

# **PARAMETRIC RESEARCH & CONTROL**

## **LEAKAGE TESTING SYSTEMS**

**WE BUILD TRUST EVERYDAY BY MANUFACTURING QUALITY  
PRODUCTS TO ENSURE SAFETY OF OUR CUSTOMERS**



## PARAMETRIC RESEARCH & CONTROL

### COMPANY PROFILE

Parametric Research and Control, briefly known as PRC, started its journey in 2005 by a dynamic team of qualified engineers having more than 20 years of technical expertise in the field of design and development of Electronics Instrumentation and Control Systems, founded by Mr. Abdul Rahim.

PRC is one of the leading manufacturers of microcontroller/PLC/PC based electronic instrumentation systems, data acquisition systems, and customized special purpose machines. . PRC is committed to delivering a world-class Instrumentation and Control solutions to its clients.

### MISSION

We at PRC have a mission to deliver the best in the class end to end solution for all Instrumentation and control needs. Our passion is to transform and build. We apply solutions that are simple, precise and easy to use in Instrumentation and Control Systems.

### VISION

To provide quality Instrumentation to industries and laboratories. We do have an objective to emerge as a company of national and international repute.

### CEO'S MESSAGE



*It Has Always Been  
Our Endeavor To  
Deliver The Quality  
Products To Our  
Renowned Client Sand  
To Undertake Most  
Challenging Jobs Of  
New Developments.  
Thanks For Being A  
Part Of Celebration Of  
Our Success.*

Sincerely

Abdul Rahim  
C.E.O.  
Parametric Research  
& Control



## OUR SERVICE COMMITMENT

As a team, our collective goal is to build long-lasting relationships with our customers. Our Sales and Service team acts as an ambassador, taking complete ownership from inception to completion of the work. We take pride in serving our customers 24X7. Our people demonstrate the highest level of professional excellence and continuously innovate to build robust solutions. Our leadership is committed to keeping a culture of service excellence which is benchmarked with International standards.

## THE QUALITY CERTIFICATION

PARAMETRIC is a registered <sup>TM</sup> company and is awarded an I.S.O. 9001:2015 (QMS) certification from PCMS. We are registered with National Small Industries Corporation (NSIC), and Small Scale Industries (SSI).



## OUR VALUED CUSTOMERS

We are proud to have a large list of satisfied customers who are rewarding us with repeated business opportunities, to name a few:



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**Website:** www.prcin.com, www.parametric.co.in, www.indiamart.com/parametric.

## WHAT IS LEAKAGE?

A leak is a flow of gas (or liquid) through the wall of the vessel via an imperfection such as a hole, crack or bad seal. Leak requires a pressure difference to generate the flow; they always flow from higher pressure to lower pressure.



Leak Testing is a process used to detect manufacturing defects which help verify the integrity of products and improve consumer safety. Leak testing is an engineering challenge. On one hand, engineers must meet stricter leak rate standards. On the other, they have to make the leak testing process less costly and less dependent on operator skill.

## LEAK TYPES

Based on the acceptable leak rate limit (shown in ml/sec), the following test methods can be used, shown in figure 1.

				Tracer Gas				Flow Rate		
							Water Submersal / Dunk Tank / Bubble Leak Test			
High Vacuum Helium						Air Decay				
10 <sup>-9</sup>	10 <sup>-8</sup>	10 <sup>-7</sup>	10 <sup>-6</sup>	10 <sup>-5</sup>	10 <sup>-4</sup>	10 <sup>-3</sup>	10 <sup>-2</sup>	10 <sup>-1</sup>	1	5

Figure 1: Leak Test Methods



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## LEAK RATE

The leak rate is affected by the pressure difference (inlet vs outlet), the type of gas that is leaking and the flow characteristics of the leak path. In terms of units, a leak rate can be defined in different ways, but if the SI units are used, then this is expressed in mbar litre/second. 1 mbar litre/sec is the amount of gas necessary to be removed from a 1-litre container in 1 second to reduce the pressure by 1mbar.

More generally, the gas flow produced by a leak in a container can be defined as follows:

$$Q = V \frac{\Delta p}{\Delta t}$$

Where  $\Delta p$  is the difference between the internal pressure and the external pressure,  $\Delta t$  is the time, and  $V$  is the volume of the container itself. The units can be changed using specific conversion factors.

