

首钢国际工程公司是由原北京首钢设计院改制成立、首钢集团相对控股的国际型工程公司，是北京市首家获得工程设计综合甲级资质的市属企业。公司可承揽各行业、各等级的所有工程设计，同时可提供规划咨询、设备成套、工程总承包等技术服务。公司在钢铁厂总体规划设计，炼铁、炼钢、轧钢、烧结、球团、焦化、工业炉单项设计，冶金设备成套等方面具有独到优势和丰富业绩。

公司业绩遍布国内70余家钢铁企业，以及巴西、印度、马来西亚、越南、孟加拉、菲律宾、津巴布韦、安哥拉、秘鲁、沙特等多个国家。

公司是北京市高新技术企业，获得国家科学技术奖和全国优秀设计奖等30余项、冶金行业和北京市优秀设计及科技成果奖等近300项，拥有数百项专利技术，多个项目创中国企业新纪录。

BSIET is an international engineering company established through reorganization of Beijing Shougang Design Institute. It is invested by Shougang Group who takes relative majority of the share.

BSIET has the Engineering Design Integrated Qualification Class A issued by the State. It is the first unit of Beijing municipal enterprises awarded this Qualification and is able to undertake engineering design for all industries and all grades. Meanwhile, it can provide technical services such as planning consultation, equipment integration and general contracting. BSIET owns unique technology and rich practical experience in overall design of iron and steel plants, individual design for iron making, steel making, steel rolling, sintering, pelletizing, coking, industrial furnace and integration of metallurgical equipment.

BSIET has served more than 70 iron and steel enterprises in China, and has its achievements in more than 20 countries such as India, Malaysia, Brazil, Viet Nam, Bangladesh, the Philippines, Zimbabwe, Angola, Peru and Saudi Arabia, etc.

BSIET is Hi-tech Enterprise of Beijing City, and has been awarded with 30-odd national science & technology prizes and national excellent design prizes, nearly 300 metallurgical industry and Beijing city excellent design and achievement prizes, and hundreds of national patents. Dozens of projects have created the new records of the Chinese enterprises.



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制氧工程与技术 AIR SEPARATION



源自百年首钢 服务世界钢铁
Expertise from hundred-year Shougang



北京首钢国际工程技术有限公司

BEIJING SHOUGANG INTERNATIONAL ENGINEERING TECHNOLOGY CO.,LTD.

首钢国际工程公司在制氧厂（站）新建及改扩建工程设计方面具有突出的技术优势和丰富的实践经验。多年来，在引进国际先进的空分设备技术及国产技术的自主创新方面，一直走在行业前列。空分新流程的创新应用、单机组规模大型化的空分设备、国际先进空分流程引进与技术消化吸收，均创下国内冶金行业的首例。

- ◎ 20世纪60年代，设计了首钢氧气厂6000m³/h制氧工程，该项目建有我国冶金行业第一套日本6000m³/h制氧机组和第一批国产6000m³/h制氧机组；
- ◎ 20世纪70年代，设计了首钢氧气厂2X6500m³/h制氧工程，该项目建有我国冶金行业第一批法国6500m³/h制氧机组；
- ◎ 20世纪80年代，设计了首钢氧气厂30000m³/h制氧工程，该项目引进林德30000m³/h制氧机组，是我国冶金行业第一套氧氮氩及稀有气体全提取的大型分子筛流程的制氧机组，成为国内空分行业大型制氧机的样机。该项目荣获国家优秀设计铜质奖、北京市科技进步一等奖、北京市优秀设计一等奖等诸多奖项；
- ◎ 近年来，建设了多套具有国际先进水平的制氧机组，包括首钢氧气厂35000m³/h快速变负荷机组、首钢京唐2X75000m³/h机组、越南蒸汽透平空压机制氧机组等，荣获多项优秀设计奖。

BSIET has extraordinary advantages and abundant practical experiences in design of construction, modification and expansion of Oxygen Plant (station). For years, on aspects of adopting advanced international air separation device & technology and independent innovation of domestic technology, BSIET keeps the leading status in the industry. The creative application of new air separation process, large sized single unit of air separation equipment and the adoption and technology digestion of advanced international air separation process all rank the first in domestic metallurgical industry.

