

(14g) **RELIEF VALVE.** A relief valve is an automatic pressure-relieving device actuated by the static pressure upstream of the valve which opens further with the increase in pressure over the opening pressure. It is used primarily for liquid service.

(15) **REPAIR.** Repair is work necessary to restore a boiler or pressure vessel to a safe operating condition.

(15g) **RUPTURE DISK.** A rupture disk is a nonmechanical overpressure relief device that releases pressure when its preestablished rating is attained.

(15m) **SAFETY RELIEF VALVE.** A safety relief valve is an automatic pressure-actuated relieving device suitable for use either as a safety valve or relief valve, depending upon application.

(15n) **SAFETY VALVE.** A safety valve is an automatic pressure-relieving device actuated by the static pressure upstream of the valve and characterized by full-opening pop action. It is used for gas or vapor service.

(16) **SECONDHAND VESSEL.** A boiler or pressure vessel when both location and ownership have been changed subsequent to the original installation.

(23) **WATER HEATER.** A water heater is a closed vessel in which water is heated by the combustion of fuels, electricity, or any other source and withdrawn for use external to the system at pressures not exceeding 160 psig and shall include the apparatus by which heat is generated and all controls and devices necessary to prevent water temperatures from exceeding 210° F.

Note: For further explanation of definitions, see the current edition of the ASME Code—Section VIII—Scope.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. (2) (b), (7), (10), Register, January, 1966, No. 121, eff. 2-1-66; am. (3), (4), (8) (a) and (b), (9), (10), (11), (12), (13), (14), (15), and cr. (16), Register, October, 1970, No. 178, eff. 11-1-70; r. and recr. Register, May, 1974, No. 221, eff. 6-1-74; cr. (Intro.), (1) (a), (2) (a), (5m), (8t), (11j), (13p), (13t), (14g), (15g), (15m), (15n), and (23), am. (2) (b) and (d), r. and recr. (14) and (15), Register, May, 1978, No. 269, eff. 6-1-78; am. (1a) and (15), cr. (9a), (11k) and (11n), Register, June, 1980, No. 294, eff. 7-1-80.

PART II GENERAL RULES

Ind 41.03 Safety rules. (1) MAXIMUM OPERATING PRESSURE. No boiler or pressure vessel shall be operated at a pressure in excess of the maximum operating pressure stated on its current certificate of operation.

(2) **ALTERATION TO SAFETY DEVICES.** No unauthorized person shall remove or tamper with any connected safety device nor shall any person adjust a connected safety valve to a greater relieving pressure than that allowed for the vessel as stated on its current certificate of operation.

(3) **INSTALLATION LOCATION.** Boiler and pressure vessels shall be so installed that there will be sufficient room between the vessel and any ceiling, wall, partition, or floor to facilitate the connection and operation of valves, pipes, and other appurtenances and shall be installed in a manner that will not block any inspection opening.

Note: To assure proper installation, alteration, or repair of a boiler or pressure vessel, it may be necessary to comply with applicable Wisconsin Administrative Code sections in

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addition to the Wisconsin Boiler and Pressure Vessel Code. Some of the Wisconsin Code sections to be considered are as follows:

- Section Ind 64.09 (combustion air intake requirements)
- Section Ind 64.47 (metal smoke stack requirements)
- Section Ind 54.14, 55.29, 56.15, 57.20 and 60.25 (boiler room requirements)
- Section Ind 69.01 (fee schedule)
- Section Ind 64.20 (1) (safety fuel burners)

Wisconsin Administrative Codes may be obtained by contacting State Department of Administration, Document Sales and Distribution, 202 So. Thornton Ave., Madison, Wis. 53702.

(4) **CONTROLS AND HEAT GENERATING APPARATUS.** (a) Oil- and gas-fired and electrically heated boilers shall be equipped with suitable primary (flame safeguard) safety controls, safety limit switches, and burners or electric elements as required by a nationally recognized standard.

(b) The symbol of the certifying organization which has investigated the equipment under par. (a) 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. A certifying organization is one that is acceptable to the department and that provides uniform testing, examination, and listing procedures under established, nationally recognized standards.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. (3), Register, January, 1966, No. 121, eff. 2-1-66; am., Register, February, 1971, No. 182, eff. 3-1-71; cr. (4), February, 1982, No. 314, eff. 3-1-82.

Ind 41.04 Reporting accidents, repairs and alterations. (1) Whenever a boiler or pressure vessel fails and causes injury to any person, the owner or user shall report the facts involved to the department within the following 24 hours. The owner or user shall not remove or disturb the boiler or pressure vessel or any of its parts nor permit any such removal or disturbance prior to receiving authorization from the department, except for the purpose of saving human life or further property damage.

(2) The owner or user shall report any repairs or alterations of a boiler or pressure vessel as required in ch. Ind 42. The owner or user shall also report conversions to other fuels.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. Register, February, 1971, No. 182, eff. 3-1-71; r. and recr., Register, May, 1974, No. 221, eff. 6-1-74; am. (2), Register, May, 1978, No. 269, eff. 6-1-78.

Ind 41.05 Notification of installation of boilers, pressure vessels and power piping. (1) **BOILER OR PRESSURE VESSEL INSTALLATION REGISTRATION.** (a) Installing contractors* shall register with the department the installation of any new or used boiler or pressure vessel before the operation of the boiler or vessel. Registration shall be in writing on form DILHR SBD-6314.

(b) Registration with the department is not required for:

1. New or used boilers or pressure vessels exempted in s. Ind 41.21.
2. Installations in cities of the first class if the appropriate city official has been notified.

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(2) **POWER PIPING INSTALLATION REGISTRATION.** The installing contractor* of any power piping system shall file an installation registration form with the department or with the city if installed in a city of the first class. (See Form SB-5204 for an example of information required on the registration form.)

*Note: Owners or users making their own installations will be considered installing contractors.

(a) **Exceptions.** 1. Registration is not required for power piping of 2 inches nominal pipe size and smaller.

2. Registration with the department is not required for installations in cities of the first class if an installation registration form has been filed with the appropriate city official.

