	CORPORATE PURCHASING SPECIFICATION	AA 104 57
		Rev. No. 06
		PAGE 1 OF 2

ELECTRIC FUSION WELDED CARBON STEEL PIPES FOR HIGH PRESSURE SERVICE AT MODERATE TEMPERATURES

ORDERING DESCRIPTION FOR ASME SA 672, Gr.:B 60, Class 22

1.0 GENERAL:

The pipes shall conform to the latest version for ASME SA 672, Gr:B 60, Class 22 and comply with the following additional requirements. This specification covers sizes of pipes greater than 400 mm NB.

2.0 APPLICATION:

For service at stress levels and temperatures allowed by ASME Boiler & Pressure Vessel Code, Indian Boiler Regulations.

3.0 The welds shall be made either manually or automatically by an electric process involving the deposition of filler metal.

4.0 DIMENSIONS AND TOLERANCES:

Sizes:

Pipe OD X Thickness shall be as specified on BHEL order. Unless otherwise specified, pipes shall be supplied in single random lengths of 5 to 7 metres.

5.0 CHEMICAL COMPOSITION:

Shall be as per ASME SA 515, Gr.:60.

6.0 HYDROSTATIC TEST:

Each length of pipe shall be subjected to hydrostatic test as per ASME SA 530.

As an alternative to the Hydrostatic test, each length of pipe shall be subjected to NDT as given below:

a) For thickness upto 3.6mm, inclusive, Eddy current test as per ASME SE 309 or for thickness upto 12mm, inclusive, Flux leakage test as per ASME SE 570.

or

b) Ultrasonic test as per ASME SE 213.

Norms of acceptance shall be as specified in the respective standards mentioned above.

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7.0 NON-DESTRUCTIVE TESTS:

100% Radiographic examination shall be performed as per clause 9.0 of ASME SA 672.

8.0 INSPECTION AT SUPPLIER'S WORKS:

BHEL's representative shall have free access at all times to all parts of the manufacture's works, until the work on the contract of BHEL is being performed. The manufacturer shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with the specification.

9.0 CERTIFICATION :

Test certificate shall be provided as per IBR FORM-III D issued by WELL KNOWN PIPE MAKER who is recognised by Central Boiler Board. Copy of certification of recognition as Well Known Pipe Maker in FORM XVI - G shall also be enclosed along with the test certificate.

10.0 PACKING AND MARKING:

As per BHEL Corporate Standard AA 049 00 01.

11.0 REJECTION AND REPLACEMENT:

If each length of pipe does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of pipes BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

CARBON STEEL PIPES-ELETRIC RESISTANCE WELDED/SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of Electric Resistance Welded/Submerged Arc Welded, Carbon Steel Pipes, of 168.3 mm to 2540 mm.

2.0 APPLICATION:

For conveying gas, water and oil.

3.0 CONDITION OF DELIVERY:

Pipes shall be supplied in straight lengths with plain ends.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following National standard and also meet the requirements of this specification.

IS : 3589 - 2001	: Steel pipes for water and sewage
Gr: ERW - Fe 410	:

5.0 DIMENSIONS AND TOLERANCES :

5.1 Sizes:

Pipes shall be supplied to the dimensions specified on BHEL order.
BHEL order shall clearly state the outside diameter and well thickness of the pipe.

5.2 Tolerances:

5.2.1 Wall Thickness:

The tolerances on wall thickness of the pipes shall be ± 10% for ERW and +20%, - 12.5% for SAW.

5.2.2 Straightness:

The deviation from a straight line shall not exceed 0.2% of the length.

5.3 Length:

Pipes shall be supplied in random length of 4 to 7 metres unless exact lengths are called for in BHEL order.

6.0 MANUFACTURE:

Electric Resistance Welded and Induction Welded, Submerged Arc Welded:

The pipes shall be made from steel plates or strips by butt welding longitudinally or spirally. The weld shall be continuous. Prior to welding, edges or plates or strips may be prepared suitably where required, by process of manufacture.

