All about Leak Test

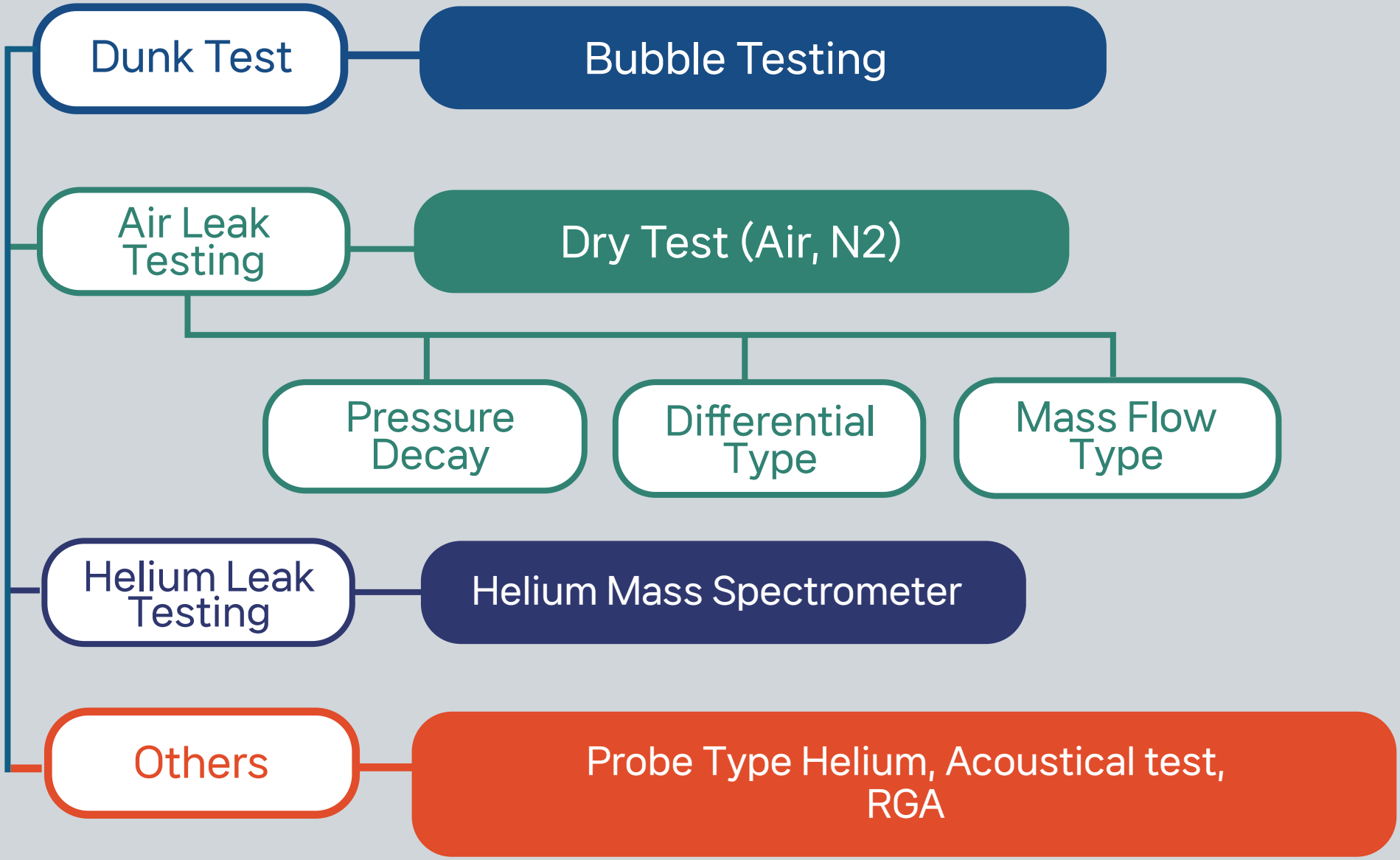
SUNIL

선일기전(주)
SUNIL LEAK & FLOW Co. Ltd
SUNIL Precision India pvt.ltd

Production

- Air Leak Test System
- Helium Leak Test System
- Flow rate and durability Test System
- Assembly automation equipment manufacturing

Leak Testing Classifiacation



[Leak]

The flow of any substance through an opening or crack through a barrier (protective wall), etc.

- Speed of leakage
- Molecular Weight of Leaking Material
- Leakage standard value

Leak Testing

- Selection of technology and development of leakage characteristics for production sites in various industries.

Quality Management	Nondestructive testing
Total Inspection	Improved reliability

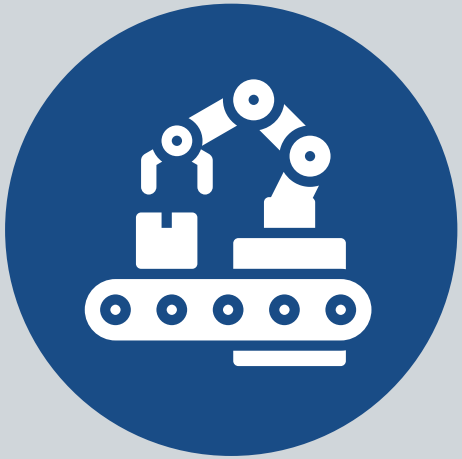
There is no perfect material without leakage.

