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2017 NBIC

NATIONAL BOARD INSPECTION CODE

PART 1 INSTALLATION

NATIONAL BOARD INSPECTION CODE

2017 EDITION

DATE OF ISSUE — JULY 1, 2017

This code was developed under procedures accredited as meeting the criteria for American National Standards. The Consensus Committee that approved the code was balanced to ensure that individuals from competent and concerned interests had an opportunity to participate. The proposed code was made available for public review and comment, which provided an opportunity for additional public input from industry, academia, regulatory and jurisdictional agencies, and the public-at-large.

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PART 1 — INSTALLATION

TABLE OF CONTENTS

Introduction	VIII
Foreword	XII
Personnel	XIV
Section 1 General Guidelines	1
1.1 Scope	1
1.2 Purpose	1
1.3 Application of these Rules	1
1.4 Certification, Inspection, and Jurisdictional Requirements	1
1.4.1 Responsibility	1
1.4.2 Equipment Certification	2
1.4.3 Jurisdictional Review	2
1.4.4 Inspection	2
1.4.5 Boiler Installation Report	2
1.4.5.1 Boiler Installation Report Form	3
1.4.5.1.1 Guide for Completing National Board Boiler Installation Report	3
1.5 Change of Service	6
1.6 General Requirements	6
1.6.1 Supports, Foundations, and Settings	6
1.6.2 Structural Steel	6
1.6.3 Exit	6
1.6.4 Ladders and Runways	6
1.6.5 Fuel	7
1.6.6 Ventilation and Combustion Air	7
1.6.7 Lighting	8
1.6.8 Chimney or Stack	8
1.6.9 Final Acceptance	8
Section 2 Power Boilers	9
2.1 Scope	9
2.2 Definitions	9
2.3 General Requirements	9
2.3.1 Supports, Foundations, and Settings	9
2.3.2 Structural Steel	9
2.3.3 Clearances	9
2.4 Equipment Room Requirements	9
2.4.1 Exit	9
2.4.2 Ladders and Runways	10
2.4.3 Drains	10
2.4.4 Water (Cleaning)	10
2.5 Source Requirements	10
2.5.1 Feedwater	10
2.5.1.1 Volume	10
2.5.1.2 Connection	10
2.5.1.3 Pumps	11
2.5.1.4 Valves	11
2.5.2 Fuel	12
2.5.3 Electrical	12
2.5.3.1 Wiring	12
2.5.3.2 Remote Emergency Shutdown Switches	12
2.5.3.3 Controls and Heat-Generating Apparatus	12
2.5.4 Ventilation and Combustion Air	13
2.5.5 Lighting	13
2.5.6 Emergency Valves and Controls	13
2.6 Discharge Requirements	13



2.6.1	Chimney or Stack	13
2.6.2	Ash Removal	13
2.6.3	Drains	13
2.6.3.1	Connection	13
2.6.3.2	Pressure Rating	13
2.6.3.3	Parts	13
2.7	Operating Systems	14
2.7.1	Breeching and Dampers	14
2.7.2	Burners and Stokers	14
2.7.3	Steam Supply	14
2.7.4	Condensate and Return	15
2.7.5	Blowoff	15
2.8	Controls and Gages	16
2.8.1	Water	16
2.8.2	Pressure Gage	17
2.8.2.1	Connection	17
2.8.3	Temperature	18
2.8.4	Pressure Control	18
2.8.5	Automatic Low-Water Fuel Cutoff and/or Water Feeding Device for Stream or Vapor System Boilers	18
2.9	Pressure Relief Valves	19
2.9.1	Valve Requirements — General	19
2.9.1.1	Number	19
2.9.1.2	Location	19
2.9.1.3	Capacity	19
2.9.1.4	Set Pressure	21
2.9.2	Forced-Flow Steam Generator	22
2.9.3	Superheaters	22
2.9.4	Economizers	23
2.9.5	Pressure-Reducing Valves	23
2.9.6	Installation and Discharge Requirements	23
2.10	Testing and Acceptance	24
2.10.1	General	24
2.10.2	Pressure Test	25
2.10.3	Nondestructive Examination	25
2.10.4	System Testing	25
2.10.5	Final Acceptance	25
2.10.6	Boiler Installation Report	25
2.11	Tables and Figures	25

Section 3 Steam Heating Boilers, Hot-Water Heating Boilers, Hot-Water Supply Boilers, and Potable Water Heaters

3.1	Scope	26
3.2	Definitions	26
3.3	General Requirements	26
3.3.1	Supports	26
3.3.1.1	Methods of Support for Steam Heating, Hot-Water Heating, and Hot-Water Supply Boilers	26
3.3.2	Settings	28
3.3.3	Structural Steel	28
3.3.4	Clearances	28
3.4	Equipment Room Requirements	28
3.4.1	Exit	28
3.4.2	Ladders and Runways	28
3.5	Source Requirements	29
3.5.1	Water	29
3.5.2	Fuel	29
3.5.3	Electrical	29
3.5.3.1	Steam Heating, Hot Water Heating, and Hot Water Supply Boilers	29



3.5.3.2	Potable Water Heaters	29
3.5.3.3	Controls and Heat Generating Apparatus	30
3.5.4	Ventilation and Combustion Air	30
3.5.5	Lighting	30
3.5.6	Emergency Valves and Controls	30
3.6	Discharge Requirements	30
3.6.1	Chimney or Stack	30
3.6.2	Ash Removal	30
3.6.3	Drains	31
3.7	Operating Systems	31
3.7.1	Oil Heaters	31
3.7.2	Breeching and Dampers	31
3.7.3	Burners and Stokers	31
3.7.4	Feedwater, Makeup Water, and Water Supply	31
3.7.5	Stop Valves	32
3.7.5.1	Steam Heating, Hot-Water Heating, and Hot-Water Supply Boilers	32
3.7.5.2	Potable Water Heaters	36
3.7.6	Return Pipe Connections	37
3.7.7	Bottom Blowoff and Drain Valves	37
3.7.7.1	Steam Heating, Hot-Water Heating, and Hot-Water Supply Boilers	37
3.7.7.2	Potable Water Heaters	38
3.7.8	Modular Steam Heating and Hot-Water Heating Boilers	39
3.7.8.1	Individual Modules	39
3.7.8.2	Assembled Modular Boilers	39
3.7.9	Provisions for Thermal Expansion	39
3.7.9.1	Expansion Tanks and Piping for Steam Heating, Hot-Water Heating, Hot-Water Supply Boilers	39
3.7.9.2	Expansion Tanks and Piping For Potable Water Heaters	42
3.8	Instruments, Fittings, and Controls	43
3.8.1	Steam Heating Boilers	43
3.8.1.1	Steam Gages	43
3.8.1.2	Water-Gage Glasses	43
3.8.1.3	Water Column and Water Level Control Pipes	44
3.8.1.4	Pressure Control	44
3.8.1.5	Automatic Low-Water Fuel Cutoff and/or Water Feeding Device	44
3.8.1.6	Modular Steam Heating Boilers	45
3.8.1.7	Instruments, Fittings, and Controls Mounted Inside Boiler Jackets	45
3.8.2	Hot-Water Heating or Hot-Water Supply Boilers	45
3.8.2.1	Pressure or Altitude Gages	45
3.8.2.2	Thermometers	45
3.8.2.3	Temperature Control	46
3.8.2.4	Low-Water Fuel Cutoff	46
3.8.2.5	Modular Hot-Water Heating Boilers	46
3.8.2.6	Instruments, Fittings, and Controls Mounted Inside Boiler Jackets	47
3.8.3	Potable Water Heaters	47
3.8.3.1	Temperature Controls	47
3.8.3.2	Thermometer	47
3.9	Pressure Relief Valves	47
3.9.1	Pressure Relief Valve Requirements — General	47
3.9.1.1	Installation of Pressure Relief Valves for Steam Heating, Hot-Water Heating, and Hot-Water Supply Boilers	47
3.9.1.1.1	Permissible Mounting	47
3.9.1.1.2	Requirements for Common Connections for Two or More Valves	48
3.9.1.2	Threaded Connections	48
3.9.1.3	Prohibited Installations	48
3.9.1.4	Use of Shutoff Valves Prohibited	48
3.9.1.5	Pressure Relief Valve Discharge Piping	48
3.9.1.6	Temperature and Pressure Relief Valves	48
3.9.2	Pressure Relief Valve Requirements for Steam Heating Boilers	49



3.9.3	Pressure Relief Valve Requirements for Hot-Water Heating or Hot-Water Supply Boilers	49
3.9.4	Pressure Relief Valve Requirements for Potable Water Heaters	50
3.9.4.1	Installation	51
3.9.4.2	Permissible Installations	51
3.9.4.3	Requirements for Common Connection for Two or More Valves	51
3.9.4.4	Threaded Connections	51
3.9.4.5	Prohibited Installations	51
3.9.4.6	Use of Shutoff Valves Prohibited	51
3.9.4.7	Temperature and Pressure Relief Valve Discharge Piping	51
3.9.5	Pressure Relief Valves for Tanks and Heat Exchangers	52
3.9.5.1	Steam to Hot-Water Supply	52
3.9.5.2	High-Temperature Water to Water Heat Exchanger	52
3.9.5.3	High-Temperature Water to Steam Heat Exchanger	52
3.10	Testing and Acceptance	52
3.10.1	Pressure Test	52
3.10.2	Final Acceptance	52
3.10.3	Boiler Installation Report	52
3.11	Tables and Figures	53
Section 4	Pressure Vessels	54
4.1	Scope	54
4.2	Definitions	54
4.3	General Requirements	54
4.3.1	Supports	54
4.3.2	Clearances	54
4.3.3	Piping	54
4.3.4	Bolting	54
4.4	Instruments and Controls	54
4.4.1	Level Indicating Devices	54
4.4.2	Pressure Indicating Devices	55
4.5	Pressure Relief Devices	55
4.5.1	Device Requirements	55
4.5.2	Number of Devices	55
4.5.3	Location	55
4.5.4	Capacity	55
4.5.5	Set Pressure	56
4.5.6	Installation and Discharge Piping Requirements	56
4.6	Testing and Acceptance	57
4.7	Requirements for Hot Water Storage Tanks	58
4.7.1	Supports	58
4.7.2	Clearance and Acceptability	58
4.7.3	Temperature and Pressure Relief Devices	58
4.7.4	Thermometers	58
4.7.5	Shut Off Valves	58
4.7.6	Testing and Acceptance	58
Section 5	Piping	59
5.1	Scope	59
5.2	General Requirements	59
5.2.1	Additions to Existing Piping	59
5.2.2	Proximity to Other Equipment and Structures	59
5.2.3	Flanges and Other Non-Welded Joints	59
5.2.4	Valves	59
5.2.5	Materials	59
5.2.6	Hangers and Supports	60
5.2.7	Protection and Cleaning	60
5.2.8	Welding and Brazing	60
5.2.9	Bolting	60
5.3	Pressure Relief Devices	60



