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## Recommended Administrative Boiler and Pressure Vessel Safety Rules and Regulations

# THE NATIONAL BOARD

OF BOILER AND  
PRESSURE VESSEL  
INSPECTORS

Approved by Board of Trustees: October 25, 2004

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\*Denotes Revised Section(s)

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NB-132 Revision 8

Recommended Boiler and Pressure Vessel Safety Legislation  
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# Recommended Boiler and Pressure Vessel Safety Legislation

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## \*INTRODUCTION

In order to protect the public from boiler and pressure vessel explosions, guidelines must be in place to ensure proper construction, installation, inspection, operation, maintenance, alterations, and repairs. However, these guidelines do little to protect the public unless they are mandated by law.

In order to encourage the development of essential safety laws in jurisdictions that have no laws, rules, or regulations in the area of boiler and pressure vessel safety, the National Board published NB-131, *Recommended Boiler and Pressure Vessel Safety Legislation*, and NB-132, *Recommended Administrative Boiler and Pressure Vessel Safety Rules and Regulations*. These documents may be used as guidelines to update a jurisdiction's existing requirements. It is the intent of the National Board that these guidelines will establish an efficient, uniform, and workable safety division. However, they may be modified as required to meet local jurisdictional conditions.

The Board of Trustees of the National Board established the Committee on Recommended Boiler and Pressure Vessel Safety Legislation – NB-131 and NB-132, and charged the committee with the responsibility for maintaining and revising both NB-131 and NB-132.

Questions, comments or proposed revisions should be addressed to the executive director of the National Board.

## \*PART I DEFINITIONS OF TERMS

1. ACT – the Boiler and Pressure Vessel Safety Act which was enacted as Chapter ....., Acts of the General Assembly.
2. ALTERATION – any change in the item described on the original Manufacturer's Data Report which affects the pressure-containing capability of the boiler or pressure vessel. Nonphysical changes such as an increase in the maximum allowable working pressure (internal or external) or design temperature of a boiler or pressure vessel shall be considered an alteration. A reduction in minimum temperature such that additional mechanical tests are required shall also be considered an alteration.
3. ANSI – American National Standards Institute
4. API CERTIFIED INSPECTOR – an inspector who is certified by the American Petroleum Institute to perform functions specified in API-510 or API-570.
5. API-510, *PRESSURE VESSEL INSPECTION CODE* – the code for maintenance inspection, repair, alteration, and re-rating procedures for

pressure vessels used by the petroleum and chemical process industries. API-510 is published by the American Petroleum Institute and is an approved ANSI standard.

6. API-570, *PIPING INSPECTION CODE* – the code for maintenance inspection, repair, alteration, and re-rating procedures for process piping used by the petroleum and chemical process industries. API-570 is published by the American Petroleum Institute and is an approved ANSI standard.
7. API-RP 579, *FITNESS-FOR-SERVICE* – A recommended practice that describes standardized fitness-for-service assessment techniques for pressurized equipment used in the petrochemical industry. Fitness-for-service is defined as the ability to demonstrate the structural integrity of an in-service component containing a flaw.
8. API/ASME CODE – the American Petroleum Institute (API), in conjunction with the ASME Code, as used in these rules and regulations shall mean the *Code for Unfired Pressure Vessels for Petroleum Liquids and Gases*, that existed from 1934-1956, and is no longer in use.
9. APPROVED – approved by the Board of Boiler and Pressure Vessel Rules.
10. ASME – the American Society of Mechanical Engineers.
11. ASME CODE – The Boiler and Pressure Vessel Code published by the American Society of Mechanical Engineers, including addenda and code cases approved by the council of that Society.
12. AUTHORIZED INSPECTION AGENCY – one of the following:

*New Construction:* *An Authorized Inspection Agency is one that meets the qualification and definition 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 in accordance with NB-369, *Qualifications and Duties for Authorized Inspection Agencies (AIAs) Performing Inservice Inspection Activities and Qualifications for Inspectors of Boilers and Pressure Vessels.*

13. BOARD – the Board of Boiler and Pressure Vessel Rules created by the Act and empowered to make, alter, amend, and interpret rules and regulations for the safe construction, installation, inspection, alteration, and repair of boilers and pressure vessels.
14. BOILER – a closed vessel in which water or another liquid is heated, steam or vapor is generated, steam or vapor is superheated, or any combination thereof, under pressure or vacuum, for use external to itself, by the direct application of energy from the combination of fuels or from electricity, solar or nuclear energy. The term “boiler” includes fired units for heating or vaporizing liquids other than water but does not include fired process heaters and systems. The term boiler also shall include the apparatus by which heat is generated as well as all controls and safety devices associated with such apparatus or the closed vessels.
  - A. Power Boiler – a boiler in which steam or other vapor is generated at a pressure of more than 15 psig for use external to itself.
  - B. High-Temperature Boiler – a boiler in which water or other fluid is heated and intended for operation at pressures in excess of 160 psig and/or temperatures in excess of 250°F.
  - C. Heating Boiler – a steam or vapor boiler operating at a pressure not exceeding 15 psig or a boiler in which water or other fluid is heated and intended for operation at pressures not exceeding 160 psig or temperatures not exceeding 250°F.
  - D. Electric Boiler – a power boiler or heating boiler in which the source of heat is electricity.
  - E. Miniature Boiler – a power boiler or high-temperature boiler which does not exceed the following limits:
    1. 16 inches inside diameter of shell;
    2. 20 square feet heating surface (not applicable to electric boilers);
    3. 5 cubic feet gross volume exclusive of casing and insulation;
    4. 100 psig maximum allowable working pressure.
  - F. Unfired Boiler – an unfired steam or other vapor-generating system using heat from the operation of a processing system or other indirect heat source.

- G. Hot Water Supply Boiler – a boiler completely filled with water that furnishes hot water to be used externally to itself at pressures not exceeding 160 psig or at temperatures not exceeding 250°F at or near the boiler outlet.
  - H. Portable Boiler – a boiler which is primarily intended for temporary location, and the construction and usage permits it to be readily moved from one location to another.
15. CERTIFICATE OF COMPETENCY – a certificate issued to a person who has passed the examination prescribed by the Board.
  16. CERTIFICATE OF INSPECTION – a certificate issued by the chief inspector for the operation of a boiler, pressure vessel, or nuclear system as required by the Act.
  17. CERTIFICATE INSPECTION – an inspection, the report of which is used by the chief inspector as justification for issuing, withholding, or revoking the inspection certificate. This certificate inspection shall be an internal inspection when required; otherwise, it shall be as complete an inspection as possible.
    - A. INTERNAL INSPECTION – as complete an examination as can reasonably be made of the internal and external surfaces of a boiler, pressure vessel, or nuclear component while it is shut down, and manhole plates, handhole plates or other inspection-opening closures are removed as required by the inspector.
    - B. EXTERNAL INSPECTION – an inspection made when a boiler, pressure vessel, or nuclear component is in operation, if possible.
  18. COMMISSION; NATIONAL BOARD – the commission issued by The National Board of Boiler and Pressure Vessel Inspectors to a holder of a certificate of competency who desires to make shop inspections or field inspections in accordance with the National Board bylaws and whose employer submits the inspector's application to the National Board for such commission.
  19. COMMISSIONER – the Commissioner (or other appropriate title) of .....
  20. CONDEMNED BOILER, PRESSURE VESSEL, OR NUCLEAR COMPONENT – a boiler, pressure vessel, or nuclear component that has been inspected and declared unsafe or disqualified by legal requirements by an inspector, and a stamping or marking has been applied by the chief or a deputy inspector designating its condemnation.

21. EXISTING INSTALLATION – includes any boiler, pressure vessel, or nuclear component constructed, installed, placed in operation, or contracted for before (date of passage of Act).
22. HOT WATER STORAGE TANK – a closed vessel connected to a water heater used exclusively to contain potable water.
23. INSPECTOR – the chief inspector, or any deputy inspector, special inspector or, owner-user inspector.
  - A. CHIEF INSPECTOR – the Chief Boiler and Pressure Vessel Inspector appointed under the Act.
  - B. DEPUTY INSPECTOR – any inspector appointed by the Commissioner under the provisions of the Act.
  - C. SPECIAL INSPECTOR – an inspector holding a certificate of competency, and who is regularly employed by an authorized inspection agency.
  - D. OWNER-USER INSPECTOR – an inspector who holds a valid National Board Owner-User Commission who has passed the examination prescribed by the Board or is an API Certified Inspector under a jurisdictionally approved owner-user inspection organization.
24. LINED POTABLE WATER HEATER – a water heater with a corrosion-resistant lining used to supply potable hot water.
25. MODIFICATION/NUCLEAR COMPONENT – the process of changing an item that requires revision of the existing design requirements and may also require a revision to the design specification.
26. NATIONAL BOARD – The National Board of Boiler and Pressure Vessel Inspectors (NB), 1055 Crupper Avenue, Columbus, Ohio 43229, whose membership is composed of the chief inspectors of jurisdictions who are charged with the enforcement of the provisions of the Boiler and Pressure Vessel Safety Act.
27. NATIONAL BOARD INSPECTION CODE ANSI/NB-23 – the code for jurisdictional authorities, inspectors, users, and organizations performing repairs and alterations to pressure-retaining items. It is published by the National Board.
28. NATIONAL BOARD COMMISSION – A certificate issued by the National Board to an individual who has passed the National Board Examination, who holds a valid certificate of competency and who is regularly employed by an Authorized Inspection Agency.



29. NATIONAL BOARD COMMISSIONED INSPECTOR – An individual who: holds a valid Certificate of Competency to perform inservice, repair and alteration inspections as defined by the National Board Inspection Code; holds a National Board commission; and is regularly employed as an inspector by an Authorized Inspection Agency.
30. NEW BOILER, PRESSURE VESSEL, OR NUCLEAR COMPONENT INSTALLATION – includes all boilers, pressure vessels, and nuclear components constructed, installed, placed in operation or contracted for after (fill in the date).
31. NONSTANDARD BOILER, PRESSURE VESSEL, OR NUCLEAR COMPONENT – a boiler, pressure vessel, or nuclear component that does not bear a stamp acceptable to the jurisdiction, or otherwise does not comply with the Act or stated rules and regulations of this jurisdiction.
32. NUCLEAR COMPONENT – the items in a nuclear power plant such as vessels, piping systems, pumps, valves, and component supports.
33. NUCLEAR POWER PLANT – one or more nuclear power systems and containment systems.
34. NUCLEAR SYSTEM – a system comprised of nuclear components which collectively serve the purpose of producing and controlling an output of thermal energy from nuclear fuel and includes those associated systems essential to the function and overall safety of the power system.
35. 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.
36. OWNER OR USER – any person, firm, or corporation legally responsible for the safe installation, operation, and maintenance of any boiler, pressure vessel, or nuclear component within the jurisdiction.
37. OWNER-USER INSPECTION ORGANIZATION – an owner or user of pressure-retaining items who maintains a regularly established inspection department, whose organization and inspection procedures meet the requirements of the National Board rules or API-510, as applicable, and are acceptable to the Board.
38. PRESSURE VESSEL – a vessel in which the pressure is obtained from an external source, or by the application of heat from an indirect source, or from a direct source other than those boilers defined in item 14.

