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IS 1785-2 (1983): plain hard-drawn steel wire for prestressed concrete, Part 2: As drawn wire [CED 54: Concrete Reinforcement]



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IS : 1785 (Part II) - 1983
(Reaffirmed 1997)

Indian Standard

SPECIFICATION FOR PLAIN HARD DRAWN STEEL WIRE FOR PRESTRESSED CONCRETE

PART II AS-DRAWN WIRE

(*First Revision*)

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NEW DELHI 110002

Indian Standard

SPECIFICATION FOR PLAIN HARD DRAWN STEEL WIRE FOR PRESTRESSED CONCRETE

PART II AS-DRAWN WIRE

(*First Revision*)

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(*Continued on page 2*)

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IS : 1785 (Part II) - 1983

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Indian Standard
**SPECIFICATION FOR
PLAIN HARD DRAWN STEEL WIRE FOR
PRESTRESSED CONCRETE**
PART II AS-DRAWN WIRE
(First Revision)

0. F O R E W O R D

0.1 This Indian Standard (Part II) (First Revision) was adopted by the Indian Standards Institution on 14 March 1983, after the draft finalized by the Joint Sectional Committee for Concrete Reinforcement had been approved by the Civil Engineering Division Council.

0.2 This standard was first published as 1785-1961 to cover the requirements of plain hard-drawn steel wire for prestressed concrete. This standard was subsequently revised in 1966 and issued in two parts; the first part was a revision of the 1961 version of the standard covering requirements of stress-relieved wire and the second part covered the requirements of cold-drawn plain high tensile wire in 'as-drawn' condition used for prestressed concrete.

0.2.1 The wire conforming to IS : 1785 (Part I)-1983 demands straightening and stress-relieving operations, whereas the wires covered in this standard need not be stress-relieved and is not intended to pay out straight from the coil. The 'as-drawn' wire supplied to the user may be tensioned subsequently at the time of use by passing it through smaller dies or milling rollers.

0.3 This revision (Part II) has been formulated with a view to modifying the earlier requirements in the light of experience gained in using this standard by both manufacturers and users. This revision incorporates a number of modifications such as including 3 mm diameter wire in place of 3.15 mm diameter wire and change in the provision relating to stress corrosion. In addition, this revision adopts SI units for specifying the various physical requirements and references to various other Indian Standards have been updated.

0.4 In the formulation of this standard, due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part II) covers the requirements for manufacture, supply and testing of plain 'as-drawn' steel wire for use in prestressed concrete pipes and similar other purposes.

2. TERMINOLOGY

2.0 For the purpose of this standard the following definitions shall apply.

2.1 Bundle — Two or more 'coils' or a number of lengths properly bound together.

2.2 Coil — One continuous length of wire in the form of a coil.

2.3 Parcel — Any quantity of finished wire presented for examination and test at any one time.

2.4 Proof Stress — The stress which produces a residual strain of 0.2 percent of the original gauge length (non-proportional elongation).

2.5 Tensile Strength — The maximum load reached in a tensile test divided by the original cross-sectional area of the gauge length portion of the test piece.

3. MANUFACTURE AND CHEMICAL COMPOSITION

3.1 The wire shall be cold-drawn from the steel made by the open hearth, electric duplex, acid bessemer, basic oxygen, or a combination of these processes. In case any other process is employed in the manufacture of steel, prior approval of the purchaser shall be obtained.

*Rules for rounding off numerical values (revised).

3.1.1 The ladle analysis when made in accordance with the relevant parts of IS : 228* shall show that the steel contains not more than 0.050 percent of sulphur and not more than 0.050 percent of phosphorous.

3.2 The rods or wires shall be treated if required to make it suitable for cold drawing and thereafter the diameter of the wire or bar shall be successively decreased to the required diameter by cold drawing it through a series of dies. The resultant wire shall not be subjected to stress relieving treatment and shall not be expected to pay out straight.

3.3 Subject to the provisions of 3.2 and 6 all finished wires shall be clearly drawn to the specified size and shall be sound, free from splits, piping and other defects likely to impair its use in prestressed concrete, and finished in a workmanlike manner.

3.4 The surface of wire shall be clean, uniform, smooth and free from harmful scratches and surface flaws, flat parts, longitudinal or transverse ribs, etc. Unless otherwise agreed to between the purchaser and the manufacturer or supplier, the wire shall not carry on its surface lubricants or other matter to a degree likely to impair its adhesion to concrete. Slight rust may be permitted, provided there is no surface pitting visible to the naked eye.

