



उत्पाद मानुयल
हाई स्पीड टूल स्टील्स के लिए विशिष्टता
IS 7291:1981 के अनुसार

PRODUCT MANUAL FOR
SPECIFICATION FOR HIGH SPEED TOOL STEELS
ACCORDING TO IS 7291 : 1981

भारतीय मानक ब्यूरो (अनुरूपता मूल्यांकन) विनियम 2018 की स्कीम- I के तहत यह उत्पाद मानुयल प्रमाणीकरणके 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.	उत्पाद Product	:	IS 7291 : 1981
	शीर्षक Title	:	Specification for High Speed Tool Steels
	संशोधन संख्या No. of Amendments	:	01
2.	नमूनाकरण दिशा निर्देश Sampling Guidelines:		
a)	कच्चा माल Raw material	:	No specific requirement for raw material
b)	समूहिकरण दिशा निर्देश Grouping guidelines	:	कृपया Annex-A देखें Please see Annex –A
c)	नमूनेका परिमाण Sample Size	:	Annealed Condition 1. For Chemical Test i) Instrumentalchemicalanalysis 5 pieces of 5 cm OR ii) Wet Chemical analysis 50 gm drillings

		2. For Hardness 3. For Macro-Structure 4. For Surface Decarburization 2 no x 1 m 5. For Carbide Form and Distribution 6. For Dimensional Tolerances 7. For Additional Test (Fracture Test) For Hardened & Tempered Condition 7. For Grain Size 2 no x 5 cm 8. For Hardness 2 no x 5 cm 9. For Additional Test (Fracture Test) 2 no x 5 cm In case of drawl of samples from Market/Dispatch Point, either 1 pc of 2 m length or 2 pcs of 1 m length may be drawn.
3.	परीक्षण उपकरणों की सूची List of Test Equipment	: कृपया Annex-B देखें Please see Annex – B
4.	निरीक्षण व परीक्षण स्कीम Scheme of Inspection and Testing	: कृपया Annex-C देखें Please see Annex – C
5.	एक दिन में संभावित परीक्षण Possible tests in a day :	: All tests are possible in a day.
6.	लाइसेन्स का कार्यक्षेत्र/Scope of the Licence:	
	IS 7291 : 1981 के अनुसार मानक मुहर का उपयोग करने के लिए लाइसेन्स निम्नलिखित कार्यक्षेत्र के लिए प्रदान किया जाता है “Licence is granted to use Standard Mark as per IS 7291:1981 with the following scope:	
	उत्पाद का नाम Name of the product	High Speed Tool Steels
	Steel Designation	XT72W18Cr4V1... etc
	Condition of supply/Heat Treatment	Hot Rolled, Forged/Annealed, Hardened and Tempered
	Finish	Hot Rolled/Forged/ Cold Drawn/ Rough Ground or Rough Turned/ Centreless ground or ground and polished/ Annealed
	Variety/Shape/Size	Hot rolled round, square, hexagon & octagon bars of nominal size ..mm to ...mm, Forged round, square, hexagon & octagon bars of nominal size ..mm to ...mm, Hot rolled flat bar of nominal size ..mm to ...mm, Forge flat bar of nominal size ..mm to ...mm, Sheet and strip of nominal size ..mm to ...mm,

		Cold drawn round, square, hexagon, octagon & flat bars of nominal size ..mm to ..mm, Cold drawn (drilled rod) of nominal size ..mm to ..mm,
	Optional Requirements	With or without additional test (fracture test)

BUREAU OF INDIAN STANDARDS
ManakBhawan, 9, Bahadur Shah ZafarMarg,
New Delhi – 110002

ANNEX – A
TO THE PRODUCT MANUAL FOR
SPECIFICATION FOR HIGH SPEED TOOL STEELS
ACCORDING TO IS 7291 :1981

GROUPING GUIDELINES

1) IS 7291:1981 classifies High Speed Tool Steels into 7 Steel Designations as specified at Table 1. As per IS 7291:1981, High Speed Tool Steel can be manufactured in the following conditions and can be further supplied in various finishes as specified at cl.16. of IS 7291:1981:-

a) Hot Rolled

b) Forged

Further, high speed steel shall be supplied either in the Annealed or the Hardened and Tempered Condition (ref cl.6. of IS 7291:1981).

