ArcelorMittal

This is how ArcelorMittal Gent produces steel

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Introduction

ArcelorMittal Gent is part of ArcelorMittal, the new steel group that was founded in 2006 as a result of the merger of Arcelor and Mittal Steel. Arcelor itself was founded in 2002 grouping Arbed, Aceralia and Usinor.

ArcelorMittal counts 61 companies in 20 countries and employs 245,000 people worldwide. The Group shipped about 84 million tonnes of steel in 2012, 4.4 million tonnes being produced in Gent. Its production capacity and its maritime location make ArcelorMittal Gent one of the most important steel production sites in Europe.

The development of modern ways to produce steel, the discovery of high-grade ore reserves in overseas areas, the tremendous evolution in exploitation techniques and the construction of giant ships – reducing transport costs significantly – must be the main reasons why steel groups decided to create new steel companies in coastal areas after World War II. There they would find themselves with many more opportunities than the traditional steel industry inland.

This is the context in which the production site in Gent was founded. In 1959, the Luxembourgian steel giant Arbed together with some other Belgian and European steel companies and financial groups took the initiative to found a “modern” steel company at the Gent-Terneuzen canal. The city of Gent helped in acquiring a 624 hectares territory on the east bank of the canal. On 27 April 1962, the project was approved by the ECSC and a few months later, on 10 July 1962, Sidmar NV/SA was founded. A maritime steelworks that was based in Flanders and that could be accessed by large vessels had now become reality. It instantly reassured anyone who had concerns about our country’s economic expansion.

However, the idea of founding a steelworks alongside the Gent-Terneuzen canal had been playing in people’s heads a lot longer. Indeed, on 5 March 1928, Emile Mayrisch, who was the then chairman of the Management Board of Arbed Luxembourg, assigned his immediate staff to buy a plot of land along the Gent-Terneuzen canal on behalf of Arbed.

Even then, Emile Mayrisch had a feeling that rich overseas iron ore would soon play an important role in European hot metal production. He wanted Arbed to be prepared. As a result, in 1932, Arbed became the owner of 211 hectares of land at the right bank of the canal. Because of World War II and post-war difficulties, these grounds would not be exploited until 1962.

The construction of Sidmar – as the site was called at the time - began in December 1963, involving driving tens of thousands of piles into the ground, pouring thousands of cubic metres of concrete, assembling thousands of tonnes of steel trusses, drawing kilometres of cable and laying just as many pipes, building roads and railways.

It is worth mentioning that the various installations were built in reverse order to the production process. This is when the production units were first used:

• First cold rolling mill	1966 (January)
• Wide hot strip mill	1966 (December)
• First sinter plant	1967 (March)
• First blast furnace	1967 (May)
• BOF steel shop	1967 (May)
• Second blast furnace	1968 (May)
• Second cold rolling mill	1971 (March)
• First coke-oven battery	1972 (April)
• Second sinter plant	1972 (July)
• Second coke-oven battery	1972 (September)
• Continuous annealing section	1981 (August)
• Continuous slab caster 1	1985 (July)
• Pulverised coal injection equipment	1987 (April)
• E2/R2 reversing rougher in the hot strip mill	1987 (November)
• First Walking beam furnace in the hot strip mill	1988 (March)
• Seventh rolling stand in the finishing mill of the hot strip mill	1991 (October)
• Organic coating line 1 (Geel)	1991
• Electrolytic galvanising line (Genk)	1993
• Vacuum degassing station in the steel shop	1994 (April)
• Turbulent pickling line coupled to the modernised tandem mill (TTS) in the cold rolling mill	1994 (November)
• Second walking beam furnace in the hot strip mill	1998 (March)
• Hot dip galvanising line 1	1998
• Hot dip galvanising lines 2 & 3	2000
• Production line for tailor-welded blanks	2000
• Continuous slab caster 2	2002
• Organic coating line 2 (Gent)	2002
• Secondary dust removal facility in the steel shop	2004
• Revamping of the exit section of the hot strip mill	2004
• New coke oven gasholder	2007
• Pickling line 3 coupled to tandem mill 2 in the cold rolling mill	2007
• Second degassing installation in the steel shop	2010
• Converter gas recovery	2010
• Connection between the gas grid of ArcelorMittal Gent and the new Electrabel power station	2010
• Third coal grinding unit	2011
• New drives and engines for 2 finishing stands in the hot strip mill	2012

ArcelorMittal Gent is a maritime integrated steel plant that fully concentrates on producing flat steel products.

MARITIME STEELWORKS

Our company lies on the right bank of the Gent-Terneuzen canal, at 15 km from the city of Gent, and at less than 17 km from the Terneuzen lock. Through the sea lock, we are connected with the Western Scheldt and, consequently, with the North Sea, one of the busiest waterways in the world.

Ships with a permitted draught of 12.50 m or a load capacity of 71,000 tonnes can call in at our company's port and directly supply all necessary raw materials, mainly iron ore and coal.

INTEGRATED STEELWORKS

Our company features all production units needed to produce finished products such as hot rolled, cold rolled and coated sheets, as well as laser-welded blanks, starting from raw materials. Moreover, these departments were built on a greenfield site, which made it possible for us to conceive an optimum company lay-out. This meant eliminating all unnecessary intermediate transport and storage.

FLAT STEEL PRODUCTS

The steel industry usually makes a distinction between long products, such as reinforcing steel, heavy sections and rails, and flat products, as there are thin hot or cold rolled coils and sheets, and medium and heavy steel coils and sheets.

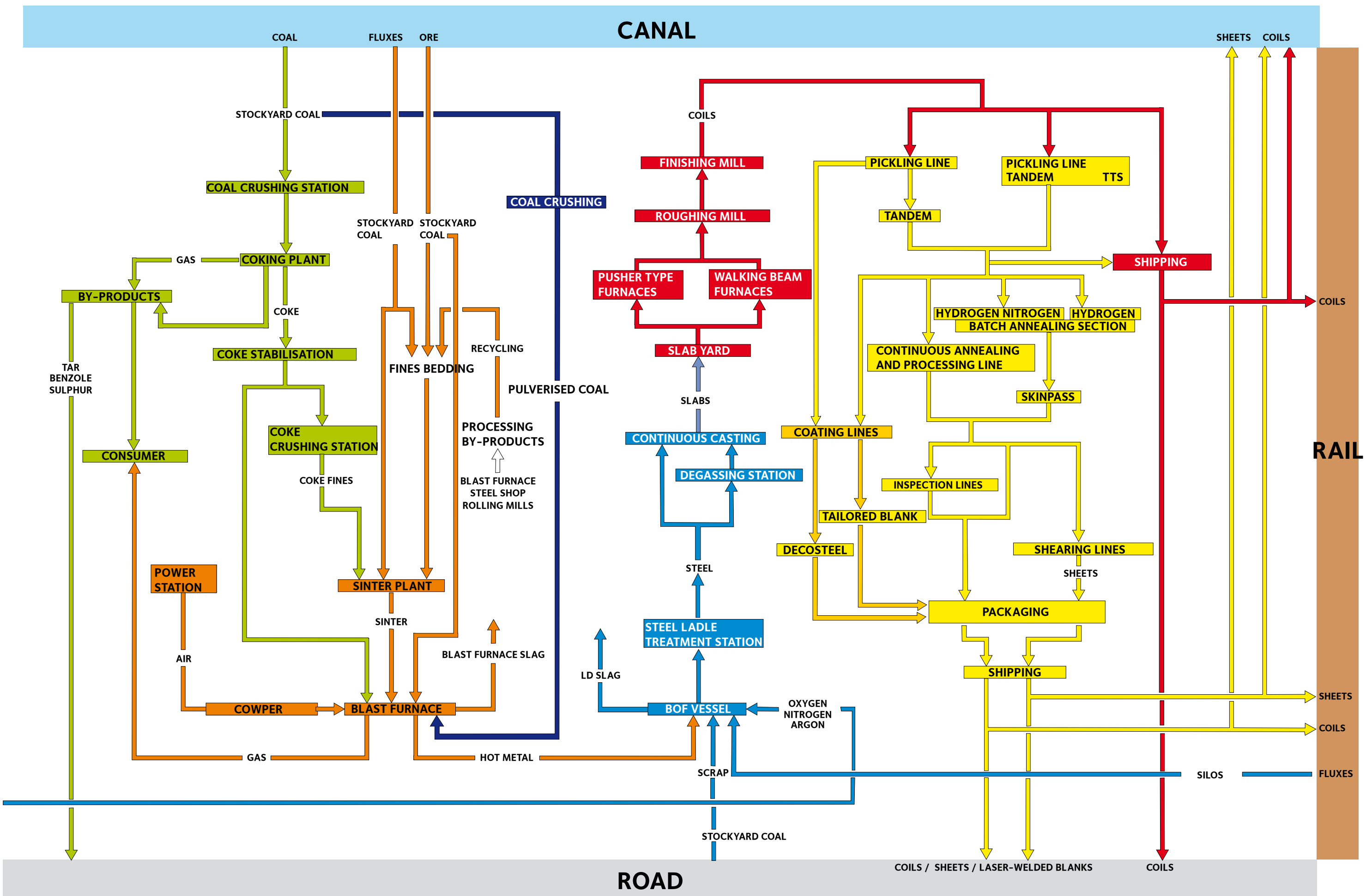
We only produce flat products with high added value that are characterised by uniform mechanical properties, pure surface, excellent flatness, high deformability and elasticity, and superior weldability.

A significant part of production is later on coated, either by hot dip galvanising, electrolytic galvanising or organic coating.

Generally speaking, we can say that our products are used in:

- car bodies for the automotive industry
- containers, tanks and drums
- radiators
- construction elements such as stairways, ceilings, wall panels, etc.
- furniture
- household appliances
- tubes
- railway equipment
- road equipment such as traffic signs, etc.

Production scheme



SUSTAINABLE DEVELOPMENT

ArcelorMittal Gent's corporate strategy is based on the 3 P's in sustainable development:

- Profit;
- People;
- Planet.

Just like any other company, our company wants to make a profit, by abiding by the ArcelorMittal principles of sustainable development and forming a long-term alliance with:

- our employees, by offering them a safe and healthy environment and stimulating them to grow as a group and as individuals;
- our customers, by delivering new steel solutions and guaranteeing the best customer service possible;
- financial institutions and suppliers, by maintaining a relationships that offers possibilities for both parties;
- our neighbours: by communicating openly and transparently and by taking our responsibility for what environmental protection is concerned.

We dedicate about 15% of our investments to measures intended to boost our environmental performance. Our environment technical achievements are among the best in Europe. A striking example is our water recycling system: every cube meter of water is used no less than 25 times in the production process.

HIGH-TECH COMPANY

Just like any modern company, our company is characterised by its drive to constantly innovate. We work closely together with different research centres within ArcelorMittal and schools to develop new steel grades and new coatings. That is why we managed to double our productivity in 15 years' time.

We aim at long-term partnerships with our customers: from the very beginning, we are involved in the development of new products. That way, ArcelorMittal research centres can test the practicability of certain prototypes and customers can keep down their development costs and accelerate their "time to market".

After a new product is designed, it is developed – which means it is optimised for production. That is the stadium in which we advise our customers on the best steel grade for reducing production costs and improving the finished products.

For the automotive industry for instance, we have developed a thinner steel sheet that however still has the same strength. As a result, car bodies become lighter, which makes driving more energy-saving and environment-friendly. The research centre ArcelorMittal Global R&D Gent (OCAS) has developed a new steel concept to reduce the noise that laundry machines make at high spin-drying speeds.

Thanks to mathematic models, production departments succeed in further optimising the production process itself, which leads to a productivity increase. The different steps in the production process are described in process models. Thanks to software systems, statistic techniques are applicable online, which is of paramount importance in product quality control and in the production process efficiency. Thanks to control models, the production process' organisational and logistic aspects are watched closely.

Gathering and centralising knowledge is crucial to our company's continuity and technological progress. That is why support services are so valuable: they allow knowledge to be passed on smoothly in case of adjustments or expansions.

COKING PLANT

The coking plant produces metallurgical coke from a blend of different coking coals, imported in large quantities by sea vessels. The coals are unloaded and transferred by conveyor belts to a stockyard area, which has a capacity of 640,000 tonnes. The coals are unloaded by two combined stacker-reclaimers that can each pile up 3,000 tonnes/h and reclaim 1,500 tonnes/h.

While reclaiming these machines feed the coking plant silos and the coal-grinding plant. This line also has a scalper, eliminating oversize objects. The coal silos contain the coals to be blended. From there, the coal blend is conveyed to a coal crushing station. The crushed blend then passes on to a mixer and is conveyed to the storage bins on top of the coke batteries.

Coal in its basic form is not suitable for direct use in the blast furnace. It contains too many harmful or useless elements for the melting process in a reducing atmosphere and it is not strong enough to carry the blast furnace burden. It must therefore be converted into metallurgical coke.

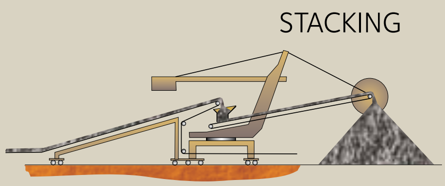
The coal is heated to 1,250 °C in the coke ovens. Since these ovens are oxygen-free, the coal does not burn. This process is called dry distillation. It takes about 18 hours to convert 35 tonnes of coal into 25 tonnes of metallurgical coke.

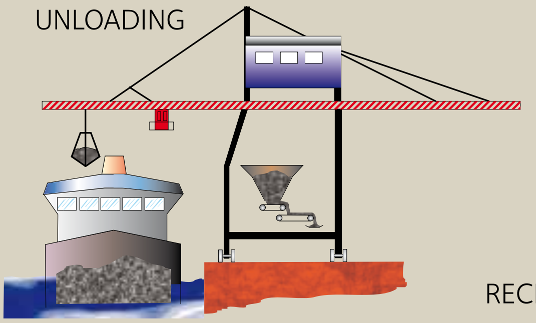
During this distillation process a large quantity of gas and smoke is generated, which will be processed into coke oven gas and other valuable by-products such as tar, sulphur, ammonia, naphthalene and benzole.

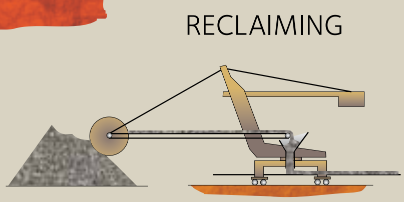
The coking plant consists of two batteries of 50 ovens each. The batteries are heated through the oven walls, which are provided with gas burners. A larry car on top of the batteries brings the coal blend from the storage bins to the coke ovens and charges the coal blend into the emptied ovens.

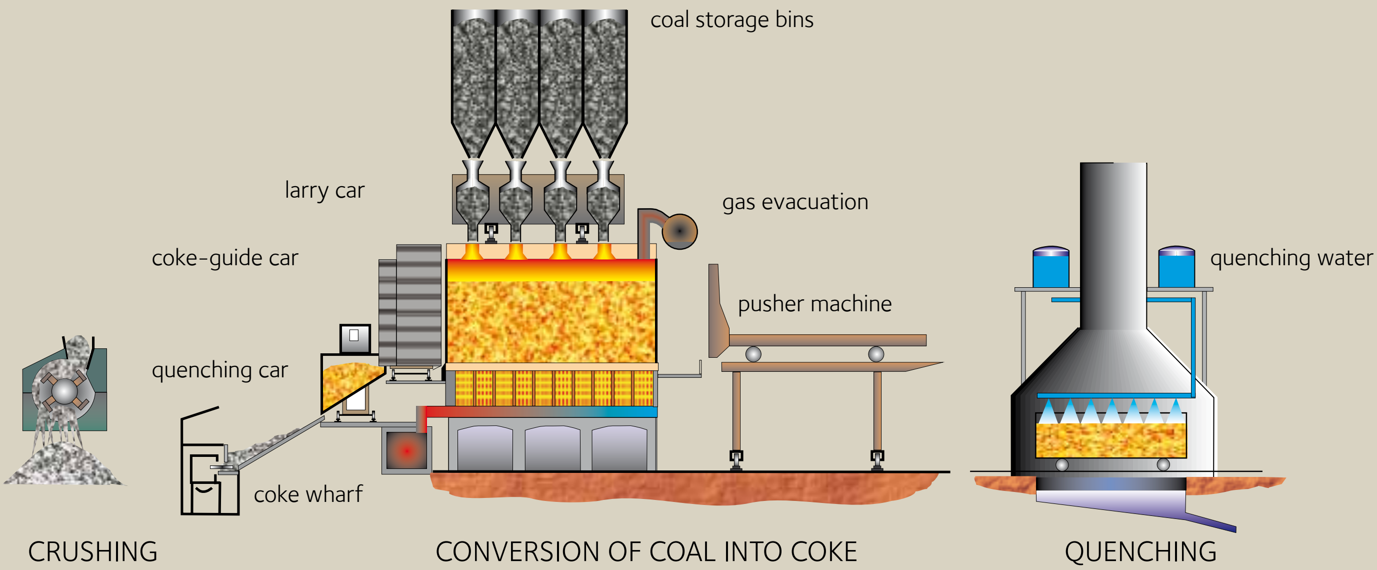
As for the unloading of the coke ovens, the coke cake is removed from the oven by means of a pusher machine, which is equipped with a pusher arm. A coke-guide car then guides the coke into the quenching car. The coke is then transferred to the coke quenching tower, where it is quenched with water. Afterwards, the coke is dumped on the coke wharf, where the remaining water evaporates.

