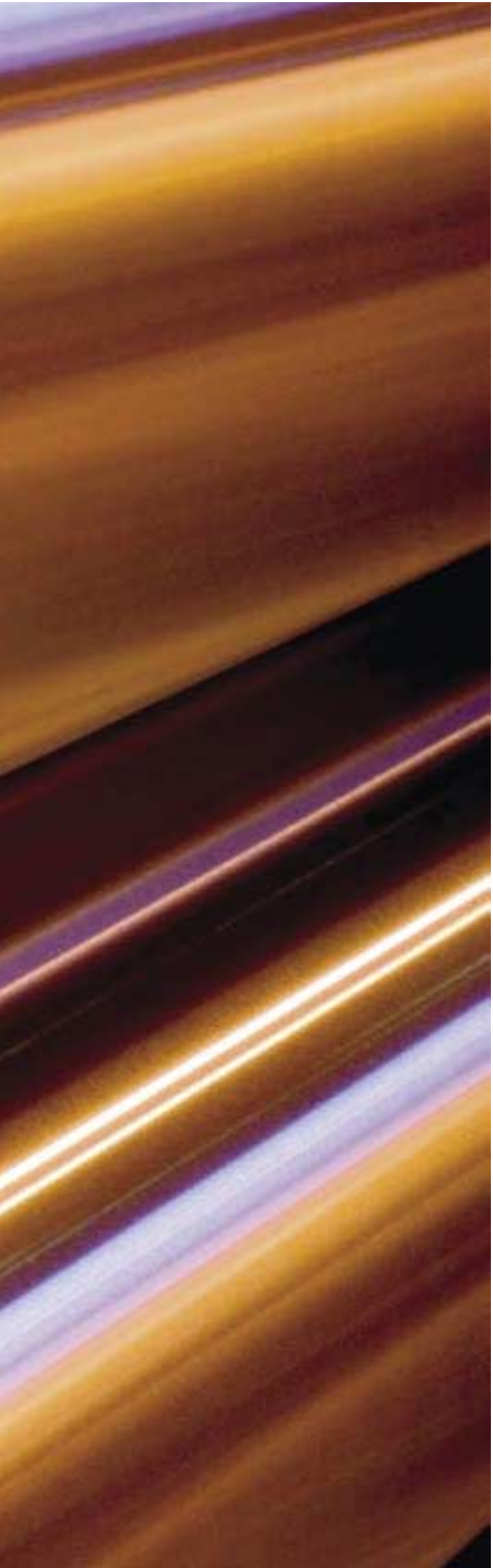
Cold rolling mill – from hot-rolled steel to high strength steel

SSAB
SWEDISH STEEL



The cold rolling mill produces finished products for customers – hot rolled pickled (Domex) sheet and cold rolled (Docol) sheet, as well as semi-manufactures for SSAB Tunnplåt branded product – hot-dip galvanised (Dogal) sheet and hot-dip galvanised and prepainted (Prelaq) sheet. The task of the cold rolling mill is to process hot rolled strip by pickling, cold rolling and/or heat treatment.

C O N T E N T S

Newly ground work rolls ready for taking into service in the tandem rolling milling.

Our products

SSAB is the largest Scandinavian sheet steel manufacturer and specialises in extra-high and ultra-high strength steels. Our products are used in applications such as vehicles, containers and packaging straps. Our customers are mainly in Europe, but also in Asia and America.

We develop, manufacture and market sheet steel that provides added value to the customer. One example of this is our range of coldrolled, high strength steels. We devote continual efforts to meeting the quality, dependability of supply and service needs of our customers. Our certification to ISO/TS 16949 is one element in these efforts.

The Toyota Yaris has high strength steel in its body.

Cold-rolled product range

Our cold-rolled product range comprises everything from mild steels to ultra-high strength steels. The steel grades are classified into the following main groups:

- Mild steels
- High strength steels
- Hardenable steels

This prize-winning lightweight container for the North American market is produced by the Jindo Corporation of South Korea.

Superior Trailor Works of California has produced this trailer. Cold rolled, ultra-high strength steel is used for the sides and floor of the body, which was awarded first prize in the Swedish Steel Prize 2003.

Karl-Inge Nilsson, Product Manager for cold rolled products.

Mild steels

Deep drawing steels Low-carbon steels are used in applications that demand everything from relatively simple to advanced forming. Deep drawing steels for enamelling are also available in our cold-rolled product range.

High strength steels

Docol YP/LA High strength, low carbon micro-alloyed steels intended for bending and relatively simple pressing.

Docol RP/BH Phosphorus alloyed steels that combine high strength with good drawing properties. The final strength of the finished part is obtained either by work hardening (RP steels) or by work hardening combined with bake hardening (BH steels).

Docol DP Dual phase steel that combines extra-high or ultra-high strength with good drawing properties.

Docol M Fully martensitic steels with extremely high strength.

Docol S Ultra-high strength steel intended for packaging straps.

Docol W Corrosion resistant, ultra-high strength steel characterised by good resistance to corrosion, good formability and impact resistance.

Docol Wear Wear resistant, ultra-high strength steel.

Docol Protect Ultra-high strength steel intended for ballistic protection.

Hardenable steels

The group of hardenable steels includes high-carbon steels, case-hardening steels and boron steels. These steel grades are characterised by good formability and the fact that very high strength and hardness are achieved by quenching the finished part.

Role of the cold rolling mill at SSAB Tunnplåt

The present cold rolling mill emerged from the massive "Strip 82" investment project in the early 1980s, which involved thorough modernisation and new construction. The most significant investments consisted of a new pickling line and the continuous annealing line.

SSAB Tunnplåt is devoting significant resorces to developing and producing high strength steels and further processing of steels. The cold rolling mill plays an important role in this work, and comprises the continuous annealing line that is unique by being able to produce advanced high strength steels.

Cold rolling produces finer surfaces, closer tolerances on thickness and width, and more consistent mechanical properties than hot rolling. Cold rolling is also capable of producing strip right down to a thickness of 0.3 mm, which is much thinner than a hot rolling mill can produce.

Flow through the cold rolling mill

Let us follow the flow of the material through the cold rolling mill to illustrate its role at SSAB Tunnplåt.

After hot rolling, the strip surface is covered with millscale, which is a layer of oxide that occurs as a result of oxygen in the air reacting with the steel strip during hot rolling. This millscale must be removed in order to ensure that it will not damage the surface during cold rolling. The millscale is removed in one of our two pickling lines, in which the strip passes through large tanks containing hydrochloric acid. Around 2 million tonnes of hot-rolled strip are pickled annually in the pickling lines. Around 700 000 tonnes of the pickled strip are delivered as hot-rolled, pickled material directly to customers.

Thinner strip

Most of the pickled strip continues through the tandem rolling mill in which it is subjected to such a high force during rolling that the material becomes thinner. Cold rolling results in improved thickness tolerances and thinner material. When the strip is subjected to these high forces, it becomes longer and harder, which makes it brittle and impairs its formability. This is corrected in a subsequent recrystallisat-ion annealing process that restores the formability of the material.

Modernization is in progress in the tandem rolling mill to enable even closer tolerances on thickness to be achieved. The modernization work will be completed in 2006.

After the tandem rolling mill, half the material continues to the metal-coating line, and the other half is heat treated in the cold rolling mill. Two techniques are used for recrystallization annealing of the material – batch annealing in bell-type furnaces, and continuous annealing. In these processes, the mechanical properties of the material are determined by heat treatment.