3.5 There shall be no welds in the finished wire as supplied to the purchaser. Any welds or joints made during manufacture to promote continuity of operations shall be removed before supply.

4. NOMINAL SIZES

4.1 The nominal diameters of the finished wires shall be 3.00, 4.00 and 5.00 mm.

5. TOLERANCE

5.1 Tolerance on nominal diameter shall be as below:

<i>Nominal Dia</i>	<i>Tolerance</i>
3.00 mm	± 0.02 mm
4.00 mm	± 0.03 mm
5.00 mm	± 0.03 mm

5.1.1 For the purpose of determining whether the actual diameter of the wire is within the specified tolerances, the diameter shall be determined with a micrometer by taking two measurements at right angles

*Methods of chemical analysis of steels (*second revision*). (Being issued in parts.)

IS : 1785 (Part II) - 1983

to each other at three places along a length of not less than 250 mm and the average of these six measurements shall be taken as the diameter of the wire.

6. REQUIREMENTS

6.0 The wire shall conform to the physical requirements specified in **6.1** to **6.4**.

NOTE — For special purposes, test evidence may be required to show that the wire is not susceptible to stress corrosion. In such case, the test method shall be mutually agreed upon between the manufacturer and the purchaser.

6.1 Tensile Strength — Unless otherwise agreed to between the purchaser and the manufacturer or supplier, the tensile strength of wire determined in accordance with **7.3** and based on the nominal diameter of the wire, shall be as given below:

<i>Nominal Diameter</i>	<i>Tensile Strength, Min</i>
mm	N/mm ²
3.00	1 765
4.00	1 715
5.00	1 570

6.2 Proof Stress — Unless otherwise specified, the proof stress of the wire shall be not less than 75 percent of the minimum specified tensile strength.

6.3 Ductility — The wire shall withstand the reverse bend test specified in **7.5**.

6.4 When uncoiled the wire shall remain flat and shall not spring up.

7. TESTS

7.1 All test pieces of wire of sufficient length for the specified tests shall be selected by the purchaser or his authorized representative either:

- from the cuttings of lengths of wires or ends of coils of wires, or
- if he so desires, from the coil or length of wire, after it has been cut to the required or specified length and the test piece taken from any part of it.

7.1.1 In neither case, the test piece shall be detached from the coil or length of wire, except in the presence of the purchaser or his authorized representative.

7.1.2 Before test pieces are selected, the manufacturer or supplier shall furnish the purchaser or his authorized representative with copies of the mill records giving the number of coils or bundles in each cast with sizes as well as the identification marks whereby each coil or bundle or wire can be identified.

7.2 Test samples shall not be subjected to any form of heat treatment. Any straightening which the test samples may require shall be done cold.

7.3 Tensile Test — The tensile strength shall be determined in accordance with IS : 1521-1972*.

7.4 Test for Proof Stress — Proof stress shall be determined in accordance with IS : 1521-1972*.

7.4.1 Alternatively, by agreement between the purchaser and the manufacturer, the stress at 1.0 percent extension under load method may be specified. In this method an initial load corresponding to a stress of 196 N/mm^2 shall be applied to the test piece and a sensitive extensometer then attached. The dial of the extensometer shall be set to a reading equal to 0.001 mm/mm of the gauge length to represent the extension due to the initial load.

7.4.1.1 The load shall be increased until the extensometer shows an extension corresponding to 1.0 percent of the gauge length, when the load shall be noted. The stress calculated for this load shall be not less than the value specified for the 0.2 percent proof stress.

7.5 Reverse Bend Test — One end of the test piece taken in accordance with 7.1 shall be firmly gripped in a vice fitted with radiused jaws. The free end of the wire shall be bent round the appropriate radius specified in Table 1 through an angle of 90° and then back to the original position, this constitutes one bend. The test sample shall then be bent through 90° in the opposite direction and back through 90° and then through 90° in the reverse direction and back through 90° .

7.5.1 The wire shall withstand the three bends without fracture.

TABLE 1 PEG RADIUS FOR REVERSE BEND TEST

DIAMETER OF WIRE	RADIUS OF JAWS
mm	mm
3.00	10
4.00	12.5
5.00	15

*Method for tensile testing of steel wire (first revision).

8. SAMPLING AND CRITERIA FOR CONFORMITY

8.1 Scale of Sampling

8.1.1 Lot — In any consignment, all the coils of wire of the same nominal diameter and manufactured at the same place under similar conditions of production and storage shall be grouped together to constitute a lot.

