## BRIEF INTRODUCTION OF YIDA CORPORATION

**YIDA** has developed four companies as ZIBO YIDA ENVIRONMENT PROTECTION ENGINEERING CO., LTD, ZIBO YISHENG ENVIRONMENT PROTECTION EQUIPMENT CO., LTD, ZIBO NASAITI CERAMICS CO., LTD. and FOSHAN YIDA IMPORT & EXPORT CO., LTD

YIDA Corporation has YIDA Company and YISHENG Company; they are two specialization coal gasifying equipments manufacturers. The companies have the certificate of manufacturing the first and second class of pressure vessels, integrated manufacturing system and advanced detecting methods. A group of technical experts gathered here. The professional team we trained is so excellent that we can supply the series services of design, manufacture, installation, test, train and technical consultation, etc. Our coal gasifying technology is listed as environment protecting ones by Chinese government. At the same time, we also develop chemical, metallurgy machinery products.

We are active in developing and studying the technology of coal gasifying. So far, we have supplied over thousands of coal gasifiers for both China and abroad market. Currently our company has won user's trust by offering high-quality products, fair and reasonable price, excellent and efficient services. Our products can be widely used in construction materials, ceramics, glassware, chemical, fire-resistance, metallurgy and machinery, etc. It sells well all over our country as well as **Indonesia, India, Vietnam, Burma, North Korea** etc.

YIDA Corporation wants to cooperate, develop and create a splendid future with all the friends from different countries and regions. Welcome to visit our companies.

**YIDA CORPORATION**

Add: 12A, Changguo East Road, Zhangdian, Zibo, Shandong, P. R. China

Postcode: 255000

Tel: +86-533- 2885108, 2885588 Fax: +86-533-2885588

E-mail：E-mail: fsyida@vip.163.com

**Foshan Office in Guangdong Province**

Address: Room H 10th Floor, Dongjian Building, No. 38 Fenjiang South Road,

Foshan, Guangdong, P. R. China

Tel: 0086-757-82300616 Fax: 0086-757 – 82301108

**YIDA CORPORATION**

**TWO STAGE GASIFIER PURIFIED GAS STATION ENGINEERING CASE (2003-2005)**

| | | |
|---|---|---|
| 1 | PT. KERAMIK DIAMOND INDUSTRIES IN INDONESIA | Φ3.2 mX2 two stage gasifier gas station |
| 2 | VIGLACERA THANG LONG COMPANY IN VIETNAM | Φ3.2 mX2 two stage gasifier gas station |
| 3 | TOKU CERIMIC COMPANY IN VIETNAM | Φ3.2 mX1 two stage gasifier gas station |
| 4 | HANOI CERIMIC TILES COMPANY IN VIETNAM | Φ3.2 mX1 two stage gasifier gas station |
| 5 | AJANTA MANUFACTURING LIMITED IN INDIA | Φ3.2mX5 two stage gasifier gas station |
| 6 | EURO CERIMICS COMPANY IN INDIA | Φ3.2 mX1 two stage gasifier gas station |
| 7 | DECO CERIMICS COMPANY IN INDIA | Φ3.2 mX1 two stage gasifier gas station |
| 8 | MURUDESHWAR CERIMICS COMPANY IN INDIA | Φ3.2 mX1 two stage gasifier gas station |
| 9 | REGENT CERIMICS COMPANY IN INDIA | Φ3.2 mX1 two stage gasifier gas station |
| 10 | WEIMEI CERIMICS COMPANY IN CHINA | Φ3.2 mX5 two stage gasifier gas station |
| 11 | GENERAL CERIMICS COMPANY IN CHINA | Φ3.2 mX3 two stage gasifier gas station |
| 12 | NEW ZHONGYUAN(QINGYUAN)CERIMICS COMPANY IN CHINA | Φ3.2 mX11 two stage gasifier gas station |
| 13 | NEW ZHONGYUAN( SHAN SHUI)CERIMICS COMPANY IN CHINA | Φ3.2 mX6 two stage gasifier gas station |
| 14 | NEW ZHONGYUAN( QINGYUAN)CERIMICS COMPANY IN CHINA | Φ3.2 mX6 two stage gasifier gas station |
| 15 | LIHANG CERIMICS COMPANY IN CHINA | Φ3.2 mX1 two stage gasifier gas station |
| 16 | NASAITI CERIMICS COMPANY IN CHINA | Φ3.2mX1two stage gasifier gas station |
| 17 | QIPENG CERIMICS COMPANY IN CHINA | Φ3.2mX1 two stage gasifier gas station |
| 18 | TIMES(FABEI)CERIMICS COMPANY IN CHINA | Φ3.2mX2two stage gasifier gas station |
| 19 | TIMES(GUIZHOU)CERIMICS COMPANY IN CHINA | Φ3.2mX1two stage gasifier gas station |
| 20 | New SHIJI CERIMICS COMPANY IN CHINA | Φ3.2mX1 two stage gasifier gas station |
| 21 | ZHENJI CERIMICS COMPANY IN CHINA | Φ3.2mX2 two stage gasifier gas station |
| 22 | YICHANG XINXING CERIMICS COMPANY IN CHINA | Φ3.2mX1 two stage gasifier gas station |
| 23 | JINGHUA METALWORK COMPANY IN CHINA | Φ3.2mX1 two stage gasifier gas station |
| 24 | HUASHUNDA CERIMICS COMPANY IN CHINA | Φ3.2mX1 two stage gasifier gas station |
| 25 | HUONGRUN CERIMICS COMPANY IN CHINA | Φ3.2mX2 two stage gasifier gas station |

## Contents

# Φ3.2m TWO-STAGE GASIFIER COLD COAL GAS STATION PROCESS PLAN

## 1 Project Introduction

Design of this project is of 3.2m two-stage coal gasifier process plan:

