

# Overview of the National Board Inspection Code



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Presented by: **Gary Scribner**  
**National Board of Boiler and Pressure Vessel Inspectors**  
**Manager of Technical Services**



Headquarters – Columbus, OH



Inspection Training Center



Pressure Relief Testing Laboratory



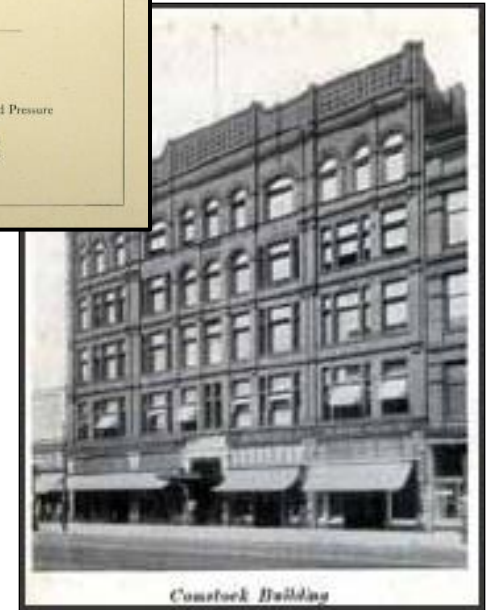
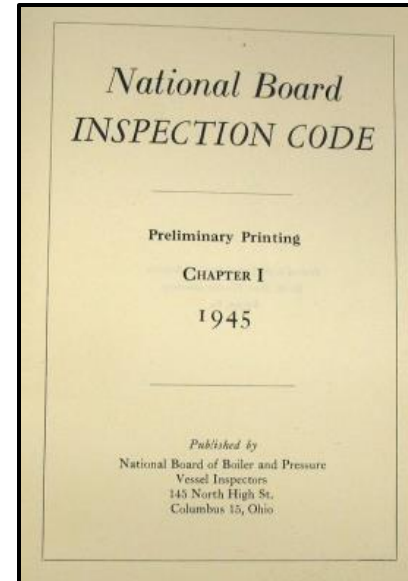
# National Board Inspection Code (NBIC)

- The purpose of the NBIC is to maintain the integrity of pressure-retaining items after fabrication by providing common rules for:
  - Installation of the new equipment
  - Inspection after the equipment has been placed in operation
  - Repairs and alterations to pressure retaining equipment
- These rules ensure that pressure-retaining items may continue to be safely used



# Background of the NBIC

- No standard rules for inspections or repairs of pressure retaining equipment existed
- Chief Inspectors of North America requested help in establishing common rules
- The National Board of Boiler and Pressure Vessel Inspectors published the first edition of the NBIC in 1946
- The NBIC became an American National Standards Institute (ANSI) Consensus Standard in 1992



# Background of the NBIC

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- The NBIC committees must be balanced to ensure that individuals with a concerned interest have an opportunity to participate in its development.
- Categories of interest represented on committees include:
  - Regulatory-Governmental agencies
  - Boiler and Pressure vessel users
  - Manufactures of pressure equipment
  - Repair companies
  - Inspection agencies
- Additions and changes to the NBIC are made available for public review and comment. This provides an opportunity for additional public input from industry, academia, regulatory and jurisdictional agencies, and the public-at-large.
- All public comments received must be addressed by the committee.



# NBIC Committee Structure

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## NBIC Main Committee (23 members)

- Subcommittee Installation (8 members)
  - Subgroup Installation (11 members)
- Subcommittee Inspection (15 members)
  - Subgroup for Inspection (16 members)
- Subcommittee Repairs and Alterations (20 members)
  - Subgroup for Repairs and Alterations (20 members)
- Subcommittee for Pressure Relief Devices (13 members)
- Special Subgroups that support all Subcommittees
  - Subgroup Locomotive Boilers (13 members)
  - Subgroup Graphite Vessels ( 9 members)
  - Subgroup Fiber-Reinforced Pressure Vessels (15 members)
  - Subgroup Historical Boilers (10 members)



# NBIC Committee Process

- The NBIC is updated and issued every 2 years
  - Latest edition was issued in July 2015
- The NBIC committees meet twice per year for four days
  - January in various locations
    - January 2017 meeting in San Diego, CA
  - July at the National Board Headquarters
- All meetings are open to the public
- All meeting schedules, agendas and minutes are posted on the NB Website