8.1.2 The number of coils to be selected at random from each lot shall depend upon the size of the lot and shall be in accordance with Table 2.

TABLE 2 SAMPLE-SIZE

NO. OF COILS IN THE LOT	NO. OF COILS TO BE SELECTED
Up to 25	3
26 to 65	4
66 to 180	5
181 to 300	7
301 and above	10

8.2 Number of Tests

8.2.1 All the coils, selected as in 8.1.2 shall be tested for chemical composition (see 3.1.1), diameter (see 5.1), tensile strength (see 6.1), proof stress (see 6.2) and ductility (see 6.3).

8.2.1.1 From each coil, one test specimen shall be selected for each test and tested in accordance with the appropriate test method.

8.3 Criteria for Conformity

8.3.1 The lot shall be considered as conforming to the requirements of this specification if the conditions specified under 8.3.2 and 8.3.3 are satisfied for all the characteristics.

8.3.2 Chemical Composition, Diameter, Tensile Strength, Proof Stress — For each of the characteristics, the mean and the range calculated from the test results shall satisfy the appropriate condition given below:

- (Mean + 0.6 Range) shall be less than or equal to the maximum specification limit.
- (Mean - 0.6 Range) shall be greater than or equal to the minimum specification limit.

NOTE — The range is the difference between the maximum and the minimum value of the test results.

8.3.3 Ductility — The number of defective test specimens (those not satisfying the requirements of the test) shall not exceed the corresponding permissible number given below:

<i>No. of Specimens Tested</i>	<i>Permissible No. of Defective Test Specimens</i>
3	0
4	0
5	1
7	1
10	2

9. DELIVERY, INSPECTION AND TESTING FACILITIES

9.1 Unless otherwise specified, general requirements relating to the supply of material, inspection and testing shall conform to IS : 1387-1967*.

9.2 No material shall be despatched from the manufacturer's or supplier's premises prior to its being certified by the purchaser or his authorized representatives as having fulfilled the tests and requirements laid down in this standard except where the bundle or coil containing the wire is marked with the ISI Certification Mark.

9.3 The purchaser or his authorized representative shall be at liberty to inspect and verify the steel maker's certificate of cast analysis at the premises of the manufacturer or supplier; when the purchaser requires an actual analysis of finished material, this shall be made at a place agreed to between the purchaser and the manufacturer or supplier.

9.4 Manufacturer's Certificate — In the case of wires which have not been inspected at the manufacturer's works, the manufacturer or supplier, as the case may be, shall supply the purchaser or his authorized representatives with the certificate stating the process of manufacture and also the test sheet signed by the manufacturer giving the result of each mechanical test and the chemical composition, if required. Each test sheet shall indicate the number or identification mark of the cast to which it applies, corresponding to the number or identification mark to be found on the material.

9.5 When test for susceptibility to stress corrosion is required to be carried out, the cost of testing shall be borne by the purchaser.

9.6 The wire shall be supplied in the cold drawn condition in ordinary mill coils. The wire is not intended to pay out straight from the coil. The purchaser may specify the diameter of the coil, if he so desires.

*General requirements for the supply of metallurgical materials (*first revision*).

10. IDENTIFICATION AND MARKING

10.1 The manufacturer or supplier shall have ingots, billets and wires or bundles of wires marked in such a way that all finished wire can be traced to the cast from which they were made. Every facility shall be given to the purchaser or his authorized representative for tracing the wires to the cast from which they were made.

10.1.1 Each bundle or coil containing the wires may also be suitably marked with the Standard Mark in which case the concerned test certificate shall also bear the Standard Mark .

10.1.2 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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AMENDMENT NO. 1 APRIL 1989

TO

IS:1785(Part 2) - 1983 SPECIFICATION FOR
PLAIN HARD DRAWN STEEL WIRE FOR PRESTRESSED
CONCRETE

PART 2 AS-DRAWN WIRE

(First Revision)

(Page 5, clause 3.2, first sentence) -
Substitute the following for the existing sentence:

'The wire rods obtained from the rolling mill shall be heat treated if required to make it suitable for cold drawing and thereafter the diameter of the wire rod shall be successively decreased to the required diameter by cold drawing it through a series of dies.'

(Page 6, clause 6.1) - Add the following note below the informal table:

'NOTE - In cases where the wires are likely to undergo further drawing, for example, in the case of prestressed concrete pipes, 10 percent reduction in tensile strength values specified above may be accepted by agreement between the purchaser and the manufacturer. In such cases, the bend test and/or torsion test requirements are also to be mutually agreed upon by the purchaser and the manufacturer.'

