

**STANDARD REFERENCE:**
**UNI EN 10084:2008 (Hot-rolled and hot-rolled + turned products) | UNI EN 10277-4: 2008 (Bright products)**
**RODACCIAI REFERENCES AND COMPARABLE STANDARDS**

|             | EUROPE                                     |        | ITALY         | GERMANY        |        | FRANCE           | UK               | USA       |
|-------------|--|--------|---------------|----------------|--------|------------------|------------------|-----------|
|             | UNI EN 10084: 2008<br>UNI EN 10277-4: 2008 |        | (UNI 7846-78) | (DIN 17210-84) |        | (NF A 35-551-86) | (BS 970 pt.1-96) | ASTM A 29 |
|             | Grade                                      | N°     |               | Werkstoff      | N°     |                  |                  |           |
| <b>RM16</b> | 16MnCr5                                    | 1.7131 | 16MnCr5       | 16MnCr5        | 1.7131 | 16 MC 5          | 590H17           | -         |
|             | 16MnCrS5                                   | 1.7139 |               | 16MnCrS5       | 1.7139 |                  |                  |           |

**CHEMICAL COMPOSITION (CAST ANALYSIS) (%)**

|               | Europe      | C         | Si / max | Mn        | P / max | S           | Cr        | Al          | Pb |
|---------------|-------------|-----------|----------|-----------|---------|-------------|-----------|-------------|----|
| <b>RM16</b>   | 16MnCr5     | 0,14÷0,19 | 0,40     | 1,00÷1,30 | 0,025   | ≤ 0,035     | 0,80÷1,10 | 0,020÷0,050 | -  |
| <b>RM16Pb</b> | 16MnCrS5 Pb |           |          |           |         | 0,020÷0,040 |           |             |    |

**MECHANICAL PROPERTIES - AS ROLLED CONDITION - Hardness (HB) in the condition**

| Treated to improve<br>sherability (+S) | Annealed to maximum hardness<br>requirements (+A) | Treated to hardness range (+TH) |       | Treated to ferrite-pearlite structure and hardness range<br>(+FP) |       |
|--|---|---------------------------------|-------|---|-------|
| ≤ 255                                  | ≤ 207   | ≥ 156                           | ≤ 207 | ≥ 140   | ≤ 187 |

**MECHANICAL PROPERTIES - BRIGHT PRODUCT CONDITION**

| Spessore<br>mm | +A*+ Turned (+A +SH) | +A*+ Cold drawn (+A+C) | FP**+ Turned (+FP +SH) | FP**+ Cold drawn (+FP +C) |
|----------------|----------------------|------------------------|------------------------|---------------------------|
|                | Hardness HB max      | Hardness HB max        | Hardness HB            | Hardness HB               |
| ≥ 5 ≤ 10       | -                    | 260                    | -                      | -                         |
| > 10 ≤ 16      | -                    | 250                    | -                      | -                         |
| > 16 ≤ 40      | 207                  | 245                    | 140÷187                | 140÷240                   |
| > 40 ≤ 63      | 207                  | 240                    | 140÷187                | 140÷235                   |
| > 63 ≤ 100     | 207                  | 240                    | 140÷187                | 140÷235                   |