3. Registration is not required for underground power piping used by public utilities as mains for providing heating service.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. Register, February, 1971, No. 182, eff. 8-1-71; r. and recr., Register, May, 1974, No. 221, eff. 6-1-74; r. and recr. Register, May, 1978, No. 269, eff. 8-1-78; cr. (2) (a), Register, June, 1980, No. 294, eff. 7-1-80; r. and recr. (1), Register, February, 1982, No. 314, eff. 3-1-82.

Ind 41.06 Identification of boilers and pressure vessels. (1) The owner or user of a boiler or pressure vessel shall number each vessel in some permanent manner and in an accessible location.

(2) Boilers and pressure vessels subject to periodic inspections (see Ind 41.20) shall be identified by a registration number supplied by the department. The registration number shall be affixed by an authorized inspector. The state tag shall be attached to the vessel at a location which can be easily viewed.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; r. and recr. Register, February, 1971, No. 182, eff. 3-1-71; am. (2), Register, May, 1974, No. 221, eff. 6-1-74.

Ind 41.08 Certificate of competency as inspector. (1) **CERTIFICATE REQUIRED.** An inspection report covering a boiler or pressure vessel may be recognized and accepted only when the inspector holds a valid certificate of competency as a boiler or pressure vessel inspector issued by the department.

(2) **ELIGIBILITY.** (a) The applicant for a certificate of competency as a boiler or pressure vessel inspector shall be an employe of the state, a municipality or an insurance company; or owners or operators of boilers and pressure vessels authorized to make their own inspections.

(3) **QUALIFICATIONS.** The applicant shall have one of the following combinations of education and experience requirements:

(a) A degree in mechanical engineering plus one year experience in design, construction, operation or inspection of high pressure boilers and pressure vessels; or

(b) A degree in a branch of engineering other than mechanical engineering, or an associate degree in mechanical technology, plus 2 years experience in design construction, operation or inspection of high pressure boilers and pressure vessels; or

BOILER AND PRESSURE VESSEL INSTALLATION REGISTRATION

Installing Contractors shall prepare this form in triplicate for each boiler or pressure vessel installed.

Distribute as follows:

WHITE: Attach Registration Fee of \$10.00.

Make check payable to: Department of Industry, Labor & Human Relations.

Send to: Safety & Buildings Division
Box 7969, Madison, WI 53707.

YELLOW: Send to owner. **PINK:** Installer's copy.

STATE OF WISCONSIN DEPARTMENT OF INDUSTRY, LABOR & HUMAN RELATIONS SAFETY AND BUILDINGS DIVISION

(Complete appropriate portion)

BOILER:		
<input type="checkbox"/> POWER	<input type="checkbox"/> HEATING	<input type="checkbox"/> MINIATURE
<input type="checkbox"/> PRESSURE VESSEL		
<input type="checkbox"/> NEW	<input type="checkbox"/> USED	

NAME OF USER OR OWNER:			LOCATION OF INSTALLATION:		
STREET ADDRESS:			WIS. REGISTRATION NO.:	NATIONAL BOARD NO.:	
CITY:	STATE:	ZIP CODE:	MFR. SERIAL NO.:	OTHER NO.:	
NAME OF INSTALLING CONTRACTOR:			SIGNATURE OF INSTALLER:		DATE:
STREET ADDRESS:			CITY:	STATE:	ZIP CODE:

**POWER PIPING
INSTALLATION REGISTRATION**

SB-5204

Installing contractor shall prepare this form in triplicate and distribute as follows:

- White -- Send to Dept. of Industry, Labor & Human Relations, Safety & Buildings Division, P.O. Box 7946, Madison, Wisconsin 53707, or City of Milwaukee, if applicable.
- Yellow -- Send to owner.
- Pink -- Retain for file.

STATE OF WISCONSIN
DEPARTMENT OF INDUSTRY, LABOR AND HUMAN
RELATIONS
SAFETY AND BUILDINGS DIVISION

Complete appropriate portion.

Description of system

Name of user or owner			Location of installation			
Street Address						
City	State	Zip				
Safety valve settings — power source		Capacity	PSIG			
1.	_____	_____	Maximum allowable pressure _____			
2.	_____	_____	Test pressure _____			
3.	_____	_____	Date tested _____			
Name of installing contractor		Street address	City	State	Zip	
I certify this system was installed and tested in accordance with Ind 41.56 of the Wisconsin Administrative Code.						
Date installation completed	Signature of installer			Title	Date registered	

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(c) A high school education or the equivalent plus 3 years experience in high pressure boiler and pressure vessel construction or repair; or in charge of high pressure boiler and pressure vessel operation; or in the inspection of high pressure boilers and pressure vessels.

(4) APPLICATION. (a) All applications for certification or recertification shall be made to the department together with the payment of the application and examination fees.

(b) Upon receipt of the application form, the department shall review and evaluate the application and make all necessary notifications to the applicant.

(5) ISSUANCE OF CERTIFICATE. Certificates of competency for a boiler or pressure vessel inspector will be issued by the department to eligible applicants successfully passing the examinations prescribed by and conducted by the department. The certificate shall bear the name of the applicant, certificate number and expiration date. The certificate shall be valid for a period of one year from the date of issuance.

(a) Applicants failing the examination may apply to retake the examination.

(b) Holders of certificates who do not apply for renewal in any 3-year period may be required to pass a scheduled examination.

(6) RENEWAL OF CERTIFICATE. Upon receipt of written notice of expiration, certification may be renewed. The request for renewal, together with the payment of the renewal fee, shall be filed with the department on or before January 1 of the calendar year for which the certificate is to be valid.

(7) DENIAL OF CERTIFICATE. (a) *Notice of denial.* Upon denial of certification or recertification, the department shall notify the applicant in writing stating the reasons for denial. The notice of denial shall be made by certified mail sent to the address filed with the application. Service will be verified by the certified mail receipt.

(b) HEARING. Upon receipt of denial, any applicant may submit a written request for hearing. The right to hearing shall be waived if the applicant fails to submit the request within 30 days. Hearings will be conducted by the department and the proceedings recorded.

(8) SUSPENSION OR REVOCATION OF CERTIFICATION. The department may suspend or revoke the certification of any inspector for any of the following reasons:

(a) Fraud or deceit in obtaining certification.

(b) Any negligence, incompetence or misconduct in the discharge of the duties required under this chapter.

