



|                |                |                        |                            |
|----------------|----------------|------------------------|----------------------------|
| <b>Quality</b> | <b>X30Cr13</b> | <b>Martensitic</b>     | <i>Technical card 2018</i> |
| Number         | <b>1.4028</b>  | <b>Stainless Steel</b> | <i>Lucefin Group</i>       |

## Chemical composition

| C%        | Si%    | Mn%    | P%      | S% <sup>a)</sup> | Cr%       |                  |
|-----------|--------|--------|---------|------------------|-----------|------------------|
|           | max    | max    | max     | max              |           |                  |
| 0,26-0,35 | 1,00   | 1,50   | 0,040   | 0,030            | 12,0-14,0 | EN 10088-3: 2014 |
| ± 0.02    | + 0.05 | ± 0.04 | + 0.005 | ± 0.003          | ± 0.15    |                  |

Product deviations are allowed

<sup>a)</sup> for improving machinability, it is allowed a controlled sulphur content of 0,015 % - 0,030 %; for polishability, it is suggested a controlled sulphur content of max 0,015 %

## Temperature °C

| Melting range           | Hot-forming         | Subcritical annealing                        | Soft annealing +A             | Full annealing       | MMA welding – AWS electrodes                               |
|-------------------------|---------------------|--|-------------------------------|----------------------|--|
| 1490-1480               | 1200-930            | 790-730<br>air                               | 825-745<br>air                | not suitable         | <i>pre-heating</i> 300<br><i>annealing after w.</i> 750    |
| Isothermal annealing +I | Quenching +Q        | Tempering +T                                 | Tempering +T                  | Stress-relieving +SR | <i>joint with steel</i>                                    |
| not suitable            | 1080-980<br>oil/air | 200-150<br>fast cooling in air<br>(HRC 50 ~) | 675-625<br>air<br>(HRC 24-31) | 300-200<br>air       | carbon<br>E70 xx<br><i>cosmetic welding</i><br>E309 – E420 |
|                         |                     |  |                               |                      | CrMo alloyed<br>E8018-B 2<br>stainless<br>E309 – E308      |

Transformation temperature during heating **Ac1** ~ 785, **Ac3** ~ 885 and during cooling **Ms** ~ 280, **Mf** ~ 130

**Chemical treatment** - *Pickling* (10 - 15% HNO<sub>3</sub>) + (0,5-1,05% HF) hot or cold

## Mechanical properties

**Heat-treated material** EN 10088-3: 2014 in conditions 1C, 1E, 1D, 1X, 1G, 2D

| size |     | Testing at room temperature |                       |         |                        |                   |                                    |
|------|-----|-----------------------------|-----------------------|---------|------------------------|-------------------|------------------------------------|
| mm   |     | R                           | Rp 0.2                | A%      | Kv <sub>2</sub> +20 °C | HBW <sup>a)</sup> | <sup>a)</sup> for information only |
| from | to  | N/mm <sup>2</sup>           | N/mm <sup>2</sup> min | min (L) | J min (L)              | max               |                                    |
|      |     | 800 max                     | -                     | -       | -                      | 245               | +A annealed material               |
|      | 160 | 850-1000                    | 650                   | 10      | 12                     | -                 | +QT850 quenched and tempered       |

**Bright bars of heat-treated material** EN 10088-3: 2014 in conditions 2H, 2B, 2G, 2P

| size |                  | Testing at room temperature |                   |                              |                       |         |                        |
|------|------------------|-----------------------------|-------------------|------------------------------|-----------------------|---------|------------------------|
| mm   |                  | R                           | HBW <sup>a)</sup> | R                            | Rp 0.2                | A%      | Kv <sub>2</sub> +20 °C |
| from | to               | N/mm <sup>2</sup>           | max               | N/mm <sup>2</sup>            | N/mm <sup>2</sup> min | min (L) | J min (L)              |
|      | 10 <sup>b)</sup> | 950                         | 305               | 900-1050                     | 700                   | 7       | -                      |
| 10   | 16               | 950                         | 305               | 900-1150                     | 650                   | 7       | -                      |
| 16   | 40               | 900                         | 280               | 850-1100                     | 650                   | 9       | 12                     |
| 40   | 63               | 840                         | 260               | 850-1050                     | 650                   | 9       | 12                     |
| 63   | 160              | 800                         | 245               | 850-1000                     | 650                   | 10      | 15                     |
|      |                  | +A annealed material        |                   | +QT850 quenched and tempered |                       |         |                        |

