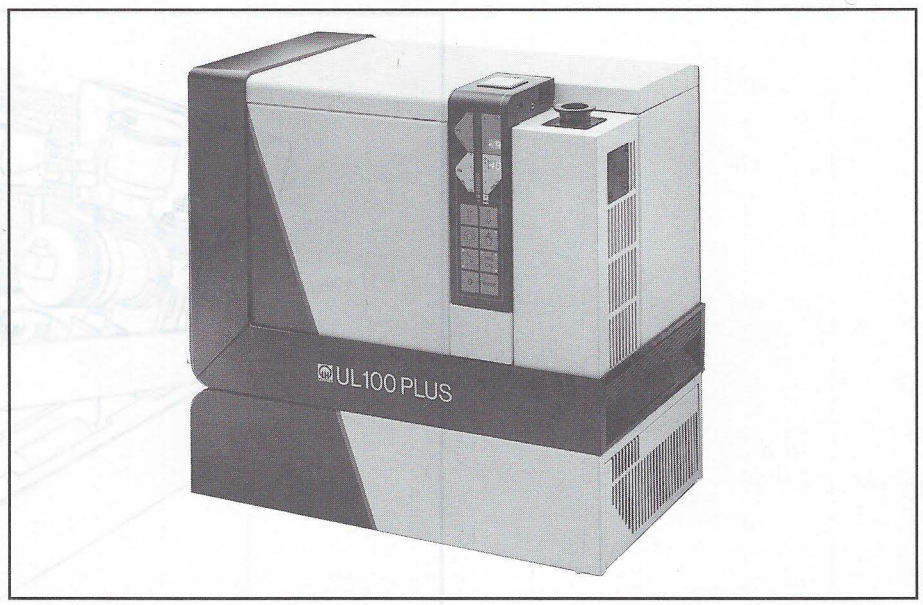
ULTRATEST® UL 100 PLUS Portable Helium Leak Detector

Helium leak detectors for general use in industry and research are increasingly expected to offer complete reliability, independent of operating conditions.

The ULTRATEST UL 100 PLUS combines advanced vacuum technology and electronics in a truly portable and top-of-the-line instrument of extremely simple handling and great mobility. Because of its light weight and compact size, this versatile helium leak detector is especially useful in field leak testing. Moreover, its multiple capabilities and wide range of accessories enable the ULTRATEST UL 100 PLUS to be easily adapted to virtually all applications and leak testing problems.



Versatile Use

As a true portable, the ULTRATEST UL 100 PLUS is particularly suitable:

- Where little space is available
- Where mobility is required (testing points at different places)
- For transport
- For rapid starting and instant turn-off.

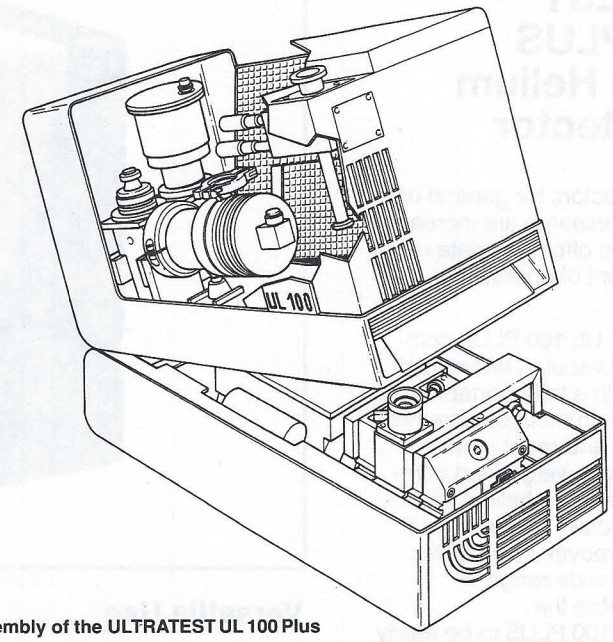
The ULTRATEST UL 100 PLUS is the ideal instrument for servicing and maintenance of:

- Process equipment, in use and during construction
- Vacuum annealing, brazing and welding systems
- Semiconductor production facilities
- Systems for high-energy physics, space simulation and nuclear research
- Chemical plants and power plants
- All types of vacuum systems
- Quality control and production leak testing is made easy with a wide range of accessories.

