



ISSUED BY
RPP/WTP PDC

RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT
ENGINEERING SPECIFICATION
FOR
ALTERATION AND REPAIR OF ON SITE STAMPED ASME CODE VESSELS
AND BOILERS FOR SUBCONTRACT

Content applicable to ALARA? Yes No

ADR No.

Rev

Specification changes retroactive?

Yes No
 N/A (alpha revision or revision 0)

Quality Level

Q

DOE Contract No.
DE-AC27-01RV14136

NOTE: Contents of this document are Dangerous Waste

	EM Permit 7/12/14						
		<i>Bharat Makadia</i>	<i>Mohan Arulamplam</i>	<i>Steve Vail</i>	<i>Jan Schneider</i>	<i>John Julyk</i>	
1	02/13/14 02/12/14 77 2/13/14	Bharat Makadia	Mohan Arulamplam	Steve Vail	Jan Schneider	John Julyk	
0	07/01/10	Mohan A	Steve Vail	Sean Sweeney	Merl Rosenthal	John Julyk	
REV	DATE	BY	CHECK	REVIEW	E&NS	EGS	
SPECIFICATION No. 24590-WTP-3PS-MVB2-T0002						Rev 1	

Revision History

Revision	Reason for Revision
0	Issued for USE
1	Incorporation of SCN's; 24590-WTP-3PN-MVB2-00010, 24590-WTP-3PN-MVB2-00011, 24590-WTP-3PN-MVB2-00015 and revised clarification related to NBIC Codes and Standards. Merged paragraphs 3.4 and 3.5 together.

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.

Contents

1	Scope	1
1.1	Description and Location	1
1.2	Definitions	1
1.3	Acronyms and Abbreviations	4
1.4	Work Included	4
1.5	Conflicts	5
1.6	Responsibilities	6
1.7	Codes and Industry Standards	6
1.8	Project Documents	7
2	Materials.....	7
2.1	General.....	7
3	Repair and Alteration	9
3.1	General.....	9
3.2	Layout	11
3.3	Welding Requirement.....	11
3.4	NDE Requirements For All Design Levels Repaired or Altered Vessels	13
3.5	Additional Requirements for Repaired or Altered Vessels Located in a Black Cell or Hard-to Reach Area	14
4	Examinations, Tests, and Inspections.....	14
4.1	Nondestructive Examinations	14
4.2	Pressure Test at Jobsite	15
4.3	Obstruction Test.....	15
4.4	Final Inspection of Completed Vessel	15
5	Preparation for Service.....	16
5.1	Cleaning	16
6	Documentation and Submittals	16
7	Quality Assurance	17
7.1	General Requirements.....	17
7.2	Additional Requirements for Quality Level Q Vessels	17
8	Revision History.....	17
8.1	Design Changes Incorporated by Design	17
8.2	Design Changes by Reference	17

Appendices

Appendix A :..... A-i
SAMPLE-Master Inspection Checklist for Repairs and Alterations..... A-i

1 Scope

1.1 Description and Location

The purpose of this specification is to provide criteria to implement repairs or alterations to ASME code-stamped pressure vessels and boilers that have been received and/or installed at the Hanford Tank Waste Treatment and Immobilization Plant (WTP) jobsite, but never placed in operation. This specification is intended to define technical and quality requirements for subcontractor.

In order to restore the vessel or boiler to its original code of construction and intended safe operating condition for the design life of the WTP Project, all repairs or alterations are required to be performed strictly as defined in this specification.

1.2 Definitions

Alterations: Any changes (physical or not) of the items described on the original manufacturer's data report (MDR) that affects the pressure containing capability of the pressure retaining item. Non-physical changes such as an increase in the maximum allowable working pressure (internal or external), increase in design temperature, or a reduction in minimum temperature of a pressure retaining item shall be considered an alteration.

Authorization: Approval/agreement to perform a specific activity (e.g., repairs, alteration). Approval or authorization shall be obtained from the Buyer prior to any work or related activity being performed.

Authorized Inspector (AI): An inspector, employed by an Authorized Inspection Agency, who performs inspections and witnesses stamping activities required by the code.

Authorized Inspection Agency (AIA): An organization designated by or acceptable to the appropriate legal authority of a state or municipality of the United States or province of Canada or the applicable country of an international project that has adopted the ASME Code as a legal requirement. The Authorized Inspection Agency may be a state of the United States, a province of Canada or an insurance company that is authorized to write boiler and pressure vessel insurance.

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

Buyer: Bechtel National Inc. (BNI).

Code: The term used in this specification to refer to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME code) or the National Board Inspection Code (NBIC), unless otherwise referenced.

Containment: Components that contain active process fluids inside the plant process system. Refer to the mechanical data sheet (MDS) for the containment classification of components.

Design Authority: The origination having the responsibility and authority for approving the design bases, the configuration, and changes thereto.

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 not subject to a static pressure head of liquid and that may come 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 contains 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, berm, or wall structure of the facility.

