHECK	REVIEW	E&NS	QA	DPEM

SPECIFICATION No.
24590-WTP-3PS-PS02-T0001

Rev
10

Revision History

Revision	Reason for Revision
10	<p>Incorporated the following by revision:</p> <ol style="list-style-type: none"> 1. Sections 3.2.2.3.6, 3.2.2.3.7, and 3.2.2.3.8 and Appendix A - incorporated BODCN 24590-WTP-BODCN-ENG-09-0007 (as accepted by DOE - reference CCN 193394 & 198448) - clarification of NDE requirements. 2. Section 1.9.3.2 - incorporated SCN-24590-WTP-3PN-PS02-00086. Minor editorial change to clarify intent. 3. Section 1.10.32 - Incorporated the following by reference: SDDR 24590-WTP-SDDR-PL-09-00008 SDDR 24590-WTP-SDDR-PL-09-00017 SDDR 24590-WTP-SDDR-MS-08-00084 SDDR 24590-WTP-SDDR-MS-09-00067. 4. Section 3.1.1.8 - incorporated PIER 24590-WTP-PIER-MGT-09-0959-D seam weld orientation requirements for DB (high pressure steam) isometrics. 5. Other minor editorial corrections as marked.
9	<p>Incorporated, as revised: 24590-WTP-3PN-PS02-00074, 24590-WTP-3PN-PS02-00076, 24590-WTP-3PN-PS02-00078, 24590-WTP-3PN-PS02-00081, and 24590-WTP-SDDR-PROC-02-0211.</p> <p>Sections 1, & 2 - incorporated black cell and hard-to-reach information and related requirements listed in BOD 24590-WTP-DB-ENG-01-001, Rev. 1M, Section 16 (BODCN 24590-WTP-BODCN-ENG-08-0008 (CCN 184737) including the DOE acceptance comments listed in letter 08-WTP-168 dated 9/25/08 (CCN 186823)).</p> <p>Section 2 - 2.1.8.2 - updated marking requirements to include use of vibro-etch tool.</p> <p>Section 3.1.1 - added requirements for titanium fabrication.</p> <p>Section 3.1.1.2 - updated marking requirements to include use of vibro-etch tool.</p> <p>Section 3.2 & Appendix A - updated Table of NDE requirements reflect BOD 24590-WTP-DB-ENG-01-001, Rev. 1M, Section 16 (BODCN 24590-WTP-BODCN-ENG-08-0008 (CCN 184737) including the DOE acceptance comments listed in letter 08-WTP-168 dated 9/25/08 (CCN 186823)). Also, listed NDE requirements in Section 3.2.2 of the specification.</p> <p>Added Pipe Class S11A spool fabrication & NDE requirements to Sections 1.2.1.3.3, 3.1.1.1, & 3.2.1.2 required for close out Action # CRPT-2008-336-2 of 24590-WTP-CRPT-QA-08-336, Rev. 0. Added statement to Section 1.2.1.3 that the design code for Pipe Class S11A is the Uniform Plumbing Code and the fabrication code is ASME B31.3-1996.</p> <p>Various other minor and editorial changes.</p>
8	<p>Incorporated, as revised, 24590-WTP-3PN-PS02-00071, 24590-WTP-3PN-PS02-00073, and 24590-WTP-FC-P-07-0157,</p> <p>Performed a general revision of the entire document; hence, revisions are not denoted by revision bars.</p> <p>Incorporated the applicable requirements of CCN 169881 which also deletes notes 4 and 8 to Appendix A.</p>
7	<p>Incorporated the following by revision:</p> <p>24590-WTP-3PN-PS02-00056, -00060, -00064, -00066, -00068 (modified within as required)</p> <p>Incorporate by reference 24590-WTP-SDDR-M-05-00024, -PL-05-00060, -PL-05-00063, -PL-06-00001, -PL-06-00005, -PL-06-00008 and -PROC-05-00759</p> <p>Revised cover page Quality Designator from 'QL' to 'Q'</p> <p>Revised Sections 1.4.1.1, 1.4.1.2, 1.4.1.3</p> <p>Deleted Section 3.1.1.5</p>
6	<p>Incorporated the following by revision:</p> <p>24590-WTP-3PN-PS02-00043, -00044, -00047-00049-00050-00052</p> <p>Incorporate by Design 24590-WTP-SDDR-PROC-04-01304, -PROC-05-00195</p> <p>Incorporate by reference 24590-WTP-SDDR-PROC-05-00058</p>
5	<p>Incorporated the following by revision:</p>

Revision	Reason for Revision
	<p>24590-WTP-3PN-PS02-00022, -00026, -00029, -00030, -00032, -00034, & -00037</p> <p>24590-WTP-SDDR-PROC-04-00604</p> <p>Incorporated the following by reference:</p> <p>24590-WTP-CDR-CON-04-0094, -0103</p> <p>24590-WTP-NCR-CON-04-0254</p> <p>24590-WTP-SDDR-PROC-04-00453, -00834, -00859, -00950, -00951, -00952, -00979, -00996, -01006, & -01007</p>
4	<p>Revised para. 1.2.1.14 to define PMI requirement per the PMI specification, not per the piping material class</p> <p>Incorporated SCNs 24590-WTP-3PN-PS02-00011, -00012, -00017, and -00018 (<u>Note</u>: 24590-WTP-3PN-PS02-00017 incorporated SDDRs 24590-WTP-SDDR-PROC-03-0391 and -0410)</p> <p>Incorporated 24590-WTP-CDR-CON-03-058 by reference</p> <p>Revised 3.1.1.4.2 to define required distance between an integral attachment to the pipe and pipe weld</p>
3	<p>Incorporated FCR-24590-WTP-FCR-P-03-041, SCN 24590-WTP-3PN-PS02-00008, SDDR 24590-WTP-SDDR-PROC-0103, SDDR 24590-WTP-SDDR-PROC-03-0104, SDDR 24590-WTP-SDDR-PROC-03-0105. Incorporated by reference SDDR 24590-SDDR-PROC-03-0152, and 24590-WTP-SDDR-PROC-03-0153.</p> <p>Included applicable Technical Notes from Section 2 of the following MRs:</p> <p>24590-CM-MRA-PS02-00001, 24590-CM-MRA-PS02-00007, 24590-CM-MRA-PS02-00008, 24590-QL-MRA-PS02-00002, 24590-QL-MRA-PS02-00003, 24590-QL-MRA-PS02-00008, 24590-QL-MRA-PS02-00009 and 24590-QL-MRA-PS02-00011. Major rewrite; changes not noted in margins.</p>
2	<p>Incorporated SCN Nos. 24590-WTP-3PN-PS02-00001</p> <p>Incorporated 24590-WTP-3PN-PS02-00003 (Also changed NDE for 'Cat M All others' from 20% PT/MT to 20% RT, correcting typo in the SCN)</p> <p>Revised per 24590-WTP-SDDR-PROC-03-0022</p>
1	<p>Revised per 24590-WTP-DCN-PL-02-001, Rev 0 (No technical requirement change is involved. Changes are necessitated by the need to clarify requirements more fully and to conform requirements between referenced document associated with this</p>
0	<p>Issued for Construction</p>

Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

Contents

Notice	iv
1 General	1
1.1 Scope	1
1.2 Work Included	1
1.3 Related Work Not Included	3
1.4 Codes and Standards	4
1.5 Reference Documents and Drawings.....	6
1.6 Quality Assurance.....	7
1.7 Cleaning and Coating	7
1.8 Packaging, Storage, Handling, and Protection.....	9
1.9 Submittals	10
1.10 Design Documents Incorporated by Reference	12
2 Products	14
2.1 Materials.....	14
3 Execution.....	19
3.1 Fabrication	19
3.2 Inspection and Testing.....	24
4 Configuration Management	27
5 Documentation and Submittals.....	27

Tables & Figures

Table 1 Minimum Required Edge Distance Between Field and Shop Welds.....	20
Table 2 Piping Weld Examination Requirements.....	A-1

Appendices

Appendix A , <i>Summary Table of Non-Destructive Examinations (NDE) of Pipe & Tubing Shop Welds</i>	A-1
---	-----

1 General

1.1 Scope

This specification defines the requirements and the work necessary for fabrication of piping subassemblies (pipe spools) in accordance with the requirements of ASME B31.3, *Process Piping*, other codes and standards, and documents as referenced in this specification. This specification applies to all quality levels as specified by the purchase order.

1.1.1 Black Cell and Hard to Reach Piping

The WTP design incorporates the “black cell” concept as a key part of the facility design of the Pretreatment (PT) and the High-Level Waste (HLW) facilities. This entails locating certain equipment in the shielded cells for which no maintenance or entry is planned for the 40-year design life of the plant. Black cell (BC) Piping - all piping and tubing within a black cell up to the first weld outside the black cell.

There are areas of the WTP facilities that have components that are considered to be hard-to-reach (HtR) because of location and expected difficulty to perform repairs or maintenance which has the potential to impact mission life. HtR areas are designated as such based on R5 area radiation levels after removal of transient sources and decontamination and 1) piping and components cannot be manually or remotely maintained, and/or 2) piping and components are isolated physically by permanent plant equipment which cannot be manually or remotely removed. HtR piping extends out to the first accessible weld. There are no valves in BC areas, and there are no inaccessible valves in HtR areas.

