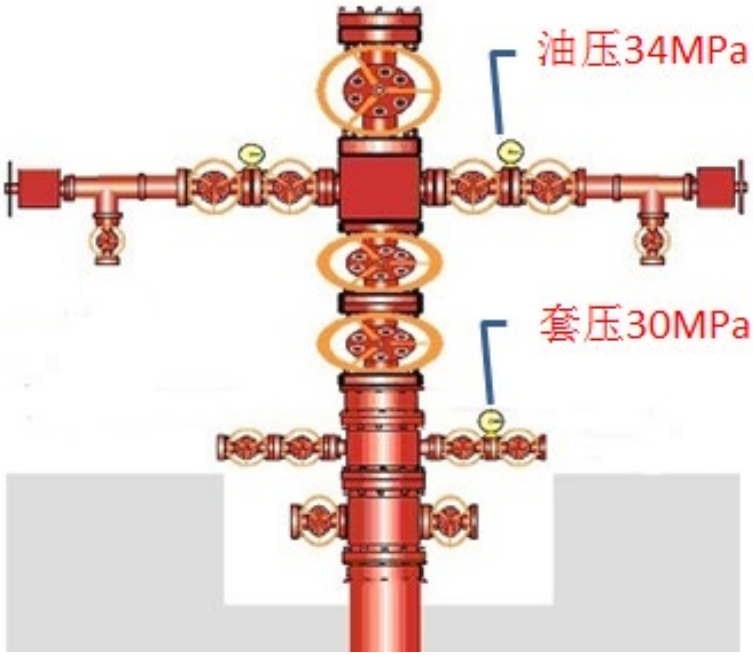
Brief Introduction of Gas Seal Detection Technology

Contents

I. Overview

ANTON 安東

In the process of natural gas production in oil and gas fields, annular channeling pressure in gas wells has always been a difficult problem threatening wellbore safety. The use of gas seal to buckle oil and casing can theoretically eliminate this risk, but the results of field application are not ideal.



Statistics show that the leakage of threaded connection between oil and casing string is the main cause of annulus pressure.

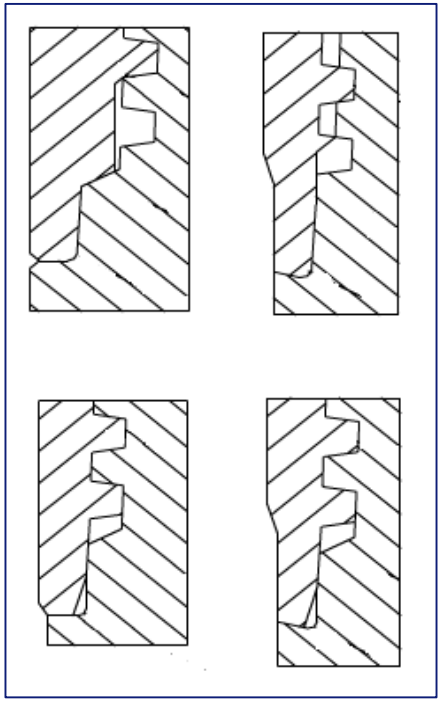
Since 2008, China's oil and gas fields have applied gas seal detection technology, which has fundamentally changed the production situation of wellbore annulus under pressure.