39. PRESSURE-RETAINING ITEM (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.
40. PSIG – pounds per square inch gage.
41. REINSTALLED BOILER, PRESSURE VESSEL, OR NUCLEAR COMPONENT – a boiler, pressure vessel, or nuclear component removed from its original setting and reinstalled at the same location or at a new location without change of ownership.
42. RELIEF VALVE – a pressure relief valve actuated by inlet static pressure having a gradual lift generally proportional to the increase in pressure over opening pressure. It may be provided with an enclosed spring housing suitable for closed discharge system application and is primarily used for liquid service.
43. REPAIR – the work necessary to restore a pressure-retaining item to a safe and satisfactory operating condition.
44. REPAIR/NUCLEAR COMPONENT – the work necessary to restore a nuclear component or system to a safe and satisfactory operating condition, provided there is no deviation from the original design requirements.
45. REPAIR/PRESSURE RELIEF VALVE – the replacement, remachining, or cleaning of any critical part, lapping of seat and disk, or any other operation which may affect the flow passage, capacity function, or pressure-retaining ability of the valve. Disassembly, reassembly, and/or adjustments which affect the pressure relief valve function are also considered a repair.
46. REPLACEMENT/NUCLEAR COMPONENT – the installation of renewal components, appurtenances and subassemblies or parts of a component or system not affecting existing design requirements.
47. SAFETY RELIEF VALVE – a pressure relief valve characterized by rapid opening or pop action, or by opening in proportion to the increase in pressure over opening pressure, depending on application.
48. SAFETY VALVE – a pressure relief valve actuated by inlet static pressure and characterized by rapid opening or pop action.
49. SECONDHAND BOILER, PRESSURE VESSEL, OR NUCLEAR COMPONENT – a boiler, pressure vessel, or nuclear component which has changed both location and ownership since primary use.

50. STANDARD BOILER, PRESSURE VESSEL, OR NUCLEAR COMPONENT – a boiler, pressure vessel, or nuclear component which bears the stamp of this jurisdiction, the ASME stamp, the API/ASME stamp, both the ASME and National Board stamp, or the stamp of another jurisdiction which has adopted a standard of construction equivalent to that required by the Board.
51. WATER HEATER – a closed vessel used to supply potable hot water which is heated by the combustion of fuels, electricity, or any other source and withdrawn for use external to the system at pressures not exceeding 160 psig, or a heat input of 200,000 BTU per hour, and shall include all controls and devices necessary to prevent water temperatures from exceeding 210°F.

## PART II ADMINISTRATION

### 1. MINIMUM CONSTRUCTION STANDARDS FOR BOILERS, PRESSURE VESSELS, OR OTHER PRESSURE-RETAINING ITEMS

- \*A. All new boilers, pressure vessels, or other pressure-retaining items installed and operated in this jurisdiction unless otherwise exempted, shall be designed and constructed in accordance with the ASME Code or a nationally recognized Code of Construction accepted by this jurisdiction. All new pressure-retaining items installed in this jurisdiction shall be marked in accordance with the Code of Construction and shall be registered with the National Board in accordance with NB-264, *Criteria for Registration of Boilers, Pressure Vessels and Other Pressure-Retaining Items*, or listed in accordance with NB-265, *Criteria for Listing of Boilers, Pressure Vessels and Other Pressure-Retaining Items Not Registered with the National Board*. Pressure-relieving devices shall be constructed to the ASME Code and certified by the National Board in accordance with NB-500, *Criteria for Certification of Pressure Relief Devices*. Copies of registration or listing documents shall be provided to the chief inspector when requested.
- B. State Special – If, due to a valid impediment to compliance with the original code of construction, a boiler, pressure vessel, or nuclear component cannot bear the required construction code and National Board stamping, details in the English language and United States customary units of the proposed construction, material specifications and calculations, approved by a registered professional engineer experienced in boiler, pressure vessel and nuclear systems design, shall be submitted to the chief inspector by the owner or user and approval as “State Special” obtained from the Board before construction is started.
- C. Before a secondhand boiler, pressure vessel, or nuclear component is installed, application for permission to install it shall be filed by the owner or user with the chief inspector and his/ her approval obtained.

\*D. The following shall be exempt from these rules:

1. Boilers and pressure vessels under federal control or regulation;
2. Pressure vessels used for transportation and storage of compressed gases when constructed in compliance with specifications of the U.S. Department of Transportation and, when charged with gas, marked, maintained, and periodically requalified for use, as required by appropriate regulations of the U.S. Department of Transportation;
3. Pressure vessels located on vehicles operating under the rules of other jurisdictional authorities and used for carrying passengers or freight;
4. Pressure vessels installed on the right-of-way of railroads and used directly in the operation of trains;
5. Pressure vessels having an internal or external operating pressure not exceeding 15 psig with no limit on size;
6. Pressure vessels having an inside diameter, width, height, or cross-section diagonal not exceeding 6 inches with no limitation on length of the vessel or pressure;
7. Pressure vessels for containing water under pressure, including those containing air, the compression of which serves only as a cushion, when none of the following limitations are exceeded:
  - a. a design pressure of 300 psig
  - b. a design temperature of 210°F
8. Pressure vessels containing water heated by steam or any other indirect means when none of the following limitations are exceeded:
  - a. a heat input of 200,000 BTU per hour
  - b. a water temperature of 210°F provided such pressure vessels shall be equipped with an ASME-NB-stamped safety relief valve;
9. Hot water supply boilers used exclusively for supplying hot water which are directly fired with oil, gas, or electricity, when none of the following limitations are exceeded:
  - a. a heat input of 200,000 BTU per hour
  - b. a water temperature of 210°F

- c. a nominal water capacity of 120 gallons

It being further provided that this exemption shall not apply to hot water supply boilers that exceed 50 gallons in volume or 100,000 BTU per hour when installed in a place of public assembly. These exempt hot water supply boilers shall be equipped with ASME/NB-stamped safety relief valves;

- 10. Potable water heaters and hot water storage tanks for operations at a pressure not exceeding 160 psig where none of the following limitations are exceeded:

- a. a heat input of 200,000 BTU per hour
- b. a water temperature of 210°F
- c. a nominal water capacity of 120 gallons

except that they shall be equipped with safety devices in accordance with HLW-800.

It being further provided that this exemption shall not apply to water heaters and hot water storage tanks that exceed 50 gallons in volume or 100,000 BTU per hour when installed in a place of public assembly;

- 11. Pressure vessels which may be classified as pressure containers which are integral parts of components of rotating or reciprocating mechanical devices such as pumps, compressors, turbines, generator engines, and hydraulic or pneumatic cylinders where the primary design considerations and stresses are derived from the functional requirements of the device;
- 12. Continuous coil-type hot water boilers used only for "steam vapor" cleaning of such things as machinery and buildings when none of the following limitations are exceeded:
  - a. 3/4-inch diameter tubing or pipe size with no drums or headers attached;
  - b. nominal water-containing capacity does not exceed six gallons;
  - c. water temperature does not exceed 35°F;
  - d. steam is not generated within the coil.

Exempted continuous coil-type hot water boilers shall be provided with one or more relief valves meeting the requirements of EBO-6, Part III of NB-132.

- E. The following boilers, pressure vessels and piping shall be exempt from the requirements of inservice inspections and certificate inspections as required by Section XIII, XIV, XV, and XVI of the Act:
  - 1. Pressure vessels not exceeding the following limitations:
    - a. 5 cubic feet in volume and 250 psig
    - b. 1-1/2 cubic feet in volume and 600 psig
  - 2. Heating boilers or pressure vessels which are located in private residences or in apartment houses of fewer than six family units;
  - 3. Pressure vessels operated entirely full of water or liquid which is not materially more hazardous than water, provided the temperature of the vessel's contents does not exceed 140°F or a pressure of 200 psig;
  - 4. Power piping and process piping beyond the scope of the *ASME Boiler and Pressure Vessel Code* (also referred to herein as the ASME Code);
  - 5. Boilers or pressure vessels located on farms and used solely for agricultural or horticultural purposes;
  - 6. Pressure vessels used as an external part of an electrical circuit breaker or transformer.
- F. In all circumstances, the owner or user shall confer with the chief inspector regarding exemption or nonexemption.

## 2. FREQUENCY OF INSPECTIONS OF BOILERS AND PRESSURE VESSELS

- A. Except as permitted in (1) below, power boilers and high-temperature water boilers shall receive a certificate inspection annually which shall be an internal inspection where construction permits; otherwise, it shall be as complete an inspection as possible. Such boilers shall also be inspected externally annually while under normal operating conditions.
  - 1. Alternative internal inspection requirements:

a. Fully attended power boilers and high-temperature boilers may be extended to thirty-six (36) months if the following requirements are met:

1. Continuous boiler water treatment under the direct supervision of persons trained and experienced in water treatment for the purpose of controlling and limiting corrosion and deposits.

2. Recordkeeping available for review, showing:

The date and time the boiler is out of service and the reason therefore.

Daily analysis of water samples that adequately show the conditions of the water and elements or characteristics that are capable of producing corrosion or other deterioration to the boiler or its parts.

3. Controls, safety devices, instrumentation, and other equipment necessary for safe operation are up-to-date, inservice, calibrated, and meet the requirements of an appropriate safety code for that size boiler, such as NFPA 85, ASME CSD-1 Controls and Safety Devices for Automatically Fired Boilers, National Board Inspection Code ANSI/NB-23, jurisdictional requirements, and are not compromised.

2. Inspection intervals beyond thirty-six (36) months may be granted at the discretion of the Board.

B. Low-pressure boilers, water heaters, and hot water storage tanks covered by these rules and regulations shall receive a certificate inspection biennially, except boilers located in places of public assembly shall receive a certificate of inspection annually, with an internal inspection at least every two years where construction permits.

1. Steam or vapor boilers shall have an external inspection and an internal inspection every two years where construction permits;

2. Hot water heating and hot water supply boilers shall have an external inspection biennially and, where construction permits, an internal inspection at the discretion of the inspector;

3. Water heaters, including hot water storage tanks, shall have an external inspection every two years which shall include the function of all controls and devices.

- C. Except as provided for in (D) and (E) below, pressure vessels subject to internal corrosion shall receive a certificate inspection biennially. This inspection shall be internal where construction permits. Pressure vessels not subject to internal corrosion shall be inspected externally biennially.
- D. Pressure vessels and unfired boilers that are under the supervision of an owner-user inspection organization shall be inspected at intervals required by NB-23 or API-510, as applicable.
- E. Nuclear components shall be inspected as provided by Section XI of the ASME Code.
- F. Based upon documentation of such actual service conditions by the owner or user of the operating equipment, the Board may, in its discretion, permit variations in the inspection frequency requirements as provided in the Act.
- G. Historical boilers, defined as steam boilers of riveted construction, preserved, restored, or maintained for hobby or demonstration use, shall be subjected to an initial inspection followed by a certificate inspection every three (3) years thereafter if stored inside a shelter and annually if stored outdoors. The initial inspection shall include ultrasonic thickness testing of all pressure boundaries. All thinned areas shall be monitored and recorded on the inspection report.

### 3. NOTIFICATION OF INSPECTION

Certificate inspection, as required in Section 2 above, shall be carried out prior to the expiration date of the certificate and at a time mutually agreeable to the inspector and owner or user.

External inspections may be performed by the inspector during reasonable hours and without prior notification.

When, as a result of external inspection or determination by other objective means, it is the inspector's opinion that continued operation of the boiler, pressure vessel, or nuclear system constitutes a menace to public safety, the inspector may request an internal inspection or an appropriate pressure test, or both, to evaluate conditions. In such instances, the owner or user shall prepare the boiler, pressure vessel or nuclear system for such inspections or tests as the inspector may designate.

### \*4. EXAMINATION FOR AN INSPECTOR'S CERTIFICATE OF COMPETENCY

An applicant for an examination shall have qualifications as required by Section X of the Act. Examination for an inspector's certificate of competency shall comply with Section X of the Act and shall be held at the office of the



Board or at any other location to be selected by the Board. The National Board examination is administered four times each year, namely the first Wednesday and one-half day Thursday in the months of March, June, September, and December.

If the applicant is successful in meeting the requirements of the Board, a certificate of competency will be issued by the chief inspector, when the applicant is employed on a fulltime basis by an inspection agency or owner-user inspection organization. The results of an applicant's examination shall be accessible to the applicant and the applicant's employer.

## 5. EXAMINATION FEES

A fee of \_\_\_\_\_ dollars (\$ \_\_\_\_\_ ) will be charged for each applicant taking the examination for a certificate of competency.

