PM/ IS 3601/ 1/ May 2020

PRODUCT MANUAL FOR
Steel Tubes for Mechanical and General Engineering Purposes
According to IS 3601:2006

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure coherence of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification licence/certificate.

1.	**Product**	:	**IS 3601:2006**
	Title	:	Steel Tubes for Mechanical and General Engineering Purposes
	No. of amendments	:	1
2.	**Sampling Guidelines**		
a)	**Raw material**	:	Steel, with ladle analysis, not showing Sulphur or phosphorus more than 0.040. For ERW pipes, HR strips as per IS 10748 are used preferably, wherever applicable.
b)	**Grouping Guidelines**	:	Please refer Annex - A
c)	**Sample Size**	:	Mechanical Test: 2 meters Chemical test : 5 pcs of 5cm x 5cm (for OES) or 50 gm drillings for testing by chemical method, 1m for Zn coating test.
3.	**List of Test Equipment**	:	Please refer Annex - B
4.	**Scheme of Inspection and Testing**	:	Please refer Annex - C
5.	**Possible tests in a day**	:	All tests
6.	**Scope of the Licence :**		
	Licence is granted to use Standard Mark as per IS 3601:2006 with the following scope:		
	Name of the product		Steel Tubes for Mechanical and General Engineering Purposes
	Grade		HFW 160, …
	Sizes		OD Thickness
	Condition		As welded,..
	With/Without		Zn coating

BUREAU OF INDIAN STANDARDS
Manak Bhawan, 9, Bahadur Shah Zafar Marg,
New Delhi – 110002

ANNEXURE A
TO PRODUCT MANUAL FOR
Steel Tubes for Mechanical and General Engineering Purposes
According to IS 3601:2006

GROUPING GUIDELINES

1. Grouping of steel tubes for Mechanical and General Engineering Purposes is carried out on the basis of following
   a) Method of manufacture
   b) Strength, Condition
   c) Bend Test
   d) Flattening Test
   e) Surface protection

2. Accordingly, for the purpose of the GOL/CSoL the product is grouped as under:

A. Welded Steel Tubes

Section	Tube Designation (in ascending order)	Size	Group	Remarks
2	WT 160 WT 210 WT 240 WT 310	Upto & Including 60.3mm	1	i. In order to cover all sizes under the group one sample of any size may be subjected to complete testing. ii. Subject to (i) above, in case Tube of higher-tube designation is tested and found conforming then lower grades may also be covered in the licence. iii. Subject to (i) & (ii) above, in case Galvanized Tubes are tested and found conforming then tubes uncoated or with manufacturer's standard mill protective coating may also be covered in the scope of the licence.
		OD Above 60.3mm OD	2	-do-
5	CEW 160 CEW 210 CEW 240	Upto & Including 60.3mm	3	-do-
		OD Above 60.3mm OD	4	-do-
	CEW 370 CEW 430	Upto & Including 60.3mm	5	-do-
		OD Above 60.3mm OD	6	-do-

B. Seamless Tubes

Section	Tube Designation (in ascending order)	Size	Group	Remarks
3	HFS 160 HFS 210 HFS 240 HFS 310	Upto and including 406.4mm OD	1	i. To cover all sizes under the group one sample, preferably of the highest OD, may be subjected to complete testing. ii. Subject to (i) above, in case Tube of higher-tube designation is tested and found conforming then lower grades may also be covered in the licence. iii. Subject to (i) & (ii) above, in case Galvanized Tubes are tested and found conforming then tubes uncoated or with manufacturer's standard mill protective coating may also be covered in the scope of the licence
4	CDS 160 CDS 210 CDS 240 CDS 310	Upto and including 406.4mm OD	2	i. To cover all sizes one sample of any size each from the group may be subjected to complete testing. ii. Subject to (i) above, in case Tube of higher-Tube designation is tested and found conforming then lower grades may also be covered in the licence. iii. Subject to (i) & (ii) above, in case Galvanized Tubes are tested and found conforming then tubes uncoated or with manufacturer's standard mill protective coating may also be covered in the scope of the licence
	CDS 370 CDS 430 CDS 540	Upto and including 406.4mm OD	3	-do-

3. Therefore, licence can be granted for all the sizes, conditions, tube designations applied by the applicant/licensee, as stated above, provided that the firm is having all necessary manufacturing capabilities and testing facilities for manufacture and testing for varieties proposed to be included in the licence scope.

