**Updates include changes proposed by Public Review comments that were approved by the NBIC committee. These updates are indicated by highlighted text in the document**

Comments must be submitted with the ‘2019 Public Review Comment Form’

All comments must be received by October 15th, 2018.

Deleted items are designated by strikethrough. Additions are designated by double underline.
c) Unless otherwise specifically required by the Jurisdiction, the duties of the inservice inspector do not include the installation's compliance to manufacturer’s recommendations or applicability of, or compliance with, other standards and requirements (e.g., environmental, construction, electrical, undefined industry standards, etc.) for which other regulatory agencies have authority and responsibility to oversee.

1.6 GENERAL REQUIREMENTS

The following are general requirements for the boilers, potable water heaters, thermal fluid heaters and pressure vessels covered in NBIC Part 1, Section 2, NBIC Part 1 Section 3, NBIC Part 1 Section 4, and NBIC Part 1 Supplement 5. Refer to each referenced section for additional requirements specific to the type of equipment covered by each section.

1.6.1 SUPPORTS, FOUNDATIONS, AND SETTINGS

Each boiler, potable water heater, thermal fluid heater and pressure vessel and its associated piping must be safely supported. Design of supports, foundations, and settings shall consider vibration (including seismic where necessary), movement (including thermal expansion and contraction), and loadings (including the weight of the fluid in the system during a pressure test) in accordance with jurisdictional requirements, manufacturer's recommendations, and/or other industry standards, as applicable.

1.6.3 EXIT

Two means of exit shall be provided for equipment rooms exceeding 500 sq. ft. (46.5 sq. m) of floor area and containing one or more boilers, potable water heaters, thermal fluid heaters or pressure vessels having a combined fuel capacity of 1,000,000 Btu/hr (293 kW) or more (or equivalent electrical heat input). Each elevation shall be provided with at least two means of exit, each to be remotely located from each other. A platform at the top of a single boiler, potable water heater, thermal fluid heater or pressure vessel is not considered an elevation.

1.6.6 VENTILATION AND COMBUSTION AIR

a) The equipment room shall have an adequate air to permit clean, safe combustion, minimize soot formation, and maintain a minimum of 19.5% oxygen in the air of the equipment room and sufficient to maintain ambient temperatures as recommended by the boiler, heater, or vessel manufacturer. The combustion and ventilation air should be supplied by either an unobstructed air opening or by power ventilation or fans. When combustion air is supplied to the boiler by an independent duct, with or without the employment of power ventilators or fans, the duct shall be sized and installed in accordance with the manufacturer’s recommendations. However, ventilation for the equipment room must still be considered.

b) When combustion air is supplied to the boiler, heater, or vessel by an independent duct, with or without the employment of power ventilators or fans, the duct shall be sized and installed in accordance with the manufacturer’s recommendations. However, ventilation for the equipment room must still be considered.
1.6.8 CHIMNEY OR STACK
Chimneys or stacks shall be installed in accordance with jurisdictional and environmental requirements, manufacturer’s recommendations, and/or industry standards, as applicable.

1.6.9 Carbon Monoxide (CO) Detector/Alarm
The owner or user shall install a carbon monoxide (CO) detector/alarm in equipment rooms where fuel fired boilers and/or fuel fired pressure vessels are located in accordance with the authority having Jurisdiction.

f) When existing boiler installations do not include remote emergency shutdown switches, it is not required that these switches be retroactively installed unless required by the Jurisdiction.

p) Boiler blowoff systems shall be constructed in accordance with the Guide for Blowoff Vessels (NB-27): which can be found on the National Board website, www.nationalboard.org.

2.9.1 GENERAL REQUIREMENTS
a) Only direct spring loaded, pilot operated, or power actuated pressure relief valves or pilot operated pressure relief valves designed to relieve steam shall be used for steam service.

b) Pressure relief valves are valves designed to relieve either steam or water, depending on the application.

cb) Pressure relief valves shall be manufactured in accordance with a national or international standard.

d) Deadweight or weighted-lever pressure relief valves shall not be used.

e) For high temperature water boilers, pressure relief valves shall have a closed bonnet, and valve bodies shall not be constructed of cast iron.

eg) Pressure relief valves with an inlet connection greater than NPS 3 (DN 80) and used for pressure greater than 15 psig (100 kPa), shall have a flanged inlet connection or a welding-end inlet connection. The dimensions of flanges subjected to boiler pressure shall conform to the applicable standards.

gf) When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be properly vented and arranged to permit servicing and normal operation of the valve.
### 2.2.1)

**17-118**  
Part 1, 2.9.1.3 (Part 4, 2.2.4 c))

The required relieving capacity in pounds per hour of the pressure relief valves on a high temperature water boiler shall be determined by dividing the maximum output in Btu at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by one thousand.

#### The required relieving capacity, $C$, of the pressure relief valves on a high temperature water boiler shall be determined as follows:

$$C = \frac{Q}{L}$$

where,

$C$ = required relieving capacity in lbs/hr (kg/hr)  
$Q$ = maximum output in BTU/hr (W) at the boiler nozzle obtained by the firing of any fuel for which the unit is designed  
$L$ = 1000 BTU/lb (646 W-hr/kg)

### 17-120

Part 1, 2.9.6 (Part 4, 2.2.10)

d) No valves of any type except a changeover valve as defined below shall be placed between the pressure relief valves and the boiler, nor on the discharge pipe between the pressure relief valves and the atmosphere. A changeover valve, which allows two redundant pressure relief valves to be installed for the purpose of changing from one pressure relief valve to the other while the boiler is operating, may be used provided the changeover valve is in accordance with the original code of construction. It is recommended that the Jurisdiction be contacted to determine the acceptability of the changeover valves on boiler applications. The changeover valve shall be designed such that there is no intermediate position where both pressure relief valves are isolated from the boiler.

### 17-133

Part 1, 3.5.3.2

d) If the equipment room door is on the building exterior, the switch shall be located just inside the door. If there is more than one door to the equipment room, there shall be a switch located at each door of egress.
3.5.3.2 POTABLE WATER HEATERS

d) If the equipment room door is on the building exterior, the switch shall should be located just inside the door. If there is more than one door to the equipment room, there shall should be a switch located at each door of egress.

S5.5.7 ELECTRICAL

d) If the equipment room door is on the building exterior, the shutdown switch shall should be located just inside the door. If there is more than one door to the equipment room, there shall should be a shutdown switch located at each door of egress. For atmospheric-gas burners, and oil burners where a fan is on a common shaft with the oil pump, the complete burner and controls should be shut off. For power burners with detached auxiliaries, only the fuel input supply to the firebox need be shut off.

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NB16-0903
Part 1,
Figure
3.7.5.2 b)
c) In addition to the requirements in a) and b) above, a secondary low-water fuel cutoff with manual reset shall be provided on each automatically fired steam or vapor system boiler.

<table>
<thead>
<tr>
<th>17-127 Part 1, 3.9.4.1 (Part 4, 2.4.4.1)</th>
<th>3.9.4.1 Temperature and pressure relief valves shall be installed by either the water heater manufacturer or installer or the manufacturer before a water heater is placed in operation.</th>
</tr>
</thead>
</table>
| NB15-0314 Part 1, 3.9.4.2 | 3.9.4.2 PERMISSIBLE INSTALLATIONS
Temperature and pressure relief valves shall be connected directly to a tapped or flanged opening in the top of the water heater, or to a fitting connected to the water heater by a short nipple, to a Y-base, or to a valveless header connecting water outlets on the same heater. Temperature and pressure relief valves shall be installed with their spindles upright and vertical with no horizontal connecting pipe, except that, when the temperature and pressure relief valve is installed directly on the water heater vessel with no more than 4 in. (100 mm) maximum interconnecting piping, the valve may be installed in the horizontal position with the outlet pointed down. The center line of the temperature and pressure relief valve connection shall be no lower than 4 in. (100 mm) from the top of the shell. No piping or fitting used to install the temperature and pressure relief valve shall be of nominal pipe size less than that of the valve inlet. |
| NB16-2806 Part 1, S6.1 b) | b) This supplement is based on Local, State or National Building Codes requiring the installation of a Carbon Monoxide (CO) detector/alarm in the boiler room. |
| NB16-2806 Part 1, S6.3 | S6.3 General Requirements
Condensing boilers shall meet all the requirements of NBIC Part 1, Section 1, Section 3 and this Supplement. The jurisdictional or National Building Codes may require the installation of a Carbon Monoxide (CO) detector/alarm in the boiler room. |
| NB15-2209 Part 1, New Supplement | Supplement X Installation of Graphite Pressure Equipment
SX.1 SCOPE
This supplement provides guidelines for the installation of impregnated graphite pressure vessels.
SX.2 Definitions: SX.2 Glossary of terms/definitions: “see last page of this document…”
Prior to installation, the
SX.3 General requirements
Sx3.1 Receiving and Initial Inspection of Graphite Pressure Equipment
Graphite equipment should be thoroughly inspected and tested as it is received in order to identify any in transit damage. Whenever possible, this inspection should be made before the exchanger is removed from the carrier. To verify the unit has arrived in an undamaged condition, a pressure test may be performed. The bolt torques and spring heights should be verified prior to a pressure test. This pressure test shall not exceed the
MAWP of the vessel. Where freezing could occur, open all vents and drains after a pressure test to drain out all water from all passes and pockets to prevent freeze damage. Follow other good practices such as to prime the unit with an antifreeze solution and/or drain and dry it completely. Graphite equipment may arrive from the manufacturer under low pressure and/or with shock detectors as an indication of undamaged arrival. Any crating should be inspected both for direct damage and/or evidence of improper handling. If there is any evidence of damage, notify the manufacturer.

Graphite pressure equipment may be shipped unassembled for later assembly. Review any packing or check list. All parts should be carefully inspected. The surfaces of graphite parts should be thoroughly examined. Avoid pry bars, chisels, wedges or excessive force to separate any protective covers from graphite nozzles or openings. Activity around graphite surfaces should progress gently and with caution.

Prior to installation, bolt torques and spring heights should be verified. Additionally, the manufacturer may be consulted for recommended commissioning activities such as thermal cycling and bolt retorqueing.

Sx3.2 Equipment parameters/ Clearances /Movement

In many cases, graphite pressure equipment is of modular construction and may be assembled or disassembled in the field. The construction details can be obtained by consulting the bill of materials and the assembly drawing provided by the manufacturer. Sufficient space for assembly and installation should be provided. Consideration should be given to the orientation of the equipment for maintenance or disassembly.

Impregnated graphite is more susceptible to damage from mishandling than metal components. Therefore, the following recommendations should be considered:

a) Lifting and transportation should be done at designated lifting points or per manufacturer’s recommendations;

b) Use only soft slings when handling;

c) Graphite parts should be protected with a barrier if steel cables or chains are employed; and

d) Avoid lifting by placing slings directly around the graphite.

Sx3.x Supports/Foundations

See NBIC Part 1, 1.6.1 for general requirements on supports, foundations, and settings. Foundations and supports should be adequate to prevent settling or the transmission of stresses, vibrations or shock loads to the graphite pressure vessel. Any base structure should be designed to support the exchanger and also to eliminate movements or moments caused by, but not limited to, possible hydraulic thrusts of process and service fluids. Additionally, graphite pressure equipment should be level and square so that all piping connections may be made without excessive force. Graphite pressure equipment may include lined components that may or may not be insulated. Any structural support attachments should avoid direct contact with lined
components, which could create a cold wall effect.

**Sx3.1 Piping Connections**

Impregnated graphite pressure equipment may require connection to graphite nozzles. Before connecting piping, graphite gasket surfaces including serrations should be thoroughly cleaned to prevent any leakage of fluids. A suitable solvent should be used to completely remove all dirt or contaminants from connections. Use caution so as not to scratch or gouge the graphite surface. Graphite piping connections require gaskets specific for graphite applications. Refer to graphite equipment manufacturer for any spring settings, gasket recommendations, and bolt torque recommendations. Flexible attachments such as expansion joints and bellows are recommended for impregnated graphite connections. Flexible attachments should be installed as close to the nozzles as possible. These are recommended to isolate the equipment from stress caused by vibration, misalignment, thermal expansion of the piping, or other loads. After positioning and initial tightening of graphite connections, the bolts/nuts should be tightened to the torque value on bolt torque charts or assembly drawings provided by the manufacturer. Bolts should be tightened in multiple stages and in a diametrically staggered (i.e. star) pattern starting with a torque value that is a small percentage of the final torque value until design values are achieved.

**Sx3.1 Instruments and controls.**

Pressure: See NBIC Part 1, 4.4.2 and 4.5 for requirements related to pressure indicating devices and pressure relief devices.

Temperature control: Automatically controlled systems, such as for heating of impregnated graphite pressure equipment, may be considered. The temperature control should provide for over temperature protection such that temperature is regulated to maintain a specified operating limit which shall be less than the maximum allowable temperature.

**Sensors:** Continuous monitoring is suggested since process streams used in graphite heat exchangers are usually corrosive and a failure path or crossover to the service side should be identified with immediate corrective action.

**Flow control:** In order to avoid damage (e.g., erosion, hammering, shock) to the graphite components, instrumentation should be installed to control and monitor flow.

**Sx3.1 Post-Installation Activities**

- Due to the nature of impregnated graphite, the surface is subject to light scratches and it is often difficult to distinguish scratches from cracks without further investigation. Consult the manufacturer as required.
- Graphite pressure equipment may be damaged by concentrated hydroblasting or pressure washing. Avoid sandblasting graphite pressure equipment.
- Careful consideration should be given to painting graphite pressure equipment because improper painting can damage the equipment.
SX.2 Glossary of terms/definitions:

**Impregnated graphite** is a composite manufactured by impregnating porous graphite with chemically resistant synthetic resins used in the construction of graphite pressure equipment. With special processing the graphite becomes impregnated, even to gases & under pressure. The final product partakes of the properties of both graphite and resin, but the predominant characteristics are similar to graphite which gives the most useful properties with its natural corrosion resistance and conductivity as a heat exchange material. Unlike corrosion resistant metals, graphite does not depend on the formation of a surface film or oxide for corrosion resistance, nor does it exhibit a measurable corrosion rate. Once rendered impregnated, however, the chemical inertness of graphite may be limited by the characteristics of the resin. For example, such as a phenolic resin which is resistant to most acids, salt solutions and organic compounds but may not be suitable to for alkalis and strong oxidizing chemicals that may degrade & weaken the material with no visible/measurable sign of material loss.

End components – Components attached to the main shell of graphite pressure equipment including heads, channels, domes, and tubesheets

Cold wall effect – a detrimental condition that promotes corrosion due to a temperature gradient between the inside of a lined vessel and its support exterior. Cold wall effect may be caused locally by attachments that protrude through insulation, or more generally by failure to install insulation.

2.3.6.2 COMPRESSED AIR VESSELS

a) Compressed air vessels include receivers, separators, filters, and coolers. Considerations of concern include temperature variances, pressure limitations, vibration, and condensation. Drain connections should be verified to be free of any foreign material that may cause plugging.

b) Inspection shall consist of the following:

1) Welds — Inspect all welds for cracking or gouging, corrosion, and erosion. Particular attention should be given to the welds that attach brackets supporting the compressor. These welds may fail due to vibration;

2) Shells/Heads — Externally, inspect the base material for environmental deterioration and impacts from objects. Hot spots and bulges are signs of overheating and should be noted and evaluated for acceptability. Particular attention should be paid to the lower half of the vessel for corrosion and leakage. For vessels with manways or inspection openings, an internal inspection should be performed for corrosion, erosion, pitting, excessive deposit buildup, and leakage around inspection openings. UT thickness testing may be used where internal inspection access is limited or to determine actual thickness when corrosion is suspected;
a. UT Acceptance Criteria

1. For line or crevice corrosion, the depth of the corrosion shall not exceed 25% of the required wall thickness.

2. Isolated pits may be disregarded provided that their depth is not more than 50% of the required thickness of the pressure vessel wall (exclusive of any corrosion allowance), provided the total area of the pits does not exceed 7 sq. in. (4,500 sq. mm) within any 8 in. (200 mm) diameter circle, and provided the sum of their dimensions along any straight line within that circle does not exceed 2 in. (50 mm).

3. For a corroded area of considerable size, the thickness along the most critical plane of such area may be averaged over a length not exceeding 10 in. (250 mm). The thickness at the thinnest point shall not be less than 75% of the required wall thickness.

b. If the corrosion exceeds any of the above criteria, the following options are available to the owner/user.

1. The owner/user may conduct a complete UT survey of the vessel to verify remaining vessel wall thickness.

2. The vessel shall be removed from service until the vessel is repaired by an "R" stamp holder.

3. The vessel shall be removed from service until it can be de-rated to a lower MAWP subject to review and approval by the Jurisdiction.

4. A fitness-for-service analysis is performed by a qualified organization.

5. The vessel is permanently removed from service.

3) Fittings and attachments — Inspect all fittings and attachments for alignment, support, deterioration, damage, and leakage around threaded joints. Any internal attachments such as supports, brackets, or rings shall be visually examined for wear, corrosion, erosion, and cracks;

4) Operation — Check the vessel nameplate to determine the maximum allowed working pressure and temperature of the vessel. Ensure the set pressure of the safety valve does not exceed that allowed on the vessel nameplate and determine that the capacity of the safety valve is greater than the capacity of the compressor. Ensure there is a functioning manual or automatic condensate drain; and

5) Quick-Closure Attachments — Filter-type vessels usually have one quick-type closure head for making filter changes, see NBIC Part 2, 2.3.6.5.
2.3.6.8

A pressure vessel for human occupancy (PVHO), as defined by ASME PVHO-1, is a pressure vessel that encloses a human being or animal within its pressure boundary while it is subject to internal or external pressure that exceeds a 2 psi (14 kPa) differential pressure. PVHOs include, but are not limited to submersibles, diving bells, personal transfer capsules, decompression chambers, recompression chambers, hyperbaric chambers, high altitude chambers and medical hyperbaric oxygenation facilities.

This section provides guidelines for inspection of medical PVHOs. Due to the many different designs and applications of PVHOs, potential failures of components or safety concerns that are not specifically covered, such as rapid decompression or fire/sparking issues should be considered.

a) General/operational

1) PVHOs should be constructed in accordance with ASME PVHO-1. This code adopts Section VIII and therefore the vessels should bear a “U” or “U2” ASME designator. Inspections may be conducted using ASME PVHO-2 for reference. PVHO-1 also has several Code Cases that address PVHOs manufactured from non-traditional materials such as various fabrics. PVHOs built under such Code Cases shall have all the documentation required by the Code Case, but may not necessarily have any related Section VIII forms.

2) Cast and ductile iron fittings are not allowed.

3) Due to the human occupancy element, a person should be in attendance to monitor the PVHO when in operation, in the event there is an accident.

4) The installation should be such that there is adequate clearance to inspect it properly. In some applications, such as underground tunneling, it may be impossible to perform a complete external inspection.

b) Internal Inspection

1) Where existing openings permit, perform a visual internal inspection of the vessel. Look for any obvious cracks and note areas that are subject to high stress such as welds, welded repairs, head-to-shell transitions, sharp interior corners, and interior surfaces opposite external attachments or supports.

2) The vessel should be free of corrosion, dents, gouges, or other damage. Special attention should be paid to areas under chamber floors and the interiors of chamber drain fittings.

3) All openings leading to external fittings or controls should be free from obstruction.

4) All exhaust inlets should be checked for the presence of fittings that
prevent a chamber occupant from inadvertently blocking the opening.

5) The inlets to all chamber pressure gage lines should be located where they either protected from possible blockage or fitted with multiple openings.

6) Chamber doors:
   a. should operate freely and smoothly. However, doors should not move on their own when released;
   b. that close/seal with pressure and which are fitted with “dogs” or other restraints to hold them in place until an initial seal is obtained, shall be fitted with features to prevent the door from maintaining a seal in the event the pressure differential on the door is reversed;
   c. should have seals that are supple, free from flat spots, cracking, etc.; and
   d. that close/seal against pressure shall have provisions as follows:
      1. Positive protection against pressurization of the vessel unless the restraint mechanism is fully engaged. This includes pressurization by back-up methods as well as primary methods; and
      2. Positive protection against release of the restraint mechanism unless pressure in the vessel is fully relieved.

c) External Inspection

1) The Inspector should closely examine the external condition of the pressure vessel for corrosion, damage, dents, gouges or other damage.

2) The lower half and the bottom portions of insulated vessels should receive special focus, as condensation or moisture may gravitate down the vessel shell and soak into the insulation, keeping it moist for long periods of time. Penetration locations in the insulation or fireproofing such as saddle supports, sphere support legs, nozzles, or fittings should be examined closely for potential moisture ingress paths. When moisture penetrates the insulation, the insulation may actually work in reverse, holding moisture in the insulation and/or near the vessel shell.

3) Insulated vessels that are run on an intermittent basis or that have been out of service require close scrutiny. In general, a visual inspection of the vessel’s insulated surfaces should be conducted once per year.

4) The most common and superior method to inspect for suspected corrosion under insulation (CUI) damage is to completely or partially remove the insulation for visual inspection. The method most commonly utilized to inspect for CUI without insulation removal is by X-ray and isotope radiography (film or digital) or by real time radiography, utilizing
imaging scopes and surface profilers. The real time imaging tools will work well if the vessel geometry and insulation thickness allows. Other less common methods to detect CUI include specialized electromagnetic methods (pulsed eddy current and electromagnetic waves) and long-range ultrasonic techniques (guided waves).

5) There are also several methods to detect moisture soaked insulation, which is often the beginning for potential CUI damage. Moisture probe detectors, neutron backscatter, and thermography are tools that can be used for CUI moisture screening. Proper surface treatment (coating) of the vessel external shell and maintaining weather-tight external insulation are the keys to prevention of CUI damage.

6) Couplers and doors that open with pressure:
   a. should operate freely and smoothly;
   b. should have seals that are supple, free from flat spots, cracking, etc.; and
   c. that close/seal against pressure shall have provisions as follows:
      1. Positive protection against pressurization of the vessel unless the restraint mechanism is fully engaged. This includes pressurization by back-up methods as well as primary methods; and
      2. Positive protection against release of the restraint mechanism unless pressure in the vessel is fully released.

d) Inspection of parts and appurtenances (e.g., piping systems, pressure gages, bottom drains, etc.)
   1) As stated above, cast iron is not allowed on PVHOs and shall be replaced with parts fabricated with other suitable materials, in accordance with ASME Code Section II.
   2) If valves or fittings are in place, check to ensure that these are complete and functional.
   3) The Inspector shall note the pressure indicated by the gage and compare it with other gages on the same system. If the pressure gage is not mounted on the vessel itself, it should be ascertained that the gage is installed on the system in such a manner that it correctly indicates actual pressure in the vessel. Lines leading to chamber primary depth gauges should connect only to the depth gauge.
   4) The Inspector shall verify that the vessel is provided with a drain opening.
   5) The system should have a pressure gage designed for at least the most severe condition of coincident pressure in normal operation. This gage should be clearly visible to the person adjusting the setting of the pressure control valve. The graduation on the pressure gage shall be graduated to not less than 1.5 times the MAWP of the vessel.
6) Provisions should be made to calibrate pressure gages or to have them checked against a standard test gage.

7) Any vents and exhausts should be piped at least 10 ft. (3.0 m) from any air intake.

8) Venting should be provided at all high points of the piping systems. Low points should be fitted with drains.

e) Inspection of view ports windows
1) Each window should be individually identified and be marked in accordance with PVHO-1.

2) If there are any penetrations through windows, they must be circular and in accordance with PVHO-1 requirements.

3) Windows must be free of crazing, cracks and scratches that exceed “superficial” defects as defined by PVHO-2.

4) Windows and viewports have a maximum interval for seat/seal inspection and refurbishment. Documentation should be checked to ensure compliance with PVHO-2, Table 7.1.3.

f) Inspection of pressure relief devices
1) Pressure relief devices for chambers only must have a quick opening manual shutoff valve installed between the chamber and the pressure relief device, with a frangible seal in place, within easy access to the operator.

2) The pressure relief device shall be constructed in accordance with ASME Code Section VIII.

3) The discharge from the chamber pressure relief device must be piped outside to a safe point of discharge as determined by the Authority having Jurisdiction.

4) Rupture disks may be used only if they are in series with a pressure relief valve, or when there is less than 2 ft³ (57 l) of water volume.

5) Verify that the safety valve is periodically tested either manually by raising the disk from the seat or by removing and testing the valve on a test stand.

g) Acceptance criteria

The following forms are required to be completed available for review:
1) ASME BPV Forms U-1, U-1A or U-2 as appropriate.

2) PVHO-1 Form PVHO-1 GR-1 Manufacturer’s Data Report for Pressure Vessels for Human Occupancy.

3) PVHO-1 Forms VP-1 PVHO-2 Fabrication Certification for Acrylic Windows (one for each window).

4) PVHO-1 Form VP-2 Design Certification for Acrylic Windows (one for each window).
5) PVHO-2 Form VP-1 Viewport Inspection (one for each window, current within PVHO-2 requirements).
6) For any repaired windows, PVHO-2 Form VP-2 Acrylic Window Repair Certificate for Windows. Repaired by the User (or his Authorized Agent) or PVHO-2 Form VP-3 Acrylic Window Repair Certificate for Severely Damaged Windows.

h) All PVHOs under the jurisdiction of the U.S. Coast Guard must also comply with 46 CFR Part 197.

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<tr>
<th>NB17-0201</th>
<th>Part 2, 2.3.6.10 c) 1)</th>
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<tr>
<td>c) Record keeping</td>
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<tr>
<td>1) Since these vessels have a finite fatigue life, it is essential a record shall be maintained of each operating cycle, recording both temperature and pressure. Deviation beyond design limits is cause for suspending operation and reevaluation of remaining fatigue life. Vessels having no operating record should shall be inspected and a fracture mechanics evaluation with a fatigue analysis test be performed to establish remaining life before resuming operation. Vessels having no operating record shall not be used for service until such time as previous operating history can be determined.</td>
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<th>NB16-3101</th>
<th>Part 2, 2.5.7.2 a)</th>
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<tr>
<td>a) If a set pressure test indicates the valve does not open within the requirements of the original code of construction, but otherwise is in acceptable condition, minor adjustments (defined as no more than twice the permitted set pressure tolerance) shall be made by a qualified organization accredited by the National Board “VR” or “T/O” Certificate Holder to reset the valve to the correct opening pressure. All adjustments shall be resealed with a seal identifying the responsible organization and a tag shall be installed identifying the organization and the date of the adjustment. Qualified organizations are considered to be National Board “VR” Certificate Holders, or organizations authorized by the Jurisdiction to make adjustments. See Supplement 3 for more information.</td>
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<th>NB16-3101</th>
<th>Part 2, 2.5.8.2</th>
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<tr>
<td>2.5.8.2 ESTABLISHMENT OF SERVICE INTERVALS</td>
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<tr>
<td>b) Pressure relief valves are mechanical devices that require periodic preventive maintenance even though external inspection and test results indicate acceptable performance. There may be wear on internal parts, galling between sliding surfaces, internal corrosion, or fouling which will not be evident from an external inspection or test. Periodic re-establishment of seating surfaces and the replacement of soft goods such as o-rings and diaphragms are also well advised preventive maintenance activities that can prevent future problems. If the valve is serviced, a complete disassembly, internal inspection, and repair as necessary, such that the valve’s condition and performance are restored to a like new condition, should be done by a National Board “VR” Certificate Holder, an organization accredited by the National Board.</td>
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<th>17-164</th>
<th>Part 2, 4.3.1.2</th>
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<tr>
<td>4.3.1.2 LIQUID PRESSURE TESTING</td>
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<td>Test pressure should be selected or adjusted in agreement between the Inspector and</td>
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The liquid test pressure shall not exceed the lesser of 150% of MAWP or test pressure established by the original code of construction. The test pressure shall not exceed the liquid test pressure of the original code of construction.

| 17-140 Part 2, 5.2 | **NOTE:** The new 5.2.1 and 5.2.2 presented below will be replacing the existing 5.2.1 and 5.2.2 in the NBIC**
|-------------------|---------------------------------------------------------------
| 5.2 Replacement of Stamping or Nameplate
| **5.2.1** Indistinct Stampings or nameplate is lost, illegible, or detached. |
| a) When the stamping on a pressure-retaining item becomes indistinct or the nameplate is lost, illegible or detached, but traceability to the original pressure-retaining item is still possible the Inspector shall instruct the owner or user to have the nameplate or stamped data replaced. All re-stamping shall be done in accordance with the original code of construction, except as modified herein. Request for permission to re-stamp data or replace nameplates shall be made to the Jurisdiction in which the nameplate or stamping is reapplied for approval. Application shall be made on the Replacement of Stamped Data Form, NB-136 (see 5.3.2) which is available on the National Board website (www.nationalboard.org). Proof of traceability to the original nameplate or stamping and other such data, as is available, shall be furnished with the request. The manufacturer of the pressure-retaining item, if available, shall be contacted prior to replacing a nameplate or stamped data in order to verify applicable code requirements. |
| b) When there is no Jurisdiction, documentation used to verify traceability, and the Replacement of Stamped Data Form, NB-136 shall be submitted to a National Board Commissioned Inspector for approval. |
| c) All re-stamping or replacement of nameplates shall be witnessed by a National Board Commissioned Inspector. |
| d) When the nameplate is welded to the pressure retaining boundary, the welding must be done by a National Board “R” Stamp Holder. |
| e) Permission from the Jurisdiction or National Board Commissioned Inspector is not required for the reattachment of nameplates that are partially attached. |
| f) The re-stamping or replacement of a code symbol stamp shall be performed only |
as permitted by the governing code of construction.

g) Replacement nameplates or stamped data shall be clearly marked “Replacement”.

h) When traceability cannot be established, the Jurisdiction where the pressure retaining item is installed shall be contacted for approval prior to replacing a nameplate or re-applying stamping.

5.2.2 Reporting

a) The completed Form NB-136 with a facsimile of the replacement stamping or nameplate applied and appropriate signatures shall be filed with the Jurisdiction, if applicable and the National Board by the owner, user or “R” Stamp Holder.

b) The owner or user shall retain all documentation provided for traceability with the completed form NB-136 for as long as the pressure-retaining item is in their ownership or use. If the pressure-retaining item is sold, Form NB-136 along with the supporting documentation shall be provided to the new owner.

