RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

Pressure Vessel Design and Fabrication

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

Content applicable to ALARA? ☒ **Yes** ☐ **No**

ADR No.
24590-WTP-ADR-M-03-008

Rev
2

Specification changes retroactive? ☐ **Yes** ☒ **No**
☐ **N/A (alpha revision or revision 0)**

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

Quality Level
Q

DOE Contract No.
DE-AC27-01RV14136

REV	**DATE**	**BY**	**CHECK**	**REVIEW**	**NSE**	**APPROVER**
5	2/9/15	Mohan Arulampalam	Hassan Ziada	Mike Seed	~~Dax Jolly~~	Sean Sweeney
4	27Sept09	Mohan Arulampalam	Bart Makadia	Mike Seed	R. Carlstrom	J. Julyk
3	23Apr07	R. Simmons	Mike Seed	William Eaton	Merl Rosenthal	J. Julyk
2	3Nov04	R. Tiwari	C. Slater	N/A	N/A	M. Hoffmann
1	7Jan03	R. Simmons	C. Slater	M. Hoffmann	N/A	M. Hoffmann for G. Duncan
0	22Apr02	R. Simmons	C. Slater	N/A	N/A	G. Duncan

SPECIFICATION No.
24590-WTP-3PS-MV00-T0001

Rev
5

Revision History

Revision	Reason for Revision	Q Specification Revision Only Margin Reduced? YES	Q Specification Revision Only Margin Reduced? NO	CM Only N/A
0	Issued for Design	N/A	N/A	N/A
1	Rewritten, Incorporates Design Changes: 24590-WTP-3PN-MV00-00001 24590-WTP-3PN-MV00-00002 24590-WTP-SDDR-PROC-02-0145 24590-WTP-SDDR-PROC-02-0155 24590-WTP-SDDR-PROC-02-0183 24590-WTP-SDDR-PROC-03-0023 24590-WTP-SDDR-PROC-03-0053 24590-WTP-SDDR-PROC-03-0075 24590-WTP-SDDR-PROC-03-0082 24590-WTP-SDDR-PROC-03-0083 24590-WTP-SDDR-PROC-03-0086 24590-WTP-SDDR-PROC-03-0100 Issued for Use	☐	☒	☐
2	Incorporates Design Changes: 24590-WTP-3PN-MV00-00009 24590-WTP-3PN-MV00-00011 Added Black cell and Primary Confinement Definitions and requirements Revised Radiographic Acceptance Requirements Revised Reference to ADR Issued for Use	☐	☒	☐
3	Incorporates Change Documents Listed in Section 11 Revised Section 3.7 to Support Nozzle Loads other than Appendix A Changed to 'Design Level' grading system Issued for Use	☐	☒	☐
4	Incorporated relevant requirements from Appendix L Section of SRD, SCN, and SDDR design changes	☐	☒	☐
5	Incorporated requirements from MR technical notes, clarifications and SDDR and design changes noted in Section 11	☐	☒	☐

Contents

Appendices

1 Scope

1.1 Project Description and Location

This specification is included in the Purchase Order, Material Requisition or in the scope of work of subcontract packages. It defines the technical requirements for the design, fabrication, and testing of pressure vessels for the Hanford Tank Waste Treatment and Immobilization Plant (WTP) project located in the southeastern part of Washington State.

1.2 Acronyms and Definitions

1.2.1 **Black Cell:** Shielded cells for which no maintenance or entry planned for the 40-year design life of the plant.

1.2.2 **Containment:** Components that contain active process fluids inside the plant process system. Refer to the MDS for the containment classification of components.

- Primary Confinement: The boundary within which the process fluids, gases, and vapors are contained and confined during the plant process operation. In this document, the entire process vessel and nozzle walls are generally referred to as the Primary Confinement.
- Primary Containment: The part of the Primary Confinement that is in contact with the process fluid. This is typically the wetted portion of the vessel wall below the top of the overflow.
- Auxiliary Containment: This term is used in this document to identify the portion of a Primary Confinement that is not subject to a static pressure head of liquid but may be in contact with splashing liquid, vapor, or gases. This is typically the vessel components above the prescribed high operating liquid level.
- Secondary Containment: The boundary that will contain process liquid if the Primary Containment is breached. This boundary will not normally be in contact with the process liquid. Typically, this is the cell liner or wall structure of the facility.

1.2.3 **CV:** Charge Vessel

1.2.4 **DBE:** Design Basis Event

1.2.5 **Design Level:** Determines allowable nozzle reinforcement methods and nondestructive examination (NDE) requirements. Buyer assigns Design Levels on the MDS or Drawings.

1.2.6 **Drawings**: The Buyer's Drawings include the vessel general outline drawing and any associated standard drawings

1.2.7 **ECDS:** The section of the MDS titled Equipment Cyclic Data Sheet. If components of a vessel are subjected to cyclic loads, those loads will be detailed in the ECDS.

1.2.8 **EQD**: Equipment Qualification Data Sheet.

1.2.9 **Hard to Reach Areas:** Facility areas located in rooms not designed for manual or remote access, replacement, or repair.

1.2.10 **MDS**: The Buyer's mechanical data sheet.

1.2.11 **NDE**: Nondestructive Examination

1.2.12 **PJM:** Pulse Jet Mixer

1.2.13 **Quality Level:** Establishes the quality assurance program requirements. Formerly, Quality Level also determined allowable nozzle reinforcement methods and NDE requirements. Refer to the Design Level for these requirements. Buyer assigns Quality Levels on the MDS or Drawings.

1.2.14 **SDDR**: Supplier Deviation Disposition Requests

1.2.15 **Seismic Category:** Classification of vessels defining the required condition, status, and operating function during and after a seismic event. The Seismic Category determines the analysis method and acceptance criteria appropriate for the intended service and safety function of the vessel. Buyer assigns Seismic Category on the MDS.

1.3 Conflicts

In cases of conflicts between this specification and other drawings or specifications, the Seller shall call attention to the conflict and request an interpretation by the Buyer.

1.4 Buyer's Responsibilities

Process parameters of the vessel for performance, capacity, or configuration are the Buyer's responsibility, and are not part of this specification.

1.5 Seller's Responsibilities

1.5.1 Seller shall assume complete responsibility for the design, fabrication, testing, inspection, and documentation as required by the Buyer and detailed in the purchase order.

1.5.2 Buyer's review of the Seller's drawings, or release of the vessel for shipment by the Buyer's representative, shall in no way relieve the Seller of the responsibility for complying with all the requirements of this specification and the purchase order.

1.5.3 The Seller shall substantiate any necessary changes to the MDS, Drawings, specifications and purchase order and obtain approval from the Buyer.

2 Applicable Documents

2.1 General

2.1.1 Work shall be in accordance with the referenced codes, standards, and documents listed below, which are integral parts of this specification.

2.1.2 When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied. When more than one code, standard, or referenced document covers the same topic, the requirements for all must be met with the most stringent governing.

2.2 Codes and Industry Standards

2.2.1 The Seller shall apply the latest issue, including addenda, at the time of request for quote or award as applicable for the following codes and industry standards with exceptions as noted.

2.2.1.1 ASME Section VIII, Division 1, *Rules for Construction of Pressure Vessels,* American Society of Mechanical Engineers

2.2.1.2 ASME Section II, *Materials,* American Society of Mechanical Engineers Use of later version of the code or standard directly comparable and equivalent in approach, Buyer approval is NOT required. If the later version of the code or standard is not directly comparable and essentially equivalent use of the later version requires AI's approval

2.2.1.3 ASME Section V, *Nondestructive Examination,* American Society of Mechanical Engineers

2.2.1.4 NBIC, *National Board Inspection Code*, National Board of Boiler and Pressure Vessel Inspectors

2.2.1.5 WRC-107, *Local Stresses in Spherical and Cylindrical Shells due to External Loading,* Welding Research Council

2.2.1.6 WRC-297, *Local Stresses in Cylindrical Shells due to External Loadings on Nozzles–Supplement to WRC Bulletin No. 107,* Welding Research Council

2.2.1.7 PFI Standard ES-24, *Pipe Bending Methods, Tolerances, Process and Mechanical Requirements*, Pipe Fabrication Institute, Engineering and Fabrication Standard

2.2.1.8 ASME Section VIII, Division 2, *Rules for Construction of Pressure Vessels - Alternative Rules,* American Society of Mechanical Engineers, *(Note: Code year not later than 2004 Edition with 2005 and 2006 Addenda).*

2.2.1.9 ASME B31.3, *Process Piping*, 1996, American Society of Mechanical Engineers

2.2.1.10 AISC M016, *ASD Manual of Steel Construction, 9th Edition*, American Institute of Steel Construction

2.2.1.11 ANSI/AISC N690, *Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities*, American Institute of Steel Construction

2.2.1.12 SNT-TC-1A, *Recommended Practice No. SNT-TC-1A*, American Society for Nondestructive Testing, Inc.(Note: Refer to the Quality Assurance Program Requirements Data Sheet in the Purchase Order for acceptable editions).

2.2.1.13 ANSI/AWS D1.1, D1.6 Structural Welding Code

2.2.2 The Seller shall apply the issue and addenda as referenced in Table U-3 of ASME Section VIII, Division 1 for the following codes and industry standards:

2.2.2.1 ASME B16.5, *Pipe Flanges and Flange Fittings NPS 1/2 through NPS 24*

2.2.2.2 ASME B16.47, *Large Diameter Steel Flanges NPS 26 through NPS 60*

2.2.3 The Seller shall apply the issue and addenda as stated for the following codes and industry standards:

2.2.3.1 ASCE 7-98, *Minimum Design Loads for Buildings and Other Structures*, American Society of Civil Engineers

2.2.3.2 ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*, 1989, 2000 Edition

2.3 Related Documents

Other project specifications, standards, and standard details as listed or referenced in Section 2 of the purchase order shall be used as applicable for the design and fabrication of the vessels.

2.4 Project Documents

2.4.1 24590-WTP-3PS-MV00-T0002, *Engineering Specification for Seismic Qualification Criteria for Pressure Vessels*

2.4.2 24590-WTP-3PS-MV00-T0003, *Engineering Specification for Pressure Vessel Fatigue Analysis*

2.4.3 24590-WTP-3PS-G000-T0002, *Engineering Specification for Positive Material Identification (PMI) for Shop Fabrication*

2.4.4 24590-WTP-MV-M59T-00001, *Pressure Vessel Tolerances Standard Details*

2.4.5 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers*

2.4.6 Deleted

2.4.7 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling and Storage Requirements*

2.4.8 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III and IV Equipment and Tanks*

3 Design Requirements

3.1 Basic Requirements

3.1.1 Unless otherwise specified, all vessels shall be designed and fabricated in accordance with ASME Section VIII, Division 1, any additional requirements of this specification, MDS, and the referenced Drawings.

3.1.2 Pressure vessels shall be U-stamped and registered with the NBIC. Any exceptions are indicated on the MDS.

3.1.3 Seller shall consider design details and material thickness shown on Drawings and MDS as the minimum requirements.

3.1.4 Seller shall not scale Drawings

3.1.5 Pulse Jet Mixers and Charge Vessels are not required to be U-Stamped

3.2 Loadings

3.2.1 Seismic analysis shall be performed per the requirements of 24590-WTP-3PS-MV00-T0002.

3.2.2 If wind or snow loadings are specified on the MDS, the design for such loadings shall be based on the requirements of the ASCE 7, using the indicated wind and snow loading parameters.

