SINGLE-STAND REVERSING COLD MILLS

SMS Siemag’s product range for the cold-rolling of carbon steels includes three plant concepts:

- Single-stand X-Roll® reversing mills (RCM, Reversing Cold Mill)
- Two-stand X-Roll® reversing mills of type CCM® (Compact Cold Mill)
- Four- or five-stand X-Roll® tandem mills (TCM) that nowadays are normally coupled to a pickling line.

The production capacities of the three plant types are tuned to each other so that an economical plant concept is available for any annual output between 100,000 t and 2.5 million t.

RCM PLANTS WITH A HIGH ECONOMIC EFFICIENCY

Our single-stand X-Roll® reversing mills (RCM) attain annual production figures of up to 500,000 t. Depending on customer’s product spectrum they will be implemented in the form of four-high or six-high plants. Compared with the other types, the investment expenditures are low.

RCM plants can be operated economically from an annual production of 100,000 t. In that case it is recommendable to use the mills both for reducing and for skin-pass rolling. In combined operation, an annual output of 300,000 t can be obtained if the product mix suits.

Moreover, single-stand X-Roll® reversing mills open up possibilities for optimizing the cold-strip production of tandem mills. Shifting of slowly- or difficult-to-roll products or of strip featuring particularly low final thicknesses on to RCM plants will enable the user to maximize the throughput of other installations and, at the same time, to reduce the production costs.

WIDE PRODUCT RANGE, HIGH FLEXIBILITY

Single-stand reversing mills cover a broad product spectrum. The number of passes and the rolling speed may be freely selected depending on the respective material. Mill users can thus react very flexibly upon the market demands with regard to material and strip thickness.

These features make the RCM plants preferable for rolling silicon steels and other special grades.

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<th>RCM</th>
<th>CCM*</th>
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<td>Up to 500,000 t/year</td>
<td>500,000 to 900,000 t/year</td>
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Cost-optimized production capacity.
TECHNOLOGICAL CONTROL ELEMENTS

In order to meet the high quality requirements of cold-rolled strip, single-stand X-Roll® reversing mills come with our practice-proven control elements, such as CVC® plus, Edge Drop Control (EDC®), Dry-Strip System or multizone cooling. Our T-roll® process technology offers additional optimizing possibilities. It allows precise advance-calculations of temperature, roll separating force, lubrication behaviour and surface roughness and, hence, an exact description of the events taking place in the roll gap.

MECHANICAL, ELECTRICAL AND AUTOMATION EQUIPMENT

As suppliers of complete systems we provide our cold mills with mechanical and hydraulic equipment as well as with X-Pact® electrical and automation systems. The close interlinking of mechanical equipment, automation and rolling technology is a decisive prerequisite for first-rate product quality and profitability.
The plant avails of two separate emulsion systems for roughing and finishing passes with speed-controlled feed pumps, our practice-proven vacuum filters, magnetic separators and skimming devices so as to arrive at top-class surfaces.

Wickeder Westfalenstahl meets these special demands by means of our X-Roll® High-Tech mill stand. For the very wide material spectrum – from alloyed high-grade steels and microalloyed close-grained steels up to and including heavily decarburized mild steels – the work-roll diameter may vary between 140 and 240 mm. In order to attain the extremely low final thicknesses, the stand was designed in a way that frictional forces have been reduced to a minimum. In addition, the direct drive of the backup rolls and of the reversing coilers provides for a highly dynamic and non-slip operation.

Wickeder Westfalenstahl reaches flatness tolerances of just +/- 1 µm for the ultrathin steel foils. This extreme accuracy to size is obtained with the aid of our practice-proven CVC® technology on the intermediate rolls and by horizontal work-roll stabilization (HS system). The HS system permits objective positioning of the intermediate rolls for each pass so that the rolling process is stabilized and horizontal deflection of the work rolls is minimized. The HS adjustment enables small-diameter work rolls to be used.
TYPE CVC® 6-HS
REVERSING COLD MILL

Commissioning: 1998

Production data
Rolled stock: Low carbon, stainless
Strip width: 400 to 1,000 mm
Strip thickness:
  Entry: 3.3 to 4.0 mm
  Exit: 0.05 to 0.5 mm
Coil weight: max. 18,000 kg

Technical data
Stand type: CVC® 6-HS
Rolling speed: max. 1,000 m/min
Roll separating force: max. 10,000 kN
Motor rating: 2,400 kW
Roll diameter:
  Work rolls: 140 mm to 240 mm
  Intermediate rolls: 360 mm to 400 mm
  Backup rolls: 800 mm to 860 mm
Capacity: 100,000 t/year

