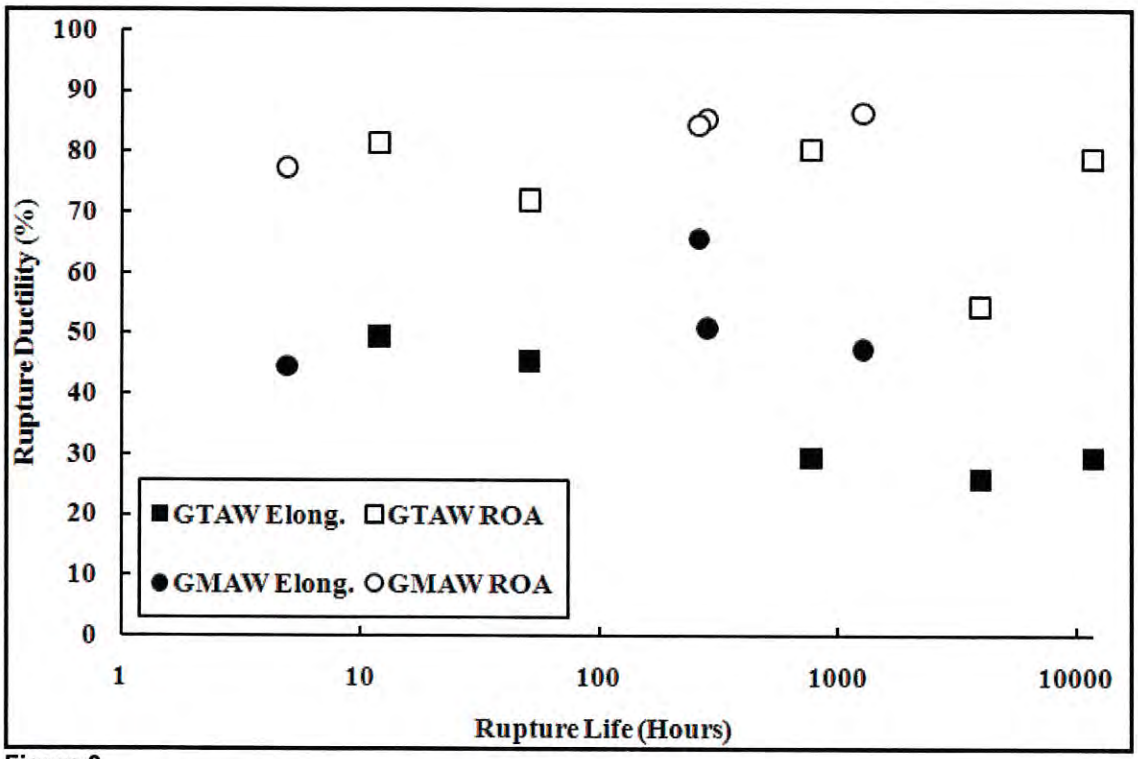

Figure 3
Creep Ductility, GTAW and GMAW All Weld Metal Creep Tests [6]

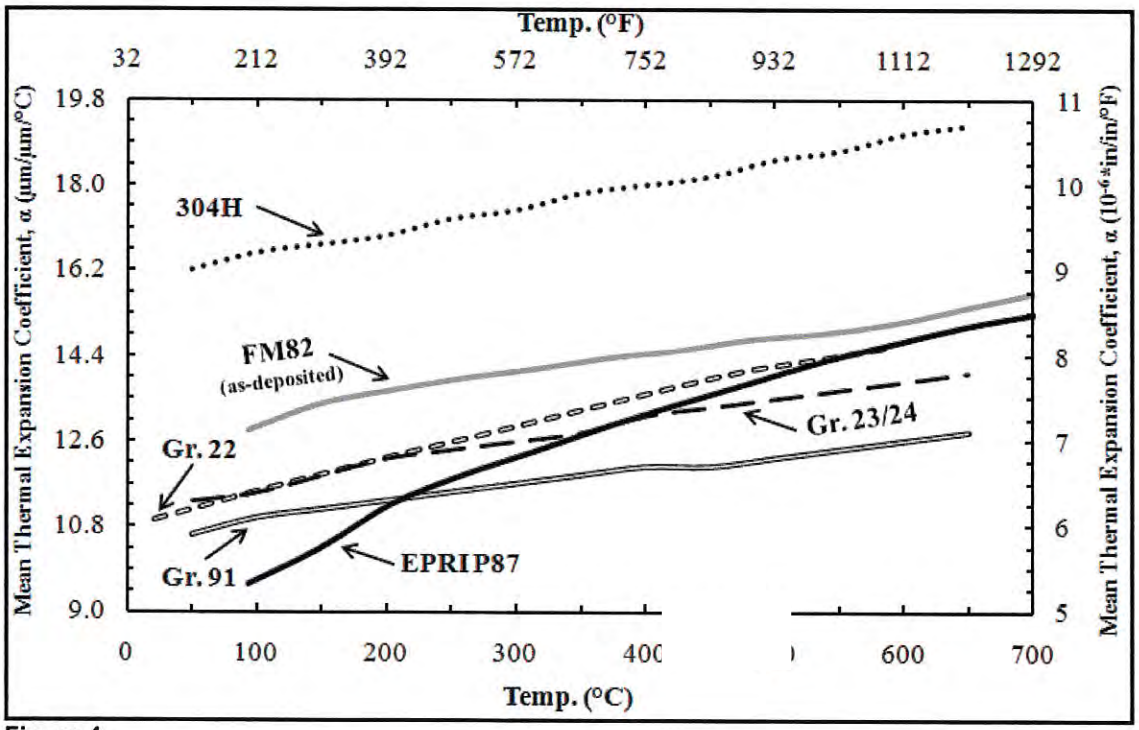

Figure 4
Mean Thermal Expansion Coefficient Comparison [6]

A low preheat (200°F, 93°C) and interpass (250°F, 121°C) was utilized to ensure complete transformation of the deposited weld metal prior to performing the next fill pass. If too high a preheat and interpass were utilized in welding Grade 91, incomplete transformation to martensite on cooling would ensure that fresh martensite would be present in the as-welded microstructure following the completion of the weld. The fresh martensite would not only increase hardness, but reduce toughness and potentially increase susceptibility to cracking phenomena like stress corrosion cracking. M_F temperatures for Grade 91 are given in Figure 5. The $M_{F,OSU}$ band represents a compilation of Grade 91 base material data at a range of cooling rates [7].

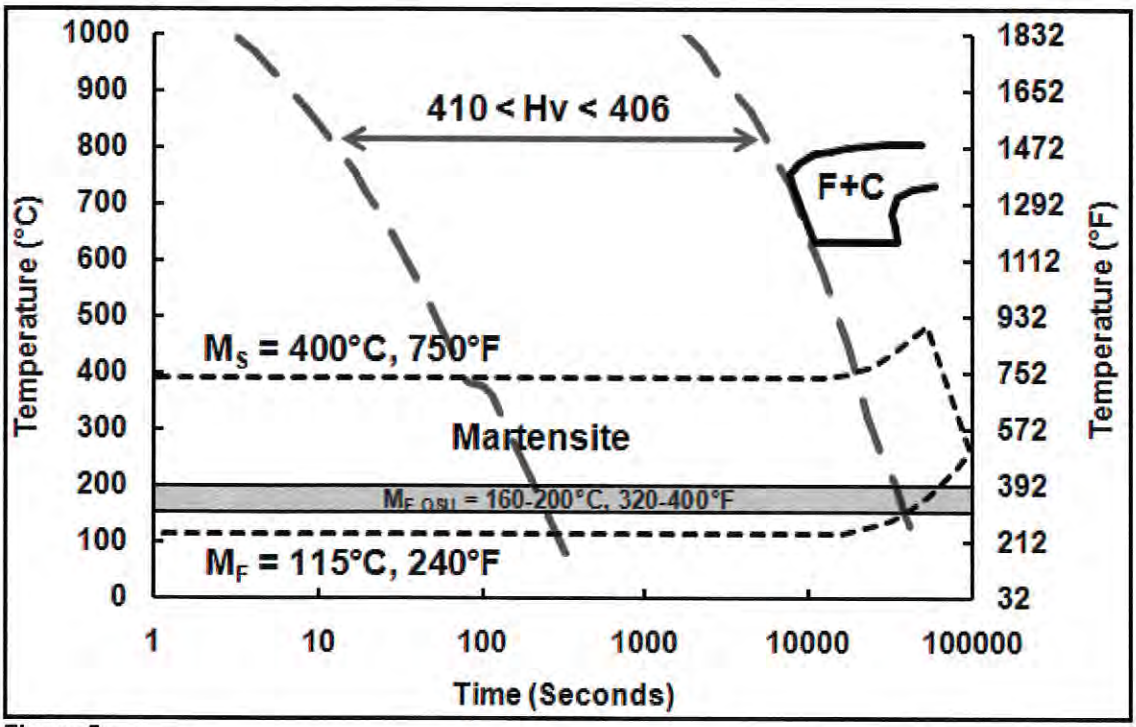

Figure 5
CCT Curve for Grade 91 Adapted from [7,8]

Because the two previously mentioned temper bead techniques were applied in this paper to *T91* material, it was critical to ensure as few weld passes and as simple a welding procedure as possible. Additionally, the development of a temper bead technique for tube to tube butt welds necessitates the consideration of the application. Tube to tube butt welds can be oriented in virtually any position and difficult to access; these two facts complicate the success of *any* welding procedure, let alone a temper bead technique. Because of this, it was decided that grinding (as in half-bead) and buttering of either side of the tube to tube butt weld (as typically done in thick-section temper bead procedures) prior to performing fill passes would be avoided. This paper details the welding development of the consistent layer and controlled deposition temper bead techniques on thin plate material representative of T91 material. Analysis was completed utilizing light microscopy and extensive hardness mapping for screening the success of the two procedures.

Experimental Procedure

Two weldments were made in Grade 91 plate using 0.035" diameter EPRI P87 filler metal. The chemical composition for the base material and filler metal are given in Table 1; these compositions are as reported from the material certifications. The semi-automated gas tungsten arc welding (GTAW) process was used to complete two weldments; one labeled "consistent layer" and the other "controlled deposition." The shielding gas was 100% Argon. Each weldment was machined to identical dimensions, Figure 6. The mismatch in the groove geometry in Figure 6 was intentional for two purposes:

1. To determine the importance of the bevel on the through-thickness tempering behavior of the HAZ;
2. To determine more accurate impact results in future mechanical testing. The 0° bevel should, theoretically, force crack propagation through the HAZ and not into the weld metal or base material.

Table 1
Chemical Composition of Grade 91 Base Material and EPRI P87 Filler Metal

Element	Grade 91		EPRI P87	
	EPRI Spec. [9]	*Plate R1976*	*Spec. [6]*	*WO35419*
C	0.08-0.12	0.080	0.09-0.14	0.11
Mn	0.30-0.60	0.46	1.2-1.8	1.55
P	0.020 max	0.009	0.01	0.008
S	0.010 max	0.004	0.01	0.003
Cu	0.25 max	0.06		
Si	0.20-0.50	0.35	0.05-0.25	0.16
Ni	0.20 max	0.09	54 max	Bal.
Cr	8.00-9.50	8.59	8.5-9.5	8.52
Mo	0.85-1.05	0.89	1.8-2.2	2.02
V	0.18-0.25	0.207		
Ti	0.010 max	0.002		
Al	0.020 max	0.009		
Zr	0.010 max	0.001		
Cb	0.06-0.10	0.078	0.90-1.40	1.09
N	0.035-0.070	0.0476		
Others	As: 0.012 max Sn: 0.010 max Sb: 0.003 max	NS	Fe: 38-42	Fe: 38.8
N/Al Ratio	4.0 min.	5.3		
C+N	>0.12	0.1276		

The welding parameters for each weldment are given in Tables 2 and 3. A 200°F (93°C) preheat and 250°F (121°C) maximum interpass was instituted; actual starting temperature of the weldment prior to each subsequent pass is shown in Tables 2 and 3. The fundamental layout of each weldment is shown in Figures 8 and 10. During welding, the fill layers were staggered along the length of the weld by ~1" (25.4mm) to allow for individual characterization of each

layer, Figure 7. A completed weldment is shown in Figure 7, detailing the sections of the weldment utilized for destructive testing and aphic analysis.

Metallographic samples were taken from each f shown in Figures 9 and 11. Analysis included detailed light microscopy and hard ng. An automated hardness mapping system, utilizing a Vickers hardness indente d with a spatial distance of 0.15mm was utilized in the creation of the hardness maps. Mapping was done on as-polished samples and every indent was visually verified for accuracy.

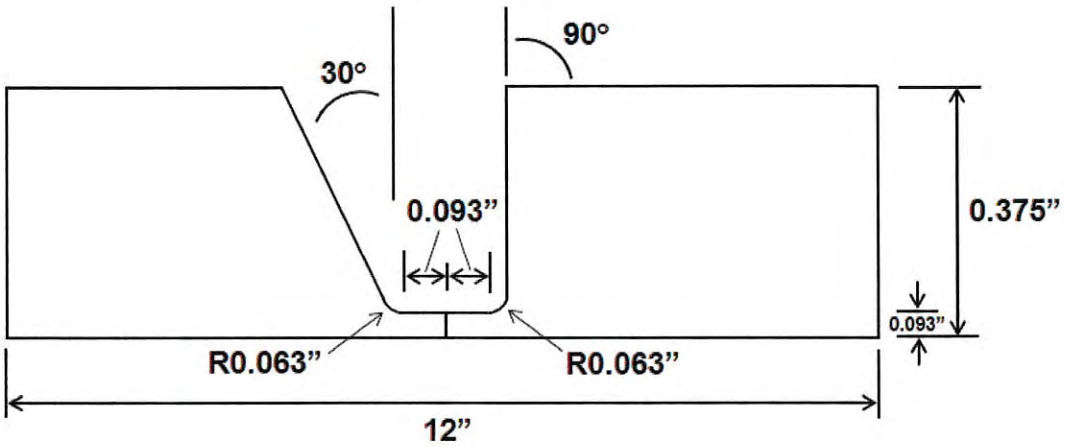

Figure 6
Weldment Dimensions

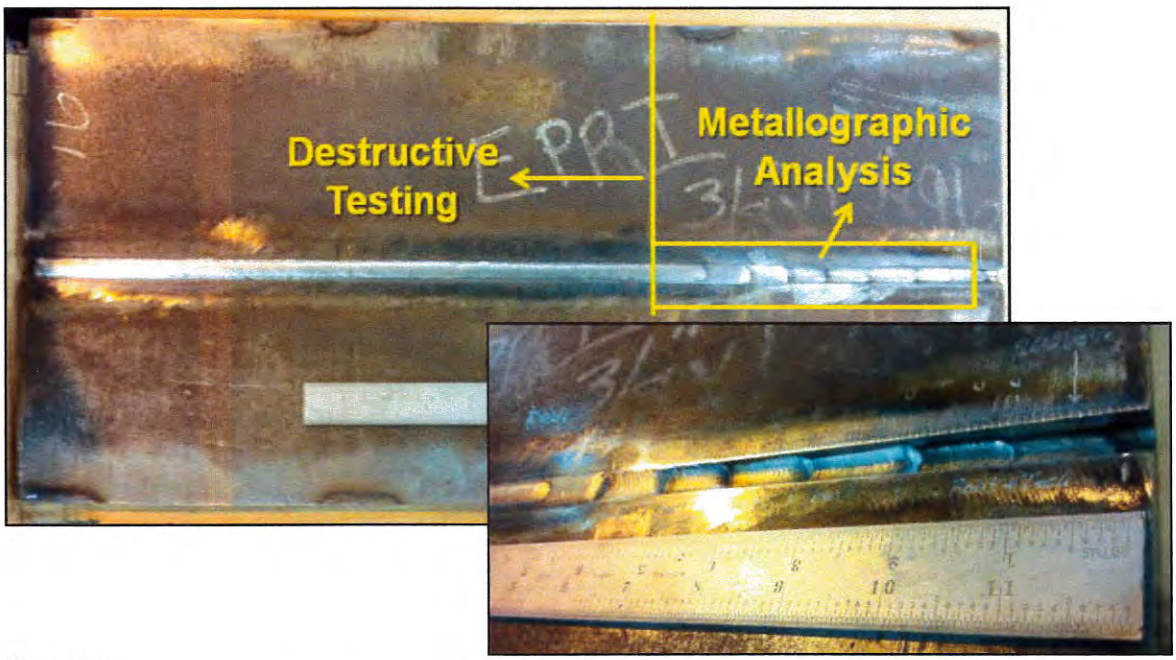

Figure 7
Example of Welded Plate and Sectioning

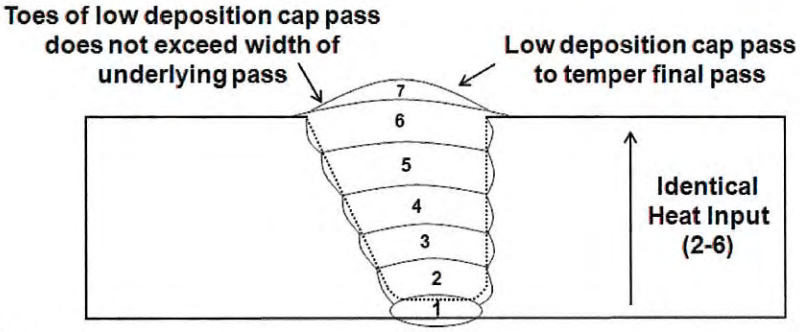

Figure 8
Consistent Layer Weldment Fill Layout

Table 2
Consistent Layer Weldment Parameters

	Current (A)	Voltage (V)	TS[1] (ipm, mm/s)	HI[2] (kJ/in, % inc.)	Start Temp.[4] (°F, °C)
Root	175			28.5, +0%	216, 102
Fill 1					220, 202
Fill 2					216, 198
Fill 3	190	9.5	3.5, 88.9	30.9, +8.4%	218, 200
Fill 4					207, 189
Fill 5					202, 184
Low Dep. Wash Pass	140			22.8, -26.2%	232, 214

[1]TS = Travel Speed

[2]HI = Heat Input; HI (kJ/in) = Voltage*Amperage*60/TS

[3]% inc. = Percentage increase in heat input over previous weld pass

[4]Start Temp. = Starting temperature of weldment prior to deposition of indicated weld pass

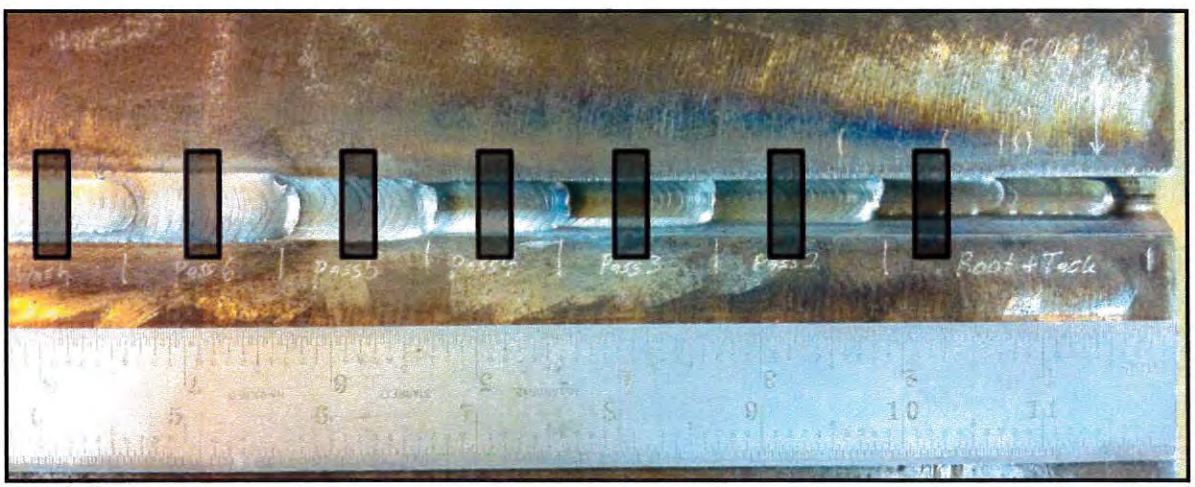

Figure 9
Consistent Layer Metallographic Sample Locations

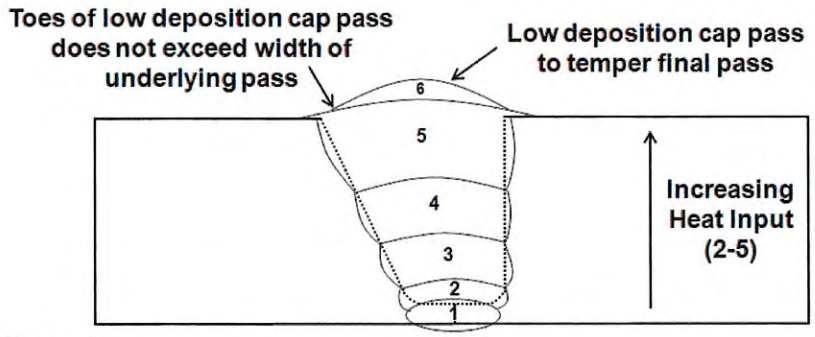

Figure 10
Controlled Deposition Weldment Fill Layout

Table 3
Controlled Deposition Weldment Parameters

Weld Pass	Current (A)	Voltage (V)	TS[1] (ipm, mm/s)	HI[2] (kJ/in, % inc.[3])	Start Temp.[4] (°F, °C)
Root	170	9.5	3.5, 88.9	27.7, +0%	220, 104
Fill 1	190			30.9, +11.5%	213, 195
Fill 2	200			32.6, +5.5%	214, 196
Fill 3	210			34.2, +4.9%	206, 188
Fill 4	220			35.8, +4.7%	219, 201
Low Dep. Wash Pass	140			22.8, -36.3%	229, 211

[1]TS = Travel Speed

[2]HI = Heat Input; HI = V*I*60/TS

[3]% inc. = Percentage increase in heat input over previous weld pass

[4]Start Temp. = Starting temperature of weldment prior to deposition of indicated weld pass

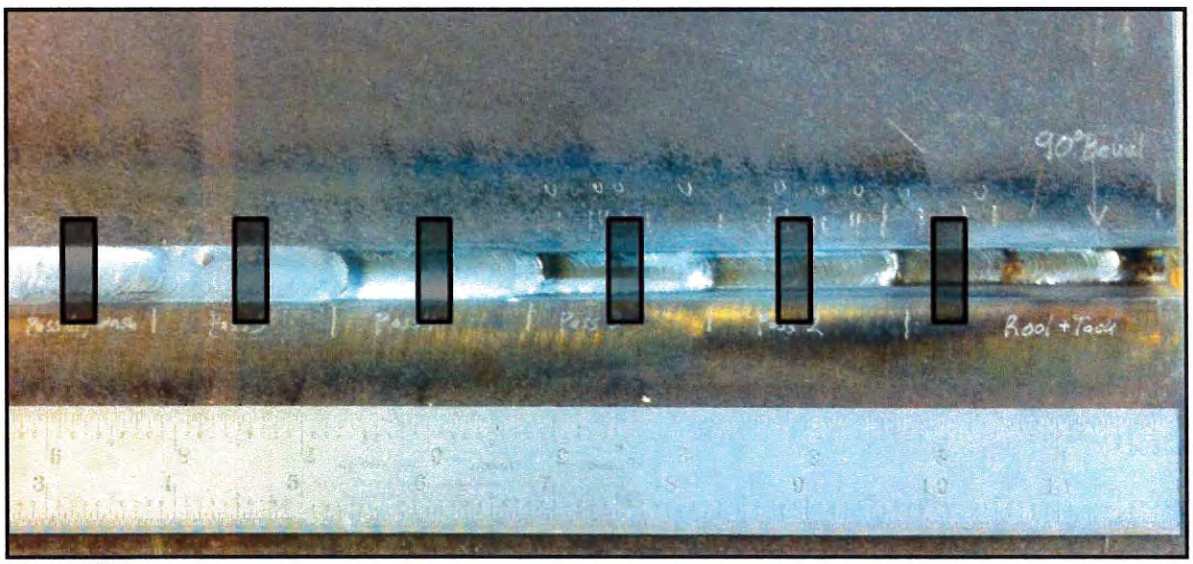

Figure 11
Controlled Deposition Metallographic Sample Locations

Results

Macro images for each weld pass in the consistent layer and controlled deposition weldments are shown in Figures 12 and 13, respectively. For each weldment, the width of the HAZ is similar with no major improvement in size or width in the 0° bevel side of the weldment. For the controlled layer technique, the wash pass provided necessary reinforcement to complete the weldment. In the case of the consistent layer technique, the wash pass was not needed to provide sufficient reinforcement. In either case, the wash pass could be ground away in the field should it be deemed excessive.

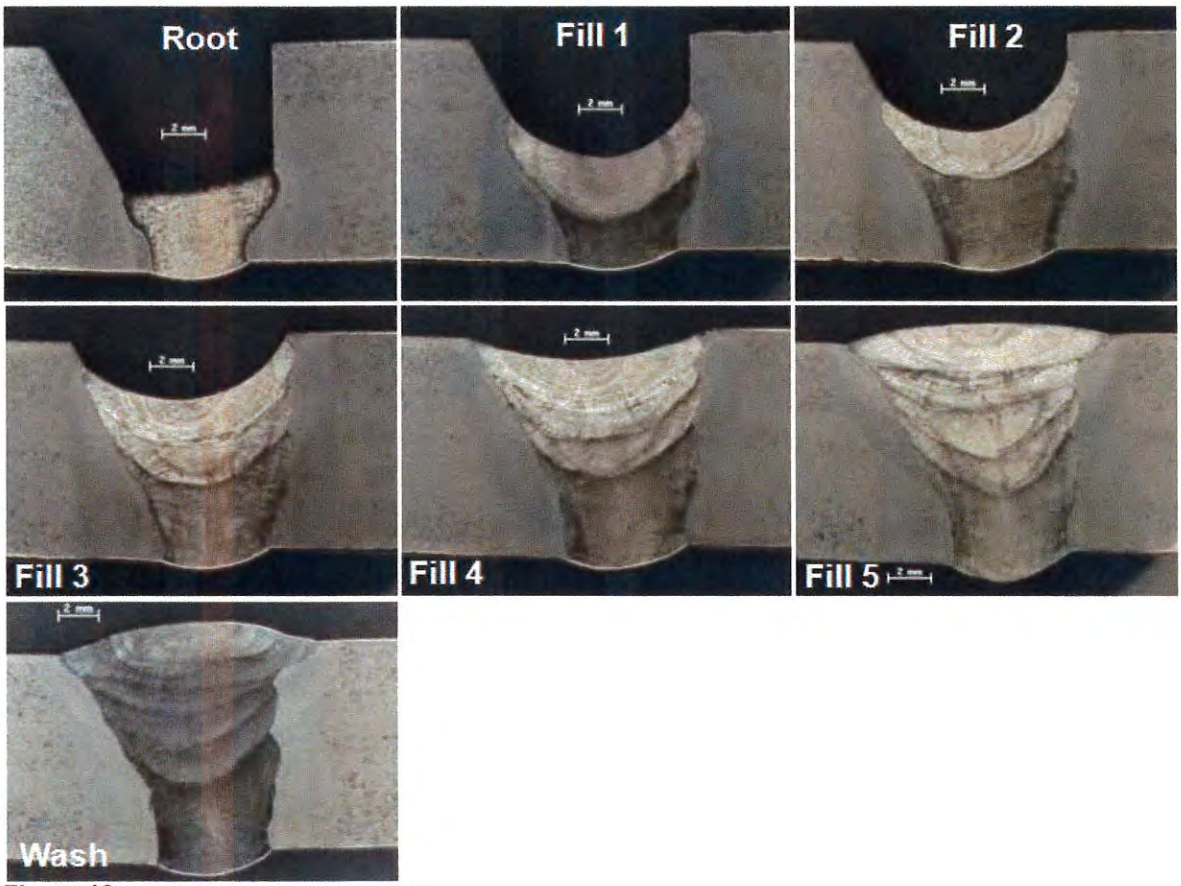

Figure 12
Consistent Layer Weld Passes

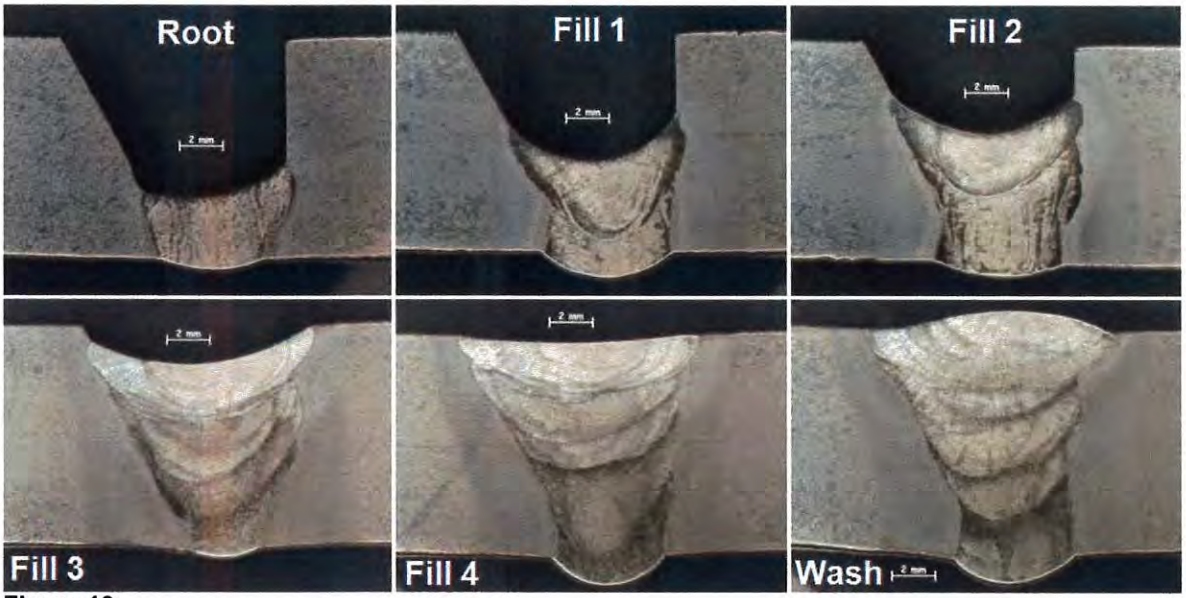

Figure 13
Controlled Deposition Weld Layers

The hardness data for each of the weldments was post-processed and plotted using a contour map. In Figures 14 and 15, each color represents a range of 50HV and the scales are identical for both maps:

- 150-200HV 0.2 ➔ Blue
- 200-250HV 0.2 ➔ Light Blue
- 250-300HV 0.2 ➔ Green
- 300-350HV 0.2 ➔ Yellow
- 350-400HV 0.2 ➔ Orange + Hashes
- 400-450HV 0.2 ➔ Red + Cross Hashes
- > 450HV 0.2 ➔ Black

To compare the overall tempering of the weldments more methodically, all of the data points in each hardness map below 225HV 0.2 were deleted for statistical analysis. This was done to eliminate all of the base metal hardness data and most (if not all) of the weld metal data. Using this comparison, the effectiveness of tempering in the HAZ was compared. The deletion of these data resulted in a sample size of 1102 indents for the consistent layer weldment and 1267 indents for the controlled deposition weldment. The histograms for each of these data sets are shown in Figure 16. The percentage of indents above a stated hardness value is shown in Table 4.

The hardness data for the consistent layer technique was plotted onto a macro image of the tested area, Figure 17. The hardness data plotted in Figure 17 was limited to the highest measured data points, those above 325HV.

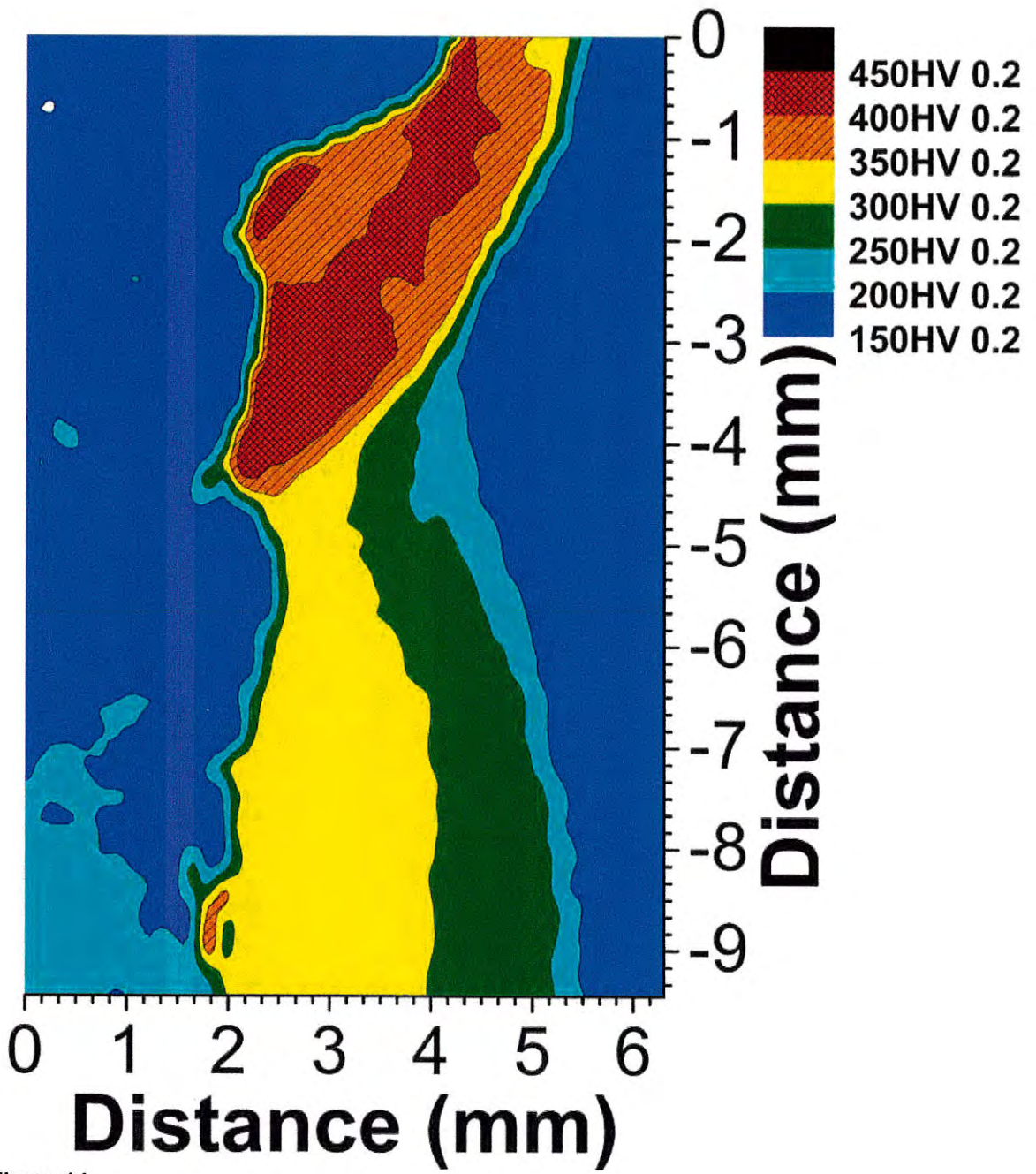

Figure 14
Consistent Layer Technique Hardness Map, 0° Bevel

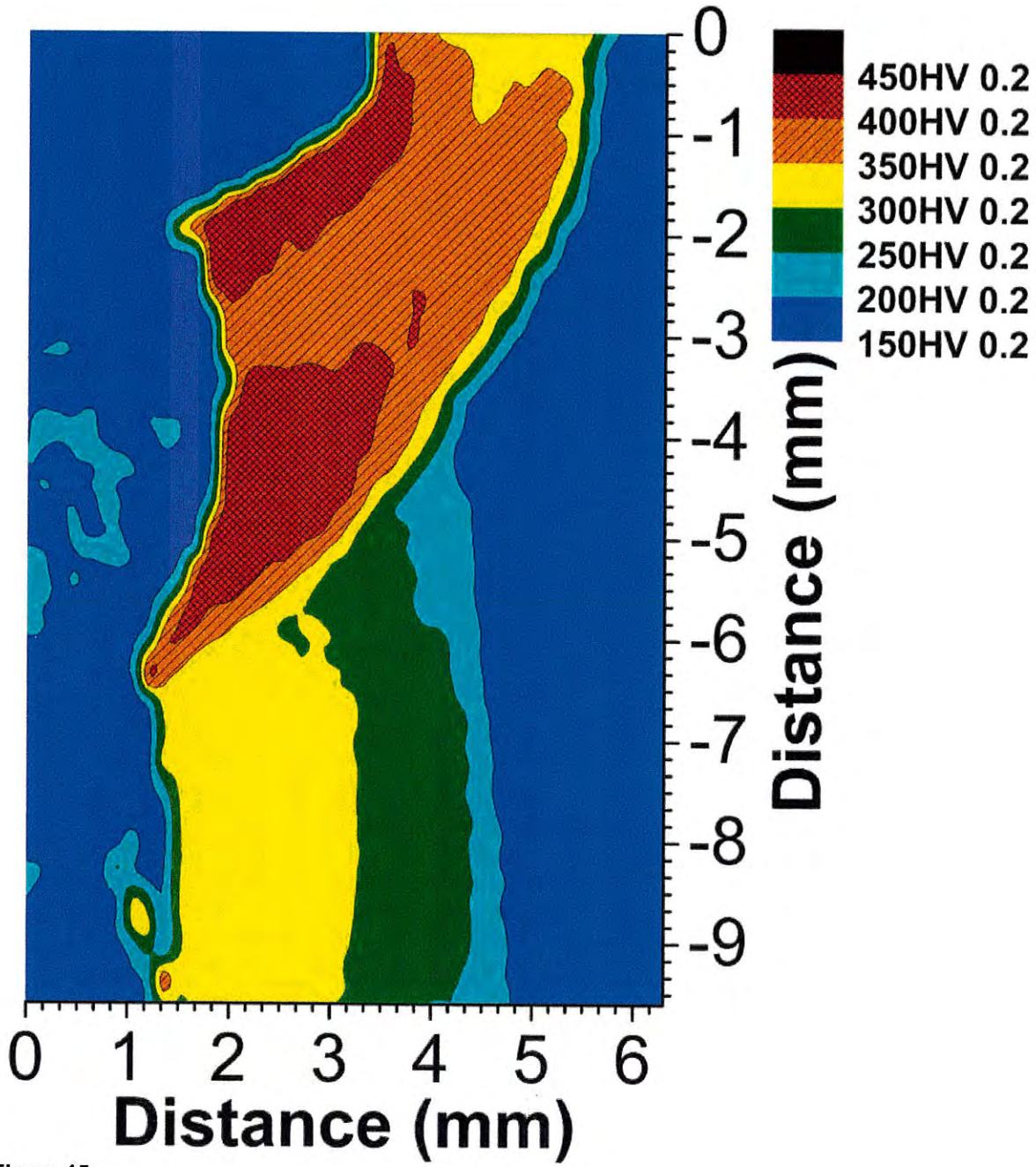

Figure 15
Controlled Deposition Technique, 0° Bevel

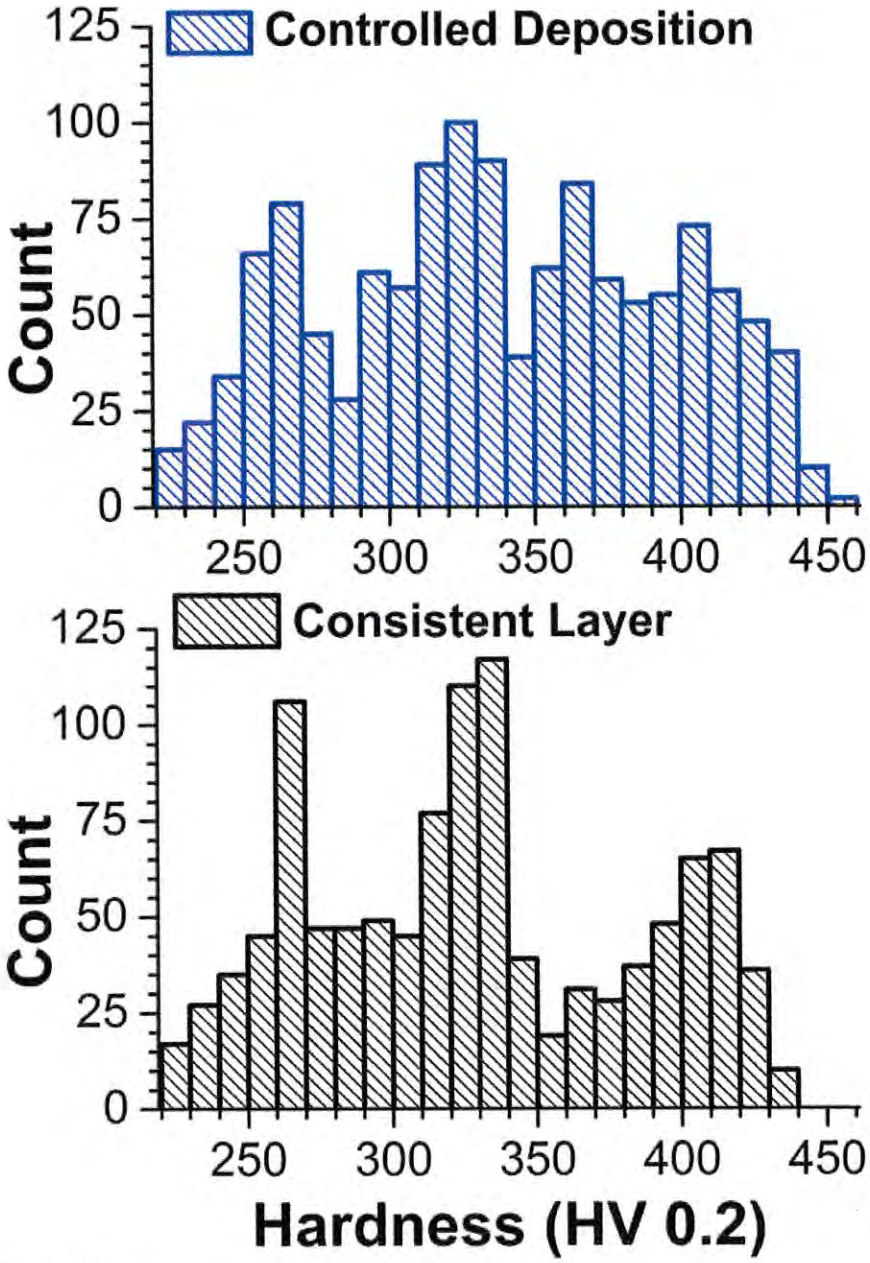

Figure 16
Histogram Comparison for Values above HV>225

Table 4
Percentage of Hardness Values for each Weldment above the Indicated Value

Weldment	>300HV	>325HV	>350HV	>375HV	>400HV	>425HV
Consistent Layer	65%	49%	34%	24%	15%	2%
Controlled Deposition	72%	56%	42%	28%	16%	5%

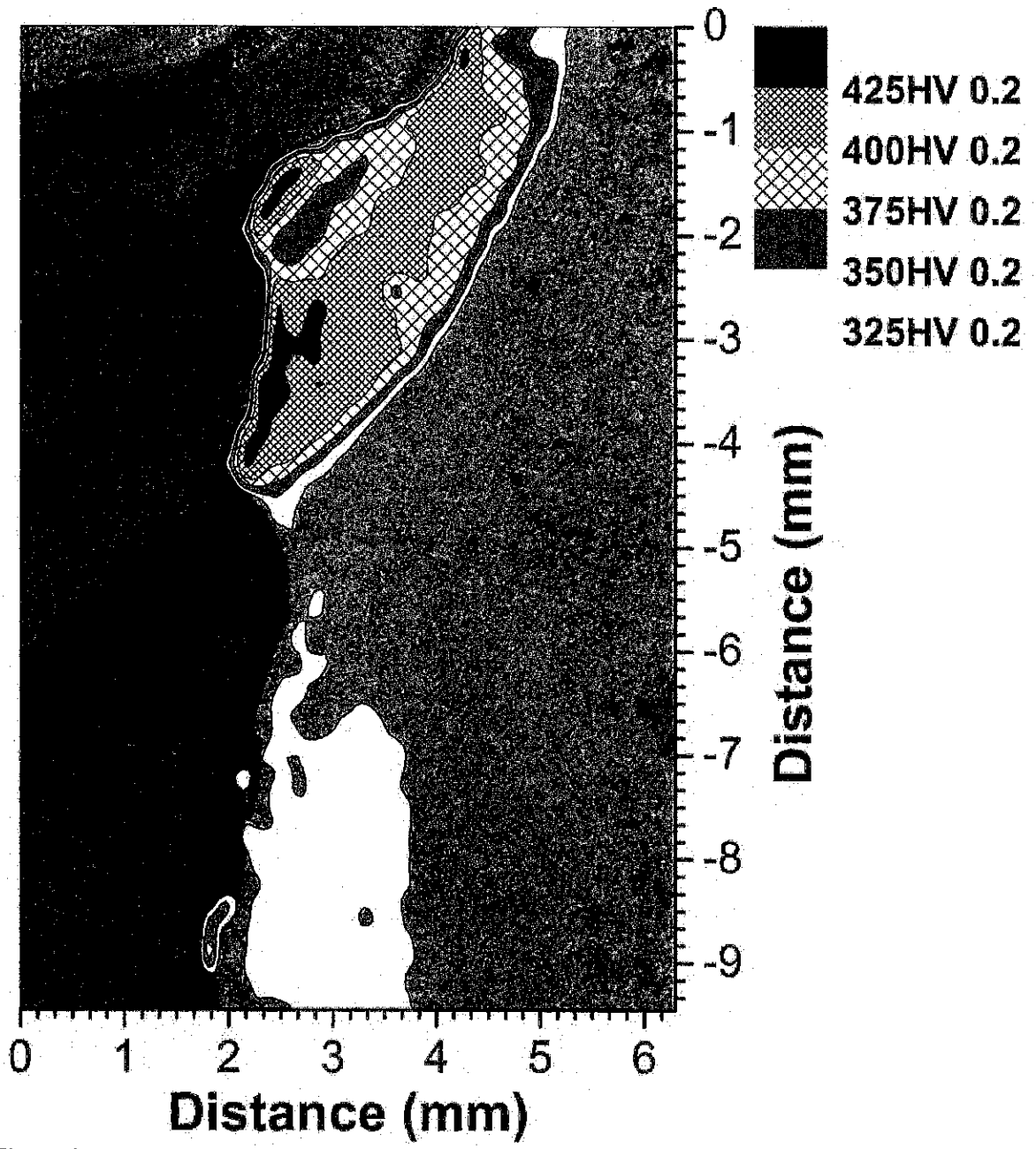

Figure 17
Location of Highest hardness Regions in the Consistent Layer Weldment

Discussion

The analysis of the 0° bevel of each procedure in Figures 14 and 15 show that ample tempering was achieved near the root and midwall on each weldment. Hardness data in typical Grade 91 weldments have shown values to approach 450HV in the HAZ. The data in Figures 14 and 15 indicate that virtually no data points lie above 450HV 0.2 with the vast majority of the data being below 400HV 0.2. To date, there has not been a systematic study governing acceptable hardness values in the HAZ of Grade 91, although hardness maximums have been instituted for as-received base material (263HV) and for the weld metal (295HV) following PWHT [9].