7.0 FREEDOM FOR DEFECTS :

All pipes shall be cleanly finished and when visually inspected shall be free defects such as cracks, surface flaws, laminations etc. The ends shall be cleanly cut and reasonably square with the axis of the pipes.

8.0 CHEMICAL COMPOSITION :

The laddle analysis of steel and the maximum permissible variation in the composition of the product from the melt analysis shall be follows :

Element	Melt analysis, percent, max.	Permissible variation, for product analysis, max
Carbon	0.20	+ 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.040	+ 0.005
Manganese	1.30	+ 0.04

9.0 TEST SAMPLES :

Unless otherwise agreed between BHEL and manufacturer, the procedure for sampling of pipe for various tests and criteria for conformance shall be as given in IS:4711. Test samples shall be cut from pipes in final condition of supply.

9.1 Flattening Test:

For pipes produced in single lengths the flattening test shall be made form each end with the welds at 0^0 and 90^0.

For pipes produced in multiple lengths, tests shall also be made on two intermediate rings cut from each multiple lengths of pipe in the weld at 0^0.

10.0 MECHANICAL PROPERTIES :

10.1 Tensile:

When tested in accordance with IS:1608, the tensile properties of strip cut longitudinally (excluding weld) from selected pipe shall show properties given below :

Tensile strength	:	410 MPa, min
Yield stress	:	235 MPa, min.
Elongation on 5.65 √So gauge length	:	18 percent , min.

10.2 Fattening Test (For ERW pipes):

A ring not less than 40mm in length taken form the end of each selected tube shall be flattened between parallel plates as follows, in accordance with IS: 3589.

The test shall be made keeping, the weld at 90^0 to the direction of the force. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original diameter of the pipe or no cracks or breaks on the metal elsewhere than the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

10.3 Guided bend test (For SAW pipes):

Strips not less than 40mm wide cut circumferentially from pipes perpendicular to weld seam with weld near the middle of sample shall without fracture be doubled over a round bar the diameter of which shall be calculated as given below: The weld reinforcement shall be removed from faces.

One face and one root bend specimen as per fig.1 of IS:3589 shall be bent 180^0 in a jig in accordance with Fig.2 of IS:3589.

$$A = \frac{1.15\,(D-2t)}{eD/t - 2e - 1}$$

1.15 = peaking factor

D = Specified OD in mm

t = Specified wall thickness in mm

e = Strain in mm i.e. 0.1275 for grade Fe 410

Acceptance of bend test shall be as per clause 9.3.2 and 9.3.3 of IS:3589.

11.0 HYDRAULIC TEST:

Each length of the pipe shall be hydraulically tested at the manufacturer's works, before the pipes is coated, wrapped or lined at the manufacturer's works.

The hydraulic test pressure shall be the pressure calculated from the following formula, except that the maximum test pressure shall not exceed 5 MPa:

$P = 2St/D$

where P = Test pressure in MPa

S = Stress in MPa which shall be taken as 60 percent of the minimum yield stress

t = Specified thickness in mm

D = Specified outside diameter in mm

Test pressure shall be applied and maintained for sufficiently long time for proof and inspection.

NOTE: Normally 5 seconds are sufficient for the purpose of test.

12.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

In addition, to the above, the supplier shall ensure to enclose one copy of the test certificate along with their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information :

AA 101 47: Rev. No. 05: Carbon Steel Pipes-ERW/SAW

BHEL order No,
Supplier's Reference :

Name
Identification
Melt No.

Results of Tests :

Results of Dimensional inspection.
Results of chemical analysis and mechanical & hydraulic tests.

13.0 PACKING AND MARKING :

As agreed to between BHEL and manufacturer, surface coating if required shall be as per guide line given in annex A to D of IS:3589. When tubes are required to be galvanised. The zinc coating shall be in accordance with IS: 4736.

Each pipe shall be die-stamped with the following information:

AA 10147: Carbon Steel Pipes - ERW/SAW

BHEL Order No.

Consignment/Identification No.

Out side Diameter and Wall Thickness.

