

LOEFFLER BOILER INSTALLATION.

17. 7. 50

IT IS SUBMITTED the Trieste Surveyors be informed by air mail the plans submitted with their letters of the 7th and 15th June, together with the remarks contained in their letter of the 12th July have been examined and the following plans merit approval for a working pressure of  $130 \text{ Kg/cm}^2$ , provided the parts be constructed as shown on the plans under the usual conditions of survey and testing.

- No. 2238 H. Preheater (see comment re welding)
- No. 2505 H. Evaporator drum.
- No. 2511 H. Piping in evaporator.
- No. 2516 H. Manhole door.

The scantlings of the tubes shown on Plan No. 2529/H of the intermediate superheater are such as could be accepted for a working pressure of  $130 \text{ Kg/cm}^2$  at a temperature of  $330^\circ\text{C}$ .

The cylindrical shell containing the tubes is commented on in the Section dealing with welding.

With reference to plans Nos. 2504H, 2497H, 2500H, 2499H, in all of which certain parts are subjected to high temperatures, it has been necessary to take account of the creep properties of the material to be used.

In this connexion it is noted from the definition given in the Surveyors' letter of the 12th instant that the limiting creep stress as defined is associated with a particular temperature namely  $475^\circ\text{C}$ .

In dealing with the plans mentioned it has been assumed that the limiting creep stress (Dauerstands festigkeit) mentioned on the plan, referred to this particular temperature and that therefore the actual limiting creep stress at temperatures above  $475^\circ\text{C}$  would be somewhat less than that given.

Thus in the case of plan No. 2504H, a limiting creep stress of  $13 \text{ Kg./mm}^2$  is mentioned as applying to the material of pipes Nos. 2, 3, 5, 6 & 7 and in calculating the thickness



of the pipes which are subject to working temperature of 500°C the limiting creep stress has in the absence of more definite information been taken at 12Kg/mm<sup>2</sup>. *7.65 lb/mm<sup>2</sup>*

Similarly on Plans 2497H, 2500H, certain parts are subjected to a working temperature of <sup>550</sup>500°C and in these cases the limiting <sup>creep</sup> stress has been taken at 10 Kg/mm<sup>2</sup>. *6.4 lb/mm<sup>2</sup>*

It should be added that where parts are subjected to these high temperatures one third of the appropriate limiting creep stress has been taken as the safe working stress, due allowance of course being made for a corrosion factor.

On this basis these plans have been considered and the following comments are made:

Plan No. 2504H. Pipes between boiler and evaporator.

- ./ Pipe No. 1 - Thickness should not be less than 21.02mm.  
 Pipes Nos. 2 & 3 - Thickness should not be less than 26.8mm  
 Pipe No. 5 - Thickness should not be less than 25.7mm.  
 Pipe No. 6 - " " " " " 14.1 mm.  
 Pipe No. 7 - " " " " " 9.18mm.  
 ./ Pipe No. 11 - " " " " " 9.35mm.  
 ./ Pipe No. 14 - " " " " " 11.38mm.

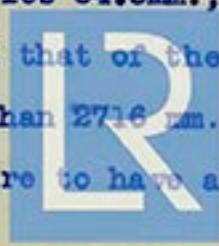
./ For pipes Nos. 1 & 11, a basic calculated stress of 10000 lb. per sq. inch has been taken, the remaining pipes having been calculated from consideration of creep as described above.

It is suggested that if these thicknesses are considered to be too great it might be advisable to fit two pipes of small diameter in place of one of larger diameter.

Plan No. 2497H. Superheater.

The thickness of the headers of 135 mm. diameter bore of molybdenum steel, having limiting creep stress of 16Kg/cm<sup>2</sup>. at 475°C and with tube holes 34.5mm., 100mm. apart should not be less than 26.8 mm. and that of the headers 139mm. diameter bore should not be less than 27.6 mm.

The tubes which are to have a working temperature of



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550°C should not be less than 8.68mm. in thickness.

Plan No. 2500H. Radiator superheater.

The thickness of the headers Nos. 43 & 44 made of molybdenum steel having a limiting creep stress of 12 Kg/mm<sup>2</sup> at 475°C, and 10Kg/mm<sup>2</sup> at 550°C with tube holes 26mm. diameter 136mm. apart, should not be less than 42.3mm. and the radiation superheater tubes subjected to the same temperature conditions should not be less than 6.9mm. in thickness.

Plan No. 2499H. Radiation superheater.

The headers Nos. 1 to 6 of molybdenum steel having a limiting creep stress of 18Kg/cm<sup>2</sup> at 475°C but subject to a temperature of 500°C and having holes 26mm. diameter, 136mm. apart, should not be less than 19.8 mm. in thickness.

In the circumstances these four plans are <sup>returned</sup> retained

for further consideration, *copies being retained in this office for reference.*

Welding.

In regard to the welding the Firm should be informed that it is necessary in the first instance to carry out a series of special tests in order to demonstrate to the satisfaction of the Society's Surveyors the soundness and reliability of their welding work having regard to the special importance of this construction and the high pressures involved.

For the purpose of this series of tests, test plates should be prepared and cut up to provide specimens which are to be tested under the supervision of the Society's Surveyors. The material of the test plates, the preparation, welding technique and process are to be the same as proposed for the actual manufacture of the boiler. In this connexion full particulars of the materials forming the welded joints should be forwarded and in cases where welds are made between two materials having different chemical and physical properties sample test plates should be made using these materials.

The test pieces cut from the test plates should include the following specimens:

\* It should be added that the working pressure on the discharge side of the steam pump has been taken as 3.5 Kg/cm<sup>2</sup> greater than in the working drum.



- (a) Tensile specimens taken transversely across the (joint).
- (b) Bend specimens.
- (c) Impact specimens. Tests to be taken in way of fusion zone, weld metal and parent plates.
- (d) Specimens selected by the Surveyor are to be polished and etched and photomicrographs taken at 100 magnifications at the following positions:-
  - (1) Parent plate remote from weld.
  - (2) Fusion zone.
  - (3) Centre of weld.

A sufficient number of tests should be taken in order that the results obtained may be regarded as representative.

With reference to the welding details shown on the plans it is observed that many of the important joints are electrically welded from one side only. It should be pointed out that in all cases joints should be arranged, as far as possible, so that welding and subsequent inspection can be carried out from both sides.

It is considered important that in the welding of parts subjected to steam pressure, complete penetration of the weld metal and the absence of entrapped slag should be ensured. In the circumstances, for those parts where it is not possible to weld on both sides, it is thought desirable that a form of joint such as that indicated in red on the plans should be adopted.

The following remarks have to be made in regard to the particular plans under notice:-

Plan No. 2500H.

It is recommended that the form of joint in way of the division plate in the headers should be as shown in red on the plan.

Plan No. 2529H.

In order that full consideration may be given to the design shown on the plan, further information should be forwarded giving particulars of the working pressure inside the cylindrical




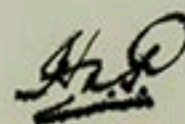



shell, and the form of longitudinal joint, if any. It may be mentioned that, depending upon this information some modification of this design may be required.

X Plan. No. 2238H.

It is recommended that the form of joint in way of the division plates in the headers should be as shown in red on the plan. ] X

The Surveyors should be asked to state whether this boiler will be completely manufactured at Trieste, and if not, to what extent it will be partially manufactured elsewhere. They should also state whether any part of the boiler unit will be finally welded on board the vessel.

   
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