

X80 Steel Pipe Fittings and Automatic Welding Machines

Science & Technology Management Department

■ 2013



CHINA NATIONAL PETROLEUM CORPORATION

*CNPC's X80 Steel Pipe Fittings and
Automatic Welding Machines—Pacemaker
for Oil and Gas Pipeline Construction!*





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[China National Petroleum Corporation \(CNPC\)](#) is a state-authorized investment agency and a state holding company. On July 1998, with the implementation of the Institutional reform of the State Council, CNPC was reorganized to become an integrated oil company of cross-regions, cross-industries and cross-countries, it adopts modern enterprise system to realize the integrations of upstream and downstream operations, internal and external trade, production and marketing. CNPC's business covers six main sectors: oil and gas operations, petroleum engineering service, petroleum engineering construction, petroleum equipment manufacturing, financial services and new energy development. In 2012 CNPC produced 110 million tons of crude oil and 79.82 billion cubic meters of natural gas, while crude processing volume reached 191 million tons. The total revenue of RMB 2,690 billion with a profit of RMB139.1 billion had been achieved the same year.

CNPC was ranked 4th among the world's largest 50 oil companies and 6th in Fortune Global 500 in 2012.

CNPC strictly follows by the combined strategies of increasing resource capacity, expanding market shares and consolidating the international role, and persists in regarding technical innovation as a key framework to advance technological progress. To develop its core businesses, focuses will be placed on the solutions of key bottleneck technologies and key proprietary technologies. Thanks to continuously improving of the technical innovation system, optimizing the configuration of technological resources and strengthening the construction of strong talent teams, CNPC's technological creativity has been considerably upgraded. Consequently, a large number of technologies have been developed independently, with its own intellectual property.

[X80 Steel Pipe Fittings and Automatic Welding Machines](#) is one of representatives for major innovations of CNPC.

CLEAN ENERGY SUPPLY FOR BETTER ENVIRONMENT

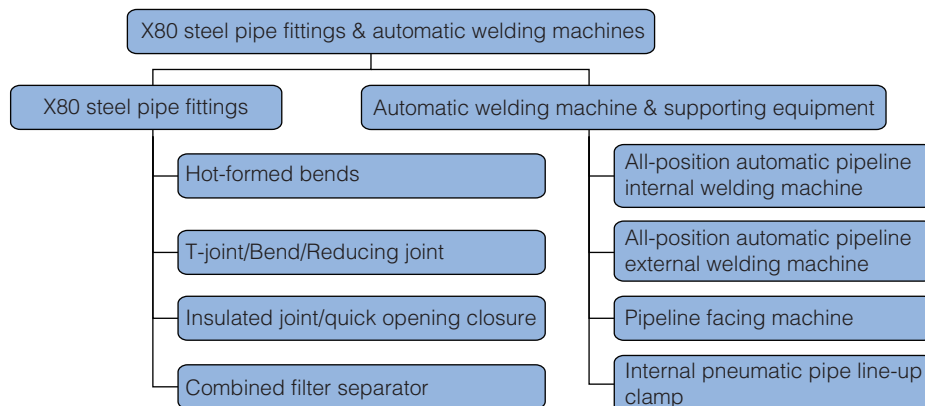
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INTRODUCTION

CNPC has developed several product categories of pipe line construction, i.e. hot-formed bends, cold-press pipe fittings, insulated joint, gas distributor, quick-opening closure, pressure vessels (e.g. pressure equipment for oil and gas pipelines, surface gathering/transportation equipment for oil and gas, LNG storage/transportation equipment). The pressure vessels (100MPa or below) and other pressure equipment or components for oil/gas storage and transportation stations can be designed and manufactured, with the total annual capacity above 20,000t. It can also produce DN200-DN1600mm hot-formed bends and DN10-DN1600mm pipe fittings of various materials (e.g. carbon steel, alloy steel, steel for oil pipeline) and for various purposes, with the annual capacity of 1016mm-plus hot-formed bends up to 7,500 pieces and that of diverse pipe fittings up to more than 10,000t. The products are widely used in many industrial fields, such as oil exploration, petrochemical engineering, oil/gas storage and transportation, LNG, chemical fiber, building material, and are marketed across China and even to Sudan, Libya, Kazakhstan,

the Niger, Chad, Kenya and other countries.

