



Steel Grade and chemical composition (Applicable for the cast analysis)

| Designation | | Steel Grade according to | Chemical composition (% by mass) ^a | | | | | |
|--------------------------------------|--------------|--------------------------|---|-------------------|--------------|-----------|--------------|--------------|
| Steel name | Steel Number | | C | Si max. | Mn | P max. | S | Pb |
| Steel not intended for eat treatment | | | | | | | | |
| 11SMn30 | 1.0715 | EN 10087 | ≤ 0,14 | 0,05 ^b | 0,90 to 1,30 | 0,11 | 0,27 to 0,33 | - |
| 11SMnPb30 | 1.0718 | EN 10087 | ≤ 0,14 | 0,05 | 0,90 to 1,30 | 0,11 | 0,27 to 0,33 | 0,20 to 0,35 |
| 11SMn37 | 1.0736 | EN 10087 | ≤ 0,14 | 0,05 ^b | 1,00 to 1,50 | 0,11 | 0,34 to 0,40 | - |
| 11SMnPb37 | 1.0737 | EN 10087 | ≤ 0,14 | 0,05 | 1,00 to 1,50 | 0,11 | 0,34 to 0,40 | 0,20 to 0,35 |
| Case hardening steel | | | | | | | | |
| 10S20 | 1.0721 | EN 10087 | 0,07 to 0,13 | 0,40 | 0,70 to 1,10 | 0,06 | 0,15 to 0,25 | - |
| 10SPb20 | 1.0722 | EN 10087 | 0,07 to 0,13 | 0,40 | 0,70 to 1,10 | 0,06 | 0,15 to 0,25 | 0,20 to 0,35 |
| 15SMn13 | 1.0725 | EN 10087 | 0,12 to 0,18 | 0,40 | 0,90 to 1,30 | 0,06 | 0,08 to 0,18 | - |
| Steel for quenching and tempering | | | | | | | | |
| 35S20 | 1.0726 | EN 10087 | 0,32 to 0,39 | 0,40 | 0,70 to 1,10 | 0,06 | 0,15 to 0,25 | - |
| 35SPb20 | 1.0756 | EN 10087 | 0,32 to 0,39 | 0,40 | 0,70 to 1,10 | 0,06 | 0,15 to 0,25 | 0,15 to 0,35 |
| 36SMn14 | 1.0764 | EN 10087 | 0,32 to 0,39 | 0,40 | 1,30 to 1,70 | 0,06 | 0,10 to 0,18 | - |
| 36SMnPb14 | 1.0765 | EN 10087 | 0,32 to 0,39 | 0,40 | 1,30 to 1,70 | 0,06 | 0,10 to 0,18 | 0,15 to 0,35 |
| 38SMn28 | 1.0760 | EN 10087 | 0,35 to 0,40 | 0,40 | 1,20 to 1,50 | 0,06 | 0,24 to 0,33 | - |
| 38SMnPb28 | 1.0761 | EN 10087 | 0,35 to 0,40 | 0,40 | 1,20 to 1,50 | 0,06 | 0,24 to 0,33 | 0,15 to 0,35 |
| 44SMn28 | 1.0762 | EN 10087 | 0,40 to 0,48 | 0,40 | 1,30 to 1,70 | 0,06 | 0,24 to 0,33 | - |
| 44SMnPb28 | 1.0763 | EN 10087 | 0,40 to 0,48 | 0,40 | 1,30 to 1,70 | 0,06 | 0,24 to 0,33 | 0,15 to 0,35 |
| 46S20 | 1.0727 | EN 10087 | 0,42 to 0,50 | 0,40 | 0,70 to 1,10 | 0,06 | 0,15 to 0,25 | - |
| 46SPb20 | 1.0757 | EN 10087 | 0,42 to 0,50 | 0,40 | 0,70 to 1,10 | 0,06 | 0,15 to 0,25 | 0,15 to 0,35 |

^a Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purpose of finishing the heat. However, elements such as Te, Bi etc., may be added by the manufacturer for improving the machinability, if this has been agreed at the time of enquiry and order.

^b If, by metallurgical techniques, the formation of special oxides is guaranteed, a Si-content of 0,10 to 0,40 % can be agreed.



