HIRDA-BF
Blast furnace charge level Infrared thermal imaging online temperature detection and analysis system
Technical Solution

Contents

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1 Overview

The blast furnace is an ironmaking equipment and the first step in steelmaking. Iron ore is smelted in the blast furnace before It can produce pig iron blocks for various purposes or molten iron for steelmaking.

The blast furnace production process is the process of smelting iron ore into pig iron at high temperature . Iron ore, coke, and slag flux (limestone) are loaded from the top of the furnace, and preheated air is blown in from the tuyere located at the bottom of the furnace along the furnace periphery. At high temperatures, the carbon in the coke (some blast furnaces also inject auxiliary fuels such as pulverized coal, heavy oil, and natural gas) The oxygen introduced into the air undergoes a combustion reaction, producing high temperature and reducing gases. These reducing gases rise through the The slowly descending charge is heated during the heating process and the iron oxides in the iron ore are reduced to metallic iron.

Blast furnace ironmaking is a relatively complex process, and it is necessary for blast furnace operators to be able to easily understand the distribution of materials. The temperature distribution in the entire furnace at the front and rear, the direction of the airflow, and the distribution of pipe leakage, material collapse, material surface inclination, etc. At the same time, the operating conditions of other equipment in the furnace can be observed, such as: Chute, cross temperature measurement, probe, etc.

Therefore, timely acquisition of information inside the blast furnace during the smelting process helps blast furnace operators to better control Blast furnaces change from passive to active operation to avoid accidents and make blast furnaces safe , stable , high-yield and low-energy The goal of consumption and longevity is to achieve good social benefits and huge economic benefits.

2 System Introduction

2.1 Product Description

HIRDA - BF Blast furnace charge surface infrared thermal imaging online temperature detection and analysis system is a system specially used for Special equipment for detecting the temperature distribution of the material surface in the blast furnace. The system consists of an infrared thermal imaging core, a high temperature resistant infrared External thermal imaging lens, automatic retracting protection device, furnace installation kit, air filtration system and field equipment box, It consists of algorithm server and intelligent temperature measurement software.

The high temperature resistant infrared thermal imaging lens is installed in a retractable metal protective cover, and the The high temperature resistant infrared thermal imaging lens is directly inserted into the furnace, and the infrared thermal imaging core stays outside the furnace to achieve the furnace Continuous real-time monitoring of the operating status of the system.

The shield is cooled by compressed cooling air, so that the infrared lens can work at a more suitable temperature; At the same time, the lens is purged to prevent the dust in the furnace from adhering to the lens protection window; the system has built-in high temperature protection Circuit, once the cooling gas or cooling water circulation abnormality occurs, the lens will be retracted to prevent damage by the high temperature in the furnace.

It has the characteristics of high temperature resistance, corrosion resistance and maintenance-free, and can display various complex processes inside the blast furnace in real time. Under the condition that the camera probe is blowing compressed air normally, it is suitable for various positive pressure kilns.

picture 1 HIRDA - BF Blast furnace charge surface infrared thermal imaging online temperature detection and analysis system product and installation diagram

2.2 System Features

◆ Equipped with all-weather passive infrared temperature measurement function, real-time display of the temperature distribution of the material surface in the furnace

◆ Adopt self-developed temperature measurement and correction algorithm to achieve accurate temperature measurement

◆ Fully sealed to prevent blast furnace gas leakage

◆ Super wide viewing angle, diagonal viewing angle up to 120 °

◆ Spiral air curtain design, no dust accumulation on the lens

◆ Overall stainless steel material, corrosion and temperature resistant

◆ Automatically exit the protection device and exit the fault indication

◆ Pneumatic / electric transmission mechanism

◆ High temperature resistant optical pinhole lens with dustproof and high temperature lens

◆ Automatically exit the furnace in case of over-temperature, under-voltage or power failure

◆ Support onvif Protocol, can be connected to the mainstream NVR

◆ Not dependent on system platform, can log in directly via web page ip Access images and configurations, and export them directly Alarm signal arrives PLC Or alarm