Supplier's Name

14.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1608 2. IS : 3589 3. IS:4711 4. IS:4736

PROCEDURE FOR MARKING AND PACKING OF SEAMLESS STEEL TUBES & PIPES

1.0 SCOPE

This standard specifies the requirements for marking and packing of seamless steel tubes and pipes.

2.0 MARKING

Sl. No.	Particulars	Upto & incl. 33.4 OD and thickness < 6 mm	Above 33.4 and up to & incl. 114.3 OD and thickness < 6 mm	Other sizes and thickness not covered in columns. (3) & (4)
(1)	(2)	(3)	(4)	(5)
I.	**DETAILS TO BE IDENTIFIED**			
1.	Purchase order No.	1 to 7 to be stamped on aluminium metal tag and securely attached to each bundle	2,3,4 & 5 only to be paint stenciled on each tube. 1 to 7 to be stamped on aluminium metal tag and securely attached to each bundle.	3, 4, & 7 to be hard stamped on the body of pipes 2, 5 and 7 to be paint stenciled on the pipes. (Alternatively paint stenciled is permitted on mutual agreement for 3, 4 & 7 only)
2.	Marker's emblem			
3.	Specn.No.& grade			
4.	Melt Number			
5.	Size (OD X TK X length)			
6.	No. of tubes/pipes			
7.	Inspector's seal			
II	**COLOUR CODING:**	Circumferentially/ Longitudinally	Circumferentially/ Longitudinally	Circumferentially/ Longitudinally

Note: If specified on order , the colour code on pipes and tubes shall be as per Annexure - I

2.1 Stamping shall be done at about 100mm from the ends of the pipe with rounded letters and depth of stamping shall not exceed 0.5 mm.

2.2 Stainless steel tubes/pipes shall be paint stenciled only and the paint shall be free from corrosion promoting agents like sulphur and chlorine.

2.3 Marking shall be legibly done in ENGLISH language only, preferably with a stencil of 20 mm.

3.0 PRESERVATION

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

3.2 Other than stainless steel, all tubes and pipes shall be applied with rust preventive coating on the outside and either with a rust preventive coating or rust inhibitor on the inside **to provide protection against corrosion for a period of 3 months for out door storage in marine / industrial atmospheres.** For heat exchanger tubes, rust preventive coating shall given dry or wet type as specified in BHEL order.

3.3 The ends of the tubes/pipes shall be closed with end caps made of PVC /plastic which should be securely held so that it will not fall off during transit.

Note: The supplier must specify the type of rust preventive at the time of supply and also the method of its easy removal.

4.0 PACKING

4.1
a) Tubes and pipes upto and including 33.4 mm OD and smaller shall be supplied in bundles.
b) Tubes and pipes above 33.4 to 114.3 OD shall also be supplied in bundles, whenever the wall thickness is less than 6.0 mm.
c) Tubes and pipes of OD above 33.4 mm and wall thickness above 6.0 mm shall be supplied loose.

4.2
a) Weight of each bundle shall not exceed 1 metric ton.
b) No wooden pellets should be used to cover the tubes.
c) The bundle must be fastened by using galvanized wire / metal straps.
d) Two straps must be fastened one at each end of the bundle at one metre from the ends. For the balance length, there shall be a wire bundling at reasonable intervals.

4.3 All the tubes of wall thickness 3.2 mm and below shall be properly packed in wooden crates to avoid any dent formation and other transit damages to the tubes.

4.4 A packing list, sealed in a thick polythene cover, shall be sent along with each consignment with the following details:

1. BHEL order number:
2. Number of bundles (including serial number also):
3. Material specification No. and grade:
4. Size of tube/pipe
5. Customer's Name