(c) Conviction of a criminal charge, misdemeanor or local regulation substantially related to the circumstances of the certified inspection activity or adjudication of mental incompetence by the courts.

(9) RECIPROCITY. A certificate of competency may be granted by the department to a boiler or pressure vessel inspector who holds a certificate issued by the national board of boiler and pressure vessel inspectors

or a certificate of competency from a city or state which has adopted the ASME Boiler and Pressure Vessel Code and which holds a written examination similar to that required by the department.

(10) **SUSPENSION AND REVOCATION PROCEEDINGS.** (a) *Investigation and notification.* The department will investigate alleged violations at its own initiative or upon the filing of a complaint. If it is determined that no further action is warranted, the department will notify the persons affected. If the department determines that there is probable cause for suspension, it shall order a hearing and notify, by mail, the persons affected.

(b) *Response.* Upon receipt of hearing notice, the charged party may respond to the charges in writing. Failure to respond within 30 days or failure to appear at the hearing may result in the charges being taken as true.

(c) *Hearings.* All hearings will be conducted by persons selected by the department.

(d) *Findings.* Any findings shall be in writing and shall be binding unless appealed to the secretary of the department.

(e) *Appeals.* All appeal arguments shall be submitted in writing.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; r. and recr. Register, February, 1971, No. 182, eff. 3-1-71; am. (1), (3) (c), (4) (a), (6) (a) 1. and 3., Register, May, 1974, No. 221, eff. 6-1-74; am. (2) (b) and (5) (a), r. (6) (a) 3., Register, May, 1978, No. 269, eff. 6-1-78; r. and recr., Register, June, 1980, No. 294, eff. 7-1-80.

Ind 41.10 Adoption of standards. (1) The standards, amendments and errata issued by the American society of mechanical engineers as listed in table 41.10-A are hereby incorporated by reference into this code.

(2) Pursuant to s. 227.025, Stats, consent has been granted to incorporate by reference the rules contained in the standards, amendments and errata listed in table 41.10-A.

(a) Copies are on file in the offices of the department, the secretary of state and the revisor of statutes.

(b) Copies may be procured for personal use from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th St., New York, New York 10017.

(c) Copies may be on file at public and university libraries.

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TABLE 41.10-A

			As amended by Summer Addenda issued June 30th and Winter Addenda issued December 31st of each respective year: S-Summer; W-Winter.		
ASME			1980	1981	1982
1. Section	I	Power Boilers, 1980 Edition	S	W	
2. Section	II	Material Specifications, 1980 Edition			
	a.	Part A—Ferrous Material	S	W	
	b.	Part B—Nonferrous Material	S	W	
	b.	Part C—Welding Rods, Electrodes and Filler Metals	S		
3. Section	III	Nuclear Power Plant Components, 1980 Edition			
	a.	Division 1 and Division 2 General Requirements Subsection NCA	S	W	
		Division 1			
	a.	Subsection NB—Class 1 Components	S	W	
	b.	Subsection NC—Class 2 Components	S	W	
	c.	Subsection ND—Class 3 Components	S	W	
	d.	Subsection NE—Class MC Components	S	W	
	e.	Subsection NF—Component Supports	S	W	
	f.	Subsection NG—Core Support Structures	S	W	
	g.	Appendices	S	W	
		Division 2			
	a.	Concrete Reactor Vessels and Containments	S	W	
4. Section	IV	Heating Boilers, 1980 Edition	S	W	
5. Section	V	Nondestructive Examination, 1980 Edition	S	W	
6. Section	VIII	Pressure Vessels, 1980 Edition			
	a.	Division 1—Pressure Vessels	S	W	
	b.	Division 2—Alternative Rules	S	W	
7. Section	IX	Welding and Brazing Qualifications, 1980 Edition	S	W	
8. Section	X	Fiberglass-Reinforced Plastic Pressure Vessels, 1980 Edition	--	W	
9. Section	XI	Rules for Inservice Inspection of Nuclear Power Plant Components, Division 1, 1980 Edition	--	W	
ANSI					
10.	Power Piping (ANSI B31.1, 1980 edition)				

History: Cr. Register, May, 1974, No. 221, eff. 6-1-74; r. and recr. Register, April, 1976, No. 232, eff. 5-1-76; r. and recr. table Register, May, 1976, No. 245, eff. 6-1-76; r. and recr. table, Register, March, 1977, No. 255, eff. 4-1-77; am. table, Register, September, 1978, No. 273, eff. 10-1-78; am. table, Register, June, 1980, No. 294, eff. 7-1-80; r. and recr. table, cr. (2) (c), Register, February, 1982, No. 314, eff. 3-1-82.

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(a) *When internal inspection is not possible.* Where an internal inspection is not possible because of the construction of the boiler, an external inspection will be acceptable.

(4) **INSPECTION OF PRESSURE VESSELS.** Except as regulated in s. Ind 41.21, pressure vessels shall be subjected to a regular internal or external inspection at least once every 36 months by a qualified inspector.

(5) **INSPECTION OF LOW PRESSURE STEAM AND HOT WATER HEATING BOILERS.** Except as regulated in s. Ind 41.21, low pressure steam and hot water heating boilers shall be subjected to a regular external or internal inspection at least once every 36 months by a qualified inspector.

(6) **INSPECTION OF SAFETY VALVES AND SAFETY RELIEF VALVES.** The inspectors shall satisfy themselves that safety valves and safety relief valves have been manually tested at least once per year.

(7) **EXTENSION OF PERIOD BETWEEN INSPECTIONS.** If operating conditions require, an extension of periods between inspections of boilers, pressure vessels, safety valves and safety relief valves may be approved by the department upon a written request from the owner or user for an extension.

Note: For inspection fees, see ch. Ind 69, Wis. Adm. Code

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. (2), (3), (4), Register, October, 1970, No. 178, eff. 11-1-70; renum. (1), (2), (3), (4) to be (3), (4), (5) and (6) and cr. (1) and (2), Register, April, 1973, No. 208, eff. 5-1-73; r. and recr. (3), (4), (5) and r. (6), Register, May, 1974, No. 221, eff. 6-1-74; am. (2) (intro.), (4) and (5), Register, May, 1978, No. 269, eff. 6-1-78; cr. (6) and (7), Register, February, 1982, No. 314, eff. 3-1-82.

