MOONEY INTERNATIONAL CORPORATION
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FAA APPROVED
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR

MOONEY M20M, M20R, M20TN, M20U, M20V
WITH
FLIGHT INTO KNOWN ICING CONDITIONS
WITH TKS ICE PROTECTION SYSTEM

MODEL NO. _____

REG. NO. _____

SERIAL NO. _____

This supplement must be included in the Pilot's Operating Handbook an FAA approved Airplane Flight Manual (POH/AFM) when TKS ice protection Systems are installed in accordance with Mooney drawing number 690007. The information contained herein supplements the information of the basic Pilot's Operating Handbook and Airplane Flight Manual.

FAA APPROVED for: _____

Manager, Southwest Flight Test Section, AIR-713
FEDERAL AVIATION ADMINISTRATION
Fort Worth, TX 76177

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SUPP0017H

LOG OF REVISIONS

REV. NUMBER	PAGE NUMBER(S)	DESCRIPTION	FAA APPROVED	APR'VD DATE
D	Title Page, Log of Revisions 8- 10, 17, 18 4 3 7, 11 17	Added Revision D data Relocated data Revised & Relocated data Added Data Added & Relocated data Deleted Duplicate Table	MM Quarley	March 2000
E	ALL ALL 5,6 6 7 8 9 13, 15 14,15 15 18, 21, 24 18, 23 27, 28	Corrected Revision Dates & Added Rev E Added M20TN to Header Added M20TN Airspeed Data & Chart Revised - M20M Annunciator Legends Revised - M20R Annunciator Legends Added M20TN to Alt/Stand-By Alternator Added - P/N & Eff. M20M Vacuum Pump Added - P/N & Eff. M20R Vacuum Pump Added M20TN Placard Added Data - Meteorological Conditions Added - M20TN to Warning Added M20TN Flap Data Revised text - may be affected Added GX Graphic Revised DX Graphic Added Data - Freezing Rain/Drizzle Conditions	MM Quarley	April 10, 2007
F	5 11 11 12 12 13, 15	Added: (for T.O. into Icing Conditions) Added: During Flyable Storage (MIN= 1 U.S. Gallon Added: Inadvertent or Icing Conditions deleted line: Pitot Heat Annunciator Illuminates Added: NOTE to identify Pitot Heat annunciator Illumination Revised Note: Garmin G1000 Stall Warning	Alfred A. Bar... for M. Monica Merritt	Aug 3, 2010
G	Title Page, Log of Revisions 7	Added Revision 'G' to footer Added data to review Note on TCDS Data Updated to "Mooney International Corporation" Incorporated M20U and M20V model aircraft	James A. Riggs	17 Sept 17
H	Table of Contents	Revised Page Numbering	MM	20 NOV 17

THE REVISED PORTIONS OF AFFECTED PAGES ARE INDICATED BY VERTICAL LINES IN THE MARGIN.

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SECTION I - GENERAL

The TKS Ice Protection System exudes ethylene glycol based fluid from: (1) porous panels attached over the airfoil leading edges, (2) a slinger ring on the propeller hub to “sling” the same fluid over rubber boots on each propeller blade and (3) a spray bar in front of the pilots wind shield area to spray, upon demand, fluid to displace ice build- up.

The ethylene glycol based de-icing fluid is stored in two inter-connected tanks located under the left rear seat. A usable capacity of 6.0 U.S. gallons, total in both tanks, provide for a limited operating time. The tanks are filled through a retractable filler on the right side of the aft fuselage. Fluid is pumped through nylon lines to proportioning units located in each wing and in the aft fuselage, and from these units, to the porous panels. Fluid is also pumped to a nozzle at the front of the engine which directs fluid into a slinger ring where centrifugal forces carry the fluid onto grooved rubber over shoes fitted to the propeller blades. The windshield is supplied with fluid through a spray bar fed by a separate pump.

SECTION II - LIMITATIONS

1. The aft center of gravity (CG) limit with the TKS system installed is:
Fuselage Station 49.5 in. (all weights) . . . . . @ 30.72% MAC.

2. Flaps are limited to a maximum deflection of TAKE OFF setting when the TKS equipped aircraft has encountered icing conditions. An icing condition is defined as visually detected ice, or the presence of visible moisture in any form at an indicated outside air temperature (OAT) of +3°C or below.

-WARNING-

Use of landing flaps with an ice contaminated horizontal stabilizer leading edge can potentially result in uncontrolled elevator oscillations and loss of pitch authority.

3. Minimum ice protection fluid (for T/O into Inadvertent or Icing Conditions) 3.8 U.S. Gallons

4. TKS Ice Protection System maximum capacity . . . . . 6.3 U.S. Gallons
. . . . . (total system capacity)
. . . . . 6.0 U.S. Gallons
. . . . . (usable tank capacity for take off into anticipated icing conditions.)
Normal Flow Duration . . . . . 150 minutes (2.5 gph)
Maximum Flow Duration . . . . . 75 minutes (5.0 gph)

5. The TKS Ice Protection System tank must be serviced with one of the following fluids:
TKS 80
AL-5 (DTD 406B)
TKS R328

6. Only the following solvents are authorized for cleaning the leading edge panels.
Water (with soap/detergent)
Approved De-Icing Fluid (see paragraph 5.)
Aviation Gasoline
Isopropyl Alcohol
Ethyl Alcohol
Industrial Methylated Spirit

7. Minimum airspeed for operation in icing conditions:

M20M, M20R, M20U . . . . . 120 KIAS
. . . . . (except for T/O and LDG)

M20TN, M20V Operation in icing conditions is limited to indicated airspeeds within the following envelope, except for Takeoff and Landing see Figure 2-1.

a.) Greater than 120 KIAS for all altitudes

b.) Less than 173 KIAS from sea level to 11,000 ft.

c.) At 11,000 ft and above, maximum indicated airspeed must be decreased from 173 KIAS at 3 KIAS per thousand feet to 140 KIAS at 22,000 ft.

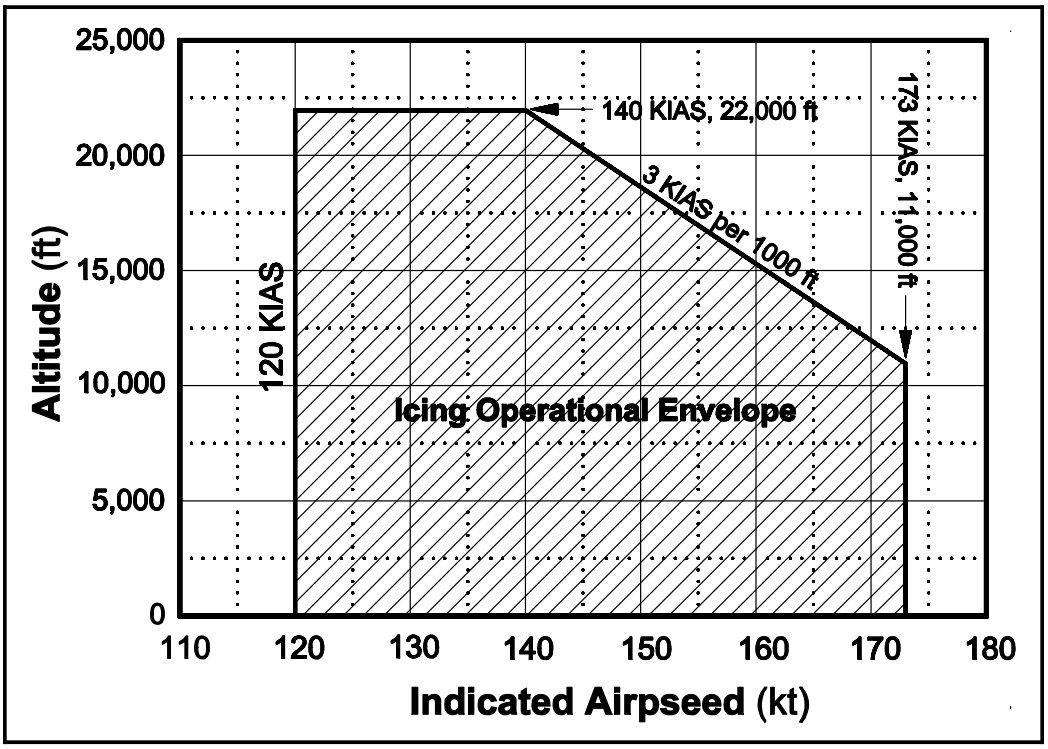


Figure 2-1 M20TN/M20V AIRSPEED LIMITATIONS IN ICING CONDITIONS

8. Checks and inspections specified under SECTION IV - NORMAL OPERATING PROCEDURES - PREFLIGHT CHECK, Before Starting Engine, and Before Take off in this supplement must be satisfactorily completed prior to flight into known icing conditions.

9. If equipped with Speedbrake System, use of Speedbrakes are prohibited during flight in icing conditions. Reference SECTION X - SAFETY INFORMATION, for description and definition of icing conditions.

