

Structural Steel - S275, S355 Chemical Composition, Mechanical Properties and Common Applications

Structural steel is a standard construction material made from specific grades of steel and formed in a range of industry-standard cross-sectional shapes (or 'Sections'). Structural steel grades are designed with specific chemical compositions and mechanical properties formulated for particular applications.

In Europe, structural steel must comply with the European Standard EN 10025, which is governed by the European Committee for Iron and Steel Standardization (ECISS), a subset of the European Committee for Standardization (CEN).

In line with the European Standard classifications, structural steels must be referenced using standard symbols including but not limited to S, 235, J2, K2, C, Z, W, JR, and JO, where:

- 'S' denotes the fact that it is structural steel.
- '275' which relates to the minimum yield strength of the steel (tested at a thickness of 16mm).
- 'J2', 'K2', 'JR', and 'JO' all demonstrate the material toughness in relation to the Charpy impact or 'V' notch test methodology.
- 'W' is weathering steel (atmospheric corrosion-resistant).
- 'Z' represents structural steel with improved strength perpendicular to the surface.
- 'C' is cold-formed.

Depending on the manufacturing process, chemical composition and relevant application, further letters and classifications might be used to reference particular grades or products of structural steel.

The EU standard classifications are not a global standard and therefore a number of corresponding grades with the same chemical and mechanical properties may be used in other parts of the world. For example, structural steels fabricated for the US market must be specified in accordance with the American Society for Testing and Materials (ASTM). International guidelines are referenced with an 'A' and then the relevant grade, for example, A36 or A53.

EU and US Equivalent Grades

EU	US
S235	A283C
S275	A570Gr40
S355	A572Gr50

In most countries, structural steel is regulated and must meet a minimum specific criterion for shape, size, chemical composition and strength.

The chemical composition of structural steel is extremely important and highly regulated. It is a fundamental factor which defines the mechanical properties of the steel. In the following table, you can see the maximum percentage levels of certain regulated elements present in European structural steel grades S275, and S355.

Chemical Composition of Structural Steels - S275 and S355

The Chemical composition of Structural Steel is extremely important and highly regulated. It is a fundamental factor which defines the Mechanical properties of the steel material. In the following table you can see the Max % levels of certain regulated elements present in European Structural steel grades S275 and S355.

EU Grade	C%	Mn%	P%	S%	Si%
S275	0.25 max	1.60 max	0.04 max	0.05 max	0.05 max
S355	0.23 max	1.60 max	0.05 max	0.05 max	0.05 max

Mechanical Properties of Structural Steel - S275, S355

The mechanical properties of structural steel are fundamental to its classification and application. Even though chemical composition is a dominant factor in determining the mechanical properties of steel, it is also very important to understand the minimum standards for the mechanical properties or performance characteristics, such as yield strength and tensile strength, which are described in more detail below.

Yield Strength

The yield strength of structural steel measures the minimum force required to create a permanent deformation in the steel. The naming convention used in European Standard EN10025 refers to the minimum yield strength of the steel grade tested at 16mm thick.

Structural Steel Grade at 16mm	Minimum Yield Strength at nominal thickness 16mm	
	psi	N/mm ² (MPa)
S275	36 000	275 N/mm ²
S355	50 000	355 N/mm ²

Tensile Strength

The Tensile Strength of structural steel relates to the point at which permanent deformation occurs when the material is pulled or stretched laterally along its length.

Structural Steel Grade	Tensile Strength MPa at Nom thickness between 3mm and 16mm
S275	370 – 530 MPa
S355	470 – 630 MPa