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Pipeline detection of alternating current materials

东方智慧 全球分享

Oriental wisdom , Global sharing

Contents

In-line inspection technology

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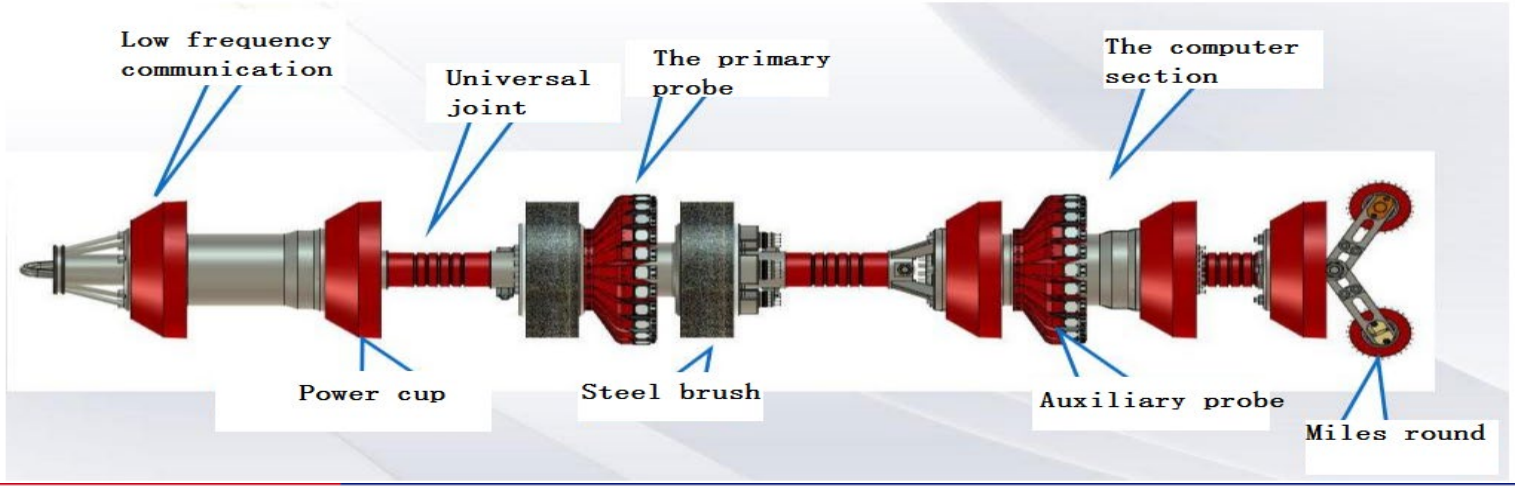
The detector takes pipeline transport medium as the driving force and carries out online non-destructive testing on the pipeline, which is currently recognized as an effective pipeline testing method at home and abroad.In order to implement these services and obtain the detection accuracy required by customers, different technologies are used in these detectors.Such as:

- Odometer wheel/distance measurement system
- Magnetic flux leakage
- Electromagnetic ultrasound (EMAT)
- Magnetic memory



In-line inspection technology

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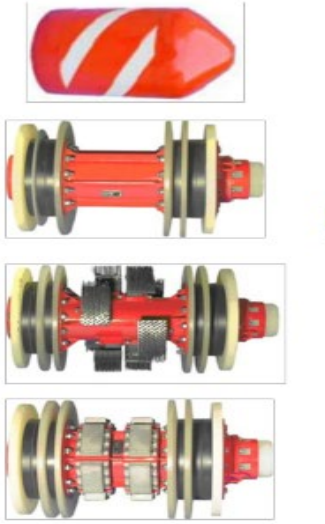
Pigging service

Engine foam cleaning

Roller cup/plate cleaning

Steel brush pigging

Magnetic resonance pigging



Caliper pigging

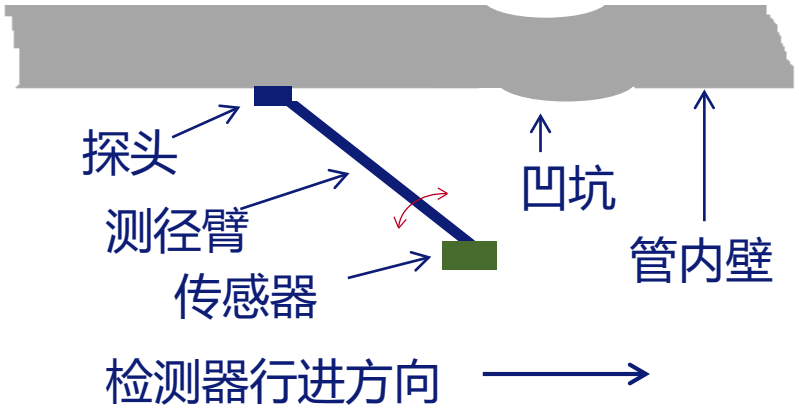
Geometric detector

Magnetic leakage detector

Geometric deformation detection

High density geometric survey arm arrays are used to achieve very high radial sensitivity and accurately detect and quantify geometric features such as pits, elliptic deformation and wall thickness changes.

- ✓ Pipe length
- ✓ Bend radius of curvature
- ✓ Pipe diameter change
- ✓ sag
- ✓ ovality
- ✓ Bend Angle
- ✓ tee
- ✓ branch
- ✓ The valve
- ✓ Girth weld

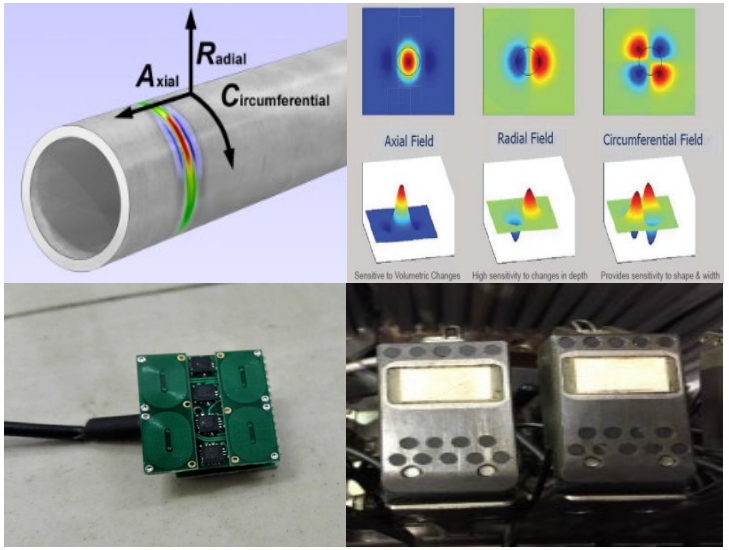


Main technical indexes of geometric test

Technical indicators	precision
Characteristics of the positioning	参考环焊缝到标识点距离：±0.1%
	Refer to the distance between the girth weld and the mark：±0.1m
	Circumferential positioning accuracy：±5°
pit	±1%D（90%Degree of confidence）
ovality	±1.5%D（90%Degree of confidence）
The bend radius	0.2D
Bend Angle	±5°
The maximum amount of pipe deformation that can pass through	25% to 30% D

