

Structural Steel Grades & Materials — Global Standard Cross-Reference for I-Beam & H-Beam Procurement

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1. Carbon Structural Steels

Carbon structural steels represent approximately **80% of global I-beam and H-beam production**. Their widespread adoption is driven by an optimal balance of mechanical performance, weldability, and cost efficiency. [Metal Asia supplies carbon structural steel grades](#) in full compliance with GB/T, ASTM, and EN specifications, direct from certified Chinese mills.

Primary Grades

Grade (GOST)	Grade (GB/T)	Grade (ASTM)	Grade (EN)	Key Characteristics
St3sp	Q235B	A36	S235JR	Killed steel, excellent weldability, general construction
St3ps	Q235B	A36	S235JR	Semi-killed, good uniformity, general structural

Mechanical Properties — Q235B / St3sp / S235JR

Property	Value	Test Standard
Tensile Strength	370 – 500 MPa	GB/T 228.1 / ASTM A370
Yield Strength	≥ 235 MPa	GB/T 228.1 / ASTM A370
Elongation	≥ 26%	GB/T 228.1
Carbon Content	≤ 0.20%	GB/T 223
Weldability	Excellent (no preheat required)	AWS D1.1 / EN ISO 15614
Service Temperature	-20°C to +425°C	Project-specific assessment

Advantages for Procurement

- ✔ **Lowest cost per ton** among structural grades
- ✔ **Unrestricted weldability** — no preheating or PWHT required
- ✔ **Globally available** — produced by virtually every steel mill worldwide
- ✔ **Sufficient strength** for the majority of commercial and residential structures

Limitations

- ✗ **Limited low-temperature performance** — not recommended for sustained service below -20°C without impact testing
- ✗ **Requires corrosion protection** — painting, galvanizing, or coating in aggressive environments
- ✗ **Not suitable for high-seismic zones** without supplementary ductility requirements

Applicable Standards

- GB/T 700-2006 — Carbon structural steels (China)
- GOST 380-2005 — Ordinary quality carbon steel (CIS)
- ASTM A36/A36M — Carbon structural steel (USA)
- EN 10025-2 — Non-alloy structural steels (Europe)

2. Low-Alloy High-Strength Steels

Low-alloy steels incorporate controlled additions of manganese (Mn), silicon (Si), and micro-alloying elements to achieve substantially higher strength while maintaining good weldability. These grades are essential for heavy-load structures, cold-climate applications, and fatigue-sensitive designs. [NDT quality verification](#) is strongly recommended for all low-alloy structural steel orders.

Primary Grade: 09G2S (GOST) / Q355B (GB/T) / S355J2 (EN)

Property	Value	Notes
Grade Decode	09 = ~0.09% C; G2 = ~1.5% Mn; S = Si	GOST system
GB/T Equivalent	Q355B (yield = 355 MPa)	GB/T 1591-2018
Tensile Strength	470 – 630 MPa	Significantly higher than Q235B
Yield Strength	≥ 355 MPa	Grade designation basis
Min Service Temperature	-70°C (with appropriate impact class)	Cold-climate capable
Weldability	Good (controlled preheat may be required >40 mm)	Per WPS qualification

Secondary Low-Alloy Grades

Grade (GOST)	Grade (GB/T)	Grade (ASTM)	Key Feature	Applications
10HSND	Q345NH	A588 Gr.A	Weathering steel (Cu, Ni, Cr)	Bridges, exposed structures
15HSND	Q460C	A913 Gr.65	Ultra-high strength	Heavy industrial, long-span bridges

Advantages

- ✓ **30–50% higher strength** than carbon steels — enables lighter structures
- ✓ **Cold-climate certified** — impact-tested to -70°C (with correct sub-grade)
- ✓ **Dynamic load resistance** — superior fatigue performance
- ✓ **Material savings** — reduced section sizes for equivalent load capacity

Limitations

- ✗ **Higher per-ton cost** (typically 15–25% premium over Q235B)
- ✗ **Stricter welding procedures** — may require preheat, controlled interpass temperature
- ✗ **Limited mill availability** in some regions — order planning required

Applicable Standards

- GB/T 1591-2018 — High strength low alloy structural steels
- GOST 19281-2014 — Increased strength steel products
- ASTM A572/A572M — High-strength low-alloy structural steel
- EN 10025-3/4 — Weldable fine grain structural steels

3. Special Structural Steels (Strength Classes)

Modern structural design increasingly classifies steels by **yield strength class** rather than by chemical composition alone. The "C" prefix ("Строительная" / Structural) denotes this classification system.