Delete 5.2.3

Instructions for Completing the Form NB-136, Replacement of Stamped Data Form

Items 1-12 shall be completed by the owner, user, or “R” Stamp holder making the request.

1. Enter purchase order, job, or other identifying number used by your company, if applicable.

2. The name, address and phone number of the Jurisdiction, Authorized Inspection Agency (when there is no Jurisdiction) the form is being submitted to for approval.

3. Enter the name and address of your company or organization.

4. Enter the name, email, and phone number of the person who can be...
contacted if there are any questions concerning this request within your company or organization.

5. Enter the name and address of the location where the pressure-retaining item is installed. If this is the same as number 3, check the box “same as # 3”. If the pressure-retaining item is being refurbished and the final installation location is unknown, check the box “Stock item - unknown”.

6. Enter the date the pressure-retaining item was installed. If unknown check the box “Unknown”.

7. Enter the name of the manufacturer of the pressure-retaining item the request is being submitted for.

8. Manufacturer’s Data Report Attached, check the appropriate box.

9. Is the pressure-retaining item registered with the National Board? Check the appropriate block. If yes, provide the National Board Registration number.

10. Provide as much information as known to help identify the pressure-retaining item.

11. Provide a true facsimile of the legible part of the nameplate or stamping.

12. Attach any other documentation that helps provide traceability of the vessels to the original stamping, such as purchase orders, blueprints, inspection reports, etc.

13. Provide the name of owner or user of the pressure-retaining item or “R” Stamp holder making the request. If an “R” Stamp holder, provide the “R” Stamp number. Signature of the requester and date requested.

14. To be completed by the Jurisdiction or Authorized Inspection Agency’s Authorized Representative.

If the original manufacturer is currently in business, concurrence shall be obtained by the owner/user.

The requester shall submit the form along with any attachments to the Jurisdiction where the pressure-retaining item is installed for approval. If there is no Jurisdiction or the pressure-retaining item is a stock item, the requester shall submit the form to a
National Board Commissioned Inspector for approval.

After authorization, the form will be returned to the owner, user, or “R” Stamp holder who made the request. The requester is required to contact the Jurisdiction or an Authorized Inspection Agency to provide a National Board Commissioned Inspector to witness the re-stamping or installation of the new nameplate. If the nameplate is being welded to the pressure-retaining boundary of the vessel, the welding shall be done by an “R” Stamp holder. The requester will provide the new nameplate or have the tools on hand to do the re-stamping in accordance with the original Code of Construction.

15. Once the re-stamping is completed or the new nameplate is attached, the requester shall provide a true facsimile of the replacement stamping.

16. The owner, user, or “R” Stamp holder shall then fill in their name (and number if an “R” Stamp holder), sign and date.

17. To be completed by the National Board Commissioned Inspector who witnessed the re-stamping or installation of the new nameplate.

Note: Once completed the requester shall file a copy with the Jurisdiction where the pressure-retaining item is installed, the National Board, and the owner or user of the vessel if the request was made by an “R” Stamp holder, and upon request to the Authorized Inspection Agency who witnessed the re-stamping or attachment of the new nameplate.
REPLACEMENT OF STAMPED DATA FORM, NB-136

2. SUBMITTED TO: ____________________________
   (Name of Jurisdiction)
   
   (Address)
   
   (Telephone no.)
   
3. SUBMITTED BY: ____________________________
   (Name of owner, user, or Certificate Holder)
   
   (Address)
   
4. ____________________________
   (Name of owner)
   
   (Email)
   
   (Telephone no.)
   
5. LOCATION OF INSTALLATION:  ☐ SAME AS #5  ☐ STOCK ITEM = UNKNOWN
   
   (Name)
   
   (Address)
   
6. DATE INSTALLED: ____________________________  ☐ UNKNOWN
   
7. MANUFACTURER:
   (Name)
   
8. MANUFACTURER'S DATA REPORT ATTACHED:  ☐ NO  ☐ YES
   
9. ITEM REGISTERED WITH NATIONAL BOARD:  ☐ NO  ☐ YES, NB NUMBER: __________
   
   (Name)
   
10. ITEM IDENTIFICATION:
    (Type) ____________________________
    (Mfr. serial no.) ____________________________
    (Jurisdiction no.) ____________________________
    (Year built) ____________________________

    SAFETY RELIEF VALVE SET AT: ____________________________
    (psig)

11. PROVIDE A TRUE FACSIMILE OF THE LEGIBLE PORTION OF THE NAMEPLATE:  ☐ ATTACHED

12. TRACEABILITY DOCUMENTATION – PROVIDE ANY DOCUMENTATION THAT WILL HELP THE JURISDICTION OR INSPECTOR VERIFY THE REQUESTED RE-STAMPING OR REPLACEMENT NAMEPLATE IS IN ACCORDANCE WITH THE ORIGINAL CODE OF CONSTRUCTION FOR THIS PRESSURE-RETAINING ITEM:  ☐ ATTACHED

This form may be obtained from the National Board of Boiler and Pressure Vessel Inspectors  1095 Crupper Avenue, Columbus, Ohio  43229-1183  Page 1 of 2
13. I request authorization to replace the stamped data or nameplate on the above described pressure-retaining item in accordance with the Rules of the National Board Inspection Code (NBIC).

NAME: ___________________________ NUMBER: ___________________________
(Owner/User or "R" Certificate Holder)

SIGNATURE: ______________________ DATE: ______________________
(Authorized Representative)

14. Based on the traceability provided, authorization is granted to replace the stamped data or to replace the nameplate of the above described pressure-retaining item.

SIGNATURE: ______________________ DATE: ______________________
(Authorized Jurisdictional Representative or Inspector)

NATIONAL BOARD COMMISSION NO.: ___________________________
(Jurisdictional Number: ___________________________ (if available)

15. The following is a true facsimile of the item's replacement stamping or nameplate (must clearly state "replacement")

16. I certify that to the best of my knowledge and belief, the statements in this report are correct, and that the replacement information, data, and identification numbers are correct and in accordance with the provisions of the National Board Inspection Code (NBIC).

NAME: ___________________________ NUMBER: ___________________________
(Owner/User or "R" Certificate Holder)

SIGNATURE: ______________________ DATE: ______________________
(Authorized Representative)

17. Witnessed by: ___________________________ EMPLOYER: ___________________________
(Name of Inspector)

SIGNATURE: ______________________ DATE: ______________________ NB COMMISSION: ___________________________
(Name of Inspector) (including endorsements)
Historical boilers shall be equipped with at least one gage glass meeting the following requirements:

a) The gage glass shall be fitted with a guard to protect the glass;

b) The gage glass shall indicate the minimum safe operating water level;

c) The gage glass shall be provided with a drain valve or petcock, piped to a safe location;

d) The gage glass shall be visually clear and fully operational; and

e) The distance from the highest point on the crown sheet to the top of the lowest packing nut of the gage glass should be checked and documented in the boiler log. This distance shall be no less than 2 in. (50 mm).

Typical finished rivet heads are shown in NBIC Part 3, Figures S2.13.13.4-a and S2.13.13.4-b. Note that a riveted seam may have more than one type of rivet, for example, to provide necessary clearance during operation, or for provision for equipment assembly and maintenance.
A continuous gas detection system shall be provided in the room or area where container systems are filled and used, in areas where the heavier than air gas can congregate and in below grade outdoor locations. Carbon dioxide (CO2) sensors shall be provided within 12 in. (305 mm) of the floor in the area where the gas is most likely to accumulate or leaks are most likely to occur. The system shall be designed to detect and notify at a low level alarm and high level alarm.

a) The threshold for activation of the low level alarm shall not exceed a carbon dioxide concentration of 5,000 ppm (9,000 mg/m3) Time Weighted Average (TWA) over 8 hours. When carbon dioxide is detected at the low level alarm, the system shall activate a signal at a normally attended location within the building.

b) The threshold for activation of the high level alarm shall not exceed a carbon dioxide concentration 30,000 ppm (54,000 mg/m3). When carbon dioxide is detected at the high level alarm, the system shall activate an audible and visual alarm at a location approved by the jurisdiction having authority.

The inspection should verify that the gas detection system and audible alarm is operational and tested and documented in accordance with manufacturer’s guidelines.

The inspection should verify that audible alarms are placed at the entrance(s) to the room or area where the carbon dioxide storage vessel and/ or fill box is located to notify anyone who might try to enter the area of a potential problem.

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**S2.14.16 FIRING OF HISTORICAL BOILERS WITH LIQUID OR GASEOUS FUELS.**

Hand firing of historical boilers with liquid or gaseous fuels poses significant additional safety concerns beyond those encountered when firing with solid fuels for which these boilers were originally designed, such as coal, straw or wood. The cautionary notes listed below are provided as examples to remind the owner or user that additional safety concerns do exist when firing historical boilers with these alternate fuels. These notes are not meant to be all-inclusive so each boiler’s fuel system should be designed appropriately.

a) **JURISDICTIONAL ACCEPTANCE**: The owner or user shall check with the Jurisdiction as applicable to determine if this alternative firing method is allowed.

b) **OWNER OR USER KNOWLEDGE**: The owner or user shall have an extensive knowledge of the fuel used, fuel transfer system, on board fuel storage, burner, firing controls, emergency shut off devices and procedures.

c) **PURGING**: To prevent a firebox explosion, the furnace shall be purged of combustible gasses prior to applying the fuel ignition source.

d) **FLAME IMPINGEMENT**: Direct flame impingement of the metal surfaces within the furnace can damage the boiler. Installation of refractory or fire brick in the firebox is a common practice to prevent this potential damage.

e) **LOW WATER**: The owner or user shall have a procedure in place to immediately shut off the fuel supply to the burner when a boiler low water condition occurs.

f) **FUEL CONTAINMENT**: The fuel storage system shall be suitably designed with the appropriate shut off devices for the specific fuel product. The mounting method and proximity of the fuel storage container to the furnace shall be considered to prevent the fuel from accidental ignition.

g) **FUEL SYSTEM**: The fuel delivery system and routing from fuel source to the burner shall be suitably designed for the specific fuel product including appropriate emergency shut off devices.

h) **FUEL AIR MIXTURE**: The burner utilized shall be designed to operate within the confines
of the boiler furnace and provide the proper fuel/air mixture.

i) SAFETY VALVE: The boilers minimum relieving capacity shall be computed for the type of fuel used.

j) COMPRRESSED NATURAL GAS (CNG) vs LIQUID PETROLEUM GAS (LPG): CNG is lighter than air and LPG is heavier than air. The owner or user should understand the properties of the fuels to ensure the gas will not accumulate in the boiler (see Purging above).

S12.2 GENERAL REQUIREMENTS (ENCLOSED AND UNENCLOSED AREAS)

The inspection should verify that LCDSVs are:

a) not located within 10 feet (3.0 m) of elevators, unprotected platform ledges or other areas where falling would result in dropping distances exceeding half the container height;

b) installed with clearance to satisfactorily allow for filling, operation, maintenance, inspection and replacement of the vessel parts or appurtenances;

c) not located on roofs;

d) adequately supported to prevent the vessel from tipping or falling, and to meet seismic requirements as required by design;

e) not located within 36 in. (0.9 m) of electrical panels; and located outdoors in areas in the vicinity of vehicular traffic are protected with barriers designed to prevent accidental impact by vehicles.

PART 3, SECTION 1

REPAIRS AND ALTERATIONS — GENERAL AND ADMINISTRATIVE REQUIREMENTS

1.1 SCOPE

a) This part provides requirements and guidelines that apply when performing repairs and alterations to pressure-retaining items.

b) The National Board administers three-four specific accreditation programs:

1) “R” — Repairs and Alterations to Pressure-Retaining Items
2) “NR” — Repair and Replacement Activities for Nuclear Items
3) “VR” — Repairs to Pressure Relief Valves
4) “T/O” — Test Only of Pressure Relief Valves

c) This part describes some of the administrative requirements for the accreditation of repair organizations. Additional administrative requirements can be found in:

1) NB-415, ACCREDITATION OF “R” REPAIR ORGANIZATIONS
2) NB-417, ACCREDITATION OF “NR” REPAIR ORGANIZATIONS
3) NB-514, ACCREDITATION OF “VR” REPAIR ORGANIZATIONS
4) NB-528, ACCREDITATION OF “T/O” TEST ONLY ORGANIZATIONS

d) Requirements for repairs to pressure relief valves can be found in NBIC Part 4.

f) 18-15 Part 3, 1.5.1
d) Statement of Authority and Responsibility

A dated Statement of Authority and Responsibility, signed by an officer, a senior management official of the organization, shall be included in the manual. Further, the Statement of Authority shall include:

1) A statement that all repairs or alterations carried out by the organization shall meet the requirements of the NBIC and the Jurisdiction, as applicable;  

2) The title of individual who has the authority and responsibility charged with ensuring the Quality System is implemented as described, and confirming the freedom to identify quality problems and to initiate, recommend and provide solutions;  

3) A statement that if there is a disagreement in the implementation of the Quality System, the matter is to be referred for resolution to a higher authority in the company and shall be resolved in a manner that will not conflict with code, jurisdiction/regulatory authority or Quality System requirements; and

2) The title of the individual who will be responsible to ensure that 1) above is followed and has the freedom and authority to carry out the responsibility. A statement of the full support of management for the Quality System.

NB16-2001 Part 3, Table 1.5.1 c)
c) Continuity records for a welder, welding operator, bonder, or cementing technician. Minimally, continuity records for a welder, bonder, or cementing technician within the Certificate Holder’s quality system shall be described and established at the time of the applicant’s initial certificate review and demonstrated at each triennial review required thereafter. As applicable to the scope of work identified on the Certificate of Authorization, the continuity records are subject to review during each National Board triennial certificate review. Continuity records shall be maintained for a minimum of 5 years.

17-168 PART 3, 1.6

2017 NBIC Part 3, 1.6

1.6 “NR” PROGRAM REQUIREMENTS
1.6.1 SCOPE

a) This section provides requirements that must be met for an organization to obtain a
National Board Certificate of Authorization to use the “NR” Symbol Stamp for repair/replacement activities to nuclear items constructed in accordance with the requirements of the ASME Code or other internationally recognized codes or standards for construction or in-service inspection of nuclear facilities.

b) For administrative requirements to obtain or renew a National Board “NR” Certificate of Authorization and the “NR” Symbol Stamp, refer to National Board Procedure NB-417, Accreditation of “NR” Repair Organizations.

1.6.2 GENERAL

a) An organization applying for an “NR” Certificate of Authorization shall have a written Quality Assurance Program (QAP) that details the specific requirements to be met based on the intended category of activities selected by that organization as described below and shown in Table 1.6.2. Controls used, including electronic capabilities, in the Quality Assurance Program shall be documented in a Quality Assurance Manual (QAM). Controls required to be included within the QAM shall include who, what, when, where, why and how with an understanding that the how can be a reference to an implementation procedure or instruction. Quality activities to be described in the Quality Assurance Program are identified in Section 1.6.5 of this part. Applicants shall address all requirements in their Quality Assurance Program based on the category of activity and scope of work to be performed (organization’s capabilities) to which certification is requested.

1) Category 1

Any ASME Code certified item or system requiring repair/replacement activities irrespective of physical location and installation status prior to fuel loading.

2) Category 2

After fuel loading, any item or system under the scope of ASME Section XI requiring repair/replacement activities irrespective of physical location. Based on regulatory or jurisdictional acceptance, Category 2 may be used prior to fuel loading.

3) Category 3

Items constructed to codes or standards other than ASME, requiring repair/replacement activities irrespective of physical location, installation status and fuel loading.

b) Repair organizations performing repairs of pressure relief devices in nuclear service shall meet the additional requirements of NBIC Part 4, Section 4 and NBIC Part 4, Supplement 6.
<table>
<thead>
<tr>
<th>Category of Activity</th>
<th>Owner</th>
<th>Organizations other than Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>10 CFR Part 50 Appendix B¹,² and ASME Section III NCA-4000</td>
<td>10 CFR Part 50 Appendix B¹,² and ASME Section III NCA-4000</td>
</tr>
<tr>
<td>Category 2</td>
<td>10 CFR Part 50, Appendix B¹ or NQA-1, Part 1 and ASME Section XI, IWA-4142</td>
<td>10 CFR Part 50, Appendix B¹, supplemented as needed with Owner’s QA program; or ASME NQA-1, Part 1; or ASME Section III, NCA-4000</td>
</tr>
<tr>
<td>Category 3</td>
<td>ASME NQA-1, or Specify the Standard to which certification is desired</td>
<td>ASME NQA-1, or Specify the Standard to which certification is desired</td>
</tr>
</tbody>
</table>

**Note 1:**

**Note 2:**
10 CFR 50 Appendix B – Title 10 of the Code of Federal Regulations Part 50 Appendix B describes the quality assurance criteria for nuclear plants and fuel reprocessing plants.

### 1.6.2.1 DEFINITIONS

The NBIC terms and definitions shall be supplemented, as applicable, by the terms and definitions of ASME Section III, Section XI, NQA-1, or other standards specified by the Regulatory Authority.

The following terms are as defined in the NBIC Glossary of Terms Section 9:

a) Authorized Inspection Agency
b) Authorized Nuclear Inspection Agency
c) Jurisdiction
d) “NR” Certificate Holder
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>Applicant</td>
<td>An Organization applying for “NR” Certificate of Authorization (new or renewal)</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>Code</td>
<td>ASME Code of Construction, Section III, Division I, (NCA, NB, NC, ND, NE, NF, NG, and NH) or ASME Section XI Rules for Inservice Inspection of Nuclear Power Plant Components as applicable.</td>
</tr>
<tr>
<td>Jurisdiction</td>
<td>Enforcement Authority</td>
</tr>
<tr>
<td>NB</td>
<td>National Board of Boiler and Pressure Vessel Inspectors</td>
</tr>
<tr>
<td>NBIC</td>
<td>National Board Inspection Code</td>
</tr>
<tr>
<td>NB-263, RCI-1</td>
<td>Rules for Commissioned Inspectors</td>
</tr>
<tr>
<td>NCA</td>
<td>ASME Section III, Subsection NCA, General Requirements for Division 1 and Division 2</td>
</tr>
<tr>
<td>NQA–1*</td>
<td>ASME Quality Assurance Requirements for Nuclear Facility Applications</td>
</tr>
<tr>
<td>NR</td>
<td>Nuclear Repair</td>
</tr>
<tr>
<td>“NR” CH</td>
<td>“NR” Certificate Holder</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>QAI–1</td>
<td>ASME Qualifications for Authorized Inspection</td>
</tr>
<tr>
<td>QAM</td>
<td>Quality Assurance Manual</td>
</tr>
<tr>
<td>QAP</td>
<td>Quality Assurance Program</td>
</tr>
<tr>
<td>QC</td>
<td>Quality Control</td>
</tr>
<tr>
<td>WA</td>
<td>ASME Section III, Division 3, Subsection WA, General Requirements</td>
</tr>
</tbody>
</table>

**Note:**

* Latest Edition endorsed by the Regulatory Authority
1.6.3 PREREQUISITES FOR ISSUING A NATIONAL BOARD “NR” CERTIFICATE OF AUTHORIZATION

Before an organization can obtain a National Board “NR” Certificate of Authorization, the organization shall:

a) Have and maintain an inspection agreement with an Authorized Nuclear Inspection Agency accepted in accordance with NB-360, Criteria for Acceptance of Authorized Inspection Agencies for New Construction or accredited in accordance with NB-369, Qualifications and Duties for Authorized Inspection Agencies (AIAs) Performing Inservice Inspection Activities and Qualification of Inspectors of Boilers and Pressure Vessels.

b) Have a written Quality Assurance Program that complies with the requirements of this section and address all controls for the intended category and scope of activities.

c) Have a current edition of the NBIC.

d) Have available ASME Section XI, the code of construction and referenced code sections and standards appropriate for the scope of work to be performed. ASME Section XI and codes of construction (Editions/Addenda) shall meet the requirements of the Regulatory Authority and the owner.

1.6.4 OBTAINING OR RENEWING A NATIONAL BOARD “NR” CERTIFICATE OF AUTHORIZATION

a) Before an “NR” Certificate of Authorization will be issued or renewed, the applicant must have the Quality Assurance Program and the implementation of the program reviewed and found acceptable by representatives of the National Board, the Jurisdiction, and the Authorized Nuclear Inspection Agency. The Jurisdiction will be the National Board Member Jurisdiction in which the applicant is located or the location where the Quality Assurance Program is demonstrated/implemented. At the request of the Jurisdiction, or where there is no National Board Member Jurisdiction, the National Board representative shall act on behalf of the Jurisdiction. The implementation of the Quality Assurance Program shall be satisfactorily demonstrated by the organization. Demonstration of implementation shall meet the most stringent (classification) code requirements for the scope and category of work to be specified on the Certificate of Authorization or as requested by the applicant.

b) If the applicant is an ASME “N” type Certificate of Authorization holder, has satisfactorily demonstrated within the last twelve (12) months the implementation of their Quality Assurance Program and can provide documentation that the organization is capable of implementing its Quality Assurance Program as being in compliance with this section, a further hardware verification implementation may not be necessary.

c) The Regulatory Authority or Jurisdiction, upon request to the National Board, may attend the survey process for an “NR” Certificate of Authorization to be issued or renewed.
d) The “NR” Certificate of Authorization holder shall be subject to an audit annually by the Authorized Nuclear Inspection Agency to ensure compliance with the Quality Assurance Program.

1.6.5 QUALITY ASSURANCE PROGRAM

a) An applicant or a holder of a National Board “NR” Certificate of Authorization (“NR” Certificate Holder) shall have and maintain a written Quality Assurance Program. The Quality Assurance Program shall satisfactorily meet the requirements of this section, and Jurisdictional and Regulatory requirements as applicable. The Quality Assurance Program may be brief or voluminous, depending on the circumstances. It shall be treated confidentially by the National Board and available for review by the Survey Team.

b) Each applicant or “NR” Certificate Holder is responsible for establishing and executing a Quality Assurance Program. The applicant or “NR” Certificate Holder may subcontract activities needed to implement the Quality Assurance Program, as limited by ASME Section III and XI, but responsibility for adherence to the Quality Assurance Program remains with the Applicant or “NR” Certificate Holder.

c) These rules set forth the requirements for planning, managing, and implementing the organization’s Quality Assurance Program to control and ensure quality is performed and maintained during repair/replacement activities of components, items, parts, and systems for nuclear facilities. These rules are to be the basis for evaluating such programs prior to the issuance or renewal of the National Board “NR” Certificate of Authorization. Rules identified in subsections 1.6.6, 1.6.7 and 1.6.8 of this section detail the Quality Assurance Program requirements for each category of activity. These rules are established to meet and follow the requirements specified in NBIC Part 3, Table 1.6.2-1 of this section.

1.6.6 QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR CATEGORY 1 ACTIVITIES

1.6.6.1 SCOPE

Owners or organizations other than owners shall have a written Quality Assurance Program meeting the criteria specified in Table 1.6.2 of this section for Category 1 activities. The following quality elements shall be specified and described within the QAM.

1.6.6.2 QUALITY PROGRAM ELEMENTS

a) Organization

The provisions identified in ASME NQA-1, Part 1, Requirement 1, shall apply in its entirety. The Authority and responsibility for individuals involved in activities affecting quality shall be clearly established and documented throughout the Quality Assurance Program and identified on a functional organizational chart contained within the QA Manual.

b) Statement of Policy and Authority shall:

1) identify the titles of individuals who have the authority and responsibility
charged with ensuring the quality program is implemented as described.
2) confirm their freedom in the organization to identify quality problems and to initiate, recommend and provide solutions.
3) include a statement that if there is a disagreement in the implementation of the quality assurance program, the matter is to be referred for resolution to a higher authority and shall be resolved in a manner that will not conflict with code, jurisdiction/regulatory authority or quality program requirements.
4) include a statement of the full support of management, and
5) be dated and signed by a senior management official within the organization.

c) Quality Assurance Program (QAP)
   The provisions identified in ASME NQA-1, Part 1, Requirement 2, shall apply, except paragraph 301. Additionally, the following criteria shall be used when developing and maintaining the QAP.
   1) The Quality Assurance Program as used in this section shall include a written Quality Assurance Manual, with supporting procedures and instructions used to meet all the requirements of this Section.
   2) Qualification of non-destructive examination personnel shall be as required by the code of construction or as specified in the owner's Quality Assurance Program.
   3) The “NR” Certificate Holder shall be responsible for advising the Authorized Nuclear Inspection Agency of proposed changes to the Quality Assurance Manual to obtain acceptance of the Authorized Nuclear Inspector Supervisor before putting such changes into effect. The “NR” Certificate Holder shall make a current controlled copy of the Quality Assurance Manual available to the Authorized Nuclear Inspector and Authorized Nuclear Inspector Supervisor. The Certificate Holder shall be responsible for notifying the Authorized Nuclear Inspector of QAM changes, including evidence of acceptance by the Authorized Nuclear Inspector Supervisor.
   4) The Quality Assurance Manual need not be in the same format or sequential arrangement as the requirements in these rules as long as all applicable requirements have been covered.
   5) The “NR” Certificate Holder shall implement and maintain a program for qualification, indoctrination, training and maintaining proficiency of personnel involved with quality functions, including personnel of subcontracted services.
   6) The “NR” Certificate Holder shall address in their QAM the requirements for interfacing with the owner specified in 1.6.9 of this section.
   7) Specified controls including responsibilities for personnel shall be described in the quality assurance program.

d) Design Control
   The provisions identified in ASME NQA-1, Part 1, Requirement 3, shall apply except Paragraph 601. The following additional requirements shall be considered when applicable.
   1) The “NR” Certificate Holder shall establish measures to ensure applicable requirements of the owner’s design specifications, owner’s requirements,
and code of construction requirements are correctly translated into drawings, specifications, procedures and instructions.

2) All design documents, including revisions, shall be verified by the “NR” Certificate Holder to be correct and adequate in accordance with the owner’s requirements.

3) Repair/replacement plans shall be completed prior to performing any work, inspections, examinations or testing; however, repair/replacement plans are not required for the design phase of a repair/replacement activity including activities that require design only (except rerating).

4) The repair/replacement plan (see Table 1.6.9) shall identify any applicable Code Edition/Addenda and Code Cases, owner’s requirements and the Construction Code Edition/Addenda utilized to perform the work.

5) The repair/replacement plan shall identify expected life of the item when less than the intended life as specified in the owner’s design specification.

6) The “NR” Certificate Holder shall ensure that specifications, drawings, procedures and instructions do not conflict with the owner’s design specifications. A system must be described in the Quality Assurance Manual to resolve or eliminate such conflicts. Resolution shall consider the Design Specification Requirements, as well as, the owner requirements, Jurisdictional and Regulatory Authority Requirements as applicable.

e) Procurement Document Control

The provisions identified in ASME NQA-1, Part 1, Requirement 4, shall apply. Procurement documents shall require suppliers to provide a Quality Assurance Program consistent with the applicable requirements of ASME Section III and this section:

f) Instructions, Procedures and Drawings

The provisions identified in ASME NQA-1, Part 1, Requirement 5, shall apply. All activities affecting quality shall be prescribed by documented instructions, procedures or drawings appropriate for the scope of work to be performed. Instructions, procedures or drawings shall describe acceptance criteria to ensure quality activities are accomplished.

g) Document Control

The provisions identified in ASME NQA-1, Part 1, Requirement 6, shall apply. The Quality Assurance Program shall detail measures to control the preparation, review, issuance, use, approval and distribution of all documents related to quality as identified in the applicants Quality Assurance Program. Revisions shall meet the same requirements as the originals unless the applicant specifies other measures within their program. Measures shall ensure the latest approved documents represent the repair/replacement activities performed.

h) Control of Purchased Material, Items, and Services

1) The provisions identified in ASME NQA-1, Part 1, Requirement 7 shall apply, except:

2) Procurement of Authorized Inspection Agency services is not applicable as specified in paragraph 507.

3) The decision to perform bid evaluation as described in paragraph 300 is
the responsibility of the “NR” Certificate Holder.

4) For Certificates of Conformance specified in paragraph 503 changes, waivers, or deviations including resolution of non-conformances must meet the requirements of ASME Section III and this Section.

5) The provisions identified in ASME NQA-1, Part 1, Requirement 7, paragraph 700 are not applicable to this section.

6) Documentary evidence for items shall conform to the requirements of ASME Section III, NCA and this Section. Materials shall meet the material certification requirements as specified in ASME Section III, NCA-3800 or NCA-4470 as applicable. Documented evidence for ASME stamped items is satisfied by a Manufacturer's Data Report. Utilization of unqualified source material shall meet the requirements of ASME Section III, NCA-4255.5

7) The “NR” Certificate Holder may obtain items from an owner, provided the owner provides the required documentation and items are identified to meet Code and the Certificate Holders Quality Assurance Program. The “NR” Certificate Holder shall not be required to audit the owner as an approved supplier, provided the items used are exclusively for the owner and the owner procured and controlled the items under the owner’s Quality Assurance Program.

8) The Quality Assurance Program shall establish controls to ensure all purchased materials, items, and services conform to the requirements of the owner’s design specifications and the code of construction Edition/Addenda used to perform the work. Materials shall meet the requirements specified in ASME Section III, NCA-3800 or NCA-4470 as applicable.

i) Identification and Control of Items

The provisions identified in ASME NQA-1, Part 1, Requirement 8, shall apply and include the following additional requirements.

1) Controls shall assure only correct and acceptable items, parts and components are used or installed when performing repair/replacement activities.

2) Welding, brazing and fusing materials shall be identified and controlled.

3) Required Certified Material Test Reports and Certificates of Conformance shall be received, traceable to the items, reviewed to comply with the material specification and found acceptable.

4) The “NR” Certificate Holder shall utilize checklists to identify required characteristics using accepted procedures, compliance with records received, results of examinations and tests performed, range of values when required, and spaces for inclusion of document numbers and revision levels, signatures, / stamps and dates of examinations or tests performed, verified, and/or witnessed by the “NR” Certificate Holder’s qualified Representative and Authorized Nuclear Inspector.

j) Control of Processes

The provisions identified in ASME NQA-1, Part 1, Requirement 9, shall apply. Documents used to control processes shall include spaces for signatures,
initials, stamps and dates that activities were performed by the Certificate Holder’s representative and the Authorized Nuclear Inspector when the processes conform to the specified acceptance criteria as listed on drawings, procedures, instructions, specifications or other appropriate documents including revisions.

k) Examinations, Tests and Inspections

The provisions identified in ASME NQA-1, Part 1, Requirement 10, shall apply, except paragraph 700 for inspections during operations is not required.

