GE Infrastructure
Sensing

GROUND EQUIPMENT MANUAL

DRUCK AIR DATA TEST SET

Part Nos. AD505-01
AD505-1-2952M0

Publication number K273

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(Not applicable)

Introduction

(1) This manual contains descriptive information and routine maintenance procedures for the unit. This unit must be repaired at the repair depot.

(2) Use suitably qualified personnel and good engineering practice for all procedures used in this publication.

(3) All weights and measurements in the manual are in metric units with imperial equivalents in parenthesis, unless otherwise stated.

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CHAPTER 1

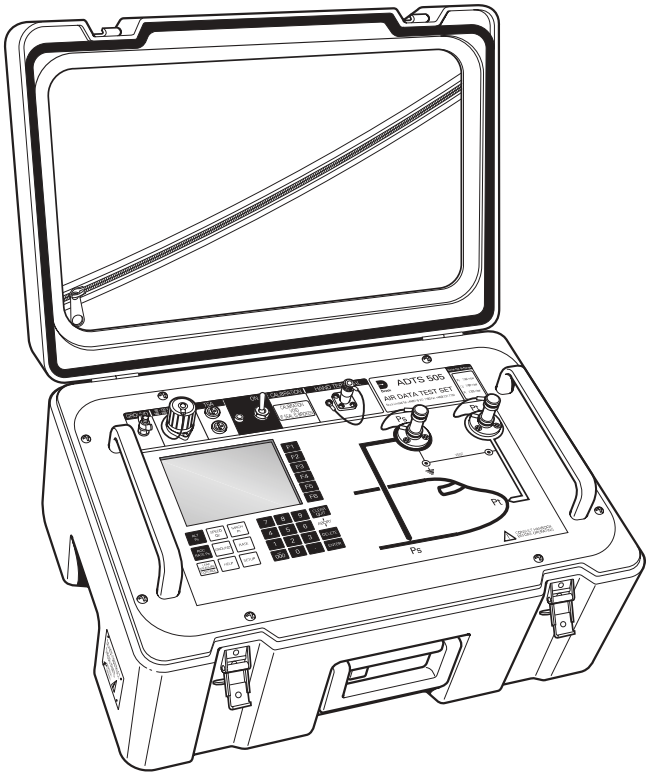
DESCRIPTION AND OPERATION

1. Description

A. General (Figure 1-1)

(1) The ADTS 505 is a self-contained flight-line air data test system, enclosed in an ABS case. The unit provides complete pressure and vacuum measuring and control for on-aircraft sense and leak testing, functional tests of air data instruments, components and systems. The ADTS 505 displays and operates in either units of pressure measurement or aeronautical units. In the control mode, the rate that the pressures change towards new set-points can be controlled in true aeronautical rate units.

(2) Two independent pneumatic channels connect to the aircraft or instrument systems, one for static and one for pitot. They can be operated as measure only channels with leak testing facilities or each can be control channels producing true pressure conditions for altitude and airspeed. Two pneumatic outlet ports, on the front panel and identified as Ps (static) and Pt (pitot) provide connection to the aircraft system or unit under test.

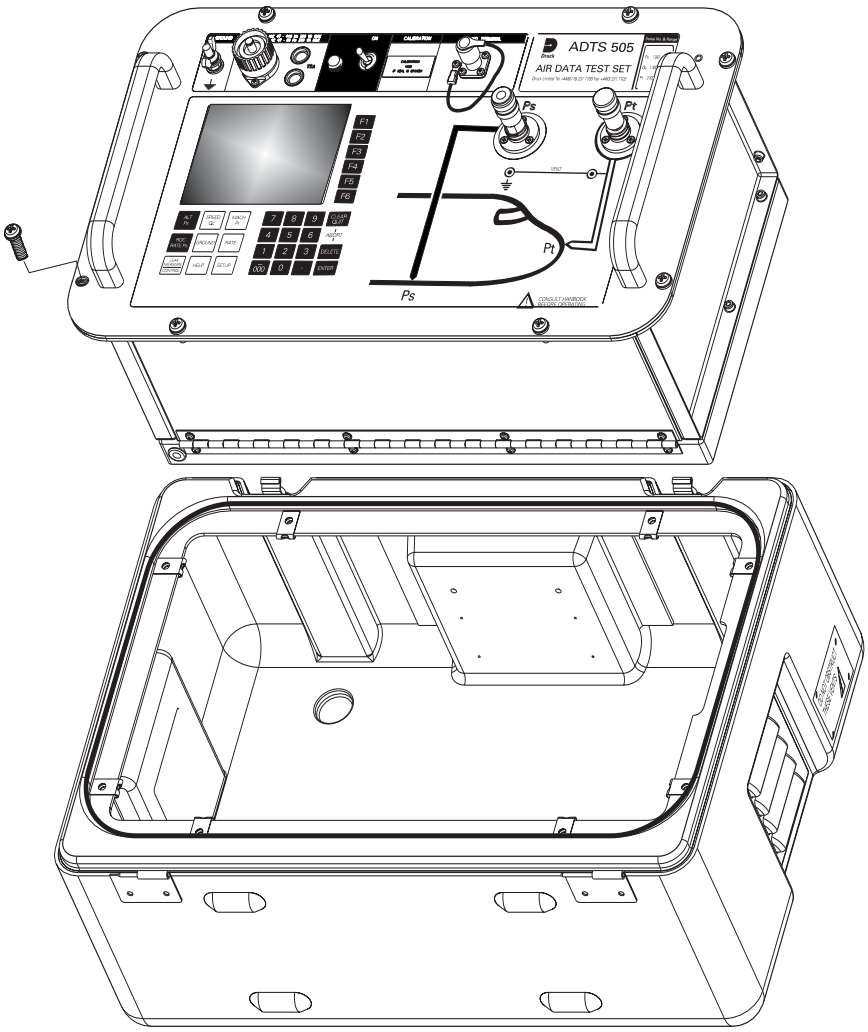


ADTS 505 General View
Figure 1-1

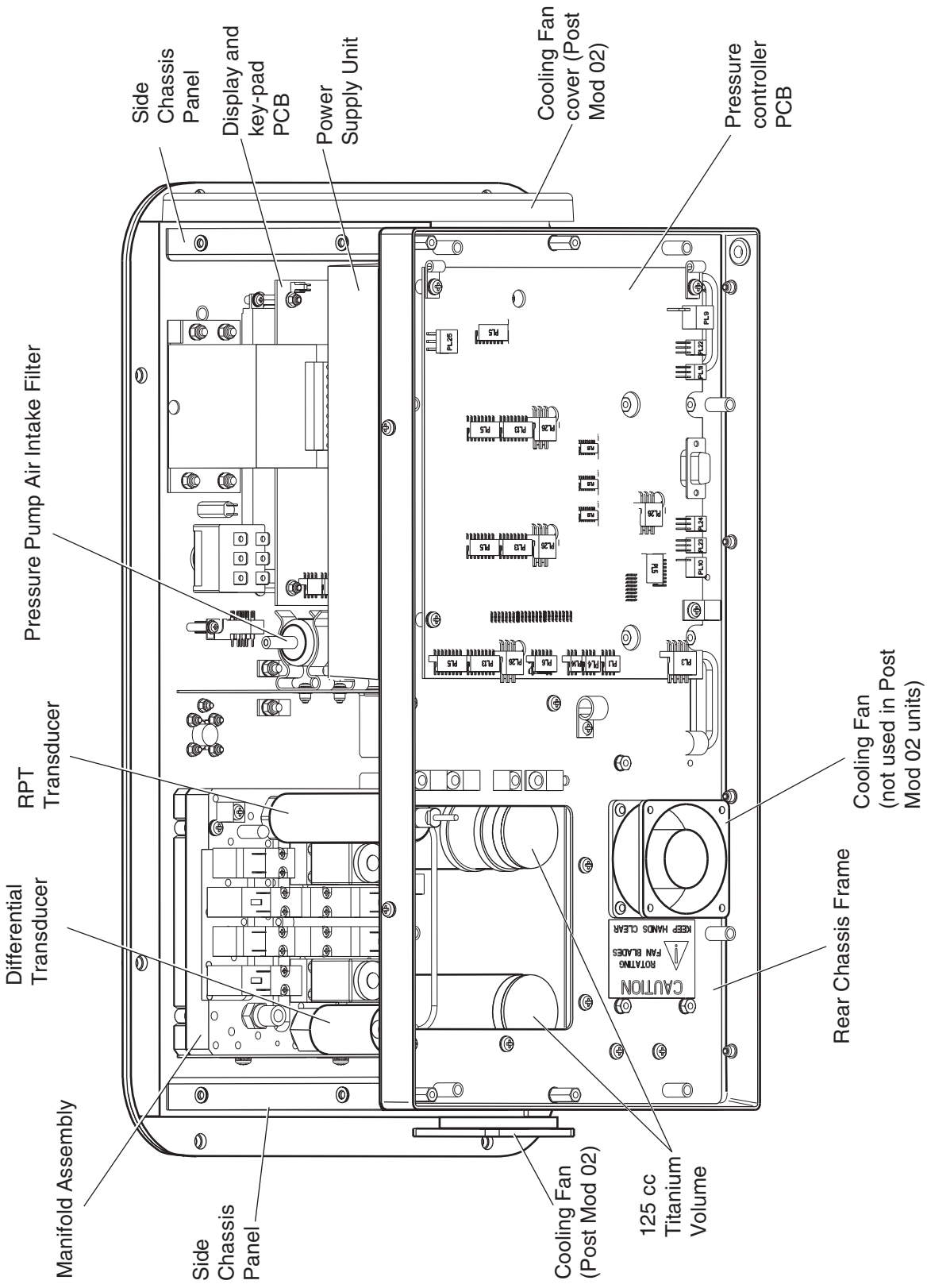
(3) To protect sensitive instruments and equipment a `ground' facility automatically and safely controls both channels to atmospheric pressure at the previously entered rates of change and then informs the user when both channels are safely at `ground'.

(4) The user interface is either the key-pad and display on the front panel or an optional hand terminal connected to the front panel. Both provide information and control selections for the user through the keys and display.

(5) The integral pumps of the ADTS 505, produce pressure and vacuum supplies for the unit's controlling requirements. The power supply connection for the unit is located on the front panel.



ADTS 505 Internal View
Figure 1-2



ADTS 505 Internal Detail (Post Mod 02)
Figure 1-3

B. Description (Ref. Fig.1-2 and 1-3)

(1) The assembled chassis locates in the ABS case. A seal fitted in a groove in the case provides weather-proof sealing for the internal components. Eight screws secure the assembled chassis in the ABS case. The lid fits over the assembled air data test system and locates on two hinge points and two securing clips.

(2) Attached to the underside of the front panel, two side chassis panels and a rear chassis frame form an enclosure for all the internal components. The pressure controller PCB locates on the outer side of the of the rear chassis frame. The power supply unit, pressure and vacuum pumps and water drain filter locate on the inside of the rear chassis frame. The manifold assembly comprises pressure transducers, 125cc titanium volumes, solenoid-operated valves attached to a two piece, nickel-plated aluminium, multi-port manifold.

(3) Manifold Assembly
Bolts secure the two halves of the manifold, a gasket provides an air-tight seal between the mating surfaces. One half of the manifold contains machined channels connecting between drilled ports for the components fitted to the manifold.

(4) Control Valves
Each channel contains two control valves, pressure and vacuum. The piezoelectric actuated control valves operate on a voltage between 0 and 40 volts d.c.

NOTE: Control valve performance can be affected by debris blocking the 0.4 mm orifice, the interior of the manifold must be kept clean. This loss of control valve performance shows as limited rates of change in Ps and Pt especially when controlling pressures in large volumes (more than 4 litres).

(6) Output, Ground and Zero Valves
These similar solenoid valves operate in the same way, spring-loaded to the de-energised condition. Each channel contains a solenoid-operated output valve connecting the air data test system to the aircraft system. The Qc zero valve connects both ports of the differential Qc sensor. The ground valve connects the Ps channel to atmosphere.

(7) Manual Let-Down Valves
Two manually operated let-down valves, fitted to the manifold, provide manual venting of the system. Two holes in the front panel provides access for a screwdriver to operate the valves. The plastic body of the let-down valve contains a metal needle valve with a proportional movement for the user to control the vent rates. In the fully open position a flow restrictor, in the valve, limits the maximum flow.

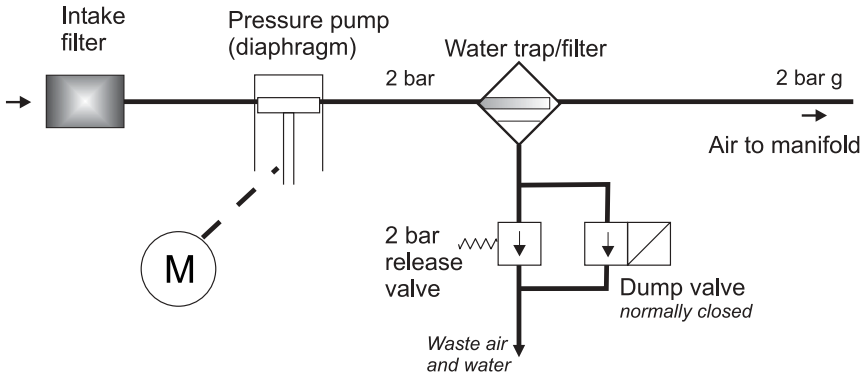
(8) Internal Volumes

Positioned on the manifold between the output port and the output valve a 125 cc titanium volume reduces the measured leak rate, in each channel, when performing a leak test with the blanking caps on.