10. The following equipment must be installed and operational for flight into known icing conditions:

a. TKS Ice Protection System including porous panels on leading edges of the wings, horizontal and vertical stabilizers, fluid slinger ring assembly on the propeller/hub assembly, windshield spray bar, and heated lift detector/stall warning vane.

b. Alternate Static Source

c. Heated Pitot Tube

d. Approved Antenna

e. Pitot heat annunciator

Annunciator Legends: . . . . . (Mooney P/N)

- M20M 880048- 619
. . . . . 880090- M002
. . . . . 880090- M004
. . . . . 880090- M006
. . . . . 880090- M008
. . . . . 880090-M021-W/O-TKS
. . . . . 880090-M022-W/TKS

- M20R, M20TN 880048- 631
. . . . . 880090- R032
. . . . . 880090- R034
. . . . . 880090- R036
. . . . . 880090- R038
. . . . . 880090- R040
. . . . . 880090- R042
. . . . . 880090- R047- W/O-TKS
. . . . . 880090- R048- W/TKS

M20U & M20V . . . . . Annunciation Displayed on G1000

Current Monitor Installation 800221- 505

f. Wing ice inspection light

Ice Light Installation 800380- 501

g. Dual Alternators

- M20M . . . . . Standard Dual Alternator Installation

- M20R, M20TN, M20U & M20V . . . . . Standard single alternator instl., plus
. . . . . Stand-by Alternator/Regulator Instl.
. . . . . Mooney P/N - 860379- 501

h. Dual Vacuum Pumps **(Not Required on Aircraft with G1000 installed or Aircraft meeting the requirements contained in Note 24 of FAA Approved Type Data Certificate Sheet 2A3 Revision 51 or later revision)**

- M20M . . . . . Standard Dual Vacuum Pump Instl.
(27-0001 THRU 27-0164) (ON ENGINE) . . . . . Mooney P/N - 880063- 505
(27-0165 THRU 27-0316) (ON ENGINE) . . . . . Mooney P/N - 880063- 507
(27-0317,27- 0319 THRU 27-0325) . . . . . Mooney P/N - 880063- 509

- M20R . . . . . Standard single vacuum pump instl., plus
. . . . . Stand-by Vacuum System Instl.
(29-0001 THRU 29-0089) (ON ENGINE) . . . . . Mooney P/N - 880063- 503
(29-0090 THRU 29-0279) (IN TAILCONE) . . . . . Mooney P/N - 880063- 501
(29-0280 THRU 29-0332) . . . . . Mooney P/N - 880063- 509

i. Cabin Heat and Defroster Systems

11. The following placards are required:

a. Adjacent to the TKS control panel.

WINDSHIELD ANTI- ICE MUST BE OFF FOR TAKEOFF AND LANDING

150110- (X)3021(Y)

b. Adjacent to the de-icing fluid tank filler.

T.K.S. ICE PROTECTION TANK
USE ONLY THE FOLLOWING FLUIDS
TKS80 ; AL- 5 (DTD 406B) ; TKS R328
CAPACITY 6.0 U.S. GALLONS

150110- (X)3022(Y)

c. Adjacent to porous panels.

T.K.S. ICE PROTECTION

CAUTION

POROUS DE- ICING PANELS MAY BE DAMAGED BY CERTAIN SOLVENTS

REFER TO SECTION 8 OF T.K.S. SUPPLEMENT TO PILOT'S OPERATING HAND BOOK

150110- (X)3023(Y)

d. On instrument panel in front of pilot.

WARNING

MAXIMUM FLAP DEFLECTION LIMITED TO TAKE OFF IF ICING CONDITIONS HAVE BEEN ENCOUNTERED

150110- (X)3020(Y)

e. On Pilot's L/H side panel.

OPERATING LIMITATIONS

THE MARKINGS AND PLACARDS INSTALLED IN THIS AIRPLANE CONTAIN OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THE NORMAL CATEGORY. THIS AIRPLANE IS CERTIFIED FOR DAY AND NIGHT VFR/IFR OPERATION AND FLIGHT INTO KNOWN ICING WHEN THE REQUIRED EQUIPMENT IS INSTALLED AND OPERATIONAL. NO AEROBATIC MANEUVERS, INCLUDING SPINS ARE APPROVED. OTHER OPERATING LIMITATIONS WHICH MUST BE COMPLIED WITH WHEN OPERATING THIS AIRPLANE IN THIS CATEGORY ARE CONTAINED IN THE AIRPLANE FLIGHT MANUAL.
MANEUVERING SPEED (3368 LBS.), 127 KIAS: (2600 LBS),111 KIAS.

EMERGENCY MANUAL GEAR EXTENSION

1. PULL LANDING GEAR ACTUATOR CIRCUIT BREAKER
2. PUT GEAR SWITCH IN GEAR DOWN POSITION.
3. PUSH RELEASE TAB FORWARD AND LIFT UP RED HANDLE.
4. PULL T–HANDLE STRAIGHT UP(12 TO 20 INCHES)
5. ALLOW T–HANDLE TO RETURN TO ORIGINALPOSITION.
6. REPEAT UNTIL GEAR DOWN LIGHT COMES ON (12 TO 20 PULLS). IF TOTAL ELECTRICAL FAILURE – SEE MECHANICALINDICATOR.

CAUTION

1. TURN OFF STROBE LIGHTS, WHEN TAXIING NEAR OTHER AIRCRAFT OR FLYING IN FOG OR IN CLOUDS. STANDARD POSITION LIGHTS MUST BE USED FOR ALL NIGHT OPERATIONS.
2. IN CASE OF FIRE TURN OFF CABIN HEAT.
3. DO NOT SCREW VERNIER CONTROLS CLOSER THAN 1/8" FROM NUT FACE.

150110- (X)1025(Y)

f.) Airspeed Limitations Placard adjacent to TKS control Panel (M20TN and M20V ONLY).

Airspeed Limitations in Icing Conditions

All altitudes: Greater than 120 KIAS

Do not exceed the following speeds:

Sea Level - 11,000 ft: 173 KIAS

11,000 ft and above: Decrease 173 KIAS by 3 KIAS per 1000 ft to 140 KIAS at 22,000 ft

150110- (X)3024(Y)

12. Flight into meteorological conditions described as freezing rain or freezing drizzle, as determined by the following visual cues, is prohibited:

a.) Unusually extensive ice accreted on the airframe in areas not normally observed to collect ice.

b.) Accumulation of ice on the upper surface of the wing aft of the protected area.

c.) Accumulation of ice on the propeller spinner farther back than normally observed.

If the airplane encounters conditions that are determined to contain freezing rain or freezing drizzle, the pilot must immediately exit the freezing rain or freezing drizzle conditions by changing altitude or course. For further information, refer to the safety information section of this supplement. (Section 10)

-NOTE-

The prohibition on flight in freezing rain or freezing drizzle is not intended to prohibit purely inadvertent encounters with the specified meteorological conditions, however, pilots should make all reasonable efforts to avoid such encounters and must immediately exit the conditions if they are encountered.

13. Use of the autopilot is prohibited when any ice is observed forming aft of the protected surfaces of the wing, or when unusual lateral trim requirements or autopilot trim warnings are encountered.

-NOTE-

The autopilot may mask tactile cues that indicate adverse changes in handling characteristics; therefore, the pilot should consider not using the autopilot when any ice is visible on the airplane.

SECTION III - EMERGENCY PROCEDURES

FLASHING RED LOW PRESSURE LIGHTS (TKS fluid - LOW PRESSURE)

1. Other MAIN pump . . . . . Select - ON

2. Flow Rate . . . . . MAXIMUM (if required)

-NOTE-

Activate the windshield pump to prime the alternate MAIN pump if necessary.

If normal operation is achieved with the other main pump:

If RED light EXTINGUISHES:

3. Continue Flight

4. TKS Ice Protection System . . . . . Monitor operation

If RED light DOES NOT EXTINGUISH: (Reference CAUTION below)

3. Icing Condition . . . . . EXIT as soon as possible

-CAUTION-

At temperatures above 32°C (90°F) or if battery voltage is low, the Low Pressure Warn lights will not extinguish at Normal flow rate. Switching to MAXIMUM flow rate should extinguish the Low Pressure lights.

AMBER HIGH PRESSURE LIGHT ILLUMINATED (TKS fluid- HIGH PRESSURE)

1. Reset Button . . . . . PRESS

If AMBER light EXTINGUISHES:

2. Continue Flight

3. TKS Ice Protection System . . . . . Monitor Operation

If AMBER light DOES NOT EXTINGUISH:

2. Icing Conditions . . . . . EXIT as soon as possible

3. TKS Ice Protection System: . . . . . Monitor Operation

Failure of ice protection system or excessive ice accumulation (observed or suspected) on protected air plane surfaces.

1. Icing Conditions . . . . . EXIT as soon as possible

2. Flaps . . . . . Do not extend beyond TAKE OFF position

3. Air speed . . . . . Maintain 120 KIAS or greater until final approach and landing.

4. Final Approach . . . . . Maintain 100 KIAS or greater

5. Landing . . . . . Multiply AFM landing distances by a factor of 1.6

Uncommanded elevator oscillation with landing flap deflection.

1. Flaps . . . . . Retract to next lowest deflection.

2. Airspeed . . . . . Maintain appropriate new flap setting.

The standard Pitot Heat annunciator/annunciation system illuminates AMBER only when pitot heat is turned ON but current is NOT flowing to the pitot heater. On some models, the French Pitot Heat annunciator system also illuminates AMBER when PITOT HEAT switch is in the OFF position.

1. Icing Conditions . . . . . EXIT as soon as possible

2. Airspeed . . . . . airspeed may be UNRELIABLE with the failure of pitot heat. . . . . Rely on pitch attitude, power setting & and rate of climb to safely fly the aircraft.

-WARNING-

Stall speeds will increase with the accumulation of ice on the wing and tail leading edges. Expect higher than normal sink rates with power reduction.

Inadvertent deployment of SpeedBrakes

[on SpeedBrake equipped aircraft] . . . . . Immediately PUSH Speedbrake Switch
. . . . . on Control Wheel to retract Speedbrakes.
OR
. . . . . Immediately PULL Speedbrake Circuit Breaker
. . . . . on C/B Panel to retract Speedbrakes.

SECTION IV - NORMAL PROCEDURES

-WARNING-

Do not delay activation of the TKS Ice Protection System if icing conditions are encountered. For best operation, the system must be ON prior to accumulation of ice on protected surfaces. In order to minimize ice accumulations on unprotected lower surfaces, maintain a minimum speed of 120 KIAS during operations in icing conditions. This will provide an angle of attack that reduces exposure (frontal area) of the lower surfaces to ice accumulation. If unable to maintain 120 KIAS at maximum continuous power, a change of altitude and/or course may be necessary to maintain minimum airspeed and/or exit the icing condition.

