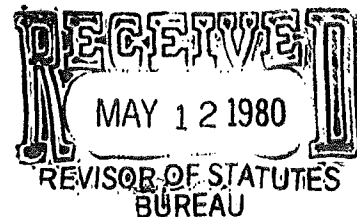


Print. eff. date 7-1-80

Ind 41, 42

# RULES CERTIFICATE



STATE OF WISCONSIN )  
 ) SS  
DEPT. OF INDUSTRY, )  
LABOR & HUMAN RELATIONS)

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

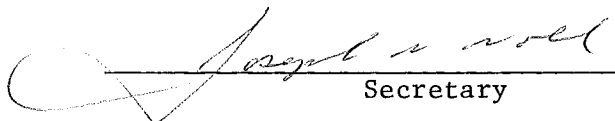
I, Joseph N. Noll, Secretary of the Department of Industry, Labor and Human Relations, and custodian of the official records of said department, do hereby certify that the annexed rule(s) relating to W.A.C. Chapter Ind 41-42 - Boiler & Pressure Vessel Code were duly approved and adopted by this department on May 12, 1980.

(Subject)

(Date)

I further certify that said copy has been compared by me with the original on file in this department and that the same is a true copy thereof, and of the whole of such original.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the official seal of the department at \_\_\_\_\_ in the city of Madison, this 12th day of May A.D. 1980.

  
Secretary

# ORDER OF ADOPTION

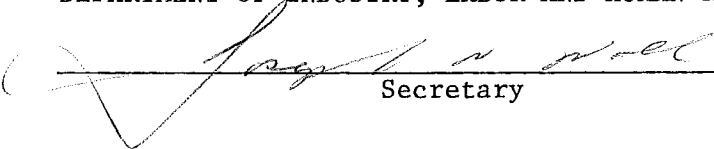
Pursuant to authority vested in the Department of Industry, Labor and Human Relations by section(s) 101.01 - 101.211, Stats., the Department of Industry, Labor and Human Relations hereby  creates;  amends;  repeals and recreates; and  repeals and adopts rules of Wisconsin Administrative Code chapter(s):

Ind. 41-42 Boiler & Pressure Vessle Code  
(Number) (Title)

The attached rules shall take effect on Publication in the Wisconsin Administrative Register, pursuant to section 227.026, Stats.

Adopted at Madison, Wisconsin, this 12th  
day of May, A.D., 1980.

DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS

  
Secretary

PROPOSED REVISIONS  
WIS. ADM. CODE CHAPTERS IND 41-42  
BOILER AND PRESSURE VESSEL CODE

Section Ind 41.01 is amended to read:

Ind 41.01 SCOPE. (1) The provisions of ~~this code~~ chapters Ind 41 and 42 shall apply to boilers, pressure vessels and piping components associated with boilers, pressure vessels and power piping in use at places of employment and in public buildings.

Note: Section 101.01 (2), Stats., provides that the phrase "place of employment" means and includes every place, whether indoors or out or underground and the premises appurtenant thereto where either temporarily or permanently any industry, trade or business is carried on, or where any process or operation, directly or indirectly related to any industry, trade or business, is carried on, and where any person is, directly or indirectly, employed by another for direct or indirect gain or profit, but does not include any place where persons employed in private domestic service which does not involve the use of mechanical power or farming. "Farming" includes those activities specified in section 102.04 (3), and also includes the transportation of farm products, supplies or equipment directly to the farm by the operator of said farm or his employes for use thereon, if such activities are directly or indirectly for the purpose of producing commodities for market, or as an accessory to such production. When used with relation to building codes, "place of employment" does not include a previously constructed building used as a community-based residential facility as defined in section 50.01 (1) which serves 20 or fewer unrelated residents, except for the purposes of section 101.11.

(2) ~~Vessels~~ The provisions of chapters Ind 41 and 42 shall apply to vessels used for the storage and transportation of flammable liquids, liquefied petroleum gas, anhydrous ammonia, and refrigerants shall be subject to the provisions of this code unless these vessels are covered by other Wisconsin administrative codes or federal codes.

Ind 41.02 DEFINITIONS.

Subsection Ind 41.02 (1a) is amended to read:

(1a) Alteration. ~~For the purposes of this code, "alteration"~~ Alteration means a change in a boiler or pressure vessel that substantially alters the original design requiring consideration of the effect of the change on the original design. It is not intended that the addition of nozzles smaller than an unreinforced opening size be considered an alteration. (Also see "repair.")

Subsections Ind 41.02 (9a), (11k) and (11n) are created to read:

(9a) Incompetence. Incompetence means conduct which evidences a lack of ability to discharge the duty required to protect the health, safety and welfare of the public, lack of knowledge of the fundamental principles of inspection services or an inability to apply those principles, or failure to maintain competency in the current practices and methods applicable to inspection services and the Boiler and Pressure Vessel Code.

(11k) Misconduct. Misconduct means an act performed in the discharge of enforcement duties which jeopardizes the interests of the public, including violation of federal or state laws, local ordinances or administrative rules relating to the position, preparation of deficient or falsified reports, failure to submit information or reports requested by the municipality or the department, conduct which evidences a lack of trustworthiness, misrepresentation of qualifications such as education, experience or certification, illegal entry of premises, misuse of funds, or misrepresentation of authority.

(11n) Negligence. Negligence means failure entirely by omission or commission to discharge the duty required to protect the health, safety and welfare of the public.

Subsection Ind 41.02 (15) is amended to read:

(15) Repair. Repair is work necessary to ~~return~~ restore a boiler or pressure vessel to a safe operating condition. ~~(Also see "alteration.")~~

Ind 41.05 NOTIFICATION OF INSTALLATION OF BOILERS, PRESSURE VESSELS AND POWER PIPING.

Subsection Ind 41.05 (2) (a) is created to read:

(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.

Section Ind 41.08 is repealed and recreated to read:

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. 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

(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.

Ind 41.10 ADOPTION OF STANDARDS.

Table Ind 41.10-A is amended to read: (1978 Summer and Winter and 1979 Summer addenda and ANSI B31.1c-1978 and B31.1d-1979 are added--see following page for complete table)

Section Ind 41.13 is amended to read:

Ind 41.13 MAINTENANCE. (1) All boilers and pressure vessels shall be installed and maintained in such a manner as to prevent excessive corrosion and deterioration.

(2) The inspector shall note conditions during internal inspection, external inspection, or hydrostatic pressure test and shall order such changes or repairs as will place the boiler or pressure vessel in a safe working condition.

Note #1: Sections VI and VII, ASME Boiler and Pressure Vessel Code, "Recommended Rules for Care and Operating of Heating Boilers" and "Recommended Rules for Care of Power Boilers" are excellent guides for boiler owners and operators.

Note #2: This section applies to both new and existing installations.

Ind 41.21 EXEMPTIONS FROM PERIODIC INSPECTIONS.

Subsection Ind 41.21 (1) (c) Note is created to read:

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.

Ind 41.26 REPORTING OF INSPECTIONS.

Subsection Ind 41.26 (2) (b) is amended to read:

(b) When violations of this code or unsafe conditions involving the safety of the vessel are found. This report shall be made on ASME-Form-P-6 forms acceptable to the department and shall explain the violation or unsafe condition with reference to code section numbers. A copy of the recommendations to the owner or user of the vessel shall accompany the report to the department.

