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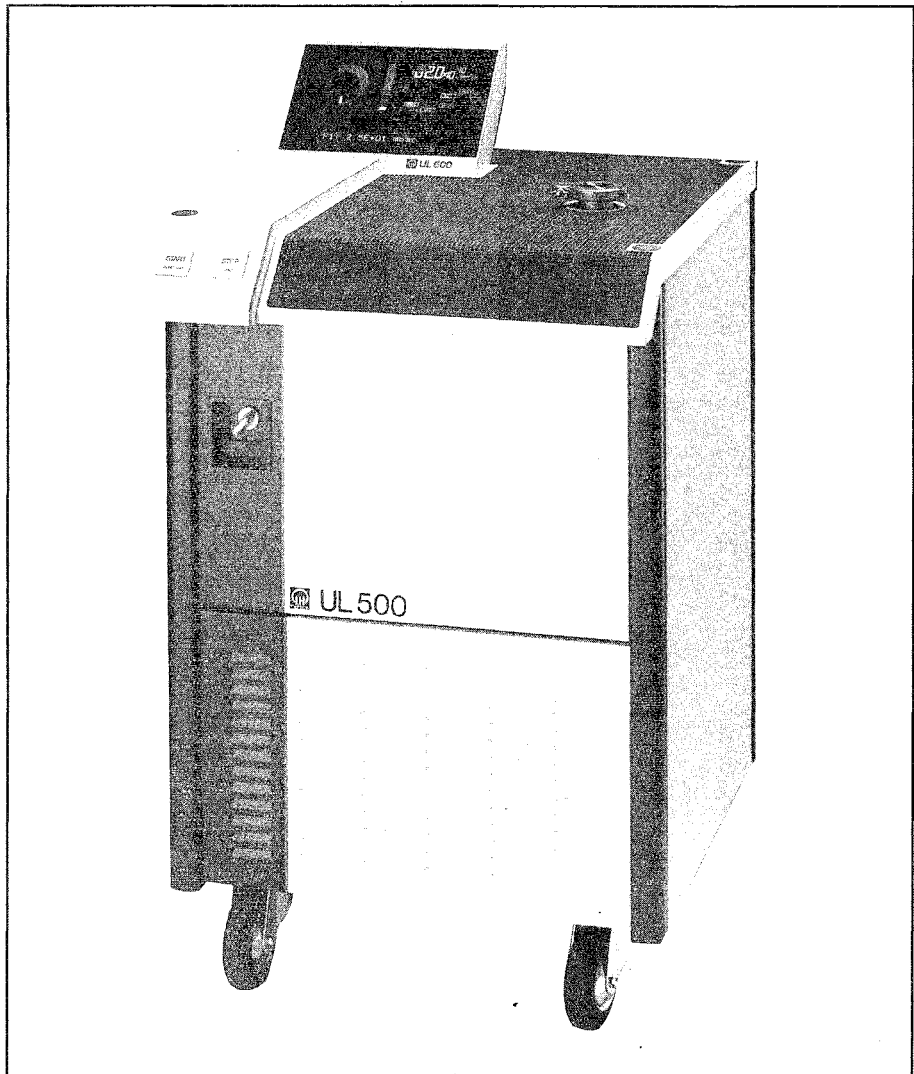
ULTRATEST UL 500 Helium Leak Detector

The ULTRATEST UL 500 is an intelligent leak detector of a new generation. Its design caters to both vacuum and overpressure leak detection methods.

Its main field of application lies in quality control of all types of components, beginning with small sized test objects with volumes of less than a cubic inch up to large components having volumes of many cubic feet. The unit is as well suited for single tests as for leak testing of large quantities at high test rates and short cycle times.

The ULTRATEST UL 500 is provided with an almost hydrocarbon-free inlet system, optimized for extremely clean test samples or systems in research and industry.

The two microprocessors controlling the unit comprise an expert system for leak detection, depending on the test method in use. A completely new vacuum concept yields results in extremely short pumpdown and response times. Because of this, the ULTRATEST UL 500 can be applied in almost all industrial areas.