A reclaimer then feeds the coke from the wharf to a conveyor belt, which transfers the coke to the crushing/screening station.


STACKING


UNLOADING


RECLAIMING


coal storage bins
larry car
gas evacuation
coke-guide car
quenching water
pusher machine
quenching car
coke wharf
CRUSHING
CONVERSION OF COAL INTO COKE
QUENCHING

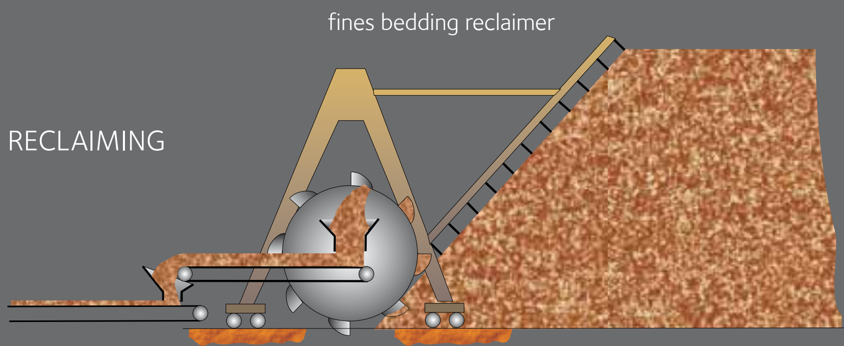
RAW MATERIAL HANDLING

Large ore vessels with a deadweight capacity of 88,000 tonnes import iron ore from overseas.

These vessels are unloaded with two gantry cranes with a maximum unloading capacity of 1,200 tonnes per hour each, one gantry crane with a maximum unloading capacity of 1,700 tonnes per hour and a jib crane that has an unloading rate of 600 tonnes per hour. Belt conveyors transfer the ore to a stockyard area, which can pile up to 12 different qualities of ore.

Four stacker-reclaimers handle the meticulous storage of the different qualities of ore. These machines reclaim the piles afterwards in well-specified proportions and feed the ore qualities to conveyor belts that transfer them to the fines bedding.

This fines bedding consists of different fine ores, fluxes and recycled products that are piled in chevron layers. In order to make an optimal blend, the fines bedding is reclaimed by a drum-type reclaimer over the full width of the bedding.

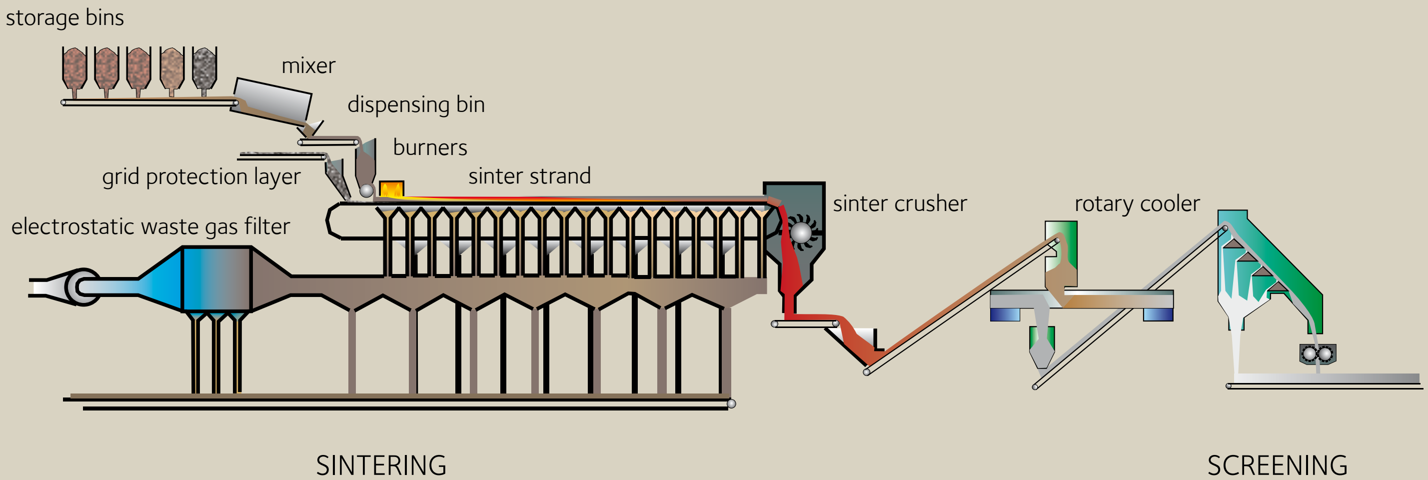


SINTER PLANTS

In both sinter plants, a mixture of iron ore fines, recycled ferriferous products (like dust from the blast furnace, mill scale, sludge from the dedusting unit in steel shop) and various fluxes are converted into an instant ore product with the optimum chemical composition, size distribution, mechanical resistance and permeability for blast furnace operation.

Therefore the sinter mixture is layered with coke breeze on a slowly moving strand. This strand consists of a number of pallets (cars) arranged as a closed loop. The layered sinter mix surface is first ignited. As the strand moves on, air is sucked away through wind boxes underneath the strand. At the end of the sinter lines, the sinter cake is discharged on a crash-deck, crushed, cooled on a cooling line (sinter plant 1) or on a separate rotary cooler (sinter plant 2), and screened. The sinter is then ready to be used and is conveyed to the blast furnace storage bins by means of conveyors.

At ArcelorMittal Gent, sinter typically accounts for 90% of the blast furnace metallic burden, the remaining part consisting of pellets and calibrated ore. That is why we have two sinter plants with a joint capacity of approximately 19,000 tonnes per day.



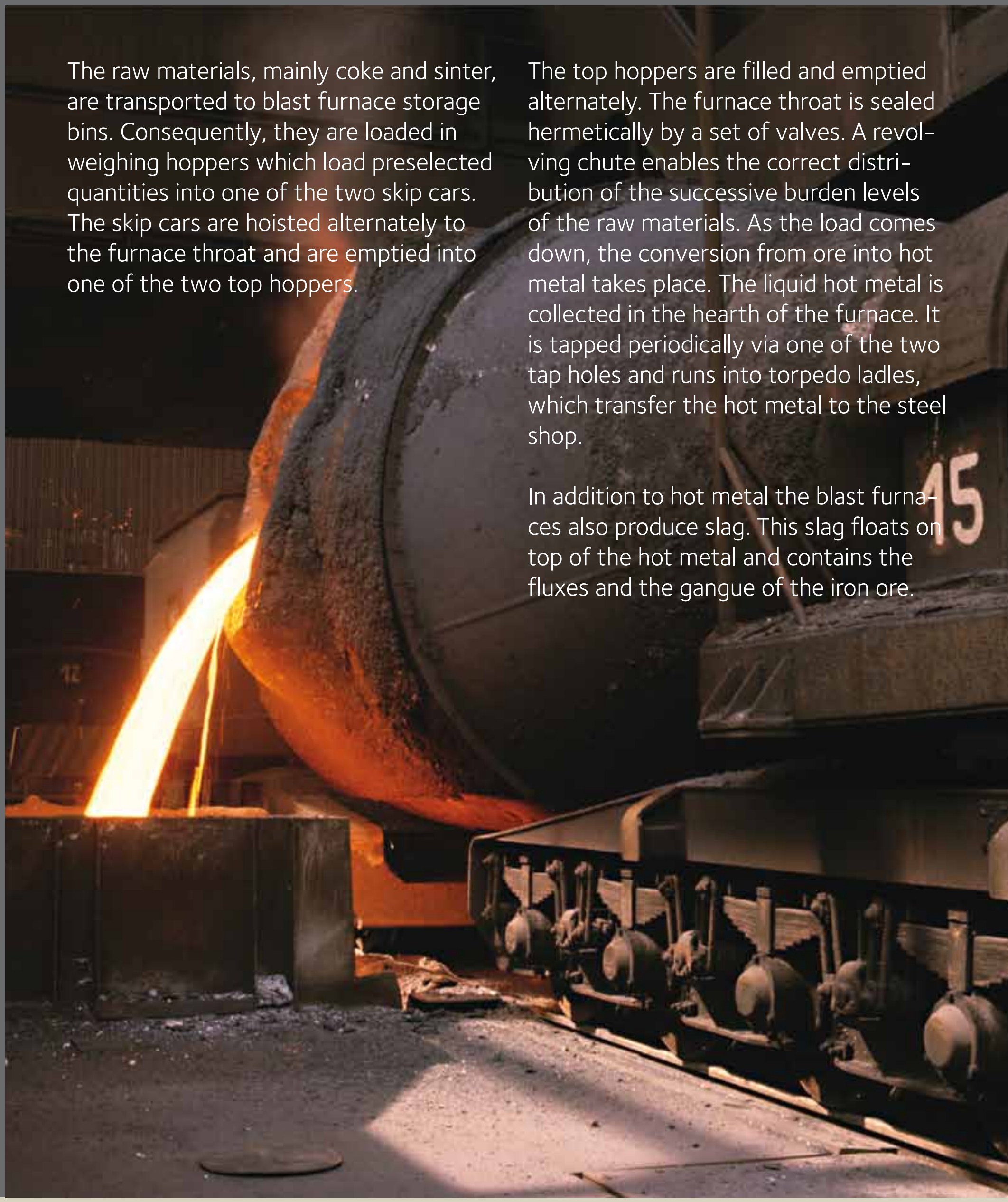
BLAST FURNACES

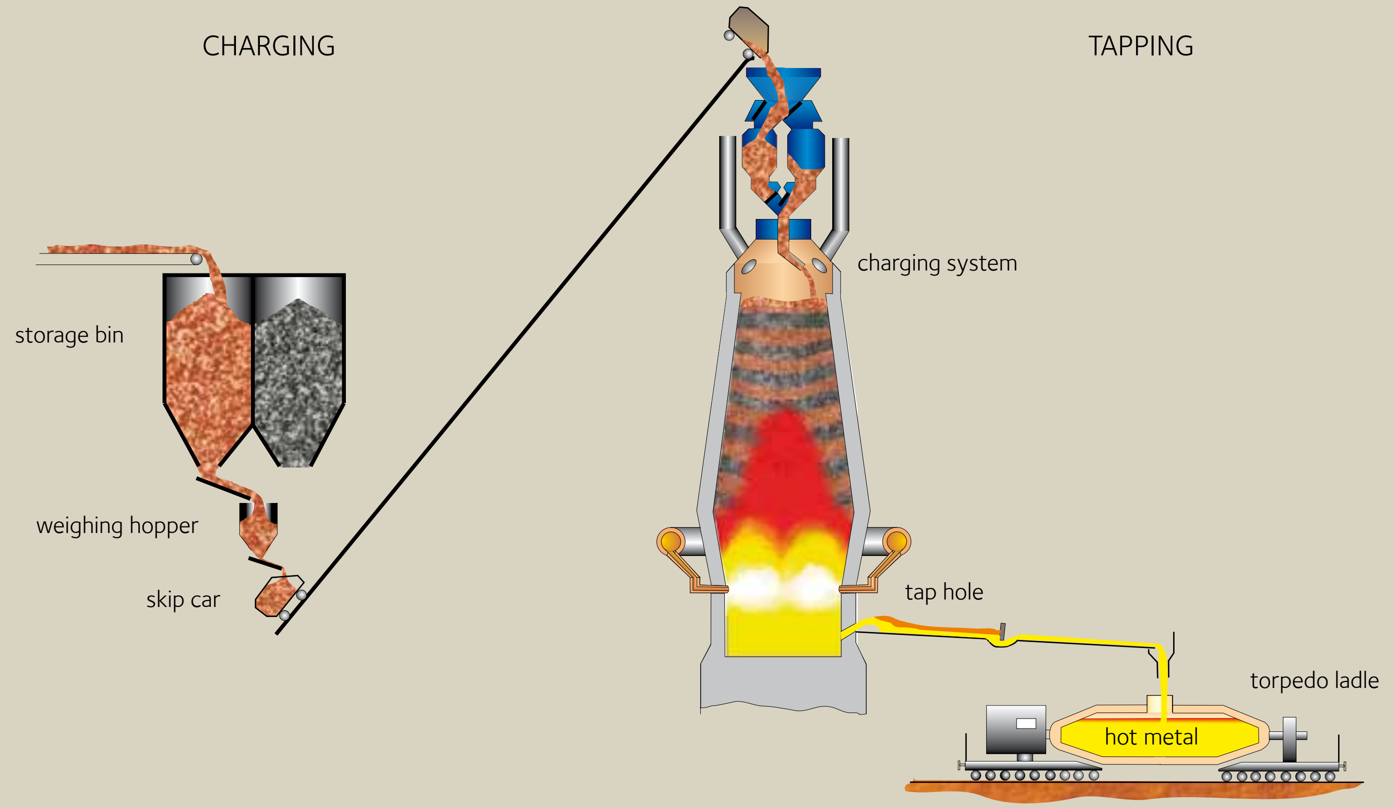
Blast furnaces produce hot metal by melting iron ore in a reducing atmosphere. Iron ore is composed of iron and oxygen. By melting iron ore in a reducing atmosphere, we remove the oxygen. The blast furnaces are loaded with coke and sinter. Hot blast (1,250 °C) is injected in the nozzle, converting the coke into the gases for reducing the iron ores and generating the necessary heat for melting the reduced ores.

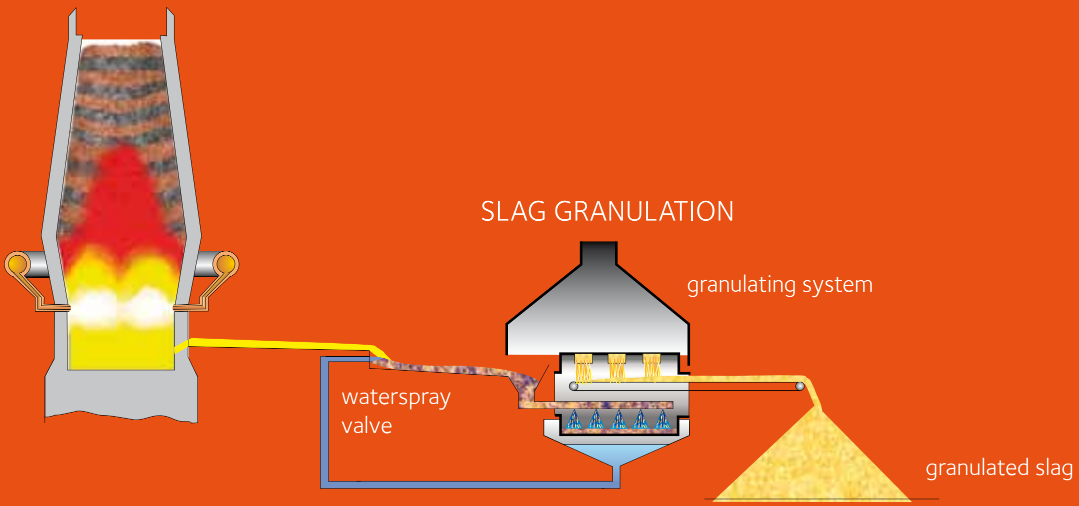
The raw materials, mainly coke and sinter, are transported to blast furnace storage bins. Consequently, they are loaded in weighing hoppers which load preselected quantities into one of the two skip cars. The skip cars are hoisted alternately to the furnace throat and are emptied into one of the two top hoppers.