3.2.3 If the MDS contains an ECDS, the Seller shall analyze for fatigue per the requirements detailed in the 24590-WTP-3PS-MV00-T0003. Seismic loadings shall not be considered when performing a fatigue analysis.

3.2.4 Unless indicated otherwise on the MDS or Drawings, the Seller shall design the vessels to support process liquid filled to the top of the overflow.

3.3 Corrosion/Erosion Allowance

3.3.1 Corrosion allowance is specified on the MDS and shall be applied to each surface exposed to process vapor or liquid. Internal piping, charge vessels, and pulse jet mixers shall have the specified corrosion allowance applied to both internal and external surfaces.

3.3.2 Unless otherwise specified, corrosion allowance shall not be applied to external vessel surfaces.

3.3.3 Erosion allowances, where required, will be specified in the MDS.

3.4 Heads

The Seller shall use head shapes as specified on the vessel drawing. Deviations from this profile may be considered for economic, space or fabrication concerns. Any change, however, requires the approval of the Buyer via SDDR.

3.5 Supports and Anchors

3.5.1 Seller shall provide vessel supports as illustrated on the Drawings.

3.5.2 Supports and anchors shall be designed to secure the buoyant vessel in case the vessel is empty and submerged to the level indicated in the MDS or EQD.

3.5.3 Criteria

Detail design of vessel supports shall be in accordance with the recommendation of ASME Section VIII, Division 1, Appendix G, except as noted below.

3.5.3.1 For safety equipment (SC or SS) the abnormal and design basis event (DBE) conditions, as defined on the EQDs, are to be used when evaluating the load combination per AISC N690, Table Q1.5.7.1. For vessel item temperatures, see appendix "E"

For Load Combinations 5, 7 and 8 from N690, the "T_o" value is to be from the EQD "abnormal" room temperature section.

For Load Combination 9 from N690, the "T_a" value is to be from the EQD "DBE" room temperature section.

For Load Combination 11 from N690, the "T_o" value is to be from the EQD "DBE" room temperature section

The thermal environmental boundary condition may also be determined through a more detailed analysis by the Seller with prior approval by the Buyer.

Note: When the T_a value from the EQD indicates that it is due to a high energy line break (HELB) then the T_a thermal environmental condition is additive to the seismic event. When the Ta value from the EQD is not due to a HELB (typical) then the thermal condition and seismic event may be evaluated separately (i.e. non-simultaneous).

3.5.3.2 For SC-III and SC-IV vessels, the stresses for carbon steel vessel supports shall not exceed the allowable stress value for the material of construction per AISC M016, *Manual of Steel Construction* as tailored, and included in Appendix C. For combined loadings, see 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks.*

3.5.3.3 SC-III and SC-IV stainless steel vessel supports are to be designed in accordance with the allowable stresses from N690 to the load combinations from 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks.*

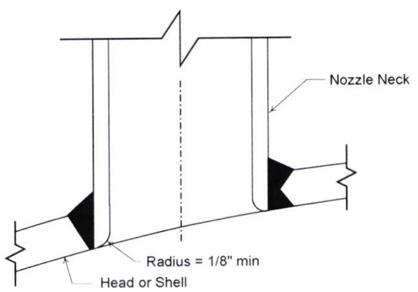
3.6 Nozzles and Manways

3.6.1 Nozzle wall thickness shall be per ASME Section VIII, Division 1 and at least that specified on the Drawings. Seller shall understand that minimum nozzle thicknesses indicated on the Drawings may not support the nozzle loading requirements listed in Appendix A.

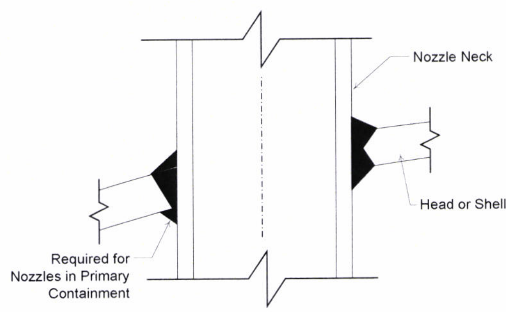
3.6.2 Nozzles and manways and their reinforcements located on the head shall be located fully within the crown region of the head unless noted otherwise on the Drawing.

3.6.3 All nozzles shall be set-in type or through type with full penetration welds. All nozzles, which are flush with the inside surface of the vessel, shall be rounded to 1/8 inch minimum radius as shown below. Nozzles for pressure relief devices, vents, and drainage shall be flush with the inside surface of the vessel. Nozzles with internal projection in primary containment shall have an additional fillet weld between the internal projection and the inside surface of the shell or head.

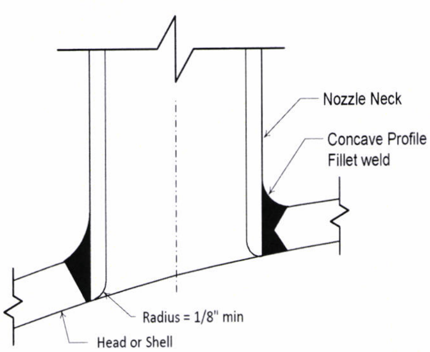
3.6.4 **<u>The following illustrates acceptable and unacceptable nozzle configurations and welding:</u>**



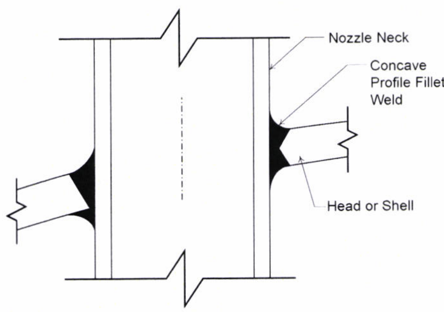
Set-in Nozzle with Full Penetration Weld



Through Nozzle with Full Penetration Weld

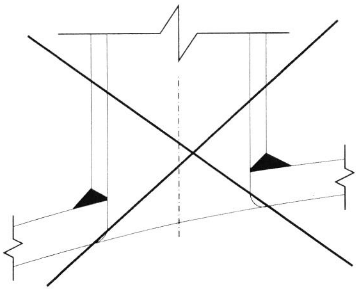


Optional Set-in Nozzle with Full Penetration Weld for Fatigue Service

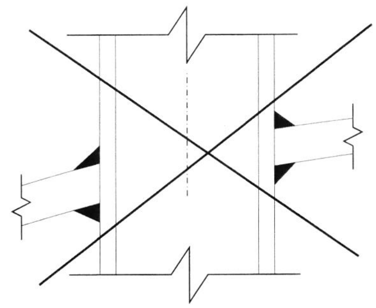


Optional Through Nozzle for Fatigue Service

Unacceptable Nozzle Connections



Set-on Nozzle with Full Penetration Weld



Through Nozzle with Double Fillet Weld

3.6.5 Flange boltholes shall straddle natural vessel centerlines unless otherwise specified.

3.7 Nozzle Loading

3.7.1 Unless otherwise specified, Seller shall design nozzles for the minimum nozzle design loads listed in the applicable table of Appendix A for the connected pipe size. For Safety (SC/SS) and Black Cell and/or Hard-to-Reach Area Vessels, nozzles are to be designed in accordance with Appendix 4 of ASME VIII, Division 2, using the allowable stress (S) from Division 1 in lieu of design stress intensity (S_m) of Division 2. Nozzles/shell on other vessels are to be designed according to the methods of WRC-107, WRC-297 as a minimum.

3.7.1.1 For Safety (SC/SS) vessels outside Black Cell/Hard-to-Reach (BC/HTR) areas, if the fatigue exemption rules are met per specification 24590-WTP-3PS-MV00-T0003, Section 8.3, then the primary local membrane (PL) and primary membrane plus primary bending (Pl+Pb) stresses in the vessel shell (or head) at nozzle and support connections shall be evaluated and limited to 1.5S for normal loads and 1.8S for normal plus seismic loads. This requirement can be satisfied using WRC-107 or WRC-297 method. Detail stress analysis per Finite Element Modeling may be used but is not required.

3.7.2 Appendix A lists minimum design nozzle loads by nozzle size, connecting pipe material, and Seismic Category for weight, seismic, and thermal expansion cases. The coordinate system conforms to the 'right hand rule'. Loads provided in Appendix A do not have a sign convention; Seller must ensure that the direction of load application provides the most conservative stresses at the nozzle to shell or head junction. The Y-axis is vertical and in the direction of gravity regardless of the orientation of the nozzle. Loads act at the juncture of the nozzle and shell.

3.7.3 Nozzle load combinations to be considered for Primary and Secondary Stress in the design shall be:

Weight + Seismic+ Operating Pressure+ Thermal Load (Appendix A)

Note: Thermal Loads listed in Appendix A are from the loads resulting from the restrained free end movement of the attached pipe and are considered as primary loads per paragraph 4-138 of Appendix 4 of ASME VIII Division 2.

With regard to the radial load, the internal pressure shall not be used to oppose the compressive stress due to the force acting inwards; for this load condition a null pressure condition is to be considered to exist.

Nozzle load combinations to be considered for Secondary Stress in the design shall be:

Weight + Operating Pressure+ Thermal Load (Appendix A)
+ General Thermal (per code definition)

3.7.4 The nozzle loads provided are for the piping connected to the external nozzle. If a nozzle projects and is loaded internally to the vessel, design the nozzle for the sum of the internal and external loads.

3.7.5 The nozzle loads due to thermal expansion listed in Appendix A are estimated based on the operating temperature of 350° F. If the maximum operating temperature of the attached pipe is less than 350° F, the nozzle thermal loads may be reduced by a scale factor of the absolute value.

of $\left|\dfrac{X-70}{350-70}\right|$

Where X is the maximum vessel operating temperature of the attached pipe.

3.7.6 The MDS shall indicate if a particular nozzle on a particular vessel has an interface with a jumper. The nozzle to jumper interface loading shall follow the tables of Appendix B.

3.7.7 The coordinate system conforms to the 'right hand rule'. Loads provided in Appendix B do not have a sign convention; supplier ensures that the direction of load application provides the most conservative stresses at the nozzle to shell or head junction. The V- axis is vertical (Appendix B, "V" for vertical) and in the direction of gravity regardless of the orientation of the nozzle. Loads and moments act at the junction of the nozzle and shell.

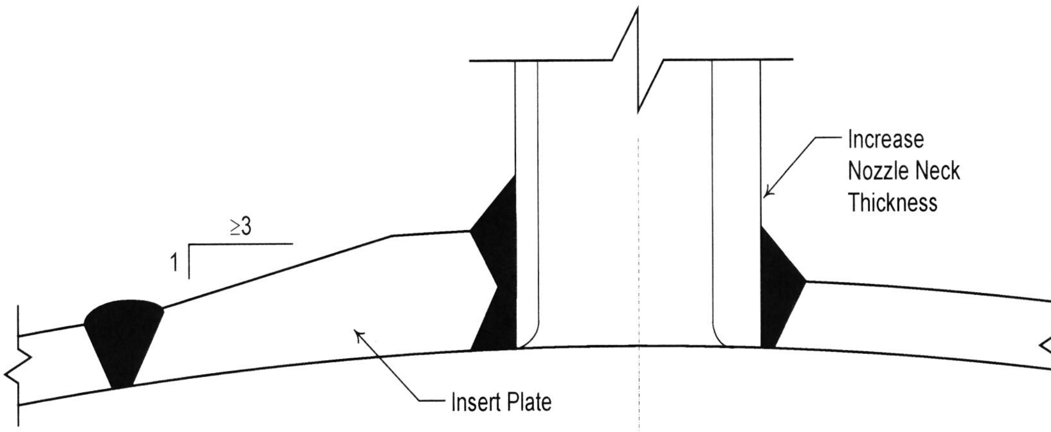
3.8 Nozzle Reinforcement

3.8.1 When required, suitable nozzle reinforcements must be provided. Reinforcement methods are limited depending on the assigned Design Level and cell designation. Refer to Section 6 for allowable reinforcement methods. If the wall thickness of the nozzle neck is greater than that of the connecting piping, the requirements of ASME Section VIII, Division 1, and Figure UW-13.4 shall be satisfied.

