SEAMLESS AND WELDED AUSTENITIC STAINLESS STEEL PIPES (Ti STABILIZED)

(GRADE : AISI 321)

1.0 GENERAL:

This specification governs the requirements of seamless and welded austenitic stainless steel pipes for high temperature and general corrosive service.

2.0 APPLICATION :

General Engineering purposes.

3.0 DELIVERY CONDITION:

Hot or cold finish pipes.

4.0 COMPLIANCE WITH STANDARDS:

This specification, in general complies with requirements laid down in ASTM A 312, grade TP 321 for welded and seamless pipes.

5.0 DIMENSIONS AND TOLERANCES :

5.1 Sizes: Our order shall clearly state outside diameter and wall thickness of the tube

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Pipes shall be supplied in lengths of not less than 4.5 metres unless exact lengths are called for in the order.

5.2 Tolerances: Pipes shall comply with the dimensional tolerances as specified in ASTM A 530

6.0 MANUFACTURE:

The steel shall be made by electric furnace or similar process agreed upon by purchaser. Pipes shall be welded using an automatic welding machine with no addition of weld filler metal. The pipes may be hot or cold finished and shall be pickled free of scale if it has not been bright annealed.

7.0 FREEDOM FROM DEFECTS:

The finished pipes shall be straight and free from injurious defects and shall have a workman like finish.

8.0 HEAT TREATMENT:

All pipes shall be supplied in the following heat treated condition.

Solution Annealing: At a temperature of 1040°C to 1060°C and subsequently quenching or cooling rapidly to achieve the Mechanical properties specified.

NOTE: If the temperature of annealing exceeds 1065°C then a low temperature re-solution annealing has to be carried out at 840°C-900°C as a stabilization treatment, for upto 5 hrs, depending on the thickness of the section.

9.0 CHEMICAL COMPOSITION:

The analysis of the material shall be as follows:

Element	C	Si	Mn	Ni	Cr	S	P	Ti
%. Min	--	-	-	9.00	17.00	-	-	5x%C
% Max.	0.08	0.75	2.00	13.00	20.00	0.030	0.040	0.70
Permissible Variation	+0.01	+0.05	+0.06	-0.10 +0.15	+0.02	+0.005	+0.008	+0.05

10.0 TEST SAMPLES:

10.1 Chemical Tests: One sample per melt shall be tested.

10.2 Mechanical Tests: One tensile test shall be made on a specimen for lots of not more than 100 pipes. For lots of more than 100 pipes, two tensile tests have to be done.

10.3 Flattening Test: For material heat treated in a batch type furnace, flattening tests shall be made on 5 percent of the pipe from each heat treatment lot. For material heat treated by the continuous process, this test shall be made on a sufficient number of pipes to constitute 5 percent of the lot, but in no case less than two lengths of pipe.

NOTE: For welded pipes whose diameter exceeds 250mm, a transverse guided face bend test of the weld may be conducted instead of a flattening test in accordance with the method outlined in the steel tubular product supplement of methods and definitions of ASTM A 370. The ductility of the weld shall be considered acceptable when there is no evidence of cracks in the weld or between the weld and base metal after bending. Test specimens from 5% of the lot shall be taken from the pipe or test plates of the same material, the test plates being attached to the end of the cylinder and welded as a prolongation of the pipe on longitudinal seam.

10.4 Hydrostatic Test: Each length of finished pipe shall be subjected to the Hydrostatic test.

NOTE: The term 'Lot' applies to all pipes of the same notional size and wall thickness, which are produced from the same heat of steel and subjected to the same finishing treatment 1) in a continuous heat treatment furnace or 2) in a batch type heat treatment

11.0 MECHANICAL PROPERTIES:

11.1 Tensile: When tested in accordance with ASTM A530, the test pieces shall show the following properties:

Tensile strength	:	515 N/mm^2 Min.
Yield strength	:	205 N/mm^2 Min.

Elongation on 50 mm gauge length:

a) Longitudinal	:	35 Percent Min.
b) Transverse	:	25 Percent Min.

11.2 Flattening Test: Shall be conducted as specified in ASTM A 530 and shall meet the requirements specified therein.

11.3 Hydrostatic Test: Shall be conducted as specified in ASTM A 530 and shall meet the requirements specified therein.

12.0 ULTRASONIC EXAMINATION:

If specified in the purchase order, ultrasonic testing shall be conducted on each pipe in accordance with Corporate Standard AA 085 01 45 and the norms of acceptance shall be as specified therein.

13.0 TEST CERTIFICATES:

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

Test certificate shall bear the following information:

BHEL References:

HY 10992

BHEL Order No.

Supplier's Reference:

Supplier's Name
Heat No.
Batch/Identification No.
Process of manufacture

Results of Tests:

Results of chemical analysis and all mechanical tests called for in this specification.

14.0 PACKING AND MARKING:

As per BHEL Corporate Standard AA 049 00 01.

15.0 REPAIR OF DEFECTS:

Repairs involving fusion welding are prohibited.

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

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	-	-