## DIFFERENT LEAK RATES FOR DIFFERENT GASES

Different gases have different values of viscosity; therefore the leak rate from an orifice of given geometry in the unit of time will be different if the leaking gas is helium or hydrogen for example.

In laminar flow conditions, the equation linking leak rates of different gases is:

$$Q_1 = \frac{\eta_1}{\eta_2} Q_2$$

In molecular flow conditions instead, the equation is:

$$Q_1 = \sqrt{\frac{\eta_1}{\eta_2}} Q_2$$

Where  $Q$  represents the leak rate of the two gases, and  $\eta$  is the relative viscosity.

Note: Sometimes leak rates are defined in atm.cc/sec. The relationship between atm.cc/sec and mbar litre/sec is the following:

$$1 \text{ atm.cc/sec} = 1013 \text{ mbar} \cdot 0.001 \text{ litres/sec} = 1.013 \text{ mbar litre/s}$$

Gross > 1 atms cc / sec

Medium > 0.01 atms cc / sec or  $1 \times 10^{-2}$

Micro > 0.000001 atms cc / sec or  $1 \times 10^{-6}$

Molecular > 0.00000001 atms cc / sec or  $1 \times 10^{-8}$



**NOTE :** 1 atms cc / sec = One cubic Centimetre of gas, at atmospheric pressure, every second.



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## INTERESTING FACT

Everything that is manufactured leaks to some degree, so having no leak at all in a product is impossible. However it is possible to have different leak rates, which of course depend on the quality of the materials, the precision of the work/forming process carried out on the parts (welding, die-casting, etc.), etc. It is therefore important to define how small the maximum acceptable leak rate is for a product; any component with a bigger leak rate should be classified as a reject or sent to a rework station.

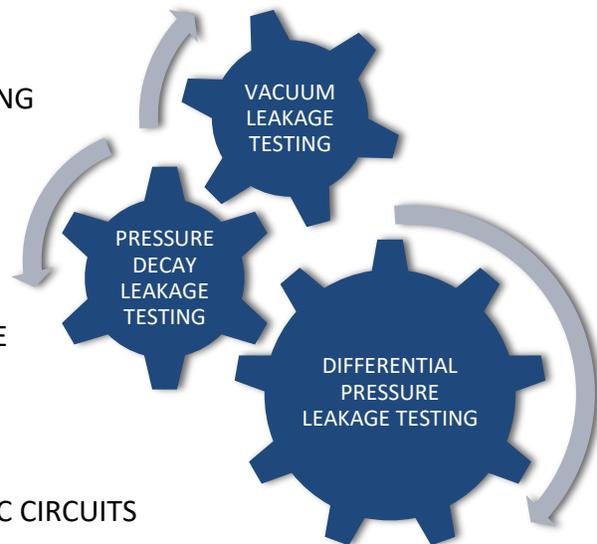
## WE PROVIDE

PRC has adopted various leak testing methods, to detect the leakage in various types of automotive engineering and medical components. We provide the following advanced and versatile leakage testing methods:

- 1) PRESSURE DECAY LEAKAGE TESTING
- 2) DIFFERENTIAL PRESSURE LEAKAGE TESTING
- 3) VACUUM LEAKAGE TESTING

### FEATURES

- ✚ HIGHLY ACCURATE AND DEPENDABLE
- ✚ QUICK LEAK DETECTION
- ✚ MULTICHANNEL OPERATION
- ✚ SMART PNEUMATIC AND ELECTRONIC CIRCUITS
- ✚ EASY CALIBRATION THROUGH LEAK MASTERS
- ✚ PC INTERFACE THROUGH RS232C AND ETHERNET
- ✚ PROVIDES SIMPLE AND HIGHLY EFFECTIVE LEAK TEST METHODS



### 1. Pressure Decay Leakage Testing Systems

Pressure decay leak detection testing instruments are extremely useful for checking components that have pressurized with air and the pressure transducer monitors the pressure for negative changes. Any pressure drop indicates a leak.



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The test is very fast, a matter of seconds, and is therefore popular in high-volume industries such as automotive components, castings, medical devices and so on.

