RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

Field Fabrication and Installation of Piping

Contents of this document are Dangerous Waste Permit affecting.

Content applicable to ALARA? ☒ Yes ☐ No

ADR No.
24590-WTP-ADR-PL-08-0001

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

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SPECIFICATION No.
24590-WTP-3PS-PS02-T0003

Rev
8

Revision History

Revision	Reason for Revision
8	Incorporated the following by revision: 1. BODCN 24590-WTP-BODCN-ENG-09-0007 (as accepted by DOE - ref CCN 193394 & 198448) - clarification of NDE requirements incorporated into Section 3.3, 3.8.2.2.4 and Appendix B. 2. SCN 24590-WTP-3PN-PS02-00082 - Section 3.8.2.2.1 is no longer required since Section 3.8.2.1 already states that NDE missed by material manufacturer or Supplier may be performed by Construction in accordance with the applicable non conformance disposition. 3. SCN 24590-WTP-3PN-PS02-00083 - revised Section 3.7.2.5 for locations of additional field welds. 4. SCN 24590-WTP-3PN-PS02-00085 - revised Section 3.7.3.4 to allow for installation of additional vent and drain valves. 5. SCN 24590-WTP-3PN-PS02-00087 - Added Section 3.2.6 6. .FC 24590-WTP-FC-P-09-0086 - Section 3.5.4 - corrected Section reference. 7. PIER 24590-WTP-PIER-GT-09-0959-D - Section 3.5 added seam weld orientation requirements for DB (high pressure steam) isometrics. Incorporated the following by reference: FC 24590-WTP-FC-P-09-0003 - see Section 1.6.11
7	Incorporated the following by revision: BODCN 24590-WTP-BODCN-ENG-08-0008 - clarification of NDE requirements listed in Section 3.8.3 (including the DOE comments as listed in letter 08-WTP-168 dated 9/25/08) SCN 24590-WTP-3PN-PS02-00080, SCN 24590-WTP-3PN-PS02-00072 (as revised), 24590-WTP-FC-P-06-0030, 24590-WTP-FC-P-07-0259, 24590-WTP-FC-P-07-0275, 24590-WTP-FC-P-08-0044 (as revised) (Retroactive) (i.e. 3.6.2.5 (2) the welds are not to be located where they come to rest on steel members.), 24590-WTP-FC-P-08-0192. Incorporated the following by reference: 24590-WTP-NCR-CON-05-0276, 24590-WTP-NCR-CON-05-0293, and 24590-WTP-NCR-CON-05-0296. Additional requirements added for welding and cleaning of titanium piping. New requirements added for field purchased pipe, piping alignment, field welding, and field NDE. Numerous wording changes to provide clarification to specific existing requirements. Clarified the NDE requirements for Black Cell and Hard-To-Reach areas. Provided definitions and locations of Black Cell and Hard-To-Reach areas. Other changes as agreed with PD, PD Chief Engineer, Construction Welding, E&NS, QA, Field Engineering, Field Q.C., and MET. Updated and clarified the Vacuum Box Leak Testing and Closure Welds requirements to be in accordance with the applicable SRD requirements and applicable code requirements related thereto Listed applicable Plumbing code. Added Appendix A to show examples of Black Cell and Hard To Reach piping weld boundaries. Added requirements for non-load bearing, non-pressure retaining piping attachments, and related welding and NDE requirements required to resolve Action 2 of PIER 24590-WTP-PIER-MGT-08-0099.

Revision	Reason for Revision
6	Incorporated the following by revision: 24590-WTP-3PN-PS02-00058, -00065, -00067, -00069, -00070 24590-WTP-FC-P-06-0036, -FC-P-06-0178 24590-WTP-SDDR-PL-06-00016 Incorporated the following by reference 24590-WTP-FC-P-06-0032 24590-WTP-CDR-CON-05-0253 24590-WTP-NCR-CON-06-0088 Other changes as noted by revision bars are as agreed with PD and MET. The design changes to this specification continue to meet the SRD requirements and codes.
5	Incorporated the following by revision: 24590-WTP-3PN-PS02-00053, -00054, -00055, -00057, -00059 24590-WTP-FC-P-05-0080, -0089, -0090 and modified section number, 24590-WTP-FC-P-06-0005 Incorporated the following by reference 24590-WTP-FCR-P-05-0120 24590-WTP-FCR-P-05-0124 Other changes as noted by revision bars are as agreed with PD, MET, Construction, E&NS and QA. The design changes to this specification continue to meet the SRD requirements and codes.
4	Incorporated the following by revision: 24590-WTP-3PN-PS02-00039, -00040, -00042, -00046 24590-WTP-FCR-P-04-0124 24590-WTP-FCR-P-05-0034 All other changes as noted by revision bars are as agreed with Construction and E&NS
3	Incorporated the following by revision: 24590-WTP-3PN-PS02-00023, - 00027, -00031, -00033, -00036 and -00038 24590-WTP-SDDR-PROC-04-00604 24590-WTP-FCR-P-04-0067 Incorporated the following by reference: 24590-WTP-CDR-CON-04-0099 24590-WTP-FCR-P-04-0067
2	Incorporated SCNs 24590-3PN-PS02-00013, -00016, -00019 and -00020; FCRs 24590-WTP-FCR-P-03-049, -065 and -075
1	Complete rewrite. Changes not noted in margins. Incorporated 24590-WTP-FCR-P-03-016, 24590-WTP-SDDR-PROC-03-0103, 24590-WTP-SDDR-PROC-03-0104, 24590-WTP-SDDR-PROC-03-0105, 24590-WTP-3PN-PS02-00002, 24590-WTP-3PN-PS02-00005, FCR 24590-WTP-FCR-P-03-041, and 24590-WTP-3PN-PS02-00009. Also incorporated 24590-WTP-3PN-PS02-00007, except as subsequently modified by EDR responses during review.
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REV	DATE	BY	CHECK	REVIEW	E&NS	QA	APEM/DEM
		SPECIFICATION No. 24590-WTP-3PS-PS02-T0003					Rev 8

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. This document contained herein on radionuclides is provide for process description purposes only.

Contents

Tables & Figures

Appendices

1 General

1.1 Scope

This specification defines the requirements and the work necessary for Construction fabrication and installation of piping and engineered process tubing, Pipe Class S11H, systems in accordance with the requirements of the ASME B31.3 Code, "Process Piping", and other codes, standards, and documents referenced in this specification. This specification applies to all quality levels.

1.2 Work Included

1.2.1 Install all piping to ASME B31.3 Code, and other codes and standards, as applicable, including shop and Construction fabricated piping, flow elements, and expansion joints. This also includes offset piping assemblies (Joggles) that are either dual wall or single wall configurations.

The term "piping" as referenced throughout this document is intended to include tubing designed in accordance with ASME B31.3, unless specified otherwise.

The term "engineered process tubing" is defined as vessel sparger tubing routed to Ultrafilter Feed Vessel UFP-VSL-00002A/B; HLW LAG Storage Vessel HLP-VSL-00027A/27B; and HLW Blend Vessel HLP-VSL-00028.

1.2.2 Fabricate and install piping, including installation of all shop fabricated spools.

1.2.3 Install valves, steam traps, drain traps, strainers, and other line item specialties, as designated on the piping drawings.

1.2.4 Receive, handle, and store shop-fabricated piping; random lengths of pipe, valves, and fittings; and other specialty devices furnished by others.

1.2.5 Perform required welding, post weld heat treatment (PWHT), and nondestructive examinations (NDE).

1.2.6 Provide Construction erection labor and associated equipment.

1.2.7 Furnish all required bolting, fasteners, and gaskets for Construction fabricated piping.

1.2.8 Repair material and weld defects.

1.2.9 Apply coatings for Construction fabricated piping in accordance with approved procedures and specifications.

1.2.10 Fabricate and install engineered process tubing to ASME B31.3 and other applicable codes and standards.

1.2.11 Install welded pipe support attachments to piping.

1.2.12 Fabricate and install non-metallic piping systems to ASME B31.3 (example, Plastic, PVC, HDPE, fiberglass) which reference ASME B31.3 as the design code.

1.3 Related Work Not Included

1.3.1 Furnishing of shop-fabricated piping, as identified in the purchase order documents

1.3.2 Furnishing of valves, valve operators, specialty devices, expansion joints, instrumentation (including sensing devices), relief valves, orifice plates, flow elements, traps, and permanent strainers, unless otherwise noted on the design documents

1.3.3 Designing any piping

1.3.4 Designing any pipe supports

1.3.5 Installing instrument or sampling tubing and their associated supports (except in black cells and hard-to-reach areas)

1.3.6 Installing fire protection sprinkler piping

1.3.7 Installing plumbing piping provided and/or designed as part of Plumbing Subcontract scope.

1.4 Codes and Standards

For the codes and standards listed below, the specific revision or effective date identified, as well as the specific revision or effective date of codes and standards that they incorporate by reference (daughter codes and standards), shall be followed.

Any conflict between the requirements of this specification, design drawings, codes, and standards referenced in this specification and other design documents shall be brought to the attention of Engineering.

1.4.1 American Society of Mechanical Engineers (ASME)

B31.3 - 1996 - *Process Piping Code*

B31.3c - 1998 Addenda paragraph 345.2.3(c) - *Process Piping Code*

1.4.2 ASME Boiler and Pressure Vessel (BPV) Code

ASME BPV Code, Section V- *Nondestructive Examination***

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

** See 24590-WTP-MN-CON-01-001-01-01, *Welding Control Manual, Introduction and Instructions* (WCM) for the applicable edition used at WTP.

1.4.3 **American Society for Testing and Materials (ASTM)**

ASTM material and testing and specifications and standards as specified in the Piping Material Classes, design drawings, this specification, and other documents referenced herein.