The consistent layer technique shows slightly better tempering through the entirety of the HAZ, as indicated in the histograms shown in Figure 16. The amount of data points below 350HV in the consistent layer technique are further shown in Table 4. The overall slight increase in tempering is likely attributed to the fact that there was one additional fill pass in this weldment as compared to the controlled deposition weldment. The increased heat input in the controlled deposition weldment appears to have had no significant affect in the tempering behavior of the Grade 91 HAZ. Based on these observations, it seems most beneficial to deposit as many fill passes as possible to increase the chances of tempering through the entirely of the HAZ.

A graph of the data points above 325HV overlaid on the analyzed area in Figure 17 shows the location of the hardest regions in the consistent layer technique. This graph clearly indicates that a great deal of the HAZ is below 325HV. The location of the hardest regions (in black) may be a result of the way in which the 0° bevel was welded. When approaching the 0° bevel, the automated voltage control will increase the arc length and cause the weld puddle to wash higher up on the wall (Figure 12, Fill 2). This added reinforcement on the wall may prevent adequate heat from overlying fill passes to penetrate the deposited weld pass to temper the HAZ.

Most of this preliminary analysis is concentrated around the measured hardness values. The importance of a threshold hardness value may have implications with respect to the stress corrosion cracking susceptibility (SCC) of the weldment. Although significant SCC has been documented in other CSEF steels (primarily Grades 23/24) [10, 11], the instances of SCC in Grade 91 weldments are not widely documented. In the few instances of documented SCC in Grade 91, the components were left in an uncontrolled environment for an extended period of time. More widespread cases of SCC have not been documented in Grade 91 due to the requirement of PWHT for *any* weld made in a Grade 91 component.

General SCC susceptibility is defined by the interaction of the environment, a susceptible material and the stress state. Because a wide variety of environments can pass through the ID of the tubing (acid cleaning, various steam qualities), it was especially prudent in these studies to reduce the hardness at the root of the weldment. The reduction in hardness at the root was evident in both procedures. Furthermore, it must be noted that the relationship between hardness and SCC susceptibility is not well understood for the CSEF family of alloys. Research on potential SCC mechanisms in Grade 24 weldments have revealed that the susceptibility of the material is not an obvious function of maximum hardness, but primarily on the water chemistry and secondarily to an acid cleaning environment passing through the tube [11]. Additionally, the application of Grade 24 in waterwalls induces this material to a very high restraint condition and

creates the necessary conditions for SCC. Because the intended application of the temper bead welding procedure described in this paper is in T91, it is conceivable that the residual stresses are substantially lower than in other highly restrained situations. The application of a temper bead procedure to T91 likely further limits its use to tubing that is present inside the boiler, and inherently shielding these locations from environmental conditions which might induce SCC on the outside diameter of the tubing.

Conclusions & Future Plans

As-welded HAZ values in Grade 91 for typical welding procedures regularly approach values 450HV. Tempering of Grade 91 using a temper bead technique and relying solely on the heat input from welding is a challenging prospect. Despite this, tempering was observed in the Grade 91, with overall hardness values being reduced by ~100HV in specific regions. A few conclusions from these preliminary set of studies are shown below:

1. Use of a nickel-base filler material offers unique advantages for repair applications in Grade 91 because it does not require tempering or removal of material (as in half-bead) to ensure adequate tempering through the thickness. This greatly reduces the complexity of the applied temper bead welding procedure.
2. The consistent layer technique demonstrated overall lower hardness values than the controlled deposition technique.
3. Regardless of welding technique, the majority (~75%) of the overall hardness values were below 375HV. Because Grade 91 HAZ hardness values regularly exceed 400HV and can reach 450HV, tempering of the Grade 91 HAZ below 375HV is encouraging considering that Grade 91 was purposely designed to be resistant to tempering.
4. The majority of the observed tempering in each weldment was documented in the root and midwall locations. Such observations suggest that there was ample heat input to temper the HAZ through ~half of the weldment. These same observations suggest that more fill passes may be required to more effectively temper the upper half of the weldment.
5. The least tempering was documented in the cap location and indicated that a low deposition wash pass was not adequate to achieve any noticeable tempering.

Planned destructive test evaluation and individual analysis on the effect of each layer will demonstrate the individual and/or cumulative effect of the fill passes on the tempering behavior of each of these weldments. Additional future studies, should address the potential implications of a temper bead procedure in Grade 91. Such studies should address the tempering characteristics of the Grade 91 HAZ in the as-welded state and at service temperature, the cross-weld creep behavior, stress corrosion cracking susceptibility and fracture toughness.

The initial hardness values indicate that the Grade 91 HAZ can be consistently tempered with relatively simple approaches and carefully controlled procedures. This tempering provides an encouraging step in the on-going examination of temper bead procedures for at least temporary repair options in T91 applications.

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11. Private Correspondence, 10/25/11.

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Novel Approaches to Repair of Grade 91 Using Temperbead Welding Procedures

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Electric Power Research Institute

George Galanes
National Board Inspection Code

Introduction

- Two on-going projects within EPRI
  - Temperbead of T91 Using EPRI P87 Filler Metal
  - Weld Repair of Grade 91 Piping and Components
- Motivation
  - Grade 91 components have been used for >20 years and widely put into service over the last 15 years
  - Little thought has been given to establishing the best repair method for specific components
  - PWHT adds a layer of complexity
  - Ensuring *good PWHT* can be very difficult
  - More life may be obtainable through eliminating PWHT

Temperbead Concept for Tubing Applications

- Nickel-base filler metal reduces complexity
- Carefully controlled procedure to temper the T91 HAZ
- Use of EPRI P87 nickel-base filler metal (matching to Grade 91 in C, Cr and carbide-formers) prevents two potential, long-term failure mechanisms:
  - Carbon migration (and the formation of a weak zone)
  - Type I carbide nucleation **and growth** along ferritic-side of fusion line (growth eventually results in creep cavitation at Type I carbides)
  - For more information, EPRI Report 1019786 (free)
- **Goal: Provide an alternative repair approach that results in safe operation without the need for PWHT.**

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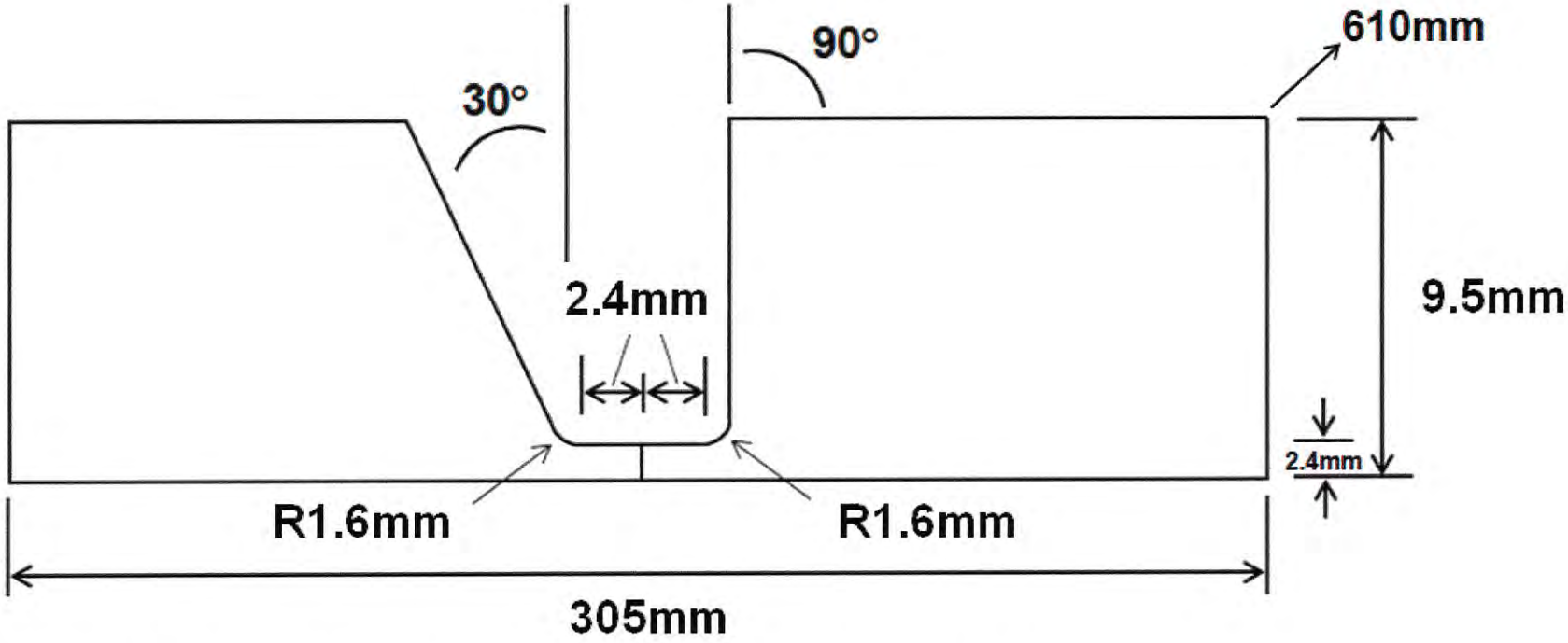
Approach

- Attempt two different, established temper bead welding techniques using automated GTAW process
  - **Consistent Layer** – heat input for fill passes was identical
  - **Controlled Deposition** – heat input was purposely increased through the thickness
- Weld was staggered to examine the effect of each layer on the tempering response of the Grade 91 HAZ
- Preheat 200°F with max interpass of 250°F to ensure complete transformation to martensite prior to deposition of the next, overlying layer

Procedure Validation and Testing

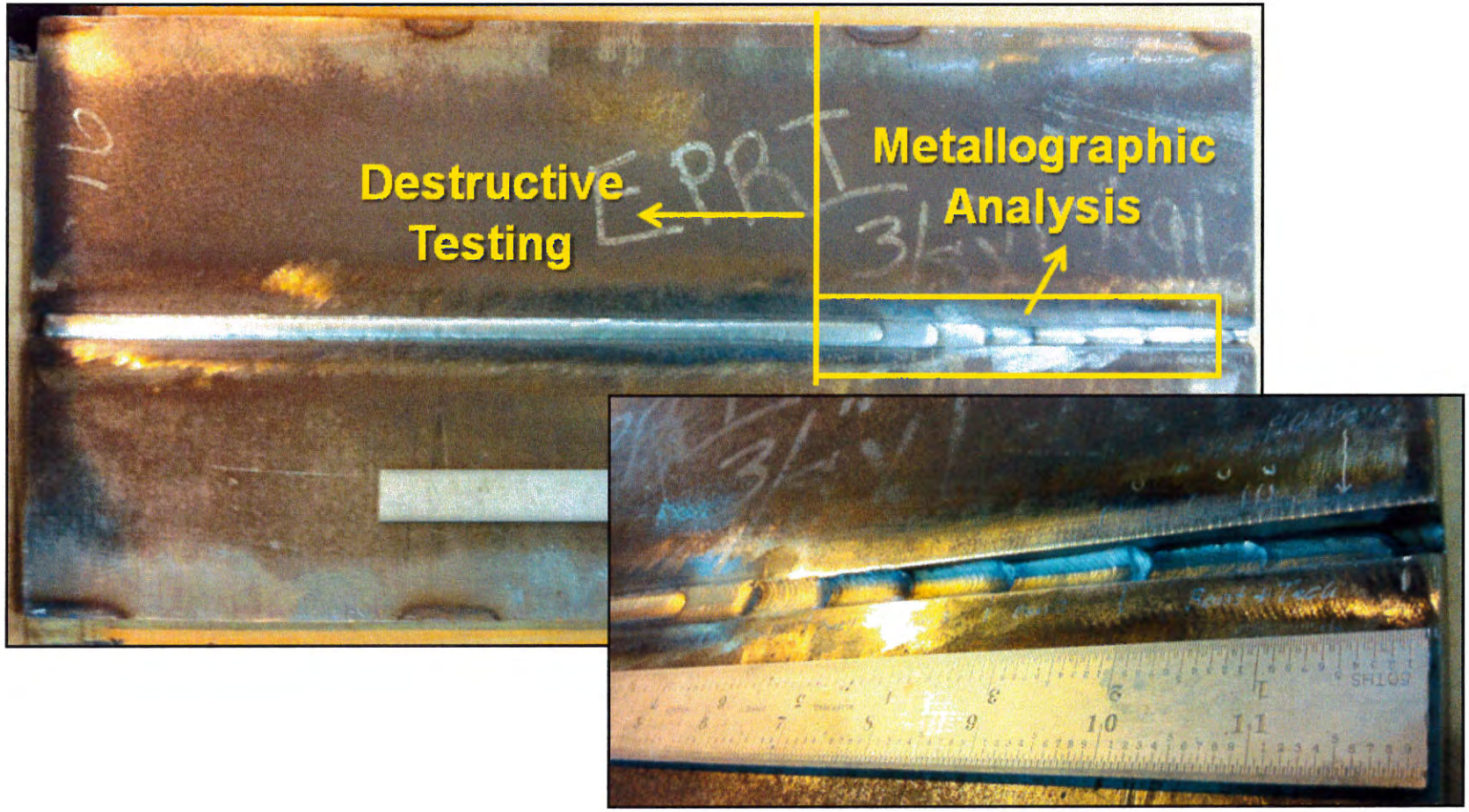
- Metallography
- Hardness (per procedure)
  - 200g Hardness Maps
  - 0.15mm spatial spacing
  - ~2800 indents per map on each side of the weld
- Mechanical Testing (per procedure)
  - Room temperature impact testing (10mm square)
  - ASME Section IX qualification (4 side bends + 2 RTTs)
  - Elevated temperature tensile testing (550-620°C @ 14°C increments)

Welding Geometry

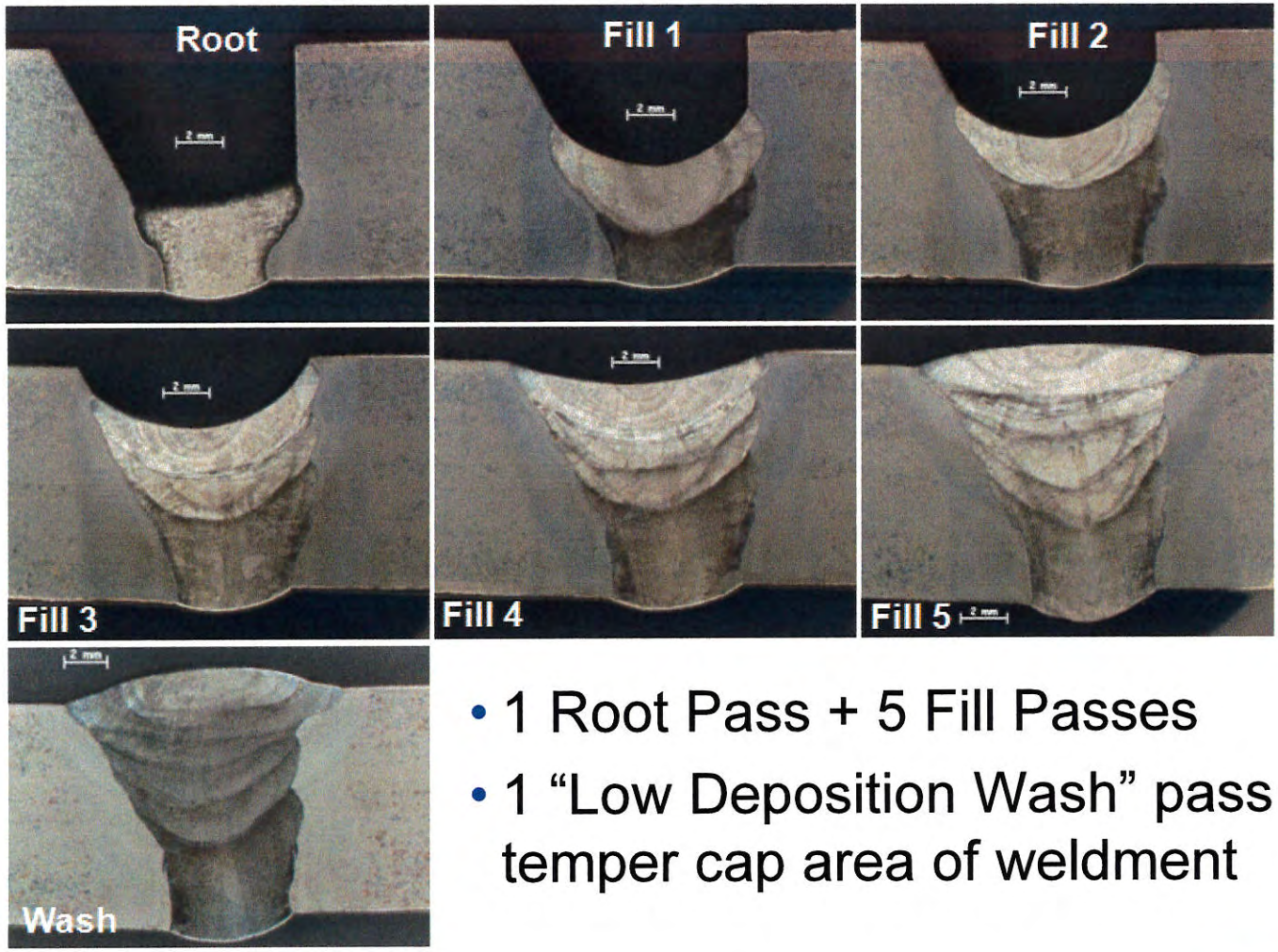


- Straight bevel was utilized for two reasons:
  - Potentially allows for impact strength measurement in HAZ
  - Establish if the bevel is a critical variable

Finished Weldment

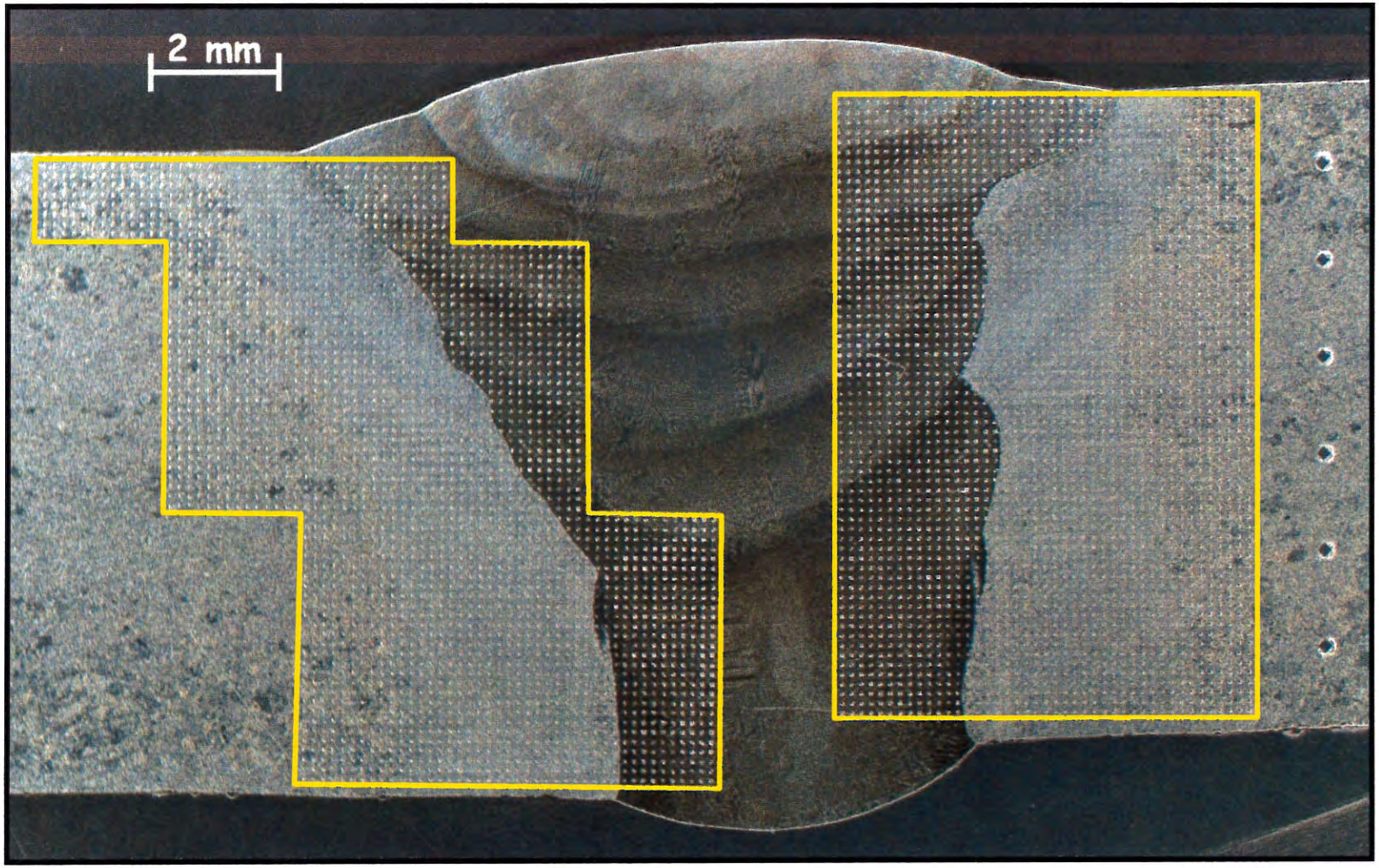


Consistent Layer Macro Images



- 1 Root Pass + 5 Fill Passes
- 1 "Low Deposition Wash" pass to temper cap area of weldment

Consistent Layer Hardness Maps in Completed Weldment



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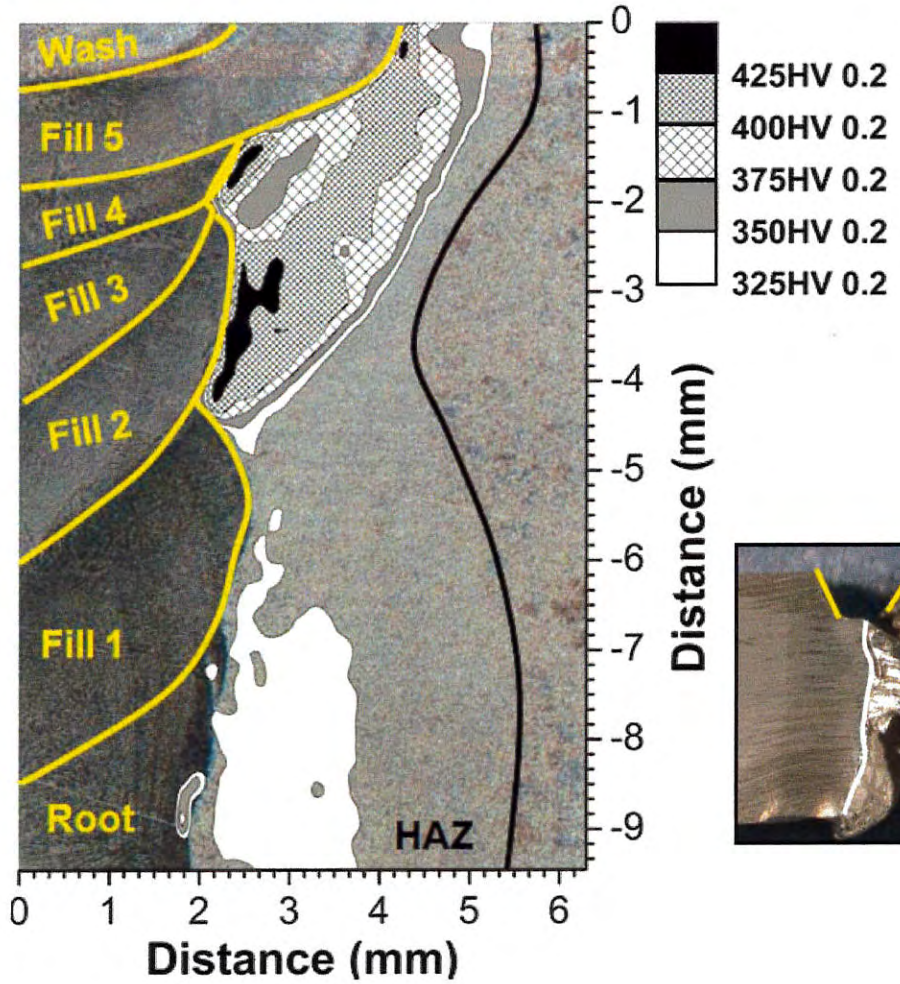
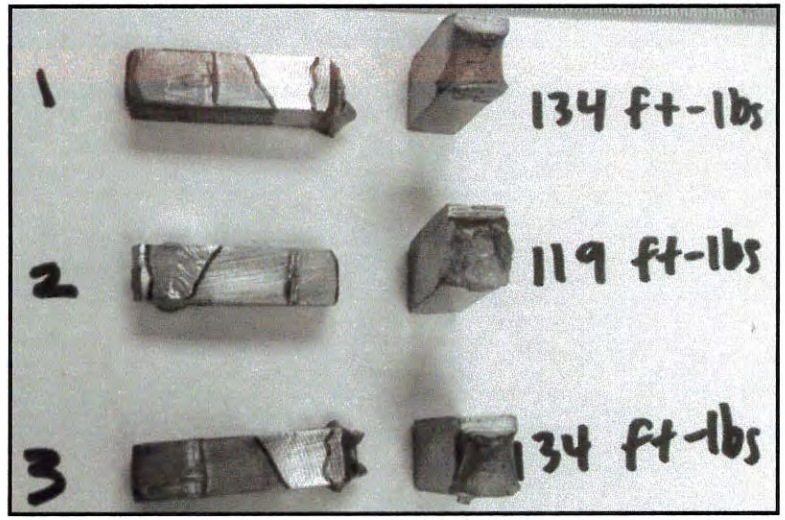
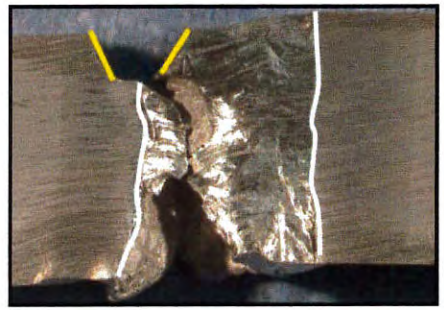
Consistent Layer – Example of Data Analysis







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Conclusions to Date and Future Work

- It is possible to temper the Grade 91 HAZ and a reduction of hardness (<350HV 0.2) at root appears feasible
- Destructive evaluation results (thus far) are promising

Future Work:

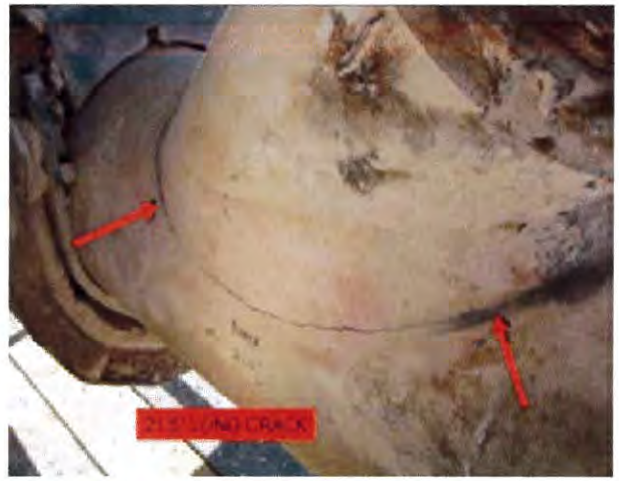
- Application manual GTAW
- Application to manual GTAW root + SMAW fill
- Metallographic, hardness and destructive evaluation

- **Questions or comments ?**

Weld Repair of Grade 91 Piping and Components

Objectives and Scope

- Ability to remove damaged material efficiently and effectively
- Design and execute repairs
- Guide to lifing and ongoing inspection requirements of repair



Value

- Minimize the time and costs associated with making a repair
- Maximize the potential that the repair will provide at least adequate in-service performance.

Details and Contact

- The participant total cost is $40,000 payable over 2 years.
- Qualifies for Tailored Collaboration

Jonathan Parker

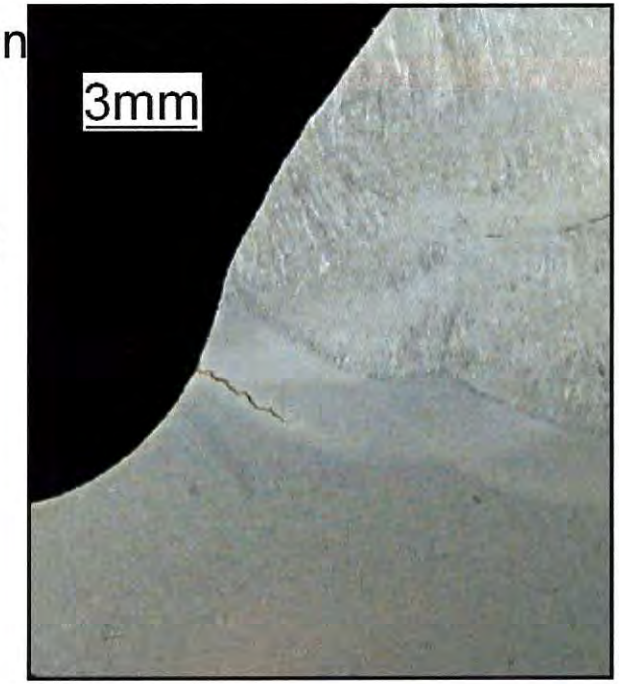
- jparker@epri.com, (704) 595-2791

SPN Number: 1022801

Have confidence that repair methods will be effective

Phase 1 – Ranking of Repair Performance

- Discussion of methods and extent of excavation
- Weld procedure considerations – identified variables:
  - Base material condition (Renormalized and service-exposed)
  - Filler metal selection (6 total)
  - Temperbead vs. normal procedure comparison
  - Proper vs. improper temperbead
  - Temperbead layer procedure (4 total)
  - Post weld heat treatment (3 total)
- Post repair evaluation of microstructure, damage, etc.
- Specimen geometry and testing conditions
- Development of test matrix



Analysis to identify best option repairs – generate ranking table

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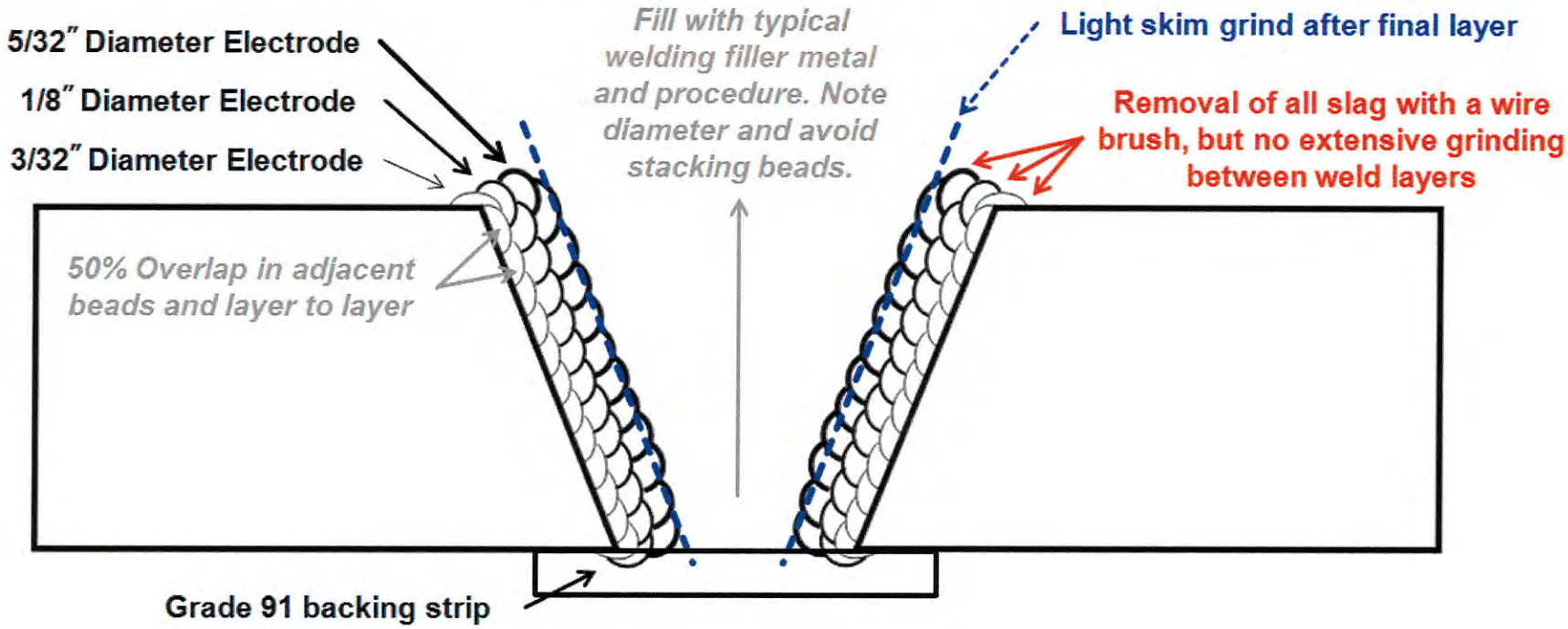
Phase 1 Welding Matrix – All Welds Completed

Weld	Base Material	Weld Metal		Preheat/ Interpass	Welding Procedure	PWHT
		AWS Desig.	Trade Name			
1A	As-received Grade 91 (Sample 8) "A" Material	E9015-B9 H4	Thermanit Chromo 9V Mod.	300°F/600°F	Normal + Rec'd. PWHT	1375±25°F/2h
2A				300°F/600°F	Normal + Min. PWHT	1250±10°F/2h
3A				300°F/600°F	Temperbead	None
4A				300°F/600°F	Poor Practice Temperbead	None
5A		E8015-B8	9Cr-1Mo	300°F/600°F	Temperbead	None
6A		E9015-G	Thermanit P23	300°F/600°F	Temperbead	None
7A				300°F/600°F	Normal + Rec'd. PWHT	1375±25°F/2h
8A		E9018-B3 H4	Bohler E9018-B3	300°F/600°F	Temperbead	None
9A		EPRI P87	EPRI P87	300°F/600°F	Temperbead	None
10A		ENiCrFe-2	INCO-WELD A	300°F/600°F	Temperbead	None
1B	Renormalized Grade 91 (Sample 8) "B" Material	E9015-B9 H4	Thermanit Chromo 9V Mod.	300°F/600°F	Normal + Renormalization + Temper	1930°F±20°F/2h 1375±25°F/2h
2B				300°F/600°F	Normal + Min. PWHT	1250±10°F/2h
3B				300°F/600°F	Temperbead	None
4B				300°F/600°F	Poor Practice Temperbead	None
5B		E8015-B8	9Cr-1Mo	300°F/600°F	Temperbead	None
6B		E9015-G	Thermanit P23	300°F/600°F	Temperbead	None
7B				300°F/600°F	Normal + Rec'd. PWHT	1375±25°F/2h
8B		E9018-B3 H4	Bohler E9018-B3	300°F/600°F	Temperbead	None
9B		EPRI P87	EPRI P87	300°F/600°F	Temperbead	None
10B		ENiCrFe-2	INCO-WELD A	300°F/600°F	Temperbead	None

Weldment 10B [ENiCrFe-2 Filler Metal, TBW]

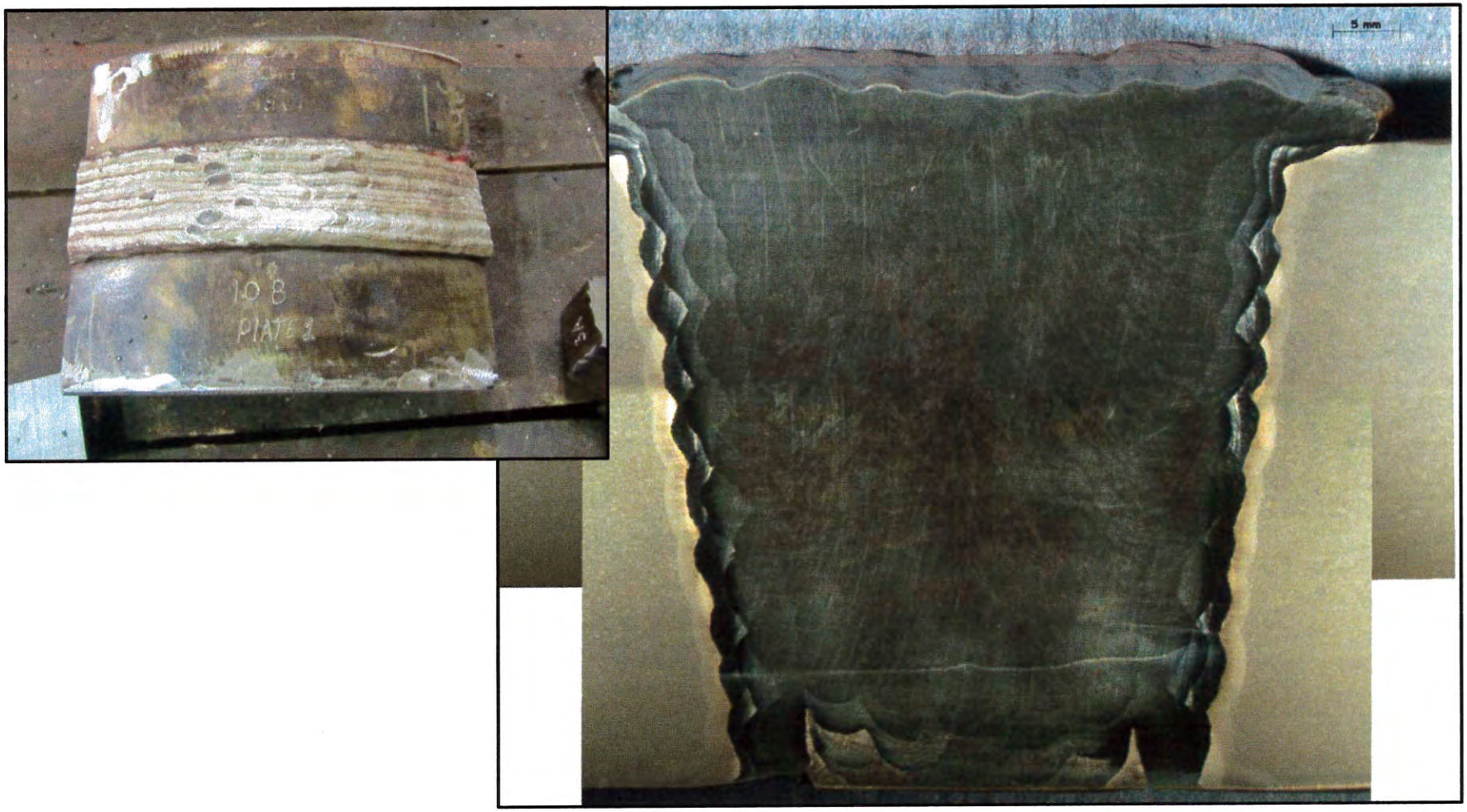
Welding Procedure for Three Layer Approach



- SMAW Process
- 300°F (149°C) Preheat, 600°F (316°C) Interpass

Weldment 10B [ENiCrFe-2 Filler Metal, TBW]

Welding Assessment – Completed Weldment



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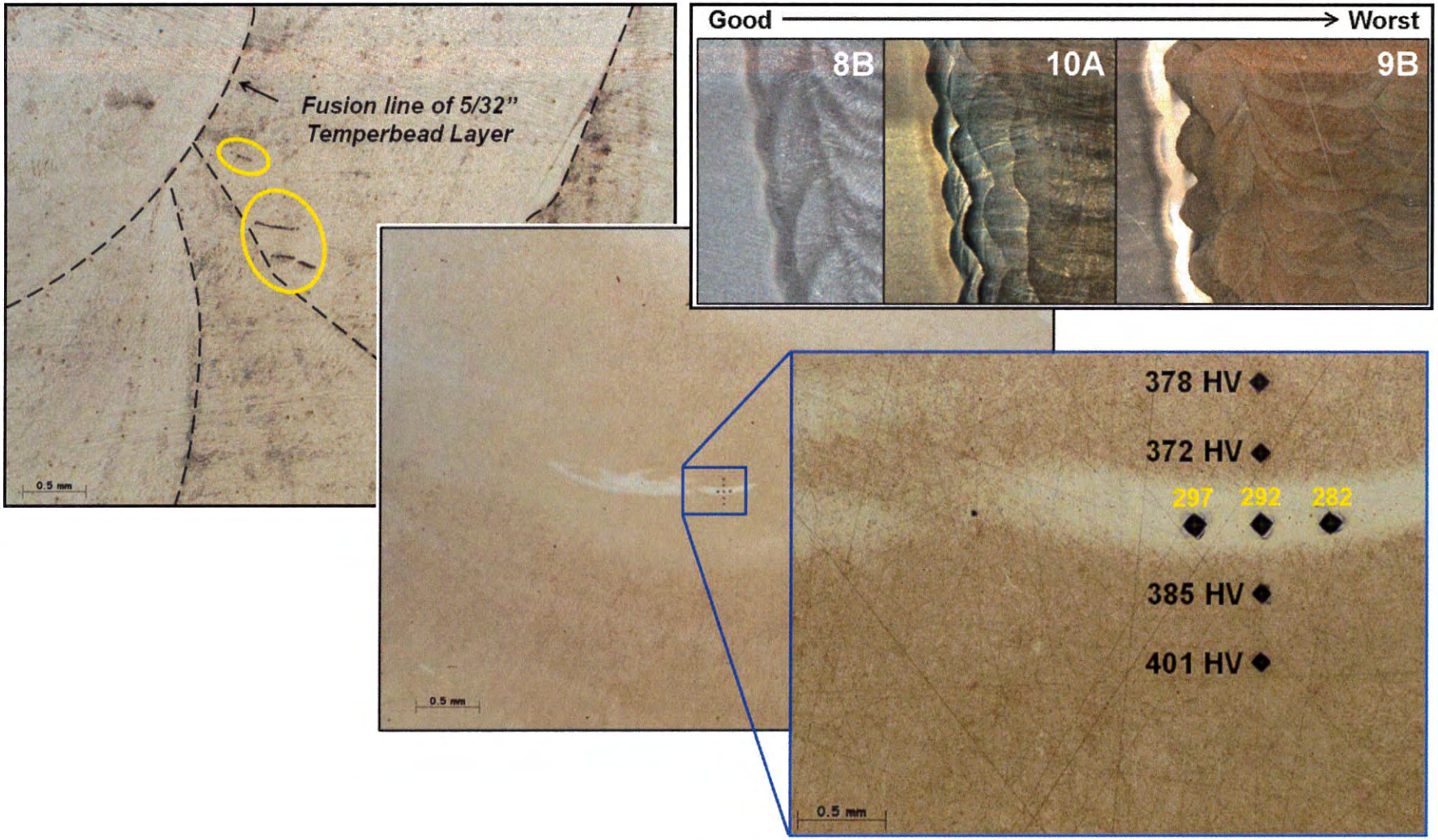
Metallographic Assessment



