

Items in bold are Terms in the Glossary

Term	Explanation
<b>200 Series</b>	A group of <b>austenitic</b> stainless steels derived from the AISI numbering system. Based on substituting <b>manganese</b> for <b>nickel</b> to provide the austenitic structure.
<b>300 Series</b>	A group of <b>austenitic</b> stainless steels derived from the AISI numbering system. Based on the use of <b>nickel</b> to provide the austenitic structure.
<b>400 Series</b>	A group of <b>ferritic</b> and <b>martensitic</b> stainless steels derived from the AISI numbering system. Characterised by no or low <b>nickel</b> .
<b>Acid Corrosion</b>	Also called <b>general corrosion</b> . Characterised by uniform metal loss. Contrast with <b>pitting corrosion</b> .
<b>Alloy</b>	A combination of two or more <b>metals</b> or other <b>elements</b> . <b>Steel</b> is an <b>alloy</b> of <b>iron</b> and <b>carbon</b> .
<b>Alumina</b>	Aluminium oxide (AL <sub>2</sub> O <sub>3</sub> ). An abrasive used on polishing belts and wheels to give a directional polish. On a micro-level gives a non-uniform appearance. Prone to trapping contaminants and giving disappointing results in external architectural applications.
<b>Aluminium</b>	An element (symbol AL) used to improve <b>oxidation</b> resistance in <b>ferritic</b> stainless steels and strength in <b>precipitation hardening</b> steels.
<b>Annealing</b>	A general term in <b>heat treatment</b> usually referring to a softening process.
<b>AOD Vessel</b>	Argon oxygen decarburisation vessel. A development in the refining process allowing cheaper production of stainless steel.
<b>Atom</b>	The smallest particle of an <b>element</b> .
<b>Austenitic</b>	The most common type of stainless steels. The austenitic structure gives the characteristic properties of this type including: <b>Formability</b> <b>Weldability</b> <b>Work hardening</b> <b>Non-magnetic</b> At an atomic level austenitic is a face centred cubic structure.
<b>Billet</b>	The starting point for the production of long products such as <b>rod</b> . May be <b>continuously cast</b> or rolled from <b>ingot or bloom</b> . Typical section size 150 mm.
<b>Bloom</b>	The starting point for the production of long products such as <b>bar</b> and <b>rod</b> . May be <b>continuously cast</b> or rolled from <b>ingot</b> . Typical section size 300-400 mm.
<b>Breareley</b>	Harry Breareley is the Sheffield metallurgist connected with the invention of stainless steel.
<b>Bright annealing</b>	The softening of stainless steel in an inert atmosphere to preserve the bright cold rolled surface.
<b>Brittle</b>	Showing low level of energy absorbed in an <b>impact toughness</b> test.
<b>Carbon</b>	The essential <b>element</b> (symbol C) added to <b>iron</b> to make <b>steel</b> . In stainless steel, the range of <b>carbon</b> content is very wide from about 0.015-1% depending on the properties required.
<b>Casting</b>	A product that is used in the as-cast condition, that is without mechanical working. The main benefit is that intricate shapes can be formed by pouring liquid metal into a mould. Castings have poorer mechanical properties compared to wrought products due to their coarser microstructure.
<b>Chemical symbol</b>	An abbreviation of the name of an element. <b>Chromium</b> = Cr.
<b>Chloride</b>	A type of <b>ion</b> , symbol CL, which is among the most common chemical species to be detrimental to the passive film on stainless steel. Seawater contains about 3% NaCL (sodium chloride). Chloride can cause <b>pitting corrosion</b> , <b>crevice corrosion</b> and <b>stress corrosion cracking</b> .
<b>Chromium</b>	The metallic <b>element</b> (symbol Cr) which is in all stainless steels. Forms a passive oxide layer which prevents <b>corrosion</b> .

