



उत्पाद मैनुअल
संघनकों और ऊष्माविनिमयकों के लिए ठोस कर्षित तांबा और तांबा मिश्रधातु की नालिकाए- विशिष्ट
1545: 1994 के अनुसार

PRODUCT MANUAL
FOR Solid Drawn Copper and Copper Alloy Tubes for Condenser and Heat
Exchangers -Specification
ACCORDING TO IS 1545:1994

विभिन्न उत्पादों के लिए भारतीय मानक ब्यूरो) अनुरूपता मूल्यांकन (विनियम, 2018 की योजना -I के तहत प्रमाणन के संचालन में एकरूपता और पारदर्शिता के लिए इस उत्पाद मैनुअल का उपयोग सभी क्षेत्रीय / शाखा कार्यालयों और लाइसेंसधारियों द्वारा संदर्भ सामग्री के रूप में किया जाएगा। दस्तावेज़ का उपयोग बीआईएस प्रमाणन प्राप्त करने के इच्छुक संभावित आवेदकों द्वारा भी किया जा सकता है।

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure uniformity 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.

1.	मानक संख्या IS No.	:	IS 1545:1994
	शीर्षक Title	:	Solid Drawn Copper and Copper Alloy Tubes for Condenser and Heat Exchangers -Specification
	संशोधनों की संख्या No. of amendments	:	NIL
2.	नमूना दिशानिर्देश Sampling Guidelines		
a)	कच्चा माल Raw material	:	No specific raw material requirement Note: This section indicates the requirements for raw material (if specified in the IS) for which compliance is to be established during Grant of Licence/Change in Scope of Licence/Factory Surveillance
b)	समूहीकरण दिशानिर्देश Grouping Guidelines	:	Please see Annex-A

c)	नमूने का परिमाण Sample Quantity	:	For chemical test: 5 pcs of 5 cm length For Hardness, Tensile Test, Flattening test, Drift Expanding Test, Microscopic Examination, Ammonia Vapour Cracking Test/Mercurous Nitrate Test: 2.5 m length The requirements of Non-Destructive Tests i.e. Eddy Current Test, Hydrostatic Test and Pneumatic Test shall be carried out on full length of tubes during factory testing only. Also, the requirements of Dimensions and Tolerances shall also be carried out in the factory only. Note: This section indicates the quantity of the sample of the product and/or the raw material (if applicable), required to be sent to the laboratory for testing, for the purpose of Grant of Licence/Change in Scope of Licence/ Factory Surveillance (in case of market surveillance, effort may be made to procure the required quantity of product sample, as far as possible since raw material sample may not be available in market)
3.	परीक्षण उपकरणों की सूची List of Test Equipment	:	Please refer to Annex-B
4.	निरीक्षण और परीक्षण की स्कीम Scheme of Inspection and Testing	:	Please refer to Annex-C
5.	एक दिन में संभावित परीक्षण Possible tests in a day		
	All tests are possible to be carried out in a day Note: This section is for the guidance of BIS Certification Officers/Technical Auditors of BIS Authorized Outside Surveillance Agencies (OSAs) during factory inspection to provide ready reference regarding the tests which can be witnessed during the inspection in the factory by the officer/auditor.		
6.	लाइसेंस का दायरा /Scope of the Licence:		
	"Licence is granted to use Standard Mark as per IS 1545. with the following scope: IS 1545:1994 के अनुसार मानक मुहर का उपयोग करने के लिए लाइसेंस निम्नलिखित कार्यक्षेत्र के लिए प्रदान किया जाता है		
	Name of the product उत्पाद का नाम		Solid Drawn Copper and Copper Alloy Tubes for Condenser and Heat Exchangers
	Grade		Cu-DLP, Cu-DHP, CuZn30As,
	Condition		As Drawn(HD), As Drawn and End Annealed, Half Hard (HB), Temper Annealed (TA), Annealed (O)
	Size		Outside Diameter from ...xx...mm to up to and includingxx... mm, Wall Thickness fromxx...mm to up to and includingxx... mm

ANNEX-A
GROUPING GUIDELINES

1) IS 1545:1994 covers the requirements of solid drawn (seamless) copper and copper alloy tubes of outside diameters 5 mm to 80 mm for use in condensers and heat exchangers. This standard covers seven grades of copper and copper alloy tubes as given in Table 1.