In the continuous annealing line, the heat treatment cycle can be varied widely. In combination with various chemical compositions of the basic material, the properties of the end product can be varied within wide limits.

The continuous annealing line also offers opportunities for quenching the strip in water at a very high rate, thus hardening the steel and providing scope for producing extra-high and ultra-high strength steels. This technique is available in only a few annealing lines around the world.

Mechanical properties

The material is subjected to skin-pass rolling after heat treatment to achieve the final mechanical properties and improve the flatness and surface finish of the strip.

The last stage consists of finishing the material by trimming the edges, inspecting, oiling and adjusting the coil weights to suit the customer's requirements. Finishing takes place in slitting lines or directly in the continuous annealing line.

Material that is to be cut to length is transported to the Western Mill, where it is cut to length and packed.

Before delivery to the customer, samples of the material are taken in order to check that it agrees with the mechanical properties specified by the customer.

Advanced production and process control enables us to tailor production to suit individual customer requirements on the material and the delivery time.

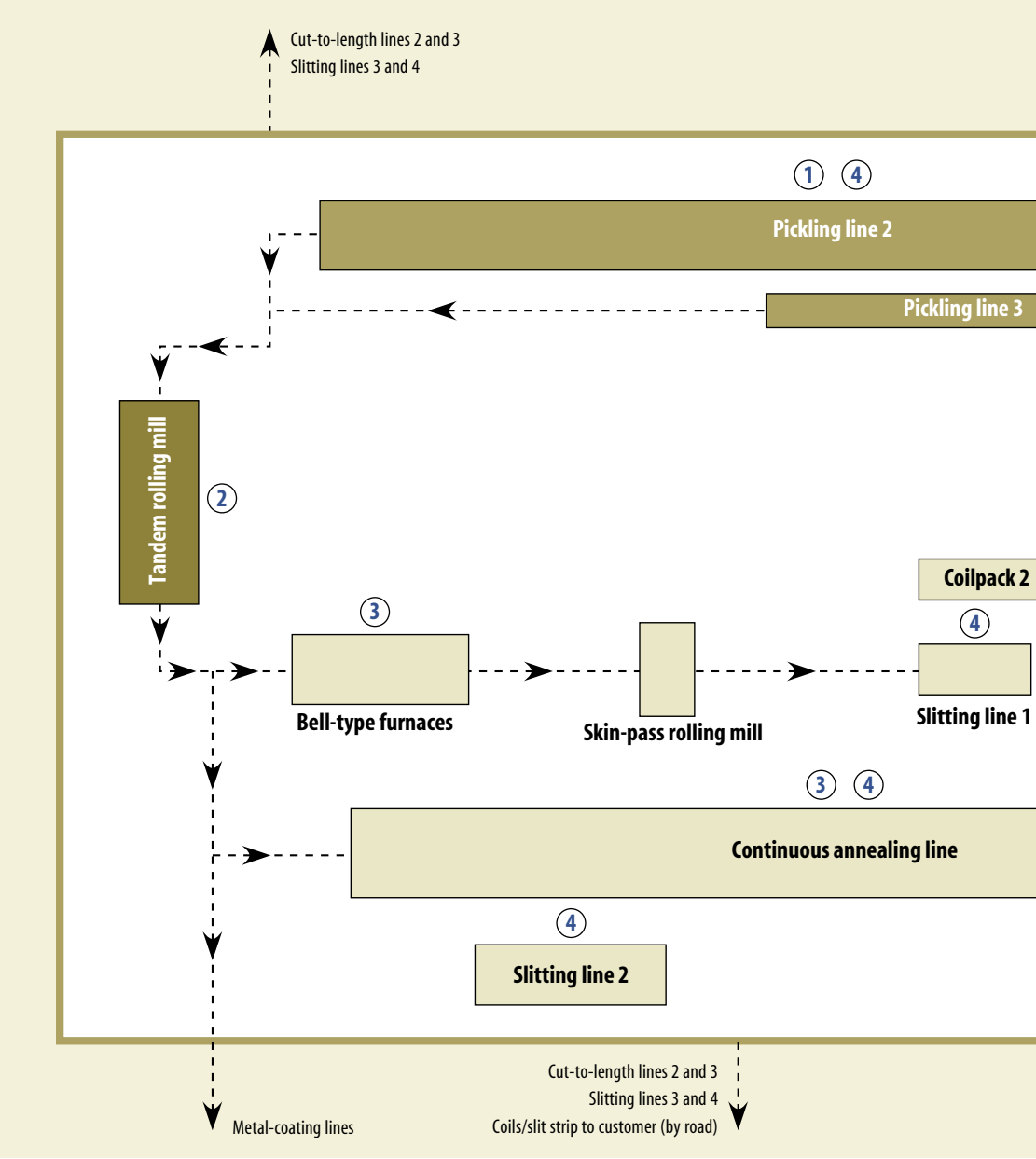
We are continually engaged on improving quality,

dependability of supply and efficiency in order to meet today the demands our customers will be making tomorrow.

Ronnie Högberg
Cold Rolling Unit Manager

Ronnie Högberg, Cold Rolling Unit Manager, at the continuous annealing line.