Outstanding benefits for users:

- Light weight and small size
- Two piece unit, consisting of upper leak detection module and lower pump modules, easily separated
- Transportable in any position by car, rail, ship or airplane
- Ready to operate in less than three minutes
- No liquid nitrogen required
- Leak tests from 0.150 torr port inlet pressure (or from 75 torr when using the gross-leak test option)
- Push-button control without manual valve actuation
- Handy control and display unit
- Automatic leak range switching (autoranging)
- Automatic zero offset compensation (autozero) by pressing one button
- Calibration with optional built-in calibrated leak
- Automatic emission switching ON/OFF
- Remote control up to 120 feet
- Detection of masses 2, 3 and 4

Contact your nearest Leybold Inficon sales office for additional information, telephone orders and technical assistance.



Module assembly of the ULTRATEST UL 100 Plus

Outstanding design features:

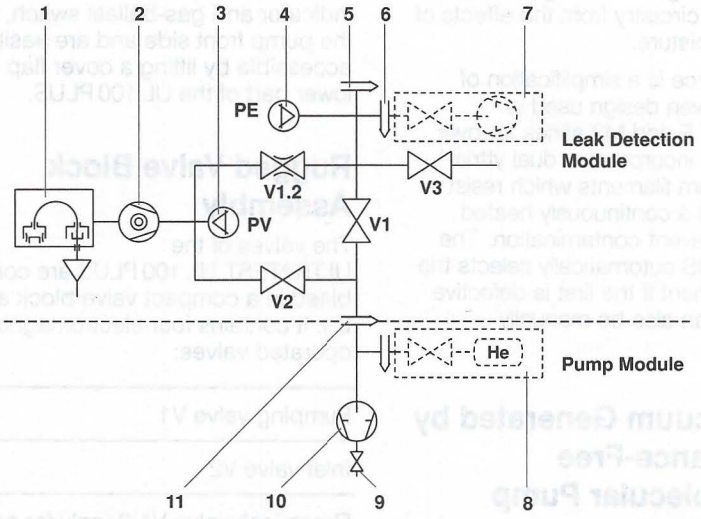
- Microprocessor controlled
- Hydrocarbon-free high vacuum generated by maintenance-free, elastically suspended, turbomolecular pump
- New, small stainless steel mass spectrometer of high resolution and stability
- Rugged, hermetically sealed, solid-state electrometric preamplifier
- Key-operated switch to lock different testing programs
- Leak rate indication by 30-segment LED bar display, covering 2 decades with digital range exponent display
- Two freely selectable trigger points for different leak rate thresholds
- Very small, hand-held test control unit due to SMD (Surface Mounted Device) technology
- RS232 interface
- Chart recorder output for measured leak rate and range index
- External triggering of leak test function

Compact Construction

The ULTRATEST UL 100 PLUS consists of two compact assemblies which are easily joined or separated in a few simple steps.

The upper assembly is the leak detection module. It includes the valve block with automatically controlled, electromagnetically-actuated valves, the air-cooled, maintenance-free TURBOVAC® TMP50 turbomolecular pump, the newly-developed magnetic sector mass spectrometer, and complete solid-state electronics. The self-contained test control and display unit is detachable from the module and has a 25 feet coiled cord for a wide range of action.

The lower assembly is the pump module. It includes the backing pump TRIVAC® D1.6B, complete with exhaust filter and outlet shutoff valve.



Layout diagram of ULTRATEST UL 100 PLUS

1 Mass Spectrometer
2 TURBOVAC TMP50 turbomolecular pump
3 Total pressure gauge point, fore-vacuum (THERMOVAC)
4 Total pressure point, inlet (THERMOVAC)
5 Test port DN KF*25
6 2nd lateral test port DN KF25 or connection for partial flow test option
7 Partial flow pump (option)
8 TL 7 He calibrated leak (option)
9 Outlet shut-off valve
10 TRIVAC D1.6B rotary vane vacuum pump
11 Disconnecting port between UL 100 pump module and detection module
V1 Pumping valve
V2 Inlet valve
V1.2 Gross leak valve
V3 Venting valve

Five Operating Modes

Because the detection and pump modules are separated in the ULTRATEST UL 100 PLUS, five different operating modes are possible.