1.4.4 **American Welding Society (AWS)**

AWS A5.32M-97 - *Specification for Welding Shielding Gases*

1.4.5 **Pipe Fabrication Institute (PFI) Standards**

ES-3 - 1994 - *Fabricating Tolerances*

ES-5 - 2002 - *Cleaning of Fabricated Piping*

1.4.6 **Washington Administrative Codes (WAC)**

WAC-173-303-640 (1/12/98) - *Dangerous Waste Regulation, Tank Systems*

1.4.7 **International Association of Plumbing and Mechanical Officials (IAPMO)**

Uniform Plumbing Code (UPC), 1997 Edition

1.4.8 **American Concrete Institute (ACI)**

ACI 318-99, *Building Code Requirements for Structural Concrete (ACI-99) and Commentary (ACI 318R-99)*

ACI 349-01, *Code Requirements for Nuclear Safety Related Concrete Structures*

1.5 Reference Documents/Drawings

1.5.1 24590-WTP-3PS-P000-T0001 - *Engineering Specification for Piping Material Classes General Description and Summary*

1.5.2 Piping Class Sheets

1.5.3 Piping Drawings

1.5.4 Pipeline Lists.

1.5.5 24590-WTP-3PS-G000-T0010 - *Engineering Specification for Positive Material Identification (PMI) for Construction*

1.5.6 24590-WTP-MN-CON-01-001-01-01 - *Welding Control Manual Introduction and Instructions -Job 24590 Only*

1.5.7 24590-WTP-3PS-NW00-T0002 - *Engineering Specification for Chemical Requirements for Materials Used in Contact With Austenitic Stainless Steel and Nickel Based Alloys*

1.5.8 24590-WTP-PW-P30T-00001 - *WTP End Prep Detail For Field Butt Welds*

1.5.9 24590-WTP-3PS-PB01-T0001 – *Engineering Specification for Technical Supply Conditions for Pipe, Fittings, and Flanges*

1.5.10 24590-WTP-3PS-AFPS-T0001 - *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*

1.5.11 24590-WTP-3PS-G000-T0005 - *Engineering Specification for Cleanness Requirements for WTP Fluid Systems.*

1.5.12 24590-WTP-3PS-G000-T0011 - *Engineering Specification for Vacuum Box Leak Testing*

1.5.13 24590-WTP-3PS-PH01-T0002 - *Engineering Specification for Installation of Pipe Supports*

1.5.14 24590-WTP-GPP-CON-7112 - *Dangerous Waste Permit (DWP) Third Party Inspection Interface*

1.5.15 24590-WTP-3PS-M000-T0014 - *Engineering Specification for Labeling of Permanent Plant Components*

1.5.16 24590-WTP-J8-50-00001, *Radar Installation Wave Guide Spool Joining Details*

1.5.17 24590-QL-BOA-PB00-00004, *Stainless Steel Piping Bulks Miscellaneous*

1.5.18 24590-QL-BOB-PB00-00004, .*Stainless Steel Piping Bulks Miscellaneous*

1.5.19 24590-WTP-3PS-M000-T0010, *Mechanical Installation Tolerances*

1.5.20 24590-WTP-3PS-F000-T0002, *Engineering Specification for Fastener Torque and Tensioning*

1.5.21 24590-WTP-3PS-PS02-T0001, *Engineering Specification for Shop Fabrication of Piping*

1.6 Design Documents Incorporated by Reference

1.6.1 24590-WTP-CDR-CON-04-0099 - Construction Deficiency Report

1.6.2 24590-WTP-FCR-P-04-0067 - Field Change Request

1.6.3 24590-WTP-FCR-P-05-0120 - Field Change Request

1.6.4 24590-WTP-FCR-P-05-0124 - Field Change Request

1.6.5 24590-WTP-FC-P-06-0032 - Field Change Request

1.6.6 24590-WTP-CDR-CON-05-0253 - Construction Deficiency Report

1.6.7 24590-WTP-NCR-CON-06-0088 - Nonconformance Report

1.6.8 24590-WTP-NCR-CON-05-0276 - Nonconformance Report

1.6.9 24590-WTP-NCR-CON-05-0293 - Nonconformance Report

1.6.10 24590-WTP-NCR-CON-05-0296 - Nonconformance Report

1.6.11 24590-WTP-FC-P-09-0003 - Field Change Request

1.7 Other

1.7.1 24590-WTP-DB-ENG-01-001, *Basis of Design*

2 Products

2.1 Materials

2.1.1 General Requirements

Piping materials shall be in accordance with the applicable Piping Material Classes (commonly referred to as Piping Class Sheets), the piping drawings, ASME B31.3, and other codes and standards, as applicable. Material substitutions listed below in Sections 2.1.1.1, 2.1.1.2, and in Section 3.7.7 are acceptable. Additionally the material substitutions (including the related requirements listed therein) listed in Specification 24590-WTP-3PS-PB01-T0001, *Engineering Specification for Technical Supply Conditions for Pipe, Fittings, and Flanges* are acceptable. Changes or substitutions beyond these require prior Engineering approval.

2.1.1.1 Flexible graphite gasket filler material is acceptable where non-asbestos filler is specified for spiral wound gaskets.

2.1.1.2 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 Construction material.

2.1.2 Positive Material Identification (PMI)

PMI shall be performed as required by 24590-WTP-3PS-G000-T0010, *Positive Material Identification (PMI) for Construction.*

2.1.3 Material Traceability

Piping material traceability (such as identification of the item to applicable specification and grade of material, 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. This includes load bearing non-pressure retaining welded attachments such as pipe support stanchions or lugs.

Material test reports are required for all piping material installed under this specification.

2.1.3.1 Material traceability is required for all piping. When a pipe is to be cut, the material identification mark(s) shall be transferred to the pipe section not having the material identification mark(s), before cutting.

2.1.3.2 Material traceability is required for the integral pipe support attachments welded by Construction to the black cell, hard-to-reach, and other Q piping. For example, a stanchion is welded to a reinforcement pad welded to the process pipe - traceability is only required for the reinforcement pad. Construction shall assure that the welded support material is traceable to its material test report and heat number.

Non-welded pipe support attachments to the process piping do not require traceability.

2.1.3.3 Non-load bearing, non-pressure retaining welded attachments (e.g., cathodic protection clips, liner plate pipe collars) welded to non-black cell and non-hard-to-reach piping do not require material traceability beyond that listed in the attachment material Purchase Order technical specification requirements (i.e., CM material is acceptable), except that the material shall be the same P-group material as the piping material.

2.1.3.4 Traceability is not required for temporary welded attachments (e.g., rigging lugs) except the material shall be the same P-group material as the piping material.

2.2 Construction Requisitioned / Procured Piping, Gaskets, and Fasteners

2.2.1 Construction requisitioning or release of bulk stainless steel piping is restricted to the requirements of 24590-QL-BOA-PB00-00004 or 24590-QL-BOB-PB00-00004.

2.2.2 Construction requisitioning or release of bulk gaskets is restricted to the requirements of 24590-CD-BPO-PG00-00002.

2.2.3 Construction requisitioning or release of bulk fasteners is restricted to the requirements of 24590-QL-BPO-F000-00001.

3 Execution

3.1 Receiving, Handling, and Storage

3.1.1 General

The following is applicable to receiving, storing, and handling of shop-fabricated piping spools, and other piping materials.

3.1.2 Unloading

After unloading, visually inspect each item and pipe spool to verify the following:

3.1.2.1 Pipe openings and flanges are properly capped or taped, and all caps or tapes meet their intended function, including the following:

3.1.2.1.1 Caps or tapes are in good condition, not ripped, torn, or damaged. See Section 3.1.3.3 for replacement requirements.

3.1.2.1.2 Flange faces are adequately protected (e.g., with wood covering or similar) from physical damage and from corrosion.

3.1.2.2 Each pipe spool is clearly marked with the identification number, and all loose materials shipped with the pipe spool are capable of being traced back to the spool to which they belong.

3.1.2.3 The proper Engineering and Quality verification documentation required by the purchasing specification was received.

3.1.2.4 Items are not damaged, broken, cracked, or deformed.

3.1.3 Protection Devices and Receipt Inspection

3.1.3.1 End caps, sealing tapes, or flange protectors shall not be removed as long as receiving inspection indicates that the sealed boundary has not been penetrated.

3.1.3.2 If, upon receipt, inspection reveals penetration of the sealed boundary, then internal inspection will proceed for that item only. If internal inspection reveals no deficiencies, the item shall be resealed for storage. If internal inspection reveals some deficiencies in cleanliness, the deficiencies shall be corrected before the item is resealed and placed in storage.

3.1.3.3 If replaced as a result of the above inspections, the caps and tape in contact with austenitic stainless steel or nickel base piping are to be in accordance and consistent with the requirements of 24590-WTP-3PS-NW00-T0002, *Engineering Specification for Chemical Requirements for Materials Used in Contact with Austenitic Stainless Steel and Nickel Based Alloys*.

3.1.4 Pipe Spools

Adhere to the requirements listed below when handling prefabricated piping spools, random lengths of pipe, and other piping materials.

3.1.4.1 Rough handling, bumping, dragging, or dropping pipe spools, pipes, and pipe components shall not be permitted.

3.1.4.2 Avoid surface damage to piping material and coatings.

3.1.5 Storage

Storage of pipe spools, random lengths of pipe, and piping components shall consider as a minimum, but not be limited to, the following:

3.1.5.1 Store austenitic stainless steel, nickel based alloy, titanium, and carbon steel pipe spools separately. However, this piping may be stored outdoors, off the ground, and out of contact with groundwater.

3.1.5.2 Other in line components, such as valves, shall be stored in accordance with respective Purchase Order requirements.

3.2 Installation of Piping

3.2.1 General

The installation of piping shall be in accordance with the piping drawings and specifications.

3.2.2 Clearances

Exercise extreme care when installing piping and provide sufficient clearance under and/or around hatchways, galleries, monorails, removable slabs, cable trays, and similar items. Also provide clearance for access, maintenance, operation, and inspection requirements. Project drawings showing the location of the above-mentioned items, along with routing of all pipe, large and small, shall be provided in order to locate piping. Where dimensional tolerances allow flexibility in pipe installation, the following shall serve as guidelines:

3.2.2.1 Give consideration to insulation thickness, as applicable, to ensure proper clearance.

3.2.2.2 The minimum vertical clearances between finished grade (or top of floor plate/platform) and the bottom of the piping, insulation, or support beam (whichever controls) are as follows in Table 1:

Table 1 Minimum Vertical Clearances from Finished Grade

Location	Minimum Clearance
Inside of buildings where **component is located** over walkways	8 Feet*
Elevated yard piping and/or pipe racks that are over roadways	15 Feet
Over railroad tracks	22 Feet

* 8 Feet clearance is required for equipment installation and removal volumes. Minimum clearance may be reduced to 7 feet 6 inches in some cases, provided an Engineering evaluation and approval is obtained prior to installation.

3.2.2.3 Piping should not be installed near the floor or in walkways or working spaces where it will constitute a hazard.

3.2.2.4 Clearance for a cable tray chase or stack should be 12 inches minimum above the top tray and 6 inches minimum below the bottom tray, with provision for a 24 inches

minimum clearance on at least one side of the cable chase or stack for personnel access.

3.2.2.5 Provide 2 inches minimum edge clearances (including allowances for flanges, valves, and insulation) between commodities, unless noted otherwise on the design drawing.

3.2.3 **Valves**

3.2.3.1 Install control valves in accordance with the piping isometrics, the applicable control valve data sheet, and the manufacturer's instructions.

3.2.3.2 Maintain adequate hand wheel clearances between adjacent valves.

3.2.4 **Vents and Drains**

3.2.4.1 Install piping for vents and drains at connections shown on the piping drawings.

3.2.4.2 Vents and drains shall be in accordance with Document 24590-WTP-3PB-P000-T0001, *Piping Assembly Details, unless* otherwise noted on the piping drawings.

3.2.5 **Threaded Connections**

3.2.5.1 Threaded connections are not allowed in black cells or hard-to-reach areas with the exception of DOE approved applications. These are as listed in Section 16 of 24590-WTP-DB-ENG-01-001, *Basis of Design.* These are also listed below in Section 3.3.

3.2.5.2 Lubricant - Huron Industries, Inc. Neolube No. 2 lubricant shall be used for threaded connections in radiation zones designated as R4, and R5. This lubricant may also be used in radiation zones designated as R1, R2, R3, and non-radiation zones.

3.2.5.3 Sealant - Team, Inc. PRI-101N, Team, Inc. PRI-102N, or Engineering approved equal, sealant shall be used for threaded connections in radiation zones designated as R4 and R5. These sealants may also be used in radiation zones designated as R1, R2, R3, and non-radiation zones.