1) A repair/replacement plan shall be described in the Quality Assurance Manual that addresses required information to perform the work needed for repair/replacement activities. Spaces shall be included for mandatory hold points where witnessing is required by the “NR” Certificate Holder’s Qualified Representative, the Authorized Nuclear Inspector or the owner’s representative, if required. Work shall not proceed beyond designated mandatory hold points without documented consent as appropriate.

2) The following guidance is provided for information to be included within the repair/replacement plan:
   a. A detailed description of repair/replacement activities to be performed;
   b. Describe any defects and examination methods used to detect the defects;
   c. Defect removal method and requirements for identifying reference points;
   d. Any procedures including revisions utilized; (e.g. welding, brazing, heat treat, examination, testing) and material requirements;
   e. Required documentation and stamping; and
   f. Acceptance criteria used to verify acceptability.
   g. Applicable Code editions/addenda and code cases

3) Repair/Replacement plans and evaluations shall be subject to review by the Jurisdictional and Regulatory Authority when required.

l) Test Control

The provisions identified in ASME NQA-1, Part 1, Requirement 11 shall apply. Testing shall be performed in accordance with written test procedures with acceptance criteria clearly defined. Pre-requisites for performing each test to include calibration, equipment, trained personnel, environmental conditions and provisions for data acquisition shall be described. Test results shall be documented and evaluated by qualified personnel.

m) Control of Measuring and Test Equipment

The provisions identified in ASME NQA-1, Part 1, Requirement 12 shall apply.

1) The “NR” Certificate Holder may perform periodic checks on equipment to determine calibration is maintained. When periodic checks are used the method and frequency shall be included in the “NR” Certificate Holder’s Quality Assurance Program and if discrepancies are found, shall be resolved to the prior periodic check.

2) The “NR” Certificate Holder may accept accreditation for calibration activities by National Voluntary Laboratory Accreditation Program (NVLAP).
American Association for Laboratory Accreditation (A2LA) or other accrediting body recognized by NVLAP through the International Laboratory Accreditation Cooperation (ILAC) mutual recognition arrangement (MRA) provided the following requirements are met:


b. Scope of the accreditation for the calibration laboratory covers needed measurement parameters, ranges and uncertainties;

c. “NR” Certificate Holder shall specify that calibration reports shall include, laboratory equipment/standards used and as found and as left data;

d. The “NR” Certificate Holder shall verify conformance to the requirements of this process; and

e. Utilization of this process shall be described and documented in the “NR” Certificate Holders QAM.

n) Handling, Storage and Shipping

The provisions of ASME NQA-1, Part 1, and Requirement 13 shall apply.

o) Quality Assurance Records

The provisions identified in ASME NQA-1, Part 1, Requirement 17, shall apply, except Paragraphs 400, 500, and 600 are not applicable. The following requirements shall be followed:

1) Records shall be identifiable and retrievable;

2) Records shall be retained consistent with the owner’s requirements for duration, location and assigned responsibility;

3) Forms NR-1 and NVR-1 as applicable shall be completed by the “NR” Certificate Holder upon completion of all repair/replacement activities. Completion of forms, registrations and stamping of the “NR” symbol stamp shall meet the requirements of NBIC Part 3, Section 5. A log shall be maintained in accordance with NBIC Part 3, 5.6; and

4) Lifetime and non-permanent records shall be as specified in ASME Section III, NCA-4134, Tables NCA-4134.17-1, and 4134.17-2.

5) Radiographs (digital images or film) may be reproduced provided that:
   a. The process shall be subject to owner’s approval;
   b. The “NR” Certificate Holder is responsible for the process used and shall include a system for controlling and monitoring the accuracy so that the image will provide the same information as the original; and
   c. Procedures shall contain requirements for exposure scanning, focusing, contrast, resolution and distinguishing film artifacts as applicable for reproduced images.

6) Records shall be classified, maintained and indexed and shall be accessible to the owner, owner’s designee, and the Authorized Nuclear Inspector.

7) When the “NR” Certificate Holder is the owner, designated records and reports received by the owner, shall be filed and maintained in a manner to allow access by the Authorized Nuclear Inservice Inspector. Suitable protection from deterioration and damage shall be provided by the owner.
All records and reports shall be retained as specified in the owners QAP for the lifetime of the component or system.

**p) Corrective Action**

The provisions identified in ASME NQA-1, Part 1, Requirement 16 shall apply.

1) Measures shall be established to ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and other non-conformances are promptly identified and corrected.

2) In the case of significant conditions adverse to quality, the measures shall also ensure that the cause of these conditions be determined and corrected to preclude repetition. The identification of significant conditions adverse to quality, the cause, condition, and the corrective action taken shall be documented and reported to the appropriate levels of management.

3) These requirements shall also extend to the performance of subcontractors’ corrective action measures.

**q) Inspection or Test Status (not to include operating status)**

The provisions identified in ASME NQA-1, Part 1, Requirement 14 shall apply. Measures shall be established to indicate inspection and test status of parts, items, or components during the repair/replacement activity. The system used shall provide positive identification of the part, item, or component by means of stamps, labels, routing cards, or other acceptable methods. The system shall include any procedures or instructions necessary to achieve compliance. Procedures shall be provided for the identification of acceptable and unacceptable items and for the control of status indicators. The authority for application and removal of status indicators shall also be specified.

**r) Nonconforming Materials or Items**

The provisions identified in ASME NQA-1, Part 1, Requirement 15 shall apply. Measures shall be established to control materials or items that do not conform to requirements to prevent their inadvertent use, including measures to identify and control the proper installation of items and to preclude nonconformance with the requirements of these rules. These measures shall include procedures for identification, documentation, segregation when practical, and disposition. Nonconforming items shall be reviewed for acceptance, rejection, or repair in accordance with documented procedures. The responsibility and authority for the disposition of nonconforming items shall be defined. Repaired or replaced items shall be re-examined in accordance with the applicable procedures. Measures that control further processing of a nonconforming or defective item, pending a decision on its disposition, shall be established and maintained. Ultimate disposition of nonconforming items shall be documented.

**s) Audits**

The provisions identified in ASME NQA-1, Part 1, and Requirement 18 shall apply and shall include the following:

A comprehensive system of planned and periodic internal audits of the “NR” Certificate Holder’s Quality Assurance Program shall be performed by the “NR” Certificate Holder. Audits shall include internal audits by the Certificate Holder.
and audits by the Authorized Inspection Agency. Audit frequency shall be specified in the organization’s Quality Assurance Manual. Audits shall be conducted at least annually for any ongoing code activity to verify compliance with Quality Assurance Program requirements, performance criteria, and to determine the effectiveness of the Quality Assurance Program. When no code work has been performed, the required annual audit need only include those areas of responsibility required to be continually maintained such as training, audits, organizational structure, and Quality Assurance Program revisions. The Quality Assurance Manual shall as a minimum describe the following:

1) Audits shall be performed in accordance with written procedures or checklists by qualified audit personnel not having direct responsibility in areas being audited;
2) Audit personnel shall be qualified in accordance with the current requirements of ASME NQA-1;
3) Audit results shall be documented and reviewed by responsible management for adequacy and effectiveness of the quality assurance program.
4) Requirements for follow-up actions shall be specified for any deficiencies noted during the audit;
5) Audit records and applicable documentation shall be made available to the Authorized Nuclear Inspector for review;
6) Audit records shall include as a minimum:
   a. Written procedures;
   b. Checklists;
   c. Reports;
   d. Written replies; and
   e. Completion of corrective actions.

**t) Authorized Nuclear Inspector**

Measures shall be taken to reference the commissioned rules for National Board Authorized Nuclear Inspector, in accordance with NB-263, RCI-1 Rules for Commissioned Inspectors. The “NR” Certificate Holder shall ensure that the latest documents including the Quality Assurance Manual, procedures and instructions are made available to the Authorized Nuclear Inspector. The Authorized Nuclear Inspector shall be consulted prior to the issuance of a repair/replacement plan by the “NR” Certificate Holder in order that the Authorized Nuclear Inspector may select any in-process inspection or hold points when performing repair/replacement activities. The “NR” Certificate Holder shall keep the Authorized Nuclear Inspector informed of progress of the repair/replacement activity so that inspections may be performed. The Authorized Nuclear Inspector shall not sign Form NR-1 or Form NVR-1, as applicable, unless satisfied that all work carried out is in accordance with this Section. The Authorized Nuclear Inspector and Authorized Nuclear Inspector Supervisor shall have access to areas where work is being performed including subcontractors facilities in order to perform their required duties. The ANI shall be involved in dispositions and verification for non-conformances and corrective actions involving quality or code requirements.
Exhibits

Forms and exhibits referenced in the Quality Assurance Manual shall be explained in the text and included as part of the referencing document or as an appendix to the Quality Assurance Manual. Forms shall be controlled and identified to show the latest approved revision, name, and other corresponding references as stated in the Quality Assurance Manual.

1.6.7 QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR CATEGORY 2 ACTIVITIES

1.6.7.1 SCOPE

Owners or organizations other than owners shall have a written Quality Assurance Program meeting one of the criteria specified in Table 1.6.2 of this section. Organizations applying for a Category 2 “NR” Certificate of Authorization shall specify in their written Quality Assurance Program which program criteria their Quality Assurance Program follows. Owners shall have a Quality Assurance Program meeting the requirements of either 10 CFR 50, Appendix B or NQA-1 Part 1 and shall include the additional requirements specified in ASME Section XI, IWA-4142 when applicable. Organizations other than the owner shall comply with requirements specified in either 10 CFR 50, Appendix B supplemented as needed with the owner’s QAP; NQA-1 Part 1; or NCA-4000. Organizations may elect to combine or supplement requirements from other specified QAP’s. When organizations elect to combine QAP requirements, it shall be clearly specified and understood in the QAM which QAP requirement is being followed for each activity specified in their QAM. The following quality elements shall be specified and described within the QAM.

1.6.7.2 QUALITY PROGRAM ELEMENTS

a) Organization

The authority and responsibility for individuals involved in activities affecting quality shall be clearly established and documented throughout the Quality Assurance Program and identified on a functional organizational chart contained within the QA Manual.

b) Statement of Policy and Authority shall:

1) identify the titles of individuals who have the authority and responsibility charged with ensuring the quality program is implemented as described,

2) confirm their freedom in the organization to identify quality problems and to initiate, recommend and provide solutions,

3) include a statement that if there is a disagreement in the implementation of the quality assurance program, the matter is to be referred for resolution to a higher authority and shall be resolved in a manner that will not conflict with code, jurisdiction/regulatory authority or quality program requirements

4) include a statement of the full support of management, and

5) be dated and signed by a senior management official within the organization.
c) Quality Assurance Program (QAP)
   1) Qualification of non-destructive examination personnel shall be as required by
      the code or as specified in the owner's Quality Assurance Program.
   2) Prior to returning an item to service, the owner shall evaluate the suitability of
      the item subjected to the repair/replacement activity. Corrective actions shall be
      taken when an item is determined to be deficient or does not satisfy the
      requirements of this section.
   3) The “NR” Certificate Holder shall provide a copy of the Quality Assurance
      Manual to the owner for review and acceptance. The “NR” Certificate Holder
      shall make a current controlled copy of the Quality Assurance Manual available
      to the Authorized Nuclear Inspector and Authorized Nuclear Inspector
      Supervisor. When a repair/replacement activity is split between the owner and
      an “NR” Certificate Holder, each Quality Assurance Program shall comply with
      this section for their respective activities. The owner shall establish interfaces
      for assuring this section is met for the two Quality Assurance Programs.
   4) The “NR” Certificate Holder shall be responsible for advising the Authorized
      Nuclear Inspection Agency of proposed changes to the Quality Assurance
      Manual to obtain acceptance of the Authorized Nuclear Inspector Supervisor
      before putting such changes into effect. The Certificate Holder shall be
      responsible for notifying the Authorized Nuclear Inspector of QAM changes,
      including evidence of acceptance by the Authorized Nuclear Inspector
      Supervisor.
   5) The Quality Assurance Manual need not be in the same format or sequential
      arrangement as the requirements in these rules as long as all applicable
      requirements have been covered.
   6) The “NR” Certificate Holder shall implement and maintain a program for
      qualification, indoctrination, training and maintaining proficiency of personnel
      involved with quality functions, including personnel of subcontracted services.
   7) The “NR” Certificate Holder shall address in their QAM the requirements for
      interfacing with the owner specified in 1.6.9 of this section.
   8) Specified controls including responsibilities for personnel shall be described in
      the quality assurance program.

d) Design Control
   1) Repair/replacement activities, code edition and addenda used shall correspond
      with the owner's Inservice Inspection Program unless later code editions and
      addenda have been accepted by the owner, the Enforcement and/or the
      Regulatory authority having jurisdiction at the plant site.
   2) The repair/replacement plan [see 1.6.7.2 j)] shall identify expected life of the
      item when less than the intended life as specified in the owner’s requirements
      and the owner shall be advised of the condition.
   3) The “NR” Certificate Holder shall assure that specifications, drawings,
      procedures and instructions do not conflict with the owner’s requirements. A
      system must be described in the Quality Assurance Manual to resolve or
      eliminate such conflicts. Resolution shall consider the design specification
      requirements, as well as, the owner Requirements, Jurisdictional and
Regulatory requirements as applicable.

4) ASME Section XI establishes that the owner is responsible for design in connection with repair/replacement activities. The “NR” Certificate Holder must ensure that the design specification, drawings, or other specifications or instructions furnished by the owner satisfy the code edition and addenda of the owner’s requirements. To satisfy this requirement, the “NR” Certificate Holder shall establish requirements that correctly incorporate the owner’s requirements into their specifications, drawings, procedures, and instructions, which may be necessary to carry out the work. The “NR” Certificate Holder’s system shall include provisions to ensure that the appropriate quality standards are specified and included in all quality records. These records shall be reviewed for compliance with the owner’s requirements and the requirements of ASME Section XI.

e) Procurement Document Control

Procurement documents shall require suppliers to provide a Quality Assurance Program consistent with the applicable requirements of ASME Section III, NCA and this section. Documents for procurement of materials, items, and subcontracted services shall include requirements to the extent necessary to ensure compliance with the owner’s requirements and IWA-4000 of ASME Section XI. To the extent necessary, procurement documents shall require suppliers to maintain a Quality Assurance Program consistent with the applicable requirements of the edition and addenda of the code of construction to which the items are constructed. Measures shall be established to ensure that all purchased material, items, and services conform to these requirements.

f) Instructions, Procedures and Drawings

Repair/replacement plans and any verification of acceptability (evaluations) shall be subject to review by Jurisdiction and Regulatory Authorities having jurisdiction at the plant site. Activities affecting quality shall be prescribed by documented instructions, procedures or drawings of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Instructions, procedures, or drawings shall include appropriate quantitative and qualitative criteria for determining that activities affecting quality have been satisfactorily accomplished. The “NR” Certificate Holder shall maintain a written description of procedures, instructions, or drawings used by the organization for control of quality and examination requirements detailing the implementation of the Quality Assurance Program requirements. Copies of these procedures shall be readily available to the Authorized Nuclear Inspector and Authorized Nuclear Inservice Inspector, as applicable.

g) Document Control

The program shall include measures to control the issuance, use, and disposition of documents, such as specifications, instructions, procedures, and drawings, including changes thereto. These measures shall ensure that the latest applicable documents, including changes, are reviewed for adequacy and approved for release by authorized personnel and distributed for use at the location where the prescribed activity is performed.
### h) Control of Purchased Material, Items, and Services

Purchase of materials and small products shall meet the requirements specified in ASME Section XI, IWA 4142. Measures shall be established to ensure that purchased material, items, and services conform to the owner’s requirements and applicable edition and addenda of the code of construction and ASME Section XI. These measures shall include identification for material traceability. Provisions shall be identified for source evaluation and objective evidence shall be provided evidencing quality standards for material examination upon receipt.

### i) Identification and Control of Items

1) Measures shall be established for identification and control of material and items, including partially fabricated assemblies. These measures shall ensure that identification is maintained and traceable, either on the material or component, or on records throughout the repair/replacement activity. These measures shall be designed to prevent the use of incorrect or defective items and those which have not received the required examinations, tests, or inspections.

2) Identification for traceability shall be applied using methods and materials that are legible and not detrimental to the component or system involved. Such identification shall be located in areas that will not interfere with the function or quality aspects of the item.

3) Certified Material Test Reports shall be identified as required by the applicable material specification in ASME Section II and shall satisfy any additional requirements specified in the original code of construction. The Certified Material Test Report or Certificate of Compliance need not be duplicated for submission with compliance documents when a record of compliance and satisfactory reviews of the Certified Material Test Report and Certificate of Compliance is provided. Quality documents shall provide a record that the Certified Material Test Report and Certificate of Compliance have been received, reviewed, and found acceptable. When the “NR” Certificate Holder authorizes a subcontracted organization to perform examinations and tests in accordance with the original code of construction, the “NR” Certificate Holder shall certify compliance either on a Certified Material Test Report or Certificate of Compliance that the material satisfies the original code of construction requirements.

### j) Control of Processes

1) The “NR” Certificate Holder shall operate under a controlled system such as process sheets, checklists, travelers, plans or equivalent procedures. Measures shall be established to ensure that processes such as welding, nondestructive examination, and heat treating are controlled in accordance with the rules of the applicable section of the ASME Code and are accomplished by qualified personnel using qualified procedures.

2) Process sheets, checklists, travelers, or equivalent documentation shall be prepared, including the document numbers and revisions to which the process conforms with space provided for reporting results of completion of specific operations at checkpoints of repair/replacement activities.

### k) Examinations, Tests and Inspections
1) A repair/replacement plan shall be prepared in accordance with the Quality Assurance Program whenever repair/replacement activities are performed. As a minimum, the repair/replacement plan shall include the requirements specified in ASME Section XI, IWA-4150.

2) In-process and final examinations and tests shall be established to ensure conformance with specifications, drawings, instructions, and procedures which incorporate or reference the requirements and acceptance criteria contained in applicable design documents. Inspection, test and examination activities to verify the quality of work shall be performed by persons other than those who performed the activity being examined. Such persons shall not report directly to the immediate supervisors responsible for the work being examined.

3) Process sheets, travelers, or checklists shall be prepared, including the document numbers and revision to which the examination or test is to be performed, with space provided for recording results.

4) Mandatory hold/inspection points at which witnessing is required by the “NR” Certificate Holder’s representative or the Authorized Nuclear Inspector/Authorized Nuclear Inservice Inspector shall be indicated in the controlling documents. Work shall not proceed beyond mandatory hold/inspection points without the consent of the “NR” Certificate Holder’s representative or the Authorized Nuclear Inspector/Authorized Nuclear Inservice Inspector, as applicable.

l) Test Control
   1) Testing shall be performed in accordance with the owner’s written test procedures, or procedures acceptable to the owner, that incorporate or reference the requirements and acceptance criteria contained in applicable design documents.

   2) Test procedures shall include provisions for ensuring that prerequisites for the given test have been met, that adequate instrumentation is available and used, and that necessary monitoring is performed. Prerequisites may include calibrated instrumentation, appropriate equipment, trained personnel, condition of test equipment, the item to be tested, suitable environmental conditions, and provisions for data acquisition.

   3) Test results shall be documented and evaluated to ensure that test requirements have been satisfied.

m) Control of Measuring and Test Equipment
   1) Measures shall be established and documented to ensure that tools, gages, instruments, and other measuring and testing equipment and devices used in activities affecting quality are of the proper range, type, and accuracy to verify conformance to established requirements. A procedure shall be in effect to ensure that they are calibrated and properly adjusted at specified periods or use intervals to maintain accuracy within specified limits. Calibration shall be traceable to known national standards, where these standards exist, or with the device manufacturer’s recommendation.

n) Handling, Storage and Shipping
   Measures and controls shall be established to maintain quality requirements for handling, storage, and shipping of parts, materials, items, and components.
o) Quality Assurance Records

Documentation, reports and records shall be in accordance with ASME Section XI, IWA-6000.

1) The owner is responsible for designating records to be maintained. Measures shall be established for the “NR” Certificate Holder to maintain these records [See 1.6.7.2 n) 2)] required for Quality Assurance of repair/replacement activities. These shall include documents such as records of materials, manufacturing, examination, and test data taken before and during repair/replacement activity. Procedures, specifications, and drawings used shall be fully identified by pertinent material or item identification numbers, revision numbers, and issue dates. The records shall also include related data such as personnel qualification, procedures, equipment, and related repairs. The “NR” Certificate Holder shall take such steps as may be required to provide suitable protection from deterioration and damage for records while in his care. Also, it is required that the “NR” Certificate Holder have a system for correction or amending records that satisfies the owner’s requirements. These records may be either the original or a reproduced, legible copy and shall be transferred to the owner at his upon request.

2) Records to be maintained as required in NBIC Part 3, 1.6.7.2 n) 1) above shall include the following, as applicable:

   a. An index that details the location and individual responsible for maintaining the records;

   b. Manufacturer’s Data Reports, properly executed, for each replacement component, part, appurtenance, piping system, and piping assembly, when required by the design specification or the owner;

   c. The required as-constructed drawings certified as to correctness;

   d. Copies of applicable Certified Material Test Reports and Certificates of Compliance;

   e. As-built sketch(es) including tabulations of materials repair/replacement procedures, and instructions to achieve compliance with ASME Section XI;

   f. Nondestructive examination reports, including results of examinations, shall identify the name and certification level of personnel interpreting the examination results. Final radiographs shall be included where radiography has been performed. Radiographs may be microfilmed or digitally reproduced in accordance with the requirements listed in ASME Section V, Article 2, Mandatory Appendix VI. The accuracy of the reproduction process shall be verified and monitored for legibility, storage, retrievability and reproduction quality;

   g. Records of heat treatments may be either the heat treatment charts or a summary description of heat treatment time and temperature data certified by the “NR” Certificate Holder. Heat treatments performed by the material manufacturer to satisfy requirements of the material specifications may be reported on the Certified Material Test Report; and

   h. Nonconformance reports shall satisfy IWA-4000 of ASME Section XI and shall be reconciled by the owner prior to certification of the Form NR-1 or NVR-1, as applicable.
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<td>3)</td>
<td>After a repair/replacement activity, all records including audit reports required to verify compliance with the applicable engineering documents and the “NR” Certificate Holder’s Quality System Program, shall be maintained at a place mutually agreed upon by the owner and the “NR” Certificate Holder. The “NR” Certificate Holder shall maintain records and reports for a period of five years after completion of the repair/replacement activity.</td>
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<td>4)</td>
<td>When the “NR” Certificate Holder is the owner, designated records and reports received by the owner, shall be filed and maintained in a manner to allow access by the Authorized Nuclear Inservice Inspector. Suitable protection from deterioration and damage shall be provided by the owner. These records and reports shall be retained as specified in the owners QAP for the lifetime of the component or system.</td>
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<td>5)</td>
<td>The original of the completed Form NR-1 or Form NVR-1, as applicable, shall be registered with the National Board and, if required, a copy forwarded to the Jurisdiction where the nuclear power plant is located. A log shall be maintained in accordance with NBIC Part 3, 5.6.</td>
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<td>p)</td>
<td>Corrective Action</td>
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s) Audits

A comprehensive system of planned and periodic internal audits of the “NR” Certificate Holder’s Quality Assurance Program shall be performed by each organization. Audits shall include internal audits by the Certificate Holder and audits by the Authorized Inspection Agency. Audit frequency shall be specified in the organization’s Quality Assurance Manual. Audits shall be conducted at least annually to verify compliance with Quality Assurance Program requirements, performance criteria and to determine the effectiveness of the Quality Assurance Program. When no code work has been performed, the required annual audit need only include those areas of responsibility required to be continually maintained such as training, audits, organizational structure, Quality Assurance Program revisions, etc. The Quality Assurance Manual shall as a minimum describe the following:

1) Audits shall be performed in accordance with written procedures or checklists by qualified audit personnel not having direct responsibility in areas being audited;
2) Audit personnel shall be qualified in accordance with the current requirements of NQA-1;
3) Audit results shall be documented and reviewed by responsible management for adequacy and effectiveness of the quality assurance program
4) Requirements for follow-up actions for any deficiencies noted during the audit;
5) Audit records and applicable documentation shall be made available to the Authorized Nuclear Inspector for review;
6) Audit records shall include as a minimum:
   a. written procedures;
   b. checklists;
   c. reports;
   d. written replies; and
   e. completion of corrective actions.

t) Authorized Nuclear Inspector

Measures shall be taken to reference the commissioned rules for National Board Authorized Nuclear Inspector, in accordance with NB-263, RCI-1 Rules for Commissioned Inspectors. The “NR” Certificate Holder shall ensure that the latest documents including the Quality Assurance Manual, procedures and instructions are made available to the Authorized Nuclear Inspector. The Authorized Nuclear Inspector shall be consulted prior to the issuance of a repair/replacement plan by the “NR” Certificate Holder in order that the Authorized Nuclear Inspector may select any in process inspection or hold points when performing repair/replacement activities. The “NR” Certificate Holder shall keep the Authorized Nuclear Inspector informed of progress of the
repair/replacement activity so that inspections may be performed. The Authorized Nuclear Inspector shall not sign Form NR-1 or Form NVR-1, as applicable, unless satisfied that all work carried out is in accordance with this section. The Authorized Nuclear Inspector and Authorized Nuclear Inspector Supervisor shall have access to areas where work is being performed including subcontractors facilities in order to perform their required duties. The ANI shall be involved in dispositions and verification for nonconformances and corrective actions involving quality or code requirements.

u) Exhibits

Forms and exhibits referenced in the Quality Assurance Manual shall be explained in the text and included as part of the referencing document or as an appendix to the Quality Assurance Manual. Forms shall be controlled and identified to show the latest approved revision, name, and other corresponding references as stated in the Quality Assurance Manual.

1.6.8 QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR CATEGORY 3 ACTIVITIES

1.6.8.1 SCOPE

Organizations requesting a Category 3 “NR” Certificate of Authorization may elect to follow the requirements specified in ASME NQA-1 Part 1 or follow specific Quality Assurance Program requirements outlined in other specified standards as required by the owner, Regulatory Authority or Jurisdiction. Organizations shall specify in the QAM what QAP requirements are followed. When standards other than ASME NQA-1 are followed, the organization shall have available a copy of that standard for review by the NB Survey Team and the ANIA, as applicable. Each organization shall, as a minimum, include in their written QAM the specified elements listed in Category 1 and/or 2 (1.6.6, 1.6.7) QAP requirements. Additional requirements, as specified within NBIC Part 3, 1.6.8 and 1.6.9 shall be included within the QAP. Also, limitations or additions to ASME NQA-1, as specified for Category 1 or 2 may be incorporated and referenced within the QAM.

1.6.8.2 QUALITY PROGRAM ELEMENTS

a) Organization

Persons and organization shall have authority and freedom to identify quality problems; initiate, recommend or provide solutions and verify implementation of solutions. The authority and responsibility for individuals involved in activities affecting quality shall be clearly established and documented throughout the Quality Assurance Program and identified on a functional organizational chart contained within the QA Manual.

b) Statement of Policy and Authority shall:

1) Identify the titles of individuals who have the authority and responsibility charged with ensuring the quality program is implemented as described.
2) Confirm their freedom in the organization to identify quality problems and to
initiate, recommend and provide solutions.