## 6. CERTIFICATE OF COMPETENCY AND IDENTIFICATION CARD

Upon request of an employer, a certificate of competency and an identification card may be issued by the chief inspector to:

- A. An inspector employed by the jurisdiction.
- B. An inspector who is exclusively employed by an inspection agency.
- C. An inspector employed as described in either (A) or (B) above who conducts shop or field inspections of new boilers, pressure vessels, or nuclear components in accordance with the applicable ASME Code requirements.
- D. An inspector who is continuously employed by a company which operates boilers and/or pressure vessels in this jurisdiction and has a valid owner-user inspection organization agreement as provided for in Part II, Section 11, provided that the applicant has satisfactorily passed the examination as set forth in Part II, Section 4, or holds a valid commission or certificate of competency from a jurisdiction that has a standard of examination substantially equal to that of this jurisdiction and a valid commission and a current commission card issued by the National Board or is certified by the American Petroleum Institute.

The request for the certificate of competency and identification card shall be completed on forms to be provided by the chief inspector and shall be accompanied by, when applicable, a facsimile of the applicant's commission and commission card, certificate of competency and identification card as named above, and a fee of \_\_\_\_\_ dollars (\$ \_\_\_\_\_).

The certificate of competency and valid identification card shall be returned to the chief inspector when the inspector is no longer employed by the agency or organization employing that inspector at the time the certificate was issued. Each person holding a valid certificate of competency, and who conducts inspections as provided by the Act, shall apply to the chief inspector on forms provided and obtain a renewal identification card annually, not later than March 31 of each year. A fee of \_\_\_\_\_ dollars (\$ \_\_\_\_\_ ) for each card shall accompany each application.

An inspector's certificate of competency may be suspended by the chief inspector after due investigation and recommendation by the Board for neglect of duty, incompetency, untrustworthiness or conflict of interest of the holder thereof, or for willful falsification of any matter or statement contained in his/her application, or in a report of any inspection made by him/her. Written notice of any such suspension shall be given to the inspector and his/her employer by the chief inspector within not more than 10 days after the effective date of such suspension. Persons whose certificates of competency have been suspended shall be entitled to an appeal to the Board as provided for in the Act and to be present in person and represented by counsel at the hearing of the appeal.

## 7. CONFLICT OF INTEREST

An inspector shall not engage in the sale of any services, article or device relating to boilers, pressure vessels, or their appurtenances.

## 8. INSPECTION REPORTS TO BE SUBMITTED BY INSPECTORS

- A. Inspectors shall, (within one year of the effective date of these rules and regulations for boilers, and two years for pressure vessels), submit to the chief inspector an inspection report on Form NB-5 of the National Board Inspection Code for each boiler and pressure vessel subject to inspection in this jurisdiction for which a Manufacturers Data Report is not available. Complete data shall be submitted on Form NB-5 for each nonstandard boiler or pressure vessel.
- B. Subsequent inspections by deputy and special inspectors, of both standard and nonstandard boilers and pressure vessels, shall be reported on Forms NB-6 and NB-7 of the National Board Inspection Code or an electronic format accepted by the jurisdiction.
- C. Inspections of nuclear components by inspectors shall be submitted to the chief inspector in such a form and with such appropriate information as the Board shall designate.

D. Inspection reports as required in (A), (B) and (C) above shall be submitted within 30 days from date of completion of the inspection.

E. Owner-user inspection organizations shall report in accordance with Paragraph 11 (C) of Section 11 of Part II.

**\*9. NOTIFICATION TO CHIEF INSPECTOR**

All inspection agencies shall notify the chief inspector of all inspection agreements for boilers, pressure vessels, or nuclear systems that are written (new agreement), cancelled, not renewed or suspended. The chief inspector shall be notified within 30 days, unless the change is because of an unsafe condition in which case the chief inspector shall be notified promptly.

**\*10. SPECIAL INSPECTORS TO NOTIFY CHIEF INSPECTOR OF UNSAFE BOILERS, PRESSURE VESSELS, AND NUCLEAR COMPONENTS**

If a special inspector finds a boiler, pressure vessel or nuclear component to be unsafe for further operation, the special inspector shall promptly notify the owner or user, stating what repairs or other corrective measures are required to bring the object into compliance with these rules and regulations. Unless the owner or user makes such repairs or adopts such other corrective measures promptly, the special inspector shall immediately notify the chief inspector. Until such corrections have been made, no further operation of the boiler, pressure vessel or nuclear component involved shall be permitted. If an inspection certificate for the object is required and is in force, it shall be suspended by the chief inspector. When reinspection establishes that the necessary repairs have been made or corrective actions have been taken and that the boiler, pressure vessel, or nuclear component is safe to operate, the chief inspector shall be notified. At that time, an inspection certificate, where applicable, will be issued.

**11. OWNER-USER INSPECTION ORGANIZATIONS**

A. Any person, firm, partnership, or corporation operating boilers and/or pressure vessels in this jurisdiction may seek approval and registration as an owner-user inspection organization by filing an application with the chief inspector on prescribed forms and request approval by the Board. Each such application shall be accompanied by a fee.

B. Application and registration shall show the name of such organization and its principal address in this jurisdiction, and the name and address of the person or persons having supervision over inspections made by said organization. Changes in supervisory personnel shall be reported to the chief inspector within 30 days after any such change.

C. Each owner-user inspection organization, as required by the provisions of the Act and these rules and regulations, shall:

1. Conduct inspection of the pressure vessels, not exempt by the Act, utilizing only qualified inspection personnel, as provided in Part II, Section 6;
2. Retain on file at the location where equipment is inspected a true record or copy of the report of each inspection signed by the inspector who made the inspection;
3. Promptly notify the chief inspector of any boiler or pressure vessel which does not meet requirements for safe operation;
4. Maintain inspection records which will include a list of boilers and pressure vessels covered by the Act, showing a serial number and such abbreviated description as may be necessary for identification, the date of the last inspection of each unit, and the approximate date for the next inspection. Such inspection records shall be readily available for examination by the chief inspector or authorized representative during business hours;
5. Transmit a statement annually, on a date mutually agreed upon, with the chief inspector. Such statement shall be signed by the individual having supervision over the inspections made during the period covered. The statement shall include the number of vessels covered by this Act inspected during the year, and shall certify that each inspection was conducted in accordance with the inspection requirements provided for by the Act. Such annual statement shall be accompanied by a filing fee as established by the Board.

Inspection certificates are not required for boilers and pressure vessels inspected by an owner-user inspection organization, when all of the above requirements are met.

## 12. DEFECTIVE CONDITIONS DISCLOSED AT TIME OF EXTERNAL INSPECTION

If, upon an external inspection, there is evidence of a leak or crack, sufficient covering of the boiler, pressure vessel, or nuclear component shall be removed to permit the inspector to satisfactorily determine the safety of the boiler, pressure vessel, or nuclear component. If the covering cannot be removed at that time, he/she may order the operation of the boiler, pressure vessel, or nuclear component stopped until such time as the covering can be removed and proper examination made.

13. OWNER OR USER TO NOTIFY CHIEF INSPECTOR OF ACCIDENT

When an accident occurs to a boiler, pressure vessel, power piping, process piping or nuclear system, the owner or user shall promptly notify the chief inspector and submit a detailed report of the accident. In the event of a personal injury or any explosion, notice shall be given immediately by telephone, or accepted means of electronic communication, and neither the boiler, pressure vessel, power piping, process piping or nuclear system, nor any parts thereof, shall be removed or disturbed before permission has been given by the chief inspector, except for the purpose of saving human life and limiting consequential damage.

14. INSPECTION CERTIFICATE AND INSPECTION FEES

A. If a boiler, pressure vessel, or nuclear system, after inspection, is found to be suitable and to conform to these rules and regulations, the owner or user shall pay directly to the jurisdiction a fee of \_\_\_\_\_ dollars (\$ \_\_\_\_\_) for each boiler, pressure vessel, and nuclear system required to be inspected under the Act upon which an inspection certificate shall be issued. Checks and money orders for payment of inspection certificate fees should be made payable to \_\_\_\_\_.

B. Schedule of fees – The owner or user of a boiler or pressure vessel required by this Act to be inspected by the chief inspector, or his/her deputy inspector, shall pay directly to the \_\_\_\_\_, upon completion of inspection, fees in accordance with the following schedule:

1. Power boilers and high-temperature water boilers  
Certificate Inspections

Boilers of 50 sq. ft. of heating surface or less \$ \_\_\_\_\_

Boilers over 50 sq. ft. of heating surface, and less than 2,000 sq. ft. of heating surface \$ \_\_\_\_\_

Boilers of 2,000 sq. ft. of heating surface or more, and less than 4,000 sq. ft. of heating surface \$ \_\_\_\_\_

Boilers of 4,000 sq. ft. of heating surface or more, and less than 10,000 sq. ft. of heating surface \$ \_\_\_\_\_

Boilers of 10,000 sq. ft. of heating surface or more \$ \_\_\_\_\_

\* External Inspections

Boilers of 50 sq. ft. of heating surface or less \$ \_\_\_\_\_

Boilers over 50 sq. ft. of heating surface, and less than 2,000 sq. ft. of heating surface \$ \_\_\_\_\_

Boilers of 2,000 sq. ft. of heating surface or more, and less than 4,000 sq. ft. of heating surface \$ \_\_\_\_\_

Boilers of 4,000 sq. ft. of heating surface or more, and less than 10,000 sq. ft. of heating surface \$ \_\_\_\_\_

Boilers of 10,000 sq. ft. of heating surface or more \$ \_\_\_\_\_

Not more than the equivalent of the certificate and external inspection fees shall be charged or collected for any and all inspections, as above, of any boiler in any one (1) year except as provided in paragraphs 5 and 6 below.

2. Heating boilers

Certificate Inspections

Heating boilers without a manhole \$ \_\_\_\_\_

Heating boilers with a manhole \$ \_\_\_\_\_

Hot water supply boilers \$ \_\_\_\_\_

Water heaters including storage tanks \$ \_\_\_\_\_

Not more than one fee shall be charged or collected for any and all inspections as above of any heating boiler, water heater, and storage tank, in any required inspection period except as provided in paragraphs 5 and 6 below.

3. For boilers where the only source of heat is electrical energy, the fees of paragraphs 1 and 2 shall apply based on one kilowatt being equal to one square foot of heating surface.

4. Pressure vessels

Certificate Inspections

Fees to be based on the maximum length of the vessel times the maximum width or diameter thereof in feet.

Each pressure vessel subject to inspection having a product as determined above 50 sq. ft. or less \$ \_\_\_\_\_

For each additional 100 sq. ft., or portions thereof, of area in excess of 50 sq. ft. \$\_\_\_\_\_

Not more than \$ \_\_\_\_\_ shall be paid for each inspection on any one vessel. A group of pressure vessels, such as the rolls of a paper machine or dryer operating as a single machine or unit, shall be considered as one pressure vessel. Not more than one fee shall be charged or collected for any and all inspections as above of any pressure vessels in any required inspection period except as provided in paragraphs 5 and 6 below.

5. Components of nuclear power systems

Fees for inspections of components of nuclear power systems shall be established by the Board.

6. Pressure tests

When it is necessary to make a special trip to witness the application of a pressure test, an additional fee based on the scale of fees applicable to a certificate inspection of the boiler or pressure vessel shall be charged.

7. All other inspections, including shop inspections, special inspections, certificate reinspections, and inspections of secondhand or used boilers, pressure vessels, or nuclear components made by the chief or deputy inspector, shall be charged for at the rate of not less than \$ \_\_\_\_\_ for one-half day of four hours or any portion thereof, or \$ \_\_\_\_\_ for one full day at four to eight hours, including travel time, plus all expenses, including traveling, meals and lodging.

C. Disposition of fees – The \_\_\_\_\_ shall account for and transfer all fees so received to the treasurer of the jurisdiction.

D. If the owner or user of a boiler, pressure vessel, or nuclear component or system which is required to be inspected refuses to allow an inspection to be made or refuses to pay the fee stipulated above, the inspection certificate shall be suspended by the chief inspector until the owner or user complies with the requirements.

