# Steel Glossary A-E


**Everything You Always Wanted to Know About Steel...But Were Afraid to Ask - December 2004**

*Michelle Applebaum Research provides this collection of terms and concepts used in our research, company and industry reports, and other steel publications as an invaluable tool for those in the steel industry.*





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**Steel –** *from Merriam-Webster Online*

Pronunciation: *stēl*
Function:*noun*
Etymology: Middle English *stele,* from Old English *style, stEle;* akin to Old High German *stahal* steel and perhaps to Sanskrit *stakati* he resists

**1** commercial iron that contains carbon in any amount up to about 1.7 percent as an essential alloying constituent, is malleable when under suitable conditions, and is distinguished from cast iron by its malleability and lower carbon content

**2** an instrument or implement of or characteristically of steel: as **a :** a thrusting or cutting weapon **b :** an instrument (as a fluted round rod with a handle) for sharpening knives **c :** a piece of steel for striking sparks from flint

**3** a quality (as hardness of mind or spirit) that suggests steel <nerves of *steel*>

**4** **a :** the steel manufacturing industry **b** *plural* **:** shares of stock in steel companies

**A**

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**Agglomerating Processes**

Fine particles of limestone (flux) and iron ore are difficult to handle and transport because of dusting and decomposition. The powdery material is therefore usually processed into larger pieces. The raw material's properties determine the technique that is used by mills.

**Sinter**

Baked particles that stick together in roughly one-inch chunks. Normally used for iron ore dust collected from the blast furnaces.

**Pellets**

Iron ore or limestone particles are rolled into little balls in a balling drum and hardened by heat.

**Briquettes**

Small lumps are formed by pressing material together. Hot Briquetted Iron (HBI) is a concentrated iron ore substitute for scrap for use in electric furnaces.

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**Aging [i]**

A change in the properties of certain metal and alloys (such as steel) that occurs at ambient or moderately elevated temperatures after a hot working heat treatment or cold working operation. Typical properties impacted are: hardness, yield strength, tensile strength, ductility, impact value, formability, magnetic properties, etc.

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**AISI (American Iron and Steel Institute)**

An association of North American companies that mine iron ore and produce steel products. There are 31 member companies and 118 associate members, which include both suppliers and customers that distribute, process, or consume steel. The AISI represents the interests of Canada, Mexico, and the United States.

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**Alloying Element**

Any metallic element added during the melting of steel or aluminum for the purpose of increasing corrosion resistance, hardness, or strength. The metals used most commonly as alloying elements in stainless steel include chromium, nickel, and molybdenum.

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**Alloy Steel**

An iron-based mixture is considered to be an alloy steel when manganese is greater than 1.65%, silicon over 0.5%, copper above 0.6%, or other minimum quantities of alloying elements such as chromium, nickel, molybdenum, or tungsten are present. An enormous variety of distinct properties can be created for the steel by substituting these elements in the recipe.

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**Aluminum Killed Steel (Special Killed) 1**

Steel deoxidized with aluminum in order to reduce the oxygen content to a minimum so that no reaction occurs between carbon and oxygen during solidification.

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**Annealing**

**What?**

A heat or thermal treatment process by which a previously cold-rolled steel coil is made more suitable for forming and bending. The steel sheet is heated to a designated temperature for a sufficient amount of time and then cooled.

**Why?**

The bonds between the grains of the metal are stretched when a coil is cold-rolled, leaving the steel brittle and breakable. Annealing “recrystallizes” the grain structure of steel by allowing for new bonds to be formed at the higher temperature.

**How?**

There are two ways to anneal cold-rolled steel coils: batch and continuous.

1. Batch (Box) Three to four coils are stacked on top of each other, and a cover is placed on top for up to 3 days, then heated in a non-oxygen atmosphere (to prevent rust) and slowly cooled.

2. Continuous. Normally part of a coating line, the steel is uncoiled and run through a series of vertical loops within a heater. The temperature and cooling rates are controlled to obtain the desired mechanical properties for the steel.

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**Apparent Supply**

Derived demand for steel using AISI reported steel mill shipments plus Census Bureau reported imports, less Census Bureau reported exports. Domestic market share percentages are based on this figure, which does not take into account any changes in inventory.

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**Argon-Oxygen Decarburization (AOD)**

**What?**

A process for further refinement of stainless steel through reduction of carbon content.

**Why?**

The amount of carbon in stainless steel must be lower than that in carbon steel or lower alloy steel (i.e., steel with alloying element content below 5%). While electric arc furnaces (EAF) are the conventional means of melting and refining stainless steel, AOD is an economical supplement, as operating time is shorter and temperatures are lower than in EAF steelmaking. In addition, using AOD for refining stainless steel increases the availability of the EAF for melting purposes.

**How?**

Molten, unrefined steel is transferred from the EAF into a separate vessel. A mixture of argon and oxygen is blown from the bottom of the vessel through the melted steel. Cleaning agents are added to the vessel along with these gases to eliminate impurities, while the oxygen combines with carbon in the unrefined steel to reduce the carbon

level. The presence of argon enhances the affinity of carbon for oxygen and thus facilitates the removal of carbon.

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**Attrition**

**What?**

A natural reduction in work force as a result of resignations, retirements, or death.

**Why?**

Most unionized companies cannot unilaterally reduce their employment levels to cut costs, so management must rely on attrition to provide openings that it, in turn, does not fill. Because the median ages of work forces at the integrated mills may be more than 50, an increasing number of retirements may provide these companies with added flexibility to improve their competitiveness.

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**Austenitic**

The largest category of stainless steel, accounting for about 70% of all production. The austenitic class offers the most resistance to corrosion in the stainless group, owing to its substantial nickel content and higher levels of chromium. Austenitic stainless steels are hardened and strengthened through cold working (changing the structure and shape of steel by applying stress at low temperature) instead of by heat treatment. Ductility (ability to change shape without fracture) is exceptional for the austenitic stainless steels. Excellent weldability and superior performance in very low-temperature services are additional features of this class.

Applications include cooking utensils, food processing equipment, exterior architecture, equipment for the chemical industry, truck trailers, and kitchen sinks.

The two most common grades are type 304 (the most widely specified stainless steel, providing corrosion resistance in numerous standard services) and type 316 (similar to 304, with molybdenum added, to increase opposition to various forms of deterioration).

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**Auto Stamping Plant**

A facility that presses a steel blank into the desired form of a car door or hood, for example, with a powerful die (pattern). The steel used must be ductile (malleable) enough to bend into shape without breaking.

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**Automatic Gauge Control**

Using hydraulic roll force systems, steelmakers have the ability to control precisely their steel sheet's gauge (thickness) while it is traveling at more than 50 miles per hour through the cold mill. Using feedback or feed-forward systems, a computer's gap sensor adjusts the distance between the reduction rolls of the mill 50–60 times per second. These adjustments prevent the processing of any off-gauge steel sheet.

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## B

**Baghouse[ii]**

An air pollutant control device used to trap particles by filtering gas streams through large cloth or fiberglass bags.

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**Bake Hardenable Steel**

A cold-rolled, low-carbon sheet steel used for automotive body panel applications. Because of special processing, the steel has good stamping and strength characteristics, and, after paint is baked on, improved dent resistance.

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**Basic Oxygen Furnace (BOF)**

**What?**

A pear-shaped furnace, lined with refractory bricks, that refines molten iron from the blast furnace and scrap into steel. Up to 30% of the charge into the BOF can be scrap, with hot metal accounting for the rest.

**Why?**

BOFs, which can refine a heat (batch) of steel in less than 45 minutes, replaced open-hearth furnaces in the 1950s; the latter required five to six hours to process the metal. The BOF's rapid operation, lower cost, and ease of control give it a distinct advantage over previous methods.

**How?**

Scrap is dumped into the furnace vessel, followed by the hot metal from the blast furnace. A lance is lowered from above, through which blows a high-pressure stream of oxygen to cause chemical reactions that separate impurities as fumes or slag. Once refined, the liquid steel and slag are poured into separate containers.

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**Bar Turning[iii]**

Involves machining a metal bar into a smaller diameter.

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**Bars**

Long steel products that are rolled from billets. Merchant bar and reinforcing bar (rebar) are two common categories of bars, where merchants include rounds, flats, angles, squares, and channels that are used by fabricators to manufacture a wide variety of products such as furniture, stair railings, and farm equipment. Rebar is used to strengthen concrete in highways, bridges, and buildings.

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**Bending 3**

The forming of metals into various angles.

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**Billet**

A semi-finished steel form that is used for "long" products: bars, channels or other structural shapes. A billet is different from a slab because of its outer dimensions; billets are normally two to seven inches square, while slabs are 30 inches to 80 inches wide and two inches to ten inches thick. Both shapes are generally continually cast, but they may differ greatly in their chemistry.

