SYSTEM MAINTENANCE MANUAL
FOR
T.K.S.
AIRFRAME, PROPELLER AND WINDSHIELD
ICE PROTECTION SYSTEMS
ON
SOCATA TB20 AND TB21 AIRCRAFT

Part Number 4700SMM

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1. Description Operation and Data.

A. General Description.

TKS Modification No 1391 (SOCATA Equipment Option No) provides liquid (fluid) ice protection systems for the airframe windshield and propeller together with passive devices for certain vents and intakes.

The extent of the liquid ice protection system is illustrated in Figure 101. It comprises liquid transpiration protection for the wings, stabilator and vertical stabiliser, and liquid spray systems for the windshield and propeller.

The transpiration system for the flying surfaces takes the form of Porous Panels which are installed on the leading edges. The windshield spray is provided by a spraybar located at the base of each windshield and the propeller equipment comprises grooved rubber overshoes attached to the propeller blades, fed with fluid through a slinger ring and associated tubing, located within the spinner.

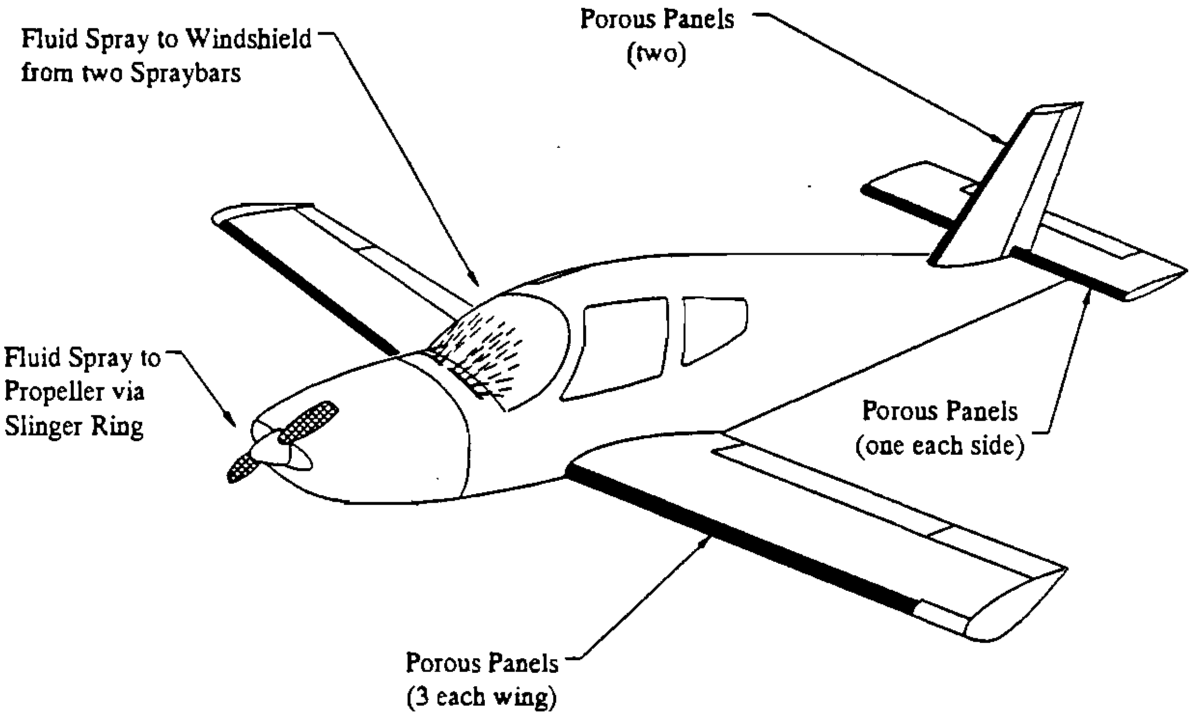


Figure 101.
Extent of Liquid Ice Protection.

The liquid ice protection devices described above are supplied with 'de-icing' fluid from a single tank, through a supply system which is illustrated schematically in Figure 102.

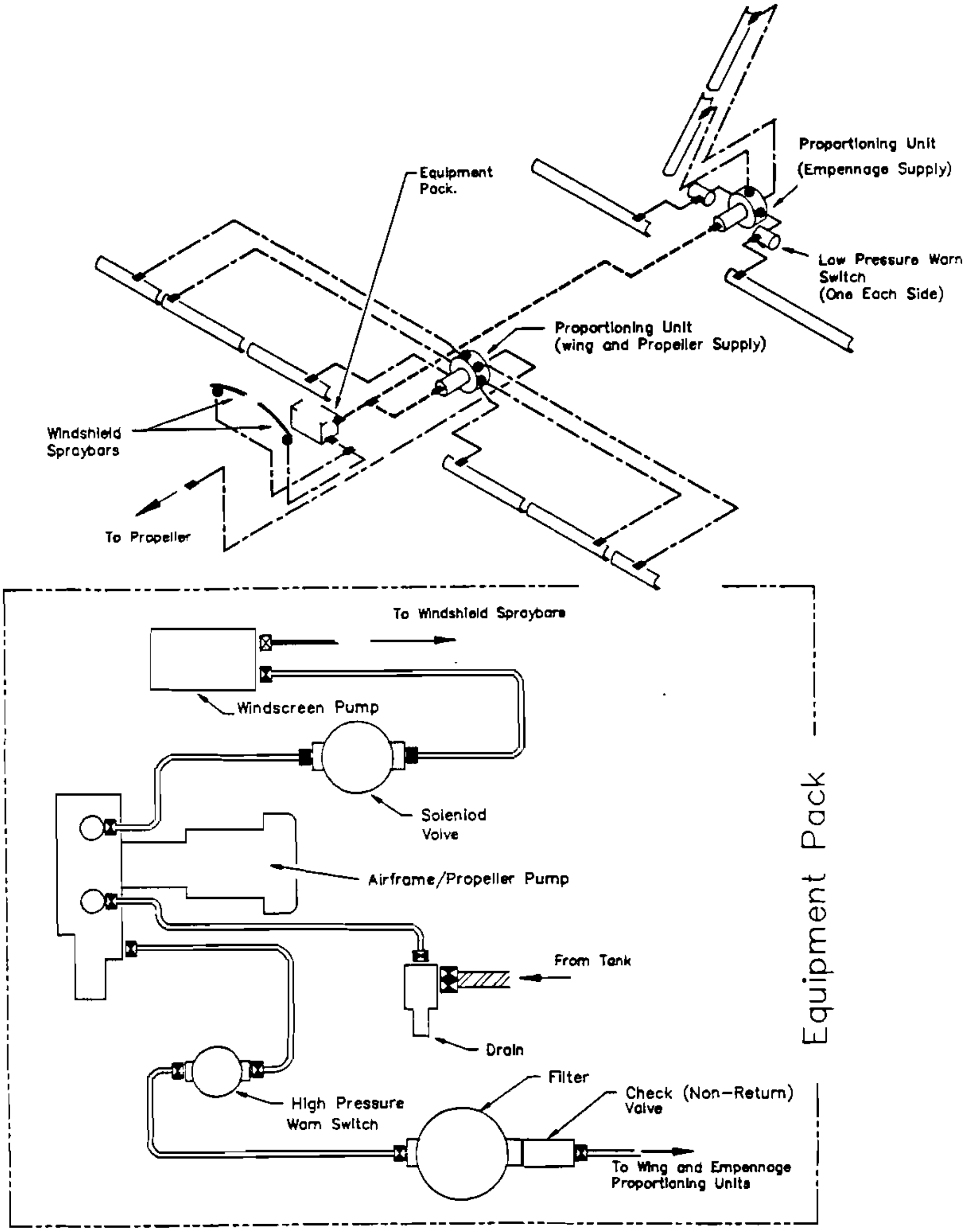


Figure 102.

Liquid Supply System Schematic.

B. Detail Description.

The non-metallic tank is located below the left side of the baggage compartment floor. Longitudinal structural reinforcement members are provided along both inboard and outboard edges of the tank to transmit the loads arising from the tank and fluid into frames 4 and 5. The upper surface of the tank is covered by an aluminium alloy sheet which forms a structural member of the aircraft. Figure 103 illustrates the Tank, Filler and Structural Reinforcements.

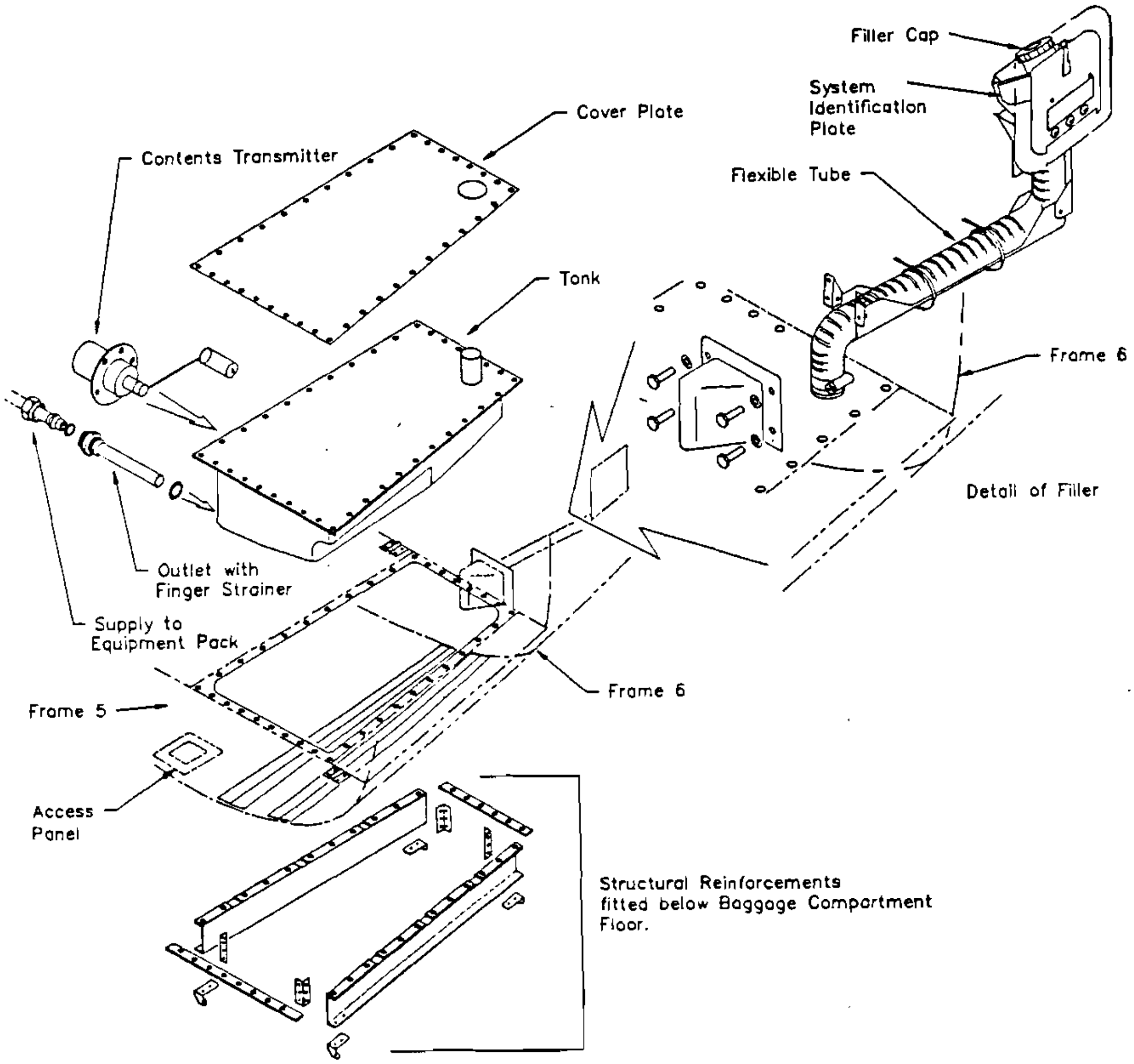


Figure 103.

De-icing Fluid Tank and Filler.

The Tank Filler is located in the left side of the fuselage, aft of the baggage compartment door. It comprises a hinged door with the filler cap mounted on an internal panel attached to the door. On opening the filler swings outwards with the door to provide unrestricted access. The filler is connected to the tank by a 1" (25mm) diameter flexible tube, this tube also serves as the tank vent, the filler cap being vented. The flexible tube is supported by a channel to maintain a positive gradient and ensure efficient filling and venting.
Any fluid spilt in the vicinity of the filler drains through holes in the door to the outside of the fuselage.

A contents transmitter is mounted on the inboard surface of the tank and an Outlet Connection with Finger Strainer is located at the forward inboard lower corner. A removable panel is installed in the lower fuselage skin to provide access to the contents transmitter and to the outlet connection and finger strainer.

Fluid supply and metering equipment is mounted in the form of an Equipment Pack which is attached to the aft side of Frame 1 and to the lower side of the right cabin floor.

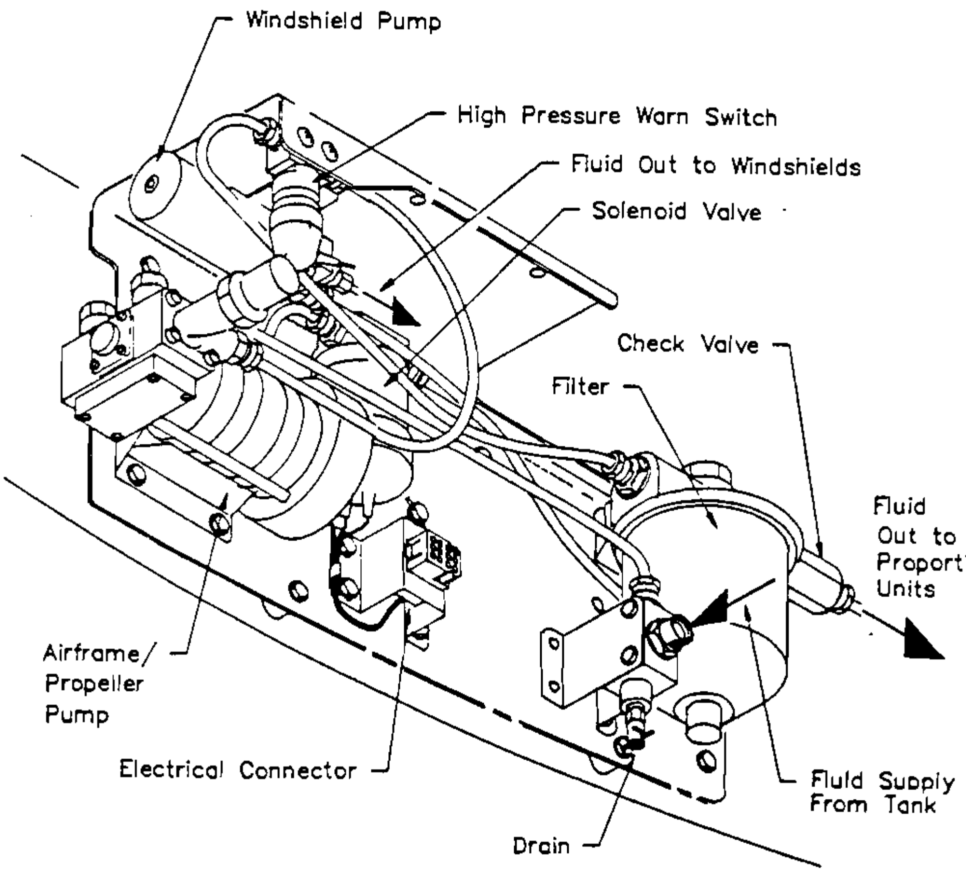


Figure 104.

Equipment Pack.

The equipment pack includes the Airframe/Propeller System Pump, the Filter, the High Pressure Warning Switch and the windshield system Pump and Solenoid Valve. A drain valve is also provided, this is accessible from below the aircraft. The equipment Pack is supplied with fluid from the Tank by a 1/2" (13mm) outside diameter nylon tube. A spring loaded check valve is fitted at the Filter outlet, and is connected by 5/16" (7,8mm) outside diameter Nylon Tubing to the Proportioning Units which supply fluid to the protected regions. The proportioning units are manifold devices with a single inlet and multiple outlets and contain a calibrated capillary tube in series with each outlet. In addition each outlet houses a check valve which prevents fluid re-entering the unit.

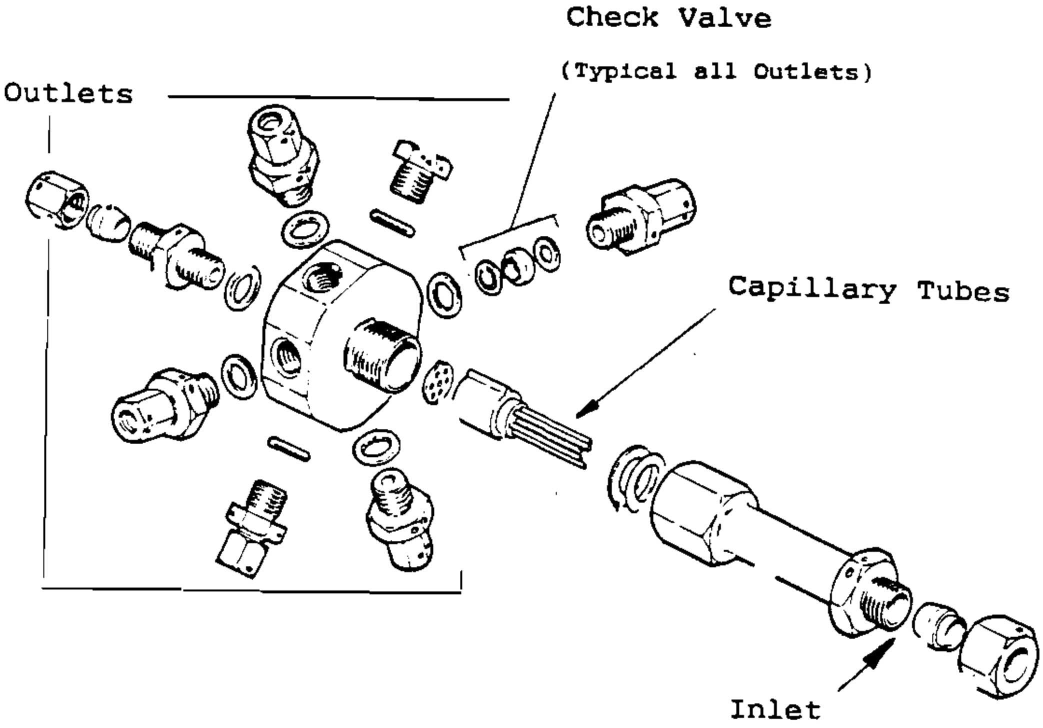


Figure 105.

Exploded View of a typical Proportioning Unit.

Two Proportioning Units are installed on the aircraft, one is located between the main landing gear wheel wells and supplies fluid to the Porous Panels fitted to the Wings and to the Propeller. The Second Proportioning Unit is installed in the tailcone fairing and this Unit supplies the Porous panels located on the stabilator and vertical stabiliser.

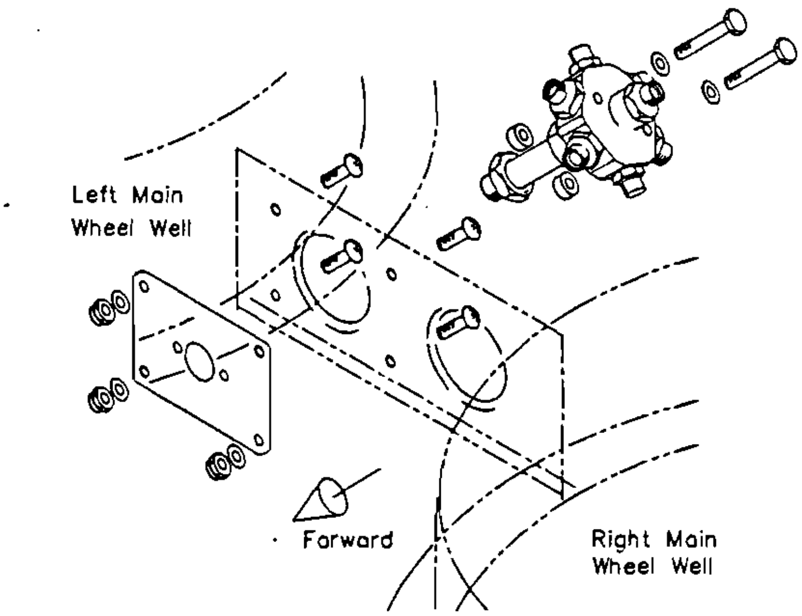


Figure 106.

Proportioning Unit between Main Landing gear wheel wells.

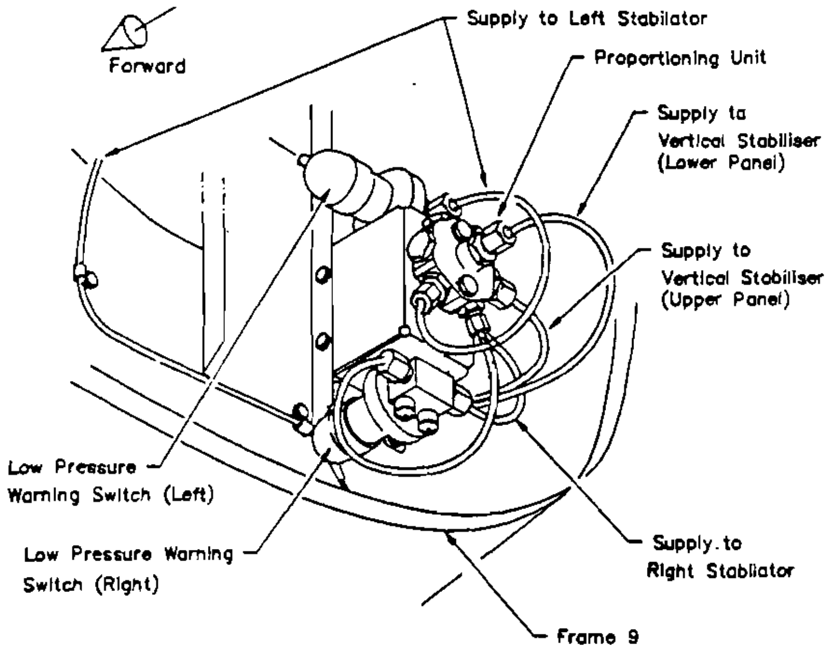


Figure 107.

Proportioning Unit and Low Pressure Warn Switches
in tailcone fairing.

The Proportioning Unit outlets are connected by 3/16" (4,8mm) outside diameter Nylon Tube to the appropriate protected regions.
Note that each outlet is calibrated, by means of the internal capillary tube, to provide the correct flow of fluid for a specific panel (or for the propeller), it is therefore important that the correct Proportioning Unit is installed at each location and that the outlets are connected to the correct panels as detailed in Table 101.

Table 101.

Location	Proportioning Unit		Region Supplied by Outlet
	Part No.	Outlet No.	
Between Main Landing Gear Wheel Wells.	PU300WGW52	1 2 3 4 5 6 7	Left Wing Outer Panel (D4701) Right Wing Mid Panel (D4704) Right Wing Inner Panel (D4706) Left Wing Inner Panel (D4705) Left Wing Mid Panel (D4703) Right Wing Outer Panel (D4702) Propeller
In Tailcone Fairing.	PU300DT51	1 2 3 4 5 6 7	Right Stabilator Panel (D4712) Left Stabilator Panel (D4711) Not Used Not Used Not Used Fin Upper Panel (D4721) Fin Lower Panel (D4723)

An articulated supply to the Porous Panels fitted to the stabilator is provided by means of the same Nylon tubing, as used in the remainder of the system. Movement of the stabilator is accommodated by flexure of this tubing guided by brackets and clamps fitted to the stabilator hinges and the fixed structure as shown in Figure 108. Two Low Pressure Warning Switches are fitted, one being installed in each of the stabilator supply tubes (See Figure 107).