Technical features
- CVC® technology with axial intermediate-roll shifting and roll bending
- Horizontal shifting of intermediate rolls to stabilize the work rolls (HS system)
- Dry-Strip System
- MORGOIL® bearings
- Backup-roll drive
KYCR COIL INDUSTRIES, Bangladesh

CVC® 6-HS-REVERSING COLD MILL

The single-stand X-Roll® reversing mill of KYCR Coil Industries in Chittagong, Bangladesh, went on stream in January 2002. The plant is the sole cold mill in Bangladesh and mainly supplies the parent KDS group’s galvanizing line with cold strip.

KYCR mainly rolls strip from low-alloy steels on the six-high stand and specializes in the production of strip 0.15 mm thick and less. Although approximately 60% of the products are covered by this thickness range, KYCR is attaining annual outputs of more than 140,000 t and thus clearly exceeds the guaranteed annual capacity of 100,000 t.

The six-high mill is equipped with the control elements CVC® and HS (Horizontal Stabilization) and avails of work- and intermediate-roll bending with the result that very good surface and flatness values as well as closest thickness tolerances are attained.

The short project handling time is likewise noteworthy. Merely 18 months passed between contract signing and rolling of the first coil. Design, erection and project management were carried out jointly by our Indian affiliate SMS Siemag Pvt. Ltd. in New Delhi and us.
TYPE CVC® 6-HS
REVERSING COLD MILL

Commissioning: January 2002

Production data
Rolled stock Low Carbon
Strip width 600 to 1,050 mm
Strip thickness
Entry 1.6 to 3.0 mm
Exit 0.12 to 0.5 mm
Coil weight max. 22,000 kg

Technical data
Stand type CVC® 6-HS
Rolling speed max. 1,000 m/min
Roll separating force max. 10,000 kN
Motor rating 1,200 kW
Roll diameter
  Work rolls 200 mm to 240 mm
  Intermediate rolls 360 mm to 400 mm
  Backup rolls 800 mm to 860 mm
Capacity 100,000 t/year

Technical features
- CVC® technology with axial intermediate-roll shifting and roll bending
- Horizontal intermediate-roll shifting to stabilize the work rolls (HS system)
- Dry-Strip System
- Intermediate-roll drive
CVC® 6-HS-REVERSING COLD MILL

The probably then most modern single-stand X-Roll® reversing cold mill went on stream at China Steel Corporation (CSC) in Kaohsiung, Taiwan, in 2003. CSC expanded, with this plant, its existing capacity of cold-rolled steel to also include silicon steels as well as medium- and high-strength carbon steels featuring low final thicknesses. The six-high RCM has been designed for strip widths of 600 to 1,270 mm and final thicknesses of 0.15 to 1.6 mm. Total production amounts to 200,000 t/year.

In addition to the mechanical equipment, our scope of supply embraced all the technological process models to precisely preset the control elements and, thus, the complete technology concept for cold-rolling special steel grades. The mill stand has been equipped with hydraulic adjusting systems, intermediate-roll shifting with CVC® plus systems, work- and intermediate-roll bending as well as multizone cooling in order to meet the high requirements particularly with regard to strip thickness and flatness.

The EDC® control (Edge Drop Control) avoids any drop of the strip thickness in the edge area caused by variation of roll flattening. To this aim, the barrel of each work roll is tapered at one side through a specific grind. This taper is shifted by the control into the edge zone of the strip in a way that the edge drop is compensated.

Erection and cold commissioning of the plant at site altogether took just six months. This short period was possible through the modular construction of the rolling mill.
TYPE CVC® 6-HS
REVERSING COLD MILL

Commissioning: January 2003

Production data
Rolled stock
- Si-steels
- Carbon steels
Strip width
- 600 to 1,270 mm
Strip thickness
- Entry: 1.0 to 3.5 mm
- Exit: 0.15 to 1.6 mm
Coil weight
- max. 25,000 kg

Technical data
Stand type
- CVC® plus 6-HS
Rolling speed
- max. 1,200 m/min
Roll separating force
- max. 16,000 kN
Motor rating
- 4,200 kW
Roll diameter
- Work rolls: 290 mm to 340 mm
- Intermediate rolls: 440 mm to 500 mm
- Backup rolls: 1100 mm to 1220 mm
Capacity
- 200,000 t/year

Technical features
- CVC® plus technology with axial intermediate-roll shifting and roll bending
- Horizontal shifting of intermediate rolls to stabilize the work rolls (HS system)
- Edge Drop Control (EDC®)
- Dry-Strip System
- Multizone cooling
- Intermediate-roll drive
CSN – A NEW COLD-STRIP COMPLEX, Brazil

CVC® 4 REVERSING COLD MILL

The new cold-strip complex of CSN (Companhia Siderúrgica Nacional) started operation in Araucária, Federal State of Paraná/Brazil, in 2003. Here, hot strip from the main works of the group in Volta Redondo is pickled, cold-rolled and subsequently refined. The products are chiefly sold to the Brazilian construction industry.