Flowchart for the cold rolling mill

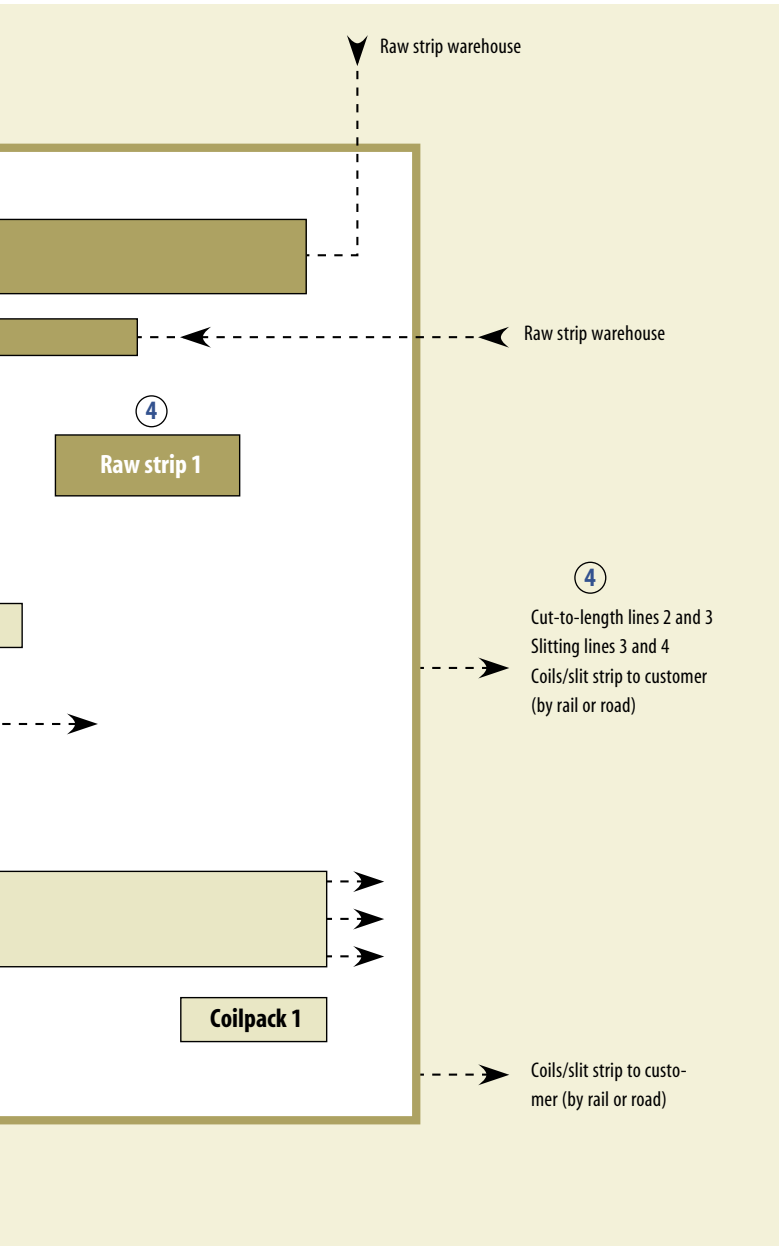


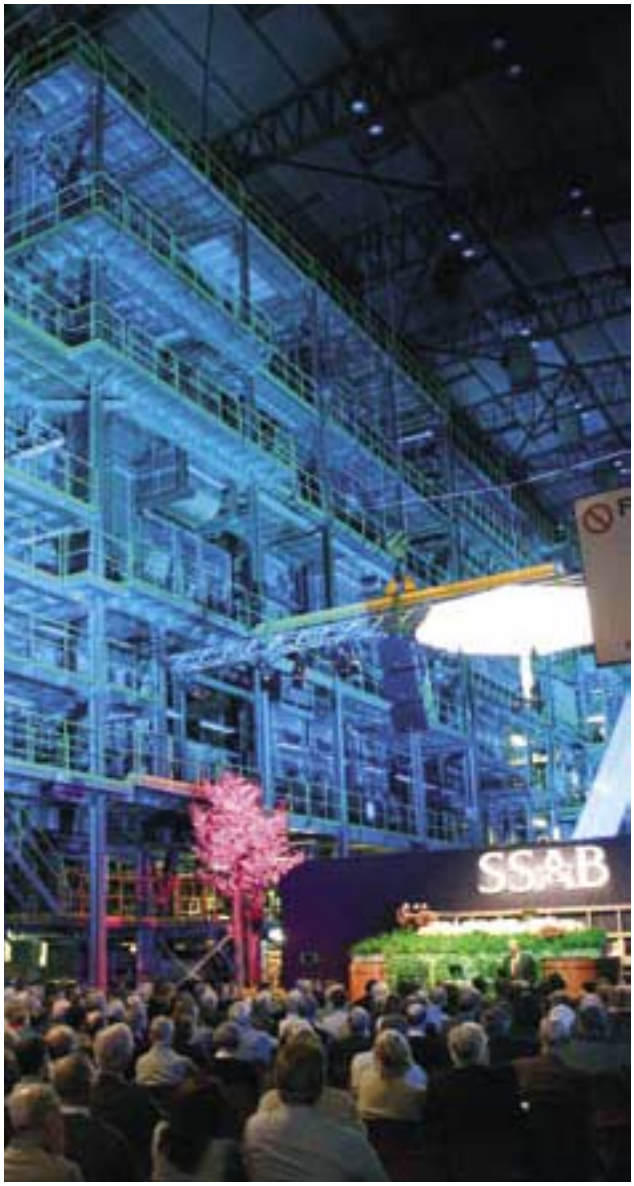
(1) Pickling
There are two pickling lines. The main purpose of pickling is to remove the mill-scale – oxide layer – formed after hot rolling. For further details see pages 10 and 11.

(2) Cold rolling
In the tandem rolling mill, the strip is rolled to its final thickness. Reduction is achieved by the high force between the rolls and by the tension from the coilers. For further details see pages 12 and 13.

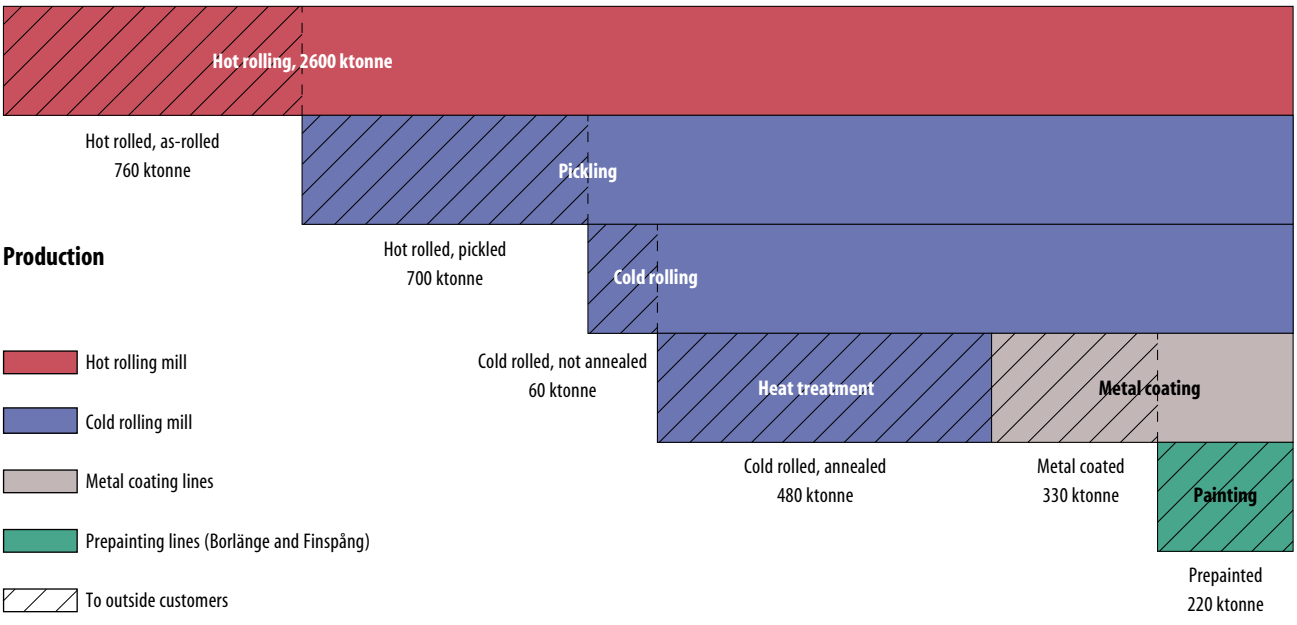
(3) Heat treatment
After cold rolling, the material is hard and brittle, and it must be subjected to re-crystallisation annealing in order to restore its forma-bility. This is done by heating the material to 650 – 840°C, during which new, stress-free grains are formed and the material again becomes soft and formable. Heating takes place in a protective gas atmosphere to ensure that no oxides will form on the surface. For further details see pages 14 to 17.

(4) Finishing
Adjustment of the coil weights, edge trimming, inspection and oiling take place directly in pickling line 2 and the continuous annealing line. The cold rolling mill has three slitting lines, i.e. raw strip 1, slitting line 1 and slitting line 2. Slitting can also be carried out in slitting lines 3 and 4 in the Western Mill. For further details see page 17.





The Annual General Meeting of SSAB Swedish Steel was held against the background of the continuous annealing line at SSAB Tunnplåt in Borlänge in the spring of 2004.