3.2.5.4 Sealant - Hercules Real-Tuff sealant, or Engineering approved equal, shall only be used for threaded connections in radiation zones designated as R1, R2, and R3.

3.2.5.5 For non-radiation zones thread applications, thread lubricants Never-Seez Nickel Nuclear Grade (NGBT-16), Never-Seez High Temp Stainless (NSSBT-16), or Engineering approved equal may be used on threads and nut bearing surfaces.

3.2.5.6 All lubricants / sealants shall be installed in accordance with the manufacturer's instructions.

3.2.5.7 All lubricants / sealants shall be purchased as commercial material (CM) and may be used in CM and Q applications.

3.2.6 Embedded Pipe

Field fabricated embedded piping (other than those passing through engineered penetrations) shall be installed in accordance with the following requirements.

3.2.6.1 To ensure compliance with ACI 318-99 and ACI 349-01, embedded pipes, other than those passing through engineered penetrations, shall satisfy all of the requirements shown in sections 3.2.6.2, 3.2.6.3, and 3.2.6.4 unless approved by the CSA structural engineer. Applicable spacing requirements are as shown in Appendix C, Embedded Pipe Spacing (Other Than Those Passing Through Engineered Penetrations)

3.2.6.2 Pipes shall not be larger, in outside dimension, than 1/3 the overall thickness of the slab or wall.

3.2.6.3 Embedded pipes, to ensure compliance with ACI 318-99 and ACI 349-01 and concrete strength integrity, shall be spaced per the following:

3.2.6.3.1 Parallel embedded pipes (adjacent not crossing) shall be placed so that the minimum space between pipes is equal to or greater than 3 diameters or widths on center of the largest pipe, but not less than 2" clear spacing between adjacent pipes unless approved by the CSA structural engineer. This spacing shall be maintained in the horizontal or vertical plane (see Figure 2, Parallel Pipes (Adjacent Not Crossing) Horizontal or Vertical Plane).

3.2.6.3.2 Three parallel embedded pipes, properly spaced, may cross (crossing perpendicular within +/- 30 degrees) any quantity of other layers of pipe. Provide an additional spacing of 10 diameters or widths on center of the largest pipe between parallel groups of pipes when they cross other layers of pipes (See Figure 3, Perpendicular Pipes Crossing (+30 Degrees to -30 Degrees; Figure 4, Multiple Crossing of Pipes - Plan View; and Figure 5, Multiple Crossing of Pipes - Elevation View). Other configurations may be documented by Plant Design and approved by the CSA structural engineer.

3.2.6.4 Field routed pipes not shown on isometrics shall not be embedded without prior CSA engineering approval to evaluate compliance to ACI code requirements.

3.2.6.5 Field routed pipes not shown on isometrics shall not be embedded without prior E&NS approval to evaluate compliance for radiological shielding requirements for piping.

3.3 Black Cell and Hard to Reach Area 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.

All-welded construction shall be used for piping and vessels. With the exception of socket welded thermowell nozzle connections, socket welded branch fittings on outer jacket pipe drains used in dual containment piping systems, and the threaded black cell liner spray nozzle connections, which will be tack welded or mechanically secured so that they will not back out, there shall be no flanged, socket welded or threaded connections in black cells or hard-to-reach areas. For black cell and hard-to-reach components there shall be no non-removable soft or non-metallic parts that could be affected by high radiation doses.

There are no valves in BC areas, and there are no inaccessible valves in hard-to-reach 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 a HTR pipe or pipe spool.

The following tables identify the rooms in the HLW and Pretreatment facilities that are classified as black cells or hard-to-reach:

Table 2 HLW Black Cell and Hard-to-Reach Areas

Hard-To-Reach Area/ Black Cells	Room Number	Room Name (Reference Only)
Hard-To-Reach (Components out of reach of crane and below filter deck)	H-0104	Filter Cave
Hard-To-Reach	H-0115	Shielded Pipeway
Hard-To-Reach	H-0121	Shielded Pipeway
Hard-To-Reach (Components out of reach of crane or below canister racks or weld table)	H-0136	Canister Handling Cave
Hard-To-Reach	H-0302	Active Services Cell - Melter No. 2
Hard-To-Reach	H-0308	Active Services Cell - Melter No. 1
Hard-To-Reach	H-B005A	Pour Tunnel No. 2
Hard-To-Reach	H-B015	Drum Transfer Tunnel
Hard-To-Reach	H-B032	Pour Tunnel No. 1
Hard-To-Reach	HCH14	Melter Cave No. 2 Vertical Pipe Chase
Hard-To-Reach	HCH15	Melter Cave No. 1 Vertical Pipe Chase
Black Cell	H-B005	SBS Drain Collection Cell No. 2
Black Cell	H-B014	Wet Process Cell
Black Cell	H-B021	SBS Drain Collection Cell No. 1

Table 3 Pretreatment Hard-to-Reach Areas

Hard-To-Reach Area	Room Number	Room Name (Reference Only)
Pits and Tunnels	P-B001	Inter Facility Transfer Line Tunnel
	P-B001A	Inter Facility Transfer Line Tunnel
	P-B002	HLW Drain Vessel Pit
	P-B003	Overflow Vessel Pit
	P-B004	Future LAW Transfer Line Tunnel
Piping out to Jumper Nozzles	P-0123	Hot Cell
Components Above the Crane	P-0123	Hot Cell
	P-0123A	Remote Decontamination Maintenance Cell
Out-of-reach of Crane and Below the Filter Deck	P-0335	Filter Cave
	P-0335A	Filter Cave Decontamination Chamber

Table 4 Pretreatment Black Cell Areas

Black Cells	Room Number	Room Name (Reference Only)
FRP (4 Pack)	P-0108	Feed Receipt Cell
	P-0108A	Feed Receipt Cell
	P-0108B	Feed Receipt Cell
	P-0108C	Feed Receipt Cell
FEP & UFP	P-0106	Feed Evaporator/Ultra-Filtration Cell
UFP, PWD & PVP	P-0104	Ultra-Filtration Cell
HLP & PJV	P-0102	HLW Storage Cell
HLP & PVP	P-0102A	HLW Receipt/Blending Cell
PWD	P-0109	Acidic/Alkaline Effluent Collection Cell
CXP & CNP	P-0111	Cs Ion Exchange Cell
RDP & CNP	P-0112	Resin Disposal/CNP Evaporated Process Cell
TXP	P-0113	Reserved Space (Technetium IX Feed Cell)
CXP	P-0114	Treated LAW Collection Cell
TLP	P-0117	Treated LAW Evaporator Cell
TLP & TCP	P-0117A	Treated LAW Concentrate Storage Cell

Appendix A, *Examples of Black Cell and Hard to Reach Piping,* shows various examples of the boundaries for BC and HTR spools and welds. This figure is from Section 16, of 24590-WTP-DB-ENG-01-001, *Basis of Design.*

Isometric drawings issued after 1 February 2008 identify the pipe spools that are to be installed in black cells (BC) or hard-to-reach (HTR) areas. The isometric drawing will identify each BC or HTR 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

(and / or "CONTAINS HARD-TO-REACH, as appropriate) PIPE" in large type located just above or beside the title block.

3.4 Welding

All Construction welding shall be in accordance with 24590-WTP-MN-CON-01-001-01-01, *Welding Control Manual, Introduction and Instructions* (WCM), and the additional requirements listed below. Review and approval of WCM documents shall be in accordance with 24590-WTP-MN-CON-01-001-01-01, *Welding Control Manual Introduction and Instructions,* Paragraph 9.0 - Required Review & Approval Matrix.

3.4.1 General Welding Requirements

3.4.1.1 Welding for field fabrication and installation shall be in accordance with ASME B31.3-1996.

3.4.1.2 All welding shall be protected from wind, rain, and other harmful weather conditions which may affect weld quality.

3.4.1.3 All surfaces to be welded shall be dry and substantially free of mill scale, oil, grease, dirt, paint (excluding weldable primer), galvanizing, and other contaminants. The welding of austenitic stainless steels or nickel based alloys to attachments which have been coated with galvanizing or zinc type paint, even after the coating or paint has been removed, is prohibited.

3.4.1.4 Weld bevel preparations for P-4 and higher alloys shall be machined or ground back to bright metal if they have been flame, arc, plasma, or laser cut.

3.4.1.5 Permanently installed backing rings or straps shall not be used on process piping. Prior approval from Engineering is required on other applications where backing rings are to be used.

3.4.1.6 The individual weld layer thickness for all processes shall not exceed 3/8 inch for materials less than 1-1/4 inch thick, or 1/2 inch for greater material thicknesses.

3.4.1.7 All weld joints for pressure retaining applications (excluding attachments) shall have a minimum of two passes, excluding autogenous welds, GTAW (manual or orbital) welds on piping or tubing with a nominal wall of 0.125" or less, and GTAW welded socket welds 1" NPS or less.

The minimum fillet weld leg dimension, for piping socket weld connections, shall be 1.25 times the nominal pipe wall, but no greater than the socket hub thickness. This applies to all applicable Piping Classes.

3.4.1.8 Peening shall not be used. The use of pneumatic tools or steel shot for slag removal is not considered peening.

3.4.1.9 Welding of stainless steel, nickel based, and titanium materials should be physically separated from carbon steel to ensure contamination by tools, grinding dust, etc., does not occur.

3.4.1.10 Prior to welding, shop applied coatings shall be removed, as required, a minimum of 2" from each side of the joint.

3.4.1.11 Load bearing, non-pressure retaining integral attachment (lug, stanchion, or wrapper plate) welds to piping shall be made to the rules of ASME B31.3, with the addition that the attachment material and the weld size shall be in accordance with the pipe support design drawing.

3.4.1.12 Where piping penetrates the liner plate, the liner plate-to-piping attachment weld shall be made to the rules of ASME B31.3, with the addition that the liner plate material shall be in accordance with the liner plate specification and the weld size shall be in accordance with the liner plate design drawing.

3.4.1.13 Other non-load bearing, non-pressure retaining integral attachments (e.g., cathodic protection lugs) to piping welds shall be made to the rules of ASME B31.3, with the addition that the attachment material shall be in accordance with the attachment specification and the weld size shall be in accordance with the attachment design drawing.

3.4.1.14 Welding of titanium shall be performed in an area isolated from all grinding, torch cutting, and painting.

3.4.1.15 Grinding or sanding wheels used on titanium shall contain no aluminum, (i.e. carbide-grit wheels are required).

3.4.1.16 Due to its pyrophoric nature, titanium dust from grinding operations shall be contained, and shall not be allowed to accumulate. The method for cleanup and disposition of titanium cutting and grinding fines shall be coordinated with the Environmental Field Representative/Waste Supervisor.

3.4.1.17 Gas backing is required when welding titanium.

3.4.1.18 Argon must be used for titanium shielding and purging gases and must meet the requirements of AWS A5.32, *Specification for Welding Shielding Gases*, Classification SG-A, with a minimum purity of 99.999% or engineering approved equal.

3.4.1.19 When welding titanium, separate gas supplies are needed for the following operations:

- 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.

