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CISDI

NEWSLETTER

Vol. 3, 2018



CISDI wins contract to transform Fangda Steel's stockyard

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- Recognition for CISDI's intelligent blast furnace technology
- Major boost for China's wire-rod producers - CISDI develops new-generation reducing and sizing mill
- CISDI reports on successful pilot for development of China's first casting process



TOTAL SOLUTIONS AND TECHNOLOGY PROVIDER
PREFERRED BY GLOBAL METAL INDUSTRY

► **FULL-PROCESS SERVICES**

CISDI provides full-process services from the bulk material handling yard to the post-processing line of the hot mill.

► **FULL-FUNCTION SERVICES**

CISDI provides standard and customized consulting, execution and operations management services.

► **FULL-LIFE-CYCLE SERVICES**

CISDI provides the FEED (front-end engineering & design), implementation, and production and operations management services through the entire project life cycle.

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CISDI'S ROLE AT FIRST SMART STEEL GIANT IN VIETNAM FEATURES ON NATIONAL CHINESE TV



Screens cut from the TV report

CISDI's role in the development of the biggest and most ambitious steel complex in Southeast Asia has been showcased on national TV in China.

China Central Television 2 (CCTV-2) conducted a special international report on Formosa Ha Tinh Steel's £11 billion complex in Vietnam for the series *Chinese Brands in Overseas Markets*.

Formosa Ha Tinh is the first overseas smart steel giant to be created by China.

Full industrial chain services are being undertaken by the China Metallurgical Group Corporation (MCC). Their remit covers the master plan, design, construction, major supply and operations management of the sintering plant, bulk material yard, ironmaking plant, steelmaking plant and rolling mill.

CISDI is providing consulting, elaborate engineering and project management services for the construction process. Its expertise is ensuring high-quality process control on design, equipment and safety from project startup to completion.

The March 10 programme showcased CISDI's expertise in providing total solutions, design, construction and operations

management and highlighted its vital role in providing ultra-high performance and low energy consumption patented blast furnace technology for the project.

Two blast furnaces each with an inner volume of 4,350m³ and the capacity of BF1 to produce a hot metal output of 3.197Mt/a – rivalling the production capabilities of the biggest mega BFs in the world – BF1 was successfully started up last year.

CISDI's unique no-bell top distributors have been incorporated into the design, in addition to CISDI-own systematic optimisation, energy-conservation and environmental-protection technologies and equipment.

The start-up of two sintering machines, each with an area of 500m², has been equally successful.

A CISDI spokesperson said: "This report was a fantastic demonstration of CISDI's strategic role as a leading metallurgical engineering and construction service provider. It has brought wide attention to Chinese brands now rising to prominence in the overseas markets.

"CISDI is an active player in transforming 'Made-in-China' into 'Created-in-China' - and in upgrading the quality and speed of China's development."

CISDI was awarded the contract for both furnaces on an EPC basis and civil construction started in 2013. Phase One of Formosa Ha Tinh in Vietnam is now operational.

The FHS construction process

Formosa Plastics Corporation chose the site, an area of arid mudflats once occupied by

fishing villages, to build its first venture into the steel industry, a plant which would be the most ambitious and competitive steelworks in Southeast Asia.

It broke ground on December 2nd, 2012 with some 10,000 workers from MCC and its 12 subsidiaries on-site.

In the last five years, more than 6,000 Vietnamese have been employed as construction workers.



This screenshot features CISDI team member Li Yunhua, who is in charge of FHS's blast furnace projects.

He has been stationed at the site from 2013 and will remain in his role until 2018. Li witnessed the smooth startup of blast furnace 1 on May 29 last year.

He has since been focused on conducting monthly inspections on operation conditions, one of the production technology assistance services requested by the client.

The nerve centre of the blast furnace plant, the control room has 10 wide screens to show real-time production status, and over 30 PC displays to chart production data and trends.



In an interview on the TV programme Li reported on current operations. He told the interviewer: "At present blast furnace 1 becomes slow at digesting charged raw materials because the hearth's heat value ascends; the issue must be urgently solved, otherwise the charge would be suspended."

"Thanks to our blast furnace intelligent production management system, we know we need to reduce blast flow rate by 200m³ per minute and drop blast temperature by 20°C."

Chinese technology breaking through the foreign technological monopoly

A blast furnace is the world's biggest single chemical reactor and is widely used in ironmaking.

However the inner workings of blast furnaces are difficult to monitor, making the identification of problems and production issues problematic. The industry has traditionally had to rely on manual identification from long-experienced, skilled operators.