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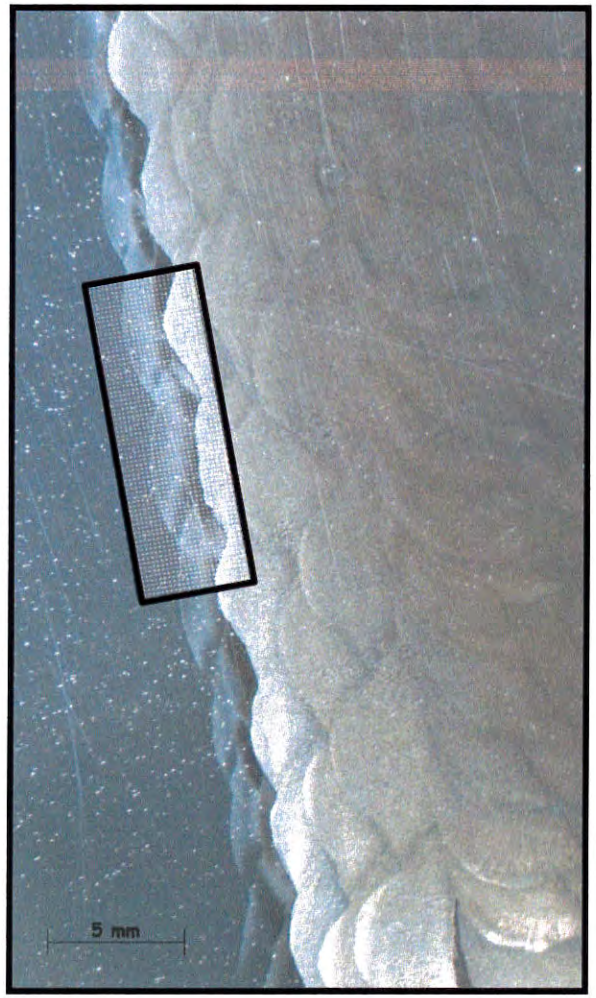
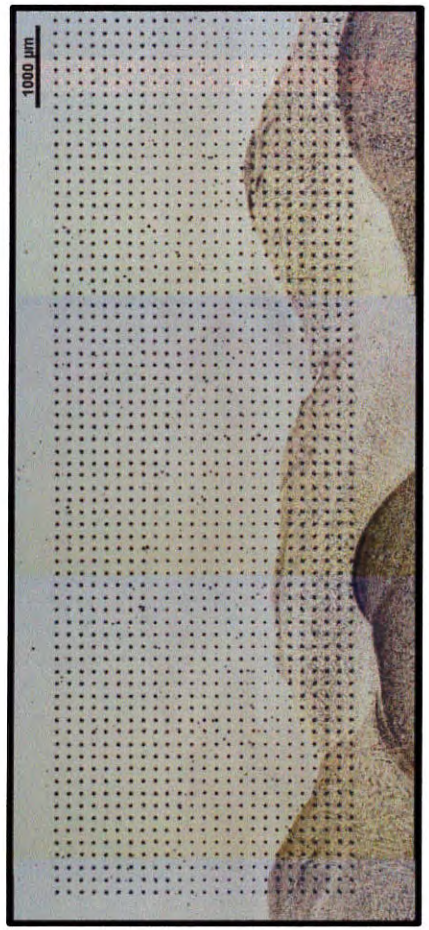
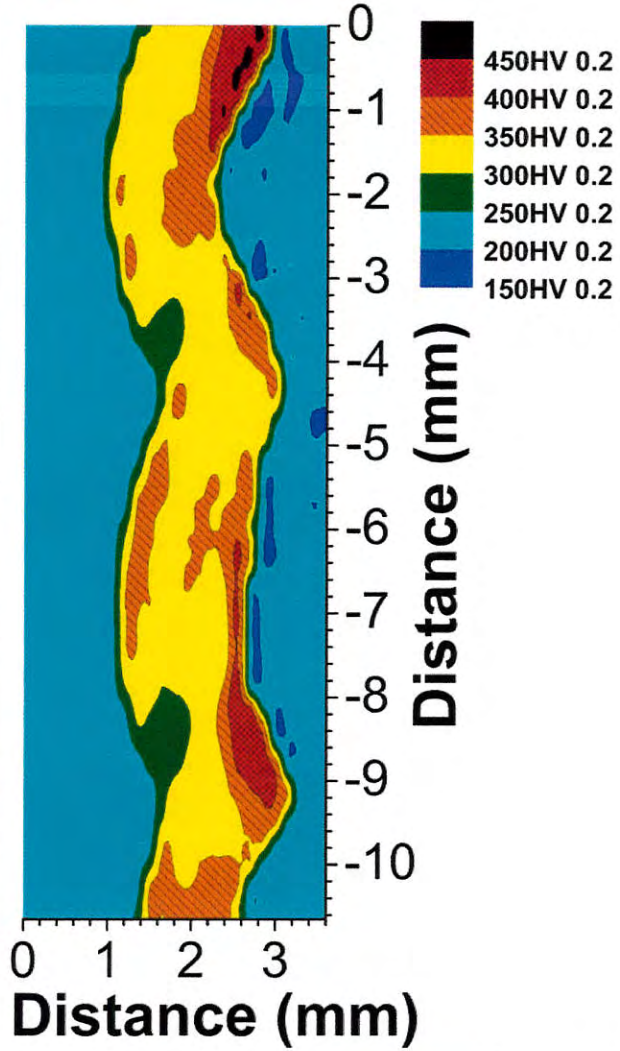
Weldment 10B [ENiCrFe-2, TBW]

Hardness Assessment – HAZ Hardness Map







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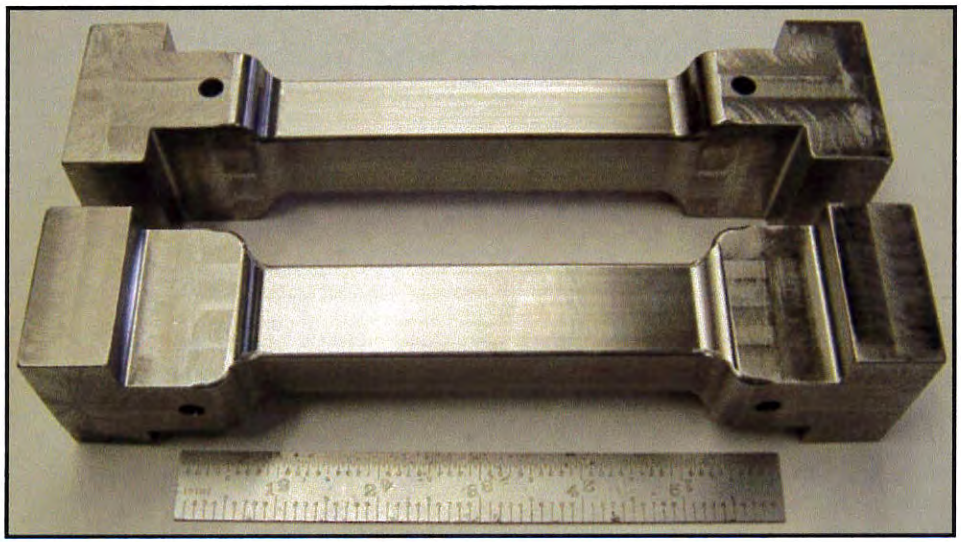
Machined and Tested Creep Samples

Creep testing being conducted at 625°C, 80MPa (~5,000 hr life)



Samples include the entirety of the weld metal and temperbead layers on either side of the weld

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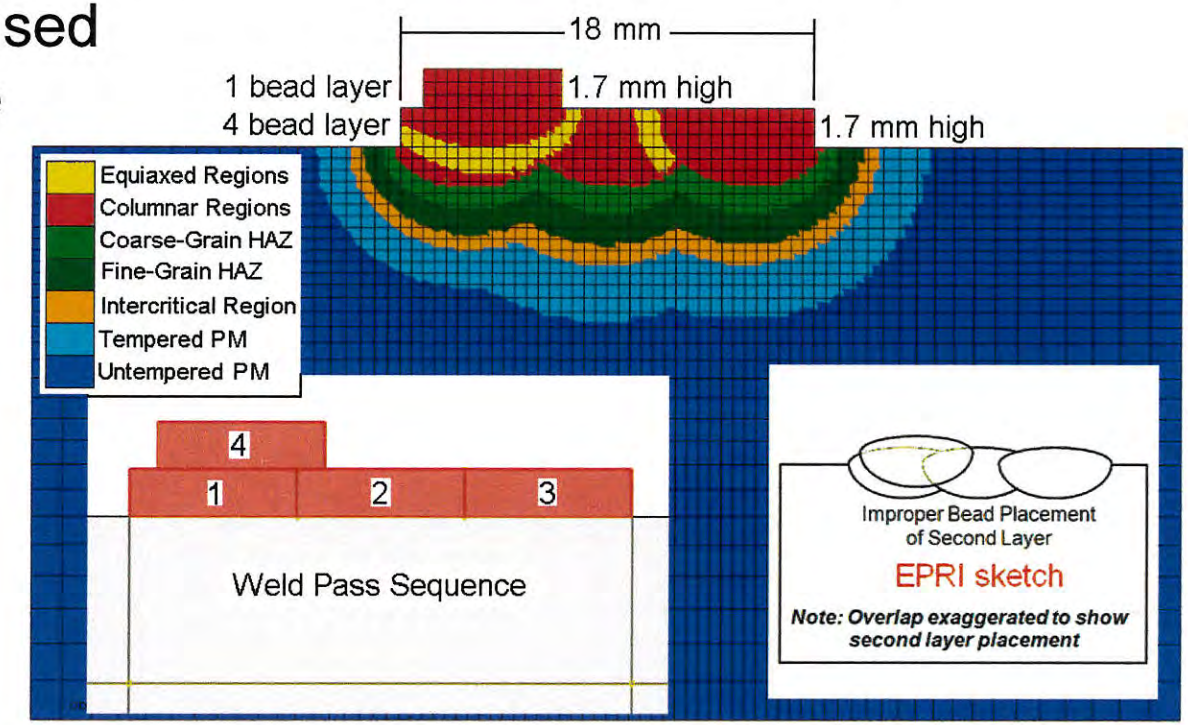
Modeling

- Modeling in Phase 1 is being conducted to understand procedure issues associated with temperbead welding (i.e. bead overlap, bead placement and electrode size)
- Modeling is focused in identifying the position and influence of overlapping thermal cycles



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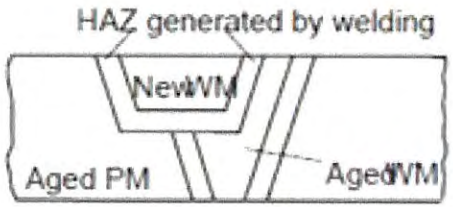
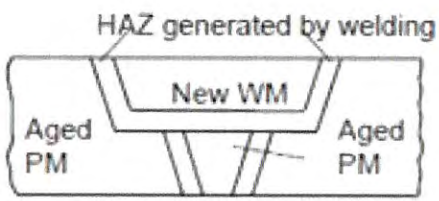
Phase 2 – Application of Best Option Repair Method(s) to Ex-service Header

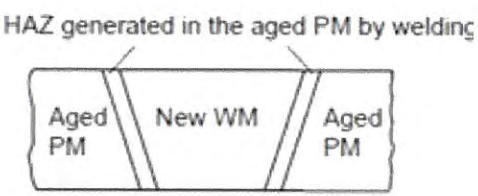
- Discussion of methods and extent of excavation



Minor

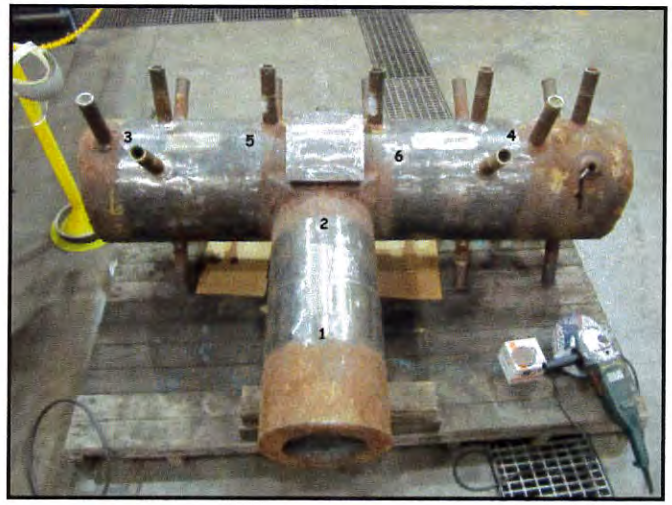


Partial



Full

- Weld procedure considerations
- Post repair evaluation of microstructure, damage, etc.
- Development of test matrix and cross-weld creep



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Conclusions

- The 20 weldments have been completed and preliminary analysis has been conducted:
  - Metallographic
  - Hardness testing and mapping
  - Statistical analysis of hardness results
- Creep testing is underway of all weldments
  - Once completed, results will be presented to NBIC
- Modeling and bead on plate studies have provided insight to "best procedure guidelines" for future Phase 2 work
- Phase 2 to being ~September/October 2012
- **Questions or comments?**

Contact Information

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- John Shingledecker, Senior Project Manager
  - 704-595-2619, jshingledecker@epri.com
- Jonathan Parker, Senior Project Manager
  - 704-595-2791, jparker@epri.com

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NBIC Subcommittee R&A Action Block

Subject Part 3, Section 3, 3.2.2 Replacement Parts – Pressure Test Requirements Prior to Installation for Pressure Parts Used in Repairs and Alterations

File Number NB12-0501 **Prop. on Pg.**

Proposal Add new paragraph 3.2.2.e. – see following page.

Explanation There are numerous occasions when ASME boiler and pressure vessel replacement parts to be used in repairs or alterations have not been pressure tested prior to installation at the test pressure required by the original code of construction. This happens for a number of reasons [e.g., impracticable to test the part in the shop (large replacement heads, shop pressure test capabilities limited), original code of construction allows shipping without test, misunderstanding of code requirements, etc]. In any case, this causes a great deal of problems for the owner, the R Certificate Holder, the Inspector and the Jurisdiction. While the data available is not well documented, it is generally agreed that there have been numerous occasions when replacement parts have been installed and the pressure retaining item allowed to operate without the part having been pressure tested at a pressure required by the original code of construction. The reasoning has generally been that the part now falls under the jurisdiction of the NBIC which, therefore, provides the owner, Inspector and Jurisdiction options not afforded under the original code of construction.

This proposal is not intended to be a "one size fits all". For example, it may not be appropriate for rerating to a different pressure or temperature. That is why it requires concurrence by the owner, the Inspector and, when required, the Jurisdiction. It does, however, clarify the options available to the owner, the Inspector and the Jurisdiction when an ASME part has not been pressure tested prior to installation at a pressure required by the original code of construction.

Project Manager J. Pillow

Task Group **TG Meeting Date**

Negatives

NBIC Subcommittee R&A Action Block

ITEM NB12-0501

Proposal: Add new paragraph:

Part 3, Section 3
Add new paragraph 3.2.2.e

e) When ASME is the original code of construction, replacement parts to be used in repairs or alterations that have not been pressure tested at the pressure required by the original code of construction prior to installation may be installed without performing the pressure test provided the owner, the Inspector and, when required, the Jurisdiction accepts the use of one or a combination of the examination and test methods shown in Part 3, Section 4, paragraph 4.4.1 (for repairs) or 4.4.2 (for alterations). The R Certificate Holder responsible for completing the R Form shall note in the Remarks section of the R Form the examination(s) and test(s) performed.

b) Replacement parts that will be subject to internal or external pressure that are preassembled by attachment welds shall have the welding performed in accordance with the original code of construction. The supplier or manufacturer shall certify that the material and fabrication are in accordance with the original code of construction. This certification shall be supplied in the form of bills of material and drawings with statement of certification. Examples include boiler furnace wall or floor panel assemblies, prefabricated openings in boiler furnace walls, such as burner openings, air ports, inspection openings, or sootblower openings;

c) When ASME is the original code of construction, replacement parts subject to internal or external pressure fabricated by welding, which require inspection by an Authorized Inspector shall be fabricated by an organization having an appropriate ASME *Certificate of Authorization*. The item shall be inspected and stamped as required by the applicable section of the ASME Code. A completed ASME *Manufacturer's Partial Data Report* shall be supplied by the manufacturer;

The "R" Certificate Holder, using replacement parts fabricated and certified to an ASME Code edition and addenda different from that used for the original construction, shall consider and seek technical advice, where appropriate, for change or conflicts in design, materials, welding, heat treatment, examinations and tests to ensure a safe repair/alteration is performed. Note that work once classified as a repair could now be considered an alteration;

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 NBIC Part 3, Section S.

Insert new 3.2.2.e here

3.2.3 DRAWINGS

As appropriate, drawings shall be prepared to describe the repair or alteration. Drawings shall include sufficient information to satisfactorily perform the repair or alteration.

3.2.4 DESIGN REQUIREMENTS FOR REPAIRS AND ALTERATIONS

a) Many repairs may not require drawings or design calculations when the original code of construction is known and drawings and/or a Manufacturer's Data Report is available;

b) The "R" Certificate Holder performing repairs and alterations shall establish the construction standard or code and sufficient controls to ensure that all required design information, applicable drawings, design calculations, specifications, and instructions are prepared, obtained, controlled, and interpreted to provide the basis for a repair or an alteration in accordance with the original code of construction. When a *Manufacturer's Data Report* is required by the original construction standard, a copy of the original data report shall be obtained, where available, for use in the design of the repair or alteration. When the original *Manufacturer's Data Report* cannot be obtained, agreements on the method of establishing design basis for the repair or alteration shall be obtained from the Inspector and the Jurisdiction, when required.

NB12-0801

Repairs and Alterations of Gasketed PHE's in the Field

By Mike Pischke

Introduction

This is intended to describe the current common industry practices of Plate Heat Exchanger (PHE) users regarding their operation, routine repairs and alterations. Because of the unique design of the PHE, the current ASME Pressure Vessel or NBIC Codes do not specifically address the design of PHE's, nor the potential alterations. The typical industries include, but not limited to the Power, Petrochemical, Maritime, HVAC, Bio-Pharmaceutical , and Food production.

Expansion and Contraction of Plate Packs

One of the primary benefits of the gasketed PHE is that the heating surface can be expanded or contracted in response to changes in fluid flow, process parameters, and/or ambient temperature variations. The plate packs are expanded or reduced due to the increase or decrease in heat transfer requirements, respectively. Also, because turbulence is necessary for effective heat transfer, the quantity of heat transfer plates are critical to ensure the proper flow rates and pressure drops during operation. This is adjusted by adding or subtracting the number of heat transfer plates. Users will often also add plates gradually as production demands are incrementally increased. This avoids the need for repeated and costly replacement of entire heat exchangers. They will also adjust the number based on seasonal temperature variations.

Code Implications: Although the Code does not specifically address the addition or removal of heat transfer plates, this has indirect Code implications. Adding or subtracting plates in no way affects the specific design parameters of Pressure and Temperature, but does change the volume of the heat exchanger and the heat transfer surface area. Unless someone counts every single plate in a PHE and compares it to the number listed on the Data Report, it would not be obvious that a change was made.

Gasket Replacement

The expected life of gaskets within a PHE plate pack may vary from one year to decades; based upon the gasket material selection, process fluid(s), operating parameters, and environmental conditions. Ideally, the gasket replacement coincides with the routine cleaning of the heat transfer plates. At this time, the entire plate pack is removed from the frame, the gaskets removed from the plates, then the plates are mechanically and/or chemically cleaned. The cleaned plates are then re-gasketed using new gaskets. Glued gaskets are typically removed using liquid nitrogen prior to cleaning. After re-gasketing, the plate pack is returned to the frame and typically hydrostatically or pneumatically tested at the MAWP.

1/2

Code Implications: Although the ASME Code does not directly address gaskets or gasket materials, the practical operating parameters are typically limited by the gasket material. Maximum operating temperatures are determined by the degradation rate of the gasket material, and the MAWP set by an adjusted test pressure when the particular gasket-heat transfer plate combination will begin to leak.

Heat Transfer Plate Replacement

Under normal operating conditions, heat transfer plates should last for decades in service. Heat transfer plates typically need to be replaced due to deformation from opening and closing, corrosion, fatigue, and/or fouling. When being replaced, they may be replaced using plates from a different manufacturer and even a different material from the original Code stamped unit. For example, if the original plates were made from 0.4mm thick, 304 stainless steel and they corroded over time due to chloride attacks, the user may choose to replace the corroded plates with something more resistant. Perhaps they would replace these plates with 316L plates and even increase the thickness to 0.5mm. This is a common practice.

Another common practice is to have multiple, identical PHE's in a chemical production facility and rotate out spare plate packs as the glued gaskets break down and need to be replaced over time. Spare plate packs with glued gaskets are kept in stock at the facility, waiting to be swapped out with the plates in production. This allows the chemical company's maintenance personnel to swap out a plate pack during a brief shut down period. The removed plate pack is re-conditioned by cleaning, removing the gaskets and gluing on new gaskets. These plate packs now become the new spares. This allows them to re-use the heat transfer plates which are often made from expensive materials such as nickel alloys, or titanium.

Code Implications: Heat Transfer plates and laser welded cassettes are considered UG-11 "Standard Pressure Parts" per Interpretations VIII-1-89-236 and VIII-1-95-21. There is also an Interpretation (VIII-81-89R) that allows the heat transfer plates to be made from non-Code material. Beyond these Interpretations, there are no rules regarding the material of the heat transfer plates. Because the heat transfer plates are contained between the frame plates, the strength of the PHE relies on the bolts and frame plates and never the strength of the heat transfer plates.

2/2

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OF BOILER AND
PRESSURE VESSEL
INSPECTORS

NB13-0501

November 8, 2012

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THE NATIONAL BOARD OF
BOILER & PRESSURE VESSEL
INSPECTORS

Secretary, NBIC Committee
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Ave.
Columbus, OH 43229

Please accept this letter as a request for an addition to an existing figure in NBIC Part 3, Section 3.

Part 3, Figure 3.3.4.6-b addresses the tube window patching method. I would suggest adding a cautionary or informational note to the existing text in the figure such as – "Note: Air currents within the tube (i.e. a chimney effect) may affect the retention of the shielding gas at the welding arc when using the gas tungsten-arc welding process on the inside of the tube."

Statement of need and background:
Users of the NBIC should benefit from the experience of others, when possible. Someone performing the tube window patch for the first time should be made aware of the possibility of air currents within the tube. They can then take the necessary steps to eliminate or diminish those effects so as to avoid porosity or other defects in the weld.

Respectfully submitted,

John Hoh
Senior Staff Engineer

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Repair and Alteration

1/1 (82)

SC PRD

Attachment 4

SC-PRD ITEM NB11-0401, Draft 4-25-12

Open Issues:

1. Editorial items
    A. Renumbering needs to be checked
    B. All cross references need to be checked/updated
    C. Index not complete
    D. Several tables did not import correctly

Organizational Comments:
1. Part 3 supplement 7 has been changed to main body text, and rearranged for flow
2. Administrative requirements moved after general repair requirements

Editorial/ other comments
1. Safety valve and safety relief valve changed to "pressure relief valve" where appropriate
2. "mounted" changed to "installed" in numerous locations
3. Organic fluid heater pressure relief requirements expanded based upon Section I of ASME Code
4. Does not include NBIC changes that have been approved by the committee but not yet published

Key:

Italics indicate new material written for this draft

~~Strikethrough~~ indicates deleted material

(Parenthetical notes are for information only, and are not to be included in publications)

Document: NBIC Part 4 draft4-12.doc

NBIC PART 4

PRESSURE RELIEF DEVICES

Table of Contents
(TO BE COMPLETED)

INTRODUCTION

This Part of the NBIC addresses requirements for the installation, in-service inspection, and repair of pressure relief devices used for the overpressure protection of pressure retaining items (PRI).

(NOTE: Include Forward, Committee member Information, copyright information, introduction (up to XVIII), table of contents (All as part of Introduction)
Also include information on jurisdictional oversight. Part 1, Par 1.1 through 1.4.4
Glossary, Interpretations, Index to be at end of document)

National Board Inspection Code
2013 Edition
Date of Issue — July 31, 2013

This code was developed under procedures accredited as meeting the criteria for American National Standards. The Consensus Committee that approved the code was balanced to ensure that individuals from competent and concerned interests had an opportunity to participate. The proposed code was made available for public review and comment, which provided an opportunity for additional public input from industry, academia, regulatory and jurisdictional agencies, and the public-at-large.

The National Board does not "approve," "rate," or "endorse" any item, construction, proprietary device, or activity.

The National Board does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable Letters Patent, nor assume any such liability. Users of a code are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code.

The National Board accepts responsibility for only those interpretations issued in accordance with governing National Board procedures and policies that preclude the issuance of interpretations by individual committee members.

The footnotes in this document are part of this American National Standard.

R

NR

R

R

®

The above National Board symbols are registered with the US Patent Office.

"National Board" is the abbreviation for The National Board of Boiler and Pressure Vessel Inspectors.

Foreword

The National Board of Boiler and Pressure Vessel Inspectors is an organization comprised of Chief Inspectors for the states, cities, and territories of the United States and provinces and territories of Canada. It is organized for the purpose of promoting greater safety to life and property by securing concerted action and maintaining uniformity in post-construction activities of pressure-retaining items, thereby ensuring acceptance and interchangeability among Jurisdictional authorities responsible for the administration and enforcement of various codes and standards.

In keeping with the principles of promoting safety and maintaining uniformity, the National Board originally published The NBIC in 1946, establishing rules for inspection and repairs to boilers and pressure vessels. The National Board Inspection Code (NBIC) Committee is charged with the responsibility for maintaining and revising the NBIC. In the interest of public safety, the NBIC Committee decided, in 1995, to revise the scope of the NBIC to include rules for installation, inspection, and repair or alteration to boilers, pressure vessels, piping, and nonmetallic materials.

In 2007, the NBIC was restructured into three Parts specifically identifying important postconstruction activities involving safety of pressure-retaining items. This restructuring provides for future expansion, transparency, and uniformity, ultimately improving public safety.

The NBIC Committee's function is to establish rules of safety governing post-construction activities for the installation, inspection and repair and alteration of pressure-retaining items, and to interpret these rules when questions arise regarding their intent. In formulating the rules, the NBIC Committee considers the needs and concerns of individuals and organizations involved in the safety of pressure-retaining items. The objective of the rules is to afford reasonably certain protection of life and property, so as to give a reasonably long, safe period of usefulness. Advancements in design and material and the evidence of experience are recognized.

The rules established by the NBIC Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design, or as limiting in any way an organization's freedom to choose any method that conforms to the NBIC rules.

The NBIC Committee meets regularly to consider revisions of existing rules, formulation of new rules, and respond to requests for interpretations. Requests for interpretation must be addressed to the NBIC Secretary in writing and must give full particulars in order to receive Committee consideration and a written reply. Proposed revisions to the Code resulting from inquiries will be presented to the NBIC Committee for appropriate action.

Proposed revisions to the Code approved by the NBIC Committee are submitted to the American National Standards Institute and published on the National Board Web site to invite comments from all interested persons. After the allotted time for public review and final approval the new edition is published.

Organizations or users of pressure-retaining items are cautioned against making use of revisions that are less restrictive than former requirements without having assurance that they have been accepted by the Jurisdiction where the pressure-retaining item is installed.

The general philosophy underlying the NBIC is to parallel those provisions of the original code of construction, as they can be applied to post-construction activities.

The NBIC does not contain rules to cover all details of post-construction activities. Where complete details are not given, it is intended that individuals or organizations, subject to the acceptance of the Inspector and Jurisdiction when applicable, provide details for postconstruction activities that will be as safe as otherwise provided by the rules in the original Code of Construction.

Activities not conforming to the rules of the original code of construction or the NBIC must receive specific approval of the Jurisdiction, who may establish requirements for design,

construction, inspection, testing, and documentation.
There are instances where the NBIC serves to warn against pitfalls; but the Code is not a handbook, and cannot substitute for education, experience, and sound engineering judgment.
It is intended that this Edition of the NBIC not be retroactive. Unless the Jurisdiction imposes the use of an earlier edition, the latest effective edition is the governing document.

Introduction

It is the purpose of the National Board Inspection Code (NBIC) to maintain the integrity of pressure-retaining items by providing rules for installation, and after the items have been placed into service, by providing rules for inspection and repair and alteration, thereby ensuring that these items may continue to be safely used.
The NBIC is intended to provide rules, information and guidance to manufacturers, Jurisdictions, inspectors, owner-users, installers, contractors, and other individuals and organizations performing or involved in post-construction activities, thereby encouraging the uniform administration of rules pertaining to pressure-retaining items.

Scope

The NBIC recognizes three important areas of post-construction activities where information, understanding, and following specific requirements will promote public and personal safety. These areas include:
• Installation
• Inspection
• Repairs and Alterations
The NBIC provides rules, information, and guidance for post-construction activities, but does not provide details for all conditions involving pressure-retaining items. Where complete details are not provided in this Code, the Code user is advised to seek guidance from the Jurisdiction and from other technical sources.
The words shall, should, and may are used throughout the NBIC and have the following intent:
• Shall – action that is mandatory and required.
• Should – indicates a preferred but not mandatory means to accomplish the requirement unless specified by others such as the Jurisdiction.
• May – permissive, not required or a means to accomplish the specified task.

Organization

The NBIC is organized into three Parts to coincide with specific post-construction activities involving pressure-retaining items. Each Part provides general and specific rules, information, and guidance within each applicable post-construction activity. Other NBIC Parts or other published standards may contain additional information or requirements needed to meet the rules of the NBIC. Specific references are provided in each Part to direct the user where to find this additional information. NBIC Parts are identified as:
• Part 1, Installation – This Part provides requirements and guidance to ensure all types of pressure-retaining items are installed and function properly. Installation includes meeting specific safety criteria for construction, materials, design, supports, safety devices, operation, testing, and maintenance.
• Part 2, Inspection – This Part provides information and guidance needed to perform and document inspections for all types of pressure-retaining items. This Part includes information on personnel safety, non-destructive examination, tests, failure mechanisms, types of pressure equipment, fitness for service, risk-based assessments, and performance-based standards.

• Part 3, Repairs and Alterations – This Part provides information and guidance to perform, verify, and document acceptable repairs or alterations to pressure-retaining items regardless of code of construction. Alternative methods for examination, testing, heat treatment, etc., are provided when the original code of construction requirements cannot be met. Specific acceptable and proven repair methods are also provided.
• *Part 4, Pressure Relief Devices – This part provides information and guidance on the installation, inservice inspection and repair of pressure relief devices.*

Each NBIC Part is divided into major Sections as outlined in the Table of Contents. Tables, charts, and figures provide relevant illustrations or supporting information for text passages, and are designated with numbers corresponding to the paragraph they illustrate or support within each Section. Multiple tables, charts, or figures referenced by the same paragraph will have additional letters reflecting the order of reference. Tables, charts, and figures are located in or after each major Section within each NBIC Part.

Text Identification and Numbering
Each page in the text will be designated in the top header with the publication's name, part number, and part title. The numbering sequence for each section begins with the section number followed by a dot to further designate major sections (e.g., 1.1, 1.2, 1.3). Major sections are further subdivided using dots to designate subsections within that major section (e.g., 1.1.1, 1.2.1, 1.3.1). Subsections can further be divided as necessary.
Paragraphs under sections or subsections shall be designated with small letters in parenthesis (e.g., a), b), c)) and further subdivided using numbers in parenthesis (e.g., 1), 2), 3)). Subdivisions of paragraphs beyond this point will be designated using a hierarchical sequence of letters and numbers followed by a dot.
Example:
2.1 Major Section
2.1.1 Section
2.1.2 Section
2.1.2. Subsection
a) paragraph
b) paragraph
1) subparagraph
2) subparagraph
a. subdivisions
1. subdivisions
2. subdivisions
b. subdivisions
1. subdivisions
2. subdivisions
Tables and figures will be designated with the referencing section or subsection identification. When more than one table or figure is referenced in the same section or subsection, letters or numbers in sequential order will be used following each section or subsection identification.

Supplements
Supplements are contained in each Part of the NBIC to designate information only pertaining to a specific type of pressure-retaining item (e.g., Locomotive Boilers, Historical Boilers, Graphite Pressure Vessels.) Supplements follow the same numbering system used for the main text only preceded by the Letter "S." Each page of the supplement will identify the supplement number and name in the top heading.

Interpretations
On request, the NBIC Committee will render an interpretation of any requirement of this Code. Interpretations are provided for each Part and are specific to the Code edition and addenda referenced in the interpretation. Interpretations provide information only and are not part of this Code.

Jurisdictional Precedence
Reference is made throughout this Code to the requirements of the "Jurisdiction." Where any provision herein presents a direct or implied conflict with any jurisdictional regulation, the Jurisdictional regulation shall govern.

Units of Measurement
Both U.S. customary units and metric units are used in the NBIC. The value stated in U.S. customary units or metric units are to be regarded separately as the standard. Within the text, the metric units are shown in parentheses. In Supplement 6, Parts 2 and 3, Continued Service and Inspection of DOT Transport Tanks, the metric units are shown first with the U.S. customary units shown in parentheses.
U.S. customary units or metric units may be used with this edition of the NBIC, but one system of units shall be used consistently throughout a repair or alteration of pressure-retaining items. It is the responsibility of National Board accredited repair organizations to ensure the appropriate units are used consistently throughout all phases of work. This includes materials, design, procedures, testing, documentation, and stamping. The NBIC policy for metrication is outlined in each part of the NBIC.

Accreditation Programs
The National Board administers and accredits three specific repair programs as shown below:
"R".....Repairs and Alterations to Pressure-Retaining Items
"VR".....Repairs to Pressure Relief Valves
"NR".....Repair and Replacement Activities for Nuclear Items
Part 3, Repairs and Alterations, of the NBIC describes the administrative requirements for the accreditation of "R" and NR" repair organizations. Requirements for "VR" repair organziations are included in Part 4.

The National Board also administers and accredits four specific inspection agency programs as shown below:
New Construction
Criteria for Acceptance of Authorized Inspection Agencies for New Construction (NB-360)

Inservice
Qualifications and Duties for Authorized Inspection Agencies (AIAs) Performing Inservice Inspection Activities and Qualifications for Inspectors of Boilers and Pressure Vessels (NB-369)
Owner-User
Accreditation of Owner-User Inspection Organizations (OUIO) (NB-371) Owners or users may be accredited for both a repair and inspection program provided the requirements for each accreditation program are met.

Federal Government

Qualifications and Duties for Federal Inspection Agencies Performing Inservice Inspection Activities (FIAs) (NB-390)
These programs can be viewed on the National Board Web site. For questions or further information regarding these programs contact:
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229-1183
Phone — 614.888.8320
Fax — 614.847.1828
Web site — www.nationalboard.org

Certificates of Authorization for Accreditation Programs
Any organization seeking an accredited program may apply to the National Board to obtain a Certificate of Authorization for the requested scope of activities. A confidential review shall be conducted to evaluate the organization's quality system. Upon completion of the evaluation, a recommendation will be made to the National Board regarding issuance of a Certificate of Authorization.
Certificate of Authorization scope, issuance, and revisions for National Board accreditation programs are specified in the applicable National Board procedures. When the quality system requirements of the appropriate accreditation program have been met, a Certificate of Authorization and appropriate National Board symbol stamp shall be issued.
1 Caution, some Jurisdictions may independently administer a program of authorization for organizations to perform repairs and alterations within that Jurisdiction.

INSTALLATION of Pressure Relief Devices

(previously in Part 1)

1.0 Installation of Pressure Relief Devices

The correct selection of appropriate pressure relief devices (PRDs) and the proper installation of those devices are critical to the safe operation of pressure retaining Items. Following are requirements for the installation of pressure relief devices for protection of different types of pressurized equipment. See NBIC Part 1 for general installation requirements.

1.1.1 ~~2.9.1~~ Pressure Relief Devices — Definitions

a) Pressure Relief Device: A device designed to prevent pressure or vacuum from exceeding a predetermined value in a pressure by the transfer of fluid during emergency or abnormal conditions.
b) Pressure Relief Valve (PRV): A pressure relief device designed to actuate on inlet static pressure and reclose after normal conditions have been restored.
c) Safety valve: A pressure relief valve characterized by rapid opening and normally used to relief compressible fluids.
d) Safety relief valve: A pressure relief valve characterized by rapid opening or by gradual opening that is generally proportional to the increase in pressure. It can be used for compressible or incompressible fluids.
e) Relief valve; A pressure relief valve characterized by gradual opening that is generally proportional to the increase in pressure. It is normally used for incompressible fluids.
f) Pilot operated pressure relief valve: A pressure relief valve in which the disk is held closed by system pressure, and the holding pressure is controlled by a pilot valves actuated by system pressure.

1.1.1.1 ~~*1.4*~~ ***Additional*** **DEFINITIONS RELATING TO PRESSURE RELIEF DEVICES**

Unless otherwise specified in these rules and procedures, the definitions relating to pressure relief devices in Section 2 of ASME PTC25-2008 shall apply.

1.1 ~~2.9~~ Pressure Relief Valves *For Boilers*

See NBIC Part 1, par. 2.2 for the boilers covered under this section.

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

1.1.1.1 ~~2.9.1.1~~ Number

At least one National Board capacity certified *pressure* ~~safety or safety~~ relief valve shall be installed on the boiler. If the boiler has more than 500 sq. ft. (46 sq. m.) of heating surface, or if an electric boiler has a

power input of more than 3.76 million BTU/hr (1100 kW), two or more National Board capacity certified pressure ~~safety or safety~~ relief valves shall be installed.

1.1.1.2 ~~2.9.1.2~~ Location

a) Pressure ~~Safety or safety~~ relief valves shall be placed on, or as close as physically possible, to the boiler proper.
b) Pressure ~~Safety or safety~~ relief valves shall not be placed on the feedline.
c) Pressure ~~Safety or safety~~ relief valves shall be connected to the boiler independent of any other connection without any unnecessary intervening pipe or fittings. Such intervening pipe or fittings shall not be longer than the face-to-face dimension of the corresponding tee fitting of the same diameter and pressure rating as listed in the applicable standards.

1.1.1.3 ~~2.9.1.3~~ Capacity

a) The pressure-relieving valve capacity for each boiler shall be such that the valve or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than 6% above the highest pressure at which any valve is set and in no case to more than 6% above the maximum allowable working pressure of the boiler.
b) The minimum relieving capacity for other than electric boilers and forced-flow steam generators with no fixed steam line and waterline shall be estimated for the boiler and waterwall heating surfaces as given in Table 1.1.1.3 ~~2.9.1.3~~, but in no case should the minimum relieving capacity be less than the maximum designed steaming capacity as determined by the manufacturer.
c) The required relieving capacity in pounds per hour of the pressure ~~safety or safety~~ relief valves on a high temperature water boiler shall be determined by dividing the maximum output in Btu at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by one thousand.
d) The minimum pressure ~~safety or safety~~ relief valve relieving capacity for electric boilers is 3.5 lbs/hr/kW (1.6 kg/hr/kW) input.
e) If the pressure ~~safety or safety~~ relief valve capacity cannot be computed, or if it is desirable to prove the computations, it should be checked by any one of the following methods; and if found insufficient, additional relieving capacity shall be provided:
1) By performing an accumulation test, that is, by shutting off all other steam discharge outlets from the boiler and forcing the fires to the maximum. This method should not be used on a boiler with a superheater or reheater or on a high temperature water boiler.
2) By measuring the maximum amount of fuel that can be burned and computing the corresponding evaporative capacity upon the basis of the heating value of the fuel.
3) By determining the maximum evaporative capacity by measuring the feedwater.
The sum of the safety valve capacities marked on the valves shall be equal to or greater than the maximum evaporative capacity of the boiler. This method should not be used on high temperature water boilers.

Table 1.1.1.3 ~~2.9.1.3~~ - Minimum Pounds of steam per hour per square foot of Heating Surface lb steam/hr/sq.ft (kg/hr/sq m)

	Firetube Boilers	**Watertube Boilers**
Boiler heating surface		
Hand-fired	5 (24)	6(29)
stoker-fired	7 (34)	8 (39)
oil, gas, or pulverized fuel-fired	8 (39)	10 (49)
Waterwall heating surface		
hand-fired	8 (39)	8 (39)
stoker-fired	10 (49)	12 (59)
oil, gas, or pulverized fuel-fired	14 (68)	16 (78)
Copper-finned watertubes		
hand-fired		4 (20)
stoker-fired		5 (24)
oil, gas, or pulverized fuel-fired		6 (29)

NOTES:

• When a boiler is fired only by a gas having a heat value not in excess of 200 Btu/cu.ft.(7.5MJ/cu. m), the minimum relieving capacity should be based on the values given for hand-fired boilers above.
• The heating surface shall be computed for that side of the boiler surface exposed to the products of combustion, exclusive of the superheating surface. In computing the heating surface for this purpose only the tubes, fireboxes,shells, tubesheets, and the projected area of headers need to be considered, except that for vertical firetube steam boilers, only that portion of the tube surface up to the middle gage cock is to be computed.
• For firetube boiler units exceeding 8000 Btu/ft.2 (9085 J/cm.2) (total fuel Btu (J) Input divided by total heating surface), the factor from the table will be increased by 1 (4.88) for every 1000 Btu/ft.2 (1136 J/cm.2) above 8000 Btu/ft.2 (9085 J/cm.2) For units less than 7000 Btu/ft.2 (7950 J/cm.2), the factor from the table will be decreased by 1 (7950 J/cm.2).
• For watertube boiler units exceeding 16000 Btu/ft.2 (18170 J/cm.2)(total fuel BTU input divided by the total heating surface) the factor from the table will be increased by 1 (4.88) for every 1000 Btu/ft.2 (1136 J/cm.2) above 16000 Btu/ft.2 (18170 J/cm.2). For units with less than 15000 Btu/ft.2 (17034 J/cm.2), the factor in the table will be decreased by 1 (4.88) for every 1000 Btu/ft.2 (1136 J/cm.2) below 15000 Btu/ft.2 (17034 J/cm.2).

1.1.1.4 ~~2.9.1.4~~ Set Pressure

One or more pressure ~~safety or safety~~ relief valves on the boiler proper shall be set at or below the maximum allowable working pressure. If additional valves are used, the highest pressure setting shall not exceed the maximum allowable working pressure by more than 3%. The complete range of pressure settings of all the pressure ~~safety~~ relief valves on a boiler shall not exceed 10% of the highest pressure to which any valve is set. Pressure setting of pressure ~~safety~~ relief valves on high temperature water boilers may exceed this 10% range.

1.1.2 ~~2.9.2~~ Forced-Flow Steam Generator

For a forced-flow steam generator with no fixed steamline and waterline, equipped with automatic controls and protective interlocks responsive to steam pressure, pressure relief ~~safety~~ valves may be provided in accordance with the above paragraphs identified in 2.9.1 or the following protection against overpressure shall be provided:
a) One or more power-actuated pressure-relieving valves shall be provided in direct boiler is under pressure and shall receive a control impulse to open when the maximum allowable working pressure at the superheater outlet is exceeded. The total combined relieving capacity of the power actuated pressure-relieving valves shall be not less than 10% of the maximum design steaming capacity of the boiler under any operating condition as determined by the manufacturer. The valves shall be located in the pressure part system where they will relieve the overpressure. An isolating stop valve of the outside-screw-and-yoke type should be installed between the power actuated pressure-relieving valve and the boiler to permit repairs provided an alternate power-actuated pressure-relieving valve of the same capacity is so installed as to be in direct communication with the boiler.
b) Spring-loaded safety valves shall be provided having a total combined relieving capacity, including that of the power-actuated pressure-relieving valve, of not less than 100% of the maximum designed steaming capacity of the boiler, as determined by the manufacturer. In this total, credit in excess of 30% of the total relieving capacity shall not be allowed for the power-actuated pressure-relieving valves actually installed. Any or all of the spring-loaded safety valves may be set above the maximum allowable working pressure of the parts to which they are connected, but the set pressures shall be such that when all these valves (together with the power-actuated pressure-relieving valves) are in operation the pressure will not rise more than 20% above the maximum allowable working pressure of any part of the boiler, except for the steam piping between the boiler and the prime mover.
c) When stop valves are installed in the water steam flow path between any two sections of a forced-flow steam generator with no fixed steamline and waterline:
1) The power-actuated pressure-relieving valve shall also receive a control impulse to open when the maximum allowable working pressure of the component, having the lowest pressure level upstream to the stop valve, is exceeded.
2) The spring-loaded safety valve shall be located to provide overpressure protection for the component having the lowest working pressure.
3) A reliable pressure-recording device shall always be in service and records kept to provide evidence of conformity to the above requirements.

1.1.3 ~~2.9.3~~ Superheaters

a) Every attached superheater shall have one or more safety valves. The location shall be suitable for the service intended and shall provide the overpressure protection required. The pressure drop upstream of each safety valve shall be considered in determining the set pressure and relieving capacity of that valve. If the superheater outlet header has a full, free steam passage from end to end and is so constructed that steam is supplied to it at practically equal intervals throughout its length so that there is a uniform flow of steam through the superheater tubes and the header, the safety valve or valves may be located anywhere in the length of header.
b) The pressure-relieving capacity of the safety valve or valves on an attached superheater shall be included in determining the number and size of the safety valves for the boiler provided there are no intervening valves between the superheater safety valve and the boiler and the discharge capacity of the pressure ~~safety~~ relief valve or valves, on the boiler, as distinct from the superheater, is at least 75% of the aggregate capacity required.
c) Every independently fired superheater that may be shut off from the boiler and permit the superheater to become a fired pressure vessel shall have one or more safety valves having a discharge capacity equal to six pounds of steam per hr/sq. ft. (29 kg per hr per sq. m) of superheater surface measured on the side exposed to the hot gases.
d) Every safety valve used on a superheater discharging superheated steam at a temperature over 450°F (230°C) shall have a casing, including the base, body, bonnet, and spindle constructed of steel, steel alloy, or equivalent heat-resistant material. The valve shall have a flanged inlet connection or a welding-end inlet connection. The seat and disk shall be constructed of suitable heat-erosive and corrosive-resistant material, and the spring fully exposed outside of the valve casing so that it is protected from contact with the escaping steam.

1.1.4 ~~2.9.4~~ ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a pressure ~~safety~~ relief valve. Economizers that may be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one pressure relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the pressure ~~safety~~ relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (Joules/hr) of the economizer, and will be determined from manufacturer data, divided by 1000. The pressure relief valve shall be located as close as possible to the economizer outlet.

1.1.5 ~~2.9.5~~ Pressure-Reducing Valves

a) Where pressure-reducing valves are used, one or more pressure ~~safety or safety~~ relief valves shall be installed on the low pressure side of the reducing valve in those installations where the piping or equipment on the low pressure side does not meet the requirements for the steam supply piping.
b) The pressure ~~safety or safety~~ relief valves shall be located as close as possible to the pressure reducing valve.
c) Capacity of the pressure ~~safety or safety~~ relief valves shall not be less than the total amount of steam that can pass from the high pressure side to the low pressure side and be such that the pressure rating of the lower pressure piping or equipment shall not be exceeded.
d) The use of hand-controlled bypasses around reducing valves is permissible. The bypass around a reducing valve may not be greater in capacity than the reducing valve unless the piping or equipment is adequately protected by pressure ~~safety or safety~~ relief valves or meets the requirements of the high pressure system.
e) See Supplement XX1 (check x-ref) for additional information on the calculation of the required capacity of pressure relief valves installed after pressure-reducing valves.