Ind 41.21 Exemptions from periodic inspections. (1) The following will not be subject to periodic inspection:

(a) Boilers or pressure vessels which receive regular inspections by United States government inspectors.

(b) Steam boilers having an internal or external operating pressure not exceeding 15 psig with an input not exceeding 500,000 Btu per hour and hot water heating boilers having an operating pressure not exceeding 30 psig with an input not exceeding 500,000 Btu per hour, all of which are located in buildings other than apartment buildings.

(c) Heating boilers, which are either steam boilers having an internal or external operating pressure not exceeding 15 psig or hot water heating boilers having an operating pressure not exceeding 30 psig and located in private residences or in apartment buildings having less than 6 living units.

Note: The department does not require periodic inspections of steam and hot water heating boilers installed in apartment buildings of 6 or more units prior to June 1, 1978.

(d) Expansion tanks for hot water heating boilers having an operating pressure of less than 50 psig with no limitation on size.

(e) Boilers used exclusively for agricultural purposes.

(f) Miniature boilers.

(g) Pressure vessels having an inside diameter not exceeding 6 inches with no limit on pressure.

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(h) Pressure vessels having a volume of less than 5 cubic feet and an operating pressure of less than 250 psi.

(i) Pressure vessels with a volume of less than 1-½ cubic feet with no limit on pressure.

(j) Pressure vessels having an internal or external operating pressure of not more than 15 psig with no limitations on size.

(k) Hot water supply boilers, water heaters and hot water storage tanks.

(l) Vessels used for the storage or processing cold water, including those with air cushions.

(m) Pressure vessels which are used in accordance with the regulations of the U.S. department of transportation.

(2) EXCEPTION. In individual cases, the boilers and pressure vessels exempted in sub. (1) will be subject to inspection by or on order of the department upon complaint of any person or upon initiative of the department when there is reasonable cause to suspect that the construction, installation, maintenance or operation of the vessel is not in keeping with the general purpose and intent of this code.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; r. and recr. Register, February, 1971, No. 182, eff. 3-1-71; am. (1) (b), (i) and (j), Register, May, 1974, No. 221, eff. 6-1-74; r. and recr. Register, May, 1978, No. 269, eff. 6-1-78.

Ind 41.22 Preparation for internal inspection. The owner or user of a boiler or a pressure vessel subject to inspection shall prepare the vessel for internal inspection after due notice from the inspector. To prepare a vessel for an internal inspection all manhole plates, all wash-out plugs, and a sufficient number of handhole plates to permit a satisfactory inspection shall be removed. The shell and heads shall be thoroughly cleaned and exposed when so requested. Each steam boiler shall be thoroughly drained of water and all fire side surfaces cleaned before an internal inspection is made.

Note: The following precautionary procedure is the recommended preparation for inspection:

Before opening the manhole or manholes and entering any part of a boiler which is connected to a common header with other boilers, the required steam or water system stop valves should be closed, tagged, and preferably padlocked, and drain valves or cocks between the two closed stop valves opened. The feed valves should be closed, tagged, and preferably padlocked, and drain valves or cocks located between the two valves opened. After draining the boiler, the blowoff valves should be closed, tagged and preferably padlocked. Blowoff lines, where practicable, should be disconnected between pressure parts and valves. All drains and vent lines should be opened.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; r. and recr. Register, February, 1971, No. 182, eff. 3-1-71.

Ind 41.23 Insurance company inspections. (1) Periodic inspections of boilers and pressure vessels by insurance companies may be accepted by the department under the following conditions:

(a) The boiler and pressure vessel inspectors employed by the insurance company shall hold certificates of competency issued by the department.

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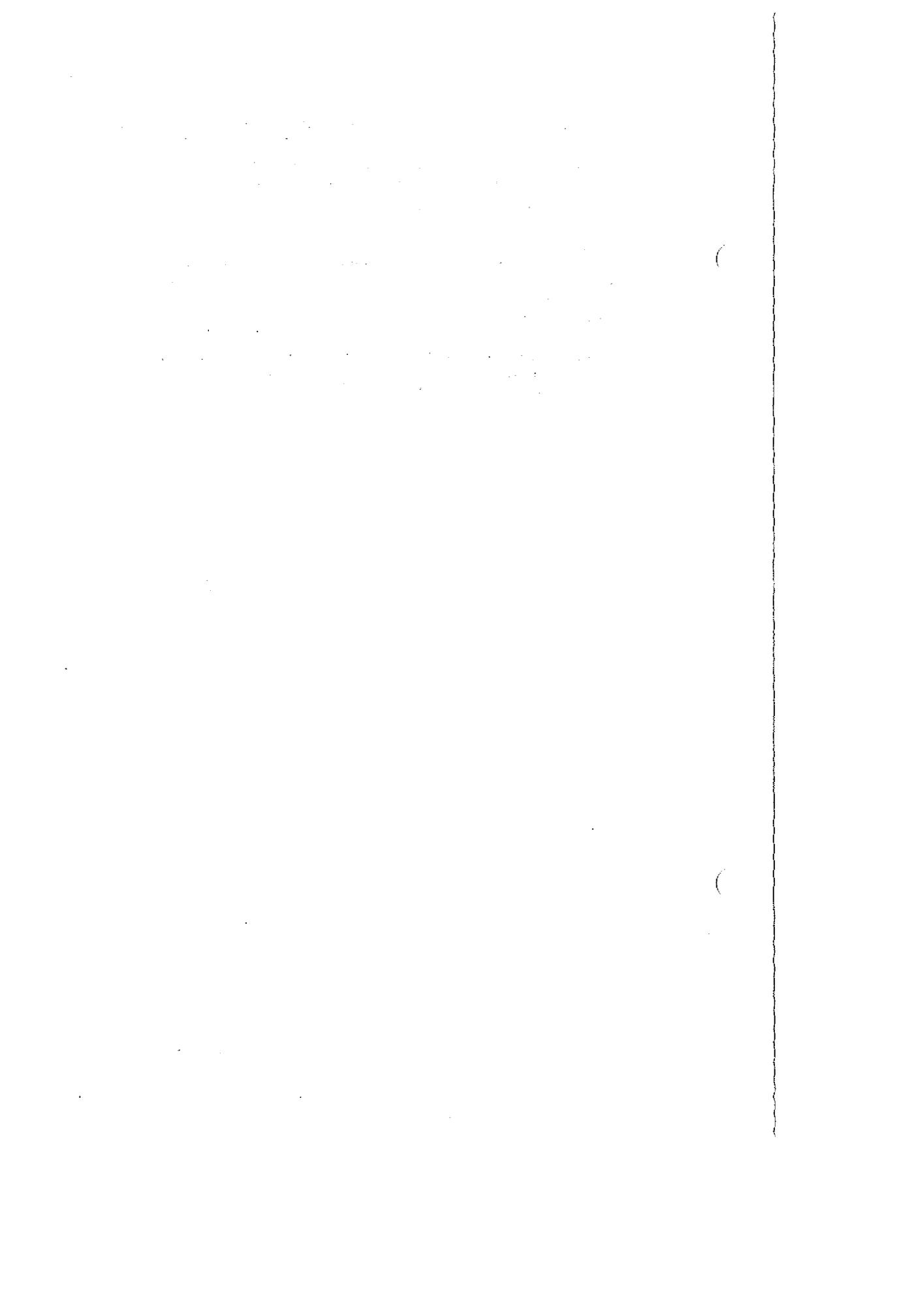
(b) The insurance company shall report inspections of boilers and pressure vessels to the department as required in s. Ind 41.26.