E. The owner or user who causes a boiler, pressure vessel, or nuclear component or system to be operated without a valid certificate shall be subject to the penalty as provided for in the Act.

15. STAMPING/REStampING OF BOILERS, PRESSURE VESSELS OR OTHER PRESSURE-RETAINING ITEMS

- A. The stamping shall not be concealed by lagging or paint and shall be exposed at all times unless a suitable record is kept of the location of the stamping so that it may be readily uncovered at any time this may be desired.
- B. When the stamping on a boiler, pressure vessel, or nuclear component becomes indistinct, the inspector shall instruct the owner or user to have it restamped. Request for permission to restamp the boiler, pressure vessel, or nuclear component shall be made to the chief inspector and proof of the original stamping shall accompany the request. The chief inspector may grant such authorization. Restamping authorized by the chief inspector shall be done only in the presence of a deputy inspector, and shall be identical with the original stamping except for the ASME Code symbol stamp. Notice of completion of such stamping shall be filed with the chief inspector by the inspector who witnessed the stamping on the boiler, pressure vessel, or nuclear component together with a facsimile of the stamping applied.

16. PENALTY FOR OPERATION OF UNSAFE BOILERS, PRESSURE VESSELS, OR NUCLEAR COMPONENTS

- A. If, upon inspection, a boiler, pressure vessel, or nuclear component is found to be in such condition that it is unsafe to operate, the inspector shall notify the chief inspector and the inspection certificate may be suspended by the chief inspector.
- B. Any person, firm, partnership, or corporation causing such objects to continue to be operated shall be subject to the penalty provided in the Act.

17. CONDEMNED BOILERS, PRESSURE VESSELS, AND NUCLEAR COMPONENTS

- A. Any boiler, pressure vessel, or nuclear component having been inspected and declared unfit for further service by an inspector shall be stamped by the chief inspector or a deputy inspector on either side of the jurisdiction number with the letters "XXX" as shown by the preceding facsimile, which will designate a condemned boiler, pressure vessel, or nuclear component.
- B. Any person, firm, partnership, or corporation using or offering for sale a condemned boiler, pressure vessel, or nuclear component for operation within this jurisdiction shall be subject to the penalties provided by the Act.



18. REINSTALLATION OF BOILERS, PRESSURE VESSELS, OR NUCLEAR COMPONENTS MOVED OUTSIDE THE JURISDICTION

When a standard boiler, pressure vessel, or nuclear component located within this jurisdiction is to be moved outside the jurisdiction for temporary use or for repair, alteration, or modification, application shall be made by the owner or user to the chief inspector for permission to reinstall the boiler, pressure vessel, or nuclear component in this jurisdiction. When a nonstandard boiler, pressure vessel, or nuclear component is removed from this jurisdiction, it shall not be reinstalled within this jurisdiction.

19. INSTALLATION, OPERATION, SALE, OR OFFERING FOR SALE OF NONSTANDARD BOILERS, PRESSURE VESSELS, OR NUCLEAR COMPONENTS

The installation, operation, sale, or the offering for sale of nonstandard boilers, pressure vessels, or nuclear components in this jurisdiction without prior permission from the Board is prohibited.

20. INSTALLATION OF USED OR SECONDHAND BOILERS, PRESSURE VESSELS, OR NUCLEAR COMPONENTS

Before a used or secondhand boiler, pressure vessel, or nuclear component may be shipped for installation in this jurisdiction, an inspection must be made by an inspector qualified by this jurisdiction or by an inspector holding a valid National Board commission, and data submitted by him/her shall be filed by the owner or user of the boiler or pressure vessel with the chief inspector for his/her approval. Such boilers, pressure vessels, and nuclear components, when installed in the jurisdiction, shall be equipped with fittings and appurtenances that comply with the rules and regulations for new installations.

21. REINSTALLED BOILERS, PRESSURE VESSELS, OR NUCLEAR COMPONENTS

When a stationary boiler, pressure vessel, or nuclear component is moved and reinstalled within this jurisdiction, the attached fittings and appurtenances shall comply with these rules and regulations for new installations.

22. WORKING PRESSURE FOR EXISTING INSTALLATIONS

Any inspector may decrease the working pressure on any existing installation if the condition of the boiler, pressure vessel, or nuclear component warrants it. If the owner or user does not concur with the inspector's decision, the owner or user may appeal to the Board, which may request a joint inspection

by the chief inspector or a deputy inspector and the inspector. The chief inspector shall render a report to the Board and the Board shall render the final decision, based upon the data contained in the inspector's reports.

## 23. REPAIRS AND ALTERATIONS TO BOILERS AND PRESSURE VESSELS

Repairs and alterations to boilers and pressure vessels shall be made in accordance with the latest edition of the *National Board Inspection Code*, or the *API Pressure Vessel Inspection Code*, as applicable.

## 24. REPAIRS TO PRESSURE RELIEF VALVES

- A. Repairs to pressure relief valves except as in (B) below, shall be made in accordance with the latest edition and addenda of the National Board Inspection Code by an organization which holds a valid Certificate of Authorization for use of the National Board Pressure Relief Valve Repair "VR" symbol stamp. At the approval of the Board, owner-user inspection organizations may test and repair pressure relief devices in accordance with the requirements of API-510. The initial installation, testing and adjustments of a new pressure relief valve on a boiler, pressure vessel, or nuclear component are not considered a repair if made by the manufacturer or assembler of the valve.
- B. The Board may authorize properly trained and qualified employees of boiler, pressure vessel, and nuclear component users or their designees to make adjustments to set pressure and/or blowdown to pressure relief valves owned by them, provided the adjusted settings and/or capacities and the date of the adjustment are recorded on a metal tag secured to the seal wire. All external adjustments shall be resealed showing the identification of the organization making the adjustments. A record of all external adjustments shall be maintained and made available to the inspector.

## 25. REPAIR, MODIFICATION, OR REPLACEMENT OF NUCLEAR COMPONENTS

Repair, modification, or replacement of nuclear components shall be made only by an organization which holds a valid Certificate of Authorization for use of the National Board nuclear "NR" symbol stamp. Repair, modification, or replacement of ASME stamped "NR" pressure relief valves shall be made only by an organization which holds valid National Board Certificates of Authorization for use of the "NR" and "VR" symbol stamps.

## 26. RIVETED PATCHES

In applying riveted patches, the design of the patch and method of installation shall be in accordance with the National Board Inspection Code, 1973 edition.

## 27. SAFETY APPLIANCES

- A. No person shall attempt to remove or do any work on any safety appliance prescribed by these rules and regulations while the appliance is subject to pressure.
- B. Should any of these appliances be removed for repair during an outage of a boiler or pressure vessel, they must be reinstalled and in proper working order before the object is again placed in service.
- C. No person shall alter any safety or safety relief valves or pressure relief devices in any manner to maintain a working pressure in excess of that stated on the boiler or pressure vessel inspection certificate.

## 28. APPLICATION OF SERIAL NUMBERS

- A. Upon completion of the installation of a boiler, pressure vessel, or nuclear system, or at the time of the initial certificate inspection of an existing installation, each boiler or pressure vessel shall be identified by a number unique to that item.
- B. All cast-iron, low-pressure heating boilers shall have securely attached to the front of the boiler a corrosion-resistant metal tag of not less than one inch by four inches in size, which shall have the serial number of the jurisdiction stamped thereon. All pressure vessels constructed of cast iron, or of material of such thickness that it should not be stamped, shall have securely attached a corrosion-resistant metal tag not less than one inch by four inches in size, which shall have the serial number of the jurisdiction stamped thereon.

## 29. VARIATIONS

- A. Any person who believes the rules and regulations promulgated by the Board are unreasonable or impose an undue burden upon the owner or user may request a variation from such rule or regulation. The request for variation shall be in writing and shall specify how equivalent safety is to be maintained. The Board, after investigation and such hearing as it may direct, may grant such variation from the terms of any rule or regulation provided such special conditions as may be specified are maintained in order to provide equivalent safety.

- B. When there is a reason to believe, or upon receipt of a complaint that a variation does not provide freedom from danger equivalent to the published rule or regulation, the Board, after notice to the owner or user and complainant after such hearing and investigation as it may direct, may continue to reaffirm, suspend, revoke, or modify the conditions specified in any variation. No declaration, act, or omission of the Board, or of the chief inspector, deputy inspectors, or special inspectors, other than a written order authorizing a variation as permitted above, shall be deemed to exempt, either wholly or in part, expressly or implied, any owner or user from full compliance with the terms of any rule or regulation.

### 30. PENALTIES

Any person, firm, or corporation violating any of the provisions of these rules and regulations shall be guilty of a misdemeanor and subject to a fine to be collected by suit or through compromise as provided for in Section XV of the Act. Each day of such operation in violation of the provisions shall be considered a separate offense.

## PART III EXISTING INSTALLATION

The term “existing installation,” as used in Part III, is as defined in Part I.

### SECTION 1 – Power Boilers

#### **EBO-1 Age Limit of Existing Boilers**

- A. The age limit of any boiler of nonstandard construction, installed prior to the date the Act became effective, shall be 30 years, except that a boiler having other than a lap-riveted longitudinal joint, after a thorough internal and external inspection and, when required by the inspector, a pressure test of 1-1/2 times the allowable working pressure held for a period of at least 30 minutes during which no distress or leakage develops, may be continued in operation at the working pressure determined by EBO-3. The age limit of any nonstandard boiler having lap-riveted longitudinal joints and operating at a pressure in excess of 50 psig shall be 20 years. This type of boiler, when removed from an existing setting, shall not be reinstalled for a pressure in excess of 15 psig. A reasonable time for replacement, not to exceed one year, may be given at the discretion of the Board.
- B. The age limit of boilers of standard construction installed prior to the date this law became effective shall be dependent on thorough internal and external inspection and, where required by the inspector, a pressure test not exceeding 1-1/2 times the allowable working pressure. If the boiler, under these test conditions, exhibits no distress or leakage, it may be

continued in operation at the working pressure determined by EB0-2.

- C. The shell or drum of a boiler in which a lap seam crack develops along a longitudinal lapriveted joint shall be condemned. A lap seam crack is a crack found in lap seams extending parallel to the longitudinal joint and located either between or adjacent to rivet holes.

### **EB0-2 Maximum Allowable Working Pressure for Standard Boilers**

The maximum allowable working pressure for standard boilers shall be determined in accordance with the applicable provisions of the edition of the ASME Code under which they were constructed and stamped.

### **EB0-3 Maximum Allowable Working Pressure for Nonstandard Boilers**

- A. The maximum allowable working pressure for boilers fabricated by riveting shall be determined by the applicable rules of the 1971 Edition of Section I of the ASME Code.

The lowest factor of safety permissible on existing installations shall be 5.0, except for horizontal-return-tubular boilers having continuous longitudinal lap seams more than 12 ft. in length, where the factor of safety shall be 8. When this latter type of boiler is removed from its existing setting, it shall not be reinstalled for pressures in excess of 15 psig.

- B. The maximum allowable working pressure for boilers of welded construction in service may not exceed that allowable in Section I of the ASME Code for new boilers of the same construction.

The maximum allowable working pressure on the shell of a boiler or drum shall be determined by the strength of the weakest course computed from the thickness of the plate, the tensile strength of the plate, the efficiency of the longitudinal joint, the inside diameter of the course, and the factor of safety allowed by these rules in accordance with the following formula:

$$\frac{TStE}{RFS} = \text{maximum allowable working pressure, psig}$$

where:

TS = specified minimum tensile strength of shell plate material, psi. When the tensile strength of steel or wrought-iron shell plate is not known, it shall be taken as 55,000 psi for steel and 45,000 psi for wrought iron

t = minimum thickness of shell plate, in weakest course, inches

- E = efficiency of longitudinal joint, method of determining which is given in Paragraph PG-27 of Section I of the ASME Code
- R = inside radius of the weakest course of the shell or drum, Inches
- FS = factor of safety, which shall be at least 5.0

- C. The inspector may increase the factor of safety, if the condition and safety of the boiler warrant it.