(9) Pumps (Figure 1-4 and 1-5)

Two pumps, pressure and vacuum supply the Ps and Pt control channels in the manifold assembly. Rubber bushed anti-vibration mountings attach the pumps to the inner side of the rear chassis frame.

A D.C. motor drives the single diaphragm (piston post Mod 02) pressure pump. The material used in the manufacture of the pump head dissipates the generated heat quickly. Special seat material for the valves in the pump head tolerate high temperatures.

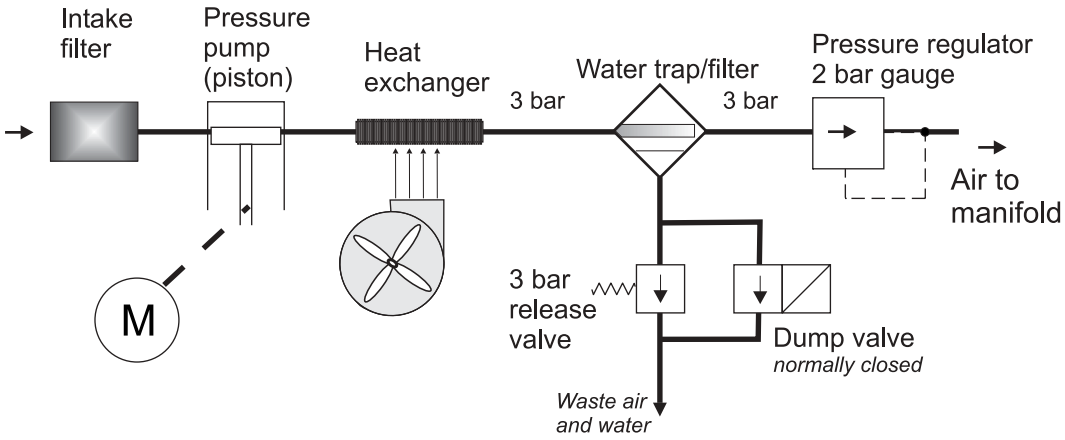


Pressure Pump Schematic (Pre Mod 02)
Figure 1-4

(10) Pre Mod 02

The output from the pressure pump connects to a 2 bar release valve via a water drain filter. A solenoid-operated water drain valve, attached to the side of the water filter, opens to allow a back-pressure purge on switch-off and prevent pump stall on switch-on. An intake filter prevents particles from entering the pump.

An identical D.C. motor drives a double diaphragm vacuum pump.

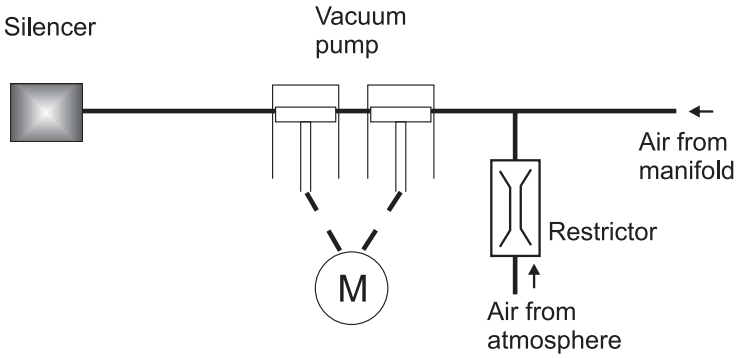


Pressure Pump Schematic (Post Mod 02)
Figure 1-4A

(10) Post Mod 02

The output from the pressure pump connects to a heat exchanger, 3 bar gauge pressure release valve and water drain and a 2 bar regulator. A solenoid-operated water drain valve, attached to the side of the water filter, opens to allow water out of the water drain filter. An intake filter prevents particles from entering the pump.

An identical D.C. motor drives a double diaphragm vacuum pump.



Vacuum Pump Schematic
Figure 1-5

A restrictor fitted between the pump vacuum output and atmosphere allows the pressures to equalise when the pump switches off; this provides for an off-load start for the pump. Air from the vacuum pump discharges to atmosphere through a silencer.

(10) Controller PCB

The controller PCB, located on the rear chassis frame, contains all the electronic components for the system. Multi-pin connectors from the manifold assembly components, power supply unit and pump units connect to the controller PCB.

(11) Power supply unit

This unit, located on the inner side of the rear chassis frame, supplies 24 volts through switching and linear voltage regulators. Heat dissipates through a grill in the anodised case of the PSU.

(12) Cooling Fans

Pre Mod 02

Two 24V cooling fans, located in one of the chassis side panels and the rear chassis frame, force air through the case to cool all the internal components.

Post Mod 02

One 24V, air exit fan locates in a chassis side panel, another 24V, air entry fan locates in the other chassis side panel. The fans create an air flow to cool a heat exchanger and the other internal components.

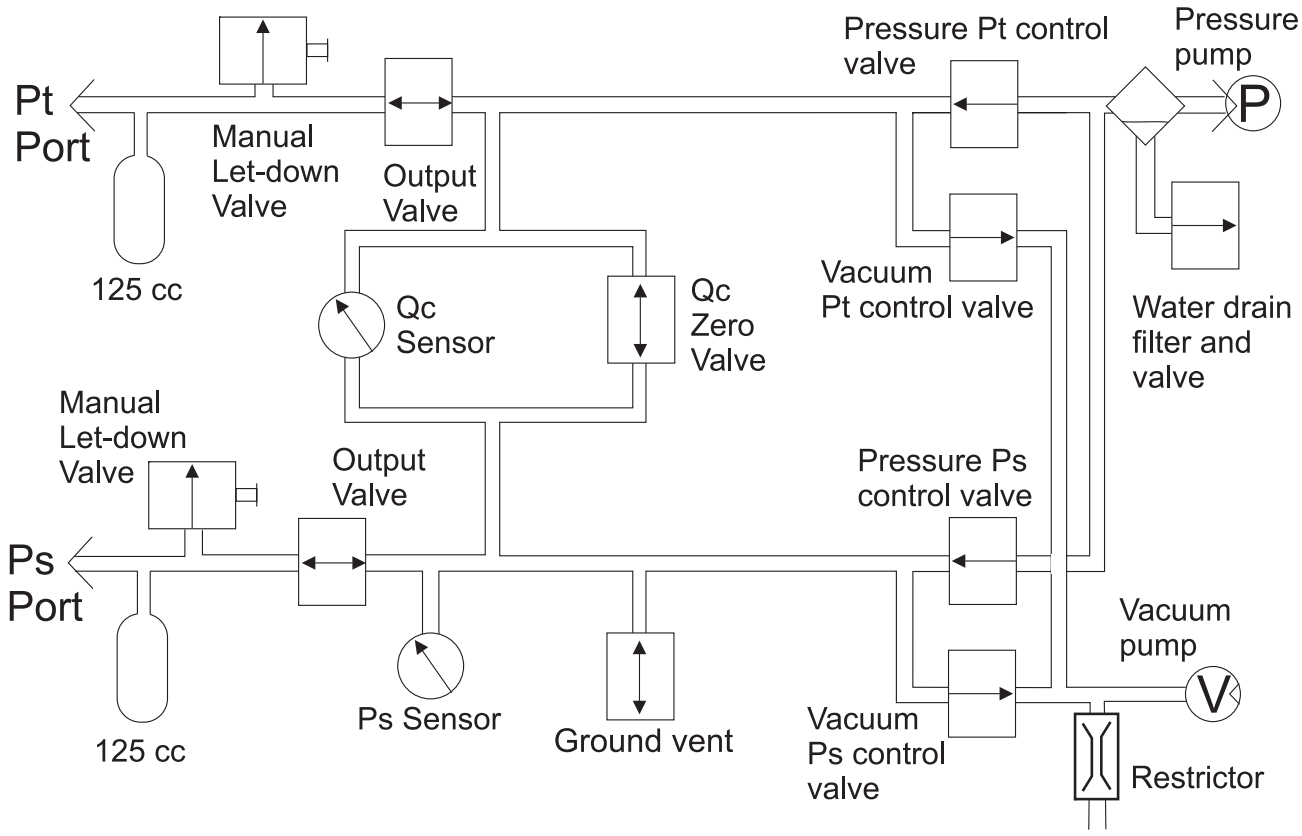
(13) Front panel Display and Key-pad PCB
Sealed into the front panel, a sealed key-pad and graphics panel display mounted on a PCB enables the user to review the current system status and set pressure values.

(14) Hand Terminal
This unit comprises a sealed key-pad and graphics panel display mounted on an enclosure containing a PCB. A rubber moulding protects the unit. A multi-pin connector provides the power supply and communication through the hand terminal cable to a similar connector on the air data test system.

(15) Calibration Switch
Located on the front panel, an adhesive label seals the calibration switch.

NOTE: Label marking: CALIBRATION VOID IF SEAL BROKEN.

In the calibration disabled position the switch stays flush with the front panel. To operate the switch the label must be removed, in the calibration enabled position the switch protrudes above the surface of the front panel.



ADTS 505 System Schematic
Figure 1-6

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2. Operational Description

A. Sensors

(1) The absolute pressure resonant transducer (RPT) measures the pressure and temperature in the static (Ps) channel. The RPT produces two electrical output a 30 to 35 kHz square wave pressure signal and an analogue temperature signal based on a diode voltage ≅ 0.7V at ambient. The microprocessor, in the controller PCB, receives these signals and applies corrections through an algorithm with several calibration constants. The resulting corrections produce an accurate pressure value of the static channel.

(2) The differential pressure transducer measures the difference between the pitot (Pt) channel and the static (Ps) channel. The differential pressure sensor incorporates an individual table of calibration points for given pressures and temperatures stored in an integral EEPROM.

B. Control Valves

(1) A varying voltage from the valve driver circuit, controls the air flow through each control valve. Each valve operates on a different voltage within the voltage range and has a “bias” voltage below which the valve remains completely closed.

(2) The valves must be characterised at the time of manufacture; the system measures and stores each valve voltage/ flow response. As part of the start-up routine, the system finds the stored bias values for all of the control valves and loads these values for optimum valve control.

(3) Piezoelectric valve drive
On the controller PCB, the main microprocessor produces a pulse width modulated signal. After filtering and amplifying a 40 V signal supplies the valve drive circuit and an LED providing a visual indication of circuit operation. The valve drive circuit generates a voltage of up to 40 V for the piezoelectric valves proportional to control requirements.

(4) Output, Ground and Qc zero Valves
The output valves only open after power-up self-checks. The applied voltage pulses and reduces to 5 to 6 Volts to prevent over-heating.
The ground valve vents the manifold to the current ground pressure allowing the system to measure the current ground pressure. The system uses this valve in the Go to Ground sequence.
The Qc zero opens to equalise pressures applied to Qc differential sensor. The output of this sensor changes to the electrical equivalent of zero. Routine operation of the Qc zero valve keeps the zero offset at a low value.