Three-axis hd magnetic leakage detection

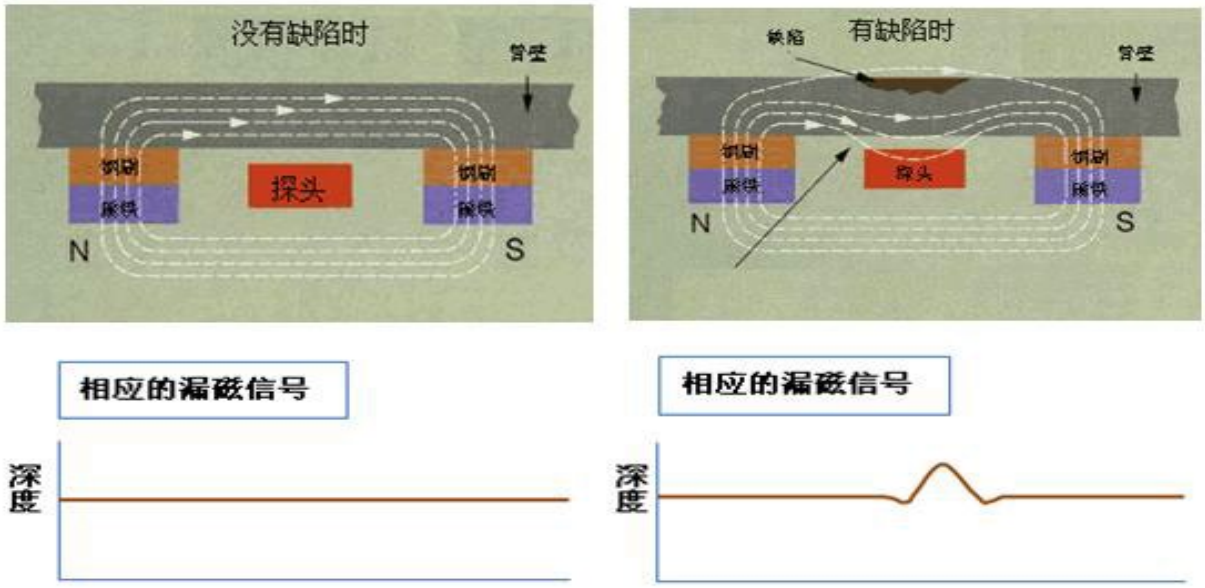
Hall sensor magnetic flux leakage detection module with axial, radial and annular distribution.The comprehensive three-dimensional magnetic flux leakage vector image can assist the deep feature detection, recognition and size quantization in the process of data analysis.



- ✓ Loss of metal due to corrosion
- ✓ Metal welded or adjacent to the wall of a pipe
- ✓ weld
- ✓ Weld abnormal
- ✓ Manufacturing process defect
- ✓ Damage during construction
- ✓ Changes in pipe wall thickness
- ✓ Various pipe fittings, including tee, branch, valve, elbow, support, etc

Magnetic flux leakage testing principle

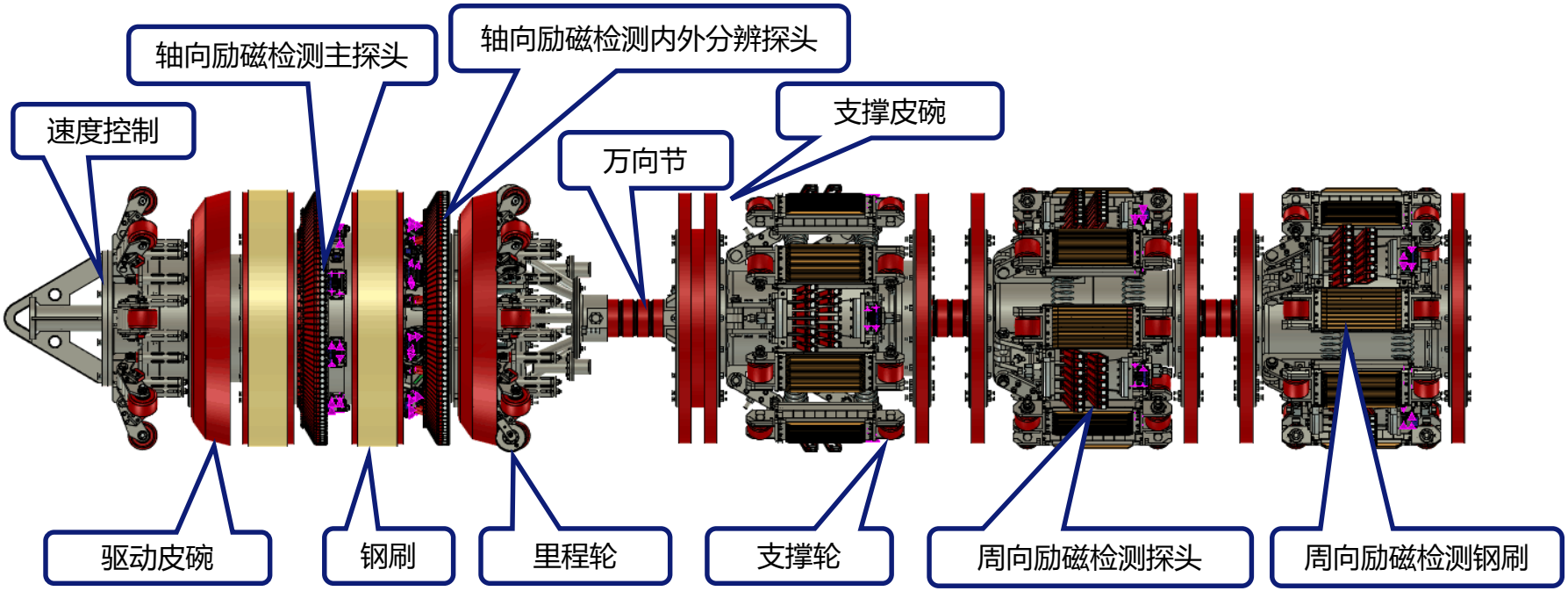
A closed magnetic circuit is formed between the permanent magnet and the pipeline under test, and the magnetic saturation is achieved.When there is a defect in the pipeline under test, the magnetic field changes and the defect signal is detected by the magnetic sensor.



Technical specifications of three-axis hd magnetic flux leakage equipment (POI)

Characteristics of the category	Reliability of test results
Internal/external defect differentiation	POI >90%
Metal loss characteristics	POI >90%
Corrosion/corrosion group	POI >90%
pinhole	POI >50%
Grooves, scratches	POI >50%
pit	POI >90%
A pit with metal losses	POI >50%
Eccentric sleeve	POI >90%
Repair bushing and sleeve	POI >90%
Straight pipe	POI >90%
The valve	POI >90%
tee	POI >90%
elbow	POI >90%
Metal or ferromagnetic material adjacent to or in contact with a pipe	POI >90%
Girth weld, straight seam and spiral weld	POI >90%
Girth weld, spiral weld crack/anomaly	POI >50%

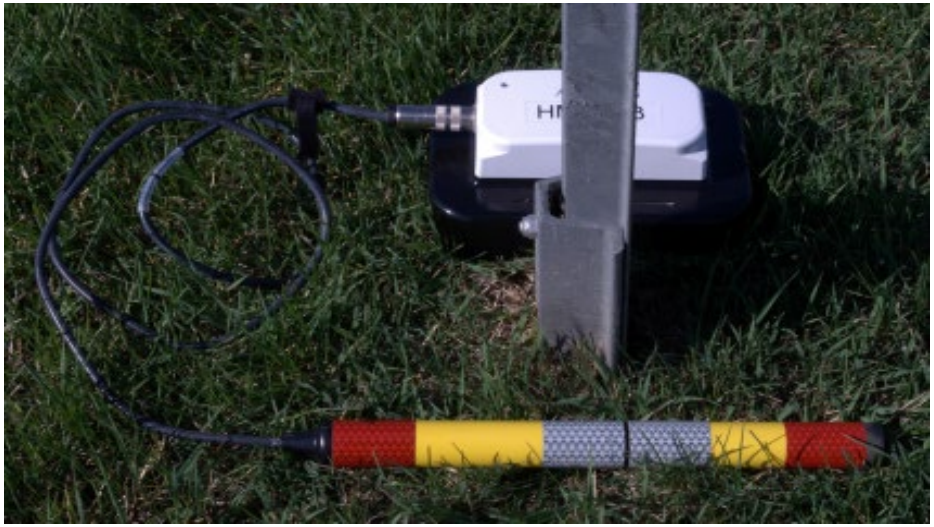
Three-axis omnidirectional field leakage detector (axial field + circumferential field combination)