Contents

II. Necessity of Gas Seal Detection

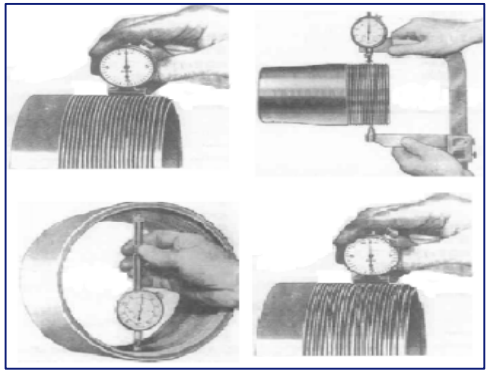
ANTON 安東

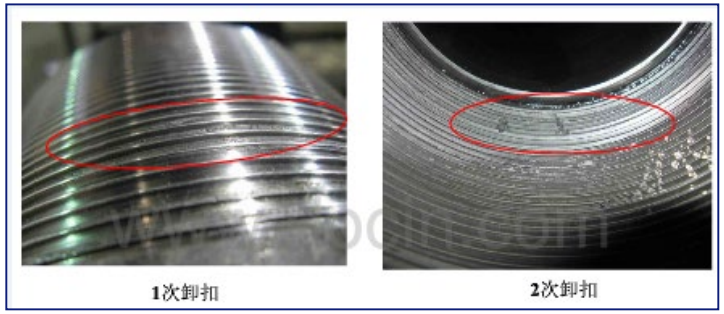
Main Causes of Leakage of Gas Seal Connection of Oil Pipe and Casing



① Limitations of Thread Types

② Machining error



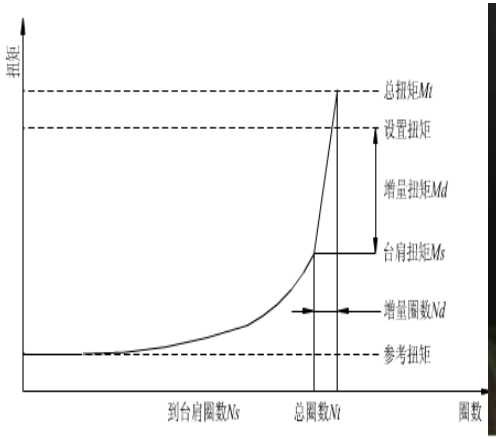


③ Material selection conditions are limited.

II. Necessity of Gas Seal Detection

ANTON 安東

Main Causes of Leakage of Gas Seal Connection of Oil Pipe and Casing



④ Knock before screwing on (transportation, mounting of drilling floor, make-up thread)

⑤ Severe service conditions (cleanning of threads and sealing surfaces, standard makeup torque)

Main Causes of Leakage of Gas Seal Connection of Oil Pipe and Casing

The influencing factors exist randomly and cannot be completely excluded, so the leaking thread will exist randomly. Gas seal detection technology can effectively eliminate leaked threads when oil pipe and casing are put into the well.

Gas seal detection technology becomes the “final judge” before oil pip and casing are put into the well.