2.3 System utility engineering requirements

2.3.1 power supply

Field probe power supply220VAC 50/60HZ Power

150W/ set Control room power supply: 220VAC

50/60HZ Power100W

2.3.2 Compressed air or nitrogen

Compressed air temperature: ≤ 35 ℃

Compressed air pressure: ≥ 0.4 Mpa

^{air} flow: 0.1-0.2m3 /Min

2.3.3 Cooling water

Cooling water temperature: ≤ 35 ℃

Cooling water pressure: ≥ 0.4 Mpa

Cooling water flow: 30L / Min

3 Application Scenario

Observe the material surface in the blast furnace, and fully understand the operation status of the chute, the wear degree of the chute lining , and the The information includes material discharge status, chute suspension status, chute operation status, etc.

4 Main technical indicators

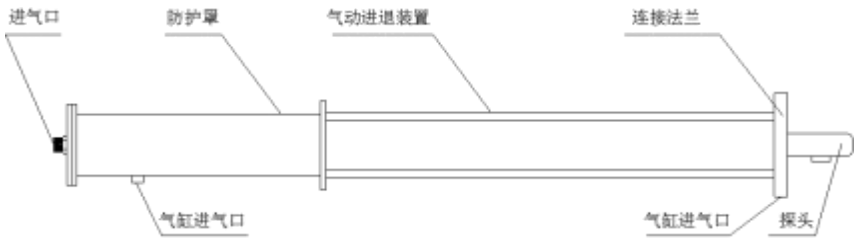
Operating ambient temperature	Furnace temperature	≦ 2000 ℃
	Control System	≦ 80 ℃
Automatic exit device	Automatic exit protection function	The probe can automatically withdraw from the furnace in case of power failure, gas failure, over-temperature or under-pressure. Chamber
	Exit device trip	100-800mm , can be customized according to the furnace thickness
	Manual in and out function	have
Controls	Integrated touch screen system	8 4- way relay Path Transistor
	Three-site control	It can realize the operation from three places: on-site central control and mobile phone
	Detector Type	Uncooled focal plane detector

Infrared thermal imaging	Resolution	640×480, 384×288
	Field of view	diagonal 120 °
	Lenses type	High temperature resistant pinhole lens
	Temperature measurement range	50℃ ~ 1600℃
	Temperature measurement accuracy	± 2 ℃ or 2%
	Network Protocol	support ONVIF/RTSP/FTP/PPPOE/DHCP/DDNS/NTP/UPnP/ TCP
Vortex cooling tube (Optional)	Compressed air inlet ≧0.35MP When the compressed air outlet temperature difference is twenty three Spend	
Protection level	IP67	
Power supply requirements	Supply voltage	AC220V±10%
	Power supply frequency	50Hz
Installation distance	The maximum distance from the equipment to the on-site control box is 15M	

5 System composition

5.1 High temperature resistant probe

The high temperature resistant probe adopts an integrated design, which is resistant to high temperature, high pressure, corrosion, power failure, gas failure, etc. Protection function. The integrated probe integrates high-temperature infrared lens, infrared thermal imaging and pneumatic advance and retreat device.



5.2 High temperature resistant infrared lens

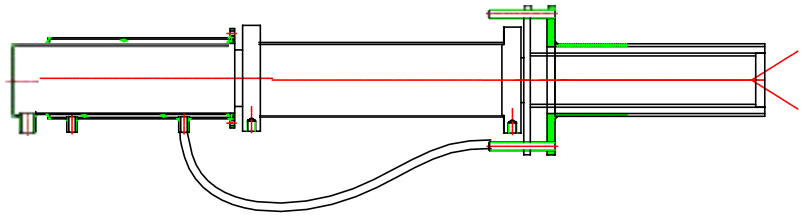
The high temperature resistant infrared lens shell is made of stainless steel, the front end imaging adopts the micro-hole imaging principle , and the reserved method The blue connector is connected to the infrared thermal imaging.

The technical parameters are as follows:

- Field of view: diagonal viewing angle 120 ° ;
- High resistance Temperature :＜2000 ℃;
- Low resistance Temperature: -40 ℃;
- Cooling medium: compressed air (oil-free and water-free);
- Air Intake mouth: Φ 12 , ZG1/2 ″;
- Inlet pressure: 0.1 ～ 0.4MPa ;
- Cylinder air inlet: Φ 12 、 ZG1/4 ″;
- Ambient humidity: 10~90% , no condensation.