2) Further, these tubes shall be supplied either of the 5 conditions namely As Drawn(HD), As Drawn and End Annealed, Half Hard (HB), Temper Annealed (TA), Annealed (O).

3) In view of above, it is proposed to have the following grouping guidelines for the purpose of GoL/CSoL:-

Group	Grades	Grouping
1	Cu-DLP Cu-DHP	One sample of grade of any size (ODx WT) and condition shall be drawn and tested. If sample drawn above is of Grade having higher Copper Purity, grades having lower Copper purity shall also be covered in the licence i.e. if sample of Cu-DLP is drawn and tested, Cu-DHP may also be covered in the scope of the licence.
2	CuZn30As CuZn29Sn1As CuZn21A12As	Two samples of grades having the lowest and highest Cu content, of any size (ODx WT) and condition shall be drawn and tested to cover all grades in the scope of the licence. For example: If sample of CuZn30As and CuZn21A12As are drawn and tested, CuZn29Sn1As may also be covered in the scope of the licence.
3	CuNi10Fe1 CuNi30Mn1Fe	One sample of each grade of any size (OD XWT) shall be drawn and tested

4) The above samples drawn shall be such which:

a) Cover the entire range of sizes (wall thickness and outside diameter) of tubes intended to be

covered in the licence (such as lowest, intermediate and highest sizes as per manufacturing capability).

b) Cover all conditions (As drawn(HB), As Drawn and Annealed (HD), Half Hard (HB), Temper Annealed (TA) & Annealed (O)) of supply of Tubes intended to be covered in the licence.

5. Scope of licence shall be restricted based on the manufacturing and testing facilities available.

6. During operation of licence, samples of each variety covered in the scope of licence, shall be tested in rotation, to the extent possible

ANNEX – B

LIST OF TEST EQUIPMENTS

(INDICATIVE LIST, FOR GUIDANCE ONLY)

Sl. No.	Tests Used in with Clause Reference	Test Equipment/Chemicals and Identification Numbers (Where applicable)
1.	Chemical Composition, cl.9.	Spectrometer, Analytical Balance(0-200gm, LC-0.1mg) ,Hot Plate, Hot Air Oven, Photometer (Absorption cell), Porcelain/Silica Crucible, Platinum Crucible, Thermometer, Filter Paper including ashless filter paper pad, Stainless steel/nickel beaker, Plastic/polyethene/SS Beaker, Pyrex beakers and other glassware
2.	Copper by the Electrolytic Method	Platinum Electrodes, Plain or Perforated Sheet, Wire Gauze, Sulphuric Acid-Nitric Acid Mixture, Urea – solid, Ethanol or M ethanol , Ferric Nitrate Solution, Concentrated Ammonium Hy droxide, Ammonium Sulphate Solution, Dilute Sulphuric Acid, Concentrated Nitric Acid,General Glasswares, Burner, Electrolysis Assembly, Filter Papers
3.	Arsenic and Antimony by the Co-Precipitation (Iodimetric Method)	All glass distillation apparatus, Concentrated Nitric Acid, Concentrated Hydrochloric Acid, Ferric Nitrate Solution, Concentrated Ammonium Hydroxide, Dilute Ammonium Hydroxide, Dilute Sulphuric Acid, Carbon Dioxide – gas, Hypophosphorus Acid, Sodium Sulphite, Sodium Hydroxide Solution, Methyl Red Indicator Solution, Dilute Hydrochloric Acid, Sodium Bicarbonate, Starch Solution, Potassium Iodide Solution, Standard Iodine Solution, Tartaric Acid Solution,Hot Plate, Filter Paper
4.	Arsenic by the Hypophosphite (Alternate Method) (Applicable in absence of Se and Te)	Dilute Sulphuric Acid, Concentrated Nitric Acid, Concentrated Hydrochloric Acid, Sodium Hypophosphite, Dilute Hydrochloric Acid, Ammonium Chloride Solution, Standard Iodine Solution, Sodium Carbonate, Starch Solution, Standard Sodium Arsenite Solution-001 N, Analytical Balance, All glass distillation apparatus, Hot Plate, Paper-pulp Pad
5.	Bismuth by the Iodide (Photometric Method)	Concentrated Nitric Acid, Ferrous Ammom'um Sulphate, Concentrated Ammonium Hydroxide, Ammonium Carbonate Solution, Dilute Ammonium Hydroxide, Dilute Sulphuric Acid, Potassium Iodide Solution, Sodium Hypophosphite Solution, Phosphoric Acid, Standard Bismuth Solution, Analytical Balance, All glass distillation apparatus, Hot Plate, Filter Paper