Applications

The ULTRATEST UL 500 is ideal for testing many components and assemblies. For example, in the:

Electrical industry

Current feedthroughs, indicating instruments, capacitors, transformers, etc.

Electronics industry

Transistors, IC's, relays, crystals, heart pacemakers, vacuum tubes, etc.

Refrigeration and air conditioning industry

Compressors, thermostats, evaporators/condensers, heat pumps, valves, etc.

Automobile industry

Cooling systems, gasoline tanks and lines, torque convertors, braking systems, etc.

Container assembly

Pressure vessels, liquified gas and cryogenic tanks, boilers, etc.

Packing industry

Cans, barrels, food packaging, etc.

Instrumentation industry

Pressure reducing apparatus, pressure sensors, membranes, weighing cells, etc.

Research

Fusion systems, accelerators, space simulation, etc.

Vacuum Technology

Vacuum Process
EngineeringMeasuring and
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Operation

Fast and simple operation

During the development of the ULTRATEST UL 500, special emphasis was placed on the simplicity of the operator interface, resulting in the following features:

Warm-up time less than 5 minutes after start

Fully automatic start-up with comprehensive self-tests

Automatic repetition of a programmed mode of operation after start

No cold trap and no liquid nitrogen

Convenient operation by two main push buttons; no manual operation of valves

Helium sensitive leak testing from inlet pressures starting at atmospheric pressure

Quantitative leak testing from inlet pressures starting at 100 mbar (75 torr)

Alphanumeric display with messages to the user

Fast automatic range switching (AUTORANGING)

Automatic zero correction for suppression of the helium background (AUTOZERO)

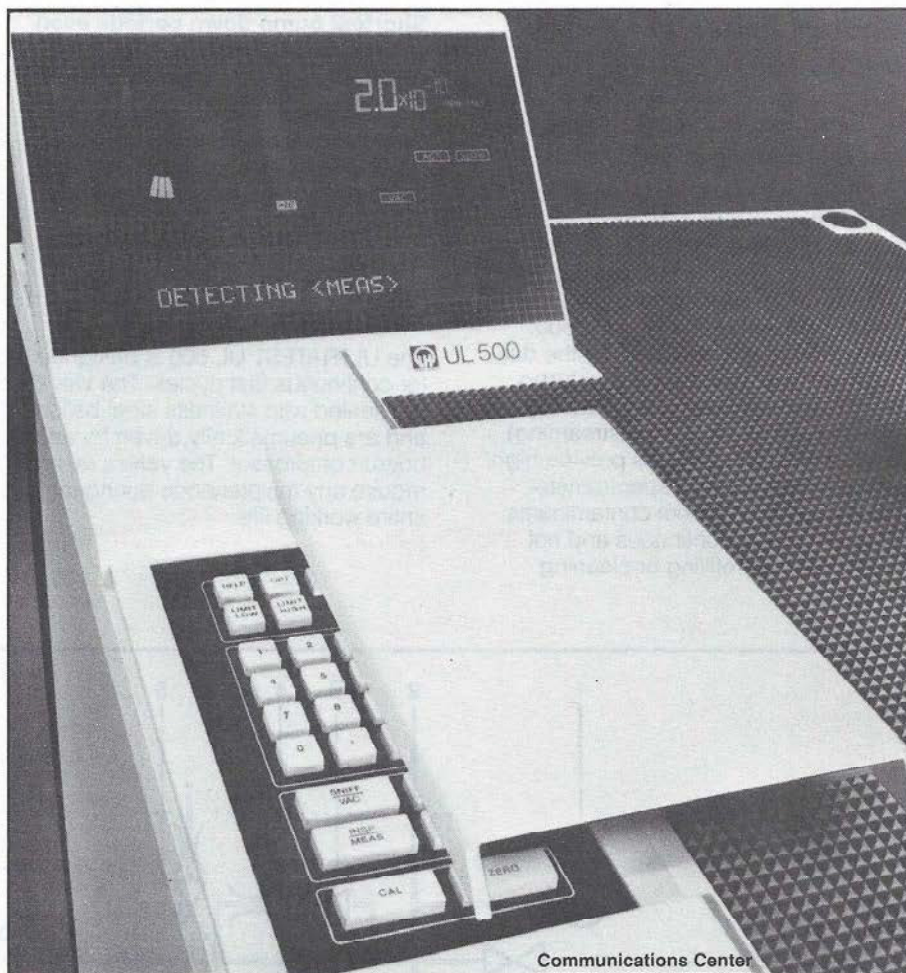
Adaptable to special applications with comprehensive measurement and display options which can be selected with a clearly arranged keyboard

