State of Affairs with Safety and Pressure Relief Devices
National Board Inspection Code
First Published in 1946

ASME Boiler and Pressure Vessel Code published in 1915

Boiler Safety Act
Section 1-Power Boilers provides requirements for all methods of construction of power, electric and miniature boilers; high temperature water boilers, heat recovery steam generator and certain fired pressure vessel to be used in stationary service and power boilers used in locomotive, portable and traction service.

Authorizing the use and application of the “V” mark for the Assembly of Safety Valves for Power Boilers
ASME Boiler and Pressure Vessel Code published in 1915

Section VII-Pressure Vessels provides requirements applicable to the design, fabrication, inspection, testing and certification of pressure vessels operating at either internal or external pressures exceeding 15 psig. Such vessels may be fired or unfired.

Authorizing the use and application of the “UV” mark for the Assembly of Pressure Vessel Relief Valves
Section IV-Heating Boilers provides requirements for design fabrication, installation and inspection of steam heating, hot water heating, hot water supply boiler and potable water heaters intended for low pressure service that are directly fired by oil, gas, electricity, coal or other solid or liquid fuels.

Authorizing the use and application of the “HV” mark for the Assembly of Safety Valves for Low pressure steam heating boilers at 15 psi only. Hot water supply and boilers to 160 psi or 250° f max.
The National Board established in 1921 a system of "registering and recording ASME boilers." This system includes two parts:

- qualifying all inspectors to a common set of requirements and issuing a National Board commission to successful candidates

- authorizing manufacturers to stamp a National Board number on boilers inspected by a National Board Commissioned Inspector.

Authorizing the use and application of the “NB” mark to specified Pressure Relief Devices in accordance with the provisions of the National Board.
The National Board - provides standards for the installation, inspection and repair and/or alteration of boilers, pressure vessels and pressure relief devices.

The NBIC is organized into three Parts:

- **Part 1 Installation** - includes meeting specific safety criteria for construction, materials, design, supports, safety devices operation, testing and maintenance.

- **Part 2 Inspection** - 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 Repair and Alterations** - information and guidance to perform, verify and document acceptable repairs or alterations to pressure retaining items regardless of code construction.

Enacted 1953; repealed 1975; reinstated 1977; latest amendment to law October 1998; latest amendment to rules and regulation November 2006
The National Board offers the Certificate of Authorization and VR Stamp for the repair of pressure relief valves. Requirements are described in NB-514, Accreditation of VR Repair Organization.

Authorizing the use and application of the “VR” mark for Machining, Testing and Valve Repair for Steam, Air/Gas & Liquid.
PRESSURE RELIEF VALVES
WHAT IS A SAFETY VALVE

A device used for steam or vapor service operating automatically with a full-opening pop action and recloses when the pressure drops to a value consistent with the blowdown requirements established by governing code or standard.
ASME Section I – 2 Ring Design

CURRENT DESIGN TOP GUIDED PRESSURE RELIEF VALVES
ASME Section VIII – 1
Ring Design
CURRENT DESIGN TOP GUIDED PRESSURE RELIEF VALVES
WHAT IS A RELIEF VALVE

A device typically used for liquid service operates automatically by opening proportionally to increase in pressure beyond to initial opening pressure and recloses when the pressure drops below the opening pressure.
WHAT IS A SAFETY RELIEF VALVE

An automatic pressure relieving device which may be used as either a safety valve or relief valve depending upon the application.

Conventional Spring Actuated

Balanced (bellows) Actuated
WHAT IS A PILOT VALVE

A pressure relief valve in which the major relieving device is combined with and is controlled by a self activated auxiliary pressure relief valve

May be used on *steam, vapor, or liquids*

Not ASME approved for Section I boiler service

Recently approved for Section I economizer service
PILOT VALVE ADVANTAGES

Smaller operating gaps (Typically 1/2%)

Eliminates back-pressure problems

Offers remote sensing to overcome chatter due to inlet pressure drop.

Choice of modulating or pop valve action

Size & weight advantages

Dual pilots
WHAT IS A TEMPERATURE AND PRESSURE SAFETY RELIEF VALVE

A device typically used on a potable water heater. In addition to its pressure relief function it also includes a temperature regardless of pressure.
WHAT IS A REPTURE DISC

A device that is classified as non-reclosing since the disc is destroyed upon actuation.
Non-Coded Relief Valves are similar in manufacturer to ASME Code Valves except they do not have the ASME Code Designator.
National Board of Inspection

Code

Part 2 ---- Inspection
2.5.7 TESTING & OPERATIONAL INSPECTION OF PRESSURE RELIEF DEVICES

Pressure relief valves must be periodically tested to ensure that they are free to operate and will operate in accordance with the original code of construction.

