Steel Plantech

Heat the World, Shape the Future

Product Information
SOLUTIONS OF STEEL PLANTECH

SOLUTION 1
Product Range Expansion

SOLUTION 2
Product Quality Enhancement

SOLUTION 3
Production Volume Increase

SOLUTION 4
Production Cost Reduction

SOLUTION 5
Customization

SOLUTION 6
Environmental Friendliness
SOLUTION 1

Product Range Expansion

We provide facilities that enable the timely manufacture and supply, at appropriate volume and costs, of products that satisfy our customers' diverse needs. In particular, we can propose facilities that are characterized by their high functionality and superior quality to finish high-class, differentiated and competitive products in various industrial fields.

• RH Degasser
• Section Rolling Mill
• Plate Leveler
• Continuous Annealing Line (CAL)
• Continuous Galvanizing Line (CGL)
• Annealing and Coating Line (ACL)
• Color Coating Line (CCL)
• Tension Leveler

SOLUTION 2

Product Quality Enhancement

From the manufacturing of pig iron and steel to casting, rolling and process lines, we offer a coherent lineup of facilities that enables facility designs with upstream and downstream processes taken into consideration. We have been supporting the technological development of the Japanese steelmaking industry for about 70 years since the time of the companies that joined hands to establish Steel Plantech. We possess world-class equipment technologies that will meet the needs of our customers for high quality and high yield steel manufacturing.

• Coke Dry Quenching (CDQ)
• KR Hot Metal Desulfurization System
• RH Degasser
• Continuous Bloom, Beam Blank and Billet Casters
• Roller Straightener
• Continuous Annealing Line (CAL)
• Continuous Galvanizing Line (CGL)
• Tension Leveler
SOLUTION 3

Production Volume Increase

We have an abundant track record in the delivery of not only new, large-scale, large-capacity facilities but also in renovating equipment to expand the capacity of an existing facility. Furthermore, we can provide optimum layout plans, original technology for continuous manufacturing processes, facilities for enabling fast line speeds, and other proposals to enhance productivity.

- Sinter Plant - Expansion Pallet Car
- Continuous Slab Caster
- Bar and Wire Rod Mill
- Plate Shear
- Zoom-Mill™
- Continuous Annealing Line (CAL)
- Continuous Galvanizing Line (CGL)

SOLUTION 4

Production Cost Reduction

A reduction of plant operating costs is achieved for upstream processes by such means as increasing the use rate of low-grade raw materials, energy conservation and automation. We take a comprehensive look at equipment prices and operating costs to propose better facilities. For downstream processes, we have various facilities on hand that will increase yields and are simple and easy to operate and maintain.

- Coke Dry Quenching (CDQ)
- Sinter Plant - Energy-saving Ignition Furnace
- Sinter Plant - Water-Sealed Circular Cooler
- Lime Kiln
- OG System
- Ecological and Economical Arc Furnace (ECOARC™)
- Next Generation Ecological and Economical Arc Furnace (ECOARC light™)
- Quality Strip Production Process (QSP)
**SOLUTION 5**

**Customization**

While responding to the different conditions and needs of individual customers through our experience and excellent personnel, we ensure good communication with our customers to propose optimum facilities for customer’s site space factors, raw materials and energy situation and product quality requirements.

- Sinter Plant – Expansion Pallet Car
- Converter
- OG System
- Electric Arc Furnace
- Computer System for Steelmaking Facilities
- Continuous Slab Caster
- Plate Shear

**SOLUTION 6**

**Environmental Friendliness**

Our globally top-level environmental and energy-saving technologies have been developed in accordance with Japan’s strict environmental regulations and energy-saving requirements. With these technologies at the core, we consistently respond to our customers, in ways that range from having consultations for achieving energy-efficient steelmaking plants to reducing carbon footprints concurrent with the recovery and reuse of resources and energy, proposing plans to realize environmental improvements, carrying out feasibility studies, procuring funds, and supplying designs for facilities. Our motto is, “For the earth and the future of humankind.”

- Coke Dry Quenching (CDQ)
- Sinter Plant - Water-Sealed Circular Cooler
- Sinter Plant - Cooler Waste Heat Recovery System (WHRS)
- OG System
- Ecological and Economical Arc Furnace (ECOARC™)
- Next Generation Ecological and Economical Arc Furnace (ECOARC light™)
Ironmaking

Steel Plantech’s ironmaking equipment and facilities have the widespread backing of customers in Japan and overseas. The company’s extensive experience and cutting-edge technologies are highly recognized by many around the world.

- Coke Dry Quenching (CDQ)
- Sinter Plant - Energy-saving Ignition Furnace
- Sinter Plant - Expansion Pallet Car
- Sinter Plant - Water-Sealed Circular Cooler
- Sinter Plant - Cooler Waste Heat Recovery System (WHRS)
- Pulverized Coal Injection (PCI) System for Blast Furnaces
- Blast Furnace Gas Cleaning System (RSW - Ring Slit Washer)

Coke Dry Quenching (CDQ)

Coke Dry Quenching (CDQ) is a heat recovery system to quench red hot coke from a coke oven to a temperature appropriate for transportation. It is an energy saving system in which, during quenching process, sensible heat of the red hot coke is recovered and utilized for power generation or as steam.

Technical Information

A Solution for Coke Carrying-over Phenomenon and Increase in Circulation Gas Flow by Introducing “Double Flue”

In order to resolve the issue of coke blowing up and carrying-over phenomenon, Steel Plantech developed the “Double Flue” which has two-decker flue paths.

- By adopting Double Flue, a two-decker flue, the flow speed of the gas, which causes coke carrying over phenomenon, can be increased by 1.4 times or more of that of Single Flue.
- As a result, circulating gas would be increased to 1,400m³/N/t-coke or more even in case of a large-scale CDQ without any trouble.
- On the other hand, if the flow rate is the same as that of single flue, it is possible to decrease abrasion of waste heat boiler, secondary dust collector and gas circulation blower. This results in remarkable extension of the life of whole facility. Furthermore, the Double Flue can reduce the load on dust treatment equipment.
- By application of Double Flue to the CDQ, remarkable efficiency can be achieved like stable operation, reducing maintenance cost and operation cost.

Rope-trolley Type Coke Bucket Hoisting Crane

As our Rope-trolley type coke bucket hoisting crane has its winch on the position near ground level, the weight of crane (Upper part of a CDQ structure) can be reduced by approx. 100 t as compared with conventional overhead crane. Thus, it can realize the following merits:

- Lower construction cost of the CDQ structure;
- Less space needed — space was conventionally allocated on the crane garter for maintenance of the crane winch;
- Easy and safe maintenance of the crane winch on near the ground level, not at a high place as conventional overhead cranes; and
- Conventional overhead crane winch and electric equipment are used on CDQ top, in a corrosive atmosphere, before. As our Rope-trolley type installs the crane winch on near the ground level, operation and maintenance environment is much improved, and this leads to life extension of the crane winch.
Steel Plantech has developed “New coke handling system (*1)” and “Rotary bucket new traverser system (*1)”. Such technologies enable the layout flexibility of CDQ. Our large CDQ can be introduced even in a narrow space where it is difficult to install the conventional CDQ system. Our design meets customer’s requirement. (*1:Patented)

Steel Plantech has technologies and experience to offer and resolve the following problems which customers may face:

- Have given up CDQ installation because of the narrow space around coke oven batteries;
- Want to increase the CDQ operation ratio;
- Want to secure stable CDQ operation;
- Want to extend the life of refractories;
- Want to resolve the trouble of Collision wall drop off in the Dust catcher; and
- Want to extend the life of equipment such as waste heat boilers and gas circulation system.

### Environmental Friendliness

- CDQ is one of the excellent countermeasure to global warming. Recovered heat by CDQ is used to generate steam or electric power, which leads to a reduction of fossil fuel usage at power plant. Thus, you can reduce CO2 emissions in total.
- In CDQ, red hot coke is quenched in a closed cooling gas circulation, CDQ remarkably reduces the dust to be released into the atmosphere as compared with the CWQ.

### Product Quality Enhancement

CDQ is a gradual coke quenching system and can improve the coke strength, as the raw material for blast furnace. And coke size distribution can be improved in the process of descending coke packed bed. These characteristics are useful for stable operation of a blast furnace, in order to secure good gas and solid reaction by keeping permeability in a blast furnace.

### Production Cost Reduction

**Feature of CDQ process are follows.**

- **CDQ (Coke Dry Quenching)** is a gradual coke quenching system, and improves coke strength and coke size distribution. Consequently, while the blending ratio of inexpensive non- or slightly-caking coal for coke oven material is only approx. 15% in case of CWQ (Coke Wet Quenching) system, it can be increased up to approx. 30% by CDQ, resulting in a cost reduction with raw materials for coke oven.
- The CDQ coke has lower moisture content (0.1 to 0.3%) than CWQ coke (2 to 5 %), and the Coke ratio of Blast furnace can be reduced.
- Combustible component and coke dust in circulating gas are burned by blowing air into the gas, and so the temperature of the circulating gas can be raised. Thus, steam generated by the waste heat boiler can be increased.
- A high annual operating ratio of 95% can be achieved by combining the Double Flue technology, appropriate refractories and highly reliable equipments.
- Steam generation of 500-700 kg/t-coke and power generation of 140-185 kWh/t-coke can be obtained, according to CDQ operation and steam conditions.
- Such excellent features realize the payback period of initial investment within three to five years.
Sinter Plant – Energy-saving Ignition Furnace

This flame from the burner nozzle hits the raw material sent to pallet cars by the feeder and ignites the fuel (coke) within the raw material.

Solutions

Production Cost Reduction

Making the furnace compact enables the shortening of installation time and reduction of facility costs. Furthermore, it makes it possible to significantly decrease the ignition furnace’s fuel consumption rate. Although the addition of a furnace pressure regulator would increase initial costs, it will further decrease the fuel consumption rate.

Technical Information

High-efficiency Burners

Equipped with high efficiency burners developed for sinter machine ignition furnaces, the straight-directionality of the nozzles allow the flames to reach the raw material surface at a fast speed, thereby increasing thermal conductivity and igniting the raw material quickly and reliably.

A lifting device is installed within the furnace in order to ensure that the burner flames hit the raw material surface accurately.

The spacing of the burners has been reduced in order to enable even ignition of the raw material surface.

The furnace temperature and the amounts of the coke oven gas and combustible air is monitored and automatically controlled by the control panel.

The ignition furnace is compact. The volume has been made smaller, and the length of the furnace has been reduced by making the burner flame shorter, reducing the furnace ceiling height and shortening ignition time through high-temperature ignition.