Clear display for easy interpretation of the test results

The ULTRATEST UL 500 incorporates:

A large, clearly arranged, easy-to-read LCD display (2×10^{-10} atm cc/sec to 1000 atm cc/sec)

A completely new display of the entire measurement range via circular analog display and a digital display



Acoustic and optical warning indications when exceeding preprogrammed leak rate thresholds

A clearly audible audio signal which may be shifted over the entire measurement range

Clear text status display

Applications

Advanced design for integration into fully automatic test systems.

While the basic concept of the ULTRATEST UL 500 is that of an easy-to-operate unit, its design incorporates all the features necessary to be part of a fully automatic system.

The basic model is prepared for the addition of an RS232C interface. Thus, the interface is fully integrated into the local operating processes, so that all

functions of the unit may be remotely controlled via the interface. The data may be transferred to a computer or a printer.

Continuous short cycle operation with the shortest possible response periods, even with large test objects.

The usual disadvantage of the counter-flow principle, namely long response times in the case of large test objects, due to the low pumping speeds, does not apply to the ULTRATEST UL 500.

The combination of the rotary vane pump TRIVAC D25B with a special turbomolecular pump produces a very high pumping speed for helium at the inlet flange (more than 2 liters/sec), resulting in response times of less than 1 second with a 10 liter test object. The use of maintenance-free pneumatically operated long-life valves provides the basis for continuous short cycle operation.

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Special Features

No Cold Trap

The counterflow principle employed in the ULTRATEST UL 500 makes the use of a cold trap superfluous.

In conventional leak detectors, the liquid nitrogen trap provides high pumping speeds for condensable vapors and protects the mass spectrometer from contaminants, at least when the trap is full. In the UL 500, these effects are achieved by the dual actions of the patented 3-port turbo pump. The inlet stages provide high speed (and block all backstreaming), and the opposing stages provide high vacuum for the mass spectrometer, while protecting it from contaminants. This process is continuous and not dependent on refilling or cleaning traps.

Shortest pump down periods even with contaminated and large test objects

The large roughing pump (21 CFM) evacuates even large and dirty parts reliably, without the need to re-adjust cross-over pressures or worry about loading a cold trap.