The term “Black Cell Weld” applies to any weld in a BC pipe or pipe spool.

The term “Hard to Reach Weld” applies to any weld in an HtR pipe or pipe spool.

Isometrics issued prior to February, 2008 are reviewed by Buyer’s Engineering to determine whether a pipe spool is “BLACK CELL” or “HARD To REACH” or not. This review and spool identification information is provided to the Supplier.

Isometric drawings issued on or after 1 February 2008 identify the pipe spools that are to be installed in black cells or hard-to-reach areas. The isometric drawing identifies each black cell or hard-to-reach pipe spool with a spool tag which will include the spool ID number and the words “BLACK CELL” or “HARD TO REACH”, as appropriate. Additionally, the respective isometric will have the words “CONTAINS BLACK CELL (or HARD TO REACH, as appropriate) PIPE” in large type located just above or beside the title block.

1.2 Work Included

- 1.2.1 Perform the following work for piping in systems listed in the purchase order in accordance with the requirements of this specification, its appendices, reference documents, and the applicable codes in accordance with the *Engineering Specification for Piping Material Classes General Description and Summary*, 24590-WTP-3PS-P000-T0001 (including the standards and documents referenced therein).

- 1.2.1.1 Furnish shop pipe spool sheets or extended spool sheets or detailed drawings when specifically required by the purchase order.
- 1.2.1.2 Furnish materials as required by the purchase order including pipe, fittings, flanges, and welding materials required for fabrication.
- 1.2.1.3 Fabricate pipe spools as follows:
 - 1.2.1.3.1 Fabricate pipe spools including the installation of fittings, nozzles, thermo well connections, radiographic access holes/bosses, breather holes when required, and the preparation of field welding ends.
 - 1.2.1.3.2 Fabricate dual containment piping spools, and offset piping assemblies (Joggles) that are either dual wall or single wall configurations.
 - 1.2.1.3.3 Fabricate Pipe Class S11A piping spools in accordance with this specification and ASME B31.3-1996. The Pipe Class S11A design code is the Uniform Plumbing Code.
- 1.2.1.4 Install valves, valve actuators, and other piping components and specialty items supplied by Buyer when required by the purchase order.
- 1.2.1.5 Supply and install integral structural attachments and supports as shown on piping isometric drawings, orthographic drawings, and/or detailed support drawings.
- 1.2.1.6 Perform post-weld heat treatment (PWHT) as required.
- 1.2.1.7 Perform all required testing and examinations.
- 1.2.1.8 Perform all required cleaning, coating, lining, preservation, and shipping preparation.
- 1.2.1.9 Chemically clean and/or pickle piping where indicated on the design drawings and/or the piping material class.
- 1.2.1.10 Mark pipe spools with identification numbers in accordance with the identification numbers shown on the piping isometric drawings, orthographic drawings, or other instructions furnished by the Buyer.
- 1.2.1.11 Furnish all required documentation.
- 1.2.1.12 Package fabricated spools and associated materials, with packing lists, for delivery to the jobsite.
- 1.2.1.13 Apply color coding for material lay down purposes when required by the purchase order.
- 1.2.1.14 Perform Positive Material Identification (PMI) on completed fabrication in accordance with specification 24590-WTP-3PS-G000-T0002, *Engineering Specification for Positive Material Identification (PMI) for Shop Fabrication*, and as required by Section 2.1.5. PMI is not to be performed on Buyer-furnished valves unless otherwise stated in the purchase order. Refer to Section 2.1.5.

- 1.2.1.15 Perform hydrostatic testing of fabricated spools when specifically required by contract documents using Buyer approved test procedures.
- 1.2.1.16 Perform pneumatic testing of fabricated spools when specifically required by contract documents using Buyer approved test procedures.
- 1.2.1.17 Supplier shall be responsible for submitting a progress report electronically on a weekly basis. This report shall identify the following information in both summary form and by detailed spool numbers with Buyer's piece mark indicated.
 - 1.2.1.17.1 Quantity of isometrics received during the period
 - 1.2.1.17.2 Quantity of spools identified
 - 1.2.1.17.3 Quantity of spools detailed
 - 1.2.1.17.4 Quantity of spools released to material control
 - 1.2.1.17.5 Quantity of spools in fabrication
 - 1.2.1.17.6 Quantity of spools complete through welding phase of fabrication
 - 1.2.1.17.7 Quantity of spools complete through radiography, heat treatment, testing, and painting
 - 1.2.1.17.8 Quantity of spools ready to ship
 - 1.2.1.17.9 Quantity of spools shipped
 - 1.2.1.17.10 Quantity of spools on hold, and reason for hold
- 1.2.1.18 Installing fusion-bonded epoxies for linings and coatings is within a Supplier's scope of supply when called for in the purchase order.

1.3 Related Work Not Included

- 1.3.1 The following items are not included in the Supplier's scope of work unless otherwise specified:
 - 1.3.1.1 Furnishing and installing flanged valves, specialty items, expansion joints, instrumentation (including sensing devices), relief valves, orifice plates, and flow elements
 - 1.3.1.2 Furnishing and installing pipe supports (except as noted in Section 1.2.1.5).
 - 1.3.1.3 Furnishing of cast or ductile iron pipe.
 - 1.3.1.4 Furnishing thermo wells.
 - 1.3.1.5 Furnishing and installing flow nozzles and associated hardware.
 - 1.3.1.6 Installing fabricated piping subassemblies in the field.

- 1.3.1.7 Furnishing and installing thermal insulation for piping.
- 1.3.1.8 Pressure testing of all piping, except as required by Sections 1.2.1.15 and 3.2.3 of this specification and the pressure test required by the applicable ASTM or ASME material specification.
- 1.3.1.9 Design of piping and preparation of piping drawings (except detailed spool drawings in accordance with Section 1.2.1.1).
- 1.3.1.10 Furnishing bolting materials, gaskets, insulating flange kits, or backing rings required for field assembly.
- 1.3.1.11 Pipe wall thickness and branch reinforcement calculations.

1.4 Codes and Standards

- 1.4.1 ASME B31.3 1996, *Process Piping*, is the piping code for the WTP Project.

For Q applications, the editions of reference codes, standards and specifications shown in Appendix E of ASME B31.3-1996 listed below, and those listed in 24590-WTP-3PS-PB01-T0001, *Engineering Specification for Technical Supply Conditions for Pipe, Fittings, and Flanges*, are acceptable for use. If the Supplier wants to use a later edition or addenda of a reference code, standard, or specification then the Supplier shall submit an SDDR.

When using ASTM material specifications for commercial material (CM) items, any version more recent than the ASTM version listed in Appendix E of ASME B31.3 1996 is acceptable. A SDDR is not required for these commercial material (CM) item ASTM material specification edition changes.

ASME materials identified in ASME Boiler & Pressure Vessel Code, Section II Material Specifications as being identical to the ASME B31.3, Appendix E listed ASTM Material Specifications, for the year, alloy, type and / or grade, (if applicable), are acceptable for use.

See Specification 24590-WTP-3PS-PB01-T0001, Section 2.1 for ASTM Material Specifications table for acceptable years.

- 1.4.1.1 The American Society of Mechanical Engineers (ASME)
 - ASME B16.11-1991, *Forged Fittings, Socket-Welding and Threaded*
 - ASME B16.25-1986, *Buttwelding Ends*
 - ASME B16.28-1986, *Wrought Steel Buttwelding Short Radius Elbows and Returns*
 - ASME B16.36-1988, *Orifice Flanges*
 - ASME B16.47-1990, *Large Diameter Steel Flanges NPS 26 through NPS 60*
 - ASME B16.5-1988, *Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inches*

ASME B16.9-1986, *Factory-Made Wrought Butt welding Fittings*

ASME B36.10M-1985, *Welded and Seamless Wrought Steel Pipe*

ASME B36.19M-1985, *Stainless Steel Pipe*

1.4.1.2 ASME Boiler and Pressure Vessel Code (B & PV)

ASME B & PV Code Section V- latest edition, *Nondestructive Examination*

ASME B & PV Code Section VIII, Division 1, latest edition, *Rules for Construction of Pressure Vessels*

ASME B & PV Code Section IX- latest edition, *Welding and Brazing Qualifications*

1.4.1.3 American Society for Testing and Materials (ASTM) Material Specifications

For ASTM material designations, refer to 24590-WTP-3PS-PB01-T0001, *Engineering Specification for Technical Supply Conditions for Pipe, Fittings, and Flanges*.

1.4.1.4 Pipe Fabrication Institute (PFI) Standards

ES-7 - 1962 (R1984), *Minimum Length and Spacing for Welded Nozzles*

1.4.1.5 Manufacturers Standardization Society

MSS SP-25-1978 (R1988), *Standard Marking System for Valves, Fittings, Flanges, and Unions*

MSS SP-83-1987, *Class 3000 Steel Pipe Unions Socket Welding and Threaded*

MSS SP-95-1986 (R1991), *Swaged Nipples and Bull Plugs*

MSS SP-97-1987, *Integrally Reinforced Forged Branch Outlet Fittings*

1.4.2 Other Standards

The following standards are not reference standards of ASME B31.3, 1996, but are acceptable for use to facilitate ASME B31.3 piping fabrication, or are used for pipe fabrication that is not within the scope of ASME B31.3.

