

## REINFORCING STEEL BAR

Reinforcing steel bars are used for reinforcement of concrete structures, manufacture of anchor bolts, etc. Reinforcing bars (rebars) can be either smooth or deformed. They are produced by hot rolling process with subsequent superficial hardening by heat treatment.

### Reinforcing steel according to GOST 5781-82

Range of products

| Bar shape No. | Diameter d, mm |              | Height of transversal rib, mm |            |
|---------------|----------------|--------------|-------------------------------|------------|
|               | Nominal        | Tolerances   | Nominal                       | Tolerances |
| 6             | 5.75           | +0.3<br>-0.5 | 0.5                           | ±0.25      |
| 8             | 7.5            |              | 0.75                          |            |
| 10            | 9.3            | +0.4<br>-0.5 | 1.0                           | ±0.5       |
| 12            | 11.0           |              | 1.25                          |            |
| 14            | 13.0           |              | 1.25                          |            |
| 16            | 15.0           |              | 1.5                           |            |
| 18            | 17.0           |              | 1.5                           |            |
| 20            | 19.0           |              | 1.5                           |            |
| 22            | 21.0           |              | 1.5                           |            |
| 25            | 24.0           |              | 1.5                           |            |
| 28            | 26.5           | +0.4<br>-0.7 | 2.0                           | ±0.7       |
| 32            | 30.5           |              | 2.0                           |            |
| 36            | 34.5           |              | 2.5                           |            |
| 40            | 38.5           |              | 2.5                           |            |

Technical characteristics

| Bar shape No. (nominal rod diameter d <sub>n</sub> ) | Rod cross-sectional area, cm <sup>2</sup> | Mass of one running meter of bar shape |              |
|--|---|--|--------------|
|  |   | Theoretical, kg                        | Tolerance, % |
| 6  | 0.283                                     | 0.222                                  | +9.0         |
| 8  | 0.503                                     | 0.395                                  | -7.0         |
| 10   | 0.785                                     | 0.617                                  | +5.0<br>-6.0 |
| 12   | 1.131                                     | 0.888                                  |              |
| 14   | 1.540                                     | 1.210                                  | +3.0<br>-5.0 |
| 16   | 2.010                                     | 1.580                                  |              |
| 18   | 2.540                                     | 2.000                                  |              |
| 20   | 3.140                                     | 2.470                                  |              |
| 22   | 3.800                                     | 2.980                                  |              |
| 25   | 4.910                                     | 3.850                                  |              |
| 28   | 6.160                                     | 4.830                                  |              |
| 32   | 8.040                                     | 6.310                                  |              |
| 36   | 10.180                                    | 7.990                                  | +3.0<br>-4.0 |
| 40   | 12.570                                    | 9.870                                  |              |

Chemical composition

| Class                              | Steel grade | Bar shape No.   | Fraction of total mass, % |               |               |                          |               |                 |      |       |          |      |
|------------------------------------|-------------|---|---------------------------|---------------|---------------|--------------------------|---------------|-----------------|------|-------|----------|------|
|                                    |             |   | C                         | Mn            | Si            | Cr                       | Ti            | Al              | Ni   | S     | P        | Cu   |
| Not more than                      |             |   |                           |               |               |                          |               |                 |      |       |          |      |
| A-I<br>(A240)<br>GOST<br>5781-82   | St3sp       | 6-40  | 0.14-<br>0.22             | 0.40-<br>0.65 | 0.05-<br>0.15 | 0.30                     | -             | -               | 0.30 | 0.05  | 0.04     | 0.30 |
|                                    | St3ps       |   |                           |               | 0.05-<br>0.30 |                          |               |                 |      |       |          |      |
| 40 (300)<br>ASTM<br>A615           | 40 (300)    | 12.7 mm<br>(№4)<br>15.88<br>mm<br>(№5)<br>19.05<br>mm<br>(№6) | -                         | -             | -             | -                        | -             | -               | -    | -     | 0.06 max | -    |
| A-III<br>(A400)<br>GOST<br>5781-82 | 25G2S       | 6-40  | 0.20-<br>0.29             | 1.20-<br>1.60 | 0.60-<br>0.90 | Not more<br>than<br>0.30 | -             | -               | 0.30 | 0.045 | 0.04     | 0.30 |
|                                    | 35GC        |   | 0.30-<br>0.37             | 0.80-<br>1.20 |               |                          |               |                 |      |       |          |      |
| 60 (420)<br>ASTM<br>A615           | 60 (420)    | 12.7 mm<br>(№4)<br>15.88<br>mm<br>(№5)<br>19.05<br>mm<br>(№6) | -                         | -             | -             | -                        | -             | -               | -    | -     | 0.06 max | -    |
| АТ 800<br>GOST<br>10884-94         | 20GS        | 14  | 0.17-<br>0.22             | 1.0-1.5       | 1.0-1.5       | Not more<br>than<br>0.30 | 0.02-<br>0.08 | 0.015-<br>0.05- | 0.30 | 0.045 | 0.045    | 0.30 |

