



उत्पाद मैनुअल
बॉल्स, रोलर्स और बियरिंग रेस के निर्माण के लिए कार्बन-क्रोमियम स्टील
IS 4398:1994 के अनुसार

PRODUCT MANUAL FOR
Carbon-Chromium Steel for the manufacture of Balls,
Rollers and bearing races- Specification as per IS 4398:1994

भारतीय मानक ब्यूरो (अनुरूपता मूल्यांकन) विनियम 2018 की स्कीम-I के तहत यह उत्पाद मैनुअल प्रमाणीकरण की संचालन रीति में सुसंगतता और पारदर्शिता सुनिश्चित करने के लिए सभी क्षेत्रीय/शाखा कार्यालयों एवं लाइसेन्सधारियों 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 4398:1994
	शीर्षक Title	:	Carbon-Chromium Steel for the manufacture of Balls, Rollers and bearing races- Specification as per IS 4398:1994
	संशोधन संख्या No. of amendments	:	3
2.	नमूनाकरण दिशानिर्देश Sampling Guidelines		For Mechanical Tests: 1 metre length For Chemical Tests: 5 pieces of 50mm x 50mm
a)	कच्चा माल Raw material	:	No specific raw material requirement

b)	समूहिकरणदिशानिर्देश Grouping Guidelines	:	Please see Annex-A
3.	परीक्षणउपकरणोकीसूची List of Test Equipment	:	Please refer Annex – B
4.	निरीक्षणवपरीक्षणस्कीम Scheme of Inspection and Testing	:	Please refer Annex – C
5.	एक दिन में संभावित परीक्षण Possible tests in a day	:	All tests are possible to be carried out in a day
6.	लाइसेन्स का कार्यक्षेत्र /Scope of the Licence:		
	IS 4398:1994 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 4398:1994 with the following scope:		
	Name of the product	Carbon-Chromium Steel for the manufacture of Balls, Rollers and bearing races	
	Grade	104Cr6, 103Cr6, 103Cr4Mn4, 98Cr6Mn4	
	Heat Treatment Condition	Fully Spheroidized Annealed/Other (to be specified)	
	Condition of Supply	Hot Rolled (As-rolled)/ Cold Drawn /Cold Finished	
	Form of Steel/Shape/Size	Billets of size fromxx...mm to up to and including ...xx.... mm Rings of size fromxx...mm to up to and including ...xx.... mm Bars (Round, Square, Hexagonal) of size fromxx...mm to up to and including ...xx.... mm Wire Rods of Diameter fromxx...mm to up to and including ...xx.... Mm Wires of size fromxx...mm to up to and including ...xx.... mm	

BUREAU OF INDIAN STANDARDS
Manak Bhawan, 9, Bahadur Shah Zafar Marg, New Delhi – 110002

ANNEX A
TO PRODUCT MANUAL FOR

**Carbon-Chromium Steel for the manufacture of Balls, Rollers and bearing races-
Specification as per IS 4398:1994
GROUPING GUIDELINES**

- 1) Table 1 of IS 4398:1994 specifies the Chemical composition of different grade designations of Carbon-chromium Steel for the Manufacture of Balls, Rollers and Bearing Races and Clause 8 of IS 4398:1994 specifies the hardness based on condition of the product that may be produced. The above two clauses forms the basis for grouping of the product.
- 2) 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 following procedure is to be followed:

Group	Grade Designations	Form of Steel	Remarks
1	103Cr6 & 104Cr6	Billets	One sample of any grade designation for each heat treatment condition, and each condition of supply of any size shall be drawn and tested.
		Rings, Bars and Wire Rods	One sample of any grade designation for each heat treatment condition, and each condition of supply of any shape/size shall be drawn and tested.
		Wires	One sample of any grade designation for each heat treatment condition, and each condition of supply of any shape/size shall be drawn and tested.
2	103Cr4Mn4 & 98Cr6Mn4	Billets	One sample of any grade designation for each heat treatment condition, and each condition of supply of any size shall be drawn and tested.
		Rings, Bars and Wire Rods	One sample of any grade designation for each heat treatment condition, and each condition of supply of any shape/size shall be drawn and tested.
		Wires	One sample of any grade designation for each heat treatment condition, and each condition of supply of any shape/size shall be drawn and tested.

3. However, it shall be ensured that the firm is having all the necessary manufacturing and testing facilities for manufacturing of all the grades/conditions/forms/shapes and sizes in the scope of the licence.

4. During the operation of license, BO shall ensure that all the grades/conditions/forms/shapes and sizes covered in the license are drawn for independent testing on rotation over a period of time.