(c) The inspection procedures used by the insurance company shall conform to the regulations of this code.

(d) The insurance company shall report to the department within 30 days when insurance coverage is started or discontinued on a boiler or pressure vessel. The reason for discontinuing the coverage shall be given on the report.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; r. and recr. Register, February, 1971, No. 182, eff. 3-1-71; am. (1) (a), (b) and (d), Register, May, 1974, No. 221, eff. 6-1-74.

Ind 41.24 Inspections by cities. (1) Periodic inspections of boilers and pressure vessels by cities of the first class may be accepted by the department under the following conditions:



Ind 41.66 Dished head restrictions. Dished heads without skirts or flanges shall not be used for any pressure.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.67 Pressure calculation for furnaces and circular flues. The maximum allowable working pressure on furnaces of vertical boilers and circular flues shall be determined as indicated in ss. Ind 41.50 and 41.51.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.68 Boiler plate thickness. (1) The minimum thickness of any boiler plate under pressure shall be 1/4 inch except that boiler plate in stayed surfaces shall be 5/16 inch thick minimum.

(2) Seamless shells for miniature boilers may be constructed of 3/16 inch boiler plate.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.69 Other methods of installing safety devices and other appliances. Where the ASME codes listed in s. Ind 41.10 permit other methods of installing safety devices and other appliances on boilers, these methods may be used on existing boilers.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. Register, May, 1974, No. 221, eff. 6-1-74.

Ind 41.70 Factor of safety. Maximum allowable working pressure shall be determined by using a factor of safety of at least 5 except as provided in s. Ind 41.62.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.71 Strength of materials. When the tensile strength of materials is not known, it shall be taken as 55,000 pounds per square inch for steel and 45,000 pounds per square inch for wrought iron, 30,000 pounds per square inch for copper and 18,000 pounds per square inch for cast iron. The resistance to crushing of mild steel shall be taken as 95,000 pounds per square inch of cross sectional area.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.72 Shearing strength of rivets. (1) MAXIMUM PER SQUARE INCH. The maximum shearing strength of rivets per square inch of cross-sectional area shall be taken as follows:

	Ultimate strength Pounds per Square inch
Iron rivets in single shear	38,000
Iron rivets in double shear	76,000
Steel rivets in single shear	44,000
Steel rivets in double shear	88,000

(2) RIVET DIMENSIONS AFTER DRIVING. When the diameter of the rivet holes in the longitudinal joints of a boiler is not known, the diameter and cross-sectional area of rivets, after driving, shall be taken from Table 3.

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TABLE 3

Thickness of Plate	1/4" 0.25"	9/32" 0.2812"	5/16" 0.3125"	11/32" 0.34375"	3/8" 0.375"	3/8" 0.375"	13/32" 0.40625"
Diameter of Rivet after Driving	11/16"	11/16"	3/4"	3/4"	3/4" up to and including 2" pitch	13/16" Over 2" pitch	13/16"
Cross sectional area of rivet after driving	0.3712 sq. in.	0.3712 sq. in.	0.4418 sq. in.	0.4418 sq. in.	0.4418 sq. in.	0.5185 sq. in.	0.5185 sq. in.
Thickness of Plate	7/16" 0.4375"	7/16" 0.4375"	15/32" 0.46875"	1/2" 0.5"	9/16" 0.5625"	5/8" 0.625"	
Diameter of Rivet after Driving	7/8" up to and including 2-1/4" pitch	15/16" over 2-1/4" pitch	15/16"	15/16"	1-1/16"	1-1/16"	
Cross sectional area of rivet after driving	0.6013 sq. in.	0.6903 sq. in.	0.6903 sq. in.	0.6903 sq. in.	0.8866 sq. in.	0.8866 sq. in.	

History: Cr. Register, April, 1961, No. 64, eff. 6-1-61; am. table, Register, February, 1982, No. 314, eff. 3-1-82.

Ind 41.73 Efficiency of joint. The efficiency of a joint is the ratio which the strength of the joint bears to strength of the solid plate, and shall be determined as follows:

- (1) For riveted joints, calculate according to ss. Ind 41.50 and 41.51 using the values stated in ss. Ind 41.71 and 41.72.
- (2) For welded joints, calculate by reference to Table 4.