-NOTE-

Conditions exist for icing when the indicated outside air temperature is +3°C or below and visible moisture, in any form, is present.

If icing conditions are inadvertently encountered, Select MAXIMUM flow rate until the ice is removed, then select NORMAL flow rate. Monitor ice build up. Select MAXIMUM flow, if necessary, to prevent ice accumulation.

The TKS liquid ice protection system should not normally be activated in dry, cold air. The ice protection fluid is designed to mix with water impinging on the aircraft surface in normal operation. If dispensed in dry, cold air, the fluid becomes a gel that takes considerable time to clear, particularly from the wind shield.

The windshield pump (either pump) cycles for approximately 4 seconds each time it is activated. It will take approximately 30 seconds to clear de-icing fluid from the windshield after the spray cycle has ended. Ice should not be allowed to accumulate on the windshield. Activate either windshield pump as necessary to maintain clear forward vision.

PRE- FLIGHT INSPECTION - WALK AROUND

1. Battery Switch . . . . . ON

2. TKS Ice Protection System . . . . . MAIN Pump Switch (either pump) - ON
. . . . . Select MAXIMUM Flow Rate

3. Airframe Inspection
Wing, Tail, Propeller, windshield . . . . . Verify free of ice
Fluid Tank . . . . . During Flyable Storage (MIN= 1 U.S. Gallon)
. . . . . Inadvertent or Icing Conditions (MIN= 3.8 U.S. Gallons)
. . . . . (MAX= 6.3 U.S. Gallons) (6.0 U.S. gallons USABLE)
. . . . . Check filter cap secure and door closed.
Porous Panels . . . . . Check condition and security
. . . . . Check evidence of fluid along length of all panels

4. Propeller . . . . . Check evidence of fluid from propeller, downward pointing slinger ring.

5. Windshield spray bar . . . . . Check condition - clean if necessary

6. Wing ice light . . . . . Check operation

7. All switches . . . . . OFF

BEFORE STARTING ENGINE

1. TKS Ice Protection System

a. Windshield Pumps I & 2 . . . . . Check Operation - each pump

b. Main Pump 1 . . . . . ON
. . . . . MAXIMUM FLOW, verify steady GREEN light
. . . . . Select NORMAL FLOW, verify steady GREEN light
. . . . . OFF

c. Main Pump 2 . . . . . ON
. . . . . MAXIMUM FLOW, verify steady GREEN light
. . . . . Select NORMAL FLOW, verify steady GREEN light
. . . . . OFF

d. High Pressure Light . . . . . Verify NOT ILLUMINATED

(if light illuminates, push RESET and verify light extinguishes and remains extinguished)

2. M20M, M20R & M20TN Main Annunciator Panel . . . . . PUSH PRESS-TO-TEST button
. . . . . Verify AMBER pitot heat light ILLUMINATES
Pitot/Stall Warning Heat switch . . . . . ON
. . . . . Verify AMBER Pitot Heat Annunciator light stays extinguished
. . . . . OFF

-NOTE-

The Pitot Heat annunciator panel only illuminates AMBER when either the "Press-to-Test" button is pressed (on models M20M, M20R, and M20TN) or when the pitot heat is in the ON position and the current is interrupted by "Loss of Power" to the pitot heater.

2. M20U & M20V G1000 Annunciation
Pitot/Stall Warning Heat switch . . . . . ON "GREEN LIGHT on Switch"
. . . . . Verify AMBER Pitot Heat Annunciation extinguished
. . . . . OFF

-NOTE-

The Pitot Heat G1000 annunciation illuminates AMBER only when pitot heat is in the ON position and current is interrupted by "Loss of Power" to the pitot heater.

If icing conditions are anticipated immediately after take off:

AT START OF TAKE OFF ROLL

1. TKS Ice Protection System . . . . . Main Pump 1 or 2 - ON
Flow Rate . . . . . NORMAL

2. Pitot/Stall Warning Heat (Pitot Heat Switch) . . . . . ON

3. Wing Ice Light . . . . . As Required

AFTER TAKE OFF

If icing conditions do exist:

1. TKS Ice Protection System . . . . . Main pump 1 or 2 - VERIFY ON
Flow Rate . . . . . NORMAL

Monitor for Ice Build-up, if ice build up occurs, then
Flow Rate . . . . . SELECT MAXIMUM
. . . . . (if required to prevent Ice Build-up)

2. Windshield Ice Fluid Pump . . . . . Either pump as necessary - ON

3. Pitot/Stall Warning Heat (Pitot Heat Switch) . . . . . Verify ON

4. Cabin Heat and Defroster Control . . . . . ON

5. Engine Alternate Air Control . . . . . As Required

(Alternate Induction Air Door automatically opens if induction air becomes restricted.)

6. Wing Ice Light . . . . . As Required

7. Airspeed . . . . . Maintain 120 KIAS or greater

CRUISE

If icing conditions still exist during CRUISE:

1. TKS Ice Protection System . . . . . VERIFY Main pump 1 or 2 - ON
Flow Rate . . . . . NORMAL

Monitor for Ice Build Up, if ice build up occurs, then
Flow Rate . . . . . SELECT MAXIMUM
. . . . . (if required to prevent ice build-up)

2. Windshield Ice Fluid Pump . . . . . Either pump as necessary - ON

3. Pitot/Stall Warning Heat (Pitot Heat Switch) . . . . . Verify ON

4. Cabin Heat and Defroster Controls . . . . . ON

5. Engine Alternate Air Control . . . . . As Required

(Alternate Induction Air Door automatically opens if induction air becomes restricted.)

6. Wing Ice Light . . . . . As Required

7. Airspeed . . . . . Maintain 120 KIAS or greater

If icing conditions are encountered during CRUISE:

1. TKS Ice Protection System . . . . . Main pump 1 or 2 - ON
Flow Rate . . . . . MAXIMUM flow
. . . . . Initially to dissipate ice build up, then
Flow Rate . . . . . NORMAL flow
. . . . . Monitor for ice build-up, if ice build-up occurs, then
Flow Rate . . . . . MAXIMUM flow
. . . . . to prevent ice build-up

2. Windshield Ice Fluid Pump . . . . . Either pump as necessary - ON

3. Pitot/Stall warning heat . . . . . ON

4. Cabin Heat and Defroster . . . . . ON

5. Engine Alternate Air Control . . . . . As Required

(Alternate Induction Air Door automatically opens if induction air becomes restricted)

6. Wing Ice Light . . . . . As Required

7. Airspeed . . . . . Maintain 120 KIAS or greater

-NOTE-

Alternate Induction Air Door may activate automatically in icing or snow conditions.

-WARNING-

On M20R, M20TN, M20U & M20V aircraft, if the primary alternator system becomes inoperative and the Stand-by Alternator system is the only power generating source, the Garmin G1000 Stall Warning will not sound.

BEFORE LANDING/DESCENT

If icing conditions exist or are anticipated:

1. TKS Ice Protection System . . . . . Main pump 1 or 2 - ON
Flow Rate . . . . . Select MAXIMUM (initially)
Flow Rate . . . . . Select NORMAL
. . . . . Monitor for ice build-up, if ice build-up occurs, then
Flow Rate . . . . . Re-select MAXIMUM (if necessary to prevent ice build-up)

2. Windshield Ice Fluid Pump . . . . . Either pump as necessary - ON

3. Pitot/Stall Warning Heat . . . . . ON

4. Cabin Heat and Defroster . . . . . ON

5. Engine Alternate Air Control . . . . . As Required

(Alternate Induction Air Door automatically opens if induction air becomes restricted)

6. Wing Ice Light . . . . . As Required

7. Airspeed . . . . . Maintain 120 KIAS
. . . . . or greater until final approach and landing

FINAL APPROACH

With residual ice on air frame:

1. Maximum flap Deflection . . . . . TAKE OFF Setting
. . . . . When aircraft has encountered icing conditions (See SECTION II - LIMITATIONS)

2. Windshield Ice Fluid Pump . . . . . OFF
. . . . . at least 30 seconds prior to landing.

3. Use FULL FLAP landing distance from SECTION V of POH/AFM.

Airspeed Take off Flap Setting (M20M, M20R, M20U)
. . . . . FULL FLAP approach speed plus 5 KIAS

Airspeed Take off Flap Setting (M20TN, M20V)
. . . . . FULL FLAP approach speed plus 7 KIAS

TAXI AFTER LANDING

1. TKS Ice Protection System . . . . . OFF

2. Pitot/Stall Warning Heat . . . . . OFF

3. Wing Ice Light . . . . . OFF

ENGINE SHUTDOWN

1. Engine Alternate Air Control . . . . . Normal

2. Follow Normal Procedures - SHUTDOWN (SECTION IV of POH/AFM)

SECTION V - PERFORMANCE

Airplane performance and stall speeds in clear air may be affected with installation of the TKS Ice Protection System.

Significant climb and cruise performance degradation, range reduction, as well as buffet and stall speed increase can be expected if ice accumulates on the airframe. Residual ice on the protected areas and ice accumulation on the unprotected areas of the airplane can cause noticeable performance losses. even with the TKS Ice Protection System operating.

Normal Rate of Climb

Residual ice on unprotected airplane surfaces can cause a loss in rate of climb of up to approximately 100 fpm. Additional accumulation of ice on the airplane can result in significant loss in normal rate of climb.

Balked Landing Climb

Residual ice on unprotected airplane surfaces can cause a loss in balked landing climb performance of up to approximately 100 fpm. Additional accumulation of ice on the airplane can result in significant loss in balked landing climb performance.