Necessity of leak test

Improved reliability

Environmental protection

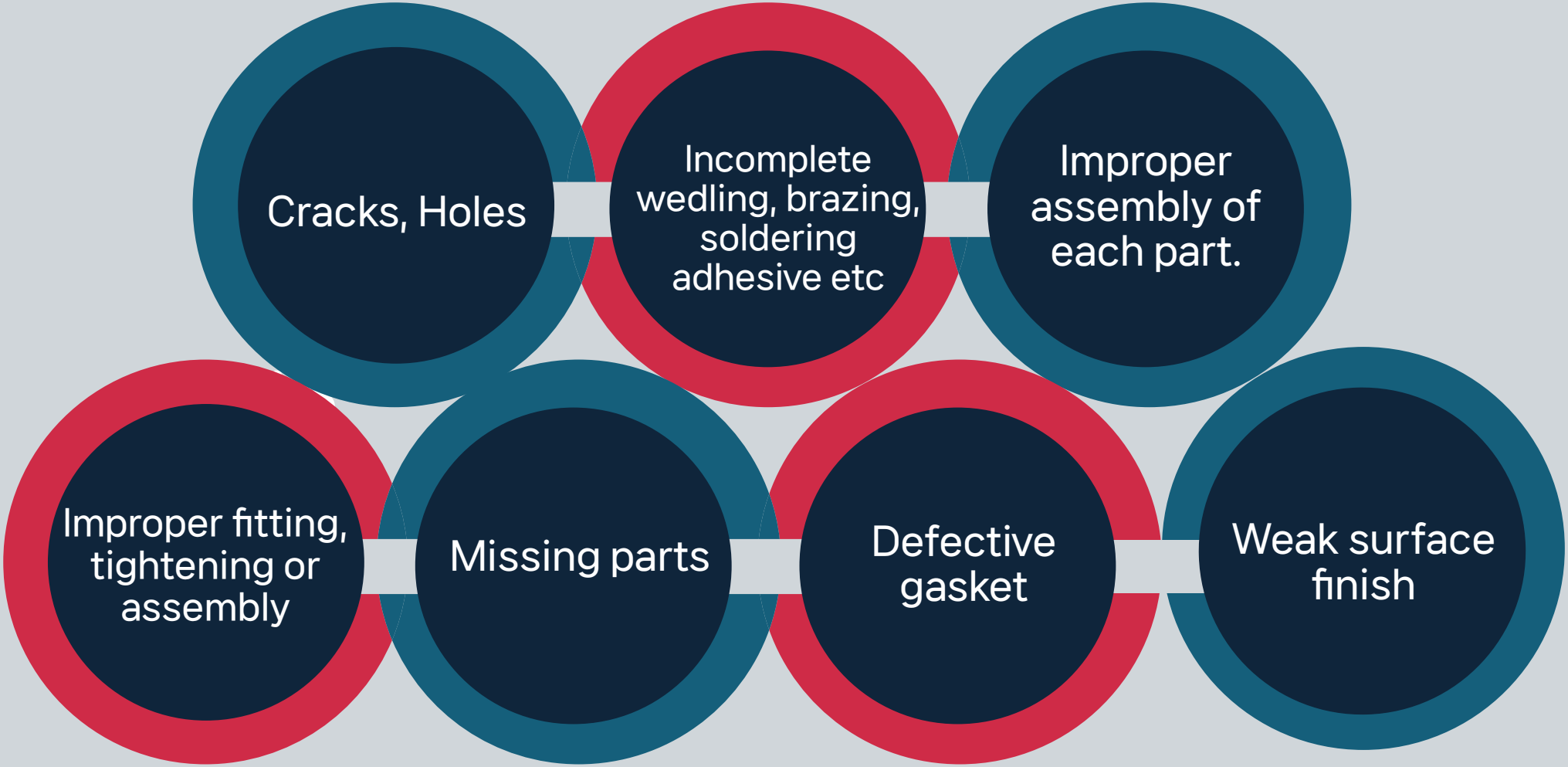
Improve customer satisfaction



Prevent additional costs for the finished assembly

Secure stable quality of the manufacturing process

Leak Generation Factors



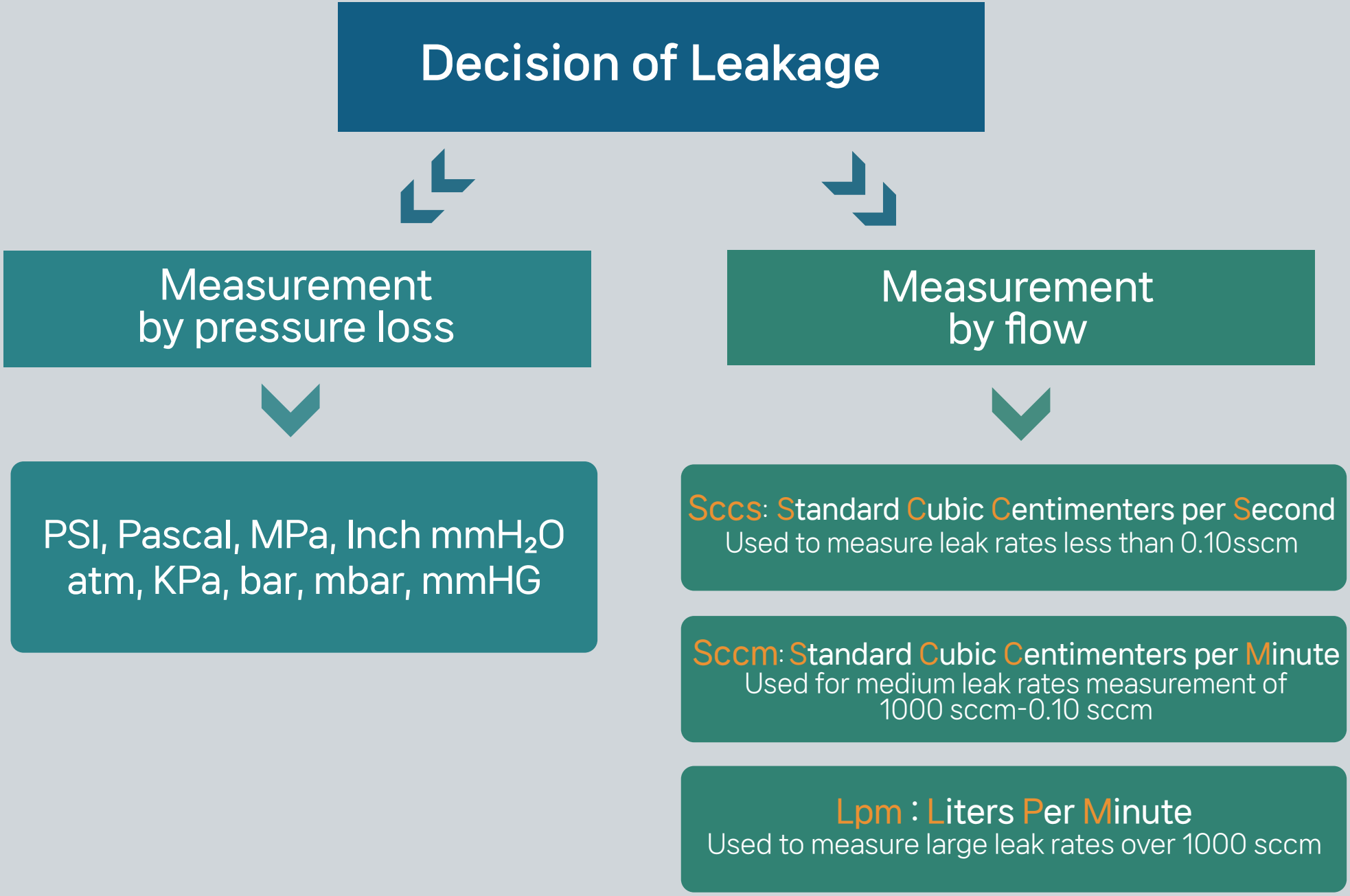
Leak test
Selection technique

It is important to select the
"test specification" for the site

→ Factors to Select Appropriate Leak Testing

- What is the standard forOK / NG leak rate?
- What is the leakage specification on site?
  - Test Pressure, Pressure decay or flow
- What is the estimated cost?
- Is it necessary to confirm the leak location?
- What is the production speed?
- What is the material?
- What are the conditions around the test site?
  - Temperature, pressure, pollution level, ambient air condition(0.7mmH20, 0.7cc change occurs at 0.01 ° C change in temperature)
- How skilled are the workers?

