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Local & Munl. (1897) Department.

MISCELLANEOUS.

G.O., No. 2712 M

DATED 6-12-97

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DESPATCHED

[Despatch Abstract.]

Madras Steam Boilers and Prime Movers Act
Recording Ld. P.W.D. approving the
Sanitary Engineer's recommendations regarding
certain rules under the — and directing
that a notification proposing additional
rules under the Act be published in the
Fort Saint George Gazette for consideration
of any suggestions with respect to those
rules which may be received on or before
15th December 1897.

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

LOCAL & MUNICIPAL DEPT.
G.O. No. 4109 M

GENERAL.
ESTABLISHMENT.

Government { 1897 } of Madras. PUBLIC WORKS.

Recd.

Enclosures

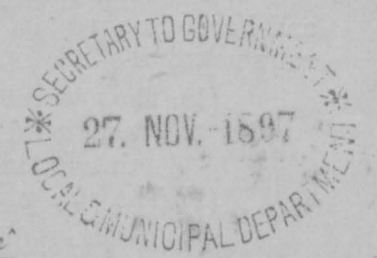
Regd.

1897.

Spare copies 6

G.O., No. 3104 W., 8th November 1897.

NOVEMBER.



Use only no 27/12 in Nov 8.12.97
Recorded.

PA 4/12/97 H 8.12.97

Cpy to the Resident, Madras
Order 7/12/97

Madras Steam Boilers and Prime Movers Act

Approving the Sanitary Engineer's recommendations regarding certain rules under the —, and directing that a notification proposing additional rules under the Act be published in the *Fort St. George Gazette* for consideration of any suggestions with respect to those rules which may be received on or before 15th December 1897.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

General.
Establishment.

READ—again the following paper:—

G.O., No. 2469 W., dated 6th September 1897.

READ—also the following papers:—

From Messrs. Richardson & Cruddas, dated 25th June 1897, No. 247.

From J. A. JONES, Esq., MEM. INST. C.E., F.R.S.E., Sanitary Engineer to Government, to the Secretary to Government, Public Works Department, dated Fort St. George, 7th July 1897, No. 1183.

I have the honour to inform you that, since the date of my No. 788 of 29th April 1897, the Boiler Inspector has found many deficiencies in the rules under the Boiler Act and has made several proposals for their amendment.

2. As the Madras rules were founded on the Bombay rules, it occurred to me that there must have been additions to the Bombay rules and on enquiry we find this to be the case.

3. I enclose a copy of the additional rules published on the 5th August 1896, and I therefore recommend that these rules should be similarly added to our existing rules noting the following:—

- (1) The new rules include a rule (addition to rule 10) which covers the rules sanctioned by Government in G.O., No. 1018 W. of 10th April 1897, and this latter rule should therefore be cancelled if new rules are approved.
- (2) The rule proposed under notification in G.O., No. 1444 W. of 28th May 1897, should also be cancelled as it is also covered by the additional rules added to rule 10 of Bombay original rules.
- (3) The words (if the proposed rules are sanctioned) "Add to rule 10 of the said rules" should be "Add to rule 22 of the said rules."
- (4) In the second paragraph of these additional rules the Boiler Inspector thinks that the words "a minimum of 27 tons may be used" should read "a minimum of 26 tons may be used," because, according to the adviser of the Board of Trade, steel may be found fit to bear only this tension.
- (5) On page 2 the words "see last paragraph of rule 10" should read "see last paragraph of rule 22."

4. I enclose a copy of the original Bombay rules for reference.

From the Sanitary Engineer, to Government, dated 12th July 1897, No. 1204.

" " " " 27th September 1897, No. 1548.

ORDER—No. 3104 W., dated 8th November 1897.

The proposals of the Sanitary Engineer are approved.

2. The following notification will be published.

published in the Fort St. George Gazette:

NOTIFICATION.

In exercise of the power conferred by section 23 of Act III of 1893, the Madras Steam Boilers and Prime Movers Act, His Excellency the Governor in Council proposes to make the following rules under the said Act. They will appear as additions to the rules published in the Fort St. George Gazette of the 26th January 1897.

"Add as note to Rule 19 Y of the said rules."

The recognition of a certificate under this rule is limited to new boilers when first licensed and to boilers not less than ten years old, provided they have not shown any defect during that period.

Add to Rule 22 of the said Rules.

The constants for plain furnaces 10 per cent.

In cases where the Inspector is satisfied from tests made on the steel from which the boiler has been constructed that it is of a certain tensile strength per square inch, that strength may be substituted for the 47,000 lb. (allowed for iron plates) in the formula given in Rule 19, but in no case is a greater strength than 32 tons (71,680 lb.) to be allowed. In other cases, provided there is sufficient proof that the boiler is of steel, a minimum of 26 tons may be used.