# NBIC Purpose

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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 of the NBIC

*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**

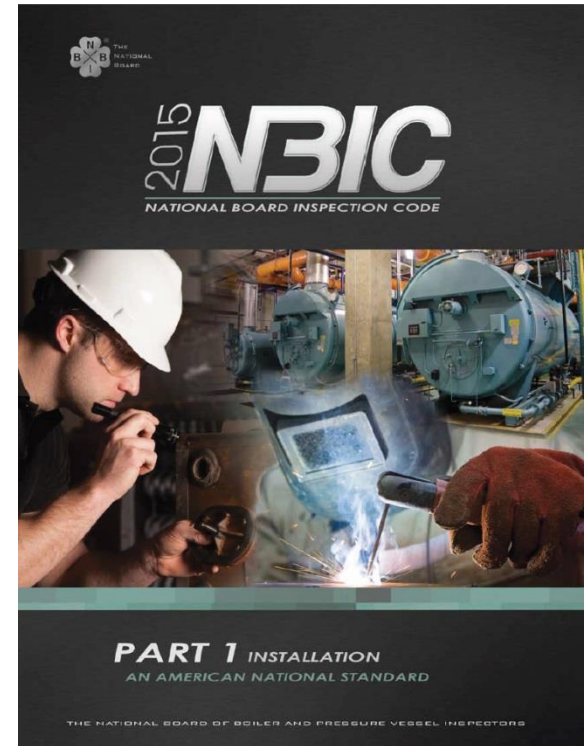
**Repairs  
and Alterations**



# NBIC Part 1, Installation

## Section 1: General Guidelines

- Introduction
- Application of these Rules
- Certification and Jurisdictional Requirements
- Responsibility
- Equipment Certification
- Jurisdictional Review
- Inspection
- Boiler Installation Report
- Guide for Completing National Board Boiler Installation Report





# NBIC Part 1, Installation

## Section 2: Power Boilers

### General Guidelines

### General Requirements

- Supports, Foundations, and Settings
- Clearances

### Boiler Room Requirements

- Boiler Room Exits
- Ladders and Runways
- Drains
- Cleaning Water



# NBIC Part 1, Installation

## Section 2: Power Boilers (cont.)

### Source Requirements

- Feedwater
- Pumps
- Valves
- Fuel
- Electrical Wiring
- Remote Emergency Shutdown Switches
- Ventilation and Combustion Air
- Lighting
- Emergency Valves and Controls



# NBIC Part 1, Installation

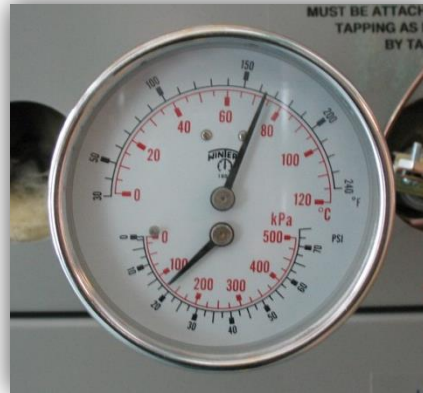
## Section 2: Power Boilers (cont.)

### Discharge Requirements

- Chimney or Stack
- Ash Removal
- Drains
- Connections
- Pressure Rating

### Operating Systems

- Breeching and Dampers
- Burners and Stokers
- Steam Supply
- Condensate and Return
- Blowoff
- Controls and Gages



# NBIC Part 1, Installation

## Section 2: Power Boilers (cont.)

### Pressure Relief Valves

- Valve Requirements
  - Number
  - Location
  - Capacity
  - Set Pressure
- Forced-Flow Steam Generator
- Superheaters
- Economizers
- Pressure-Reducing Valves
- Mounting and Discharge Requirements



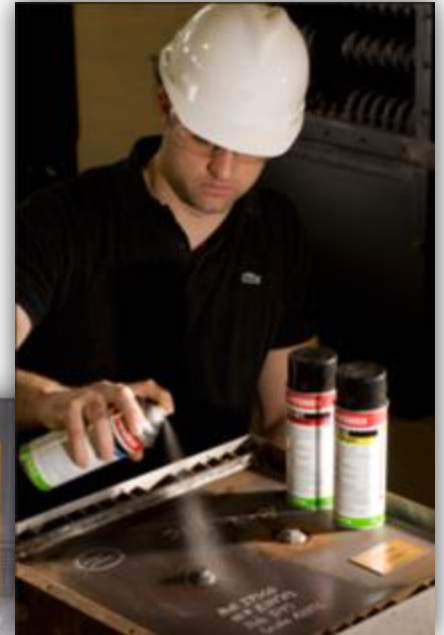


# NBIC Part 1, Installation

## Section 2: Power Boilers (cont.)

### Testing and Acceptance

- General
- Pressure Test
- Nondestructive Examination
- System Testing
- Final Acceptance
- Boiler Installation Report



# NBIC Part 1, Installation

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**Section 3:** Contains the Installation requirements for...