3.8.2 Nozzle reinforcing pads, where permitted, shall have one-piece construction (not segments). Nozzle insert plates (integral pads) shall be in accordance with ASME Section VIII with a 3 to 1 taper.

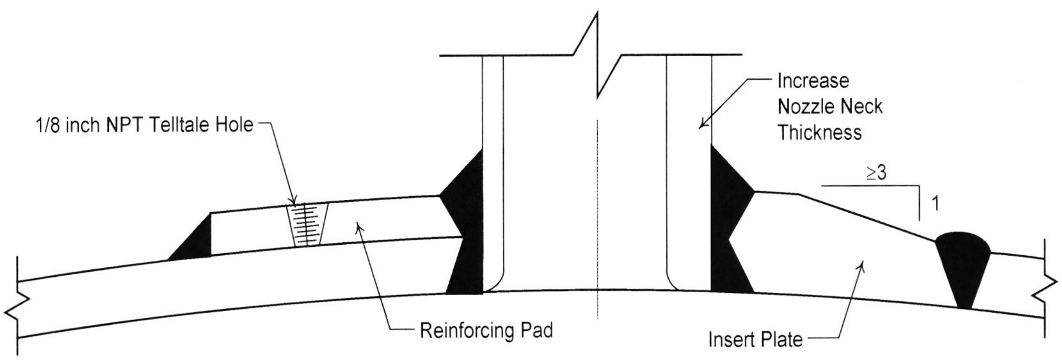
3.8.3 For external nozzle reinforcing pads, the pad thickness shall not exceed 1.5 times the thickness of the penetrated shell. To meet nozzle loading requirements, pad diameter may exceed the limits of reinforcement per ASME Section VIII, Division 1. Pad width shall be at least 2 inches but shall not exceed ten times the thickness of the pad. Each pad shall have single 1/8 inch nominal pipe size (NPT) telltale hole for testing purposes. On completion of all fabrication activities, the hole shall be fitted loosely with a screwed plug of the same material as the reinforcement plate.

3.8.4 The following illustrates acceptable reinforcement practices for nozzles irrespective of Design Level:



Nozzle Reinforcement Methods
for All Design Levels

3.8.5 Nozzles on Commercial Grade vessels not located in a BC or HTR area may use external reinforcing pads (See figure below). As a warning, the nozzle loads specified in Appendix A may exceed the practical use of repads. In such cases, the Seller should consider locally increasing the thickness of the shell or head with an insert plate or increasing the nozzle neck thickness as required. The following illustrates acceptable reinforcing practices with full penetration welds for nozzles on Commercial Grade vessels not located in a BC or HTR area.



Nozzle Reinforcement Methods
Only for Commercial Grade Vessels
Not Located in a Black Cell

3.8.6 Material used for nozzle reinforcement shall be the same as the parent vessel unless approved by the Buyer as stated on the MDS.

3.8.7 Structural reinforcing elements such as reinforcing rings or pads (integral or non-integral) can be used as necessary to accommodate new design load combinations on fabricated and partially fabricated vessels. Any butt-weld seams to be covered by the pads shall be ground flush and radiographically examined, in accordance with ASME Section VIII, Division 1, subdivision UW-51, before the reinforcing pads are welded in place. Reinforcing pads may be formed to the required shape by any process that will not unduly impair the physical properties of the material. Reinforcing pads shall be fitted to conform to the curvature of shell, head, or other surfaces to which they are attached to minimize flat spots and horizontal surfaces that could collect solids. Edges of non-integral pads shall be tapered 3 to 1 minimum to match the height of the legs of the attaching fillet welds. The fillet welds shall fully seal the dead space between the pad and the shell, head, or other surfaces to which the pad is attached.

3.9 Internal Components and Supports

3.9.1 Design of support members for vessel internals shall be the responsibility of the Seller. For pulse jet mixers, charge vessels, and their supports, the Seller shall submit a preliminary layout for review prior to detail design.

3.9.1.1 Piping Internal to the Vessel

Piping internal to the vessel is to be designed in accordance with ASME B31.3-1996, Process Piping with following modification:

In Table D300, the description of welding tee per ASME B16.9 shall be revised so it is consistent with that shown in Table D300 of ASME B31.3-2002:

		Stress Intensification Factor [Notes (2), (3)]			
Description	**Flexibility Factor k**	**Out-of-Plane, i_o**	**In-Plane i_i**	**Flexibility Characteristic, h**	**Sketch**
Welded tee per ASME B16.9 [Notes (2), (4), (6), (11), (13)]	1	$\frac{0.9}{h^{2/3}}$	3/4 i_o + 1/4	$3.1\frac{\overline{T}}{r_2}$	Same as ASME B31.3-1996

This means that for welding tees per ASME B16.9, note 11 in Table D300 is also changed to:

(11) If $r_x \geq 1/8D_b$ and $T_c \geq 1.5\overline{T}$, a flexibility characteristic of $4.4\overline{T}/r_2$ may be used.

3.9.1.2 Support Structures for Components Internal to the Vessel

Support structures for SC-I and SC-II components within the vessel that connect and support items such as the internal piping, Pulse Jet Mixers, charge vessels, or other internal components, that are away from the discontinuity shall be designed to meet the requirements of either AISC N690 or ASME Section VIII, Div-2. The tailoring of ANSI/AISC N690 in

Appendix D of this specification is required for use by the WTP contractor as an Implementing Standard for structural design. The support at the connection discontinuity is within the code pressure boundary shall be designed per ASME Section VIII.

3.9.1.3 SC-III and SC-IV carbon steel support structures within the vessel that connect and support items such as the internal piping, pulse Jet Mixers, charge vessel, or other internal components, that are away from the discontinuity shall be designed in accordance with AISC M016 to the load combinations from 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks*. The support at the connection discontinuity with the vessel is within the code pressure boundary and shall be designed per ASME Section VIII.

3.9.1.4 SC-III and SC-IV stainless steel support structures within the vessel that support items such as the internal piping, pulse Jet Mixers, charge vessel, or other internal components, that are away from the discontinuity shall be designed in accordance with the allowable stresses from N690 to the load combinations from 24590-WTP-3PS-FB01-T0001, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks*. The support at the discontinuity with the vessel is within the code pressure boundary and shall be designed per ASME Section VIII.

3.9.2 Pulse Jet Mixers and Charge Vessels.

Pulse Jet Mixers and Charge Vessels are to be designed to the same criteria as the parent vessel; requires no code stamping

3.9.3 Seller shall design support members to avoid the column of space directly below the manway.

3.9.4 The design of internal supports shall consider stresses caused by differential thermal expansion.

3.9.5 If indicated on Drawings, the internal surface of the head or shell subjected to direct impingement of process fluid shall be protected by a wear plate. See the MDS for the wear plate material.

3.9.6 Internal process piping which opens to the vessel contents shall be designed for the vessel design pressure and temperature or greater. Internal process piping which is connected to equipment internal to the vessel (e.g., Charge Vessel, Pulse Jet Mixer), shall be designed to that internal equipment design pressure and temperature.

3.10 External Components and Supports

3.10.1 If the MDS specifies insulation, the Seller shall provide and install insulation supports per the Drawings.

3.10.2 Lifting and tailing lugs shall be provided and installed by the Seller per the Drawings. The Seller may propose alternate designs and submit SDDR for Buyer approval prior to detail design.

3.10.3 The Seller is responsible for determining the necessity of stiffening rings. The material shall match the material of the shell and attachment welds shall be continuous on both sides of the ring. Reinforcement Pads for nozzles, guides etc., shall match the material of parent vessel.

3.10.4 If specified on the Drawings, Seller shall provide and install support clips for piping or platforms. The materials welded to the shell shall match the material of the shell.

3.10.5 If indicated on the Drawings, Seller shall provide and install grounding lugs.

3.10.6 Seller shall provide all vessels with a nameplate of Type 300 stainless steel attached securely on a bracket welded to the vessel at the location indicated on the Drawings. The bracket shall be the same material type as the adjoining vessel shell. The nameplate shall be in accordance with the specified Drawing.

3.10.7 The base of the vertical vessel support skirt shall be marked, using a line of welding bead, at the 0 degree orientation as shown on the Drawings.

3.10.8 If a separate ring beam support is specified on the vessel drawing, the top flange shall be marked, using a line of welding bead, at the 0 degree orientation as shown on the Drawings. Vendor shall include ring beam geometry in their vessel/skirt analysis and shall provide forces and moments at the bottom of ring beam at embed location/interface.

3.10.9 The external supports skirts, legs, saddle, lugs etc., shall be designed in accordance with AISC M016 for carbon steel or N690 for Stainless Steel Structures. The support at the discontinuity and with vessel is within the code pressure boundary and shall be designed per ASME Section VIII.

4 Materials

4.1 General

4.1.1 Materials shall be new and free from defects. Classification of fabrication materials shall be in accordance with ASME Section II. The Seller shall furnish legible copies of the mill test reports from the manufacturer for materials comprising the Primary Confinement, internals, supports, and welded attachments. Other materials shall be provided with certified statements that the material meets the requirements of ASME Section II.

4.1.2 Material shall be furnished to the specification and grade shown on the MDS. The fabricator shall not substitute materials without written approval from the Buyer.

4.1.3 Contact materials including marking materials, temperature indicating crayons, adhesive backed and pressure sensitive tape, and barrier and wrap materials may be used only under the following limits:

- The total halogen content shall not exceed 200 parts per million (PPM)
- The total sulfur content shall not exceed 400 PPM
- No intentionally added low melting point metals such as lead, zinc, copper, tin, antimony, and mercury.

Anti spatter compounds shall not contain chlorine, fluorine, sulfur, mercury or other low melting point metals.

Materials and residue shall be completely removed when no longer required. Cleaning materials may be non-halogenated solvents or potable water containing no more than 50 PPM chloride. Contact materials shall be controlled and documented in accordance with the Seller's inspection and test plan as approved by the Buyer.

4.1.4 Seller shall maintain a positive system of identification of materials used in the fabrication of each vessel per 24590-WTP-3PS-G000-T0002.

4.2 Pipe Fittings

Pipe fittings shall conform to the appropriate ASME and ANSI standards for materials and dimensions unless otherwise stated in the purchase order.

5 Fabrication

5.1 General

5.1.1 Seller shall, if necessary, provide temporary stiffening and jigging to prevent shell distortion during fabrication, welding processes, heat treatment, hydrostatic testing, or shipment.