Decision of Leakage



Leakage Management

Currently Korean Management Standards

Manage by pressure loss

PSI, Pascal, MPa, Inch mmH_2O
atm, KPa, bar, mbar, mmHG

Developed countries management standards

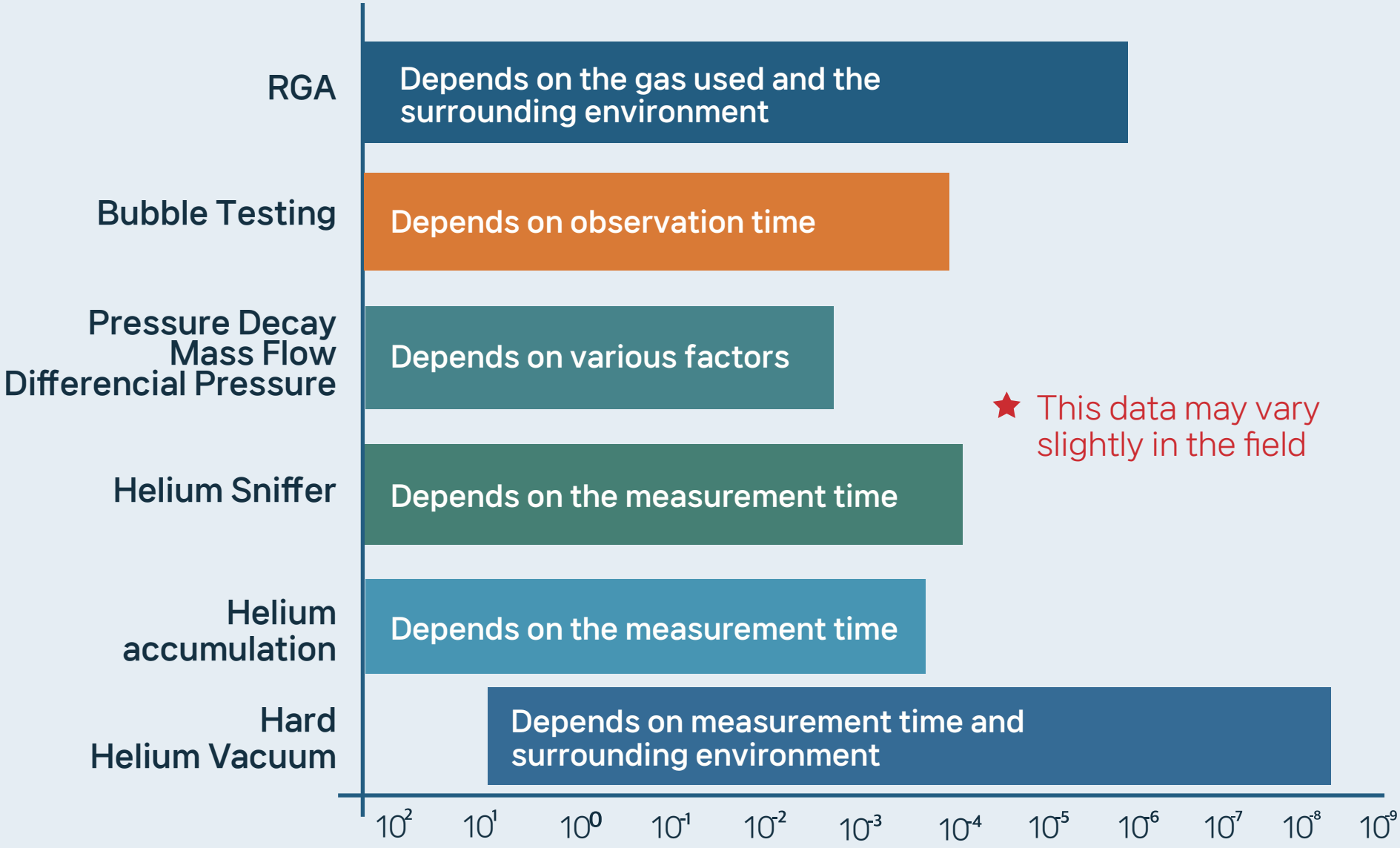
Manage by Flow Rate

The amount of leakage actually generated per hour is managed by the drifting unit. (Consider test volume)

Equation for converting pressure loss per hour to flow

$$LeakRate(sccm) = \frac{V(cm^3) \times \Delta P(psi) \times 60}{T(\text{sec.}) \times 14.7}$$

Leak measurement range according to the leak test method



Leakage unit : standard .atm/cc/sec. or mbar, 1/sec

Typical Refrigerant Leakage Limits

Typical Specification

0.1 oz.(2.8g) Freon/year = 1.8 X10^{-5}scc/sec = 1.8 X10^{-5}mbar l/sec.

Leak Rate (scc/sec.)	Time required for 3mm Air bubbles to form	Volum Comparison
10^{-2}	25/mins	-
10^{-3}	2/mins	-
10^{-4}	1 in 5/mins	-
10^{-5}	-	1 scc/24 hour
10^{-7}	-	3 scc/year
10^{-9}	-	1 scc/30year

