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Steel Q345

Description

Q345 is the most widely used low-alloy high-strength structural steel in China. By adding alloying elements such as Mn, V, Nb, and Ti, it achieves a yield strength of 345 MPa—approximately 50% higher than Q235—while maintaining good weldability. Not heat-treatable, and its enhanced mechanical properties are primarily achieved through thermo-mechanical controlled processing (TMCP), which refines grain structure. Quality grades A to E differ mainly in low-temperature impact toughness. Q345D and Q345E are suitable for severely cold environments at -20°C and -40°C, respectively. It is widely used in bridges, construction, machinery, vehicles, ships, and other fields so that it is the preferred material for steel structures. Compared to Q235, Q345 offers higher strength but slightly inferior weldability. Compared to high-strength steels (such as Q390, Q420), Q345 provides better cost-effectiveness, making it the optimal choice for balancing strength and cost.

Note: All material data listed in Xometry's data sheets is sourced from trusted Original Equipment Manufacturers (OEMs), material distributors, and databases.

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Q345 Low Alloy High Strength Structural Steel Material Data Sheet

1. Chemical Composition (%)

Elements	Q345A/B	Q345C	Q345D/E	Applications
C	≤0.20	≤0.20	≤0.18	Balanced strength and weldability
Mn	≤1.70	≤1.70	≤1.70	Primary strengthening element to enhance strength and toughness
Si	≤0.50	≤0.50	≤0.50	Deoxidation and strengthening
P	≤0.045	≤0.030	≤0.030/0.025	The lower the content of harmful element, the better
S	≤0.045	≤0.030	≤0.025/0.020	The lower the content of harmful element, the better
Al	—	≥0.015	≥0.015	Refine grain size, improve toughness
V	0.02~0.15	0.02~0.15	0.02~0.15	Microalloying for refined grain size
Nb	≤0.07	≤0.07	≤0.07	TMCP for improved strength
Ti	≤0.20	≤0.20	≤0.20	Refine grain size for improved weldability

Key difference: Grades D and E have lower carbon content (⩽0.18%) and stricter control of phosphorus (P) and sulfur (S) to ensure low-temperature toughness.

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2. Physical Properties

Performance parameters	Value	Unit	Note
Density	7.85	g/cm³	Standard steel density
Melting range	1480~1526	°C	Solidus–Liquidus range
Elastic modulus	200~215	GPa	Tensile state
Poisson's ratio	0.29~0.30	—	
Coefficient of Thermal Expansion	11.2~13.8	$\times 10^{-6}$/°C	20~ 100°C
Thermal conductivity	25~93	W/(m·K)	Change with temperature
Specific heat capacity	465	J/(kg·K)	
Resistivity	1.43~1.74×10^{-7}	Ω·m	20°C

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3. Mechanical Properties (Graded by Thickness)

Thickness range (mm)	Yield strength Rp0.2 (MPa)	Tensile strength Rm (MPa)	Elongation A (%)	Impact energy KV2(J)	Note
t≤16	≥345	470~630	≥21~22	≥34	Standard values
16<t≤40	≥335	470~630	≥21~22	≥34	Increased thickness, slightly reduced strength
40<t≤63	≥325	470~630	≥20~21	≥34	For heavy-duty structures
63<t≤80	≥315	470~630	≥20~21	≥34	Thick plate structures
80<t≤100	≥305	470~630	≥20	≥34	Extra-thick plate
t>100	≥285	470~630	≥18	≥34	Ultra-thick plate

Actual measurement: Yield strength typically ranges from 350 to 370 MPa, and tensile strength ranges from 550 to 620 MPa, which are better than the standard values.

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4. Cross reference of Domestic and International Designations

Standard system	Designation	Standard No.	Note
Chinese standard	Q345	GB/T 1591--2018	Primary standard
European standard	S355JR/J0/J2	EN 10025-2	Closest in composition and properties
U.S. standard	ASTM A572 Gr.50	ASTM A572/A572M	Same strength grade
Japanese standard	SM490A/B	JIS G3106	For welding structures
German standard	St52-3	DIN 17100	Former standard (obsolete)
International standard	Fe510B	ISO 630	

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