1.1.6 ~~2.9.6~~ Installation ~~Mounting~~ and Discharge Requirements

a) Every boiler shall have outlet connections for the pressure relief valve, or valves, independent of any other outside steam connection, the area of opening shall be at least equal to the aggregate areas of inlet connections of all of the attached pressure relief valves. An internal collecting pipe, splash plate, or pan should be used, provided the total area for inlet of steam thereto is not less than twice the aggregate areas of the inlet connections of the attached pressure relief valves. The holes in such collecting pipes shall be at least 1/4 in. (6 mm) in diameter, and the least dimension in any other form of

opening for inlet of steam shall be 1/4 in. (6 mm). If pressure relief valves are attached to a separate steam drum or dome, the opening between the boiler proper and the steam drum or dome shall be not less than 10 times the total area of the safety valve inlet.
b) Every pressure relief valve shall be connected so as to stand in an upright position with spindle vertical.
c) The opening or connection between the boiler and the pressure relief valve shall have at least the area of the valve inlet. No valve of any description should be placed between the pressure relief valves and the boiler, nor on the discharge pipe between the pressure relief valves and the atmosphere. When a discharge pipe is used, the cross-sectional area shall not be less than the full area of the valve outlet or of the total of the areas of the valve outlets, discharging thereinto and shall be as short and straight as possible and arranged to avoid undue stresses on the valve or valves.
d) When two or more safety valves are used on a boiler, they should be mounted either separately or as twin valves made by placing individual valves on Y-bases, or duplex valves having two valves in the same body casing. Twin valves made by placing individual valves on Y-bases or duplex valves having two valves in the same body shall be of equal size.
e) When two valves of different sizes are *installed* ~~mounted~~ singly, the relieving capacity of the smaller valve shall not be less than 50% of that of the larger valve.
f) When a boiler is fitted with two or more pressure relief valves on one connection, this connection to the boiler shall have a cross sectional area not less than the combined areas of inlet connections of all the pressure relief valves with which it connects.
g) All pressure relief valves shall be piped to a safe point of discharge so located or piped as to be carried clear from running boards or platforms. Ample provision for gravity drain shall be made in the discharge pipe at or near each pressure relief valve, and where water or condensation may collect. Each valve shall have an open gravity drain through the casing below the level of the valve seat. For iron- and steel bodied valves exceeding NPS 2 (DN 50), the drain hole shall be tapped not less than NPS 3/8 (DN 10).
h) Discharge piping from pressure relief valves on high temperature water boilers shall have adequate provisions for water drainage as well as steam venting.
i) If a muffler is used on a pressure relief valve, it shall have sufficient outlet area to prevent back pressure from interfering with the proper operation and discharge capacity of the valve. The muffler plates or other devices shall be so constructed as to avoid a possibility of restriction of the steam passages due to deposits. Mufflers shall not be used on high temperature water boiler pressure relief valves.

1.1.6.1 ~~2.3.1~~ SUPPORTS, FOUNDATIONS, AND SETTINGS

Each boiler *pressure relief valve* and its associated piping must be safely supported. Design of supports, foundations, and settings shall consider vibration (including seismic where necessary), movement (including thermal movement), and loadings (including *reaction forces* ~~the weight of water during a hydrostatic test~~) in accordance with jurisdictional requirements, manufacturer's recommendations, and/or other industry standards, as applicable. (adapted from Part 1, 2.3.1)

1.1.7 ~~2.2.12.7~~ *Pressure Relief Valves* for Thermal Fluid Heaters

f. Pressure Relief Valves — Pressure relief valves shall be a closed bonnet design with no manual lift lever. A valve body drain is not required.
The pressure relief discharge should be connected to a closed, vented storage tank or blowdown tank with solid piping (no drip pan elbow, or other air gap). When outdoor discharge is used, the following should be considered for discharge piping at the point of discharge:
1. Both thermal and chemical reactions (personnel hazard)
2. Combustible materials (fire hazard)
3. Surface drains (pollution and fire hazard)
4. Loop seal or rain cap on the discharge (keep both air and water out of the system)
5. Drip leg near device (prevent liquid collection)
6. Heat tracing for systems using high freeze point fluids (prevent blockage)

(The following was developed based upon ASME Code Section I, Part PVG)

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

8. In order to minimize the loss by leakage of material through the pressure relief valve, a rupture disk may be installed between the pressure relief valve and the vaporizer, provided the following requirements are met.
8.1 The cross - sectional area of the connection to a vaporizer shall be not less than the required relief area of the rupture disk.
8.2 The maximum pressure of the range for which the disk is designed to rupture does not exceed the opening pressure for which the pressure relief valve is set or the maximum allowable working pressure of the vessel.
8.3 The opening provided through the rupture disk, after breakage, is sufficient to permit a flow equal to the capacity of the attached valve, and there is no chance of interference with the proper functioning of the valve, but in no case shall this area be less than the inlet area of the valve.
8.4 The space between a rupture disk and the valve should be provided with a pressure gage, try cock, free vent, or a suitable telltale indicator. This arrangement permits the detection of disk rupture or leakage.
8.5 Pressure relief valve discharge capacity shall be determined from the following equation:

$W = CKAP\sqrt{M/T}$

Where
A = discharge area of pressure relief valve
C = constant for vapor that is a function of the ratio of Specific Heats $k = c_p/c_v$.

Note: Where k is not known, k = 1.001.

K = coefficient of discharge for the valve design
M = molecular weight
P = (set pressure × 1.03) + Atmosphere Pressure
T = absolute temperature at inlet, °F + 460 (°C + 273)
W = flow of vapor

The required minimum pressure relief valve relieving capacity shall be determined from the following equation:

$W = C \times H \times 0.75/h$

where
C = maximum total weight or volume of fuel burned per hour, lb (kg) or ft^3 (m^3)
H = heat of combustion of fuel, Btu/lb (J/kg) or Btu/ft^3 (J/m^3)
h = latent heat of heat transfer fluid at relieving pressure, Btu/lb (J/kg)
W = weight of organic fluid vapor generated per hour

The sum of the pressure relief valve capacities marked on the valves shall be equal to or greater than W.

1.2 ~~3.9~~ Pressure Relief Valves *for Steam Heating Boilers, Hot-Water heating boilers, Hot water supply Boilers and Potable Hot Water Heaters*

See PART 1, par. 3.2 for the scope of pressure retaining items covered by these requirements.

1.2.1 ~~3.9.1~~ Pressure Relief ~~Safety~~ Valve Requirements — general

The following general requirements pertain to the installation of ~~mounting, and connecting~~ pressure relief ~~safety~~ valves on *heating* boilers.

1.2.1.1 ~~3.9.1.1~~ *Installation of* ~~Mounting~~ *Pressure Relief* ~~Safety and Safety Relief~~ Valves for Steam Heating, Hot-Water Heating, and Hot-Water Supply Boilers

1.2.1.1.1 ~~3.9.1.1.1~~ Permissible *Installation* ~~Mounting~~

Safety valves and safety relief valves shall be located at the top side of the boiler. The top side of the boiler shall mean the highest practicable part of the boiler proper but in no case shall the safety valves be located below the normal operating level and in no case shall the safety relief valve be located below the lowest permissible water level.

They shall be connected directly to a tapped or flanged opening in the boiler, to a fitting connected to the boiler by a short nipple, to a Y-base, or to a valveless header connecting steam or water outlets on the

same boiler. Coil or header type boilers shall have the safety valve or safety relief valve located on the steam or hot water outlet end. Safety valves and safety relief valves shall be installed with their spindles vertical. The opening or connection between the boiler and any safety valve or safety relief valve shall have at least the area of the valve inlet.

1.2.1.1.2 ~~3.9.1.1.2~~ Requirements for Common Connections for Two or More Valves

a) When a boiler is fitted with two or more safety valves on one connection, this connection shall have a cross-sectional area not less than the combined areas of inlet connections of all the safety valves with which it connects.

b) When a Y-base is used, the inlet area shall be not less than the combined outlet areas. When the size of the boiler requires a safety valve or safety relief valve larger than NPS-4 (DN100), two or more valves having the required combined capacity shall be used. When two or more valves are used on a boiler, they may be single, directly attached, or *installed* ~~mounted~~ on a Y-base.

1.2.1.2 ~~3.9.1.2~~ Threaded Connections

A threaded connection may be used for attaching a valve.

1.2.1.3 ~~3.9.1.3~~ Prohibited *Installations* ~~Mountings~~

Pressure relief ~~Safety and safety relief~~ valves shall not be connected to an internal pipe in the boiler.

1.2.1.4 ~~3.9.1.4~~ Use of Shutoff Valves Prohibited

No shutoff *valve* of any description shall be placed between the safety or safety relief valve and the boiler or on discharge pipes between such valves and the atmosphere.

1.2.1.5 ~~3.9.1.5~~ *Pressure Relief* ~~Safety and Safety Relief~~ Valve Discharge Piping

a) A discharge pipe shall be used. Its internal cross-sectional area shall be not less than the full area of the valve outlet or of the total of the valve outlets discharging thereinto, and shall be as short and straight as possible and so arranged as to avoid undue stress on the valve or valves. A union may be installed in the discharge piping close to the valve outlet. When an elbow is placed on a safety or a safety relief valve discharge pipe, it shall be located close to the valve outlet downstream of the union to minimize reaction moment stress.
b) The discharge from safety or safety relief valves shall be so arranged that there will be no danger of scalding attendants. The safety or safety relief valve discharge shall be piped away from the boiler to a safe point of discharge, and there shall be provisions made for properly draining the piping. The size and arrangement of discharge piping shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the relieving devices below that required to protect the boiler.

1.2.1.6 ~~3.9.1.6~~ Temperature and Pressure Safety Relief Valves

Hot-water heating or supply boilers limited to a water temperature of 210°F (99°C) may have one or more National Board capacity certified temperature and pressure safety relief valves installed. The requirements of 3.9.1.1 through 3.9.1.5 shall be met, except as follows:
a) A Y-type fitting shall not be used.
b) If additional valves are used, they shall be temperature and pressure safety relief valves.
c) When the temperature and pressure safety relief valve is *installed* ~~mounted~~ directly on the boiler with no more than 4 in. (100 mm) maximum interconnecting piping, the valve *may* ~~should~~ be installed in the horizontal position with the outlet pointed down.

1.2.2 ~~3.9.2~~ Safety Valve Requirements for Steam *Heating* Boilers

a) Safety valves are to be manufactured in accordance with a national or international standard.
b) Each steam boiler shall have one or more National Board capacity certified safety valves of the spring pop type adjusted and sealed to discharge at a pressure not to exceed 15 psig (100 kPa).

c) No safety valve for a steam boiler shall be smaller than NPS 1/2 (DN 15). No safety valve shall be larger than NPS 4 (DN 100). The inlet opening shall have an inside diameter equal to, or greater than, the seat diameter.
d) The minimum valve capacity in pounds (kilograms) per hour shall be the greater of that determined by dividing the maximum Btu (Watts) output at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by 1000 Btu/lb (645 W/hr/kg), or shall be determined on the basis of the pounds (kilograms) of steam generated per hour per square foot (square meter) of boiler heating surface as given in Table 3.9.2. For cast-iron boilers, the minimum valve capacity shall be determined by the maximum output method. In many cases a greater relieving capacity of valves will have to be provided than the minimum specified by these rules. In every case, the requirement of 3.9.2(e) shall be met.
e) The safety valve capacity for each steam boiler shall be such that with the fuel burning equipment installed, and operated at maximum capacity, the pressure cannot rise more than 5 psig (34 kPa) above the maximum allowable working pressure.
f) When operating conditions are changed, or additional boiler heating surface is installed, the valve capacity shall be increased, if necessary, to meet the new conditions and be in accordance with 3.9.2(e). The additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.

1.2.3 ~~3.9.3~~ Safety Relief Valve Requirements for Hot Water Heating or Hot Water Supply Boilers

a) Safety relief valves are to be manufactured in accordance with a national or international standard.
b) Each hot-water heating or hot-water supply boiler shall have at least one National Board capacity certified safety relief valve, of the automatic reseating type set to relieve at or below the maximum allowable working pressure of the boiler.
c) Hot-water heating or hot-water supply boilers limited to a water temperature not in excess of 210°F (99°C) may have, in lieu of the valve(s) specified in (b) above, one or more National Board capacity certified temperature and pressure safety relief valves of the automatic reseating type set to relieve at or below the maximum allowable working pressure of the boiler.
d) When more than one safety relief valve is used on either hot-water heating or hot water supply boilers, the additional valves shall be National Board capacity certified and may have a set pressure within a range not to exceed 6 psig (40 kPa) above the maximum allowable working pressure of the boiler up to and including 60 psig (414kPa), and 5% for those having a maximum allowable working pressure exceeding 60 psig (413 kPa).
e) No safety relief valve shall be smaller than NPS 3/4 (DN 20) nor larger than NPS 4 (DN 100), except that boilers having a heat input not greater than 15,000 Btu/hr (4.4kW) should be equipped with a rated safety relief valve of NPS 1/2 (DN 15).
f) The required relieving capacity, in pounds per hour (kg/hr), of the pressure relieving device or devices on a boiler shall be the greater of that determined by dividing the maximum output in Btu (Watts) at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by 1000 Btu/lb (645 w/kg), or shall be determined on the basis of pounds (kilograms) of steam generated per hour per square foot (square meter) of boiler heating surface as given in Table
3.9.2. For cast-iron boilers, the minimum valve capacity shall be determined by the maximum output method. In many cases a greater relieving capacity of valves will have to be provided than the minimum specified by these rules. In every case, the requirements of 3.9.3(h) shall be met. When operating conditions are changed, or additional boiler heating surface is installed, the valve capacity shall be increased, if necessary, to meet the new conditions and shall be in accordance with 3.9.3(h). The additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.
h) Safety relief valve capacity for each boiler with a single safety relief valve shall be such that, with the fuel burning equipment installed and operated at maximum capacity, the pressure cannot rise more than 10% above the maximum allowable working pressure. When more than one safety relief valve is used, the over pressure shall be limited to 10% above the set pressure of the highest set valve allowed by 3.9.3(b).

1.2.4 ~~3.9.4~~ Safety Relief Valve Requirements for Potable Water Heaters

a) Each water heater shall have at least one National Board capacity certified temperature and pressure safety relief valve. No safety relief valve shall be smaller than NPS 3/4 (DN 20).
b) The pressure setting shall be less than or equal to the maximum allowable working pressure of the water heater. However, if any of the other components in the hot-water supply system (such as valves,

pumps, expansion or storage tanks, or piping) have a lesser working pressure rating than the water heater, the pressure setting for the safety relief valve(s) shall be based upon the component with the lowest maximum allowable working pressure rating. If more than one safety relief valve is used, the additional valve(s) may be set within a range not to exceed 10% over the set pressure of the first valve.
c) The required relieving capacity in Btu/hr (W) of the safety relief valve shall not be less than the maximum allowable input unless the water heater is marked with the rated burner input capacity of the water heater on the casing in a readily visible location, in which case the rated burner input capacity may be used as a basis for sizing the safety relief valves. The relieving capacity for electric water heaters shall be 3500 Btu/hr (1.0 kW) per kW of input. In every case, the following requirements shall be met. Safety relief valve capacity for each water heater shall be such that with the fuel burning equipment installed and operating at maximum capacity, the pressure cannot rise more than 10% above the maximum allowable working pressure.
d) If operating conditions are changed or additional heating surface is installed, the safety relief valve capacity shall be increased, if necessary, to meet the new conditions and shall be in accordance with the above provisions. In no case shall the increased input capacity exceed the maximum allowable input capacity. The additional valves required, on account of changed conditions, may be installed on the outlet piping providing there is no intervening valve.

1.2.4.1 ~~3.9.4.1~~ Installation

Safety relief valves shall be installed by either the installer or the manufacturer before a water heater is placed in operation.

1.2.4.2 ~~3.9.4.2~~ Permissible *Installations* ~~Mountings~~

Safety relief valves shall be connected directly to a tapped or flanged opening in the top of the water heater, to a fitting connected to the water heater by a short nipple, to a Y-base, or to a valveless header connecting water outlets on the same heater. Safety relief valves shall be installed with their spindles upright and vertical with no horizontal connecting pipe, except that, when the safety relief valve is *installed* ~~mounted~~ directly on the water heater vessel with no more than 4 in. (100 mm) maximum interconnecting piping, the valve may be installed in the horizontal position with the outlet pointed down. The center line of the safety relief valve connection shall be no lower than 4 in. (100 mm) from the top of the shell. No piping or fitting used to *install* ~~mount~~ the safety valve shall be of nominal pipe size less than that of the valve inlet.

1.2.4.3 ~~3.9.4.3~~ Requirements for Common Connection for Two or More Valves

a) When a potable water heater is fitted with two or more safety relief valves on one connection, this connection shall have a cross sectional area not less than the combined areas of inlet connections of all the safety release valves with which it connects.
b) When a Y-base is used, the inlet area shall be not less than the combined outlet areas.
c) When the size of the water heater requires a safety relief valve larger than NPS 4 (DN 100) two or more valves having the required combined capacity shall be used. When two or more valves are used on a water heater, they may be single, directly attached, or installed ~~mounted~~ on a Y-base.

1.2.4.4 ~~3.9.4.4~~ Threaded Connections

A threaded connection may be used for attaching a *pressure relief* valve.

1.2.4.5 ~~3.9.4.5~~ Prohibited *Installations* ~~Mountings~~

Pressure ~~Safety~~ relief valves shall not be connected to an internal pipe in the water heater or a cold water feed line connected to the water heater.

1.2.4.6 ~~3.9.4.6~~ Use of Shutoff Valves Prohibited

No shutoff *valve* of any description shall be placed between the safety relief valve and the water heater or on discharge pipes between such valves and the atmosphere.

1.2.4.7 ~~3.9.4.7~~ Safety Relief Valve Discharge Piping

a) When a discharge pipe is used, its internal cross-sectional area shall be not less than the full area of the valve outlet or of the total of the valve outlets discharging thereinto, and shall be as short and straight as possible and so arranged as to avoid undue stress on the valve or valves. When an elbow is placed on a safety relief discharge pipe, it shall be located close to the valve outlet.
b) The discharge from safety relief valves shall be so arranged that there will be no danger of scalding attendants. When the safety relief valve discharge is piped away from the water heater to the point of discharge, there shall be provisions for properly draining the piping and valve body. The size and arrangement of discharge piping shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the relieving devices below that required to protect the water heater.

1.2.5 ~~3.9.5~~ *Pressure Relief* ~~Safety and Safety Relief~~ Valves for Tanks and Heat Exchangers

1.2.5.1 ~~3.9.5.1~~ Steam to Hot-Water Supply

When a hot-water supply is heated indirectly by steam in a coil or pipe within the service limitations set forth in *Part 1, paragraph* 3.2, *Definitions*, the pressure of the steam used shall not exceed the safe working pressure of the hot water tank, and a safety relief valve at least NPS 1 (DN 25), set to relieve at or below the maximum allowable working pressure of the tank, shall be applied on the tank.

1.2.5.2 ~~3.9.5.2~~ High Temperature Water to Water Heat Exchanger

When high temperature water is circulated through the coils or tubes of a heat exchanger to warm water for space heating or hot-water supply, within the service limitations set forth in *Part 1, paragraph* 3.2, *Definitions*, the heat exchanger shall be equipped with one or more National Board capacity certified *pressure* ~~safety~~ relief valves set to relieve at or below the maximum allowable working pressure of the heat exchanger, and of sufficient rated capacity to prevent the heat exchanger pressure from rising more than 10% above the maximum allowable working pressure of the vessel.

1.2.5.3 ~~3.9.5.3~~ High Temperature Water to Steam Heat Exchanger

When high temperature water is circulated through the coils or tubes of a heat exchanger to generate low pressure steam, within the service limitations set forth in *Part 1, paragraph* 3.2, *Definitions*, the heat exchanger shall be equipped with one or more National Board capacity certified *pressure relief* ~~safety~~ valves set to relieve at a pressure not to exceed 15 psig (100 kPa), and of sufficient rated capacity to prevent the heat exchanger pressure from rising more than 5 psig (34 kPa) above the maximum allowable working pressure of the vessel. For heat exchangers requiring steam pressures greater than 15 psig (100 kPa), refer to *Part 1*, Section 2 or Section 4 ~~of this Part~~.

1.3 Pressure Vessel Pressure Relief Devices

See Part 1, par. 4.1 for the scope of pressure vessels covered by these requirements..

All pressure vessels shall be protected by pressure relief devices in accordance with the following requirements.

1.3.1 ~~4.5.1~~ Device Requirements

a) Pressure relief devices are to be manufactured in accordance with a national or international standard and shall be certified for capacity (or resistance to flow for rupture disk devices) by the National Board.
b) Dead weight or weighted lever pressure relief valves shall not be used.
c) An unfired steam boiler shall be equipped with pressure relief valves as required in Section 2 of this Part. (See 2.9).
d) Pressure relief devices shall be selected (i.e., material, pressure, etc.) and installed such that their proper functioning will not be hindered by the nature of the vessel's contents.

1.3.2 ~~4.5.2~~ Number of Devices

At least one device shall be provided for protection of a pressure vessel. Pressure vessels with multiple chambers with different maximum allowable working pressures shall have a pressure relief device to protect each chamber under the most severe coincident conditions.

1.3.3 ~~4.5.3~~ Location

a) The pressure relief device shall be installed directly on the pressure vessel, unless the source of pressure is external to the vessel and is under such positive control that the pressure cannot exceed the maximum overpressure permitted by the original code of construction and the pressure relief device cannot be isolated from the vessel, except as permitted by 4.5.6 e) 2) (CHECK PAR. X-REF).
b) Pressure relief devices intended for use in compressible fluid service shall be connected to the vessel in the vapor space above any contained liquid or in the piping system connected to the vapor space.
c) Pressure relief devices intended for use in liquid service shall be connected below the normal liquid line. *The liquid level during upset conditions shall be considered.*

1.3.4 ~~4.5.4~~ Capacity

a) The pressure relief device(s) shall have sufficient capacity to ensure that the pressure vessel is not exposed to pressure greater than that specified in the original code of construction.
b) If an additional hazard can be created by exposure of a pressure vessel to fire or other unexpected source of external heat, supplemental pressure relief devices shall be installed to provide any additional capacity that should be required.
c) Vessels connected together by a system of piping not containing valves that can isolate any pressure vessel *may* ~~should~~ be considered as one unit when determining capacity requirements.
d) Heat exchangers and similar vessels shall be protected with a pressure relief device of sufficient capacity to avoid overpressure in case of internal failure.
e) When a non-reclosing device is installed between a pressure relief valve and the pressure vessel, the reduction in capacity due to installation of the non-reclosing device shall be determined in accordance with the code of construction by use of a National Board certified Combination Capacity Factor (CCF). For rupture disks, if a certified combination capacity factor is not available, the capacity of the pressure relief valve shall be multiplied by 0.9 and this value used as the capacity of the combination installation.
f) The owner shall document the basis for selection of the pressure relief devices used, including capacity, and have such calculations available for review by the Jurisdiction.

1.3.5 ~~4.5.5~~ Set Pressure

a) When a single pressure relief device is used, the set pressure marked on the device shall not exceed the maximum allowable working pressure.
b) When more than one pressure relief device is provided to obtain the required capacity, only one pressure relief device set pressure needs to be at the maximum allowable working pressure. The set pressures of the additional pressure relief devices shall be such that the pressure cannot exceed the overpressure permitted by the code of construction.

1.3.6 ~~4.5.6~~ Installation and Discharge Piping Requirements

a) The opening through all pipe and fittings between a pressure vessel and its pressure relief device shall have at least the area of the pressure relief device inlet. The characteristics of this upstream system shall be such that the pressure drop will not reduce the relieving capacity below that required or adversely affect the proper operation of the pressure relief device.
b) A non-reclosing device installed between a pressure vessel and a pressure relief valve shall meet the requirements of 4.5.6(a) **(check cross reference here).**
c) The opening in the pressure vessel wall shall be designed to provide unobstructed flow between the vessel and its pressure relief device.
d) When two or more required pressure relief devices are placed on one connection, the inlet cross-sectional area of this connection shall be sized either to avoid restricting flow to the pressure relief devices or made at least equal to the combined inlet areas of the pressure relief devices connected to it. The flow characteristics of the upstream system shall satisfy the requirements of 4.5.6(a).
e) There shall be no intervening stop valves between the vessel and its pressure relief device(s), or between the pressure relief device(s) and the point of discharge, except under the following conditions:

1) When these stop valves are so constructed or positively controlled that the closing of the maximum number of block valves at one time will not reduce the pressure relieving capacity below the required relieving capacity; or,
2) Upon specific acceptance of the Jurisdiction, when necessary for the continuous operation of processing equipment of such a complex nature that shutdown of any part is not feasible, a full area stop valve between a pressure vessel and its pressure relief device should be provided for inspection and repair purposes only. This stop valve shall be arranged so that it can be locked or sealed open, and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station.
3) A full area stop valve should also be placed on the discharge side of a pressure relief device when its discharge is connected to a common header for pressure relief devices to prevent discharges from these other devices from flowing back to the first device during inspection and repair. This stop valve shall be arranged so that it can be locked or sealed open, and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked and sealed in the open position before the authorized person leaves the station. This valve shall only be used when a stop valve on the inlet side of the pressure relief device is first closed.
4) A pressure vessel in a system where the pressure originates from an outside source should have a stop valve between the vessel and the pressure relief device, and this valve need not be sealed open, provided it also closes off that vessel from the source of the pressure.
5) Pressure vessels designed for human occupancy (such as decompression or hyperbaric chambers) shall be provided with a quick opening stop valve between the pressure vessel and its pressure relief valve. The stop valve shall be normally sealed open with a frangible seal and be readily accessible to the pressure relief attendant.
f) Pressure relief device discharges shall be arranged such that they are not a hazard to personnel or other equipment and, when necessary, lead to a safe location for disposal of fluids being relieved.
g) Discharge lines from pressure relief devices shall be designed to facilitate drainage or be fitted with drains to prevent liquid from collecting in the discharge side of a pressure relief device. The size of discharge lines shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the pressure relief device or adversely affect the operation of the pressure relief device.
h) Pressure relief devices shall be installed so they are readily accessible for inspection, repair, or replacement.
i) Pressure vessel pressure relief devices and discharge piping shall be safely support. Design of supports, foundations, and settings shall consider vibration (including seismic where necessary), movement (including thermal movement), and loadings (including reaction forces during device operation ~~the weight of water during a hydrostatic test~~) in accordance with jurisdictional requirements, manufacturer's recommendations, and/or other industry standards, as applicable. (Based upon Part 1, 4.3.1.)

1.4 ~~5.3~~ Piping System Pressure Relief Devices

See NBIC Part 1, par. X.x for the piping systems covered under this section.

When required by the original code of construction, piping shall be protected by pressure relief devices in accordance with the following requirements.

1.4.1 ~~5.3.1~~ Device Requirements

a) Pressure relief devices are to be manufactured in accordance with a national or international standard and be certified for capacity (or resistance to flow for rupture disc devices) by the National Board.
1) In certain cases piping standards permit the use of regulators, which may include integral pressure relief valves to limit the pressure in a piping system. In this case, capacity certification of the pressure relief valve is not required.
b) Dead weight or weighted lever pressure relief devices shall not be used.
c) Pressure relief devices shall be selected (i.e., material, pressure, etc.) and installed such that their proper functioning will not be hindered by the nature of the piping system's contents.

1.4.2 ~~5.3.2~~ Number of Devices

At least one pressure relief device shall be provided for protection of a piping system. A pressure relief device installed on a pressure vessel or other component connected to the piping system should be used to meet this requirement.
Portions of piping systems with different maximum allowable working pressures shall have a pressure relief device to protect each portion separately.

1.4.3 ~~5.3.3~~ Location

Pressure relief devices, except those covered by Sections *1.1 through 1.3* ~~2 and 3~~ of this Part, may be installed at any location in the system provided the pressure in any portion of the system cannot exceed the maximum overpressure permitted by the original code of construction. Pressure drop to the pressure relief device under flowing conditions shall be considered when determining pressure relief device location.
The pressure-relief device shall not be isolated from the piping system except as permitted by 5.3.6 e). **check cross reference**

1.4.4 ~~5.3.4~~ Capacity

a) The pressure relief device(s) shall have sufficient capacity to ensure that the piping is not exposed to pressures greater than that specified in the original code of construction.
b) When a non-reclosing device is installed between a pressure relief valve and the pipe, the reduction in capacity due to installation of the non-reclosing device shall be determined in accordance with the code of construction by use of a National Board certified Combination Capacity Factor (CCF). For rupture disks, if a certified combination capacity factor is not available, the capacity of the pressure relief valve shall be multiplied by 0.9 and this value used as the capacity of the combination installation.
c) The owner shall document the basis for selection of the pressure relief devices used, including capacity, and have such calculations available for review by the Jurisdiction, when required.

1.4.5 ~~5.3.5~~ Set Pressure

a) When a single pressure relief device is used, the set pressure marked on the device shall not exceed the maximum allowable working pressure, except when allowed by the original code of construction.
b) When more than one pressure relief device is provided to obtain the required capacity, only one pressure relief device set pressure needs to be at the maximum allowable working pressure. The set pressures of the additional pressure relief devices shall be such that the pressure cannot exceed the overpressure permitted by the code of construction.

1.4.6 ~~5.3.6~~ Inlet and Discharge Piping Requirements

a) The opening through all pipes and fittings between a piping system and its pressure relief device shall have at least the area of the pressure relief device inlet. The characteristics of this upstream system shall be such that the pressure drop will not reduce the relieving capacity below that required or adversely affect the operation of the pressure relief device.
b) A non-reclosing device installed between a piping system and a pressure relief valve shall meet the requirements of 5.3.6(a). **check cross reference**
c) The opening in the pipe shall be designed to provide unobstructed flow between the pipe and its pressure relief device.
d) When two or more required pressure relief devices are placed on the connection, the inlet cross-sectional area of this connection shall be sized either to avoid restricting flow to the pressure relief devices or made at least equal to the combined inlet areas of the pressure relief devices connected to it. The flow characteristics of the upstream system shall satisfy the requirements of 5.3.6(a).
e) There shall be no intervening stop valves between the piping system and its pressure relief device(s), or between the pressure relief device(s) and the point of discharge except under the following conditions:

1) When these stop valves are so constructed or positively controlled that the closing of the maximum number of block valves at one time will not reduce the pressure relieving capacity below the required relieving capacity; or,

2) Upon specific acceptance of the Jurisdiction, when necessary for the continuous operation of processing equipment of such a complex nature that shutdown of any part is not feasible, a full area stop valve between a piping system and its pressure relief device ~~should~~ *may* be provided for inspection and repair purposes only. This stop valve shall be arranged so that it can be locked or sealed open and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station.
3) A full area stop valve may be placed on the discharge side of a pressure relief device when its discharge is connected to a common header for pressure relief devices to prevent discharges from these other devices from flowing back to the first device during inspection and repair. This stop valve shall be arranged so that it can be locked or sealed open, and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station. This valve shall only be used when a stop valve on the inlet side of the pressure relief device is first closed.
4) A piping system where the pressure originates from an outside source should have a stop valve between the system and the pressure relief device, and this valve need not be sealed open, provided it also closes off that vessel from the source of pressure.
f) Pressure relief device discharges shall be arranged such that they are not a hazard to personnel or other equipment and, when necessary, lead to a safe location for disposal of fluids being relieved.
g) Discharge lines from pressure relief devices shall be designed to facilitate drainage or be fitted with drains to prevent liquid from collecting in the discharge side of a pressure relief device. The size of discharge lines shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the pressure relief device or adversely affect the operation of the pressure relief device.
h) The reaction forces due to discharge of pressure relief devices shall be considered in the design of the inlet and discharge piping.
I) Pressure relief devices shall be installed so they are accessible for inspection, repair, or replacement.

In-Service Inspection (previously in Part 2)

2.0 ~~2.5~~ *In-Service Inspection of* Pressure Relief Devices

Once a pressure relief device is installed on a piece of pressurized equipment or system, it must be periodically inspected and tested to assure that the pressure relieving function can still be relied upon. The inspection of pressure relief devices is often coordinated with the inspection of the system. See NBIC Part 2 for in service inspection requirements and procedures for other portions of the equipment not discussed below.

2.1 ~~2.5.1~~ Scope

a) The most important appurtenances on any pressurized system are the pressure relief devices provided for overpressure protection of that system. These are devices such as safety valves, safety relief valves, pilot valves, and rupture disks or other nonreclosing devices that are called upon to operate and reduce an overpressure condition.
b) These devices are not designed or intended to control the pressure in the system during normal operation. Instead, they are intended to function when normal operating controls fail or abnormal system conditions are encountered.
c) Periodic inspection and maintenance of these important safety devices is critical to ensure their continued functioning and to provide assurance that they will be available when called upon to operate. See 2.5.8 **(CHECK X-REF)** for recommended testing frequency for PRDs.
d) Inspection areas of concern include:

1) correct set pressure; (matching of set pressure to MAWP)
2) safety considerations; (is something missing here? Need information on respecting pressure, noise, heat etc)
3) device data;
4) condition of the device;
5) condition of the installation; and
6) testing and operational inspection.

2.1.1 ~~2.5.2~~ Pressure Relief Device Data

a) Nameplate marking or stamping of the device should be compared to stamping on the protected pressure-retaining item.
For a single device, the set pressure shall be no higher than the maximum allowable working pressure (MAWP) marked on the protected pressure-retaining item or system.
b) If multiple devices are provided, the difference between set pressures shall not exceed that permitted by the original code of construction. The set pressure of additional devices may exceed the MAWP, as permitted by the original Code of Construction.
c) Verify nameplate capacity and, if possible, compare to system capacity requirements.
d) Check identification on seals and ensure they match nameplates or other identification (repair or reset nameplate) on the valve or device.

2.1.2 ~~2.5.3~~ Device conditions

a) Check for evidence that the valve or device is leaking or not sealing properly. Evidence of leakage through pressure-relief valves may indicate that the system is being operated at a pressure that is too close to the valve's set pressure. (See ~~Part 2,~~ Supplement 2 ~~8~~ *for guidance on the pressure differential between the pressure relief valve set pressure and system operating pressure.)*
b) Seals for adjustments *shall* ~~should~~ be intact and show no evidence of tampering.
c) Connecting bolting should be tight and all bolts intact.
d) The valve or device should be examined for deposits or material buildup.
e) Evidence of rust or corrosion should be checked.
f) Check for damaged or misapplied parts.
g) If a drain hole is visible, ensure it is not clogged with debris or deposits.
h) Check for test gags left in place after pressure testing of the unit.

i) Bellows valves shall be checked to ensure the bonnet vent is open or piped to a safe location. The vent shall not be plugged since this will cause the valve set pressure to be high if the bellows develops a leak. Leakage noted from the vent indicates the bellows is damaged and will no longer protect the valve from the effects of back pressure.

2.1.3 ~~2.5.4~~ Installation Condition

a) Inspect inlet piping and ensure it meets the requirements of the original Code of Construction. For pressure relief valves, check that the inlet pipe size is not smaller than the device inlet size.
b) Inspect discharge piping and ensure it meets the original Code of Construction. Check that the discharge pipe size is not smaller than the device outlet size.
c) Check that the valve drain piping is open.
d) Check drainage of discharge piping.
e) Check that inlet and discharge piping are not binding or placing excessive stress on the valve body, which can lead to distortion of the valve body and leakage or malfunction.
f) Check the condition and adequacy of piping supports. Discharge piping should be supported independent of the device itself.
g) Check for possible hazards to personnel from the valve discharge or discharge pipe.
h) Check that there are no intervening isolation valves between the pressure source and the valve inlet or between the valve outlet and its point of discharge. (Isolation valves may be permitted in some pressure vessel service. See Part 1, 5.3.6 e.), and jurisdictional requirements. Isolation valves are not permitted for power boilers, heating boilers, or water heaters.)
i) A change-over valve, which is used to install two pressure relief devices on a single vessel location for the purpose of switching from one device to a spare device, is not considered a block valve if it is arranged such that there is no intermediate position that will isolate both pressure relief devices from the protected system. Change-over valves should be carefully evaluated to ensure they do not have excessive pressure drop that could affect the pressure relief device operation or capacity. These devices are commonly used in pressure vessel service. They may also be used in some boiler applications. It is recommended that the Jurisdiction be contacted to determine their acceptability on boiler applications.

2.1.4 ~~2.5.5~~ Additional Inspection Requirements

Following are additional items that should be considered for the specified types of installations or services.

2.1.4.1 ~~2.5.5.1~~ BOILERS

a) If boilers are piped together with maximum allowable working pressures differing by more than 6%, additional protective devices may be required on the lower pressure units to protect them from overpressure from the higher pressure unit.
b) Hot-Water Heating Boilers and Water Heaters
1) These units generally do not use any water treatment and therefore may be more prone to problems with deposits forming that may impair a safety device's operation. Particular attention should be paid to signs of leakage through valves or buildups of deposits.
2) Hot-water boilers tend to have buildups of corrosion products since the system is closed with little makeup. These products can foul or block the valve inlet.
3) Water heaters will have cleaner water due to continuous makeup. However, these valves usually have a thermal element that will cause the valve to open slightly when the water is heated *and the heat* is not removed from the system. When this hot water evaporates in the discharge piping, *scale* ~~calcium~~ deposits may tend to form in the valve inlet and outlet.

2.1.4.2 ~~2.5.5.2~~ PRESSURE VESSELS AND PIPING

Standard practice for overpressure protection devices is to not permit any type of isolation valve either before or after the device. However, some pressure vessel standards permit isolation valves under certain controlled conditions when shutting down the vessel to repair a damaged or leaking valve. If isolation block valves are employed, their use should be carefully controlled by written procedures. Block valves should have provisions to be either car-sealed or locked in an open position when not being used. For ASME Section VIII, Div. 1 pressure vessels, see UG-135, Appendix M, and jurisdictional rules for more information.

2.1.4.3 ~~2.5.5.3~~ RUPTURE DISKS

a) Rupture disks or other non-reclosing devices may be used as sole relieving devices or in combination with safety relief valves to protect pressure vessels.
b) The selection of the correct rupture disk device for the intended service is critical to obtaining acceptable disk performance. Different disk designs are intended for constant pressure, varying pressure, or pulsating pressure. Some designs include features that make them suitable for back pressure and/or internal vacuum in the pressure vessel.
c) The margin between the operating pressure and the burst pressure is an important factor in obtaining acceptable performance and service life of the disk. Flat and prebulged solid metal disks are typically used with an operating pressure that is no more than 60% to 70% of the burst pressure.
Other designs are available that increase the operating pressure to as much as 90% of the burst pressure. Disks that have been exposed to pressures above the normal operating pressure for which they are designed are subject to fatigue or creep and may fail at unexpectedly low pressures. Disks used in cyclic service are also subject to fatigue and may require a greater operating margin or selection of a device suitable for such service.
d) The disk material is also critical to obtaining acceptable service life from the disk. Disks are available in a variety of materials and coatings, and materials that are unaffected by the process fluid should be used. Disks that experience corrosion may fail and open at an unexpectedly low pressure.
e) Disk designs must also be properly selected for the fluid state. Some disk types are not suitable for use in liquid service. Some disks may have a different flow resistance when used in liquid service, which may affect the sizing of the disk.
f) Information from the rupture disk manufacturer, including catalog data and installation instructions, should be consulted when selecting a disk for a particular service.
g) For rupture disks and other non-reclosing devices, the following additional items
should be considered during inspections.
1) The rupture disk nameplate information, including stamped burst pressure and coincident temperature, should be checked to ensure it is compatible with the intended service. The coincident temperature on the rupture disk shall be the expected temperature of the disk when the disk is expected to burst and will usually be related to the process temperature, not the temperature on the pressure vessel nameplate.
2) Markings indicating direction of flow should be carefully checked to ensure they are correct. Some rupture disks when installed in the incorrect position may burst well above the stamped pressure.
3) The marked burst pressure for a rupture disk installed at the inlet of a safety relief valve shall be equal to or less than the safety relief valve set pressure. A marked burst pressure of 90% to 100% of the safety relief valve set pressure is recommended. A disk with a non-fragmenting design that cannot affect the safety relief valve shall be used.

Note: If the safety relief valve set pressure is less than the vessel MAWP, the marked burst pressure may be higher than the valve set pressure, but no higher than the MAWP.

4) Check that the space between a rupture disk and a safety relief valve is supplied with a pressure gage, try cock, or telltale indicator to indicate signs of leakage through the rupture disk. The safety relief valve shall be inspected and the leaking disk shall be replaced if leakage through the disk is observed.
5) If a rupture disk is used on a valve outlet, the valve design must be of a type not influenced by back pressure due to leakage through the valve. Otherwise, for nontoxic and non-hazardous fluids, the space between the valve and the rupture disk shall be vented or drained to prevent the accumulation of pressure.
6) For rupture disks installed on the valve inlet, the installation should be reviewed to ensure that the combination rules of the original Code of Construction have been applied. A reduction in the valve capacity up to 10% is expected when used in combination with a non-reclosing device.
7) The frequency of inspection for rupture disks and other non-reclosing devices is greatly dependent on the nature of the contents and operation of the system and only general recommendations can be given. Inspection frequency should be based on previous inspection history. If devices have been found to be leaking, defective, or damaged by system contents during inspection, intervals should be shortened until acceptable inspection results are obtained. With this in mind, the inspection frequency guidelines specified in 2.5.8 are suggested for similar services.
8) Rupture disks are often used to isolate pressure relief valves from services where fouling or plugging of the valve inlet occurs. This tendency should be considered in establishing the inspection frequency.

9) Since these devices are for one time use, a visual inspection is the only inspection that can be performed. Rupture disks that are installed using a specified bolting torque procedure cannot be reused after inspection and must be replaced.
10) It is recommended that all rupture disks be periodically replaced to prevent unintended failure while in service due to deterioration of the device.
Rupture disks should be carefully checked for damage prior to installation and handled by the disk edges, if possible. Any damage to the surface of the ruptured disk can affect the burst pressure.

~~**2.5.6 Packaging, Shipping and Transportation of Pressure Relief Devices**~~
(moved to Supplement 4 for repair procedures and combined with similar text)

2.1.5 ~~2.5.7~~ Testing and Operational Inspection of Pressure Relief Devices

a) Pressure relief valves must be periodically tested to ensure that they are free to operate and will operate in accordance with the requirements of the original Code of Construction. Testing should include device set or opening pressure, reclosing pressure, where applicable, and seat leakage evaluation. Tolerances specified for these operating requirements in the original Code of Construction shall be used to determine the acceptability of test results.
b) Testing may be accomplished by the owner on the unit where the valve is installed or at a qualified test facility. In many cases, testing on the unit may be impractical, especially if the service fluid is hazardous or toxic. Testing on the unit may involve the bypassing of operating controls and should only be performed by qualified individuals under carefully controlled conditions. It is recommended that a written procedure be available to conduct this testing.
1) The Inspector should ensure that calibrated equipment has been used to perform this test and the results should be documented by the owner.
2) If the testing was performed at a test facility, the record of this test should be reviewed to ensure the valve meets the requirements of the original Code of Construction. Valves which have been in toxic, flammable, or other hazardous services shall be carefully decontaminated before being tested. In particular, the closed bonnet of valves in these services may contain fluids that are not easily removed or neutralized. If a test cannot be safely performed, the valve shall be disassembled, cleaned, and decontaminated, repaired, and reset.
3) If a valve has been removed for testing, the inlet and outlet connections should be checked for blockage by product buildup or corrosion.
c) Valves may be tested using lift assist devices when testing at full pressure may cause damage to the valve being tested, or it is impractical to test at full pressure due to system design considerations. Lift assist devices apply an auxiliary load to the valve spindle or stem, and using the measured inlet pressure, applied load and other valve data allow the set pressure to be calculated. If a lift assist device is used to determine valve set pressure, the conditions of Part 3, *Repairs and Alterations*, Section 4.5.3 **(need new cross reference here)** shall be met. It should be noted that false set pressure readings may be obtained for valves which are leaking excessively or otherwise damaged.
d) If valves are not tested on the system using the system fluid, the following test mediums shall be used:
1) High pressure boiler safety valves, high temperature hot-water boiler safety relief valves, low pressure steam heating boilers: steam;
2) Hot-water heating boiler safety relief valves: steam, air, or water;
3) Hot water heater temperature and pressure relief valves: air or water;
4) Air and gas service process safety relief valves: air, nitrogen, or other suitable gas;
5) Liquid service process pressure relief valves: water or other suitable fluid;
6) Process steam service safety relief valves: steam or air with manufacturer's steam to air correction factor.

Note: Valves being tested after a repair must be tested on steam except as permitted by Part 3, *Repairs and Alterations*, Section 4.5.2 **(CHECK X-REF).**

e) As an alternative to a pressure test, the valve may be checked by the owner for freedom of operation by activating the test or "try" lever (manual check). For high pressure boiler and process valves, this test should be performed only at a pressure greater than 75% of the stamped set pressure of the valve or the lifting device may be damaged. This test will only indicate that the valve is free to operate and does not provide any information on the actual set pressure. All manual checks should be performed with some pressure under the valve in order to flush out debris from the seat that could cause leakage.

