NB11-1804

Changes to NBIC Part 3 – Revised Section: S1.2.2 Threaded Staybolts

S1.2.2 THREADED STAYBOLTS [SEE NBIC PART 3, ~~FIGURE S1.2.2~~ FIGURES S1.2.2 (a) and S1.2.2 (b)]

a) All threaded staybolts shall have either 11-or 12-thread pitch. Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from 11 to 12 or the reverse shall be considered a repair.

b) All staybolts shorter than 8 in. (200 mm) in length shall have telltale holes. Staybolt telltale holes in existing ~~bolts~~ staybolts shall be 3/16 in. (5 mm) to 7/32 in. (5.5 mm) in diameter and at least 1-1/4 in. (32 mm) deep in the outer end. When staybolts 8 in. (200 mm) or less in length are replaced, they shall be replaced with staybolts that have a telltale hole 3/16 in (5 mm) to 7/32 in. (5.5 mm) in diameter their entire length, or with ones that have a 3/16 in (5 mm) to 7/32 in. (5.5 mm) diameter hole in each end, drilled a minimum of 1-1/4 in. (32 mm) deep. On reduced body staybolts the telltale hole shall extend beyond the fillet and into the reduced section of the staybolt. Ball socket-type flexible staybolts may have telltale holes that extend from the threaded end of the bolt into the bolt head for a distance of one-third the spherical bolt head diameter.

c) Telltale holes shall be reopened after driving and riveting heads.

d) Staybolt length shall be sized so the length of bolt projecting through the sheet is not less than 1/8 in. (3 mm) and is sufficient to produce a full head after driving and riveting the head.

e) The thread lead of both bolt ends and both firebox sheets shall be synchronized to permit the bolt to be installed without stripping the threads.

f) When riveting staybolt heads, the ~~bolt's~~ staybolt's opposite end shall be bucked or braced to prevent damaging the ~~bolt's~~ staybolt's threads. Bracing can be done several ways, such as using a pneumatic holder or a heavy steel bucking bar. Driving the heads on both ends of the staybolt simultaneously using two pneumatic rivet hammers (double gunning) is acceptable. Staybolts ~~bolts~~ are to be driven in such a manner as to expand radially the staybolt ~~bolt~~ body and threads into the sheet prior to forming the head. Merely riveting over the head is not acceptable.

g) Ball socket-type flexible staybolts shall not be braced by inserting a spacer under the cap.

h) Installation of ~~different~~ larger diameter staybolts shall be considered a repair.

i) If the ends of staybolts are heated to facilitate forming the head or expanding the threads into the sheet, the lower critical temperature of the sheet and staybolt material shall not be exceeded.

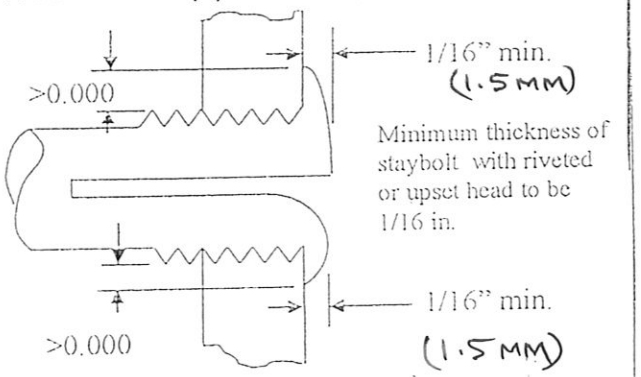
j) The minimum height of the staybolt head measured at its highest point shall be 1/16". [1.5MM)

k) When the diameter of a staybolt head has been reduced to the major diameter of the staybolt thread at any location either because of erosion during service or problems during installation, the staybolt shall be replaced. Repair is prohibited.

Change "Figure S1.2.2..." to "FIGURE S1.2.2 (a)..."

Add new FIGURE S1.2.2 (b) titled "RIVETED STAYBOLT HEAD DIMENSIONS"

FIGURE S1.2.2 (b) Riveted Staybolt Head Dimensions



Minimum diameter of staybolt riveted or upset head shall be greater than the staybolt major thread diameter at all points.

a) SA-516 steel is recommended for firebox repairs. It is a fine grain steel that accepts flanging and bending with less tendency to crack than coarse grain steels such as SA-515 or SA-285 Grade C. Coarse grain steels have, on occasion, been found to crack or split after complicated flanging, bending, and forming.

b) SA-36 shall not be used to make any pressure-retaining part such as shells, staybolt sleeves, or caps.

c) When rivets are made from SA-675, the finished rivets must meet the physical requirements of the original rivet specification or SA-31 Grade A or B.

d) When staybolt material tensile strength is greater than that of the firebox sheets, the firebox sheets deflect instead of the staybolts, which can result in the sheets developing cracks and leaking staybolts. In addition, high tensile strength steels are difficult to drive. Maximum allowable tensile strength shall be 7,500 psi (51.71 MPa).