COLOUR CODES FOR TUBES AND PIPES ***ANNEXURE - I***

Specification	Colour - 1	Colour - 2	Colour - 3
13 x 1 MF	RED	YELLOW	-
13 Cr Mo 44	ALUMINIUM	BLACK	-
A 200 Gr. T5	ALUMINIUM	RED	YELLOW
A 200 Gr. T9	ALUMINIUM	GREEN	YELLOW
AISI 602	WHITE	YELLOW	-
API 5L Gr. B	ALUMINIUM	-	-
BS 3059 PART2 CDS /HFS 360	ALUMINIUM	BLACK	BROWN
BS 3602 PART 1 CDS 360	ALUMINIUM	BLACK	BLUE
NFA 49 - 213 42 C	ALUMINIUM	BLUE	BROWN
NFA49 - 213 TU 10 CD 9.10	ALUMINIUM	BLUE	RED
NFA49 - 213 TU 15 CD 2.05	ALUMINIUM	BLUE	GREEN
NFA49 - 213 TU Z10 CD 9	ALUMINIUM	BLUE	YELLOW
NFA49 - 213 TU Z10C VNSB 09.01	ALUMINIUM	GREEN	RED
SA 106 Gr. B	RED	-	-
SA 106 Gr. C	BLUE	-	-
SA 179	BLACK	BLUE	GREEN
SA 192	WHITE	-	-
SA 199 T5	BLUE	BROWN	RED
SA 209 Gr. T1	ALUMINIUM	RED	-
SA 210 Gr. A1	YELLOW	-	-
SA 210 Gr. C	BLUE	GREEN	-
SA 213 Gr. T11	ALUMINIUM	YELLOW	-
SA 213 Gr. T12	BROWN	YELLOW	-
SA 213 Gr. T2	BROWN	GREEN	-
SA 213 Gr. T22	GREEN	RED	-
SA 213 Gr. T5	BLACK	BROWN	GREEN
SA 213 Gr. T9	BROWN	WHITE	-
SA 213 Gr. T91	GREEN	YELLOW	-
SA 213 Gr. TP 304	BLUE	GREEN	YELLOW
SA 213 Gr. TP 304 H	BLACK	BLUE	YELLOW
SA 213 Gr. TP 304 L	BLUE	WHITE	YELLOW
SA 213 Gr. TP 304 M	BLACK	BROWN	YELLOW
SA 213 Gr. TP 316	BROWN	-	-
SA 213 Gr. TP 316 Ti	BLACK	BLUE	-
SA 213 Gr. TP 316L	BLUE	BROWN	YELLOW
SA 213 Gr. TP 321	BLUE	WHITE	-
SA 213 Gr. TP 321H	BLACK	WHITE	-
SA 213 Gr. TP 347H	BLACK	YELLOW	-
SA 268 Gr. TP 405	ALUMINIUM	GREEN	-
SA 268 Gr. TP 410	BROWN	RED	YELLOW
SA 268 Gr. TP 443	BLUE	GREEN	WHITE
SA 269 TP 315	GREEN	RED	YELLOW
SA 312 Gr. TP 304	BLUE	YELLOW	-
SA 312 Gr. TP 304L	BLUE	RED	YELLOW
SA 312 Gr. TP 316	BLACK	GREEN	-
SA 312 Gr. TP 304L	BLACK	BLUE	BROWN
SA 312 Gr. TP 321	BLUE	BROWN	-
SA 312 Gr. TP 3347	BLUE	RED	WHITE
SA 333 Gr. 1	BLACK	BROWN	RED
SA 333 Gr. 3	BLACK	GREEN	RED
SA 333 Gr. 6	BLUE	GREEN	RED
SA 334 Gr. 1	BROWN	GREEN	RED
SA 334 Gr. 3	BLACK	RED	YELLOW
SA 334 Gr. 6	BLACK	BLUE	RED
SA 335 Gr. P1	BROWN	GREEN	YELLOW
SA 335 Gr. P11	GREEN	WHITE	-
SA 335 Gr. P12	BLACK	RED	-
SA 335 Gr. P2	BLUE	BROWN	GREEN
SA 335 Gr. P22	BLUE	RED	-
SA 335 Gr. P5	BLACK	BROWN	-
SA 335 Gr. P29	ALUMINIUM	BROWN	-
SA 335 Gr. P291	BROWN	RED	-
SB 163 Incono1	BLACK	GREEN	YELLOW
ST 35.4	ALUMINIUM	BLUE	-
STEEL 20	GREEN	-	-
Structural Tubes & Pipes	BLUE	BROWN	WHITE
X20 Cr Mo V 121	BLACK	-	-