

**FUEL - SERVICING****1. General****A. Fuel.**

- (1) The fuel used in the airplane must have an anti-icing additive incorporated, or must be added to the fuel when the tanks are filled. The fuel may contain anti-icing and biocidal additives, if desired.
- (2) When preblended fuel is available, add fuel to tanks as described. The wing fuel tank capacities and acceptable fuel specifications are shown in Replenishing - Description and Operation.
- (3) Mixing of anti-icing additives is accomplished as fuel is added to the tank. Procedures for mixing are identical for both the left and right wing tanks.

**B. Fuel Tanks.**

- (1) An area of each wing, from WS 53.00 to WS 214.30, is sealed to form an integral fuel bay. Fuel bays must be filled after each flight to lessen the possibility of condensation in fuel bays and lines. The fuel filler caps are located on top of the wings, forward of the spoilers. For additional information on fuel tanks, refer to Chapter 28, Fuel Storage - Description and Operation.
- (2) Plugs or caps must be installed on lines, hoses, and fittings to prevent thread damage, residual fuel drainage, and contamination.

**C. Fuel Drains.**

- (1) Fuel drains are provided at various locations throughout the fuel system for drainage of water and sediment from the fuel system. For fuel drain locations and maintenance of fuel system, refer to Chapter 28, Fuel - General. To activate drain valves, a fuel sampler cup screwdriver is provided. The fuel must be checked before the first flight of the day and each refueling.
- (2) Place fuel sampler cup to valve; depress valve with Phillips head end of rod protruding from cup.

**2. Tools, Equipment and Materials**

**NOTE:** Equivalent substitutes may be used for the following listed items:

<b>NAME</b>	<b>NUMBER</b>	<b>MANUFACTURER</b>	<b>USE</b>
HI-FLO Prist (Aerosol Cans)	PFA-55MB (MIL-DTL-27686)	PPG Industries, Inc 1 Gateway Center Suite 6 South Pittsburgh, PA 15222	Fuel system icing inhibitor.
LO-FLO Prist (Aerosol Cans)	PFA-55MB (MIL-DTL-27686)	PPG Industries, Inc.	Fuel system icing inhibitor.
Prist (Bulk)	PFA-55MB (MIL-DTL-27686)	PPG Industries, Inc.	Fuel additive (to be used with proportioner PRB-101).
Prist Hi-Flash	MIL-DTL-85470	PPG Industries, Inc.	Fuel system icing inhibitor.
Proportioner (Dispensers)	PRB-101	Quannah Corp. 6713 Pharoah Drive Corpus Christi, TX 78412	To dispense fuel inhibitors.
Anti-Ice Concentration Test Kit	CJMD 128-002	Cessna Aircraft Co. Citation Marketing Div. Department 579 P.O. Box 7706 Wichita, KS 67277	To test MIL-DTL-27686 anti-ice additive to fuel concentration.
Anti-Ice Concentration Test Kit	HB-P-C B/2	Gammon Tech Product 2300 Hwy 34 Manasquan, NJ 08736	To test anti-ice additive to fuel concentration in fuel (will test both MIL-DTL-27686 and MIL-DTL-85470).

Anti-Static Additive	Shell ASA3	Royal Lubricants Co. P. O. Box 518 Hanover, NJ 07936	Antistatic fuel additive.
Anti-Static Additive	Dupont Stadis 450	Dupont	Antistatic fuel additive.
Biocidal Protection Additive	Sohio Biobor JF	Sohio Engineered Materials Co. Refractories Division 3425 Hyde Park Blvd. P. O. Box 664 Niagra Falls, NY 14302	Biocidal protection additive.
Biocidal Protection Additive	KATHON FP 1.5	Dow Microbial Control . A subsidiary of The Dow Chemical Company 100 Independence Mall West Philidelphia, PA 19106-2399 United States	Biocidal protection additive.
Anti-Icing Additive	Fluid I		Anti-Icing Additive
Anti-Icing Additive	Fluid I-M		Anti-Icing Additive
Anti-Static Additive	Sigbol		Anti-Static Additive
Hum-Bug Detector Kit		Biobor Fuel Additives 910 Rankin Road Houston, TX 77073 Phone: 800-548-9166 Email: sales@biobor.com	To test fuel for microbial contamination

**NOTE:** When using RT and TS-1 fuels with Anti-Icing additives Fluid I and Fluid I-M, maintenance requirements of Pratt and Whitney Canada Service Bulletin SB1244, Revision 17 or latest revision must be obeyed.

