Comments must be submitted on the attached Public Review Comment Form

Draft 2013 Edition

Deleted items are designated by strikethrough. Additions are designated by double underline.
Comments Must be Received No Later Than: December 17, 2012

Instructions: If unable to submit electronically, please print this form and fax or mail. Print or type clearly.

Date: 

Commenter Name: 

Commenter Address: 

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Section/Subsection Referenced: 


Source: □ Own Experience/Idea □ Other Source/Article/Code/Standard 

Submit Form To: Robin Hough, Secretary, NBIC Committee, The National Board of Boiler & Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, OH 43229, fax 614-847-1828, email, rhough@nationalboard.org
2.2 Definitions in this section were moved to the Glossary.

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3.2.3 Definitions in this section were moved to the Glossary.

4.2 Definitions in this section were moved to the Glossary.

4.7 Requirements for installation of hot water storage tanks was added.

S3 A new supplement for the installation of (CO₂) Carbon Dioxide Beverage Systems was added.

S3.1 The scope of the CO₂ Beverage Systems supplement was added.

S3.2 General Requirements for storage tank location of CO₂ Systems was added.

S3.3 Text regarding the Fill box location/safety relief/vent valve circuit termination was added.

S3.4 Gas detection systems for CO₂ tanks was added.

S3.5 Warning signage for CO₂ tanks was added.

S3.6 Valves, Piping, Tubing and Fittings for CO₂ tanks was added.

S3.6.1 A figure of CO2 Phase Diagram was added.

S3.6.2 A new table of operating pressures and temperatures for CO₂ tanks was added.

S3.6 a) A new table Minimum LCDSV System Safety Relief/Vent Line Requirements was added.

S3.6 b) A new table Metric Minimum LCDSV System Safety Relief/Vent line requirements table was added.
Part 2 Inspection

- **1.3**
  New codes that can be used as reference tools were added.
- **1.5.2.1**
  Text concerning inspection planning was added.
- **2.2.10.6**
  Text for operating controls was added.
- **2.3.6.5**
  Text for the inspection of Anhydrous Ammonia Nurse Tanks was added.
- **2.3.6.7**
  Text for inspection of Pressure Vessels for human Occupancy was added.
- **4.3.1.1**
  Text was revised to change the word metal into material.
- **S1.1**
  Scope for Supplement 1, Steam Locomotive Firetube Boiler Inspection and Storage was added.
- **S2.1**
  Scope for Supplement 2, Inspection of Historical Steam Boilers was added.
- **S2.10.4.1**
  New wording and tables addressing staybolts was added.
- **S2.7.3.1**
  Text for the initial inspection for Historical Boilers was added.
- **S2.10.2**
  Text and figures to include rivet heads were added
- **S2.10.2.1**
  New wording for the Inspection of Corroded Rivets was added.
- **S7.2**
  Text was revised to include the specific location for commercially refurbished containers in the NBIC.
- **S7.3**
  New wording for the inservice inspection for containers is LP Gas service was added.
- **S7.4**
  New wording to address the external inspection of pressure vessels in liquefied petroleum gas service was added.
- **S7.8.6**
  Text for the inspection of Anhydrous Ammonia Containers was added.
- **S7.9**
  Text to address ASME LPG containers less than 2000 gallons being refurbished by a commercial source was added.
- **Forms NB-6 and NB-7**
  Revised forms that are more consistent with current Jurisdictional forms were added.
Part 3 Repair and Alteration

- 1.3.2
  Text verifying the existence of a name plate was added.
- 1.5.1
  The administrative requirements of the NBIC were removed.
- 1.5.2
  The administrative requirements of the NBIC were removed.
- 1.6
  The administrative requirements of the NBIC were removed.
- 1.6.5.1
  Text in the outline of requirements for a quality system for qualification for the National Board “R” Certificate was revised.
- 1.7.1
  The administrative requirements of the NBIC were removed.
- 1.7.3
  The administrative requirements of the NBIC were removed.
- 1.7.4
  The administrative requirements of the NBIC were removed.
- 1.7.5
  The administrative requirements of the NBIC were removed.
- 1.7.7.5
  Text clarifying welding references was added.
- 1.8.5.1
  Text establishing guidelines for internal audits was added.
- 1.8.6
  The administrative requirements of the NBIC were removed.
- 2.2.6
  Text concerning welder’s continuity was revised.
- 2.5.1
  Table was revised to include P-No 15 E Group 1
- 2.5.2 b)
  Text addressing post weld heat treatment was revised.
- 2.5.3.1
  Text was revised to include different temperatures for P-No. 1 Groups.
- 2.5.3.2
  Text was revised in Welding method 2.
- 2.5.3.4
  Text was revised in Welding method 4.
- 3.2.1
  Text was revised to clarify what can be welded.
3.2.2 Text concerning alternative welding methods without postweld heat treatment was added.
3.3.4.3 Text concerning wasted areas on tubes was added.
4.4.1 a) Replaced wording and added a table to address liquid pressure tests.
4.4.2 a) Replaced wording and added a table to address liquid pressure tests.
4.5.3 Lift assist testing text was revised.
5.2 Documentation of “R” forms text was revised.
5.5 The registration of “R” Forms text was revised.
5.5.2 Registration for Alterations text was revised to include the Quality System Manual.
5.8.2 Text concerning Stamping for Alterations was revised.
5.12.4 Text for the Test only nameplate was revised.
5.13.4.1 Text was revised on R-2 Instruction sheet item #12
S1.1 Text was revised to correct a typographical error.
S1.2.2 Text concerning Threaded Staybolts was revised.
S1.2.9.7 Text concerning Ferrules was revised.
S1.2.12.1 Text concerning the Caulking of Riveted Seams and Rivet Heads was revised.
S2.7.1 The material list for Historical Boilers was revised.
S2.13.9.1 Text and figures concerning Weld Buildup of Wastage and Grooving in Unstayed Areas was revised.
S2.13.9.2 Text was revised and new figures of cracks in unstayed areas were added.
S2.13.10.1 Text concerning Weld Buildup of Wastage and Grooving in Stayed areas was revised.
S2.13.10.2 Text concerning Welded Repair of Cracks in Stayed Areas was revised.
• S2.13.10.4
  Text concerning the Repair of Stayed Firebox Sheets Grooved or Wasted at the Mudring was revised.
• S2.13.13.1
  Text was revised to include caulking tool.
• S2.13.14.2
  Text concerning the repair of Handhole Openings was revised.
• S2.13.14.3
  Text and figure were replaced
• S3 5.5
  Text regarding the plugging or leaking of a damaged tube was added.
• S7.10.1
  Text was altered to include to or confirming or restoring name plate set pressure.

Glossary

• Several new definitions were added to appear in all three parts of the book.
Part 1 Installation
2.2 DEFINITIONS

A power boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler includes fired units for vaporizing liquids other than water but does not include fired process heaters and systems. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel.

a) Power Boiler — a boiler in which steam or other vapor is generated at a pressure in excess of 15 psig (100 kPa) for use external to itself.

b) High-Temperature Water Boiler — a boiler in which water is heated and operates at a pressure in excess of 160 psig (1.1 MPa) and/or temperature in excess of 250°F (121°C).

See the Glossary in NBIC Part 1, Section 9.

3.2 DEFINITIONS

3.2.1 STEAM HEATING BOILERS

Steam heating boilers are steam boilers installed to operate at pressures not exceeding 15 psig (100 kPa).

3.2.2 HOT-WATER HEATING AND HOT-WATER SUPPLY BOILERS

Hot-water heating and hot-water supply boilers are hot water boilers installed to operate at pressures not exceeding 160 psig (1100 kPa) and/or temperatures not exceeding 250°F (121°C), at or near the boiler outlet.

3.2.3 POTABLE WATER HEATERS

Water heaters are exempted from NBIC Part 1, Section 3 when none of the following limitations are exceeded:

a) Heat input of 200,000 Btu/hr (59 kW);

b) Water temperature of 210°F (99°C); and

c) Nominal water containing capacity of 120 gal. (454 l), except that they shall be equipped with safety devices in accordance with the requirements of NBIC Part 1, 3.9.4.

See the Glossary in NBIC Part 1, Section 9.
4.2 DEFINITIONS
Pressure vessels are containers other than boilers or piping used for the containment of pressure.

See the Glossary in NBIC Part 1, Section 9.

NB12-0301

4.7 REQUIREMENTS FOR HOT WATER STORAGE TANKS

4.7.1 SUPPORTS
Each hot water storage tank shall be supported in accordance with NBIC Part 1, 4.3.1.

4.7.2 CLEARANCE AND ACCEPTABILITY
a) The required nameplate (marking or stamping) should be exposed and accessible.

b) The openings when required should be accessible to allow for entry for inspection and maintenance.

c) Each hot water storage tank shall meet the requirements of NBIC Part 1, 4.3.2.

4.7.3 SAFETY RELIEF DEVICES
a) Each hot water storage tank shall be equipped with an ASME NB approved temperature and pressure relieving device set at a pressure not to exceed the maximum allowable working pressure and 210°F.

b) The temperature and pressure relieving device shall meet the requirements of NBIC Part 1, 4.5.

4.7.4 THERMOMETERS
a) Each hot water storage tank shall be equipped with a thermometer.

b) Each hot water storage tank shall have a thermometer so located that it shall be easily readable at or near the outlet. The thermometer shall be so located that it shall at all times indicate the temperature of the water in the storage tank.

4.7.5 SHUT OFF VALVES
a) Each hot water storage tank shall be equipped with stop valves in the water inlet piping and the outlet piping in order for the hot water storage tank to be removed from service without having to drain the complete system.

b) Each hot water storage tank shall be equipped with a bottom drain valve to provide for flushing and draining of the vessel.
4.7.6 TESTING AND ACCEPTANCE

Testing and acceptance shall be in accordance with NBIC Part 1, 4.6.

NB12-0304

SUPPLEMENT 3
INSTALLATION OF LIQUID CARBON DIOXIDE STORAGE VESSELS

S3.1 SCOPE
This section provides requirements for the installation of Liquid Carbon Dioxide Storage Vessels (LCDSV's), fill boxes, fill lines and pressure relief discharge/vent circuits used for carbonated beverage systems, swimming pool PH control systems and other fill in place systems storing 1,000lbs (454 kg) or less of liquid CO2.

S3.2 GENERAL REQUIREMENTS STORAGE TANK LOCATION
LCDSV's should be installed in an unenclosed area whenever possible. LCDSV's that do not meet all criteria for an unenclosed area shall be considered an enclosed area installation. An unenclosed area:

- Shall be outdoors
- Shall be above grade
- Shall not have a roof or overhead cover
- Shall not obstruct more than three sides of the perimeter with supports and walls. At least 25% of the perimeter area as calculated from the maximum height of the storage container shall be open to atmosphere and openings shall be in direct conveyance with ground level.

S3.2 a) GENERAL REQUIREMENTS (enclosed and unenclosed areas)
1) LCDSV’s shall not be located within 10 feet (3050 mm) of elevators, unprotected platform ledges or other areas where falling would result in dropping distances exceeding half the container height.

2) LCDSV’s shall be installed with sufficient clearance for filling, operation, maintenance, inspection and replacement.

3) Orientation of nozzles and attachments shall be such that sufficient clearance between the nozzles, attachments, and the surrounding structures is maintained during the installation, the attachment of associated piping, and operation.

4) LCDSV’s shall not be installed on roofs.

5) LCDSV’s shall be safely supported. Vessel supports, foundations and settings shall be in accordance with jurisdictional requirements, manufacturer recommendations and/or other industry standards as applicable. The weight of the vessel when full of liquid carbon dioxide shall be considered when designing vessel supports. Design of supports, foundations, and settings shall consider vibration (including seismic and wind loads where necessary), movement (including thermal movement), and loadings. Vessel foundations or floors in multistory buildings must be capable of supporting the full system weight and in accordance with building codes.
6) LCDSV’s shall not be installed within 36 in. (915 mm) of electrical panels.

7) LCDSV’s installed outdoors in areas in the vicinity of vehicular traffic shall be guarded to prevent accidental impact by vehicles. The guards or bollards shall be installed in accordance with local building codes or to a national recognized standard when no local building code exists.

8) LCDSV’s shall be equipped with isolation valves in accordance with paragraph S3.6.

S3.2 b) UNENCLOSED AREA LCDSV INSTALLATIONS.
If LCDSV’s are installed outdoors and exposed to the elements, appropriate additional protection may be provided as necessary based on the general weather conditions and temperatures that the tank may be exposed to. Some possible issues include:
   a. Exposure to high solar heating loads will increase the net evaporation rate and will decrease hold times in low CO2 usage applications. The vessel may be covered or shade provided to help reduce the solar load and increase the time needed to reach the relief valve setting in low use applications.
   b. If supply line is not UV resistant then supply line should be protected via conduit or appropriate covering.

S3.2 c) ENCLOSED AREA LCDSV INSTALLATIONS
1) Permanent LCDSV installations with remote fill connections.
   a. Shall be equipped with a gas detection system installed in accordance with paragraph S3.4
   b. Shall have signage posted in accordance with paragraph S3.5
   c. Shall be equipped with fill boxes; fill lines and safety relief/vent valve circuits installed in accordance with paragraph S3.6

2) Portable LCDSV installations with no permanent remote fill connection. Warning: LCDSV’s shall not be filled indoors or in enclosed areas under any circumstances. Tanks must always be moved to the outside to an unenclosed, free airflow area for filling.
   a. Shall be equipped with a gas detection system installed in accordance with paragraph S3.4
   b. Shall have signage posted in accordance with paragraph S3.5
   c. Shall have safety relieve/vent valve circuit connected at all times except when the tank is being removed for filling. Connects may be fitted with quick disconnect fitting meeting the requirements of paragraph S3.6
   d. Shall be provided with a pathway that provides a smooth rolling surface to the outdoor, unenclosed fill area. There shall not be any stairs or other than minimal inclines in the pathway.

S3.3 FILL BOX LOCATION / SAFETY RELIEF/VENT VALVE CIRCUIT TERMINATION
Fill boxes and/or vent valve terminations shall be installed above grade, outdoors in an unenclosed, free airflow area. The fill connection shall be located so not to impede means of egress or the operation of sidewalk cellar entrance doors, including during the delivery process and shall be:
   a) At least three (3) feet (915 mm) from any door or operable windows,
   b) At least three (3) feet (915 mm) above grade.
c) Shall not be located within ten (10) feet (3050 mm) from side to side at the same level or below, from any air intakes.

d) Shall not be located within ten (10) feet (3050 mm) from stair wells that go below grade.

**S3.4 GAS DETECTION SYSTEMS**

Rooms or areas where carbon dioxide storage vessel(s) are located indoors or in enclosed or below grade outdoor locations shall be provided with a gas detection and alarm system for general area monitoring that is capable of detecting and notifying building occupants of a CO2 gas release. Alarms will be designed to activate a low level pre-alarm at 1.5% concentration of CO2 and a full high alarm at 3% concentration of CO2 (which is the NIOSH & ACGIH 15 minute Short Term Exposure Limit for CO2.) These systems are not designed for employee personal exposure monitoring. Gas detection systems shall be installed and tested in accordance with manufactures installation instructions and the following requirements:

   a) Activation of the gas detection system shall activate an audible alarm within the room or area in which the carbon dioxide storage vessel is located.
   
   b) Audible alarms shall also be 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.

**S3.5 SIGNAGE**

Warning signs shall be posted at the entrance to the building, room, enclosure, or enclosed area where the container is located. The warning sign shall be at least 8 in (200mm) wide and 6 in. (150mm) high. The wording shall be concise and easy to read and the upper portion of the sign must be orange as shown in figure S3.5. The size of the lettering must be as large as possible for the intended viewing distance and in accordance with jurisdictional requirements. When no jurisdictional requirements exist, the minimum letter height shall be in accordance with NEMA American National Standard for Environmental and Facility Safety Signs (ANSI Z535.2). The warning signs shall state the following:

*WARNING*

![Figure S3.5](image)

A high carbon dioxide gas (CO2) concentration in this area can cause suffocation.

**a)** Additional instruction signage shall be posted outside of the area where the container is
located and such signage shall contain at minimum the following information;

Carbon Dioxide Monitors for general area monitoring (not employee personal exposure monitoring) are provided in this area. These monitors are set to alarm at 15,000ppm (1.5% concentration) for the low level alarm and at 30,000ppm (3% concentration) for high level alarm.

Low Level Alarm (15,000ppm) – Provide appropriate cross ventilation to the area. Personnel may enter area for short periods of time (not to exceed 15 minutes at a time) in order to identify and repair potential leaks.

High Level Alarm (30,000ppm) – Personnel should evacuate the area and nobody should enter the affected area without proper self contained breathing apparatus until the area is adequately ventilated and the concentration of CO2 is reduced below the high alarm limit.