Mechanical properties of free-cutting steels not intended for heat treatment

| Designation | | Thickness ^a mm | Mechanical properties ^a | | | | |
|-------------|--------------|------------------------------|------------------------------------|--------------|--|---------------------------|----------------|
| Steel name | Steel number | | As rolled and turned (+SH) | | Cold drawn (+C) | | |
| | | | Hardness ^b HBW | R_m MPa | $R_{p0.2}$ ^c MPa min. | R_m ^c MPa | A % min. |
| 11SMn30 | 1.0715 | ≥ 5 ≤ 10 | - | - | 440 | 510 to 810 | 6 |
| 11SMnPb30 | 1.0718 | > 10 ≤ 16 | - | - | 410 | 490 to 760 | 7 |
| 11SMn37 | 1.0736 | > 16 ≤ 40 | 112 to 169 | 380 to 570 | 375 | 460 to 710 | 8 |
| 11SMnPb37 | 1.0737 | > 40 ≤ 63 | 112 to 169 | 370 to 570 | 305 | 400 to 650 | 9 |
| | | > 63 ≤ 100 | 107 to 154 | 360 to 520 | 245 | 360 to 630 | 9 |

a For thicknesses < 5 mm the mechanical properties may be agreed at the time of enquiry and order.
b Only for information.
c For flats and special sections the yield strength ($R_{p0.2}$) may deviate by -10 % and the tensile strength (R_m) by ±10%.

Mechanical properties of free-cutting steels for case hardening

| Designation | | Thickness ^a mm | Mechanical properties ^a | | | | |
|-------------|--------------|------------------------------|------------------------------------|--------------|--|---------------------------|----------------|
| Steel name | Steel number | | As rolled and turned (+SH) | | Cold drawn (+C) | | |
| | | | Hardness ^b HBW | R_m MPa | $R_{p0.2}$ ^c MPa min. | R_m ^c MPa | A % min. |
| 10S20 | 1.0721 | ≥ 5 ≤ 10 | - | - | 410 | 520 to 780 | 7 |
| 10SPb20 | 1.0722 | >10 ≤ 16 | - | - | 390 | 490 to 740 | 8 |
| | | > 16 ≤ 40 | 107 to 156 | 360 to 530 | 360 | 460 to 720 | 9 |
| | | > 40 ≤ 63 | 107 to 156 | 360 to 530 | 295 | 410 to 660 | 10 |
| | | > 63 ≤ 100 | 105 to 146 | 350 to 490 | 235 | 380 to 630 | 11 |
| 15SMn13 | 1.0725 | ~ 5 ≤ 10 | - | - | 450 | 560 to 840 | 6 |
| | | > 10 ≤ 16 | - | - | 430 | 500 to 800 | 7 |
| | | > 16 ≤ 40 | 128 to 178 | 430 to 600 | 390 | 470 to 770 | 8 |
| | | > 40 ≤ 63 | 128 to 172 | 430 to 580 | 350 | 460 to 680 | 9 |
| | | > 63 ≤ 100 | 125 to 160 | 420 to 540 | 265 | 440 to 650 | 10 |

a For thicknesses < 5 mm the mechanical properties may be agreed at the time of enquiry and order.
b Only for information.
c For flats and special sections the yield strength ($R_{p0.2}$) may deviate by -10 % and the tensile strength (R_m) by ±10%.


