

**PRODUCT MANUAL FOR
Steels for Cold Heading/Cold Extrusion Application
Part 1 Wrought Carbon and Low Alloy Steels
According to IS 11169(Part 1):1984**

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 11169 (Part 1):1984
	Title	:	Steels for Cold Heading/Cold Extrusion Application Part 1 Wrought Carbon and Low Alloy Steels
	No. of amendments	:	1
2.	Sampling Guidelines		
a)	Raw material	:	No specific requirement for manufacturers with steel making facilities and re-rollers. The input material for manufacturers starting with bars/wire rods/wires shall be ISI marked and complying to IS 11169 Pt.1
b)	Grouping Guidelines	:	Please refer Annex – A
c)	Sample Size	:	Mechanical: 1m X 3 No.s or prepared pieces (above 25 mm thickness/dia) Chemical: 5 pcs of 5cm long 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 physical and chemical tests
6.	Scope of the Licence :		
	Licence is granted to use Standard Mark as per IS 11169 (Part 1):1984 with the following scope:		
	Name of the product	Steels for Cold Heading/Cold Extrusion Application Part 1 Wrought Carbon and Low Alloy Steels	
	Designation	20C8,..	
	Condition	As-rolled, ..	
	Type of Condition for Delivery	A,B, C,..	
	Variety(Size)	Bars: ..X ...mm upto and including ..X ...mm, Wire Rods:..mm upto and including ...mm, Wires: : ..mm upto and including ...mm	

ANNEXURE A
TO PRODUCT MANUAL FOR
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GROUPING GUIDELINES

Page 1 of 1

IS 11169(Part 1):1984 standard covers the requirements for wrought carbon and alloy steels which are intended for cold heading/cold extrusion and are delivered as wires, wire rods or bars having a diameter of 2 to 100 mm.

This standard covers the following groups of steels:

- a) Steels not intended for heat treatment (Table 1),
- b) Steels for quenching and tempering (Table 2), and
- c) Case hardening steels (Table 3).

Steels shall be supplied in any one of the following conditions as agreed to between the purchaser and the manufacturer:

- a) in the as-rolled condition,
- b) in the as-rolled and spheroidize-annealed condition,
- c) in bright drawn condition with or without annealing,
- d) in the peeled and/or centerless ground condition with or without annealing, and
- e) in drawn annealed and coated condition.

Upon examination of the variety of steels covered by the standard and various delivery conditions, it is evident that all steel covered is unique as per customer requirement. Therefore, Grouping is being proposed on the basis of size only as follows:

“All grades are required to be tested from any one size offered by the firm. In case applicant/licensee can supply product in annealed condition, sample of same size and grade offered by the firm as above shall be tested for hardness also. Coverage of sizes may be made as per the manufacturing and testing capability of the firm from 2 mm to 100 mm wires, wire rods and bars.”

It shall, however, be ensured that firm has necessary manufacturing and testing facilities for the entire range of designations/delivery conditions proposed to be covered under the scope of licence.

During the operation of license, BO shall ensure that all sizes / conditions/ designations 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

Page 1 of 3

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	(chemical composition, Inclusion content, microstructure, hardenability) 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	4 for C,S,P,Mn,Si,Ni,Cu,Cr ,N,Mo,Sn,V Mn,S,P,Si,Mo,
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	4 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 (NaNO ₂), 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	4 (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	4 (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 Sulphuric Acid, Perchloric Acid, Tartaric acid and hydrofluoric acid	4 (Silicon content) (chemical method, alternative to instrumental method)
7	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	4 (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	4 (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.	4 (Cr content) (chemical method, alternative to instrumental method)
10	Inert gas fusion followed by determination using thermal conductivity detector	4 (Nitrogen content)
11	Measuring Tape, Vernier caliper, Micrometer, ruler	6.2 (Dimensional Tolerance)
12	Magnifying glass, Stereo Microscope, Acid Etching Chamber	7.2 (surface defects)
13	Punch-Die arrangement with press for heading load	7.3 (Cold Heading Test)

14	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 stannous 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.	7.4(Macro-etch) Test
15	Microscope with Magnification (100x, 200x, 500x, 1000x)- computer aided,	7.5 (Decarburization)
16	Brinell Hardness Tester with Tungsten Carbide Indenter	8(Hardness)
17	Tensile testing machine fitted with extensometer,	9(UTS, proof stress, Elongation)
16	Laboratory Furnace, Metallographic Sample Preparation Equipment, Etching Reagent(either nital or picral), Metallurgical Microscope	10.1,10.2 (Microstructure & Grain Size)
18	Microscope with Magnification (100x, 200x, 500x, 1000x)	10.3 (Inclusions)
19	Unit having Quenching fixtures, arrangement for keeping specimen in place with water jet emerging from cone at the bottom to touch the lower end of the sample. Muffle furnace, safety equipment, Rockwell hardness tester.	11 (Hardenability)

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

ANNEXURE C
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SCHEME OF INSPECTION AND TESTING

Page 1 of 6

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.

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 steel wires/wire rods/bars manufactured from same cast/heat having same dimensions and processed to same delivery condition under uniform conditions of production in a day in the same place.