3.4.2 Welding Process Requirements and Limitations

The Construction welding process requirements and limitations shall be in accordance with 24590-WTP-MN-CON-01-001-07-01, *Welding and NDE MATRIX - Form 167.*

3.4.3 Welding Filler Materials

3.4.3.1 Austenitic stainless steel (A-No. 8) welding materials for pressure boundary and load bearing welds shall contain a minimum delta ferrite content of five percent. No ferrite testing required on welds.

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

3.4.4 Preheat and Interpass Temperatures

3.4.4.1 Preheat and interpass temperatures shall be in accordance with the highest of that required by the applicable codes and Form 167, Welding and NDE Matrix, portion of the WCM, except that code recommended minimum preheat temperatures shall be mandatory. Preheat requirements shall apply to all welding, including tack welding and welding of temporary attachments.

3.4.4.2 The interpass temperature for austenitic stainless steels and nickel based alloys shall not exceed 350°F.

3.4.4.3 If oxy-fuel torches are used for preheating, the torch tip shall be appropriate for the work (i.e., a "rosebud," not a cutting or welding tip).

3.4.4.4 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.

3.4.5 Workmanship and Inspection

3.4.5.1 Each layer of welding shall be smooth and free of slag inclusions, porosity, excessive undercut, cracks and lack of fusion prior to beginning the next layer. In addition, the final weld layer shall be sufficiently free of coarse ripples, non-uniform bead patterns, high crown, and deep ridges to permit the performance of any required inspection. All arc strikes, starts, and stops shall be confined to the welding groove or shall be removed by grinding. Welds containing cracks shall be locally repaired or removed in accordance with the applicable requirements of the WCM.

3.4.5.2 Marking materials, temperature indicating crayons and liquid penetrant materials used on austenitic stainless steels and nickel based alloys shall not cause corrosive or other

harmful effects. See Specification 24590-WTP-3PS-NW00-T0002, *Engineering Specification for Chemical Requirements for Materials Used in Contact With Austenitic Stainless Steel and Nickel Based Alloys.*

3.4.5.3 Socket welds shall have an approximate gap of 1/16-inch between the bottom of the socket and the end of the pipe prior to welding.

3.4.5.4 Internal misalignment (high-low) in butt joints shall be as specified on the WCM.

3.4.5.5 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.

3.4.5.6 Each weld shall be marked with the welder's unique symbol or number identification. The use of documentation that identifies the weld with the welder or welding operator is acceptable as an alternate method to marking each weld. Only low-stress stamps may be used on piping and piping components.

3.5 Field Fabrication

Field fabrication of piping shall be in accordance with the piping design drawings, the applicable Piping Material Class, and this specification.

Field fabrication of piping for 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.

3.5.1 Branch Connections

Branch connections shall be in accordance with applicable Piping Material Class unless otherwise shown on the design drawings.

3.5.2 Thermowells

Install thermowells in accordance with the applicable design documents.

3.5.3 Field Weld Joint Preparation

Unless otherwise noted on the design drawings, field butt weld end preparations shall be in accordance with 24590-WTP-PW-P30T-00001, *WTP End Prep Detail for Field Butt Welds.*

3.5.4 Dimensional Tolerances

Unless otherwise shown on the design drawings, do not exceed dimensional tolerances of fabricated piping assemblies specified in PFI ES-3, *Fabricating Tolerances*. For pipe slope tolerances, see section 3.7.5.5.

3.5.5 Temporary Attachments

For criteria associated with temporary attachments, see 24590-WTP-3PS-PH01-T0002, *Engineering Specification for Installation of Pipe Supports.*

3.5.6 Painting and Preservation

For bulk materials purchased and installed by Construction, the external surface coating requirements for carbon steel materials are as listed in 24590-WTP-3PS-AFPS-T0001, *Engineering Specification for Shop Applied Special Protective Coatings for Steel Items and Equipment*, Appendix D, Item 3.30, 3.70, or 3.80.

3.6 Cleaning of Construction-Fabricated Piping

3.6.1 General

3.6.1.1 Wire brushing or grinding of stainless steel or nickel based alloy material shall be performed only with stainless steel brushes or tools not previously used in contact with other non-stainless steel or non-nickel based alloy material.

3.6.1.2 Stainless steel wire brushes that have not been used on other materials shall be used to clean titanium.

3.6.1.3 Solvent cleaning may be used to remove grease, oil, or other foreign matter. Non-halogen solvents are recommended. Cleaning solvents used in cleaning stainless steel and nickel based alloy materials shall contain a maximum chloride content of 200 ppm and a maximum sulfur content of 400 ppm. Cleaning solvents used for cleaning titanium materials are methyl alcohol, acetone, or other chlorine-free solvents.

3.6.1.4 Mechanically clean Construction fabricated carbon steel piping as necessary to remove loose foreign material, such as scale, sand, weld spatter particles, cutting chips, and similar items from the inside of the piping by any suitable means, such as a mechanically driven rotary cleaning tool, wire brush, or air blow. Air used to perform air blows shall be clean, filtered, and oil-free.

3.6.1.5 Flush water quality shall meet the same requirements as water used for pressure testing, specified in Section 3.8.4.

3.6.1.6 External rust staining of austenitic stainless steel and nickel based alloys due to contact with carbon steel is acceptable.

3.6.1.7 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. Caution - Most of these solvents have a low flash point, be sure they have fully evaporated before striking an arc.

3.7 Installation Requirements

3.7.1 General

The piping, valves, and other specialty items shall be installed as shown on the design drawings and the following installation requirements.

3.7.2 Piping

3.7.2.1 The Shop Fabricator (Supplier) cleans the pipe spools in accordance with applicable requirements listed in 24590-WTP-3PS-PS02-T0001, *Engineering Specification for Shop Fabrication of Piping*. Construction shall clean the pipe spools in accordance with the applicable requirements listed in 24590-WTP-3PS-G000-T0005, *Engineering Specification for Cleanness Requirements for WTP Fluid Systems* , for Q piping and 24590-WTP-3PS-PS02-T0001, *Engineering Specification for Shop Fabrication of Piping,* for CM piping.

Prior to installation, visually check all piping for cleanness. Remove all loose rust, mill scale, dirt or foreign matter as well as grease, oil, flux, weld spatter, and other contaminants. Air-flush the piping using clean, dry, oil-free air, if necessary.

In general, the following conditions are acceptable for piping:

- Rust films on both corrosion-resistant alloys and carbon and low alloy steel surfaces
- Tightly adherent mill scale on non machined carbon and low alloy steel surfaces that resist removal by hand scrubbing with a stiff metal brush
- Paint and preservative coatings on carbon or low alloy steel surfaces that will not peel or flake when subjected to cold water flushing

3.7.2.2 During installation of piping and equipment, cover openings for pipe connections, access openings, and open-ended pipes whenever work is not in progress. Temporary covers made of plywood or sheet metal may be used to cover manholes and flanged connections.

3.7.2.3 Note: In order to prevent surface damage, proper care in handling and installation of all piping should be exercised at all times.

Defects or imperfections not exceeding 12-1/2 percent of the specified nominal wall thickness, such as scratches, gouges and pits caused by mechanical operations,

handling, arc strikes, or weld spatter, shall be removed and the area blended smooth with at least a 3:1 transition into the surrounding material.

Weld repair for surface defects, or reworked areas, exceeding 12-1/2 percent of the specified nominal wall in depth, shall be performed in accordance with approved welding procedures in the Form 167 portion of 24590-WTP-MN-CON-01-001-01-01, *Welding Control Manual, Introduction and Instructions* (WCM). Completed weld repairs shall be examined to assure compliance with code and Project requirements. All weld repairs shall be recorded on appropriate welding documentation. Wall thickness after repair shall be no less than 87-1/2 percent of the specified nominal wall.

3.7.2.4 The length of short pieces of pipe that are used to facilitate pipe-to-pipe fit-up, replace damaged, or defective piping, should not be less than one nominal pipe diameter, or 6 inches, whichever is greater.

The location of the additional field weld shall be in accordance with Section 3.7.2.5.

3.7.2.5 The initial field weld locations are shown on the piping isometric drawings. Field conditions may require more or fewer welds as necessary to accommodate proper installation. The following criteria must be met for added field welds:

1) The overall dimensional configuration must be met according to the issued documents;
2) Socket welded couplings may be added only to socket welded piping systems provided the criteria in this section and Section 3.3 are met;
3) Addition of butt welds is preferred over the addition of socket welds, even in a socket welded system;
4) The welds or couplings are not to be located where they come to rest on steel members.
5) The minimum required edge distance (D) between an added field weld and existing shop weld is as listed in Table 5 Minimum Required Edge Distance Between Field and Shop Welds.

3.7.2.6 Configuration of installed piping shall be confirmed by visual comparison of the installed piping components to the approved drawing. Configuration of field-fabricated components shall be verified to the approved drawing.

3.7.2.7 Location of fabricated piping components is not required to be verified or confirmed by Construction provided the configuration is found to be acceptable.

Table 5 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

3.7.2.8 Construction verification of dimensional, material, and location information shown on piping isometrics that relate to shop fabricated piping components is not required.

3.7.2.9 The use of Lok-Rings is acceptable for the installation, rework, or repair of radar guide tubes outside of black cells and hard-to-reach areas. This application is only for radar guide tubes located in the LAW and LAB facilities and where the existing design allows for the application of Lok-Rings. In addition, the installation of Lok-Rings shall also be in accordance with 24590-WTP-J8-50-00001, *Radar Installation Wave Guide Spool Joining Detail.*

3.7.3 **Valves and Specialty Items**

3.7.3.1 Install all specialty items, including expansion joints, strainers, filters, etc., in accordance with the manufacturer's recommended instructions and design drawings.

3.7.3.2 Install startup strainers as shown on the design and installation drawings. Permanent ring spacers to replace startup strainers shall conform to the applicable piping class sheet.

3.7.3.3 All valves and inline components that are assigned a permanent plant identification number shall be labeled in accordance with 24590-WTP-3PS-M000-T0014 - *Engineering Specification for Labeling of Permanent Plant Components* at time of turnover. Prior to turnover to Startup and Commissioning, identification tags supplied by the Vendor or temporary identification tags supplied by Construction Piping Field Engineering are acceptable.

3.7.3.4 Install valves and other specialty items not mentioned above, such as steam traps, drain traps, and flexible hose assemblies, as shown on the design drawings, and use manufacturer's drawings, installation manuals, or instructions. Thread lubricants and/or sealants used are as listed in above Section 3.2.5.

High point vent and low point drain valves may be added as required to accommodate hydro testing. These additional vents and drains are not allowed to be added in PTF and HLW Hard-to-Reach or black cell areas. These additional vents and drains are to be added in accordance with the applicable requirements in 24590-WTP-3PB-P000-T0001, *Piping Assembly Details*, and the associated material requirements listed in 24590-WTP-3PS-P000-T0001, *Engineering Specification for Piping Material Classes General Description and Summary.*

3.7.3.5 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 removed and the valve body cooled, if required by manufacturer's 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 austenitic stainless steel and nickel based alloy valves shall contain a maximum chloride content of not greater than 200 ppm.

3.7.3.6 To prevent damage or distortion to the valve seat and disc, follow the manufacturer's instructions with respect to position of the valve stem and the disc during installation and welding.