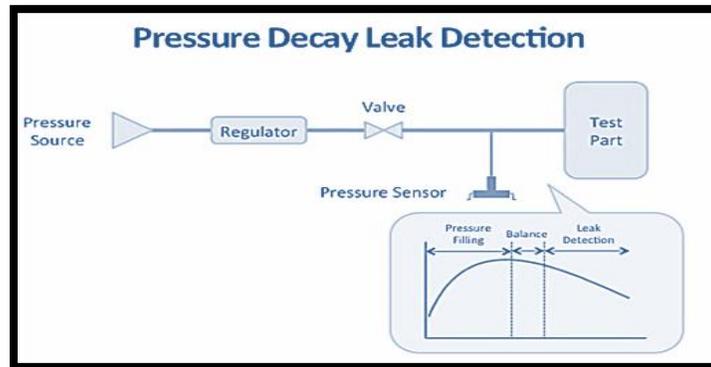


Figure 2: Pressure Decay Leak Detection Block Diagram.

## Benefits of Pressure Decay Leak Testing:

- ✦ Provides sensitivity to detect very small leaks
- ✦ Can test in pressure or vacuum environments
- ✦ Determines a leak rate based on pressure or vacuum
- ✦ Can calibrate to a volumetric flow
- ✦ Can report pressure or flow loss (psig or cc/min)
- ✦ Provides a simple and highly effective leak test method

## 2. Differential Pressure Leakage Testing Systems

One of the fastest methods of leak testing, differential pressure decay is well-suited for many applications. Like pressure decay, this method also involves measuring the drop in pressure inside the part over time as a result of escaping material.

However, in a differential pressure test, the change in pressure is measured inside the part compared to the pressure inside a control volume charged to the same pressure as the part.

The differential pressure leak test, like the pressure decay test, is easy to setup but can prove much more sensitive in certain leak detection applications. The sensitivity of the transducer is not related to the actual pressure in absolute or gauge pressure terms, but to the sensitivity of the differential pressure transducer at the test pressure.



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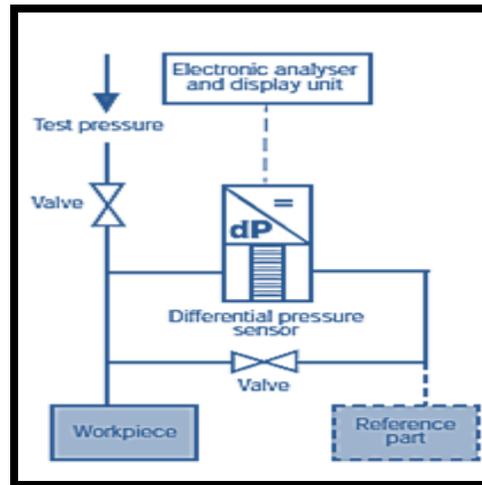


Figure 3: Differential Pressure Leak Detection Block Diagram.

### 3. Vacuum Leakage Testing Systems

Vacuum leak testing is the principal leak test method for testing parts that could have leakage from an external source into their housings and casings. Parts like underwater sensors or housings, outdoor electrical housings, sealed components, and components associated with vacuum sources are all prime candidates for vacuum leak testing. Operation of instruments that supply vacuum to test parts instead of pressure works in a similar, yet essentially opposite, manner as pressure decay testing.

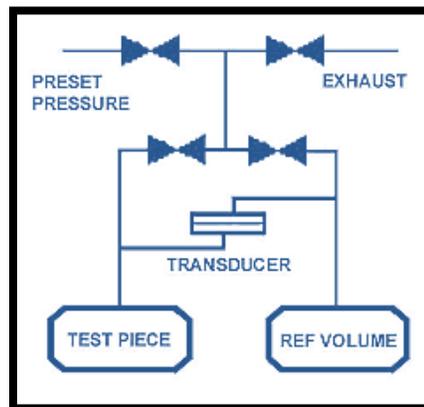


Figure 4: Vacuum Leak Detection Block Diagram

Vacuum decay means evacuation of air from the test object. For this method, it is the loss of vacuum that indicates a leak, rather than loss of pressure. However, it does take more time to evacuate the air from an object than to fill it with high-pressure air, although the difference is minimal for the small volumes.