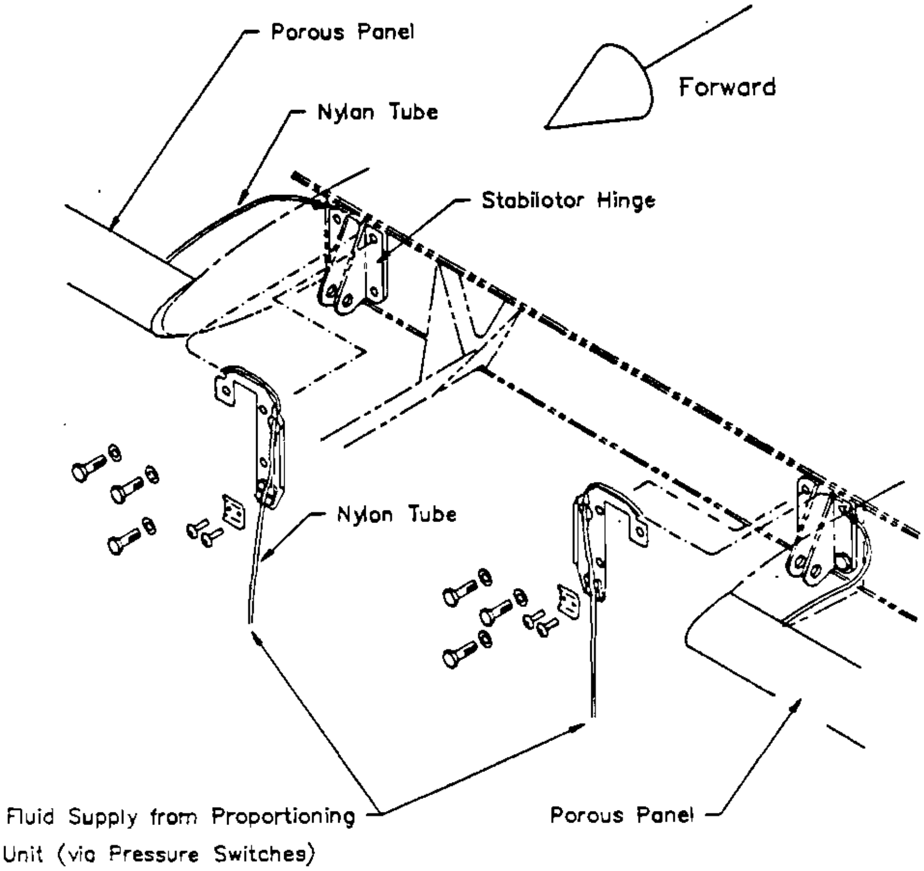


Figure 108

Fluid Supply to Stabilator Panels.

Figure 109 illustrates the fluid supply for propeller ice protection which is provided from the Proportioning Unit located between the main gear wheel wells. The feed to the propeller consists of Nylon Tube from the Proportioning Unit to the firewall, this is routed forward along the left side of the fuselage, a Flexible Hose from the firewall to the rear engine baffle and Stainless Steel Tube from the rear engine baffle to front of the engine. A nozzle is fitted at the forward end of this tube arrangement to direct the fluid into a Slinger Ring which is attached to the spinner backplate. The Slinger Ring has two outlets, these supply fluid through tubes to the root of each propeller blade under the influence of centrifugal forces. Grooved rubber Overshoes are bonded to the inner leading edges of the propeller blades.

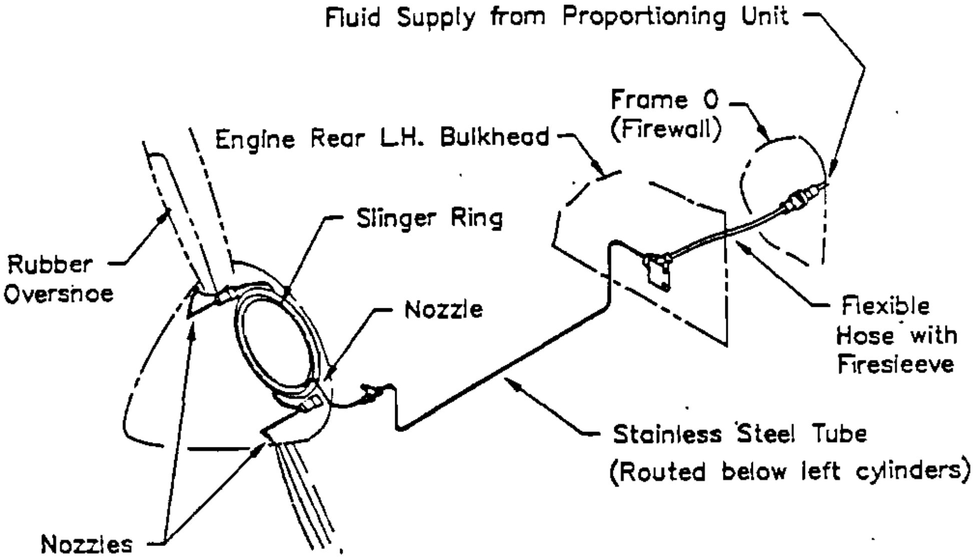


Figure 109.

Fluid Supply to Propeller.

NOTE: Propeller ice protection components forward of the rear engine baffle are identical with those provided by the TKS Propeller Ice Protection Kit for this aircraft. (SOCATA Equipment Option Number 522)

A shielded Spraybar is fitted across the base of each windshield to project fluid onto the region ahead of the pilot.
These Spraybars are provided with fluid by a small electrically operated pump, connected in series with a Solenoid Valve. The Solenoid Valve is normally closed and opens only when the Pump is energised.

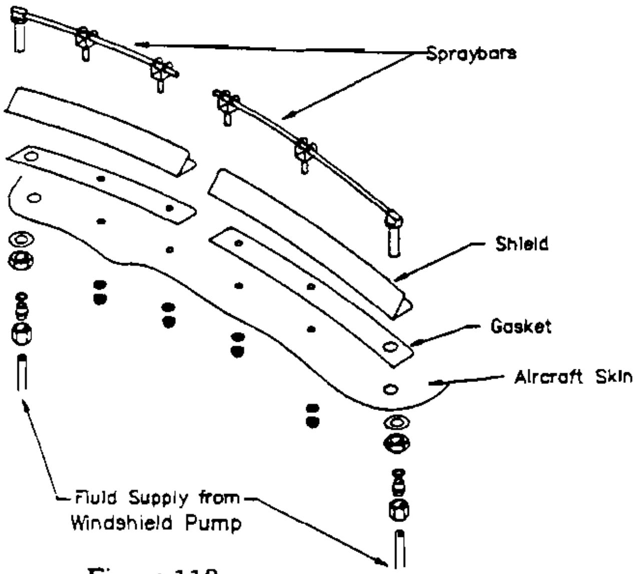


Figure 110.

Windshield Spraybars.

Nylon Pipelines are used throughout the ice protection system, with the exception of those within the engine compartment (Reference Figure 109). Special compression fittings are used for both nylon and metal pipelines. The connections are either Aluminium Alloy where nylon tubing only is connected or Stainless Steel when the connection is to the Stainless Steel tube in the engine compartment or to Stainless Steel (or Titanium) fittings at other parts of the system. An elastomeric seal is used within the coupling at nylon tube connections only.
The fitting is illustrated in Figure 111. Refer to TKS General Practices Manual 30-09-46 for further information and instructions.

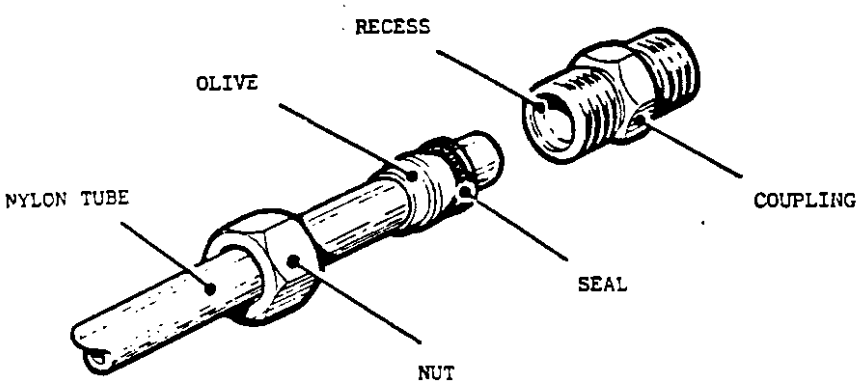


Figure 111.

TKS Tube Connector.

A lamp is provided to illuminate the left wing leading edge, this lamp is attached to the firewall and aligns with an aperture cut in the lower cowling. The lamp is adjustable to permit optimum beam alignment.

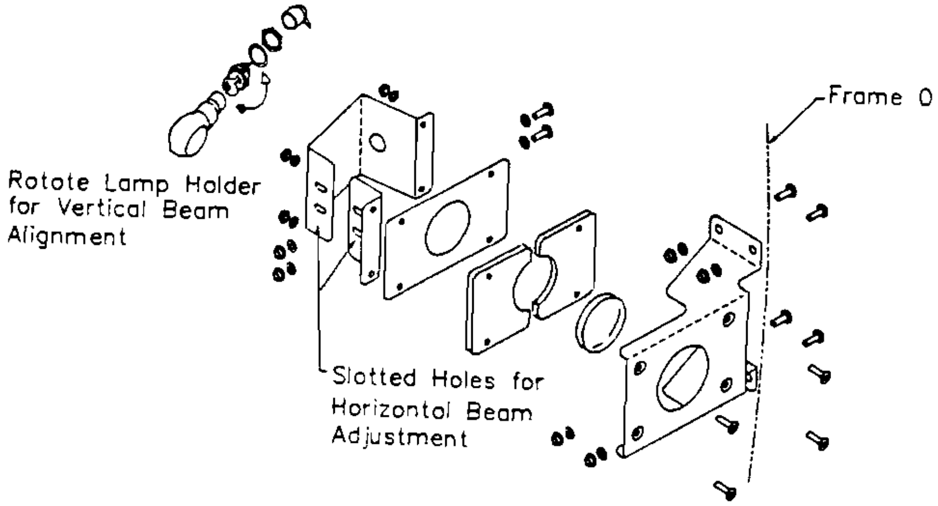


Figure 112.

Wing Inspection Lamp.

With the exception of pitot heat, all controls and displays related to ice protection are grouped on a Control Panel which is located to the right of the centre pedestal, below the transponder.
The Control Panel is illustrated in Figure 113.

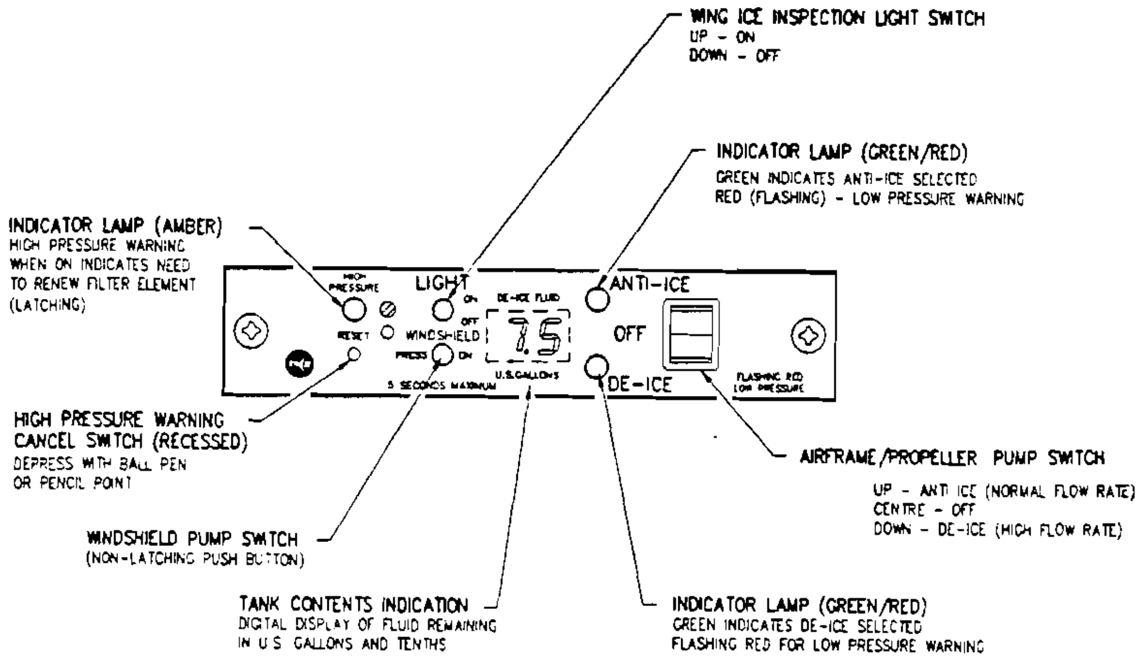


Figure 113

Control Panel.

The Control Panel includes a digital tank contents display which indicates the approximate de-icing fluid quantity remaining in U.S. Gallons. This display has automatic dimming for night operations.

Three indicator lights are provided; the two lights adjacent to the Airframe/Propeller Switch are dual function, providing status and Low Pressure Warning information. The third light provides a high pressure warning.

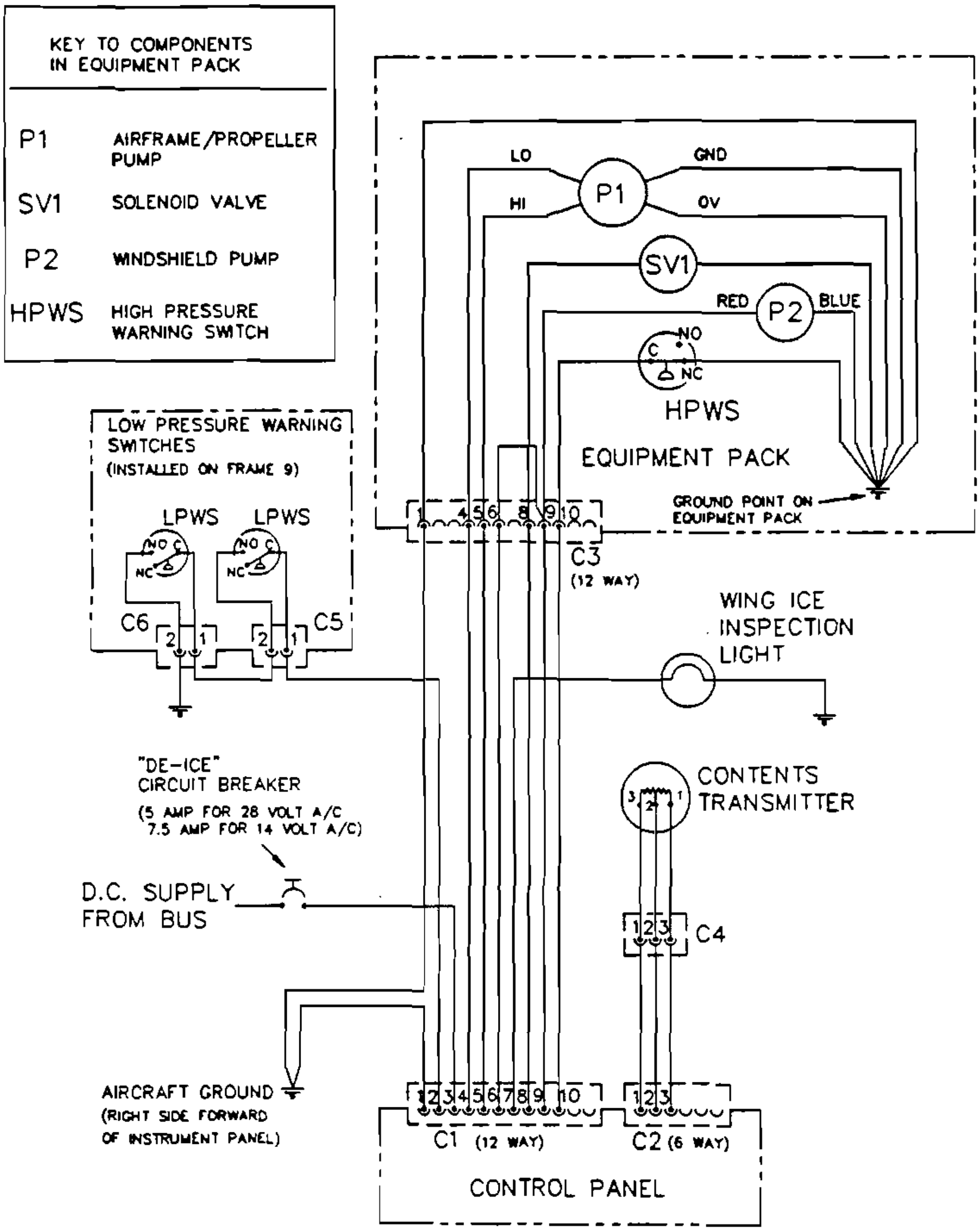


Figure 114.

Electrical System Schematic.

A deflector tube is installed in place of mesh in the Cabin Heat Air Intake and shields are provided for the Fuel Tank Vents. These devices are illustrated in Figure 115. In addition a deflector strip is fitted within the tailcone to divert water and/or de–icing fluid away from the connections to the ADF Antenna.

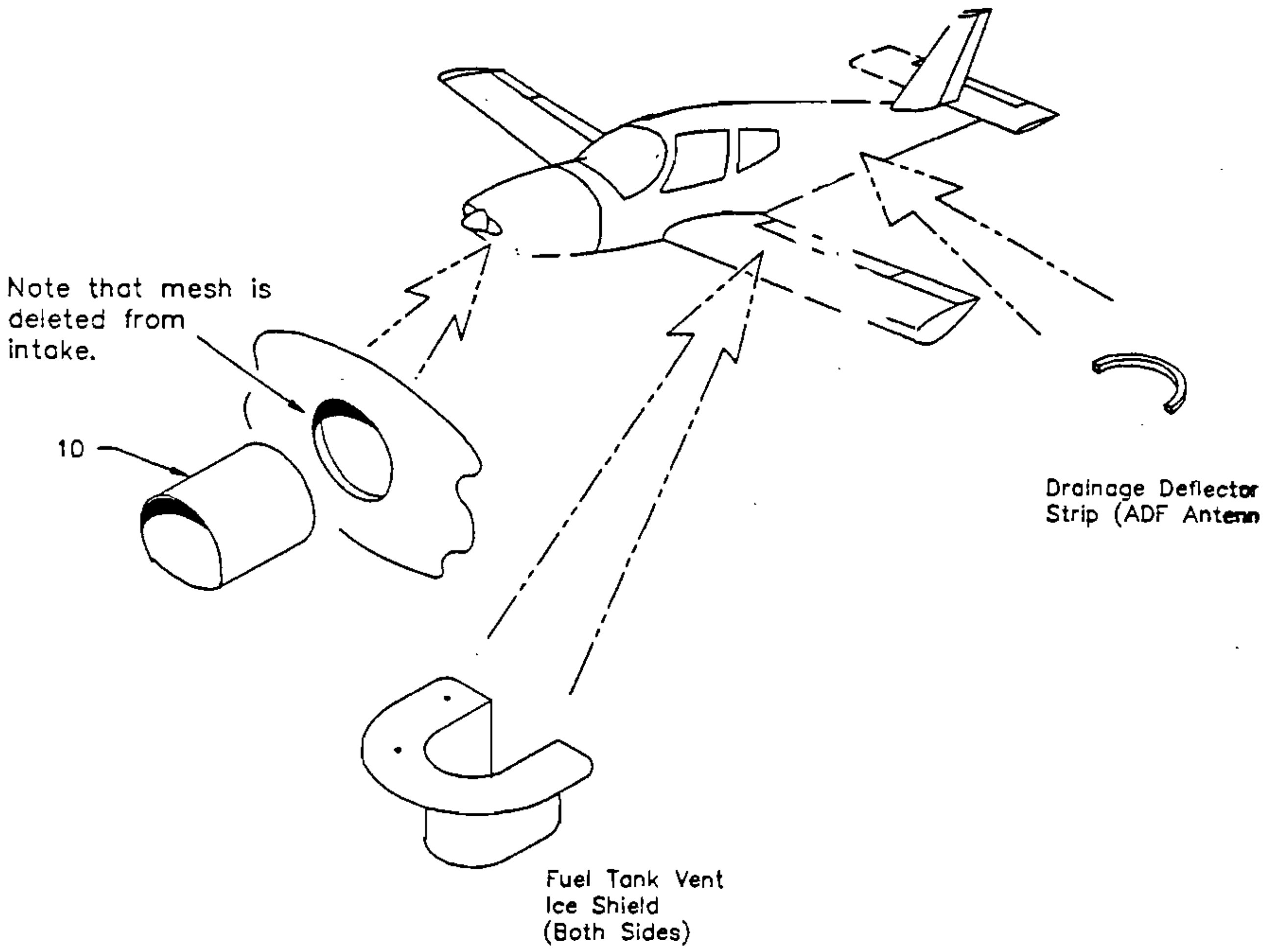


Figure 115

Cabin Heat Air Intake and Fuel Tank Vent Shields.

C. Operation.

(1) Airframe/Propeller System.

(Reference Figures 102 and 116)

De-icing Fluid is supplied simultaneously to the Porous Panels fitted to aerofoil leading edges and to the propeller by the Airframe/Propeller Pump. Two pre-set flow rates are provided, 'De-ice and 'Anti-ice'. With 'De-ice' selected the flow rate is approximately twice the 'Anti-ice' flow rate.

'De-ice' is intended to be used for short periods only at system start-up. It reduces the time taken for flow to be established from the extremities of the system and expedites the removal of ice accretions formed prior to selection of the ice protection system. The use of 'De-ice' at other times is normally unnecessary and wasteful of fluid.

'Anti-ice' is intended for continuous use in icing conditions. (In light icing the system may be selected on and off periodically as required but in this case, as in all other icing encounters, it is recommended that initial 'on' selection is made immediately the onset of icing is observed or, if possible, slightly in advance.)

The Airframe/Propeller Pump is a positive displacement pump incorporating a pressure limiting mechanism. It provides the appropriate constant flow output, as selected, over the temperature range of the icing envelope with the flow rate reducing eventually to zero at higher system back pressure. This protects system components from damage due to operation at excessively low temperature and in the case of system blockage such as crushed tubing.

The Airframe/Propeller Pump may not be self priming and may be primed by use of the Windshield Pump (See C.(3) below).

The means by which metering and proportioning of fluid within the Airframe/Propeller system is achieved is illustrated in Figure 116.

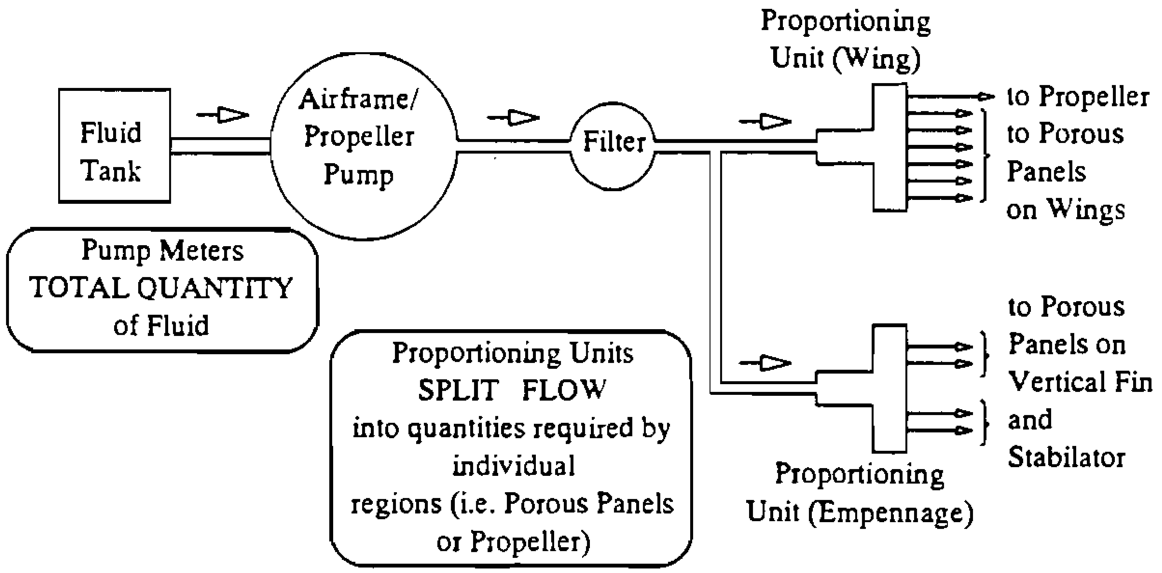


Figure 116

Airframe/Propeller System, Principle of Operation.

Figure 117 shows a diagrammatic cross section of a porous panel.
Fluid from the proportioning units is fed into a cavity formed between the inner and outer skins and passes through the plastic membrane and the outer skin to exude from the surface of the panel, where it melts the bond between ice and the surface of the panel. Airflow also carries the fluid rearwards so that ice protection is obtained on both the panel and aerofoil surfaces aft of the porous zone.

The primary purpose of the plastic membrane is to provide even fluid coverage, countering the effects of gravity and airflow pressure variation at the panel surface. A secondary function is to minimise drainage of fluid from the panel when the system is inoperative. This is achieved as a result of surface tension effects within the small pores of the membrane; this retains fluid within the cavity during prolonged periods of inactivity. Aside from reducing the obvious nuisance effects of fluid drainage from parked aircraft, retaining the panels filled with fluid improves system efficiency by reducing the response time at system start-up. The main function of the porous outer skin is a structural one; it plays little part in controling fluid coverage.