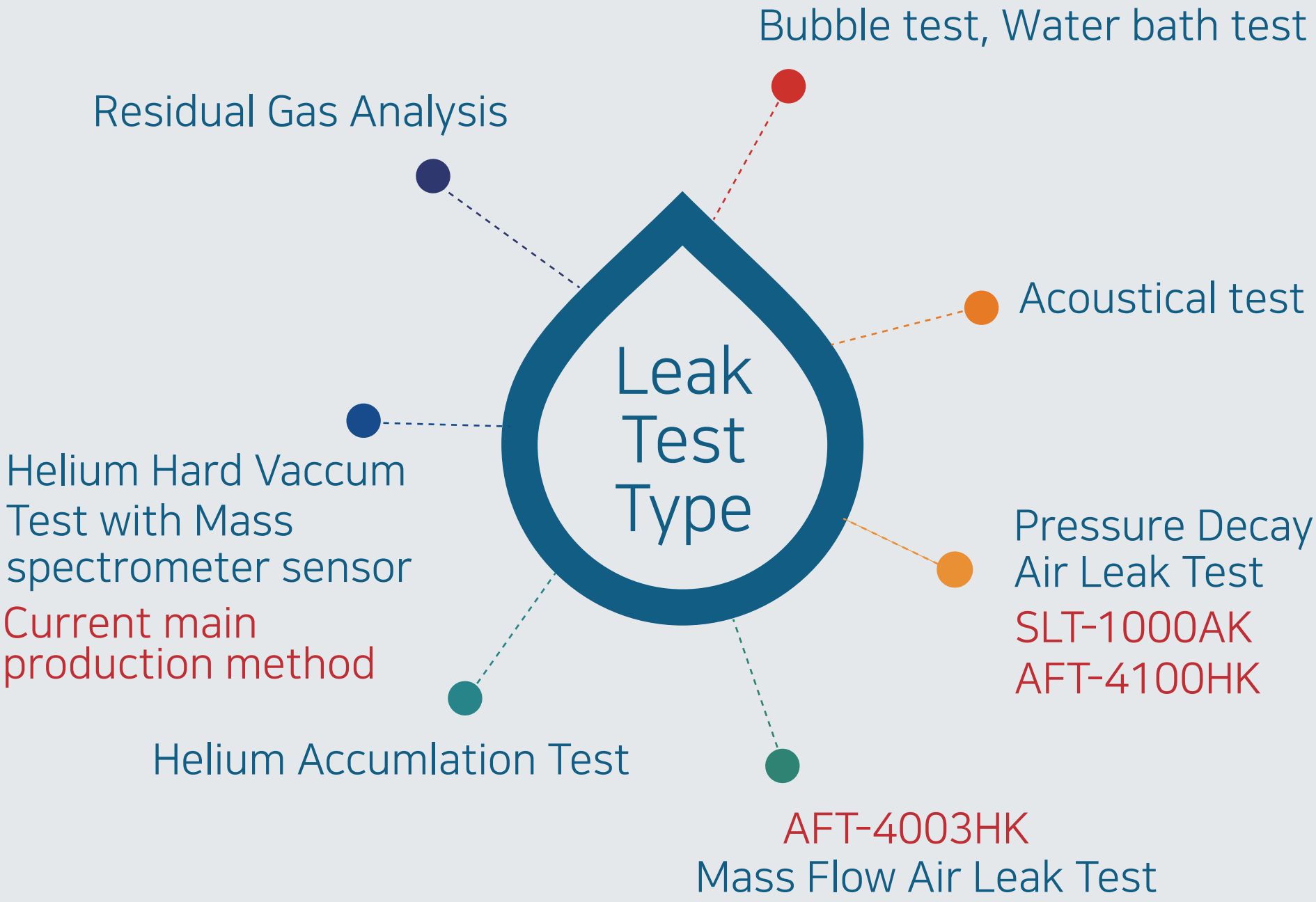
Leak Test Comparison

Leak test method	Water bath test	Acoustical test	Pressure Decay Air Leak Test ✓	Mass Flow ✓	Helium sniffer	Helium Accumlation	Helium Hard Vaccum ✓	Residual Gas Analysis
System configuration	Simple	Appropriate	Simple	Simple	Simple	Complicacy	Complicacy	Complicacy
Cost	Low	Medium	Medium	Medium	Medium	High	Very high	Very high
Worker dependence	High	-	-	-	High	-	-	-
Sensitivity, sccs (Based on work site)	0.001	0.01	0.01	0.01	0.00001	0.00001	0.0000 00001	0.0000 00001
Leakage location Check	Possible	Possible	Impossible	Impossible	Possible	Impossible	Impossible	Impossible
Fields	· Leakage location check required · Leakage specification of 0,001sccs or more required · Low production speed and low budget · Field that is not affected by water	· Steam pipe (Maintenance) · Snowfall specification requirements greater than 0,01 sccs · Parts with flexure leakage	· Various auto parts -Coolers, radiators, Brakes, fuel parts, Power handle, battery · Device &apparatus -Valves, pumps, storage tanks · Medical device	· Various auto parts -Liquid reservoir, radiator piping parts, transmission housing, engine block ·Device &apparatus -Valves, pumps, storage tanks ·Medical device	· Welding, Blazing Part · Valve stem in refrigerator · Refrigerator, air conditioner connection · Where there is a local leak.	·Temperature sensitive compo-nents with leakage specifications of 0.001 or more · Automotive Parts Radiator, oil cooler Fuel Rail, Heater Core	· Parts of refrigerators using Freon · Airbag · Aluminum wheel rim of car · Parts of the flue system	·Gas-filled parts ·Cooler using Freon gas ·Aluminum wheel rims ·Parts of fuel tank

Equivalent Comparison of Leakage Rate to Leaking Fluid

Freon (R-12) leakage ounces/year.	The time required for one droplet to form in a water drop test	Equal Leakage Rate for Helium std. atm. cc/sec.or mbar l/s.
10.00	13.3 sec.	1.8×10^{-3}
3.00	40.0 sec.	5.4×10^{-4}
1.00	145.0 sec.	1.8×10^{-4}
.50	290.0 sec.	9.0×10^{-5}
.10	24.0 min.	1.8×10^{-5}
.01	240.0 min.	1.8×10^{-6}
.00006	667.0 hrs.	1.0×10^{-8}

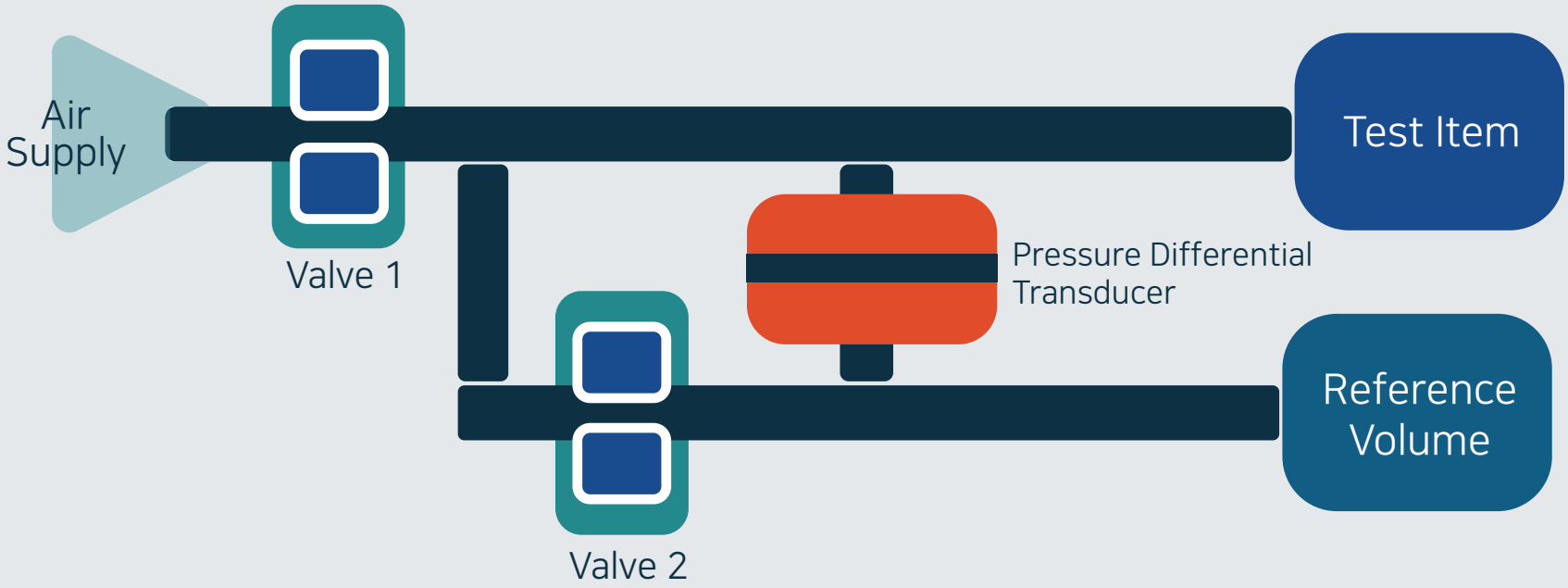
✓ The above conditions are approximate for the same test conditions.