Note: The manual check at 75% or higher is based on lift lever design requirements for ASME Section I and VIII valves. Code design requirements for lifting levers for Section IV valves require that the valve be capable of being lifted without pressure.

i) Systems with multiple valves will require the lower set valves to be held closed to permit the higher set valves to be tested. A test clamp or "gag" should be used for this purpose. The spring compression screw shall not be tightened. It is recommended that the test clamps be applied in accordance with the valve manufacturer's instructions when the valve is at or near the test temperature, and be applied hand tight only to avoid damage to the valve stem or spindle.
j) Upon completion of set pressure testing, all pressure relief valve gags shall be removed.

2.1.5.1 *CORRECTIVE ACTION*

~~f)~~ If a valve is found to be stuck closed, the system should immediately be taken out of service until the condition can be corrected, unless special provisions have been made to operate on a temporary basis (such as additional relief capacity provided by another valve).

The owner shall be notified and corrective action such as repairing or replacing the inoperable valve shall be taken.

2.1.5.2 *VALVE ADJUSTMENTS*

~~g)~~ a) If a *set* pressure test indicates the valve does not open within the requirements of the original Code of Construction, but otherwise is in acceptable condition, minor adjustments (defined as no more than twice the permitted set pressure tolerance) shall be made by an *qualified* organization accredited by the National Board to reset the valve to the correct opening pressure. All adjustments shall be resealed with a seal identifying the responsible organization and a tag shall be installed identifying the organization and the date of the adjustment. *Qualified organizations are considered to be National Board "VR" stamp holders, or organizations authorized by the Jurisdiction to make adjustments. See Supplement 3 for more information.*
~~h)~~ b) If a major adjustment is needed, this may indicate the valve is in need of repair or has damaged or misapplied parts. Its condition should be investigated accordingly.

2.1.6 ~~2.5.8~~ RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

a) Power Boilers
1) Pressure less than 400 psig (2.76 MPa):
Manual check every 6 months; pressure test annually to verify nameplate set pressure or as determined by operating experience as verified by testing history.
2) Pressure greater than 400 psig (2.76 MPa):
Pressure test to verify nameplate set pressure every three years or as determined by operating experience as verified by testing history.
3) Pressure tests should be performed prior to bringing the boiler down for planned internal inspection so needed repairs or adjustments can be made while the boiler is down.
b) High-Temperature Hot-Water Boilers
Pressure test annually to verify nameplate set pressure or as determined by operating experience as verified by testing history. For safety reasons, removal and testing on a steam test bench is recommended. Such testing will avoid damaging the safety valve by discharge of a steam water mixture, which could occur if the valve is tested in place.
C) Organic Fluid Vaporizers
Pressure relief valves shall be disconnected from the vaporizer at least once yearly, when they shall be inspected, tested, repaired if necessary, and then replaced on the vaporizer. (From Section I part PVG 12.2)

d) Low-Pressure Steam Heating Boilers
Manual check quarterly; pressure test annually prior to steam heating season to verify nameplate set pressure.
e) Hot-Water Heating Boilers
Manual check quarterly; pressure test annually prior to heating season to verify nameplate set pressure.

Note: The frequencies specified for the testing of pressure relief valves on boilers is primarily based on differences between high pressure boilers that are continuously manned, and lower pressure automatically controlled boilers that are not monitored by a boiler operator at all times. When any boiler experiences an overpressure condition such that the safety or safety relief valves actuate, the valves should be inspected for seat leakage and other damage as soon as possible and any deficiencies corrected.

f) Water Heaters
Manual check every two months. Due to the relatively low cost of safety valves for this service, it is recommended that a defective valve be replaced with a new valve if a repair or resetting is indicated.
g) Pressure Vessels and Piping
Frequency of test and inspection of pressure relief devices for pressure vessel and piping service is greatly dependent on the nature of the contents and operation of the system and only general recommendations can be given. Inspection frequency should be based on previous inspection history. If valves are found to be defective or damaged by system contents during inspection, intervals should be shortened until acceptable inspection results are obtained. Where test records and/or inspection history are not available, the following inspection and test frequencies are suggested.

(following to be presented as a table)

Service	Inspection Frequency
Steam	Annual
Air and Clean Dry Gases	Every three years
Pressure relief valves in combination with rupture disks	Every five years
Propane, Refrigerant	Every five years
All Others	Per inspection history

2.1.6.1 ~~g~~) Establishment of Inspection and Test Intervals

Where a recommended test frequency is not listed, the valve user and Inspector must determine and agree on a suitable interval for inspection and test. Some items to be considered in making this determination are:
1) Jurisdictional requirements;
2) Records of test data and inspections from similar processes and similar devices in operation at that facility;
3) Recommendations from the device manufacturer. In particular, when the valve includes non-metallic parts such as a diaphragm *or soft seat*, periodic replacement of those parts may be specified;
4) Operating history of the system. Systems with frequent upsets where a valve has actuated require more frequent inspection;
5) Results of visual inspection of the device and installation conditions. Signs of valve leakage, corrosion or damaged parts all indicate more frequent operational inspections;
6) Installation of a valve in a system with a common discharge header. Valves discharging into a common collection pipe may be affected by the discharge of other valves by the corrosion of parts in the outlet portion of the valve or the buildup of products discharged from those valves;
7) Ability to coordinate with planned system shutdowns. The shutdown of a system for other maintenance or inspection activities is an ideal time for the operational inspection and test of a pressure relief valve;
8) Critical nature of the system. Systems that are critical to plant operation or where the effects of the discharge of fluids from the system are particularly detrimental due to fire hazard, environmental damage, or toxicity concerns all call for more frequent inspection intervals to ensure devices are operating properly;
9) Where the effects of corrosion, blockage by system fluid, or ability of the valve to operate under given service conditions are unknown (such as in a new process or installation), a relatively short inspection interval, not to exceed one year or the first planned shutdown, whichever is shorter, shall be established. At that time the device shall be visually inspected and tested. If unacceptable test results are obtained, the inspection interval shall be reduced by 50% until suitable results are obtained.

2.1.6.2 ~~h~~) Establishment of Service Intervals
1) The above intervals are guidelines for periodic inspection and testing. Typically if there are no adverse findings, a pressure relief valve would be placed back in service until the next inspection. Any unacceptable conditions that are found by the inspection shall be corrected immediately by repair or

replacement of the device. Many users will maintain spare pressure relief devices so the process or system is not affected by excessive downtime.
2) Pressure relief valves are mechanical devices that require periodic preventive maintenance even though external inspection and test results indicate acceptable performance. There may be wear on internal parts, galling between sliding surfaces or internal corrosion, and fouling which will not be evident from an external inspection or test. Periodic re-establishment of seating surfaces and the replacement of soft goods such as o-rings and diaphragms are also well advised preventive maintenance activities that can prevent future problems. If the valve is serviced, a complete disassembly, internal inspection, and repair as necessary, such that the valve's condition and performance are restored to a like new condition, should be done by an organization accredited by the National Board.
3) Service records with test results and findings should be maintained for all overpressure protection devices. A service interval of no more than three inspection intervals or ten years, whichever is less, is recommended to maintain device condition. Results of the internal inspection and maintenance findings can then be used to establish future service intervals.

REPAIR (previously in Part 3)

3.0 ~~S7.1~~ REPAIR OF PRESSURE RELIEF DEVICES, SCOPE

This *section* ~~supplement~~ provides general requirements that apply to repairs to pressure relief valves. Repairs may be required because of defects found during periodic inspections, because testing has identified that valve performance does not meet the original code of construction requirements, failure during operation, or for routine preventative maintenance.

Since pressure relief devices are provided for safety and the protection of personnel and property, repairs are often regulated by the jurisdiction where the pressure relief device is installed. The jurisdiction should be contacted for their specific requirements.

3.1 ~~S7.2~~ GENERAL REQUIREMENTS

a) Repair of a pressure relief valve is considered to include the disassembly, replacement, re-machining, or cleaning of any critical part, lapping of a seat and disc, reassembly, adjustment, testing, or any other operation that may affect the flow passage, capacity, function, or pressure-retaining integrity.
b) Conversions, changes, or adjustments affecting critical parts are also considered repairs. The scope of conversions may include changes in service fluid and changes such as bellows, soft seats, and other changes that may affect Type/Model number provided such changes are recorded on the document as required for a quality system and the repair nameplate. (See 5.9.1 check cross reference).
c) The scope of repair activities shall not include changes in ASME Code status.

3.1.1 ~~d~~) When a repair is being performed under the administrative requirements for National Board Accreditation, a repair shall consist of the following operations as a minimum:
1) Complete disassembly, cleaning, and inspection of parts, repair or replacement of parts found to be defective, reassembly, testing as required by 4.5 (check x-ref), sealing and application of a repair nameplate. When completed, the valve's condition and performance shall be equivalent to the standards for new valves.
2) The administrative requirements for National Board Accreditation apply only to valves that are stamped with an ASME "V," "UV," or "NV" Code symbol or marked with an ASME "HV" symbol and have been capacity certified on the applicable fluid by the National Board.

3.1.2 ~~1.2~~ Construction Standards for pressure *relief devices* ~~retaining items~~

d) For pressure relief ~~ving~~ devices the applicable *new construction* standard ~~for new valves~~ to be used for reference during repairs is the ASME Code. ASME code cases shall be used for repairs when they were used in the original construction of the valve. ASME code cases may be used when they have been accepted for use by the NBIC committee and the Jurisdiction where the pressure-retaining item is installed.
1) For pressure relieving devices the code case number shall be noted on the repair document and, when required by the code case, stamped on the repair nameplate.
2) The Jurisdiction where the pressure retaining item is installed shall be consulted for any unique requirements it may have established.

3.1.3 INSTALLATION OF PRESSURE RELIEF DEVICES

Installation of a pressure relief device by mechanical methods is not considered to be a repair, as long as no changes or adjustments are made to the device. Seals installed by the device manufacturer or repair organization shall not be removed when the device is installed.

When a pressure relief device is to be installed by welding on an existing pressure retaining item, the requirements of Part 3 of the NBIC for welded repairs shall be followed.

A. If a pressure relief valve must be disassembled or its adjustments changed as part of the installation process, the reassembly, resetting, retesting or other such activities shall be done by a qualified

organization which meets the requirements of NBIC, Part 4. For a new pressure relief valve, the original valve manufacturer shall perform this activity as required by the original code of construction.

The installation of a non-reclosing pressure relief device or the replaceable element of a non-reclosing pressure relief device such as a rupture disk is not considered to be a repair. The manufacturer's procedures and instruction shall be followed for the installation of these devices.

3.1.4 ~~S7.6~~ INITIAL ADJUSTMENTS TO PRESSURE RELIEF VALVES

The initial installation testing and adjustments of a new pressure relief valve on a boiler or pressure vessel are not considered a repair if made by the manufacturer or assembler of the valve.

3.2 ~~S7.4~~ MATERIALS FOR PRESSURE RELIEF DEVICE *REPAIR*

The materials used in making repairs shall conform to the requirements of the original code of construction. The "VR" Certificate Holder is responsible for verifying identification of existing materials from original data, drawings, or unit records and identification of the materials to be installed.

3.2.1 ~~S7.5~~ REPLACEMENT PARTS FOR PRESSURE RELIEF DEVICES

a) Critical parts shall be fabricated by the valve manufacturer or to the manufacturer's specifications. Critical parts are those that may affect the valve flow passage, capacity, function, or pressure-retaining integrity.
b) Critical parts not fabricated by the valve manufacturer shall be supplied with material test certification for the material used to fabricate the part.
c) Replacement critical parts receiving records shall be attached or be traceable to the valve repair document (see S7.3[a] check x-ref). These records shall conform to at least one of the following.
1) Receiving records documenting the shipping origin of the part fabricated by the valve manufacturer (such as packing list) from the valve manufacturer or assembler of the valve type.
2) A document prepared by the "VR" Certificate holder certifying that the replacement part used in the repair has the manufacturer's identification on the part or is otherwise labeled or tagged by the manufacturer and meets the manufacturer's acceptance criteria (e.g., critical dimensions found in maintenance manual).
3) Receiving records for replacement critical parts obtained from a source other than the valve manufacturer or assembler of the valve type shall include a *Certificate of Compliance* that provides as a minimum:
a. The part manufacturer and part designation.
b. A certifying statement that either:
1. The part was fabricated by the valve manufacturer and meets the manufacturer's acceptance criteria (e.g., critical dimensions found in maintenance manual), or
2. The part meets the manufacturer's specifications and was fabricated from material as identified by the attached material test report.
c. The signature of an authorized individual of the part source.
d. The name and address of the part source for whom the authorized individual is signing.
d) Material for bolting shall meet the manufacturer's specification, but does not require material test certification if marked as required by the material specification.

3.3 ~~S7.12~~ WELDING FOR PRESSURE RELIEF VALVES

When welding is used as a repair technique during a pressure relief valve repair, the following requirements shall apply.

a) Welding shall be performed in accordance with the requirements of the original code of construction used for the pressure relief valve.
b) Cast iron and carbon or alloy steel having a carbon content of more than 0.35% shall not be welded.
c) Defects in pressure relief valve parts such as cracks, pits, or corrosion that will be repaired by welding shall be completely removed before the weld repair of the part is performed. Removal of the defect shall be verified by suitable NDE as required.
d) Consideration shall be given to the condition of the existing material, especially in the weld preparation

area.

3.3.1 ~~S7.12.1~~ WELDING PROCEDURE SPECIFICATIONS

Welding shall be performed in accordance with Welding Procedure Specifications (WPS) qualified in accordance with the original code of construction. When this is not possible or practicable, the WPS may be qualified in accordance with Section IX of the ASME Code.

3.3.2 ~~S7.12.2~~ STANDARD WELDING PROCEDURE SPECIFICATIONS

A "VR" Certificate Holder may use one or more applicable Standard Welding Procedure Specifications shown in 2.3 of Part 3 ~~of this part.~~

3.3.3 ~~S7.12.3~~ PERFORMANCE QUALIFICATION

Welders or welding operators shall be qualified for the welding processes that are used. Such qualification shall be in accordance with the requirements of the original code of construction or Section IX of the ASME Code.

3.3.4 ~~S7.12.4~~ WELDING RECORDS

The "VR" Certificate Holder shall maintain a record of the results obtained in welding procedure qualifications, except for those qualifications for which the provisions of Supplement S7.12.2 are used, and of the results obtained in welding performance qualifications. These records shall be certified by the "VR" Certificate Holder and shall be available to the National Board.

3.3.5 ~~S7.12.5~~ WELDERS' IDENTIFICATION

The "VR" Certificate Holder shall establish a system for the assignment of a unique identification mark to each welder/welding operator qualified in accordance with the requirements of the NBIC. The "VR" Certificate Holder shall also establish a written procedure whereby welded joints can be identified as to the welder or welding operator who made them. This procedure shall use one or more of the following methods and shall be described in the quality control system written description. The welder's or welding operator's identification mark may be stamped (low stress stamp) adjacent to welded joints made by the individual, or the "VR" Certificate Holder may keep a documented record of welded joints and the welders or welding operators used in making the joints.

3.3.6 ~~S7.12.6~~ WELDERS' 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.
b) When there is specific reason to question their ability to make welds that meet the specification, the qualification that supports the welding that is being performed shall be revoked. All other qualifications not questioned remain in effect.

3.3.7 ~~S7.3~~ WELD REPAIRS TO PRESSURE RELIEF VALVE PARTS *BY AN "R" STAMP HOLDER*
(MOVED HERE SO ALL WELDING REQUIREMENTS ARE IN ONE LOCATION)

a) 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 this Supplement~~ provided the following documentation is provided to the "R" Certificate Holder:
1) Code of Construction, year built;
2) Part identification;
3) Part material specified; and
4) "VR" Certificate Holder's unique identifier for traceability as required by the Repair Inspection Program.
b) Prior to performing weld repairs to pressure relief valve (PRV) parts, the "R" Certificate Holder shall receive repair information required by Supplement S7.3(a) check x-ref from the "VR" Certificate Holder responsible for the pressure relief valve repair.

1) PRV part weld repairs shall be performed under the "R" Certificate Holder's quality system; however, the requirements for in-process involvement of the Inspector (see *Part 1*, 1.3.2 check x-ref) may be waived. The requirement for stamping is waived.
2) The process of identifying and controlling repairs shall be documented in the "R" Certificate Holder's quality system.
3) PRV part repairs shall be documented on a Form R-1 with a statement under Remarks "PRV Part Repair." The owner's name and location of installation shall be that of the "VR" Certificate Holder. The information received from the "VR" Certificate Holder as required in Supplement S7.3(a) check x-ref shall be noted under "Description of Work."
4) Upon completion of the repair, the repaired part and completed Form R-1 shall be returned to the "VR" Certificate Holder responsible for completing the PRV repair.

3.4. ~~S7.13~~ HEAT TREATMENT

3.4.1 ~~S7.13.1~~ PREHEATING

Preheating may be employed during welding to assist in completion of the welded joint (2.5.1 of this part check x-ref). The need for and the temperature of preheat are dependent on a number of factors, such as chemical analysis, degree of restraint of the items being joined, material thickness, and mechanical properties. The welding procedure specification for the material being welded shall specify the preheat temperature requirements.

3.4.2 ~~S7.13.2~~ POSTWELD HEAT TREATMENT

Postweld heat treatment shall be performed as required by the original code of construction in accordance with a written procedure. The procedure shall contain the parameters for postweld heat treatment. *A time and temperature report or temperature record shall be maintained to document the work performed.*

3.5 ~~4.5~~ PRESSURE RELIEF VALVE PERFORMANCE TESTING AND TESTING EQUIPMENT

Each pressure relief valve to which the "VR" repair symbol stamp is to be applied shall be subjected to the following tests by the repair certificate holder.

3.5.1 ~~4.5.1~~ TEST MEDIUM AND TESTING EQUIPMENT

Valves marked for steam service, or having special internal parts for steam service, shall be tested on steam. Valves marked for air, gas,or vapor service shall be tested with air or gas. Valves marked for liquid service shall be tested with water or other suitable liquid. ASME Code, Section IV hot-water valves, shall be tested on water, steam, or air.
a) Each valve shall be tested to demonstrate the following:
1) Set pressure (as defined by the valve manufacturer and as listed in NB-18, (*Pressure Relief Device Certifications*);
2) Response to blowdown, when required by the original code of construction;
3) Seat tightness; and
4) For valves designed to discharge to a closed system, the tightness of the secondary pressure zone shall be tested as required by the original code of construction.
b) The equipment used for the performance testing prescribed above shall meet the following requirements:
1) The performance testing equipment shall include a pressure vessel of adequate volume and pressure source capacity to ensure compliance with 4.5.1a)1).
2) Prior to use, all performance testing equipment shall be qualified by the certificate holder to ensure that the equipment and testing procedures will provide accurate results when used within the ranges established for that equipment. This qualification may be accomplished by benchmark testing, comparisons to equipment used for verification testing as specified in the quality system, or comparisons to field performance. This qualification shall be documented and provisions made to retain such documentation for a period of at least five years after the testing equipment is retired. Documentation of this qualification shall include but not be limited to:

a. Schematic of the performance test equipment;

b. Size and pressure ranges of valves to be tested and the test fluid to be used;
c. Dimensions of test vessels;
d. Accuracy of pressure measuring equipment;
e. Size and design type of valves used to control flow; and
f. Method of qualifying.

3) Prior to the implementation of any addition or modification to the testing equipment that would alter the contents of the document required in 4.5.1(b)(2), the certificate holder shall re-qualify the performance test equipment in accordance with 4.5.1(b)(2).
If the equipment changed was used to satisfy the requirements of verification testing, the certificate holder shall notify the National Board and additional verification testing, in accordance with the quality system, may be required.

3.5.2 ~~4.5.2~~ OWNER-USER ASME CODE SECTION VIII STEAM TESTING

When ASME Code Section VIII valves are repaired by the owner for the owner's own use, valves for steam service may be tested on air for set pressure and, if possible, blowdown adjustment, provided the valve manufacturer's corrections for differential in set pressure between steam and air are applied to the set pressure.

3.5.3 ~~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 4.5.1a)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;
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.

3.5.4 ~~4.5.4~~ PRESSURE TEST OF PARTS

a) Parts used in repaired valves shall be pressure tested and documentation provided according to the following categories:

1) Replacement Parts
The "VR" certificate holder is responsible for documentation that the appropriate pressure test has been completed as required by the original code of construction.
2) Parts Repaired by Welding
These parts shall be subjected to a pressure test required by the original code of construction. The "VR" certificate holder shall be responsible for documentation of such test.
b) Parts repaired by re-machining within part specifications, lapping, or polishing do not require a pressure test.

3.6 ~~5.9~~ STAMPING REQUIREMENTS FOR PRESSURE RELIEF DEVICES

3.6.1 ~~5.9.1~~ NAMEPLATES

Proper marking and identification of tested or repaired valves is critical to ensuring acceptance during subsequent inspections, and also provide for traceability and identification of any changes made to the valve. All operations that require the valve's seals to be replaced shall be identified by a nameplate as described in 5.9.2 or 5.9.4 check x-ref.

3.6.2 ~~5.9.2~~ REPAIR NAMEPLATE

When a pressure relief valve is repaired, a metal repair nameplate stamped with the information required below shall be securely attached to the valve adjacent to the original manufacturer's stamping or nameplate. If not installed ~~mounted~~ directly on the valve, the nameplate shall be securely attached so as not to interfere with valve operation and sealed in accordance with the quality system.
a) Prior to attachment of the repair nameplate, the previous repair nameplate, if applicable, shall be removed from the repaired valve.

b) As a minimum, the information on the valve repair nameplate (see Figure 5.7.5-e check x-ref) shall include:
1) The name of the repair organization preceded by the words "repaired by";
2) The "VR" repair symbol stamp and the "VR" certificate number;
3) Unique identifier (e.g., repair serial number, shop order number, etc.);
4) Date of repair;
5) Set pressure;
6) Capacity and capacity units (if changed from original nameplate due to set pressure or service fluid change);
7) Type/Model number (if changed from original nameplate by a conversion. See Supplement S7.2 check x-ref); and
8) When an adjustment is made to correct for service conditions of superimposed back pressure and/or temperature or the differential between popping pressure between steam and air (see 4.5.2 check x-ref), the information on the valve repair nameplate shall include the:
a. Cold Differential Test Pressure (CDTP); and
b. Superimposed Back Pressure (BP) (only when applicable).

(need nameplate figures here)

FIGURE 5.7.5-e
Required markings for repair of ASME/National Board "V," "UV," and "HV"-stamped pressure relief valves
®
REPAIRED BY CERTIFICATE HOLDER
(1)
TYPE/MODEL NUMBER
(1)
SET PRESSURE CAPACITY
(1) (1)
CDTP BP
REPAIR IDENTIFICATION
NATIONAL BOARD "VR" DATE REPAIRED
CERTIFICATE NUMBER

FIGURE 5.7.5-g
Required markings for repair or replacement of nuclear pressure relief valves

CERTIFICATE HOLDER
DATE OF REPAIR OR REPLACEMENT
NATIONAL BOARD
CERTIFICATE NOS.
COMPLETED IN ACCORDANCE WITH ASME SECTION XI
EDITION ADDENDA CODE CASE(S)
REPAIR
REPLACEMENT
®
NR VR
SET PRESSURE CAPACITY
(IF CHANGE IN SET PRESSURE)

Note 1. *Required* ~~To be indicated~~ only when changed

3.6.3 ~~5.9.3~~ CHANGES TO ORIGINAL PRESSURE RELIEF VALVE NAMEPLATE INFORMATION

a) If the set pressure is changed, the set pressure, capacity, and blowdown, if applicable, on the original nameplate or stamping shall be marked out but left legible. The new capacity shall be based on that for which the valve was originally certified.
b) If the service fluid is changed, the capacity, including units, on the original nameplate or stamping shall be marked out but left legible. The new capacity shall be based on that for which the valve was originally certified, or if a conversion has been made, as described in S7.2 (check x-ref) on the capacity certification for the valve as converted.
c) If the Type/Model number is changed, the Type/Model number on the original nameplate shall be marked out but left legible.
d) If the blowdown is changed, the blowdown on the original nameplate or stamping shall be marked out but left legible. The new blowdown may be based on the current ASME Code requirements.
e) Incorrect information on the original manufacturer's nameplate shall be marked out but left legible. Corrected information shall be indicated on the repair nameplate and noted on the document as required by the quality system.

3.6.4 ~~5.9.4~~ TEST ONLY NAMEPLATE

a) Where a valve has been tested and adjusted, as permitted by S7.10.1, (check x-ref) but not otherwise repaired, a "Test Only" nameplate shall be applied that contains the following information:
1) Name of responsible organization;
2) Date of test;
3) Set Pressure; and
4) Identification, such as "Test Only."
b) A "Test Only" nameplate is also recommended when periodic testing has been performed, even when no adjustments have been made, for the purpose of identifying the date the valve was tested.
c) The existing repair nameplates, if applicable, shall not be removed during such testing.

3.6.5 ~~5.9.5~~ REPLACEMENT OF ILLEGIBLE OR MISSING NAMEPLATES

a) Illegible Nameplates
When the information on the original manufacturer's or assembler's nameplate or stamping is illegible, but traceability can be confirmed, the nameplate or stamping will be augmented by a nameplate furnished by the "VR" stamp holder stamped "Duplicate." It shall contain all information that originally appeared on the nameplate or valve, as required by the applicable section of the ASME Code, except the "V," "HV," or "UV" symbol and the National Board mark. The repair organization's nameplate, with the "VR" stamp and other required data specified in 5.9.2, will make the repairer responsible to the owner and the Jurisdiction that the information on the duplicate nameplate is correct.
b) Missing Nameplates
When the original valve nameplate is missing, the repair organization is not authorized to perform repairs to the valve under the "VR" program, unless positive identification can be made to that specific valve and verification that the valve was originally stamped with an ASME "V" or UV" symbol or marked with an ASME "HV" symbol. Valves that can be positively identified will be equipped with a duplicate nameplate, as described in this section, in addition to the repairer's "VR"-stamped nameplate. The repairer's responsibilities for accurate data, as defined in 5.9.5(a) (Illegible Nameplates), shall apply.
c) Marking of Original Code Stamp
When a duplicate nameplate is affixed to a valve, as required by this section, it shall be marked "Sec. I," "Sec. IV," or "Sec. VIII," as applicable, to indicate the original ASME Code stamping.

3.7 ~~1.7~~ ACCREDITATION OF "VR" REPAIR ORGANIZATIONS

3.7.1 ~~1.7.1~~ SCOPE

a) These administrative rules and procedures are provided 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.

3.7.2 ~~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.

3.7.3 ~~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.

3.7.4 ~~1.7.4~~ REPAIR OF NUCLEAR VALVES

Provided that the requirements of Supplement 9 check x-ref 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.

3.7.5 ~~1.7.5~~ ISSUANCE AND RENEWAL OF THE "VR" *CERTIFICATE OF AUTHORIZATION*

3.7.5.1 ~~1.7.5.1~~ 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 check x-ref of this Part, provides rules for the repair of ASME Section III "NV" stamped pressure relief devices.

3.7.5.2 ~~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.

3.7.5.3 ~~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 check x-ref 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.

3.7.5.4 ~~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).

3.7.5.5 ~~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 check x-ref 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.

3.7.5.6 ~~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.

3.7.6 ~~1.7.6~~ USE OF THE "VR" AUTHORIZATION

3.7.6.1 ~~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 *NBIC Part 4, sections 3.0 through 3.6* ~~Supplement 7 of the NBIC~~. Those requirements shall be mandatory when a "VR" repair is performed.

3.7.6.2 ~~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.

3.7.6.3 ~~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.

3.7.6.4 ~~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.

3.7.6.5 ~~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.*

3.7.6.6 ~~1.7.6.6~~ CHANGES TO VR 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.

3.7.6.7 ~~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*.

3.7.7 ~~1.7.7~~ QUALITY SYSTEM

3.7.7.1 ~~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.

3.7.7.2 ~~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.

3.7.7.3 ~~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.

3.7.7.4 ~~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.

3.7.7.5 ~~1.7.7.5~~ OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM

The following establishes the minimum requirements of the written description of the quality system. It is required that each valve repair organization develop its own quality system that meets the requirements of its organization. For this reason it is not possible to develop one quality system that could apply to more than one organization. The written description shall include, as a minimum, the following features:
a) Title Page
The title page shall include the name and address of the company to which the National Board *Certificate of Authorization* is to be issued.
b) Revision Log
A revision log is required to assure revision control of the quality system manual. The log should contain sufficient space for date, description and section of revision, company approval, and National Board acceptance.
c) Contents Page
The contents page should list and reference, by paragraph and page number, the subjects and exhibits contained therein.
d) Statement of Authority and Responsibility
A statement of authority and responsibility shall be dated and signed by an officer of the company. It shall include:
1) A statement that the "VR" stamp shall be applied only to pressure relief valves
that meet both of the following conditions:
a. Are stamped with an ASME "V", "UV", or "NV" Code symbol or marked with an ASME "HV" symbol and have been capacity certified by the National Board; and
b. Have been disassembled, inspected, and repaired by the Certificate Holder such that the valves'

condition and performance are equivalent to the standards for new valves.
2) The title of the individual responsible to ensure that the quality system is followed and who has authority and freedom to effect the responsibility;
3) A statement that if there is a disagreement in the implementation of the written quality system, the matter is to be referred to a higher authority in the company for resolution; and
4) The title of the individual authorized to approve revisions to the written quality system and the method by which such revisions are to be submitted to the National Board for acceptance before implementation.
e) Organization Chart
A chart showing the relationship between management, purchasing, repairing, inspection, and quality control personnel is required and shall reflect the actual organization in place.
f) Scope of Work
1) The scope of work section shall indicate the scope and type of valve repairs, including conversions the organization is capable of and intends to perform. The location of repairs (shop, shop and field, or field only), ASME Code Section(s) to which the repairs apply, the test medium (air, gas, liquid, or steam, or combinations thereof), and special processes (machining, welding, postweld heat treatment, or nondestructive examination, or combinations thereof) shall be specifically addressed.
2) The types and sizes of valves to be repaired, pressure ranges and other limitations, such as engineering and test facilities, should also be addressed.
g) Drawings and Specification Control
The drawings and specification control system shall provide procedures assuring that the latest applicable drawings, specifications, and instructions required are used for valve repair, including conversions, inspection, and testing.
h) Material and Part Control
The material and part control section shall describe purchasing, receiving, storage, and issuing of parts.
1) State the title of the individual responsible for the purchasing of all material.
2) State the title of the individual responsible for certification and other records as required.
3) All incoming material and parts shall be checked for conformance with the
purchase order and, where applicable, the material specifications or drawings. Indicate how material or part is identified and how identity is maintained by the quality system.
i) Repair and Inspection Program
The repair and inspection program section shall include reference to a document (such as a report, traveler, or checklist) that outlines the specific repair and inspection procedures used in the repair of pressure relief valves. Repair procedures shall require verification that the critical parts meet the valve manufacturer's specification. Supplement S7.14 outlines recommended procedures covering some specific items. Provisions shall be made to retain this document for a period of at least five years.
1) Each valve or group of valves shall be accompanied by the document referred to above for processing through the plant. Each valve shall have a unique identifier (i.e., repair serial number, shop order number, etc.) appearing on the repair documentation and repair nameplate such that traceability is established.
2) The document referred to above shall describe the original nameplate information, including the ASME Code symbol stamping and the repair nameplate information, if applicable. In addition, it shall include material checks, replacement parts, conversion parts (or both), reference to items such as the welding procedure specifications (WPS), fitup, NDE technique, heat treatment, and pressure test methods to be used. Application of the "VR" stamp to the repair nameplate shall be recorded in this document. Specific conversions performed with the new Type/Model number shall be recorded on the document. There shall be a space for "signoffs" at each operation to verify that each step has been properly performed.
3) The system shall include a method of controlling the repair or replacement of critical valve parts. The method of identifying each spring shall be indicated.
4) The system shall also describe the controls used to ensure that any personnel engaged in the repair of pressure relief valves are trained and qualified in accordance with Supplement S7.
j) 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 S7.
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 Supplement S7.
2) The completed Form R-1 shall be noted on and attached to the "VR" Certificate Holder's document required in 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.
k) Valve Testing, Setting, and Sealing
The system shall include provisions that each valve shall be tested, set, and all external adjustments sealed according to the requirements of the applicable ASME Code Section and the National Board. The seal shall identify the "VR" Certificate Holder making the repair. Abbreviations or initials shall be permitted, provided such identification is acceptable to the National Board.
l) Valve Repair Nameplates
An effective valve stamping system shall be established to ensure proper stamping of each valve as required by 5.9.2. The manual shall include a description of the nameplate or a drawing.
m) Calibration
1) The manual shall describe a system for the calibration of examination, measuring, and test equipment used in the performance of repairs. Documentation of these calibrations shall include the standard used and the results.
2) All calibration standards shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.
n) Manual Control
The quality system shall include:
1) Measures to control the issuance of and revisions to the quality system manual;
2) Provisions for a review of the system in order to maintain the manual current with these rules and the applicable sections of the ASME Code;
3) The title(s) of the individual(s) responsible for control, revisions, and review of the manual;
4) Provision of a controlled copy of the written quality system manual to be submitted to the National Board; and
5) Revisions shall be submitted for acceptance by the National Board prior to being implemented.
o) Nonconformities
The system shall establish measures for the identification, documentation, evaluation, segregation, and disposition of nonconformities. A nonconformity is a condition of any material, item, product, or process in which one or more characteristics do not conform to the established requirements.
These may include, but are not limited to, data discrepancies, procedural and/or documentation deficiencies, or material defects. Also, the title(s) of the individual(s) involved in this process shall be included.
p) Exhibits
Forms used in the quality system shall be included in the manual with a written description. Forms exhibited should be marked SAMPLE and completed in a manner typical of actual valve repair procedures.
q) Testing Equipment (See Supplement 5 *for a guide on the sizing of pressure vessels used as part of pressure relief valve test equipment*)
The system shall include a means to control the development, addition, or modification of testing equipment to ensure the requirements of 4.5.1(b) are met.
r) Field Repairs (See ~~Supplement S7.7~~ check x-ref)
If field repairs are included in the scope of work, the system shall address any differences or additions to the quality system required to properly control this activity, including the following:
1) Provisions for annual audits of field activities shall be included;
2) Provisions for receipt and inspection of replacement parts, including parts received from the owner-user, shall be addressed;
3) If owner-user personnel will assist with repairs, provisions for the use of owner user personnel shall be included; and
4) Provisions for use of owner-user measurement and test equipment, if applicable, shall be addressed.

3.7.8 ~~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 check x-ref. 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.*

3.7.9 ~~S7.7~~ FIELD REPAIR

Repair organizations may obtain a "VR" *Certificate of Authorization* for field repair, either as an extension to their in-shop/plant scope, or as a field-only scope, provided that:
a) Qualified technicians in the employ of the certificate holder perform such repairs;
b) An acceptable quality system covering field repairs, including field audits, is maintained;
c) Functions affecting the quality of the repaired valves are supervised from the address of record where the "VR" certification is issued.

3.7.9.1 ~~S7.8~~ AUDIT REQUIREMENTS

Upon issuance of a *Certificate of Authorization*, provided field repairs are performed, annual audits of the work carried out in the field shall be performed to ensure that the requirements of the certificate holder's quality system are met.
The audit shall include, but not be limited to, performance testing, in accordance with 4.5, of valve(s) that were repaired in the field. The audits shall be documented.

3.7.9.2 ~~S7.9~~ USE OF OWNER-USER PERSONNEL

For the repair of pressure relief valves at an owner-user's facility for the owner-user's own use, the "VR" Certificate Holder may utilize owner-user personnel to assist certificate holder technician(s) in the performance of repairs provided:
a) The use of such personnel is addressed in the "VR" Certificate Holder's quality system;
b) The owner-user personnel are trained and qualified in accordance with Supplement S7.10 check x-ref;
c) Owner-user personnel work under direct supervision and control of the "VR" Certificate Holder's technician(s) during any stage of the repair when they are utilized;
d) The "VR" Certificate Holder shall have the authority to assign and remove owner-user personnel at its own discretion; and
e) The names of the owner-user personnel utilized are recorded on the document as required for a quality system.

3.8 ~~S7.11~~ TRAINING AND QUALIFICATION OF PERSONNEL

~~S7.11.1 GENERAL~~

3.8.1 ~~S7.11.2~~ CONTENTS OF TRAINING PROGRAM

The repair organization shall establish a documented in-house training program. This program shall establish training objectives and provide a method of evaluating training effectiveness. As a minimum, training objectives for knowledge level shall include:
a) Applicable ASME Code and NBIC requirements;
b) Responsibilities within the organization's quality system; and
c) Knowledge of the technical aspects and mechanical skills for the applicable position held.

3.8.2 ~~S7.11.3~~ QUALIFICATION OF PERSONNEL

Each repair organization shall establish minimum qualification requirements for those positions within the organization as they directly relate to pressure relief valve repair. Each repair organization shall document the evaluation and acceptance of an individual's qualification for the applicable position.

3.8.3 ~~S7.11.4~~ ANNUAL REVIEW OF QUALIFICATION

The repair organization shall annually review the qualifications of repair personnel to verify proficiency as well as compliance with the certificate holder's quality system. This review shall include training records, documented evidence of work performed, and when necessary, monitoring job performance. The review shall be documented.

SUPPLEMENTS

SUPPLEMENT 1

PRESSURE RELIEF VALVES ON THE LOW PRESSURE SIDE OF STEAM PRESSURE-REDUCING VALVES *(was Part 1 Supplement 2)*

S1.1 ~~S2.1~~ SCOPE

a) The subject of protection of vessels in steam service connected to the low-pressure side of a steam-pressure-reducing valve is of considerable importance to proper operation of auxiliary equipment such as pressure cookers, hot-water heating systems, etc., operating at pressures below that which the primary boiler generating unit is operating.
b) To automatically reduce the primary boiler pressure for such processing equipment, pressure-reducing valves are used. The manufacturers of such equipment have data available listing the volume of flow through reducing valves manufactured by them, but such data are not compiled in a form that the results can be deduced readily.
To protect the equipment operating on the low pressure side of a pressure-reducing valve, safety valves of a relieving capacity sufficient to prevent an unsafe pressure rise in case of failure of the pressure-reducing valve, should be installed.
c) The pressure-reducing valve is a throttling device, the design of which is based on certain diaphragm pressures opposed by spring pressure which, in turn, controls the opening through the valve. If the spring, the diaphragm, or any part of the pressure- reducing valve fails, steam will flow directly through the valve and the low pressure equipment will be subjected to the boiler pressure. To protect the equipment operating on the low pressure side of the pressure-reducing valve, safety valve(s) should be installed on the low pressure side of the pressure-reducing valve, which will provide a relieving capacity sufficient to prevent the pressure from rising above the system design pressure.
d) In most cases pressure-reducing valves used for the reduction of steam pressures have the same pipe size on the inlet and outlet. In case of failure of a pressure-reducing valve, the safety valve on the low-pressure side must have a capacity to take care of the volume of steam determined by the high pressure side and the area of the pipe.

S1.2 ~~S2.2~~ SAFETY VALVE CAPACITY

a) The capacity of the safety valve(s) on the low-pressure side of the pressure-reducing valve should be based on the capacity of the pressure-reducing valve when wide open or under maximum flow conditions or the flow capacity through the bypass valve.
b) By using the formula in S2.3 below, Inspectors may calculate the required relieving capacities of the safety valve(s) installed on the low-pressure side of the pressure reducing valve.
c) Usually a pressure-reducing valve has a bypass arrangement so that in case of failure of the pressure-reducing valve the boiler pressure may be short circuited into the low-pressure line without passing through the pressure-reducing valve. When determining the required relieving capacity of safety valves for the low-pressure side of the pressure-reducing valve, the steam flow through the bypass must be taken into consideration.

S1.3 ~~S2.3~~ CALCULATION OF SAFETY VALVE RELIEVING CAPACITY

a) When a pressure-reducing valve is installed, there are two possibilities of introducing boiler pressure into the low-pressure system:
1) the failure of the pressure-reducing valve so that it remains wide open; and
2) the possibility of the bypass valve being open.
b) It is necessary therefore, to determine the flow under both circumstances in paragraph a) above and check that the size of the safety valve under either condition will be adequate. The following formula should be used:
1) steam flow, W in lbs/hr (kg/hr) through the pressure-reducing valve
$W = AKC$
where,

A = internal area in sq. in. (sq. mm) of the inlet pipe size of the pressure reducing valve (see S2.5)
K = flow coefficient for the pressure reducing valve (see S2.4)
C = flow of saturated steam through a 1 sq. in. (1 sq. mm) pipe at various pressure differentials from Tables S2.3-a, S2.3-b, or S2.3-c.
(for U.S. Customary units) or Tables S2.3M-a, S2.3M-b, or S2.3M-c (for metric units).
2) steam flow, W in lbs/hr (kg/hr) through the by-pass valve
W = A1 K1 C1
where,
A1 = internal area in sq. in. (sq. mm) of the pipe size of the bypass around the pressure-reducing valve
K1 = flow coefficient for the bypass valves (see S2.4)
C1 = flow of saturated steam through a 1 sq. in. (1 aq. mm) pipe at various pressure differentials from Tables S2.3-a, S2.3-b, or S2.3-c.
(for U.S. Customary units) or Tables S2.3M-a, S2.3M-b, or S2.3M-c (for metric units).

S 1.4 ~~S2.4~~ STEAM FLOW WHEN FLOW COEFFICIENTS ARE NOT KNOWN

a) It is possible that the flow coefficients K and K1 may not be known and in such instances for approximating the flow, a factor of 1/3 may be substituted for K and 1/2 for K1.
The formulas in S2.3 then becomes:
W = 1/3 AC for the capacity through the pressure-reducing valve; and
W = 1/2 A1 C1 for the capacity through the bypass valve.
b) Caution should be exercised when substituting these factors for the actual coefficients since this method will provide approximate values only and the capacities so obtained may in fact be lower than actual. It is recommended that the actual flow coefficient be obtained from the pressure-reducing valve manufacturer and reference books be consulted for the flow coefficient of the bypass valve.

(Tables did not import correctly)

TABLE S2.3-a
Capacity of Saturated Steam, in lb./hr., per sq. in. of Pipe Area

	1500	1450	1400	1350	1300	1250	1200	1150	1100	1050	1000	950	900
1000	76560	72970	69170	64950	60540	55570	49930	43930	35230	25500			
950	77430	74180	70760	67000	63100	58770	53920	48610	42380	34890	24910		
900	77750	74810	71720	68340	64870	61040	56820	52260	47050	41050	33490	23960	
850	77830	74950	72160	69130	66020	62610	58900	54930	50480	45470	39660	29080	23190
800		75070	72330	69490	66700	63680	60390	56910	53060	48800	43980	38340	31610
750			69610	66880	64270	61260	58200	54840	51170	47080	42420	37110	
700				66900	64270	61520	58820	55870	52670	49170	45230	40860	
650					61550	58860	56260	53480	50440	47070	43400		
600						58980	56270	53660	51020	48470	45010		
550							53810	51040	48470	45800			
500											45850		
450											45870		
400													
350													
300													
250													
200													
175													
150													
125													
110													
100													
85													
75													
60													
50													
40													
30													
25													

15 . . . . . .
10 . . . . . .
5 . . . . . .
Outlet
pres.,
psi
Pressure-reducing valve inlet pressure, psi
Where capacities are not shown for inlet and outlet conditions, use the highest capacity shown under the applicable inlet pressure column.
TABLE S2.3M-a
Capacity of Saturated Steam, in kg/hr., per sq. mm of Pipe Area
10.25 10.00 9.75 9.50 9.25 9.00 8.75 8.50 8.25 8.00 7.75 7.50 7.25 7.00 6.75 6.50 6.25
6.75 53.44 51.68 49.82 47.85 45.77 43.63 41.28 38.73 36.01 33.09 29.47 25.37 20.89 . . . . . .
6.50 53.87 52.23 50.52 48.69 46.79 44.83 42.69 40.40 37.95 35.30 32.33 29.02 25.31 20.46 . . . . . .
6.25 54.07 52.55 50.96 49.27 47.51 45.71 43.75 41.67 39.46 37.08 34.46 31.59 28.43 24.45 19.36 . . . . . .
6.00 54.15 52.67 51.19 49.62 47.99 46.33 44.53 42.63 40.62 38.74 36.12 33.59 30.83 27.53 23.13 17.64 . . . . .
5.75 54.19 52.74 51.32 49.85 48.33 45.80 45.14 43.40 41.56 39.62 37.51 35.25 32.82 30.04 26.20 21.90 18.76
5.50 54.20 52.78 51.40 49.97 48.53 47.11 45.60 44.00 42.32 40.55 38.56 36.63 34.48 32.05 29.37 26.41 23.01
5.25 . . . . . 50.00 48.60 47.20 45.82 44.35 42.78 41.17 39.44 37.62 35.68 33.52 31.16 28.59 25.72
5.00 . . . . . 50.01 48.62 47.23 45.89 44.49 43.02 41.55 39.98 38.33 36.57 34.64 32.56 30.01 27.84
4.75 . . . . . 47.24 . . . . . 44.52 43.13 41.75 40.31 38.81 37.22 35.50 33.64 31.66 29.51
4.50 . . . . . 44.53 43.14 41.77 40.43 39.08 37.63 36.07 34.41 32.65 30.76
4.25 . . . . . 43.15 41.82 40.46 39.10 37.74 36.33 34.90 33.39 31.60
4.00 . . . . . 41.84 40.48 39.12 37.82 36.45 35.12 33.76 32.15
3.75 . . . . . 39.14 37.88 36.48 35.13 33.81 32.45
3.50 . . . . . 32.47
3.25 . . . . . 32.48
3.00 . . . . . .
Outlet
pres.,
MPa
Pressure-reducing valve inlet pressure, MPa
Where capacities are not shown for inlet and outlet conditions, use the highest capacity shown under the applicable inlet pressure column.