Table 41.10-A is amended to read:

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	1977	1978	1979	
I.	Section I	Power Boilers, 1977 Edition	S W	S W	S	
2.	Section II	Material Specifications, 1977 Edition				
	a.	Part A - Ferrous Material	S W	S W	S	
	b.	Part B - Nonferrous Material	S W	S W	S	
	b.	Part C - Welding Rods, Electrodes and Filler Metals	S W	S -	S	
3.	Section III	Nuclear Power Plant Components, 1977 Edition				
	a.	Division 1 and Division 2 General Requirements	S W	S W	S	
		Division 1				
	a.	Subsection NB - Class 1 Components	S W	S W	S	
	b.	Subsection NC - Class 2 Components	S W	S W	S	
	c.	Subsection ND - Class 3 Components	S W	S W	S	
	d.	Subsection NE - Class MC Components	S W	S W	S	
	e.	Subsection NF - Component Supports	S W	S W	S	
	f.	Subsection NG - Core Support Structures	S W	S W	S	
	g.	Appendices	S W	S W	S	
		Division 2				
	a.	Concrete Reactor Vessels and Containments	S W	S W	S	
4.	Section IV	Heating Boilers, 1977 Edition	S W	S W	S	
5.	Section V	Nondestructive Examination, 1977 Edition	S W	S W	S	
6.	Section VIII	Pressure Vessels, 1977 Edition				
	a.	Division 1	S W	S W	S	
	b.	Division 2 - Alternative Rules	S W	S W	S	
7.	Section IX	Welding and Brazing Qualifications, 1977 Edition	S W	S W	S	
8.	Section X	Fiberglass-Reinforced Plastic Pressure Vessels, 1977 Edition	- W	S -	S	
9.	Section XI	Rules for Inservice Inspection of Nuclear Power Plant Components, Division 1, 1977 Edition	S W	S W	S	
ANSI						
10.	ANSI B31.1 Power Piping, 1977 edition, including Addenda ANSI B31.1a-1977, ANSI B31.1b-1978, ANSI B31.1c-1978, ANSI B31.1d-1979.					

Ind 41.27 INSPECTION REPORT FORMS.

Subsections Ind 41.27 (1) and (2) are amended to read:

(1) An internal or external boiler inspection that conforms to periodic inspection requirements (Ind 41.20) shall be reported to the department on inspection ~~form-SB-210~~ forms acceptable to the department or National Board of Boiler and Pressure Vessel Inspectors standard form.

(2) A pressure vessel inspection that conforms to periodic inspection requirements (Ind 41.20) shall be reported to the department on inspection ~~form-SB-209~~ forms acceptable to the department or National Board of Boiler and Pressure Vessel Inspectors standard form.

(a) Multiple vessels on a single report. A group of pressure vessels of the same design and use that are interconnected or are operated so as to form a unit, machine or apparatus may be included in a single report. The report shall contain the number, description, and use of the vessel and shall be reported to the department on inspection ~~form-SB-209~~ forms acceptable to the department or National Board of Boiler and Pressure Vessel Inspectors standard form.

Ind 41.93 MAINTENANCE.

Section Ind 41.93 is repealed.



The title of Chapter Ind 42 is amended to read:

CHAPTER IND 42  
~~WELDED-REPAIRS-AND-ALTERATIONS~~  
REPAIRS, ALTERATIONS, MISCELLANEOUS REQUIREMENTS

PART I  
WELDED REPAIRS AND ALTERATIONS

Section Ind 42.01 is repealed and recreated to read:

Ind 42.01 RULES AND REPORTS. (1) Welded repairs or alterations. Welded repairs or alterations to any boiler or pressure vessel or their fittings, settings, or appurtenances shall be completed in accordance with the requirements of sections Ind 42.01 through 42.17. Other methods may be acceptable provided they are approved by the department. In the absence of specific rules, the rules for new construction shall apply. No welded repair or alteration shall be made without the approval of an Authorized Inspector who shall, if it is considered necessary, inspect the object before granting an approval.

(2) Additional requirements for alterations. (a) Alterations to boilers and pressure vessels, with the exception of rerating with no physical change in the boiler or pressure vessel, shall be performed by an organization in possession of a valid ASME certificate of authorization, provided the alterations are within the scope of such authorization.

(b) The organization responsible for the preparation of the report of alteration shall also be responsible for adding a nameplate to the boiler or pressure vessel, as shown below:

Nameplate for rerating when no physical change is made  
in the boiler or pressure vessel

RERATED BY _____  <div style="display: flex; justify-content: space-between; align-items: center;"> <span>_____ (MAWP)</span> <span>PSI AT _____ (Temp)</span> <span>_____ F</span> </div> <div style="text-align: center; margin-top: 10px;">           _____            (Date Rerated)         </div>
---

Stamping or nameplate shall be applied adjacent to the original manufacturer's stamping or nameplate in letters at least 5/16" high.

Nameplate for all other alterations

ALTERED BY _____		
_____	PSI AT _____	F
(MAWP)		(Temp)
_____ (Manufacturer's Alteration Number, if used)		
_____ (Date Altered)		

Stamping or nameplate shall be applied adjacent to the original manufacturer's stamping or nameplate in letters at least 5/16" high.

(c) A copy of the original manufacturer's data report and any required manufacturer's partial data reports shall be a part of the completed report of alteration and shall be attached thereto. Where the manufacturer's data report is unavailable, documentation acceptable to the department shall be submitted.

(d) A pressure test shall be applied after the alteration has been completed, at a pressure of at least the operating pressure, but not to exceed 150% of the maximum allowable working pressure. In lieu of a pressure test, if approved by the authorized inspector, radiographic testing or ultrasonic testing may be utilized.

Note: Where water is used in a hydrostatic test, the temperature of the water should not be less than 70° F and the maximum temperature during inspection should not exceed 120° F. If a test is conducted at 1-1/2 times the maximum allowable working pressure (MAWP) and the owner specifies a temperature higher than 120° F, the pressure should be reduced to the (MAWP) and the temperature to 120° F for the close examination.

(3) Examples of repairs. (a) Weld repairs or replacements of pressure parts or attachments that have failed in a weld or in the base material.

(b) The addition of welded attachments to pressure parts, such as:

1. Studs for insulation or refractory lining;
2. Hex steel or expanded metal for refractory lining;
3. Ladder clips;
4. Brackets;
5. Tray support rings;
6. Corrosion-resistant strip lining;
7. Corrosion-resistant weld overlay;
8. Weld buildup of wasted areas.

(c) Replacement of heat exchanger tube sheets in accordance with the original design.

(d) Replacement of boiler and heat exchanger tubes where welding is involved.

(e) In a boiler, a change in the arrangement of tubes in furnace walls, economizer or superheater sections.

(f) Replacement of pressure retaining parts identical to those existing on the boiler or pressure vessel and described on the original manufacturer's data report. For example:

1. Replacement of furnace floor tubes or sidewall tubes, or both, in a boiler.
2. Replacement of a shell or head in accordance with the original design.
3. Rewelding a circumferential or longitudinal seam in a shell or head.
4. Replacement of nozzles.

