



उत्पाद मैनुअल
यांत्रिक स्प्रिंग के लिए इस्पात के तार –विशिष्ट
भाग -1 अतः कर्षित अमिश्रित इस्पात तार
IS 4454 (Part 1): 2001 के अनुसार

**Product Manual for
Steel Wire for Mechanical Springs
Part 1 Cold Drawn Unalloyed Steel Wire
According to IS 4454 (Part 1): 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.	भारतीय मानक संख्या IS No.	:	IS 4454 (Part 1):2001
	शीर्षक Title	:	Steel Wire for Mechanical Springs Part 1 Cold Drawn Unalloyed Steel Wire
	संशोधनों की संख्या No. of amendments	:	01
2.	नमूना दिशानिर्देश Sampling Guidelines		
a)	कच्चा माल Raw material	:	No specific 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 test: 1m x 3 Nos. For Chemical Tests: 5 Pcs of 5 cm or 50 gm 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 (in case of market surveillance, effort may be made to procure the required quantity of product sample, as far as possible since raw material sample may not be available in market)
d)	परीक्षण अनुरोध में घोषित किए जाने वाले पैरामीटर Parameters to be Declared in Test Request	:	Grade, Sizes, Addition of Micro Alloying Elements, Method for dissolution of the coating (if applicable) Note: Apart from the above, any other requirements/parameters may also be declared as per the standard, as applicable.
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 Physical and Chemical Tests 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:		
	IS 4454 (Part 1):2001 के अनुसार मानक मुहर का उपयोग करने के लिए लाइसेंस निम्नलिखित कार्यक्षेत्र के लिए प्रदान किया जाता है □Licence is granted to use Standard Mark as per IS 4454 (Part 1):2001 with the following scope:		
7.	उत्पाद का नाम Name of the product		Steel Wire for Mechanical Springs Part 1 Cold Drawn Unalloyed Steel Wire
	Grade		SL,.....
	Sizes		Nominal Diameter frommm upto and including..... mm

Annex-A
To Product Manual for
Steel Wire for Mechanical Springs Part 1 Cold Drawn Unalloyed Steel Wire
According to IS 4454 (Part 1):2001

GROUPING GUIDELINES

1. This standard covers the requirements of cold drawn unalloyed steel wires, both round and shaped.
2. Grouping has been done on the basis of duty. Within a group, grade of higher tensile strength is considered as higher grade. The following may be followed for considering grant of licence/inclusion as per IS 4454 (Pt-1):2001:

Group	Grades	Sampling
1	SL, SM, SH	One sample of any size, preferably of lowest size, may be drawn. If sample of higher grade is tested, then recommendation may include lower grades also alongside the higher grade. Separate samples shall be drawn for round wire and shaped wire in order to cover both within the scope of the licence. Eg: SH is superior grade in group-1
2	DM, DH	One sample of any size, preferably of lowest size, may be drawn. If sample of higher grade is tested, then recommendation may include lower grades also alongside the higher grade. Separate samples shall be drawn for round wire and shaped wire in order to cover both within the scope of the licence. Eg: DH is superior grade in group-2

2. A declaration on chemical composition suitably selected from Table-2 of IS 4454 (Pt-1):2001 against all grades and corresponding size ranges intended to manufacture shall be obtained from the manufacturer. In addition, a declaration on method of test for coating, if any equipped by the manufacturer, may be obtained. Also method for dissolution of the coating, as applicable, may also be obtained so that information may be shared with laboratories enabling them for chemical analysis of steel wire.
3. The test for Cast of the wire, 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. If sample passes, licence/inclusion can be granted for all grades and sizes of wires mentioned in the specification and as applied by the applicant/licensee, provided that the firm is having all necessary manufacturing and testing facilities for manufacturing and testing of the sizes of wires proposed to be included in the licence.
5. During the operation of licence, BO shall ensure that all the finishes and sizes of wires covered in the license are drawn for independent testing on rotation over a period of time.