Pickling

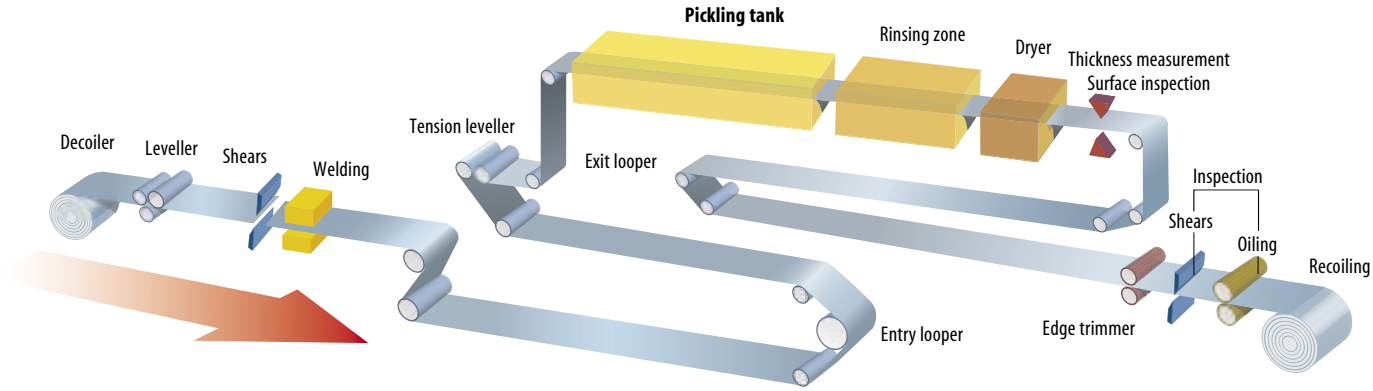
The main purpose of pickling is to remove the mill-scale, i.e. the iron oxide, formed on the surface after hot rolling. The cold rolling mill has two pickling lines.

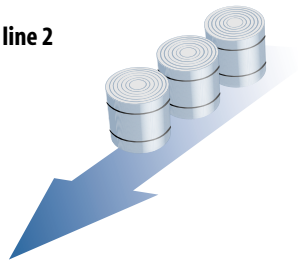
Pickling line 2

Pickling line 2 is a continuous line in which the hot rolled strip ends are cut and welded together into a continuous strip. The strip then passes through a tension leveller that improves the flatness and breaks up the oxide layer in order to ease the pickling process. Pickling takes place in hydrochloric acid, and the strip is then rinsed in several stages in order to remove any acid residues before the strip is dried. The strip is protected against corrosion by applying an oil film to the surface. Edge trimming and adjustment of the coil weights are carried out in pickling line 2.

Pickling line 3

Pickling line 3 is a "push-pull pickling line" in which the sheet is uncoiled, straightened and pushed through the plant





Pickling line 2

Pickling line 2

Development

1981 Commissioning.
1986 Raw strip weight increased from 9 kg/mm to 18 kg/mm of strip width
1991 Double-sided electrostatic oiling
1995 Automatic surface inspection
1998 Automatic marking
2001 New exit looper

General data

Capacity:	1 600 000 tonnes/year

Strip dimensions

Width:	650 – 1650 mm
Thickness:	1.5 – 6.0 mm
Max. coil weight:	30 tonnes

Maximum speeds

Entry section:	550 m/min
Pickling section:	250 m/min
Exit section:	350 m/min

Lengths

Total line length:	240 m
Strip length in entry looper:	500 m
Strip length in exit looper:	500 m

Pickling line 3

Development

1994 Commissioning
1997 Automatic surface inspection. Improvement of threading and cutting.

General data

Capacity:	400 000 tonnes/year

Strip dimensions

Width:	600 – 1650 mm
Thickness:	2.0 – 12.7 mm
Max. coil weight:	30 tonnes

Maximum speeds

Line speed:	60 m/min

Lengths

Total line length:	93 m

Pickling line 2
Pickling line 3
Acid regeneration

Energy and environmental data

Energy raw materials

LP gas:	20 kWh/tonne
Electrical energy:	5 kWh/tonne

Emissions to atmosphere

Carbon dioxide (CO-2):	<5 kg/tonne
Dust (iron oxide):	5 g/tonne
Nitrogen oxides (NOx):	6 g/tonne*

Emissions to water recipient

Solid particles:	0.5 g/tonne
Iron:	0.1 g/tonne

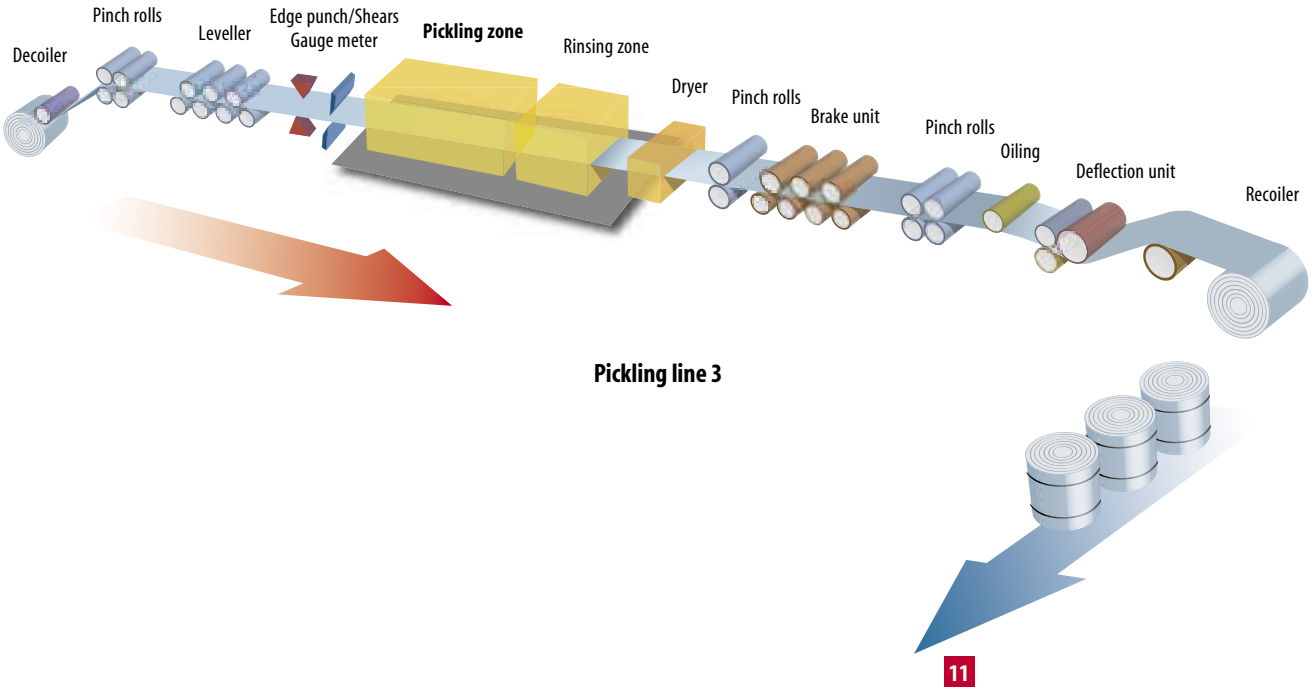
*) NOx expressed as NO2

individually. The sheet pickled in hydrochloric acid is rinsed to remove acid residues, and is dried and oiled before being coiled.