1.4.2.1 Pipe Fabrication Institute (PFI) Standards

ES - 3, *Fabricating Tolerance*

ES - 5, *Cleaning of Fabricated Piping*

ES - 16, (Deleted)

ES - 24, *Pipe Bending Methods, Tolerances, Process, and Material Requirements*

ES - 31, *Standard for Protection of Ends of Fabricated Piping Assemblies*

1.4.2.2 International Association of Plumbing & Mechanical Officials

Uniform Plumbing Code (UPC), 1997 Edition

1.4.3 In case of a conflict between the requirements of the referenced codes, standards, specifications, regulations, and procedures, the Supplier shall submit a recommended resolution to the Buyer via a Supplier Deviation Disposition Request (SDDR) for review and permission to proceed prior to implementation.

1.5 Reference Documents and Drawings

The entire list of documents below may or may not apply in all cases. Refer to the purchase order for a listing of those documents that are applicable.

- 1.5.1 24590-WTP-3PS-P000-T0001, *Engineering Specification for Piping Material Classes General Description and Summary*
- 1.5.2 24590-WTP-3PS-PS02-T0002, *Engineering Specification for Cold Bending of Pipe*
- 1.5.3 24590-WTP-3PS-NWP0-T0001, *Engineering Specification for General Welding and NDE Requirements for Supplier Fabricated Piping*
- 1.5.4 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*
- 1.5.5 24590-WTP-3PS-PX04-T0001, *Engineering Specification for Shop Applied Fusion Bonded Epoxy Coating for Underground Carbon Steel Pipe*
- 1.5.6 Deleted
- 1.5.7 24590-WTP-3PS-PX04-T0003, *Specification for Shop and Field Application of an Epoxy Coating for Underground Carbon Steel Fittings, Valves, and Special Items*
- 1.5.8 24590-WTP-3PS-PX04-T0004, *Engineering Specification for Epoxy Coating for Stainless Steel Items that are Buried, Embedded or Insulated*
- 1.5.9 24590-WTP-3PS-G000-T0002, *Engineering Specification for Positive Material Identification (PMI) for Shop Fabrication*
- 1.5.10 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*
- 1.5.11 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*
- 1.5.12 Deleted

- 1.5.13 24590-WTP-PW-P30T-00001, *WTP End Prep Detail for Field Butt Welds*
- 1.5.14 24590-WTP-3PS-PB01-T0001, *Engineering Specification for Technical Supply Conditions for Pipe, Fittings, and Flanges*
- 1.5.15 Deleted

1.6 Quality Assurance

- 1.6.1 The Supplier shall develop and implement a Quality Assurance (QA) program in accordance with document 24590-WTP-3PS-G000-T0001 and 24590-WTP-3PD-PS02-00005, *Supplier Quality Assurance Program Requirements Data Sheet* as required in the purchase order.
- 1.6.2 The Supplier shall submit a copy of Supplier's QA manual for Buyer's review and permission to proceed. The Supplier shall be responsible to request Buyer's written permission to proceed for any revisions to the reviewed QA Manual and associated procedures. The Buyer or its representatives reserve the right to carry out quality audits of the Supplier or Sub-supplier's QA programs at any time during the period of the contract.

1.7 Cleaning and Coating

1.7.1 Cleaning

- 1.7.1.1 Perform cleaning after fabrication has been completed. Cleaned piping shall be free of loose rust or mill scale, blisters, grease, sand, oil, dirt, and other foreign materials.
- 1.7.1.2 Fabricated spools shall be cleaned in accordance with the standard cleaning method described in PFI-ES-5.
- 1.7.1.3 Clean austenitic stainless steel, nickel alloy, and titanium piping in a protected area that is free from airborne chloride contamination. Prevent contamination from non-stainless steel, non-nickel alloy or non-titanium particles such as machine chips, grinding dust, weld spatter, and other debris during fabrication by shielding or other suitable means.
- 1.7.1.4 Only austenitic stainless steel brushes not previously used on other material may be used on austenitic stainless steel piping.

Stainless steel wire brushes that have not been used on other materials shall be used to clean nickel alloy or titanium.
- 1.7.1.5 Where solvent is required to remove grease or oil from austenitic stainless steel piping, acetone, or alcohol (ethyl, methyl, or isopropyl) shall be used. Alternatively, a detergent flush may be used in lieu of solvent cleaning with prior permission to proceed from Buyer.

Cleaning solvents used for cleaning titanium materials are methyl alcohol, acetone, or other chlorine-free solvents.

Titanium weld preparation includes removing any oil, grease, dirt, or grinding dust from surfaces to be joined. Steam cleaning or an alkali dip in a dilute solution of sodium hydroxide can remove most of these contaminants. To remove the last remaining organic

compounds just before welding, use a lint-free glove and methyl alcohol, acetone, or other chlorine-free solvent.

1.7.1.6 Final cleaning materials in contact with austenitic stainless steel shall contain less than 200 ppm chlorides. If detergent cleaning is used, rinse austenitic stainless steel with potable water having no more than 100 ppm chloride content. After rinsing, the piping shall be drained out completely such that no standing pockets/puddles of water remain that may later concentrate by evaporation. Removal of excess rinse water may be augmented by swabbing, use of a "squeegee," or air blowing.

1.7.1.7 After cleaning, blow dry the interior surfaces of all piping with clean, filtered, oil-free air.

1.7.2 Pickling

When pickling of carbon steel piping is required by the design drawing and/or piping material class, the following shall apply:

1.7.2.1 Degrease to remove all protective coating.

1.7.2.2 Acid clean to remove mill scale, rust, and other foreign substances on the inside of the pipe, without loss of base metal.

1.7.2.3 Neutralize, rinse, and completely remove pickling solution.

1.7.2.4 Dry thoroughly. The interior of the pipe shall be free of mill scale, rust, acid, and all other foreign materials.

1.7.2.5 Coat the inside of pipe with one of the following rust preventatives (or Buyer-approved equal):

1.7.2.5.1 Lectra Shield and SP-400, CRC Industries

1.7.2.5.2 Mobilarma 247, Mobil

1.7.3 External Surface Coating

1.7.3.1 Apply external surface coating in accordance with specification 24590-WTP-3PS-AFPS-T0001, Appendix D, Item 3.30, 3.70, or 3.80.

1.7.3.2 Apply a preservative coating of Tempil "Bloxide" or D-C Sales & Engineering, Inc. (formerly known as AACCO) "Deoxaluminite" (or Buyer approved equal) weldable primer on all field weld end preparations to carbon steel surfaces including coating the hold back area. Overlap onto the coating is acceptable. Weldable primers containing zinc are not acceptable.

1.7.3.3 Coat the exterior surfaces of buried carbon steel in accordance with specifications 24590-WTP-3PS-PX04-T0001 and 24590-WTP-3PS-PX04-T0003. Coat the exterior surfaces of buried or embedded stainless steel in accordance with specification 24590-WTP-3PS-PX04-T0004.

- 1.7.3.4 Do not paint the gasket seating surface of flange faces. The gasket seating surface of flange faces shall be cleaned and coated with a one of the following rust preventives:
 - 1.7.3.4.1 Grease (manufacturer's standard)
 - 1.7.3.4.2 Lectra Shield and SP-400, CRC Industries
 - 1.7.3.4.3 Mobilarma 247, Mobil
 - 1.7.3.4.4 Any preservative listed in specification 24590-WTP-3PS-AFPS-T0001

1.8 Packaging, Storage, Handling, and Protection

Packaging, handling, and storage of pipe spools are as list below. These requirements are based on the applicable requirements listed in Specification 24590-WTP-3PS-G000-T0003.

1.8.1 Sealing Openings

- 1.8.1.1 Comply with the minimum end protection requirements criteria outlined in PFI-ES-31 to protect all openings and/or as required in the purchase order. The Buyer must provide review and give permission to proceed prior to use of each specific type of desiccant material. Fabrications must be clearly marked indicating desiccant inside.
- 1.8.1.2 Cover all pipe openings with metal, polyethylene, or nonmetallic end caps, flange protectors, or plugs. Polyethylene or nonmetallic end caps and plugs shall be friction fit, (e.g., Niagara series) or secured by other means. At a minimum, one of the caps or plugs on each spool shall be provided with a 1/8-inch max diameter vent hole to preclude the buildup of internal pressure. Avoid placing the cap or plug with the vent hole on a spool that is oriented in an upward, vertical position. Tape shall not be used to secure end caps or plugs. Clamps used for securing end caps, on stainless steel or alloy spools, shall be made of stainless material.
- 1.8.1.3 Deleted

1.8.2 Marking

Additional marking requirements may apply for coaxial (i.e., double-contained) piping systems. Refer to the purchase order for additional marking requirements, if any, for coaxial piping.

- 1.8.2.1 Mark each section of fabricated pipe, pipe assembly, or separate fitting with appropriate piece mark. The spool piece mark number (example, LAW-PJV-PW00006001-A) is indicated on the isometric drawing. Mark spools of 15 feet or less in length once on one end. Mark spools greater than 15 feet in length once on each end, with markings appearing on opposite sides of the spool. Piece marks shall be stenciled or legibly hand lettered, in not less than 2-inch-high letters (when possible), with a black weatherproof marker. Piece marks shall not be placed on end caps or flange protectors. Piece marks shall be readable from a reasonable distance.
- 1.8.2.2 Place paint markings so that paint is at least 4 inches away from a surface to be welded.