Drawings: The original vessel manufacturer's design drawings, the subcontractor's drawings, and the Buyer's drawings including VDCN are prepared to show all information necessary for repairs or alterations.

Fabrication: A general term used to describe those actions required to join parts and material to form items.

Hard-to-Reach Areas: Facility areas where piping and equipment is not designed for manual or remote access, replacement, or repair.

Installation: Those alterations and or repair actions required to set equipment into place and attach components to their supports, and to join items to form completed systems.

Inspector: Chief Inspector, State Inspector, or Special Inspector.

Chief Inspector: Washington State Chief Boiler and Pressure Vessel Inspector.

State Inspector: Washington State Boiler and Pressure Vessel Inspector.

Special Inspector: Inspector holding a valid commission issued by the National Board and employed by an accredited in-service Authorized Inspection Agency (AIA) - an insurance company authorized to write boiler and pressure vessel insurance in Washington State.

Items: A broad term for components, parts, and piping subassemblies which provide a pressure retaining barrier or act as a pressure retaining member. Items are normally manufactured or fabricated, are inspected by an authorized inspector, and require an MDR.

Jurisdiction: A government entity with the power, right, or authority to interpret and enforce law, rules, or ordinances pertaining to boiler, pressure vessels or other pressure retaining items

(PRI), including National Board member jurisdictions defined in the NBIC as jurisdictional authorities.

Material: Metallic materials that are manufactured to ASME Section II requirements or to specification permitted by ASME Section I and VIII, Division 1.

Manufacturer's Documentation: The documentation that includes technical information and certifications required by the original code of construction.

Mechanical Data Sheet: The Buyer's mechanical data sheet.

Monitor: To watch over, observe, or examine a work operation. Results of the observations and examinations may be recorded; however, sign-off responsibility is not included.

Nonconformance: For code items, a deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate, or does not meet the requirements of the code.

Owner or User: DOE/Office of River Protection, Hanford, or the assigned agent legally responsible for the safe operation of any pressure retaining item (e.g., Stamped ASME Vessel) within the WTP jobsite.

Part: An item subject to internal or external pressure, that is fabricated by welding, and which requires inspection by authorized inspector. A part shall be fabricated by a manufacturer having an ASME Certificate of Authorization and the appropriate code symbol stamp. A completed manufacturer's partial data report shall be supplied by the manufacturer.

Pressure Retaining Item (PRI): Any boiler, pressure vessel, piping, or material used for the containment of pressure, either internal or external. The pressure may be obtained from an external source, or by the application of heat from a direct source, or any combination thereof.

Quality Level: Establishes the quality assurance program requirements. Formerly, quality level also determined allowable nozzle reinforcement methods and nondestructive examination (NDE) requirements. Refer to the design level for these requirements. Buyer assigns quality levels on the MDS or drawings.

QVD Package: Vessel manufacturer (supplier) generated document or collection of documents, providing objective evidence that specified material quality requirements have been satisfied. See **Manufacturer's Documentation** above.

Repair: The work necessary to restore a pressure retaining item to a safe and satisfactory operating condition provided there is no deviation from the original design.

"R" Symbol Stamp: Symbol stamp for the National Board Inspection Code (NBIC) authorization program for the repair and/or alteration of boilers, pressure vessels, and other pressure-retaining items, issued by a valid "R" certificate holder authorized by the National Board.

1.3 Acronyms and Abbreviations

AI	Authorized Inspector
AIA	Authorized Inspection Agency
ASME	American Society of Mechanical Engineers
BNI	Bechtel National Inc.
HPAV	hydrogen in piping and ancillary vessels
MDR	manufacturer's data report
MDS	mechanical data sheet
MOB	multiple overblow
MT	magnetic particle examination
NBIC	National Board Inspection Code
NDE	nondestructive examination
PMI	Positive Material Identification
PRI	pressure retaining item
PQR	procedure qualification record
PT	dye-penetrant examination
PWHT	post weld heat treatment
QVD	Quality Verification Documents
RGM	revised ground motion
RT	radiographic examination
UT	ultrasonic examination
VDCN	Vendor Document Change Notice
WAC	Washington Administrative Code
WPS	welding procedure specification
WSGM	WTP site-specific ground motion

1.4 Work Included

The NBIC "R" certificate holder (subcontractor) is responsible for furnishing all materials and labor needed to repair (or alter), test, and prepare the pressure vessels or boiler for the intended service in accordance with this specification and the repair package.

Alterations or repairs are made to ASME Section VIII, Division 1 stamped pressure vessels (or Section I stamped boilers) which are currently received or installed, but never placed in operation at the jobsite.

Typical repairs include adding internal attachments and reinforcement (i.e., integral or non-integral) to the vessel pressure boundary and to internal components (e.g., pulse jet mixers, charge vessel, internal pipes). Other possible repairs include weld build-up, or replacement of wear plates, cutting and re-welding the vessel access door, and removal of previously installed internal supports.

Typical alterations include vessel re-rating (i.e., increase in maximum allowable working temperature or temperature of a pressure retaining item), adding new attachments to the vessel heads or shell, and/or adding new nozzles that are larger than what was on the original ASME Section VIII, code calculation; in such cases, reinforcement and nozzle strength calculations are required.