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**Black Plate**

Cold-reduced sheet steel, 12 inches to 32 inches wide, that serves as the substrate (raw material) to be coated in the tin mill.

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**Blast Furnace**

A towering cylinder lined with heat-resistant (refractory) bricks, used by integrated steel mills to smelt iron from iron ore. Its name comes from the "blast" of hot air and gases forced up through the iron ore, coke, and limestone that load the furnace.

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**Blanking**

An early step in preparing flat-rolled steel for use by an end user. A blank is a section of sheet that has the same outer dimensions as a specified part (such as a car door or hood), but that has not yet been stamped. Steel processors may offer blanking for their customers to reduce their labor and transportation costs; excess steel can be trimmed prior to shipment.

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**Bloom**

A semi-finished steel form, with a rectangular cross-section that is more than 8". This large cast steel shape is broken down in the mill to produce the familiar I-beams, H-beams, and sheet piling. Blooms are also part of the high-quality bar manufacturing process: Reduction of a bloom to a much smaller cross-section can improve the quality of the metal.

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**Breakout**

An accident caused by the failure of the walls of the hearth of the blast furnace, resulting in liquid iron or slag (or both) flowing uncontrolled out of the blast furnace.

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**Brownfield Expansion**

A "brownfield" contrasts to a "greenfield" (or a facility new from the ground up). A brownfield expansion means adding on to an existing facility.

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**Burr**

The very subtle ridge on the edge of strip steel left by cutting operations such as

slitting, trimming, shearing, or blanking. For example, as a steel processor trims the sides of the sheet steel parallel or cuts a sheet of steel into strips, its edges will bend with the direction of the cut (see Edge Rolling).

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**Busheling**

Scrap consisting of sheet clips and stampings from metal production. This term arose from the practice of collecting the material in bushel baskets through World War II.

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**Butt-Weld Pipe**

The standard pipe used in plumbing. Heated skelp is passed continuously through welding rolls, which form the tube and squeeze the hot edges together to make a solid weld.

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## C

**Camber 1**

**1** Camber is the deviation of a side edge from a straight edge. Measurement is taken by placing a straight edge on the concave side of a sheet and measuring the distance between the sheet edge and the straight edge in the center of the arc. Camber is caused by one side being elongated more than the other.

**2** The hook or dogleg near the ends of a coil.

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**Camber Tolerances 1**

Camber is the deviation from edge straightness. Maximum allowable tolerance of this deviation of a side edge from a straight line are defined in ASTM Standards.

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**Capacity**

Normal ability to produce metals in a given time period. This rating should include maintenance requirements, but because such service is scheduled to match the needs of the machinery (not those of the calendar), a mill might run at more than 100% of capacity one month and then fall well below rated capacity as maintenance is performed.

**Engineered Capacity**

The theoretical volume of a mill or smelter, given its constraints of raw material supply and normal working speed.

**“True” Capacity**

Volume at full utilization, allowing for the maintenance of equipment and reflecting current material constraints. (Bottlenecks of supply and distribution can change over time — capacity will expand or reduce.)

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**Carbon Steel**

Steel that has properties made up mostly of the element carbon and which relies on the carbon content for structure. Most of the steel produced in the world is carbon steel.

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**Casing**

Casing is the structural retainer for the walls of oil and gas wells, and accounts for 75% (by weight) of OCTG shipments. Casing is used to prevent contamination of both the surrounding water table and the well itself. Casing lasts the life of a well and is not usually removed when a well is closed.

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**Casting[iv]**

The process of pouring molten metal into a mould so that the cooled, solid metal retains the shape of the mould.

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**Castrip**

Process to directly cast molten steel into a final shape and thickness without additional hot or cold rolling. This reduces capital investment, energy, and environmental cost.

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**Charge**

The act of loading material into a vessel. For example, iron ore, coke, and limestone are charged into a Blast Furnace; a Basic Oxygen Furnace is charged with scrap and hot metal.

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**Chemistries 1**

The chemical composition of steel indicating the amount of carbon, manganese, sulfur, phosphorous and a host of other elements.

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**Chromium (Cr)**

An alloying element that is the essential stainless steel raw material for conferring corrosion resistance. A film that naturally forms on the surface of stainless steel self-repairs in the presence of oxygen if the steel is damaged mechanically or chemically, and thus prevents corrosion from occurring.

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**Cladding**

**What?**

Method of applying a stainless steel coating to carbon steel or lower alloy steel (i.e., steel with alloying element content below 5%).

**Why?**

To increase corrosion resistance at lower initial cost than exclusive use of stainless steel.

**How?**

By 1) welding stainless steel onto carbon steel; 2) pouring melted stainless steel around a solid carbon steel slab in a mold; or 3) placing a slab of carbon steel between two plates of stainless steel and bonding them by rolling at high temperature on a plate mill.

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**Coating 1**

The process of covering steel with another material (tin, chrome, and zinc), primarily for corrosion resistance.

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**Coils**

Metal sheet that has been wound. The metal, once rolled flat, is more than one-quarter mile long; coils are the most efficient way to store and transport sheet steel.

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**Coke**

**What?**

The basic fuel consumed in blast furnaces in the smelting of iron. Coke is a processed form of coal. About 1,000 pounds of coke are needed to process a ton of pig iron, an amount which represents more than 50% of an integrated steel mill's total energy use.

**Why?**

Metallurgical coal burns sporadically and reduces into a sticky mass. Processed coke, however, burns steadily inside and out, and is not crushed by the weight of the iron ore in the blast furnace.

**How?**

Inside the narrow confines of the coke oven, coal is heated without oxygen for 18 hours to drive off gases and impurities.

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**Coke Oven Battery**

A set of ovens that process coal into coke. Coke ovens are constructed in batteries of ten to 100 ovens that are 20 feet tall, 40 feet long, and less than two feet wide. Coke batteries, because of the exhaust fumes emitted when coke is pushed from the ovens, often are the dirtiest area of a steel mill complex.

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**Cold Reduction**

**What?**

Finishing mills roll cold coils of pickled hot-rolled sheet to make the steel thinner, smoother, and stronger by applying pressure, rather than heat.

**How?**

Stands of rolls in a cold-reduction mill are set very close together and press a sheet of steel from one-quarter inch thick into less than an eighth of an inch, while more than doubling its length.

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**Cold-Rolled Strip (Sheet)**

Sheet steel that has been pickled and run through a cold-reduction mill. Strip has a final product width of approximately 12 inches, while sheet may be more than 80 inches wide. Cold-rolled sheet is considerably thinner and stronger than hot-rolled sheet, so it will sell for a premium (see Sheet Steel).

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**Cold Working (Rolling)**

**What?**

Changes in the structure and shape of steel achieved through rolling, hammering, or stretching the steel at a low temperature (often room temperature).

**Why?**

To create a permanent increase in the hardness and strength of the steel.

**How?**

The application of forces to the steel causes changes in the composition that enhance certain properties. In order for these improvements to be sustained, the temperature must be below a certain range, because the structural changes are eliminated by higher temperatures.

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**Consumption**

Measures the physical use of a metal by end users. Metal consumption estimates, unlike steel demand figures, account for changes in inventories.

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**Continuous Casting**

**What?**

A method of pouring steel directly from the furnace into a billet, bloom, or slab directly from its molten form.

**Why?**

Continuous casting avoids the need for large, expensive mills for rolling ingots into slabs. Continuous cast slabs also solidify in a few minutes versus several hours for an ingot. Because of this, the chemical composition and mechanical properties are more uniform.

**How?**

Steel from the BOF or electric furnace is poured into a tundish (a shallow vessel that looks like a bathtub) atop the continuous caster. As steel carefully flows from the tundish down into the water-cooled copper mold of the caster, it solidifies into a ribbon of red-hot steel. At the bottom of the caster, torches cut the continuously flowing steel to form slabs or blooms.

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**Contract Sales**

Metal products committed to customers through price agreements extending three to 12 months. About one-half of all flat-rolled steel is sold on this basis, primarily because the auto companies sign agreements to cover at least one year's model. Price increases that the steel mills might announce during the year do not generally affect the revenues from the contract side of the business.

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**Conversion Cost**

Resources spent to process material in a single stage, from one type to another. The costs of converting iron ore to hot metal or bauxite to aluminum can be isolated for analysis.

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**Converter / Processor**

Processes steel into a more finished state, such as pipe, tubing, and cold-rolled strip, before selling it to end users. Such steel generally is not sold on contract, making the converter segment of the mills' revenues more price sensitive than their supply contracts to the auto manufacturers.

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**COREX®**

**What?**

COREX® is a coal-based smelting process that yields hot metal or pig iron. The output can be used by integrated mills or EAF mills.

**How?**

The process gasifies non-coking coal in a smelting reactor, which also produces liquid iron. The gasified coal is fed into a shaft furnace, where it removes oxygen from iron ore lumps, pellets, or sinter; the reduced iron is then fed to the smelting reactor.

