



# High Speed Steel

## TG M-35 (DIN-1.3243)



**Steel Properties :** This kind steel is suitable for conditions involving thermal stresses and discontinuous cutting. Heavy-duty milling cutters of all kinds, gear cutter, highly stressed twist drills and taps, profile knives, machining of high-strength material, broaches.

**Applications :** It is one of the W-Mo Co hss grade with good cutting character. The res hardness, hot hardness and wearing resistance are all better than W6M05Cr4V2.

**Similar Steel Grade :**

| CHINA | BRAZIL   | AUSTRIA | GERMANY | SLOVANIA | JAPAN   |        | CHEZ. REP |
|-------|----------|---------|---------|----------|---------|--------|-----------|
| TG    | VILLARES | BOHLER  | DEW     | RAVNE    | HITACHI | NIPPON | RAVNE     |
| TGM35 | VK5E     | S700    | 1.3245  | BRCMO    | YXM4    | HM35   | MAXSP 75D |

**Chemical Composition: (%)**

| Indian IS | Chemical Analysis Typical Value % (Min - Max) |        |        |           |           |           |           |           |           |           | Delivery Condition |          |
|-----------|---|--------|--------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------------|----------|
|           | C   | S      | P      | Si        | Mn        | Cr        | Mo        | V         | W         | Co        | Heat Treatment     | Hardness |
| M35       | 0.88-0.96                                     | <0.03  | <0.03  | 0.20-0.45 | 0.20-0.40 | 3.80-4.50 | 4.70-0.52 | 1.70-2.00 | 6.00-6.70 | 4.55-5.50 | Annealed           | <255     |
| M35A      | 0.91-6.0                                      | <0.003 | <0.022 | ***       | ***       | 4.0       | 4.8       | 1.92      | ***       | 4.85      | Annealed           | <255     |

**New Development M35A Application :** • Suitable for fabricating various abrasion-resistant and impact-resistant tools for powerful cutting, high-level trimming dies, screw dies, tools of complicated shapes requiring tenacity, reamers, milling cutters, punches, etc. • Mainly used as roller cutters, drawing tools, end mills, etc.

**Production process:**

EAF→LF→VD→ESR→BLOOM IN FOLLOWING MACHINE :  
 QUICK FORGING (12.5MN), HAMMER, PRECISION FORGING →

- Precision Forging :  $\phi$  81 - 255mm
- Hot Rolled & Annealed Peeled (HRAP) :  $\phi$  14.5 - 80.0mm
- Cold Drawn / Sand Blasted (Coil) :  $\phi$  2.0 - 13.5mm
- Cold Drawn / Centreless Ground :  $\phi$  2.0 - 14.4mm

**UNDER ANNEALED CONDITION :**  
Hardness : HB205-255

**REDUCTION RATIO :**  
As 1:4 or 1:5

**DELIVERY STATUS :**  
As Cold drawn / Hot rolled / forged, in annealed condition.

**SIZE : Rounds**

| Cold Drawn/Centreless Ground Bar | Hot Rolled Bar       | Forged bar            | Coil                |
|----------------------------------|----------------------|-----------------------|---------------------|
| $\phi$ 2.0 - 14.4mm              | $\phi$ 14.5 - 80.0mm | $\phi$ 81.0 - 255.0mm | $\phi$ 2.0 - 13.5mm |

**SIZE : Flats**

| Thickness   | Width       |
|-------------|-------------|
| 5mm - 150mm | 5mm - 810mm |

**SIZE : Squares**

|              |
|--------------|
| 4mm to 100mm |
|--------------|

**SIZE : Sheets**

| Thickness     | Width | Length |
|---------------|-------|--------|
| 0.5mm to 12mm | 810mm | 2500mm |

**HEAT TREATMENT :**

**Annealing :** Annealing temperature: 860-880°C, keep this temperature by 2-4 hours, then cooling to 600°C in the speed of less than 30°C/h if after cold drawn process, suggest and stress relieving annealing process. Under the temperature of 600-700°C, keep this temperature by 2 hours. Quenching & Tempering (salt bath).

**QUENCHING :**

Pre-heating in two steps :

Heating temperature under : 400-500°C and 850-900°C

Austenitizing temperature : 1180-1220°C

Heating coefficient 10-15sec/mm, quenching under 580-620°C, then cooling to room temperature

**Tempering :**

Tempering temperature under : 540-560°C, tempering 3 times, each time 1 hour, then cooling to room temperature.