**NOTE:** Use Kathon FP 1.5 at a maximum concentration of 100 parts to one million

### 3. Safety and Maintenance Precautions

#### A. Safety Precautions.

**WARNING:** During all fuel system servicing procedures, fire fighting equipment must be available. Two ground wires from tiedown rings on the airplane to approved ground stakes must be used to prevent accidental disconnection of one ground wire. Make sure battery switch is turned off, unless otherwise specified.

**WARNING:** MIL-DTL-27686 and MIL-I- 85470 anti-ice additives are toxic. They are dangerous to health when breathed and/or absorbed into the skin. When servicing fuel with anti-ice additive in an unventilated area, use appropriate personal protective equipment such as eye goggles/shield, respirator with organic vapor cartridges, non- absorbing gloves and additional skin protection from spraying or splashing anti- ice additive. If anti-ice additive enters the eyes, flush with water and contact a physician immediately.

**WARNING:** Make sure that you put weights at the same location as that of removed components and use a tail stand if heavy interior components are removed from the airplane. This is very important during defueling operations. When weights or a tail stand is not used under these conditions, it can cause serious personal injury or structural damage to the airplane.

- (1) Ground the fueling/defueling equipment (vehicle or fuel hydrant equipment) to the airplane with designated grounding cable(s). Make sure the fueling/defueling equipment is grounded to an approved static ground. Ground the airplane to an approved static ground with grounding cable. Ground fuel nozzle to the tie down lug on the wing strut. Ground airplane as follows:
  - (a) Ground airplane first.

- (b) Ground vehicle (or hose cart) to the same ground as the airplane.
- (c) Bond vehicle (or hose cart) to airplane.
- (d) Bond refuel nozzle to airplane.
- (2) Make sure fire fighting equipment is positioned and immediately available.
- (3) Do not wear clothing that has a tendency to generate static electricity such as nylon or synthetic fabrics.
- (4) Do not wear metal taps on shoes.
- (5) The airplane must be in a designated fuel loading/unloading area.
- (6) High wattage, pulse transmitting avionics equipment must not be operated in the vicinity of the fueling/defueling operation.

B. Maintenance Precautions.

- (1) Use designated equipment for fuel loading/unloading to prevent contamination.
- (2) Due to the chemical composition of anti-ice additive, improper blending of fuel and anti-icing additive may cause the deterioration of the integral fuel tanks interior finish, thus promoting corrosion. It is very important that proper anti-ice additive blending procedures be followed.
- (3) Use authorized type of fuel and anti-ice additive.
- (4) During defueling, Make sure anti-ice additive blended fuel and unblended fuel are not mixed.

#### 4. Use of Biocide

A. The use of anti-ice additive as a biocide in the Model 208/208B is NOT APPROVED.

- (1) Bacterial and fungal microorganisms multiply where water and fuel interface. Because the weather, temperature and climate differ where a particular airplane is based and operated, the amount of water condensation in the fuel tank varies.
- (2) Microbiological contamination can be an expensive and potentially dangerous condition. This type of contamination is related to water which gravitates to low points in fuel reservoirs and is not circulated or removed. Airborne spores find their way into the fuel tanks and migrate to the water, which they utilize as a growth medium while feeding off the hydrocarbon fuel. The first indication of microbiological contamination is a light grayish slime. Heavy contamination will be a thick grey, fibrous formation which may contain black masses of decay products. If the contamination is left unchecked, it can eventually move as a mass and block the fuel system and/or cause corrosion.
- (3) Examination of the fuel tank for bacterial and fungal microorganisms requires opening areas of the fuel tank and checking where trapped water may exist, such as the lower corners near wing ribs. Also, check internal screens at flapper valve openings into the sump area for bacterial and fungal microorganisms which have formed a mass and may be caught on the screen during their movement. For cleaning fuel tanks, refer to Chapter 28, Fuel Contamination - Maintenance Practices.
- (4) Kathon FP 1.5 and Sohio Biobor JF are biocidal protection additives, which are used to inhibit fungal and bacterial growth in aircraft fuel systems.

**NOTE:** Sohio Biobor JF biocide additive is approved to be used for fuel at a concentration not to exceed 20 ppm (270 ppm total additive) of elemental boron.

**NOTE:** Kathon FP 1.5 is acceptable for use in Cessna Part 23 and Part 25 turbine powered airplanes at the manufacturer's recommended concentration. Refer to the manufacturer's manual for proper dosing concentrations and precautions.

**NOTE:** Kathon FP 1.5 has been used in the aircraft industry as a biocide additive for many years with no detrimental effects to common fuel system components, seals, and finishes.