2) Designations have been grouped based upon their chemical composition as specified at Table1. Thus, for the purpose of GoL/CSoL, the following grouping guidelines shall be considered

Group	Steel Designation	Remarks
1	XT72W18Cr4V1 XT75W18Co5Cr4MoV1 XT80W20Co12Cr4V2Mo1 XT125WCo10CrMo4V3	<i>One sample of any steel designation of each condition of supply and heat treatment of any shape and size shall be drawn and tested for all requirements of the specification.</i>
2	XT90W6CoMo5Cr4V2 XT110Mo10Co8MnCr2 XT87W6Mo5Cr4V2	<i>One sample of any steel designation of each condition of supply and heat treatment of any shape and size shall be drawn and tested for all requirements of the specification.</i>

3. If the above sample passes, then license may be granted/inclusion be done for the all the steel

designations, sizes, shapes and finishes to be included in the licence.

4. Separate Samples are not required to be drawn for each shape and size. However, it shall be ensured that the firm is having all the necessary manufacturing and testing facilities for the manufacture and testing of the sizes/grade designations /varieties of high-speed tool steels to be included in the license.
5. During the operation of license, BO shall ensure that all the sizes/grade designations/ varieties covered in the license are drawn for independent testing on rotation over a period of time.

ANNEX – B
TO THE PRODUCT MANUAL FOR
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ACCORDING TO IS 7291 :1981

List of test equipment

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

Sr. No.	Tests used in with Clause Reference	Test Equipment/Chemicals
1.	Preparation of specimen	Rough Polishing Machine, Abrasive Cutting Machine, Fine Polishing Machine, Grinding Machine, Molding machine, Longitudinal cutting machine
2.	cl.5. (Chemical Composition) C, Si, Mn, Cr, Mo, V, W, Co, S, P, Ni, Cu, Sn, Mo Mn, S, P, Si, Mo,	Instrumental methods Spectrometer: atomic-absorption spectrometry, inductively coupled plasma atomic emission, inductively coupled plasma mass spectrometry techniques, spark source optical emission spectrometry. Spectrophotometer
3.	cl.5. (Chemical Composition) C & S (chemical method, alternative to instrumental method)	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
4.	cl.5. (Chemical Composition) (Phosphorus content) (chemical method, alternative to instrumental method)	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
5.	cl.5. (Chemical Composition) (Manganese content) (chemical method, alternative to instrumental method)	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
6.	cl.5. (Chemical Composition) (Silicon)	Medium textured filter paper, Porcelain casserole, platinum crucible, filter paper pulp, hot plate, hot air oven, muffle furnace

	content)(chemical method, alternative to instrumental method)	Reagents: Silver nitrate solution, concentrated nitric acid, concentrated sulphuric acid, Dilute Hydrochloric Acid, Dilute Sulphuric Acid, Perchloric Acid, Tartaric acid and hydrofluoric acid
7.	cl.5. (Chemical Composition) (Cu content) (chemical method, alternative to instrumental method)	Plate, Muffle Furnace, porcelain or silica crucible, Reagents: Hot Wash Solution (dilute sulphuric acid solution 1: 99v/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
8.	cl.5. (Chemical Composition) (Ni content) (chemical method, alternative to instrumental method)	ashless paper pulp, paper pulp pad, hot plate, desiccator, Reagents: ammonium nitrate, methyl red, dilute ammonium hydroxide, Concentrated hydrochloric acid, Concentrated nitric acid, Perchloric acid, Hydrofluoric Acid
9.	cl.5. (Chemical Composition) (Cr content) (Chemical method, alternative to instrumental method)	Hotplate, stopwatch 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.
10.	7.1 (Brinell Hardness Test) 7.2 (Rockwell / Vickers Hardness Test)	Hardness Tester (Brinell / Rockwell / Vickers) with Standard Calibration Blocks
11.	8.1 (Macro-structure) 15.1, 15.1.1 (Fracture in Heat Treated Condition)	Vision-based inspection system, Magnifying glass up to 10X magnification
12.	9.1, 9.1.1, 9.2, 9.2.1 (Surface Decarburization) 10.1, 10.1.1, 10.2 (Carbide Form & Distribution) 11, 11.1 (Grain Size)	Metallurgical Microscope with Magnification (100x, 200x, 500x, 1000x)-computer aided
13.	12, 12.1, 12.2, 12.2.1, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 12.9.1, 12.10 (Dimensional Tolerances)	Vernier Calipers, Micrometer, Steel Scale, Cord, Measuring Tape, Straight Edge, Flat bench, Surface Plate

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

ANNEX C
TO THE PRODUCT MANUAL FOR
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Scheme of Inspection And Testing

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 and implement 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 AND 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 requirements 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”.

4. CONTROL UNIT – For the purpose of this scheme, a control unit is defined as material of same cast, finish, condition & shape and processed to same dimensions under uniform conditions of production.