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**Corrosion**

The gradual degradation or alteration of metal caused by atmosphere, moisture, or other agents.

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**Culvert Pipe**

Heavy gauge, galvanized steel that is spiral-formed or riveted into corrugated pipe, which is used for highway drainage applications.

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**Cut-to-Length**

Process to uncoil sections of flat-rolled steel and cut them into a desired length. Product that is cut to length is normally shipped flat-stacked.

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**Deburring 3**

The process used to smooth the sharp, jagged edges of a cut piece of steel.

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**Deep Drawing Applications 1**

Parts/applications that require deep drawing in their fabrication. Examples are motor shells, fenders, quarter panels, and door panels.

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**Defined Benefit Retirement Plan**

A type of pension plan whereby the employer promises to make pension payments to retired employees in specified amounts, regardless of the performance of the fund. Because the employees' total years of service and their length of retirement are uncertain, the employer's future liabilities must be estimated and can fluctuate over time.

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**Defined Contribution Retirement Plan**

A pension plan in which the employer promises to make specified contributions to the pension fund, but the amount of pension benefits ultimately paid to retired employees depends on how well the pension fund's assets are managed. There are no balance sheet items for Defined Contribution Plans because all liabilities are satisfied in full each year.

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**Descaling 1**

The process of removing scale from the surface of steel. Scale forms most readily when the steel is hot by union oxygen with iron. Common methods are: (1) crack the scale by use of roughened rolls and remove by a forceful water spray, (2) throw salt or

wet sand or wet burlap on the steel just previous to its passage through the rolls.

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**Desulfurization**

**What?**

Operation that injects a chemical mixture into a ladle full of hot metal to remove sulfur prior to its charging into the Basic Oxygen Furnace.

**Why?**

Sulfur enters the steel from the coke in the blast furnace smelting operation, and there is little the steelmaker can do to reduce its presence. Because excess sulfur in the steel impedes its welding and forming characteristics, the mill must add this step to the steelmaking process.

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**Direct Reduced Iron (DRI)**

**What?**

Processed iron ore that is iron-rich enough to be used as a scrap substitute in electric furnace steelmaking.

**Why?**

As mini-mills expand their product abilities to sheet steel, they require much higher grades of scrap to approach integrated mill quality. Enabling the mini-mills to use iron ore without the blast furnace, DRI can serve as a low residual raw material and alleviate the mini-mills' dependence on cleaner, higher priced scrap.

**How?**

The impurities in the crushed iron ore are driven off through the use of massive amounts of natural gas. While the result is 97% pure iron (compared with blast furnace hot metal, which, because it is saturated with carbon, is only 93% iron), DRI is only economically feasible in regions where natural gas is attractively priced.

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**Drawn-Over-Mandrel**

A procedure for producing specialty tubing using a drawbench to pull tubing through a die and over a mandrel, giving excellent control over the inside diameter and wall thickness. Advantages of this technique are its inside and outside surface quality and gauge tolerance. Major markets include automotive applications and hydraulic cylinders.

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**Drill Pipe**

Pipe used in the drilling of an oil or gas well. Drill pipe is the conduit between the wellhead motor and the drill bit. Drilling mud is pumped down the center of the pipe during drilling, to lubricate the drill bit and transmit the drilled core to the surface. Because of the high stress, torque and temperature associated with well drilling, drill pipe is a seamless product.

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**Ductility**

Ability of steel to undergo permanent changes in shape without fracture at room temperature.

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**Dumping**

Dumping occurs when imported merchandise is sold in, or for export to the domestic market at less than the normal value of the merchandise — that is, at a price that is less than the price at which identical or similar merchandise is sold in the comparison market, the home market (the market of the exporting country), or third-country market (in this case, "market" is used as proxy for "home market" in cases where home market cannot be used). The normal value of the merchandise cannot be below the cost of production.

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**Dumping Margin**

The amount by which the normal value exceeds the export price or constructed export price of the subject merchandise.

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**Duplex**

A category of stainless steel with high amounts of chromium and moderate nickel content. The duplex class is so named because it is a mixture of austenitic

(chromium-nickel stainless class) and ferritic (plain chromium stainless category) structures. This combination was originated to offer more strength than either of those stainless steels. Duplex stainless steels provide high resistance to stress corrosion cracking (formation of cracks caused by a combination of corrosion and stress) and are suitable for heat exchangers, desalination plants, and marine applications.

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## E

**Edge Rolling (Edge Conditioning)**

Rolling a strip of steel to smooth the edges. By removing the burr off the coil, it is safer for customers to manipulate.

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**Electric Arc Furnace (EAF)**

Steel-making furnace where scrap is generally 100% of the charge. Heat is supplied from electricity that arcs from the graphite electrodes to the metal bath. Furnaces may be either an alternating current (AC) or direct current (DC). DC units consume less energy and fewer electrodes, but they are more expensive.

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**Electric Resistance Welded (ERW) Pipe**

Pipe made from strips of hot-rolled steel which are passed through forming rolls and welded. While seamless pipe is traditionally stronger and more expensive than comparable ERW pipe, ERW technology is improving and the technique now accounts for approximately 48% of OCTG shipments by tonnage.

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**Electrical Steel**

(See Silicon Electrical Steel)

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**Electrolytic Galvanized 1**

Cold Rolled or Black Plate to which a coating of zinc is applied by electro-deposition; used for applications in which corrosion resistance and paintability is a primary concern.

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**Electrolytic Tin Coated Sheets (ETCS) 1**

Cold rolled sheets coated with tin by electro-deposition through an acid or alkaline process.

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**Electrolytic Tin Plate (ETP) 1**

- Light-gauge, low-carbon, cold reduced steel on which tin has been electrodeposited.
- Black plate coated with Tin Sn electron deposition.

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**Electropolishing 3**

The process used on stainless steel tubing and fittings to simultaneously smooth, brighten, clean, and passivate the interior surfaces of these components. Electropolishing is an electrochemical removal process that selectively removes a thin layer of metal, including surface flaws and imbedded impurities. Electropolishing is a required surface treatment process for all ultra high-purity components used in the gas distribution systems of semiconductor manufacturers worldwide and many sterile water distribution systems of pharmaceutical and biotechnology companies.

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**Exotic Alloys [i]**

Zirconium, niobium, hafnium, and tantalum products.

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**Extrusion**

The process of shaping material by forcing it to flow through a shaped opening in a die.

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[i]Source: Allegheny Technologies 10-K

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[i] Source: Weirton Steel Glossary

[ii] Source: Dofasco Glossary of Terms

[iii] Source: Reliance Steel 10-K

[iv]Source: BlueScope Steel Glossary of Terms

## Steel Glossary F - J


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*Michelle Applebaum Research provides this collection of terms and concepts used in our research, company and industry reports, and other steel publications as an invaluable tool for those in the steel industry.*



**QUICK LINKS**

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## F

**Fabricate**

To work a material into a finished state by machining, forming, or joining.

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**Fabricator**

A producer of intermediate products that does not also produce primary metal. For example, a rebar (see Reinforcing Bar) fabricator purchases rebar and processes the material to the specifications of a particular construction project.

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**FAS 106**

An accounting rule established in 1990 that requires companies to change their accounting for the cost of their retirees' future nonpension benefits (life insurance and health services). What were once "pay as you go" or "cash basis" expense items were changed to an accrual basis. Such costs are now recognized during the employees' working years.

When the steel companies shifted to the new accounting rule, most companies charged the "catch-up" to equity in large one-time write-downs as they established the new liabilities on their balance sheets.

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**FAS 109**

An accounting rule for deferred taxes that requires companies to explain within their financial statements the difference between the tax expense found on the income statement and the check actually sent to the Internal Revenue Service (IRS). (This rule superseded FAS 96 and APB 11.)

Some steel companies carry net operating losses (NOLs) on their balance sheets as assets that can be used to offset future taxes. Under the rules of FAS 109, however, a valuation allowance may be recorded to reduce these NOLs unless there is a high probability that they will be used.

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**Fastmet**

A process to directly reduce iron ore to metallic iron pellets that can be fed into an electric arc furnace with an equal amount of scrap. This process is designed to bypass the coke oven-blast furnace route to produce hot metal from iron ore. It is also one of several methods that mini-mills might use to reduce their dependence on high-quality scrap inputs (see Direct Reduced Iron and Hot Briquetted Iron).

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**Feedstock**

Any raw material. Substrate.

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**Ferritic**

The second-largest class of stainless steel, constituting approximately 25% of stainless production.

Ferritic stainless steels are plain chromium steels with no significant nickel content; the lack of nickel results in lower corrosion resistance than the austenitics (chromium-nickel stainless steels). Ferritics are best suited for general and high-temperature corrosion applications rather than services requiring high strength. They are used in automotive trim and exhaust systems, interior architectural trim, and hot water tanks. Two of the most common grades are type 430 (general-purpose grade for many applications, including decorative ones) and type 409 (low-cost grade well suited to withstanding high temperatures).