S3.6 VALVES, PIPING, TUBING AND FITTINGS

Materials - Materials selected for valves, piping, tubing, hoses and fittings used in the LCDSV system shall meet following requirements:

a) Components must be compatible for use with CO2 in the phase, (gas, or liquid) it encounters in the system.

b) Components shall be rated for the operational temperatures and pressures encountered in the applicable circuit of the system.

c) Shall be stainless steel, copper, brass, or plastic/polymer materials rated for CO2.

d) Only fittings and connections recommended by the manufacturer shall be used for all hoses, tubes, and piping.

e) All valves and fittings used on the LCDSV shall be rated for the maximum allowable working pressure stamped on the tank.

f) All piping, hoses and tubing used in the LCDSV system shall be rated for the working pressure of the applicable circuit in the system and have a burst pressure rating of at least four times the maximum allowable working pressure of the piping, hose or tubing.

Relief Valves – Each LCDSV shall have at least one ASME/NB stamped & certified relief valve with a pressure setting at or below the MAWP of the tank. The relief valve shall be suitable for the temperatures and flows experienced during relief valve operation. The minimum relief valve capacity shall be designated by the manufacturer Additional relief valves that do not require ASME stamps may be added per Compressed Gas Association pamphlet, CGA S-1.3 Pressure Relief Device Standards Part 3, Stationary Storage Containers for Compressed Gases, recommendations. Discharge lines from the relief valves shall be sized in accordance with tables S3.6a & S3.6b Note: due to the design of the LCDSV the discharge line may be smaller in diameter than the relief valve outlet size.

Caution: Company's and or individuals filling or refilling LCDSV's shall be responsible for utilizing fill equipment that is acceptable to the manufacture to prevent over pressurization of the vessel.

Isolation Valves - Each LCDSV shall have an isolation valve installed on the fill line and tank discharge, or gas supply line in accordance with the following requirements:

a) Isolation valves shall be located on the tank or at an accessible point as near to the storage tank as possible.
b) All valves shall be designed or marked to indicate clearly whether it is open or closed.
c) All valves shall be capable of being locked or tagged in the closed position for servicing.
d) Gas Supply and Liquid CO2 Fill Valves shall be clearly marked for easy identification.

Safety Relief/Vent Lines—Safety relief/vent lines shall be as short and straight as possible with a continuous routing to an unenclosed area outside the building and installed in accordance with the manufacturer’s instructions. The vent line shall be a continuous run from PRD to outside vent line discharge fitting, without any splices. These lines shall be free of physical defects such as cracking or kinking and all connections shall be securely fastened to the LCDSV and the fill box. The minimum size and length of the lines shall be in accordance with table S3.6a and S3.6b. Fittings or other connections may result in a localized reduction in diameter have been factored into the lengths given by the tables S3.6a and S3.6b.

NB13-0101

S3.6.1 System Description

The Liquid Carbon Dioxide Beverage systems include the Liquid Carbon Dioxide Storage Vessel or LCDSV (tank) and associated sub-system circuits - Liquid CO2 fill circuit, and associated sub-system circuits and Pressure relief / vent line circuit. The LCDSVs are vacuum insulated pressure vessels, constructed of stainless steel, with Super Insulation wrapping between the inner pressure vessel and the outer vacuum jacket. (See Figure ....) These Pressure vessels are typically designed for a Maximum Allowable Working Pressure (MAWP) of either 300 psig (2068 kPa) or 283 psig (1951 kPa). The LCDSV come equipped with a ASME/NB certified “UV” Primary Relief Valve (PRV) set at or below the MAWP of the vessel. Additionally as recommended by the Compressed Gas Association pamphlet CGA S-1.3, (PRESSURE RELIEF DEVICE STANDARDS PART 3 - STATIONARY STORAGE CONTAINERS FOR COMPRESSED GASSES) a secondary relief valve may be installed. This secondary relief valve is beyond the scope of ASME Section VIII, Division 1 and is not required to be ASME/NB stamped and certified. This additional PRV is typically rated no higher than 1.5 times the vessel MAWP.

Operating conditions of the system, components, and inner pressure vessel can vary between cause temperatures and pressures to range from 90 psig (-56°F) to and 300 psig (+2°F) (620 kPa (-49°C) to 2068 kPa (-16°C)). Below about 60 psig (413 kPa) in the tank, liquid CO2 begins changing to solid phase (dry ice). If the tank becomes completely depressurized to 0 psig, temperatures inside the tank could reach -109°F (-78°C) (solid dry ice). When liquid CO2 turns to solid dry ice in a completely depressurized tank, all CO2 gas flow in the system ceases and the tank becomes nonfunctional. See the attached CO2 Phase Diagram figure Figure 4.6.xxxS3.2xxx3.6.1, showing the typical operating range of these systems. Components external to the LCDSV inner tank pressure vessel may encounter pressures and temperatures between 90 psig, and -56°F to 300 psig and +2°F respectively (between 620 kPa, and -49°C to 2068 kPa and -16°C, respectively).
Typical operating pressures and temperatures vary in each of the associated sub-system circuits. See Table 4.6.xxxS3.2xxx3.6.2. 

**Figure 3.6.1 CO2 Phase Diagram**

### Table S#.xxx3.6.2 Typical Operating Pressures & Temperatures of the LCDSV System

<table>
<thead>
<tr>
<th>System Component</th>
<th>Operating Pressure</th>
<th>Operating Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Vessel (tank internal conditions)</td>
<td>90 - 300 psig</td>
<td>-56°F to +2°F</td>
</tr>
<tr>
<td>Liquid CO2 Fill Line</td>
<td>150 - 300 psig</td>
<td>-34°F to +2°F</td>
</tr>
<tr>
<td>Pressure Relief Gas Vent Line</td>
<td>0 - 120 psig</td>
<td>Ambient to -50°F</td>
</tr>
<tr>
<td>Tank Size (Pounds)</td>
<td>Fire Flow Rate Requirements (Pounds per Minute)</td>
<td>Maximum Length of 3/8 inch ID Nominal Metallic Tube Allowed</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Less than 500</td>
<td>2.60 maximum</td>
<td>80 feet</td>
</tr>
<tr>
<td>500-750</td>
<td>3.85 maximum</td>
<td>55 feet</td>
</tr>
<tr>
<td>Over 750-1000</td>
<td>5.51 maximum</td>
<td>18 feet</td>
</tr>
</tbody>
</table>

Table S3.6a) Minimum LCDSV System Safety Relief/Vent Line Requirements (Metallic)

<table>
<thead>
<tr>
<th>Tank Size (Kg)</th>
<th>Fire Flow Rate Requirements (Kg per Minute)</th>
<th>Maximum Length of 10 mm ID Nominal Metallic Tube Allowed</th>
<th>Maximum Length of 13 mm Metallic Tube Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 227</td>
<td>1.18 maximum</td>
<td>24 m</td>
<td>30.5 m</td>
</tr>
<tr>
<td>227-340</td>
<td>1.75 maximum</td>
<td>17 m</td>
<td>30.5 m</td>
</tr>
<tr>
<td>Over 340-454</td>
<td>2.50 maximum</td>
<td>5.5 m</td>
<td>30.5 m</td>
</tr>
</tbody>
</table>

Table S3.6 b) Metric Minimum LCDSV System Safety Relief/Vent Line Requirements (Metallic)

<table>
<thead>
<tr>
<th>Tank Size (Kg)</th>
<th>Fire Flow Rate Requirements (kg per Minute)</th>
<th>Maximum Length of 10 mm ID Nominal Metallic Tube Allowed</th>
<th>Maximum Length of 13 mm ID plastic/polymer materials Tube Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 227</td>
<td>1.18 maximum</td>
<td>30.5 m</td>
<td>30.5 m</td>
</tr>
<tr>
<td>227-340</td>
<td>1.75 maximum</td>
<td>30.5 m</td>
<td>30.5 m</td>
</tr>
<tr>
<td>Over 340-454</td>
<td>2.50 maximum</td>
<td>N/A see 13 mm</td>
<td>30.5 m</td>
</tr>
</tbody>
</table>

Table S3.6 b) Metric Minimum LCDSV System Safety Relief/Vent Line Requirements (plastic/polymer)
Part 2 Inspection
1.3 Other existing inspection codes, standards, and practices pertaining to the in-service inspection of pressure-retaining items can provide useful information and references relative to the inspection techniques listed in this Part. Use of these codes, standards, and practices is subject to review and acceptance by the Inspector, and when required the Jurisdiction. Any inconsistency or discrepancy between the requirements of the NBIC and these inspection codes, standards, and practices shall be resolved by giving precedence to requirements in the following order:

a) The requirements of the Jurisdiction having authority.

b) The requirements of the NBIC supersede general and specific requirements of other inspection codes, standards and practices.

c) The general and specific requirements of the References to other Codes and Standards listed herein that are recognized and generally accepted good engineering practices.

Some examples are as follows:

a) National Board Bulletin - National Board Classic Articles Series

b) American Society of Mechanical Engineers ASME Boiler and Pressure Vessel Code Section V (Nondestructive Examination)

c) American Society of Mechanical Engineers- ASME Boiler and Pressure Vessel Code Section VI (Recommended Rules for the Care and Operation of Heating Boilers) this section when performing inspections of pressure vessels. There may be occasions where more detailed procedures will be required.

d) American Society of Mechanical Engineers- ASME Boiler and Pressure Vessel Code Section VII (Recommended Guidelines for the Care of Power Boilers)

e) American Society of Mechanical Engineers-ASME B31G (Manual for Determining the Remaining Strength of Corroded Pipelines)

f) American Society of Mechanical Engineers - ASME PCC-J (Guidelines for Pressure Boundary Bolted Joint Assembly)

g) American Society of Mechanical Engineers- ASME PCC-2 (Repair of pressure Equipment and Piping)

h) American Society of Mechanical Engineers - ASMECRTD Volume 41Risk-Based Inspection for Equipment Life Management: An Application Handbook

i) American Petroleum Institute/American Society of Mechanical Engineers - API 579-1/ASME FFS-I (Fitness-For-Service)

j) American Petroleum Institute – API-510 (Pressure Vessel Inspection Code: In-service Inspection Rating Repair and Alteration)

k) American Petroleum Institute-API 570 (Piping Inspection Code: In-service Inspection Rating Repair and Alteration of Piping Systems)

l) American Petroleum Institute - API 572 (Inspection of Pressure Vessels)
1.5.2.1 INSPECTION PLANNING

An inspection plan should be developed to better assure continued safe operation of a pressure retaining item (PRI).

A formal inspection plan is a document providing the scope of inspection activities necessary to determine if in-service damage has occurred. The plan identifies methods of examination, qualifications of examiners and frequency of examination necessary to assure PRI is suitable for continued service. It may provide a time interval for external and internal inspection as well as describe methods of repair and maintenance for a PRI.

A plan may include the following, as appropriate for a PRI:

1) The known or expected failure mechanisms that affect the specific equipment. See 3.3 Corrosion, 3.4 Failure Mechanisms, and 4.4.6 Identification of Damage Mechanisms for examples.

2) The extent and locations of NDE methods and inspections required to detect and evaluate the failure mechanisms. See 4.0 Examinations, Test Methods, and Evaluations for examples.

3) The necessary corrosion and erosion monitoring activities such as NDE surveys and changes in process conditions.

4) The preparation required to accomplish the examination and inspection activities.

5) The projected time interval for the inspection and evaluation activities. See 4.4.7 Determining Inspection Intervals and 4.4.8 Evaluating Inspection Intervals of Pressure Retaining Items Exposed to Inservice Failure Mechanisms.

Recent operating history (e.g., process upsets or process changes or operating excursions) and management of change records should be reviewed during preparation of the inspection plan.
Industry standards may be used to prepare an inspection plan. A plan may be a simple single document or may be complex having numerous documents. Risk-Based Assessment may be included in a plan. See 4.5 Risk-Based Assessment Programs.

Once a plan has been implemented, deferral of scheduled inspection or assessment activities specified in the plan is to be avoided. Any deviation from the planned intervals or inspection activities needs to be justified and documented. Additional monitoring of the PRI during a deferral period may be employed to better assure safe PRI operation until the planned activity can be completed.

NB10-1101

2.2.10.6 CONTROLS

Establishing proper operation and maintenance of controls and safety devices is essential to safe boiler operation. Owner/Users are responsible for establishing and implementing management programs which will ensure such action is taken. In addition, any repairs to controls and safety devices must only be made by qualified individuals or organizations. Documentation of compliance with these management systems and repairs is an essential element of demonstrating the effectiveness of such systems.

When required by the Jurisdiction, the following guidelines are provided to aid in the evaluation of installed operating control devices:

a) Verify that the burner is labeled and listed by a recognized testing agency, that piping and wiring diagrams exist, that commissioning tests have been conducted and that a contractor/manufacturer's installation report has been completed and is available for review.

b) Verify that the Owner/User has established function tests, inspection requirements, maintenance and testing of all controls and safety devices in accordance with manufacturer’s recommendations. Verify that these activities are conducted at assigned intervals in accordance with a written procedure, that non-conformances which impact continued safe operation of the boiler are corrected, and that the results are properly documented. These activities shall be conducted at a frequency recommended by the manufacturer or the frequency required by the jurisdiction. Where no frequencies are recommended or prescribed, the activity should be conducted at least annually.

1) Where allowed by the jurisdiction, Performance Evaluation may be used to increase or decrease the frequencies based on document review and approval by an appropriate engineer.

c) Verify that combustion air is supplied to the boiler room as required by the Jurisdiction or if no jurisdictional requirements exist see NBIC, Part 1, 2.4.5 and 3.5.4 for additional guidance.

d) Verify that a manually operated remote boiler emergency stop button exists at each boiler room exit door, when required by the jurisdiction.

e) Verify operation of low-water protection devices by observing the blowdown of these controls or the actual lowering of boiler water level under carefully controlled conditions with the burner operating. This test should shut off the heat source to the boiler. The return to normal condition such as the restart of the burner, the silencing of an alarm, or stopping of a feed pump should be noted. A sluggish response could indicate an obstruction in the connections to the boiler.

f) The operation of a submerged low-water fuel cutoff mounted directly in a steam boiler shell should be tested by lowering the boiler water level carefully. This should be done only after being assured that the water level gage glass is indicating correctly.
g) On a high-temperature water boiler, it is often not possible to test the control by cutoff indication, but where the control is of the float type, externally mounted, the float chamber should be drained to check for the accumulation of sediment.

h) On forced circulation boilers the flow sensing device should be tested to verify that the burner will shut down the boiler on a loss of flow.

i) On electric boilers it should be verified that the boiler is protected from a low water condition either by construction or a low water cutoff or a low flow sensing device.

j) In the event controls are inoperative or the correct water level is not indicated, the boiler shall be taken out of service until the unsafe condition has been corrected.

k) All automatic low water fuel cutoff and water feeding devices should be examined by the Inspector to ensure that they are properly installed. The Inspector should have the float chamber types of control devices disassembled, and the float linkage and connections examined for wear. The float chamber should be examined to ensure that it is free of sludge or other accumulation. Any necessary corrective action shall be taken before the device is placed back into service. The Inspector should check that the operating instructions for the devices are readily available.

l) Check that the following controls/devices are provided:
   a. Each automatically fired steam boiler is protected from overpressure by not less than two pressure operated controls, one of which may be an operating control.
      1. When required by the code of construction or the jurisdiction the high pressure limit control shall be of the manual reset type.
   b. Each automatically fired hot water boiler or hot water boiler system is protected from over-temperature by not less than two temperature operating controls, one of which may be an operating control.
      1. When required by the code of construction or the jurisdiction the high temperature limit control shall be of the manual reset type.
   c. Each hot-water boiler is fitted with a thermometer that will, at all times, indicate the water temperature at or near the boiler outlet.

m) Verify that any repair, alteration, or replacement of a control or safety device complies with the following:
   a. The requirements of the original installation code or jurisdiction, as appropriate.
   b. The work is conducted by trained and qualified individuals, with any additional certification as required by the jurisdiction.
   c. The work is documented.

NB10-1301

2.3.6.5 ANHYDROUS AMMONIA NURSE TANKS

a) Nurse tanks (considered as implements of husbandry) are anhydrous ammonia pressure vessels on farm wagons, not exceeding a capacity of 3,000 water gallons (11,355 liters), used for agricultural application of liquid anhydrous ammonia to farm fields as fertilizer. Nurse tanks come under United States Department of Transportation (DOT) requirements and may also be subject to various local jurisdictional requirements. Nurse tanks shall be inspected closely by the owner or operator at least once per seasonal use. Inspections of nurse tanks include the following items. These items are not meant to be all inclusive.

b) Inspection shall consist of the following:
   1) Pressure Vessel - Verify that the pressure vessel is constructed for anhydrous ammonia service and that it is ASME stamped and National Board registered, as required by the jurisdiction. Check that the
data plate is legible and not painted over or sand blasted. If the data plate is missing or illegible, welding is prohibited, and the tank shall be tested and operated under the DOT Hazardous Material Regulation (HMR) as required in Title 49 Code of Federal Regulations (CFR) 173.315m or the tank shall be removed from service. Post-construction welding, if any, to the pressure vessel, nozzles or support legs shall be in accordance with NBIC procedures and stamping as required in Part 3. (Also see ANSI K61.1 for the definition of repair.) Cracks, dents, bulges, cuts, gouges and corrosion shall not exceed the acceptance criteria of Section 2.3.6.4 (f).