6.	Iron (by the Dichromate (Volumetric) Method)	Dilute Nitric Acid, Concentrated Nitric Acid, Perchloric Acid, Hydrobromic Acid, Concentrated Ammonium Hydroxide, Ammonium Chloride Solution, Dilute Hydrochloric Acid, Starmous Chloride Solution, Mercuric Chloride Solution, Sulphuric Acid-Phosphoric Acid Mixture, odium Diphenylumine Sulphonate Indicator Solution, Standard Potassium Bichromate Solution, Ammonium Thiocyanate Solution, Standard Iron Solution, Analytical Balance, All glass distillation apparatus, Hot Plate, Filter Paper
7.	Iron (by the Ammonium Thiocyanate (Photometric)Method)	Dilute Nitric Acid, Concentrated Nitric Acid, Perchloric Acid, Hydrobromic Acid, Concentrated Ammonium Hydroxide, Ammonium Chloride Solution, Dilute Hydrochloric Acid, Starmous Chloride Solution, Mercuric Chloride Solution, Sulphuric Acid-Phosphoric Acid Mixture, odium Diphenylamine Sulphonate Indicator Solution, Standnrd Potassium Bichromate Solution, Ammonium Thiocyanate Solution, Standard Iron Solution, Analytical Balance, All glass distillation apparatus, Hot Plate, Filter Paper, Cover Glass, Spectrophotometer
8.	Lead by Colorimetric Method	Platinum Electrodes, Plain or Perforated Sheet, Wire Gauze, Dilute Nitric Acid, Hydrogen Peroxide Solution, Acidified Hydrogen Sulphide Solution, Ammonium Acetate Solution, Sucrose Solution, Standard Lead Acetate Solution, Analytical Balance, Hot Plate, Electrolysis Assembly, Titration Assembly
9.	Nickel by the dimethylglyoxime (gravimetric) method	Concentrated sulphuric acid, concentrated nitric acid, Tartatic Acid Solution, Concentrated Ammonium Hydroxide, Dimethylglyoxime Solution, Analytical Balance, Hot Plate, General Glasswares
10.	Selenium by the gravimetric method	Concentrated Nitric Acid, Ferric Nitrate Solution, Concentrated Hydrochloric Acid, Concentrated Ammonium Hydroxide, Dilute Ammonium Hydroxide, Dilute Hydrochloric Acid, Sulphur Dioxide Solution, Rectified Spirit, Analytical Balance, Hot Plate, General Glasswares, Filter Papers, Drying Oven
12.	Determination of tellurium by the gravimetric method	Tartaric Acid, Concentrated Ammonium Hydroxide, Sulphur Dioxide Solution, Hydrarine Hydrochloride Solution, Rectified Spirit, Carbon Dioxide, Analytical Balance, Hot Plate, General Glasswares, Sintered Glass Crucible, Drying Oven
13.	Determination of tin by the iodimetric method	Concentrated Hydrochloric Acid, Dilute Nitric Acid, Ferric Nitrate Solution, Concentrated Ammonium Hydroxide, Ammonium Chloride Solution, Dilute Hydrochloric Acid, Antimony Chloride Solution, Test Lead, a roll of nickel sheet , Carbon Dioxide – gas,