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**Ferroalloy**

A metal product commonly used as a raw material feed in steelmaking, to aid various stages of the steelmaking process such as deoxidation, desulfurization, and adding strength. Examples: ferrochrome, ferromanganese, and ferrosilicon.

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**Ferrochrome**

An alloy of iron and chromium with up to 72% chromium. Ferrochrome is commonly used as a raw material in the making of stainless steel.

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**Ferrous**

Metals that consist primarily of iron.

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**Finmet**

The process reduces iron ore fines with gas in a descending series of fluidized bed reactors. The reduced iron is hot briquetted.

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**Finish**

The surface appearance of steel after final treatment.

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**Finishing Facilities**

The portion of the steelmaking complex that processes semi-finished steel (slabs or billets) into forms that can be used by others. Finishing operations can include rolling mills, pickle lines, tandem mills, annealing facilities, and temper mills.

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**Finishing Stand 1**

The last stand in a rolling mill, which determines the surface finish and final gauge.

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**Flat-Rolled Steel**

Category of steel that includes sheet, strip, and tin plate, among others. Produced by passing ingot/slab through pairs of rolls.

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**Flux**

An iron cleaning agent. Limestone and lime react with impurities within the metallic pool to form a slag that floats to the top of the relatively heavier (and now more pure) liquid iron.

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**FOB Pricing**

Free on Board Pricing

Phrase that explains whether the transportation costs of the steel are included. “FOB Mill” is the price of steel at the mill, not including shipping.

Freight Equalization

A common industry practice when a mill sells steel outside its geographic area; it will

assume any extra shipping costs (relative to the competition) to quote the customer an equivalent price to get the business.

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**Forging**

A metal part worked to predetermined shape by one or more processes such as hammering, pressing, or rolling.

****

**Full Hard Cold Rolled 1**

Hot rolled pickled steel that is cold reduced to a specified thickness and subject to no further processing (not annealed or temper rolled). The product is very stiff; it is not intended for flat work where deformation is very minimal.

****

**Full Hard Temper 1**

Full Hard Cold Rolled steel produced to a Rockwell hardness of 84 and higher on the B scale.

****

**Forming 3**

Bending and forming plate or sheet products into customer specified shapes and sizes with press brakes.

****

**G**

---

**Galfan 1**

A galvanized product coated with 95% free zinc, 5% aluminum and traces of mish metal in the coating; provides extra corrosion protection with lighter coating weight; has improved formability over regular free zinc coatings (hot dipped galvanized regular products).

****

**Galvaneal Coating 1**

Coatings on hot-dipped galvanized steels processed to convert the coating completely to zinc-iron alloys; dull gray in appearance, have no spangle, and after proper preparation, are well suited for painting.

****

**Galvanize Coatings 1**

Free zinc coatings applied to a hot-rolled or cold-rolled steel to produce Galvanized steel. The coating can be applied by the hot-dip or electrodeposition process.

****

**Galvanized Steel**

Steel coated with a thin layer of zinc to provide corrosion resistance in underbody auto parts, garbage cans, storage tanks, or fencing wire. Sheet steel normally must be cold-rolled prior to the galvanizing stage.

Hot-Dipped

Steel is run through a molten zinc coating bath, followed by an air stream “wipe” that controls the thickness of the zinc finish.

Electrogalvanized

Zinc plating process whereby the molecules on the positively charged zinc anode attach to the negatively charged sheet steel. The thickness of the zinc coating is readily controlled. By increasing the electric charge or slowing the speed of the steel through the plating area, the coating will thicken.

Differences

Electrogalvanizing equipment is more expensive to build and to operate than hot dipped, but it gives the steelmaker more precise control over the weight of the zinc coating. The automotive manufacturers, because they need the superior welding, forming, and painting ability of electrogalvanized steel, purchase 90% of all tonnage produced.

****

**Galvalume®**

Steel sheet with a unique coating of 55% aluminum and 45% zinc that resists corrosion. The coating is applied in a continuous hot-dipped process, which improves

the steel's weather resistance. Galvalume® is a trademark of BHP Steel, and the product is popular in the metal building market.

****

**Galvannealed 1**

An extra tight coat of galvanizing metal (zinc) applied to a soft steel sheet, after which the sheet is passed through an oven at about 1200 degrees F. The resulting coat is dull gray without spangle especially suited for subsequent painting.

****

**Gauge**

The thickness of sheet steel. Better-quality steel has a consistent gauge to prevent weak spots or deformation.

****

**GigaJoule 2**

A measure of energy. A GigaJoule equals 1,000,000,000 Joules. A 100-watt light bulb turned on for one second consumes 100 Joules.

****

**Grinding 3**

Involves grinding the top and/or bottom of carbon or alloy steel plate or bars into close tolerance.

****

**Greenfield Facility**

New metalmaking complex that is built "from scratch," presumably on a green field.

****

## H

**Hafnium 5**

An exotic alloy usually obtained as a by-product of zirconium production with outstanding corrosion resistance and good mechanical properties. It is added to specialty alloys for use in jet engine parts and as control rod material in nuclear reactors.

****

**Hardening**

What?

Process that increases the hardness of steel, i.e., the degree to which steel will resist cutting, abrasion, penetration, bending, and stretching.

Why?

The increased endurance provided by hardening makes steel suitable for additional applications.

How?

Hardening can be achieved through various methods, including 1) heat treatment, where the properties of steel are altered by subjecting the steel to a series of temperature changes; and 2) cold working, in which changes in the structure and shape of steel are achieved through rolling, hammering, or stretching the steel at a relatively low temperature.

****

**Hardness 1**

Defined in terms of the method of measurement.

Usually the resistance to indentation

2 Stiffness or temper of wrought products

Machinability characteristics

****

**Heat Treatment**

What?

Altering the properties of steel by subjecting it to a series of temperature changes.

Why?

To increase the hardness, strength, or ductility of steel so that it is suitable for additional applications.

How?

The steel is heated and then cooled as necessary to provide changes in the structural form that will impart the desired characteristics. The time spent at each temperature and the rates of cooling have significant impact on the effect of the treatment.

****

**Heavy Structural Shapes**

A general term given to rolled flanged sections that have at least one dimension of their cross sections three inches or greater. The category includes beams, channels, tees and zees if the depth dimension is three inches or greater, and angles if the length of the leg is three inches or greater.

****

**High-Carbon Steel**

Steel with more than 0.3% carbon. The more carbon that is dissolved in the iron, the less formable and the tougher the steel becomes. High-carbon steel's hardness makes it suitable for plow blades, shovels, bedsprings, cutting edges, or other high-wear applications.

****

**High Strength Low Alloy (HSLA) 1**

A specific group of steel in which higher strength, and in some cases additional resistance to atmospheric corrosion or improved formability, are obtained by moderate amounts of one or more alloying elements such as columbium, vanadium, titanium, used alone or in combination.

****

**Hot Band (Hot-Rolled Steel)**

A coil of steel rolled on a hot-strip mill (hot-rolled steel). It can be sold in this form to customers or further processed into other finished products.

****

**Hot Briquetted Iron (HBI)**

Direct reduced iron that has been processed into briquettes. Instead of using a blast furnace, the oxygen is removed from the ore using natural gas and results in a substance that is 90%–92% iron. Because DRI may spontaneously combust during transportation, HBI is preferred when the metallic material must be stored or moved.

****

**Hot End**

The section of a steelmaking complex from the furnace up to, but not including, the hot-strip mill.

****

**Hot Metal**

The name for the molten iron produced in a blast furnace. It proceeds to the basic oxygen furnace in molten form or is cast as pig iron.

****

**Hot Mill 1**

The rolling mill that reduces a hot slab into a coil of specified thickness; the processing is done at a relatively high temperature (when the steel is still "red").

****

**Hot Roll 1**

Product that is sold in its "as produced state" off the Hot Mill with no further reduction or processing steps aside from being pickled and oiled (if specified).

****

**Hot-Strip Mill**

A rolling mill of several stands of rolls that converts slabs into hot-rolled coils. The hot-strip mill squeezes slabs, which can range in thickness from two to ten inches, depending on the type of continuous caster, between horizontal rolls with a progressively smaller space between them (while vertical rolls govern the width) to produce a coil of flat-rolled steel about a quarter-inch in thickness and a quarter mile in length.

****

**HYL I, HYL III**

Processes for producing DRI and HBI developed by Hylsa. The processes reduce iron ore lump or pellets with reformed natural gas in a vertical shaft furnace. The HYL I process uses four fixed-bed reactors; HYL III uses a single-shaft furnace.

****

**Hydrate[i]**

An aluminum oxide with three molecules of chemically combined water.