2) Valves and Fittings - Verify that the pressure relief device is ASME constructed and National Board capacity certified, has correct capacity and set pressure, is date current, and is not leaking, corroded or painted. Check that a rain cap is installed. Ensure that the hydrostatic relief valve is set for 350-400 psi (2415-2760 kPa), is in place in or on the liquid withdrawal valve and that it is in good condition and date current. A liquid level float gage shall be installed and be operable. In addition, a fixed liquid level gage (85% gage) shall be operable and unobstructed by tape or paint. A pressure gage with a clear lens and with a 0-400 psi (0-2760 kPa) dial range shall be installed and be observed to be operable. A liquid withdrawal valve shall be in place and observed to be in good condition. Liquid and vapor fill valves shall be in operable condition and their end fittings protected with valve covers. In addition, check that no galvanized, brass, or cast iron fittings are installed.

3) Nurse Tank Painting, Decals, and Marking – The paint shall be white or aluminum, the painted surface not damaged or faded, and the tank surface not rusted. A nurse tank unique owner identification number shall be observed to be in place. A DOT approved slow-moving vehicle (SMV) emblem or sign shall be installed at the rear. Legible transfer and safety decals shall be in place near the fill valves. “INHALATION HAZARD” markings or decals shall be observed to be in place on each side. On each side and on each end, observe that “DOT 1005” markings or decals and “ANHYDROUS AMMONIA” markings or decals are in place. (Note that these markings or decals are not required on the end of a tank with valves and fittings on that end.) Liquid and vapor valves shall be observed to be color coded or labeled for liquid or vapor. Markings for tests and inspections required due to a missing or illegible data plates shall be in place as required by DOT Hazardous Material Regulations.

4) Safety Specific and Miscellaneous Equipment - Roll-over protection for valves and appurtenances, to include the pressure relief device, shall be observed to be in place. This required protection must include any bottom liquid withdrawal valves. Observe that the transfer hose, if so equipped, is date current and in good condition (not cut to the cords or showing stretch damage, bulging, or kinking). Check that a fitting is in place to secure the transfer hose (if so equipped) during transport and storage. Protective gloves and Z87 rated goggles shall be observed to be in a safety kit on the nurse tank. A safety water container [5 gallon (19 liter) minimum capacity] with adequate withdrawal hose shall be on the nurse tank and be in usable condition.

5) Trailer and Running Gear – Ensure that the hitch and undercarriage are in good repair. Observe that welds are not cracked or the rails bent. The trailer tires shall be in serviceable condition with no cuts to the cords. Two safety chains and hooks shall be in place with one hitch pin and lock pin available. The tank to trailer anchorage shall be satisfactory and any bolting tightened. Spring leaves shall not be cracked or broken on inspection and the ends secured.

NB11-1701

2.3.6.7 INSPECTION OF PRESSURE VESSELS FOR HUMAN OCCUPANCY (PVHO's)

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 differential pressure. PVHO’s 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 PVHO’s. Due to the many different designs and applications of PVHO’s, 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) PVHO’s must be constructed in accordance with ASME PVHO-1 and PVHO-2. These codes adopt Section VIII and therefore the vessels should bear a "U" or "U2" ASME stamping.
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) Because of the human occupancy element, these vessels should have a depressurization rate less than 145 PSI/sec.
5) 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, damage, dents, gouges or other damage.
3) All openings leading to external fittings or controls should be free from obstruction.
4) All exhaust inlets should be checked to prevent a chamber occupant from inadvertently blocking the opening.

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.

6) Proper surface treatment (coating) of the vessel external shell and maintaining weather tight external insulation are the keys to prevention of CUI damage.

d) Inspection of Parts and Appurtenances (piping systems, pressure gage, bottom drain)

1) As stated above, cast iron is not allowed on PVHO's 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.

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 gauge 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 feet from any air intake.

8) Venting should be provided at all high points of the piping system.

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.

3) Windows must be free of crazing, cracks and scratches.
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 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 pressure relief device must be piped outside to a safe point of discharge.

4) Rupture disks may be used only if they are in series with a pressure relief valve, or when there is less than 2 cubic feet 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:

1) Form PVHO-1 Manufacturer's Data Report for Pressure Vessels for Human Occupancy

2) Form PVHO-2 Fabrication Certification for Acrylic Windows

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

NB12-1901

4.3.1.1 ALL PRESSURE TESTING

Careful design of test procedure can limit potential damage. For testing of pressure retaining items, parameters that should be considered are the test media, test pressure, materials of construction and metal material temperature and temperature of test media. Some carbon steel and low alloy steel materials that were manufactured prior to 1970 may not have sufficient notch toughness to prevent brittle fracture during pressure testing conducted at, or even above, the generally acceptable temperature of 60°F (16 deg C).

For thick-walled pressure-retaining items, it is recommended to seek technical guidance in establishing notch toughness characteristics of steel plate prior to pressure testing so that the metal material temperature may be warmed above 60 deg F (16 deg C) to avoid brittle fracture.

The organization making any pressure test shall determine pressure-retaining item material has adequate notch toughness at the minimum temperature of the material and test media during pressure test.

NB11-1801

S1.1 SCOPE

This Supplement is provided as a guide for inspection and storage of steam locomotive firetube boilers operating on tracks gaged 24" or greater or for steam locomotives under the requirements of the Federal Railroad Administration (FRA). These rules shall be used in conjunction with the applicable rules of the NBIC. See NBIC Part 2, Figures S1.1-a and S1.1-b.
S2.1 SCOPE

a) This Supplement is provided as a guide to inspection of historical steam boilers of riveted and/or welded construction not falling under the scope of NBIC Part 2, Supplement 1. These historical steam boilers would include: steam tractors, traction engines, hobby steam boilers, portable steam boilers, certain steam locomotive boilers and other such boilers that are being preserved, restored, and maintained for demonstration, viewing, or educational purposes. (See Note Below)

Note: This supplement is not to be used for steam locomotive boilers operating on tracks gaged 24 inches or greater or for steam locomotive boilers falling under the requirements of the Federal Railroad Administration (FRA). FRA rules for steam locomotive boilers are published in 49CFR 230. Specific rules and special requirements for inspection, repairs, alterations, and storage of steam locomotive boilers are identified in NBIC Part 2, Supplement 1.

b) The rules specified in this supplement shall be used in conjunction with the applicable rules in this Code. References specified or contained in this Supplement may provide additional information to assist the user when applying the requirements of this Supplement.

S2.7.3.1 INITIAL INSPECTION

a) Initial inspections shall be performed to determine baseline criteria needed for the operating life of the boiler. The owner-user shall maintain documentation and inspection results, as required by this Section. In addition to the required Jurisdiction inservice inspection report identified in NBIC Part 2, S2.7.2, Form C-1 (See NBIC Part 2, S2.12) may be used for the documentation of initial examinations and inspections.

b) Boilers initially evaluated in accordance with this inspection code shall be subject to the following examinations and tests:

1) A visual internal examination per NBIC Part 2, S2.5.2;
2) A visual inservice examination per NBIC Part 2, S2.7.1;
3) Initial UT test requirements per NBIC Part 2, S2.6.2;
4) MAWP calculation per NBIC Part 2, S2.10;
5) Hydrostatic Pressure Testing per NBIC Part 2, S2.6.1; and
6) Other examinations (UT, PT, MT) as required by the Jurisdiction or Inspector to determine boiler integrity.

c) For new boilers constructed to a design code acceptable to the jurisdiction, the initial inspection shall be a visual inservice exam per NBIC Part 2, S2.7.1. Subject to jurisdictional acceptance, the other initial inspection items above may be omitted. These new boilers may be mounted on existing running gear or settings and may include the original appurtenances.

S2.10.2 RIVETS AND RIVET HEADS

When the diameter of the rivet holes in the longitudinal joint of a boiler is not known, the diameter of the rivets, after driving, may shall be ascertained from Table S2.10.2.
RIVET HEAD TYPES
Finished rivet heads are shown in NBIC Part 3, Figure S2.13.13.4. Note that a riveted seam may have more than one type of rivet to, for example, provide necessary clearance during operation, or for provision for equipment assembly and maintenance.

S2.10.2.1 INSPECTION OF CORRODED RIVETS
A riveted seam or joint is very redundant by design. Therefore, the following guidelines apply when generalized corrosion is present and consistent on a group of adjacent rivets (typically 4 or more), and not to individual rivets. The inspector must consider the frequency and consistency of corroded rivet heads, and condition, location, and type of riveted joint (and how it may fail) in determining allowable corrosion.

a. Visually identify all connections containing rivets which show signs of significant corrosion.

b. Categorize each connection as the type which loads the rivets in one of three possible modes (pure shear, pure tension, or combined shear and tension). Refer to Figure S2.10.2.

c. A leak around a rivet head may be indicative of a rivet which is loose, broken, or otherwise failing to provide adequate clamping force and shall require further inspection.

   i. A rivet shall be deemed loose if it can be felt to move after being struck on the side of the head in a direction approximately perpendicular to its shank with a 40oz engineer’s hammer.
   ii. NBIC Part 3, S2.13.13 defines procedures to address a leak around a rivet head.

d. Allowable corrosion:
   i. For rivets in pure shear load, the amount of measured head deterioration shall not exceed 80% of its total head volume. Where rivets have countersunk heads, the head diameter must be equal or greater than 65% of the original head diameter. Severe head corrosion shall require further evaluation of the condition and thickness of the plate at the joint.

---

**TABLE S2.10.2**
Sizes for Rivets Based on Plate Thickness

<table>
<thead>
<tr>
<th>Thickness of Place, inches (mm)</th>
<th>Diameter of Rivet after Driving, inches (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 (6)</td>
<td>11/16 (17)</td>
</tr>
<tr>
<td>9/32 (7)</td>
<td>11/16 (17)</td>
</tr>
<tr>
<td>5/16 (8)</td>
<td>3/4 (19)</td>
</tr>
<tr>
<td>11/32 (9)</td>
<td>3/4 (19)</td>
</tr>
<tr>
<td>3/8 (10)</td>
<td>13/16 (21)</td>
</tr>
<tr>
<td>13/32 (10)</td>
<td>13/16 (21)</td>
</tr>
<tr>
<td>7/16 (11)</td>
<td>15/16 (24)</td>
</tr>
<tr>
<td>15/32 (12)</td>
<td>15/16 (24)</td>
</tr>
<tr>
<td>1/2 (13)</td>
<td>15/16 (24)</td>
</tr>
<tr>
<td>9/16 (14)</td>
<td>1-1/16 (27)</td>
</tr>
<tr>
<td>5/8 (16)</td>
<td>1-1/16 (27)</td>
</tr>
</tbody>
</table>
ii. For rivets in pure tension, the amount of measured head deterioration shall not exceed 35% of its total head volume. Where rivets have countersunk heads, the head diameter must be equal or greater than 85% of original head diameter. Application of this value shall take into consideration the consistency and frequency of adjacent rivets showing excessive corrosion.

iii. For connections subjected to combined shear and tension loads, the amount of measured head deterioration shall not exceed 60% of its total head volume. Where rivets have countersunk heads, the head diameter must be equal or greater than 75% of original head diameter. Application of this value shall take into consideration the consistency and frequency of adjacent rivets showing excessive corrosion.

The condition of the plate surrounding the rivets including general wastage, pitting, and the condition of the caulking edge, must be considered.

Figure S2.10.2

The condition of the plate surrounding the rivets including general wastage, pitting, and the condition of the caulking edge, must be considered.

NB11-1601

**S2.10.4.1 STAYBOLTS**

The maximum allowable working pressure for symmetrically spaced corroded staybolts will be calculated using the formula provided in either of the 2 following paragraphs or the accompanying tables. Equations calculate MAWP based on measuring the staybolt spacing on the stayed surface and the minimum diameter of the corroded staybolt.

a) **IRON STAYBOLTS**

Staybolts which are of iron or of unknown material shall be calculated using the following formula or Table S2.10.4.1.a. The table is based on a stress value of 7,500 psi (51.7 MPa) for staybolts. Refer to ASME Section 1, 1971 Edition, Table PG-23.3 for allowable loads for all staybolts.

\[
P = \frac{\pi \left[ \frac{d}{2} \right]^2 S}{p^2} \quad S = 11,300 \text{ psi} (78.0 \text{ MPa})
\]
b) STEEL STAYBOLTS

Staybolts of known, steel material shall be calculated using the following formula or Table S2.10.4.1.b. The table is based on a stress value of 11,300 psi (78.0 MPa) for staybolts. Refer to ASME Section 1, 1971 Addenda for allowable loads for all staybolts.

\[ P = \frac{4 \pi d^2 s}{3 L} \times \frac{S}{1.1 \times 10^6}, \quad S = 11,300 \text{ psi (78.0 MPa)} \]
<table>
<thead>
<tr>
<th>Staybolt Spacing, in.</th>
<th>Actual Diameter of Corroded Iron Staybolts, in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.35</td>
<td>59 68 77 87 97 108 120 133 145 159 173 188 203 219 236 253 270 289 308 327 347 368 389</td>
</tr>
<tr>
<td>0.375</td>
<td>55 63 72 81 91 101 112 124 136 148 161 175 189 204 220 236 252 269 287 305 324 343 363</td>
</tr>
<tr>
<td>0.4</td>
<td>51 59 67 76 85 95 105 115 127 138 151 164 177 191 205 220 236 252 268 285 303 321 339</td>
</tr>
<tr>
<td>0.425</td>
<td>48 55 63 71 79 89 98 108 119 130 141 153 166 179 192 206 221 236 251 267 283 300 318</td>
</tr>
<tr>
<td>0.45</td>
<td>45 52 59 66 75 83 92 101 111 122 133 145 156 168 180 194 207 219 236 251 266 282 298</td>
</tr>
<tr>
<td>0.475</td>
<td>42 49 55 63 70 78 87 95 105 114 125 135 146 158 170 182 195 208 222 236 250 265 280</td>
</tr>
<tr>
<td>0.5</td>
<td>40 46 52 59 66 74 82 90 99 108 117 127 138 149 160 171 183 196 209 222 235 250 264</td>
</tr>
<tr>
<td>0.525</td>
<td>38 43 49 56 62 69 77 85 93 102 111 120 130 140 151 162 173 185 197 209 222 236 249</td>
</tr>
<tr>
<td>0.55</td>
<td>36 41 47 53 59 66 73 80 88 96 105 114 123 133 143 153 164 175 186 198 210 223 236</td>
</tr>
<tr>
<td>0.6</td>
<td>34 39 44 50 56 62 69 76 83 91 99 108 116 125 135 145 155 165 176 187 199 211 223</td>
</tr>
<tr>
<td>0.625</td>
<td>32 37 42 47 53 59 65 72 79 86 94 102 110 119 128 137 147 157 167 178 189 200 211</td>
</tr>
<tr>
<td>0.65</td>
<td>30 35 40 45 50 56 62 68 75 82 89 97 105 113 121 130 139 149 159 169 179 190 201</td>
</tr>
<tr>
<td>0.675</td>
<td>29 33 38 43 48 53 59 65 71 78 85 92 100 107 115 124 133 142 151 160 170 180 191</td>
</tr>
<tr>
<td>0.7</td>
<td>27 32 36 41 45 51 56 62 68 74 81 88 95 102 110 118 126 135 144 153 162 172 182</td>
</tr>
<tr>
<td>0.725</td>
<td>25 29 33 37 41 46 51 56 62 67 73 80 86 93 100 107 115 122 130 139 147 156 165</td>
</tr>
<tr>
<td>0.75</td>
<td>24 27 31 35 39 44 49 54 59 64 70 76 82 89 95 102 110 117 125 133 141 149 158</td>
</tr>
<tr>
<td>0.8</td>
<td>23 26 30 34 38 42 47 51 56 62 67 73 79 85 91 98 105 112 119 127 135 143 151</td>
</tr>
<tr>
<td>0.825</td>
<td>22 25 29 32 36 40 45 49 54 59 64 70 75 81 87 94 100 107 114 121 129 136 144</td>
</tr>
<tr>
<td>0.85</td>
<td>21 24 27 31 35 39 43 47 52 56 61 67 72 78 84 90 96 103 109 116 123 131 138</td>
</tr>
<tr>
<td>0.9</td>
<td>20 23 26 30 33 37 41 45 49 54 59 64 69 75 80 86 92 98 105 111 118 125 133</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S = 7,500 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>P = MAWP psi</td>
</tr>
</tbody>
</table>

\[ p = \frac{\pi \left( \frac{d}{2} \right)^2 S}{p^2} \]

\[ d = \text{Minimum diameter of corroded staybolt, in.} \]

\[ p = \text{staybolt spacing, in.} \]

Table S2.10.4.1.a [US Customary Units]

Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Iron Staybolt
<table>
<thead>
<tr>
<th>Staybolt Spacing, mm</th>
<th>Actual Diameter of Corroded Iron Staybolts, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>501</td>
</tr>
<tr>
<td>11</td>
<td>475</td>
</tr>
<tr>
<td>12</td>
<td>450</td>
</tr>
<tr>
<td>13</td>
<td>92.5</td>
</tr>
<tr>
<td>14</td>
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\[
S = 51,700 \text{ kPa} \\
P = \text{MAWP kPa} \\
\frac{d^2}{2} = \text{Minimum diameter of corroded staybolt, mm} \\
P = \pi \frac{d^2}{2} \frac{S}{\rho^2} \\
\rho = \text{staybolt spacing, mm}
\]

Table S2 10.4.1.a [Metric Units]

Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Iron Staybolt

---

Inspection  Page 15 of 25
### Table S2.10.4.1.b [US Customary Units]

Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Steel Staybolt

<table>
<thead>
<tr>
<th>Staybolt Spacing, in.</th>
<th>Actual Diameter of Corroded Steel Staybolts, in.</th>
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<tbody>
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<td>0.35</td>
<td>0.375 0.4 0.425 0.45 0.475 0.5 0.525 0.55 0.575 0.6 0.625 0.65 0.675 0.7 0.725 0.75 0.775 0.8 0.825 0.85 0.875 0.9</td>
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<td>75 86 98 111 124 139 153 169 186 203 221 240 259 280 301 323 345 369 393 418 444 470 497</td>
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<tr>
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<td>4.75</td>
<td>46 53 60 68 76 85 94 104 114 125 136 147 159 172 185 198 212 227 241 257 273 289 306</td>
</tr>
<tr>
<td>4.75</td>
<td>44 50 57 65 72 81 89 99 108 118 129 140 151 163 175 188 201 215 229 243 258 274 290</td>
</tr>
<tr>
<td>4.875</td>
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<tr>
<td>5</td>
<td>40 45 52 58 65 73 81 89 98 107 116 126 136 147 158 170 182 194 207 220 233 246 261</td>
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<tr>
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<tr>
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<tr>
<td>5.5</td>
<td>33 38 43 48 54 60 67 74 81 88 96 104 113 122 131 140 150 160 171 182 193 204 216</td>
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<tr>
<td>5.625</td>
<td>31 36 41 46 52 58 64 70 77 84 92 100 108 116 125 134 143 153 163 174 184 195 207</td>
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<tr>
<td>5.75</td>
<td>30 34 39 44 49 55 61 67 74 81 88 95 103 111 120 128 137 147 156 166 176 187 198</td>
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<tr>
<td>5.875</td>
<td>29 33 37 42 47 53 58 64 71 77 84 91 99 107 115 123 131 140 150 159 169 179 189</td>
</tr>
<tr>
<td>6</td>
<td>27 32 36 40 45 51 56 62 68 74 81 88 95 102 110 118 126 135 143 153 162 172 182</td>
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<td>6.125</td>
<td>26 30 34 39 44 49 54 60 65 71 77 84 91 98 105 113 121 129 138 146 155 165 174</td>
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<tr>
<td>6.25</td>
<td>25 29 33 37 42 47 52 57 62 68 74 81 87 94 101 109 116 124 132 141 149 158 167</td>
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<td>6.375</td>
<td>24 28 32 36 40 45 50 55 60 66 71 78 84 90 97 104 112 119 127 135 143 152 161</td>
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<tr>
<td>6.5</td>
<td>23 27 31 34 39 43 48 53 58 63 69 75 81 87 94 100 107 115 122 130 138 146 155</td>
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<tr>
<td>6.625</td>
<td>22 26 29 33 37 41 46 51 56 61 66 72 78 84 90 97 103 110 118 125 133 141 149</td>
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<tr>
<td>6.75</td>
<td>21 25 28 32 36 40 44 49 54 59 64 69 75 81 87 93 100 106 113 121 128 136 143</td>
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<tr>
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</tr>
<tr>
<td>7</td>
<td>20 23 26 30 33 37 41 45 50 54 59 64 70 75 81 87 93 99 105 112 119 126 133</td>
</tr>
</tbody>
</table>

\[ S = 11,300 \text{ psi} \]

\[ P = \text{MAWP psi} \]

\[ p = \frac{\pi \left( \frac{d}{2} \right)^2 S}{1.1 \times p^2} \]

\[ d = \text{Minimum diameter of corroded staybolt, in.} \]

\[ p = \text{staybolt spacing, in.} \]
### Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Steel Staybolt

- **Inspection**

<table>
<thead>
<tr>
<th>Staybolt Spacing, mm</th>
<th>Actual Diameter of Corroded Steel Staybolts, mm</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Table S2.10.4.1.b [Metric Units]**

<table>
<thead>
<tr>
<th>$S$ = 78,000 kPa</th>
<th>$P$ = $MAWP$ kPa</th>
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</thead>
<tbody>
<tr>
<td>$p = \pi \frac{d^2}{1.1 \times \rho}$</td>
<td></td>
</tr>
</tbody>
</table>

$P =$ staybolt spacing, mm

$d =$ Minimum diameter of corroded staybolt, mm
S2.7.3.1 INITIAL INSPECTION

a) Initial inspections shall be performed to determine baseline criteria needed for the operating life of the boiler. The owner-user shall maintain documentation and inspection results, as required by this Section. In addition to the required Jurisdiction inservice inspection report identified in NBIC Part 2, S2.7.2, Form C-1 (See NBIC Part 2, S2.12) may be used for the documentation of initial examinations and inspections.

b) Boilers initially evaluated in accordance with this inspection code shall be subject to the following examinations and tests:
   1) A visual internal examination per NBIC Part 2, S2.5.2;
   2) A visual inservice examination per NBIC Part 2, S2.7.1;
   3) Initial UT test requirements per NBIC Part 2, S2.6.2;
   4) MAWP calculation per NBIC Part 2, S2.10;
   5) Hydrostatic Pressure Testing per NBIC Part 2, S2.6.1; and
   6) Other examinations (UT, PT, MT) as required by the Jurisdiction or Inspector to determine boiler integrity.

c) For new boilers constructed to a design code acceptable to the jurisdiction, the initial inspection shall be a visual inservice exam per NBIC Part 2, S2.7.1. Subject to jurisdictional acceptance, the other initial inspection items above may be omitted. These new boilers may be mounted on existing running gear or settings and may include the original appurtenances.

SUPPLEMENT 7

INSPECTION OF PRESSURE VESSELS IN LIQUEFIED PETROLEUM GAS (LPG) SERVICE

S7.1 SCOPE

a) Pressure vessels/containers designed for storing LPG can be stationary or can be mounted on skids. LPG is generally considered to be non-corrosive to the interior of the vessel. NBIC Part 2, Supplement 7 is provided for guidance of a general nature for the owner, user, or jurisdictional authority. There may be occasions where more detailed procedures will be required such as changing from one gas service to another (i.e., anhydrous ammonia to LPG above ground to under ground; or containers that are commercially refurbished).

b) The application of this Supplement to underground vessels/containers will only be necessary when evidence of structural damage to the vessel has been observed, leakage has been determined, or the tank has been dug up, and is to be reinstalled. Special consideration will be given to containers that are going to be commercially refurbished. (see NBIC Part 2, Supplement 7.10)
S7.2 PRE-INSPECTION ACTIVITIES

a) A review of the known history of the pressure vessel/container should be performed. This should include a review of information, such as:

b) The vessel/container shall be sufficiently cleaned to allow for visual inspection. For commercially refurbished containers see NBIC Part 2, Supplement 7.10

S7.3 INSERVICE INSPECTION FOR VESSELS IN LP GAS SERVICE

The type of inspection given to pressure vessels should take into consideration the condition of the vessel and the environment in which it operates. The inspection may be external or internal, and use a variety of nondestructive examination methods. Where there is no reason to suspect an unsafe condition or where there are no inspection openings, internal inspections need not be performed. When service conditions change from one service to another, i.e., aboveground to underground; or containers that are commercially refurbished), such as ammonia to LPG, an internal inspection may be required. The external inspection may be performed when the vessel is pressurized or depressurized, but shall provide the necessary information that the essential sections of the vessel are of a condition to operate.

S7.3.1 NONDESTRUCTIVE EXAMINATION (NDE)

Listed below are a variety of methods that may be employed to assess the condition of the pressure vessel. These examination methods should be implemented by experienced and qualified individuals. Generally, some form of surface preparation will be required prior to the use of these examination methods: visual, magnetic particle, liquid penetrant, ultrasonic, radiography, radioscoppy, eddy current, metallographic examination, and acoustic emission. When there is doubt as to the extent of a defect or detrimental condition found in a pressure vessel/container, additional NDE may be required.

S7.4 EXTERNAL INSPECTION

All parts of the vessel/container shall be inspected for corrosion, distortion, cracking, or other conditions as described in this Section. In addition, the following should be reviewed, where applicable:

a) Insulation or Coating

If the insulation or coating is in good condition and there is no reason to suspect an unsafe condition behind it, then it is not necessary to remove the insulation or coating in order to inspect the vessel. However, it may be advisable to remove a small portion of the insulation or coating in order to determine its condition and the condition of the vessel/container surface. For commercially refurbished containers see NBIC Part 2, Supplement 7.10

S7.7 FIRE DAMAGE

c) A pressure vessel that has been subjected to action of fire shall be removed from service until it has been properly evaluated. The general intent of this requirement is to remove from service pressure vessels which have been subject to action of fire that has changed the metallurgical structure or the strength properties of the steel. Visual examination with emphasis given to the condition of the protective coating can be used to evaluate exposure from a fire. This is normally determined by visual examination as described above with particular emphasis given to the condition of the protective coating. If there is evidence that the protective coating
has been burned off any portion of the pressure vessel surface, or if the pressure vessel is burned, warped, or distorted, it is assumed that the pressure vessel has been overheated. If, however, the protective coating is only smudged, discolored, or blistered, and is found by examination to be intact underneath, the pressure vessel shall not be considered affected within the scope of this requirement. Vessels that have been involved in a fire and show no distortion shall be requalified for continued service by retesting using the liquid pressure test.

S7.8.2 DENTS

a) Shells

The maximum mean dent diameter in shells shall not exceed 105% of the shell diameter, and the maximum depth of the dent shall not exceed 105% of the mean dent diameter. The mean dent diameter is defined as the average of the maximum dent diameter and the minimum dent diameter. If any portion of the dent is closer to a weld than 5% of the shell diameter, the dent shall be treated as a dent in a weld area, see (b) below.

b) Welds

The maximum mean dent diameter on welds (i.e., part of the deformation includes a weld) shall not exceed 10% of the shell diameter. The maximum depth shall not exceed 1/205% of the mean dent diameter.

c) Heads

The maximum mean dent diameter on heads shall not exceed 10% of the shell diameter. The maximum depth shall not exceed one twentieth5% of the mean dent diameter. The use of a template may be required to measure dents on heads.

S7.8.4 CUTS OR GOUGES

When a cut or a gouge exceeds 1/425% of the thickness of the vessel, the vessel shall be removed from service until it is repaired by a qualified repair organization or permanently removed from service.

S7.8.5 CORROSION

a) Line and Crevice Corrosion

For line and crevice corrosion, the depth of the corrosion shall not exceed 1/425% of the original wall thickness.

b) Isolated Pitting

Isolated pits may be disregarded provided that:

1) Their depth is not more than 1/225% the required thickness of the pressure vessel container wall (exclusive of corrosion allowance);

2) The total area of the pits does not exceed 7 sq. in. (4500 sq. mm) within any 8 in. (200 mm) diameter circle; and

3) The sum of their dimensions along any straight line within this circle does not exceed 2 in. (50 mm).
c) General Corrosion

For a corroded area of considerable size, the thickness along the most critical plane of such damaged area may be averaged over a length not exceeding 20-10 in. (500250 mm). The thickness at the thinnest point shall not be less than 5075% of the required wall thickness, and the average shall not be less than 7590% of the required wall thickness. When general corrosion is identified that exceeds the limits set forth in this paragraph, the pressure vessel shall be removed from service until it is repaired by a qualified organization “R” stamp holder or permanently removed from service unless an acceptable for service evaluation is performed in accordance with NBIC Part 2- 4.4.

S7.8.6 ANHYDROUS AMMONIA SERVICE

Containers that have been previously used in anhydrous ammonia service shall not be converted to LPG service. Any blue coloring of the brass valves indicates that the container has been in anhydrous ammonia service.

S7.9 REQUIREMENT FOR CHANGE OF SERVICE FROM ABOVE GROUND TO UNDERGROUND

(New Section)

S7.10 ASME LPG Containers Less Than 2000 Gallons Being Refurbished By a Commercial Source.

Commercially refurbished containers are used containers that are temporarily taken out of service for repair and or renewal and sent to a company which specializes in this type of work. Because the history of some of these containers is unknown, special attention shall be given to inspection and repair before returning any of these containers back to service. ASME LPG containers less than 2000 gallons may be refurbished subject to the following conditions:

1. A complete external inspection shall be completed under the guidelines of this supplement. If any defects are found, as defined in 7.8.1 through 7.8.5, the defect shall be repaired under NBIC Part 3, Repairs and Alterations by qualified personnel or permanently removed from service.

2. Containers that have been previously used in anhydrous ammonia service shall not be converted to LPG service. See NBIC Part 2, Supplement 7.8.6

3. The coating on the outside of the container shall be removed down to bare metal so that an inspection can be performed under the guidelines of this supplement.

4. Verify that there is no internal corrosion if the tank has had its valves removed or is known to have been out of service for an extended period.
5.3.4 BOILER OR PRESSURE VESSEL DATA REPORT FORM (NB-5)

FORM NB-5 BOILER OR PRESSURE VESSEL DATA REPORT
FIRST INTERNAL INSPECTION
Standard Form for Jurisdictions Operating Under the ASME Code

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<td>in.</td>
<td>in.</td>
<td>in.</td>
<td>SECTIONS</td>
<td>DOES WELDING ON STEAM, FEED BLOWOFF AND OTHER PIPING COMPLY WITH CODE</td>
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<td>SHOW ALL CODE STAMPING ON BACK OF FORM. One detail (see sketch) for special items not covered above, such as double walls and manholes, etc.</td>
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</table>

I HEREBY CERTIFY THIS IS A TRUE REPORT OF MY INSPECTION

SIGNED|

Page 22 of 25
# FORM NB-6 BOILER-FIRED PRESSURE VESSEL
## REPORT OF INSPECTION

Standard Form for Jurisdictions Operating Under the ASME Code

<table>
<thead>
<tr>
<th>1</th>
<th>DATE INSPECTED</th>
<th>CERT EXP DATE</th>
<th>CERTIFICATE POSTED</th>
<th>OWNER NO.</th>
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<th>NAT'L BD NO.</th>
<th>OTHER NO.</th>
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<td></td>
<td>MO</td>
<td>DAY</td>
<td>YEAR</td>
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<td>YEAR</td>
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| 3 | OWNER'S STREET ADDRESS NUMBER | OWNER'S CITY | STATE | ZIP |
|   | | | | |

| 4 | USER'S NAME – OBJECT LOCATION | SPECIFIC LOCATION IN PLANT | OBJECT LOCATION - COUNTY |
|   | | | |

| 5 | CERTIFICATE COMPANY NAME | CERTIFICATE COMPANY CONTACT NAME | EMAIL |
|   | | | |

| 6 | CERTIFICATE COMPANY ADDRESS | CERTIFICATE COMPANY CITY | STATE | ZIP |
|   | | | |

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<th>MAWP</th>
<th>SAFETY-RELIEF VALVES</th>
<th>HEATING SURFACE OR BTU (Input/Output)</th>
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</thead>
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<table>
<thead>
<tr>
<th>9</th>
<th>IS CONDITION OF OBJECT SUCH THAT A CERTIFICATE MAY BE ISSUED?</th>
<th>HYDRO TEST</th>
<th>WITH</th>
<th>Yes</th>
<th>No (If no, explain fully under conditions)</th>
<th>Yes</th>
<th>psi</th>
<th>Date</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>10</th>
<th>REQUIREMENTS: (List Code Violations)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>11</th>
<th>NAME AND TITLE OF PERSON TO WHOM REQUIREMENTS WERE EXPLAINED:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>12</th>
<th>SIGNATURE OF INSPECTOR</th>
<th>IDENT NO.</th>
<th>EMPLOYED BY</th>
<th>IDENT NO.</th>
</tr>
</thead>
</table>

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229

NB-6 Rev. 4
FORM NB-7 PRESSURE VESSELS
REPORT OF INSPECTION
Standard Form for Jurisdictions Operating Under the ASME Code

