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The laying head test run takes place at ASSB's high-speed wire-rod mill

IN THIS ISSUE

CISDI

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 INSTIGATES LAUNCH OF UNITED FRONT

to advance China's green and smart electric arc furnace industry

Attendees at the inauguration of China's Green and Smart EAF Industrial League in Chongqing on February 2

CISDI and University of Science & Technology Beijing (USTB) have teamed up to launch the first cross-China federation aiming to advance the technology which will upgrade the country's electric arc furnace industry.

China's Green and Smart EAF Industrial League, based in Chongqing, launched on February 2. Its 21 members from across the country include electric arc furnace manufacturers and suppliers, science and technology research institutes and trade organisations.

The formation of the league comes against the backdrop of China's determination to make its technology processes and upgrades greener and smarter. It will push China's electric arc furnace technology to become more efficient, cleaner and more environmentally-friendly, which will aid the development of electric arc furnace steelmaking and mini-mill construction.

The League plans to set up platforms for research and development, standardisation and application.

It hopes to develop greater interaction between enterprises, universities and research institutes and create a new eco-manufacture chain for full production process, multi-faceted management and full product life-cycle.

In its role as one of the initiators of the league, CISDI set up research and development management systems characteristic of an engineering company and created a complete technological innovation eco-chain covering theoretical study to lab research, pilot base, engineering design and industrial application.

CISDI has successfully developed a new-generation green electric arc furnace, with the support of its own national technology research centre and the State's scientific and technological programme.

The CISDI-Green EAF upgrades the technology and production process of a conventional EAF.

CISDI's many years of exploration and experience have enabled the company to create a synergised environment-friendly EAF design, manufacture, management and research process, enabling the design and manufacture of EA equipment. The new generation arc furnace is in line with and some areas exceed world-leading technical and economical indicators with excess fume heat from the smelting process used for pre-heating the scrap and effective dioxin control. This latest technology greatly reduces energy consumption and ensures hazardous effluent is discharged in compliance with national and regional standards.

A site photo of a 90 tonne CISDI EAF exported to VINAKYOEI STEEL in Vietnam

One successful reference is the export of a high-impedance, ultra-high power EAF which uses 100% scrap as the main raw material for smelting and consumes only 385kW·h of energy per tonne of steel, a world leading figure for 100% scrap production.

BAOSTEEL ZHANJIANG ACHIEVES WORLDCLASS LEVELS

thanks to CISDI's no-bell blast furnace top technology and equipment

Mega-blast furnaces at Baosteel's Zhanjiang plant have been officially recognised as reaching world-leading levels.

The evaluation comes from the Chinese Society for Metals, who carried out an evaluation forum at the plant and examined the scientific and technological benefits achieved by the application of CISDI's mega-blast furnace no-bell top key technology and equipment.

After investigating Zhanjiang's blast furnace 1 and 2 central control buildings, casthouses and command centres and examining all the documentation, the reviewers came to a consensus that the applications had reached world-leading levels.

All key technologies and equipment were solely developed by CISDI and have been granted 55 patents, including 21 patents of invention and four overseas patents.

In addition to Zhanjiang's two blast furnaces, CISDI's no-bell key technology and equipment have been successfully incorporated into over 10 mega-blast furnaces, including those at Baosteel Shanghai, POSCO and Formosa Ha Tinh. Strong social and economic benefits have been praised by CISDI's clients.

Key innovations of CISDI's no-bell blast furnace top:

- The BCQ (Baosteel, CISDI and Qinye) top distributor at the core of the patented technologies and equipment has a simple structure, works reliably, gives an extended service life and withstands high pressure and high temperature. This contributes to higher-precision production

- Self-reliant top equipment and facility enables the blast furnace to run smoothly, operate more efficiently and consume less energy, ensuring an overall enhancement of the blast furnace's production indicators and stable operation

Pilot test equipment for a 5,000m^3-level blast furnace no-bell top system, at a scale of 1:1

The serial-hopper no-bell top

The parallel-hopper no-bell top

TEST RUN OF ASSB MILLS ACHIEVES TOP ROLLING SPEEDS

Celebrating the startup and test run stage of the high-speed wire-rod mill and bar mill at ASSB

ASSB's high-speed wire rod mill and No.2 bar mill were successfully started up and put through a test run at the end of last year.

This successful startup occurred only twelve months after order placement.

