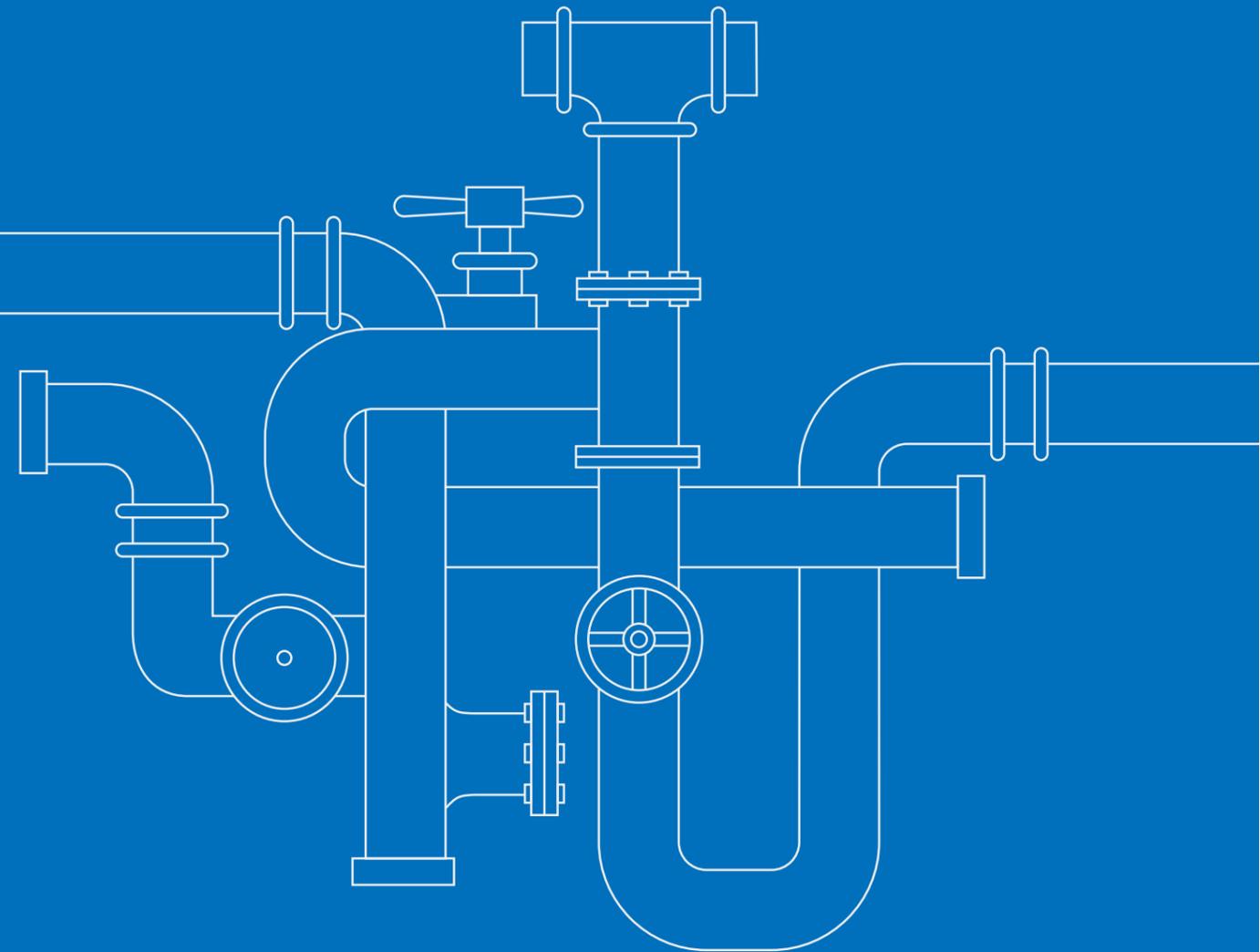




**SHENLAN  
INTELLIGENT**



## Shenlan Intelligence & ZQY Group Make Pipeline Inspection And Repair Smarter



**Shenlan Intelligence & ZQY Group**

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# Shenlan Intelligent & ZQY Group

Become a leader in the pipeline intelligent robotics industry

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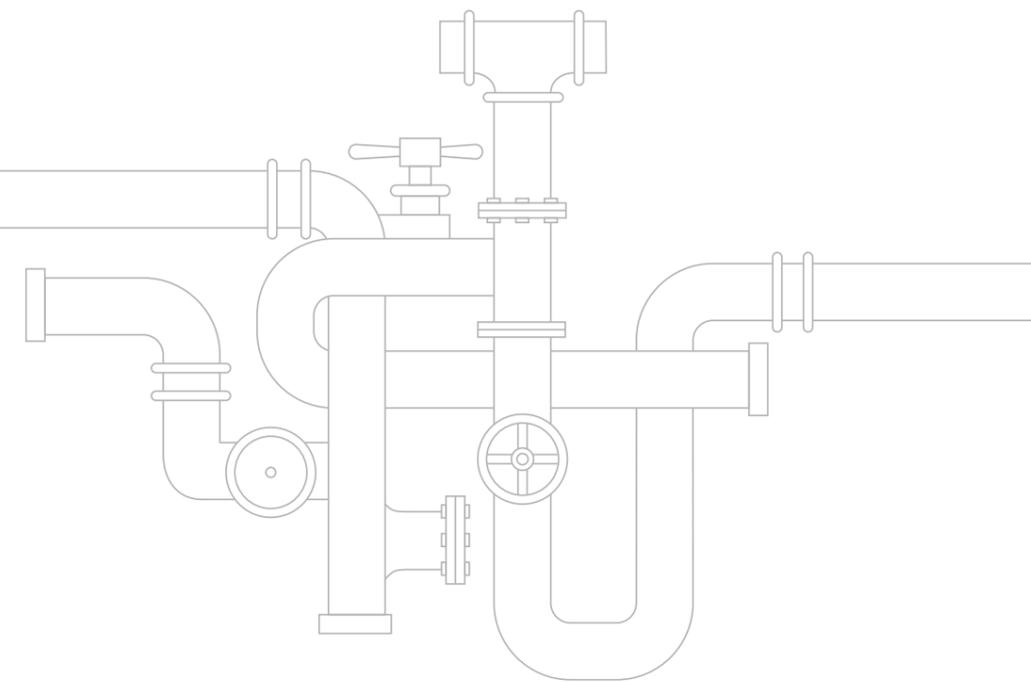
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## Company Profile

National Specialized, High-end And Innovation-driven Little Giant" Firm .  
National Green Manufacturing System Solution Provider.