**CAUTION:** Do not use Kathon FP 1.5 at a concentration that exceeds 100 ppm (by volume).

- (5) Kathon FP 1.5 meets the requirements of MIL-S-53021 and is listed as an approved additive in ASTM D1655.
- (6) Typically, biocide additives are used intermittently during maintenance turn-around and during flight.

#### 5. Aviation Fuel Additives

**WARNING:** Ethylene Glycol Monomethyl Ether (EGME) MIL-DTL-27686 anti-ice additive is toxic and dangerous to health when it is breathed and/or absorbed into the skin. When you put an anti-ice additive into fuel in an unventilated area, use appropriate personal protective equipment such as eye goggles/shield, a respirator with organic vapor cartridges, non-absorbing gloves, and other personal protective

**equipment to protect skin from the anti-ice additive. If anti-ice additive enters the eyes, flush them with water and contact a physician immediately.**

**CAUTION: Diethylene Glycol Monomethyl Ether (DIEGME) MIL-DTL-85470 is slightly toxic if you swallow it. It can cause eye redness, swelling, and irritation. It is also combustible. Before you use this material, refer to all safety information on the container. Make sure the additive is directed into the flowing fuel stream. Start the additive flow after the fuel flow starts and stop the additive flow before the fuel flow stops. Do not allow concentrated additive to contact the coated interior of the fuel tank or the airplane painted surface.**

- A. When servicing fuel with anti-icing additives containing ethylene glycol monomethyl ether (EGME, MIL-DTL-27686) or diethylene glycol monomethyl ether (DIEGME, MIL-DTL-85470), remember that they are harmful if inhaled, swallowed or absorbed through the skin, and will cause eye irritation. Also, they are combustible. Before using this material, refer to all safety information on the container.
- B. EGME is toxic under sustained exposure environments. When inhaled, EGME is primarily a central nervous system depressant, although various animal studies have revealed that acute inhalation overexposure may cause kidney injury. The primary symptoms of inhalation overexposure in confined or poorly ventilated areas include headache, drowsiness, blurred vision, weakness, lack of coordination, tremor, unconsciousness and even death. When ingested (swallowed) in massive doses, EGME is reported to exhibit a narcotic action, but at lower dosage levels, death is delayed and is accompanied by lung edema (excessive serious fluid in lungs), slight liver injury and marked kidney injury. EGME is only mildly irritating to the eyes and skin; however, it can be readily absorbed through the skin in toxic amounts. Symptoms of overexposure due to skin absorption are essentially the same as those outlined for inhalation.
- C. In cases of acute exposure, DIEGME is an eye and mucous membrane irritant, a nephrotoxin and central nervous system depressant. It is toxic by skin absorption. Inhalation may cause irritation to mucous membranes, although, due to its low volatility, this is not an extreme hazard at room temperature or below. If DIEGME contacts the eye, it may cause pain and transient injury. It is absorbed through the skin in toxic amounts.
- D. In the event EGME or DIEGME contact is experienced, the following emergency and first aid procedures must be used.
  - (1) If EGME or DIEGME is inhaled, remove person to fresh air. If the person is not breathing, give artificial respiration, preferably mouth-to-mouth; however, if breathing is difficult, administer oxygen. Always call a physician.
  - (2) If ingested (swallowed), drink large quantities of water. Then induce vomiting by placing a finger far back into the throat. Contact a physician immediately. If vomiting cannot be induced, take victim immediately to the hospital or a physician. If victim is unconscious or in convulsions, take victim immediately to the hospital or a physician. Do not induce vomiting or give anything by mouth to an unconscious person.
  - (3) If eye or skin contact is experienced, flush with plenty of water (use soap and water for skin) for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Thoroughly wash contaminated clothing and shoes before reuse.
- E. Additional antistatic and biocidal protection may be provided using approved products. Refer to the Tools, Equipment and Materials section for approved manufacturers. Refer to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for concentration levels of these products.

## 6. Fuel Loading

**CAUTION: Make sure the proper grade and type of fuel is used to service the airplane. Refer to Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for a list of approved fuels.**

- A. Approved fuels for the Model 208/208B airplanes may or may not contain an anti-ice additive. If fuel reservoirs become contaminated with fungi or bacteria, refer to Chapter 28, Fuel Contamination - Maintenance Practices. Mixing anti-ice additive and fuel during refueling involves the utilization of an aerosol or proportioner dispenser. Refer to Tools and Equipment.
- B. Mixing Icing Inhibitor Procedures.
 