Stall Speeds

Stall speed is not affected by residual ice on unprotected airplane surfaces. Stall speeds increase significantly with even small accumulations of ice on the wing leading edge. The first 1/4 inch of ice accumulation on the wing leading edge causes the most rapid increase in stall speed. Additional ice accumulation on the wing leading edges results in a continued increase in stall speed, although at a less rapid rate.

-WARNING-

On M20R, M20TN, M20U & M20V aircraft, if the primary alternator system becomes inoperative and the Stand-by Alternator system is the only power generating source, the Garmin G1000 Stall Warning will not sound.

Landing

When the aircraft has encountered icing conditions, flap deflection is limited to take off setting as a MAXIMUM. An icing condition is defined as visually observing ice accumulation or flight in temperatures at or below +30°C when any type of visible moisture is present.

The M20M, M20R, M20U use FULL FLAP landing distance from SECTION V of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for landing with TAKE OFF FLAPS. For TAKE OFF FLAPS landing approach speed, use the approach speed listed for FULL FLAP landing plus (+) 5 KIAS.

The M20TN, M20V - Use FULL FLAP landing distance from SECTION V of the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for landing with TAKE OFF FLAPS, but Increase the Landing Distance by 40%. For TAKE OFF FLAPS landing approach speed, use the approach speed listed for FULL FLAP landing plus (+) 7 KIAS.

SECTION VI - WEIGHT AND BALANCE

The fluid density is 9.2 pounds per U.S. Gallon. Reference TABLE 1.

TABLE 1 - WEIGHT AND BALANCE TABLE FOR ICE PROTECTION FLUID

Volume (gal.)	Weight (lb.)	Arm (in.)	Moment (in. lb.)
1	9.2	70.7	650
2	18.4	70.7	1301
3	27.6	70.7	1951
4	36.8	70.7	2602
5	46.0	70.7	3252
6	55.2	70.7	3903

SECTION VII - SYSTEM DESCRIPTION

The TKS Ice Protection System consists of porous panels installed on the leading edges of the wings and tail surfaces, a slinger ring on the propeller hub, a spray bar for the pilot's windshield, pumps (two Main & two windshield), fluid reservoir, and associated plumbing.

See Schematic, Figure 7-1.

The porous panels are attached to the aircraft leading edges. When the system is functioning, these panels exude de-icing fluid at a low steady flow rate. Protection for the propeller is provided by a pipe which passes through the engine compartment and directs fluid into a slinger ring located on the spinner back plate. Centrifugal action throws the fluid from the slinger ring through tubes and on to grooved rubber over shoes fitted to the root end of each propeller blade.

Two individually selectable pumps provide pressure for windshield de-icing. Operation of these pumps is controlled by a non-latching switch on the ice protection control panel and applies a four (4) second timed burst of fluid from a multiple outlet spray bar onto the left hand side of the windshield. The windshield de-icing system is designed for intermittent operation to establish pilot's forward vision as required.

Fluid pressure for airframe/propeller ice protection is provided by two, individually selectable, two-speed, electrically driven pumps. The low speed provides the required flow when NORMAL is selected, and the high speed provides the required flow when MAXIMUM is selected.

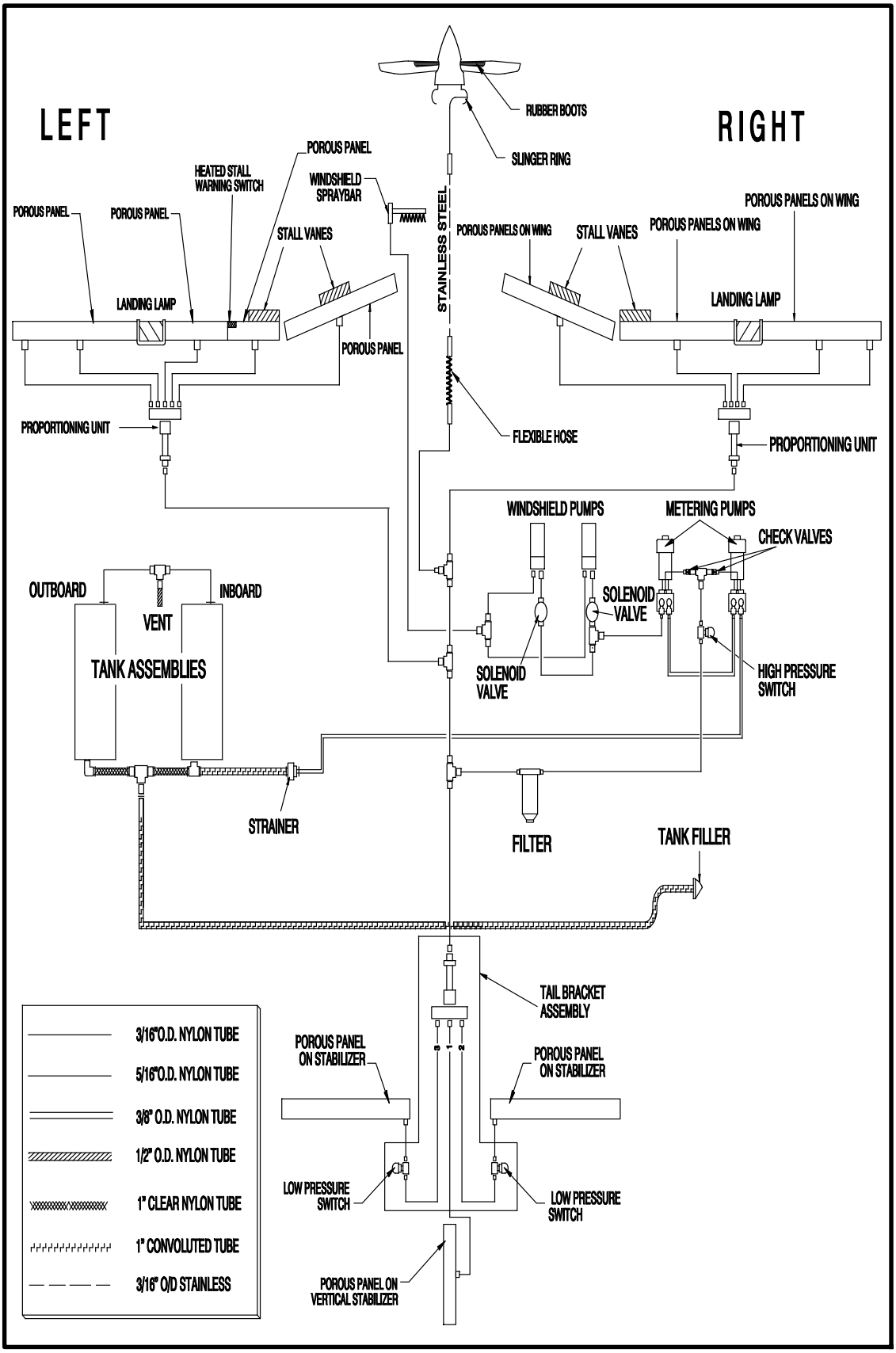
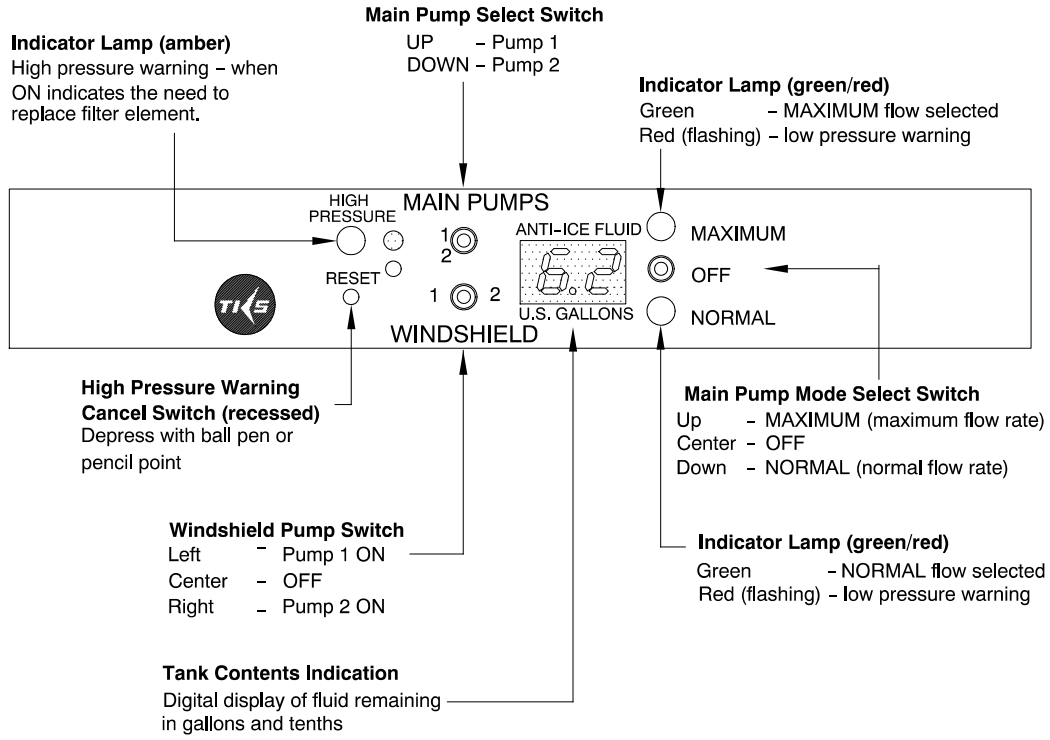


FIGURE 7- 1 FLUID SYSTEM SCHEMATIC

DX - CONTROL PANEL (PRE-G1000)