<table>
<thead>
<tr>
<th>1</th>
<th>DATE INSPECTED</th>
<th>CERT EXP DATE</th>
<th>CERTIFICATE POSTED</th>
<th>OWNER NO.</th>
<th>JURISDICTION NUMBER</th>
<th>NAT'L BD NO.</th>
<th>OTHER NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MO</td>
<td>DAY</td>
<td>YEAR</td>
<td>MO</td>
<td>YEAR</td>
<td>Yes</td>
<td>No</td>
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<table>
<thead>
<tr>
<th>2</th>
<th>OWNER</th>
<th>NATURE OF BUSINESS</th>
<th>KIND OF INSPECTION</th>
<th>CERTIFICATE INSPECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Int</td>
<td>Ext</td>
<td>Yes</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>OWNER'S STREET ADDRESS</th>
<th>OWNER'S CITY</th>
<th>STATE</th>
<th>ZIP</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>USER'S NAME - OBJECT LOCATION</th>
<th>SPECIFIC LOCATION IN PLANT</th>
<th>OBJECT LOCATION - COUNTY</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>USER'S STREET ADDRESS</th>
<th>USER'S CITY</th>
<th>STATE</th>
<th>ZIP</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>CERTIFICATE COMPANY NAME</th>
<th>CERTIFICATE COMPANY CONTACT NAME</th>
<th>EMAIL</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>CERTIFICATE COMPANY ADDRESS</th>
<th>CERTIFICATE COMPANY CITY</th>
<th>STATE</th>
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<table>
<thead>
<tr>
<th>5</th>
<th>TYPE</th>
<th>YEAR BUILT</th>
<th>MANUFACTURER</th>
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<tbody>
<tr>
<td></td>
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<td>Ext</td>
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<table>
<thead>
<tr>
<th>5</th>
<th>USE</th>
<th>SIZE</th>
<th>PRESSURE GAGE TESTED</th>
</tr>
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<tr>
<td></td>
<td>Int</td>
<td>Ext</td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7</th>
<th>PRESSURE ALLOWED</th>
<th>THIS INSPECTION</th>
<th>PREVIOUS INSPECTION</th>
<th>SAFETY RELIEF VALVES</th>
<th>SET AT</th>
<th>TOTAL CAPACITY</th>
<th>EXPLAIN IF PRESSURE CHANGED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Int</td>
<td>Ext</td>
<td>Yes</td>
<td>No</td>
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<thead>
<tr>
<th>8</th>
<th>IS CONDITION OF OBJECT SUCH THAT A CERTIFICATE MAY BE ISSUED?</th>
<th>HYDRO TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No (IF NO EXPLAIN FULLY UNDER CONDITIONS)</td>
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<tr>
<th>9</th>
<th>CONDITIONS:</th>
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<tbody>
<tr>
<td></td>
<td>With respect to the internal surface, describe and state location of any scale, oil or other deposits. Give location and extent of any corrosion and state whether active or inactive. State location and extent of any erosion, grooving, warping, cracking or similar condition. Report on any defective rivets, bowed, loose or broken stays. Describe any adverse conditions with respect to pressure gage, water column, gage glass, gage cocks, safety valves, etc. Describe any major changes or repairs made since last inspection.</td>
<td></td>
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<table>
<thead>
<tr>
<th>10</th>
<th>REQUIREMENTS: (LIST CODE VIOLATIONS)</th>
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<tr>
<th>10</th>
<th>NAME AND TITLE OF PERSON TO WHOM REQUIREMENTS WERE EXPLAINED:</th>
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<tbody>
<tr>
<td></td>
<td>I HEREBY CERTIFY THIS IS A TRUE REPORT OF MY INSPECTION</td>
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This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229

NB-7 Rev. 2
<table>
<thead>
<tr>
<th>DATE INSPECTED</th>
<th>OWNER-USER</th>
<th>LOCATION</th>
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* In this column show the number of years for which the inspector authorizes the issuance of the certificate.
Part 3 Repair and Alteration
1.3.2 ACCEPTANCE INSPECTION

a) The Inspector making the acceptance inspection shall be the same Inspector who authorized the repair or alteration. Where this is not possible or practicable, another Inspector may perform the acceptance inspection; however, in all cases, the Inspector who performs the acceptance inspection shall be an employee of the same organization as the Inspector who authorized the repair or alteration.

b) Before signing the appropriate NBIC Report Form, the Inspector shall review the drawings, ensure the repair or alteration was performed in accordance with the accepted code of construction or standard, witness any pressure test or any acceptable alternative test method applied, ensure that the required nondestructive examinations have been performed satisfactorily, and that the other functions necessary to ensure compliance with the requirements of this Code have been satisfactorily performed.

c) The inspector shall verify the stamping or nameplate is correct and where applicable, the nameplate has been properly attached.

NB12-0603

1.5.1 ACCREDITATION PROCESS

d) When the quality system requirements of this Section have been met, a Certificate of Authorization and appropriate National Board symbol stamp shall be issued.

d) e) The accreditation programs provide requirements for organizations performing repairs and alterations to pressure-retaining items. Depending upon the expected scope of activities at the time of review, organizations may be authorized to perform design only, metallic or non-metallic repairs, and/or alterations either in the shop only, field only, or shop and field. Repairs and/or alterations to metallic and non-metallic pressure-retaining items are made by welding, bonding and/or mechanical assembly.

1.5.2 SCOPE ISSUANCE AND REVISION TO A QUALITY SYSTEM

a) Any scope revision shall require authorized inspection agency acceptance of quality system changes. These changes shall be submitted to the National Board for acceptance. A program review may be required by the National Board or the Jurisdiction to ensure quality system requirements are met for scope changes. Upon acceptance of the changes, the National Board will issue a Certificate of Authorization with a revised scope.

b) The “VR” accreditation program provides requirements for organizations performing repairs to pressure relief valves. For scope issuance and revisions, refer to 1.7.

1.6 ACCREDITATION OF “R” REPAIR ORGANIZATIONS

1.6.1 SCOPE

a) This section provides requirements that must be met by organizations in order to obtain a National Board Certificate of Authorization to use the “R” Symbol Stamp for the repair or alteration of pressure-retaining items. Organizations may be authorized to perform repairs only, or repairs and alterations.

b) The issuance of the “R” Stamp is not restricted to organizations whose primary business is to repair and alter pressure-retaining items, nor to manufacturers of pressure-retaining items. Owners and Users of pressure-retaining items and other organizations that qualify in accordance with these rules may also obtain the “R” Stamp.

c) Owners or users may be accredited for both a repair and inspection program provided the owner or user complies with the requirements of the “R” program and the National Board requirements of NB 371 for an
Owner-User Inspection Organization. The requirements of 1.6.2(a) do not apply if the owner or user chooses to use the Owner-User Inspection Organization to accept the repair quality system when:

1) There is no conflict with jurisdictional requirements.

2) The line of authority for the Owner-User Inspection Organization shall be independent of the organization responsible for execution of “R” program work.

3) The process and Inspector limitations are described in the written Owner-User Inspection Organization’s quality system manual.

1.6.2 PREREQUISITES FOR ISSUING A NATIONAL BOARD CERTIFICATE OF AUTHORIZATION

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

a) Have and maintain an Inspection Agreement with an Authorized Inspection Agency;

b) Have, in the English language, a written Quality System that complies with the requirements of this section and includes the expected scope of activities;

c) Have the current edition and addendum of the National Board Inspection Code, all parts; and

d) Have available a copy of the code of construction appropriate to the intended scope of work.

1.6.3 PROCEDURE FOR OBTAINING OR RENEWING A NATIONAL BOARD CERTIFICATE OF AUTHORIZATION

a) Prior to issuance or renewal of a National Board “R” Certificate of Authorization, the organization and its facilities are subject to a review of its Quality System. The implementation of the Quality System shall be satisfactorily demonstrated by the organization. The National Board reserves the absolute right to cancel, refuse to issue, or renew such authorization.

e) b) 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) c) When an organization has plants or shops in more than one location, the organization shall submit separate applications for each plant or shop. The organization may perform repairs or alterations in its plants, shops, or in the field, provided such operations are described in the organization’s Quality System.

d) Upon notification of the review dates from the National Board, it is the responsibility of the organization to make arrangements for the review.

e) The Review Team, as a minimum, shall consist of one representative each from the Authorized Inspection Agency and the Jurisdiction.

f) The Review Team shall conduct an evaluation of the organization’s Quality System. The organization shall demonstrate sufficient implementation of the Quality System to provide evidence of the organization’s knowledge of welding, nondestructive examination, postweld heat treatment, and other repair or alteration activities performed appropriate for the requested scope of work. The demonstration may be performed using current work, a demonstration mock-up, or a combination of both.

g) A recommendation to issue, renew, or withhold the National Board Certificate of Authorization shall be included in a Review Report prepared by the Review Team. The completed Review Report shall be forwarded to the National Board.
h) If proper administrative fees are paid and all other requirements are met, a Certificate of Authorization will be issued evidencing permission to use the “R” Symbol Stamp. The certificate shall expire on the triennial anniversary date.

i) When an organization holding a National Board Certificate of Authorization changes ownership, name, location, or address, the National Board shall be notified. The Certificate of Authorization may be revised by submitting an application for National Board “R” Certificate of Authorization; however, a re-review may be required.

j) The holder of an ASME Code Symbol Stamp, whose facilities were reviewed (with the exception of “V,” “UV,” “HV,” “NV,” and “H” [cast iron]) may obtain National Board authorization without a review of its facilities, provided:

1) The organization has a Quality System to cover the scope of the repairs or alterations to be made, subject to review by the Jurisdiction; and
2) The application for the “R” Certificate of Authorization is submitted within 12 months from the issuance of the ASME Certificate of Authorization. The initial Certificate of Authorization shall be issued to expire concurrent with the ASME Certificate of Authorization. Subsequent certificates shall be renewed upon a successful review and implementation of its Quality System by a National Board Representative.

k) The Jurisdiction may audit the Quality System and activities of an organization upon a valid request from an owner, user, inspection agency, or the National Board.

h) The NBIC Committee may at any time change the rules for the issuance of Certificates of Authorization and use of the “R” Symbol Stamp. These rules shall become binding on all certificate holders.

**NB10-0701**

1.6.5.1 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM FOR QUALIFICATION FOR THE NATIONAL BOARD “R” Certificate of authorization

**t) 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 “R” Certificate of Authorization.

1) Records may represent any information used to further substantiate the statements used to describe the scope of work completed to a pressure-retaining item (PRI), and documented on a Form “R” report.

2) Records are not limited to those depicting or calculating an acceptable design, material compliance or certifications, NDE-reports, PWHT-charts, a WPS used, a welder, bonder, or cementing technician’s process continuity records, drawings, sketches, or photographs.

3) The record retention schedule described in the Quality System Manual is to follow the instructions identified in NBIC Part 3, Figure 1.6.5.1.
<table>
<thead>
<tr>
<th>Form “R” Reports, Records, or Documents</th>
<th>Instructions</th>
<th>Minimum Retention Period</th>
</tr>
</thead>
<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, 5.13.4.1, 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-years</td>
</tr>
<tr>
<td>b) Form “R” Report with REPORT OF FITNESS FOR SERVICE ASSESSMENT FORM (NB-403) attached</td>
<td>When the method of repair described in NBIC Part 3.3.3.4.8 is used, the record retention period shall be for the duration described on the FITNESS FOR SERVICE ASSESSMENT (FFSA) Form required by the repair method and as described in NBIC Part 2, 4.4 Notes: 1. The “R” Certificate Holder should be aware that when used, some of the referenced codes and standards identified in NBIC Part 2, 1.3 describe requirements for permanent record retention throughout the service life of each equipment item. 2. When the “R” Certificate Holder is not the owner or user of the equipment, the record retention period is limited to the FFSA-results described on line 8 of the Report of Fitness for Service Assessment Form (NB-403)</td>
<td>5 years or as described on line 8 as reported on Form NB-403; whichever period is longer</td>
</tr>
<tr>
<td>c) Continuity records for a welder, welding operator, bonder, or cementing technician</td>
<td>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.</td>
<td>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.</td>
</tr>
</tbody>
</table>
1.7 ACCREDITATION OF “VR” REPAIR ORGANIZATIONS

1.7.1 SCOPE

a) These administrative rules and procedures are provided by the National Board for those who wish to obtain a National Board Certificate of Authorization for use of the “VR” (Repair of Pressure Relief Valves) symbol stamp. It should be noted that the issuance of the “VR” stamp is not restricted to companies whose primary business is the repair of pressure relief valves, nor to manufacturers or assemblers that hold an ASME “V,” “HV,” “UV,” or “NV” Code symbol stamp. Owners and users of boilers and pressure vessels and other organizations that qualify in accordance with the National Board Rules and Regulations may also obtain the “VR” Certificate and stamp.

b) In order to provide due process in the issuance, renewal, and revocation of “VR” symbol stamps and certificates of authorization, the National Board Appeals Committee procedures provide an affected “VR” Certificate of Authorization applicant the right of appeal, or to provide additional information that may affect the Committee’s decision.

1.7.2 JURISDICTIONAL PARTICIPATION

The National Board member jurisdiction in which the “VR” 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 repair organization and the demonstration and acceptance of the repair organization’s quality system manual.

1.7.3 GENERAL RULES

The general rules of the National Board “VR” certification program apply only to the repair of National Board capacity certified ASME Code Section I “V” stamped, Section IV “HV” marked, and Section VIII “UV” stamped pressure relief valves that:

a) Have been in service or have been exposed to environmental or other conditions such that there is reason to question their ability to perform equivalent to the standards for new valves; or

b) Any or all of the valve’s external adjustment seals have been broken, opened, or otherwise disturbed, regardless of the valve’s age or service status.

1.7.4 REPAIR OF NUCLEAR VALVES

Provided that the requirements of Supplement 9 and applicable requirements of these rules are met, the “VR” certificate may be extended to apply to the repair of any ASME Code Section III, Class 1, 2, or 3, pressure relief devices that have been capacity certified by the National Board and have been in service, regardless of their intended function, in a nuclear system.
1.7.3 1.7.5 ISSUANCE AND RENEWAL OF THE “VR” CERTIFICATE OF AUTHORIZATION

1.7.3.1 1.7.5.4 GENERAL

Authorization to use the stamp bearing the official National Board “VR” symbol as shown in Section 5 of this Part, will be granted by the National Board pursuant to the provisions of the following administrative rules and procedures. Supplement 9 of this Part, provides rules for the repair of ASME Section III “NV” stamped pressure relief devices.

1.7.3.2 1.7.5.2 ISSUANCE OF CERTIFICATE

a) Repair organizations, manufacturers, assemblers, or users that make repairs to the American Society of Mechanical Engineers (ASME) Code symbol, stamped or marked (as applicable), and The National Board of Boiler and Pressure Vessel Inspectors (National Board) capacity certified pressure relief valves may apply to the National Board for a Certificate of Authorization to use the “VR” symbol. The National Board may at any time, through the NBIC Committee, modify the regulations concerning the issuance and use of such valve repair symbol. All such modified regulations shall become binding upon holders of valid Valve Repair Certificates of Authorization.

b) Authorization to use the “VR” stamp may be granted or withheld by the National Board in its absolute discretion. If authorization is granted and proper administrative fees paid, a Certificate of Authorization will be issued evidencing permission to use such a symbol, expiring on the triennial anniversary date. The certificate will be signed by the National Board Chairman of the National Board of Trustees, the Executive Director, or any other duly authorized officer.

c) The certificate shall list the physical, permanent address of record for the certificate holder’s shop/plant. For field-only scopes, this address of record shown on the Certificate of Authorization is where administrative, technical, and quality aspects of the business are controlled.

1.7.5.3 RENEWAL OF CERTIFICATE

The Certificate of Authorization is renewable every three (3) years subject to a review of the Quality System by a representative of the National Board, review and acceptance of the representative’s report by the National Board, and successful completion of capacity verification tests. See 1.7.8 for exceptions. The applicant should apply to the National Board for renewal of authorization and re-issuance of the certificate prior to the date of expiration. The National Board reserves the absolute right to cancel, refuse to issue, or renew such authorization.

1.7.5.4 REVIEW OF APPLICANT’S FACILITY

a) Before issuance or renewal of pressure relief “VR” Certificates of Authorization, the repair organization, its written quality system, and its facilities are subject to a review and verification of implementation of its quality system by a representative of the National Board. The implementation demonstration shall include, as a minimum, disassembly, inspection, repair, application of special processes, reassembly, setting, and testing of valves within the scope of the applicant’s quality system.

b) The applicant shall repair and submit for verification testing one (1) valve for each Code section (except Section III) and test fluid (steam, air/gas, liquid) which will appear on the Certificate of Authorization. A minimum of two (2) valves are required regardless of Code sections or test fluid. The valves shall be within the capabilities of the National Board accepted laboratory. When an applicant is using the provisions of 4.5.2, the applicant shall submit one additional Section VIII steam valve set on air for verification testing on steam.

c) The applicant shall have a copy of the National Board Pressure Relief Device Certifications publication, NB-18, dated within one year (available from the National Board Web page), the latest edition and addenda of the
National Board Inspection Code (NBIC), all parts; and the ASME Code section(s) that the organization is including in its scope.

d) It is the responsibility of the valve repair organization to make arrangements for this review. Certificates cannot be issued or renewed until the National Board is in receipt of approval of this review. Wherever possible, National Board reviews of valve repair organizations shall be coordinated with ASME reviews, when applicable.

e) For field-only repair scopes, the review shall encompass both the applicant’s address of record and field repair demonstration site. The demonstration site shall be representative of that typically encountered by the applicant (see 1.7.5.6).

