TCR Advanced Engineering P. Ltd

Experts in Metallography, Failure Investigation and RLA

Metallurgy for Industries

Power | Petrochemical | Fertilizer | Chemical | Refinery | Engineering | Automobile

A Monthly News Letter | August, 2016 | **Volume 42**

Hellium Leak Detection

An Introduction.

Leak testing is a form of nondestructive technique used in either pressurized or evacuated system for components at detection location of leaks and quantitative measurement of fluid leakage. Leak refers to physical defect/ flaw that allows certain quantity of fluid passing through a system under differential pressure. A leak may be in form of a crack, crevice, fissure, hole or passage that admits air, gas, water or any other fluid.

Leaks are special types of anomalies that can have tremendous significance where they influence safety or performance of engineered systems. The operational reliability of many devices is greatly reduced if they are not sufficiently leak tight. The leak testing is performed for following major reasons.

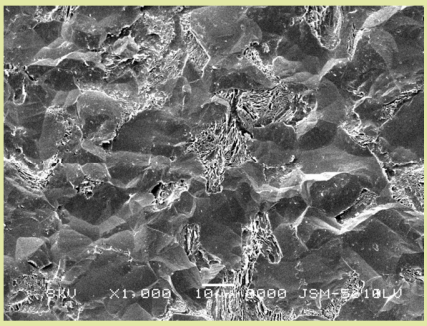
1. To prevent material loss that interferes with the system operation.
2. To prevent fire, explosion and environmental contamination and nuisance caused accidental leakage.
3. To detect unreliable components whose leakage rates exceed acceptance standards.

Various methods employed for performing leak testing in industry are listed below.

- Bubble solution
- Ultrasonic/acoustic
- Voltage discharge/Ionization
- Pressure drop/ pressure change
- Conductivity
- Radiation absorption
- Chemical based
- Halogen detector
- Radioisotope
- Mass spectrometer

Selection of suitable leak testing method depends on several parameters such as design of system, accessibility, acceptance criteria for leak rate, reactivity of material of construction and safety requirements.

Microstructure of the Month



Magnification: *1000X*

MOC: *SA 516 Grade 70*

Component: *Steam Drum*

Etchant: *2 % Nital*

Observation: *Microstructure shows fine-grained ferrite & pearlite structure..*

Useful hints:

Quality Control check during production stage through Microstructure examination would help in process control during heat treatment to eliminate the problem. Faster cooling rate is required during final stage of heat treatment to produce Pearlitic matrix.

Helium Leak Detection

Helium Leak detection is based on mass spectrometry technique employing mass spectrometer sensitive to helium gas. It is commonly referred as Mass Spectrometer Leak Detector (MSLD). It is used to locate and measure the size of leaks into or out of a system or containing device. In this testing helium is used as tracer gas, and is introduced to a test part that is connected to the leak detector. The helium leaking through the test part enters in the helium leak detector. The amount of the helium is directly proportional to the leak rate of the part. The partial pressure of helium is measured by the leak detector and the measured value is converted to display the leak rate of the part.

Helium is the best choice of tracer gas to find leaks for number of reasons. It is non-toxic, inert, non-condensable, non-flammable and not normally present in the atmosphere (< 5 ppm). Helium is the smallest molecule which is inert. Due to its small atomic size, helium passes easily through leaks.

A helium leak detector consists of the following components:

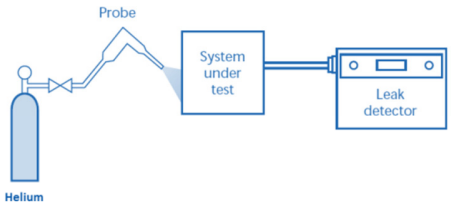
- A mass spectrometer tuned to detect helium gas
- A vacuum system to maintain the vacuum in the mass spectrometer
- A pumping system to evacuate the part to be tested
- Valves system for various testing stages such as evacuation, testing & venting
- A standard leak with known leak rate to standardize the machine.
- An amplifier and readout instrumentation to display the output signal
- Power supplies and controls
- Fixtures that attache the part to be tested to the detector.

Methods of Leak Testing

Mainly there are two methods to leak test parts using helium: Vacuum Testing (outside-in) and Pressure Testing (sniffer technique). The detection method should be selected based on the working conditions of the part to be tested. It is important to maintain the same pressure conditions during the test as they will exist during the actual use of the part. Vacuum systems should be tested with a vacuum inside the chamber. A compressed air cylinder should be tested with high pressure inside the cylinder.

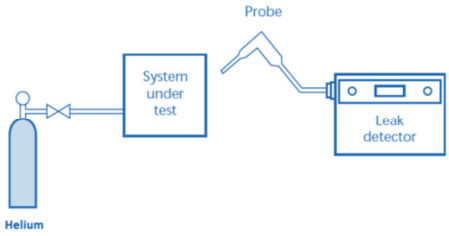
Vacuum Testing (Outside-in)

In vacuum testing, the part is evacuated with a separate pumping system for larger volumes, or by detector itself for smaller volumes. To locate a leak, helium is sprayed to the suspected leak sites of the part using a spray probe with an adjustable flow.



Pressure Testing (Inside-out/ Sniffer method)

In Pressure Testing, the part is pressurized with helium or a mixture of helium and air. To Locate a Leak, the potential leak sites of the part are scanned using a Sniffer Probe connected to the inlet of the leak detector.



Helium Leak Detection Applications

Quality control of production parts and assemblies using helium leak detectors can help assure the integrity. Helium leak testing applications include: hermetically sealed packages, valves, manifolding seals, vacuum vessels and systems, medical devices, high purity piping, brake lines, fuel lines, hydraulic lines, refrigeration assemblies, radiators, heat exchangers, condensers, storage tanks, systems operating in hazardous environments. It also has applications in field of maintenance. Industrial processes that use vacuum systems or pressure systems must be tested to check for occasional leaks. This can either be part of preventative maintenance or in the event of an unexpected failure. Typical examples of vacuum systems include: Vacuum furnaces, vacuum coaters, glove boxes, linear accelerators, semiconductor process equipment and laser process equipment. Typical examples of pressurized systems include: power plants, gas handling systems, bioreactors, liquid gas facilities, underground tanks, underground cables and pipes.

TCR Advanced has the expertise in provides helium leak testing services. Please visit our website for more details on leak testing

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