



Air Separation

- A. Superiority**
- B. Inspection Standards**
- C. Outstanding Achievements**

A. One-stop Service



Design



Produce



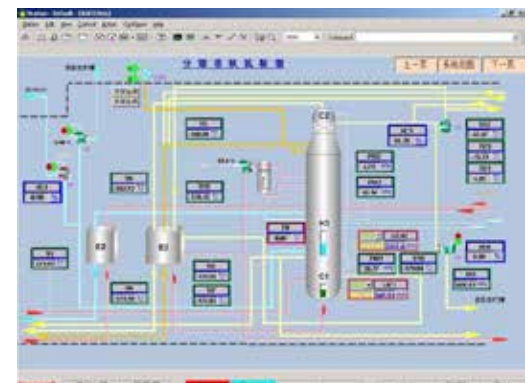
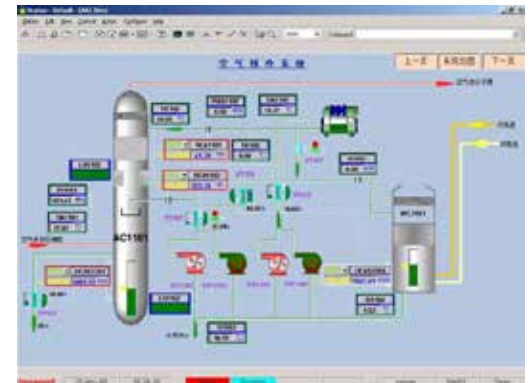
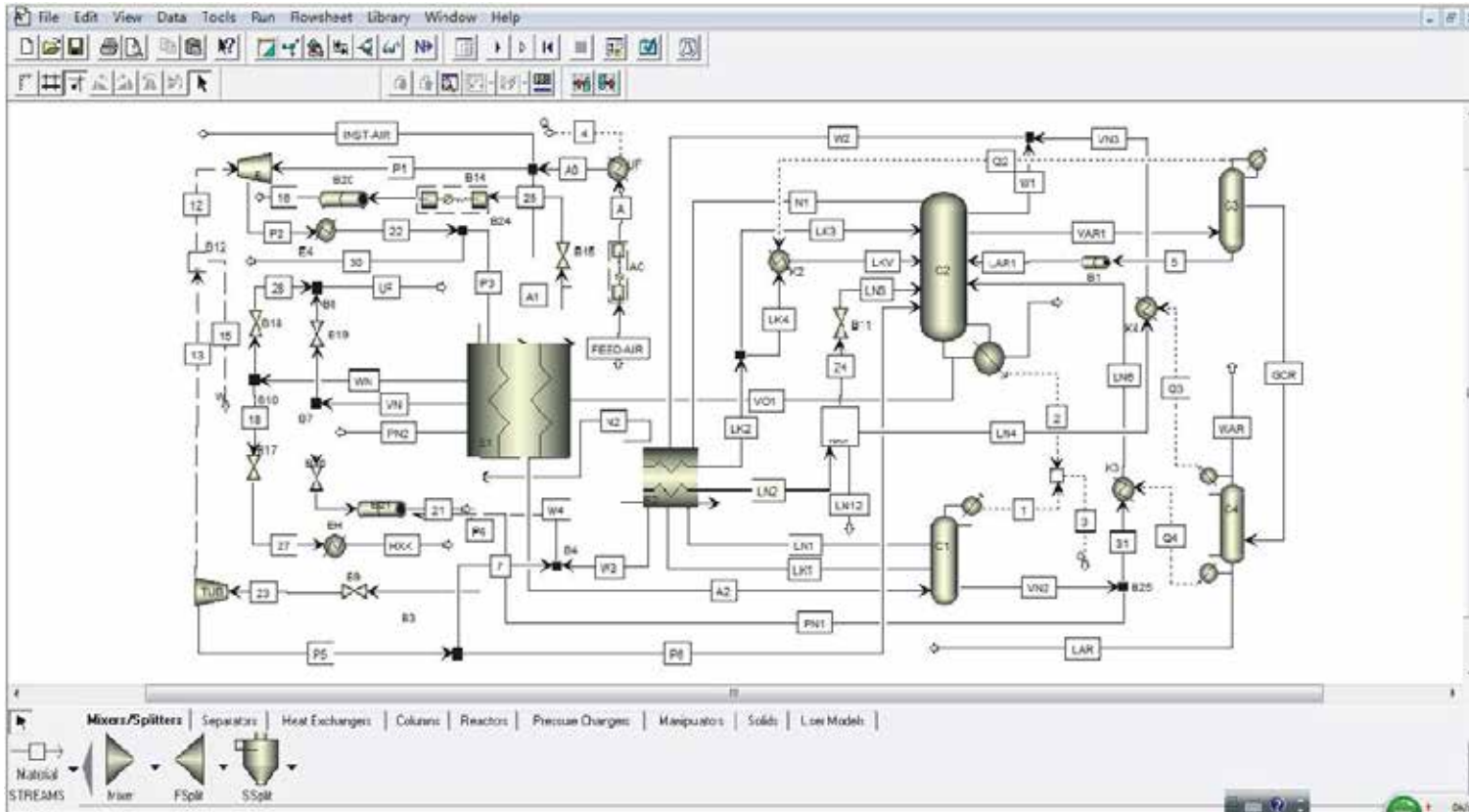
Install



