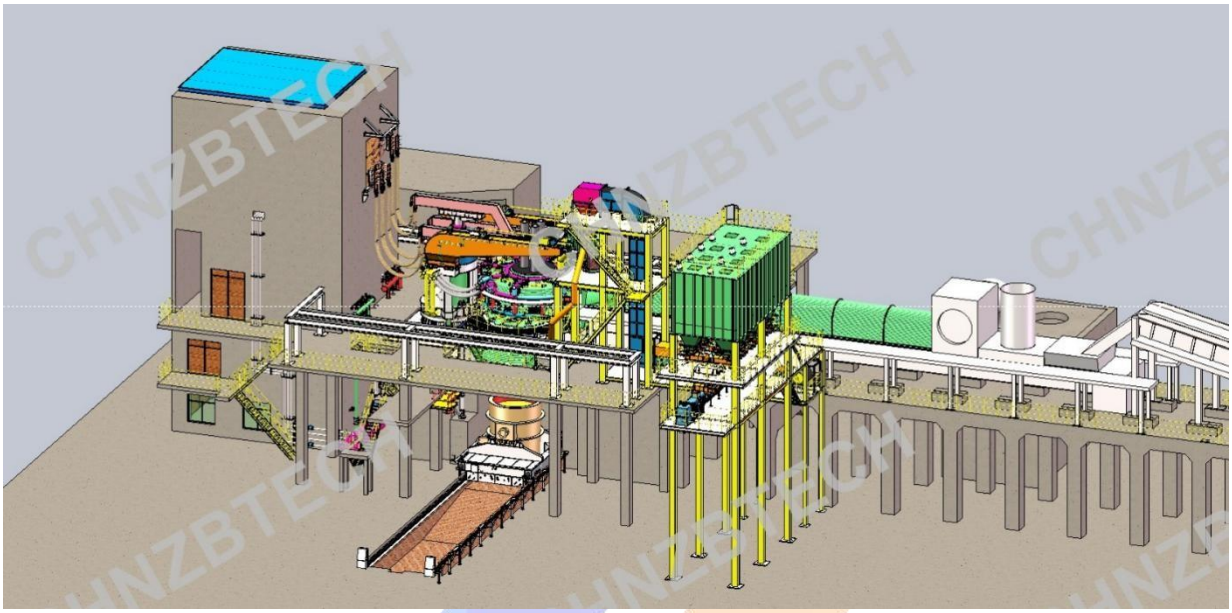
BESHAY STEEL

EAF160t UPGRADE CONSTEEL TECHNICAL Proposal



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CHNZBTECH CO., LTD

Address: 25t-26th, Block A, Merchants Group Silk Road Center, 3rd Gangxing Road, International Trade&Logistics Park, Xi'an, China.

Up to EAF 350 Revamp, LF 330t EP project.