5.1.2 Fabrication tolerances shall be in accordance with ASME Section VIII, Division 1 and standard drawing 24590-WTP-MV-M59T-00001.

5.1.3 The sequence of fabrication shall be planned to permit maximum access to the internal surfaces to enable examination of all welds.

5.1.4 Plates and pipes shall be cut to size and shape by machining, grinding, shearing, plasma, laser, or water jet cutting. Plates, 3/8 inch thick and above, cut by shearing, shall either be dye penetrant tested on the sheared edge or have 3/8 inch allowance left on the edges which shall be removed by machining or grinding. All thickness of plate or pipe cut by air plasma cutting shall have the edges dressed to a smooth, bright finish. Material cut by the inert gas shielded plasma, laser or water jet process will not require further dressing other than deburring. All lubricants, burrs, and debris shall be removed after cutting.

5.1.5 All stamps used for identification reference markings shall be of the low stress type. Stampings shall not be located near discontinuities.

5.1.6 If a butt welded seam is required between materials of different thickness, the thicker material shall normally be machined on the side away from the process liquid. Machining shall ensure a smooth finished profile with no sharp corners and shall be in accordance with ASME Section VIII, Division 1.

5.1.7 When rolling any austenitic stainless plate, care shall be taken to prevent carbon pickup or contamination of rolled material. The work area shall be free of carbon steel grindings and general cleanliness shall be maintained to preclude carbon contamination.

5.1.8 Only stainless steel brushes, clean iron-free sand, ceramic, or stainless steel grit shall be used for cleaning stainless steel or nonferrous alloy surfaces. Cleaning tools or materials shall not have been previously used on carbon steel.

5.1.9 Internal piping bends shall have a center line radius of four times the pipe nominal diameter. In confined spaces, the centerline radius may be reduced to three times the outside diameter of the pipe. Piping shall not be terminated or butt welded within the bend. If a circumferential butt weld in the arc of a pipe bend is necessary, the bending process shall comply with PFI Standard ES-24 and require Buyer's prior approval via the SDDR process. The circumferential butt weld shall be radiographed prior to and after bending.

5.1.10 Pipe bending methods, tolerances, processes, and material requirements shall comply with PFI Standard ES-24 and require Buyer's approval. These requirements shall apply equally to tube bending processes. Seller shall submit a pipe bending procedure for Buyer review prior to use.

5.2 Layout

5.2.1 Plate size shall be chosen to minimize welding. For horizontal vessels, the longitudinal seams in cylindrical shells and conical heads shall be located above the specified normal operating level, where practical. Longitudinal seams shall be completed before welding any adjoining circumferential seam.

5.2.2 The longitudinal seams of adjacent shell courses shall be staggered by a minimum length (measured from the toe of the welds) of 5 times the plate thickness, or 4 inches whichever is greater. Where it is considered impractical to meet this requirement, Seller shall submit a proposed layout to the Buyer for approval via the SDDR process.

5.2.3 For large diameter formed heads, where two or more plates are butt welded prior to forming, the butt welds shall be located such that the weld in the knuckle region is minimized.

5.2.4 Saddles shall be continuously welded to the shell. Welded seams under the saddle or wear plate are not permitted. Longitudinal weld seams in the shell should not be located within 15 degrees of the horn of the saddle or wear plate.

5.2.5 Plate layouts shall be arranged so that longitudinal and circumferential weld seams clear all nozzles, manways, and their reinforcing pads to the maximum extent possible. A minimum clearance of eight times the plate thickness from the toes of the welds is required. Where it is considered impractical to meet this requirement, Seller shall submit a proposed layout of all weld joints to the Buyer for approval via the SDDR process.

5.2.6 Structural attachment welds such as internal support rings or clips, external stiffening rings, insulation support rings, and ladder, platform or pipe support clips shall clear weld seams by a minimum of 2 inches. If overlap of pad type structural attachments and weld seams is unavoidable, the portion of the seam to be covered shall be ground flush and radiographically examined before the attachment is welded. The seam shall be radiographed per ASME Section VIII, Division 1, Paragraph UW-51 for a minimum distance of 2 inches beyond the edge of the overlapping attachment. Any protrusion through the weld seam when unavoidable shall be radiographically examined after completing the joint weld for at least minimum distance of 8 times the thickness of thicker material at protrusion. Radiographic examination of longitudinal weld seams is not required when single plate edge type attachments such as tray support rings, stiffening rings, insulation support rings, ladder, platform, or pipe support clips cross such weld seams.

5.3 Nozzles, Manways, and Reinforcing Pads

5.3.1 For forged nozzles connecting to pipe of lesser wall thickness, the Seller shall prepare the nozzles per ASME Section VIII, Division 1, Figure UW-13.4.

5.3.2 If a manway is specified with a welded cover, the cover shall be tack welded to the manway neck, prepared for field welding to the manway neck, sealed to prevent dirt and water from entering the vessel using adhesive tape which meets the contact material requirements. The cover shall be marked with the plant item number of the vessel.

5.3.3 Nozzles to be butt welded to connecting pipe shall be prepared for field welding and fitted with a plastic or rubber protective cover and sealed to prevent dirt and water from entering the vessel using adhesive tape which meets the contact material requirements.

5.4 Welding Requirements

5.4.1 Seller shall comply with 24590-WTP-3PS-MVB2-T0001.

5.4.2 All welding shall be continuous. Stitch welding is prohibited.

5.4.3 Joints shall be assembled and retained in position for welding. The use of manipulators or other devices to permit welding in the flat position should be employed where practical.

5.4.4 All attachments such as lugs, brackets, nozzles, pads and reinforcements around openings and other members (when permitted) shall follow the contour and shape of the surface to which they will be attached. The gap at all exposed edges to be welded shall not exceed the greater of 1/16 inch or 1/20 of the thickness of the attachment at the point of attachment.

5.4.5 Where fillet welds only are used, the maximum gap between the components being joined shall be 1/8 inch. The components shall be clamped or otherwise maintained together during welding.

5.4.6 Attachment point of spiders, braces, or other temporary attachments shall match the material of the vessel.

5.4.7 All temporary attachments shall be removed prior to shop hydrotest unless specifically approved by the Buyer.

5.4.8 Where practical, internal structural components and piping welds shall be full penetration. If it is not practical, seller shall propose fillet welded attachments for Buyer approval via the SDDR process.

6 Design and NDE Requirements

6.1 All Design Levels

6.1.1 The shell and head sections which are subjected to concentrated or large loads through welded attachments (such as lifting and tailing lugs, PJM supports, or agitator mountings) shall, prior to welding, be ultrasonically examined over 100 percent of the areas, in accordance with the following:

- For connections or attachments directly welded to the shell or head, the area tested shall extend 3 inches beyond the extremity of the proposed weldment
- For connections or attachments welded via a reinforcement or doubler plate, the shell area tested shall extend 5 inches beyond each side of the perimeter of the proposed fillet weld attaching the reinforcing or doubler plate to the shell or head
- Not required for nozzle penetrations.

6.1.2 All full penetration welds attaching internal or external structural components to the heads or shell shall be ultrasonically tested. If fillet welds except for Lifting and Tailing Lugs are permitted by writing by the Buyer and are not readily ultrasonically tested, they may be dye penetrant tested or magnetic particle tested with approval from the Buyer via the SDDR process.

6.1.3 All full penetration welds forming part of the jacket shall be ultrasonically tested.

6.1.4 Records of the NDE and other tests shall be submitted to the Buyer as described in the purchase order.

6.1.5 Deleted

6.1.6 Additional NDE requirements are specified in the drawings and MDS

6.2 Additional Requirements for Design Level 1 (L-1) Vessels

6.2.1 All nozzle reinforcement on L-1 vessels shall be integral. Using additional reinforcing elements such as reinforcing rings or pads is prohibited. Reinforcing material shall be taken as excess thickness on the shell or head and nozzle neck. Additional reinforcing material may be provided, when required, by increasing the shell, head or nozzle thickness, or by providing a thicker insert plate of a suitable diameter, butt welded into the shell or the head.

6.2.2 The following weldments shall be subject to volumetric testing:

- All welds forming part of the primary containment, including weldments joining nozzles to the vessel shell or head.
- Where a main seam butt weld is located such that only part of its length lies within the Primary Containment, the complete length of that particular seam.
- All butt welds in internal piping.

- For multi-chambered vessels, where an adjacent chamber is categorized other than L-1, all interconnecting butt welds which provide Primary Containment between the two chambers to L-1 requirements.
- For vessels fitted with a shell-type jacket, all Primary Containment welds in the main shell enclosed by the jacket and found satisfactory prior to fitting the jacket and associated rings.

Radiography is the preferred method of volumetric testing. Where it is considered impractical to perform radiographic examination due to joint configuration, the Seller may propose ultrasonic examinations; the seller shall use the SDDR process to propose ultrasonic examinations. The SDDR shall include UT procedure reference, technical justification of UT proposal for every weldment and schematic location of every weldment proposed to be UT tested.

6.2.3 Where components attach to any part of the vessel by full or partial penetration tee weld (including a corner weld), the parent plate in the vicinity of the weld shall be ultrasonically tested prior to welding, to ensure that no defects are present that could result in laminar type tearing during welding.

In particular, the following components shall always be examined as detailed above:

- Supports for vessel internals
- Vessel supports where a small local area of the vessel takes the support load (ultrasonic inspection is not required for skirt or ring supported vessels)
- Not required for nozzle penetrations

6.3 Additional Requirements for Design Level 2 (L-2) Vessels

6.3.1 All nozzle reinforcement on L-2 vessels shall be integral. Using additional reinforcing elements, such as reinforcing rings or pads, is prohibited. Reinforcing material shall be taken as excess thickness on the shell or head and nozzle neck. Additional reinforcing material may be provided, when required, by increasing the shell, head or nozzle thickness, or by providing a thicker insert plate of a suitable diameter, butt welded into the shell or the head.

6.3.2 The following weldments shall be subject to volumetric testing:

- At least 10 percent of the length of each welder's production of welds forming part of the Primary Containment. The minimum extent of volumetric testing shall include all "T" junctions, and 10 percent of the remaining longitudinal weld with a 6 inches minimum length of volumetric testing.
- For nozzle-to-shell welds located in the Primary Containment, at least 10 percent of the number of welds made by each welder over 100 percent of its circumference, with a minimum of one nozzle to shell weld per vessel.
- All butt welds in internal piping

Radiography is the preferred method of volumetric testing. Where it is considered impractical to perform radiographic examination due to joint configuration, the Seller may propose ultrasonic examinations; the seller shall use the SDDR process to propose ultrasonic examinations. The SDDR shall include UT procedure reference, technical justification of UT proposal for every weldment and schematic location of every weldment proposed to be UT tested.

6.3.3 Where components attach to any part of the vessel by full or partial penetration tee weld (including a corner weld), the parent plate in the vicinity of the weld shall be ultrasonically tested prior to welding, to ensure that no defects are present that could result in laminar type tearing during welding.

In particular, the following components shall always be examined as detailed above:

- Supports for vessel internals.
- Vessel supports where a small local area of the vessel takes the support load (ultrasonic inspection is not required for skirt or ring supported vessels)
- Not required for nozzle penetrations

6.4 Additional Requirements for Commercial Grade (CM) Vessels

6.4.1 Nozzles may use either a pad or integral reinforcement.

6.4.2 The following weldments shall be subject to volumetric testing unless otherwise indicated on the MDS or Drawings:

- At least 10 percent of the length of each welder's production of vessel main seams butt welds. The minimum extent of volumetric testing shall include all "T" junctions and 10 percent of the remaining longitudinal weld with a 6 inch minimum length of volumetric testing.
- For nozzle-to-shell welds located in the Primary Containment, at least 10 percent of the number of welds made by each welder over 100 percent of its circumference.
- At least 10 percent of butt welds in internal piping for the full circumference.