TABLE 4
MAXIMUM ALLOWABLE EFFICIENCIES FOR FUSION
WELDED JOINTS

Type of Joint	Limitations	Maximum Joint Efficiency (Per Cent)
Double-Welded Butt Joint	None	80
Single-Welded Butt Joint with Backing Strip	Longitudinal joints not over 1-1/4" thick. No thickness limitations on circumferential joints.	80
Single-Welded Butt Joint without Backing Strip	Circumferential joints only not over 5/8" thick.	70
Double-Welded Full-Fillet Lap Joint	Longitudinal joints not over 3/8" thick. Circumferential joints not over 5/8" thick.	60
Single-Welded Full-Fillet Joints with Plug Welds	Circumferential joints only not over 5/8" thick and for attachments of heads not over 24" outside diameter to shells not over 5/8" thick.	50
Single-Full Fillet Joint without Plug Welds	For attachments to heads convex to pressure to shell not over 5/8" thick, only with use of fillet weld on inside shell; for attachments to heads having pressure on either side, with fillet weld on outside of head flange only, to shells not over 24" inside diameter and not over 1/4" required thickness.	50
Forged Weld	None	70
Brazed Steel	None	80
Brazed Copper	None.	90

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.74 Ligament between parallel tube holes. When a shell or drum is drilled for tube holes in a line parallel to the axis of the shell or drum, the efficiency of the ligament between the tube holes shall be determined as shown in ss. Ind 41.50 and 41.51.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.75 Ligaments between diagonal tube holes. When a shell or drum is drilled for tube holes in a line diagonal with the axis of the shell or drum, the efficiency of the ligament between the tube holes shall be determined as shown in ss. Ind 41.50 and 41.51.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.76 Maximum pressure for cast iron boilers. (1) The maximum allowable working pressure on a steam boiler constructed wholly or principally of cast iron shall not exceed 15 pounds per square inch.

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(2) The maximum allowable working pressure on boilers, the tubes of which are secured to cast iron headers, shall not exceed 160 pounds per square inch.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.77 Safety or relief valves required on boilers. Every boiler shall have one or more safety or relief valves set at or below the maximum allowable working pressure. On power boilers the remaining valves may be set at a higher pressure in accordance with s. Ind 41.78.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.78 Safety valves for low pressure steam, miniature and power boilers. (1) Every boiler shall be provided with safety valve capacity sufficient to discharge all the steam that can be generated without an increase over the maximum allowable working pressure or to which the valve is set, except a 6% increase while the valve is discharging for power and miniature boilers, and a 5 pound per square inch increase while the valve is discharging for low pressure steam boilers.

(2) The steam generating capacity of a boiler in pounds of steam per hour may be determined by one of the following:

(a) Manufacturer's maximum output rating.

(b) Pounds of steam.

$$\text{per hour} = \frac{\text{Maximum Btu input per hour} \times 0.75}{1000}$$

(c) Actual evaporation test.

(d) On the basis of boiler heating surface or waterwall heating surface as given in Table 5.

TABLE 5
MINIMUM POUNDS OF STEAM PER HOUR
PER SQUARE FOOT OF SURFACE

Type of Boilers	Surface	Firetube Boilers	Watertube Boilers
Power Boilers	Boiler heating surface		
	Hand-fired	5	6
	Stoker-fired	7	8
	Oil, gas, or pulverized fuel fired	8	10
	Waterwall heating surface		
	Hand-fired	8	8
	Stoker-fired	10	12
	Oil, gas, or pulverized fuel fired	14	16
Low Pressure Steam and Miniature Boilers	Boiler heating surface any method of firing	5	5*

*Shall include cast iron boilers.

Note: Compliance with s. Ind 41.78 (1) will be required in every case.

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(3) On power boilers one or more safety valves on the boiler proper shall be set at or below the maximum allowable working pressure. The remaining valves may be set within a range of 3% above the maximum allowable working pressure, but the range of setting of all of the valves on a boiler shall not exceed 10% of the highest pressure to which any valve is set.

(4) Safety valves shall be constructed in accordance with the standards as specified in s. Ind 41.50.

(5) When 2 or more safety valves are used on a boiler, they may be mounted either separately or as twin valves made by placing individual valves on Y-bases, or duplex, triplex, or multiplex valves having 2 or more valves in the same body casing. The valves shall be made of equal sizes, if possible, and in any event if not of the same size, the smaller of the 2 valves shall have a relieving capacity of at least 50% of that of the larger valve.

(6) The safety valve or valves shall be connected to the boiler independent of any other steam connection, and attached as close as practical to the boiler, without any unnecessary intervening pipe or fitting. Every safety valve shall be connected so as to stand in an upright position, with spindle vertical, when possible.

(7) The opening or connection between the boiler and the safety valve or valves shall have at least the area of the inlet of the valve or valves. No valve of any description shall be placed between the required safety valve or valves and the boiler, nor on the discharge pipe between the safety valve and the atmosphere. When a discharge pipe is used, the cross-sectional area shall be not less than the full area of the valve outlet or of the total of the areas of the valve outlets discharging thereinto, and shall be as short and straight as possible and so arranged to avoid undue stresses on the valve or valves.

(a) All safety-valve discharges shall be so located or piped as to be carried clear from running boards, platforms, or otherwise carried to a safe location.

(b) Provision for gravity drain shall be made in the discharge pipe, at or near each safety valve, and where water or condensation may collect.

(8) (a) The spring in a safety valve in service for pressures up to and including 250 pounds shall not be used for any pressure more than 10% above or 10% below that for which it was designed. For higher pressures, the spring shall not be used for any pressure more than 5% above or 5% below that for which it was designed.

(b) If the operating conditions of a valve are changed so as to require a new spring for a different pressure, the valve shall be adjusted by the manufacturer or their authorized representative who shall furnish and install a new name plate.

(9) Every superheater shall have one or more safety valves near the outlet. The discharge capacity of the safety valve or valves on an attached superheater may be included in determining the number and size of the safety valves for the boiler, provided there are no intervening valves between the superheater safety valve and the boiler, and provided the discharge capacity of the safety valve or valves on the boiler, as

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distinct from the superheater, is at least 75% of the aggregate valve capacity required. A soot-blower connection may be attached to the same outlet from the superheater that is used for the safety valve connection.

(10) (a) Every boiler shall have outlet connections for the required safety valve or valves, independent of any other outside steam connection. The area of the boiler opening or openings shall be at least equal to the aggregate areas of inlet connections of all of the safety valves to be attached thereto. An internal collecting pipe, splash plate or pan may be used, provided the total area for inlet of steam thereto is not less than twice the aggregate areas of the inlet connections of the attached safety valves. The holes in such collection pipes shall be at least $\frac{1}{4}$ " in diameter and the least dimension in any other form of opening for inlet of steam shall be $\frac{1}{4}$ ".