Bubble test, Water bath test
Residual Gas Analysis
Acoustical test
Leak
Test
Type
Helium Hard Vaccum
Test with Mass
spectrometer sensor
Current main
production method
Pressure Decay
Air Leak Test
SLT-1000AK
AFT-4100HK
Helium Accumlation Test
AFT-4003HK
Mass Flow Air Leak Test

Differential Pressure

AFT-4100HK

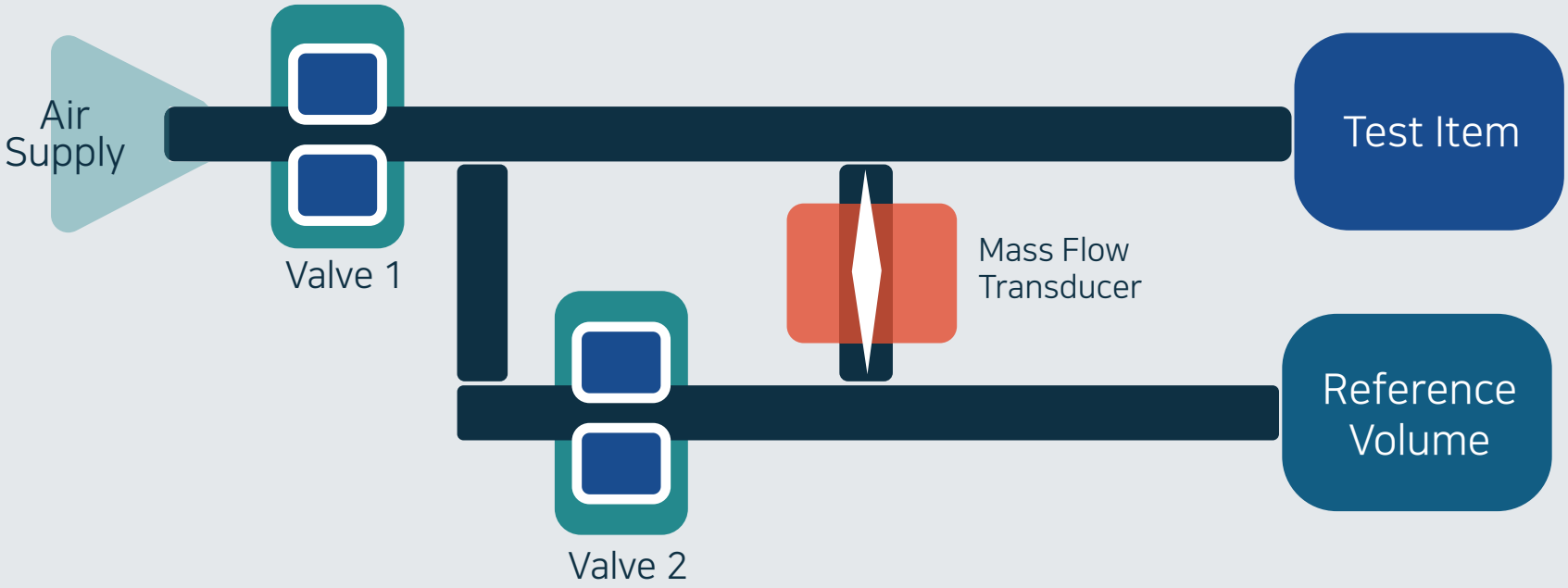
- A method of measuring the pressure of a test item versus a reference using a differential pressure sensor.



Mass Flow Type

AFT-4003HK

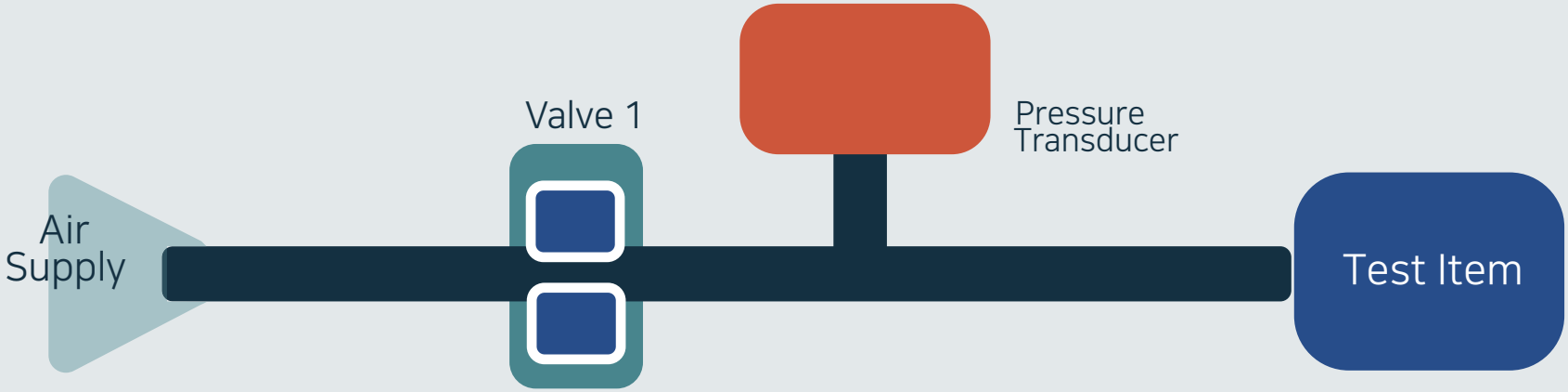
- A method of measuring the flow of test items vs. reference air using a mass flow sensor



Pressure Decay

SLT-1000AK

- After supplying a constant test pressure to the sealed product, the injection port is blocked to detect the leakage of the pressure change using the Pressure Sensor.



