


TD-106-2 Rev-5	Form No.		<h1 style="text-align: center;">PRODUCT STANDARD</h1> <h2 style="text-align: center;">HEAT EXCHANGERS</h2> <h3 style="text-align: center;">HYDERABAD</h3>		No: HE 5 1173
					REV. NO. 10
					Page 1 of 4

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SPECIFICATION FOR SEAMLESS TUBES FOR H.P. HEATERS L.P. HEATERS & DRAIN COOLERS (STAINLESS STEEL TUBES)

- Bend/straight tubes shall conform to SA 213 TP 304 / TP 304L/ TP 304N/ TP 316 as per drawing/enquiry/P.O with Carbon limited to 0.05 % max. in case of TP 304/ TP 304N/TP 316 and 0.035% in case of TP 304L. Carbon content Specified in the drawing/P.O shall be governing. Tubes shall be seamless cold drawn.
- Straight tubes or tubes ready for 'U' bending shall be furnished in the bright annealed condition (both inside and outside surfaces) with a minimum temperature of 1040°C followed by rapid cooling to below 370°C. The cooling rate shall be sufficiently rapid to prevent harmful carbide precipitation.
- After U bending U bent portion plus not less than 150 mm (6") of each straight leg of the tube beyond the tangent point of U bend shall be solution annealed to a minimum temp of 1040 °C followed by rapid cooling to below 370°C. U-bent tubes inside shall be purged with inert gas during heat treatment of U-bent portion.
- If the heat treatment of the U-bends as specified above is done by resistance heating methods, wherein electrodes are clamped to the tubes, the clamped areas shall be visually examined for arc burns. Burn indications shall be cause for rejection unless they can be removed by local polishing without encroaching upon, minimum wall thickness.

Temperature control shall be accomplished through the use of optical or omission pyrometers or both. No temperature indicating crayons, Lacquers or pellets shall be used.

- For tubes supplied in bend condition, tube thinning shall be governed by the following formula.

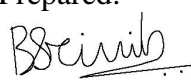
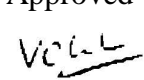
$$t = t_o (1 + d/4R) \quad \text{where}$$


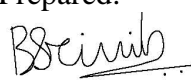
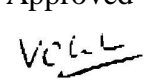
$$t = \text{Specified minimum wall tube thickness.}$$


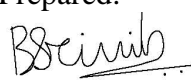
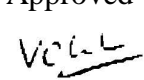
$$t_o = \text{Thickness after bending.}$$

$$D = \text{Outside diameter of tube.}$$

$$R = \text{Center line bend radius.}$$
- Minimum thickness, ovality etc., achieved for minimum bend radius tube for each thickness shall be proved.
- Hot bending to form U tubes shall not be acceptable.
- The tubes shall be tested for corrosion resisting properties as follows :
 - One full section sample 1 inch (25.4mm) long from the center of a sample tube of the smallest radius bend which is heat treated shall be tested in the heat treated condition in accordance with practices A262, practice-E.

