



उत्पाद मैनुअल
ज्वाला और प्रेरण कठोरीकरण इस्पात -विशिष्ट
IS 3930:1994 के अनुसार

PRODUCT MANUAL FOR
Flame and Induction Hardening Steels
According to IS 3930:1994

भारतीय मानक ब्यूरो (अनुरूपता मूल्यांक) विनियम की स्कीम-I के तहत यह उत्पाद मानुयल प्रमाणीकरण के प्रचलन में रीति और पारदर्शिता के सुसंगत सुनिश्चित करने के लिए सभी क्षेत्रीय/शाखा कार्यालयों एवं लाइसेन्स धारियों द्वारा संदर्भ सामग्री के रूप में उपयोग किया जाएगा। बीआईएस लाइसेन्स/प्रमाण पत्र प्राप्त करने के इच्छुक भावी आवेदकों द्वारा भी इस दस्तावेज़ का उपयोग किया जा सकता है।

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 3930:1994
	Title	:	Flame and Induction Hardening Steels-Specification
	No. of amendments	:	- Nil -
2.	Sampling Guidelines		
a)	Raw material	:	No specific requirement for raw material
b)	Grouping Guidelines	:	Please refer Annex - A
c)	Sample Size	:	For Mechanical Properties and metallographic tests: 2 pcs of 1 m length For Chemical analysis: 5pcs each of length 5 cm
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 can be performed in a day

6.	Scope of the Licence:	
	License is granted to use Standard Mark as per IS 3930:1994 with the following scope:	
	Name of the product	Flame and Induction hardening steels
	Steel Designation	30C8,35C8, 45C8,.....
	Condition of Supply	Hot Rolled, Forged
	Heat Treatment	As rolled, Treated for Improved Machinability, Normalized, Annealed, Hardened & Tempered.
	Shape(Sizes)	Hot Rolled Round/Square/Hexagonal/Octagonal Bars of size fromxx.... mm to up to and includingxx.... mm Hot Rolled Round Rods of diameter fromxx.... mm to up to and includingxx.... mm Hot Rolled Flats of width fromxx.... mm to up to and includingxx.... mm, thickness from width fromxx.... mm to up to and includingxx.... Hot Rolled Billets/Blooms of size fromxx.... mm to up to and includingxx.... Hot Rolled Slabs of width fromxx.... mm to up to and includingxx.... mm, thickness from width fromxx.... mm to up to and includingxx.... Forged Bars, Billets, Blooms etc. of size/dimension fromxx.... mm to up to and includingxx....
	Optional Requirements	With or Without Ultrasonic test, Macro Etch Test, Cleanliness of Steel.....

ANNEXURE A

TO PRODUCT MANUAL FOR
Flame and Induction Hardening Steels
IS 3930:1994

GROUPING GUIDELINES

- 1) Grouping of different steel designations has been done on the basis of chemical composition/alloying elements. Guidelines for drawing of samples from each group are as under:

Group	Steel Designation	Remarks
1	30C8 35C8 45C8 55C6	Two samples each from the group with one designation of minimum carbon limit and one designation of maximum carbon limit, of any any shape and size shall be drawn and tested to cover all steel designations within the group. However, separate samples are required to be drawn for each condition of supply and heat treatment condition.
2	37Mn6 47Mn6 40Mn15S12 35Mn6Mo3 35Mn6Mo4	Two samples each from the group with one having the lowest total percentage alloying content (Cr+Mo+V+Ni) and one having the highest total percentage alloying content (Cr+Mo+V+Ni) of any shape and size shall be drawn and tested to cover all steel designations within the group. However, separate samples are required to be drawn for each condition of supply and heat treatment condition.
3	40Cr4 50Cr4 50Cr4V2 42Cr4Mo2	Two samples each from the group with one having the lowest total percentage alloying content (Cr+Mo+V+Ni) and one having the highest total percentage alloying content (Cr+Mo+V+Ni) of any shape and size shall be drawn and tested to cover all steel designations within the group. However, separate samples are required to be drawn for each condition of supply and heat treatment condition.
4	40 Ni14 35Ni5Cr2 40Ni6Cr4Mo2 40Ni6Cr4Mo3 31Ni10Cr3Mo6	Two samples each from the group with one having the lowest total percentage alloying content (Cr+Mo+V+Ni) and one having the highest total percentage alloying content (Cr+Mo+V+Ni) of any shape and size shall be drawn and tested to cover all steel designations within the group. However, separate samples are required to be drawn for each condition of supply and heat treatment condition.