Solid steel screwed stays which have not been welded or otherwise worked after heating may be allowed a working stress of 9,000 lb. per square inch of net section. Steel stays which have been welded or worked in the fire have been found to be unreliable; therefore, they should not be passed.

When furnaces are machine-made by Messrs. The Leeds Forge Company, of the Fox corrugated and Morison suspension types, or by Messrs. John Brown & Co., Sheffield, of the Purves ribbed and grooved type, if they are

practically true circles, and the plates not less than $\frac{1}{16}$ inch thick, the working pressure is found by the following formula:

$$\frac{C \times T}{D} = \text{working pressure.}$$

C = 14,000 for Fox's corrugated and Brown's ribbed and grooved furnaces.

C = 13,500 for Morison's suspension furnace.

T = thickness in inches.

D = outside diameter in inches, measured at the bottom of the corrugations when the furnace is of the corrugated or suspension type, or over the plain parts when it is of the ribbed and grooved description.

In Fox's corrugated furnaces, the pitch of the corrugations and the length of the plain parts at the ends should not exceed 6 inches, and in Morison's suspension furnaces the pitch should not exceed 8 inches, and the length at the ends 5 inches. In both descriptions of furnaces the depth from top of corrugations outside to bottom of corrugations inside should not be less than 2 inches, and the plates at the ends should not be unduly thinned in the flanging.

The plates of ribbed and grooved furnaces should be formed by rolling, the ribs should not be less than $1\frac{1}{2}$ inches above the plain parts, and the depth of the grooves not more than $\frac{3}{4}$ inch, the length between the centres of the ribs not over 9 inches, and that of the plain parts at the ends not over 6 inches, and the ends rolled slightly thicker than the plain parts, and not reduced at any part by flanging, &c., below the thickness of the body of the furnace.

If the furnace is rivetted in one or more lengths the case should be submitted for consideration.

When horizontal furnaces of ordinary diameter are constructed of a series of rings welded longitudinally, and the ends of each ring flanged and the rings rivetted together, and so forming the furnace, the working pressure is found by

the following formula, provided the length in inches between the centres of the flanges of the rings is not greater than $(120 T - 12)$, and the flanging is performed at one heat by a suitable flanging machine, and also the conditions which follow the formula are complied with:

$$\frac{9,900 \times T}{3 \times D} \left(5 - \frac{l + 12}{60 \times T} \right) = \text{working pressure.}$$

T = thickness of plate in inches.

l = length between centre of flanges in inches.

D = outside diameter of furnace in inches.

The radii of the flanges on the fire side should be about $1\frac{1}{2}$ inches. The depth of the flanges from the fire side should be three times the diameter of the rivet plus $1\frac{1}{2}$ inches, and the thickness of the flanges should be as near the thickness of the body of the plate as practicable. The distance from the edge of the rivet holes to the edge of the flange should not be less than the diameter of the rivet, and the diameter of the rivets at least $\frac{3}{8}$ inch greater than the thickness of the plate. The depth of the ring between the flanges should be not less than three times the diameter of the rivets, the fire edge of the ring should be about the termination of the curve of flange, and the thickness not less than half the thickness of the furnace plate. Turned rings are such as may be considered a first-class method of construction.

The holes in the flanges and rings should be drilled in place if practicable, but if not drilled in place they should be drilled sufficiently small, and afterwards when in place rimmed out until the holes are quite fair, the holes should be slightly tapered and the heads of the rivets of moderate size.

After all welding, and after all flanging and heating, each ring should be efficiently annealed in one operation.

Compressive stress on tube plates.

A greater compressive stress should not be allowed on tube plates than 10,000 lb., which is that used in the following formula:

$$\frac{(D - d) T \times 20,000}{W \times D} = \text{working pressure.}$$

D = least horizontal distance between centres of tubes in inches.

d = inside diameter of ordinary tubes in inches.

T = thickness of tube plate in inches.

W = extreme width of combustion-box in inches from front of tube plate to back of fire box, or distance between combustion-box tube plates when boiler is double-ended and the box common to the furnaces at both ends.