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.

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 11169 Pt.1:1984 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 TESTINGPage 2 of 6
TABLE 1: LEVELS OF CONTROL

(1)				(2)	(3)		(4)
TEST DETAILS					LEVELS OF CONTROL		REMARKS
Clause	Requirements	Test Method		Test equipment requirement R: required (or) S: Sub-contracting permitted	No. of Samples	Frequency	
		Clause	Reference				
3	Manufacture	3.1,3.2 3.3,3.4 3.5,3.6	IS 11169(Pt.1):1984	R	-----	-----	Applicable for all manufacturers including: i) manufacturers with steel making facilities ii) Re-rollers: Must ensure that steel procured by them complies with CI 3.1 and/or CI 3.2 of IS 11169 Pt.1:1984. Accordingly, records in support of the same shall be maintained which shall include raw material certificate indicating steel manufacturing process, size of input material etc. iii) Other manufacturers, excluding manufacturers with steel making facilities and re-rollers, starting with input material as one of bars/wire rods shall ensure that the material procured by them is ISI marked as per IS 11169(Pt.1):1984.

4	Chemical composition: a) Ladle Analysis	4.1.2, 4.1.2.1, 4.1.3, 4.2.4.4&Table -1,2,3	IS 11169(Pt.1):1984 Relevant parts of IS 228 or any other established instrumental/ chemical method. Also, See Note-3.	R	i) One	i) Each Heat	i) Applicable for manufacturers with steel making facilities. ii) Re-rollers shall maintain records in support of the material used which shall include certificate for inputs/starting material certificate indicating ladle analysis , steel manufacturing process, size of input material etc.
4	b) Product Analysis	4.3, 4.4 & Table-1,2,3,4	IS 11169(Pt.1):1984 Relevant parts of IS 228 or any other established instrumental/chemical method. Also, see Note-3. IS 3711	R	i) Nil ii) One	i) Nil ii) Each Heat	i) Applicable for manufacturers with steel making facilities. ii)Applicable for manufacturers other than those with steel making facilities. However, No testing is required if the material received is ISI marked and received with Test Certificate.
5	Ordering and Delivery Condition	5.1	IS 11169(Part 1):1984	R	----	----	Steels shall be supplied in any of the following conditions mentioned in cl.5.1 of IS 11169(Part 1) as agreed between the purchaser and supplier. Also, See Note-5
6	Dimensions and Tolerances	6.1 6.2	IS 11169(Part 1):1984 IS 3739 IS 9550	R	one	Each Coil/bundle or package	1.Nominal dimensions of the bar, wire rod or wire shall be as specified by the purchaser. 2. For wires the tolerances are as agreed to between the purchaser and the supplier.
7	Freedom from defects	7.1 7.2	IS 11169(Part 1):1984	R	Adequate inspection to ensure that Each Coil/bundle or package is free from internal and surface defects.		

7.3	Cold Heading Test	7.3, Appendix B	IS 11169(Part 1)	R	----	----	If agreed to between manufacturer and purchaser. Also, See Note-5
7.4	Macro-Etch Test	7.4	IS 7739(Part 5)	R	One	Each Control Unit	
7.5	Decarburization Test	7.5	IS 11169(Part 1)	R	One	Each Control Unit	
8	Hardness	8, Table-5	IS 11169(Part 1)	R	----	----	Applicable only for products delivered in Annealed condition Also, See Note-5
9	Mechanical properties	The mechanical properties of the steel in any particular condition supply shall be according to the agreement between the purchaser and the manufacturer.					
	i)Brinell Hardness ii)Ultimate Tensile Strength iii)0.2 percent yield strength iv)Elongation v)Izod Impact strength	9.1, 9.1.1, 9.2, 9.2.1, 9.2.2, Fig.1, Table- 6 & 7	IS 11169(Part 1) IS 1500 IS1608 IS 1598	R	----	----	If agreed to between manufacturer and purchaser. Also,see Note-5.
10	Metallurgical Properties						
10.1	Microstructure	10.1	IS 11169(Part 1)	R	----	----	The microstructure of the steel shall be fixed by mutual agreement between the purchaser and the manufacturer.
10.2	Grain Size	10.2	IS 4748	R	----	----	If for the steel grades included in Table 2 and Table 3, a controlled austenitic grain size is required. Also,see Note-5.
10.3	Inclusion Rating	10.3 , 10.3.1	IS 4163	R	1	Every Control Unit	

11	HARDENABILITY						
11.1	End-Quenched Hardenability	11.1& 11.1.1	IS 11169(Part 1) IS 3848	R ^s	----	----	As and if mutually agreed to between manufacturer and purchaser. Also see Note-5.
11.1.2	Core Hardenability	11.1.2, Appendix C	IS 11169(Part 1)	R ^s	----	----	See Note-5.

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.

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: For cases where the methods of chemical analysis are not covered by IS 228, mutually agreed methods may be adopted by the manufacturer and the customer.

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.

Note- 5: Test equipments to be possessed by the manufacturer only for the conditions (A,B,C,D,E,F) in which they intend to supply the material.