Radiography is the preferred method of volumetric testing. Where it is considered impractical to perform radiographic examination due to joint configuration, the Seller may propose ultrasonic examinations; the seller shall use the SDDR process to propose ultrasonic examinations. The SDDR shall include UT procedure reference, technical justification of UT proposal for every weldment and schematic location of every weldment proposed to be UT tested.

6.5 Additional Requirements for Vessels Located in a Black Cell or Hard-to-Reach Area

6.5.1 If a vessel is located in a Black Cell it shall be noted on the MDS.

6.5.2 All nozzle reinforcement shall be integral (one piece construction) and attached by full penetration welds regardless of Design Level. Using additional non-integral (external) reinforcing elements, such as reinforcing rings or pads, is prohibited unless used to accommodate occasional loads such as the revised ground motion accelerations, hydrogen in pipes and ancillary vessel loads, or multiple overblow loads, in vessels that are already fabricated. Buyer approval via the SDDR process is required for non-integral type reinforcement. Integral reinforcing material shall be taken as excess thickness on the shell or head and nozzle neck. Additional integral reinforcing material may be provided, when required, by increasing the shell, head or nozzle thickness, or by providing a thicker insert plate of a suitable diameter, butt welded into the shell or the head. Nozzle weld details of Section 3.8.4 for integral or Section 3.8.5 for non-integral reinforcement, and Section 3.8.7 shall be followed.

6.5.3 All welds joining components of the Primary Confinement shall be subject to full volumetric testing. Radiography is the preferred method of volumetric testing. Where it is considered impractical to perform radiographic examination due to joint configuration, the Seller may propose ultrasonic examinations; the seller shall use the SDDR process to propose ultrasonic examinations. The SDDR shall include UT procedure reference, technical justification of UT proposal for every weldment and schematic location of every weldment proposed to be UT tested.

6.5.4 All welds to internal components and supports, which include pulse jet mixer and charge vessel supports, dip pipe supports, sparger supports, instrumentation piping supports, and pump discharge and return line supports shall, as a minimum be dye penetrant tested per ASME Section VIII, Division 1 requirements.

6.5.5 All welded construction shall be used for vessels and piping. There shall be no flanged, socket welded or threaded connections with the exception of socket welded thermowell nozzle connections. There shall be no non-removable soft or non-metallic parts that could be affected by high radiation doses.

7 Tests and Inspections

7.1 Hardness Testing for Austenitic Stainless Steel Components

7.1.1 Hardness testing is required when austenitic stainless steel plates are cold formed to make sections such as angles, channels, and conical sections. This requirement is not applicable to the cold forming of dished heads, which is covered by the relevant section of ASME Section VIII, Division 1.

7.1.2 Hardness testing is required when austenitic stainless steel pipe is cold formed for bends with a centerline radius less than three times the nominal pipe diameter.

7.1.3 Any cold forming process, which may significantly increase hardness, shall be in accordance with an approved procedure, which contains hardness testing. The procedure shall be submitted for Buyer's approval.

7.1.4 Hardness testing shall be performed on areas subject to the greatest deformation after cold working or any rework or rectification. The maximum permitted hardness is HRB 92 or as indicated by the material specification acceptance criteria for hardness.

7.1.5 If the maximum permitted hardness is exceeded, the Seller shall solution anneal (heat treatment) in accordance with the applicable ASME specification for that material. Heat Treatment process shall include heating and cooling rates, thermocouple locations, and type of heating equipment. Seller shall submit a written procedure for suitable heat treatment and testing for Buyer's approval

7.2 Nondestructive Examinations

7.2.1 Radiography, ultrasonic testing, visual examination, magnetic particle, and dye penetrant examination, where specified or required, shall be performed in accordance with ASME Section VIII, Division 1 and ASME Section V, and procedures developed and submitted to the Buyer for review prior to use.

7.2.2 All mandatory nondestructive examination (visual, surface flaw, and volumetric) shall be carried out after the completion of fabrication, including any heat treatment. Where Seller carries out additional nondestructive examination prior to any heat treatment process, such examinations shall be included in the Quality Plan or Inspection Schedule. The Buyer's representative need not witness this additional nondestructive examination; however, the records of such inspection shall be made available to the Buyer's representative.

7.2.3 Nondestructive examination must be performed by an inspector certified to the requirements of SNT-TC-1A. The interpretation of the results shall be by either Level II or Level III inspectors certified to SNT-TC-1A. Visual examination is not included in this requirement.

7.2.3.1 All weld visual examinations shall be performed by personnel certified in accordance with American Society for Non-Destructive testing (ASNT) Recommended practice SNT-TC-1A, Level I, II, or III or certified in accordance with AWS QC-1 as either a Certified Welding Inspector (CWI) or a Senior Certified Weld Inspector (SCWI)

7.2.4 Ultrasonic testing, where specified by the Buyer or proposed by the Seller, shall be in accordance with Appendix 12 of ASME Section VIII, Division 1.

7.2.5 Radiographic acceptance criteria shall be in accordance with ASME Section VIII, Division 1, Paragraph UW-51 where full radiography is required or UW-52 where spot radiography as defined in this specification is per Section 6.4.2.

7.2.6 Deleted

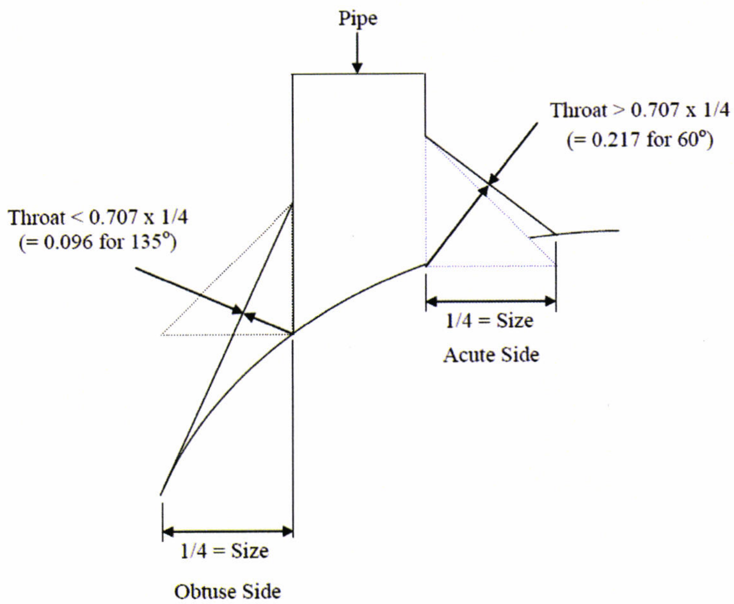
7.2.7 Dye Penetrant testing, where specified by the Buyer or proposed by the Seller, shall be in accordance with Appendix 8 of ASME Section VIII, Division 1.

7.2.8 Magnetic Particle testing, where specified by the Buyer or proposed by the Seller, shall be in accordance with Appendix 6 of ASME Section VIII, Division 1.

7.2.9 Weld visual examination, where specified by the Buyer or proposed by the Seller, shall be in accordance with ASME Section V, Article 9

7.2.10 Fillet Weld Measurement:

- A fillet weld leg size specified on the drawing weld symbol is the minimum size required 360 degrees around the nozzle/attachment. The effective throat based on that fillet size must be fully met around that circumference, including the obtuse (downhill) location. Both leg and throat dimensions must be met as an example, for a specified fillet weld leg size of 1/4", the throat thickness on the obtuse side as shown in the figure below is NOT acceptable (less than 0.707 x 1/4") and consequently the actual leg size must be increased on the obtuse side to meet an effective throat thickness of 0.707 x 1/4". For angles greater than 135 degrees, submit an SDDR for buyer review and approval. Fillet weld design is applicable between 60 degrees and 135 degrees (per AWS D1.1, Section 16, D1.6 Annex B) any weld outside these limits is not considered a fillet weld and shall be designed accordingly.



Off Set Nozzle Fillet Weld

7.3 Hydrotests

7.3.1 If paint is specified, the vessel shall not be painted prior to the pressure test. Coating shall not be applied to external welds of items requiring leak/hydrostatic testing prior to testing.

7.3.2 All welds shall be sufficiently cleaned and free of scale or paint prior to hydrostatic testing.

7.3.3 Testing of vessels or components made of austenitic stainless steel materials shall be conducted with potable water containing no more than 50 PPM chloride.

7.3.4 For vessels of carbon and low alloy steel, before application of the test pressure, the test water and the vessel material shall be allowed to equalize to approximately the same temperature. The temperature of the pressure resisting components during the pressure test, regardless of test media, shall be at least 30° F warmer than the minimum design metal temperature to be stamped on the nameplate, but need not exceed 120° F.

7.3.5 The final hydrostatic test pressure shall be held for a minimum of one hour.

7.3.6 After completion of the hydrostatic test, the vessel shall be drained, dried, cleaned thoroughly inside and outside to remove grease, loose scale, rust, and dirt and closed as quickly as practicable. Test water shall not be in contact with austenitic stainless steel for more than 72 hours, unless treated with an appropriate biocide.

7.3.7 If field assembly or erection is involved, the final hydrostatic test shall be at the job site. The Seller or the field subcontractor shall provide the Buyer with a detailed test procedure for review and approval prior to testing.

7.3.8 A horizontal vessel shall be tested while resting on its support saddles without additional supports or cribbing.

7.3.9 Tall vertical vessels may be shop hydrotested in the horizontal position. The vessel shall be designed for vertical hydrotest loading. These vessel supports must be adequately designed to support the vessel (in accordance with the ASME code) during the hydrotest to prevent damage.

7.3.10 Each chamber of a multi-chamber vessel (jacketed vessel) shall be subject to a hydrotest pressure with atmospheric pressure in the adjacent chamber.

7.3.11 Parent vessels are in the Black Cell or Hard to Reach Areas, no hydrotest required for Pulse Jet Mixers and Charge Vessels.

7.3.12 Seller shall submit a hydrostatic test procedure in accordance with the requirements of Section 7.3 of this specification and ASME Section VIII, Division 1, Paragraph UG-99 for buyer review prior to use.

7.4 Leak Tests

7.4.1 If gas or pneumatic testing is specified in the MDS, Drawings or in the purchase order, the Seller shall conduct the tests in accordance with ASME Section V. Seller shall submit a test procedure for Buyer review prior to use.

7.4.2 Reinforcing pad attachment welds and accessible surfaces of inside nozzle to vessel wall welds shall be tested for leaks with 15 PSIG dry air or nitrogen and bubble forming solution. This test shall be performed prior to the final hydrostatic or pneumatic test as applicable.

7.5 Obstruction Test

7.5.1 Seller shall ensure and document that all internals, internal piping, and jacketing are free from obstructions.

7.6 Final Inspection of Completed Vessel

7.6.1 Final inspection of the completed vessel shall be the sole responsibility of the Seller. The finished dimensions and cleanliness of the vessels shall comply with the relevant Drawings and specifications after completion of all tests.