Tel:+86-29-88087080

http://www.chnzbtech.com/www.zbmetaltech.com

Email: leonard.kzao@chnzbtech.com

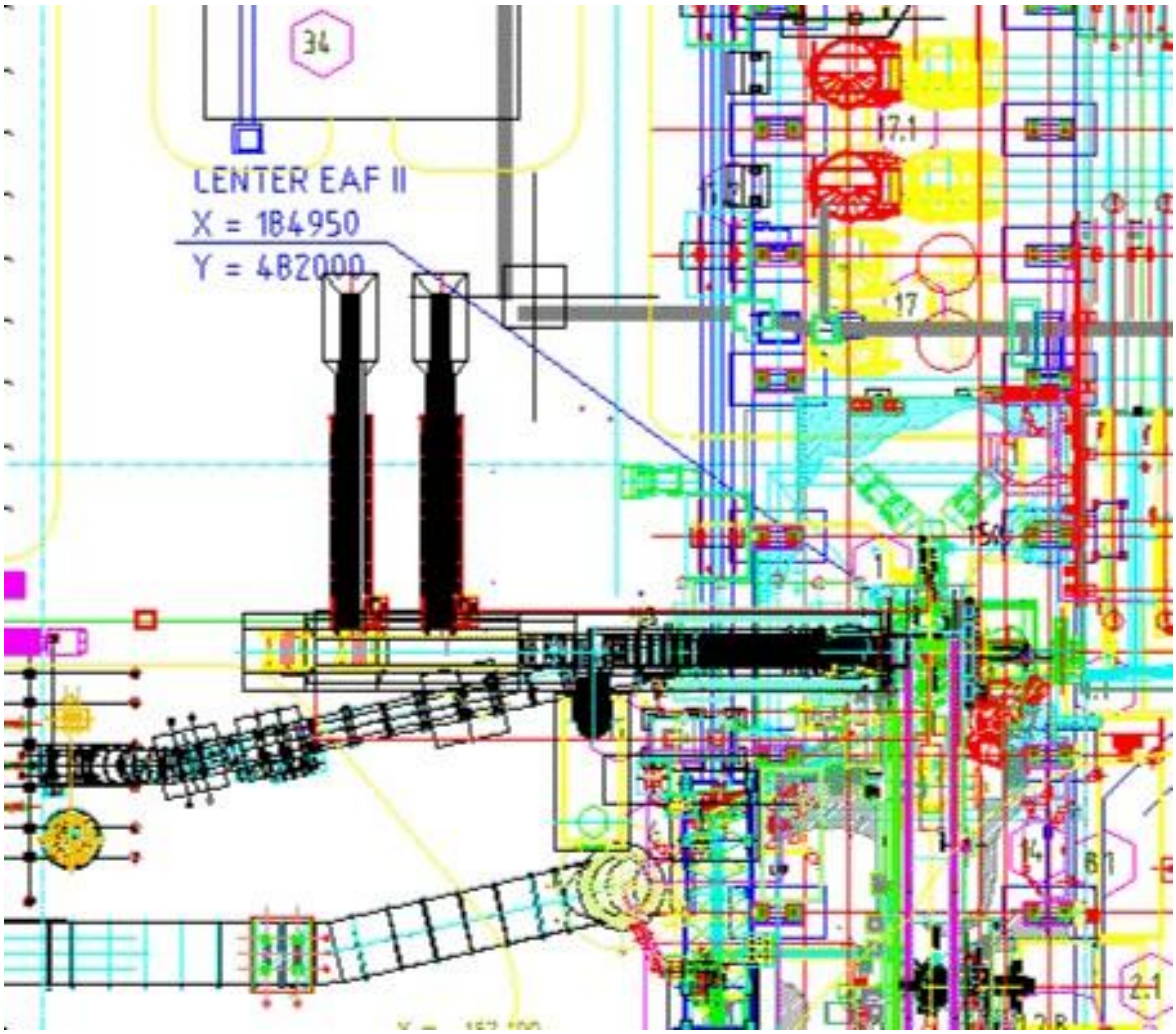
Catalogue

1. Overview

BESHAY STEEL in Egypt, currently has 2x160t traditional top bucket feeding EAF, plans to add a horizontal continuous feeding & preheating system to one of them to replace the scrap bucket feeding, in order to reduce tap to tap time of EAF, increase productivity of EAF, reduce power consumption, and lower the production cost of EAF.

2. Process Description of Electric Arc Furnace

2.1 Process layout



2.2 Advantages of Horizontal Continuous Feeding Steelmaking Electric Arc Furnace

The horizontal continuous feeding steelmaking electric arc furnace has a unique continuous melting and smelting process. Continuously add preheated scrap steel and furnace charge to the molten steel in the furnace and achieve rapid melting. It can ensure a constant flat melt operation, which is the key to the horizontal continuous feeding arc furnace. The arc can operate stably on the flat melting pool. Due to the stable electrode

operation, it can significantly reduce voltage flicker and harmonics, have a small impact on the previous power grid, reduce the capacity of the arc furnace transformer, and save energy. At the same time, it also makes the exhaust gas discharged more evenly, which is beneficial for the configuration and control of the dust removal system. By adopting continuous feeding, the time for adding scrap steel to the rotary furnace cover is saved, and the transformer's efficiency can be maximized during the smelting process, thereby shortening the smelting time.

2.3 Process characteristics of horizontal continuous feeding EAF

The main process characteristics of horizontal continuous feeding are: always maintaining a certain amount of steel retention (40%~50%, all scrap operation) as a hot start for melting scrap steel; Maintain the temperature of the molten pool within an appropriate range to ensure a constant equilibrium and continuous decarburization boiling between the metal and slag, ensuring uniform temperature and composition in the molten pool; The foam slag operation can be continuously and accurately controlled, which is very important for the smooth operation process. Due to continuous feeding, the furnace cover is not loosened, resulting in low heat loss and reduced non electrification time. The operating cycle of the electric furnace can be reduced to less than 40 minutes.

2.4 Production capacity of EAF

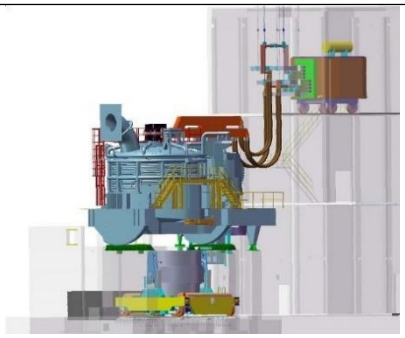
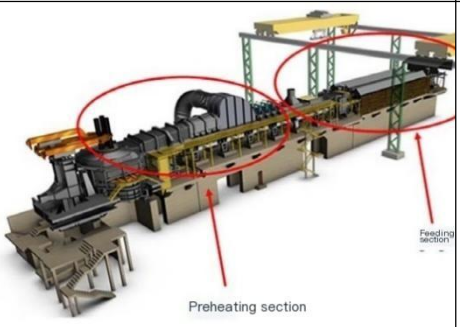
Calculate the annual steel production of an electric furnace based on its nominal capacity of 175t:

Annual effective homework days are calculated as 300 days

The daily effective homework time is 24 hours

$$\frac{24 \times 60 \times 175}{40} \times 300 = 1{,}890{,}000 t/a$$

3 Smelting process objectives

Item	Existing indicators	Target value after renovation	remarks
	Conventional communication EBT steelmaking arc furnace	Horizontal continuous feeding AC EAF	
			
Steel output	160t	175t	
Hot heel	30t	85t	Newly built
Tap to tap	46min	≤40min	
Daily heats (full day production)	31 heats	36 heats	
Horizontal feeding time		20-25 minutes	
Oxygen blowing		25-28 minutes	
Tapping time	~3 minutes	~3 minutes	
Electricity consumption per ton of steel	365kWh/t	≤340kWh/t	
Annual output (Full day production)	~1,488,000t	1,890,000t	According to 300 days/year
Scrap conditions		The requirements for raw materials are lower than those for furnace top feeding! In general, a length of less than 80 centimeters is acceptable!	

4 Main technical conditions and requirements

4.1 Smelting conditions

Smelting conditions and requirements

Sr	project	Unit	Indicators	Remarks
1	Nominal capacity of EAF furnace	ton	175t	
2	Hot heel	ton/heat	85	
3	Average tapping output	ton/heat	175	
4	Average tap to tap	min	≤40	

4.2 Public auxiliary medium conditions

✧ cooling water system

1.1	Water cooling system:			
	Inlet water temperature	℃	≤45	
	Return water temperature	℃	≤65	
	Water inlet pressure	bar	9~11	User point gauge pressure
	Return water pressure	bar	4~5	User point gauge pressure
	Total flow	m^3/h	～4150	Equipment cooling
Among				
	Water-cooled furnace roof	m^3/h	700	
	Water-cooled furnace shell	m^3/h	900	
	Electrode arm	m^3/h	180	
	Copper busbar	m^3/h	40	
	Water-cooled cable	m^3/h	36	
	Transformer	m^3/h	70	
	Reactor	m^3/h	50	