All alterations or repairs of pressure retaining items shall comply with the NBIC Part 3, *Repair and Alterations of Pressure-Retaining Items*.

Prior to starting alterations or repairs the Buyer shall obtain appropriate permit approvals for vessel design changes from the Washington State Department of Ecology in accordance with the Dangerous Waste Permit Condition III.10.C.2.e.

Prior to performing any alterations or repairs, the subcontractor shall prepare a field traveler in accordance with appendix A to present Buyer's review. The subcontractor shall prepare a submittal package for registering the completed modification/repair with the NBIC, and for obtaining a vessel "R" stamp.

The subcontractor shall define the scope of required rework and must give a detailed description of the required repairs and alterations for each reworked vessel or boiler. A procedure shall be developed to fully define in accordance with exhibit F in subcontract for all rework and authorized inspector (AI) and the Buyer must review and concur prior to initiating any repair or alteration work. The procedure must include all welding specification procedures (WPSs), supporting procedure qualifications records (PQRs), and nondestructive examination procedures, and leak test procedures. On a case by case basis, preparation for repair work may proceed (e.g. cutting, grinding) prior to the submission of all the procedures for the repair scope, provided the Buyer and the Authorized Inspector review and concur with the procedures for the preparation work. Hold points, established by the Buyer, shall be required to ensure the repair work is not initiated before appropriate procedures have been reviewed and concurred by the Buyer and the Subcontractor. Release of these HOLD points, by the Buyer, shall be required to commence any additional work.

For any alteration or repair, a meeting shall be held, unless specifically excluded by the Buyer, to include the Buyer, the authorized inspector, and other necessary parties to resolve all issues and to gain a clear understanding of the rework as directed on the Buyer's drawings and documents.

Subcontractors, and Buyer construction personnel, including field engineers, do not have authority to change or waive any of the technical or quality requirements established by Buyer's engineering organization with design authority, without the proper documented approval of that engineering organization.

1.5 Conflicts

In cases where a conflict exists between this specification and other drawings or specifications, the subcontractor shall call attention to the conflict and request an interpretation in writing from the Buyer.

1.6 Responsibilities

The Buyer (BNI) will provide code Manufacturer's Data Report(s), as-built shop drawings for stamped vessel, vessel internal drawings, and new support drawings (VDCN) with the bill of materials and applicable documents. The subcontractor is responsible for ensuring that the correct design documents provided are used for the performance and integrity of the work.

Vessel manufacturer's generated documents are available from the Quality Verification Documents (QVD) package. Engineering and Construction will provide required information as part of the subcontract for repairs and alterations.

The subcontractor is responsible for making the detail fabrication drawings and performing all code calculations, but BNI reserves the right to perform the design work, including drawing and calculations, needed for the repair or alteration of each vessel as defined on VDCN.

1.7 Codes and Industry Standards

- 1.7.1 The subcontractor shall apply the ASME Code Edition and Addenda in accordance to the R-Stamp Holder program, as applicable for the following codes and industry standards.
- 1.7.2 ASME Section VIII, Division 1, *Rules for Construction of Pressure Vessels*, American Society of Mechanical Engineers.
- 1.7.3 ASME Section II, *Materials*, American Society of Mechanical Engineers.
- 1.7.4 ASME Section V, *Nondestructive Examination*, American Society of Mechanical Engineers.
- 1.7.5 ASME Section VIII, Division 1, *Appendix 12*, Ultrasonic Examination of Welds (UT).
- 1.7.6 NBIC, Part 3, *National Board Inspection Code*, National Board of Boiler and Pressure Vessel Inspectors Repair and Alterations. See Subcontract for applicable edition year of NBIC.
- 1.7.7 PFI Standard ES-24. *Pipe Bending Methods, Tolerances, Process and Mechanical Requirements*, Pipe Fabrication Institute, Engineering and Fabrication Standard.
- 1.7.8 ASNT SNT-TC-1A, *Recommended Practice No. SNT-TC-1A*, American Society for Nondestructive Testing, Inc. *Applicable June 1980 Edition through 2001 Edition and its applicable supplements*.
- 1.7.9 ASME. NQA-1 2000. *Quality Assurance Program Requirements for Nuclear Facilities*.
- 1.7.10 ASME, SA-240/SA-240M. *Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*.
- 1.7.11 State of Washington Boiler & Unfired Pressure Vessel RCW laws & Washington Administrative Code (WAC) rules: *Chapter 70.79 RCW & 296-104 WAC*
- 1.7.12 OSHA, Occupational Safety, and Health Administration (OSHA) Permit-required confined spaces, *per 29 CFR 1910.146*.