Strength Class Hierarchy

Class	Min Yield Strength	Typical Applications
C245	245 MPa	Light structures, temporary works, secondary members
C255	255 MPa	Standard commercial buildings, warehouses
C345	345 MPa	Heavy-load structures, industrial halls
C355	355 MPa	Bridges, crane runways, offshore structures
C390	390 MPa	Heavy industrial, arctic construction
C440	440 MPa	Seismic-resistant, nuclear, defense applications

Mapping: Strength Class → Steel Grade

Class	GOST Grades	GB/T Grades	EN Grades
C245	St3sp, St3ps	Q235B	S235JR
C255	St3sp5, St3ps5	Q235B	S275JR
C345	09G2S, 09G2SD	Q355B	S355J2
C355	09G2, 10HSND	Q355B	S355K2
C390	10HSND, 15HSND	Q390B	S420M
C440	15HSND, 15HSNDA	Q460C	S460ML

4. European & American Steel Grades

European Standard Grades (EN 10025)

Grade	Min Yield	Charpy Impact	GOST Equivalent	Application
S235JR	235 MPa	+20°C, 27J	St3sp / C245	General construction
S275JR	275 MPa	+20°C, 27J	St3sp5 / C255	Standard structures
S355JR	355 MPa	+20°C, 27J	09G2S / C345	Heavy-duty buildings
S355J2	355 MPa	-20°C, 27J	09G2S / C345	Cold-climate projects
S355K2	355 MPa	-20°C, 40J	09G2 / C355	Critical structures

EN Naming Convention: J = 27J impact energy; K = 40J; R = +20°C test; 2 = -20°C test; 0 = 0°C test.

American Standard Grades (ASTM)

Grade	Min Yield	Min Tensile	GOST Equivalent	Application
A36	250 MPa (36 ksi)	400 – 550 MPa	St3sp / C245	Most common US structural grade
A572 Gr.50	345 MPa (50 ksi)	450 MPa	09G2S / C345	High-strength applications
A572 Gr.60	415 MPa (60 ksi)	520 MPa	10HSND / C355	Extra high-strength
A992	345 – 450 MPa (50–65 ksi)	450 MPa	09G2S / C345, C355	W-shapes for buildings

Grade	Min Yield	Min Tensile	GOST Equivalent	Application
A913 Gr.65	450 MPa (65 ksi)	550 MPa	15HSND / C390	High-performance seismic

5. Aluminum Alloys for Structural Extrusions

Aluminum H-sections are produced by extrusion for applications where **weight minimization** is the primary design driver.

Key Properties

Property	Value
Density	2.7 g/cm³ (3× lighter than steel)
Yield Strength (6082-T6)	260 – 310 MPa
Elastic Modulus	70 GPa (1/3 of steel)
Service Temperature	-196°C to +150°C
Corrosion Resistance	Excellent (natural oxide layer)

Standard Extrusion Alloys

Alloy	Temper	Primary Application
6060-T6	T6	Architectural, anodized finishes
6063-T6	T6	Complex profiles, decorative
6082-T6	T6	Structural, marine, transport

Procurement Note

Aluminum extrusions are **NOT drop-in replacements for steel beams** in structural applications. The significantly lower modulus of elasticity results in deflections approximately **3× greater** than steel under equivalent loads. Use only where weight savings justify the structural design modifications.

6. Timber Materials for I-Beam Construction

Timber I-beams (TJIs) utilize engineered wood products for low-rise residential and light commercial applications.

Component Specifications

Component	Material	Standard
Flanges	Dry planed lumber or LVL (Laminated Veneer Lumber)	EN 14081, ANSI/TPI 1
Web	OSB-3 (moisture-resistant) or plywood (FSC/PEFC)	EN 300, EN 636
Adhesive	PUR (polyurethane) D4 class (waterproof)	EN 204, ASTM D5573

Requirements

- Lumber moisture content: **12 ± 2%**
- OSB classification: **OSB-3** (load-bearing, humid conditions)
- Plywood: **FSC-certified** where sustainability requirements apply
- Adhesive: Class D4 per EN 204 (exterior-grade waterproof bond)

7. Comparative Material Properties Matrix

Property	Q235B / St3 / S235	Q355B / 09G2S / S355	6082-T6 Aluminum	LVL + OSB Timber
Yield Strength	235 MPa	355 MPa	260–310 MPa	20–40 MPa (bending)
Elastic Modulus	210 GPa	210 GPa	70 GPa	10–13 GPa
Density	7.85 g/cm³	7.85 g/cm³	2.7 g/cm³	0.5–0.6 g/cm³
Service Temp.	-20°C to +425°C	-70°C to +425°C	-196°C to +150°C	-30°C to +60°C
Weldability	Excellent	Good	TIG/MIG	N/A
Corrosion Res.	Requires protection	Requires protection	Excellent	Requires protection
Relative Cost	1.0 (baseline)	1.15 – 1.25	3.0 – 4.0	0.8 – 1.0
Design Life	50+ years	50+ years	50+ years	50+ years
Primary Use	Standard construction	Heavy/cold-climate	Lightweight/non-struct.	Residential

8. Material Selection by Climate Zone

Selecting the appropriate steel grade for the service environment is a critical compliance requirement. The following guide aligns Chinese GB/T grades with international climate classifications.

