www.bis.gov.in

उत्पाद मैन्युअल
मैकेनिकल स्प्रिंग्स के लिए स्टील के तार पार्ट 4
स्टेनलेस स्टील के तार
IS 4454 (Pt-4: 2001 के अनुसार

PRODUCT MANUAL FOR
Steel Wire for Mechanical Springs Part4Stainless Steel Wire
ACCORDINGTO IS 4454 (Pt-4):2001

विभिन्न उत्पादों के लिए भारतीय मानक ब्यूरो) अनुरूपता मूल्यांकन (विनियम, 2018 की योजना -I के तहत प्रमाणन के संचालन में एकरूपता और पारदर्शिता के लिए इस उत्पाद मैनुअल का उपयोग सभी क्षेत्रीय / शाखा कार्यालयों और लाइसेंसधारियों द्वारा संदर्भ सामग्री के रूप में किया जाएगा। दस्तावेज़ का उपयोग बीआईएस प्रमाणन प्राप्त करने के इच्छुक संभावित आवेदकों द्वारा भी किया जा सकता है।

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure uniformity 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.

1.	**मानक संख्या** **IS No.**	:	4454 (Pt-4):2001
	शीर्षक **Title**	:	Steel Wire for Mechanical Springs Part 4 Stainless Steel Wire
	संशोधनों की संख्या **No. of amendments**	:	02
2.	**नमूना दिशानिर्देश** **Sampling Guidelines**		
a)	**कच्चा माल** **Raw material**	:	No specific raw material requirement Note: This section indicates the requirements for raw material (if specified in the IS) for which compliance is to be established during Grant of Licence/Change in Scope of Licence/Factory Surveillance
b)	**समूहीकरण दिशानिर्देश** **Grouping Guidelines**	:	Please refer Annex - A

c)	**नमूने का परिमाण** **Sample Quantity**	:	For physical tests: 1 m X 4Nos (for tensile test, 2 samples within a coil are to be drawn for determination of deviation in tensile strength. Please refer cl.10.1.3 of IS 4454 (Part 4) : 2001) For chemical tests:5 pcs of 50 cm length or 50gm cut pieces of wire **Note: This section indicates the quantity of the sample of the product and/or the raw material (if applicable), required to be sent to the laboratory for testing, for the purpose of Grant of Licence/Change in Scope of Licence/ Factory Surveillance (incase of market surveillance, effort may be made to procure therequired quantity of product sample, as far as possible since raw material sample may not be available in market**)
3.	**परीक्षण उपकरणों की सूची** **List of Test Equipment**	:	Please refer to Annex-B
4.	**निरीक्षण और परीक्षण की स्कीम** **Scheme of Inspection and Testing**	:	Please refer to Annex- C
5.	**एक दिन में संभावित परीक्षण** **Possible tests in a day**		
	All tests are possible to be carried out in a day Note: This section is for the guidance of BIS Certification Officers/Technical Auditors of BIS Authorized Outside Surveillance Agencies (OSAs) during factory inspection to provide ready reference regarding the tests which can be witnessed during the inspection in the factory by the officer/auditor.		
6.	**लाइसेंस का दायरा /Scope of the Licence:**		
	"Licence is granted to use Standard Mark as per IS 4454 (Pt.4) :2001 with the followingscope: IS 4454 (Pt.4) :2001 के अनुसार मानक मुहर का उपयोग करने के लिए लाइसेंस निम्नलिखित कार्यक्षेत्र के लिए प्रदान किया जाता है		
	Name of the product **उत्पाद का नाम**	Steel Wire for Mechanical Springs Part 4 Stainless SteelWire	
	Grade	X07Cr18Ni9 / X04Cr19Ni9 / X04Cr17Ni12Mo2	
	Sizes (Diameter)	_____mm up to and including 10 mm	

ANNEXURE A
GROUPING GUIDELINES

1. IS 4454 (Part 4):2001 covers Stainless Steel Wires, in circular cross-section, up to 10 mm in diameter for the manufacture of springs. 3 grades of Stainless Steel Wire, with their chemicalcomposition, have been specified at Table 1. Tensile Strength of Stainless Steel Wires have been specified at Table 4 as per which the lower diameters have the higher specified strength. Further, Grade 2 has the highest specified tensile strength and Grade 3 has the lowest specified tensile strength for all diameters of Stainless Steel Wire.