CISDI's self-developed intelligent production management system, which has been applied to both blast furnaces at FHS, combines big data analysis technology with practical operation. The data provides exacting guidance and recommendations for improvements.

CISDI has been focussed on the research and development of large blast furnace core technology and equipment since 1991 and progressing Chinese manufacture of core equipment such as the no-bell top and top distributor (importing such equipment is costly for China).

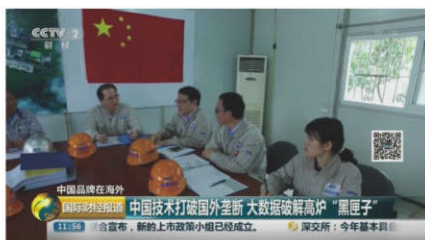
Li Yunhua explained to the CCTV-2 reporter: "All raw materials pass through the top distributor into the furnace. Its accurate

distribution is so important; it can influence the material profile and uniformity and furthermore, can decide the distribution of gas flow and a smooth production outcome."

"This distributor is our own creation; made-in-China capabilities are breaking through the 40-year technological monopoly held by foreign suppliers."

Chinese-made equipment such as casthouses, slag granulators, blowers and hot stoves are now performing to world-class levels.

At FHS, over 90% of the core equipment and facilities are manufactured in China.



The stable and highly-efficient operation of a blast furnace with a volume of 4,000m³ level cannot be achieved without high quality sinter, one of the raw materials charged into the blast furnace.

The sintering machines at FHS have been developed and supplied by Zhongye Changtian International Engineering Co., Ltd.

Their highly-efficient, energy-saving specifications also provide valuable environmental benefits - these sintering machines can entirely control the air leakage ratio to within 20%, far less than the general ratio of 35%.

Another highlight of CIE's technological advancements is its innovative liquid sealing development, which replaces the less

effective conventional rubber film sealing for annular coolers. The improved seal can save sintering plants an annual power consumption of at least 15x10⁶ kWh.

At FHS, the Chinese-made 500m² sintering machines have passed 72-hour strict performance tests and are producing sinter ore consistently.

Local fishermen working at the Chinese enterprise

The FHS steel plant is situated in the VUNG ANG economic zone in Ha Tinh province, an area previously used solely for agriculture and fishing.

FHS's construction, production and operation has employed 6,000 local people and trained around 3,000 technicians and is introducing advanced technologies, equipment and expertise to the region.

Duan Zhongji, a local employee by FHS, told the CCTV-2 reporter: "I have been working at FHS for five years and am learning the Chinese language, technical basics and operation skills and am now in charge of the blower operation. My friends admire me for working at such a modern steelworks."

FHS projects have created an USD3.35 billion export volume of Chinese outsourced services, of which high-quality equipment and materials account for around USD2.45 billion.



RECOGNITION FOR CISDI'S INTELLIGENT BLAST FURNACE TECHNOLOGY

CISDI's intelligent blast furnace energy conservation technology has been awarded the only accreditation given to steel industrial technology in 2017 by the National Development and Reform Commission.

It was listed in the *National Key Energy-saving and Low-carbon Technological Promotion Directory 2017*. The directory began in 2009 and has featured 32 steel-related technologies.

CISDI applied for five related core technologies, all of which are based on the bosh gas volume index:

1. High-efficiency and low-consumption theoretical system
2. Optimised blast furnace profile design by simulation
3. Structural technology for the optimised profile of a large blast furnace
4. Systematic energy conservation technology for a large blast furnace
5. Intelligent production management system for a large blast furnace

These technologies are world leaders in terms of high efficiency and low consumption. They are capable of achieving an ideal fuel ratio of no more than 485kg/t and a gas utilisation efficiency of no less than 52% for a large blast furnace.

The composite package of energy conservation technology has been granted 19 patents for national-level inventions and 67 utility model patents.

They have been applied to 21 large blast furnaces with volumes of over 4,000m³ and 24 medium-sized blast furnaces with volumes range from 2,000m³ to 4,000m³. Remarkable economic and social returns have been produced.

Baosteel's Blast Furnace 3 is a strong example. Its one-generation campaign service life is 19 years and the hot metal output is 15,700t per unit of volume.

During that service life, the average coke ratio is 302kg/t, coal ratio is 196kg/t and the fuel ratio 498kg/t - world-class high efficiency and low consumption targets.

CISDI's technologies have also been applied to two blast furnaces at FHS, which each has a volume of 4,350m³ and at India's TATA KPO blast furnace 2 (with a volume of 5,870m³).