Contents

III. Technical Principle of Gas Seal Detection

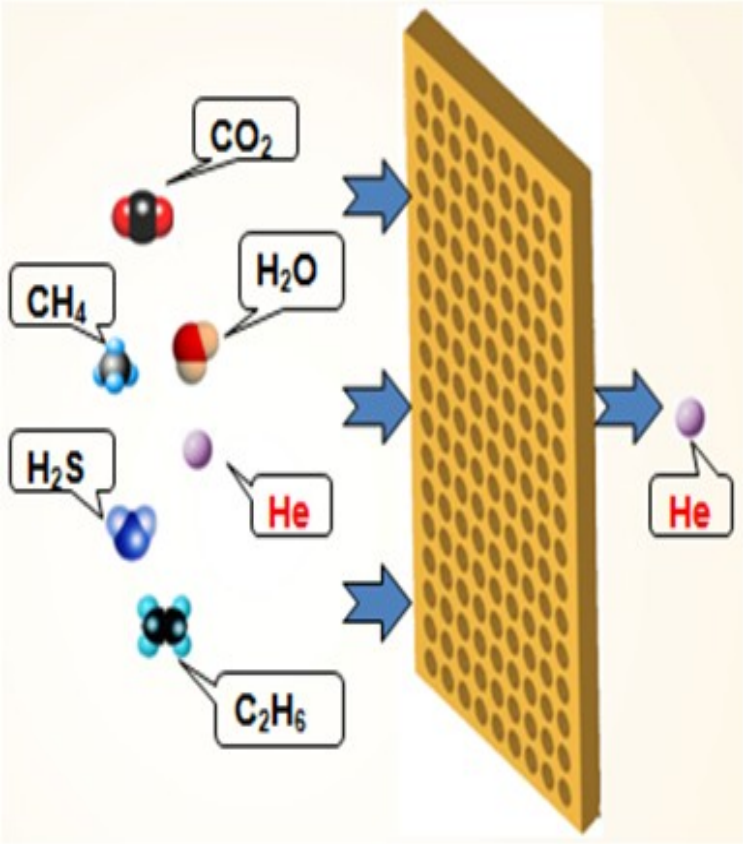
ANTON 安東

1.Principle of Detection Method—Helium Leak Detection Method

① In 1970, helium leak detection technology was first applied to gas tightness test of oil jacket in the world.

② Helium molecule diameter is small, it is easy to permeate along the micro-gap channel, and can predict leakage in time;

③ Helium is an inert gas, which is non-toxic to human beings, harmless and not corrosive to metal pipes, safe and clean.



III. Technical Principle of Gas Seal Detection

ANTON 安東

1. Principle of Detection Method—Helium Leak Detection Method

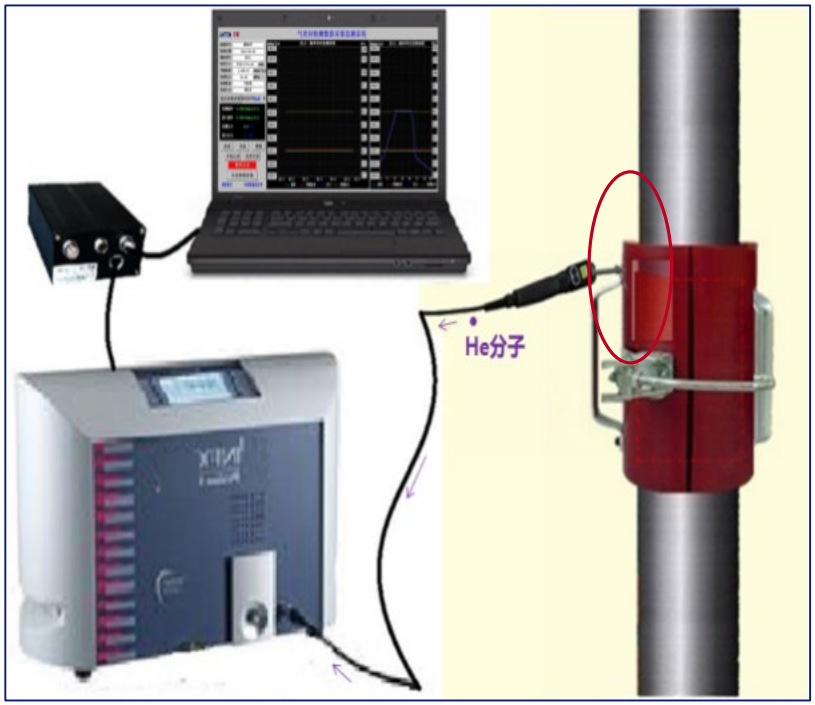
Permeability of different media(78℉(25.5℃)，compared with helium)