On-site
Guidance

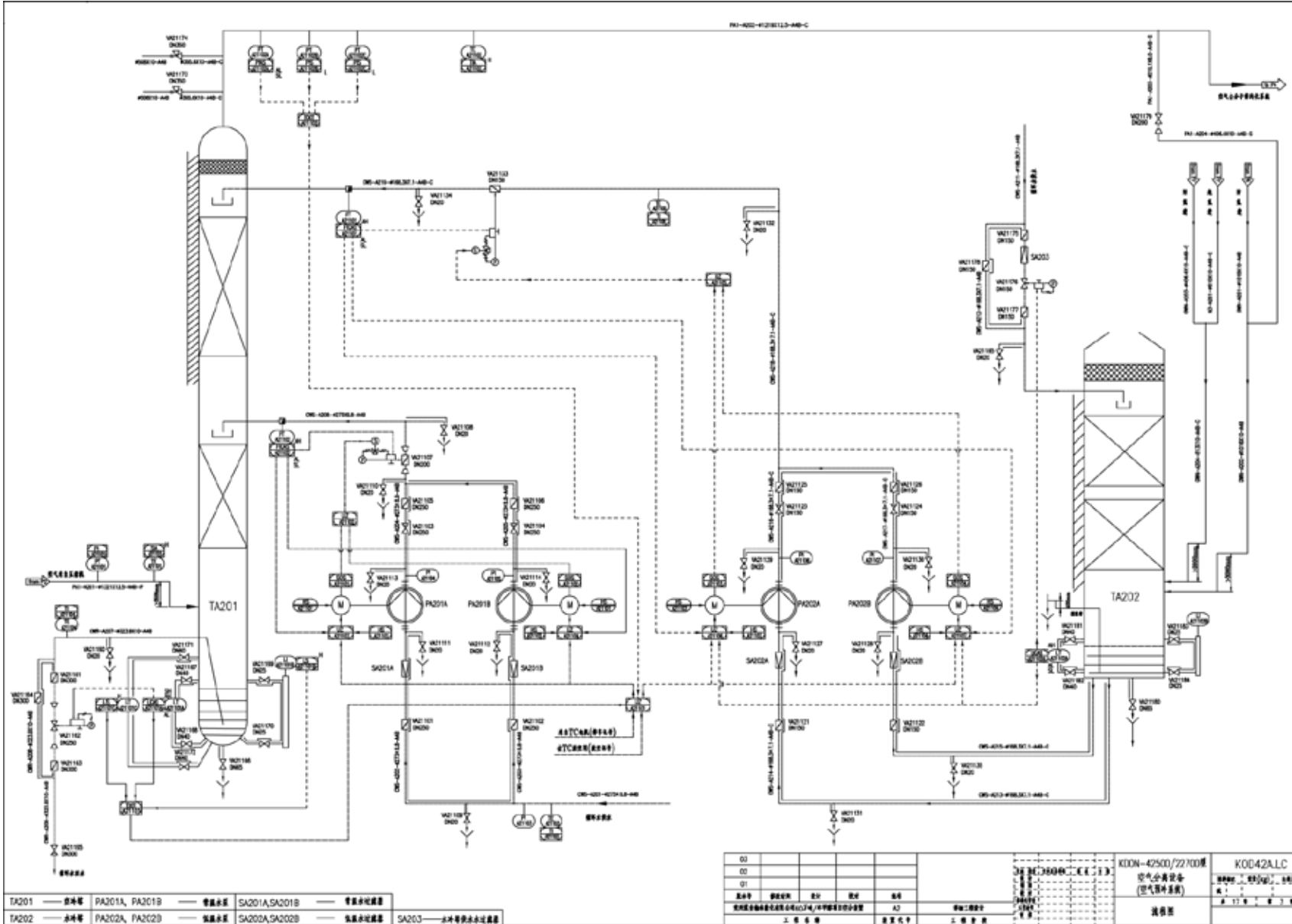
PCC offer the full support and services from feasibility studies - process development - product design & manufacturing - construction - site guidance

Design



The combination of eight key elements is: Process Design, Equipment Design, Automatic Control System design, Manufacture, Engineering Design, Installation, Commissioning & Training, After-sales Service, which provides the company with the ability of undertaking turnkey projects independently.

