PRODUCT MANUAL FOR
High Carbon Steel Wire Rods
According to IS 7904:2018

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 7904:2018**
	Title	**:**	High Carbon Steel Wire Rods
	No. of amendments	**:**	0
2.	**Sampling Guidelines**		
a)	**Raw material**	**:**	No specific requirement
b)	**Grouping Guidelines**	**:**	Please refer Annex – A
c)	**Sample Size**	**:**	For physical tests:1 m X 3 No.s For chemical composition: 50 gm drillings or 5pcs each of length 5 cm for OES (ref:LPPD/OES dtd:21 Sep 2015)
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 physical and chemical tests
6.	**Scope of the Licence :**		
	Licence is granted to use Standard Mark as per IS 7904:2018 with the following scope:		
	Name of the product		High Carbon Steel Wire Rods
	Dimensions		Wire rods of dia from …mm upto and including …mm,
	Steel Grade		HC42, HC46,… HCT 535 to HCT 840,…
	Grade		A, B with & without suffix Cr
	Shape of Wire Rod		Round, Hexagon ,..
	Type		X,Y

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

ANNEXURE A
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GROUPING GUIDELINES
Page 1 of 1

Classification for grades of High Carbon Steel Wire Rods is considered as under:

i) Chemical composition, Cl 5.1 and Table 1 of IS 7904:2018. These grades classified on the basis of chemical composition can be supplied in two varieties namely with suffix-A, B based on Mn content, or with suffix-Cr based on Cr content.
ii) Tensile Strength, Cl 5.2 and Table 2 of IS 7904:2018
iii) Limits of Partial Decarburization Cl 13 of IS 7904:2018
iv) Wire rods with various sections such as square, hexagonal, rectangular etc, alongside round wire rod, Cl 9 of IS 7904:2018

Note: 1. Tests for non-metallic inclusions and/or Maximum resolvable Pearlite limits are to be carried out only if agreed to between the manufacturer and purchaser.

1. In view of the above and in order to follow a uniform policy for the purpose of grant of licence /inclusion of additional varieties in the existing licence, for drawl of samples for independent testing as per IS 7904:2018, the following are to be considered:

HC38 to HC88	One sample each of grade with lowest specified carbon limit and highest specified carbon limit for each shape (viz. Round, Hexagon, Square, rectangular) and of any size intended to be covered shall be tested for covering all sizes, grades including and falling between those carbon limits. The above samples drawn may be preferably of grade B and/or micro-alloyed high carbon steel, as applicable. In case it is intended to cover wire rods of Type –X then the above samples drawn shall be of Type-X. As wire rods of different shapes are produced from round wire rods, among various samples drawn of same grade but of different shapes as mentioned above, only one sample is to be subjected to all tests as per IS 7904:2018, as applicable. The remaining samples are to be tested only for Dimensional Tolerance(Cl 9), Decarburization test (Cl 13) as per IS 7904:2018.
HCT535 to HCT1250	One sample each of grade with lowest minimum tensile strength and highest tensile strength for each shape (viz. Round, Hexagonal, Square, rectangular) and of any size intended to be covered shall be tested for covering all sizes, grades including and falling between those Strength limits. The samples drawn as above may be preferably of alloyed/ micro-alloyed high carbon steel, as applicable. In case it is intended to cover wire rods of Type –X then the above samples drawn shall be of Type-X.

2. It shall, however, be ensured that firm has necessary manufacturing and testing facilities for the entire range of sizes/classes proposed to be covered under the scope of licence.
3. During the operation of license, BO shall ensure that all sizes / grades covered in the license are drawn for independent testing on rotation over a period of time.

ANNEXURE B
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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	(chemical composition, Inclusion content, microstructure) 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. Spectrophotometer	7 for C,S,P,Mn,Si,Ni,Cu,Cr ,N Mn,S,P,Si
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 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_2NO_3), Ammonium Molybdate [$(NH_4)_2 Mo_2O_7$], Ammonium Phosphate [$(NH_4)_3 PO_4$], Potassium Nitrate (K_2NO_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 (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 (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 SulphuricAcid, PerchloricAcid, Tartaric acid and hydroflouric acid	7 (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(Cu content) (chemical method, alternative to instrumental method)
8	ashless paper pulp, paper pulp pad, hot plate, dessicator, Reagents: ammonium nitrate, methyl red, dilute ammonium hydroxide, Concentrated hydrochloric acid Concentrated nitric acid, Perchloric acid, Hydrofluoric Acid	7 (Ni content) (chemical method, alternative to instrumental method)
9	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 (Cr content) (chemical method, alternative to instrumental method)
10	Inert gas fusion followed by determination using thermal conductivity detector	7 (Nitrogen content)
11	Measuring Tape, Vernier caliper, Micrometer, ruler	9 (Dimensional Tolerance)
12	Tensile testing machine(0-400kN, 0.001 kN) fitted with extensometer,	10 (UTS, RA)
13	Magnifying glass, Stereo Microscope, X ray scanning flaw detector, Dye Penetrant Test Kit, Acid Etching Chamber	12(Surface Defects)
14	Microscope with Magnification (100x, 200x, 500x, 1000x)- computer aided,	13(Decarburization)

15	Microscope with Magnification (100x, 200x, 500x, 1000x)	14 (Inclusions)
16	Laboratory Furnace, Metallographic Sample Preparation Equipment, Etching Reagent(either natal or picral), Metallurgical Microscope	15 (Microstructure)
17	Microscope with Magnification (100x, 200x, 500x, 1000x)	16(Axial Segregation)

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 equipments.