5.3 Pneumatic advance and retreat device

The high temperature resistant probe is integrated in the pneumatic transmission device, and the reciprocating motion of the cylinder piston is used to realize the camera detection. The front side of the pneumatic device is equipped with advance and retreat indicators to indicate the "advance and retreat" of the camera probe. Bit” and “abdicationThe internal parts of the cylinder are made of high temperature and wear resistant materials, suitable for high temperature, corrosion and and operate in high dust environment.



The main technical parameters are as follows:

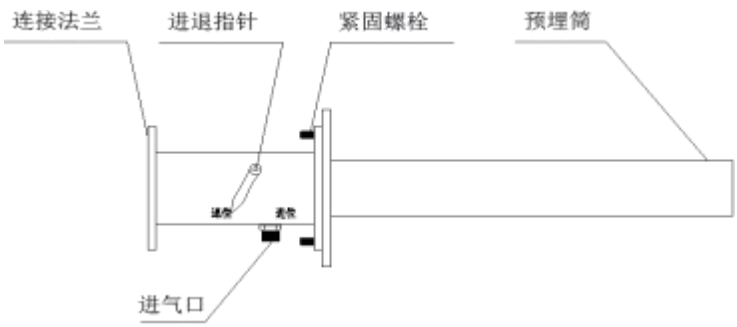
- Cylinder diameter:Φ 100mm
- Working stroke: can be customized according to the thickness of the furnace wall
- Ambient temperature: -40 ℃~ 250 ℃
- Air Intake mouth: Φ 12 、 ZG1/4 ″

5.4 Embedded parts

When installing the equipment, the embedded parts are pre-installed in the monitoring hole, and a special flange is connected to the camera probe. The embedded parts are made of high temperature resistant stainless steel and equipped with special mounting guard plates to seal the four sides of the monitoring hole. The embedded part body is connected to the camera probe. The camera probe is installed on both sides of the embedded part. There is an automatic door installed at the rear end. When the camera probe is pushed forward, the automatic door is pushed open by the front end of the probe. After exiting, the automatic door automatically closes to protect the camera probe from exiting the monitoring position due to lack of protective compressed air. It will not be damaged by high temperature dust inside the kiln.

The main technical parameters are as follows:

- Installation diameter: Φ 110 (standard)
- Buried depth: Determined by the thickness of the furnace wall
- Ambient temperature : < 2000 ℃
- Cooling medium: compressed air
- Air Intake mouth:Φ 12、 ZG1/2 ″

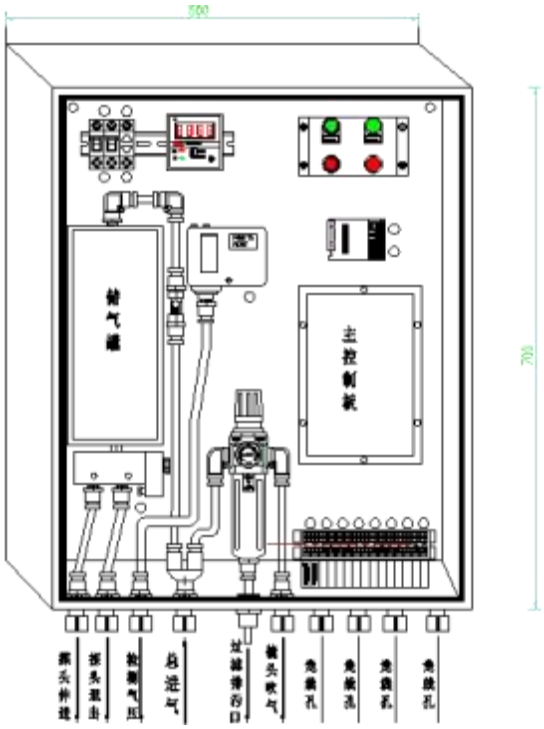


5.5 Control cabinet

The control cabinet provides working power to the camera probe and automatically controls the advance and retreat of the probe. The coded instructions sent out drive the various control functions of the camera probe after conversion. Enter the operation controller to control the camera probe.

