4) **Rivets do not meet the specifications set forth in ASTM A31-B**

The tensile strength exceeds the maximum limit set forth by the A31 grade B material specification. This in turn violates CFR49 Part 230.29 (b) (1), and NBIC Section 3, S1.1.3.1 material specifications for locomotive boilers.

TABLE 1 Chemical Requirements

	Grade A		Grade B	
	Heat Analysis	Product Analysis	Heat Analysis	Product Analysis
Carbon, max, %	...	...	0.28	0.31
Manganese, %	0.30–0.60	0.27–0.63	0.30–0.80	0.27–0.83
Phosphorus, max, %	0.040	0.048	0.040	0.048
Sulfur, max, %	0.050	0.058	0.050	0.058

determined shall be reported to the purchaser or his representative and shall conform to the requirements for heat analysis in accordance with Table 1.

5.3 *Product Analysis*—An analysis may be made by the purchaser from finished materials representing each heat. The chemical composition thus determined shall conform to the requirements for product analysis prescribed in Table 1.

5.4 Application of heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted.

5.5 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology A751.

6. Mechanical Properties

6.1 *Rivet Bend Tests*:

6.1.1 The rivet shank of Grade A steel shall stand being bent cold through 180° flat on itself, as shown in Fig. 1, without cracking on the outside of the bent portion.

6.1.2 The rivet shank of Grade B steel shall stand being bent cold through 180° without cracking on the outside of the bent portion in accordance with Table 2.

6.2 *Rivet Flattening Tests*—The rivet head shall stand being flattened, while hot, to a diameter 2½ times the diameter of the shank, as shown in Fig. 2, without cracking at the edges.

6.3 *Bar Tensile Properties*—Bars shall conform to the tensile requirements in accordance with Table 3.

6.4 *Bar Bend Tests*:

6.4.1 The test specimen for Grade A steel bars shall stand being bent cold through 180° flat on itself without cracking on the outside of the bent portion.

6.4.2 The test specimen for Grade B steel bars shall stand being bent cold through 180° without cracking on the outside of the bent portion to an inside diameter which shall have a relation to the diameter of the specimen in accordance with Table 4.

7. Dimensions, Mass, and Permissible Variations

7.1 *Rivets*:

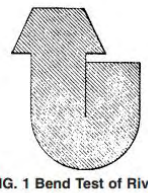

FIG. 1 Bend Test of Rivet

TABLE 2 Bend Requirements, Rivets

Diameter of Rivet Shank, in.	Ratio of Bend Diameter to Diameter of River Shank	
	Grade A	Grade B
¾ and under	flat	1
Over ¾	flat	1½

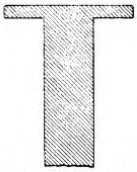

FIG. 2 Flattening Test of Rivet

TABLE 3 Tensile Requirements, Bars

	Grade A	Grade B
Tensile strength, psi (MPa)	45 000–55 000 (310–380)	58 000–68 000 (400–470)
Yield point, min, psi (MPA)	23 000 (160)	29 000 (200)
Elongation in 8 in. or 200 mm, min, %	27	22
Elongation in 2 in. or 50 mm, min, %	33	25

TABLE 4 Bend Requirements, Bars

Specimen Diameter, in.	Ratio of Bend Diameter to Diameter of Specimen	
	Grade A	Grade B
¾ and under	flat	½
Over ¾	flat	1

7.1.1 The dimensions of rivets shall conform to B18.1.2 for nominal diameters in. and larger and B18.1.1 for nominal diameters 7/16 in. and less.

7.1.2 Snap gage measurement shall be made at the point of minimum diameter, but it is not required that the rivet shall turn completely in the gage. Measurements of the maximum tolerance shall be made with a ring gage, all rivets to slip full to the head in the gage of the required size for the various diameters.

7.2 *Bars*—The diameter of hot-finished rivet bars shall not vary from the size specified by more than the amounts in accordance with Table 5.

8. Workmanship, Finish, and Appearance

8.1 *Rivets*—The finished rivets shall be true to form, concentric, and free of injurious defects.

8.2 *Bars*:

8.2.1 Bars shall be free of visible pipe, undue segregation, and injurious surface imperfections.

8.2.2 *Surface Finish*—The bars shall have a commercial hot-wrought finish obtained by conventional hot rolling. See 4.4 for producer's descaling option.