<b>Compound</b>	A combination of two or more <b>elements</b> which is quite different in nature to any of the constituents.
<b>Continuous casting</b>	A method of casting allowing continuous casting of <b>slab, bloom</b> or <b>billet</b> . Reduced cost and improved yield compared to individual <b>ingot</b> casting.
<b>Continuously Produced Plate (CPP)</b>	Plate cut from hot rolled coil. A maximum thickness of about 13 mm in widths of up to 2000 mm can be produced via this process route. Sometimes called coil plate.
<b>Copper</b>	<b>Element</b> (symbol Cu) normally found in all steels in small quantities. Deliberately added to stainless steel to improve resistance to acids such as sulphuric acid and to lower the work hardening for cold heading of fasteners.
<b>Corrosion</b>	The attack of a <b>metal</b> or <b>alloy</b> by a chemical substance. It is electrochemical in nature.
<b>Creep</b>	A type of deformation which depends on the time as well as the <b>steel</b> applied. In steels, this phenomenon is important above about 550°C.
<b>Crevice Corrosion</b>	A type of <b>corrosion</b> resulting from the exclusion of oxygen from between tightly contacting surfaces.
<b>Critical Crevice Temperature (CCT)</b>	The temperature at which a stainless steel starts to show <b>crevice corrosion</b> in a standard laboratory solution. Used for comparing stainless steels.
<b>Critical Pitting Temperature (CPT)</b>	The temperature at which a stainless steel starts to show <b>pitting corrosion</b> in a standard laboratory solution. Used for comparing stainless steels.
<b>Crystal</b>	A structure which, at the atomic level, has a regular arrangement of <b>atoms</b> .
<b>Deep Drawing</b>	A method of forming involving pressing a sheet into a hollow mould without restraining the outer edges of the sheet. Compare with <b>stretch forming</b> .
<b>Ductile</b>	Two distinct meanings: <ol style="list-style-type: none"> <li>1) A material is said to be ductile if it shows a high level of elongation in the <b>tensile</b> test.</li> <li>2) A material is said to be ductile if it shows a high level of absorbed energy in an <b>impact toughness</b> test.</li> </ol>
<b>Ductile/Brittle Transition Temperature</b>	The temperature at which a series of impact test specimens shows 50% <b>brittle</b> and 50% <b>ductile</b> fracture surfaces.
<b>Duplex</b>	A type of stainless steel having approximately 50% <b>austenite</b> and 50% <b>ferrite</b> . This gives it higher strength than either structure on its own.
<b>Elongation</b>	In a <b>tensile test</b> , the % increase in the gauge length on the test sample.
<b>En</b>	“Emergency number”. An obsolete (from 1970) type of grade used in British standards. It is still used mainly because many drawings and specifications in use date back before the official date of obsolescence.
<b>EN Standard</b>	European Norm. EN Standards are published in the main European languages by each national standards body. BS EN is published by British Standards in English. DIN EN in German and AFNOR EN in French.
<b>Ferritic</b>	A type of stainless steel based on <b>chromium</b> and only small additions of other <b>elements</b> . At an atomic level ferritic is a body centred cubic structure.
<b>Forging</b>	The deformation of metal usually from high temperature. Open-die forging allows a rough approximation of the final shape to be achieved. Closed-die forging or drop forging using a mould allows a shape much closer to the final shape to be achieved.
<b>Formability</b>	Loose term covering a wide range of processes. Generally it means the ability to be formed into complex shapes. Formability is dependent on the grade of steel, its <b>mechanical properties</b> and the forming operation. It is important to note that formability in one type of operation may not carry over to another. <b>Stretch forming</b> and <b>deep drawing</b> are examples of forming operations.
<b>Formula</b>	Shorthand way of writing a <b>compound</b> . Example Fe <sub>2</sub> O <sub>3</sub> is <b>iron</b> oxide.
<b>Galvanic corrosion</b>	A type of <b>corrosion</b> involving the contact of dissimilar metals joined by an electrolyte. In some circumstances stainless steel and aluminium in contact can accelerate the corrosion of the aluminium.