3.7.3.7 Relief and safety valve settings shall not be modified in any way.

3.7.3.8 Manual gate, globe, and check valves shall be disassembled and reassembled, if required, in accordance with the manufacturer's disassembly and reassembly procedures.

3.7.3.9 If disassembly beyond the manufacturer's standard installation instruction is required, valves and actuators shall be disassembled and reassembled only after documented concurrence has been obtained from Engineering that doing so will not compromise the warranty and performance of the valve.

3.7.3.10 Valves shall be handled and supported with care to preclude damage to handwheels, motor operators, appurtenances, flanges, and weld ends. Lifting lugs should be used whenever they are provided on a valve. In no case shall a valve be picked up by the operator.

3.7.3.11 Control valve orientation shall be in accordance with the applicable control valve data sheet, the manufacturer's instructions, and the design drawing.

3.7.3.12 Appropriate manufacturer's precautions shall be taken to protect tubing, gauges, positioners, and similar items on control valves or other pneumatically operated devices.

3.7.3.13 Remote operators (extension bars, floor stands, etc.) shall be installed as shown on the design drawings.

3.7.3.14 Ensure that directional in-line components (e.g. check valves) are installed correctly to permit the intended direction of flow as shown on the isometric drawing.

3.7.3.15 **Flanged Connections**

3.7.3.16 Remove any rust preventive coatings from the gasket-seating surface of the flange faces.

3.7.3.17 Install flanged joints using bolting and gasket materials as specified on the design installation drawings and 2.1.1.1 of this specification. Bolt lengths and stock code

numbers listed on the design installation drawings may be replaced by the field provided the bolt is of the same material, same specification, and same quality level as specified on the design installation drawings. Bolt holes shall be aligned and the flanges shall be brought to bear uniformly on the gaskets when bolted. Bolt holes shall straddle centerlines unless otherwise specified on the design drawings. At least one full thread shall be showing after tightening the nuts.

3.7.3.18 Install insulating flange kits (using non-conductive gasket material compatible with the service) where shown on the design drawings.

3.7.3.19 Flanged joints shall be assembled in accordance with ASME B31.3 - 1996, paragraph 335.2. For Q and CM piping installations, all flanges utilizing spiral wound metallic gaskets shall have the fasteners tightened in accordance with the requirements of Section 4.3.1 of 24590-WTP-3PS-F000-T0002, *Engineering Specification for Fastener Torque and Tensioning.*

3.7.3.20 For Q and CM piping installations, flanges utilizing bonded fiber type or rubber gaskets shall have all fasteners tightened "tool tight" per Section 4.3.3 of 24590-WTP-3PS-F000-T0002. Thread lubricants used are as listed in above Section 3.2.5.

3.7.3.21 Install and align flanges to rotating equipment (e.g. pumps) in accordance with 24590-WTP-3PS-M000-T0010, *Mechanical Equipment Installation Tolerances*, or the manufacturer's requirements, whichever is less.

3.7.4 Embedded and Underground Waste Transfer Piping

3.7.4.1 Before any completed piping is embedded in concrete, or controlled density fill (CDF), perform a leak test. Gravity drainage systems are tested per requirements of requirements of Section 3.8.3.7. Minimum test pressure shall be based on the design pressure given in the Pipeline List.

Exception: Piping need not be leak tested before embedment when there are no welds, welded attachments, or mechanical joints associated with the spool pieces being installed.

3.7.4.2 Install piping embedded in concrete, or CDF as shown on the design drawing. Any defect evidenced by pressure testing shall be repaired and the piping shall be successfully retested before it is embedded.

3.7.4.3 Underground waste transfer piping shall be coated, if applicable, in accordance with the requirements shown on design drawing before pressure testing. However, joints shall be exposed for the testing. The coating of the field weld areas, after successful completion of the pressure testing, shall meet the requirements shown on the design documents.

3.7.5 Installation Tolerances

Unless specifically required by the design drawings:

3.7.5.1 The following position tolerances are acceptable for piping systems for all services:

3.7.5.1.1 All piping 1/2-inch NPS and larger in size (except safety valve open vent stacks) shall be installed within 2 inches of design.

3.7.5.1.2 The erected position of an open-inlet safety valve (or pressure relief valve) vent stack shall be established with respect to the as-built position of the valve discharge tail pipe. The erected annular position and penetration of the tail pipe within the vent stack entrance shall not vary more than 1/4 inch from the designed cold offset position. The entry end of a vent stack shall not be modified to compensate for relative position error.

3.7.5.2 Valves and other in-line piping components, except flow elements and metal bellows expansion joints (which are both installed in accordance with the Supplier installation instructions), may vary from design position within the following tolerances, unless specifically required by the design drawing:

3.7.5.2.1 The position in elevation or in horizontal location may vary, as dictated by the allowable variations for the piping in which the component is installed.

3.7.5.2.2 Where position is specified, the horizontal orientation of a component about the centerline of a vertical pipe leg may vary ±10 degrees.

3.7.5.2.3 Where position is specified, the orientation of a component about the centerline of a horizontal pipe leg may vary ±10 degrees, except where a specified valve stem position is horizontal; in such case, a valve stem position may vary by only +10 degrees.

3.7.5.3 Position tolerances of metal bellows expansion joints may have unique requirements established by the manufacturer. In the absence of these, the following limits apply:

3.7.5.3.1 In no case may the design-installed length or configuration of an expansion joint assembly be altered or modified to overcome a piping misfit, except where specific design considerations have been provided.

3.7.5.3.2 The position in elevation or horizontal location of an expansion joint assembly may vary, as dictated by the allowable variations for the piping in which it is installed, within the manufacturer's limitations for the expansion joint.

3.7.5.3.3 Expansion joint assemblies that are completely symmetrical about a centerline axis, with no lateral connections or bottom drain point, may be erected with any orientation about their axis, provided the joint assembly does not incorporate the use of hinged restraint hardware. Gimbal joints may be rotated about the centerline axis.

3.7.5.3.4 A hinged expansion joint assembly must be installed for angulation in a specific direction. The design orientation of the assembly hinge pins shall be verified and the installation achieved shall be within a rotational variation of 1/2 degree.

3.7.5.4 The erected position tolerances permitted for all piping systems shall be qualified or limited by the following considerations:

3.7.5.4.1 Where piping segments must accommodate thermal expansion and the designed clearance between adjacent pipes or structures is 6 inches or less (as measured to the outside diameter, including insulation), the design clearance and tolerance must be maintained, and the 2 inches installation tolerance shall not apply.

3.7.5.4.2 When parallel piping runs are erected in a ganged position with design clearances of 6 inches or less (as measured to the outside diameter, including insulation), the design clearance shall be maintained, and the 2 inches installation tolerance shall not apply.

3.7.5.4.3 When position variations and effect of the variations on the location of high point vents and low point drains occur, the specified slope requirements for drainage shall be maintained as a minimum design requirement for a piping system as shown on the design drawing.

3.7.5.4.4 Variations within tolerance, which may impair service, access, or operability of piping system components or in-line instrumentation, should be presented to Engineering.

3.7.5.5 **Pipe Slope**

The following are general pipe slope requirements, allowed deviations, definitions applicable to field fabrication, installation of piping, and pipe slope verification requirements.

3.7.5.5.1 For lines where no slope is shown on the governing isometric drawing, there shall be no puddling, ponding, or pocketing in lines containing dangerous waste material (DWP lines).

3.7.5.5.2 Black cell and hard-to-reach piping shall be routed as "Self Draining" and "Do Not Pocket" where no slope is indicated, except as noted below in deviations from pipe slope.

3.7.5.5.3 Non-black cell or non-hard-to-reach piping shall be free draining, unless otherwise noted.

3.7.5.5.4 Deviations from Pipe Slope.

3.7.5.5.4.1 Short sections of a self-draining line that requires a slope between vertical segments (10% or less of the pipe run), may be less than the specified slope. This does not apply to underground waste transfer lines between facilities or coaxial piping.

3.7.5.5.4.2 Piping connections to tanks, vessels, equipment, cabinets, bulges, and jumpers may be horizontal, prior to the connection as required, to facilitate connecting the

piping to the component nozzle. The required piping slope should be achieved as soon as practical at the connection and within five pipe diameters or 2 feet, whichever is greater.

3.7.5.5.4.3 Valves, fittings and other miscellaneous inline components are exempt from sloping requirements unless specifically noted on design documents.

3.7.5.5.5 Definitions

3.7.5.5.5.1 "Puddling or ponding" is defined as any horizontal pipe run where a dip or depression in the horizontal pipe run results in the bottom inside diameter of the pipe being lower than the upstream or downstream segments of the pipe (example: pipe sag).

3.7.5.5.5.2 Pocketing "is defined as any change to a horizontal pipe run that creates a low point without provisions for adequate draining. Adequate draining may be self draining or be a low point drain.

3.7.5.5.5.3 "Self-Draining" is defined as having a continuous slope or having horizontal lines without intermediate low points or pockets.

3.7.5.5.5.4 "Free Draining" is defined as having low point drains were necessary to drain the line.

3.7.5.5.6 Installation Tolerances

3.7.5.5.6.1 Slope deviations are not permitted for underground waste transfer lines or coaxial piping without an approved FC from Engineering.

3.7.5.5.6.2 Where slopes greater than or equal to 1:100 are identified on an isometric or piping design drawing, the slope shall be maintained with no more than -10% deviation in the direction shown, except that slope greater than that specified on the drawing is acceptable.

Example:
If the isometric or piping design drawing specifies a slope of 1:100, then the field installed slope cannot be less than 1:110 slope, but is allowed to have greater slope than 1:100.

3.7.5.5.6.3 Where slopes less than or equal to 1:100 are identified on an isometric or piping design drawing, the measured slope shall be maintained greater than 0" in the direction shown (including instrument accuracy allowance).

- Elimination of "puddling or ponding" is not an inspection requirement in these instances.
- Minimal puddling or ponding is acceptable for lines that don't contain radioactive material or dangerous waste material.

3.7.5.5.7 Slope Verification

Construction shall verify that the pipe slopes in the direction indicated on isometric or piping design drawings using the following measurement intervals:

- Slope measurements shall be taken at a minimum of one location between each change in direction.
- For straight runs exceeding 20 feet in length, slope measurements shall be taken near or adjacent to the fitting, bend, in-line component, or termination point. This will insure overall fall was maintained as specified on the associated drawings.

Pipe slope conversions are as listed below in Table 6, Pipe Slope Conversions.

Table 6 Pipe Slope Conversions

Slope	Equivalent inches/foot
1:400	1/32
1:300	3/64
1:200	1/16
1:100	1/8
1:50	1/4
*For slopes not shown, equivalents may be interpolated to the next higher 1/32"	

3.7.6 Piping Alignment

3.7.6.1 Construction shall consult Engineering for pipe stress and/or non-rotating equipment (e.g. tank) nozzle load evaluation when the following welded and flanged joint gap and alignment criteria are exceeded:

- Ability to close an axial gap not exceeding 1/4" by non-mechanical means.
- With both ends of the pipe in an at rest condition, the maximum distance between pipe centerlines to perform welding or flange alignment by a non-mechanical means shall be:

  2" maximum for pipe NPS 2 or less

  1" maximum for NPS 2-1/2 to NPS 6

  1/2" maximum for NPS 8 and larger

Gap is defined as the face-to-face distance (same plane) of the two pipes to be joined.