5.3.1	Device Requirements	60
5.3.2	Number of Devices	61
5.3.3	Location	61
5.3.4	Capacity	61
5.3.5	Set Pressure	61
5.3.6	Inlet and Discharge Piping Requirements	61
5.4	Examination, Inspection, and Testing	62
Section 6	Supplements	63
Supplement 1	Installation of Yankee Dryers (Rotating Cast-Iron Pressure Vessels) with Finished Shell Outer Surfaces	63
S1.1	Scope	63
S1.2	Assessment of Installation.....	64
S1.3	Determination of Allowable Operating Parameters	66
S1.4	ASME Code Primary Membrane Stress Criteria	67
S1.5	Pressure Testing.....	67
S1.6	Nondestructive Examination.....	68
Supplement 2	Pressure Relief Valves on the Low-Pressure Side of Steam Pressure Reducing Valves	69
S2.1	Scope	69
S2.2	Pressure Relief Valve Capacity	69
S2.3	Calculation of Pressure Relief Valve Relieving Capacity	69
S2.4	Steam Flow When Flow Coefficients Are Not Known	77
S2.5	Two-Stage Pressure Reducing Valve Stations	77
Supplement 3	Installation of Liquid Carbon Dioxide Storage Vessels	79
S3.1	Scope	79
S3.2	General Requirements Storage Tank Location	79
S3.2.1	General Requirements (Enclosed and Unenclosed Areas)	79
S3.2.2	Unenclosed Area LCDSV Installations	80
S3.2.3	Enclosed Area LCDSV Installations	80
S3.3	Fillbox Location/Safety Relief/Vent Valve Circuit Termination	80
S3.4	Gas Detection Systems	81
S3.5	Signage	81
S3.6	Valves, Piping, Tubing, and Fittings	81
S3.6.1	System Description	84
Supplement 4	Installation of Biomass (Wood/Solid Fuel) Fired Boilers	87
S4.1	Scope	87
S4.2	Purpose	87
S4.3	Determination of Allowable Operating Parameters	87
S4.4	General Requirements	88
S4.5	Fuel System Requirements and Controls.....	88
S4.6	Combustion Requirements.....	89
Supplement 5	Installation of Thermal Fluid Heaters	91
S5.1	Scope	91
S5.2	Definitions.....	91
S5.3	General Requirements	91
S5.3.1	Supports, Foundations, and Settings	91
S5.3.2	Structural Steel	91
S5.3.3	Settings	91
S5.3.4	Clearances	91
S5.4	Thermal Fluid Heater Room Requirements.....	92
S5.4.1	Exit	92
S5.4.2	Ladders and Runways.....	92
S5.5	System Requirements	92

S5.5.1	Thermal Liquids (Heat Transfer Fluids)	92
S5.5.2	Expansion	92
S5.5.3	Connection	93
S5.5.4	Circulating Pump	93
S5.5.5	Piping and Valves	93
S5.5.6	Fuel	94
S5.5.7	Electrical	94
S5.5.8	Ventilation and Combustion Air	96
S5.5.9	Lighting	96
S5.5.10	Emergency Valves and Controls	96
S5.6	Discharge Requirements	96
S5.6.1	Chimney or Stack	96
S5.6.2	Drains	96
S5.6.3	Air Vent	96
S5.7	Overpressure Protection	96
S5.7.1	General Requirements	96
S5.7.2	Pressure Relief Devices	96
S5.7.3	Location	97
S5.7.4	Capacity	97
S5.7.5	Set Pressure	97
S5.7.6	Installation	97
S5.8	Testing and Acceptance	98
S5.8.1	General	98
S5.8.2	Pressure Test	98
S5.8.3	Nondestructive Examination	98
S5.8.4	System Testing	98
S5.8.5	Final Acceptance	98
S5.8.6	Installation Report	98

Supplement 6 Special Requirements for the Installation of Condensing Boilers

S6.1	Scope	99
S6.2	Determination of Allowable Operating Parameters	99
S6.3	General Requirements	99
S6.4	Flue Gas Venting System Piping Requirements	99
S6.5	Sealed Combustion System Requirements	99
S6.6	Condensate Drain System Requirements	100

Section 7	NBIC Policy for Metrication	101
7.1	General	101
7.2	Equivalent Rationale	101
7.3	Procedure for Conversion	101
7.4	Referencing Tables	102

Section 8	Preparation of Technical Inquiries to the <i>National Board Inspection Code</i> Committee	107
8.1	Introduction	107
8.2	Inquiry Format	107
8.3	Code Revisions or Additions	108
8.4	Code Interpretations	108
8.5	Submittals	109

Section 9	Glossary of Terms	110
9.1	Definitions	110

Section 10	NBIC Approved Interpretations	117
10.1	Scope	117

Section 11	Index	126
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INTRODUCTION

It is the purpose of the National Board Inspection Code (NBIC) to maintain the integrity of pressure-retaining items by providing rules for post-construction activities including installation, and after the items have been placed into service, by providing rules for inspection and repair and alteration, thereby ensuring that these items may continue to be safely used.

The NBIC is intended to provide rules, information, and guidance to manufacturers, Jurisdictions, inspectors, owner-users, installers, contractors, and other individuals and organizations performing or involved in post-construction activities, thereby encouraging the uniform administration of rules pertaining to pressure retaining items.

SCOPE

The NBIC recognizes three important areas of post-construction activities where information, understanding, and following specific requirements will promote public and personal safety. These areas include:

- Installation
- Inspection
- Repairs and Alterations

The NBIC provides rules, information, and guidance for post-construction activities, but does not provide details for all conditions involving pressure-retaining items. Where complete details are not provided in this code, the code user is advised to seek guidance from the Jurisdiction and from other technical sources.

The words shall, should, and may are used throughout the NBIC and have the following intent:

- Shall – action that is mandatory and required.
- Should – indicates a preferred but not mandatory means to accomplish the requirement unless specified by others such as the Jurisdiction.
- May – permissive, not required or a means to accomplish the specified task.

ORGANIZATION

The NBIC is organized into four parts to coincide with specific post-construction activities involving pressure-retaining items. Each part provides general and specific rules, information, and guidance within each applicable post-construction activity. Other NBIC parts or other published standards may contain additional information or requirements needed to meet the rules of the NBIC. Specific references are provided in each part to direct the user where to find this additional information. NBIC parts are identified as:

- Part 1, Installation – This part provides requirements and guidance to ensure all types of pressure retaining items are installed and function properly. Installation includes meeting specific safety criteria for construction, materials, design, supports, safety devices, operation, testing, and maintenance.
- Part 2, Inspection – This part provides information and guidance needed to perform and document inspections for all types of pressure-retaining items. This part includes information on personnel safety, non-destructive examination, tests, failure mechanisms, types of pressure equipment, fitness for service, risk-based assessments, and performance-based standards.
- Part 3, Repairs and Alterations – This part provides requirements and guidance to perform, verify, and document acceptable repairs or alterations to pressure retaining items regardless of code of construction. Alternative methods for examination, testing, heat treatment, etc., are provided when the original code of construction requirements cannot be met. Specific acceptable and proven repair methods are also provided.
- Part 4, Pressure Relief Devices – This part provides information and guidance to ensure pressure relief devices are installed properly, information and guidance needed to perform and document inspections for pressure relief devices, and information and guidance to perform, verify, and document acceptable repairs to pressure relief devices.

Each NBIC part is divided into major sections as outlined in the Table of Contents.

Tables, charts, and figures provide relevant illustrations or supporting information for text passages, and are designated with numbers corresponding to the paragraph they illustrate or support within each section. Multiple tables, charts, or figures referenced by the same paragraph will have additional letters reflecting the order of reference. Tables, charts, and figures are located in or after each major section within each NBIC part.

TEXT IDENTIFICATION AND NUMBERING

Each page in the text will be designated in the top header with the publication's name, part number, and part title. The numbering sequence for each section begins with the section number followed by a dot to further designate major sections (e.g., 1.1, 1.2, 1.3). Major sections are further subdivided using dots to designate subsections within that major section (e.g., 1.1.1, 1.2.1, 1.3.1). Subsections can further be divided as necessary. Paragraphs under sections or subsections shall be designated with small letters in parenthesis (e.g., a), b), c)) and further subdivided using numbers in parenthesis (e.g., 1), 2), 3)).

Subdivisions of paragraphs beyond this point will be designated using a hierarchical sequence of letters and numbers followed by a dot.

Example: 2.1 Major Section
 2.1.1 Section
 2.1.2 Section
 2.1.2. Subsection
 a) paragraph
 b) paragraph
 1) subparagraph
 2) subparagraph
 a. subdivisions
 1. subdivisions
 2. subdivisions
 b. subdivisions
 1. subdivisions
 2. subdivisions

Tables and figures will be designated with the referencing section or subsection identification. When more than one table or figure is referenced in the same section or subsection, letters or numbers in sequential order will be used following each section or subsection identification.

SUPPLEMENTS

Supplements are contained in each part of the NBIC to provide requirements and guidance only pertaining to a specific type of pressure-retaining item (e.g., Locomotive Boilers, Historical Boilers, Graphite Pressure Vessels.) Supplements follow the same numbering system used for the main text only preceded by the Letter "S." Each page of the supplement will be tabbed to identify the supplement number.

EDITIONS

Editions, which include revisions and additions to this code, are published every two years. Editions are permissive on the date issued and become mandatory six months after the date of issue.

CODE STAMPING

ASME Code "Stamping" referenced throughout the NBIC includes the ASME Boiler and Pressure Vessel Code Symbol Stamps used for conformity assessment prior to the 2010 edition/2011 addendum and the equivalent ASME Certification Mark with Designator required to meet the later editions of the ASME Boiler and Pressure Vessel Code Sections. When other construction codes or standards are utilized for repairs or alterations, stamping shall mean the identification symbol stamp required by that code or standard.

INTERPRETATIONS

On request, the NBIC Committee will render an interpretation of any requirement of this code. Interpretations are provided for each part and are specific to the code edition and addenda referenced in the interpretation. Interpretations provide clarification of existing rules in the code only and are not part of this code.

JURISDICTIONAL PRECEDENCE

Reference is made throughout this code to the requirements of the "Jurisdiction." Where any provision herein presents a direct or implied conflict with any jurisdictional regulation, the Jurisdictional regulation shall govern.

UNITS OF MEASUREMENT

Both U.S. customary units and metric units are used in the NBIC. The value stated in U.S. customary units or metric units are to be regarded separately as the standard. Within the text, the metric units are shown in parentheses. In Part 2, Supplement 6 and Part 3, Supplement 6 regarding DOT Transport Tanks, the metric units are shown first with the U.S. customary units shown in parentheses.

U.S. customary units or metric units may be used with this edition of the NBIC, but one system of units shall be used consistently throughout a repair or alteration of pressure-retaining items. It is the responsibility of National Board accredited repair organizations to ensure the appropriate units are used consistently throughout all phases of work. This includes materials, design, procedures, testing, documentation, and stamping. The NBIC policy for metrication is outlined in each part of the NBIC.

ACCREDITATION PROGRAMS

The National Board administers and four specific accreditation programs, as shown below:

- "R".....Repairs and Alterations to Pressure-Retaining Items (NB-415)
- "VR".....Repairs to Pressure Relief Valves (NB-514)
- "NR".....Repair and Replacement Activities for Nuclear Items (NB-417)
- "T/O".....Testing of Pressure Relief Valves (NB-528)

The administrative requirements for the accreditation for these accreditation programs can be viewed on the National Board Website at www.nationalboard.org.