CISDI expects to boost steel energy efficiency development around the globe with its blast furnace energy-saving advancements.

It predicts that in the next five years, 23% of blast furnace ironmaking production will opt to use this package in order to comply with green and intelligent upgrading trends.

The resulting energy savings would be vast - and would also lead to significant environmental benefits as a result of reductions in emissions.

Blast furnaces consume 60% of the energy used by the steel industry. A future investment of 5.37 billion USD in energy conservation technologies would save 3.24 million tce energies a year and reduce carbon dioxide emissions by 8.55 million tonnes a year.

TYPICAL PROJECTS

Baosteel Zhanjiang 2x5,050m³ blast furnaces

Production capacity

8Mt/a hot metal

Main equipment

blast furnace proper, no-bell top, high-temperature top-combustion stove, all made in China

Construction period

30 months

Results

an annual energy saving of 396,000 tce, a reduction of carbon emission by 1.045Mt CO₂, and an annual economic benefit of 50 million USD from saving energy



Anyang Steel No.3 blast furnace with a volume of 4,747m³

Production capacity

3.8Mt/a hot metal

Main equipment

blast furnace proper, high-temperature top-combustion stove, blast furnace intelligent production management system

Construction period

24 months

Results

an annual energy conservation of 137,000 tce, a reduction of carbon emission by 362,000t CO₂ and an annual economic benefit of 17 million USD from saving energy



CISDI AND ERZHONG JOIN FORCES IN PUSH FOR GLOBAL CLIENTS



Teams from CISDI and Erzhong at the signing ceremony

CISDI and China's National Erzhong Group are to work together to take their hot strip rolling expertise global.

Erzhong, based in Deyang in Sichuan, is a renowned manufacturer of key machinery and a core supplier

of metallurgical package equipment and intelligent forging within China.

Over the last 60 years it has supplied over two million tonnes of key machineries to Chinese and foreign clients.

CISDI provides total solutions and package supply of full-process ferrous equipment, from equipment research and development to design, manufacture and technical services.

The two companies signed an agreement at CISDI headquarters in February to bring together their machinery and upgrading skills and plan a global exploration strategy.

CISDI CHAIRMAN VISITS FORMOSA

CISDI's chairman heralded China's lunar new year with a visit to Formosa Plastics Group in Taiwan.

Xiao Xuewen led a delegation from CISDI which met with leaders of FPG's Formosa Ha Tinh Steel project in Vietnam, the biggest and most ambitious steel complex in Southeast Asia.

Wang Wenyuan and Wang Ruihua, chairman and vice chairman of FHS, and the plant's chairman Chen Yuancheng and CEO Zhang Funing, debated the current steel situation and future issues with Mr. Xiao and his team.

CISDI was also keen to discuss how it might best serve the next phase of construction and development at Ha Tinh Steel.

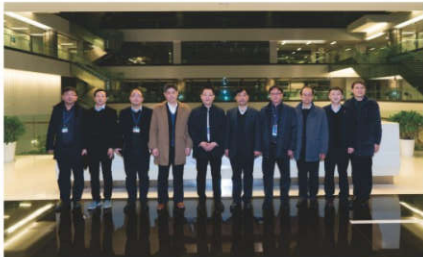
Mr. Xiao expressed his hopes that the startup of blast

furnace 1 and the impending startup of blast furnace 2 would mark an opportunity for deepening cooperation on projects, and for CISDI to continue its work at FHS via operations management and the delivery of spare parts.

He told his hosts: "FHS has been always our most important client; we put your needs first and aim to provide services of the highest quality."

In reply, FPG praised CISDI's consistent support, professionalism and strategic vision in the creation of Ha Tinh Steel as the most competitive in the region.

MASTEEL'S CEO VISITS CISDI



Masteel guests were welcomed to CISDI's HQ

Ding Yi, the CEO of Masteel, brought a delegation to CISDI's headquarters in January to discuss orientation and developments.

CISDI gave a presentation on consulting services and intelligent applications and chairman Xiao Xuewen discussed the company's advancements in technological

and business redeployment for national supply-side restructuring reform and upgrading.

He explained how CISDI's unique technologies for systematic optimisation and big data analysis have been playing outstanding roles in reducing operational costs and increasing labour productivity and told Mr. Ding: "CISDI and Masteel are standing at a new juncture. We hope our latest developments will work alongside your upgrades and enhancements to create greater Chinese competitiveness."