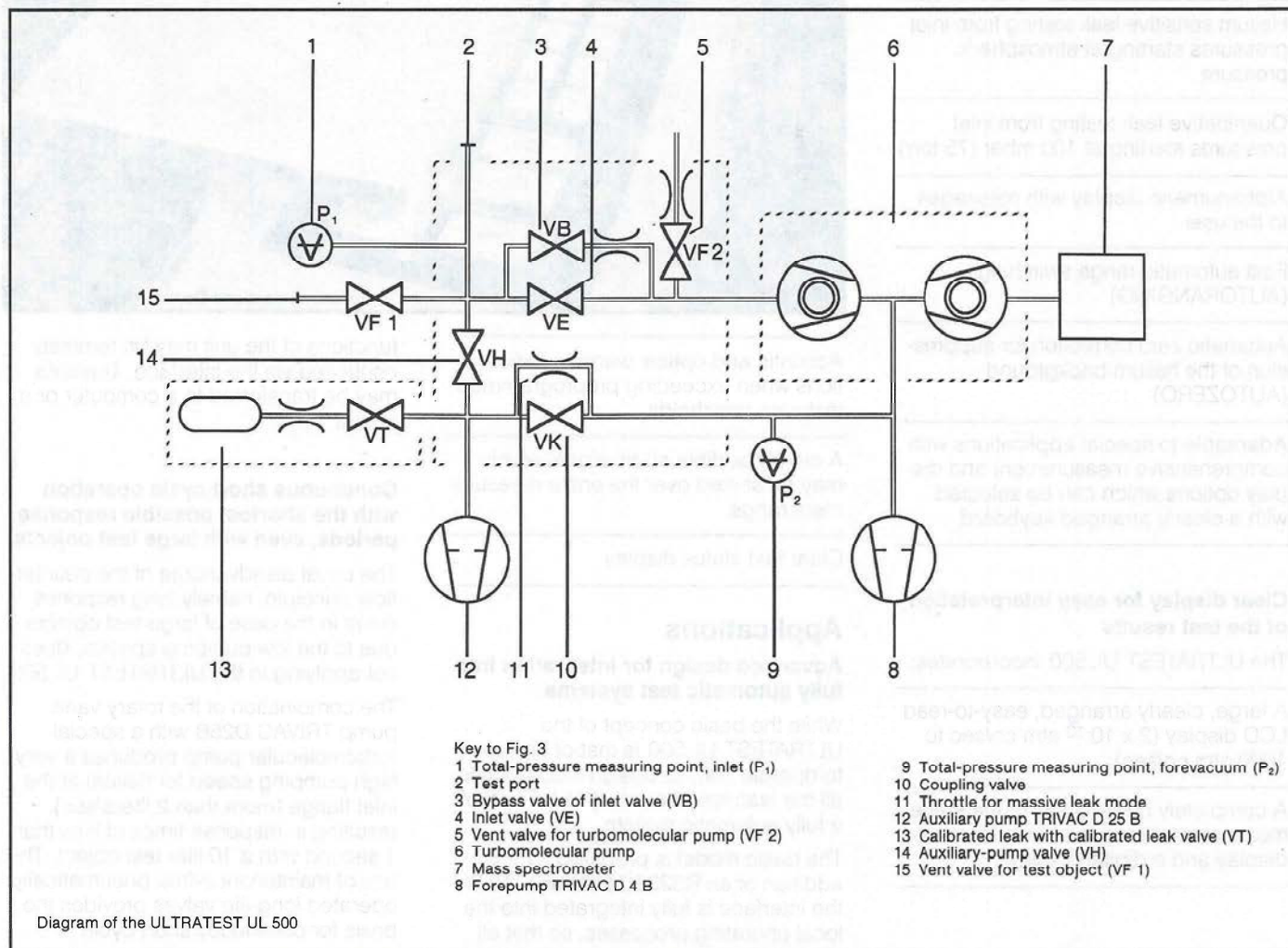
Long life of the pneumatically actuated valves

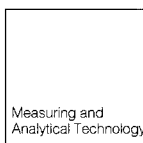
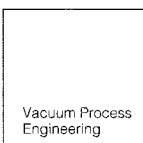
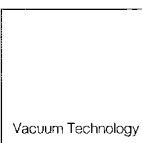
The ULTRATEST UL 500 is designed for continuous fast cycles. The valves are sealed with stainless steel bellows and are pneumatically driven by an on-board compressor. The valves do not require any maintenance during their entire working life.

Trouble-free seals of a new design

The entire vacuum system of the ULTRATEST UL 500 utilizes a new flat polymer gasket developed by Leybold. These gaskets have a helium permeation rate nearly as low as metal seals, while providing reuseability.

In addition, these plastic gaskets are very tolerant of shock and vibration and their installation requires no more skill or precision than do o-rings.





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Measurement

Stability, reliability and precision are achieved by:

True automatic tuning to mass 2, 3 or 4

True automatic tuning to the built-in calibrated leak or an external leak

True fool-proof operation due to micro-processor control and monitoring

Highest possible reliability and accuracy of measured values through a complete range of automatic functions

In order to guarantee a high degree of accuracy in the measurements made with the ULTRATEST 500, the control processor carries out different automatic routines and monitoring functions.

The AUTORANGE process provides the most sensitive range for a given leak rate by selecting the correct valve and amplifier settings. This ensures a high resolution over the entire range. The switching operation is performed so quickly that the displayed values will always be correct. A qualitative leak rate indication is possible starting with the inlet at atmospheric pressure.