Φ3.2m two-stage coal gasifier gas station engineering Introduction

| No | item | Unit | Capacity |
|---|---|---|---|
| 1 | Total Heat consumption | kcal/h | 14,000,000 |
| 2 | Φ3.2m two-stage coal gasifier number | Set | 1 |
| 3 | Fix carbon in coal | | >60% |
| 4 | Dry Coal Gasification Rate | $Nm^3$/kgcoal | 3.3 |
| 5 | Heating value of coal gas | kcal/$Nm^3$ | 1,500 |
| 6 | Production capacity of coal gas per hour per set | $Nm^3$/h.set | 10,000 |
| 9 | Coal consumption per hour | kg/h | 3,030 |
| 10 | Coal consumption per day | kg/d | 72727 |
| 13 | Amount of ash per day (10 %) | kg/d | 7272 |
| 15 | Soften water consumption per hour | kg/h | 1,400 |
| 16 | Soften water consumption per day | kg/d | 33,600 |
| 17 | Coal gas station steam consumption | kg/h | 1,400 |
| 18 | Cold circulation water qty. per hour(recycle use) | $m^3$/h | 150 |
| 19 | Cold circulation water consumption per day(recycle use) | $m^3$/d | 3,000 |
| 20 | Water for living per day | $m^3$/d | 10 |
| 21 | Coal gas station power consumption | | |
| | Installed power | KW | 306 |
| | Use power | KW | 193.5 |
| | Effective power consumption | kW | 170 |
| 22 | Operating workers | person/day | 15 |

## 2 Design basis

According to dates supplied by customer, coal gas will be used for sets of batch frit kiln. As 3.3Nm³ coal gas needs 1kg coal, The gas used for whole power plant is about 14000Nm³/h. Under such conditions, gas gasifier will be in high race running. Thus, construct 1 set Dia. 3.2m two-stage coal gasifier gas station to meet the requirement of production.

## 3 Design principles

3.1 Choose updated, mature, reliable technology and equipment

3.2 Process plan can satisfy the requirements of burning and environmental protection

3.3 Ensure the rationality of technology and stability of long running

3.4 Connection of practical and economic investment.

3.5 《Environment protection rules for construction projects 》 IN CHINA STANDARD

3.6 《Rules for gasifier station design 》 IN CHINA STANDARD

3.7 《Safety rules of coal gas for industrial enterprises》 IN CHINA STANDARD

## 4 Design of coal gas station process plan

**Φ3.2m two stage coal gasifier gasifying parameters**

| gasifying intensity | gasifier gasifying area | gasifier gasifying coal capacity | Coal Gasification Rate | Coal Gas producing Qty | Max. coal gas consumption | Choice of coal gasifier | Needed gasifier number |
|---|---|---|---|---|---|---|---|
| kg /h.m² | m² | kg/h | m³/kg | m³/h | Nm³/h | | set |
| 380 | 8.04 | 3,030 | 3.3 | 10,000 | 10,000 | Φ3.2 | 1 |

This plan needs 1 set of Φ3.2m two-stage coal gasifier system to meet the requirement of production.

## 5 Coal sort and main gasification index

**5.1 Coal Sort**: Suggest using bituminous coal with calories >5500 KCal/kg

Coal gasification rate of different coal

| Heat value of coal kcal/kg | Gasification efficiency % | Total converted heat value kcal/kg | Coal gas heat value kcal/m³ | Coal gas ratio Nm³/kg |
|---|---|---|---|---|
| 5500 | 80% | 4400 | 1500 | 2.93 |
| 6000 | 80% | 4800 | 1500 | 3.2 |

| | | | | |
|---|---|---|---|---|
| 6500 | 80% | 5200 | 1500 | 3.46 |

**5.2 Main Gasification Index**

| | |
|---|---|
| Gasification Capacity | 375-400 kg/m²h |
| Dry Coal Gasification Rate | 3-3.5 Nm³/kg |
| Coal Gas Heating Value | 1450-1500 kCal/Nm³ |
| Slag Carbon Rate | <10-15% |
| Steam Consumption Rate | 0.3-0.5 kg/kg Coal |
| Air Consumption Rate | 2.3-2.5 Nm³/kg Coal |
| Slag Output Rate | 15-20% |

## 6 Coal Quality & Coal Gas Quality Requirements

### 6.1 Coal Quality Requirements

In order to guarantee the quality of coal gas and meet the process demand of two-stage gasifier coal gas producing, the suitable coals are non-caking coals. See the following form for detailed targets:

| Project | Technical Requirements |
|---|---|
| Heating Value | ≥ 5500 kcal/kg |
| Type & size | Non-caking or weak caking coal granularity: 40-60mm |
| Max. Granularity/Min. granularity | ≤2 |
| Piece coal filling rate | <10% |
| Stone rate | <2% |
| Volatilization rate (dry base) | >25% |
| Ash rate (dry base) | <18% |
| Total sulfur (dry base) | ≤2% |
| Coal ash soften temperature (ST) | >1100 Celsius degree |
| Hot stability (RW+6) | >60% |
| Broken resistance intension (>25mm) | >60% |
| Roga index (R.I) | <20 |

| | |
|---|---|
| free-swelling index (F.S.I), | <2 |

**6.2 Coal Gas Content and Quality Index**

**Cold coal gas content (%)**

| CO | $H_2$ | $CO_2$ | $N_2$ | $CH_4$ | $O_2$ |
|---|---|---|---|---|---|
| 23-30 | 10-15 | 4-5 | 45-50 | 2-3 | 0.2-0.6 |

Coal gas quality index

| No. | Name | Unit | index |
|---|---|---|---|
| 1 | Tar | $Mg/Nm^3$ | <100 |
| 2 | Coal gas dust content | $Mg/Nm^3$ | <100 |
| 3 | Coal gas heating value | $kCal/Nm^3$ | >1450 |

**7 Coal gasification theory and technical process**

**7.1 Coal gasification theory**

Basic chemical reaction Producer gas is made by the gasification agent, which is mixture of steam and air, goes through red-hot fixed burning bed. The oxygen and steam content in the air react with the carbon in the fuel, generate the producer gas with ingredients like CO, $CO_2$, $H_2$, $CH_4$, $C_2H_4$, $N_2$ etc.

