

Pelletisation Plant



Allbest Creative Development Ltd. (ALLBEST)

TCS Shaft Process

Pelletisation (TCS Shaft Furnace, 0.1-1.0 M Tons/Year)



TCS Shaft Furnace

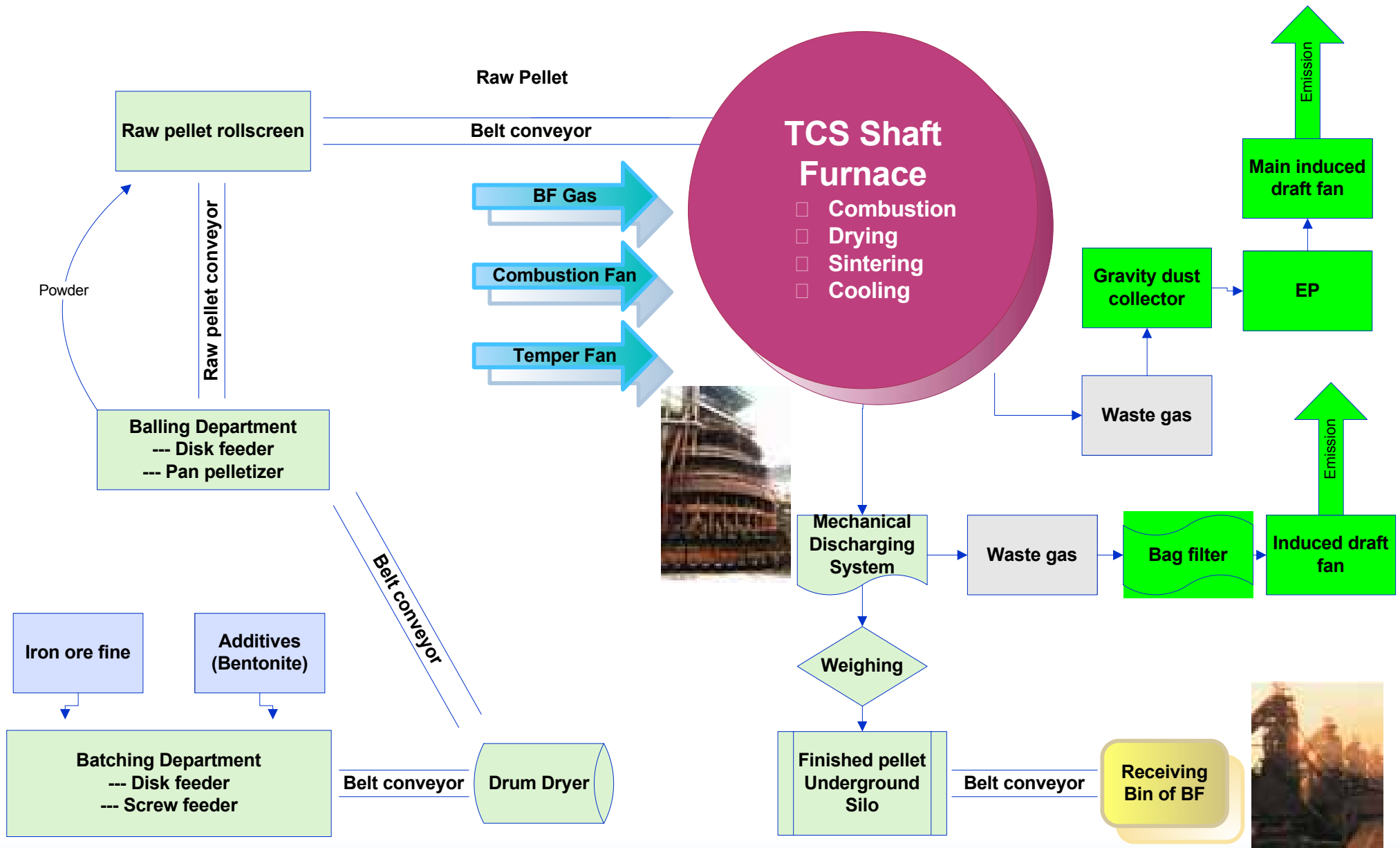
General Description of TCS Shaft Furnace