SUPPLEMENT 2

PRESSURE DIFFERENTIAL BETWEEN SAFETY OR SAFETY RELIEF VALVE SETTING AND BOILER OR PRESSURE VESSEL OPERATING PRESSURE (Was Part 2, Supplement 8)

S 2.1 ~~S8.1~~ SCOPE

If a safety valve or safety relief valve is subjected to pressure at or near its set pressure, it will tend to weep or simmer, and deposits may accumulate in the seat and disk area. Eventually, this can cause the valve to freeze closed and thereafter the valve could fail to open at the set pressure. Unless the source of pressure to the boiler or pressure vessel is interrupted, the pressure could exceed the rupture pressure of the vessel. It is important that the pressure differential between the valve set pressure and the boiler or pressure vessel operating pressure is sufficiently large to prevent the valve from weeping or simmering.

S2.2 ~~S8.2~~ HOT WATER HEATING BOILERS

For hot-water heating boilers, the recommended pressure differential between the pressure relief valve set pressure and the boiler operating pressure should be at least 10 psi (70 kPa), or 25% of the boiler operating pressure, whichever is greater. Two examples follow:
a) If the safety relief valve of a hot-water heating boiler is set to open at 30 psi (200 kPa), the boiler operating pressure should not exceed 20 psi (140 kPa).
b) If the safety relief valve of a hot water heating boiler is set to open at 100 psi (700 kPa), the boiler operating pressure should not exceed 75 psi (520 kPa). Section IV of the ASME Code does not require that safety relief valves used on hot water heating boilers have a specified blowdown. Therefore, to help ensure that the safety relief valve will close tightly after opening and when the boiler pressure is reduced to the normal operating pressure, the pressure at which the valve closes should be well above the operating pressure of the boiler.

S2.3 ~~S8.3~~ STEAM HEATING BOILERS

For steam heating boilers, the recommended pressure differential between the safety valve set pressure and boiler operating pressure should be at least 5 psi (35 kPa), i.e., the boiler operating pressure should not exceed 10 psi (70 kPa).
Since some absorption-type refrigeration systems use the steam heating boiler for their operation, the boiler operating pressure may exceed 10 psi (70 kPa). If the boiler operating pressure is greater than 10 psi (70 kPa), it should not exceed 15 psi (100 kPa), minus the blowdown pressure of the safety valve. This recommendation can be verified by increasing the steam pressure in the boiler until the safety valve pops, then slowly reducing the pressure until it closes, to ensure that this closing pressure is above the operating pressure.

S2.4 ~~S8.4~~ POWER BOILERS

For power boilers (steam), the recommended pressure differentials between the safety valve set pressure and the boiler operating pressure are as follows:

(following to be prepared in table format)

MINIMUM PRESSURE DIFFERENTIAL AS PERCENTAGE OF BOILER DESIGN PRESSURE

over 15 psi to 300 psi (100 KPa to 2.10 MPa): 10% but not less than 7 psi (50 KPa)
over 300 psi to 1000 psi (2.14 MPa to 6.89 MPa): 7% but not less than 30 psi (200 KPa)
over 1000 psi to 2000 psi (6.89 MPa to 13.8 MPa): 5% but not less than 70 psi (480 KPa)
over 2000 psi (13.8 MPa): per designer's judgment

Notes:
1. Above 2000 psi (13.8 MPa) the pressure differential between operating pressure and the maximum allowable working pressure is a matter for the designer's judgment , taking into consideration such factors as satisfactory operating experience and the intended service conditions.
2. Safety relief valves in hot water service are more susceptible to damage and subsequent leakage, than safety valves relieving steam. It is recommended that the maximum allowable working pressure of

the boiler and safety relief valve setting for high-temperature hot -water boilers be selected substantially higher than the desired operating pressure, so as to minimize the time the safety relief valve must lift.
3. For organic fluid vaporizers a pressure differential of 40 psi (280 kPa) is recommended.

S2.5 ~~S8.5~~ PRESSURE VESSELS

Due to the variety of service conditions and the various designs of pressure relief valves, only general guidelines can be given regarding differentials between the set pressure of the valve and the operating pressure of the vessel. Operating difficulty will be minimized by providing an adequate differential for the application. The following is general advisory information on the characteristics of the intended service and of the pressure relief valves that may bear on the proper pressure differential selection for a given application. These considerations should be reviewed early in the system design since they may dictate the maximum allowable working pressure of the system. To minimize operational problems it is imperative that the user consider not only normal operating conditions of the fluids (liquids or gases), pressures, and temperatures, but also start-up and shutdown conditions, process upsets, anticipated ambient conditions, instrument response time, and pressure surges due to quick-closing valves, etc. When such conditions are not considered, the pressure relief devices may become, in effect, a pressure controller, a duty for which it was not designed. Additional consideration should be given to the hazard and pollution associated with the release of the fluid. Larger differentials may be appropriate for fluids which are toxic, corrosive, or exceptionally valuable. The blowdown characteristics and capabilities are the first consideration in selecting a compatible valve and operating margin. After a self-actuated release of pressure, the valve must be capable of reclosing above the normal operating pressure. For example: if the valve is set at 100 psi (700 kPa) with a 7% blowdown, it will close at 93 psi (640 kPa). The operating pressure must be maintained below 93 psi (640 kPa) in order to prevent leakage or flow from a partially open valve.

Users should exercise caution regarding the blowdown adjustment of large, spring-loaded valves. Test facilities, whether owned by the manufacturer, repair house, or user, may not have sufficient capacity to accurately verify the blowdown setting. The setting cannot be considered accurate unless made in the field on an actual installation.

Pilot operated valves represent a special case from the standpoint of both blowdown and tightness. The pilot portion of some pilot operated valves can be set at blowdowns as short as 2%. This characteristic is not, however, reflected in the operation of the main valve in all cases. The main valve can vary considerably from the pilot depending on the location of the two components in the system. If the pilot is installed remotely from the main valve, significant time and pressure lags can occur, but reseating of the pilot ensures reseating of the main valve. The pressure drop in connecting piping between the pilot and the main valve must not be excessive, otherwise the operation of the main valve will be adversely affected.

Tightness capability is another factor affecting valve selection, whether spring-loaded or pilot operated. Tightness varies somewhat depending on whether metal or resilient seats are specified and also on such factors as corrosion and temperature. The required tightness and test method should be specified to comply at a pressure not lower than the normal operating pressure of the process. It should be remembered that any degree of tightness obtained should not be considered permanent. Service operation of a valve almost invariably reduces the degree of tightness.

The following minimum pressure differentials are recommended unless the safety or safety relief valve has been designed or tested in a specific or similar service and a smaller differential has been recommended by the manufacturer:

(following to be prepared in table format)

a) for set pressures up to 70 psi (480 kPa), the recommended pressure differential is 5 psi (35 kPa);
b) for set pressure between 70 and 1000 psi (480 kPa and 6.89 MPa), the recommended pressure differential is 10% of set pressure; and
c) for set pressures above 1000 psi (6.89MPa), the recommended pressure differential is 7% of set pressure.

SUPPLEMENT 3

GUIDE TO JURISDICTIONS FOR AUTHORIZATION OF OWNERS-USERS TO MAKE ADJUSTMENTS TO PRESSURE RELIEF VALVES (WAS PART 3 S7.10)

S3.1 ~~S7.10.1~~ GENERAL

The Jurisdiction may authorize properly trained and qualified employees of boiler and pressure owners-users or their designees to restore 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.

S3.2 ~~S7.10.2~~ TRAINING

a) The user shall establish a documented in house training program. This program shall establish training objectives and provide a method of evaluating the training effectiveness. As a minimum, training objectives for knowledge level shall include:
1) Applicable ASME Code and NBIC requirements;
2) Responsibilities within the organization's quality system;
3) Knowledge of the technical aspects and mechanical skills for making set pressure and/or blowdown adjustments to pressure relief valves;
4) Knowledge of the technical aspects and mechanical skills for marking of pressure relief valve adjustments.
b) If the user established a designee, the designee shall establish a training program and make their documentation available to the user and the jurisdictional authority.

S3.3 ~~S7.10.3~~ DOCUMENTATION

Each user shall document the evaluation and acceptance of an employee's or designee's qualifications.

S3.4 ~~S7.10.4~~ QUALITY SYSTEM

a) A written quality system shall be established by either the user or the designee with a written description available to the jurisdictional authority.
b) The written description shall include at a minimum:
1) Calibration of Test Equipment: This shall describe a system for the calibration of measuring and test equipment. Documentation of these calibrations shall include the standard used and the results. Calibration standards shall be calibrated against the equipment having valid relationships to nationally recognized standards.
2) Valve Testing, Setting, and Sealing: This system shall include provisions that each valve shall be tested, set, and all external adjustments sealed according to the requirements of the applicable ASME Code Section and S7.10.1(a).
3) Valve Marking: An effective marking system shall be established to ensure proper marking of the metal tag required by S7.10.1(a). The written quality system shall include a description or drawing of the metal tag.

S3.5 ~~S7.10.5~~ EXTERNAL ADJUSTMENTS

Only external adjustments to restore the required set pressure and/or performance of a pressure relief valve shall be made under the provisions of S3.1 ~~S7.10.1~~.

S3.6 ~~S7.10.6~~ REPAIRS

If disassembly, change of set pressure, or additional repairs are necessary, the valve shall be repaired by an organization that meets the requirements of the NBIC.

SUPPLEMENT 4

RECOMMENDED PROCEDURES FOR REPAIRING PRESSURE RELIEF VALVES (Was supplement S7.14)

S4.1 ~~S7.14.1~~ INTRODUCTION

a) It is essential that the repair organization establish basic, specific procedures for the repair of pressure relief valves. The purpose of these recommended procedures is to provide the repair organization with guidelines for this important aspect of valve repair. It is realized that there are many types of valves and conditions under which they are repaired and, for this reason, the specific items in these recommended procedures may not apply, or they may be inadequate for each of those types or to the detailed repairs that may be required for each valve.
b) S4.2 ~~S7.14.2~~ contains recommended procedures for the repair of spring-loaded pressure relief valves, and S4.3 ~~S7.14.3~~ contains recommended procedures for the repair of pilot operated types of safety relief valves. *Information on Packaging, Shipping and Transportation is included as S4.5.*

S4.2 ~~S7.14.2~~ SPRING-LOADED PRESSURE RELIEF VALVES

Prior to removal of a valve from a system for a repair or any disassembly, ensure that all sources of pressure have been removed from the valve.
a) Visual Inspection as Received
1) This information is to be recorded:
a. Record user (customer) identification number.
b. Complete nameplate data, plus any important information received from customer.
c. Check external adjustment seals for warranty repair.
d. Check bonnet for venting on bellows type valves.
e. Check appearance for any unusual damage, missing, or misapplied parts.
2) If sufficient damage or other unusual conditions are detected that may pose a safety risk during preliminary testing, then proceed directly to S7.14.2 c).
3) Valves that are to be repaired in place proceed to S7.14.2 c), unless preliminary testing has been authorized by the owner.
b) Preliminary Test as Received
1) Information from the recommended preliminary performance test and subsequent disassembly and inspections will provide a basis for any repair interval change that should be necessary to ensure that the valve will function as intended.
2) Determine set pressure or Cold Differential Test Pressure (CDTP) in accordance with manufacturer's recommendations and appropriate ASME Code Section. Do not allow test pressure to exceed 116% of set pressure unless otherwise specified by the owner. A minimum of three tests is usually required to obtain consistent results.
3) If results do not correlate with field performance, then steps to duplicate field conditions (fluid and temperature) may be necessary.
4) Record preliminary test results and test bench identification data.
c) Disassembly
1) Remove cap and lever assembly, if applicable.
2) Remove release nut assembly, if applicable.
3) Loosen jam nut on adjusting (compression) screw.
4) Record measurement and remove adjusting (compression) screw.
5) Remove bonnet or yoke.
6) Remove spring and washers, and tag (identify) including upper and lower washers, as appropriate.
7) Remove spindle and disk assembly.
8) Remove ring pins.
9) Record measurement and remove adjusting rings, nozzle, and guide, as applicable.
d) Cleaning
1) Wire all small parts together and clean by means of an abrasive. (Caution: do not use a cleaning method that will damage the parts.)
2) Do not clean in a chemical solution except under acceptable circumstances.
3) Protect seating surfaces and nameplates prior to cleaning.
e) Inspection

1) Check spring for damage such as erosion, corrosion, cracking, breakage, or compression below free height.
2) Check nozzle for cracks (NDE as applicable) or unusual wear.
3) Check disk assembly for cracks (NDE as applicable) or unusual wear.
4) Check spindle for trueness, bearing areas, and thread condition.
5) Check guide for wear and galling.
6) Check adjusting ring(s) for worn threads and wear.
7) Check ring pins for bent or broken pin and thread condition.
8) Check bellows, if provided, for pinholes and corrosion.
9) Check flange gasket facings for wear and cuts.
f) Machining
Machine nozzle and disk as necessary to the manufacturer's critical dimension charts.
g) Lapping
1) Machine or hand lap disk and nozzle to be sure of flatness.
2) Lap bevel seats to a grey finish; then re-machine disk or plug to the manufacturer's critical dimension.
h) Adjusting Rings
Install lower ring and guide ring to the same position they were when removed, or to manufacturer's specifications.
i) Bearing Points
Grind all bearing areas with grinding compound to make sure they are round and true.
j) Testing
Test data shall be recorded. Testing will be done in accordance with manufacturer's recommendations and appropriate ASME Code section. To preclude unsafe and unstable valve operations or erroneous performance test results, it is recommended that low volume testing equipment (e.g., gas cylinders without a test vessel, hand pumps, tubing) should be avoided.
k) Sealing
After final adjusting and acceptance by quality control inspection, all external adjustments will be sealed with a safety seal providing a means of identification of the organization performing the repair.
l) Nameplate
The repairer will place a repair nameplate on each repaired valve. The nameplate shall, as a minimum, meet the requirements of 5.9.1 **(CHECK X-REF).**

~~m) Packaging, Shipping and Transportation~~ (moved to the end of this section and combined with Part 2 info)
~~1) Valves should be securely fastened to pallets in the vertical position to avoid side loads on guiding surfaces.~~
~~2) Threaded and socket weld valves up to 2 in. (50 mm) may be securely packaged and cushioned during transport.~~
~~3) Valve inlet and outlet connection, drain connections and bonnet vents should be protected during shipment and storage to avoid internal contamination of the valve. Ensure all covers and/or plugs are removed prior to installation.~~
~~4) Lifting levers should be wired or secured so they cannot be moved while the valve is being shipped or stored.~~
~~5) Valves for special services, including but not limited to oxygen, chlorine, and hydrogen peroxide, should be packaged in accordance with appropriate standards and/or owner procurement requirements.~~

S4.3 ~~S7.14.3~~ PILOT OPERATED SAFETY RELIEF VALVES
a) Visual Inspection as Received
1) This information is to be recorded:
a. Complete nameplate data, plus any other important information received from the customer.
b. User identification number, if applicable.
c. Seals on external adjustments (~~yes/no~~, *are seals intact?*).
d. Identification on seal.
e. Obvious damage and external condition including missing or misapplied parts.
b) Disassembly
1) Remove pilot and disassemble per manufacturer's maintenance instruction.
2) Disassemble main valve. Where lift adjustments are provided, do not remove the locking device or change the lift unless it is required as part of conversion.
3) Remove the nozzle if recommended by the manufacturer's maintenance instructions and/or when required as part of conversion.

c) Cleaning
1) Pilot — Components of pilot are small and must be handled carefully to prevent damage or loss. Clean parts and nameplates with solvents that will not affect the parent metal and/or polish with 500 grit paper.
2) Main Valve — Clean by appropriate means such as abrasive blast. Finishes of machined surfaces must not be affected.
(Caution: Do not use a cleaning method that will damage the parts or nameplates.)
d) Inspection
1) Pilot
a. Check spring for damage such as corrosion, cracks, out of square ends, etc.
b. Inspect all parts for damage. Small burrs or scratches may be removed by polishing. Severely damaged parts should be replaced. (Internal components or pilots should not be repaired by machining as the functions of the pilot could easily be impaired.)
c. Check strainers *and filters* on inlet and outlet lines.
d. Replace all soft goods per manufacturer's recommendation.
2) Main Valve
a. Check nozzle seating surface for nicks. These can be removed by machining or lapping as required.
b. Check the piston and liner (or other moving member) for galling or excessive wear. The piston should move freely in the liner.
c. Replace soft goods or re-lap disk as required.
d. Where lift adjustments are provided, measure the lift per the manufacturer's specifications.
e) Testing
Test data shall be recorded. Testing will be done in accordance with the manufacturer's recommendation and in accordance with the applicable ASME Code section. To preclude unsafe and unstable valve operations or erroneous performance test results, it is recommended that low volume testing equipment (e.g., gas cylinders without a test vessel, hand pumps, tubing) should be avoided.
f) Sealing
After final adjustment and acceptance by quality control, all external adjustments will be sealed by means assuring positive identification of the organization performing the repair.
g) Nameplate
The repairer will place a repair nameplate on each repaired valve. The nameplate, as a minimum, shall meet the requirements of 5.9.1 (**NEED NEW X-REF**).

S4.5 ~~2.5.6~~ Packaging, Shipping and Transportation of Pressure Relief Devices (moved from in-service inspection and combined with similar information from spring loaded and pilot operated repair)

a) The improper packaging, shipment, and transport of pressure relief devices can have detrimental effects on device operation. Pressure relief devices should be treated with the same precautions as instrumentation, with care taken to avoid rough handling or contamination prior to installation.
b) The following practices are recommended:
1) Valves should be securely fastened to pallets in the vertical position to avoid side loads on guiding surfaces except threaded and socket-weld valves up to 2 in. (DN 50 ~~50mm~~) may be securely packaged and cushioned during transport.
2) Valve inlet and outlet connection, drain connections, and bonnet vents should be protected during shipment and storage to avoid internal contamination of the valve. Ensure all covers and/or plugs are removed prior to installation.
3) The valve should not be picked up or carried using the lifting lever. Lifting levers should be wired or secured so they cannot be moved while the valve is being shipped or stored. These wires shall be removed before the valve is placed in service.
4) Pilot valve tubing should be protected during shipment and storage to avoid damage and/or breakage.

~~h) Packaging, Shipping and Transportation~~
~~1) Valves should be securely fastened to pallets in the vertical position to avoid side loads on guiding surfaces.~~
~~2) Threaded and socket-weld valves up to 2 in. (50 mm) may be securely packaged and cushioned during transport.~~
~~3) Valve inlet and outlet connection and drain connections should be protected during shipment and storage to avoid internal contamination of the valve. Ensure all covers and/or plugs are removed prior to installation.~~
~~4) Lifting levers should be wired or secured so they cannot be moved while the valve is being shipped or~~

~~stored.~~
~~5) Tubing should be protected during shipment and storage to avoid damage and/or breakage.~~
~~6)~~ 5)Valves for special services, including but not limited to oxygen, chlorine, and hydrogen peroxide, should be packaged in accordance with appropriate standards and/or owner procurement requirements.

SUPPLEMENT 5

RECOMMENDED GUIDE FOR THE DESIGN OF A TEST SYSTEM FOR PRESSURE RELIEF DEVICES IN COMPRESSIBLE FLUID SERVICE (Was Part 3, Supplement 8)

S5.1 ~~S8.1~~ INTRODUCTION

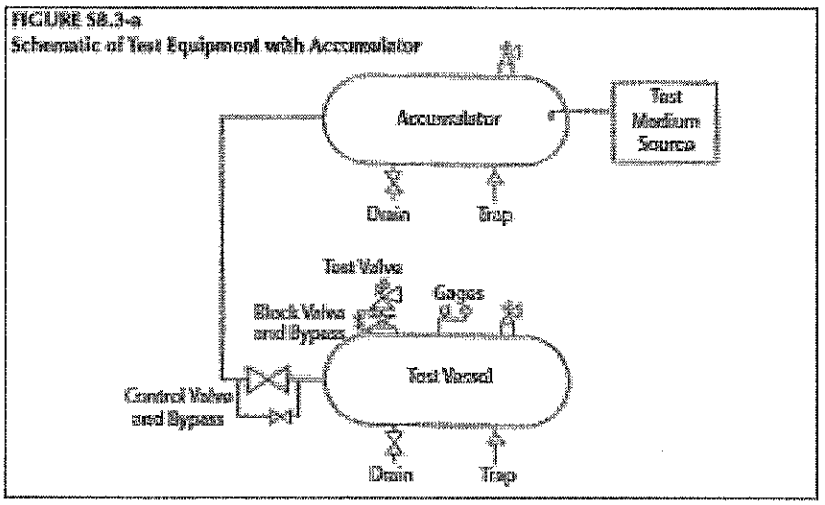
This supplement provides guidance for the design of a test system using compressible fluids (e.g., steam or air/gas) and permits the determination of pressure relief valve set pressure and valve operating characteristics such as blowdown. The size of the test vessel needed depends on the size of the valve, its set pressure, the design of the test system, and whether blowdown must be demonstrated. A repair organization may use the information provided in this supplement to determine the minimum size test vessel needed so that the measured performance is characteristic of the valve and not the test system.

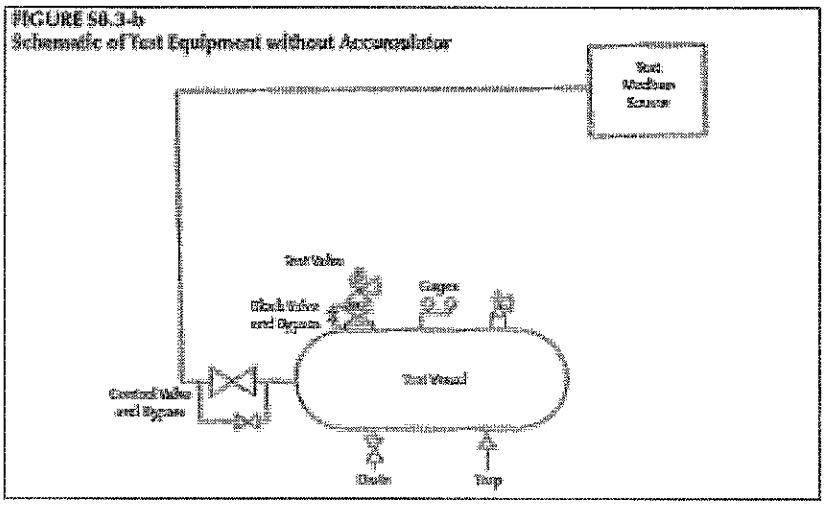
S5.2 ~~S8.2~~ GENERAL

a) The National Board administrative rules and procedures for the "VR" *Certificate of Authorization* and symbol stamp require that pressure relief valves, after repair, be tested in accordance with the manufacturer's recommendations and the applicable ASME Code. The purpose of this testing is to provide reasonable assurance that valves will perform according to design when they are returned to service.
b) It is recognized that a full evaluation of the performance of some pressure relief valve designs requires testing at maximum allowable overpressure. However, it is beyond the scope of this supplement to define test equipment or facilities for such testing.
c) Section 9 of this part provides a glossary, S8.3 describes typical test equipment, and S8.4 provides data for estimating the size of test vessels required.

S5.3 ~~S8.3~~ TEST SYSTEM DESCRIPTION

a) An optimum configuration, particularly when the test medium source is of small capacity, is shown in Figure S8.3-a. The test medium flows from the pressure source, usually a compressor or boiler, to an accumulator. It then flows through a pressure-controlling valve into the test vessel, from which it is discharged, through the pressure relief valve installed ~~mounted~~ on the test vessel. The pressure-controlling valve is usually a globe valve, although any throttling valve is acceptable. If the pressure-controlling valve
is of adequate size and can open quickly, large transient flows can be generated, increasing the pressure above the pressure relief valve set pressure, causing it to lift, and be sustained in its lifted condition.
b) Figure S8.3-b shows a simpler test system in which the test vessel is pressurized directly from the pressure source without the use of an accumulator. In this configuration, flow-rates through the pressure relief valve and any consequent over-pressure are dependent on the flow generating capacity of the pressure source.
c) In a test facility, the pressure relief valve is usually installed ~~mounted~~ on an isolating valve that should be of sufficient size that it will not choke flow to the pressure relief valve. There should be no intervening piping between the two valves to avoid any significant pressure drop between the test vessel and the pressure relief valve.
d) The isolating valve and any adapter flanges or valve test nozzles must be designed to sustain pressure relief valve discharge forces, and so secured that these forces are not transmitted to the test vessel. This is especially important for larger valves set at pressures greater than 100 psig (700 kPa).





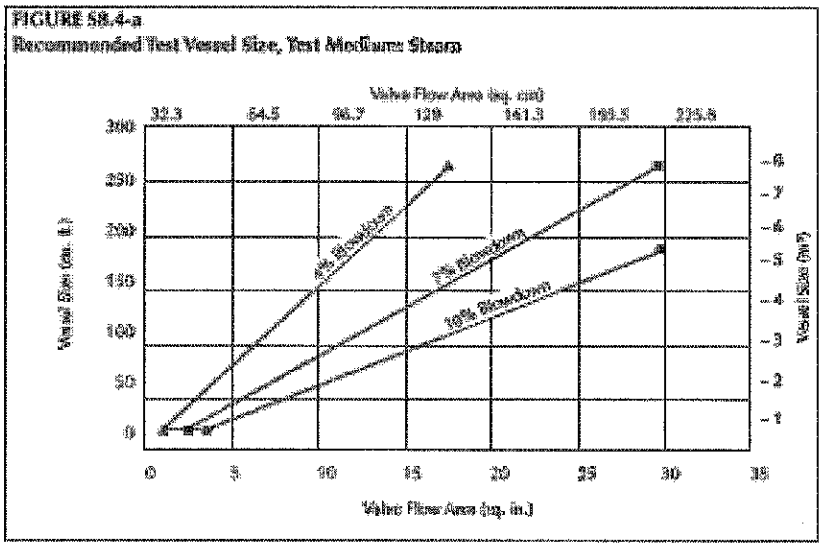
e) The vessel should have a length-to-diameter ratio as low as is practical, and should be suitably anchored.
f) Pressure sensing lines should be connected to the test vessel well away from any inlet or outlet connections where pressure distortions due to transient changes in flow velocity during testing could cause erroneous pressure readings. When testing with steam, any water head that develops in the gage line must be taken into consideration.
g) Any intervening piping between the test vessel and the pressure relief valve should be as short and as straight as possible and be of adequate size to minimize inlet pressure drop.
h) In the case of steam, the equipment should be insulated and steam traps should be installed, as appropriate, to ensure that the test steam is dry, saturated steam with a minimum quality of 98%.
i) Safety valves shall be used to protect the test vessel and the accumulator.

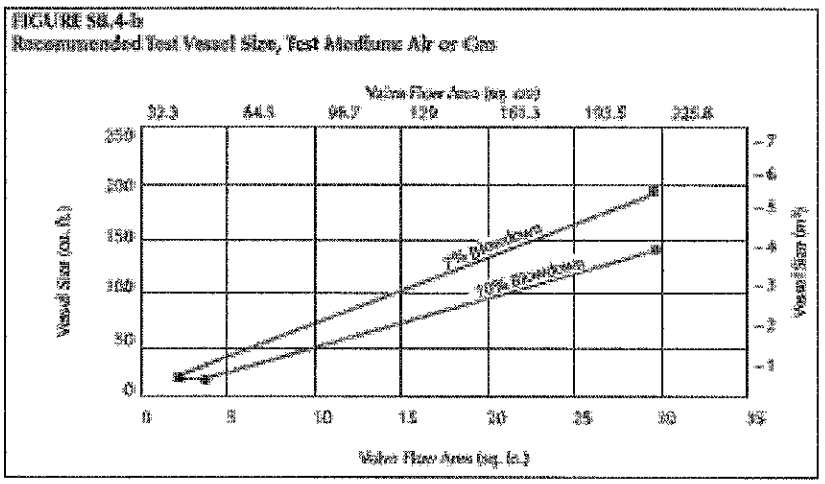
S 5.4 ~~S8.4~~ TEST VESSEL SIZING DATA

a) Recommended test vessel sizes are given in Figures S8.4-a and S8.4-b for a configuration using one vessel fed directly from the source of the test medium. Figure S8.4-a gives the test vessel size in cu. ft. vs. the valve orifice area in sq. in. for dry, saturated steam. Curves are shown for set pressures up to 500 psig (3.45MPa) for three different blowdowns: 4%, 7%, and 10%. The source is assumed to be capable of feeding the test vessel at 2500 lbs/hr. (1135 kg/hr). Figure S8.4-b gives similar curves for air with a source capable of feeding the test vessel at 200 SCFM (5.66 cu. m./minute).
b) For valves, with effective orifices less than 1.28 sq. in. (826 sq. mm), the size of the test vessel needed becomes less dependent on the flow capacity of the source. For these valves, a 15 cu. ft. (.425 cu. m.) minimum size test vessel is recommended. This should allow the accurate measurement and setting of

blowdown for small valves. This minimum size should also be adequate for determining set pressures of larger valves; however, larger test vessels must be used if blowdown is to be set accurately. It is recognized that there are practical limits on the size and maximum pressure of a test vessel used to demonstrate pressure relief valve operational characteristics. In such cases, determination of valve set pressure remains the only viable production and repair test option. The recommended minimum size test vessel (15 cu. ft. [0.425 cu. m]) is normally adequate for this purpose.

S8.5 TABLES, CHARTS, AND FIGURES





SUPPLEMENT 6

PROCEDURES TO EXTEND THE "VR" CERTIFICATE OF AUTHORIZATION AND STAMP TO ASME "NV" STAMPED PRESSURE RELIEF DEVICES (Was part 3, suppl. 9)

S6.1 ~~S9.1~~ INTRODUCTION

Approval to extend the scope of the National Board "VR" *Certificate of Authorization* to the Certificate Holder to use the "VR" stamp on ASME Code "NV" Class 1, 2, or 3 stamped pressure relief devices, which have been capacity certified by the National Board, may be given subject to the provisions that follow.

S6.2 ~~S9.2~~ ADMINISTRATIVE PROCEDURES

a) The repair organization shall hold a valid "VR" Certificate of Authorization.
b) The repair organization shall obtain a National Board "NR" Certificate of Authorization and stamp. The requirements for said certificate and stamp include, but are not limited to, the following. The repair organization shall:
1) Maintain a documented quality assurance program that meets the applicable requirements of 1.8 (**CHECK X-REF**) . This program shall also include all the applicable requirements for the use of the "VR" stamp;
2) Have a contract or agreement with an Inspection Agency to provide inspection of repaired "NV"-stamped pressure relief devices by Inspectors who have been qualified in accordance with the requirements of ASME QAI-1, *Qualifications for Authorized Inspection*;
3) Successfully complete a survey of the quality assurance program and its implementation. This survey shall be conducted by representatives of the National Board, the Jurisdiction wherein the applicant's repair facilities are located, and the applicant's Authorized Inspection Agency. Further verification of such implementation by the survey team may not be necessary if the applicant holds a valid ASME "NV" certificate and can verify by documentation the capability of implementing the quality assurance program for repair of "NV"-stamped pressure relief devices, covered by the applicant's ASME "NV" certificate.
c) The application of the "NR" *Certificate of Authorization* and stamp shall clearly define the scope of intended activities with respect to the repair of Section III, "NV"- stamped pressure relief devices.
d) Revisions to the quality assurance program shall be acceptable to the Authorized Nuclear Inspector Supervisor and the National Board before being implemented.
e) The scope of the "VR" Certificate of Authorization shall include repair of "NV"-stamped pressure relief devices.
f) Verification testing of valves repaired by the applicant shall not be required provided such testing has been successfully completed under the applicant's "VR" certification program.
g) A survey of the applicant for the "VR" Certificate
of Authorization and endorsement of the repair of "NV"-stamped pressure relief devices may be made concurrently.

S6.2 ~~S9.3~~ GENERAL RULES

a) ASME Code Section III, "NV"-stamped pressure relief devices, which have been repaired in accordance with these rules, shall be stamped with both the "VR" and "NR" stamps.
b) The "VR" and "NR" stamps shall be applied only to "NV" stamped (Class 1, 2, or 3) National Board capacity certified pressure relief devices that have been disassembled, inspected, and repaired as necessary, such that the valves' condition and performance are equivalent to the standards for new valves.
c) All measuring and test equipment used in the repair of pressure relief devices shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.
d) Documentation of the repair of "NV" stamped pressure relief devices shall be recorded on the National Board Form NVR-1, *Report of Repair/ Replacement Activities for Nuclear Pressure Relief Devices*, in accordance with the requirements of 1.8 of Part 3 ~~this part~~.
e) When an ASME "NV"-stamped pressure relief device requires a duplicate nameplate because the original nameplate is illegible or missing, it may be applied using the procedures of 5.9.5 provided concurrence is obtained from the Authorized Nuclear Inspector and Jurisdiction. In this case the nameplate shall be marked "SEC. III" to indicate the original ASME Code stamping.

PART 4, SECTION 7

PART 4, SECTION 7
INSTALLATION — NBIC POLICY FOR METRICATION

7.1 GENERAL
This policy provides guidance for the use of US customary units and metric units. Throughout the NBIC, metric units are identified and placed in parentheses after the US customary units referenced in the text and associated tables. In Supplement 6, Continued Service and Inspection of DOT Transport Tanks the metric units are shown first with U.S. Customary units shown in parentheses. For each repair or alteration performed, selection of units shall be based on the units used in the original code of construction. For example, items constructed using US customary units shall be repaired or altered using US customary units. The same example applies to items constructed using metric units. Whichever units are selected, those units are to be used consistently throughout each repair or alteration. Consistent use of units includes all aspects of work required for repairs or alterations (i.e. materials, design, procedures, testing, documentation, and stamping, etc.).

7.2 EQUIVALENT RATIONALE
The rationale taken to convert metric units and US customary units involves knowing the difference between a *soft* conversion and a *hard* conversion. A soft conversion is an exact conversion. A hard conversion is simply performing a soft conversion and then rounding off within a range of intended precision. When values specified in the NBIC are intended to be approximate values, a hard conversion is provided. If an exact value is needed to maintain safety or required based on using good engineering judgment, then a soft conversion will be used. In general, approximate accuracy is acceptable for most repairs or alterations performed using the requirements of the NBIC. Therefore, within the NBIC, metric equivalent units are primarily hard conversions. The following examples are provided for further clarification and understanding of soft conversions versus hard conversions:
Example 1: Using 1 in. = 25.4 mm;
12 in. = 304.8 mm (soft conversion)
Example 2: Using the above conversion, a hard conversion may be 300 mm or 305 mm depending on the degree of precision needed.

7.3 PROCEDURE FOR CONVERSION
The following guidelines shall be used to convert between US customary units and metric units within the text of the NBIC:
a) All US customary units will be converted using a soft conversion;
b) Soft conversion calculations will be reviewed for accuracy;
c) Based on specified value in the NBIC, an appropriate degree of precision shall be identified;
d) Once the degree of precision is decided, rounding up or down may be applied to each soft conversion in order to obtain a hard conversion; and
e) Use of hard conversion units shall be used consistently throughout the NBIC wherever soft conversions are not required.
Note: Care shall be taken to minimize percentage difference between units.

7.4 REFERENCING TABLES
The following tables are provided for guidance and convenience when converting between US customary units and metric units. See NBIC Part 1, Tables 7.4-1 through 7.4-8.
Temperature shall be converted to within 1°C as shown in NBIC Part 1, Table 7.4-2.
Fractions of an inch shall be converted according to NBIC Part 1, Table 7.4-3. Even increments of inches are in even multiples of 25 mm. For example, 40 inches is equivalent to 1000 mm. Intermediate values may be interpolated rather than converting and rounding to the nearest mm.
For nominal pipe sizes, the following relationships were used as shown in NBIC Parts 1, 2 or 3, Table 7.4-4.
Areas in square inches (in^2) were converted to square mm (mm^2) and areas in square feet (ft^2) were converted

to square meters (m^2). See examples in NBIC Parts 1, 2 or 3 Tables 7.4-5a and 7.4-5b.
Volumes in cubic inches ($in.^3$) were converted to cubic mm (mm^3) and volumes in cubic feet (ft^3) were converted to cubic meters (m^3). See examples in NBIC Parts 1, 2 or 3, Tables 7.4-6a and 7.4-6b.
Although the pressure should always be in MPa for calculations, there are cases where other units are used in the text. For example, kPa is used for small pressures. Also, rounding was to two significant figures. See examples in Table 7.4-7. (Note that 14.7 psi converts to 101 kPa, while 15 psi converts to 100 kPa. While this may seem at first glance to be an anomaly, it is consistent with the rounding philosophy.)
Material properties that are expressed in psi or ksi (e.g., allowable stress, yield and tensile strength, elastic modulus) were generally converted to MPa to three significant figures. See example in NBIC Parts 1, 2 or 3, Table 7.4-8.
An often seen metric pressure rating is the expression BAR, one BAR equals 14.5 psi — to convert psi rating to a BAR rating, multiply by 0.069.

TABLE 7.4-3
US Fractions/Metric Equivalents

Inches	Millimeters
1/32	0.8
3/64	1.2
1/16	1.5
3/32	2.5
1/8	3
5/32	4
3/16	5
7/32	5.5
1/4	6
5/16	8
3/8	10
7/16	11
1/2	13
9/16	14
5/8	16
11/16	17
3/4	19
7/8	22
1	25

TABLE 7.4-1
Soft Conversion Factors
(US x Factor = Metric)

US Customary	Metric	Factor
in.	mm	25.4
ft.	m	0.3048
$in.^2$	mm^2	645.16
$ft.^2$	m^2	0.09290304
$in.^3$	mm^3	16,387.064
$ft.^3$	m^3	0.02831685
US gal.	m^3	0.003785412
US gal.	liters	3.785412
psi	MPa	0.0068948
psi	kPa	6.894757
ft-lb	J	1.355818
°F	°C	5/9 x (°F–32)
R	K	5/9
lbm	kg	0.4535924
lbf	N	4.448222
in.-lb	N-mm	112.98484
ft.-lb	N-m	1.3558181
$ksi\sqrt{in}$	$MPa\sqrt{m}$	1.0988434
Btu/hr	W	0.2930711
lb/ft^3	kg/m^3	16.018463
in.-wc	kPa	0.249089

Note: The actual pressure corresponding to the height of a vertical column of fluid depends on the local gravitational field and the density of the fluid, which in turn depends upon the temperature. This conversion factor is the conventional value adopted by ISO. The conversion assumes a standard gravitational field (g_n – 9.80665 N/kg) and a density of water equal to 1,000 kg/m^3.

TABLE 7.4-2
Temperature Equivalents

Temperature °F	Temperature °C
60	16
70	21
100	38
120	49
350	177
400	204
450	232
800	427
1150	621

TABLE 7.4-4
Pipe Sizes/Equivalents

US CustomaryPractice	Metric Practice
NPS 1/8	DN 6
NPS 1/4	DN 8
NPS 3/8	DN 10
NPS 1/2	DN 15
NPS 3/4	DN 20
NPS 1	DN 25
NPS 1-1/4	DN 32
NPS 1-1/2	DN 40
NPS 2	DN 50
NPS 2-1/2	DN 65
NPS 3	DN 80
NPS 3-1/2	DN 90
NPS 4	DN 100
NPS 5	DN 125
NPS 6	DN 150
NPS 8	DN 200
NPS 10	DN 250
NPS 12	DN 300
NPS 14	DN 350
NPS 16	DN 400
NPS 18	DN 450
NPS 20	DN 500
NPS 22	DN 550
NPS 24	DN 600
NPS 26	DN 650
NPS 28	DN 700
NPS 30	DN 750
NPS 32	DN 800
NPS 34	DN 850
NPS 36	DN 900
NPS 38	DN 950
NPS 40	DN 1000
NPS 42	DN 1050
NPS 44	DN 1100
NPS 46	DN 1150
NPS 48	DN 1200
NPS 50	DN 1250
NPS 52	DN 1300
NPS 54	DN 1350
NPS 56	DN 1400
NPS 58	DN 1450
NPS 60	DN 1500

Table 7.4-5a

Area (US Customary)	Area (Metric)
3 in^2	650 mm^2
6 in^2	3,900 mm^2
10 in^2	6,500 mm^2

Table 7.4-5b

Area (US Customary) Area (Metric)
5 ft^2 0.46 mm^2

Table 7.4-6a
Area (US Customary) Area (Metric)
1 in^3 16,000 mm^3
6 in^3 96,000 mm^3
10 in^3 160,000 mm^3

Table 7.4-6b
Area (US Customary) Area (Metric)
5 ft^3 0.14 m^3

TABLE 7.4-7
Pressure/Equivalents
Pressure (US Customary) Pressure (Metric)
0.5 psi 3 kPa
2 psi 15 kPa
3 psi 20 kPa
10 psi 70 kPa
15 psi 100 kPa
30 psi 200 kPa
50 psi 350 kPa
100 psi 700 kPa
150 psi 1.03 MPa
200 psi 1.38 MPa
250 psi 1.72 MPa
300 psi 2.10 MPa
350 psi 2.40 MPa
400 psi 2.76 MPa
500 psi 3.45 MPa
600 psi 4.14 MPa
1,200 psi 8.27 MPa
1,500 psi 10.34 MPa

Table 7.4-8
Strength (US Customary) Strength (Metric)
95,000 psi 655 MPa

PRESSURE RELIEF DEVICES – PREPARATION OF TECHNICAL INQUIRIES TO THE NATIONAL BOARD INSPECTION CODE COMMITTEE

PART 4, SECTION 8

PART 4, SECTION 8
PRESSURE RELIEF DEVICES — PREPARATION OF TECHNICAL INQUIRIES TO THE NATIONAL BOARD INSPECTION CODE COMMITTEE

8.1 INTRODUCTION

The NBIC Committee meets regularly to consider written requests for interpretations and revisions to the Code rules. This section provides guidance to Code users for submitting technical inquiries to the Committee.

Technical inquires include requests for additions to the Code rules and requests for Code Interpretations, as described below.

a) Code Revisions

Code revisions are considered to accommodate technological developments, address administrative requirements, or to clarify Code intent.

b) Code Interpretations

Code Interpretations provide clarification of the meaning of existing rules in the Code, and are also presented in question and reply format. Interpretations do not introduce new requirements. In cases where existing Code text does not fully convey the meaning that was intended, and revision of the rules is required to support an Interpretation, an intent Interpretation will be issued and the Code will be revised. As a matter of published policy, the National Board does not approve, certify, or endorse any item, construction, propriety device or activity and, accordingly, inquiries requiring such consideration will be returned. Moreover, the National Board does not act as a consultant on specific engineering problems or on the general application or understanding of the Code rules.
Inquiries that do not comply with the provisions of this Section or that do not provide sufficient information for the Committee's full understanding may result in the request being returned to the inquirer with no action.

8.2 INQUIRY FORMAT
Inquiries submitted to the Committee shall include:
a) Purpose
Specify one of the following:
1) revision of present Code rules;
2) new or additional Code rules; or
3) Code Interpretation.
b) Background
Provide concisely the information needed for the Committee's understanding of the inquiry, being sure to include reference to the applicable Code Edition, Addenda, paragraphs, figures, and tables. Provide a copy of the specific referenced portions of the Code.
c) Presentations
The inquirer may attend a meeting of the Committee to make a formal presentation or to answer questions from the Committee members with regard to the inquiry. Attendance at a Committee meeting shall be at the expense of the inquirer. The inquirer's attendance or lack of attendance at a meeting shall not be a basis for acceptance or rejection of the inquiry by the Committee.

8.3 CODE REVISIONS OR ADDITIONS
Request for Code revisions or additions shall provide the following:
a) Proposed Revisions or Additions
For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.
b) Statement of Need
Provide a brief explanation of the need for the revision or addition.
c) Background Information
Provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request that will allow the Committee to adequately evaluate the proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate.
When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

8.4 CODE INTERPRETATIONS
Requests for Code Interpretations shall provide the following:
a) Inquiry

Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a "yes" or a "no" reply, with brief provisos if needed, is acceptable.
The question should be technically and editorially correct.
b) Reply
Provide a proposed reply that will clearly and concisely answer the inquiry question. Preferably the reply should be "yes" or "no" with brief provisos, if needed.
c) Background Information
Provide any background information that will assist the Committee in understanding the proposed Inquiry and Reply Requests for Code Interpretations must be limited to an interpretation of the particular requirement in the Code. The Committee cannot consider consulting type requests such as:
1) A review of calculations, design drawings, welding qualifications, or descriptions of equipment or Parts to determine compliance with Code requirements;
2) A request for assistance in performing any Code-prescribed functions relating to, but not limited to, material selection, designs, calculations, fabrication, inspection, pressure testing, or installation;
3) A request seeking the rationale for Code requirements.

8.5 SUBMITTALS
Submittals to and responses from the Committee shall meet the following criteria:
a) Submittal Inquiries from Code users shall be in English and preferably be submitted in typewritten form; however, legible handwritten inquiries will be considered. They shall include the name, address, telephone number, fax number, and email address, if available, of the inquirer and be mailed to the following address:
Secretary, NBIC Committee
The National Board of Boiler and
Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229
As an alternative, inquiries may be submitted via fax or email to:
Secretary NBIC Committee
Fax: 614.847.1828
Email: *NBICinquiry@nationalboard.org*
b) Response
The Secretary of the NBIC Committee shall acknowledge receipt of each properly prepared inquiry and shall provide a written response to the Inquirer upon completion of the requested action by the NBIC Committee.

PRESSURE RELIEF DEVICES- GLOSSARY OF TERMS
PART 4, SECTION 9

PART 4, SECTION 9
PRESSURE RELIEF DEVICES — GLOSSARY OF TERMS
9.1 DEFINITIONS
For the purpose of applying the rules of the NBIC, the following terms and definitions shall be used herein as applicable to each Part:
Additional terms and definitions specific to DOT Transport Tanks are defined in Part 2, Supplement 6.