G1000 - CONTROL PANEL

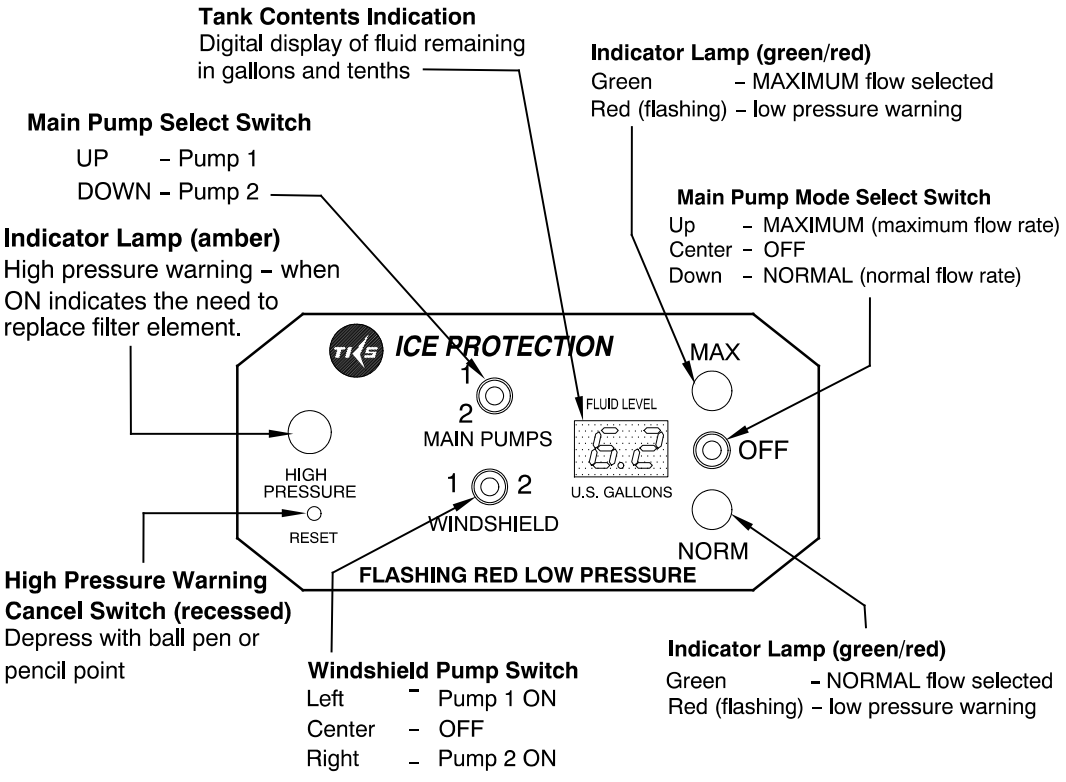


FIGURE 7-2 ICE PROTECTION CONTROL PANEL

The operational state of the air frame/propeller system is displayed by two LED's which indicate when NORMAL or MAXIMUM flow is selected. The option selected will cause the corresponding LED to illuminate GREEN. If a low pressure is experienced in the system, the option selected will alternately flash GREEN and RED. The LED of the un-selected option will flash RED. From the selected pump, the ice protection fluid passes through a filter and then through a spring loaded check valve which prevents flow when the pump is not operating.

A system of plastic tubing carries the fluid to proportioning units located in the tail and in each wing. The proportioning units divide the flow into the requirements of the individual items fed from each proportioning unit outlet.

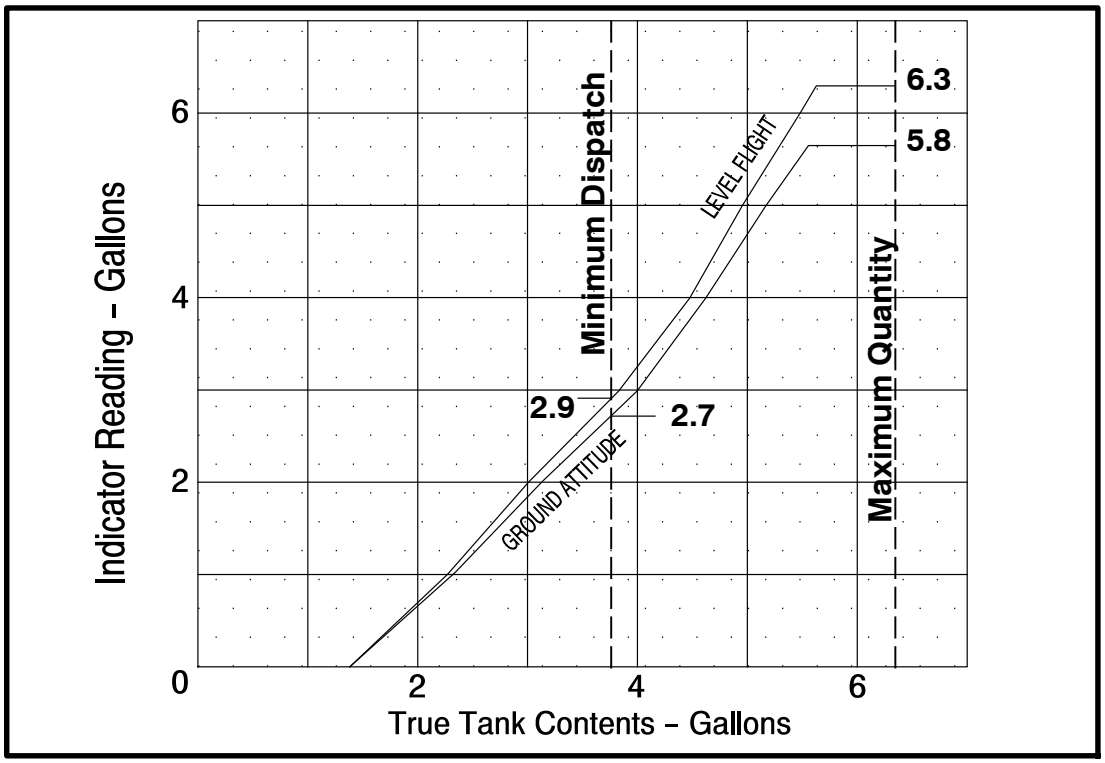


FIGURE 7-3 FLUID INDICATOR CALIBRATION

The tank is serviced through a single filler located on the right fuselage aft of the baggage compartment, and has a total capacity of 6.3 gallons. The unusable volume is 0.10 gallons. It is the pilot's responsibility to ensure that an adequate quantity of fluid is carried. A full tank of fluid is required before take off if the system is to be considered operational for icing conditions. Fluid quantity is measured by a float operated sensor which transmits an electrical signal to the indicator located on the ice protection control panel.

The contents indicator display is a digital read-out in gallons and 1/10 of a gallon. This display automatically dims for night operations.

A wing inspection light, controlled by the ice light switch, is provided to illuminate the leading edge of the left wing during night operations.

The aircraft is equipped with both pitot and stall vane heaters for ice protection of each respective device. The two systems are activated by pressing PITOT HEAT circuit breaker/switch located near bottom of instrument panel, in front of the pilot. Each device and circuit is protected by the breaker action of the switch. See Figure 7-4 & Figure 7-4A.

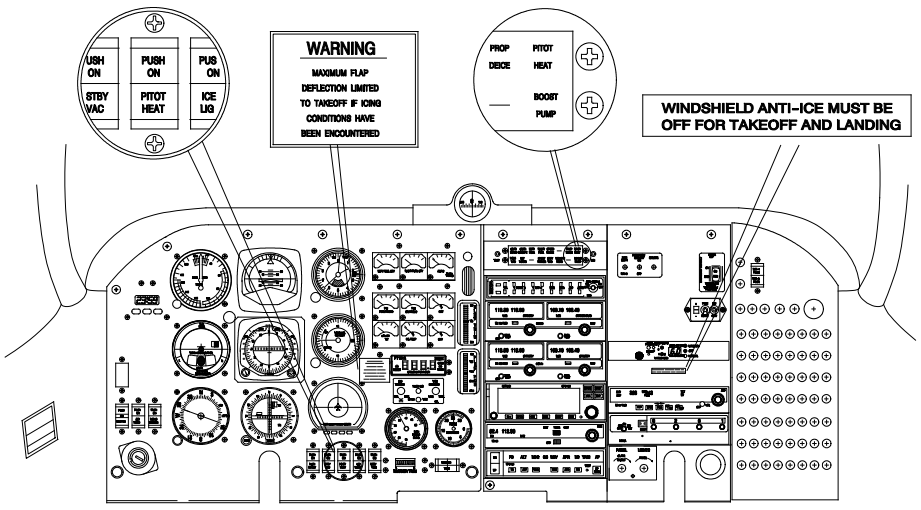
The standard Pitot Heat annunciator/annunciation is a warning device that alerts the pilot to loss of power to the pitot heater only. The AMBER annunciator will illuminate when no current is flowing to the pitot heater when the PITOT HEAT switch is in the ON position. When the PITOT HEAT switch is in the OFF position, the annunciator will NOT illuminate.

Under normal conditions, the standard configuration annunciator will be extinguished when PITOT HEAT switch is turned ON. See Figure 7-4 & Figure 7-4A.

If a failure occurs while the PITOT HEAT system is ON and it results in a loss of current to the pitot heater, the annunciator/annunciation will illuminate AMBER.

On some models, the French configuration annunciator will also illuminate AMBER when the Pitot Heat Switch is in the OFF position.