Alignment is defined as the distance between the centerlines of the two pipes to be joined, or the pipe to non-rotating equipment nozzle connection.

Flange alignment criteria for rotating equipment connections are as discussed above in Section 3.7.3.21.

3.7.6.2 Cold springing or pulling is prohibited if it exceeds the gaps and alignment criteria listed above in Section 3.7.6.1.

3.7.6.3 Before bolting up, parallel alignment of flange faces shall not deviate from the indicated position measured across any diameter more than 1/32 in./ft or 1/32 in., which ever is greater, and flange bolts shall be aligned within 1/8 in. maximum offset.

3.7.7 Material Exchange

Construction shall control the material exchange ensuring that the level of traceability and compatibility required by the drawings and specifications is maintained. Spool numbers provided for the design location shall be maintained on the piping through installation acceptance.

Piping material from excess shop fabricated spools and/or bulk piping may be used to replace an entire spool or any part of the spool provided compatibility is confirmed by matching the material stock codes (material types, sizes, schedules, ratings), quality levels, and Piping Material Classes specified by the current isometrics or piping drawings. This would also include verification of PMI of material and shop welds, and shop weld NDE requirements.

Construction may upgrade material that is found lacking, within the requirements specified, provided the upgrade details are documented. Permission to upgrade material does not extend to the use of this upgraded material, or Deleted Reusable Material (DRM) material, in BC or HTR areas.

BC or HTR spools slated for DRM, without required certification (MTR or C of C), or spools otherwise found non compliant or not feasible to Rework, are dispositioned per the NCR or CDR process as "Reject". Rejected BC or HTR spools shall not be reused at WTP.

Prior Engineering approval is required for any piping material exchanges that do not comply with the above criteria and that listed above in Section 2.1.1.

3.8 Examination, Inspection, and Testing

3.8.1 General

All examination, inspection, and testing shall be in accordance with this specification and other governing codes and standards, as applicable.

3.8.2 Examination of Field Welds

3.8.2.1 Examine all completed pressure boundary welds in accordance with the applicable Engineering requirements herein and with the governing code. Procedures and acceptance standards shall be in accordance with the governing code. Weld repair shall be examined according to the requirements applied to the original weld.

NDE required by an ASTM material specification that was not performed by the material manufacturer or the pipe spool Supplier may be performed by Construction in accordance with the applicable non-conformance disposition.

3.8.2.2 **BC and HTR Weld NDE and Inspection Requirements**

Requirements of this section are retroactive to all previously installed materials, inspections, and installations covered by this section.

The NDE and inspection requirements for the BC and HTR welds, which are in excess of ASME B31.3-1996, are provided in Table 7 in Appendix B. The acceptance criteria are as listed in ASME B31.3, Table 341.3.2, for Normal Fluid Service Conditions.

Where radiographic examination (RT) is allowed or specified for field performed welds, the radiographic acceptance criteria for Normal Fluid Service applies, except that incomplete penetration and internal undercut shall not be permitted.

Where ultrasonic examination (UT) is allowed or specified for field performed welds, UT techniques shall be performed with automated devices. Use of manual or semi-automated scanning devices shall be subject to the evaluation and approval of a Bechtel UT Level III. UT acceptance criteria shall be in accordance with the following. 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 the location of all such imperfections and evaluate them in terms of the acceptance standards given in (A) and (B) following:

(A) Indications characterized as cracks, lack of fusion, or incomplete penetration is unacceptable regardless of length.

(B) Other imperfections are unacceptable if the indication exceeds the reference level amplitude and has lengths which exceed:

- ¼ inch for t up to ¾ inch
- (⅓) t for t from ¾ inch to 2 ¼ inch

("t" is the thickness of the weld or thinner of the two materials being joined)

Where liquid penetrant examination (PT) or magnetic particle examination (MT) is allowed or specified, no cracks shall be permitted.

3.8.2.2.1 DELETED.

3.8.2.2.2 Joggle assemblies (piping designed to ASME 31.3 code) passing through or penetrating into BC or HTR areas are to be treated by the field as Black Cell or Hard-to-Reach piping, respectively, and require the same NDE as required for any other Black Cell or Hard-to-Reach piping.

3.8.2.2.3 DELETED.

3.8.2.2.4 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.

3.8.2.3 **Non-BC and Non-HTR Weld NDE and Inspection Requirements**

The NDE and inspection requirements for non-BC and non-HTR piping welds lying outside of the BC and HTR boundaries, which are in excess of ASME B31.3-1996, are provided in Table 7 of Appendix B. The acceptance criteria are as listed in ASME B31.3, Table 341.3.2, for Normal Fluid Service Conditions. These requirements also apply to all embedded piping not protruding into a BC or HtR area.

Where radiographic examination (RT) is allowed or specified for field performed welds, the radiographic acceptance criteria for Normal Fluid Service applies, except that incomplete penetration shall not be permitted.

Where ultrasonic examination (UT) is allowed or specified for field performed welds, UT techniques shall be performed with automated devices. Use of manual or semi-automated scanning devices shall be subject to the evaluation and approval of a Bechtel UT Level III. UT acceptance criteria shall be in accordance with the following. 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 the location of all such imperfections and evaluate them in terms of the acceptance standards given in (A) and (B) following:

(A) Indications characterized as cracks, lack of fusion, or incomplete penetration is unacceptable regardless of length.

(B) Other imperfections are unacceptable if the indication exceeds the reference level amplitude and has lengths which exceed:

- ¼ inch for t up to ¾ inch
- (⅓) t for t from ¾ inch to 2 ¼ inch

("t" is the thickness of the weld or thinner of the two materials being joined)

Where liquid penetrant examination (PT) or magnetic particle examination (MT) is allowed or specified, no cracks shall be permitted.

3.8.2.3.1 All field performed piping girth welds require NDE examination in accordance with the requirements of ASME B31.3-1996, para 341.4.1, plus the requirements of Table 7 of Appendix B.

3.8.2.3.2 NDE requirements for field performed joggle assembly and dual containment piping welds exceed Normal Fluid Service piping requirements in ASME B31.3-1996 and are stated in Table 7 of Appendix B.

3.8.2.3.3 When approved by Engineering, 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 344.7.1(e).

3.8.2.4 **Bonded Plastics Weld NDE and Inspection Requirements**

Bonded plastics welds require examination in accordance with the requirements of ASME B31.3, para A341.4.1.

3.8.3 **Leak Testing**

3.8.3.1 Test pressures shall be in accordance with the design documents (e.g., applicable issued Pipeline List). The test pressure shall not exceed that allowed for any component or equipment within the boundary of the line being tested.

3.8.3.2 Perform hydrostatic or pneumatic testing of partial or completed systems in accordance with ASME B31.3 paragraph 345.

3.8.3.3 For piping designed for vacuum, the pipe shall be tested at an internal gage pressure equal to no less than 1.5 times the design external differential pressure, but not less than 15 psig while examining for leakage in accordance with ASME B31.3 paragraph 345.2.2(a). If the same line is also designed for positive pressure, the pressure testing requirement shall be considered satisfied when the test pressure is equal to or exceeds the required test pressure for vacuum. That is, the selected test pressure shall be the one that results in the highest test pressure.

3.8.3.4 **Vacuum Box Testing**

Vacuum box testing shall only be used on BC welds in lieu of hydrostatic or pneumatic testing in accordance with specification 24590-WTP-3PS-G000-T0011, *Engineering Specification for Vacuum Box Leak Testing* (including applicable change notices). The BC boundaries, including welds, are as defined in Section 3.3.

It is important to identify welds to be vacuum box tested before the weld is started in order to ensure that all in-process weld inspections and other requirements are scheduled, completed, and documented prior to vacuum box testing

3.8.3.5 **Closure Welds**

The following are the requirements for all piping system closure welds performed on piping not specifically located within BC areas. The scope of this section applies to HtR piping and all other piping not located within a BC.

The exception to leak testing of closure (termination) welds, using the provisions of ASME B31.3 (c)-1998 addendum, paragraph 345.2.3 (c), applies to all ASME B31.3 piping in all facilities except that it shall not be used for closure welds in BC areas, including the weld boundaries, as defined above in Section 3.3.

Closure welds shall meet the requirements of ASME B31.3 (c) - 1998 Addenda, paragraph 345.2.3(c); need not be leak tested, provided the following criteria are met:

a) The requirements shall only be invoked on full penetration butt welds in straight pipe, full penetration butt welds at the safe-end of an equipment nozzle, or full penetration butt welds at the safe-end of branch connections. The safe-end is defined as the piping to equipment nozzle connecting weld or branch connection to branch connecting welds. Construction locates the closure welds in a system.

b) The piping systems and/or components on both sides of the closure weld shall have been subjected to a hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.4, a pneumatic leak test in accordance with ASME B31.3-1996 paragraph 345.5, a combination pneumatic-hydrostatic leak test in accordance with ASME B31.3-1996 paragraph 345.6, or in the case of components leak tested in accordance with the Code or Standard applicable to the design of the component.

c) For manual welds, the requirements of ASME B31.3-1996 para 344.7.1 (a) thru (g), with the exception that the requirement of subparagraph 344.7.1 (e) "...aided by liquid penetrant or magnetic particle examination when specified in the engineering design" shall not be required. This consists of the following:

   1. Joint preparation and cleanliness;
   2. Preheating;
   3. Fit-up, joint clearance, and internal alignment prior to joining,
   4. Variables specified by the joining procedure, including filler material, position, and electrode;
   5. Condition of root pass after cleaning-external and, where accessible, internal. Use of MT or PT examination is not required;
   6. Slag removal and weld condition between passes; and
   7. Appearance of the finished joint.

d) For welds made using orbital welding machines, the requirements of ASME B31.3-1996 paragraph 344.7.1 (a), (b), (c), (d), and (g) shall be invoked. This consists of the following:

   1. Joint preparation and cleanliness;
   2. Preheating;
   3. Fit-up, joint clearance, and internal alignment prior to joining,
   4. Variables specified by the joining procedure, including filler material, position, and electrode;
   5. Appearance of the finished joint.

e) The implementation of the requirements listed in c) and d) above shall be documented in the weld inspection report.

f) The closure weld passes 100% radiographic examination in accordance with ASME B31.3, paragraph 344.5, or 100% ultrasonic examination in accordance with B31.3, paragraph 344.6. See Section 3.8.2.4 for RT and UT acceptance criteria.

g) Piping welds and the associated line numbers for which the closure weld classification is invoked shall be documented in the appropriate weld documentation.

3.8.3.6 **Wet Lay-up**

3.8.3.6.1 Where practical, all lines shall be drained dry after flushing or testing to remove stagnant water.

3.8.3.6.2 Carbon steel lines may be left in a wet lay-up condition provided a rust inhibitor is added to the water to prevent internal rusting with design engineering approval. Otherwise, they shall be gravity drained, and/or blown dry.

3.8.3.6.3 Stainless steel, titanium, and nickel based alloy lines may be left in a temporary wet lay-up condition provided the water quality meets the requirements of Section 3.8.4.