Testing should include:
- Device set or opening pressure
- Reclosing pressure
- Seat leakage evaluation

Tolerances specified in the original code apply.
2.5.7 TESTING & OPERATIONAL INSPECTION OF PRESSUR RELIEF DEVICES

MAY BE DONE BY OWNER OR A CONTRACTOR IN THE FIELD OR AT A QUALIFIED TEST FACILITY.

CALIBRATED EQUIPMENT
WRITTEN PROCEDURE
AUXILIARY LIFT DEVICE
USE OF ‘LIFT’ LEVER’
Testing Results:

- **VALVE STUCK CLOSED** – REMOVE SYSTEM FROM SERVICE UNTIL PRV CAN BE REPAIRED

- **IF SET POINT IS FOUND TO BE OUT OF TOLERANCE:** MINOR ADJUSTMENTS (NO MORE THAN 2X THE PERMITTED TOLERANCE) SHALL BE MADE BY A NBBI ACCREDITED ORGANIZATION
2.5.7 TESTING & OPERATIONAL INSPECTION OF PRESSUR RELIEF DEVICES

Testing Results:

• MAJOR ADJUSTMENTS MAY INDICATE THAT THE VALVE IS IN NEED OF DISASSEMBLY, INSPECTION AND REPAIR

• ALL ADJUSTMENTS MUST BE SEALED
2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

POWER BOILERS - PRESSURES LESS THAN 400 PSIG

"Manual check every 6 month; pressure test annually to verify nameplate set pressure or as determined by operating experience as verified by testing history."
2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

POWER BOILERS - PRESSURES GREATER THAN 400 PSIG

"Pressure test to verify nameplate set pressure every three years or as determined by operating experience as verified by testing history."
2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

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."
2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

LOW PRESSURE STEAM HEATING BOILERS

"Manual check quarterly; pressure test annually prior to steam heating season to verify nameplate set pressure."
2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

HOT WATER HEATING BOILERS

"Manual check quarterly; pressure test annually prior to steam heating season to verify nameplate set pressure."
2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

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."
"Frequency of test and inspection is greatly dependent on the nature of the contents and operation of the system and only general recommendations can be given."
### 2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

**PRESSURE VESSELS AND PIPING**

<table>
<thead>
<tr>
<th>Service</th>
<th>Inspection Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>Annual</td>
</tr>
<tr>
<td>Air and Clean Dry Gases</td>
<td>Every three years</td>
</tr>
<tr>
<td>Pressure relief valves in combination with rupture disks</td>
<td>Every five years</td>
</tr>
<tr>
<td>Propane, Refrigerant</td>
<td>Every five years</td>
</tr>
<tr>
<td>All Others</td>
<td>Per inspection history</td>
</tr>
</tbody>
</table>
2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

HOW TO ESTABLISH FREQUENCIES?

Jurisdictional Requirements
Consultation With Insurance Underwriters
Records Of Test Data & Inspection
Manufacturer’s Recommendations
Operating History Of System
Results Of Visual Inspections
Common Discharge Headers
Outage Schedules
Critical Nature Of System
PART 3 SUPPLEMENT 7
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 other operation that may affect the flow passage, capacity, function or pressure-retaining integrity."
PART 3 SUPPLEMENT 7
S7.2 GENERAL REQUIREMENTS

"b) Conversion, changes or adjustments affecting critical parts are also considered repairs. The scope of the 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 require for a quality system and the repair nameplate."
PART 3 SUPPLEMENT 7
S7.2 GENERAL REQUIREMENTS

"c) The scope of repair activities shall not include changes in ASME Code."

WHEN COMPLETED, THE VALVE’S CONDITION AND PERFORMANCE SHALL BE EQUIVALENT TO THE STANDARDS FOR NEW VALVES.
PART 3 SUPPLEMENT 7
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."
PART 3 SUPPLEMENT 7
S7.5 REPLACEMENT PATS FOR PRESSURE RELIEF DEVICES

"b) Critical parts not fabricated by the valve manufacturer shall be supplied with material test certification for the material used to fabricate the part.