DX - CONTROL PANEL



DX - REDUCED HEIGHT CONTROL PANEL

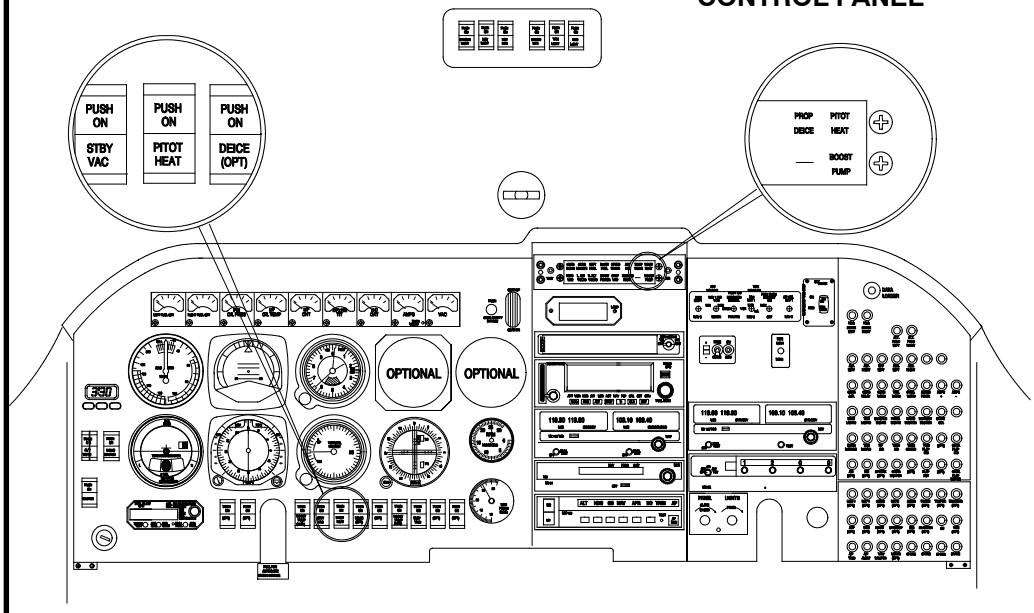


FIGURE 7-4 PITOT HEAT SWITCH & ANNUNCIATOR LOCATIONS

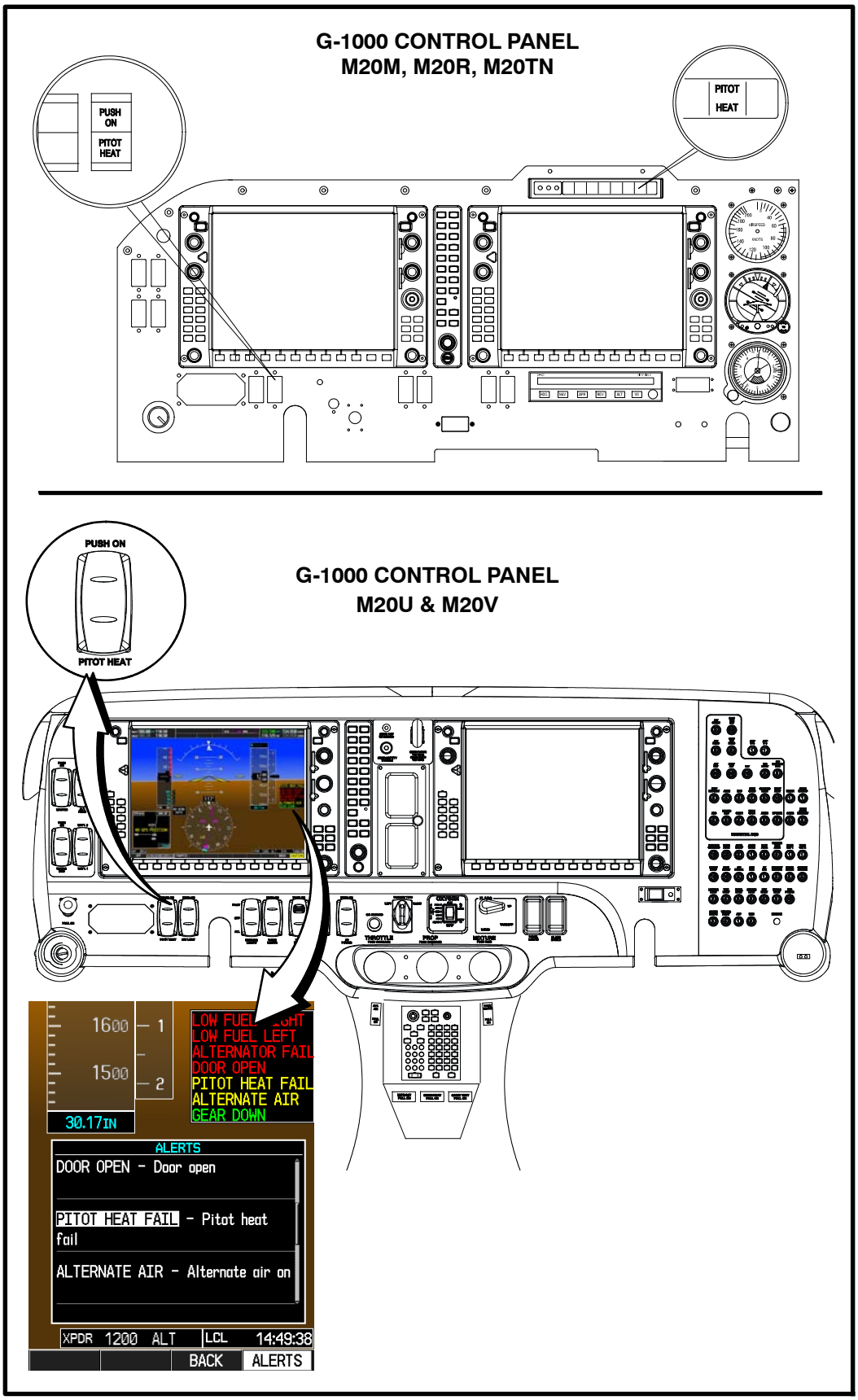


FIGURE 7-4A PITOT HEAT SWITCH & ANNUNCIATOR LOCATIONS

Maximum System Endurance: (SEE FIGURE 7-5 BELOW)
With NORMAL selected . . . . . 2 hours, 30 minutes
With MAXIMUM selected . . . . . 1 hour, 15 minutes

The above item includes an allowance of 5% for the use of windshield de-icing.