1. The standard mode, using the complete UL 100 PLUS (detection and pump modules). The UL 100 PLUS is a compact, fully automatic and complete helium leak detector with direct read-out quantitative leak rate indication. The integrated TRIVAC fore-vacuum pump evacuates smaller test piece volumes. In addition, the UL 100 PLUS can be connected to any part of a vacuum system at a pressure of less than 150 mtorr.
2. The UL 100 PLUS complete with Partial-Flow Pump assembly (See UL 100 PLUS Options). In this combination, the high pumping speed (approximately 11 CFM) at the test port allows large volumes and contaminated equipment to be tested. Leak location and measurement can be started at 75 torr inlet pressure.
3. The UL 100 PLUS leak detection module, with external backing or fore-vacuum pump. In this mode, the detection can be operated with any other suitable fore-vacuum pump, when a higher pumping speed at the test port and shorter pump-down times are required.
4. The complete UL 100 PLUS, equipped with the QT 100 PLUS sniffer system (See UL 100 PLUS Options). This combination provides the ability to sense leaks in pressurized parts or vessels. Standard probe length is 16 feet; hose of up to 100 plus feet can be fitted.
5. The UL 100 PLUS leak detection module only. The detection module, without the pump module, can be connected via its test port to any vacuum system at a pressure of less than 150 mtorr. It then operates as a leak detector, without the need for its own backing or fore-vacuum pump.

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No Cold Trap Owing to the Counter-Flow Architecture

The ULTRATEST UL 100 PLUS operates on the counter-flow principle. The test port is not connected through an inlet valve directly to the mass spectrometer, as in conventional helium detectors. Instead, it is connected to the backing or fore-vacuum side of the turbomolecular pump. The principle is based on the different compression ratios attained by turbomolecular pumps for various gases. While the compression ratio is very small for light gases (e.g. helium), it is much higher for heavier gases (e.g. air or water vapor). This enables the trace gas helium to diffuse backward through the turbomolecular pump to the mass spectrometer where it is detected, while the gases of higher molecular weight are pumped out. The turbomolecular pump thus acts as a helium-permeable filter, while protecting the mass spectrometer from all other gases (e.g. condensable vapors) and especially from contamination. Therefore, a cold trap and protection by liquid nitrogen are no longer necessary.

New Design Mass Spectrometer

High resolution and maximum sensitivity combined with minimum weight are achieved by a magnetic sector mass spectrometer with 180° magnetic deflection and Z focusing. The small size of this mass spectrometer allows it to fit easily into the portable UL 100 PLUS. Although the design is optimized for detection of helium, it can also be used for masses 2 and 3 by switch selection. The stainless steel welded housing incorporates a 40 mm diameter vacuum flange, assuring that the full 33 liters per second pumping speed of the turbomolecular pump is delivered to the mass spectrometer. This provides rapid evacuation on start-up and continuous freedom from contamination. In addition, the magnets are made of samarium cobalt which has a very low thermal coefficient and low weight. The preamplifier, amplifier, and range-switching circuits are mounted on the mass spectrometer in an inert-gas-filled, hermetically-sealed housing. This design protects all sensitive circuitry from the effects of dust and moisture.

The ion source is a simplification of the well-proven design used in ULTRATEST F and M2 series for over a decade. It incorporates dual yttria-coated iridium filaments which resist burnout and a continuously heated anode to prevent contamination. The UL 100 PLUS automatically selects the second filament if the first is defective. Filaments can also be manually selected.

High Vacuum Generated by Maintenance-Free Turbomolecular Pump

The turbomolecular pump used as the high-vacuum pump offers definite advantages over an oil diffusion pump, which is often employed in helium leak detectors. Some of these advantages are:

- Hydrocarbon-free vacuum in the mass spectrometer
- Minimum start-up and stop times
- High-stability indication of the leak rate, due to constant helium compression ratio of the turbomolecular pump
- Completely forgiving of accidental air bursts

The single-ended, axial-flow TURBOVAC TMP50 used in the ULTRATEST UL 100 PLUS is the smallest and lightest turbomolecular pump of the Leybold product line. It is air-cooled and has additional outstanding benefits, such as:

- Life-time lubrication of the ceramic ball bearings, making it maintenance-free
- Integrated rotor/spindle assembly, ensuring maximum precision of bearing guidance and thus minimum wear on the ball bearings

Also, a two-stage TRIVAC D1.6B rotary vane vacuum pump, used as the backing pump, is lightweight and compact.

