The manufacturing route for tinplate products

From hot strip to tinplate

The basic raw material for the production of tinplate products is hot rolled steel strip. The production process reduces this to the required thickness by cold-rolling. This rolled strip is then coated with tin or chromium in an electrolytic process. For some applications polymer coatings are applied for additional protection of the metal.

Hot rolled strip
Hot rolled steel strip is the raw material for the production of tinplate. Large coils of steel, measuring about 2 – 3mm in thickness and weighing up to 25 tonnes, are supplied to the plant.

1 Acid bath pickling
Processing begins with the pickling of the hot rolled strip in an acid bath to remove the iron oxide layer formed during rolling. After the continuous pickling process, the strip is rinsed, dried, edge trimmed, oiled and rewound into coils.

2 Cold rolling
The tandem cold rolling mill takes the pickled hot rolled strip and rolls it to achieve its final thickness of between 0.12 and 0.49 mm

The tandem mill has several stands equipped with a four high arrangement of rolls. At the bottom and top of each stand are large back-up rolls with two smaller working rolls in the centre through which the strip passes. By passing the hot strip through these rolls, the strip is reduced to less than 10% of its original thickness. The strip and rolls require lubrication with an oil and water mixture.

Water also provides essential cooling of the rolls. Consumption of water is minimised through the use of a closed loop re-cycling system.

3 Cleaning and degreasing
After cold rolling, the strip requires degreasing. First it is cleaned of impurities and lubricant residue and then in an electrolytic degreasing cycle, the strip is passed through an alkaline bath through which an electric current is passed.

Next the strip is scrubbed, rinsed, dried and rewound into coils.

4 Continuous annealing
Cold rolling makes the strip hard and brittle and in this condition it is unsuitable for use as a packaging material. The strip requires annealing to restore its crystal structure and ductility. In continuous annealing the strip passes in vertical loops through a furnace in a controlled atmosphere that prevents oxidation of its surface.

Strip annealed in a continuous furnace for approximately two minutes at up to 680°C is harder and more resilient than batch-annealed material.

5 Batch annealing
An alternative option for restoring the ductility of steel strip after cold rolling is the batch-annealing method.

This three-day process restores the crystal structure of the strip that was changed during cold-rolling. As many as four coils are stacked on top of each other and placed under a system of inner protective and outer furnace covers. The coils are heated to around 600°C. Oxidation of the strip surface is prevented by an oxygen-free controlled atmosphere. When compared with the continuous annealing method, batch annealing yields a product of lower hardness.

6 Temper rolling
For most applications, after annealing the steel strip is too soft to handle and lacks the required strength. Its strength is brought to the desired level by a light reduction on a temper mill which also gives the steel its required surface quality and flatness.

At this stage, the product can be sold as blackplate, mainly for applications other than packaging. For packaging purposes steel strip needs extra protective coatings and this is when it becomes known as tinplate.

7 Double reduction rolling
Higher strength steels can be obtained by giving the steel strip a stronger reduction on a double reduction mill. Although this makes the steel less deformable, the added strength is recognised and valued for making very thin and lightweight packaging.

8 Tin / chromium coating
Steel strip when coated becomes tinplate. The steel is joined in an endless strip by welding, and the material is passed through an electrolytic strip coating line where a thin layer of tin or chromium is applied to its surface.

9 Polymer coating
Polymer coatings can be applied to the steel for specific applications. These coatings are made by either applying a ready-made polymer film or by a direct extrusion process.

There are different sorts of polymer, the principle types being PET and PP, available in a range of grades and colours.