The National Board also administers and accredits four specific inspection agency programs as shown below:

New Construction

Criteria for Acceptance of Authorized Inspection Agencies for New Construction (NB-360)

Inservice

Qualifications and Duties for Authorized Inspection Agencies (AIAs) Performing Inservice Inspection Activities and Qualifications for Inspectors of Boilers and Pressure Vessels (NB-369)

Owner-User

Accreditation of Owner-User Inspection Organizations (OUIO) (NB-371)

Owners or users may be accredited for both a repair and inspection program provided the requirements for each accreditation program are met.

Federal Government

Qualifications and Duties for Federal Inspection Agencies Performing Inservice Inspection Activities (FIAs) (NB-390)

These programs can be viewed on the National Board Website at www.nationalboard.org. For questions or further information regarding these programs contact the National Board by phone at (614) 888-8320 or by fax at (614) 847-1828.

CERTIFICATES OF AUTHORIZATION FOR ACCREDITATION PROGRAMS

Any organization seeking an accredited program may apply to the National Board to obtain a Certificate of Authorization for the requested scope of activities. A confidential review shall be conducted to evaluate the organization's quality system. Upon completion of the evaluation, a recommendation will be made to the National Board regarding issuance of a Certificate of Authorization.

Certificate of Authorization scope, issuance, and revisions for National Board accreditation programs are specified in the applicable National Board procedures. When the quality system requirements of the appropriate accreditation program have been met, a Certificate of Authorization and appropriate National Board symbol stamp shall be issued.

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FOREWORD

The National Board of Boiler and Pressure Vessel Inspectors is an organization comprised of Chief Inspectors for the states, cities, and territories of the United States and provinces and territories of Canada. It is organized for the purpose of promoting greater safety to life and property by securing concerted action and maintaining uniformity in post-construction activities of pressure-retaining items, thereby ensuring acceptance and interchangeability among Jurisdictional authorities responsible for the administration and enforcement of various codes and standards.

In keeping with the principles of promoting safety and maintaining uniformity, the National Board originally published the NBIC in 1946, establishing rules for inspection and repairs to boilers and pressure vessels. The *National Board Inspection Code* (NBIC) Committee is charged with the responsibility for maintaining and revising the NBIC. In the interest of public safety, the NBIC Committee decided, in 1995, to revise the scope of the NBIC to include rules for installation, inspection, and repair or alteration to boilers, pressure vessels, piping, and nonmetallic materials.

In 2007, the NBIC was restructured into three parts specifically identifying important post-construction activities involving safety of pressure-retaining items. This restructuring provides for future expansion, transparency, uniformity, and ultimately improving public safety.

In 2017, the NBIC was once again restructured into 4 parts, adding a new Part 4, Pressure Relief Devices. This purpose of this restructuring was to provide one distinct integrated part for pressure relief devices compiled from all PRD information referenced in Part 1, Installation; Part 2, Inspection; and Part 3, Repairs and Alterations.

The NBIC Committee's function is to establish rules of safety governing post-construction activities for the installation, inspection, and repair and alteration of pressure-retaining items, and to interpret these rules when questions arise regarding their intent. In formulating the rules, the NBIC Committee considers the needs and concerns of individuals and organizations involved in the safety of pressure-retaining items. The objective of the rules is to afford reasonably certain protection of life and property, so as to give a reasonably long, safe period of usefulness. Advancements in design and material and the evidence of experience are recognized.

The rules established by the NBIC Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design, or as limiting in any way an organization's freedom to choose any method that conforms to the NBIC rules.

The NBIC Committee meets regularly to consider revisions of existing rules, formulation of new rules, and respond to requests for interpretations. Requests for interpretation must be addressed to the NBIC Secretary in writing and must give full particulars in order to receive Committee consideration and a written reply. Proposed revisions to the code resulting from inquiries will be presented to the NBIC Committee for appropriate action.

Proposed revisions to the code approved by the NBIC Committee are submitted to the American National Standards Institute and published on the National Board web-site to invite comments from all interested persons. After the allotted time for public review and final approval, the new edition is published. The Foreword, Introduction, Personnel and Index Sections of the NBIC are provided for guidance and informational purposes only and shall not be considered a part of the Code. These sections are not approved by the NBIC Committee or submitted to the American National Standards Institute.

Organizations or users of pressure-retaining items are cautioned against making use of revisions that are less restrictive than former requirements without having assurance that they have been accepted by the Jurisdiction where the pressure-retaining item is installed.

The general philosophy underlying the NBIC is to parallel those provisions of the original code of construction, as they can be applied to post-construction activities. The NBIC does not contain rules to cover all details of post-construction activities. Where complete details are not given, it is intended that individuals or organizations, subject to the acceptance of the Inspector and Jurisdiction when applicable, provide details

for post-construction activities that will be as safe as otherwise provided by the rules in the original code of construction.

Activities not conforming to the rules of the original code of construction or the NBIC must receive specific approval from the Jurisdiction, who may establish requirements for design, construction, inspection, testing, and documentation.

There are instances where the NBIC serves to warn against pitfalls; but the code is not a handbook, and cannot substitute for education, experience, and sound engineering judgment. It is intended that this edition of the NBIC not be retroactive. Unless the Jurisdiction imposes the use of an earlier edition, the latest effective edition is the governing document.



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PERSONNEL XXI

PART 1, SECTION 1 INSTALLATION — GENERAL GUIDELINES

(17) 1.1 SCOPE

This part provides requirements and guidelines for the installation of power boilers, steam heating boilers, hot-water heating boilers, hot-water supply boilers, potable water heaters, pressure vessels and piping.

The proper installation of boilers, pressure vessels, piping, and other pressure-retaining items is essential for safe and satisfactory operation. The owner-user is responsible for ensuring that installations meet all the requirements of the Jurisdiction at the point of installation including licensing, registration, or certification of those performing installations. NBIC Part 1 identifies minimum safety requirements for installing pressure-retaining items when NBIC Part 1 is mandated by a Jurisdiction. Otherwise, the requirements specified in NBIC Part 1 provide information and guidance for installers, contractors, owners, inspectors, and Jurisdictions to ensure safe and satisfactory installation of specified pressure-retaining items. Jurisdictions may require other safety standards, including following manufacturer's recommendations. When a Jurisdiction establishes different requirements or where a conflict exists, the rules of the Jurisdiction prevail. Users of NBIC Part 1 are cautioned that other requirements may apply for a particular installation and NBIC Part 1 is not a substitute for sound engineering evaluations.

1.2 PURPOSE

- a) The purpose of these rules are to establish minimum requirements, which, if followed, will ensure that pressure-retaining items, when installed, may be safely operated, inspected, and maintained.
- b) It should be recognized that many of the requirements included in these rules must be considered in the design of the pressure-retaining item by the manufacturer. However, the owner-user is responsible for ensuring that the installation complies with all the applicable requirements contained herein. Further, the installer is responsible for complying with the applicable sections when performing work on behalf of the owner-user.

1.3 APPLICATION OF THESE RULES

- a) As referenced in lower case letters, the terms "owner," "user," or "owner-user" means any person, firm, or corporation legally responsible for the safe operation of the boiler, pressure vessel, piping, or other pressure-retaining item. Further, where the term "owner" is used, it shall mean the owner, or user, or the owner's or user's designee.
- b) Where the owner is required to perform an activity, it is intended that the owner or the owner's designee may perform the activity; however, the owner retains responsibility for compliance with these rules.
- c) These rules refer to documentation obtained from the Jurisdiction (installation permit, operating permit). It is not intended to require the Jurisdiction to issue such permits but rather a caution to owners and installers that such permits may be required.

1.4 CERTIFICATION, INSPECTION, AND JURISDICTIONAL REQUIREMENTS

1.4.1 RESPONSIBILITY

- a) The owner is responsible for satisfying jurisdictional requirements for certification and documentation. When required by jurisdictional rules applicable to the location of installation, the boilers, pressure vessels, piping, and other pressure-retaining items shall not be operated until the required documentation has been provided by the installer to the owner and the Jurisdiction.

- b) The National Board Commissioned Inspector providing inservice inspection for the facility in which the pressure-retaining item is installed has the following responsibilities:
 - 1) Verify the *Boiler Installation Report* (I-1 Report) has been completed and signed by the installer, when required by the Jurisdiction;
 - 2) Verify pressure-retaining items comply with the laws and regulations of the Jurisdiction governing the specific type of boiler or pressure vessel;
 - 3) Verify any repairs or alterations to pressure-retaining items, which are conducted prior to, or during, the initial installation, are in accordance with the NBIC;
 - 4) Request or assign jurisdictional identification number, when required by the Jurisdiction; and
 - 5) Complete and submit the first inservice inspection/certificate report to the Jurisdiction when required by the Jurisdiction.
- c) Unless otherwise specifically required by the Jurisdiction, the duties of the inservice inspector do not include the installation's compliance to other standards and requirements (e.g., environmental, construction, electrical, undefined industry standards, etc.) for which other regulatory agencies have authority and responsibility to oversee.

1.4.2 EQUIPMENT CERTIFICATION

- a) All boilers, pressure vessels, piping, and other pressure-retaining items shall have documented certification from the manufacturer indicating that the boiler, pressure vessel, piping, or any other pressure-retaining items comply with the requirements of the code of construction. The certification shall identify the "Addenda" for a code of construction to which all pressure-retaining items were fabricated.
- b) Package boilers having external piping disassembled and shipped with the boiler shall have a method for traceability of the disassembled piping that can be verified at the time of installation and inspection. The manufacturer of the package boiler is responsible for determining a method of traceability.

1.4.3 JURISDICTIONAL REVIEW

- a) The owner shall determine jurisdictional requirements (e.g., certificates, permits, licenses, etc.) before installing the equipment. The organization responsible for installation shall obtain all permits required by the Jurisdiction prior to commencing installation.
- b) The owner shall determine jurisdictional requirements (e.g., certificates, permits, licenses, etc.) before operating the equipment. The owner shall obtain operating certificates, permits, etc., required by the Jurisdiction prior to commencing operation.

1.4.4 INSPECTION

All boilers, pressure vessels, piping, and other pressure-retaining items shall be inspected and tested after installation and prior to commencing operation.

1.4.5 BOILER INSTALLATION REPORT

- a) Upon completion, inspection, testing, and acceptance of the installation, the installer shall complete and certify the *Boiler Installation Report* (I-1) for all power boilers, hot-water heating boilers, steam-heating boilers, hot-water supply boilers, and potable water heaters.

b) The *Boiler Installation Report* (I-1) shall be submitted as follows:

- 1) One copy to the owner; and
- 2) One copy to the Jurisdiction, if required.