- 1.7.13 ASTM Hardness Standard Testing, *E18 Standard Test Method for Rockwell Hardness of Metallic Materials.*
- 1.7.14 ASTM A578/A578M. *Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications*

1.8 Project Documents

- 1.8.1 24590-WTP-3PS-G000-T0010, *Engineering Specification for Positive Material Identification (PMI) for Construction.*
- 1.8.2 24590-WTP-MV-M59T-00001, *Pressure Vessel Tolerances Standard Details.*
- 1.8.3 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers, and Boilers.*
- 1.8.4 24590-WTP-3PS-G000-T0001, *Engineering Specification for Supplier Quality Assurance Program Requirements.*
- 1.8.5 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packing, Handling and Storage Requirements.*
- 1.8.6 24590-WTP-3PS-G000-T0005, *Engineering Specification for Cleanness Requirements for WTP Fluid Systems.*
- 1.8.7 24590-WTP-3PS-NW00-T0002, *Engineering Specification for Chemical Requirements for Materials Used in Contact With Austenitic Stainless Steel and Nickel Based Alloys.*
- 1.8.8 24590-WTP-LIST-CON-08-0001, *Restricted Materials List WTP Safety Assurance.*
- 1.8.9 24590-WTP-3PS-PS02-T0002, *Engineering Specification for Cold Bending of Pipe.*

2 Materials

2.1 General

- 2.1.1 Materials provided by the subcontractor shall be new and free from defects. All materials shall be in accordance with ASME Section VIII, Division 1. The Seller shall furnish legible copies of the mill test reports from the manufacturer/material supplier for base and filler materials comprising the primary confinement, supports, and welded attachments. Other materials shall be provided with certified statements that the material meets the requirements of the applicable material specification and grade/type in ASME Section II.
- 2.1.2 Material shall be furnished to the specification and grade/type shown on the original manufacturer's vessel drawings associated with the vessel being repaired or altered and Buyer's issued changed documents such a VDCN. The subcontractor shall not substitute materials without written approval from the Buyer.

- 2.1.3 Certain materials are restricted on the WTP project due to their health risks and regulatory requirements. These materials are listed in 24590-WTP-LIST-CON-08-0001, *Restricted Materials List WTP Safety Assurance*. No substance on this list is allowed on the WTP Project without specific authorization from the Buyer (Safety Assurance).
- 2.1.4 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 as defined on 24590-WTP-3PS-NW00-T0002, *Engineering Specification for Chemical Requirements for Materials Used in Contact With Austenitic Stainless Steel and Nickel Based Alloys*.
- 2.1.5 Anti-spatter compounds used in welding, shall not be compounded of or have as intentional additions the following elements: chlorine, fluorine, sulfur, mercury, lead, tin, bismuth, antimony, zinc and cadmium.
- 2.1.6 Materials and residue shall be completely removed when no longer required. Cleaning materials may be non-halogenated solvents or potable water that meet the requirements in 24590-WTP-3PS-NW00-T0002, *Engineering Specification for Chemical Requirements for Materials Used in Contact With Austenitic Stainless Steel and Nickel Based Alloys*.
- 2.1.7 Subcontractor shall submit a material traceability procedure for BNI review and acceptance. In addition, PMI shall be performed on all new materials used in the repair or alteration work to ensure that correct materials have been used during repair or alteration work of each vessel. If the assembled equipment configuration prevents PMI of any new base material, then that base material shall be tested prior to assembly and be noted as such on the PMI documentation.
- PMI shall also be performed on new completed/deposited welds made during repair or alteration work. PMI is required on the external and internal weld areas when accessible. PMI is not required on the existing vessel materials unless stated otherwise in the contract scope.
- PMI shall be performed per 24590-WTP-3PS-G000-T0010, *Engineering Specification for Positive Material Identification (PMI) for Construction*.
- 2.1.8 All pipes and any fittings shall be seamless, unless approved by the Buyer. Any pipe which is not seamless shall follow Section 3.4 for the NDE and Section 4 for the PMI requirements
- 2.1.9 Internal support and piping systems shall comply with the ASME Section VIII, Division 1 parent vessel requirements for material, fabrication, examination, and testing. Pipe fittings also comply with the appropriate ASME standards for materials and dimensions unless otherwise stated in the purchase order.

3 Repair and Alteration

3.1 General

- 3.1.1 All repairs or alterations of existing vessels or boilers shall be performed in accordance with the rules of NBIC as adopted in WAC 296-104-502(1) by a valid R-certificate holder (subcontractor).
- 3.1.2 Prior to starting any repairs or alterations, the acceptance by the AI of the work plan and procedures for alterations shall be obtained. The subcontractor is responsible for coordinating with the AI and the BNI field engineering manager for all activities related to the vessel repairs and alterations.
- 3.1.3 All documentation required in Section 6 of the specification for repairs and alterations shall be submitted to Buyer and AI. A final single document containing all required submittals, with and index shall be submitted for record copy.
- 3.1.4 The subcontractor shall be responsible to provide temporary stiffening and jiggling to prevent shell distortion during rework, welding, heat treatment, or NDE examination. The parts of temporary stiffening and rigging that contacts or is welded to austenitic stainless steels or nickel based alloy shall be made from the same grade of vessel material as at the attachment point. Subcontractor shall take precautions to ensure that any temporary work shall not result in permanent damage to the vessel or boiler.