The ignition furnace fuel consumption rate has been significantly reduced as a result of the above.

Furnace Pressure Regulator

An ignition furnace fuel consumption rate of 10Mcal/t-sinter or less (on a COG basis) can be achieved with greater certainty through the installation of a furnace pressure regulator to maintain an appropriate furnace temperature.
Sinter Plant – Expansion Pallet Car

Pallet cars are one of the important components of a sinter machine. Sinters are made by igniting the surface of the raw material fed into the pallet car while suction from the underside forces air downward. Sinter grate bars are used to make this possible. Because technology to expand the width of the pallet cars has been adopted, only minimal retrofitting is required to increase the production volume of the sintered ore.

Solutions

Production Volume Increase

Grate bars that take permeability into consideration are used at the extension points. This ensures complete sintering without the return fines that occur in the extension points of competitor products. Adopting the Steel Plantech’s expansion pallet car will allow you to maximize the production volume of sintered ore.

Customization

It can be applied regardless of the type of the existing sinter machine and or the current pallet width. Existing equipment can be fully utilized to increase the production volume of sintered ore with little retrofitting.

Customer comments

a Japanese blast furnace steel manufacturer

We appreciated the fact that no major retrofitting or huge investment was required to adopt the pallet car extensions. What is more, we realized that the increase in the production volume of the sintered ore was even greater than we anticipated before adoption.

Technical Information

Grate bar

This is technology that enables an increase in sinter ore production volume with only minimal retrofitting of existing sinter machines. Adoption of a structure that allows the placement of grate bars at the extension area ensures that there will be no return fines, which occur in the area of competitor’s products, allowing for a maximum effect in production volume increases.

Customization

There are two types of existing pallet cars: those that are in a single unit, and those that can be separated into three pieces. If the existing pallet car is the latter kind, only the both side-ends need to be replaced to extend the pallet width. Because the middle piece can be reused, it makes it possible to increase production volume at a low cost.
Sinter Plant – Water-Sealed Circular Cooler

A sinter plant takes fine ore and other materials, and fuses them together to produce sintered ore for use in blast furnaces. Roughly speaking, a sinter plant can be divided into four parts: raw material mixing system, sinter machine, sinter cooler and sinter screening system. This is a water-sealed cooler, which improves upon conventional rubber air seal type coolers.

Solutions

Production Cost Reduction

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% or less</td>
<td>Air leakage rate</td>
</tr>
<tr>
<td>30% reduction</td>
<td>in cooling fan power</td>
</tr>
</tbody>
</table>

The adoption of a water seal has enabled a significant decrease in air leakage. This has reduced the amount of air required for cooling to two-thirds of a conventional system, thereby making it possible to keep running costs low.

Environmental Friendliness

The air chamber is built into the trough, significantly reducing dust generation, and making it possible to maintain a clean environment.

Technical Information

Characteristics of the new-type water-seal cooling

- Energy Saving
- Labor Saving Efficiency
- Environmentally Beneficial

Water-seal cooling type performance comparison

<table>
<thead>
<tr>
<th>Conventional Cooler</th>
<th>Seal Point</th>
<th>Water Seal Cooler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any type of labyrinth seal or double slide seal is applicable.</td>
<td>1. Hood/Trough Seal</td>
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</tr>
<tr>
<td>Sealing are exposed to severe condition at discharge and when wheel descends.</td>
<td>2. Wheel Cover Seal</td>
<td>No sealing required.</td>
</tr>
<tr>
<td>Sealing are exposed to severe condition between movable trough and stationary air chamber, and it causes interior seal efficiency/shaft life.</td>
<td>3. Trough/Chamber Seal</td>
<td>Sealing provide reliable performance due to fixed type and renewed service life.</td>
</tr>
<tr>
<td>No sealing required.</td>
<td>4. Duct Seal</td>
<td>Water seal mechanism show certain performance and Reduce air leakage remarkably.</td>
</tr>
</tbody>
</table>
Sinter Plant - Cooler Waste Heat Recovery System (WHRS)

This is a system for recovering the sinter cooler’s high-temperature waste gas as steam, which can be used for power generation. Furthermore, reuse of the waste heat as the thermal source of sintered ore production will improve the productivity of sinter machines.

Environmental Friendliness

- **Waste gas recirculating waste heat recovery flow**

Advantages of a recirculating system:
During recovery of waste heat from cooler waste gas, a recirculating system returns waste gas that has decreased in temperature in heat exchange to the cooler, then uses it again as coolant gas for the sinter. This makes a recirculating-type system more efficient than a non-recirculating-type system.

- **Power generated per sinter 1t**: 26kW
- **Steam flow per sinter 1t**: 132 kg-steam

Environmental Friendliness Production Cost Reduction

Production Cost Reduction
In addition to a dust collection function, RSW (Ring Slit Washer) has a function to control the top pressure of a blast furnace with a built-in RSE (Ring Slit Element). Therefore, this system does not require septum valves, and can realize facility cost reduction. Furthermore, combined with a TRT (top pressure recovery turbine), this system can generate high efficiency power by blast furnace top gas pressure.

Customization
The RSE is raised by a hydraulic cylinder, and a hydraulic oil room is installed near the RSW. If a customer requires only the dust collection function, hydraulic oil room becomes unnecessary by adopting an electro-hydraulic hybrid system, and it can be reduced a construction cost.

The electro-hydraulic hybrid system is a system where a hydraulic cylinder is directly operated by adjusting the forward and reverse flow of an inverter motor type hydraulic pump, and whole hydraulic power unit is stored in the lower part of a RSW main unit.

Technical Information

The features of RSW
The RSW jointly contains an auxiliary spray tower-type scrubber in its upper part and a variable throat-type venturi scrubber called RSE in its lower part. An axis flow mist separator is installed in the downstream to separate air and liquid. In this way, this system realizes the dust content at the outlet of the system of 5 mg/Nm3 or lower.

- **Features**
  - Compact, space-saving system
  - Achieved excellent dust collection performance with its low load differential pressure and liquid-gas ratio.
  - The load differential pressure is 30 kPa, and the dust content at the outlet of the RSW is 5 mg/Nm3 or lower.
  - Realized excellent blast furnace top pressure control performance.
  - Adopted Steel Plantech’s unique large diameter hollow cone spray nozzle.

Solutions

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Pulverized Coal Injection (PCI) System for Blast Furnaces

In the past, reactions within the blast furnace were stimulated by injecting heavy oil, as auxiliary fuel, along with the blasts and oxygen. The heavy oil was replaced by pulverized coal after the oil crisis. This made it possible to use cheap coal, such as non-coking coal. Furthermore, the amount of coke used can be reduced if huge amounts of pulverized coal are injected. Therefore, in recent years, Pulverized Coal Injection (PCI) systems are used in order to lower production costs as well as extend the life cycle of coke ovens.

Steel Plantech’s intermediate transfer station can handle long-distances of up to 1.5km between pulverization and drying facilities to injection facility. This allows the pulverization and drying facilities to be set up at a distance from the blast furnace, so this Pulverized Coal Injection (PCI) system can be installed even if there is only limited space around the blast furnace.
The features of facility

The features of the Pulverized Coal Injection (PCI) System are as follows:

- A Simple system conveying pulverized coal from injection vessels to the distributor through a single pipe and distributing it to the tuyeres at the distributor;
- Dense phase conveying system (Solid-gas ratio 30 kg/kg or more) which reduces conveying gas consumption by 50% compared with a dilute phase conveying system;
- Conveying at low gas velocities (5 m/s or lower) which requires no measures to be taken against the wear of expensive pipes;
- Adopted an automatic purging system which provides for the immediate detection of clogging in injection pipes; and
- Switching type injection vessels (side-by-side-vessel design) which realize low structure and facility cost reduction.

Waste Plastic Injection System (WPIS)

As a related technology, Steel Plantech delivered the systems to inject waste plastic, as a reduction agent for blast furnaces, from tuyeres. The features of the facility are as follows:

- Capacity 30,000 t/year;
- Stable and constant mechanical feeder (table feeder), which enables:
  - An easy adjustment of the injection amount and
  - High accuracy of the injection amount;
- Adopted a branched system where a single injection pipe can be divided to distribute to two tuyeres, improving the heat balance of a furnace;
- Adopted an automatic purging system which immediately detects clogging in injection pipes;
- Adopted a large-capacity storage hopper (300 m³) and mechanical discharge system which enables constant discharge; and
- Switching type injection vessels (side-by-side-vessel design) which realize low structure and facility cost reduction.
BOF

Steel Plantech offers converter furnaces and other BOF steelmaking facilities and systems on the basis of its advanced technological competence and rich experience as a leading company in the field of steelmaking engineering and facilities supply. In particular, Steel Plantech's OG System has a high reputation for its high level of safety and energy-saving performance, while reducing the load on the environment.

Converter

A steel manufacturing plant centered on converter systems is Steel Plantech's core product, and more than 130 units have been delivered to date since 1960. In addition to providing equipment that constitutes a steel manufacturing plant, including KR hot metal desulfurization systems, converter systems, exhaust treatment systems (OG) and secondary refining systems (RH/LF), Steel Plantech can coordinate the whole plant. Our OG system is rated highly for its high level of safety, low environmental burden, and energy saving effects.


### Solutions

#### Production Cost Reduction

By making use of the know-how we gained through our rich experience constructing steel manufacturing plants, we will provide optimal layouts. Along with our optimized handling methods for materials and molten steel ladles, we have introduced state-of-the-art technologies into the steel making processes. Thus, we can improve your productivity and reduce your basic operation costs. The technologies backed with our rich experiences will work extremely well, not only in green fields, but also in brown fields accompanied by the remodeling or renewal of an existing plant.

#### Production Volume Increase

We have experience delivering converter systems with many different capacities, ranging from 60 to 330 t. A two-point support method is adopted for the furnace body, and necessary parts are cooled down. Moreover, the furnace bottom is replaceable, which can shorten the period required for furnace repair. Combined with auxiliary equipment, such as converter tilting devices, lance and sub lance facilities, secondary dust collecting facilities, alloy conveyance and charging facilities, ladle transfer cars, ladle maintenance stations, and converter brick laying devices, we will realize the most powerful steel making plant.

#### Customization

Experienced instructors, who have a good knowledge of production and maintenance in many places of the world, will strictly meet delivery times and secure product quality. Through effective installation work instructions and control of trial operations which are appropriate to each construction site, you can achieve a certain amount of production soon after the start of operation.