Because of the AUTOTUNE process, the mass spectrometer is always optimally adjusted to the programmed mass. In doing so, the ULTRATEST UL 500 does not need any external aids, as a helium calibrated leak is already built-in. An adjustment to mass 2, 3 or 4 can be selected.

As the AUTOZERO loop is carried out continuously, the control processor is in a position to detect an internal helium background and to automatically suppress it. In this process, drifts due to aging, temperature influences and helium contamination are measured and then taken into account in the display of the measured values. Should these values exceed certain limits, the user is automatically informed.

In order to ensure that the quantitative display of the leak rate is always correct, the user may call up an automatic calibration process (AUTOCAL), which makes use of either the built-in calibrated leak or an externally connected calibrated leak. In the case of using an external calibrated leak, the user is

guided by the display of the ULTRATEST UL 500.

Dynamic measurement range of 14 decades

The preamplifier provides three states of amplification, automatically switched. Together with the flexibility of the pumping and valving system, this provides helium sensitivities from 1000 atm cc/sec down to 2×10^{-10} atm cc/sec. Accuracy and precision are provided from 75 torr inlet pressure and 10 atm cc/sec downward.

Highest accuracy due to an especially stable mass spectrometer

The stability of the calibration of a mass spectrometer, which is in continuous use over prolonged periods of time, is of considerable significance. The sector field mass spectrometer, as used in the ULTRATEST UL 500, is able to meet the highest expectations in this respect.

Signal stability is very high because of the high intensity field and low temperature coefficients of the rare earth magnets, heated anode and large internal spacings. As all internal potentials are fixed, no further calibrations are required, except for the adjustment of the anode potential for full scale reading; even this is carried out by the software-based AUTOTUNE function.

Microprocessor Control

There are two microprocessors on board, one to control and monitor the pumping and spectrometer functions, and one for the display, keyboard, and external communications.

Automatic control via an independent control processor

The control processor monitors and controls all pumping, valving and leak detection functions. This includes the rotation and temperature of the turbomolecular pump and current drawn by the TRIVAC rotary vane pumps, valve positions, pressures, emission current, etc. Because it is not involved in display or functions, the control processor can react quickly to all changes in status, thereby insuring the correct operation of the leak detector.

Simple operation due to a special communications processor

The second microprocessor of the ULTRATEST UL 500 simplifies operations for the user. Because of this communications processor, extensive operating information is displayed and entry of incorrect operating commands is prevented.

Basic leak/testing functions are controlled by two main push buttons: START and STOP/VENT. During normal operation, no other commands are required. For special applications and to establish different operating modes, a clearly arranged keyboard is provided for entering all commands.

All user-relevant information is displayed on an attractively arranged, easy-to-read display. This display consists of a number of different areas for quasi-analog display of leak rate, a digital display for readout of measured values, and lighted areas for status indication of the leak tester. Additional selected values and user guiding test can be viewed on a universal alphanumeric display.

A variable-pitch audible signal and a 0-10 Volt recorder output for the leak rate or the pressure are incorporated.

Highest possible reliability due to modern circuit design techniques

Besides the use of two microprocessors with comprehensive self-test facilities, special emphasis was placed on the circuit design of all the other modules within the unit.

This is especially true for those modules which incorporate the power electronics; these have been developed following the latest low-loss concepts. The "cool" circuits of the DC power supply, the mass spectrometer supply and the supply of the turbomolecular pump virtually guarantee a long life for all the components used.

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Moreover, the ULTRATEST UL 500 offers:

Microprocessor-supported troubleshooting for service

Recorder output for leak rate, measurement range, pressure values

RS232 interface

Completely new ways of making measurements (Helium concentration, quantitative sniffing methods, etc., microprocessor-supported)

Internal monitoring via a large number of internal sensors

All components which make up the vacuum system of the leak detector are monitored by special modules which, in turn, are monitored by the control processor.