<b>Grade</b>	A type of <b>steel</b> or other metallic <b>alloy</b> with defined chemical composition limits.
<b>Grit size</b>	The nominal size of abrasive particles on a polishing belt or wheel. 180, 240 and 320 are common grit sizes. The abrasive material eg <b>alumina</b> or <b>silicon carbide</b> is important in determining the surface roughness.
<b>Hardness</b>	The ability of a material to withstand the indentation by a hardened steel or diamond indenter. Methods of hardness testing include Brinell, Vickers and Rockwell. Charts showing conversions between different methods and conversion to <b>UTS</b> should be treated with caution.
<b>Heat treatment</b>	The use of heating and cooling of a substance usually with the intention of modifying its <b>microstructure</b> and therefore its <b>mechanical properties</b> . Heat treatments relevant to stainless steel include: <b>Solution annealing</b> <b>Quenching</b> <b>Tempering</b> <b>Stress relieving</b> <b>Precipitation hardening</b>
<b>Ion</b>	An <b>atom</b> or <b>molecule</b> which has an excess or lack of electrons thereby giving it a positive or negative electric charge.
<b>Impact toughness</b>	The ability of a material to resist a sudden impact. Measured in the Charpy test by allowing a swinging hammer to hit a small notched sample and measuring the distance swung after the impact. All steels except austenitic types show a sudden loss of impact toughness at low temperatures.
<b>Ingot</b>	A discrete lump of cast metal poured into individual moulds. Depending on shape can be further rolled into <b>slab</b> or <b>bloom</b> . Also used in <b>forging</b> .
<b>Intergranular corrosion</b>	A form of <b>corrosion</b> caused by the formation of chromium carbide which reduces the <b>chromium</b> content of the steel below that required to form the <b>passive film</b> .
<b>Iron</b>	Metallic <b>element</b> (symbol Fe) which is the basis for all <b>steels</b> . In its pure form it is soft.
<b>Lattice</b>	A pattern or regular arrangement of <b>atoms</b> often in a simple geometric shape such as a cube or prism.
<b>Lean Duplex</b>	An imprecise term applied to <b>duplex</b> stainless steels with a lower alloy content than 2205 (1.4462) grade duplex steel.
<b>Magnetic Permeability</b>	More accurately Relative Magnetic Permeability. A measure of a material's ability to be attracted by a magnet. A relative magnetic permeability of 1 means completely non-magnetic.
<b>Manganese</b>	<b>Element</b> (symbol Mn) normally found in all steels. Added to stainless steel as an alternative to <b>nickel</b> to give the <b>austenitic</b> structure in the <b>200 series</b> .
<b>Martensitic</b>	A type of stainless steel based on <b>chromium</b> and small additions of other elements. Levels of <b>carbon</b> can be high, allowing the quenching and tempering of the steel to very high strength.
<b>Molecule</b>	The smallest particle of a <b>compound</b> . A molecule contains 2 or more <b>atoms</b> .
<b>Metal</b>	An <b>element</b> that is usually shiny, easy to form, conducts heat and electricity well.
<b>Molybdenum</b>	Metallic <b>element</b> (symbol Mo) used to improve resistance to <b>pitting</b> and <b>crevice corrosion</b> in stainless steels.
<b>Multiple Certification</b>	The practice of certifying a batch of steel to more than one grade or standard. Allows more efficient production in the melting shop and more flexibility at the stockholder. Common examples are: 1.4301/1.4307 (304/304L) 1.4401/1.4404 (316/316L) EN 10088-2/EN 10028-7 EN 10088-2/ASTM A240 EN 10088-3/BS 970
<b>Nanometre</b>	One-millionth of a millimetre or $10^{-9}$ metres. The <b>passive film</b> on stainless steel is a few nanometres thick.