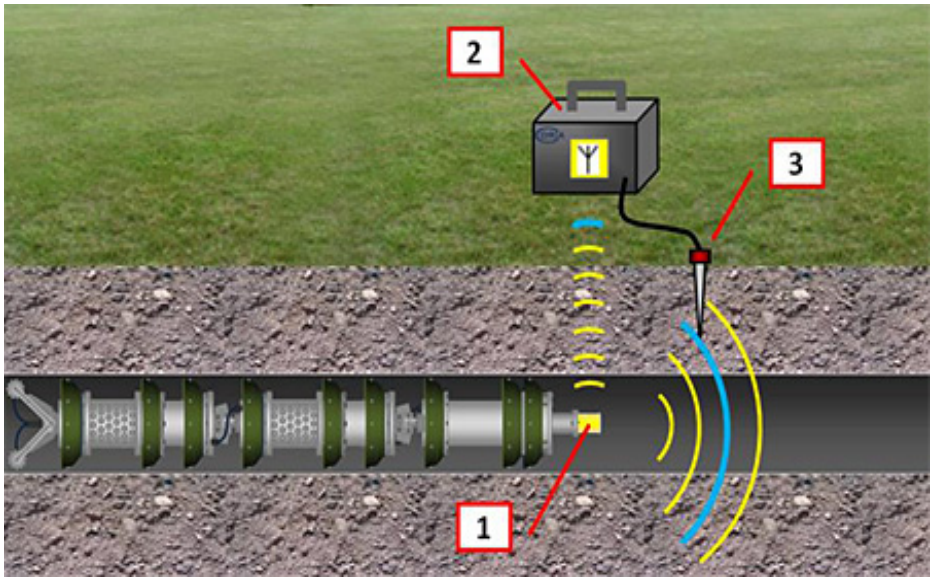


Detector length: 6500mm, number of probe channels up to 8148.
Through the combination of axial excitation and circumferential excitation, the pipeline defect detection in the whole direction can be completed.

Intelligent positioning box

Receives the low frequency transmitter signal and detector magnetic field signal, and automatically records the passage time.Recording data can realize seamless connection between background and internal detection data analysis software, and all of them can be imported into the database.





Pipe mapping

- It can be operated separately or in combination with three - axis hd magnetic flux leakage or geometric interior detection tools.
- The data of three-way gyroscope, three-way accelerometer and odometer are collected and stored in the system memory.
- Combined GPS and odometer signals into a combined measurement method -- GPS signals are used for position correction every 1~2km and real-time speed correction is conducted with odometer data to achieve high-precision position mapping.
- After the pipeline detection, the system downloaded all data to the ground computer. Combined with the GPS position information of the high-precision reference point on the ground, the integrated navigation software was used for data processing to obtain the position parameters of the entire pipeline and the track of the pipeline's center line.

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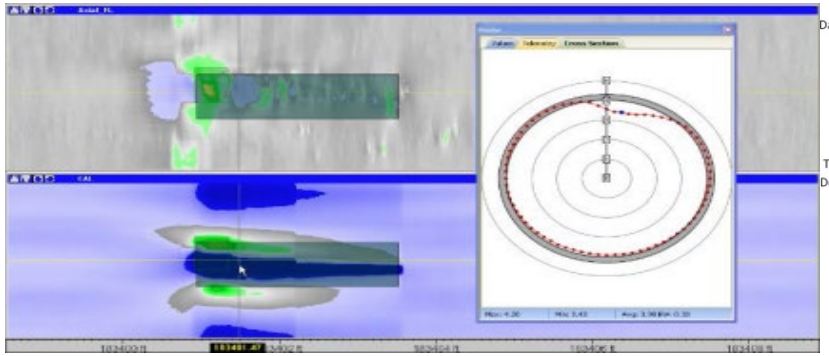
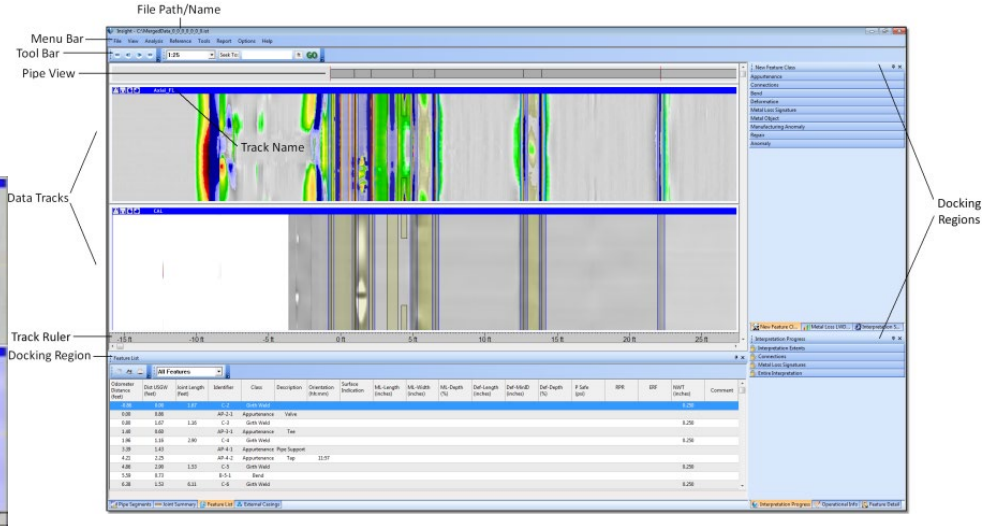
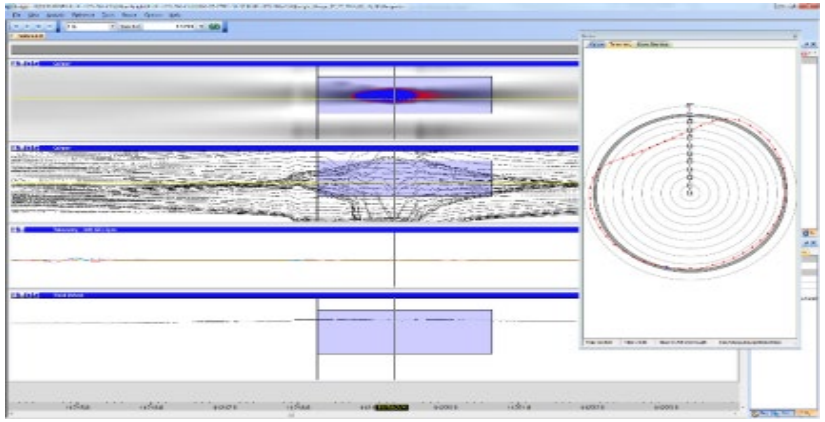
Data analysis and excavation verification

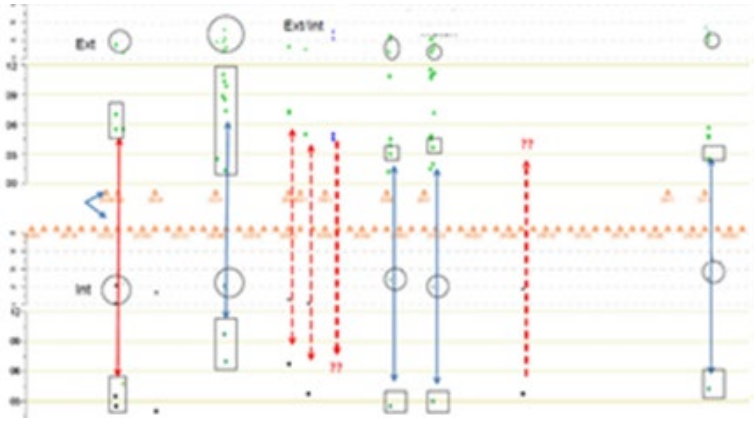






Data comparison within multiple rounds

- Align and align the groove girth seam
- Match analysis of the defect point to point
- Contrast of defect detection signals
- Statistical analysis of corrosion activity
- To calculate the corrosion rate



Ability of qualification:

- The qualification of magnetic leakage testing (MFL) issued by the general administration of quality supervision, inspection and quarantine.
- In pieces to hold the state administration of quality supervision, inspection and quarantine issued by the magnetic flux leakage Ⅱ level personnel qualifications.