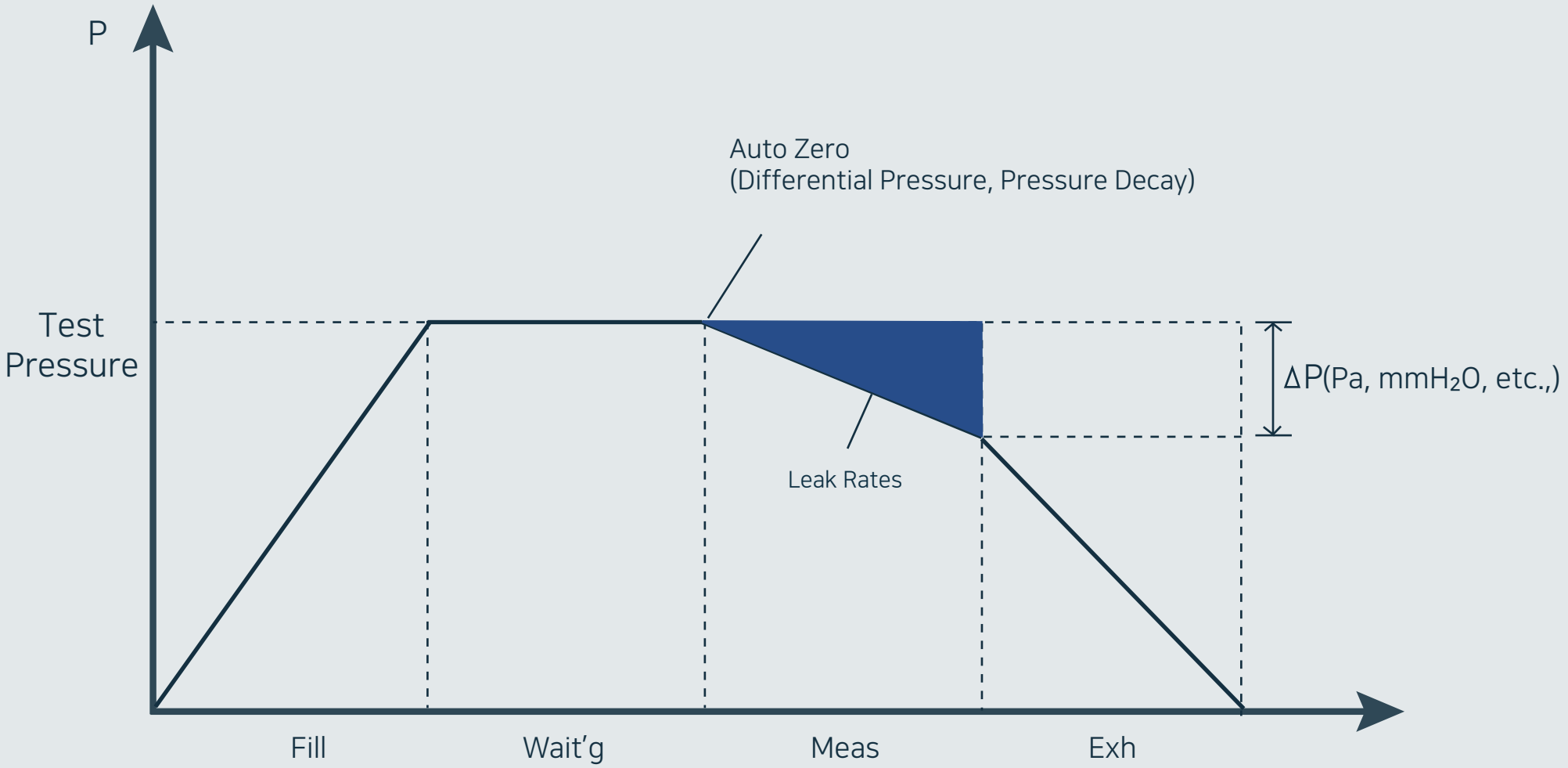
- Disadvantages

  - Very low detection of fine leakage
  - Measurement of pressure change takes longer in large volume products