Based on the features of pipeline welding techniques and different pipelines as well as years of technical efforts, CNPC has developed proprietary PIW All-position Automatic Pipeline Internal Welding Machine, PAW2000 Single-torch All-position Automatic Pipeline External Welding Machine, PAW3000 Double-torch All-position Automatic Pipeline External Welding Machine, PFM Pipeline Facing Machine, PPC Internal Pneumatic Pipe Line-up Clamp, PPC-GA Large-tension and Gap-adjustable Internal Pneumatic Pipe Line-up Clamp and supporting facilities, which are regarded as novel products in the automatic pipeline welding field. CNPC's automatic welding equipment and supporting welding techniques have been successfully applied in many domestic projects (e.g. First and Second West-East Gas Pipeline, Third Shaanxi-Beijing Gas Pipeline), as well as foreign pipeline projects (India's East-West Gas Pipeline e.g. Kazakhstan-China, Central Asia-China, Uzbekistan-China, Russia-China), and have won worldwide acclaim.



2 UNIQUE TECHNOLOGIES

2.1 Hot-formed Bends

The hot-formed bend, one of the important components for pressure piping, is used at pipe bend to change the direction of long-distance pipeline. It is composed of straight pipe and curved pipe and mainly applied in oil/gas transmission pipelines, urban pipeline network and other pipeline projects. CNPC's hot-formed bend covers 6 proprietary technologies and 4 patents for utility model, and is widely applied in Shaanxi-Beijing Gas Pipeline (Phase I & II), Se-Ning-Lan Gas Pipeline Project, Lanzhou-Chengdu-Chongqing Oil Pipeline, Zhongxian-Wuhan Gas Pipeline, First and Second West-East Gas Pipeline, as well as foreign pipeline projects (Central Asia-China, China-Myanmar, China-India, Russia-China, Chad, the Niger, Sudan, Libya, Kenya, Australia, etc.).

- The product features precise control of pipe end, ellipticity and other geometrical shapes;
- The reduction of outer arc wall thickness is controlled below 10%;
- Whole-course heating technology is used to process high steel-grade pipe fittings;
- The product's maximum outer diameter reaches 1,620mm and wall thickness 40mm.

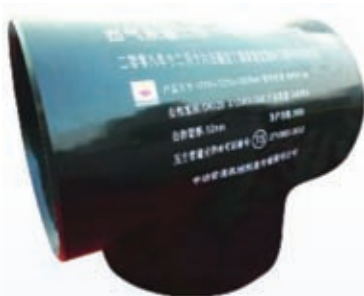


Hot-formed bend

2.2 Hot-press Pipe Fittings

Pipe fitting, as an essential component to connect pipes in oil/gas transmission pipeline construction, is the umbrella name for spare parts used for connection, control, turning, bypass, sealing, supporting, etc., including T-joint, elbow, pipe cap, reducing joint and other similar products. CNPC's self-developed pipe fittings cover 6 proprietary technologies and 4 patents for utility model and

have been widely applied in Shaanxi-Beijing Gas Pipeline (Phase I & II), Se-Ning-Lan Gas Pipeline Project, Lanzhou-Chengdu-Chongqing Oil Pipeline, Zhongxian-Wuhan Gas Pipeline, First and Second West-East Gas Pipeline, as well as foreign pipeline projects (Central Asia-China, China-Myanmar, China-India, Russia-China, Chad, the Niger, Sudan, Libya, Kenya, Australia, etc.).



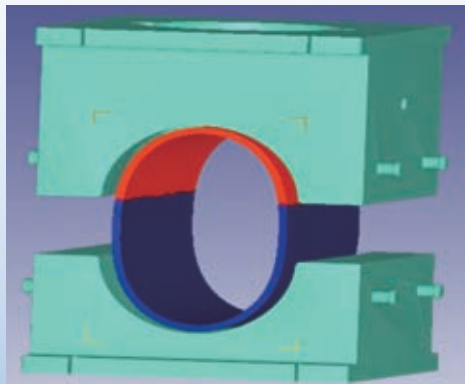
T-joint



Elbow



Reducing joint



Thermal simulated forming of hot-press T-joint



Pressing of hot-press elbow strap

- Compared with traditional empirical design methods, the simulated analysis technology makes finite element analysis and precise control over pipe forming dimension via thermal simulation.
- Through hundreds of physical and chemical experiments, CNPC has grasped the welding and heat treatment technologies for large-diameter pipe fittings of steel-grade X80 or below.
- CNPC is China's only pipe fitting manufacturer that use mechanized blank charging, process transfer for hot workpieces, mechanized truck loading of hot workpieces and other operations.
- CNPC's 4,000-ton pressure machine has the largest processing capability in China's pipe fitting manufacturing sector.
- CNPC grasps the automatic welding technology for high steel-grade pipe fittings used in pipelines, effectively enhancing the productivity of hot-press pipe fittings.

2.3 Integral Isolating Joint

The integral isolating joint is one of the necessary pressure piping components in long-distance oil/gas transmission pipeline, urban pipeline network and other projects. It is used for breaking the longitudinal current of steel pipes and separating the pipe section with cathodic protection from that without. CNPC's Integral Isolating Joint covers one patent for utility model, 4 proprietary technologies and one enterprise standard, and has been widely applied in the Dushanzi Petrochemical and Eastern Section of Second West-East Gas Pipeline, Mohe-Daqing Section of Russia-China Oil Pipeline, Daqing-Tieling Oil Pipeline, Shandong Gas Pipeline Network and other major domestic projects.