<b>Nickel</b>	Metallic <b>element</b> (symbol Ni) used in stainless steel to give improved <b>weldability</b> and <b>formability</b> . Also improves high temperature <b>oxidation</b> resistance.
<b>Niobium</b>	A metallic element (symbol Nb) used in stainless steels to prevent formation of chromium carbide which can lead in turn to <b>intergranular corrosion</b> .
<b>Nitrogen</b>	An element (symbol N) which is used to give higher strength, increased <b>pitting corrosion</b> resistance and lower <b>magnetic permeability</b> in stainless steels.
<b>Oxidation</b>	The high temperature combination of a <b>metal</b> or <b>alloy</b> with oxygen in the atmosphere.
<b>Passivation</b>	The process of forming the <b>passive film</b> on the surface of stainless steel. Stainless steel passivates in normal atmospheric conditions. However passivation can be accelerated using acids such as nitric or citric.
<b>Passive Film</b>	The <b>chromium</b> oxide layer that forms on stainless steel to give it <b>corrosion</b> resistance.
<b>Pickling</b>	The removal of high temperature oxide from the surface of stainless steel. High temperature oxide is formed during processes such as hot working and welding. If left un-pickled high temperature oxide reduces corrosion resistance. Strong acids such as a mixture of nitric and hydrofluoric are commonly used.
<b>Pitting Corrosion</b>	<b>Corrosion</b> characterised by local attack. Caused by chemical species notably <b>chloride ions</b> . Contrast with general corrosion.
<b>Pitting Resistance Equivalent Number (PREN)</b>	A measure of the ability of a stainless steel to resist <b>pitting corrosion</b> . Calculated from the formula: $PREN = \%Cr + 3.3 \times (\%Mo + 0.5 \times \%W) + 16 \times \%N$
<b>Polished</b>	An overall term covering wide range of surface finishes on stainless steel including <b>dull polished, satin polished, bright polished</b> . In defining a polished finish it is advisable to use <b>surface roughness, Ra</b> , to describe the required finish.
<b>Precipitation Hardening</b>	A heat treatment in certain special steels which forms tiny particles leading to high strength.
<b>Proof Stress</b>	In a <b>tensile test</b> , stress at which the sample shows a particular strain, often 0.2%. Used in place of a defined yield stress.
<b>Quarto Plate</b>	Hot rolled plates made from rolled <b>slab</b> on a reversing mill. Quarto plates remain flat throughout processing. Thicknesses of up to 150 mm can be produced by this method. Contrast with <b>Continuously Produced Plate</b> .
<b>Ra</b>	A measure of surface roughness. An important factor in determining the <b>corrosion</b> resistance of a stainless steel surface. Measured in micron = one thousandth of a millimetre. An Ra of <0.5 micron is regarded as acceptable for external architectural applications.
<b>Residual Element</b>	An element which is not deliberately added to stainless steel. These elements cannot be removed during the steelmaking process. Copper, tin, zinc and lead are examples.
<b>Rust</b>	<b>Iron</b> oxide. The produce of corrosion in steels.
<b>Sensitisation</b>	The precipitation of <b>chromium carbide</b> as a result of holding stainless steel at temperatures around 650°C. Can give rise to <b>intergranular corrosion</b> . Prevented by using low <b>carbon</b> <0.030% or using <b>titanium</b> or <b>niobium</b> to combine preferentially with <b>carbon</b> .
<b>Silicon</b>	<b>Element</b> (Symbol Si) normally found in all steels. Added to stainless steel for high temperature oxidation resistance.
<b>Silicon carbide</b>	SiC. An abrasive used on polishing belts and wheels to give a directional polish. On a micro-level gives a uniform appearance. For the same grit size gives a much better <b>corrosion</b> performance than <b>alumina</b> .
<b>Steel</b>	An <b>alloy</b> of <b>iron</b> and <b>carbon</b> . Other elements added to steel to improve the mechanical properties include <b>chromium, nickel, molybdenum</b> and <b>manganese</b> .