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In-line inspection technology

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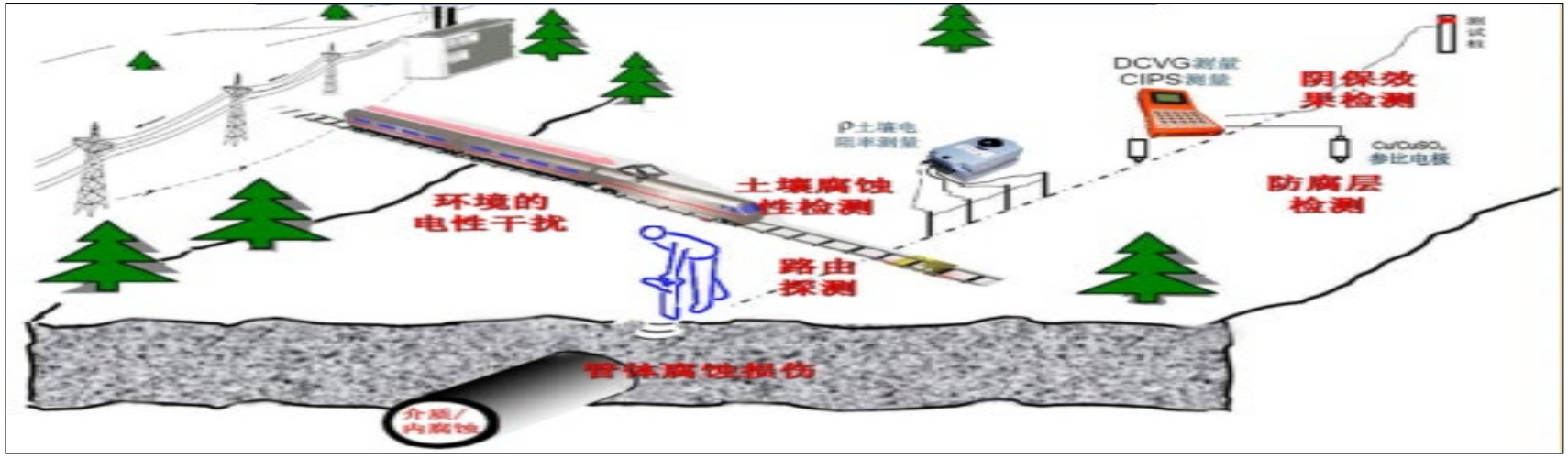
- The facilities such as oil and gas gathering and transportation station, storage and transportation station, pressurization station, cathodic protection station and pipeline, etc., exist environmental, material, stress and other factors in the process of use, causing gradual corrosion damage and causing major accidents.
- In order to find corrosion, CIPC interval potential detection technology, DCVC dc level gradient detection technology and stray current detection technology are adopted to effectively find corrosion points and repair them in time.



Testing equipment

PCM+ corrosion tester

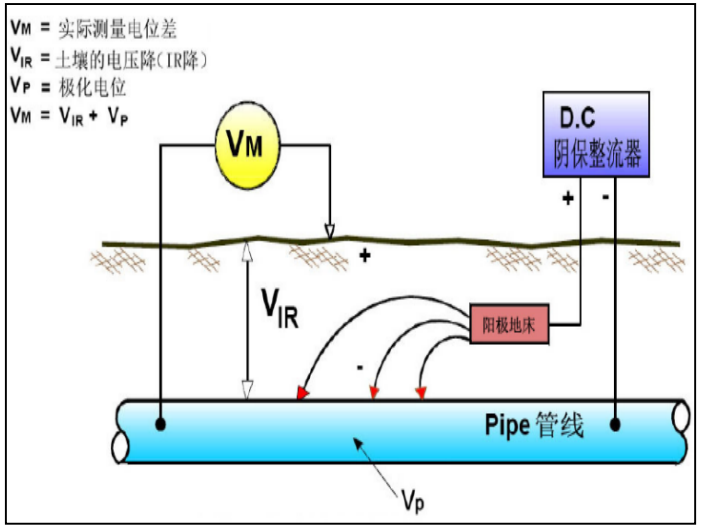
DCVG detector

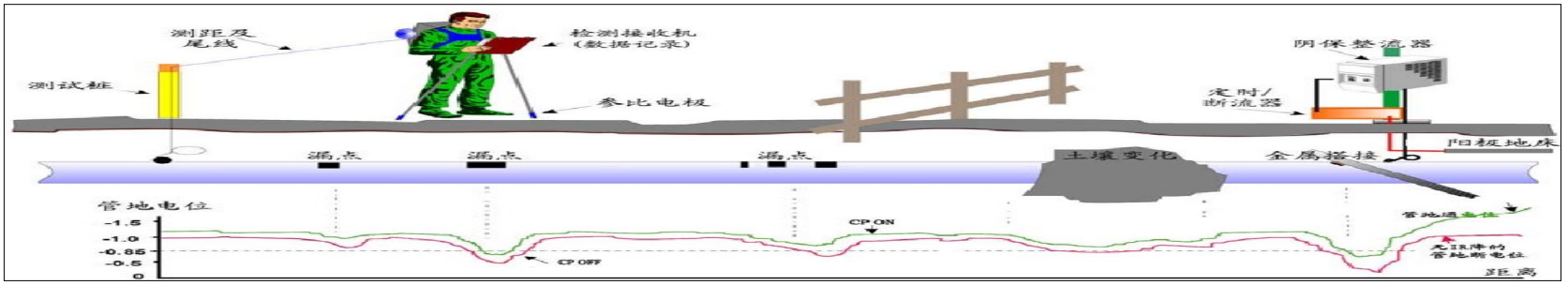
LD-PDM corrosion tester

SCM messy current detector

CIPS interval potential detection technology

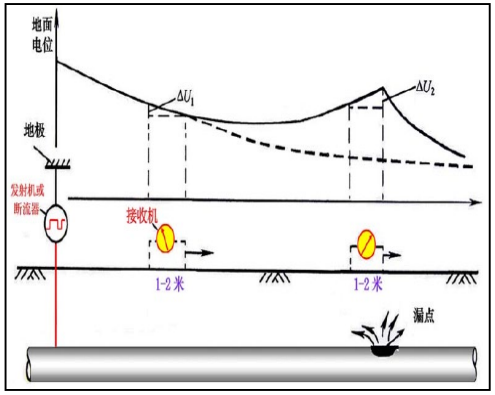
In CIPS close interval pipe-to-soil potential detector, using a long wire connected to the test on the column, and then along the direction of pipeline to very small interval (1.0 ~ 1.5 m) using a dedicated data recorder, plot of continuous on/off pipe-to-soil potential, so that you can test the electric potential and potential power, to determine the effectiveness of the cathodic protection effect, and can indirectly find out the defect location, size, reflect the status of the coating, can be measured along the pipeline, pipeline cathodic protection system and DCVG comprehensive evaluation to find and identify the damaged point on the coating corrosion active points.

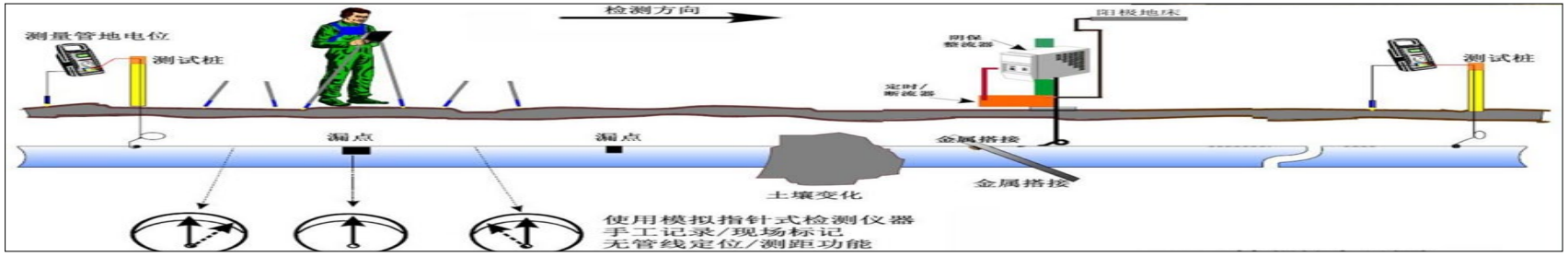




DCVC dc level gradient detection technology

The DCVG detection technique is actually a highly sensitive millivoltmeter that measures the output of two Cu/CuSO4 electrodes (rods) inserted into the surface at the level of potential gradient equilibrium at the surface.When the current is loaded onto the pipeline, the ground electric field distribution is set up on the ground above the pipeline corresponding to the potential gradient formed by the pipeline anti-corrosion layer damage and soil.The closer it is to the point of failure, the greater the potential gradient, the greater the current density on the ground above the pipeline, and the greater the bare area, the greater the current density near it, the greater the potential gradient on the ground.