The main technical parameters are as follows:

- Power supply: 220VAC/50Hz
- achievement Power consumption: 50W
- Control input: RS485
- Control output: switch
- Power output: 12VDC/1.5A
- Video Input: IP network
- Video output: Network, optical fiber SC interface
- Temperature control: 0-60 degrees
- Gas supply index: 0.4MPa ~ 1MPa , temperature ≤ 40 ℃ , Flow rate ≥ 3m 3 /h
- Gas outlet index:
- Cooling gas: 0.1 MPa ～ 0.4MPa , flow rate ≥ 2m 3 /h
- Purge gas: 0.1 MPa ～ 0.4 MPa , Self-contained air filtration, flow rate ≥ 0.2 m3 / h
- Protection level: IP65
- Dimensions : 700 (width) × 500 (height) × 200 (depth)
- Mounting hole size: 640 (width) × 400 (height) × Φ 10



5.6 Stainless steel hose

Stainless steel hose has the characteristics of high temperature resistance, high pressure resistance and corrosion resistance. In order to facilitate the movement of the camera probe, The cables and compressed air connected to the camera probe use stainless steel hoses as the connecting media.

- Pass path:Φ 12,Φ 10,Φ 8,Φ 6
- catch Mouth: ZG1/2″
- Material: Heat-resistant stainless steel

5.7 High temperature resistant cables

As the ambient temperature at the work site is generally high, in order to ensure stable and reliable communication and video transmission, the cables Choose high temperature resistant, fire resistant, and shielded composite cables.

The main technical parameters are as follows:

- Rated temperature: -65 ℃ ~ +250 ℃ (maximum ambient temperature: 250 ℃, Minimum use environment Temperature : -65 ℃)
- Rated voltage: 600V
- Implementation standard: GJB773A-2000
- Conductor: Stranded tinned copper wire
- Color : red, black DC12V 0.5m 2 ; Orange and white, orange, green and white, green, blue and white, blue, gray and white, Gray network cable.

- Insulator: Polytetrafluoroethylene (PTFE)
- Performance: corrosion resistance, strong acid resistance, strong alkali resistance, oxidation resistance; high voltage resistance, non-flammable , non -aging
- Test voltage: 7000V No breakdown

5.8 Optical cable and interface (on demand)

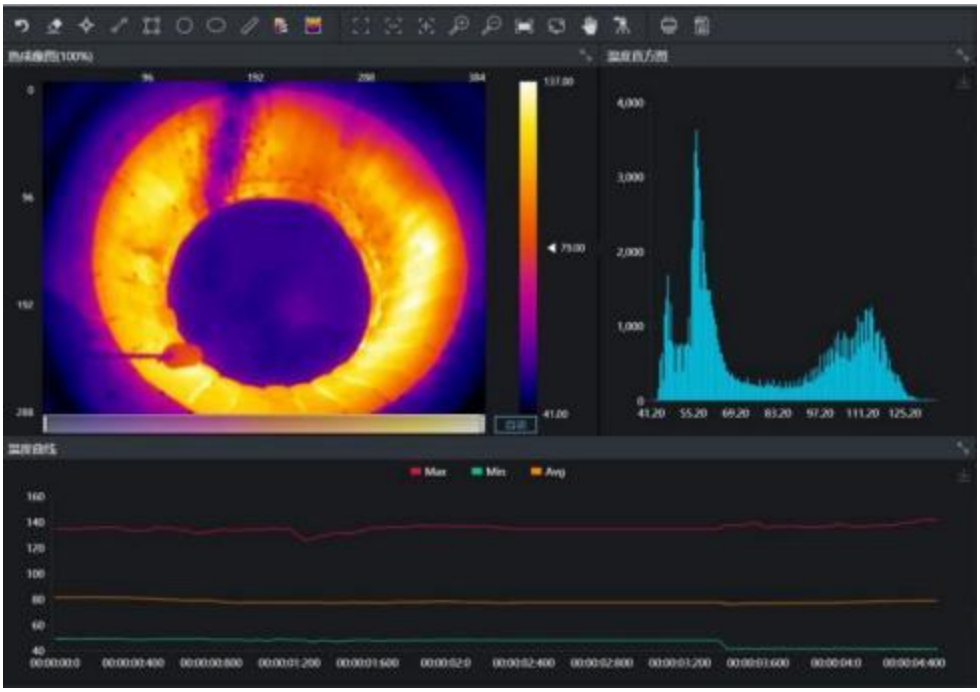
The control signals and video signals transmitted over long distances are all transmitted using single-mode optical fiber. Optical fiber transmission has the characteristics of high signal quality and anti-interference. The signal transmission distance can reach 20km Above. In addition, the system configuration SC Type Light Cable interface, convenient for optical cable connection.