C. Manual Let-down Valves

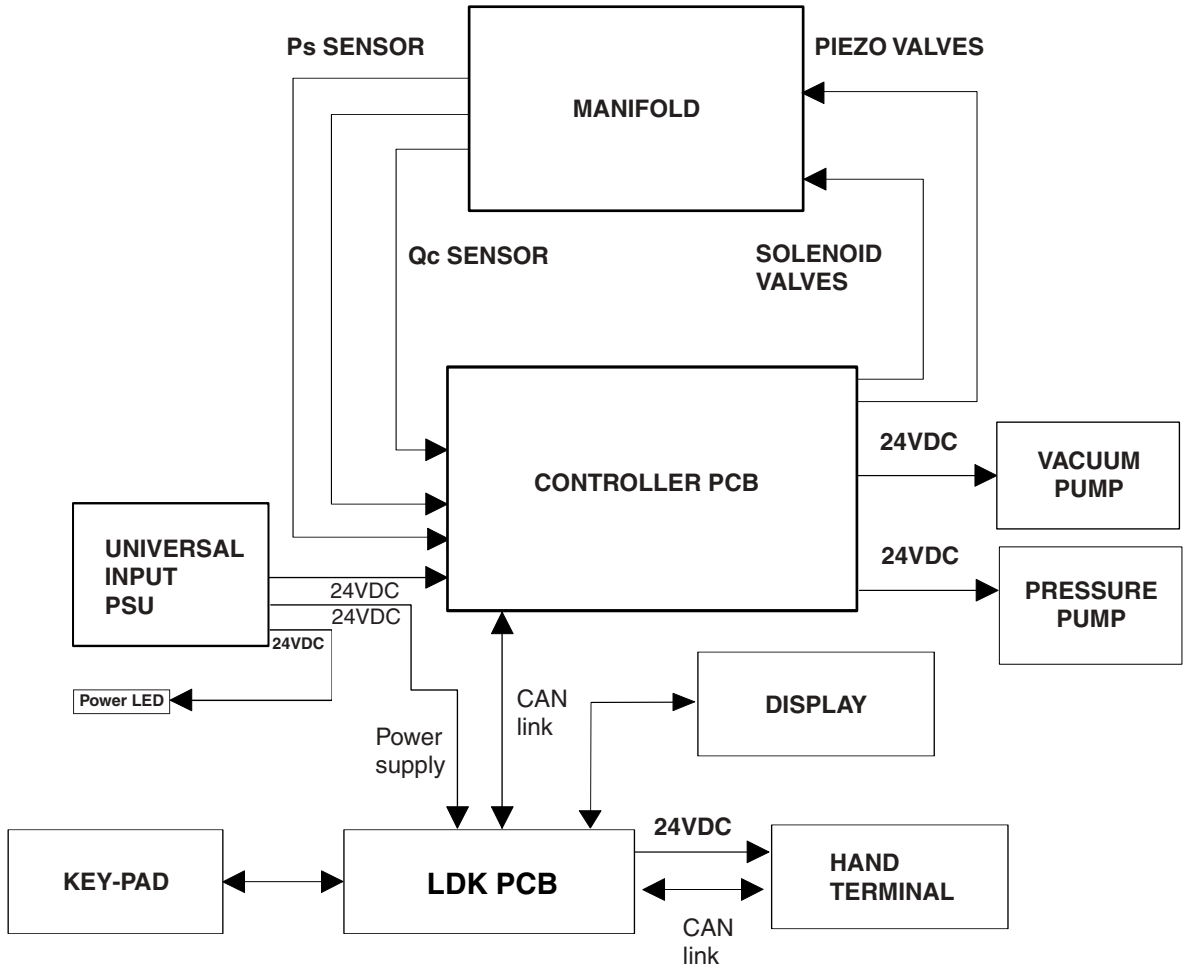
(1) These manually-operated valves should only be used when the power supply fails and the system contains pressures. The aircraft system pressures must be slowly changed to atmospheric pressure. Rapid pressure changes cause damage to sensitive aircraft instruments.

D. Pumps

(1) The pumps only operate in control mode and have an operating life in excess of 1,000 hours.

(2) Pressure
Pre Mod 02
The single-headed diaphragm of the pressure pump, driven by a brush DC motor draws air into the cylinder through a one-way valve. The diaphragm compresses the air and at the highest compression the air is discharged through an output valve. The 2 bar gauge release valve ensures a stable supply pressure to the manifold as the flow rate changes within the system. When switched off, the water filter drain dump valve opens and the residual pressure blows any water in the filter out through the drain. The valve stays open until the pump operates again; starting without any back pressure.
Post Mod 02
The single-headed piston of the pressure pump, driven by a brush DC motor draws air into the cylinder through a one-way valve. The piston compresses the air and at the highest compression the air is discharged through an output valve. The compressed air flows through the heat exchanger, the air cools and any moisture in the air condenses. The water drain filter collects the condensation. The water drain filter release valve opens, at 3 bar gauge, the excess system air forces the water out of the water drain. The 2 bar gauge regulator ensures a stable supply pressure to the manifold as the flow rate changes within the system. When switched off, the water filter drain valve opens and the residual pressure forces any water in the water drain filter out through the drain. The valve stays open until the pump operates again; starting without any back pressure.

(3) Vacuum
The double-headed diaphragm of the vacuum pump, driven by a brush DC motor, draws air from the manifold into the first cylinder through a one-way valve. The second diaphragm draws air from the first diaphragm through a one-way valve and discharges the air through a silencer. The restrictor, between the pump and the atmosphere, allows a small airflow during normal operations. When switched off, the restrictor allows air to leak back into the system (10 to 15 seconds). Atmospheric pressure stays until the pump operates again; starting without back pressure.



Circuit Diagram
Figure 5

(4) Pump motor drive and control
In the controller PCB, the pump micro-controller switches the pumps on and off through the driver IC. The main microprocessor receives status signals from the pump micro-controller and can detect pump conditions: normal operation on or off, off - pump stalled, open circuit, driver IC failed. The micro-controller starts the two pumps in sequence, this avoids high peak currents and keeps the power supply above the minimum 15 Volts.

(5) Controller PCB
The 32 bit microprocessor uses 16 Mbit of flash memory and 1 Mbit of RAM to supply the processing requirements of the controller PCB. The controller PCB receives signals from the transducers and sends data to the LDK PCB using the CAN link. In the control mode, the controller receives set-point data from the LDK and uses the control valves to achieve and maintain the set-point values.

(6) The universal input PSU produces 24 Volt DC and supplies the controller PCB and LDK PCB. Through a switching regulator and linear regulators the controller PCB uses 5V for the logic circuits, 10 and 15 V to supply the transducers. The controller PCB contains the driver IC for all the valves in the system. Feedback circuits provide signals for the valve monitoring circuits within the controller.

(7) The LDK PCB receives pressure values from the controller and sends, to the controller, user-generated commands and set-point values. After connection of the hand terminal, the LDK PCB detects a change in power consumption and sends a signal to the hand terminal. It receives a response from the hand terminal and changes the display on the LDK.

3. Specifications and Capabilities

A. Physical Specification

Size ..... 265 mm x 520 mm x 355 mm (10.4” x 20.5" x 14")
Weight ..... 15 kg [33 lb]

B. Power Supply

Auto-selection between:

..... Single phase AC 90 to 132 V
..... frequency range 47 to 440 Hz
..... Single phase AC 180 to 265 V
..... frequency range 47 to 66 Hz
Power ..... 200 VA

Safety performance

EMC emissions/immunity EN61326
Electrical/mechanical EN61010

Shock and vibration

..... MIL-T-28800 Class 2

C. Environment

Temperature Range

Calibrated ..... +5° to +35°C (+41° to +95°F)
Operating ..... +5° to +50°C (+32° to +122°F)
Storage ..... -20° to +70°C (-4° to +158°F)

Humidity

..... 0 to 95% non condensing

D. Pressure/Vacuum Requirements

Pressure connections

Ps ..... AN-4, 37° flare
Pt ..... AN-4, 37° flare

Performance

The ADTS 505 at a control set-point operating into a leak tight system, consumes very little air.

Rate of climb ..... 6,000 ft/min into 4 litre (240 cu.in) to 30,000 ft
Rate of speed ..... 300 knots/min into 2 litre (120 cu.in) to 650 knots

NOTE: These rates of change decrease for larger volumes.

E. Measurement and Control Range Specifications

(1) Operating Range and Performance

Limits are set pre-defined tabular limits known as STANDARD, CIVIL and MAX these can be selected through the SETUP menu. Operators may configure the display to aeronautical or pressure units. When configured to units of pressure, for some parameters, a wider full-scale pressure limits can be enabled.

(2) Performance expressed in aeronautical units

	Altitude	**Rate of Climb (ROC)**	**Calibrated Airspeed (CAS)**	**Mach**
Units	feet	ft/min	knots	-
Operating Range (1)	-2000 to 60,000 (3)	0 to 6000 (4)	20 to 650 (3)	0.16 to 2.8
Measurement	up to 105,000	0 to 6000 (4)	0 to 1000	10
Accuracy (2)	±3 at sea level ±7 at 30,000 ±29 at 60,0000	±2% of value	±0.5kts at 50kts ±0.5kts at 550kts	Better than 0.005
Repeatability	±1 at sea level ±2 at 30,000 ±7 at 60,0000	±0.5% (measurement)	±0.4kts at 50kts ±0.02kts at 550kts	0.001 rising to 0.005
Resolution	1	1	0.1	0.001

Notes

(1) Maximum operating range can be achieved using the internal pump at airfield altitudes to a maximum of 7,500 ft above sea level.

(2) Accuracy at ambient +5° to +35°C.

(3) Not all combinations are available to prevent excessive Mach number. For the Mach number 2.8 limit to be maintained:

Altitude of 60,000 ft means a CAS limit of 590.2 knots.
Airspeed of 650 knots means a limit of 55,147 ft.

(4) Default CIVIL limits, in MAX limits ROC = 40,000 ft/min.

(3) Performance expressed in pressure units

	Altitude Sensor (Ps)		Airspeed Sensor (Qc)		EPR
Units	mbar abs	inHg abs	mbar diff	inHg diff	-
Maximum Range (1)	71.7 (3) to 1355	2.1 to 40	-950 to +2490	1 to 73.53	0.1 to 10
Accuracy (2)	±0.1	±0.003	±0.1% reading ±0.125 mbar	±0.1% reading ±0.0037 inHg	better than 0.005
Repeatability	±0.05	±0.0015	0.05 rising to 0.17	0.0015 rising to 0.0051	-
Resolution	0.01	0.0001	0.01	0.0001	0.001

Notes

(1) Maximum operating range can be achieved using the internal pump at airfield altitudes to a maximum of 7,500 ft above sea level.

(2) The accuracy figures stated include 12 months stability.

(3) The system measures below this value but, because of pump capacity, controls to 71.7 mbar absolute. 35 mbar is the lowest calibration point.

Max Pt 3000 mbar absolute (with Ps >500 mbar absolute)

Max Qc 2500 mbar differential (with Ps <500 mbar absolute)

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4. Shipping

A. Materials

(1) The following materials are necessary to put the unit in a container to prevent damage under usual storage conditions.

NOTE: Equivalent alternatives may be used.

Material	Specification	Manufacturer	Use
(1) Adhesive tape	DTD900-4483	-	Securing
(2) Polythene bag	DEF STAN 1317	-	Inner wrap
(3) Cardboard container	Commercially available	-	Outer container
(4) Corrugated paper	DEF STAN 1253	-	Cushion packing

B. Preservation and packaging

(1) Place the unit with an identification label into a polythene bag, make sure the label can be seen.

(2) Remove the air from the polythene bag and seal with adhesive tape.

(3) Put the unit into a cardboard container with corrugated paper or equivalent material.

(4) Seal the cardboard container with adhesive tape and put on an identification label.

(5) Put on the correct label to show the type of contents.

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5. Storage

(1) Prepare the container as described in (1-4 paragraph B.).

(2) Store the prepared unit in the environment detailed in (1-3 paragraph C.).

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CHAPTER 2

MAINTENANCE

1. Servicing

A. General

This section details the maintenance tasks to be carried out by the operator. The maintenance chart shows the maintenance tasks, the periodicity of each task and a code referenced to the task detailed in paragraph C.

Maintenance Chart

TASK	CODE	PERIOD
Inspect	A	Daily, before use.
Inspect	B	Weekly
Test	C	Before use.
Test	D	Daily, before use.
Calibrate	E	Every 12 months *
Replace	F	As detailed in troubleshooting or when detailed after inspection.
Clean	G	Weekly *
Service	H	1,000 hours recorded by the unit's operational timer or the equipment running log.
Service	J	1,000 hours recorded by the pump operational timer or the equipment running log.

* Periodicity may change depending on usage and environment, refer to the Engineering Authority.

B. Materials and Tools

(1) This section provides lists of the materials and tools required for the user to maintain the ADTS 505.

Materials List

ITEM NUMBER	ITEM NAME, DESCRIPTION
1	Cloth, Cotton, Lint-Free
2	Alcohol, Isopropyl (MIL-A-10428, Grade A)
3	Detergent, Mild, Liquid
4	Brush, Soft-bristle (MIL-B-43871)

NOTE: Equivalent substitutes can be used.

C. Maintenance Tasks

TASK CODE	TASK DETAIL
A	Check that all the equipment is present; record any deficiencies. Visually inspect the external of the ADTS 505, and its associated equipment, for obvious signs of damage, dirt, and the ingress of moisture. If necessary, use mild liquid detergent (item 3, Materials List) and a lint-free cloth (item 1, Materials List) to clean the external surfaces. Inspect the pressure outlet ports for ingress of dirt and moisture, clean if necessary with a lint-free cloth.
B	Visually inspect the pneumatic output connectors for damage. Inspect the small o-ring on each pneumatic output connector for cuts and any signs of wear; replace as necessary. Visually inspect pneumatic hoses, electrical cables for cuts, splits and damage; replace as necessary.
C	Before use, check the date of the last calibration and, if necessary, refer to task E. Record any error messages and refer to Troubleshooting.
D	Daily and before use, carry out the test detailed in paragraph D.
E	Normal calibration period 12 months. When calibration is due, the unit should be withdrawn from service and returned to depot or calibration facility. The date of calibration is stored in the unit and displayed in the power-up sequence and on a label on the front panel. Do not use a unit with out-of-date calibration. Engineering authority may change the periodicity of calibration depending on usage and the operating environment.
F	As detailed in fault finding or when detailed after inspection replace the listed item 4 in the Parts List.
G	Clean the unit every week. Clean the front panel with a damp lint-free cloth (item 1, Materials List) and mild liquid detergent (item 3, Materials List). Remove any stubborn dirt using isopropyl alcohol (item 2, Materials List) and allow to dry. Clean all pneumatic connectors with a soft brush (item 4, Materials List). Remove any stubborn dirt using isopropyl alcohol (item 2, Materials List) and allow to dry.
H	Withdraw the unit from service and carry out Maintenance Schedule 1.
J	Withdraw the unit from service and carry out Maintenance Schedule 2.