### Technical Information

#### Converter Furnace Two-point Support Method

- Simple structure where the furnace body is supported by two points at the upper part of trunnion, one is on the actuated side and the other is on the unactuated side.
- The entire axial load is supported by two points on the trunnion ring and the unbalanced moment of the furnace body is supported by the lower bracket. With the adoption of this method, the trunnion shaft is unaffected by time-related deformations of the furnace body. Consequently, we have realized a maintenance-free system.
- This method has been used in all of our converters since it was developed and adopted for use in an actual furnace in 1969. It has been a source of customer satisfaction for a great number of years.
OG System

The OG system (Oxygen Converter Gas Recovery System) is a suppressed type LD gas recovery system for the converters of steel making shops. The OG system was jointly developed and improved by both Nippon Steel Corporation (NSC/ now NSSC) and Kawasaki Heavy Industries Ltd. (KHI), in Japan. In 2004, steel plant division of KHI was transferred to JP Steel Plantech, Co (SPCO). Therefore, SPCO and NSC have developed the technologies and own the patents of the OG system. Until now, totally 192 OG systems have been installed in all over the world, thus the name of “OG” is widely admitted not only as the safest process for recovering LD gas with high efficiency but also as a synonym of the best solution for energy saving and environmental control.

Functions of the OG System

The exhaust gas discharged from the converter furnace is the gas of high temperature (1,450°C) containing high concentration of CO (95%). The OG unit is an oxygen converter gas treatment system which is designed for the purpose of cooling this exhaust gas by burning it as little as possible, removing the dust contained in the exhaust gas at high concentration and recovering the gas as CO gas which can be used as fuel.

- The combustion of the CO gas generated by the converter furnace is lowered to 10% or less by the hood pressure control system.
- The high temperature (1,450°C) CO gas is cooled down to approximately 600°C to 1,000°C by the cooling system.
- If the cooling system is changed to the boiler type, the sensible heat of the high temperature gas can be recovered as steam.
- The steam recovery amount can be further increased by introducing the convection heat transfer area to boiler.
- The gas cooled by the cooling system is further cooled to approximately 70°C by the wet dust collector and 99.9% of the high concentration dust in the gas is removed.
- The high concentration (70 to 80%) CO gas which was cooled and treated for the dust removal is stored in the gas holder and used as fuel, etc. The gas recovery rate is 70% to 90%.

OG Boiler System

86 units (All steelmakers adopt OG in Japan)
The Hood pressure control system of OG can ensure to suppress combustion rate of LD gas down to 5 -10%, by automatic control of the Ring Slit Washer (RSW) being also functioned as key part(s) of the Dust collecting system of OG. This system leads to minimize LD-gas flow rate throughout converter’s operations, that surely makes it possible to get much more compact facilities compared with the system of full-combustion type. Therefore, the key components such as IDFan, pumps can also be minimized so that cost-saving can be certainly achieved more in terms not only of their initial investment but also of their electrical power consumption.

The compact facility of OG system featuring suppressed combustion type ensures you to provide more flexible design, compared with others of full-combustion type. The compact facility and its high-flexibility of design of OG surely can correspond to any site-condition fully well enough for your needs especially for revamping projects.

1. The venturi scrubber-type Ring Slit Washer (RSW), being as the key part(s) of the 2nd stage dust collecting system of OG, allows superior dust collection efficiency to be maintained even when amount of LD-gas fluctuates during blowing.
2. All the inside surfaces of Gas duct of OG keeps fully-wet as always so that there is no ignition source at all, that surely ensure you to keep positive safety throughout converter’s operations.
3. Not only LD-gas recovery with high density of CO, steam generation by boiler system can be simultaneously achieved by OG. Also our unique technologies of installing convection heat transfer part(s) additionally can give you more amount of steam.

### Production Cost Reduction

<table>
<thead>
<tr>
<th>Basic unit of recovered gas</th>
<th>Basic unit of recovered steam</th>
<th>Dust-collection performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>70~100 MW/1t-steel (at 2000kcal/MN)</td>
<td>70~100 kg/t-steel</td>
<td>30~50 mg/Nm (at flare stack outlet)</td>
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### Solutions

#### Customization

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### Environmental Friendliness

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**KR Hot Metal Desulfurization System**

Demand for high purity steel is becoming stronger as quality demands for steel become higher. This is especially true for sulfur content, and there is now a need to make strict adjustments to the amount contained in the manufactured steel. This process of removing impurities from molten metal in advance before charging it into a converter furnace is called hot metal preliminary processing. The KR Hot Metal Desulfurization System developed by Steel Plantech will achieve high-level desulfurization efficiency as well as contribute to a reduction of operating costs.

**Solutions**

**Product Quality Enhancement**

Utilization of the KR Hot Metal Desulfurization System will achieve high-level desulfurization efficiency, curb operating costs and reduce processing time as well as allow high-capacity processing. Furthermore, it will also prove effective in reducing the amount of dust generated.

**Product Quality Enhancement**

The KR Hot Metal Desulfurization System achieves roughly 20% higher desulfurization efficiency as compared to powder injection desulfurization.

**Technical Information**

**Pattern of Operation and Processing Time**

- Processing time is less than 12 minutes, and the total cycle time is within the tap-to-tap times of converter furnaces.
- The free board of the hot metal ladle is between 0.7m and 1m. It is possible to keep the free board lower than the injection method (for desulfurization at the same level).

**RH Degasser**

Molten steel, taken out of the converter furnace, is ultimately refined and degassed during the secondary refining process. The RH Vacuum Degasser is ideal for the swift degassing of large amounts of molten steel. The RH Vacuum Degasser is also suitable for the mass production of high purity steel at integrated steelworks, realizing decarburization and heating by injecting pure oxygen gas into the vacuum vessel. Furthermore, it has extended refining functions, such as the acceleration of desulfurization and deoxidation through addition of flux while controlling the form of the impurities.

**Solutions**

**Product Range Expansion and Product Quality Enhancement**

We propose the optimal layout to achieve high production efficiency. This makes it possible to achieve a high degree of vacuum as well as to smelt ultra-low carbon steel. Furthermore, it makes it possible to achieve a high degree of vacuum as well as smelt ultra-low carbon steel.

**Technical Information**

**Ladle Hoisting Device**

- Hoisting achieved through four synchronized hydraulic cylinders.
- The next ladle can be placed on standby during processing, thereby contributing to improvement of production efficiency.
- Construction costs lower than hydraulic elevation devices with a single cylinder.
EAF

Electric furnaces are one of Steel Plantech’s core products that were succeeded from JFE Engineering (formerly NKK). The company’s wealth of experience as a user of such facilities allows us to offer not only electric furnaces and ancillary facilities but also a broad range of metallurgical and operational technologies.

- Ecological and Economical Arc Furnace (ECOARC™)
- Next Generation Ecological and Economical Arc Furnace (ECOARC light™)
- Electric Arc Furnace
- Computer System for Steelmaking Facilities
Ecological and Economical Arc Furnace (ECOARC™)

ECOARC™, the ecological and economical arc furnace developed independently by Steel Plantech, is filled with innovative technology. It comes with advanced scrap preheating technology that eliminates the white smoke and foul odors generated when melting scrap metal, and addresses environmental requirements of the future. Furthermore, it is equipped with melting technology that achieves higher productivity than conventional electric arc furnaces.

Installation of the ECOARC™ can be realized an early recovery of the investment costs, and an increase in revenues. Although, the installation of the preheating system would increase initial costs in the short term, however, it will provide high investment returns, and customers will be able to enjoy high investment returns by dramatic decrease of production costs, and increase in high revenue. You would feel the benefits of this investment immediately after installation through the phenomenal performance exhibited by the ECOARC™.

Customer comments

Plant Manager of the steelmaker in Thailand
“We are producing reinforcing steel bars to be used in a high-rise building. ECOARC™ is a strong weapon to become one of the most competitive producers in Thailand from the viewpoint of production cost. We hope to increase of greater domestic shares in a future.”
Environmental Friendliness

Installation of the ECOARC™ will dramatically reduce the environmental impact.

- Reduction of greenhouse gasses
- Dioxin emission of not more than 0.1ng-TEQ/m³
- 40% reduction of dust emissions
- 15dB reduction of noise under operation
- 40% reduction of flicker levels
- Elimination of white smoke and foul odor generated during scrap preheating

Customization

Existing facilities can be reused when install the ECOARC™ system, it will contribute significantly to the initial investment cost reduction.

- Can reuse the existing building
- Can reuse the existing power supply facilities
- Can reuse the existing foundation
- Can reuse the existing water treatment facilities
- Can reuse the other existing auxiliary equipment

High-efficiency Melting Technology

Preheating scraps with high-temperature exhaust gas is possible because the preheating shaft and melting chamber are directly and rigidly connected, so the scraps are continually present, from the steel to preheating areas. This enables high-temperature preheating of the scraps, resulting in a significant reduction of power consumption. The melting chamber is sealed off from outside air, to prevent the excess air inlet. It prevents over oxidation of scrap under high temperature preheating. As the ECOARC™ keeps always flat bath operation, electrode consumption is significantly improved. Furthermore, the electric facilities necessary to meet power quality regulation can be drastically reduced on it may not even unnecessary depending on required regulation.

GREEN STEEL TECHNOLOGY

The decomposition and decomposition of dioxins are reduced through an exhaust gas combustion chamber and rapid quench chamber in the exhaust gas duct system, which realizes dioxin emissions of not more than 0.1ng-TEQ/m³. Not only dioxins but also a volatile material that causes foul odors and white smoke will be decomposed and the dispersal of them are also prevented. The furnace prevents diluting of exhaust gasses. Therefore, the CO within the exhaust gas can be used as fuel, reducing the amount of fuel gas consumed. Flat bath operation dramatically reduces noise during operation. The reduction of power consumption also contributes to the reduction of emission of greenhouse gasses during power generation.
Next Generation Ecological and Economical Arc Furnace (ECOARC light™)

ECOARC light™, “the next generation ecological and economical arc furnace” has been developed to dramatically improve your existing conventional type EAF, through converting the existing furnace. ECOARC light™ succeeds ECOARC™ keeping all of its merits. ECOARC light™ saves initial cost and shortens the construction period, compared with ECOARC™ by simplifying the scrap charging system and reusing your existing facilities.

