

**PRODUCT MANUAL FOR
Carbon Steel Forgings for General Engineering Purposes
according to IS 2004:1991**

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 2004:1991
	Title	:	Carbon Steel Forgings for General Engineering Purposes
	No. of amendments	:	0
2.	Sampling Guidelines		
a)	Raw material	:	Starting/input material the production of carbon steel forgings shall be in accordance with IS 1875.
b)	Grouping Guidelines	:	Please refer Annex – A
c)	Sample Size	:	Physical Properties: 3 No.s Chemical: 5pcs of length 5 cm X 5cm or 50 gm drillings
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 are possible in a day
6.	Scope of the Licence :		
	Licence is granted to use Standard Mark as per IS 2004:1991 with the following scope:		
	Name of the product	Carbon Steel Forgings for General Engineering Purposes	
	Steel Designation	14C6,..	
	Class	1,..	
	Conditions of Supply	As forged,..	
	Dimensions	Sizes, Length etc..	
	Supplementary requirements	With or without..	

ANNEXURE A
TO PRODUCT MANUAL FOR
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GROUPING GUIDELINES

In order to follow a uniform policy in the drawl of samples for independent testing for the purpose of grant of license/ inclusion of additional varieties in the existing license, the procedure as mentioned below is to be followed:

1. One sample of Carbon Steel forgings as given below for Class & Designation (also see Table 1& Table 2) has to be tested for all the requirements of the specification and applicable to the variety tested. If the sample passes, then licence may be granted/inclusion may be done for Class & Designation as per the groupings given below, provided that the firm is having all the necessary manufacturing and testing facilities for the manufacture and testing of the Class of Carbon Steel forgings to be included in the licence.

Class (in ascending order)	Designation	No of Sample
1	14C6	One sample of any size, condition of supply of any Class & Designation may be drawn. If sample is tested for higher Class & Designation the recommendation may also include lower Class & Designation.
1A	15C8	
2	20C8	
2A	25C8	
3	30C8	
3A	35C8	
4	45C8	
5	55C8	
6	65C6	

2. The sample tested may be any of the size (see Cl.6) from Carbon Steel forgings specified in the specification. However, the licence can be granted for all the sizes of the Carbon Steel forgings specified in the specification and applied by the applicant/licencee, provided that the firm is having all the necessary manufacturing and testing facilities for the manufacture and testing of all other sizes and type of the Carbon Steel forgings proposed to be included in the licence.
3. In case the manufacturer is desirous of supplying the product along with supplementary requirements, an undertaking to this effect is to be obtained from applicant/licensee drawn and samples drawn as mentioned above be tested for supplementary tests as well.
4. In case of licensees supplying products along with purchaser's supplementary requirements, BO shall ensure that samples drawn during surveillance be tested for supplementary tests as well, provided that samples from same Heat/Batch of Carbon Steel forgings supplied to the purchaser with agreed upon supplementary requirements are available during surveillance.

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LIST OF TEST EQUIPMENTS

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, Cutting Machine, Micro Polisher, Grinder Machine, Automatic Mount Press, Surface grinder to remove burr, Lathe/Shaper Machine	Preparation of specimen (chemical composition, grain flow)
2	Visual Inspection System	Freedom from Defects (6.1)
3	Steel Scale, Vernier Calipers, measuring tape Micrometer	Dimensional Tolerances(6.2)
4	Instrumental methods Spectrometer: atomic-absorption spectrometry, inductively coupled plasma atomic emission, inductively coupled plasma mass spectrometry techniques, spark source optical emission spectrometry. Spectrophotometer	C, S, P, Mn, Si, Ni,Cr, Mo(7) Mn, S, P,Si, Mo
5	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	C& S(7) (chemical method, alternative to instrumental method)

6	<p>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</p> <p>Potassium Permanganate (KMnO₄), Sodium Nitrite (Na₂NO₃), Ammonium Molybdate [(NH₄)₂ Mo₂O₇], Ammonium Phosphate [(NH₄)₃ PO₄], Potassium Nitrate (K₂NO₃), Phenolphthalein Solution, Rectified spirit or methyl alcohol, Sodium Hydroxide (NaOH), Hydrofluoric Acid (HF), Perchloric Acid (HClO₄), Sulphurous Acid, Hydrobromic Acid (HBr), other chemicals and reagent as applicable</p>	Phosphorus content (7) (chemical method, alternative to instrumental method)
7	<p>Hot plate, Conical flask Reagents:</p> <p>silver nitrate, ammonium persulphate sodium arsenite solution, Dilute Nitric Acid, Phosphoric Acid, Dilute Sulphuric Acid, Concentrated Nitric Acid, NaCl Solution, Permanganic acid</p>	Manganese content(7) (chemical method, alternative to instrumental method)
8	<p>Medium textured filter paper, Porcelain casserole, platinum crucible, filter paper pulp, hot plate, hot air oven, muffle furnace</p> <p>Reagents: Silver nitrate solution, concentrated nitric acid, concentrated sulphuric acid, Dilute Hydrochloric Acid, Dilute Sulphuric Acid, Perchloric Acid, Tartaric acid and hydrofluoric acid</p>	Silicon content (7) (chemical method, alternative to instrumental method)
9	<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>	Mo content(7) (for determination of Mo by thiocyanate photometric method)
10	<p>Ashless paper pulp, paper pulp pad, hot plate, dessicator,</p> <p>Reagents: ammonium nitrate, methyl red, dilute ammonium hydroxide, Concentrated hydrochloric acid, Concentrated nitric acid, Perchloric acid, Hydrofluoric Acid</p>	Ni content(7) (chemical method, alternative to instrumental method)
11	<p>Hot plate, stop watch</p> <p>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.</p>	Cr content(7) (chemical method, alternative to instrumental method)
12	Brinell Hardness Tester with Tungsten Carbide Indenter	Mechanical Test (9)