2. Testing and Troubleshooting

A. General

(1) The following tests should be carried out when it is necessary to prove the unit serviceable. Testing should be carried out at an ambient temperature between 10°C and 30°C (50°F and 85°F).

B. Test Equipment

(1) No test equipment is necessary to carry out the following tests.

C. Testing (Figure 2-3)

(1) The following procedure shows if the unit is serviceable and checks functions and facilities of the ADTS 505. In this procedure:

(a) All key presses are highlighted in **BOLD** and shown as identified on the front panel.

(b) Key presses inside brackets e.g., [Units], are soft key presses (i.e., function key selections {F1 to F6} indicated on the screen).

(2) Procedure

(a) Connection and power-on checks.

(b) Connect power to the unit.

(c) Make sure the blanking caps are fitted to the Ps and Pt front panel outputs.

(d) Set the power supply switch to ON.

(e) Check power indicator is on.

(f) Check the display shows the first power-up message.

(g) Check the display all the power-up messages.

(h) If the ADTS 505 displays any detected errors, refer to para. E. Troubleshooting.

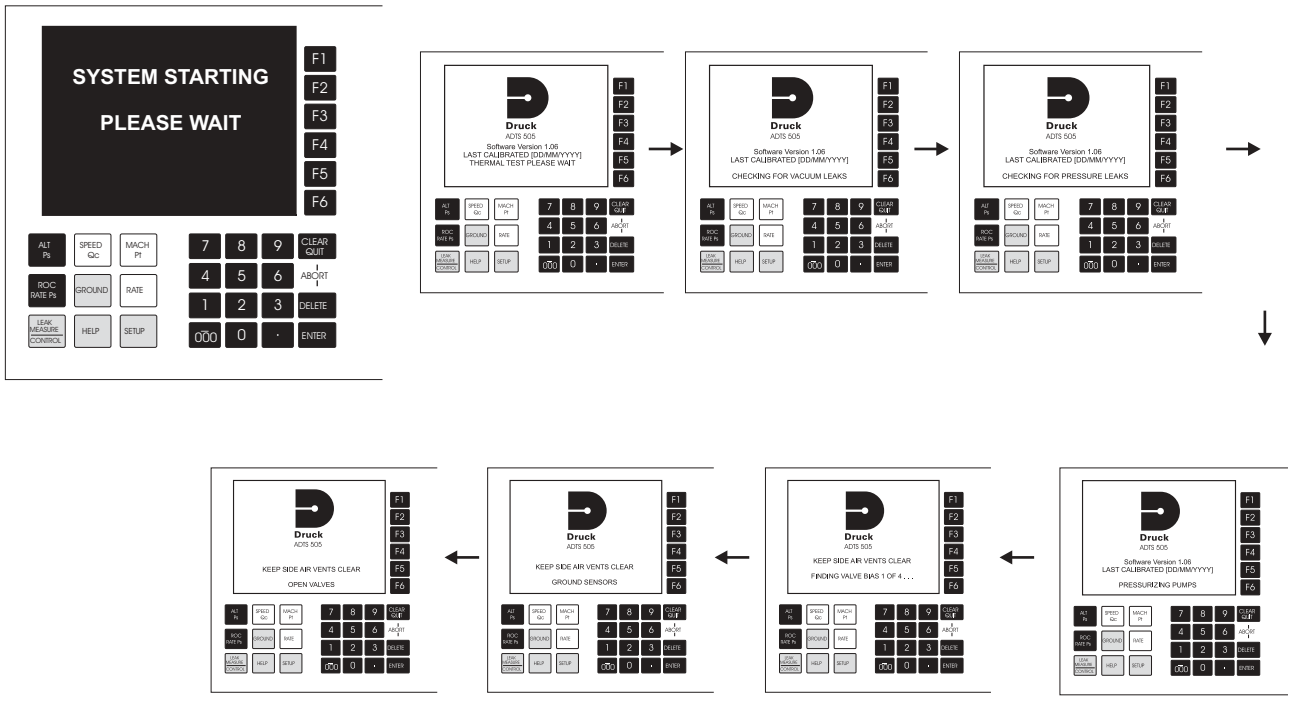


Figure 2-1 Start-up Sequence (AD505-01)

(i) Check that the display then changes to show measured aeronautical or pressure values. This depends on the display set-up.

NOTE: 1 The displayed values change as atmospheric pressure changes at power-up.

NOTE: 2 The unit requires 15 minutes to warm-up to achieve full accuracy and stability.

NOTE: 3 Figure 2-1 shows the start-up sequence for part number AD505-01. The start-up sequence displays for part number AD505-1-2952M0 show different screens with the same start-up sequence.

(j) Set the display to **QUAD** format and aeronautical units of ft, kts and ft/min.

(k) Press **ALT/Ps**, **ROC/RtPs**, **SPEED/Pt** and **RATE** to display the required parameters.

(l) Press **LEAK MEASURE/CONTROL** to go to control mode.

(m) Set the **ROC/RtPs** to 5000 ft/min.

(n) Enter an altitude aim of 500 ft and an airspeed aim of 400 knots.

(o) Check that these aim values are achieved, the rate of change are within the selected rates and that the achieved aim values are stable.

(3) Completion

(a) Press **GROUND** (go to ground).

(b) Wait until the display shows `Safe at Ground' woth the message "Press Clear/Quit to continue.

(c) It is now safe to continue testing or to switch off and disconnect the power supply.

D. Further Testing

(1) The following tests should only be carried out if a pneumatic leak or a controller instability is suspected.

(2) Test Environment and Preliminary Operations

These tests should be carried out in a room with a stable temperature environment within the operating temperature range. The room must be free from drafts.

(a) Review and become familiar with the whole of the test procedure before beginning the test procedure.

(b) The unit must be thermally stable; switch on and leave the unit for at least one hour to achieve thermal stability.

(c) Make sure the blanking caps are fitted to the Ps and Pt front panel outputs.

(3) Change the units to mbar as follows:

(a) Select [UNITS] then select mbar and mbar/min.

(b) Select [Save/Lock] and then press **CLEAR/QUIT** and the display now shows **ALT/Ps** and **Speed/Qc** in units of mbar.

(4) Change the pressure limits to MAX as follows:

(a) Press **SETUP** then select [LIMITS].

(b) Use [▲] or [▼] to move through the list and press F3 to select MAX limits.

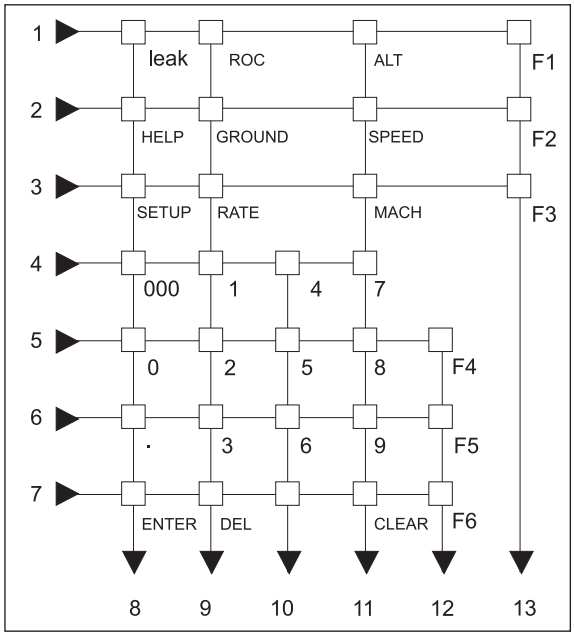


Figure 2-2 Key-pad Test Display

(5) Key-pad Testing (Figure 2-2)

(a) The front panel key-pad and the hand terminal key-pad can be tested using the facility in the maintenance/calibration selection of the set-up menu.

(b) The procedure to test the key-pad requires each key to be pressed in turn and to confirm the correct key press on the display. Make sure the display shows only the appropriate key press.

NOTE: Connecting the hand terminal disables the front panel key-pad.

(6) Pressure leak check
This procedure verifies that the unit is leak tight under positive pressure conditions.

(a) Press **LEAK MEASURE/CONTROL** to enter control mode.

(b) Enter an **ALT/Ps** Aim of 1016 mbar.

(c) Enter a **SPEED/Qc** Aim of 272 mbar. Wait for the aim values to be achieved then wait for 1 min.

(d) Press **LEAK MEASURE/CONTRO**L to return to Leak Measure mode.

(e) Select [Rate Timer] and select [Set Wait 05:00], [Set Time 01:00] and then select [Start Timing].

(f) At the end of the timing period, the display shows the rate of change of Ps, Qc and Pt.

(g) Check that the Ps, Qc and Pt rates are less than or equal to ±0.5 mbar/ min. If the leak rate is not achieved, allow further thermal stabilization time and re-test by selecting [Rate Timer] and selecting [Set Wait 05:00], [Set Time 01:00].

(h) Press **CLEAR/QUIT** to exit rate timer display.

(7) Vacuum leak check

This procedure verifies that the unit is leak tight under vacuum conditions.

(a) Press **LEAK MEASURE/CONTROL** to enter control mode.

(b) Enter an **ALT/Ps** Aim of 100 mbar.

(c) Enter a **Speed/Qc** Aim of 0 mbar.

(d) Wait the required time for temperature stabilization e.g., one minute. Press **LEAK MEASURE/CONTROL** return to Leak Measure mode.

(e) Select [Rate Timer] and select [Set Wait 05:00], [Set Time 01:00] and then select [Start Timing].

(f) At the end of the timing period, press **ROC/RtPs** to display the measured rate of change of **ALT/Ps**.

(g) Check that the Ps, Qc and Pt rates are less than or equal to ±0.5 mbar/ min. If the leak rate is not achieved, allow further thermal stabilization time and re-test by selecting [Rate Timer] and select [Set Wait 05:00], [Set Time 01:00].

(h) Press **CLEAR/QUIT** to exit rate timer display.

(8) Range check

(a) Control the Ps and Qc pressures to the normal limits of operation and make sure that these are achieved. Use minimum Ps and zero Qc and then maximum Ps and maximum Qc.

NOTE: Do not exceed the maximum Pt as shown on the front panel of the unit. Use maximum available rates of change to minimise test times.

(9) Controller Stability

This section verifies the control stability.

(a) Press **LEAK MEASURE/CONTROL** to turn the pressure controllers on.

(b) Enter an **ALT/Ps** Aim of 510 mbar with a rate of change of 204 mbar/min.

(c) Enter a **Speed/Qc** Aim of 0 mbar with a rate of change of 204 mbar/min.

(d) Press **ALT/Ps** and wait for the aim values to be achieved.

(e) Observe the measured values of Ps and Qc on the display for 1 min.

(f) Check that the displayed value of Ps remains within ±0.068 mbar.

(g) Check that the displayed value of Qc remains within ±0.068 mbar.

E. Troubleshooting

(1) System Messages

In the event of a malfunction, the built-in, self-test and diagnostic system displays a message and a code. The message heading WARNING indicates a fault or condition that affects normal operation. The following tables list the warning messages with the probable cause and action to be taken.

(2) If the display shows a message heading of APPLICATION_FATAL or SYSTEM_FATAL the unit must be switched off. If the display shows the same message after switching on, the unit should be returned to the repair depot:

NO.	MESSAGE	PROBABLE CAUSE	ACTION
7	Autoleak recovery activated	Excessive leak rate detected in Ps/Qc pressures	Check hoses and aircraft systems for leaks
31	Test set must be at ground	Invalid user request	Select Go to Ground first
32	Pressure leak in Ps. Leak rate =	Leaking Ps channel pressure control valve	Return unit to repair depot
33	Pressure leak in Pt. Leak rate =	Leaking Pt channel pressure control valve	Return unit to repair depot
36	Ps Aim Overshoot	Connected system leak rate changing	Check hoses and aircraft systems for leaks
37	"Ps aim value unobtainable"	Leak rate on Ps too high to control	Check port caps, hoses and connectors for leaks
40	Pt Aim Overshoot	Connected system leak rate changing	Check hoses and aircraft systems for leaks
41	"Pt aim value unobtainable"	Leak rate on Pt too high to control	Check port caps, hoses and connectors for leaks
45	Vacuum leak in Ps. Leak rate =	Leaking Ps channel vacuum control valve	Return unit to repair depot
46	Vacuum leak in Pt. Leak rate =	Leaking Pt channel vacuum control valve	Return unit to repair depot
48	Ps pressure control valve cannot be calibrated	Valve fault	Return unit to repair depot
49	Pt pressure control valve cannot be calibrated	Valve fault	Return unit to repair depot
50	Ps vacuum control valve cannot be calibrated	Valve fault	Return unit to repair depot
51	Pt vacuum control valve cannot be calibrated	Valve fault	Return unit to repair depot
53	Current Pressure Limits Exceeded	Limits for Ps or Qc exceeded.	Make sure pressures are within limits, check leak rates
56	Stabilising Qc to Zero	Possible negative airspeed detected	System safety feature opens zero valve to stop this condition. If constant display of this message, check for leaks.