- ◎ In 1960s, BSIET designed the 6000m³/h air separation project for Shougang Oxygen Plant, which was equipped with the first Japanese 6000m³/h air separation unit and first lot of domestic 6000m³/h air separation units in domestic metallurgical industry.
- ◎ In 1970s, BSIET designed the 2X6500m³/h air separation project of Shougang Oxygen Plant, which was equipped with the first lot of French 6500m³/h air separation units in domestic metallurgical industry.
- ◎ In 1980s, BSIET designed the 30000m³/h air separation project of Shougang Oxygen Plant. This project adopted the Linde 30000m³/h air separation unit, which was the first air separation unit to extract all oxygen, nitrogen, argon and noble gas by large molecular sieve process, and the demonstration of large air separation unit in domestic air separation industry. The project was also honored the bronze prize of National Excellent Design, first prize of Beijing Science and Technology Progress and first prize of Beijing Excellent Design etc.
- ◎ In recent year, BSIET has designed and constructed many air separation units with international leading standards, including Shougang Oxygen Plant 35000m³/h quick variable load unit, Shougang Jingtang 2X75000m³/h unit and Vietnam unit with steam turbine air compressor etc. and honored numerous excellent design prizes.



优势技术 Advantageous Technology

- ◎ 根据大型钢铁厂产品大纲进行氧、氮、氩气体平衡，结合钢铁生产工艺的用气特点和使用制度，优化设备技术选型和工艺流程；
 - ◎ 采用快速变负荷、氧气内压缩、分子筛纯化、填料塔等先进技术，确保钢铁厂用气的安全性、连续性、经济性；
 - ◎ 大型液体储存后备系统的确定及优化设计；
 - ◎ 大型气体储存设备（球罐）及氧气调节分配技术；
 - ◎ 简约紧凑的工艺设备布置、工艺管线优化等工厂设计技术；
 - ◎ 高温、高压、低温等管道的管系柔性计算技术；
 - ◎ 工艺生产过程中的冷凝水回收及液体排放水封等专利技术。
- ◎ Based on product mix of large scale iron and steel plants, balance the proportion of oxygen, nitrogen and argon; considering the gas use characteristics and utilizing systems of iron & steel making process, optimize equipment selection and process flow.
 - ◎ Adopt advanced technologies such as quick varying load, oxygen internal compression, molecular sieve purifying and packing column etc. to make sure the safe, continuous and economic use of gas in iron & steel plants.
 - ◎ Determination and optimized design of backup system for large scale liquid storage.
 - ◎ Large scale gas storage device(spherical tank) and oxygen regulating and distributing technology.
 - ◎ Factory design technologies such as concise and compact process device layout, process piping optimization.
 - ◎ Flexible calculation technology for high temperature, high pressure and low temperature piping.
 - ◎ Patented technologies such as condensate water reclaim and liquid discharge water seal in production process.



简约紧凑的工厂设计
Concise and Compact Factory Layout



液体后备系统
Liquid Backup System



球罐区及管网
Spherical tank Zone and Pipe Network



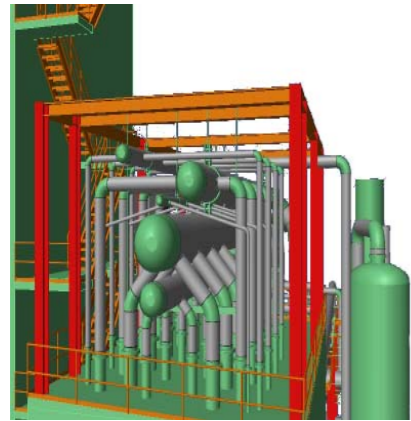
氧气调压站
Oxygen Pressure Regulating Station

设计手段 Means of Design

三维设计 3-Dimension Design

- 有效解决复杂管网、设备、结构的碰撞问题
- 提高工程组织的确定性，加快工程进度
- 精准的材料量统计，避免材料浪费，有效控制工程成本

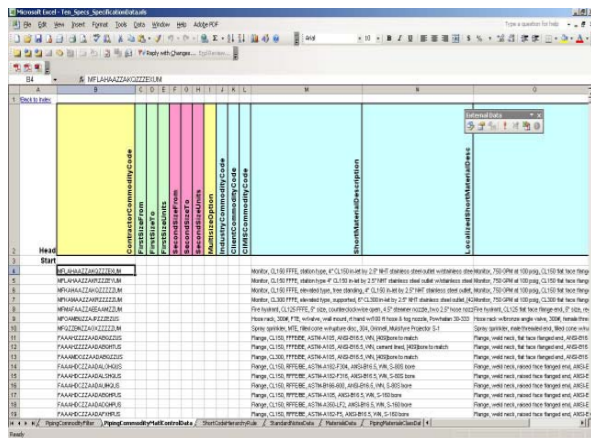
- Effectively solved the collision problems between complicated pipe networking, device and structure
- Enhanced the certainty of project organization, quickened the project progress
- Precise statistics of material volumes, avoided material waste, effective project cost control