3) include a statement that if there is a disagreement in the implementation of the quality assurance program, the matter is to be referred for resolution to a higher authority and shall be resolved in a manner that will not conflict with code, jurisdiction/regulatory authority or quality program requirements

4) include a statement of the full support of management, and

5) be dated and signed by a senior management official within the organization.

c) QAP

The quality assurance program shall be documented by written policies, procedures and instructions. It shall account for special controls, processes, test equipment, tools and skills to obtain quality and for verification of quality by inspections and tests. Indoctrination, training and maintaining proficiency of personnel effecting quality shall be described. The status, adequacy, and effectiveness of the QAP shall be regularly reviewed by management. The scope shall be included within the written QAM. The “NR” Certificate Holder shall make a current controlled copy of the Quality Assurance Manual available to the Authorized Nuclear Inspector and Authorized Nuclear Inspector Supervisor. The “NR” Certificate Holder shall address in their QAM the requirements for interfacing with the owner specified in 1.6.9 of this section. Specified controls including responsibilities for personnel shall be described in the quality assurance program.

d) Design Control

Established measures to assure applicable quality standards and regulatory requirements are accurately specified and translated into design documents. Any deviations shall be identified and controlled. Control measures (such as review, approval, release, distribution and revisions) for suitability of materials, parts, equipment, procedures, instructions and processes, shall be performed to ensure adherence to specified design basis requirements. Qualifications, responsibilities and certifications of design personnel shall be clearly defined within the quality assurance program.

e) Procurement/Document Control

Documents for procurement of material, equipment and services shall ensure regulatory requirements, design bases and other quality requirements and are included or referenced. Procurement documents shall require contractors or subcontractors provide a Quality Assurance Program consistent with the provisions specified herein in this NBIC Part 3, 1.8.8. Controls necessary to ensure materials, equipment, and services meet specified design criteria shall be clearly described within the quality assurance program.

f) Instructions, Procedures and Drawings

Activities affecting quality shall be accomplished in accordance with prescribed instructions, procedures or drawings and shall include quantitative or qualitative acceptance criteria to determine activities are satisfactorily accomplished.
g) Document Control

Shall define measures to control the preparation, issuance, use, review, approval, revisions and distribution of all documents, including procedures, instructions and drawings related to quality. Responsibilities shall be described within the quality program.

h) Control of Purchased, Materials, Items and Services

Purchased material, items and services shall conform to the procurement documents. Measures shall be established for source evaluation and selection, objective evidence of quality, inspections at the source and examination of products upon delivery. Effectiveness of quality of suppliers shall be assessed by the applicant or designee at specified intervals. Documented evidence shall be performed and made available to assure materials and services conform to procurement documents, quality procedures and instructions.

i) Identification and Control of Items

Specified controls shall ensure only correct and acceptable items, parts and components are used and installed and traceable to required documents such as certified material test reports, certificates of conformance, or data reports. These controls shall include traceability on the items or on records traceable to the items during fabrication and final acceptance and test.

j) Control of Processes

Documents used to control processes shall be prepared, including the document numbers and revision to which the process conforms and conform to specified acceptance criteria. shall include space for providing reporting of results of specific operations at checkpoints of repair/replacement activity, and provide for signatures, initials, stamps and dates for activities performed by the Certificate Holder's representative and the Authorized Nuclear Inspector. Special processes including welding, nondestructive examinations, heat treating, and bending are performed using qualified and approved procedures and qualified personnel in accordance with applicable codes, standards and other specified criteria.

k) Examinations, Tests and Inspections

A repair / replacement plan, developed in accordance with Table 1.6.9, shall address all required information for performing examinations, tests and inspections including but not limited to:

1) Establishing hold points
2) Identifying procedures, methods, acceptance criteria
3) Defects identified, removal methods, welding, brazing, fusing, and material requirements, reference points used for identification
4) Evaluations of results
Examinations, tests and inspections shall be performed using trained and qualified personnel. Personnel records for qualification and training shall be available for review.

l) Test Control

Tests shall be performed using written procedures identifying prerequisites, acceptance limits, calibration, equipment, personnel qualifications, environmental conditions, and required documentation. Personnel responsibilities shall be described for performance, acceptance/inspection and documenting results.

m) Control of Measuring and Test Equipment

Procedures, methods and frequency of calibration shall be described for all types of measuring and test equipment used to verify quality. Controls shall ensure accuracy within specified limits. Any discrepancies shall be identified and resolved.

n) Handling, Storage and Shipping

Processes or procedures shall be established to prevent damage, deterioration or misuse of material, items or components used and stored. Controls for handling, shipping, storage, cleanliness and preservation shall be specified in the quality program.

o) Records

1) All quality related records shall be classified, identified, verified, maintained, distributed, retrievable and accessible. When the “NR” Certificate Holder is the owner, designated records and reports received by the owner, shall be filed and maintained in a manner to allow access by the Authorized Nuclear Inservice Inspector (ANII). Suitable protection from deterioration and damage shall be provided by the owner. These records and reports shall be retained as specified in the owner’s QAP for the lifetime of the component or system. Records to support evidence of activities affecting quality shall include as applicable:

   a. Inspections and acceptance criteria/results
   b. Tests performed and supporting reports
   c. Procedures/instructions
   d. Qualification of personnel, procedures, and equipment
   e. Types of observations and results
   f. Audits,
   g. Nonconformances, and:
   h. Corrective actions

2) The original of the completed Form NR-1 or Form NVR-1, as applicable, shall be registered with the National Board and, if required, a copy forwarded to the Jurisdiction where the nuclear power plant is located. A log for registration
shall be maintained in accordance with NBIC Part 3, 5.6.

p) Corrective Action

1) Measures shall be established to ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and other nonconformances are promptly identified and corrected.

2) In the case of significant conditions adverse to quality, the measures shall also ensure that the cause of these conditions be determined and corrected to preclude repetition. The identification of significant conditions adverse to quality, the cause, condition, and the corrective action taken shall be documented and reported to the appropriate levels of management.

3) Corrective action requirements shall also extend to the performance of subcontractors' activities.

Measures established to assure conditions adverse to quality are promptly identified and corrected and action taken to preclude repetition.

q) Inspection or Test Status

Measures shall be established to indicate inspection and test status of parts, items or components during repair/replacement activity. Measures shall include identification, procedures, control indicators (acceptable, unacceptable) and responsibility of personnel.

r) Nonconforming Material or Items

Measures to control material or items, nonconforming to specified criteria shall be established. Measures shall include identifying, controlling, documenting, reviewing, verifying, dispositioning and segregation when practical.

s) Audits

A system of planned and periodic audits shall be established to verify compliance of the Quality Assurance Program. Audits shall include written procedures, checklists, trained/qualified personnel not having direct responsibility for areas being audited, documentation, review by management and follow up actions when required. A comprehensive system of planned and periodic audits of the “NR” Certificate Holder’s Quality Assurance Program shall be performed. Audits shall include internal audits by the Certificate Holder and audits by the Authorized Inspection Agency. Audit frequency shall be specified in the organization’s Quality Assurance Manual. Audits shall be conducted at least annually to verify compliance with Quality Assurance Program requirements, performance criteria and to determine the effectiveness of the Quality Assurance Program. When no code work has been performed, the required annual audit need only include those areas of responsibility required to be continually maintained such as training, audits, organizational structure, Quality Assurance Program revisions, etc. The Quality Assurance Manual shall as a minimum describe the following:

1) Audits shall be performed in accordance with written procedures or checklists by qualified audit personnel not having direct responsibility in areas being audited;
2) Audit personnel shall be qualified in accordance with recognized standards, such as NQA-1;
3) Audit results shall be documented and reviewed by responsible management for adequacy and effectiveness of the quality assurance program
4) Requirements for follow-up actions for any deficiencies noted during the audit;
5) Audit records and applicable documentation shall be made available to the Authorized Nuclear Inspector for review;
6) Audit records shall include as a minimum:
   a. written procedures;
   b. checklists;
   c. reports;
   d. written replies; and
   e. completion of corrective actions.

t) Authorized Nuclear Inspector
   Qualifications and duties shall be as specified in ASME QAI-1 and NB-263, RCI-1 for the Authorized Inspection Agencies, Authorized Nuclear Inspector and the Authorized Nuclear Inspector Supervisor, for the Authorized Inspection Agencies, Authorized Nuclear Inspector and the Authorized Nuclear Inspector Supervisor. Additional requirements are specified in Sections 1.8.6.2 s), 1.8.7.2 s), and 1.6.8.9.

u) Exhibits
   Quality related forms and exhibits described in the Quality Assurance Program shall be identified, controlled and where applicable included as a reference document within the QAM or referenced procedures.

1.6.9 INTERFACE WITH THE OWNER’S REPAIR/REPLACEMENT PROGRAM (FOR CATEGORIES 1, 2, AND 3 AS APPLICABLE)

Interface with the owner’s repair/replacement program shall meet the following:

a) The “NR” Certificate Holder’s repair/replacement plan (see Table 1.6.9) shall be subject to the acceptance of the owner and the owner’s Authorized Nuclear Inservice Inspector (ANII) and shall be subject to review by the Jurisdiction and Regulatory Authorities having jurisdiction at the plant site.

b) Repair/Replacement activities of nuclear components shall meet the requirements of ASME Section III, ASME Section XI, and/or other applicable standard, and the owner’s requirements, and shall be subject to verification by the Jurisdiction and Regulatory Authorities having jurisdiction at the plant site.

c) Documentation of the repair/replacement activities of nuclear components shall be recorded on the Report of Repair/Replacement Activities of Nuclear Components and Systems for Nuclear Facilities, Form NR-1, or Report of Repair/Replacement
Activities for Nuclear Pressure Relief Devices, Form NVR-1, in accordance with the NBIC Part 3, Section 5. The completed forms shall be signed by a representative of the “NR” Certificate Holder and the Authorized Nuclear Inspector when the repair/replacement activity meets the requirements of this section. For repair/replacement activities that involve design changes, Form NR-1, or Form NVR-1, as applicable, shall indicate the organization responsible for the design or design reconciliation in accordance with the owner’s requirements.

d) The “NR” Certificate Holder shall provide a copy of the signed Form NR-1 or Form NVR-1, as applicable, to the owner, the Enforcement, and the Regulatory Authority if required, and the Authorized Nuclear Inspection Agency. The original Form NR-1 or Form NVR-1, as applicable, shall be registered with the National Board by the “NR” Certificate Holder. A NB registration log shall be maintained by the “NR” Certificate Holder. See NBIC Part 3, Section 5.5 and 5.6.

e) The “NR” Certificate Holder shall provide a nameplate/stamping for repair/replacement activities for each nuclear component unless otherwise specified by the owner’s Quality Assurance Program. The required information and format shall be as shown in NBIC Part 3, Section 5.

<table>
<thead>
<tr>
<th>Table 1.6.9</th>
<th>Repair/Replacement Plan Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Essential Requirements</td>
</tr>
<tr>
<td>A</td>
<td>Edition and/or addenda of codes</td>
</tr>
<tr>
<td>B</td>
<td>Identification of items</td>
</tr>
<tr>
<td>C</td>
<td>Performance of the Repair/Replacemn activity</td>
</tr>
<tr>
<td>D</td>
<td>Materials</td>
</tr>
<tr>
<td>E</td>
<td>Description of Repair/Replacement activity</td>
</tr>
<tr>
<td></td>
<td>Instruction</td>
</tr>
<tr>
<td>A</td>
<td>Including codes of construction, code cases, or standards used for the work performed, the NBIC Code edition, and the owner's requirements.</td>
</tr>
<tr>
<td>B</td>
<td>Description of items affected by the repair/replacement activity, including serial numbers, vendor identification, and code classes if applicable.</td>
</tr>
<tr>
<td></td>
<td>Location of installation if applicable.</td>
</tr>
<tr>
<td>C</td>
<td>Description of any defects, and nondestructive examination methods used to detect the defects</td>
</tr>
<tr>
<td></td>
<td>Defect removal method, measurement, and area identification/reference points.</td>
</tr>
<tr>
<td></td>
<td>Applicable welding/brazing procedures, heat treatment, nondestructive examination, and tests.</td>
</tr>
<tr>
<td></td>
<td>Final examination criteria to verify acceptability.</td>
</tr>
<tr>
<td></td>
<td>Preservice examination criteria if applicable.</td>
</tr>
<tr>
<td>D</td>
<td>Original specifications, new material specifications, including heat numbers, code edition/class and reconciliation requirements if applicable.</td>
</tr>
</tbody>
</table>
| E          | Include expected life of the item after completion if different from the original intended life as specified by the design specification. Application of the “NR” code symbol stamp if
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F</strong> Documentation</td>
<td>Generated as required by the quality assurance program and/or the owner's requirements.</td>
<td>Retention and submittal in accordance with the quality assurance program and/or the owner's requirements.</td>
</tr>
<tr>
<td><strong>G</strong> Evaluations/Acceptance</td>
<td>Evaluations/acceptance by the jurisdictional/regulatory authority as applicable.</td>
<td></td>
</tr>
<tr>
<td><strong>H</strong> Testing</td>
<td>Post repair/replacement testing criteria.</td>
<td>Test acceptance criteria to verify acceptability.</td>
</tr>
<tr>
<td><strong>I</strong> Design</td>
<td>When applicable, design documents shall be certified by qualified/certified engineer.</td>
<td></td>
</tr>
<tr>
<td><strong>J</strong> Authorized Inspection Agency</td>
<td>Authorized Nuclear Inspector review/acceptance.</td>
<td>Authorized Nuclear Inservice Inspector review/acceptance.</td>
</tr>
<tr>
<td><strong>K</strong> Responsibilities for review, verification, and acceptance</td>
<td>Design, quality, work performed, examination/test, and records.</td>
<td>Owner acceptance of the repair/replacement plan.</td>
</tr>
</tbody>
</table>

**NB16-0610**

**Part 3, 1.6.2 a)** An organization applying for an “NR” Certificate of Authorization shall have a written Quality Assurance Program (QAP) that details the specific requirements to be met based on the intended category of activities selected by that organization as described below and shown in Table 1.6.2. Controls used, including electronic capabilities, in the Quality Assurance Program shall be documented in a Quality Assurance Manual (QAM). Controls required to be included within the QAM shall include who, what, when, where, why and how with an understanding that the how can be a reference to an implementation procedure or instruction. Quality activities to be described in the Quality Assurance Program are identified in Section 1.6.5 of this part. Applicants shall address all requirements in their Quality Assurance Program based on the category of activity and scope of work to be performed (organization’s capabilities) to which certification is requested.

1) Category 1
Any ASME Section III Code certified item or system requiring repair/replacement activities irrespective of physical location and installation status prior to fuel loading.

2) Category 2
After fuel loading, any item or system under the scope of ASME Section XI requiring repair/replacement activities irrespective of physical location. Based on regulatory or jurisdictional acceptance, Category 2 may be used prior to fuel loading.

3) Category 3
Items constructed to codes or standards other than ASME other than those covered by Category 1 or Category 2, requiring repair/replacement activities.
irrespective of physical location, installation status and fuel loading.

b) Repair organizations performing repairs of pressure relief devices in nuclear service shall meet the additional requirements of NBIC Part 4, Section 4 and NBIC Part 4, Supplement 6.

<table>
<thead>
<tr>
<th>Category of Activity</th>
<th>Owner</th>
<th>Organizations other than Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>10 CFR Part 50 Appendix B, and ASME Section III NCA-4000 &amp; NQA-1, Part 1</td>
<td>10 CFR Part 50 Appendix B, and ASME Section III NCA-4000 &amp; NQA-1, Part 1</td>
</tr>
<tr>
<td>Category 2</td>
<td>10 CFR Part 50, Appendix B, or NQA-1, Part 1 and ASME Section XI, ANSI-31.42</td>
<td>10 CFR Part 50, Appendix B, supplemented as needed with Owner's QA program, or ASME NQA-1, Part 1; or ASME Section III, NCA-4000</td>
</tr>
<tr>
<td>Category 3</td>
<td>ASME NQA-1, Parts 1, or Specify the Standard to which certification is desired</td>
<td>ASME NQA-1, Parts 1, or Specify the Standard to which certification is desired</td>
</tr>
</tbody>
</table>

**Note 1:**

**Note 2:**
10 CFR 50 Appendix B – Title 10 of the Code of Federal Regulations Part 50 Appendix B describes the quality assurance criteria for nuclear plants and fuel reprocessing plants.

**Note 3:**
The Edition (and Addenda, as applicable) of NQA-1 to be utilized shall be the latest endorsed by the Regulatory Authority, or as specified in the Owner’s QA Program descriptions reviewed and approved by the Regulatory Authority.
### TABLE 1.6.2.1
**ACRONYMS**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>Applicant</td>
<td>An Organization applying for “NR” Certificate of Authorization (new or renewal)</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>Code</td>
<td>ASME Code of Construction, Section III, Division I, (NCA, NB, NC, ND, NE, NF, NG, and NH) or ASME Section XI Rules for Inservice Inspection of Nuclear Power Plant Components as applicable.</td>
</tr>
<tr>
<td>Jurisdiction</td>
<td>Enforcement Authority</td>
</tr>
<tr>
<td>NB</td>
<td>National Board of Boiler and Pressure Vessel Inspectors</td>
</tr>
<tr>
<td>NBC</td>
<td>National Board Inspection Code</td>
</tr>
<tr>
<td>NB-263, ROI-1</td>
<td>Rules for Commissioned Inspectors</td>
</tr>
<tr>
<td>NCA</td>
<td>ASME Section III, Subsection NCA, General Requirements for Division 1 and Division 2</td>
</tr>
<tr>
<td>NQA-1*</td>
<td>ASME Quality Assurance Requirements for Nuclear Facility Applications</td>
</tr>
<tr>
<td>NR</td>
<td>Nuclear Repair</td>
</tr>
<tr>
<td>“NR” CH</td>
<td>“NR” Certificate Holder</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>QAI-1</td>
<td>ASME Qualifications for Authorized Inspection</td>
</tr>
<tr>
<td>QAM</td>
<td>Quality Assurance Manual</td>
</tr>
<tr>
<td>QAP</td>
<td>Quality Assurance Program</td>
</tr>
<tr>
<td>QC</td>
<td>Quality Control</td>
</tr>
<tr>
<td>WA</td>
<td>ASME Section III, Division 3, Subsection WA, General Requirements</td>
</tr>
</tbody>
</table>

*Note:*

*Latest Edition(s) endorsed by the Regulatory Authority*

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**1.6.6.2 – Quality Program Elements (Category 1)**

**l) Control of Measuring and Test Equipment**

The provisions identified in ASME NQA-1, Part 1, Requirement 12 shall apply.

1. The “NR” Certificate Holder may perform periodic checks on equipment to determine calibration is maintained. When periodic checks are used the method and frequency shall be included in the “NR” Certificate Holder’s Quality Assurance Program and if discrepancies are found, shall be resolved to the prior periodic check.

2. The “NR” Certificate Holder may accept accreditation for calibration activities by National Voluntary Laboratory Accreditation Program (NVLAP), American Association for Laboratory Accreditation (A2LA) or other accrediting body recognized by NVLAP through the International Laboratory Accreditation Cooperation (ILAC) mutual recognition arrangement (MRA) provided the following requirements are met:


   b. Scope of the accreditation for the calibration laboratory covers needed measurement parameters, ranges and uncertainties;
c. “NR” Certificate Holder shall specify that calibration reports shall include, laboratory equipment/standards used and as found and as left data;

d. The “NR” Certificate Holder shall verify conformance to the requirements of this process; and e. Utilization of this process shall be described and documented in the “NR” Certificate Holders QAM.

1.6.7.2 – Quality Program Elements (Category 2)

l) Control of Measuring and Tests Elements

Control of Measuring and Test Equipment Measures shall be established and documented to ensure that tools, gages, instruments, and other measuring and testing equipment and devices used in activities affecting quality are of the proper range, type, and accuracy to verify conformance to established requirements. A procedure shall be in effect to ensure that they are calibrated and properly adjusted at specified periods or use intervals to maintain accuracy within specified limits. Calibration shall be traceable to known national standards, where these standards exist, or with the device manufacturer’s recommendation.

1.6.8.2 – Quality Program Elements (Category 3)

l) Control of Measuring and Test Equipment

Control of Measuring and Test Equipment Procedures, methods and frequency of calibration shall be described for all types of measuring and test equipment used to verify quality. Any discrepancies shall be identified and resolved.

Add to Category 1, 2, and 3 the following:

The “NR” Certificate Holder may utilize calibration and test activities performed by subcontractors when surveys and audits are performed. As an alternative to performing a survey and audit for procuring Laboratory Calibration and Test Services, the “NR” Certificate Holder as documented in their Quality Program may accept accreditation of an International Calibration and Test Laboratory Services by the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) provided this alternative method is described in the “NR” Certificate Holder’s Quality Program and the following requirements are met:

a) The “NR” Certificate Holder shall review and document verification that the supplier of calibration or test services was accredited by an accredited body recognized by the ILAC MRA encompassing ISO/IEC-17025:2005, “General Requirements for the Competence of Testing and Calibration Laboratories”;

b) For procurement of calibration services, the published scope of accreditation for the calibration laboratory covers the needed measurement parameters, ranges and uncertainties.

c) For procurement of testing services, the published scope of accreditation for
the test laboratory covers the needed testing services including test methodology and tolerances/uncertainty.

d) The "NR" Certificate Holder’s purchase documents shall include:
1) Service provided shall be in accordance with their accredited ISO/IEC-17025:2005 program and scope of accreditation;
2) As-found calibration data shall be reported in the certificate of calibration when items are found to be out-of-calibration;
3) Standards used to perform calibration shall be identified in the certificate of calibration;
4) Notification of any condition that adversely impacts the laboratories ability to maintain the scope of accreditation;
5) Any additional technical and/or quality requirements, as necessary, which may include; tolerances, accuracies, ranges, and standards.
6) Service suppliers shall not subcontract services to any other supplier.

e) The "NR" Certificate Holder shall upon receipt inspection, validate that the laboratory documentation certifies that:
1) Services provided by the laboratory has been performed in accordance with their ISO/IEC-17025:2005 program and performed within their scope; and
2) Purchase order requirements have been met.

| 17-154 | v) Audits |
| 17-154 Part 3, 1.6.6.2 r) | The provisions identified in ASME NQA-1, Part 1, and Requirement 18 shall apply and shall include the following:
A comprehensive system of planned and periodic internal audits of the "NR" Certificate Holder’s Quality Assurance Program shall be performed by the “NR” Certificate Holder. Audits shall include internal audits by the Certificate Holder and audits by the Authorized Inspection Agency. Audit frequency shall be specified in the organization’s Quality Assurance Manual. Audits shall be conducted at least annually for any ongoing code activity to verify compliance with Quality Assurance Program requirements, performance criteria and to determine the effectiveness of the Quality Assurance Program. When no code work has been performed, the required annual audit need only include those areas of responsibility required to be continually maintained such as training, audits, organizational structure, and Quality Assurance Program revisions. The Quality Assurance Manual shall as a minimum describe the following: |

| 17-154 | f) Nondestructive examination reports, including results of examinations, shall identify the ASNT, SNT-TC-1A, CP-189, or ACCP name and certification level of personnel interpreting the examination results. |
| 17-154 Part 3, 1.6.7.2 n) 2) | f. |

| 17-154 | r) Audits |
| 17-154 Part 3, | A comprehensive system of planned and periodic internal audits of the “NR” Certificate Holder’s Quality Assurance Program shall be performed by each organization. Audits |
A system of planned and periodic audits of the “NR” Certificate Holder’s Quality Assurance Program shall be established to verify compliance of the Quality Assurance Program. Audits shall include; written procedures, checklists, trained/qualified personnel not having direct responsibility for areas being audited, documentation, review by management and follow up actions when required.
person applying the material joining process. Welding, brazing and fusing shall be performed in accordance with Welding Procedure Specifications (WPS) procedure specifications for welding (WPS), brazing (BPS), and fusing (FPS) qualified in accordance with the original code of construction or the construction standard or code selected. When this is not possible or practicable, the WPS procedure specification may be qualified in accordance with ASME Section IX.

2.2.3 PERFORMANCE QUALIFICATION
Welders and welding operators shall be qualified for the welding processes that are used. The “R” Certificate Holder shall qualify the performance of personnel for each process they will use for repairs and alterations of pressure retaining items. Such qualification shall be in accordance with the requirements of the original code of construction, the construction standard, code selected, or ASME Section IX. Use of a Standard Welding Procedure Specification shown in NBIC Part 3, 2.3 is permitted for performance qualification testing.

2.2.4 WELDING QUALIFICATION RECORDS
The “R” Certificate Holder shall maintain a record of the results obtained in Welding Procedure Qualifications, procedure specification qualification (except for those qualifications for which the provisions of NBIC Part 3, 2.2.2 are used) and of the results obtained in welding performance qualifications. These records shall be certified by the “R” Certificate Holder and shall be available to the Inspector.

2.2.5 WELDER’S QUALIFIED PERSONNEL IDENTIFICATION
The “R” Certificate Holder shall establish a system for the assignment of a unique identification mark to each welder/welding operator person qualified in accordance with the requirements of the NBIC. The “R” Certificate Holder shall also establish a written procedure whereby welded production joints are identified and traceable to the person as to the welder or welding operator who made them. This procedure shall use one or more of the following methods and be acceptable to the Inspector.

a) The welder’s or welding operator’s person’s identification mark may be stamped (low stress stamp, if used) adjacent to welded production joints made by the individual, or

b) The “R” Certificate Holder may keep a documented record of welded production joints and the welders or welding operators persons used in making the joints.

2.2.6 WELDER’S CONTINUITY OF QUALIFIED PERSONNEL
The performance qualification of a welder or welding operator qualified person shall be affected when one of the following conditions occur:

a) When the welder or welding operator person has not welded using a specific process during a period of six months or more, their qualifications
for that process shall expire; or
b) When there is specific reason to question a welder’s ability to make welds that meet the specification, the qualification which supports the welding process that is being performed shall be revoked. All other qualifications not questioned remain in effect.

2.2.6.1 WELDER’S PROCESS CONTINUITY RECORDS
a) The “R” Certificate Holder shall maintain a welding process continuity records and shall make the records available to the Inspector.
b) The method of recording welding process continuity and the record retention period shall be described in the “R” Certificate Holder’s Quality System Manual.
c) When there is specific reason to question a welder’s person’s ability to make welds that meet the specification, the qualification which supports the welding process that is being performed shall be revoked. All other qualifications not questioned remain in effect.

2.5 HEAT TREATMENT

2.5.1 PREHEATING
a) Preheating may be employed during welding use of a process to assist in completion of the welded joint. The need for and the temperature of preheat are dependent on a number of factors such as chemical analysis, degree of restraint of the items being joined, material thickness, and mechanical properties. The Welding Procedure Specification procedure specification for the material being welded joined shall specify the preheat temperature requirements.
b) See minimum temperatures for preheating given in NBIC Part 3, Table 2.5.1 as a general guide. It is cautioned that the preheating temperatures listed may not be the same as those of the original code of construction and do not necessarily ensure satisfactory completion of the welded joint. Requirements for individual materials within the P-Number listing may have preheating requirements more or less restrictive than this general guide. When reference is made in this section to materials by the ASME designation, P-Number and Group Number, the suggestions of this section apply to the applicable materials of the original code of construction, either ASME or other, which conform by chemical composition and mechanical properties to ASME materials having the ASME P-Number and Group Number designations.

PART 3, SECTION 9
REPAIRS AND ALTERATIONS—GLOSSARY OF TERMS

9.1 DEFINITIONS
Add the following:
Brazing – see Welding
Fusing – see Welding

Welding (Brazing, Fusing) – a group of processes which produce a localized coalescence of metallic or nonmetallic materials.

<table>
<thead>
<tr>
<th>18-14</th>
<th>2.3 STANDARD WELDING PROCEDURE SPECIFICATIONS</th>
</tr>
</thead>
</table>
| Part 3, 2.3 and Table 2.3 | a) One or more SWPSs from NBIC Part 3, Table 2.3 may be used as an alternative to one or more WPS documents qualified by the organization making the repair or alteration, provided the organization accepts by certification (contained therein) full responsibility for the application of the SWPS in conformance with the application as stated in the SWPS. When using SWPSs, all variables listed on the Standard Welding Procedure are considered essential and, therefore, the repair organization cannot deviate, modify, amend, or revise any SWPSs. US Customary Units or metric units may be used for all SWPSs in NBIC Part 3, Table 2.3, but one system shall be used for application of the entire SWPS in accordance with the metric conversion table contained in the SWPS. The user may issue supplementary instructions as allowed by the SWPS. Standard Welding Procedures Specifications shall not be used in the same product joint together with the other Standard Welding Procedure Specifications or other welding procedure specifications qualified by the organization.

b) The AWS reaffirms, amends or revises SWPSs in accordance with ANSI procedures.

- **Reaffirmed SWPSs**: When reaffirmation occurs without revision to the SWPS, the letter R is added to the SWPS designation.
- **Amended SWPSs**: When an amendment occurs the suffix “AMD1” is added to the SWPS designation. Amendments are issued when essential for the prompt correction of an error that could be misleading. Amendments are incorporated into the existing text of the SWPS, which is reprinted and clearly marked as incorporating an amendment(s), and which is identified in the revised Foreword of the amended SWPS.
- **Revised SWPSs**: When a revision to a published SWPS occurs, the publication date is added to the SWPS designation. The date of the superseded SWPS is also noted on the cover page. Previous versions of the superseded SWPS may be used at the option of the R Certificate holder.

SMAW — Shielded Metal Arc Welding

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E7018, As-Welded or PWHT Condition.</td>
<td>B2.1.016-94 and B2.1-1-016-94R</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010, As-Welded or PWHT Condition.</td>
<td>B2.1.017-94 and B2.1-1-017-94R</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Uphill) followed by E7018, As-Welded or PWHT Condition.</td>
<td>B2.1.1-022-94 and B2.1.1-022-94R</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Downhill) followed by E7018, As-Welded or PWHT Condition.</td>
<td>B2.1.1-026-94 and B2.1.1-026-94R</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Uphill) As-Welded Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-201-96, and B2.1.1-201-96(R2007)</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-202-96(R2007)</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-203-96 and B2.1.1-203-96(R2007)</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical downhill root with balance vertical uphill), As-Welded Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-204-96 and B2.1.1-204-96(R2007)</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Uphill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-205-96 and B2.1.1-205-96(R2007)</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-206-96 and B2.1.1-206-96(R2007)</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-208-96</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td>B2.1.1-208-96(R2007)</td>
</tr>
</tbody>
</table>

**GTAW — Gas Tungsten Arc Welding**

| Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application. | B2.1-1-207-96 |
| Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application. | B2.1-1-207-96(R2007) |
| Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, INMS1 and ER70S-2, As-Welded or | B2.1-1-210-96 |
### FCAW — Flux Core Arc Welding

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, INMs1-1, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td></td>
<td>B2.1.1-210:2001 R2012</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, E71T-8, As-Welded Condition.</td>
<td></td>
<td>B2.1.1-018-94 and B2.1.1-018-94R</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, E70T-1M and E71T-1M, As-Welded or PWHT Condition.</td>
<td></td>
<td>B2.1.1-019-94, B2.1.1-019-94R and B2.1.1-019-94 AMD1</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification (SWPS) for Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 1/2 in. (38 mm) Thick, E7XT-XM, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
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<td>B2.1.1-234:2006</td>
</tr>
</tbody>
</table>

### GMAW — Gas Metal Arc Welding

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 1/2 in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td></td>
<td>B2.1.1-233:2006</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 1/2 in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td></td>
<td>B2.1.1-235:2006</td>
</tr>
</tbody>
</table>

### GTAW/SMAW Combination of Welding Processes

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 1/2 in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition.</td>
<td></td>
<td>B2.1.1-209-96 R(2007)</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td></td>
<td>B2.1.1-209-96</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 1/2 in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td></td>
<td>B2.1.1-211-96</td>
</tr>
<tr>
<td>Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, INMs1 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.</td>
<td></td>
<td>B2.1.1-210:2001 R2012</td>
</tr>
</tbody>
</table>
### Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root
Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, INMs-1, ER70S-2, and E7018 As-Welded or PWHT Condition, Primarily Pipe Applications.


### GMAW/FCAW – Combination of Welding Processes


### Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) Followed by Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (m-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3 and EXT-X, As-Welded or PWHT Condition, Primarily Pipe Applications.

