BUILDING WITH LGS - STEEL COIL GENERAL INFORMATION

Structural Steel - Steel Grades Explained

The FRAMECAD system used advanced technology to provide a building system with the key competitive advantages of speed maximisation and waste minimisation.

As with all advanced technology using the correct specifications of material and components is essential in the smooth functioning of the technology. FRAMECAD Solution can source and supply all components of your structural building system, including steel.

To ensure your machine runs at peak performance FRAMECAD ensures that all steel supplied has the correct levels of tensile strength and yield as well as ratios of elongation. This maximises your machines performance as well as economising the amount of steel and increasing efficiencies in production.

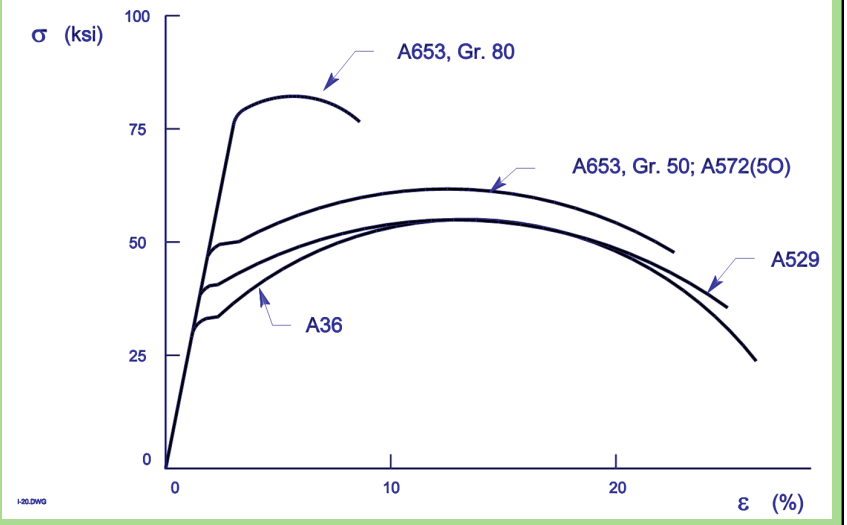
When using FRAMECAD approved steel your yield and steel usage is maximised and you can have confidence in that your structures are compliant to International Standards.

Steel Specifications

The term 'steel specification' is very closely related to 'steel standards' and the terms are often used interchangeably. The standards specify strict parameters or boundaries on the finished steel's chemical composition and/or mechanical properties. (JIS, ASTM, AISI, etc.)

Some of the typical mechanical properties and tolerances that may be specified, are minimum tensile strength, minimum yield strength, minimum ductility, and toughness.

Other material properties may not appear in a specification, yet are critical in building design; the most important such property is perhaps the elastic modulus, or stiffness. The reason that this does not appear in specifications because there is little variability amongst the various steels.



Tensile Strength and Elasticity Comparison by Grade
The above graph shows the relative elongation, yield, tensile and ultimate points of Gr.80 and Gr.50.

The following are the general characteristics of the steel standards recommended as the base specifications for galvanised slit coil used in FRAMECAD machines:

Japanese International Standard (JIS) and equivalent ASTM Standards						
Steel Thickness	Standard	Grade	Tensile Strength MPa (Ksi)	Yield Point MPa (Ksi)	Ft/Fy	Elongation (min)
1.15mm and less	ASTM A653	(SS) Gr.80	570 (82)	550 (80)	1.04	(**) N/A
	JIS G3302	SGC570	570 (83)	560 (81)	1.02	(**) N/A
Over 1.15mm	ASTM A653	(SS) Gr.50	450 (65)	340 (50)	1.32	12
	JIS G3302	SGC490	490 (70)	365 (53)	1.34	16
FL650 Floor Joist*	JIS G3302	SGC440	440	335	1.31	18

* The FL650 Floor Joist Machine requires Steel with a higher targeted elongation.
** Specification does not specified minimum elongation requirements.

STRUCTURAL STEEL - MECHANICAL PROPERTIES

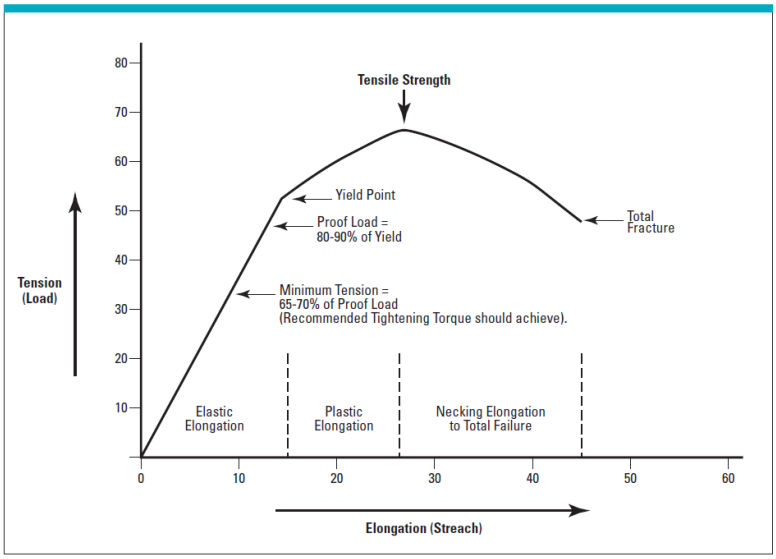
The following are the key property of Structural Steel and their definitions, also each is discussed with relevance to how each characteristic affects how steel performs in structural applications:

Elasticity

The elasticity of the steel is shown by the elongation which takes place in direct proportion to the load. Elasticity is important in structural steel because it indicates the level amount the steel can deform 'elastically' and then return to its original shape once the force or stress is removed.