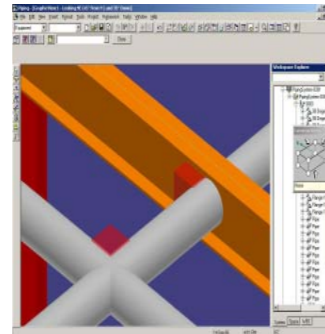
空分板式冷箱顶部综合管道三维设计模型
3-Dimension Design Model of Comprehensive Piping at the top of Plate Cold Box of Air Separation



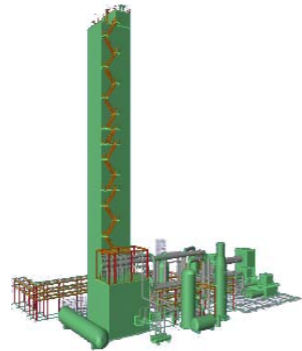
首钢京唐 75000m³/h 制氧工程三维设计模型
3-Dimension Design Model of 75000m³/h Air Separation Project of Shougang Jingtang



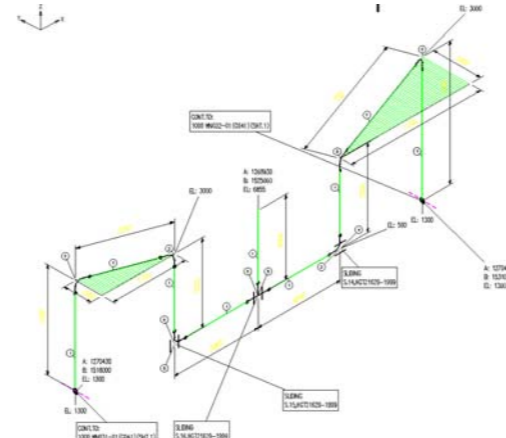
三维设计数据库
3-Dimension Design Database



管道碰撞检查
Pipe Collision Inspection



首钢氧气厂 35000m³/h 制氧工程三维设计模型
3-Dimension Design Model of 35000m³/h Air Separation Project of Shougang Oxygen Plant

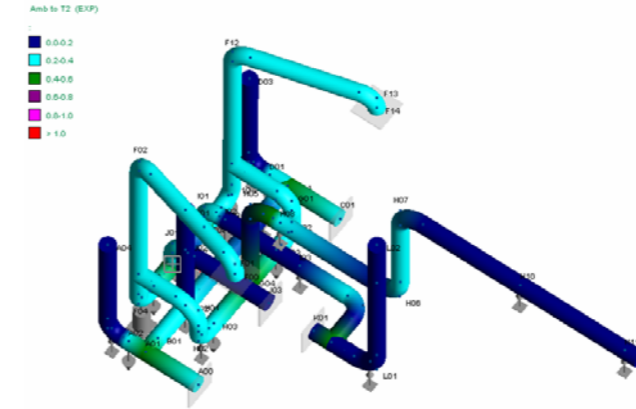


管道三维施工图
3-Dimension Diagram of Pipe Construction

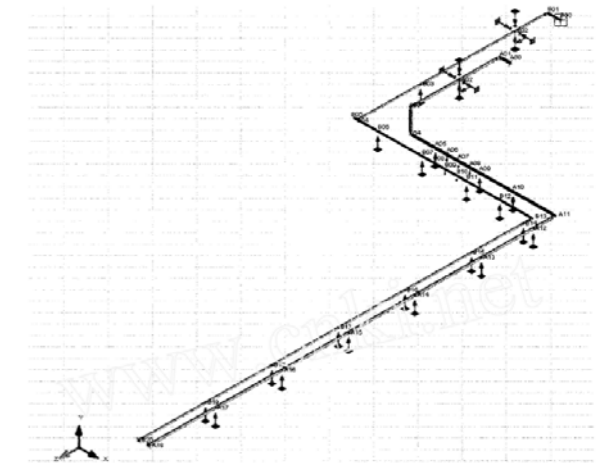
应力分析 Stress Analysis

利用 Bentley PSDS 三维工厂设计软件建立管道模型，导入 Bentley Autopipe 管道应力分析计算软件，进行管道系统的应力分析计算，通过调整支架位置和设备管口膨胀节的技术参数，满足设备管口的受力要求，确保工程投产后的安全运行。