Technical parameters are as follows:

- Fiber type: Single mode
- Working wavelength: 1310nm and 1550nm
- Attenuation characteristics: 13l0nm The wavelength is 0.36dB / km ; 1550nm The wavelength is 0.21dB / km
- Bending loss: Φ 75 × 100 Loop, additional bending loss ≤ 0.5dB
- Fiber optic interface: single mode SC

6 System Software

The system client software interface is shown in the figure bel



picture 2 System software interface

The basic functions of the software are as follows:

1. Real-time video display of the material surface in the furnace: can clearly observe the center position of the airflow, the distribution of the edge airflow, Chute shape, degree of wear of chute lining, chute unloading conditions, chute suspension status, chute operation conditions, etc.

2. Real-time display of the full radiation thermal map of the material surface in the furnace, and the temperature at any position in the infrared thermal map can be checked. The display frequency can be set. The default setting is the same as the cycle of one rotation of the chute. When the chute rotates to the opposite side of the system installation Collect temperature.

3. Temperature tracking: Automatically display the highest and lowest temperature points, highlight the designated temperature range; The habit of blast furnace operators achieves the effect of "cross temperature measurement".

4. Data capture: Thermal imaging image data can be collected regularly for later analysis.

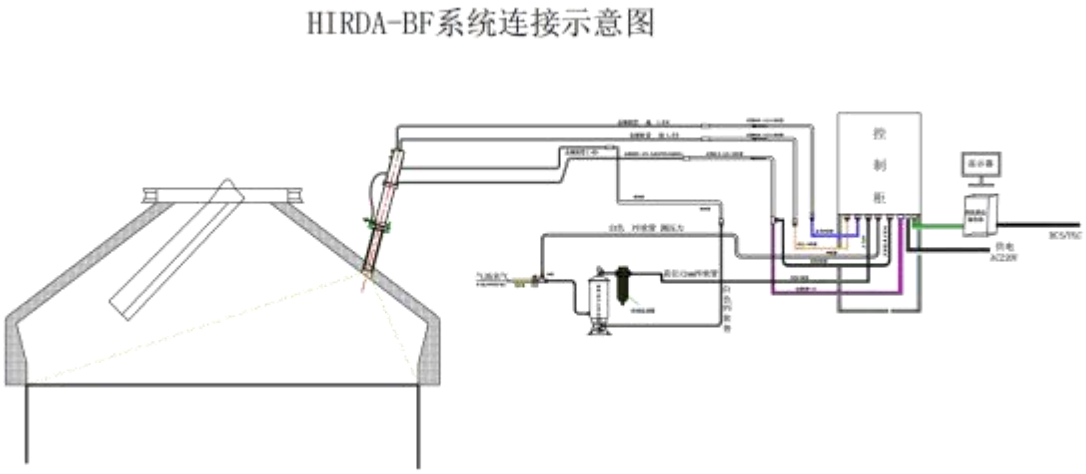
5. High temperature trigger shooting and alarm: When abnormal temperature occurs, the background can detect it in time, trigger the alarm, and the software The background of the software will take infrared and visible light pictures of the incident.

6. Fault self-diagnosis: When a terminal device fails, the system automatically alarms.

7. Customized alarm thresholds and levels: The system can define multiple different alarm thresholds and levels to assist workers The staff will assess the urgency and development trend of the hidden dangers.