	Hydraulic station	m^3/h	20	
	Water-cooled bent beam	m^3/h	20	
	Electrode lifting column	m^3/h	30	
	Electrode spray	m^3/h	4	
	Water for car water cooling tank and water cooling baffle	m^3/h	450	
	Water for water-cooled hood	m^3/h	750	
	Water for preheating section water cooling tank	m^3/h	1000	
1.2	Water quality requirements:			
	PH value		7～8.5	
	Total hardness		<0.2 mmol/l <20mg/l(CaCO3)	
	Calcium hardness		<0.2 mmol/l <20mg/l(CaCO3)	
	Suspended solids	mg/L	＜10	
	alkalinity	mg/L	＜60	
	Chloride ion	mg/L	Average<60 Maximum 200 mg/L	
	Sulfate ions	mg/L	＜100	
	conductivity	Millisemens per meter	five hundred	
1.3	Accident water			
	Total flow	m^3/h	～1300	Guaranteed for 30 minutes

Among	Water-cooled furnace roof	m^3/h	250	
	Water-cooled furnace shell	m^3/h	300	
	Water for car water cooling tank and water cooling baffle	m^3/h	150	
	Water for water-cooled hood	m^3/h	250	
	Water for preheating section water cooling tank	m^3/h	350	
	Inlet water temperature	℃	≤45	
	Water inlet pressure	bar	4~5	
	Water quality requirements		～2000	

✧ Compressed air system

21	Ordinary compressed air system:			
	pressure	bar	5~6	working pressure
	temperature	℃	normal atmospheric temperature	
	Moisture content:		Saturated water, oil-free, dust-free, at room temperature	
	Maximum consumption	Nm^3/h	10	Intermittent operation: used for blowing and cylinder cleaning

			200	Furnace door carbon oxygen gun powder spraying drive

✧ Oxygen system

3.1	Oxygen system:			
	pressure	bar	8~12	working pressure
	temperature	℃	normal atmospheric temperature	
	purity		98%	
	Maximum consumption	Nm^3/h	10500	Furnace door and furnace wall oxygen lance

✧ Argon system

4.1	Argon system:			
	pressure	bar	16	Air source pressure
			2~10	working pressure
	temperature	℃	normal atmospheric temperature	
	purity		98%	
	Maximum consumption	Nm^3/h	55	Ladle bottom blowing

✧ Natural gas system

5.1	Natural gas system:			
	pressure	bar	2.5～3.5	working pressure
	temperature	℃	normal atmospheric temperature	
	purity		98%	
	Maximum consumption	Nm^3/h	7800	Furnace wall burner

✧ Hydraulic system

six point one	Hydraulic system:			
	pressure	bar	160	system pressure

	temperature	℃	15~50	
	medium		Polyester flame-retardant hydraulic oil (tentative)	

✧ Power system

6	Electricity conditions		
6.1	Voltage level		
	1. High voltage supply voltage	33kV±10％	Electric furnace transformer
	2. Low voltage supply voltage	Rated 380V/220V (± 10%)	
	3. Power frequency	50Hz±1%	
	4. AC control voltage	220V±5％2	
	5. DC control voltage of high-voltage cabinet	220V±5％	Equipment comes with itself
	6. DC control voltage	24V±5％	Equipment comes with itself
	7. Detecting component voltage	24VDC	Equipment comes with itself
6.2	Electric furnace capacity		
	High voltage 20KV	Capacity: 140MVA	
	Power electric 380V/220V	Capacity: 700kw	
	Instrument and meter power supply DC24V		Powered by the rectifier power supply of the equipment power cabinet

5 Main renovation contents

(1) Configure one set of DP175 scrap preheating continuous feeding equipment and 2 scrap chain plate conveyors to achieve scrap conveying preheating.

(2) Renovation of existing electric furnaces, suitable for horizontal continuous feeding.

The specific instructions are as follows:

5.1 New scrap preheating horizontal continuous feeding equipment

5.1.1. Main technical parameters of DP175 scrap preheating continuous feeding equipment

Sr	Item			numerical value	remarks
1	steel scrap condition	Bulk density		0.4-1t/m3 The density of mechanical load design is 1.4t/m3	Iron and steel scrap GB/T4223-2017
		Block size		1000×600×600mm	
		Single weight		≤1.5t	
2	Rear vibrator machine	Feeding and conveying capacity		350~400t/h	
		Conveyor groove size		3000×1070mm	Width x height
		Vibration frequency		2.5～5Hz	Adjustable
		Feeding speed		0～7m/min	
		Horizontal amplitude		20～28mm	
		Vertical amplitude		0	
		Motor	power	220kw	Voltage 380V
			speed	740 r/min	frequency control
3	Cart vibrator machine	Feeding capacity		350~400t/h	
		Conveyor groove size		3260×1000mm	Width x height
		Vibration frequency		2.5～5Hz	Adjustable
		Feeding speed		6.5m/min	
		Horizontal amplitude		20～28mm	
		Vertical amplitude		0	
		Motor	power	45kw	Voltage 380V
			speed	960r/min	frequency control
4	Preheating section length			~32m	provisional
5	Length of feeding section			~17.7m	provisional
6	Total length of conveyor			63.27m	provisional
7	Dynamic	wind pressure		800Pa	

	sealing	Air volume	~80000m3/h	preliminary
		Motor power	30kw	VVVF

5.1.2 Equipment Description

5.1.2.1 Mechanical equipment

1) Smoke hood, outlet smoke hood

The fume hood is installed above the preheating section of the material conveying chute, with its front end connected to the four holes on the furnace wall of the electric furnace. The fume hood is composed of multiple sections: the front section is a water-cooled pipe-type fume hood, welded from seamless steel pipes. The remaining sections, including the outlet fume hood, are insulated fume hoods, welded from steel plates and lined with refractory insulation materials. A flue gas temperature measurement device is installed on the fume hood.

An electric butterfly valve is installed above the fume hood. The computer control system adjusts the opening of the electric butterfly valve based on the measurements from the oxygen analysis device to control the amount of air intake. Inside the electric furnace, O2 reacts with carbon powder to produce CO, which then undergoes secondary combustion with O2 in the newly introduced air in the preheating section. This ensures the combustion of CO and other pollutants in the furnace gas, significantly contributing to energy saving and emission reduction. Additionally, it increases the flue gas temperature in the channel, thereby improving the preheating temperature of the furnace charge.