Air Leak Test Pressure change curve

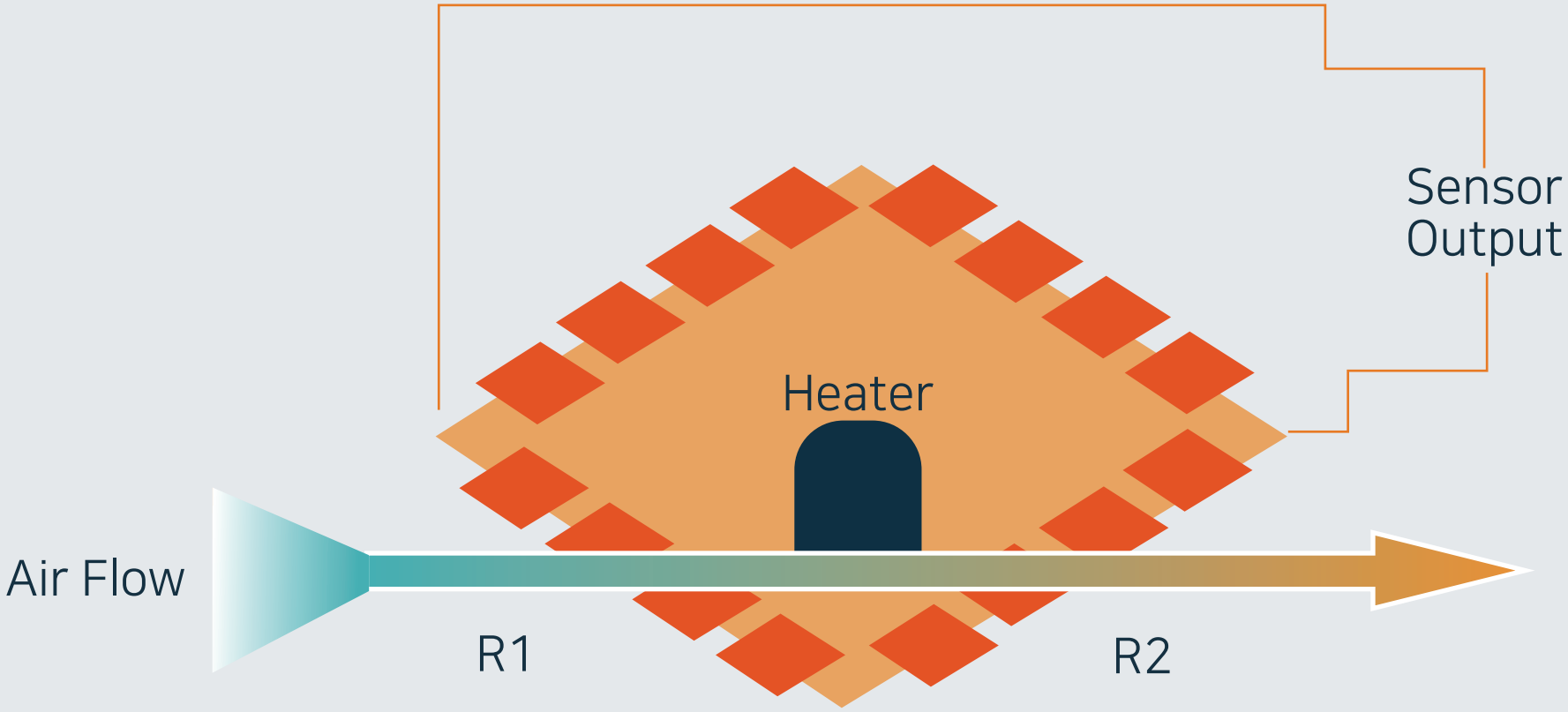
Differential Pressure
AFT-4100HK

Pressure Decay
SLT-1000AK



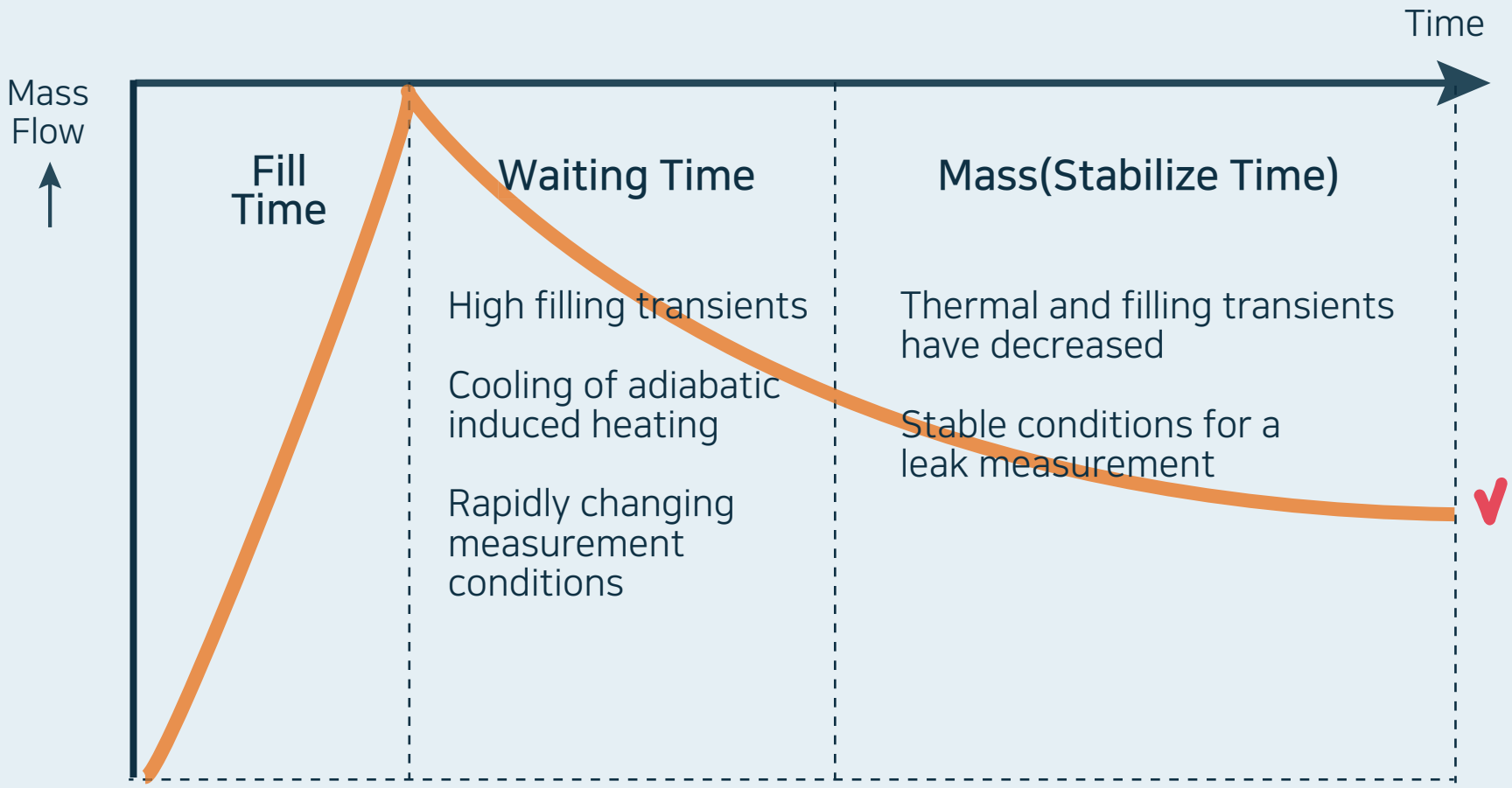
Thermal Mass Flow Sensors AFT-4003HK

- Mass Flow Sensing Method using Heat Transfer Principle
  Very short test time and very high accuracy sensing method in at least 0.02 seconds



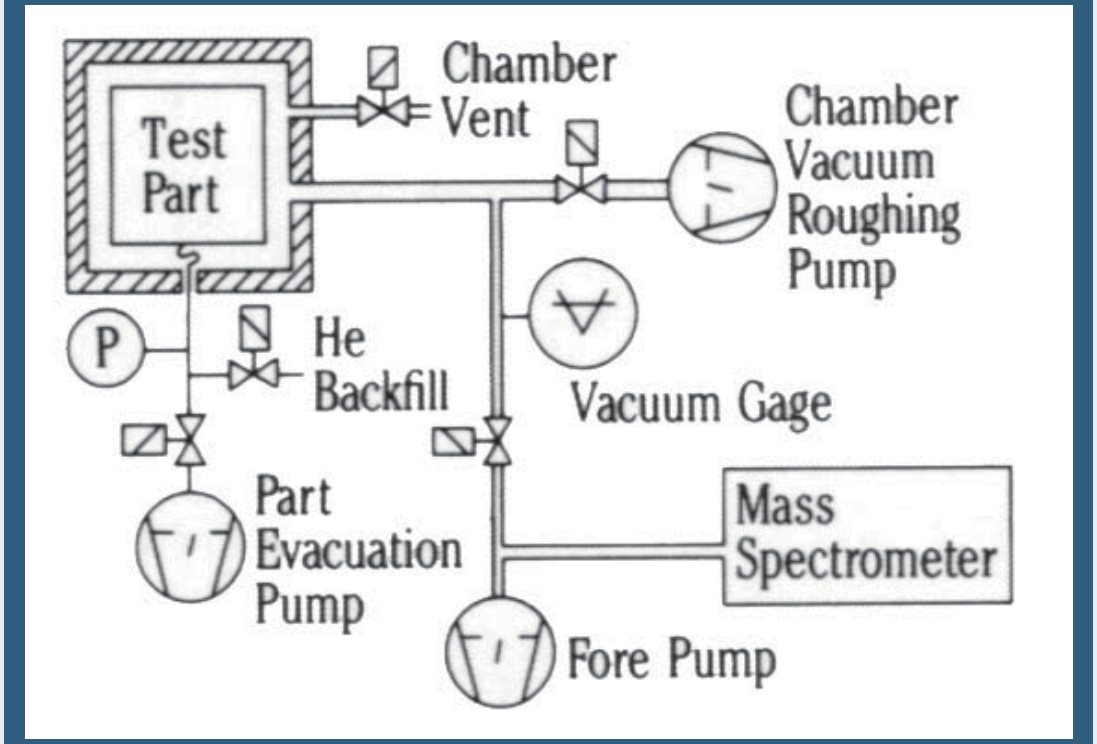
- R1, R2 : Temperature-Sensitive Resistors(Thermisters)
- Output Voltage = Mass Flow of Air

Mass Flow Leak Test Curve



✓ Mass flow requires only one measurement at the stabilized end.