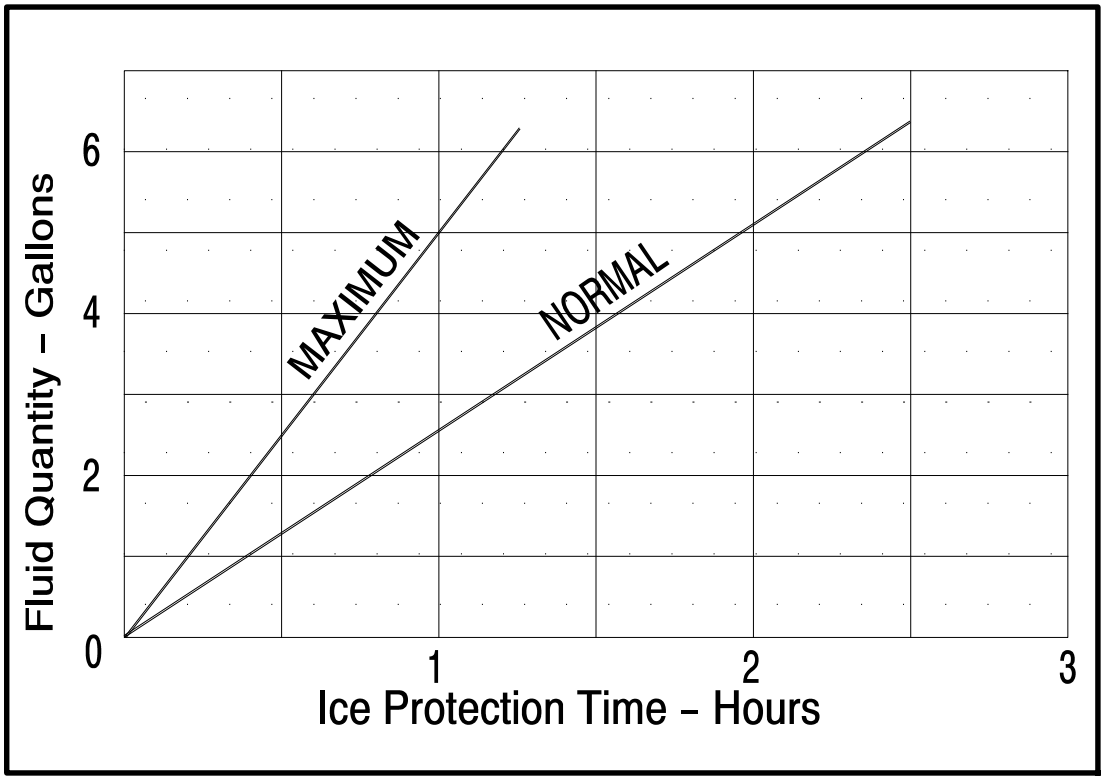


FIGURE 7-5 FLUID QUANTITY CHART

EFF: M20M 27-0001 THRU 27-0317, 27-0319 THRU 27-0325
EFF: M20R 29-0001 THRU 29-0332

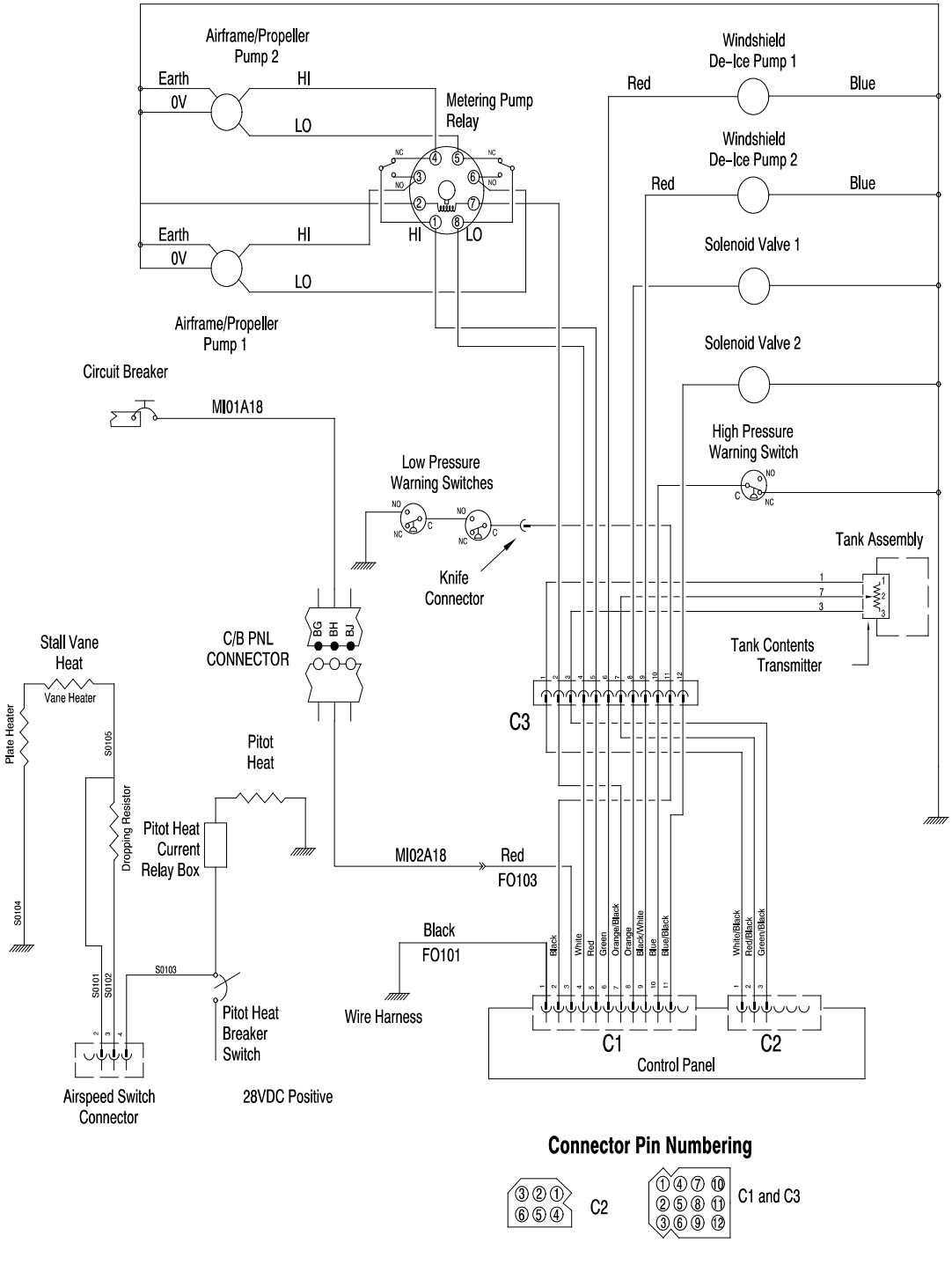


FIGURE 7-6 WIRING SCHEMATIC - DX MODELS

MODELS WITH G-1000:

EFF: M20M 27-0318, 27-0326 THRU 27-0355
EFF: M20R 29-0333 THRU 29-0525
EFF: M20TN 31-0001 THRU 31-0143

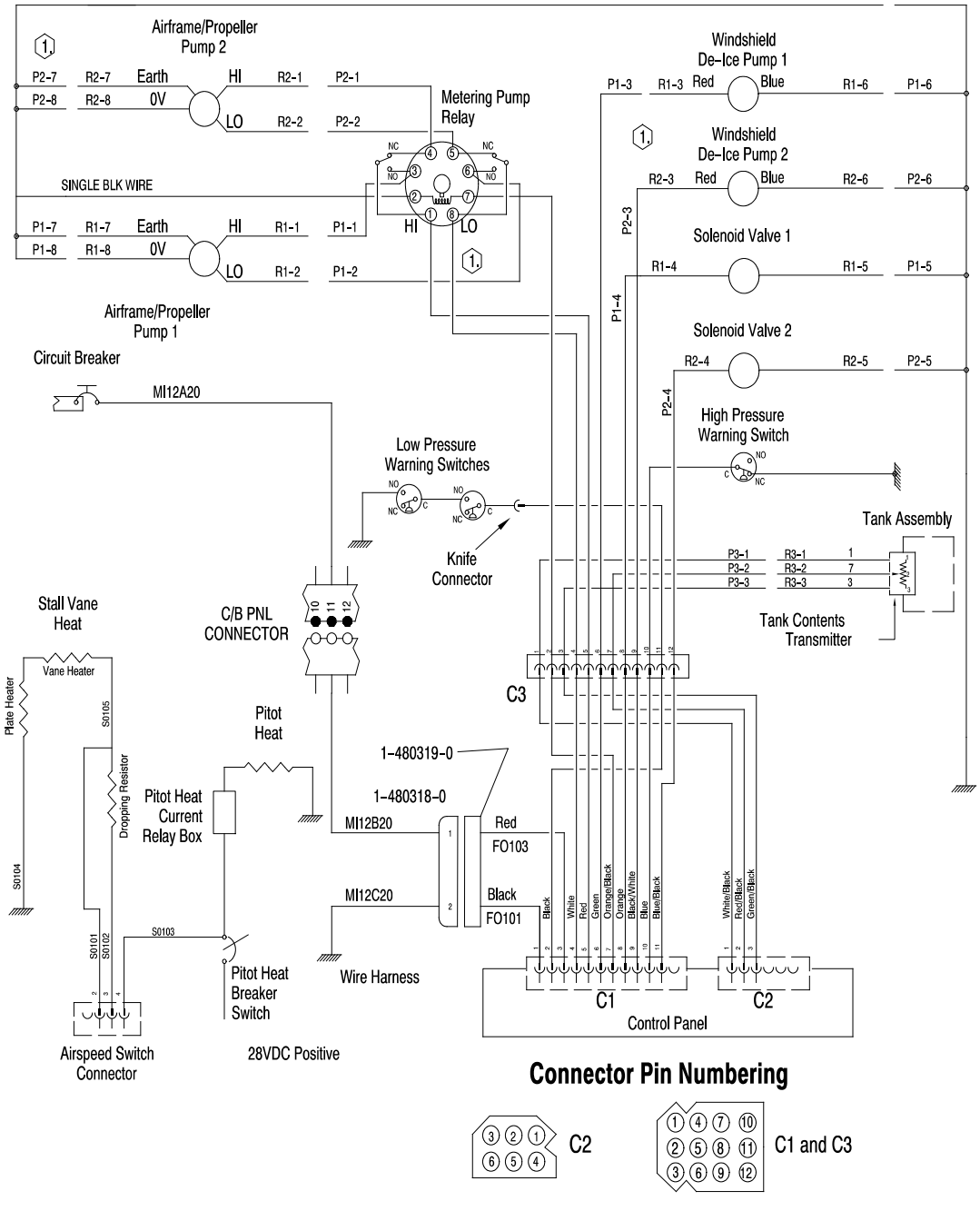


FIGURE 7-6A WIRING SCHEMATIC - M20M, M20R, M20TN MODELS (G-1000)

MODELS WITH G-1000:

EFF: M20U 32-0001 AND ON
EFF: M20V 33-0001 AND ON

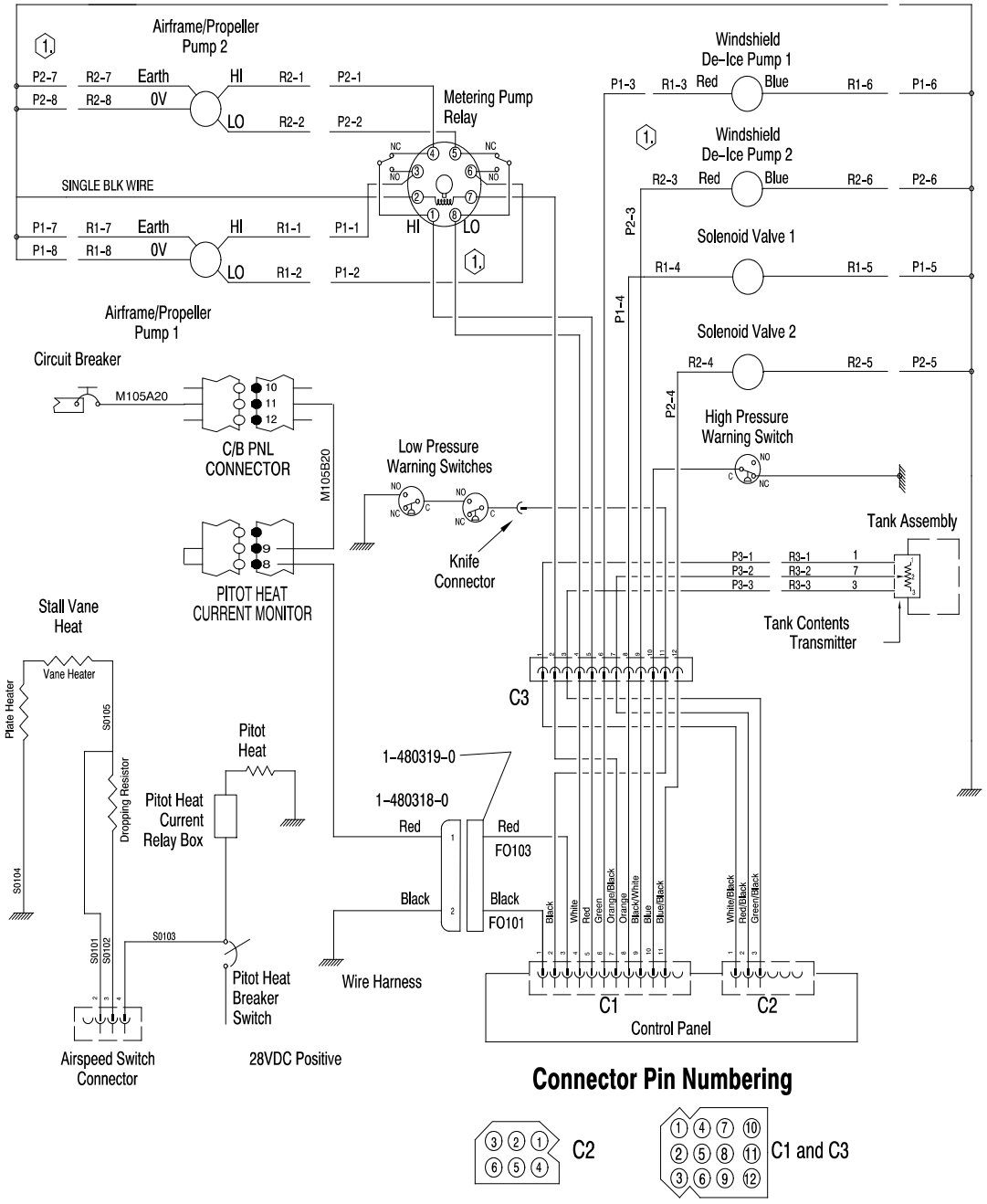


FIGURE 7-6B WIRING SCHEMATIC - M20U & M20V MODELS (G-1000)

SECTION VIII - HANDLING, SERVICING AND MAINTENANCE

Prolonged out of Service Care

During Flyable Storage

Ensure that the de-icing fluid tank contains at least the minimum take off quantity of fluid (1 gallon), and that all system components are filled with fluid. If necessary, operate pump(s) until all air is dispelled from components and pipe lines (See Priming, below). Recheck tank contents.

Servicing

1. De-Icing Fluid Tank

See limitations for specified de-icing fluids. The filler cap is located on the right fuselage aft of the baggage compartment. To preclude the possibility of contaminated fluid, always clean the top of fluid containers before dispensing, and if required, maintain a clean measuring vessel solely for de-icing fluid. Secure the filler cap immediately after filling. The tank is vented through the filler cap and an additional vent line is provided.

2. Ice Protection Fluid Strainer

Ordinarily, the de-icing fluid strainer in the fluid tank outlet should not require cleaning, unless there is a definite indication of foreign matter in the tank.

3. Ice Protection Fluid Filter

Illumination of the HIGH PRESSURE warning in flight (or during ground testing) indicates the need for filter element replacement. Warnings arising from system operation in the MAXIMUM flow mode and/or at abnormally low temperatures (below - 30°C, 22°F) may be ignored.

4. Pump Priming

The airframe/propeller pumps may not self prime, but can be primed when required, by operation of the corresponding windshield pump. Windshield pump 1 primes main pump 1, and windshield pump 2 will prime main pump 2.

5. Porous Leading Edge Panels.

-CAUTION-

Porous panels contain a plastic membrane which may be damaged by certain solvents, particularly Methyl Ethyl Ketone (MEK) Lacquer Thinner, and other types of thinners. Mask panels when painting aircraft or when using solvents for other purposes in the proximity of the porous panels.

Only the solvents listed in the LIMITATIONS section of this supplement are permitted for use on porous panels.

The porous panels may be washed with mild soap and water, using a brush or cloth.

TABLE 2 - OVERHAUL OR REPLACEMENT GUIDE

COMPONENT	OVERHAUL OR REPLACE
Airframe/Propeller Pump	On Condition
Motor Brushes, Air frame/Propeller Pump	Every 2,000 Hrs.
Windshield Pump	On Condition
Solenoid Valve (Windshield)	On Condition
Low Pressure Switch	On Condition
Filter	On Condition (Subject to element replacement detailed in Servicing)
Fluid Tank	On Condition
Pipelines and Couplings	On Condition
Proportioning Units	On Condition
Porous Panels	On Condition
Propeller & Spinner Mounted Equipment	On Condition
Control Panel	On Condition

Maintenance

The tailcone, wheel wells, empennage and other areas aft of the TKS de-icing fluid flow should be inspected after each use of the ice protection system. This inspection should concentrate on extraneous fluid build-up on electrical contacts, flight control surface bearings, bell cranks, etc. The ice protection system fluid may attract contaminates to areas of joints, skin laps, etc. that may cause corrosive action to be accelerated.

SECTION IX - SUPPLEMENTS

Not applicable; except that a copy of this AFM Supplement will be provided in SECTION IX of basic AFM.

SECTION X - SAFETY INFORMATION

Flight in Icing Conditions

This airplane has been approved for flight in icing conditions as defined in FAR 25, Appendix C, in accordance with the criteria contained in Advisory Circular 23.1419- 2, and the applicable requirements of CAR 3 and FAR 23. These conditions do not include, nor were tests conducted in, all icing conditions that may be encountered (e.g. freezing rain, freezing drizzle, mixed conditions, or conditions defined as severe). Some icing conditions not defined in FAR 25 have the potential of producing hazardous ice accumulations which; 1) exceed the capabilities of the airplane's ice protection equipment, and/or 2) create unacceptable airplane performance. Flight into icing conditions which lie outside the FAR defined conditions is not specifically prohibited; pilots are advised, however, to be prepared to divert the flight promptly if hazardous ice accumulations occur.

Safe operation in icing conditions is dependent upon pilot knowledge of atmospheric conditions conducive to ice formation, familiarity with the operation and limitation of the installed ice protection equipment, and the exercise of good judgment when planning a flight into areas where possible icing conditions exist. Flight into areas with known icing conditions should be avoided or limited to the minimum amount of time absolutely necessary. FAR 25 did not envision long duration ice encounters. The intent of the regulation was to allow aircraft to fly through icing conditions. When possible, prolonged operations in icing should be avoided. When icing conditions

are encountered, the recommended procedure is to change to an altitude where icing conditions are not present, particularly if it is known that the icing conditions at the present altitude are wide spread. Ice accumulations on the airplane increase aero dynamic drag, reduce airplane range, reduce climb performance, and increase stall speed.

Normal operation of the TKS Ice Protection System results in a continuous “build and shed” of small quantities of ice along the leading edges. Engine alternate air should be selected, as required. The primary indication of the loss of primary induction air will be a drop in indicated manifold pressure.

To achieve the best visibility, a straight-in approach should be utilized when ever possible if ice has accumulated on the right windshield and unprotected areas of the left windshield. The windshield pump should be OFF at least 30 seconds prior to landing to allow adequate time for the windshield to clear of de-icing fluid.

Accumulation of ice on unprotected lower surfaces is minimized by maintaining a minimum air speed of 120 KIAS, until a lower speed is required for final approach and landing. This speed provides an angle of attack that minimizes exposure (frontal area) of lower air frame surfaces to ice accumulation. The pilot should take appropriate actions to maintain this minimum speed including increasing power (up to maximum available if necessary), change of altitude, descent, etc. Prolonged operation at lower speeds may result in substantially greater performance losses than specified in SECTION IV & V of this AFM supplement.

By definition, icing conditions are considered to exist when the indicated outside air temperature is below +30°C and any kind of visible moisture is present. Outside air temperature should be closely monitored when flying in clouds or precipitation. The most significant icing, found in stratus type clouds, is generally located near the top of a well defined cloud formation.

Severe icing conditions exceeding the capability of the ice protection system can be encountered in many different situations. Examples of these conditions include rapidly building cumulus clouds up slope environments, etc. The prudent pilot must remain alert to the possibility that icing conditions may become so severe that the TKS ice protection equipment can not cope with the situation. If such a condition is encountered, the pilot should immediately take the most safe and expeditious course of action to exit the condition.

-CAUTION-

Severe icing comprises environmental conditions outside of those for which the airplane is certified. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in hazardous ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protection systems, and it may seriously degrade the performance and controllability of the airplane.

The Following Shall Be Used to Identify Freezing Rain/Freezing Drizzle Icing Conditions:

a.) Unusually extensive ice accreted on the airframe areas not normally observed to collect ice.

b.) Accumulation of ice on the upper surface (for low wing- airplanes) or lower surface (for high- wing airplanes) of the wing aft of the protected area.

c.) Accumulation of ice on the propeller spinner farther back than normally observed.

The Following May Be Used to Identify Possible Freezing Rain/Freezing Drizzle Conditions:

a.) Visible rain at temperatures below +5°Celsius (outside air temperature - OAT).

b.) Droplets that splash or splatter on impact at temperatures below +5°Celsius OAT.

Procedures for Exiting the Freezing Rain/Freezing Drizzle Environment

These procedures are applicable to all flight phases from takeoff to landing. Monitor the outside air temperature. While severe icing may form at temperatures as cold as - 18°Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the AFM for identifying possible freezing rain or freezing drizzle conditions are observed, accomplish the following:

a.) Exit the freezing rain or freezing drizzle severe icing conditions immediately to avoid extended exposure to flight conditions outside of those for which the airplane has been certified for operation. Asking for priority to leave the area is fully justified under these conditions.

b.) The flight crew should reduce the angle- of- attack by increasing speed as much as the airplane configuration and weather allow, without exceeding design maneuvering speed.

c.) Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.

d.) Do not engage the autopilot. The autopilot may mask unusual control system forces.

e.) If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.

f.) If an unusual roll response or un-commanded control movement is observed, reduce the angle of attack by increasing airspeed or rolling wings level (if in a turn), and apply additional power, if needed.

g.) Avoid extending flaps during extended operation in icing conditions. Operation with flaps extended can result in a reduced wing angle- of- attack, with ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.

h.) If the flaps are extended, do not retract them until the airframe is clear of ice. Report these weather conditions to Air Traffic Control.