Enhanced rolling and processing portfolio of Primetals Technologies for the production of flat products

The merging of the former Mitsubishi-Hitachi Metals Machinery and Siemens VAI Metals Technologies in January 2015 to become Primetals Technologies, considerably enlarged the company portfolio of downstream technologies in the flat product sector. This article presents an overview of the extensive scope of rolling and processing solutions offered to producers of both steel and non-ferrous metals.

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Shortly after the start of operations at Primetals Technologies, an extensive review of the combined product portfolio was performed by the company's centres of competence for downstream technologies located in Austria, France, Germany, Japan and the UK. The respective strengths and features of available process solutions were compared, and the results showed that while certain technologies were better suited for new plant installations, the strengths of others were particularly applicable for modernisation steps. Above all, it was clearly recognised that the full scope of existing company solutions is needed to ideally serve the international metals market. A technology exchange programme is now underway to maximise the joint venture's product-synergy effect as well as the capability and skills of the company's expert personnel. A global Intranet communication platform is therefore being established to share accumulated experience and project results.

The target is to supply best solutions available from the different centres of competence at a local level to meet specific market requirements. Furthermore, the worldwide network of sales offices, engineering locations, workshops, service centres and maintenance outposts of Primetals Technologies ensures a close relationship with customers for fast supply and support. Key elements of the company's combined downstream portfolio for flat products are presented. The combination of advanced technology and state-of-the-art automation solutions is the basis for outstanding, value-added products illustrated in Figure 1, amply illustrated by a typical control pulpit shown in Figure 2.

Primetals Technologies solutions will now be described.

**ARVEDI ESP – ENDLESS STRIP PRODUCTION FROM CASTER TO COIL**

In the Arvedi ESP process, coiled hot rolled strip is produced in a combined, continuous and uninterrupted
casting and rolling line (see Figure 3). Energy consumption and the associated costs and CO₂ emissions are reduced by up to 45% compared to conventional casting and rolling processes. With a length of just 180m, the plants are also considerably more compact than conventional casting and rolling mills, and a wide range of high quality and ultra-thin steel grades can be produced for demanding steel applications.

**HOT STRIP MILLS**

The demand for advanced, high strength steel grades is continually growing, as are the requirements placed on product quality, mill productivity and plant availability. In order to remain competitive, new and existing steel plants must meet this challenge in the best possible way. A wide range of solutions for high performance for new and modernised hot strip mills is offered to meet specific customer demands. This includes rougher/edger combinations for rolling forces up to 60,000kN (see Figure 4) and finishing mills for rolling forces up to 55,000kN. The cooling setups comprise Turbo Laminar as well as Power Cooling for high strength steel production (see Figure 5). Power Coilers are able to handle API grades up to 25mm thickness at 2,083mm width. The new key technologies developed include slab sizing presses, pair cross mills, work roll shift mills, Mill Stabilising Device (MSD), Looper Shape Meter (LSM), On-line Roll Profiler (ORP), Power Cooling, and advanced down coilers.

In addition to the conventional batch-type process, the endless hot rolling line using the bar joining machine can be supplied in order to achieve an expansion of product line-up and increase in productivity.

**PLATE MILLS**

The main selection criteria for plate mills are the final thickness, width and the material grade. For products greater than 25mm thick, and where high strength and toughness in certified applications are important, a conventional reversing plate mill is the appropriate solution. If the product requirement is for low volume coil-plate or coil-strip between ~2mm and 25mm thick and ~1,600mm to 2,500mm wide, a Steckel mill is the best solution. However, if the product requirement includes coils, coil-plates and discrete plates with a minimum thickness ≥4mm, coil widths up to 2,500mm and a plate or coil-plate width up to 3,200mm, then a Plate-Steckel mill is the appropriate solution.