Bird’s-eye view of ECOARC light™

Solutions
Production Cost Reduction

70~80 kWh/t
Reduction of power consumption

1% Improvement of metal yield

1.0~1.2 kg/t A unit consumption of electrode of about

Features Comparison ECOARC™ with ECOARC light™

<table>
<thead>
<tr>
<th>Item</th>
<th>ECOARC™</th>
<th>ECOARC light™</th>
</tr>
</thead>
<tbody>
<tr>
<td>scrap charging method</td>
<td>auto charging by skipcar</td>
<td>bucket + existing charging crane</td>
</tr>
<tr>
<td>charging count</td>
<td>10-12times/heat</td>
<td>5-6times/heat</td>
</tr>
<tr>
<td>structure of furnace body and shaft</td>
<td>integral</td>
<td>separated</td>
</tr>
<tr>
<td>structure of tilting platform</td>
<td>rigid</td>
<td>flexible</td>
</tr>
<tr>
<td>tilting method</td>
<td>locker roller or locker rail</td>
<td>locker rail</td>
</tr>
<tr>
<td>volume of shaft</td>
<td>30% of charging volume</td>
<td>same</td>
</tr>
<tr>
<td>dioxin, odor counter-measures</td>
<td>burning + slow cooling (by water-cooled duct) or rapid cooling (water spray)</td>
<td>same</td>
</tr>
<tr>
<td>standard construction period</td>
<td>2.5~3months</td>
<td>1.0~1.5months (excluding preparatory work)</td>
</tr>
</tbody>
</table>
Electric Arc Furnace

Steel Plantech’s electric furnaces for steelmaking are core products succeeded from JFE Engineering (formerly NKK). Its abundant experience as a steelmaker (or in other words, a user) in addition to technical know-how gleaned from experience in the design and engineering of electric furnaces for steelmaking, accumulated since 1968, enabled the provision not only of electric arc furnaces and auxiliary equipment, but also a wide range of metallurgical and operational technology.

Steel Plantech is a pioneer in high-efficiency, high-impedance long-arc electric furnaces. A well-balanced body design, improved water-cooled panels and advancements in slag-foaming technology have realized high-power, high-impedance electric arc furnaces operation. The latest electric arc furnace for ANSDK of Egypt meets a difficult demand: to melt the main raw material—DRI—at a high speed while achieving lower power consumption. With a maximum of 110MVA/t, it is one of the largest electric arc furnaces in the world, which goes far beyond UHP arc furnaces.

Three-phase Collective Control System Out-pile Refining Furnace (SMF)

Conventional secondary refining furnaces (ladle furnaces) are based on AC electric arc furnace technology. They have three independent masts with electrode arms and the lifting was individually controlled. Steel Plantech takes advantage of flat bath operation, a characteristic of secondary refining furnaces, and developed a secondary refining furnace that controls three electrodes simultaneously, naming it the Single-Mast Furnace (SMF). SMFs have a simple mechanical configuration and enable high-power-factor short-arc operation.

- Reduce ladle refractory wear by minimized PCD
- Low impedance, high power factor and high power
- Easy maintenance
- Easy operation by the simple single electrode lifting system
- Reduce electromagnetic induction loss by ideal conductor placement

Steel Plantech can design and provide a wide range of facilities, from standard type electric furnaces and auxiliary equipment that cater to customers’ needs. We also provide fine-tuned services—from the diagnosis of existing equipment and operations to remodeling, updating and after-sales service—according to the facility’s stage in its lifecycle.

AC Electric Arc Furnace (AC-EAF)

Steel Plantech's electric furnaces for steelmaking are core products succeeded from JFE Engineering (formerly NKK). Its abundant experience as a steelmaker (or in other words, a user) in addition to technical know-how gleaned from experience in the design and engineering of electric furnaces for steelmaking, accumulated since 1968, enabled the provision not only of electric arc furnaces and auxiliary equipment, but also a wide range of metallurgical and operational technology.

DC Electric Arc Furnace (DC-EAF)

With a single long arc at its center, a DC electric arc furnace can be considered an ultimate long-arc AC electric arc furnace with no electrode PCD. The turn coil system at the bottom of Steel Plantech’s DC electric arc furnace provides perfect arc deflection control as well as powerful molten steel stirring. Furthermore, they are equipped with a long-life, maintenance-free bottom electrode (2,000-4,000 charges). Steel Plantech delivered the largest DC electric arc furnace in the world.

High Melting-speed Dual Electrode DC Electric Arc Furnace

Electric arc furnaces, which use direct-reduced iron, etc., as the main raw ingredient, need to be able to melt the raw materials, which are continuously supplied during flat bath operation, at high speeds. The dual electrode DC electric arc furnace uses the turn coil at the bottom of the furnace to intentionally deflect the arc from two electrodes towards the center. This creates an optimal “hot spot” at the center of the furnace, resulting in a high melting speed.
Computer System for Steelmaking Facilities

Automatic operation system is necessary for Melt Shop in order to achieve more efficient and stable operation. For the solution to such needs, Steel Plantech offers the AUTO-ARC (for Electric Arc Furnace) and AUTO-LF (for Ladle Furnace) as high quality and low price computer system.

Both the AUTO-ARC and AUTO-LF provide not only automatic power input control but also a wide variety of functions for the improvement and standardization of your operations, including management functions such as monitoring and control of the facility, data collection, operation report, daily report, monthly logs, and statistical analysis of the collected performance data.

Solutions

Production Volume Increase (Enhancement of Productivity)

Suitable power patterns by scrap, power, fuel additive and time slot can be pursued through the operational data analysis function, which is based on the pattern power control function and additional scrap charge/melt down determination control.

Flicker control and power demand control can also be provided.

Production Cost Reduction

The reduction of power and refractory consumption can be achieved through hot spot control, slag foaming guidance, heat loss analysis and other functions distinctive to the AUTO-ARC.

Customization

Records of each heat event, power/auxiliary fuel/auxiliary materials, analytical values, etc., are collected, and data for more than 10,000 charges are kept. A diverse range of functions for the improvement of operations are provided, including reporting functions for operational logs, daily logs, and monthly logs as well as statistical analysis functions to support the evaluation of operations from past performance data.
Continuous Casting

Steel Plantech’s continuous casting facilities are the result of bringing together 50 years of metallurgical knowledge and technological know-how and experience in machinery and control. We will continue developing cutting-edge technologies in order to meet our customer's high-level requirements.

- Continuous Slab Caster
- Continuous Bloom, Beam Blank and Billet Casters
- Quality Strip Production Process (QSP)
Continuous Slab Caster

This is a facility for casting molten steel into semi-finished products (slabs) by continuously cooling, solidifying molten steel – which was melted and ingredients adjusted in a blast furnace, electric arc furnace, direct reduction furnace, etc. - and cutting them into given lengths. The casted semi-finished products are then transported to the next process at the rolling facility. The casted semi-finished products can be in various sizes. Those with a thickness of between 120mm-600mm and a width of 700mm or more are called slabs. Final products from slabs include thin plates, thick plates and pipes.

Steel Plantech's continuous slab caster enhances product quality dramatically through various functions.

1. Originally developed mold level control system, which suppresses molten steel level fluctuation
2. Electro-hydraulic oscillator, which makes non-sinusous vibration that reduces friction within the mold possible
3. Dynamic secondary cooling system, which realized the optimum thermal profile
4. Dynamic soft reduction system, which suppresses center segregation, and
5. Decrease of internal and surface strain of slab through an optimum design of roll profiles.
Production Cost Reduction / Production Volume Increase

Cost reductions can be realized through adoption of a Steel Plantech continuous slab caster.

1. High-speed, stable casting at speeds of over 3.0m/minute allows production of 200,000 tons or more per month per strand, significantly reducing the number of strands.
2. A break-out prediction device (learning type) prevents breakouts.
3. The dynamic secondary cooling system and stepless spray-width control system minimizes unsteady portions.
4. An improvement in operating rate by high durability and advanced maintainability of each equipment.

Customization

Responding to customer’s requirements, we contribute to a superior positioning of customers’ products, e.g.; Steel Plantech can supply various type of high-quality casters to all customers. (Vertical, V-Bending, Circular, C-Multi unbending, etc.)

1. Revamping work to vertical bending caster in shorter shut down period based on a detailed and careful plan.
2. Optimum and minimum period renovation planning and on schedule start-up of the machine according to plant facilities’ conditions.
3. Wide rage of slab production for high quality heavy plates.
4. Dual-use twin/triple-caster machines that make it possible to cast slabs/blooms/billets in various sizes.

3.0 m/min
high-speed casting

Technical Information

Dynamic Secondary Spray Cooling System (SP-DSSC) and Stepless Spray Width Control System

Through a dynamic control model original to Steel Plantech, this system automatically controls the amount of spray in the secondary cooling zone after the mold, according to the optimum thermal pattern for the steel grade and the operating conditions, such as casting speed.

The secondary cooling spray nozzle, which is installed in each segment, has a hydraulic width adjuster. In addition to conventional fixed spray nozzle cutoff valve type cooling system, we also offer a mobile spray nozzle type for which continuous adjustments to the spray width can be carried out according to size or steel grade.

SP-Dynamic Soft Reduction System (SP-DSR): Continuous Slab Caster

Soft reduction is one of methods to prevent the center segregation of continuous cast slabs during solidification by secondary cooling.

Steel Plantech proposes its SP-Dynamic Soft Reduction System (SP-DSR), which can always achieve the optimum soft reduction.

The final solidification position and internal temperature required for soft reduction are continually calculated online by the SP-Dynamic Secondary Spray Cooling System during casting according to changes in operation conditions, such as molten steel temperature, components, casting speed and amount of cooling water. The SP-DSR system uses the information to calculate the segment roll gap for the best reduction pattern and sends out movement directives based on the calculations.

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Continuous Bloom, Beam Blank and Billet Casters

Bloom, beam blank and billet casters continuously cast molten steel into semi-products (bloom, beam blank, billet) of various sizes and shapes from various kinds of steel grades with cross-section smaller than slab semi-products. In order to meet customers’ needs, Steel Plantech’s casters highly excel in production efficiency and energy saving and realize various kinds and small quantity production of high quality casting semi-products.

Solutions

Production Cost Reduction / Production Volume Increase

Adoption of Steel Plantech’s continuous casting facilities makes it possible to reduce production costs.

1. Energy-saving through sequentialized processes enabled by direct coupling to rolling machines.
2. Power-saving through automated and serialized operational procedures, and equipment monitoring system.
3. Realization of productivity enhancement through improved capacity utilization and high-speed casting.
4. Ensured maintainability through easy access to major equipment and use of maintenance equipment and failure diagnosis system.
5. Stable casting and reduction of unstable parts through mold-level control and optimum secondary cooling capabilities.
6. Reduction of energy and costs required for rolling through near net shape casting (castings close in shape to the final product).

Product Range Expansion

Steel Plantech has abundant experience in the development of multifunctional machines for a wide variety of sizes and steel grades.