Mechanical properties

| Class                           | Steel grade    | Bar shape No.   | Yield strength, N/mm <sup>2</sup> | Ultimate strength, N/mm <sup>2</sup> | Relative elongation, % | Uniform elongation, % | Cold bending test (c-mandrel thickness, d-rod diameter) |
|---------------------------------|----------------|---|-----------------------------------|--------------------------------------|------------------------|-----------------------|---|
| A-I<br>(A240)<br>GOST 5781-82   | St3sp<br>St3ps | 6-40  | 235                               | 373                                  | 25                     | -                     | 180°<br>c=d   |
| 40 (300)<br>ASTM<br>A615        | 40 (300)       | 12,7 mm<br>(№4)<br>15,88 mm<br>(№5)<br>19,05 mm<br>(№6) | 300                               | 500 min                              | 11 min                 | -                     | 180°<br>c=3d  |
| A-III<br>(A400)<br>GOST 5781-82 | 25G2S<br>35GS  | 6-40  | 390                               | 590                                  | 14                     | -                     | 90°<br>c=3d   |
| 60 (420)<br>ASTM<br>A615        | 60 (420)       | 12.7 mm<br>(№4)<br>15.88 mm<br>(№5)<br>19.05 mm<br>(№6) | 420                               | 620 min                              | 9 min                  | -                     | 180°<br>c=3.5d  |
| АТ 800<br>GOST 10884-94         | 20GS           | 14  | 800                               | 1000                                 | 8                      | 2                     |   |

### Reinforcing steel A500S

Steel grade standard – STO ASChM 7-93.

Steel grade group – commercial quality carbon steel.

Product standard – STO ASChM 7-93.

Field of application – concrete structure reinforcement.

Material condition – thermomechanical hardening in the rolling mill line.

Dimensions:

Nominal diameter  $d_n = 12-25$ ,

Length is 6000-12000 mm.

Shape numbers: №12-25, in rods.

Workmanship Intricacy – according to STO ASChM 7-93. The product is certified by the All-Russia Scientific and Research Institute of steel.

Chemical composition

| Value | Fraction of total mas, % |      |      |       |       |      |      |      |       |
|-------|--------------------------|------|------|-------|-------|------|------|------|-------|
|       | C                        | Si   | Mn   | P     | S     | Cr   | Ni   | Cu   | N     |
| Min   | 0.18                     |      | 0.80 |       |       |      |      |      |       |
| Max   | 0.22                     | 0.15 | 1.00 | 0.040 | 0.050 | 0.30 | 0.30 | 0.30 | 0.012 |

Note: intermediate ageing at  $t=100^{\circ}\text{C}$ , test - at  $t=20^{\circ}\text{C}$ .

Tolerance standards according to STO ASChM 7-93.

Workmanship accuracy according to STO ASChM; cutting accuracy is conventional.

### Reinforcing steel A400C

Steel grade standard: STO ASChM 7-93.

Steel grade group: commercial quality carbon steel.

Product standard – in accordance with technical agreements.

Field of application – concrete structure reinforcement.

Material condition – thermomechanical hardening in the rolling mill line.

Nominal diameter  $d_n = 8$  mm.

Reinforcing steel is delivered in coils.

Chemical composition

| Value | Fraction of total mass, % |      |      |       |       |      |      |      |       |
|-------|---------------------------|------|------|-------|-------|------|------|------|-------|
|       | C                         | Si   | Mn   | P     | S     | Cr   | Ni   | Cu   | N     |
| Min   | 0.18                      |      | 0.80 |       |       |      |      |      |       |
| Max   | 0.22                      | 0.15 | 1.00 | 0.040 | 0.050 | 0.30 | 0.30 | 0.30 | 0.012 |

Mechanical properties

| Specimen diameter, $d_H$ , mm | Bend  |                |              | Bend/unbend                                   |                |  | Ultimate strength, MPa (kg/mm <sup>2</sup> ) | Yield strength $\sigma_T$ , N/mm <sup>2</sup> , min | Relative elongation, $\delta_{5r}$ , %, min |
|-------------------------------|---|----------------|--------------|---|----------------|--|--|---|---|
|                               | Specimen type or length of estimated part, mm | Specimen axis  | Note         | Specimen type or length of estimated part, mm | Specimen axis  | Note   |  |   |   |
| 8                             | d=16  | Along specimen | For 160-180° | d=40  | Along specimen | Bend to be not less than 90°, Unbend to be not less than 20° | 500  | 400   | 16  |

Note: intermediate ageing at  $t=100^\circ\text{C}$ ; test at  $t=20^\circ\text{C}$ .

Tolerance standards according to STO ASChM 7-93.

Workmanship accuracy according to STO ASChM 7-93, die-rolled section, conventional accuracy of cutting.

**Reinforcing bar according to ASTM A615**

Shape number: N<sup>o</sup>4 (12.7 mm), N<sup>o</sup>5 (15.88 mm), N<sup>o</sup>6 (19.05 mm),

It is possible to manufacture rebars with transversal ribs of different shapes.