Benxi Iron & Steel POSCO Thickness Gauge Zero Solid Project

Technical Agreements

(FY2024)

Party A: Benxi Iron and Steel POSCO Cold-rolled Sheet Co., Ltd

Signature and seal:

Party B:

Signature and seal:

Company authorities

Signature and seal:

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The user Benxi Iron and Steel POSCO Cold Rolled Sheet Co., Ltd. (hereinafter referred to as Party A) and the supplier (hereinafter referred to as Party B) have reached the following agreement on the thickness gauge of the acid rolling mill, and this agreement has the same legal effect as the body of the contract as an annex to the supply contract.

一、 Introduction to performance and functions

The X-ray thickness gauge in this technical agreement is installed at the first outlet of one and two at the outlet of five of Benxi Steel's POSCO rolling mill to measure the thickness of the strip. One of the outlet thickness gauges has the function of an all-in-one speed measuring machine.

二、the main content and technical parameters

2.1 Measuring principle

Thickness gauge rays work according to the principle of transmission. The source emits X-rays or isotope rays through the object being measured (i.e., the strip).

The intensity of the rays is measured by a detector on the other side of the strip to be tested.

The ionization chamber has always been used as a detector on thickness gauges,

Specially designed for practical applications. As the rays pass through the strip, the strip material absorbs some of the rays. The rest, i.e., the unabsorbed radiation reaches the detector. The detector measures the intensity of these radiations and produces an ionizing current Im, which is proportional to the thickness of the strip. The ionization current is converted into a digital signal in a measurement converter located in a C-frame. This signal is then transmitted to the gauge signal processing computer via an Ethernet connection.

2.2 Technical Parameter Requirements

(1) Measuring range: 1 outlet: 1.0–6.0 mm;

5 outlets: 0.2–2.5 mm.

(2) Measurement accuracy: The detection accuracy required for automatic thickness control of the rolling mill must be met, and the following accuracy is generally required:

Linearity: ±0.05%; or ± 0.15 μm;

Long-term drift: ±0.1%;

Repeatability: ±0.1%;

Statistical noise value (2): ±0.1%;

Total accuracy: ±0.15%. = (square of linear + square of drift + square of repeatability)

(3) Considering the cost and interchangeability of spare parts, the thickness gauge must have a speed measurement function (all-in-one machine), and the spare parts of each frame thickness gauge can be interchangeable, in order to improve the stability of the equipment, the detector must be redundantly designed, the tube must be a cermet tube rather than a glass tube, and its working voltage must be fixed within the full range, and can not exceed 60% of the rated voltage.

The all-in-one thickness and speed measuring machine is installed at the outlet of 1 frame, and its measurement accuracy is as follows:

Repeatability: <±0.02%;

Measurement time: >1ms;

Laser diode: 70mW, 785nm;

Laser class: 3B.

1. Party A's strip condition: the thickness range of the incoming material at the entrance of the rolling mill: 1.8-6.0mm, the width range: 800-1900mm, the thickness range of the strip at the outlet of the rolling mill: 0.2-2.5mm, and the width range: 8

(5) Interface: The interface of Party B's product should be compatible with the field interface to achieve the interchange of general and installed PLC data. Party A is responsible for providing the original communication files and interface protocols to Party B for programming.

Hardwire Input:

Linear speed: 0-10VDC/0–1650m/min

Hard-wired output:

Normal good, 24VDC contact type

Automatic mode, 24VDC contact type

AGC error, ± 10VDC/±200μm

Error (standby), ± 10VDC

(6) The thickness gauge is required to achieve real-time transmission of data tracking with the original Hitachi main PLC, that is, to achieve the same function as the original Toshiba thickness gauge.

(7) It contains other common functions of thickness gauges, such as communication, fault self-diagnosis, historical status recording, X-ray source status monitoring and display and diagnosis.

(8) The thickness gauge requires a database of standard alloy composition and standard compensation value, which can verify the output data in case the data connection fails. For the automatic alloy compensation for different steel grades, the correction system used is obtained from a lookup table on the thickness gauge, or from the setting data downloaded (from the mill computer), or by manual input using a keyboard and mouse.

(9) The thickness measurement error caused by the expansion and contraction of the strip steel when the temperature changes, as well as the angle between the strip steel and the ray beam ≠ 90°, and the resulting error will be corrected by the angle compensation function of the thickness gauge computer, and the thickness gauge should have the function of strip temperature compensation and angle compensation.

2.3 Media conditions that Party A can provide

(1) Compressed air (please provide pneumatic three components)

Pressure: 0.4~0.7MPa;

Maximum oil content: 0.1mg/m3;

Maximum particle diameter: 1μm;

Maximum dust content: 1mg/m3;

Pressure dew point: -40°C.

(2) Power supply

AC： 380V，50Hz；

220 V, 50Hz (single phase);

DC： 220 V，24 V。

If other media are needed, please clarify with Party B.

三、Delivery time

13 months after the contract comes into force.