Important controls, such as the oil-level indicator and gas-ballast switch, are on the pump front side and are easily accessible by lifting a cover flap at the lower part of the UL 100 PLUS.

Rugged Valve Block Assembly

The valves of the ULTRATEST UL 100 PLUS are combined in a compact valve block assembly. It contains four electromagnetically operated valves:

- Pumping valve V1
- Inlet valve V2
- Gross-leak valve V1.2 (only for partial-flow gross leak testing)
- Venting valve V3

The valve block also accommodates two pressure measurement points (Pirani gauges) to check inlet pressure (PE) and fore-vacuum pressure (PV), the test port with KF®25 flange, and a side port of equal flange size to connect the gross leak-test option. When the UL 100 PLUS is delivered from the factory, this connection port is closed by a blank-off plate.

New Sealing System Minimizes Helium Absorption

Flat gaskets of a new high-grade, synthetic material that offers maximum security against helium permeation and absorption seal the mass spectrometer detection system and the vacuum system.

Formerly such low permeation rates could only be achieved by use of metal gaskets. The new synthetic elastomer flat gaskets are resistant to shock and vibration and can even be re-used. They provide a very reliable seal, even against helium, while being easier to service.

Latest Microprocessor-Based Electronics

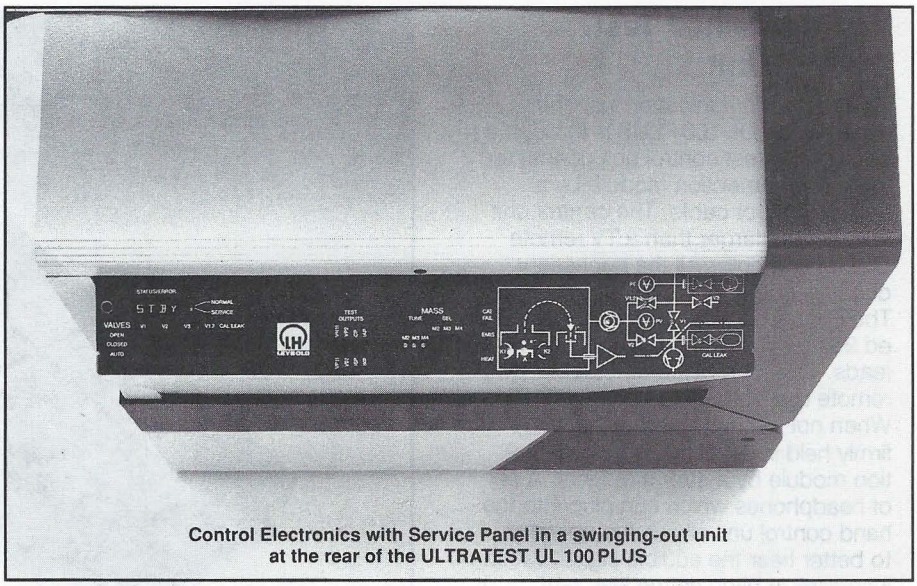
The complete leak testing cycle in the ULTRATEST UL 100 PLUS, as well as signal processing and conversion, are microprocessor-controlled. All internal operational steps, from initiation of evacuation to actual leak testing to switching-off, are fully automated. Valve actuations occur in the correct sequence. This precludes operator errors.

Automatic range selection (autoranging) of the correct sensitivity range and operating mode is standard in the ULTRATEST UL 100 PLUS. The unit is switched from autoranging to manual range selection simply by pressing a button. Automatic zero correction (autozero) can be triggered any time. To facilitate leak detection and direct reading of the leak rate where there is a high helium background, simply press a button on the hand-held test control unit.

The built-in autocalibration feature enables fast and simple tuning of the ULTRATEST UL 100 PLUS. The cathode (emission) is automatically switched on at the correct pressure.