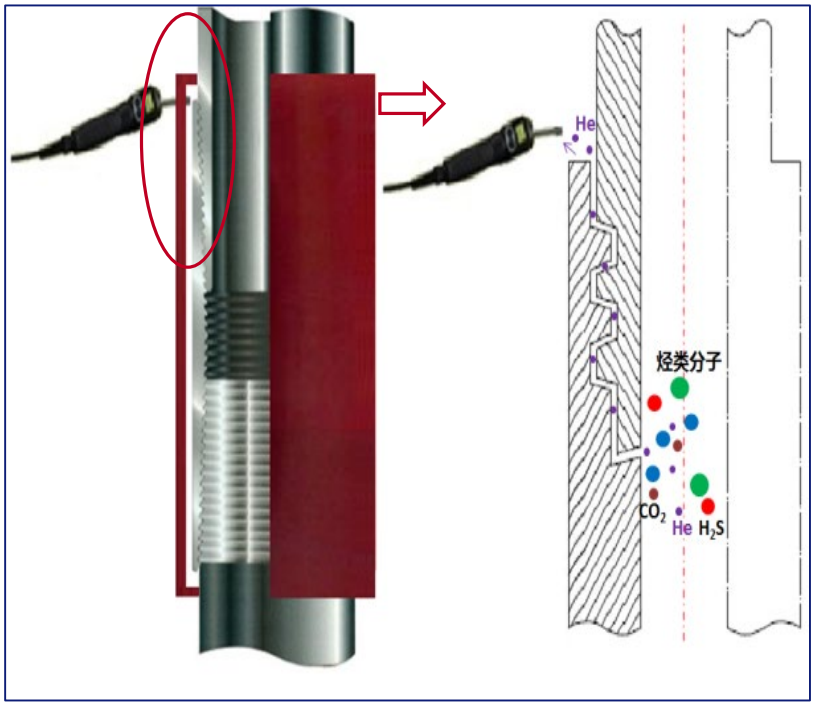
Gas	Hydrogen	Helium	Water Vapor	Neon	Nitrogen	Air	Argon
Molecular Weight	2	4	18	10	28	29	40
Permeability of Molecular Flow	1.41	1	0.47	0.45	0.37	0.37	0.32

Minimum Leakage Rate of Sealing Test Method(bar·mL/s), Quantitative comparison		
Water pressure drop method	1×10^{-2}	315000**bar·mL/Year**
Air pressure drop method	1×10^{-3}	31500**bar·mL/Year**
Soapy Water bubble method	1×10^{-4}	3150**bar·mL/Year**
Gas seal detection method	1×10^{-7}	3.15**bar·mL/Year**