1.8.2.3 Any marking material and packing tape used on stainless steel or alloy material is required to be made from low chloride (less than 200 ppm) and low sulfur (less than 400 ppm) type material. The Supplier shall provide a chemical analysis report of the marker/tape for each lot or typical representative sample. The chemical analysis report shall be submitted for Buyer's review and permission to proceed. A copy of the report is not required with each shipment of pipe spools.

1.8.2.4 Deleted

1.8.3 Protection During Shipping

1.8.3.1 Block, strap, or otherwise hold pipe, fittings, and valves in position and further separate them by dunnage as necessary to prevent damage during shipment.

1.8.3.2 Deleted

1.8.3.3 Deleted

1.9 Submittals

1.9.1 Preparing, maintaining, and submitting any documents for Buyer's review and permission to proceed does not relieve the Supplier from the responsibility of complying with the requirements of the purchase order.

1.9.2 Submit the following documents for Buyer's review and permission to proceed as specifically noted in the purchase order:

1.9.2.1 Quality Assurance Manual.

1.9.2.2 Pipe spool sheets/extended spool sheets/detailed drawings for shop-fabricated spools (including identification of shop welds), when specifically required in the purchase order. Shop spool drawings and/or extended spool sheets based on isometric drawings provided by the Buyer may be generated by the Supplier. However, unless otherwise noted in the purchase order, pipe spool sheets/extended spool sheets/detailed drawings are not required to be submitted for review and permission to proceed. Final Supplier Quality inspection will be in accordance with the isometric or orthographic drawing, as applicable.

1.9.2.3 Deleted

1.9.2.4 Welding/weld repair procedures and procedure qualification records (WPS/PQR).

1.9.2.5 Nondestructive examination (NDE) procedures prepared in accordance with the applicable code and/or standard, and ASME Section V and NDE reports including all radiographs as applicable to the purchase order and piping material class.

1.9.2.6 Acid cleaning and/or pickling procedures.

1.9.2.7 Cleaning and coating procedures. Refer to documents 24590-WTP-3PS-AFPS-T0001, 24590-WTP-3PS-PX04-T0001, 24590-WTP-3PS-PX04-T0003, and 24590-WTP-3PS-

- PX04-T0004. For components that are not coated, cleaning procedures only are to be submitted.
- 1.9.2.8 Shipment preparation procedure.
 - 1.9.2.9 Bending procedures and bend qualification records.
 - 1.9.2.10 Deleted
 - 1.9.2.11 Positive Material Identification (PMI) procedure.
 - 1.9.2.12 Wall thickness measurement procedure for pipe bends.
 - 1.9.2.13 Inspection and test plan.
 - 1.9.2.14 Inspection procedure.
 - 1.9.2.15 Chemical analysis report for marking material and packing tape.
 - 1.9.2.16 Each specific type of desiccant material.
 - 1.9.2.17 Procedure for measuring minimum wall thickness for bulk pipe and butt weld fittings. Submittal shall include Supplier's inspection and sampling plan. The term "butt weld fitting" includes elbows, tees, reducers, caps, laterals, crosses, and swages; however, it excludes, pipe nipples, flanges, socket weld fittings, and integrally reinforced fittings.
 - 1.9.2.18 Deleted - see Section 1.2.1.17.
 - 1.9.3 The following documentation shall be submitted for each spool as appropriate, with the spool shipment:
 - 1.9.3.1 Pipe spool sheets/extended spool sheets/detailed drawings (as applicable) with heat numbers of piping and pressure containing parts or items.
 - 1.9.3.2 Material test reports (MTRs) shall be submitted for each pipe spool shipment for all metallic pipe spool and weld filler materials. This is not applicable to Buyer supplied valve and /or components.
 - 1.9.3.3 PMI results for individual items and weld deposits.
 - 1.9.3.4 NDE results (including volumetric, surface, and visual examination results, as applicable) shall be documented and forwarded with the pipe spool shipment. For Q pipe spools, HLW pipe spools, and PTF pipe spools, actual NDE test results shall be submitted. CM pipe spools outside the HLW and PTF require a Certificate of Conformance (C of C) certifying the NDE was performed in accordance with the applicable codes and the test results were acceptable.
 - 1.9.3.5 Pressure test results for fabricated piping, as applicable. CM pipe spools require a Certificate of Conformance (C of C) from the vendor certifying the pressure test was performed in accordance with the applicable codes and the test results were acceptable. For

Q pipe spools and black cell and hard-to-reach pipe spools, actual pressure test results shall be submitted with the pipe spool shipment.

1.9.3.6 Cleaning and Coating Verification reports refer to the pre-cleaning of fabricated spools that are specified to receive an exterior surface coating. A Cleaning and Coating Verification report is not required to be submitted for the “standard cleaning” of pipe spools not requiring coating after fabrication has been completed.

1.9.3.7 Wall thickness measurement reports. Wall thickness measurement applies to pipe bends, piping, bulk piping, and butt weld fittings. The wall thickness reports are to be submitted for these components for each heat/lot used for spool fabrication. In addition, the applicable bulk pipe and butt weld fitting wall thickness report is to be linked to every pipe and fitting on each extended spool sheet or referenced on each extended spool sheet where that heat/lot of pipe or butt weld fittings has been used. The term “butt weld fitting” includes elbows, tees, reducers, caps, laterals, crosses, and swages; however, it excludes pipe nipples, flanges, socket weld fittings, and integrally reinforced fittings.

This requirement is not applicable to CM carbon steel pipe bends, piping, bulk piping, and butt weld fittings.

1.9.3.8 Record of any major weld repairs. A major weld repair is when the depth of repair encroaches on specified minimum wall thickness which is 87 1/2% of generally published specification or standard nominal wall thickness. CM pipe spools require a C of C from the vendor certifying a major repair was performed and accepted in accordance with the applicable Buyer reviewed procedure where the Supplier has been granted permission to proceed. The C of C shall identify the spool piece mark and the work performed. For black cell, hard-to-reach, and “Q” pipe spools, actual record of major repair results shall be submitted with the pipe spool shipment.

Per Section 2.1.9, base metal repairs using welding shall not be performed.

1.10 Design Documents Incorporated by Reference

- 1.10.1 Deleted
- 1.10.2 24590-WTP-SDDR-PROC-02-0137, *Supplier Deviation Disposition Request*
- 1.10.3 24590-WTP-NCR-CON-02-137, *Nonconformance Report*
- 1.10.4 24590-WTP-SDDR-PROC-02-0124, *Supplier Deviation Disposition Request*
- 1.10.5 24590-WTP-SDDR-PROC-03-0152, *Supplier Deviation Disposition Request*
- 1.10.6 24590-WTP-SDDR-PROC-03-0153, *Supplier Deviation Disposition Request*
- 1.10.7 24590-WTP-SDDR-PROC-03-0391, *Supplier Deviation Disposition Request*
- 1.10.8 24590-WTP-SDDR-PROC-03-0410, *Supplier Deviation Disposition Request*
- 1.10.9 24590-WTP-CDR-CON-03-058, *Construction Deficiency Report*

- 1.10.10 24590-WTP-SDDR-PROC-04-00453, *Supplier Deviation Disposition Request*
- 1.10.11 24590-WTP-CDR-CON-04-0094, *Construction Deficiency Report*
- 1.10.12 24590-WTP-CDR-CON-04-0103, *Construction Deficiency Report*
- 1.10.13 24590-WTP-NCR-CON-04-0254, *Nonconformance Report*
- 1.10.14 24590-WTP-SDDR-PROC-04-00453, *Supplier Deviation Disposition Request*
- 1.10.15 24590-WTP-SDDR-PROC-04-00834, *Supplier Deviation Disposition Request*
- 1.10.16 24590-WTP-SDDR-PROC-04-00859, *Supplier Deviation Disposition Request*
- 1.10.17 24590-WTP-SDDR-PROC-04-00950, *Supplier Deviation Disposition Request*
- 1.10.18 24590-WTP-SDDR-PROC-04-00951, *Supplier Deviation Disposition Request*
- 1.10.19 24590-WTP-SDDR-PROC-04-00952, *Supplier Deviation Disposition Request*
- 1.10.20 24590-WTP-SDDR-PROC-04-00979, *Supplier Deviation Disposition Request*
- 1.10.21 24590-WTP-SDDR-PROC-04-00996, *Supplier Deviation Disposition Request*
- 1.10.22 24590-WTP-SDDR-PROC-04-01006, *Supplier Deviation Disposition Request*
- 1.10.23 24590-WTP-SDDR-PROC-04-01007, *Supplier Deviation Disposition Request*
- 1.10.24 24590-WTP-SDDR-PROC-05-00058, *Supplier Deviation Disposition Request** (This applies to CM pipe spools only.)
- 1.10.25 24590-WTP-SDDR-M-05-00024, *Supplier Deviation Disposition Request*
- 1.10.26 24590-WTP-SDDR-PL-05-00060, *Supplier Deviation Disposition Request*
- 1.10.27 24590-WTP-SDDR-PL-05-00063, *Supplier Deviation Disposition Request*
- 1.10.28 24590-WTP-SDDR-PL-06-00001, *Supplier Deviation Disposition Request*
- 1.10.29 24590-WTP-SDDR-PL-06-00005, *Supplier Deviation Disposition Request*
- 1.10.30 24590-WTP-SDDR-PL-06-00008, *Supplier Deviation Disposition Request*
- 1.10.31 24590-WTP-SDDR-PROC-05-00759, *Supplier Deviation Disposition Request*
- 1.10.32 24590-WTP-SDDR-PL-09-00008, *Supplier Deviation Disposition Request*
- 1.10.33 24590-WTP-SDDR-PL-09-00017, *Supplier Deviation Disposition Request*
- 1.10.34 24590-WTP-SDDR-MS-08-00084, *Supplier Deviation Disposition Request*

1.10.35 24590-WTP-SDDR-MS-09-00067, *Supplier Deviation Disposition Request*

2 Products

2.1 Materials

2.1.1 General

2.1.1.1 All materials shall conform to the specified material specification and the applicable code. All materials shall be new and traceable to the respective MTRs.