The microprocessor provides comprehensive internal safety and monitoring function, such as:

- Continuous monitoring of inlet and fore-vacuum pressure
- Checking of TURBOVAC TMP50 rotational speed
- Filament turn-off when pressure is too high
- Instant closing of the inlet valve if the pressure gets too high
- Display of fault codes as a service aid



Control Electronics with Service Panel in a swinging-out unit at the rear of the ULTRATEST UL 100 PLUS

Control Electronics with Service Panel

The complete power control electronics for the mass spectrometer and the internal interfaces to the microprocessor are located in a swing-out unit at the rear of the ULTRATEST UL 100 PLUS leak detection module.

The front panel of the electronics displays useful information about the leak detector, including:

- Vacuum flow chart with LEDs displaying the current status of all valves and pumps, as well as essential functions of the mass spectrometer
- LEDs for cathode and emissions failure
- Mass selector and one trimming potentiometer each for masses 2, 3 and 4
- Test outputs to check instrument voltages in troubleshooting
- Flip switches for manual control of each individual valve in service mode
- 4-digit alphanumeric display field for status or failure-code indication

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Self-Contained Test Control Unit

Operator communication with the ULTRATEST UL 100 PLUS is through a detachable test control unit connected to the leak detection module by a flexible 25 foot cable. The control unit is not much larger than a TV remote control and holds all the necessary displays and controls for leak testing. The connecting cable can be extended 95 feet using the optional extension leads. This long distance cable allows remote use of the test control unit. When not used, the test control unit is firmly held in its recess on the detection module by a strong magnet. A set of headphones which can plug into the hand control unit allows the operator to better hear the audible signal, which increases in pitch as the leak rate rises.

Hand-held test control unit of ULTRATEST UL 100 PLUS

The handy self-contained test control unit incorporates three functions:

Control section with start and stop/vent switches, which direct all leak testing functions, signaled by a red/green status display

Display section with combination display of inlet and fore-vacuum pressure (during evacuation) and display of leak rate by 30-bar LED array and numerical exponent display covering 2 decades

Programming section, only for preselection of parameters or special functions, not used for leak testing. This includes threshold and volume settings for the audible leak signal and selection of two independent trigger points for desired leak-rate threshold signals. In addition, it includes the calibration and re-zeroing function.

Multifunction Output

The ULTRATEST UL 100 PLUS is equipped for communication with a great variety of auxiliary apparatus. A 25-pin receptacle provides analog outputs for leak-rate and range identification and floating relays for the two selectable trigger points of leak-rate threshold signals. The leak detector functions (pumping, venting, stop) can be externally commanded by relay or switch closure. Also, a standard serial transfer interface (RS232) is available to connect the ULTRATEST UL 100 PLUS to a printer, programmable logic controller or a computer.

The analog outputs are also available on an adjacent 6-pin connector, and the RS232 functions on an adjacent 9-pin connector.

ULTRATEST UL100 PLUS Options

Calibration Leak TL7

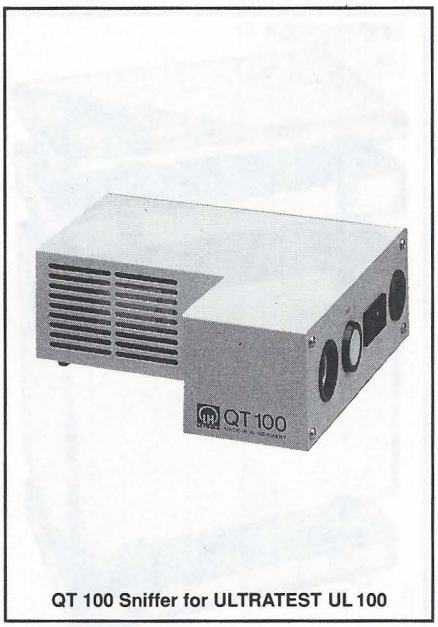
The calibrated leak includes its own helium reservoir and has a leak rate in the 10^{-7} mbar ltr/sec range. It is supplied with a solenoid valve and connection fittings. It is incorporated into the UL 100 PLUS and is triggered via the calibration programming button, thus enabling simple calibration of the leak detector.

Helium Sample Probes (Sniffers)

The QT 100 Sniffer provides fast response in testing pressurized parts. Leak rate response is approximately $^1/_{1000}$ of the leak size. Hose lengths to 100 feet can be used.