4. In case of tube designations under section-2, for ratio of OD: thickness greater than 33:1, agreed upon tolerances to be declared by the manufacturer.

5. During the operation of license, BO shall ensure that all Grades & Product types covered in the license are drawn for independent testing on rotation over a period of time.

ANNEXURE B
TO PRODUCT MANUAL FOR
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LIST OF TEST EQUIPMENTS

Major test equipment required to test as per requirements of Indian Standard.

Sl. No.	Test Equipment/Chemicals and Identification Numbers (Where applicable)	Tests Used in with Clause Reference
1	Straightedge, String, Concrete platform and Vernier calliper	Straightness (6)
2	i) Vernier calliper gauge or any other suitable device ii) Steel scale iii) Outside micrometer iv) Weighing Balance v) Measuring Tape	Dimensions(10)
3	Universal Testing Machine (UTM)	Tensile Test (13.1)
4	UTM with suitable attachments	Crush test (13.6)
5	UTM with flattening test attachments	Flattening test (13.2)
6	Variable Speed Press or UTM, Conical Mandrels with angles 30^0,45^0,60^0 etc	Drift Test (13.5)
7	UTM, bars of suitable dia	Strip Bend Test(13.3)
8	Tube-bending machines with grooved former	Bend Test Whole Tube (13.4)
9	Copper carbonate (laboratory grade) or Copper hydroxide (laboratory grade), Copper Sulphate Crystals – Technical grade, Ammonium Hydroxide, Alcohol, Distilled water, Volatile organic solvent such as ether, trichloroethylene, carbon tetrachloride, etc. and other chemicals and reagents applicable, Thermostatically Controlled Freezer (Capable of achieving 15 deg to 20 deg Celsius temp., LC = 1 deg. C)	Surface Protection(11.2)
10	**Instrumental methods** Spectrometer: atomic-absorption spectrometry, inductively coupled plasma atomic emission, inductively coupled plasma mass spectrometry techniques, spark source optical emission spectrometry. Spectrophotometer	S,P (7,14,20,25) S,P
11	Strohlein or Leco apparatus with all attachments Barometer with chart, Hot plate, Muffle furnace, Complete range of glass wares, measuring cylinders, Desiccator, porcelain boats or ceramic crucibles, Thermometer, Electronic Balance, Distilled Water,Hot air oven, Oxygen - 99.5 percent minimum purity,ether or acetone, Standard Reference Material (NML) with certificate	S -chemical method, alternative to instrumental method (7,14,20,25)

	Reagents for C: tin granules or pure iron fillings, acidulated water/brine water, methyl red,caustic potash Reagents for S: Ceramic boats/crucibles – desiccators, Fluxes -Low sulphur copper, tin or iron, Dilute hydrochloric acid, Starch Iodide solution, Potassium iodate	
12	Weighing balance, Heater/ Heating element along with energy regulator, Ice water bath, Vol Flask Cap – 1 litre, (Whatman) filter paper No. 040,Suction Filtration Facility, Filter paper pulp pad,Standard Reference Material (NML) with certificate Potassium Permanganate ($KMnO_4$), Sodium Nitrite (Na_2NO_3), Ammonium Molybdate [$(NH_4)_2 Mo_2O_7$], Ammonium Phosphate [$(NH_4)_3 PO_4$], Potassium Nitrate (K_2NO_3), Phenolphthalein Solution, Rectified spirit or methyl alcohol, Sodium Hydroxide (NaOH), Hydrofluoric Acid (HF), Perchloric Acid ($HClO_4$), Sulphurous Acid, ,Hydrobromic Acid (HBr) , other chemicals and reagent as applicable	Phosphorus content- chemical method, alternative to instrumental method (7,14,20,25)

Note: The above is an indicative list for the purpose of guidance only

ANNEXURE C
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SCHEME OF INSPECTION AND TESTING

LABORATORY - A laboratory shall be maintained which shall be suitably equipped (as per the requirement given in column 2 of Table 1) and staffed, where different tests given in the specification shall be carried out in accordance with the methods given in the specification.