<b>Steel Name</b>	In the EN Standards, this is a long description of a <b>grade</b> of steel. For example, X5CrNi18-10. This is the Steel Name for Steel Number 1.4301. The X = stainless. Cr and Ni show the main <b>elements</b> and the 18 10 show the approximate contents of the <b>elements</b> .
<b>Steel Number</b>	In the EN Standards, this is the short description of <b>grade</b> of steel. For example, 1.4301. The number is partly meaningful. The first “1” indicates steel. “4” indicates a stainless steel. The last 3 digits are effectively arbitrary.
<b>Strain</b>	The increase per unit length when a material has a <b>stress</b> applied to it.
<b>Stress</b>	The load applied to a material divided by the area over which it is applied. Common units of stress include:  N/mm <sup>2</sup> = Newtons per square millimetre MPa = Megapascals (identical to N/mm <sup>2</sup> ) These are used in EN Standards  tsi = tons per square inch This was used in the old BS standards  psi = pounds per square inch ksi = thousands of pounds per square inch Used in American standards
<b>Stress Corrosion Cracking</b>	A type of <b>corrosion</b> requiring a tensile <b>stress</b> , a sufficiently high temperature and a corrosive environment.
<b>Stretch Forming</b>	A method of forming involving pressing a sheet into a hollow mould whilst restraining the outer edges of the sheet allowing stretching to occur. Compare with <b>deep drawing</b> .
<b>Sulphur</b>	An <b>element</b> (symbol S) used to improve the machinability of steels. In genuine free-machining steels a content of at least 0.15% S is used.
<b>Superduplex</b>	A generic term applied to <b>duplex</b> stainless steels with at least 25% <b>chromium</b> .
<b>Tempering</b>	A <b>heat treatment</b> usually following a hardening operation which softens <b>martenistic</b> steels to provide a useful combination of strength and <b>ductility</b> .
<b>Temper Rolling</b>	A rather misleading term meaning cold working to produce an increase in strength. Stainless steel can be supplied in a number of “tempers” eg quarter hard, half hard, three quarter hard, full hard. These correspond to increasing levels of strength/hardness and decreasing elongation and therefore formability.
<b>Tensile Test</b>	A mechanical test involving the slow pulling apart of a standard test sample. The test measures: 0.2% <b>Proof Stress</b> <b>Ultimate Tensile Stress (UTS)</b> <b>Elongation</b>
<b>Thermal Conductivity</b>	The ability of a material to allow heat to pass through it. <b>Austenitic</b> stainless steels have a lower value than <b>ferritic</b> stainless steels or <b>carbon</b> steels.
<b>Thermal Expansion Coefficient</b>	The measure of the increase in size of a material with increased temperature. <b>Austenitic</b> stainless steels have a higher value than <b>ferritic</b> stainless steels or <b>carbon</b> steels.
<b>Titanium</b>	A metallic element (symbol Ti) used in stainless steels to prevent formation of <b>chromium</b> carbide which can lead in turn to <b>intergranular corrosion</b> .
<b>Tungsten</b>	A metallic <b>element</b> (symbol W) used to improve <b>pitting corrosion</b> in some <b>duplex</b> stainless steels.
<b>Ultimate Tensile Stress (UTS)</b>	In a <b>tensile test</b> , the maximum stress measured on the sample before the sample fractures.

## Glossary of Terms Relevant to Stainless Steel

White Bros Ltd

Phone: 0191 2130455 Fax: 0191 2841351( [www.whitebros.co.uk](http://www.whitebros.co.uk))

<b>Weldability</b>	A general term meaning that a material can be welded without requiring pre-heating or post-heating, tight control of welding parameters and resulting in welds with good mechanical properties. <b>Austenitic</b> stainless steels are regarded as having good weldability as they can be welded in a wide range of section thicknesses. <b>Ferritic</b> steels are less so as they can only be welded in thin sections. <b>Duplex</b> steels can be welded with care required in selection of welding consumables and control of welding parameters. <b>Martensitic</b> steels are not easily welded and often need pre-heating and post-weld heat treatment. Low carbon martensitic steels have been developed to avoid pre and or post heating.
<b>Weld Decay</b>	Equivalent to <b>intergranular corrosion</b> . So called because early high <b>carbon</b> stainless steels were found to corrode near welds due to <b>chromium carbide</b> precipitation.
<b>Work Hardening</b>	The property of inducing increased strength to a material as it is being deformed. Also called cold working or <b>temper rolling</b> . <b>Austenitic</b> stainless steels have a high degree of work hardening.
<b>Young's Modulus</b>	The ration of <b>stress</b> to <b>strain</b> on the straight line portion of a stress-strain curve in a tensile test. Does not change much with grade.