During the test run, the high-speed wire rod mill's maximal rolling speed was set at 105m/s and the No.2 bar mill's speed at 45m/s, which compete with global mill statistics.

Project-based company ASSB - Alliance Steel (M) SDN BHD - is the first project in the Malaysia-China Kuantan Industrial Park.

Once completed, it will be the biggest steelworks in Malaysia and the most competitive producer of high-quality long products in Southeast Asia.

Its production target of 3.50 million tonnes a year of high-end bars, wire rods and H sections will supply demand in Southeast Asia.

CISDI is responsible for the process design

CISDI-supplied mill stands at ASSB

The laying head test run takes place at ASSB's high-speed wire-rod mill

and package equipment supply of the mills as part of its contract to produce ASSB's overall design, logistics management and core equipment package supply. The project is a prime example of the Chinese engineering company's excellence in design, manufacture, automation commissioning and system integration.

The automaton-controlled mills are the most technologically advanced in Malaysia and were completed to a tight construction schedule significantly shorter than timescales for similar projects around the world.

CISDI's independently researched and developed equipment installed at ASSB includes short-stress path rolling mills, flying shears and DC main drives. Applied key technologies include direct rolling, groove-free rolling, no-twist rolling, high-speed rolling and TMCP (Thermo Mechanical Control Process).

CISDI engineers and SV employees give commissioning guidance at the ASSB site

BLAST FURNACE 2 STOVES ARE HEATED UP AT FORMOSA HA TINH STEEL TWO MONTHS EARLY

The stoves of blast furnace 2 at Formosa Ha Tinh steelworks were heated up in January, two months ahead of schedule and a major stepping stone towards the blast furnace's hot commissioning.

Formosa Ha Tinh Phase One has twin blast furnaces, both with a volume of 4,350m^3.The first has been running stably since start-up last May.

Blast furnace 2, currently under construction at Formosa Ha Tinh steelworks

Production at blast furnace 1 at Formosa Ha Tinh steelworks, running smoothly

Systems at the second are approaching the final stages in readiness for hot commissioning and start-up. The hot commissioning spare parts are due to arrive at site in mid March and start-up is scheduled for May.

Once the twins are operating, Formosa Ha Tinh expect to boast world-beating performances. The ironmaking plant will save 140,000 tonnes of coal and reduce emissions of carbon dioxide by 600,000 tonnes every year. In addition, workforce productivity is expected to increase to triple that of conventional blast furnaces.

CISDI-designed and -constructed blast furnace 1 showcases CISDI's high-efficiency and low-consumption blast furnace key technologies and no-bell top equipment.

The daily tapping output of this blast furnace can achieve a maximum of 9,425 tonnes, some 290 tonnes more than the guaranteed daily output of 9,135 tonnes. Its 4,000m^3-level blast furnace technology, standard and equipment have been widely recognised as a successful package export.

The Ministry of Industry and Information Technology of the People's Republic of China listed the development of the Formosa Ha Tinh steelworks in a report on China's Top 10 Major Events of 2017. It was the only engineering project to be given such an honour.

CHINA'S FIRST MEMBRANE-STRUCTURE STOCKYARD CREATED FOR RIZHAO STEEL

The environmentally-friendly Rizhao Steel stockyard has latticed shells and membrane structures

CISDI achieved numerous industry firsts during its creation of a unique new environment-friendly stockyard for Rizhao Steel in China.

It is the first large-scale metallurgical industry stockyard to be fully enclosed with a membrane structure.

Membrane structures have numerous advantages over regular enclosures, which are usually made from coloured steel. They are more lightweight, have better resistance to corrosion and require less maintenance. In addition, they have a more pleasant appearance and give better access to daylight.

Built by CISDI on an EPC basis, the new stockyard went into operation late last year, becoming the largest single floor membrane building in China and CISDI's first demonstration of utilising new material for stockyards.

The structure has a latticed shell over which a membrane skin is stretched and the stockyard project required an online build which was complex and challenging. Site space was also at a premium with complex existing facilities coupled with a tight schedule.

CISDI applied a number of advanced technologies to master the complexities of the new materials and processes it was working with. They ranged from large-area tensile membrane design and installation to computational fluid dynamics-based flow field simulation and finite element analysis strength simulation.

To ensure the work did not interfere with production, CISDI kept meticulously to a tight time schedule, completing the joining of the first latticed shells in just over two months - the fasted construction cycle of its kind. The entire project took 220 days.