Two rows of preheating oxygen lances (three in each row) are installed on the fume hood, using natural gas as fuel. These lances can heat the scrap steel in the conveying path, reducing the electric arc furnace's power consumption and shortening the smelting cycle.

Technical parameters:

Seamless pipe for smoke hood	Diameter: 76 × 8, Material: 20g
Smoke temperature measuring instrument	S-shaped Measurement range: 0-2000 ℃ Set up 3, reserve 2
Electric valve	DN300
Preheating temperature of scrap steel	600℃
Parameters for a Single Preheating Oxygen Lance:	
Mach Number:	M = 2.0
Main Oxygen:	Qmax = 800 Nm^3/h (tentative), with a 2 1/2" connection
Annular Oxygen:	Qmax = 200 Nm^3/h (tentative), with a 1 1/2" connection
Fuel Gas	Qmax = 150 Nm^3/h (tentative), with a 1 1/2" connection

2) Support frame platform

The support frame platform fixed on the basic platform is used to support the entire hood system, including water-cooled hood and insulated hood. The support platform is composed of I-beams, channel steels, steel plates, railings, etc.

Technical parameters:

Platform width	1300mm

3) Vibration feeding device

The vibration feeding device consists of a small car vibrator, frame, connecting frame, support suspension assembly, wheel assembly, lateral damping device, longitudinal damping device, hydraulic cylinder, limit switch, etc. It is installed at the discharge end of the preheating area, with a hydraulic cylinder at the rear and a water-cooled material tank at the upper part. During operation, the upper water-cooled material trough extends into the furnace. When the water-cooled material tank needs to be withdrawn from the furnace, the hydraulic cylinder contracts and moves the vibrating feeding device as a whole backwards.

The water-cooled material trough extends into the electric furnace during feeding and operates at high temperatures. Therefore, the discharge port adopts a seamless steel pipe structure with a material of 20g and a wall thickness of 14mm. It is forced to cool with water to prevent local heating and weld cracking.

A vibrator is composed of a box body and 2 sets of parallel shafts with different inertia moments, including a pair of high-speed shafts rotating at the same speed in reverse, a pair of low-speed shafts rotating at the same speed in reverse, a gear set, a lubrication system, etc. Fixing the rotation ratio of the 2 main axes of the vibrator to 2:1 to generate composite harmonic vibration can achieve differential motion characteristics in the vibration conveying system. The shaft hole processing of the exciter box must be formed in one go to ensure its coaxiality; There is lubricating oil inside the gearbox to lubricate the gears. The car vibrator uses special bearings for vibration equipment and a centralized oil and gas lubrication system for lubrication. The service life is 10000 hours. Each bearing is equipped with a bearing temperature measurement device, and the temperature of each bearing can be displayed on the electrical control HMI interface. The vibrator drive device consists of a motor, belt, pulley, pulley protection device, motor base, etc. The motor is installed on the vibrator and vibrates together with the vibrator.

Technical parameters:

Seamless pipe for water-cooled material tank	φ89×14
electric machinery	Power: 45kw, IP65, IE3 Speed: 960 Insulation level F,
wheel	Diameter 400, Material: 42CrMo

pulley	Six group narrow V-band

4) Tail conveyor

The conveyor consists of a tail vibrator, a feeding section, a preheating section, a support device, a bracket, etc.

The feeding part is composed of components such as the tail vibrator connecting plate, side plate, bottom plate, connecting beam, support beam, and lateral damping device (the stabilizer bar has hinge mechanisms at both ends, one end is fixed on the support leg, and the other end is fixed on the bracket).

The connection plate between the tail vibrator and the tail vibrator is connected by hinged bolt, and the side plate, bottom plate, and connecting beam are connected by ring groove rivets to prevent deformation caused by scrap steel impact. The feeding section is connected to the side plate by bolts, with a top plate sandwiched in the middle to cushion the impact of scrap steel. The steel plate material of the conveyor material groove is Q355. The suspension rod bolts are made of 42CrMo material and undergo quenching and tempering treatment. The suspension rod nuts are made of anti loosening nuts, with a service life of 2 years.

The lateral damping device can prevent the tail conveyor from swinging laterally during vibration. The supporting device consists of a bracket, convex washer, concave washer, high-strength double head bolt, etc. The support device is used to suspend the tail conveyor body, and its function is to make the conveyor swing back and forth through a suspension swing system composed of convex washers, concave washers, and high-strength double headed bolts.

The preheating part of the water-cooled material trough is made of Q355 material and installed at the discharge end of the conveyor. Its function is to prevent deformation when high-temperature flue gas and furnace materials pass through.

The four shafts of the tail vibrator are installed in a box, with gear transmission to ensure synchronization. The speed of the tail vibrator motor is controlled by the frequency converter installed in the MCC. The shaft holes of the vibrator box must be machined in one go to ensure their coaxiality. The tail vibrator uses large clearance bearings specially designed for vibration machinery, lubricated with a centralized oil and gas lubrication system, with a service life of 10000 hours. Each bearing is equipped with a bearing temperature measurement device, and the temperature of each bearing can be displayed on the electrical control HMI interface.

The tail of the conveyor is equipped with a pressure device, consisting of a crossbeam, hydraulic cylinder, pressure roller, and limiter. When the scrap material exceeds the requirements, it can be pressed down.

Technical parameters:

Thickness of groove bottom plate	25mm
Side panel thickness	16mm，
Thickness of connecting plate	45mm
Circular groove rivet	Diameter: 400, Material: 45 # steel The clamping force of a single rivet is 126KN
High strength double head bolts	Specification: M72; Material: 42CrMo
Tail vibrator bearing	Inner diameter: ID 315; Spherical Roller Bearings
Gearbox:	Diagonal teeth, hard tooth surface, modulus: 10, Axis material: 40GrMnMo
Tail vibrator motor	Power: 200kw, IP65, IE3 Speed: 740 Insulation level F,
Automatic lubrication system	Motor power: 2.2KW * 2, Fuel tank capacity: 700L
Pressure roller	Diameter: Ø 426, Material: Q235

5) Gas dynamic sealing device

The gas dynamic sealing device is installed at the end of the continuous feeding hood, and its function is to generate negative pressure to prevent the leakage of electric furnace flue gas and the entry of atmospheric air into the flue.