****

**Hydroforming**

A forming process in which a tube is placed into a forming die. The tube is then formed to the shape of the die through the application of internal water pressure.

The hydroforming process allows for severe shape deformation, making it ideal for automotive structural parts such as engine cradles, radiator supports, and body rails. Various shaped and sized holes can be punched in the tube almost anywhere during the process.

****

## I

**I-Beams**

Structural sections on which the flanges are tapered and are typically not as long as the flanges on wide-flange beams. The flanges are thicker at the cross sections and thinner at the toes of the flanges. They are produced with depths of three inches to 24 inches.

****

**Import Administration**

Import Administration, within the International Trade Administration of the Department of Commerce, enforces laws and agreements to protect U.S. businesses from unfair competition within the U.S. resulting from unfair pricing by foreign companies and unfair subsidies to foreign companies by their governments.

****

**Ingot**

A form of semi-finished type of metal. Liquid metal is teemed (poured) into molds, where it slowly solidifies. Once the metal is solid, the mold is stripped, and the 25- to 30-ton ingots are then ready for subsequent rolling or forging.

****

**Inmetco**

What?

Inmetco is a coal-based process similar to FASTMET that uses iron oxide fines and pulverized coal to produce a scrap substitute. Mill scale and flue dust, inexpensive by-products of steelmaking, can be mixed with the iron oxide fines. Inmetco, unlike other direct reduction products, is intended to be hot charged into an EAF, with attendant energy savings.

How?

The process includes three steps. First, iron oxide fines, pulverized coal and a binder are formed into pellets. Second, the pellets, two to three layers deep, are heated in a gas-fired rotary hearth furnace for 15–20 minutes to produce sponge iron. Subsequently, the iron must be desulfurized. The coal in the pellets provides much of the energy required in the second phase.

****

**Integrated Mills**

These facilities make steel by processing iron ore and other raw materials in blast furnaces. Technically, only the hot end differentiates integrated mills from mini-mills. However, the differing technological approaches to molten steel imply different scale efficiencies and, therefore, separate management styles, labor relations, and product markets. Nearly all domestic integrated mills specialize in flat-rolled steel or plate.

****

**Interstitial Free Steel**

A recently developed sheet steel product with very low carbon levels that is used primarily in automotive deep-drawing applications. Interstitial Free Steel's improved ductility (drawing ability) is made possible by vacuum degassing.

* * * *

**Iron Carbide**

One of several substitutes for high-quality, low-residual scrap for use in electric furnace steelmaking. Iron carbide producers use natural gas to reduce iron ore to iron carbide.

* * * *

**Iron Ore**

Mineral containing enough iron to be a commercially viable source of the element for use in steelmaking. Except for fragments of meteorites found on earth, iron is not a free element; instead, it is trapped in the earth's crust in its oxidized form.

* * * *

## Steel Glossary K - O

**Everything You Always Wanted to Know About Steel...But Were Afraid to Ask - December 2004**

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**QUICK LINKS**

Glossary A - E
Glossary F - J
Glossary K - O
Glossary P - T
Glossary U - Z

## L

**Ladle** 4

A "bucket" lined with refractory (heat resistant) bricks, used to transport molten steel from process to process in a steel plant.

****

**Ladle Metallurgy Furnace (LMF)**

An intermediate steel processing unit that further refines the chemistry and temperature of molten steel while it is still in the ladle. The ladle metallurgy step comes after the steel is melted and refined in the electric arc or basic oxygen furnace, but before the steel is sent to the continuous caster.

****

**Lance 4**

A long metallic tube through which oxygen is blown into the BOS vessel under high pressure.

****

**Lead-Time 1**

Delivery time for an item of inventory to be moved from a source location to a destination via a specific route. Detail is specific to the level of the location. Also the time to produce a customer's order from order placement to shipment.

****

**Legacy Costs**

Any costs that are associated with prior operations. Employee liabilities (pensions and health care benefits) and environmental cleanup costs usually are included under this moniker.

****

**Leveling 1**

The process by which a leveling machine flattens metal strip, coil, or sheets by bending it up and down over the interrupting arcs of upper and lower sets of long, slender work rolls. Machines generally employ 17, 19, or 21 relatively small diameter rolls whose deflection under load is controlled by additional back-up rollers and a rigid frame.

****

**Life Cycle Costing**

An accounting method of costing where expenses are allocated over the life of the product. Life cycle costs are often lower for stainless steel than for alternatives

despite a higher initial outlay, because stainless products generally last longer and require little maintenance.

****

**Light-Gauge Steel**

Very thin steel sheet that has been temper-rolled or passed through a cold-reduction mill. Light gauge steel normally is plated with tin or chrome for use in food containers.

****

**Line Pipe**

Pipe used in the surface transmission of oil, natural gas and other fluids.

****

**London Metal Exchange (LME)** [i]

A metals trading center for the Western World. The LME also determines the metal price for aluminum trading for current and future delivery.

****

**Long Products**

Classification of steel products that includes bar, rod and structural products, that are "long," rather than "flat."

****

**Low-Carbon Steel**

Steel with less than 0.005% carbon is more ductile (malleable): It is capable of being drawn out or rolled thin for use in automotive body applications. Carbon is removed from the steel bath through vacuum degassing.

****

## M

**M sections (Bantam Beams™, Junior Beams™)**

Light footweight beams primarily used in the construction of pre-engineered housing. These beams are produced in lighter footweights, usually six to ten pounds per foot, than traditional structural products.

****

**Machining 3**

Refers to performing multiple processes to a piece of metal to produce a customer specified component part.

****

**Magnesium 6**

A light, silvery, moderately hard metallic element used in processing metals and chemicals, and in alloying aluminum to give it desired metallurgical properties.

****

**Man-Hours per Ton (M-H/T)**

This is a measure of labor efficiency — the ratio of total hours worked by steel employees to the tons shipped for a given period of time. Changes in the inventory level and work that is contracted out will affect the reported measurement.

****

**Martensitic**

Small category of stainless steel characterized by the use of heat treatment for hardening and strengthening. Martensitic stainless steels are plain chromium steels with no significant nickel content. They are utilized in equipment for the chemical and oil industries and in surgical instruments. The most popular martensitic stainless steel is type 410 (a grade appropriate for non-severe corrosion environments requiring high strength).

****

**Matte Finish 1**

A dull or grit surface appearance achieved by rolling on rolls which have been roughened by mechanical, chemical, or electrical means to various degrees of surface texture.

****

**Mechanical Properties 1**

Those properties of a material that reveal the elastic and inelastic reaction when force is applied, or that involve the relationship between stress and strain; for example, the modulus of elasticity, tensile strength, and fatigue limit. These properties have often been designated as "physical properties," but the term "mechanical properties" is much to be preferred.

****

**Merchant Bar**

A group of commodity steel shapes that consist of rounds, squares, flats, strips, angles, and channels, which fabricators, steel service centers, and manufacturers cut, bend, and shape into products. Merchant products require more specialized processing than reinforcing bar.

****

**Metric Ton (mt)**

A unit of mass and weight equal to 1,000 kilograms, or 2,204.6 pounds.

****

**Mini-Mills**

Normally defined as steel mills that melt scrap metal to produce commodity products. Although the mini-mills are subject to the same steel processing requirements after the caster as the integrated steel companies, they differ greatly in regard to their minimum efficient size, labor relations, product markets, and management style.

****

**Molybdenum (Mo)**

An alloying element used as a raw material for some classes of stainless steel. Molybdenum in the presence of chromium enhances the corrosion resistance of stainless steel.

****

**Months of Inventory**

Ratio of the end-of-period inventory to average monthly level of sales for the period.

****

## N

---

**Net Operating Loss (NOLs)**

An income-averaging provision that allows companies with losses to either carry forward the loss up to 15 years to offset otherwise taxable future income, or carry back the NOLs up to three years to receive a refund for taxes previously paid (see FAS 109).

****

**Nickel (Ni)**

An alloying element used as a raw material for certain classes of stainless steel. Nickel provides high degrees of ductility (ability to change shape without fracture) as well as resistance to corrosion. Approximately 65% of all nickel is used in the making of stainless steel.

****

**Nickel-Based Superalloys 5**

Nickel-based alloys developed for very high temperature service where relatively high stresses are encountered and where high surface stability is frequently required. Typical applications are aircraft turbine and land-based turbine components.

****

**Niobium 5**

An exotic alloy valued for its strength at extremely high temperatures and its ability to superconduct, or pass electricity with minimal resistance, at very low temperatures. It is used in aerospace applications, in superconducting magnets in MRI (magnetic resonance imaging) equipment, when alloyed with titanium, and in particle accelerators.

****

**No. 1 Heavy Melt**

Obsolete steel scrap grade, at least one-quarter inch in thickness and in sections no larger than five feet by two feet. Much of the metal comes from demolished buildings,

truck frames and heavy duty springs. Mini-mills are primary consumers of No. 1 heavy scrap.