Design

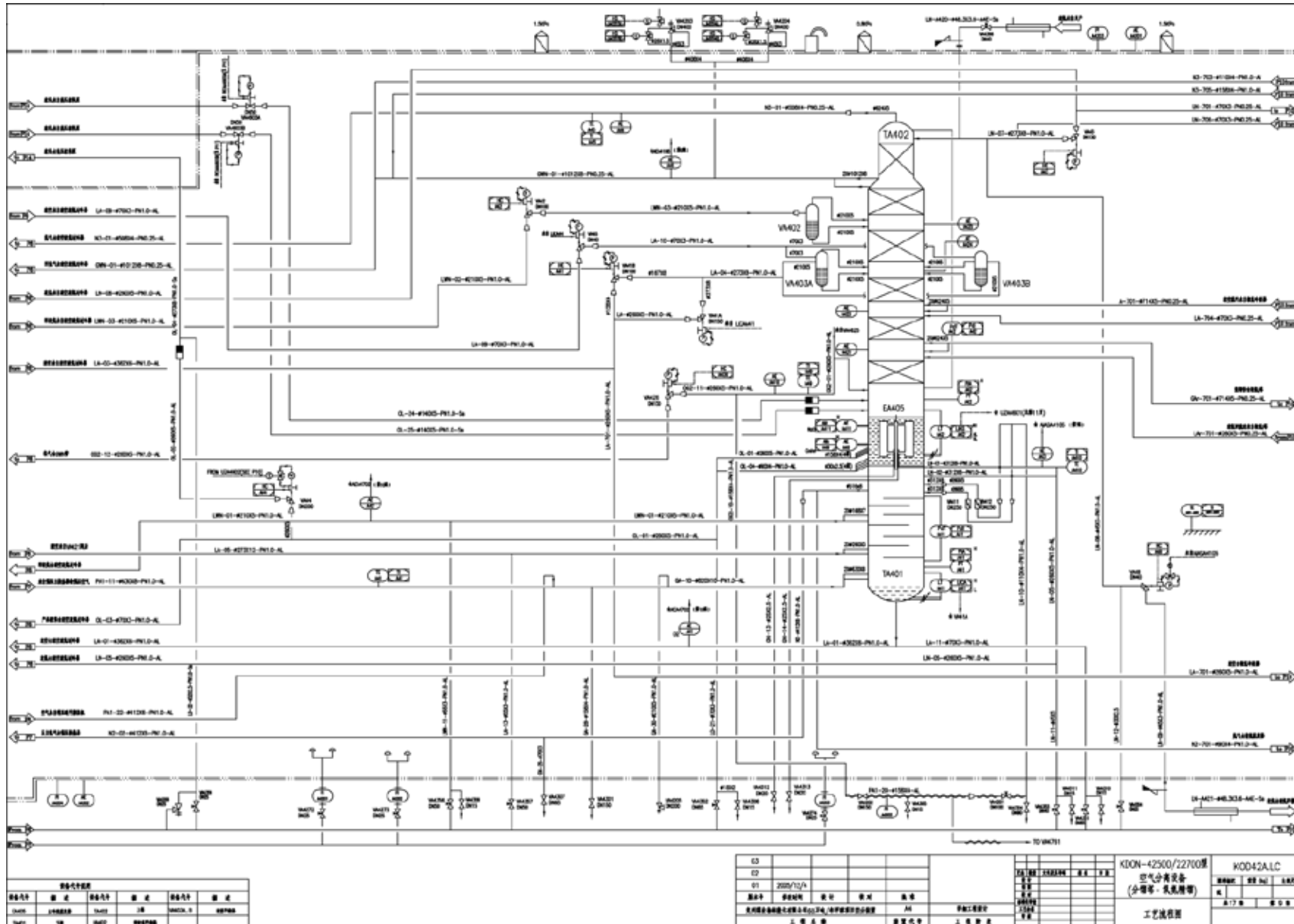


Engineering Flow Sheet: Air Separation Equipment (Air pre cooling device)

Project:
Air Separation device of methanol project(600,000 ton/y)

Client:
Yanzhou coal industry Yulin Co.

Design



Engineering Flow Sheet:

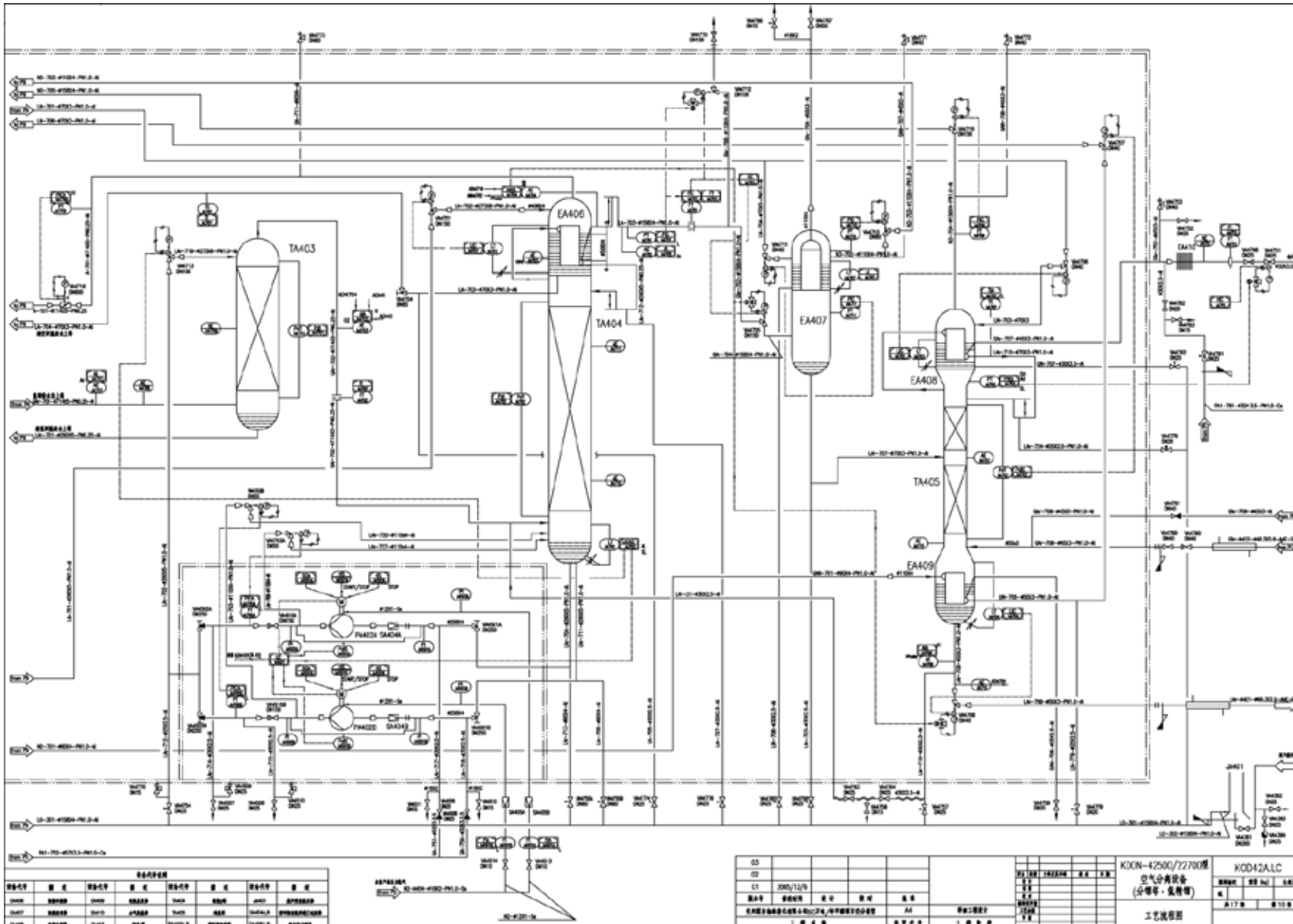
Air Separation Equipment

(Fractionating tower distillation, oxygen and nitrogen)

Project:
Air Separation device of methanol project(600,000 ton/y)

Client:
Yanzhou coal industry Yulin Co.

Design



Engineering Flow Sheet:

Air Separation Equipment

(Fractionating column, argon distillation)

Project:

Air Separation device of methanol project (600,000 ton/y)

Client:

Yanzhou coal industry Yulin Co.

设备号	设备名称	规格	材质	重量	备注
EA406	空气压缩机	200/12/9	碳钢	1500kg	
EA407	空气压缩机	200/12/9	碳钢	1500kg	
EA408	空气压缩机	200/12/9	碳钢	1500kg	
EA409	空气压缩机	200/12/9	碳钢	1500kg	

设备号	设备名称	规格	材质	重量	备注
TA403	精馏塔	φ1200×12000	碳钢	15000kg	
TA404	精馏塔	φ1200×12000	碳钢	15000kg	
TA405	精馏塔	φ1200×12000	碳钢	15000kg	

K00N-42500/72700 空气分离设备 (分馏塔、氮精馏)	KOD42ALC 分馏塔、氮精馏 分馏塔、氮精馏 分馏塔、氮精馏
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LNG Cold Energy Utilization Air Separation Plant

n LNG Cold Energy Utilization Air Separation Plant Principle



Air Separation Plant in Panzhihua

LNG cold energy utilization air separation plant refers to a new process of air separation plant. The main features include: an inner nitrogen cycle cooled by cold energy of LNG and an outer nitrogen cycle cooled by a cryogenic compression refrigeration system are applied, the compressed air is pre-cooled by a Freon coolant cooled by residual cool energy of LNG, and a twin zone heat exchanger between LNG and cycled nitrogen is applied. Simulation results based on different work conditions showed that the energy consumption of producing 1kg liquid oxygen can be saved 60%-73.5% by the new system compared with conventional air separation systems without LNG, and the energy-saving effectiveness is better than that of any method presented by other technology.