National High-tech Enterprise  
Pipeline Intelligent Robotics Service Provider

Xi'an Shenlan, a subsidiary of Supernet Industry, is a high-tech enterprise specializing in the research, development and production of intelligent robot solutions. It has been deeply involved in the field of robot technology research and application for a long time, and is committed to providing customers with one-stop solutions including research and development, design, production, engineering technology services, and sales.

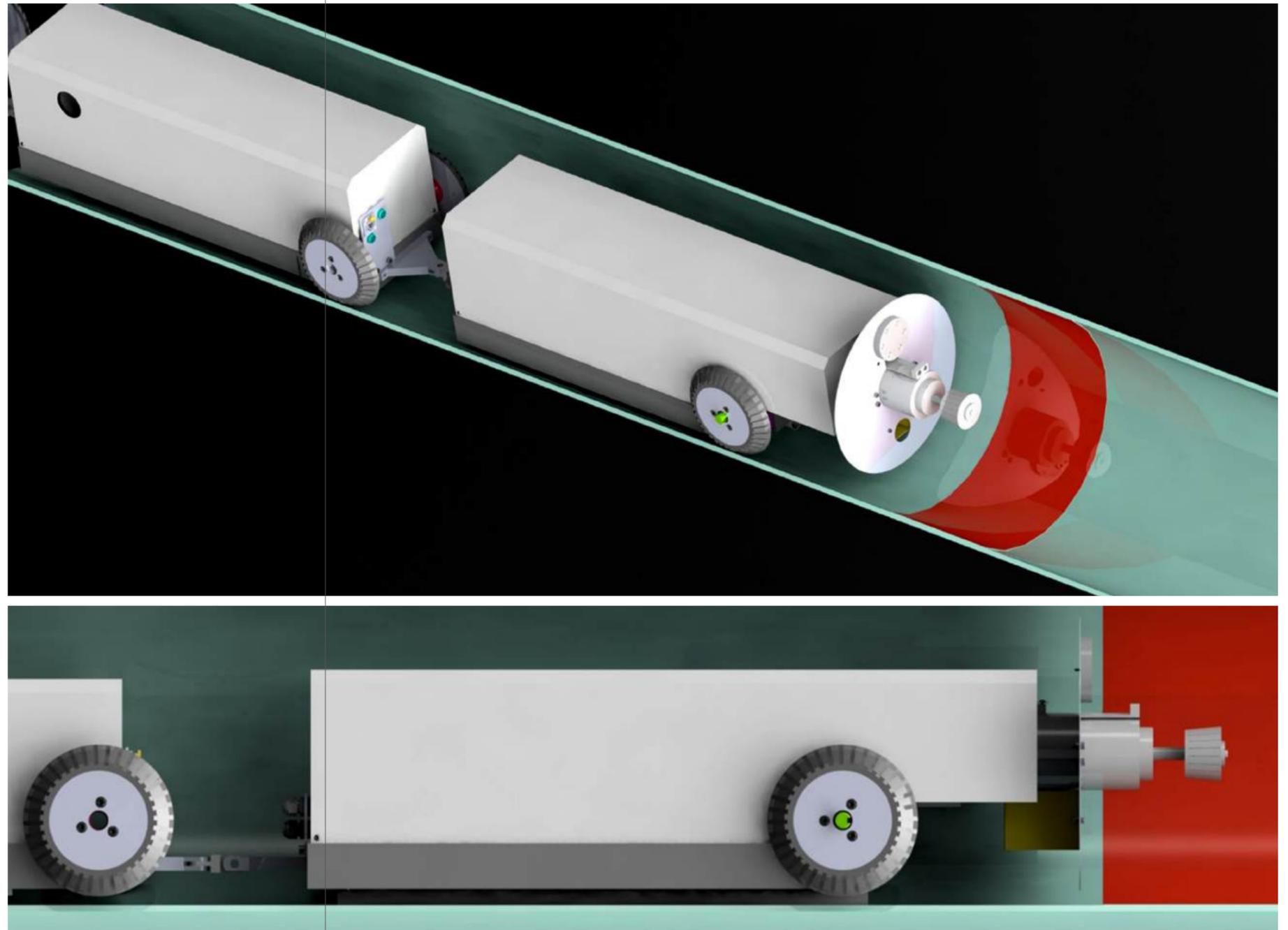
In the field of pipeline robots, with deep technical accumulation and more than ten years of engineering service experience, we have successfully applied for more than 12 patents, and a number of technical achievements have filled the gaps in domestic technology. As a Key & Core Technology high-tech enterprise, we will continue to optimise the technical structure, and strive to provide our customers with more efficient and smarter intelligent robot solutions.

**Pipeline Robotics products:** Patch anticorrosion robot, all-terrain pipeline internal anticorrosion robot, automatic sand blasting robot, weld laser scanning imaging robot, video endoscopic robot, weld trimming robot, external 3PE coating inspection machine. video endoscopic robot, weld trimming robot, external 3PE coating inspection machine.