- The Monolithic Isolating Joint features much better sealing performance than ordinary isolating joint and flange.



Monolithic isolating joint

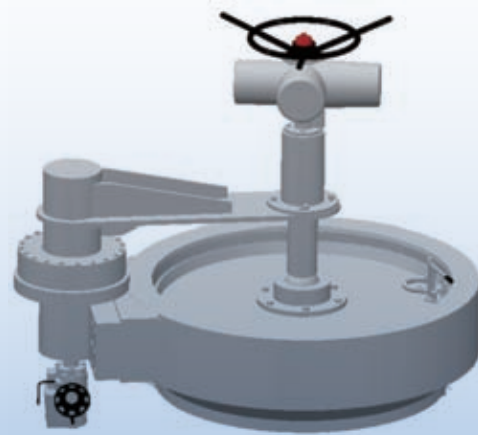
- Its distinctive U-shaped leak-proof structure and high-voltage protection measure ensure more remarkable isolating effect.
- Compared with the ordinary isolating joint and flange, it functions much better in bearing thermal stress in pipeline or bending moment caused by natural crustal movement, and the axial stress in connected pipeline that it can withstand attains 0.72 times as high as its yield strength.
- Forming dimension is controlled precisely by thermal simulation and fine element analysis.
- Its sealing reliability under working conditions (i.e. high pressure and large diameter) is ensured by a series of tests such as high water pressure + bending moment test, water pressure test and electric insulation test.
- Special sealing material endows it with stronger anti-aging, anti-corrosion and high/low temperature resistance.

2.4 Safe Self-locking Quick Opening Closure

The quick opening closure, one of the essential components for the equipment used in long-distance oil/gas pipelines and stations, is able to realize quick opening and closure, thus enhancing the efficiency of operation and maintenance and reducing maintenance cost. CNPC's Quick Opening Closure covers 5 patents for utility model, 4 proprietary technologies and one enterprise standard. It has been widely applied in a large number of major projects both home and abroad, e.g. Chad Oil Pipeline, the Niger Oil Pipeline, Kenya Oil Pipeline, Underground Gas Storage Base of second shaanxi-Beijing pipeline, Heilongjiang Section of Russia-China Oil Pipeline, Jiangsu LNG Pipeline, Puguang Gas Field, Shanxi Qinshui CBM Field, CNOOC's platform in Bohai Sea, West-East Gas Pipeline Modification Project.



Horizontal safe self-locking quick opening closure



Vertical safe self-locking quick opening closure

- Safe Self-locking Quick Opening Closure features compact structure, material saving, superior performance and quicker opening.
- Finite element analysis was applied in design, with fatigue load considered, making the product scientific, economical and reliable.
- Its C-shaped compound self-sealing structure enables more reliable performance and easier maintenance.
- Its locking structure, based on the self-locking principle, has the duplex stainless cone-shaped self-locking retainer stuck between the pipe end cover and end flange, thus realizing 360-degree compression of uniform pressure.
- Large Vertical Safe Self-locking Quick Opening Closure realizes automation in the lifting and rotating mechanism driven by electric power, thus enhancing efficiency and convenience. It is the first-ever in the world while other quick opening closures can be opened only by use of a crane.
- Its sealing technology is mature, i.e. sealing ring resistant to acidic moistures cause by high hydrogen sulfide content, double sealing structure and buildup welding techniques.
- It is processed by skilled welding and heat treatment techniques.
- Its mechanical key interlocking system prevents artificial misoperation.

2.5 Combined Filter Separator

The cyclone assembly and filtration coalescence assembly are both connected to the barrel in a removable structure. The coalescence cartridge and filtration cartridge are interchangeable—removing the cyclone assembly and replacing the coalescence cartridge with filtration cartridge, which can effectively cut material costs and energy consumption during operation.



Combined filter separator

- The product adopts integrated design which drastically reduces the occupied area.
- Compared with the split-type filter separator and cyclone separator, its coalescence cartridge and filtration cartridge are interchangeable, thus effectively reducing energy consumption during operation and material cost.
- DN50~DN150 Multiple-series Gas-liquid and Gas-solid Separation Components can be used in different working conditions, thus ensuring optimum performance.
- CFD simulation (computational fluid dynamics) helps optimize the product design.
- Large Vertical Quick Opening Closure developed independently by CNPC features easy operation and maintenance.
- Its cyclone and cartridge have undergone performance calibration by CNPC's own separation performance testing laboratory that masters the testing methods for cyclone and cartridge performance.
- CNPC boasts technologies of performance testing and high-pressure online detection under constant-

pressure working condition for whole set of combined filter separator.