The single-stand X-Roll® reversing cold mill (RCM) featuring an annual capacity of 350,000 t constitutes the works’ cold-rolling stage. The four-high stand is equipped with the CVC® plus technology and the Dry-Strip System. The strip widths cover a range between 700 and 1,600 mm, and the final thicknesses are 0.2 to 1.55 mm.

The complete plant in Southern Brazil was built on a turnkey basis by an international consortium under SMS Siemag’s leadership. Besides the reversing cold mill we supplied, jointly with our Canadian affiliate, additional facilities such as a skin-pass stand, the hot-dip galvanizing line, the push-pull pickling plant and several ancillaries. Moreover, we were responsible for plant commissioning and staff training.

Shipment of finished coils.
Works entry.
Reversing cold mill.
TYPE CVC® 4 REVERSING COLD MILL

Commissioning: 2003

Production data
Rolled stock: Low Carbon, IF-steels, microalloyed steels
Strip width: 700 to 1,600 mm
Strip thickness
  Entry: 1.5 to 5.0 mm
  Exit: 0.2 to 1.55 mm
Coil weight: max. 25,000 kg

Technical data
Stand type: CVC® plus 4
Rolling speed: max. 1,350 m/min
Roll separating force: max. 22,000 kN
Motor rating: 6,000 kW
Roll diameter
  Work rolls: 400 mm to 450 mm
  Backup rolls: 1,150 mm to 1,250 mm
Capacity: 350,000 t/year

Technical features
- CVC® plus technology with axial work-roll shifting and roll bending
- Work-roll drive
THE “JACK-OF-ALL-TRADES”
OF TUBOS EUROPA, Spain

CVC® 4 REVERSING
COLD MILL

Tubos de Europa S.A. in Jerez de los Caballeros, in the southwest of Spain, has set up its own cold-strip production by procuring a single-stand reversing cold mill. The four-high mill supplies the company’s galvanizing line and its pipe manufacturing plant with cold strip.

700 to 1,560 mm wide strip with a final thickness of down to 0.4 mm is produced. Tubos Europa uses the cold mill both for reducing and for skin-pass rolling. Its annual capacity approximates 400,000 t.

As supplier of complete systems, SMS Siemag also planned and manufactured the X-Pact® electrical and automation systems in addition to the mechanical equipment for this very flexible and highly efficient plant. All pass schedules were calculated with the help of our T-roll® technology package that comprises process know-how of more than 20 years. The mill stand has hydraulic adjusting elements for the backup rolls to precisely control the thickness. An outstanding strip flatness within close tolerance limits is attained by means of CVC® plus and work-roll bending. Moreover, CVC® plus enables the most varying sizes to be produced without having to carry out any time-consuming roll change. Multizone cooling likewise attributes to an extraordinary strip flatness.
TYPE CVC® 4 COMBINED REVERSING AND SKIN-PASSING COLD MILL

Commissioning: January 2005

Production data
Rolled stock: Low carbon
Strip width: 700 to 1,560 mm
Strip thickness:
Reversing Mode
   Entry: 1.2 to 6.0 mm
   Exit: 0.4 to 3.0 mm
Temper Mode
   Entry: 0.4 to 3.0 mm
   Exit: 0.4 to 3.0 mm
Coil weight: max. 30,000 kg

Technical data
Stand type: CVC® plus 4
Rolling speed: max. 1,200 m/min
Roll separating force: max. 20,000 kN
Motor rating: 5,500 kW
Roll diameter:
   Work rolls: 400 mm to 450 mm
   Backup rolls: 1,150 mm to 1,250 mm
Capacity: 400,000 t/year

Technical features
- CVC® plus technology with axial work-roll shifting and roll bending
- Dry-Strip System
- Multizone cooling
- T-roll®
- Work-roll drive
TWO MILLS ORDERED AT THE SAME TIME: BENXI IRON & STEEL, China

CVC® 6-HS REVERSING COLD MILLS

Benxi Iron & Steel, Liaoning province in northern China, has ordered two X-Roll® six-high reversing cold mills at the same time. The harmonized overall solution including mechanical equipment, utilities, X-Pact® electrics and automation from one source was the decisive factor for awarding this order to us. Each plant’s annual production amounts to 250,000 t. The first of the two cold mills went on stream in December 2007 and the second followed in March 2008.