8 Preparation and Shipment

8.1 Cleaning

8.1.1 Seller shall comply with 24590-WTP-3PS-G000-T0003.

8.1.2 If specified in the purchase order and in any event following hot working or heat treatment, the equipment shall be descaled. The procedure to be used by Seller shall be submitted for Buyer's prior approval.

8.1.3 If blast (mechanical) descaling process is specified in the purchase order for stainless steel construction, clean and iron-free glass or ceramic beads, or sand of alumina or zirconia type shall be used. The type, grade, and chemical composition of the abrasive shall be submitted for Buyer's approval prior to its use. Recycling of abrasive is prohibited. Blast cleaning shall not be used on weld metal or as a final finish on fabrications.

8.2 Packaging

8.2.1 Machined carbon steel surfaces, which are not protected by blind flanges, shall be coated with rust preventative. Rust preventative coating shall be approved by Buyer.

8.2.2 All flanged openings, which are not provided with a cover, shall be protected by an ASME B16.5 or B16.47 carbon steel blind flange of the same rating as the flange, a full faced rubber gasket with a minimum thickness of 1/8 inch and carbon steel bolts with stainless steel washers.

8.2.3 For internal parts, suitable supports shall be provided to avoid damage during shipment. Temporary internal bracing shall be painted yellow and a label, located near the nameplate shall state that the vessel contains temporary bracing that must be removed.

8.2.4 Small parts, which are to be shipped loose, shall be bagged or boxed and marked with the order and plant item number of the vessel.

8.3 Shipping

8.3.1 Seller shall take all necessary precautions in loading by blocking and bracing the vessel and furnishing all necessary material to prevent damage.

8.3.2 The Seller shall verify, by calculation, that the vessel and internals will withstand loads occurring during shipping for the chosen mode of transportation. The Buyer shall inform the Seller of the chosen mode of transportation

9 Documentation and Submittals

9.1 Seller shall comply with the requirements of forms G321-E and G321-V of the material requisition or subcontract. Furnish all applicable drawings, MDS, design calculations, reports of special analyses, welding procedure specifications with procedure qualification records, test procedures, and all other required documents. |

9.2 Design calculations shall include relevant ASME Section VIII, Division 1 formulas, and source paragraphs, values used in the formulas, the calculated results, and comparison with acceptable values. Where calculations are based on other than the ASME Section VIII, Division 1 formulas, the source of the formulas shall be referenced. Where a computer program is used for calculations, a brief program description shall be given, including name and version of the program. If the program is not commercially available to industry, Seller shall maintain and provide, upon request, program documentation. Calculations shall include, but not be limited to:

- Code calculations
- Nozzle neck calculation per UG45, average primary stress Pm across the nozzle wall
- Seismic calculations including base horizontal seismic force and moment and loads for anchorage and anchor bolt design
- Support calculations including empty weight, operating weight and location of center of gravity
- Calculations associated with lifting and erection of the vessel
- Nozzle load analysis for local and gross effect, per Section 3.7 above, or by other approved method
- Design of attachments, both internal and external
- Thermal and discontinuity stresses as applicable
- Fatigue analysis as applicable for vessels in fatigue services

9.2.1 Seller shall submit an Outline drawing for each item. The Outline drawing shall include the following minimum for each item:

- Shell and head thickness
- Head type
- Vessel empty weight, test weight and shipping weight
- Center of Gravity
- Lifting lugs and tailing lugs
- Diameter, tangent-to-tangent dimensions and appropriate support details
- Nozzle, flange support locations from datum point
- Nozzle schedule with nozzle marks and service conditions
- All appropriate design conditions, NDE and materials of construction
- Foundation/Mounting details
- Installations of appropriate internals

9.3 Seller shall make a complete set of Buyer approved drawings and other documents available to the Buyer's representative at the time the quality surveillance activities are being conducted.

9.4 All records pertaining to the nondestructive examination, base materials, filler materials, fabrication, and inspection shall be traceable to the area and part inspected and is accessible for Buyer's examination.

9.5 Seller shall provide ASME Section VIII, Division 1 data reports per ASME Section VIII Division 1, Paragraph UG-120.

9.6 Seller shall submit assembly drawings and shop detail drawings for buyer's review. These drawings shall include bill of materials, weld symbol, and NDE for each weld, and parts used in vessel construction. Assembly and shop detail drawings shall also include shell and head plate layout (including nozzles) for compliance with Section 5.2 of this specification.

9.7 Seller shall provide a detailed description of their work inspections and tests planned during the receipt of materials, manufacturing, testing, and conformance verification activities. This shall include identification of Bechtel and supplier witness and hold points.

9.8 Seller shall supply quality records and test results in accordance with the G321V form of the Material Requisition to include the following.

9.8.1 Document Category 16.0 – Heat Treat Reports – in accordance with section 7.1 of this specification. A complete record of any applicable heat treatment including charts.

9.8.2 Document Category 19.0 Ultrasonic Examination and Verification Reports - in accordance with Section 7.2.4 of this specification.

9.8.3 Document Category 20.0 Radiographic Examination and Verification Reports- in accordance with Section 7.2.5 of this specification.

9.8.4 Document Category 20.1 RT Film and Reader Sheets-Seller shall submit the original set of radiographic film with associated technique and reader sheets for radiographic tests performed. Radiographic film must be suitably packaged to preclude moisture and handing damage.

9.8.5 Document Category 21.0 Magnetic Particle Examination and Verification Reports-in accordance with Section 7.2.8 of this specification.

9.8.6 Document Category 22.0 Liquid Penetrant Examination and Verification Reports-in accordance with Section 7.2.7 of this specification.

9.8.7 Document Category 24.0 Pressure Testing and Verification Reports

- Hydrostatic Leak Testing I accordance with section 7.3 of this specification.
- Gas or Pneumatic Testing in accordance with section 7.4 of this specification.

9.8.8 Document Category 25.0 Inspection and Verification Report-

- Final dimensional verifications comply with Section 7.6 of this specification.
- Visual Weld Inspections in accordance with Section 7.2.9 and 7.2.10

of this specification.
- Hardness Test report (if applicable_ in accordance with Section 7.1 of this specification.

9.8.9 Document Category 26.1 Mechanical Test Report-

- Load testing,
- Pipe bending documentation in accordance with Section 5.1.9 and 5.1.10 of this specification.
- Obstruction documentation per Section 7.5 of this specification.

10 Quality Assurance

10.1 General Requirements

10.1.1 Deleted

10.1.2 Deleted

10.1.3 Seller's QAP, as a minimum, shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements Data Sheets listed in Section 2 of the material requisition.

10.2 Additional Requirements for Quality Level Q Vessels

10.2.1 Seller shall have in place a QA program meeting the requirements of ASME NQA-1, marked as applicable in Supplier Quality Assurance Program Requirements Data Sheet attached to the material requisition.

10.2.2 The successful bidder must pass a pre-award survey by the Buyer. Seller shall demonstrate that its quality program is in compliance with the procurement quality requirements listed in the Supplier Quality Assurance Program Requirements Data Sheet.

10.2.3 All items shall be manufactured in accordance with the Seller's Quality Assurance Program that meets the requirements of ASME NQA-1, and has been previously evaluated and accepted by the RPP-WTP Quality Organization.

10.2.4 Seller shall submit their QAP and work plan to Buyer for review prior to commencement of work. The plan shall include documents and procedures to implement the work and include a matrix of essential quality assurance elements cross-referenced with the documents and procedures.

11 Revision History (Internal Use Only)

NOTE: Asterisk (*) denotes a new entry for this revision of the Specification

11.1 Deleted

11.2 Design Changes Incorporated by Design

24590-WTP-SDDR-PROC-02-0145
24590-WTP-SDDR-PROC-02-0155
24590-WTP-SDDR-PROC-02-0183
24590-WTP-SDDR-PROC-03-0023
24590-WTP-SDDR-PROC-03-0053
24590-WTP-SDDR-PROC-03-0075
24590-WTP-SDDR-PROC-03-0082
24590-WTP-SDDR-PROC-03-0083
24590-WTP-SDDR-PROC-03-0086
24590-WTP-SDDR-PROC-03-0100
24590-WTP-3PN-MV00-00001
24590-WTP-3PN-MV00-00002
24590-WTP-3PN-MV00-00009
24590-WTP-3PN-MV00-00011
24590-WTP-3PN-MV00-00012
24590-WTP-3PN-MV00-00014
24590-WTP-3PN-MV00-00015
24590-WTP-3PN-MV00-00016 with modifications:
24590-WTP-SDDR-PROC-05-00100 is incorporated by reference in lieu of 24590-WTP-SDDR-PROC-04-00100
24590-WTP-SDDR-PROC-05-00197 is incorporated by reference in lieu of 24590-WTP-SDDR-PROC-04-00197
24590-WTP-3PN-MV00-00017
24590-WTP-3PN-MV00-00019
24590-WTP-3PN-MV00-00020
24590-WTP-3PN-MV00-00022
24590-WTP-3PN-MV00-00033
24590-WTP-3PN-MV00-00027
24590-WTP-3PN-MV00-00028
24590-WTP-3PN-MV00-00030
24590-WTP-3PN-MV00-00032
24590-WTP-3PN-MV00-00033
* 24590-WTP-3PN-MV00-00034
* 24590-WTP-3PN-MV00-00035
* 24590-WTP-3PN-MV00-00038

11.3 Design Changes Incorporated by Reference

24590-WTP-SDDR-PROC-02-0128
24590-WTP-SDDR-PROC-02-0136
24590-WTP-SDDR-PROC-02-0182

24590-WTP-SDDR-PROC-03-0020
24590-WTP-SDDR-PROC-03-0066
24590-WTP-SDDR-PROC-03-0076
24590-WTP-SDDR-PROC-03-0157
24590-WTP-SDDR-PROC-03-0168
24590-WTP-SDDR-PROC-03-0169
24590-WTP-SDDR-PROC-03-0226
24590-WTP-SDDR-PROC-03-0240
24590-WTP-SDDR-PROC-03-0242
24590-WTP-SDDR-PROC-03-0255
24590-WTP-SDDR-PROC-03-0263
24590-WTP-SDDR-PROC-03-0285
24590-WTP-SDDR-PROC-04-00130
24590-WTP-SDDR-PROC-04-00184
24590-WTP-SDDR-PROC-04-00201
24590-WTP-SDDR-PROC-04-00216
24590-WTP-SDDR-PROC-04-00269
24590-WTP-SDDR-PROC-04-00411
24590-WTP-SDDR-PROC-04-00551
24590-WTP-SDDR-PROC-04-00613
24590-WTP-SDDR-PROC-04-00645
24590-WTP-SDDR-PROC-04-00744
24590-WTP-SDDR-PROC-04-00788
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24590-WTP-NCR-CON-03-202
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24590-WTP-SDDR-PROC-05-00101
24590-WTP-SDDR-PROC-05-00197
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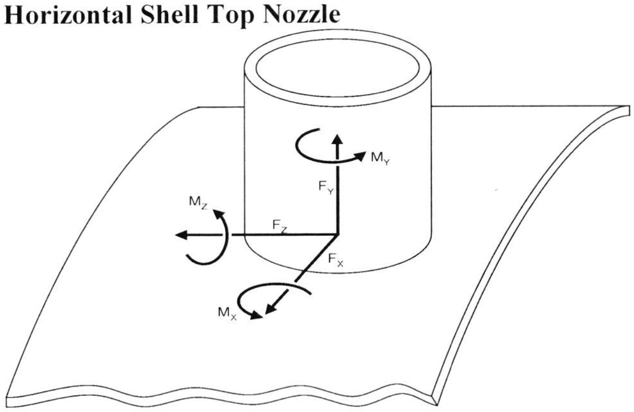
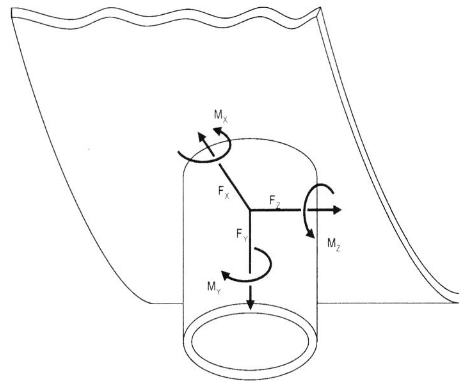
Appendix A: Minimum Nozzle Design Loads