For access openings required for vessel alteration, the opening sizes shall be kept to the minimum size to allow efficient work and avoid existing weld seams in the vessel where practicable and shall be designed and reinforced to ensure that the vessel will not collapse, rupture, or fail during alteration and to reduce vessel distortion during replacement. Subcontractor is responsible for stiffening and stabilizing the openings and removing plate as required. Subcontractor shall use approved welding procedure designated to minimize vessel distortion during re-welding of these access openings. The maximum size of cut-out for access opening shall not exceed 8.0 ft. by 8.0 ft.

- 3.1.5 Fabrication tolerances shall be in accordance with ASME Section VIII, Division 1, and BNI standard drawing 24590-WTP-MV-M59T-00001, *Pressure Vessel Tolerances Standard Details*.
- 3.1.6 The sequence of repairs and alterations shall be planned to permit maximum access to the internal surfaces to enable examination of all welds.
- 3.1.7 Plates and pipes shall be cut to size and shape by machining, grinding, shearing, plasma, laser, or water jet cutting. Plates, 3/8 in. thick and above, cut by shearing, shall have 1/8 in. allowance left on the edges which shall be removed by machining or grinding. All thicknesses 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.
- 3.1.8 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.

- 3.1.9 For stainless steel and nickel based alloy, the work area shall be free of carbon steel grindings and general cleanliness shall be maintained to preclude iron contamination.
- 3.1.10 Caution shall be exercised to avoid to any arc strike or grinding on the pressure boundary of the vessel. Removal of any structural component that is attached to the pressure boundary shall be cut off 1/2-inch minimum (1.0-inch maximum) away from the vessel wall of attached component and its edges shall be ground smooth. Subcontractor shall take every precaution to protect the vessel from dropping any objects in order to protect the vessel inside surfaces from any damage.
- 3.1.11 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.
- 3.1.12 Internal piping bends shall have a center-line radius of a minimum of three times the pipe nominal diameter. Piping shall not be terminated or butt welded prior to bending 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 approval via the SDDR process. The circumferential butt weld shall be radiographed prior to and after bending..
- 3.1.13 Cold Pipe bending methods, tolerances, processes, and material requirements shall comply with project specification of 24590-WTP-3PS-PS02-T0002, *Engineering Specification for Cold Bending of Pipe*, and require Buyer's approval. These requirements shall apply equally to tube bending processes. Measurement and verification of the bend shape and radius shall be provided to the buyer.
- 3.1.14 Cold forming austenite stainless steel shall be controlled to prevent over working materials and causing susceptibility to stress corrosion cracking. Process may be qualified by hardness testing on areas subject to the greatest deformation after cold working or any rework or alteration. The maximum permitted hardness as per ASME SA-240 is HRB 92 for Type 304L and HRB 95 for Type 316L.
- 3.1.15 Registration of "R" forms for repairs or alterations with the NBIC is the responsibility of the subcontractor.
- 3.1.16 A temporary access opening in the vessel shell may be required in order to perform repairs or alterations. Subcontractor shall submit drawings showing access opening location relative to existing weld seams to avoid cutting across an existing weld seam. Subcontractor shall include the proposed cutting method on their drawing. The access opening shall be cut with a 2-inch minimum corner radius.
- Subcontractor is responsible to clean up and remove any debris from the cutting or machining operation. The internal and external parts of the vessel and any nearby internal or external components shall be protected from molten metal, slag, dross, splatter, water, oil or abrasives utilized in the cutting operation. Prior to performing the procedure, the subcontractor shall install protective measures which capture or direct the particulates in a controlled manner to the extent that minimal cleanup is necessary.
- 3.1.17 The original cut-out of the access opening shall be prepared and re-welded to the vessel using a full penetration butt weld. The root gap opening for re-welding shall be consistent with the

Welding Procedure Specification(s) (WPS) utilized for the weld. Prior to performing welding the root gap shall be visually examined for compliance to the WPS(s). Cut-out pieces of the vessel shall be tacked into place and prepared for welding prior to the examination. All tack welds shall be made in the groove using an approved WPS and consumed in the weld out of the joint.

- 3.1.18 100% of the new weld seam shall be examined using either radiographic or ultrasonic examination in accordance with the applicable submitted procedure reviewed by the Buyer and WTP Project Specifications.

3.2 Layout

- 3.2.1 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 existing weld seams by a minimum of 2 in. from the closest edge of the welds. If the overlap between a pad-type structural attachment and a new or existing weld seam(s) is unavoidable, then the portion of the seam to be covered shall be ground flush and radiographed before the attachment is welded. The existing weld seam shall be radiographed per ASME Section VIII, Division 1, and Paragraph UW-51 for a minimum distance of 2 in. beyond each edge of the overlapping attachment.