**REVERSING PLATE MILLS**

Reversing plate mills as typified in Figure 6 are quite literally the most powerful metalworking tools on Earth, but they are also precision tools – not just in terms of dimensional control, but also in imparting mechanical properties to the rolled product. Accurate microstructural...
control starts with expert process knowledge and for a given chemical composition, rolling and cooling are most important process for the final mechanical properties.

**STECKEL MILL**
The Steckel mill (see Figure 7) occupies special niches in hot flat rolling. Operating at a lower volume than tandem hot strip mills, but capable of greater widths, it is especially suitable for higher alloyed and harder steels, including stainless steels. It can produce either coiled plate or coiled strip.

**PLATE-STECKEL MILL**
The Plate-Steckel mill as shown in Figure 8 is a highly specialised hybrid mill, combining the best of both the above and capable of rolling wide structural steel products in both flat plate and coil form. There are few examples and even fewer truly successful project references, but Primetals Technologies is prominent as a proven supplier. High productivity comes with the concept, but it also includes metallurgical precision, maintainability and reliability.

![Fig 6 Reversing plate mill](image)
PICKLING LINES
Our modularly designed continuous and push-pull pickling lines are characterised by their efficiency, economic operation and use of advanced, but proven, technologies such as compact scale breakers, state-of-the-art welders and i Box® pickling systems to deliver scale-free surfaces. Customers have the choice of different well-proven pickling concepts that include i Box® turbulent tank and shallow-bath tanks to meet specific requirements or preferences. (see Figure 9).

TANDEM COLD MILLS
Tandem cold mill solutions are the key to achieving high product yields, low operational costs and reduced maintenance. A comprehensive range of cold rolling solutions is available to satisfy all market demands for high quality strip products.

The latest solutions provide maximum added value for customers and apply the experience acquired from hundreds of mill installations across the world. Depending on the product mix, the annual production capacity typically exceeds 1.2Mt. Both 4-high and 6-high mill stands equipped with advanced stand actuators are supplied following detailed analyses of product and customer requirements. A universal crown control mill (UCM) 6-high example is shown in Figure 10.

COUPLED PICKLING LINE AND TANDEM COLD MILL (PLTCM)
For numerous product applications, the required strip thickness, flatness and surface quality can be achieved more economically by coupling the pickling and cold rolling processes. This results in significant improvements with respect to mill productivity, yield and production cost savings due to the elimination of strip threading and tailing-out operations. Maintenance, roll consumption and manpower requirements are also lowered. The combined line length achieved is 350-400m (see Figure 11) and by use of very accuracy strip tracking and speed optimisation systems the highest throughput rates under all operating conditions are ensured.

REVERSING COLD MILL
The advanced reversing cold mill is a suitable lower capex solution for small to medium sized production capacities, or for the rolling of smaller order lots of special steel grades. Depending on the product mix and quality demands, both 4-high and 6-high mill stands are offered to meet the respective product and customer requirements.

SPECIAL STEEL MILLS
Special steel mills are designed chiefly for the rolling of stainless steel, electrical steel and other special-purpose steels. The most common configuration is the single reversing mill type. Various mill designs are offered that include 6-high UCMs, 20-high ZR mills (see Figure 12) and 12-high cold-rolling mills with small diameter work rolls for the rolling of high hardness materials.

SKIN-PASS MILLS
Skin-pass mills are installed downstream of the cold mill for adjusting the final mechanical properties, flatness and surface finish of cold rolled strip. They can be inline or
of steel grades and dimensions at very high process speeds. Line equipment also includes fully automatic coil feeding, mash-lap or laser welders, strip cleaning sections, and state-of-the-art drive and automation solutions.

**METALLIC COATING LINES**

A current trend in the steel industry is the greater emphasis placed on product value and thus the profit margin for rolled products with the use of special coating techniques. A broad range of solutions is offered for the metallic coating of both hot and cold rolled strip in continuous hot-dip galvanising or electrolytic tinning lines. This value-added, high quality material is extensively used in construction, appliance, automotive and packaging applications. A typical example is illustrated in Figure 13.