(g) Installation of new nozzles or openings of such a size that reinforcement is not a consideration. For example, the installation of a 3-inch (76 mm) pipe size nozzle to a shell or head of 3/8-inch (10 mm) or less in thickness or the addition of a 2-inch (50 mm) pipe size nozzle to a shell or head of any thickness.

(h) The addition of a nozzle where reinforcement is a consideration may be considered to be a repair provided the nozzle is identical to one in the original design, is located in a similar part of the vessel, and is not closer than 3 times its diameter from another nozzle. The addition of such a nozzle shall be restricted by any service requirements.

(i) The installation of a flush patch to a boiler or pressure vessel.

(j) The replacement of a shell course in a cylindrical pressure vessel.

(k) Welding of gage holes.

(L) Welding of wasted or distorted flange faces.

(m) Replacement of slip-on flanges with weld neck flanges or vice versa.

(n) Seal welding of butt straps and rivets.

(4) Examples of alterations. (a) To increase the maximum allowable working pressure or temperature of a boiler or pressure vessel regardless of whether or not a physical change was made to the boiler or pressure vessel.

(b) The addition of new nozzles or openings in a boiler or pressure vessel except those classified as repairs.

(c) A change in the dimensions or contour of a pressure vessel.

(d) In a boiler, an increase in any heating surface which results in increasing the heat output or the final temperature above that specified in the original design.

(e) The addition of a pressurized jacket to a pressure vessel.

(5) Inspection reports. Anyone making welded repairs or alterations in accordance with these rules shall furnish the department with a report of every welded repair or alteration. The report shall be signed by the Authorized Inspector who inspected or approved the repair or alteration. The owner of the equipment shall retain a copy of the report for review by an Authorized Inspector. The report shall contain the information indicated on form SB-190.

STATE OF WISCONSIN  
DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS  
SAFETY AND BUILDINGS DIVISION  
201 East Washington Avenue  
Post Office Box 7969  
Madison, Wisconsin 53707

Record of Repair or Alteration Completed on: Power Boiler  Wis. Reg. No. \_\_\_\_\_  
Heating Boiler  NB No. \_\_\_\_\_  
Pressure Vessel  Serial No. \_\_\_\_\_  
Miniature Boiler  Other \_\_\_\_\_  
Mfd. by: \_\_\_\_\_

Work completed by contractor \_\_\_\_\_  
(Name)

Address: \_\_\_\_\_  
(Zip)

Located in the plant of \_\_\_\_\_  
(Name of owner)

Address: \_\_\_\_\_  
(Zip)

Description of repair: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(Use reverse side for sketch description of repair or alteration.)

Hydrostatic Test psi \_\_\_\_\_

Repair or alterations were made in accordance with the requirements of the Wisconsin Department of Industry, Labor and Human Relations, Wis. Adm. Code Chapter Ind 42. The welding was completed by \_\_\_\_\_  
(Name of Welder and Social Security No.)  
who has made the test requirements of said rules.

\_\_\_\_\_  
(Welding Process) Signed by \_\_\_\_\_  
(Contractor Representative)

\_\_\_\_\_  
(Welding Procedure) Dated \_\_\_\_\_

I, the undersigned, have inspected the work described in the report and state that to the best of my knowledge and belief, this work has been done in accordance with the requirements of Wis. Adm. Code Chapter Ind 42. By signing this certificate, neither the inspector nor the inspector's employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the inspector nor the inspector's employer shall be liable in any manner for any personal injury or property damage or loss of any kind arising from or connected with this inspection, except such liability as may be provided in a policy of insurance which the inspector's insurance company may issue upon said object and then only in accordance with the terms of said policy.

\_\_\_\_\_  
Authorized Inspector--Wis. Com. No. \_\_\_\_\_ Employed by \_\_\_\_\_

\_\_\_\_\_  
Date

(a) Exceptions. The following items are exempt from the reporting requirements of Ind 42.01 (5):

1. The welded repair of tubes, or the alteration or replacement of tubes in boilers or pressure vessels;
2. Piping, nozzels, valves and fittings of 2-inch nominal pipe sizes and smaller.

Section Ind 42.02 Note is created to read:

Note: Where water is used in a hydrostatic test, the temperature of the water should not be less than 70° F and the maximum temperature during inspection should not exceed 120° F. If a test is conducted at 1-1/2 times the maximum allowable working pressure (MAWP) and the owner specifies a temperature higher than 120° F, the pressure should be reduced to the (MAWP) and the temperature to 120° F for the close examination.

Sections Ind 42.03 and Ind 42.04 are repealed.

Section Ind 42.05 is repealed and recreated to read:

Ind 42.05 WELDING PROCEDURE. Anyone undertaking repairs or alterations shall have available at the job site a written welding procedure specification acceptable to the Authorized Inspector that shall be followed in making the necessary repair and also a record of procedure qualification tests. Welding procedure specifications shall have been prepared and qualified in accordance with the requirements of section IX of the ASME code (table 41.10-A).

Section Ind 42.06 is repealed and recreated to read:

Ind 42.06 WELDERS. (1) Welder qualifications. Anyone undertaking repairs or alterations shall have available at the job site records of welder qualification tests showing that each welder to be employed on the work has satisfactorily passed tests as prescribed in section IX of the ASME code (table 41.10-A).

(2) Welding tests; responsibility; inspector's duty. Preparation of welding procedure specifications and the conducting of tests of procedures and welders shall be the responsibility of the party undertaking repairs or alterations. Before repairs or alterations are started, it shall be the duty of the inspector to be satisfied by examination of the written welding procedure and records of qualification tests that procedures and welders have been properly qualified as required in section IX of the ASME code (table 41.10-A). Witnessing of the tests by the inspector shall not be mandatory but the inspector shall have the right to call for and witness the making of test plates by any welder, at any time, and to observe the physical testing of such plates.

Section Ind 42.07 is repealed and recreated to read:

Ind 42.07 CRACKS, PERMISSIBLE WELDED REPAIRS. A repair of a defect, such as a crack in a welded joint or base material, shall not be made until the defect has been removed. A suitable nondestructive examination method shall be used to assure complete removal of the defect. If the defect penetrates the full thickness of the material, the repair shall be made with a complete penetration weld such as a double butt weld or a single butt weld with or without backing.

Note: Before repairing a cracked area, care should be taken to investigate its cause and to determine its extent. Where circumstances indicate that the crack is likely to recur, consideration should be given to removing the cracked area and installing a patch.

(1) Cracks in unstayed shells, drums or headers of boilers or pressure vessels may be repaired by welding, providing the cracks do not extend between rivet holes in a longitudinal seam or parallel to a rivet seam within 8 inches, measured from nearest caulking edge. The total length of any one such crack shall not exceed 8 inches. Cracks of a greater length may be welded, provided the complete repair is radiographed and stress relieved in accordance with section Ind 42.14. See Figure 2 for acceptable methods.

(2) Cracks of any length in stayed areas may be repaired by fusion welding except that multiple or star cracks radiating from rivet or staybolt holes shall not be welded. See Figure 2 for acceptable methods.