Using steel with high elasticity values allow the completed steel structure to "*move and flex without permanent structural damage".* Materials are considered to flex *'elastically'* until they reach their Yield Point.

Typical Tension/Elongation Chart



Yield Strength (also Yield Point)

In practice, this is the material property of greatest importance for characterising a particular steel grade, commonly referred to as Yield Strength (*Fy*). Yield strength is measured in ksi or MPa.

The **yield strength** of a material is the materials 'elastic limit', and is defined in engineering and materials science as *"the level of stress at which a material begins to deform plastically"*. Beyond this 'elastic limit', some fraction of the deformation will be permanent and non-reversible, a structural component with permanent deformation is considered 'damaged' and may be deemed 'unsafe' or 'unsound'.

"For structural applications plastic deformation is unacceptable because it means that the structure has been damaged permanently - Yield Strength is therefore used as the design limitation of steel."

Tensile Strength (or Ultimate Strength)

After the Yield Point, ductile materials will undergo a period of 'strain hardening', in which the stress point (or tensile strength) increases again with the increasing strain until at a certain point the steel will typically begin to 'neck'. Necking is when the materials cross sections starts to contract rapidly.

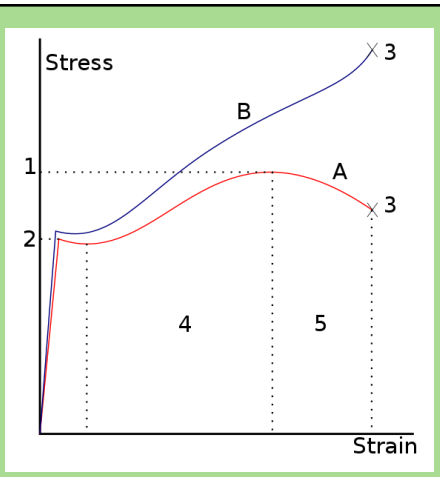
The Tensile Strength is the maximum stress a material can withstand while being stretched or deformed before 'necking' takes place.

When necking is substantial it causes the stress strain curve to curve downwards - this is because the curve measures the *'Engineering Stress'* which is calculated using the original cross section area and does not take into account the 'necking' or 'narrowing' of the sample cross section.

The *'True Stress'* curve shows the increasing 'hardness' of the steel taking into account the proportionate change in the cross section during necking.

Ultimate Failure

The Ultimate Failure describes the breaking point of the material. In Structural Steel this is typically 'fracture'. The fracture of a material occurs when either an internal or external crack elongates the width or length of the material, ultimately resulting in a complete break of the material.



Stress vs. Strain Curve typical of Structural Steel

1. Ultimate strength
2. Yield strength
3. Fracture
4. Strain hardening region
5. Necking region

A: Engineering stress
B: True stress

STEEL COIL STRIP WIDTHS & WEIGHTS PER LINEAL METRE

Kilogram Weight Per Lineal Metre for Standard Coil Strip Widths and Thicknesses								
Profile Width (Web)			65mm	75mm	89mm	100mm	150mm	254mm
Strip/Feed Width[3]			158mm	168mm	182mm	194mm	242mm	369mm
BMT[4]	TCT[5]	Gauge[1]	Weight per Lineal Metre[2]					
0.55mm	0.6mm	25	0.682	0.725	0.786	0.838	1.045	1.594
0.75mm	0.8mm	22	0.930	0.989	1.072	1.142	1.425	2.174
0.95mm	1.0mm	20	1.178	1.253	1.357	1.447	1.805	2.754
1.15mm	1.2mm	18	1.426	1.517	1.643	1.751	2.185	3.334
1.55mm	1.6mm	16	1.922	2.044	2.214	2.360	2.945	4.493
1.95mm	2.0mm	14	2.419	2.572	2.786	2.970	3.704	5.653

Note 1: Gauge references are closest equivalent gauge measurement to metric BMT.
Note 2: Weights based AISC definition of the weight of Structural Steel at 7,870kg per m3.
Note 3: Above strip widths assume constant flange and lips of 39/41mm and 10mm.
Note 4: BMT or Base Metal Thickness is before any coating is applied and is used for all engineering calculations.
Note 5: TCT or Total Coated Thickness is approximate thickness after coating is applied (used when referring to Mass)