1.4.5.1 BOILER INSTALLATION REPORT FORM, see Pg. 5

1.4.5.1.1 GUIDE FOR COMPLETING NATIONAL BOARD BOILER INSTALLATION REPORT

- 1) INSTALLATION: Indicate the type and date of installation — new, reinstalled, or second hand.
- 2) INSTALLER: Enter the installer's name and physical address.
- 3) OWNER-USER: Enter the name and mailing address of the owner-user of the boiler.
- 4) OBJECT LOCATION: Enter the name of the company or business and physical address where the installation was made.
- 5) JURISDICTION NO.: Enter the Jurisdiction number if assigned at the time of installation.
- 6) NATIONAL BOARD NO.: Enter the assigned National Board number.
Note:
Cast-iron section boilers do not require National Board registration.
- 7) MANUFACTURER: Enter the boiler manufacturer's name.
- 8) MFG. SERIAL NO.: Enter the assigned boiler manufacturer's serial number.
- 9) YEAR BUILT: Enter the year the boiler was manufactured.
- 10) BOILER TYPE: Enter the type of boiler, e.g., watertube, firetube, cast iron, electric, etc.
- 11) BOILER USE: Enter the service for which or for how the boiler will be used, e.g., heating (steam or water), potable water, etc.
- 12) FUEL: Enter the type of fuel, e.g., natural gas, diesel, wood, etc. If more than one fuel type, enter the types for which the boiler is equipped.
- 13) METHOD OF FIRING: Enter the method of firing, e.g., automatic, hand, stoker, etc.
- 14) Btu/KW INPUT: Enter the Btu/hr or kW input of the boiler.
- 15) Btu/KW OUTPUT: Enter the Btu/hr or kW output of the boiler.
- 16) OPERATING PSI: Enter the allowed operating pressure.
- 17) ASME CODE STAMP(S): Check the ASME Code stamp shown on the code nameplate or stamping of other certification mark (specify).
- 18) STAMPED MAWP: Enter the maximum allowable working pressure shown on the nameplate or stamping.
- 19) HEATING SURFACE SQ. FT.: Enter the boiler heating surface shown on the stamping or nameplate.
Note:
This entry is not required for electric boilers.
- 20) CAST IRON: Enter the total number of sections for cast-iron boilers.



- 21) MANHOLE: Indicate whether the boiler has a manway.
- 22) SPECIFIC ON-SITE LOCATION: Enter the on-site location of the boiler in sufficient detail to allow location of that boiler.
- 23) PRESSURE RELIEF VALVE SIZE: Enter the inlet and outlet size of all installed boiler safety or safety relief valves.
- 24) PRESSURE RELIEF VALVE SET PRESSURE: Enter the set pressure of all installed boiler safety or safety relief valves.
- 25) PRESSURE RELIEF VALVE CAPACITY: Enter the capacity in either lbs. of steam per hour or Btu/hr for each installed boiler safety or safety relief valve.
- 26) MANUFACTURER: Enter the manufacturer of each installed boiler safety and safety relief valve.
- 27) LOW-WATER FUEL CUTOFF: Enter the manufacturer's name, type, number, and maximum allowable working pressure of all installed low-water fuel cutoff devices.
- 28) PRESSURE/ALTITUDE GAGE: Enter the dial range of the installed pressure or altitude gage, cutout valve or cock size, a maximum allowable working pressure, and gage pipe connection size. For steam boilers, indicate gage siphon or equivalent device installed.
- 29) EXPANSION TANK: Indicate code of construction of installed expansion tank, tank maximum allowable working pressure, and tank capacity in gallons.
- 30) VENTILATION AND COMBUSTION AIR: Indicate total square inches of unobstructed opening or total cubic feet per minute of power ventilator fan(s) available for ventilation and combustion air.
- 31) WATER LEVEL INDICATORS: Enter the number of gage glasses and/or remote indicators and connecting pipe size.
- 32) FEEDWATER SUPPLY: Enter the total number of feeding means, connecting pipe size, stop and check valve size, and maximum allowable working pressure.
- 33) STOP VALVE(S): Enter the number of stop valves installed, valve size, and maximum allowable working pressure.
- 34) POTABLE WATER HEATER UNIQUE REQUIREMENTS: Indicate if stop valves are installed and, if so, enter size and maximum allowable working pressure. Enter drain valve size and indicate installation of thermometer at or near boiler outlet.
- 35) MANUFACTURER'S CERTIFICATION ATTACHED: Indicate if manufacturer's certificate is attached (mandatory for new installations).
- 36) CLEARANCE REQUIREMENTS AND REPLACEMENT OF EXISTING BOILER: Indicate clearances and whether the installation replaced an existing boiler.
- 37) ADDITIONAL REMARKS: Enter any remarks or comments you deem appropriate.
- 38) INSTALLER'S NAME AND SIGNATURE: Print installer name and registration number and sign completed report.
- 39) BOTTOM BLOWDOWN CONNECTIONS: Indicate number of valves, valve size, and MAWP. Indicate if piping run is full size to point of discharge.
- 40) EXTERNAL PIPING ASME CODE AND FUEL TRAIN: Indicate if external piping is ASME Code, if not, indicate what code or standard external piping is manufactured to. Indicate if the fuel train meets the requirements of CSD-1 or NFPA-85. If other, indicate code or standard used.



BOILER INSTALLATION REPORT I-1

 INSTALLATION: ① ☐ New ☐ Reinstalled ☐ Second Hand Date ____/____/____

② INSTALLER	③ OWNER-USER	④ OBJECT LOCATION
Name	Name	Name
Street	Street, PO Box, RR	Street
City, State, ZIP	City, State, ZIP	City, State, ZIP

Jurisdiction No. ⑤	National Board No. ⑥	Manufacturer ⑦		Mfg. Serial No. ⑧	Year Built ⑨	Boiler Type ⑩	Boiler Use ⑪
Fuel ⑫	Method of Firing ⑬	Btu/kw input ⑭	Btu/kw output ⑮	Operating PSI ⑯	Code Stamp(s) ⑰	☐ A ☐ S ☐ U ☐ HLW ☐ M ☐ E ☐ H ☐ Other	
Stamped MAWP ⑱	Heating Surface, Sq. Ft. ⑲	Cast Iron ⑳	Manhole ㉑	Specific On-Site Location, i.e., Utility Room ㉒			
Pressure Relief Valve Size ㉓	Pressure Relief Valve Set Pressure ㉔	Pressure Relief Valve Capacity ☐ BTU/hr ☐ Lb/hr ㉕	Manufacturer ㉖	Low-Water Fuel Cutoff Mfg. No. ㉗ Probe Type _____ Flow Switch _____ Float & Chamber _____ Other (Specify) _____			
1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____				

PRESSURE/ALTITUDE GAGE: ㉘ Dial Graduation _____ Valve/Cock Size _____ MAWP _____ Pipe Connection Size _____ Siphon or Equivalent Device ☐ Yes ☐ No	EXPANSION TANK: ㉙ ASME Constructed ☐ Yes ☐ No Other _____ MAWP _____ No. Gallons _____	VENTILATION AND COMBUSTION AIR ㉚ Unobstructed Opening (sq. in.) _____ Power Ventilator Fan (CFM) _____
WATER LEVEL INDICATORS: ㉛ Number of Gage Glasses _____ Number of Remote Indicators _____ Size of Connection Piping _____	FEEDWATER SUPPLY: ㉜ Number of Feeding Means _____ Pipe Size _____ Stop Valve Size _____ MAWP _____ Check Valve Size _____ MAWP _____	
STOP VALVES: ㉝ Number of Valves _____ Valve Size _____	EXTERNAL PIPING ASME CODE: ㉞ ☐ Yes ☐ No ☐ Other _____	FUEL TRAIN: ㉟ ☐ CSD-1 ☐ NFPA-85 ☐ Other _____
BOTTOM BLOWDOWN CONNECTIONS: ㊱ Number of Valves _____ Valve Size _____ MAWP _____ Piping Run Full Size ☐ Yes ☐ No	POTABLE WATER HEATER UNIQUE REQUIREMENTS ☐ Yes ☐ No Inlet Stop Valve Size _____ MAWP _____ Outlet Stop Valve Size _____ MAWP _____ Drain Valve Size _____ Thermometer ☐ Yes ㊲	
Manufacturer's Certification Attached: ☐ Yes ☐ No ㊳ Does boiler replace existing one: ☐ Yes ☐ No ㊴	Clearance from walls and floors: Side _____ Bottom _____ Top ㊵	

Additional recommendations and remarks by installer:

㊶ _____ Installer Name (PRINT)		I HEREBY CERTIFY THAT THE INSTALLATION COMPLIES WITH APPENDIX I _____ Installer Signature
_____ Registration #		

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229

NB-365 Rev. 2


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1.5 CHANGE OF SERVICE

See NBIC Part 2, Supplement 9 for requirements and guidelines to be followed when a change of service or service type is made to a pressure-retaining item.

Whenever there is a change of service, the Jurisdiction where the pressure-retaining item is to be operated shall be notified for acceptance, when applicable. Any specific jurisdictional requirements shall be met.

1.6 GENERAL REQUIREMENTS

(17)

The following are general requirements for the boilers, heaters and pressure vessels covered in NBIC Part 1, Section 2, NBIC Part 1 Section 3, NBIC Part 1 Section 4, and NBIC Part 1 Supplement 5. Refer to each referenced section for additional requirements specific to the type of equipment covered by each section.

1.6.1 SUPPORTS, FOUNDATIONS, AND SETTINGS

(17)

Each boiler, heater, vessel and its associated piping must be safely supported. Design of supports, foundations, and settings shall consider vibration (including seismic where necessary), movement (including thermal expansion and contraction), and loadings (including the weight of the fluid in the system during a pressure test) in accordance with jurisdictional requirement, manufactures recommendations, and/or other industry standards, as applicable.

1.6.2 STRUCTURAL STEEL

(17)

- a) If the boiler, heater, or vessel is supported by structural steel work, the steel supporting members shall be so located or insulated that the heat from the furnace will not affect their strength.
- b) Structural steel shall be installed in accordance with jurisdictional requirements, manufacturer's recommendations, and/or other industry standards, as applicable.

1.6.3 EXIT

(17)

Two means of exit shall be provided for equipment rooms exceeding 500 ft.² (46.5 m²) of floor area and containing one or more boilers having a combined fuel capacity of 1,000,000 Btu/hr (293 kW) or more (or equivalent electrical heat input). Each elevation shall be provided with at least two means of exit, each to be remotely located from each other. A platform at top of a single boiler, heater, or vessel is not considered an elevation.

1.6.4 LADDERS AND RUNWAYS

(17)

- a) All walkways, runways, and platforms shall be:
 - 1) of metal construction or equivalent material;
 - 2) provided between or over the top of boilers, heaters, or vessels that are more than 8 ft. (2.4 m) above the operating floor to afford accessibility for normal operation, maintenance, and inspection;
 - 3) constructed of safety treads, standard grating, or similar material and have a minimum width of 30 in. (760 mm);
 - 4) of bolted, welded, or riveted construction; and
 - 5) equipped with handrails 42 in. (1,070 mm) high with an intermediate rail and 4 in. (100 mm) toe board.

- b) Stairways that serve as a means of access to walkways, runways, or platforms shall not exceed an angle of 45 degrees from the horizontal and be equipped with handrails 42 in. (1,070 mm) high with an intermediate rail.
- c) Ladders that serve as a means of access to walkways, runways, or platforms shall:
 - 1) be of metal construction and not less than 18 in. (460 mm) wide;
 - 2) have rungs that extend through the side members and are permanently secured;
 - 3) have a clearance of not less than 30 in. (760 mm) from the front of rungs to the nearest permanent object on the climbing side of the ladder;
 - 4) have a clearance of not less than 6.5 in. (165 mm) from the back of rungs to the nearest permanent object; and
 - 5) have a clearance width of at least 15 in. (380 mm) from the center of the ladder on either side across the front of the ladder.
- d) There shall be at least two permanently installed means of exit from walkways, runways, or platforms that exceed 6 ft. (1.8 m) in length.