<sup>a)</sup> for information only

<sup>b)</sup> in the range of 1 mm ≤ d < 5 mm, values are valid only for rounds – the mechanical properties of non round bars of < 5 mm of thickness have to be agreed at the time of request and order

**Forged** UNI EN 10250-4: 2001

| size |     | Testing at room temperature |                       |         |           |     |                              |
|------|-----|-----------------------------|-----------------------|---------|-----------|-----|------------------------------|
| mm   |     | R                           | Rp 0.2                | A%      | Kv +20 °C | HB  |                              |
| from | to  | N/mm <sup>2</sup>           | N/mm <sup>2</sup> min | min (L) | J min (L) | max |                              |
|      |     | 800 max                     | -                     | -       | -         | 245 | +A annealed material         |
|      | 160 | 850-1000                    | 650                   | 10      | -         | -   | +QT850 quenched and tempered |

**Table of tempering** values at room temperature on rounds of Ø 10 mm after quenching at 1000°C in oil

| R            | N/mm <sup>2</sup> | 1700 | 1650 | 1630 | 1630 | 1620 | 1600 | 1350 | 1000 | 850 | 800 |
|--------------|-------------------|------|------|------|------|------|------|------|------|-----|-----|
| Rp 0.2       | N/mm <sup>2</sup> | 1400 | 1380 | 1360 | 1350 | 1340 | 1300 | 1100 | 790  | 650 | 600 |
| A            | %                 | 9    | 10   | 10   | 9    | 9    | 10   | 11   | 12   | 15  | 18  |
| Kv           | J                 | 18   | 20   | 18   | 14   | 12   | 12   | 16   | 22   | 32  | 40  |
| Tempering °C |                   | 200  | 300  | 350  | 400  | 450  | 500  | 550  | 600  | 650 | 700 |

Effect of **cold-working** (hot-rolled +A+C). Approximate values

| R           | N/mm <sup>2</sup> | 700 | 780 | 850 | 900 | 950 | 1000 | -   | -   | -   |
|-------------|-------------------|-----|-----|-----|-----|-----|------|-----|-----|-----|
| Rp 0.2      | N/mm <sup>2</sup> | 500 | 620 | 680 | 720 | 750 | 780  | 800 | 880 | 960 |
| A           | %                 | 20  | 13  | 12  | 11  | 11  | 11   | 10  | 10  | 10  |
| Reduction % |                   | 0   | 10  | 20  | 30  | 40  | 50   | 60  | 70  | 80  |

X30Cr13 n° 1.4028 martensitic stainless steel

Lucefin Group

|                                |                           |   |            |       |      |      |      |     |
|--------------------------------|---------------------------|---|------------|-------|------|------|------|-----|
| Thermal expansion              | $10^{-6} \cdot K^{-1}$    | ▶ | 10.5       | 11.0  | 11.5 | 12.0 | 12.6 |     |
| Modulus of elasticity          | longitudinal GPa          |   | 215        | 212   | 205  | 200  | 190  |     |
| Poisson number                 | $\nu$                     |   | 0.235      | 0.210 |      |      |      |     |
| Electrical resistivity         | $\Omega \cdot mm^2/m$     |   | 0.65       |       |      |      |      |     |
| Electrical conductivity        | Siemens·m/mm <sup>2</sup> |   | 1.54       |       |      |      |      |     |
| Specific heat                  | J/(Kg·K)                  |   | 460        |       |      |      |      |     |
| Density                        | Kg/dm <sup>3</sup>        |   | 7.70       |       |      |      |      |     |
| Thermal conductivity           | W/(m·K)                   |   | 30         |       |      |      |      |     |
| Relative magnetic permeability | $\mu_r$                   |   | 700-1000 ~ |       |      |      |      |     |
| °C                             |                           |   | 20         | 100   | 200  | 300  | 400  | 600 |