3.8.3.7 **Gravity Drainage System**

All portions of the gravity drainage piping system shall be subjected to a water test as follows:

3.8.3.7.1 Those sections of the drainage systems embedded in a base mat or for piping buried beneath a slab on grade shall be tested by filling with water to the point of overflow from the highest drain outlet on the section (outlets at lower elevations shall be plugged). The water level in the highest outlet shall show no drop for a period of 15 minutes. Minimum test pressure shall be a 10 foot head of water, inserting a test plug with extension, if necessary. Draining after water testing is not required.

3.8.3.7.2 Drainage sections below grade level shall be tested before the connection to the site sewer is made.

3.8.3.7.3 All sections of drainage systems above the base mat or slab on grade shall be subjected to static head tests. The pressure at the highest point on the section under test shall be 10 feet of water higher than the maximum static head which can develop at the base of the section with overflow occurring from open drains on the next higher level. Test pressure shall be maintained without drop for 15 minutes.

3.8.3.8 If motor- or air-operated valves or control valves are used as boundaries, care must be taken to preclude excessive differential pressure as determined from manufacturer's data.

3.8.3.9 Verify the maximum allowable pressure or differential pressure from manufacturer's data for pumps, valves, heat exchangers (shell-to-tube differential), and other in-line equipment before testing.

3.8.3.10 Instrument tubing may be tested simultaneously with the process lines. Remove or isolate instruments during testing.

3.8.3.11 For hydrostatic testing, pressure gauges shall be located at the piping system high point, if practical, exclusive of temporary piping or the test pump; otherwise, proper compensation shall be made for the liquid pressure head above the gauge. Pressure gauges shall be of the test gauge variety, with an accuracy of 1/2 of 1 percent and shall be in calibration before being used to perform hydrostatic testing.

3.8.3.12 All welds, mechanical joints, thickness transitions, except shop-fabricated piping that has been coated and wrapped, must be completely visible during system hydrotesting.

3.8.3.13 Complete all attachment welds before system testing. In cases where the installation of the attachments to the piping system is required after leak testing, it shall meet the requirements of the governing piping code, ASME B31.3, Paragraph 345.2.6.

3.8.3.14 Relief valves shall be removed and blanked off (preferable), or gagged according to the valve manufacturer's recommendations during pressure tests. In no case will it be permissible to change the spring setting on the valve without prior permission from Engineering. Provide special relief valves with a maximum set pressure of 1-1/3 times the hydrotest pressure for hydrotesting when the test pressure is to be maintained for a period of time great enough to encounter a significant pressure increase due to thermal expansion of the entrapped fluid.

3.8.3.15 Temporarily restrain, isolate, or otherwise protect expansion joints from the additional loads accompanying a hydrotest, unless they are fully capable of withstanding the more severe loads. The expansion joint manufacturer's instructions shall prevail when hydrotesting the portion of the piping system containing the expansion joint.

Prior to hydrotesting the expansion joint, Construction shall ensure all permanent deadweight supports/restraints are installed or Engineering approval has been obtained (via Field Change Request) for the addition of temporary supports.

3.8.3.16 The system temperature during hydrostatic testing shall be in excess of 70°F for piping attached to the boilers. For all other piping, the temperature shall be in excess of 32°F. Pipe and test media temperatures shall be approximately equal.

3.8.3.17 Except for flanged joints, valve seats, and valve packing, repair pressure boundary leaks then perform appropriate nondestructive tests before retesting. Flanged joints, valve seats, and valve packing do not need to be repaired, at this time, for the pressure test to be conducted, provided the test pressure can be maintained for the duration of the test.

3.8.3.18 Hydrostatic tests may be performed with the test pump in operation.

3.8.3.19 Where valves are used as test boundaries, the pressure shall not exceed the maximum hydrostatic seat pressure as determined from the valve manufacturer's data.

3.8.3.20 Leakage through a valve used as a test boundary shall neither constitute a failed pressure test nor shall it be a reason to terminate a test in progress provided that the test pressure in the section of piping being tested can be maintained.

3.8.3.21 Adequately vent all piping during filling to eliminate entrapped air.

3.8.3.22 Take post-hydrostatic test precautions to preclude tank collapse because of vacuum formation during draining.

3.8.4 Precautions to Preclude Microbiologically Induced Corrosion (MIC)

To minimize the potential for microbiologically induced corrosion, only treated or potable water shall be used for cleaning, flushing, and hydro testing. Stagnant water should not be left in the pipe or component for more than 72 hours. For longer times, not to exceed 160 hours, sodium hypochlorite shall be added in small amounts and the water tested so that the initial chlorine content does not exceed 15 ppm, and residual concentrations are greater than zero but less than 1 ppm after 24 hours. The water shall be drained as soon as practicable and within 160 hours. Where water cannot be completely drained or where pocketing, ponding, or puddling can occur after draining, Engineering approval shall be obtained prior to filling.

3.8.5 Source Water Quality Requirements

3.8.5.1 Only water treated with sodium hypochlorite or potable water shall be used for cleaning and testing and shall meet the requirements of Section 3.8.4 if left in the pipe or component for more than 72 hours.

3.8.5.2 Flushing shall be performed using potable or treated water, except that potable water systems shall be cleaned, flushed, and tested using potable water only.

3.8.5.3 In stainless steel, nickel based alloy, and titanium lines, water treated with sodium hypochlorite shall be tested if the water is to be left in a pipe or component for more than 72 hours to ensure that the chlorine content is greater than 0 ppm but less than 1 ppm to ensure the absence of microbiological activity using Rapid Check II, by Strategic Diagnostic Inc., or an approved equal.

3.9 Dangerous Waste Piping

Construction shall notify and coordinate with the independent Dangerous Waste Permit Inspector as required by 24590-WTP-GPP-CON-7112, *Dangerous Waste Permit (DWP) Third Party Inspection Interface*, the inspection activities related to the installation of dangerous waste tank systems and miscellaneous treatment systems. The issued P&ID line list and outstanding DCNs associated with each P&ID will identify which pipe is DWP.

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, Engineering shall be promptly notified. Fabrication and installation shall not proceed until such time as a resolution is approved and proper documentation is provided.

5 Documentation and Submittals

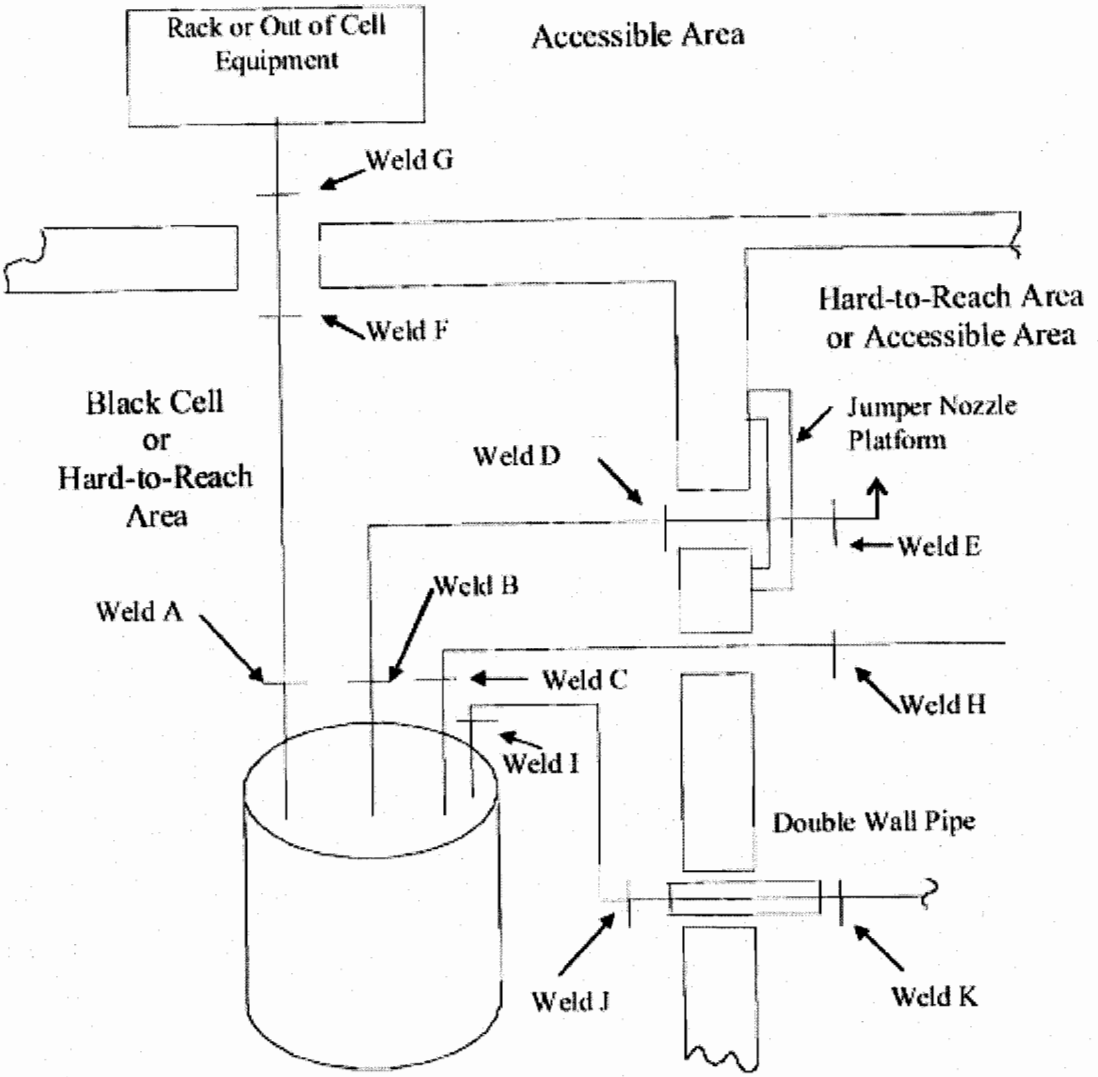
Documentation is provided by approved procedures and drawings. Any records generated by working to procedures and drawings shall be submitted to PDC for logging and issuance.

Appendix A, *Examples of Black Cell and Hard to Reach Piping*

This figure is Figure 16-1 Examples of black cell and hard-to-reach piping that is shown in Section 16 of 24590-WTP-DB-ENG-01-001, Basis of Design. This supplements the BC and HTR requirements listed above in Section 3.3 of this Specification.

Figure 1 Examples of Black Cell and Hard-to-Reach Piping

Notes related to this Figure are on following sheet.