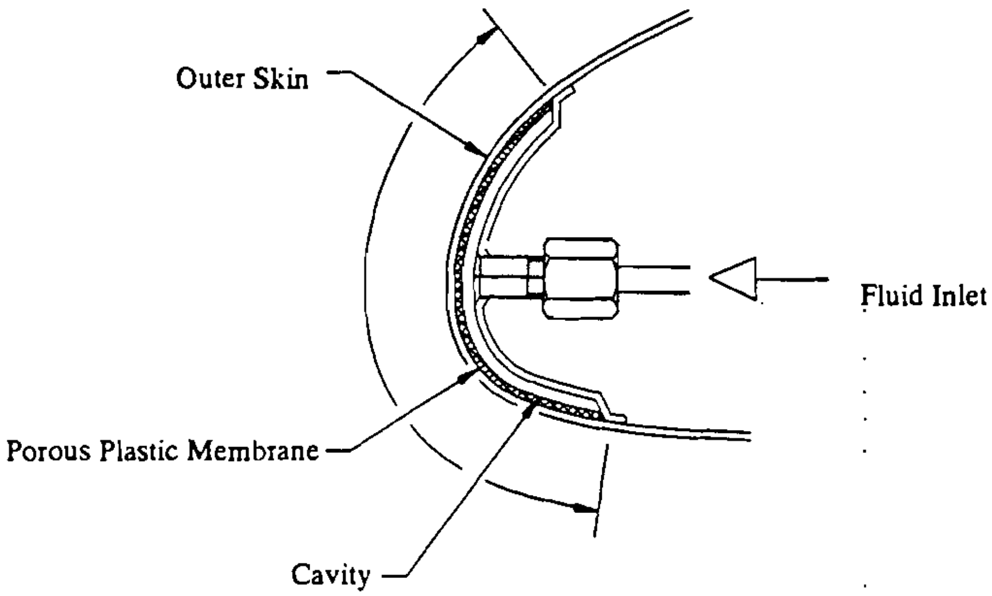


Figure 117
Cross Section of a Porous Panel

An air bleed is fitted to each Porous Panel as illustrated in Figure 118; this bleed is tapped into the highest point of the Panel cavity and permits air to escape through the capillary tube. If there is no air within the panel a very small quantity of fluid flows through the tube. The check valve prevents air entering the cavity with the panel inoperative.
The primary purpose of the air bleed is to facilitate ground checks. The same surface tension effects that prevent drainage will tend to trap any air which may be pumped into the Panels behind the plastic membrane and cause temporary dry regions. At low temperatures, when higher fluid viscosity results in an increase in pressure within the Panels this air will be forced through the membrane, but when the system is ground tested under temperate conditions the effects of air can be apparent. By providing an escape route from behind the membrane the air bleed reduces these effects. (It does not however entirely eliminate them, especially under very warm conditions, due to the finite opening pressure of the check valve.)

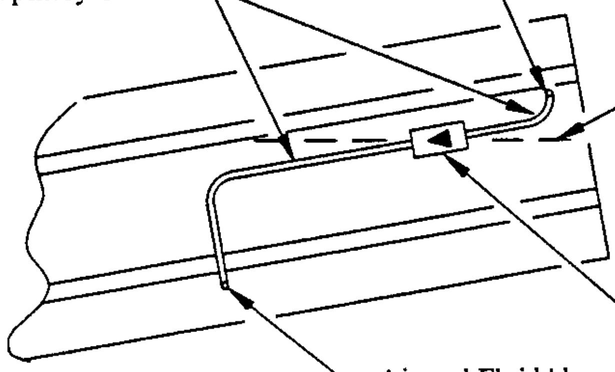


Figure 118
Typical View on Rear of Porous Panel to show Air Bleed System

As described on Page 114, the Airframe/Propeller system is designed to operate at either of two flow rates. Each of these flow rates is nominally constant, hence pressures within the system will vary with temperature as a result of changing fluid viscosity. (The pressure will also vary slightly dependant on which specification De-icing Fluid is used as viscosity / temperature characteristics differ marginally between fluids). Pressure also varies from place to place within the system, being highest at the outlet of the Pump and lowest within the Porous Panels.

Figure 119 illustrates the viscosity characteristics of the approved De-icing Fluids.

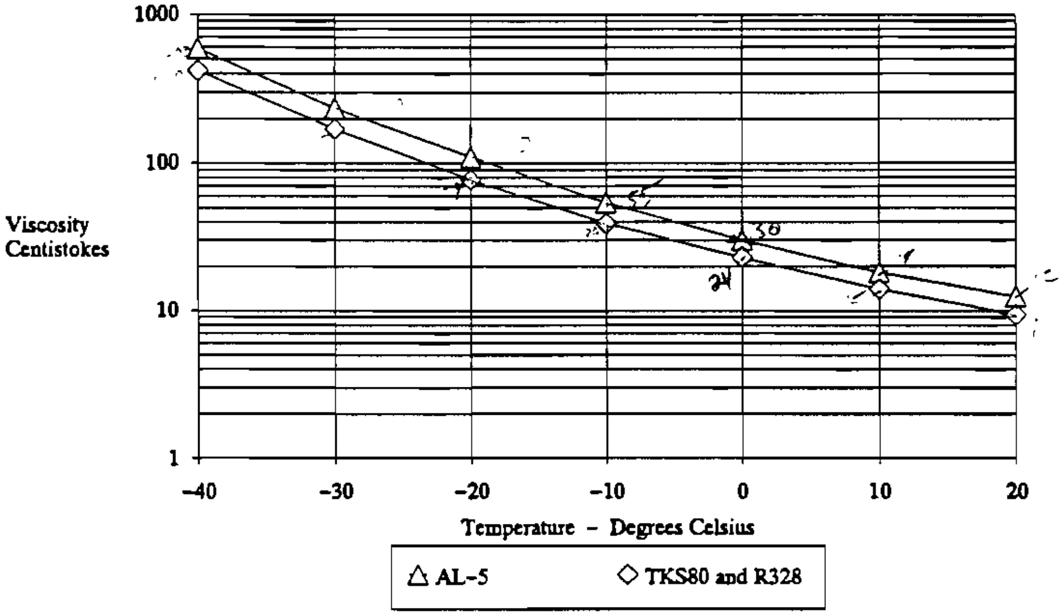


Figure 119
Temperature/Viscosity Characteristics of De-icing Fluids

(2) Airframe/Propeller System High and Low Pressure Warnings.

Three Pressure Switches are installed to provide warnings of abnormally high or low pressures. These switches are tapped into the system at the locations shown in Figure 120. The two low pressure switches are wired in series so that low pressure in either (or both) Stabilator Panel Feed(s) will be displayed as a warning.

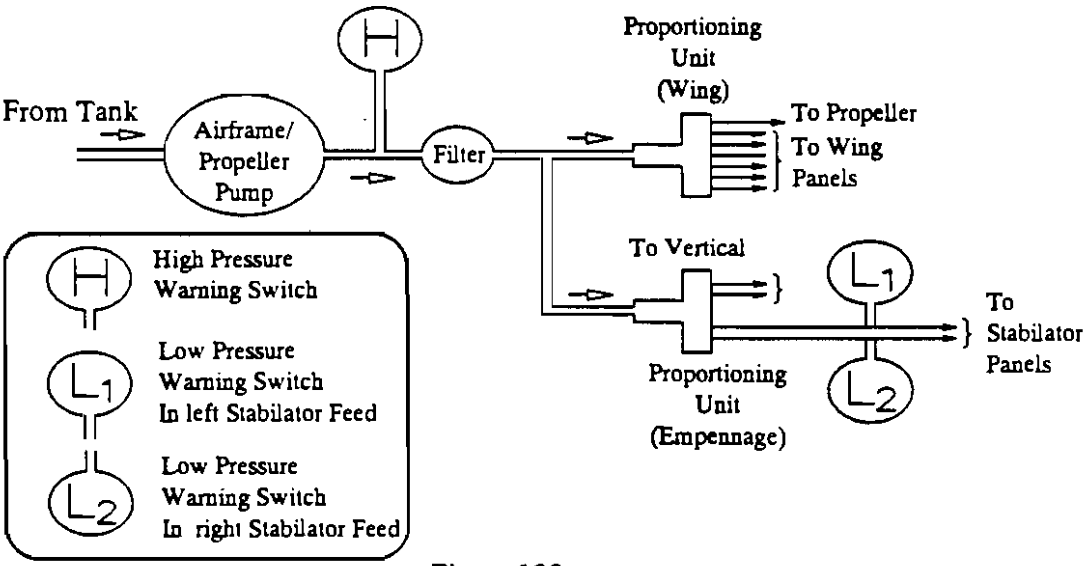


Figure 120

Schematic showing Location of High and Low Pressure Warning Switches

(A) High Pressure Warning

As Figure 120 illustrates, the High Pressure Warning Switch monitors system pressure at the outlet of the Airframe/Propeller Pump, at a location which is upstream of the Filter. The pressure at this location will vary with temperature, but as will be seen from Figure 121, with a clean Filter Element, it is always below the operating pressure of the Switch, over the normal icing temperature range (Zero to -30 degrees Celsius), at Anti-ice Flow Rate. As the pressure drop through the Filter Element increases in service due to the collection of dirt, the margin between system pressure and switch operating pressure reduces until, eventually, the switch will operate and signal a High Pressure Warning. This warning is displayed on the Control Panel as an Amber Light which remains on until it is cancelled or electrical power is removed from the TKS Control Panel. (See 1.C.(4) for additional information relating to the Control Panel display)

Note the following with respect to the High Pressure Warning System:-

(i) Figure 121 assumes a constant temperature throughout the system, equal to O.A.T. In practice the fluid in the tank and pipelines will usually be rather warmer so that the pressure will tend to be less than illustrated, giving a greater margin for Filter Element blockage before the switch will operate.

(ii) The High Pressure Warning is intended as a cautionary warning to indicate that the

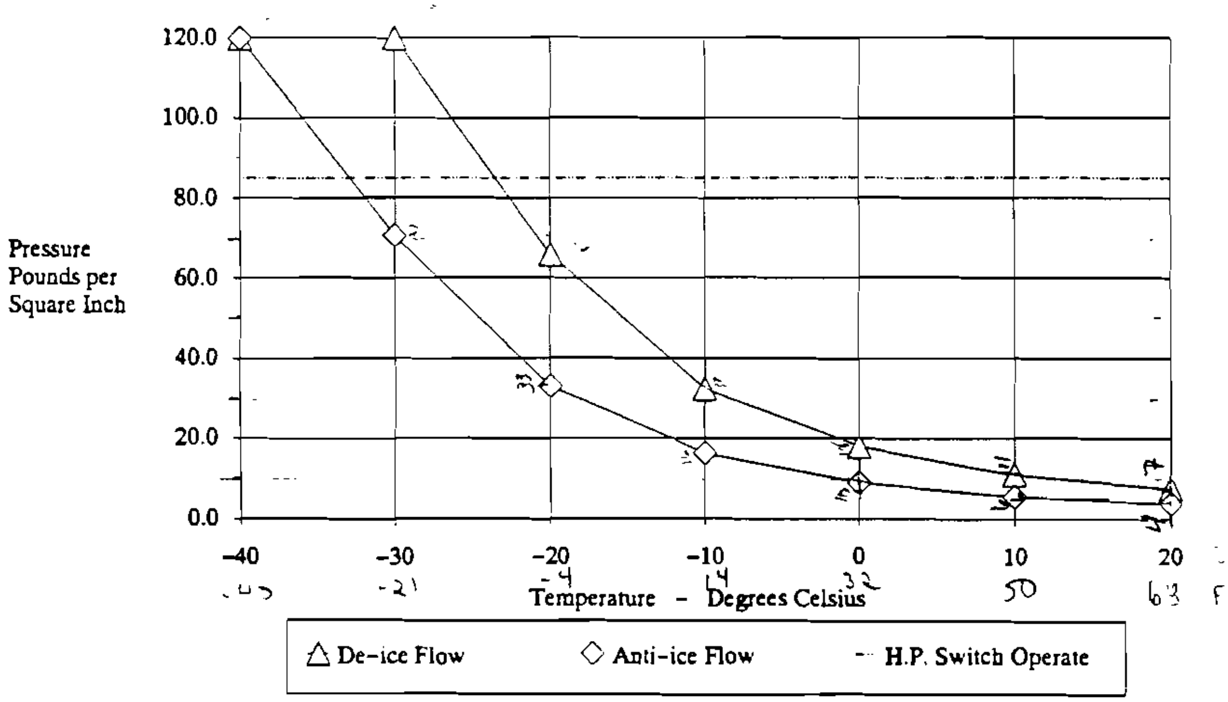


Figure 121
Typical Pressure at High Pressure Warning Switch
as a function of Temperature (Clean Filter Element).

filter element may require renewal. It also indicates that the pump is approaching a pressure where flow reduction, with a corresponding reduction of ice protection capability, will occur due to off-loading (see Figure 122). **Some margin exists between the switch operating pressure and significant flow reduction so that the warning does not necessarily indicate that the ice protection system is unserviceable.** Unless no action has been taken to renew the Filter Element with repeated High Pressure Warnings, when a warning occurs it is probable that the ice protection system is still operating at or close to its design flow rate. Hence when this warning occurs the pilot need not take immediate action to vacate icing conditions, but should increase visual monitoring of the protected aerofoil surfaces and note the O.A.T. to aid post-flight assessment of the need for Filter Element renewal.

(iii) The High Pressure Warning system is disabled when 'De-ice' is selected to avoid spurious warnings.

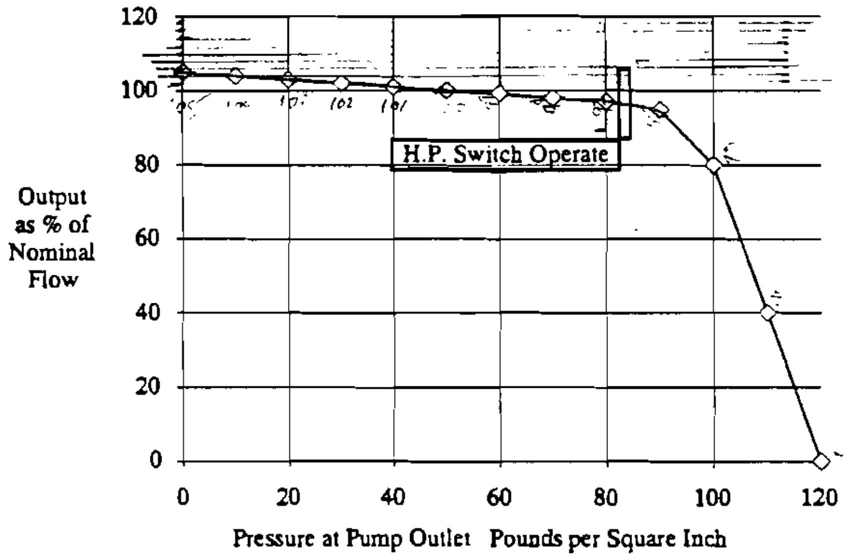


Figure 122
Effect of Pressure at Pump Outlet on Flow Rate (Airframe/Propeller system)

(B) Low Pressure Warning

A Low Pressure Warning will occur if the fluid supply fails to either or both Stabilator Panels. The relationship between the Low Pressure Switch settings and pressure in the supply lines to the Stabilator Panels is shown in Figure 123. Note that although the normal pressure is well in excess of the Low Pressure Switch setting at temperatures in the icing range, spurious Low Pressure Warnings can be expected when the system is operated under warm conditions. Low Pressure Warnings are displayed by two flashing Red Lights on the Control Panel (See 1.C.(4) for additional information relating to the Control Panel Display). **In the event of a Low Pressure Warning the pilot should take immediate action to vacate icing conditions** because the most probable causes involve total ice protection system failure or at least loss of ice protection on one or both sides of the stabilator which cannot be tolerated for continued flight in icing conditions.

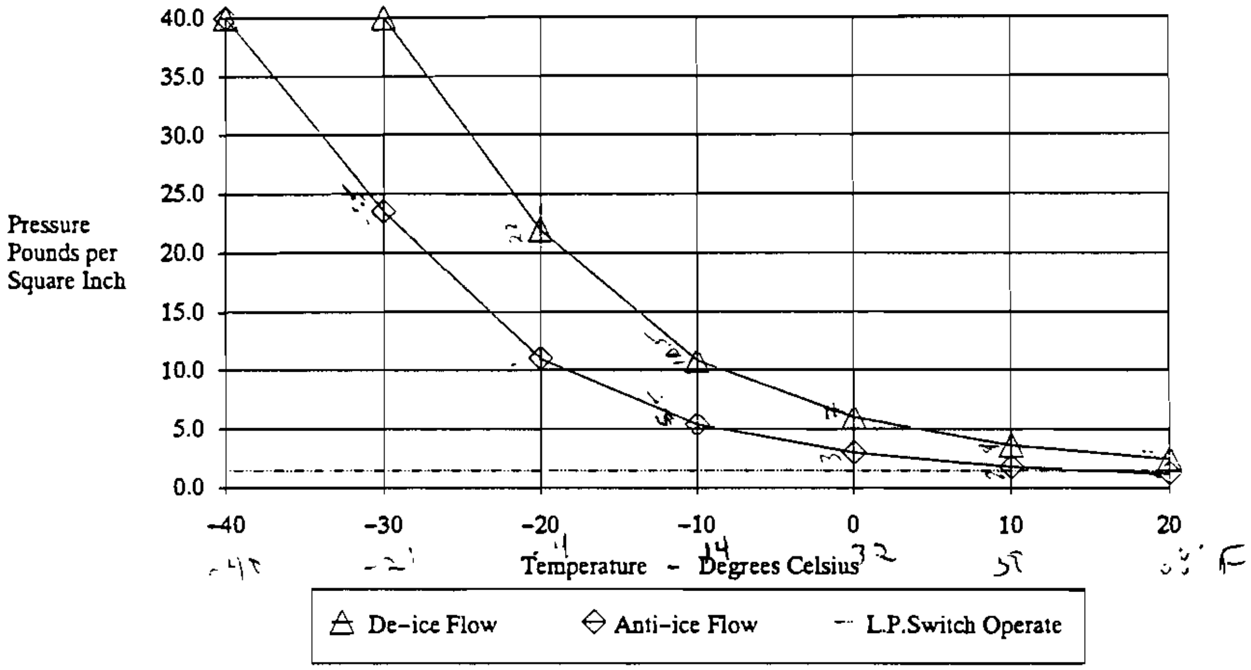


Figure 123
Typical Pressure at Low Pressure Warning Switches
as a Function of Temperature

(3) Windshield System.

(Reference Figures 102 and 121)

CAUTIONS:

1. THE WINDSHIELD PUMP IS INTERMITTENTLY RATED. DO NOT OPERATE FOR PERIODS IN EXCESS OF 5 SECONDS. ALLOW AT LEAST 10 SECONDS BETWEEN OPERATIONS.

2. AVOID DRY RUNNING THE WINDSHIELD PUMP FOR PROLONGED PERIODS: USE DRAIN TO BLEED AIR FROM LINE BETWEEN TANK AND EQUIPMENT PACK WHEN FIRST FILLING SYSTEM OR AFTER TANK HAS BEEN RUN DRY. IF FLUID IS NOT DISCHARGED FROM SPRAYBARS WITHIN 5 OPERATIONS (OF 5 SECONDS MAXIMUM DURATION) DO NOT CONTINUE. STOP AND INVESTIGATE CAUSE.

The Windshield Spraybars are provided with fluid by a small electrically operated Pump, connected in series with a Solenoid Valve. The Solenoid Valve is normally closed and opens only when the Pump is energised.

The Windshield Pump is capable of self-priming and is arranged to draw its supply of fluid from a connection fitted to the Inlet Chamber of the Airframe/Propeller Pump. By this means it can be used to prime the Airframe/Propeller Pump.

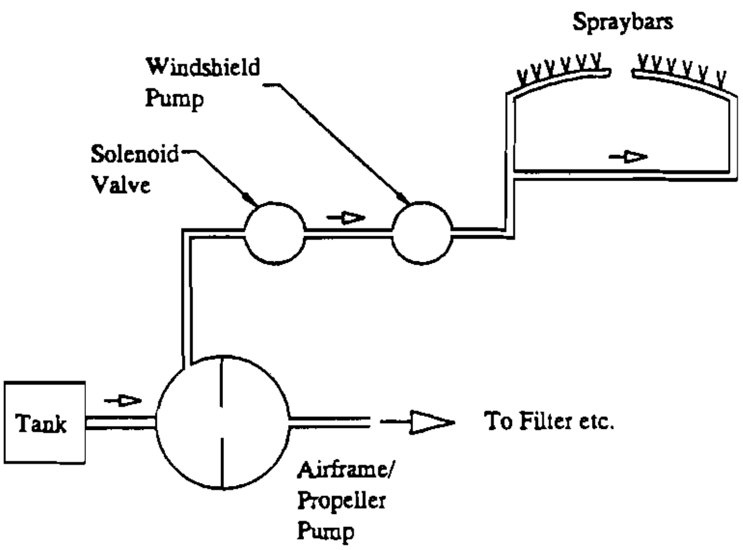


Figure 123
Diagram of Windshield System

(4) Control Panel and Tank Contents Indication System

(Reference Figure 113)

(A) Primary Controls.

The Airframe/Propeller Pump, Windshield Pump and Solenoid Valve and Wing Ice Inspection Light are controlled by miniature switches located on the front of the Control Panel. These switches operate miniature relays within the Control Panel to switch the load currents.

(B) Indicator Lamps

Lamps on the front of the Control Panel provide the following information:

(i) Status of the Airframe/Propeller Pump Switch
(ii) Low Pressure Warning
(iii) High Pressure Warning

Airframe/Propeller Pump Status and Low Pressure warning.

Functions (i) and (ii) are displayed by the two dual colour (red/green) Light Emiting Diodes (LEDs) adjacent to the Airframe/Propeller Pump Switch. The display modes of these LEDs are detailed in Table 102.

Table 102

Display Modes of Airframe/Propeller System Status and Low Pressure Indicators

Airframe/Propeller Pump Switch Position.	System Pressure	LED Display	
		"Anti-ice"	"De-ice"
Off		Off	Off
Anti-ice	Low	Alternating Red/Green	Flashing Red
Anti-ice	Normal	Steady Green	Off
De-ice	Low	Flashing Red	Alternating Red/Green
De-ice	Normal	Off	Steady Green

Note that in Normal operation, whenever the system is first switched on a Low Pressure Warning will be displayed whilst the Pressure rises and then replaced by the Steady Green Indication. This will normally take less than 1 minute. If the system is switched between modes (i.e. De-ice to Anti-ice or the reverse) either directly or with only a brief delay a Low Pressure warning will not occur.

High Pressure Warning

The amber High Pressure Warn LED will latch in the illuminated state when tripped by pump outlet pressures in excess of normal operation (Refer to para 1.C.(2).(A)).

The warning will be cancelled when power is removed from the Ice Protection Control Panel and/or may be reset by depressing the recessed "Reset" switch on the front of the Control Panel.

Operation of the High Pressure Warn Lamp may be checked with the Airframe/Propeller Pump not operating by depressing the "Reset" switch.

The amber LED should illuminate whilst the switch is held down and cancel as the switch is released.

(C) Tank Contents Indication System.

(Reference Figure 124)

The Tank Contents Transmitter contains a potentiometer with the wiper driven by a float through a magnetic coupling. The Control Panel provides the ends of the potentiometer resistance track with stabilised d.c. supplies at +5 and -5 volts and senses float position from the potential of the wiper. The angular position of the potentiometer is adjustable and is set to provide zero potential with the tank empty. Full scale reading is calibrated by means of VR2 which adjusts the gain of the Analogue to Digital Converter. Electronic damping is provided to eliminate continual display changes due to fluid surge.