Reaction of steam and carbon is endothermic reaction:

$$C + H_2O = CO + H_2$$

When oxygen and carbon react, then heat output:

$$2C + O_2 = 2CO$$

Reaction of carbon monoxide and steam:

$$CO + H_2O = CO_2 + H_2$$

Some steam here reacts with carbon monoxide. When every volume of carbon monoxide translates into carbon dioxide, generates the same volume of hydrogen at the same time. In the reducing zone, quick

reaction is occurred when the temperature is below 1200 Celsius degree .

$$CO_2 + C = 2CO \text{ and}$$

$$H_2O + C = H_2 + CO$$

When the coal gas goes through the reducing zone, flammable gas content rises rapidly, carbon dioxide and steam content decrease. Across the reducing zone, a part of coal gas is exported, flows through bottom cyclone and wind cooler, this part of gas is called "downstage coal gas", its temperature is around 400-550 Celsius degree.

In the carbonation stage, the coals added in the gasifier are dried, preheated and carbonated, generate steam, tar and coal gas, exported from the top of gasifier together, this part of gas is called "up-stage coal gas", its temperature is around 100-120 Celsius degree.

**7.2 Brief introduction of production process flow**

40-60mm coal are lifted to the coal storage bin by lifting system, the coal is added in the carbonation stage of two-stage coal gasifier by a programmable control feeding system. Air is blown in the bottom of furnace by air blower, at the same time, low pressure steam goes through the blending bin and blends with air, becomes the gasification agent, which will carry on the gasification reaction with 1200 Celsius degree semi coke in the gasification stage, generate 31-33% CO, 9-10% $H_2$, 0.4-0.5% $CH_4$ flammable gas; at the same time, the excess heat of downstage coal gas carbonate the coals at the carbonation stage, generate 29-31% CO, 17-19% $H_2$, 1-3% $CH_4$, 0.2-0.4% $C_nH_m$ flammable gas.

The temperature of upstage coal gas is about 100-150 Celsius. The temperature of downstage coal gas is 550-600 Celsius degree.

**8. System Compositions and Description Of Gas Station**

Coal gas station is consist of coal storage, lifting and conveying system, coal feeding system, gas making system, purification and cooling system, storage and transportation system etc.

**8.1 Coal storage system**

The size of coal yard depends on the conveying distance of the coal, if the conveying distance is farer, ensure to store coal for one month, minimum 15 days, the area of coal yard is 2000 square meters.

Due to the coal is easy to come into the coal powder during the long distance transportation, so the coals need to sieve before they are fed into the gasifier. If the size of coal purchased is not even, the coal is above 40-60mm, need fragmentation system.

**8.2 Coal lifting and conveying system**

Coal gas station coal yard ---- sieving system---- electric hoister ---- coal storage bin.

The quantity of gasifier in coal gas station is below five sets, use electric hoister to feed coal (dual system); if the quantity is above 5 sets, can use belt to feed coal.

The volume of coal storage bin is 20m$^3$, coal in it can use 8 hours for the gasifier.

**8.3 Gasification system**

Gasification system is **NORMAL PRESSURE FIXED BED GASIFIER**, it is consist of coal feeding system, furnace body(up-stage & down-stage), grate, hydraulic driving system, de-ash system.

**8.3.1 Hydraulic coal feeding system**

Stoking uses two-way double faucet stoking valve. There is a surge bin in the middle of every two stoking valves. Stoking is controlled by the PLC in the control room, including automatic, semi-automatic and manual control. Faucet stoking valve is driven by the hydraulic system.

**8.3.2 Furnace body system**

At the carbonation stage, a 36-group ventilation hole refractory lining is laid in furnace body. Heat-proof stainless central tube is fixed in the center of furnace body, which makes a heating space both inside and outside; the coal entering the furnace will get heat transfer from the two relative directions of inside central pipe and outside refractory material, that the coal can be carbonated completely. Inside the refractory lining, on the coal gas pipe, there is an adjustable valve, it can adjust the coal gas flow amount of gasification stage and carbonation stage, in turn adjust the proportion of upstage and downstage gas. At the bottom of furnace body, there is a normal pressure water jacket, it can produce steam itself for gasification.

**8.3.3 Grate system**

Grate is made from heat-proof wear resistant alloy cast iron. It is fixed on the base of grate, The base of grate is antifriction cast iron. Gasification agent goes through tuyere of grate and lay evenly in the furnace for the gasification reaction.

**8.3.4 Hydraulic ash handling system**

There is a big ash plunge and a small ash knife on the furnace body symmetry fixed. Through the rotation of ash tray, plunge out the ash, drop into ash bucket. This system uses wet ash removing, ash driving uses hydraulic system.

**8.3.5 Central grease lubrication system**

The lubrication of gasifier stoking valve and ash driving machine uses grease lubrication system. Lubrication station can pour into every oil site automatically.

**8.5 Gas station soften water supply system**

Because the water jacket is at the high temperature stage of gasifier, to avoid the water jacket fouling, water jacket of gasifier must use softening water.