2. In view of above, the following Grouping Guidelines shall be considered for the purpose of GoL/CSoL:-

Grade	Designation	Sampling
1	X07Cr18Ni9	Two samples (Minimum and Maximum diameter of Stainless-Steel Wire) of each grade/designation shall be drawn and tested to cover all sizes for that Grade Designation.
2	X04Cr19Ni9	
3	X04Cr17Ni12Mo2	

3. The test for Cast of the wire (cl.10.4), property to be tested when a ring is cut from coil, may be carried out, as applicable, in factory itself on coils of samples being drawn for independent testing:

4. Scope licence shall be restricted based on the manufacturing and testing facilities available.

5. During operation of licence, samples of each variety covered in the scope of licence, shall be tested inrotation, to the extent possible.

ANNEX – B

LIST OF TEST EQUIPMENTS

(INDICATIVE LIST, FOR GUIDANCE ONLY)

Sl. No.	Tests Used In With Clause Reference	Test Equipment/Chemical
1.	Preparation of specimen	Rough Polishing Machine, Abrasive Cutting Machine, Fine Polishing Machine, Grinding Machine, Molding machine, Longitudinal cutting machine
2.	Cl 7, 7.1, 7.2 for C, S, P, Mn, Si, Ni, Cr, Mo Mn,S,P,Si	**Instrumental methods** Spectrometer: atomic-absorption spectrometry, inductively coupled plasma atomic emission, inductively coupled plasma mass spectrometry techniques, spark source optical emission spectrometry. Spectrophotometer
3.	Cl7,7.1,7.2forC&S (chemical method, alternative to instrumental method)	Strohlein 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 : tingranules or pureiron fillings, acidulated water/brine water, methyl red, caustic potash Reagents for S : Ceramic boats/crucibles–desiccators, Fluxes -Low sulphur copper, tinoriron, Dilute hydrochloric acid, Starch Iodide solution, Potassium iodate
4.	Phosphorus content Cl 7,7.1,7.2(chemical method, alternative to instrumental method)	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 (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 chemical sand reagent as applicable
5.	Manganese contentCl7,7.1, 7.2 (chemical method, alternative to instrumental method)	Hotplate, Conical flask Reagents: silver nitrate, ammonium per sulphate sodium arsenite solution, Dilute Nitric Acid, Phosphoric Acid, Dilute Sulphuric Acid, Concentrated. Nitric Acid, NaCl Solution, Permanganic acid
6.	Silicon content Cl 7, 7.1, 7.2(chemical method, alternative to instrumental method)	Medium textured filter paper, Porcelainc asserole, platinum crucible, filter paper pulp, hot plate, hot air oven, muffle furnace Reagents : Silver nitrate solution, concentrated nitric acid, concentrated sulphuric acid, Dilute Hydro chloric Acid, Dilute Sulphuric Acid, Perchloric Acid, Tartaric acid and hydroflouric acid
7.	Cu content Cl 7, 7.1, 7.2(chemical method, alternative to instrumental method)	Plate, Muffle Furnace, porcelain or silicacrucible, 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
8.	Ni content Cl 7, 7.1, 7.2(chemical method, alternative to instrumental method)	Ashless paper pulp, paper pulppad, hot plate, dessicator, Reagents: ammonium nitrate, methyl red, dilute ammonium hydroxide, Concentrated hydrochloric acid Concentrated nitric acid, Perchloric acid, Hydro fluoric Acid
9.	Mo content Cl 7, 7.1, 7.2(chemical method, alternative to instrumental method)	Weighing Balance, Heater/Heating Element, Ashless Filter Paper, Glassware, Ashless Paper Pulp, Stirre, Platinum Crucible, Hot Plate Reagents: Dilute Sulphuric Acid, Conc. Nitric Acid, Hydroflouric Acid, Boric Acid Solution (4%), Solid Potassium Bisulphide, Ferrous Sulphate Solution (5%),Alpha-Benzoinoxime, Ethanol, Bromine Water, Dilute Ammonium Hyrdoxide Solution,Sulphuric Acid- Benzoinoxime Wash Solution, Conc.HCl, Dil.HCl, Solid Tartaric Acid, Hydrogen Sulphide Gas, Hydrogen Sulphide Wash Solution, Cinchonine Hydrochloride
10.	8 (Freedom from defects)	Vision-based inspection system
11.	9 (Dimensions and Dimensional Tolerances)	Vernier Calipers, Micrometer
12.	10.1 (Tensile Test)	UTM Machine
13.	10.2 (Wrapping Test)	Wrapping Machine,10X magnifying glass
14.	10.3 (Reverse Torsion Test)	Torsion Testing Machine