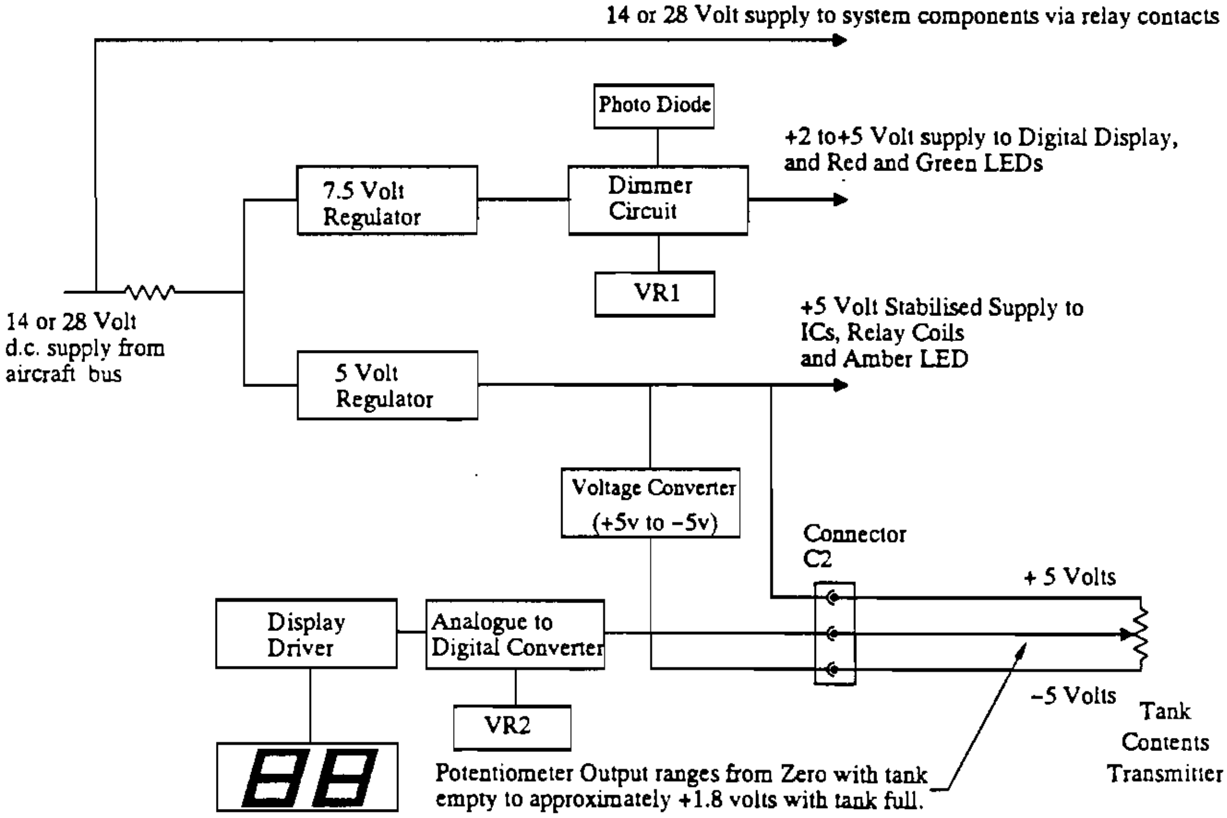


Figure 124

Block Diagram of Control Panel and Tank Contents System

The contents display is arranged to under-read when the tank contents are low, it is also affected by aircraft attitude. A calibration chart is provided in the Flight Manual Supplement and is included herein at Section 1.D.(3).

(D). Dimming for Night Operations.

Automatic dimming is provided for all illuminated displays except the High Pressure Warning LED. Ambient light level is sensed by a Photo Diode in the front of the Control Panel to control the dimmer circuitry. Trimmer VR1 may be used to adjust the minimum illumination intensity. VR1 is accesible through a small hole in the front of the Control Panel.

(5) Tank Drain.

The Tank Drain is located below the fuselage and may be used to remove fluid from the tank for maintenance and/or weight and balance adjustment. In addition this drain provides a means to remove air from the feed tube between the tank and pumps as part of the priming procedure.

(6) Cabin Heat Air Intake.

The tubular shield fitted to the Cabin Heat Air Intake serves to shelter the intake from icing. It also prevents de-icing fluid, sprayed onto the front of the cowling by the propeller, from running into the intake. Note that the mesh fitted to unprotected aircraft is deleted with this intake.

D. Data.

(1) Approved De-icing Fluids.

CAUTION:

UNDER NO CIRCUMSTANCES ARE FLUIDS OTHER THAN THOSE LISTED TO BE USED IN THE TKS SYSTEM.
SOME FLUIDS CURRENTLY USED FOR GROUND DE-ICING PURPOSES CONTAIN THICKENING AGENTS WHICH MAY BLOCK THE POROUS PANELS. THESE ARE KNOWN AS AEA/ISO/SAE TYPE II (THICKENED) FLUIDS. IF IT IS KNOWN OR SUSPECTED THAT SUCH A FLUID HAS BEEN PLACED IN THE TANK, DO NOT OPERATE THE SYSTEM. CONTACT TKS FOR INSTRUCTIONS.

Fluids to the following specifications only are approved for use in the TKS system:

TKS R328, TKS 80, DTD 406B

(Fluid to DTD 406B is designated AL-5, it is also available under a number of proprietary names e.g. Aeroshell Compound 07).

The above approved fluids may be mixed in the aircraft tank in any proportions.
All TKS approved fluids consist principally of mono-ethylene glycol. Further details are as follows:

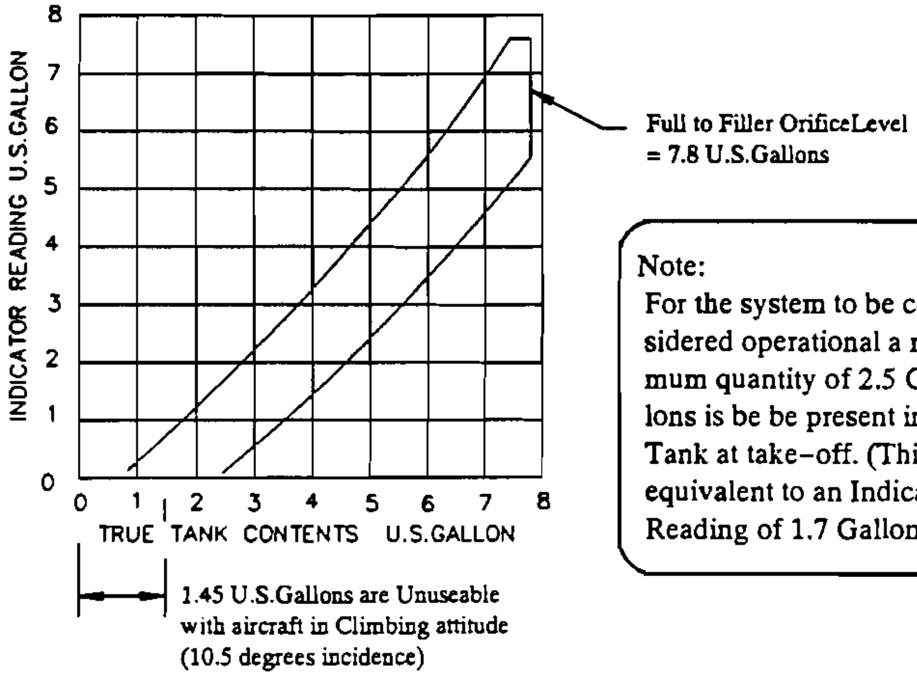
TKS R328	Proprietary fluid available from TKS/Kilfrost.
TKS 80	80% Mono-ethylene glycol 20% De-ionised water.
AL-5 (DTD 406B)	85% Mono-ethylene glycol, 5% Alcohol, 10% De-ionised water.

The three fluids have approximately the same density and weigh 9.2 pounds per U.S.Gallon (1,1 kilogrammes/litre)

(2) Tank Capacity

Nominal Tank Capacity	.. ..	7.8 U.S. Gallons (29,6 litres)
Unusable Volume	- Level Attitude -	0.1 U.S. Gallon (0,4 litre)
	- Climbing Attitude (10.5 degrees nose up) -	1.45 U.S.Gallons (5,5 litres)
Usable Volume	- Level Attitude -	7.7 U.S. Gallons (29,2 litres)
	- Climbing Attitude (10.5 degrees nose up) -	6.35 U.S.Gallons (24,1 litres)

(3) Fluid Quantity Indicator Calibration.



Note:
For the system to be considered operational a minimum quantity of 2.5 Gallons is be be present in the Tank at take-off. (This is equivalent to an Indicator Reading of 1.7 Gallons)

Figure 125
Fluid Quantity Indicator Calibration

(4) Flow Rates/System Endurance.

Airframe/Propeller System Flow Rates.

The Airframe/Propeller System Pump is calibrated to provide two nominally constant outputs with minimum values as follows:-

"De-ice" Flow Rate	4.50 U.S.Gallons/Hour (17.04 Litres/Hour)
"Anti-ice" Flow Rate	2.25 U.S.Gallons/Hour (8.52 Litres/Hour)

In order to allow for the pump calibration tolerance and possible effects of voltage and temperature variations during flight, these flow rates are stated in terms of maximum values in the Flight manual Supplement as reproduced below:-

"De-ice" Flow Rate	4.80 U.S.Gallons/Hour (18.2 Litres/Hour)
"Anti-ice" Flow Rate	2.40 U.S.Gallons/Hour (9.1 Litres/Hour)

The fluid is apportioned to the porous panels and to the propeller as detailed in Table 103

Table 103

Design Fluid Flow Rates to Individual Regions

Region	Porous Panel Part No.	Proportioning Unit Part No.	Proportioning Unit Outlet No	Flow Rate ml/min
Mainplane Left Outer	D4701	PU300GW52	1	7.2
Mainplane Right Outer	D4702		6	11.2
Mainplane Left Mid	D4703		5	15.6
Mainplane Right Mid	D4704		2	15.6
Mainplane Left Inner	D4705		4	15.1
Mainplane Right Inner	D4706		3	15.1
Propeller	-		7	17.5
Stabilator Left	D4711	PU300DT51	2	17.6
Stabilator Right	D4712		1	17.6
Vertical Stabiliser Upper	D4721		6	4.6
Vertical Stabiliser Lower	D4723		7	4.1

Windshield System Flow Rate.

Fluid is sprayed onto the windshields at a rate of approximately 0.1 U.S. Gallon/ minute (0,4 litre/minute) hence a three second operation of this system will dispense approximately 1/25 U.S.Pint (20 ml).

Endurance.

NOTE: The Airframe/Propeller system is intended to be operated continuously in icing conditions at the "Anti-icing" flow rate. With "De-ice" selected the rate of fluid consumption is doubled.

The endurance with the Airframe/Propeller system only operating is calculated below based on the maximum values for flow rates:-

With Anti-ice selected... 3 hours 20 minutes

With De-ice selected..... 1 hours 40 minutes

Endurance for a typical mission (Assuming De-ice used for 2 minutes in every 30 and windscreen De-ice used for 5 seconds in every 10 minutes):-

2 hours 50 minutes

(5) Weight and Balance

There are no changes to the weight and balance limits of the aircraft with the ice protection systems fitted.

The approximate weight and moment of the fixed equipment including unusable fluid is 40.6 pounds (18,4 kilogrammes) and 3.036 x1000 pound inches (34.982 kilogramme metres).

Refer to individual aircraft weight schedule for actual values.

The moment arm of the de-icing fluid is 109 inches (2.767 metres).

Weight and moment for various quantities of fluid are given in Table 104.

Table 104

Weight and Balance Table for Contents of De-icing Fluid Tank

(Aircraft in level attitude on ground)

Contents U.S.Gallon		Weight		Moment	
Indicator Reading	True Contents	Pound	Kilogramme	Pound Inch / 1000	Kg Metre
zero	0.7 (or less)	6.4	2.90	0.70	8.06
0.5	1.2	11.0	4.99	1.20	13.83
1	1.7	15.6	7.08	1.71	19.20
2	2.8	25.7	11.66	2.81	32.38
3	3.8	35.0	15.88	3.81	43.90
4	4.7	43.2	19.60	4.72	54.38
5	5.5	50.6	22.95	5.52	63.60
6	6.3	58.0	26.31	6.32	72.82
7	7.0	64.4	29.21	7.02	80.88
7.7	7.5 to 7.8	69.0 to 71.8	31.30 to 32.57	7.52 to 7.83	86.64 to 90.21

(6) Electrical Equipment and Loading.

The Airframe/Propeller Pump, Windshield Pump, Solenoid Valve and Ice Light Filament Lamp are sensitive to supply voltage and are therefore supplied in different variants for 14 volt and 28 volt equipped aircraft.

The Control Panel, Pressure Switches and Tank Contents Transmitter are not sensitive to aircraft system voltage.

Electrical characteristics of the ice protection system components are listed in Table 105.

Table 105

Electrical Component Data

Component	Selection (where appropriate)	Voltage	Rating (3)	Electrical Load (amps) Normal	Starting Peak
Airframe/ Propeller Pump	De-ice	14	Continuous	3.0	20 (approx)
	Anti-ice	14	Continuous	2.6	20 (approx)
	De-ice	28	Continuous	1.5	12 (approx)
	Anti-ice	28	Continuous	1.3	12 (approx)
Windshield Pump		14	Intermittent (1)	1.2	6 (approx)
		28	Intermittent (1)	0.6	4 (approx)
Solenoid Valve		14	Continuous (2)	1.2	-
		28	Continuous (2)	0.6	-
Ice Lamp		14	Continuous	2.8	-
		28	Continuous	1.4	-
Control Panel		14 and 28	Continuous	0.2	-

Notes:

(1) Operation not to exceed 5 seconds on in every 10 seconds, or "single" operation of 10 seconds duration (with at least 5 minutes between operations).

(2) The Solenoid Valve is capable of continuous operation but in this application is only operated when windshield pump energised.

(3) Note that the Control Panel (and its associated warning and tank contents systems) is energised continuously whilst the aircraft bus is powered. All other components are energised only when selected on.

(7) Placards.

Placards are fitted as illustrated in Figure 126, of a language as appropriate to the registration/nationality of the aircraft.

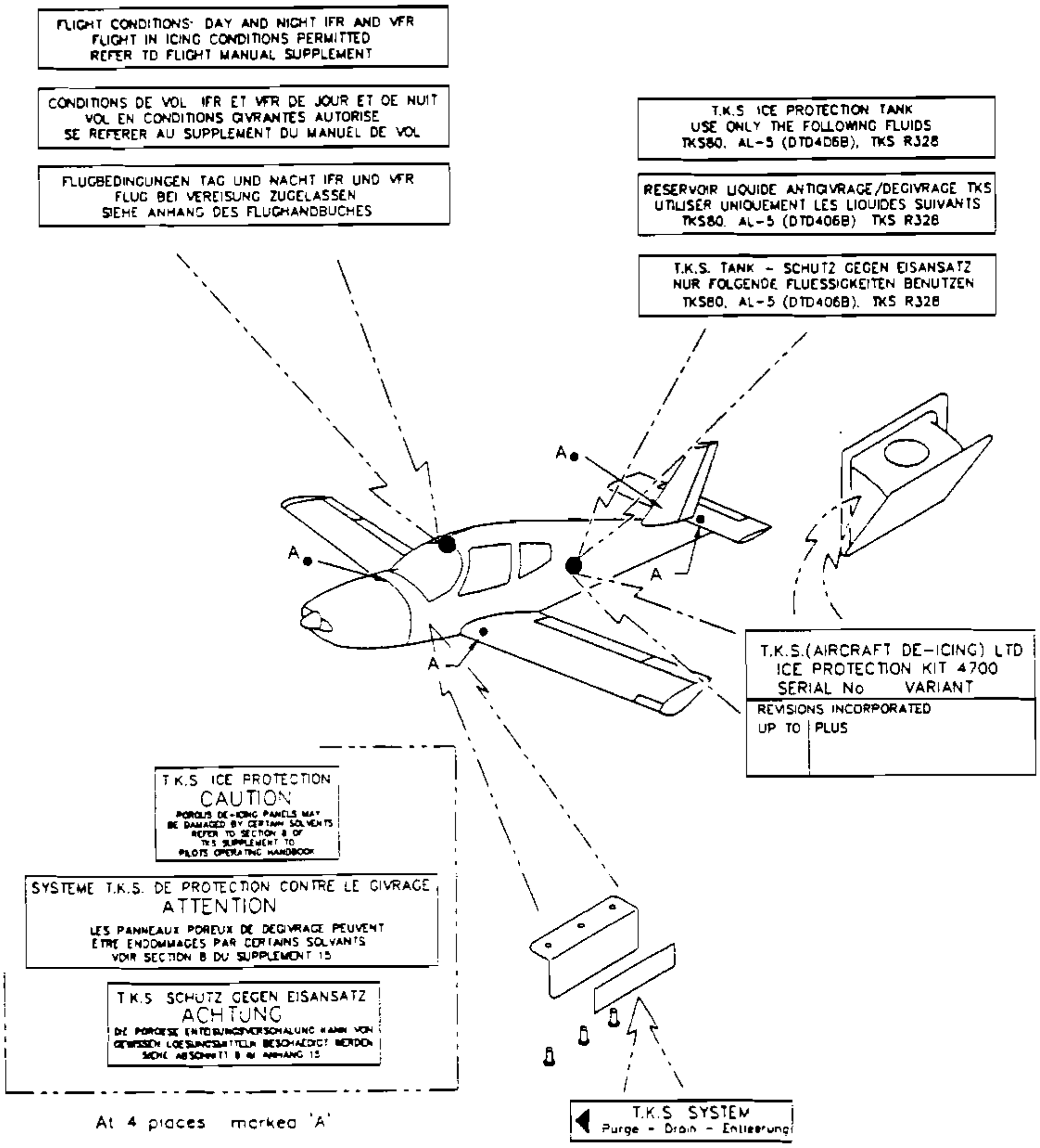


Figure 126
Placards

2. Fault Isolation

General.

Fault Isolation/Trouble Shooting may be accomplished by reference to the charts on the following pages.
Refer to Figure 200 "Fault Isolation Master Chart" to determine which of the subsequent charts is applicable to the apparent fault, then work through the appropriate chart in the sequence shown. Refer to Section 1 for descriptive data as appropriate, Figures 102, 114, 116, 120, 123 and 124, in particular, may be found to be useful for Fault Isolation Purposes.
Refer to Sections 3, 5 and 7 for data and instructions relating to component removal, testing and installation.

FAULT	REFER TO CHART:-	
	Fig. No	TITLE
No De-icing fluid flow from airframe/ propeller system	201	FAULT.... Airframe/propeller system does not operate
No flow from part(s) of airframe/ propeller system	202	FAULT.... No flow from part(s) of airframe/propeller system
No flow from windshield spraybar	203	FAULT.... Windshield system does not operate
High pressure warning illuminated	204	FAULT.... High pressure warning
Low pressure warning not cancelled	205	FAULT.... Low pressure warning
Contents display not operating (or providing erroneous data)	206	FAULT.... Control panel/contents system indicating fault
Indicator/warning L.E.D.s on Control Panel do not operate or operate incorrectly Electrically operated components do not operate or operate incorrectly	207	FAULT.... Control Panel operating fault

Figure 200

Fault Isolation Master Chart

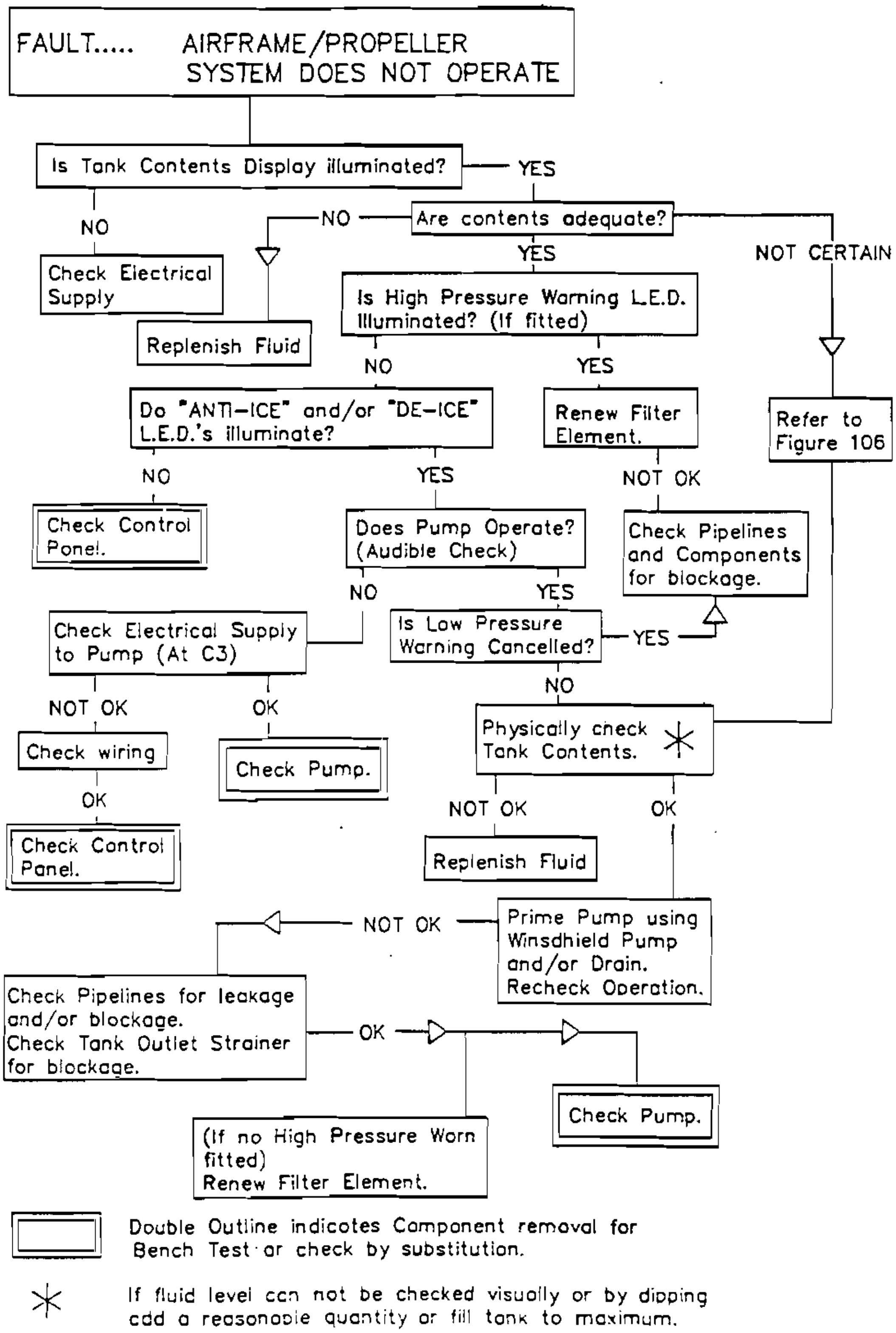


Figure 201
Fault Isolation Chart
Fault.... Airframe/propeller system does not operate