1.7.5.5 VERIFICATION TESTING

a) Before the “VR” Certificate of Authorization and stamps may be issued or renewed, the demonstration valves must successfully complete capacity and operational verification tests at a National Board accepted testing laboratory. See 1.7.5.6 and 1.7.8 for exceptions. The valves shall be typical of those repaired by the organization and within the capabilities of the testing laboratory.

b) Tests conducted at the accepted testing laboratory shall be witnessed by a representative of the National Board. The purpose of the tests is to ensure that the repairs have been satisfactorily carried out and the function and operation of the valves meet the requirements of the section of the ASME Code to which they were manufactured.

c) Valves not meeting the function or operational requirements of the section of the ASME Code to which they were manufactured shall be considered to have failed. Replacement valves shall be repaired and selected for testing as stated above, at a rate of two (2) valves for each one (1) that failed.

   1) If either or both of these replacement valves fail to meet the above criteria, the applicant shall document the cause of the noted deficiencies and actions taken to guard against future occurrence. Upon acceptance of this information by the National Board, one (1) additional valve for each replacement valve that failed shall be repaired and tested. The valve(s) shall be of the same ASME Code Section, fluid and set pressure scope, as the valve previously failing to meet the test requirement.

   2) Failure of this valve(s) to meet the ASME Code to which the valve was manufactured shall be cause for consideration by the National Board of revocation of the “VR” Certificate of Authorization or acceptance of alternative corrective action.

1.7.5.6 VERIFICATION TESTING ALTERNATIVES

a) In such cases where all valves repaired by the applicant for a specified ASME Code Section or test fluid exceed the capabilities of the accepted testing laboratory, valves for that ASME Code Section or test fluid shall be selected as specified in 1.7.5.4, and a demonstration test shall be successfully performed in lieu of verification testing specified in 1.7.5.5 above. The demonstration tests shall be conducted at a facility mutually agreeable to the National Board representative, the facility owner, and the applicant. The purpose of these tests is to demonstrate, in the presence of a National Board representative, that the repaired valves shall have adequate seat tightness at the maximum expected operating pressure prior to lifting, shall open within the required set pressure tolerance, operate consistently without chatter, and reclose within the required blowdown.

b) If a valve lift-assist device is used by the applicant to establish set pressure after repairs, this device must also be used to set the demonstration valves.

c) If either of these valves fail to meet the above criteria, then replacement valves shall be repaired and tested at a rate of two valves for each one that failed.
1) If either or both of these replacement valves fail to meet the above criteria, the applicant shall document the cause of the noted deficiencies and actions taken to guard against future occurrence. Upon acceptance of this information by the National Board, one (1) additional valve for each replacement valve that failed shall be repaired and tested. The valve(s) shall be of the same ASME Code section, fluid, and set pressure scope as the valve previously failing to meet the test requirement.

2) Failure of this valve(s) to meet the ASME Code to which the valve was manufactured shall be cause for consideration by the National Board of revocation of the “VR” Certificate of Authorization or acceptance of alternative corrective action.

1.7.4 1.7.6 USE OF THE “VR” AUTHORIZATION

1.7.4.1 1.7.6.1 TECHNICAL REQUIREMENTS

The administrative requirements of 1.7 for use of the “VR” stamp shall be used in conjunction with the technical requirements for valve repair as described in Supplement 7 of the NBIC. Those requirements shall be mandatory when a “VR” repair is performed.

1.7.6.2 STAMP USE

Each “VR” symbol stamp shall be used only by the repair firm within the scope, limitations, and restrictions under which it was issued.

1.7.4.2 1.7.6.3 RETURN OF STAMP

Each applicant shall agree, if authorization to use the stamp is granted, that the stamp is at all times the property of the National Board and will be promptly returned upon demand. If the applicant discontinues the repair of such valves or if the “VR” Certificate of Authorization issued to such applicant has expired and no new certificate has been issued, the stamp will be returned to the National Board.

1.7.6.4 MULTIPLE LOCATIONS

A holder of a National Board “VR” stamp shall not permit any others to use the “VR” symbol stamp loaned to it by the National Board. When a repair organization, manufacturer, or user has a repair department and/or equipment in fixed plants or shops located in more than one geographical area, it must submit separate applications for each plant or shop with the addresses of all such repair locations.

1.7.6.5 CERTIFICATE OF AUTHORIZATION CONTENTS

Qualification for repair location (shop, shop and field, or field only), code section (Section I, III, IV, and/or VIII valves), special processes, and test media shall be specified on the repair organization’s “VR” Certificate of Authorization.

1.7.6.6 CHANGES TO CERTIFICATES OF AUTHORIZATION

a) When a “VR” Certificate Holder intends to change the address of record (location), the certificate holder shall notify the National Board in writing prior to relocating. The new facilities and related quality system for the new location shall be reviewed in accordance with 1.7.5.4. Issuance of a new Certificate of Authorization is subject to the procedures herein.

b) When a “VR” Certificate Holder intends to change ownership or scope, the certificate holder shall notify the National Board in writing prior to the change. A review, in accordance with 1.7.5.4, may be required depending upon the nature and extent of the change to the quality system manual, repair procedures, or facilities. Issuance of a new Certificate of Authorization is subject to the procedures herein.
1.7.6.7 ISSUANCE OF MORE THAN ONE “VR” SYMBOL STAMP TO A CERTIFICATE OF AUTHORIZATION HOLDER

The holder of a Certificate of Authorization may obtain more than one “VR” symbol stamp provided its quality system manual controls the use of such stamps from the address of record shown on the Certificate of Authorization.

1.7.5 1.7.7 QUALITY SYSTEM

1.7.5.1 1.7.7.1 GENERAL

Each applicant for a new or renewed “VR” 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, including material control, fabrication, machining, welding, examination, setting, testing, inspection, sealing, and stamping will be met.

1.7.5.2 1.7.7.2 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 1.7.7.5. 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 repair firm will use to validate a valve repair.

1.7.7.3 REVIEW

A review of the applicant’s quality system will be performed by a representative of the National Board. The review will include a demonstration of the implementation of the provisions of the applicant’s quality system.

1.7.5.3 1.7.7.4 MAINTENANCE OF CONTROLLED COPY

Each applicant to whom a “VR” 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.

1.7.5.4 1.7.7.5 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM

1.7.8 ASME “V,” “HV,” OR “UV” CERTIFICATE HOLDERS

a) A manufacturer holding a valid ASME Certificate of Authorization for use of an ASME “V”, “HV”, or “UV” Code symbol stamp may obtain the “VR” Certificate of Authorization for the repair of pressure relief valves covered by the ASME Certificate of Authorization and that meet the requirements of 1.7.3. This can be accomplished without a review of the facilities provided there is a written quality system to cover the scope of the repairs to be made and the repairs are carried out at the same location where the ASME valves are manufactured. Unless the repaired valves are tested on the same facilities and to the same procedures as new valves, two (2) repaired valves shall be selected by a National Board representative for verification tests.

b) The initial Certificate of Authorization shall be issued to expire concurrent with the ASME Certificate of Authorization. Subsequent certificates shall be renewed upon a successful review and verification of implementation of its quality system by a National Board representative. This review shall be performed concurrently with the ASME Certificate renewal review.

c) A manufacturer may also perform field repairs of pressure relief valves covered by the ASME Certificate of Authorization provided the provisions of Supplement S7.7 are met.
d) Assemblers holding ASME Certificates of Authorization shall qualify for the “VR” Certificate of Authorization as required elsewhere in these rules.

e) The quality system manual shall be submitted for review and acceptance by the National Board.

f) In order for an ASME Code symbol stamp holder to qualify for the National Board “VR” stamp, the following areas to the written quality system usually require attention.

1) Statement of Authority and Responsibility

This should clearly indicate that valve repairs are carried out in accordance with the requirements and the rules of the National Board and the quality system manual. In addition, the scope and type of valve repairs covered by the manual should be indicated.

2) Organization

Unless the functions which affect the quality of valve repairs are carried out by individuals other than those responsible for manufacturing or assembly, it should not be necessary to revise the organization chart.

3) General Quality Functions

Usually quality system requirements regarding valve repairs may be controlled in the same manner as for ASME manufacturing or assembly provided applicable shop and/or field activities are covered. If this is the case, the applicant for the “VR” stamp should include in its quality system manual a separate section covering valve repairs that references the applicable section of the manual. For a more explicit explanation see 1.7.7.5, Outline of Requirements for a Quality System.

NB11-0501

1.7.7.5.j)

5) Welding, NDE, and Heat Treatment (when applicable)

The quality system manual shall indicate the title of the person(s) responsible for and describe the system used in the selection, development, approval, and qualification of welding procedure specifications, and the qualification of welders and welding operators in accordance with the provisions of NBIC Part 3, S7.12 & S7.13.

1) The quality system manual may include controls for the “VR” Certificate Holder to have the pressure relief valve part repaired by a National Board “R” Certificate Holder, per NBIC Part 3, S7.3.

2) The completed Form R-1 shall be noted on and attached to the “VR” Certificate Holder’s document required in NBIC Part 3, 1.7.7.5 i). Similarly, NDE and heat treatment techniques must be covered in the quality system manual. When outside services are used for NDE and heat treatment, the quality system manual shall describe the system whereby the use of such services meet the requirements of the applicable section of the ASME Code.
"NR" ACCREDITATION REQUIREMENTS

1.8.1 SCOPE

a) This section provides the requirements that must be met for an organization to obtain a National Board Certificate of Authorization to use the "NR" Symbol Stamp for the Repair/Replacement activities performed in accordance with this Part and ASME Section XI requirements.

b) The issuance of the "NR" stamp is not restricted to organizations whose primary business is to perform repair/replacement activities or to manufacturers or assemblers that hold an ASME "N"-type Code symbol stamp. Owners and users of nuclear components and other organizations that qualify in accordance with these rules may also obtain the "NR" stamp from the National Board.

1.8.2 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 accredited Nuclear Inspection Agency in accordance with NB-360, NB-369, and ASME Section XI;

b) Have in the English language a written Quality System Program that complies with the requirements of this Section and addresses controls for the intended scope of activities;

c) Have a current edition and addenda of the NBIC, all parts; and

d) Have available copies of the original code of construction appropriate to the intended scope of work and the applicable edition and addenda of ASME Section XI, as required by the regulatory authority.

1.8.3 PROCEDURES FOR OBTAINING OR RENEWING A NATIONAL BOARD “NR” CERTIFICATE OF AUTHORIZATION

a) Prior to issuance or renewal of a National Board “NR” Certificate of Authorization, the organization and its facilities are subject to a review of its Quality System Program. The implementation of the Quality System Program shall be satisfactorily demonstrated by the organization. Demonstration of implementation shall meet the most stringent code requirements for the scope of work to be performed by the organization. The National Board reserves the absolute right to cancel, refuse to issue;

1.8.4 NATIONAL BOARD “NR” SYMBOL STAMP

a) All “NR” Symbol Stamps shall be obtained from the National Board of Boiler and Pressure Vessel Inspectors. Authorization to use the “NR” Symbol Stamp may be granted by the National Board at its absolute discretion.

b) The National Board, for a nominal fee, furnishes the “NR” Symbol Stamp. Each organization shall agree, if authorized to use the “NR” Symbol Stamp, that the “NR” Symbol Stamp is at all times the property of the National Board and will be promptly returned upon demand. If the organization discontinues the use of the “NR” Symbol Stamp or if the Certificate of Authorization has expired and no new Certificate of Authorization has been issued, the “NR” Symbol Stamp shall be returned to the National Board.

c) The organization’s Quality System Program shall provide for adequate control of the “NR” Symbol Stamp.

d) The organization authorized to use the “NR” Symbol Stamp may obtain more than one “NR” Symbol Stamp provided the organization’s Quality System Program describes how the use of such stamps are controlled from the location shown on the “NR” Certificate of Authorization.

b) e) The organization shall not permit other organizations to use the “NR” Symbol Stamp loaned to it by the National Board.

1.8.5 QUALITY SYSTEM PROGRAM
A holder of a National Board Certificate of Authorization shall have and maintain a written Quality System Program. The system shall satisfactorily meet the requirements of the NBIC, jurisdictional requirements, and shall be available for review. The Quality System Program may be brief or voluminous, depending on the circumstances. It shall be treated confidentially by the National Board.

1.8.3.1 4.8.5.1 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM PROGRAM FOR QUALIFICATION FOR THE NATIONAL BOARD “NR” SYMBOL STAMP

NB11-1202

1.8.5.1

g) AUDITS (New Text to replace existing text)

A comprehensive system of planned and periodic internal audits shall be performed by each organization. Audit frequency shall be specified in the organization's Quality Assurance Manual. Audits shall be conducted at least annually to verify compliance with quality program requirements, performance criteria and to determine the effectiveness of the quality program. When no Code work has been performed, the required annual audit may 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;
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:
   a. written procedures;
   b. checklists;
   c. reports;
   d. written replies; and
   e. completion of corrective actions.

1.8.6 INTERFACE WITH THE OWNER’S REPAIR/REPLACEMENT PROGRAM

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

a) The repair/replacement plan shall be subject to the acceptance of the Jurisdiction and the owner’s Authorized Nuclear In-service Inspector (ANII).

b) Repair/replacement activities of nuclear components shall meet the requirements of Section XI of the ASME Boiler and Pressure Vessel Code and the Jurisdiction where the nuclear power plant is located.

c) Documentation of the repair/replacement activities of nuclear components shall be recorded on the National Board Report of Nuclear Repair/Modification or Replacement activities, Form NR-1, or Form NVR-1, as applicable. The completed forms shall be signed by a representative of the authorized nuclear repair organization and the Authorized Nuclear Inspector if the repair/replacement activity meets the requirements of ASME Section XI. For repair/replacement activities that involve design changes as specified in 1.8.5.1(c), Form NR-1, or Form NVR-1, as applicable, shall indicate the responsible organization satisfying the owner’s design specification requirements.

d) The authorized nuclear repair organization shall provide a copy of the signed Form NR-1 or Form NVR-1, as applicable, to the owner, if required, the Jurisdiction, and the Authorized Nuclear Inspection Agency.
original Form NR-1 or Form NVR-1, as applicable, shall be registered with the National Board by the authorized nuclear repair organization.

e) The authorized nuclear repair organization shall provide a nameplate/stamping for repair/replacement activities for each nuclear component unless otherwise required by the Owner’s Quality System Program. The required information and format shall be as shown in Section 5 of this Part.

NB10-0701

2.2.6 WELDER’S CONTINUITY

The performance qualification of a welder or welding operator shall be affected when one of the following conditions occur:

a) When the welder or welding operator has not welded using a specific process during a period of six months or more, their qualifications for that process shall expire. The “R” Certificate Holder shall maintain a welding continuity record and shall make the record available to the Inspector. The method of recording welding continuity and the record retention period shall be described in the “R” Certificate Holder’s Quality System Manual.

2.2.6.1 WELDER CONTINUITY RECORDS

a) The “R” Certificate Holder shall maintain a welding continuity record and shall make the record available to the Inspector.

b) The method of recording welding continuity and the record retention period shall be described in the “R” Certificate Holder’s Quality System Manual.
NB12-0402

Table 2.5.1
Minimum Temperatures for Preheating

<table>
<thead>
<tr>
<th>Thicknesses referenced are nominal at the weld for the parts to be joined.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a) P-No. 1 Group Nos. 1, 2, and 3</strong></td>
</tr>
<tr>
<td><strong>b) P-No. 3 Group Nos. 1, 2, and 3</strong></td>
</tr>
<tr>
<td><strong>c) P-No. 4 Group Nos. 1 and 2</strong></td>
</tr>
<tr>
<td><strong>d) P-No. 5A Group 1 and 5B, Group 1 and P-No. 15 E Group 1</strong></td>
</tr>
</tbody>
</table>

NB10-1501

2.5.2 POSTWELD HEAT TREATMENT (PWHT)

a) Postweld heat treatment shall be performed as required by the original code of construction, the construction standard or code selected in accordance with a written procedure. The procedure shall contain the parameters for postweld heat treatment.

b) Postweld heat treatment shall be performed by heating either the entire item or a circumferential band around the item. When heating a circumferential band, the heat treatment procedure shall specify the soak band (SB) width, the heated band (HB) width, the gradient control band (GCB) width, the location of thermocouples and method of attachment of thermocouples in addition to the heating rate, holding time, temperature and cooling rate.

Figure XXX shows these bands. AWS 010.10, Recommended Practices for Local Heating of Welds in Piping and Tubing may be referred to for further information.
c) When it is impractical or detrimental to Postweld Heat Treat (PWHT) the entire item or band around the item, the following local PWHT method may be performed on spherical or cylindrical pressure-retaining items using the time and temperature parameters in the original code of construction and in accordance with a written procedure acceptable to the Inspector and, when required, by the Jurisdiction.

1) Heat a local area around the nozzle, welded attachment, or repair area such that the area is brought up uniformly to the required PWHT temperature. The application of local PWHT should be performed with controlled heating methods, such as induction or electric resistance heaters, and employing thermocouples to monitor PWHT temperature. The Soak Band (SB) shall extend tangentially and radially from the edge of the nozzle wall, or attachment weld or repair area equally by a minimum distance as defined by the thickness of the shell, t or 2 in. (50 mm), whichever is less. See Figure YYY.

