

## 6. Flat Steel

### 6.1. Coils: Processing and Service Centers

There are two kinds of flat products: strips or sheets coming from coils and plates.

The coils themselves may be final products for a rolling mill, but they are always further processed; either at a mill or at steel service centers or at end-users facilities. They are produced as a feedstock for cold rolled coil and coated coil, but also for direct use in a variety of industrial applications including steel tubes used in transport, construction, shipbuilding, gas containers, pressure vessels and energy pipelines. Hot rolled sheet with an anti-slip surface and a diamond or teardrop pattern is typically used for stairs, industrial floors and tailboards for goods vehicles.

Strips are produced by slitting on slitting lines. Slitting involves selecting a master coil of a given width and passing it through circular knives separated by spacers. The knives act as a rotary shear, slitting the coil to a desired width. After the material passes through the knives and has been slit, each width is recoiled separately. If the baby coils are destined for further processing, they are banded and strapped together with a binding strip.

Sheets are produced by cutting on cut-to length lines. Cut-to-length leveling lines convert coil into sheet and plate. These fully automatic, high-speed, cut-to-length lines employ levelers to flatten coil as it moves through the line. Dot matrix stenciling systems can custom-mark each sheet or plate according to customer requirements. After stenciling, a heavy-duty shear cleanly cuts the sheet to specification, and then provides edge conditioning. Light-gauge cut-to-length leveling lines also include decoiling systems, heavy-duty levelers, PVC plastic applicators, precision shearing assemblies, and highly advanced automatic stackers. The pneumatic-driven plastic applicators provide superior protection for cut sheets of cold rolled, coated, stainless, and aluminum -- eliminating possible surface damage during fabrication. And the automatic stacking and conveying system ensures that each order is precisely cut, protected, inspected, and packaged all on the same line. Cut-to-length sheet can be quickly readied for primary processing such as burning, shearing, plasma punching, and laser cutting.

Blanking – Blanking can be considered a step beyond the conventional cut-to-length line in terms of both speed and accuracy. The process allows for slit coil to be leveled and cut-to-length in narrow widths and much closer tolerances than can be achieved by shearing. Its high speed and superior accuracy make blanking operation especially well-suited for precision jobs involving a high number of repeat parts.

A Steel Service Center buys steel products in large quantities from producing mills and holds the material in inventory until sold to a customer. When a service center sells steel it will perform any processing the customer requests, load the steel and deliver it to the user. Service Centers usually offer varying degrees of material "pre-processing." Pre-processing involves basic cutting services, such as sawing, shearing, and shape burning to cut material to a size and/or shape that is either immediately usable by the customer, or greatly reduces the customer's time to make the steel usable.

The type, quantity, and sophistication of pre-processing services offered by a particular Service Center are determined by the Service Center's product and customer mix. But about seventy percent of the metal passing through Service Centers undergoes some form of pre-

production processing, such as slitting, shearing, sawing, grinding, flame cutting, coil coating, and cutting-to-length.

The existence of Steel Service Centers allows the steel user to have huge inventories readily available while only paying for the steel they need, when they need it. This reduces or eliminates the need for end users to tie up capital in inventory, pre-processing equipment, processing personnel, and trucks.

## **6.2. Plates**

Plates differ from other flat products because their widths can go up to 5.0 meters; their thickness is above 4.8 mm (up to 1000 mm) and their mechanical routes are rather sophisticated (high mechanical characteristics and product niches). Plates are usually rolled on reversing quarto mills (one or two rolling stands), so they are also called “reversing mill plates” or “quarto plates”.

Before the 16<sup>th</sup> century, plates were made by hammering small steel ingots. One of the first rolling stands was drawn in 1495 by Leonardo da Vinci. The production process involves reheating slabs, rolling, cutting and heat treatment.

## **6.3. Main markets for plates**

The main markets for plates are: construction (bridges, building columns), machinery (boilers, cranes, bulldozers, excavators, metal equipment, wagons...), energy markets (line pipe, windmill, offshore) and shipbuilding.

### **6.3.1. Construction**

The main usage of plates in the construction market is to build bridges. The strength of steel enables large areas to be spanned without the need for intrusive columns. Bridge forms include “I” girders, trapezoidal boxes or truss designs, which can be found in short to long spans. Weathering steel grades are popular due to lower painting costs.

Plates are also used in building construction for base plates, heavy support members and splice plates.