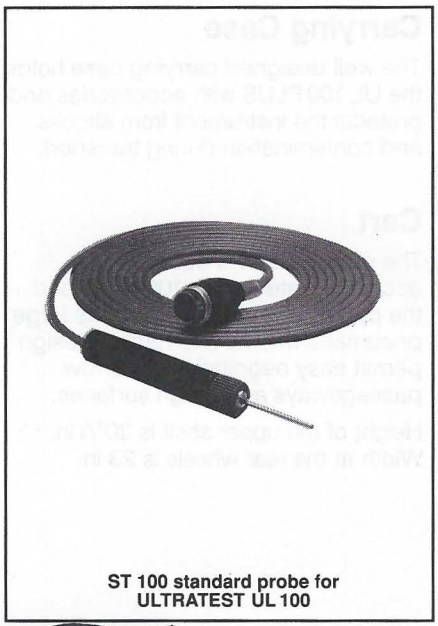
Refer to page 15.25 for technical discussion of the Quick-Test and ST 100.

The ST 100 standard probe incorporates an evacuated hose of 10 foot length. Flow impedance is at the probe tip; longer hoses are not recommended. Indicated leak rate is the true value of the helium entering the probe.



QT 100 Sniffer for ULTRATEST UL 100

Part No. 15594-1



ST 100 standard probe for ULTRATEST UL 100

Part No. 15590

Contact your nearest Leybold Inficon sales office for additional information, telephone orders and technical assistance.

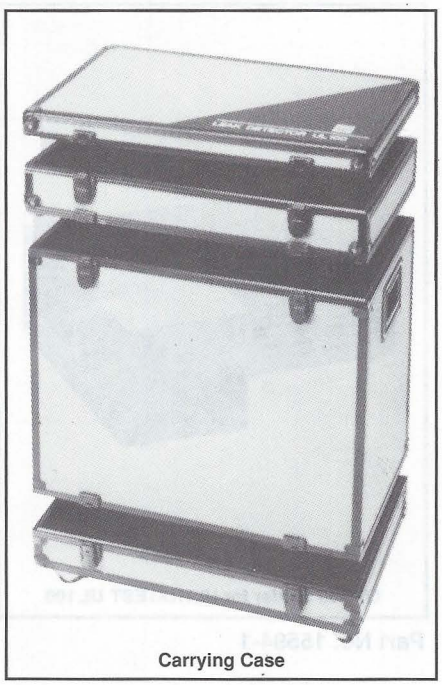
Carrying Case

The well designed carrying case holds the UL 100 PLUS with accessories and protects the instrument from shocks and contamination during transport.

Cart

The optional cart is designed to accommodate the UL 100 PLUS and the partial flow pump system. Its large pneumatic wheels and narrow design permit easy negotiation of narrow passageways and rough surfaces.

Height of the upper shelf is $30^{1}/_{4}$ in. Width at the rear wheels is 23 in.



Carrying Case

ULTRATEST UL 100 PLUS shown with Partial Flow Pump Option and Cart

Partial Flow Pump Option

Incorporating a D16B (11.9 CFM) pump and automatic valving, this option permits quick testing of large or contaminated parts. The UL 100 PLUS (and the start and stop/vent buttons on the handpiece) controls the external valve, providing rapid evacuation, response and clean up.

Testing can start at 75 torr. The UL 100 PLUS automatically sequences its valves to permit detection of leaks from 10 ATM cc/sec to 1×10^{-9} ATM cc/sec.

Included in the partial flow option are:

- TRIVAC D16B rotary vane pump (110V, 60 Hz)
- Electromagnetically-operated valve with control and power cable, including plug to connect to the leak detection module
- Stainless steel flexible vacuum line, 40 inch length, with KF25 fittings
- Exhaust demister for D16B pump

The electromagnetic valve, with its cables, is available for cases when a suitable auxiliary pump is already available.