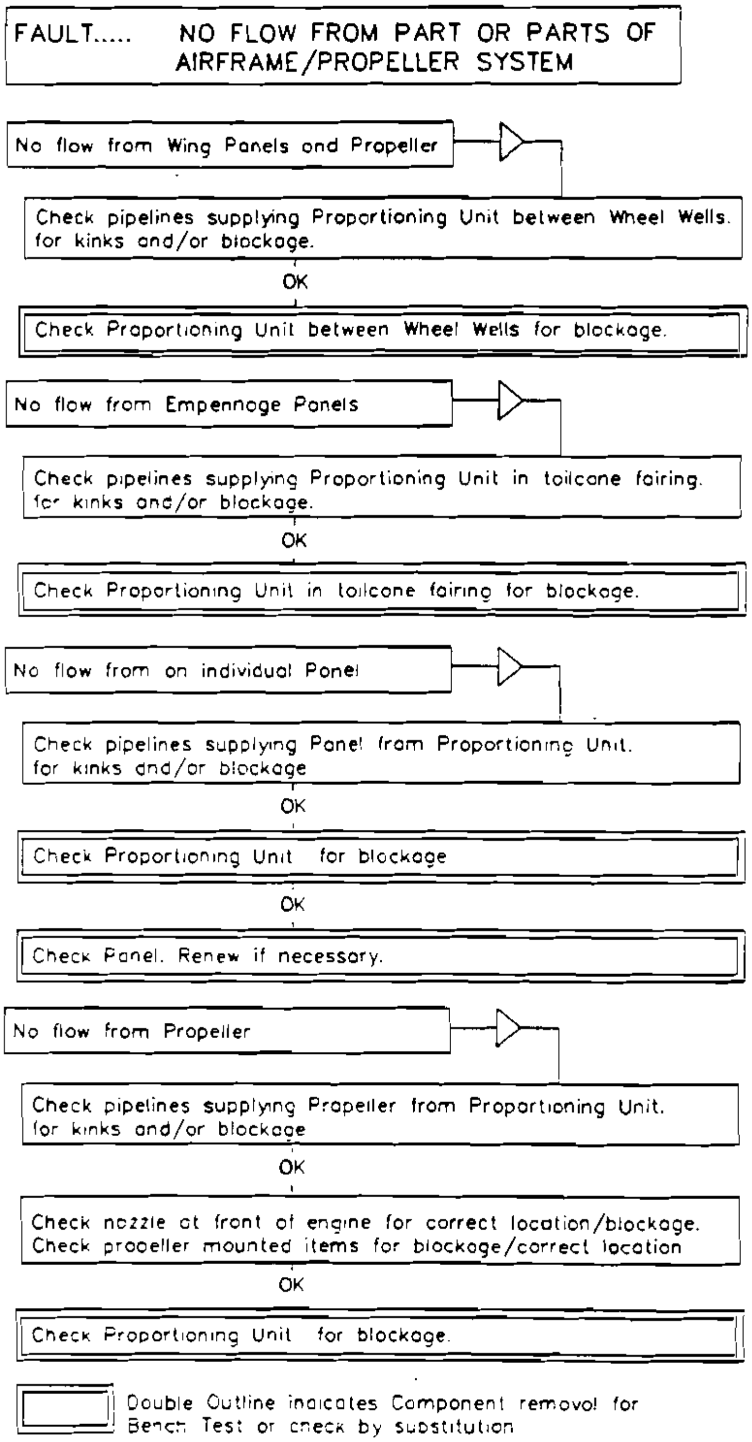


Figure 202
Fault Isolation Chart

FAULT.... No flow from part(s) of airframe/propeller system

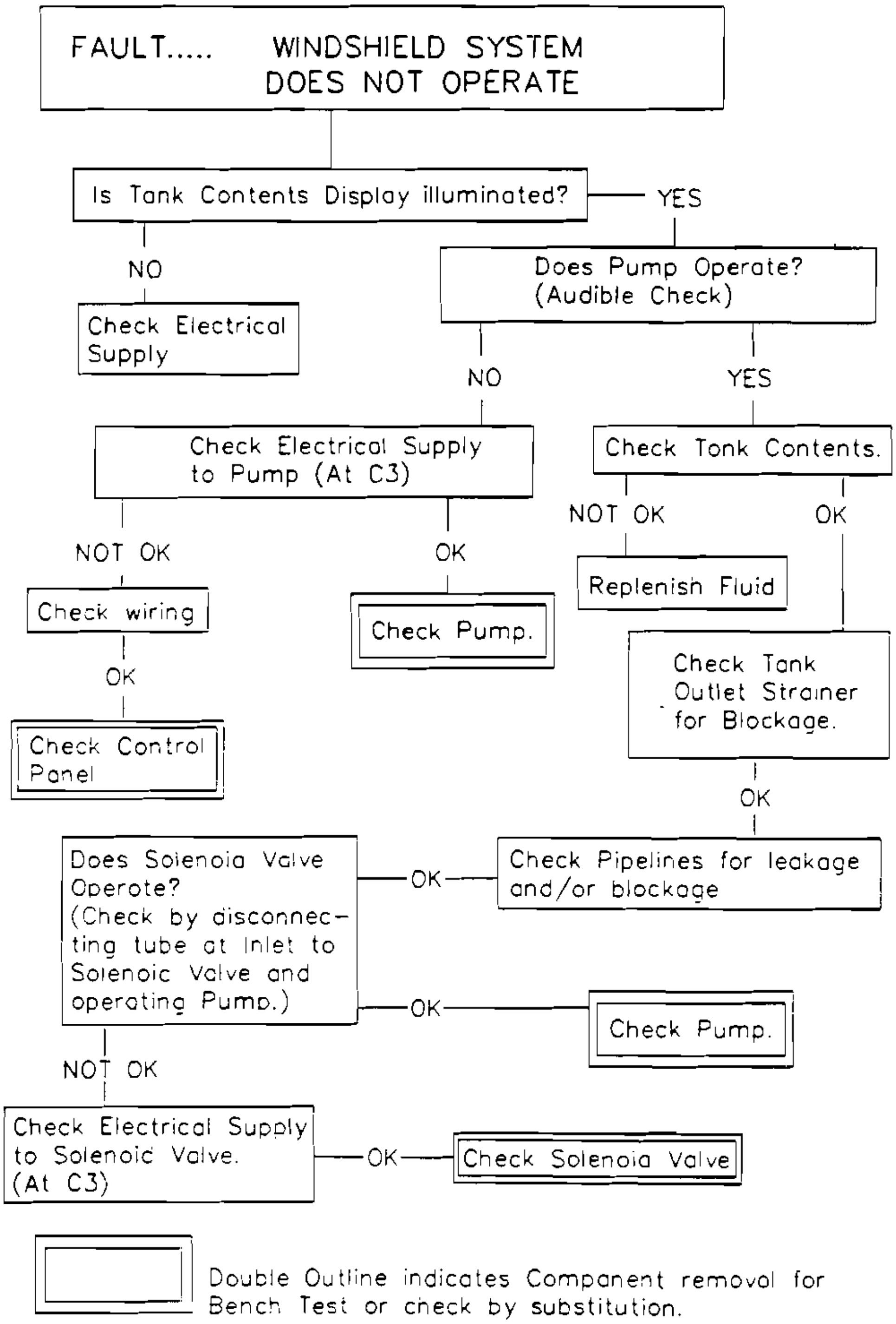


Figure 203
Fault Isolation Chart

FAULT.... Windshield system does not operate

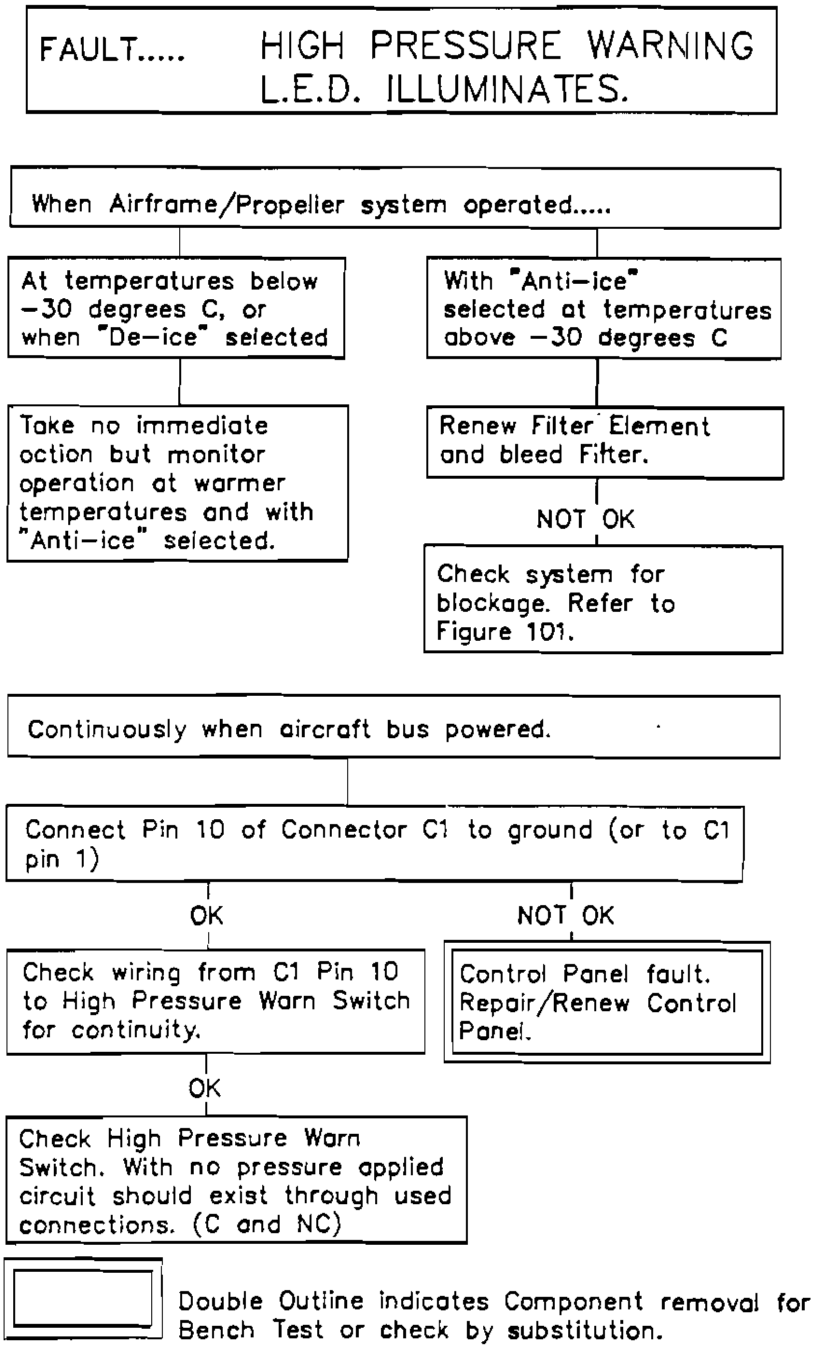


Figure 204
Fault Isolation Chart
FAULT.... High pressure warning

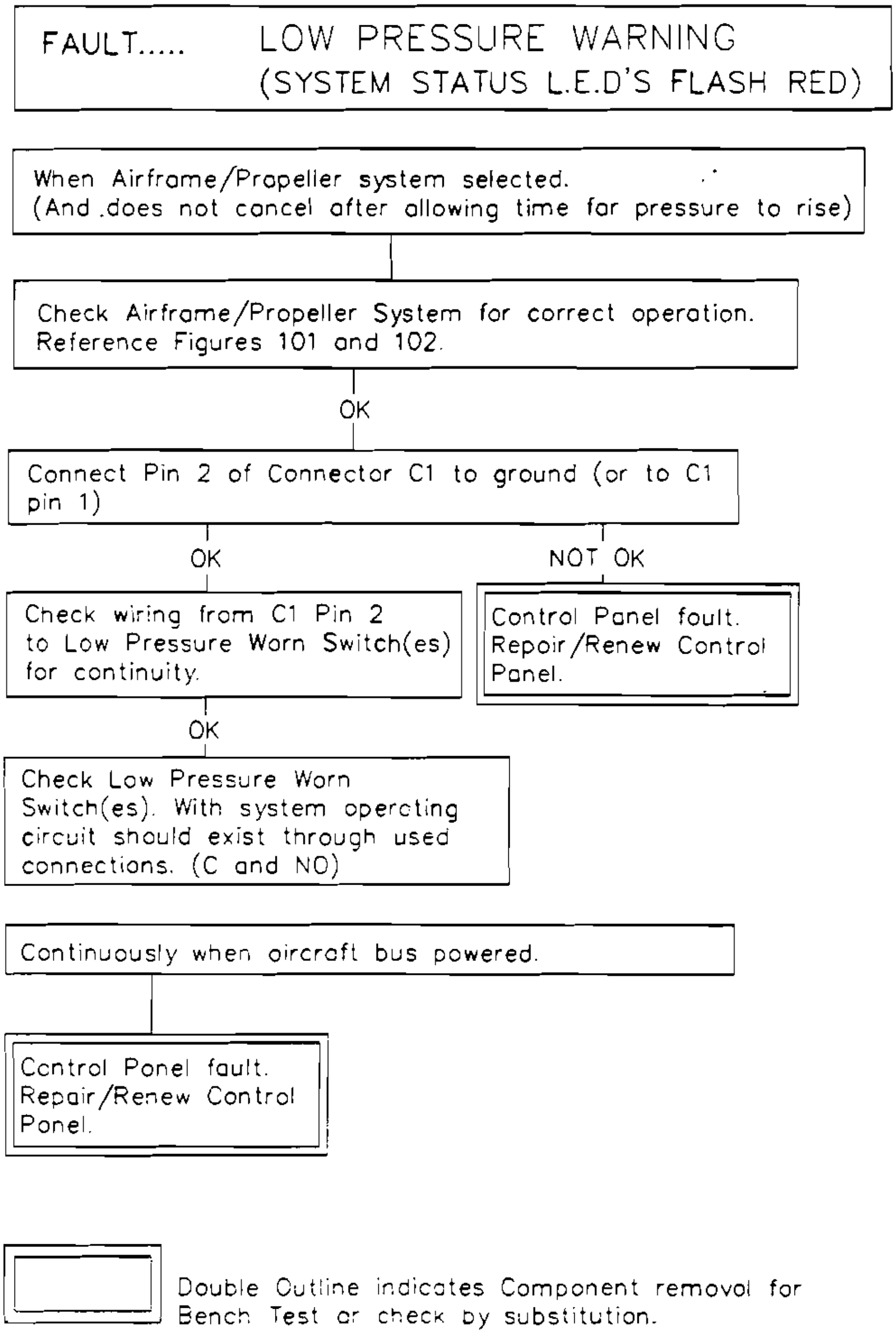


Figure 205
Fault Isolation Chart
FAULT.... Low pressure warning

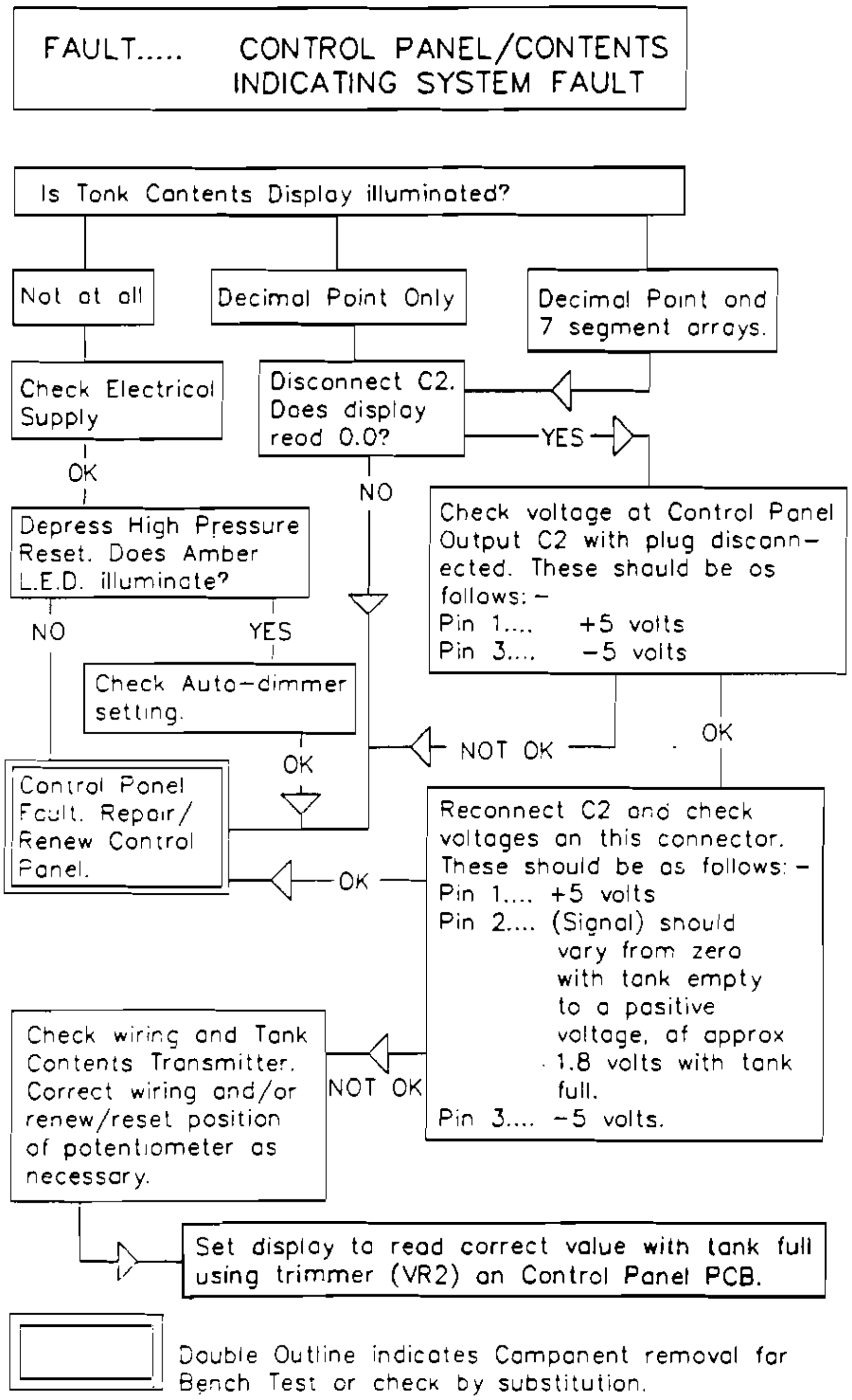


Figure 206
Fault Isolation Chart

FAULT.... Control panel/contents system indicating fault

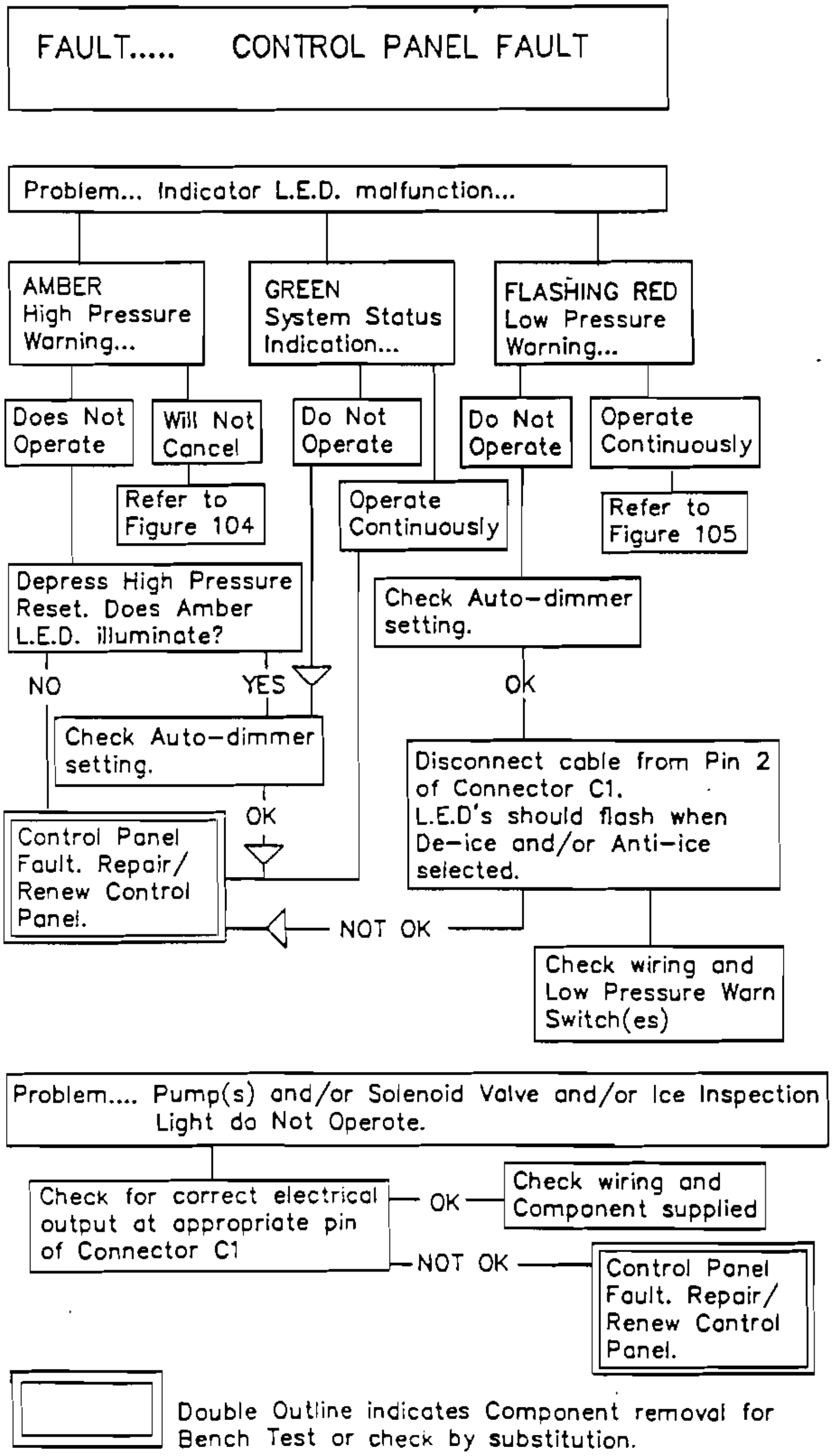


Figure 207
Fault Isolation Chart

FAULT.... Control Panel operating fault

3. Maintenance Practices.

A. Serviceability Checks.

Four levels of Serviceability Check are recomended in the following paragraphs:-

Level I. Daily and/or Pre-flight if icing is forecast or expected.
This level of checking is intended to determine the immediate servicibility of the equipment without recourse to the use of tools or special procedures

Level II. 50 Hours.
Level II checks extend the functions recommended for Level I checking to include more comprehensive tests of a qualitative nature.

Level III Yearly.
At this level quantitative checks and more detailed examinations of components are introduced.

Level IV. As required for trouble shooting.
Level IV defines checks for individual components.

Serviceability Checks

Level I.

Daily and/or Pre-flight Checks if icing is forecast or expected.

This level of checking is intended to determine the immediate servicibility of the equipment without recourse to the use of tools or special procedures.

Maintenance Practice	Notes
- Check security and condition of visible components	
- Switch on electrical power. Check that contents display illuminates and stabilises at a sensible value within 1.5 minutes. Replenish tank contents if necessary for intended flight.	The time taken for the display to stabilise will depend on the quantity of fluid present in the tank as the display reading will rise from zero at about 0.1 gallon per second.
- Operate Airframe/Propeller system at "De-ice". Check that both indicator L.E.Ds flash red then change to a single green (opposite De-ice) as pressure rises. Check that High Pressure warning L.E.D. does not illuminate.	
- Press High Pressure Reset. Check that amberL.E.D. illuminates whilst switch is depressed.	
- Switch Airframe/Propeller system directly to "Anti-ice", check that pump speed reduces (audible check) and that the green L.E.D. which is illuminated changes to match the switch selection. Check that de-icing fluid flow is evident from visible panels if weather conditions permit. Switch Airframe/Propeller system off.	It may not be possible to observe fluid flow if moderate or heavy rain is falling.
- Press windshield de-ice swiich. Check that de-icing fluid is discharged from spraybars.	
- Check that wing ice inspection lamp functions.	If night flight.
- Switch off electrical power if no longer required.	

Serviceability Checks

Level I. (Continued)

Daily and/or Pre-flight Checks if icing is forecast or expected.

The following additional checks are recommended when weather conditions permit. It is not necessary for these items to be checked on every occasion.

Maintenance Practice	Notes
- Check that fluids flows evenly from the active zone of all porous panels. - Check that fluid is discharged into the propeller slinger ring from the nozzle fitted at the front of the engine crankcase.	

Additional bad weather checks (Not associated with the TKS equipment) should include:-

- Check that flying surfaces are free from ice and/or snow deposits. Check that transparencies are clear and that regions ahead of transpariencies will not shed frozen deposits onto transpariencies during take off. (In particular check that the top of the engine cowling and the spinner will not shed deposits which may obscure the windshield.) - Check that all intakes, vents and sensor ports are free from ice and snow. - Check that the propeller is free from ice and snow. - Check control surfaces for full and free movement and that there are no frozen deposits in gaps, around hinges, control rods etc. - Check that the undercarriage, wheel bays and doors are free from frozen deposits which may restrict retraction or cause damage during retraction.	**Note that the TKS ice protection systems are not intended to remove frozen deposits whilst the aircraft is on the ground. It is essential that all critical areas are de-iced before any attempt to take-off is made.**

Serviceability Checks

Level II.
At 50 Hour Check.

Level II Checks are similar to those Checks recommended at Level I but require the removal of the engine cowling. At this Level the checks are still qualitative and are made without recourse to the use of special tools or procedures.

Maintenance Practice	Notes
- Remove Engine cowlings. Check security and condition of visible components paying particular attention to those components attached to the engine and spinner.	
- Switch on electrical power. Check that contents display illuminates and stabilises at a sensible value within 1.5 minutes. Replenish tank contents if necessary.	(i) If in doubt regarding accuracy of indication make calibration check as detailed in Section 7. (ii)The indicator is electronically damped and should rise from 0.0, at switch on, at an average rate of about one display count per second.
- Operate Airframe/Propeller system at "De-ice". Check that both indicator l.e.ds flash red then change to a single green (opposite De-ice) as pressure rises. Check that High Pressure warning l.e.d does not illuminate.	
- Check operation of High Pressure Warn l.e.d. by depressing High Pressure Reset. The amber l.e.d should illuminate whilst switch is depressed and cancel on switch release. - Switch Airframe/Propeller system directly to "Anti-ice", check that pump speed reduces (audible check) and that the green l.e.d. which is illuminated changes to match the switch selection. Check that de-icing fluid flows from all porous panels and that a jet is directed into the slinger ring from the nozzle at the front of the engine.	Note that fluid should be exuded evenly over the active zone of the porous panels. At high temperatures a "waterline" may be observed at the top of some panels due to insufficient pressure being developed to expel entrained air. This is acceptable unless performance of the panel in icing conditions indicates that this is other than of a temporary nature.