(17) 1.6.5 FUEL

All fuel systems shall be installed in accordance with jurisdictional and environmental requirements, manufacturer's recommendations, and/or industry standards, as applicable.

(17) 1.6.6 VENTILATION AND COMBUSTION AIR

- a) The equipment room shall have an adequate air to permit clean, safe combustion, minimize soot formation, and maintain a minimum of 19.5% oxygen in the air of the equipment room and sufficient to maintain ambient temperatures as recommended by the boiler, heater, or vessel manufacturer. The combustion and ventilation air should be supplied by either an unobstructed air opening or by power ventilation or fans. When combustion air is supplied to the boiler by an independent duct, with or without the employment of power ventilators or fans, the duct shall be sized and installed in accordance with the manufacturer's recommendations. However, ventilation for the equipment room must still be considered.
- b) When combustion air is supplied to the boiler, heater, or vessel by an independent duct, with or without the employment of power ventilators or fans, the duct shall be sized and installed in accordance with the manufacturer's recommendations. However, ventilation for the equipment room must still be considered.
- c) Unobstructed air openings shall be sized on the basis of the manufacturer's recommendations, or as specified by the National Fire Protection Association (NFPA) standards for oil and gas burning installations for the particular job conditions, or 1 in.² (650 mm²) free area per 2000 Btu/hr (586 W) maximum fuel input of the combined burners located in the equipment room. The equipment room supply openings shall be kept clear at all times.
- d) Power ventilators or fans shall be sized on the basis of 0.2 cfm (0.0057 m³/min) for each 1000 Btu/hr (293 W) of maximum fuel input for the combined burners of all boilers and heaters located in the equipment room. Additional capacity may be required for other fuel burning equipment in the equipment room.
- e) When power ventilators or fans are used to supply combustion air, they shall be installed with interlock devices so that burners will not operate without an adequate number of ventilators/fans in operation.

- f) The size of openings specified in c) above may be reduced when special engineered air supply systems approved by the Jurisdiction are used.
- g) Care should be taken to ensure that steam, water and fluid lines are not routed across combustion air openings, where freezing may occur.

1.6.7 LIGHTING (17)

The equipment room should be well lighted and it should have an emergency light source for use in case of power failure.

1.6.8 CHIMNEY OR STACK (17)

Chimneys or stacks shall be installed in accordance with jurisdictional and environmental requirements, manufacturer's recommendations, and/or industry standards, as applicable.

1.6.9 FINAL ACCEPTANCE (17)

Boilers, heaters, or pressure vessels may not be placed into service until its installation has been inspected and accepted by the appropriate jurisdictional authorities.

PART 1, SECTION 2 INSTALLATION — POWER BOILERS

(17) 2.1 SCOPE

This section provides requirements and guidelines for the installation of power boilers.

2.2 DEFINITIONS

See NBIC Part 1, Section 9, *Glossary*.

2.3 GENERAL REQUIREMENTS

(17) 2.3.1 SUPPORTS, FOUNDATIONS, AND SETTINGS

See NBIC Part 1, Section 1.6.1, *Supports, Foundations and Settings*.

(17) 2.3.2 STRUCTURAL STEEL

See NBIC Part 1, Section 1.6.2, *Structural Steel*.

2.3.3 CLEARANCES

- a) Boiler installations shall allow for normal operation, maintenance, and inspections. There shall be at least 36 in. (915 mm) of clearance on each side of the boiler to enable access for maintenance and/or inspection activities. Boilers operated in battery shall not be installed closer than 48 in. (1220 mm) from each other. The front or rear of any boiler shall not be located nearer than 36 in. (915 mm) from any wall or structure.

Note:

Alternative clearances in accordance with the manufacturer's recommendations are subject to acceptance by the Jurisdiction.

- b) Boilers shall be installed to allow for removal and installation of tubes.
- c) Boilers with a top-opening manhole shall have at least 84 in. (2135 mm) of unobstructed clearance above the manhole to the ceiling of the equipment room.
- d) Boilers without top-opening manholes shall have at least 36 in. (915 mm) of clearance from the top of the boiler or as recommended by the manufacturer.
- e) Boilers with a bottom opening used for inspection or maintenance shall have at least 12 in. (305 mm) of unobstructed clearance.

2.4 EQUIPMENT ROOM REQUIREMENTS

(17) 2.4.1 EXIT

See NBIC Part 1, Section 1.6.3, *Exit*.

2.4.2 LADDERS AND RUNWAYS

(17)

See NBIC Part 1, Section 1.6.4, *Ladders and Runways*.

2.4.3 DRAINS

At least one floor drain shall be installed in the equipment room.

2.4.4 WATER (CLEANING)

A convenient water supply shall be provided for flushing out the boiler and its appurtenances, adding water to the boiler while it is not under pressure, and cleaning the equipment room floor.

2.5 SOURCE REQUIREMENTS

2.5.1 FEEDWATER

2.5.1.1 VOLUME

The source of feedwater shall be capable of supplying a sufficient volume of water as determined by the boiler manufacturer in order to prevent damage to the boiler when all the safety relief valves are discharging at full capacity.

2.5.1.2 CONNECTION

- a) To prevent thermal shock, feedwater shall be introduced into a boiler in such a manner that the water will not be discharged directly against surfaces exposed to high temperature gases or to direct radiation from the flame.
- b) For boiler operating pressures of 400 psig (2.8 MPa) or higher, 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.
- c) Feedwater other than condensate return shall not be introduced through the blowoff.
- d) Boilers having more than 500 sq. ft. (46.5 sq. m) of water heating surface shall have at least two means of supplying feedwater. For boilers that are fired with solid fuel not in suspension, and boilers whose setting or heat source can continue to supply sufficient heat to cause damage to the boiler if the feedwater supply is interrupted, one such means of supplying feedwater shall not be subject to the same interruption as the first method. Boilers fired by gaseous, liquid, or solid fuel in suspension may be equipped with a single means of supplying feedwater, provided means are furnished for the immediate removal of heat input if the supply of feedwater is interrupted.
- e) For boilers having a water heating surface of not more than 100 sq. ft. (9 sq. m), the feedwater piping and connection to the boiler shall not be smaller than NPS 1/2 (DN 15). For boilers having a water heating surface more than 100 sq. ft. (9 sq. m), the feedwater piping and connection to the boiler shall not be less than NPS 3/4 (DN 20).
- f) Electric boiler feedwater connections shall not be smaller than NPS 1/2 (DN 15).
- g) High-temperature water boilers shall be provided with means of adding water to the boiler or system while under pressure.

**Documents**

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SECTION 2 10

(17) 2.5.1.3 PUMPS

- a) Boiler feedwater pumps shall have discharge pressure in excess of the highest set pressure relief valve in order to compensate for frictional losses, entrance losses, regulating valve losses, and normal static head, etc. Each source shall be capable of supplying feedwater to the boiler at a minimum pressure of 3% higher than the highest setting of any pressure relief valve on the boiler proper. Detailed engineering evaluation of the pump selection shall be performed and available. Table 2.5.1.3 is a guideline for estimating feedwater pump differential.
- b) For forced-flow steam generators with no fixed steam or water line, each source of feedwater shall be capable of supplying feedwater to the boiler at a minimum pressure equal to the expected maximum sustained pressure at the boiler inlet corresponding to operation at maximum designed steaming capacity with maximum allowable pressure at the superheater outlet.
- c) Control devices may be installed on feedwater piping to protect the pump against overpressure.

TABLE 2.5.1.3
GUIDE FOR FEEDWATER PUMP DIFFERENTIAL

Boiler Pressure		Boiler Feedwater Pump Discharge Pressure	
psig	(MPa)	psig	(MPa)
200	(1.38)	250	(1.72)
400	(2.76)	475	(3.28)
800	(5.52)	925	(6.38)
1,200	(8.27)	1,350	(9.31)

2.5.1.4 VALVES

- a) The feedwater piping shall be provided with a check valve and a stop valve. The stop valve shall be located between the check valve and the boiler.
- b) When two or more boilers are fed from a common source, there shall also be a globe or regulating valve on the branch to each boiler located between the check valve and the feedwater source.
- c) When the feedwater piping is divided into branch connections and all such connections are equipped with stop and check valves, the stop and check valve in the common source may be omitted.
- d) On single boiler-turbine unit installations, the boiler feedwater stop valve may be located upstream from the boiler feedwater check valve.
- e) If a boiler is equipped with duplicate feedwater supply arrangements, each such arrangement shall be equipped as required by these rules.
- f) A check valve shall not be a substitute for a stop valve.
- g) A combination feedwater stop-and-check valve in which there is only one seat and disk and a valve stem is provided to close the valve when the stem is screwed down shall be considered only as a stop valve, a separate check valve shall be installed.
- h) Whenever globe valves are used on feedwater piping, the inlet shall be under the disk of the valve.
- i) Stop valves and check valves shall be placed on the inlet of economizers or feedwater-heating devices.

- j) The recirculating return line for a high-temperature water boiler shall be provided with the stop valve, or valves, required for the main discharge outlet on the boiler.

2.5.2 FUEL

(17)

See NBIC Part 1, Section 1.6.5, *Fuel*.

2.5.3 ELECTRICAL

A disconnecting means capable of being locked in the open position shall be installed at an accessible location at the boiler so that the boiler can be disconnected from all sources of potential. This disconnecting means shall be an integral part of the boiler or adjacent to it.

2.5.3.1 WIRING

All wiring for controls, heat generating apparatus, and other appurtenances necessary for the operation of the boiler or boilers should be installed in accordance with the provisions of national or international standards and comply with the applicable local electrical codes.

2.5.3.2 REMOTE EMERGENCY SHUTDOWN SWITCHES

(17)

- a) A manually operated remote shutdown switch(es) or circuit breaker shall be located just outside the equipment room door and marked for easy identification. Consideration should also be given to the type and location of the switch(es) in order to safeguard against tampering. Where approved by the Jurisdiction, alternate locations of remote emergency switch(es) may be provided.
- b) For equipment rooms exceeding 500 ft.² (46 m²) floor area or containing one or more boilers having a combined fuel capacity of 1,000,000 Btu/hr. (293 kW) or more, additional manually operated remote emergency shutdown switches shall be located at suitably identified points of egress acceptable to the Jurisdiction.
- c) Where a boiler is located indoors in a facility and not in an equipment room, a remote emergency shutdown switch shall be located within 50 ft. (15 m) of the boiler along the primary egress route from the boiler area.
- d) For atmospheric-gas burners and for oil burners where a fan is on the common shaft with the oil pump, the emergency remote shutdown switch(es) or circuit breaker(s) must disconnect all power to the burner controls.
- e) For power burners with detached auxiliaries, the emergency remote shutdown switch(es) or circuit breaker(s) need only shut off the fuel input to the burner.

2.5.3.3 CONTROLS AND HEAT-GENERATING APPARATUS

- a) Oil and gas-fired and electrically heated boilers shall be equipped with suitable primary (flame safe-guard) safety controls, safety limit switches and controls, and burners or electric elements as required by a nationally or internationally recognized standard.
- b) The symbol of the certifying organization that has investigated such equipment as having complied with a nationally recognized standard shall be affixed to the equipment and shall be considered as evidence that the unit was manufactured in accordance with that standard.
- c) These devices shall be installed in accordance with jurisdictional and environmental requirements, manufacturer's recommendations, and/or industry standards, as applicable.