Annex-B

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

S. No.	Test Equipment	Test used in with Clause Reference
1.	Optical Emission Spectrometer or Carbon Sulphur (Strohlein's type) Apparatus – Complete set consisting of glass parts, combustion furnace, oxygen cylinder, combustion tubes/ boats etc. a) Electronic Balance b) Hot plate c) Muffle furnace d) Barometer e) Thermometer f) Distilled water plant g) Burette, Pipette and Full Range of Laboratory Glassware - Conical Flasks, Beakers, Funnel, Pipettes Glass rod, watch Glass, Brush etc. h) Standard Reference Material i) Platinum/Silica Crucible for Silicon Test j) Desiccator k) Watt Man Filter Paper & Ash less clippings l) Arrangements for nitrogen testing m) Drilling machine n) Chemicals and reagents as applicable	Chemical composition Cl. 5.1, Table 1, Cl. 5.2, Table 2
2.	Metallurgical Microscope	Microstructure Cl. 7.1 & 7.2
3.	Brinell Hardness Testing machine	Hardness Cl. 8.1 & 8.2
4.	Metallurgical Microscope	Inclusion content Cl. 9.1 & Table-3
5.	Metallurgical Microscope, Magnetic Particle inspection	Decarburization and Surface defects Cl. 10.1, 10.2, Table 4 & 5
6.	Muffle furnace, Universal Tensile testing machine	Fracture test Cl. 10.3, 11.1 & 11.2
7.	Macro etching Heater, Macro etchant-Hydrochloric acid 1:1	Macro etch test, Cl. 12.1
8.	Micrometer, Vernier Caliper, Steel tape and Steel scale	Dimensions and Tolerances Cl. 14.1, 14.2, 14.3, 14.4 Table-6 & 7

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

ANNEX C
To Product Manual for
Carbon-Chromium Steel for the manufacture of Balls, Rollers and bearing races-
Specification as per IS 4398:1994

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 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 Licence Number (i.e., CM/L.....) shall be incorporated on the product and on the Test Certificate, 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.
- 4. CONTROL UNIT** – All billets, bars, wires and wire rods of same type and manufactured under similar conditions of production from the same raw material, in a day, 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.
- 6. TEST CERTIFICATE:** For each consignment of BIS Certified material conforming to IS 4398:1994 there shall be a test certificate which shall contain the Standard Mark, the lot/cast 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 to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1
LEVELS OF CONTROL

TEST DETAILS				Test equipment requirement R: required (or) S: Sub-contracting permitted	LEVELS OF CONTROL		
Clause	Requirement	Test Methods			No. of samples	Frequency	Remarks
		Clause	Reference				
4	Manufacture	4.2 and 4.3	IS 4398	R	Applicable for all manufacturers including: i) manufacturers with steel making facilities ii) manufacturers without steel making facilities: Must ensure that steel procured by them complies with cl.4.1, cl.4.1.1., 4.2 and 4.3 of IS 4398. 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 etc.		
5	Chemical composition						
	i) Ladle Analysis	5.1 & 5.1.1 and Table 1	Relevant parts of IS 228 or any other established	R	One	Each Cast	Applicable for primary steel producers only
	ii) Product analysis*	5.2 and Table 2 (w.r.t Table 1)	instrumental /chemical Method	-	-	-	i) For Primary Steel Producers with Steel Making facilities , if check analysis is required.

				R	One	Each Cast	ii)For Manufacturer s without steel making facilities. In case input material as one of billets/bars/wire rods procured by such manufacturers is ISI marked and is received with Test Certificate, no further testing is required.
7	Microstructure	7.1, 7.1.1 and 7.2	IS 4398	R	One	Every control unit	
8.	Hardness	8.1 & 8.2	IS 4398; IS 1500 and IS 1586	R	One	Every Control unit	1. Applicable only for Hot rolled, Annealed products and Annealed, cold drawn products. 2. In case of cold drawn wire for cold heading process the hardness shall be as agreed to between manufacturer and purchaser.
9.	Inclusion Content	9.1 and Table 3	IS 4398 and IS 4163	R	One	Each Control Unit	

				R	Six	Each cast	
10	Decarburization and Surface Defects	10.1 (with note), 10.2 and Table 4 and 5	IS 4398; and IS 6396 (subject to mutual agreement between the purchaser and the manufacturer)	R	One	Every Control unit	
11	Fracture test	10.3 , 11.1 & 11.2	IS 4398 IS 4748	R	One	Every Control unit	The grain size shall be subject to mutual agreement between the purchaser and the manufacturer
12	Macro etch test	12.1	IS 4398; IS 11371	R	One	Every Control unit	
13	Additional tests	13.1	IS 4398	S	As agreed to between the purchaser and the manufacturer		
14	Dimensions & Tolerances	14.1, 14.1.1 , 14.2, 14.3, 14.4 , Table 6 & and Table 7	IS 4398; IS 3739	R	Adequate inspection to ensure that each item to be within the limits mentioned in cl.14 of IS 4398:1994		

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 recommendatory and the licensee can submit his own levels of control which can be followed consequent to approval of Head BO.



ANNEXURE – I
(PARA 6 OF THE SCHEME OF INSPECTION AND TESTING)
XYZ IRON AND STEEL COMPANY
(REGD OFFICE AND WORKS ADDRESS)

TEST CERTIFICATE FOR Carbon-Chromium Steel for the manufacture of Balls, Rollers and bearing races- Specification
TEST CERTIFICATE NO. _____, DATE: _____

TO M/S _____

We certify that the material below fully conforms to IS 4398:1994. Chemical and mechanical properties of the product, 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

(PLEASE REFER TO 4398:1994 FOR SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order No.	Form/Shape /Size	Control Unit No.	Grade, condition, heat treatment, condition of supply	Qty	Chemical Composition (in % by wt)						Micro structure	Hardness	Inclusion Content	Macro Etch	Fracture	Decarburization and Surface Defects
					C	Si	Mn	Cr	S	P						

REMARKS
WAGON NO.
TRUCK NO.

FOR XYZ IRON AND STEEL COMPANY

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