The **turbomolecular pump supply** controls the turbomolecular pump and monitors the:

Rotational speed of the pump

Pump current

Pump temperature

Pump supply voltage

The **power distribution system** switches all motors and valves and monitors the:

Current consumption of the rotary vane pumps

Current consumption of the compressor motor

Positions of the pneumatic valves

Current consumption of the electro-magnetic valves

The **mass spectrometer supply** provides all the necessary voltages for operation of the mass spectrometer and monitors the:

Anode voltage

Emission current (automatic cut-out)

Cathode current (automatic switching to the second cathode)

The **control module** collects all the signals from the other modules, prepares them for the control processor, and additionally monitors the:

Pressure at the inlet with a Pirani gauge

Pressure in the fore-vacuum with a Pirani gauge

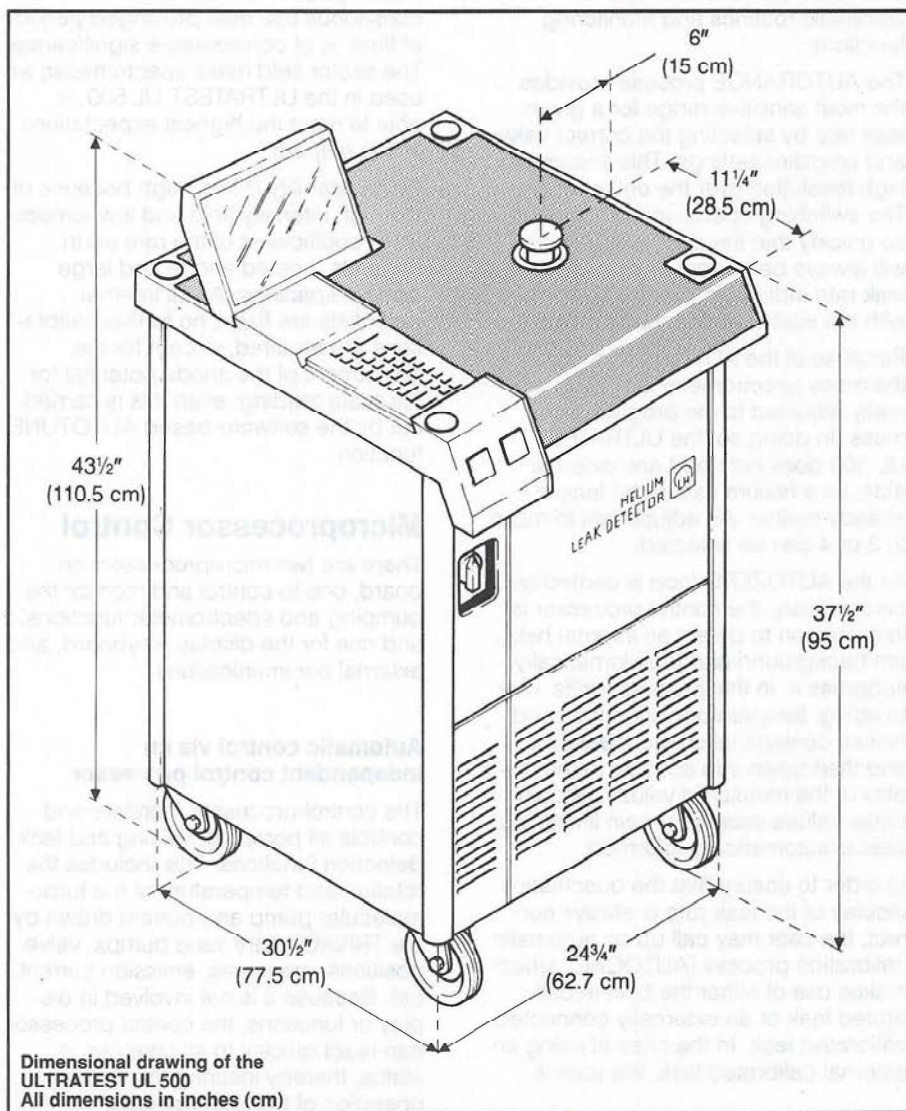
Operation of the pressure sensors (short circuit, open circuit)

Pressure within the compressed air reservoir

Temperature of the entire unit

Presence of the supply voltages

In addition, the control module contains an internal interface connected permanently to the communications processor.