Mr. Ding expressed Masteel's keenness to grow cooperation between the two companies. He commented: "We expect to see mutual collaboration in intelligence, systematic optimisation and prefabricated construction."

CHINA'S TOP AI ACADEMIC VISITS CISDI

A highly respected Chinese academic pioneering the use of AI in the engineering sector was recently invited to CISDI's HQ.

Mr. Pan Yunhe, a member of the Chinese Academy of Engineering, is a pioneer of China's artificial intelligence application. The leading visionary in boosting AI 2.0 concepts has been tasked with building a national AI think-tank in China.

Yu Zhaohui, president of CISDI, gave a presentation on the introduction of corporate IT and smart applications, after which Mr. Pan praised CISDI's big data

accurate function in cloud platforms for business invitation and settlement and Sigma management.

He commented, "CISDI has reaped bumper harvests in steel and is now cultivating a future in IT and smart applications for the steel industry."

"You have great potential to tap into developments in steel with further applications for intelligent technologies and industries with IT-based applications; you are combining the studies of micro-economy and macro-economy."

CISDI WINS CONTRACT TO TRANSFORM FANGDA STEEL'S STOCKYARD



An artist's impression of how the environment-friendly Fangda stockyard will look

CISDI is to transform the steel stockyard of one of China's largest producers to meet the latest environmental standards.

The EPC-based contract to rebuild Fangda Steel's stockyard, involving a total floor area of over 200,000m², was signed in January.

Fangda Group is China's largest producer of spring flats and automobile plate springs and is one of the main production bases for constructional steel products. It ranks Number One in China for the profit value achieved per tonne of steel, and also for

total profits.

CISDI is executing the environment-friendly modification of the stockyard's process, equipment, enclosed yard and utilities. The east and west areas of the stockyard are to be rebuilt in two separate packages.

CISDI's unique online rebuild expertise, its competitiveness and holistic approach won it the bid and Fangda has now invited the company to bid for its water treatment plant and landscaping projects.

CISDI WINS A BID FOR GUIGANG STEEL'S BILLET CASTER PROJECT

CISDI has won a bid for Guigang Steel's 7-strand billet caster project in Guangxi.

Guigang Steel is a private, 60-year-old enterprise which produces 4.50 million tonnes of steel a year, incorporating ironmaking, steelmaking, casting and rolling production.

CISDI's contract is for package supply and installation of the billet caster, which will eventually produce 1.50 million tonnes of billets a year with the steel grades of carbon structural steel, low alloy steel, alloy structural steel and spring steel. Billet product cross section size will be 165mmx165mm.

CISDI IS AWARDED ADDITIONAL OPERATIONS MANAGEMENT CONTRACT AT FHS

CISDI signed its second operations management contract with Formosa Ha Tinh in January.

The company will manage the site's second blast furnace.

CISDI have already been responsible for continuous operations management of the site's first blast furnace, which was started up last May.

Production was not without its challenges; issues faced included a lack of operational experience on the part of the client, and uneven production in the upstream and downstream blast furnaces processes.

In one instance, sinter ore could not be fed adequately, coke quality failed to reach standard and the steelmaking shop was unable to receive the required quantities of hot metal. As a result, the blast furnace was

working under load.

But CISDI was able to rectify the problems and ensure the blast furnace withstood numerous hard tests without the incident of slip or massive falling of skull.

As a result, casthouse operation is now highly stable, the hot metal tapping is long-lasting without frequent letups which can release burdens of taphole plugging and drilling. The slag granulation system is now working fully, the cooling system for furnace proper is operated as designed and the copper staves are well maintained.

In addition to taking care of the blast furnace 2's blow-in and startup, CISDI will continue its supervision of the operational services of both furnaces as well as on coordinating the stockyard and steelmaking processes' production.

STOVES OF ASSB BLAST FURNACE 1 HEATING UP

The stoves at ASSB's blast furnace 1 were successfully heated up on February 8, a significant step towards successful blow-in.

Designed and package-supplied by CISDI, the stoves feature CISDI's top-combustion hot stove patented technology, which is designed to give greater energy efficiencies and a longer service life.

Each stove is 38 metres high, and is blasting to the designed temperature of 1,200°C hot air and able to heat up a maximum of 2,900Nm³/min air.

The stoves heated up on schedule thanks to CISDI's instructions on installation and commissioning, and create the right conditions for the successful completion of other units.

The blow-in and system pressure test of blast furnace 1, and commissioning of its charging system, are soon to follow.