Table 2-1 Error Messages

NO.	MESSAGE	PROBABLE CAUSE	ACTION
219	Abort sequence started by user	Abort key pressed on hand terminal	Wait until system completes abort sequence
220	"Cannot Modify Altitude Correction in Pressure Units"	Altitude Correction selected with pressure units displayed	Change units in setup to aero units
221	"Changed Aim to ARINC Limit"	Value out of ARINC limit range	Re-enter value within allowed range
222	Calibration data failed	Incorrect pressure value entered during calibration	Check and enter correct pressure value for reference pressure point
223	"Cannot enter EPR in Aero Units"	EPR selected with aero units displayed	Change units in setup to pressure units then select EPR
227	"Changed Aim to Current Limit"	Value out of limit range	Enter value within allowed range
228	"Limit Overlap"	Value conflicts with limit ranges	Enter value within allowed range
229	"Limit Saved"	Value out of acceptable range	Enter value within allowed range
241	"Ground Request in Leak Mode"	System must be in control mode	Select control mode
243	"LDK has an invalid EEPROM archive"	Invalid/corrupted data - recovery in progress	Check custom limit sets not lost
245	"Controller has an invalid EEPROM archive"	Invalid/corrupted data - recovery in progress	Check/correct calibration
247	"Handset has an invalid EEPROM archive"	Invalid/corrupted data - recovery in progress	Return unit to repair depot
250	"Vacuum pump processor has failed"	Internal fault	Return unit to repair depot
251	"Vacuum pump lead is disconnected"	-	Return unit to repair depot
252	"Vacuum pump transistor is faulty or drive inhibited"	Internal fault	Return unit to repair depot
253	"Vacuum pump has stalled"	Internal mechanical fault	Restart system, if fault repeats - return unit to repair depot

Table 2-2 Warning Messages

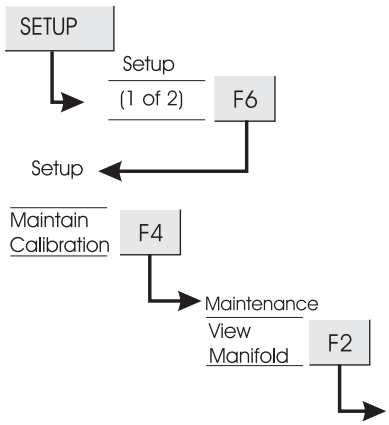
(3) Additional Messages

Internal temperature

The temperature sensor in the pressure measurement system measures the temperature of the pressure manifold. At a temperature greater than 60°C the sensor triggers an overheat fault. In measure mode, the display flashes between the normal aim/measure screen and "Ps Sensor Outside Calibrated Range". In control mode, the display shows "CONTROL HALTED" the system stops controlling and switches off the pumps. When the sensor detects a temperature of 55°C the display stops flashing.

Before re-entering control mode check the air vents for obstructions. To re-enter control mode press **LEAK MEASURE/CONTROL** twice. If this overheat fault happens again switch off the unit and return to repair depot.

(4) On-screen Assessment (Figure 2-3)



(a) This procedure enables real time assessment of the system. Each valve and transducer is characterized to obtain maximum performance. Any values shown on the screen are an indication and not a precise value.

(b) To assess the system, enter a set-point and a rate so that achieving the set-point takes at least 5 minutes. Once set and controlling, select setup and display the system data screen using the menu selection below:

RPT DIAGNOSTICS
RPT DIODE [mV]: 000.000000
RPT COUNT: 0000000
TEMP [c] 00.000000

PDCR DIAGNOSTICS
PDCR VC [mV]: 000.0000
PDCR VD [mV]: 000.0000

VALVE DIAGNOSTICS
PS OUTPUT L:L
PT OUTPUT L:L
GROUND -:-
QC ZERO -:-
VACUUM PS [%]: 0000
PRESSURE PS [%]: 0000
VACUUM PT [%]: 0000
PRESSURE PT [%]: 0000

PUMP DIAGNOSTICS
PRESSURE : POF
VACUUM : VOF

PROCESSED INFO
PS 000.000000
QC 000.0000
PT 000.000000
GROUND 000.000000
PS VOL 0.000000
PT VOL 0.000000

CHARACTERISATION
PWM VPS VB 0000.000000
PWM VPS ERR 00.000000
PWM PPS VB 0000.000000
PWM PPS ERR 00.000000
PWM PPT VB 0000.000000
PWM PPT ERR 00.000000
PWM VPT VB 0000.000000
PWM VPT ERR 00.000000

TERTIARY INFO
CAL: ENABLED
DUMP: SHUT

Figure 2-3 System Screen for Diagnosis

DATA IDENTIFIER	FUNCTION	EXPECTED DISPLAY OR VALUE
RPT Diagnostics	Ps/Altitude Sensor	
RPT Diode [mV]	Temperature Compensation	400 (hot) ..... 800 (cold)
RPT Count	Value proportional to pressure	248,553 4,473,600
TEMP [c]	Ps channel (RPT) measured temperature	5° .....60°C (over permitted ambient range)
PDCR Diagnostics	Qc/Airspeed Sensor	
PDCR Vc [mV	Temperature Compensation	980 2100
PDCR Vd [mV]	Value proportional to pressure	0 to 140 mV (always active)
VALVE DIAGNOSTICS	PRESSURE OUTPUT AND CONTROL	
Ps Output	Ps Port isolation valve state	L:L <—> H:H (open) —:— (closed)
Pt Output	Pt Port isolation valve state	L:L <—> H:H (open) —:— (closed)
Ground	Ground pressure sense valve state	—:— (closed,normal), H:H (at ground)
Qc Zero	Qc auto-zero valve state	—:— (closed,normal), H:H (at ground,auto-zero)
Pressure Ps	Ps pressure valve drive level	0 (Leak/Measure), varying to 9999 (control)
Vacuum Ps	Ps vacuum valve drive level	0 (Leak/Measure), varying to 9999 (control)
Pressure Pt	Pt pressure valve drive level	0 (Leak/Measure), varying to 9999 (control)
Vacuum Pt	Pt vacuum valve drive level	0 (Leak/Measure), varying to 9999 (control)
PUMP DIAGNOSTICS	CONTROLLER SOURCE PRESSURES	
Pressure	Pressure pump drive state	POV (Pressure On Flow) or blank (pump off)
Vacuum	Vacuum pump drive state	VOF (Vacuum On Flow) or blank (pump off)
PROCESSED INFORMATION	MAJOR MEASUREMENT/CONTROL PARAMETERS	
Ps	Ps Channel Pressure, mbar absolute	0 to 1355
Qc	Qc Channel Pressure, mbar differential	-1355 to 2490
Pt	Pt Channel Pressure, mbar absolute	0 to 3845
ground	Ambient pressure estimate	800 to 1300
Ps VOL	System Ps volume estimate	0.125 (min) varies with connected system
Pt VOL	System Pt volume estimate	0.125 (min) varies with connected system
CHARACTERISATION	CONTROL VALVE DATA	
PWM PPS VB	Valve bias (VB) calculated in real time	Variable with temperature
PWM PPS ERR	Determined during manufacture or service operations	Constant
PWM VPS VB	Valve bias (VB) calculated in real time	Variable with temperature
PWM VPS ERR	Determined during manufacture or service operations	Constant
PWM PPT VB	Valve bias (VB) calculated in real time	Variable with temperature
PWM PPT ERR	Determined during manufacture or service operations	Constant
PWM VPT VB	Valve bias (VB) calculated in real time	Variable with temperature
PWM VPT ERR	Determined during manufacture or service operations	Constant
TERTIARY INFORMATION	OTHER SYSTEM CONTROL STATES	
CAL:	Calibration lock switch state	Disabled (normal)
DUMP:	Pump pressure vent state	Shut (normal)

Figure 2-4 System Screen Information

3. Removal/Installation

A. General

(1) There are two scheduled maintenance procedures for the ADTS 505 both are based on operating hours recorded by the system. To find out the operational hours go to SET-UP menu - 2 of 2, the display shows total operating hours and pump operating hours.
Maintenance procedure 1 - 1000 operating hours
Maintenance procedure 2 - 1000 pump operating hours

B. Conditions

(1) Absolute cleanliness of the work area, tools and equipment must be observed.

(2) Expendable items must be discarded.

(3) Protect open ports and pneumatic connections from dirt and moisture.

C. Maintenance Procedures

WARNING: SWITCH OFF AND DISCONNECT THE POWER SUPPLY BEFORE STARTING ANY MAINTENANCE TASK.

(1) Replacing the output connector o-ring (Figure 2-5)
After inspection as detailed in maintenance task B, carry out the following if the o-ring is worn or damaged.

NOTE: Fuses/o-ring kit (PL item 15) contains this o-ring.

(a) Carefully remove the o-ring from the small groove at the top of the connector.

(b) Fit a new o-ring in the small groove at the top of the connector.

(c) Make sure the o-ring is tight in the groove and not damaged after fitting.

NOTE: Damage to this o-ring causes leaks.

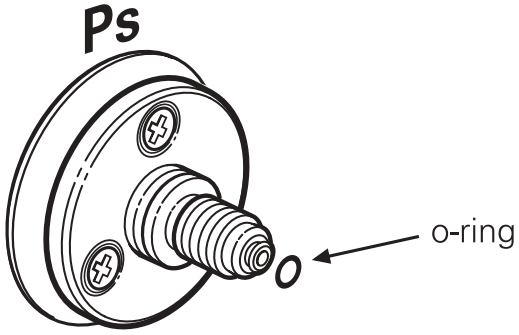


Figure 2-5 Bulkhead Connector

(1) Maintenance Schedule 1 (Figure 2-6)
(a) The following procedure requires a Filter Kit (1000 hours) (PL item 20).

DESCRIPTION	QUANTITY
Knitmesh filters	2
Special tool, Knitmesh filter	1
Muffler M5	2
Intake filter, pressure pump	1
Mist filter element (water drain filter)	1
Restrictor, vacuum pump	1

(2) Procedure
(a) Switch off and disconnect the power supply.

(b) Unscrew and remove the eight screws securing the front panel to the case. Carefully lift out the unit of the case, disconnect the water drain pipe from the inside of the case.

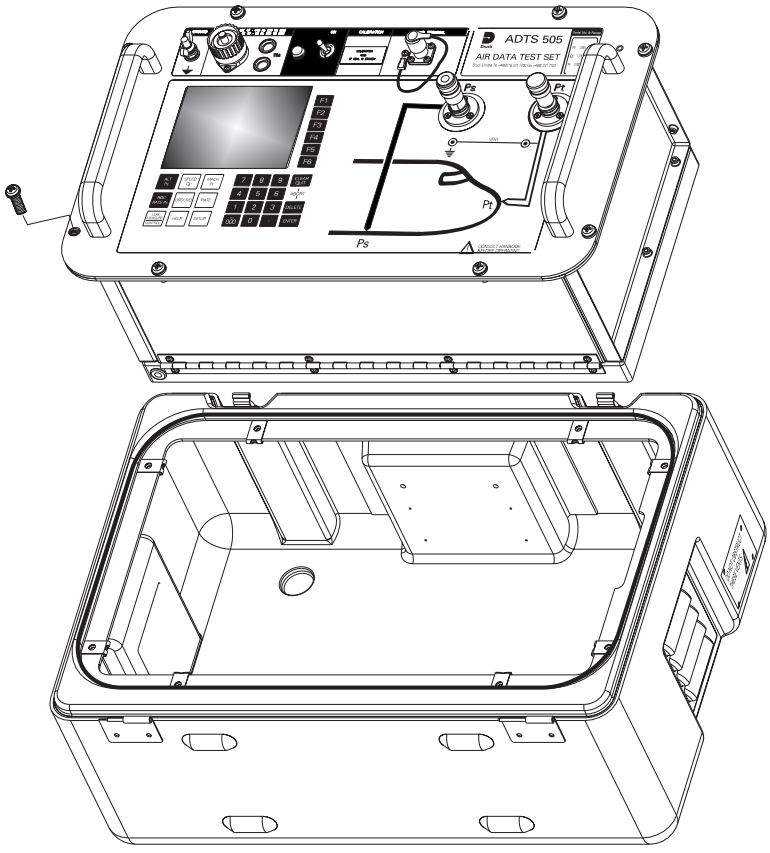


Figure 2-6 Front panel and case

(c) Unscrew and remove the six screws and washers securing the top cover plate. Remove the top cover plate.

(d) Unscrew and remove the eight screws and washers securing the rear cover plate. Remove the rear cover plate.