The top hoppers are filled and emptied alternately. The furnace throat is sealed hermetically by a set of valves. A revolving chute enables the correct distribution of the successive burden levels of the raw materials. As the load comes down, the conversion from ore into hot metal takes place. The liquid hot metal is collected in the hearth of the furnace. It is tapped periodically via one of the two tap holes and runs into torpedo ladles, which transfer the hot metal to the steel shop.

In addition to hot metal the blast furnaces also produce slag. This slag floats on top of the hot metal and contains the fluxes and the gangue of the iron ore.



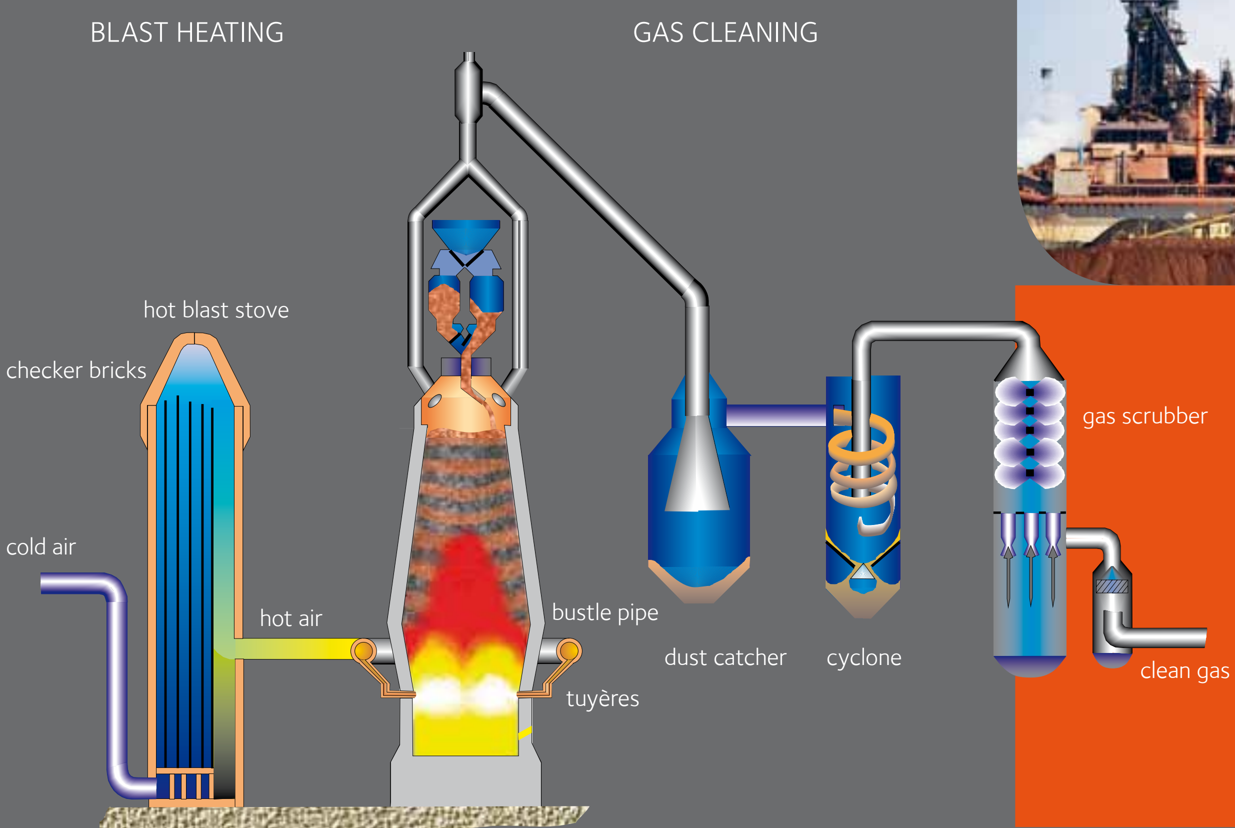




The slag is tapped simultaneously with the hot metal. It is conveyed to a separate installation where it is granulated by means of a high-pressure water spray. The water is separated from the granulated slag in rotating drum filters. The slag is then loaded into trucks and transported to the stockyards, to the port or directly to the consumer.

The reduction process in the blast furnaces consumes a vast amount of air, which is supplied by three blowers (at a ratio of 250,000m³/h). The air is heated in hot blast stoves, which consist of a vertical cylindrical structure, surrounded by a dome. Refractory checker bricks inside the cylinder work as heat exchangers and are heated by means of blast furnace gas. As soon as these checker bricks have reached the right temperature, the air generated by the blowers is forced through the checker bricks in opposite directions. The heated air then reaches a temperature of approximately 1,200 °C and is blown in the blast furnace via the bustle pipe through the tuyere.

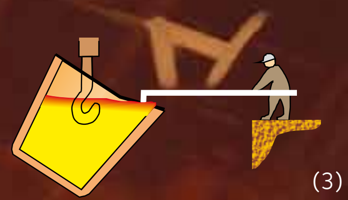
During the production of iron ore, large quantities of gas are generated in the blast furnace containing a certain amount of dust from the blast furnace burden. The gas is collected at the blast furnace top by four uptakes and taken to a dust catcher where the greater amount of mostly coarse particles is removed. In a next stage, a cyclone and finally a gas scrubber remove the finer dust particles. The clean blast furnace gas is distributed to different users, the main user being the Electrabel power plant located nearby.



STEEL SHOP

Steel making

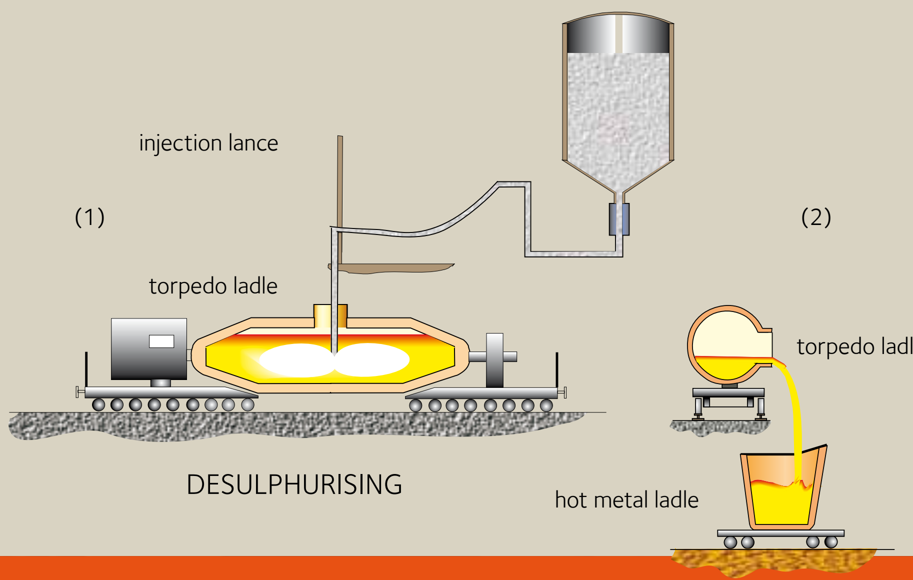
At the steel shop, hot metal coming from the blast furnaces is converted into liquid steel by removing any impurities. To this end, pure oxygen (LD process) is blown onto the liquid bath and an inert gas (TBM process) is injected through the bottom of the vessel.



Hot metal is transported to the steel shop by means of torpedo ladles with a capacity of up to 200 tonnes. If necessary, the hot metal is first desulphurised. Therefore, a desulphurising agent consisting of calcium carbide is injected into the liquid iron by means of a submerged lance.

Subsequently, the torpedo ladles are emptied into the hot metal ladle. A crane conveys the ladle to the skimming station, where the desulphurising slag is removed. The temperature is measured and a sample is taken from the hot metal to verify its composition.

After the desulphurising slag has been removed, the hot metal is poured into the BOF vessel and accurately weighed quantities of scrap are added by means of scrap charging trays. The BOF vessel is brought back into its vertical position and pure oxygen is blown on the hot metal bath by means of a water-cooled lance. In order to optimise the refining process, a certain quantity of lime and other elements are added and an inert gas is injec-

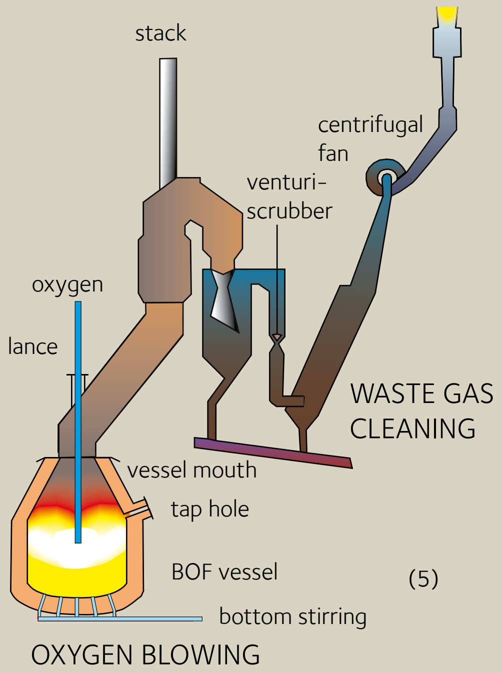


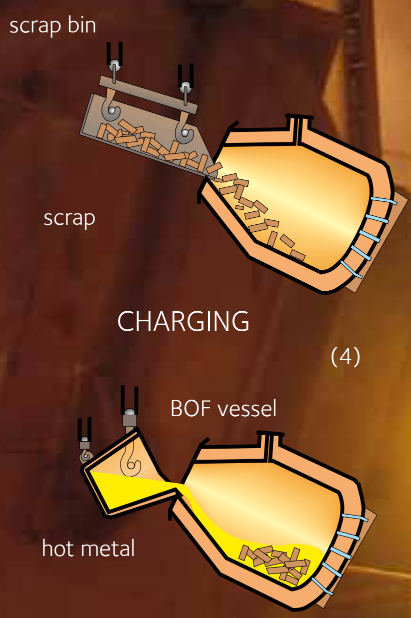
ted via the bottom of the BOF vessel. The impure elements are converted into slag floating on top of the liquid bath, or into gas. The flue gases are cooled in a boiler and scrubbed in a dust removal installation. Part of this treated converter gas is used in our production departments as an alternative to natural gas, the rest is used to produce steam in an Electrabel power station nearby.

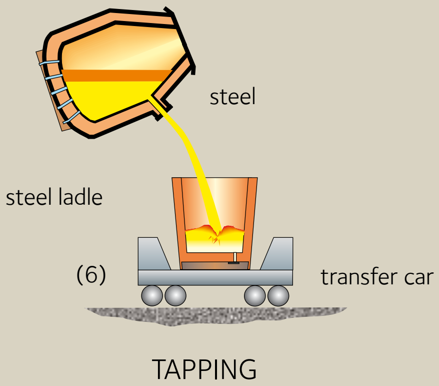
At this stage, the temperature of the bath amounts to 1,650 °C. After oxygen blowing, the lance is withdrawn, a sample is taken and the temperature and oxygen activity are measured: the hot metal has now become steel.

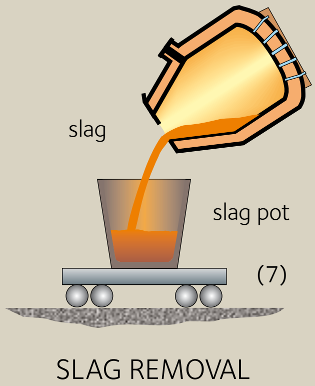
Thanks to this "stirring operation" the steel can be properly homogenised. Both the temperature of the bath and the oxygen level can be measured and adjusted, for instance by adding scrap to lower the temperature. In other words: to optimise the steel quality, we can modify the steel composition in all sorts of ways. Moreover, the bath movement allows any inclusions and impurities to be brought to the surface and ensure the steel purity.

Special steel grades are treated in one of the two RH-vacuum degassing stations. This allows the steel to be profoundly decarbonised, deoxidised in a vacuum and alloyed. The RH-degassing stations also have a multifunctional top lance. By blowing oxygen into the steel bath, we can accelerate the decarbonisation, heated the steel bath and convert CO into CO_2.





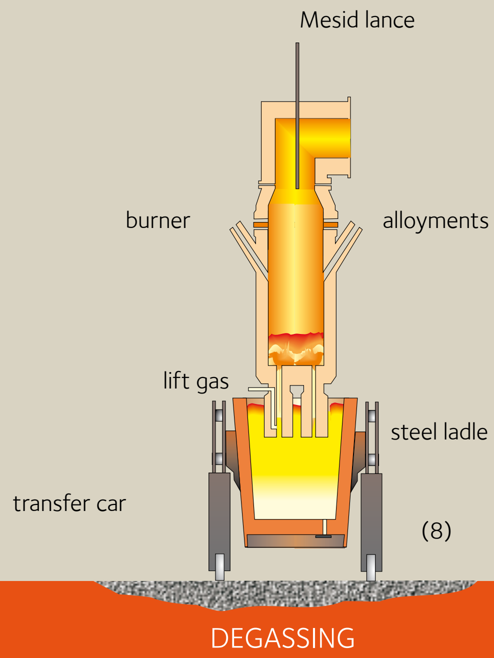




The BOF vessel is tilted and the steel is tapped into the steel ladle. In the meantime, alloying elements are added to obtain the required steel quality.

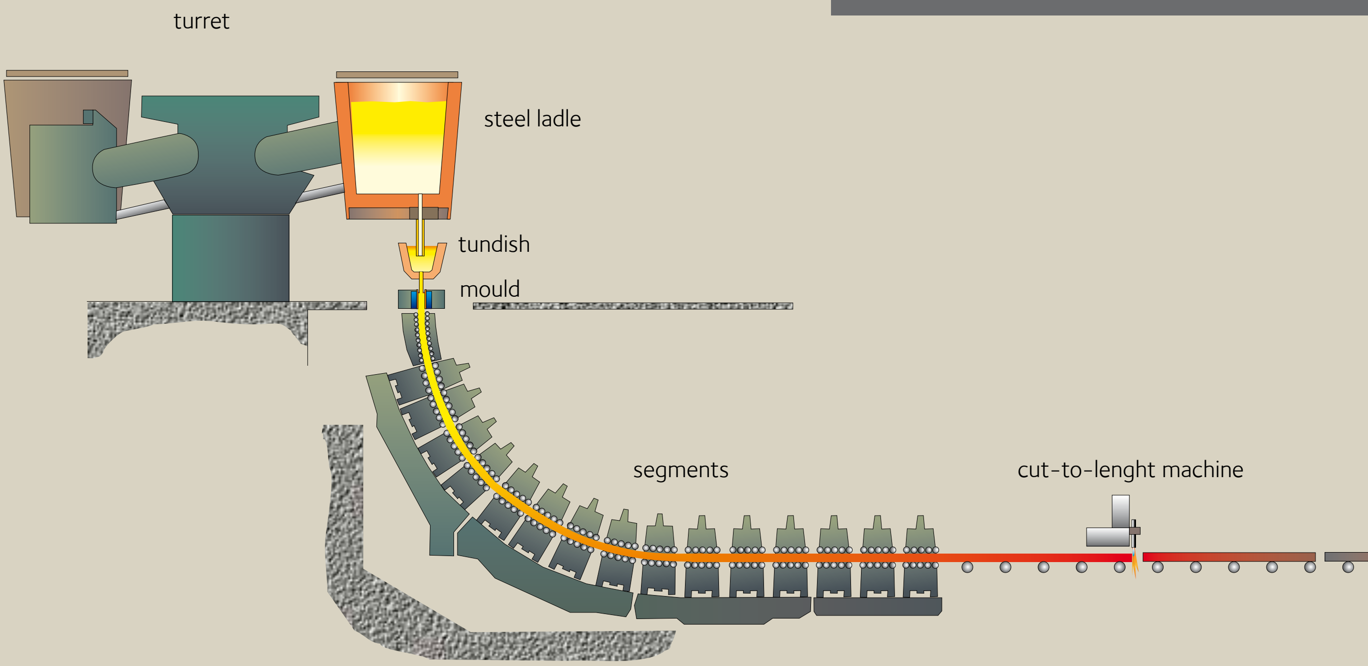
The vessel is then tilted to the other side to pour the slag into the slag pot via the vessel mouth. A slag transporter picks up the slag pot from the transfer car and pours it into slag pits. In order to optimise the steel quality, the steel ladle is transported to the steel ladle treatment section, which has 3 treatment stands. The installation is equipped with a lance to inject argon deep down in the steel bath.