- Soften water consumption: 1000-1400 kg/h

| | | | |
|---|---|---|---|
| 1 | Soften water consumption per hour | kg/h | 1,400 |
| 2 | Soften water consumption per day | kg/d | 33,600 |

- Use type pump 2 sets, 5.5kW×2
- Lift: P=41-45m,
- Flow rate: Q=7-14m³/h
- Water quality should satisfy the following standard:

**Water quality standard of boiler with solid fuel**

| Item | Water supply | | Furnace water | |
|---|---|---|---|---|
| | Add-drug treatment in the boiler | Chemical treatment outside of boiler | Add-drug treatment in the boiler | Chemical treatment outside of boiler |
| Suspended water(mg/L) | ≤20 | ≤5 | | |
| Total hardness(me/L) | ≤3.5 | ≤0.03 | | |
| Total alkalinity (me/L) | | | 10-22 | ≤22 |

| | | | | |
|---|---|---|---|---|
| Ph(25 Celsius degree ) | ≥7 | ≥7 | 10-12 | 10-12 |
| Dissolution solids(mg/L) | | | <5000 | <5000 |
| Relative alkalinity(free NaOH/dissoluti on solids) | | | <0.2 | 0.2 |

Note: me/L instruments of nonofficial measurement , 1 me/L=50 mg/L , use $CaCO_3$

**8.6 Coal gas transportation system**

Coal gas transportation system is the system that the gas came out from the equipment, after pressurized to send to the users. It consists of coal gas pressure adder and coal gas pipelines. Coal gas pressure adding system aims to increase the gas pressure, it is easy to convey for long distance and satisfy the requirements of users.

**8.7 Phenolic water treatment system**

Phenolic water treatment system consists of phenolic water pump, transportation pipeline, phenolic water incinerator. Its function is to collect and incinerate. Use tar and coal gas produced from gas station as fuel, burn the phenolic water which is atomized in the incinerator, generate carbon dioxide and steam, discharge to the air, then stop the phenolic water from polluting to underground water and air.

**9. Gasification technical character of two-stage coal gasifier**

Two-stage coal gasifier has its special character both on technical and process.

**9.1** Technology of Φ3.2m two-stage coal gasifier is an updated gasification technology which is based on the imported most advanced equipments and technology, then digest, absorb and optimize continuously.

**9.2** Use two-stage coal gasifier to produce coal gas, it has high gasification efficiency and hot efficiency, lower producing and running cost, higher autoinmunization, lower working intention, better operation environment, less coal gas impurity, higher heating value and stability. Compared to the traditional single-stage gasifier, it can improve heat efficiency 10%, coal gas heating value goes up 200-300Kcal/$Nm^3$.

**9.3** Use closed cycle cooling, no waste water discharged.

Small amount of phenolic water and coal powder mixed and made into water coal slurry or burn in the incinerator; satisfy the requirements of environmental protection.

**9.4** The tar produced is low-temperature carbonization tar, with low viscosity, good liquidity, good quality, and easy to store and burn. It is can be exported for chemical material.

**9.5** Coal feeding machine made up of two-way double faucet valves machine, with compact conformation, safe and reliable, easy to maintain.

**9.6** Use heat-proof stainless central pipe with good heat transformation, low heat loss.

**9.7** High effective height of ash tray, high pressure of fan, high gasification intensity, far transportation distance, which ensure the normal running of system, reliable and convenient.

**9.8** Grate uses overall structure, the grate uses heat resisting casting, high temperature resistant, abrasion resistant.

**9.9** Coal feeding and ash tray driving use hydraulic system, with stable running, simple structure, safe and reliable, long life-span, easy to maintain.

**9.10** High automatation, perfect inspection method, more self control links, easy to operate and manage, low labor intensity.

**9.11** use water jacket cyclone, it can recover the excess heat of downstage coal gas, generate 0.2MPa steam.

## 10. Main Equipments Models

### 10.1 Coal Gasifier

Model: Φ3.2m two-stage coal gasifier sets, its techniques specifications & parameters see the following table: **Φ3.2 two-stage coal gasifier techniques specifications & parameters**

| No. | Name | | Specification & Parameter |
|---|---|---|---|
| 1 | Hearth Diameter | | 3.2m |
| 2 | Hearth cross-stage area | | 8.04m² |
| 3 | Suitable fuel | | Non-caking or weak-caking coal ,size :40-60mm |
| 4 | Size grade | | 20-40 , 25-50 , 30-60 ㎜ |
| 5 | Coal consumption | | 3030 kg/h |
| 6 | Coal gas output | | 10,000 m³/h |
| 7 | Coal gas heating value | Upstage coal gas | (1600-1700) KCal/m³ |
| | | Downstage coal gas | (1200-1300) KCal/m³ |
| | | Mixed coal gas | (1450-1550) KCal/m³ |
| 8 | Outlet coal gas temperature | Upstage coal gas | 100-150 Celsius degree |
| | | Downstage coal gas | 550-600 Celsius degree |
| 9 | Outlet coal gas pressure | Upstage coal gas | 980-1960Pa(100-200mm $H_2O$) |
| | | Downstage coal gas | 1960-2940Pa(200-300mm $H_2O$) |
| 10 | Saturated steam pressure | | 7.0 kPa |
| 11 | Saturated steam temperature | | 55-65 Celsius degree |
| 12 | Water jacket heated area | | 17m² |
| 13 | Water jacket steam pressure | | 70(294) kPa |
| 14 | Water jacket steam output | | 550 kg/h |
| 15 | Ash tray rotary speed | | 1.5 r/h |
| 16 | hydraulic station power | | 11 kW |
| 17 | Poking hole steam pressure | | 294 kPa |
| 18 | Coal gas outlet size | Up stage | DN500 |
| | | Down stage | 866X866 |
| 19 | Gasifier bottom fan pipe diameter | | DN500 |

### 10.2 Cyclone

**10.2.1 Up-stage coal gas cyclone**

There is a cyclone at the outlet of upstage coal gas. It will remove the big granular tar and dust in up-stage coal gas, at the same time, prevent the big granular tar is condensed in the coal gas pipe to stuck the pipeline.

**10.2.2 Down-stage coal gas cyclone (with water Jacket)**

It is purification equipment in the coal gas purification area outdoor. It will remove dust in down-stage coal gas, and can recover the excess heat of down-stage coal gas, generate 0.2MPa steam. This design has provided 2 water jacket cyclone dust remover.