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 7291:1981 there shall be a test certificate which shall contain the Standard Mark, the cast/batch number and the corresponding test results (as given in Annexure-I, enclosed)

7. REJECTION- 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 notconforming to the requirements of the Specification and the method of its disposal. Such material shall in nocase be stored together with that conforming to the Specification. The StandardMark (if already applied) on rejected material should be defaced

TABLE 1 (Levels of Control)
(Para 5 of Scheme of Inspection and Testing)

(1)				(2)	(3)		
Test Details				Test equipment requirement R: required (or)	Levels of Control		
Cl.	Requirement	Test Methods			No. of Sample	Frequency	Remarks
		Clause	Reference				
4	Manufacture	4.1, 4.2, 4.3 4.4, 4.4.1	IS 7291:1981	R	As deemed adequate by the manufacturer for each item being manufactured		Applicable for all manufacturers including: i) manufacturers with steel making facilities ii) Manufacturers producing tool steels from Ingots as raw material: Must ensure that Ingots procured by them comply with Cl 4.1 to 4.4 of IS 7291:1981. Accordingly, records in support of the same shall be maintained which shall include raw material certificate indicating steel manufacturing process, freedom from defects etc.
5	Chemical Composition	Relevant parts of IS 228 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	5.1, 5.1.1, 5.1.2, 5.1.3 Table-1	IS 7291:1981	R	One	Each Heat	Applicable to manufacturers having steel making facilities
	Check analysis	5.1.3, 5.2 Table-1,2	IS 7291:1981	R	i) Nil ii)One	i) Nil ii) Each Cast	i) Applicable to manufacturers having steel making facilities ii) Applicable for manufacturers procuring ingots as raw material and feeding to forging/rolling mills.

7	Hardness	7.1 Table 3	IS 7291:1981 IS 1500	R	One	Each Control Unit	----
		0.2 (C), 7.2 Table 4	IS 7291:1981 IS 1501 IS 1586 (Part 2)	R	One	Each Control Unit	Hardness in the Hardened and Tempered Condition is tested by heat-treating samples in the annealed condition to the Hardened and Tempered state.
8	Macro-structure	8.1	IS 7291:1981 IS 11371	R	One	Each Control Unit	----
9	Surface Decarburization	9.1, 9.1.1, 9.2, 9.2.1 Table 5 to 8	IS 7291:1981 IS 6396 or any other method agreed	R	One	Each Control Unit	----
10	Carbide Form & Decarburization	10.1,10.1.1, 10.2 Table 9, Fig. 1, 2	IS 7291:1981	R	One	Each Control Unit	----
11	Grain Size	11.1	IS 7291:1981 IS 4748	R	One	Each Control Unit	Samples are required to be in the Hardened and Tempered condition before testing
12	Dimensional Tolerances	12, 12.1, 12.2, 12.2.1, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 12.9.1, 12.10 Table 10 to 20	IS 7291:1981	R	Adequate inspection to ensure that each item conforms to the requirements of the specification		
15	Additional Test (Fracture Test)	15.1, 15.1.1	IS 7291:1981	S	----	----	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 empanelled by the Bureau.

Note-2: The control unit and levels of control as decided by the Bureau are obligatory to which the licensee shall comply with.

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

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Annexure-I

(Para 6 of the Scheme of Inspection and Testing)
XYZIRONANDSTEELCOMPANY

BISSTANDARD
MARK

(RegisteredofficeAddressandworksaddress)

TESTCERTIFICATEFORSPECIFICATIONFORHigh Speed Tools Steels

TEST CERTIFICATE No. _____ Date _____
ToM/s. _____

We certified that the material described below fully conforms to IS 7291:1981 Chemical composition, metallurgical and Physical properties of the product,as testedinaccordancewiththeSchemeofInspection andTesting containedin theBISCertificationMarks LicenceNo.CM/L____areasindicatedbelowagainsteachorderNo.

(PLEASE REFER TO IS 7291:1981 FOR DETAILS OF SPECIFICATION REQUIREMENTS)TESTRESULTS

Order no and date	Size/ Shape /Type	Designation/ Condition	Cast	Quantity	Chemical Composition												Hardness		Grain Size	Macrostructure, Decarburization, Carbide Form & Distribution	Tolerances	Additional # tests/ Remarks
																	Annealed	Hardened & Tempered				
					C	Si	Mn	P	S	Cr	Ni	Cu	Mo	V	W	Co				Satisfactory / Unsatisfactory		

**asrequired by purchaser*

REMARKS

WAGON NO.

TRUCKNO.

(It issuggestedthatsizeA4paperbeusedforthis testcertificate)

FORXYZIRONANDSTEEL COMPANY