GLOSSARY OF STEEL TERMS

Abrasion — The process of rubbing, grinding or wearing away steel by friction.

Aging — In a metal or alloy a change in properties that generally occurs slowly at room temperature and more rapidly at higher temperatures.

Alloy — A mixture with metallic properties composed of two or more elements of which at least one is a metal.

Alloy Elements — Alloy elements in steel would be chromium, cobalt, nickel, molybdenum, tungsten and vanadium. These are added to steel to modify its properties. Other common elements added are copper, aluminum, titanium, columbium and boron. In each case established minimum percentages must be met to qualify the element as an alloy addition.

Annealing — The term annealing usually implies relatively slow cooling in a heat treating furnace. The more important purposes for which steel is annealed are as follows: to remove stresses, to induce softness, increase ductility and increase electrical and magnetic properties.

Anodizing — Forming of a conversion coating on a metal surface by anodic oxidation most frequently applied to aluminum.

As Rolled — A term used to describe steel bars or plate that are hot rolled only without any subsequent heat treating operation.

Bend Radius — The inside radius of a bent section.

Brinell Hardness — A test for determining the hardness of a metal by forcing a hard steel or carbide ball of specified diameter into the surface of the steel. The hardness number is a number in direct proportion to the diameter of the hole.

Carbon Equivalent — Various formulas used to determine the weldability of steel by adding the percentage of carbon plus the equivalent carbon of the other elements. It is assumed that if the carbon equivalent (CE) is not more than .45% the steel is considered weldable without preheating or postheating.

Carburizing — Increasing the surface carbon content of steel in a heat treating furnace. This process is used to increase water resistance.

Case Hardening — A heat treatment method of surface treating steel for wear resistance. The most common methods would be carburizing and nitriding. Both of these elements are added to the surface of the steel to increase wear resistance. The other two methods are flame hardening and induction hardening with electrical current.

Charpy — An impact test to determine the toughness of steels conducted on a Charpy Impact Machine. The test is conducted on a small steel bar with a V-notch. The test is abbreviated CVN.

GLOSSARY OF STEEL TERMS *(Continued)*

Coil Breaks — Creases or ridges across a metal sheet transverse to the direction of coiling occasionally occurring when the metal has been coiled hot and uncoiled cold.

Cold Drawing — Reducing the cross section of steel bars by pulling the steel through a die of reduced size, usually 1/32". This process is done at ambient temperatures and is used to enhance the surface appearance, produce close tolerances and increase machinability.

Cold Rolling — Reducing the thickness of steel by rolling or ironing the steel below the recrystallization temperature. This method is used for sheet steel to produce lighter gauges and increase surface finish appearance.

Cold Working — Any method used to plastically deform or reduce the thickness or cross sectional size of steel at ambient temperatures.

Corrosion — The deterioration of a metal by chemical or electrochemical reaction with its environment.

Crown — A contour on a sheet or roll where the thickness or diameter increases from edge to center.

Decarburization — A loss of carbon on the surface of steel which accelerates at temperatures above 1400 degrees F. All steels which are hot rolled, forged or heat treated in furnaces without controlled atmosphere will have a decarburized surface.

Deep Drawing — A process for stretching sheet steel in a die with a punch which is mounted in a stamping press.

Ductility — The ability of a material to deform plastically without fracturing. It is commonly evaluated by tensile testing.

Elastic Limit — The greatest unit stress to which a material may be subjected without permanent deformation remaining upon complete release of the stress.

Elongation — The percentage increase in the gauge length of a tensile specimen after it has been tension tested to failure.

Fatigue — The phenomenon leading to fracture under repeated or fluctuating stresses having a maximum value less than the tensile strength of the material.

Ferrite — Technical terms for the two types of iron occurring in steel.

Flame Hardening — Heating the surface of steel to its hardening temperature range and then immediately quenching the surface with water or a synthetic quenchant.

Forging — Plastically deforming metal, usually hot, into desired shapes with compressive force, with or without dies.

GLOSSARY OF STEEL TERMS *(Continued)*

Free Machining — Pertains to the machining characteristics of steel to which an ingredient has been introduced to give small broken chips, lower power consumption, better surface finish and longer tool life.

Galvanizing — In steel terms to hot dip steel in a bath of molten zinc.

Hardenability — The property that determines the depth of hardness of steel after it has been heat treated by quenching and temperature.

Hardness — The ability of metal to resist penetration. The principal methods of hardness testing are the Rockwell and Brinell hardness testers.

Heat Affected Zone (HAZ) — That portion of the base metal which was not melted during grazing, cutting or welding but whose microstructure and physical properties were altered by the heat.

Honing — Removing stock generally on the internal cylindrical surface of a tube with an abrasive tool mounted in a holder.

