**Section 120.1041 Repair and Alteration Requirements**

a) Repairs. Except as permitted for low pressure boilers, no repair to a pressure vessel or high pressure boiler shall be initiated without the authorization of the Inspector who shall be satisfied that the welding procedures and welders are qualified and that the repair methods are acceptable. The Inspector may give prior approval for repairs of a routine nature. In every case, however, the Inspector shall be advised of each repair under such prior agreement.

b) Alterations. Except as permitted for owner-users in Section 120.1000(b), alterations to boilers and pressure vessels shall be performed by an authorized repairer. No alteration to a boiler or pressure vessel shall be initiated without the authorization of the Inspector who shall be satisfied that the alteration methods and calculations are acceptable. If the Inspector considers it necessary, the Inspector shall make an inspection of the object before granting such authorization.

c) Welded Repairs to Low Pressure Boilers. All welded repairs to low pressure boilers shall be performed by an authorized repairer and shall comply with all the rules as required by the Board, except no third party inspection is required. Prior to the start of any low pressure boiler repair, the authorized repairer shall contact the Division and request a low pressure boiler repair permit authorization number and inform the Division of the physical location of the boiler to be repaired. Upon completion of the repair, the authorized repairer will submit a completed "Low Pressure Boiler Repair Form" (LP-1) to the Division.

d) Acceptance of Repairs and Alterations. Provided that repairs or alterations are acceptable to the Authorized Inspection Agency responsible for the boiler or pressure vessel, acceptance of repairs and alterations may be made by an Inspector employed by any of the following:

1) The Division.

2) The Inspection Agency of record of the organization making the repair or alteration.

3) The Authorized Inspection Agency, provided the work was not performed by the Agency employing the Inspector, except as provided in subsection (f) of this Section.

e) Acceptance Inspection. It shall be the responsibility of the organization making the repair or alteration to coordinate the acceptance inspection of the repair or alteration. Except for repairs of a routine nature, a completed record of welding repairs shall be submitted to the Division by those organizations authorized under Section 120.1000(c)(2). Authorized repairers shall submit the appropriate National Board Form to the Division upon completion of repairs or alterations.

f) Owner-User Acceptance Inspection of Repairs. An Owner-User Inspector may perform acceptance inspections of repairs and alterations to boilers and pressure vessels when such repairs and alterations have been performed by the Inspector's employer, provided the repair organization and inspection procedures have the Division's specific approval. Such acceptance inspection procedures shall be subject to the concurrence of the Authorized Inspection Agency responsible for the boiler or pressure vessel.

g) Replacement Pressure Parts. In general, replacement pressure parts may be classified as follows:

1) Replacement parts subject to internal or external pressure that consist of materials which may be formed or assembled to the required shape by bending, forging or other forming methods, but on which no shop fabrication welding is performed may be supplied as material. Material and part identification shall be supplied in the form of bills of material and drawings with ASME Code compliance.

2) Replacement parts subject to internal or external pressure that are fabricated preassembled by welding, but on which shop inspection is not required by the ASME Code, shall have the welding performed in accordance with Section IX and other applicable Sections of the ASME Code. The replacement part assembly identification shall be supplied in the form of bills of material and drawings. The supplier or manufacturer shall certify that the material, design and fabrication are in accordance with the applicable Section of the ASME Code.

3) Replacement parts subject to internal or external pressure fabricated by welding which require shop inspection by an Authorized Inspector shall be fabricated by a manufacturer having an ASME Certificate of Authorization and the appropriate Code Symbol Stamp. A Manufacturer's Partial Data Report shall be supplied by the manufacturer.

h) Pressure Tests

1) Repairs. The Inspector may require a pressure test after the completion of a repair to a boiler or pressure vessel when in the Inspector's judgment one should be conducted.

2) Alterations. A pressure test in accordance with the National Board Inspection Code shall be applied to the boiler or pressure vessel on the completion of an alteration.

i) Repair Methods. Repair methods in this Section shall be used in conjunction with the general requirements in Section 120.1000(b) of this Part.

j) Defect Repairs

1) General. 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 method shall be used to assure its complete removal. If the defect penetrates the full thickness of the material, the repair shall be made with a complete penetration weld such as double butt weld or a single butt weld with or without backing. Before repairing a cracked area, care shall be taken to investigate its cause and to determine its extent.

2) Unstayed Boiler Furnace Cracks. Cracks at the knuckle or at the turn of the flange of the furnace opening require immediate replacement of the affected area or specific approval of repairs by the Authorized Inspection Agency.

3) Rivet or Staybolt Hole Cracks. 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.

4) Minor Defects. Minor cracks, isolated pits, and small plate imperfections shall be examined to determine the extent of the defect and whether welding is required. When welding is required, these defects shall be prepared for welding by removing to solid metal. Liquid penetrant or magnetic particle examination may be used before and/or after welding.

5) Defective Bolting. Defective bolting material shall not be repaired but shall be replaced with suitable material which meets the specifications of the applicable Section of the ASME Code.

k) Wasted Areas

1) Shells, Drums, Headers. Wasted areas in stayed and unstayed shells, drums and headers 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 (nondestructive examination) for the complete surface of the repair. For repairs of minor defects see Section 120.1041(j)(4) of this Part.

2) Access Openings. Wasted areas around access openings may be built up by welding or they may be repaired. In boilers, the area to be so repaired shall not be closer than 2 inches (50.8mm) from any knuckle.

3) Flanges. 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. 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 which leak because of warpage or distortion and which cannot be remachined shall be replaced with new flanges which have at least the dimensions conforming to the applicable Section of the ASME Code.

4) Tubes. Wasted ares on tubes may be repaired by welding provided that in the judgment of the Inspector the strength of the tube will not be impaired.