After treatment, the ladle, which can contain up to 295 tonnes of steel, is transported to the casting bay by means of a transfer car. The ladle is picked up by a casting crane and brought to the turret of one of the two continuous casting machines.



Steel casting

The steel ladle is placed by the casting crane into the turret, which is turned 180° to bring the ladle into casting position. By opening the nozzle at the bottom of the steel ladle, the steel flows into an 80 tonnes tundish. The tundish has two tap holes, each of them leading to a mould, which determines the size of the cast slabs. As soon as the nozzle of the ladle is opened, the steel is cast continually until the ladle is completely empty. Because of the large capacity of the tundish, an empty steel ladle can easily be replaced by a full without interrupting the casting process, by simply turning the turret 180°. That is why this process is referred to as continuous casting.



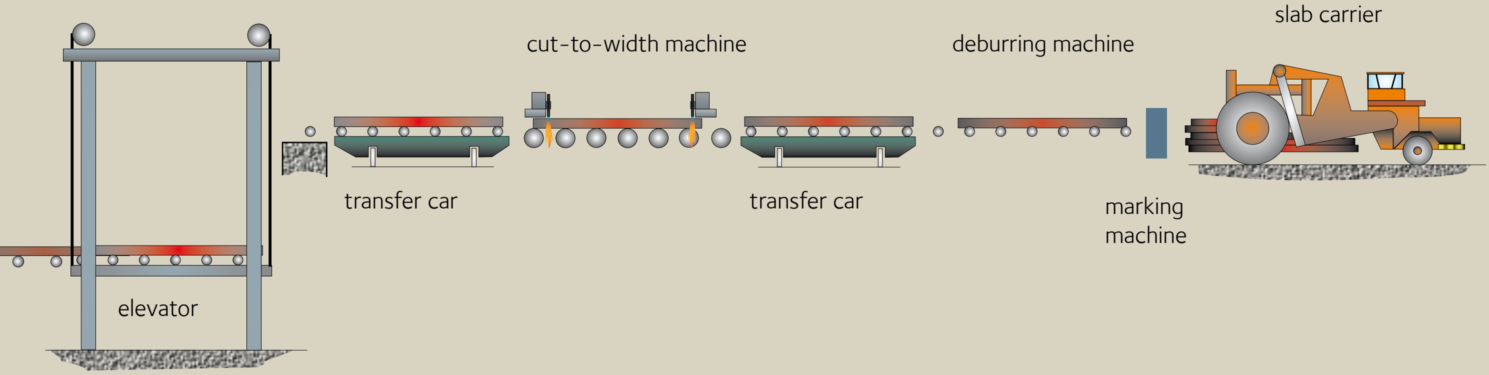
or each slab. The marking machine then provides each slab with an identification number. Finally, the slabs are piled and transported to the slab yard by means of a slab carrier.

The steel shop has two continuous casters that are similar in numerous ways, but there are also some substantial differences:

- Contrary to slab caster 1, slab caster 2 is a vertical-straightening machine. This means that the first part of the caster – starting from the mould – is oriented vertically. This causes any inclusions to rise to the surface more easily and enhances steel purity.
- Continuous slab caster 2 is equipped with an automatic mould level control and a hydraulic oscillation system that are capital to the surface quality of the slabs.
- At continuous caster 2, water is vaporised with compressed air to cool the slabs in a more controllable and steady manner.
- At continuous caster 2, slabs with single width are cast (contrary to slabs with double width like in caster 1), needing no further cutting. The casting width obtained at caster 1 lies between 1,310 and 2,630 mm and between 950 and 2,000 mm at caster 2.

After leaving the mould, the steel is supported by a series of rolls – grouped into segments – through which the slab is guided. Large quantities of cooling water are then sprayed upon the slab between the rolls in order to solidify it. The slab is cast vertically, but is steadily bent horizontally. By that time, the slab is completely solidified. The slabs leaving the casting machine are cut to length by natural gas and high-pressure oxygen cutting machines.

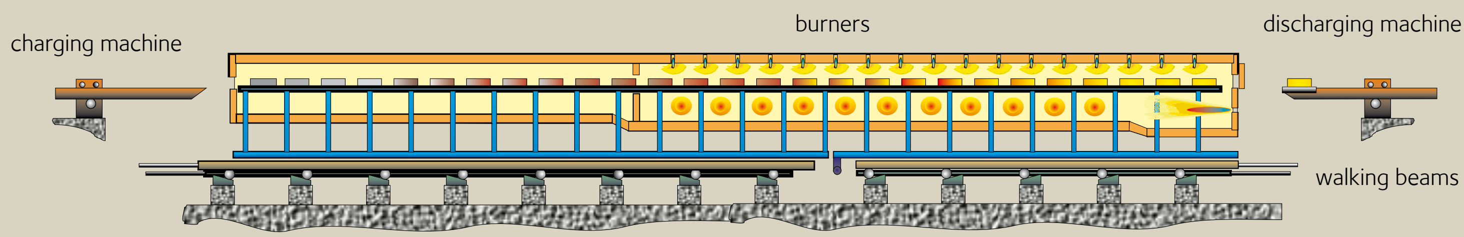
At continuous slab caster 1 the slab is brought up by an elevator and conveyed onto one of four slitting lines that cut the slabs to width. They then move on to a roller table where a deburring machine removes cutting flash at the front and back



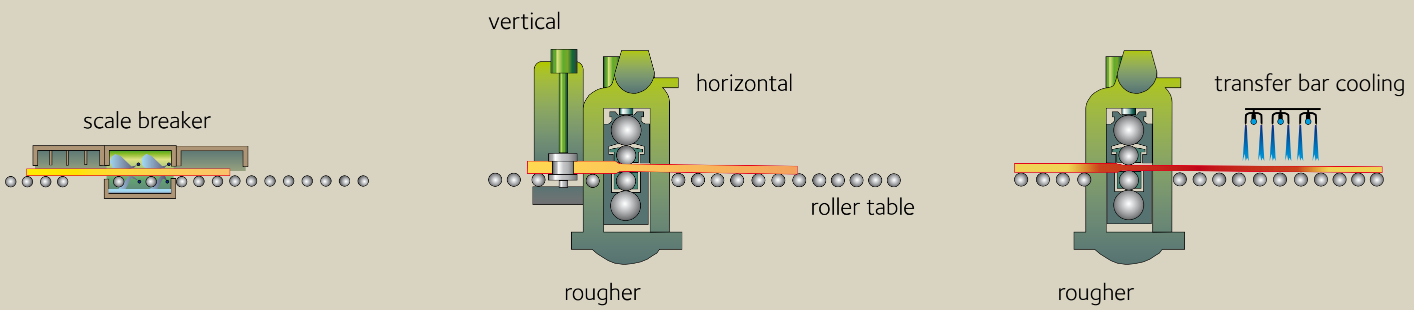
WIDE HOT STRIP MILL

Slab yard

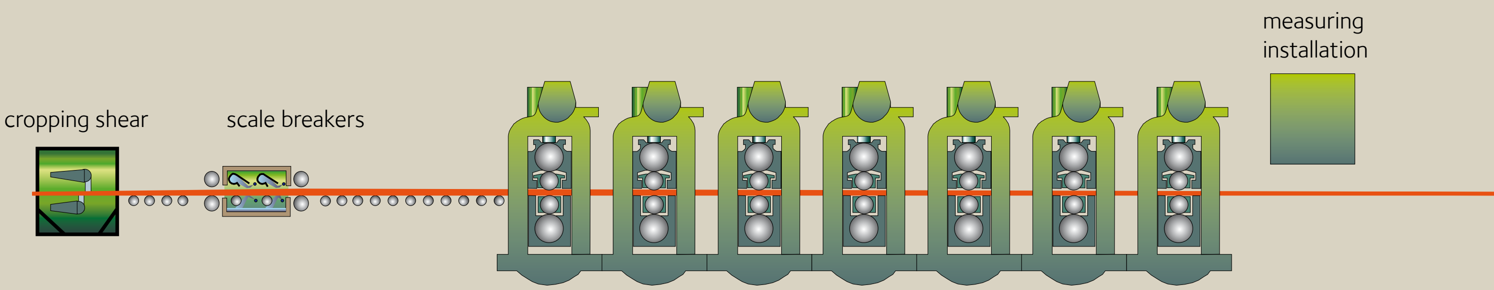
In the slab yard, any surface faults are removed by oxygen-natural gas torches. The slabs are stored in piles of slabs with similar characteristics (slab families) and are brought to the storage area adjacent to the charging area of the walking beam furnaces and the pusher type furnaces.



HEATING



ROUGHING



FINISHING MILL

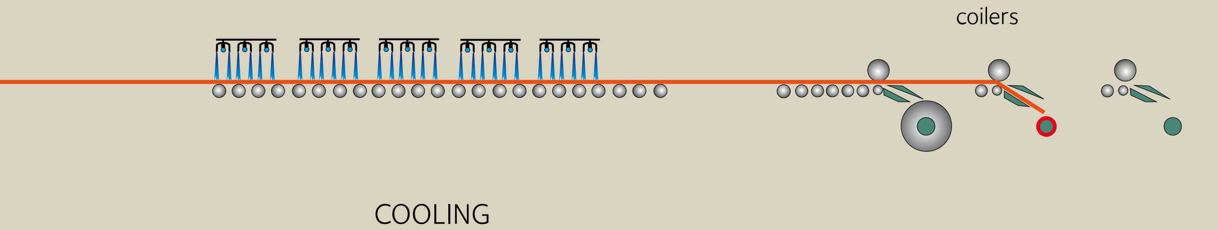
Walking beam furnaces and pusher type furnaces

In normal circumstances, the hot strip mill is fed by two walking beam furnaces. There are also two pusher type furnaces on stand-by for should there be an interruption in walking beam furnace operations for maintenance purposes. These furnaces reheat the slabs to discharging temperatures between 1,000 and 1,270 °C.

The difference between a walking beam furnace and a pusher type furnace lies in the way the slabs move through it. In a walking bream furnace, the slabs are transported through the furnace by resting alternately on fix and movable water-cooled beams. The movable beams make a rectangular movement compared to the fixed beams and in this way transport the slabs through the furnace. In a pusher type furnace, a pusher arm pushes the slabs transversely through the furnace, over a fixed framework of water-cooled skid pipes. Towards the discharging side of the furnace, the slabs go through a soaking zone to heat the colder spots on the slabs caused by the water-cooled skid pipes. A discharging machine takes the slabs out of the furnace and feeds the hot strip mill.

Roughing mill

A slab that comes out of the furnace has a scale layer that needs to be removed before it can be rolled. The breaking and removing of the scale layer is done by a scale breaker, with water jets under a pressure of 120 bar. The slab is conveyed to the rougher on a roller table. In this reversing rougher the thickness of the slabs can be reduced from 22 cm to approximately 5 cm in five rolling passes. A simultaneous net width reduction of 140 to 160 mm can be achieved in three reducing passes. In the following continuous rougher, the thickness of the slab is further reduced to approximately 3 cm. At the end of the roughing mill, the temperature of the slab can decrease at 50 °C per second thanks to a transfer bar cooling.



Finishing mill

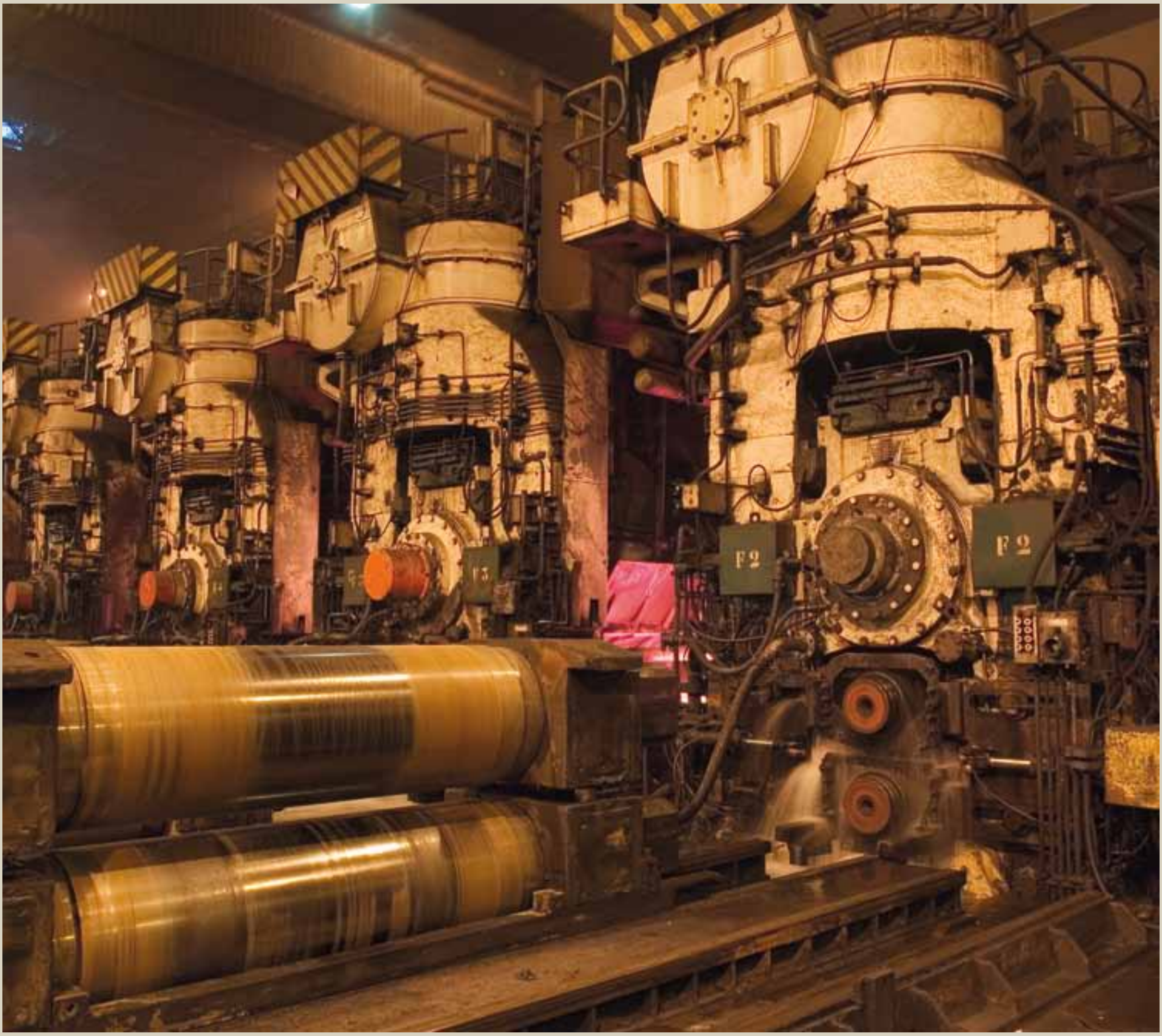
A rotating crop shear that is located in front of the finishing mill crops the head and tail ends of the strip. Subsequently, the strip passes through a scale breaker, which removes the built-up scale layer, before the strip enters the first stand of the finishing mill.

Each stand of the finishing mill reduces the thickness to form a strip with a thickness range from 1.25 to 13 mm. The rolling force in each stand of the mill must therefore be carefully adjusted. In the hot strip finishing mill, the speed increases from stand to stand towards the end, because of the decrease in strip thickness. Hot rolling is exclusively performed by exerting pressure on each of the working rolls in each of the stands.

The slightest tension on the material would give rise to a width constriction. As soon as the strip leaves the finishing mill, its thickness, width, profile, flatness, temperature and surface quality are measured.

Between the finishing mill and the coilers, the strip is cooled by a low-pressure water flow in such a way that it reaches one of the three coilers at the scheduled temperature range of between 450 and 750 °C. The strip is coiled by one of the three coilers, positioned onto the conveyor chain, automatically strapped, weighed and marked by means of a robot.

Subsequently, the coils are transported towards the entrance storage hall of the cold rolling mill on an underground conveyor belt. Part of the hot rolled coils pass on straight to customers. In the hot strip mill finishing section, these coils are packed and piled in storage.