The CISDI team at ASSB's blast furnace 1 site, pictured at the heated-up hot stoves

YANGZHOU HENGRUN'S SLAB CASTER 3 HOT COMMISSIONED

The last day of January ushered in the successful first hot commissioning of a rebuilt 2-strand slab caster at the meltshop of Yangzhou Hengrun Heavy Machinery Co., Ltd.

Seven heats of strands were cast sequentially for producing the Q235-grade slabs in a cross section of 230mmx1,400mm and at a casting speed of 0.8m/min.

The slabs are required to reach multiple specifications (200mm, 230mm and 250mm x 1,000mm, 1,100mm, 1,250mm and 1,400mm) and an annual target capacity of 2.50 million tonnes.

CISDI's project team, in charge of the package supply and installation, completed refined design, installation and commissioning within a year.

A spokesperson for Yangzhou Hengrun expressing the company's gratitude to CISDI

for the high quality of the hot-commissioned products being produced, and commented, "CISDI's dedication, and united efforts from the sub-suppliers and construction company, have ensured hot commissioning went to schedule and that guaranteed figures were achieved."



Slab glows red-hot as it is cast

BAYI STEEL APPROVES CISDI DESIGNS FOR INTELLIGENT REBUILD OF HOT-ROLLED COIL STORAGE

CISDI's basic design work for the intelligent rebuild of a hot-rolled coil storage in Xinjiang for Bayi Steel has been approved.

This initial intelligent rebuild project is aimed at reducing labour and enhancing

productivity and performance.

CISDI is the general contractor and has worked to solve issues with the logistics flow and storage facility.

FIVE-STAND TANDEM COLD MILL BEING CREATED FOR GANGLU STEEL



A machining tool working on the housing of the five-stand PL-TCM for Ganglu Steel

CISDI Equipment Company is in the process of manufacturing a five-stand tandem cold mill for Tangshan Ganglu Steel.

CISDI is providing package supply services for the project, which includes the large pickling line and tandem cold mill.

More than 100 sets of mechanical equipment are involved, from pickling line entry and exit to cold mill entry, five-stand 6-hi cold mill and exit.

The tandem mill is comprised of five stands, upper cross beams and roll change rails. The mill housing is being machined to an outline dimension of 9.3m x 3.8m x 1.4m and will weigh around 80.5 tonnes.

Housing and assembly is being created with high machining accuracy. A standard

parallelism for each piece of the housing should be controlled and the flatness should be kept within 0.04mm. Its squareness and symmetry must be controlled to within 0.08mm and 0.015mm and the complete alignment of the five stands must be achieved during assembly.

To ensure machining accuracy, engineers from CISDI Equipment are on-site to track manufacturing and instantly solve any technical problems that arise. CISDI's manufacturing shop makes optimized arrangements on rough and fine machining to better adapt to machining requirements.

Seven of the ten housings have been completed. One of them is in assembly and the machining and assembly workshops are running to schedule.

MAJOR BOOST FOR CHINA'S WIRE-ROD PRODUCERS

CISDI develops new-generation reducing and sizing mill

A new-generation wire-rod reducing and sizing mill has been created by CISDI and is now reaching the world's highest speed of 140m/s.

A reducing and sizing mill is the most critical piece of equipment on a high-speed rolling line, as it decides the performance and quality of wire-rod products.

It operates via state-of-the-art controlled-rolling and controlled-cooling technology.

But China's wire-rod producers have always had to rely on importing their reducing and sizing mills at a high cost.

CISDI have come to their aid, designing its own high-speed RSM. Its teams have worked right from the research and development to equipment design and manufacture, and now have a series of patented RMS technology and equipment.

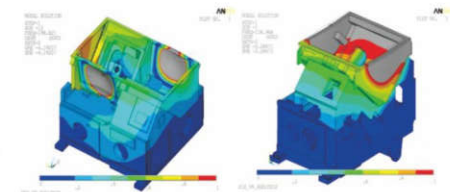
Self-developed wire-rod RSM - Key Facts

CISDI's wire-rod RSM has been granted 25 patents and achieved world-leading results for product dimensional accuracy.

It has the least number of clutches for its combined gearbox, which requires multiple gears for different speeds, the structure is simple and equipment is lightweight.



The SRSCD wire-rod reducing and sizing mill, pictured during testing



3D modal analysis charts, showing reducing mill stands and sizing mill stands

The gearbox relies on a patented base oil return technology, which lowers the gravitational centre and creates more stability during operation.

The two-stand ultra-heavy-duty mill and two-stand high-precision mill can roll at temperatures as low as 750°C. Products through this mill train can be enhanced not only by mechanical property, but also result in a final dimensional accuracy controlled to within plus or minus 0.1mm.