The negative pressure formed by the dynamic sealing fan absorbing air is slightly lower than the negative pressure formed by the main fan of the dust removal system, and the negative pressure value at the interface is about -276Pa (preliminary).

The negative pressure at the dynamic sealing point will be controlled by the frequency converter, and the control of the dynamic sealing frequency converter will be controlled by the automation system.

The gas dynamic sealing device consists of a dynamic sealing base, a gas damping grid, an axial flow fan, an electric motor, a gas pressure measurement device, etc.

6) Loading skirt edges and brackets

The loading skirt edge is located after dynamic sealing and is used for loading in the opposite direction. The edge of the loading skirt is a steel structural component, and the material in contact with the material is Q355 steel plate.

7) Water cooling system

The parts in contact with high-temperature flue gas, such as the water-cooled smoke hood, trolley conveyor, and water-cooled material trough in the preheating section of scrap steel, are forced to cool with circulating water. The water-cooled system consists of hoses, various valves, and cooling water distribution pipes. Before leaving the factory, the water-cooled tank and water-cooled pipe shall undergo post weld annealing treatment and undergo non-destructive testing.

There is a pressure transmitter and thermocouple (pt100) installed on the main inlet pipeline of the cooling water. A flow meter, pressure transmitter, and thermocouple (pt100) are installed on the main return pipe. There are hoses and shut-off valves on each cooling water branch. The water cooling tank of the car adopts separate water supply and is equipped with a flow meter to detect and alarm.

8) Hydraulic system

The horizontal feeding hydraulic system uses polyester fire-resistant hydraulic oil as the working medium. It is employed for the driving and control of the hydraulic cylinders of the trolley conveyor, the scrap steel pressing device, and the fume hood tilting mechanism. The system consists of the main hydraulic power unit (including the motor, hydraulic pump, oil tank, and hydraulic accessories), various control circuits (such as the oil filtration circuit, overflow circuit, trolley conveyor in/out circuit, scrap steel pressing circuit, and fume hood tilting circuit), as well as a circulation pump unit and accumulators. The core components, including pumps, valves, and cylinders, are from brands such as Rexroth, Parker, Vickers, and Siemens.

Equipment Composition and Parameters:

— Oil Tank Unit 1 set

The oil tank unit includes a stainless steel tank, liquid level controller, air filter, oil temperature controller, plate cooler, and return oil filter.

Plate Cooler 1 unit

Return Oil Filter 1 unit

Rated flow 400 L/min,

filtration accuracy 20
— *Circulation Pump Unit 1 unit
The circulation
Circulation Pump 1 unit
Flow rate 100 L/min,
Motor power 0.75kw
Circulation Filter 1 unit
— Main Pump Unit 2 units (1 operational, 1 standby)
Main pump type: Constant pressure variable axial piston pump
Rated pressure: 21 MPa
Working pressure: 14 MPa
Each main pump unit: Flow rate: 100 L/min, motor power: 30 kW (variable frequency motor)
The main pump unit, in addition to the main pump, main pump motor, and high-pressure filter, is equipped with a pump safety valve, pressure relay, and pressure gauge
High-Pressure Filter 2 units (1 for each main pump unit)
Hydraulic Cylinder Technical Parameters:
Carriage Hydraulic Cylinder:
Cylinder diameter: Ø250
Rod diameter: Ø180
Speed: 50 mm/s
Stroke: 2000 mm
Pressing Hydraulic Cylinder:
Cylinder diameter: Ø125
Rod diameter: Ø95
Speed: 50 mm/s
Stroke: 600 mm
Hood Tilting Hydraulic Cylinder:
Cylinder diameter: Ø180
Rod diameter: Ø90
Speed: 50 mm/s
Stroke: 1500 mm

9) Scrap chain conveyor

Chain conveyor is a conveying equipment that is composed of a series of metal chain plates supported on roller chains that overlap with each other, forming a continuously moving working surface to transport bulk solid materials. At the same time, due to the large traction force of the traction chain of the chain plate conveyor, it has many advantages such

as large bearing capacity, high conveying capacity, small operating resistance, long conveying distance, convenient installation and maintenance, and long service life.

The scrap chain conveyor is composed of a power device (motor), a transmission shaft, a drum, a tensioning device, a sprocket, a chain, bearings, lubricants, chain plates, and so on. The two main parts of conveying animal feed are: the chain, which provides traction power through its cyclic motion; Metal plates serve as load-bearing bodies during the conveying process.

Conveyor Trough Width:	1800mm
Distance Between Head and Tail Pulleys:	～32.2m
Conveying Angle:	～17°
Conveying Capacity:	200t/h
Motor Power (Variable Frequency Drive):	55kW
Apron Plates:	Th 10mm(Up ） +6mm(Lower ） , reinforced
Chain:	The tensile strength of a single strand should not be less than: 650kN
Horizontal Feeding Hopper Dimensions:	8400mm×5300mm(L×W)

5.1.2.2 Electrical equipment

1) Low voltage distribution system

The low-voltage distribution system includes a cabinet placed in the control room, consisting of isolation switches, circuit breakers, busbars, and related branch switches.

Set up necessary indicator instruments on the panel.

2) Tail conveyor control system

The tail conveyor motor is set at the tail end of the continuous preheating feeding conveyor system.

The motor of the tail conveyor is controlled by a frequency converter to ensure that the speed of the conveying device is continuously adjustable. It can be controlled automatically and manually. During automatic control, the conveying system receives a 4-20mA feeding control signal from the electric furnace system.

Install a local control box and necessary interlocking protection.

3) Vibration feeding control system

The vibration feeding control system completes the control work of the vibration feeding cart. The feeding motor of the vibration feeding cart is controlled by a frequency converter and operates at a variable speed to ensure that the speed of the scrap steel material on it is greater than the speed of the conveyor, thereby ensuring the normal transportation of the material.

Install a local control box.