2.6 PIW All-position Automatic Pipeline Internal Welding Machine

CNPC's self-developed PIW All-position Automatic Pipeline Internal Welding Machine features integrated design of the matching and welding systems, which realizes pipe aligning and root welding during the large-diameter pipeline welding process. It ranks among the "National Key New Products" and "New Record of Chinese Enterprises (14th batch)", covers 4 national patents and has been successfully applied in many projects, e.g. First and Second West-East Gas Pipeline, Shaanxi-Beijing Double-track Pipeline.

- The advanced pneumatic and digital control technologies enable the pipeline internal welding machine to realize multiple functions such as moving freely, pipe aligning, multiple torch simultaneous positioning, and quick automatic internal circumferential welding.



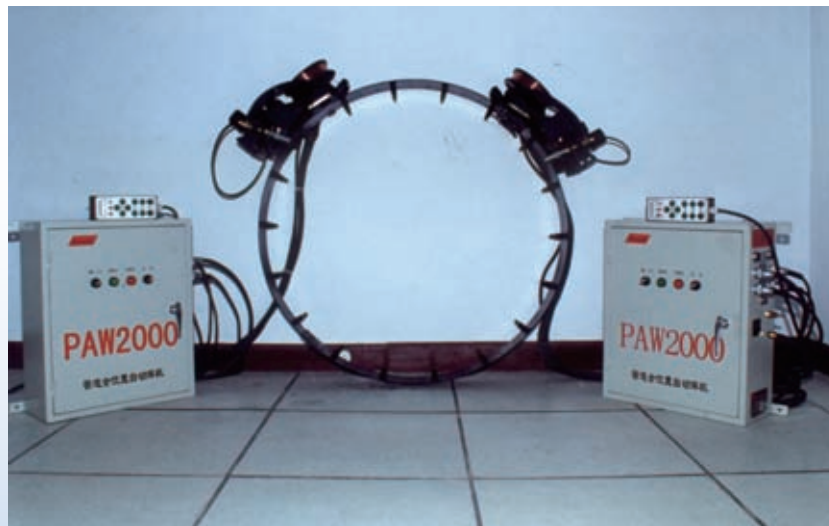
PIW All-position automatic pipeline internal welding machine

2.7 PAW2000 Single-torch All-position Automatic Pipeline External Welding Machine

CNPC's self-developed PAW2000 Single-torch All-position Automatic Pipeline External Welding Machine is mainly applied in automatic welding of pipe orifices in long-distance pipeline construction, with major components such as welding tractor, guide rail, computer-control system, shielding gas supply system, etc. With completely independent intellectual property, the product won the second prize of CNPC Technology Innovation Award, covers 2 national patents and has been successfully used in

Sebei-Xining-Lanzhou Gas Pipeline, First and Second West-East Gas Pipeline, Kazakhstan–China Oil Pipeline, India's East-West Gas Pipeline, Abu Dhabi Oil Pipeline, etc. The welding length has totaled 1,000-plus meters, with the first-pass yield above 97%. Moreover, it hit a welding record of 128 weld beads in the West-East Gas Pipeline Project.

- The whole welding process is precisely controlled through programming preset of all welding parameters by the computer or programming unit, with welding speed, wire feed speed, swing speed, welding voltage, welding current and other parameters varying with the welding condition.



PAW2000 Single-torch all-position automatic pipeline external welding machine

2.8 PAW3000 Double-torch All-position Automatic Pipeline External Welding Machine

CNPC's self-developed PAW3000 Double-torch All-position Automatic Pipeline External Welding Machine is mainly applied in automatic welding of pipe orifices in long-distance pipeline construction, with major components such as welding tractor, dedicated package-type rail, computer-control system, welding control system, shielding gas system, dedicated welding power source, etc. The product won the second prize of CNPC Technology Innovation Award, second prize of CPCIF Science

and Technology Progress Award and third prize of Hebei Province Science and Technology Progress Award. It is rated as the CNPC Key Self-developed Product and National Key New Product, covers 3 national patents and has been successfully employed in the Second West-East Gas Pipeline, with the first-pass yield above 97%.

- This product adopts the full-digital intelligent motion control technology (with DSP and CPLD as its core) and embedded operating system, which can precisely control each torch's spatial position, welding speed, wire feed speed, welding voltage, swing with, swing speed and edge stay.