		Potassium Iodide Solution, Starch Solution, Standard Potassium Iodate Solution, General Glasswares, Analytical Balance, Hot Plate, Filter Paper
14.	Determination of phosphorus by alkalimetric method	Concentrated Nitric Acid, Potassium Permanganate Solution, Ammonium Nitrite Solution, Ammonium Nitrate, Ammonium Molybdate Solution, Potassium Nitrate Wash Solution, Phenolphthalein Indicator Solution, Sodium Hydroxide Solution, Standard Hydrochloric Acid Solution, Analytical Balance, Erlenmeyer flask, Other General Glass Wares, Hot Plate, Filter Paper, Titration Assembly
15.	Hardness Test, cl.10.1.1	Vickers Hardness Testing Machine with standard calibration blocks
16.	Tensile Test , cl.10.1. 2	Universal Tensile Testing Machine with extensometer
17.	Flattening Test, cl.10.2	Flattening Test Machine, Vernier Caliper, Filing or Chamfering Equipment
19.	Drift Expanding Test, cl.10.3	Variable Speed Pressor UTM, Conical Mandrels with angles 30 degree, 45 degree, 60 degree etc
20.	Eddy Current Test, cl.10.4.1	Eddy Current Tester with all assemblies
21.	Hydrostatic Test, cl.10.4.2	Hydrostatic Test Equipment, Pressure Gauge
22.	Pneumatic Test, cl.10.4.3	Pneumatic Test Equipment, Pressure Gauge
23.	Microscopic Examination, cl.10.5	Metallurgical Microscope (Magnification-100X), Sample Polishing Machines, Etchant
24.	Ammonia Vapor Cracking Test, cl.10.6.1	Analytical Balance, Ammonium Chloride, Glass Electrode, pH meter, Sodium Hydroxide flakes, 10% Sulphuric Acid Solution, Dessicator
25.	Mercurous Nitrate Test, cl.10.6.2.	Mercurous Nitrate Solution, Concentrated Nitric Acid, Distilled Water, Sulphuric Acid, Pickling Solution, Magnifying Equipment (10 to 18X)
26.	Dimensions and Tolerances, cl.8.	Micrometer, Vernier Caliper, Steel Tape, Straight Edge, Cord, Flat Table

ANNEX C

SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that manufacturers (licensees/applicants) will implement a Quality Assurance Plan i.e. a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan defining the control unit (i.e. lot/batch etc.) and the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and submit the same to BIS Branch Office for information. The manufacturer shall comply with the same and maintain test records in accordance with para 2.4.

1.3 RECOMMENDED LEVELS OF CONTROL/CONTROL UNIT:

1.3.1 For the guidance of manufacturers, the recommended definition of control unit is : **All copper tubes of the same size, condition, grade and manufactured from the same cast raw material on the same line in one go shall constitute a control unit.**

1.3.2 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in **Table 1**.

1.3.3 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan. Alternatively, the manufacturer has the option of adherence to the quality plan as per levels of control recommended in column 3 of Table 1.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING- It is expected that manufacturers (licensees/applicants) will establish a suitably equipped and staffed in house laboratory (In house testing facility) for testing at least those parameters of the Indian Standard which require routine testing for ensuring quality of the product. This includes in-process controls as may be defined and put in place by the manufacturer and testing parameters/requirements which can only be performed in the factory.

2.1 For the guidance of manufacturers, Table 1 giving the recommended levels of control is given below. Column 2 of Table 1 indicates routine tests where test equipment is required in house as "R" or other tests which can be subcontracted as "S". Subcontracting is permitted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.2 For MSME manufacturers, the requirement of maintaining a laboratory/in-house testing facility for routine tests (indicated as "R" in Column 2 of Table 1) is also optional.

2.2.1 MSME manufacturers may utilize common cluster based facilities as per guidelines for the utilization of cluster based test facilities by MSMEs or the provisions of Sharing of testing facilities or get testing done from BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.3 Large Scale manufacturers shall maintain an in-house laboratory equipped at least with test facilities for routine tests (indicated as “R” in Column 2 of Table 1), where different tests given in the specification shall be carried out in accordance with the method given in the specification. They shall also implement a calibration plan for the in-house test equipment.

2.3.1 Alternatively, in lieu of an in-house laboratory, large scale manufacturers can also utilize the provisions of Sharing of testing facilities as per the Guidelines for Grant of Licence available on BIS website www.bis.gov.in. (Under Conformity Assessment>Product Certification Process). Even for subcontracted tests, provisions for sharing of testing facilities can be utilized.