Acid regeneration plant

The hydrochloric acid from the iron-rich pickling acid used in pickling lines 2 and 3 is recovered in the acid regeneration plant. The acid is evaporated in an LP gas-fired furnace in which the iron oxide falls to the bottom of the furnace and is transferred to a silo. A textile barrier filter is included in the iron oxide storage container. After the furnace, the vapour is cooled and transferred to an adsorption column in which the hydrochloric acid is separated. The acid is then stored and reused as fresh acid for the pickling lines. The water vapour and air emitted are washed with an alkaline liquid in order to reduce any remaining dust and hydrochloric acid before the air is discharged to atmosphere.

The cold rolling mill has two pickling lines. Pickling line 2 is a continuous line, whereas pickling line 3 is a push-pull pickling line. The exit of pickling line 2 is seen here.



Pickling line 3

Cold rolling

The hot-rolled, pickled strip is cold rolled in the tandem rolling mill to reduce the thickness and produce a better surface. The strip is threaded from the decoiler into the mill, is cold rolled once in the five stands, and is then coiled in the recoiler. In order to dissipate the heat generated by the deformation work and friction, the rolls and strip are cooled with an emulsion consisting of 2 – 3 percent of oil in water. The oil emulsion also reduces the friction and washes away the impurities formed in the rolling process.

In order to maintain the close tolerances on thickness and achieve a high and uniform surface quality and flatness, the tandem rolling mill is equipped with three gauge meters, tension measuring equipment after all stands, roll force measuring equipment, roll deflection system, flatness meter and an advanced control system.

Upgrading in 2004 – 2006

In order to achieve even closer tolerances on thickness, the screw machinery that controls the strip thickness is being replaced by hydraulic setting cylinders in the four earlier stands. This will ensure faster and more accurate control. The control and regulating systems will also be changed in order to achieve even more accurate process control. The result will be a cold rolling mill of world class in terms of thickness tolerances.

The tandem rolling mill is also being modified in order to allow for faster roll changes. This will be achieved by installing a new wedge system that automatically gives a constant pass line height, regardless of the roll diameters.

Enclosed

Finally, the entire tandem rolling mill will be enclosed to ensure that the oil emulsion mist formed during rolling will not spread into the premises. Noise will also be damped, which will contribute to a better working environment in the cold rolling mill.

Tandem rolling mill

Development

1970 Commissioning.
1981 Installation of stand 5 (six-high) Installation of roll deflection system.
1984 Keyless back-up roll bearings in stands 1 – 2 for better thickness tolerances.
2004 Hydraulic roll setting for stands 1 – 4 for better thickness tolerances.
2004-2005 New control system.
2005 New roll grinding machine.
2006 New wedge system for constant pass line height. The entire tandem rolling mill will be enclosed to provide a better environment.

General data

Capacity:	1 250 000 tonnes/year
Max. roll force:	3000 tonnes
Reductions:	50 – 84%

Strip dimensions

Width:	600 – 1550 mm
Entry thickness:	1.5 – 6.0 mm
Exit thickness:	0.32 – 3.0 mm
Max. coil weight:	24 tonnes

Maximum speeds

Max. exit speed:	1420 m/min

Lengths

Total line length:	28 m

Work roll diameters

Stands 1 – 4:	540 – 600 mm
Stand 5:	500 – 540 mm
Back-up rolls:	1400 – 1525 mm

Energy and environmental data

Energy raw materials

Electrical energy:	60 kWh/tonne

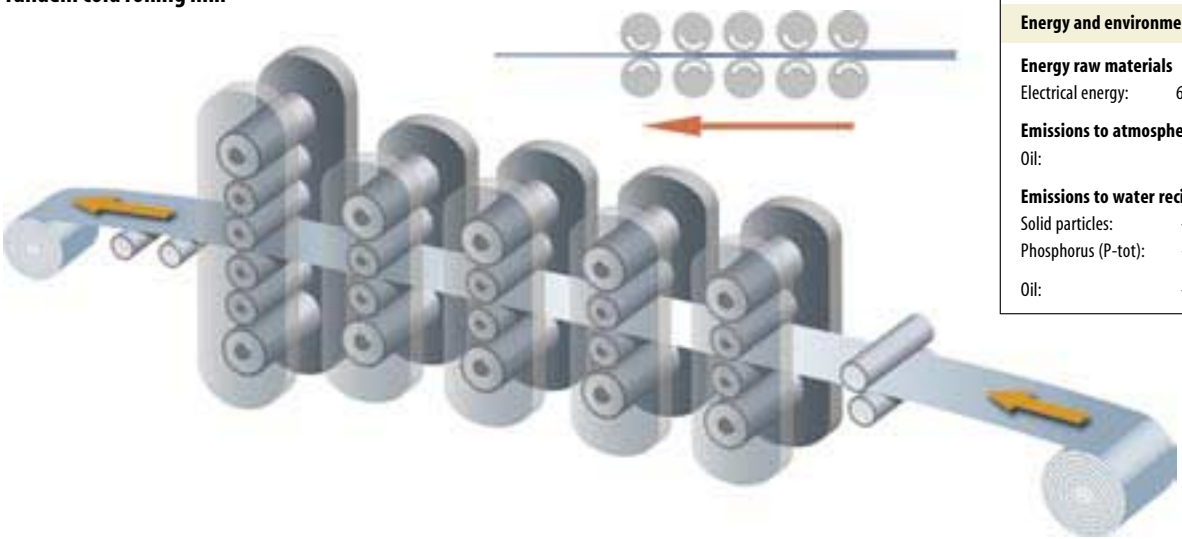
Emissions to atmosphere

Oil:	<6 g/tonne

Emissions to water recipient

Solid particles:	<0.2 g/tonne
Phosphorus (P-tot):	<0.1 g/tonne
Oil:	<0.1 g/tonne

Tandem cold rolling mill



The tandem rolling mill is the only line in the cold rolling mill that is not enclosed. Following the current modernization work due for completion in 2006, the tandem rolling mill will also be enclosed.

Heat treatment

Heat treatment in the cold rolling mill is carried out either continuously in the continuous annealing line or in batches in the bell-type furnaces. All heat treatment takes place in a protective gas atmosphere in order to prevent surface oxidation. The heat treatment time and temperature are of vital importance for ensuring that the material will acquire the necessary properties. After heat treatment, the material is usually skin-pass rolled in order to achieve the required final mechanical properties, good flatness and the right surface finish.

Continuous annealing line

All materials from deep-drawing mild steels to ultra-high strength steels can be processed in the continuous annealing line. Due to the continuous nature of the process, heat treatment is much quicker than the process in bell-type furnaces. The process time is 15 minutes, as against three days in the bell-type furnace. Another benefit is that a large proportion of finishing is carried out directly in the line. When the material leaves the line, only packing is needed before the material is dispatched to the customer.