**Application Scenarios:** Crude oil transportation pipeline, natural gas transportation pipeline, chemical sewage pipeline, city water pipeline, drinking water long-distance pipeline, underground comprehensive pipeline corridor, aviation kerosene pipeline and so on. drinking water long-distance pipeline, underground comprehensive pipeline corridor, aviation kerosene pipeline and so on.

**Wall climbing robot products:** Sandblast cleaning robot, spraying anti-corrosion robot.

**Application scenarios:** oil storage tanks, wind power towers, air separation towers, etc.



### Corporate Vision

Become a leader in the pipeline intelligent robotics industry

### Enterprise mission

Make urban lifelines safer

# Development History

In 2020, The R&D center was established and merged into the Science Park of University of Electronic Science and Technology of China, Chengdu.

In 2019, We undertook the project of China Flight Test and Research Institute and entered the field of anti-corrosion of aviation kerosene transport pipeline.

In 2018, We undertook the comprehensive underground pipeline corridor project of China Railway First Bureau, in Pingtan, Fujian, China Railway First Bureau, and entered the field of corridor pipeline anti-corrosion testing.

In 2016, The company was established with a clear focus on intelligent robotics.

2022 Undertook an inspection project for PetroChina's Southwest Oilfield, evaluating the quality of oil and gas pipeline circumferential welds for the first time with a robot.

In 2021, The fully automatic sandblasting internal patching robot system was successfully developed, breaking the monopoly of foreign technology.

In 2023, We undertook the Yunnan Dianzhong Water Diversion Project of China Railway Fifth Bureau, and successfully developed an anti-corrosion robot for all terrain pipelines

## Qualifications Honors

Shenlan Intelligence has always attached importance to R&D first and innovation first, and continuously invested resources to promote technology research and development and patent layout. Up to now, the company has successfully obtained a number of core patented technologies, especially in the field of pipeline internal anticorrosion patching robot, with excellent technical strength and continuous innovation, won a number of honors and qualifications in the industry, and established its leading position in the industry.

National High-tech Enterprise

Hard Technology Enterprise



榮譽

## Product Value

With the recovery of the global economy and accelerated urbanisation, coupled with the support of national policies, the demand for the pipeline market will continue to grow. As steel pipes by virtue of highly sophisticated manufacturing process, thin and light wall thickness and excellent pressure-bearing capacity. It has been widely used in many key areas such as infrastructure construction, energy transportation, potable water transmission, oil and gas, chemical and pharmaceutical industries. It has been widely used in many key areas such as infrastructure construction, energy transportation, potable water transmission, oil and gas, chemical and pharmaceutical industries, and has become an indispensable and major material in these industries. However, the treatment of ring welds and anti-corrosion measures have not yet kept pace with the development.

Data analysis shows that 90% of pipeline leakage is caused by cracks or perforations formed by internal corrosion, and the ring weld is a prone area for this problem. Therefore, there is a "pipeline without patching, as no anti-corrosion", so the ring weld anti-corrosion treatment is extremely important in the safe operation of pipelines. the safe operation of pipelines.