Serviceability Checks

Level II. (Continued)
At 50 Hour Check.

Maintenance Practice	Notes
- Switch Airframe/Propeller system off. - Press windshield de-ice switch. Check that de-icing fluid is discharged from spraybars. Check that no holes are blocked. - Check that wing ice inspection lamp functions and that filament bulb and window are clean and secure. - Switch off electrical power if no longer required.	

Serviceability Checks

Level III.
Yearly.

At Level III it is recomended that all Level II Checks are carried out and that the following checks are added/included.

Maintenance Practice	Notes
- Remove underbelly panels and tailcone fairing. Check security and condition of components pipelines and wiring paying particular attention to those components close to control rods etc.	
- Drain tank. Remove and clean strainer in tank outlet. (Access is through panel below fuselage at tank location)	
- Refil tank checking accuracy of tank contents indicator during process.	The contents indicator does not display actual contents over the entire range, refer to calibration chart at Section 1.D.(3)

Serviceability Checks

Level IV.
Component Checks

The following checks are detailed for use in conjunction with Section 2, Fault Isolation. In cases where components can be checked on the aircraft as an alternative to bench testing, both methods are described.

Maintenance Practice	Procedure
Check fluid delivery rate from Airframe/ Propeller Pump	1. Fill tank to top of filler tube. Operate pump at De-ice or Anti-ice, as required, for a timed period. Refill tank, measuring the quantity necessary to replenish to the original level. Calculate flow rate. Permitted limits are:- De-ice 280 to 300 ml/minute Anti-ice 140 to 150 ml/minute OR 2. Remove Airframe/Propeller Pump and bench test as detailed in Section 7.
Check High Pressure Warn Switch	1. Disconnect Nylon Tube from inlet to Filter. Connect a pressure gauge with a range of 0 to 180 lbf/in2 (0 to 13 bar) to the tube, using TKS Nylon Tube fittings as required. Operate Airframe/Propeller pump in a series of short bursts (in order to limit rate of pressure rise) and observe pressure at which the High Pressure Warn L.E.D. on the control panel illuminates. Permitted limits are:- 75 to 90 lbf/in^2 (5 to 6 bar) OR 2. Remove High Pressure Switch and bench test as detailed in Section 7.

Level IV. (Continued)
Component Checks

Maintenance Practice	Procedure
Check Low Pressure Warn Switch (Note that since the two Low Pressure Switches are connected in series, it is necessary to test both in order to determine which is unserviceable. Procedure 1 to the right accomplishes this)	1. Remove tailcone fairing for access. Disconnect Nylon Tube from outlet of one Pressure Switch (i.e. Tube connecting Switch to Stabilator Panel). Connect a pressure gauge with a range of 0 to 5 lbf/in^2 (0 to 0,3 bar) to the Pressure Switch Outlet, using TKS Nylon Tube fittings as required. Disconnect plugs at end of Pressure Switch Pigtails from Wiring Harness and connect a suitable resistance and continuity measuring device across pins 1 and 2 of each switch plug. With no pressure present there should be no circuit through either switch and the resistance should be greater than 10 megohms. Operate Airframe/ Propeller pump (in a series of short bursts in order to limit the rate of pressure rise, if necessary) and observe the pressure at which each switch operates. This pressure is to be not greater than 1.5 lbf/in^2 (0,1bar). With the switch at a pressure above the operating pressure, there is to be a circuit between pins 1 and 2 with a resistance not greater than 10 ohms. Switch off the pump and observe the pressure at which the switches reset. This is to be not less than 0.5 lbf/in^2 (0,03 bar). OR 2. Remove Low Pressure Switches and bench test as detailed in Section 7.

Serviceability Checks

Level IV. (Continued)
Component Checks

Maintenance Practice	Procedure
Check Proportioning Unit (Note, Proprtioning Units can only be fully checked by bench testing, however, the normal reason for checking will be when a blockage is suspected. Procedure 1, to the right, accomplishes this and provides an approximate quantitive check)	1. Remove underbelly panels or tailcone fairing for access as appropriate. Disconnect Nylon Tube from suspect outlet of the Proportioning Unit. Operate Airframe/Propeller pump and observe for fluid flow from the outlet. If in doubt as to the adequacy of flow, measure the quantity discharged by collection over a timed period. The flow rate should be nominally two to three times the panel flow rate as defined in Section 1.D.(4), Table 103. OR 2. Remove Proportioning Unit and bench test as detailed in Section 7.
Check Porous Panel (Note, Porous Panels can only be fully checked by "bench testing", however, the normal reason for checking will be when a blockage or uneven flow is suspected. Procedure 1, to the right, accomplishes this. "Bench testing" of Porous Panels is in most cases made with the Panel on the aircraft, due to the difficulty of removing panels in an undamaged state.)	1. Remove underbelly panels or tailcone fairing for access to Proportioning Unit as appropriate. Disconnect Nylon Tube connecting suspect Panel from the outlet of the Proportioning Unit. Connect a suitable supply of filtered fluid to the tube (Refer to Section 7 for equipment and filtration requirements). Purge tube and Panel at a pressure not exceeding 40 lbf/in^2 (2,6 bar). If a blockage exists it will probably become apparent at this stage. Reduce the pressure to 4 lbf/in^2 (0,26 bar) and examine the porous region of the panel for even fluid coverage. OR 2. "Bench test" as detailed in Section 7.

Serviceability Checks

Level IV. (Continued)
Component Checks

Maintenance Practice	Procedure
Check fluid delivery from Windshield Pump	1. Remove underbelly panel for access. Disconnect Nylon Tube connecting Pump to Solenoid Valve. Operate pump by pressing "WINDSHIELD" switch on Control Panel. Collect fluid over a timed period of 5 seconds. The quantity dispensed should not be less than 25 ml. OR 2. Remove Windshield Pump and bench test as detailed in Section 7.
Check Solenoid Valve (Note, service experience has shown the Solenoid Valve to be extremely reliable. If proper operation of the Windshield Spray is not obtained it is suggested that all other components, including electrical supplies, are checked first.)	1. First check Windshield Pump as detailed above. Reconnect Windshield Pump to Solenoid Valve. Operate pump by pressing "WINDSHIELD" switch on Control Panel. Fluid should be discharged onto the windshield, if it is not, disconnect Nylon Tube from outlet of Solenoid Valve and repeat the test. Fluid should be discharged from the outlet of the Solenoid Valve. If fluid is still not discharged from the outlet of the valve, check that electrical power is present at the connections to the Solenoid valve (C3 pin 8 and ground) when the pump is operating. If the Solenoid valve is suspected of not closing, disconnect electrical power to the valve (C3 pin 8 and/or ground) operate the Windshield Pump. No fluid should be discharged from the spraybar (or Solenoid Valve outlet). OR 2. Remove Solenoid Valve and bench test as detailed in Section 7.

Serviceability Checks

Level IV. (Continued)
Component Checks

Maintenance Practice	Procedure
Check Control Panel. (Note, the voltages specified in the right column assume the use of a volt-meter with a resistance of at least 10 000 ohms per volt. Those readings marked * will differ if a lower resistance voltmeter is used.)	1. Remove the two securing screws and withdraw Control Panel as far as the electrical wiring will permit. Use a probe to measure electrical voltage at the various pins in Connectors C1 and C2 on the rear of the Panel as follows: [1] Aircraft Power ON, all Switches OFF. All pins zero volts except: C1-3 to be aircraft voltage. C1-2 to be 7.5 volts * C2-1 to be +5 volts C2-2 to be between zero and +2 volts * (depending on tank contents) C2-3 to be -5 volts [2] As [1], but with DE-ICE selected. All pins zero volts except: C1-3 and -5 to be aircraft voltage. C1-2 to be 7.5 volts * initially, changing to zero as pressure rises. All pins on connector C2 as [1] [3] As [1], but with ANTI-ICE selected. All pins zero volts except: C1-3 and -4 to be aircraft voltage. C1-2 to be 7.5 volts * initially, changing to zero as pressure rises. All pins on connector C2 as [1] [4] As [1], but with WINDSHIELD switch depressed. All pins zero volts except: C1-3, -6, -8 and -9 to be aircraft voltage. C1-2 to be 7.5 volts * All pins on connector C2 as [1]

Serviceability Checks

Level IV. (Continued)
Component Checks

Maintenance Practice	Procedure
Check Control Panel. (Continued)	[5] As [1], but with LIGHT on All pins zero volts except: C1-3 and -7 to be aircraft voltage. All pins on connector C2 as [1] OR 2. Remove Control Valve and bench test as detailed in Section 7.
Check Tank Contents Transmitter	Remove access panel in lower skin for access. Disconnect Connector C4. Measure resistance across Contents Transmitter Leads at pins of C4 as follows: All pins to ground >10 megohms Pin 1 to pin 3, 10 000 ohms (nominal) Pin 1 to pin 2 should vary from 1/2 the resistance between pins 1 and 3 (i.e. 5 000 ohms nominal) with the tank empty to approximately 3000 ohms with the tank full. OR 2. Remove Contents Transmitter and bench test as detailed in Section 7.

B. Refil De-icing Fluid Tank.

The De-icing Fluid Tank is replenished through a retractable filler located on the left side of the fuselage aft of the baggage compartment door.

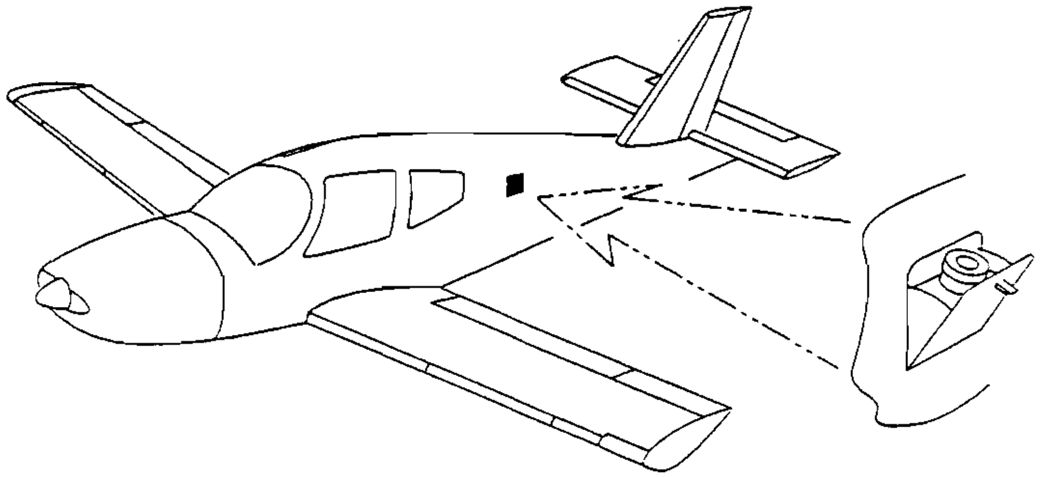


Figure 301
Location of De-icing Tank Filler.

CAUTIONS:

1. USE ONLY DE-ICING FLUIDS LISTED IN SECTION 2 (LIMITATIONS) OF THE FLIGHT MANUAL SUPPLEMENT. THESE APPROVED FLUIDS ARE LISTED BELOW FOR REFERENCE.

2. SOME DE-ICING FLUIDS (KNOWN AS "TYPE II FLUIDS") CURRENTLY USED FOR DE-ICING OF PARKED AIRCRAFT CONTAIN THICKENING AGENTS WHICH MAY BLOCK THE POROUS PANELS. IF IT IS KNOWN OR SUSPECTED THAT SUCH A FLUID HAS BEEN PLACED IN THE TANK, DO NOT OPERATED THE SYSTEM, CONTACT TKS FOR INSTRUCTIONS.

3. DE-ICING FLUIDS CONTAIN MONO-ETHYLENE GLYCOL WHICH IS POISONOUS IF SWALLOWED. DO NOT DRINK DE-ICING FLUID.

4. OBSERVE CLEANLINESS PRECAUTIONS WHEN FILLING TANK.

5. DE-ICING FLUID ACTS AS A LUBRICANT MAKING SOME FLOOR SURFACES, AIRCRAFT SKINS ETC. VERY SLIPPERY. WASH SPILT FLUID AWAY WITH WATER.

The following fluids ONLY are approved for use in the TKS ice protection system:

TKS R328
TKS80
Fluid to specification DTD406B
(Fluid to DTD406B is available under a number of names including military reference AL-5, NATO Code S745, Aeroshell Compound 07 etc.)

Cleanliness Precautions:

The TKS system has filtration to protect components against damage/blockage by particulate matter, but it must be remembered that these will not always be effective against liquid contaminants. For this reason and to extend the life of the filter element and strainer the following precautions are recommended:

- Where possible eliminate unnecessary handling by purchasing fluid in small (5 litre) containers, from which it can be poured directly into the tank.
- Always clean the top of containers before removing the cap and poring from the container.
- Always replace the cap on containers containing fluid or used for the transfer of fluid.
- If fluid is transferred from original containers to others for storage/transfer ensure that these are clean and of suitable materials. Tin plated steel or similar containers susceptable to rusting are not suitable.
- If not filling directly from original containers, keep a set of vessels/implements solely for use with de-icing fluid.
- Maintain the region around the aircraft filler clean. Check that the overboard drain holes in the filler door are not blocked.
- Always replace the filler cap on the aircraft immediately after filling.

C. Renew Filter Element.

Determination of Filter Condition.

The need to renew the Filter Element is indicated by tripping of the High Pressure Warning on the Ice Protection Control Panel.

Since the margin available for element blockage is reduced during low temperature operation (See 1.C.(1).(A)., Page 118) a degree of judgement as to the need for element renewal may be applied, taking into account the actual and normal operating temperatures which the aircraft experiences. For example, if repeated warnings occur or if the aircraft is habitually operated at low temperatures (below -20°C) the Filter Element should be renewed promptly. If on the other hand, an isolated warning occurs due to an unusually low temperature encounter it may be reasonable to defer element renewal to the next service period.

Procedure.

References:

(i) TKS Overhaul Manual for Filter F903, 30-09-11
(ii) Figure 302

Obtain Filter Element Spares Pack (TKS Part No 19295), this contains the following items:

Part No	Description	Usage/Location
X117/2	Sealing Washer	below head of Centre Bolt
X162/1	'O' Ring	base of Guide Tube to Filter Bowl
2051	Element	-
X162/5	'O' Ring	Bowl to Head

Remove underbelly panel forward of wing spar for access.

Remove locking wire from the two hexagonal bolts on the top of the Filter Head.

Unscrew the Centre Bolt to lower and remove the Filter Bowl and Element.

Discard fluid in bowl, Filter Element and Seals.

Clean and inspect Bowl, Guide Tube, Spring and Head.

Fit new 'O' Rings in groove underneath Head and in groove inside Guide Tube.

Reassemble with new Element. Tighten Centre Bolt to 7 +/- 1 pounds feet torque. (97 +/-14 kg.cm.)

Remove Air Bleed Screw. Operate Airframe/Propeller system until air free fluid is discharged from bleed hole. Replace Air Bleed Screw (preferably whilst system still operating). Tighten Air Bleed Screw to 1 pound foot torque (14 kg.cm.).

Wipe all traces of spilt fluid from Filter. Operate system. Check that no leakage occurs.

Wire lock Bleed Screw to Centre Bolt.

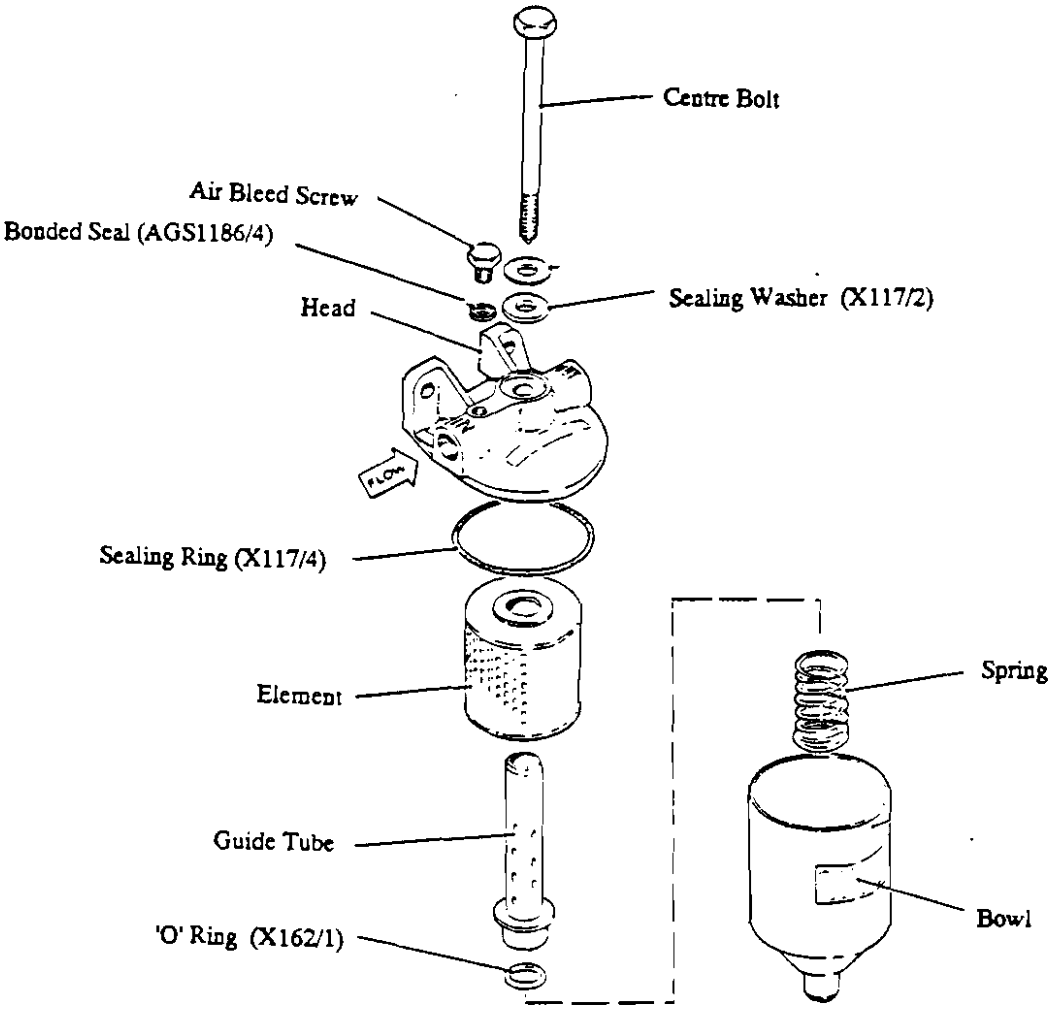


Figure 302
Filter F903

4. Cleaning

CAUTIONS:

1. POROUS PANELS CONTAIN A PLASTIC MEMBRANE WHICH MAY BE DAMAGED BY CERTAIN SOLVENTS, PARTICULARLY METHYL ETHYL KEYTONE (MEK), ACETONE, PAINT THINNERS, PAINT STRIPPER AND OTHER TYPES OF THINNERS AND SOLVENTS. DO NOT USE THESE MATERIALS TO CLEAN PANELS. MASK PANELS WITH NON-POROUS SOLVENT RESISTANT MATERIAL IF SOLVENTS OF THIS NATURE ARE BEING USED ON ADJACENT PARTS OF THE AIRCRAFT.

2. DO NOT PAINT THE OUTER SURFACE OF POROUS PANELS.

A. General.

Reference SOCATA TB20 - TB21 MAINTENANCE MANUAL Section II.8

Cleaning of the airframe is to be carried out in accordance with Section II.8 of the SOCATA TB20 - TB21 MAINTENANCE MANUAL, except where this conflicts with the CAUTIONS above and the following instructions.

11.8.1. De-icing fluid has a softening effect on insect debris, it may therefore be found to be advantageous to operate the ice protection for sufficient period to wet the leading edges with de-icing fluid before attempting to clean them.
The suggested procedure is to spread the fluid over the insect encrusted area with a cloth or sponge whilst the ice protection system is operating, then to switch off and leave for about 10 minutes before continuing with cleaning as described in the SOCATA Manual.

11.8.8. Do not polish the surface of the porous panels when polishing painted surfaces. Wax or silicone polishes impair the wetting qualities of the de-icing fluids and so may degrade ice protection efficiency. Repeated or intensive polishing may also block some of the pores in the panels.

B. De-icing Fluid.

In its clean state, De-icing fluid is non-corrosive, contains no particulate matter and will dry leaving no residues.
However, the the glycol component of de-icing fluid has a relatively low rate of evaporation so that traces of fluid may remain for some time under conditions of low temperature and high humidity or in pools where it collects due to inadequate drainage. De-icing fluid mixes readily with water and any surface deposits which have not evaporated will normally be removed by atmospheric moisture and airflow during flight. Attention should be paid to keeping the airframe drain holes clear to avoid pooling of de-icing fluid which may become contaminated with dirt or airborne pollutants.

A water rinse is suggested if the aircraft is wetted with de-icing fluid and is to be stored (hangared) under cool damp conditions for a period of weeks before its next flight.

De-icing fluid spilt on aircraft fabrics and/or clothing will normally dry without staining, or may be rinsed off with water.

De-icing fluid spilt on the aircraft structure and/or components during maintenance/servicing should be wiped dry or water rinsed and wiped dry.

C. Cleaning of Porous Panels.

From the functional aspect Porous Panels are self cleaned by the "backflushing" action of the De-icing Fluid when the system is operated.

Dirt and insect debris may be cleaned from the Panels during normal aircraft cleaning as described at A. above.

Deposits in the nature of oils, greases, adhesives, paints etc. may be removed by use of the following solvents ONLY:

Water (Soaps and detergents are permitted), De-icing Fluids as listed in Section 3., White Spirit (*), Gasoline(*), Kerosine(*), Isopropyl Alcohol(*), Ethyl Alcohol(*) or Industrial Methylated Spirit(*).

(*) Take appropriate precautions to prevent fire.

In severe cases removal of the deposit may be assisted by the use of "Scotchbrite" and/or careful scraping.

D. Polishing of Porous Panels.

Do not use any form of polish on Porous Panels. The panels may be restored to their original condition by the use of "Scotchbrite". Where necessary, mask the aircraft skin adjacent to the Panel to avoid damage to the paint. Polish in a chordwise direction to obtain a matching texture to the original. Use Very Fine grade if necessary for initial cleaning/polishing, followed by Ultra Fine grade.

Scotchbrite is available from TKS or from the manufacturer, the 3M Company in the grades listed in Table 401.

Table 401
"Scotchbrite" Grades and Recomended Usage.

Grade No	Description	Recomended Usage
7486	Heavy Duty	Use very sparingly on deep scores
7448	Very Fine	Cleaning of difficult deposits Initial polishing.
7486	Ultra Fine	Normal cleaning. Final polishing.

5. Removal/Installation

A. General.

Apart from the exceptions that are detailed in the following paragraphs, removal and installation of items comprising the TKS ice protection system is straightforward and follows normal aeronautical practices.

B. Porous Panels.

(1) General.

(A) Method of Attachment.

Three methods are used to attach the porous panels:

(i) Those panels in the region of the fuel tanks are bonded to the wing leading edges using polysulphide rubber sealant material. A small number of rivets are inserted through that part of the panels which extends beyond the limits of the fuel tank, primarily for electrical bonding purposes.
It is extremely difficult to remove these panels without causing a significant amount of damage to them. In most cases re-use of a removed panel is impractical.