Both X-Roll® reversing mills were specifically designed for the cold-rolling of carbon steels featuring low final thicknesses of 0.18 to 1.6 mm with strip widths of 750 to 1,300 mm.

Our scope of supply covered two identical, powerful six-high CVC® plus mills with horizontal work-roll stabilization (HS system) and intermediate-roll drive, inclusive of all X-Pact® electrics and automation. Highlights in the field of automation are the innovative setup model for maximum yield and the technological control elements specially tuned to each other.
TYPE CVC® 6-HS
REVERSING COLD MILL

Commissioning: December 2007/March 2008

Production data
Rolled stock: Low Carbon
Strip width: 750 to 1,300 mm
Strip thickness:
  Entry: 1.8 to 3.0 mm
  Exit: 0.18 to 1.6 mm
Coil weight: max. 22,000 kg

Technical data
Stand type: CVC® plus 6-HS
Rolling speed: max. 1,000 m/min
Roll separating force: max. 18,000 kN
Motor rating: 6,000 kW
Roll diameter:
  Work rolls: 290 mm to 340 mm
  Intermediate rolls: 440 mm to 500 mm
  Backup rolls: 1,150 mm to 1,250 mm
Capacity: 250,000 t/year

Technical features
- CVC® plus technology with axial intermediate-roll shifting and roll bending
- Horizontal shifting of intermediate rolls to stabilize the work rolls (HS system)
- Edge Drop Control (EDC®)
- Dry-Strip System
- Multizone cooling
- Intermediate-roll drive
COLD MILL FOR SI-STRIP: WISCO, China

CVC® 6-HS REVERSING COLD MILL

Wuhan Iron & Steel Corporation (Wisco), one of China’s largest steel companies, has continually extended its cold-strip production within recent years. In this context, we in 2005 supplied a combined pickling/tandem plant for an annual capacity of 2.3 million t which Wisco chiefly uses to produce material for the automotive industry.

A single-stand X-Roll® reversing cold mill (RCM) for an annual production of 306,000 t there went on stream in the summer of 2008. Wisco particularly concentrates, with this plant, on the rolling of silicon strip featuring an Si-content of up to 3.5 % in the grades HNGO (High Non-Grain-Oriented) and HIB (High Grain-Oriented). This efficient mill has been equipped with CVC® plus technology, EDC® system and horizontal work-roll stabilization (HS system).

Decisive for awarding the contract to SMS Siemag were, above all, our plant concept tuned to the production of electric-quality strip as well as the perfected control elements. The yield is maximized by special arrangements in our setup model matched to the rolling of silicon strip. In addition, our flatness measuring rollers are being employed which are optimally adapted to the increased strip temperature when rolling Si-strip.
TYPE CVC® 6-HS
REVERSING COLD MILL

Commissioning: summer 2008

Production data
Rolled stock: Si-steel (HNGO, HIB)
Strip width: 750 to 1,280 mm
Strip thickness:
   Entry: 1.3 to 3.0 mm
   Exit: 0.2 to 0.85 mm
Coil weight max.: 20,000 kg

Technical data
Stand type: CVC® plus 6-HS
Rolling speed: max. 900 m/min
Roll separating force: max. 18,000 kN
Motor rating: 5,500 kW
Roll diameter:
   Work rolls: 290 mm to 340 mm
   Intermediate rolls: 440 mm to 500 mm
   Backup rolls: 1,150 mm to 1,250 mm
Capacity: 306,000 t/year

Technical features
- CVC® plus technology with axial intermediate-roll shifting and roll bending
- Horizontal shifting of intermediate rolls to stabilize the work rolls (HS system)
- Edge Drop Control (EDC®)
- Dry-Strip System
- Multizone cooling
- Intermediate-roll drive
Novolipetskt Steel (NLMK) has commissioned us in April 2008 to build a six-high single-stand X-Roll® reversing cold mill. We are going to supply the complete mechanical and electrical as well as the automation equipment for this plant whilst our affiliate SMS Lubrication will develop the rolling emulsion. In this way the cooling lubricant can be optimally tuned to the rolling process.

