



**PRODUCT MANUAL FOR
STEEL FOR VALVES FOR INTERNAL
COMBUSTION ENGINES ACCORDING
TO IS 7494:1981**

1.	Product	:	IS 7494:1981
	Title	:	STEEL FOR VALVES FOR INTERNAL COMBUSTION ENGINES
	No. of amendments	:	1
2.	Sampling Guidelines		
a)	Raw material	:	No specific requirement for raw material
b)	Grouping Guidelines	:	Please refer Annex -A
c)	Sample Size	:	For Chemical tests: i) For instrumental chemical analysis- 5 pieces of 5cm ii) For Wet Chemical analysis - 50 gm drilling For mechanical tests- 3 Nos. x 1.0 Meter
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	:	Please refer Annex -D
6.	Scope of the Licence:		
	License is granted to use Standard Mark as per IS 7494:1981 with the following scope:		
	Name of the product	STEEL FOR VALVES FOR INTERNAL COMBUSTION ENGINES	
	Valve Steel No./Steel Designation	V-1/55C8, V-2/40Cr4 V-15/X53Cr22Mn9Ni4N etc. As per Table 1	
	Heat treatment condition	Solution Treated/Normalized/ Quenched and Tempered or any other condition	

	Form, Size and Condition	<ul style="list-style-type: none">i. Round steel bars of diameter from ___ mm up to and including ___ mm (≤ 40 mm) in hot rolled/forged/drawn/ground and centre less condition, and/orii. Square steel bars of side ___ mm up to and including ___ mm (≤ 40 mm) in hot rolled/forged/drawn/ground and centre less condition, and/oriii. Flat steel bars of width across flat ___ mm up to and including ___ mm (≤ 40 mm) in hot rolled/forged/drawn/ground and centre less condition
	Elevated Temperature Properties (Optional Requirement)	If required, guaranteed Tensile properties at elevated temperature to be mentioned as per the format at Annex C of IS 7494:1981 (also see grouping guidelines)

ANNEXURE A

GROUPING GUIDELINES for
STEEL FOR VALVES FOR INTERNAL
COMBUSTION ENGINES as per IS
7494:1981

1. This Indian Standard defines 15 steel grades (and corresponding steel designations) for this product based on chemical composition as Valve Steel Numbers from V-1 to V-15. Steels V-1 to V-7 are generally used for inlet valves while V-8 to V-15 are generally used for exhaust valves. Accordingly, based on typical use, the steels have been classified into two groups as follows:

Group	Valve steel No/Steel Designation	Remarks
I	V-1/55C8, V-2/40Cr4, V-3/40Cr4Mo3, V-4/50Cr4V2, V-5/ 25Cr13Mo6, V-6/40Ni10Cr3Mo6, V-7/40Ni6Cr4Mo3	One sample of any Valve Steel No./Steel Designation, Heat treatment condition (N, ST, Q+T etc.) , Form (round, square or flat bars), Size and Condition (hot rolled/forged/drawn/ground and centre less) from the group may be drawn and tested to cover all the varieties within the group for the purpose of grant of licence or change in scope (inclusion) subject to passing of the sample in testing
II	V-8/X45Cr9Si3, V-9/X80Cr20Si2Ni1, V-10/X85Cr18Mo2V, V-11/X40Ni14Cr14W3Si2, V-12/X20Cr21Ni12N, V-13/X70Cr21Mn6Ni2N, V-14/X55Cr21Mn8Ni2N, V-15/X53Cr22Mn9Ni4N	-do-

2. In case the licensee/applicant desires tensile properties at elevated temperatures to be covered in the scope of licence, the licensee/applicant shall declare the guaranteed tensile properties at elevated temperatures as per the format given at Annex C of IS 7494:1981 and sample of each valve steel number for which the properties are guaranteed shall be tested for the guaranteed tensile properties at elevated temperatures for covering the same in the scope of licence.
3. However, it shall be ensured that the firm is having all the necessary manufacturing and testing facilities for the manufacture and testing of the varieties of steel bars to be covered in the scope of licence.
4. During the operation of licence, BO shall ensure that all the varieties covered in the license are drawn for independent testing on rotation over a period of time.