1. The scope and quantity of supply

|  |  |  |  |
| --- | --- | --- | --- |
| The item code | The name of the item | Number | Additional Packages |
| C2477272 | 测厚仪 | 3 | 1. One HMI (including hardware, software and genuine license) is placed in the main control room of the rolling mill  2. One quality data management system (including server hardware, software and genuine authorization) is placed in the instrument room on the third floor of the rolling mill.  3. 1 notebook for maintenance, including genuine software and genuine authorization required for maintenance.  4. Each is equipped with corresponding control cabinets and server displays, alarm lights, water coolers and other accessories |

五、Design, manufacturing, and inspection standards

Standards and specifications applied:

• DGUV V3 Accident Prevention Regulations - Electrical Systems and Equipment

• DGUV V11 Laser Radiation Implementation Instructions

• DIN 25430 safety mark for radiation protection

• StrlSchG radiation protection method

• StrlSchV Radiation Protection Regulations

• DIN ISO 2919 General Requirements and Classification for Sealed Radioactive Sources

六、 Delivery of materials

The operator's manual includes comprehensive information on proper operation and maintenance of the gauge;

Product certificate or test report;

radiograms;

HMI software installation CD-ROM (or other installation media) and genuine license materials;

Quality data management system software installation CD-ROM (or other installation media) and genuine authorization materials;

七、 Equipment supervision, inspection and acceptance

During the manufacturing of the equipment, the user can send personnel to the factory to supervise the production.

After the installation of the equipment, the user cooperates with the supplier to debug the project.

During the commissioning period, both parties debug and inspect the equipment parameters specified in the annex to the contract.

The basic principles of the assessment:

Each assessment can only start after the confirmation of the on-site representatives of both parties;

If the assessment project fails to reach the guaranteed value for the first time, the project can be assessed again, but it must be completed within the specified time, and the assessment content and standards remain unchanged. If it is unqualified, the seller will be responsible for the follow-up commissioning free of charge. The assessment criteria are subject to technical indicators.

八、Painting, packaging and transportation

Party B is responsible for packaging and transportation. Packaging and shipping standards for equipment; Party B shall be responsible for any damage to spare parts during the transportation process.

九、Relevant requirements for on-site commissioning

1. Adjusting and calibrating the thickness gauge requires the production line to stop.

2. Debugging premise:

1) The thickness gauge is installed correctly;

2) The commissioning personnel can use all the equipment of the measuring instrument without interruption;

3) The required energy such as water and electricity needs to be prepared;

**Cold commissioning (production line needs to be temporarily stopped):**

1) Installation inspection;

2) All analog input and output parameter settings;

3) Check the interface of all users and thickness gauges;

4) Debugging operation station and quality and safety equipment;

5) Thickness gauge calibration;

6) Functional testing.

Thermal commissioning (temporary shutdown of the production line):

1) Verification of measurement values;

2) Validation and optimization of the entire equipment under maintenance conditions;

3) Operator guidance;

4) Final acceptance report.

Detailed scope of commissioning services:

1) Check the entire scope of supply;

2) Visual inspection of transport damage;

3) Check all mounting positions of the gauge assembly;

4) Check the cables, types and methods of laying;

5) Visually inspect the damage of the cable;

6) Check the medium supply (air, water);

7) Check the power supply and warning light;

8) Filling of the secondary circuit of the water cooling device;

9) Check the tightness of all cooling circuits;

10) Check all ground (ground) connections for all parts;

11) determine the radiation control area around the measurement system;

12) Check the C-frame and the measuring head drive system; Check shutter open/close operation and associated warning light indications;

13) Turn on the X-ray system voltage;

14) Check the operation of all computer peripherals supplied by Party B, including operator station and process visualization station;

15) Check all interfaces, including: Ethernet, analog/digital I/O;

16) Adjust the instrument calibration, check the instrument performance (measurement accuracy, statistical noise, etc.), and perform the linearization procedure;

17) Conduct instrument performance inspection with Party A;

18) Instruct Party A's maintenance personnel;

19) Instruct Party A's operators;

20) monitor system performance under normal operating conditions;

21) The production line is stopped and prepared. Other optimization projects.

十、 Quality objections

The warranty period is 12 months after acceptance, or 18 months after the goods arrive at the site, whichever is the case. In the event of a quality problem during the warranty period, the supplier must provide free repair or replacement, and send maintenance personnel to the installation site in time.

十一、Other Notes

1. Scope of supply of non-Party B:

• Equipment and the foundation of all cabinets

• Modification of the user's production line

• Dismantling, moving and installing existing plant equipment

• New installation or removal of cable and pipe trays and covers

• Bumper plates, thermal protection plates, baffles, pedestrian walkways, radiation protection

• Power supply, including grounding protection (where needed)

• Direct connection to existing equipment electrical and electrical connections. The required interfaces are provided by the user.

• Existing plant pipeline route map (civil drawing)

• Piping for hydraulics, cooling water circuits and compressed air connections

• Electrical connection and installation of system equipment

• Installation and connection of cables and lines between components of the gauge equipment and between the user's network and the gauge

• Supply and installation of cables to user equipment (signals, voltages, etc.).

• Installation of encoders and proximity switches on the production line

• Equipment for evaluating and utilizing the output signal of the thickness gauge

• Lighting fixtures

• Lifting equipment

• Radiation safety equipment and tools for the user's staff

• Fixtures and accessories for installing thickness gauge equipment

• Gaskets for thickness gauge C-frames or other measuring points

• Purge device to keep the measuring point free of rolling oil/emulsion

• General arrangement

• Basic drawings

• Detailed drawings of thermal insulation, radiation protection, transition plates

2. Party B reserves the right to make improvements according to the results of technological progress and development.

3. For the documents of patents and technical know-how, Party B promises not to disseminate them to third parties.

4. If Party B modifies the drawings, it shall obtain the consent of Party A and hand over the final revised drawings (including electronic drawings) to Party A.

5. Party A shall assist Party B to go through the factory procedures and on-site loading and unloading in a timely manner.

6. This agreement shall be executed in five copies, with Party A and Party B each holding one copy, and the rest to each unit. This Agreement is an annex to the order contract and has the same legal effect as the business contract after it is signed.

7. The unfinished matters shall be resolved through negotiation between the two parties.

8. The agreement is valid from June 2024 to December 2026.