UDC 669.14-427.5:691.714:693.554:620.1 June 1986

Reinforcing steel
Reinforcing steel fabric and wire
Testing

DIN 488 Part 5

Betonstahl; Betonstahlmatten und Bewehrungsdraht; Prüfungen

Supersedes April 1972 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

The DIN 488 series includes:

DIN 488 Part 1 Reinforcing steel; grades, properties, marking
DIN 488 Part 2 Reinforcing steel; reinforcing steel bars; dimensions and masses
DIN 488 Part 3 Reinforcing steel; reinforcing steel bars; testing
DIN 488 Part 4 Reinforcing steel; reinforcing steel fabric and wire; design, dimensions and masses
DIN 488 Part 5 Reinforcing steel; reinforcing steel fabric and wire; testing
DIN 488 Part 6 Reinforcing steel; quality control
DIN 488 Part 7 Reinforcing steel; verification of weldability of reinforcing steel bars; test procedure and evaluation

Dimensions in mm

1 Field of application

This standard serves to determine the properties specified in DIN 488 Part 1, and to check the dimensions specified in DIN 488 Part 4 for ribbed wires used for the manufacture of welded reinforcing steel fabric of grade BSt 500 M and of plain and indented wires of grades BSt 500 G and BSt 500 P.

See DIN 488 Part 3 for methods of testing reinforcing steel bars.

2 Cross-sectional area and size

The cross-sectional area, A_s, shall be determined from the mass of a section of wire by means of equation (1):

$$A_s = \frac{1{,}274 \cdot G}{l} \quad (1)$$

and the corresponding nominal size, d_s, by means of equation (2):

$$d_s = 12{,}74 \sqrt{\frac{G}{l}} \quad (2)$$

In both equations, the mass of the section of wire, G, shall be expressed in g and its length l in mm so as to give the cross-sectional area in cm^2 and the nominal size in mm.

3 Surface configuration

3.1 Ribbed wires for reinforcing steel fabric of grade BSt 500 M

The dimensions of the oblique ribs and the relative rib area shall be determined as specified in DIN 488 Part 3.

Alternatively, the relative rib area, f_R, may be calculated using the following approximation equation:

$$f_R = \frac{(d_s \cdot \pi - \Sigma e) \cdot [h + 2\,(h_{1/4} + h_{3/4})]}{6 \cdot d_s \cdot \pi \cdot c} \quad (3)$$

where

d_s is the nominal size of the wire;
Σe is the aggregate of the non-ribbed portions of the wire circumference between the rows of ribs;
h is the height of the ribs at mid-rib [1];
$h_{1/4}$ $h_{3/4}$ is the height of the ribs at the quarter points [1];
c is the spacing of the ribs [1].

3.2 Indented wire BSt 500 P

3.2.1 Indentation depth

The indentation depth, t, shall be the average found from measurements made on not less than 2 successive indentations in each row to the nearest 0,01 mm. The measurements shall be made in the middle of corresponding edges.

3.2.2 Indentation width

The indentation width of the raised parts of the surface, b, shall be the average found from measurements made on not less than 2 successive indentations in each row, to the nearest 0,01 mm.

3.2.3 Spacing of the raised parts of the indentations

The spacing of the raised parts of the indentations, c, shall be determined parallel to the longitudinal axis, to the nearest 0,1 mm, as the mean of the centre-to-centre distance values for not less than 11 successive indentations in each row.

3.2.4 Inclination of the indentations to the wire axis

The angle of inclination of the raised parts of the indentations to the longitudinal axis of the wire, β, shall be checked at several points.

[1]) Average determined from all three rows of ribs.

Continued on pages 2 to 4

3.2.5 Spaces between indentation rows

The aggregate e of the spaces between the indentation rows over the wire circumference shall be determined to the nearest 0,1 mm as the mean of measurements made at not less than 2 points.

4 Mechanical properties

4.1 Tensile test

Compliance with the values specified in DIN 488 Part 1 for the yield strength and 0,2 % proof stress, for tensile strength and elongation after fracture shall be verified as specified in DIN 50 145.

In the case of fabric, the tensile test shall be carried out on test pieces having at least one welded-on cross wire; in the case of wire, it shall be carried out on test pieces without a welded-on cross wire. The clear length of the test pieces between the grips shall not be less than $20 \cdot d_s$ and in any case shall not be less than 180 mm.