#### **EB0-4 Cast-Iron Headers and Mud Drums**

The maximum allowable working pressure on a water tube boiler, the tubes of which are secured to cast-iron or malleable iron headers, or which have cast-iron mud drums, shall not exceed 160 psig.

#### **EB0-5 Pressure on Cast-Iron Boilers**

The maximum allowable working pressure for any cast-iron boiler, except hot water boilers, shall be 15 psig. See EHB-1, 2, and 4.

#### **\*EB0-6 Safety Valves**

- A. The use of weighted-lever safety valves or safety valves having either the seat or disk of cast-iron are prohibited; valves of this type of construction shall be replaced by direct, springloaded, pop-type valves that conform to the requirements of ASME Code, Section 1.
- B. Each boiler shall have at least one ASME/NB stamped and certified safety valve, and if it is a high pressure boiler with a high pressure more than 500 sq. ft. of water-heating surface, or an electric power input of more than 1,100 kW, it shall have two or more safety valves of the same type.
- C. The valve or valves shall be connected to the boiler, independent of any other steam connection and attached as close as possible to the boiler without unnecessary intervening pipe or fittings. Where alteration is required to conform to this requirement, owners or users shall be allowed reasonable time in which to complete the work as permitted by the chief inspector.
- D. No valves of any description shall be placed between the safety valve and the boiler nor on the escape pipe, if used. When an escape pipe is used, it shall be at least the full size of the safety valve discharge and fitted with an open drain to prevent water lodging in the upper part of the safety valve or in the escape pipe. When an elbow is placed on a safety valve

escape pipe, it shall be located close to the safety valve outlet, or the escape pipe shall be anchored and supported securely. All safety discharges shall be so located or piped as to be carried clear from walkways or platforms.

- E. The safety valve capacity of each boiler shall be such that the safety valve or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than 6 percent above the highest pressure to which any valve is set, and in no case to more than 6 percent above the maximum allowable working pressure.
- F. One or more safety valves on every boiler shall be set at or below the maximum allowable working pressure. The remaining valves may be set within a range of 3 percent above the maximum allowable working pressure, but the range of setting of all the safety valves on a boiler shall not exceed 10 percent of the highest pressure to which any valve is set.
- G. When boilers of different maximum allowable working pressures with minimum safety valve settings varying more than 6 percent are so connected that steam can flow toward the lower pressure units, the latter shall be protected by additional safety valve capacity, if necessary, on the lower pressure side of the system. The additional safety valve capacity shall be based upon the maximum amount of steam which can flow into the lower pressure system.
- H. In those cases where the boiler is supplied with feedwater directly from water mains without the use of feeding apparatus (not to include return traps), no safety valve shall be set at a pressure greater than 94 percent of the lowest pressure obtained in the supply main feeding the boiler.
- I. The relieving capacity of the safety valves on any boiler shall be checked by one of the following three methods and, if found to be insufficient, additional valves shall be provided:
  - 1. By making an accumulation test, which consists of shutting off all other steam discharge outlets from the boiler and forcing the fires to the maximum. The safety valve capacity shall be sufficient to prevent a rise of pressure in excess of 6 percent of the maximum allowable working pressure. This method should not be used on a boiler with a superheater or reheater;
  - 2. By measuring the maximum amount of fuel that can be burned and computing the corresponding evaporative capacity (steam-generating capacity) upon the basis of the heating value of this fuel. These computations shall be made as outlined in the Appendix of the ASME Code, Section I;

3. By measuring the maximum amount of feedwater that can be evaporated.

When either of the methods outlined in 2 or 3 is employed, the sum of the safety valve capacities shall be equal to or greater than the maximum evaporative capacity (maximum steam-generating capacity) of the boiler.

### **EB0-7 Boiler Feeding**

Each boiler shall have a feed supply which will permit it to be fed at any time while under pressure.

A boiler having more than 500 sq. ft. of water heating surface shall have at least two suitable means of feeding, at least one of which shall be a feed pump. A source of feed at a pressure 6 percent greater than the set pressure of the safety valve with the highest setting may be considered one of the means. Boilers fired by gaseous, liquid, or solid fuel in suspension may be equipped with a single means of feeding water, provided means are furnished for the shutoff of heat input prior to the water level reaching the lowest safe level.

The feedwater shall be introduced into a boiler in such a manner that the water will not be discharged directly against surfaces exposed to gases of high temperature to direct radiation from the fire. For pressures of 400 psig or over, the feedwater inlet through the drum shall be fitted with shields, sleeves, or other suitable means to reduce the effects of temperature differentials in the shell or head.

The feed piping to the boiler shall be provided with a check valve near the boiler and a valve or cock between the check valve and the boiler. When two or more boilers are fed from a common source, there shall also be a valve on the branch to each boiler between the check valve and the source of supply. Whenever a globe valve is used on feed piping, the inlet shall be under the disk of the valve.

In all cases where returns are fed back to the boiler by gravity, there shall be a check valve and stop valve in each return line, the stop valve to be placed between the boiler and the check valve, and both shall be located as close to the boiler as is practicable. It is recommended that no stop valves be placed in the supply and return pipe connections of a single boiler installation.

Where deaerating heaters are not employed, it is recommended that the temperature of the feedwater be not less than 120°F to avoid the possibility of setting up localized stress. Where deaerating heaters are employed, it is recommended that the minimum feedwater temperature be not less than 215°F so that dissolved gases may be thoroughly released.



## **EB0-8 Water Level Indicators**

Each boiler, except forced-flow steam generators with no fixed steam and waterline, and high temperature water boilers of the forced circulation type that have no steam and waterline, shall have at least one water gage glass. Boilers operated at pressures over 400 psig shall be provided with two water gage glasses which may be connected to a single water column or connected directly to the drum.

Two independent remote level indicators may be provided instead of one of the two required gage glasses for boiler drum water level indication in the case of power boilers with all drum safety valves set at or above 900 psig. When both remote level indicators are in reliable operation, the remaining gage glass may be shut off, but shall be maintained in serviceable condition.

When the direct reading of the gage glass water level is not readily visible to the operator in his/her working area, two dependable indirect indications shall be provided, either by transmission of the gage glass image or by remote level indicators.

The lowest visible part of the water gage glass shall be at least 2 in. above the lowest permissible water level, at which level there will be no danger of overheating any part of the boiler when in operation at that level. When remote level indication is provided for the operator in lieu of the gage glass, the same minimum level reference shall be clearly marked.

Connections from the boiler to the remote level indicator shall be at least 3/4 in. pipe size to and including the isolation valve and from there to the remote level indicator at least 1/2 in. O.D. tubing. These connections shall be completely independent of other connections for any function other than water level indication. For pressures of 400 psig or over, lower connections to drums shall be provided with shields, sleeves, or other suitable means to reduce temperature differentials in the shells or heads.

Boilers of the horizontal firetube type shall be set so that when the water is at the lowest reading in the water gage glass, there shall be at least 3 in. of water over the highest point of the tubes, flues, or crown sheets.

Boilers of locomotives shall have at least one water glass provided with top and bottom shutoff cocks and lamp, and two gage cocks for boilers 36 in. in diameter and under, and three gage cocks for boilers over 36 in. in diameter.

The lowest gage cock and the lowest reading of water glass shall not be less than 2 in. above the highest point of crown sheet on boilers 36 in. in diameter and under, nor less than 3 in. for boilers over 36 in. in diameter. These are minimum dimensions, and on larger locomotives and those operating on steep

grades, the height should be increased, if necessary, to compensate for change of water level on descending grades.

The bottom mounting for water glass and for water column, if used, must extend not less than 1-1/2 in. inside the boiler and beyond any obstacle immediately above it, and the passage therein must be straight and horizontal.

Tubular water glasses must be equipped with a protecting shield.

All connections on the gage glass shall be not less than 1/2 in. pipe size. Each water gage glass shall be fitted with a drain cock or valve having an unrestricted drain opening of not less than 1/4 in. diameter to facilitate cleaning. When the boiler operating pressure exceeds 100 psig, the glass shall be furnished with a connection to install a valved drain to the ash pit or other safe discharge point.

Each water gage glass shall be equipped with a top and a bottom shutoff valve of such through-flow construction as to prevent stoppage by deposits of sediments. If the lowest valve is more than 7 ft. above the floor or platform from which it is operated, the operating mechanism shall indicate by its position whether the valve is open or closed. The pressure-temperature rating shall be at least equal to that of the lowest set pressure of any safety valve on the boiler drum and the corresponding saturated-steam temperature.

Straight-run globe valves shall not be used on such connections.

Automatic shutoff valves, if permitted to be used, shall conform to the requirements of Section I of the ASME Code.

### **EBO-9 Water Columns**

The water column shall be so mounted that it will maintain its correct position relative to the normal waterline under operating conditions.

The minimum size of pipes connecting the water column to a boiler shall be 1 in. For pressures of 400 psig or over, lower water column connections to drums shall be provided with shields, sleeves, or other suitable means to reduce the effect of temperature differentials in the shells or heads. Water glass fittings or gage cocks may be connected directly to the boiler.

The steam and water connections to a water column or a water gage glass shall be such that they are readily accessible for internal inspection and cleaning. Some acceptable methods of meeting this requirement are by providing a cross or fitting with a back outlet at each right-angle turn to permit inspection and cleaning in both directions, or by using pipe bends or fittings of a type which does not leave an internal shoulder or pocket in the pipe connection and with a radius of curvature which will permit the passage of a rotary cleaner. Screwed plug

closures using threaded connections as allowed by Section I of the ASME Code are acceptable means of access for this inspection and cleaning. For boilers with all drum safety valves set at or above 400 psig, socket-welded plugs may be used for this purpose in lieu of screwed plugs. The water column shall be fitted with a connection for a drain cock or drain valve to install a pipe of at least 3/4 in. pipe size to the ash pit or other safe point of discharge. If the water connection to the water column has a rising bend or pocket which cannot be drained by means of the water column drain, an additional drain shall be placed on this connection in order that it may be blown off to clear any sediment from the pipe.

The design and material of a water column shall comply with the requirements of Section I of the ASME Code. Water columns made of cast iron in accordance with SA-278 may be used for maximum boiler pressures not exceeding 250 psig. Water columns made of ductile iron in accordance with SA-395 may be used for maximum boiler pressures not exceeding 350 psig. For higher pressures, steel construction shall be used.

Shutoff valves shall not be used in the pipe connections between a boiler and a water column or between a boiler and the shutoff valves required for the gage glass, unless they are either outside screw-and-yoke or lever-lifting-type gate valves or stopcocks with lever permanently fastened thereto and marked in line with their passage, or of such other through-flow construction as to prevent stoppage by deposits of sediment, and to indicate by the position of the operating mechanisms whether they are in open or closed position; and such valves or cocks shall be locked or sealed open. Where stopcocks are used, they shall be of a type with the plug held in place by a guard or gland.

No outlet connections, except for control devices (such as damper regulators and feedwater regulators), drains, steam gages, or apparatus of such form as does not permit the escape of an appreciable amount of steam or water there from, shall be placed on the pipes connecting a water column or gage glass to a boiler.

### **EB0-10 Gage Glass Connections**

Gage glasses and gage cocks that are not connected directly to a shell or drum of the boiler shall be connected by one of the following methods:

- A. The water gage glass or glasses and gage cocks shall be connected to an intervening water column.
- B. When only water gage glasses are used, they may be mounted away from the shell or drum and the water column omitted, provided the following requirements are met:
  1. The top and bottom gage glass fittings are aligned, supported, and secured so as to maintain the alignment of the gage glass; and

2. The steam and water connections are not less than 1 in. pipe size and each water glass is provided with a valved drain; and
3. The steam and water connections comply with the requirements of the following:
  - a. the lower edge of the steam connection to a water column or gage glass in the boiler shall not be below the highest visible water level in the water gage glass. There shall be no sag or offset in the piping which will permit the accumulation of water; and
  - b. the upper edge of the water connection to a water column or gage glass and the boiler shall not be above the lowest visible water level in the gage glass. No part of this pipe connection shall be above the point of connection at the water column.