2.1.1.1.1 For all Q piping and black cell (BC) and all hard-to-reach (HtR) area piping, each heat/lot of bulk pipe and butt weld fittings shall be examined to establish that the minimum wall thickness meets or exceeds 87 1/2% of generally published specification or standard nominal wall thickness. This requirement applies to both CM and Q piping in black cells and hard-to-reach areas and to all associated butt weld fittings. The term “butt weld fitting” includes elbows, tees, reducers, caps, laterals, crosses, and swages; however, it excludes pipe nipples, flanges, socket weld fittings, and integrally reinforced forged welded branch fittings.

2.1.1.1.2 For all Q piping and all black cell piping and all hard-to-reach piping identify material by the specific ASTM or ASME material specification number and grade or type on shop spool drawings and extended spool sheets (as applicable), along with heat number or heat number code applied to or maintained on the piping material, traceable to the Material Test Report (MTR).

For CM piping, outside BC or HtR areas, identify material by the specific ASTM or ASME material specification number and grade or type on shop spool drawings and extended spool sheets (as applicable), along with heat number or heat number code applied to or maintained on the pipe, traceable to the MTR.

2.1.1.2 Unless otherwise identified on piping design drawings, all materials shall conform to the piping material classes for the pipe class, except as allowed by specification 24590-WTP-3PS-PB01-T0001 and as specified below.

Seamless pipe and fittings, if available, are preferred in all cases, including use in black cell or hard-to-reach areas.

2.1.1.2.1 Where material is specified as triple stamped, seamless A106/A53/API 5L Grade B, the following single stamped materials are acceptable:

- (a) A106 Grade B
- (b) Seamless A53 Grade B
- (c) Seamless API 5L Grade B

2.1.1.2.2 Where material is specified as double stamped, seamwelded A53/API 5L Grade B, the following single stamped materials and/or triple stamped material are acceptable:

- (a) Seamwelded A53 Grade B
 - (b) Seamwelded API 5L Grade B
 - (c) Seamless A53/A106/API 5L Grade B
- 2.1.1.2.3 Where material is specified as dual grade Type 316/316L stainless steel, a single grade Type 316L is acceptable. Single grade Type 316 is not acceptable.
- 2.1.1.2.4 Where material is specified as dual grade Type 304/304L stainless steel, a single grade Type 304L is acceptable. Single grade Type 304 is not acceptable.
- 2.1.1.2.5 Where the purchase order description specifies pipe to be furnished “Beveled Both Ends,” pipe furnished with “Plain Ends” is acceptable.
- 2.1.1.2.6 Where the purchase order description specifies pipe is to be furnished “Double Random Lengths,” pipe furnished in “Single Random Lengths” is not acceptable.
- 2.1.1.2.7 Where ASTM B675, N08367 Class 1 pipe with hydrostatic test is specified, ASTM B675, N08367 Class 2 pipe with hydrostatic test is acceptable.
- 2.1.1.2.8 Where ASTM B619 UNS N06022 Class I pipe is specified, ASTM B619 UNS N06022 Class II is acceptable. The hydrostatic and nondestructive electric tests specified for Class I shall also apply to Class II pipe.
- 2.1.1.2.9 Double Submerged-Arc Welded (DSAW) API 5L Grade B is acceptable in lieu of Electric Resistance Welded (ERW) API 5L Grade B for all pipe sizes larger than NPS 24.
- 2.1.1.3 Individual line service class material will be identified on piping design drawings by indicating the appropriate piping class. Stock codes will generally be assigned for each item of shop material. The supplier shall ensure that the stock code shown on the isometric Bill of Material matches stock codes attached to or inscribed on materials prior to their installation.
- 2.1.1.4 Moved to Section 2.1.1.1.2.
- 2.1.1.5 The Supplier shall purchase material based on the Buyer stock code’s “long” or “purchase” description. The Buyer’s short description shall not be used for purchasing material.
- 2.1.2 **Material Traceability**
- 2.1.2.1 Material traceability (such as identification of the item to applicable material specification, heat, batch, lot, part, or serial number or specified inspection, test, or other records) also includes transferring material identification mark(s) prior to subdividing material for all piping material. Traceability is being able to trace the piping material to the applicable MTR. All piping material, regardless of quality level, requires traceability.
- 2.1.2.2 As a minimum, individual spools shall have a pipe spool sheet, extended spool sheet, or detailed drawing that reflects the heat number of pressure containing items. Heat numbers and general PMI locations of piping and pressure containing parts or items shall be noted on the pipe spool sheet, extended spool sheet, or detailed drawing for material traceability. A pipe spool sheet, extended spool sheet, or detailed drawing may be defined as the actual

fabrication detail drawing, Bill of Materials, and/or traveling data table for that spool piece. Second sheets, if used, that provide spool material heat number information that is not shown on the pipe spool sheet, extended spool sheet or detailed drawing shall list the pipe spool number in order to maintain traceability. These sheets/drawings shall accompany each shipment of fabricated spools.

- 2.1.2.3 The Supplier is not required to submit MTRs for “Customer Furnished” weld-in valves. Traceability of these valves to the original procurement source will be the responsibility of the Buyer. The Supplier shall notify the Buyer if tags (see Section 2.1.8.5) on Customer-furnished valves are missing.

2.1.3 **NDE Requirements for Manufacturer’s Materials used in Black Cell and Hard-to-Reach Pipe Spools**

- 2.1.3.1 All black cell and hard-to-reach pipe spools fabricated using seam welded pipe and / or seam welded fittings shall have the seam weld tested 100% volumetrically (using either ultrasonics or radiography) by the pipe/fitting manufacturer in accordance with the pipe classification requirements and the requirements of Section 2.1.3.5 through 2.1.3.10. A copy of the testing Certificate of Conformance, or other documentation that shows the volumetric exam was performed and found to be acceptable, shall be forwarded to Buyer with the spool shipment. The notation of these NDE results on the applicable material test report that is supplied with the spool shipment is acceptable.

- 2.1.3.2 Where the seam welded pipe and / or fitting was received without adequate testing and / or certification to the pipe classification, the Supplier may augment the testing by performing the missing or questionable examinations to the requirements of the pipe classification, documenting the test results, and submitting copies of the documentation with the pipe spool shipment.

- 2.1.3.3 Ultrasonic testing (UT) of the seam weld shall be performed in accordance with:

- the ASTM specification under which the pipe or fitting was procured.
- or, in accordance with ASME B31.3-96, para. 344.6 except that indications characterized as cracks, lack of fusion, or incomplete penetration is unacceptable regardless of length. Imperfections which produce a response greater than 20% of the reference level shall be investigated to the extent that the operator can determine the shape, identity, and location of all such imperfections and evaluate them in accordance with the acceptance standards given above.

- 2.1.3.4 Radiographic testing (RT) of the seam weld shall be performed in accordance with:

- the ASTM specification under which the pipe or fitting was procured.
- or, in accordance with ASME B31.3-96, para. 344.5 except that incomplete penetration and internal undercut shall not be permitted.

- 2.1.3.5 Comply with ASTM B619 (UNS N06022), as applicable, using ultrasonic testing for Class I or II seam welded piping to be performed in accordance with ASTM B775.