COLD ROLLING MILL

Before the hot rolled coil can be cold rolled, we need to remove the scale layer which has formed during hot rolling. Therefore, the coil goes through a heated acid solution. This process is referred to as "pickling". We have three pickling lines using hydrochloric acid. Two of these lines, line 2 and line 3, have been coupled to tandem mills 2 and 1 respectively. The third autonomous pickling line produces pickled hot rolled coils that are destined directly for the market.

Before pickling, the stored coils are put on a conveyor belt one by one and taken to the entry section of the pickling lines. The strap is removed and the head of each coil is scrapped. The outer spire is then folded in such a way that it facilitates the entry of the coil head into the entry section of the pickling lines.

The autonomous pickling line (pickling line 1)

The entry section comprises:
- a pay-off reel;
- a processor for guiding and levelling the strip;
- a mechanical crop shear with an automatic scrap conveyor;
- a welding machine to weld the tail of one coil to the head of the next;
- an accumulator serving as a buffer between the discontinuous entry section and the continuous pickling section.

Next, the strip is fed into pickling tanks containing dissolved hydrochloric acid at a temperature of about 85 °C. This hot acid solution removes the scale layer on the surface of the strip.

Immediately after pickling, the strip passes through rinsing tanks to remove the pickling acid. The strip is then dried with hot air and conveyed to the exit accumulator consisting of a looper wagon, which serves as a buffer before the strip enters the discontinuous exit section.

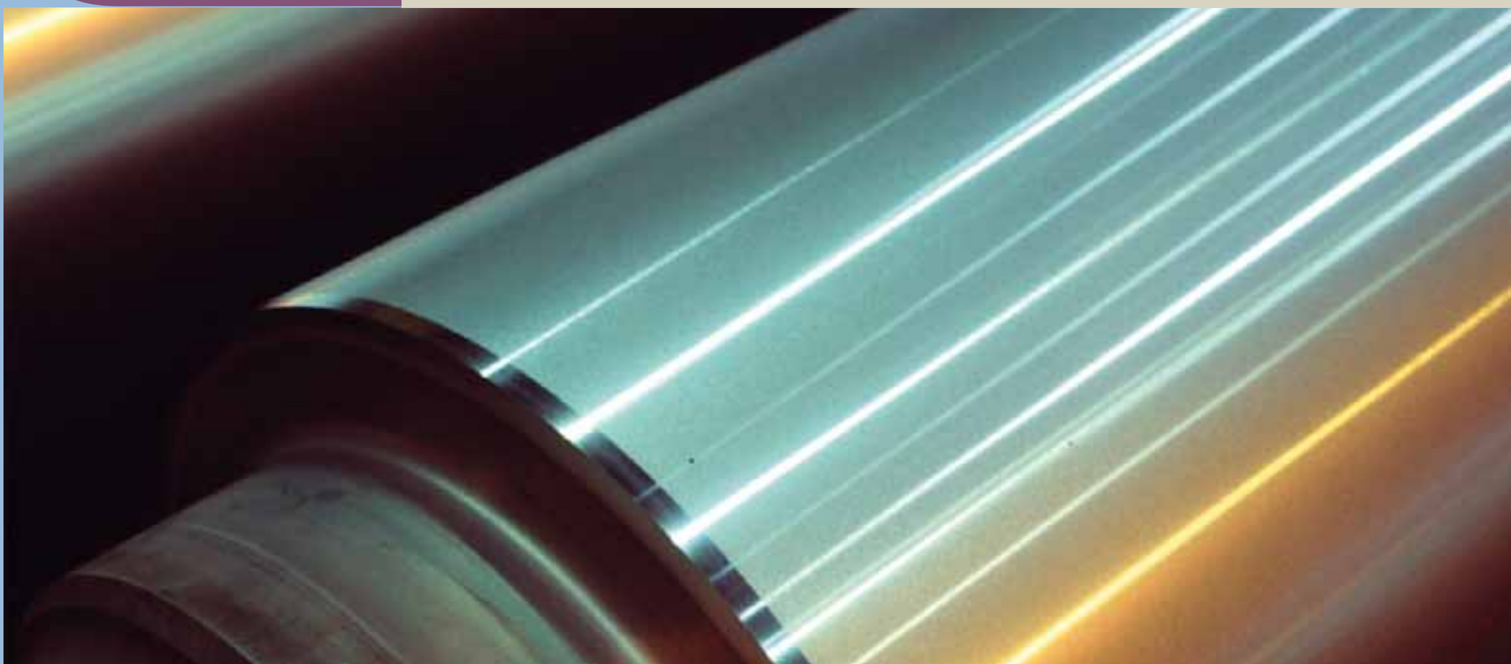
This exit section comprises:
- a side trimmer that cuts the strip to the required width;
- a scrap chopper to scrap the cut sides;
- two stretching rolls;
- an oiling machine that oils the pickled strip to prevent rusting;
- a hydraulic shear that cuts the strip to the required length;
- two coilers.

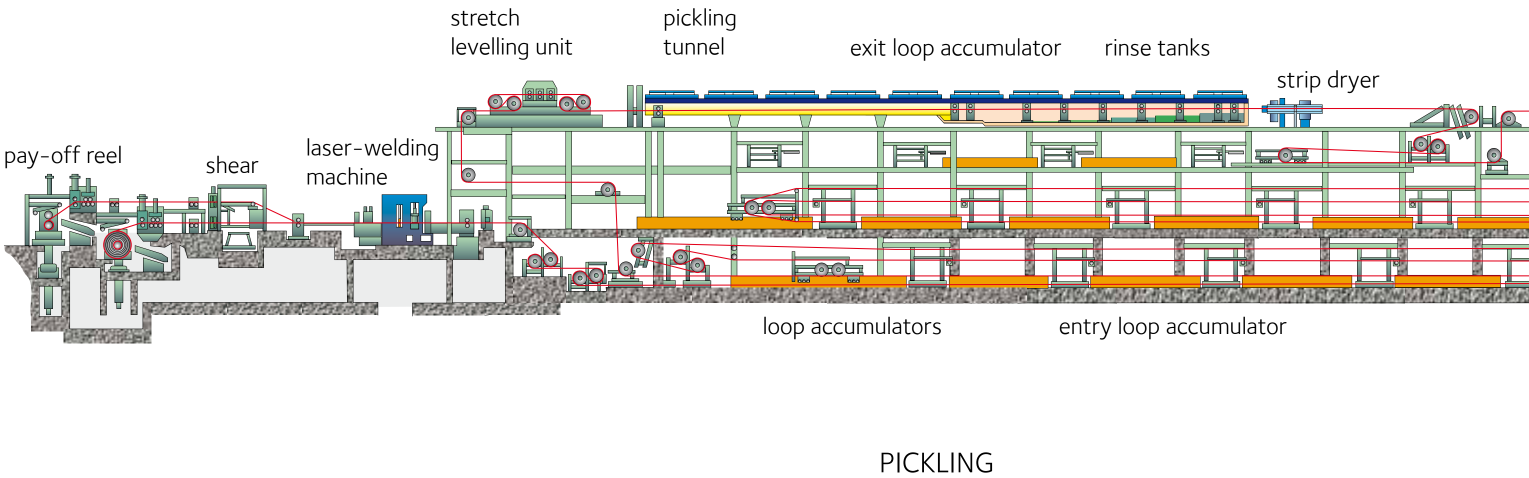
The coupled pickling lines and tandem mills

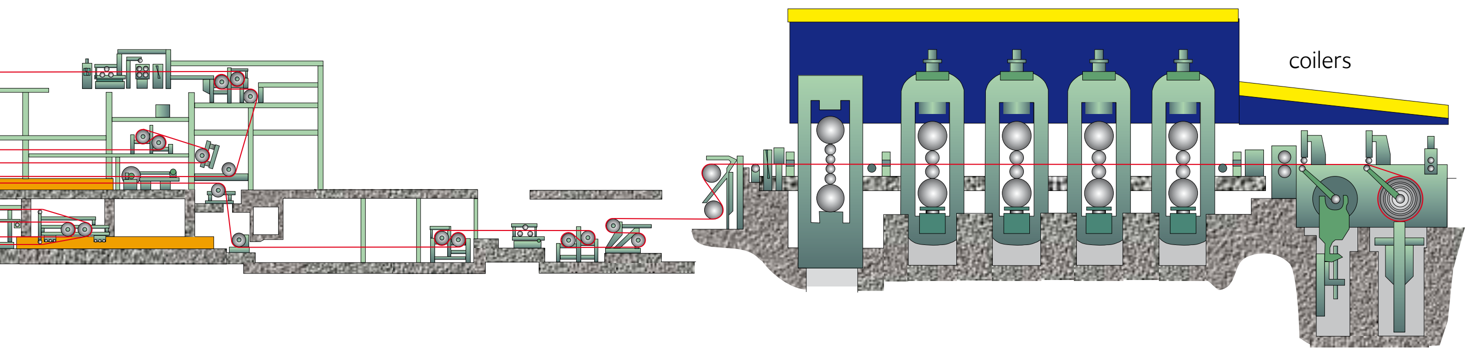
Traditionally, pickling and cold rolling are done in two separate production lines. Merging these two processes into one single production step however offers genuine benefits:

- We avoid having to constantly constantly new coils into the entry zone of the tandem mills, which reduces the risk of damages to the coils and enhances control of the rolling process and strip thickness.
- There is no need to stock coils between pickling and rolling. This not only reduces the risk of damages to the coils, but also has a positive impact on lead time. Lead time refers to the time lapse between the placement of an order and the delivery of (semi-) finished products.
- When these two production lines are coupled, the pickling line has no exit section (consisting of coilers, a conveyor belt, marking installation and binding machine) and the tandem mill has no entry section, which has a positive impact on the production costs.

Early 1994, we coupled pickling line 3 to the revamped tandem mill 1 to form the TTS line, which stands for "Turbulentiebeitserij Tandem Sidmar" or "Turbulent pickling line Tandem Sidmar". In 2007, pickling line 2 was coupled to tandem mill 2. Thanks to a combination of tensile forces and pressure the hot rolled pickled strip is cold reduced in thickness. According to the type of material and customer specifications, this reduction can be anywhere between 45% and 84%. In most cases, it lies between 60% and 80%. The result is a cold rolled coil.







COLD ROLLING (TTS)

TTS line

By coupling pickling line 3 to the five stands of tandem mill 1, we have had a continuous pickling and cold rolling line, without any interruption between both processes, since 1994.

Pickling

The pickling line that has been integrated in the TTS line differs from the other two pickling lines, as it is of the turbulent type. In traditional pickling lines, the hot rolled strip is submerged in deep pickling tanks, whereas in the TTS line the strip is stretched and drawn through a tunnel. In this tunnel, pickling acid is sprayed upon the strip under pressure, accelerating chemical reactions and enhancing control of the pickling process.

Rolling

The tandem mill consists of the four modernised four-high stands of the former tandem mill 1, to which a six-high stand was added as stand n° 0. The final stand, stand n° 4, was fitted with shiftable working rolls. In the tandem mill, hot rolled coils are processed into cold rolled coils with a thickness ranging between 0.3 and 3.85 mm.

The exit section has two coilers, enabling coils to be split up while the line is running. Moreover, the exit section has an inspection stand which allows sample sheets with a length of approximately 10 m to be cut at a coil transition. Each stand is equipped with an automated system for changing the working rolls.

BT2 line

In 2007, pickling line 2 was coupled to tandem mill 2 thus forming the BT2 line. The exit section of pickling line 2 was removed and the strip is guided directly to the accumulator of tandem mill 2 via a reversing roll. Moreover, the welding machine of tandem mill 2 was moved to the entry zone of pickling line 2 to replace an old flash butt welding machine.

The main difference between the two coupled production lines is the maximum strip width: in the TTS line the strip width is limited to 1,880 mm, in the BT2 line it is limited to 1,320 mm. The average strip thickness is also different: in the TTS line it amounts to 1 mm on average, at the exit of the BT2 line, it is 0.65 mm, with a minimum thickness of 0.28 mm.

And there are more ways in which the BT2 line differs from the TTS line:

- no stand has been fitted with shiftable work rolls;
- all stands are four-high stands;
- there is no flatness measuring after the first stand;
- as the exit section has only one coiler, there is a fixed shear instead of a rotating shear;
- strips are fed to the coiler from the bottom side.

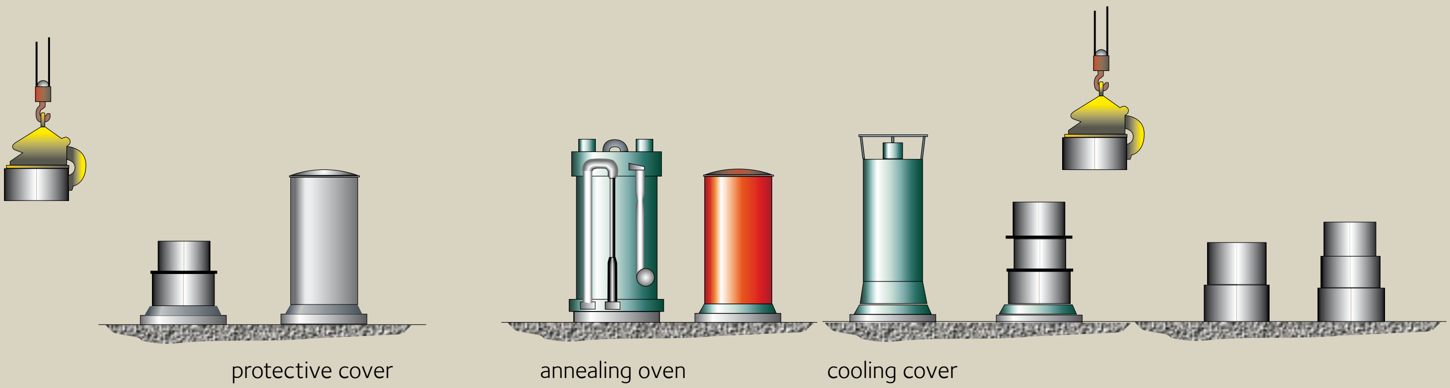
Annealing section

In order to ensure the cold deformability of the steel sheet, the material first has to be annealed because it has been hardened by the cold rolling process and could otherwise no longer be processed. This annealing is done in a neutral atmosphere at a temperature of about 700 °C. For this purpose, ArcelorMittal Gent has two batch annealing sections and of a continuous annealing and processing line.

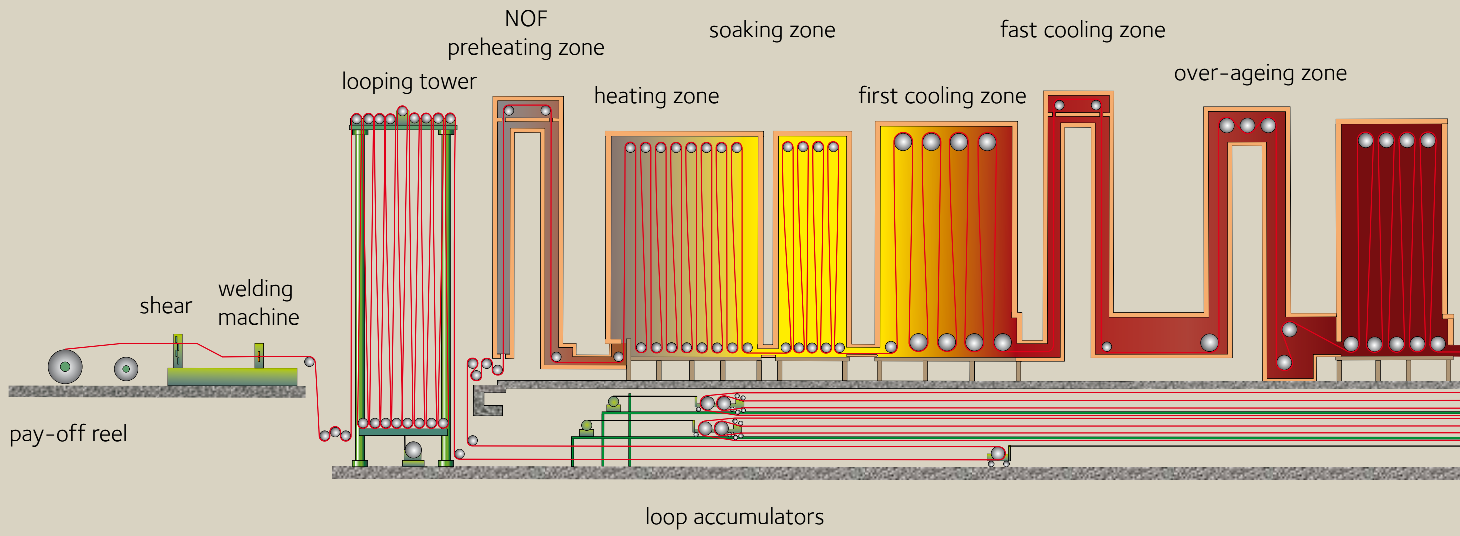
Batch annealing section

The coils to be annealed are transported between the oven bases (a total number of 215 for annealing sections 1 and 2) in coil carriers and are then stacked to a maximum height of 4.5 metres. This stack is cut off from the outside air by means of a protective cover. The annealing oven itself is placed over the protective cover. Inside the cover, the air that remained there is replaced by protective gas (pure hydrogen or a mixture of hydrogen and nitrogen). The gas mixture prevents the steel from oxidising during annealing. The actual annealing oven is fed by enriched blast furnace gas or coke oven gas. The hot gases heat the protective cover, which in turn heats the protective gas. This gas finally brings the steel to the desired temperature of approximately 700 °C, a process which takes about 30 hours.