1.1 The manufacturer shall prepare a calibration plan for the test equipments.

2. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity.

3. LABELLING, MARKING, PACKING – The Standard Mark as given in the Schedule of the license and Licence Number (i.e. CM/L…….) shall be incorporated, and the marking and packing shall be done as per the provisions of the Indian Standard, provided always that the product thus marked and packed conforms to all the requirement of the specification.

4. CONTROL UNIT – For the purpose of this SIT, tubes of same size, type, grade designation, processed to same condition, manufactured from the same consignment of material (Cast/Heat of steel) under identical conditions in a shift on each tube mill shall constitute one control unit.

5. LEVELS OF CONTROL - The tests as indicated in column 1 of Table 1 and the levels of control in column 3 of Table 1, shall be carried out on the whole production of the factory which is covered by this plan and appropriate records maintained in accordance with paragraph 2 above.

5.1 All the production which conforms to the Indian Standards and covered by the licence should be marked with Standard Mark.

5.2 General requirements relating to the supply of material shall conform to IS 1387. Steels shall Steel tubes shall be manufactured as per Cl 7, 17, 21,26 & 30 of IS 3601:2006, as applicable.

6. TEST CERTIFICATE-For each consignment of BIS Certified material conforming to IS 3601:2006 there shall be a test certificate which shall contain the Standard Mark, the cast/Control Unit number and the corresponding test results (as given in Annexure-I enclosed)

7. REJECTIONS – Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1: LEVELS OF CONTROL

Section-1: GENERAL REQUIREMENTS APPLICABLE TO ALL THE FOUR TYPES OF STEEL TUBES

(1)				(2)	(3)		(4)
TEST DETAILS					**LEVELS OF CONTROL**		
Clause	**Requirements**	**Test Method**		**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**No. of Samples**	**Frequency**	**REMARKS**
		Clause	**Reference**				
4	Material i)Ladle Analysis	4.1	IS 3601:2006 IS 228(various Parts) or any established chem/instr.method	R	One	Each Heat	Applicable only for manufacturers with steel making facilities.
	ii)Check Analysis	4.2		S	One	Each Cast	No testing is required if material is ISI marked and received with test certificate.
6	Workmanship	6	IS 3601:2006	R	Each Tube	Each Tube	
8	Straightness	8	IS 3601:2006	R	Each Tube	Each Tube	
9	Length	9.1 9.2	IS 3601:2006	R	One	One hour's production of one size, type and grade	In case of failure all the tubes shall be checked and only those tubes found conforming shall be Marked.
10	Dimensions and properties	10	IS 3601:2006	R	One	-do-	
11	Surface Protection	11.1 11.2	IS 3601:2006 IS 2633	R[$]	One	Each Control Unit	This is an optional requirement. See Note-3.

Section-2: WELDED STEEL TUBES (WT)

(1)				(2)	(3)		(4)
TEST DETAILS					**LEVELS OF CONTROL**		
Clause	**Requirements**	**Test Method**		**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**No. of Samples**	**Frequency**	**REMARKS**
		Clause	**Reference**				
18	Mechanical Properties	13.1 to 13.1.3 Table-2,3 14 15	IS 3601:2006 IS 1608 Pt.1 IS 4711	R	One	Each Control Unit	
19	Tolerances	19.1 to 19.1.3 Table-4	IS 3601:2006	**R**	One (One hour's Production of each size, type & grade)	Every Hour	1. In case internal fin is required to be cut the maximum fin height is to be as agreed to between the manufacturer and the purchaser. 2. In case of failure all the tubes shall be checked and only those tubes found conforming shall be Marked.
20	Other Tests	13.2 13.4 13.5 14 15 Table-5,6,7	IS 3601:2006 IS 2329 IS 2328 IS 2335	R[$]	---do----	---do----	See Note-3

Section-3: HOT FINISHED SEAMLESS STEEL TUBES (HFS)