The cross-sectional area to be considered for calculating the yield strength or 0,2 % proof stress and tensile strength shall be determined as described in clause 2.

Prior to testing, the test pieces may be conditioned (aged) for half an hour at a temperature of 250 °C and then cooled in air to an ambient temperature of 15 to 35 °C as specified in DIN 50 014. The test report shall state whether this has been done. In cases of arbitration, the test in the aged condition shall be determining.

4.2 Shear test (for fabric)

The shear force of the joint, S, as specified in DIN 488 Part 1 shall be verified on test pieces as indicated in figure 1 using the device illustrated in figure 2. The test pieces shall be taken from a sheet of fabric that is ready for despatch. The test pieces that have undergone prior loading in a tensile test may also be used, provided that the weld is outside the necking region of the fracture.

In the case of shear test pieces consisting of single wires, the thicker shall in all cases be the one pulled. In the case of shear test pieces consisting of double wires, a single wire of the double wire shall be pulled and the shear force determined in this way either as a function of the cross-sectional area of the pulled wire or, if the cross-sectional area of the anchoring wire is larger than the sum of the cross-sectional areas of the individual wires of the double wire, of half the cross-sectional area of the anchoring wire.

The shear test piece shall be so mounted in the shear testing device as to ensure that the pulled wire is located axially and that distortion of the anchoring wire is prevented as far as possible. The upper free end of the pulled wire shall be so supported (e.g. by means of rollers) that the measured shear force is not increased by frictional forces.

The rate of stress increase shall not exceed 20 N/(mm^2 · s).

For calculating the shear force of the joint, the nominal values of wire cross-sectional area and yield strength or 0,2 % proof stress shall be used.

4.3 Fatigue test (for fabric)

The fatigue test shall be carried out on non-embedded straight wires having at least one welded-on cross wire (single wire or double wire). The thinner wire shall be tested. See DIN 488 Part 6 for scope of test and wire combinations to be used.

The test pieces shall be taken from sheets of fabric ready for despatch. For the test piece shape, subclause 4.1 shall apply as appropriate; the cross wires shall be approximately 40 mm long and shall have the same overhangs on either side of the weld. To avoid fracturing at the grips the test pieces may be suitably prepared at the ends.

The fatigue strength shall be determined for a maximum stress of $\sigma_O = 0{,}7 \cdot R_e$ or $0{,}7 \cdot R_{p\,0{,}2}$ corresponding to a maximum load $P_O = 0{,}7 \cdot R_e \cdot A_s$ or $0{,}7 \cdot R_{p\,0{,}2} \cdot A_s$, the nominal values being substituted for $R_e/R_{p\,0{,}2}$ and for the cross-sectional area A_s.

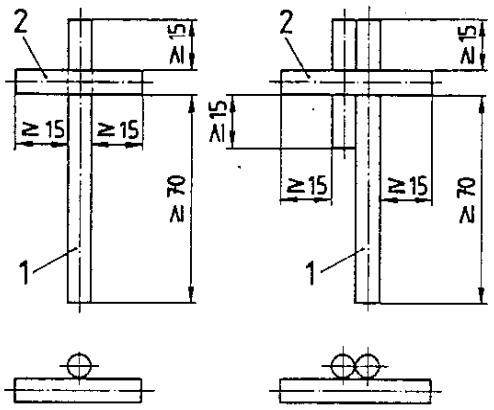
The tests shall be carried out in a pulsator under load control. The load indication of the testing machine shall conform at least to class 1 as specified in DIN 51 220. The maximum load shall not be less than 10 % of the maximum load of the measuring range used. The permitted test frequency shall be 15 to 150 Hz.

5 Testing the resistance spot welded joints (for fabric)

On the thicker wire a bend test as described in DIN 50 111 shall be carried out with the weld lying in the tension zone. The mandrel diameter shall be $6 \cdot d_s$ and the bend angle 60°. Minor incipient cracks in the weld shall not give grounds for complaint.

Subject to fulfilment of the requirements to be met in the bend test, the tensile test (as described in subclause 4.1) and in the shear test (as described in subclause 4.2), verification of proper welding of the fabric deemed to have been furnished.