CISDI'S BLAST FURNACE FAST REVAMP TECHNOLOGY

contributes to higher efficiency and lower consumption operation of the steelworks

Revamping a blast furnace dramatically upgrades its quality and performance. Results achieved include higher efficiency, intelligent energy conservation and greater environmental protection.

CISDI has a strong reference list of fast revamp expertise, having worked on multiple major blast furnace projects.

Its fast revamp service provides:

- **A complete technological diagnosis and process optimisation before the revamp operation, including**
  - blast furnace optimised profile design
  - long hearth campaign diagnosis and analysis
  - blast furnace shaft diagnosis and analysis
  - hot stove system diagnosis and optimisation
  - PCI system diagnosis and optimisation
- **Significant improvements in energy conservation and environmental protection**
- **Flexible and fast revamp and expansion expertise**

Technological diagnosis and process optimisation technology

A profile ensures long service life, high efficiency and low consumption

CISDI' blast furnace technology provides the most appropriate optimised profile design considering raw material and fuel conditions with a goal of long service life, high efficiency and low consumption. CISDI's designs come from analysing the long-term operations and testing of its many blast furnace installations world wide.

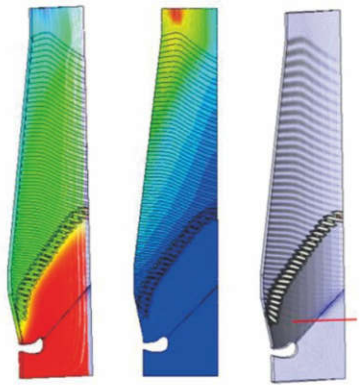
CISDI took the lead on the bosh gas volume index theory for a mega blast furnace, and from it developed blast furnace simulation studies for a range of internal smelting characteristics in furnace hearth, bosh, belly and shaft zones. Simulations addressed temperature field, press field and mass field of the internal zones.

This work created a solid foundation for the design of tailor-made profiles which reduce the vulnerability of coolers in a thin-wall furnace's bosh and shaft zones. Damaged coolers can cause abnormal distribution of gas flow inside the furnace.

To solve this problem, CISDI have invented a three-section furnace shaft and bosh structure equipped with both cooling plates and cooling staves. This combination of coolers is tailored around gas flow movements in the different zones and the furnace lining corrosion rules.

The unique streamlined profile extends the service life of the furnace and improves gas flow distribution.

The combined coolers for furnace bosh, cooling plates and cooling staves



Diagrams showing blast furnace simulation

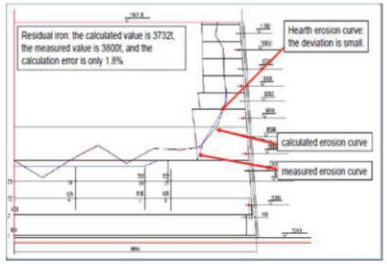
Furnace hearth status - CISDI's diagnosis and analysis technology

The hearth counts one of the most important factors in blast furnace service life.

CISDI's research and development teams have created a complete set of hearth long service life design and technology systems and systematic evaluation methods for the hearth service life.

A hearth design encompasses optimized refractory configuration, highly-efficient cooling staves, a cooling water system and intelligent monitoring. CISDI's evaluation methods assess the existing hearth remnant thickness of carbon block and activity state, plus the status of salamander. This provides a thorough basis for decision-making in a hearth rebuild project.

The intelligent diagnosis and management model for a blast furnace hearth



This graph shows how closely the calculated effects of hearth corrosion in a 4,000m^3-level blast furnace matched the actual measured effects of corrosion.

The accuracy of the calculated prediction could then be taken as a scientific basis for exacting methods for discharging the salamander from the hearth. In a hearth rebuild project this facilitates fast and smooth emptying of the remaining iron and saves schedule time.

Furnace shaft diagnosis and analysis technology

The cohesive zone of the furnace shaft comprises of two subzones, wet and dry - and they differ greatly in service life.

The wet subzone is generally defined as the furnace bosh, belly and lower shaft, which reply on skull on the hot side of the coolers for protection. The dry subzone is generally located in the middle and upper shaft, and can be protected in the early stages of production by the carbon block lining and by the coolers in the latter stages.