### 6 Core Values

Extend pipe life and reduces maintenance costs



Protecte the environment



Reduce friction between pipe wall and medium



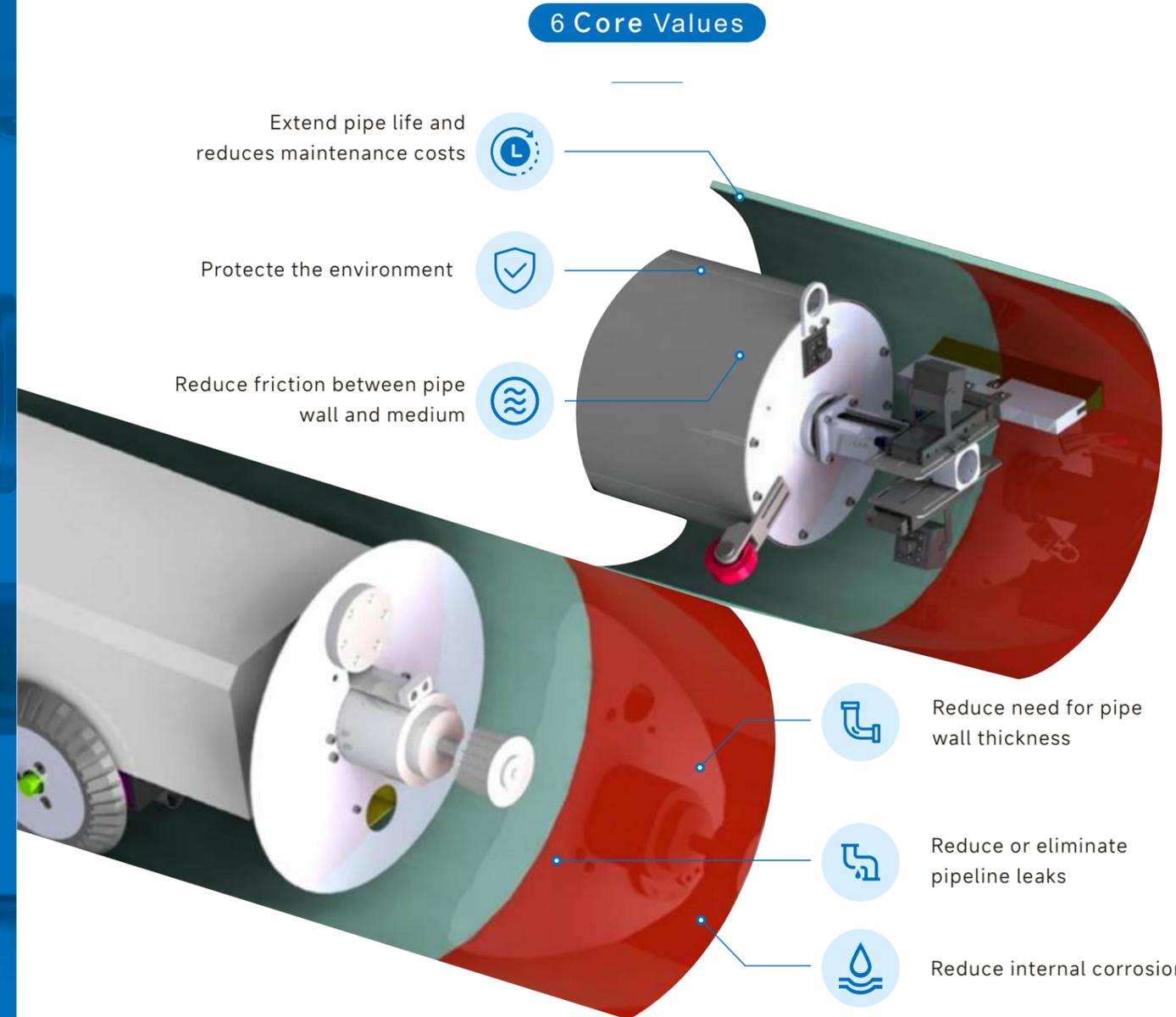
Reduce need for pipe wall thickness



Reduce or eliminate pipeline leaks



Reduce internal corrosion



## Product Introduction

### Automatic identification and positioning system for pipeline welds:

Pipeline welding seam automatic identification and positioning system equipped with high-precision cameras and analysis software, the robot can automatically identify the ring welding seam, so as to avoid the human eye recognition of the situation of missed welding seams. automatically identify the ring welding seam.



#### Key Features

- 1、 Intelligent operation of the internal mending robot is realised with high efficiency and reliability.
- 2、 The weld can be numbered and big data statistics can be carried out, and each weld has complete data.

◆ **Core Value:** It can accurately and clearly find the defects of weld seams, take timely remedial measures to avoid leakage of pipelines, save energy and reduce emissions, and protect the environment. emissions.

### Pipeline external anti-corrosion layer 3PE stripping inspection machine:

3PE peeling testing machine, for external 3PE anti-corrosion pipeline, testing the peeling strength value of PE layer.



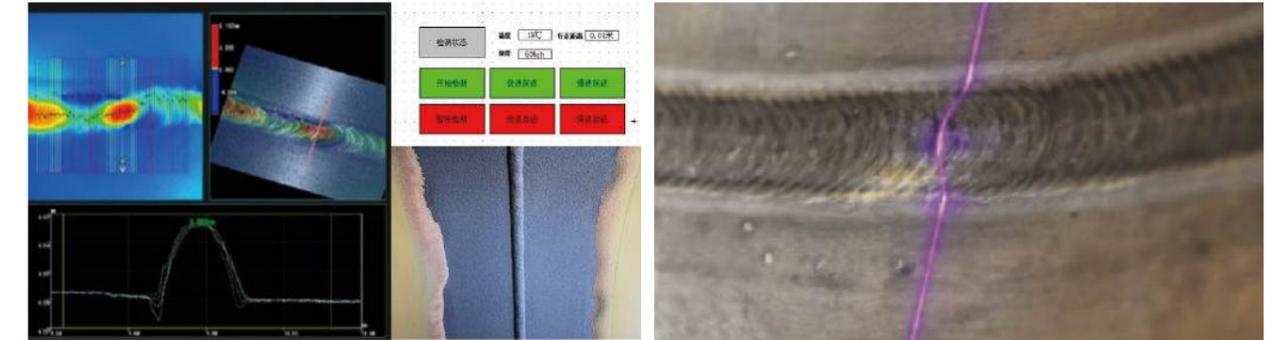
#### Key Features

- 1、 The current standard for the 80's manual stripping detection, human factors lead to the detection of data is not allowed, resulting in pipeline laying project outside the PE layer off. project outside the PE layer off.
- 2、 Using lithium battery power supply, equipped with high-precision force sensor, stable measurement of peeling force, real-time curve display, comes with a printer on-site printing report.
- 3、 Anti-corrosion production line and engineering projects welding seam outside PE filler can be used.

◆ **Core Value:** It can detect the unqualified PE layer in time and avoid the significant economic loss caused by PE layer falling off in pipeline projects.

### Laser scanning imaging system for pipe root welding:

Pipeline root welding laser scanning imaging system, root welding is the first welding of pipeline ring weld, but also the most important, the root welding often have wrong edge, bite edge, unfused defects, but can not be observed from the inside of the pipeline, the laser scanning imaging device by the welding often have wrong edge, bite edge, unfused defects, but can not be observed from the inside of the pipeline, 360 ° scanning of the root weld, the three-dimensional data feed back to the analytical software, the observed image will be presented. The three-dimensional data feed back to the analytical software, the observed image will be presented.



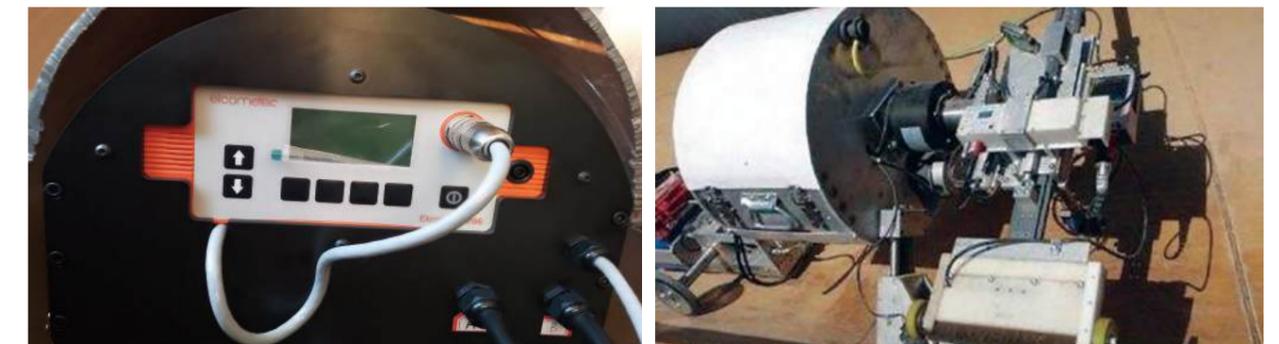
#### Key Features

- 1、 The laser system is stable, high data acquisition efficiency, fast imaging, accuracy up to 0.01mm.
- 2、 Laser system portable, pipeline robot carrying can enter the minimum pipe diameter of 300mm pipe.