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

3. LABELLING, MARKING, PACKING –
The Standard Mark as given in 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. 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 wire rod of same cross-sectional dimensions manufactured by rolling continuously using steel of same heat and manufactured under uniform conditions of production in a day in the same place.

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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.

6. TEST CERTIFICATE-For each consignment of BIS Certified material conforming to IS 7904:2018 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.

SCHEME OF INSPECTION AND TESTING

TABLE 1: LEVELS OF CONTROL

(1)				(2)	(3)		(4)
TEST DETAILS					**LEVELS OF CONTROL**		
Clause	**Requirements**	**Test Method**		**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**No. of Samples**	**Frequency**	**REMARKS**
		Clause	**Reference**				
5	Tensile Strength	5.2	IS 7904:2018 IS 1608(Pt.1)	R S	i) One ii) -----	i)Each Control Unit ii) -----	i) Applicable for manufacturers producing grades classified on tensile strength. ii) Applicable for manufacturers producing grades classified on chemical composition only
6	Manufacture	6.1 6.2 6.3	IS 7904:2018	R	Sufficient discard shall be made from each ingot to ensure freedom from piping, segregation and other harmful defects. Adequate inspection to ensure that scales on wire rods shall be controlled to the minimum.		
7	Chemical Composition a) Ladle Analysis	5.1 7.1 Table-1	IS 7904: 2018 IS 228 (various parts)	R S	i) One ii) ----	i) Each Heat ii)-----	i) Applicable for manufacturers with steel making facilities and producing grades classified on chemical composition. ii) Applicable for manufacturers producing grades classified on tensile strength or for manufacturers with no steel making facilities.

7	b) Product Analysis	5.1 7.2 Table-3	IS 7904: 2018 IS 228 (various parts)	R R S	i)Nil ii)One ----	i)Nil ii)Each Cast -----	i) Applicable for manufacturers with steel making facilities and producing grades classified on chemical composition. ii) Applicable for manufacturers with no steel making facilities and producing grades classified on chemical composition(see Note-3). iii) Applicable for manufacturers producing grades classified on tensile strength.
9	Dimensional Tolerance	9	IS 7904: 2018 IS/ISO 16124	R	Adequate inspection to ensure that finished products are within limits of the specification		
12	Surface Defects		IS 7904: 2018	R	One	Each Control Unit	One sample for every 100 tonnes or part thereof rolled out of billets and blooms from the same cast.
13	Decarburization Test	12 13, Table-5	IS 7904:2018 IS 6396	R	Two	Each Control Unit	
14	Non- Metallic Inclusions	8, 14.1,14.2, Table-6	IS 7904: 2018 IS 4163 (Method A)	S	Two	Each Control Unit	If specifically agreed to between purchaser and supplier.
15	Microstructure	8, 15, Table-7	IS 7904: 2018	S	Two	Each Control Unit	If specifically agreed to between purchaser and supplier.
16	Axial Segregation	8 16	IS 7904:2018	S	The method as well as assessment criteria shall be agreed upon at the time of ordering.		

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 product analysis is required if material fed to rolling mills is ISI marked and received with test certificate

Note -4 : ------- means the levels of control in Column(3) of Table-1 and the requirements are as agreed to between the manufacturer and purchaser.

Annexure-I

(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 High Carbon Steel Wire Rods as per IS 7904:2018

TEST CERTIFICATE No._____ DATE_____

To M/s_____

We certified that the material described below fully conforms to 7904:2018 Chemical composition and Mechanical properties of the product, as tested in accordance with the Scheme of Testing and Inspection contained in the BIS Certification Marks LicenceNo.CM/L_____ are as indicated below against each order No.

(PLEASE REFER TO IS 7904:2018 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order No.	Dimensions	Control unit No.	Grade	Quantity (Tonnes)	Chemical Analysis								Decarburization test	Mechanical Properties		Non metallic inclusion (If required by purchaser)	Microstructure (If required by purchaser)
					C (%)	Si (%)	Mn (%)	S (%)	P (%)	Cr (%)	Al (%)	Micro alloy elements		Tensile Strength	RA		

Remarks:

SIGNATURE:

DESIGNATION:

FOR XYZ IRON & STEEL COMPANY

(It is suggested that size A-4 paper (210 X 297 mm) be used for this certificate