THE NATIONAL BOARD
BODY OF KNOWLEDGE
FOR

INSERVICE INSPECTORS

Approved by: [Signature]
Executive Director
(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