4) Dynamic sealing and other control systems

The dynamic sealing motor is controlled by a frequency converter and is an independent automatic control system. The automatic control system converts the pressure difference signal between the flue gas duct and atmospheric pressure into corresponding electrical signals, and then uses this signal to adjust the frequency of the frequency control equipment of the frequency converter. Finally, the pressure of the flue gas duct is balanced with the pressure of the dynamic sealing. This system can also be switched to manual control.

Set up on-site operation box.

5) Other auxiliary control systems

Other auxiliary controls that are indispensable for systems such as material pressing devices. The material pressing device is equipped with an on-site operation box (shared with dynamic sealing).

6) PLC system

The PLC system mainly completes the data acquisition and logic control functions of all switches and analog signals of the continuous feeding equipment for scrap preheating.

7) Instrument detection system

The instrument detection system includes the differential pressure detection and control function of the dynamic fan, as well as the detection and conversion of other equipment.

8) Equipment electrical control console

The electronic control console of the equipment is installed in the main control room of the electric furnace, mainly used for the start and stop of the tail conveyor and the trolley conveyor, the entry and exit of the trolley conveyor, the conveying of the tail conveyor, the conveying of the trolley conveyor, the manual and automatic adjustment of the dynamic sealing speed, the setting display of the connecting trolley speed, and the automatic adjustment of the dynamic sealing device. It is displayed through the HMI screen installed on the main control panel, and important measurements are displayed digitally.

9) Automation control system

The DP series scrap preheating continuous feeding equipment automation control system is used to meet all the requirements of the continuous preheating feeding conveying device. The main components of the automatic control system configuration are as follows.

-1 set of PLC

-1 set of Human Machine Interface (HMI), equipped with a 24 inch LCD display, keyboard, and mouse.

-PLC: The CPU is Siemens S7 1500 series

-Human machine interface and process PC hardware: Dell or similar brand desktop computers of the same level and type

-Protection level: IP40

The DP equipment PLC can communicate with the PLC and HMI of the electric furnace, and the communication between the PLC and the remote I/O is carried out through the bus. The communication handover point is located on the electrical cabinet in the buyer's control room or PLC room.

Basic system software and application software

The operating system for HMI devices and PCs is Microsoft's Windows system.

The application software for HMI devices is developed using TIA portal and WINCC.

Develop application software for PLC during the design process.

Automatic Control System Function Description

Each component of the basic level automation system and process control system

performs specific tasks, which are classified according to their functions as follows:

PLC, control console, machine side control box, and HMI device.

The main control console is installed in the main control room of the electric furnace and is mainly used for:

a. Start and stop of tail conveyor and trolley conveyor;

b. Car conveyor in and out, start and stop;

c. Manual and automatic adjustment of conveyor speed;

d. Manual setting of conveyor speed;

e. Manual and automatic adjustment of dynamic sealing speed;

The electrical control system of the continuous feeding equipment for preheating scrap steel is a complete industrial control system, which includes data collection, processing, display, and self-control. Receive and send necessary data from the system under specified conditions.

Mainly reflected in the following control screens

--Conveyor monitoring screen

The motor speed of the tail conveyor is controlled by the system: the motor speed is directly related to the vibration frequency of the tail conveyor. The motor controls the frequency converter through the analog output signal of the PLC, so that the motor speed (rpm) is obtained from the analog input signal of the PLC. The instruction is divided into 20 steps at an interval of 4-20mA in the analog output (each step is 5% of the motor speed, from 0 to 100%)

The start of the tail conveyor can be set in automatic/manual mode, with the option to choose manual mode: the control buttons on the control panel can be used to easily adjust the frequency of the tail vibrator according to the actual production situation, thereby achieving the purpose of conveying volume. According to the console command, the operation can increase/decrease the speed of the tail conveyor corresponding to the% value (4mA-0%, 20mA-100%) on the console and industrial computer.

On the HMI interface, the speed of the tail conveyor can be displayed as a percentage from 0% to 100%, and can be connected

Control the motor of the tail conveyor through a frequency converter. Simultaneously display the operating status of the lubrication system on the HMI interface and

Automatic control and related detection data (including 0: concentration, flue gas temperature, and flue gas pressure).

--Vibration feeding device monitoring screen

The control system controls the start/stop of the motor for the trolley conveyor, and the motor speed is adjustable. The screen clearly displays the running status of the vibrating feeding cart.

The speed of the trolley conveyor is much higher than the maximum value of the tail conveyor, so regardless of the speed of the tail conveyor, the trolley conveyor ensures the transfer of materials into the electric furnace and avoids stacking.

There are switches on the control console that control the forward or backward movement, as well as the start and stop of the trolley conveyor.

When the hydraulic cylinder extends and reaches the limit switch for extending (inside the furnace) by pressing the button, the conveyor motor is automatically triggered.

Press the "stop" button to stop the conveyor. When the "out of furnace" button is pressed, the hydraulic cylinder contracts until the "out of furnace" limit switch is pressed.

When using the local start button for mobile control, if the button is continuously pressed (the motor stops when the button is released), only movement will be generated, so only the local box can complete all operations, including the maintenance position at which the operation ends.

The operation status and position status of the vibration feeding device can be displayed on the HMI interface, and relevant detection data (including flue gas temperature and pressure) can be displayed on the HMI interface.

--Water cooling system screen

Necessary testing and monitoring of the water cooling system.

5.1.3. DP equipment performance guarantee

(1) Feeding and conveying capacity: ≥ 350t/h

(2) Preheating temperature of scrap steel at the inlet of the electric furnace: ≥ 600 ℃

(3) Preheating section water-cooled hood system lifespan: ≥ 10000 heats

(4) Service life of water-cooled material tank: ≥ 10000 heats

(5) Service life of vibrator and trolley conveyor: ≥ 10000 heats

(6) Service life of water-cooled material tank in the furnace: ≥ 1500 heats

Among them, items (1) and (2) are the basic capabilities of the equipment.

The rest are the lifespan of the equipment within its normal service life, which means that new components need to be replaced after the service life expires.