Documents

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SECTION 2 | 12

(17) 2.5.4 VENTILATION AND COMBUSTION AIR

See NBIC Part 1, Section 1.6.6, *Ventilation and Combustion Air*.

(17) 2.5.5 LIGHTING

See NBIC Part 1, Section 1.6.7, *Lighting*.

2.5.6 EMERGENCY VALVES AND CONTROLS

All emergency shut-off valves and controls shall be accessible from a floor, platform, walkway, or runway. Accessibility shall mean within a 6 ft. (1.8 m) elevation of the standing space and not more than 12 in. (305 mm) horizontally from the standing space edge.

2.6 DISCHARGE REQUIREMENTS**(17) 2.6.1 CHIMNEY OR STACK**

See NBIC Part 1, Section 1.6.8, *Chimney or Stack*.

2.6.2 ASH REMOVAL

Ash removal systems shall be installed in accordance with jurisdictional and environmental requirements, manufacturer's recommendations, and/or industry standards, as applicable.

2.6.3 DRAINS**2.6.3.1 CONNECTION**

- a) Each boiler shall have at least one drain pipe fitted with a stop valve at the lowest point of the boiler. If the connection is not intended for blowoff purposes, a single valve is acceptable if it can be locked in the closed position or a blank flange can be installed downstream of the valve. If the connection is intended for blowoff purposes, requirements of NBIC Part 1, 2.7.5 shall be followed.
- b) For high-temperature water boilers, the minimum size of the drain pipe shall be NPS 1 (DN 25).
- c) Drain pipes, valves, and fittings within the same drain line shall be the same size.
- d) The discharge from the drain shall be piped to a safe location.

2.6.3.2 PRESSURE RATING

Drain piping from the drain connection, including the required valve(s) or the blanked flange connection, shall be designed for the temperature and pressure of the drain connection. The remaining piping shall be designed for the expected maximum temperature and pressure. Static head and possible choked flow conditions shall be considered. In no case shall the design pressure and temperature be less than 100 psig (700 kPa) and 220°F (104°C), respectively.

2.6.3.3 PARTS

- a) When parts (e.g., economizers, etc.) are installed with a stop valve between the part and the boiler or the part cannot be completely drained through the drain on the boiler, a separate drain shall be installed

on each such part. These drains shall meet the additional requirements of NBIC Part 1, 2.6.3, as applicable.

- b) Each water column shall have a drain pipe fitted with a stop valve at the lowest point of the water column. The stop valve shall have the capability of being locked in the closed position while the boiler is under pressure. The minimum size of the drain shall be NPS 3/4 (DN 20) and all other requirements of NBIC Part 1, 2.6.3, as applicable.

2.7 OPERATING SYSTEMS

2.7.1 BREECHING AND DAMPERS

Breeching and dampers shall be installed in accordance with jurisdictional and environmental requirements, manufacturer's recommendations, and/or industry standards, as applicable.

2.7.2 BURNERS AND STOKERS

Burners and stokers shall be installed in accordance with jurisdictional and environmental requirements, manufacturer's recommendations, and/or industry standards, as applicable.

2.7.3 STEAM SUPPLY

- a) Provisions shall be made for the expansion and contraction of steam mains connected to boiler(s) so that there shall be no undue stress transmitted to the boiler(s). Steam reservoirs shall be installed on steam mains when heavy pulsations of the steam flow cause vibration of the boiler shell plates.
- b) Each discharge outlet of the boiler drum or superheater outlet shall be fitted with a stop valve located at an accessible point in the steam-delivery line and as near the boiler nozzle as is convenient and practicable. The valve shall be equipped to indicate from a distance whether it is closed or open, and shall be equipped with a slow-opening mechanism. When such outlets are over NPS 2 (DN 50), the valve or valves used on the connection shall be of the outside screw-and-yoke-rising spindle type, so as to indicate from a distance by the position of its spindle whether it is closed or open and the wheel should be carried either on the yoke or attached to the spindle. In the case of a single boiler and prime mover installation, the stop valve may be omitted provided the prime mover throttle valve is equipped with an indicator to show whether the valve is open or closed and is designed to withstand the required hydrostatic test pressure of the boiler.
- c) Stop valves and fittings shall comply with the appropriate national standard except that austenitic stainless steel is not permitted for water wetted service.
- d) Stop valves and fittings shall be rated for the maximum allowable working pressure of the boiler and shall be at least rated for 100 psig (700 kPa) at the expected steam temperature at the valve or fitting, in accordance with the appropriate national standard.
- e) The nearest stop valve or valves to the superheater outlet shall have a pressure rating at least equal to the minimum set pressure of any safety valve on the superheater and at the expected superheated steam temperature; or at least equal to 85% of the lowest set pressure of any safety valve on the boiler drum at the expected steam temperature of the superheater outlet, whichever is greater.
- f) Provision for an ample gravity drain shall be provided when a stop valve is so located that water or condensation may accumulate. The gravity drain(s) shall be located such that the entire steam supply system can be drained.
- g) When boilers are connected to a common header, the connection from each boiler having a man-hole opening shall be fitted with two stop valves having an ample free-blow drain between them. The



Documents

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SECTION 2 14

discharge of this drain shall be visible to the operator while operating the valve. The stop valves shall consist of one stop check valve (set next to the boiler) and a second valve of the outside screw-and-yoke type; or two valves of the outside screw-and-yoke type.

- h) The second steam stop valve shall have a pressure rating at least equal to that required for the expected steam temperature and pressure at the valve; or the pressure rating shall be not less than 85% of the lowest set pressure of any safety valve on the boiler drum and for the expected temperature of the steam at the valve, whichever is greater.
- i) Pressure-reducing valves may be installed in the steam supply piping downstream from the required stop valve or valves.

2.7.4 CONDENSATE AND RETURN

Each condensate return pump, where practicable, shall be provided with an automatic water level control set to maintain an adequate water level in the condensate tank. Condensate tanks not constructed in accordance with an accepted code or standard shall be vented to the atmosphere.

(17) 2.7.5 BLOWOFF

- a) Except for forced-flow steam generators with no fixed steam or water line, each boiler shall have a blowoff pipe, fitted with a stop valve, in direct connection with the lowest water space practicable. When the maximum allowable working pressure of the boiler exceeds 100 psig (700 kPa), there shall be two valves installed.
- b) The blowoff piping for each electric boiler pressure vessel having a nominal water content not exceeding 100 gal. (378 l) is required to extend through only one valve.
- c) When two valves are required, each bottom blowoff pipe shall have two slow-opening valves, or one quick-opening valve, at the boiler nozzle followed by a slow-opening valve.
- d) Two independent slow-opening valves or a slow-opening valve and quick-opening valve may be combined in one body provided the combined fitting is the equivalent of two independent slow-opening valves or a slow-opening valve and a quick-opening valve, and the failure of one to operate cannot affect the operation of the other.
- e) Straight-run globe valves or valves where dams or pockets can exist for the collection of sediment shall not be used.
- f) The blowoff valve or valves and the pipe and fittings between them and the boiler shall be of the same size. The minimum size of pipe and fittings shall be NPS 1 (DN 25), except boilers with 100 ft.² (9.3 m²) or less of heating surface should be NPS 3/4 (DN 20). The maximum size of pipe and fittings shall not exceed NPS 2-1/2 (DN 65).
- g) For electric boilers, the minimum size of blowoff pipes and fittings shall be NPS 1 (DN 25), except for boilers of 200 kW input or less. The minimum size should be NPS 3/4 (DN 20).
- h) Fittings and valves shall comply with the appropriate national standard except that austenitic stainless steel and malleable iron are not permitted.
- i) When the maximum allowable working pressure exceeds 100 psig (700 kPa), blowoff piping shall be at least Schedule 80 and the required valves and fittings shall be rated for at least 1.25 times the maximum allowable working pressure of the boiler. When the maximum allowable working pressure exceeds 900 psig (6.2 MPa), blowoff piping shall be at least Schedule 80 and the required valves and fittings shall be rated for at least the maximum allowable working pressure of the boiler plus 225 psi (1.6 MPa).

- j) All blowoff piping, when exposed to furnace heat, shall be protected by fire brick or other heat resisting material so constructed that the piping may be readily inspected.
- k) On a boiler having multiple blowoff pipes, a single master stop valve should be placed on the common blowoff pipe from the boiler and one stop valve on each individual blowoff. Either the master valve or the valves on the individual blowoff lines shall be of the slow-opening type.
- l) The discharge of blowoff pipes shall be located so as to prevent injury to personnel.
- m) All waterwalls or water screens that do not drain back into the boiler and integral economizers forming part of a boiler shall be equipped with blowoff piping and valves conforming to the requirements of this paragraph.
- n) Blowoff piping from a boiler should not discharge directly into a sewer. A blowoff tank, constructed to the provisions of a code of construction acceptable to the Jurisdiction, shall be used where conditions do not provide an adequate and safe open discharge.
- o) Galvanized pipe shall not be used.
- p) Boiler blowoff systems shall be constructed in accordance with the *Guide for Blowoff Vessels* (NB-27): which can be found on the National Board website, www.nationalboard.org.
- q) Where necessary to install a blowoff tank underground, it shall be enclosed in a concrete or brick pit with a removable cover so that inspection of the entire shell and heads of the tank can be made.
- r) 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. Further, such connections shall not exceed NPS 2-1/2 (DN 65).

2.8 CONTROLS AND GAGES

2.8.1 WATER

- a) Each automatically-fired steam boiler shall be equipped with at least two low-water fuel cutoffs. The water inlet shall not feed water into the boiler through a float chamber.
- b) Each electric steam boiler of the resistance element type shall be equipped with an automatic low-water cutoff so located as to automatically cut off the power supply to the heating elements before the surface of the water falls below the visible part of the glass. No low-water cutoff is required for electrode-type boilers.
- c) Designs embodying a float and float bowl shall have a vertical straightaway drainpipe 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.
- d) The water column shall be directly connected to the boiler. Outlet connections (except for damper regulator, feedwater regulator, low-water fuel cutoff, drains, steam gages, or such apparatus that does not permit the escape of an appreciable amount of steam or water) should not be placed on the piping that connects the water column to the boiler.
- e) Straight-run globe valves of the ordinary type shall not be used on piping that connects the water column to the boiler. Where water columns are 7 ft. (2.1 m) or more above the floor level, adequate means for operating gage cocks or blowing out the water glass shall be provided.