3.3 Welding Requirement

- 3.3.1 Seller shall comply with 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchanges, and Boilers*.
- 3.3.2 Welds made by a welder employed by the R-stamp holder (subcontractor) shall be identified by the welder's unique symbol or number applied using low stress stamps. For identifying welds on vessels in which the wall thickness is less than 1/4 in. for steel material and less than 1/2 in. for nonferrous material, vibro-etching or other suitable engraving methods shall be used in accordance with paragraph UW-37(f) of ASME Section VIII, Division 1. Any alternative method of marking shall be submitted for Buyer's review and approval.
- 3.3.3 The subcontractor shall be responsible for the control of the weld filler material. Procedures for the storage and control of weld filler material shall describe in detail the following as a minimum:
- Marking of containers (filler metal manufacturer's marking, Suppliers additional marking, CMTR marking or control marking)
 - Heat and Lot Number Identification on the containers
 - Marking of bare electrodes
 - Receiving Inspection and disposition of damaged containers
 - Description of storage area; Description of how unopened and opened containers are stored by weld filler material type (e.g., bare wire straight lengths, wire spools, covered electrodes, flux)
 - Identification, storage and segregation of low hydrogen electrodes
 - Electrode Oven marking to identify weld filler material classifications
 - How weld filler material issuance is controlled and traceability to the fabricated items
 - Moisture control of low hydrogen electrodes and SAW flux
 - Disposition of unused and returned material

- Protection of spooled wire left on the wire drive unit between and after shifts
- 3.3.4 All welds shall be continuous. Stitch welding is prohibited, unless specified otherwise on the drawing.
- 3.3.5 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.
- 3.3.6 Where fillet welds only are used, the maximum gap between the components being joined shall be 3/16 in. The components shall be clamped or otherwise supported during welding.
- 3.3.7 All internal structural component and piping welds shall be full penetration. Partial penetration and fillet welded attachments are subject to approval by the Buyer if not shown on the Buyer's drawings.
- 3.3.8 Weld maps for welding shall be submitted to Buyer for review prior to starting any repairs or alteration work. The weld maps shall be submitted with the Welding Procedure Specifications (WPSs) and type of NDE intended to use as shown on the Buyer's document. The weld map shall contain or specify, as a minimum, all of the following items:
- (a) Sketch of the vessel.
 - (b) Material type(s) and grade(s) for each component/part (i.e., head, shell, nozzle, attachments).
 - (c) The WPS to be used for each weld joint (joints of the same design and similar thickness need only be shown once, including typical large and small nozzles and attachments) and whether back gouging & back welding will be performed.
 - (d) Actual base metal thickness (es) where each WPS will be used (this is NOT the qualified thickness range of the WPS).
 - (e) Type of joint (e.g., full penetration, partial penetration, fillet etc.) and weld size.
 - (f) Preheat temperature to be used for each joint.
 - (g) The Post Weld Heat Treatment (PWHT), if required, and if an intermediate stress relief will be used.
- 3.3.9 NDE Plan shall be submitted for review and shall contain, specify, or address, as a minimum, all of the following items in addition to the contract requirements:
- (a) An NDE map shall be included and contain a sketch of the vessel and each NDE procedure utilized for each weld joint.
 - (b) The field fabrication stage is stated (before PWHT, after PWHT) indicating which NDE is to be performed (this can be detailed in the NDE Map).
- 3.3.10 NDE procedure shall be submitted for review and shall contain, specify, or address, as a minimum, all of the following items in addition to the contract requirements:

- (a) For radiographic examination, composite film viewing is not allowed.
- (b) The actual weld acceptance criteria to be applied shall be specified in the Procedure. References to "See applicable code" or "See ASME Section VIII" are unacceptable.
- (c) Surface preparation prior to the examination shall be described in detail (e.g. brushing, grinding, chipping, blasting, machining, solvent clean etc.).
- (d) Post examination cleaning for magnetic particle examination (MT), liquid penetrant examination (PT), and ultrasonic examination (UT) shall be described (e.g., demagnetization for MT).
- (e) The minimum information to be recorded on a form documenting the examination shall be specified. A copy of the report form shall be attached to the procedure. This form is referenced in 24590-WTP-3PS-MVB2-T0001, *Engineering Specification for Welding of Pressure Vessels, Heat Exchangers, and Boilers*.

3.4 NDE Requirements For All Design Levels Repaired or Altered Vessels

- 3.4.1 The altered shell and head sections, which are subjected to loads through welded attachments (such as lifting and tailing lugs), shall, prior to welding, be ultrasonically examined over 100 % of the areas to check for possible laminations in accordance with ASTM 578 Acceptance level C.
- For connections or attachments directly welded to the shell or head, the area examined shall extend a minimum of 3 in. beyond the extremity of the proposed weldment.
 - For connections or attachments welded via a reinforcement or doubler plate, the shell area examined shall extend a minimum of 5 in. beyond each side of the perimeter of the proposed fillet weld attaching the reinforcing or doubler plate to the shell or head.
- 3.4.2 All full penetration welds attaching internal or external structural components to the heads or shell shall be volumetrically examined. If they cannot be ultrasonically or radiographically examined, they may be dye-penetrant examined with prior approval from the Buyer which will require design change through Buyer's Subcontract Administrator.
- 3.4.3 All full penetration butt welds forming part of the jacket shall be ultrasonically examined or radiographically examined. All other jacket welds require MT or PT examined.
- 3.4.4 NBIC 2007, Part 3, Section 4, paragraph 4.2 a) states in part "Weld repairs and alterations shall be subject to same nondestructive examination requirements as the original welds.