#### Austenitic Stainless Steel — (M8/P8/S8 Materials)

### SMAW — Shielded Metal Arc Welding

| B2.1-8-023-94 |

### GTAW — Gas Tungsten Arc Welding

| B2.1-8-024-94 |
| B2.1-8-024:2001 |
| B2.1-8-212-97 |

### Combination Processes GTAW/SMAW

| B2.1-8-025-94 |
| B2.1-8-025:2001 |
| B2.1-8-214-97 |
e) Nondestructive Examination of Welds

Prior to welding, the area prepared for welding shall be examined using either the Magnetic Particle (MT) or the Liquid Penetrant (PT) examination method to determine that no defects exist. After the finished weld has reached ambient temperature, and, when required by the specific welding method, the surface temper bead reinforcement layer has been removed substantially flush with the surface of the base metal, the weld shall be examined again by either of the above methods to determine that no defects exist using acceptance standards acceptable to the Inspector or original code of construction. In addition, welds greater than 3/8 in. (10 mm) deep or welds in a boiler, pressure vessel, or piping system pressure retaining item that were originally required to
be **radiographed volumetrically examined** by the rules of the original code of construction, shall be **radiographically examined in accordance with paragraph 4.2 of Part 3**. In situations where it is not practical to perform radiography, the accessible surfaces of each non-radiographed repair weld shall be fully examined using the MT or PT method to determine that no defects exist and the maximum allowable working pressure and/or allowable temperature shall be re-evaluated to the satisfaction of the jurisdiction at the location of installation.

<table>
<thead>
<tr>
<th>17-152 Part 3, 2.5.3.2 d) 4)</th>
<th>2.5.3.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4) For ASME Section VIII, Division 2 pressure vessels, where application of PWHT on in-service vessels has been demonstrated to cause harm to vessel material, full thickness temper bead repairs are permitted to pressure-retaining items of P-No. 4 and P-No. 5A materials. They shall be completed per NBIC Part 3, 3.3.5 with the following requirements:</td>
<td></td>
</tr>
<tr>
<td>4) Full thickness temper bead weld repairs are permitted to pressure retaining items of P-No 4 and P-No 5A materials under the following conditions;</td>
<td></td>
</tr>
<tr>
<td>a) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on in-service vessels has been demonstrated to cause harm to vessel material.</td>
<td></td>
</tr>
<tr>
<td>b) For <strong>tube-to-header</strong> welds in steam service.</td>
<td></td>
</tr>
</tbody>
</table>

**Full thickness weld repairs** above shall be completed per NBIC Part 3, 3.3.5 with the following requirements:

1. The full thickness repair weld shall be verified as being the full penetration.
2. Volumetric examination of the full thickness weld shall be performed.

<table>
<thead>
<tr>
<th>17-170 Part 3, 2.5.3.4 a)</th>
<th>2.5.3.4 WELDING METHOD 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>When using this method, the following is required:</td>
<td></td>
</tr>
<tr>
<td>a) This method is limited to repair welds in pressure retaining items for which the applicable rules of the original code of construction did not require notch toughness testing. The repair depth for temper bead repairs to pressure retaining items is limited to welds not penetrating though the full thickness.</td>
<td></td>
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</table>

**Full thickness temper bead weld repairs are permitted under the following conditions;**

1) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on in-service vessels has been demonstrated to cause harm to vessel material.
2) For **tube-to-header** welds in steam service.
**Full thickness weld repairs** shall be completed per NBIC Part 3, 3.3.5 with the following requirements:

1) The full thickness repair weld shall be verified as being full penetration.
2) Volumetric examination of the full thickness weld shall be performed.

**2.5.3.6 WELDING METHOD 6**

This welding method provides requirements for welding only Grade 91 tube material within the steam boiler setting, and when it is impracticable to perform local postweld heat treatment (PWHT). When using this welding method, the following applies:

1) The welding shall be limited to the SMAW and/or GTAW processes, manual or automatic, using suitably controlled maintenance procedures to avoid contamination by hydrogen producing sources. The surface of the metal shall be free of contaminants and kept dry.

**u) Repairs to plate heat exchangers (PHE) are limited to the following:**

1. Welding on any pressure part, i.e. not limited to a flange, nozzle, or endplate;
2. In kind replacement of endplates, or welded nozzles,
3. Replacement of any failed connection or frame bolting, representing the replacement parts described in Part 3, 3.2.2-a), with no change of material or grade as described on the Manufacturer’s Data Report (MDR) or Original Equipment Manufacturer’s (OEM) drawing,
4. The addition or repair of load bearing attachments (e.g., welded supports or lifting lugs) to the endplates,
5. Replacement of parts bearing certification or manufacturer’s stamping with no change in material allowed as described on the MDR or verifiable OEM drawing.

**d) The pressure-retaining item has been pressure tested, as required, for the new service conditions. Any insulation, coatings, or coverings that may inhibit or compromise a meaningful pressure test shall be removed, to the extent identified by the Inspector. The pressure test may be waived if the original pressure test as recorded on the Manufacture’s Data Report is at least equal to the calculated test pressure required to verify the integrity of the pressure-retaining item for the new conditions. If the pressure test is waived it shall be documented on Form R-2 with this statement in the Remarks section: “Pressure test waived in accordance with NBIC Part 3, 3.4.1 d).”**

**3.4.4 EXAMPLES OF ALTERATIONS**

- **a)** An increase in the maximum allowable working pressure (internal or external) or temperature of a pressure-retaining item regardless of whether or not a physical change was made to the pressure-retaining item;
- **b)** A decrease in the minimum temperature;
- **c)** The addition of new nozzles or openings in a boiler or pressure vessel except those classified as repairs;
- **d)** A change in the dimensions or contour of a pressure-retaining item;
- **e)** In a boiler, an increase in the heating surface or steaming capacity as described on the original Manufacturer’s Data Report (MDR);
<p>| | |</p>
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<tbody>
<tr>
<td>f)</td>
<td>The addition of a pressurized jacket to a pressure vessel;</td>
</tr>
<tr>
<td>g)</td>
<td>Except as permitted in NBIC Part 3, 3.3.3 s), replacement of a pressure retaining part in a pressure retaining item with a material of different allowable stress or nominal composition from that used in the original design;</td>
</tr>
<tr>
<td>h)</td>
<td>The addition of a bracket or an increase in loading on an existing bracket that affects the design of the pressure-retaining item to which it is attached;</td>
</tr>
<tr>
<td>i)</td>
<td>The replacement of a pressure relieving device (PRD) as a result of work completed on a pressure-retaining item (PRI) that changes the resultant capacity to exceed the minimum required relieving capacity (MRRC) required by the original code of construction as described on the original Manufacturer’s Data Report.</td>
</tr>
<tr>
<td>j)</td>
<td>For plate heat exchangers, in addition to all the applicable examples of alterations above, the following changes from what is listed on the MDR or described on the Original Equipment Manufacturer’s (OEM)-drawing:</td>
</tr>
<tr>
<td></td>
<td>1) For heat transfer plates:</td>
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<tr>
<td></td>
<td>a) A change in material grade or nominal thickness;</td>
</tr>
<tr>
<td></td>
<td>b) A reduction in number beyond any minimum, or when no minimum is specified;</td>
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<tr>
<td></td>
<td>c) An increase in number beyond any maximum, or when no maximum is specified;</td>
</tr>
<tr>
<td></td>
<td>d) A change in model type;</td>
</tr>
<tr>
<td></td>
<td>2) Any change in material whether described at 3.3.3 s) or as described at 3.4.4 g):</td>
</tr>
<tr>
<td></td>
<td>a) A change in connection bolt or frame compression bolt diameter or material grade;</td>
</tr>
<tr>
<td></td>
<td>b) A change in material grade or nominal dimensions of any end plates or nozzles.</td>
</tr>
</tbody>
</table>

**NB16-0810**

**PART 3, 3.4.4 E)**

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<table>
<thead>
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<tbody>
<tr>
<td>e)</td>
<td>In a boiler, an increase in the heating surface or steaming capacity as described on the original Manufacturer’s Data Report;</td>
</tr>
<tr>
<td>e)</td>
<td>In a boiler, Heat Recovery Steam Generator (HRSG), or Pressure Retaining Item (PRI), an increase in the steaming capacity by means of increasing heating surface, total heat input, firing rate, adjustment, or other modification to the primary or auxiliary heat source, resulting in the steaming capacity exceeding the original Manufacturer’s Minimum RequiredRelieving Capacity (MRRC) as described on the nameplate and or Manufacturer’s Data Report (MDR);</td>
</tr>
</tbody>
</table>
Pressure tests shall be conducted using water or other liquid medium. The test pressure shall be the minimum required to verify the leak tightness integrity of the repair. The test pressure shall not exceed the maximum liquid test pressure of the original code of construction. When original test pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance.

1) Based on the nature and scope of the alterations activity, one or a combination of the following examination and test methods shall be applied to alterations (unless waived in accordance with 3.4.1 d) of this Part) and replacement parts used in alterations.

"R" or “NR” Certificate Holders shall maintain a log or multiple logs documenting unique and sequentially numbered Form “R” Reports that are registered with the National Board. The logs shall include as a minimum, each form’s unique registration number, form type (R-1, R-2, NR-1, etc.), description of work performed, date completed of acceptance by the Authorized Inspection Agency, and date the report was sent submitted to the National Board.

PART 3, SECTION 5
REPAIRS AND ALTERATIONS —
CERTIFICATION/DOCUMENTATION AND STAMPING

5.1 SCOPE

This section provides requirements for certification, stamping, and documentation of repairs and alterations to pressure-retaining items. Applicable forms are provided in this section for reference. Forms may be obtained from the National Board website.

5.2 DOCUMENTATION

a) Repairs that have been performed in accordance with the NBIC shall be documented on a Form R-1, Report of Repair, as shown in this section. A Form R-4, Report Supplementary Sheet, shall be used as needed to record additional data when the space provided on Form R-1 is not sufficient.

b) Alterations performed in accordance with the NBIC shall be documented on a Form R-2, Report of Alteration, as shown in this section. A Form R-4, Report Supplementary Sheet, shall be used as needed to record additional data when the space provided on Form R-2 is not sufficient.

c) The organization performing repairs and alterations shall retain a copy of the completed Form “R” Report on file and all records and documentation substantiating the summary of work as described throughout Section 5, and as identified in the “R” Certificate.
5.2.1 PREPARATION OF FORM R-1 (REPAIRS) REPORT OF REPAIR

a) Using the instructions found at NBIC Part 3, 5.12.4.1 preparation of Form R-1 shall be the responsibility of the “R” Certificate Holder performing the repair.

b) Information describing the scope of work used to repair a pressure-retaining item (PRI) shall be documented on a Form R-1 and extended to a Form R-4 as needed to fully describe the repair activities completed per the instructions at NBIC Part 3, 5.12.4.1.

c) An Inspector shall indicate acceptance by signing Form R-1, and Form R-4, if attached.

d) The Form R-3, Report of Parts Fabricated by Welding, Manufacturer’s Data Reports, and Certificates of Compliance described in this section shall be a part of the completed Form R-1 and shall be attached thereto.

5.2.2 PREPARATION OF FORM R-2 (ALTERATIONS) REPORT OF ALTERATION

a) Using the instructions found at NBIC Part 3, 5.12.4.2, initial preparation of Form R-2 shall be the responsibility of the “R” Certificate Holder responsible for the design portion of the alteration. The design organization shall complete and sign the “Design Certification” section of the Form R-2. An Inspector shall indicate acceptance of the design by signing the “Certificate of Design Change Review” section of the Form R-2.

b) The information describing an alteration to a pressure-retaining item shall be identified on Form R-2 with a complete description of the scope of work for physical or non-physical changes. When the scope of work represents a change that will increase the Minimum Required Relieving Capacity (MRRC) of a pressure-retaining item, such as a change in heating surface, Maximum Designed Steaming Capacity (MDSC), or BTU/hr (W) heating capacity, the new MRRC shall be documented on Form R-2 and indicated on the appropriate nameplate of NBIC Part 3, Figure 5.7.5-b or NBIC Part 3, Figure 5.7.5-c.

c) Final preparation of Form R-2, including gathering and attaching supporting reports, shall be the responsibility of the “R” Certificate Holder that performed the construction portion of the alteration. The construction organization shall complete the Form R-2 provided by the design organization, including the “Construction Certification” section of the form. An Inspector shall indicate that the work complies with the applicable requirements of this code by completing and signing the “Certificate of Inspection” section of the form. When no construction work is performed (e.g., a re-rating with no physical changes), the “R” Certificate Holder responsible for the design shall prepare the Form R-2, including gathering and attaching of supporting reports documentation.
d) The following shall be attached to and become a part of completed Form R-2:

1) For ASME boilers and pressure vessels, a copy of the original Manufacturer’s Data Report, when available;

2) Form R-3, Report of Parts Fabricated by Welding, Manufacturer’s Partial Data Reports, or Certificates of Compliance, if applicable; and

3) For other than ASME, the manufacturer’s reports (i.e., reports required by the original code of construction, etc.), when available.

5.2.3 PREPARATION OF FORM R-3 REPORT OF PARTS FABRICATED BY WELDING

a) Using the instructions found at NBIC Part 3, 5.12.4.3 preparation of Form R-3 shall be the responsibility of the “R” Certificate Holder responsible for performing the work.

5.2.4 PREPARATION OF FORM R-4 REPORT SUPPLEMENTARY SHEET

a) Using the instructions found at NBIC Part 3, 5.12.4.4 preparation of Form R-4 shall be the responsibility of the “R” Certificate Holder responsible for performing the work.

SKIP 5.3 through 5.11

5.12 REPAIR AND ALTERATION FORMS AND INSTRUCTIONS FOR COMPLETING FORMS

The following forms may be used for documenting specific requirements as indicated on the top of each form.

5.12.1 FORM R-1, REPORT OF REPAIR, NB-66
5.12.2 FORM R-2, REPORT OF ALTERATIONS, NB-229
5.12.3 FORM R-3, REPORT OF PARTS FABRICATED BY WELDING, NB-230
5.12.4 FORM R-4, REPORT SUPPLEMENTARY SHEET, NB-231
5.12.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM “R” REPORTS R-1
These instructions are to be used when completing the National Board Form “R” Reports R-1, Report of Repair. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form “R” Reports R-1 shown in NBIC Part 3, 5.12.1 through 5.12.4. The numbers below correspond to the “circled” numbers shown on the Form R-1. Note that a fillable version of the Form R-1 (NB-66,) is available on the National Board website, www.nationalboard.org.

INFO NOTE: DELETE NUMBERS 1 THROUGH 55 and INSERT 1 THROUGH 40 LISTED BELOW ALONG WITH 5.12.4.2, 5.12.4.3, and 5.12.4.4

1) Initials of the authorized representative of the “R” Certificate Holder.

2) Initials of the Inspector reviewing the “R” Certificate Holders work

3) When registering a Form R-1 Report with the National Board, this line is solely designated for a unique sequential number assigned by the “R” Certificate Holder. When the “R” Form is not to be registered, indicate so by “N/A”. As described in NBIC Part 3, 5.6, a log shall be maintained identifying sequentially, any Form “R” registered with the National Board.

4) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

5) The name and address of the National Board “R” Certificate Holder performing the work as it appears on the “Certificate of Authorization”.

6) Name and address of the owner of the pressure-retaining item.

7) Name and address of plant or facility where the pressure-retaining item is installed.

8) Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.

9) Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by “unknown.”

10) Document the serial number of the pressure-retaining item if assigned by the original manufacturer. If there is no serial number assigned or is unknown, indicate “unknown.”

11) When the pressure-retaining item is registered with the National Board, document the applicable registration number. If the pressure-retaining item is installed in Canada, indicate the Canadian design registration number (CRN), and list the drawing number under “other.” If the item is not registered, indicate “none.”

12) Indicate the jurisdiction number assigned to the pressure retaining item, if available.

13) Indicate any other unique identifying nomenclature assigned to the pressure retaining
item by the owner or user.

14) Identify the year in which fabrication/construction of the pressure retaining item was completed.

15) Indicate edition and addenda of the NBIC under which this work is being performed.

16) Indicate the name, section, division, edition, and addenda (if applicable) of the original code of construction for the pressure-retaining item.

17) Indicate the name, section, division, edition, and addenda (if applicable) of the construction code used for the work being performed. If code cases are used, they shall be identified in the “Remarks” section.

18) Check the repair type performed on the pressure retaining item.

19) Provide a detailed summary describing the scope of work that was completed to a pressure retaining item (PRI). The information to be considered when describing the scope of work should include such items as, the nature of the repair (i.e. welding, bonding, cementing), the specific location of the work performed to the PRI, the steps taken to remove a defect or as allowed by 3.3.4.8 to remain in place, the method of repair described as listed in the examples of Part 3, Section 3 or supplemental section if applicable, and the acceptance testing and or examination method used in accordance with the NBIC. When additional space is required to describe the scope of work, a Form R-4 shall be used and attached (check box). If a FITNESS FOR SERVICE Form (NB-403) is part of the Form R-1 repair package, check box and attach the form. Information determined to be of a proprietary nature need not be included, but shall be stated on the form.

20) Indicate type of pressure test applied (Liquid, Pneumatic, Vacuum, Leak). If no pressure test applied, indicate “none.”

21) Indicate test pressure applied.

22) Indicate maximum allowable working pressure (MAWP) for the pressure retaining item, if known.

23) As applicable, identify what Replacement Parts manufactured by welding or bonding were introduced as needed to complete the scope of work. Indicate part, item number, manufacturer’s name, stamped identification, and data report type or Certificate of Compliance.

24) Indicate any additional information pertaining to the work involved (e.g., routine repairs, code cases).

25) When registering a Form R-1 Report with the National Board, this line is solely designated for a unique sequential number assigned by the “R” Certificate Holder. When the “R” Form is not to be registered, indicate so by “N/A”. As described in NBIC Part
3. 5.6. a log shall be maintained identifying sequentially, any Form “R” registered with the National Board.

26) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

27) Type or print name of authorized representative of the “R” Certificate Holder attesting to accuracy of the work described.

28) Indicate National Board “R” Certificate or Authorization number.

29) Indicate month, day, and year that the “R” Certificate or Authorization expires.

30) Record name of “R” Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.

31) Signature of “R” Certificate Holder authorized representative.

32) Enter month, day, and year repair certified.

33) Type or print name of Inspector.

34) Indicate Inspector’s Jurisdiction.

35) Indicate Inspector’s employer.

36) Indicate address of Inspector’s employer (city and state or province).

37) Indicate month, day, and year of final inspection by Inspector. For routine repairs this shall be the month, day, and year the Inspector reviews the completed routine repair package.

38) Inspector’s National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

39) Signature of Inspector.

40) Indicate month, day, and year of Inspector signature.

5.12.4.2 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-2 REPORT

INFO NOTE: THE FORM R-2 ON PAGE 91 DOES NOT HAVE THE “BUDDLED’
These instructions are to be used when completing the National Board Form R-2, Report of Alteration. The numbers below correspond to the “circled” numbers depicted on Form R-2 in NBIC Part 3, 5.12.2. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-2 Report of Alteration. Note that a fillable version of the Form R-2 (NB-229) is available on the National Board website.

1) Initials of the National Board “R” Certificate of Authorization authorized representative who registers the Form R-2.

2) Initials of the Inspector who certified the completed Form R-2 for registration.

3) When registering a Form R-2 with the National Board, this line is solely designated for a unique sequential number assigned by the “R” Certificate Holder. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form “R” reports that are registered with the National Board. For rerating only, the Design Organization registers the Form R-2.

4) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

5) The name and address of the National Board “R” Certificate of Authorization holder performing the design as it appears on the “Certificate of Authorization.”

6) The name and address of the National Board “R” Certificate of Authorization holder performing the construction activity as it appears on the “Certificate of Authorization.”

7) Name and address of the owner of the pressure retaining item.

8) Name and address of the plant or facility where the pressure retaining item is installed.

9) Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.

10) Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by “unknown.”

11) Document the serial number of the pressure-retaining item if assigned by the original manufacturer. If there is no serial number assigned or it is unknown, indicate “unknown.”

12) When the pressure-retaining item is registered with the National Board, document the applicable registration number. If the pressure-retaining item is installed in Canada, indicate the Canadian design, registration number (CRN), and list the drawing number under “other.” If the item is not registered, indicate “none.”

13) Indicate the jurisdiction number assigned to the pressure retaining item, if available.
14) Indicate any other unique identifying nomenclature assigned to the pressure retaining item by the owner or user.

15) Identify the year in which fabrication/construction of the pressure retaining item was completed.

16) Indicate edition and addenda of the NBIC under which this work is being performed, as applicable.

17) Indicate the name, section, division, edition, and addenda (if applicable) of the original code of construction for the pressure-retaining item.

18) Indicate the name, section, division, edition, and addenda (if applicable) of the construction code used for the work being performed. If code cases are used, they shall be identified in the “Remarks” section.

19) Provide a detailed summary of the scope of design that was performed. When additional space is required to describe the design scope, a Form R-4 shall be used and attached (check box if needed).

20) The information to be considered when describing the construction scope of work should include such items as, the nature of the alteration (i.e. welding, bonding, cementing), the specific location of the work performed to the pressure retaining item, the steps taken to remove a defect or as allowed by NBIC Part 3, Paragraph 3.3.4.8 to remain in place, and the method of alteration described as listed in the examples of NBIC Part 3, Paragraph 3.4.4 or applicable supplement. When additional space is required to describe the construction scope, a Form R-4 shall be used and attached (check box if needed).

21) Indicate type of pressure test applied (liquid, pneumatic, vacuum, leak). If no pressure test applied, indicate "none."

22) Indicate test pressure applied.

23) Indicate maximum allowable working pressure (MAWP) for the pressure retaining item. (As altered)

24) When registering a Form R-2 with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. For rerating only, the Design Organization registers the Form R-2.

25) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

26) As applicable, identify what parts manufactured by welding or bonding were
introduced as needed to complete the scope of work. Indicate part, item number, manufacturer's name, stamped identification, and data report type or Certificate of Compliance.

27) Indicate any additional information pertaining to the work involved (e.g. code cases, interpretations used).

28) Type or print name of the National Board “R” Certificate of Authorization authorized representative responsible for design certification.

29) Indicate National Board “R” Certificate or Authorization number.

30) Indicate month, day, and year that the “R” Certificate or Authorization expires.

31) Indicate month, day, and year the alteration was certified.

32) Record the name of National Board “R” Certificate of Authorization holder who performed the design portion of the work, using full name as shown on the “Certificate of Authorization” or an abbreviation acceptable to the National Board.

33) Signature of National Board “R” Certificate of Authorization authorized representative for the design change.

34) Type or print the name of Inspector certifying the design review.

35) Indicate Inspector’s Jurisdiction.

36) Indicate Inspector’s employer.

37) Indicate address of Inspector’s employer (city and state or province).

38) Indicate the month, day and year of the design certification by the Inspector.

39) Signature of the Inspector certifying the design review.

40) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

41) Type or print name of the National Board “R” Certificate of Authorization authorized representative responsible for any construction.

42) Indicate the National Board “R” Certificate or Authorization number.

43) Indicate month, day, and year the National Board “R” Certificate of Authorization expires.

44) Indicate the date the alteration was certified.

45) Record the name of National Board “R” Certificate of Authorization holder who performed the construction portion of the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.


47) Type or print the name of Inspector certifying the construction inspection.

48) Indicate the Inspector’s Jurisdiction.

49) Indicate Inspector’s employer.

50) Indicate address of Inspector’s employer (city and state or province).

51) Indicate the month, day and year of the final inspection by the Inspector.
52) Indicate the month, day and year the completed Form R-2 was signed by the Inspector.

53) Signature of the Inspector certifying the construction inspection.

54) Inspector’s National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

5.12.4.3 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-3 REPORT

This guide is to be used when completing the National Board Form R-3, Report of Parts Fabricated by Welding. The numbers below correspond to the “circled” numbers shown on the Form R-3 in NBIC Part 3, 5.12.3. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-3 Report of Parts Fabricated by Welding. Note that a fillable version of the Form R-3 (NB-230) is available on the National Board website.

1) Initials of the National Board “R” Certificate of Authorization authorized representative who registers the Form R-3.

2) Initials of the Inspector who certified the completed Form R-3 for registration.

3) When registering a Form R-3 Report with the National Board, this line is solely designated for a unique sequential number assigned by the “R” Certificate Holder. When the “R” Form is not to be registered, indicated so by “N/A”. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form “R” reports that are registered with the National Board.

4) The name and address of the National Board “R” Certificate Holder who manufactured the welded parts as it appears on the “Certificate of Authorization”.

5) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

6) Document name and address of organization that purchased the parts for incorporation into the repair or alteration. If the part’s origin is unknown or the part was built for stock, so state.

7) Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are not known, state “unknown.”

8) Document name of organization responsible for performing the code design, if known. If code design organization is not known, state “unknown.”

9) Name, section, and division of the design code, if known. If the design is not known, state “unknown.”

10) Indicate code edition year used for fabrication.

11) Indicate code addenda date used for fabrication, if applicable.

12) Indicate the code paragraph reference for formula used to establish the MAWP, if known. If the code reference of the formula is not known, state “unknown.”

13) If available, identify component by part’s original name, function, or use the original equipment manufacturer’s “mark or item number.”
14) Indicate quantity of named parts.

15) Match line number of part references for Identification of Parts in item 5 and the Description of Parts in item 6.

16) Indicate manufacturer’s serial number or identification number for the named part.

17) Indicate drawing number for the named part.

18) Indicate maximum allowable working pressure (MAWP) for the part, if known.

19) Indicate test pressure, if applied.

20) Identify the year in which fabrication/construction of the item was completed.

21) Use inside diameter for size: indicate shape as square, round, etc.

22) Indicate the complete material specification number and grade.

23) Indicate nominal thickness of plate and minimum thickness after forming.

24) Indicate shape as flat, dished, ellipsoidal, or hemispherical.

25) Indicate minimum thickness after forming.

26) Indicate the complete material specification number and grade for the head or end.

27) Indicate outside diameter.

28) Indicate minimum thickness of tubes.

29) Indicate the complete material specification number and grade for tubes.

30) Indicate any additional information pertaining to the work involved (e.g. code cases).

The part manufacturer is to indicate the extent he has performed any or all of the design function. If only a portion of the design, state which portion.

31) When registering a Form R-3 Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicated so by “N/A”. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board.

32) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

33) Type or print name of authorized representative of the “R” Certificate Holder attesting to accuracy of the work described.

34) Indicate National Board “R” Certificate of Authorization number.

35) Indicate month, day, and year that the “R” Certificate of Authorization expires.

36) Indicate the date the repair was certified.

37) Record name of "R" Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.

38) Signature of National Board "R" Certificate of Authorization authorized representative.

39) Type or print name of Inspector.

40) Indicate Inspector’s Jurisdiction.

41) Indicate Inspector’s employer.

42) Indicate address of Inspector’s employer (city and state or province).
5.12.4.4 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-4 REPORT

This guide is to be used when completing the National Board Form R-4, Report Supplement Sheet. The numbers below correspond to the “circled” numbers shown on the Form R-4 in NBIC Part 3, 5.12.4. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-4, Report Supplement Sheet. Note that a fillable version of the Form R-4 (NB-231) is available on the National Board website.

1) When registering a Form “R” Report with the National Board, this line is solely designated for a unique sequential number assigned by the “R” Certificate Holder. When the “R” Form is not to be registered, indicate so by “N/A”. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form “R” reports that are registered with the National Board. Complete information identical to that shown on the Form “R” to which this sheet is a supplement.

2) If applicable, document the unique purchase order, job, or tracking number, assigned by the organization performing work.

3) The name and address of the Certificate Holder performing the work as it appears on the “Certificate of Authorization”.

4) Name and address of the owner of the pressure-retaining item.

5) Name and address of plant or facility where the pressure-retaining item is installed.

6) Indicate the Form “R” type to which this report is supplementary. Example: Form R-1, Form R-2, Form R-3.

7) Indicate the reference line number from the Form “R” to which this report is supplementary.

8) Complete information for which there was insufficient space on the reference Form “R”.

9) Indicate the date certified.

10) Signature of the repair organizations authorized representative.

11) Record name of “R” Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.

12) Indicate the date the form was completed by the Inspector.