****

## O

**Oil Country Tubular Goods (OCTG)**

Label applied to the pipe products used by petroleum exploration customers. OCTG includes casing, drill pipe, and oil well tubing, which, depending on their use, may be formed through welded or seamless processes.

****

**OPEB Expense**

Other Postretirement Employment Benefits: Usually refers to health care obligations to a mill's retired workers, although its meaning also can include layoff benefits (see FAS 106).

****

**Open Hearth Furnace**

A broad, shallow hearth to refine pig iron and scrap into steel. Heat is supplied from a large, luminous flame over the surface, and the refining takes seven to nine hours. Open Hearths, at one time the most abundant steelmaking furnaces among integrated companies, have been replaced by the basic oxygen furnace.

****

**Operating Rates**

The ratio of raw steel production to the mill's stated capacity. Each December, steel companies report to the AISI their estimated capacity (if they could sell all steel they produced) for the following year, adjusted for any facility downtime.

****

**Order Rate**

The ratio of new orders recorded to the mill's capacity to produce the steel to fill the orders. Many analysts view trends in the order rate as harbingers of future production levels.

****

**Oscillating**

A method of winding narrow strip steel over a much wider roll. Customers want to have as much steel on a coil as will fit in their machines, so they can spend less time moving the material and more time using it. By coiling the strip like fishing line (or thread) over a spool, a much longer strip can fit onto a coil of proper diameter. Oscillate-wound coils allow the customer to enjoy longer processing runs.

****



Source: Alcoa 10-K

Source: Dofasco Glossary of Terms

Source: Reliance Steel 10-K

Source: BlueScope Steel Glossary of Terms

## Steel Glossary P - T


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**P**

**Peak Earnings**

The ultimate earnings level of a company at the top of the business cycle. This is the expected profit during the time of the highest commodity demand and the strongest product pricing.

****

**Pellets 4**

Fine particles of iron ore mixed with bonding clay and roasted into hard round balls for blast furnace feed.

****

**Pickling**

**What?**

Process that cleans a steel coil of its rust, dirt and oil so that further work can be done to the metal.

**Why?**

When hot-rolled coils cool, rust forms on the unprotected metal; often coils are stored or transported while exposed to outside air and water.

**How?**

Through a continuous process, the steel is uncoiled and sent through a series of hydrochloric acid baths that remove the oxides (rust). The steel sheet is then rinsed and dried.

****

**Pig Iron**

The name for the melted iron produced in a blast furnace, containing a large quantity of carbon (above 1.5%). Named long ago when molten iron was poured through a trench in the ground to flow into shallow earthen holes, the arrangement looked like newborn pigs suckling. The central channel became known as the "sow," and the molds were "pigs."

****

**Piling (Sheet Piling)**

A structural steel product with edges designed to interlock; used in the construction of cofferdams or riverbank reinforcement.

****

**Pipe**

Technically a tube is used to transport fluids or gases. However, pipe and tube are

**QUICK LINKS**

Glossary A - E
Glossary F - J
Glossary K - O
Glossary P - T
Glossary U - Z

often used interchangeably in steel lexicon, with a given label applied primarily as a matter of historical use.

****

**Pipe Threading 3**

Cutting of threads around the circumference of the pipe.

****

**Plate**

Sheet steel with a width of more than eight inches, with a thickness ranging from one quarter of an inch to more than one foot (see Sheet Steel).

****

**Powder Metals**

Fabrication technology in which fine metallic powder is compacted under high pressure and then heated at a temperature slightly below the melting point to solidify the material. Primary users of powder metal parts are auto, electronics and aerospace industries.

****

**Precipitation Hardening (PH)**

A small group of stainless steels with high chromium and nickel content, with the most common types having characteristics close to those of martensitic (plain chromium stainless class with exceptional strength) steels. Heat treatment provides this class with its very high strength and hardness. Applications for PH stainless steels include shafts for pumps and valves as well as aircraft parts.

****

**Precision Plate Sawing 3**

Involves sawing plate (primary aluminum plate products) into square or rectangular shapes to tolerances as close as 0.003 of an inch.

****

**Pulverized Coal Injection System (PCI)**

A blast furnace enhancement to reduce an integrated mill's reliance on coke (because of environmental problems with its production). Up to 30% of the coke charged into the blast furnace can be replaced by this talcum-like coal powder, which is injected through nozzles at the bottom of the furnace.

****

**Punching 3**

The cutting of holes into carbon steel beams or plates by pressing or welding per customer specifications.

****

## Q

**Q-BOP**

Modified Basic Oxygen Furnace in which the oxygen and other gases are blown in from the bottom, rather than from the top. While the Q-BOP stirs the metal bath more vigorously, allowing for faster processing, the design produces essentially the same steel grades as the top-blowing basic oxygen furnace. Today's state-of-the-art furnace design combines the previous technologies: 60% of the oxygen is blown from above, with the rest blown through the bottom of the vessel.

****

**Qualification Trials**

The testing required for a new process adopted to make certain grades of steel with exacting end uses. In order for the process to become qualified, the steel made by the process must be tested.

****

**Quench Hardening 1**

A process of hardening a ferrous alloy of suitable composition by heating within or above the transformation range and cooling at a rate sufficient to increase the hardness substantially. The process usually involves the formation of martensite.

****

## R

**Reducing Agent**

Either natural gas or coal can be used to remove the oxygen from iron ore in order to produce a scrap substitute. In gas-based processes, the iron ore is heated in a vessel as reformed natural gas passes through. In coal-based processes, iron ore is combined with gasified or ground coal and heated. The oxygen in the ore combines with carbon and hydrogen in the gas or coal, producing reduced, or metallic, iron.

****

**Refractory Brick**

Heat-resistant brick. Because its melting point is well above the operating temperatures of the process, refractory bricks line most steelmaking vessels that come in contact with molten metal, like the walls of the blast furnace, sides of the ladles, and inside of the BOF.

****

**Reinforcing Bar (Rebar)**

A commodity-grade steel used to strengthen concrete in highway and building construction.

****

**Reline**

The process of replacing the refractory lining of a liquid steel vessel. Once it wears out, the brick lining of a furnace must be cooled, stripped, and replaced. This maintenance can be significant because a blast furnace reline may require up to three months to complete.

****

**Residuals**

The impurities in mini-mill steel as the result of the mix of metals entering the process dissolved in obsolete scrap. Residuals are key concerns regarding the mini-mills' recent entry into the flat-rolled market, where high residuals can leave sheet steel too brittle for customer use.

****

**Reversing Mill**

The stand of rolls used to reduce steel sheet or plate by passing the steel back and forth between the rolls; the gap between the rolls is reduced after each pass.

****

**Rod**

Round, thin semi-finished steel length that is rolled from a billet and coiled for further processing. Rod is commonly drawn into wire products or used to make bolts and nails. Rod trains (rolling facilities) can run as fast as 20,000 feet per minute — more than 200 miles an hour.

****

**Roll Force Systems**

Mill stands place considerable pressure on slabs, blooms and coils to further process the material. There are two general ways of applying the force to the steel — screw and hydraulic systems.

**Screw (Incline Plane)**

This older method used the basic principle of the screw to adjust the space between the mill rolls. Because metal touches metal, these configurations will wear down over time and can cause quality problems.

**Hydraulic (Pancake Cylinder)**

This modern system uses fluid pressure to rapidly adjust the roll spacing several times per second. These minute, instantaneous adjustments allow for superior gauge tracking and higher quality products.

****

**Rolling Mill 1**

Any of the mills in which metal undergoes a rolling process. These include the slabbing mill, hot roll mills, cold roll mills, SR mills, and DR mills.

Any operating unit that reduces gauge by application of loads through revolving cylindrical rolls; operation can be hot or cold. The elevated temperature rolling mill is the Hot Mill and is capable of reducing the gauge of a slab 92-99%.

********

**Roughing Stand 1**

The first rolling stand through which metal passes during hot rolling. Once reduced by the roughing stands, the metal continues on to the finishing stands where smoother rolls with a smaller gap are used to complete the hot roll process.

****

**Routing 3**

Produces various sizes and shapes of aluminum plate according to customer-supplied drawings through the use of CNC controlled machinery.

****

## S

**Sawing 3**

Cutting metal into customer specified lengths, shapes, or sizes.

****

**Scale**

The oxide of iron that forms on the surface of steel after heating.

****

**Scrap (Ferrous)**

Ferrous (iron-containing) material that generally is remelted and recast into new steel. Integrated steel mills use scrap for up to 25% of their basic oxygen furnace charge; 100% of the mini-mills' raw material for their electric furnaces generally is scrap.

**Home Scrap**

Waste steel that is generated from within the steel mill, through edge trimming and rejects. It normally is sent directly back to the furnace.