LNG Cold Energy Utilization Air Separation Plant

n LNG Cold Energy Utilization



LNG Transport Ship

- LNG contains abundant high quality cold energy. Under 0.1 MPa, when transforming natural gas from -161°C into 27°C , it release about 950 KJ/kg cold energy. When transforming into 8 MPa it is about 833 KJ/kg. If use of 3 million tons LNG per year, it contains more than 2.5 KJ/kg old energy, equivalent to 690~ 700 million degrees of electricity. More importantly, LNG cold energy quality is very high, and can be used according to cold energy quality grading, that is, low temperature cold energy shall be used as far as possible at low temperature.
- Oxygen and liquid nitrogen have important applications, and usually are produced by circular low temperature liquefied air. After air liquefaction, according to different boiling points of different component, finally obtain high purity oxygen, nitrogen, hydrogen. This approach should be under -150°C ~ -191°C , and create and consumes a lot of energy to create and maintain low temperature. Therefore, LNG cold energy is considered to offer cold source for air separation.

n Innovation of the New Process

- Apply inner nitrogen cycle and an outer nitrogen cycle cooled by cold energy of LNG, and the compressed air is pre-cooled by a Freon coolant cooled by residual cool energy of LNG.
- Adopt nitrogen cryogenic compression in nitrogen cycle system, and the energy-saving effectiveness is remarkable.
- Add circular nitrogen heat exchange path in the main heat exchanger. The heat exchanger between LNG and nitrogen divides into 2 sections: LNG heat exchanger and low- high pressure circular nitrogen heat exchanger.

LNG Cold Energy Utilization Air Separation Plant



n Demonstration Project

- By use of the new process, the power consumption of producing per kilogram liquid oxygen can be reduced from traditional ***1.05 ~ 1.25 kWh/kg to 0.315 ~ 0.315 kWh/kg (0.413~0.56 kWh/Nm³_O₂).***
- As for 10000Nm³/h air separation plant, its daily produces liquid oxygen 330t, liquid nitrogen 300t, and liquid argon 17t. Its power saving is about ***100 million degrees per year, valued ¥50~60 million, and LNG cold energy consumption is 700 t/day.***

Air composition				
Composition	N ₂	O ₂	Ar	Others
Volume %	78.09	20.95	0.93	0.03
Weight %	75.51	23.14	1.28	0.07

Air and product composition				
Air	LO ₂ 0.996	LN ₂ 1.000	LAr 1.000	Waste N ₂
1 kg	0.22	0.20	0.0113	0.5687
1500 t/d	330	300	17	853.05
62500 kg/h	13750	12500	708	35542

[A]

Introduction for Air-separation Packing (Mono Type)

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Introduction for Air-separation Packing(Mono Type)



Advantages And Features :

- PCC has been in a leading position in the field of air separation in the world, with a wealth of experience and technology. We offer the full support and services from process design - product manufacturing - installation – start-up guidance.
- PCC is one of the largest manufacturers of packing and column internals. There are more than 1,000 sets of air separation columns using our technology and products, and single set ranging from 1500m³/h - 80000m³ / h.
- PCC has his own know-how on **PSA** of air separation and **energy-saving and emission-reduction**, and have gained approval on market application during recent years.
- PCC fills this gap in national technology on rare gas, like neon – helium tower, krypton – xenon tower.

Introduction for Air-separation Packing(Mono Type)



- n Due to technical level and manufacture equipment limits, almost companies in the world only can produce the air-separation packing with the biggest diameter about 3 meters for mono type.



- n PCC conquered the technical barrier, and designed & manufactured the whole production line for the mono type packing in 2005.
- n From that on, PCC had manufactured lots of big diameter air-separation packing, and the largest column diameter even up to 5.5 meters.

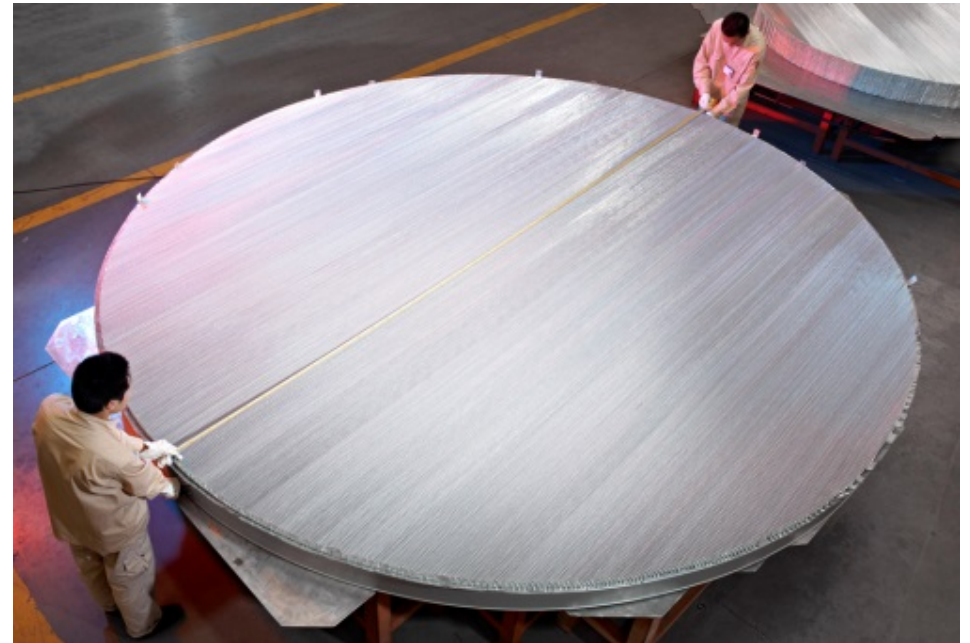
Introduction for Air-separation Packing(Mono Type)