PAW3000 Double-torch all-position automatic pipeline external welding machine

2.9 PFM Pipe Facing Machine

CNPC's self-developed PFM Pipe Facing Machine is mainly applied in pipe end bevel processing during long-distance pipeline welding, as the critical supporting equipment that uses fully automatic welding technology in pipeline construction. The complete machine mainly consists of host machine and hydraulic pressure station, with the former part for positioning and cutting and the latter part providing power, which can process V-shaped, U-shaped and X-shaped end bevels and those of mixed shapes. CNPC's PFM ranks among the "New Record of Chinese Enterprises" and won the second prize

of CNPC Science and Technology Innovation Award, as well as one national patent. It has been successfully employed in the First and Second West-East Gas Pipeline, Indian gas pipeline, Central Asia-China Gas Pipeline and other major projects both home and abroad. It once hit a welding record of 100 weld beads per day, fully meeting the requirements for end bevel shaping and precision in automatic welding.

- The tracking and copying unit in rotary cutterhead ensures uniform end bevel shape and dimension. PFM Pipe Facing Machine features easy operation, high precision, good end bevel shape, etc.



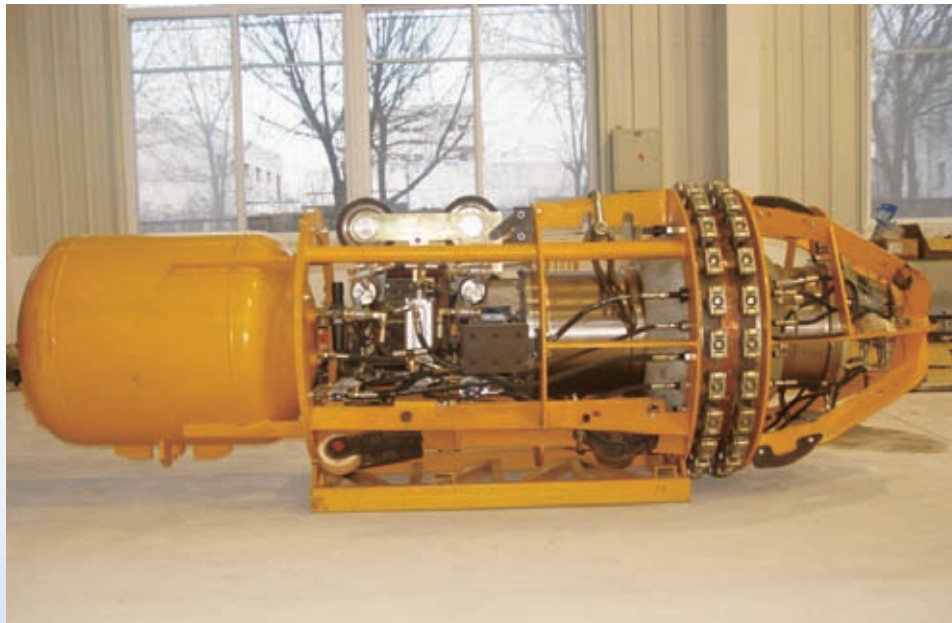
PFM Pipe facing machine

2.10 PPC Internal Pneumatic Pipe Line-up Clamp

CNPC's self-developed PPC Internal Pneumatic Pipe Line-up Clamp (PPC Line-up Clamp) is mainly applied in roundness correction and aligning. With a horizontal structure, the product consists of expansion device, running device, barrier, guide & control device, pneumatic system, etc. It covers one national patent and one enterprise standard, and has been successfully applied in many Chinese pipeline

projects (e.g. First and Second West-East Gas Pipeline, Shaanxi-Beijing Double-track Pipeline) and foreign projects in India, Central Asia and Russia.

- Compared with the external line-up clamp, the PPC Internal Pneumatic Pipe Line-up Clamp features large tension force, high precision of pipe end alignment, easy operation and other advantages.
- The interlocking technique of driving wheel and braking mechanism ensures the product's higher reliability in running and braking.



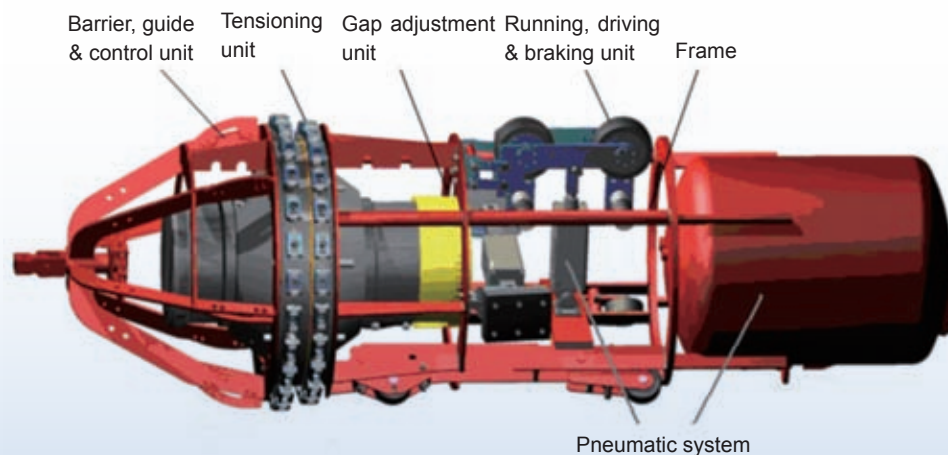
PPC Internal pneumatic pipe line-up clamp