After annealing, the oven is taken away and replaced by a cooling cover with a fan on top. The coils are cooled to a temperature of 125 to 55 °C (depending on the quality), which takes about another 30 hours. After cooling, both the cooling cover and the protective cover are removed.



BATCH ANNEALING



Continuous annealing and processing line (CAPL)

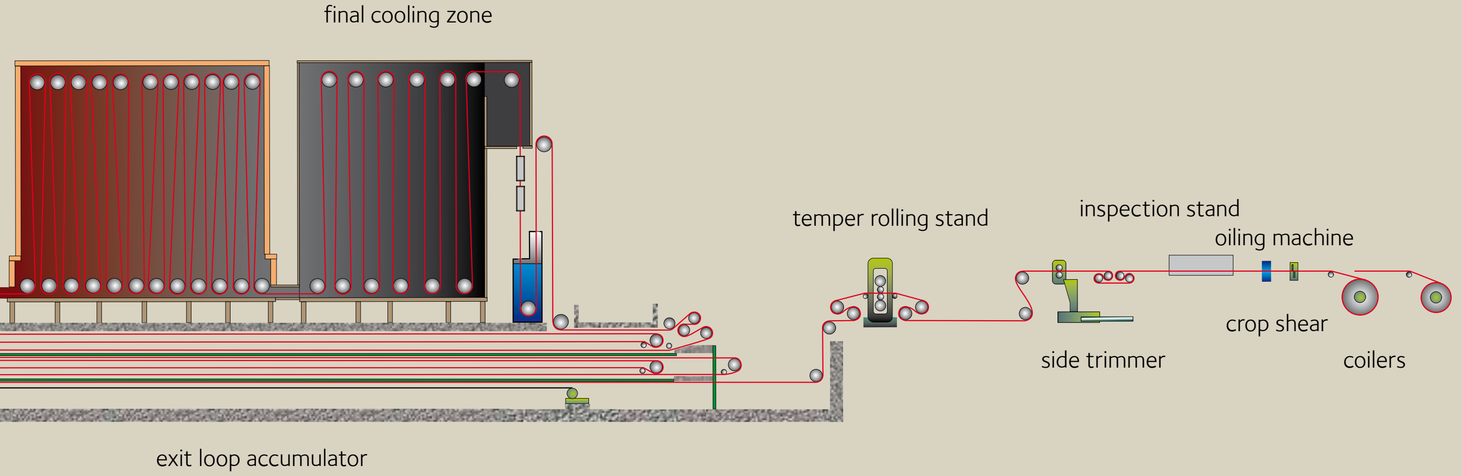
The goal of the continuous annealing and processing line or CAPL is to apply a heat treatment to the steel in a rapid, homogenous and uniform way. The steel properties obtained by this process should be at least equivalent to those obtained by batch annealing.

The supplied coils are put on the pay-off reels and the over-gauge at the head and tail of each coil is cut. The coils are then welded together, forming a continuous strip.

First, the sheet is degreased in a tank filled with an alkaline solution. After rinsing and drying, the clean sheet enters the looper tower, which is the link between the discontinuous entry section and the continuous oven section.

The oven section consists of different zones; the sheet is taken through an oven roll network moving vertically up and down:

- the Non-Oxidising Furnace (NOF): the sheet is heated to a minimum temperature of 420 °C. The sheet is first heated by flue gases, subsequently by burners in a reducing atmosphere in order to avoid oxidising.
- the heating zone: the steel is heated to a temperature varying between 715 and 820 °C – according to the metallurgical demands – by means of radiation burners.
- the soaking zone: the strip is kept to a constant temperature by means of electrical resistors.
- the first cooling zone: the strip temperature decreases to 675 °C. Six fans circulate the protective gas, which fills the oven, in a closed circuit over external heat exchangers. The cooled gas is then blown again into the cooling zone and onto the strip.
- the fast cooling zone: the strip is cooled to 400 °C by means of six fans. This can be done at a rate of 80 °C/s if a 0.8 mm HSS strip is concerned.
- the over-ageing zone: the strip is kept at a constant temperature.
- the second cooling zone: the strip is cooled to about 115 °C by the same mechanism as in the first cooling zone.
- the final cooling zone: water is

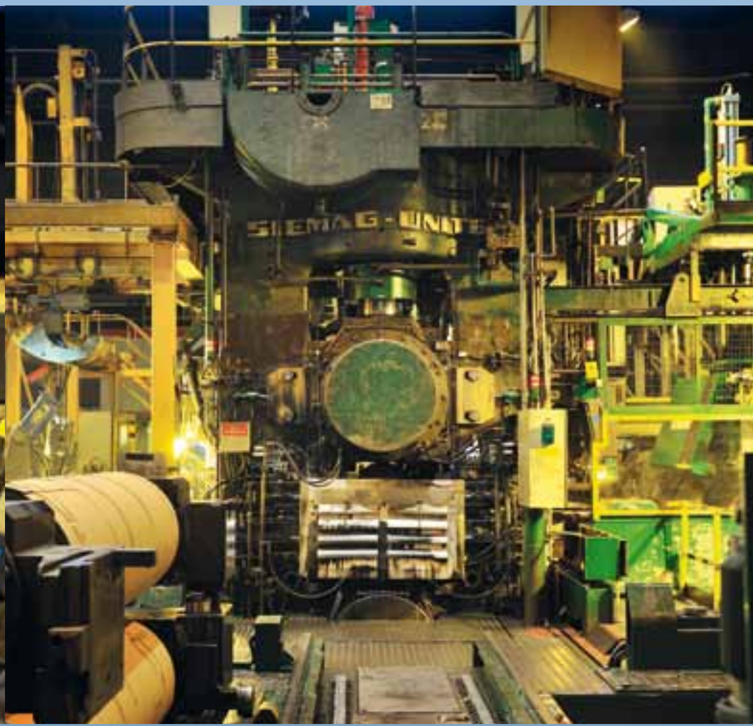


sprayed onto the strip before it is quenched in a water tank to 35 °C. Afterwards the strip is dried.

The discontinuous exit section is connected to the continuous oven section by means of a looping system that stores the strip horizontally.

In order to obtain the required elongation, roughness and flatness, the strip passes through a four-high temper rolling stand in the exit section. A side trimmer guarantees a constant strip width. After inspection, oiling and marking, the strip is cut to the required length or weight by a crop shear. The strip is then coiled on one of the two coilers.

The steel is now ready to be packed and shipped.



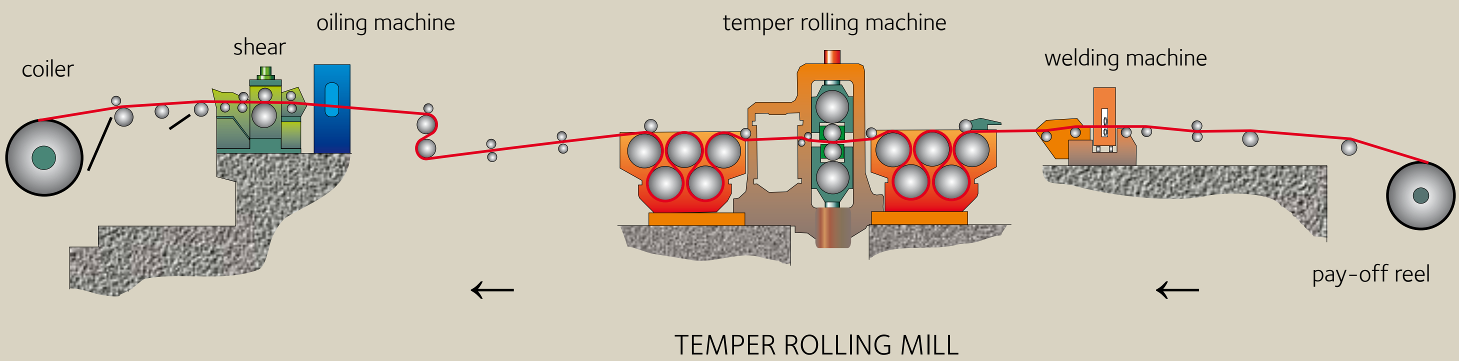
Temper rolling mills

The batch-annealed strip has to undergo an extra cold deformation in order to obtain even better mechanical properties and surface quality. This deformation is done in one of the three cold rolling mills, which can reduce thickness by 0.3 to 1.5%. Since every steel grade requires its own specific roughness, the work rolls are previously roughened in the roll shop.

The temper rolling section consists of two 4-high stands with respective widths of 80” and 56”. Temper rolling mill n° 1 is equipped with automatic gauge control, which allows the rolling pressure to be substantially driven up. In order to control the strip flatness effectively, the temper rolling mill is able to measure and adjust it. It also has an electrostatic oiling machine and an automated scrap removal system at the entry and exit.

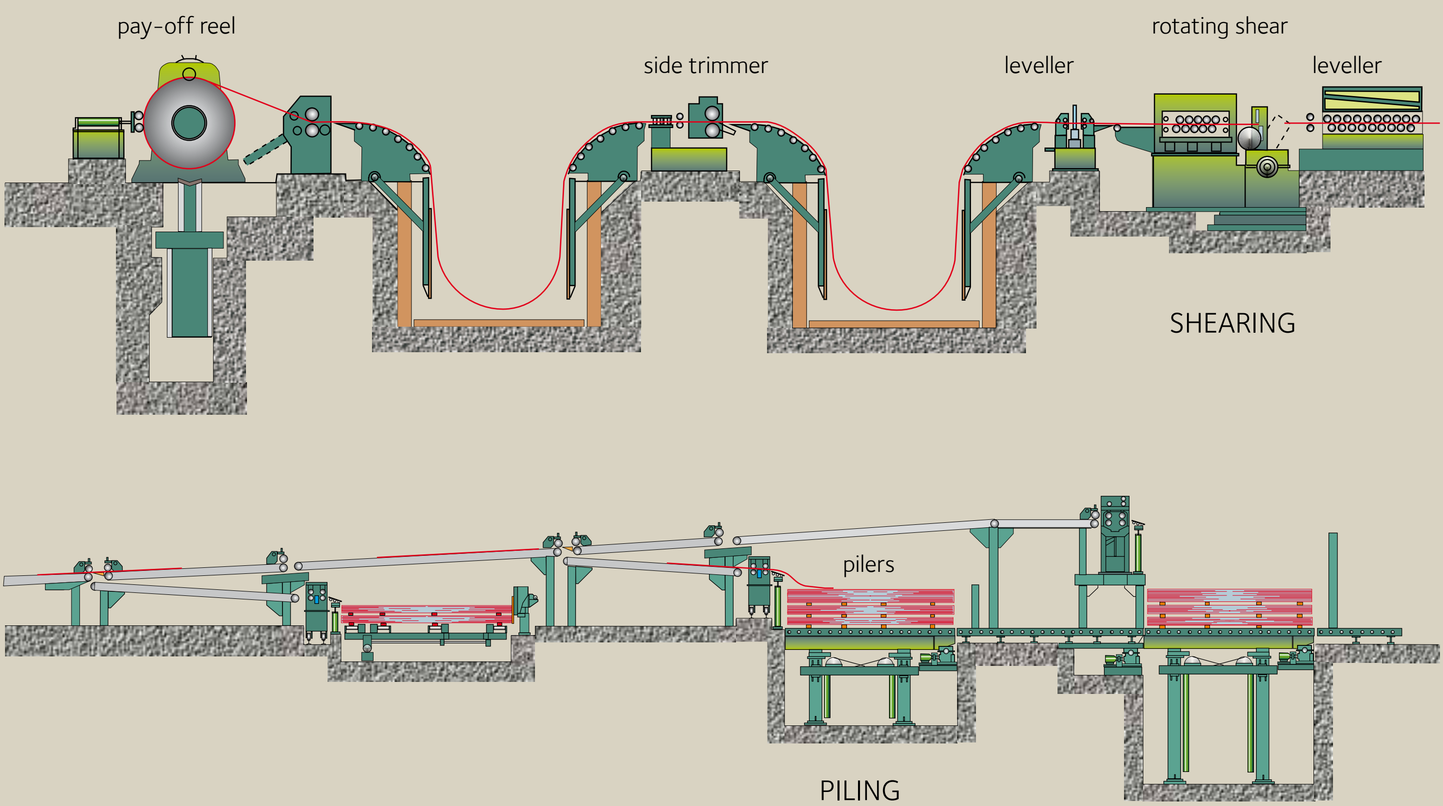
Temper rolling mill n° 3 is totally different from the other two in structure and in working principles. It has for instance two pay-off reels and a welding machine that makes it possible to form a long continuous strip. A set of bridle rolls in front of and behind the stands, together with the rolling pressure in the mill stand, make it possible to obtain a maximum elongation of 8% for special qualities.

In front of the two coilers, there is a shear crop that cuts the strip to the required length. The weld that was made in front of the stand is removed.



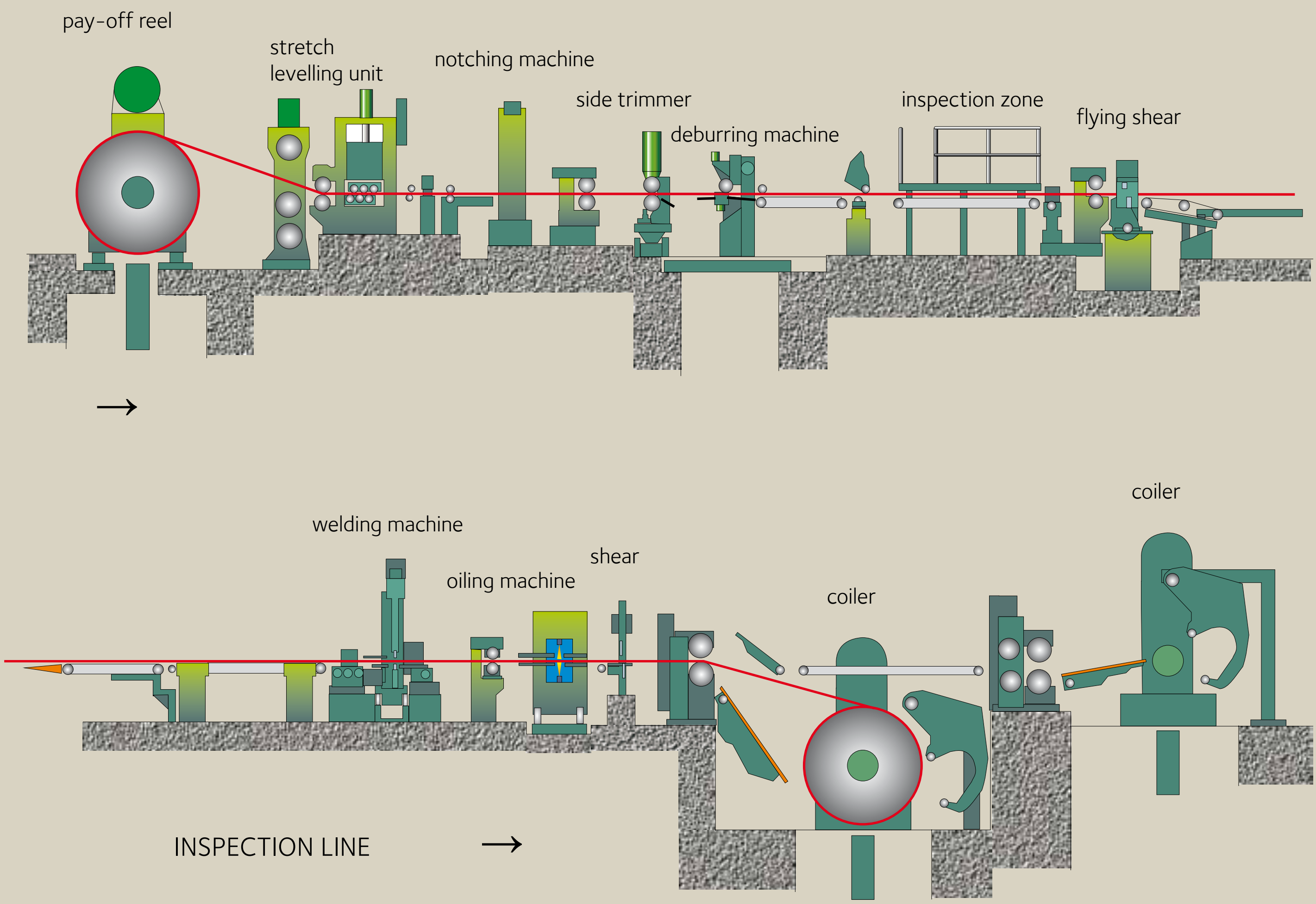
Cut-to-length lines

In the cold rolling mill, we have two shearing lines, which cut the coils to length and width. The coils coming from the continuous annealing and processing line or from the temper rolling mills are uncoiled. A side trimmer adjusts the strip width and a rotating shear cuts the coils into sheets of the required length. If necessary, the flatness of the strip can be improved by means of a levelling machine. After inspection, oiling and marking, the strips are piled in stacks according to the order specifications (weight, number of sheets per pile...) and are ready for packing and shipping. The strip speed amounts to approximately 105 m/min.