Each boiler (except those not requiring water level indicators) shall have three or more gage cocks located within the visible length of the water glass, except when the boiler has two water glasses located on the same horizontal lines.

Boilers not over 36 in. in diameter in which the heating surface does not exceed 100 sq. ft. need have but two gage cocks.

The gage cock connections shall be not less than 1/2 in. pipe size.

### **EB0-11 Pressure Gages**

Each boiler shall have a pressure gage so located that it is easily readable. The pressure gage shall be installed so that it shall at all times indicate the pressure in the boiler. Each steam boiler shall have the pressure gage connected to the steam space or to the water column or its steam connection. A valve or cock shall be placed in the gage connection adjacent to the gage. An additional valve or cock may be located near the boiler, providing it is locked or sealed in the open position. No other shutoff valves shall be located between the gage and the boiler. The pipe connection shall be of ample size and arranged so that it may be cleared by blowing out. For a steam boiler, the gage or connection shall contain a syphon or equivalent device which will develop and maintain a water seal that will prevent steam from entering the gage tube. Pressure gage connections shall be suitable for the maximum allowable working pressure and temperature but if the temperature exceeds 406°F, brass or copper pipe or tubing shall not be used. The connections to the boiler, except the syphon (if used), shall not be less than 1/4 in. inside diameter standard pipe size. But where steel or wrought iron pipe or tubing is used they shall not be less than 1/2 in. The minimum size of a syphon (if used) shall be 1/4 in. inside diameter. The dial of the pressure gage shall be graduated to approximately double the pressure at which the safety valve is set, but in no case to less than 1-1/2 times this pressure.

Each forced-flow steam generator with no fixed steam and waterline shall be equipped with pressure gages or other pressure-measuring devices located as follows:

- A. At the boiler or superheater outlet (following the last section which involves absorption of heat), and
- B. At the boiler or economizer inlet (preceding any section which involves absorption of heat), and
- C. Upstream of any shutoff valve which may be used between any two sections of the heatabsorbing surface.

Each high-temperature water boiler shall have a temperature gage so located and connected that it shall be easily readable. The temperature gage shall be installed so that it, at all times, indicates the temperature in degrees Fahrenheit of the water in the boiler, at or near the outlet connection.

### **EB0-12 Stop Valves**

Each steam outlet from a boiler (except safety valve and water column connections) shall be fitted with a stop valve located as close as practicable to the boiler.

When a stop valve is so located that water can accumulate, ample drains shall be provided. The drainage shall be piped to a safe location and shall not be discharged on the top of the boiler or its setting.

When boilers provided with manholes are connected to a common steam main, the steam piping connected from each boiler shall be fitted with two stop valves having an ample free blow drain between them. The discharge of the drain shall be visible to the operator while manipulating the valves and shall be piped clear of the boiler setting. The stop valves shall consist preferably of one automatic nonreturn valve (set next to the boiler) and a second valve of the outside-screw-and-yoke type.

### **EB0-13 Blowoff Piping**

A blowoff as required herein is defined as a pipe connection provided with valves located in the external piping through which the water in the boiler may be blown out under pressure, excepting drains such as are used on water columns, gage glasses, or piping to feedwater regulators, etc., used for the purpose of determining the operating conditions of such equipment. Piping connections used primarily for continuous operation, such as deconcentrators on continuous blowdown systems, are not classed as blowoffs, but the pipe connections and all fittings up to and including the first shutoff valve shall be equal at least to the

pressure requirements for the lowest set pressure of any safety valve on the boiler drum and with the corresponding saturated-steam temperature.

A surface blowoff shall not exceed 2-1/2 in. pipe size, and the internal pipe and the terminal connection for the external pipe, when used, shall form a continuous passage, but with clearance between their ends and arranged so that the removal of either will not disturb the other. A properly designed steel bushing, similar to or the equivalent of those shown in Fig. PG-59.1 of Section I of the ASME Code, or a flanged connection shall be used.

Each boiler, except forced-flow steam generators with no fixed steam and waterline and high temperature water boilers, shall have a bottom blowoff outlet in direct connection with the lowest water space practicable for external piping conforming to PG-58.3.6 of Section I of the ASME Code.

All water walls and water screens which do not drain back into the boiler, and all integral economizers, shall be equipped with outlet connections for a blowoff or drain line and conform to the requirements of PG-58.3.6 or PG-58.3.7 of the ASME Code.

Except as permitted for miniature boilers, the minimum size of pipe and fittings shall be 1 in., and the maximum size shall be 2-1/2 in., except that for boilers with 100 sq. ft. of heating surface or less; the minimum size of pipe and fittings may be 3/4 in.

Condensate return connections of the same size or larger than the size herein specified may be used, and the blowoff may be connected to them. In such cases, the blowoff shall be so located that the connection may be completely drained.

A bottom blowoff pipe, when exposed to direct furnace heat, shall be protected by firebrick or other heat-resisting material which is so arranged that the pipe may be inspected.

An opening in the boiler setting for a blowoff pipe shall be arranged to provide free expansion and contraction.

### **EB0-14 Repairs and Renewals of Boiler Fittings and Appliances**

Whenever repairs are made to fittings or appliances or it becomes necessary to replace them, the work shall comply with the requirements for new installations.

## **EB0-15 Conditions Not Covered By These Requirements**

All cases not specifically covered by these requirements shall be treated as new installations or may be referred to the chief inspector for instructions concerning the requirements.

### **SECTION 2 — HEATING BOILERS**

#### **EHB-1 Standard Boilers**

The maximum allowable working pressure of standard boilers shall in no case exceed the pressure indicated by the manufacturer's identification stamped or cast on the boiler or on a plate secured to it.

#### **EHB-2 Nonstandard Riveted Boilers**

The maximum allowable working pressure on the shell of a nonstandard riveted heating boiler shall be determined in accordance with EB0-3 of Part III, Section 1 – Power Boilers, except that in no case shall the maximum allowable working pressure of a steam-heating boiler exceed 15 psig, or a hot water boiler exceed 160 psig or 250°F temperature.

#### **EHB-3 Nonstandard Welded Boilers**

The maximum allowable working pressure of a nonstandard steel or wrought-iron heating boiler of welded construction shall not exceed 15 psig for steam. For other than steam service, the maximum allowable working pressure shall be calculated in accordance with Section IV of the ASME Code, but in no case shall it exceed 30 psig.

#### **EHB-4 Nonstandard Cast-Iron Boilers**

The maximum allowable working pressure of a nonstandard boiler composed principally of cast iron shall not exceed 15 psig for steam service or 30 psig for hot water service.

The maximum allowable working pressure of a nonstandard boiler having cast-iron shell or heads and steel or wrought-iron tubes shall not exceed 15 psig for steam service or 30 psig for hot water service.

#### **\*EHB-5 Potable Water Heaters**

A potable water heater shall not be installed or used at pressures exceeding 160 psig or water temperatures exceeding 210°F.

## EHB-6 Safety Valves

- A. Each steam boiler shall have one or more ASME/National Board-stamped and certified safety valves of the spring pop-type adjusted and sealed to discharge at a pressure not to exceed 15 psig. Seals shall be attached in a manner to prevent the valve from being disassembled without breaking the seal. The safety valves shall be arranged so that they cannot be reset to relieve at a higher pressure than the maximum allowable working pressure on the boiler. A body drain connection below seat level shall be provided by the manufacturer and this drain shall not be plugged during or after field inspection. For valves exceeding 2-1/2 in. pipe size, the drain hole or holes shall be tapped not less than 3/8 in. pipe size. For valves 2-1/2 in. in pipe size and smaller, the drain hole shall not be less than 1/4 in. in diameter.
- B. No safety valve for a steam boiler shall be smaller than 1/2 in. No safety valve shall be larger than 4-1/2 in. The inlet opening shall have an inside diameter equal to, or greater than, the seat diameter.
- C. The minimum relieving capacity of the valve or valves shall be governed by the capacity marking on the boiler.
- D. The minimum valve capacity in pounds per hour shall be the greater of that determined by dividing the maximum BTU output at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by 1,000, or shall be determined on the basis of the pounds of steam generated per hour per square foot of boiler heating surface as given in Table EHB-6. In many cases a greater relieving capacity of valves than the minimum specified by these rules will have to be provided. In every case, the requirements of EHB-6(E) shall be met.

TABLE EHB-6  
MINIMUM POUNDS OF STEAM PER HOUR  
PER SQUARE FOOT OF HEATING SURFACE

	Firetube Boilers	Watertube Boilers
Boiler Heating Surface:		
Hand-fired	5	6
Stoker-fired	7	8
Oil, gas, or pulverized fuel-fired	8	10
Waterwall Heating Surface:		
Hand-fired	8	8
Stoker-fired	10	12
Oil, gas, or pulverized fuel-fired	14	16



1. When a boiler is fired only by a gas giving a heat value not in excess of 200 BTU per cu. ft., the minimum safety valve or safety relief valve relieving capacity may be based on the value given for hand-fired boilers above.
  2. The minimum safety valve or safety relief valve relieving capacity for electric boilers shall be 3-1/2 pounds per hour per kilowatt input.
  3. For heating surface determination see ASME Code Section IV, Paragraph HG-403.
- E. The safety valve capacity for each steam boiler shall be such that with the fuel burning equipment installed and operating at maximum capacity, the pressure cannot rise more than 5 psig 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 EHB-6(E). When additional valves are required, they may be installed on the outlet piping provided there is no intervening valve.
- G. If there is any doubt as to the capacity of the safety valve, an accumulation test shall be run (See ASME Code, Section VI, Recommended Rules for Care and Operation of Heating Boilers).
- H. No valve of any description shall be placed between the safety valve and the boiler, nor on the discharge pipe between the safety valve and the atmosphere. **THE DISCHARGE PIPE SHALL BE AT LEAST FULL SIZE AND BE FITTED WITH AN OPEN DRAIN TO PREVENT WATER LODGING IN THE UPPER PART OF THE SAFETY VALVE OR IN THE DISCHARGE PIPE.** When an elbow is placed on the safety valve discharge pipe, it shall be located close to the safety valve outlet or the discharge pipe shall be securely anchored and supported. All safety valve discharges shall be so located or piped as not to endanger persons working in the area.

#### **EHB-7 Safety Relief Valve Requirements for Hot Water Heating and Hot Water Supply Boilers**

- A. Each hot water heating and hot water supply boiler shall have at least one ASME/National Board-stamped and certified safety relief valve set to relieve at or below the maximum allowable working pressure of the boiler. Each hot water supply boiler shall have at least one ASME-National Board-stamped and certified safety relief valve of the automatic reseating

type set to relieve at or below maximum allowable working pressure of the boiler. Safety relief valves ASME-National Board-stamped and certified as to capacity shall have pop action when tested by steam. When more than one safety relief valve is used on either a hot water heating or hot water supply boiler, the additional valve or valves shall be ASME/National Board-stamped and certified and may be set within a range not to exceed 6 psig above the maximum allowable working pressure of the boiler up to and including 60 psig and 5 percent for those having a maximum allowable working pressure exceeding 60 psig. Safety relief valves shall be spring-loaded. Safety relief valves shall be so arranged that they cannot be reset at a higher pressure than the maximum permitted by this paragraph.