n Why to Use The Mono Type Packing, Instead of The Segment Type?

Base on the integral structure of the mono type, it has obvious advantages in following three aspects compared with the segment type:

1. Manufacture Aspects:

- Lower diameter tolerance, Lower out-of-roundness tolerance
- Selection of high-quality alloy material
- Advanced assembly technology, which can guarantee density and flatness by adopting overall pattern hoop and anti-wall flow ring.
- Cleanness Guarantee of air separation, by washing and assembling under factory conditions.
- Use of specialized cleaning equipment and oil testing equipment, which can effectively reduce oil content under $25\text{mg}/\text{m}^2$ and incidence of fault.



Introduction for Air-separation Packing(Mono Type)

2. Installation Aspects:

- Easy to install with overall lifting, which can greatly shorten the construction period;
- Maintaining good flatness and compactness by reduce the installation cumulative tolerance ;
- Reducing the difficulty of installation due to no on-site assembly, and avoiding uneven distribution due to rough installation;
- Effectively ensuring the tower clean by reducing the operating time of workers in the tower;



Introduction for Air-separation Packing(Mono Type)

3. Mass Transfer Aspects:

Advantages on manufacture and installation enables gas-liquid two-phase mass more stable, and substantially increases operating flexibility; and distribute gas and liquid uniformly, with smaller pressure drop and mass transfer efficiency.



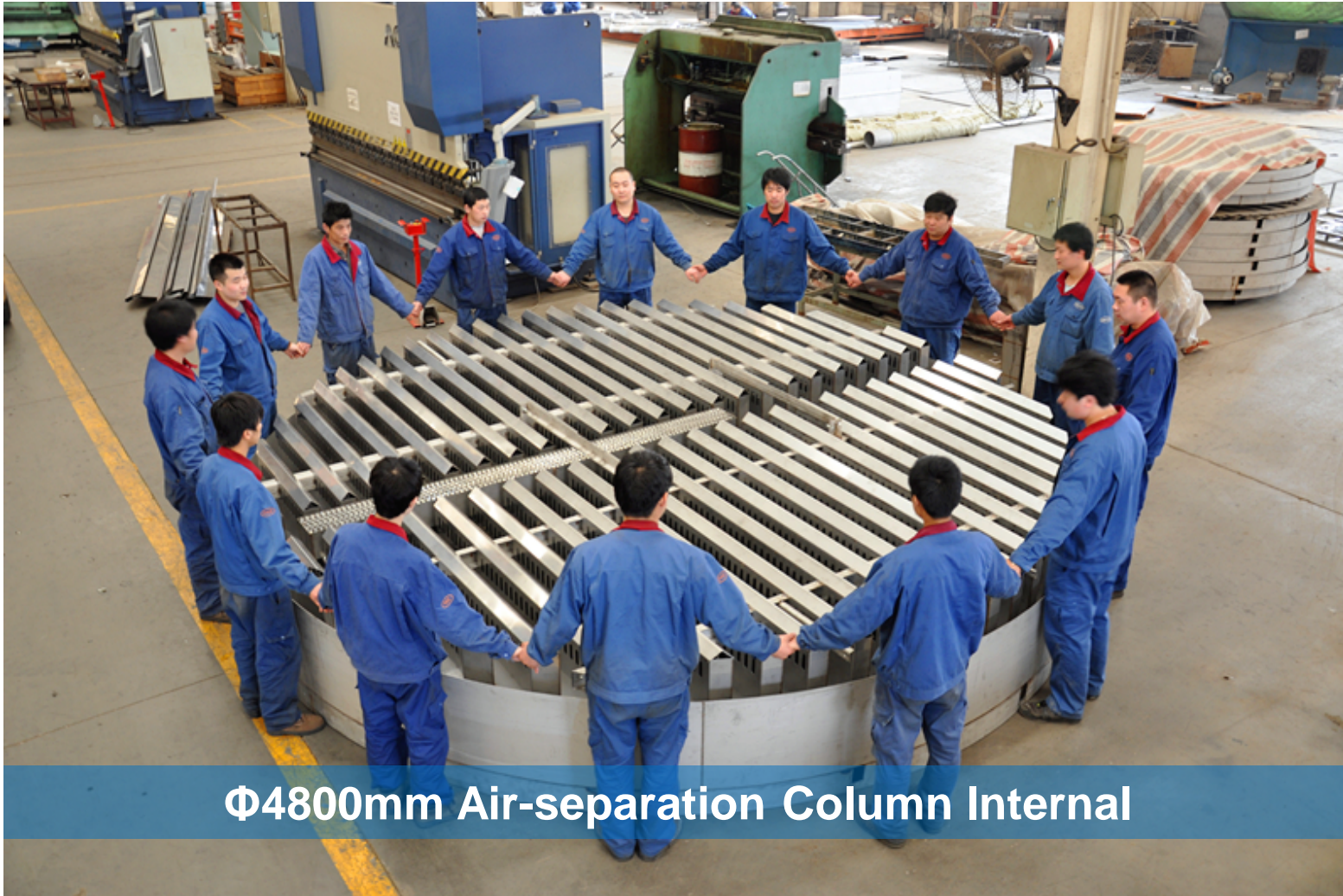
Introduction for Air-separation Packing(Mono Type)