## ADVANTAGE OF USING AIR LEAK TESTERS

Automaton and Work Saving	Quality Improvement	Cost Cutting
Process can be automated	Test performance is improved	The number of claims reduced
Manpower can be reduced	Leak standards can be quantified	Yield rate is improved
Easy operation, skill not required	Defective rate is reduced	Drying process is not needed
Work environment is improved	Statistical processing and analysis of data	Test time is reduced
Easy maintenance	Less human error	Running cost is low

Table 1: Advantage of using air leak testers.

## MULTICHANNEL FEATURE

The front-end interface consists of a display and a functional keypad from which all the instrument parameters and results can be obtained. In addition to the facilities for simultaneous testing provided by the multiple valve modules, the front-end interface allows:

- ✚ Consecutive testing of different volumes and different pressures.
- ✚ Within the instrument's memory can be stored up to 99 different sets of leakage testing parameters.

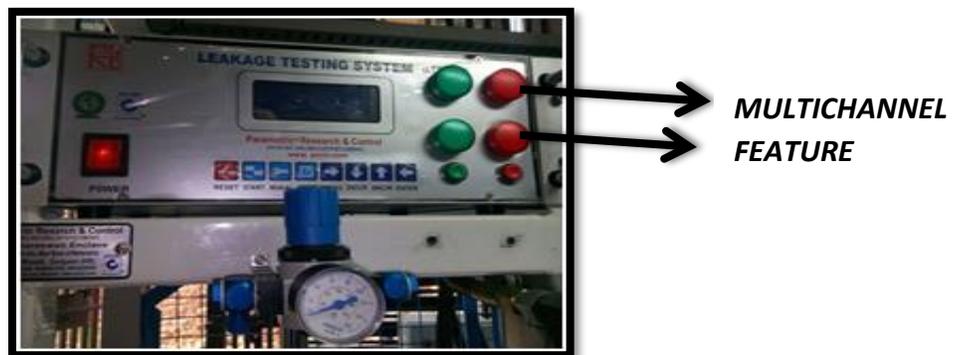


Figure 5: Multichannel Feature in Testers.



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## SMART PNEUMATIC CIRCUITS

Technical expertise and functional enhancements of leak detection brought up the concept of smart Pneumatic circuits.

- ✚ Air operated valve provides high flow rate and durability, minimizing the generation of heat.
- ✚ Faster measurement of large volume parts.
- ✚ Self-diagnostic functions prevent incorrect judgments caused malfunctions.
- ✚ The Orifice, installed in preset Pneumatic, generates the differential pressure.
- ✚ Sensor operation is performed by detecting differential pressure at exhaust time.
- ✚ Air blow cleaning is performed during the process of exhaustion to prevent water, oil or any other contamination inside the system.

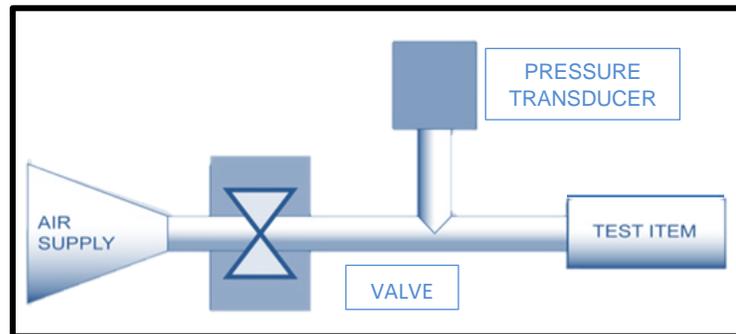


Figure 6: Pneumatic Diagram for Pressure Decay Leak Detection.

## MOUNTING FIXTURES

At PRC, the mounting fixtures are designed exclusively as per the component design using the latest Mechanical designing Software.

- ✚ Allows easy mounting and removal of the test component.
- ✚ Enables the test component to be installed accurately in confined spaces.
- ✚ Easy to replace test components.



