

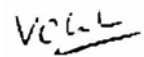


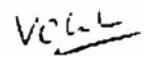



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| TD-106-1 Rev-5 | Form No. |  | PRODUCT STANDARD HEAT EXCHANGERS HYDERABAD | | HE 5 1103 |
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| <p align="center"><u>SPECIFICATION FOR SS WELDED TUBES FOR HP HEATERS, LP HEATERS AND DRAIN COOLERS</u></p> <ol style="list-style-type: none"> Bend/straight tubes shall conform to SA 688 TP 304/304L with maximum carbon limited to 0.05% in case of 304 and 0.035% in case of 304L. (The material specification shall be as per drawing/PO and ASME Sec II Part A edition and addenda as indicated in the drawing/P.O.) Eddy current test shall be done as per supplementary requirement 'S1' of specification SA 688. Heat treatment of straight tube and bent portion shall be carried out as per SA688. Straight tubes/straight tubes of U-Tubes before U-bending shall be bright annealed (both inside and out surfaces). U bend shall be purged with inert gas during Heat Treatment of U-bent portion. Flaring test on each lot atleast two tests from each lot are to be conducted as per SA 450. Longitudinal welds of tubes shall be ultrasonic tested. For tubes supplied in bent conditions, tube thinning shall be governed by the following formula. $t = t_o (1 + d/4R)$ where t = specified minimum tube wall thickness. t_o = Thickness after bending d = Outside diameter of tube R = 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. Bending, heat treatment and hydrotest shall be as per Quality Plan latest revision and relevant drawing. Each tube shall be hydrotested to test pressure mentioned in the drawing/P.O. Corrosion test shall be carried out as per requirement of SA 688 TP 304/304L Inspection and certification shall be as per ASME Sec. II Part A edition & Addenda as indicated in the drawing / P.O. & enclosed quality plan. In case of Lloyds inspection, where the material is sourced from suppliers other than India, the certification shall be in IBR form III C duly signed by Lloyds Register. | | | | | |
| Ref.Doc | Revisions: Refer to record of revisions | Prepared:  | Approved  | Date: 24.09.2004 | |

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| <p>11. Packing shall be seaworthy and capable for withstanding mechanical damage. Tube ends shall be capped or plugged for protection against ingress of moisture / water during transit and storage.</p> <p>12. -----</p> <p>13. Tubes inside & outside surfaces shall be tested for residual chloride salt contamination to limit as per of SA 688. The same shall be reported in T.Cs. Procedure of measuring residual chloride contamination shall be furnished.</p> <p>14. Cleanliness of inside surface of all U-tube shall be confirmed by blowing close fitting acetone soaked felt plugs. Inert gas or N2 / dry oil free compressor air shall be used for blowing.</p> <p>15. Inspection agency: Third party inspection agency. Additionally D.O.B. in case of H.P.Heaters (For Indegenious suppliers only).</p> <p style="padding-left: 40px;">a) The extent/ quantum of witness by Third party inspection agency shall be indicated as follows . However Vendor to carry out the tests on 100% of tubes.</p> <p style="padding-left: 80px;">i) Eddy current testing: 10% online and 100% for offline</p> <p style="padding-left: 80px;">ii) Ultrasonic testing (UST): 10%</p> <p style="padding-left: 80px;">iii) Hydro testing: 100%</p> <p>16. Product markings shall be as per SA 688.</p> <p>17. ----</p> <p>18. Packing and marking standard ref. no. for:</p> <p style="padding-left: 40px;">(a) Straight tubes - AA0490002</p> <p style="padding-left: 40px;">(b) U – tubes - AA0490003.</p> <p>19. In case of indigenous vendors the raw strip used for manufacturing tubes shall be procured from BHEL approved vendors.</p> <p>20. The residual circumferential stresses after tube straightening and U-bending shall be kept as low as possible .In any case these shall be limited to 4kg/mm² (compressive or tensile). One specimen shall be tested per lot. The procedure for residual stress measurement shall be approved by BHEL.</p> | | | | | |
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| RECORD OF REVISIONS | | | | | |
| 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 | 09 | 02-07-93 | STANDARD REWRITTEN AS PER NEW FORMAT | B.U.G | D.S |
| | 10 | 23-06-93 | QUALITY PLAN Nos. IN CLAUSE No. 7 AND 11 ARE REVISED | M.R.RAO | V.C.K |
| | 11 | 10-06-96 | TITLE & CL. No. 10 & 14 REVISED CL. No. 15 & 16 ADDED | M.R.RAO | V.C.K |
| | 12 | 26-06-98 | CLAUSE No. 17 ADDED | B.U.G. | V.S |
| | 13 | 22-01-03 | STANDARD REVISED INLINE WITH SQP AND PRQC MEETING DT:28-12-02 | B.S | V.S |
| | 14 | 06-05-04 | REVISED INLINE WITH MOM DT:30-03-04 | B.S | V.C.K |
| | 15 | 24-09-04 | REVISED INLINE WITH MOM DT:24-09-04 | B.S | V.C.K |
| | 16 | 12-01-07 | CL. no. 10 Revised. | <i>B.Scrib</i> | <i>V.C.K</i> |
| | 17 | 04-09-07 | CL. N0s. 1, 11 and 12 are revised. CL. NO 19 ADDED. | <i>B.Scrib</i> | <i>V.C.K</i> |
| | 18 | 10-11-08 | CL. NO 20 ADDED. | <i>B.Scrib</i> | <i>V.C.K</i> |
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