15.	10.5 (Bend Test)	Bend test arrangement with mandrel for all sizes above 3mm
16.	10.6(Coiling and stretching test)	Test arrangement with suitable mandrels and provision for Applying reason ably uniform tension on wires from 0.50-1.50 mm.
17.	10.4(Cast of the wire)	Vernier Calipers

ANNEX C

SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that manufacturers (licensees/applicants) will implement a Quality Assurance Plan i.e. a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan defining the control unit (i.e. lot/batch etc.) and the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and submit the same to BIS Branch Office for information. The manufacturer shall comply with the same and maintain test records in accordance with para 2.4.

1.3 **RECOMMENDED LEVELS OF CONTROL/CONTROL UNIT**:

1.3.1 For the guidance of manufacturers, the recommended definition of control unit is: For the purpose of this Scheme, a control unit is defined as Stainless steel wires of the same dimension, ,same grade manufactured by using steel of same heat under uniform conditions of production on the same line in one go.

1.3.2 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in **Table 1**.

1.3.3 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan. Alternatively, the manufacturer has the option of adherence to the quality plan as per levels of control recommended in column 3 of Table 1.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING- It is expected that manufacturers (licensees/applicants) will establish a suitably equipped and staffed in house laboratory (In house testing facility) for testing at least those parameters of the Indian Standard which require routine testing for ensuring quality of the product. This includes in-process controls as may be defined and put in place by the manufacturer and testing parameters/requirements which can only be performed in the factory.

2.1 For the guidance of manufacturers, Table 1 giving the recommended levels of control is given below. Column 2 of Table 1 indicates routine tests where test equipment is required in house as “R” or other tests which can be subcontracted as “S”. Subcontracting is permitted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.2 For MSME manufacturers, the requirement of maintaining a laboratory/in-house testing facility for routine tests (indicated as “R” in Column 2 of Table 1) is also optional.

2.2.1 MSME manufacturers may utilize common cluster based facilities as per guidelines for the utilization of cluster based test facilities by MSMEs or the provisions of Sharing of testing facilities or get testing done from BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.3 **Large Scale manufacturers shall maintain an in-house laboratory equipped at least with test facilities for routine tests (indicated as "R" in Column 2 of Table 1)**, where different testsgiven in the specification shall be carried out in accordance with the method given in the specification**.** They shall also implement a calibration plan for the in-house test equipment.

2.3.1 Alternatively, in lieu of an in-house laboratory, large scale manufacturers can also utilize the provisions of Sharing of testing facilities as per the Guidelines for Grant of Licence available on BIS website www.bis.gov.in. (Under Conformity Assessment>Product Certification Process). Even for subcontracted tests, provisions for sharing of testing facilities can be utilized.

2.4 **TEST RECORDS**- The manufacturers maintaining an in-house laboratory or utilizing common cluster based facilities or shared test facilities shall maintain test records for the tests carried out to establish conformity. For the tests being subcontracted to BIS recognized/empanelled laboratoryor any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025, test reports issued by the laboratories shall be available for inspection by BIS.

3. PACKING AND MARKING - The Standard Mark as given in the Schedule of the license and Licence Number (i.e. CM/L) shall be incorporated on metal tag/sticker/label attached to each coil or bundle of wires and on the Test Certificate, provided always that the product thus marked conforms to all the requirement of the specification.