S1.1.4 FORMULA AND CALCULATIONS FOR STEAM LOCOMOTIVE BOILERS

a) Most steam locomotive boilers were manufactured in the first half of the 20th century or before. The calculations, formula, and shop practices used are now distant history and quite difficult to obtain. The rules for riveted construction were last published by ASME in Section I Code, 1971 Edition.

b) This Supplement herein, is based in part on the ASME Code, Section III, 1952 Edition,[12] which was the last published edition of the Steam Locomotive Code. The railroad industry has attempted to collect the old formula and some shop practices. These have been published by The Engineering Standards Committee for Steam Locomotives, Inc. (ESC) as Compendium, Volume 1, Compilation of Calculations.[13]

S1.2 LOCOMOTIVE FIRETUBE BOILER REPAIRS

S1.2.1 REPAIR OF STAYBOLT HOLES

a) Staybolt holes may be repaired by welding, reaming, or retapping to a larger size or by installing a flush patch.

b) If the staybolt hole was threaded and is to be repaired by welding, the threads shall be removed prior to welding.

S1.2.2 THREADED STAYBOLTS (SEE NBIC PART 3, FIGURE S1.2.2)

a) All threaded staybolts shall have either 11- or 12-thread pitch. Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from 11 to 12 or the reverse shall be considered a repair.

b) All staybolts shorter than 8 in.(200 mm) in length shall have telltale holes. Staybolt telltale holes in existing bolts shall be 3/16 in. (5 mm) to 7/32 in. (5.5 mm) in diameter and at least 1-1/4 in. (32 mm) deep in the outer end. When staybolts 8 in. (200 mm) or less in length are replaced, they shall be replaced with staybolts that have a telltale hole 3/16 in. (5 mm) to 7/32 in. (5.5 mm) in diameter their entire length, or with ones that have a 3/16 in. (5 mm) to 7/32 in. (5.5 mm) diameter hole in each end, drilled a minimum of 1-1/4 in. (32 mm) deep. On reduced body staybolts, the telltale hole shall extend beyond the fillet and into the reduced section of the staybolt.

12 This Code is available from the National Board.

13 Copies of *The Engineering Standards Committee for Steam Locomotives, Inc., Compendium, Volume 1, Compilation of Calculations,* may be obtained from the Strasburg Rail Road, P.O. Box 96, Strasburg, PA 17579, 717.687.8421.

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Ball socket-type flexible staybolts may have telltale holes that extend from the threaded end of the bolt into the bolt head for a distance of one-third the spherical bolt head diameter.

c) Telltale holes shall be reopened after driving.

d) Staybolt length shall be sized so the length of bolt projecting through the sheet is not less than 1/8 in. (3 mm) and is sufficient to produce a full head after driving.

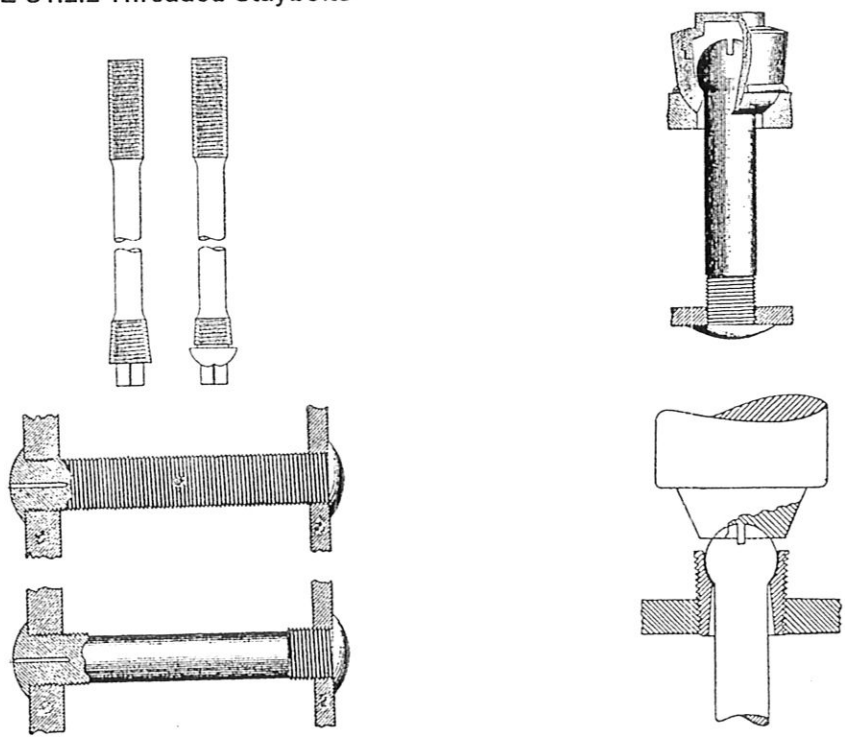
e) The thread lead of both bolt ends and both firebox sheets shall be synchronized to permit the bolt to be installed without stripping the threads.

f) When driving staybolt heads, the bolt's opposite end shall be bucked or braced to prevent damaging the bolt's threads. Bracing can be done several ways, such as using a pneumatic holder or a heavy steel bucking bar. Driving the heads on both ends of the staybolt simultaneously, using two pneumatic rivet hammers (double gunning), is acceptable. Bolts are to be driven in such a manner as to expand radially the bolt body and threads into the sheet prior to forming the head. Merely driving over the head is not acceptable.

g) Ball socket-type flexible staybolts shall not be braced by inserting a spacer under the cap.

h) Installation of different diameter staybolts shall be considered a repair.

FIGURE S1.2.2 Threaded Staybolts



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