LHCD laying head unit - Key Facts

The laying head tube is designed on the basis of smooth and continuous laying curves, thus alleviating wire rod resistance and causing less wear on the head tube, which extends service life.



Side view of the laying head unit



Coils of the high quality wire rod produced by the LHCD laying head

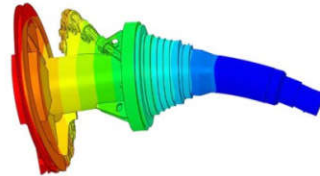
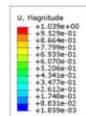
The designed speed is 140m/s and the guaranteed speed is 120m/s, equivalent to the world-leading levels. This greatly improves output and mill utilisation ratio.

The mill can adapt to single-pass rolling and free-specification (all-passes) rolling. The consumption of roll collars can be reduced; the rolling production becomes more flexible.

The head is mechanically equipped with a new-model damping mechanism and is manufactured with a lower ratio of length to diameter. This improves the head's rigidity and absorbs mechanical vibration.

The laying head's swing function can improve distribution of wire rods and array them in more dense and compact forms.

A specially-designed wire loop upgrades the circular shape of the head and tail of the wire-rod, and helps to control the whipping of wire-rod tail. The wire loop is of a modular structure, easy for change.



Step: Step-2
Node: 5; Value = 1.440766e+05 Freq = 60.411 (cycles/time)
Primary Var: U1 Magnitude
Deformed Var: U1 Deformation Scale Factor: +1.000e+03

A 3D model of the laying head's rotor

High-speed water cooler and enclosed-loop temperature control system - Key Facts

Water cooling nozzles have been designed as split and embedded structures. The inner cores can be changed so as to save the nozzle spares and increase availability.

High-speed wire-rod rolling puts big demands on the controlled temperature (cooling) and controlled rolling process. CISDI-developed software can simulate the temperature distribution of the entire rolling line. This provides an effective guide for the offline water cooling process design.

A stable and sensitive control for the water cooling box switches can ensure the shortest possible uncooled segment on the wire-rod's head and tail ends. Such highly-accurate temperature control creates better uniformity throughout the full length of wire rod and ensures stable product performance.

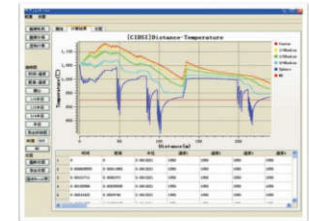


Diagram of the controlled-temperature and controlled-rolling simulation software, which guides the offline water cooling process design



Diagram of the water cooling box control

The brand-new high-speed wire-rod rolling technology featured by independent dual modulars

CISDI is leaving no stone unturned in its bid to create the high-speed wire-rod rolling technology of the future.

Currently the high-speed wire-rod mill is centrally driven by a large power motor, has a complicated structure and is dogged by uncontrollable vibration, noise and high operation costs.

CISDI resorts to Theory of Inventive Problem Solving (TRIZ or TIPS) to develop a trailblazing dual-modular wire-rod finishing mill which has a separately driven motor.

It features three major technical advancements - the SRSCD reducing and sizing mill, the LHCD20 laying head and an individually-driven finishing mill.

Technical highlights:

The dual-modular-based high-speed wire-rod mill equipment can completely replace the conventional 10-stand or 8-stand finishing mill which relies on centralised-controlled motors. It features the following technical and economical advantages:

- 1) A more flexible configuration of mill stands and a more adaptable arrangement of inter-stand gap. There are one to five modulars available which can be used in numerous combinations to cater for different product orientations - an effective means of achieving differentiated rolling lines.
- 2) Ability to cool between the mill stands,

which effectively controls the temperature rise of work-piece, enhances product performance and bring about cost savings. A more flexible single-pass reduction ratio facilitates an adaptable pass design. Individual control of rolling speed and tension between the modulars improves product's dimensional accuracy and performance.

3) A simpler equipment structure, which can be arranged in a more compact way. A shorter driving chain makes installation and maintenance easier and ensures a more stable operation at a high speed.

4) Significant cost savings from a reduction in roll consumption, spare parts and quantities of roll collars.