5.2 Content of electric furnace renovation

(1) The EAF deepens the furnace body while keeping the diameter of the furnace shell constant;

(2) Install a furnace weighing system;

(3) Install scrap steel feeding doors on the upper furnace shell and furnace cover;

(4) Verify whether the tilting hydraulic cylinder meets the thrust requirements after the weight of molten steel increases;

5.2.1.1Main technical parameters of 175t EAF

Sr	Technical parameter name	Unit	Existing parameters	Modified parameters	remarks
1	Electric furnace form		Overall platform style	Overall platform style	remain unchanged
2	Steel tapping method		EBT	EBT	remain unchanged
3	Furnace system:				
	Nominal capacity	ton	160	175	
	Hot heel	ton	30	85	newly lining
	Steel tapping	ton	160	175	newly lining
	Inner diameter of furnace shell	mm	Φ7100	Φ7100	unchanged
	Thickness of slag layer	mm	300	300	
	Depth of molten steel	mm	1325	1525	Increase 200
	Total height of furnace shell	mm	6520	6720	Increase 200
	Furnace wall thickness	mm	526	526	Working layer 450
	Thickness of refractory material at the furnace bottom	mm	800	800	
	Total height of lower furnace shell	mm	3210	3410	Increase by 200
5	transformer:				
	Rated capacity of transformer	MVA	140	140	remain unchanged
6	Electrodes:				
	Graphite electrode	mm	Φ660	Φ660	remain

	nominal diameter				unchanged
7	Tilting system:	Replace with a new tilting hydraulic cylinder			
8	Furnace cover lifting system:				remain unchanged
9	Hydraulic system:				remain unchanged
10	Water cooling system:				
	Inlet water temperature	℃		＜45	
	Return water temperature	℃		＜65	
	Water inlet pressure	bar		9~11	Water point
	Return water pressure	bar		4~5	Water point
	Total flow rate of EAF body	m^3/h		～2050	

5.2.2 Equipment Description

5.2.2.1 Mechanical equipment

1) Furnace body

Technical description:

The furnace body is composed of upper and lower furnace shells, furnace door mechanism, EBT mechanism, and tubular water-cooled furnace wall.

The lower furnace shell is welded from a cylindrical furnace shell and a conical furnace bottom.

The main body of the upper furnace shell is a water-cooled frame with inner tube type water-cooled furnace walls, and the total height remains unchanged. Side wall opening for scrap steel feeding, opening size: 3520mm x 2300mm. Install the furnace wall oxygen gun on the upper furnace shell (to be determined by both parties during detailed design), located in the cold zone of the electrode. The fixed support for installing the furnace wall oxygen gun is located on the outer side of the furnace shell, making it easy to load, unload, and adjust.

The water-cooled furnace wall is a densely packed tube structure. The water-cooled furnace wall is uniformly distributed on the upper part of the furnace shell; The total inlet water is equipped with pressure, flow rate, and temperature detection, while the total return water is equipped with temperature and flow rate detection. The pressure, temperature, and flow rate can be displayed on the computer.

The inner diameter of the lower furnace shell remains unchanged at 7100mm, and the

total height is increased by 200mm. At the same time, a horizontal base for weighing is added, and the overall furnace body is raised by 50mm for accurate weighing; The steel outlet mechanism moves downwards by 200mm.

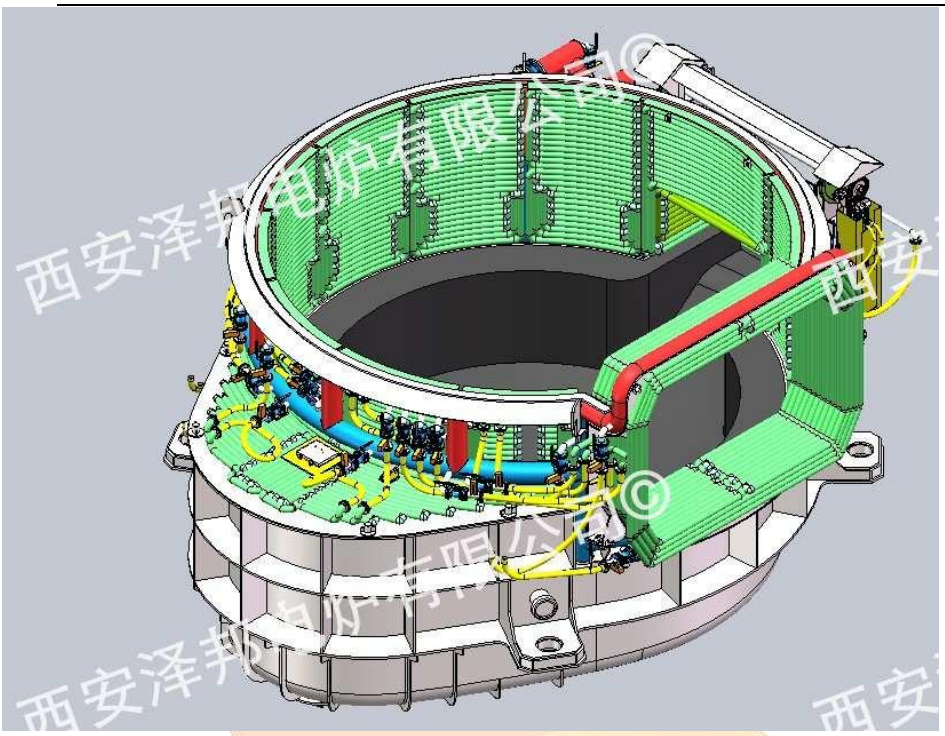
The upper and lower furnace shells are connected by a pin shaft, with a movable furnace shell structure that is easy to disassemble. The furnace body has solid lifting ears, so the furnace shell can be lifted out or in as a whole. According to the lifting capacity of the workshop, the upper and lower furnace shells can also be lifted separately.