- f) When automatic shutoff valves are used on piping that connects the water column to the boiler, they shall conform to the requirements of the code of construction for the boiler.
- g) When shutoff valves are used on the connections to a water column, they shall be either outside-screw-and-yoke or lever-lifting-type gate valves or stop cocks with levers permanently fastened thereto and marked in line with their passage, or of such other through-flow constructions to prevent stoppage by deposits of sediment and to indicate by the position of the operating mechanism whether they are in open or closed position; and such valves or cocks shall be locked or sealed open.
- h) Each steam boiler having a fixed waterline shall have at least one water-gage glass except that boilers operated at pressures over 400 psig (2.8 MPa) shall be provided with two water-gage glasses that may be connected to a single water column or connected directly to the drum. The gage glass connections and pipe connection shall be not less than NPS 1/2 (DN 15). Each water-gage glass shall be equipped with a valved drain.
- i) Electric steam boilers shall have at least one water-gage glass. On electrode-type electric boilers, the gage glass shall be located as to indicate the water levels both at startup and maximum steam load conditions, as established by the boiler manufacturer. On resistance element type electric steam boilers, the lowest visible part of the gage glass shall be located at least 1 in. (25 mm) above the lowest permissible water level established by the boiler manufacturer.
- j) The lowest visible part of the water-gage glass shall be at least 2 in. (50 mm) above the lowest permissible water level established by the boiler manufacturer.
- k) For all installations where the water-gage glass or glasses are not easily viewed by the operator, consideration should be given to install a method of remote transmission of the water level to the operating floor.
- l) Boilers of the horizontal firetube type shall be so set that when the water is at the lowest reading in the water-gage glass, it shall be 3 in. (75 mm) above the lowest permissible water level as determined by the manufacturer. Horizontal firetube boilers that do not exceed 16 in. (400 mm) in inside diameter shall have the lowest visible level in the gage glass at least 1 in. (25 mm) above the lowest permissible level as determined by the manufacturer.
- m) Each water-gage glass shall be equipped with a top and a bottom shutoff valve of such through-flow construction as to prevent blockage by deposits of sediment and to indicate by the position of the operating mechanism whether they are in the open or closed position. 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.

2.8.2 PRESSURE GAGE

- a) Each steam boiler shall have a pressure gage connected to the steam space or to the steam connection to the water column. When a pressure-reducing valve is installed in the steam supply piping, a pressure gage shall be installed on the low pressure side of the pressure-reducing valve.
- b) The dial range shall not be less than 1.5 times and no greater than two times the pressure at which the lowest pressure relief valve is set.

2.8.2.1 CONNECTION

- a) For a steam boiler the gage or connection shall contain a siphon or equivalent device that will develop and maintain a water seal that will prevent steam from entering the gage tube. A valve or cock shall be placed in the gage connection adjacent to the gage. An additional valve or cock should be located near the boiler providing it is locked or sealed in the open position. No other shut-off valves shall be located between the gage and the boiler.

- b) Pressure gage connections shall be suitable for the maximum allowable working pressure and temperature, but if the temperature exceeds 406°F (208°C), brass or copper pipe or tubing shall not be used. The connections to the boiler, except for the siphon, if used, shall not be less than NPS 1/4 (DN 8). Where steel or wrought iron pipe or tubing is used, it shall not be less than 1/2 in. (13 mm) inside diameter. The minimum size of a siphon, if used, shall be 1/4 in. (6 mm) inside diameter.

2.8.3 TEMPERATURE

Each high-temperature water boiler shall have a temperature gage or other reporting device located to provide an accurate representation of the temperature at or near the boiler outlet.

2.8.4 PRESSURE CONTROL

(17)

Each automatically fired steam boiler shall be protected from overpressure by two pressure operated controls.

- a) Each individual steam boiler or each system of commonly connected steam boilers shall have a control that will cut off the fuel supply when the steam pressure reaches an operating limit, which shall be less than the maximum allowable working pressure.
- b) Each individual automatically fired steam boiler shall have a safety limit control, with a manual reset, that will cut off the fuel supply to prevent steam pressure from exceeding the maximum allowable working pressure of the boiler. Each control shall be constructed to prevent a pressure setting above the maximum allowable working pressure of the boiler.
- c) Shutoff valves of any type shall not be placed in the steam pressure connection between the boiler and the controls described in a) and b) above. These controls shall be protected with a siphon or equivalent means of maintaining a water seal that will prevent steam from entering the control. The connections to the boiler shall not be less than NPS 1/4 (DN 8), but where steel or wrought iron pipe or tubing is used, they shall not be less than NPS 1/2 (DN 15). The minimum size of an external siphon shall be NPS 1/4 (DN 8) or 3/8 in. (10 mm) outside diameter nonferrous tubing. For manifold connections, the minimum size shall be as specified in the original code of construction.

2.8.5 AUTOMATIC LOW-WATER FUEL CUTOFF AND/OR WATER FEEDING DEVICE FOR STEAM OR VAPOR SYSTEM BOILERS

(17)

- a) Each automatically fired steam-or vapor-system boiler shall have 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 visible part of the water-gage glass. 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.
- b) Such a fuel cutoff or water feeding device may be attached directly to a boiler. A fuel cutoff or water feeding device may also be installed in the tapped openings available for attaching a water glass directly to a boiler, provided the connections are made to the boiler with nonferrous tees or Y's not less than NPS 1/2 (DN 15) between the boiler and water glass so that the water glass is attached directly and as close as possible to the boiler; the run of the tee or Y shall take the water glass fittings, and the side outlet or branch of the tee or Y shall take the fuel cutoff or water feeding device. The ends of all nipples shall be reamed to full-size diameter.
- c) In addition to the requirements in a) and b) above, a secondary low-water fuel cutoff with manual reset shall be provided on each automatically fired steam or vapor system boiler.
- d) Fuel cutoffs and water feeding devices embodying a separate chamber shall have a vertical drain pipe, extended to a safe point of discharge, and a blowoff valve not less than NPS 3/4 (DN 20), located at the

lowest point in the water equalizing pipe connections so that the chamber and the equalizing pipe can be flushed and the device tested.

2.9 PRESSURE RELIEF VALVES

(17) 2.9.1 VALVE REQUIREMENTS – GENERAL

- a) Only direct spring loaded pressure relief valves or pilot operated pressure relief valves designed to relieve steam shall be used for steam service.
- b) Safety relief valves are valves designed to relieve either steam or water, depending on the application.
- c) Pressure relief valves shall be manufactured in accordance with a national or international standard.
- d) Deadweight or weighted-lever pressure relief valves shall not be used.
- e) For high-temperature water boilers, safety relief valves shall have a closed bonnet, and valve bodies shall not be constructed of cast iron.
- f) Pressure relief valves with an inlet connection greater than NPS 3 (DN 80) used for pressure greater than 15 psig (103 kPa), shall have a flange or a welded inlet connection. The dimensions of flanges subjected to boiler pressure shall conform to the applicable standards.
- g) When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be properly vented and arranged to permit servicing and normal operation of the valve.

2.9.1.1 NUMBER

At least one National Board capacity certified pressure relief valve shall be installed on the boiler. If the boiler has more than 500 ft². (46.5 m²) of heating surface, or if an electric boiler has a power input of more than 3.76 million Btu/hr (1,100 kW), two or more National Board capacity certified pressure relief valves shall be installed.

2.9.1.2 LOCATION

- a) Pressure relief valves shall be placed on, or as close as physically possible to, the boiler proper.
- b) Pressure relief valves shall not be placed on the feedline.
- c) Pressure relief valves shall be connected to the boiler independent of any other connection without any unnecessary intervening pipe or fittings. Such intervening pipe or fittings shall not be longer than the face-to-face dimension of the corresponding tee fitting of the same diameter and pressure rating as listed in the applicable standards.

(17) 2.9.1.3 CAPACITY

- a) The pressure relief valve capacity for each boiler shall be such that the valve or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than 6% above the highest pressure at which any valve is set and in no case to more than 6% above the maximum allowable working pressure of the boiler.
- b) The minimum relieving capacity for other than electric boilers and forced-flow steam generators with no fixed steam line and waterline shall be estimated for the boiler and waterwall heating surfaces as given

in NBIC Part 1, Table 2.9.1.3, but in no case shall the minimum relieving capacity be less than the maximum designed steaming capacity as determined by the manufacturer.

- c) The required relieving capacity in pounds per hour of the pressure relief valves on a high temperature water boiler shall be determined by dividing the maximum output in Btu at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by one thousand.
- d) The minimum pressure relief valve relieving capacity for electric boilers shall not be less than 3.5 lbs/hr/kW (1.6 kg/hr/kW) input.
- e) If the pressure relief valve capacity cannot be computed, or if it is desirable to prove the computations, it should be checked by any one of the following methods; and if found insufficient, additional relieving capacity shall be provided:
 - 1) By performing an accumulation test, that is, by shutting off all other steam discharge outlets from the boiler and forcing the fires to the maximum. This method should not be used on a boiler with a superheater or reheater, or on a high-temperature water boiler;
 - 2) By measuring the maximum amount of fuel that can be burned and computing the corresponding evaporative capacity upon the basis of the heating value of the fuel;
 - 3) By determining the maximum evaporative capacity by measuring the feedwater. The sum of the pressure relief valve capacities marked on the valves shall be equal to or greater than the maximum evaporative capacity of the boiler. This method should not be used on high-temperature water boilers.



TABLE 2.9.1.3

MINIMUM POUNDS OF STEAM PER HOUR PER SQUARE FOOT OF HEATING SURFACE
lb steam/hr ft² (kg steam/hr m²)

	Firetube Boiler	Watertube Boiler
Boiler Heating Surface		
Hand-fired	5 (24)	6 (29)
Stoker-fired	7 (34)	8 (39)
Oil, gas, or pulverized coal	8 (39)	10 (49)
Waterwall Heating Surface		
Hand-fired	8 (39)	8 (39)
Stoker-fired	10 (49)	12 (59)
Oil, gas, or pulverized coal	14 (68)	16 (78)
Copper-finned Watertubes		
Hand-fired		4 (20)
Stoker-fired		5 (24)
Oil, gas, or pulverized coal		6 (29)

Notes:

- When a boiler is fired only by a gas having a heat value not in excess of 200 Btu/ft.³ (7.5MJ/m³), the minimum relieving capacity should be based on the values given for hand-fired boilers above.
- The heating surface shall be computed for that side of the boiler surface exposed to the products of combustion, exclusive of the superheating surface. In computing the heating surface for this purpose only the tubes, fireboxes, shells, tubesheets, and the projected area of headers need to be considered, except that for vertical firetube steam boilers, only that portion of the tube surface up to the middle gage cock is to be computed.
- For firetube boiler units exceeding 8,000 Btu/ft.² (9,085 J/cm.²) (total fuel Btu (J) Input divided by total heating surface), the factor from the table will be increased by 1 (4.88) for every 1,000 Btu/ft.² (1,136 J/cm.²) above 8,000 Btu/ft.² (9,085 J/cm.²). For units less than 7,000 Btu/ft.² (7,950 J/cm.²), the factor from the table will be decreased by 1 (4.88).
- For watertube boiler units exceeding 16,000 Btu/ft.² (18,170 J/cm.²) (total fuel Btu input divided by the total heating surface) the factor from the table will be increased by 1 (4.88) for every 1,000 Btu/ft.² (1,136 J/cm.²) above 16,000 Btu/ft.² (18,170 J/cm.²). For units with less than 15,000 Btu/ft.² (17,034 J/cm.²), the factor in the table will be decreased by 1 (4.88) for every 1,000 Btu/ft.² (1,136 J/cm.²) below 15,000 Btu/ft.² (17,034 J/cm.²).