\*+A = annealed to maximum hardness requirement

\*\*+FP = treated to ferrite-perlite structure and hardness range

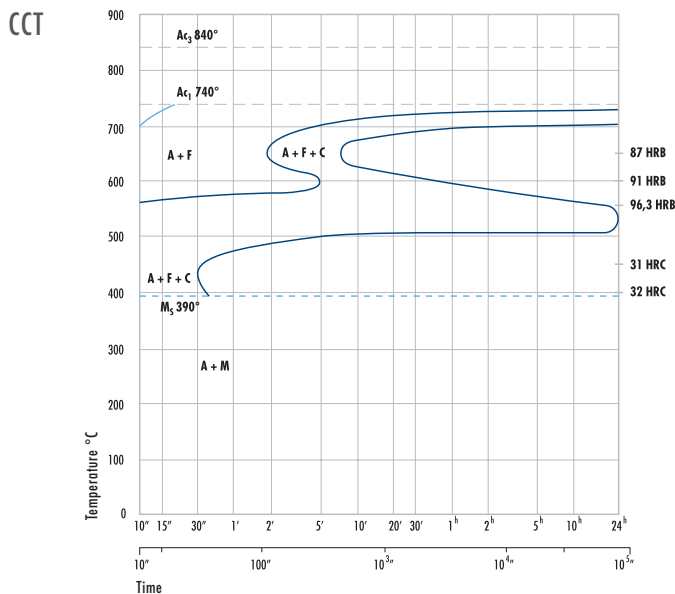
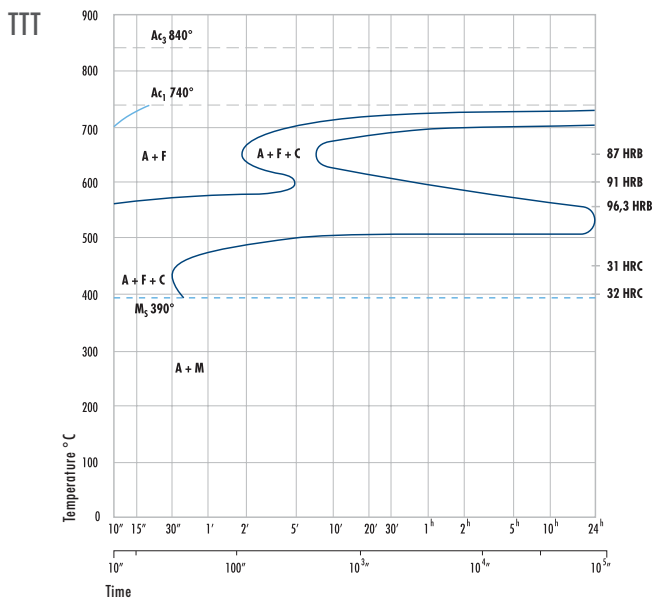
For size <5 mm the mechanical properties may be agreed at the time of enquiry and order

**WORKING TEMPERATURES RECOMMENDED**

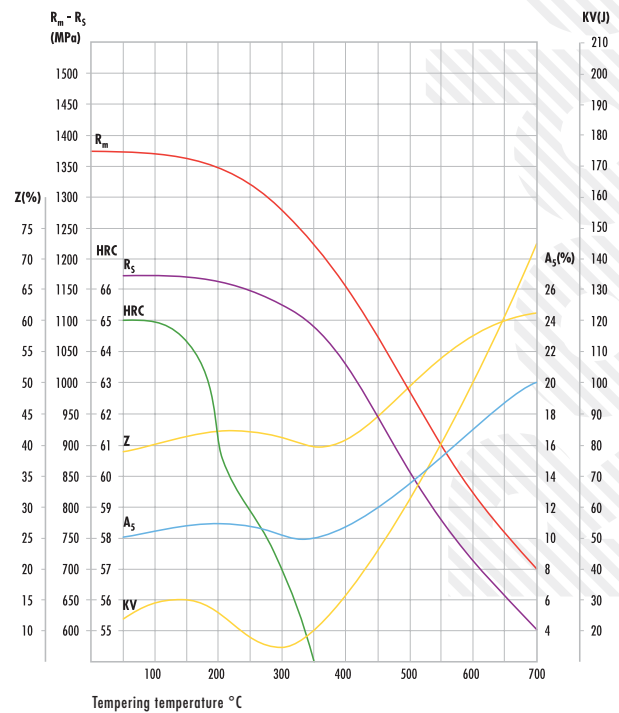
| Operation | Hot forgings deformation | Carburizing temperature | Core quenching temperature | Case quenching temperature | Tempering |
|-----------|--------------------------|-------------------------|----------------------------|----------------------------|-----------|
| °C        | 900÷1150                 | 880÷980                 | 860÷900                    | 780÷820                    | 150÷200   |

## HARDNESS LIMITS (JOMINY TEST)

| Limits of range | Hardness HRC at a distance from quenched end of test pieces (mm) |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------|--|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                 | 1,5  | 3  | 5  | 7  | 9  | 11 | 13 | 15 | 20 | 25 | 30 | 35 | 40 |    |
| +H              | Max  | 47 | 46 | 44 | 41 | 39 | 37 | 35 | 33 | 31 | 30 | 29 | 28 | 27 |
|                 | Min  | 39 | 36 | 31 | 28 | 24 | 21 | -  | -  | -  | -  | -  | -  | -  |
| +HH             | Max  | 47 | 46 | 44 | 41 | 39 | 37 | 35 | 33 | 31 | 30 | 29 | 28 | 27 |
|                 | Min  | 42 | 39 | 35 | 32 | 29 | 26 | 24 | 22 | 20 | -  | -  | -  | -  |
| +HL             | Max  | 44 | 43 | 40 | 37 | 34 | 32 | 30 | 28 | 26 | 25 | 24 | 23 | 22 |
|                 | Min  | 39 | 36 | 31 | 28 | 24 | 21 | -  | -  | -  | -  | -  | -  | -  |



## TEMPERING CURVE



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