13	Universal Testing Machine	Tensile test (9)
14	Bending device with two supports and formers of suitable sizes, capable of the bringing legs of the test piece parallel to each other at a specified distance apart by direct pressure	Bend Test (12.1.2)
15	Metallographic Sample Preparation Equipment, Etching Reagent(either natal or picral), Metallurgical Microscope	Grain flow(12.1.2.4)
16	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 (r.d. 1.2) , developer-made up of 5 ml of saturated stanneous 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	Macro etch test (12.1.2.5)
17	Ultrasonic flaw detector with amplifier/attenuator calibrated in steps of at least 2dB, CRT/Monitor, Double Crystal probes, calibration blocks	Ultrasonic test (12.1.2.5)
18	Alternating current (a.c.)/ single phase half-wave rectified alternating current (HW) / three phase fullwave rectified direct current (FWDC) induced magnetization, Magnetic powder suspended in an aqueous or a well refined, light petroleum distillate.	Magnetic Particle Inspection test (12.1.2.5)

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

ANNEXURE C
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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 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. MARKING, PACKING – The Standard Mark as given in Column (1) of the First 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 Scheme, steel forgings manufactured from same cast/heat having same chemical composition and processed to same delivery condition under uniform conditions of production 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 licence should be marked with Standard Mark.

5.2 General requirements relating to the supply of material shall conform to IS 1387. The manufacture of steel forgings shall be as per Cl 5 and shall be supplied to purchasers as per Cl 11 of IS 2004:1991.

6. TEST CERTIFICATE - For each consignment of BIS Certified material conforming to IS 2004:1991 there shall be a test certificate which shall contain the Standard Mark, the 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.

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SCHEME OF INSPECTION AND TESTING

TABLE 1: LEVELS OF CONTROL

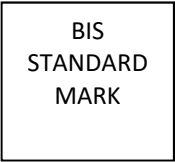
(1) Test Details				(2) Test equipment requirement R: required (or) S: Sub-contracting permitted	(3) Levels of Control		
Cl.	Requirement	Test Methods Clause Reference			No. of Sample	Frequency	Remarks
6	Freedom from Defects	6.1 6.2 6.2.1	IS 2004:1991 IS 3469 Pt.1 to 3	R	Adequate inspection to ensure that the products conform to the tolerance specified and free from harmful defects		
7	Chemical Composition i) Ladle Analysis	7.1, 7.3, 12.1.1 & Table 1	IS 2004:1991 and Relevant parts of IS 228 or any other established	R	One	Each Ladle	Applicable for manufacturers with steel making facilities
	ii) Check Analysis	7.1, 7.2, 7.3, 12.1.1 & Table 1	Instrumental/chemical method.	S	One	Each Control Unit	Applicable for manufacturers without steel making facilities. (See Note-3)
9	Mechanical Test	9.1, 10 to 10.1.1 , 13.1,13.2, Table-2	IS 2004:1991 IS 1608 Pt.1	R	One	Each Control Unit	
12	Supplementary Requirements i) Bend Test ii) Grain Flow iii) Microscopic test iv) Macroscopic test v) Magnaflux test vi) Ultrasonic test.	12.1.2 to 12.1.2.5	IS 2004:1991 IS 1599	S	These requirements shall apply only when specified by the purchaser in the inquiry, contract and order. Details of these requirements shall be as agreed to between the manufacturer and purchaser. Records of agreed upon values shall be maintained.		

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

Note-3: No testing for check analysis is required if starting material being subjected to processing is ISI marked and received with test certificate.

ANNEXURE I



(Para 6 of the Scheme of Inspection and Testing)

XYZ STEEL COMPANY

(Registered office Address and works address)

TEST CERTIFICATE FOR Carbon Steel Forgings for General Engineering Purposes

TEST CERTIFICATE No. _____

DATE _____

TO M/s _____

We certified that the material described below fully conforms to IS 2004:1991 Chemical, Physical and Mechanical properties of the product, as tested in accordance with the Scheme of Testing and Inspection contained in the BIS Certification Marks Licence No. CM/L _____ are as indicated below against each order No.

(PLEASE REFER TO IS 2004:1991 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order No. & Date	Nominal Dimensions	Control Unit No.	Qty in tonnes	Chemical Composition					Mechanical Properties				Tolerances	Additional tests*	
				C	S	P	Mn	Si	Al	Other elements*	TS	YS			%EL

* as required by purchaser

REMARKS

WAGON NO.

TRUCK NO.

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

FOR XYZ STEEL COMPANY