In view of the above, the NDE requirements for the repaired or altered vessels shall follow the same NDE requirements documented on the original manufacturer's vessel design drawings and vessel manufacturer's generated documents in the Quality Verification Documents (QVD) package unless specified otherwise by Buyer. Prior approval from the Buyer shall be obtained to deviate from the original NDE requirements for the vessel being repaired or altered. During repair or alteration work, if the subcontractor determines that the same NDE requirements are not clear or do not exist, contact the Buyer for clarifications/instructions and guidance/directions

3.4.5 Radiography is the preferred method of volumetric examination. Where it is considered impractical to perform radiographic examination due to joint configuration, the subcontractor may propose ultrasonic examination for Buyer's consideration. The approval to use UT in lieu of RT shall require design change process through Buyer's Subcontract Administrator.

3.5 Additional Requirements for Repaired or Altered Vessels Located in a Black Cell or Hard-to Reach Area

3.5.1 If a vessel is located in a black cell or hard-to-reach area, it shall be noted on the MDS.

3.5.2 All nozzle reinforcement when required on VDCN for repairs or alterations shall be integral, regardless of design level. Using additional reinforcing elements, such as reinforcing rings or non-integral pads, is prohibited.

3.5.3 DELETED.

3.5.4 DELETED.

3.5.5 Non-integral reinforcing pads are acceptable to accommodate occasional loads due to revised ground motion accelerations (RGM) loads, WTP site-specific ground motion (WSGM) loads, hydrogen detonation (HPAV) loads or multiple overblow (MOB) loads as defined on the MDS.

4 Examinations, Tests, and Inspections

4.1 Nondestructive Examinations

4.1.1 Radiographic examination, ultrasonic examination, magnetic particle examination, dye penetrant examination, and visual examination, where specified or required, shall be performed in accordance with ASME Section VIII, Division 1 and ASME Section V.

4.1.2 Where subcontractor carries out additional nondestructive examination, such examinations shall be included in the Quality Plan or Inspection Schedule. The Buyer's representative need not witness this additional nondestructive examination but shall be notified of the NDE to be performed prior to the exam and the records of such inspections shall be made available to the Buyer's representative.

4.1.3 Nondestructive examination, including visual, must be performed by an inspector certified to the requirements of ASNT SNT-TC-1A. The interpretation of the results shall be by either Level II or Level III inspectors certified to ASNT SNT-TC-1A.

4.1.4 Ultrasonic examination shall be in accordance with ASME Section VIII, Division 1, paragraph UW-53 and Appendix 12.

4.1.5 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 is required.

- 4.1.6 Penetrant examination shall be in accordance with Appendix 8 of ASME Section VIII, Division 1.
- 4.1.7 Magnetic particle examination shall be in accordance with Appendix 6 of ASME Section VIII Division 1.
- 4.1.8 Visual examination shall be in accordance with Article 9 of ASME Section V.
- 4.1.9 See Paragraph 2.1.7 for Positive Material Identification (PMI) requirements for new materials. PMI for the shop or field welds on any repaired or altered vessel is required.

4.2 Pressure Test at Jobsite

- 4.2.1 The test or examinations shall comply with NBIC 2007, Part 3, Section 4, paragraph 4.4.1 and subject contract scope.

Based on the nature and scope of the repair or alteration activities, NDE may be conducted when pressure test such as hydrostatic pressure test, pneumatic pressure test, etc. is not practicable. Concurrence of the Buyer shall be obtained in addition to the AI and Jurisdiction/Owner where required. However, when pressure test such as hydrostatic, pneumatic, etc. is required by the Buyer, the test pressure, hold time, etc. shall meet the original vessel requirements per cited NBIC section stated above and per 24590-WTP-3PS-MV00-T0001. Prior approval from the Buyer shall be obtained to deviate from the original test pressure, hold time, etc. requirements for the vessel being repaired or altered. During repair or alteration work, if the subcontractor determines that the pressure test requirements are not clear or do not exist, contact the Buyer for clarifications/instructions and guidance/direction. The final field test pressure shall be held for minimum of one hour.

- 4.2.2 Reinforcing pad attachment welds shall be tested for leaks with 15 psig dry air, or nitrogen and bubble forming solution.
- 4.2.3 The subcontractor shall advise the Buyer of any external piping connected to the vessel or boiler and how the piping will be isolated from the vessel during the hydrostatic or pneumatic test.

4.3 Obstruction Test

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

4.4 Final Inspection of Completed Vessel

Final inspection of the repaired or altered vessel by the subcontractor's AI to R-stamp the vessel shall be the sole responsibility of the subcontractor. The finished dimensions and cleanliness of the vessels shall comply with the relevant drawings and specifications after completion of all tests.