Safety floor plates are used in stairways and loading docks while water storage tanks represent another segment of the construction market that uses plates, primarily carbon grades.

### **6.3.2. Machinery**

The machinery market covers a variety of plate applications including construction and earthmoving equipment, cranes and mold, tool and die. The steel used must be weldable and formable to allow for a variety of fabrication demands and generally higher strength level grades are used. Because of the tight tolerances needed to assembly some machinery, laser cutting is used.

In rail transportation, plates are used to construct structural portions of rail cars that support or contain cargo. Car types include tank cars for carrying liquid cargo and hopper cars for hauling grain or other solid materials. Coal cars often use weathering steel grades containing copper for corrosion resistance. Stainless grades are used to construct rail cars for hauling coal and other corrosive materials and carbon grades are used in structural parts of locomotives.

### **6.3.3. Energy markets**

The oil and gas market uses plates to build exploration, drilling, transmission and refining equipment for the collection, processing and distribution of petroleum-based products and natural gas. Special applications include offshore platforms and pressure vessels in oil refineries.

The pipe and tube market uses discrete and coiled plate steel. Manufacturers form plates into pipes and tubing. Pipes are used to transport petroleum products, natural gas or water. Specifications for these applications vary by use and geographic location. API (American Petroleum Institute) specifications form the basis of most petroleum-based applications.

Various parts of electricity generation and distribution equipment are built from plate steel. Electric utilities, nuclear or fossil-fuel based, use plate steel to form pressure vessels that contain steam needed for power generation. Hydroelectric applications use plate steel to construct turbines, penstocks and other related equipment. Transmission towers carrying high voltage lines and utility poles often are constructed from weathering steel grades. Utility poles are also often painted and made from galvanized plate steel.

### **6.3.4. Shipbuilding**

The shipbuilding market consumes significant amounts of steel plates. Shipyards use plate steel for production of bulk carriers, barges and container and cruise ships. In the United States, most steel made for ship construction is specified by the American Bureau of Shipping (ABS).

U.S. Navy ships use significant amounts of alloy armor plate steels in surface and submarine applications.

### **6.3.5. Specialty markets**

But there are also specialty markets, where we can find: wear resistant plates, armor plates, cryogenic plates, molds, tools plates, or clad plates.

The US military uses carbon steel and military alloys for Army and Navy applications. Plate steel is produced to their specifications. Military alloy armor grades for Army and Navy applications are quenched, tempered and tested to very stringent requirements. These plates are used in armored tanks, personnel vehicles, submarines, aircraft carriers and cruisers.

Mining, quarrying and lumbering applications use a variety of plate steels. Mining equipment includes power shovels and dragline buckets for above ground use and underground equipment, such as that used in long wall mining. Quarries use plate steel for digging apparatus and in chutes for conveying aggregate. Lumbering operations use plate steel in saws, shear blades and structural elements.

Plate steel is used selectively for certain parts of agricultural equipment, including harvesters, plows and tillers.

Plate steel is not used extensively by the aircraft and aerospace market. However, the industry does require “aircraft quality” plate steels for specialized parts. Although very little plate steel becomes part of an aircraft, the machine tools, forming presses and other equipment used to fabricate aircraft parts are built from a variety of plate steels.

Plate steel is not used directly in automotive construction; however, it is used to fabricate heavy axles for trucks. Plate steel is used in presses to cold form automotive sections or in plastic injection molding equipment.

### Points to remember:

- There are two kinds of flat products: Strips or sheets coming from coils and plates.
- Strips are produced by slitting on slitting lines.
- Sheets are produced by cutting on cut-to length lines.
- A Steel Service Center buys steel products in large quantities from producing mills and holds the material in inventory until sold to a customer.
- Plates are produced on reversing quarto mills and differ from sheets: plates are thicker and usually wider.
- The main markets for plates are: construction, machinery, energy markets and shipbuilding.
- But there are also specialty markets, where we can find: wear resistant plates, armor plates, cryogenic plates, molds, tools plates, or clad plates.

### Glossary:

English	Czech
Armored plate	Pancéřový plech
Axle	Náprava kola
Cut-to-length line	Příčná dělicí linka
Harvester	Kombajn
Leveler	Rovnačka
Long wall	Porubní stěna
Penstock	Koryto stavidla
Quarry	Kamenolom
Quarto plate	Quarto plech
Slitting line	Podélná dělicí linka

Tiller	Kypřič
Weathering steel	Ocel se zvýšenou odolností proti proti atmosférické korozi