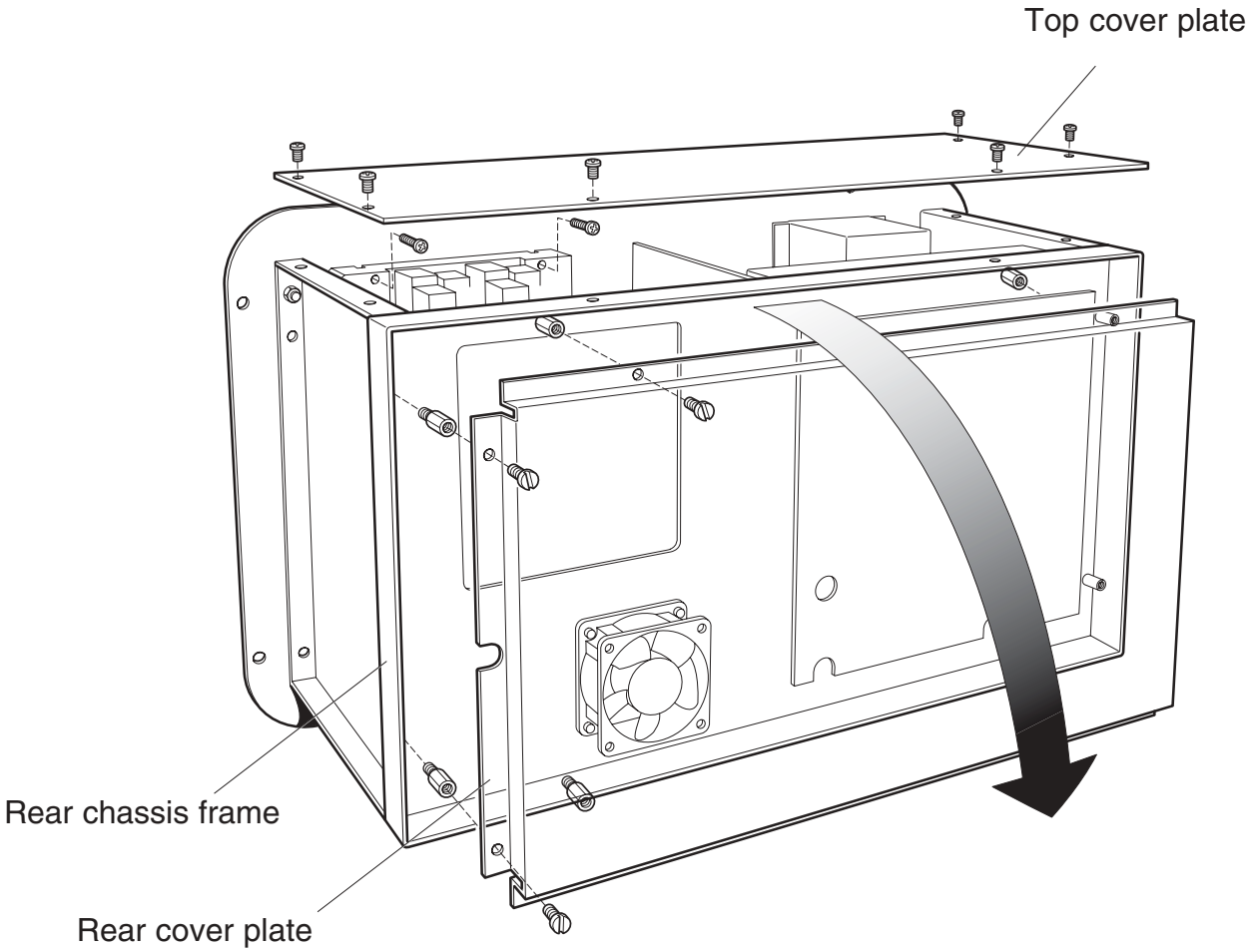


Figure 2-7 Chassis

(e) Unscrew and remove the three counter sunk screws securing the Ps and Pt bulkhead connectors (Fig. 2-5).

(f) Carefully lift out each connector from the front panel. Protect the open ports of the manifold assembly.

(g) Using a small pair of long nose pliers, remove the Knitmesh filter.

(h) Using the insertion tool, fit a new knitmesh filter into the bulkhead connector.

(i) Repeat (g) and (h) for the second bulkhead connector.

(j) Inspect each bulkhead connector for damage and wear. If necessary, replace a damaged or worn bulkhead connector.

NOTE: Visually inspect the small o-ring on each bulkhead connector for cuts and signs of wear.

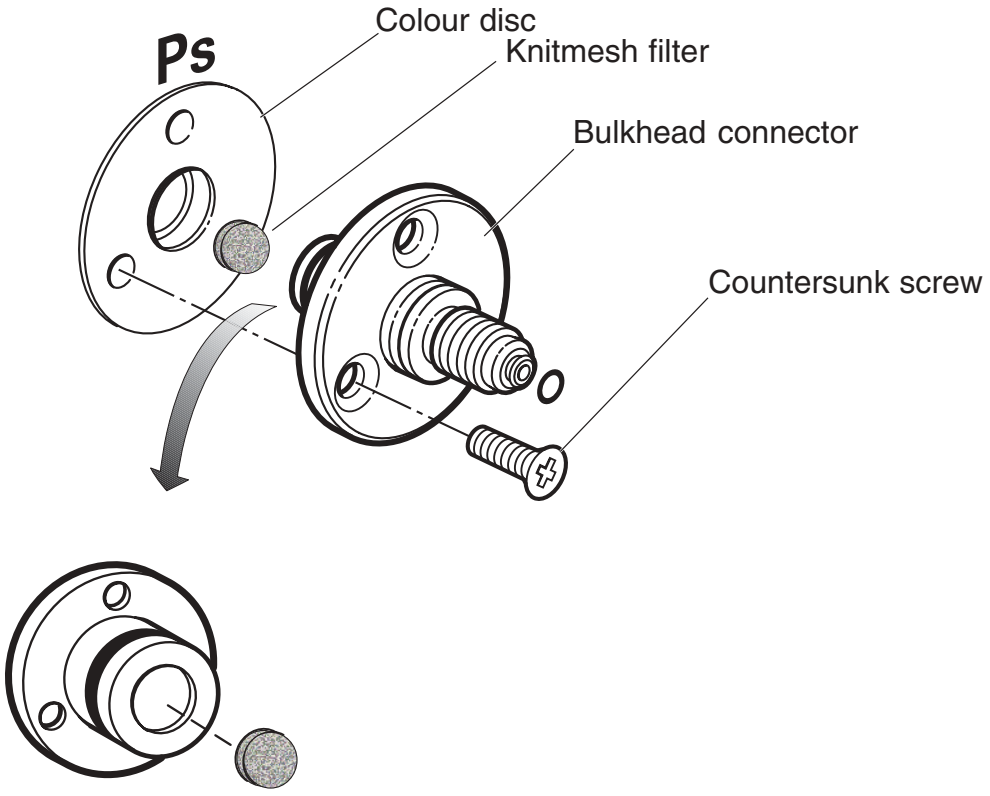


Figure 2-8 Knitmesh filter

(k) Unscrew and remove the four hexagonal pillars and washers securing the rear chassis frame to the chassis side plates.

(l) Unscrew and remove the two screws and washers attaching the manifold assembly to the rear of the front panel. This releases the top of the rear chassis frame from the top panel. The rear chassis frame hinges at the bottom for access to the manifold assembly.

(m) Loosen the four screws attaching the manifold assembly. Protect the open ports of the manifold assembly. Remove the screws securing each of the P-clips (A) to the chassis frame. Disconnect the transducer and solenoid connectors (B) at the Controller PCB. Carefully lift out the manifold assembly.

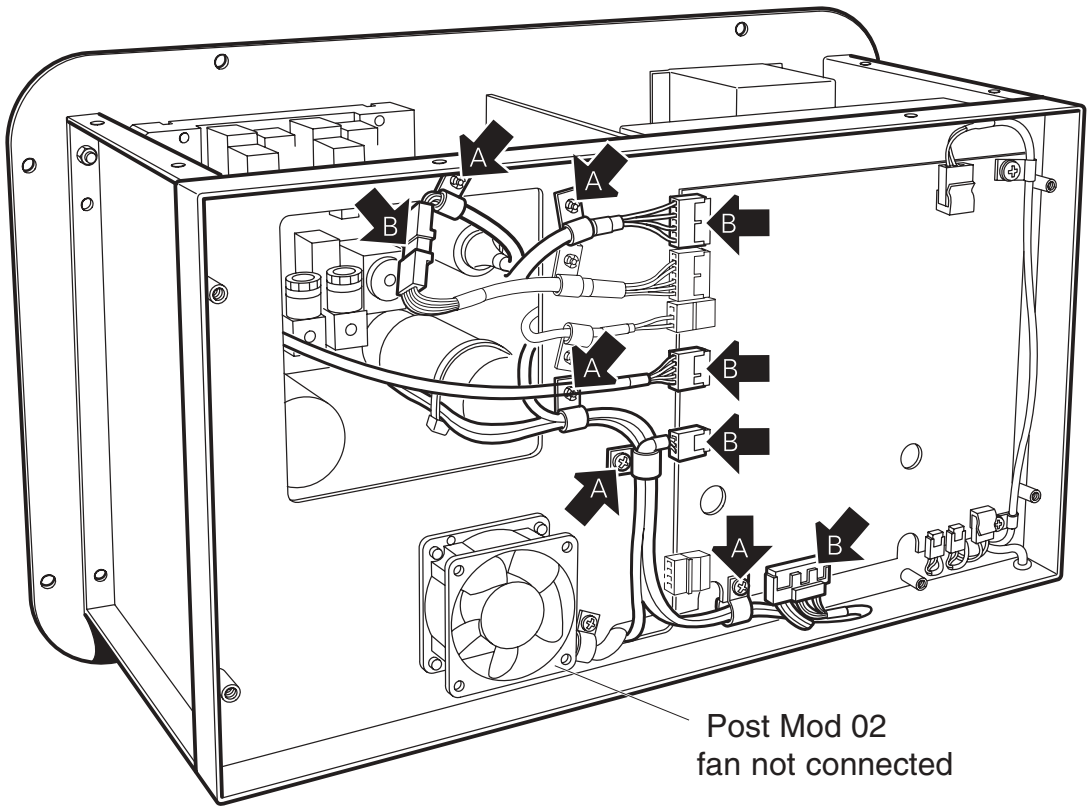


Figure 2-9 Manifold connections

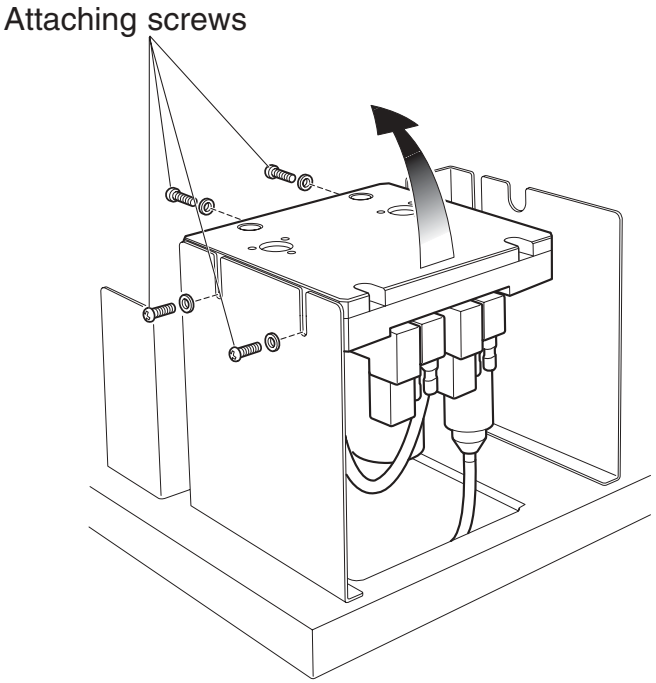


Figure 2-10 Manifold

(n) Unscrew the blue filters from the manifold assembly. Screw-in, finger-tight only, two new blue filters in the manifold assembly.

(o) Re-locate the manifold assembly on the rear chassis frame and secure by tightening the four screws. Reconnect the transducer and solenoid connectors to the Controller PCB. Secure the cables to the rear chassis frame with the p-clips and tyraps.