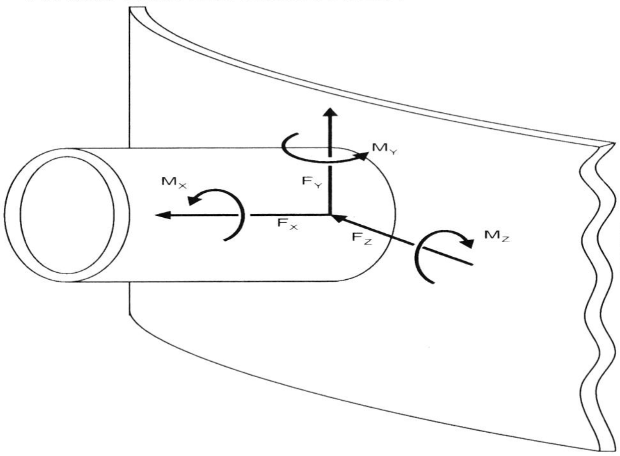
Horizontal Shell Top Nozzle



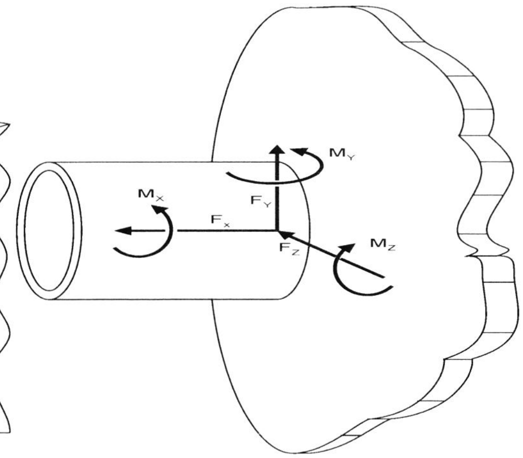
Horizontal Shell. Bottom Nozzle



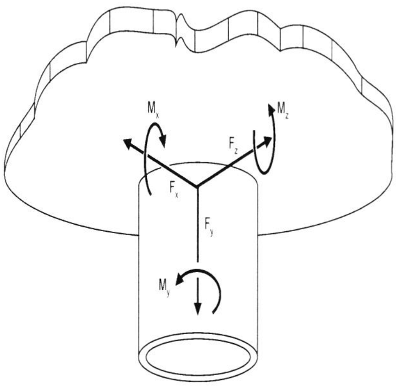
Vertical Shell Horizontal Nozzle



Horizontal Head Nozzle



Vertical Bottom Head Nozzle



Vertical Top Head Nozzle

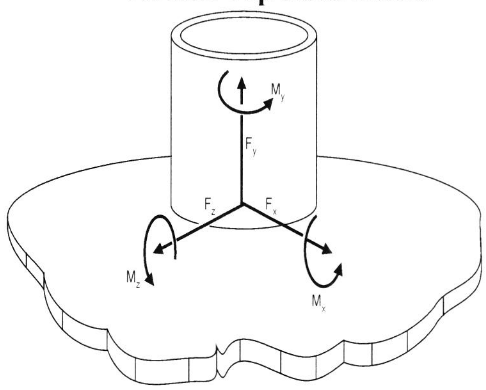


Table A1- Minimum Nozzle Loads Due to Stainless Steel Piping on Vessels Designated as SC-I

Pipe Size	Load Type	Forces			Moments		
		Fx (lb)	Fy (lb)	Fz (lb)	Mx (ft-lb)	My (ft-lb)	Mz (ft-lb)
1 in	Weight	10	16	10	10	6	6
	Seismic	30	20	30	37	55	55
	Thermal	30	26	40	38	77	77
1-1/2 in	Weight	20	32	20	24	15	15
	Seismic	60	40	60	91	137	137
	Thermal	64	56	86	96	192	192
2 in	Weight	36	56	36	42	26	26
	Seismic	106	70	106	158	237	237
	Thermal	114	100	152	169	337	337
3 in	Weight	69	111	69	158	99	99
	Seismic	215	143	215	623	934	934
	Thermal	228	203	305	664	1330	1330
4 in	Weight	116	186	116	288	180	180
	Seismic	365	243	365	1170	1760	1760
	Thermal	393	350	524	1260	2520	2520
6 in	Weight	279	446	279	797	498	498
	Seismic	884	590	884	3230	4850	4850
	Thermal	980	872	1310	3580	7160	7160
8 in	Weight	311	497	311	988	618	618
	Seismic	978	653	978	3930	5890	5890
	Thermal	1190	1060	1590	4800	9590	9590
10 in	Weight	351	561	351	1880	1180	1180
	Seismic	1090	728	1090	7340	11000	11000
	Thermal	1270	1130	1690	8500	17000	17000
12 in	Weight	485	776	485	2710	1700	1700
	Seismic	1510	1010	1510	10500	15800	15800
	Thermal	1780	1580	2370	12400	24800	24800
14 in	Weight	581	930	581	3320	2080	2080
	Seismic	1800	1200	1800	12600	18900	18900
	Thermal	2140	1900	2860	15000	30100	30100
16 in	Weight	729	1170	729	4170	2610	2610
	Seismic	2280	1520	2280	16100	24200	24200
	Thermal	2800	2490	3730	19800	39500	39500
18 in	Weight	911	1460	911	5070	3170	3170
	Seismic	2820	1880	2820	20000	29900	29900
	Thermal	3550	3160	4730	25200	50300	50300
20 in	Weight	1120	1790	1120	6310	3950	3950
	Seismic	3400	2270	3400	23900	35800	35800
	Thermal	4440	3950	5920	31200	62400	62400
22 in	Weight	1340	2150	1340	7300	4560	4560
	Seismic	4030	2690	4030	28100	42200	42200
	Thermal	5430	4830	7240	37900	75800	75800
24 in	Weight	1570	2510	1570	8510	5320	5320
	Seismic	4710	3140	4710	32400	48700	48700
	Thermal	6560	5840	8750	45200	90400	90400

Note: Unless otherwise specified on the MDS utilize the minimum nozzle loads specified

Table A2- Minimum Nozzle Loads Due to Stainless Steel Piping on Vessels Designated as SC-II, III, and IV

Pipe Size	Load Type	Forces			Moments		
		Fx (lb)	Fy (lb)	Fz (lb)	Mx (ft-lb)	My (ft-lb)	Mz (ft-lb)
1 in	Weight	10	16	10	11	7	7
	Seismic	66	44	66	92	137	137
	Thermal	28	24	38	38	77	77
1-1/2 in	Weight	20	32	20	26	16	16
	Seismic	138	92	138	228	342	342
	Thermal	58	52	78	96	192	192
2 in	Weight	34	56	34	46	29	29
	Seismic	244	162	244	398	597	597
	Thermal	104	92	138	169	337	337
3 in	Weight	71	113	71	180	112	112
	Seismic	491	327	491	1570	2350	2350
	Thermal	209	185	278	664	1330	1330
4 in	Weight	120	192	120	342	214	214
	Seismic	834	557	834	2960	4440	4440
	Thermal	356	317	474	1260	2520	2520
6 in	Weight	290	462	290	951	595	595
	Seismic	2025	1350	2025	8290	12400	12400
	Thermal	875	777	1170	3580	7160	7160
8 in	Weight	333	534	333	1210	758	758
	Seismic	2360	1580	2360	10700	16000	16000
	Thermal	1050	938	1410	4800	9590	9590
10 in	Weight	361	578	361	2210	1380	1380
	Seismic	2540	1690	2540	19400	29100	29100
	Thermal	1110	991	1490	8500	17000	17000
12 in	Weight	502	803	502	3240	2020	2020
	Seismic	3510	2340	3510	28100	42100	42100
	Thermal	1550	1380	2070	12400	24800	24800
14 in	Weight	591	946	591	3870	2420	2420
	Seismic	4160	2780	4160	33900	50900	50900
	Thermal	1850	1640	2460	15000	30100	30100
16 in	Weight	757	1210	757	5080	3180	3180
	Seismic	5310	3540	5310	44100	66100	66100
	Thermal	2380	2120	3180	19800	39500	39500
18 in	Weight	1200	1930	1200	8190	5120	5120
	Seismic	8490	5660	8490	71500	107000	107000
	Thermal	2990	2660	3980	25200	50300	50300
20 in	Weight	1280	2050	1280	8630	5400	5400
	Seismic	8910	5940	8910	75900	114000	114000
	Thermal	3660	3260	4880	31200	62400	62400
22 in	Weight	1380	2200	1380	9380	5860	5860
	Seismic	9510	6340	9510	81500	122000	122000
	Thermal	4420	3930	5900	37900	75800	75800
24 in	Weight	1600	2570	1600	11000	6870	6870
	Seismic	11100	7430	11100	96100	144000	144000
	Thermal	5240	4660	6990	45200	90400	90400

Note: Unless otherwise specified on the MDS utilize the minimum nozzle loads specified

Table A3- Minimum Nozzle Loads Due to Carbon Steel Piping on Vessels Designated as SC-I