Utilize Bentley PSDS 3-Dimension Factory Design Software construct the pipe model, import the Bentley Autopipe Pipe Stress Analyzing and Calculating Software and conduct the analysis and calculation, satisfy the stress requirement of the pipe end by adjusting the rack position and technical parameter of Pipe End Expansion Joint and to ensure the safe operation after the start up.



分子筛纯化系统标准应力比对比图
Standard Stress Comparison Diagram of Molecular Sieve Purifying System



氮气增压机出口管道应力计算三维图
3-Dimension Diagram of Stress Calculation of Exit Pipe of Nitrogen Booster

表1 氮气增压机出口管路应力计算结果

管号	200GALN030										
	管点名称 A00, 固定点										
	约束力										
荷载组合	力/9.8N			结果	力矩/ (9.8N cm)			结果	力最大值/9.8N		
	X	Y	Z		X	Y	Z		X	Y	Z
GR	18	-133	-21	136	909	-708	10781	10842	-360	-242	313
T1	-111	-106	-277	317	6696	-46194	8146	47382			
E1	-263	102	313	421	-9561	27803	11194	31460			
W1	0	0	0	0	0	0	0	0			
P1	-4	-3	-2	5	184	-883	157	915			
GT1	-93	-239	-298	393	7604	-46902	18927	51145			
GE1	-245	-31	292	382	-8653	27095	21975	35943			
GW1	18	-133	-21	136	909	-707	10781	10842			
GT1P1	-97	-242	-300	397	7788	-47784	19084	52040			
GT1P1E1	-360	-140	13	386	-1773	-19981	30278	36320			

注：表1为管点号A00（固定管口）在各荷载工况下的受力情况。表1中G/GR表示重力工况，T1、P1、E1、W1分别表示温度、压力、地震、风载工况，GT1、GT1P1等分别表示以上单一工况的组合情况。