3.1 Packing and Marking shall be done as per the Indian Standard.

4. TEST CERTIFICATE: For each consignment of BIS Certified material conforming to IS 4454 (Pt.4):2001 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)

5. REJECTION - All the production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. 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.

TABLE 1
(ONLY FOR GUIDANCE PURPOSE)

(1)				(2)	(3)		
Test Details				**Test equipment requirement R: required (or) S: Sub-contracting permitted**	**Levels of Control**		
Cl.	**Requirement**	**Test Methods**			**No. of Sample**	**Frequency**	**Remarks**
		Clause	**Reference**				
7	Chemical Composition						
	Ladle Analysis	7.1 , Table-1	IS4454 (Pt.4): 2001 & IS228 (Various Parts) / any established Chemical / Instr. Method.	R	One	Each Cast	Applicable for manufacturers with steel making facilities.
	Product Analysis	7.2, Table-2		S	i) Nil ii)One	i)Nil ii) Each Cast	i) Applicable for primary steel producers with steel making and rolling facilities, wherever traceability to the heat is ensured by manufacturer. ii) Applicable for manufacturers not having steel making facilities and procuring billets/wire rods as raw material and feeding to rolling mills / drawing dies No further testing is required if the raw material being procured is ISI marked and is received with test certificate.
8	Freedom from Defects	8	IS4454(Pt.4):	R	Manufacturer shall exercise adequate in-process controls to ensure that the material remains free from harmful defects		

9	Dimensions & Tolerances	9.1,9.2, 9.3,9.4,9.5 &Table-3	IS4454(Pt.4): 2001	R	Firm to have adequate in-process controls to check compliance of this parameter as per the tolerances given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity		
					between manufacturer and purchaser.		
10.1	Tensile Test	10.1	IS 4454(Pt.4): 2001 IS1608 (part 1)	R	One	Each Control Unit	---
10.2	Wrapping Test	10.2	IS1755	R	One	Each Control Unit	----
10.3	Reverse Torsion Test	10.3.1, 10.3.2, 10.3.3, 10.3.4	IS4454(Pt.4): 2001 IS1717	R	One	Each Control Unit	----
10.5	Bend Test	10.5	IS4454(Pt.4): 2001	R	One	Each Control Unit	Applicable to wires of diameter greater than 3.00 mm
10.6	Coiling Test	10.6	IS4454(Pt.4): 2001	S	-----	-----	Applicable to wires of diameter between 0.50 mm to 1.50 mm Also See Note 3
10.4	Cast of the Wire	10.4	IS4454(Pt.4): 2001	R	One	Each Control Unit	-------
		10.4.1, Fig.1	IS4454(Pt.4): 2001	S	-----	-----	Applicable to wires of diameter greater up to 5.00 mm Also See Note 3
11	Surface Finish	11	IS4454(Pt.4): 2001	S	-----	-----	The wire may be coated or uncoated. The specific coating and finish for stainless steel spring wire for example uncoated, polished finish, nickel coated etc. shall be mutually agreed to between the manufacturer and purchaser Also See Note 3

Annexure-I

XYZ IRON AND STEEL COMPANY

BIS STANDARD MARK

TEST CERTIFICATE FOR SPECIFICATION FOR
Steel Wire for Mechanical Springs Part 4 Stainless Steel Wire

TEST CERTIFICATE No_____ Date _____

To M/s._____

We certified that the material described below fully conforms to IS 4454 (Pt-4) : 2001 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_are as indicated below against each order No.

(PLEASE REFER TO IS 4454 (Pt-4): 2001 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TESTRESULTS

Order no and date	(nom Size)	Cast/ Control Unit No.	Grade	Quantity	Chemical Composition									MECHANICAL PROPERTIES	Bend Test	Reverse Torsion test	Wrapping Test	Coating & Surface finish
					C %	S %	P %	Si %	Mn %	Cr %	Ni %	Cr %	Mo%					

as required by purchaser

REMARK
S WAGON
NO.
TRUCKNO.

FOR XYZ IRON AND STEEL COMPANY

(It is suggested that size A 4 paper be used for this test certificate)