- B. No materials liable to fail due to deterioration or vulcanization when subject to saturated steam temperature corresponding to capacity test pressure shall be used for any part.
- C. No safety relief valve shall be smaller than 3/4 in. nor larger than 4-1/2 in. standard pipe size, except that boilers having a heat input not greater than 15,000 BTU per hour may be equipped with a safety relief valve of 1/2 in. standard pipe size. The inlet opening shall have an inside diameter approximately equal to, or greater than, the seat diameter. In no case shall the minimum opening through any part of the valve be less than 1/4 in. in diameter or its equivalent area.
- D. The required steam-relieving capacity, in pounds per hour, of the pressure relieving device or devices on a boiler shall be the greater of that determined by dividing the maximum output in BTU at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by 1,000 or shall be determined on the basis of pounds of steam generated per hour per square foot of boiler heating surface as given in Table EHB-6. 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 EHB-7(F) shall be met.
- E. 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 EHB-7(F). The additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.
- F. Safety relief valve capacity for each boiler shall be such that, with the fuel burning equipment installed and operated at maximum capacity, the pressure cannot rise more than 10 percent above the maximum allowable working pressure. When more than one safety relief valve is used, the

over-pressure shall be limited to 10 percent above the set pressure of the highest set valve allowed by EHB-6(A).

- G. If there is any doubt as to the capacity of the safety relief valve, an accumulation test shall be run (See ASME Code, Section VI, Recommended Rules for Care and Operation of Heating Boilers).
- H. No valve of any description shall be placed between the safety relief valve and the boiler, nor on the discharge pipe between the safety relief valve and the atmosphere. **THE DISCHARGE PIPE SHALL BE NOT LESS THAN THE DIAMETER OF THE SAFETY RELIEF VALVE OUTLET AND FITTED WITH AN OPEN DRAIN TO PREVENT WATER LODGING IN THE UPPER PART OF THE SAFETY RELIEF VALVE OR IN THE DISCHARGE PIPE.** When an elbow is placed on the safety relief valve discharge pipe, it shall be located close to the safety relief valve outlet, or the discharge pipe shall be securely anchored and supported. All safety relief valve discharges shall be so located or piped as not to endanger persons working in the area.

### **EHB-8 Steam Gages**

Each steam boiler shall have a steam gage or a compound steam gage connected to its steam space or to its water column or to its steam connection. The gage or connection shall contain a siphon or equivalent device which will develop and maintain a water seal that will prevent steam from entering the gage tube. The connection shall be so arranged that the gage cannot be shut off from the boiler except by a cock placed in the pipe at the gage and provided with a tee or lever handle arranged to be parallel to the pipe in which it is located when the cock is open. The connections to the boiler shall be not less than 1/4 in. standard pipe size, but where steel or wrought-iron pipe or tubing is used, they shall be not less than 1/2 in. standard pipe size. The minimum size of a siphon, if used, shall be 1/4 in. inside diameter. Ferrous and nonferrous tubing having inside diameters at least equal to that of standard pipe sizes listed above may be substituted for pipe.

The scale on the dial of a steam boiler gage shall be graduated to not less than 30 psig nor more than 60 psig. The travel of the pointer from 0 to 30 psig pressure shall be at least 3 in.

### **EHB-9 Pressure or Altitude Gages and Thermometers**

- A. Each hot water boiler shall have a pressure or altitude gage connected to it or to its flow connection in such a manner that it cannot be shut off from the boiler except by a cock with tee or lever handle, placed on the pipe near the gage. The handle of the cock shall be parallel to the pipe in which it is located when the cock is open.

- B. The scale on the dial of the pressure or altitude gage shall be graduated approximately to not less than 1-1/2 nor more than three times the pressure at which the safety relief valve is set.
- C. Piping or tubing for pressure or altitude-gage connections shall be of nonferrous metal when smaller than 1 in. pipe size.
- D. Each hot water boiler shall have a thermometer so located and connected that it shall be easily readable when observing the water pressure or altitude. The thermometer shall be so located that it shall at all times indicate the temperature in degrees Fahrenheit of the water in the boiler at or near the outlet.

### **EHB-10 Water Gage Glasses**

Each steam boiler shall have one or more water gage glasses attached to the water column or boiler by means of valved fittings not less than 1/2 in. pipe size, with the lower fitting provided with a drain valve of a type having an unrestricted drain opening not less than 1/4 in. in diameter to facilitate cleaning. Gage glass replacement shall be possible under pressure. Water glass fittings may be attached directly to a boiler.

Boilers having an internal vertical height of less than 10 in. may be equipped with a water level indicator of the glass bull's-eye type, provided the indicator is of sufficient size to show the water at both normal operating and low-water cutoff levels.

The lowest visible part of the water gage glass shall be at least 1 in. above the lowest permissible water level recommended by the boiler manufacturer. With the boiler operating at this lowest permissible water level, there shall be no danger of overheating any part of the boiler.

Each boiler shall be provided at the time of manufacture with a permanent marker indicating the lowest permissible water level. The marker shall be stamped, etched, or cast in metal; or it shall be a metallic plate attached by rivets, screws, or welding; or it shall consist of material with documented tests showing its suitability as a permanent marking for the application. This marker shall be visible at all times. Where the boiler is shipped with a jacket, this marker may be located on the jacket.

In electric boilers of the submerged electrode type, the water gage glass shall be so located to indicate the water levels both at startup and under maximum steam load conditions as established by the manufacturer.

In electric boilers of the resistance heating element type, the lowest visible part of the water gage glass shall not be below the top of the electric resistance heating

element. Each boiler of this type shall also be equipped with an automatic low-water electrical power cutoff so located as to automatically cut off the power supply before the surface of the water falls below the top of the electrical resistance heating elements.

Tubular water glasses on electric boilers having a normal water content not exceeding 100 gal. shall be equipped with a protective shield.

### **EHB-11 Stop Valves**

When a stop valve is used in the supply pipe connection of a single steam boiler, there shall be one used in the return pipe connection.

Stop valves in single hot water heating boilers shall be located at an accessible point in the supply and return pipe connections, as near the boiler nozzle as is convenient and practicable, to permit draining the boiler without emptying the system.

When the boiler is located above the system and can be drained without draining the system, stop valves may be eliminated.

A stop valve shall be used in each supply and return pipe connection of two or more boilers connected to a common system.

All valves or cocks shall conform to the applicable portions of HF-203 of Section IV of the ASME Code and may be ferrous or nonferrous.

The minimum pressure rating of all valves or cocks shall be at least equal to the pressure stamped upon the boiler, and the temperature rating of such valves or cocks, including all internal components, shall be not less than 250°F.

Valves or cocks shall be flanged, threaded or have ends suitable for welding or brazing.

All valves or cocks with stems or spindles shall have adjustable pressure-type packing glands and, in addition, all plug-type cocks shall be equipped with a guard or gland. The plug or other operating mechanism shall be distinctly marked in line with the passage to indicate whether it is opened or closed.

All valves or cocks shall have tight closure when under boiler pressure test.

When stop valves are used, they shall be properly designated substantially by tags of metal or other durable material fastened to them.

## **EHB-12 Feedwater Connections**

- A. Feedwater, makeup water, or water treatment shall be introduced into a boiler through the return piping system. Alternatively, makeup water or water treatment may be introduced through an independent connection. The water flow from the independent connection shall not discharge directly against parts of the boiler exposed to direct radiant heat from the fire. Makeup water or water treatment shall not be introduced through openings or connections provided for inspection or cleaning, safety valve, safety relief valve, blowoff, water column, water gage glass, pressure gage, or temperature gage.
- B. The makeup water pipe shall be provided with a check valve near the boiler and a stop valve or cock between the check valve and the boiler or between the check valve and the return pipe system.

## **EHB-13 Water Column and Water Level Control Pipes**

The minimum size of ferrous or nonferrous pipes connecting a water column to a steam boiler shall be 1 in. No outlet connections, except for damper regulator, feedwater regulator, steam gages, or apparatus which does not permit the escape of any steam or water except for manually operated blowdowns, shall be attached to a water column or the piping connecting a water column to a boiler (see HG-705 of Section IV of the ASME Code for introduction of feedwater into a boiler). If the water column, gage glass, low-water fuel cutoff, or other water level control device is connected to the boiler by pipe and fittings, no shutoff valves of any type shall be placed in such pipe, and a cross or equivalent fitting to which a drain valve and piping may be attached shall be placed in the water piping connection at every right-angle turn to facilitate cleaning. The water column drain pipe and valve shall be not less than 3/4 in. pipe size.

The steam connections to the water column of a horizontal firetube wrought-iron boiler shall be taken from the top of the shell or the upper part of the head, and the water connection shall be taken from a point not above the center line of the shell. For a cast-iron boiler, the steam connection to the water column shall be taken from the top of an end section or the top of the steam header, and the water connection shall be made on an end section not less than 6 in. below the bottom connection to the water gage glass.

## **EHB-14 Return Pump**

Each boiler equipped with a condensate return pump shall be provided with a water level control arranged to automatically maintain the water level in the boiler within the range of the gage glass.

## EHB-15 Repairs and Renewals of Fittings and Appliances

Whenever repairs are made to fittings or appliances, or it becomes necessary to replace them, the repairs must comply with Section IV of the ASME Code for new construction.

### SECTION 3 — PRESSURE VESSELS

#### EPV-1 Maximum Allowable Working Pressure for Standard Pressure Vessels

The maximum allowable working pressure for standard pressure vessels shall be determined in accordance with the applicable provisions of the edition of the ASME Code or the API-ASME Code under which they were constructed and stamped.

#### EPV-2 Maximum Allowable Working Pressure for Nonstandard Pressure Vessels, Except as Provided in EPV-3

- A. The maximum allowable working pressure of a nonstandard pressure vessel shall be determined by the strength of the weakest course computed from the thickness of the plate, the tensile strength of the plate, the efficiency of the longitudinal joint, the inside diameter of the course, and the factor of safety set by these rules.

$$\frac{TStE}{RFS} = \text{maximum allowable working pressure, psig}$$

where:

TS = specified minimum tensile strength of shell plate material, psi (When the tensile strength of carbon steel plate is not known, it may be taken as 55,000 psi for temperatures not exceeding 650°F. For other materials, use the lowest stress values for that material from Section VIII of the ASME Code.)

t = minimum thickness of shell plate of weakest course, inches

E = efficiency of longitudinal joint depending upon construction

Use the following values: for riveted joints – calculated riveted efficiency; for fusion welded and brazed joints.

	Percent
Single lap weld	40
Double lap weld	50
Single butt weld	60
Double butt weld	70
Forge weld	70
Brazed steel	80

R = Inside radius of weakest course of shell (inches) provided the thickness does not exceed 10 percent of the radius. If the thickness is over 10 percent of the radius, the outer radius shall be used

FS = factor of safety allowed by these rules

- B. The minimum factor of safety shall in no case be less than 5 for existing installations. The working pressure shall be decreased when deemed necessary by the inspector to ensure the operation of the vessel within safe limits. The condition of the vessel and the particular service to which it is subject will be the determining factors.
- C. The maximum allowable working pressure permitted for formed heads under pressure shall be determined by using the appropriate formulas from ASME Code Section VIII, Div. 1, and the tensile strength and factors of safety given in Paragraphs EPV-1 and EPV-2(A) and (B).
- D. The maximum allowable working pressure for nonstandard pressure vessels subjected to external pressure shall be determined by the rules of Section VIII, Div.1, of the ASME Code.

### **EPV-3 Formulas**

Pressure vessels that were not ASME Code-stamped but which were constructed of known materials and were designed and constructed in accordance with sound engineering standards, formulas, and practices that provide safety equivalent to the intent of the Code shall be calculated on the same basis as used in the original design.

### **EPV-4 Inspection of Inaccessible Parts**

Where, in the opinion of the inspector, as the result of conditions disclosed at the time of inspection, it may be necessary to remove interior or exterior lining, covering or brickwork to expose certain parts of the vessel not normally visible, the owner or user shall remove such material to permit proper inspection and to determine remaining thickness.