氮气增压机出口管道应力计算结果
Result of Stress Calculation of Exit Pipe of Nitrogen Booster

工程业绩 Performance reference

序号 No.	工程名称 Project name	流程形式 Process	氧气产量 Oxygen output	实施方式 Way of Service	投产时间 Start-up time	获奖情况 Honor
1	首钢氧气厂 30000m ³ /h 制氧工程 Shougang oxygen plant 30000m ³ /h air separation project	氧、氮、氩及氪、氙、氦全提取工艺, 外压缩 Oxygen, nitrogen, argon, krypton, xenon, helium general extraction process external compression	30000m ³ /h	设计 Engineering	1988	北京市科技进步一等奖, 北京市优秀设计一等奖, 国家优秀设计铜奖 1 st Prize of Beijing science and technology progress, 1 st Prize of Beijing excellent design, Bronze Prize of national excellent design
2	首钢氧气厂 2X3350m ³ /h 空分挖潜改造工程 Shougang oxygen plant 2 × 3350m ³ /h air separation revamping project	外压缩 External compression	单套机组 3350m ³ /h Single unit compressor 3350m ³ /h	设计 Engineering	1992	
3	首钢氧气厂 2X16000m ³ /h 制氧工程 Shougang oxygen plant 2 × 16000m ³ /h air separation project	外压缩 External compression	单套机组 16000m ³ /h Single unit compressor 16000m ³ /h	设计 Engineering	1992	
4	首钢小王庄 2X16000m ³ /h 制氧工程 Shougang Xiaowangzhuang 2 × 16000m ³ /h air separation project	外压缩 External compression	单套机组 16000m ³ /h Single unit compressor 16000m ³ /h	设计 Engineering	1997	
5	越南太钢 3200m ³ /h 制氧工程 Vietnam TNS 3200m ³ /h air separation project	外压缩 External compression	3200m ³ /h	设计 Engineering	2000	
6	首秦 2 X12000m ³ /h 制氧工程 Shouqin 2 × 12000m ³ /h air separation project	外压缩 External compression	单套机组 12000m ³ /h Single unit compressor 12000m ³ /h	设计 Engineering	2003	
7	首钢迁钢氧气厂 23000m ³ /h 制氧工程 (1# 制氧机) Shougang Qiangang oxygen plant 23000m ³ /h air separation project(1# air separation unit)	氧、氮、氩内压缩 Oxygen, nitrogen, argon internal compression	23000m ³ /h	设计 Engineering	2004	冶金行业全国优秀工程设计二等奖 2 nd Prize of Ministerial Excellent Project Design in Metallurgical Industry
8	首钢氧气厂 35000m ³ /h 制氧工程 Shougang oxygen plant 35000m ³ /h air separation project	氧、氮、氩及粗制氪、氙、氦全提取, 带快速变负荷工艺, 氧气内压缩 Oxygen, nitrogen, argon and raw krypton, xenon, helium all-extraction process with quick variable load process, oxygen internal compression	31000m ³ /h+4000m ³ /h	设计 Engineering	2005	冶金行业全国优秀工程设计一等奖 1 st Prize of Ministerial Excellent Project Design in Metallurgical Industry
9	首钢迁钢氧气厂 35000m ³ /h 制氧工程 (2# 制氧机) Shougang Qiangang oxygen plant 35000m ³ /h air separation project(2# air separation unit)	氧气内压缩 Oxygen internal compression	35000m ³ /h	设计 Engineering	2006	冶金行业全国优秀工程设计二等奖 2 nd Prize of Ministerial Excellent Project Design in Metallurgical Industry
10	首钢迁钢氧气厂 2X35000m ³ /h 制氧工程 (3#、4# 制氧机) Shougang Qiangang oxygen plant 2 × 35000m ³ /h air separation project(3# 4# air separation units)	氧气内压缩 Oxygen internal compression	单套机组 35000m ³ /h Single unit compressor 35000m ³ /h	设计 Engineering	2009	
11	首钢京唐 2X75000m ³ /h 制氧工程 Shougang Jingtang 2 × 75000m ³ /h air separation project	氧、氮、氩及粗制氪、氙、氦全提取, 带 VAROX 工艺, 氧气内压缩 Oxygen, nitrogen, argon and raw krypton, xenon, helium all-extraction process with VAROX process, oxygen internal compression	单套机组 75000m ³ /h Single unit compressor 75000m ³ /h	设计 Engineering	2009	冶金行业全国优秀工程设计一等奖 1 st Prize of Ministerial Excellent Project Design in Metallurgical Industry
12	越南(煤头)化肥项目 35000m ³ /h 制氧工程 Vietnam Ninh Binh Fine Coal Based Urea Plant project 35000m ³ /h air separation project	蒸汽透平空压机 氧气内压缩 Steam turbine-air compressor air separation unit Oxygen internal compression	35000m ³ /h	设计 Engineering	2011	
13	首钢迁钢氧气厂 35000m ³ /h 制氧工程 (5# 制氧机) Shougang Qiangang oxygen plant 35000m ³ /h air separation project(5# air separation unit)	氧气内压缩 Oxygen internal compression	35000m ³ /h	设计 Engineering	2011	

典型工程 Typical projects

首钢迁钢氧气厂 23000m³/h 制氧工程 Shougang Qiangang oxygen plant 23000m³/h air separation project

系统特点 System features

- ◎ 中压气体（氧、氮、氩）全部采用内压缩的工艺流程，这是国内第一套创新采用该工艺的制氧机组；
- ◎ 取消氧压机和中压氮压机，极大提高了机组的可靠性和稳定性，减少了设备和建设投资；
- ◎ 采用国际先进的齿轮组合式空气压缩机组，有效地解决了工程占地紧张的难题，并大量节省工程投资，加快工程进度；
- ◎ 独具特色的氧气调压站。根据用氧要求及调节设备的性能特点，增设小用户氧气调压站，确保满足炼铁（不含富氧鼓风用氧）、连铸切割、废钢切割、检化验等小用户的用氧需求，有效减少用户氧气放散和压力波动频繁的现象。
- ◎ Medium-pressure gas (oxygen, nitrogen, argon) all introduced internal compression process, and this is the first oxygen generating unit which creatively adopted this process in China.
- ◎ The cancellation of oxygen compressor and medium-pressure nitrogen compressor has greatly enhanced the reliability and stability of the unit as well as reduced the cost of equipment and construction.
- ◎ The adoption of internationally advanced gear combination air compressors set has effectively solved the problem of occupying too much land, and saved project investment greatly and quickened the process of the project.
- ◎ Unique oxygen pressure regulating station. According to the requirements of oxygen consumers and characters of regulating equipment, we designed special oxygen regulating station for low requirement users, meeting the needs of iron making (exclude the oxygen-enriched blast), casting incision, scraps incision, lab tests. It effectively reduced user's oxygen venting and frequent pressure fluctuation.