5) The term t, or definition of thickness for calculating the holding time, for local PWHT as used above to determine SB, HB and GCB shall be the nominal thickness of either a full penetration weld, or the groove weld depth of a partial penetration repair weld. If a fillet weld is used in combination with a groove weld, the nominal thickness for PWHT shall be the depth of the groove weld.

Figure XXX

Local Postweld Heat Treatment Temperature Control Band

Butt Weld in Cylinder

Gradient Control Band Width (Insulation Width)

Heated Band Width (Heating Element Width)

Soak Band Width

Weld Width

Welding Elements

Insulation
2.5.3.1 WELDING METHOD 1

e) The weld area shall be preheated and maintained at a minimum temperature of 300°F (149°C) during welding. Alternatively, for P-No.1, Groups 1, 2 and 3 materials, the preheat may be reduced to 175°F (79°C) provided:

1) Provided the carbon equivalent of the base material to be welded is determined to be 0.40 or less.
2) The electrodes and filler metals are classified by the filler metal specification with a diffusible –hydrogen
designator of H4 or lower.
3) When shielding gas is used, it shall have a dew point that is -60°F (-50°C) or lower.
f) The preheat 300°F (149°C) temperature shall be checked to assure that 4 in. (102 mm) of the material or four times the material thickness (whichever is greater) on each side of the groove (or full thickness of joint for a groove weld) is maintained at the preheat minimum temperature during welding. The maximum interpass temperature shall not exceed 450°F (232°C). When the weld does not penetrate through the full thickness of the material, the minimum preheat and maximum interpass temperatures need only be maintained at a distance of 4 in. (102 mm) or four times the depth of the repair weld, whichever is greater, on each side of the joint.

NB11-1401

2.5.3.2

d) The Welding Procedures Specifications shall be qualified in accordance with the temper bead procedure qualification requirements in QW-290 of ASME Section IX, and shall include the following additional requirements:

1) For P-No. 1 Groups 1, 2, and 3 and P-No. 3 Groups 1, 2, and 3, the minimum preheat temperature shall be 350°F (232°C)

2) For P-No. 9A, P-No. 10A, P-No. 10B, P-No. 10C, P-No. 11A, or P-No. 11B, the minimum preheat and interpass temperature requirements shall be in accordance with the guidelines in NBIC Part 3, 2.5.1.

3) For P-No. 4 and P-No. 5A materials, the minimum preheat, interpass temperature and technique shall be in accordance with NBIC Part 3, 2.5.3.4. The repair depth for temper bead repairs to P-No. 4 and P-No. 5A materials shall be in accordance with the requirements of NBIC Part 3, 2.5.3.4 a) The repair depth for temper bead repairs to pressure-retaining items of P-No. 4 and P-No. 5A materials is limited to welds not penetrating through full thickness.

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:

   a) The full thickness repair weld shall be verified.

   b) Volumetric examination of the full thickness weld shall be performed.

2.5.3.4

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 through full thickness.

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. They shall be completed per NBIC Part 3, 3.3.5 with the following requirements:

1. The full thickness repair weld shall be verified.

2. Volumetric examination of the full thickness weld shall be performed.

NB10-1701

3.2.1 b)

b) For corrugating rolls manufactured per the requirements of paragraph UF-7 of ASME Section VIII, Div. 1, weld overlay of the surfaces restoration of worn corrugating roll surfaces by weld overlay is permitted for all classes of SA-649 forging material and an exception to the 0.35% carbon limit is permitted. The requirements to qualify welding procedures and welder performance shall be in accordance with ASME Section IX for hard facing (wear resistance) and corrosion resistant overlays.
d) Alternative welding methods without postweld heat treatment as described in NBIC Part 3, 2.5.3 shall not be used for routine repairs.

d) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure, fabricated by welding 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 “R” Certificate of Authorization; replacement parts shall be documented on Form R-3 and the “R” symbol stamp applied as described in Section 5 of this Part.

NB12-0201

3.3.2 d) 3)

3) Weld buildup of wasted areas in heads and shells, flanges and fittings shall not exceed an area of 100 sq. inches (64,520 sq. mm) or a thickness of 25% of nominal wall thickness or ½ inch (13 mm), whichever is less;

NB12-0201

3.3.4.3

d) Tubes

1) Wasted areas on tubes may be repaired by welding, provided that, in the judgment of the Inspector the strength of the tube has not been impaired. Where deemed necessary, competent technical advice should be obtained from the manufacturer or from another qualified source. This may be necessary when considering such items as size limitations of repaired areas, minimum tube thickness to be repaired, tube environment, location of the tube in the boiler, and other similar conditions.

2) The WPS followed shall be qualified for weld metal buildup in accordance with ASME Section IX. When the code of construction required postweld heat treatment (PWHT) for butt welds, the WPS followed for the weld buildup, shall be qualified with PWHT.

e) External Weld Metal Buildup

2) All of the following conditions shall apply for this repair method to be permitted:

(d. The WPS followed shall be qualified for weld metal buildup in accordance with ASME Section IX. The nominal chemical analysis of the deposited weld metal shall be equivalent to the base material that is to be repaired. In addition, the nominal tensile strength of the deposited weld metal shall be equal to or exceed the specified minimum tensile strength and shall be based on the requirements of the welding consumable of the base material. If butt joints welded in the component being overlaid required postweld heat treatment (PWHT) by the code of construction, the WPS followed for the weld buildup, shall be given qualified with PWHT.

NB12-2101

4.2 NONDESTRUCTIVE EXAMINATION

a) 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. Where this is not possible or practicable, alternative NDE methods acceptable to the Inspector and the Jurisdiction where the pressure-retaining item is installed, where required, may be used.

b) 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 Nondestructive Testing Personnel Qualification and Certification (2001-2006 edition), or ASNT CP-189, Standard for Qualification and Certification of Nondestructive Testing Personnel (2001-2006 edition), shall be used as a guideline for employers to establish their written practice. The ASNT Central Certification Program (ACCP, Rev. 3, Nov. 1997) 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.

NB10-0802

4.4.1.3

4) Hold-time for the pressure test shall be a minimum of 10 minutes prior to examination by the Inspector. Where the test pressure exceeds the MAWP of the item, the test pressure shall be reduced to the MAWP for close examination by the Inspector. Hold-time for close examination shall be as necessary for the Inspector to conduct the examination.

4. Table 4.4.1.4 may be used for liquid pressure testing of steels supplied as coarse-grained under the following specifications:

ASME SA 212,
ASME SA 515 Grade 70, and
ASME SA 299

If supplied as coarse-grained, the above steels can exhibit low toughness at room temperature and in lieu of conducting notch toughness tests, Table 4.4.1.4 can be used to establish a pre-warming temperature for the liquid to reduce the risk of brittle fracture. Table 4.4.1.4 contains minimum pre-warming liquid temperature requirements based on metal thickness of the pressure retaining part.

Table 4.4.1.4

<table>
<thead>
<tr>
<th>Minimum Liquid Temperature for Pressure Testing (deg F)</th>
<th>Thickness (inches) of Pressure Retaining Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>t&lt;=&quot;0.5&quot;</td>
</tr>
<tr>
<td>70</td>
<td>t&gt;0.5&quot;&lt;=&quot;1&quot;</td>
</tr>
<tr>
<td>85</td>
<td>t&gt;1&quot;&lt;=&quot;2&quot;</td>
</tr>
<tr>
<td>100</td>
<td>t&gt;2&quot;&lt;=&quot;4&quot;</td>
</tr>
<tr>
<td>110</td>
<td>t&gt;4&quot;</td>
</tr>
</tbody>
</table>

5) Hold-time for the pressure test shall be a minimum of 10 minutes prior to examination by the Inspector. Where the test pressure exceeds the MAWP of the item, the test pressure shall be reduced to the MAWP for close examination by the Inspector. Hold-time for close examination shall be as necessary for the Inspector to conduct the examination.
4.4.2 a)

5) Hold-time for the pressure test shall be a minimum of 10 minutes prior to examination by the Inspector. The test pressure shall be reduced to the MAWP for close examination by the Inspector.
   a. Hold-time for close examination shall be as necessary for the Inspector to conduct the examination;

5) Unless it can be demonstrated that the material has been supplied as fine grained, it is recommended that Table 4.4.2 be followed to pressure testing of steels supplied under the following specifications:

ASME SA 212,
ASME SA 515, and
ASME SA 299

<table>
<thead>
<tr>
<th>Minimum Liquid Temperature for Pressure Testing (deg F)</th>
<th>Thickness (inches) of Pressure Retaining Object (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>$t \leq 0.5''$</td>
</tr>
<tr>
<td>70</td>
<td>$t &gt; 0.5 \leq 1''$</td>
</tr>
<tr>
<td>85</td>
<td>$t &gt; 1'' \leq 2''$</td>
</tr>
<tr>
<td>100</td>
<td>$t &gt; 2'' \leq 4''$</td>
</tr>
<tr>
<td>110</td>
<td>$t &gt; 4''$</td>
</tr>
</tbody>
</table>

Note (1): Thickest section of the pressure retaining object.

6) Hold-time for the pressure test shall be a minimum of 10 minutes prior to examination by the Inspector. Where the test pressure exceeds the MAWP of the item, the test pressure shall be reduced to the MAWP for close examination by the Inspector. Hold-time for close examination shall be as necessary for the Inspector to conduct the examination.

NB11-0503

4.5.3 LIFT ASSIST TESTING

a) A device may be used to apply an auxiliary lifting load on the spring of a repaired valve to establish the set pressure in lieu of the tests required in 4.5.1 a)1) when such testing at full pressure:

1) may cause damage to the valve being tested; or

2) is impractical when system design considerations preclude testing at full pressure.

b) While actual valve blowdown and valve performance characteristics cannot be verified, valve set pressure may be determined to an acceptable degree of accuracy using this testing technique provided, as a minimum, that:

1) equipment utilized is calibrated as required in the quality system; including, but not limited to:

   a. System pressure measurement equipment,

   b. Lifting force measurement equipment and

   c. other measuring elements required by the device manufacturer.
2) the device and test procedures that have proved to give accurate results are used and followed;

3) a static inlet pressure is applied with the test medium specified in 4.5.1; and

4) adjustments are made in accordance with the valve manufacturer's recommendations to ensure proper lift and blowdown.

c) 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 and provisions made to retain such documentation for a period of at least five years after the lift device is retired. Documentation of this qualification shall include but not be limited to:

1) A description of the lift assist device including model number, serial number and manufacturer

2) Size and pressure ranges of valves to be tested with the lift assist device and the test fluid to be used. Note: Maximum set pressure is determined by available lift force and system pressure.

3) Accuracy of pressure measuring equipment;

4) Method of qualifying

d) After initial qualification of the device the device shall be re-qualified if:

1) Modifications or repairs to the device are made which would affect test results

2) The manufacturer issues a mandatory recall or modification to the device which will affect test results.

NB10-0701 (cont.)

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, Supplementary Sheet, shall be used as needed to record additional data when the space provided on Form R-2 is not sufficient.

c) For those “R” Forms not registered with the National Board, the organization performing repairs and alterations shall retain a copy of the completed Form “R” Report Form on file and all records and documentation substantiating the summary of work as described throughout Section 5, and as identified in the “R” Certificate Holder’s Quality System Manual.

5.5 REGISTRATION OF “R” FORMS

-GENERAL

a) When registration of the Form “R” Report is required, the “R” Certificate Holder performing a repair or alteration shall submit the completed Form “R” Report, meeting the requirements of the Code, to the National Board.
b) When registration of the Form “R” Report is not required by the Code, the “R” Certificate Holder may register the completed Form “R” Report, meeting the requirements of the Code, with the National Board.

1) The “R” Certificate Holder should be aware that some Jurisdictions may require registration of repairs and alterations with the National Board.

c) For those “R” Forms not registered with the National Board, the organization performing repair or alterations shall retain a copy of the “R” Form on file for a minimum period of five years.

5.5.2 REGISTRATION FOR ALTERATIONS

b) If the item was not registered with the National Board, one original Form R-2, together with attachments, may be registered with the National Board or retained as required by The Quality System Manual.

NB11-0303

5.8.2 STAMPING FOR ALTERATIONS

The nameplate shall be applied in accordance with NBIC Part 3, 5.7. Location of nameplate shall be documented under “Remarks” on NBIC Form R-2 line 9.

NB10-1402

5.12.4 TEST ONLY NAMEPLATE

a) Where a valve has been tested and adjusted to restore the Nameplate set pressure, as permitted by NBIC Part 3, S7.10.1, 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.”

NB10-1701 and NB12-2001

5.13.4.1

Box 12 Instructions:

12. 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 or alteration (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 or alteration 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 needed to describe the scope of work, a Form R-4 shall be used and attached. Information determined to be of a proprietary nature need not be included, but shall be stated on Form.

NB10-0502

STEAM LOCOMOTIVE FIRETUBE BOILER REPAIRS

S1.1 GENERAL REQUIREMENTS

This part Supplement applies to all boilers attached to steam locomotives operating on track gaged 24” and greater.
S1.2.2 Threaded Staybolts (See NBIC Part 3, Figures S1.2.2 a) and S1.2.2 b))

a) 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.

b) All staybolts shorter than 8 in. (200 mm) in length shall have telltale holes. Staybolt telltale holes in existing bolts shall be 3/16 in. (5 mm) to 7/32 in. (5.5 mm) in diameter and at least 1-1/4 in. (32 mm) deep in the outer end. When staybolts 8 in. (200 mm) or less in length are replaced, they shall be replaced with staybolts that have a telltale hole 3/16 in. (5 mm) to 7/32 in. (5.5 mm) in diameter their entire length, or with ones that have a 3/16 in. (5 mm) to 7/32 in. (5.5 mm) diameter hole in each end, drilled a minimum of 1-1/4 in. (32 mm) deep. On reduced body staybolts, the telltale hole shall extend beyond the fillet and into the reduced section of the staybolt. Ball socket-type flexible staybolts may have telltale holes that extend from the threaded end of the bolt into the bolt head for a distance of one-third the spherical bolt head diameter.

c) Telltale holes shall be reopened after driving and riveting heads.

d) Staybolt length shall be sized so the length of bolt projecting through the sheet is not less than 1/8 in. (3 mm) and is sufficient to produce a full head after driving and riveting the head.

e) The thread lead of both bolt ends and both firebox sheets shall be synchronized to permit the bolt to be installed without stripping the threads.

f) When riveting bolts, the staybolt’s opposite end shall be bucked or braced to prevent damaging the bolt threads. Bracing can be done several ways, such as using a pneumatic holder or a heavy steel bucking bar. Driving the heads on both ends of the staybolt simultaneously using two pneumatic rivet hammers (double gunning) is acceptable. Bolts are to be driven in such a manner as to expand radially the bolt body and threads into the sheet prior to forming the head. Merely riveting over the head is not acceptable.

g) Ball socket-type flexible staybolts shall not be braced by inserting a spacer under the cap.

h) Installation of different diameter staybolts shall be considered a repair.

i) If the ends of staybolts are heated to facilitate forming the head or expanding the threads into the sheet, the lower critical temperature of the sheet and staybolt material shall not be exceeded.

j) The minimum height of the staybolt head measured at its highest point shall be 1/16 in. (1.6 mm).

k) When the diameter of the staybolt head has been reduced to the major diameter of the staybolt thread at any location either because of erosion during service or problems during installation, the staybolt shall be replaced. Repair is prohibited.
S1.9.7 FERRULES

a) Ferrous or non-ferrous ferrules may be used on either or both ends of flues and arch tubes.
b) The application of ferrules, where none were used before, shall be considered a repair.
c) The application without ferrules, where they were used before, shall be considered a repair.
d) If ferrules are recessed, the recess depth shall not exceed 1/16” measured from the flue sheet fireside edge.
e) Protrusion of the ferrule beyond the edges of either flue sheet is permitted provided the ferrule does not interfere with any further attachment procedures.
f) For steel ferrules, if the flue is installed by expanding it straight and seal welding it to the flue sheet, the seal weld shall be arranged to contact the flue sheet and the flue. Seal welding the flue to the ferrule only is prohibited.
g) The applications of ferrules where none were used before shall be considered a repair.
h) The application without ferrules, where none were used before shall be considered a repair.
a) Caulking refers to the sealing of plate seams and rivet heads by driving the edge of one surface onto the other by use of an impact tool.

b) Riveted seams and rivet heads may be caulked in accordance with ASME Code Section I, 1971.14

1. Replacement rivets shall have heads of sufficient size to conform to NBIC Part 2, S1.4.2.3.1. Changing the rivet head style at either end shall be considered a repair. Changing the rivet body diameter, or changing the rivet hole diameter shall be an alteration.

b) Rivet heads shall completely cover the perimeter of the hole, in the plate or entirely fill the countersink.

c) During driving of rivets, where the factory head moves away from the sheet because of insufficient bucking, such rivets shall be removed and discarded.

d) Rivets shall be heated sufficiently to be driven completely with the equipment being used.

e) Reheating of rivets above 600 degrees F after the original installation is prohibited. When seal welding rivet heads, inter or post-pass head temperature shall be kept below 600 degrees F.

f) Each rivet head shall contact the plate over the entire circumference upon completion of the installation. Rivets on which either head does not have contact with the plate over the entire area of the driven head, not including any excess washer (excess material at the base of the rivet head), shall be replaced. Repair is prohibited.

g) Caulking refers to the sealing of plate seams and rivet heads by driving the edge of one surface onto the other by use of an impact tool.

h) Caulked rivet seams and rivet heads shall be in accordance with ASME Code Section I, Part PR, 1971.