ANNEXURE B

**LIST OF TESTING EQUIPMENT for STEEL FOR
VALVES FOR INTERNAL COMBUSTION
ENGINES as per IS 7494:1981**

Major test equipment 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	Vision-based inspection system	Clause 5 (Freedom from Defects)
3	<p>Instrumental methods Spectrometer: atomic-absorption spectrometry, inductively coupled plasma atomic emission, inductively coupled plasma mass spectrometry techniques, spark source optical emission spectrometry, Standard Reference Material with certificate</p> <p>Chemical methods Laboratory reagents and apparatus as per parts of IS 228 (indicative list enclosed)</p>	Chemical Composition Clause - 6, 6.1, 6.2 for C, Si, Mn, Ni, Cr, Mo, T, V, S, P, N
4	Brinell Hardness Tester of suitable Range preferably 9,807 N to 29,42 kN with Standard Reference Blocks of Thickness 6mm, 12mm and 16mm. Conditioning Facilities - control the temperature within a range, such as 23 °C ± 5 °C.	Hardness, Clause 8
5	Tensile Testing Machine of suitable range fitted with extensometer	Mechanical Properties, Clause 9
6	Microscope of suitable magnification	Inclusion Rating, Clause 10
7	Elevated Temperature test facilities if applicable	Tensile Test at Elevated Temperatures, Clause 11
8	Vernier Calipers, Micrometer, Scale, Cord, Measuring Tape, Straight Edge, Flatbench, surface plate	12 (Dimensions and Dimensional Tolerances)

Note 1: The list above is meant for guidance and may not be taken as exhaustive.

Note 2: The least count/accuracy, range and specification of the apparatus, chemicals and reagents used shall be as per the Indian Standard specifications.

INDICATIVE LIST OF TEST APPARATUS, CHEMICALS AND REAGENTS FOR CHEMICAL ANALYSIS THROUGH CHEMICAL METHODS AS PER IS 228

1.	Strohlein or Leco apparatus with all attachments Barometer with chart, Hot plate, Muffle furnace, Complete range of glass wares, measuring cylinders, Desiccators, 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	C & S (chemical method, alternative to instrumental method)
2.	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	Phosphorus content (chemical method, alternative to instrumental method)
3.	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	Manganese content (chemical method, alternative to instrumental method)
4.	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	Silicon content (chemical method, alternative to instrumental method)
5.	Plate, Muffle Furnace, porcelain or silica crucible, Reagents: Hot Wash 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	Cu content (chemical method, alternative to instrumental method)
6.	ashless paper pulp, paper pulp pad, hot plate, desiccators, Reagents: ammonium nitrate, methyl red, dilute ammonium hydroxide, Concentrated hydrochloric acid Concentrated nitric acid, Perchloric acid, Hydrofluoric Acid	Ni content (chemical method, alternative to instrumental method)
7.	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, and standard potassium permanganate solution.	Cr content (chemical method, alternative to instrumental method)

8.	<p>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)</p> <p>Spectrophotometer, Volumetric flask, conical flask, titration apparatus (burette, pipette etc.), hot plate, thermometer, separating funnel, dry filter paper and other laboratory glassware and apparatus</p>	<p>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) as per IS 228 Part 10</p>
9.	<p>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</p> <p>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</p>	<p>Mo content (for determination of Mo by Alpha-benzoinoxime method in alloy steels for Mo > 1 percent and not containing Tungsten)</p>

Note 1: The list above is meant for guidance and may not be taken as exhaustive.

Note 2: The least count/accuracy, range and specification of the apparatus, chemicals and reagents used shall be as per the Indian Standard specifications.