(Page 7, clause 7.4) - Add the following in the end:

'Alternatively, stress at 1.0 percent extension under load method as specified in 7.4.1 may be determined.'

(Page 7, clause 7.4.1) - Substitute the following for the first two sentences:

'When stress at 1.0 percent extension under load method is to be determined, an initial load corresponding to a stress of 196 N/mm^2 shall be applied to the test piece and a sensitive extensometer then attached.'

AMENDMENT NO. 2 DECEMBER 1993
TO
IS 1785 (Part 2) : 1983 SPECIFICATION FOR PLAIN
HARD-DRAWN STEEL WIRE FOR PRESTRESSED
CONCRETE

PART 2 AS-DRAWN WIRE

(First Revision)

(Page 4, clause 2.1) — Delete and renumber the subsequent clauses as 2.1 to 2.4.

(Page 5, clause 5.1.1) — Add new clause 5.1.2 as follows:

‘5.1.2 Where the diameter measurements (taken in two directions at right angles in the same plane) show an ovality of not more than half of the total diameter tolerance, no checks on section by weighing shall be necessary. Where ovality is more than half of the total diameter tolerance, and tolerance on nominal mass of the finished wire shall be as given below:

<i>Nominal Diameter</i>	<i>Nominal Mass</i>	<i>Tolerance</i>
mm	g/m	g/m
8.00	395	±5.9
7.00	302	±4.3
5.00	154	±3.1
4.00	98.9	±2.0
3.00	55.5	±1.5
2.50	38.5	±1.25

(Page 6, clause 6.2) — Delete ‘Unless otherwise specified’ from the beginning of this clause.

(Page 9, clause 8.3.3) — Rewrite as follows:

‘8.3.3 Ductility — In case one or more of the test pieces first selected fail to pass this test, twice the number of samples originally tested shall be selected for testing. All the samples so tested shall satisfy the requirement of this test. Should any of the test piece from these additional samples fail, the material represented by the samples shall be considered as not having complied with this standard.’

(*Page 9, clause 9.4, line 6*) — Delete 'if required'.

(*Page 9, clause 9.6*) — Add the following para at the end:

'It is necessary to protect the wires against damage and contamination during transport and storage. The coils of wire shall be packed as agreed to between the purchaser and the manufacturer.'

AMENDMENT NO. 3 APRIL 1997
TO
IS 1785 (Part 2) : 1983 SPECIFICATION FOR PLAIN
HARD DRAWN STEEL WIRE FOR PRESTRESSED
CONCRETE

PART 2 AS-DRAWN WIRE

(First Revision)

[Page 6, clause 5.1.2 (see also Amendment No. 2)] — Delete in Amendment No. 2 the following values of Nominal Diameter and their corresponding values of Nominal Mass and Tolerance:

<i>Nominal Diameter</i>	<i>Nominal Mass</i>	<i>Tolerance</i>
mm	g/m	g/m
8.00	395	± 5.9
7.00	302	± 4.3

(Page 5, clause 3.1.1, line 3) — Substitute the following for existing matter:

‘0.040 percent of sulphur’ and ‘not more than 0.040 percent of phosphorus’.

(Page 5, clause 5.1) — Insert the following in the existing clause:

<i>Nominal Dia</i>	<i>Tolerance</i>
2.50 mm	± 0.02 mm

(Page 6, clause 6.1) — Insert the following in the existing clause:

<i>Nominal Diameter</i>	<i>Tensile Strength, Min</i>
mm	N/mm ²
2.50	1 800

(Page 7, clause 7.5.1, Table 1) — Insert the following in the beginning:

<i>DIAMETER OF WIRE</i>	<i>RADIUS OF JAWS</i>
mm	mm
2.50	7.5

AMENDMENT NO. 4 DECEMBER 2004
TO
IS 1785 (PART 2) : 1983 SPECIFICATION FOR PLAIN
HARD DRAWN STEEL WIRE FOR PRESTRESSED
CONCRETE

PART 2 AS- DRAWN WIRE

(First Revision)

(*Page 10, clause 10.1*) — Add the following new clause after **10.1** and renumber **10.1.1** and **10.1.2** as **10.2.1** and **10.2.2** respectively.

10.2 Marking — Each bundle or coil shall be securely attached with a tag bearing the following information:

- a) Identification of the manufacturer,
- b) Length or mass of coil,
- c) Nominal diameter of wire, and
- d) Batch/Coil Number'.