14 This Code is available from the National Board.
S2.7.1 MATERIAL LIST FOR HISTORICAL BOILERS REPAIRS

SEE ASME SECTION II FOR OTHER ACCEPTABLE SECTION I MATERIALS

<table>
<thead>
<tr>
<th>Application</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler Tubes &amp; Flues</td>
<td>SA-178 Grade A, SA-192, SA-210</td>
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<tr>
<td>Boiler &amp; Firebox Plate</td>
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<td>Forged Parts &amp; Fittings</td>
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<td>Hollow Cylindrical</td>
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<td>Pressure Retaining Parts</td>
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<td>Bronze Castings &amp;</td>
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</tr>
<tr>
<td>Washout Plugs</td>
<td></td>
</tr>
</tbody>
</table>

c) When rivets are made from SA-675, the finished rivets must meet the physical and test requirements of the original ASME rivet specification SA-31.

SB11-0203

S2.13.9.1 WELD BUILDUP OF WASTAGE AND GROOVING IN UNSTAYED AREAS

a) Weld buildup shall not be used if the affected section of plate has wasted below 60% of the minimum required thickness per NBIC Part 2, S2 in an area exceeding 3 sq. inches (1,950 sq. mm). (See NBIC Part 3, Figure S2.13.9.1).

b) Wasted sections that have wasted below 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1,950 sq. mm), shall be repaired by installing a flush patch using full penetration welds.

Replace existing Figure S2.13.9.1
S2.13.9.2 WELDED REPAIR OF CRACKS IN UNSTAYED AREAS

a) Prior to repairing cracks, the plate shall be NDE examined for other defects. All affected sections shall be repaired. (See NBIC Part 3, Figure S2.13.9.2).

b) Cracks in unstayed areas may be repaired by welding. Before cracks are repaired, however, the inner surface of the plate should be examined for possible excessive corrosion or grooving.

c) Cracks in unstayed areas may be repaired by welding, providing the cracks do not extend between rivet holes in a longitudinal seam or parallel to a longitudinal seam within 2 in. (50 mm) from the center line of the outer most row of rivets. Minimum 175 degree preheat shall be used within 8 in. (200 mm). The completed repair must be radiographed and stress relieved. Alternative methods in lieu of Postweld Heat Treatment identified in NBIC Part 3, 2.5.3 may be used. (See NBIC Part 3, Figure S2.13.9.2 a)

d) Cracks radiating from a common point (star cracking) shall not be repaired; installation of a flush patch is required. Cracks radiating from a rivet hole in a girth circumferential seam may be repaired if the plate is not seriously damaged. (See NBIC Part 3 Figure S2.13.9.2 b).

e) Prior to welding, the rivets into which cracks extend and the rivets on each side of them shall be removed.

f) In riveted joints, tack bolts should be placed in alternating holes to hold the plate laps firmly.

g) Rivets holes should be reamed after welding.

h) Welding shall not cover rivet heads.
S7.10.1 GENERAL
The Jurisdiction may authorize properly trained and qualified employees of boiler and pressure vessel owners/users or their designees to confirm or restore nameplate set pressure and/or performance of pressure relief valves. All external adjustments shall be resealed with a seal identifying the responsible organization and a metal tag that identifies the organization and the date the adjustment shall be installed.

NB11-0202
S2.13.10.1 WELD BUILDUP OF WASTAGE AND GROOVING IN STAYED AREAS
Requirements specified in NBIC Part 3, S2.13.9.1 shall apply with the following additional requirements identified below. Welding shall not cover rivet or Staybolt heads:

a) Prior to welding, the rivets and or staybolts in the wasted areas should be removed.
b) Threaded staybolt holes shall be retapped after welding.
c) Welding shall not cover rivet or staybolt heads; and
d) See NBIC Part 3, Figure S2.13.10.3-a.

S2.13.10.2 WELDED REPAIR OF CRACKS IN STAYED AREAS
Requirements specified in NBIC Part 3, S2.13.9.2 shall apply with the following additional requirements identified below:

a) If the crack extends into a staybolt hole, the staybolt shall be removed prior to making the repair;
b) In riveted joints, tack bolts should be placed in alternating holes to hold the plate laps firmly;
c) Rivets holes should be reamed after welding; and
d) Welding shall not cover rivet or staybolt heads.
b) Threaded staybolt holes shall be retapped after welding.

S2.13.10.4 REPAIR OF STAYED FIREBOX SHEETS GROOVED OR WASTED AT THE MUDRING
a) Mudrings of the Ogee style (knuckle) shall be repaired in accordance with NBIC Part 3, S2.13.11.
b) For Mudrings of the locomotive style (see NBIC Part 3, Figure S2.13.10.4), grooved or wasted weld buildup shall not be used if the affected section of plate has wasted below 60% of the minimum required thickness per NBIC Part 2, Supplement 2 in an area exceeding 3 sq. in. (1950 sq. mm.) firebox sheets having greater than 60% of the minimum required thickness (see NBIC Part 3, Figure S2.13.9.1). Repair by weld buildup cannot be used if the wastage extends below the waterside surface of the mudring or if the strength of the structure will be impaired. If extensive welding is required, the affected area shall be

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**Figure S2.13.9.2-a**
Unstayed Area Crack

Cracks Acceptable to Repair by Welding

**Figure S2.13.9.2-b**
Unstayed Area Crack

Cracks Not Acceptable to Repair by Welding
removed and replaced with a flush patch. Remaining may be repaired by weld buildup provided the wastage does not extend below the waterside surface of the mudring and the strength of the structure will not be impaired. If extensive welding is required, the affected area shall be removed and replaced with a flush patch.

b) If the sheet thickness has been reduced to less than 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1950 sq. mm.) shall be repaired by installing a flush patch using a full penetration weld.

c) If the sheet thickness has been reduced to less than 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1950 sq. mm.) shall be repaired by installing a flush patch using a full penetration weld.

d) If wastage and grooving extends below the mudring waterside surface and if the plate thickness remaining has been reduced to less than the minimum required thickness, the affected section shall be removed and replaced with a flush patch. (See NBIC Part 3, Figure S2.13.10.4).

e) Flush patches shall be arranged to include the mudring rivets and at least the first row of staybolts above the mudring. (See NBIC Part 3, Figure S2.13.10.4-a).

f) For mudrings of the locomotive style, pitted and wasted sections of mudrings may be built up by welding provided the strength of the mudring will not be impaired. Where extensive weld buildup is employed, the Inspector may require an appropriate method of NDE for the repair.

g) Cracked or broken mudrings may be repaired by welding or installing flush patches using full penetration welds. Patches shall be made from material that is at least equal in strength and thickness to the original material. Patches shall fit flush on waterside surfaces. Where necessary, firebox sheets on both sides of the defect may be removed to provide access for inspection and welding.

NB10-1004

S2.13.13.1 CAULKING RIVETED SEAMS AND RIVET HEADS

a) Caulking refers to the sealing of plate seams and rivet heads by driving the edge of one surface onto the other by use of an impact caulking tool.

S2.13.13.1 Caulking Rivet Seams

Plate Edge

70 Degrees

Caulking Rivet Seam

Caulking Tool

S2.13.14.3 REPAIR OF FUSIBLE PLUG OPENING

a) Threaded holes with damaged threads may be repaired by weld buildup and re-tapping. The threads shall be removed prior to welding.
b) Threaded openings with damaged threads that cannot be repaired by re-tapping or rethreading should be repaired by welding a flush patch or a connection in the sheet. The connection shall be of such a size as to not interfere with proper operation. The coupling shall be welded flush, using a full penetration weld, with the fireside and must not project higher than 1/2 in. (13 mm) from the water side. (See Figure S2.13.14.3).

c) Patches are to be flush type, using full penetration welds. If the load on the patch is carried by other forms of construction, such as staybolts, rivets, or tubes, radiographic examination of the welds is not required.

NB13-0201

S2.13.14.2 REPAIR OF HANDHOLE OPENINGS

a) Weld buildup shall not be used if the affected section of plate has wasted below 60% of the original thickness per NBIC Part 3, Supplement 2 in an area exceeding 3 sq. in. (1950 sq. mm). (See NBIC Part 3, Figure S2.13.9.1). Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm).

b) Weld buildup is to replace material that has been lost due to wastage and grooving, and is not to replace thickness on the opposite side of the sheet. Weld buildup must be applied to the side of the sheet that is wasted or grooved.

c) Wasted sections that have wasted below 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1950 sq. mm) shall be repaired by installing a flush patch using full penetration welds, or by the installation of a ring on the inside (pressure side) of the sheet. (See NBIC Part 3, Figure S2.13.14.2).

d) Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm).

NB10-1001

S2.13.14.3 REPAIR OF FUSIBLE PLUG OPENING

a) Threaded holes with damaged threads may be required by re-tapping or weld buildup and re-threading. The threads shall be removed prior to welding.

b) Threaded opening with damaged threads that cannot be repaired by re-tapping or rethreading should be repaired by welding a flush patch or half coupling connection to the sheet.

c) The half coupling connection shall be such a size as to not interfere with proper operation of the fusible plug. The half coupling shall be welded flush to the fire side using a full penetration weld. The half coupling must not project higher than ½ inch (13 mm) from the water side. (See Figure S2.13.14.3).

d) Flush patch type repairs are to be installed in accordance with S2.13.9.3 and S2.13.10.3. (See Figure S2.13.14.3 a).
Replace existing Figure S2.13.14.3 with new figure.
S3.5.5 -- Plugging of Leaking or Damaged Tubes

a) 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/labeled on the tubesheet, and recorded.

c) A minimum of two (2) graphite plugs, each with a minimum length of 1”, shall be used to plug each end of the tube(s) in question. This represents a minimum total of four (4) plugs per tube.

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".
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” 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.

e) 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.

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

g) 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.

h) 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.

i) 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.

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

k) Repaired tubes shall be tested in accordance with this Code, using a method acceptable to the Inspector, with a written procedure approved by the manufacturer's internal quality system, to ensure leaks have been repaired.

l) The scope of the work completed shall be described and reported on a Form R-1.
S7.10.1 GENERAL

The Jurisdiction may authorize properly trained and qualified employees of boiler and pressure vessel owners/users or their designees to confirm or restore nameplate set pressure and/or performance of pressure relief valves. All external adjustments shall be resealed with a seal identifying the responsible organization and a metal tag that identifies the organization and the date the adjustment shall be installed.

S7.10.5 EXTERNAL ADJUSTMENTS

Only external adjustments to restore the required nameplate set pressure and/or performance of a pressure relief valve shall be made under the provisions of NBIC Part 3, S7.10.1 and Part 2, 2.5.7.
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)
(address)

1b. Construction performed by
(name of “R” organization responsible for construction)
(address)

2. Owner of Pressure Retaining Item
(name)
(address)

3. Location of installation
(name)

4. Item identification
(boiler, pressure vessel, or piping)
Name of original manufacturer

5. Identifying nos.:
(mfg. serial no.)  (National Board No.)  (Jurisdiction No.)  (other)  (year built)

6. NBIC Edition / Addenda:
(edition)  (addenda)
Original Code of Construction for Item:
(name / section / division)  (edition / addenda)
Construction Code Used for Alteration Performed:
(name / section / division)  (edition / addenda)

7a. Description of Design Scope:

7b. Description of Construction Scope:

☐ Form R-4, Report Supplementary Sheet is attached

Pressure Test, if applied
psi  MAWP  psi

8. Replacement Parts. Attached are Manufacturer’s Partial Data Reports or Form R-3’s properly completed for the following items of this report:
(name of part, item number, data report type or Certificate of Compliance, mfg’s. name and identifying stamp)
DESIGN CERTIFICATION

I, [name of design organization], certify that to the best of my knowledge and belief the statements in this report are correct and that the Design Change described in this report conforms to the National Board Inspection Code. National Board “R” Certificate of Authorization No. [number], expires on [date].

Signed [signature] (authorized representative)

CERTIFICATE OF DESIGN CHANGE REVIEW

I, [name of inspector], holding a valid Commission issued by The National Board of Boiler and Pressure Vessel Inspectors and certificate of competency issued by the jurisdiction of [jurisdiction name] and employed by [employer name], have reviewed the design change as described in this report and state that to the best of my knowledge and belief such change 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.

Signed [signature] (inspector) Commissions [National Board and jurisdiction no.]

CONSTRUCTION CERTIFICATION

I, [name of alteration organization], certify that to the best of my knowledge and belief the statements in this report are correct and that all material, construction, and workmanship on this Alteration conforms to the National Board Inspection Code. National Board “R” Certificate of Authorization No. [number], expires on [date].

Signed [signature] (authorized representative)

CERTIFICATE OF INSPECTION

I, [name of inspector], holding a valid Commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency issued by the jurisdiction of [jurisdiction name] and employed by [employer name], have inspected the work described in this report on [date] 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.

Signed [signature] (inspector) Commissions [National Board and jurisdiction no.]
**Biomass** – Fuels which result from biological sources requiring a relatively short time for replenishment; Wood and bagasse are typical examples.

**Boiler** — A boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel.

a) **Power Boiler** — a boiler in which steam or other vapor is generated at a pressure in excess of 15 psig (100 kPa) for use external to itself. The term power boiler includes fired units for vaporizing liquids other than water, but does not include fired process heaters and systems. (See also High-Temperature Water Boiler).

b) **High-Temperature Water Boiler** — a power boiler in which water is heated and operates at a pressure in excess of 160 psig (1.1 MPa) and/or temperature in excess of 250°F (121°C).

c) **Steam Heating Boiler** - A steam boiler installed to operate at pressures not exceeding 15 psig (100 kPa).

d) **Hot-Water Heating Boiler** - A hot water boiler installed to operate at pressures not exceeding 160 psig (1100 kPa) and/or temperatures not exceeding 250°F (120°C) at or near the boiler outlet.

e) **Hot-Water Supply Boiler** - a boiler that furnishes hot water to be used externally to itself at a pressure less than or equal to 160 psig (1,100 kPa gage) or a temperature less than or equal to 250°F (120°C) at or near the boiler outlet.

**Carbons Recycle** – See Flyash Recycle

**Emissions** – The discharge of various Federal or State defined air pollutants into the surrounding atmosphere during a given time period.

**Emissions Control System** – An arrangement of devices, usually in series, used to capture various air pollutants and thereby reduce the amount of these materials, or gases, being admitted to the surrounding atmosphere, below Federal or State defined standards.

**Fluidized Bed** – A process in which a bed of granulated particles are maintained in a mobile suspension by an upward flow of air or gas.

**Fluidized Bed (Bubbling)** – A fluidized bed in which the fluidizing velocity is less than the terminal velocity of individual bed particles where part of the fluidizing gas passes through as bubbles.

**Fluidized Bed (Circulating)** - A fluidized bed in which the fluidizing velocities exceed the terminal velocity of the individual bed particles.
**Flyash** – Suspended ash particles carried in the flue gas.

**Flyash collector** – A device designed to remove flyash in the dry form from the flue gas.

**Flyash Recycle** – The reintroduction of flyash/unburned carbon from the flyash collector into the combustion zone, in order to complete the combustion of unburned fuel, thereby improving efficiency.

**Fuel Transport Fan** – A fan which generates airflow capable of moving fuel particles, in suspension, from a metering device to the combustion zone.

**Grate** – The surface on which fuel is supported and burned and through which air is passed for combustion.

**Induced Draft Fan** – A fan exhausting hot gases from the heat absorbing equipment.

**Metering Device** – A method of controlling the amount of fuel, or air, flowing into the combustion zone.

**Overfire Air** – Air admitted to the furnace above the grate surface/fuel bed. Used to complete the combustion of fine particles, in suspension. Also aids in reducing NOx formation.

**Pressure Vessel** – A pressure vessel is a container other than a boiler or piping used for the containment of pressure.

**Safe Point of Discharge** – A location that will not cause property damage, equipment damage, or create a health or safety threat to personnel in the event of discharge.

**Suspension Burner** – A combustion system in which the fuel is in the form of relatively small particles. Their buoyancy is maintained in the transport airstream and the fuel/air mixture flow stream, until combustion is completed.

**Thermal Fluid Heater** – A thermal fluid heater is a closed vessel in which a fluid other than water is heated by the direct application of heat from a thermal energy source. Depending on the process heating requirements, the fluid may be vaporized with normal circulation but, more often, the fluid is heated and circulated by a pump.

**Underfire Air** – A method of introducing air beneath the grate surface/fuel bed.