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उत्पाद मैन्युअल

यांत्रिक स्प्रिंग के लिए इस्पात के तार –विशिष्टि भाग-2 तेल कठोरित व नम्रित इस्पात के तार IS 4454 (Part 2): 2025 के अनुसार

Product Manual for
Steel Wire for Mechanical Springs Part 2 Oil Hardened and Tempered Steel Wire According to IS 4454 (Part 2): 2025

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 2):2025
	शीर्षक **Title**	:	Steel Wire for Mechanical Springs Part 2 Oil Hardened and Tempered Steel Wire
	संशोधनों की संख्या **No. of amendments**	:	0
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 tests: 1 m X 4 Nos

			(for tensile test, two samples within a coil are to be drawn for determining range of tensile strength. Please refer Cl. 10.1 of IS 4454 Pt.2:2025) 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 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 2):2025 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 2):2025 with the following scope:		
7.	**उत्पाद का नाम** **Name of the product**		Steel Wire for Mechanical Springs Part 2 Oil Hardened and Tempered Steel Wire
	Grade		TDSiCr,……..
	Sizes		For Round Wire Nominal Diameter-From…….. mm upto and including …….mm

		For Shaped Wire Nominal Dimension- From…….. mm upto and including …….mm

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

Annex-A
To Product Manual for
Steel Wire for Mechanical Springs Part 2 Oil Hardened and Tempered Steel Wire
According to IS 4454 (Part 2):2025

GROUPING GUIDELINES

1. Grouping has been done on the basis of Chemical Composition as tensile strength is dependent on chemistry and size of wire. Within a group, grade with stricter limits for S% and P% and higher fatigue strength is considered as higher grade. The following may be followed for considering grant of licence/inclusion as per IS 4454 (Pt-2):2025 :

Group	Grades	Sampling
1	**FDC** **TDC** **VDC**	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 (any shape) in order to cover both within the scope of the licence. Eg: VDC is superior grade in group-1
2	**FDCrV-A** **TDCrV-A** **VDCrV-A**	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 (any shape) in order to cover both within the scope of the licence. Eg: VDCrV-A is superior grade in group-2
3	**FDCrV-B** **TDCrV-B** **VDCrV-B**	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 (any shape) in order to cover both within the scope of the licence. Eg: VDCrV-B is superior grade in group-3
4	**FDSiCr** **TDSiCr** **VDSiCr**	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 (any shape) in order to cover both within the scope of the licence. Eg: VDSiCr is superior grade in group-4

5	**FDSiCrV** **TDSiCrV** **VDSiCrV**	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 (any shape) in order to cover both within the scope of the licence. Eg: VDSiCrV is superior grade in group-5

2. The Eddy current test for VD grades, as applicable, may be carried in factory itself on coils of samples being drawn for independent testing as this test is performed during in-line inspection of wires.

Note: Eddy current test be carried out only if applicant has facilities for the test. In such case a declaration on test method is to be obtained from applicant, alongside agreed upon values for VD grades.

3. If sample passes, licence/inclusion can be granted for all grades and sizes 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.

4. 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	Optical microscope	6.3 (Manufacture)
3	**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,V,Cu,Cr) Mn,S,P,Si
4	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)
5	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	7, 7.1, 7.2 (Phosphorus content, chemical method, alternative to instrumental method)

	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 chemicals and reagent as applicable	
6	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)
7	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, 7.1, 7.2 (Silicon content , chemical method, alternative to instrumental method)
8	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, 7.1, 7.2 (Cu 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, 7.1, 7.2 (Cr content, chemical method, alternative to instrumental method)

10	Vision-based inspection system	8 (Freedom from defects)
11	Vernier Calipers, Micrometer	9 (Dimensions and Tolerances)
12	UTM Machine (LC 0.1KN, Range:0-400KN)	10.1(Tensile Test)
13	Wrapping Machine, 10X magnifying glass	10.2 (Wrapping Test)
14	Torsion Testing Machine	10.3(Torsion Test)
15	Bend test arrangement with mandrel for all sizes above 6mm	10.4 (Bend Test)
16	test arrangement with suitable mandrels and provision for applying reasonably uniform tension on wires less than 0.7mm.	10.5(Coiling and stretching test)
17	Deep etch testing HCL tank, Heater, Acid container, Thermocouple, Lead bath, Stop watch	10.6(Deep Etch Test)
18	Instrument for detecting defects using eddy current method	10.7 (Eddy Current Test)
19	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
20	Heating furnace and quenching media (non hardened material), Vickers or Knoop Hardness tester	10.8 (Decarburization) Using microindentation hardness traverses
21	Stereo microscope	11 (Surface finish)

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 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 2):2025 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**			
6	Manufacture	6.1 to 6.3	IS 4454 (Part-2) IS 4163	i) Adequate inspection as agreed to between manufacturer and purchaser. ii) Records shall be maintained for allowable level of inclusions for grade VD as agreed between manufacturer and purchaser. iii) No testing is required if material fed to rolling mills/drawing dies is ISI marked and received with test certificate mentioning the requirement.		
7	Chemical Composition					
	Ladle Analysis	7.1 Table 2	IS 4454 (Part-2) & IS 228 (Various Parts) / any established Chemical/ Instr. Method.	One	Each Heat	Applicable for manufacturers with steel making facilities
	Product Analysis	7.2 Table-2 & 3		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 feeding to rolling mills/ drawing dies.

						No testing for product analysis is required if material fed to rolling mills/drawing dies is ISI marked and received with test certificate.
8	Freedom from Defects	8	IS 4454 (Part-2)	Adequate inspection to ensure each item to be free from defects		
9	Dimensions & Tolerances	9.1 to 9.4	IS 4454 (Part-2)	Adequate inspection to ensure each item to be within the limits of specification. Records shall be maintained for sizes & tolerances other than those specified in Table- 4 & 5 and as agreed between manufacturer and purchaser.		
10.1	Tensile Test	10.1, Table 6(A) Table 6(B) Table 7(A) Table 7(B)	IS 4454 (Part-2) IS 1608 (Part 1)	Two	Each Coil	—
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,	IS 4454 (Part-2) IS 1717	One	One in every 5 coils or part thereof	Refer Note-1
10.4	Bend Test	10.4	IS 4454 (Part-2)	One	One in every 5 coils or part thereof	Refer Note-1
10.5	Coiling and Stretching Test	10.5	IS 4454 (Part-2)	—	—	—
10.6	Deep Etch Test	10.6.1 10.6.2	IS 4454 (Part-2)	One	One in every 5 coils or part thereof	Refer Note-1

10.7	Eddy Current Test	10.7	IS 4454 (Part-2)	—	—	Records of test method and values as agreed between shall be maintained.
10.8	Decarburization test	10.8	IS 4454 (Part-2) IS 6396	One	One in every 5 coils or part thereof	Refer Note-1
11	Surface Finish	11	IS 4454 (Part-2)	Each Coil	Each Coil	

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.

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

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

Test Certificate for Steel Wire for Mechanical Springs Part 2 Oil Hardened and Tempered Steel Wire According to IS 4454 (Part 2):2025

TEST CERTIFICATE NO._____

To M/s_____ Dated_____

We certified that the material described below fully conforms to IS 4454 (Part 2):2025. 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 (Part 2):2025 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	#Other Tests
						C	S	P	Si	Mn	Cu	V	Cr	TS	RA (%)						

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)