(3) Cracks of any length in unstayed furnaces may be welded, provided the welds are thermally stress relieved in accordance with section Ind 42.14. Welds applied from one side only shall be subject to the approval of the authorized inspector. Field repair of cracks at the knuckle or the turn of the flange of the furnace opening are prohibited unless specifically approved by the department. See Figure 3 for acceptable methods.

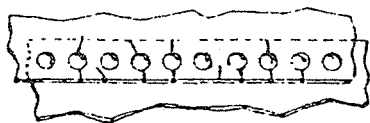
Section Ind 42.08 is repealed and recreated to read:

Ind 42.08 CORRODED SURFACES AND SEAL WELDING. (1) Corroded areas in stayed surfaces may be built up by fusion welding, provided the remaining plate has an average thickness of not less than 50% of the original thickness, and further provided that the areas so affected are not sufficiently extensive to impair the safety of the object. See Figure 4 for acceptable welding methods.

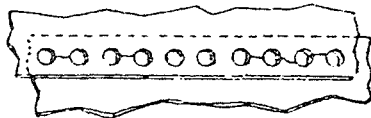
(2) Corroded areas around manhole or handhole openings in either stayed or unstayed plates may be built up by fusion welding, provided that the average loss of the thickness does not exceed 50% of the original plate thickness and that the area to be repaired does not extend more than 3 inches from the edge of the hole nor closer than 2 inches to any knuckle. See Figure 5 for acceptable methods.

(3) Corroded areas in unstayed shells, drums or headers may be built up by fusion welding provided that, in the judgment of the authorized inspector, the strength of the structure has not been impaired. See Figure 6 for acceptable welding methods.

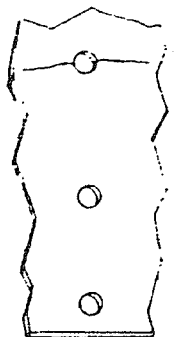
(4) Edges of butt straps or of plate laps and nozzles or connections attached by riveting may be restored to original dimensions by welding. Seal welding shall not be used except with the special approval of the authorized inspector, and in no case where cracks are present in riveted areas. See Figure 7 for acceptable welding methods.



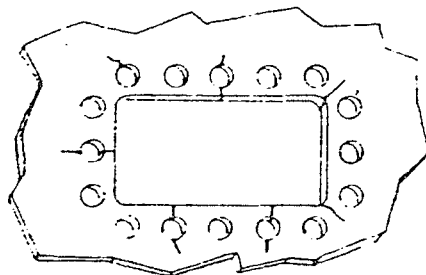
*Fire Cracks at Girth Seams*



*Circumferential Cracks at Girth Seams*



*Cracks in Stayed Plates*

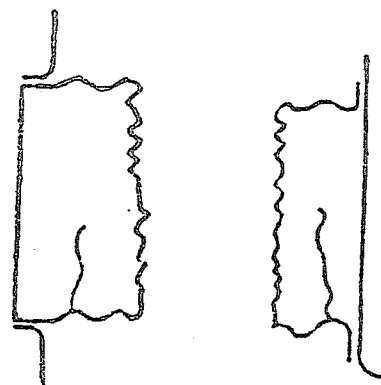


*Fire Cracks at Door Openings*

Cracks radiating from rivet or staybolt holes may be repaired if the plate is not seriously damaged. If the plate is seriously damaged, it shall be replaced. A suggested repair method is described below:

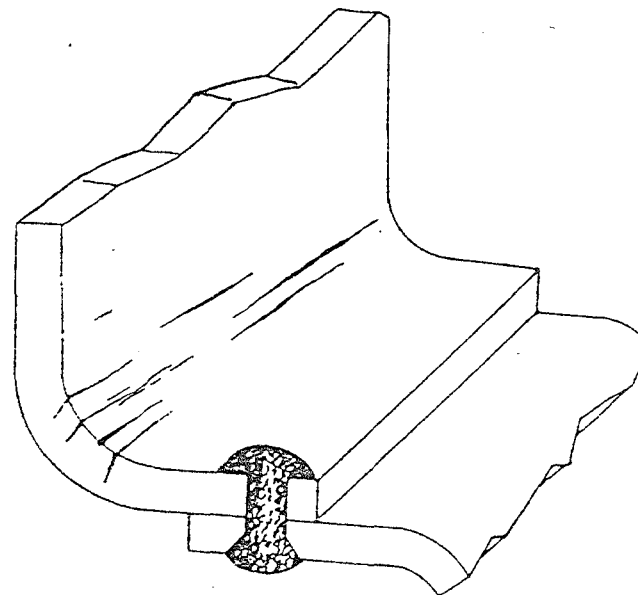
- a. Prior to welding, the rivets or staybolts from which the cracks extend and the adjacent rivets (or staybolts if appropriate) should be removed.
- b. In riveted joints, tack bolts should be placed in alternate holes to hold the plate laps firmly.
- c. The cracks should then be prepared for welding by chipping, grinding or gouging.
- d. In riveted joints, cracks which extend past the inner edge of the plate lap should be welded from both sides.
- e. Rivet holes should be reamed before new rivets are driven.
- f. Threaded staybolt holes should be retapped and new staybolts properly driven and headed.

**FIGURE 2 — RIVET AND STAYBOLT HOLE CRACKS**



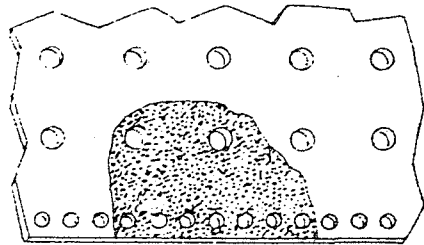
Caution: Successful performance of this repair requires a ductile weld free from slag inclusions, voids, cracks or other defects.

Cracks shall be chipped, ground or gouged to provide required welding groove; root of weld shall be cleaned by chipping or flame gouging and welding applied from both sides of the plate. Thermal stress relieving is recommended.



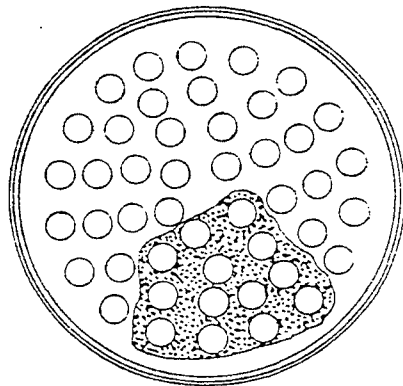
Cracks at the knuckle or at the turn of the flange of the furnace opening require immediate replacement of the affected area. If repairs are attempted, specific approval of the department is required.

**FIGURE 3 — UNSTAYED BOILER FURNACES**



#### RIVET & STAYBOLTS

- a. Prior to welding, the rivets or staybolts in the wasted area should be removed.
- b. Threaded staybolt holes should be retapped after welding.
- c. Rivet holes should be reamed after welding.
- d. Welding should not cover rivet or staybolt heads.