**Prompt (Industrial) Scrap**

Excess steel that is trimmed by the auto and appliance stampers and auctioned to scrap buyers as factory bundles. This is a high-quality scrap as the result of its low-residual content and consistent chemistry.

**Obsolete Scrap**

Iron-bearing items such as old automobiles; household appliances; farm, office, and industrial equipment; ships and railroad cars; buildings and bridges that have completed their useful life which can be recovered from the junkyard and remelted. The residual impurity of such scrap normally relegates obsolete scrap to the mini-mills (see No. 1 Heavy Melt).

****

**Scrap Substitute**

Raw material that can be charged in place of scrap in electric arc furnaces and basic oxygen furnaces. Scrap substitutes include, among others, DRI, HBI, iron carbide, and pig iron.

****

**Scrubber 2**

An air pollutant device that reduces the temperature of an emission – a liquid spray is used to remove pollutants from a gas stream by absorbtion or chemical reaction.

****

**Seamless Pipe**

Pipe made from a solid billet, which is heated, then rotated under extreme pressure. This rotational pressure creates an opening in the center of the billet, which is then shaped by a mandrel to form pipe.

****

**Secondary Steel**

Steel that does not meet the original customer's specifications because of a defect in its chemistry, gauge or surface quality. Mills must search to find another customer (that can accept the lower quality) to take the off-spec steel at a discount. While secondary will not affect the reported yield, margins will suffer.

****

**Semi-finished Steel**

Steel shapes — for example, blooms, billets, or slabs — that later are rolled into

finished products such as beams, bars, or sheet.

****

**Sendzimir Mill (Z-Mill)**

**What?**

Compact mill used for rolling cold coils of stainless steel in order to make the steel thinner, smoother, and stronger.

**Why?**

To control the thickness of steel better at lower capital cost, and to roll thinner sheets and strips.

**How?**

Stainless steel sheet or strip passes between a matching pair of small work rolls with extremely smooth surfaces, heavily reinforced by clusters of back-up rolls. The rolls reduce the steel to the desired thickness.

****

**Service Center**

A catchall name for an operation that buys steel, often processes it in some way and then sells it in a slightly different form. A service center is distinguished from an end-user by the fact that, unlike an end-user, a service center sells steel, not a fabricated product. Service centers are manufacturers to the extent that they add labor to steel by providing a service.

****

**Shape Correcting**

Rolling, heating, and quenching steel sheets often affect the dimensions of the steel. Levelers, temper mills, and edge trimmers rework the processed steel to match customer specifications.

****

**Shearing**

If the edges of sheet and strip are not controlled during reduction, they must be trimmed parallel by shears. This process may be performed by either the steel mill or steel processor to match customer needs.

****

**Sheet Steel**

Thin, flat-rolled steel. Coiled sheet steel accounts for nearly one-half of all steel shipped domestically and is created in a hot-strip mill by rolling a cast slab flat while maintaining the side dimensions. The malleable steel lengthens to several hundred feet as it is squeezed by the rolling mill.

The most common differences among steel bars, strip, plate, and sheet are merely their physical dimensions of width and gauge (thickness).

****

**Shredded Scrap**

Fist-sized, homogenous pieces of old automobile hulks. After cars are sent through a shredder, the recyclable steel is separated by magnets. Mini-mills consume shredded scrap in their electric arc furnace operations.

****

**Silicon Electrical Steel**

A type of specialty steel created by introducing silicon during the steelmaking process. Electrical steel exhibits certain magnetic properties, which make it optimum for use in transformers, power generators, and electric motors.

**Grain-Oriented**

The metal's grain runs parallel within the steel, permitting easy magnetization along the length of the steel. Although grain-oriented steel may be twice as expensive to produce, its magnetic directional characteristics enable power transformers, made from this metal, to absorb less energy during operation.

**Non-Grain-Oriented**

Because there is no preferential direction for magnetization, non-grain-oriented steel is best used in rotating apparatus such as electric motors.

****

**Sintering**

A process that combines iron-bearing particles, once recovered from environmental control filters, into small pellets. Previously, these materials were too fine to

withstand the air currents of the smelting process and were thrown away. The iron is now conserved because the chunks can be charged into the blast furnace (see Agglomerating Processes).

****

**Skelp**

Steel that is the entry material to a pipe mill. It resembles hot-rolled strip, but its properties allow for the severe forming and welding operations required for pipe production.

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**Skin Milling 3**

Grinds the top and/or bottom of a large aluminum plate into close tolerance.

****

**Slab**

The most common type of semi-finished steel. Traditional slabs measure ten inches thick and 30–85 inches wide (and average about 20 feet long), while the output of the recently developed "thin-slab" casters is approximately two inches thick. Subsequent to casting, slabs are sent to the hot-strip mill to be rolled into coiled sheet and plate products.

****

**Slag**

The impurities in a molten pool of iron. Flux such as limestone may be added to foster the congregation of undesired elements into a slag. Because slag is lighter than iron, it will float on top of the pool, where it can be skimmed.

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**Slitting**

Cutting a sheet of steel into narrower strips to match customer needs. Because steel mills have limited flexibility as to the widths of the sheet that they produce, service centers normally will cut the sheet for the customer.

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**Spangle 1**

Finish achieved when zinc is allowed to "freeze" naturally on the sheet – galvanize. Achieved by adding antimony to the hot dip bath.

****

**Special Bar Quality (SBQ)**

SBQ represents a wide variety of higher quality carbon and alloy bars that are used in the forging, machining, and cold-drawing industries for the production of automotive parts, hand tools, electric motor shafts, and valves. SBQ generally contains more alloys than merchant quality and commodity grades of steel bars, and is produced with more precise dimensions and chemistry.

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**Specialty Steel**

Category of steel that includes electrical (see Silicon Electrical Steel), alloy (see Alloy Steel), stainless (see Stainless Steel), and tool steels (see Tool Steels).

****

**Specialty Tube**

Refers to a wide variety of high-quality custom-made tubular products requiring critical tolerances, precise dimensional control and special metallurgical properties. Specialty tubing is used in the manufacture of automotive, construction, and agricultural equipment, and in industrial applications such as hydraulic cylinders, machine parts, and printing rollers. Because of the range of industrial applications, the market typically follows general economic conditions.

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**Spot Market**

Sales for delivery in less than three months.

****

**Stainless Steel**

The term for grades of steel that contain more than 10% chromium, with or without

other alloying elements. Stainless steel resists corrosion, maintains its strength at high temperatures, and is easily maintained. For these reasons, it is used widely in items such as automotive and food processing products, as well as medical and health equipment. The most common grades of stainless steel are:

**Type 304**

The most commonly specified austenitic (chromium-nickel stainless class) stainless steel, accounting for more than half of the stainless steel produced in the world. This grade withstands ordinary corrosion in architecture, is durable in typical food processing environments, and resists most chemicals. Type 304 is available in virtually all product forms and finishes.

**Type 316**

Austenitic (chromium-nickel stainless class) stainless steel containing 2%–3% molybdenum (whereas 304 has none). The inclusion of molybdenum gives 316 greater resistance to various forms of deterioration.

**Type 409**

Ferritic (plain chromium stainless category) stainless steel suitable for high temperatures. This grade has the lowest chromium content of all stainless steels and thus is the least expensive.

**Type 410**

The most widely used martensitic (plain chromium stainless class with exceptional strength) stainless steel, featuring the high level of strength conferred by the martensitics. It is a low-cost, heat-treatable grade suitable for non-severe corrosion applications.

**Type 430**

The most widely used ferritic (plain chromium stainless category) stainless steel, offering general-purpose corrosion resistance, often in decorative applications.

****

**Statistical Process Control (SPC)**

A technique used to predict when a steelmaking function's quality may deteriorate. By tightly monitoring the product's variance from specifications, the operator can determine when to apply preventative maintenance to a machine before any low-quality (secondary) steel is produced.

****

**Steckel Mill**

A reversing steel sheet reduction mill with heated coil boxes at each end. Steel sheet or plate is sent through the rolls of the reversing mill and coiled at the end of the mill, reheated in the coil box, and sent back through the Steckel stands and recoiled. By reheating the steel prior to each pass, the rolls can squeeze the steel thinner per pass and impart a better surface finish.

****

**Steel Intensity**

The amount of steel used per unit of gross domestic product. Intensity reflects the secular demand for steel, as opposed to cyclical demand. The amount of steel used in vehicles and the popularity of alternative materials affect the intensity, or how much steel is needed per unit produced. The state of the economy, however, determines the number of units.

****

**Steel-Intensive Products**

Consumer products such as automobiles and appliances that, because so much of their weight is from steel, exhibit a high demand correlation with steel.

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**Steel Service Center Inventories**

End-of-period material stocks reported by the Metals Service Center Institute (MSCI).

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**Steel Strapping**

Banding and packaging material that is used to close and reinforce shipping units, such as bales, boxes, cartons, coils, crates, and skids.