Mechanical properties of free-cutting steels for quenching and tempering

| Designation | | Thickness ^a mm | Mechanical properties ^a | | | | | | | | | | |
|----------------------|--------------|------------------------------|------------------------------------|--------------|--|---------------------------|---|---------------------------|--------------|----------------|---|--------------|----------------|
| Steel name | Steel number | | As rolled + turned (+SH) | | Cold drawn (+C) | | Cold drawn + quenched and tempered (+c + OT) ^{b,f} | | | | Quenched and tempered + cold drawn (+OT + C) ^f | | |
| | | | Hardness ^c HBW | R_m MPa | $R_{p0.2}$ ^d MPa min. | R_m ^d MPa | A % min. | $R_{p0.2}$ MPa min. | R_m MPa | A % min. | $R_{p0.2}$ MPa min. | R_m MPa | A % min. |
| 35S20 35SPb20 | 1.0726 | ≥ 5 ≤ 10 | - | - | 480 | 640 to 880 | 6 | - | - | - | 490 | 700 to 900 | 9 |
| | 1.0756 | > 10 ≤ 16 | - | - | 400 | 590 to 830 | 7 | - | - | - | 490 | 700 to 900 | 11 |
| | | > 16 ≤ 40 | 154 to 201 | 520 to 680 | 360 | 560 to 800 | 8 | 380 | 600 to 750 | 16 | 455 | 650 to 850 | 12 |
| | | > 40 ≤ 63 | 154 to 198 | 520 to 670 | 340 | 530 to 760 | 9 | 320 | 550 to 700 | 17 | 400 | 570 to 770 | 13 |
| | | > 63 ≤ 100 | 149 to 193 | 500 to 650 | 300 | 510 to 680 | 9 | 320 | 550 to 700 | 17 | 385 | 550 to 750 | 14 |
| 36SMn14 36SMnPb14 | 1.0764 | ≥ 5 ≤ 10 | - | - | 500 | 660 to 960 | 6 | - | - | - | 525 | 750 to 1000 | 6 |
| | 1.0765 | > 10 ≤ 16 | - | - | 440 | 620 to 920 | 6 | - | - | - | 520 | 740 to 990 | 6 |
| | | > 16 ≤ 40 | 166 to 222 | 560 to 750 | 390 | 600 to 900 | 7 | 420 | 670 to 820 | 15 | 505 | 720 to 970 | 8 |
| | | > 40 ≤ 63 | 166 to 219 | 560 to 740 | 360 | 580 to 840 | 8 | 400 | 640 to 790 | 16 | 475 | 680 to 930 | 9 |
| | | > 63 ≤ 100 | 163 to 219 | 550 to 740 | 340 | 560 to 820 | 9 | 360 | 570 to 720 | 17 | 405 | 580 to 840 | 9 |
| 38SMn28 38SMnPb28 | 1.0760 | ≥ 5 ≤ 10 | - | - | 550 | 700 to 960 | 6 | - | - | - | 595 | 850 to 1000 | 9 |
| | 1.0761 | > 10 ≤ 16 | - | - | 500 | 660 to 930 | 6 | - | - | - | 545 | 775 to 925 | 10 |
| | | > 16 ≤ 40 | 166 to 216 | 560 to 730 | 420 | 610 to 900 | 7 | 420 | 700 to 850 | 15 | 490 | 700 to 900 | 12 |
| | | > 40 ≤ 63 | 166 to 216 | 560 to 730 | 400 | 600 to 840 | 7 | 400 | 700 to 850 | 16 | 490 | 700 to 900 | 13 |
| | | > 63 ≤ 100 | 163 to 207 | 550 to 700 | 350 | 580 to 820 | 8 | 380 | 630 to 800 | 16 | 440 | 625 to 850 | 14 |
| 44SMn28 44SMnPb28 | 1.0762 | ≥ 5 ≤ 10 | - | - | 600 | 760 to 1030 ^e | 5 ^e | - | - | - | 595 | 850 to 1000 | 9 |
| | 1.0763 | > 10 ≤ 16 | - | - | 530 | 710 to 980 ^e | 5 ^e | - | - | - | 595 | 850 to 1000 | 9 |
| | | > 16 ≤ 40 | 187 to 242 | 630 to 820 | 460 | 660 to 900 ^e | 6 ^e | 420 | 700 to 850 | 16 | 490 | 700 to 900 | 11 |
| | | > 40 < 63 | 184 to 235 | 620 to 790 | 430 | 650 to 870 | 7 | 410 | 700 to 850 | 16 | 490 | 700 to 900 | 12 |
| | | > 63 ≤ 100 | 181 to 231 | 610 to 780 | 390 | 630 to 840 | 7 | 400 | 700 to 850 | 16 | 490 | 700 to 900 | 12 |
| 46S20 46SPb20 | 1.0727 | ≥ 5 ≤ 10 | - | - | 570 | 740 to 980 | 5 | - | - | - | 595 | 850 to 1000 | 8 |
| | 1.0757 | > 10 ≤ 16 | - | - | 470 | 690 to 930 | 6 | - | - | - | 560 | 800 to 950 | 9 |
| | | > 16 ≤ 40 | 175 to 225 | 590 to 760 | 400 | 640 to 880 | 7 | 430 | 650 to 800 | 13 | 490 | 700 to 850 | 10 |
| | | > 40 ≤ 63 | 172 to 216 | 580 to 730 | 380 | 610 to 850 | 8 | 370 | 630 to 780 | 14 | 490 | 700 to 850 | 11 |
| | | > 63 ≤ 100 | 166 to 211 | 560 to 710 | 340 | 580 to 820 | 8 | 370 | 630 to 780 | 14 | 455 | 650 to 850 | 11 |

- a** For thicknesses < 5 mm the mechanical properties may be agreed at the time of enquiry and order.
b These values are also valid for the 'quenched and tempered + turned' condition.
c Only for information.
d For flats and special sections the yield strength ($R_{p0.2}$) may deviate by -10 % and the tensile strength (R_m) by ±1 0 %.
e By means of heavy drafting these steels may be supplied with a minimum tensile strength (R_m) of 920 MPa and a minimum elongation (A) of 4 %.
f In EN 10087, the term 'direct hardening' was used. This term must be changed to 'quenching and tempering' during the next revision of that standard.