- Steam Heating Boilers
- Hot-Water Heating Boilers
- Hot-Water Supply Boilers
- Potable Water Heaters

(formatted the same way as Power Boilers with detailed rules)

**Section 4:** Contains the installation requirements for Pressure Vessels

**Section 5:** Rules for installation of Piping systems





# NBIC Part 1, Installation

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## Section 6: Supplements

- Supplement 1 - Installation of Yankee Dryers (Rotating Cast-Iron Pressure Vessels) with Finished Shell Outer Surfaces
- Supplement 2 - Safety Valves on the Low-Pressure Side of Steam Pressure-Reducing Valves
- Supplement 3 - Installation of Liquid Carbon Dioxide Storage Vessels
- Supplement 4 – Installation of Biomass (Wood/Solid Fuel) Fired Boilers
- Supplement 5 – Installation of Thermal Fluid Heaters



# **NBIC Part 1, Installation**

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**Section 7: NBIC Policy for Metrication**

**Section 8: Preparation of Technical Inquiries to the National Board Inspection Code Committee**

**Section 9: Glossary of Terms, Definitions**

**Section 10: NBIC Approved Interpretations for Previous Editions and Addenda's.** (Interpretations for the current Edition can be found on the NB Web Site)

**Section 11: Index**

(Sections 7-10 are identical in all three parts of the NBIC)

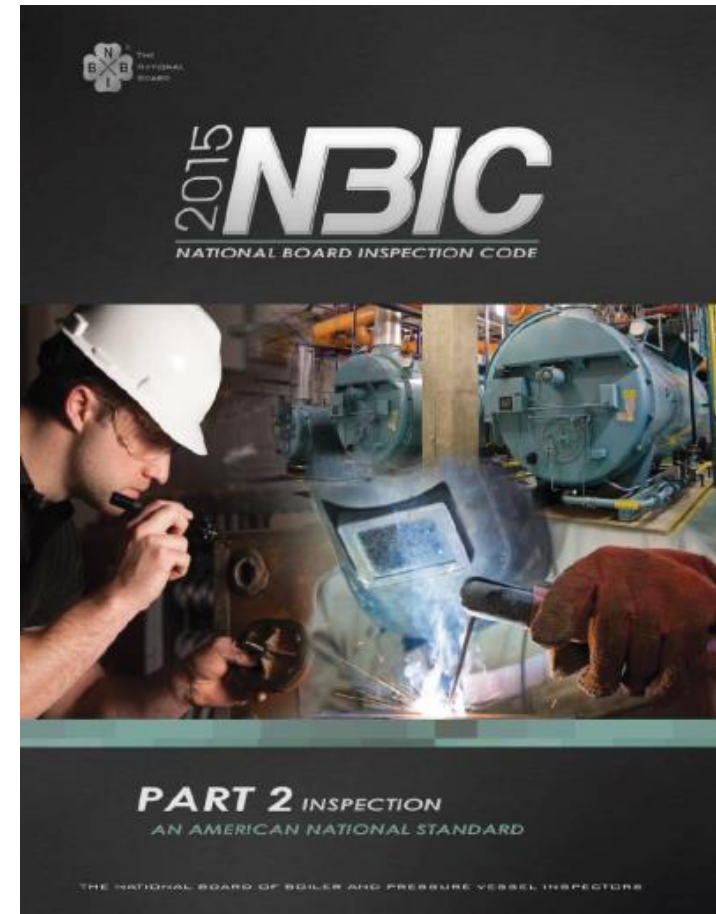


# NBIC Part 2, Inspection

Part 2 provides information and guidance needed to perform and document inspections for all types of pressure-retaining items.

**Part 2, Inspection includes information on:**

- Personnel safety
- Non-destructive examinations
- Tests
- Failure mechanisms
- Types of pressure equipment
- Fitness for service
- Risk-based assessments
- Performance-based standards.



