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BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPALLI 620 014 INDIA

TECHNICAL DELIVERY CONDITION	FOR	COLD DRAWN SEAMLESS ALLOY STEEL TUBES TO SPECIFICATION AISI 602	TDC:0:108/00 PAGE 1 of 5

EFFECTIVE DATE 01.07.94

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REVISION NO.	DATE	APPROVED BY	SIGNATURE
00	01.07.94	SM/QA	

ISSUED BY : QUALITY ASSURANCE

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1.0 SCOPE

1.1 This Technical Delivery Condition specifies the additional requirements for the delivery of cold drawn seamless alloy steel tubes conforming to AISI 602.

1.2 This TDC is supplementary to the mandatory requirements covered in the specification.

1.3 The size and quantity shall be as specified in the purchase order.

2.0 CHEMICAL COMPOSITION AND PROCESS

2.1 The tubes shall be made from fully killed steel made by any one of the electric furnace processes.

2.2 The tubes shall be made by cold drawing only.

2.3 The chemical composition of the steel shall conform to the requirements given below, in both ladle and product analysis:

Element	% Composition
C	0.20 - 0.33
Mn	0.45 - 0.65
Si	0.55 - 0.75
P	0.04 max.
Cr	1.00 - 1.50
Mo	0.40 - 0.60
V	0.20 - 0.30

3.0 DIMENSIONAL TOLERANCES

3.1 All tubes shall conform to the dimensional tolerances as given below:

+0.0 -0.5

Tolerance on outside diameter : + 0.5 mm, - 0 mm
Tolerance on thickness : ± 10%

4.0 HEAT TREATMENT

4.1 All tubes shall be supplied in the normalised and tempered condition as given below:

Normalise at 940 - 980 deg. C/ 0.5 hour per inch thick soaking/ air cool.

Temper at 650 - 680 deg. C/ 1 hour per inch thick soaking/ air cool.

5.0 MECHANICAL TESTS

5.1 The tubes shall be subjected to mechanical tests as per specification. The acceptance criteria for tensile testing shall be as follows:

Tensile strength	: 130 - 260 Ksi
Yield strength	: 110 - 200 Ksi
% Elongation	: 10 min.
% Reduction in area	: 40 - 60

6.0 NON DESTRUCTIVE TESTS

6.1 ULTRASONIC TEST

6.1.1 Each length of tube shall be subjected to ultrasonic test in accordance with ASTM E213 with calibration notch of depth 5% of the wall thickness of the tube or 0.3 mm whichever is greater. However, the maximum notch depth shall be limited to 1.5 mm.

6.1.2 The calibration tube shall contain two longitudinal notches not exceeding 50 mm, which have been accurately machined along with longitudinal axis of the tube. For tubes of outer diameter exceeding 30 mm, one notch shall be on the outside and the other notch shall be on the inside separated by atleast 75 mm.

6.1.3 Each tube shall be scanned so that the sound beam is propagated in both the clockwise and counter clockwise directions as observed from one end of the tube.

6.2 HYDRAULIC TEST

6.2.1 Each length of the tube shall be hydraulically tested, if specified in the PO, to the pressure indicated.

7.0 REPAIR

7.1 Repairs involving fusion welding is prohibited.

7.2 Wherever defects are rectified by mechanical means, the wall thickness requirements shall be satisfactorily met with, and the surfaces shall be smoothly dressed up without any sharp edges.

8.0 WORKMANSHIP

8.1 The tubes shall be free from mill scales both on the inside and outside and shall present a workman like finish.

9.0 MARKING AND PACKING

9.1 The tubes shall be marked and despatched as given below:

9.2 MARKING

	Upto Dia. 76.1 mm (incl.)	Dia. above 76.1 mm upto 108 mm (incl.)
I. DETAILS TO BE IDENTIFIED:		
1. Purchase Order No. 2. Steel maker's emblem 3. Specn. & grade 4. Heat number 5. Size (OD X Wt. length) 6. No. of tubes 7. Inspector's seal.	1 to 7 to be stamped on metal tag attached to bundle. 1, 2, 3, 4 & 5 only to be paint stenciled on each tube (Stencil size shall be 20mm min.) for dia. 31.8 mm & above.	2, 3, 4 & 7 to be hard stamped on the body of the tubes. 1 & 5 to be paint stenciled on the tubes.
II. COLOUR CODING (Yellow & White)	Circumferential at both ends	

9.2.1 The marking shall be legibly done in ENGLISH language only.

9.3 PRESERVATION

9.3.1 All painted details shall be protected with one coat of transparent rust preventive.

9.3.2 All tubes shall be applied with resin type translucent rust preventive coating on the outside and either with rust preventive coating or rust inhibitor on the inside.

9.3.3 The ends of the tube shall be closed with end caps, which should be securely held so that it will not fall off during transit.

9.4 PACKING

9.4.1 All the tubes shall be supplied in bundles, properly packed in wooden crates to avoid any dent formation and other transit damages to the tubes. The weight of each consignment shall not exceed 2 tons.

9.4.2 A metal tag with Purchase Order number, tube specification and grade, outside diameter, nominal wall thickness, length of tubes in the bundle, no. of tubes in the bundle, serial no. and weight stamped shall be securely fastened in each bundle.

9.4.3 A packing list should be sent along with each consignment, with the following details:

1. Purchase order number
2. Number of bundles (indicating serial no. also)
3. No. of tubes in each bundle
4. Material specification and grade
5. Size of tube.

10.0 INSPECTION AND CERTIFICATION

10.1 All the tubes must be inspected at the works and the test certificates countersigned by an Inspection Authority, recognised by Indian Boiler Regulations, 1950. If the tube manufacturer is recognised as a "Well known tube maker" under IBR, then the tube maker's certificate is enough, with the prior approval of BHEL.

10.2 The certificates shall furnish the following details, in ENGLISH language only.

1. Purchase Order reference (BHEL)
2. Test certificate number
3. Specification
4. Quantity & Size
5. Heat number
6. Steel making process
7. Ladle analysis heat-wise
8. Product analysis heat-wise
9. Heat treatment details
10. Mechanical test results
11. NDT results with reference standard
12. Hydraulic test results.

10.3 Wherever specified in Purchase Order, the tubes shall be subjected to inspection by Authorities nominated by BHEL and the test certificates shall be countersigned by them.

11.0 END USE

11.1 These tubes are intended for use in the lance tubes of soot blowers.

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