2.4 TEST RECORDS- The manufacturers maintaining an in-house laboratory or utilizing common cluster based facilities or shared test facilities shall maintain test records for the tests carried out to establish conformity. For the tests being subcontracted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025, test reports issued by the laboratories shall be available for inspection by BIS.

3. PACKING AND MARKING - The Standard Mark as given in the Schedule of the licence shall be incorporated legibly and indelibly on the box containing the Tubes and on test certificate accompanied along with each consignment, and the marking and packing shall be done as per the provisions of the Indian Standard provided always that the material so marked conforms to each requirement of the specification.

3.1 Packing and Marking shall be done as per the Indian Standard.

4. REJECTION - All the production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. 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
(ONLY FOR GUIDANCE PURPOSE)

(1)				(2)	(3)		(4)
TEST DETAILS					LEVELS OF CONTROL		REMARKS
Clause	Requirements	Test Method		Test equipment requirement R: required (or) S: Sub-contracting permitted	No. of Samples	Frequency	
		Clause	Reference				
7	Freedom from Defects	---	IS 1545	R	Manufacturer shall exercise adequate in-process controls to ensure that the material remains free from harmful defects		
8	Dimensions and Tolerances	8.1, 8.2, 8.2.1, 8.2.2, 8.2.3	IS 1545 IS 5493	R	Firm to have adequate in-process controls to check compliance of this parameter as per the tolerances given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity		
9	Chemical Composition	9.1, 9.2, Table 1	IS 1545 IS 440 or any other established instrumental/chemical method	R	One	Each Heat/Cast	In case of raw material procured from outside, the manufacturer shall ensure that the material is received with test certificate.

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							No further testing is required if the raw material procured is ISI marked
10.1.1	Hardness Test	Table 2	IS 1545 IS 1501 (Part 1)	R	One	Each Control Unit	-----
10.1.2	Tensile Test	Table 2	IS 1545 IS 1608 (Part 1)	R	One	Each Control Unit	-----
10.2	Flattening Test	10.2.1, 10.2.2	IS 1545 IS 2328	R	One	Each Control Unit	-----

10.3	Drift Expanding Test	10.3.1, 10.3.2	IS 1545 IS 2335	R	One	Each Control Unit	-----
10.4.1	Eddy Current Test	10.4.1, 10.4.1.1	IS 1545 IS 11612	R	Each Tube	Each Tube	-----
10.4.2	Hydrostatic Test	----	IS 1545	R	Each Tube	Each Tube	-----
10.4.3	Pneumatic Test	----	IS 1545	R	Each Tube	Each Tube	-----
10.5	Microscopic Examination	----	IS 1545 IS 4748	R	One	Each Control Unit	-----
10.6.1	Ammonia Vapour Cracking Test	-----	IS 1545	S	As per agreement between the manufacturer and purchaser		
10.6.2	Mercurous Nitrate Test	----	IS 1545 IS 2305	S	As per agreement between the manufacturer and purchaser		

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ANNEXURE I

XYZ COPPER COMPANY

(Registered office Address and works address)

TEST CERTIFICATE

**Solid Drawn Copper and Copper Alloy Tubes for Condenser and Heat Exchangers -Specification
as per IS 1545:1994**

TEST CERTIFICATE No.

Date_____

To M/s_____

We certified that the material described below fully conforms to IS **1545:1994** Chemical composition and Mechanical properties of the product, as tested in accordance with the Scheme of Testing and Inspection contained in the BIS Certification Marks LicenceNo.CM/L_____ are as

Indicated below against each order No.

PLEASE REFER TO IS **1545:1994** FOR DETAILS OF SPECIFICATION
REQUIREMENTS)

TEST RESULTS

Order No. & Date	Size	Control Unit No.	Quantity in tonnes	CHEMICAL COMPOSITION											Hardness	Tensile Strength	% Elongation	Flattening Test	Tolerances	Microscopic Examination	Non-Destructive tests	Drift Expanding Test	Ammonia Vapour Crack Test/Mercurous Nitrate Test	Remarks
				Cu %	Mn %	Sn %	Pb %	Fe %	Ar %	Al %	Ni %	Zn %	P %	T.I. %										

REMA

RKS

WAGO

N NO.

TRUCK NO.

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

FOR XYZ ALUMINUM COMPANY