- ◆ TCS shaft furnace is a patented technology. Patent No.: **ZL00260319.5**.
- ◆ Overcome the difficulty of macro-scale operations technology for shaft furnace
- ◆ Preheat combustion-supporting air over 280°C by using self waste heat
- ◆ Leading technology in the industry with low investment, low occupied land, low energy consumption, low cost and higher quality, which is the project with little investment but quick result in metallurgical industry.
- ◆ Over 13 sets of TCS shaft furnace in China have been installed within 5 years.
- ◆ Series size of TCS shaft furnace have been developed from 200,000 to 1,000,000 tons per year

Features of TCS shaft furnace:

1. The pneumatic charge distributor at the top of furnace works reliable with simple structure
2. Drying area is increased with upper and down drying beds. The air temperature can be controlled by zone, which can dry material in low speed through the changing of temperature and direction, so enable to avoid problems of over-wet and bursting.
3. The drying bed is with the function of air sifter and fixed screen, which can separate most powder and reverberatory fines in advance and discharge them out of the furnace. Therefore, the venting quality and air distribution of the charging column in roasting zone shall be improved, strengthen the adaptability to the fluctuation caused from raw materials and operation. Productivity of shaft furnace can be reached into 7.5 (t/m².h) .
4. The burner and combustion room is located inside of the furnace, the combustion is from inner to outer side, which is taken use of fringe effect, so increase the air volume and temperature of low-temp zone at the area of outer wall opposite to burner; make the reasonable distribution of airflow and temperature in roasting zone. So the quality of pellet is improved and avoid the scaffolding inside the furnace.
5. The feature of ring-type roasting zone is to design the larger roasting area without increasing the width of roasting zone, which is benefit to macro-scale operations technology of the furnace.
6. The combustion rooms, roasting zone, drying zone and anti over-wet stage can be inspected and controlled in each section by computer, the accuracy of operation is increased dramatically, the best parameters can be adjusted through the commissioning and operation.
7. The discharging temperature of the pellet can be below 300°C due to big cooling capability inside the furnace, so as to increase the capacity usage ratio and be environmental friendly consideration. This advantage is against the extra investment and environmental problems caused from outside large cooler of other type furnace.
8. Loop discharger at the tope of furnace is operated through variable frequency control(VFC) with simple structure, which can make a good discharging.
9. The effective height of roasting zone in TCS shaft furnace is higher than rectangular SP shaft furnace. But the independent structure is adopted in TCS shaft furnace, the total height is lower, therefore, saving length of belt conveyor and occupied land.
10. The pressure of combustion room in TCS shaft furnace is only 12~15kPa due to its good venting quality and air distribution of the charging column in roasting zone. The consumption of power and gas can be reduced. In normal production, the consumption of generator gas can be reduced into 160~200m³/T. Pellet.
11. Lower maintaining cost since the structure of TCS shaft furnace is simple.

Typical Process Flowchart of Pelletisation (TCS Shaft Furnace)



Brief Description of the Process

Iron ore fine is sent to batching silos by loader, then transported on the belt conveyor through disk feeder. Bentonite is delivered to the bentonite store by truck, fed manually into the silos, then transported on the belt conveyor through the rigid impeller feeder and screw feeder under the silos. The mixing ratio between iron ore fine and bentonite is 98:2 on a dry basis.

The batched meal is sent to drum dryer through belt conveyor for drying and mixing. The drying source is 600~800°C waste gas generated from the combustion of BF gas, combustion room is designed as counterflow. After drying, moisture of meal is below 7%. Meal from dryer shall be transported into damp mill, then sent to reel type blender by belt conveyor. The bed blending meal is transported to balling room on the third floor.