ANNEXURE C
To PRODUCT MANUAL FOR
STEEL FOR VALVES FOR
INTERNAL COMBUSTION
ENGINES as per IS 7494:1981

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 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. PACKING AND MARKING— The Standard Mark, as given in the Schedule of the licence, shall be incorporated on each bundle of the material or on a metal tag affixed to each bundle, provided always that material so marked conform to requirements of the specification.

3.1 Marking shall be done as per the provisions of the Indian Standard. In addition, the following shall be incorporated on each bundle of steel bars or the metal tag affixed thereto:

- i) BIS Licence Number CM/L—and
- ii) BIS website details i.e. “For details of BIS certification please visit www.bis.gov.in”

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

4. 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.

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

5. TEST CERTIFICATE-For each consignment of BIS Certified material conforming to IS 7494:1981 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)

6. 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. 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 resalable be sheared or cut or deformed in such a manner that it cannot be used for any other purpose. A separate record shall be maintained giving information on quantity and batch number/control unit number, as applicable, relating to all such rejections/defective/substandard 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 4 OF THE SCHEME OF INSPECTION AND TESTING)**

(1)				(2)	(3)		
Test Details				Test equipment requirement	Levels of Control		
Cl.	Requirement	Test Methods		R:required (or)S: Sub- contracting permitted	No. of Sample	Frequency	Remarks
		Clause	Reference				
4	Manufacture	4.1	IS 7494:1981	R	Each Bar	Each Bar	If found defective, item shall be rejected and not be marked.
5	Freedom from Defects	5.1	IS 7494:1981	R	-do-	-do-	-do-
6	Chemical Composition	Any established instrumental/chemical method. However, records of referee method as agreed to between manufacturer and purchaser shall be maintained.					
	Ladle Analysis	6.1 13.1 14.1 Table-1	IS 7494:1981	R	One	Each Heat	Applicable for primary producers only. Manufacturers without steel making facilities shall maintain records of test certificates for ladle analysis of each heat.
	Product analysis	6.2 13.1 14.1 Table-1,2	IS 7494:1981	S	One	Each Cast	Chemical analysis is not required in case input material is ISI marked as per IS 7494

8, 9 & 10	Mechanical Properties						
	Tensile Properties	9.1,9.2, 13.3, 13.4, 13.5, 14.2, Fig.1, Table- 3 to 5	IS7494:1981 IS 1608(Pt.1) IS 3711	R	----	----	
	Hardness Test	8.1,9.4, 13.2, 13.3, 13.4, 13.5 & Table-3 to 5	IS 7494:1981 IS1500 table 3	R	----	----	
	Inclusion Rating	10.1 10.1.1	IS 7494:1981 IS 4163	R	----	----	
11	Elevated Temperature test Properties (Optional)	11	IS 7494:1981	S	----	----	Optional
12	Dimensional Tolerances		IS 7494:1981, IS 3739:1987, IS 10604 (Pt. 2):1983	R	Adequate inspection to ensure each item to be within the limits of specification.		

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.

Annexure-I

(Para 5 of the Scheme of Inspection and Testing)
____ IRON AND STEELCOMPANY
(Registered office Address and works address)



**TEST CERTIFICATE
FOR STEEL FOR VALVES FOR INTERNAL COMBUSTION ENGINES**

TEST CERTIFICATE No. _____

DATE _____

To M/s _____

We certified that the material described below fully conforms to IS 7494:1981 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 _____ areas indicated below against each order No.

(PLEASE REFER TO IS 7494:1981 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order no and date	Size/Shape /Type	Designation/ Condition	Cast	Quantity	Chemical Composition											Mechanical Properties [#]				Elevated Temperature tests/ Remarks								
					C	Si	Mn	Ni	Cr	Mo	T	V	S	P	N	Others	YS (Mpa)	TS (Mpa)	Elongati on (%)		%Ra	Hardness						

if required by purchaser

REMARKS WAGON

NO.

TRUCK NO.

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

FOR _____ IRON AND STEELCOMPANY