- 2.1.3.6 Comply with ASTM B675 (UNS N08367) Class 1 seam welded piping, as applicable, using ultrasonic testing in accordance with ASTM B775. ASTM B675 Class 2 seam welded piping shall be hydrostatically tested and ultrasonically tested in accordance with ASTM B775.
- 2.1.3.7 Comply with ASTM B366, as applicable, which requires 100% radiography of all welds made using filler material for Class WPHC22-W (UNS N06022) fittings (Pipe Class N11E). ASTM B366 requires 100 % radiography in accordance with ASME Section VIII, Div. 1, UW-51, of all welds made with or without filler material for Class WP6XN-WX (UNS N08367) fittings (Pipe Classes N11F, N11K), except that the starting material manufacturer or fitting manufacturer has the option to ultrasonically test in accordance with Appendix 12 of ASME Section VIII, Div. 1.
- 2.1.3.8 Comply with ASTM A403, as applicable, which requires 100% radiography for the entire length of all seam welds made with or without filler materials for Class WP316/316L-WX fittings (Pipe Class S11B) in accordance with UW-51 of ASME Section VIII, Div. 1.
- 2.1.3.9 Deleted
- 2.1.3.10 All ASTM A312 seam welded pipe, to be installed in black cell and hard-to-reach areas, shall have the seam welds 100% volumetrically inspected by the manufacturer, using radiography in accordance with ASME Section VIII, Div. 1, UW-51.
- 2.1.3.11 Black cell and Hard-to-Reach seam welded fittings are no longer required to have the seam weld 100% dye penetrant tested (PT). Seam welded fittings that were PT tested and passed are acceptable. Seam welded fittings which did not pass the PT test of the seam weld are not acceptable.

2.1.4 **NDE for Pipe and Fitting Materials in High Level Waste (HLW) and Pretreatment Facility (PTF) Outside Black Cells or Hard-to-Reach Areas.**

Longitudinal seam welds in seam welded Stainless Steel, Hastelloy, AL-6XN, Inconel and Titanium pipe and fittings that are not in black cell and hard-to-reach areas but are within the HLW and PTF shall be 100% volumetrically (UT or RT) examined. HLW and PTF piping can be identified by the spool piece mark number (example, HLW-BSA-GB0001103-A). Based on service applications this requirement is not applicable to seam welded carbon steel pipe and fittings within the HLW and PTF.

Stainless Steel, Hastelloy, AL-6XN, Inconel, and Titanium seam welded pipe and fittings that had the seam weld UT examined are no longer additionally required to have the seam weld 100% dye penetrant tested (PT). Seam welded pipe and fittings that were PT tested and passed are acceptable. Seam welded pipe and fittings which did not pass the PT test are not acceptable.

2.1.5 **Positive Material Identification (PMI)**

To ensure material is correctly supplied as specified, the Supplier shall perform Positive Material Identification (PMI) tests in accordance with Specification 24590-WTP-3PS-G000-T0002. The Supplier shall submit their PMI test procedure for Buyer's review and permission to proceed. Note that PMI is not applicable for carbon steel materials and titanium materials. PMI is not to be performed on Buyer furnished valves unless otherwise stated in the purchase order.

Positive Material Identification (PMI) shall be used to check to ensure that the correct material has been used in black cell and hard-to-reach shop fabricated piping.

2.1.6 **Material Commitment**

The Supplier shall submit to the Buyer a complete itemized listing of all materials purchased or reserved from the Supplier's inventory for each project. The Supplier shall also provide, upon request, the current status of pre-bought or Buyer-furnished material.

2.1.7 **Material Substitutions**

All materials shall be in accordance with the Buyer-furnished drawings, the purchase order, and specifications, unless written permission to proceed is granted by the Buyer via the SDDR in accordance with the purchase order requirement.

2.1.8 **Material Identification and Marking**

2.1.8.1 All materials shall be marked with the information and using marking materials required by the specific ASTM or ASME material specification.

2.1.8.2 Labeling with a marking pen on stainless steel and nickel based alloy material shall be done by any permanent method that will neither result in harmful contamination or sharp discontinuities, nor infringe upon the minimum wall thickness. All marking materials other than material manufacturer's marks shall be of the low chloride (less than 200 ppm) and low sulfur (less than 400 ppm) type. It is acceptable to use a rounded, low stress, vibro-etch tool for this marking.

2.1.8.3 Weld identification symbols must be recorded on detailed spool sheets and extended spool sheets (as applicable) with a cross-reference to any NDE report numbers.

2.1.8.4 Any piece of material not readily identifiable during fabrication shall be rejected, including other components welded thereto.

2.1.8.5 All valves installed by the Supplier shall be tagged after being welded into the pipe spool (this tag is in addition to the tag being furnished with the valve). Each tag shall be stamped (not etched) with the individual "unique" valve identification number specified on the face of the isometric drawing (example, CHW-V-04558). Tags shall be 1/2 in. by 2 in. (min.) rectangle or 1 in. diameter (min.) stainless steel material and securely attached to the valve with 1/32 in. diameter (min.) braided stainless steel wire. Characters shall be 3/16 in. (min.) height.

2.1.8.6 Class 600 SW end ball valves, when identified with the proper Buyer stock code, are acceptable to be used where the valve description, both short (listed on the isometric Bill of Material) and the purchase description (specified in the piping class), specifies 150 or 300 SW end ball valves.

2.1.9 **Damaged Materials**

2.1.9.1 Materials that have been damaged, gouged, or found to have defects affecting their form, fit, function, or encroaching on minimum wall thickness, shall not be used. Minor surface

marks may be dressed, provided that the minimum wall thickness is not encroached upon after considering the manufacturing tolerances defined in the appropriate material or technical specification. Raised metal shall be blended into surrounding base metal. Base material repair of damaged material, using welding shall not be permitted.

- 2.1.9.2 Particular care must be taken with flange faces. Radial grooves or scratches are not permitted. Re-facing or repair of damaged flange facing is not permitted.
- 2.1.9.3 Deleted
- 2.1.9.4 The Supplier shall not make any base metal material repairs using welding.

3 Execution

3.1 Fabrication

3.1.1 General

- 3.1.1.1 Fabricated piping shall be in accordance with Buyer-furnished design drawings and specifications. This includes fabrication of the Pipe Class S11A piping spools in accordance with ASME B31.3-96. Use welded joint construction for all piping, except where otherwise called for on the design drawings and the piping material class.
- 3.1.1.2 Make all welds full penetration butt welds except as permitted otherwise for welded attachments, socket welds, slip-on flanges, and joggle pipe jacket. Mark all welds with welder's unique identification marks. It is acceptable to use a rounded, low stress, vibro-etch tool for this marking.
- 3.1.1.3 All flanges shall be installed with the bolt holes straddling the vertical centerline unless otherwise specified on the design drawings.
- 3.1.1.4 All welds performed by a supplier shall be shown on vendor spool sheets and extended spool sheets, as applicable. Additional requirements are as follows:
 - 3.1.1.4.1 Pipe lengths composed of two or more welded-together segments of straight pipe at intervals of less than 6 feet are not permitted, except as specified in Sections 3.1.1.4.2 and 3.1.1.4.3.
 - 3.1.1.4.2 Shop butt welds not represented on the isometric drawing(s) may be added to fabricate the spool(s) in accordance with the general configuration portrayed on the isometric drawing(s), provided the additional welds do not rest on pipe supports and provided the additional weld is not within 2 feet of existing butt welds or additional new butt welds. Bends shall not be replaced by elbows without prior written concurrence from the Buyer. The minimum required edge distance (D) between an integral attachment to the pipe and pipe weld or other inline components is provided in the table below. (The equation used to develop this table is \sqrt{Rmt} . Rm = Mean Radius of the pipe and t = thickness of the pipe.)

Table 1 Minimum Required Edge Distance Between Field and Shop Welds

Nominal Pipe Size (inches)	D (inches)
3" and under	1
3.5" to 6"	1 5/8
8" to 12"	2 3/4
14" to 18"	3 7/8
20" to 24"	5 1/8

- 3.1.1.4.3 Addition of butt welds is preferred over the addition of socket welds, even in a socket welded system. However, socket welded couplings may be added by the Supplier to socket welded piping systems, provided the couplings are not located any closer than 2 feet from other welds, and provided the added couplings do not rest on pipe supports. No socket welds are allowed on black cell or hard-to-reach piping unless specifically shown on the Buyer's isometric drawing.
- 3.1.1.5 Deleted
- 3.1.1.6 Welding of titanium shall be performed in a clean area, isolated from all grinding, torch cutting, and painting. In addition, the welding area shall be protected from wind, rain, and other harmful weather conditions which may affect weld quality.
- 3.1.1.7 The following are the requirements for titanium fabrication:
 - 3.1.1.7.1 Grinding or sanding wheels used on titanium shall contain no aluminum, (i.e. carbide-grit wheels are required). When grinding, the surface temperature shall be kept below 500°F.
 - 3.1.1.7.2 Gas backing is required when welding titanium.
 - 3.1.1.7.3 Argon must be used for titanium shielding and purging gases and must meet the requirements of AWS A5.32, Classification SG-A with a minimum purity of 99.999% or Buyer approved equal.

- 3.1.1.7.4 When welding titanium, separate gas supplies are needed for:
- Primary shielding of the molten weld puddle.
 - Secondary shielding to cool the recently-made weld deposit and associated heat-affected zones.
 - Backup shielding for the backside of the weld and associated heat-affected zones.
- 3.1.1.7.5 For titanium base metals, do not use oxy-fuel torches for preheating. Instead, use a small, hot-air blower (hair dryer-style) to warm the part slightly to ensure that no moisture has condensed on the surface to be welded.
- 3.1.1.7.6 When welding titanium, each bead and the adjacent metal shall be cleaned to remove all surface discoloration prior to deposition of the next bead.
- Even though a clean, silver-colored weld is desirable, the final weld surface may have intermittent straw-colored oxides. Blue-colored weld surfaces are unacceptable
- 3.1.1.8 Pipe Class C12B or C14A isometrics with DB (high pressure steam) in fluid code portion of the isometric drawing number shall have the longitudinal seam weld of horizontal piping runs oriented in the 12 o'clock "up" position.