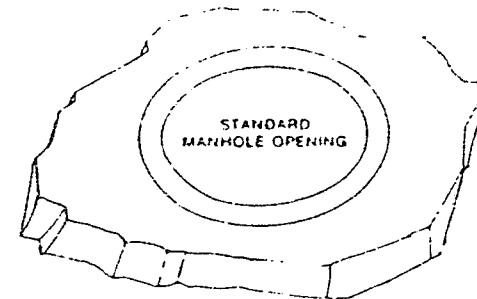


#### TUBESHEET

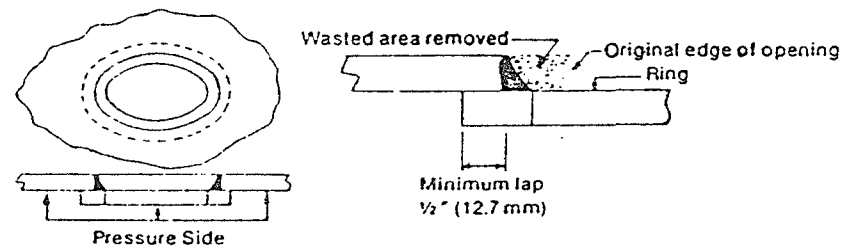
- a. Prior to welding, the tubes in the wasted area should be removed.
- b. After welding the tube holes may be reamed before new tubes are installed.

Wasted areas in stayed and unstayed surfaces may be built up by welding provided that in the judgment of the Inspector the strength of the structure will not be impaired. Where extensive weld build-up is employed, the Inspector may require an appropriate method of NDE for the complete surface of the repair.

FIGURE 4 — WELD BUILD-UP OF WASTED AREAS



A badly wasted manhole flange may be removed and replaced with a ring-type frame as shown above. The requirements of 4.2.15 (c) for flush patches shall be met. A full penetration weld is required. May either be double welded or welded from one side with or without a backing ring.



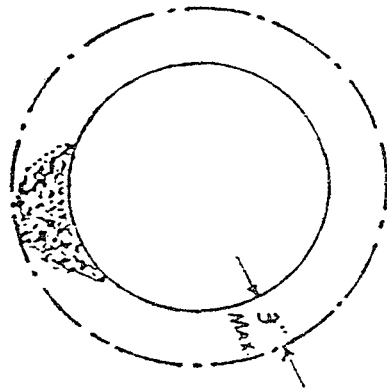
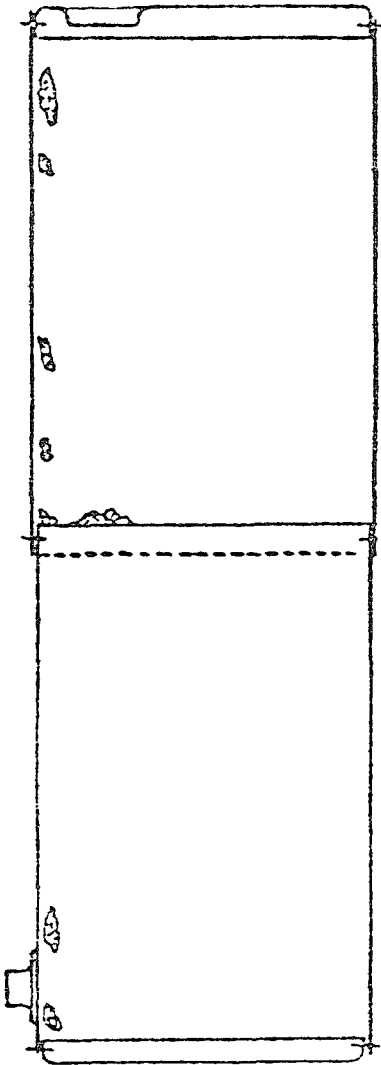
A badly wasted area around a handhole opening may be repaired by adding a ring as shown above on the inside of the object.

FIGURE 5 — REPAIRS FOR ACCESS OPENINGS





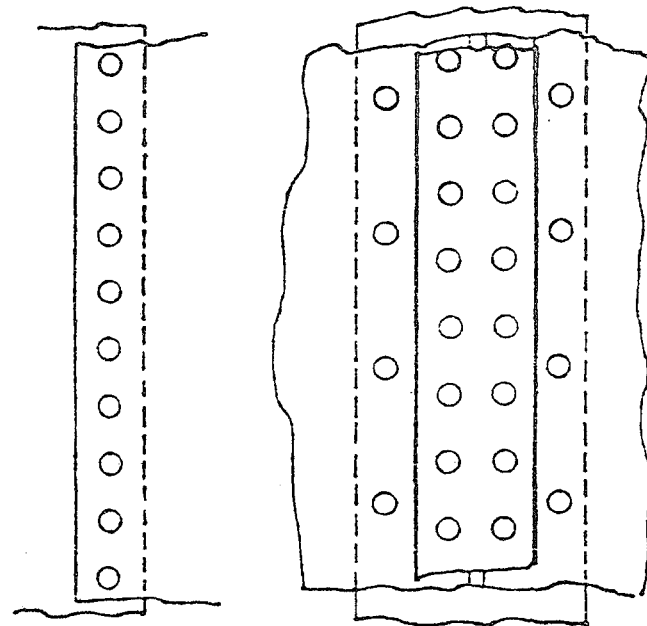
No corroded area which is shown in this sketch and which exceeds in size the permissible area of an unreinforced opening or exceeds in average depth 60% of the plate required thickness shall be "built up" by welding. Larger areas in vessels which are subject to internal corrosion or erosion but where the required thickness would be satisfactory for the pressure, can be built up under this rule.



Corroded Area around manhole or handhole openings.  
Corroded area shall be thoroughly cleaned before welding.

FIG. 6  
CORRODED AREAS

SEAL WELDING OF CAULKING EDGES



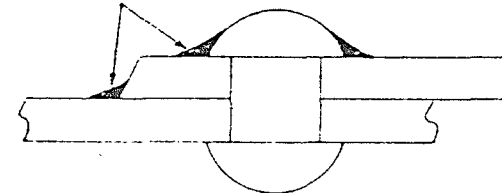
Caution—Seal welding shall not be applied if cracks are present in riveted areas.

Indications of persistent or recurring leakage may be a sign of cracking. No welding shall be applied until a careful examination—including removal of rivets if necessary—has been made of such areas.

Seal welding shall be applied in one light layer if practicable but not more than two layers shall be used.

-15-

Throat Approx. 1/8 in. (3.2 mm)



TYPICAL RIVET JOINT SHOWING SEAL WELD

Seal welding of riveted joints requires the approval of the jurisdiction. Seal welding shall not be considered a strength weld.

Prior to welding, the area should be examined by an appropriate method of NDE to assure that there are no cracks radiating from the rivet holes. If necessary, the rivets should be removed to assure complete examination of the area. Seal welding should not be performed if cracks are present in riveted areas.

FIGURE 7 — SEAL WELDING OF RIVETED JOINTS

(5) Wasted flange faces may be cleaned thoroughly and built up with weld metal. They should be machined in place, if possible, to a thickness not less than that of the original flange or that required by calculations in accordance with the provisions of the applicable section of the ASME code (table 41.10-A). Wasted flanges may also be remachined in place without building up with weld metal provided the metal removed in the process does not reduce the thickness of the flange to a measurement below that calculated above. Flanges that leak because of warpage or distortion and that cannot be repaired shall be replaced with new flanges that have at least the dimensions conforming to the applicable section of the ASME code (table 41.10-A).

