Xometry

Datasheet

40Cr

Description

40Cr is an alloy steel designation that offers excellent comprehensive mechanical properties after quenching and tempering, along with good low-temperature impact toughness and low notch sensitivity. 40Cr steel has moderate cold forming plasticity, fair machinability, poor weldability, and good toughness indicators. It is one of the most widely used steels in the machinery manufacturing industry, primarily for manufacturing critical components subjected to cyclic loads, moderate speeds, moderate loads, and severe wear without significant impact. Examples include automotive steering knuckles, rear axles, machine tool gears, intake valves, booster valves, and pressure reducer bolts. It is also suitable for manufacturing fasteners operating at temperatures between -20~400℃, as well as shafts and gears with a diameter of over 400 mm that require low-temperature impact toughness. Additionally, it is suitable for medium-sized plastic molds.

Features

1. Mechanical properties

After quenching and tempering, it achieves an excellent balance between strength and toughness, enabling it to withstand high mechanical loads while resisting impact and preventing brittle fracture. This makes it suitable for components subjected to cyclic loading. Through various heat treatment processes such as annealing, normalizing, quenching and tempering, and nitriding, the material's hardness can be flexibly adjusted to meet different operational requirements from machinability to wear resistance under load-bearing conditions.

2. Process characteristics

Compared to ordinary medium-carbon steels (such as 45# steel), 40Cr offers significantly improved hardenability. It can achieve a deep hardened layer through both oil quenching and water quenching, ensuring uniform hardness distribution between the surface and the core, making it suitable for mechanical parts with medium cross-sections. After annealing or normalizing, the material has a moderate hardness (≤229 HBW), resulting in low cutting resistance. It can be easily machined through turning, milling, drilling, and grinding. However, after quenching, the hardness increases, making machining more difficult.

Parameters

Density

7.85 g/cm³

Chemical Composition of 40Cr Steel (%)

Composition	C	Si	Mn	P	S	Cr	Ni	Cu	Mo
Min.	0.37	0.17	0.5	-	-	0.8	-	-	-
Max.	0.44	0.37	0.8	0.03	0.03	1.1	0.3	0.3	0.1

The composition shall comply with the requirements of GB/T 3077-2015.

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Physical Properties

Density: 7.85 g/cm³

Elastic modulus E： 206 GPa

Poisson's ratio: 0.3

Coefficient of linear expansion (20～100℃) 11.5×10⁻⁶ /℃

Thermal conductivity: 48 W/(m·K)

Mechanical Properties (Standard Values in Quenched and Tempered Condition)

Tensile strength σb: ≥ 980 MPa

Yield strength σs: ≥ 785 MPa

Elongation at break δ_5: ≥ 9%

Reduction of area ψ: ≥ 45%

Impact energy Akv: ≥ 47