

| | |
|-----------------------|---------------------------|
| Quality | 41CrAlMo7-10 |
| According to standard | UNI EN 10085: 2003 |
| Number | 1.8509 |

Chemical composition

| C% | Si% | Mn% | P% | S% | Cr% | Mo% | Al% | Deviations allowed for analysis product |
|---------------------|----------------|---------------------|------------------|------------------|---------------------|---------------------|---------------------|---|
| | max | | max | max | | | | |
| 0,38-0,45 ± 0.02 | 0,40 + 0.03 | 0,40-0,70 ± 0.04 | 0,025 + 0.005 | 0,035 + 0.005 | 1,50-1,80 ± 0.05 | 0,20-0,35 ± 0.04 | 0,80-1,20 ± 0.10 | |

Temperature °C

| Hot-forming | Stress-relieving after machining | Quenching | Tempering | Nitrocarburizing | Final stress-relieving |
|--------------------------------|----------------------------------|---------------------------|-------------------------------|-------------------------|--|
| 1050-950 | 550-570 air | 870-930 oil or polymer | 580-700 air | 570-580 | 50° under the temperature of tempering |
| Soft annealing | Isothermal annealing | Nitriding | End quench hardenability test | Pre-heating welding | Stress-relieving after welding |
| 650-750 air (HB max 248) | | 480-570 (HV 1150) | 900 water | 300 Ac1 Ac3 | 550 furnace cooling Ms Mf |
| | | | | 790 920 | 320 100 |

Mechanical and physical properties

Hot-rolled mechanical properties in **quenched and tempered** condition UNI EN 10085: 2003

| size mm | | Testing at room temperature (longitudinal) | | | | | | Surface hardness in quenched and tempered and nitrided condition | |
|---------|-----|--|------------------------|------|------|--------|-------------|--|--|
| from | to | R | Rp 0.2 | A% | C% | Kv | HB | HV 1 | |
| | | N/mm ² | N/mm ² min. | min. | min. | J min. | for inform. | | |
| 16 | 40 | 950-1150 | 750 | 11 | | 25 | 286-347 | | |
| 40 | 100 | 900-1100 | 720 | 13 | | 25 | 271-331 | 950 | |
| 100 | 160 | 850-1050 | 670 | 14 | | 30 | 253-319 | | |
| 160 | 250 | 800-1000 | 625 | 15 | | 30 | 240-298 | | |

Table of tempering values obtained at room temperature on rounds of Ø 10 mm after quenching at 930°C in oil

| | | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 | 700 |
|-----------------|-------------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| HB | | 568 | 560 | 550 | 525 | 518 | 496 | 475 | 455 | 432 | 400 | 376 | 336 | 294 | 253 |
| HRC | | 55.5 | 55 | 54.5 | 53 | 52.5 | 51 | 49.5 | 48 | 46 | 43 | 40.5 | 36 | 31 | 25 |
| R | N/mm ² | 2100 | 2060 | 2030 | 1950 | 1900 | 1820 | 1740 | 1630 | 1530 | 1400 | 1280 | 1110 | 980 | 850 |
| Rp 0.2 | N/mm ² | 1300 | 1350 | 1480 | 1520 | 1510 | 1490 | 1450 | 1380 | 1300 | 1190 | 1080 | 940 | 800 | 700 |
| A | % | 7.5 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.2 | 9.0 | 10.5 | 12.0 | 14.2 | 17.5 | 19.5 |
| C | % | 28 | 28 | 35 | 38 | 39 | 39 | 38 | 37 | 39 | 44 | 51 | 56 | 60 | 64 |
| Kv | J | 28 | 38 | 46 | 64 | 64 | 64 | 64 | 54 | 64 | 80 | 96 | 116 | 126 | 132 |
| Tempering at °C | | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 | 700 |

High-temperature testing

| | | 20 | 100 | 200 | 300 | 400 | 500 | 600 |
|---------------------|-------------------|-----------|------------|------------|------------|------------|------------|------------|
| R | N/mm ² | | 1010 | 960 | 900 | 880 | 830 | 700 |
| Rp 0.2 | N/mm ² | | 860 | 800 | 740 | 700 | 620 | 580 |
| A | % | | 18 | 16 | 14 | 14 | 20 | 26 |
| C | % | | 58 | 58 | 52 | 56 | 74 | 80 |
| Kv | J | | 76 | 78 | 110 | 110 | 118 | 110 |
| Test temperature °C | | 20 | 100 | 200 | 300 | 400 | 500 | 600 |

Thermal expansion

| | | 20 - 100 | 20 - 200 | 20 - 300 | 20 - 400 | 20 - 500 |
|------------------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|
| 10 ⁻⁶ • K ⁻¹ | | 11.1 | 12.1 | 12.9 | 135 | 13.9 |
| Temperature °C | | 20 - 100 | 20 - 200 | 20 - 300 | 20 - 400 | 20 - 500 |

41CrAlMo7-10

| Cold-drawn | | | | | Hot-rolled peeled-reeled | | | | |
|---|----|--|-----------------------|-----|--|-------------------|-----------------------|-----|----|
| size mm | | Testing at room temperature (longitudinal) | | | Testing at room temperature (longitudinal) | | | | |
| from | to | R | Rp 0.2 | A% | HB | R | Rp 0.2 | A% | HB |
| | | N/mm ² | N/mm ² min | min | | N/mm ² | N/mm ² min | min | |
| No indications from reference standards | | | | | | | | | |