Notes:

1. Black cell piping extends between termination welds. Examples include the piping and welds extending from Weld A to Weld G, From Weld B to Weld E, from Weld C to Weld H, and Weld I to Weld K.
2. The piping procured as part of equipment and penetrating the black cell or hard to reach area walls shall meet the same design, fabrication, construction, testing, and inspection requirements as the black cell or hard-to-reach piping to which it attaches out to the first weld outside of a black cell or a hard to reach area. An example of this is the component piping between Weld F and Weld G, and Weld J to Weld K.
3. The piping procured as part of a jumper platform that penetrates a black cell or hard-to-reach area wall shall meet the same design, fabrication, construction, testing, and inspection requirements as the black cell or hard to reach piping to which it attaches out to the first weld outside of the black cell or hard to reach area. An example of this is the piping between Weld D and Weld E.
4. Hard-to-reach piping includes pipe spools extending from a field weld inside the hard-to-reach area across a wall or slab out to the first accessible field weld out in an R2/R3 area. Examples include the piping and welds extending from Weld A to Weld G and Welds C to Weld H.
5. Joggles:
    a. Joggles are considered black cell pipe from the weld inside the black cell out to the first accessible field weld located in an R2/R3 area, similar to the straight-through piping show in the figure from Weld C to Weld H.
    b. Joggles are considered hard-to-reach pipe from the weld inside the hard-to-reach area out to the first accessible field weld located in an R2/R3 area, similar to the straight-through piping show in the figure from Weld C to Weld H.
    c. Joggle configurations come in three basic types:
        1) Single Pipe Joggle: joggle pipe directly embedded, treated as either black cell, hard-to-reach, or standard pipe, depending on classification of piping attached to the ends and is designed, fabricated, installed, inspected, examined, and tested to ASME B31.3-1996.
        2) Sleeve Joggle: joggle pipe is surrounded by an outer joggle sleeve, where the function of the sleeve is solely to provide space between the joggle pipe and the concrete. Here the sleeve only serves as a concrete form, similar to a standard straight-through penetration sleeve. These joggles may be insulated or may have only an open air space between the inner pipe and the outer sleeve. The inner joggle pipe can be black cell, hard-to-reach, or standard pipe, depending on what type of piping attaches to the ends and is designed, fabricated, installed, inspected, examined, and tested to ASME B31.3-1996. The outer joggle pipe is a pipe sleeve only and is not required to be designed o r fabricated to ASME code, but is required to meet the structural design and fabrication codes.
        3) Double Encased Pipe Joggle: joggle pipe surrounded by an outer pipe that serves as a secondary confinement boundary as defined within WTP WDOE permit documents. These joggles cannot be insulated and can be black cell, hard-to-reach, or standard pipe, depending on what type of piping attaches to the ends. Both the inner and outer pipe are designed, fabricated, installed, inspected, examined, and tested to ASME B31.3-1996.

Appendix B, *Summary Table of Non-Destructive Examinations (NDE) of Pipe & Tubing Field Welds*

Table 7 Piping Field Performed Weld Examination Requirements

See Section 3.8.2.3 for BC and HTR Weld NDE and Inspection Requirements. Acceptance criteria are as called out in ASME B31.3-1996, Table 341.3.2.

Type of Weld ↓	Piping Outside Black Cells and Hard-To-Reach areas[1,2,3]	Piping Inside Black Cells and Hard-To-Reach areas[Error! Bookmark not defined.,4,5]	Dual Containment (outside BC or HtR areas)	
			Inner Piping	Outer/Jacket Piping[Error! Bookmark not defined.,]
All Girth and Miter Welds[6]	100% VT 5% RT or 5% UT	100% VT 100% RT or 100% UT	100% VT 100% RT or 100% UT	100% VT 5% RT or 5 % UT
All Manufacturer Produced Longitudinal Seam Welds[7]	N/A	100% RT or 100% UT	100% RT or 100% UT	N/A
Outer Pipe Field Performed Longitudinal/Clam Shell Welds for Dual Contained Piping	N/A	100% VT 100% RT or 100% UT	N/A	100% VT 5% RT or 5 % UT
Double Encased Pipe Joggle Assemblies (field performed welds on both inner and outer piping)	N/A	100% VT 100% PT 100% RT or 100% UT	100% VT 100% PT 100% RT or 100% UT	100% VT 100% PT 100% RT or 100 % UT
Sleeved Joggle Assemblies (field performed welds on inner piping only)	N/A	100% VT 100% PT 100% RT or 100% UT	100% VT 100% PT 5% RT or 5 % UT	N/A
All Pipe and Integral Attachment Fillet Welds - including thermowell socket welds, integral support welds, liner plate-to-piping attachment welds, non pressure & non load bearing piping attachment welds.	100% VT	100% VT 100% PT	100% VT 100% PT or MT	100% VT
All integrally reinforced forged welded branch fittings welded to main piping run. If 100% RT will not produce an interpretable radiograph, In-Process Examination and liquid penetrant examination on exterior of both the root and final pass weld may be substituted.[6]	100% VT	100% VT 100% RT	100% VT 100% PT or MT	100% VT

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). [8] 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			

[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 7.

[2] Where radiographic examination (RT) is allowed or specified for field performed welds, the radiographic acceptance criteria for ASME B31.3-1996, Table 341.3.2, Normal Fluid Service applies, except that incomplete penetration shall not be permitted.

[3] Where ultrasonic examination (UT) is allowed or specified for field performed welds, UT techniques shall be performed with automated devices. Use of manual or semi-automated scanning devices shall be subject to the evaluation and approval of a Bechtel UT level III. UT acceptance criteria shall be in accordance with the following. 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 the location of all such imperfections and evaluate them in terms of the acceptance standards given in (A) and (B) following:

(A) Indications characterized as cracks, lack of fusion, or incomplete penetration are unacceptable regardless of length.
(B) Other imperfections are unacceptable if the indication exceeds the reference level amplitude and has lengths which exceed:

- ¼ inch for t up to ¾ inch
- (⅓) t for t from ¾ inch to 2 ¼ inch

("t" is the thickness of the weld or thinner of the two materials being joined).

[4] Where radiographic examination (RT) is allowed or specified for field performed welds, the radiographic acceptance criteria for ASME B31.3-1996, Table 341.3.2, Normal Fluid Service applies, except that incomplete penetration and internal undercut shall not be permitted.

[5] Where liquid penetrant examination (PT) or magnetic particle examination (MT) is allowed or specified, no cracks shall be permitted.

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

[7] Only applies to stainless, titanium, or nickel alloy pipe and fittings used in Black Cells or Hard-to-Reach areas within the HLW and PTF facilities or for the inner pipe of dual containment piping.

[8]This is applicable to specifically allowed applications in black cell and hard-to-reach areas listed in Section 3.8.2.2.4.

Appendix C, *Embedded Pipe Spacing (Other Than Those Passing Through Engineered Penetrations)*

Figure 2 Parallel Pipes (Adjacent Not Crossing) Horizontal or Vertical Plane

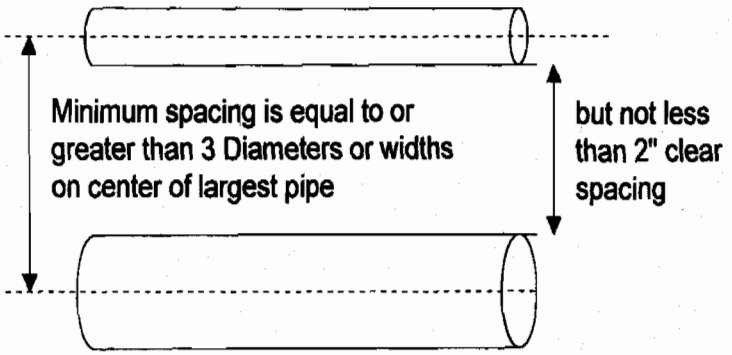


Figure 3 Perpendicular Pipes Crossing (+30 Degrees to - 30 Degrees)

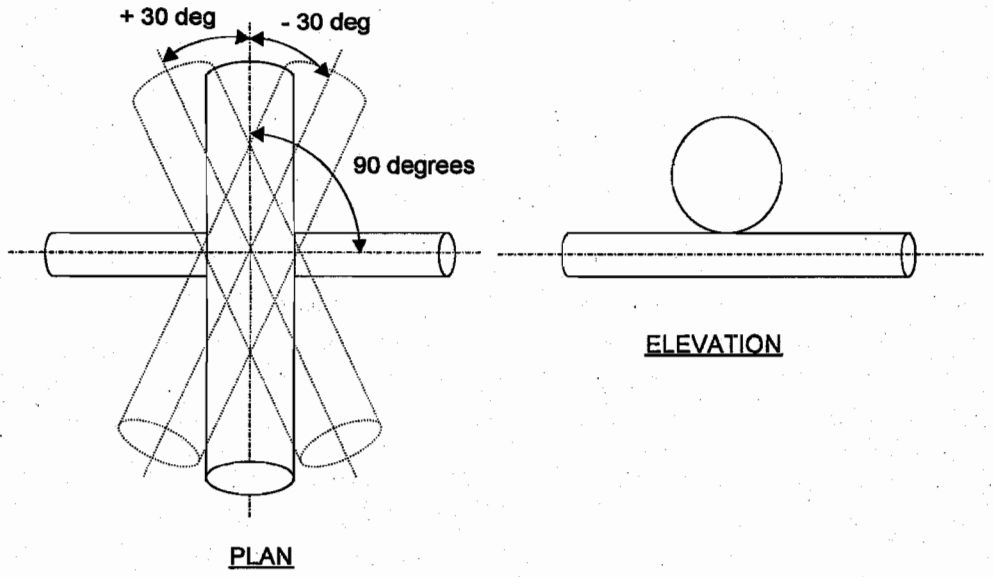


Figure 4 Multiple Crossing of Pipes - Plan View

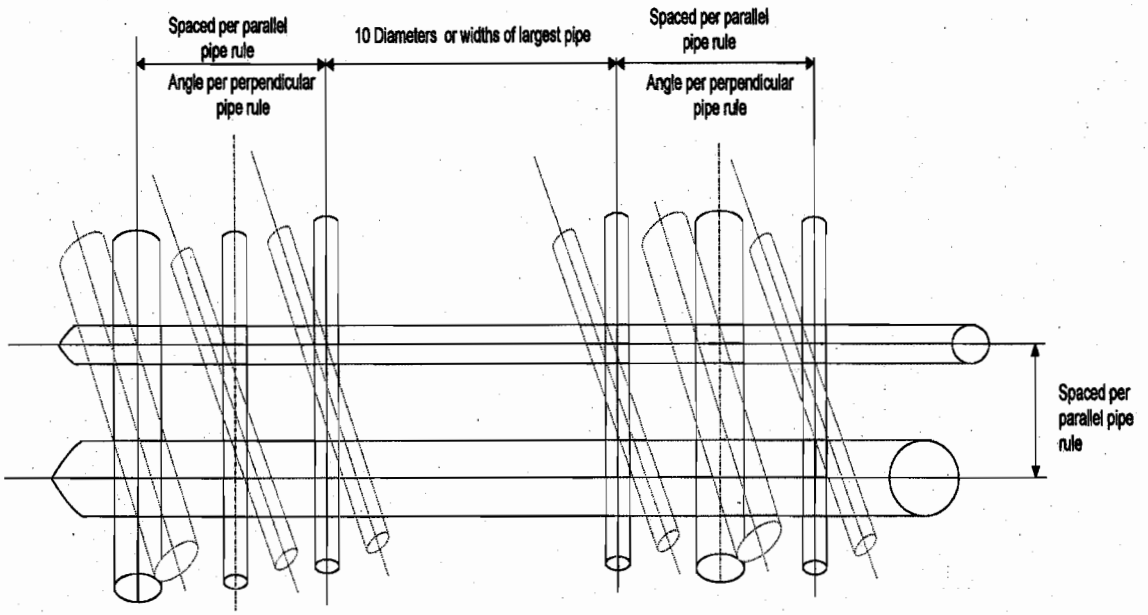


Figure 5 Multiple Crossing of Pipes - Elevation View