5) The dual-modular finishing mill and SRSCD reducing and sizing mill are

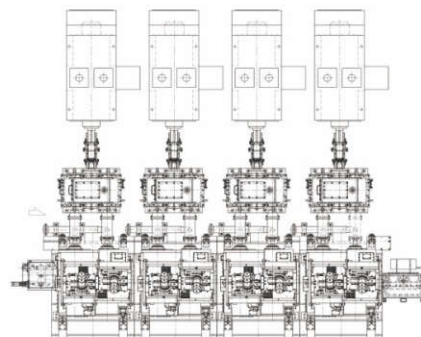
equipped with $\phi 230\text{mm}$ super-heavy machinery models; the reduction gearbox and roll housing can be mutually replaced, which greatly reduces the specifications and quantities of spare parts.

6) The innovative finishing mill uses low-power standard motors and low to medium voltage drives instead of the conventional large-power motors and high-voltage drives. This shortens the lead time of the motor and reduces investment and operation costs.

7) The idle mill stand can be brought to a halt without consuming electricity, unlike the conventional version, which has to be running without any loads but while still consuming electricity. The new model, with three modulars in use, would reduce power consumption by 30 per cent per tonne of steel.



Dual-modular finishing mill for a high-speed wire-rod rolling line



A configuration chart for the new dual-modular finishing mill

A wide range of applications

The first supply of CISDI's modularised reducing and sizing mill was to the stainless steel high-speed wire-rod line at Jiangsu Yasheng Metal Products.

The mill has been started up and the main



CISDI's SRSCD reducing and sizing mill

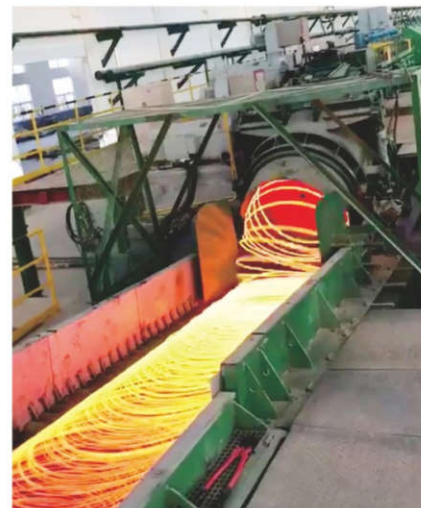
technical figures have reached world-leading levels.

Yasheng's wire-rod line is to take up CISDI's proposal for a process of eight plus two stands. Compared with the conventional 10-stand process, the eight finishing stands will have a dimension of $\phi 230\text{mm}$ barrel length, there will be two sizing stands and supportive controlled cooling facilities.

The two-stand sizing mill is based on CISDI's new design concept, which has a modularised multi-gear-ratio driving mechanism and a compact arrangement.

The first domestic reference saw a high accuracy of product dimension and a high surface quality. The rolling line has successfully rolled out small specification $\phi 5.3\text{mm}$ stainless steel wire rods with a dimensional accuracy to within plus or minus 0.05mm , a world-leading level.

The dual-modular finishing mill has been also successfully implemented at the high-speed bar rolling line and light bar rolling line in South Liaoning. It has become a preference for the new or rebuild projects.



The LHCD20 laying head in operation, spouting the coiled rods out at Yasheng's stainless steel wire-rod line

CISDI REPORTS ON SUCCESSFUL PILOT FOR DEVELOPMENT OF CHINA'S FIRST CASTING PROCESS

CISDI reported on its role in research into China's first development in casting at a science and technology programme for China's 12th five-year plan.

At an experts' review meeting in late January, CISDI spoke on the critical technological development of ultra-thick slab casting and typical grades of ultra-thick plate rolling during the research topic, *Development and Application of High-quality Special Steel: New Minimill Process*.

CISDI reported that a pilot ultra-thick slab casting shop had been built, and that all target indicators had been reached. The results of the pilot study had recognised by the experts, teamed up with Xinyu Steel and

China Iron and Steel Research Institute Group.

The pilot, a rolling ultra-thick plate process which aims to supersede conventional die-casting continuous casting, is China's first casting development.

The innovation will cut operation costs and save energy while creating economic and social benefits.

Twenty theses have been published and seven invention patents have been applied for. Six have been granted. Standardisation is also being conducted, including four national standards and one industry standard.



Xinyu Steel's slab caster was built by CISDI on a package supply basis. It is now producing 420mmx2,400mm-sized ultra-thick slabs

CHONGQING STEEL AND CISDI

Working together a combined enterprise and research platform for accelerating industrialisation

Many positive results have been achieved in the five years since Chongqing Steel and CISDI joined forces to develop new innovations.

The steel giants formed an enterprise and research platform at Chongqing Steel's Changshou Plant in July 2012.