◆ **Core Value:** Early detection of root weld defects and timely remediation to avoid safety accidents caused by weld breakage.

### Pipeline coating inspection robot:

Pipeline internal coating inspection robot, until the internal patching robot to complete the coating of the weld position, the coating to achieve complete curing, the internal coating inspection robot into the pipeline, for each patching position, high-voltage EDM leakage detection and 4-6 points of the coating thickness measurement, and the use of video cameras on the coating of a 360 ° careful observation of the data and video real-time sent back to the control centre.



#### Key Features

- 1、 Carrying high voltage EDM leak detector and coating thickness gauge with high definition camera to evaluate the coating of the inner patch.
- 2、 The most advanced and first process in China, which can realize the process of pipeline coating integrity testing.

◆ **Core Value:** Timely detection of defects such as peeling, blistering, porosity and insufficient thickness of the anti-corrosion layer in the pipeline to avoid safety accidents such as leaks caused by corrosion from within the pipeline..

## Pipe root welding and grinding robot:

The pipe root welding and grinding robot comes with a high-speed grinding wheel to grind the raised high points inside the weld, so that the height meets the standard requirements of the weld, thus clearing up the obstacles for the subsequent internal patching. The pipe root welding and grinding robot comes with a high-speed grinding wheel to grind the raised high points inside the weld, so that the height meets the standard requirements of the weld, thus clearing up the obstacles for the subsequent internal patching.



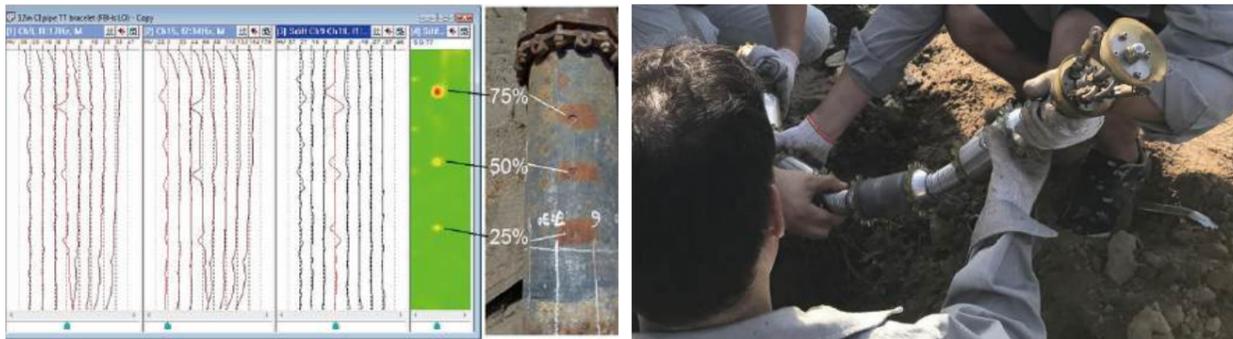
### Key Features

- 1、 Precise positioning of the weld seam, multi-degree-of-freedom manoeuvring system, high grinding precision.
- 2、 With its own battery, wireless remote control, can be deep pipeline 300 meters operation.

- ◆ **Core Value:** Grinding away slag, oxidised skin, and excessive projections from the inside of the weld to avoid cutting and rewelding of the weld. Save money and time costs for the builder and enhance the progress of the project.

## Electromagnetic eddy current internal detector:

Electromagnetic eddy current internal detector is the use of far-field eddy current technology principle, the pipeline wall defects such as cracks, corrosion pits, perforation and other characteristics of the data stored in the internal detector, to be detected after the detection of the detector is detected. the internal data will be imported into the analysis software to form a curve, and then for professional analysis.



### Key Features

- 1、 The device is portable, adapted to 60-219 mm tiny pipes, qualitative and quantitative analysis of pipeline defects.
- 2、 Pre-advance prediction of the weak position of the pipeline, to prevent pipeline rupture and leakage, to avoid environmental pollution and explosion accidents.

- ◆ **Core Value:** Identify defects in the internal and external walls of oil pipelines, such as corrosion pits, cracks, and wall thickness thinning, and replace and remedy them in a timely manner, effectively avoiding crude oil spills, saving money for oilfield companies and protecting the environment.

## Electromagnetic eddy current detection technology:

### 一、 Array eddy current detection technology

Eddy current inspection coils are large in size and cover a large sweep area; a complete inspection coil consists of multiple independent coils arranged to provide consistent detection sensitivity for linear defects in different directions.