# NBIC Part 2, Inspection

## Section 1: General Requirements for Inservice Inspection of Pressure Retaining Items



- Administration
- Personnel Safety
- Personal Safety Requirements for Entering Confined Spaces
- Equipment Operation
- Inspection Activities
- Pre-Inspection Activities
- Inspection Planning
- Preparation for Internal Inspection
- Post-Inspection Activities



# NBIC Part 2, Inspection

## Section 2: Detailed Requirements for Inservice Inspection of Pressure-Retaining Items

### Boilers:

- Service Conditions
- Condition of Boiler Room
- External and internal Inspections
- Leakage
- Corrosion Considerations
- Waterside Deposits
- Piping, Parts, and Appurtenances
- Flanged or Other Connections
- Gages
- Pressure Relief Devices
- Controls
- Records Review



# NBIC Part 2, Inspection

## Section 2: Detailed Requirements for Inservice Inspection of Pressure-Retaining Items (cont.)

### Concerns for Specific Types of Boilers:

- Cast-Iron Boilers
- Firetube Boilers
- Watertube Boilers
- Electric Boilers
- Fired Coil Water Heater
- Fired Storage Water Heaters
- Thermal Fluid Heaters
- Waste Heat Boilers
- Black Liquor Recovery Boilers





# NBIC Part 2, Inspection

## Section 2: Detailed Requirements for Inservice Inspection of Pressure-Retaining Items (cont.)

### Pressure Vessels

- Service Conditions
- External and Internal Inspection
- Inspection of Pressure Vessel Parts and Appurtenances
- Gages
- Safety Devices
- Controls/Devices
- Records Review



# NBIC Part 2, Inspection

## Section 2: Detailed Requirements for Inservice Inspection of Pressure-Retaining Items (cont.)

### Specific Types of Pressure Vessels

- Deaerators
- Compressed Air Vessels
- Expansion Tanks
- Liquid Ammonia Vessels
- Pressure Vessels with Quick-Actuating Closures
- Anhydrous Ammonia Nurse Tanks
- Pressure Vessels for Human Occupancy (PVHO)

### Piping and Piping Systems

### Pressure Relief Devices

- Inspection Requirements for Pressure Relief Devices
- Rupture Disks
- Testing and Operational Inspection of Pressure Relief Devices
- Recommended Inspection and Test Frequencies for Pressure Relief Devices



# NBIC Part 2, Inspection

## Section 3: Corrosion and Failure Mechanisms

### Corrosion

- Macroscopic Corrosion Environments
- Control of Corrosion
- Process Variables
- Protection
- Material Selection
- Coatings
- Engineering Design

### Failure Mechanisms

- Fatigue
- Creep
- Temperature Effects
- Hydrogen Embrittlement
- High-Temperature Hydrogen Attack
- Hydrogen Damage
- Bulges and Blisters
- Overheating
- Cracks

# NBIC Part 2, Inspection

## Section 4: Examinations, Test Methods, and Evaluations

### Description of Nondestructive Examination Methods (NDE)

#### Testing Methods

- Non Destructive Methods
- Pressure Testing
- Liquid Pressure Testing
- Pneumatic Pressure Testing

#### Determining Inspection Intervals

- Subject to Erosion
- Exposure to Corrosion
- Where Corrosion Is Not a Factor
- Exposed to Inservice Failure Mechanisms

#### Risk-Based Inspection Assessment Programs (RBI)

- Key Elements of an RBI Assessment Program
- RBI Assessment
- Risk Evaluation
- Risk Management
- Jurisdictional Relationships



# NBIC Part 2, Inspection

## Section 5: Stamping, Documentation, and Forms

### Replacement of Stamping During Inservice Inspection

- Authorization
- Replacement of Stamped Data
- Reporting

### National Board Inspection Forms

- Replacement of Stamped Data
- Boiler or Pressure Vessel Data Report
- Boiler-Fired Pressure Vessels Report of Inspection
- Pressure Vessels Report of Inspection
- Report of Fitness For Service Assessment
- Guide For Completing Fitness For Service Assessment Reports



# NBIC Part 2, Inspection

## Section 6: Supplements

Provides information regarding the inspection of specific types of pressure equipment