- 2) However, it shall be ensured that the firm is having all the necessary manufacturing and testing facilities for the manufacture and testing of the shapes and sizes/steel designations /heat treatment conditions of Rolled or Forged Steel Bars, Billets, etc. to be included in the license.
- 3) During the operation of license, BO shall ensure that all the shapes/sizes/steel designations/conditions/heat treatments covered in the license are drawn for independent testing on rotation over a period of time.

ANNEXURE B
TO PRODUCT MANUAL FOR
Flame and Induction Hardening Steels
According to IS 3930:1994
LIST OF TESTING EQUIPMENT

Page 1 of 2

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

Sr. No	Test Equipment/Chemicals	Tests Used in with Clause Reference
1.	Rough Polishing Machine, Abrasive Cutting Machine, Fine Polishing Machine, Grinding Machine, Molding machine, Longitudinal cutting machine	Preparation of specimen
2.	Instrumental methods Spectrometer: atomic-absorption spectrometry, inductively coupled plasma atomic emission, inductively coupled plasma mass spectrometry techniques, spark source optical emission spectrometry. spectro polisher (sample preparation) Spectrophotometer	7.1,7.2,7.3, Table 2 (C,S,P,Mn,Si, Ni, Cr, Mo, V,Cu, Sn)
3.	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 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	7.1,7.2,7.3, Table2 (for C& S, chemical method, alternative to instrumental method)
4.	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 ₂ NO ₃), Ammonium Molybdate [(NH ₄) ₂ Mo ₂ O ₇], Ammonium Phosphate [(NH ₄) ₃ PO ₄], Potassium Nitrate (K ₂ NO 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	7.1,7.2,7.3, Table2 (Phosphorus content , chemical method, alternative to instrumental method)

5.	Hot plate, Conical flask Reagents: silver nitrate, ammonium persulphate sodium arsenite solution, Dilute Nitric Acid, Phosphoric Acid, Dilute Sulphuric Acid, Concentrated Nitric Acid, NaCl Solution, Permanganic acid	7.1,7.2,7.3, Table2 (Manganese content , chemical method, alternative to instrumental method)
6.	Medium textured filter paper, Porcelain casserole, platinum crucible, filter paper pulp, hot plate, hot air oven, muffle furnace Reagents: Silver nitrate solution, concentrated nitric acid, concentrated sulphuric acid, Dilute Hydrochloric Acid, Dilute Sulphuric Acid, Perchloric Acid, Tartaric acid and hydrofluoric acid	7.1,7.2,7.3, Table2 (Silicon content , chemical method, alternative to instrumental method)
7.	Plate, Muffle Furnace, porcelain or silica crucible, Reagents: HotWash Solution(dilute sulphuric acid solution 1: 99 v/v with hydrogen sulphide), dilute sulphuric acid, hydrogen sulphide, Dilute Nitric Acid, Sodium Fluoride, solid, Dilute Ammonium Hydroxide, Acetic Acid, Potassium Iodide, Starch Solution, Sodium Thiosulphate Solution, Ammonium Bifluoride Solution	7.1,7.2,7.3, Table2 (Cu content , chemical method, alternative to instrumental method)
8.	Hot plate, stop watch Reagents: dilute sulphuric acid and phosphoric acid mixture, concentrated nitric acid, ammonium persulphate, silver nitrate, dilute hydrochloric acid, ferrous ammonium sulphate, standard potassium permanganate solution.	7.1,7.2,7.3, Table2 (Cr content ,chemical method, alternative to instrumental method)
9.	Reagents: Perchloric Acid, Phosphoric Acid, Nitric Acid, Hydrochloric Acid, Dilute sulphuric acid, potassium thiocyanate solution, stannous chloride solution, n-butyl acetate, Iron-Mo free, molybdenum metal (99.9 pc pure) Spectrophotometer, Volumetric flask, conical flask, titration apparatus (burette, pipette etc.), hot plate, thermometer, separating funnel, dry filter paper and other laboratory glassware and apparatus	7.1,7.2,7.3, Tabe2 Mo content (for determination of Mo by thiocyanate photometric method) method in low and high alloy steels for Mo 0.01 to 1.50 percent)
10.	Reagents: Dilute sulphuric acid, conc nitric acid, hydrofluoric acid, boric acid solution, potassium bisulphite, ferrous sulphate solution, Alpha-Bentoinoxime Solution, Bromine Water, Sulphuric Acid-Benzoinoxime Wash Solution, Dilute Ammonium Hydroxide Solution, Concentrated Hydrochloric Acid, Dilute Hydrochloric Acid, Tartaric Acid, solid, Hydrogen Sulphide, gas, Hydrogen sulphide Wash Solution, Cinchonine Solution Platinum crucible, Volumetric flask, conical flask, titration apparatus (burette, pipette etc.), hot plate, thermometer, separating funnel, ashless filter paper and other laboratory glassware and apparatus	7.1,7.2,7.3, Tabe2 Mo content (for determination of Mo by Alpha-benzoinoxime method in alloy steels for Mo > 1 percent and not containing Tungsten)
11.	Vision-based inspection system(10X magnifying glass), Stereo microscope	6 (Freedom from defects)
12.	Vernier Calipers , Micrometer, tape	13 (Dimensions and Dimensional Tolerances)