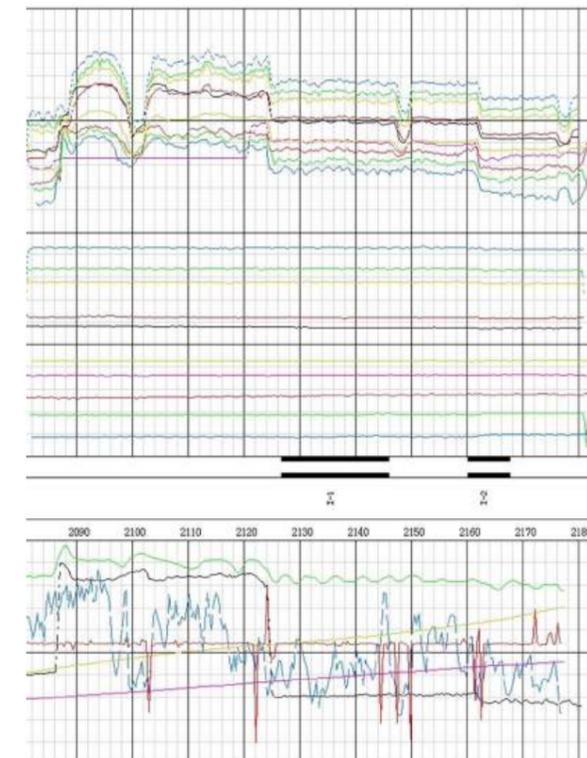
### 二、 Application Scenario

#### Array electromagnetic eddy current (oil pipeline)

- 1、 For the detection of oil pipelines, currently on the basis of electromagnetic eddy current detection, the development of array eddy current detection For the detection of oil pipelines, currently on the basis of electromagnetic eddy current detection, the development of array eddy current detection equipment, on the basis of 60 detection equipment, can be arranged to detect the probe 6-8, not only can detect the defects existing inside the pipeline, but also define the size and depth of defects exist, significantly improve the current eddy current detection effect.



- 2、 The effect of array eddy current detection is similar to that of magnetic leakage detection, and the curve is shown below.



## Robot for internal patching of pipe welds:

Pipeline weld internal patching is a technology that links the unprotected areas on both sides of the inner surface of the pipeline circumferential weld to the prefabricated coating inside the pipeline by sandblasting to remove rust, cleaning treatment, spraying anticorrosion and other processes.



### Key Features

- 1、Replacing manual labour and human inaccessible pipes to complete the operation.
- 2、 Full-automatic intelligent operation, high coating quality, stop pipeline corrosion, prevent leakage.
- 3、 comes with lithium battery power supply, wireless remote control, video real-time monitoring.

**Core Value:** Adopting wireless power and remote monitoring,

- ◆ it can work continuously for a long time without external power supply and communication cable, with high quality and fast mending.

Table of pipe diameter division and patching efficiency

Number	Pipe Diameter(mm)	Internal patching efficiency (lanes/10 hours per day)
1	219.1~273.0	55-56
2	323.8~406.4	65-75
3	426.0~529.0	65-70
4	558.8~660.4	50-60
5	711.2~812.8	45-60
6	863.6~1016.0	35-45
7	1066.8~1219.2	25-35

## All Terrain Pipeline Internal Corrosion Protection Robot:

Pipelines are vital in modern industry, the corrosion protection layer is the key to protect the pipeline from erosion, the corrosion protection of flat With the promotion of major projects, the internal corrosion protection requirements for steel pipelines laid in mountainous areas for water transmission are increasing. The corrosion protection layer is key to protect the pipeline from erosion, the corrosion protection of flat and straight pipelines, the existing robotic technology is sufficient to cope with.

Due to the influence of mountainous pipelines by the terrain, the slope is large, some slopes even up to 60-80 °, and there are a large number of bends, turning angle up to 90 °. In order to meet the corrosion protection needs of these special pipelines, we have successfully developed an all-terrain pipeline internal corrosion protection robot that can adapt to the complex terrain conditions.



### Application Scenarios

All Terrain Pipeline Applications

### Device Parameters

Applicable pipe diameter: DN200-DN700

Use voltage: Ac220

Variable diameter capability: variable diameter

Travelling speed: 0-30米/min

Maximum distance:

1000 metres deep into the pipeline

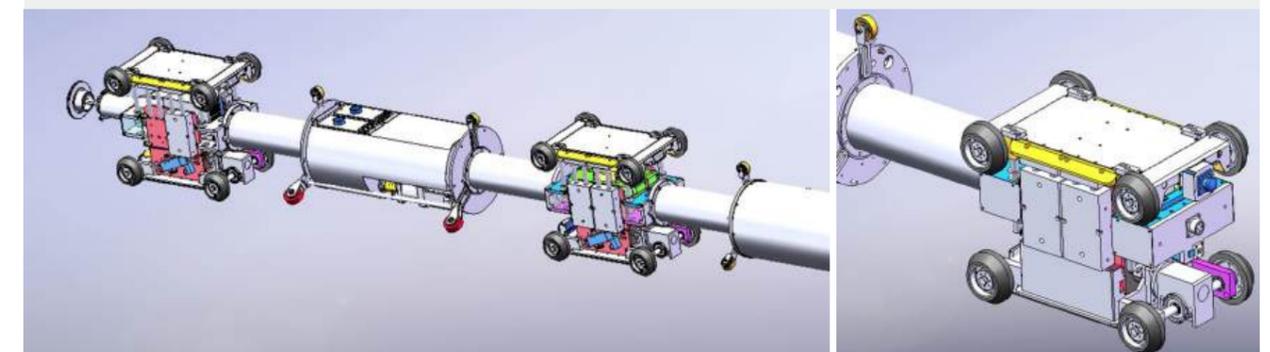
Climbing capacity: 90° (vertical)

Cornering ability: 5D90°

Adaptation of paint: all types of coatings

Camera: Real-time 4 million HD

video transmission



## Typical Case

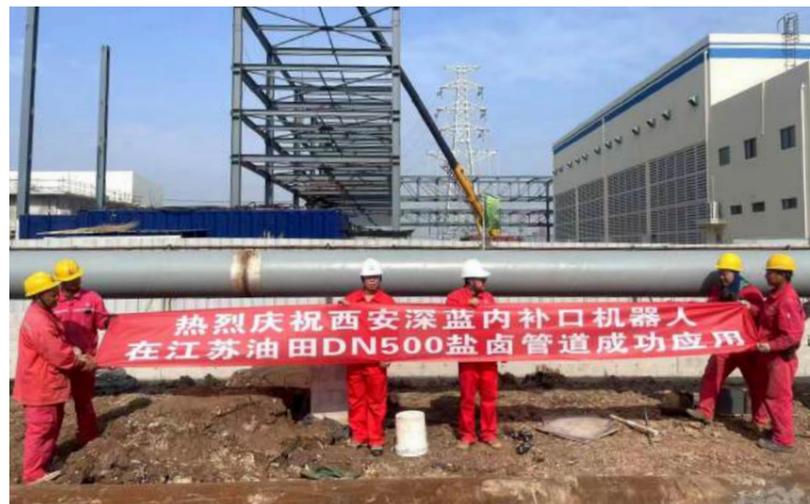
### Sinopec Jiangsu Oilfield Brine Pipeline Project