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......"
VISUAL IN SERVICE INSPECTION

Inspect Inlet and Discharge Piping for Code Compliance

Verify Discharge Piping is Draining

Verify Inlet/Discharge Piping Is Not Binding or Placing Stress on the Valve Body or Connections
VISUAL IN SERVICE INSPECTION

Check Condition of Inlet/Discharge Piping Supports

Verify No Block Valves on Valve Inlet

Inspect and Verify Function of Changeover Valve if Present
VALVE IN SERVICE INSPECTION

Current Nameplate Marking or Stamping

Verify Nameplate Capacity

Check for Identification, Presence and Integrity of Seal

Check for Evidence of Leaking
VALVE IN SERVICE INSPECTION

Bolting Condition and Tightness

Deposits or Material Buildup

Evidence of Rust or Corrosion

Damaged or Misapplied Parts

Verify No Obstructions for Proper Valve Operation

Bonnet Vent is Open (applies only to bellows valves)
No Adverse Findings--Return Valve to Service Till Next Inspection or Test Interval

PRV's are Mechanical Devices that Require Periodic Maintenance Even Though External Inspection and Test Results Indicate Acceptable Performance

Service Interval of No More Than Three Inspection Intervals or Ten years, Whichever is Less, Is Recommended to Maintain Device Condition

Service Records with Test Results and Finding Should be Maintained for all Overprotection devices.

Reference NBIC Part 2.5.8
"The Jurisdiction may authorize properly trained and qualified employees of boiler and pressure owner-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 date the adjustment shall be installed."
PART 3 SUPPLEMENT 7
S7.10 GUIDE TO JURISDICTIONS FOR AUTHORIZATION OF OWNER-USERS TO MAKE ADJUSTMENTS TO PRESSURE RELIEF VALVES

Owners-users or their designees must establish a documented in-house training program.

Owners-users or their designees must document the evaluation and acceptance of an employee's or designee's qualifications.

Owners-users or their designees must establish a written quality system including: calibration test equipment; valve testing, setting and sealing; and valve marking.
"Only External Adjustments to Restore the Required Set Pressure and/or Performance of a Pressure Relief Valve shall be made under the Provisions of S7.10.1(a)"
WHO SHOULD REPAIR MY VALVES?

State of Kansas Boiler Safety Act Section 49-50-10
Safety Valve Repair

All ASME Code Section I "V" and Section VIII "UV" shall be repaired in accordance with the NBIC "VR" program

Repair Organizations in possession of a "VR" certificate of authorization
WHAT DO YOU NEED TO REPAIR VALVES?

Training
Practice
Technical Documentation including
Critical dimensions, spring charts and repair procedures
Specialized Tooling
Certified Test Equipment
WHAT TO LOOK FOR IN A REPAIR SHOP?

NBBI "VR" Certificate Holder

National Board Approved Quality Assurance Manual

Established Personnel Qualification and Training System

Test Stands Benchmarked Against Certified Flow Loops
VALVE SERVICE ORGANIZATION

PROVEN ABILITY TRACK RECORD

FACTORY TRAINING/AFFILIATION

UP TO DATE CRITICAL DIMENSIONS

UP TO DATE REPAIR PROCEDURES

FACTORY TRAINED TECHNICIANS

ACCESS TO NATIONWIDE PARTS & VALVE INVENTORIES

USE OF OEM PARTS
VALVE SERVICE ORGANIZATION

HIGH CAPACITY TEST STANDS
AUXILLIARY LIFT DEVICE
MOBILE REPAIR FACILITY
24/7 SERVICE
FULL TIME TECHNICIANS
ASSET MANAGEMENT SYSTEM
OUTREACH TRAINING
SAFETY RECORD
REDUCTION IN SUPPLIER BASE
VALVE REPAIR COSTS

1/2" TO 2" NPT CONNECTIONS
(non standard materials)
2" AND ABOVE

If the valve can be removed: Shop Repair

If the valve is welded in-place: Field Repair
### Consolidated Valves

#### Sizing and Selection Report

**Tag Number:** PSV-3574

**Valve Type:** 1905-30L-1-04-MS-31-RF-QS-JK

**Notes:**
- **P&D No. - Location:** -
- **Rf Area:** 3.317 in²
- **Sizing Code:** AMRE Section VIII
- **Material:** METHYL ALCOHOL
- **Vessel:** -
- **Body:** -
- **Bolt No.:** B3557