Φ4800mm Air-separation Packings

**Air-separation
Packings**

Introduction for Air-separation Packing(Mono Type)



$\Phi 4800\text{mm}$ Air-separation Column Internal

$\Phi 4800\text{mm}$ Trough-drum
Liquid-gas Distributor

Introduction for Air-separation Packing(Mono Type)



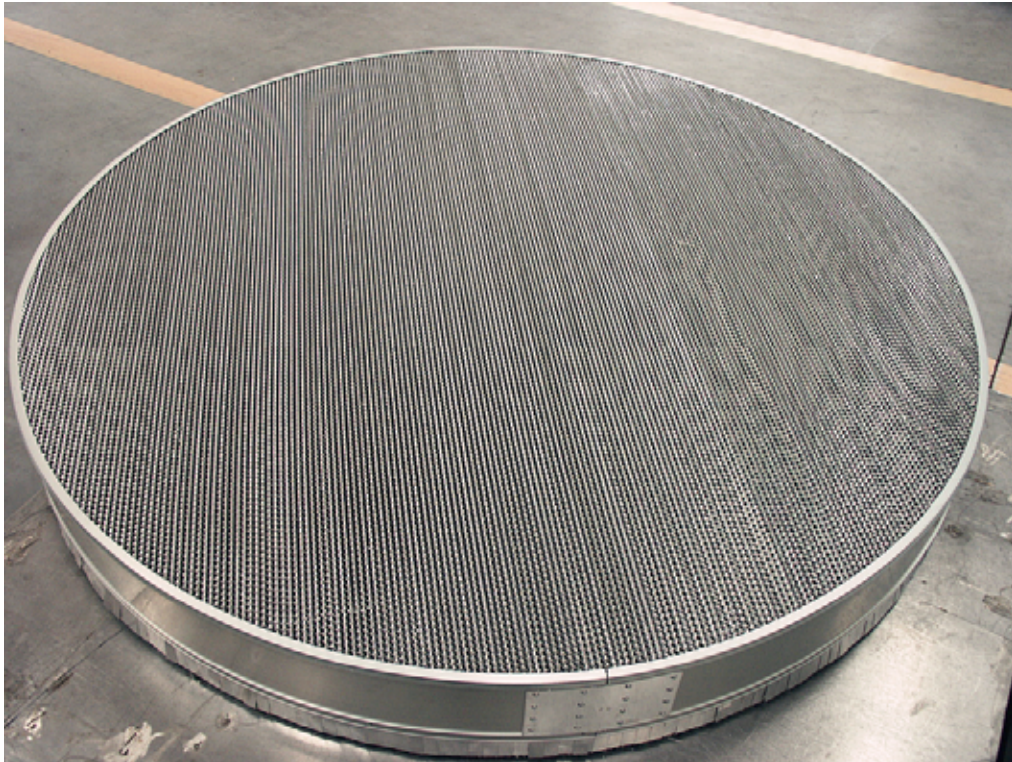
Typical Mono Air-separation Packing

Introduction for Air-separation Packing(Mono Type)



Assembly of Advanced Technology

Introduction for Air-separation Packing(Mono Type)



Typical Mono Air-separation Packing



Strict Inspection System

Introduction for Air-separation Packing(Mono Type)

Professional Packaging



Professional Shipping Equipment

[B]

The Main Outstanding Achievements

The Main Outstanding Achievements

PCC's products not only meet the needs of domestic customers, as many large enterprises' long-term supplier and technical cooperation partner such as PetroChina, Sinopec, MCC, CNASPC, Hangyang, Kaifeng Air Separation and Henan Kaiyuan Air Separation etc., but also be exported to France, Italy, Japan, the United States and other countries around the world.