- Supplement 1 – Locomotive Boilers
- Supplement 2 – Historical Boilers
- Supplement 3 – Graphite Vessels
- Supplement 4 – FRP Vessels
- Supplement 5 – Yankee Dryers
- Supplement 6 – DOT Transport Tanks
- Supplement 7 – LPG Service Vessels
- Supplement 8 – Safety Valve Pressure Differential
- Supplement 9 – Change of Service Requirements
- Supplement 10 – High Pressure Composite Vessels

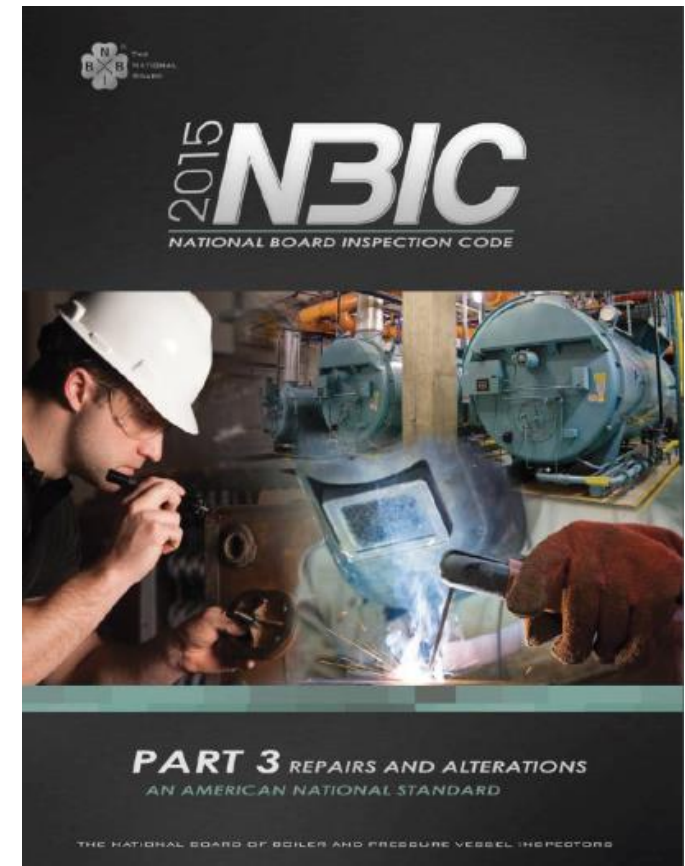




# NBIC Part 3, Repairs and Alterations

Part 3 provides:

- Information and guidance to perform, verify, and document acceptable repairs or alterations to pressure-retaining items.
- Alternative methods for examination, testing, heat treatment are provided when the original code of construction requirements cannot be met.
- Specific acceptable and proven repair methods.



# NBIC Part 3, Repairs and Alterations

## Section 1: General and Administrative Requirements

- Construction Standards for Pressure-Retaining Items
- National Board Commissioned Inspector
- National Board “R” Program
  - “R” Stamp Quality System
- National Board “VR” Program for Safety Valve Repairs
  - “VR” Stamp Quality System
- National Board “NR” Program for Nuclear Repairs
  - “NR” stamp Quality system



# NBIC Part 3, Repairs and Alterations

## Section 2: Welding and Heat Treatment

- Welding Procedure Specifications
- Standard Welding Procedure Specifications
- Performance Qualification
- Welding Records
- Welder's Identification
- Welder's Continuity
- Welder's Continuity Records
- AWS Standard Welding Procedure Specifications
- Heat Treatment
- Preheating
- Postweld Heat Treatment (PWHT)
- Alternative Welding Methods Without Postweld Heat Treatment



# **NBIC Part 3, Repairs and Alterations**

## **Section 3: Requirements for Repairs and Alterations**

- Material Requirements
- Replacement Parts
- Drawings
- Design Requirements
- Calculations
- Routine Repairs
- Examples of Repairs
- Repair Methods
- Defect Repairs
- Wasted Areas
- Seal Welding
- Re-Ending or Piecing Pipes or Tubes
- Patches
- Repair Plan
- Alterations
- Re-Rating
- Examples of Alterations

# NBIC Part 3, Repairs and Alterations

## Section 4: Examination and Testing

- Nondestructive Examination
- Pressure Gages, Measurement, Examination, and Test Equipment
- Examination and Test for Repairs and Alterations
- Test or Examination Methods Applicable to Repairs
- Test or Examination Methods Applicable to Alterations
- Pressure Testing of Parts