**10.6 Air Blower**

It's kind of wind supplying equipment arranged inside fan room whose main function is to pressurize air and feed into coal gasifier furnace, which could gasify the coal and generate coal gas. As the design, three units of 9-19No7.1A air blowers are equipped, and main parameters are full wind pressure P= 10426Pa, air quantity is Q=9988m$^3$ / h, power of motor is 37kW, with two for running and one for standby.

**10.7 Coal Gas Pressure Adder**

It is coal gas delivery equipment in the coal gas pressure adder room. Its main function is to pressure the coal gas which has been purified and sent it to users. This design has three Q=5000m$^3$/n P=21720Pa MZ120-2200 coal gas pressure adders, one is working one is for standby, main parameters are: whole air pressure 21720Pa, flow quantity 10000 m$^3$ / h,. Motor power is 90kW.

**10.8 Hydraulic system**

There is 2 set of hydraulic system, including 2 set of hydraulic station, 4 sets of ash pan driving hydraulic cylinders, and 8 sets of coal filler hydraulic cylinders in the hydraulic system per gasifier. The ashtray hydraulic system's working pressure is 16MPa and its testing pressure is 20 MPa. Coal filler hydraulic system's working pressure is 12.5 MPa, and testing pressure is 16MPa.

Its equipments' detailed layout refers to the technical flow chart and equipment list

**11 Gas station pipeline network**

The coal gas station has coal gas pipeline network, steam pipeline network, station circulation water pipeline network, soft water pipeline network, tap water pipeline network, fire control water pipeline network, tar, light oil and Phenolic water pipeline network.

**12 Process Collocations**

Coal gasifier, coal gas pressure adder and fan are collocated indoor.

**13. Construction structure**

Main workshop of coal gas generation room is second grade exploration danger manufacture workshop; construction fire resistance grade should be no lower than second grade. Coal gas generation room main workshop has five floors, concrete structure, there are 4.0m、8.7m、14.7m、21.7m four floor operation platform, the roof elevation is about 28.7m. Main workshop of one set of gas generation room, length is 21.3m, width is 12m. (the detailed layout refers to the plane layout drawing)

**14 Power supply circuit**

Power supply in the gas station is three-phase four-wire system 380V and single phase 220V, the bigger gas station need to set up the transformer station. The power supply circuit is duplicate supply.

**15. Automatic Controls**

**15.1 Automatic Control**

Instrument measurement

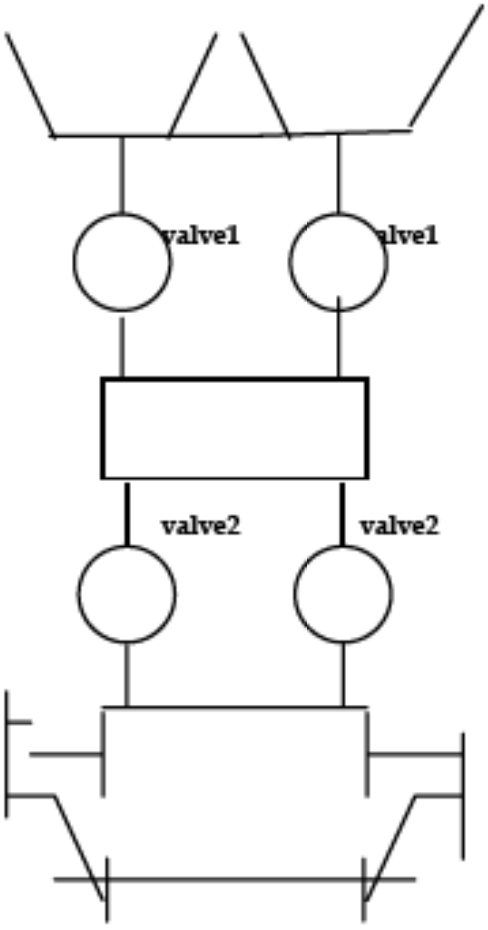
| Instrument measurement Measured Equipment | Measured project name & symbol | | Measured medium | Meters installed position | meter character | unit | Normal Operation parameter | Measured range |
|---|---|---|---|---|---|---|---|---|
| Φ3.2 m two-stage coal gasifier | Upper-stage coal gas outlet temperature | $T_1$ | Coal gas | Central control | target | Celsius degree | 120 | 0-400 |
| | Upper-stage coal gas outlet pressure | $P_1$ | Coal gas | Central control | target | Pa | 3500 | 0-5000 |
| | Lower-stage coal gas outlet temperature | $T_2$ | Coal gas | Central control | target | Celsius degree | 600 | 0-1000 |
| | Lower-stage coal gas outlet pressure | $P_2$ | Coal gas | Central control | target | Pa | 4500 | 0-6000 |
| | Saturation air pressure | $P_3$ | Saturation air | Central control | target | Pa | 7000 | 0-10000 |
| | Air main pressure | $P_4$ | air | Central control | target | Pa | 9000 | 0-12000 |
| | Saturation air temperature | $T_3$ | Saturation air | Central control | target | Celsius degree | 58 | 0-150 |
| | Gasifier checkpoint's temperature | $T_4$ | Coal gas | Central control | target | Celsius degree | 1100 | 0-1500 |
| | Coal gas outlet pressure | $P_5$ | Coal gas | local | target | Pa | 3000 | 0-5000 |
| Steam drum | Steam outlet pressure | $P_6$ | steam | local | target | MPa | 0.3 | 0-0.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pressure adder | Coal gas low pressure gas main pipe pressure | $P_7$ | Coal gas | Central control, pressure adder operation room | target | Pa | 2500 | 0-5000 |
| | Coal gas high pressure gas main pressure | $P_8$ | Coal gas | pressure adder operation room, local | target | Pa | 23000 | 0-30000 |
| | High pressure gas main temperature | $T_{10}$ | Coal gas | local | target | Celsius degree | 35 | 0-100 |
| | Fan outlet pressure | $P_9$ | air | local | target | Pa | 12000 | 0-15000 |
| Flow | Filled air quantity | Q | air | Central control | target | $Nm^3/h$ | 4500 | 0-6000 |

Amortizing coal store should always keep a fight of coal. Automatic coal filler control program (controlled by PLC). Fill coal when Up stage coal gas outlet temperature is over 125 Celsius degree , then valve 2 is open, the coal of amortizing coal store filled into coal gasifier, close valve 2 and open valve 1, coal in coal store fill into amortizing coal store, then close valve 1. This is a coal-filling program. Every valve will be open 6 seconds and close 1 second total 7 seconds, one circulation is about 14 seconds, and it can be adjusted.