13.	UTM Machine with Extensometer	10 (Tensile Test)
14.	Unit having Quenching fixtures, arrangement for keeping specimen in place wait water jet emerging from cone at the bottom to touch the lower end of the sample. Muffle furnace, safety equipment, Rockwell hardness tester	12 (Hardenability)
15.	Brinell Hardness Tester with Tungsten Carbide Indenter, Standard Calibration Blocks	9 (Hardness)
16.	Metallurgical Microscope with image analyzer or Metallurgical Microscope (100 X or better resolution), Heating furnace suitable for normalizing or annealing, sample preparation using compression mounting, 3 % Nital as etchant Band saw machine, Belt grinder, micro polisher, sample polishing machine, auto mount,	11 (Grain Size), 16 (Cleanliness of steel) 16 (Microstructure)
19.	Machine grinding unit with metallographic polish paper No. 00, 000 for finer finish, etchant (see Table-1&2 of IS 7739 Pt.3), glycerin, photographic paper, 2 percent aqueous solution of sulphuric acid, hypo, ammonium molybdate (5 g per 100 ml of water), nitric acid (rd. 1.2) , developer-made up of 5 ml of saturated stannous chloride solution, 50 ml hydrochloric acid, 100 ml water and 1 g alum. Caustic resistant filter paper, 5 percent caustic soda, 5 percent sodium sulphide solution, distilled water	16 (Macro etch test)
20.	Ultrasonic flaw detector with amplifier/attenuator calibrated in steps of at least 2dB, CRT/Monitor, Double Crystal probes, calibration blocks	16(Ultrasonic test)
21.	Upset Machine Heating furnace and quenching media	16 (Hot upset for forgeability)
22.	Izod Impact Machine consisting of a pendulum with a determined weight scale and pointer, fixed base to cantilever test specimen, V-notch maker	10 (Impact Test)

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

ANNEXURE C
To PRODUCT MANUAL FOR
Flame and Induction Hardening Steels
According to IS 3930:1994

SCHEME OF INSPECTION AND TESTING

Page 1 of 4

1. 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 equipment.

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

3. LABELLING & MARKING – The Standard Mark as given in the Schedule of the license and License Number (i.e. CM/L.....) shall be incorporated, labelling and the marking shall be done as per the provisions of the Indian Standard, provided always that the product thus marked conforms to all the requirement of the specification. In addition, details of BIS website shall be marked as follows: “For details of BIS certification please visit www.bis.gov.in”, on metal tags tied to bundles.

4. CONTROL UNIT – For the purpose of this Scheme, a control unit is defined as material of the same cast, condition, shape, heat treated to same condition and processed to the same dimensions shall constitute a 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 license should be marked with Standard Mark.

6. TEST CERTIFICATE- For each consignment of BIS Certified material conforming to IS 3930:1994 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. Any rejected material which is potentially re-salable be sheared or cut or deformed in such a manner that it cannot be used for any other purpose except re-melting. A separate record shall be maintained giving information on quantity and cast number/coil number/control unit number, as applicable, relating to all such rejections/defective/sub-standard material of the production not conforming to the requirements of the Specification and the method of its disposal. Such material shall in no case be stored together with that conforming to the Specification. The Standard Mark (if already applied) on rejected material should be defaced.

