

	BHEL – Tiruchirappalli - 620014, India. Quality Assurance Department TECHNICAL DELIVERY CONDITIONS	DOC No: TDC:0:105 Rev: 04 Effective Date: 05/08/2019 Page: 1 of 3
Product: COLD DRAWN SEAMLESS MULTIRIFLED TUBES TO SPEC. SA210 Gr A1 & Gr C (for BOILERS)		

Revision record:

Rev 01: Dated 20/12/03: Totally revised. Major changes include Gr.A1,UT before rifling and equipment details removed. Annexure introduced in Cl.11.

Rev 02: Dated 25/06/04: Cl.6.0 revised

Rev 03: Dated 29/12/07:Cl 1.0-A1 included. Cl.2.0,4.0,6.0,8.0 modified. & Cl.11.0 modified for clarity

Rev 04: Dated 05/08/2019: *Cl 1 & 2 modified, Cl. 3 added to include billet/ bloom requirements, Subsequent clauses renumbered; Cl 6, 8 & 9 modified, Cl. 10 preservation requirements modified; Cl 11 modified, Cl 12 modified to bring inline with the latest IBR form and certification requirements; Cl 12.3 (g), (h) & Cl 13 added.*

1. MATERIALS

Specification: ASME (Latest as on the date of *Enquiry/PO, whichever is earlier*):

Material : SA 210 Gr. A1 & Gr. C

Additional Requirement : As listed below (Supplementary to *above material* specifications)

Size and Quantity : As per Purchase order

2. CHEMICAL COMPOSITION AND PROCESS OF MANUFACTURE OF TUBES:

Tubes shall be Cold Drawn. Ladle and Product analysis is required.

Maximum Carbon: 0.25% for SA210 GrA1 and 0.30 % for SA210 GrC.

3. BILLET/BLOOM REQUIREMENTS:

(a) The billets/blooms shall be fully killed and vacuum degassed.

Ladle analysis is required for all steels

(b) The billet/bloom shall conform to the chemical and process requirements of respective tube specifications. The billet/bloom shall be sourced from IBR well known steel makers or with inspection and certification by IBR authorized Inspecting Authority in case the mill is not approved by IBR.

Mill test certificate shall be submitted to BHEL.

4. DIMENSIONAL TOLERANCES

Dimensional tolerance shall be as per SA 450. The number of ribs, its configuration, width and lead angle shall be as per the drawing.

5. HEAT TREATMENT - Normalized condition

6. MECHANICAL TESTS

As per specification. Quantum of test:– *For each nominal size per heat per heat treatment batch* - Minimum 2 tubes for first 100 tubes and 1 per 100 or part thereof for tubes over 100 numbers, as per IBR. Full cross section of the tube shall be taken for tensile test and the area shall be computed by dividing the specific weight in kg/m by 7840.

7. NON DESTRUCTIVE TEST

Ultrasonic testing as per ASTM E213 on all tubes after rifling.

Calibration: Longitudinal notch 50mm long in OD. ID longitudinal notch shall be in between ribs and on top of rib. Depth of notch shall be 5% max. of specified wall thickness or 0.3 mm whichever is maximum. Scanning shall be in clockwise & anti clockwise direction. The smallest reflection echo obtained from the notches shall be calibrated not less than 50% of full screen height.

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8. FINISH AND REPAIR

Inside and outside *surfaces shall be* free from scales and defects like laps, seams, folds, cracks, pitting etc. Repairs by welding is prohibited. Surface defects can be removed mechanically, *ensuring smooth curved surface and* maintaining specified minimum thickness *without affecting the workmanlike finish.*

9. MARKING: (in English only)

a) **Details to be identified:** *Tubes shall be marked repeatedly & continuously along its entire length with the following details as indicated below:*

(1) PO Number, (2) Maker's emblem/code, (3) Specification & grade, (4) Heat number, (5) Size (OD x Thickness x Length, in mm), (6) No. of tubes, (7) Inspector's seal

Sl Nos: 1 to 5 to be paint stenciled, *repeatedly through the entire length* of each tube. Also Sl.No:1 to 7 to be stamped on Metal/Plastic tag attached to bundle. In addition, each tube shall be paint stenciled as rifled/ribbed.

b) **Colour Coding:** *Continuous longitudinal colour coding shall be done on the entire length of all tubes, without masking stenciling.* Colour coding scheme as per Procedure SIP: PP: 21 (latest).

10. PRESERVATION:

All tubes, shall have Rust Preventive Fluid (RPF) coating on the external surface as follows: *The Tubes shall be coated with suitable RPF with minimum DFT of 50 microns. RPF coated steel surfaces shall be capable of withstanding salt spray corrosion test for minimum 1000 hours. The RPF coating should be sea worthy, ensuring freedom from corrosion when transported through sea voyage. The RPF coating shall get dried and shall be a transparent coating, so that it is possible to see the tube surface clearly as well as read any stenciled matter on tube surface. The inside surface of the tube shall be protected with volatile corrosive rust inhibitor. Rust preventive coating shall withstand at least one year storage at open yard from receipt of materials. The supplier shall stand guarantee for this. Tube ends shall be closed with push type plastic end caps/plugs secured tightly to avoid entry of water during transportation and storage.*

11. PACKING:

Bundles to be ≤ 4 tons of equal no. of tubes, fastened with galvanized strap (1x25mm.min.) at both ends & at 1m interval in between. *Covering of tube bundles is not permitted.*

12. INSPECTION AND CERTIFICATION:

12.1 *Products shall be inspected at works and the applicable IBR Form must be Countersigned by the Inspecting Authority as indicated below:*

Imported Items: Inspecting Authority approved by IBR for the Country of origin (*Vendor shall obtain BHEL's concurrence for inspecting authority.*)

Indigenously Supply: Director of Boilers/Chief Inspector of Boilers/Inspecting Authority approved by IBR, for the respective state.

12.2 *Certification in IBR Form III-B for finished tubes from "IBR-Well Known Tube Maker" or "Inspecting Authority", as applicable, shall be submitted to BHEL. Also, certification in IBR Form IV for the raw material signed by "IBR-Well Known Steel Maker" or "Inspecting Authority", as applicable, shall be submitted to BHEL. Refer to BHEL Engineering Drawing: 4-03-000-00061 (Latest Rev) for MAWP values for various material grades & sizes at various temperatures.*

12.3 **Additionally, Manufacturer's Test certificate(MTC)** (ORIGINAL in ENGLISH) with following details shall be submitted to BHEL:

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- Purchase Order No. (BHEL), TDC No *and its Rev No*, Test certificate No., Size and Quantity-Melt wise.
- Specification and Grade with year of code, Heat Number, Steel & Tube making process, chemistry including incidental elements-Ladle and product Analysis.
- Heat Treatment details *with actual temperature and soaking time*
- Mechanical test results
- Detailed NDE report *with reference norms, acceptance standards and test results.*
- Grain size, as applicable.
- Certification for minimum DFT of rust preventive coating*
- Mill test certificate of the raw material (billets/blooms) as per Cl. 3.*

In the MTC a clause for Certificate of Compliance (as per SA 1016) shall be added stating that: All materials/components supplied to Purchase Order meet all requirements contained in the PO, this Technical delivery conditions and applicable ASME specifications.

13. These tubes are meant for use in Boilers. These tubes shall be capable of undergoing forming, bending and welding operations necessary for the application without developing defects.

 05/08/2019	 05/08/2019	 5/8/19	 05/08/19	 05/09/2019
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