Technical Data

Specifications	
Smallest Detectable Helium Leak Rate ..... mbar ltr/sec*	2×10^{-10}
Range of Leak-Rate Indication ..... mbar ltr/sec	2×10^{-10} to 1×10^{-2}
With Partial Flow Pump Option ..... mbar ltr/sec	1×10^{-9} to 1
Display	2 logarithmic decades at a time, numerical exponent display, automatic or manual range switching
Maximum Admissible Inlet Pressure ..... torr (mbar)	0.150 (0.2)
With Partial Flow Pump Option ..... torr (mbar)	75 (100)
Maximum Admissible Gas Flow Rate Throughput ..... mbar ltr/sec	6×10^{-2}
With Partial Flow Pump Option ..... mbar ltr/sec	600
Leakage Signal Response Time (63% of Peak Value) ..... sec	1
Leak-Rate Display Range ..... decades	7
With Gross Leak Test Option ..... decades	9
Start-up Time ..... min	<3
Mass Spectrometer	Stainless steel 180° magnetic sector
Ion Source	2 burnout-proof yttria-coated iridium cathodes
Detectable Masses ..... AMU	2, 3 and 4
Test Connection	2 x KF25
Test Control Unit Cable Length, Extended ..... ft	25
Vacuum Pump System	
Backing Pump (In Pump Module)	TRIVAC D1.6B
Pumping Speed (Volume Flow Rate) ..... CFM	1.1
High-Vacuum Pump (In Detection Module)	TURBOVAC TMP50 L
Pumping Speed (Volume Flow Rate) ..... ltr/sec	33
Inputs/Outputs	
Leak-Rate, Linear (Min. Internal Resistance of Recorder, 2.5 kOhms) V	0 to 10
Leak-Rate, Exponent (In 1 V Steps Per Decade), (Min. Internal Resistance of Recorder, 2.5 kOhms) V	-4 to 9
Leak-Rate Threshold Triggers	2 floating output relays, independent of each other
Switching capacity ..... V (A)	60 (1), N.O. or N.C. SPST
Switching Capacity (Max.), 60 V (Ohmic Load) ..... A	2
External Triggering Of Leak Detector Functions ..... V DC	24 to 48
Serial Digital Communication	RS232

* mbar ltr/sec = atm cc/sec (within 2%)
Leybold Inficon products are constantly improving; therefore, specifications are subject to change without notice.

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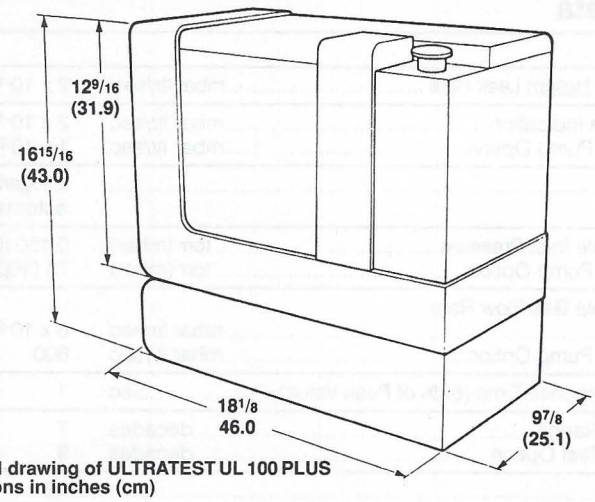
Dimensional Data



Dimensional drawing of ULTRATEST UL 100 PLUS
All dimensions in inches (cm)

Technical Data

Power Requirements		
Leak Detection Module		
Voltage (Selectable)	V	120/220/240
Frequency	Hz	50/60
UL 100PLUS		
Voltage, Frequency	V	120,50/60
Power	VA	320
Pump Module		
Voltage	V	110
Frequency	Hz	50/60
Leak Detection Module		
Voltage, Frequency	V	120,220,240 (Selectable) 50/60 Hz
Power	VA	80
Weight		
Leak Detection Module	lb (kg)	44 (20)
Pump Module	lb (kg)	30 (13.5)

Ordering Information

Model	**Catalog No.**
ULTRATEST UL 100 PLUS Helium Leak Detector	89638-10
With Calibrated Leak Built-In	89638-11
Upper Module Only	15583-1
Options (See page 15.24 for Accessories)	
Calibrated Leak TL 7 (For Installation)	15593
Complete with solenoid valve and adapter kit, with He reservoir, calibration range 10^{-7} mbar ltr/sec	
Partial Flow Pump Option	16544-2
Valve Only, Automatic	28752-2
Cart	070-582
Carrying Case	15597

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