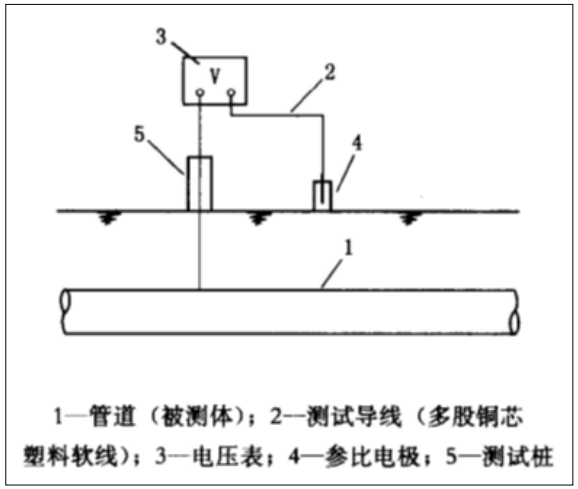




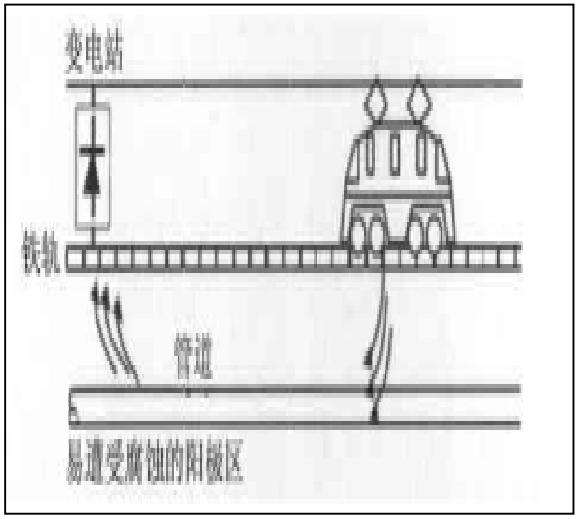
Stray current detection technology

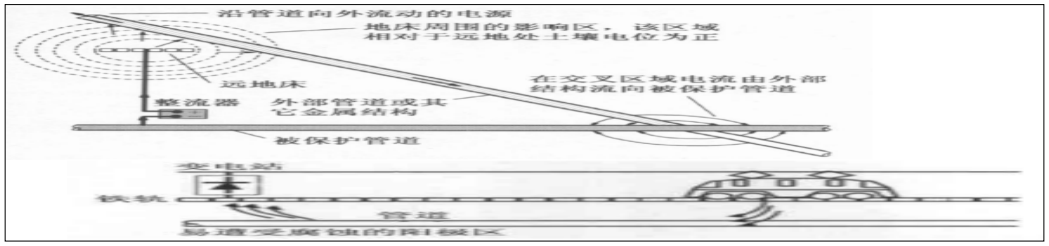
The corrosion caused by stray current is called stray current corrosion, which is essentially the electrolysis of electrochemical corrosion.Stray current is divided into dc stray current (direct current transportation system, other pipeline negative protection system, disturbance of geomagnetic field) and ac stray current (high-voltage transmission line, ac electrified railway power supply line, landmine current).

Spurious current detection technology determines the direction and size of the interference current by continuously measuring the potential difference, and determines the position of the interference current invasion point, the direction of current flow and the position of the interference current leaving the target pipeline from the discharge point, so as to achieve the purpose of detecting the corrosion point.



1—管道（被测体）；2—测试导线（多股铜芯塑料软线）；3—电压表；4—参比电极；5—测试桩





Metal magnetic memory testing

In the geomagnetic environment, ferromagnetic materials are subject to periodic loading, and the magnetic permeability at the defect decreases, and the leakage magnetic field on the surface of the workpiece at the defect increases. After unloading the load, the workpiece still retains these characteristics. The leakage magnetic field "remembers" the defect or stress concentration of the ferromagnetic components, which is known as the "magnetic memory" effect.Based on the basic principle of metal magnetic memory effect, the testing instrument can be used to evaluate the stress concentration degree of components and whether there are microdefects by recording the distribution of magnetic field intensity component perpendicular to the surface of metal components in a certain direction.

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Leakage detection technology -- intelligent ball

A new technology of leakage acoustic detection system which can move freely, the core component is a spherical core made of aluminum alloy, which is equipped with acoustic sensor and circuit system

When the pressure medium passes through the leakage point of the pipeline, the acoustic signal will be generated at the leakage point and transmitted along the pipeline medium

The leakage detector determines whether there is a leakage point in the pipeline by collecting and analyzing all abnormal acoustic signals in the pipeline through a highly sensitive sensor. The stronger the noise signal is at the leakage point under high pressure

The detector is equipped with an audio transmitter, which releases high frequency signals. SBR is used to track the detector's track and position, record acoustic signals and their related positions in real time. Meanwhile, an electromagnetic transmitter with a frequency of 22Hz is installed, enabling the ground marker box (AGM) to track the detector position in real time

The leakage detector is designed to be spherical, which can reduce the noise of the pipeline and the detector when rolling along the pipeline. The foam or polyurethane enclosure can also reduce the noise that the intelligent ball may produce in the pipeline, making the sensor highly sensitive and free from external interference

Leakage detection and monitoring techniques

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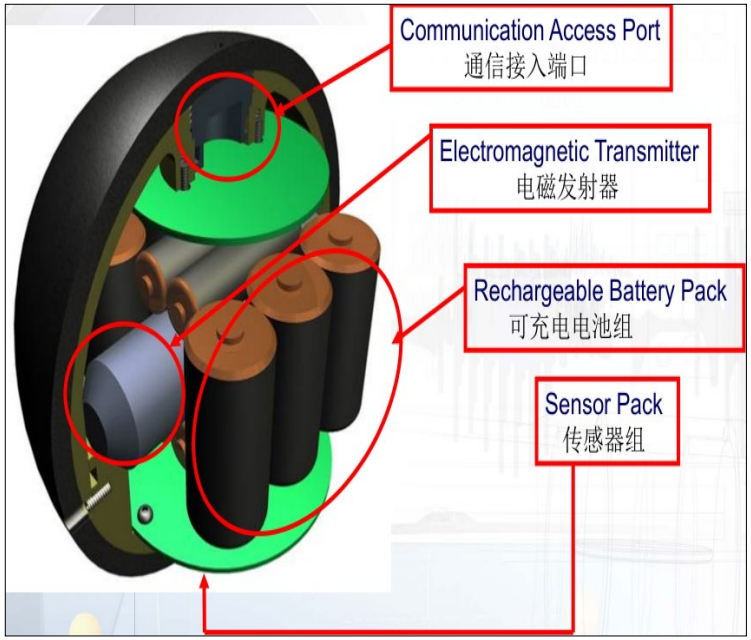
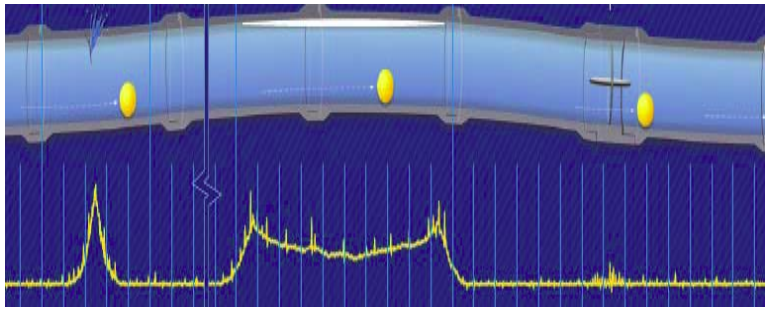