13) Signature of the Inspector.
14) Inspector's National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.
FORM R-1 REPORT OF REPAIR
in accordance with provisions of the National Board Inspection Code

1. WORK PERFORMED BY: (name of repair organization)
   (address)

2. OWNER: (name)
   (address)

3. LOCATION OF INSTALLATION: (name)
   (address)

4. ITEM IDENTIFICATION: (Boiler, pressure vessel, or piping)
   NAME OF ORIGINAL MANUFACTURER:

5. IDENTIFYING NOS:
   (National Board No.)
   (Jurisdiction No.)
   (other)
   (year built)

6. NBIC EDITION ADDENDA:
   Original Code of Construction for Item:
   Construction Code Used for Repair Performed:

7. REPAIR TYPE: □ welded □ gas sparging equipment □ FRP equipment □ DOT

8. DESCRIPTION OF WORK: □ Form R-4, Report Supplementary Sheet is attached □ FFSA Form (NB-403) is attached
   (Use Item R-4 as necessary)

9. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-2's properly completed for the following items of this report)
   (Name of part, item number, data report, etc. or certificate of compliance or its name and identifying item)

10. PRESSURE TEST: □ Yes □ No
    Pressure Test, if applied: ______ psi

11. MAWP: ______ psi

REMARKS:

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors - 1355 Cooper Avenue, Columbus, Ohio 43201-1983
CERTIFICATE OF COMPLIANCE

I. ____________, certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, construction, and workmanship on this Repair conforms to the National Board Inspection Code. National Board "R" Certificate of Authorization No. ____________ Expiration date: ____________

Repair Organization: ____________
Signed: ____________
(authorized representative)
Date: ____________

CERTIFICATE OF INSPECTION

I. ____________, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the jurisdiction of ____________ and employed by ____________, have inspected the work described in this report on ____________, and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the National Board Inspection Code. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Commissions: ____________
Signed: ____________
(National Board and jurisdiction no, including endorsement)
Inspector)
Date: ____________
FORM R-2 REPORT OF ALTERATION
in accordance with provisions of the National Board Inspection Code

1a. DESIGN PERFORMED BY:  
(name of “R” organization responsible for design)

1b. CONSTRUCTION PERFORMED BY:  
(name of “R” organization responsible for construction)

2. OWNER OF PRESSURE RETAINING ITEM:  
(name)

3. LOCATION OF INSTALLATION:  
(name)

4. ITEM IDENTIFICATION:  
(bolier, pressure vessel, or piping)

5. IDENTIFYING NO.:

6. NBIC EDITION/ADDENDA:

7a. DESCRIPTION OF DESIGN SCOPE:  
Form R-4, Report Supplementary Sheet is attached

7b. DESCRIPTION OF CONSTRUCTION SCOPE:  
Form R-4, Report Supplementary Sheet is attached

Pressure Test, if applied  
MAGP  

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors - 1855 Chasen Avenue, Columbus, Ohio 43229-1933
8. REPLACEMENT PARTS: (Attach a complete list of parts or form P-35 property completed for the following items of this report:
(name of parts, serial numbers, date report type or Certificate of Compliance, ref. name and identifying stamp)

9. REMARKS:

DESIGN CERTIFICATION

L. [Signature] certify that to the best of my knowledge and belief the statements in this report are correct and that the

Date

[Signature]

[Authorization representative]

CERTIFICATE OF DESIGN CHANGE REVIEW

L. [Signature], holding a valid Commission issued by The National Board of Boiler and Pressure Vessel
Inspector and certificate of competency, where required, issued by the jurisdiction of

Date

[Signature]

[Commission expiration date]

CONSTRUCTION CERTIFICATION

L. [Signature], holding a valid commission issued by the National Board of Boiler and Pressure Vessel
Inspectors and certificate of competency, where required, issued by the Jurisdiction of

Date

[Signature]

[Commission expiration date]

CERTIFICATE OF INSPECTION

L. [Signature], holding a valid commission issued by the National Board of Boiler and Pressure Vessel
Inspectors and certificate of competency, where required, issued by the Jurisdiction of

Date

[Signature]

[Commission expiration date]
FORM R-3 REPORT OF PARTS FABRICATED BY WELDING

in accordance with provisions of the National Board Inspection Code

1. MANUFACTURED BY: ____________________________
   (name of "B" certificate holder)
   (address)

2. MANUFACTURED FOR: ____________________________
   (name of user)
   (address)

3. DESIGN CONDITION SPECIFIED BY: ____________________________
   CODE DESIGN BY: ____________________________

4. DESIGN CODE: ____________________________

5. REPAIR/ALTERATION/MODIFICATION ACTIVITIES

<table>
<thead>
<tr>
<th>Name of Part</th>
<th>Qty.</th>
<th>Line No.</th>
<th>Manufacturer's Identifying No.</th>
<th>Manufacturer's Drawing No.</th>
<th>NAACP</th>
<th>Shop Hydro PSI</th>
<th>Year Built</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
</tr>
</tbody>
</table>

6. DESCRIPTION OF PARTS

<table>
<thead>
<tr>
<th>Line No.</th>
<th>(a) Connections other than tubes</th>
<th>(b) Tubes</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>

7. REMARKS: ____________________________
CERTIFICATE OF COMPLIANCE

I, _____________________________, certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, fabrication, construction, and workmanship of the described parts conforms to the National Board Inspection Code and the standards of construction cited.

National Board "R" Certificate of Authorization No. _____________________________

Date _____________________________

Signed _____________________________

Name of "R" Certificate holder _____________________________

Authorized Representative _____________________________

CERTIFICATE OF INSPECTION

I, _____________________________, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the jurisdiction of _____________________________ and employed by _____________________________, have inspected the part described in this report on _____________________________ and state that to the best of my knowledge and belief the parts comply with the applicable requirements of the National Board Inspection Code.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Date _____________________________

Signed _____________________________

Inspector _____________________________

(National Board and Jurisdiction No. including endorsement)
The replacement of threaded staybolts with fillet welded staybolts is permissible. The work shall be done in accordance with the ASME BPVC, Section I, Part PL-30 and Figure PL-30.4.2-1. When replacing a threaded staybolt with a fillet welded staybolt, the existing
threads in the sheets must be removed prior to installation. Cautionary Note: Larger minimum diameter staybolts will transfer stresses to other structures and will be subject to higher extreme fiber stresses.

Repairs to un-threaded fillet welded staybolts shall be performed in accordance with the original code of construction. If the original code of construction is not known, repairs shall be performed as follows in accordance with an appropriate code of construction that allows fillet welded staybolts:

a) The replacement of un-threaded fillet welded staybolts is permissible.

b) Existing un-threaded fillet welded staybolts that leak shall be repaired by re-welding after mechanically removing the entire weld. Only the leaking stays are to be re-welded.

c) Minor leakages (sweat pores) may be repaired by gently caulking the fillet weld. However, identifiable cracks shall be removed before re-welding.

S1.2.9.6 RE-ROLLING OF FLUE-TUBES AFTER SEAL WELDING
All flues and tubes that are installed by rolling and seal welding shall be re-rolled after seal welding is complete.

S1.2.9.6 INSTALLATION OF BOILER FLUES
Maximum allowable working pressure and nominal wall thickness for flues shall be determined using TABLE S1.2.9.1 and TABLE S1.2.9.1M

Except as otherwise specified in this Part, flues shall be attached as illustrated in Figure S1.2.9.6 (a thru e). Flues shall not be attached by welding alone.

All flues smaller than 3 in. (75 mm) O.D. shall be expanded and beaded, with or without seal welding, or expanded and welded on the firebox end. At least 1 in 10 distributed evenly on the front flue sheet shall be expanded and beaded or expanded and welded. All flues 3 in. (75 mm) O.D. and larger shall be expanded and beaded, with or without seal welding, or expanded and welded at both ends. All adjacent flues smaller than 3 in. (75 mm) O.D. that are within the area occupied by the larger superheater flues shall be expanded and beaded or expanded and welded at both ends. At least 1 in 10 of the remaining flues smaller than 3 in. (75 mm) O.D. shall be beaded and/or welded on the front flue sheet, in addition to expanding. Where less than all flues are welded or beaded on the front flue sheet, those welded or beaded shall be distributed as evenly as
practicable throughout the flue pack.

Flues shall be re-expanded upon completion of seal welding or beading, or both. The new reduced wall thickness of the enlarged flue end shall be reviewed to confirm that upon completion of the flue expansion process the new wall thickness will be sufficient for the MAWP.

When stipulated by the original design, the ends of boiler flues may be swaged to a smaller or larger diameter as required to fit the tube sheet holes. The swaging shall create smooth surfaces, smooth curves, and a uniform diameter reduction across the entire swaged length. Swaging or not swaging is considered a repair.

When flues are applied by expanding and seal welding, the seal weld shall protrude beyond the sheet a distance of 1/8 in. to 1/4 in. (3 mm to 6 mm) inclusive [see Figure S1.2.9.1-b] and the end of the flue shall not protrude past the weld. The end of the flue shall be ground or polished to eliminate any sharp edges.

Prior to welding, beading, or both, ensure that the flue is satisfactorily seated in the sheet. Seal welding may be done with water in the boiler, provided the water is heated to between 100°F and 120°F (38°C and 50°C).

Ferrous or nonferrous ferrules may be used on either or both ends of flues. When seal welding over ferrous ferrules used in straight-expanded and seal-welded flues, the weld shall attach to the sheet and not just to the ferrule. Care shall be taken to avoid contamination of seal welds when nonferrous ferrules are used.

Cautionary Note:

Boiler flues shall be cut to or made to the correct length required for installation when the boiler and flues are at equal temperature. The use of heating or stretching the flue during installation to obtain the required length by thermal or mechanical expansion is prohibited.

S1.2.9.8 FLUES SMALLER THAN 3 INCHES

All flues smaller than 3 in. (76 mm) OD shall be rolled and beaded or rolled and seal welded on the firebox.
end, and at least one in ten at the front flue sheet end. All flues 3 in. (76 mm) OD and larger shall be rolled and beaded or rolled and seal welded at both ends and all adjacent flues smaller than 3 in. (76 mm) OD that are within the large flue pack shall be rolled and beaded or rolled and seal welded at both ends. At least one in ten of the remaining flues smaller than 3 in. (76 mm) OD shall be beaded or seal welded on the front flue sheet, in addition to rolling. Where less than all flues are seal welded or beaded on the front flue sheet, those seal welded or beaded shall be distributed as evenly as practicable throughout the flue pack. This shall be considered a repair.

<table>
<thead>
<tr>
<th>17-160 Part 3, S1.2.11.5</th>
<th>Action Item—Rivet Joint to One Piece Welded Joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action Item—Rivet Joint to One Piece Welded Joint</td>
<td></td>
</tr>
</tbody>
</table>

**S1.2.11.5** *REPAIR OF FIREBOX AND TUBESHEET KNUCKLES*

**S1.2.11.5** *Repair of Firebox, Wrapper, and Tubesheet Knuckles*

a) Welds within the points of tangency of a knuckle are permitted. Welds with angles of less than 45 degrees to the longitudinal axis of the knuckle shall be radiographically examined. (See NBIC Part 3, Figures S1.2.11.5-a through S1.2.11.5-g).

b) Any patch not supported by means other than the weld, such as rivets, staybolts, tubes, or other forms of construction, shall have all weld seams radiographically examined.

c) Patches shall be formed to proper shape and curvature.

d) Wasted sections of knuckles that have not wasted below 60% of the minimum required thickness may be repaired by weld buildup provided the strength of the structure will not be impaired. Where weld buildup is employed, the Inspector may require an appropriate method of NDE for the repair.

e) Wasted sections of knuckles that have wasted below 60% of the minimum required thickness shall be replaced.

f) Flanges shall be made so as to avoid stress intensifiers such as abrupt ridges and grooves.

g) Flanges shall be made smooth and free of ridges, valleys and grooves.

h) Flanges may be welded in accordance with this section and all applicable
sections of this code.

i) For one-piece flange knuckle joint patches in portions of a riveted lap joint or in mud ring corners with a lap joint in the firebox, the knuckle patch shall be supported on at least one of the two planes adjacent to the flange, by means other than the weld. See Figure S1.2.11.5-c1. The weld shall be at least the full thickness of the new plate being installed. Volumetric examination is not required. This type of repair shall be considered a repair.

Cautionary note: Where a double-riveted lap joint is replaced with a seamless plate, stay pitch and stress must be considered since the doubling effect of the lap seam is being eliminated.

Add Figure S1.2.11.5-c1

Figure S1.2.11.5-c1

![Diagram showing new patch alignment with original material](image)

**S1.2.14 Throttle Pipes, Dry Pipes, Superheater Headers & Front End Steam Pipes**

1) Cracks in throttle pipes, dry pipes, superheater headers, and front end steam pipes made from steel may be repaired by welding. All welded repairs shall be done in accordance with NBIC Part 3.

2) Throttle castings, dry pipes, super heater headers, and front end steam pipes constructed of cast iron may be repaired by brazing **provided the components are internal to the boiler shell or smokebox shell**. Brazing shall be done in accordance with
**NBIC Part 3.** Appropriate to the type of repair, and shall be acceptable to the Inspector and the jurisdiction if applicable. Cast iron shall not be fusion welded.

3) Weld build-up may be used for repair of steel components in accordance with NBIC Part

4) Throttle pipes, dry pipes and superheater headers, should be supported by hangers, brackets or other structural methods as needed.

| NB16-1801 Part 3, S1 | Materials - NBIC S1.1.3.1-d); Maximum staybolt *tensile strength* shall be 7,500 psi? Errata. Should be tensile stress:  

   d) When staybolt material tensile strength is greater than that of the firebox sheets, the firebox sheets deflect instead of the staybolts, which can result in the sheets developing cracks and leaking staybolts. In addition, high tensile strength steels are difficult to drive. Maximum allowable tensile *strength-stress* shall be 7,500 psi (51.71 MPa). |
Threaded Staybolts –
NBIC S1.2.2 a); The thread pitch shall be either 11 or 12.

Current wording:
All threaded staybolts shall have either 11 or 12 thread pitch. Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from 11 to 12 or the reverse shall be considered a repair.

Proposed wording:
All threaded staybolts shall have a pitch between 10 and 13 threads per inch inclusive, (2 mm to 2.5 mm). Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from any pitch within the allowed range to another pitch within the allowed range shall be considered a repair.

NBIC S1.2.2 h)
Current wording:
Installation of larger diameter staybolts shall be considered a repair.
Proposed wording:
Installation of different diameter staybolts shall be considered a repair provided the stay stress does not exceed 7500 psi (52.5 MPa). Cautionary Note: Larger diameter staybolts will transfer stresses to other structures and will be subject to higher extreme fiber stresses.

NBIC S1.2.5 d)
Current wording:
Installation of different diameter staybolts shall be considered a repair.
Proposed wording:
Installation of different diameter staybolts shall be considered a repair provided the stay stress does not exceed 7500 psi (52.5 MPa). Cautionary Note: Larger diameter staybolts will transfer stresses to other structures and will be subject to higher extreme fiber stresses.

Arch tubes –
NBIC S1.2.9.3;
Current wording:
The minimum wall thickness of replacement arch tubes shall be as shown in Table S1.2.9.3.
Proposed wording:
The minimum wall thickness of replacement arch tubes shall be as determined by the following formulas.

(U.S. Customary Units)
\[ t = \frac{PD}{16,000} + 0.125 \]

(SI Units)
\[ t = \frac{PD}{111} + 3.175 \]

where
\[ D = \text{outside diameter of tube, in. (mm)} \]
\[ P = \text{maximum allowable working pressure, psi (MPa)} \]
\[ t = \text{thickness of tube wall, in. (mm)} \]

Delete Table S1.2.9.3

Thermic Syphons –
NBIC S1.2.9.4 b);
Current wording:
All weld repairs to the unstayed sections of the syphon neck and body shall be radiographically examined.

Proposed wording:
Except for the attachment weld to the throat sheet, welds on the thermic syphon unit shall be full penetration, and the unit shall be stress relieved in accordance with ASME, Section I, PW-39. Volumetric examination is not required.

Water Gage Connection –
NBIC S1.2.13.1 a);
Current wording:
Water gage glasses shall be applied so that the lowest water reading in the water glass gage glass of a horizontal firetube boiler on level track shall be at least 3 inches above the highest point of the tubes, flues, or crownsheet”.

Proposed wording:
NBIC S1.2.13.1 a); Water gage glasses shall be applied so that the lowest water reading in the water glass gage glass of a horizontal firetube boiler on level track shall be not less than 3 inches (75 mm) above the highest point of the crownsheet.

### S2.7.1 MATERIAL LIST FOR HISTORICAL BOILERS REPAIRS

Table S2.7.1 is intended as a basic guideline only and covers just the basic carbon steel and some alloy steel material specifications. Other alloy materials may be available for these applications if necessary.

**Note:** See ASME Section II for Other Acceptable Section I Materials.

### TABLE S2.7.1
MATERIALS LIST FOR HISTORICAL BOILERS

<table>
<thead>
<tr>
<th>Application</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler Tubes &amp; Flues</td>
<td>SA-178 Grade A,</td>
</tr>
<tr>
<td></td>
<td>SA-192, SA-210</td>
</tr>
<tr>
<td>Boiler &amp; Firebox Plate</td>
<td>SA-285 Grade C,</td>
</tr>
<tr>
<td></td>
<td>SA-515, SA-516</td>
</tr>
<tr>
<td>Staybolts &amp; Patch Bolts</td>
<td>SA-675, SA-36,</td>
</tr>
<tr>
<td></td>
<td>ASTM A-31</td>
</tr>
<tr>
<td>Boiler Braces</td>
<td>SA-675, SA-36</td>
</tr>
<tr>
<td>Rivets</td>
<td>SA-675, SA-31</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Forged Parts &amp; Fittings</td>
<td>SA-105, SA-217</td>
</tr>
<tr>
<td>Hollow Cylindrical Pressure Retaining</td>
<td>Parts SA-105 Forgings SA-675 Bar Stock,</td>
</tr>
<tr>
<td>Pipe Flanges</td>
<td>SA-181, SA-105</td>
</tr>
<tr>
<td><strong>Flange Bolts, Studs &amp; Nuts</strong></td>
<td>SA-193-B7, SA-194-2H</td>
</tr>
<tr>
<td>Bronze Castings &amp; Washout Plugs</td>
<td>SB-61, SB-62</td>
</tr>
</tbody>
</table>

18-54
Part 3, S2.7.2

**S2.7.2 REPLACEMENT PARTS**

Replacement pressure parts formed by casting, forging, or die forming, and on which no welding has been performed shall be supplied as material. Such parts shall be marked with the material identification required by the construction standard used for the repair. Replacement parts fabricated by welding shall be manufactured by an organization certified as required by the construction standard used for the repair. When it is not possible or practical for a manufacturer to supply replacement parts fabricated by welding, an organization accredited as described in NBIC Part 3, 1.6 may fabricate the part with the approval of the Jurisdiction.

18-50
Part 3, S2.11 a)

**S2.11 NONDESTRUCTIVE EXAMINATION**

a) The Inspector may require nondestructive examination (RT, PT, MT, and UT, and VT) as necessary to ensure satisfactory welded repairs have been accomplished.

b) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction for the pressure-retaining item. Weld repairs and alterations shall be subjected to the same nondestructive examination requirements as the original welds.

c) Where the original code of construction is unknown or the NDE method is not possible or practicable, alternative NDE methods may be used. These methods shall be acceptable to the owner, the Inspector and where required, the Jurisdiction of the pressure-retaining item.

d) NDE methods used shall be suitable for providing meaningful results to verify the integrity of the repair and or alteration.

e) Exclusive use of visual examination (VT) for repair inspection is only
permitted when performing final examination for routine repairs following the requirements in accordance with Part 3, 4.4.1 e).

**S2.11 NONDESTRUCTIVE EXAMINATION AND TESTING**

The integrity of repairs and alterations shall be verified by examination or test as required by Part 3, 4.4.

**NB16-0503**

**PART 3, S2.13.13.1**

**NEW FIGURE S2.13.13.4-C**

b) Rivets shall be of sufficient length to completely fill the rivet holes and form heads at least equal in strength to the bodies of the rivets. Common Forms of finished rivet heads that will be acceptable are shown in NBIC Part 3, Figure S2.13.13.4-a, S2.13.13.4-b and S2.13.13.4-c.

c) For rivet head designs not shown in Figure S2.13.13.4-a, S2.13.13.4-b and S2.13.13.4-c, the strength of the rivet head design may be calculated to demonstrate strength equivalent to the body of the rivet. Formulas for calculation are permitted at the discretion of the inspector.

**Figure S2.13.13.4-c**

**Historic Large Rivets (C.I.S)**

<table>
<thead>
<tr>
<th>Nom. Body Dia. D</th>
<th>Head Dia. A</th>
<th>Height H</th>
<th>Head Dia. A</th>
<th>Height H</th>
<th>Head Dia. A</th>
<th>Height H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Double Radius Button Head</td>
<td>Steeple Head</td>
<td>Flat Head</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>0.950</td>
<td>0.350</td>
<td>1.000</td>
<td>0.500</td>
<td>0.875</td>
<td>0.250</td>
</tr>
<tr>
<td>5/8</td>
<td>1.188</td>
<td>0.438</td>
<td>1.250</td>
<td>0.625</td>
<td>1.094</td>
<td>0.313</td>
</tr>
<tr>
<td>3/4</td>
<td>1.425</td>
<td>0.525</td>
<td>1.500</td>
<td>0.750</td>
<td>1.313</td>
<td>0.375</td>
</tr>
<tr>
<td>7/8</td>
<td>1.663</td>
<td>0.613</td>
<td>1.750</td>
<td>0.875</td>
<td>1.531</td>
<td>0.438</td>
</tr>
<tr>
<td>1</td>
<td>1.900</td>
<td>0.700</td>
<td>2.000</td>
<td>1.000</td>
<td>1.750</td>
<td>0.500</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>1-1/8</td>
<td>2.138</td>
<td>0.788</td>
<td>2.250</td>
<td>1.125</td>
<td>1.969</td>
<td>0.563</td>
</tr>
<tr>
<td>1-1/4</td>
<td>2.375</td>
<td>0.875</td>
<td>2.500</td>
<td>1.250</td>
<td>2.188</td>
<td>0.625</td>
</tr>
<tr>
<td>1-3/8</td>
<td>2.613</td>
<td>0.963</td>
<td>2.750</td>
<td>1.375</td>
<td>2.406</td>
<td>0.688</td>
</tr>
<tr>
<td>1-1/2</td>
<td>2.850</td>
<td>1.050</td>
<td>3.000</td>
<td>1.500</td>
<td>2.625</td>
<td>0.750</td>
</tr>
<tr>
<td>1-5/8</td>
<td>3.088</td>
<td>1.138</td>
<td>3.250</td>
<td>1.625</td>
<td>2.844</td>
<td>0.813</td>
</tr>
<tr>
<td>1-3/4</td>
<td>3.325</td>
<td>1.225</td>
<td>3.500</td>
<td>1.750</td>
<td>3.063</td>
<td>0.875</td>
</tr>
</tbody>
</table>

All Dimensions are given in inches.

Tolerance for diameter of body is plus and minus 10% of nominal (shank diameter).

The following formulas give basic dimensions for manufactured shapes:

- **Double Radius Button Head**, \( A = 1.900D; \ H = 0.700D; \ G = 2.000D. \)
- **Steeple Head**, \( A = 2.000D; \ H = 1.000D. \)
- **Flat Head**, \( A = 1.750D; \ H = 0.500D. \)

Length \( L \) is measured parallel to the rivet axis, from the extreme end to the bearing surface plane for flat bearing surface head-type rivets, or to the intersection of the head top surface with the head diameter for countersunk head-type rivets.

<table>
<thead>
<tr>
<th>NB16-1302</th>
<th>Part 3, S3.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>p) Completed repairs shall be subjected to a pressure test. The test pressure shall not be less than the maximum allowable working pressure or twice the operating pressure, whichever is lower. Operating pressure or more than maximum allowable working pressure. The test pressure shall be maintained for 30 minutes minimum.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NB16-1303</th>
<th>Part 3, S3.5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>f) All damage should be examined and should be evaluated to determine the cause. Identification and elimination of the cause is essential in helping to prevent a recurrence.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NB15-2210</th>
<th>Part 3, S3</th>
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<tbody>
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<td>f) Completed repairs shall be subjected to a pressure test. The test pressure shall not be less than the maximum allowable working pressure or twice the operating pressure, whichever is lower. Operating pressure or more than maximum allowable working pressure. The test pressure shall be maintained for 30 minutes minimum.</td>
<td></td>
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<th>Part 3, S3.5.1</th>
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<tbody>
<tr>
<td>f) All damage should be examined and should be evaluated to determine the cause. Identification and elimination of the cause is essential in helping to prevent a recurrence.</td>
<td></td>
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<table>
<thead>
<tr>
<th>NB15-2210</th>
<th>Part 3, S3</th>
</tr>
</thead>
<tbody>
<tr>
<td>f) Completed repairs shall be subjected to a pressure test. The test pressure shall not be less than the maximum allowable working pressure or twice the operating pressure, whichever is lower. Operating pressure or more than maximum allowable working pressure. The test pressure shall be maintained for 30 minutes minimum.</td>
<td></td>
</tr>
</tbody>
</table>
SUPPLEMENT 3
REPAIR AND ALTERATION OF GRAPHITE PRESSURE EQUIPMENT

$3.1 SCOPE

a) This supplement provides requirements and guidelines for repairs to graphite pressure equipment requiring the use of certified impregnated graphite and cement. The determining factor in establishing the desired material properties is the resin impregnation cycle. If the resin impregnation cycle is not controlled, it is not possible to meet the minimum design values.

b) The letter "G" shall be included on the "R" Certificate of Authorization for those organizations authorized to perform repairs/alterations of graphite pressure equipment except as permitted by Part 3, §3.5.41.

$3.2 REPAIRS

The requirements provided in this supplement shall apply, insofar as they are applicable to graphite pressure equipment. Graphite specific requirements include:

a) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure shall be manufactured by an organization certified as required by the original code of construction. The item shall be inspected and stamped as required by the original code of construction. Certification to the original code of construction as required by the original code of construction or equivalent shall be supplied with the item. When this is not possible or practicable, the organization fabricating the part shall have a National Board Certificate of Authorization; replacement parts shall be documented on Form R-3 and the "R" Symbol Stamp applied as described in NBIC Part 3, Section 5.

b) When the standard governing the original construction is not the ASME Code, repairs or alterations shall conform to the edition of the original construction standard or specification most applicable to the work. Where the original code of construction is unknown, the edition and addenda of the ASME Code most appropriate for the work shall be used, provided the "R" Certificate Holder has the concurrence of the inspector and the Jurisdiction where the pressure-retaining item is installed.

c) The materials used in making repairs or alterations shall conform to the requirements of the original code of construction except as provided in NBIC Part 3, §3.2(j). The "R" Certificate Holder is responsible for verifying identification of existing materials from original data, drawings, or unit records and identification of the materials to be installed.

d) When ASME is the original code of construction, replacement parts subject to internal or external pressure, which require shop inspection by an Authorized Inspector, shall be fabricated by an organization having an appropriate ASME Certificate of Authorization. The item shall be inspected and stamped as required by the applicable section of the ASME Code. A completed ASME Manufacturer's Partial Data Report shall be supplied by the manufacturer. Further, all impregnated graphite material subject to internal or external pressure shall be fabricated by an organization having the appropriate ASME Certificate of Authorization. The impregnated graphite material shall be inspected and stamped as required by the applicable section of the ASME Code. A completed ASME Manufacturer's Partial Data Report with supplementary U1B shall be supplied by the impregnated graphite material manufacturer.

e) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure shall be manufactured by an organization certified as required by the original code of construction. The item shall be inspected and stamped as required by the original code of construction. Certification to the original code of construction as required by the original code of construction or equivalent shall be supplied with the item. When this is not possible or practicable, the organization fabricating the part may have a National Board Certificate of Authorization; replacement parts shall be documented on Form R-3 and the "R" Symbol Stamp applied as described in NBIC Part 3, Section 5.
e) Rodrill a 7/8 in. (22 mm) hole at every other pilot hole. Holes must be drilled the full depth of the crack. The depth and direction of the crack can be checked with hydrophilic solvent.

f) A 7/8 in. (22 mm) diameter reamer may be used to true the drilled holes.

g) Dry fit a plug into the holes. There should be 0.005 in. to 0.010 in. (0.13 mm to 0.25 mm) clearance for the cement joint. At no time should there be a force fit of plugs into any drilled hole. Provisions shall be provided for venting trapped air.

h) Sand the outside surface of the plugs. Thoroughly clean all the surfaces of the repair, plugs, and drilled holes with hydrophilic solvent.

i) Apply graphite cement to both plugs and holes. All surfaces of plugs and holes to be joined are to be wetted with cement.

j) Insert the cemented plugs into the holes allowing 1/16 in. (1.5 mm) of the plug to extend beyond the surface of the graphite part.

k) Cure the graphite cement according to the cement manufacturer's instruction.

l) At this point, half of the plug stitch repair is completed. A row of plugs has been installed with 1/4 in. (6 mm) pilot holes between them.

m) Redrill the remaining pilot holes to 7/8 in. (22 mm) diameter. The drill will remove part of the plugs that were installed. It is important to have the plugs replace all of the fracture. If the new holes do not cut into the installed plugs, it will be necessary to repeat the procedure between these holes and plug locations to ensure that all of the crack has been repaired. The line of fracture is completely removed by the overlapping effect of the graphite plugs.

n) After the second set of holes have been drilled, repeat the plug cementing procedures.

o) Contour the plugs to provide a smooth transition into the adjoining surface area. The finished repair may be coated with a wash coat for appearance.

S3.5.3.2 FIGURES — TYPICAL PLUG STITCHING PROCEDURE

a) Step one: Layout hole centers.

b) Step two: Drilling pilot holes.

c) Step three: Drilling the first set of holes.

d) Step four: Cementing and curing the first set of plugs.

e) Step five: Drilling the second set of holes.

f) Step six: Plug stitching repair completed.

S3.5.4 REIMPREGNATION OF GRAPHITE PARTS (TUBESHEETS, HEADS, AND BLOCKS)

a) As a function of time, temperature, and chemical exposure, the resin used to impregnate graphite may shrink and/or degrade. As such, it is possible for voids to develop in impregnated graphite that has been in chemical service for a period of time. The resin loss can vary from slight to almost complete loss of impregnation. There is no practical way to determine the amount of resin remaining in the pores. However, a pressure test will determine if the graphite has continuous porosity.
b) Reimpregnation of a graphite component may be used to reduce porosity in an existing graphite component, which in turn will improve the performance and expected life of the existing graphite components. A written re-impregnation procedure acceptable to the Inspector is required. The reimpregnation procedure shall include at a minimum:

1) Decontamination and drying of the graphite component
2) Subjetting the component to a vacuum
3) Introducing resin under pressure
4) Curing the resin at a specified temperature and time
5) Leak test

§3.5.4.1 CONTROL OF IMPREGNATION MATERIAL

c) Impregnation material shall be the same as that specified in the Reimpregnation Procedure. Each impregnation material shall be traceable by the name of its manufacturer and the trade name or number of that manufacturer.

b) The impregnation material manufacturer shall supply the Certificate Holder a Certificate of Analysis for each material. It shall include the following:

1) Impregnation material identification
2) Batch number(s)
3) Date of manufacture
4) Shelf life
5) Viscosity per ASTM D 2933
6) Specific gravity

c) Prior to reimpregnation, and at subsequent intervals not to exceed 14 days, the Certificate Holder shall test each batch of impregnation material to assure that the characteristics of the material have not changed from values specified in the Reimpregnation Procedure. The values obtained for viscosity and specific gravity for the impregnation material shall be within the limits specified by the manufacturer and as listed in the Reimpregnation Procedure. The test values shall be made available to the Inspector.

§3.5.4.2 FINISHING THE REPAIR

e) The parts should be held in place to prevent movement while curing the cemented joint to achieve a proper repair. The repair firm should take care to ensure that the cement joint thickness is within the range recommended by the cement manufacturer. Care spent in precisely aligning the parts while clamping will avoid many finishing and machining operations later. Particular attention should be given to gasket and other bearing surfaces.

b) Gasket and bearing surfaces may have to be machined, filed, or sanded before the job is completed. Gasket serrations must be clean and continuous. Serrations can be easily re-cut into graphite and any repair plugs that erode the gasket surface.
§3.5.5 PLUGGING OF LEAKING OR DAMAGED TUBES

The material used for plugging tubes shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

b) The point(s) of leakage shall be verified, and the corresponding leak site(s) shall be marked/identified on the tubesheet, and recorded.

c) A plug shall be used to plug each end of the tube(s) in question and each plug shall have a minimum length of 1 in. (25 mm). Multiple plugs may be used.

d) The tube(s) shall be prepared for plugging by enlarging the inside of the tube(s) with a suitable drill bit or reamer.