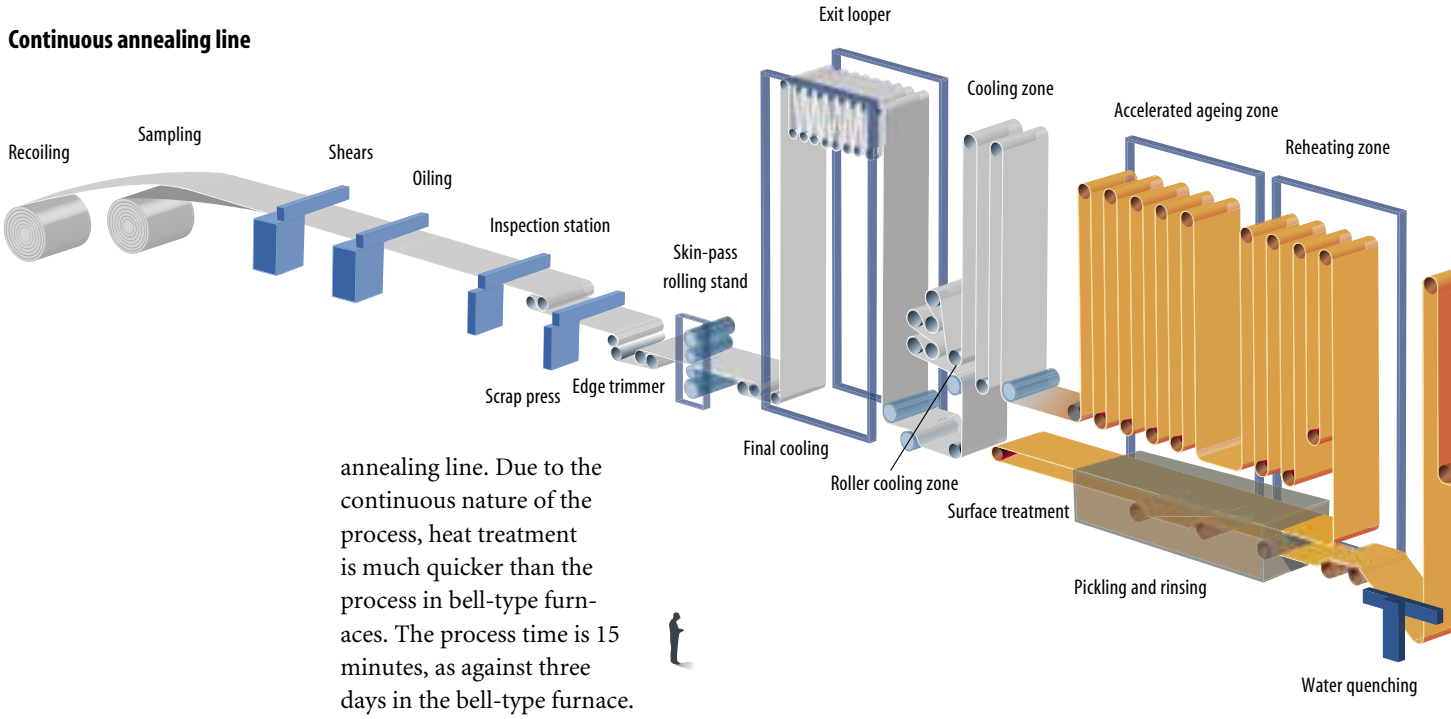
Due to the rapid cooling at cooling rates of around 1000°C per second achieved in water quenching, unique scope is available for producing dual phase and martensitic steels. Dual phase steels are characterised by a wide span between the yield strength and the tensile strength, which offers excellent forming properties in spite of the high tensile strength of the material. These unique properties are due to the fact that the material consists of two phases, i.e. martensite that accounts for high strength and ferrite that provides good formability properties.

The higher the proportion of martensite, the higher the tensile strength, but the formability is reduced, since the amount of ferrite decreases. In addition, the low contents of alloying elements in dual phase steels ensure excellent weldability.

Process stages

- Pre-treatment section
  - Decoiling
  - Cutting away of strip ends at which the thickness is incorrect
  - Welding together into a continuous strip
  - Cleaning of the strip surface
- Heat treatment section 1
  - Heating
  - Evening the strip temperature
- Cooling
  - Gas jet cooling (very rapid cooling by means of protective gas)
  - Quenching in water

Continuous annealing line



The continuous annealing line was taken into operation in 1982 and is the biggest single line in the cold rolling mill.

- Surface treatment section
  - Pickling
  - Neutralising
- Heat treatment section 2
  - Reheating
  - Soaking or cooling
  - Rapid cooling with protective gas
  - Cooling with water-cooled rollers
- Skin-pass rolling mill
  - Skin-pass rolling (wet or dry)
- Finishing section
  - Edge trimmer
  - Inspection
  - Oiling
  - Shears
  - Sampling for pre-delivery testing
  - Recoiling

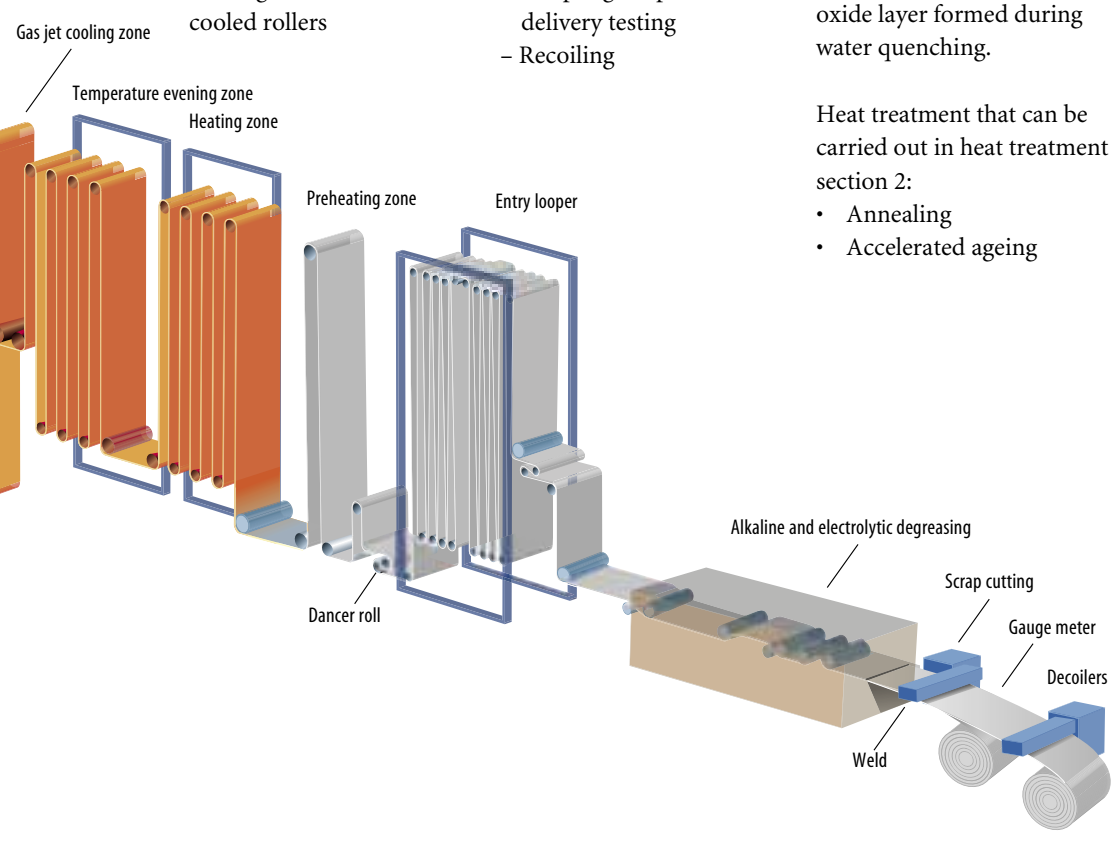
Heat treatment that can be carried out in heat treatment section 1:

- Recrystallisation annealing
- Hardening
- Grain growth

Pickling after heat treatment section 1 removes the thin oxide layer formed during water quenching.