Inspection lines

There are three inspection lines. Their main objective is to perform an additional inspection of the surface quality. Afterwards, the sheet is side-trimmed, marked and oiled. If necessary, it can be welded or cut to weight. The finished coils are then packed, stored in the warehouse and sent to the client.



HOT DIP GALVANISING LINES

Between 1998 and 2001, we built three hot dip galvanising lines, well integrated in the infrastructure of the cold rolling mills.

The first line was originally called Galtec, was founded as a joint venture with Corus (formerly known as Hoogovens Steel Strip Mill Products) and is located in the hall between the batch annealing section and the continuous annealing and proccessing line (CAPL). The other two lines were built on a fallow ground next to the CAPL hall.

Each line has been conceived for a particular application domain:

- hot dip galvanising line 1: galvanised sheet for the automotive industry, the construction industry and the white goods sector
- hot dip galvanising line 2: galvanised sheet in thin gauges for the packing industry and applications for the building industry
- hot dip galvanising line 3: galvanised sheet for the automotive industry

Although each application domain has its own particularities, the main steps in the production process are the same.

Entry section

Full-hard cold rolled coils (exceptionally also hot rolled and pickled coils) coming from the TTS, the other coupled pickling line and tandem mill or exceptionally from pickling line 1 are conveyed to the pay-off reels (there are two uncoilers for continuous operation). The head of the new coil is welded to the tail of the preceding. An entry looper tower connects the discontinuous entry section to the continuous processing section.

Processing section

The full hard coil is now ready to be annealed. This thermal treatment is necessary for obtaining an optimal adhesion of the zinc coating to the steel strip and for obtaining the required mechanical properties. Hot dip galvanising lines are conceived for achieving both goals at the same time.

In the first stage of the oven, the strip is heated to 650 °C in direct firing and in a reducing atmosphere in the Non Oxidising Furnace; the strip is cleaned at the same time. In the second stage, the strip is heated to a temperature between 700 and 800 °C by radiation burners. Hot rolled and pickled strips do not require such high temperature for annealing: 550 °C is sufficient.

The galvanising ovens only use radiation burners and the strip is cleaned in an alkalic degreasing section that is located in front of the oven.

After cooling to a temperature of 460 °C, the strip is drawn through a tank filled with molten zinc. The strip is guided into the zinc bath by an immersion roll. Two stabilising rolls ensure the correct flatness and the position of the strip between the wiper blades. Two inductors keep the liquid zinc to the correct temperature.

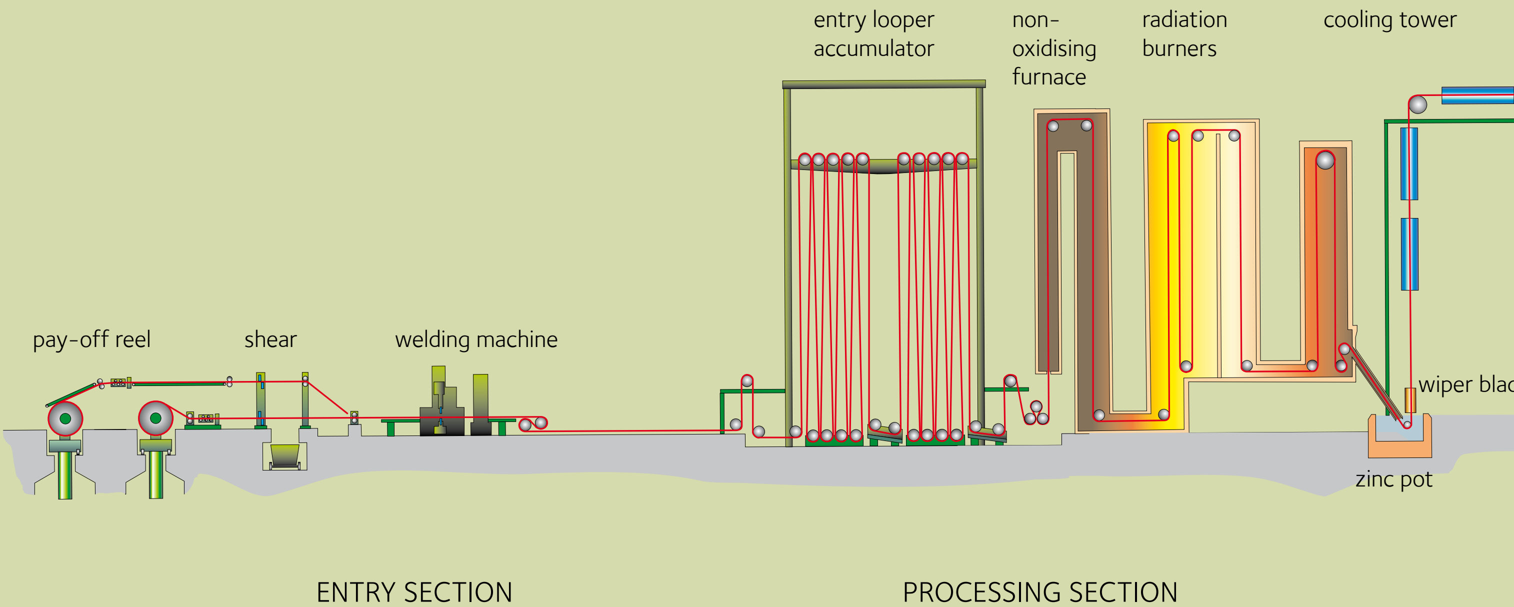
The zinc layer is blown off by air wipers until the desired coat thickness is reached. The strip is cooled, first with air coolers, then in a water tank. The third galvanising line leaves open the option of building a "galvannealing" section. "Galvannealing" means performing an additional annealing operation, ensuring the zinc coating is alloyed with approximately10% of iron in order to obtain a better surface quality together with optimum weldability.

The deformation behaviour and the flatness of the strip can be further optimised by means of a temper rolling stand and a stretch-leveller.

In the next step a chromate layer (of 10 to 20 mg/m²) is applied on the strip to prevent "white rust" (caused by the oxidation of the zinc coating). Hot dip galvanising line 1 is also equipped with a "chem-coater"; lines 2 and 3 have space provisions allowing to apply a permanent coating of approximately 1g/m². This coating, with anti-fingerprint properties, is dried at 70 °C in an oven and cooled to 50 °C.

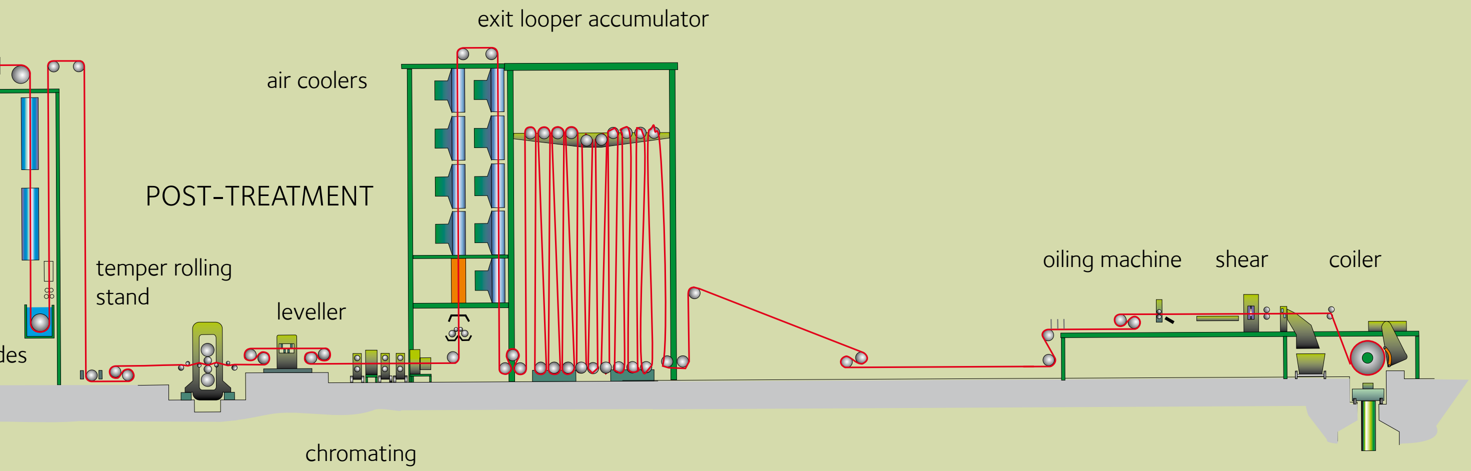
Exit section

The looper tower is the link between the continuous processing section and the discontinuous exit section, which consists of installations for inspections, oiling, cutting-to-weight and coiling.



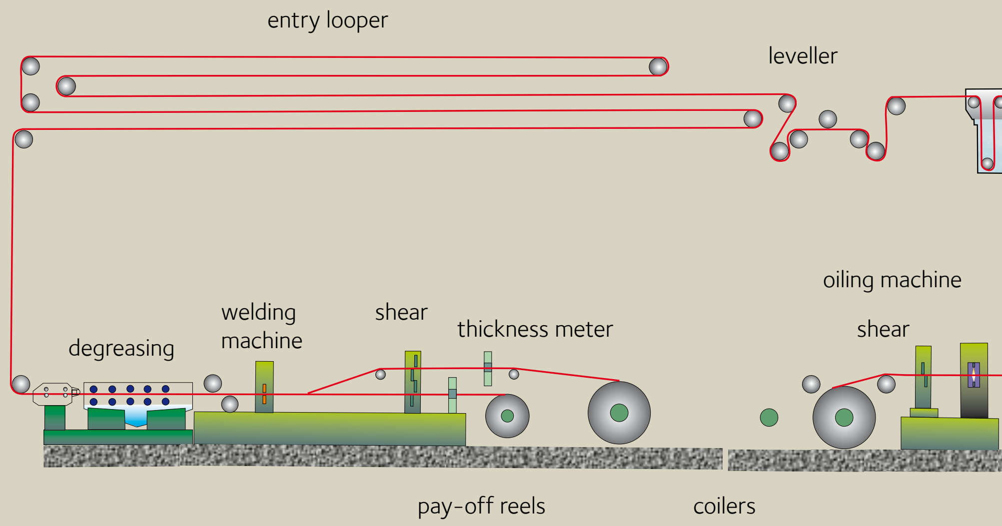
	GALVANISING LINE 1	GALVANISING LINE 2	GALVANISING LINE 3
Year capacity (kt)	480	360	600
Applications	Building, white goods and automotive	Thin gauges, building	Automotive
Strip width (mm)	750 - 1.550	700 - 1.300	800 - 1.880
Strip thickness (mm)	0,3 - 2,5	0,15 - 1,0	0,4 - 2,0
Zinc coating (g/m^2)	80 - 350	80 - 500	80 - 350
Speed (m/min)	180	200	160

Characteristics of the hot dip galvanising lines



ELECTROLYTIC GALVANISING LINE

At the end of the 80s, we decided to build an electrolytic galvanising line in Genk together with the German company Stahlwerke Bremen (nowadays called ArcelorMittal Bremen) as a joint venture. We wanted to meet the European car industry's demand of improving the corrosion resistance in car bodies. ArcelorMittal Genk offers a wide product range, from one-sided and double-sided zinc coatings to full zinc coatings or coatings based on a zinc nickel alloyment, and finishing layers. Moreover, the electrogalvanising line in Genk is the largest in the world.



Entry section

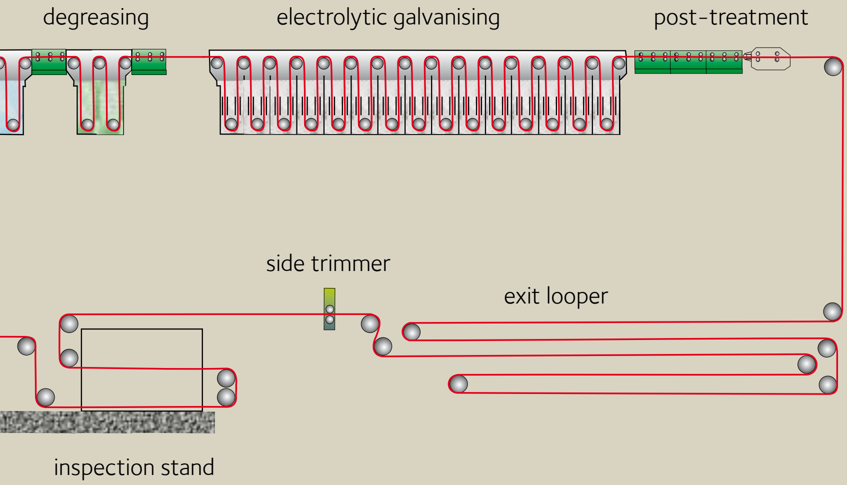
Cold rolled coils are fed from ArcelorMittal Gent or ArcelorMittal Bremen. After the entry inspection stand, the coils are uncoiled by means of two pay-off reels. For obtaining a continuous process, the head of one coil is welded to the tail of the preceding. In order to promote the zinc adhesion during the electrogalvanising process, the coils are first thoroughly degreased, cleaned and pickled.

Processing section

Electrogalvanising means that the steel sheet is guided between 15 galvanising cells filled with an electrolyte at a speed of about 100 m/min. An electrolyte consists of diluted sulphuric acid in which zinc is dissolved and split up in zinc ions. The steel sheet is electrically charged with a million amperes, attracting the zinc ions and promoting adhesion. This electrochemical process is called electrolysis.

The thickness of the zinc coating is determined by the customer and can vary from 1.5 to 20 μm. The electrogalvanising process is done fully automatically. In order to control the zinc layer thickness, ArcelorMittal Genk has a thickness meter using isotopes, which ensures quick and accurate online measuring during the production process and without making contact with the sheet.

ArcelorMittal Genk is the only electrolytic galvanising line within the ArcelorMittal Group that is capable of processing coils with a width up to 2,080 mm. Such sheets are mainly used in volume cars and SUVs (Sports Utility Vehicle), which have become increasingly popular.



Exit section

According to customer demand, the steel sheet can undergo further treatments, such as phosphatising. This treatment allows the steel sheet to be pressed more easily and promotes the adhesion of a future organic coating to the zinc coating. For industrial customers that do not paint the sheet, a chromate layer can be applied as a finishing layer.