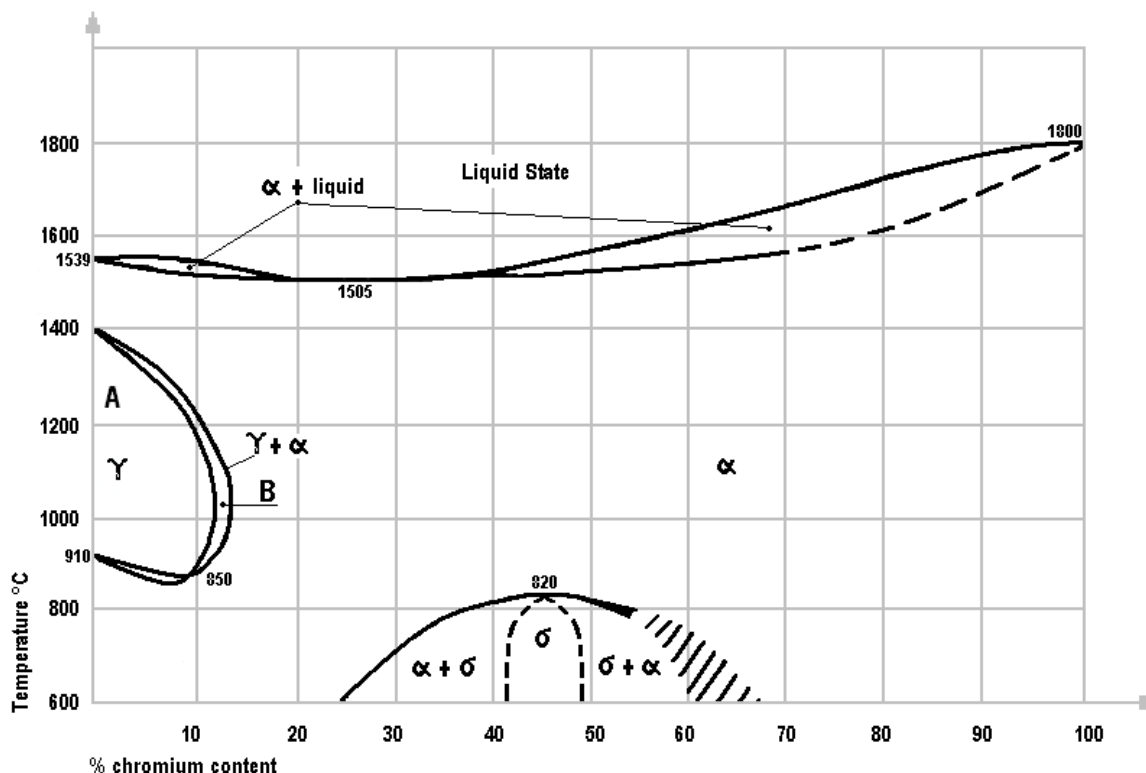
The symbol ▶ indicates between 20 °C and 100 °C, 20 °C and 200 °C .....

|                             |                   |               |               |                  |                 |   |
|-----------------------------|-------------------|---------------|---------------|------------------|-----------------|---|
| <b>Corrosion resistance</b> | Atmospheric       |               | Chemical      |                  |                 | x rust, diluted nitric acid, weak organic acids |
| Fresh water                 | <i>industrial</i> | <i>marine</i> | <i>medium</i> | <i>oxidizing</i> | <i>reducing</i> |   |
| x                           |                   |               |               |                  |                 |   |

|                                   |  |
|-----------------------------------|--|
| <b>Magnetic</b>                   | yes  |
| <b>Machinability</b>              | excellent  |
| <b>Hardening</b>                  | by quenching   |
| <b>Service temperature in air</b> | continuous service up to 650 °C; intermittent service up to 750 °C |

|               |            |            |              |               |              |              |                          |
|---------------|------------|------------|--------------|---------------|--------------|--------------|--------------------------|
| <b>Europe</b> | <b>USA</b> | <b>USA</b> | <b>China</b> | <b>Russia</b> | <b>Japan</b> | <b>India</b> | <b>Republic of Korea</b> |
| EN            | UNS        | ASTM       | GB           | GOST          | JIS          | IS           | KS                       |
| X30Cr13       | (S42000)   | (420)      | 3Cr13        | 30Ch13        | SUS 420J2    | (X30Cr13)    | STS 420J2                |

Iron – Chromium alloys diagram



Inside zone A, with the chromium content lower than 0.12%, the stable phase is usually called austenite.

Inside zone B, next to the "pocket", ferrite (delta or alpha) is stable.

The sigma phase ( $\sigma$ ) is deleterious due to the toughness and the resistance to corrosion.