8. Data recording: The operation status of the blast furnace can be recorded regularly, and the calculation results of each thermal image and The images themselves can be recorded in the computer and the existing records can be called up for playback at any time

7 System Wiring Diagram



picture 3 System wiring diagram

8 Configuration List

No.	name	model	unit	quantity	Remark
1	Infrared heat for blast furnace Imaging	HIRDA - BF - NX 26 Exx	tower		Resolution: focal length: Temperature measurement range:
2	High temperature resistant probe	HIRDA-HTP	indivual		
3	Pneumatic advance and retreat device	HIRDA-CY	indivual		
4	Embedded parts	HIRDA-EMB	indivual		
5	Control cabinet	SEB 752	indivual		
6	Image algorithm server	IDS	set		Including hardware and software Parts, Display
7	Air Compressor	YBM -15A	tower		Optional
8	Cold dryer	S-100 AFB	tower		Optional
9	High temperature metal hose	φ 12mm	set		
10	High temperature hose	φ 12mm	set		
11	Supporting cables	/	set		
12	Mounting accessories	HIRDA-FJ	set		

9 Division of labor between the two parties

Supplier:

1) Provide HIRDA-BF Manufacturing and operation of infrared thermal imaging online temperature detection and analysis system for blast furnace charge surface Transmission, installation and commissioning services to ensure the normal operation of the system, ensure the integrity of the system, and achieve on-site use requirements.

2) Responsible Choice HIRDA - BF Blast furnace charge surface infrared thermal imaging online temperature detection and analysis system equipment Installation location: provide equipment installation location diagram before construction.

3) Responsible for the purchaser's personnel HIRDA - BF Infrared thermal imaging online temperature detection and analysis of blast furnace charge surface Provide training on commissioning, use, maintenance and overhaul of analysis systems, so that the purchaser can master the operation skills independently. able.

4) Provide relevant technical information such as product certificates, inspection reports, operating and maintenance instructions , etc.

Buyer:

1) Provide HIRDA - BF Installation of infrared thermal imaging online temperature detection and analysis system for blast furnace charge surface Relevant on-site information and design drawings required for debugging.

2) Drill holes at appropriate locations of the kiln and weld embedded parts for equipment installation according to design requirements.

3) Undertake HIRDA - BF Infrared thermal imaging online temperature detection and analysis system equipment for blast furnace charge surface Piping, wiring and fiber fusion of cooling air, cooling water, optical fiber and cables.

4) Ensure that the site has the installation conditions required by the supplier, and notify the supplier's technical staff in advance to participate in guiding the installation and commissioning.

5) The purchaser shall assist in providing working conditions for the supplier's on-site service personnel.

10 Acceptance Criteria

1) Able to HIRDA - BF Blast furnace charge surface infrared thermal imaging online temperature detection and analysis system software The surface shows the production status of the material surface in the kiln. When the cooling air and cooling water meet the use requirements, the thermal imager can Maintain good working results;

2) The system is equipped with cooling water flow monitoring, cooling air pressure monitoring, inlet / outlet device, and equipment temperature monitoring The device is in a state of insufficient cooling air or cooling water pressure, or when the cooling air or cooling water is interrupted or the temperature of the thermal imager is too high. Under normal circumstances, the system will automatically exit to ensure the safety of the thermal imager and high-temperature lens;

3) The supplier shall provide professional training to the personnel designated by the purchaser.

11After -sales Commitment

1) HIRDA-BF The warranty period of the infrared thermal imaging online temperature detection and analysis system for blast furnace charge surface is From the date 12 Months or after the equipment arrives18 Months (Warranty period for purchased products and servers including internal hardware starts from Equipment arrival date calculation 12 months).

2) If the thermal imager is damaged due to water or gas outage, the buyer shall orderspare parts in time and the supplier shall provide maintenance services.

3) HIRDA-BF Blast furnace charge surface infrared thermal imaging online temperature detection and analysis system long-term use, free of charge Provide software upgrade service.

4) Upon receiving a call from the buyer, the supplier is responsible for guiding the buyer to handle the fault; if the buyer is unable to resolve the problem, the supplier promises to48 The company will rush to the scene to handle the problem within hours. The company's service phone number is: 400-080-4288 .