At the end, the sheet is cut, marked, inspected and oiled. ArcelorMittal Genk also has its own inspection line, enabling it to perform supplementary quality inspections or adjustments like cutting, welding and oiling, all according to the customers' wishes.

	ELEKTROLYTIC GALVANISING LINE
Year capacity	470
Sheet width	600 mm to 2.080 mm
Sheet thickness	0,5 mm to 2,5 mm
Number of galvanising cells	15
Maximum speed	190 m/min
Minimum zinc coating	1,5 µm
Maximum zinc coating	20 µm
Destination	car industry

Characteristics of the electrolytic galvanising line

ORGANIC COATING LINES

Ten years after a first organic coating line was commissioned in Geel (ArcelorMittal Geel), a second organic coating line was set up in Gent. This organic coating line was built next to the expedition halls of the hot dip galvanising lines.

Entry section

The hot dip galvanised coils and/or the electrogalvanised coils are conveyed from the respective galvanising lines and are uncoiled.

The coils are connected mechanically with each other to create a new continuous process.

In the first alkalic degreasing process, the protective oil is removed from the strip before it goes into the entry looper tower.

After the second alkalic cleaning (involving two degreasings and four rinsings) a chrome-based layer is applied on the strips by means of a "rollcoater", in order to:

- promote adhesion of the paint to the substrate;
- increase corrosion resistance.

The strip is immediately dried at a temperature of 80 °C.

Processing section

In the organic coating line, four layers of paint can be applied through one line passage. Because there are seven painting machines, the four layers of paint can be changed without any line interruption.

A "rollcoater" is used to apply each layer of paint. A combination of direction of rotation, roll speed and pressure between the rolls, allows the paint to be applied to the strip in coating thicknesses of 2 microns to 200 microns dry.

First, a primer is applied on the pre-treated strip. This layer promotes the adhesion between the metal and the top coat.

The painting line consists of two ovens, a "primer oven" and a "finish oven". Both are identical in design and are heated by hot air.

In a first phase, the solvents are removed, after which the paint is polymerised on its specific Peak Metal Temperature. Depending on the type of paint, this temperature lies between 210 and 250 °C. The strip is then watercooled and dried by means of squeeze rolls. In the next phase, the "finishing" layers are applied. When the strip leaves the finish oven, an additional structure can be marked into the PVC paint by means of two embosser rolls. Different patterns are possible.

After the finishing layer has been cooled, a stretch-leveller can still adjust the flatness of the painted strip.

The exit looper tower connects the continuous processing zone to the discontinuous exit section. The exit section comprises installations for inspection, oiling, marking of automotive products and coiling.

Additional installations

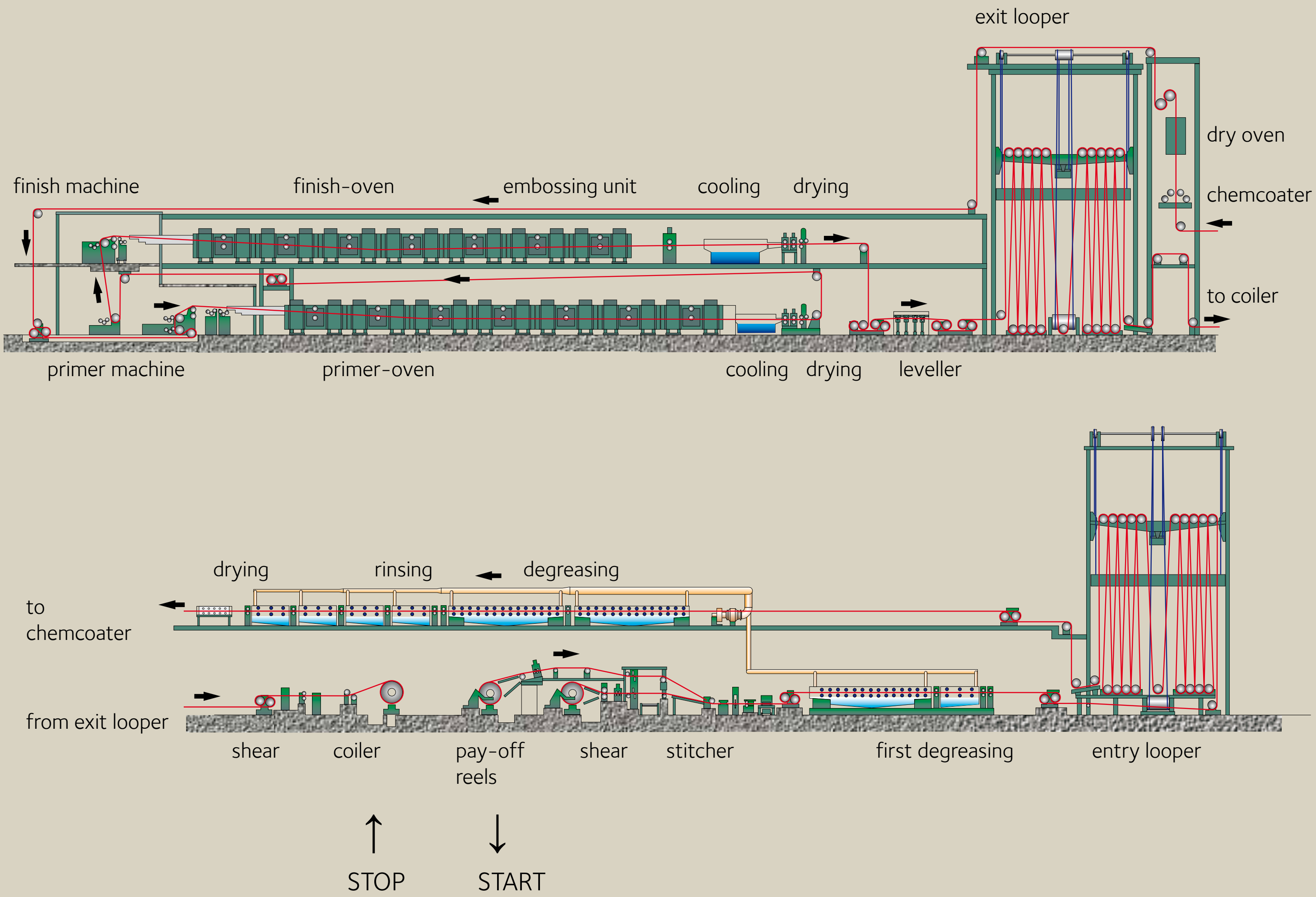
Within the framework of our company's environmental strategy, the organic coating line was conceived using the most recent technologies.

Air emission

In order to destroy the solvents, we built a new regenerative afterburner. This thermoreactor is characterised by extremely low gas consumption and lower CO_2 emissions. The afterburner is "autotherm", which means that it is able to combust the solvents and convert them into CO_2 by using only the energy from the solvents, without any natural gas being added. The cleaned flue gases are cooled down by three heat exchangers to a stack temperature below 200°C.

Waste water cleaning

The organic coating line has its own waste water treatment station to clean all water used in the process before discharging it.



Characteristics of the organic coating lines

	ORGANIC COATING LINE (GEEL)	ORGANIC COATING LINE (GENT)
Year capacity (kt)	150	200
Strip width (mm)	750 – 1.550	700 – 1.850
Strip thickness (mm)	0,15 – 1,25	0,30 – 1,80
Speed (m/min.)	100	120
Applications	construction, white goods, brwon goods	construction, automotive

PRODUCTION LINE OF TAILOR-WELDED BLANKS

We also have a department that produces sheets, called tailor-welded blanks, for car body components. Tailor-welded blanks consist of polygonal sheets that may have a different thickness or different material characteristics which are welded together. By combining various materials and thicknesses, we can ensure minimum weight, maximum strength, maximum lifetime and minimum costs.

ArcelorMittal Gent Tailored Blanks has all machines necessary to produce laser-welded blanks out of wide strips. These installations consist of two sections: two cutting or "blanking" lines and six welding lines.

Blanking activities

The blanking activity is realised by semi-automatic blanking lines. They consist essentially of a decoiler, a straightener, a leveller, a mechanical press, a magnetic stacker and an evacuation towards the automated warehouse.

In the blanking lines, coated and uncoated coils are cut or punched into "subblanks" according to the geometry specified by the customer. This cutting and punching is done by a shear or a die that is mounted in the mechanical press (which has a force of 1,250 tonnes). Depending on the construction of the die, every press cycle can produce one or more subblanks with high cutting edge quality. These subblanks are removed from the die by means of magnetic conveyor belts and are piled on pallets by a stacker. These pallets are then sent to the automated warehouse, using roller conveyors and shifting cars, for further processing.

Welding activities

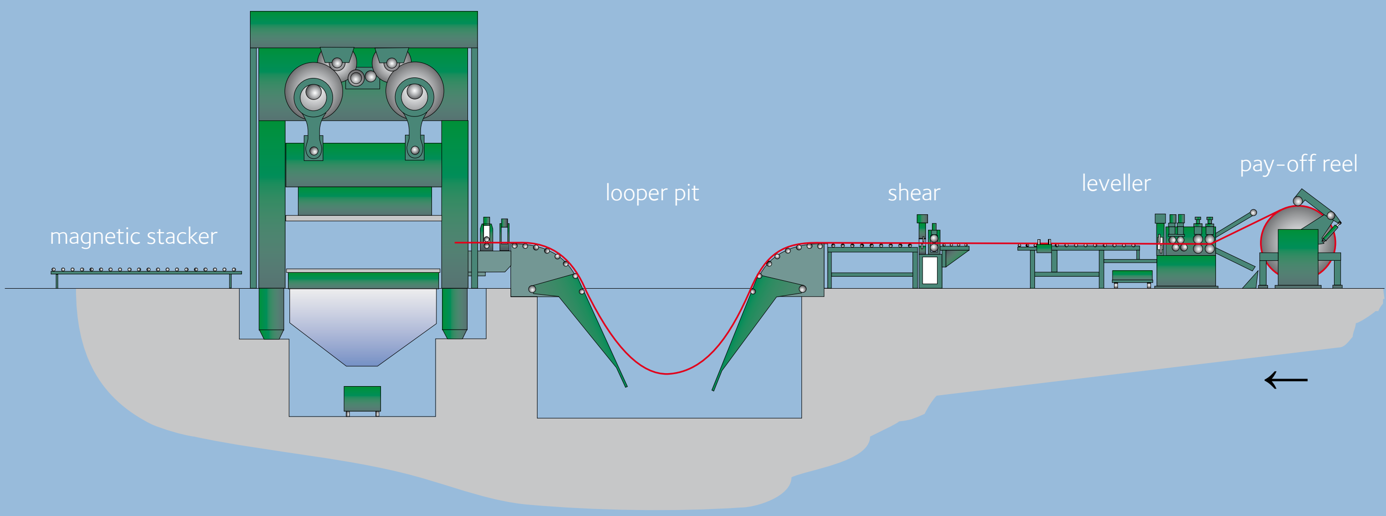
The welding activity consists of welding two or more subblanks together by means of a laser beam (power up to 9 kW) without lead-in wire. Because there is no lead-in wire, the edge of the side to weld needs to meet strict demands concerning rectilinearity, smoothness, and uniformity. These parameters do not only have a direct impact on the quality of the finished product, but also determine the welding efficiency (% of scrap).

ArcelorMittal Tailored Blanks Gent has six welding lines. One welding lines consist of:

- an entry side with pallets of un-welded subblanks
- a set of robots that put the subblanks on a moving welding table
- a fixed welding head and the laser (Yag of CO2 laser)
- the weld seam treatment zone where the weld seam is cleaned and oiled
- an oiling machine and its dimpling* and marking installation
- a robot at the discharge side with evacuation installation for the welded finished product

During welding, the geometry and the surface quality of the weld are constantly monitored.

(*) dimpling involves pressing small bumps into the thinnest strip in order to compensate the differences in thickness when the blanks are piled onto pallets.



BLANKING LINE

BLANKING LINE

Maximum strip width	2.100 mm
Maximum coil weight	35 tonnes
Strip thickness	0,5 to 3 mm
Maximum speed	60m/min
Press force	1.250 tonnes, maximum 60 strokes/min
Maximum die dimensions	4.600 x 2.800 x 1.500 mm (LxWxH)

LASER WELDING LINE

Laser oscillator	9 KW CO2 – or 4 KW Yag-laser
Maximum welding speed	12 m/min
Dimensions of the welding zone	3.100 x 1.600 mm

The main characteristics of the blanking line and the laser welding line

ArcelorMittal Gent, Geel and Genk in figures

Port

Total	wharf lenght	1.050		m
	raw material wharf	650		m
	shipping wharf	400		m
Max. deadweight of the vessels		71.000		tonnes

Raw material stockyard

Storage capacity	coal	640.000		tonnes
	iron ore	900.000		tonnes
	miscellaneous	180.000		tonnes
	total	1.550.000		tonnes

Coking plant

Annual capacity	coke	1.250.000		tonnes
	gas	520.000.000		m^3
	tar	45.000		tonnes
	benzol	11.000		tonnes
	sulphur	2.000		tonnes
Ovens	number	100		mm
1 oven	length	16.600		mm
	width	440		mm
	height	6.780		mm

Sinter plants

Annual capacity bruto sinter		6.500.000		tonnes
Sinter strand		1	2	
	length	48	113	m
	width	3,66	4,25	m
	sinter area	175	485	m^2
	cooling area	190	290	m^2

Blast furnaces

Annual capacity		4.380.000		tonnes
		A	B	
	hearth diameter	11,1	10,5	m
	working volume	2.550	2347	m^3
	burden distribution system	revolving chute		
	number of tuyères	28	27	number
	effective skip volume	21	17	m^3


Steel shop

Annual capacity		5.000.000 (slabs)	tonnes
BOF vessels		2	number
	height	10.685	mm
	internal diameter	7.700	mm
	total internal volume	407	mm
	charge weight	max. 300	tonnes
Continuously cast slabs			
	lenght	max. 10,6	m
	width	950 - 2.630	mm
	thickness	220	mm

Hot strip mill

Annual capacity		5.500.000	tonnes
Slabs			
	length	4,45 - 10,6	m
	width	600 - 1.955	mm
	thickness	180 - 250	mm
Hot rolled coils			
	outside diameter	max. 1.990	mm
	width	600 - 1.930	mm
	weight	4 - 30,75	tonnes
	strip thickness	1,25 - 13	mm

Cold rolling mills

Annual capacity			
Pickled products		1.600.000	tonnes
TTS + tandem mill 2		4.000.000	tonnes
		(full-hard cold rolled coils)	
Cold rolled coils			
	outside diameter	max. 2.286	mm
	width	600 - 1.880	mm
	weight	2,5 - 35	tonnes
	thickness	0,2 - 3,85	mm
Cold rolled strip			
	lengt	610 - 7.000	mm
	width	584 - 1.880	mm
	thickness	0,48 - 3	mm

Hot dip galvanising lines

Hot dip galvanising line 1

capacity	480.000	tonnes
strip width	750 - 1.550	mm
strip thickness	0,3 - 2,5	mm
zinc coating	80 - 350	g/min^2
speed	180	m/min

Hot dip galvanising line 2

capacity	360.000	tonnes
strip width	700 - 1.300	mm
strip thickness	0,15 - 1,0	mm
zinc coating	80 - 500	g/min^2
speed	200	m/min

Hot dip galvanising line 3

capacity	600.000	tonnes
strip width	800 - 1.880	mm
strip thickness	0,4 - 2,0	mm
zinc coating	80 - 350	g/min^2
speed	160	m/min

Electrolytic galvanising line

capacity	470.000	tonnes
strip width	600 - 2.080	mm
strip thickness	0,5 - 2,5	mm
galvanising cells	15	number
max. speed	190	m/min
min. zinc coating	1,5	µm
max. zinc coating	20	µm

Organic coating lines

Organic coating line 1

capacity	150.000	tonnes
strip width	750 - 1.550	mm
strip thickness	0,15 - 1,25	mm
speed	100	m/min

Organic coating line 2

capacity	200.000	tonnes
strip width	700 - 1.850	mm
strip thickness	0,3 - 1,8	mm
speed	120	m/min


ArcelorMittal Tailored Blank Gent

Blanking line

	force of the press	1.250	tonnes
	strip width	2.100	mm
	coil weight	35	tonnes
	strip thickness	0,5 - 3	mm
	speed	60	m/min

Laser line

	type of laser	9 kW CO_2-laser or 4 kW YAG-laser	
	welding speed	12	m/min





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