Hot Rolling — Rolling bars, plate, sheet, structurals through a series of rolls for size reduction or shape at temperatures of 1550 to 2100 degrees F.

Impact Test — A test used to determine the toughness of steel by impact with a falling pendulum. The common test used is the Charpy or Izod impact test which is conducted on specially designed equipment.

Inclusions — Non-metallic impurities in steel in the form of oxides, sulfides, or silicates. These impurities are formed during the solidification of the steel in the ingot molds, or continuously cast blooms, billets or slabs.

Induction Hardening — This is a method of hardening the surface of a steel part electrically with high frequency current. The current is passed through a coil that is held very close to the surface to be hardened and the surface is immediately heated to approximately 1600° F. The surface is immediately quenched with water or a synthetic oil.

Killed Steel — Steel which is deoxidized or degassified in the melting operation to eliminate porosity and produce more sound steel products. Silicon and aluminum are two elements used to eliminate the gases in steel.

Laminations — The general term used for surface or internal defects parallel to the rolled surface of the steel product. Surface defects are slivers and laps; internal lamination is called piped steel and occurs in plate and sheet.

Longitudinal Direction — The principal direction of flow in a worked metal.

Mechanical Properties — Defined as tensile and yield strength, elongation, torsional strength and impact strength.

Modules of Elasticity — The ratio within the limit of elasticity of the stress to the corresponding strain. The stress in pounds per square inch is divided by the elongation in fractions of an inch for each of original gauge length of the specimen.

GLOSSARY OF STEEL TERMS *(Continued)*

Normalizing — Heating steels to approximately 100°F above the critical temperature range followed by cooling to below that range in still air at ordinary temperatures. This heat treat operation is used to erase previous heat treating results in carbon steels and to produce a uniform grain structure in forged and cold worked steel parts.

Orange Peel — A pebble grained surface which develops in forming of metals having coarse grains.

Oxidation — A reaction with oxygen. In the case of steel, oxidation burns the carbon out of the surface of steel if the temperatures are above 1200° F. The resultant surface is termed decarburized.

Physical Properties — Are defined as electrical, magnetic, density coefficient of thermo expansion, etc.

Pickling — A chemical treatment with acids to remove the scale or iron oxides on the surface of hot rolled steel products.

Pitting — Forming small sharp cavities in a metal surface by nonuniform electro-deposition or by corrosion.

Post Heating — Heating the weld and weld area to slow down the rate of cooling to eliminate weld cracking or cracking in the heat affected area.

Pre Heating — A welding term used to designate heating steel to a specific temperature prior to welding to prevent weld cracks.

Quenching — Rapid cooling of a metal during a heat treating operation. The quenching coolant could be water, oil or air. This is the method used to increase the hardness and strength of steel.

Reduction of Area — The percentage reduction of area is the difference between the original cross-sectional area and the least cross-sectional area of a tensile test specimen after rupture.

Rimmed Steel — A method of producing very low carbon steels in an ingot mold by letting the steel form gases and solidify slowly. This results in a pure iron rim on the surface of the ingot which remains on the surface of the rolled product which is generally sheet steel.

Rockwell — Hardness testing device used to measure the resistance of metal to be indented. The numbers usually in Rockwell B or C hardness will designate the relative hardness and strength of the metal.

Scale — A complex iron oxide formed on the surface of steel when it is hot rolled or forged. Iron oxide will start to form at approximately 1100° in air.

Seams — A defect on the steel surface which is always in the rolling direction and appears as a thin crack.

Semi-Killed — Steel that is partially deoxidized where some of the gases from the solidification in the ingot mold are still remaining. Semi-killed steels are intermediate between rimmed and killed.

GLOSSARY OF STEEL TERMS *(Continued)*

Special Killed — Steel that has been completely deoxidized to prevent gases from forming during solidification in the ingot mold. Deoxidizing elements used to remove the gases are aluminum and silicon. The term "killed" is used because such additions cause the steel to be quiet in the molds instead of boiling from the gases.

Tensile Strength — The maximum load per unit of original cross-sectional area obtained before rupture of a tensile specimen.

Trepanning — A type of boring where an annular cut is made into a solid material with the coincidental formation of a plug or solid cylinder.

Transverse — Across, usually signifying a direction or plain perpendicular to the direction of working such as cold drawing or rolling.

Toughness — Ability of a metal to absorb energy and deform plastically before fracturing. It is usually measured by the energy absorbed in a notch impact test. The most common test is the Charpy V-Notch Test.

Yield Point — This is the load per unit area at which the tensile specimen starts to deform or elongate without increase of load. The yield point can also be defined as the stress at which a marked increase in strain occurs without an increase in stress.

Yield Strength — Stress corresponding to some fixed permanent deformation such as .1 or .2% offset from the modulus slope in the tensile test.