Accumulator — A vessel in which the test medium is stored or accumulated prior to its use for testing.
Alteration — A change in the item described on the original Manufacturer's Data Report which affects the pressure containing capability of the pressure-retaining item. (See Subsection 3.4.3, EXAMPLES OF ALTERATION) Nonphysical changes such as an increase in the maximum allowable working pressure (internal or external), increase in design temperature, or a reduction in minimum temperature of a pressure-retaining item shall be considered an alteration.
ANSI — The American National Standards Institute
Appliance — A piece of equipment that includes all controls, safety devices, piping, fittings, and vessel(s) within a common frame or enclosure that is listed and labeled by a nationally recognized testing agency for its intended use.
ASME Code — The American Society of Mechanical Engineers' Boiler and Pressure Vessel Code published by that Society, including addenda and Code Cases, approved by the associated ASME Board.
Assembler — An organization tbat purchases or receives from a manufacturer the necessary component parts of valves and assembles, adjusts, tests, seals, and ships safety or safety relief valves at a geographical location, and using facilities other than those used by the manufacturer.
Authorized Inspection Agency — New Construction: An Authorized Inspection Agency is one that is accredited by the National Board meeting the qualification and duties of NB-360, *Criteria for Acceptance of Authorized Inspection Agencies for New Construction.*
Inservice: An Authorized Inspection Agency is either:
a) a jurisdictional authority as defined in the National Board Constitution; or
b) an entity that is accredited by the National Board satisfying the requirements of NB-369, *Qualifications and Duties for Authorized Inspection Agencies Performing Inservice Inspection Activities and Qualifications for Inspectors of Boilers and Pressure Vessels*; NB-371, *Accreditation of Owner-User Inspection Organizations (OUIO)* or NB-390, For *Federal Inspection Agencies (FIAs) Performing Inservice Inspection Activities.*
Capacity Certification — The verification by the National Board that a particular valve design or model has successfully completed all capacity testing as required by the ASME Code.
Chimney or Stack — A device or means for providing the venting or escape of combustion gases from the operating unit.
Confined Space — Work locations considered "confined" because their configurations hinder the activities of employees who must enter, work in and exit them. A confined space has limited or restricted means for entry or exit, and it is not designed for continuous employee occupancy. Confined spaces include, but are not limited to, underground vaults, tanks, storage bins, manholes, pits, silos, process vessels, and pipelines.
Regulatory Organizations often use the term "permit-required confined space" (permit space) to describe a confined space that bas one or more of the following characteristics: contains or has the potential to contain a hazardous atmosphere; contains a material that has the potential to engulf an entrant; has walls that converge inward or floors that slope downward and taper into a smaller area which could trap or asphyxiate an entrant; or contains any other recognized safety or health hazard, such as unguarded machinery, exposed live wires, or heat stress. Confined space entry requirements may differ in many locations and the Inspector is cautioned of the need to comply with local or site- specific confined space entry requirements.
Conversion — Pressure Relief Devices: The change of a pressure relief valve from one capacity-certified configuration to another by use of manufacturer's instructions.
Units of Measure: Changing the numeric value of a parameter from one system of units to another.
Demonstration — Making evident by illustration, expl anation, and completion of tasks documenting evaluation of an applicant's ability to perform Code activities, including the

adequacy of the applicant's quality program, and by a review of the implementation of that program at the address of record and/or work location.

Dutchman — Generally limited to tube or pipe cross-section replacement. The work necessary to remove a compromised section of material and replace the section with material meeting the service requirements and installation procedures acceptable to the Inspector. Also recognized as piecing.

Examination — In process work denoting the act of performing or completing a task of interrogation of compliance.

Visual observations, radiography, liquid penetrant, magnetic particle, and ultrasonic methods are recognized examples of examination techniques.

Exit — A doorway, hallway, or similar passage that will allow free, normally upright unencumbered egress from an area.

Field — A temporary location, under the control of the Certificate Holder, that is used for repairs and/or alterations to pressure-retaining items at an address different from that shown on the Certificate Holder's *Certificate of Authorization*.

Forced-Flow Steam Generator — A steam generator with no fixed steamline and waterline.

Hydrostatic Test — A liquid pressure test which is conducted using water as the test medium.

Inspection — A process of review to ensure engineering design, materials, assembly, examination and testing requirements have been met and are compliant with the Code.

Inspector — See National Board Commissioned Inspector and National Board Owner-User Commissioned Inspector.

Intervening — Coming between or inserted between, as between the test vessel and the valve being tested.

Jurisdiction — A governmental entity with the power, right, or authority to interpret and enforce law, rules, or ordinances pertaining to boilers, pressure vessels, or other pressure-retaining items. It includes National Board member jurisdictions defined as "jurisdictional authorities."

Jurisdictional Authority — A member of the National Board, as defined in the *National Board Constitution*.

Lift Assist Device — A device used to apply an auxiliary load to a pressure relief valve stem or spindle, used to determine the valve set pressure as an alternative to a full pressure test.

Liquid Pressure Test — A pressure test using water or other incompressible fluid as a test medium.

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

Mechanical Assembly — The work necessary to establish or restore a pressure retaining boundary, under supplementary
materials, whereby pressure-retaining capability is established through a mechanical, chemical, or physical interface, as defined under the rules of the NBIC.

Mechanical Repair Method — A method of repair, that restores a pressure retaining boundary to a safe and satisfactory operating condition, where the pressure retaining boundary is established by a method other than welding or brazing, as defined under the rules of the NBIC

NBIC — The *National Board Inspection Code* published by The National Board of Boiler and Pressure Vessel Inspectors.

"NR" Certificate Holder — An organization in possession of a valid "NR" *Certificate of Authorization* issued
by the National Board.

National Board — The National Board of Boiler and Pressure Vessel Inspectors.

National Board Commissioned Inspector — An individual who holds a valid and current National Board Commission.

Nuclear Items — Items constructed in accordance with recognized standards to be used in nuclear power plants or fuel processing facilities.
Original Code of Construction — Documents promulgated by recognized national standards writing bodies that contain technical requirements for construction of pressure-retaining items or equivalent to which the pressure retaining item was certified by the original manufacturer.
Owner or User — As referenced in lower case letters means any person, firm or corporation legally responsible for the safe operation of any pressure-retaining item.
Owner-User Inspection Organization — An owner or user of pressure-retaining items that maintains an established inspection program, whose organization and inspection procedures meet the requirements of the National Board rules and are acceptable to the jurisdiction or jurisdictional authority wherein the owner or user is located.
Owner-User Inspector — An individual who holds a valid and current National Board Owner-User Commission.
Piecing — A repair method used to remove and replace a portion of piping or tubing material with a suitable material and installation procedure.
Pneumatic Test — A pressure test which uses air or another compressible gas as the test medium.
Potable Water Heaters — A corrosion resistant appliance that includes the controls and safety devices to supply potable hot water at pressure not exceeding 160 psig (1100 kPa) and temperature not in excess of 210°F (99°C).
1) Fired Storage Water Heater - A potable water heater in which water is heated by electricity, the combustion of solid, liquid, or gaseous fuels and stores water within the same appliance.
2) Indirect Fired Water Heater - A potable water heater in which water is heated by an internal coil or heat exchanger that receives its heat from an external source. Indirect fired water heaters provide water directly to the system or store water within the same appliance.
3) Circulating Water Heater - A potable water heater which furnishes water directly to the system or to a separate storage tank. Circulating water heaters may be either natural or forced flow.
Pressure-Retaining Items (PRI) — Any boiler, pressure vessel, piping, or material used for the containment of pressure, either internal or external. The pressure may be obtained from an external source, or by the application of heat from a direct source, or any combination thereof.
Pressure Test — A test that is conducted using a fluid (liquid or gas) contained inside a pressure-retaining item.
Repair — The work necessary to restore pressure-retaining items to a safe and satisfactory operating condition.
Re-ending — A method used to join original code of construction piping or tubing with replacement piping or
tubing material for the purpose of restoring a required dimension, configuration or pressure-retaining capacity.
Re-rating — See alteration.
"R" Certificate Holder — An organization in possession of a valid "R" *Certificate of Authorization* issued by the National Board.
Safety Relief Valves — A safety relief valve is a pressure relief valve characterized by rapid opening or pop action, or by opening in proportion to the increase in pressure over the opening pressure, depending on application.
Settings — Those components and accessories required to provide support for the component during operation and during any related maintenance activity.
Shop — A permanent location, whose address is shown on the *Certificate of Authorization*, from which a Certificate Holder controls the repair and/or alteration of pressure-retaining items.

Testing Laboratory — National Board accepted laboratory that performs functional and capacity tests of pressure relief devices.
Transient — An occurrence that is maintained only for a short interval as opposed to a steady state condition.
Velocity Distortion — The pressure decrease that occurs when fluid flows past the opening of a pressure sensing line. This is a distortion of the pressure that would be measured under the same conditions for a non or slowly moving fluid.
"VR" Certificate Holder — An organization in possession of a valid "VR" *Certificate of Authorization* issued by the National Board.
Water Head — The pressure adjustment that must be taken into account due to the weight of test media (in this case, water) that is 0.433 psi per vertical ft. (10 kPa per m.) added (subtracted) from the gage pressure for each foot the gage is below (above) the point at which the pressure is to be measured.

PRESSURE RELIEF DEVICES – NBIC-APPROVED INTERPRETATIONS

PART 4, SECTION 10

PART 1 INSTALLATION

National Board of Boiler and Pressure Vessel Inspectors

National Board Inspection Code

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Date: 11/20/2012

Commenter Name: Randall Austin

Commenter Address: 800 W. Washington St., Phoenix, AZ 85007

Commenter Phone: 602-542-1648

Commenter Fax: 602-542-1614

Commenter Email: raustin@ica.state.az.us

Section/Subsection Referenced: 4.7.3 SAFETY RELIEF DEVICES

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

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.

4.7.3 SAFETY RELIEF DEVICES

a) Each hot-water storage tank that is designed to operate at or below 210°F (99°C) and served by a hot-water supply boiler, shall have a temperature relief valve installed and set to relieve at or below 210°F (99°C). This valve shall be installed within the top 6 in. (150 mm) of the system's hot-water storage tank.

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

Source: ☒ Own Experience/Idea ☒ Other Source/Article/Code/Standard CSD-1 (2012)CW-520(b) Requirements of Hot-Water Supply Boilers

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

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Commenter No. Issued: PR13-01

Comment No. Issued: 01

Committee Referred To: SC Installation

Reason for changing text: (proposed text was borrowed in part from ASME, CSD-1, CW-520(b), with modifications, see below.)

(Item 1)

The first part requires only ASME approved PRD, "shall be equipped with an ASME" NB "approved". When paragraph (b) requires to meet Part 1, 4.5.. Part 1, 4.5.1 (see below) requires "national or international standard", I feel there is a conflict here. At this point in time the National Board approves no PRD's other than ASME constructed and stamped objects, but that does not say next week this may change, but hot-water storage tanks could only use an ASME stamped T&P valve.

4.5.1 DEVICE REQUIREMENTS

Pressure relief devices are to be manufactured in accordance with a national or international standard and be certified for capacity (or resistance to flow for rupture disk devices) by the National Board.

(Item 2)

Requiring all hot water storage tanks be installed with a T&P valve would restrict those tanks designed to operate above the 210°F. ASME Code Section VIII, Division 1 permits a stainless steel tank to have a MAWT of 650°F. If an owner purchases a hot water supply boiler (Section IV) with an MAWT of 250°F and a storage tank (Section VIII, Division 1) with an MAWT of 650°F because there process requires a final rinse of 230°F, they could not use a hot-water storage tank in the system, because of the T&P valve having a lift set at 210°F.

(Item 3)

Removing the reference to the MAWP was because NBIC, Part 1, 4.5.5(a) already states this requirement.

(Item 4)

NBIC, Part 1, 4.5.3 has no specific reference to the installation location of a T&P valve on hot-water storage tanks. This is the reason for the " installed within the top 6 in." reference.

CSD-1, CW-520 Requirements of Hot-Water Supply Boilers

(a) Each hot-water supply boiler shall have at least one officially rated safety relief valve mounted directly on the boiler and set to relieve at or below the maximum allowable working pressure of the boiler. The required steam-relieving capacity in Btu/hr (W) shall equal or exceed the maximum Btu/hr (W) output rating of the boiler.

(b) Each hot-water system consisting of a hot-water supply boiler and hot-water storage tank served by a hot-water supply boiler that is designed to operate at or below 210°F (99°C) shall have a temperature relief valve installed and set to relieve at or below 210°F (99°C). This valve shall be installed either in combination with that required in (a) above or within the top 6 in. (150 mm) of the system's hot-water storage tank.

(c) Safety relief valves shall be installed and tested in accordance with the ASME Boiler and Pressure Vessel Code. Temperature relief valves shall be rated, tested, and installed in accordance with ANSI Z21.22/CSA 4.4 and combination pressure-temperature relief valves in accordance with ANSI Z21.22/CSA 4.4 for temperature and the ASME Boiler and Pressure Vessel Code for pressure.

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Date: 12/5/12

Commenter Name: Francis Brown

Commenter Address: 1055 Crupper Avenue

Columbus, OH 43229

Commenter Phone: 614-431-3226

Commenter Fax: 614-431-3208

Commenter Email: fbrown@nationalboard.org

Section/Subsection Referenced: Part 1 4.7

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

In 4.7.1 and 4.7.2 change "should" to "shall". Should indicates good practice. The referenced statements need to be stronger.

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard

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Comment No. Issued: 01

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Commenter Address: 1055 Crupper Avenue

Columbus, OH 43229

Commenter Phone: 614-431-3226

Commenter Fax: 614-431-3208

Commenter Email: Part 1, S3.4

Section/Subsection Referenced:

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

Revise to read: "Alarms shall be designed to activate a low level alarm at 1.5% concentration of CO2 and a high alarm level at 3% concentration of CO2…"

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

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Comment No. Issued: 02

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Commenter Email: fbrown@nationalboard.org

Section/Subsection Referenced: Part 1 S3.5a)

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

Revise "instruction" to "instructional"

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard

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Comment No. Issued: 03

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Commenter Phone: 614-431-3226

Commenter Fax: 614-431-3208

Commenter Email: fbrown@nationalboard.org

Section/Subsection Referenced: Part 1: S3.6a)

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

Revise a) to read: Components shall be compatible with CO2 in the phase (gas or liquid) in the applicable circuit,

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard _____

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Comment No. Issued: 04

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Commenter Fax: 614-431-3208

Commenter Email: fbrown@nationalboard.org

Section/Subsection Referenced: Part 1: S3.6.1

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

The description of the system should be at the beginning of supplement 3. Renumber S3.6.1 to S3.2 and renumber following paragraphs appropriately.

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard

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Comment No. Issued: 05

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Commenter Address: 1055 Crupper Avenue

Columbus, OH 43229

Commenter Phone: 614-431-3226

Commenter Fax: 614-431-3208

Commenter Email: fbrown@nationalboard.org

Section/Subsection Referenced: Part 1 S3.6

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

S3.6: Relief Valves: Two comments: 1) The note concerning the discharge line does not comply with ASME Code. A line smaller in diameter than the relief valve will increase the back pressure and reduce the flow, 2) the sizing of discharge lines need to be moved to the paragraph on Safety Relief/Vent Lines.

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard _____

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Commenter Address: 1055 Crupper Avenue

Columbus, OH 43229

Commenter Phone: 614-431-3226

Commenter Fax: 614-431-3208

Commenter Email: fbrown@nationalboard.org

Section/Subsection Referenced: Part 1 S3.6

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

Safety Relief/Vent Lines: The term "PRD" is located in the third line, and is the only place in S3.6. For consistency, change "relief valves" and "relief" to "PRD", or change "PRD" to "Relief Valve".

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard

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Revise to read: "Alarms shall be designed to activate a low level alarm at 1.5% concentration of CO2 and a high alarm level at 3% concentration of CO2…"

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Commenter Phone: 614-431-3226

Commenter Fax: 614-431-3208

Commenter Email: fbrown@nationalboard.org

Section/Subsection Referenced: Part 1 S3.5a)

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

Revise "instruction" to "instructional"

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard

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Section/Subsection Referenced: Part 1: S3.6.1

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

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Section/Subsection Referenced: Part 1 S3.6

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

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Commenter No. Issued: PR13-02

Comment No. Issued: 06

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Safety Relief/Vent Lines: The term "PRD" is located in the third line, and is the only place in S3.6. For consistency, change "relief valves" and "relief" to "PRD", or change "PRD" to "Relief Valve".

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

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Commenter No. Issued: PR13-02

Comment No. Issued: 07

Committee Referred To: SC Installation

National Board of Boiler and Pressure Vessel Inspectors

National Board Inspection Code

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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: VICTOR KENNEY

Commenter Address: 80 WESTCREEK BLVD.
BRAMPTON, ON L6T 0B8

Commenter Phone: 905-595-3795

Commenter Fax: _____

Commenter Email: VICTOR-KENNEY@PRAXAIR.COM

Section/Subsection Referenced: Part 1, S3.2

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☐ Revise Text ☐ Delete Text

S3.2 GENERAL REQUIREMENTS STORAGE TANK LOCATION

Recommend deleting " Should not have a roof or overhead cover."

In the northern US and Canada it is preferable to have an overhead cover on CO2 storage tanks that are located outside. This prevents the buildup of snow and/or ice in the cold months.

Having overhead cover on a gas that is heavier than air does not pose any potential hazard by allowing high concentrations to accumulate.

S3.2 b also allows for weather protection making the statement in S3.2, " Should not have a roof or overhead cover.", confusing to readers.

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard _____

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Commenter No. Issued: PR13-05

Comment No. Issued: 01

Committee Referred To: SC Installation

National Board of Boiler and Pressure Vessel Inspectors

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BRAMPTON, ON L6T 0B8

Commenter Phone: 905-595-3795

Commenter Fax: _____

Commenter Email: VICTOR-KENNEY@PRAXAIR.COM

Section/Subsection Referenced: Part 1, S3.2 a)

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☐ Revise Text ☐ Delete Text

S3.2 a) General Requirements (enclosed and unenclosed areas)
Change the following section to read;
6) LCDSV's shall not be installed within 36' of ***the front of*** electrical panels.

NB Use Only
Commenter No. Issued: PR13-05
Comment No. Issued: 02
Committee Referred To: SC Installation

National Board of Boiler and Pressure Vessel Inspectors

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BRAMPTON, ON L6T 0B8

Commenter Phone: 905-595-3795

Commenter Fax: _____

Commenter Email: VICTOR_KENNEY@PRAXAIR.COM

Section/Subsection Referenced: Part 1, S3.2 c)

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☐ Revise Text ☐ Delete Text

S3.2c ENCLOSED AREA LCDSV INSTALLATIONS

Recommend changing 1) a. as follows;

a. Shall be equipped with a gas detection system installed in accordance with paragraph S3.4 ***if the area that the tank is located in cannot be determined to have adequate ventilation to prevent a hazardous concentration*** *of CO2 to build up.*

Because this publication defines any indoor installation as an enclosed area, there needs to be provisions in this publication that identifies indoor installations that do not pose a hazard. As an example, there are many indoor installations today that are located in kitchens that have very high rates of ventilation that would not result in a hazardous concentration of CO2 even if a leak was to develop.

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard _____

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NB Use Only
Commenter No. Issued: PR13-05
Comment No. Issued: 03
Committee Referred To: SC Installation

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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: December 14, 2012

Commenter Name: Richard Craig, CGA Technical Director

Commenter Address: The Compressed Gas Association, Inc.

14501 George Carter Way, Suite 103, Chantilly, VA 20151

Commenter Phone: (703) 788-2730

Commenter Fax: 703-961-1831

Commenter Email: rcraig@cganet.com

Section/Subsection Referenced: Supplement 3, S3.2, General Requirements Storage Tank Location

Comment/Recommendation: *Proposed Solution:* ☐ New Text **X** Revise Text ☐ Delete Text

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
- ~~Should 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.

Rationale: For the northern climates, overhead coverings are preferred in order to prevent the buildup of ice and snow. For southern climates, solar heat load affects container temperature. This statement conflicts with S3.2b of this draft standard. *Note*: Dissipation of carbon dioxide is not affected by a roof or cover since it is heavier than air.

Source: **X** 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

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Commenter No. Issued: PR13-06

Comment No. Issued: 01

Committee Referred To:

SC Installation

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Commenter Address: The Compressed Gas Association, Inc.
14501 George Carter Way, Suite 103, Chantilly, VA 20151

Commenter Phone: (703) 788-2730

Commenter Fax: 703-961-1831

Commenter Email: rcraig@cganet.com

Section/Subsection Referenced: Supplement 3, S3.6, Valves, Piping, Tubing and Fittings

Comment/Recommendation: *Proposed Solution:* ☐ New Text **X** Revise Text ☐ Delete Text

S3.6 VALVES, PIPING, TUBING AND FITTINGS

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 the vessel PRD vent piping to the outside vent line discharge fitting~~, without any splices~~. Mechanical joints in metallic piping and tubing shall be visible and inspectable. Any splices in plastic or polymeric tubing shall be done within three feet of the vessel and must be visible and inspectable. 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.

Rationale: Allows the use of connectors but requires that they are seen and can be inspected for verification of integrity.

Source: **X** Own Experience/Idea ☐ Other Source/Article/Code/Standard _____

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Commenter No. Issued: PR13-06 Committee Referred To:

Comment No. Issued: 02 SC Installation

NB08-2101

Part 1, Section 6
Supplement 3

Installation and Control of Solid Fuel (Wood/Biomass) Fired Boilers

(Draft for Review and Comment 6/29/12)

S3.1 – Scope

a) This supplement is intended to provide guidance for the installation and control of boilers which use biomass as a major fuel component. In this context Biomass is intended to mean various types of wood wastes, or wood byproducts.
Many of the requirements of the earlier Sections of Part 1 are common to all boiler installations irrespective of the fuel being fired; therefore this supplement will address the differences that occur when solid fuels, such as Biomass, are being used. Thus the primary thrust of this section will be directed toward the control of the fuel handling and distribution systems.

b) Fuels will vary widely depending upon source, moisture content, particle size and distribution, however once the fuel has been established, good practice dictates that the specification be adhered to as closely as possible in order to minimize handling, combustion and emissions problems.

c) Additionally the emissions control equipment is designed around the initial fuel specification. Any changes in fuel fired will impact on the performance of the various elements of the emissions control system.

d) The typical biomass fired boiler room will comprise not only the boiler with the normal water treatment and feed systems, blow off systems, condensate return systems, steam or hot water systems, but also may include

- Transportation of the fuel from a storage facility to a metering device within the boiler room
- Transportation of the metered fuel to the boiler, for distribution to a combustion system whether it be a grate upon which the combustion takes place, a bubbling fluidized bed, circulating fluidized bed or suspension burner.
- In grate based combustion systems combustion air is typically divided into an underfire air system and an overfire air system, each of which must be closely controlled in order to produce clean, efficient combustion.

- Induced draft fans to overcome the pressure drop of the emissions control equipment
- A fly ash or carbons recycle system, to return unburned carbon to the combustion zone.

S3.2 – Assessment of Installation

a) A general assessment of the complete installation shall be undertaken, in terms of observable results of operating and maintenance practices. Indicators include the general boiler room cleanliness, for example significant quantities of fuel particles (dust) should not be apparent in the boiler room.

b) The combustion air inlet shall be free of any debris or dust particle build up, and where moveable louvered intakes exist, the actuating mechanisms shall be clean and operate freely. Corrective action is required when non-compliance is noted.

c) The flue gas venting system shall be checked for tightness, with no observable signs of leakage. Corrective action is required if leakage is noted.

d) The intakes of the various fans or blowers shall be free of fuel particle build up or signs of other debris. Corrective action in terms of cleaning is required when discrepancies are noted.

e) The fuel metering equipment and the fuel transportation system shall be free from signs of particulate or dust leakage. Corrective action in terms of cleaning and repair work is required as necessary.

f) Electrical equipment and controls shall be properly protected from the ingress of dust, by ensuring that all cover plates are properly installed and all panel doors are intact, operable and closed.

g) Verify that all guards for rotating equipment (shafts, bearings, drives) are correctly installed and fan inlet screens are in place.

h) On the boiler, generally check for signs of potential problems, including;

- Water leaks
- Missing or misaligned pieces or parts
- Condition of support systems
- Provision of "Danger" or "Caution" signs
- Excess vibration
- Excess noise

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

S3.3 – Determination of Allowable Operating Parameters

a) In the case of the combustion side of biomass fired boilers the determination of the allowable operating parameters is most often mandated by the local Air Pollution Control Authority. Thus provided that the defined fuel requirements are adhered to consistently, there is little for the inspector to get involved in.

b) The pressure vessel operating parameters are defined by its design working pressure, rated capacity and safety valve, or relief valve, capacity and thus is no different than boilers fired by more traditional fuels, it terms of inspection requirements.

c) All areas subject to corrosion and erosion shall be closely reviewed. Appropriate repairs shall be undertaken as necessary.

S3.4 – Boiler Installation Requirements

a) Power boilers shall be installed in accordance with the requirements of Section 2 of this Standard. Additionally the requirements of paragraphs S3.5 and S3.6, below should be followed.

b) Steam Heating and Hot Water Heating Boilers shall be installed in accordance with the requirements of Section 3 of this Standard. Additionally the requirements of paragraphs S3.5 and S3.6, below, should be followed.

S3.5 – Fuel System Requirements and Controls

a) Fuel Transport Systems irrespective of type should address certain requirements, including preserving fuel particle size distribution, the prevention of the possibility of fire and the suppression of fires or explosions.
In a single installation various types of fuel transportation systems may co-exist, as follows:

- Conveyor systems
  In these systems fuel is dropped onto a moving belt, bucket elevator, drag link conveyor or a screw or auger mechanism. Speed of the conveyor may be varied to meet fuel demand.
- Lean phase pneumatic systems
  In these systems fuel is dropped into a moving airstream, mixes with the air, and travels through a pipe at a velocity of approximately 5000 ft/min. Air pressures are in the region of 25 inches water column.

b) Solid Fuel Metering Systems may take a variety of forms depending upon the fuel used and the particle size distribution, as follows:

- Variable speed augers
  Variable speed, helically flighted, augers can be located in the bottom of a fuel metering bin. Alternatively they could be a part of a retort type stoker. The auger dimensions, flighting, and speed range are selected on the basis of fuel being burned, its size range, heating value and required boiler turndown range. The metered fuel typically is then dropped into the throat of a venturi, (or in some cases a plain pipe) though which the fuel transport air flows to carry the fuel into the boiler combustion zone, for distribution on a grate, upon which the burning of the fuel takes place.
- Variable speed air-lock valves
  This valve is basically a rotating slotted cylinder, operating within an outer cylinder, suitably sealed to prevent leakage. Rotational speed and slot dimensions can be varied to accommodate changes in fuel flowrate. The fuel passing through the valve, typically, is deposited onto a moving grate type stoker.
- Variable stroke rams
  This is another device that can be located on the bottom of a metering bin, is typically used on smaller units and is essentially a batch feed mechanism. The stroke of the ram is adjusted to set fuel flowrate.

S3.6 – Combustion Requirements

a) Overfire Air/Underfire Air Distribution

When solid fuels are burned on a grate, rather than in fluidized bed units or in suspension, it is normal practice to introduce some of the combustion air under the grate, or bed, and the remainder over the bed. In many cases fuel transport air becomes a part of the over-the-bed combustion air. The proportioning of the overfire to underfire airflow rates is dependent upon several factors, such as fuel particle size, fuel density, burn rate and volatiles. In general the objective is to get as complete a burn on the grate as possible, without creating large quantities of particulate emissions, and then using the overfire air to complete burning of the volatile and small particulate matter, leaving the fuel bed.
Loss of combustion air from either the underfire or overfire source shall cause shutoff of the fuel supply.

The control system shall be capable of maintaining the correct relationship between underfire air and overfire air, over the complete firing range of the boiler, while promoting complete burning with minimum particulate emissions.

b) Programming Controls

Programming controls may be relay based, or on more current units, PLC based. Interactive graphics displays may also be incorporated into the system.
Access to PLC based controls and interactive graphic displays shall be limited to qualified individuals and password protected. PLC functions shall be confined to the normal boiler operating logic, covering startup, interlocks, and normal shutdown sequences.
Safety controls, which cause boiler safety shutdown when activated, shall not be interfered with by the PLC logic.
Consideration should be given to having the PLC logic comply with the requirements of NFPA-85

c) Pre-firing Checks/interlocks

In addition to the Safety Controls defined in Section 3, proof that the various air handling fans or blowers are operating properly is required. This includes:

- Induced draft fans
- Fuel transport fans
- Underfire air and Overfire air fans, and
- Carbon, or flyash, re-injection fans.

In cases where variable speed drives are used on fans, the combustion system manufacturer's instructions shall be followed in terms of the allowable upper and lower limits of the power supply frequency (Hz).

d) Pre-purging

While the need for pre-purging the boiler and its venting system is not as critical in solid fuel fired boilers, as it is in boilers firing the more volatile gaseous or liquid fuels, it is still a requirement. Unless defined otherwise by the manufacturer of the fuel burning equipment, the pre-purge can be achieved by operating the induced draft fan prior to starting the remaining fans in the installation.
Purge air volume shall be set during commissioning by the combustion system manufacturer, or the manufacturer's representative, in accordance with applicable Codes or Standards and shall not be capable of being reset by operating personnel.

e) Ignition Systems

Solid fuel ignition systems, or methods, can vary from the placement of manually ignited, oil soaked rags on the fuel bed, to gas or oil fired pilot burners or lances.

f) Firing Rate Control and Fuel/Air Ratio Control
The control system shall be capable of maintaining the desired air to fuel ratio over the entire firing range of the boiler, while promoting clean, stable combustion.

g) Re-injection Systems
In installations where fly ash is re-injected from a multi-cyclone collector into the combustion zone for carbon re-burn; precautions should be taken to ensure that plugging of the reinjection pipe work does not occur. Consideration should be given to installing cleanouts in the pipe work.

h) Shutdown and Post Purge
Unless the boiler manufacturer's instructions state otherwise, the fuel supply shall be terminated at shutdown, and the overfire air should remain on until the fuel bed is burned out, and the residue cooled.

S3.7 – Boiler Room Cleanliness

a) While boiler room cleanliness is of primary importance in all boiler rooms it is of particular importance in biomass fired boiler rooms. Biomass can contain fine particulate, which if allowed to leak from the transportation system into the surrounding boiler room, will eventually be drawn into fans, resulting in the possibility of combustion air systems becoming plugged.

b) Boiler rooms containing quantities of fine dusts are susceptible to fire or explosion, again emphasizing the need for high standards of cleanliness.

S3.8 – Emission Control Requirements

a) Emission control is dependent upon the fuel being fired and the emission requirements prevailing at the location of the boiler installation. As such they are a part of the initial design and installation process, and apart from ensuring that they are kept in top working condition, so that emission requirements are not violated; there is little that can be done from the inspector's point of view.

b) When Continuous Emissions Monitors (CEM's) are in use, they should be demonstrated to be functioning properly and have a current calibration sticker.

c) Delta-P pressure gauges which measure the pressure drop across the various elements of the emission control system should all be functioning correctly.

d) There should be no sign of erosion caused by entrained particulate matter, in any part of the breaching, ductwork, stack or the individual emission control elements.

e) In systems in which the emissions control system incorporates a baghouse, appropriate fire detection and suppression systems shall be incorporated and functioning properly.

Definitions

The following definitions are to be added to the Glossary:

Biomass – Fuels which result from biological sources requiring a relatively short time for replenishment: Wood and bagasse are typical examples.

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.

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

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

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.

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.

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

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.

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

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.

Carbons Recycle – See Flyash Recycle

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

Fw: LB NB11-2001
Robin Hough To Jeanne Bock 07/24/2012 03:59 PM

From: Robin Hough/NationalBoard
To: Jeanne Bock/NationalBoard@NationalBoard

Robin Hough
NBIC Committee Coordinator
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229
614-888-8320 x 228
614-431-3236 Direct Line
----- Forwarded by Robin Hough/NationalBoard on 07/24/2012 03:59 PM -----

From: Robin Hough/NationalBoard
To: bryan.schulte@nrgenergy.com, chopkins@seattleboiler.com, david.parrish@fmglobal.com, canonicod@epbfi.com., DCook@dir.ca.gov, fhart@furmanite.com, Gary.Scribner@dfs.dps.mo.gov, ggalanes@MWGen.com, HMICHAELRICHARDS.PE@GMAIL.COM, Paul Welch <Paul.Welch@dol.state.ga.us>, banthony@dlt.state.ri.us, jim.riley@conocophillips.com, "Pate, Ralph" <Ralph.Pate@labor.alabama.gov>, jpillow@commonarc.com, jsekely@comcast.net, jwrichar@aol.com, pcbourge@travelers.com, paul.edwards@shawgrp.com, raymond.snyder@ariseinc.com, breetz@state.nd.us, Robert_Wielgoszinski@hsbct.com, RLPulliam@babcock.com, stanleys@dot.gov, Terry Parks/NationalBoard@NationalBoard, mike.webb@xcelenergy.com, Lmac@gLabap.com
Cc: Don.Patten@RFMacDonald.com
Date: 04/16/2012 10:47 AM
Subject: LB NB11-2001

Gentlemen:

The subject letter ballot has now closed. The ballot has passed but due to the concerns of the negative voters the project chair, Don Patten, has decided to withdraw the ballot and take it back to the subcommittee for more work. This item will appear on the agendas for the July meeting.

Thank you,

Robin Hough
NBIC Committee Coordinator
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229
614-888-8320 x 228
614-431-3236 Direct Line

COMMITTEE CORRESPONDENCE

COMMITTEE: NBIC

TO: NBIC Committee

ADDRESS WRITER CARE OF:
The National Board of Boiler &
Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, Ohio 43229-1183
Phone: (614) 888-8320
Fax: (614) 847-1828

FROM: Robin Hough
NBIC Secretary

SUBJECT: Letter Ballot NB11-2001 MC

DATE: March 30, 2012

Committee Members,

Letter ballot NB11-2001 MC has now closed. The ballot was approved. The voting results are:

20	Approved
1	Disapproved
1	Abstained
1	Not Voting
3	Not Returned

Per the NBIC Procedures 7.3.2:

"NBIC Committee or subcommittee members shall be apprised of any unresolved comments and given two (2) weeks from notification to reconsider their original vote."

The ballot will remain open until April 13, 2012 for your reconsideration.

:rmh

Ballot Votes NB11-2001 MC

Name	Email	Votes	Vote Date
Paul Edwards	paul.edwards@shawgrp.com	Abstention	03/26/12
Benjamin Anthony	banthony@dlt.state.ri.us	Approve	03/20/12
Bob Reetz	breetz@nd.gov	Approve	03/06/12
Bryan Schulte	bryan.schulte@nrgenergy.com	Approve	03/21/12
Dave Parrish	david.parrish@fmglobal.com	Approve	03/01/12
Domenic canonico	canonicod@epbfi.com	Approve	02/29/12
Don Cook	dcook@hq.dir.ca.gov	Approve	03/01/12
Frank Hart	fhart@furmanlle.com	Approve	02/29/12
Gary Scribner	Gary.Scribner@dfs.dps.mo.gov	Approve	03/05/12
George Galanes, PE	ggalanes@nwgen.com	Approve	03/02/12
Jim Riley	jim.riley@conocophillips.com	Approve	03/02/12
Jim Sekely	jsekely@comcast.net	Approve	02/29/12
John Richardson	jwrichar@aol.com	Approve	03/07/12
Lawrence McManamon	lmac@glabap.com	Approve	03/02/12
Michael Richards	hmrichar@southernco.com	Approve	03/02/12
Michael Webb	mike.webb@xcelenergy.com	Approve	03/01/12
Paul Bourgeois	pcbourge@travelers.com	Approve	03/06/12
Paul Welch	paul.welch@dol.state.ga.us	Approve	03/20/12
Raymond Snyder	raymond.snyder@arlseinc.com	Approve	03/01/12
Ronald Pulliam	rlpulliam@babcock.com	Approve	03/04/12
Stanley Staniszewski	stanley.staniszewski@dot.gov	Approve	03/21/12
James Pillow	jpillow@commonarc.com	Disapprove	03/21/12
Craig Hopkins	chopkins@seattleboiler.com	Not Voted	N/A
Ralph Pate	ralph.pate@labor.alabama.gov	Not Voted	N/A
Robert Wielgoszinski	Robert_Wielgoszinski@hsbct.com	Not Voted	N/A
Terry Parks	tparks@nationalboard.org	Not Voting	02/29/12

Ballot Comments NB11-2001 MC

Ballot Comments

Name	Document	Comment	Date Created
Donald Patten	NB11-2001	I looked at ASME 2007 edition Addenda 2009 and found nothing stipulating the location of a relief valve for isolable economizers. Please see a copy of the attached from said edition. If anyone can point me in the direction of where I can find this information I would greatly appreciate it.	03/27/2012
Donald Patten	NB11-2001	I responded with a copy of the attached from ASME. I could not find any stipulation for isolable economizers relief valve location. I had asked Mr. Pillows to please provide this information so I could review.	03/27/2012
Donald Patten	NB11-2001	I look at ASME Section 1 2007 Addenda 2009. I could not find any stipulation of relief valve location. See attached copy of PG 67.2.6. If you could point me to the section that designates or stipulates installation location of a relief valve for an isolable economizer I would greatly appreciate it.	03/27/2012
Paul Edwards		I would like to see a rosponse to Mr. Pillow's concern.	03/26/2012
James Pillow		Jpillow 3/21/12 I disapprove because the proposal is an attampt to re-write ASME Section I rules that already address mounting of pressure relief valves. Section I does not allow the mounting of the valvee "as recommended by the Manufacturer". Keep in mind that Part 1 of the NBIC does not overrule the Section I rules.	03/21/2012
Donald Patten		Mr. Richardson, I queried Mr. Olson at Victory Energy and below is his comments: Locating the PSV at the outlet without specifying an outlet location does not support an idea that the outlet of an isolated economizer is the strategic location for the PSV. The commenter is correct that, when the economizer is isolated, rarified fluid will immediately begin to collect at the upper areas. Due to the fact that the PSV can be set very close to operating pressures, the time element may not always come into affect. Anyway we look at it, allowing or the PSV location to be determined by the Designer is most beneficial. Regards, David Olson	03/21/2012
John Richardson		I approve this ballot with some hesitation. During normal operation the cooler, more dense fluid if. water or wet steam would be entering the top of the exchanger. The valve is apparently sized for steam but is the slower discharge rate advisable ?? When isolation occurs a sudden transient would follow in which the more rarified fluid would collect at the top. Is it possible that the original requirement to place the PRV at or near the outlet was due to the time element?? How rapid is the pressure rise in the heat	03/07/2012

	exchanger?? How long does the heat input continue?? I trust Victory Energy has looked at all the credible scenarios. Perhaps I will have a chance to look at this a bit closer before the ballot closes.	
George Galanes, PE	This is more of an editorial comment, but I believe it would be better stated below; The safety valve shall be installed in a location either recommended by the manufacturer, or if no recommendation is provided shall be located as close as practical to the economizer outlet.	03/02/2012

Ballot Comments NB11-2001

Name	Document	Comment	Date Created
Paul Edwards		I would like to see a response to Mr. Pillow's concern.	03/26/2012
James Pillow		Jpillow 3/21/12 I disapprove because the proposal is an attempt to re-write ASME Section I rules that already address mounting of pressure relief valves. Section I does not allow the mounting of the valves "as recommended by the Manufacturer". Keep in mind that Part 1 of the NBIC does not overrule the Section I rules.	03/21/2012
Donald Patten		Mr. Richardson, I queried Mr. Olson at Victory Energy and below is his comments: Locating the PSV at the outlet without specifying an outlet location does not support an idea that the outlet of an isolated economizer is the strategic location for the PSV. The commenter is correct that, when the economizer is isolated, rarified fluid will immediately begin to collect at the upper areas. Due to the fact that the PSV can be set very close to operating pressures, the time element may not always come into affect. Anyway we look at it, allowing or the PSV location to be determined by the Designer is most beneficial. Regards, David Olson	03/21/2012
John Richardson		I approve this ballot with some hesitation. During normal operation the cooler, more dense fluid ie. water or wet steam would be entering the top of the exchanger. The valve is apperently sized for steam but is the slower discharge rate advisable ?? When isolation occurs a sudden transient would follow in which the more rarified fluid would collect at the top. Is it possible that the original requirement to place the PRV at or near the outlet was due to the time element?? How rapid is the pressure rise in the heat exchanger?? How long does the heat input continue?? I trust Victory Energy has looked at all the credible scenarios. Perhaps I will have a chance to look at this a bit closer before the ballot closes.	03/07/2012
George Galanes, PE		This is more of an editorial comment, but I believe it would be better stated below; The safety valve shall be installed in a location either recommended by the manufacturer, or if no recommendation is provided shall be located as close as practical to the economizer outlet.	03/02/2012

Name	Document	Comment	Date Created
Robin Hough		This commnat comes from Donald Patten: I was unaware of any conflicts with ASME. When we as the subcommitte voted we all voted for the submitted change. Now that there is a conflict. I agree that this should be sent back to us and I will submit to the ASME on this subject. 04/13/2012	04/13/2012
Robin Hough		I was unaware of any conflicts with ASME. When we as the subcommitte voted we all voted for the submitted change. Now that there is a conflict. I agree that this should be sent back to us and I will submit to the ASME on this subject. 04/13/2012	04/13/2012
Donald Patten		I was unaware of any conflicts with ASME. When we as the subcommitte voted we all voted for the submitted change. Now that there is a conflict. I agree that this should be sent back to us and I will submit to the ASME on this subject.	04/13/2012
Robert Wielgoszinski		I vote negative on this in support of the other negative ballotors. First, was this item discussed at the Part 1 Installation subcommittee meeting? If so, what was the result of the deliberation? Was there a vote taken? What was the result of that vote? Secondly, this proposal conflicts with the intent of the ASME Code Section I and inclusion in the NBIC would usurp the completion of ASME Code requirements. If this valve alignment is something that is allowed or common in other international boiler standards, then perhaps the	04/11/2012

		proposal should be revised accordingly.	
Michael Webb		To Jim Pillow's comment: Seemingly the original code of construction may be circumvented. As indicated by the statement of need, there is no intent to deviate from the requirements of ASME Section 1 or Section VIII, Div.I as applicable; but the proposed language as stated does not align the manufacturer to the original code of construction. In my opinion, Mr. Pillow's comment needs to be addressed and the language refined to reflect an alignment to the original code of construction. M. Webb	04/11/2012
George Galanes, PE		GWG 4/11/12; I am changing my vote from approve to disapprove. After further re-consideration and no follow-up response to Mr. Pillow's original comment regarding Section I rules by the PM, I believe the proposed change is unnecessary because the NBIC is not a construction code. There is no need to reference the Manufacturer's recommendation in locating a PRD. The original wording is acceptable and does not conflict with Section I.	04/11/2012
Bob Reetz		I would like to change my vote from approve to disapprove after viewing Mr. James Pillow's comments. We should not be addressing this issue as it is the jurisdiction of Section I and should be handled there. Part I of the NBIC cannot be used to overrule Section I. The request should be handled by Section I. Section I, Figure PG 58.3.1(b), shows the location of a safety valve for an isolable economizer to be the outlet and not the inlet. I am not sure if Donald Patten has viewed this section.	04/02/2012
Donald Patten	NB11-2001	I looked at ASME 2007 edition Addenda 2009 and found nothing stipulating the location of a relelf valve for isolable economizers. Please see acopy of the attached from said edition. if anyone can point me in the direction of wher I can find this information I would greatly appreciate it.	03/27/2012
Donald Patten	NB11-2001	I responded with a copy of the attached from ASME. I could not find any stipulation for isolable economizers relief valve location. I had asked Mr. Pillows to please provide this information so I could review.	03/27/2012
Donald Patten	NB11-2001	I look at ASME Section 1 2007 Addenda 2009, I could not find any stipulation of relief valve location. See attached copy of PG 67.2.6. If you could point me to the section that designates or stipulates installation location of a relief valve for an isolable economizer I would greatly appreciate it.	03

Don Patten Comment

Copy from ASME Section 1 – 2007 Edition Addenda 2009

PG-67.2.6 Any economizer that may be shut off from the boiler, thereby permitting the economizer to become a fired pressure vessel, shall have one or more pressure relief valves with a total discharge capacity, in lb /hr (kg/hr), calculated from the maximum expected heat absorption in Btu/hr (W), as determined by the Manufacturer, divided by 1,000 (646). This absorption shall be stated in the stamping (PG-106.4). For overpressure conditions where the fluid relieved is water, the discharge capacity of the pressure relief valve, or valves shall be sufficient to prevent the pressure from exceeding the limits of PG-67.2.

NB 11-2001 *Part 1, 2.9.4 SG Pressure Vessels and Piping* - Address the safe venting isolatable economizers where the outlet is below the inlet of other communicable chambers (Headers, drums, etc.)

Current Language:

2.9.4 ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a safety relief valve. Economizers that may be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one safety relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the safety relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (Joules/hr) of the economizer, and will be determined from manufacturer data, divided by 1000. The safety relief valve shall be located as close as possible to the economizer outlet.

Proposed Language:

2.9.4 ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a safety relief valve. Economizers that may be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one safety relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the safety relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (Joules/hr) of the economizer, and will be determined from manufacturer data, divided by 1000. The safety relief valve shall be installed in a locationed recommended by the manufacturer, when no recommendation exists the location shall be as close as practical possibleto the economizer outlet.

Statement of Need

Victory Energy intends to design isolatable economizers, in accordance with ASME Section I and VIII Div1, and have the PSV located on the uppermost chamber instead of the Outlet connection. ASME requirements for PSVs ensure that the PSV is large enough to vent the energy in the form of steam. The same size PSV venting hot water potentially releases many more times the energy as venting steam. The amount of energy released in a given time is often excessive for vent piping, condensate tanks, and drains to handle. It is preferred to vent the energy as steam, over a longer period of time. Rapid draining of the economizer also allows the economizer to rapidly increase in temperature, causing undue stress. Furthermore, this request should serve to more closely align this part of the code with the ASME codes.