We should consider half-automatic coal filler and manual coal filler, manual automatic coal filler should not affect coal filler; if any parts of automatic filler are broken, it should not affect the manual filler.

Φ3.2m two-stage furnace automatic coal filling control system sees the following drawing:




**Half-automatic Coal Filler**

As soon as the half-automatic electric switch is on, the coal will be filling one by one calculatedly, continuously filling; close the switch if stop coal filling.

**Manual Coal Filler**

The steps to set up manual electric switch on the control disc are as following:

A <1> Open valve 2, <2> Close valve 2, <3> Open valve 1, <4> Close valve 1.

B Saturation temperature will be controlled automatically.

Adjust range is 58-60 Celsius degree , precision±0.5 Celsius degree .

C Steam drum hydraulic level will be adjusted automatically; fill water automatically when the steam bag hydraulic level is low, stop filling when it is high. It will sound the alarm if it is low.

D 6 temperatures in the furnace will be checked automatically.

**15.2 Alarm**

A Alarm for the first time when low-pressure coal gas general pipe falls to 300Pa, alarm secondly when it falls to 150Pa. We use automatically turning off.

B Alarm automatically when the temperature of insulation box is lower than 110 Celsius degree .

C Alarm automatically when steam bag hydraulic plane is lower than low water level.

The sounds of three alarms should be different.

**15.3 Lighting, Thunder Prevention & Grounding Connection**

Main workshop and coal gas pressure adder are exploration prevention area; other floors of main workshop are non-exploration prevention area. Recent regular practice is to use exploration prevention lights. We use cast lighting in purification equipments area, emergency lighting in machine room, central control room and main passage. Part lighting is set for meters.

Main workshop, purification equipments, diffusing pipe should be earthed static, fix a lightning rod on the diffusing pipe.

**15.4 The Connection of Coal Gas Adder & Air Blower**

It can start coal gas adder only when air blower is started; the coal gas adder should be stopped automatically when the air blower is stopped. The connection should make all the fans working alternately.

## 16 Safety, Environment & Fire Control

**16.1 Safety**

A Consider the thunder prevention & static prevention earthing measures on pipeline and accessory equipments.

B There should be lift; platform and safety bluster on the equipments, which need to be repaired, and maintenance.

C There should be safety pressure discharge water cover on different part of the whole coal gas station system.

D There should be special steam blow & brush and safety diffusing system when repair.

E Make management system and operation rules.

F There should be insulation area and doorman on the coal gasifier station area and strict management.

**16.2 Environmental Protection**

A Prevention of noise: The noise below 85db.

B Disposition of Tar Tar, light oil is calculated with 60-80 kg/t coal.

Detarrer and deoiler to be stored in tar pool and light oil pool collect tar, light oil. They can be used

as fuel or be sold out as chemical raw material.

C Phenolic water treatment

The content of phenolic water is calculated as 60-80kg/t coal. Phenolic water treatment uses incineration technology, burning the phenolic water in the incinerator or mix with coal powder to make water coal slurry, which supply for the drier's hot blast furnace.

D Waste residue treatment

The solid waste residue in the production process of gas station is ash. Because the ash discharging of gasifier is wet ash discharging, there is no dust dispersed in the air. The amount of ash is relative to the coal ash, the general requirement of coal ash is below 15%. A 300m² field is placed in the gas station to keep the ash for 5 to 7 days. Ash can be used to make road or be sold as the material of producing hollow bricks, it is no effect on the environment.

**16.3 Fire Control**

Equip several handle fire extinguishers in this area. Fix fire fighting road and outdoor hydrant.

## 17 Coal Gas Station water, Steam , Power

**17.1 Water consumption**

Water consumption for life: 5m³/d

17.2 **Cold circulation water & Water for living consumption**

Indirect cooler water consumption (recycle use)

| | Unit | set | Unit consumption t/h |
|---|---|---|---|
| Cold circulation water qty. per hour | m³/h | 1 | 150 |
| Cold circulation water consumption per day | m³/d | 1 | 150 |

**17.3 Steam**

Self-made steam is used for gasification agent, and steam outside station is used for poking hole sealing, heat preservation of insulator and sweeping pipeline.

