

AMENDMENT NO. 3 MARCH 2017
TO
IS 1786 : 2008 HIGH STRENGTH DEFORMED BARS AND WIRES
FOR CONCRETE REINFORCEMENT — SPECIFICATION

(Fourth Revision)

[Page 1, clause 1.1 (see also Amendment No.1)] — Substitute the following for existing clause:

‘1.1 This standard covers the requirements of deformed bars and wires for use as reinforcement in concrete, in the following strength grades:

- a) Fe415, Fe415D, Fe415S;
- b) Fe500, Fe500D, Fe500S;
- c) Fe550, Fe550D;
- d) Fe600;
- e) Fe650; and
- f) Fe700.

NOTES

1 The figure following the symbol Fe indicate the specified minimum 0.2 percent proof stress or yield stress in N/mm².

2 The letter D and S following the strength grade indicates the categories with same specified minimum 0.2 proof stress/ yield stress but with enhanced and additional requirements.’

[Page 2, clause 4.2 (see also Amendment No.1)] — Substitute the following for the existing clause:

‘4.2 The ladle analysis of steel for various grades, when carried out by the method specified in the relevant parts of IS 228 or any other established instrumental/chemical method, shall have maximum permissible percentage of constituents as follows. In case of dispute, the procedure given in IS 228 and its relevant parts shall be the reference method and where test methods are not specified it shall be as agreed to between the purchaser and the manufacturer/supplier.

Constituent	Percent, Maximum										
	Fe 415	Fe 415D	Fe 415S	Fe 500	Fe 500D	Fe 500S	Fe 550	Fe 550D	Fe 600	Fe 650	Fe 700
Carbon	0.30	0.30	0.25	0.30	0.25	0.32	0.30	0.25	0.30	0.32	0.32
Sulphur	0.060	0.045	0.040	0.055	0.040	0.040	0.055	0.040	0.040	0.040	0.040
Phosphorous	0.060	0.045	0.040	0.055	0.040	0.040	0.055	0.040	0.040	0.040	0.040
Sulphur and phosphorous	0.110	0.085	0.075	0.105	0.075	0.075	0.100	0.075	0.075	0.075	0.075
Carbon equivalent	—	0.50	0.56	—	0.50	0.61	—	0.61	—	—	—

NOTES

1 Carbon equivalent will be calculated using the formula:

$$CE = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

2 Addition of microalloying elements is not mandatory for any of the above grades. When strengthening elements like Nb, V, B and Ti are used individually or in combination, the total contents shall not exceed 0.30 percent, in such case manufacturer shall supply the purchaser or his authorized representative a certificate stating that the total contents of the strengthening elements in the steels do not exceed the specified limit.

3 Low alloy steel may be produced by adding alloying elements like Cr, Cu, Ni, Mo and P either individually or in combination, to improve corrosion resistance properties. However, the total content of these elements shall not be less than 0.40 percent. In such case, the manufacturer shall supply the purchaser or his authorized representative a test certificate stating the individual contents of all the elements. In such low alloy steels when phosphorous is used, it shall not exceed 0.12 percent and when used beyond the limit prescribed in 4.2, the carbon shall be restricted to 0.15 percent, and in such case the restriction to maximum content of sulphur and phosphorous as given in 4.2 and the condition of minimum all content 0.40 shall not apply.

4 Nitrogen content of the steel should not exceed 0.012 percent (120 ppm), which will be ensured by the manufacturer by occasional check analysis. Higher nitrogen contents upto 0.025 percent (250 ppm) may be permissible provided sufficient quantities of nitrogen binding elements, like Nb, V, Ti, Al, etc, are present. In order to ascertain whether sufficient quantities of nitrogen binding elements are present, following formula may be used, where all elements are in ppm.

$$(N - 120) < \frac{Al_{free}}{10} + \frac{(Ti + V)}{7} + \frac{Nb}{14}$$

Price Group 2

Amendment No. 3 to IS 1786 : 2008

[Page 6, Table 3 (see also Amendments Nos.1 and 2)] — Substitute the following for the existing table:

Table 3 Mechanical Properties of High Strength Deformed Bars and Wires
(Clause 8.1)

Sl No.	Property	Fe 415	Fe 415D	Fe 415S	Fe 500	Fe 500D	Fe 500S	Fe 550	Fe 550D	Fe 600	Fe 650	Fe 700
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	0.2 percent proof stress/ yield stress, <i>Min</i> , N/mm ²	415.0	415.0	415.0	500.0	500.0	500.0	550.0	550.0	600.0	650.0	700.0
ii)	0.2 percent proof stress/ yield stress, <i>Max</i> , N/mm ²	—	—	540.0	—	—	650.0	—	—	—	—	—
iii)	TS/YS ratio ¹⁾ , N/mm ²	≥ 1.10 (but TS not less than 485 N/mm ²)	≥ 1.12 (but TS not less than 500 N/mm ²)	≥ 1.25	≥ 1.08 (but TS not less than 545 N/mm ²)	≥ 1.10 (but TS not less than 565 N/mm ²)	≥ 1.25	≥ 1.06 (but TS not less than 585 N/mm ²)	≥ 1.08 (but TS not less than 600 N/mm ²)	≥ 1.06 (but TS not less than 660 N/mm ²)	≥ 1.06 (but TS not less than 700 N/mm ²)	≥ 1.06 (but TS not less than 770 N/mm ²)
iv)	Elongation, percent, <i>Min</i> , on gauge length $5.65\sqrt{A}$, where <i>A</i> is the cross-sectional area of the test piece	14.5	18.0	18.0	12.0	16.0	16.0	10.0	14.5	10.0	10.0	10.0
v)	Total elongation at maximum force, percent, minimum on gauge length $5.65\sqrt{A}$, where <i>A</i> is the cross-sectional area of the test piece (see 3.0) ²⁾	—	5	8	—	5	8	—	5	—	—	—

¹⁾ TS/YS ratio refers to ratio of tensile strength to the actual Yield strength or 0.2 percent of yield stress of the test piece.

²⁾ Test, wherever specified by the purchaser.

[Page 7, clause 9.3, Table 4 (see also Amendment No.1)] — Substitute the following for the existing table:

Table 4 Maximum Mandrel Diameter for Bend Test
(Clause 9.3)

Sl No.	Nominal Size of Specimen	Minimum Mandrel Diameter for Different Grades										
		Fe415	Fe415D	Fe415S	Fe500	Fe500D	Fe500S	Fe550	Fe550D	Fe600	Fe 650	Fe 700
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	Up to and including 20 mm	3φ	2φ	2φ	4φ	3φ	3φ	5φ	4φ	5φ	6φ	7φ
ii)	Over 20 mm	4φ	3 φ	3 φ	5 φ	4 φ	4 φ	6 φ	5 φ	6 φ	7φ	8φ

NOTE — φ is the nominal size of the test piece, in mm.

[Page 7, clause 9.4.1 (see also Amendment No.1)] — Substitute the following for the existing clause:

9.4.1 The diameter of the mandrel shall be as given below:

<i>Sl No.</i>	<i>Nominal Size of Specimen</i>	<i>Minimum Dia of Mandrel for Fe 415 and Fe 500</i>	<i>Minimum Dia of Mandrel for Fe 415D, and Fe 500D</i>	<i>Minimum Dia of Mandrel for Fe 415S and Fe 500S</i>	<i>Minimum Dia of Mandrel for Fe 550 and Fe 600</i>	<i>Minimum Dia of Mandrel for Fe550D</i>	<i>Minimum Dia of Mandrel for Fe 650 and Fe 700</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Up to and including 10 mm	5 ϕ	4 ϕ	4 ϕ	7 ϕ	6 ϕ	7 ϕ
ii)	Over 10 mm	7 ϕ	6 ϕ	6 ϕ	9 ϕ	7 ϕ	9 ϕ

NOTE — ϕ is the nominal size of the test piece, in mm.