Pan pelletizers are equipped in the balling room. On the top of each pan pelletizer, surge bin with disk feeder (frequency converter) are installed. The meal is offered to pan pelletizer through disk feeder to make green pellet. All green pellets shall be sent to raw pellet screening room.

Rollscreen is installed in raw pellet screening room. Powder with size less than 6mm shall be returned to mixing belt conveyor to reel type blender, then sent through belt conveyor to balling room to make green pellet again; Green pellets with size over 6 mm are sent by belt conveyor to the top of furnace for distribution.

Green pellets meet anabatic hot air during its dropping down, the pellet is formed after the processes of anti over-wet, drying, preheating, roasting, heat soak, cooling, etc. The pellet is discharged into ring type platform through the outlets installed in the furnace (temperature 300 C) for cooling, then discharging to mechanical discharging car to underground silo, then, sent through belt conveyor to finished pellet silos or raw material bin of BF.

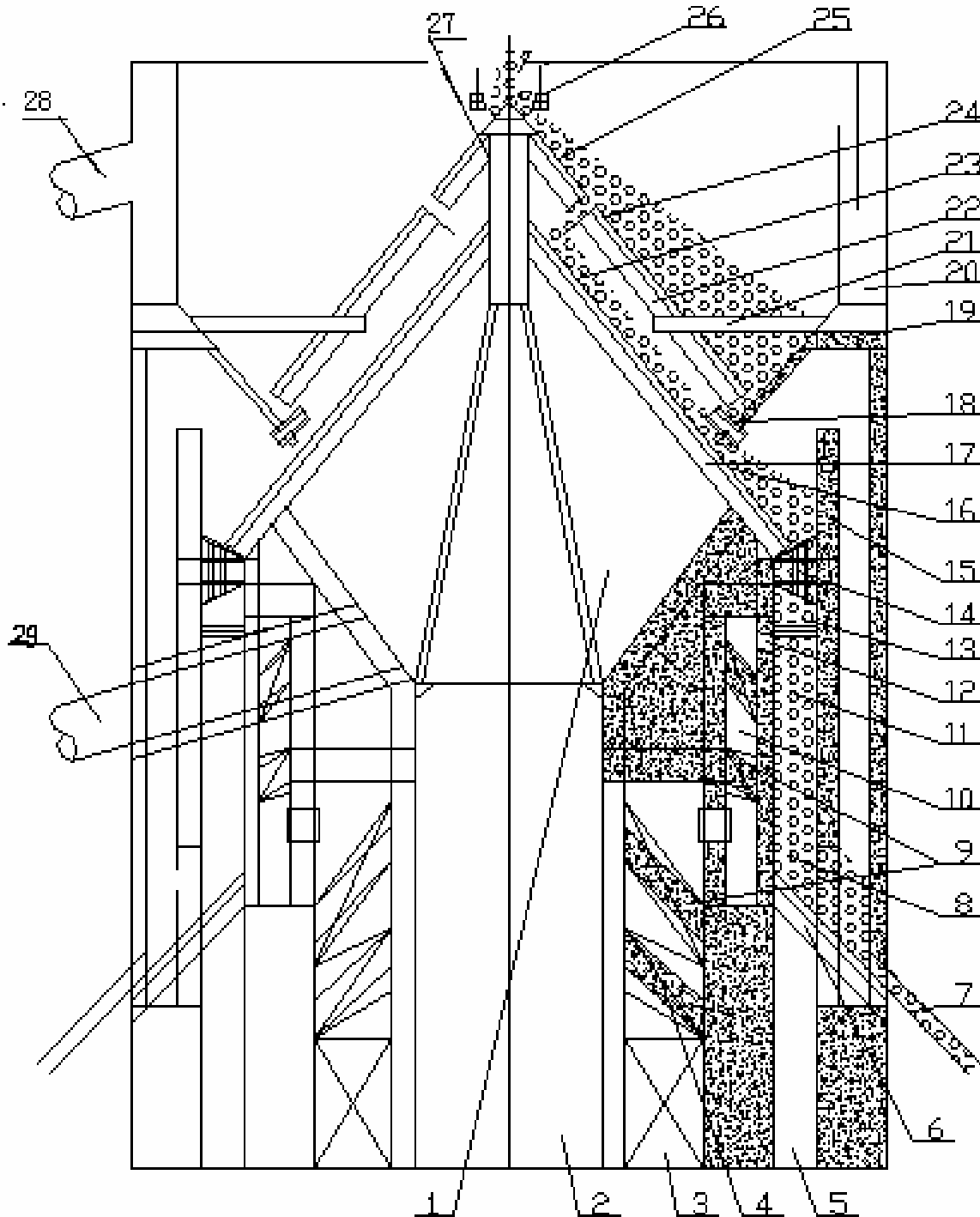
At start-up or conditioning the furnace, fired pellets shall be supplemented. At the end of green pellet belt conveyor, fired pellet bin shall be installed.