2.9.1.4 SET PRESSURE

One or more pressure relief valves on the boiler proper shall be set at or below the maximum allowable working pressure. If additional valves are used, the highest pressure setting shall not exceed the maximum allowable working pressure by more than 3%. The complete range of pressure settings of all the pressure relief valves on a boiler shall not exceed 10% of the highest pressure to which any valve is set. Pressure setting of pressure relief valves on high temperature water boilers may exceed this 10% range.

2.9.2 FORCED-FLOW STEAM GENERATOR

For a forced-flow steam generator with no fixed steamline and waterline, equipped with automatic controls and protective interlocks responsive to steam pressure, pressure relief valves may be provided in accordance with the above paragraphs identified in NBIC Part 1, 2.9.1 or the following protection against overpressure shall be provided:

- a) One or more power-actuated pressure relief valves shall be provided in direct communication with the boiler when the boiler is under pressure and shall receive a control impulse to open when the maximum allowable working pressure at the superheater outlet is exceeded. The total combined relieving capacity of the power-actuated pressure relief valves shall be not less than 10% of the maximum design steaming capacity of the boiler under any operating condition as determined by the manufacturer. The valves shall be located in the pressure part system where they will relieve the overpressure. An isolating stop valve of the outside-screw-and-yoke type should be installed between the power-actuating pressure relief valve and the boiler to permit repairs provided an alternate power-actuated pressure relief valve of the same capacity is so installed as to be in direct communication with the boiler;
- b) Pressure relief valves shall be provided having a total combined relieving capacity, including that of the power-actuated pressure relief valve, of not less than 100% of the maximum designed steaming capacity of the boiler, as determined by the manufacturer. In this total, credit in excess of 30% of the total relieving capacity shall not be allowed for the power-actuated pressure relief valves actually installed. Any or all of the pressure relief valves may be set above the maximum allowable working pressure of the parts to which they are connected, but the set pressures shall be such that when all these valves (together with the power-actuated pressure relief valves) are in operation the pressure will not rise more than 20% above the maximum allowable working pressure of any part of the boiler, except for the steam piping between the boiler and the prime mover;
- c) When stop valves are installed in the water-steam flow path between any two sections of a forced-flow steam generator with no fixed steamline and waterline:
 - 1) The power-actuated pressure relief valve shall also receive a control impulse to open when the maximum allowable working pressure of the component, having the lowest pressure level upstream to the stop valve, is exceeded;
 - 2) The pressure relief valve shall be located to provide overpressure protection for the component having the lowest working pressure; and
 - 3) A reliable pressure-recording device shall always be in service and records kept to provide evidence of conformity to the above requirements.

2.9.3 SUPERHEATERS

- a) Every attached superheater shall have one or more pressure relief valves. The location shall be suitable for the service intended and shall provide the overpressure protection required. The pressure drop upstream of each pressure relief valve shall be considered in determining the set pressure and relieving capacity of that valve. If the superheater outlet header has a full, free steam passage from end to end and is so constructed that steam is supplied to it at practically equal intervals throughout its length so that there is a uniform flow of steam through the superheater tubes and the header, the pressure relief valve or valves may be located anywhere in the length of header.
- b) The pressure-relieving capacity of the pressure relief valve or valves on an attached superheater shall be included in determining the number and size of the pressure relief valves for the boiler provided there are no intervening valves between the superheater pressure relief valve and the boiler and the discharge capacity of the pressure relief valve or valves, on the boiler, as distinct from the superheater, is at least 75% of the aggregate capacity required.

- c) Every independently fired superheater that may be shut off from the boiler and permit the superheater to become a fired pressure vessel shall have one or more pressure relief valves having a discharge capacity equal to 6 pounds of steam per hr/ft.² (29 kg per hr per sq. m) of superheater surface measured on the side exposed to the hot gases.
- d) Every pressure relief valve used on a superheater discharging superheated steam at a temperature over 450°F (230°C) shall have a casing, including the base, body, bonnet, and spindle constructed of steel, steel alloy, or equivalent heat-resistant material. The valve shall have a flanged inlet connection or a welded-end inlet connection. The seat and disk shall be constructed of suitable heat-erosive and corrosive-resistant material, and the spring fully exposed outside of the valve casing so that it is protected from contact with the escaping steam.

(17) 2.9.4 ECONOMIZERS

An economizer that can not be isolated from a boiler does not require a pressure relief valve. Economizers that can be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one pressure relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the pressure relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (W) of the economizer, and will be determined from manufacturer data, divided by 1,000 Btu/lb (2,326kJ/kg). The pressure relief valve shall be installed in a location recommended by the manufacturer, when no recommendation exists the location shall be as close as practical to the economizer outlet.

(17) 2.9.5 PRESSURE-REDUCING VALVES

- a) Where pressure-reducing valves are used, one or more pressure relief valves shall be installed on the low pressure side of the reducing valve in those installations where the piping or equipment on the low pressure side does not meet the requirements for the steam supply piping.
- b) The pressure relief valves shall be located as close as possible to the pressure-reducing valve.
- c) Capacity of the pressure relief valves shall not be less than the total amount of steam that can pass from the high pressure side to the low pressure side and be such that the pressure rating of the lower pressure piping or equipment shall not be exceeded.
- d) The use of hand-controlled bypasses around reducing valves is permissible. The bypass around a reducing valve may not be greater in capacity than the reducing valve unless the piping or equipment is adequately protected by pressure relief valves or meets the requirements of the high pressure system.
- e) See Supplement 2 for additional information on the calculation of the required capacity of pressure relief valves installed after pressure-reducing valves.

(17) 2.9.6 INSTALLATION AND DISCHARGE REQUIREMENT

- a) Every boiler shall have outlet connections for the pressure relief valve, or valves, independent of any other outside steam connection, the area of opening shall be at least equal to the aggregate areas of inlet connections of all of the attached pressure relief valves. An internal collecting pipe, splash plate, or pan should be used, provided the total area for inlet of steam is not less than twice the aggregate areas of the inlet connections of the attached pressure relief valves. The holes in such collecting pipes shall be at least 1/4 in. (6 mm) in diameter, and the least dimension in any other form of opening for inlet of steam shall be 1/4 in. (6 mm). If pressure relief valves are attached to a separate steam drum or dome, the opening between the boiler proper and the steam drum or dome shall be not less than 10 times the total area of the pressure relief valve inlet.
- b) Every pressure relief valve shall be connected so as to stand in an upright position with spindle vertical.

- c) The opening or connection between the boiler and the pressure relief valve shall have at least the area of the valve inlet and the inlet pipe to the pressure relief valve shall be as short and straight as possible, no longer than twice the center-to-end (face) dimension of a corresponding tee fitting of the same diameter, pressure class, and connection type. When a discharge pipe is used, the cross-sectional area shall not be less than the full area of the valve outlet or of the total of the areas of the valve outlets. It shall be as short and straight as possible and arranged to avoid undue stresses on the valve or valves.
- d) No valves of any type except a changeover valve as defined below, shall be placed between the pressure relief valves and the boiler, nor on the discharge pipe between the pressure relief valves and the atmosphere.

A changeover valve, which allows two redundant pressure relief valves to be installed for the purpose of changing from one pressure relief valve to the other while the boiler is operating, may be used provided the changeover valve is in accordance with the original code of construction. It is recommended that the Jurisdiction be contacted to determine the acceptability of changeover valves on boiler applications. The changeover valve shall be designed such that there is no intermediate position where both pressure relief valves are isolated from the boiler.

- e) When two or more pressure relief valves are used on a boiler, they should be mounted either separately or as twin valves made by placing individual valves on Y-bases, or duplex valves having two valves in the same body casing. Twin valves made by placing individual valves on Y-bases or duplex valves having two valves in the same body shall be of equal size.
- f) When two valves of different sizes are installed singly, the relieving capacity of the smaller valve shall not be less than 50% of that of the larger valve.
- g) When a boiler is fitted with two or more pressure relief valves on one connection, this connection to the boiler shall have a cross-sectional area not less than the combined areas of inlet connections of all the pressure relief valves with which it connects.
- h) All pressure relief valves shall be piped to a safe point of discharge so located or piped as to be carried clear from running boards or platforms. Provision for an ample gravity drain shall be made in the discharge pipe at or near each pressure relief valve, and where water or condensation may collect. Each valve shall have an open gravity drain through the casing below the level of the valve seat. For iron- and steel-bodied valves exceeding NPS 2 (DN 50), the drain hole shall be tapped not less than NPS 3/8 (DN 10).
- i) Discharge piping from pressure relief valves on high-temperature water boilers shall have adequate provisions for water drainage as well as steam venting.
- j) If a muffler is used on a pressure relief valve, it shall have sufficient outlet area to prevent back pressure from interfering with the proper operation and discharge capacity of the valve. The muffler plates or other devices shall be so constructed as to avoid a possibility of restriction of the steam passages due to deposits. Mufflers shall not be used on high-temperature water boiler pressure relief valves.

2.10 TESTING AND ACCEPTANCE

2.10.1 GENERAL

- a) Care shall be exercised during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the boiler. Where possible, an inspection of the interior of the boiler and its appurtenances shall be made for the presence of foreign debris prior to making the final closure.

- b) Safe operation should be verified by a person familiar with boiler system operations for all boilers and connected appurtenances and all pressure piping connecting them to the appurtenances and all piping up to and including the first stop valve, or the second stop valve when two are required.
- c) The wall thickness of all pipe connections shall comply with the requirements of the code of construction for the boiler.
- d) All threaded pipe connections shall engage at least five full threads of the pipe or fitting.
- e) In bolted connections, the bolts, studs, and nuts shall be marked as required by the original code of construction and be fully engaged (e.g., the end of the bolt or stud shall protrude through the nut).
- f) Washers shall only be used when specified by the manufacturer of the part being installed.

2.10.2 PRESSURE TEST

Prior to initial operation, the completed boiler, including pressure piping, water columns, superheaters, economizers, stop valves, etc., shall be pressure tested in accordance with the original code of construction. Any pressure piping and fittings such as water columns, blowoff valves, feedwater regulators, superheaters, economizers, stop valves, etc., which are shipped connected to the boiler as a unit, shall be hydrostatically tested with the boiler and witnessed by an Inspector.

2.10.3 NONDESTRUCTIVE EXAMINATION

Boiler components and subcomponents shall be nondestructively examined as required by the governing code of construction.

2.10.4 SYSTEM TESTING

Prior to final acceptance, an operational test shall be performed on the complete installation. The test data shall be recorded and the data made available to the jurisdictional authorities as evidence that the installation complies with the provisions of the governing code(s) of construction. This operational test may be used as the final acceptance of the unit.

(17) 2.10.5 FINAL ACCEPTANCE

See NBIC Part 1, Section 1.6.9, *Final Acceptance*.

2.10.6 BOILER INSTALLATION REPORT

- a) Upon completion, inspection, and acceptance of the installation, the installer shall complete and certify the *Boiler Installation Report* I-1. See NBIC Part 1, 1.4.5.1.
- b) The *Boiler Installation Report* I-1 shall be submitted as follows:
 - 1) One copy to the owner; and
 - 2) One copy to the Jurisdiction, if required.

2.11 TABLES AND FIGURES

- a) NBIC Part 1, Table 2.5.1.3 - Guide for Feedwater Pump Differential
- b) NBIC Part 1, Table 2.9.1.3 - Minimum Pounds of Steam per Hour Per Square Foot of Heating Surface