5 Preparation for Service

5.1 Cleaning

- 5.1.1 Subcontractor shall comply with 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling, and Storage Requirements*.

Contact materials including marking materials, temperature indicating crayons, adhesive backed and pressure sensitive tape, and barrier and wrap materials if used shall conform to 24590-WTP-3PS-NW00-T0002, *Chemical Requirements for Materials Used in Contact With Austenitic Stainless Steel and Nickel Based Alloys* (this does not apply to blankets, sheeting etc. to be used for temporary protective measures during cutting and welding operations).

6 Documentation and Submittals

- 6.1 Subcontractor shall comply with the requirements of Attachment D1 (G321-E) and D2 (G321-V) of the subcontract. Furnish all applicable drawings, design calculations, reports of special analysis, Welding Procedure Specifications with Procedure Qualification Records, Test Procedures, Weld and NDE Map, and all other required documents generated during repair or alteration activities.

The subcontractor shall provide completed copy of "R" reports (R-1, R-2, etc.), photo copy, or tracing of the R-Stamp plate, and documented evidence that subject reports were submitted to National Board.

- 6.2 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, and 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. The Code calculations by subcontractor shall include the basic ASME Section VIII, Division 1 calculations. BNI will perform the supplemental Calculations when the rules or design methods are not given in this Division to satisfy UG-22 applicable loading on vessel.
- 6.3 All records pertaining to the nondestructive examination, base materials, and weld filler metals shall be provided as required on the D2 (G-327-V) form. Documents shall maintain identification traceable to the items or activities performed. Items of production (batch, lot, component, part) shall be identified from the initial receipt and fabrication of items up to and including installation and use. Records shall be traceable to associated items and activities and accurately reflect the work accomplished or information required.

7 Quality Assurance

7.1 General Requirements

- 7.1.1 The subcontractor's quality assurance program requirements are included in 24590-WTP-3PS-G000-T0001, *Engineering Specification for Supplier Quality Assurance Program Requirements*.
- 7.1.2 The R-certificate holder (subcontractor) shall submit their Quality Control manual for review to the Buyer and AI in accordance with 24590-WTP-3PS-G000-T0001. A photo copy of the R-Stamp certificate is required.
- 7.1.3 Subcontractor's QA program, as a minimum, shall contain the requirements detailed in the supplier quality assurance program requirements data sheets listed in contract documents.

7.2 Additional Requirements for Quality Level Q Vessels

- 7.2.1 Subcontractor shall have in place a QA program meeting the requirements of ASME NQA-1, marked as applicable in the *Supplier Quality Assurance Program Requirements Data Sheet* attached to the material requisition, and 24590-WTP-3PS-G000-T0001.
- 7.2.2 All items procured or manufactured by the subcontractor in accordance with the subcontractor's QA program that meets the requirements of ASME NQA-1, and has been previously evaluated and accepted by the RPP-WTP Quality Organization.
- 7.2.3 Subcontractor shall submit their QA program 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.

8 Revision History

8.1 Design Changes Incorporated by Design

24590-WTP-3PN-MVB2-00010
24590-WTP-3PN-MVB2-00011
24590-WTP-3PN-MVB2-00015

8.2 Design Changes by Reference

None

Appendix A:

SAMPLE-Master Inspection Checklist for Repairs and Alterations

MASTER INSPECTION CHECKLIST FOR REPAIRS AND ALTERATIONS									
Project: _____ Job No.: _____ <input type="checkbox"/> Repair <input type="checkbox"/> Alteration Original Code: _____ <small style="display: inline-block; width: 30%; text-align: center;">(Section/Div.)</small> <small style="display: inline-block; width: 30%; text-align: center;">(Edition Year)</small> <small style="display: inline-block; width: 30%; text-align: center;">(Addenda)</small>									
Code for Repair or Alteration: _____ <small style="display: inline-block; width: 30%; text-align: center;">(Section/Div.)</small> <small style="display: inline-block; width: 30%; text-align: center;">(Edition Year)</small> <small style="display: inline-block; width: 30%; text-align: center;">(Addenda)</small>									
Boiler Identification: _____									
Pressure Vessel Identification: _____									
Reference Drawings: _____									
No.	Activity / Task Description	Required		AI Hold Point		Field Engr. Accept		AI Accept	
		Yes	No	Yes	No	Init	Date	Init	Date
1	Valid certificate of authorization available	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
2	Drawings available for repairs; Drawings available for alterations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
3	Manufacturer's Partial Data Reports for purchased parts reviewed and accepted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
4	Receiving inspection reports for Materials Completed, MTR's & C of C's Available	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
5	WR-4 Records for Welding, NDE and Heat Treatment Completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
6	Final Visual Examination for Material ID, Dimensions, Configuration, Location and Surface Defects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
7	Pressure Test Complete	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
8	Records Retained	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
9	Reports of welded repair or alteration complete	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
10	Nameplate attached or stamping performed ("R" symbol stamp)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				

Master Inspection Checklist for Repairs & Alterations