#### Project Status:

The project involved the corrosion protection of a 2.3 kilometer long section of DN500 mm diameter pipe with 2,600 welded joints in the directional drilling precast. The corrosion protection was a critical and challenging task as the pipeline had to traverse complex terrain, especially in some of the directional drilling prefabricated sections.

#### Solution:

Shenlan 500 wireless remote control fully automatic internal patching robot, one side deep into the pipeline 1200 metres, equipped with multiple high-definition cameras, real-time transmission screen, remote monitoring Shi and timely detection of problems. In addition, the inner coating inspection robot is the first attempt to use pipeline robots to remotely measure the quality of the coating on the inner wall of the steel pipe, the technology can accurately assess the quality of the coating, to ensure that the pipeline anti-corrosion effect meets the expected requirements.



### Sinopec Guangdong Natural Gas Transmission Pipeline Project

#### Project Status:

Pipeline welding in this project is the key to ensure the safety and efficiency of natural gas transportation, and its welding procedure includes four layers: root welding, hot welding, filler welding and cover welding. Root welding, as the most important part, is directly related to the integrity and sealing of the inner wall of the pipeline. Due to the limitations of the pipeline structure, the inspection of root welding must be carried out on the inside of the pipeline, but personnel cannot enter the inside of the pipeline.

#### Solution:

In response to the pipeline root weld inspection challenges, Shenlan has developed a high-definition zoom endoscopic inspection robot. This technology greatly improves the efficiency of pipeline construction and saves customers a lot of manpower, material and time costs.



## Typical Case

### Daqing Oilfield Gagdachi Crude Oil Pipeline Project

#### Project Status:

The project's DN250-400 pipe diameter crude oil pipeline is difficult to implement weld seam anti-corrosion work due to the narrow pipe diameter. Due to the lack of effective technical means, it is impossible to carry out internal anticorrosion treatment on the weld seams, resulting in gradual corrosion of the weld seams, which in turn increases the risk of crude oil leakage and threatens the safety of neighbouring farmland and water sources.

#### Solution:

For DN250-400 pipe diameter crude oil pipelines, we provide a small and efficient internal anti-corrosion robot, which is designed for small pipe diameters, and can easily enter the interior of the pipeline, and accurately spray anti-corrosion on the weld seam.



### China Railway Fifth Bureau Yunnan Dianzhong Water Diversion Project

#### Project Status:

Diversion of water from central Yunnan is an important infrastructure project in Yunnan, which involves pipelines with a variety of pipe diameters, including different sizes such as DN400, DN500, DN600 and DN700. The complex terrain, including mountain slopes and rivers, led to a large number of bends and elbows in the pipeline, some with almost vertical slopes as a challenge.

#### Solution:

We have developed an all-terrain internal anticorrosion robot, which can crawl vertically, easily pass through 5D and above elbows, carry anticorrosive coatings several hundred meters deep into the pipeline, and realise precise spraying of anticorrosive coating on weld seams. technological innovation effectively solves the internal anti-corrosion work which is difficult to be done manually, and has won high praise from China Railway Fifth Bureau.



## Typical Case

### Fujian Nanping Shaowu Chemical Park Sewage Pipeline Project

#### Project Status:

The pipeline connects the sewage in the park to the municipal sewage treatment plant, and the sewage is rich in salt ions and acid root ions, which corrode the welds of the steel pipe very fast, bringing serious challenges to the safe and stable operation of the pipeline. The pipe diameter is  $\Phi 426 \times 8\text{mm}$ , total length is 16.6 kilometers, including 1432 welds.

#### Solution:

In order to ensure the long-term stable operation of the pipeline, 3PE anti-corrosion technology is adopted outside the steel pipe body; epoxy resin is chosen as the anti-corrosion coating inside to prevent the erosion of sewage on the inner wall of the steel pipe. The whole pipeline adopts overhead design, 3.5m from the ground, and adopts lead-in pipe technology to optimise the construction process, and precisely installs the internal patching machine in the lead-in pipe, which greatly improves the construction efficiency and construction safety.



### Wushui Group Wuhan City Water Dispatch Pipeline Project

#### Project Status:

The original internal coating of the steel pipe of the project adopts epoxy coal asphalt coating, of which the pipe diameters  $\Phi 529 \times 10\text{mm}$  and  $\Phi 325 \times 8\text{mm}$ , with a total length of 10.3 kilometres, contain 879 welds. As no internal patch area is reserved at the pipe opening, the coating is prone to high-temperature carbonisation after welding, which has a serious impact on the protective effect of the inner wall of the steel pipe.

#### Solution:

In response to the problem of high temperature carbonisation of the coating after welding, a grinding robot is used to thoroughly treat the carbonised coating produced after welding, ensuring that the surface of the inner patch of the steel pipe reaches ST3 level standards, thus meeting the coating requirements. This effectively solves the problem of coating carbonisation and ensures the long-term protective effect of the inner wall of the steel pipe.