When full allowance is wished the rivet section, if iron, in the longitudinal seams of cylindrical shells should, when those seams are lapped, be at least $\frac{1}{8}$ times the net plate section, and if steel rivets are used, their section should be at least $\frac{2}{3}$ of the net section of the plate, if the tensile stress of the rivets is not less than 26 tons and not more than 32 tons per square inch. In calculating the working pressure, the percentage strength of the rivets may be found in the usual way by the Board of Trade rules, but in the case of iron rivets the percentages found should be divided by $\frac{1}{8}$, and in the case of steel rivets by $\frac{2}{3}$, the results being the percentages required. If the percentage strength of the rivets by calculation is less than the calculated percentage strength of the plate, calculate the working pressure by both the method of construction as by the rules for iron boilers, may be used as the nominal factor of safety, but when using the percentage strength of the rivets 4.5 may be used as the factor of safety. The less of the two pressures so found is the working pressure to be allowed for the cylindrical portion of the shell, or otherwise in accordance with the formulæ in Appendix.

Plate and rivet section.

Add as an Appendix to the said Rules.

APPENDIX.

(See last paragraph of Rule 22.)

CYLINDRICAL BOILER SHELLS.

JOINTS WITH DRILLED HOLES.

Formulæ for ordinary chain-riveted and ordinary zigzag-riveted joints, and for joints of these descriptions, when every alternate rivet in the outer or in the outer and inner rows have been omitted—

Let E = distance from edge of plate to centre of rivet in inches.

V = distance between rows of rivets in inches.

V¹ = distance between inner and middle row of rivets in inches for joints J and K (Figs. 19 and 15).

B = boiler pressure in lb. per square inch.

C = 1 for lap or single butt joints.

C = 1.75 for double butt joints.

d = diameter of rivets in inches.

D = inside diameter of boiler in inches.

F = factor of safety for shell plates, as by clause 87 or clause 103.

n = number of rivets in one pitch.

p^D = diagonal pitch in inches.

P^D = diagonal pitch in inches between inner and middle rows of rivets in inches for joint J.

p = greatest pitch of rivets in inches.

r = percentage of plate left between holes in greatest pitch.

R = percentage of rivet section.

R¹ = percentage of combined plate and rivet section.

S = tensile strength of material in lb. per square inch of section.

T = thickness of plate in inches.

T¹ = thickness of each butt-strap in inches.

% = least value of r, R, R¹, as the case may be, divided by 100.

When joints are used in boiler construction other than those shown in the attached sketches, or when any of the rivets are pitched less than two diameters apart, the particulars of such joints should be submitted for the consideration of the Senior Inspector.

ORDINARY CHAIN AND ZIGZAG RIVETTED JOINTS.

Iron plates and iron rivets or steel plates and steel rivets:

$$\frac{100(p - d)}{p} = r.$$

Iron plates and iron rivets:

$$\frac{100 \times d^2 \times .7854 \times n \times C}{p \times T} = R.$$

Steel plates and steel rivets:

$$\frac{100 \times 23 \times d^2 \times .7854 \times n \times C \times F}{4.5 \times 28 \times p \times T} = R.$$

GIVEN C, d, F, n, T, TO FIND p, SO THAT r AND R ARE EQUAL.

Iron plates and iron rivets:

$$\frac{d^2 \times .7854 \times n \times C}{T} + d = p.$$

Steel plates and steel rivets:

$$\frac{23 \times d^2 \times .7854 \times n \times C \times F}{4.5 \times 28 \times T} + d = p.$$

GIVEN C, F, n, T, r, TO FIND p AND d.

Iron plates and iron rivets:

$$\frac{r \times T}{(100 - r) \times .7854 \times n \times C} = d.$$

$$\frac{100 \times r \times T}{(100 - r)^2 \times .7854 \times n \times C} = p.$$

Steel plates and steel rivets:

$$\frac{4.5 \times 28 \times r \times T}{23 \times (100 - r) \times .7854 \times n \times C \times F} = d.$$

$$\frac{100 \times 4.5 \times 28 \times r \times T}{23 \times (100 - r)^2 \times .7854 \times n \times C \times F} = p.$$

Iron plates and iron rivets or steel plates and steel rivets when d is found first, then:

$$\frac{100d}{100 - r} = p.$$

BUTT-STRAPS.

Iron plates and iron butt-straps or steel plates and steel butt-straps:

Double butt-straps:

$$\frac{5 \times T}{8} = T^1$$

Single butt-straps:

$$\frac{9 \times T}{8} = T^1$$

FOR DISTANCE BETWEEN ROWS OF RIVETS, &c.

Iron and steel:

$$\frac{3 \times d}{2} = E.$$

Chain-riveted joints (Figs. 2, 4, 6, 9, 11), not less than:

$$2 \times d = V.$$

See note at the end.