**CONTINUOUS STAINLESS STEEL ANNEALING AND PICKLING LINES**

Stainless steel annealing and pickling lines link the traditionally separate processes of rolling, annealing, pickling, skin passing and levelling into one fully integrated rolling and processing plant, making them both efficient and economic. An efficient cleaning section ensures that the required strip cleanliness prior to annealing is achieved. A tunnel furnace is installed in the annealing section, and acid pickling is applied in the pickling sections.

**ALUMINIUM HOT ROLLING MILLS**

Aluminium hot rolling mills are not unlike steel strip mills and would typically comprise reversing plate mill (sometimes with edger) followed by a 5-stand finishing mill producing strip about 1.6mm thick. A complete range of aluminium hot rolling mills is available for both new and revamp projects providing high product quality, yield and plant flexibility. With a flexible mill configuration, high quality strip can be rolled in capacities between 100,000 and 800,000 t/a. Advanced solutions feature a synthesis of mechanical actuators, electrical and automation control systems, and applied process know-how to deliver gauge, profile/flatness, temperature and surface quality with the highest level of consistency.

**ALUMINIUM COLD MILL**

Again, not unlike steel cold mills, the aluminum cold rolling portfolio offers a unique blend of innovative design and proven technology for both new and existing plants. Strip, down to about 0.2mm, is produced with very tight tolerances at high productivity by high speed rolling at 2,000m/min and with maximum yield on a single or two stand mill for cold rolling operations (see Figure 14). An accurate mill setup is crucial for meeting quality requirements. The solutions include physical online process models, integrated process control and drive systems that...
employ industry standard platforms to ensure optimum rolling results at all times.

**ALUMINIUM FOIL MILL**
Primetals Technologies supplies the world’s most advanced foil-rolling mills. It combines the latest developments in automated foil feed and process control to enable producers to achieve the highest quality foil at the lowest costs. Increasing demands on the quality of aluminium foil applications mean higher demands for production equipment. At present, rolling mills are expected to produce foil of less than 6µm thick at widths of up to 2m, and at speeds in excess of 2,000m/min.

**COPPER FOIL ROLLING MILL**
The X-mill, featuring intelligent shape control with an air bearing type shape meter, is designed for ultra-thin rolling of copper strip or foil at 6-9µm used in electronic elements (see Figure 15). The rolls are arranged in an X shape in which a pair of parallel backup rolls support the small-diameter work roll to prevent horizontal deflection. Stable and reliable thin-gauge rolling is the result. Narrow-width UCMs are also available for copper finish rolling to foil-gauge thicknesses.

**PRIMETALS TECHNOLOGIES CENTRES OF COMPETENCE FOR FLAT PRODUCT PRODUCTION**

- **Sheffield, UK**
  - Plate, Steckel and Plate-Steckel mills
  - Hot- and cold-rolling mills for aluminium

- **Montbrison, France**
  - Processing lines for carbon and stainless steel
  - Cold-rolling mills for stainless steel

- **Erlangen, Germany**
  - Electrics, Level 1 and Level 2 automation for all types of rolling mills and processing lines

- **Linz, Austria**
  - Arvedi ESP (endless strip production)
  - Hot strip mills for carbon steel
  - Cold rolling mills for carbon steel, including pickling lines

- **Hiroshima/Tokyo, Japan**
  - Plate and Steckel mills
  - Hot rolling mills for strip and aluminium
  - Cold rolling mills for carbon steel, stainless steel and aluminium
  - Processing lines and furnace technology for carbon steel, silicon steel and stainless steel
The combined downstream product portfolio of Primetals Technologies means that the finest rolling and processing technologies are available for customers to add the finishing touch to metal products. Decades of plant building experience and the acquired know-how from thousands of successfully implemented projects add up to superb production facilities, outstanding products and new market opportunities.

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