

| | | |
|-----------------------|-------------------------|-----------------------|
| Quality | 39NiCrMo3 | <i>Technical card</i> |
| According to standard | EN 10083-3: 2006 | <i>Lucefin Group</i> |
| Number | 1.6510 | |

Chemical composition

| C% | Si% max | Mn% | P% max | S% max | Cr% | Mo% | Ni% | |
|---------------------|----------------|---------------------|------------------|------------------|---------------------|---------------------|---------------------|--------------------------------|
| 0,35-0,43 ± 0.02 | 0,40 + 0.03 | 0,50-0,80 ± 0.04 | 0,025 + 0.005 | 0,035 + 0.005 | 0,60-1,00 ± 0.05 | 0,15-0,25 ± 0.03 | 0,70-1,00 ± 0.05 | Product deviations are allowed |

On request, this steel grade may be supplied Calcium (Ca) treated

On request, it can also be supplied with the addition of lead (Pb 0,15 – 0,35%) or sulphur (S 0,020-0,040) for improved machinability

Temperature °C

| Hot-forming | Normalizing | Quenching | Quenching | Tempering | Stress-relieving | | |
|------------------------------------|--|------------------------------------|----------------------------------|---------------------|--|------------------|------------------|
| 1100-900 | 860 air | 850 oil or polymer | 840 water | 550-650 air | 50° under the temperature of tempering | | |
| Soft annealing | Isothermal annealing | Full annealing | End quench hardenability test | Pre-heating welding | Stress-relieving after welding | | |
| 700 air cooling (HB max 240) | 820 furnace cooling to 650, then air (HB 195-240) | 820 air cooling (HB max 235) | 850 water | 300 | 550 furnace cooling | | |
| | | | | Ac1 740 | Ac3 790 | Ms 330 | Mf 110 |

Mechanical and physical properties

Hot-rolled mechanical properties in **quenched and tempered** condition EN 10083-3: 2006

| size d / t mm | | Testing at room temperature (longitudinal) | | | | | | |
|------------------|---------|--|-----------------------------|------------|------------|--------------|---------|--|
| from | to | R N/mm ² | Rp 0.2 N/mm ² | A% min. | C% min. | Kv J min. | HB | |
| | 16/8 | 980-1180 | 785 | 11 | 40 | | 295-354 | |
| 16/8 | 40/20 | 930-1130 | 735 | 11 | 40 | 35 | 278-339 | |
| 40/20 | 100/60 | 880-1080 | 685 | 12 | 45 | 40 | 263-327 | |
| 100/60 | 160/100 | 830-980 | 635 | 12 | 50 | 40 | 249-295 | |
| 160/100 | 250/160 | 740-880 | 540 | 13 | 50 | 40 | 224-263 | |

d = diameter t = thickness

Table of tempering values obtained at room temperature on rounds of Ø 10 mm after quenching at 850 °C in oil

| | | | | | | | | | | | | | | |
|-----------------|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| HB | | 577 | 560 | 525 | 496 | 468 | 442 | 426 | 409 | 390 | 362 | 336 | 286 | 240 |
| HRC | | 56 | 55 | 53 | 51 | 49 | 47 | 45.5 | 44 | 42 | 39 | 36 | 30 | 22.5 |
| R | N/mm ² | 2160 | 2070 | 1950 | 1820 | 1700 | 1580 | 1500 | 1430 | 1340 | 1220 | 1100 | 950 | 800 |
| Rp 0.2 | N/mm ² | 1440 | 1520 | 1540 | 1520 | 1490 | 1440 | 1370 | 1290 | 1220 | 1110 | 980 | 830 | 670 |
| A | % | 8.0 | 9.8 | 10.4 | 10.6 | 10.7 | 10.8 | 11.0 | 11.5 | 12.5 | 13.8 | 16.0 | 19.0 | 22.0 |
| C | % | 30 | 42 | 48 | 52 | 53 | 53 | 54 | 55 | 56 | 57 | 60 | 63 | 68 |
| Kv | J | 28 | 31 | 32 | 28 | 28 | 27 | 27 | 28 | 36 | 46 | 86 | 114 | 128 |
| Tempering at °C | | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 | 700 |

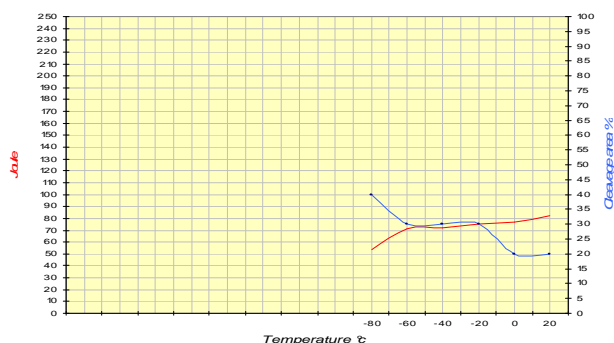
Transition curve; LUCEFIN experience

Kv values obtained on hot-rolled 100 mm round

Quenched and tempered (induction) R **1002** N/mm²

Rp 0.2 **879** N/mm² – A% **14,6** – C% **54**

| °C | J | Lat. Exp. mm | Shear % |
|------------|----------|----------------|---------|
| +20 | 85-82-79 | 0,94-0,91-0,93 | 20 |
| 0 | 78-76-77 | 0,88-0,84-0,83 | 20 |
| -20 | 73-77-75 | 0,83-0,88-0,80 | 30 |
| -40 | 68-74-74 | 0,78-0,77-0,81 | 30 |
| -60 | 66-70-64 | 0,80-0,78-0,77 | 30 |
| -80 | 55-50-58 | 0,45-0,57-0,51 | 40 |