服务方式 Way of Service	设计	Engineering
完成时间 Start-up time	2004	2004
运行情况 Performance	投产至今，保持安全稳定运行，产品各项指标达到或超过设计值	Run safely and steadily by now, every criteria reached or exceeded the designed capacity
获奖情况 Honors	冶金行业全国优秀工程设计二等奖	2 nd Prize of Ministerial Excellent Project Design in Metallurgical Industry

首钢氧气厂 35000m³/h 制氧工程 Shougang oxygen plant 35000m³/h air separation project

系统特点 System features

- ◎ 开发应用快速变负荷工艺，减少放散损失；
- ◎ 利用原有液氧、液氮储槽对液体后备系统加以改造，实现新旧设备有机结合应用，实现机组的快速变负荷功能，并减少设备投资和占地；
- ◎ 新旧管网连接，设计精细，确保生产正常运行。
- ◎ Adopted the quick variable load process, reduced oxygen venting loss.
- ◎ Reconstruct the liquid backup system by reusing the existing liquid oxygen and liquid nitrogen tanks, combined the used and new equipment, realized the fast variable load function and reduced the cost of equipment and land.
- ◎ Connected the used and new pipelines with a scrupulous design, ensured a smooth running.

服务方式 Way of Service	设计	Engineering
完成时间 Start-up time	2005	2005
运行情况 Performance	投产至今，首钢氧气厂的氧气综合放散率从 7.63% 下降到 3.42% 以下	Run safely and steadily by now, the general oxygen venting rate dropped from 7.63% to less than 3.42%
获奖情况 Honors	冶金行业全国优秀工程设计一等奖	1 st Prize of Ministerial Excellent Project Design in Metallurgical Industry



首钢京唐 2X75000m³/h 制氧工程 Shougang Jingtang 2x75000m³/h air separation project

系统特点 System features

- 目前国内冶金行业单机组规模最大的制氧机组；
- 采用 VAROX 先进工艺等多项国际先进技术；
- 配置大型液体储槽，实现 25% 以上的氧气负荷变化，同时满足临时停车时的生产用气。
- Adopted the largest single unit in present metallurgical industry.
- Adopted several internationally-advanced technologies, such as VAROX process.
- Adopted large-scale liquid tanks, realized the oxygen supply load variability by over 25%, at the same time satisfied the production need when temporarily running down.

服务方式 Way of Service	设计	Engineering
完成时间 Start-up time	2009	2009
运行情况 Performance	投产至今，保持安全稳定运行，产品各项指标达到或超过设计值	Run safely and steadily by now, every criteria reached or exceeded the designed capacity
获奖情况 Honors	冶金行业全国优秀工程设计一等奖	1 st Prize of Ministerial Excellent Project Design in Metallurgical Industry



越南（煤头）化肥项目 35000m³/h 制氧工程 Vietnam Ninh Binh Fine Coal Based Urea Plant project 35000m³/h air separation project

系统特点 System features

- 采用蒸汽透平驱动式空压机，是体现化工企业能源综合利用的化工型制氧机组；
- 5.1MPa 高压氧气采用液氧泵内压缩，使机组运行更加安全；5.5MPa 和 8.3MPa 的高压氮气取自氮气循环增压机，节省产品氮压机的设备投资和占地；
- 三维设计提高设计精度，有效控制工程投资。
- Adopted steam turbine-air compressor air separation unit, which is a chemical air separation unit representing a comprehensive utilization of energy in modern chemical plant.
- 5.1MPa high-pressure oxygen is internally compressed by liquid oxygen pump, enabling the unit run more safely; 5.5MPa and 8.3MPa high-pressure nitrogen is made by nitrogen circulating booster, saved the cost of equipment and land of product nitrogen compressors.
- Increased the design precision and controlled the project investment by using 3D design.

服务方式 Way of Service	设计	Engineering
完成时间 Start-up time	2010	2010
运行情况 Performance	正在建设中	Under construction



正在建设中的越南（煤头）化肥项目 35000m³/h 制氧工程
Vietnam Ninh Binh Fine Coal Based Urea Plant project 35000m³/h air separation project is under construction.