ANTON 安東

2. Principle of Detection Technology



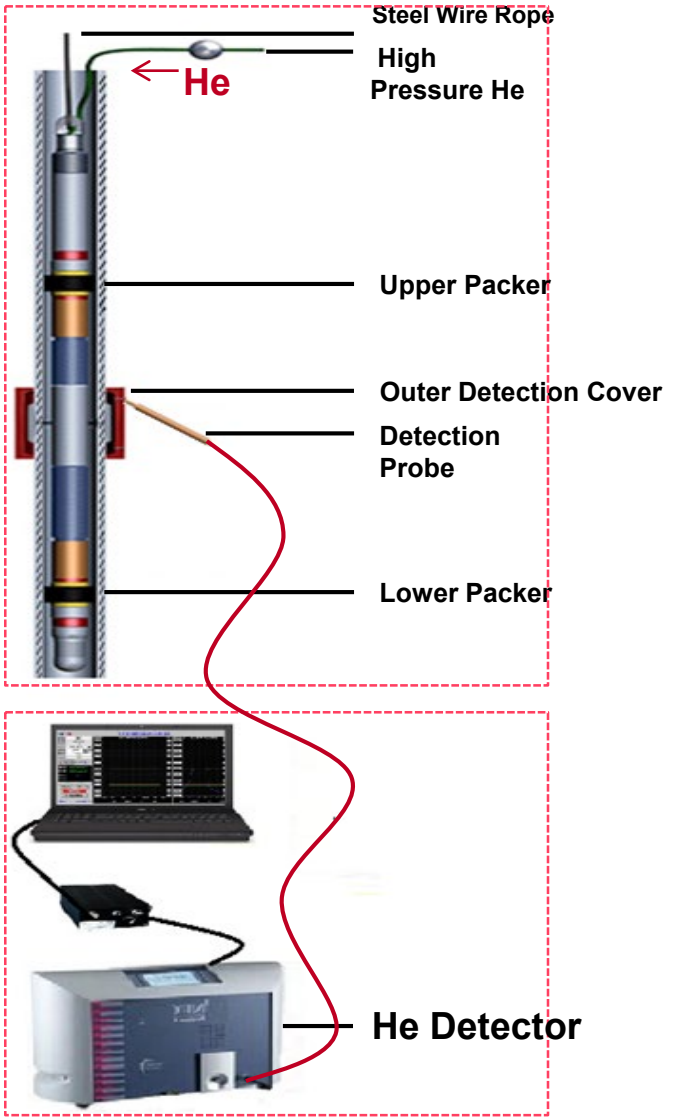


III. Technical Principle of Gas Seal Detection

ANTON 安東

2. Principle of Detection Technology

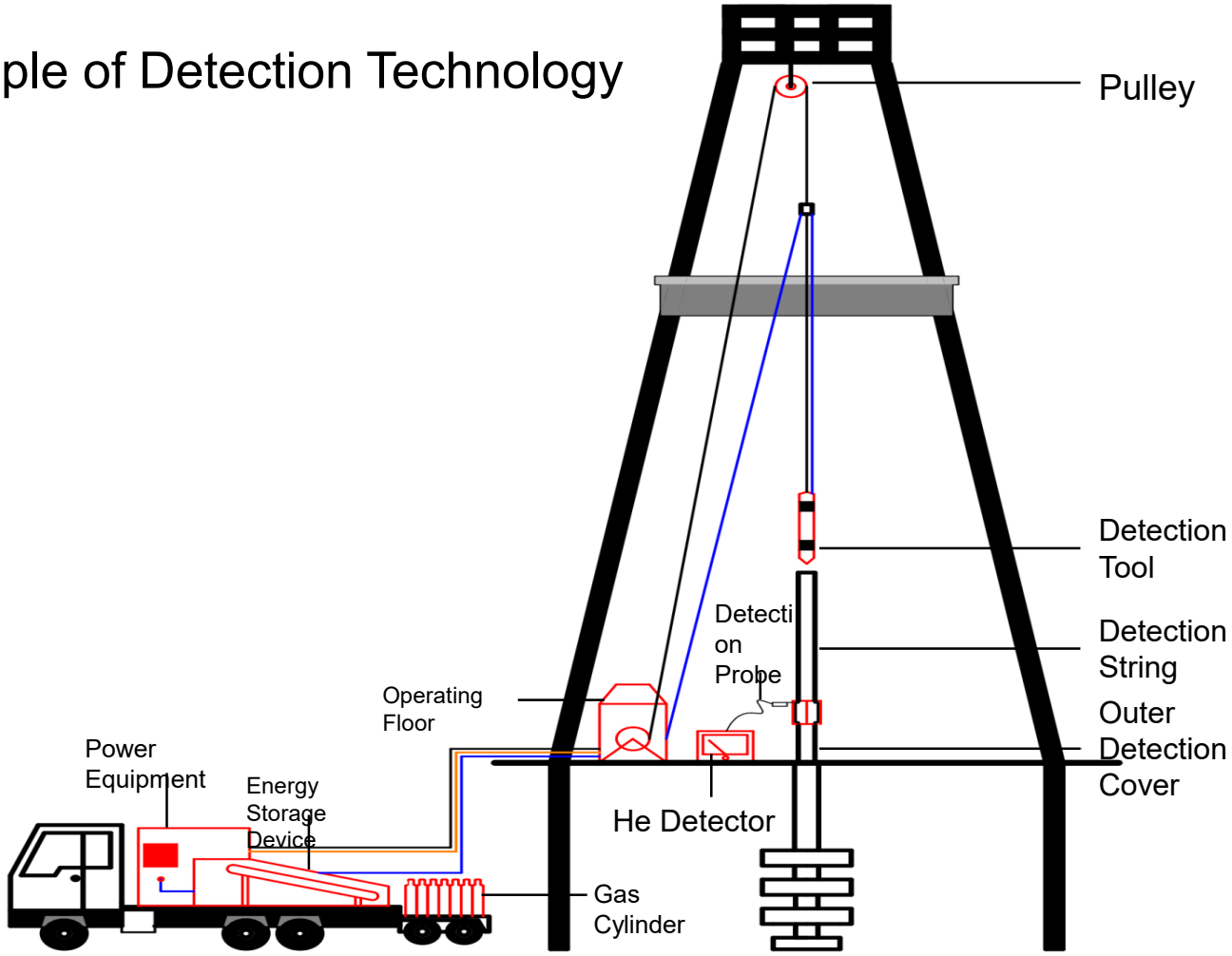
On the operation well platform, after the threaded connection of the two oil pipes or casings is completed, the double seal detection tool is positioned up and down on the threads in the pipe body, and a sealed space is established by setting, high-pressure helium is injected into the sealed space, and a high-sensitivity detector probe is used for detection outside the threads, and the helium leak will cause an alarm, indicating that the thread seal is unqualified.