1. Billet (vertical, horizontal and circular machines for square, round, octagon and other shapes)
2. Bloom size (not only small to large sizes but round also possible)
3. Beam blank (maximum size of manufacture: 450x1,048x110mm)
4. Dual-use slab/billet and bloom casters
5. Blast furnace ordinary steel, electric arc furnace ordinary steel, special steel, stainless steel
6. Learning-type break-out (BO) prediction device that prevents breakouts
7. Dynamic secondary cooling system and dynamic soft reduction system

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Technical Information

Electric Servo Oscillation System (Hydraulic system is not required)

Although the oscillating speed on conventional mold oscillation systems driven by electric motor, only a single wave form (sinusoidal) of the same stroke could be achieved. The electric servo oscillation system makes it possible to control the wave form, stroke and oscillation frequency, so that molds can be freely vibrated. It is a technology that enables stable, high-speed casting by reducing friction within the mold by promoting the flow of powders and other lubricants through non-sinusoidal wave vibration.

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Quality Strip Production Process (QSP)

The QSP is a mini mill process for the continuous production of high-quality coils from thin or medium-thickness slab. In the process, reheating furnace and quantity of rolling mill-stands can be significantly reduced for producing thin strips from molten steel. Steel Plantech’s QSP is capable of producing the highest-quality thin slab with superior casting speed compared to the other process of thin slab casters.

Production Cost Reduction

- The continuous caster enables a maximum casting speed of $V_c=6\text{m/min}$ (achieved a casting speed of $8\text{m/min}$ at our test facilities), and although compact, it achieves a level of productivity that is equal to regular continuous slab casters.
- The reduction in quantity of rolling mill-stands required and the smaller energy consumption made possible by coupling directly to rolling mills enables a significant reduction of facilities/production costs.
- The break-out prediction device (learning type) prevents breakouts.

Product Quality Enhancement

- Steel Plantech’s quality strip production process (QSP) adopts parallel molds and utilizes liquid core reduction technology, to enable manufacturing of the world’s highest quality thin slabs.
- Slab sizes of between 60mm and 100mm in thickness and between 900mm and 1,650mm in width
- The liquid core reduction function makes it possible to change thicknesses during casting.
- Can be adapted for cold rolling mills, which require deep drawability.
- A dynamic secondary cooling system
- Superior casting surface quality by a parallel mold.
Steel Plantech has a track record of supplying high-quality, high-precision rolling mills of any range. We will continue to provide, in all of the rolling mills required by our customers, state-of-the-art technology of the highest levels at competitive prices.

Long Products Rolling

Section Rolling Mill

Rolling mills are facilities that carry out a series of processes including rolling the billets, blooms, slab and beam blanks – extracted from the reheating furnace – into the prescribed size and correcting any bending, cutting them into given lengths, then piling or bundling as needed for shipment. The rolling mills offered by Steel Plantech, with its rich track record of supplying steelmakers in Japan, can meet demanding requirements in terms of production efficiency and product precision.

- Section Rolling Mill
- Bar and Wire Rod Mill
- Shifting Reverse Mill
- Roller Straightener
Solutions

Customization

Steel Plantech has accumulated a rich track record in all types of rolling mills. Using this as a basis, we can design and propose flexible rolling mill lines that are suitable for various plant layouts. Furthermore, by carrying out equipment diagnosis of your existing rolling mill, we can examine the possibilities regarding the expansion of your production sizes and steel grades. Revamping as necessary can also boost the capabilities of your rolling mills.

Product Quality Enhancement & Production Volume Increase

The precision of the measurements of the shaped steel being manufactured can be enhanced through the combination of a high-rigidity mill, various roll chock locking devices, roll position adjustment functions and optional functions.

- Universal rolling mill with hydraulic roll gap control
- Universal rolling mill with mill pass line adjuster
- Universal rolling mill with vertical roll offset device
- Vertical roll drive universal rolling mill
- Universal rolling mill capable of UE rolling

Technical Information

Tandem Rolling Mill Technology

Highly productive rolling can be carried out by setting up as many rolling mills (2Hi mills or universal rolling mills) in a straight line as there are rolling passes for non-reversible rolling. It is a method that is often applied for rolling small to medium-sized shaped steel. The predominant style is the stand-exchanging method through which the roll is exchanged in its stand.

Swing-open Yoke Device

This is a device for universal rolling mills that allows the yoke to swing open on the roll exchange side for faster roll changes. It contributes to the shortening of roll exchange times.

Hydraulic Roll Gap Control Device

In shaped steel of the past, the adjustment of roll gaps was usually carried out through the electric screw-down method. However, with the higher demand in recent years in terms of size tolerance, the need to control roll gaps even more closely began to arise. Theoretically speaking, hydraulic roll gap control allows the mill modulus to be infinite. By combining it with a profile meter for automatic hydraulic roll gap control, this device will contribute to improving the precision of the shaped steel measurements.

Reversing Rolling Mill Technology

This is a rolling method in which two or three universal rolling mills and 2Hi rolling mills are combined to manufacture the shaped steel. Although production efficiency declines, it allows for efficient use of space through the compact layout of the production line.

Stand Pass Line Adjuster

In the case of universal rolling mills, there is a need to always guide non-rolled materials through the center of the stand. In the past, the material was guided to the center of the stand by lowering or raising the head and tail ends of the rolling mill. However, this had an adverse effect on shaped steel measurements because the materials go into the roll bite while going up and down the slope. With this device, it is possible to maintain the table height in a horizontal position and adjust the height of the stand to center it. This allows non-rolled materials to be continually guided horizontally into the roll bite.
Bar and Wire Rod Mill

Steel Plantech provides the Bar and Wire Rod Rolling System that meet variety of customer needs. For example, we provide solutions that meet customer needs such as the Slit Rolling System and the High Speed Mill (40m/s) which increase productivity, the Hot Direct Rolling System which is directly connected with a continuous caster, not via a reheating furnace, and thereby greatly reduces the energy consumption, the Water Quenching System which helps in enhancing the strength of bars, and Endless Bar Rolling System (EBROS™) which significantly boosts yield. Moreover, we can suggest and provide a package solution by supplying integrated lines of electric arc furnaces, continuous casting facility and rolling mills.

Solutions

Production Volume Increase

High speed rolling technology
Increased production volume and stable operations become possible through high speed rolling technology.

Block mills
Using a block mill, which drives multiple rolling mills and has been used on 100m/s class wire rod lines, as the bar steel finishing mill, will achieve speeds far beyond the finishing speed of about 20m/s that was the limit of conventional mills. Rolling using ultra-hard rolls provides advantages such as precise measurements and enhanced surface finish. Additional advantages are easier roll exchange and maintenance.

High Speed Dividing Shears (HSDS)
Ordinarily, shears were start-stop types, which began moving when the shearing point arrived. However, there was a limit to the speed of the blade rotation (shearing speed) because the blades went from a standstill then began rotation and acceleration. Continuous rotating shears were adopted for the HSDS system, enabling faster shearing speeds. This makes stable shearing possible at even faster rolling speeds.

EBROS™ stands for Endless Bar Rolling System. Its objective is to enhance productivity and yield ratios. Simply put, the function of the EBROS™ is to weld the heads and tails of the billets that are extracted at constant intervals from a reheating furnace, and to create a billet of unlimited lengths.

- It enhances productivity by doing away with gap time
- It does away with cropped items or items of irregular lengths
- It reduces miss-rolls and enables uniform quality

Production Volume Increase

Table: EBROS™

<table>
<thead>
<tr>
<th>Increase in operation rate</th>
<th>Improvement of yield ratios</th>
<th>Increase in production volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>10~75%</td>
<td>2%</td>
<td>15%</td>
</tr>
</tbody>
</table>

approximately 20~40 m/s
Speeding up of finishing speeds
HDR (Hot Direct Rolling) is a system where the billet from a continuous casting facility is conveyed through roller table and directly input into a mill without being reheated. It is an excellent energy-saving technology. For the realization of this HDR system, comprehensive engineering capabilities for furnaces and continuous casting and rolling facilities are required. Such includes (1) high-temperature casting technology; (2) technology to minimize the temperature decrease; and (3) optimal layout for delivery to the next process.

We, Steel Plantech, will make the utmost use of these comprehensive engineering technologies to meet our customers’ needs.

Technical Information

Controlled Water-cooling Device

- Structure of Cooling Nozzle

![Diagram of cooling nozzle]

The manufacturing of water-cooled reinforced steel is possible through an online heat treatment process in the rolling mill line. There is no need to add expensive alloy elements vanadium and niobium.

Online Flaw Detection System

- Placing a flaw detector right behind the finishing mill has made it possible to track the position of surface flaws on deformed steel bar products. Operators can easily find where the flaw is, thereby it can significantly reduce defective products mixed in.

Housingless Stand

- Simple, highly sturdy construction
  - Housingless
  - The weight has been trimmed, creating the possibility that a larger stand can be adopted in the rolling mill yard where there is a limit on the crane capacity.
  - The midsection of the rolling screw shaft is secured on the pass line
  - This results in a more balanced construction than when the lower portion of the rolling screw shaft is secured.
  - Buttress screw thread used at the rolling screw shaft
  - The same position is securely maintained even if a strong rolling reaction force is applied.

- Wide area supporting the load as well as a chock self-aligning system
  - Upper area of the chock supported at two points
  - The area on the bearing that receives the pressure becomes wider, extending the life of the bearing.
  - Self-aligning mechanism (spherical seat) embedded in the chock
  - Equal load is applied on the bearing because the chock tilts in accordance with roll slack, extending the life of the bearing.

- Simultaneous rolling by top and bottom rolls
  - Fixed pass line that enables stable rolling
  - Shim adjustment, carried out at the roll shop according to the roll diameter, unnecessary

- Non-hydraulic inner stand
  - Mechanical roll balance has been adopted
  - The hydraulic motor for rolling has been placed in the spindle support
  - Serviceability improved by removing hydraulics from the inner stand, where conditions are harsh for hydraulic piping due to water, scaling and miss-rolls

- Continuous Spindle Support
  - Structured so that the spindle is supported even when there is no inner stand in place
  - Suitable for automated stand exchange.

Slit Rolling

- Multislit rolling methods include 2-slit, 3-slit, and 4-slit rolling. 2-slit rolling is currently the mainstream method, providing stable quality and good measurement systems. Furthermore, even higher production efficiency can be achieved through speeding up technology. 3-slit and 4-slit rolling allows production volume to be increased even with a small number of rolling mills. Slit rolling is also suitable for revamping a low productivity 2-slit line mill to a high productivity mill with greater production volume while keeping the number of rolling mills the same.