The gas for the furnace and dryer is from BF gas pressurizing station.

Combustion fan, temper fan, induced draft fans shall be installed for the furnace.

The temperature of waste gas is 300°C, dust content is 3-5g/ m³. The dust shall be collected and emitted through the dust collecting system.

Body Structure of Shaft Furnace



- | | |
|------------------------------|------------------------------------|
| 1-central ash bucket; | 16- preheating zone; |
| 2-central air pipe; | 17-down drying bed; |
| 3-burner; | 18-air pipe; |
| 4-flame stabilizer | 19-temper blower |
| 5-cooling blower; | 20-Waste gas dust collector; |
| 6-firegrate in cooling zone; | 21-intake duct of temper air; |
| 7-discharging outlet; | 22-upper drying bed; |
| 8-cooling zone; | 23-down desiccating zone; |
| 9-blending machine; | 24-upper desiccating zone; |
| 10- flame path; | 25-anti over-wet stage; |
| 11- soaking zone; | 26-charge distributor; |
| 12- crater; | 27-top central air pipe; |
| 13- roasting zone; | 28-top waste gas delivery line; |
| 14-induce gas brick; | 29-central waste gas delivery line |
| 15-induce air wall; | |

Departments of Shaft Furnace:

- Batching room
- Drying room
- Damp mill room
- Balling room
- Green pellet screening rom
- Body of shaft furnace
- Blower room
- Power switch room
- Gas pressurizing station
- Pump room
- Induced draft fan room
- Dust collecting system
- Finished pellet transporting system
- Central control room

Environmental Protection

Standards adopted in the design of TCS shaft furnace

- Waste Water Emission Standard of Metallurgical Industry, GB13546-92
- Waste Emission Standard of Metallurgical Industry, GB4911-85
- Noise Control Design Criterion of Industrial Enterprise, GBJ87-85
- Noise Standard at the Area of Industrial Enterprise, GB12348-90
- Emission Standard of Waste of Boiler, GB13271-91
- Dust Emission Standard of Industrial Furnace, GB9078-88

The main waste/pollution source and control methods

1. Purified BF gas is adopted into the combustion of TCS shaft furnace, therefore, this can avoid the secondary pollution caused from the emission of BF gas.
2. Atmospheric pollution sources and control
After dust collection, the dust content is conform to the standard and be emitted into the air through induced draft fan and chimney.
All of dust and sludge generated from the production can be used as raw material of pelletisation or send to sinter to be recycled for the use. Sewage generated from dust collection can be used by self circulation, no emission and the secondary pollution.

Requirements of raw materials and fuel

Magnetite iron ore fine:

TFe $\geq 67\%$

FeO $\geq 27\%$

Size: -200 mesh $\geq 80\%$

Moisture: $< 10\%$

TFe	FeO	CaO	MgO	SiO ₂	Al ₂ O ₃	S	P	Moisture
67.2	27	0.21	0.41	2.42	0.10	0.017	0.015	10

Bentonite

Particle Size: -200 mesh $\geq 95\%$

Colloid valency: $\geq 68\text{cm}^3/15\text{g}$

Submethyl blue adsorption: $\geq 30\text{g}/100\text{g}$

Dilatation capacity: $\geq 10\text{ml/g}$

Moisture: $< 10\%$

SiO ₂	Al ₂ O ₃	CaO	MgO	TFe
66.34	14.52	0.84	2.24	2.5

Fuel

Blast furnace gas (BF gas), or other gas

Calorific value: 3.35MJ/ M3 (800kcal/ m³)

The gas pressurized from gas pressurizing station is sent into shaft furnace and drying room.