1 Pulled wire
2 Anchoring wire



a) For single wires b) For double wires

Figure 1. Shear test pieces taken from welded fabric

1 Pulled wire
2 Anchoring wire
3 Attachment piece for grips of testing machine
4 Clamp for anchoring wire
5 Rest for anchoring wire
6 Holder for pulled wire to prevent bending
7 Antifriction surface or roller bearing

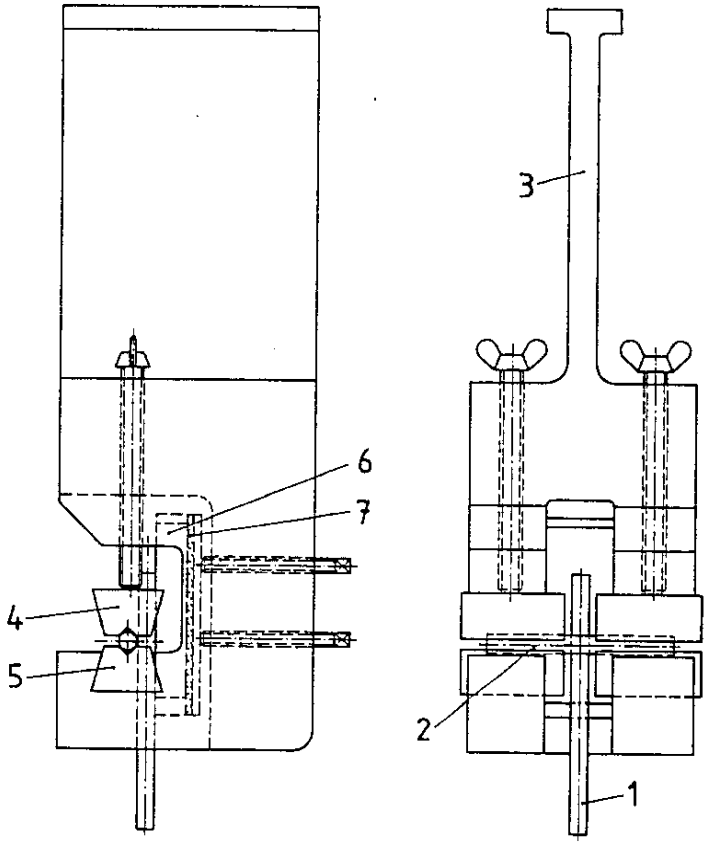


Figure 2. Example of a device for carrying out the shear test

Standards referred to

DIN 488 Part 1	Reinforcing steel; grades, properties, marking
DIN 488 Part 3	Reinforcing steel; reinforcing steel bars; testing
DIN 488 Part 4	Reinforcing steel; reinforcing steel fabric and wire; design, dimensions and masses
DIN 488 Part 6	Reinforcing steel; quality control
DIN 50 014	Climates and their technical application; standard atmospheres
DIN 50 111	Testing of metallic materials; bend test
DIN 50 145	Testing of metallic materials; tensile test
DIN 51 220	Materials testing machines; general codes of practice

Previous editions

DIN 488 Part 5: 04.72

Amendments

The following amendments have been made in comparison with the April 1972 edition (see also Explanatory notes).

a) All specifications for non-welded fabric have been deleted.

b) The rebend test and the bend test on fabric made from plain wire have been deleted.

Explanatory notes

This edition of DIN 488 Part 5 has been prepared in the context of the discussions on the revision of the technical delivery conditions for reinforcing steel by a joint committee of the *Normenausschuß Eisen und Stahl* (Iron and Steel Standards Committee) and of the *Normenausschuß Bauwesen* (Building Standards Committee). The standard lays down the specifications for checking dimensions and surface configuration, and for determining the mechanical properties of welded fabric of grade BSt 500 M manufactured from ribbed wires, and also of plain and indented wire of grades BSt 500 G and BSt 500 P.

In line with the agreements on the classification into grades specified in DIN 488 Part 1, all particulars relating to the testing of non-welded fabric, to the rebend test on fabric manufactured from ribbed and indented wires, and to the bend test on fabric manufactured from plain wires have been deleted.

The standard remains otherwise largely unchanged in substance compared with DIN 488 Part 5, April 1972 edition.

International Patent Classification

E 04 C 5/03
E 04 C 5/04
G 01 N 3/00