Their quest was to develop new grades, improve product quality, reduce operation costs and maintain stable production.

In the first phase of the project, research into 13 subjects was carried out. They included converter's duplex dephosphorisation, automatic feeding of the optimised converter and dynamic soft reduction of the optimised caster.

In the second phase, six new subjects were introduced, covering ironmaking,

steelmaking and energy conservation. Nitrogen recovery of pulverised coal injection, optimised shearing quality by rotary dual-sided cutters, and optimised oxygen duty system were the focus.

The platform has now researched the full process for steel production. Both Chongqing Steel and CISDI are conducting synergised studies on production management, IT, flow optimisation, grade development, production technology, critical equipment, control technology, energy conservation, environmental protection and resources integrated reutilisation.

Of the 30 subjects, 25 have been concluded and the research results have been transferred to industrial production.

© Enterprise-level cost evaluation system

To assist Chongqing with greater cost savings, the platform completed a procedure-based cost evaluation system.

By monitoring online data, the lean production cost calculation and examination system made a dynamic analysis on costs and energy consumption during production and operation.

The intention is to tap the potential for

reducing cost and improving efficiency, and to provide support in decision-making by top management.

This cost calculation and examination system has been successfully verified at the hot strip mill of Chongqing Steel. The shortest calculation and examination cycle is less than 24 hours. It displays consummate functions stably. A full coverage of enterprise-level costs is checked.

© RH multi-functional top lance

SCAP top lance for RH refining process was put into use as an industrial pilot test at the No.1 duty position of Chongqing Steel's 210t RH refining facility in March 2017.

SCAP is named after its technical connotation - supersonic, co-jet annular nozzle and powder-spraying.

It is a multi-tasker, blowing oxygen, spraying coal powder, providing secondary combustion of carbon dioxide for heating the vacuum tank in a vacuum condition; baking the vacuum tank and melting the frozen steel by fueling the gas in an atmospheric condition.

The top lance has an automatic ignition and flame monitor, and continuously measures temperature.

Over 2,000 heats were tested at

Chongqing Steel's 210t RH facility, treating around 420,000 tonnes of liquid steel.

The test results proved the SCAP top lance to be reliable, safe and easy to maintain, and with much less slag stuck.

All industrial pilot test performance indicators meet production requirements, and the future looks bright for industrialisation.



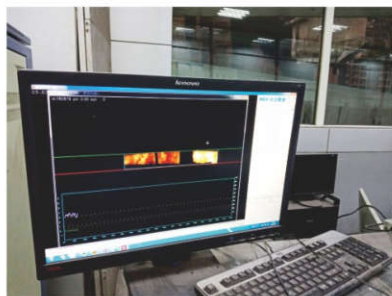
© BOF's iLance

Chongqing Steel's basic-oxygen furnace is undergoing a year-long iLance system test.

Data are being continuously acquired, and the splashing during smelting is being analysed. A method of intelligent identification of splashing and prevention control is being built, and is presently reaching a hit ratio of 97%.

Software and hardware platforms are being established for picking up, accumulating and passing on experience and knowledge.

The iLance system takes care of every specific requirement at various process control levels and will serve to solve practical problems at the steelmaking plant in an intelligent manner.



A screen shows the iLance system analysing the splashing data at the BOF steelmaking plant

CISDI'S ROTARY HEARTH FURNACE

CISDI self-developed rotary hearth furnace is an environment-friendly treatment for solid waste.

The furnace utilises coal-based direct reduction technology to treat metallurgical dusts containing zinc.

Cooled dusts are reduced to metallised pellets within 15-25 minutes. This process allows iron, carbon and zinc elements to be recovered from the smelted zinc and alkali-rich dusts.



PROJECTS IN DETAIL



Baosteel Zhanjiang's rotary hearth furnace project

- Raw materials to be treated: blast furnace secondary dusts, converter's OG dusts, dedusting ashes from refining procedure
 - Treatment capacity: 200,000t/a
 - Technical indicators: metallisation ratio $\geq 75\%$; dezincification ratio $\geq 85\%$
 - Product to be used as the raw materials for the blast furnace and converter.
- Started up in June 2016



Yanshan Steel's rotary hearth furnace project

- Raw materials to be treated: blast furnace dusts from bag filter system, ore bin dusts, steelmaking dedusting ashes
 - Treatment capacity: 200,000t/a
 - Technical indicators: metallisation ratio $\geq 70\%$; dezincification ratio $\geq 85\%$
 - Product to be used as the raw materials for blast furnace and converter.
- Started up in June 2015