Fiber optic leakage monitoring technology

Distributed optical fiber vibration sensing early warning system (DVS)

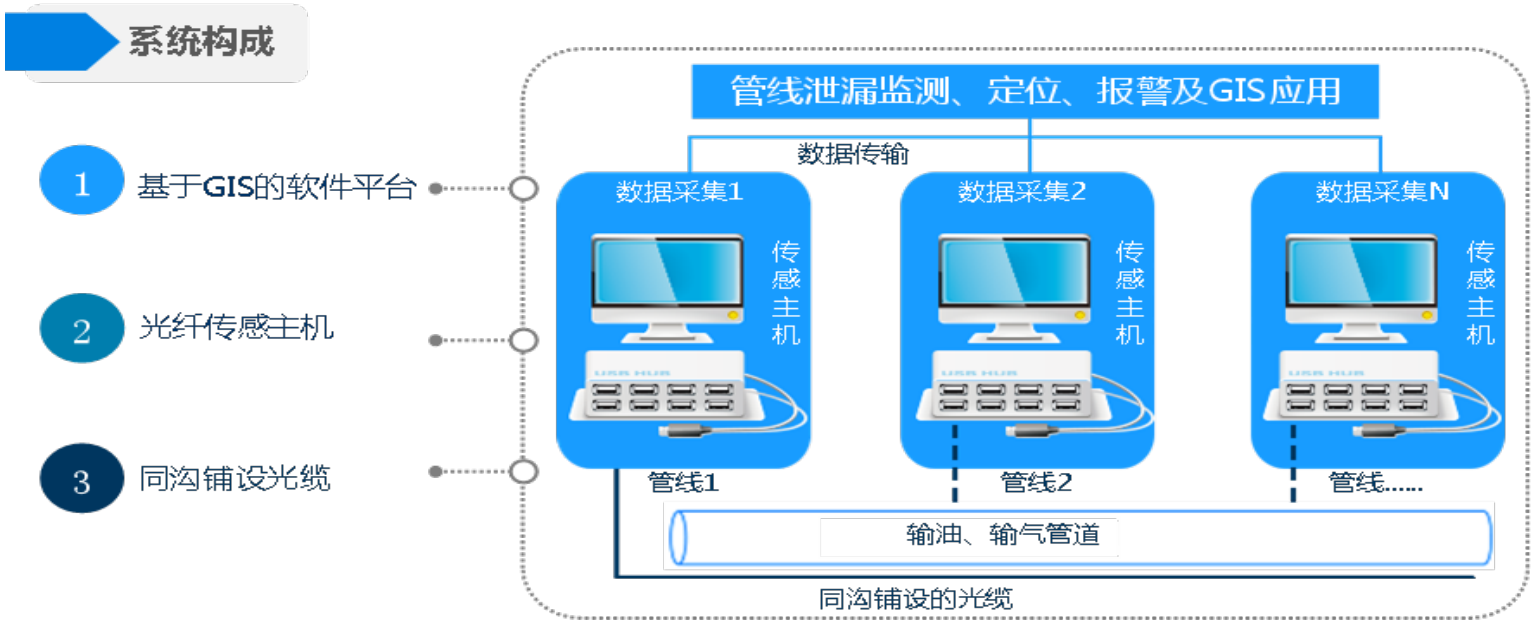
Unauthorized and unsupervised third-party intrusions such as construction, theft and sabotage are the main causes of accidents such as oil and gas pipeline leakage.

It can realize real-time detection, advance warning and positioning of the whole pipeline vibration, so as to realize the early intervention of pipeline intrusion and timely disposal, avoid the expansion of the situation, effectively improve the safety and prevention ability, and avoid and reduce the occurrence of accidents.

It can realize the identification of different vibration sources such as excavator digging, card-stealing oil, manual digging and vehicle passing.

Distributed optical fiber temperature sensing leakage monitoring system (DTS)

According to the temperature change along the pipeline, determine whether leakage occurs in the pipeline and locate the leakage point.To solve the problem of oil and gas mixing and gas pipeline leakage detection.



Leakage detection and monitoring techniques

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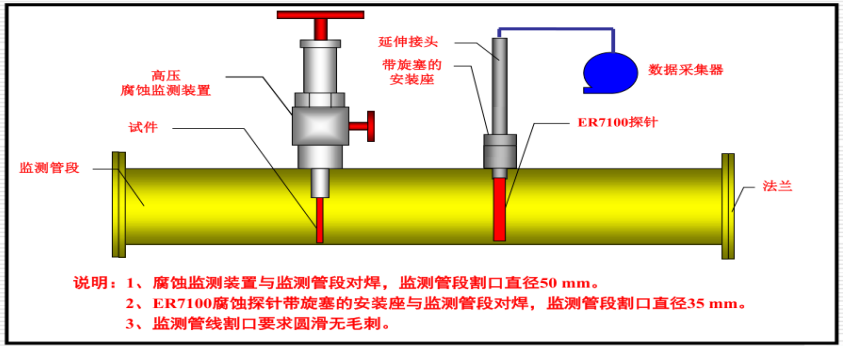
Corrosion monitoring technique Is an indirect monitoring equipment corrosion resistance probe an effective method, the principle of which is based on the metal specimen by corrosion effect and reduce the cross sectional area, resulting in specimen, the characteristics of the resistance increase by measuring the change of the specimen in the process of corrosion resistance to calculate the amount of corrosion and corrosion rate of the specimens of a kind of monitoring method.Compared with weightlessness method, this method has the advantages of precision and external data transmission, and is free from the influence of temperature change and the interference of corrosion products.



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Suitable for use evaluation

"Suitable for use" and "complete structure" in concept structure may be building shape, material performance under the premise of deviation and defect, through the stress analysis, fracture mechanics, material testing, quality inspection, nondestructive testing, such as scientific analysis, undertake not to occur any known structure in service mechanisms such as brittle failure, fatigue failure and stress corrosion failure accidents.

According to the standard "regular inspection rules for pressure pipelines - long distance transportation (oil and gas) pipelines" (TSG d7003-2010), after the completion of the comprehensive inspection, the joint usage evaluation will be conducted to determine the allowable pipeline parameters and the date of the next comprehensive inspection.Suitable for the use of evaluation content includes the length () of oil and gas pipeline for using evaluation conclusion report, the data review report, and the stress checking report, the residual strength assessment report, the overweight defect safety assessment report, the residual life forecast report, the material suitability evaluation report, the risk assessment report again.

Qualification & capability:

- The qualification of magnetic leakage testing (MFL) issued by the general administration of quality supervision, inspection and quarantine.
- Hold the quality of pipeline inspection teachers issued by the general administration of quality supervision, inspection and quarantine.

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Integrity management techniques