Pipe Size	Load Type	Forces			Moments		
		Fx (lb)	Fy (lb)	Fz (lb)	Mx (ft-lb)	My (ft-lb)	Mz (ft-lb)
1 in	Weight	10	16	10	11	7	7
	Seismic	30	20	30	45	67	67
	Thermal	36	32	46	53	106	106
1-1/2 in	Weight	20	32	20	28	18	18
	Seismic	60	40	60	111	166	166
	Thermal	72	64	96	132	265	265
2 in	Weight	34	54	34	50	31	31
	Seismic	100	68	100	192	288	288
	Thermal	122	108	162	232	465	465
3 in	Weight	68	108	68	192	120	120
	Seismic	207	138	207	755	1130	1130
	Thermal	251	222	335	915	1830	1830
4 in	Weight	113	180	113	357	223	223
	Seismic	344	230	344	1420	2130	2130
	Thermal	420	374	561	1740	3480	3480
6 in	Weight	260	416	260	1000	626	626
	Seismic	792	528	792	3950	5930	5930
	Thermal	989	879	1320	4930	9870	9870
8 in	Weight	302	482	302	1290	806	806
	Seismic	932	621	932	5250	7870	7870
	Thermal	1170	1040	1560	6610	13200	13200
10 in	Weight	411	658	411	2390	1500	1500
	Seismic	1270	848	1270	9130	13700	13700
	Thermal	1630	1450	2180	11700	23400	23400
12 in	Weight	608	973	608	3760	2350	2350
	Seismic	1880	1250	1880	14200	21300	21300
	Thermal	2430	2160	3240	18400	36800	36800
14 in	Weight	744	1190	744	4710	2940	2940
	Seismic	2350	1560	2350	18500	27800	27800
	Thermal	3030	2700	4040	23900	47900	47900
16 in	Weight	1030	1650	1030	7040	4400	4400
	Seismic	3250	2170	3250	27700	41500	41500
	Thermal	4200	3730	5600	35800	71500	71500
18 in	Weight	1410	2250	1410	9840	6150	6150
	Seismic	4240	2830	4240	38700	58000	58000
	Thermal	5580	4960	7440	50900	102000	102000
20 in	Weight	1730	2770	1730	12700	7970	7970
	Seismic	5340	3560	5340	49600	74400	74400
	Thermal	7160	6360	9540	66500	133000	133000
22 in	Weight	2080	3340	2080	13100	8200	8200
	Seismic	6290	4190	6290	50300	75500	75500
	Thermal	8590	7640	11500	68800	138000	138000
24 in	Weight	2650	4240	2650	20700	12900	12900
	Seismic	7980	5320	7980	79900	120000	120000
	Thermal	11100	9870	14800	111000	222000	222000

Note: Unless otherwise specified on the MDS utilize the minimum nozzle loads specified

Table A4- Minimum Nozzle Loads Due to Carbon Steel Piping on Vessels Designated as SC-II, III or IV

Pipe Size	Load Type	Forces			Moments		
		Fx (lb)	Fy (lb)	Fz (lb)	Mx (ft-lb)	My (ft-lb)	Mz (ft-lb)
1 in	Weight	10	16	10	13	8	8
	Seismic	68	46	68	110	166	166
	Thermal	32	30	44	53	106	106
1-1/2 in	Weight	20	32	20	31	20	20
	Seismic	140	92	140	275	412	412
	Thermal	68	60	90	132	265	265
2 in	Weight	34	54	34	55	34	34
	Seismic	234	156	234	480	721	721
	Thermal	114	100	150	232	465	465
3 in	Weight	62	99	62	176	110	110
	Seismic	482	321	482	1910	2870	2870
	Thermal	231	206	308	915	1830	1830
4 in	Weight	104	167	104	335	209	209
	Seismic	804	536	804	3610	5420	5420
	Thermal	387	344	516	1740	3480	3480
6 in	Weight	243	389	243	949	593	593
	Seismic	1860	1250	1860	10200	15200	15200
	Thermal	906	806	1210	4930	9870	9870
8 in	Weight	353	564	353	1450	903	903
	Seismic	2690	1800	2690	13400	20200	20200
	Thermal	1320	1180	1770	6610	13200	13200
10 in	Weight	384	615	384	2600	1630	1630
	Seismic	2920	1950	2920	23700	35600	35600
	Thermal	1450	1290	1930	11700	23400	23400
12 in	Weight	567	908	567	4150	2590	2590
	Seismic	4310	2880	4310	37100	55600	55600
	Thermal	2140	1910	2860	18400	36800	36800
14 in	Weight	707	1130	707	5400	3380	3380
	Seismic	5380	3590	5380	48100	72200	72200
	Thermal	2670	2380	3570	23900	47900	47900
16 in	Weight	980	1570	980	8040	5020	5020
	Seismic	7450	4970	7450	71900	108000	108000
	Thermal	3700	3290	4940	35800	71500	71500
18 in	Weight	1300	2080	1300	11300	7090	7090
	Seismic	9890	6590	9890	102000	152000	152000
	Thermal	4950	4400	6600	50900	102000	102000
20 in	Weight	1640	2630	1640	14900	9330	9330
	Seismic	12500	8320	12500	132000	198000	198000
	Thermal	6300	5600	8400	66500	133000	133000
22 in	Weight	1900	3040	1900	15400	9620	9620
	Seismic	14400	9610	14400	135000	203000	203000
	Thermal	7330	6520	9770	68800	138000	138000
24 in	Weight	2510	4020	2510	24800	15500	15500
	Seismic	19000	12700	19000	217000	326000	326000
	Thermal	9760	8680	13000	111000	222000	222000

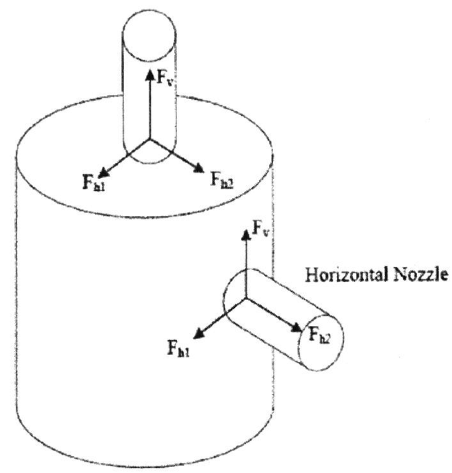
Note: Unless otherwise specified on the MDS utilize the minimum nozzle loads specified

Appendix B: Minimum Nozzle Loads Due to Jumpers

[redacted]

Minimum Nozzle Forces Due to HLW Jumpers on Vessels/Equipment

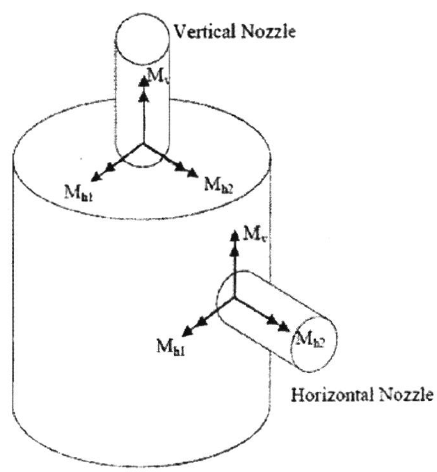
Jumper Pipe Size	Load Type	Forces		
		F_v (lb)	F_{h1} (lb)	F_{h2} (lb)
2 in	Weight	150	30	30
	Seismic	140	100	100
	Thermal	80	200	200
3 in	Weight	490	170	170
	Seismic	290	430	430
	Thermal	360	610	610
4 in	Weight	800	500	500
	Seismic	500	550	550
	Thermal	600	1300	1300
6 in	Weight	2000	600	600
	Seismic	1500	1500	1500
	Thermal	2000	2000	2000
8 in	Weight	3600	1800	1800
	Seismic	3100	3100	3100
	Thermal	3100	3100	3100



Orientation of Forces With Respect to the Jumper Nozzle

Minimum Nozzle Moments Due to HLW Jumpers on Vessels/Equipment

Jumper Pipe Size	Load Type	Moments		
		M_v (ft-lb)	M_{h1} (ft-lb)	M_{h2} (ft-lb)
2 in	Weight	20	100	100
	Seismic	200	225	225
	Thermal	200	250	250
3 in	Weight	280	300	300
	Seismic	400	600	600
	Thermal	500	1010	1010
4 in	Weight	500	950	950
	Seismic	650	650	650
	Thermal	1000	1050	1050
6 in	Weight	700	2000	2000
	Seismic	1500	1500	1500
	Thermal	2000	2000	2000
8 in	Weight	1800	3100	3100
	Seismic	3100	3600	3600
	Thermal	3100	3100	3100



Orientation of Moments With Respect to the Jumper Nozzle

NOTE: Loads are applied at the nozzle to shell/head juncture. Loads provided do not have a sign convention: supplier ensures that the direction of load application provides the most conservative stresses at the nozzle to shell or head junction. The V-axis is vertical and in the direction of gravity regardless of the orientation of the nozzle. Thermal reductions per section 3.7.5 are not applied to jumper nozzle loads.

Appendix C: AISC M016 Tailoring

Implementing Standards for AISC M016, Manual of Steel Construction, Allowable Stress Design (ASD)

Revision: 9th Edition
Sponsoring Origination: American Institute of Steel Construction

WTP Specific Tailoring

The following tailoring of M016 is required for use by the WTP contractor as an implementing standard for design of structural steel for Seismic Category III SSCs.

No specific section

Load combination for design of structural steel members utilize those identified in UBC 97, section 1612.3

Justification: These load combination represent the commercial requirements for allowable stress design of structural steel. Use of these load combinations will ensure compliance with commercial design in accordance with the UBC.

No specific section

Seismic detailing requirements shall be in accordance with UBC 97, Chapter 22, Division V, section 2214, for moderate seismic risk structures.

Justification: The requirements contained in this section contain accepted industry practice for design of important commercial steel structures. Use of this section will ensure compliance with commercial design in accordance with the UBC.

Appendix D: 3.0 ANSI/AISC N690 WTP Specific Tailoring

3.0 ANSI/AISC N690, "Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities"

Revision: 1994
Sponsoring Origination: American National Standards Institute/American Institute of Steel Construction.

The following tailoring of ANSI/AISC N690 is required for use by the WTP contractor as an Implementing Standard for structural design.

Ref ANSI/AISC N690 Page 22, Section Q1.5.7.1 Primary Stresses with revised Stress Limit Coefficient for WTP project.

Revised stress limit coefficients for compression in Table Q1.5.7.1 as follows:

- 1.3 instead of 1.5 [stated in footnote (c)] in load combinations 2, 5, and 6
- 1.4 instead of 1.6 in load combinations 7, 8, and 9
- 1.6 instead of 1.7 in load combination 11

Page 22, Section Q1.5.7.1 Primary Stresses

Do not Consider the following load combinations:

- 4. D + L + Eo
- 6. D + L + Ro + To + Eo

  For carbon steel structures see section 3.9.1.3

Appendix E: Vessel Item Temperature

There are four temperatures to be considered when developing the vessel and support (e.g. skirt) model and analysis.

From Vessel MDS

T_D Vessel Design temperature
Tov Vessel Operating temperature

From Vessel EQD

To 'Abnormal' temperature
Ta 'DBE' temperature

Temp.	ASME Sect VIII (vessel stress checks)	ASME B31.3 (vessel piping stress checks)	AISC N690 (internal vessel support members)	AISC N690 (outer vessel support members, e.g. skirt, and embed/anchorage)
T_D	Used for vessel component design, in design load case summations.	Used for piping design, in design load case summations.	Used for supports design, in design load case summations.	Used for support design (skirt), in design load case summations, when doing so gives a greater thermal differential than T_O or T_a.
	Not used in occasional (seismic) load case summations.			
T_{OV}	Used for vessel component design, in occasional load case summations.	Used for piping design, in occasional load case summations.	Used for supports in occasional load case summations.	Used for support design (skirt), in occasional load case summations, when doing so gives a greater thermal differential than T_O.
	Not used with design load case summations.			
T_O	Used for support interface design (skirt), in design and occasional load case summations, when doing so gives a greater thermal differential than T_D or T_{OV}.	Not applicable to vessel piping.	Not applicable to vessel internal supports.	Used for support design (skirt), in design and occasional load case summations, when doing so gives a greater thermal differential than T_D or T_{OV}.

T_a	Used for support interface design (skirt), in design load case summations when doing so gives a greater thermal differential than T_D.	Not applicable to vessel piping.	Not applicable to vessel internal supports	Used for support design (skirt), in design load case summations when doing so gives a greater thermal differential than T_D.
	Not used with occasional (seismic) load case summations.			