The RCM will process 750 to 1,570 mm wide and up to 4.5 mm thick strip. The thinnest finished strip will be 0.35 mm thick. The product range above all covers higher-strength and high-strength carbon steels and IF-grades. The mill stand, scheduled to start up in the summer of 2010, will be designed for an annual capacity of 350,000 t.

The six-high mill comes with CVC® plus on the intermediate rolls and with the HS system that reduces the deflection of the work rolls by horizontal shifting of the intermediate rolls, thus stabilizing the rolling process. Additionally the plant will be prepared to later incorporate an Edge Drop Control facility.

All systems can be exactly matched to each other due to the supply of mechanical, electrical and automation equipment from a single source. This tight interlinking is an important precondition for high product quality and economical efficiency. The supply extent of X-Pact electrics and automation will include the electric drive systems, the control systems and the process models.

An integration test with training of the operating staff and instruction of client’s maintenance personnel rounds off the broad contractual field.
TYPE CVC® 6-HS REVERSING COLD MILL

Commissioning: summer 2010

Production data

Rolled stock: Hot-rolled and pickled low-alloy carbon steels, IF-steels, HSLA steels
Strip width: 750 to 1,570 mm
Strip thickness:
  Entry: 1.5 to 4.5 mm
  Exit: 0.35 to 2.6 mm
Coil weight: max. 25,000 kg

Technical data

Stand type: CVC® 6-HS
Rolling speed: max. 1,300 m/min
Roll separating force: 20,000 kN
Motor rating: 5,800 kW
Roll diameter:
  Work rolls: 290 to 340 mm
  Intermediate rolls: 440 to 500 mm
  Backup rolls: 1,150 to 1,250 mm
Capacity: 350,000 t/year

Technical features

- CVC® plus technology with axial intermediate-roll shifting and roll bending
- Horizontal shifting of intermediate rolls to stabilize the work rolls (HS system)
- Dry-Strip System
- Multizone cooling
- Intermediate-roll drive
INTERNATIONAL STEELS LIMITED, ISL, Pakistan

PAKISTAN’S FIRST X-ROLL® RCM

In April 2008 we received an order from International Steel Limited (ISL) for the supply of the first X-Roll® Reversing Cold Mill (RCM) to Pakistan. ISL is one of the country’s leading companies and is so far specializing in the production of tubes for line construction as well as for machine and vehicle construction. With the new single-stand four-high reversing cold mill ISL is now expanding its market range to also embrace cold strip. The main field is intended to be the production of deep-drawing grades.

The plant is going to be designed for processing 700 to 1,250 mm wide strip with a starting thickness of 5.0 mm. The minimum final strip thickness will be 0.25 mm and the annual capacity will amount to 248,000 t. Provisions will be made during the first stage of construction already to be able to extend the plant to a two-stand Compact Cold Mill (CCM) at a later date.

The mill will be designed in the form of a four-high stand and have one uncoiler and two reversing reels. For precise thickness control the stand will come with hydraulic adjusting cylinders that can achieve a maximum total roll separating force of 15,000 kN. Our CVC® plus technology and work-roll bending system will provide for close tolerance limits.

As regards the delivery of mechanical equipment, we are cooperating with an Indian consortium partner who will be responsible for the entry and exit components, for the ancillaries and utilities as well as for the work-roll change. The core components such as the mill stand, the reversing coilers and the high-pressure-hydraulics valve stands will be supplied by us. The plant is scheduled to start operation mid-2010.
TYPE CVC® 4 REVERSING COLD MILL

Commissioning: 2010

Production data

Rolled stock Deep-drawing grades (CQ, DQ, DDQ)
Strip width 700 to 1,250 mm
Strip thickness
Entry 1.6 to 5.0 mm
Exit 0.25 to 2.0 mm
Coil weight max. 25,000 kg

Technical data

Stand type CVC® 4
Rolling speed max. 1,200 m/min
Roll separating force max. 15,000 kN
Motor rating 5,800 kW
Roll diameter
Work rolls 360 to 400 mm
Backup rolls 1,000 to 1,100 mm
Capacity 248,000 t

Technical features

- CVC® plus technology with axial work-roll shifting and roll bending
- Work-roll drive
"The information provided in this brochure contains a general description of the performance characteristics of the products concerned. The actual products may not always have these characteristics as described and, in particular, these may change as a result of further developments of the products. The provision of this information is not intended to have and will not have legal effect. An obligation to deliver products having particular characteristics shall only exist if expressly agreed in the terms of the contract."