(b) If safety 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 required by s. Ind 41.78 (10) (a).

(c) When boilers allowed different pressures are connected to a common steam main and all safety valves are not set at the lowest pressure allowed, no safety valve shall be set to exceed by more than 50% the lowest pressure allowed.

(d) For conditions exceeding those specified in par. (c), the case shall be referred to the department for decision.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. (4) and (10) (d), Register, May, 1974, No. 221, eff. 6-1-74; am. (4), Register, February, 1982, No. 314, eff. 3-1-82.

Ind 41.79 Water-relief valves for hot water boilers. (1) Each hot water boiler shall have one or more relief valves of the spring loaded type, without disk guides on the pressure side of the valve. The valves shall be set to relieve at a pressure at or below the maximum allowable working pressure of the boiler.

(2) Relief valves shall be constructed in accordance with the standards as specified in s. Ind 41.50.

(3) Water-relief valves shall be attached directly or as close as possible to the boiler without any unnecessary intervening pipe or fitting. A water-relief valve shall not be connected to an internal pipe in the boiler. Water-relief valve shall be connected so as to stand upright with the spindle vertical when possible.

(4) No shut-off of any description shall be placed between the water-relief valve and the boiler, nor on discharge pipes between such valve and the atmosphere.

(5) When a discharge pipe is used its area shall be not less than the area of the valve or aggregate area based on the nominal diameters of the valves with which it connects. The discharge pipe shall be pitched away from the valve to prevent water from lodging in the upper part of the valve or in the pipe. The water-relief valve shall be so located and piped that there will be no danger of scalding attendants.

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(6) The required water-relief valve capacity for any hot water boiler shall be equal to the maximum Btu output at the boiler nozzle or shall be equal to the boiler heating surface multiplied by 5000.

(7) The water-relief valve capacity for each hot water boiler shall be such that the valve or valves will relieve all the pressure that can be generated by the boiler without allowing the pressure to rise more than 3 pounds above the maximum allowable working pressure of the boiler.

(8) Every boiler shall have proper outlet connections for the required water-relief valves, independent of any other connection outside the boiler. The area of the opening or openings shall be at least equal to the aggregate area based on the nominal diameters of all of the water-relief valves with which it connects.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. (2), Register, May, 1974, No. 221, eff. 6-1-74; am. (2), Register, February, 1982, No. 314, eff. 3-1-82.

Ind 41.80 Thermometers for hot water boilers. Every hot-water boiler shall have a thermometer so located and connected that it shall be easily readable when observing the water pressure or altitude. The thermometer shall be so located that it shall at all times indicate the temperature in degrees Fahrenheit of the water in the boiler, at or near the outlet.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.81 Water glass. Every low pressure steam, miniature and power boiler shall have at least one water glass, equipped with a valved drain, the lowest visible part of which shall be at or above the following location except that in all cases it shall be so placed as to give adequate protection to those parts of a boiler proper subject to the heat of the products of combustion:

(1) Horizontal return tubular boilers—not less than 4 inches above the upper surface of the upper row of tubes except when the distance between the uppermost surface of the tubes and the top of the steam space is 13 inches or less the distance may be reduced to 2 inches.

(2) Locomotive type boilers—3 inches above the highest part of the crown sheet.

(3) Vertical fire tube boilers—not less than $\frac{1}{3}$ the length of the tube above the lower tube sheets.

(4) Water tube boilers—as specified by the manufacturer.

(5) Scotch marine type boilers—3 inches above the combustion chamber top.

Note: For Dry Back, see s. Ind 41.81 (1).

(6) Cast iron boilers—as specified by the manufacturer.

(7) Other types and designs—for other types and new designs the location shall be fixed by the manufacturer subject to approval by the department.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. (7), Register, May, 1974, No. 221, eff. 6-1-74.

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Ind 41.82 Gage cocks. (1) Every steam boiler, except those exempted below, shall have 3 gage cocks located within the range of the visible portion of the water glass.

(2) The following boilers shall not be required to have gage cocks:

(a) Boilers which do not have a definite water level.

(b) Boilers which have 2 water glasses spaced not less than 2 feet apart on the same horizontal line.

(c) Boilers which have 2 remote water level indicators in addition to the required water glass.

(d) Miniature boilers.

(3) The following boilers shall be required to have only 2 gage cocks:

(a) Low pressure steam boilers.

(b) Locomotive type boilers not over 36 inches in diameter.

(c) Firebox or water leg boilers in which the water heating surface does not exceed 50 square feet.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.83 Water column piping. (1) No connections shall be placed on pipes connecting the water column to the boiler except connections for damper regulator, feed water regulator, steam gage or drains.

(2) The minimum size of the pipes connecting the water column to a boiler shall be 1 inch. Water-glass fittings or gage cocks may be connected directly to the boiler.

(3) The water connections to the water column of a boiler, when practicable, shall be provided with a cross at each right-angle turn to facilitate cleaning. The water column shall be fitted with a drain cock or drain valve with a suitable connection to the ashpit or other safe point of waste, and if the water connection thereto has a rising bend or pocket which cannot be drained by means of the water column drain, an additional drain shall be placed in this connection in order that it may be blown off to clear any sediment from the pipe.

(4) The steam connection to the water column of a horizontal-return tubular boiler shall be taken from the top of the shell or the upper part of the head; the water connection shall be taken from the front head at a point not less than 6 inches below the center line of the shell. For the firebox types of boilers, the water connection to the water column shall be taken at a point not less than 6 inches below the lowest water line or as near thereto as possible, and in no case less than 18 inches above the mud ring.

Ind 41.92 Manholes. Where manholes are provided, such manholes shall be not less than 11 inches by 15 inches, or 10 inches by 16 inches in size. A circular manhole opening shall be not less than 15 inches in diameter.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.94 Threaded openings. (1) All pipe threads shall conform to the American Pipe Thread standard and all connections one inch pipe size or over shall have not less than the number of threads given in Table 6. For smaller pipe connections there shall be at least 4 threads in the opening.

(2) If the thickness of the shell of the boiler is not sufficient to give such number of threads a construction shall be employed which will provide at least the required number of threads.