CISDI has multiple solutions for protecting the bosh, belly and lower shaft from very high temperatures, in accordance with the raw materials used and fuel conditions and operations.

Its 6-tube intensified cast-iron cooling stave technology was successfully applied to Baosteel Zhanjiang's 5,050m^3 blast furnaces. Copper cooling stave technology has been applied to Baosteel's blast furnace 1, and combined plate and stave technology has been applied to Anyang Steel's blast furnace 3.

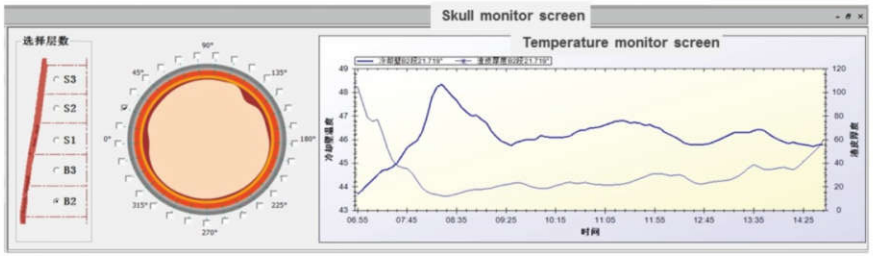


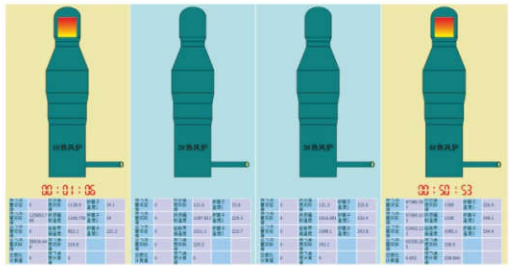
Diagram showing the dynamic online model for blast furnace skull state

Stove system diagnosis and analysis technology

As blast furnaces near the end of their campaign life, their hot stove systems are subject to weakening high blast temperatures and overheating in the hot blasting pipeline. In such circumstances hot stoves can struggle to provide the high temperature blast needed for the furnace.

After extensive research on three models of hot stove systems - internal combustion, external combustion and top combustion - CISDI has created specific technologies to deal with these issues.

Its stove system diagnosis, stove automatic burning model and stove opimised rebuild technologies are now available for clients needing to change their existing stove system or add new stoves.



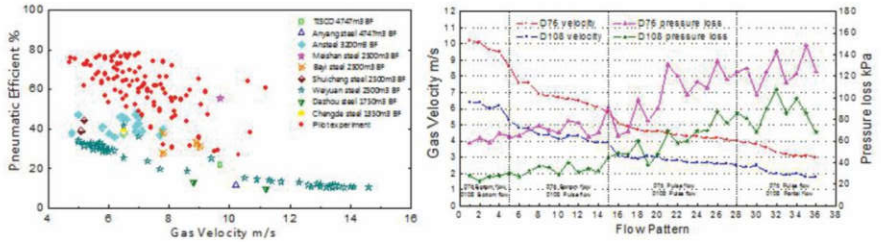
Hot stove automatic burning model

Site image of a stove system rebuilt as a top-combustion model

PCI system diagnosis and optimisation technology

Uniformity and stability can fail in pulverized coal injection systems and the change of injecting distance and coal quantity can block the injecting lance.

CISDI has conducted industrial pilot tests of PCI systems, simulating real working conditions, to find solutions to these problems. Test results showed a clear relationship between design parameters and operating data for different injecting distances and different coal quantities.



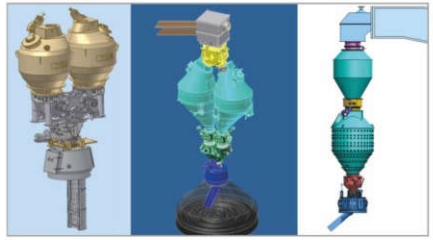
Charts showing the data analysis process for optimising PCI parameters

Complete core equipment series

CISDI has range of core equipment and manufacturing expertise for mega blast furnaces. Equipment can be configured for rebuilds and delivery times and costs are highly competitive.

Its products and services are high quality, precise and reliable and include high-temperature top-combustion or external-combustion stoves, large-sized no-bell top, environment-friendly and energy-conserving slag granulation facilities and dry-way dedusting facilities for 5,000m^3-level blast furnaces.