(6) Tubes may be seal welded provided the ends of the tube have sufficient wall thickness to prevent burn-through and the requirements of the appropriate sections of the ASME code (table 41.10-A) are satisfied. See Figure 8 for acceptable methods.

Section Ind 42.09 is repealed and recreated to read:

Ind 42.09 RE-ENDING AND PIECING TUBES. Re-ending or piecing of tubes or pipes in either fire tube or water tube boilers is permitted provided the thickness of the tube or pipe has not been reduced by more than 10% from that required by the applicable section of the ASME code (table 41.10-A).

Section Ind 42.10 is repealed and recreated to read:

Ind 42.10 MATERIALS. The materials used in making repairs or alterations shall conform to the requirements of the applicable section of the ASME code (table 41.10-A). Materials shall be of known weldable quality, have at least the minimum physical properties of the material to be repaired and be compatible with the original material. The thickness of any patch shall be at least equal to, but not more than 1/8-inch greater than, the material being patched. Carbon or alloy steel having a carbon content of more than 0.35% shall not be welded.

Section Ind 42.11 is repealed.

Section Ind 42.13 is repealed and recreated to read:

Ind 42.13 POSTWELD HEAT TREATMENT. (1) General. In repairing carbon or low alloy steels, postweld heat treatment shall be required if it would be required for new construction by the ASME code (table 41.10-A) or when considered necessary by the authorized inspector.

(2) Alternative methods. Under certain conditions, postweld heat treatment as outlined above may be inadvisable or impractical. In such instances, any other method of postweld heat treatment or special welding method acceptable to the inspector may be used. Examples of special welding methods for P1 and P3 materials are described in section Ind 42.13 (3). Where deemed necessary, competent technical advice should be obtained from the manufacturer of the object or from another qualified source. When such procedures are used, the inspector shall be assured that the requirements of (3) are met.

(3) Welding methods as alternatives to postweld heat treatment. Two welding methods that may be used as alternatives to postweld heat treatment are given below as a general guide. The use of these alternatives is limited to P1 and P3 steels, and to the more routine repairs required in boiler and pressure vessel maintenance. They should not be used in highly stressed areas, or if service conditions are conducive to stress corrosion cracking or, in some cases, to hydrogen embrittlement.

(a) Method 1, Higher preheat temperatures. 1. Material applicability: P-No. 1, 3.

2. Method details. Preheat the materials to be welded to at least 300° F and maintain this temperature during welding. The 300° F temperature should be checked to assure that 4 inches of the steel on each side of the joint, or 4 times the plate thickness (whichever is greater) will be maintained at the minimum preheat.

Note: Preheat of carbon steel to the temperature range of 300° F to 400° F has been shown by some laboratory tests to be the equivalent of the conventional postheat temperature of 1200° F insofar as mechanical properties of the weldment are concerned. In the use of this method it should be ascertained that the notch ductility in the as welded condition is adequate at operating and pressure test temperatures. When this alternative meets the above requirements, any code credit for postweld heat treatment can be continued.

(b) Method 2, Temper bead. 1. Material applicability: P-No. 1, 3.

2. Limitations. a. The weld metal shall be deposited by the manual shielded metal arc process using low hydrogen electrodes. The maximum bead width shall be 4 times the electrode core diameter.

b. The depth of the repair shall not be greater than 3/8-inch or 10% of the base metal thickness, whichever is less, and the individual area shall not be greater than 10 square inches.

c. When the temper bead method is used, it shall require the approval of the department. The inspector shall assure that the method has been qualified in accordance with the guidelines of section IX of the ASME code (table 41.10-A).

3. Method details. a. Step 1. The weld area shall be preheated and maintained at a minimum temperature of 350° F during welding. The maximum interpass temperature shall be 450° F.

b. Step 2. The initial layer of weld metal shall be deposited over the entire area with 1/8-inch maximum diameter electrode. Approximately one-half the thickness of this layer shall be removed by grinding before depositing subsequent layers. Subsequent layers shall be deposited with a 5/32-inch maximum diameter electrode in a manner to ensure tempering of the prior beads and their heat affected zones.

c. Step 3. Heat input shall be controlled within a specified range.

d. Step 4. The weld area shall be maintained at a temperature of 400-500° F for a minimum period of 2 hours after completion of the weld repair.

(4) Joints between austenitic stainless steels. Postweld heat treatment is neither required nor prohibited for joints between austenitic stainless steels. It shall not be attempted except in accordance with the recommendations of the manufacturer of the material or the requirements of section Ind 41.10.

Note: See ASME code, section VIII, division 1, paragraph UHA-105.

(5) Peening. In lieu of postweld heat treatment of carbon steels, peening or other methods acceptable to the Authorized Inspector may be used.

Section Ind 42.14 is repealed.

Section Ind 42.15 is repealed and recreated to read:

Ind 42.15 WELDED PATCHES. (1) Flush or butt welded patches. (a) The weld around a flush patch shall be a full penetration weld and the accessible surfaces shall be ground flush where required by the applicable section of the ASME code (table 41.10-A). Flush welded patches shall be subjected to an appropriate nondestructive examination which shall be consistent with the original construction requirements. See Figure 9 for acceptable methods.

(b) In some situations it is necessary to weld a flush patch on a tube, such as when replacing tube sections and accessibility around the complete circumference of the tube is restricted, or when it is necessary to repair a small bulge. This is referred to as a window patch. Suggested methods for window patches are shown in Figure 10.

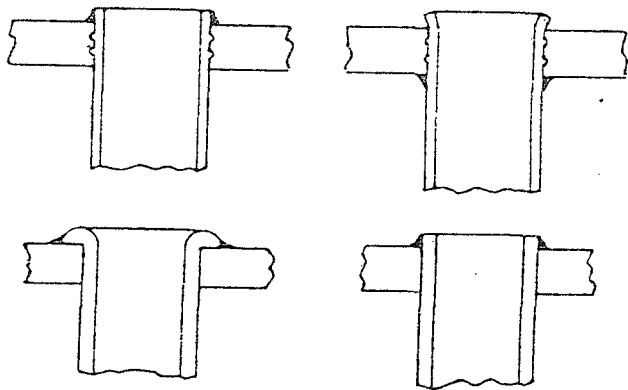
(2) Lapped and fillet welded patches. Lapped and fillet welded patches may be applied to stayed plates provided they are not exposed to radiant heat. Lapped and fillet welded patches may be applied on the pressure side of the sheet in unstayed areas, provided the maximum diameter of the opening so repaired does not exceed 16 times the thickness of the plate, but in no case larger than 8 inches in diameter. See Figure 11 for acceptable methods.

Section Ind 42.16 is repealed and recreated to read:

Ind 42.16 STAYS. Threaded stays may be replaced by welded-in stays provided that, in the judgment of the inspector, the plate adjacent to the staybolt has not been materially weakened by wasting away. All requirements of the ASME code (table 41.10-A) governing welded-in stays shall be met, except that stress relieving other than thermal may be used as provided in section Ind 42.13.