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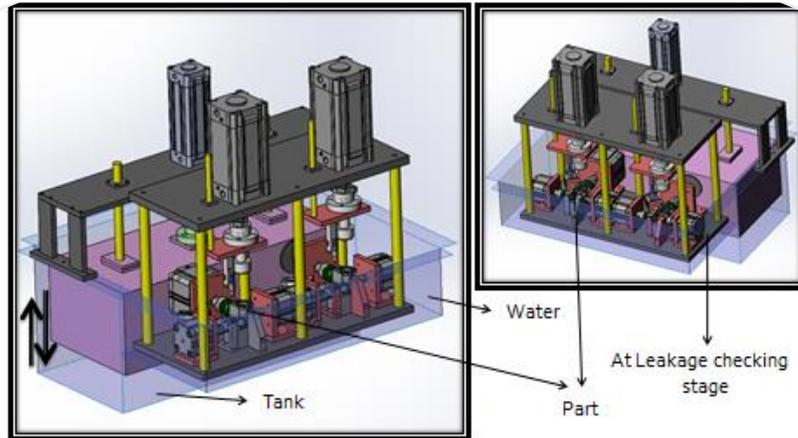


Figure 7: Solid Work Diagram of Leakage Detection Fixtures.

## COMPUTER CONNECTIVITY AND DATA STORAGE

- ✚ Lab view software is used for system data logging.
- ✚ During a test, RS232C port outputs the test data and results, continuously.
- ✚ This data includes measurements, OK/NG judgments and component parameters which can be used for subsequent analysis.
- ✚ The system can store a maximum of 1,000 measurements, depending upon the memory. Thus data retrieval makes it easy to perform further analysis.

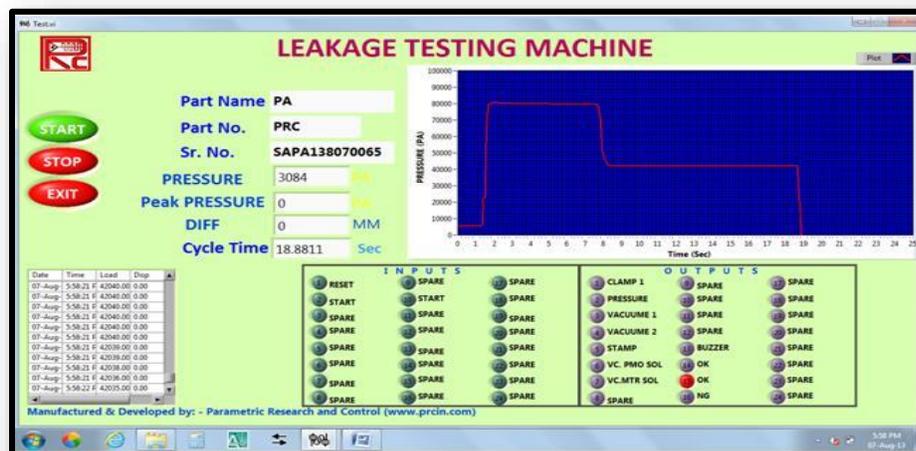


Figure 8: Lab View Software Leak Test Execution.



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## LEAK CALIBRATION

For converting the detected differential pressure to leak rate, a flow rate coefficient is required which is achieved by leak calibration. This calibration facility ensures the correct leak rate measurement. At PRC, this parameter is given a special attention to ensure the correct measurement of leak rate.

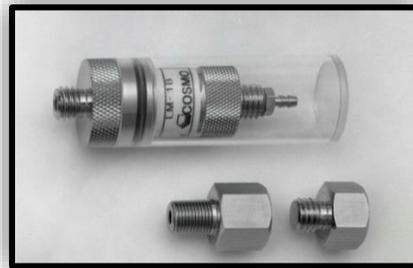


Figure 9: Leak Calibration Master Equipment.

## PARAMETRIC AIR LEAKAGE TESTERS

PRESSURE DECAY LEAK TESTER	DIFFERENTIAL PRESSURE LEAK TESTER	VACUUM LEAK TESTER
 <p>The original dry-air method is pressure decay, in which the test part is pressurized and then isolated from the pressure source. Any decrease in pressure indicates the presence of a leak. Algorithms then convert pressure changes into an approximation of leak rate.</p>	 <p>With this method, a leak-free reference volume is pressurized along with the test component. A transducer then reads the difference in pressure between the no leaking reference and the test component over time. This method is more precise and detects minor leakage than the pressure decay method.</p>	 <p>Vacuum decay, evacuates air from the test object. For this method, it is the loss of vacuum that indicates a leak, rather than loss of pressure. However, it does take more time to evacuate the air from an object than to fill it with high-pressure air, although the difference is minimal for the small volumes.</p>



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## THE HMI EQUIPMENT

Real-time graph plotting facility makes it more convenient for user to analysis the result with data storage facility. This equipment is successfully applicable for Pressure Decay, Differential Pressure, and Vacuum leak measurements.