Vacuum Technology

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Service and Maintenance

Simple diagnosis by software-supported functions

The ULTRATEST UL 500 is provided with a special servicing mode for especially simple troubleshooting within the entire vacuum system. The maintenance functions are entered via the user keyboard. All components may be separately actuated and may, therefore, be tested either manually or semi-automatically. Because of the modular electronics of the ULTRATEST UL 500, and test points on all modules, the fault locating process is speeded up considerably, so that faults can usually be rectified by simply exchanging the module in question.

System concept which hardly requires any maintenance

As the ULTRATEST UL 500 does not contain a cold trap, diffusion pump, or cold cathode gauge, maintenance for these parts is eliminated.

The only requirements are to refill or change the oil of the backing pump and roughing pump and to replace the dust filters, if contaminated. A replacement of the ion source is only required after several thousand operating hours, as cathode 2 is automatically switched on if cathode 1 fails.

All maintenance can be carried out immediately after turning off the unit, and it is ready to work again in five minutes or less after turning it back on.

Easy access to all important equipment components via the front panel

The ULTRATEST UL 500 is arranged to provide easy access for all service functions. The structure of the ULTRATEST UL 500 is divided into three levels:

Lower level (access from the front):

Oil drain and fill

Gas ballast switch

Middle level (access from the front):

Replacement of the ion source

Service of the control electronics

Observation of all valve sequencing and status

Upper level (access from the top):

Cleaning of the valves

Servicing of the communications electronics

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Technical Data

Specifications

ULTRATEST UL 500

Part Number	15585-100	15585-000	15585-200
Max. Measureable <u>Helium</u> Leak Rate	atm cc/sec	10	
Max. Indicated <u>Helium</u> Leak Rate (Qualitative)	atm cc/sec	1000	
Min. Measureable <u>Helium</u> Leak Rate	atm cc/sec	2×10^{-10}	
Max. Inlet Pressure			
For Quantitative Measurement	torr	75	
For Qualitative Measurement	torr	760	
Time Until Ready to Display	min	<5	
Detectable Masses	amu	2, 3 and 4	
Pumping Speed for Helium at the Test Connection	ltr/sec	≥ 12	
Response Time	sec	≤ 1	
Leak Rate Display	Quasi-analog 360° circular indicator, 1 decade per revolution		
Leak Rate Display, Exponent	Bar scale; digital exponent display from -10 to +3, 2 digit mantissa, 2 digit exponent, prefixed sign		
Units Displayed (Selectable)		atm cc/sec mbar ltr/sec Pa m ³ /sec ppm	
Calibrated Leak (Built-In)			
Leak Rate	atm cc/sec	In the range of 10^{-7}	
Test Connection		KF40	

Vacuum Pump System

Backing Pump		TRIVAC D4B		
Nominal Displacement	CFM	3		
Roughing Pump		TRIVAC D25B	TRIVAC D16B	TRIVAC D65B
Nominal Displacement	CFM	20.9	13.4	53.0
High Vacuum Pump		TURBOVAC TMP150LS		

Outputs

Recorder Output (Min. Internal Resistance of Recorder, 2.5 kOhms)				
Leak-Rate, Linear	V		1.0 to 9.9 per decade	
Leak-Rate, Exponent (Staircase Voltage)	V		0.5 per decade	
Leak-Rate, Logarithmic	V		0.5 per decade	
Inlet Pressure and Forepressure, Logarithmic	V		0.5 per decade	
Max. Headset Output Power				
(Min. Internal Resistance of Head Set 8 Ohms)	mW	500		

Electrical Requirements

Voltage (Selectable)	V	200/220/240/380	115	208 or 230, 3 phase
Power	Watt	4600	2000	5800
Frequency	Hz		50/60	

Shipping Information

Weight	lb	451		
Shipping Size; L x W x H (Weight)	in (lb)	35 x 30 x 51 (525)		

Leybold Inficon products are constantly improving; therefore, specifications are subject to change without notice.