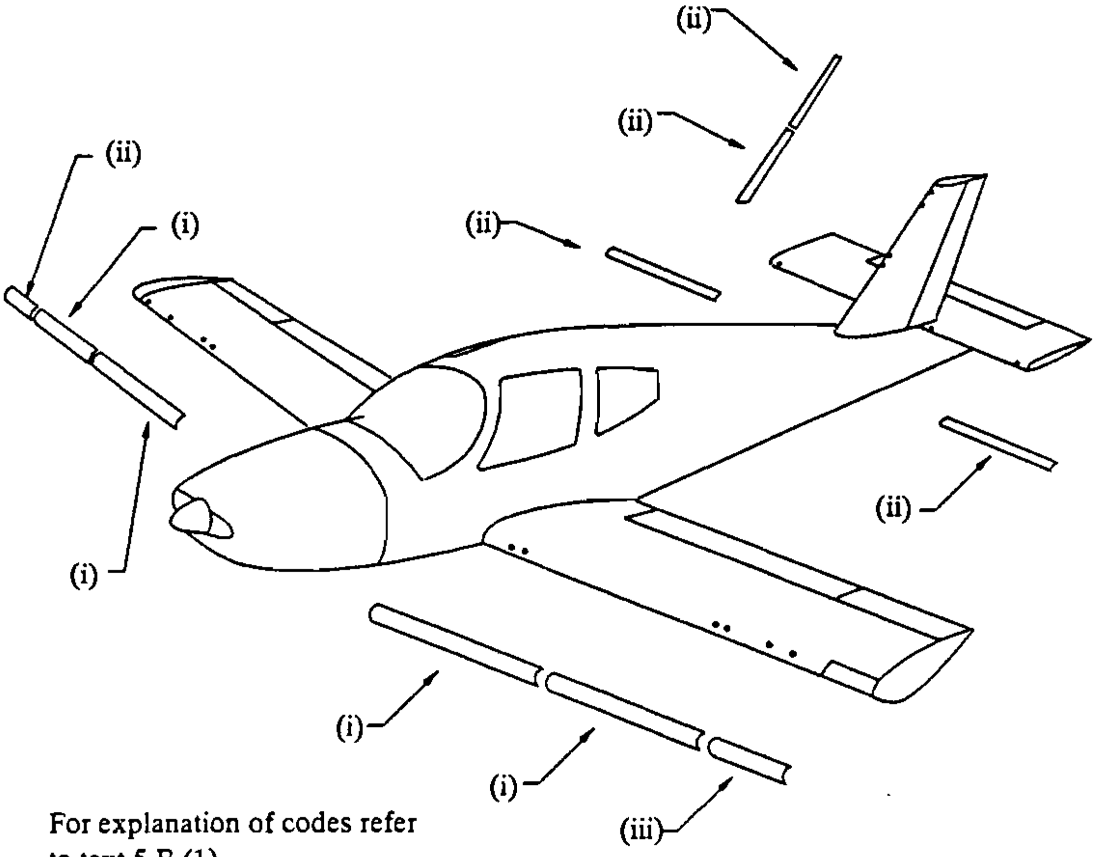
(ii) The panels on the empennage and the right wing tip are attached by rivets. Polysuhphide rubber sealant is used along the edges to seal and isolate the panels from the aerofoil skins. A glass/teflon tape is interposed along the edges of the panels to ease sealant release.
With care, these panels can be removed without undue difficulty in a serviceable condition.

(iii) The panel on the left wing tip is attached by screws. Polysuhphide rubber sealant is used along the edges to seal and isolate the panel from the aerofoil skins. A glass/teflon tape is interposed along the edges of the panel to ease sealant release.
This panel is readily removable to provide access to the lift detector vane/ switch for maintenance/adjustment.

The locations of the panels with respect to the method of attachment is illustrated in Figure 501.

(B) Interchangeability of Porous Panels.

TKS Modification 1464 introduced Porous Panels with holes for the attachment



For explanation of codes refer to text 5.B.(1)

Figure 501
Method of Attachment of Porous Panels

rivets pre-drilled and dimpled to an interchangeable standard. Prior to this modification the panels were drilled on installation. Undrilled replacement panels are required for aircraft with pre-mod 1464 systems. Refer to Illustrated Parts List for details of Panels and Section 8 for identification of System Modification State.

(2) Removal of Porous Panels

Panels Attached by Bonding (Method (i))

- Protect the wing skins behind the edges of the porous panel by applying masking tape and/or other suitable material.
- Drill out rivets attaching the panel to the wing skin. (These are the widely spaced rivets close to the upper and lower edges of the panel. The inner panels have qty. 8, positioned inboard of the fuel tank and the mid panels have qty. 4, positioned outboard of the fuel tank).

- If the panel is unserviceable and irrepairable, the most expedient means of removal is to peel the panel from the wing by tearing the outer panel skin and winding the edges of the panel around a pair of pliers to peel them from the skin. With the edges removed the central part of the panel can be pulled away from the skin by working inwards from the ends.

- If the panel is serviceable and/or repairable it may be possible with care to remove it in a relatively undamaged condition by progressively cutting and parting the sealant which attaches the panel to the skin using a thin flexible blade. (A suitable blade can be made by grinding a hacksaw blade.)

- Withdraw the panel and disconnect the nylon supply tube. Blank the end of the tube to prevent the ingress of dirt.

Panels Attached by Riveting (Method (ii))

- Protect the wing skins behind the edges of the porous panel by applying masking tape and/ or other suitable material.

- Drill out rivets attaching the panel to the wing skin. (These are the widely spaced rivets close to the upper and lower edges of the panel.)

- Carefully part the edges of the panel from the skin by working a thin flexible blade between the panel and the tape on the wing skin.

- Withdraw the panel and disconnect the nylon supply tube. Blank the end of the tube to prevent the ingress of dirt.

Panels Attached by Screws (Method (iii))

- Remove the eight screws attaching the panel to the wing skin.

- The panel may now lift off, if it does not, carefully part the edges of the panel from the skin by working a thin flexible blade between the panel and the tape on the wing skin.

- If the reason for panel removal was to obtain access to the stall warning vane (lift detector) the panel can usually be withdrawn sufficiently without the need to disconnect the supply tube. Do not allow the panel to hang supported by the tube as the edges of the hole in the skin may cut or kink the tube.

- If the panel is to be removed, withdraw the panel and disconnect the nylon supply tube. Blank the end of the tube to prevent the ingress of dirt.

(3) Install Porous Panels.

CAUTION:

POROUS PANELS CONTAIN A PLASTIC MEMBRANE WHICH MAY BE DAMAGED BY CERTAIN SOLVENTS, PARTICULARLY METHYL ETHYL KETONE (MEK), ACETONE, PAINT THINNER AND OTHER TYPES OF THINNERS AND SOLVENTS. DO NOT APPLY THESE SOLVENTS TO THE SURFACES OF THE POROUS PANELS.

THE FOLLOWING SOLVENTS ARE PERMITTED FOR USE ON POROUS PANELS:

WATER (WITH SOAPS OR DETERGENTS)	APPROVED DE-ICING FLUIDS
GASOLENE	KEROSINE
ISOPROPYL ALCOHOL	ETHYL ALCOHOL
INDUSTRIAL METHYLATED SPIRIT	WHITE SPIRIT

(A) General Preparation Applicable to All Porous Panels.

- Dertermine chordwise location for the replacement by reference to the original Panel, or make templates as appropriate from Figures 502 and /or 503. Note that the Panels fitted to the stabilator are intentionally offset in an upward direction. It is important that the profile for the stabilator shown in Figure 503 is maintained. No template is required for the vertical stabiliser where the panels are attached symetrically about the leading edge.

- Check Panel for general fit to airframe. Ideally the Panel edges should have a light positive contact with the skin. If necessary they may be adjusted slightly by hand bending to achieve this. Where protruding rivets occur along the contact line the edge of the Panel is to be dressed around the rivet head.

- Where required trim the ends of the Panels to match the available length. Avoid trimming closer than 0.05" (1,2 mm) to the ends of the inner skin, or to the air bleed tube in cases where this is routed across the end of the Panel.

- Pre Mod 1464 installations will require the use of non-predrilled Panels. In this case the holes in the aircraft skins are to be transferred to the panels using a suitable "hole finder". Drill and dimple holes for the attachment rivets as shown in Figure 504. After drilling, file the inner surface of the dimple as shown to aviod interference with the skin.
  For Post Mod 1464 aircraft, replacement Panels are available pre-drilled and dimpled, in this case check that the panel attachment holes align with those existing in the skins. If difficulties are experienced with hole alignment the use of undrilled replacement panels is permitted.

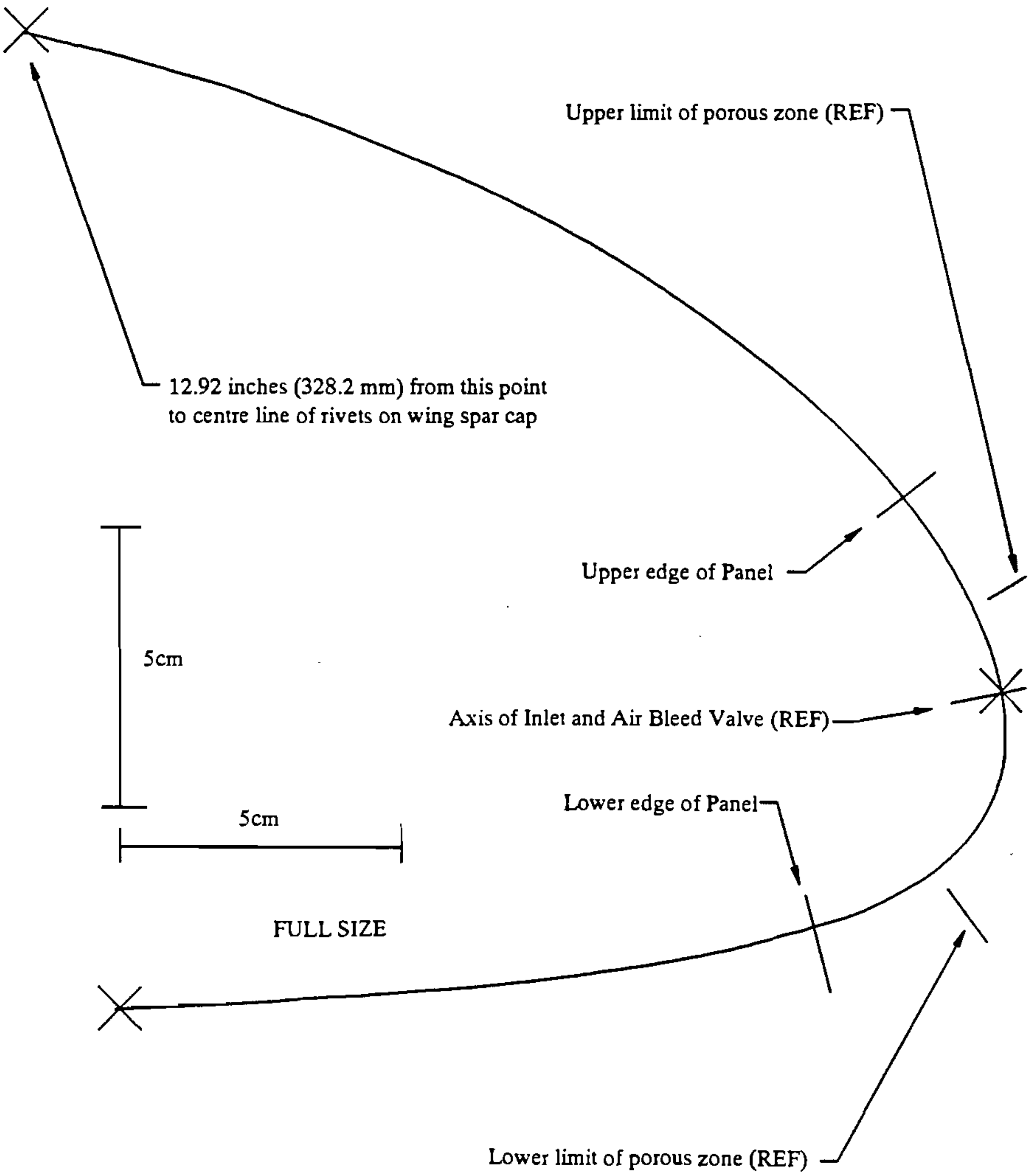


Figure 502

Template for Chordwise Location of Panels on Wing

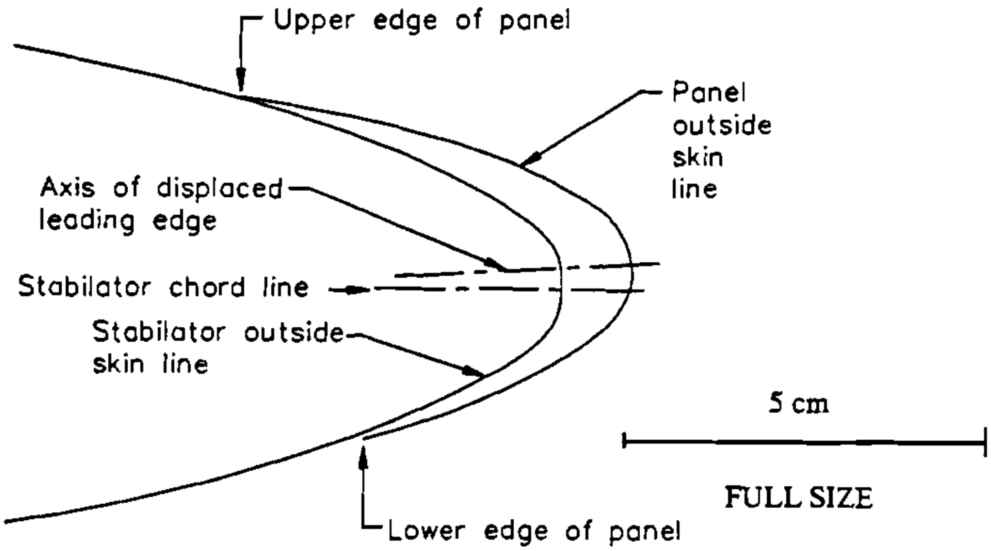
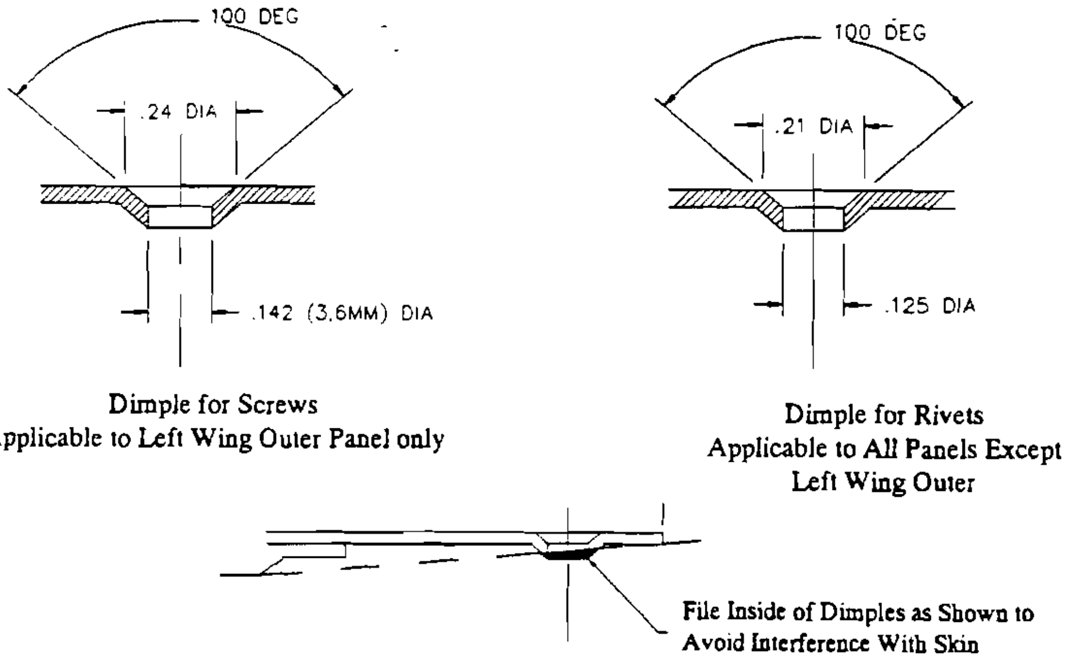


Figure 503
Template for Chordwise Location of Panels on Stabilator



Detail for Dressing of Dimples on Inner Surface of Panel
Applicable to All Panels

Figure 504
Details of Dimples for Panel Attachment Rivets and Screws

- Clean and degrease the aerofoil leading edges where the Panels are to be attached using materials permitted by the aircraft manufacturer. Do not touch the skin with ungloved hands after cleaning.

  Mark the edges of the Panel on both skins. Mask the aerofoil skins 0.20" (5mm) behind the marked line.

- Mask entire front surface of panels with non-absorbent material (such as good quality glazed paper attached on all four edges with paper masking tape). Clean and degrease rear surface of panel using iso-propyl or ethyl alcohol. Do not touch rear surface after this operation. Dry panel (with warm air up to 50 degrees Centigrade if necessary).

- Support panel to prevent straining pipeline and connect feed pipe to each panel using the techniques described in Section 5.C.
  Mix a suitable quantity of Sealant PR1221. Apply sealant to feed connection to cover exposed connector threads, nut and pipeline for at least 1/2 inch [12 mm] beyond the nut. (This is intended to provide locking and a secondary seal).

- Continue with installation as described in Section 5.B.(3).(B) or 5.B.(3).(C) depending on the panel being fitted.

(B) Panels Attached by Adhesive Bonding (Method (i))

- Mix a suitable quantity of Sealant PR1221. Apply four beads of the sealant to the rear surface of porous panel as shown in Figure 505.

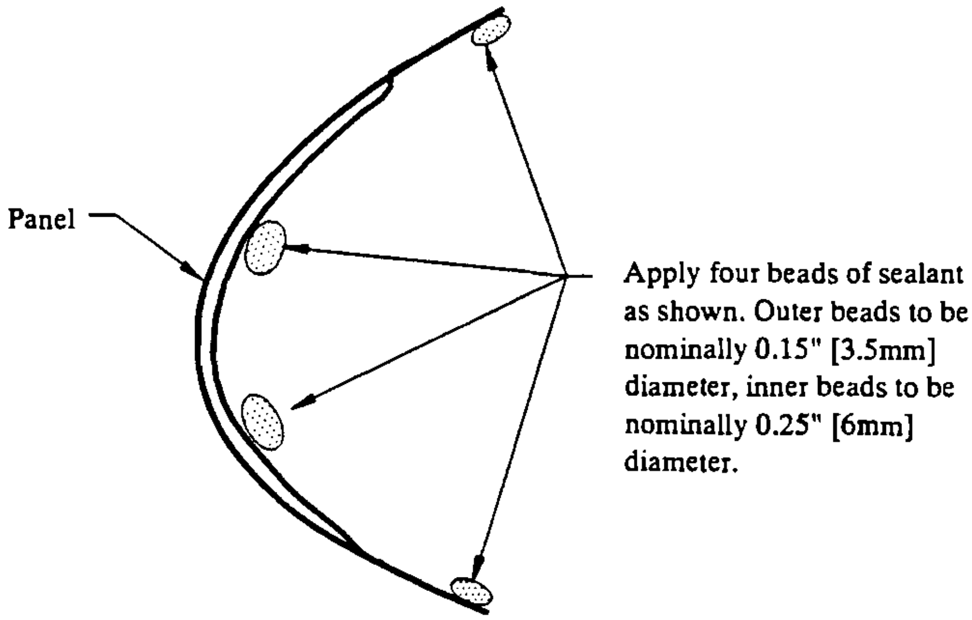


Figure 505
Application of Sealant to Panels Attached by Method (i)

- Press panel firmly into position and maintain pressure for sufficient time to allow sealant to flow into place. Scrape away any surplus sealant from edges [*]. Secure panels temporarily with a few strips of adhesive tape. Insert the electrical bonding rivets using the sealant on the rivets.Secure the panels to aerofoil skin with strips of strong adhesive tape applied in a chordwise direction and pulled tightly. It may be found advantageous to insert strips of rubber or a similar suitable material along the edges of the panels as shown in Figure 506 to ensure that the panel edges are held in contact with the skin by the tape. Pay particular attention to the joint between the panels at the centre of the fuel tank to avoid a discontinuity.

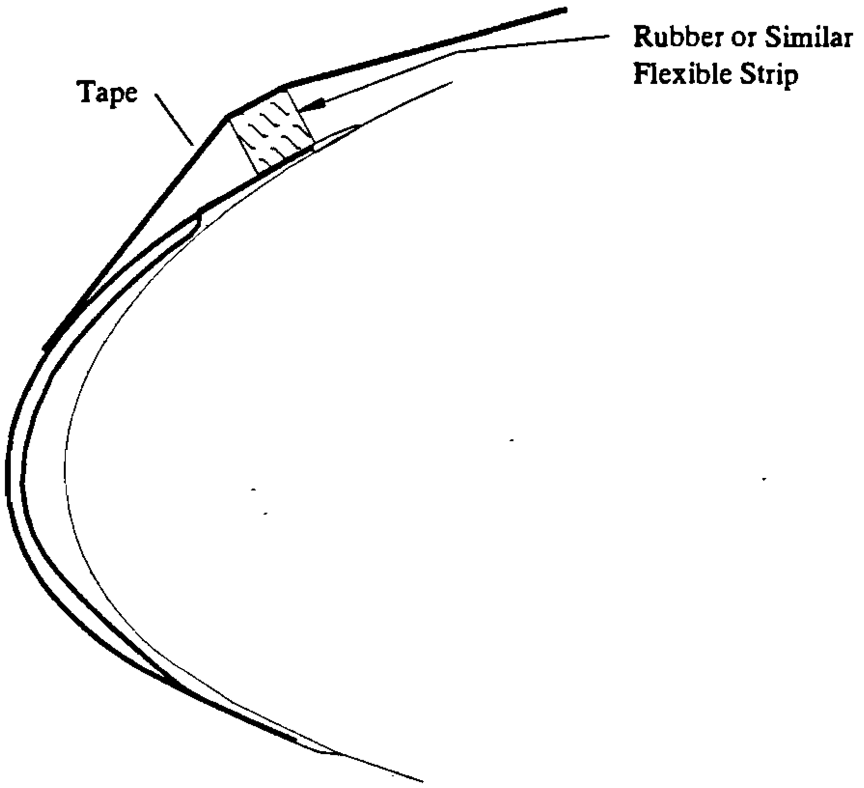


Figure 506
Securing of Panel During Adhesive Cure

- Remove tape and masking following curing (the cure time will depend upon temperature, but may be determined by retaining a sample of the sealant mix for examination.)

- Trim and clean sealant around perimeter of panel as necessary [*]. A hard rubber eraser will be found to be useful. If necessary, clean panels with an approved solvent – see CAUTION at the beginning of this Section.

[*] The objective is to form a fillet of sealant between the aft edge of the panel and the skin as shown in Figure 507.

Figure 507
Filleting at Edge of Panel

(C) Panels Attached by Rivets/Screws (Methods (ii) and (iii))

- Apply strips of glass/ptfe tape to the skin as shown in Figure 508.

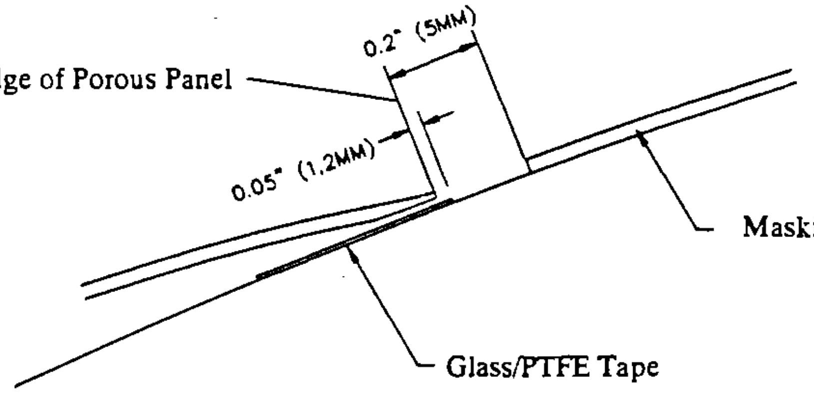


Figure 508
Sealant Release Tape

- Mix a suitable quantity of Sealant PR1221. Apply two beads of the sealant to the rear surface of porous panel as shown in Figure 509.