The Main Outstanding Achievements



Air-separation Packing Project (Foreign Customers)

NO.	PROJECT	SCALE	PACKING QUANTITY (m ³)	INTERNALS QUANTITY (T)	DELIVERY DATE	PROJECT UNIT
1	Taiwan high nitrogen project	2000	32.13	1.407	2003.10	Sichuan Air Separation Group
2	Taiwan Lianhua project	2000	32.13	1.407	2004.01	Sichuan Air Separation Group
3	Messer project	20000	180.045		2005.01	Hangyang Limited
4	Messer (2) project	20000	327.48		2005.07	Hangyang Limited
5	India project	3000	66.3345		2005.10	Hangyang Limited
6	Messer (Zhangjiagang) project	4800	88.25		2006.01	Hangyang Limited
7	India project	6000		5.289	2006.06	Sichuan Air Separation Group
8	Spain Messer project	16000	153.15		2006.07	Hangyang Limited
9	India project	3000	66.33		2007.03	Hangyang Limited
10	Libya project	6360	72.02	4.581	2007.06	Henan Kaiyuan Air Separation Group

The Main Outstanding Achievements



Air-separation Packing Project (Foreign Customers)

NO.	PROJECT	SCALE	PACKING QUANTITY (m ³)	INTERNALS QUANTITY (T)	DELIVERY DATE	PROJECT UNIT
11	Linde project	21000	315.763		2008.07	Hangyang Limited
12	Vietnamproject	3400	45.04	2.543	2008.09	Kaili Air Separation Co.
13	Vietnamproject	3200	50.25	12.18	2008.10	WeilongAir Separation Co.
14	Mexico project		233.77		2008.12	Hangyang Limited
15	India project	3000	66.311		2008.12	Hangyang Limited
16	India project	3300	29.4		2009.03	Hangyang Limited
17	Iran project	10000	81.67		2009.04	Hangyang Limited
18	Iran project	30000	239.866		2009.04	Hangyang Limited
19	German project	32000	239.866		2009.05	Hangyang Limited
20	Vietnamproject	6700	99.79	5.411	2009.08	Henan Kaiyuan Air Separation Group

The Main Outstanding Achievements



Air-separation Packing Project (Foreign Customers)

NO.	PROJECT	SCALE	PACKING QUANTITY (m ³)	INTERNALS QUANTITY (T)	DELIVERY DATE	PROJECT UNIT
21	Iran project	10000	81.67		2009.11	Hangyang Limited
22	Iran project	30000	239.866		2009.12	Hangyang Limited
23	Ukraineproject	10000	152.4		2010.01	Hangyang Limited
24	Austriaproject	4000	30.25		2012.05	Hangyang Limited
25	Messer project	8500	101.15	7.51	2012.08	Sichuan Air Separation Group

The Main Outstanding Achievements



Air-separation Packing Project (Above 50000 m³ /h)

NO.	PROJECT	SCALE	PACKING QUANTITY (m ³)	INTERNALS QUANTITY (T)	DELIVERY DATE	PROJECT UNIT
1	Zhongyuan Dahua project	52000		1.407	2005.12	Hangyang Limited
2	Bao Steelproject	60000		1.407	2007.08	Hangyang Limited
3	Rizhao Yingde project	60000			2008.01	Hangyang Limited
4	Shenhua project	60000			2008.06	Hangyang Limited
5	Yingde Tianfu project	52000			2008.1	Hangyang Limited
6	Zhongyuan Dahua project	52000	364.15		2005.10	Hangyang Limited
7	Bao Steelproject	60000	489	5.289	2007.07	Hangyang Limited
8	Rizhao Yingde project	60000	489.523		2007.11	Hangyang Limited
9	Shenhua project	60000	645.464		2008.04	Hangyang Limited
10	Yingde Tianfu project	52000	359.65	4.581	2008.09	Hangyang Limited

The Main Outstanding Achievements



Air-separation Packing Project (Above 50000 m³ /h)

NO.	PROJECT	SCALE (m ³ /h)	PACKING QUANTITY (m ³)	INTERNALS QUANTITY (T)	DELIVERY DATE	PROJECT UNIT
11	Jinjiang project	55000	320.58		2010.03	Hangyang Limited
12	Hunan Yingde gas project	60000	489.52		2011.04	Hangyang Limited
13	Yingde project	60000	489.5		2011.08	Hangyang Limited
14	Yingde project	60000	489.5		2011.12	Hangyang Limited
15	Huaxian Yingde project	52000	456.89		2012.01	Hangyang Limited
16	Yingde project	60000	489.52		2012.01	Hangyang Limited
17	Qitou fangchenggang project	80000	266.17	18	2012.03	Hangyang Limited
18	China coal Shaanxi project	60000	404.6	28	2012.05	Hangyang Limited
19	Yingde project	60000	489.52		2012.05	Hangyang Limited
20	China coal Shaanxi project	60000	202.3	14	2012.08	Hangyang Limited
21	Yingde Binzhou project	60000	833.5	37.6	2012.08	Kaifeng Air Separation company
22	Yingde Shijiazhuang project	57900	416.75	18.809	2012.09	Kaifeng Air Separation company