Heat treatment that can be carried out in heat treatment section 2:

- Annealing
- Accelerated ageing



Continuous annealing line

Development

1982 Commissioning
1984 Entry rebuilt for maximum thickness of 2.0 mm. New final cooling
1994 New process and production control.
1998 Increased heating capacity by the addition of four induction furnaces. Increased cooling capacity by expanded gas jet cooling.
2003 Improved cooling technique in water cooling. Catalytic exhaust gas treatment for reduced nitrogen oxide emissions.

General data

Capacity:	450 000 tonnes/year
Max. furnace temperature:	950°C
Protective gas:	5% H2, 95% N2
Process time: approx.	15 min
Headroom:	37 m
Furnace height:	25 m
Total line length:	223 m

Strip dimensions

Width:	750 – 1550 mm
Thickness:	0.4 – 2.0 mm
Max. coil weight:	24 tonnes

Maximum speeds

Entry:	233 m/min
Furnace:	180 m/min
Exit:	233 m/min

Lengths

Strip lengths in the line: 1500 – 2000 m

Energy and environmental data

Energy raw materials

LP gas:	310 kWh/tonne
Electrical energy:	50 kWh/tonne

Energy recovery

Hot water:	55 kWh/tonne

Emissions to atmosphere

Carbon dioxide (CO2):	70 kg/tonne
Nitrogen oxides (NO-x):	<0.1kg/tonne*

Emissions to water recipient

Solid particles:	<10g/tonne
Phosphorus (Ptot):	<0.05 g/tonne
Iron:	<0.05g/tonne
Oil:	<0.05 g/tonne

*) NOx expressed as NO2
As from 2004, the emissions have been reduced by about 70% by treatment.

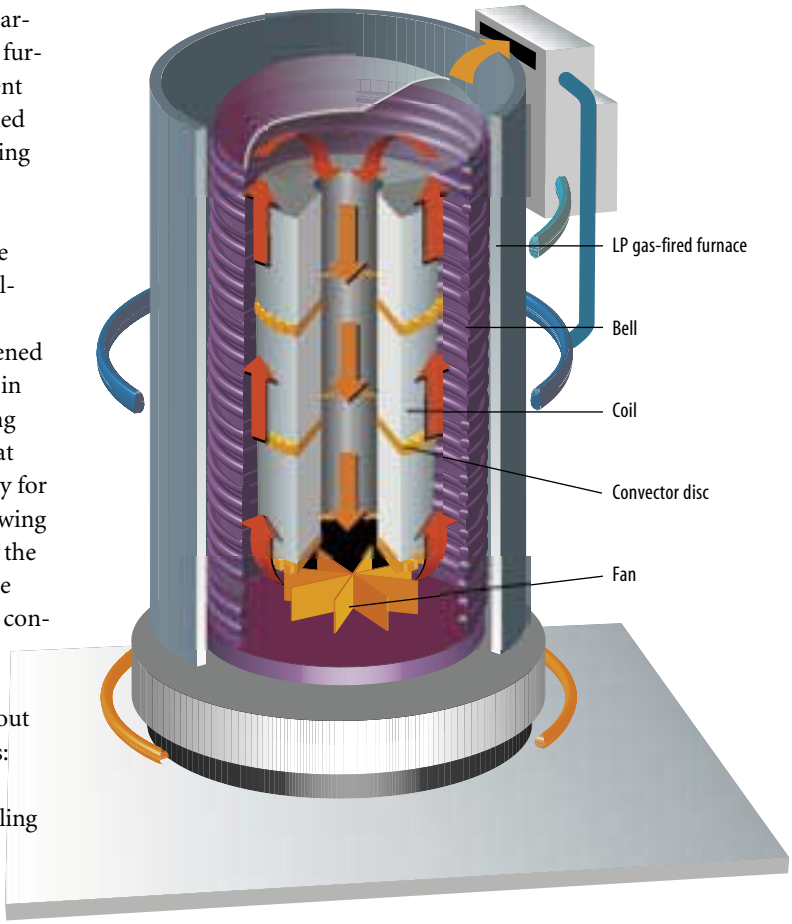
Bell-type furnaces and skin-pass rolling mill

Only heat treatment is carried out in the bell-type furnaces, and the subsequent skin-pass rolling is carried out in the skin-pass rolling mill.

Hardenable steels can be annealed only in the bell-type furnaces, since the material would be hardened by the water quenching in the continuous annealing line. Due to the long heat treatment time necessary for the extra-mild deep drawing steels, heat treatment in the bell-type furnace is more suitable than that in the continuous annealing line.

Heat treatment carried out in the bell-type furnaces:
- Annealing
- Recrystallisation annealing
- Grain growth

Bell-type furnace



Bell-type furnaces

Development

1969 Commissioning of 4 electric furnaces, 9 bases
1975 Commissioning of 4 electric furnaces, 9 bases
1992 – 1995 Five furnaces and nine bases converted to LP gas furnaces, with scope for using 100% hydrogen as protective gas.

General data

Bell-type furnaces

Capacity:	45 000 tonnes/year
Number of furnaces:	4
Number of bases:	9
Charge weight:	68 tonnes
Maximum temperature:	880°C
Protective gas:	7% H2, 93% N2
Heat treatment cycle	
Heating:	55 hours
Cooling:	35 hours
Cooling method:	External gas cooler
Process control:	Not automated

Hydrogen bell-type furnaces

Capacity:	75 000 tonnes/year
Number of furnaces:	5
Number of bases:	9
Charge weight:	80 tonnes
Maximum temperature:	850°C
Protective gas:	100% H2 or 100% N2
Heat treatment cycle	
Heating:	22 hours
Cooling:	24 hours
Method of cooling:	Water cooling
Process control:	Siemens

Energy and environmental data

Energy raw materials

LP gas:	170 kWh/tonne
Electrical energy:	70 kWh/tonne

Emissions to atmosphere

Nitrogen oxides:	65 g/tonne
Oil:	<0.1 kg/tonne

Heat treatment processes

Recrystallisation annealing
The internal structure of the steel is deformed during cold rolling, since the grains are flattened and elongated in the direction of rolling, which produces a hard and brittle material. To restore the formability of the strip, it must be recrystallisation annealed, which takes place by heating the strip to 650 - 750°C, when new stress-free grains will be formed and the material will again be soft and formable. Heating takes place in a protective gas atmosphere so that no oxides will be formed on the surface.

Grain growth
In order to improve the formability of steels intended for drawing, the material is held at the recrystallisation temperature for a sufficient length of time to enable the grains to grow to the required size. If the heat treatment temperature is raised, the grain growth rate will be increased. The larger the grains, the softer the material, and the softer the material, the better the formability.

Hardening and tempering
At room temperature, steel usually consists of a mixture of soft ferrite and perlite. The pearlite consists of laminations of ferrite and cementite, which is an iron carbide (Fe3C). The purpose of hardening is to dissolve the carbon out of the iron carbide by heating and to force the carbon by the subsequent rapid quenching to dissolve in the ferrite. The new phase thus formed is known as martensite. Martensite is hard and has high strength, but is brittle. Carbon begins to dissolve out of the iron carbide at around 730°C.

During tempering, the dissolved carbon diffuses out of solution and the hardness of the material decreases, while the toughness increases. The amount of carbon that diffuses out increases with increasing temperature and duration of the heat treatment. Tempering is carried out at 230 - 400°C, depending on the grade of steel.

Annealing
Hardenable steels are annealed in order to improve their machinability. This is done by heating the material to just over 700°C, when the cementite layers in the pearlite are transformed into spheroidised cementite. The heat treatment time is adjusted to ensure that the cementite transformation is complete, and the material is then allowed to cool slowly down to around 650°C.