- Press panel firmly into position and maintain pressure for sufficient time to allow sealant to flow into place. Scrape away any surplus sealant from edges [*]. Secure panels temporarily with a few strips of adhesive tape. Insert the rivets (or screws in the case of the left wing outer panel) using the sealant on the rivets.If any parts of the panel edges do not fit closely to the skin these should be pulled down with strips of strong adhesive tape applied in a chordwise direction and pulled tightly. It may be found

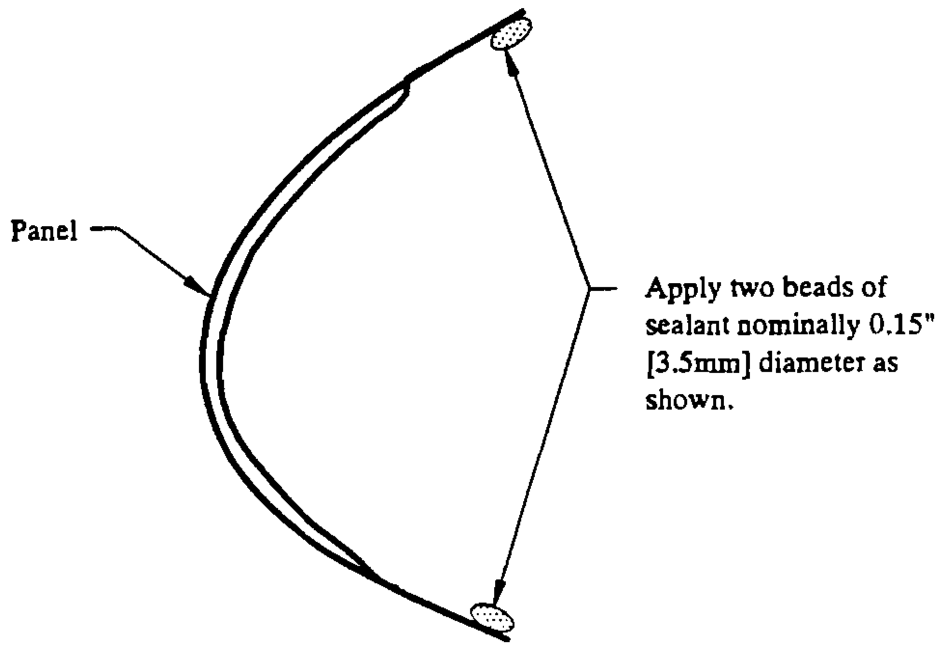


Figure 509
Application of Sealant to Panels Attached by Methods (ii) and (iii)

advantageous to insert strips of rubber or a similar suitable material along the edges of the panels as shown in Figure 506 to ensure that the panel edges are held in contact with the skin by the tape.

- Remove tape and masking following curing (the cure time will depend upon temperature, but may be determined by retaining a sample of the sealant mix for examination.)
- Trim and clean sealant around perimeter of panel as necessary [*]. A hard rubber eraser will be found to be useful. If necessary, clean panels with an approved solvent – see CAUTION at the beginning of this Section.

[*] The objective is to form a fillet of sealant between the aft edge of the panel and the skin as shown in Figure 508.

C. Pipelines and Couplings

Full data relating to Pipelines and Couplings is contained in TKS General Practices Manual 30-09-46. Extracts from the following sections of this manual are included for reference:

DISASSEMBLY
CHECK
ASSEMBLY

Extracts from TKS General Practices Manual 30-09-46:-

DISASSEMBLY

1. Disassembly Procedure

NOTE: When disassembling a coupling always hold the coupling body with a suitable spanner whilst unscrewing the coupling nut.

A. Hold the coupling body, unscrew the coupling nut(s) and extract the tubing from the coupling. Remove and discard the sealing ring(s).

B. in the case of a bulkhead coupling, remove the tubing as detailed in para. 1.A. then hold the coupling body using a suitable spanner and remove the locking nut fron the extended thread of the coupling. Extract the coupling from the bulkhead.

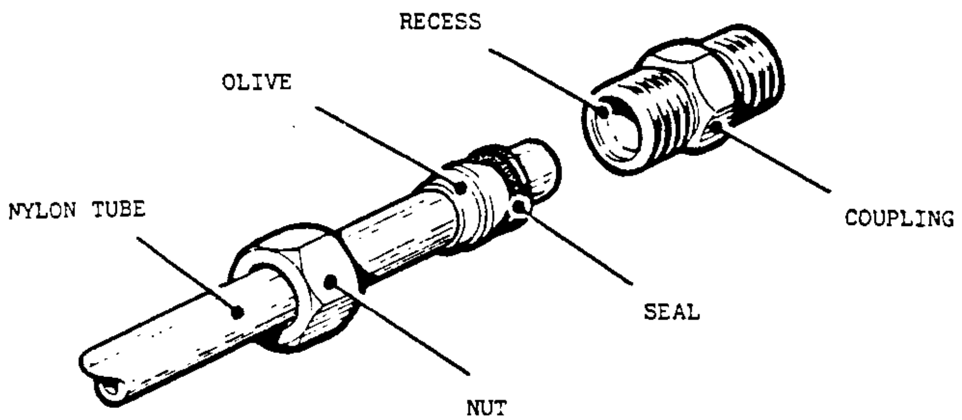


Figure 301
Typical Disassembled Coupling

Extracts from TKS General Practices Manual 30-09-46 (Continued):-

CHECK

1. *Check Procedure.*

   A.. *Visually examine all component parts for damage, corrosion and wear with particular attention to corrosion and cracking of aluminium alloy components.*

   B. *Examine the anti-seize coating on all aluminium alloy external threads. If more than 20% of the total thread area is exposed renew the coating or reject the component.*

   C. *Check the olives for damage and overtightening. The olive may be capable of rotation by hand on the tube, but must not be obviously loose. Suspect olives should be removed and the joint re-clenched as detailed in Assembly.*

   D. *Check the nylon tube for cuts, cracks, abrasion and damage caused by crushing and kinking. Check that the tubing is not permanently deformed in the region of the olive in such a way as to make the olive loose. Discoloration of the tubing is not detrimental and is therefore acceptable.*

ASSEMBLY

1. *Special Tools*

Tool Part Number	*Description*	*Remarks*
T300-112A comprising T333-112-01 and T300-112-02	*Clenching Tool for 3/16 inch outside diameter tubing.*	*Clenching tool comprising a body and spigot.*
T300-120A comprising T333-120-01 and T300-120-02	*Clenching Tool for 5/16 inch outside diameter tubing.*	*Clenching tool comprising a body and spigot.*
T300-145	*Clenching Tool for 3/8 inch outside diameter tubing.*	
T300-144	*Clenching Tool for 1/2 inch outside diameter tubing.*	

Extracts from TKS General Practices Manual 30-09-46 (Continued):-

2. Assembly Procedure

CAUTION:

1. *TO PREVENT TENSION OCCURRING AT THE COUPLING, ENSURE THAT THE TUBING IS SUFFICIENTLY LONG TO ALLOW AT LEAST 3% OR 1 INCH PER THREE FEET OF SLACK WHEN THE TUBING IS INSTALLED AND CLIPPED IN POSITION.*

2. *THE OLIVE MUST BE CLENCHED TO THE TUBING BEFORE THE INTRODUCTION OF THE SEALING RING. CLENCHING THE OLIVE WTH THE SEALING RING IN POSITION WILL PREVENT THE OLIVE FROM LOCKING CORRECTLY ON THE TUBING AND DESTROY THE SEALING RING. ALWAYS USE A NEW SEALING RING WHENEVER ASSEMBLING A COUPLING.*

A. Remaking a Coupling.

(1) Slide the nut along the tubing away from the olive.

(2) Cut the tubing square as close as possible behind the olive to remove the damaged olive and tubing.

(3) Assemble a new olvie onto the tubing and remake the coupling loint as detailed in paras. 2.B or 2.C.

NOTE : The olive may be clenched to the tubing using the coupling components but to obtain maximum coupling security the use of a clenching tool is rcommended.
Refer to the Aircraft Maintenance Manuals for coupling assembly instructions with particular reference to the use of clenching tools.

B Clenching an Olive Using a Clenching Tool. -

1) Refer to para. 1.A. Special Tools and obtain the appropriate clenching tool to suit the tubing size.

NOTE : The clenching tools for 3/16 inch. and 5/16 inch. O.D. tubing are fitted with a support spigot. Ensure that the spigot is correctly fitted in the tool before use.

(2) Cut the end of the tubing square and remove all fraze.

(3) Assemble the nut and love over the end of the tubing and press the end of the tubing fully home into the end of the clenching tool.

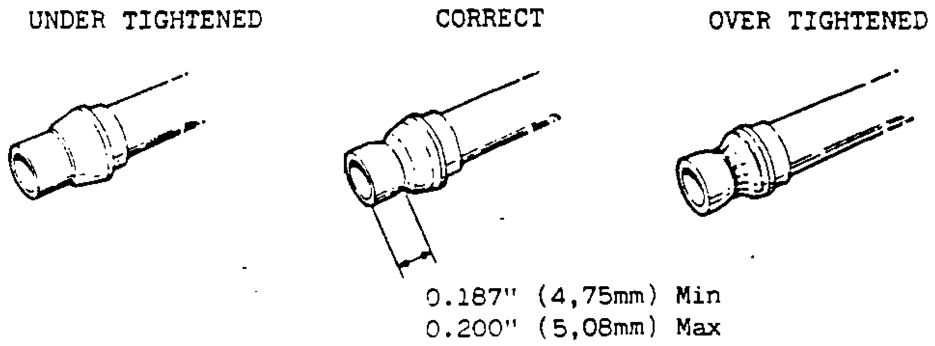
(4) Slide the nut and olive towards the end of the clenching tool, engage the nut and tighten finger tight. Ensure that the spigot on the outer end of the olive is correctly located in the bore of the nut.

Extracts from TKS General Practices Manual 30-09-46 (Continued):-

(5) *Tighten the nut until the torgue begins to rise rapidly, approximately 315 degrees from finger tight. A correctly clenched ol ive should be obtained if tighting ceases just after the point where rapid torque increase commences.*

(6) *Unscrew the nut and remove the tubing from the clenching tool.*

(7) *Refer to Figure 701 and check that the olive is correctly clenched onto the tubing and the required length of tubing extends beyond the clenched end of the olive*



Olive Clenching
Figure 701

C. *Clenching an Olive Using a Coupling Body.*

CAUTION: *USING A COUPLING BODY FOR CLENCHING WILL CAUSE RAPID WEAR TO THE INTERNAL CONICAL BORE OF THE COUPLING LEADING TO INCORRECT CLENCHING OF THE OLIVE. THE SAME COUPLING BODY MUST NOT BE USED REPEATEDLY FOR CLENCHING OLIVES. THE RECOMMENDED PROCEDURE IS TO USE A COUPLING BODY ONCE ONLY FOR THIS PURPOSE, AFTER WHICH IT MAY BE PUT INTO SERVICE.*

NOTE: *The preferred method of clenching an olive to the tubing is by use of a clenching tool. In the case of emergency a satisfactory but less strong joint may be obtained using a coupling body in place of a clenching tool. Reference must be made to the Aircraft Maintenance Manual as in some cases the Aircraft Manufacturer may make the use of a clenching tool mandatory.*

Extracts from TKS General Practices Manual 30-09-46 (Continued):-

(1) *Cut the end of the tubing square and remove all fraze.*

(2) *Assemble the nut and olive over the end of the tubing and press the tubing fully home in the coupling body.*

(3) *Slide the nut and olive towards the coupling body, engage the nut and tighten finger tight. Ensure that the spigot on the outer end of the olive is correctly located in the bore of the nut.*

CAUTION: IF THE COUPLING IS PART OF AN ASSEMBLED COMPONENT, RESTRAIN THE COUPLING FROM ROTATION DURING THE CLENCHING OPERATION..

(4) *Tighten the nut until the torque begins to rise rapidly, approximately 315 degrees from finger tight. A correctly clenched olive should be obtained if tightening ceases just after the point where rapid torque increase commences.*

(5) *Unscrew the nut and remove the tubing from the coupling body.*

(6) *Refer to Figure 701 and check that the olive is correctly clenched onto the tubing and the required length of tubing extends beyond the clenched end of the olive.*

D. *Assembly of a Coupling*

(1) *If it is necessary to renew the anti-seize coating on aluminium alloy external threads proceed as follows:-*

(a) *Remove all traces of existing anti-seize compound using trichloroethane or a suitable chemical solvent.*

(b) *Mix the Moly-vi-Bond anti-seize compound in accordance with the manufacturers instructions, brush coat to cover the engaging parts of external threads.*

CAUTION: WHEN FITTING A NEW SEALING RING ENSURE THAT IT IS CORRECTLY LOCATED AND NOT TRAPPED OR TWISTED.

(2) *Place a new sealing ring over the end of the tubing, then insert the tubing into toe coupling body and guide the sealing ring into the recess at the end of the coupling body.*

(3) *Push the tubing towards the coupling body so that the olive retains the sealing ring in position, engage the nut and tighten finger tight.*

(4) *Tighten the nut until the torque just begins to rise rapidly, approximately 180 degrees from finger tight.*

(5) *Wirelock the nut as detailed in the Aircraft Maintenance Manual.*

D. Proprotioning Units.

It is important that the outlets of the Proportioning Units are connected to the Porous Panels (or Propeller supply) for which they are intended and that no major changes are made to the length of any pipeline.

Connection Data for the Proportioning Units is given in Section 1, Table 101.

6. Adjustment/Test

A. Measure Fluid Delivery from Airframe/Propeller Pump.

See Section 3 (Page 307) and Section 7.A.

B. Measure Operating Pressure of High Pressure Warn Switch.

See Section 3 (Page 307) and Section 7.B.

C. Measure Operating Pressure of Low Pressure Warn Switch.

See Section 3 (Page 308) and Section 7.C.

D. Measure Operating Pressure of Low Pressure Warn Switch.

See Section 3 (Page 308) and Section 7.D.

E. Test Proportioning Unit.

See Section 3 (Page 309) and Section 7.E.

F. Test Porous Panel.

See Section 3 (Page 309) and Section 7.F.

G. Test Windshield Pump.

See Section 3 (Page 310) and Section 7.G.

H. Test Soleniod Valve.

See Section 3 (Page 310) and Section 7.H.

I. Test Control Panel and Contents Transmitter.

See Section 3 (Page 311) and Sections 7.I and 7.J.

J. Calibrate Contents Indicator.

- Drain Tank. With tank empty, contents display should read zero. If it does not, measure voltages on lines to Contents Transmitter by means of a probe at C2 or C4 (reference Section 1, Figure 114). The voltages should be as shown in Table 601.

Table 601
Voltages on Connections to Contents Transmitter

Connector C2 or C4	Tank Empty	Tank Full
Pin No 1	+5 volts	+5 volts
Pin No 2	zero volts	Approximately 2 volts
Pin No 3	−5 volts	−5 volts

- If the voltage at Pins 1 and 3 is not correct a Control Box or wiring fault is indicated. This must be corrected before proceding with the calibration.

- If Pin No 2 does not read zero voltage a Contents Transmitted fault or misalignment is indicated. Alternatively, if Pin 2 reads nominally +5 or −5 volts a wiring or potentiometer discontinuity is probable.

- To align the Contents Transmitter remove the panel on the lower fuselage skin below the baggage compartment for access and remove the snap fit plastic Cover on the Tank Conetnts Transmitter. Slacken the threeClamping Screws and rotate the Potentiometer case until zero voltage is obtained. Tighten the clamping screws and replace the cover and access panel.

- Fill the tank completely. The Contents Display should read 7.8. If it does not, remove the two screws securing the Control Panel and withdraw it as far as the electrical connections will permit. Remove the two screws on each side, closest to the forward end of the box, (reference Figure 601) and remove the lid to gain access to the adjusting potentiometer. (On later units the lid does not need to be removed. An access hole with a sliding cover is provided.) Adjust potentiometer VR2 (reference Figure 602) to obtain the correct display. Note that the contents display circuit is heavily damped to aviod display fluctuations in flight. Allow sufficient time for the display to stabilise when making adjustments.

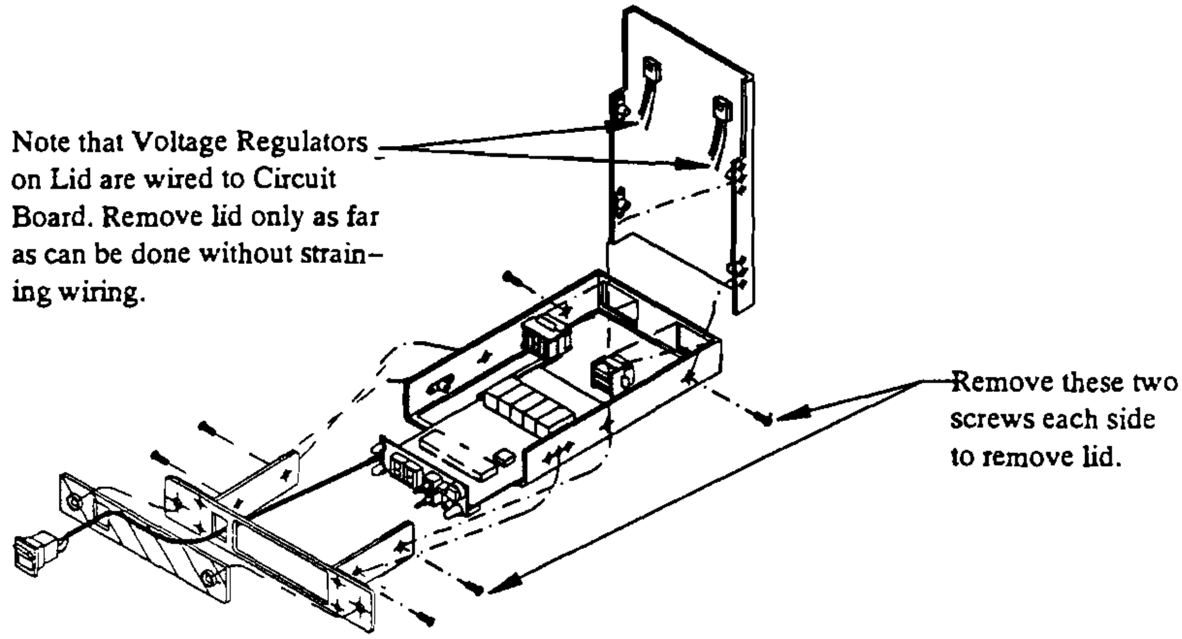


Figure 601
Exploded View of Control Box

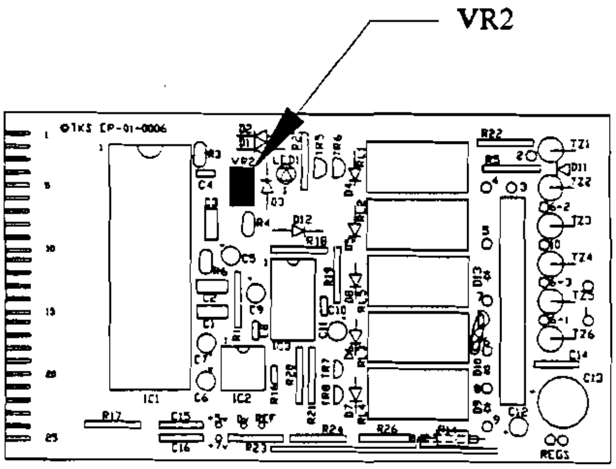


Figure 602
Location of Potentiometer VR2

8. Identification and Modification History.

A. Equipment Identification.

For Product Support and Airworthiness purposes T.K.S. Ice Protection Equipment Kits are identified by the following;-

(i) A kit part number.
This is 4700 for all SOCATA TB 20 and TB 21 aircraft.

(ii) A kit variant code.
This is in the form of an alphabet character, and defines the content of the kit to take into account the aircraft variables defined in Table 801.
Note that in some respects (but not all) the kit variant becomes irrelevant once the kit is installed. For example fitting a variant N kit to an aircraft which originally had propeller de-icing installed, produces an installation which is identical to that obtained by fitting a variant M kit to an aircraft not previously equipped with propeller de-icing.

(iii) A serial number.
Kits for TB20 and TB21 are serialised sequentially and are prefixed "TB".
(Kits are also identified by a TKS build reference number which incorporates a year date code (for example 89-46/8409). This number is not shown on the installed equipment and it is not essential to quote this for product support/airworthiness purposes.)

(iv) A revision code.
This code is in the form of a number (or numbers) and provides a compact means of identifying the modification status of the kit.
Typically the identification of a kit will state "All revisions up to [ ] and revisions [ ],..... [ ] "
For details refer to Table 802.

A data plate showing details of installed kits is provided and will be found on the side of the filler access panel. (Reference Figure 126) The data plate is visible only when the access panel is open.
This data plate is to be updated as necessary when modifications are incorporated. (Normally this will be by means of attaching small supplementary placards which will be provided in the modification kits.)

A list of kit details by serial number is included at Annexure 1 to this section.

Annexure 1 will be updated periodically but where information is required relating to more recent equipment than is listed, this is available on request from T.K.S.

Table 801

Variant Codes

Variant Code	Applicability		
	Aircraft Voltage	Propeller De-ice previously fitted	Language of Placards
A*	14	No	English
B*	14	Yes	English
C*	14	No	French
D*	14	Yes	French
E*	14	No	German
F*	14	Yes	German
G*	28	No	English
H*	28	Yes	English
I*	28	No	French
J*	28	Yes	French
K*	28	No	German
L*	28	Yes	German
M	14	No	English, French and German
N	14	Yes	English, French and German
O	28	No	English, French and German
P	28	Yes	English, French and German

Note Variants M through P, containing three sets of placards, were introduced in order to simplify ordering and stocking. In all other respects these are equivalent to the earlier variants marked *.

B. Modification History

A summary of Modifications is given in Table 802.
Where retrofit of a Modification is feasible/desirable/mandatory this is identified in the "Description" column together with any applicable Service Bulletin references.

Table 802

Revision Code and Modification History

Revision Code	TKS Mod. No. and Date	SOCATA Mod. No. (If applicable)	Description
-	1391 and 1412 (27-11-87)		Introduction of Ice Protection Systems for SOCATA TB20 and TB21
-	1418 (18-5-88)		Minor drawing amendments
-	1423 (18-5-88)		Cabin Heat Air Intake Shield changed to prevent ingestion of de-icing fluid.
-	1425 (18-5-88)		(i) French and German language placards introduced (ii) Access panel on lower skin repositioned to ease access to tank outlet and contents transmitter.
-	1436 (7-6-89)		Equipment introduced for 28 volt equipped aircraft.
-	1441 (9-1-89)		Drawing correction to call up correct inserts for connector "C5".
-	1453 (7-6-89)		Fluid tank lid strengthened.
-	1454 (7-6-89)		Electrical component part numbering changed as a result of the introduction of a new numbering policy.
0	1456 (29-9-89)		Minor drawing alterations and corrections. Kit revision identification introduced.
1	1460 (27-9-89)		Switch on control panel changed from toggle to rocker type. (To reduce the risk of inadvertent operation). Retrofit is feasible at Customer Option.
2	1462 (16-1-90)		Minor amendments to ease installation.

Table 802 (Continued)

Revision Code and Modification History

Revision Code	TKS Mod. No. and Date	SOCATA Mod. No. (If applicable)	Description
3	1464 (2-2-90)		Introduction of Porous Panels with pre-drilled attachment holes. Template for baggage compartment floor amended to provide increased clearance for installation of tank.
4	1457 (2-2-90)		Introduction of rotationally moulded tank. Retrofit is feasible at Customer Option
4	1468 (8-2-90)		Minor amendments.
5	1469 (12-2-90)		Introduction of pressure switch with damper. (To eliminate spurious high pressure warnings). Retrofit Recomended on aircraft where spurious warnings are found to occur.
5	1465 (16-2-90)		Additional part numbers introduced for spares items.
6	1471 (19-4-90)		Support bracket for Control Panel and Transponder amended. Grommets added to kit for wing spar holes.
7	1472 (#)		Waterproof connectors introduced at Low Pressure Warn Switch locations. Retrofit recomended. Service Letter to be issued.

(#) Not yet issued

Section 8 Annexure 1

Summary of Ice Protection Kits SOCATA TB20 AND TB21
TKS Part Number 4700

Serial No.	Variant Code	Revision Status	Date of Manufacture	Fitted to aircraft no	TKS Reference
TB1	Prototype	0		343	
TB2	C	0	4/89		89/13-7872
TB3	K	0	7/89		89/15-8029
TB4	G	0	9/89		89/14-8080
TB5	F	0	9/89		89/16-8081
TB6	B	0	9/89		89/17-8081
TB7	I	1	10/89		89/30-8143
TB8	I	1	10/89		89/31-8143
TB9	I	1	10/89		89/32-8143
TB10	I	1	10/89		89/33-8143
TB11	G	1	11/89		89/34-8186
TB12	I	1	11/89		89/35-8186
TB13	D	1	11/89		89/18-8187
TB14	D	1	11/89		89/19-8186
TB15	M	2	2/90		89/20-8295
TB16	M	5	3/90		89/21-8408
TB17	O	2	2/90		89/36-8296
TB18	O	2	2/90		89/37-8296
TB19	N	5	3/90		89/22-8408

Summary of Ice Protection Kits SOCATA TB20 AND TB21
TKS Part Number 4700

Serial No.	Variant Code	Revision Status	Date of Manufacture	Fitted to aircraft no	TKS Reference
TB20	N	2	2/90		89/23-8295
TB21	N	5	3/90		89/24-8408
TB22	N	5	3/90		89/25-8408
TB23	O	5	3/90		89/43-8409
TB24	O	5	3/90		89/44-8409
TB25	O	5	3/90		89/45-8409
TB26	O	5	3/90		89/46-8409