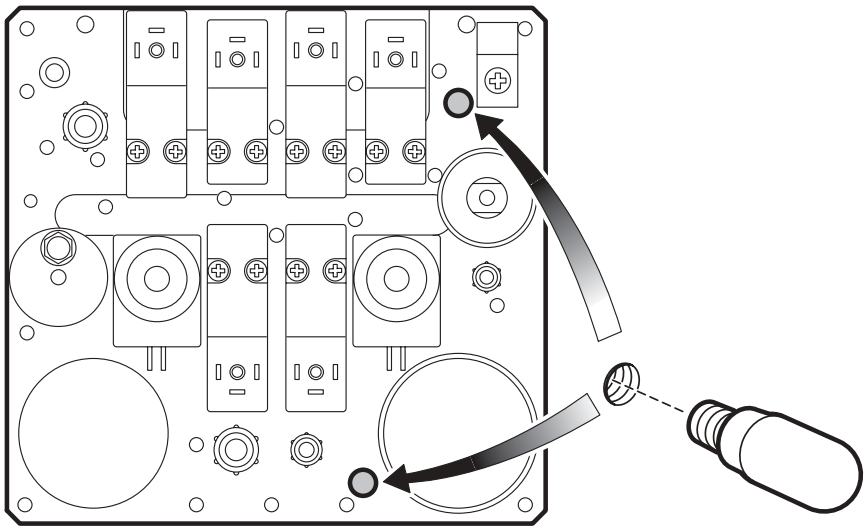


Figure 2-11 Manifold filters

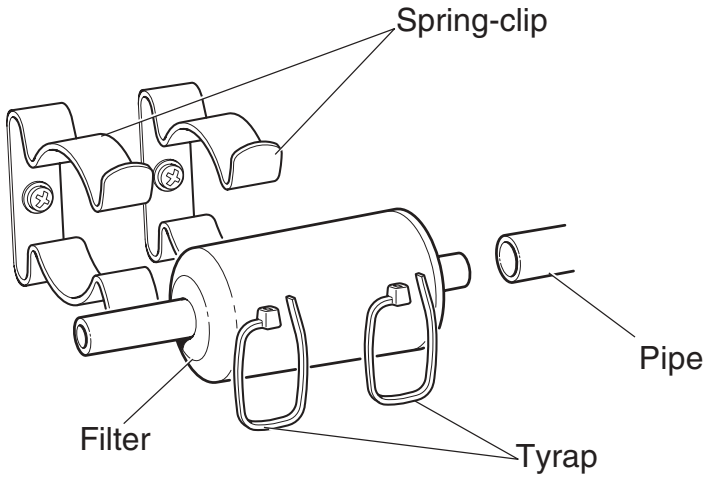
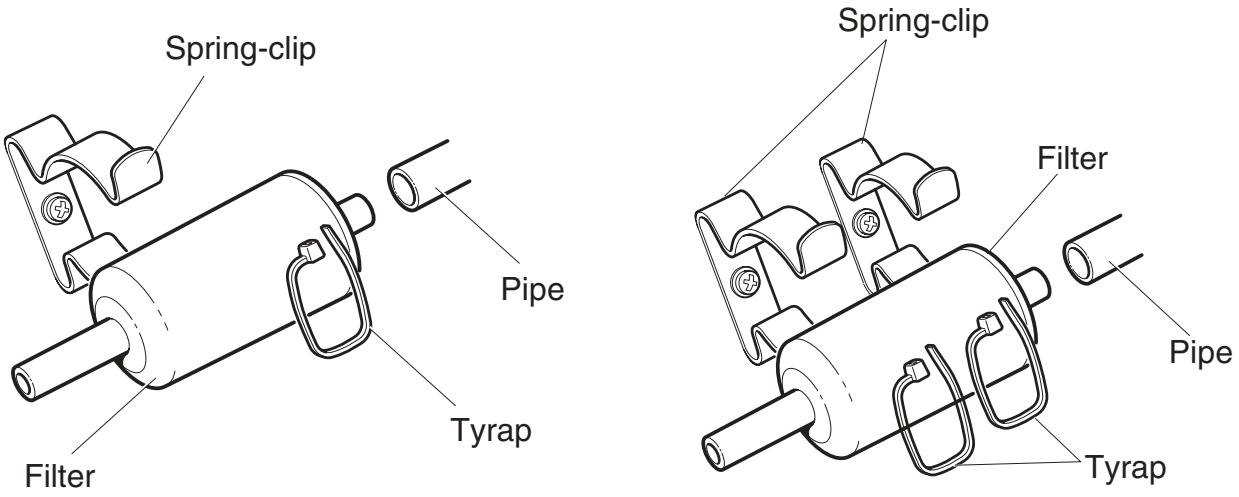


Figure 2-12 Pressure inlet filter (Pre Mod 02)

(p) Cut and remove the two tyraps securing the filter in the two spring clips.

(q) Remove the filter from the spring clips and disconnect the pipe from the pressure pump. Connect the pipe from the pressure pump to the new filter and locate the filter in the two spring clips. Secure the filter with two tyraps.



existing units post mod 02 new units post mod 02

Figure 2-12A Pressure inlet filter (Post Mod 02)

(r) Cut and remove the tyrap securing the filter in the spring clip.

(s) Remove the filter from the spring clip and disconnect the pipe from the pressure pump. Connect the pipe from the pressure pump to the new filter and locate the filter in the spring clip. Secure the filter with a tyrap.

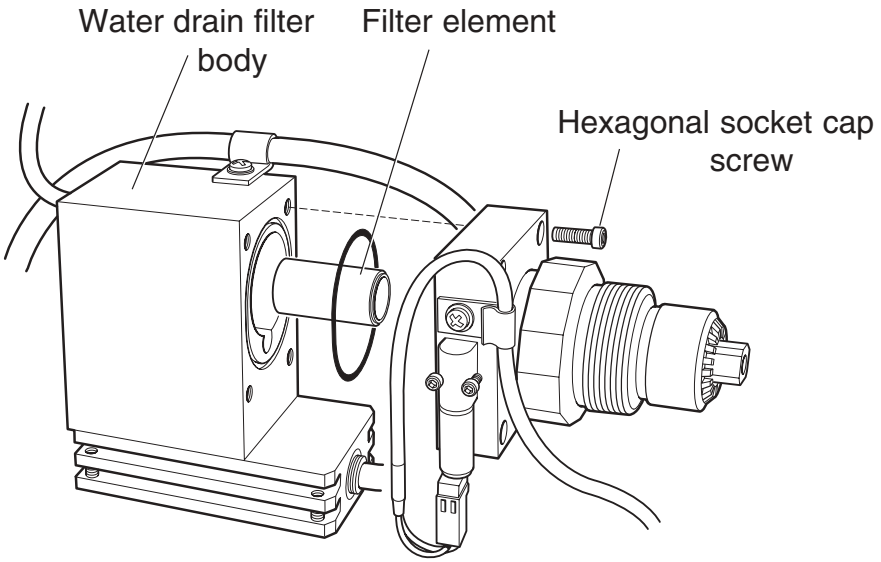


Figure 2-13 Water drain filter (Pre Mod 02)

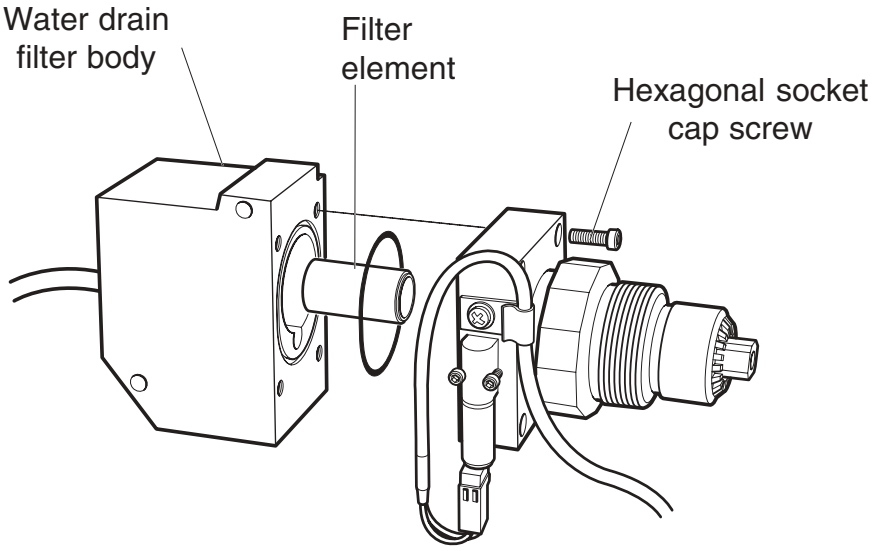


Figure 2-13A Water drain filter (Post Mod 02)

(t) Unscrew the four hexagonal socket cap screws of the water drain filter and withdraw the top of the water drain filter from the body.

(u) Pull off the filter element from the top of the water drain filter and slide on the new filter element. Insert the top of the water drain filter into the body and secure with the four hexagonal socket cap screws.

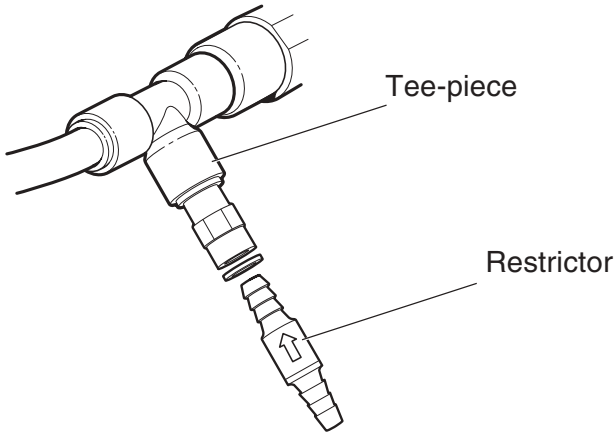


Figure 2-14 Vacuum restrictor

(v) Restrain the tee-piece of the vacuum pump outlet pipe and pull out the restrictor. Make sure the arrow marking of the new filter points towards the tee-piece and insert correctly into the tee-piece.

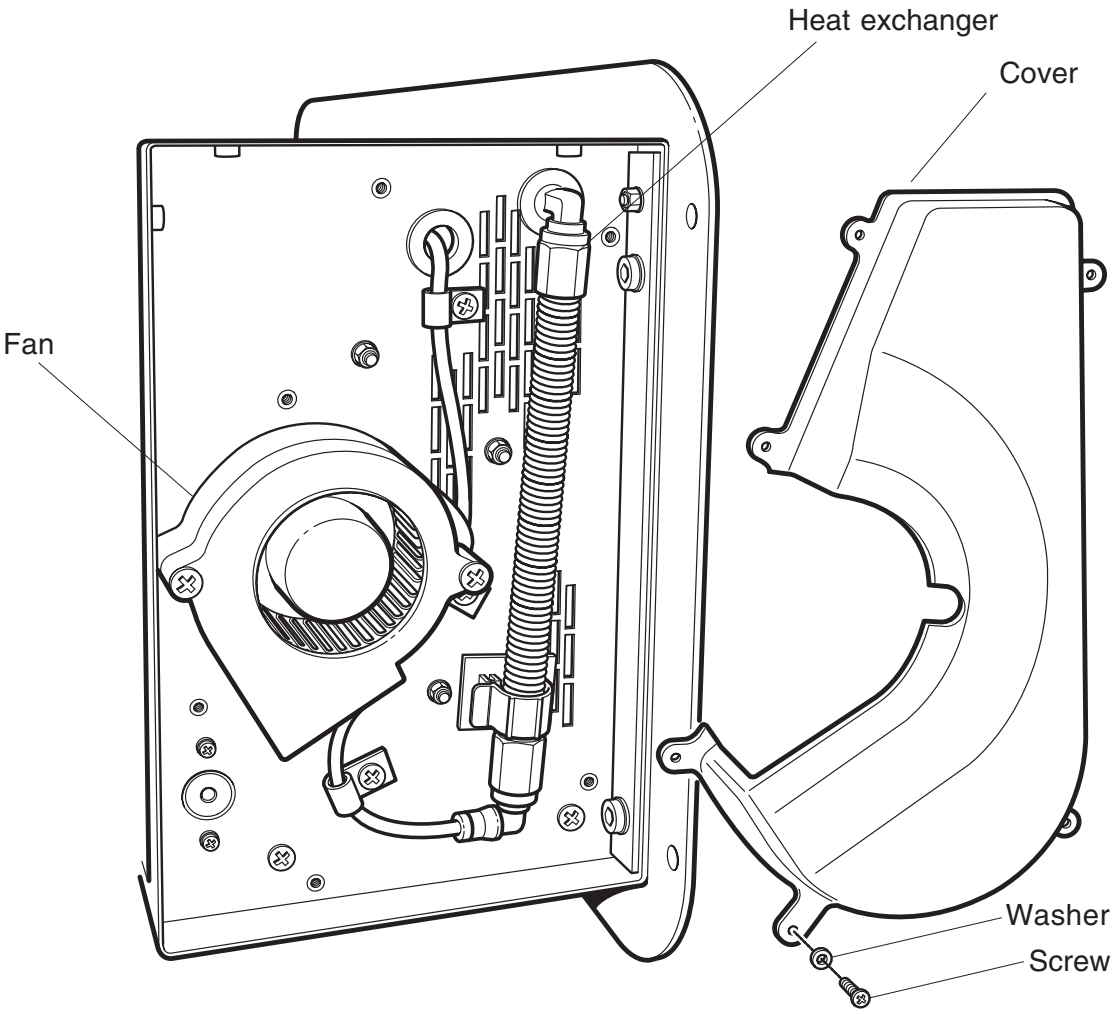


Figure 2-15 Heat exchanger (Post Mod 02)

(w) Unscrew the six screws and washers, remove the heat exchanger cover. Remove any dust/debris from the heat exchanger, cover and fan. Refit the cover and secure with the six screws and washers.

(x) To complete the 1000 hour maintenance procedure refer to paragraph (4) completion.