****

**Strength**

Properties related to the ability of steel to oppose applied forces. Forms of strength include withstanding imposed loads without a permanent change in shape or structure and resistance to stretching.

****

**Stress Corrosion Cracking (SCC)**

Slow growth of cracks in stainless steel caused by the combined effect of mechanical stress and exposure to a corrosive environment.

****

**Strip**

Thin, flat steel that resembles hot-rolled sheet, but it is normally narrower (up to 12 inches wide) and produced to more closely controlled thicknesses. Strip also may be cut from steel sheet by a slitting machine (see Sheet Steel).

****

**Structurals**

Steel product group that includes I-beams, H-beams, wide-flange beams, and sheet piling. These products are used in the construction of multi-story buildings, industrial buildings, bridge trusses, vertical highway supports, and riverbank reinforcement.

****

**Substrate**

Raw material used as an input for steel processing: For example, hot-rolled steel is the substrate for cold-rolling operations.

****

**Superalloy 5**

An alloy, usually based on nickel, cobalt, or iron, developed for high temperature service where relatively severe mechanical stressing is encountered and where high surface stability is frequently required.

****

**Super Stainless Steel 5**

Stainless steel alloys with significant additions of chromium, nickel, molybdenum, or copper. Super stainless steel is used in chemical processing, petroleum refining, marine, heat treating, pollution, and waste control industries where there are requirements for extra corrosion protection, strength, or heat resistance.

****

**Suspension Agreement**

A resolution of an unfair trade dispute that can suspend further proceedings in an unfair trade suit. The U.S. government, in consultation with the domestic industry, can enter into such an agreement with the foreign industry.

****

## T

**Taconite**

What?

Natural mineral containing less than 30% iron. It is the primary ore used in blast furnaces.

**Why?**

Domestic supplies of iron-rich ores (greater than 50% iron) were largely depleted in the 1940s, so integrated steel companies now process the lower grade taconite to make it useful.

****

**Tailored Blanks**

A section of sheet or strip that is cut-to-length and trimmed to match specifications for the manufacturer's stamping design for a particular part. Because excess steel is cut away (to save shipping costs), all that remains for the stamper is to impart the three-dimensional shape with a die press (see Blanking).

****

**Tandem Mill**

A type of cold-rolling mill, the tandem mill imparts greater strength, a uniform and smoother surface, and reduced thickness to the steel sheet. Unlike the original single-stand mills, a tandem mill rolls steel through a series of rolls (generally three to five in a row) to achieve a desired thickness and surface quality.

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**Tantalum 5**

An exotic alloy having high corrosion resistance; used for medical implants, chemical process equipment, and aerospace engine components.

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**Tap-to-Tap Time**

The length of time between successive melting cycles or heats.

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**Teeming**

Pouring; ingot molds are filled (teemed) by iron-bearing ladles.

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**Tee Splitting**

Involves splitting metal beams. Tee straightening is the process of straightening split beams.

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**Temper Mill**

A type of cold-rolling mill, usually with only one or two stands, that finishes cold-rolled, annealed sheet steel by improving the finish or texture to develop the required final mechanical properties. By changing the rolls of the temper mill, steel can be shipped with a shiny, dull, or grooved surface.

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**Terne**

Sheet steel coated with a mixture of lead and tin. Terne principally is used in the manufacture of gasoline tanks, although it also can be found in chemical containers, oil filters, and television chassis.

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**Tin Mill**

Continuous tin-plating facility to produce tin mill steel sheet to be used in food and beverage cans and other containers.

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**Tin/Chrome Plating**

A plating process whereby the molecules from the positively charged tin or chromium anode attach to the negatively charged sheet steel. The thickness of the coating is readily controlled through regulation of the voltage and speed of the sheet through the plating area.

****

**Tin-Free Steel**

Chromium-coated steel. Because it is used in food cans just like tin plate, it ironically is classified as a tin mill product. Tin-free steel is easier to recycle because tin will contaminate scrap steel in even small concentrations.

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**Tin Plate**

Thin sheet steel with a very thin coating of metallic tin. Tin plate is used primarily in canmaking.

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**Titanium**

Titanium and its alloys have very high strength-to-weight ratios. At normal temperatures, they have high resistance to corrosion. Used primarily in aerospace and chemical processing applications.

****

**Tolerances**

A customer's specifications can refer to dimensions or to the chemical properties of steel ordered. The tolerance measures the allowable difference in product specifications between what a customer orders and what the steel company delivers. There is no standard tolerance because each customer maintains its own variance objective. Tolerances are given as the specification, plus or minus an error factor; the smaller the range, the higher the cost.

****

**Toll Processing**

The act of processing steel for a fee ("toll"). Owners of the steel sheet may not possess the facilities to perform needed operations on the material (or may not have the open capacity). Therefore, another steel mill or service center will slit, roll, coat, anneal, or plate the metal for a fee.

****

**Tool Steels**

Steels that are hardened for the use in the manufacture of tools and dies.

****

**Ton**

Unit of measure for steel scrap and iron ore.

Gross Ton: 2,240 pounds.

Long (Net) Ton: 2,240 pounds.

Short (Net) Ton: 2,000 pounds. Normal unit of statistical raw material input and steel output in the United States.

Metric Ton: 1,000 kilograms. 2,204.6 pounds or 1.102 short tons.

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**Tubing**

When referring to OCTG, tubing is a separate pipe used within the casing to conduct the oil or gas to the surface. Depending on conditions and well life, tubing may have to be replaced during the operational life of a well.

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**Tundish**

The shallow refractory-lined basin on top of the continuous caster. It receives the liquid steel from the ladle, prior to the cast, allowing the operator to precisely regulate the flow of metal into the mold.

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**Tungsten Materials 5**

Include tungsten and tungsten carbide powders, sintered tungsten carbide products and cutting tools for the metalworking, mining, oil and gas, and other industries requiring tools with extra hardness.

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**Tunnel Furnace**

Type of furnace whereby stock to be heated is placed upon cars, which are then pushed or pulled slowly through the furnace.

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**Twin Milling 3**

Grinds one or all six sides of a small square or rectangular piece of aluminum plate into close tolerance.

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## Steel Glossary U - Z


**Everything You Always Wanted to Know About Steel...But Were Afraid to Ask - December 2004**

*Michelle Applebaum Research provides this collection of terms and concepts used in our research, company and industry reports, and other steel publications as an invaluable tool for those in the steel industry.*





## U

**Unfair Trade Suit**

A type of lawsuit filed by U.S. companies against their foreign counterparts in response to imports at prices being lower than those in the prices in the U.S. market. Sanctions can be imposed by the ITC and the Commerce Department on foreign producers involved in dumping and government subsidization, if domestic manufacturers can prove material injury.

****

## V

**Vacuum Degassing**

An advanced steel refining facility that removes oxygen, hydrogen and nitrogen under low pressures (in a vacuum) to produce ultra-low-carbon steel for demanding electrical and automotive applications. Normally performed in the ladle, the removal of dissolved gases results in cleaner, higher quality, more pure steel (see Ladle Metallurgy).

****

**Vacuum Oxygen Decarburization (VOD)**

**What?**

Process for further refinement of stainless steel through reduction of carbon content.

**Why?**

The amount of carbon in stainless steel must be lower than that in carbon steel or lower alloy steel (i.e., steel with alloying element content below 5%). While electric arc furnaces (EAF) are the conventional means of melting and refining stainless steel, VOD is an economical supplement, as operating time is reduced and temperatures are lower than in EAF steelmaking. Additionally, using VOD for refining stainless steel increases the availability of the EAF for melting purposes.

**How?**

Molten, unrefined steel is transferred from the EAF into a separate vessel, where it is heated and stirred by an electrical current while oxygen enters from the top of the vessel. Substantial quantities of undesirable gases escape from the steel and are drawn off by a vacuum pump. Alloys and other additives are then mixed in to refine the molten steel further.

****

## W

**Walking Beam Furnace** [1]

A hot strip mill reheat furnace where the slab is repeatedly lifted and set down at a more forward point in the furnace; this is in contrast to a batch reheat furnace or a pusher-type reheat furnace.

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**Welding** [3]

Joining of two or more pieces of metal.

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**Wheelabrating, Shotblasting, and Bead Blasting** [3]

Involves pressure blasting metal grid into carbon steel products to remove rust and scale from the surface.

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**Wire** [5]

A long product that is from 0.030 inch (0.76 mm) to ¼ inch (6.35 mm) in diameter, in round, square, octagonal, or hexagonal cross-sections.

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**Yield** [2]

The ratio of the amount of product compared with the amount of material input to a process or group of processes.

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Source: Alcoa 10-K

[ii] Source: Dofasco Glossary of Terms

[iii] Source: Reliance Steel 10-K

[iv] Source: BlueScope Steel Glossary of Terms