**NOTE: Equivalent procedures may be substituted.**

  - (1) When using proportioner follow directions provided.
  - (2) When using aerosol cans, utilize the following procedures.
    - (a) Insert the fueling nozzle and fuel additive nozzle into the fuel filler.

**WARNING: Ethylene Glycol Monomethyl Ether (EGME) MIL-DTL-27686 anti-ice additive is toxic and dangerous to health when it is breathed and/or absorbed into the skin. When you put an anti-**

**ice additive into fuel in an unventilated area, use appropriate personal protective equipment such as eye goggles/shield, a respirator with organic vapor cartridges, non-absorbing gloves, and other personal protective equipment to protect skin from the anti-ice additive. If anti-ice additive enters the eyes, flush them with water and contact a physician immediately.**

**CAUTION: Diethylene Glycol Monomethyl Ether (DIEGME) MIL-DTL-85470 is slightly toxic if you swallow it. It can cause eye redness, swelling, and irritation. It is also combustible. Before you use this material, refer to all safety information on the container. Make sure the additive is directed into the flowing fuel stream. Start the additive flow after the fuel flow starts and stop the additive flow before the fuel flow stops. Do not allow concentrated additive to contact the coated interior of the fuel tank or the airplane painted surface.**

- (b) Start refueling; then, direct the fuel additive into the fuel stream to blend the additive simultaneously with the fuel as it fills the tank. The additive concentration range must be maintained in accordance with instructions in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

#### C. Tank Filling Procedure.

**WARNING: Perform fuel loading in area which permits free movement of fire equipment.**

**WARNING: Make sure that the fuel supply unit is grounded, and that the ground to airplane is connected.**

- (1) Connect fueling nozzle ground to the tie down lug on airplane strut.
- (2) Place a protective pad on the wing adjacent to the fuel filler and remove the filler cap.
- (3) Service as follows:
  - (a) If the turbine fuel has the fuel system icing inhibitor added, fill wing tanks.
  - (b) If the turbine fuel does not have fuel system icing inhibitor added, select an inhibitor. Refer to Tools, Equipment and Materials for approved icing inhibitors; and add in accordance with Mixing Icing Inhibitor Procedures.

**CAUTION: Make sure filler cap is secured.**

- (4) Remove fuel nozzle; remove protective pad; disconnect fueling nozzle ground; install fuel filler cap.

## 7. Checking Fuel in Wing Tank

#### A. Fuel Samples.

- (1) Sampling of fuel, and checking and draining sediment from the tanks, are the main purposes of the poppet-type drain valves installed on the lower side of the fuel tank. The valves are installed mainly in the vicinity of the fuel tank sump area.
- (2) The poppet-type valve is a spring-loaded poppet, housed in the drain valve body. The poppet is spring-loaded in the closed position. A slot in the end of the poppet allows for screwdriver operation. To operate the valve, depress the slot end to open valve and rotate to lock the valve to the open position. Depress, rotate and release, slot end will also set the valve to a closed position.
- (3) During cold weather, if more than one hour elapses between removal of airplane from a heated shelter and takeoff, all fuel sumps must be drained through the drain valves during the preflight inspection. Enough fuel must be drained from each drain point to make sure that the fuel is free from water and/or other contaminants. At least 30 minutes must elapse between fueling and checking for contamination. The fuel must be drained into a clear, clean container suitable to permit a careful visual examination for water and other contaminants. To aid in distinguishing water from fuel, add one or two drops of water soluble food coloring in the container prior to draining fuel samples. The food coloring will mix readily with water but not with fuel.

#### B. MIL-DTL-27686 Anti- Ice Additive Concentration Check using CJMD128-002 Anti-Ice Concentration test kit.

**NOTE: Refer to Tools, Equipment and Materials list in the test kit.**

**NOTE: When you add anti-icing additive to fuel which does not contain the additive and/or to determine if the anti-icing additive concentration has fallen outside the limits specified in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, do the following check.**

- (1) Get a sample of the fuel to be tested.
- (2) Fill a beaker with approximately 250 ml of water (tap water is acceptable). Put the beaker on a hot plate and bring to a full boil.
- (3) Attach the repeating pipet filler to the 10-ml transfer pipet and adjust to the 10 ml mark.

- (4) Transfer 10-ml of distilled water into a clean ampoule.
- (5) Transfer 10-ml of the fuel test sample to the ampoule with the 10-ml of water.
- (6) Screw the cap on the ampoule and shake the tube for two minutes (use the timer).

**NOTE:** This extracts the anti-ice additive from the fuel.

- (7) Allow the ampoule to stand undisturbed for at least two minutes (use the timer).