Accelerated ageing
Aluminium or titanium can be added to the steel melt to produce an ageing-resistant steel (nitrogen-stabilized steel), which neutralises the loose nitrogen by forming aluminium nitride or titanium nitride respectively. Titanium also has the ability to bind loose carbon to form titanium carbide. On accelerated ageing, these processes are speeded up by raising the temperature to 200 - 400°C, depending on the grade of steel. As a result of this treatment, the formability of the material changes much more slowly during storage.

Finishing

Finishing consists of adjusting the coil weights, edge trimming, cutting to length, slitting, inspection, sampling for pre-delivery testing, oiling and packing.

Adjustment of coil weights, edge trimming, inspection, sampling for pre-delivery testing and oiling are carried out directly in pickling line 2 and the continuous annealing line.

Slitting

Adjustment of coil weights, edge trimming, slitting, inspection, sampling for pre-delivery testing and oiling are carried out in the slitting lines. The cold rolling mill has three slitting lines: Raw strip line 1, slitting line 1, and slitting line 2. Pickled and unpickled hot-rolled strip is processed in raw strip line 1. Slitting lines 3 and 4 are located in the Western Mill.

Each of the slit coils is initially strapped around the periphery, and the coils are then strapped together through the centre hole before being dispatched for packing.

Cutting to length

Cutting to length is carried out in cut-to-length lines 2 and 3 in the Western Mill.

Packing

The material must be appropriately packed to protect it in transit. Different forms of packaging are available to suit different shipment distances and methods of transport.

Coils are packed in Coilpack lines 1 and 2 in the cold rolling mill. In Coilpack line 1, packing is largely done manually by paper packaging. Shrink film is used is Coilpack line 2, which is automated.

The fully automated packing lines adjacent to cut-to-length lines 2 and 3 use shrink film for packing the cut-to-length strip.

The material is packed to protect it in transit.

Returnable packaging

SSAB Tunnplåt AB already recovers some of the coil end protections, inner rings and wood pallets. Work is continually in progress on developing packaging components so that more of them can be recycled.

Focus on the environment

Society is making increasingly strict demands on our production system and also on our products. It is therefore important for environmental matters to be included in all aspects of our operations.

The environmental management system is our tool for organising the environmental work in the company, promoting involvement of the employees, and increasing the effectiveness of our environmental work. We are working along definite guidelines, which involves following the ISO 14001 environmental standard.

Our environmental certification dates back to 2002, but we are continually developing new improvements in the field of the environment, including those emerging from periodic environmental audits.

The environment is playing an increasingly important role in the development of products and production processes. Safety, recycling and conservation of resources are the guiding elements in this development.

Steel is eminently well suited for recycling, since it can be recycled time after time for use in new products. As an example, our high strength steels lead to lighter structures and products, which reduces the raw material consumption and cuts the fuel consumption during transport. Our specialisation in high strength steels thus leads to a better environment and sustainable development.

For further information, visit www.ssabtunnplat.com.

Our environmental investment in 2003 - 2005 in equipment for the continuous annealing line for removing nitrogen oxides (see the diagrammatic arrangement below).

Environment

Developmen

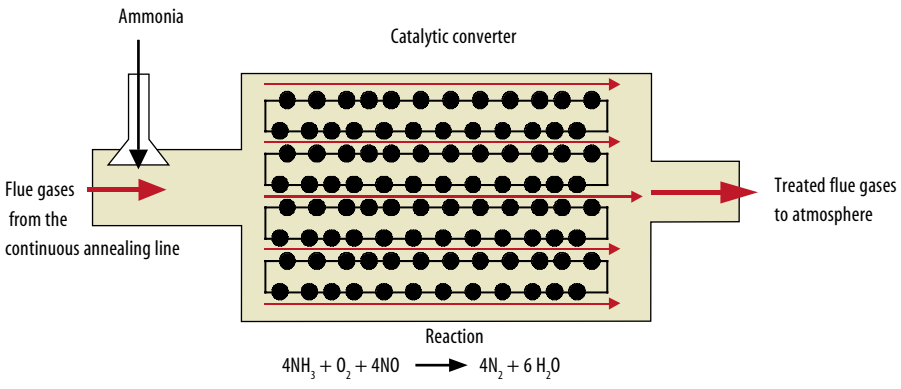
1970s
Focus on local emissions. Treatment equipment with operation and monitoring within the given permits and emission conditions.

1980s
Focus on energy recovery. Process development for reduced energy consumption.

1990s
Focus on the product. Development of environment-friendly products with a minimum of harmful substances.

2000s
Focus on sustainable development. Focus on safety, recycling and conservation of resources

Diagrammatic arrangement of the treatment system for removing nitrogen oxides (NOx) in the continuous annealing line



Most of the heat energy supplied to the material during the heat treatment cycle originates from the combustion of LP gas. Nitrogen oxides are formed during combustion. In order to remove most of these emissions, the continuous annealing line has been equipped with catalytic exhaust gas treatment equipment in which nitrogen oxide is converted to nitrogen and water.

Automated materials handling

Automatic trucks significantly reduce the risk of handling damage. The cold rolling mill includes both automatic trucks and an automated stores system.

Automatic ram-type trucks and an intermediate warehouse with an automatic overhead travelling crane, known as the automatic stores, are provided in order to minimise handling damage in the cold rolling mill. Both the automatic trucks and the automatic stores are controlled directly from the automatic stock management system.

A large proportion of the internal transport of coils in the cold rolling mill is carried out by automatic trucks. Hot-rolled, pickled material is stored in the automatic stores before being transferred for finishing and dispatch. In the intermediate stores, the coils are handled by an automatic overhead travelling crane, which is much less likely to cause damage than a manually controlled crane. A stock control system uses the intermediate stores for ensuring that the correct coils are transferred to the dispatch stores at the right time. This minimises the movement of coils in the dispatch stores, which reduces the risk of handling damage to the coils.

Material testing

The mechanical properties of the material produced are tested at the laboratory. The personnel work in shifts and testing is carried out around the clock. The most common test is the tensile test, in which the yield strength and tensile strength are some of the properties determined. More than 250 000 tests are carried out every year.

Other properties that can be checked include bendability, impact strength, hardness and surface finish. The internal purity of the material can also be checked. The laboratory issues annually around 80 000 test certificates that accompany the deliveries.

In the laboratory, tests are carried out around the clock. The impact testing machine determines the toughness of the material.

SSAB Tunnplåt AB is the largest Scandinavian sheet steel manufacturer and a leader in Europe in the development of high strength steels.

SSAB Tunnplåt, which is a member of the SSAB Swedish Steel Group, has a turnover of SEK 12 billion and employs around 4000 people in Sweden. The company's annual production is around 2.6 million tonnes of sheet steel.

We have an environmental policy that involves continual improvements in the efficiency of processes and environmental plant, and development of the environmental properties of the product from the lifecycle perspective.

We manufacture the following steels in our modern, high-efficiency production lines and rolling mills for strip products:

DOMEX®
Hot-rolled steel sheet

DOCOL®
Cold-rolled steel sheet

DOGAL®
Hot-dip galvanised steel sheet

PRELAQ®
Prepainted steel sheet

We assist our customers in selecting the steels that are best able to improve their competitiveness. Our strength lies in the quality of our products, the reliability of our supplies, and our flexible technical customer service

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GB 498 / 2004 / CONFETTI / Print: Gävle Offset / Photo: Pär K Olsson / Illustrations: Jorma Haula