4-Roll Sizing Mill

- High measurement control technology
- Simple configuration and high rigidity

SPCL Chockless Stand

- Ultra High Rigidity Stand

HDR (Hot Direct Rolling) is a system where the billet from a continuous casting facility is conveyed through roller table and directly input into a mill without being reheated. It is an excellent energy-saving technology.

For the realization of this HDR system, comprehensive engineering capabilities for furnaces and continuous casting and rolling facilities are required. Such includes (1) high-temperature casting technology; (2) technology to minimize the temperature decrease; and (3) optimal layout for delivery to the next process.

We, Steel Plantech, will make the utmost use of these comprehensive engineering technologies to meet our customers’ needs.

Technical Information

Controlled Water-cooling Device

- Structure of Cooling Nozzle

![Diagram of cooling nozzle]

The manufacturing of water-cooled reinforced steel is possible through an online heat treatment process in the rolling mill line. There is no need to add expensive alloy elements vanadium and niobium.

Online Flaw Detection System

- Placing a flaw detector right behind the finishing mill has made it possible to track the position of surface flaws on deformed steel bar products. Operators can easily find where the flaw is, thereby it can significantly reduce defective products mixed in.

Housingless Stand

- Simple, highly sturdy construction
  - Housingless
  - The weight has been trimmed, creating the possibility that a larger stand can be adopted in the rolling mill yard where there is a limit on the crane capacity.
  - The midsection of the rolling screw shaft is secured on the pass line
  - This results in a more balanced construction than when the lower portion of the rolling screw shaft is secured.
  - Buttress screw thread used at the rolling screw shaft
  - The same position is securely maintained even if a strong rolling reaction force is applied.

- Wide area supporting the load as well as a chock self-aligning system
  - Upper area of the chock supported at two points
  - The area on the bearing that receives the pressure becomes wider, extending the life of the bearing.
  - Self-aligning mechanism (spherical seat) embedded in the chock
  - Equal load is applied on the bearing because the chock tilts in accordance with roll slack, extending the life of the bearing.

- Simultaneous rolling by top and bottom rolls
  - Fixed pass line that enables stable rolling
  - Shim adjustment, carried out at the roll shop according to the roll diameter, unnecessary

- Non-hydraulic inner stand
  - Mechanical roll balance has been adopted
  - The hydraulic motor for rolling has been placed in the spindle support
  - Serviceability improved by removing hydraulics from the inner stand, where conditions are harsh for hydraulic piping due to water, scaling and miss-rolls

- Continuous Spindle Support
  - Structured so that the spindle is supported even when there is no inner stand in place
  - Suitable for automated stand exchange.

Slit Rolling

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4-Roll Sizing Mill

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- Simple configuration and high rigidity

SPCL Chockless Stand

- Ultra High Rigidity Stand

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We, Steel Plantech, will make the utmost use of these comprehensive engineering technologies to meet our customers’ needs.
Shifting Reverse Mill

In the case of conventional 3Hi Reversing Mills, the material (blooms and billets) is laterally moved utilizing a manipulator, sent into the next pass caliber and rolled. On the other hand, in the case of a shifting reverse mill, the material is kept at the same place while the rolling mill is shifted to the next pass caliber position for rolling. This prevents the generation of flaws and twists on the material due to handling. Furthermore, unlike conventional rolling mills that required a manipulator operator each at the start and end, complete automation can be achieved with the shifting reverse mill by the placement of a turner.

Solutions

Production Volume Increase

1. The rolling mill automatically shifts for each rolling pass and aligns the roll caliber with the pass line.
   - There is no lateral movement of the rolled material, so it is possible to reduce product warping and surface damage.
   - No device is needed to move the rolled material, and the table width can be minimized, giving the equipment an overall compact size.

2. There is a degree of freedom in selection of the number of rolling passes.
   - The number of rolling passes can be freely selected according to the rolling size and shape. From 2 to 12 rolling passes can be selected with the H-V shifting reverse mill, and 2 or 4 passes with the H shifting reverse mill.
   - It can contribute to change-free rolling that enables rolling at a number of sizes from a pair of rolls.

3. Measures have been implemented to reduce the time required for mold replacement.
   - Preparation of specialized grooved rolls for each size/shape in the roll pairs makes it possible to replace molds of different dimensions and shapes within each size range easily.
   - Mold replacement time is minimized by automation of housing replacement and roll replacement using a replacement cart and a backup housing.
   - Guides can be placed in guide holders in advance, making it possible to replace them holder and all guide position can be changed with a holder shift mechanism, both online and offline.

4. It is possible to automate rolling mills and minimize the workforce.
   - The stand moves for each pass, and rolling is conducted using specialized grooved rolls, thereby eliminating the need to stop the line to move the rolling mill or adjust spaces between rolls, making it possible to implement full automation and minimize the workforce needed for adjustments.

Product Quality Enhancement

Eliminating the lateral movement of rolled materials and enabling rectilinear rolling makes it possible to minimize the occurrence of product warping, twisting, and surface damage.

Full Automation

The reverse rolling and material handling (rotation) of blooms and billets are completely automated.

Chance Free Rolling

Horizontal/Vertical Combination Rolling

By setting up the shifting stands for the Horizontal and Vertical stands in an H-V sequence and rolling in reverse, it becomes possible to carry out chance-free rolling through optimal caliber placement.

Twist Free

A variety of sizes can be rolled without the need to exchange rolls.

1 size roll in the H-V pass, 1 size roll in the H-V-V-H pass. A maximum of 4 passes in 1 roll family. A maximum of 8 sizes can be produced in combination with changes in the guide position.

Technical Information

Ironmaking

BOF

EAF

Continuous Casting

Long Products Rolling

Flat Products Rolling

Strip Processing Lines

Eliminating the lateral movement of rolled materials and enabling rectilinear rolling makes it possible to minimize the occurrence of product warping, twisting, and surface damage.

Updating conventional 3Hi reversing mills will save space while realizing high efficiency.
Roller Straightener

This is a facility for straightening any bending of rolled products.

Types of Roller Correction Machine

Combinations of the following can be selected according to needs:

- Single-sided/Double-sided support
- Fixed pitch/Variable pitch
- Variable roll width
- Hydraulic rolling/mechanical rolling

Technical Information

Solutions

Product Quality Enhancement

In the past, roller straighteners with single sided-support were the mainstream. However, because of the growth in the size of the products, Steel Plantech provides roller straighteners with double-sided support in order to suppress the effect of axial tilting, which is a weakness of roller straighteners with single-sided support. A variable pitch roller straightener has been adopted in order to reduce the amount of un-straightened sides during the lengthwise straightening of products. We also have a track record in the installation of roll width variable mechanisms, and in the case of shaped steel, we can handle up to H1100.

Production Cost Reduction

Adoption of the en-bloc roll exchange method enables simplification of roll exchange operations. Additionally, the shortening of roll exchange time improves productivity. Furthermore, use of variable width rolls will contribute to the lowering of production costs.

Reduction of the percentage of straightening defects

by about 25 minutes

Shortening of roll exchange times
Steel Plantech, based on our advanced technological strength backed by our rich experience, provides plate levelers, cold rolling mills and plate shears equipped with our own innovative and unique technologies, thereby helping our customers realize cost reduction and the production of high quality products.

**Cold Mill (TCM,CRM)**

Steel Plantech proposes a cutting-edge tandem cold mill (4Hi/6Hi) according to the customer’s needs. We can also provide total engineering, including auxiliary equipment such as utility facilities, inspection lines and roll shops.

### Solutions

**Product Quality Enhancement**

The adoption of the SPEOS™ (Superior Profile with Edge Oriented Shifting) technology developed by Steel Plantech, realizes rolling technology that can both control a strip crown and improve edge drop. Furthermore, optimum, stable concentration control will be possible at the pickling line by utilizing the acid concentration control system.

We have provided not only the conventional 4-Hi and 6-Hi mills which are produced based on our rich experience, but also state-of-the-art mills including Zoom-Mill™ and SPEOS™, which Steel Plantech has originally developed by making use of new technologies.

We will suggest the optimal type of rolling mills as well as their layout.

- Continuous pickling and cold rolling line that is sequentially connected with the pickling line
- 4-Hi reversible rolling mills that produce high-quality products while cutting down the cost
- 6-Hi reversible rolling mills that are suitable for the rolling of thin materials of various types
- Combination mills that have a skin pass function too
- Zoom-Mill™ and reverse rolling mill that have high productivity

### Lineup

- Cold Mill (TCM,CRM)
- Zoom-Mill™
- Plate Leveler
- Plate Shear

**Flat Products Rolling**

Steel Plantech, based on our advanced technological strength backed by our rich experience, provides plate levelers, cold rolling mills and plate shears equipped with our own innovative and unique technologies, thereby helping our customers realize cost reduction and the production of high quality products.

**Technical Information  SPEOS™ Crown**

A technology for achieving an optimum strip crown and reducing edge drop was developed by shifting the work roll given a special curve. This technology is being used in cold rolling mills (CRM) as well as tandem cold mills (TCM) and contributing to the higher quality of products and improved yield in the sheet width direction.

- A single roll crown has a wide crown range, from broad to narrow.
- When the roll shifts to the crown position in accordance with the strip width, the gap expanding transitional zone (GETZ) is automatically set around the strip edges, reducing edge drop.
- In other words, a single pair of work rolls can control both crown and edge drop.
**Zoom-Mill™**

Steel Plantech can propose cold rolling mills (CRM) or state-of-the-art tandem cold mills (TCM) according to the customer’s needs. Furthermore, the ZOOM (zero oriented off-gauge minimization) function developed by Steel Plantech can be added to improve yield ratios and reduce production costs as compared to conventional CRMs.

**Technical Information**

**Zoom-Mill™ (Zero Oriented Off-gauge Minimization)**

The Zoom-Mill™ rolling method was developed by Steel Plantech with the purpose of minimizing off-gauge sheets in reverse rolling by applying a leader strip and a spot welder. Zoom-Mill™ rolling improves off-gauge rolling ratios by 1% as compared to conventional rolling mills. In the case of 6-pass rolling, the length of the off-gauge portion of the coil periphery will usually be more than 10 meters. However, the use of the Zoom-Mill™ rolling method will enable a finish with the off-gauge at less than 2 meters. Because tensile force can be added from the tip of the chord when rolling, the Zoom-Mill™ rolling method is superior to other methods for reducing off-gauges during reverse rolling, with better threading stability, plate thickness precision and shape. Because the next strip is held above the threading on the outside tension reel while waiting for the rolled coil to go offline, there is no need to wait to wind rolls, making it possible to decrease processing time per coil even if the welding takes time. Therefore, you can expect improved productivity by adopting this method. Furthermore, it leads to the saving of labor since it prevents the generation of off-gauge small coils (pup coils) and does away with the need for tasks such as the extraction of small coils, strapping, discharging and disposal.