3.1.2 **Weld Joint Preparation**

- 3.1.2.1 Unless otherwise noted on the design drawings, field butt weld end preparations shall be in accordance with drawing 24590-WTP-PW-P30T-00001.
- 3.1.2.2 Do not use backing rings.

3.1.3 **Bending**

Pipe bending shall be in accordance with document 24590-WTP-3PS-PS02-T0002, except as follows:

- 3.1.3.1 Refer to standard PFI ES-24, Paragraph 5.1, for tolerances associated with specific bend angles as shown on project isometric drawings. Also, refer to PFI-ES-24, Paragraph 6 for form tolerances related to buckling.
- 3.1.3.2 Where bends shown on isometric drawings are labeled with no specific bend angle shown, the bend angle is understood to be 90 degrees. The tolerances in the previous subparagraph also apply to these bends.
- 3.1.3.3 Where a pipe class notes that the specified pipe thickness includes an allowance for thinning due to bending, the minimum wall thickness after bending shall not be less than the specified nominal wall thickness minus the 12-1/2 % mill tolerance allowed by the material specification, minus an additional thinning allowance due to bending. Accordingly, where 20 % thinning is allowed due to bending, the aggregate allowable

minimum wall thickness, at the bend, results in (1 - 0.125) times (1 - 0.20) or 70 % of the specified pipe nominal wall thickness. Thinning that exceeds that allowed in the pipe class shall be brought to Buyer's attention via an SDDR.

3.1.4 Dimensional Tolerances, Except For Pipe Bends

Unless otherwise indicated on the design drawing, do not exceed the dimensional tolerances of PFI-ES-3 for fabricated piping assemblies.

3.1.5 Welding Processes

Use welding processes in accordance with document 24590-WTP-3PS-NWP0-T0001 and the applicable code and/or standard.

3.1.6 Welding Procedures and Welder Qualifications

3.1.6.1 Welding shall be performed by qualified welders in accordance with welding procedures prepared and qualified in accordance with the applicable code and/or standard, and ASME Section IX using procedures reviewed by the Buyer and after receiving permission to proceed.

3.1.6.2 Type 316L or Type 316LSi weld filler metal may be used for welding Type 304L stainless steel.

3.1.7 Flanges

Furnish flanges for flanged connections in accordance with the piping material classes and as shown on design drawings.

3.1.7.1 All slip-on flanges shall be double welded in accordance with paragraph 328.5.2 of ASME B31.3 unless directed otherwise by design document(s).

3.1.7.2 There shall be no flanged or threaded connections in the Black Cell or Hard-to-Reach areas unless specifically directed otherwise by the Buyer's isometric drawing.

3.1.8 Branch Connections

3.1.8.1 Branch connections shall be in accordance with the applicable piping material class (es).

3.1.8.2 Threaded branch fittings on piping spools that have been hot-dip galvanized shall have the threads "chased" after dipping to ensure that threads are free from excess galvanizing materials that would prevent the threaded joints from being made up upon installation.

3.1.9 Orifice Runs

Straight pipe orifice runs shall not contain welds, except at flanges. Pipe ends at orifice flanges shall be machine cut perpendicular to the pipe axis. Welds at orifice flanges shall be ground smooth inside. Pipe tap connections (if required) are to be drilled through the pipe wall and shall be smooth inside. Orifice flanges shall be drilled and tapped for jack screws. Buyer supplied drawings show the orientation of

orifice flange taps and the locations of pipe taps. Unused orifice flange taps shall be supplied with appropriate plugs.

3.1.10 Valves

- 3.1.10.1 Install all valves in accordance with the manufacturer's recommended instructions and design drawings. Buyer shall furnish valve manufacturer's installation/disassembly instructions for Supplier's use and reference. The Supplier shall notify the Buyer if they have not been sent the applicable valve manufacturer's installation/disassembly instructions.
- 3.1.10.2 In addition to manufacturer's instructions, the following apply for valve installation:
 - 3.1.10.2.1 Valve stems shall be positioned in accordance with the isometric and is normally not be inclined below the horizontal. Also, flow arrows, when present on the valve, must align with the flow arrow shown on the isometric.
 - 3.1.10.2.2 Before conducting any welding on diaphragm valves or other soft-seated valves, the bonnet assembly and diaphragm, and any other heat-sensitive components shall be disassembled and valve body cooled, if required by vendor instructions. Particularly for stainless steel valves, care shall be exercised to ensure that contact with cooling medium (e.g., water-soaked wick) is not harmful. Water used for cooling of stainless steel valves shall have a maximum chloride content of 200 ppm.
 - 3.1.10.2.3 To prevent damage or distortion to valve seat and disc, follow the vendor's instructions with respect to position of the valve stem and the disc during installation and welding.
 - 3.1.10.2.4 If disassembly beyond the vendor's standard installation instruction is required, valves and actuators shall be disassembled and reassembled only after documented concurrence has been obtained from the Buyer that doing so will not compromise the warranty and performance of the valve.
 - 3.1.10.2.5 Manual valves shall be disassembled and reassembled, if required, in accordance with the manufacturer's disassembly and reassembly procedures.
 - 3.1.10.2.6 Valves shall be handled and supported with care to preclude damage to handwheels and appurtenances. Lifting lugs shall be used whenever they are provided on a valve. In no case shall a valve be picked up by the valve actuator

3.1.11 Rework of Fabricated Spools

- 3.1.11.1 Reworked spools being shipped to the jobsite shall be provided with a Certificate of Conformance (C of C) stating the spools identified are the same spool number(s) originally delivered and received. The C of C shall state that the re-worked spools are in strict accordance and fully comply with the purchase order and all procedures and specifications. The C of C shall also state the re-work performed on each spool.

If additional materials are added, or if additional documentation is provided (NDE reports, MTRs, etc.) a complete documentation package for that spool shall be furnished.

3.2 Inspection and Testing

3.2.1 General

- 3.2.1.1 The Supplier is responsible for nondestructive examination and testing of piping furnished under this specification.
- 3.2.1.2 All examination, inspection, and testing shall be in accordance with this specification and other governing codes and standards, as applicable. This includes nondestructive examination of the piping spools in accordance with the requirements for Normal Fluid Service piping in ASME B31.3-96.
- 3.2.1.3 Buyer's representative shall be provided free access to the Supplier's and Supplier's subcontractor's or Supplier's facilities, to witness, inspect, and report progress of work.
- 3.2.1.4 Note: No sub-supplier shall perform NDE work without prior submittal of the sub-supplier's NDE procedure and Buyer's review and permission to proceed.

3.2.2 Examination of Fabrication Welds

- 3.2.2.1 Examine all completed pressure boundary welds in accordance with the ASME B31.3-96 and/or standard, including the requirements listed below, as applicable. Weld repair shall be examined according to the requirements used for the original weld.
- 3.2.2.2 Perform and evaluate examinations in accordance with procedures and acceptance standards prepared in accordance with the ASME B31.3-96 and/or standard, and the *ASME Boiler & Pressure Vessel Code*, Section V.

3.2.2.3 **BC and HtR Weld NDE and Inspection Requirements**

The NDE and inspection requirements for the BC and HtR welds, which are in excess of ASME B31.3-96, are provided in Appendix A. The acceptance criteria are as listed in ASME B31.3, Table 341.3.2, for Normal Fluid Service Conditions with the following additions:

- 3.2.2.3.1 Where radiographic examination (RT) is allowed or specified for shop welds, the radiographic acceptance criteria for Normal Fluid Service apply, except that incomplete penetration and internal undercut shall not be permitted.
- 3.2.2.3.2 Where liquid penetrant examination (PT) or magnetic particle examination (MT) is allowed or specified, no cracks shall be permitted.
- 3.2.2.3.3 The material manufacturer is required to perform 100% full volumetric examination, either by radiographic (RT) or ultrasonic (UT) methods, as allowed by the applicable material specification, for all longitudinal seam welds in pipe and fitting material using the examination techniques in accordance with the requirements of applicable material specification. Where these inspections have not been performed, as required, by the piping manufacturer, the Supplier may perform them to the specified material specification requirements. The results of this inspection shall be included in the spool documentation package.
- 3.2.2.3.4 Fillet welds, called out on the piping isometrics require NDE in accordance with ASME B31.3, para 341.4.1 except these welds require 100% visual examination, and 100% liquid penetrant (PT) or 100% magnetic particle examination (MT).
- 3.2.2.3.5 For integrally reinforced forged branch fittings:
- A full radiographic examination of the single bevel groove weld connecting the fitting to the run pipe is required unless it will not produce an interpretable radiograph, in which case, in-process examination and liquid penetrant examination of the exterior of the root and final pass weld is acceptable.
 - Full volumetric examination of the full penetration girth weld connecting the fitting to the connecting branch pipe is required.
 - In-Process exam is per ASME B31.3, para 344.7
- 3.2.2.3.6 Welded branch connection fittings either with or without added reinforcement that are not designed for volumetric examination may be used in specifically allowed applications in black cells and hard-to-reach areas where specified on the isometric or approved by Buyer's Engineering, provided they are full penetration groove welds and are radiographed. When a radiographic examination will not produce an interpretable radiograph, the weld shall be in-process examined per ASME B31.3, para 344.7 using liquid penetrant (PT) examination of the exterior of both the root pass and the final pass of the weld is acceptable.