TABLE 6
MINIMUM NUMBER OF PIPE THREADS FOR CONNECTIONS TO BOILERS

Size of pipe connections, inches.....	1 & 1¼	1½ & 2	2½ to 4 incl	4½ to 6 incl	7 & 8	9 & 10	12
Number of threads, per inch.....	11½	11½	8	8	8	8	8
Minimum number of threads required for opening.....	4	5	7	8	10	12	13
Minimum thickness of material required to give above number of threads, inches.....	0.348	0.435	0.875	1	1.25	1.5	1.6265

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.95 Boiler setting and installation. (1) A horizontal return tubular boiler over 72 inches in diameter shall be supported from steel hangers by the outside suspension type of setting, independent of the boiler side walls. The hangers shall be so designed that the load is properly distributed between the rivets attaching them to the shell and so that no more than 2 of these rivets come in the same longitudinal line on each hanger. The distance girthwise of the boiler from the centers of the bottom rivets to the center of the top rivets attaching the hangers shall be not less than 12 inches. The other rivets used shall be spaced evenly between these points. If more than 4 hangers are used they shall be set in 4 pairs.

(2) A horizontal return tubular boiler over 54 inches and up to and including 72 inches in diameter, shall be supported by the outside suspension type of setting, or at 4 points by not less than 8 steel or cast iron brackets, set in pairs. A horizontal return tubular boiler up to and including 54 inches in diameter shall be supported by the outside suspension type of setting, or by not less than 2 steel or cast iron brackets on each side.

(3) Lugs or hangers, when used to support a boiler of any type shall be properly fitted to the surfaces to which they are attached. If riveted, the

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shearing and crushing stresses on the rivets used for attaching the lugs or hangers shall not exceed 8% of the strength given in s. Ind 41.72. Where it is impractical to use rivets, studs with not less than 10 threads per inch may be used. In computing the shearing stress, the area at the bottom of the thread shall be used. Strength welding may be used, if done in accordance with ss. Ind 41.50 and 41.51.

(4) Wet bottom stationary boilers shall have a space of not less than 12 inches between the bottom of the boiler and the floor line, with access for inspection.

(5) The upper surface of the fire grate of an internally fired boiler of the open bottom locomotive, vertical fire tube or similar type, shall not be below the water space in the water leg, except where the rivets at the bottom of the water leg are protected from the action of the fire and products of combustion.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.96 Access and firing doors. The minimum size of an access door to be placed in a boiler setting shall be 12 inches by 16 inches or equivalent area, 11 inches to be the least dimension in any case.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.97 Water tube boiler doors. A water tube boiler shall have the firing doors, furnace inspection doors and clinker doors of the inward opening type, unless such doors are provided with latching or fastening devices or otherwise so constructed as to prevent them, when closed, from being blown open by pressure on the furnace side.

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61.

Ind 41.99 Pressure relief devices required for unfired pressure vessels. (1) Every unfired pressure vessel shall be provided with or protected by a pressure relief device.

(2) The relieving capacity of the pressure relief device shall be equal to or greater than the input to the vessel or shall be great enough to prevent the pressure in the vessel from rising more than 10% above the maximum allowable working pressure of the vessel.

(3) Safety valves and safety relief valves shall be constructed in accordance with the standards as specified in s. Ind 41.50.

(4) Rupture disks may be used in lieu of safety valves on vessels containing substances that may render a safety valve inoperative, or where a loss of valuable material by leakage should be avoided, or contamination of the atmosphere by leakage of noxious gases must be avoided. Such rupture disks shall be tested, marked, and installed in accordance with the ASME codes listed in s. Ind 41.10.

(5) When hot water supply is heated indirectly by steam in a coil or pipe a water relief valve of at least one inch in diameter, set to relieve at or below the maximum allowable working pressure of the tank shall be used.

(6) Each safety or relief valve shall have a full size direct connection to the pressure vessel. When an escape pipe is used it shall be full sized and fitted with an open drain, to prevent water lodging in the upper part

of the safety or relief valve or escape pipe. When a pressure vessel is fitted with 2 safety or relief valves on one connection, this connection to the pressure vessel shall have a cross-sectional area equal to or greater than the combined area of the 2 safety or relief valves. No valve of any description shall be placed between the safety or relief valve and the pressure vessel, nor on the escape pipe between the safety or relief valve and the atmosphere.

(7) When an elbow is placed on a safety or relief valve escape pipe it shall be located close to the safety or relief valve outlet, or the escape pipe shall be securely anchored and supported.

(8) When the capacity of the safety valve on an existing tank for containing gases is not known, the relieving capacity of such safety valve shall be determined from Table 7. Such safety valves shall not exceed 4 inches in diameter.

TABLE 7
 MAXIMUM FREE AIR SUPPLIED IN CUBIC FEET PER MINUTE FOR
 DIFFERENT SIZES OF SAFETY VALVES AT STATED PRESSURES

Diameter of Valve (inches)	Gage pressure, pounds							
	50	100	150	200	250	300	350	400
1/4	.....	.....	.....	.....	.....	.....	.....	53
1/2	20	32	42	51	59	67	74	111
3/4	37	59	78	96	112	127	141	176
1	58	94	124	152	178	202	224	248
1-1/4	84	135	180	221	259	293	325	.....
1-1/2	114	186	248	302	354	400	444	.....
2	189	306	410	501	592	668	741	.....
2-1/2	282	457	613	750	880	998	1114	.....
3	398	638	856	1050	1230	1398	1557	.....

Diameter of Valve (inches)	Gage pressure, pounds							
	500	600	800	1000	1200	1600	2000	2400
1/4	61	70	84	97	109	128	147	167
1/2	129	147	177	205	230	270	304	330
3/4	224	232	242	346	386	423	474	518
1	286	324	390	450	500	586	.....	.....
1-1/4	374	.....	509	.....	.....	.....	.....	.....
1-1/2	472	.....	634	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....	.....	.....
2-1/2	.....	.....	.....	.....	.....	.....	.....	.....
3	.....	.....	.....	.....	.....	.....	.....	.....

History: Cr. Register, April, 1961, No. 64, eff. 5-1-61; am. (3) and (4), Register, May, 1974, No. 221, eff. 6-1-74; am. (3), Register, February, 1982, No. 314, eff. 3-1-82.