Figure 10: Parametric Research & Control Leak Tester HMI Equipment.

### FEATURES

- ✦ EASY-TO-NAVIGATE AND OPERATE
- ✦ ELIMINATING FALSE REJECTION
- ✦ EASY TO CALIBRATE
- ✦ SELF-CHECK FACILITY PROVIDED.
- ✦ EASY MAINTENANCE
- ✦ USB PORT FOR DATA STORAGE
- ✦ SENSOR RESOLUTION IS VERY HIGH AND CAN DETECT PRESSURE DROP AS LOW AS 0.1 P.a.
- ✦ PHOENIX CONTACT CONNECTORS PROVIDED AT THE REAR PANEL
- ✦ COMPENSATION FOR ENVIRONMENTAL CHANGES.

### THE HMI OUTPUT SCREEN

Along with the on-line plotting, the HMI output screen displays the following information of the component testing status, including:

- ✦ Preset test pressure,



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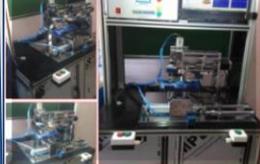
- ✚ Drop pressure,
- ✚ Calculated leak rate,
- ✚ Process cycle time,
- ✚ Component status,
- ✚ Number of parts tested,
- ✚ Type of parts tested and
- ✚ Clamping time.



SR. NO.	ENTITY	OUTPUT IN
1	TEST PRESSURE	BAR
2	DROP PRESSURE	PASCAL
3	LEAK RATE	CC/MIN
4	CYCLE TIME	SEC
5	COMPONENT STATUS	OK/NG
6	NUMBER & TYPE OF PARTS TESTED	No.s
7	NUMBER OF OK/NG COMPONENTS	No.s
8	STATUS OF ALL I/O PORTS	-

Table 2: List of Output Parameters.

## APPLICATIONS

AUTOMOTIVE COMPONENTS	ENGINEERING COMPONENTS	MEDICAL EQUIPMENTS	OTHER APPLICATIONS
 <p>Cylinder Heads, Engine Assembly, Transmission Case, Fuel Filler, Water Tanks, Fuel Pipes, Manifolds, Cam Covers, Clutch Housing, Gearboxes, Automotive Lights, Cylinder Blocks, etc.</p>	 <p>Leak Testing For Pumps, Valves, Taps, Sprinklers, Hydraulic Cylinders, Air Cylinders, Electronic Enclosures, etc.</p>	 <p>Leak Testing For Syringes, Transfusion Tubes, Tubing Sets, IV Sets, Drug Delivery Devices And Pumps, etc.</p>	 <p>Domestic Appliances, Handheld Weapons, Chilled Beam Ceiling Units, Shotgun Cartridges, etc.</p>



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# OUR LEAKAGE TESTING PRODUCTS

**MUFFLER LEAKAGE TESTING MACHINE**



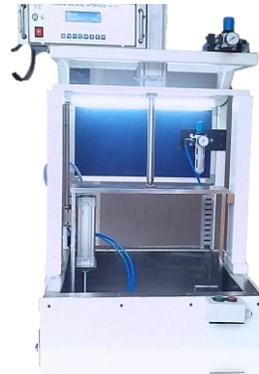
**CRANK CASE LEAKAGE TESTING MACHINE**



**CYLINDER HEAD LEAKAGE TESTING MACHINE**



**FUEL FILLER LEAKAGE TESTING MACHINE**



**RG2 LEAKAGE TESTING MACHINE**



**FUEL PIPE LEAKAGE TESTING MACHINE**



# OUR LEAKAGE TESTING PRODUCTS

**FUEL NECK LEAKAGE TESTING MACHINE**



**REAR AXLE LEAKAGE TESTING MACHINE**



**FLANGE LEAKAGE TESTING MACHINE**



**PERFORMANCE & LEAKAGE TESTING MACHINE**



**AUTOMOTIVE LIGHT LEAKAGE TESTING MACHINE**



**FILTER COVER LEAKAGE TESTER**



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