ANNEX – B

LIST OF TEST EQUIPMENTS
(INDICATIVE LIST, FOR GUIDANCE ONLY)

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

Sl. No.	Test Equipment/Chemicals and Identification Numbers (Where applicable)	Tests Used in with Clause Reference
1	Rough Polishing Machine, Abrasive Cutting Machine, Fine Polishing Machine, Grinding Machine, Molding machine, Longitudinal cutting machine	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, 7.1, 7.2 (C,S,P,Mn,Si,Ni,Cu,Cr) 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, 7.1, 7.2 (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 ₂ NO ₃), Ammonium Molybdate	7, 7.1, 7.2 (Phosphorus content, chemical method, alternative to instrumental method)

	[(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	
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, 7.1, 7.2 (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	7, 7.1, 7.2 (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	7, 7.1, 7.2 (Cu content , chemical method, alternative to instrumental method)
8	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, 7.1, 7.2 (Cr content, chemical method, alternative to instrumental method)
9	ashless paper pulp, paper pulp pad, hot plate, dessicator, Reagents: ammonium nitrate, methyl red, dilute ammonium hydroxide, Concentrated	7, 7.1, 7.2 (Ni content, chemical method, alternative to instrumental method)

	hydrochloric acid Concentrated nitric acid, Perchloric acid, Hydrofluoric Acid	
10	Inert gas fusion followed by determination using thermal conductivity detector	6.1 (Nitrogen Content)
11	Vision-based inspection system	8 (Freedom from defects)
12	Vernier Calipers , Micrometer	9 (Dimensions and Dimensional Tolerances)
13	UTM Machine (LC 0.1KN, Range:0-400KN)	10.1(Tensile Test)
14	Wrapping Machine, 10X magnifying glass	10.2 (Wrapping Test)
15	Torsion Testing Machine	10.3(Torsion Test)
16	Bend test arrangement with mandrel for all sizes above 6mm	10.4 (Bend Test)
17	test arrangement with suitable mandrels and provision for applying reasonably uniform tension on wires less than 0.7mm.	10.5(Coiling and stretching test)
18	Vernier Calipers	10.6(Cast of the wire)
19	Deep etch testing HCL tank, Heater, Acid container, Thermocouple, Lead bath, Stop watch	10.7(Deep Etch Test)
20	Metallurgical Microscope with image analyzer or Metallurgical Microscope (100 X or better resolution), Heating furnace suitable for normalizing or annealing, sample preparation using compression mounting, 3 % Nital	10.8 (Decarburization) Using Microscopic method
21	Heating furnace and quenching media (non hardened material), Vickers or Knoop Hardness tester	10.8 (Decarburization) Using microindentation hardness traverses

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

ANNEX- C SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that during operation of BIS licence, manufacturers will implement a Quality Assurance Plan (QAP) 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 (QAP) defining the control unit (i.e. lot/batch etc.), the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and declare the arrangement for testing i.e. whether in-house or subcontracting/sharing for each applicable test and submit the same to BIS Branch Office for information. The manufacturer shall comply with the QAP and maintain test records in accordance with para 2.1.

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 steel wire of same cross sectional dimensions and same grade manufactured by using steel of same heat and manufactured under uniform conditions of production in a day.

1.3.2 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in Table 1. Manufacturer has the discretion of declaring their own levels of control or accept the levels of control given in this document.

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.

2. ENSURING COMPLIANCE THROUGH TESTING- manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard for which they may have in-house test facilities. However, there is no obligation to maintain in-house laboratory. Licensee may use alternative arrangements for tests of the production as per the declared QAP. Various alternatives are available for operation of BIS certification as given below and the relevant guidelines for availing such relaxations by the manufacturers, as amended from time to time, are to be referred:

- i) Shared testing resources like common facility,
- ii) Cluster based testing facility,
- iii) Sub-contracting to outside laboratories which may either be:
 - a) BIS recognised/empanelled laboratories, or
 - b) Any accredited laboratory as per ISO/IEC 17025

2.1 TEST RECORDS- The manufacturers shall maintain test records for the tests carried out (either in-house or at a sub-contracted or at shared test facility) to establish conformity of the product to the Standard for operation of licence. For the tests being subcontracted or conducted at a shared test facility, test results issued by the laboratories or test facilities, shall be made 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 suitably on each coil of wire & bundle of straightened and cut lengths and on the Test Certificate issued along with each Consignment provided always that the product thus marked and packed conforms to all the requirement of the specification.