# NBIC Part 3, Repairs and Alterations

## Section 5: Certification, Documentation, and Stamping

- Preparation and Distribution of Form R-1 (Repair) and Form R-2 (Alteration)
- Form “R” Log
- Stamping Requirements for:
  - Repairs
  - Alterations
  - Parts
  - Fiber-Reinforced Vessels
  - Pressure Relief Devices
- Removal of Original Stamping or Nameplate





# NBIC Part 3, Repairs and Alterations

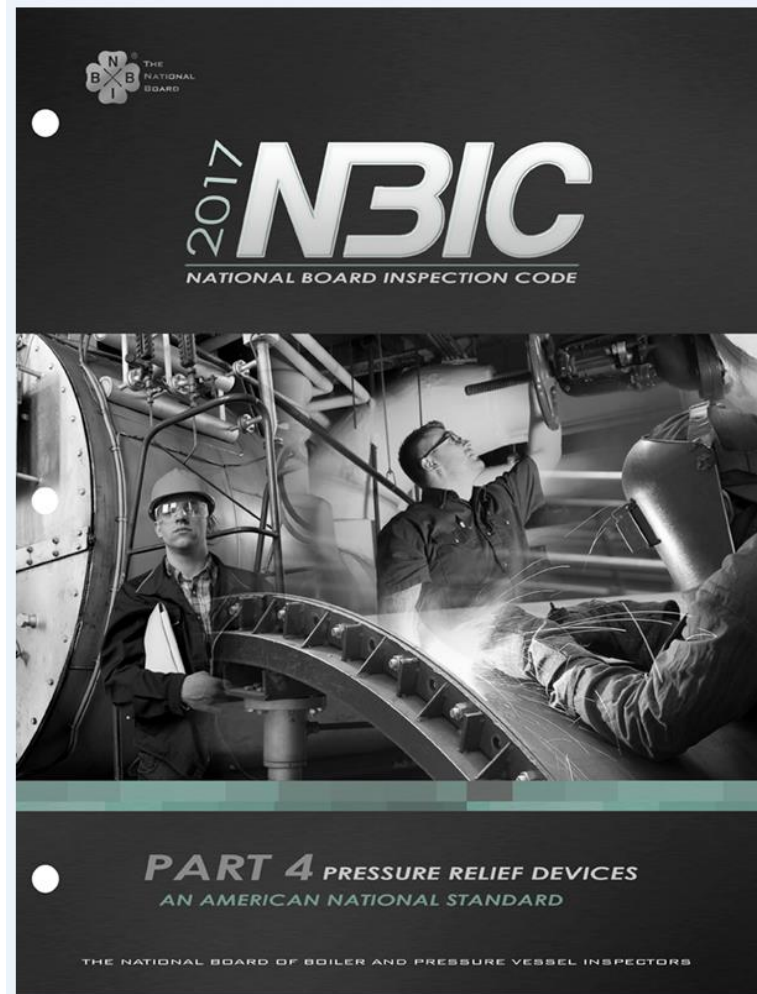
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Provides information regarding the repair and alteration of specific types of pressure equipment

- Supplement 1 – Locomotive Boilers
- Supplement 2 – Historical Boilers
- Supplement 3 – Graphite Vessels
- Supplement 4 – FRP Vessels
- Supplement 5 – Yankee Dryers
- Supplement 6 – DOT Transport Tanks
- Supplement 7 – Pressure Relief Devices
- Supplement 8 – Design of Test Systems for Pressure Relief Devices in Compressible Fluid Service
- Supplement 9 – Procedures to Extend the “VR” Certificate of Authorization and Stamp to ASME “NV” Stamped Pressure Relief Devices
- Supplement 10 – LPG Service Vessels



# 2017 NBIC Part 4 – Pressure Relief Devices



# NBIC Part 4 – Pressure Relief Devices

- Requirements for Pressure Relief Devices in NBIC Parts 1 and 2 will remain and also be duplicated in Part 4.
- This will ensure continuing oversight by the Subcommittee PRD and help the committee maintain these requirements up to date.
- Requirements for Pressure Relief Devices in NBIC Part 3 will now be in the new NBIC Part 4



# Questions?

Contact Information:  
The National Board  
1055 Crupper Avenue  
Columbus, Ohio 43229  
[www.nationalboard.org](http://www.nationalboard.org)