**Solutions**

- **Production**
  - Volume Increase/Production Cost Reduction
  - **Customization**

<table>
<thead>
<tr>
<th>Production Volume Increase/Production Cost Reduction</th>
<th>1.0~1.4% enhancement in yield (as compared to conventional CRMs)</th>
<th>6% Production increase effect</th>
</tr>
</thead>
</table>

By adopting the Zoom-Mill™ developed by Steel Plantech, you can reduce production costs (reduction in off-gauge sheets), recover the investment quickly, and increase revenues.

1. Removing the Pup Coil has done away with the Pup Coil extraction process, realizing a reduction in required processes.
2. Less time is required to exchange a coil as compared to ordinary cold rolling mills, ensuring a high production volume.

**Technical Information**

### Zoom-Mill™ Characteristics

- **Production Volume Increase**
  - **Yield**: 1% improvement per year
  - **Shutdown period**: 2 weeks
  - **Investment cost recovery time (average)**: 2 years

- **Pup Coil Extraction Process**: Removed
- **Processing Time**: Reduced by waiting for rolls to go online, allowing for faster processing per coil.
- **Investment Recovery**: Quick payback on the investment.

**Technical Information**

### Zoom-Mill™ Key Benefits

- **Enhanced Production Efficiency**: Increased yield and reduced downtime.
- **Cost Reduction**: Minimized production costs through improved yield and reduced downtime.
- **Product Improvement**: Better threadability, plate thickness precision, and shape.
- **Labour Savings**: Prevention of off-gauge small coil generation, reducing tasks such as extraction, strapping, discharging, and disposal.

**Technical Information**

### Zoom-Mill™ Functionality

- **Zero Oriented Off-gauge Minimization**: Minimizes off-gauge sheets in reverse rolling.
- **Leader Strip and Spot Welder**: Essential for improved yield ratios.
- **Improved Rolling Ratios**: 1% better than conventional methods.

**Technical Information**

### Zoom-Mill™ Applications

- **Cold Rolling Mills (CRM)**: Existing CRMs can be upgraded to Zoom-Mill™ technology.
- **Tandem Cold Mills (TCM)**: Suitable for tandem mill environments.
- **Other Manufacturers**: Remodeled for compatibility with CRMs from other manufacturers.

**Technical Information**

### Zoom-Mill™ Advantages

- **Yield Improvement**: 0.6 to 1.1% increase.
- **Production Increase**: 1.6% enhancement.
- **shutdown period**: 2 weeks
- **Investment cost recovery time (average)**: 2 years

**Technical Information**

### Zoom-Mill™ Technical Specifications

- **Yield Improvement**: 1.0% to 1.4%.
- **Shutdown period**: 2 weeks.
- **Investment cost recovery time (average)**: 2 years.

**Technical Information**

### Zoom-Mill™ Benefits

- **Enhanced Production Efficiency**: Increased yield and reduced downtime.
- **Cost Reduction**: Minimized production costs through improved yield and reduced downtime.
- **Product Improvement**: Better threadability, plate thickness precision, and shape.
- **Labour Savings**: Prevention of off-gauge small coil generation, reducing tasks such as extraction, strapping, discharging, and disposal.
Plate Shear

Steel Plantech offers shears that can shear all types of steel, regardless of plate type, thickness, or width, including high-tensile steel plates.

**Solutions**

**Production Volume Increase / Product Range Expansion**

Each of Steel Plantech’s shear devices, including crop shear, double-side shear, slitting shear, and end shear, contributes to the productivity increase of a plate shear line.

1. Available for plates with a thickness of up to 50 mm, width of up to 5,500 m, and material tensile strength of up to 1,200 MPa
2. Easy, safe and quick exchange of shear knives by use of automated exchange equipment
3. Low-maintenance design realizing effective maintenance cycle and shortening working time
4. Suggesting efficient and optimal layout of plate shears

**Product Quality Enhancement**

Steel Plantech’s plate shears are devices with high performance. They incorporate a design that aims to achieve the optimal quality of shear plane and they have been created with production technologies based on our rich experience.

1. Mitigating shear deformation, rollover and slip mark on shear plane by adopting optimal rolling cut motion
2. Realizing consistent and fine shear plane quality with the use of high-precision knife gap adjustment equipment
3. Providing plate shears with sufficient stiffness, which are designed based on reliable analysis simulation models

Double-side shear

A new double-sided shear has been developed by Steel Plantech in order to realize a simpler assembly process and easier maintenance. We have also reduced the size of its structure compared with the conventional triple-shaft, triple-crank-type product, and hence it can meet the need to renew a shear in a seasonal plate shear line.

Plate Leveler

The SuPerLeveler™ was developed by JP Steel Plantech in 1998 as equipment to improve the flatness of steel plates (6 mm to 50 mm thick) produced in plate mills. Warping generated in the leveler (surface preparation materials to increase horizontal precision) during correction is also completely corrected through infinity control of rigidity. This has made it possible to flatten TMCP steel plates, hardened steel plates, and other steel plates that require straightening reaction, and which did not become stable using conventional levelers.
Solutions

Product Quality Enhancement

The SuPerLeveler™ utilizes the “dynamic crowning method” to control roll gap deviation throughout the entire steel plate, something that was not possible with conventional “preset levelers” (a method in which the amount of lateral deflection is set in accordance with the anticipated amount immediately before straightening begins). In particular, flatness is improved significantly within a range of approximately 1.2 m from the front and rear ends, compared to preset levelers.

Production Volume Increase

“High-load-capacity backup roll,” “bite correction control,” and other functions developed by JP Steel Plantech have significantly expanded the correctable range compared to conventional levelers.

Product Range Expansion

Uniform correction of areas in which the front and rear edge straightening reaction fluctuates sharply as well as constant areas has been made possible, as has the reduction of residual stress in steel plates. This enables the manufacturing of steel plates that do not become deformed after cutting.

Technical Information

Dynamic crowning control

There are 3 types of deflection that occur in levelers: lateral deflection, vertical deflection, and compression deflection. Correction of each through a hydraulic cylinder makes it possible to maintain a constant gap between leveling rolls. With conventional levelers in particular, lateral deflection, for which the preset type prevented changes to correction amounts during straightening, is measured with a deflection sensor installed inside the lower frame, making it possible to achieve accurate corrections with the hydraulic cylinder installed between the upper frame and the roll carriage.

Bite correction control

Because it is difficult for thin, rigid plates to feed the front edge of thick plates into the leveler, a control method called “bite correction” has been implemented to apply a light intermeshing when the leading edge is guided in, then apply the full intermeshing after that. In this case as well, a constant, fixed roll gap can be maintained in the plate’s lateral direction, even if the reactive force of the light reduction and the full reduction of the leading edge differ.

Off-center straightening

In addition to the sensors that are ordinarily used, deflection sensors are installed inside the upper and lower frames in accordance with the number of crowning cylinders, and laser sensors installed on the front surface of the leveler are used to enable off-center straightening for which the plate does not need to be centered.

LP steel plate straightening

In the case of LP steel plates with differing lengthwise thicknesses, the straightening reaction also fluctuates, but regardless of how the reactive force changes during straightening, the SuPerLeveler™ can maintain the set roll gap, making it possible to straighten LP steel plates, and thereby significantly increasing the reliability of straightening.
Strip Processing Lines

Steel Plantech leverages its world-class technological capabilities and proven track record to supply strip processing equipment that meets customer needs. The reliability of our various strip processing lines and the high quality of the manufactured products are highly recognized by our customers around the world.

Continuous Annealing Line (CAL)

This line facility changes the crystal structure of steel sheet by heat treatment, and improves properties such as hardness, strength, and elongation. It integrates the 5 processes of cleaning, heating, cooling, temper rolling, and refining, and carries them out in a single line, thus saving space and lowering costs. Steel Plantech’s CAL for high-quality cold-rolled sheet for industries around the world including the automobile and household appliance industries.
Solutions

Product Quality Enhancement
High-quality cold-rolled sheet for automobiles can be produced because of systems for integrated tracking control, uniform temperature profile (heating/cooling) in the width direction and accurate measurement of strip temperature by a multi-reflection type pyrometer. For this reason, we have a track record of delivering our line to many customers around the world.

Product Range Expansion
Three kinds of cooling processes are adopted: rapid gas-jet cooling, roll quenching and water quenching. This makes it possible to produce a wide range of cold-rolled sheet, from common sheet to deep drawing cold-rolled sheet and ultra-high-tensile strength sheet.

Production Volume Increase
Adoption of high-speed continuous annealing technology improves productivity.

Technical Information

Rapid Cooling System

Rapid gas-jet cooling
Uniform strip temperature through a unique gas-jet nozzle shape
Strip temperature controlled through the adjustment of the gas jet velocity in the strip’s width direction
Cooling capacity raised through a high concentration of hydrogen

Roll quenching
Rapid quenching through water-cooled rolls
Uniform strip temperature through auxiliary gas-jet nozzles
Reduction of operating costs

Water quenching
Makes the manufacturing of ultra-high strength steel for automobiles possible by ultra-rapid quenching
Continuous Galvanizing Line (CGL)

The purpose of the Continuous Galvanizing Line (CGL) is to apply a coat of zinc onto the surface of steel sheets in an effort to increase their corrosion resistance. There is a wide range of control of zinc coat thickness, and the galvanized steel sheets are used for a broad range of purposes, including construction materials, automobiles and electrical appliances. Steel Plantech’s CGLs possess unsurpassed functions that are highly evaluated by customers around the world.

Product Quality Enhancement

High-quality galvanized steel strips for use in automobiles can be produced through the use of air knife and highly precise zinc coating weight gauge. That quality is attested to by our track record of supply to many customers around the world.
**Product Range Expansion**

- Single-pot/double-pot layout
- Hot-dip galvanized steel strips (GI)
- High-tensile strength products for use in automobiles through rapid gas jet cooling
- A lineup of GF and GL production facilities for construction materials
- Incorporation of an in-line coater

**Production Volume Increase**

High speed stable operation allows for greater productivity enhancement as compared to conventional products.