**TABLE 1 LEVELS OF CONTROL
(PARA 5 OF THE SCHEME OF INSPECTION AND TESTING)**

(1)				(2)	(3)		
Test Details				Test equipment requirement R: required (or)S: Sub-contracting permitted	Levels of Control		
Cl.	Requirement	Test Methods			No. of Sample	Frequency	Remarks
		Clause	Reference				
5	Manufacture	5.1, 5.2, 5.3	IS 3930	R	----	-----	Applicable for all manufacturers including: i) manufacturers with steel making facilities ii) manufacturers without steel making facilities and are procuring billets/blooms/slabs/bars as input material for further rolling/forging : Must ensure that steel procured by them complies with cl.5.1, Cl 5.2, cl.5.3 of IS 3930. Accordingly, records in support of the same shall be maintained which shall include raw material certificate indicating steel manufacturing process, type of killing of steel, size of input material etc. Such manufacturers must ensure that the material procured by them is ISI Marked only as per IS 3930 and is received with Test Certificate

6	Freedom from defects	6.1 6.2	IS 3930:	R	Manufacturer shall maintain adequate inspection/in-process controls to ensure freedom from defects		
7	Chemical Composition	IS 228(in parts) or any other established instrumental/ chemical method. However, records of referee method in case of no referee method in IS 228 and as agreed to between manufacturer & purchaser shall be maintained.					
	Ladle Analysis	7.1, 7.3 Table-2	IS 3930	R	One	Each Heat	Applicable for manufacturers with steel making facilities
	Check analysis	7.2, 7.3, Table-2 & 3 14.1 15.1	IS 3930	R	Nil	Nil	Applicable for manufacturers with steel making facilities
S				One	Each Cast	Applicable for manufacturers without steel making facilities. Such manufacturers must ensure that the billets/blooms/slabs/bars procured by them for further rolling/forging are ISI Marked only as per IS 3930 and are received with Test Certificate. Further testing for chemical composition is not required in such cases	
9	Hardness	9.1, 9.2,14.2, 8.3 ,15.2 & Table-4	IS 1500 Pt.1	R	One	Each Control Unit	-----

10	Mechanical properties	10.1, 10.1.1, 10.2, 14.3 15.3, Fig.1 Annex B Table-5,6	IS 1598 IS 1608 Pt.1	R	One	Each Control Unit	----
11	Grain Size	11.1, 11.2, 11.3	IS 4748	R	One	Each Control Unit	----
13	Dimensional Tolerances	13.1, 13.2,13.3	IS 3739 IS 3469 (Parts 1 to 3) ,IS3930	R	Adequate inspection to ensure that the each item conforms to the dimensions and tolerances specified.		
16	Additional tests a) Macro etch test b) Ultrasonic test c) Hardenability d) Blank hardening test e) Cleanliness test f) Microstructure for machinability, including banding e) Hot up-set for forgeability.	16.1, 16.2	IS 3930 IS 11371 IS3848 IS 10138	S	As agreed between the manufacturer and the purchaser.		

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 empanelled 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: ----- means the levels of control in Column (3) of Table-1 are as agreed to between the manufacturer and purchaser.

Annexure-I**Page 4 of 4**

(Para 6 of the Scheme of Inspection and Testing)

XYZ IRON AND STEEL COMPANY

(Registered office Address and works address)

BIS
STANDARD
MARK**TEST CERTIFICATE FOR SPECIFICATION FOR FLAME AND INDUCTION HARDENING**

TEST CERTIFICATE No. _____

DATE _____

To M/s _____

We certify that the material described below fully conforms to IS 3930:1994 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 Licence No. CM/L _____ are as indicated below against each order No.

(PLEASE REFER TO IS 3930:1994 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order no and date	Size/ Shape /Type	Designation/ Condition	Heat Treatment	Quantity	Chemical Composition (%)												Mechanical properties				Grain Size	Hardenability	Additional # tests/ Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
					C	Si	Mn	S	P	Cr	Mo	Ni	V	Cu	Ti	Cu+10xTi	0.2% Proof	TS	elongation	hardness				Izod impact																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

as required by purchaser

The material supplied conforms to the specified dimensions and tolerances

REMARKS

WAGON NO.

TRUCK NO.

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

FOR XYZ IRON AND STEEL COMPANY