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

3.2 Additional Marking requirements: Additionally, the following shall also be marked on each package of the material:

- a) “For BIS certification details please visit www.bis.gov.in”
- b) Any other requirement not specified in the Indian Standard

4. TEST CERTIFICATE – For each consignment of BIS Certified material conforming to IS 4454 (Part 1):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 - 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
(Recommended Levels of Control by BIS- For Guidance Only)

(1)				(3)		(4)
TEST DETAILS				LEVELS OF CONTROL		REMARKS
Clause	Requirements	Test Method		No. of Samples	Frequency	
		Clause	Reference			
7	Chemical Composition					
	Ladle Analysis	7.1, 7.1.1, Table 2	IS 4454(Pt.1) : 2001 & IS 228 (Various Parts)	One	Each Heat	Applicable for manufacturers with steel making facilities
	Product Analysis	7.2, 7.2.1, Table-2 & 3	/ any established Chemical/ Instr. Method.	i) Nil 		

		Table 4 & 5		other than those specified in Table- 4 and as agreed between manufacturer and purchaser.		
10.1	Tensile Test	10.1, Table 6	IS 4454 (Part 1): 2001 IS 1608 (Part 1)	One	One in every 5 coils or part thereof	Refer Note-1
10.2	Wrapping Test	10.2	IS 1755	One	One in every 5 coils or part thereof	Refer Note-1
10.3	Torsion Test	10.3.1, 10.3.2, 10.3.3, 10.3.4, 10.3.5	IS 4454 (Part 1): 2001 IS 1717	One	One in every 5 coils or part thereof	Refer Note-1
10.4	Bend Test	10.4	IS 4454 (Part 1): 2001	As agreed to between the manufacturer and purchaser.		
10.5	Coiling and Stretching Test	10.5	IS 4454 (Part 1): 2001	As agreed to between the manufacturer and purchaser.		
10.6	Cast of the Wire	10.6	IS 4454 (Part 1): 2001	One	One in every 5 coils or part thereof	Refer Note-1
		10.6.1, 10.6.2 Fig.2	IS 4454 (Part 1): 2001	As agreed to between the manufacturer and purchaser.		
10.7	Deep Etch Test	10.7, 10.7.1, 10.7.1.1, 10.7.1.2	IS 4454 (Part 1): 2001	One	One in every 5 coils or part thereof	Refer Note-1
10.8	Decarburization Test	10.8 & 10.8.1	IS 4454 (Part 1): 2001 IS 6396	One	One in every 5 coils or part thereof	Refer Note-1

11	Coating and Surface Finish	11, 11.1, 11.2, 11.3	IS 4454 (Part 1): 2001	Wherever metallic coating is required by the purchaser, records of agreed upon mass of coating and their method of test shall be maintained.
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Note-1: When any sample fails in respect of a given requirement, four previous coils of the same control unit shall be subjected to test or inspection of that requirement and the defective material so found shall be sorted out and rejected.

Annexure-I
(Para 4 of the Scheme of Inspection and Testing)
XYZ IRON AND STEEL COMPANY
(Registered office Address and works address)

ISI Mark
With IS No.
and CM/L
no.

Test Certificate for Steel Wire for Mechanical Springs Part 1 Cold Drawn Unalloyed Steel Wire
According to IS 4454 (Part 1):2001

TEST CERTIFICATE NO. _____

To M/s _____

Dated _____

We certified that the material described below fully conforms to IS 4454 (Part 1):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 Licence No. CM/L _____ are as indicated below against each order No.

(PLEASE REFER TO IS 4454 (Part 1):2001 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

TEST RESULTS

Order No. & Date	Wire shape	Nom Size	Cast/ Control Unit No.	Grade	Qty.	Chemical Composition (%)								Mechanical Properties	Bend Test	Torsion test	Wrapping Test	Decarburization	Condition	Coating & Surface finish [#]
						C	S	P	Si	Mn	Cu	N	Cr	TS						

as required by purchaser

Remarks

Wagon No.

Truck No.

FOR XYZ IRON AND STEEL COMPANY

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