AADFW, INC.
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ACCREDITED
TESTING CERT. # 0603.01

Tensile Test Certificate

ASTM A 370-17 Rounded Per ASTM E 29-13

Prime: General ID: N/A

Jason Sobczynski
Next Generation Rail SVC
138 Farly Lane
Alvaton, KY 42122

PH: (404) 550-2823 FX:

Date Issued : 12/05/2017
Lab Number : L17173785
PO Number : KT14-1
Location: AADFW Lab
Date Tested : 11/30/2017
File Number : 0090492-00
Rev Date : Rev: 00

Part #: 1
Material: Low Carbon Steel

Specification: ASTM A 31 -14

Hardness Test Location: Core

Equipment	Method	REV
Tensile: Satec 120 HVL, SN:1290	ASTM A 370	17
Hardness: Newage Model Ni-300c, SN:91907	ASTM E 18	17e1

Bar Type: Round
Specification: N/A
Material:

Yield Criterion: Upper Yield
Rev:

Gage Length: 2.0 "

Elongation: % in 4D

	------ Dimensions (in) ------			---- Ultimate ----		-------Yield -------		Elong	R. A.	Hard.
Sample Req:		Dia.	Dia Final	(lbs)	(ksi)	(lbs)	(ksi)	(pct)	(pct)	HRB (W)
1		0.492	0.314	15105	79.5	12020	63.0	31	59	82

Disposition: For Review Only, based only on test data reported above. Nadcap requirement: Strain Rate prior to yield is .003 - .007 in/in/min; strain rate after yield is approximately .125 in/in/min. I certify that these are accurate and true results of the indicated tests performed in accordance with the AADFW applicable test procedures and relate only to the samples tested. AADFW is accredited by A2LA, Mechanical field of testing, Cert # 0603.01. All sample identification information was supplied by the customer.

AADFW, Inc. Jeremy Wilson, B.S., P.E., C.W.I., Metallurgist

5) **Interior Firebox Corners, Plate Misalignment, Lack of Full Penetration Weld**

PW-9.3.1 lays out permissible tolerances associated with sheet misalignment, the maximum allowable is 25% of sheet thickness. Misalignment on the waterside of the sheet are up to 83% or 5/16". This in turn violates CFR49 Part 230.29 (b) (1).

PW-9.3.1 Alignment of Shells and Vessels (Including Pipe or Tube Used as a Shell). In longitudinal shell joints, the middle lines of the adjoining thicknesses shall be in alignment within the fabricating tolerances specified in PW-33.

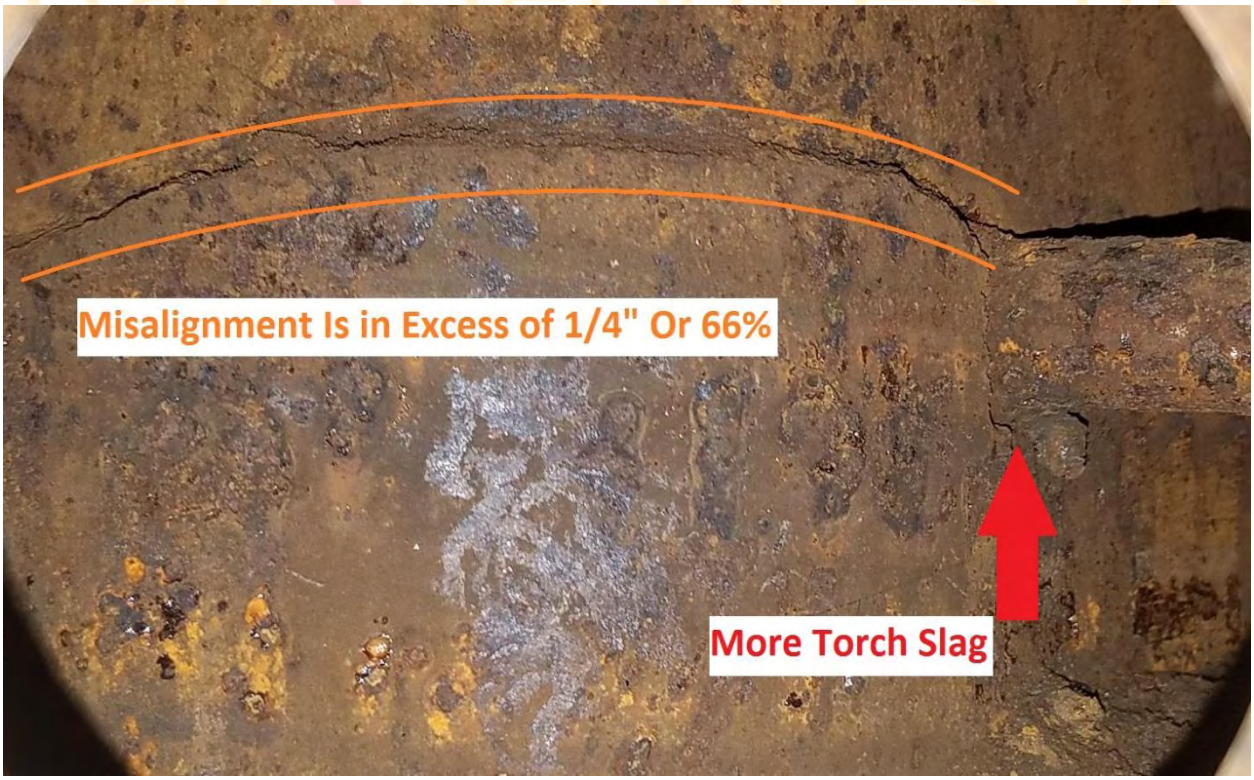
Alternatively, the middle lines of plates of differing thickness may be offset so that the inside or outside diameters of the thinner and thicker portions of the shell form a continuous surface, provided the following conditions are met:

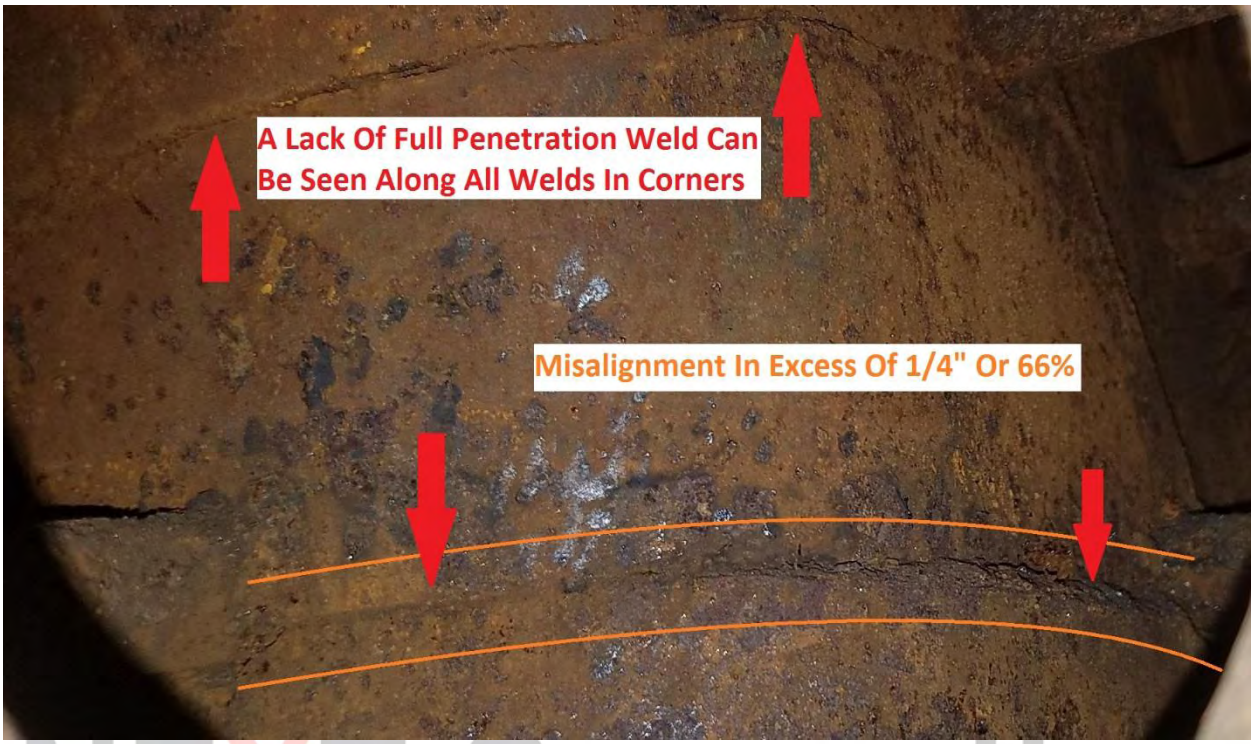
(a) The ratio of the thickness of the thicker plate to the thickness of the thinner plate shall not exceed 2:1.

(b) The maximum design temperature shall not exceed 750°F (400°C).

TABLE PW-33
ALIGNMENT TOLERANCE OF SECTIONS TO BE BUTT WELDED

Section Thickness, In. (mm)	Direction of Joints in Cylindrical Shells	
	Longitudinal In. (mm)	Circumferential In. (mm)
Up to ½ (13), incl.	¼t	¼t
Over ½ (13) to ¾ (19), incl.	⅛ (3.0)	¼t
Over ¾ (19) to 1½ (38), incl.	⅛ (3.0)	5/16 (5)
Over 1½ (38) to 2 (50), incl.	⅛ (3.0)	⅛t
Over 2 (50)	Lesser of 1/16t or ⅜ (10)	Lesser of ⅛t or ¾ (19)





PW-9.1. states that all welds are to be full penetration. It can be seen from the above photos that there is no 1 in 3 blending of the above limit offset, and no sign of weld coming through to the waterside of the plate. This in turn violates CFR49 Part 230.29 (b) (1).

PW-9 DESIGN OF WELDED JOINTS

PW-9.1 Longitudinal, circumferential, and other joints, uniting the material used for drums, shells, or other pressure parts, except as otherwise provided in PG-31, PG-39, PW-41, PWT-11, and Part PFT shall be full penetration butt welds. The welds should preferably be of the double-welded butt type, but may also be of the single-welded butt type with the filler metal added from one side only when made to be the equivalent of the double-welded butt joint by providing means for accomplishing complete penetration.