2.11 PPG-GA Large-tension and Gap-adjustable Internal Pneumatic Pipe Line-up Clamp

In structural design, CNPC's self-developed PPC-GA Large-tension and Gap-adjustable Internal Pneumatic Pipe Line-up Clamp adopts the brand-new two-step force amplifier and adds the function of pipe end gap adjustment that ordinary line-up clamps lack. Its tensioning cylinder is horizontally set to eliminate the axial stress in base disc, thus

enhancing the transfer efficiency of tension force. The tensioning mechanism adopts two-step force amplifying technique to improve the clamp's tension force. Gap adjustment is flexible and very precise. PPC-GA covers 3 national patents and ranks among the "New Record of Chinese Enterprises (12th batch)".

- The two-step force-amplifying technique heightens the clamp's tension force.
- The quantitative gap adjustment technique ensures flexible gap positioning and high aligning precision.



PPC-GA Large-tension and gap-adjustable internal pneumatic pipe line-up clamp

3

TYPICAL CASES

CNPC's self-developed high steel-grade pipe fittings, hot-formed bend, quick opening closure, isolating joint, combined filter separator and other products have been widely applied in many industrial fields, such as oil exploration, petrochemical engineering, oil/gas storage and transportation, LNG, chemical fiber, building material. They have earned certification from many Chinese oil companies and make CNPC the core supplier for long-distance pipeline construction. Moreover, they have been successfully applied in Dushanzi Petrochemical and Eastern Section of Second West-East Gas Pipeline, Mohe-Daqing Section of Russia-China Oil Pipeline, Daqing-Tieling Oil Pipeline, Shandong Gas Pipeline Network, as well as foreign pipeline projects in Central Asia, Chad, the Niger, Kenya, etc.



Cyclone separator of second west-east gas pipeline

Filter separator of Central Asia-China gas pipeline



CNPC's self-developed PIW All-position Automatic Pipeline Internal Welding Machine, PAW2000 Single-torch All-position Automatic Pipeline External Welding Machine, PAW3000 Double-torch All-position Automatic Pipeline External Welding Machine, PFM Pipe Facing Machine, PPC Internal Pneumatic Pipe Line-up Clamp and other welding equipment are widely applied in the First and Second West-East Gas Pipeline, Third Shaanxi-Beijing Gas Pipeline, India's East-West Gas Pipeline, as well as foreign pipeline projects (e.g. Kazakhstan-China, Central Asia-China,

Uzbekistan-China, Russia-China). CNPC's automatic pipeline welding technology, with many advantages such as higher welding speed, better welding quality and higher first-pass yield, effectively eliminates influence of artificial factors in manual welding and semi-automatic welding and reduces welding workers' labor intensity. Its advantages are more notable in highly efficient welding for long-distance, high steel-grade, large-diameter and thick-wall oil/gas pipelines.



West-east gas pipeline of China



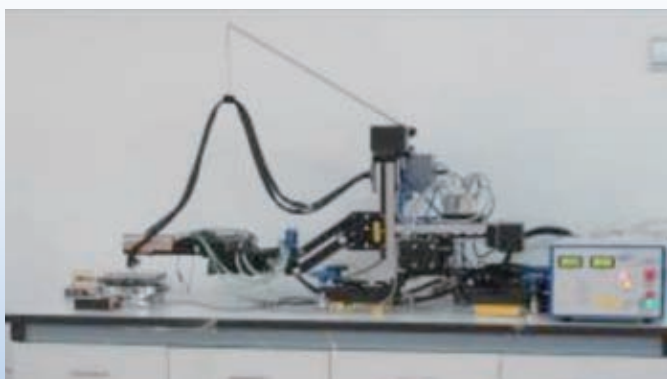
East-west gas pipeline of India

4 R&D EQUIPMENT

CNPC owns the National Engineering Laboratory of Transportation Safety of Oil & Gas Pipeline, one of the 100 national engineering laboratories in the “12th Five-Year Plan” period, with 7 subordinate professional separate labs. The national engineering laboratory possesses 237 different sets of research equipment worth RMB150 million and 98 sets of world-class key scientific research apparatus (e.g. thermal simulation test machine, transmission electron microscope, electro-hydraulic servo-controlled fatigue test machine, micro-shear test machine, wide plate tensile test machine), with coefficient of equipment ageing up to 0.7. Relying on such equipment, CNPC is able to conduct lifecycle and safety evaluation of pipelines and tanks, overall performance analysis and test for metallic and non-metallic materials.