Helium Vacuum Technology



Leakage measurement range: ~ 1 X 10^{-8} CC / S

System method

- Inside-out or outside-in
- Determined by the use or function of the product

Fill product first with mixed helium gas or automatically fill test chamber

The setting in the chamber around the product is set to the optimum vacuum level by a vacuum pump of the appropriate size

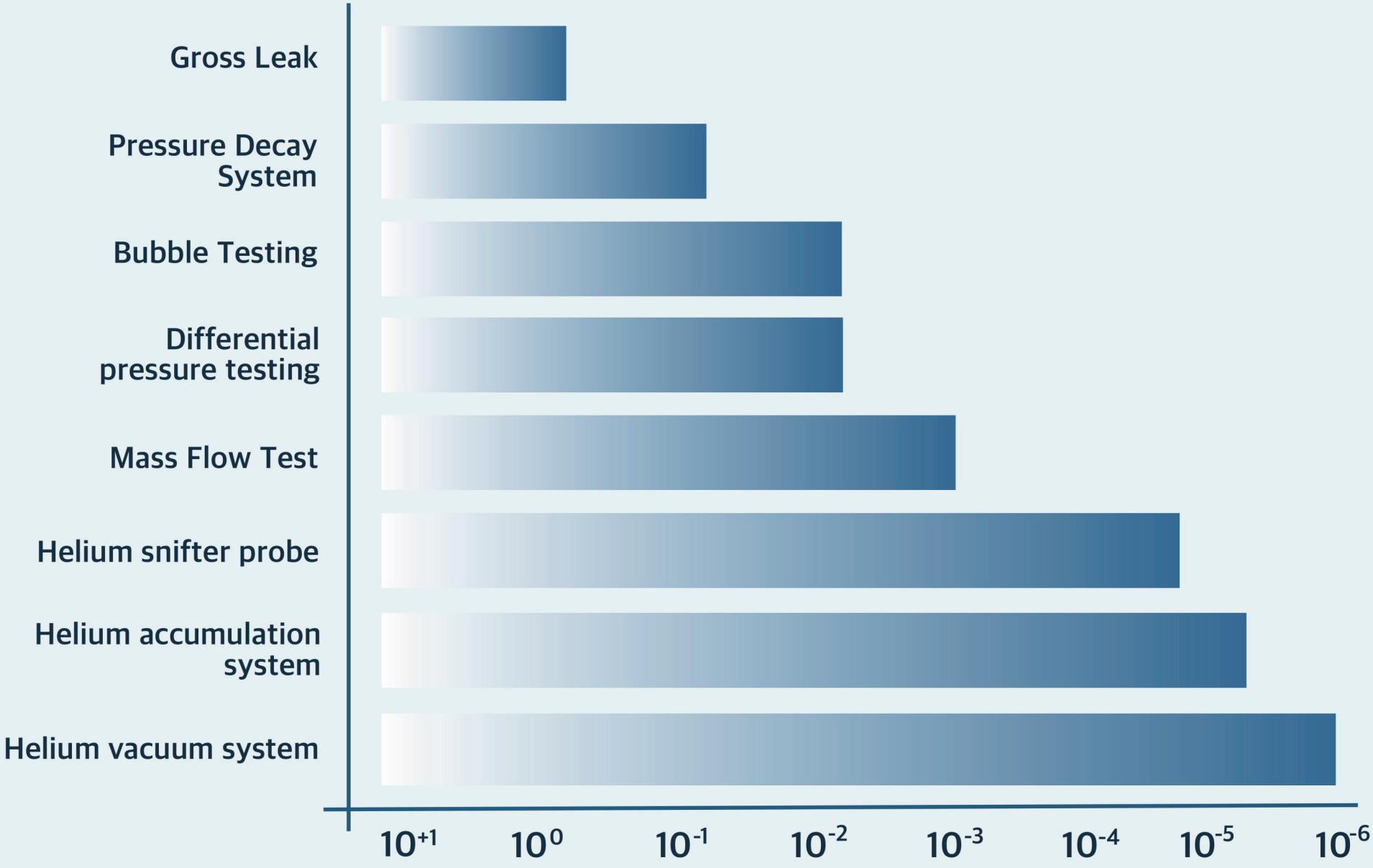
When the correct vacuum level is reached, the shutoff valve opens

Mass spectrometer samples the concentration of helium to determine the leak rate

OK/NG criteria are established during the calibration procedure using the leak standard in the chamber

With this vacuum method, on-site measurable leakage levels reach 1.0 x 10^{-8} sccs or more.
This strength can be achieved in environments with vacuum levels below 120 microns (0.120 Torr)

Leak Test Rates In Standard cc/second



Factors Affecting Air Leak Testing

Environmeatal Factors

- Fill-air temperature
- Ambient temperature

Factor of test product itself

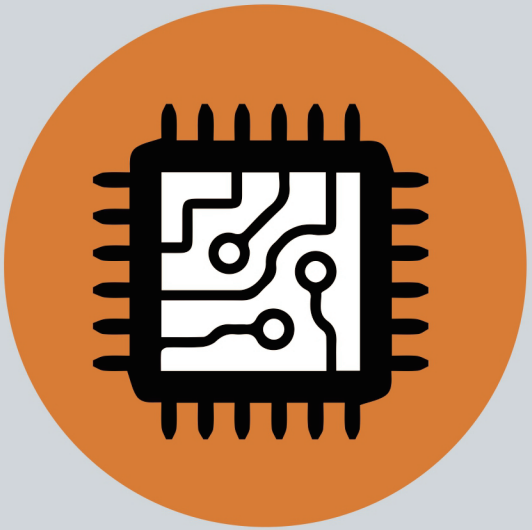
- Part temperature
- Part elasticity
- Part absorption

Factors of Sealing Fixtures

- Aging of seals

[Various factors play a role in reducing repeatability and reproducibility by adversely affecting the leakage test results regardless of the resolution of the leak detector.]

Other Experience with Leak & Automation



Semiconductor

Watches

Paper cup

Medical Product

Missile

Thank You

SUNIL Leak & flow co. ltd
SUNIL Precision India pvt.ltd