Background Information

An example would be a vertical counterflow economizer where the inlet header is located above the outlet (as in Figure 1) If the designer can specify where the PSV be located then the PSV may be placed such that the release of energy, via steam, happens more slowly through the same size PSV.

Figure 1 illustrates a counter-flow economizer, in a vertical up gas path, having horizontal headers, with the outlet header below the inlet. When this type of economizer is isolated during operation, and the PSV is tripped, steam will begin to collect in the upper "inlet" header. This design allows a more controlled venting of isolatable economizers by venting steam instead of hot water. Figure 1 also illustrates moving the safety relief valve from the outlet to the preferred location.

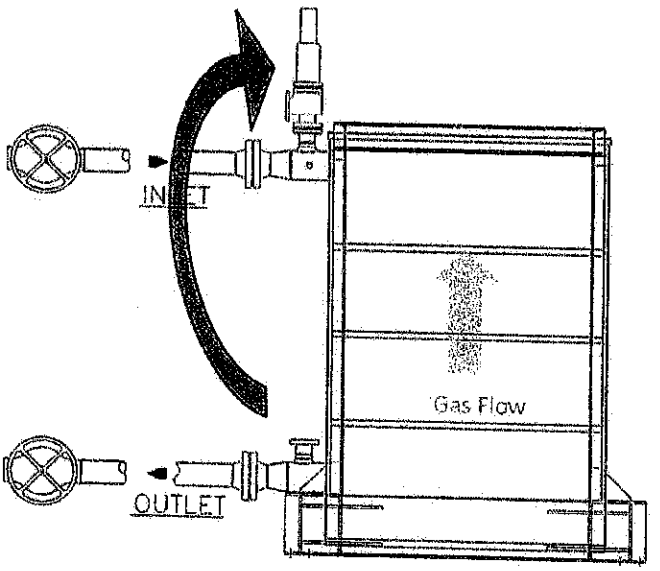

Figure 1

David Olson

QCM

Victory Energy Operations, LLC

918-340-9942

Committee members casting abstained responses should include a reason for the abstention.

7.1.4 Approval of committee actions shall be by a majority vote. Approval of the following actions of the NBIC Committee or subcommittee shall require two-thirds (2/3) majority vote of the committee membership, excluding not voting responses or not returned ballots:

- committee procedures and interest categories
- reaffirmation of the NBIC as an ANSI Standard
- NBIC revisions
- interpretation of the NBIC
- scope of the NBIC Committee or subcommittee
- New ANSI standard

7.1.5 Voting by NBIC Committee members not present at a meeting or by letter ballot may be obtained by letter, facsimile, or by other electronic means.

7.2 *Voting at Meetings*

NBIC Committee members not present at a meeting for final approval of Code revisions shall be afforded the opportunity to submit their vote within two weeks after the date of the NBIC Committee meeting. It is the responsibility of the National Board to provide the information relating to the items prior to the meeting in the form of posted Agendas.

NBIC Committee members shall be apprised of any unresolved comments and attempts at resolution and given two (2) weeks from notification to respond, reaffirm, or change their original vote. At the end of the two (2) week period, if the required number of affirmative votes is achieved, the vote shall be considered approved. If not enough affirmative votes is received, the vote fails and the item will be returned to the Committee for action.

Votes for committee action at meetings not approved shall be placed on the agenda for the next scheduled meeting of the NBIC Committee.

7.3 *Voting by Letter Ballot*

7.3.1 A letter ballot on any subject may be authorized by the Chair of the NBIC Committee, Chair of a subcommittee, Chairman of the Board, or a majority vote of those present and voting

NB-240 Proposed Changes
Terry Parks to: Robin Hough 03/07/2012 01:55 PM

Robin,

Please include this in the action item you already open for NB-240 proposed changes.

Thanks,

Terry

----- Forwarded by Terry Parks/NationalBoard on 03/07/2012 01:52 PM -----

From: Wielgoszinski Robert <robert_wielgoszinski@hsbct.com>
To: "TParks@nationalboard.org" <TParks@nationalboard.org>
Date: 03/07/2012 01:36 PM
Subject:

Terry, here is a suggested revision for NB 240 para 7.2 to deal with resolution of votes. Could you please include this as an agenda item for the next meeting. If you think it is appropriate, forward to the Executive Committee for their input.

Regards,
Bob Wielgoszinski
860-722-5064 phone
860-722-5705 fax

NB 240 Proposed Revision to 7 2 draft 2.docx

RE: Revision to NB-240 NBIC Procedures
Reetz, Bob D.
to:
'TParks@nationalboard.org', chopkins@seattleboiler.com, hmrichar@southernco.com, Wielgoszinski Robert, ripullman@babcock.com, DCook@dir.ca.gov
03/01/2012 09:48 AM
Show Details

Terry,

I also wish to reaffirm my negative vote. My reasons are the same as those given by Don Cook. As for a counter proposal, I believe the wording should go back to the previous wording. Thank you for the opportunity to comment.

Robert Reetz
Chief Boiler Inspector
State of North Dakota
(701) 328-9607
(701) 400-1043 - Cellular
breetz@nd.gov

From: TParks@nationalboard.org [mailto:TParks@nationalboard.org]
Sent: Wednesday, February 29, 2012 12:48 PM
To: chopkins@seattleboiler.com; hmrichar@southernco.com; Wielgoszinski Robert; ripullman@babcock.com; DCook@dir.ca.gov; Reetz, Bob D.
Subject: Revision to NB-240 NBIC Procedures

Gentleman,

At the NBIC meeting in January 2012 you opposed and cast negative votes on the revision change to paragraphs 4.1.3 f, 4.2.3 f, and 4.3.3 f. the proposed changes are as follows:

1. Delete Paragraph 4.1.3 f - A candidate for membership on the NBIC Committee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the NBIC Committee must provide a work history/resume to the NBIC secretary.

2. Delete Paragraph 4.1.3 f - A candidate for membership on the subcommittee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subcommittee must provide a work history/resume to the NBIC secretary.

3. Delete Paragraph 4.1.3 f - A candidate for membership on the subgroup must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subgroup must provide a work history/resume to the NBIC secretary.

4.

This item passed by majority vote and proceeded forward with the other approved changes to NB-240 to the Board of Trustees. The Board of Trustees unanimously voted in favor of all the changes.

I know your concerns and would like to resolve your negative votes. If any of you have a counter proposal to the revision please forward it to me and I will make a point of including it for discussion at the meeting in July. If you would be willing to withdraw your negatives for now I will make sure a revision to the changes be included for the revision to NB-240. Or you can reaffirm you negative vote.

I appreciate all that you do for the NBIC Committees

Best Regards,

Terry Parks
Manager of Field Services
614-431-3221

RE: Revision to NB-240 NBIC Procedures

Cook, Don@DIR to: 'TParks@nationalboard.org', chopkins@seattleboiler.com, hmrichar@southernco.com, Wielgoszinski

02/29/2012 04:21 PM

I will maintain my negative.

I think that is important to establish that a candidate has the support of their management to participate on the NBIC and also to determine what interest category they should be placed. This change treats all members as self-employed persons with no linkage to their employer and their interest category. We've seen this happen when a member has changed employers and went into a different interest category. Without a requirement for a letter from the employer, there is no way to administratively note the change.

As an example, let's say a member retires from his company and opens a bar. While the committee may have great interest in the bar, owning a bar is not an NBIC interest category. Our procedure would now allow this individual to remain a NBIC committee member.

Don Cook

From: TParks@nationalboard.org [mailto:TParks@nationalboard.org]
Sent: Wednesday, February 29, 2012 10:48 AM
To: chopkins@seattleboiler.com; hmrichar@southernco.com; Wielgoszinski Robert; ripullman@babcock.com; Cook, Don@DIR; breetz@state.nd.us
Subject: Revision to NB-240 NBIC Procedures

Gentleman,

At the NBIC meeting in January 2012 you opposed and cast negative votes on the revision change to paragraphs 4.1.3 f, 4.2.3 f, and 4.3.3 f. the proposed changes are as follows:

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2. Delete Paragraph 4.1.3 f - A candidate for membership on the subcommittee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subcommittee must provide a work history/resume to the NBIC secretary.
3. Delete Paragraph 4.1.3 f - A candidate for membership on the subgroup must provide both a

resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subgroup must provide a work history/resume to the NBIC secretary.

4.

This item passed by majority vote and proceeded forward with the other approved changes to NB-240 to the Board of Trustees. The Board of Trustees unanimously voted in favor of all the changes.

I know your concerns and would like to resolve your negative votes. If any of you have a counter proposal to the revision please forward it to me and I will make a point of including it for discussion at the meeting in July. If you would be willing to withdraw your negatives for now I will make sure a revision to the changes be included for the revision to NB-240. Or you can reaffirm you negative vote.

I appreciate all that you do for the NBIC Committees

Best Regards,

Terry Parks
Manager of Field Services
614-431-3221

RE: Revision to NB-240 NBIC Procedures
Richards, H. Michael
to:
'TParks@nationalboard.org', chopkins@seattleboiler.com, Wielgoszinski Robert, ripullman@babcock.com, DCook@dir.ca.gov, breetz@state.nd.us, 'rhough@nationalboard.org'
03/01/2012 03:25 PM
Show Details

1. While still clinging to my negative I could be persuaded to vote 'Affirmed' if the wording was..... "A candidate for membership on the NBIC Committee must provide a**n NBIC-related** work history/resume to the NBIC secretary.

//hmr

From: TParks@nationalboard.org [mailto:TParks@nationalboard.org]
Sent: Wednesday, February 29, 2012 12:48 PM
To: chopkins@seattleboiler.com; Richards, H. Michael; Wielgoszinski Robert; ripullman@babcock.com; DCook@dir.ca.gov; breetz@state.nd.us
Subject: Revision to NB-240 NBIC Procedures

Gentleman,

At the NBIC meeting in January 2012 you opposed and cast negative votes on the revision change to paragraphs 4.1.3 f, 4.2.3 f, and 4.3.3 f. the proposed changes are as follows:

2. Delete Paragraph 4.1.3 f - A candidate for membership on the NBIC Committee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the NBIC Committee must provide a work history/resume to the NBIC secretary.
2. Delete Paragraph 4.1.3 f - A candidate for membership on the subcommittee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subcommittee must provide a work history/resume to the NBIC secretary.
3. Delete Paragraph 4.1.3 f - A candidate for membership on the subgroup must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subgroup must provide a work history/resume to the NBIC secretary.
4.

This item passed by majority vote and proceeded forward with the other approved changes to NB-240 to the Board of Trustees. The Board of Trustees unanimously voted in favor of all the changes.

I know your concerns and would like to resolve your negative votes. If any of you have a counter proposal to the revision please forward it to me and I will make a point of including it for discussion at the meeting in July. If you would be willing to withdraw your negatives for now I will make sure a revision to the changes be included for the revision to NB-240. Or you can reaffirm you negative vote.

I appreciate all that you do for the NBIC Committees

Best Regards,

Terry Parks
Manager of Field Services
614-431-3221

RE: Revision to NB-240 NBIC Procedures
Pulliam, Ronald L
to:
tparks
03/05/2012 07:08 AM
Show Details

Terry-

I choose to maintain my negative, for much of the same reasons as outlined in Don Cook's last e-mail. A "letter of support" can come from either an individual or a company, both stating a financial commitment towards assuring active participation in NB activities.

Ron Pulliam

From: TParks@nationalboard.org [mailto:TParks@nationalboard.org]
Sent: Wednesday, February 29, 2012 1:54 PM
To: Pulliam, Ronald L
Subject: Revision to NB-240 NBIC Procedures

Gentleman,

At the NBIC meeting in January 2012 you opposed and cast negative votes on the revision change to paragraphs 4.1.3 f, 4.2.3 f, and 4.3.3 f. the proposed changes are as follows:

1. Delete Paragraph 4.1.3 f - A candidate for membership on the NBIC Committee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the NBIC Committee must provide a work history/resume to the NBIC secretary.

2. Delete Paragraph 4.1.3 f - A candidate for membership on the subcommittee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subcommittee must provide a work history/resume to the NBIC secretary.

3. Delete Paragraph 4.1.3 f - A candidate for membership on the subgroup must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subgroup must provide a work history/resume to the NBIC secretary.

4.

This item passed by majority vote and proceeded forward with the other approved changes to NB-240 to the Board of Trustees. The Board of Trustees unanimously voted in favor of all the changes.

I know your concerns and would like to resolve your negative votes. If any of you have a counter proposal to the revision please forward it to me and I will make a point of including it for discussion at the meeting in July. If you would be willing to withdraw your negatives for now I will make sure a revision to the changes be included for the revision to NB-240. Or you can reaffirm you negative vote.

I appreciate all that you do for the NBIC Committees

Best Regards,

Terry Parks

Revision to NB-240 NBIC Procedures

Terry Parks to: chopkins, hmrichar, Wielgoszinski Robert, ripullman, DCook, breetz

02/29/2012 01:47 PM

Gentleman,

At the NBIC meeting in January 2012 you opposed and cast negative votes on the revision change to paragraphs 4.1.3 f, 4.2.3 f, and 4.3.3 f. the proposed changes are as follows:

1. Delete Paragraph 4.1.3 f - A candidate for membership on the NBIC Committee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the NBIC Committee must provide a work history/resume to the NBIC secretary.
2. Delete Paragraph 4.1.3 f - A candidate for membership on the subcommittee must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subcommittee must provide a work history/resume to the NBIC secretary.
3. Delete Paragraph 4.1.3 f - A candidate for membership on the subgroup must provide both a resume and a letter of support from their employer if the are employed and replace with A candidate for membership on the subgroup must provide a work history/resume to the NBIC secretary.

This item passed by majority vote and proceeded forward with the other approved changes to NB-240 to the Board of Trustees. The Board of Trustees unanimously voted in favor of all the changes.

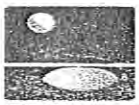
I know your concerns and would like to resolve your negative votes. If any of you have a counter proposal to the revision please forward it to me and I will make a point of including it for discussion at the meeting in July. If you would be willing to withdraw your negatives for now I will make sure a revision to the changes be included for the revision to NB-240. Or you can reaffirm you negative vote.

I appreciate all that you do for the NBIC Committees

Best Regards,

Terry Parks
Manager of Field Services
614-431-3221

Frank Hart changed Vote to approve



Fw: Proposed Revisions to NB-240

Terry Parks to: Robin Hough 12/15/2011 12:57 PM

This will need to be an attachment for the Main Committee.

Terry

----- Forwarded by Terry Parks/NationalBoard on 12/15/2011 12:56 PM -----

From:	Dick Allison/NationalBoard
To:	Terry Parks/NationalBoard@NationalBoard, Chuck Withers/NationalBoard@NationalBoard
Cc:	David Douin/NationalBoard@NationalBoard
Date:	12/08/2011 12:35 PM
Subject:	Proposed Revisions to NB-240

Listed below are proposed revisions to three paragraphs in NB-240:

1. Delete Paragraph **4.1.3 f** and replace with:

   A candidate for membership on the NBIC Committee must provide a work history/resume to the NBIC Committee secretary.

2. Delete Paragraph **4.2.3 f** and replace with:

   A candidate for membership on the subcommittee must provide a work history/resume to the NBIC Committee secretary.

3. Delete Paragraph **4.3.3 f** and replace with:

   A candidate for membership on a subgroup must provide a work history/resume to the NBIC Committee secretary.

It would be appreciated if these proposed revisions could be included for discussion/action in the agenda for the January 2012 NBIC Committee meeting.

Thanks.

Dick

DON COOK - 8 OPPOSED, 16 OKAY
A LETTER FROM EMPLOYER SHOULD BE MANDATORY TO INDICATE CATEGORY OF INTEREST.

Don Cook
1/19/12

dcook@hg.dir.ca.gov

CRAIG HOPKINS 1/19/12

VOTE NO TO

NB-240 REV 11

RATIONAL: I BELIEVE LETTER FROM EMPLOYER PROVIDES ADD'L SUPPORT FROM COMPANY & AIDS IN COMMITTEE CONSIDERATION OF NOMINEE.

Chopkins@seattleboiler.com
hmrichar@southernco.com

Mark
Nice

1/19/2012

TO: NBIC SECRETARY, ROBIN HOUGH
FROM: ROBERT V. WIELGOSZINSKI, NBIC MEMBER

RE: NB 240 Rev. 11

I VOTE NEGATIVE ON THIS REVISION TO DELETE THE NEED FOR "LETTERS OF SUPPORT" FROM THE PERSON'S EMPLOYER. I BELIEVE THERE IS VALUE FOR THE EMPLOYER TO PROVIDE A WRITTEN DOCUMENT CONFIRMING THEIR SUPPORT FOR THE INDIVIDUAL.

Robert V Wielgoszinski

WESTIN HOTELS & RESORTS
westin.com
Robert_Wielgoszinski@hsbct.com

RE: Negative reasoning
Pulliam, Ronald L
to:
rhough
01/24/2012 04:28 PM
Show Details

r.pullman@babcock.com

Robin-

You are correct – the specific issue brought to vote (essentially) involved deleting the requirement that committee member applicants be supported by a written letter from their respective employer. The only reasoning shared with the committee was "why do we need it?" A question is not reasoning. If the proposal had been qualified with a fact such as, "after a comprehensive review of member files over the last 5 years, we have determined that no member has been "negative voted" for failure to submit a letter", then THAT supports the notion to delete. Since I was not a party as to the original reasoning behind putting the letter requirement in place originally, I was not in a position to answer the question as it was posed.

Numerous committee members answered that question, all giving valid reasons on their own behalf, including myself. In a larger company, these letters assure that proper management are aware of and support the activities of their reports. These letters also hold merit with those of us (Committee Members) who vote on an individual's potential membership – they provide acknowledgement of the required technical and financial support of that individual. My guess is that those who voted to "approve" the deletion of the letter have never needed to write or receive such a letter and therefore could not fully comprehend the reasoning behind our negative votes.

Respectfully,

Ron Pulliam

From: RHough@nationalboard.org [mailto:RHough@nationalboard.org]
Sent: Tuesday, January 24, 2012 4:11 PM
To: bryan.schulte@nrgenergy.com; chopkins@seattleboiler.com; david.parrish@fmglobal.com; canonicod@epbfi.com; DCook@dir.ca.gov; fhart@furmanite.com; Gary.Scribner@dfs.dps.mo.gov; ggalanes@MWGen.com; HMICHAELRICHARDS.PE@GMAIL.COM; Paul Welch; banthony@dlt.state.ri.us; jim.riley@conocophillips.com; Pate, Ralph; jpillow@commonarc.com; jsekely@comcast.net; jwrichar@aol.com; pcbourge@travelers.com; paul.edwards@shawgrp.com; raymond.snyder@ariseinc.com; breetz@state.nd.us; Robert_Wielgoszinski@hsbct.com; Pulliam, Ronald L; stanleys@dot.gov; TParks@nationalboard.org
Subject: Negative reasoning

Gentlemen:

If you voted to disapprove any of the action items that were presented at the NBIC Committee meetings last week and did not give me your written reasoning for your disapproval I need that from you as soon as possible. I know a lot of you disapproved of the changes to the NBIC procedure and the only people I received reasoning from are Don Cook, Craig Hopkins and Mike Richards.

Thanks,
Robin Hough
NBIC Committee Coordinator
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229

breetz@nd.gov

1-19-12

Proposed Revisions To NB-240

I voted negative to the three changes because I feel that a prospective member needs to show approval for his/her committee work by any supervisor. Otherwise, we may have prospective members approved that cannot take the time to serve.

Robert Beeby

National Board Inspection Code Procedure

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

Approved by NBIC Committee:
Approved by the Board of Trustees:
Approved by ANSI:

The National Board of Boiler & Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229-1183
Phone: (614)888-8320

Table of Contents

1.0 Purpose

This procedure defines the organization, scope, duties and responsibilities of the NBIC Committee, subcommittees, subgroups and task groups. The NBIC Committee is established by the Board of Trustees for the purpose of maintaining the NBIC. The NBIC Committee is accredited by ANSI as a "developer of American National Standards" in accordance with the ANSI Essential Requirements. This procedure also describes the administrative process for the publication of the National Board Inspection Code.

Revisions to this procedure must be approved by the NBIC Committee, the Board and ANSI.

A copy of this procedure or any referenced document is either available on the National Board's Web site: www.nationalboard.org or may be obtained from the NBIC secretary.

2.0 Responsibilities

The Executive Director of the National Board is responsible for ensuring that the requirements of this procedure are met. The Secretary of the NBIC Committee is responsible for the day-to-day implementation of this procedure. Other responsibilities are described throughout this procedure.

3.0 Definitions

The following are terms and their definitions used throughout this document.

ANSI	American National Standards Institute
Board	The Board of Trustees of the National Board
Code	The National Board Inspection Code (NBIC)
NBIC Committee	The NBIC Main Committee, accredited by ANSI as the final consensus body for the purpose of approving American National Standards
committee	The NBIC Committee and all subcommittees, subgroups and task groups
National Board	The National Board of Boiler and Pressure Vessel Inspectors

NB Mark	A National Board Code Symbol Stamp
NBIC	The National Board Inspection Code which was established to provide rules and guidelines for the repair, alteration, inspection, installation, maintenance and testing of boilers, pressure vessels and other pressure retaining items.
subcommittee	A unit established to address recurring functions, address specific issues or maintain specific sections of the NBIC. A subcommittee is established by the NBIC Committee. Each subcommittee will follow rules for consensus approval insofar as possible but is not considered the final consensus body for the purpose of approving American National Standards.
subgroup	A unit established to address recurring topics or functions specific to a subcommittee. A subgroup is established by the NBIC Committee. Subgroup actions are reported to the subcommittee for approval.
task group	A unit established to address a specific topic. A task group may be established by the NBIC Committee, subcommittee or subgroup.

4.0 Committee Structure

The committee structure consists of the NBIC Committee, subcommittees, and subgroups appointed by the NBIC Committee and task groups appointed by the NBIC Committee, a subcommittee or subgroup. The duties, responsibilities and administration of each are described below.

4.1 NBIC Committee

4.1.1 Responsibilities:

The NBIC Committee is responsible for:

a. approving new rules and revising existing rules of the Code and voting on such additions and revisions;

b. approving interpretations of the rules of the Code;

c. hearing requests for reconsideration regarding interpretations and revisions to the Code;

d. acting on any matter related to the scope of the Code as may be assigned by the Board.

4.1.2 Membership:

The NBIC Committee shall consist of not more than twenty-six (26) voting members within the interest categories described in paragraph 4.5.

a. At least one individual representing manufacturers shall be employed by a manufacturer of safety relief devices.

b. At least one individual representing National Board Certificate Holders shall be employed by an organization holding a valid "R" Certificate of Authorization.

c. At least one individual representing National Board Certificate Holders shall be employed by an organization holding a valid "VR" Certificate of Authorization.

d. Not more than one-third of the total NBIC Committee membership shall represent any single category of interest. The chair and vice chair of the NBIC Committee are considered within this membership. The secretary is a member of the NBIC Committee without vote.

e. Each member of the NBIC Committee may recommend a person, within the same interest category, as a representative to serve in the absence of the member at a specific meeting. Representatives have the same privileges and responsibilities as the member when serving in the member's capacity. The representative's involvement terminates at the conclusion of the specific meeting requested by the member.

f. NBIC Committee members, upon change of employment status affecting the member's category of interest will be deemed to have submitted their resignations from the NBIC Committee.

4.1.3 NBIC Committee Member Selection, Approval and Term

a. A candidate for appointment or reappointment as a voting member of the NBIC Committee is selected by a majority vote of the NBIC Committee membership. The candidate's name is then submitted to the Chairman of the Board for consideration. All voting members of the NBIC Committee must be appointed by the Chairman of the Board.

b. A candidate for appointment or reappointment as the NBIC Committee Chair ~~is selected by the Executive Director and confirmed by a majority vote of the NBIC Committee members. The NBIC Committee~~ or Vice Chair is selected by a majority vote of the NBIC Committee membership.

The candidate's name ~~are~~ is then submitted to the Chairman of the Board for consideration. The chair and vice chair must be appointed by the Chairman of the Board.

c. The NBIC Committee secretary is selected by the Executive Director of the National Board and is considered to be a non-voting member of the NBIC Committee without any interest affiliation.

d. The term of all voting members is three (3) years. Voting members are eligible for reappointment.

e. The term for the chair and vice chair is the same as their NBIC Committee membership expiration date. The chair and vice chair are eligible for renewal of their terms of office.

f. A candidate for membership on the NBIC Committee must provide both a resume and a letter of support from their employer (if they are employed).

4.2 Subcommittees

4.2.1 Responsibilities

Subcommittees are responsible for:

a. maintaining (adding new requirements, revising existing requirements) those sections of the NBIC that are assigned to the subcommittee.

b. acting on requests for interpretations of the rules for those assigned sections of the NBIC;

c. acting on any matter related to the scope of the NBIC as may be assigned by the NBIC Committee;

d. forwarding all subcommittee actions to the NBIC Committee.

4.2.2 Membership

a. The number of members appointed to each subcommittee shall be as necessary to carry on the assigned responsibility. The size of subcommittees will be limited to numbers which will best serve operational needs.

b. Each member of the NBIC subcommittee may recommend a person, within the same interest category, as a representative to serve in the absence of the member at a specific meeting. Representatives shall have the same privileges and responsibilities as the member when serving in the member's capacity. The representative's involvement automatically terminates at the conclusion of the specific meeting requested by the member.

c. NBIC subcommittee members, upon change of employment status affecting the member's category of interest will be deemed to have submitted their resignations from the subcommittee.

4.2.3 Subcommittee Member Selection, Approval and Term

a. A candidate for appointment or reappointment as a voting member of the subcommittee is selected by majority vote of the NBIC Committee membership. Subcommittee members need not necessarily be members of the NBIC Committee or subgroup. The candidate's name is then submitted to the Chairman of the Board for consideration. All voting members of the subcommittee must be appointed by the Chairman of the Board.

b. Candidates for appointment or reappointment as the subcommittee chair and vice chair are selected by a majority vote of the subcommittee membership. The candidate's names are then submitted to the Chairman of the Board for consideration. The chair and vice chair must be appointed by the Chairman of the Board.

c. The subcommittee secretary is a member of the subcommittee without vote and is selected by the Executive Director of the National Board.

d. The term for all voting members is three (3) years. Voting members are eligible for reappointment.

e. The term for the chair and vice chair is the same as their subcommittee membership expiration date. The chair and vice chair are eligible for renewal of their terms of office.

f. A candidate for membership on the subcommittee must provide both a resume and a letter of support from their employer (if they are employed).

4.3 Subgroups

4.3.1 Responsibilities

Subgroups are responsible for:

a. developing new rules and revising existing rules for specific Code sections or paragraphs;

b. acting on requests for interpretations of the rules for specific Code sections or paragraphs;

c. acting on any matter related to the scope of the Code as may be assigned by the committee or subcommittee;

d. forwarding all subgroup actions to the subcommittee, as appropriate

4.3.2 Membership

The number of members appointed to each subgroup shall be as necessary to carry out the assigned work. The size of subgroups will be limited to numbers to best serve operational needs.

4.3.3 Subgroup member selection, approval and term

a. A candidate for appointment or reappointment as a member of the subgroup is selected by the majority vote of the subcommittee membership. Subgroup members need not necessarily be members of the Committee or subcommittee. The candidate's name is then submitted to the Chairman of the Board for consideration. All voting members of the subgroup must be appointed by the Chairman of the Board.

b. Candidates for appointment or reappointment as subgroup chair and vice chair are selected by a majority vote of the subcommittee membership. The chair and vice chair of each subgroup shall be appointed by the NBIC Committee Chair.

c. The subgroup secretary is selected by the Executive Director of the National Board and is a member of the subgroup without vote. In the absence of a selected secretary, the subgroup chair may appoint a voting member of the subgroup to act as secretary.

d. The term for all voting members is for three years. Voting members are eligible for reappointment.

e. The term for the chair or vice chair is the same as their membership expiration date and these positions are eligible for renewal.

f. The name of a National Board Member who is a candidate to serve on a subgroup, but is not a member of the NBIC Committee or a subcommittee, must be submitted to the Chairman of the Board for approval.

g. A candidate for membership on a subgroup must provide both a resume and a letter of support from their employer (if they are employed).

4.4 Task Groups

4.4.1 Responsibilities

Task groups are responsible for:

a. developing new rules and revising existing rules for specific Code topics or paragraphs;

b. acting on requests for interpretations of the rules for specific Code topics or paragraphs;

c. acting on any matter related to the scope of the Code as may be assigned by committees

d. forwarding all task group actions to the committee as appropriate.

4.4.2 Membership

The number of members appointed to each task group shall be as necessary to carry out the assigned task. The size of task groups will be limited to numbers which will best serve operational needs.

4.4.3 Task Group Member Selection, Approval and Term

a. When the committee agrees on the need or at the discretion of the chair of a committee, a task group, members, and chair shall be appointed by the committee chair. A member of the task group may be appointed as task group secretary by the task group chair. Task group members need not necessarily be members of a committee.

b. The name of a National Board Member who is a candidate to serve on a task group, but is not a member of the NBIC Committee or a subcommittee, must be submitted to the Chairman of the Board for approval.

c. The task group will be dismissed once the task has been completed or at the discretion of the chair of the committee.

4.5 Interest Categories

4.5.1 NBIC Committee, subcommittee, subgroup and task group members shall not be considered as representing any specific organization. Participation by individuals employed by governmental agencies or affiliated with industry is not to be interpreted as government or industry endorsement. Membership shall be selected from the categories of interest listed below.

a. General Interest: Individuals who are not employed by an organization characterized by b through h shall be considered General Interest.

b. Manufacturers: Any organization accredited by ASME to hold an ASME Code symbol stamp.

c. Authorized Inspection Agency: An authorized (insurance) inspection agency recognized by the National Board.

d. Jurisdictional Authorities: National Board members.

e. National Board Certificate Holders: Repair organizations accredited by the National Board to hold "R", "NR" or "VR" certification.

f. Users: Owners or users of boilers/pressure vessels.

g. Labor: Individuals representing labor organizations whose members are skilled workers in boiler or pressure vessel manufacturing or repairing, such as the United Association of Journeymen and Apprentices of Plumbing and Pipe Fitting Industry of the United States and Canada or the International Brotherhood of Boilermakers, Ship Builders, Blacksmiths, Forgers and Helpers.

h. Regulatory Authorities: Representatives of US Governmental agencies that regulate boilers or pressure vessels or both.

4.5.2 Lack of any particular representative of any interest category at a meeting shall not preclude the committee from conducting its business when a quorum is present.

5.0 Duties of NBIC Committee, Subcommittee, Subgroup and Task Group Membership

5.1 Chair

The chair shall preside at meetings of the committee and shall perform other duties as are customarily assigned to that position.

The chair of the NBIC Committee shall make an annual review of the activity of each voting member of the NBIC Committee, subcommittee and subgroup with regard to the member's contribution to the work, attention to correspondence, and attendance at meetings. Based on this review, if a consistent lack of attendance or participation within the past year is noted, the chair may recommend to the Chairman of the Board that the member's appointment to the NBIC Committee be terminated. The chair's report of NBIC Committee member's activities shall be sent to the Chairman of the Board and the Executive Director of the National Board.

5.2 Vice Chair

The vice chair shall, in the absence of the chair, fulfill the duties of the chair.

5.3 Secretary

In addition to the responsibilities required by this procedure, the Secretary shall prepare agendas and record minutes of meetings and shall perform such other duties as are customarily assigned to such an office.

In the absence of the chair and vice chair at a meeting, the secretary shall take the chair for the purpose of receiving nominations from the members present for election of a chair pro tem, who shall then preside at the meeting.

5.4 Members

The duty of each member is to give thorough consideration to each subject brought before the committee for action, vote on acceptance or rejection of each proposal, and assist generally in carrying out the assigned functions. Such duties may be carried out by attendance at meetings, by correspondence, and by telephone.

6.0 Meetings

6.1 Scheduling Meetings

NBIC Committee meetings shall be held at the call of the Chair, as decided upon by a majority of NBIC Committee members, or as directed by the Chairman of the Board. Subcommittee, subgroup and task group meetings held at times and locations other than in conjunction with the NBIC Committee meeting shall require the approval of the National Board Executive Director. Meeting requests shall be in writing to the Executive Director and include the subcommittee, subgroup or task group members' roster.

6.2 Locations

The NBIC Committee shall meet in National Board member jurisdictions.

6.3 Meeting Notification

All committee meeting schedules shall be posted on the National Board web site. The National Board member in whose jurisdiction the NBIC Committee is meeting shall be invited to attend the meeting.

A meeting agenda shall be made available to the members prior to the meeting and shall be subject to approval at the commencement of each meeting.

6.4 Public Meetings

Meetings at which the committee considers proposed revisions to the NBIC, reaffirmation of previously considered revisions or withdrawal of previously approved revisions shall be open to the general public. Unless matters to be discussed by the committee are deemed to be of a confidential nature by the chair, committee meetings shall be open to any interested person who shall be given an opportunity to participate in the discussions on subjects of interest to them.

6.5 Quorum

Fifty-one percent of the NBIC Committee, subcommittee or subgroup voting membership must be present to conduct committee business.

6.6 Meeting Conduct

The committee shall conduct meetings in accordance with the latest available edition of Roberts Rules of Order (Revised) unless rules to the contrary are specified in these procedures.

6.7 Recording Meeting Proceedings

Taping of committee meetings, other than by the secretary, is prohibited.

6.8 Minutes

All meetings of the NBIC Committee, subcommittees and subgroups shall be documented in minutes of the meeting. The minutes are not to be considered a verbatim record of the meeting but rather a record of the voted actions and highlights of significant discussions or conclusions.

The title page of committee minutes shall include the following statements:

"These minutes are subject to approval and are for committee use only. They are not to be duplicated or quoted for other than committee use."

Minutes of committee meetings will be distributed to the members of the committees, the Executive Director, National Board members and Advisory Committee members, as requested. Copies of committee minutes will be made available on the National Board's Web site for review until the next scheduled meeting minutes are available.

7.0 Voting

7.1 General

7.1.1 Each committee member shall exercise their vote within the presented time limits. When a committee member fails to report when due, or consistently abstains from voting, the committee member's appointment shall be subject to termination. The individual may appeal such action. Committee members are encouraged to vote as soon as possible.

7.1.2 Votes for committee actions may be obtained by letter, fax, recorded votes at meetings, or electronic means. All committee members shall have an opportunity to vote. When recorded votes are taken at meetings, the committee members who are absent shall be given the opportunity to vote.

7.1.3 The vote of each committee member shall be in one of the following categories:

- Approved
- Disapproved
- Abstention
- Not voting (for possible conflict of interest)

A response of not voting signifies neither approval nor disapproval and should be executed only when the committee member believes that they have a conflict of interest or potential conflict of interest and is removing themselves from the voting process.

Committee members casting disapproved responses should include an alternate action that will resolve their disapproved vote.

Committee members casting abstained responses should include a reason for the abstention.

7.1.4 Approval of committee actions shall be by a majority vote. Approval of the following actions of the NBIC Committee or subcommittee shall require two-thirds (2/3) majority vote of the committee membership, excluding not voting responses or not returned ballots.:

- committee procedures and interest categories
- reaffirmation of the NBIC as an ANSI Standard
- NBIC revisions
- interpretation of the NBIC
- scope of the NBIC Committee or subcommittee
- New ANSI standard

7.1.5 Voting by NBIC Committee members not present at a meeting or by letter ballot may be obtained by letter, facsimile, or by other electronic means.

7.2 Voting at Meetings

NBIC Committee members not present at a meeting for final approval of Code revisions shall be afforded the opportunity to submit their vote within two weeks after the date of the NBIC Committee meeting. It is the responsibility of the National Board to provide the information relating to the items prior to the meeting in the form of posted Agendas.

7.3 Voting by Letter Ballot

7.3.1 A letter ballot on any subject may be authorized by the Chair of the NBIC Committee, Chair of a subcommittee, Chairman of the Board, or a majority vote of those present and voting at a NBIC Committee or subcommittee meeting. The voting period for a letter ballot may be four (4) calendar weeks; however, in order to expedite the item, this period may be shortened to no less than two calendar weeks by the person authorizing the letter ballot. Voting periods shall be closed upon receipt of all responses, but not later than the

established closing date. All letter ballots shall be coordinated by the NBIC Committee secretary.

7.3.2 At the conclusion of the letter ballot period, the NBIC Committee or subcommittee secretary shall tally the votes and report the results to the members. The secretary shall collect the comments accompanying votes and distribute these to the appropriate committee for disposition. If approved disposition is not accomplished, the item shall be placed on the agenda for the next meeting. All disapproved comments shall be reviewed by the NBIC Committee or subcommittee.

All negative voters shall be advised in writing of the disposition of their comment(s) and of their right to appeal the NBIC Committee's or subcommittee's decision.

NBIC Committee or subcommittee members shall be apprised of any unresolved comments and attempts at resolution and given two (2) weeks from notification to ~~reconsider~~ respond, reaffirm, or change their original vote. If the required vote approval percentage is affirmative after this time period, the ballot shall be considered approved. Letter ballots not approved shall be placed on the agenda for the next scheduled meeting of the NBIC Committee or subcommittee.

8.0 National Board Inspection Code Publication Administration

8.1 ANSI Approval Process

The NBIC Committee is accredited by ANSI as a developer of American National Standards. The NBIC Committee, subcommittees, subgroups and task groups must conduct activities in accordance with this procedure and the current rules and procedures of ANSI.

8.1.1 Documentation

a. After the NBIC Committee has approved the revisions to be included in the edition, the secretary shall prepare and submit a Standards Action Public Review Request (BSR-8) form. A notice of all revisions shall be posted on

the National Board's Web site for public review and comment.

b. At the conclusion of the required comment period, the secretary shall collect all comments submitted and distribute the comments to the appropriate subcommittee.

c. The secretary shall coordinate the disposition of public review comments.

d. The disposition of all public review comments shall be approved by the NBIC Committee.

e. The commenter shall be advised, in writing, of the disposition of the comment and the commentator's right to appeal the NBIC Committee's decision.

f. All NBIC Committee members shall be notified of all unresolved comments and attempts at resolution to afford all members an opportunity to respond, reaffirm or change their vote.

g. Resolutions involving substantive changes to approved text shall be resubmitted for public review at the next scheduled public review and comment period or a new action shall be generated to address the commentators recommended change as appropriate. No substantive changes shall be made to an approved revision unless ANSI Essential Requirements are met.

h. When the disposition of all comments has been completed, or if no comments were submitted, the secretary shall prepare and submit the Formal Submittal Checklist for approval or withdrawal as an American National Standard (BSR-9) Form.

8.1.2 Secretariat

a. The National Board is the secretariat for the NBIC Committee. Its duties include:

1. providing administrative support for the activities of the secretary, and

2. publishing and distributing the Code, , minutes, and interpretations approved in accordance with these procedures.

b. It shall be the responsibility of the secretary to:

1. ensure that the NBIC Committee adheres to these and other referenced or applicable procedures,
2. apply to ANSI for accreditation of the NBIC Committee by that organization,
3. maintain a committee roster of the members which shall include names of the officers, and members, their address, business affiliation, category of interest, appointment expiration date,
4. comply with ANSI requirements for the NBIC Committee administration, and
5. submit proposed revisions to this procedure to ANSI for approval.

8.1.3 Internal Audits

At least once every three years, the Executive Director of the National Board shall have an audit made of the NBIC Committee's activities to ensure these procedures are followed. The audit shall be conducted by person(s) who are not members of the NBIC Committee. The audit report and follow-up action of deficiencies uncovered by an audit shall be reported to the NBIC Committee and the Chairman of the Board.

8.1.4 Patent Policy

The National Board ~~complies~~ shall comply with the ANSI patent policy as described in the ANSI Essential Requirements.

8.1.5 Commercial Terms

The National Board ~~complies~~ shall comply with the ANSI Commercial

Terms and Conditions Policy as described in the ANSI Essential Requirements

8.1.6 Withdrawal of an American National Standard (ANS)

When required by ANSI Essential Requirements or the National Board elects to withdraw an American National Standard, the National Board shall immediately notify ANSI for announcement in ANSI Standards Action. The National Board shall comply with all ANSI Essential Requirements for withdrawal of an American National Standard.

8.2 Revisions to the NBIC

8.2.1 Any interested person may request consideration of a revision to the NBIC by submitting such request in writing to the secretary. If deemed editorial as determined by the secretary, requests will be incorporated into the NBIC draft edition for distribution and public review. Comments which are editorial in nature need not be submitted to the NBIC Committee or subcommittees for consideration prior to inclusion in the edition . Any public review comments associated with these editorial comments will be handled as such and will be considered by the NBIC Committee and subcommittee at the next scheduled meetings for final approval.

Requests which are technical in nature will be forwarded to the appropriate subcommittee for consideration and recommendations made to the NBIC Committee, for their approval. Once approved, these revisions will be incorporated into the next draft. If approval is not reached, the item will be returned to the subcommittee for further action.

8.2.2 Following approval of a revision by the NBIC Committee and acceptance under ANSI procedures, the approved revision shall be published in the next edition.

8.3 Interpretations of the NBIC

8.3.1 The NBIC Committee has the responsibility for interpreting and replying to questions concerning the application of NBIC rule or guideline. Any interested person may request, in

writing, an interpretation of a rule or guideline contained in the NBIC through the NBIC Committee secretary.

8.3.2 Upon receipt of such a request the NBIC Committee secretary determines which subcommittee should develop a technical response.

When responding to questions concerning the interpretation of a rule or guideline, the following is to be used as a response:

> "The NBIC was developed under procedures approved by the American National Standards Institute. The NBIC Committee that approved the NBIC and revisions thereto is a consensus NBIC Committee balanced to assure that individuals from competent and concerned interests have been afforded the opportunity to participate. Further, all proposed revisions to the NBIC are made available for public review and comment which provides an opportunity for additional input from jurisdictions, industry and the public at large."

From time to time a request for interpretation regarding a superseded edition of the NBIC may be submitted to the NBIC Committee. If in the opinion of the members of the NBIC Committee, a response can be formulated, the NBIC Committee should respond to the inquirer's question. However, when it is the consensus of the NBIC Committee that a response cannot be formulated, the NBIC Committee should respond as follows:

> "The (edition of the NBIC) has been superseded. The historical knowledge that the NBIC Committee feels is needed to respond to your request for interpretation is no longer available to the NBIC Committee."

8.3.3 All interpretations of the NBIC shall be approved by the NBIC Committee.

8.3.4 All interpretations of the NBIC shall be posted on the National Board web site. A written response will also be sent to the inquirer.

8.3.5 The National Board accepts responsibility for, and recognizes only those interpretations approved by the NBIC Committee.

8.4 Publications

8.4.1 NBIC

The NBIC shall be identified as "An American National Standard" and "ANSI/NB-23" in accordance with ANSI procedures.

A new edition of the NBIC shall be published every two years.

Each edition shall have a date of issue. The NBIC may be used beginning with the date of issue. Six (6) months after the date of issue, the edition becomes the requirement for compliance with NBIC.

Complimentary copies of the NBIC will be provided to the members of the NBIC Committee and subcommittees.

8.4.2 Forms

National Board forms are part of the standard and follow the same requirements for revision as outlined in this procedure.

8.5 General

8.5.1 Referencing Other Standards

When the NBIC Committee wishes to reference another code or standard, the date of the specific, referenced code or standard shall not be cited unless required.

8.5.2 Copyrights

Copyright and all rights in all materials produced by the committee are owned by the National Board.

9.0 Due Process

The National Board provides due process for the impartial handling of complaints regarding procedural or technical issues for any action or inaction. As part of this due process there are several levels to which an aggrieved party may appeal. This section gives criteria regarding right to appeal, how appeals are made and what may be appealed.

At any level of the appeal process, there shall be no informal discussions between the body hearing the appeal and representatives of the appellant.

Persons who have directly and materially affected interests and who have been or will be adversely affected by any procedural or technical action or inaction with regard to the development of a proposed American National Standard or the revision, reaffirmation or withdrawal of the NBIC have the right to appeal. Appeals shall be addressed promptly and a decision made expeditiously. The following process shall be followed:

a. Any person aggrieved by an interpretation, disposition of comments, procedural or technical issues may appeal to the NBIC Committee.

b. The aggrieved person shall first request reconsideration by the NBIC Committee. Such request shall be in writing, addressed to the NBIC Committee secretary, and shall state the reasons for requesting reconsideration.

c. Should the person remain aggrieved following such reconsideration by the NBIC Committee or should such reconsideration be denied, the aggrieved person then, in writing, addressed to the National Board's Executive Director, may request review by the National Board Appeals Committee.

   The findings of the National Board Appeals Committee operating under their procedures, shall be binding on the NBIC Committee as to the specific item under appeal and it shall be incumbent upon the NBIC Committee to consider incorporating the National Board Appeals Committee findings.

d. Should the person remain aggrieved following the National Board Appeals Committee's decision, further appeal may be taken to the Board. Such appeal is initiated by a written request, addressed to the National Board's Executive Director setting forth the grounds for such appeal. The appeal shall be heard at the next regular or special

meeting of the Board which is held at a time of sufficient duration following such request as to allow distribution of all relevant documents and materials to the Board members. The Board, upon considering such appeal, by affirmative majority vote of those present, may allow a variance, may direct the NBIC Committee to consider a revision, or may sustain the action of the National Board Appeals Committee. The decision of the Board of Trustees on such appeal shall be final.

10.0 Records

~~*TABLE 1~~
~~Document Retention Schedule~~
Table 1 deleted

~~Note 1:~~

Records shall be retained for a minimum of five (5) years or until approval of the subsequent revision or reaffirmation of the complete standard.

Records for withdrawn standards shall be retained for a minimum of 5 years after withdrawal or until the next ANSI audit, whichever is longer.

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