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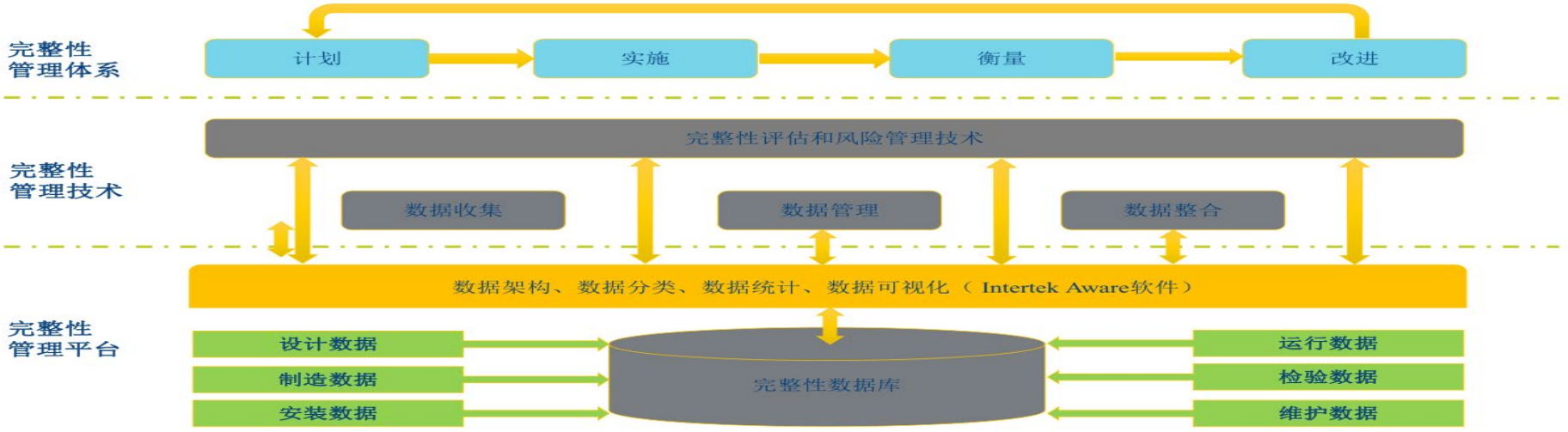
Pipeline integrity management is defined as: the company in the face of the changing factors, the risk factors related to the operation of the oil and gas pipelines for identification and evaluation, through monitoring, testing, inspection and so on a variety of ways, combined with professional management for the integrity of the pipeline information, formulate the corresponding risk control measures, continue to improve recognition to the negative impact of the factors, which will run the risk of pipe level control in a reasonable and acceptable range, ultimately achieve continuous improvement, reduce and prevent the pipeline accidents, the purpose of the economic and reasonable to ensure safe operation of the pipeline.

National standard "code for integrity management of oil and gas pipeline - gb32167-1015"



Integrity management techniques

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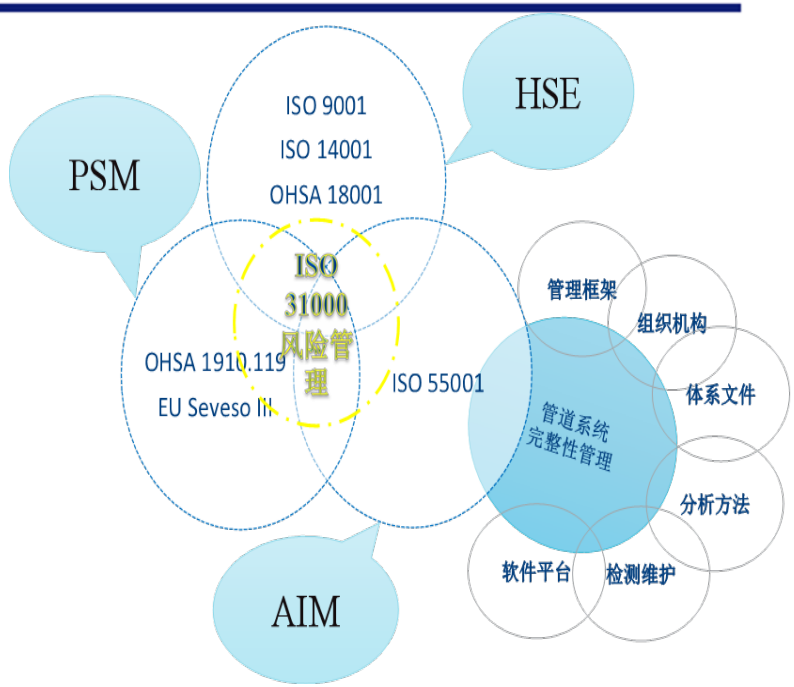
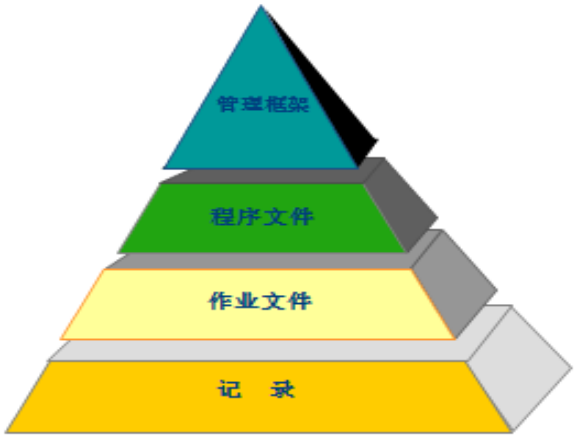
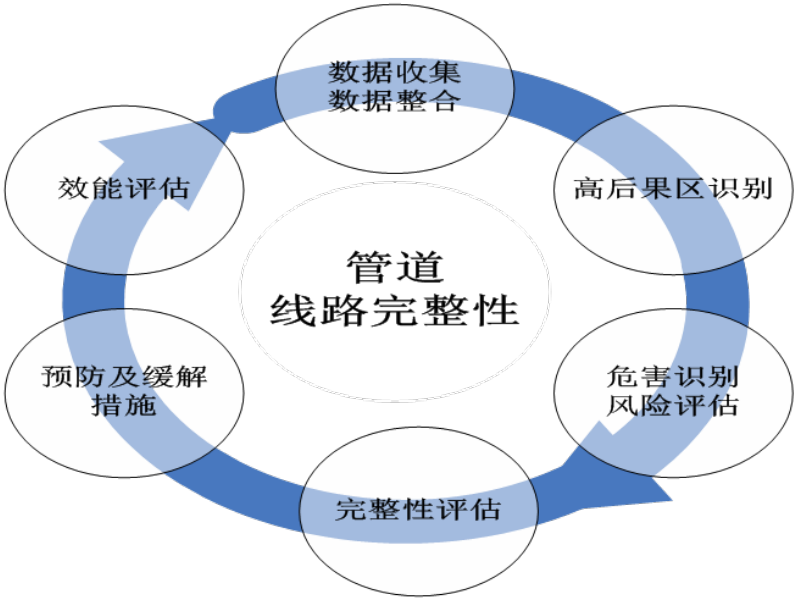
Pipeline integrity system construction

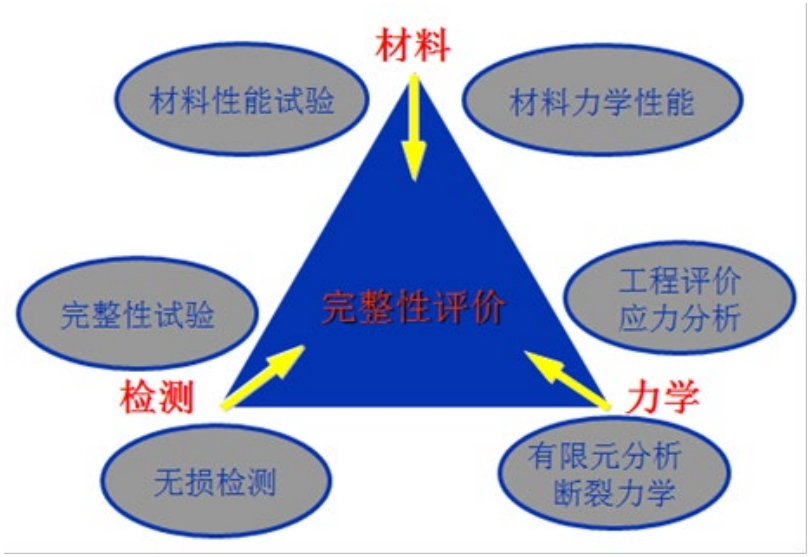
- Check the integrity management system and gap analysis
- Design of integrity management system framework
- File management of integrity procedures
- The enterprise promotion of integrity management system
- The integrity management organization and medium - and long-term planning
- Compile and guide the pilot program of integrity management