1) To ensure a sound cement joint between the tube sidewall and the plug, a slightly smaller diameter plug shall be selected. The maximum clearance between the tube inside diameter and the outside diameter of the plug shall not exceed 3/32 in. (2.4 mm).

2) As an alternative to d(1), a mandrel with an abrasive, such as sandpaper, may be used, as long as the maximum tube I.D. to plug O.D. clearance of 3/32 in. (2.4 mm) is not exceeded.

3) The minimum plug insertion depth of the prepared hole(s) shall meet the minimum combined plug length requirements of ‘c’. When the minimum plug length of ‘c’ is exceeded, the total insertion depth of the plugs may exceed the combined length of the plugs; however, the longer plugs shall not project outside the face of the tube(s) being plugged.

c) Plugging of leaking or damaged tubes shall be performed by certified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

(See below for new §3.5.4.6.)

The cement shall be prepared per the cement manufacturer’s instructions.

When cementing the plugs, 100% of individual plugs, as well as the inside diameter of the tube opening(s), shall be coated with cement. The plugs shall then be inserted one by one, against each other, into each end of the tube(s) being plugged.

Once the plugging is completed, and before the cement cures, the endplugs may need to be held in place, as newly cemented plugs may exhibit a tendency to dislodge from the plugged tube(s) prior to final curing of the cement.

Curing time is dependent upon the cement manufacturer’s instructions, and is considered complete when the cement is hardened to the point that it cannot be indented with pressure from a flat screwdriver or other similar instrument.

After the cement is completely cured, the plugged, cemented area(s) on the tubesheet face may be dressed with sandpaper or other suitable abrasive.

Repaired tubes shall be tested in accordance with this code, using a method acceptable to the inspector, with a written procedure as approved by the manufacturer’s internal quality system, to ensure leaks have been repaired.

The scope of the work completed shall be described and reported on a Form R-1.

§3.5.6 TUBE REPLACEMENT

Tube replacement should be performed with the unit preferably in the horizontal position. Avoid replacing adjacent tubes simultaneously because the replacement areas may overlap or reduce the ligament between
holes and possibly damage the tubesheet. The general steps used in horizontal tube replacement follow below.

a) The material used for tube replacement shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UG.

b) Tube replacement shall be performed by qualified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UG-79 and UG-80.

c) Determine the thickness of each tubesheet and inside distance between the tubeshells to obtain tube and sleeve length.

d) Access each tubesheet face, clearly identify and mark each tube hole on each tubesheet of the tubes to be replaced.

e) Prepare/clean the existing tube hole in preparation for extracting the damaged tube. Some holes may contain plugs which require removal. A boring tool slightly larger than the outside diameter of the tube being replaced is required.

f) Drill/bore out the tube hole in each tubesheet to release the tube from the tubesheet. Exercise caution when centering and align cutting to the common axis of the tube.

g) The damaged tube should disengage and become loose. Using guides, remove the damaged tube. Ensure that no debris is trapped in the space where the tube was removed (Fig. S3.5.5-a).

h) Replacement tube shall have sleeves at the ends cemented in the bored holes to replace the material in the tubesheet that was bored out to access the damaged tube (Fig. S3.5.5-b and S3.5.5-c).

1) Dry-fit a new tube and sleeve.

2) The sleeve length may vary.

3) Prior to applying cement, prepare and clean all surfaces to be cemented.

i) Cement the ID of the prepared bore in the floating tubesheet and the tube end OD at the fixed tubesheet. (Fig. S3.5.5-b).

j) Insert the tube through the fixed tubesheet and through the floating tubesheet cemented bore so that it protrudes. Cement the ID of the fixed tubesheet bore as shown in (Fig. S3.5.5-e). The use of alignment dowels can assist/guide in tube handling.

k) Cement the OD of the tube end protruding from the floating tubesheet. Cement the ID of the mating sleeve end, fit it to the cemented tube end and push the assembly part-way into the floating tubesheet. Cement the remainder of the OD of the floating tube end sleeve. Push this cemented assembly the rest of the way into the floating tubesheet (Fig. S3.5.5-c).

l) Cement the ID and OD of the sleeve for the fixed tubesheet and insert it until it mates with the tube end inside. Push together cemented sleeve assemblies. (Fig S3.5.5-d). Clean/wipe away any excess cement.

m) Apply slight pressure on the sleeves to seat the joints. Remove excess cement.

n) Maintain pressure and cure both ends of the cemented assembly according to the cement manufacturer's instructions.

 o) Sleeves may be trimmed after curing.
p) Replaced tubes shall be tested in accordance with this code per a written procedure acceptable to the inspector.

q) The scope of work completed shall be described and reported on a Form P-1.

FIGURE S3.5.8-a
CLEANED AND PREPARED TUBESHEETS

FIGURE S3.5.8-b
STARTING TUBE REPLACEMENT
§3.5.7

REIMPREGNATION OF GRAPHITE PARTS (TUBESHEETS, HEADS, AND BLOCKS)

a) As a function of time, temperature, and chemical exposure, the resin used to impregnate graphite may shrink and/or degrade. As such, it is possible for voids to develop in impregnated graphite that has been in chemical service for a period of time. The resin loss can vary from slight to almost complete loss of impregnation. There is no practical way to determine the amount of resin remaining in the pores. However, a pressure test will determine if the graphite has continuous porosity.

b) Reimpregnation of a graphite component may be used to reduce porosity in an existing graphite component, which in turn will improve the performance and expected life of the existing graphite components. A written re-impregnation procedure acceptable to the Inspector is required. The reimpregnation procedure shall include as a minimum:
17. CONTROL OF IMPREGNATION MATERIAL

a) Impregnation material shall be the same as that specified in the Reimpregnation Procedure. Each impregnation material shall be traceable by the name of its manufacturer and the trade name or number of that manufacturer.

b) The impregnation material manufacturer shall supply the Certificate Holder with a Certificate of Analysis for each material. It shall include the following:
   1) Impregnation material identification
   2) Batch number(s)
   3) Date of manufacture
   4) Shelf life
   5) Viscosity per ASTM D 2393
   6) Specific gravity

c) Prior to reimpregnation, and at subsequent intervals not to exceed 14 days, the Certificate Holder shall test each batch of impregnation material to assure that the characteristics of the material have not changed from values specified in the Reimpregnation Procedure. The values obtained for viscosity and specific gravity for the impregnation material shall be within the limits specified by the manufacturer and as listed in the Reimpregnation Procedure. The test values shall be made available to the inspector.
As an alternative to e) any \( P \) Certificate Holder, with or without the letter "G" included on the "R" Certificate of Authorization, may install graphite tube plugs provided the following conditions are met. The \( P \) Certificate Holder shall gain the concurrence of the Inspector, and shall utilize a tube plugging kit provided by an ASME Certificate Holder authorized to use the \( G \) designator. The kit shall include the following items:

1. Certified graphite plugs and certified cement ingredients, both accompanied by the appropriate documentation (Partial Data Report).

2. The qualified cementing procedure of the ASME Certificate Holder authorized to use the \( GC \) designator, and a step-by-step procedural checklist that shall be followed explicitly. The procedure shall address the entire tube plugging process including plug configuration, tube hole cleaning and preparation, mixing and applying of the cement, application of the plugs, securing the plugs during the curing process, controlling the curing process, and leak testing, thereby meeting S3.3.

3. Additional materials and procedure shall be provided and used to prepare a demonstration plug joint prior to performing the repair. This demonstration plug joint shall be tested by a twist (torsional) test designed to demonstrate acceptable application and curing of the cement (Fig. S3.5.4). The test procedure shall include acceptance criteria, which may be based on a principle of breakage of part of the test piece. A successful twist test, in conjunction with the completed procedural checklist, shall serve as a valid cement technician certification for a single repair operation. The twist test shall be witnessed by the Inspector.

The \( P \) Certificate Holder shall review the material certifications including verification that the shelf life of the cement has not been exceeded, and assure that the certified cement technician has completed the qualification demonstration, and has access to the procedure and checklist. The Inspector shall review and verify that the procedure and the other elements of the certified kit, as provided by the authorized and designated ASME Certificate Holder authorized to use the \( GC \) designator, have been administered and completed prior to his acceptance. The \( P \) Certificate Holder shall note on Line 8 of the R-1 Form the installation of cemented graphite tube plugs in accordance with this section. The letter "G" shall not be applied to the vessel when performing this alternative repair. The \( P \) Certificate Holder shall identify and document the location of the plugged tubes on the \( P \) Form.
**New Figure**

NOTE: THIS DEMONSTRATION APPLIES TO PLUGS OF ALL DIAMETERS AND LENGTHS.
S6.10.3 PREHEATING

Preheating may be employed during welding to assist in completion of the welded joint (see NBIC Part 3, 2.5.1). The need for and the temperature of preheat are dependent on a number of factors such as chemical analysis, degree of restraint of the items being joined, material thickness, and mechanical properties of the base metals being joined. The Welding Procedure Specification for the material being welded shall specify the preheat temperature requirements.

S6.10.2 POSTWELD HEAT TREATMENT

Postweld heat treatment may be performed as required by the original code of construction in accordance with a written procedure. The procedure shall contain the parameters for postweld heat treatment. Local PWHT that is not specified by the original code of construction may be performed in accordance with an Alternative Postweld Heat Treatment Method described in NBIC Part 3, 2.5.3, with acceptance by the Inspector and required by the Competent Authority.

S6.10.3 ALTERNATIVES TO POSTWELD HEAT TREATMENT

a) Under certain conditions, postweld heat treatment in accordance with the original code of construction may be inadvisable or impractical. In such instances, alternative methods of postweld heat treatment or special welding methods in accordance with NBIC Part 3, 2.5.3, and acceptable to the Inspector and Competent Authority may be used.

b) When the standard governing the original construction is the Code of Federal regulation for DOT/MC 331 cargo tanks for propane, butane, anhydrous ammonia, and other DOT permitted commodities, and the tanks are made to the ASME Code, Section VIII, Division I, Part UHT, repairs, alterations, or modifications shall conform insofar as possible, to the edition of the construction standard or specification most applicable to the work. Where this is not possible or practicable, it is permissible to use other codes, standards, or specifications provided the “TR” Certificate Holder has the concurrence of the DOT. Shells and heads of MC 331 cargo tanks were made from quenched and tempered alloy steel plate, SA517, Grade E (originally Code Case 1298) and Grade F (originally Code Case 1204) prior to 1994.

c) The 1994 ASME Code Addenda revised UHT-5(b) to permit the joining of UHT materials to UCS or UHA materials in head and shell sections. Propane, butane, and anhydrous ammonia are the most common transported commodities and the shipper is required by DOT to comply with certain composition limitations. Propane and butane transported must have sufficiently low hydrogen sulfide content so as not to exceed the limitations for Classification One of the ASTM D1838-74 copper strip test, and the anhydrous ammonia transported must be inhibited with a minimum water content of 0.2% by weight. In addition, such cargo tanks made for propane, butane, and anhydrous ammonia service must be postweld heat treated, unless specifically exempted by a DOT special permit that exempts PWHT.

S6.11 NONDESTRUCTIVE EXAMINATION
b) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction used for the pressure vessel, and repairs, alterations, and modifications shall be subjected to the same nondestructive examination requirements as the original welds. Where this is not possible or practicable, alternative NDE methods acceptable to the Inspector and the Competent Authority may be used on a case-by-case basis.

c) NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer’s written practice. ASNT SNT-TC-1A, *Recommended Practice for Nondestructive Testing Personnel Qualification and Certification (2006 Edition)*, or ANSI/ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel (2006 Edition)*, shall be used as a guideline for employers to establish their written practice. The ASNT Central Certification Program (ACCP) may be used to fulfill the examination and demonstration requirements of the employer’s written practice. Provisions for training, experience, qualification and certification of NDE personnel shall be described in the “R” Certificate Holder’s written quality system.
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### 2.2.1 GENERAL REQUIREMENTS

| **a)** Only direct spring loaded, pilot operated, or power actuated pressure relief valves or pilot operated pressure relief valves designed to relieve steam shall be used for steam service. |
| **b)** Pressure relief valves are valves designed to relieve either steam or water, depending on the application. |
| **c)** Pressure relief valves shall be manufactured in accordance with a national or international standard. |
| **d)** Deadweight or weighted-lever pressure relief valves shall not be used. |
| **e)** For high temperature water boilers, pressure relief valves shall have a closed bonnet, and valve bodies shall not be constructed of cast iron. |
| **f)** Pressure relief valves with an inlet connection greater than NPS 3 (DN 80) and used for pressure greater than 15 psig (100 kPa), shall have a flanged inlet connection or a welding-end inlet connection. The dimensions of flanges subjected to boiler pressure shall conform to the applicable standards. |
| **g)** When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be properly vented and arranged to permit servicing and normal operation of the valve. |

### Part 4, 2.3.6

| **h)** A suitable condenser that will condense all the vapors discharged from the pressure relief valve may be used in lieu of piping the vapors to the atmosphere. |

### Part 4, 2.4.2 PRESSURE RELIEF VALVE REQUIREMENTS FOR STEAM HEATING BOILERS

| **a)** Pressure relief valves shall be manufactured in accordance with a national or international standard. |
| **b)** Each steam boiler shall have one or more National Board capacity certified pressure relief valves of the spring pop type adjusted and sealed to discharge at a pressure not to exceed 15 psig (100 kPa). |
| **c)** No pressure relief valve for a steam boiler shall be smaller than NPS 1/2 (DN 15). No pressure relief valve shall be larger than NPS 4 (DN 100). The inlet opening shall have an inside diameter equal to, or greater than, the seat diameter. |
d) The minimum valve capacity in lbs/hr (kg/hr) shall be the greater of that determined by dividing the maximum Btu/hr (W) output at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by 1,000 Btu/hr/lb (645 W/kg), or shall be determined on the basis of the lbs steam/hr/ft\(^2\) of boiler heating surface as given in Table 2.2.4.1, as follows:

1) The minimum pressure relief capacity as declared on the boiler nameplate for the specified fuel.

2) If the capacity is not marked on the boiler nameplate or the fuel has been changed: the capacity shall be the greater of the following:
   a) Minimum mass of steam per area of heating surface: lbs steam/hr ft\(^2\) (kg steam/hr m\(^2\)), as specified in Table 2.9.1.3.
   b) The maximum output method: required valve capacity is determined by the following equation:

   \[
   \text{Capacity (lb/hr)} = \frac{\text{Heat Input (Btu/hr)}}{1,000 (\text{Btu/lb})} \]
   or \[
   \text{Capacity (kg/hr)} = \frac{\text{Heat Input (kJ/hr)}}{2326 (\text{kJ/kg})}
   \]

   The Heat Input shall be based upon the firing of the highest energy content fuel used in the unit.

3) For cast-iron boilers, the minimum valve capacity shall be determined by the maximum output method.

In many cases a relieving capacity greater than the minimum capacity specified by these rules will have to be provided. In every case, the requirement of 2.4.2 e) shall be met.

e) The pressure relief valve capacity for each steam boiler shall be such that with the fuel burning equip- ment installed, and operated at maximum capacity, the pressure cannot rise more than 5 psig (34 kPa) above the maximum allowable working pressure.

f) When operating conditions are changed, or additional boiler heating surface is installed, the valve capacity shall be increased, if necessary, to meet the new conditions and be in accordance with 2.4.2 e). The additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.

1.4 ACCREDITATION

h) The National Board administers four specific accreditation programs:

- “R” – Repairs and Alterations to Pressure-Retaining Items
- “VR” – Repairs to Pressure Relief Valves
- “NR” – Repair and Replacement Activities for Nuclear Items
- “T/O” – In-service Testing Only of Pressure Relief Valves

Organizations performing repairs and in-service testing to pressure relief
valves shall be accredited as described in this section, as appropriate for the scope of work to be performed.

bc) Organizations performing repairs and in-service testing to pressure relief valves outside the scope of the NBIC may be accredited and shall meet any additional requirements of the Jurisdiction where the work is performed.

1.4.1 ACCREDITATION PROCESS

a) The National Board administers accreditation programs for authorization of organizations performing repairs and in-service testing to pressure relief valves.

b) Any organization may apply to the National Board to obtain a Certificate of Authorization for a requested scope of activities. A review shall be conducted to evaluate the organization’s Quality System. The individual assigned to conduct the evaluation shall meet the qualification requirements prescribed by the National Board. Upon completion of the evaluation, any deficiencies within the organization’s Quality System will be documented and a recommendation will be made to the National Board regarding issuance of a Certificate of Authorization.

c) National Board procedures provide for the confidential review resulting in recommendations to issue or not issue a Certificate of Authorization.

d) The accreditation program provides requirements for organizations performing repairs and in-service testing to pressure relief valves. Depending upon the expected scope of activities at the time of review, organizations may be authorized to perform repairs and in-service testing either in the shop only, field only, or shop and field. Repair and in-service testing activities shall be limited to the scope of work authorized.

e) Organizations desiring to renew or obtain a National Board Certificate of Authorization shall apply to the National Board using forms obtained from the National Board. Application for renewal shall be made prior to the expiration date of the Certificate of Authorization.

f) When an organization has shops in more than one location, the organization shall submit separate applications for each shop. The organization may perform repairs in its shop or in the field, provided such operations are described in the organization’s Quality System.
3.3 ACCREDITATION OF “T/O” TEST ONLY ORGANIZATIONS

3.3.1 SCOPE

a) This section provides requirements that must be met for an organization to obtain a National Board Certificate of Authorization to use the “T/O” Certification Mark for in-service testing and performing minor adjustments of pressure relief valves constructed in accordance with the requirements of the ASME Code.

b) For administrative requirements to obtain or renew a National Board “T/O” Certificate of Authorization and “T/O” Certification Mark, refer to NB-528, Accreditation of “T/O” Test Only Organizations.

c) Authorization to use the official National Board “T/O” Certification Mark as shown in Figure 3.5.2-a), will be granted by the National Board provided the requirements of the administrative rules in NB-528 and the NBIC are met.

3.3.2 JURISDICTIONAL PARTICIPATION

The National Board member jurisdiction in which the “T/O” organization is located is encouraged to participate in the review and demonstration of the applicant’s quality system. The Jurisdiction may require participation in the review of the testing organization and the demonstration and acceptance of the repair organization’s quality system manual.

3.3.3 QUALITY SYSTEM

3.3.3.1 GENERAL

Each applicant for a new or renewed “T/O” Certificate of Authorization shall have and maintain a quality system which shall establish that all of these rules and administrative procedures and applicable ASME Code requirements, testing, inspection, sealing, and applying the T/O certification mark will be met.

3.3.3.2 WRITTEN DESCRIPTION

A written description, in the English language, of the system the applicant will use shall be available for review and shall contain, as a minimum, the
features set forth in 3.3.3.4. This description may be brief or voluminous, depending upon the projected scope of work, and shall be treated confidentially. In general, the quality system shall describe and explain what documents and procedures the testing firm will use to validate a test and/or minor adjustment.

3.3.3.3 MAINTENANCE OF A CONTROLLED COPY

Each applicant to whom a “T/O” Certificate of Authorization is issued shall maintain thereafter a controlled copy of the accepted quality system manual with the National Board. Except for changes that do not affect the quality system, revisions to the quality system manual shall not be implemented until such revisions are accepted by the National Board.

3.3.3.4 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM

The following establishes the minimum requirements of the written description of the quality system. It is required that each testing organization develop its own quality system that meets the requirements of its organization. For this reason it is not possible to develop one quality system that could apply to more than one organization. The written description shall include, as a minimum, the following features:

a) Title Page

The title page shall include the name and address of the company to which the National Board Certificate of Authorization is to be issued.

b) Revision Log

A revision log is required to ensure revision control of the quality system manual. The log should contain sufficient space for date, description and section of revision, company approval, and National Board acceptance.

c) Contents Page

The contents page should list and reference, by section paragraph or page number, the subjects and exhibits contained therein.

d) Statement of Authority and Responsibility

A statement of authority and responsibility shall be dated and signed by an
officer of the company. It shall include:

1) A statement that the “T/O” Certification Mark shall be used only for pressure relief valves that meet the following conditions:
   a. Are marked with an ASME “V”, “UV”, or “HV” Code symbol or marked with the ASME Certification Mark with “V”, “UV”, or “HV” designator and have been capacity certified by the National Board;
   b. Have been visually inspected, and successfully tested in accordance with this program; and
   c. Only external adjustments to restore the nameplate set pressure and/or performance of a pressure relief valve shall be made under the provisions of this program. If disassembly, change of set pressure, or additional repairs are necessary, the valve shall be repaired by a National Board “VR” Certificate Holder or replaced.

2) The title of the individual responsible for ensuring that the quality system is followed and who has authority and freedom to affect the responsibility;

3) A statement that if there is a disagreement in the implementation of the written quality system, the matter is to be referred to a higher authority in the company for resolution; and

4) The title of the individual authorized to approve revisions to the written quality system and the method by which such revisions are to be submitted to the National Board for acceptance before implementation.

e) Organization Chart
A chart showing the relationship between management, inspection, testing, and quality control personnel is required and shall reflect the actual organization in place.

f) Scope of Work
The scope of work section shall indicate the scope and type of valve testing the organization is capable of and intends to perform. The location of testing (shop, shop and field, or field only), ASME Code Section(s) to which the tests apply, and the test medium (air, gas, liquid, or steam, or combinations thereof) shall be included.

2) The types and sizes of valves to be tested, pressure ranges and other limitations shall also be addressed.

g) Specification Control
The specification control system shall provide procedures assuring that the
latest applicable specifications and instructions required are used for valve inspection and testing.

h) Inspection and Testing Program

The inspection and testing program section shall include reference to a document (such as an inspection and test report, or checklist) that outlines the specific inspection and testing procedures used in the testing of pressure relief valves. Provisions shall be made to retain this document for a period of at least five years.

1) Each valve or group of valves shall be accompanied by the document referred to above for processing through the plant. Each valve shall have a unique identifier assigned by the Test Only organization (e.g., job serial number, shop order number, work order number, etc.) appearing on the test documentation and test only nameplate such that traceability is established.

2) The document referred to above shall describe the original nameplate information, including the ASME Code symbol stamping and, if applicable, the repair nameplate information. In addition, it shall include pressure test methods to be used. Application of the “T/O” Certification Mark to the test nameplate shall be recorded in this document. There shall be a space for “signoffs” at each operation to verify that each step has been properly performed by qualified personnel.

3) The system shall also describe the controls used to ensure that any personnel engaged in the testing of pressure relief valves are trained and qualified in accordance with 3.4.

i) Valve Adjustment and Sealing

1) The system shall include provisions that each pressure relief valve requiring adjustment as permitted by 3.2.5.2 shall have existing seal(s) removed only for the required adjustment(s), be tested, set, and external adjustment(s) re-sealed according to the requirements of the applicable ASME Code Section and the NBIC. The seal shall identify the “T/O” Certificate Holder performing the test or making the adjustment. Abbreviations or initials are permitted, provided such identification is defined in the quality system and acceptable to the National Board.

2) The system shall include provisions that each pressure relief valve requiring the use of a Lift Assist Device for testing as permitted by 3.2.5 c) may have the seal(s) removed for testing.
Upon completion of testing, external adjustments shall be resealed in accordance with i) 1) above.

j) Test Only Nameplates
The quality system shall include a description of a nameplate or a drawing. An effective valve marking system shall be established to ensure proper marking and nameplate attachment for each valve as required by 3.5.2. The manual shall include a description of the nameplate or a drawing.

k) Calibration
1) The quality system shall describe a system for the calibration of examination, measuring, and test equipment used in the performance of testing. Documentation of these calibrations shall include the standard used and the results.
2) All calibration standards shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.

l) Manual Control/Procedures
The quality system manual and referenced procedures shall include:
1) Measures to control the issuance of and revisions to the quality system manual;
2) Provisions for a review of the system in order to maintain the manual current with these rules and the applicable sections of the ASME Code and NBIC;
3) The title(s) of the individual(s) responsible for preparation, revision distribution, approval, and implementation of the quality system manual;
4) Provision for a controlled copy of the written quality system manual to be submitted to the National Board for acceptance prior to implementation; and
5) Revisions shall be submitted for acceptance by the National Board prior to being implemented.

m) Nonconformities
The quality system shall establish measures for the identification, documentation, evaluation, segregation, and disposition of nonconformities. A non-conformity is a condition of any material, item, product, or process in which one or more characteristics do not conform to the established requirements. These may include, but are not limited to, data discrepancies, procedural and/or documentation deficiencies, or material defects. Also, the title(s) of the individual(s) involved in this process shall be included.
n) Testing Equipment (See NBIC Part 4, Supplement 5)
The quality system shall include a means to control the development, addition, or modification of testing equipment to ensure the requirements of NBIC Part 4, 4.6.1 b) are met.

o) Field Testing
If field testing is included in the scope of work, the system shall address any differences or additions to the quality system required to properly control this activity, including the following:

1) Provisions for annual audits of field activities shall be included;

2) Provisions for use of owner-user measurement and test equipment, if applicable, shall be addressed.

p) Records Retention
The quality manual shall describe a system for filing, maintaining, and easily retrieving records supporting or substantiating the administration of the Quality System within the scope of the “VR” Certificate of Authorization. The record retention schedule described in the Quality System Manual is to follow the instructions identified in Table 3.3.3.4 p).

q) Exhibits
Forms used in the quality system shall be included in the manual with a written description. Forms exhibited should be marked “SAMPLE” and completed in a manner typical of actual valve testing procedures.

<table>
<thead>
<tr>
<th>Reports, Records, or Documents for “T/O” Certificate Holders</th>
<th>Instructions</th>
<th>Minimum Retention Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td>Retention Period</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>------------------</td>
</tr>
<tr>
<td>a) Record of testing or inspection</td>
<td>The testing and inspection program section shall include reference to a document (such as a report, traveler, or checklist) that outlines the specific testing and inspection procedures used in the testing of pressure relief valves.</td>
<td>5 years</td>
</tr>
<tr>
<td>b) Records related to equipment qualification and instrument calibration</td>
<td>Prior to use, all performance testing equipment shall be qualified by the certificate holder to ensure that the equipment and testing procedures will provide accurate results when used within the ranges established for that equipment. This qualification may be accomplished by benchmark testing, comparisons to equipment used for verification testing as specified in the quality system, or comparisons to field performance.</td>
<td>5 years after the subject piece of equipment or instrument is retired.</td>
</tr>
<tr>
<td>c) Record of lift assist device qualification</td>
<td>Prior to use, all lift assist devices shall be qualified by the certificate holder to ensure that the equipment and testing procedures will provide accurate results when used within the ranges established for that equipment used for verification testing as specified in the quality system, or comparisons to field performance. This qualification shall be documented.</td>
<td>5 years after the lift assist device is retired.</td>
</tr>
<tr>
<td>d) Records of employee training and qualification</td>
<td>Each testing organization shall establish minimum qualification requirements for those positions within the organization as they directly relate to pressure relief valve testing. Each testing organization shall document the evaluation and acceptance of an individual’s qualification for the applicable position.</td>
<td>5 years after termination of employment.</td>
</tr>
</tbody>
</table>
3.3.4 TESTING & ADJUSTMENT

a) Each Pressure Relief Valve to be tested shall be inspected in accordance with Section 3.2.2.
b) Pressure Relief Valves with missing or illegible nameplates shall not be tested under the T/O program and shall be referred to a VR Certificate Holder or replaced.
c) Pressure Relief Valves shall be tested to confirm that the Set Pressure (defined as the average of at least three consecutive tests) is within the allowable tolerance specified by the applicable ASME Code Section and NBIC. Test Results, including Test Gauge Identification, shall be recorded on the document referred to above. Pressure Relief Valve seals shall not be removed unless required for adjustment or testing using a lift assist device.
d) Testing organizations may obtain a “T/O” Certificate of Authorization for field testing, either as an extension to their in-shop/plant scope, or as a field-only scope, provided that the Quality System includes the following provisions:
   1) Qualified technicians in the employ of the certificate holder perform such testing;
   2) An acceptable quality system covering field testing, including field audits is maintained; and
   3) Functions affecting the quality of the tested valves are supervised from the address of record where the “T/O” certification is issued.

3.3.4.1 AUDIT REQUIREMENTS

Upon issuance of a Certificate of Authorization, provided field tests are performed, annual audits of the work carried out in the field shall be performed to ensure that the requirements of the certificate holder’s quality system are met. The audit shall include, but not be limited to, performance testing, in accordance with paragraph 4.6, of valve(s) that were tested in the field. The audits shall be documented.

3.4 TRAINING AND QUALIFICATION OF PERSONNEL

3.4.1 CONTENTS OF TRAINING PROGRAM

The applicant shall establish a documented in-house training program. This program shall establish training objectives and provide a method of evaluating the training effectiveness. As a minimum, training objectives for knowledge level shall include:

   a) Applicable ASME Code and NBIC requirements:
b) Responsibilities within the organization’s quality system:

e) Knowledge of the technical aspects and mechanical skills for making set pressure and/or blowdown adjustments to pressure relief valves;

d) Knowledge of the technical aspects and mechanical skills for marking and sealing of pressure relief valve adjustments.

3.5 MARKING REQUIREMENTS FOR VALVES TESTED UNDER THE T/O PROGRAM

3.5.1 NAMEPLATES
Proper marking and identification of tested valves is critical to ensuring acceptance during subsequent inspections, and also provide for traceability and identification to the valve.