The top-combustion stoves for a 5,000m^3-level blast furnace, blasting a high temperature of 1,280℃



CISDI's new-model no-bell top equipment

An environmentally-friendly, energy-conserving slag granulating drum equipment on-site at a 4,747m^3-level blast furnace

Dry-way dedusting facility for a 5,000m^3-level blast furnace

Energy conservation and environmental protection technology

Rebuild cannot but a good opportunity of upgrading the energy and environmental benefits of blast furnace systems.

Besides the conventional profile optimisation, high-temperature stoves and efficient granulating drum technologies, CISDI has developed the advanced and reliable furnace top pressure equalizing and gas recovery technology. Such a technology can, on one hand, increase recovery of the blast furnace gas (BFG) per tonne of hot metal by about 5m^3, and on the other, more importantly, be a good player to optimisation and upgrading of the working environment.

The clean operating environment of a casthouse platform for Baosteel Zhanjiang's 5,050m^3 blast furnaces

CISDI's top equalizing and BFG recovery technology, in operation at Baosteel Zhanjiang 5,050m^3 blast furnaces

Flexible fast revamp and expansion expertise

CISDI provides both conventional and modularised technologies for the fast revamp and expansion of blast furnaces. Its tailored rebuilds are carried out to short schedules and result in significant economies.

Optimal blast furnace volumes are calculated on system capacities and evaluation of integrated operational benefits.

The process of a fast revamp for a blast furnace with a volume of over 4,000m^3

References for CISDI's fast-revamped blast furnaces

S/No.	Client name	BF numbering	BF volume before rebuild (m^3)	BF volume after rebuild (m^3)	Reconstruction days	Startup year	Service mode
1	TISCO	BF5	4,747	4,850	under construction	2017	E
2	Benxi Steel	BF6	2,650	2,650	under construction	2017	
3	Benxi Steel	BF7	2,650	2,650	72	2017	E
4	Yingkou Steel	BF1	450	600	64	2017	EPC
5	Yingkou Steel	BF2	450	600	77	2017	EPC
6	JSW DOLVI	BF1	2,508	4,323	146	2016	E
7	Rizhao Steel	BF11	850	1,000	55	2016	EPC
8	Rizhao Steel	BF12	850	1,000	56	2016	EPC
9	Shaoguan Steel	BF6	750	1,080	144	2015	EPC
10	Handan steel	BF4	920	1,080	110	2014	EPC
11	Baosteel	BF3	4,350	4,850	76	2013	E
12	Baosteel	BF1	4,063	5,046	78	2009	E
13	Baosteel	BF2	4,063	4,706	98	2006	E

CISDI REPORTS PHASED IMPLEMENTATION OF TECHNOLOGICAL TEST OF COKING WASTE WATER TREATMENT

Treatment of coking waste water has long been a problem for the global environmental industry.

Produced during the chemical production of coke, tar and gas, with coal usually the primary raw material, it is a highly-toxic and carcinogenic liquid.

Its complicated chemical composition includes benzene ring, heterocyclic oxygen, nitrogen organic matters and ammonia, cyanide, thiocyanide and fluoride.

It is hard to treat with biological methods because of its biodegradation characteristics, so additional advanced treatment methods are needed to achieve the required discharge or recovery standards.

CISDI recently set up a brainstorming team to research coking waste water treatment technology and develop key equipment to make the process easier, more efficient and less expensive.

The team has studied a biological process of two-step A/O intensified decarburisation and denitrification and a process based on advanced oxidation and resin absorption.

It aims to make the biological treatment more efficient and reduce the cost of the advanced treatment.

Biological treatment tests have now been running continuously for six months and investigations are still underway.

But an innovative combined system of moving bed biofilm reactor (MBBR) and an activated sludge process is achieving its design function of intensified denitrification and withstanding impact loads.

The first stage of tests has resulted in an enhanced efficiency and lays a solid foundation for the second stage - how to lower the cost of advanced treatment methods.

CISDI has completed the phased implementation of its analysis of the coking waste water treatment global problem. Through hundreds of tests and monitoring procedures and dozens of adjustments and optimisations of working parameters, CISDI has gained the know how to develop ground breaking technology in this field and an industrial pilot test plant should soon be on the agenda.

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 ≥75%; dezincification ratio ≥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 ≥70%; dezincification ratio ≥85%
- Product to be used as the raw materials for blast furnace and converter.
- Started up in June 2015

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