**Steam Consumption**

| Steam usage | Steam pressure MPa | Consumption kg/h | | Remark |
|---|---|---|---|---|
| | | Continuous | Intermittent | |
| Gasification agent | 0.098 | 1000 | 0 | |
| Sealing poking hole | 0.25-0.3 | 0 | 40 | |
| Insulator box | 0.3-0.4 | 160 | 0 | |
| Tar pipe heating | 0.3-0.4 | 100 | 0 | |
| Tar pool | 0.3-0.4 | 100 | 0 | |
| Total | | 1360 | 40 | 1400 |

| Φ3.2M TWO-STAGE GASIFIER GAS STATION POWER CONSUMPTION | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| No | Name | Model | Unit | Qty | kW/set | Install power kW | Use power kW | Use Frequency % | Actul power consumption |
| 1 | Electric hoister | BH43-3t×30 | set | 1 | 5 | 5 | 5 | 50% | 2.5 |
| 2 | Hydraulic system motor | | set | 1 | 11 | 11 | 11 | 50% | 5.5 |
| 3 | Coal feeder dry oil pump | DDB-18 | set | 1 | 1 | 1 | 1 | 50% | 0.5 |
| 4 | Ash try dry oil pump | GDB-4 | set | 1 | 1 | 1 | 1 | 30% | 0.3 |
| 7 | Air Blower | 9-19No7.1A | set | 2 | 40 | 80 | 40 | 100% | 40 |
| 8 | Gas pressure adder | MZ120-2200 | set | 3 | 45 | 135 | 90 | 100% | 90 |
| 9 | Cooling system pump + Cooling tower pump | | set | 2 | 22 | 44 | 22 | 100% | 22 |
| 10 | Phenolic pump | FLGH-32-200 | set | 1 | 4 | 4 | 4 | 30% | 1.2 |
| 11 | Gear oil pump | KCB-200 | set | 1 | 4 | 4 | 4 | 30% | 1.2 |
| 12 | Soft water pump | IS50-32-200B | set | 2 | 5.5 | 11 | 5.5 | 50% | 2.75 |
| 13 | Lighting | | one | | | 10 | 10 | 40% | 4 |
| 16 | Total | | | | | 306 | 193.5 | | 170 |

Electricity consumption: Installation power is 306 kW, Running power is 193.5 kW, Effective power consumption is 170 kW.

**18 Station workers**

**Coal gas station worker**

| Post | Shift I | Shift II | Shift III | Day-off in shift | Total |
|---|---|---|---|---|---|
| Stoker | 2 | 2 | 2 | 2 | 8 |
| Coal & slag carrying | 1 | 1 | 1 | 1 | 4 |
| Air fan, Gas fan & Pump Room etc. | 1 | 1 | 1 | | 3 |
| Station head & Technician | 1 | | | | 1 |
| Total | 9 | 8 | 8 | 4 | 16 |

**19 Communication & Connection**

Telephone in gas station is tool for internal & external connection; it is user's responsibility to do so.

**20 Master plan**

**20.1 Master plan and orientation**

The construction of gas station depends on the actual situation of manufacturer. The gasifier, pressurization system, boiler room, circulation water disposing system, coal yard of the newly-built gas station are set up at the windward side of summer minimum wind frequency in the factory.

There should be 20-30% forestation area in the gas station.

The size of coal yard should ensure the storage of coal for one month, area is 2000 square meter.

Ash yard should ensure the storage of ash for 15 days, area is 300 square meter.

**20.2 Transportation**

The coal is transported to the coal yard by truck. The traffic route way is set up at the surrounding of gas station and coal yard in the gas station.