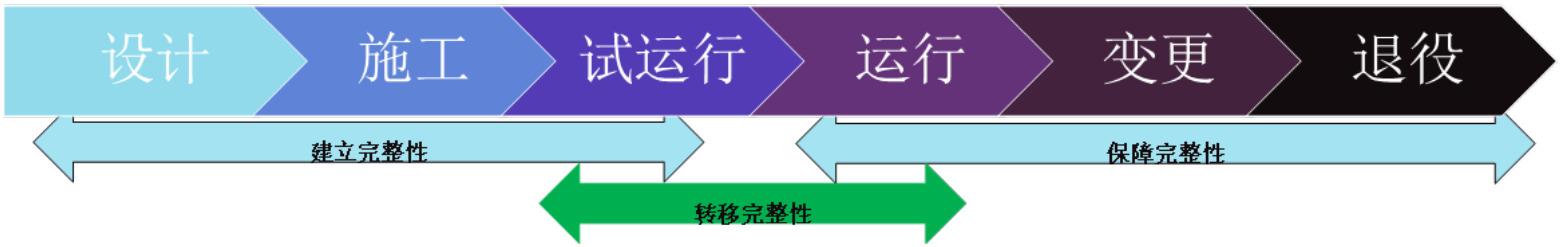




Line integrity management technology







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Site integrity management techniques

Surface pipelines, including receiving and serving devices, small diameter pipelines and auxiliary pipelines

Buried pipeline

The main line portion of the station that is not within the mainline integrity management

Atmospheric tank

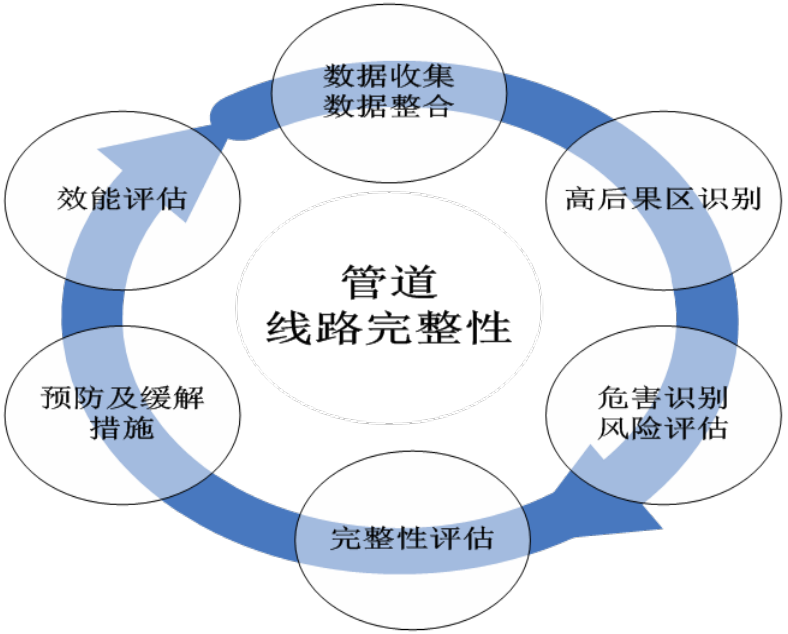
The pressure vessel

Pumps, sewage pumps and compressors

Valve and valve actuator

Flanges and fittings

Safety instrument

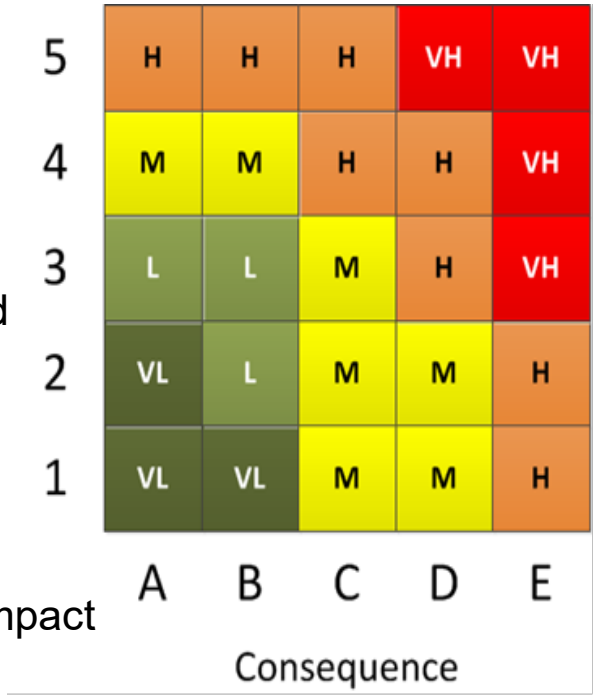


Risk assessment techniques for high-consequence areas

The general method adopted is to determine the overall failure risk (RoF) by comprehensive failure probability (PoF) and failure consequence (CoF) (generally by risk matrix).

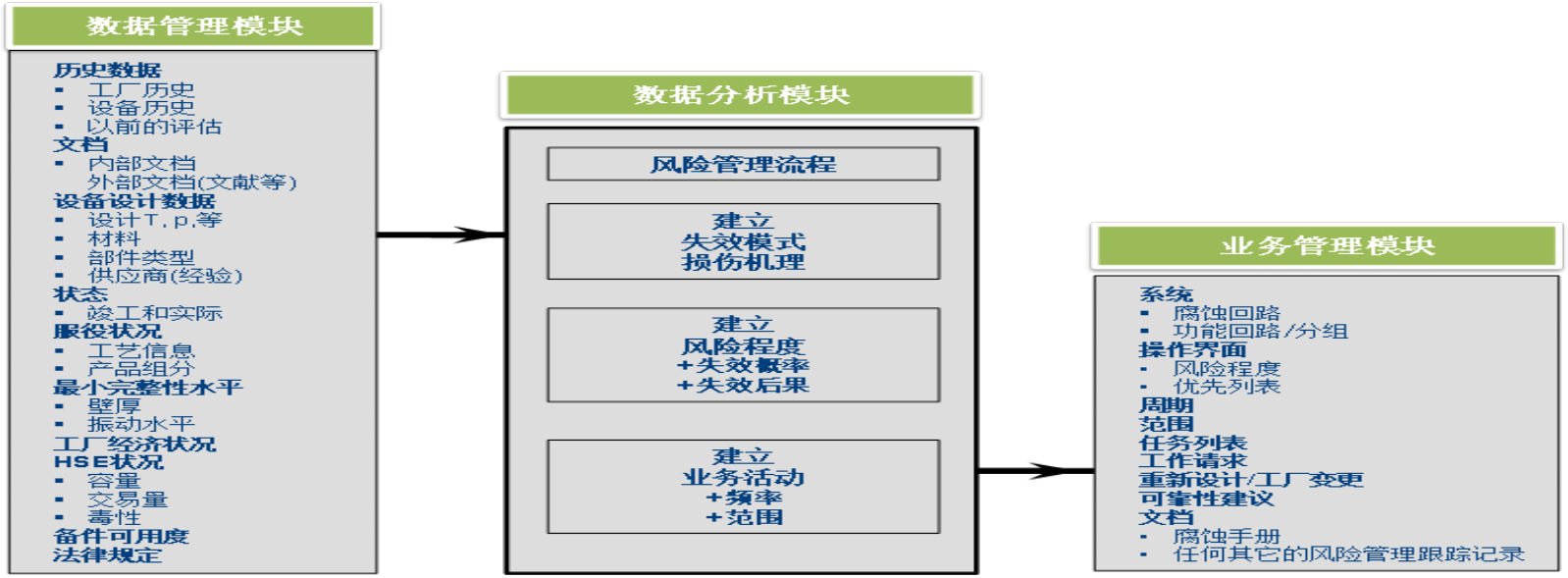
Detailed risk assessment of high-consequence zone segment was considered as a low failure probability but a high failure consequence. There were 3 research categories:

- Gas pipe section in high population density area
- Is a high population density zone
- The oil pipeline section where the river runs through
- The specific method will be adjusted to meet the detailed information of different pipelines, generally including:
- Denotes the damage mechanism
- Denotes the failure probability
- Denotes the consequences of failure
- Identify control measures to prevent failure/reduce the impact of failure



Integrity management platform-aware software

Joint equipment manufacturers, service providers and equipment owner to jointly develop the Aware integrity management software, can be applied to any type of equipment (such as pressure vessel, pipeline and storage tank, such as static equipment, pumps, compressors, motors, valves and other equipment, safety instrument, etc.) and related activities (inspection and maintenance, etc.), allowing the user to against every kind of equipment document, report and retrieve all kinds of inspection and maintenance report.



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