## **EPV-5 Overpressure Protection**

Each pressure vessel shall be provided with pressure relief devices which are ASME-NB-stamped and certified or indicating and controlling devices as necessary to protect against overpressure. These devices shall be so constructed, located, and installed that they cannot readily be rendered inoperative. The relieving capacity of such pressure relief devices shall be adequate to prevent a rise in pressure in the vessel of more than 10 percent or 3 psig, whichever is greater, above the maximum allowable working pressure except when multiple relieving devices are provided, they shall prevent the pressure from rising more than 16 percent or 4 psig, whichever is greater, above the maximum allowable working pressure. When multiple pressure relieving devices are provided, at least one device shall be set at or below the maximum allowable working pressure and the additional devices shall be set no higher than 105 percent of the maximum allowable working pressure. Where an additional hazard is involved due to fire or other unexpected sources of external heat, the pressure relief devices shall meet the requirements of ASME Code Section VIII, Div. 1, Paragraph UG-125, or Div. 2, Paragraph AR-130, whichever is applicable.

## **EPV-6 Repairs and Renewals of Fittings and Appliances**

Whenever repairs are made to fittings and appliances or it becomes necessary to replace them, the work must comply with the requirements for new installations.

## **PART IV GENERAL REQUIREMENTS**

### **GR-1 Inspection of Boilers and Pressure Vessels**

All boilers and pressure vessels not exempted by the Act or by rules and regulations promulgated under the Act and which are subject to regular inspections shall be prepared for such inspections as required in GR-2.

### **GR-2 Preparation for Inspection**

The owner or user shall prepare each boiler or pressure vessel for inspection, and shall prepare for and apply a hydrostatic or pressure test, whenever necessary, on the date arranged by the inspector which shall not be less than seven (7) days after the date of notification.

- A. Boilers – The owner or user shall prepare a boiler for internal inspection in the following manner:
  1. Water shall be drawn off and the boiler washed thoroughly;
  2. Manhole and handhole plates, washout plugs, and inspection plugs in water column connections shall be removed as required by the

inspector. The furnace and combustion chambers shall be cooled and thoroughly cleaned;

3. All grates of internally fired boilers shall be removed;
4. Insulation or brickwork shall be removed as required by the inspector in order to determine the condition of the boiler, headers, furnace, supports, or other parts;
5. The pressure gage shall be removed for testing as required by the inspector;
6. Any leakage of steam or hot water into the boiler shall be prevented by disconnecting the pipe or valve at the most convenient point or any appropriate means approved by the inspector;
7. Before opening the manhole or handhole covers and entering any parts of the steam generating unit connected to a common header with other boilers, the non-return and steam stop valves must be closed, tagged, and padlocked, and drain valves or cocks between the two valves opened. The feed valves must be closed, tagged, and padlocked, and drain valves or cocks located between the two valves opened. After draining the boiler, the blowoff valves shall be closed, tagged, and padlocked. Blowoff lines, where practicable, shall be disconnected between pressure parts and valves. All drains and vent lines shall be opened.

- B. Pressure Vessels – Pressure vessels shall be prepared for inspection to the extent deemed necessary by the inspector and the applicable procedures outlined in (A) above.

### **GR-3 Boilers and Pressure Vessels Improperly Prepared for Inspection**

If a boiler or pressure vessel has not been properly prepared for an internal inspection, or if the owner or user fails to comply with the requirements for a pressure test as set forth in these rules, the inspector may decline to make the inspection or test and the inspection certificate shall be withheld or right-to-operate revoked, until the owner or user complies with the requirements.

### **GR-4 Removal of Covering to Permit Inspection**

If, upon an external inspection, there is evidence of a leak or crack, sufficient covering of the boiler or pressure vessel shall be removed to permit the inspector to satisfactorily determine the safety of the boiler or pressure vessel.

### **GR-5 Lap Seam Crack**

The shell or drum of a boiler or pressure vessel (in which a lap seam crack is discovered along a longitudinal riveted joint) shall be immediately discontinued from use. Patching is prohibited. (Lap seam crack refers to a crack found in lap seams extending parallel to the longitudinal joint, and located either between or adjacent to rivet holes.)

### **GR-6 Pressure Test**

A pressure test, when applied to boilers or pressure vessels, need not exceed the maximum allowable working pressure or the setting of the lowest set safety valves. The pressure shall be under proper control so that in no case shall the required test pressure be exceeded.

During a pressure test the safety valve or valves shall be removed or each valve disk shall be held to its seat by means of a testing clamp and not by screwing down the compression screw upon the spring. A plug device designed for this purpose may be used.

It is suggested that the minimum metal temperatures during a pressure test shall be not less than 70°F, and that the maximum metal temperature during inspection shall not exceed 120°F.

When a pressure test is applied to determine tightness, the pressure shall be equal to the normal operating pressure but need not exceed the release pressure of the safety valve having the lowest release setting.

When the contents of the vessel prohibit contamination by any other medium or when a water pressure test is not possible, other testing media may be used providing the precautionary requirements of the applicable section of the ASME Code are followed. In such cases, there shall be agreement between the owner and the inspector.

### **\*GR-7 Automatic Low-Water Fuel Cutoff and/or Water Feeding Device**

Each automatically fired steam or vapor system boiler shall be equipped with an automatic low-water fuel cutoff so located as to automatically cut off the fuel supply when the surface of the water falls to the lowest safe waterline. If a water-feeding device is installed, it shall be so constructed that the water inlet valve cannot feed water into the boiler through the float chamber and so located as to supply requisite feedwater. The lowest safe waterline should not be lower than the lowest visible part of the water glass.

Hot water heating boilers shall be equipped with a Low Water Fuel Cutoff with a manual reset function.

Such fuel or feedwater control devices may be attached directly to a boiler or for low pressure boilers, to the tapped openings provided for attaching a water glass directly to a boiler, provided that such connections from the boiler are nonferrous tees or Ys not less than 1/2 in. pipe size between the boiler and the water glass, so that the water glass is attached directly and as close as possible to the boiler; the straightway tapping of the Y or tee to take the water glass fittings, the side outlet of the Y or tee to take the fuel cutoff or water-feeding device. The ends of all nipples shall be reamed to full size diameter.

Designs embodying a float and float bowl shall have a vertical straightaway valve drain pipe at the lowest point in the water equalizing pipe connections by which the bowl and the equalizing pipe can be flushed and the device tested.

### **GR-8 Pressure Reducing Valves**

Where pressure reducing valves are used, one or more safety or safety relief valves shall be provided on the low-pressure side of the reducing valve when the piping or equipment on the lowpressure side does not meet the requirements for the full initial pressure. The safety or safety relief valves shall be located adjoining or as close as possible to the reducing valve. Proper protection shall be provided to prevent injury or damage caused by the escaping fluid from the discharge of safety or safety relief valves if vented to the atmosphere. The combined discharge capacity of the safety or safety relief valves shall be such that the pressure rating of the lower pressure piping or equipment shall not be exceeded in case the reducing valve fails in the open position.

The use of hand-controlled bypasses around reducing valves is permissible. If a bypass is used around the reduction valve, the safety valve required on the low pressure side shall be of sufficient capacity to relieve all the fluid that can pass through the bypass without over-pressuring the lowpressure side.

A pressure gage shall be installed on the low-pressure side of a reducing valve.

### **GR-9 Boiler Blowoff Equipment**

The blowdown from a boiler or boilers that enters a sanitary sewer system or blowdown which is considered a hazard to life or property shall pass through some form of blowoff equipment that will reduce pressure and temperature as required hereinafter.

The temperature of the water leaving the blowoff equipment shall not exceed 140°F.

The pressure of the blowdown leaving any type of blowoff equipment shall not exceed 5 psig.

All blowoff equipment shall be fitted with openings to facilitate cleaning and inspection.

Blowoff equipment shall conform to the provisions set forth in the recommended rules for *Sizing Blowoff Vessels 2004 Edition*.

### **GR-10 Location of Discharge Piping Outlets**

The discharge of safety valves, blowoff pipes, and other outlets shall be located and supported as to prevent injury to personnel.

### **GR-11 Supports**

Each boiler and pressure vessel shall be supported by masonry or structural supports of sufficient strength and rigidity to safely support the boiler or pressure vessel and its contents. There shall be no excessive vibration in either the boiler, pressure vessel, or its connecting piping.

### **GR-12 Boiler Door Latches**

A watertube boiler shall have the firing doors of the inward opening type, unless such doors are provided with substantial and effective latching or fastening devices or otherwise so constructed as to prevent them, when closed, from being blown open by pressure on the furnace side.

These latches or fastenings shall be of the positive self-locking type. Friction contacts, latches, or bolts actuated by springs shall not be used. The foregoing requirements for latches or fastenings shall not apply to coal openings of downdraft or similar furnaces.

All other doors, except explosion doors, not used in the firing of the boiler, may be provided with bolts or fastenings in lieu of self-locking latching devices.

Explosion doors, if used and if located in the setting walls within 7 ft. of the firing floor or operating platform, shall be provided with substantial deflectors to divert the blast.

### **GR-13 Clearance**

When boilers are replaced or new boilers are installed in either existing or new buildings, a minimum height of at least 3 ft. shall be provided between the top of the boiler proper and the ceiling, and at least 3 ft. between all sides of the boiler and adjacent walls or other structures. Boilers and pressure vessels having manholes shall have 5 ft. clearance from the manhole opening and any wall, ceiling or piping that will prevent a person from entering the boiler or vessel. All boilers and pressure vessels shall be so located that adequate space will be

provided for the proper operation of the boilers and pressure vessels and their appurtenances, for the inspection of all surfaces, tubes, waterwalls, economizers, piping, valves and other equipment, and for their necessary maintenance and repair and replacement of tubes.

#### **GR-14 Ladders and Runways**

When necessary for safety, there shall be a steel runway or platform of standard construction installed across the tops of adjacent boilers or pressure vessels or at some other convenient level for the purpose of affording safe access. All walkways shall have at least two means of exit, each to be remotely located from the other.

#### **GR-15 Exit from Boiler Room**

All boiler rooms exceeding a 500 sq. ft. floor area and containing one or more boilers having a fuelburning capacity of 1,000,000 BTU, or equivalent electrical heat input, shall have at least two means of exit. Each exit shall be remotely located from the other. Each elevation in such boiler room shall have two means of exit, each remotely located from the other.

#### **GR-16 Suggestions for Operations**

It is suggested that the *Recommended Rules for Care of Power Boilers*, Section VII, and the *Recommended Rules for Care and Operation of Heating Boilers*, Section VI, of the ASME Code be used as a guide for proper and safe operating practices.

#### **\*GR-17 Air and Ventilation Requirements – Combustion Air Supply and Ventilation of Boiler Room**

A permanent source of outside air shall be provided for each boiler room to permit satisfactory combustion of the fuel as well as proper ventilation of the boiler room under normal operating conditions.

- A. The total requirements of all burners for all fired pressure vessels and air compressors or other air-consuming equipment in the boiler room must be used to determine the net louvered area in square feet:

INPUT BTU/HOUR	REQUIRED AIR CU/FT/MIN.	MIN. NET LOUVERED AREA, SQ. FT.
500,000	125	1.0
1,000,000	250	1.0
2,000,000	500	1.6
3,000,000	750	2.5
4,000,000	1,000	3.3
5,000,000	1,250	4.1
6,000,000	1,500	5.0
7,000,000	1,750	5.8
8,000,000	2,000	6.6
9,000,000	2,250	7.5
10,000,000	2,500	8.3

- B. When mechanical ventilation is in lieu of paragraph (A), the supply of combustion and ventilation air to the boiler room and the firing device will not operate with the fan off. The velocity of the air through the ventilating fan shall not exceed 500 feet per minute and the total air delivered shall be equal to or greater than shown in paragraph (A) above.

### **GR-18 Gas Burners**

For installations which are gas-fired, the burners used shall conform to the applicable requirements of nationally recognized standards.

### **GR-19 Conditions Not Covered by These Rules and Regulations**

For any conditions not covered by these requirements, the applicable provisions of the ASME Code, the *National Board Inspection Code*, or the *American Petroleum Institute Pressure Vessel Inspection Code* shall apply.