39NiCrMo3 1.6510 EN 10277-5: 2008

Lucefin Group

| Cold-drawn + quenched and tempered +C +QT | | | | | | Hot-rolled annealed + peeled-reeled +A +SH | | | |
|---|-----|--|-----------------------|-----|-------------|--|-----------------------|-----|-----|
| size | | Testing at room temperature (longitudinal) ^{e)} | | | | | | | |
| mm | | R | Rp 0.2 | A% | HB | R | Rp 0.2 | A% | HB |
| from | to | N/mm ² | N/mm ² min | min | for inform. | N/mm ² | N/mm ² min | min | max |
| 5 ^{b)} | 10 | | | | | | | | |
| 10 | 16 | | | | | | | | |
| 16 | 40 | 930-1130 | 735 | 11 | 278-339 | | | | 240 |
| 40 | 63 | 880-1080 | 735 | 12 | 263-327 | | | | 240 |
| 63 | 100 | 880-1080 | 735 | 12 | 263-327 | | | | 240 |

^{b)} for thickness < 5 mm, mechanical properties should be agreed before order placement^{e)} values valid also for +C+QT+SL

| Hot-rolled, quenched and tempered, cold-drawn +QT +C ^{c)} ^{e)} | | | | | | Hot-rolled annealed + cold-drawn +A +C | | | |
|--|-----|--|-----------------------|-----|-------------|--|-----------------------|-----|-----|
| size | | Testing at room temperature (longitudinal) | | | | | | | |
| mm | | R | Rp 0.2 | A% | HB | R | Rp 0.2 | A% | HB |
| from | to | N/mm ² | N/mm ² min | min | for inform. | N/mm ² min | N/mm ² min | min | max |
| 5 ^{b)} | 10 | 980-1180 | 735 | 8 | 295-354 | | | | 295 |
| 10 | 16 | 930-1130 | 700 | 8 | 278-339 | | | | 290 |
| 16 | 40 | 930-1130 | 700 | 9 | 278-339 | | | | 285 |
| 40 | 63 | 880-1080 | 625 | 10 | 263-327 | | | | 280 |
| 63 | 100 | 880-1080 | 600 | 10 | 263-327 | | | | 280 |

^{c)} for flats and special sections, tensile strength (R) may differ by ± 10%^{b)} for thickness < 5 mm, mechanical properties should be agreed before order placement^{e)} values valid also for +QT+C+SL**Forged** quenched and tempered UNI 7874: 1979. Use only as reference

| size | | Testing at room temperature | | | | | | | |
|------|------|-----------------------------|-----------------------|-------|-------|-----------|-----------|-------------|--|
| mm | | R | Rp 0.2 | A% | A% | Kv +20 °C | Kv +20 °C | HB | |
| from | to | N/mm ² | N/mm ² min | min L | min T | J min L | J min T | for inform. | |
| | 100 | 880-1080 | 685 | 12 | | 40 | | 263-327 | |
| 100 | 250 | 685-835 | 540 | 13 | 12 | 30 | 25 | 209-250 | |
| 250 | 500 | 655-805 | 490 | 15 | 14 | 30 | 25 | 201-241 | |
| 500 | 1000 | 635-785 | 440 | 16 | 15 | 25 | | 195-234 | |
| 1000 | | 590-740 | 390 | 15 | 14 | 25 | | 176-224 | |

L = longitudinal T = tangential

d = diameter t = thickness

EN 10083-3: 2006 **Jominy test HRC** grain size 5 min.

| mm distance from quenched extremity | | | | | | | | | | | | | | | | |
|-------------------------------------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--------|
| | 1.5 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | H |
| min | 52 | 51 | 50 | 49 | 48 | 46 | 44 | 43 | 39 | 36 | 34 | 33 | 32 | 31 | 30 | normal |
| max | 60 | 60 | 59 | 58 | 58 | 57 | 57 | 56 | 55 | 52 | 51 | 49 | 48 | 46 | 45 | |

| Temperature | Mod. of elasticity GPa | | Thermal expansion | | Density |
|---------------|------------------------|---------|------------------------------------|--|--------------------|
| Testing at °C | E long. | G tang. | 10 ⁻⁶ · K ⁻¹ | | Kg/dm ³ |
| 20 | 210 | 80 | 11.2 | | 7.80 |

| EUROPE EN | ITALY UNI | CHINA GB | GERMANY DIN | FRANCE AFNOR | U.K. B.S. | RUSSIA GOST | USA AISI/SAE |
|-----------|-----------|----------|-------------|--------------|-----------|-------------|--------------|
| 39NiCrMo3 | 39NiCrMo3 | | 36CrNiMo4 | 40NCD3 | | 39HNM | 9840 |