Furthermore, CNPC owns a professional machinery manufacturing factory covering an

occupied area of $20 \times 10^4 \text{m}^2$ and floorage of $6 \times 10^4 \text{m}^2$, with 14 production buildings, 430-plus sets of production equipment and 50-plus sets of testing equipment. The factory with RMB130 million fixed assets has all the equipment and techniques required to produce equipment for pipelines, stations and oil/gas gathering and transmission. It is able to design and manufacture pressure vessels (100MPa or below), holistic LNG tanks (200m^3 or below) and other pressure equipment and components for oil/gas storage and transmission stations, with the total annual capacity above 20,000t. It can also produce DN10-DN1600mm hot-formed bends and pipe fittings of various materials (e.g. carbon steel, alloy steel, steel for oil pipeline) and for various purposes, with the annual capacity of 1016mm-plus hot-formed bends up to 7,500 pieces and that of diverse pipe fittings up to more than 10,000t.



X-ray residual stress tester



Thermal simulation tester



2000t Wide plate tensile test machine



MTS Fatigue test machine



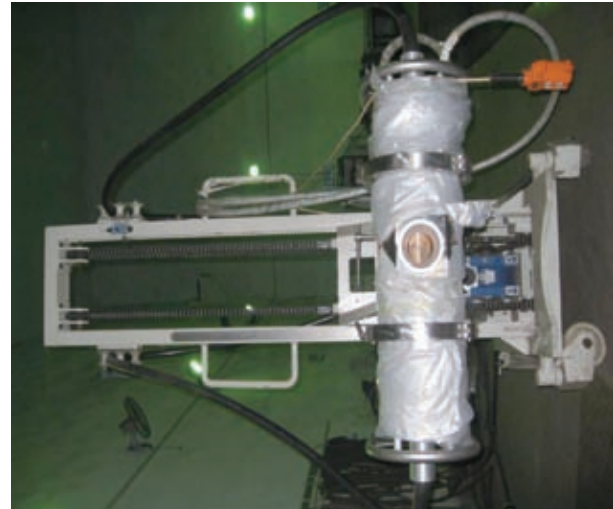
4000t Pressure machine



Billet heating furnace



Automatic submerged-arc welding machine



Mobile X-ray diagnostic machine



CNC Plasma cutting machine



15m Beveling machine

5 QUALIFICATIONS & STANDARDS

CNPC has the manufacturing license of class-A and class-B pressure pipe components, as well as design and manufacture license of A1 and A2 pressure vessels.



Patents list

No.	Patent	Patent No./Application No.
1	Quick Opening Device	ZL 2009 2 0158134.0
2	Dual-phase Sealing Ring	ZL 2009 2 0153881.5
3	A Large-diameter and High-voltage Monolithic Isolating Joint	ZL 2009 2 0277612.X
4	T-joint Drawing and Plate-feeding Device	ZL 2010 2 0242167.6
5	Manufacturing Technique and Process for High Steel-grade, Large-diameter and Thick-wall T-joint	201010214950.6
6	Roundness Control Device for Hot-formed bend	ZL 2010 2 0242171.2
7	Integral Tempering Technique and Process for Automatic Submerged Arc Welding of X80 Steel Pipe Fittings	201010283153.3
8	Package-type Automatic Pipe Welding Rail	01258930.6
9	Articulated Multifunction Welding Tractor	01258927.6
10	Pipe End Facing Machine	01258928.4
11	Automatic Locking Running Mechanism for All-position Welding Tractor	200320103054.8
12	Symmetrical Arc Swing Mechanism for Double-torch All-position Automatic Pipe Welding Machine	200320103052.9
13	Dedicated Welding Unit for Automatic Pipe Internal Circumferential Welding Machine	03217442.X
14	Multi-welding-head and Simultaneous-welding Driving Mechanism for Automatic Pipe Internal Circumferential Welding Machine	03217441.1
15	Multi-welding-head Simultaneous Positioning Mechanism for Automatic Pipe Internal Circumferential Welding Machine	03217443.8
16	Gap Adjustor for Internal Line-up Clamp	03206062.9
18	Internal Pipe Line-up Clamp	03206063.7
19	Copper pack-added Internal Pneumatic Pipe Line-up Clamp	200520118135.4
20	Internal Large-tension Pipe Line-up Clamp	200520113989.3
21	Double-piston Regulating Mechanism for Circumferential Weld Joint Gap	200520013990.6
22	Gap-adjustable Mechanism for Internal Pneumatic Pipe Line-up Clamp	200820080679.x
23	Cable-interior-wound Rotary Mechanism for Internal Pipe Welding Machine	200820080678.5