III. Technical Principle of Gas Seal Detection

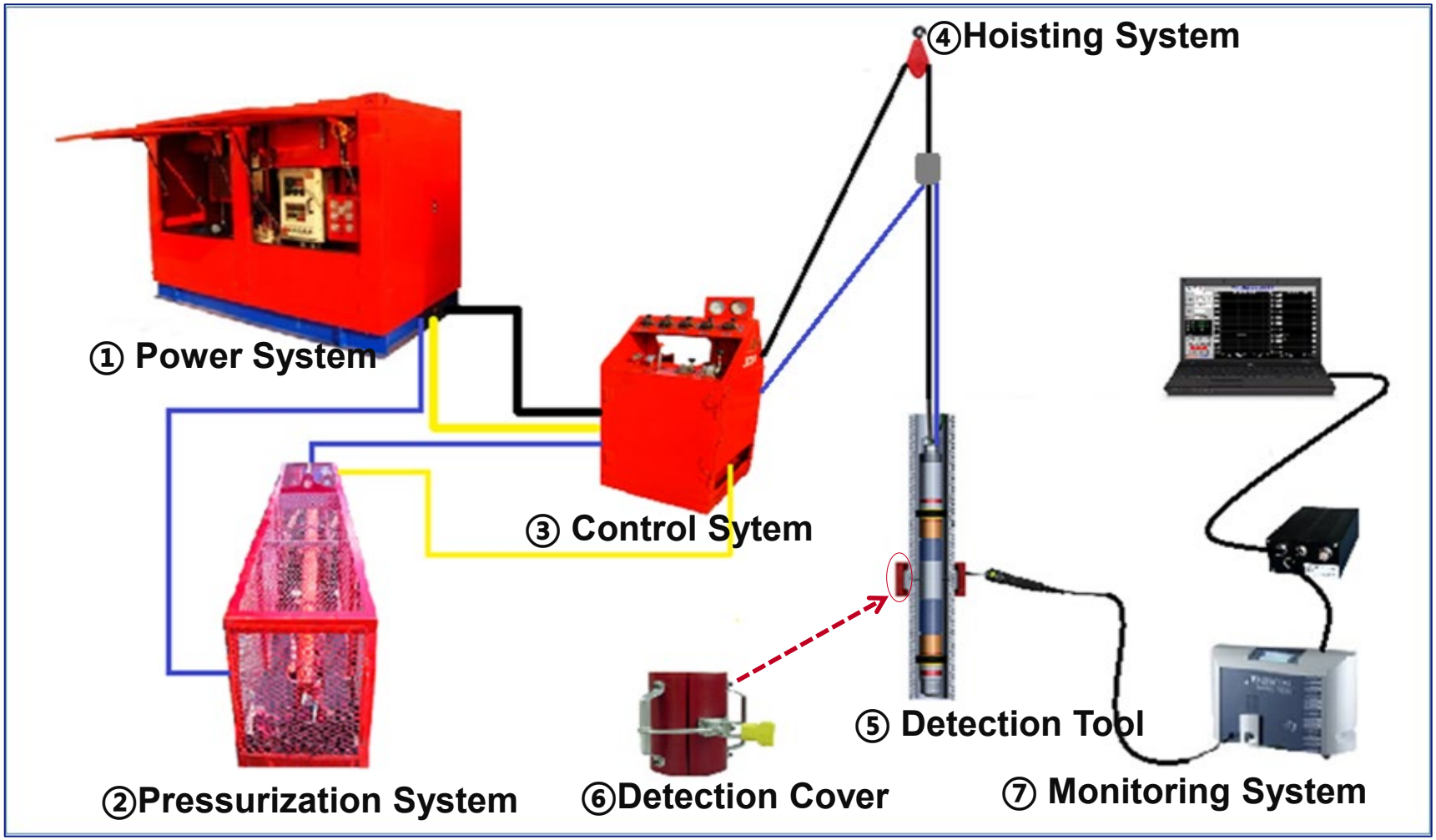
ANTON 安東

2. Principle of Detection Technology



Schematic Diagram of On-site Detection

3. Main Equipment



4. Service Scope

- It is suitable for various natural gas wells, gas injection wells, gas storage reservoirs and shale gas wells.
- It is suitable for all kinds of gas-tight buckle oil (casing) pipe, nipple, column in Φ 60.3 mm ~ Φ 339.7 mm;
- It is suitable for various drilling machines, workover rigs, offshore platforms and other conditions.
- It is suitable for working environment in various harsh environments such as desert, mountain and ocean.

5. Characteristics of Gas Seal Detection Technology

- It can realize the gas tightness detection under 120MPa pressure and meet the requirements of high standards.
- The gas tightness is quantitatively described by the permeation rate of small molecular helium, and helium with a leakage rate of 10-7 bar mL/s is detected with high sensitivity within 0.7s, which is more accurate.
- It can simultaneously detect the factory end and the on-site connection end of the oil (casing) pipe coupling under the actual tension working condition, which is more real and reliable.
- The single-point detection time can reach 1.5min and the speed is fast.

Contents

IV. Application of Gas Seal Detection in China

ANTON 安東

Statistical Table of Threads for Gas Seal Detection in China