5) Corrosion, Grooving.

A) Localized corrosion that produced a groove, especially along or immediately adjacent to a joint, could be more serious than a similar amount of corrosion on solid plate away from the joint. Grooving and cracks along longitudinal joints are especially significant as they are likely to occur where the material is more highly stressed. Severe corrosion is likely to occur at points where the circulation of the corrosive fluid is poor; such places shall be examined most carefully.

B) For the purposes of estimating the effect of corrosion or other defects upon the strength of a shell, comparison shall be made with the efficiency of the longitudinal joint of the boiler or pressure vessel, the strength of which is always less than that of a solid sheet.

C) All flanging shall be inspected thoroughly, particularly the flanges of heads that are not stayed. Internal grooving in the fillets of such heads and external grooving in the outer surfaces of heads concave to pressure are very common since there is a slight movement in heads of this character which produces this kind of defect. Some types of boilers or pressure vessels have the ogee or reversed-flange construction in a few of their parts that may be inaccessible to the eye, but the conditions shall be determined by the insertion of a borescope, fiber optics or a mirror which, at a proper angle, will reflect back to the eye the condition of such a part.

D) On new vessels and on vessels for which service conditions are being changed, one of the following methods shall be employed to determine the probable rate of corrosion from which the remaining wall thickness at the time of the next inspection can be estimated:

i) The corrosion rate as established by accurate data collected by the owner or user on vessels in the same or similar service.

ii) If accurate data for the same or similar service are not available, the probable corrosion rate as estimated from the Inspector's knowledge and experience on vessels in similar service.

iii) If the probable corrosion rate cannot be determined by either of the above mentioned methods, thickness determinations shall be made after approximately 1000 hours of service, or one normal run if longer than this; subsequent sets of thickness measurements shall be taken after additional similar intervals until the corrosion rate is determined by this method; the corrosion data indicated by the first inspection may be used as a first approximation of the corrosion rate but shall be excluded from all subsequent computations of the corrosion rate, since attack on the initial surfaces may not be indicative of subsequent attack on corroded surfaces.

l) Seal Welding

1) Seal Welding of Tubes. Tubes may be seal welded provided the ends of the tubes have sufficient wall thickness to prevent burn through and the requirements of the appropriate Sections of the ASME Code are satisfied.

2) Seal Welding of Riveted Joints. Edges of butt straps, plate laps and nozzles, or of connections attached by riveting may be restored to original dimensions by welding. Seal welding of riveted joints, butt straps or rivets shall require the approval of the Authorized Inspection Agency.

m) Re-Ending or Piecing Pipes and Tubes. Re-ending or piecing pipes and tubes is permitted provided the thickness of the remaining tube or pipe is not less than 90 percent of that required by the applicable Section of the ASME Code.

n) Patches

1) Flush Patches. 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. Flush welded patches shall be subjected to an appropriate nondestructive examination which shall be consistent with the original construction requirements.

2) Tube Patches. 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.

3) 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 deterioration or wasting away. All requirements of the applicable Section of the ASME Code governing welded-in stays shall be met.

o) Alteration Methods. Alteration methods shall comply with the general requirements of Section 120.1000(b) of this Part.

p) Replacement Drums and Shells. Major replacement of pressure parts, including drums and shells, which are fabricated by welding and for which a Manufacturer's Data Report is required by the applicable Code Section shall be fabricated by a manufacturer having an ASME Certificate of Authorization and the appropriate Code Symbol Stamp. The item shall be inspected, stamped with the applicable Code Symbol and the word "PART", and reported on the appropriate Manufacturer's Partial Data Report.

q) Replaced Stamping. When a repair or alteration requires removal of that part of a boiler or pressure vessel containing the Code Stamping, the Inspector shall, subject to the approval of the jurisdiction, witness the making of a facsimile of stamping, the obliteration of the old stamping and the transfer of the stamping to the new part. When the stamping is on a nameplate, the Inspector is to witness the transfer of the nameplate to the new part. The Code Symbol is not to be restamped.

r) Rerating of a Boiler or Pressure Vessel. Rerating of a boiler or pressure vessel by increasing the maximum allowable working pressure (internal or external) or temperature, or decreasing the minimum temperature such that additional mechanical tests are required, shall be considered an alteration and shall be done only after the following requirements have all been met to the satisfaction of the Authorized Inspection Agency:

1) Revised calculations verifying the new service conditions shall be required from the original manufacturer for review and acceptance by the Authorized Inspection Agency. When such calculations cannot be obtained from this source, they may be prepared by an Engineer and forwarded for review and acceptance by the Authorized Inspection Agency.

2) 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 definitely known to comply with the edition of the Code to which the object was built.

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

4) The boiler or pressure vessel has been pressure tested for the rerated condition as required by subsection (h)(2) of this Section.

s) Suggestions

1) The Inspector should be well informed of the natural and neglectful causes of defects and deterioration of boilers and pressure vessels. The Inspector should be conscientious and extremely careful in observing, taking sufficient time to make the examinations thorough in every way, taking no one's statement as final as to conditions not personally observed, and, in the event of inability to make thorough inspections, the Inspector should note it in the report and not accept the statements of others.

2) The Inspector shall make a general observation of the conditions of the boiler room and apparatus, as well as of the attendants, as a guide in forming an opinion of the general care of the equipment.

3) The Inspector shall weigh very carefully the condition of any defects in order to determine their relation to, or influence upon, the safety of the inspected boiler or pressure vessel. The Inspector shall question responsible employees as to the history of old boilers or pressure vessels, their peculiarities and behavior; ascertain what, if any, repairs have been made; ascertain the character of repairs; and investigate and determine whether repairs were made properly and safely.

(Source: Amended at 21 Ill. Reg. 997, effective January 1, 1997)