Section Ind 42.17 is repealed and recreated to read:

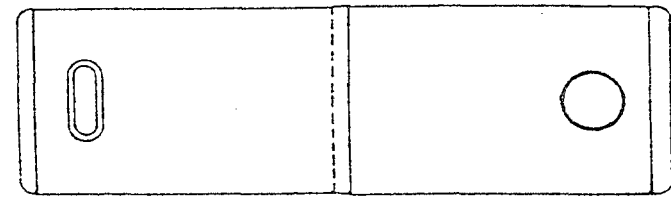
Ind 42.17 ADDITIONAL ACCEPTABLE REPAIR METHODS. Repairs and repair methods not covered in this chapter may be used if acceptable to the inspector. Some additional methods are illustrated in Figures 12 and 13.



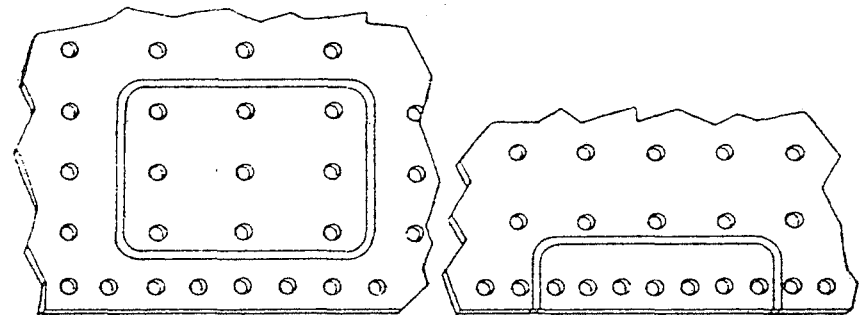
Tubes may be seal welded provided the ends of the tubes have sufficient wall thickness to prevent burn through. Seal welding should be applied with a maximum of three light layers in lieu of one or two heavy layers.

In water tube boilers, tubes may be seal welded on the inside or outside of the tube-sheet.

**FIGURE 8—TYPICAL EXAMPLES OF SEAL WELDING TUBES**



**FLUSH PATCHES IN UNSTAYED AREAS**



**FLUSH PATCHES IN STAYED AREAS**

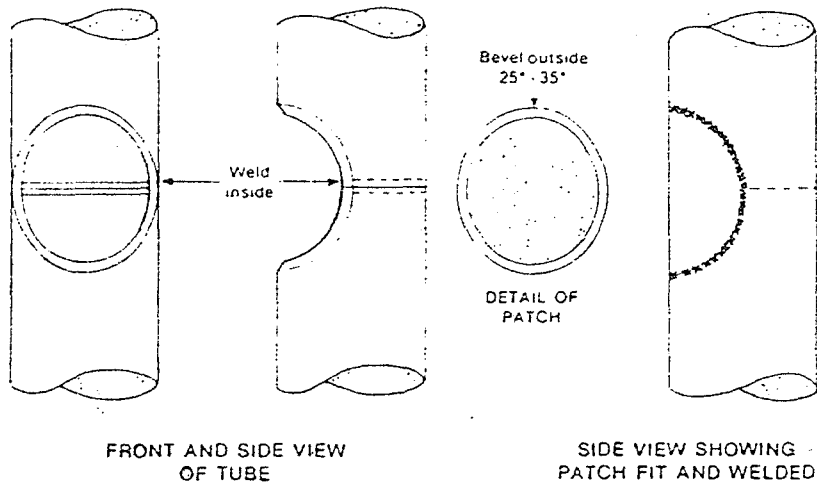
Before installing a flush patch, the defective metal should be removed until sound metal is reached. The patch should be rolled or pressed to the proper shape or curvature. The edges should align without overlap.

In stayed areas, the weld seams should come between staybolt rows or riveted seams.

Patches should be made from material that is at least equal in quality and thickness to the original material.

Patches may be of any shape or size. If the patch is rectangular, an adequate radius should be provided at the corners. Square corners should be avoided.

**FIGURE 9—FLUSH OR BUTT-WELDED PATCHES**

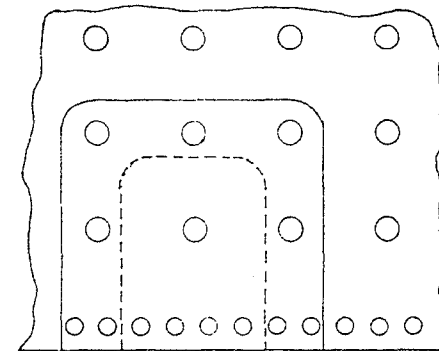


It may be necessary to weld a flush patch on a tube, since in some situations, accessibility around the complete circumference of the tube is restricted. Listed below are suggested methods for making window patches:

- a. The patch should be made from tube material of the same type, diameter and thickness as the one being repaired.
- b. Fitup of the patch is important to weld integrity. The root opening should be uniform around the patch.
- c. The gas tungsten arc welding process should be used for the initial pass on the inside of the tube and for the initial pass joining the patch to the tube.
- d. The balance of the weld may be completed by any appropriate welding process.

FIGURE 10— TUBE WINDOW PATCHING METHOD

Fig. 11  
LAP-FILLET WELDED PATCHES



Patches shall be of material equal to the original in quality and thickness.

If area to be patched includes a riveted seam rivets shall be removed before patch is applied and new rivets driven before patch is welded at edges.

New staybolts shall be installed in patched area, the heads of staybolts shall not be covered by welding.

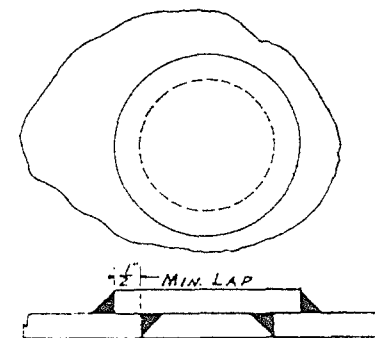
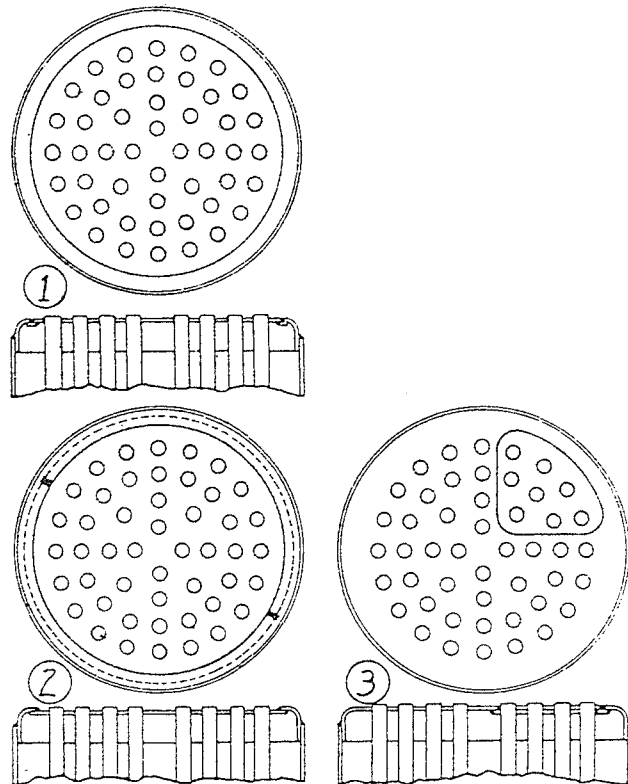


Fig. 12

ACCEPTABLE REPAIRS FOR CORRODED OR WORN HEADS OF VERTICAL TUBE OR SIMILAR TYPE BOILERS



1. Flush Butt Welded Head

With this repair the old head is cut close to the point of tangency of the knuckle of the flange and the new head, previously drilled for tube holes and beveled for adequate welding groove is butt welded to flanged section of old head. Pack up ring, inserted in sections if necessary, shall be used to insure weld penetration for full head thickness.