- Optimum setup of roll crowns
- Layout of optimum steering rolls
- Optimum control of tensile forces

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**Technical Information**

**Rapid Cooling Technology**

**Rapid Gas Jet Arrangement**

- Rapid gas-jet cooling
- Uniform strip temperature through a unique gas-jet nozzle shape
- Strip temperature controlled through the adjustment of the air volume in the strip’s width direction
- Cooling capacity raised through a high concentration of hydrogen

**Control of Zinc Coating Amounts**

- Highly-functional galvanizing facility
- Capable of thin zinc-coating products
- Non-contact baffle plate control
Annealing and Coating Line (ACL)

The Annealing and Coating Line (ACL) produces magnetic steel sheets and strips to make electrical equipment with high efficiency, compactness, high precision, and high reliability. Steel Plantech’s ACL adopts a horizontal pass system for the high temperature annealing of thin sheets under low tension (heat treatment for removing internal strain and giving the materials superior electromagnetic properties).

Solutions

Product Quality Enhancement

The ACL can be used for annealing temperatures of over 1,000°C as needed according to variety. It will stabilize quality at a high level through state-of-the-art furnace control and high-precision tension control. What is more, it also offers quality assurance devices such as an online magnetic property measurement, coating thickness meter, sheet thickness meter, sheet width meter, and surface defect meter.

Production Volume Increase

Highly efficient production would be achieved because the coating, baking, and cooling equipment are incorporated into the line. Furthermore, productivity can be enhanced through accurate tension control and stable operation of the line.

Technical Information

Heating Control

Optimal placement of burners and electric heaters as well as zone load control are realized to allow heating and soaking at annealing temperatures of over 1,000°C.

Cooling Facilities

The optimal cooling sequences have been achieved through the combination of a Brick Zone, Cooling Tube Zone, Slow Jet Cooling Zone and Fast Jet Cooling Zone, which allows slow cooling and rapid cooling to be finely controlled.
Color Coating Line (CCL)

This is a pre-coating line that forms coats through advance application and baking of coating materials onto strips produced by Continuous Galvanizing Lines (CGL; to enhance corrosion resistance) and Continuous Annealing Lines (CAL; to improve properties, such as strength and elongation). It is an add-on for visual aspects of strips, such as color and gloss, as well as for protective elements, such as weather and corrosion resistance.

解决方案

产品品质提升

预涂钢板

The manufacturing of double-coated, double-baked pre-coated steel sheets with good weather resistance, primarily used in construction and home appliances, is possible. An in-line tension leveler can also be installed to manufacture straightened steel sheets.

Temper / Skin Pass Mills

The device uses skin pass rolling to improve the mechanical properties and surface texture, and improve flatness, in order to form materials such as hot-rolled steel sheets, cold-rolled steel sheets, stainless steel plates, and aluminum plate into final products. Since it conducted tests with its own test equipment in 1965, Steel Plantech has continued to develop theories and deliver actual devices. As a result, the company has delivered 63 skin pass mills worldwide up to this point in time.

技术信息

组合皮肤滚压机和张力平整机技术

通过将皮肤滚压机与张力平整机组合在一起，我们的最擅长的皮肤滚压机可以承担提高机械性能和改善表面纹理的角色，而张力平整机可以改善板平度，从而实现高效的分担角色。当设备组合时，必须对前端、后端和中心引导轮的位置、卷筒的数量和电机的容量，以及提议的操作方法进行密切的关注。JP Steel Plantech已经交付了45个组合皮肤滚压机和张力平整机系统，并有能力提出最优化的解决方案给我们的客户。

内嵌不锈钢皮肤滚压机技术

在最近几年，由于简化了处理过程与离线皮肤滚压机和高张力皮肤滚压机，它已经成为一种标准的皮肤滚压机安装。对于不锈钢，在特殊情况，材料和卷筒很容易损坏，因此有必要移动皮肤滚压机至焊接的点，而不会造成损害。为了实现这一点，JP Steel Plantech利用其技术来移动项目点，使用高精度的延长控制。

引导滚轮机械驱动技术

这种驱动机制利用了差动齿轮减法和2个电机（主电机和延长电机）来提供延长控制，它具有高精度在30到50倍之间的单个驱动。延长精度的旋转速度的电机有所提高，但这种技术正在生产线中使用，要求稳定延长控制。
Tension Leveler

Tension levelers level and improve the flatness of materials such as hot rolled steel, cold rolled steel, stainless steel, aluminum, copper and specialized materials, and finish them into a final product. The range of the materials that can be used for leveling are those with a thickness of between 0.05mm-8.0mm, a width of between 300m-2,300mm and a yield strength of between 50MPa-1,500MPa. Tests of various materials using original testing equipment have been carried out on Steel Plantech’s tension levelers since 1970. Theories have been constructed, tested, and supply of tension levelers made, with this repeated many times over the years. 194 sets have been supplied around the world, practically making Steel Plantech a specialist in tension levelers.

Product Quality Enhancement

The tension leveler is equipped with an optimum roll layout and an originally-developed wet system. This enables the product of steel sheets with only few marks on the surface from leveling force.

Product Range Expansion

The customers have various needs, so there are many different kinds of materials that need to be leveled. Steel Plantech provides tension levelers that are optimal for use with a wide variety of materials and specifications.

<table>
<thead>
<tr>
<th>Thickness (mm)</th>
<th>Width (mm)</th>
<th>Yield Strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05-8.0</td>
<td>300-2300</td>
<td>50-1500</td>
</tr>
</tbody>
</table>

The customers have various needs, so there are many different kinds of materials that need to be leveled. Steel Plantech provides tension levelers that are optimal for use with a wide variety of materials and specifications.
In the past, we have supplied a tension leveler with a line speed of 1,340 mpm, among the fastest in the world. Furthermore, we have supplied 6 tension levelers with line speeds of more than 1,000 mpm.

Technical Information

Tension Leveler Roll Helper Drive technology

In the case of tension levelers for stainless steel, aluminum and specialized materials, wet leveling is sometimes adopted to prevent marks on the surface made from leveling force. However, if the materials are soft or if the requirements for the quality of the surface are very severe, there is a need to drive the roll that comes in contact with the board in order to prevent roll slippage. Steel Plantech is the only company that possesses the technology for driving the small diameter roll of a tension leveler. Because of roll placement technology, resulting from tests on various materials using test facilities, and differential technologies, such as the helper drive, Steel Plantech is the only company in Japan that currently makes tension levelers.

Ultra-fast Tension Leveler Technology

In the past, the maximum speed was 1,200 mpm, but a tension leveler with an even higher line speed of 1,340 mpm, among the fastest in the world, was supplied in 2006 to JFE Steel East Japan Works (Chiba).

Tension Leveler with Ultra-high Tensile Strength

In 1986, we supplied to the Nippon Steel & Sumikin Stainless Steel Corporation, Hikari Works, a tension leveler with tension of 50 tons, which was the highest at the time. Currently, we are producing a tension leveler with the world’s top-level tensile strength of 100 tons (world’s top class) for use with 1,500 Mpa super-high tensile materials.

Wet Leveling Technology of Tension Levelers for Stainless Materials

The quality of the surface of the finished product is particularly severe for stainless steel. Marks occurred by leveling force were the biggest challenge in the case of tension levelers for stainless steel. Our technology for the resolution of this problem was jointly developed with Japanese users, resulting in this leveler. It is currently the de facto standard in Asia of tension levelers for stainless steel.

Mechanical Drive Technology for Bridle Rolls—Enabling High Elongation Accuracy Control

Differential gear reducer is used in this drive unit. It provides elongation rate control of a precision that is 30 to 50 times greater to each of two motors—the main motor and elongation rate motor. This technology is used in ultra-fast lines and lines that require high-grade surface quality.

Tension Leveler with a Multi-roll Unit for Reduction of Residual Stress and Stabilization of Bow

Tension levelers for aluminum and copper may, depending on the intended use of the materials, require the reduction of residual stress for the next process, such as longitudinal cutting, edging and processing into chips. The tension leveler with a multi-roll unit was developed for this purpose.

Tension Leveler with Ultra-high Tensile Strength

In 1986, we supplied to the Nippon Steel & Sumikin Stainless Steel Corporation, Hikari Works, a tension leveler with tension of 50 tons, which was the highest at the time. Currently, we are producing a tension leveler with the world’s top-level tensile strength of 100 tons (world’s top class) for use with 1,500 Mpa super-high tensile materials.
Contributing to The Environment
Focusing on extensive CO₂ reduction and energy savings

Steel Plantech has accumulated the world’s top-level environmental and energy-saving technologies. We are contributing to steel mills worldwide by proposing solutions and supplying facilities for energy-saving, waste energy recovery, CO₂ reduction and environmental protection.

1. Coke Dry Quenching (CDQ)

2. Waste Heat Recovery System (WHRS) for Sinter Plant

3. System for waste plastic pretreatment and plastics utilization for BF and kiln fuel
Steel Plantech supports the world’s steel mills’ energy savings and CO₂ reduction efforts with the following services:

1. Examination of environmental and energy-saving situation for plants and proposal of solutions
2. Support for steel mills in their efforts to reduce CO₂ emissions
   1. Introduction and proposal of proper energy-saving measures
   2. Formulation, feasibility studies and execution of a series of procedure for Japan’s Joint Crediting Mechanism (JCM)
   3. Consulting on verification and monitoring of CO₂ reduction after project implementation

* CDM: Clean Development Mechanism, JI: Joint Implementation * PDD: Project Design Document

**Support for the World’s Steel Mills in Saving Energy and Reducing CO₂**

Steel Plantech’s proprietary technology

General energy-saving technology

- ECOARC™ Ecological and Economical Arc Furnace

- Steel Plantech’s proprietary technology

- General energy-saving technology

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Technical Service
Trust built by people and technologies and ties with customers

Steel Plantech offers through its Technical Service diverse services including after-sales service and pre-sales service. This enables customers to maintain their plants and equipment at the highest level and use them safely and securely.

Technical Service
In order to enable customers to use Steel Plantech’s plants and equipment safely and securely, we offer after-sales service for delivered plants and equipment in a prompt and responsible manner. We also offer pre-sales service for a range of products. We supply to customers up-to-date and sophisticated plants and equipment through collaboration among all relevant operational units of the company including units for sale, planning and special projects.

Furnace shell revamping work
Lime shaft kiln refractory reconstruction
Overhaul of rolling mill reduction gears
Renewal of segments for round beam blank casting plant
Renewal of tension reel head of ETL
Total Engineering

Technical Service

Visiting service

Equipment diagnosis and consulting

Parts supply, inspection and repair

Equipment maintenance and revamping

Engineering

Delivery

Operation guidance

Manufacturing and construction

Planning and designing

function of Technical Service