- 3.2.2.3.7 The final pass of fillet welds used on socket welded branch fittings on outer jacket pipe drains in dual wall piping systems shall be fully visually (VT) and fully dye penetrant (PT) examined.
- 3.2.2.3.8 The fillet or full penetration welds attaching the end plate or cap closing the annulus between the outer jacket pipe and inner process pipe of dual containment piping spools shall be fully visual (VT) examined, and fully radiographic examined (RT) unless it will not produce an interpretable radiograph, in which case in-process examination per ASME B31.3, para 344.7 using liquid penetrant (PT) examination of the exterior of both the root pass and the final pass of the weld is acceptable.

3.2.2.4 **Non-BC and Non-HtR Weld NDE and Inspection Requirements**

The following are the NDE and inspection requirements for non-BC, and non-HtR piping welds lying outside of the BC and HtR boundaries. These requirements are summarized in Appendix A. The acceptance criteria are as listed in ASME B31.3, Table 341.3.2, for Normal Fluid Service Conditions with the following additions:

- 3.2.2.4.1 Where radiographic examination (RT) is allowed or specified for shop welds, the radiographic acceptance criteria for Normal Fluid Service apply, except that incomplete penetration shall not be permitted.
- 3.2.2.4.2 Where liquid penetrant examination (PT) or magnetic particle examination (MT) is allowed or specified, no cracks shall be permitted.
- 3.2.2.4.3 All shop girth welds require full visual examination in accordance with the requirements of ASME B31.3-1996, para 341.4.1(a), and NDE examination in accordance with the requirements of ASME B31.3-1996, para 341.4.1(b).
- 3.2.2.4.4 NDE requirements for shop performed joggle assembly and dual containment piping welds exceed Normal Fluid Service piping requirements in ASME B31.3-1996 and are stated in Appendix A
- 3.2.2.4.5 Individual dual containment pipe jacket girth welds requiring 5% random RT or UT may, on a case by case basis, be examined by in-process examination in accordance with ASME B31.3, para 344.7 with VT of the root pass in accordance with ASME B31.3, para 344.7.1(e). The Supplier shall submit the request for in process examination to the Buyer via a Supplier Deviation Disposition Request (SDDR) for review and permission to proceed prior to implementation.
- 3.2.2.4.6 Fillet welds including socket welds, integral support welds, and non pressure and non load bearing piping attachment welds (e.g., cathodic protection clips) welds require NDE in accordance with ASME B31.3, para 341.4.1.
- 3.2.2.4.7 Integrally reinforced forged branch fitting connection welds, welded to the main piping run shall be examined in accordance with the requirements of ASME B31.3, para 341.4.1. The girth weld that connects the fitting to the branch pipe run shall be examined in accordance with requirements of ASME B31.3, para 341.4.1.

3.2.3 **Pressure Testing**

- 3.2.3.1 Do not perform hydrostatic test on fabricated piping assemblies other than piping coated and wrapped in the Supplier's shop, and other spools when designated by approved documents.
- 3.2.3.2 Perform pressure test of coated piping in accordance with the applicable code prior to coating operations, unless the Buyer opts to leave joints uncoated for inspection during field hydrotest. Potable water shall be used for the pressure test performed by the Supplier. When pressure testing stainless steel piping, the test water shall not contain more than 200 ppm halogen. The Supplier shall submit a pressure testing procedure for Buyer's review and permission to proceed prior to performing the test. The Supplier shall also include a record of the test result as part of pipe spool documentation
- 3.2.3.3 Welding of integral supports shall be avoided in previously hydrostatically or pneumatically tested piping. Buyer Engineering shall be consulted immediately when this situation occurs.
- 3.2.3.4 After installation, all fabricated assemblies will be tested by others in accordance with the applicable code. Should any defect be detected during field testing, the defect will be repaired by the Buyer at Supplier's expense.

4 Configuration Management

Configuration management is maintained by fabrication and installation in accordance with approved drawings and procedures. Fabrication and installation shall be performed in accordance with approved documents. Where fabrication and installation cannot be accomplished in accordance with approved procedures and drawings, the Buyer shall be promptly notified via a SDDR or other suitable means. Fabrication and installation shall not proceed until a resolution is approved and proper documentation is provided.

5 Documentation and Submittals

Documentation is provided by approved procedures and drawings. Any records generated by working to procedures and drawings shall be submitted to the Buyer for logging and issuance. Refer to section 1.9 for submittal details.

Appendix A, Summary Table of Non-Destructive Examinations (NDE) of Pipe & Tubing Shop Welds

Table 2 Piping Weld Examination Requirements

SEE SECTIONS 2.1.4, 3.2.2.2, 3.2.2.3, 3.2.2.4 FOR APPLICABLE SHOP WELD NDE, INSPECTION, AND ACCEPTANCE CRITERIA REQUIREMENTS. 2. SEE NEXT SHEET FOR NDE LEGEND AND TABLE FOOTNOTES.

Type of Weld ↓	Piping Outside Black Cells and Hard-To-Reach areas ¹	Piping Inside Black Cells and Hard-To-Reach areas	Dual Containment (outside BC or HtR areas)	
			Inner Piping	Outer/Jacket Piping
<u>All</u> Girth and Miter Welds	100% VT 5% RT or 5% UT	100% VT 100% RT	100% VT 100%RT	100% VT 5% RT
<u>All</u> Longitudinal Seam Welds on Seamwelded Pipe and Fittings	See Note 2	100% RT or 100% UT ³	100% RT or 100% UT ³	N/A
Outer Pipe Shop Performed Longitudinal/Clam Shell Welds for Dual Contained Piping	N/A	100% VT 100% RT	N/A	100% VT 5% RT
<u>Double Encased Pipe Joggle Assemblies</u> (shop welds on both inner and outer piping)	N/A	100% VT 100% RT	100% VT 100% RT	100% VT 100% RT
<u>Sleeved Joggle Assemblies</u> (shop welds on inner piping only)	N/A	100% VT 100% RT	100% VT 5% RT	N/A
<u>All</u> Pipe and Integral Attachment Fillet Shop Welds - including thermowell socket welds, integral support welds, non pressure & non load bearing piping attachment welds	100% VT	100% VT 100% PT or 100% MT	100% VT 100% PT or 100% MT	100% VT
<u>All</u> integrally reinforced forged branch fittings welded to main piping run. For BC/HtR piping, if 100% RT will not produce an interpretable radiograph, In-Process Examination and liquid penetrant examination of the exterior of both the root and final pass weld is acceptable. ⁴	100% VT	100% VT 100% RT	100% VT 100% PT or 100% MT	100% VT

For BC/HtR piping, welded branch connection fittings with or without added reinforcement welded to main piping run ⁵ . If 100% RT will not produce an interpretable radiograph, In-Process Examination and liquid penetrant examination of the exterior of both the root and final pass weld is acceptable.		100% VT 100% RT			
For BC/HtR piping, final pass of fillet weld on socket welded branch fitting to outer jacket pipe drains used in dual wall piping systems. ⁶		100% VT 100% PT			
For BC/HtR piping, fillet or full penetration welds attaching the end plate or cap closing the annulus between the outer jacket pipe and inner process pipe of dual containment piping spools shall be fully visual (VT) examined and fully radiographic examined (RT). ⁷ If 100% RT will not produce an interpretable radiograph, In-Process Examination and liquid penetrant examination of the exterior of both the root and final pass weld is acceptable.		100% VT 100% RT			

- Legend:** VT = Visual Examination per ASME B31.3 para 344.2
RT = Radiographic Examination per ASME B31.3 para 344.5
UT = Ultrasonic Examination per ASME B31.3 para 344.6
PT = Liquid Penetrant Examination per ASME B31.3 para 344.4
MT = Magnetic Particle Examination per ASME B31.3 para 344.3

¹ Includes embedded piping, but does not apply to dual containment piping, double encased joggles, or sleeved joggles. Those requirements are specified elsewhere in Table 2.

² Longitudinal seam welds in seam welded stainless steel, Hastelloy, AL-6XN, Inconel and titanium pipe and fittings that are not in black cell and hard-to-reach areas but are within the HLW and PTF shall be 100% volumetrically (UT or RT) examined. Based on service applications this requirement is not applicable to seam welded carbon steel pipe and fittings within the HLW and PTF.

³ Applies to longitudinal seam welds in all pipe and fittings, including all stainless, titanium, or nickel alloy, used in Black Cells or Hard-to-Reach areas, or for the inner pipe of dual containment piping.

⁴ The circumferential weld that connects an integrally reinforced forged branch fitting to the branch pipe run shall be examined as a girth weld.

⁵ This is applicable to specifically allowed applications in black cell and hard-to-reach areas listed in Section 3.2.2.3.6.

⁶ This is applicable to specifically allowed applications in black cell and hard-to-reach areas listed in Section 3.2.2.3.7.

⁷ This is applicable to specifically allowed applications in black cell and hard-to-reach areas listed in Section 3.2.2.3.8.