(1)				(2)	(3)		(4)
TEST DETAILS					**LEVELS OF CONTROL**		
Clause	**Requirements**	**Test Method**		**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**No. of Samples**	**Frequency**	**REMARKS**
		Clause	**Reference**				
22	Mechanical Properties	13.1 to 13.1.3 Table-8 14 15	IS 3601:2006 IS 1608 Pt.1 IS 4711	R	One	Each Control Unit	
23	Dimensions and Properties	23.1 23.1.1 Table-9	IS 3601:2006	R	One (One hour's Production of each size, type & grade)	Every Hour	In case of failure all the tubes shall be checked and only those tubes found conforming shall be Marked.
24	Tolerances	24.1 to 24.1.2	IS 3601:2006	**R**	---do----	---do----	
25	Other Tests	13.2 13.3 14 15 25.1 to 25.3 Table-10,11	IS 3601:2006 IS 2328	R[$]	---do----	---do----	See Note-3

Section-4: COLD DRAWN SEAMLESS STEEL TUBES (CDS)

(1)				(2)	(3)		(4)
TEST DETAILS					**LEVELS OF CONTROL**		
Clause	**Requirements**	**Test Method**		**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**No. of Samples**	**Frequency**	**REMARKS**
		Clause	**Reference**				
27	Mechanical Properties	13.1 to 13.1.3 Table-12 14 15	IS 3601:2006 IS 1608 Pt.1 IS 4711	R	One	Each Control Unit	
28	Tolerances	28.1 to 28.1.3 Table-13	IS 3601:2006	**R**	One (One hour's Production of each size, type & grade)	Every Hour	In case of failure all the tubes shall be checked and only those tubes found conforming shall be Marked.
29	Other Tests	13.2 13.6 14 15 29.1 to 29.3 Table-14,15	IS 3601:2006 IS 2328	R[$]	---do----	---do----	See Note-3

Section-5:COLD DRAWN ELECTRIC RESISTANCE WELDED STEEL TUBES & HIGH FREQUENCY INDUCTION BUTT WELDED STEEL TUBES (CEW)

(1)				(2)	(3)		(4)
TEST DETAILS					LEVELS OF CONTROL		
Clause	Requirements	Test Method		Test equipment requirement R: required (or) S: Sub-contracting permitted	No. of Samples	Frequency	REMARKS
		Clause	Reference				
32	Mechanical Properties	13.1 to 13.1.3 Table-16 14 15	IS 3601:2006 IS 1608 Pt.1 IS 4711	R	One	Each Control Unit	
33	Tolerances	33.1 to 33.1.3 Table-17	IS 3601:2006	**R**	One (One hour's Production of each size, type & grade)	Every Hour	In case of failure all the tubes shall be checked and only those tubes found conforming shall be Marked.
34	Other Tests	13.2 13.5 13.6 14 15 34.1 to 34.4 Table-18 to 20	IS 3601:2006 IS 2328 IS 2335	R[$]	---do----	---do----	See Note-3

Note-1: Whether test equipment is required or sub-contracting is permitted in column 2 shall be decided by the Bureau and shall be mandatory. Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empaneled by the Bureau.

Note-2: Levels of control given in column 3 are only recommendatory in nature. The manufacturer may define the control unit/batch/lot and submit his own levels of control in column 3 with proper justification.

[$]Note-3: Test equipment(s) to be possessed by the manufacturer only for type(s) and condition(s) in which they intend to supply the material.

ANNEXURE I

BIS STANDARD MARK

(Para 6 of the Scheme of Inspection and Testing)

XYZ IRON AND STEEL COMPANY

(Registered office Address and works address)

TEST CERTIFICATE FOR Steel Tubes for Mechanical and General Engineering Purposes

TEST CERTIFICATE No._____ DATE_____

To M/s_____

We certified that the material described below fully conforms to IS 3601:2006 Chemical composition and Physical properties of the product, as tested in accordance with the Scheme of Inspection and Testing contained in the BIS Certification Marks LicenceNo.CM/L_____ are as indicated below against each order No.

(PLEASE REFER TO IS 3601:2006 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order No. & Date	Control Unit No.	Qty in tonnes	Size			CHEMICAL COMPOSITION		PHYSICAL PROPERTIES@								Surface protection #	Remarks
			OD	Thk	Length	S %	P %	TS	YS	%EL	Drift test	Crushing test	Bend Test	Strip bend test	Flattening test		

If agreed between

@ As applicable

REMARKS

WAGON NO.

TRUCK NO.

FOR XYZ IRON AND STEEL COMPANY

(It is suggested that size A4 paper be used for this test certificate)