

32CRMOV12-10, 1.7665

32CrMoV12-10, 1.7665 is a high-strength, low-alloy steel commonly used in the manufacturing of components that require excellent toughness and resistance to wear and high temperatures. This material is often utilized in applications such as turbine components, high-stress machinery parts, and tools. Its chemical composition includes chromium, molybdenum, and vanadium, which contribute to its mechanical properties and resistance to various forms of stress and corrosion.

Chemical Composition

Element	Min	Max	Similar	Note
V	0.2500	0.3500	-	
Si	-	0.3500	-	
S	-	0.0100	-	
P	-	0.0250	-	
Mo	0.8000	1.2000	-	
Mn	-	0.6000	-	
Cr	2.8000	3.2000	-	
C	0.3000	0.3500	-	

Mechanical Properties

Variant	+QT Cond.	Format	Dimension [mm]	Yield strength min [MPa]	Tensile strength [MPa]	Elongation A _s [%]	Reduction of area Z _{min} [%]	Hardness	Impact (ISO-V) strength _{min}
32CrMoV12-10, 1.7665	+QT	Tube,wall	0 typical	800*	940 typical	19	70	300 HB typical	20 °C 200 J (long) 20 °C 130 J (transv)
Rp _{0.2} * R _{eh} ** R _{el}									

Quenched and Tempered Cond.

- Hardness: 290 to 330 BHN (29 HRc to 33 HRc)
- Tensile Strength , Rm MPa 930 – 1070
- Yield Strength 0.2%, Rp MPa 760 Min
- Impact Strength @RT : Min 120 J
- @ -20° C : Min 60 J
- @ -40° C : Min 60 J
- Elongation: 15 % Min
- Grain Size : # 6 or Smaller
- Non Metallic Inclusion Method K

- K3 = Max 5
- K2= Max 10
- M Value = Max 3

Physical Properties

- Density: Approximately 7.85 g/cm³.
- Melting Point: Typically around 1400-1450°C (2550-2640°F).
- Elastic Modulus: Approximately 210 GPa.
- Thermal Conductivity: Around 30-35 W/m·K.
- Specific Heat Capacity: Approximately 460 J/kg·K.
- Tensile Strength: After heat treatment, it can range from 900 to 1200 MPa.
- Yield Strength: Around 800-1000 MPa, depending on the heat treatment.
- Hardness: Can be in the range of 280-350 HB (Brinell Hardness) after quenching and tempering.

Heat Treatment

<h3>Heat Treatment Regime for 32CrMoV12-10:</h3>

1. **Forging:**
- **Temperature Range:** 1150-850°C.

- **Cooling:** Slow cooling in sand or controlled cooling in a furnace is recommended to avoid cracking.
2. **Annealing:**
- **Purpose:** To relieve stresses and soften the material for further machining or forming.

- **Temperature:** Heat to 680-720°C.

- **Holding Time:** Hold the material at this temperature for a suitable time to ensure uniform temperature throughout the section.

- **Cooling:** Slow cooling in the furnace to around 550°C, then air cooling.
3. **Normalizing:**
- **Purpose:** To refine the grain structure and improve mechanical properties.

- **Temperature:** Heat to 850-880°C.

- **Holding Time:** Hold the material at the normalizing temperature for 1 hour per 25 mm of thickness.

- **Cooling:** Air cooling outside the furnace.
4. **Quenching:**
- **Purpose:** To increase hardness and strength.

- **Temperature:** Heat to 900-950°C.

- **Holding Time:** Hold at this temperature to ensure uniform heating.

- **Quenching Medium:** Oil or air, depending on the desired properties and the component size.

- **Cooling:** Rapid cooling in oil (for higher hardness) or air (for moderate hardness).
5. **Tempering:**

- **Purpose:** To reduce brittleness and achieve the desired mechanical properties.
- **Temperature:** 550-700°C, depending on the required mechanical properties.
- **Holding Time:** Typically 1-2 hours, depending on the size of the component.
- **Cooling:** Air cooling.

6. **Stress Relieving:**

- **Purpose:** To remove residual stresses from quenching or machining operations.
- **Temperature:** 500-650°C.
- **Holding Time:** 1-2 hours.
- **Cooling:** Air cooling.

Note:

- **Final Properties:** The mechanical properties achieved will depend on the specific combination of quenching and tempering temperatures used.
- **Hardness After Quenching and Tempering:** The material can achieve hardness in the range of 280-350 HB, depending on the exact heat treatment process.

Always consider the specific requirements of the application when designing the heat treatment process.

Welding Properties

- **Weldability:** 32CrMoV12-10 has medium weldability, meaning it can be welded but with precautions. Due to its alloying elements like chromium, molybdenum, and vanadium, it is prone to cracking if not properly preheated or post-weld heat-treated.
- **Preheating:** Typically required, with a recommended preheating temperature between 200-300°C.
- **Post-Weld Heat Treatment (PWHT):** Often necessary to relieve stresses and restore mechanical properties, usually involving tempering.
- **Filler Material:** A matching filler material or a low-hydrogen type is recommended to avoid hydrogen-induced cracking.

Machining Properties

Machinability: The material has moderate machinability. It can be challenging to machine due to its high strength and hardness, particularly after heat treatment.

- **Cutting Tools:** Carbide tools are recommended for machining to ensure efficient material removal and tool life.
- **Cutting Speed:** Lower cutting speeds are advisable to reduce the risk of tool wear and to manage the heat generated during machining.
- **Cooling:** Proper cooling and lubrication are essential during machining to prevent overheating and to achieve a good surface finish.