Typical Technical and economical Index

1	Sintering area	5m ²
2	Daily output	600~900t
3	Annual capacity	200,000-300,000 t
4	Working days per year	330 days
5	Operating rate	90.40%
6	Productivity of shaft furnace	5~7.5
7	Performance of finished pellet	
	Compressive strength(N/pellet)	1500—2300
	Tumbler index (%)	≥88%—93%
	Content of FeO (FeO%)	≤3%
	Size	5—18mm
	Percent of pass (%)	≥86-92%
8	Consumption	
	Iron ore fine	1.02t/t.pellet
	Bentonite	<0.03t/t.pellet
	Gas consumption	230-270m ³ /t.pellet
	Steam	For upkeep
	Water	0.06t/t.pellet
	Power	23-32 kwh/t.pellet
9	Manpower	146
10	Area of plant	14000~16000m ²

Performance figures of the finished acid pellet

Name	TFe	FeO	CaO	MgO	SiO ₂	Al ₂ O ₃	S	P	Moisture
TCS pellet	65.8	0.78	0.79	0.71	2.77	0.16	0.004	0.015	0

Traveling Grate Machine-Rotary Kiln -Annular Cooler Process

Traveling Grate Machine-Rotary Kiln-Annular Cooler palletizing is an advanced technique with sufficient utilization of recycled energy, clean surroundings, high quality of pellet, low energy consumption as well as high economic and environmental benefit.

In this system, raw material has high and broad adaptability, man can use not only magnetite, but also hematite concentrate, and the produced pellet has following advantages in commercialization: high grade of iron content, good metallurgical property, suitability for long time storage and long distance transportation and so on.

Now man has set up scores of Traveling grate machine-Rotary kiln-Annular cooler palletizing lines in China , whose performance is excellent



Main system:

Annular cooler, Rotary kiln, Traveling grate machine, Screen & distributor, Disc pelletiser, Damp mill, Dryer, Proportioning, Water charging & discharging, Gas flow system, Dust collecting, Electrical, Instrument & automation and so on.

Pelletisation (Rotary Kiln Type, 0.7 - 2 M Tons/Year)



Loop Cooler



Balling Device



Chain Grate



Rotary Kiln



Process Reference of Pelletisation Plant

Items	Process	TCS Shaft (Our patented technology)	Rotary kiln
Capacity (t/y)		100,000-1,000,000	800,000-2,000,000
Raw materials		Magnetite (Fe ₃ O ₄) as main raw materials; Hematite (Max. 20-30%) If using 60-70% of hematite as raw material, the finished product could not be applied for blast furnace, but which may be used as the input of sponge iron making(compressive strength >400 N/P)	Magnetite (Fe ₃ O ₄); Hematite (Fe ₂ O ₃);
Basic requirement of iron ore		FeO ₂ ≥20%; Fe>67%	
Fuel		Blast furnace gas or other gaseous fuel	Coal and gaseous fuel
Key Application of the finished products		Iron making / blast furnace(800-1500 N/P)	Iron making / blast furnace(800-1500 N/P)
Investment		Lower	Higher

Service:

- **Advanced and reliable technology & engineering**
- **Procurement, manufacture, and delivery of the goods**
- **Project management**
- **Construction, installation, and commissioning**
- **Technical service**
- **Training program**
- **Service after completion of the project**
- **Financing assistance and export credit**
- **Other services and functions upon request**

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Allbest Creative Development Ltd. (ALLBEST)

Beijing, China

allbest@china.com