Forged quenched and tempered UNI 8552: 1984. Use only as reference

| size mm | | Testing at room temperature (longitudinal) | | | | | | | |
|---------|-----|--|-----------------------|------|------|------|-------|-------|-----------------|
| from | to | R | Rp 0.2 | A% L | A% T | A% Q | Kcu L | Kcu T | HB |
| | | N/mm ² | N/mm ² min | min | min | min | J min | J min | for information |
| | 100 | 930-1130 | 735 | 12 | | | 19.5 | | 278-339 |
| 100 | 160 | 835-980 | 640 | 14 | | | 22.5 | | 250-295 |

L = longitudinal T = tangential Q = radial Mechanical properties obtained on test blanks

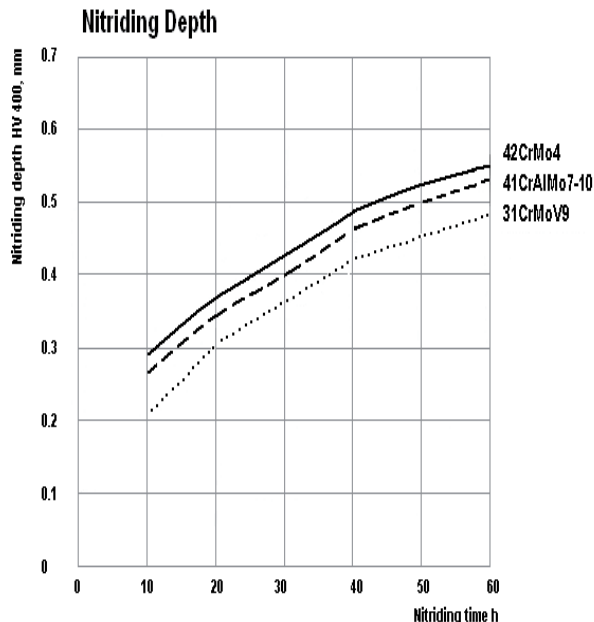
Jominy test HRC 41CrAlMo7 UNI 8552

mm distance from quenched extremity

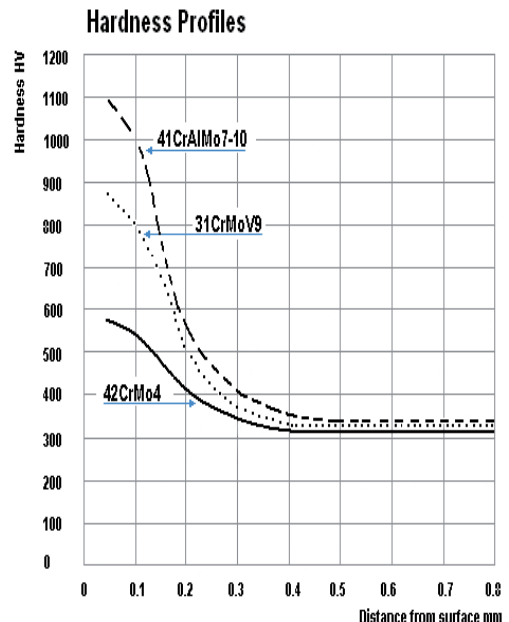
| | 1.5 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|-----|-----|----|------|------|----|----|------|----|------|------|------|------|----|----|----|
| min | 53 | 52 | 51 | 50 | 49 | 48 | 47.5 | 47 | 44.5 | 41 | 39.5 | 37.5 | 36 | 35 | 33 |
| max | 60 | 60 | 59.5 | 59.5 | 59 | 59 | 58.5 | 58 | 57 | 56.5 | 55 | 53 | 51 | 49 | 47 |

| Temperature Testing at °C | Mod. of elasticity GPa | | Rp 0.2 | R | A | Kv | Hardness HV05 after nitriding at mm depth: | | | | | |
|------------------------------|---------------------------|---------|-------------------|-------------------|----|-----|---|------|------|------|------|------|
| | E long. | G tang. | N/mm ² | N/mm ² | % | J | mm | 0.01 | 0.06 | 0.12 | 0.18 | 0.25 |
| 20 | 210 | 80 | 850 | 1000 | 18 | 85 | mm | 0.01 | 0.06 | 0.12 | 0.18 | 0.25 |
| 100 | | | 800 | 990 | 16 | 90 | HV min | 950 | 950 | 930 | 850 | 800 |
| 200 | | | 750 | 980 | 16 | 110 | HV max | 1140 | 1140 | 1140 | 1110 | 1110 |
| 300 | | | 700 | 960 | 17 | 120 | | | | | | |
| 400 | | | 620 | 880 | 19 | 122 | mm | 0.5 | 0.6 | 0.7 | 0.8 | 1 |
| 500 | | | 550 | 750 | 22 | 110 | HV min | 210 | | | | |
| 600 | | | 280 | 500 | 38 | 85 | HV max | 750 | 400 | 350 | 350 | 350 |

| EUROPE EN | ITALY UNI | CHINA GB | GERMANY DIN | FRANCE AFNOR | U.K. B.S. | RUSSIA GOST | USA AISI/SAE |
|--------------|-----------|----------|-------------|--------------|-----------|-------------|-----------------|
| 41CrAlMo7-10 | 41CrAlMo7 | 38CrMoAl | 41CrAlMo7 | 40CAD6.12 | 905M39 | 40X2MI-O | J24056 - E71400 |



Nitriding depth 400 HV as function of the nitriding time.
Plasma nitriding 510°C



Variation of Hardness with distance from surface.
Plasma nitriding 510°C