A set of components:

Upper furnace shell	2*1 set (new production)
Lower furnace shell	2*1 set (new production)
Water-cooled plate	2*36 sets (new production)
Furnace door device	2*1 set (new production)
Steel tapping mechanism	2*1 set (new production)
Eccentric top cover	2*1 set (new production)

Technical parameters:

Inner diameter of lower furnace shell	φ7100mm
Inner diameter of upper furnace shell	φ7200mm
Furnace shell height	~7720mm
Upper furnace shell height	3470mm
Lower furnace shell height	3410mm
Weight of upper furnace shell	40
Lower furnace shell weight	45+142 (refractory)
Melt pool diameter	φ6048mm
Depth of molten pool	1525mm
Thickness of refractory material at the furnace bottom	800mm
Thickness of sidewall refractory material	526mm
Main frame seamless pipe Ø 219x12	20G
Seamless water-cooled plate tube Ø 89 × 10	20G
Wall KT oxygen lance	4 pieces, Flow rate 4 × 2800m3/h Power 4 × 2.5MW,
Furnace wall carbon lance	2 pieces



2) Furnace Roof

Technical description:

The furnace cover adopts a combination of a large furnace cover and a central refractory small furnace cover. The large furnace cover is composed of a seamless welded frame and a tubular water-cooled plate, with the tubular water-cooled plate being a split type. The original dust removal hole on the large furnace cover has been cancelled. Here, the water-cooled plate is matched with the scrap steel feeding port on the furnace body, and another water-cooled plate is equipped with a lime alloy feeding hole.

A set of components:

Main framework	2*1 set
Water-cooled plate	2*4 sets
Central coil	2*1 set
Center refractory furnace cover (user provided)	2*1 set

Technical parameters:

Weight	30t
Furnace roof diameter	φ7900mm

3) Furnace weighing system

Due to the use of scrap preheating and continuous feeding system, the operator in front of the furnace needs to constantly grasp the total weight of steel material in the furnace, in order to determine the stopping time of continuous feeding and the amount of various auxiliary materials added.

Four sensors are installed between the electric furnace ear base and the platform, located under the lower furnace shell installation flange, near the inner side of the furnace shell lifting ear; The bottom is welded to the platform to support the weight of the furnace body, refractory materials, molten steel, and furnace cover in the electric furnace equipment; The measurement accuracy requirement is high, and it can be read at any time when the furnace body is in a horizontal position.

The furnace body is weighed using high-temperature resistant products and equipped with water-cooled protective sleeves.

A set of components:

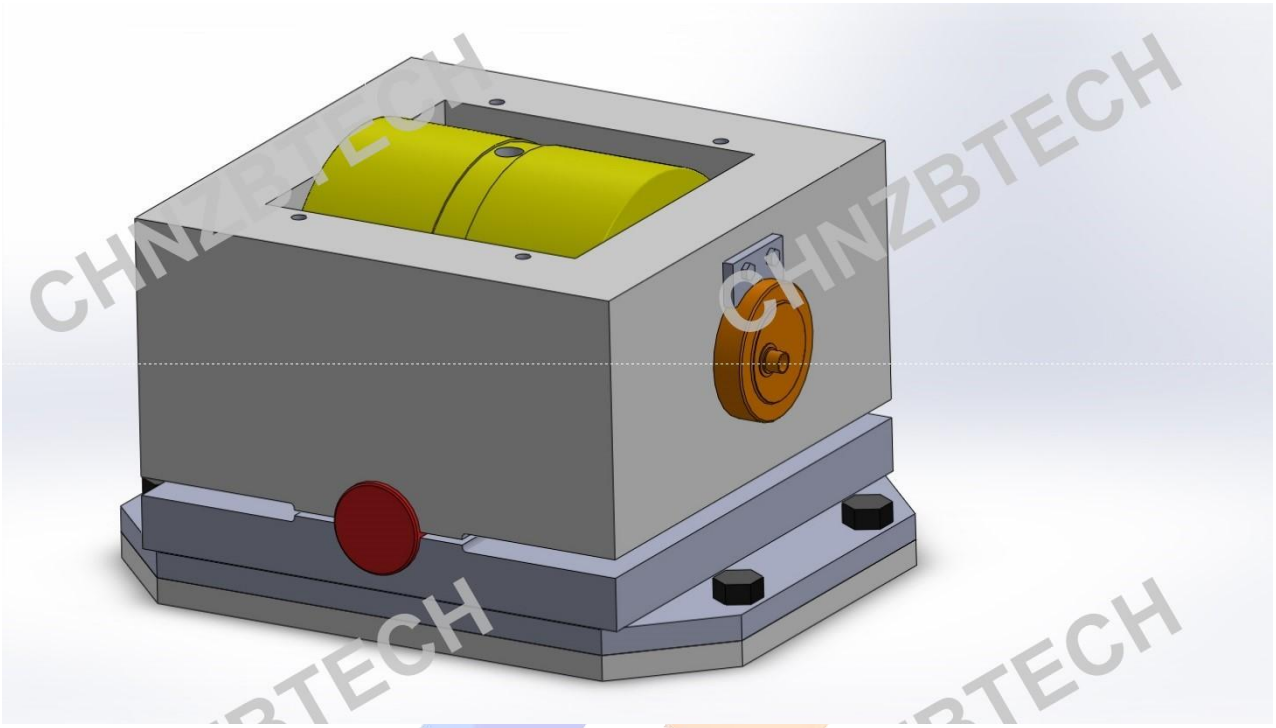
High temperature weighing module	4 sets
Weighing module upper and lower connection plate	4 sets
Weighing module horizontal pull rod	4 sets
Junction box	1 piece

Weighing terminal 1 set

Technical parameters:

High temperature weighing module Range: 250t/set

Brand Schenck



4) Reuse of other mechanical and electrical equipment

6. Vendor list

The seller promises that all equipment suppliers selected for this project have legal and valid identities; All have corresponding qualifications in design, manufacturing, and other related fields.

The selection of suppliers for critical and proprietary equipment can be determined through mutual consultation between the buyer and seller.

The equipment listed below is of concern to the buyer and shall be fully considered and supplemented by the equipment seller. If there are any omissions, both parties shall agree to make up for them.

List of Supporting Suppliers

Number	Name	Vendor	remarks
1	Bearing	SKF/NSK	
2	Frequency converter	Siemens/ABB	
3	PLC	SIEMENS	
4	Motor	SIMENS	
5	Main electrical comp1nts	Schneider /ABB	
6	Hydraulic system	Bosch Rexroth/PARKER/SIMENS/VICKERS	
7	Weighing sensor	Schenck	