(3) Maintenance Schedule 2 (Figure 2-16)

This procedure requires Pressure Pump (PL item 5) and Vacuum Pump (PL item 10). Carry out Maintenance Schedule 1 and then proceed as follows:

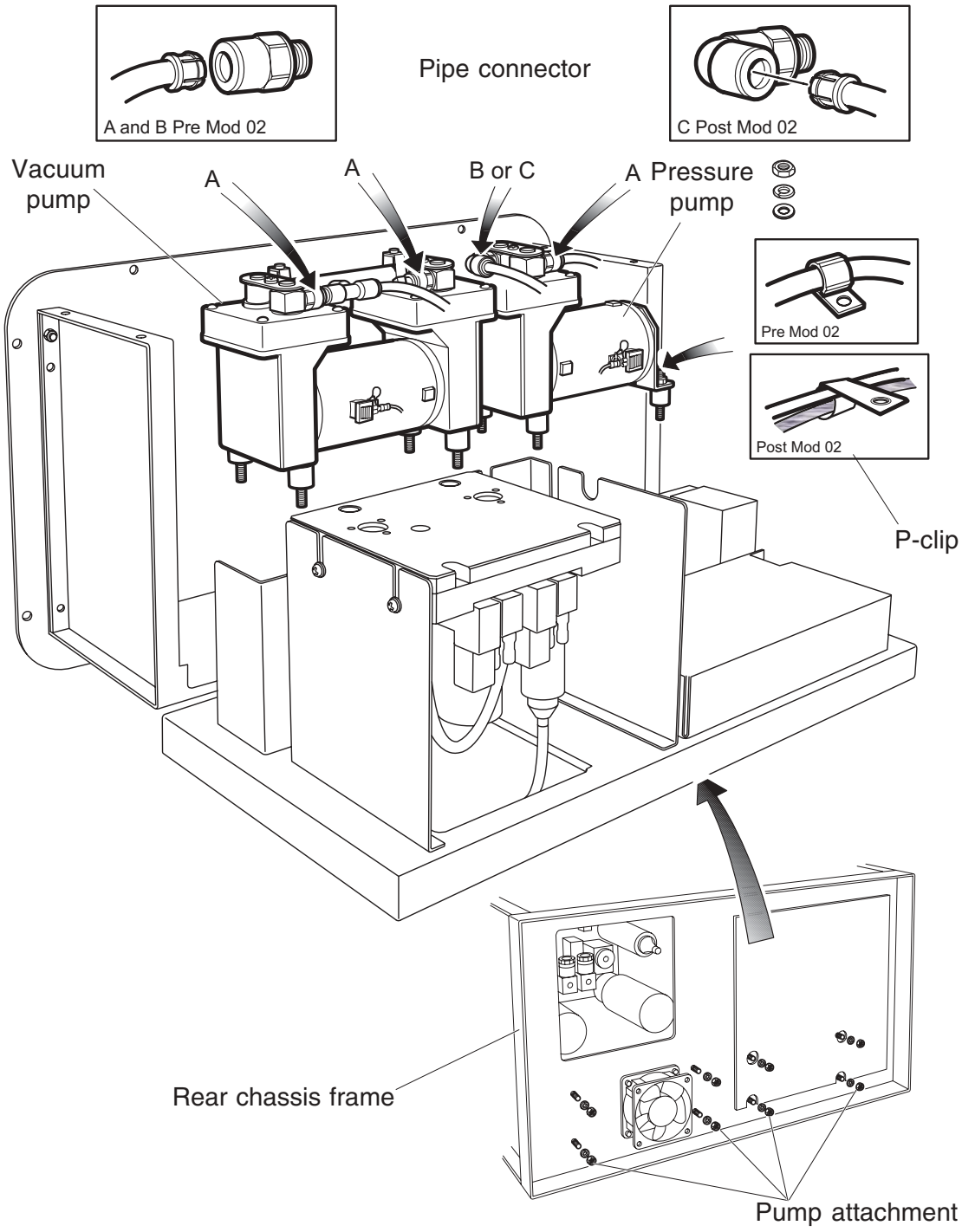


Figure 2-16 Pump location

(a) Disconnect the input pipe from the top of the pressure pump. Disconnect the output pipe from the top of the pressure pump. Unscrew and remove the nut, plain washer and spring washer securing the p-clip retaining the output pipe.

(b) On the outer side of the rear chassis frame, on gaps in the controller PCB, unscrew and remove the four nuts and spring washers securing the pressure pump. Support the pressure pump and, using a soldering iron, remove the capacitors from the terminals of the pressure pump.

(c) Disconnect the power supply cables from the pressure pump. Remove the pressure pump.

(d) Connect the power supply cables to the new pressure pump. Using a soldering iron, connect the capacitors to the terminals of the pressure pump. Locate the studs of the pressure pump mountings through the holes in the rear chassis frame. Secure the pressure pump with the four nuts and spring washers.

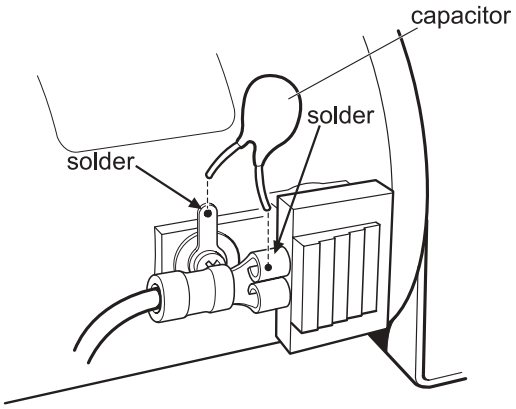


Figure 2-17 Pump motor capacitors

(e) Locate the p-clip, retaining the output pipe, on the stud on the pressure pump mounting. Secure the p-clip with the nut, plain washer and spring washer.

(f) Locate the p-clip, retaining the input pipe, on the top of the pressure pump. Secure the p-clip with the screw and washer.

(g) Connect the input and output pipes on the top of the pressure pump.

(h) Disconnect the output pipe from the vacuum pump. On the outer side of the rear chassis frame, unscrew and remove the four nuts and spring washers.

(i) Support the vacuum pump and, using a soldering iron, remove the capacitors from the terminals of the vacuum pump.

(j) Disconnect the power supply cables from the vacuum pump. Remove the vacuum pump.

(k) Connect the power supply cables to the new vacuum pump. Using a soldering iron, connect the capacitors to the terminals of the vacuum pump. Locate the studs of the vacuum pump mountings through the holes in the rear chassis frame. Secure the vacuum pump with the four nuts and spring washers.

(l) Connect the output pipe to the vacuum pump.

4. Completion

(a) Reconnect the water drain pipe to the water drain filter. Remove the protection from the open ports of the manifold assembly. Locate the top of the rear chassis frame to the top of the front panel.

(b) Align the recesses of the manifold assembly with the pillars on the rear of the front panel and secure with the two screws and washers.

(c) Temporarily protect the open ports of the manifold assembly. Secure the rear chassis frame to the chassis side plates with four hexagonal pillars and washers.

(d) Carefully locate each bulkhead connector in the front panel and secure with three countersunk screws.

(e) Secure the top cover plate with six screws and washers.

(f) Secure the rear cover plate with eight screws and washers.

(g) Carefully rest the assembled unit on the top of the case and locate the water drain pipe in the grommet in the case.

(h) Carefully lower the assembled unit in the case and secure with eight screws and washers.

D. Cleaning

(1) Materials

(a) The following materials are approved cleaning agents.

NOTE: Equivalent alternatives may be used for listed items.

Material	Specification
Lint-free cloth	Commercially available
Acetone	TBA
Soft bush	Commercially available

(2) Procedure

NOTE: Do not allow solvent to enter the pressure port.

(a) Clean the external surfaces of the unit using lint-free cloth and a soft brush. Remove stubborn dirt using solvent and allow to dry.

(b) Clean the electrical connector using a soft brush. Remove stubborn dirt using solvent and allow to dry.

(3) Check

Inspection

(a) Make sure that the unit is clean. Refer to CLEANING.

(b) Check for the unit obvious defects in accordance with standard industry practices.

(c) Check the electrical connector for loose, bent or broken pins and contamination.

(d) Make sure there is no foreign matter in the pressure connector or damage to stainless steel diaphragm.

NOTE: If foreign matter or damage is found, the unit should be replaced.

E. Parts List

FIGURE ITEM NO.	AIRLINE PART NUMBER	PART NUMBER	NOMENCLATURE	EFF	UNITS PER ASSY
18-					
1		AD505-01	TEST SET, AIR DATA ADTS 505		RF
			ALTERNATIVE		
-1A		AD505-01-2952M0	TEST SET, AIR DATA (BARFIELD DPS 450)		RF
5		.AS505-01-3124M0	.PUMP, PRESSURE		1
10		.AS505-04-3124M0	.PUMP, VACUUM		1
15		.AS505-18-3124M0	.KIT, FUSES/O-RINGS		1
-20		.AS505-22-3124M0	.KIT, FILTERS (1000 HOURS)		1
25		.AS505-30-3124M0	.CASE AND LID		1
30		.AS405-47-1728M0	.CABLE, POWER. 5M (260V OPEN END)		1
			ALTERNATIVE		
- 30A		.AS505-41-3124M0	.CABLE, POWER, 5M (USA CONNECTOR) ALTERNATIVE		1
- 30B		.AS505-40-3124M0	.CABLE, POWER , 5M (UK CONNECTOR)		1
35		.AS505-46-3124M0	.BULKHEAD, AN4		2
40		.AS505-52-3124M0	.KIT, HOSE		1
45		.AS505-54-3124M0	.CABLE, HAND TERMINAL		1
-50		.AS505-55-3124M0	.CABLE, HAND TERMINAL, CONNECTOR ASSEMBLY		1
55		.AS505-56-3124M0	.HAND TERMINAL (MATCHED WITH ITEM 1)		1
			ALTERNATIVE		
-55A		AD505-3-3952M0	.HAND TERMINAL (MATCHED WITH ITEM1A) (BARFIELD DPS 450)		1
60		.AS505-57-3124M0	.BAG, ACCESSORY, HAND TERMINAL		1

- ITEM NOT ILLUSTRATED

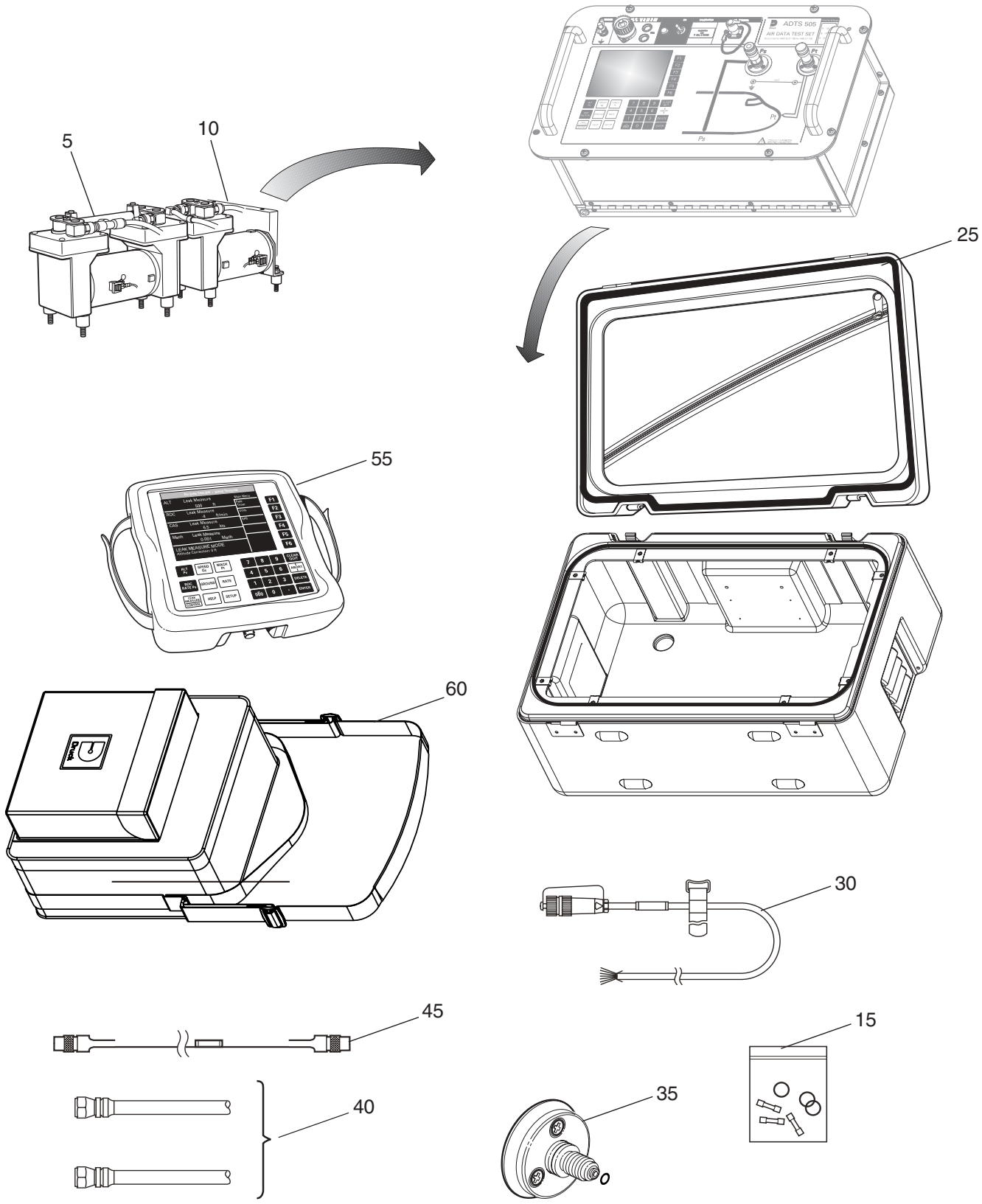


Figure 2-18 Parts