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**THE NATIONAL BOARD  
BODY OF KNOWLEDGE  
FOR**

**INSERVICE INSPECTORS**

Approved by: \_\_\_\_\_

  
Executive Director

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(date of approval)

\*Denotes Revisions

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# THE NATIONAL BOARD

## BODY OF KNOWLEDGE FOR INSERVICE INSPECTORS

\* The National Board has developed this Body of Knowledge to outline the duties, responsibilities, knowledge, and skills required for the inservice inspection of pressure-retaining items during their installation and operation.

### OBJECTIVES

An Individual responsible for inservice inspection of pressure-retaining items should have knowledge, and the ability to apply that knowledge, of the following:

- \* • Code Calculations
- Nondestructive Examination
- Pressure Testing
- Inservice Inspection
- Boiler and Pressure Vessel Terminology
- Conditions Causing Deterioration or Failures
- Pressure Relief Devices
- Control and Safety Devices
- Installation

### REFERENCE MATERIAL

The following reference material is required to obtain and apply the knowledge of the listed objectives in this Body of Knowledge.

- \* • RCI-1, NB-263, *Rules for Commissioned Inspectors*
- *National Board Inspection Code, Parts 1 and 2*
- ASME Section I, *Power Boilers*
- ASME B.31.1, *Power Piping*
- ASME Section IV, *Heating Boilers*
- ASME Section VIII, Division 1, *Pressure Vessels*
- ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*

*Approved translations are acceptable.*

### BODY OF KNOWLEDGE OUTLINE

This outline provides information regarding the listed objectives of this Body of Knowledge, and further describes the duties and responsibilities of the Inservice Inspector.

#### 1. *Inservice Inspection*

Familiarity with the requirements for the inservice inspection of pressure-retaining items, as outlined in *National Board Inspection Code, Part 2, Inspection*, including a knowledge of internal/external inspection requirements, safety and confined space entry requirements, and deterioration.

2. *Boiler and Pressure Vessel Types and Terminology*

Ability to identify boiler and pressure vessel types and their corresponding parts.

3. *Conditions Causing Deterioration or Failures*

Ability to identify and understand the effects of operations on pressure-retaining items, including:

- Types of Corrosion and Deterioration
  - corrosion by water
  - corrosion by process fluids
  - deterioration due to hydrogen
  - stress corrosion cracking
  - atmospheric corrosion and corrosion under installation
  - erosion and erosion-corrosion
  - other types of corrosion
- Failure Mechanisms
  - mechanical and thermal problems
  - high temperature problems
- Corrosion Calculations
  - corrosion rate determination
  - corrosion averaging
  - widely scattered pitting
  - surfaces remote from a weld
  - corrosion in central portion of dished heads
  - estimated remaining life and corrosion rate

4. *Installation*

Ability to identify and understand the general requirements for installation of pressure-retaining items including requirements for:

- steam/hot water heating boilers
- hot water supply boilers
- potable water heaters
- pressure vessels
- piping
- power/heating boilers
  - equipment requirements
  - source requirements
  - discharge requirements
  - operating systems
  - controls and gages
  - pressure relief valves

5. *Code Calculations*

Ability to perform calculations, as they apply to re-ratings and remaining life. For example:

- components under internal pressure
  - calculation of minimum required thickness or maximum allowable working pressure (MAWP) of items such as tubing, piping, drums, shells, headers, and heads
- static head calculations
  - difference between vessel MAWP and vessel component MAWP

- static head pressure on any vessel component
- total pressure (MAWP + static head) on any vessel component
- remaining life and inspection interval calculations
  - calculation of metal loss (including corrosion averaging), corrosion rates, remaining service life, and inspection interval.

#### 6. *Nondestructive Examination*

Ability to define and understand the requirements and guidelines for performing examinations and tests for the installation and inspection of pressure-retaining items; ability to define and understand the principles of the following nondestructive examination methods:

- radiography
- ultrasonic testing
- magnetic particle testing
- liquid penetrant testing
- visual testing

#### 7. *Pressure Testing*

\* Ability to define and understand the requirements and guidelines for performing examinations and tests for the installation and inspection of pressure-retaining items; ability to define and understand the different pressure testing methods and principles, such as:

- liquid pressure test
- pneumatic test
- initial service leak test
- vacuum test

#### 8. *Pressure Relief Devices*

Ability to define and understand set pressure and relieving capacity requirements for pressure-relieving devices, including:

- application and limitations
- sizing for pressure and capacity
- set pressures and allowable deviations
- causes of improper performance
- reasons for inspection and frequency determination
- inspection and test service procedures
- maintenance inspection safety practices

#### 9. *Controls and Safety Devices*

Ability to define and understand controls and devices, including:

- fuel
- waterside
- fireside
- limit switches and device types
- level indicators