**NOTE:** The fuel and water/anti-ice additive will separate into two separate phases or layers.

**CAUTION:** The contents of the ampoule are a strong acid. Do not let the contents touch your skin. If they do touch the skin, wash skin with running water for 15 minutes and get immediate medical attention.

- (8) Snap off the top of the glass ampoule and empty the potassium dichromate/sulfuric acid solution into a clean ampoule. Do not discard the empty ampoule.
- (9) With a clean pipet, add a few drops (not over 2 ml) of distilled water to the ampoule. Empty the rinse solution into the ampoule with the acid. Discard the empty ampoule.
- (10) Attach the repeating pipet filler to the 5 ml transfer pipet and adjust to the 5 ml mark.
- (11) Carefully withdraw 5 ml of the bottom (water/anti-ice additive) phase from the ampoule of fuel and water. Make sure that none of the fuel phase is transferred.
- (12) Empty the pipet with the water/anti-ice additive into the ampoule with the potassium dichromate/sulfuric acid solution.
- (13) Thoroughly mix the acid-water solution by swirling it carefully. Do not cap the ampoule.
- (14) Immediately place the ampoule in the boiling water bath (beaker on the hot plate) for 10 minutes, +30 or -30 seconds, using the timer for control. Acid-water solution may chemically react, which will create erroneously high results.

**NOTE:** If the acid-water solution cannot be immediately placed in the boiling water, it must be maintained in an ice water bath until just prior to heating. Otherwise, the acid-water solution may chemically react and, as a result, will create erroneously high results.

- (15) Remove the ampoule from the bath and allow to cool gradually to room temperature.
- (16) Transfer the reaction solution from the ampoule into a clean 10 ml sample cell. Fill to the 10 ml mark.
- (17) Fill the second sample cell with 10 ml of distilled water.
- (18) Insert the sample cell containing the reaction solution into the right opening of the optical comparator.
- (19) Insert the remaining sample cell into the left opening.
- (20) Hold the optical comparator lens approximately 10 inches from the eye. Do not make the mistake of placing the eye close to the lens. Face the backplate of the optical comparator directly toward any indirect outdoor (natural) lighting (northern exposure is best). Take care that no shadows fall on the backplate, as this causes uneven illumination of the observation fields. Do not prolong the observations for more than 10 to 15 seconds. Let the eyes rest between observations, preferably by viewing a gray or green surface.
- (21) Slowly rotate the color disk so that one color standard after another is brought into the observation field until the nearest color match is obtained. Read the concentration in either the upper or lower openings at the right side of the optical comparator. If the color of the test solution falls between the two standards, for example between 0.06 and 0.08, report the concentration as 0.07 percent.
- (22) Record the results of the above test as the volume percent of anti-ice additive to the nearest 0.01 percent.
- (23) If concentration is not within the limits specified in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual, defuel airplane and refuel with properly mixed fuel.
- (24) Dispose of the acid solution by diluting the acid into a beaker almost filled with tap water. The diluted solution may then be safely poured down a drain. Flush for a few seconds with tap water.

C. Anti-Ice Additive Concentration Check using HB-P-C B/2 Anti-Icing Additive Test Kit.

**NOTE:** Refer to Tools, Equipment and Materials list in the test kit.

- (1) Perform check in accordance with instruction supplied with test equipment.
- (2) Verify that anti-icing additive concentration is within the limits specified in the Pilot's Operating Handbook and Approved Airplane Flight Manual.

## 8. Defueling

### A. Defueling Fuel Bays.



- (1) Ground airplane to suitable ground or stake.
- (2) Make sure battery switch is turned OFF.
- (3) Turn fuel selector valves OFF.
- (4) Remove filler cap(s) from tank(s) to be defueled; insert defueling nozzle.
- (5) Remove as much fuel as possible with defueling nozzle.
- (6) Remove drain valves from bottom of fuel tank and drain remaining fuel.

## 9. Purging

### A. Fuel Bay Purging.

**WARNING: Purge fuel tank(s) with argon or carbon dioxide before you repair leaks. This will minimize the possibility of and explosion. Use a portable vapor detector to determine when it is safe to repair fuel tank(s).**

- (1) Ground airplane to suitable ground or stake.
- (2) Make sure battery is disconnected from electrical system.
- (3) Drain all fuel from tank(s) as outlined in Defueling above.
- (4) Remove access door and place inert gas supply hose in fuel tank.
- (5) Allow gas to flow into tank until fuel vapor cannot be detected. Non-sparking tools must be used to make repairs (air motors, plastic hammers and scrapers, etc.).