Application of Helium mass spectrometry leak detection technology in steel drum industry

To promote the technological progress of the industry and facilitate its technological development
01 Necessity of leak testing
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Because of safety, environmental protection, energy saving needs to prevent internal storage material leakage, leakage, overflow.

External water, air, and other environmental substances react with internal substances, making the internal matter deteriorate.

Find out the process defects of welding, material, flanging and sealing

Quickly screen out the products that meet the customer's quality requirements in mass production to avoid unqualified products flowing into the client
GB/T17344-1998
only a test method, not a standard

- Are recommended in GB/T17344-1998 air tightness test methods is inflatable (Ⅱ) 20-30 (Ⅲ) KPa pressure maintaining 5 min no leakage (usually in weld brush soap bubble or sink sink observation in the presence of air bubbles) No leakage, observation, bubble these words belong to descriptive language, it is difficult to quantitative and qualitative, in practical production is difficult to operate.

Leakage is absolute, non-leakage is relative!

Therefore, each product will have different requirements in different environments because of the different materials it contains. It is necessary to define a leakage scale for each batch of products.

Definition of leakage criteria

- 1. Operating environment: temperature and humidity
- 2. need to prevent leakage of media
- 3. Pressure difference under the limit of dressing medium
- 4. Effectiveness of the medium in unit time
Calculation of leakage rate of steel barrel

Usually expressed as: at what temperature and pressure for many Kpa, filled with product in how long time do not allow the how many grams or outside air leakage is not allowed to enter how many ML. For steel barrels packaging, because feature is the packaging, not unified definition with loading medium, uniform standard very hard, because most of the steel barrel medium for fluid, fluid molecules and viscosity are larger than the air molecules, and usually prevent external and internal reaction is the medium of air leakage test, the significance of using air as test medium leakage as the calculation basis is the most rigorous.

Assumption: the steel barrel loaded with polyurethane, the limit pressure is 30Kpa, the validity of the packaging for 12 months, the amount of leakage is not allowed to exceed 100ML, calculated delta p within 12 months: 0.015kpa this pressure difference in 5min is no way to measure, calculated as leakage rate for air leakage rate 1.25E-7mbar/S(Q= delta PV/ delta T), polyurethane leakage within 12 months of five hundred thousand.
Why test steel drums leak with Helium?

- Not poisonous or toxic
- Not expensive
- light
- noncombustible
- Helium
- Chemically inactive
- Small gas molecules

Leak rate

- Bubble leak test
- Pressure drop leak test
- Helium leak test
Why test steel drums leak with Helium?

1. If the concentration is 1%, then the leakage rate of 20 micron holes should be $e^{-5}$. If the same holes are tested by bubble method, 1Bar of compressed air should be filled for 5min before 1mm bubbles visible. Therefore, the Helium test meets the requirements of high accuracy and high speed.

6. The leakage requirements of different materials are different, because the molecular radius and viscosity are not the same, customers can adjust their own standards from $e^{-3}$ to $e^{-6}$ according to the requirements of their customers.

5. Helium concentration is proportional to the leakage rate. Higher leakage rate needs higher concentration. Low helium concentration is close to the background value. Our equipment upgrades the helium filling system to quantitative filling, which can save 120,000 RMB of helium cost for customers with an annual output of 500,000 drums.

2. The value measured by the Helium leak detector includes the accumulated value of the background of the Vacuum box, the leakage of Vacuum box itself, and the leakage of steel drums. Therefore, it is important to control the background above the leakage rate of qualified drums. Generally, it is necessary to control the value above the order of $e^{-6}$ to effectively test the leakage.

3. The equipment shall test the standard drum (with standard 20 micron leak hole) in time to prevent external factors from affecting the test results.

4. Small leaks can’t be detected with a fast beat, because it takes time for any material to penetrate. The leak is called "seep". Helium leaks can detect "seep" faster, but not with a fast beat.

Shanghai Size Test & Control Technology Co., LTD
Principle of steel drum Helium leak test

Drum Helium Leak detection Process Flow Diagram

- Drum
- Chamber vacuum valve
- Sampling pipeline
- Vacuum gauge
- Exhaust Vacuum Valve
- Filter
- Helium leak detector
- Anti-return oil valve
- Roughing vacuum
- Roots vacuum pump
- Single-stage rotary vane vacuum pumps
Introduction of steel drum Helium leak detection equipment
1. Standard steel drum Φ560mm-Φ598mm, H880mm-H910mm weight about 30Kg

2. The steel drum is clean, oil-free, dry and paint-free

3. Fill helium automatically and quantitatively before testing (0.8L \ 1.2\ 2L)

4. Cycle time: 12 pcs/min (dual station), 6 pcs/min (single station)

5. Detection accuracy: minimum detection helium leakage rate < 1 ×10^{-8}mbar.l/s

6. Control mode: touch screen operation, PLC electrical control, automatic display of leakage rate to determine whether qualified, mechanical automatic elimination of unqualified products
➢ During the 10 years development, always insist customer first concept
➢ Shanghai high-tech enterprise, certificated by TUV/CE, has more than 40 patents
➢ Provides world-class leak detection solutions for steel drums
➢ Provides over 350 sets of Helium inspection equipment over the years
➢ The equipment were exported to USA, Malaysia, India, Taiwan, Singapore and other countries and regions
➢ Set up service offices in Hong Kong, Singapore, Malaysia, India, the United States, Taiwan and China Mainland to ensure fast service to customers
Market status of STT equipment

Accumulated detection quantity
Over 500 million

Equipment performance
Running steadily for 10 years

Application rate
Biggest market rate in Steel drum industry

Shanghai Size Test & Control Technology Co., LTD
Customers list

Mauser package group
CPMC HOLDINGS LIMITED
Tianjin Datian package
Taicang Datian package
Dongguan Datian package
Yantai Guoxin drum Mfg. company
Yantai Tongyi package
Jiangsu Jintai package
Shanghai Tianhaoda package Co., Ltd
Shanghai lingxin package
Zhejiang qianjiang jinsheng package container Co., Ltd.
Laiyang Yuandong drum Mfg.

Ningbo Jilong package
Ningbo donghaian package
Ningbo jinrui package
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