Zigzag-riveted joints (Figs. 3, 5, 7, 10, 12):

$$\sqrt{\frac{(11p + 4d)(p + 4d)}{10}} = V.$$

Diagonal pitch (Figs. 3, 5, 7, 10, 12):

$$\frac{6p + 4d}{10} = p^D.$$

TO DETERMINE THE WORKING PRESSURE.

$$\frac{S \times \% \times 2 T}{F \times D} = B.$$

CHAIN AND ZIGZAG RIVETTED JOINTS IN WHICH EVERY ALTERNATE RIVET HAS BEEN OMITTED IN THE OUTER ROW, OR IN THE OUTER AND THE INNER ROWS SUCH AS ARE SHOWN BY THE FOLLOWING SKETCHES:—

Iron plates and iron rivets or steel plates and steel rivets:

$$\frac{100(p-d)}{p} = r.$$

Iron plates and iron rivets:

$$\frac{100 \times d^2 \times .7854 \times n \times C}{p \times T} = R.$$

Steel plates and steel rivets:

$$\frac{100 \times 23 \times d^2 \times .7854 \times n \times C \times F}{4.5 \times 28 \times p \times T} = R.$$

Iron plates and iron rivets or steel plates and steel rivets:

$$\frac{100(p-2d)}{p} + \frac{R}{n} = R^1.$$

BUTT-STRAPS.

Where the number of rivets in the inner row is double the number in the outer row—

Iron plates and iron butt-straps or steel plates and steel butt-straps—

$$\frac{5 \times T(p-d)}{8 \times (p-2d)} = T^1.$$

Single butt-straps:

$$\frac{9 \times T(p-d)}{8 \times (p-2d)} = T^1.$$

When the number of rivets in the inner row is the same as in the outer row—

Double butt-straps:

$$\frac{5 \times T}{8} = T^1.$$

Single butt-straps:

$$\frac{9 \times T}{8} = T^1.$$

FOR DISTANCE BETWEEN ROWS OF RIVETS, &c.

Iron and steel:

$$\frac{3 \times d}{2} = E.$$

Chain-riveted joints (Figs. 13, 14, 15, 16):

$$\sqrt{\frac{(11p+4d)(p+4d)}{10}} = V$$

or

$$2 \times d = V$$

For joint K (Fig. 15):

$$2 \times d = V^1. \text{ See note at the end.}$$

Zigzag riveted joints (Figs. 17, 18, 19, 20):

$$\sqrt{\frac{(\frac{11}{2}p+d)(\frac{1}{2}p+d)}{20}} = V.$$

Diagonal pitch (Figs. 17, 18, 19, 20):

$$\frac{3}{16}p + \frac{1}{4}d = p^D.$$

For joint J (Fig. 19):

$$\sqrt{\frac{(11p+8d)(p+8d)}{20}} = V^1$$

Diagonal pitch (Fig. 19):

$$\frac{3p+4d}{10} = P^D.$$

TO DETERMINE THE WORKING PRESSURE—

$$\frac{S \times \% \times 2 T}{F \times D} = B.$$

MAXIMUM PITCHES FOR RIVETTED JOINTS.

T = Thickness of plate in inches.

p = Maximum pitch of rivets in inches, provided it does not exceed 10 inches.

C = Constant applicable from the following table:

Number of Rivets in one Pitch.	Constants for Lap Joints.	Constants for Double Butt Strap Joints.
1	1.31	1.75
2	2.62	3.50
3	3.47	4.63
4	4.14	5.52
5	—	6.00

$$(C \times T) + 1\frac{5}{8} = p.$$

When the work is first class, such pitches may be adopted so far as safety is concerned, yet in some cases it may be well not to adopt the greatest pitch found by the formula. The maximum pitch should *not*, however, exceed 10 inches with the thickest plates for boiler shells. If in any case the pitch is found to exceed that arrived at by the foregoing formula, for the particular description of joint and thickness of plate, such pitches should *not* be passed, but in all cases reported.

NOTE.—The minimum value of V or V¹ for chain riveted joints is given as 2d, but $\frac{4d+1}{2}$ is more desirable."

The rules proposed in the notifications published on pages 566 and 738 of the *Fort St. George Gazette*, dated 4th May and 15th June 1897, respectively, which are covered by the additions now made to rule 22, will be cancelled.

The Government will consider any suggestions made in respect of the above rules which may be received on or before the 15th December 1897.

(True Extract.)

Communtan
Under Secretary to Government.

To the Superintendent, Government Press.
" the Sanitary Engineer to Government.
" the Local and Municipal Department.
" the Judicial Department.
" Messrs. Richardson and Cruddas.

When given for copying _____
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READ AGAIN G.O., No. _____
189

DATED

CURRENT No.

CLOSURES TO C. No.

ORDER OF GOVERNMENT A A A A A A A

LETTER OF GOVERNMENT.

STATEMENT WITH DITTO.

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