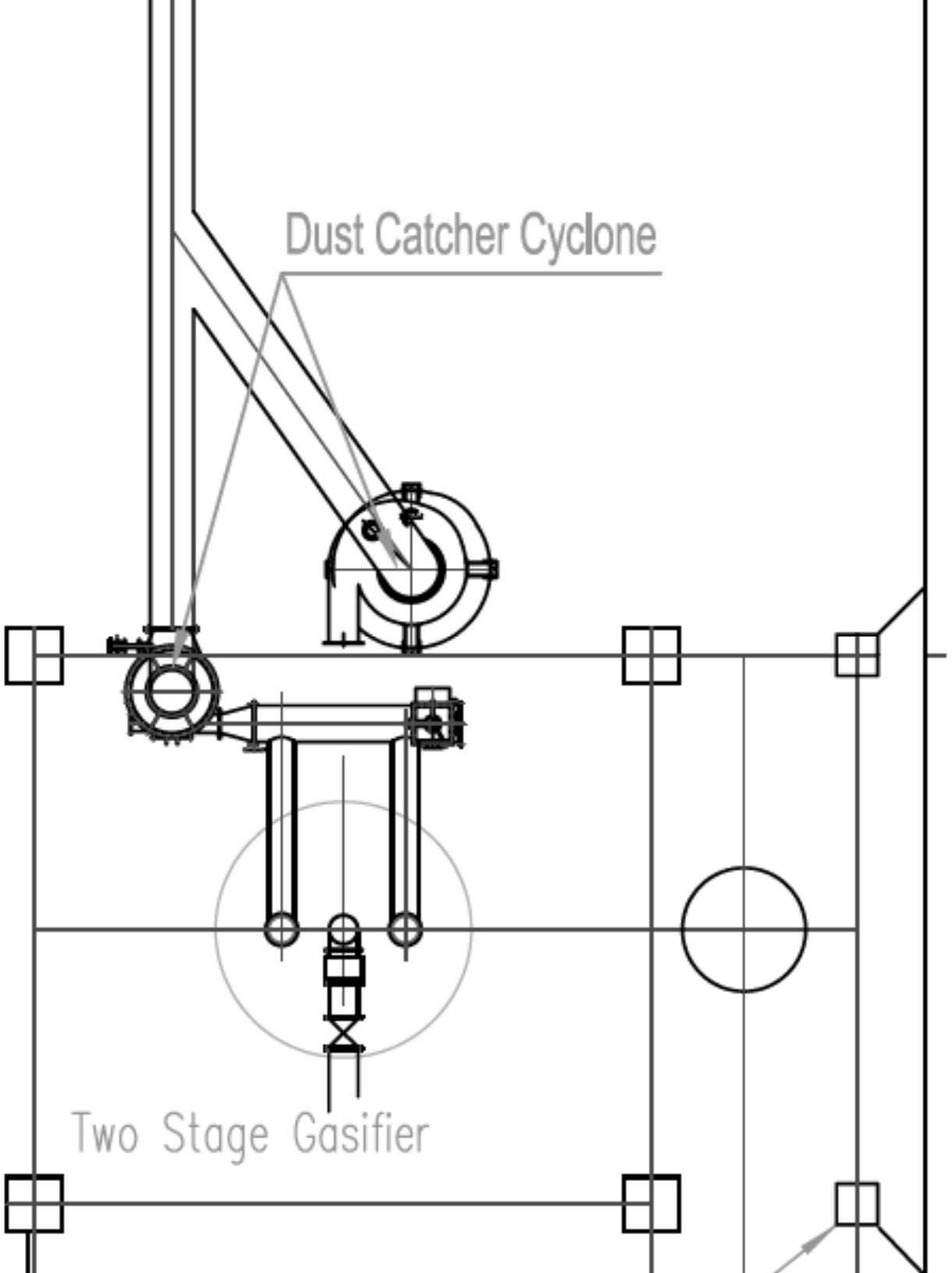
## 21. COMMERCIAL TERMS AND CONDITIONS

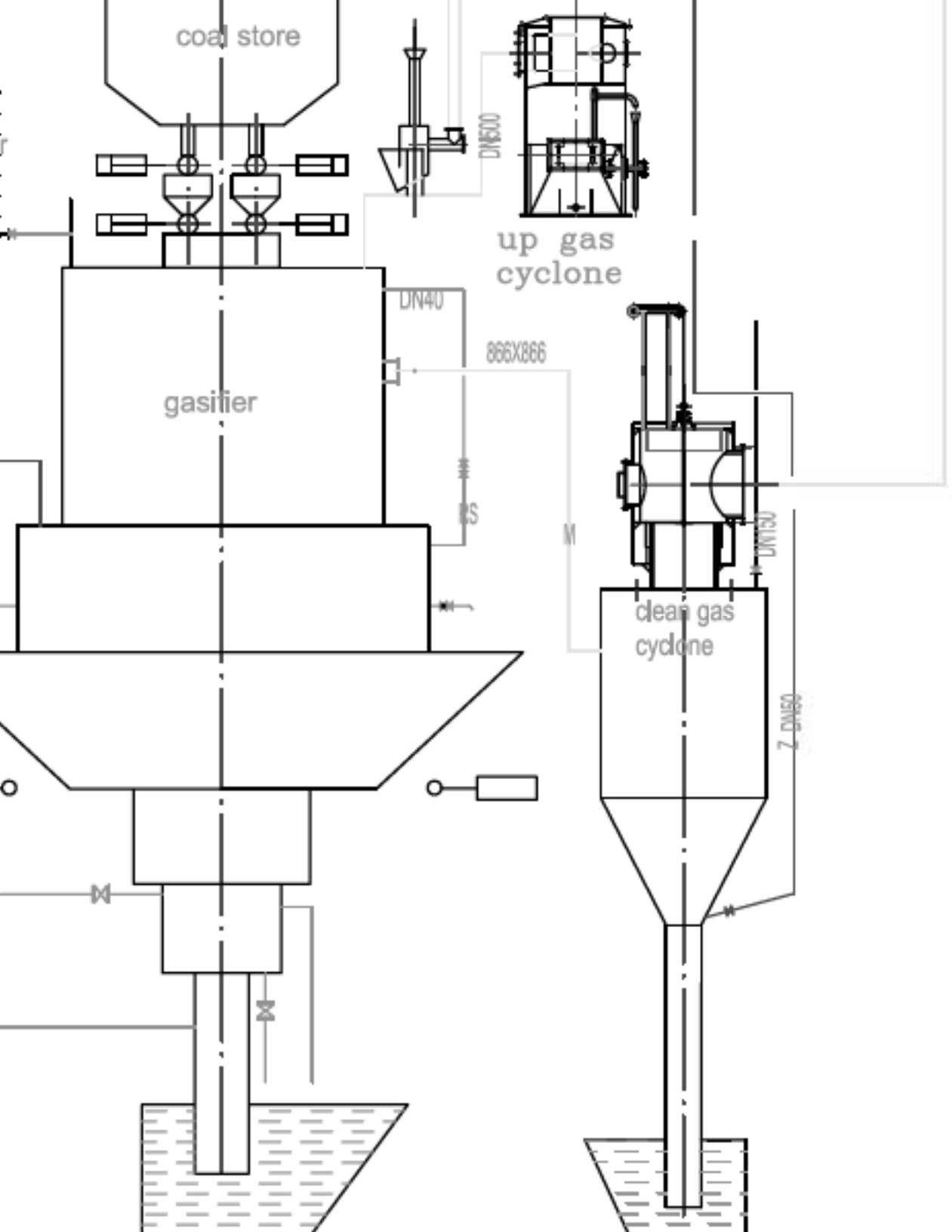
| | |
|---|---|
| **21.1 PRICE** | **USD 200,000** |
| **21.2 DELIVERY TERM** | **FOB QINGDAO** |
| **21.3 DELIVERY TIME** | **30 DAYS FROM ORDER** |
| **21.4 PAYMENT TERM** | **30% ADVANCE, 70% BY LC AT SIGHT** |

*** Above price includes Installation, Commissioning and Training to your peoples at factory site.**

**ZIBO YISHENG ENVIRONMENTAL PROTECTION EQUIPMENT CO., LTD.**
Add: 12A, Changguo East Road, Zhangdian, Zibo, Shandong, China
Postcode: 255000
Tel: +86-533- 2889667, 2885588 Fax: +86-533-2885588
http// www.zbyisheng.com E-mail：fsyida@vip.163.com

**Foshan Office**
Address: Room T 10th Floor, Dongjian Building, No. 38 Fenjiang South Road, Foshan, Guangdong, P. R. China
Tel: 0086-757-82300616 Fax: 0086-757 – 82301108


Dust Catcher Cyclone
Two Stage Gasifier


coal store
DN500
up gas
cyclone
DN40
866X866
gasifier
clean gas
cyclone
DN150
2 DN50