3.5.2 TEST ONLY NAMEPLATE & VALVE SEALING
When a pressure relief valve is tested, a metal test only nameplate marked with the information required below shall be securely attached to the valve adjacent to the original manufacturer’s stamping or nameplate and/or repair nameplate. If not installed directly on the valve, the nameplate shall be securely attached to the valve independent of the external adjustment seals in a manner that does not interfere with valve operation and sealed in accordance with the quality system.

a) Existing manufacturer/assembler and VR nameplates if applicable shall not be removed.

b) Existing manufacturer/assembler, VR, and/or TO seals shall remain in place unless removal is required to perform testing or adjustment. Following testing, the valve shall be resealed by the responsible T/O Certificate Holder.

c) Any previous test only nameplates shall be removed.

d) As a minimum, the information on the T/O nameplate (see Figure 3.5.2-a) shall include:

1) The name of responsible organization preceded by the words “Tested by” shall be applied
2) Date of test shall be applied
3) Set pressure shall be applied
4) Unique identifier of test shall be applied (eg, shop order
5) The T/O Certification Mark as provided by the National Board

6) National Board T/O certificate number

![FIGURE 3.5.2-a]

**REQUIRED MARKINGS FOR TESTING OF ASME/NATIONAL BOARD “V,” “UV,” AND “HV” — STAMPED PRESSURE RELIEF VALVES UNDER THE T/O PROGRAM**

**TESTED BY**

CERTIFICATE HOLDER

DATE OF TEST

SET PRESSURE

UNIQUE IDENTIFICATION

NATIONAL BOARD “T/O” CERTIFICATE NUMBER

### 4.1 SCOPE

This section provides requirements and guidelines that apply to repairs to pressure relief valves.

a) Repairs may be required because of defects found during periodic inspection, testing, operation, or maintenance. Since pressure relief devices are provided for safety and the protection of personnel and property, repairs are often regulated by the jurisdiction where the pressure relief device is installed. The jurisdiction should be contacted for their specific requirements.

b) The National Board administers four specific accreditation programs:

   - “R” = Repairs and Alterations to Pressure-Retaining Items
   - “VR” = Repairs to Pressure Relief Valves
   - “NR” = Repair and Replacement Activities for Nuclear Items
   - “T/O” = In-service Testing Only of Pressure Relief Valves
This section describes some of the administrative requirements for the accreditation of repair organizations. Additional administrative requirements can be found in NB-514, Accreditation of “VR” Repair Organizations. Some jurisdictions may independently administer a program of authorization for organizations to perform repairs within that Jurisdiction.

d) Requirements for the “T/O” are found in NB-528, Accreditation of “T/O” Test Only Organizations.

e) Requirements for repairs and alterations to pressure-retaining items and repair and replacement activities for nuclear items can be found in NBIC Part 3.

4.2 GENERAL REQUIREMENTS

a) Repair of a pressure relief valve is considered to include the disassembly, replacement, re-machining, or cleaning of any critical part, lapping of a seat and disc, reassembly, adjustment, testing, or any other operation that may affect the flow passage, capacity, function, or pressure-retaining integrity.

b) Conversions, changes, or adjustments (excluding those as defined in 3.2.5.2a) or Part 2 Paragraph 2.5.7.2a) affecting critical parts are also considered repairs. The scope of conversions may include changes in service fluid and changes such as bellows, soft seats, and other changes that may affect Type/Model number provided such changes are recorded on the document as required for a quality system and the repair nameplate. (See 4.7.1).

c) The scope of repair activities shall not include changes in ASME Code status.

4.7.4 TEST ONLY NAMEPLATE

a) Where a valve has been tested and adjusted to restore the set pressure shown on the unmodified original nameplate or stamping, or repair nameplate, as permitted by S3.1, but not otherwise repaired, a "Test Only” nameplate shall be applied that contains the following information:
1) Name of responsible organization;

2) Date of test;

3) Set Pressure; and

4) Identification, such as “Test Only.”

b) A “Test Only” nameplate is also recommended when periodic testing has been performed, even when no adjustments have been made, for the purpose of identifying the date the valve was tested.

c) The existing repair nameplates, if applicable, shall not be removed during such testing.

SUPPLEMENT
RECOMMENDED PROCEDURES FOR TEST ONLY OF PRESSURE RELIEF VALVES

S7.1 INTRODUCTION

a) It is essential that the test only organization establish basic, specific procedures for the testing of pressure relief valves. The purpose of these recommended procedures is to provide the test only organization with guidelines for this important aspect of valve testing. It is realized that there are many types of valves and conditions under which they are tested and, for this reason, the specific items in these recommended procedures may not apply, or they may be inadequate for each of those types or for the detailed test procedures that may be required for each valve.

b) If the valve is to be bench tested, ensure that all sources of pressure have been removed from the valve prior to removal from service. If the valve is to be field tested using system pressure, ensure that all sources of pressure are under the control of the person performing the test.

c) S7.2 contains recommended procedures for the test only of spring-loaded and pilot operated pressure relief valves.

S7.2 PRESSURE RELIEF VALVES

Prior to field testing of a relief valve using system pressure or removal for bench testing, ensure that all sources of pressure have been removed from the valve.

a) Visual inspection

1) This information is to be recorded
a) User (customer) identification number;

b) Complete original pressure relief valve nameplate data, previous VR repair nameplate data, previous T/O test only nameplate data plus any important information received from customer.

c) If nameplate is missing, illegible or has incorrect information, the pressure relief valve shall not be tested. Relief valve should be sent to VR repair shop per paragraph 4.7.5

2) Verify external adjustment seals are installed and match manufacturer and/or VR – T/O nameplate.

3) Check bonnet for venting on bellows type valves.

4) Check appearance for any unusual damage, missing, or misapplied parts. If sufficient damage or other unusual conditions are detected that may pose a safety risk during testing, set aside for review by the Quality Department.

b) Existing Nameplate

1) An existing VR Nameplate, if applicable, shall not be removed from the relief valve

2) An existing TO Nameplate shall be removed from the relief valve

c) Relief Valve Data

1) “Set Pressure Definition” shall be obtained from National Board Document # NB-18

2) CDTP (Cold Differential Test Pressure), Manufacturer’s steam to air correction factor, if applicable, shall be obtained from Manufacturer.

d) Set Pressure Test

1) If set pressure test indicates the valves opens within the requirements of the original code of construction. Proceed to Seat Tightness.

2) If set pressure test indicates the valve does not open within the requirements of the original code of construction, but opens within twice the set pressure tolerance allowed per the requirements of the original code of construction and is otherwise in acceptable condition, set pressure restoration (defined as no more than twice the permitted set pressure tolerance) shall be made. Proceed to Seat Tightness.

3) If set pressure test indicates the valve does not open within twice the set pressure tolerance allowed per the requirements of the original code of construction, valve should be sent to a VR shop for repair or scrapped.

e) Seat Tightness

1) Seat tightness must be tested at a level which meets the requirements of the end user.
f) Sealing

1) After completion of set pressure test, set pressure restoration (if applicable) and seat tightness testing, all external adjustments shall be sealed in accordance with the original code of construction with a seal providing a means of identification of the organization performing the set pressure test.

g) T/O Nameplate

1) The tester shall prepare a T/O nameplate for each valve tested.

2) The nameplate shall, as a minimum, meet the requirements of 3.5.2 a)

3) Nameplate shall be installed independent of sealing used for external adjustments and/or VR nameplate attachment.

Nameplate shall receive a safety seal providing a means of identification of the organization performing the set pressure testing.
2.2.4 CAPACITY

a) The pressure relief valve capacity for each boiler shall be such that the valve or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than 6% above the highest pressure at which any valve is set and in no case to more than 8% above the maximum allowable working pressure of the boiler.

b) The minimum relieving capacity for other than electric boilers and forced-flow steam generators with no fixed steam line and waterline shall be estimated for the boiler and waterwall heating surfaces as given in Table 2.2.4.1, but in no case shall the minimum relieving capacity be less than the maximum designed steaming capacity as determined by the manufacturer.

c) The required relieving capacity in lbs/hr of the pressure relief valves on a high-temperature water boiler shall be determined by dividing the maximum output in Btu at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by one thousand.

d) The minimum pressure relief valve relieving capacity for electric boilers shall not be less than 3.5 lbs/hr/kW (1.6 kg/hr/kW) input.

e) If the pressure relief valve capacity cannot be computed, or if it is desirable to prove the computations, it should be checked by any one of the following methods; and if found insufficient, additional relieving capacity shall be provided:

1) By performing an accumulation test, that is, by shutting off all other steam discharge outlets from the boiler and forcing the fires to the maximum. This method should not be used on a boiler with a superheater or reheater or on a high-temperature water boiler.

2) By measuring the maximum amount of fuel that can be burned and computing the corresponding evaporative capacity upon the basis of the heating value of the fuel.

3) By determining the maximum evaporative capacity by measuring the feedwater. The sum of the pressure relief valve capacities marked on the valves shall be equal to or greater than the maximum evaporative capacity of the boiler. This method should not be used on high-temperature water boilers.

The required relieving capacity, $C$, of the pressure relief valves on a high-temperature water boiler shall be determined as follows:

$$C = \frac{Q}{L}$$

where,

$C$ = required relieving capacity in lbs/hr (kg/hr)

$Q$ = maximum output in BTU/hr (W) at the boiler nozzle obtained by the firing of any fuel for which the unit is designed

$L$ = 1000 BTU/lb (646 W/hr/kg)

2.4.4.1 Temperature and pressure relief valves shall be installed by either the water heater manufacturer or installer or the manufacturer before a water heater is placed in operation.

2.4.4.2 PERMISSIBLE INSTALLATIONS

Temperature and pressure relief valves shall be connected directly to a tapped or flanged opening in the top of the water heater, or to a fitting connected to the water heater by a short nipple, to a Y-base, or to a valveless header connecting water outlets on the same
Temperature and pressure relief valves shall be installed with their spindles upright and vertical with no horizontal connecting pipe, except that, when the temperature and pressure relief valve is installed directly on the water heater vessel with no more than 4 in. (100 mm) maximum interconnecting piping, the valve may be installed in the horizontal position with the outlet pointed down. The center line of the temperature and pressure relief valve connection shall be no lower than 4 in. (100 mm) from the top of the shell. No piping or fitting used to install the temperature and pressure relief valve shall be of nominal pipe size less than that of the valve inlet.

3.2.5.2 VALVE ADJUSTMENTS
a) If a set pressure test indicates the valve does not open within the requirements of the original code of construction, but otherwise is in acceptable condition, minor adjustments (defined as no more than twice the permitted set pressure tolerance) shall be made by a qualified organization accredited by the National Board “VR” or “T/O” Certificate Holder to reset the valve to the correct opening pressure. All adjustments shall be resealed with a seal identifying the responsible organization and a tag shall be installed identifying the organization and the date of the adjustment. Qualified organizations are considered to be National Board “VR” Certificate Holders, or organizations authorized by the Jurisdiction to make adjustments. See Supplement 3 for more information.

3.2.6.2 ESTABLISHMENT OF SERVICE INTERVALS
b) Pressure relief valves are mechanical devices that require periodic preventive maintenance even though external inspection and test results indicate acceptable performance. There may be wear on internal parts, galling between sliding surfaces, internal corrosion, or fouling which will not be evident from an external inspection or test. Periodic re-establishment of seating surfaces and the replacement of soft goods such as o-rings and diaphragms are also well advised preventive maintenance activities that can prevent future problems. If the valve is serviced, a complete disassembly, internal inspection, and repair as necessary, such that the valve’s condition and performance are restored to a like new condition, should be done by a National Board “VR” Certificate Holder or an organization accredited by the National Board.

PART 4, 4.2.1 VR REPAIR
a) When a repair is being performed under the administrative requirements for National Board Accreditation, a repair shall consist of the following operations as a minimum:

1) Complete disassembly, cleaning, and inspection of parts, repair or replacement of parts found to be defective, reassembly, testing as required by 4.6, sealing and application of a repair nameplate. When completed, the valve’s condition and performance shall be equivalent to the standards for new valves.

2) The administrative requirements for National Board Accreditation apply only to valves that are stamped marked with the ASME Certification Mark and the “V”, “UV”, “HV”, or “NV” Designator or the supplanted ASME “V,” “UV,” “HV” or “NV” Code symbol or marked with an ASME “HV” symbol and have been capacity certified on the applicable fluid by the National Board.

4.7.2 REPAIR NAMEPLATE
When a pressure relief valve is repaired, a metal repair nameplate stamped with the information required below shall be securely attached to the valve adjacent to the original manufacturer’s
4.7.2 stamping or nameplate. If not installed directly on the valve, the nameplate shall be securely attached to the valve independent of the external adjustment seals in a manner that does not interfere with valve operation and sealed in accordance with the quality system.

PART 4, 4.7.5 REPLACEMENT OF ILLEGIBLE OR MISSING NAMEPLATES

a) Illegible Nameplates
When the information on the original manufacturer’s or assembler’s nameplate or stamping is illegible, but traceability can be confirmed, the nameplate or stamping shall be augmented by a nameplate furnished by the “VR” stamp holder stamped “Duplicate.” It shall contain all information that originally appeared on the nameplate or valve, as required by the applicable section of the ASME Code, except the ASME Certification Mark and the “V,” “UV,” or “HV” Designator or the supplanted “V,” “HUV,” or “UHV” symbol and the National Board mark. The repair organization’s nameplate, with the “VR” stamp and other required data specified in 4.7.2, will make the repairer responsible to the owner and the Jurisdiction that the information on the duplicate nameplate is correct.

b) Missing Nameplates
When the original valve nameplate is missing, the repair organization is not authorized to perform repairs to the valve under the “VR” program, unless positive identification can be made to that specific valve and verification that the valve was originally stamped-marked with the ASME Certification Mark and the “V,” “UV,” or “HV” Designator or the supplanted an ASME “V,” “UV,” or “HV” symbol or marked with an ASME “HV” symbol. Valves that can be positively identified shall be equipped with a duplicate nameplate, as described in this section, in addition to the repairer’s “VR”-stamped nameplate. The repairer’s responsibilities for accurate data, as defined in 4.7.5(a) (Illegible Nameplates), shall apply.

c) Marking of Original Code Stamp
When a duplicate nameplate is affixed to a valve, as required by this section, it shall be marked “Sec. I,” “Sec. IV,” or “Sec. VIII,” as applicable, to indicate the original ASME Code stampingmarking.

d) Statement of Authority and Responsibility
A statement of authority and responsibility shall be dated and signed by an officer of the company. It shall include:

1) A statement that the “VR” stamp shall be applied only to pressure relief valves that meet both of the following conditions:

a. Are stamped-marked with the ASME Certification Mark and the “V,” “UV,” “HV,” or “NV” Designator or the supplanted an ASME “V,” “UV,” or “HV” Code symbol or marked with an ASME “HV” symbol; and have been capacity certified by the National Board; and

PART 4, 4.8.5.4 i)

i) Repair and Inspection Program
The repair and inspection program section shall include reference to a document (such as a report, traveler, or checklist) that outlines the specific repair and inspection procedures used in the repair of pressure relief valves. Repair procedures shall require verification that the critical parts meet the valve manufacturer’s specification. Supplement 4 outlines recommended procedures covering some specific items. This document shall be retained in accordance with Table 4.8.5.4 s).
1) Each valve or group of valves shall be accompanied by the document referred to above for processing through the plant. Each valve shall have a unique identifier (i.e., repair serial number, shop order number, etc.) appearing on the repair documentation and repair nameplate such that traceability is established.

2) The document referred to above shall describe the original nameplate information, including the ASME Code symbol stamping and the repair nameplate information, if applicable. In addition, it shall include material checks, replacement parts, conversion parts (or both), reference to items such as the welding procedure specifications (WPS), fitup, NDE technique, heat treatment, and pressure test methods to be used. Application of the “VR” stamp to the repair nameplate shall be recorded in this document. Specific conversions performed with the new Type/Model number shall be recorded on the document. There shall be a space for “signoffs” at each operation to verify that each step has been properly performed.

3) The system shall include a method of controlling the repair or replacement of critical valve parts. The method of identifying each spring shall be indicated on the repair document described in 4.8.5.4 i). Such identification shall be based on the Manufacturer’s spring chart current at the time of the repair, except that the spring removed from the valve during the repair bearing different identification may be reinstalled provided the “VR” Certificate Holder has verified the spring is acceptable to the Manufacturer. Such verification shall be documented on the repair document described in 4.8.5.4 i).

4) The system shall also describe the controls used to ensure that any personnel engaged in the repair of pressure relief valves are trained and qualified in accordance with this section.

<table>
<thead>
<tr>
<th>18-74 Part 4, S4.1 and S4.2</th>
<th>S4.1 INTRODUCTION</th>
</tr>
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<tr>
<td>a) It is essential that the repair organization establish basic, specific procedures for the repair of pressure relief valves. The purpose of these recommended procedures is to provide the repair organization with guidelines for this important aspect of valve repair. It is realized that there are many types of valves and conditions under which they are repaired and, for this reason, the specific items in these recommended procedures may not apply, or they may be inadequate for each of those types or to the detailed repairs that may be required for each valve.</td>
<td></td>
</tr>
</tbody>
</table>
b) Prior to removal, repair, or disassembly of a pressure relief valve ensure that all sources of pressure have been removed.

bc) S4.2 contains recommended procedures for the repair of spring-loaded pressure relief valves, and S4.3 contains recommended procedures for the repair of pilot operated types of pressure relief valves. Information on packaging, shipping and transportation is included as S4.5.

**S4.2 SPRING-LOADED PRESSURE RELIEF VALVES**

Prior to removal of a value from a system for a repair or any disassembly, ensure that all sources of pressure have been removed from the valve.

a) Visual inspection as received

1) This information is to be recorded:
   a. Record user (customer) identification number;
   b. Complete original PRV nameplate data, previous repair nameplate data, plus any important information received from customer;
   c. Check external adjustment seals for warranty repair;
   d. Check bonnet for venting on bellows type valves; and
   e. Check appearance for any unusual damage, missing, or misapplied parts.

2) If sufficient damage or other unusual conditions are detected that may pose a safety risk during preliminary testing, then proceed directly to S4.2 c)

3) Valves that are to be repaired in place proceed to S4.2 c) unless preliminary testing has been authorized by the owner.

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**SUPPLEMENT 6**

PROCEDURES FOR REPAIRS TO ASME “NV” STAMPED PRESSURE RELIEF DEVICES OF NUCLEAR SAFETY RELATED PRESSURE RELIEF VALVES

**S6.1 INTRODUCTION**

ASME Code “NV” Class 1, 2, or 3 stamped pressure relief devices, which have been
Nuclear safety related pressure relief valves and power actuated pressure relief valves may be repaired provided the following requirements are met. Valves being repaired under these provisions are intended to be those protecting the nuclear pressure boundary. Other pressure relief valves in the nuclear power plant (such as pressure relief valves on air compressors and auxiliary boilers) shall be repaired as required by the applicable Jurisdiction.

S6.2 DEFINITIONS

Safety Related – As used in this supplement and when applied to nuclear power plants, safety related means a structure, system, or component or part thereof that affects its safety function necessary to assure:

a) The integrity of the reactor coolant pressure boundary;

b) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

c) The capability to prevent or mitigate the consequence of accidents which could result in potential offsite exposures.

S6.3 NUCLEAR SAFETY RELATED VALVE GROUPS

These rules classify nuclear safety related pressure relief valves into three groups based upon the original code of construction and capacity certification status.

Group 1: ASME Section I and Section VIII pressure relief valves accepted by the Jurisdiction for use used in nuclear safety related service with National Board capacity certification.

Group 2: ASME Section III NV stamped Class 1, 2, or 3 pressure relief valves with National Board capacity certification.

Group 3: Pressure relief valves not addressed in Group 1 or Group 2. This group shall include pressure relief valves without National Board capacity certification and/or pressure relief valves constructed to codes or standards other than ASME (see NBIC Part 3, Category 3).

The term pressure relief valve includes power actuated pressure relief valves. Replacement of rupture disks in rupture disk holders or in systems is not considered a repair activity under the scope of this supplement.

S6.42 ADMINISTRATIVE PROCEDURES

a) The repair organization shall hold/obtain a valid "VR" Certificate of Authorization and stamp.
b) The repair organization shall obtain a National Board “NR” Certificate of Authorization and stamp. The requirements for said certificate and stamp include, but are not limited to the following. The repair organization shall:

1) Maintain a documented quality assurance program that meets the applicable requirements of NBIC Part 3, 1.6. This program shall also include all the applicable requirements for the use of the “VR” stamp;

2) Have a contract or agreement with an Authorized Nuclear Inspection Agency that is qualified in accordance with the requirements of ASME QAI-1, Qualifications for Authorized Inspection to provide inspection of repaired nuclear “NN”-stamped pressure relief devices valves by Inspectors who have been qualified in accordance with the requirements of ASME QAI-1, Qualifications for Authorized Inspection;

3) Successfully complete a survey of the quality assurance program and its implementation. This survey shall be conducted by representatives of the National Board, the Jurisdiction wherein the applicant’s repair facilities are located, and the applicant’s Authorized Inspection Agency. Further verification of such implementation by the survey team may not be necessary if the applicant holds a valid ASME “NV” certificate and can verify by documentation the capability of implementing the quality assurance program for repair of “NV”-stamped pressure relief devices, covered by the applicant’s ASME “NV” certificate.

c) The application of the “NR” Certificate of Authorization and stamp shall clearly define the scope of intended activities with respect to the repair of Section III, “NN”-stamped nuclear pressure relief devices.

d) Revisions to the quality assurance program shall be acceptable to the Authorized Nuclear Inspector Supervisor and the National Board before being implemented.

e) The scope of the “VR” Certificate of Authorization shall include repair of “NN”-stamped nuclear pressure relief devices (denoted on the VR Certificate as Section III).

f) Verification testing of valves repaired by the applicant shall not be required provided such testing has been successfully completed under the applicant’s “VR” certification program for the applicable test fluids.

g) A survey of the applicant for the “VR” Certificate of Authorization and endorsement of the repair of “NN”-stamped nuclear pressure relief devices may be made concurrently.

h) S6.53 GENERAL RULES
a) **Group 1 and Group 2 pressure relief valves** ASME Code Section III, “NV”-stamped pressure relief devices, which have been repaired in accordance with these rules, shall be stamped with both the “VR” and “NR” stamps. They shall be classified as either NR Category 1 or Category 2 as applicable. **Group 3** pressure relief valves which have been repaired in accordance with these rules shall be stamped with the “NR” stamp. They shall be classified as either NR Category 2 or Category 3 as applicable.

b) The “VR” and “NR” stamps shall be applied only to “NV”-stamped (Class 1, 2, or 3) National Board capacity certified nuclear safety related pressure relief devices that have been disassembled, inspected, and repaired as necessary, such that the valves’ condition and performance are equivalent to the standards for new valves.

c) All measuring and test equipment used in the repair of pressure relief devices shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.

d) Documentation of the repair of “NV”-stamped nuclear safety related pressure relief devices shall be recorded on the National Board Form NVR-1, Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices, in accordance with the requirements of NBIC Part 3, 1.6. The original code of construction and capacity certification status shall be identified on the NVR-1 form.

e) When an ASME “V”, “UV” or “NV” stamped pressure relief device requires a duplicate nameplate because the original nameplate is illegible or missing, it may be applied using the procedures of NBIC Part 4, 4.7.5 provided concurrence is obtained from the Authorized Nuclear Inspector and Jurisdiction. In this case the nameplate shall be marked “SEC I”, “SEC. III”, or “SEC VIII” to indicate original ASME Code stamping.

f) Repair activities for pressure relief devices shall not include rerating of the device. Set pressure changes within the range of the valve manufacturer’s capacity certification and the design pressure of the valve (see NBIC Part 4, 4.7.3) are permitted, provided the new set pressure and capacity rating are reconciled with the design of the system where the device will be used. These set pressure changes are not considered to be rerating.

g) Conversions of pressure relief devices as described in NBIC Part 4, 4.2 b) are permitted as part of repair activities.

h) Set pressure changes or conversions of pressure relief devices shall be described in the “Remarks” section of Form NVR-1.
For Committee Use Only

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### Glossary

| NB12-0801 | **Plate Heat Exchanger (PHE):** An assembly of components consisting of heat transfer plates and their supporting frame. The frame provides structural support and pressure containment and may consist of fixed endplates, moveable endplates, an upper carrying bar and lower guide bar which provide plate alignment, and frame compression bolts. |
| GLOSSARY | **Changeover valve** – A three-way stop (or diverter) valve with one inlet port and two outlet ports designed to isolate either one of the two outlet ports from the inlet port, but not both simultaneously during any mode of operation. |
| GLOSSARY | **Potable Water Storage Tank** - an unfired pressure vessel used to store potable hot water at temperatures not exceeding 210°F (99°C). |
| Glossary | **Jurisdiction** – The National Board member Jurisdiction where the organization is located. Alternatively, where the Jurisdiction elects not to perform the review or where there is no Jurisdiction or where the Jurisdiction is the organization’s Authorized Inspection Agency, The National Board of Boiler and Pressure Vessel Inspectors will represent the Jurisdiction. At the Jurisdiction’s discretion, the Jurisdiction may choose to be a member of the review team if the Jurisdiction chooses not to be the team leader. **Jurisdiction** – A governmental entity with the power, right, or authority to interpret and enforce law, rules, or ordinances pertaining to boilers, pressure vessels, or other pressure-retaining items where the pressure retaining item is installed. It includes National Board member jurisdictions defined as “jurisdictional authorities.” Where there is no National Board Member Jurisdiction, the National Board shall act on behalf of the Jurisdiction. |
Editorial Changes

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Note:

* Latest Edition endorsed by the Regulatory Authority

1.6.3 **PREREQUISITES FOR ISSUING A NATIONAL BOARD “NR” CERTIFICATE OF AUTHORIZATION**

Before an organization can obtain a National Board “NR” Certificate of Authorization, the organization shall:

a) Have and maintain an inspection agreement with an Authorized Nuclear Inspection Agency accepted in accordance with NB-360, *Criteria for Acceptance of Authorized Inspection Agencies for New Construction National Board Acceptance of Authorized Inspection Agencies (AIAs) Accredited by the American Society of Mechanical Engineers (ASME) or accredited in accordance with NB-399, Qualifications and Duties for Authorized Inspection Agencies*.

b) Have a written Quality Assurance Program that complies with the requirements of this section and address all controls for the intended category and scope of activities.

c) Have a current edition of the NBIC.
Inservice - An Authorized Inspection Agency is either:
   a) a jurisdictional authority as defined in the National Board Constitution, or
   b) an entity that is accredited by the National Board meeting NB-369, Accreditation of Authorized Inspection Agencies Performing Inservice Inspection Activities; NB-371, Accreditation of Owner-User Inspection Organizations (OUIO); or NB-390, Accreditation of Federal Inspection Agencies (FAA) Qualifications and duties for Federal Inspection Agencies (FAA) Performing Inservice Inspection Activities.

Nuclear Construction - An Authorized Inspection Agency is one that is accredited by the National Board meeting the qualification and duties of NB-369, National Board Acceptance of Authorized Inspection Agencies (AIA) Accredited by the American Society of Mechanical Engineers (ASME) Criteria for Acceptance of Authorized Inspection Agencies for New Construction.

Authorized Nuclear Inspection Agency - An Authorized Inspection Agency intending to perform nuclear inspection activities and employing nuclear Inspectors / Supervisors.

Biomass - Fuels which result from biological sources requiring a relatively short time for replenishment. Wood and bagasse are typical examples.

Biomass Fired Boiler - A boiler which fires biomass as its primary fuel.

Capacity Certification - The verification by the National Board that a particular valve design or model has successfully completed all capacity testing as required by the ASME Code.
present a direct or implied conflict with any jurisdictional regulation, the Jurisdictional regulation shall govern.

UNIT'S OF MEASUREMNENT
Both U.S. customary units and metric units are used in the NBIC. The value stated in U.S. customary units or metric units are to be regarded separately as the standard. Within the text, the metric units are shown in parentheses. In Part 2, Supplement 6 and Part 3, Supplement 6 regarding DOT Transport Tanks, the metric units are shown first with the U.S. customary units shown in parentheses.

U.S. customary units or metric units may be used with this edition of the NBIC, but one system of units shall be used consistently throughout a repair or alteration of pressure-retaining items. It is the responsibility of National Board accredited repair organizations to ensure the appropriate units are used consistently throughout all phases of work. This includes materials, design, procedures, testing, documentation, and stamping. The NBIC policy for metrication is outlined in each part of the NBIC.

ACCREDITATION PROGRAMS
The National Board administers and four specific accreditation programs as shown below:

- "R" Repairs and Alterations to Pressure-Retaining Items (NB-415)
- "VR" Repairs to Pressure Relief Valves (NB-514)
- "NR" Repair and Replacement Activities for Nuclear Items (NB-417)
- "T/O" Testing of Pressure Relief Valves (NB-529)

The administrative requirements for the accreditation for these accreditation programs can be viewed on the National Board Website at www.nationalboard.org.

The National Board also administers and accredits four specific inspections agency programs as shown below:

- **New Construction**
  - National Board Acceptance of Authorized Inspection Agencies (AIA) Accredited by the American Society of Mechanical Engineers (ASME) Criteria for Acceptance of Authorized Inspection Agencies for New Construction (NB-386)
- **Inspection**
  - Accreditation of Authorized Inspection Agencies (AIA) Performing Inservice or Repair/Alteration Inspection Activities Qualifications and Duties for Authorized Inspection Agencies (AIAs) Performing Inservice Inspection Activities and Qualifications for Inspectors of Boilers and Pressure Vessels (NB-386)
- **Owner/Operator**
  - Accreditation of Owner/Operator Inspection Organizations (OUIO) (NB-371)
  - Owners or users may be accredited for both a repair and inspection program provided the requirements for each accreditation program are met.
- **Federal Government**
  - Accreditation of Federal Inspectors (FI) Qualifications and Duties for Federal Inspection Agencies Performing Inservice Inspection Activities (FIAs) (NB-386)

These programs can be viewed on the National Board Website at www.nationalboard.org. For questions or further information regarding these programs contact the National Board by phone at (614) 888-8320 or by fax at (614) 847-1826.

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<th>Instructions</th>
<th>Minimum Retention Period</th>
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<tbody>
<tr>
<td>a) Form “R” Reports and supporting records and documentation</td>
<td>The organization performing repairs and alterations shall retain a copy of the completed “R” Form report on file, and all records substantiating the summary of work described in NBIC Part 3, Subpart B, Item 12, for a minimum of 5 years. When the method of repair described in NBIC Part 3, 3.3.4.8 is used, the record retention period shall be described in b).</td>
<td>5.12.4.1</td>
<td>5 years</td>
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