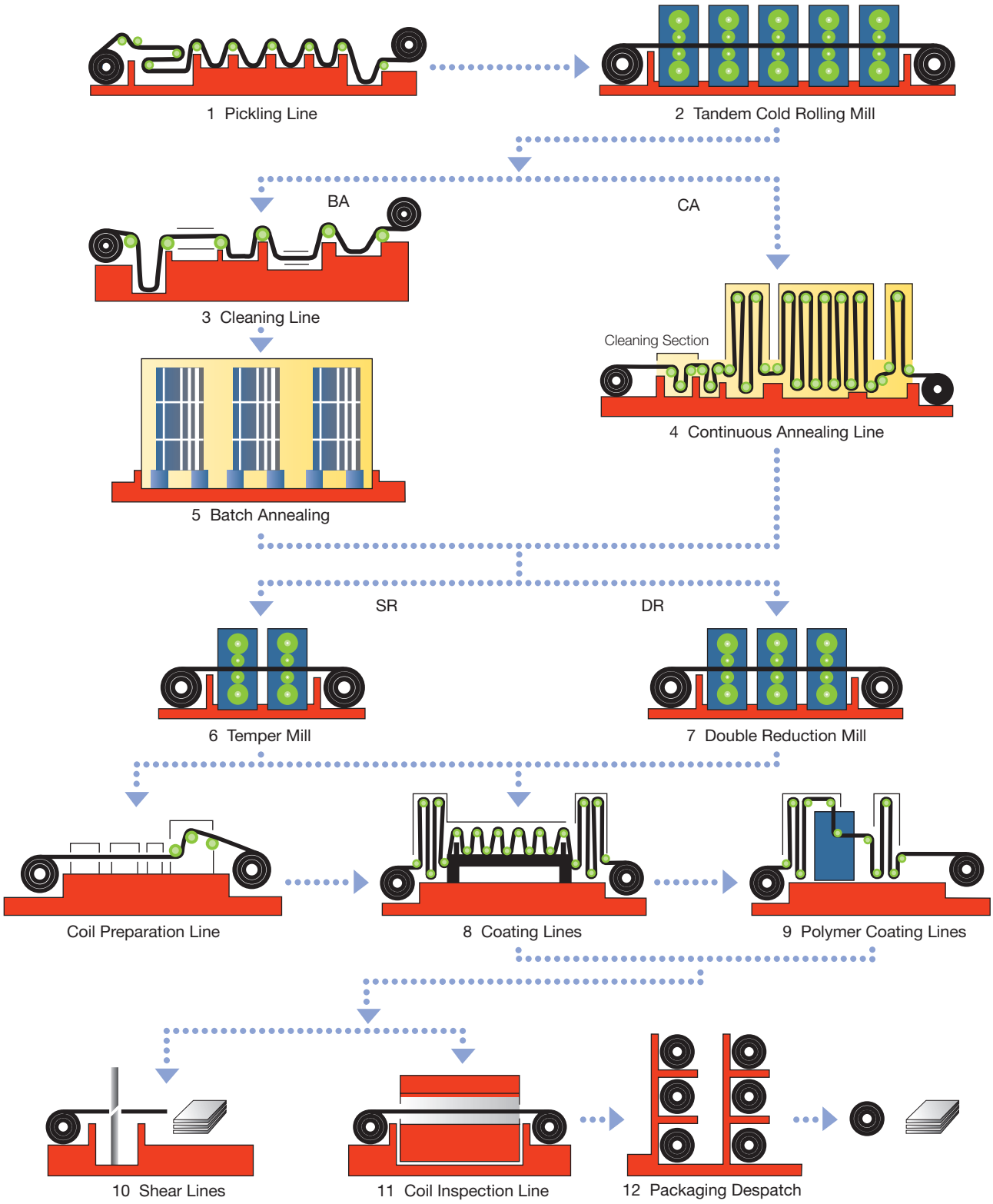
Polymer coatings are applied predominantly to chromium coated steel. Polymer-coated steel can be directly converted into cans and offers outstanding protection properties.

10 Sheet cutting
After coating, the tinplate either remains in a coil or is cut into sheets in various cut-to-size formats for shipping to the processor.

Sheets can be straight-edged for rectangular sheet metal parts such as body can sections or scroll-cut for round sheet metal parts such as can ends or cups.

11 Coil inspection line
The sophisticated instrumentation system, together with advanced temperature control and visual inspection, ensures a final product with consistent adhesion, appearance and structure.

12 Storage and despatch
All products are carefully packed and stored before shipment. Our steel products are transported to customers in any part of the world by rail, truck or ship.


1 Pickling Line
2 Tandem Cold Rolling Mill
BA
CA
3 Cleaning Line
Cleaning Section
4 Continuous Annealing Line
5 Batch Annealing
SR
DR
6 Temper Mill
7 Double Reduction Mill
Coil Preparation Line
8 Coating Lines
9 Polymer Coating Lines
10 Shear Lines
11 Coil Inspection Line
12 Packaging Despatch