## Typical Case

### China Railway First Bureau Fujian Pingtan Round Island Comprehensive Pipe Corridor Project

#### Project Status:

The project consists of drinking water pipelines, central water pipelines and sewage pipelines. Among them, the sewage pipeline is made of PE material, while the drinking water pipeline and the water pipeline are made of steel pipe. The project involves a variety of pipe diameters, including  $\Phi 1220 \times 22\text{mm}$ ,  $\Phi 914 \times 14\text{mm}$ ,  $\Phi 820 \times 12\text{mm}$ ,  $\Phi 630 \times 10\text{mm}$ ,  $\Phi 426 \times 8\text{mm}$ ,  $\Phi 325 \times 6\text{mm}$ , with a total length of 28.6 kilometres and 7017 welds, which is a huge amount of work with high technical requirements.

#### Solution:

In view of the project characteristics, Deep Blue introduced the process of internal patching of pipe ring welds to ensure the sealing and reliability of the pipe after welding. For different pipe diameters, we have formulated detailed construction programmes and quality control measures to ensure that every section of pipe and every weld meets the design requirements and quality standards.



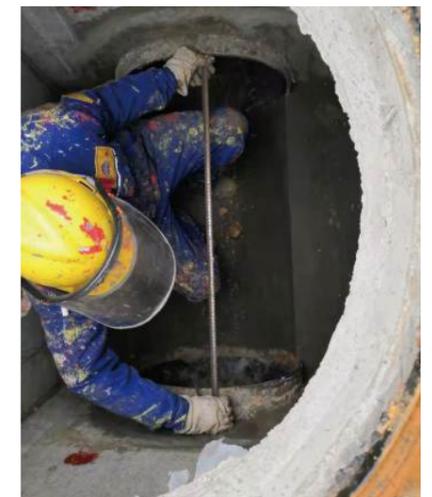
### Wanhua Chemical Group Rainwater Collection Pipeline Project

#### Project Status:

This project contains steel pipes of different diameters, with specification pipe diameters of  $\Phi 630 \times 10\text{mm}$ ,  $\Phi 529 \times 10\text{mm}$ ,  $\Phi 426 \times 8\text{mm}$ ,  $\Phi 325 \times 6\text{mm}$ , with a total length of 4.26 kilometres, containing 712 welds. Currently, the steel pipe has been installed in the ground, with only the ground-level patio reserved as an internal filler access. This particular installation method and working conditions have brought serious challenges to the subsequent patching operations.

#### Solution:

In view of the actual working conditions in the project, Deep Blue has developed the internal patching grinding and descaling machine with independent structure. With a length of 850mm, the machine is able to flexibly enter and exit the reserved ground patio, solving the problem of patching operation caused by the buried installation of steel pipes and guaranteeing the smooth progress of the project.



## Typical Case

### Shanxi Water Investment Group Yellow River Diversion Irrigation Project

#### Project Status:

Shanxi Water Investment Group has raised the demand for corrosion-proofing of the internal filler for the first time in the previous projects, highlighting the importance and specificity of the project. The project aims to introduce the Yellow River water into the reservoir and distribute it to the canals to ensure stable irrigation for agricultural production. The main pipe diameter specifications include  $\Phi 630 \times 10 \text{mm}$ ,  $\Phi 529 \times 10 \text{mm}$ ,  $\Phi 478 \times 8 \text{mm}$ , with a total length of 29.2 kilometres, containing 2,892 welds.

#### Solution:

In response to the need for corrosion protection for patching within the project, we will adopt advanced anti-corrosion technologies and materials, efficient construction methods and strict quality control for the 29.2km-long pipeline and 2,892 welds to ensure the stability and durability of the pipeline over a long period of time in operation.



### Xinjiang Production and Construction Corps Water Supply Pipeline Project

#### Project Status:

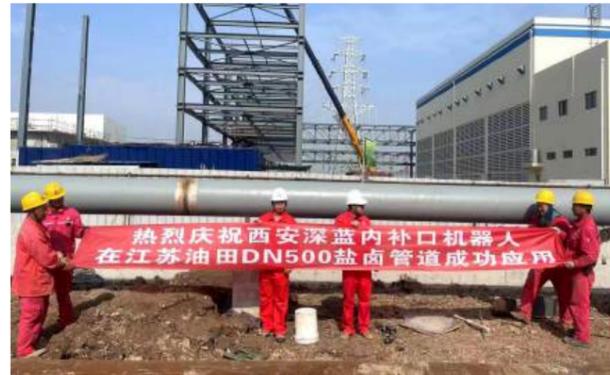
The pipeline is 46.1 kilometres long from Krakash River Valley to 224 Mission Reservoir in Kunyu City, containing 3921 welds, with a pipe diameter of  $\Phi 630 \times 10 \text{mm}$ . The project is supplied with steel pipes by Xinjiang Pilot Pipe Industry, and installed and implemented by Jiangsu Chenghe Pipeline Technology Co.

#### Solution:

Anti-corrosion treatment is implemented inside the pipeline, and drinking water silo grade epoxy resin coating is used as the original coating of the steel pipe to ensure the purity and non-pollution of the conveyed water quality. The internal patching port is polished and descaled to St3 cleanliness by wire brush, coated with two-component white epoxy resin, reserving 8-10cm of unprotected area to ensure that the connection operation is not affected by the coating. Each orifice is clearly numbered, providing great convenience for subsequent maintenance, management and traceability.



# Typical Case



In close cooperation with numerous industry leaders,  
We have received widespread praise from the industry, and looking forward to the future,  
We will adhere to our original intention of serving,  
Join hands with more partners to create a better future.



中国石油大庆油田



中国石油西南油气田



中国石油长庆油田



中国石化西南石油局



中国石化西北石油局



中国石化东北石油局



中国中铁一局



中国中铁五局



中国中铁隧道局集团



中国飞行试验研究院



武水集团



山西水务集团



万华化学



滇中引水



香港水务署



深圳市政设计研究院



新疆兵团勘测设计院集团



新疆领航管业



新疆生产建设兵团