2. Lapped and Fillet Welded Head

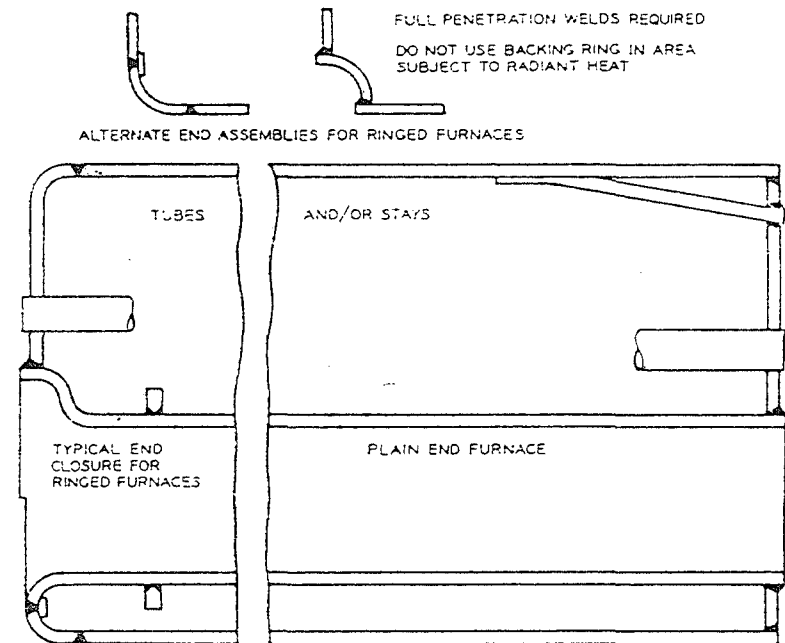
With this repair, the new head is lapped under the flange knuckle of old head, previously slotted as shown to admit new head, then fillet welded at edge.

3. Segmental or Pie-Shaped Butt Welded Patch

Fig. 13

SUGGESTED FURNACE RENEWAL

Longitudinal seam in furnace double butt-welded and thermally stress-relieved. For repair, final joint to each head may be stress-relieved by peening. Furnace may be welded into a riveted boiler by using adaptable end closures. Ringed furnace shall be thermally stress-relieved after longitudinal seam and rings have been applied.



Part II is renumbered Part IV.

Part II is created to read:

PART II  
RIVETED REPAIRS

Sections Ind 42.18, 42.19, 42.20 and 42.21 are repealed and recreated to read:

Ind 42.18 RIVETED PATCHES. When riveted patches are used, they shall be designed and applied using methods acceptable to the department.

Note: Information regarding the use of riveted patches is available from the department and may be found in Wis. Adm. Code Chapters Ind 41-42, Boiler and Pressure Vessel Code, Register, May, 1974, No. 221.

Ind 42.19 REPORT OF RIVETED REPAIR. Anyone making a riveted repair shall furnish the department and the owner of the equipment with a report of the repair as specified under section Ind 42.01 (5).

Ind 42.20 PRESSURE TEST. The authorized inspector may require a pressure test, as specified in section Ind 42.02, after completion of a riveted repair.

Ind 42.21 MATERIALS FOR RIVETED PATCHES. Patch material shall meet the requirements of section Ind 42.10.

Part III is renumbered Part V.

Part III is created to read:

PART III  
RERATING OF A BOILER OR PRESSURE VESSEL

Section Ind 42.22 is repealed and recreated to read:

Ind 42.22 RERATING OF A BOILER OR PRESSURE VESSEL. (1) Rerating of a boiler or pressure vessel by increasing the maximum allowable working pressure or temperature shall be considered an alteration and may be done only after the following requirements have been met to the satisfaction of the department:

(a) Revised calculations verifying the new service conditions shall be requested from the original manufacturer and shall be made available to the authorized inspection agency. Where such calculations cannot be obtained from this source, they may be prepared by a Wisconsin registered professional engineer and forwarded for review by the department.

(b) All reratings shall be established in accordance with the requirements of the code to which the boiler or pressure vessel was built, or by computation using the appropriate formulas in the latest edition of the ASME code if all essential details are known to definitely comply with the latest edition of the code (table 41.10-A)

(c) Current inspection records verify that the boiler or pressure vessel is satisfactory for the proposed service conditions.

(d) The boiler or pressure vessel rerating is acceptable to the authorized inspection agency responsible for the object.



(2) The requirements of section Ind 42.01 (2) (b), (c) and (d) shall be met and an alteration report shall be submitted in accordance with section Ind 42.01 (5).

PART IV  
SECONDHAND VESSELS--PORTABLE BOILERS

Section Ind 42.26 is amended to read:

Ind 42.26 CODE CONSTRUCTED VESSELS. Secondhand pressure vessels which were constructed and stamped to some edition of the ASME Boiler and Pressure Vessel code or other recognized pressure vessel codes acceptable to the department may be installed and operated at or below the working pressure stamped on the vessel.

Section Ind 42.28 is amended to read:

Ind 42.28 VESSELS FROM ~~OTHER-STATES~~ OUT OF STATE. Secondhand pressure vessels ~~previously-operated-in-other-states~~ from out of state shall meet the requirements of section Ind 42.26. A copy of the manufacturer's data report shall be furnished to the department for each vessel indicating that it was manufactured originally to the requirements of an earlier edition of the applicable ASME code. If a vessel has been repaired or altered since its fabrication, a copy of the manufacturer's data report, welded repair report or alteration report shall be furnished to the department.

Section Ind 42.31 is repealed and recreated to read:

Ind 42.31 INSPECTION AND TESTING. (1) Every secondhand vessel shall be inspected and given a hydrostatic pressure test at one and one-half times the working pressure at its new point of installation location before it is placed in operation. The test shall be witnessed by an authorized inspector.

(2) When the department determines that a hydrostatic test at one and one-half times the working pressure is not possible or desirable, the department may accept alternate means to determine if the vessel is safe for its intended use.

Note: Where water is used in a hydrostatic test, the temperature of the water should not be less than 70° F and the maximum temperature during inspection should not exceed 120° F. If a test is conducted at 1-1/2 times the maximum allowable working pressure (MAWP) and the owner specifies a temperature higher than 120° F, the pressure should be reduced to the (MAWP) and the temperature to 120° F for the close examination.

PART V  
INSPECTION AND REPAIR OF PRESSURE VESSELS IN PETROLEUM REFINERIES

Ind 42.37 QUALIFICATIONS OF INSPECTORS.

Subsection Ind 42.37 (2) is repealed.

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