Climate Zone	Examples	Recommended Grade	Min Design Temp
Temperate	Southern Europe, US Southeast, Central China	Q235B / S235JR	-20°C
Cold	Northern Europe, Northern China, Korea	Q355B / S355J2	-20°C
Sub-Arctic	Scandinavia, Canada, Northern Russia	Q355C / Q355D	0°C / -20°C
Arctic	Alaska, Siberia, Northern Canada	Q355D / Q355E	-20°C / -40°C
Tropical	Southeast Asia, Brazil, West Africa	Q235B + coating	+5°C

9. Global Steel Grade Cross-Reference Table

This table enables rapid grade matching across the four major steel standards used in international construction and procurement.

GOST (CIS)	EN (Europe)	ASTM (USA)	JIS (Japan)	GB/T (China)	Strength Class
St3sp	S235JR	A36	SS400	Q235B	C245
St3sp5	S275JR	—	SS400	Q255A	C255
09G2S	S355J2	A572 Gr.50	SM490A	Q355B	C345
10HSND	S355K2+N	A709 Gr.50W	—	Q345NH	C355
15HSND	S460ML	A913 Gr.65	—	Q460C	C390
—	S235J0	—	—	Q235C	—
—	S355J0	—	—	Q355C	—

10. Chinese GB Steel Grades for Export

Chinese mills produce to GB/T standards that are technically equivalent to ASTM and EN grades. Understanding the Chinese grade designation system is essential for specification writing and supplier qualification. [Our engineers](#) assist buyers in translating project specifications into Chinese mill orders.

GB/T Grade Designation System

Prefix	Meaning	Example
Q	"Qūfú" (Yield strength in MPa)	Q235 = 235 MPa yield
Number	Minimum yield strength, MPa	Q355 = 355 MPa yield
Suffix (A–E)	Impact test temperature	B = +20°C, C = 0°C, D = -20°C, E = -40°C

GOST → GB Grade Mapping with Properties

GOST Grade	GB Grade	Standard	Tensile	Yield	Impact Temp
St3sp	Q235B	GB/T 700	370–500	235	+20°C
09G2S	Q355B	GB/T 1591	470–630	355	+20°C
09G2S (cold)	Q355C	GB/T 1591	470–630	355	0°C
09G2S (arctic)	Q355D	GB/T 1591	470–630	355	-20°C
09G2S (extreme)	Q355E	GB/T 1591	470–630	355	-40°C

Impact Class Selection Guide

GB Impact Class	Test Temperature	Recommended Markets
Q355B	+20°C	Middle East, Southeast Asia, Southern Europe, Africa
Q355C	0°C	Central Europe, Northern China, Japan, Korea
Q355D	-20°C	Northern Europe, Canada, Russia, Kazakhstan, Mongolia
Q355E	-40°C	Alaska, Siberia, Arctic projects

Critical Procurement Notes

1. **Mechanical Property Variance:** Even with similar chemical composition, mechanical properties may vary slightly due to melting and rolling process differences. For safety-critical structures, specify steel with a margin above calculated strength requirements.
2. **Certification:** Chinese mills provide Mill Test Certificates (MTC) with mechanical properties correlated to GOST 27772 strength classes (C255, C355) or ASTM/EN equivalents for international projects. [Independent NDT verification](#) is available through Metal Asia.
3. **Low-Temperature Applications:** For sustained service temperatures below -40°C, specify Q355E or transition to specialty nickel-alloyed grades (consult our engineering team).

[Additional guidance on international steel sourcing](#) is available in our FAQ section.

11. Metal Asia Quality Assurance Services

Material grade verification is the cornerstone of structural steel procurement. A misidentified grade — or a sub-grade substituted without disclosure — can compromise structural integrity and expose project stakeholders to liability. Metal Asia's quality assurance protocol eliminates this risk.

Our Material Verification Services

Service	Scope	Deliverable
Mill Certificate Audit	Independent verification of MTC against order specifications	Compliance report with red-flag analysis
Spectrometric Analysis	On-site chemical composition testing (C, Mn, Si, S, P, micro-alloys)	Lab report with grade confirmation
Mechanical Testing	Tensile, Charpy impact, hardness testing at certified labs	Test certificates per ISO 17025

Service	Scope	Deliverable
Dimensional Survey	Full cross-section measurement (height, flange width, web thickness)	Dimensional compliance report
Pre-Shipment Inspection	Visual + NDT inspection at mill before release	Release certificate with photo documentation

Procurement Support

- **Grade selection consulting** — Q235B vs. Q355B/C/D/E based on project climate zone and design codes
- **Standard cross-reference** — GOST, ASTM, EN, GB grade mapping for specification documents
- **Mill qualification** — ISO 9001, ISO 14001, CE marking capability verification
- **Documentation package** — Full traceability from heat number to shipping mark

[Logistics management](#) | [Payment terms](#) | [Request Mill Audit](#)

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Specializes in mill audits across China's steel-producing provinces, cross-standard steel grade matching (GOST/ASTM/EN/GB), and oversized cargo logistics. **Core principle:** «A steel grade is not just a designation — it is the materialization of the structural engineer's calculations. Q235B for temperate climates, Q355D for the Arctic. We verify chemical composition with a handheld spectrometer on the mill floor — before the truck is loaded. No exceptions, no surprises.»



REQUEST A MILL AUDIT

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