Ref.Doc	Revisions: Refer to record of revisions	Prepared: 	Approved 	Date: 06.05.2004
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company		<div style="margin-left: 40px;"> <p>b) One full section sample 1 inch (25.4mm) long from each lot ("lot" refers to all tubes prior to cutting to length, of the same Nominal dia, and wall thickness, produced from the same heat of steel and annealed in a continuous furnace at the same temperature, time at heat, and furnace speed) of straight tubes shall be tested in the finished condition in accordance with practices A262, practice-E.</p> <p>c) The appearance of any fissures or cracks in the test specimen when evaluated in accordance with practices A262, practice-E. indicating the presence of inter granular attack, shall be cause for rejection of that lot.</p> <p>7. Eddy current test shall be carried out as per E426. Eddy Current testing to be carried out 100% online OR 100% Offline which shall be witnessed by BHEL/BHEL nominated inspection agency (BHEL TPIA) with quantum of inspection 100%. (The The type of notch and acceptance norm shall be Transverse tangential notch as per SA1016.)</p> <p>7a. Flaring test on each lot, atleast two tests from each lot are to be conducted as per SA1016.</p> <p>8. Permissible variation from the specified outside diameter shall not exceed ± 0.1 mm for stainless steel tubes (seamless). This includes ovality also.</p> <p>9. Permissible variations from the specified wall thickness.</p> <div style="margin-left: 20px;"> <p>a) Permissible variations from the specified minimum wall thickness shall not exceed $+20\% - 0$.</p> <p>b) Permissible variation from the specified average wall thickness are $\pm 10\%$ of the nominal wall thickness.</p> </div> <p>10. At the bend portion of the U-tube for $R=1.5 \times d$ or greater neither the major nor minor diameter of tube shall deviate from nominal prior to bending by more than 10%.</p> <p>11. Leg spacing measuring between the points of tangency of the bend to the legs shall not vary from the value ($2R$- specified tube O.D) by more than 1.5 mm. Where 'R' is the center line bend radius.</p> <p>12. The bend portion of the U-tube shall be substantially uniform in curvature and not exceed the normal center line radius by ± 1.5 mm.</p> <p>13. Permissible deviation from the plane of bend shall not exceed 1.5 mm as measured from point of tangency.</p> <p>14. Each tube shall be subjected to the hydrostatic test by DM water with a chloride content not exceeding 10 PPM, to the pressure indicated in the drawing / enquiry / P.O.</p> <p>15. Manufacturing, inspection, testing, certification & marking shall fully confirm to SA 213 TP 304 / TP 304L/ TP 304N/ TP 316 (as per drawing /enquiry / P.O) of ASME SEC II PART A, year of edition and addenda as indicated in drawing / enquiry / P.O and as per this standard.</p> <p>16. Packing shall be seaworthy and capable of withstanding mechanical damage. Tube ends shall be capped or plugged for protection against ingress of moisture / water during transit & storage. Supplier shall submit packing procedure with sketch of packing box along with the offer for BHEL's approval.</p> </div>			
Ref.Doc	Revisions: Refer to record of revisions	Prepared: 	Approved 	Date: 06.05.2004	

TD-106-2 Rev-5 Form No.		PRODUCT STANDARD HEAT EXCHANGERS HYDERABAD		No: HE 5 1173	
				REV. NO. 10	
				Page 3 of 4	
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company		<p>17. Supplier shall furnish test certificates in 6 copies. Test certificates shall contain the following information duly attested by BHEL Approved Third Party Inspection Agency, Additionally by Director Of Boilers for H.P. Heaters in case of indigenous supplies.</p> <ul style="list-style-type: none"> a) Purchase order No and Grade b) Specification No and Grade c) Heat No and Heat analysis d) Product analysis e) Size, thickness and quantity of tubes f) Results of all test as per specification & as per this standard carried out with BHEL Approved Third Party Inspection Agency. <p>18. Tubes inside & Outside surfaces shall be tested for residual chloride salt contamination to limits as per SA 688. The same shall be reported in Test Certificates. Procedure of measuring residual chloride contamination shall be furnished.</p> <p>19. Cleanliness of inside surface of all U tube shall be confirmed by blowing close fitting acetone soaked felt plugs. Inert gas or N2 shall be used for blowing.</p> <p>20. In the event of an order supplier shall furnish annealing procedure in advance for approval and also furnish co-related TC with all relevant details of heat treatment in accordance with approved procedure.</p> <p>21. ----</p> <p>22. -----</p> <p>23. Packing & Marking for U tubes – AA 049003.</p> <p>24. Packing & Marking for Straight Tubes – AA049002.</p> <p>25. Inspection and certification :</p> <ul style="list-style-type: none"> i) H.P.HEATERS: <ul style="list-style-type: none"> a) where the material is sourced from suppliers other than India ,the certification shall be in IBR form III B duly signed by BHEL Approved Third Party Inspection Agency(BHEL TPIA).BHEL TPIA shall be authorised by Central Boiler Board for that country. b) Where the material is sourced from Indigenous Suppliers, the certification shall be by Director of Boilers in form III B and also by BHEL Approved Third Party Inspection Agency(BHEL TPIA) as per ASME SEC.II Part A.Edition & Addenda as indicated in the drawing/P.O & enclosed quality plan. ii) L.P.HEATERS & DRAIN COOLER: <ul style="list-style-type: none"> a) Inspection & Certification shall be by BHEL Approved Third party Inspection Agency(BHEL TPIA) as per ASME SEC.II Part A. Edition & Addenda as indicated in the drawing/P.O & enclosed quality plan. 			
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	Refer to record of revisions			06.05.2004	



PRODUCT STANDARD
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HYDERABAD

No: **H E 5 1173**

REV. NO. 10

Page 4 of 4

RECORD OF REVISIONS

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