### Dimensions and Weight

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Unit</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>D1</td>
<td>in</td>
<td>4.25</td>
</tr>
<tr>
<td>D2</td>
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<tr>
<td>D3</td>
<td>in</td>
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<tr>
<td>D6</td>
<td>in</td>
<td>0.5</td>
</tr>
<tr>
<td>D7</td>
<td>in</td>
<td>0.25</td>
</tr>
</tbody>
</table>

**Weight:** 33.5 kg

**Material:**
- 316L STAINLESS STEEL
- 304L STAINLESS STEEL
- 316 STAINLESS STEEL
- 316L STAINLESS STEEL
- 304 STAINLESS STEEL
- 316L STAINLESS STEEL
- 304 STAINLESS STEEL
- 316L STAINLESS STEEL
- 316 STAINLESS STEEL
- 304 STAINLESS STEEL
- 316L STAINLESS STEEL

**Note:**
- **Part Name:** VALVE BODY
- **Model:** V424-2Q
- **Material:** 316L STAINLESS STEEL

### Pressure and Temperature

**Operating:**
- **COPD:** 1500 psi (g)
- **Temp:** 500 °F

**Design:**
- **COPD:** 5000 psi (g)
- **Temp:** 850 °F

**Superimposed Maximum:**
- **COPD:** 1500 psi (g)
- **Temp:** 500 °F

**Safety:**
- **Min:** 500 psi (g)
- **Max:** 5000 psi (g)

**Gaskets:**
- **1.5 in:** Graphite

**Temperature:**
- Operating: 215 °C
- Design: 260 °C

**Flow Area:**
- **Design:** 3.517 in²

**API Certification:**
- 5858 Certified

**Capacity:**
- **Maximum:** 4440 MCF
- **Maximum:** 3630 SCF

**Other:**
- **Drilled:** 154.068 in. @ 3.14
New Relief Valve Data Sheet
Owner Plant: PQ CORPORATION Kansas City

Work Ticket: 618200-1
Customer PO: 46176658

Sales Order: 618200
Customer L. D.: PSV-2624

**VALVE DATA**
- **Model Number:** 3975-XLC-1.54-MS-30-BP-GS-117
- **Serial Number:** S989057
- **Trim Material:** STAINLESS STEEL
- **Seat Seal Mat.:** STAINLESS STEEL
- **Seat Pressure:** 60 PSI
- **Cold Diff. Heat Press:** 50 PSI
- **Back Pressure:** 0 PSI
- **Rated Lift:** IN
- **ASME Code:** VIII
- **Material:** STAINLESS STEEL

**VALVE SIZE:** 3.4 " D. X 2.635 IN. 2
**Service:** VANE / FCY M
**Cap Type:** SCREWED
**Operating Temp:** 100 ° F
**Refrigerant Down:** –
**Net Lift:** IN

**ASSEMBLER’S INFORMATION**
- **Comment:**

**ASSEMBLED BY:** BARR NECK
**Date Assembled:** 2014/02/10

**TEST RESULTS**
- **Date Tested:** 2014/02/20
- **Tested By:** NOAMER JERRY
- **Test Location:** THEIR SHREDDER
- **Sat:** 12 PSI
- **Resea Press:** 3 PSI
- **Seal Tight:** 41 PSI
- **SF Test:** 38 @ PSI

**Gauges Calibrated Using Equipment Tareable to NIST**
- **Gauge 1:** 517 PSI
- **Gauge 2:** 515 PSI

**FINAL INSPECTION**
- **Certified Individual:** JAYCOX RUSTY
- **Certified Date:** 2014/02/29
- **Check List / Quality Control:**
  - All Testing Complete: YES
  - PSI Listed: YES
  - PSV Listed: YES
  - PSI Pared: YES
  - VPR Stamped Attached: NO
  - Test Only Tag Attached: NO
  - Customer ID Attached: YES

**REPAIRED BY:** PIONEER INDUSTRIAL CORP.
**ST. LOUIS, MO**

**SO**

**MODEL**

**SET**

**CAP**

**CDTP**

**BP**
INDUSTRY TRENDS

INCREASED JURISDICTION OVERSIGHT

STRICTER NATIONAL BOARD AUDITS

LONGER REPAIR INTERVALS

INCREASED APPLICATION OF PILOT OPERATED VALVES FOR EMISSION CONTROL

APPROVAL OF PILOT VALVES FOR SEC I – ON BOILER SYSTEMS