Detection Year	String Type	Detected Connection Type	Detection Pressure (MPa)	Total Detection Number	Number of Leakage	Leakage Ratio
2009	Casing	VAM-TOP; TP-CQ; BGC; 3SB; BEAR TP-FJ BGT2, etc	35-105	1563	66	4.22%
2010				10833	341	3.15%
2011				26028	517	1.99%
2012				51700	925	1.79%
2013				55309	905	1.64%
2014				38382	709	1.85%
2015				17411	323	1.86%
2016				11053	229	2.07%
2017				11275	648	5.75%
Subtotal				223554	4663	2.09%
2009	Oil Pipe	VAM-TOP; BGT; BEAR; NP110-VAM TP-G2 FOX, etc.	35-110	17029	421	2.47%
2010				24145	572	2.37%
2011				34335	811	2.36%
2012				45866	797	1.74%
2013				53971	1128	2.09%
2014				36388	675	1.86%
2015				26974	518	1.92%
2016				20091	396	1.97%
2017				13089	261	1.99%
Subtotal				271888	5579	2.05%
Total				495442	10242	2.07%

IV. Application of Gas Seal Detection in China

ANTON 安東

Statistical Table for Detection of Casing and Tubing in a Gas Storage Depot

Detection Year	String Type	Detected Connection Type	Detection Pressure (MPa)	Total Detection Number	Number of Leakage	Leakage Ratio
2011	Casing (63 Well Time)	FJL TP-CQ TP-FJ VAM-TOP VAMFJL等	32-64	383	6	1.57%
2012				698	15	2.15%
2013				3150	65	2.06%
2014				1004	30	2.99%
2015				311	11	3.54%
2016				830	28	3.37%
Total				6376	155	2.43%
2012	Oil Pipe (15 Well Time)	BGT1 VAM-TOP	20-47	477	10	2.09%
2013				1415	28	1.98%
2014				476	10	2.10%
2015				540	27	5.00%
2016				416	10	2.40%
2017				235	5	2.13%
Total				3559	90	2.53%

ANTON 安東

THANKS!

Helping others succeed…

www.antonoil.com