Standards

No.	Standard	Standard No.
1	Technical Specification for All-position Automatic Pipeline Welding Machine	Q/CNPC-GD 0237-2001
2	Technical Specification for Pipe Facing Machine	Q/CNPC-GD 0239-2001
3	Technical Specification for Internal Pneumatic Pipe Line-up Clamp	Q/CNPC-GD 0238-2001
4	General Technical Requirement for Induction-heating Pipe Bending in Oil-Gas Pipeline Project	CDP-S-OGP-PL-016-2011-2
5	Steel Pipe Bending for Oil/Gas Transportation	SY/T 5257
6	General Technical Requirement for Induction-heating Pipe Bending in Oil-Gas Pipeline Project	Q/SY GJX 111-2010
7	General Technical Requirement for ≤DN350 Pipe Fittings in Oil/Gas Pipeline Project	CDP-S-OGP-PL-010-2011-2
8	General Technical Requirement for ≤DN400 Pipe Fittings in Oil/Gas Pipeline Project	CDP-S-OGP-PL-011-2011-2
9	Steel-plate Butt-welded Pipe Fittings	GB/T13401-2005
10	Steel Butt-welded Pipe Fittings	GB/T12459-2004
11	Technical Requirement for ≤DN350 Pipe Fittings in Oil/Gas Pipeline Project	Q/ SY GJX 105
12	Technical Requirement for ≤DN400 Pipe Fittings in Oil/Gas Pipeline Project	Q/ SY GJX 106
13	Premium Steel Butt-welded Pipe Fitting Code	SY/T-0609
14	Specification for high test wrought butt-welding fittings	MSS-SP-75
15	Factory-made wrought steel butt welding fittings	ASME B16.9
16	Pressure Vessel	GB150
17	Safety Technology Supervision Regulation for Fixed Pressure Vessel	TSG R0004
18	Gas Pipeline Design Code	GB50251
19	Oil Pipeline Design Code	GB50253
20	Integral Isolating Joint	Q/ST GDJ0325-2009
21	Analysis and Design Standard for Steel Pressure Vessel	JB4732
22	Safe Self-locking Quick Opening Closure	Q/ST GDJ0324-2009
23	Natural Gas Transportation and Distribution Pipeline System	ASME B31.8
24	Pipeline Transportation System for Hydrocarbon Fluid and Other Fluids	ASME B31.4
25	ASME Boiler and Pressure Vessel Code	ASME VIII Division (Chapter I)
26	ASME Boiler and Pressure Vessel Code	ASME VIII Division (Chapter II)

6

EXPERT TEAM

CNPC has experts in pipe fitting and welding equipment technologies and an expert team headed by academic pacesetters, so it is able to offer users with satisfying products, perfect technical consulting solutions and after-sales service.



Li Helin Materials scientist, expert in petroleum pipe materials, academician of Chinese Academy of Engineering and a pioneer of CNPC pipe materials research.
E-mail: lhelin@cnpc.com.cn



Gao Zetao Professor, senior technical expert in welding, expert granted Special Government Allowance. He has presided over key technological research for major pipeline projects, such as First and Second West-East Gas Pipeline.
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Xue Zhenkui Professor, doctoral supervisor and senior technical expert in welding granted with Special Government Allowance. He has presided over welding research for many pipeline projects (e.g. First and Second West-East Gas Pipeline) and undertaken multiple national, provincial and ministerial-level research subjects.
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Liang Junzhi Professor and senior mechanical expert granted Special Government Allowance. He has undertaken multiple national, provincial and ministerial-level research subjects.
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Zou Feng Senior expert in pipeline technology and senior engineer. He has been engaged in technological research on high steel-grade pipe fittings and equipment for stations and undertaken multiple station equipment research projects, with solid theoretical foundation and rich hands-on experience.
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Li Yuzhuo Expert in pipe bending manufacture and senior engineer. He has been engaged in technological research on high steel-grade pipe fittings for years and undertaken multiple technological R&D of high steel-grade large-diameter pipe bending, with solid theoretical foundation and rich hands-on experience.
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Sui Yongli Senior expert in pipeline technology and senior engineer. She has been engaged in research on pipeline welding techniques and processes for years, undertaken a number of national and ministerial-level research subjects and won multiple provincial and ministerial-level awards, with rich hands-on experience.
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Zeng Huilin Expert in pipeline technology and senior engineer. He has been engaged in welding equipment R&D for years, undertaken a number of national, provincial and ministerial-level research subjects and won multiple provincial and ministerial-level awards.
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Yang Yunlan Senior engineer. She has been engaged in the design and R&D of oil/gas pipeline equipment for years, fulfilled a number of new product development and achievement transformation projects and finished multiple reviews of key oil/gas pipeline equipment both home and abroad, with solid theoretical foundation and rich hands-on experience.
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