3. Safety and Maintenance Precautions

A. Safety Precautions.

(1) Ground the fueling/defueling equipment (vehicle or fuel hydrant equipment) to the airplane with designated grounding cable(s). Ensure 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 appropriate ground near the fuel filler. 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.

WARNING: MIL-I-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.

(2) Ensure fire fighting equipment is positioned and immediately available.

(3) Do not wear clothing that has a tendency to generate static electricity, such asnylonorsynthetic fabrics.

(4) Do not wear metal taps on shoes.

(5) The airplane should be in a designated fuel loading/unloading area.

(6) High-wattage, pulse transmitting avionic equipment shall 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 antiicing additive may cause deterioration of the integral fuel tanks interior finish, thus promoting corrosion. It is of paramount importance that proper anti-ice additive blending procedures be followed.

(3) Use authorized type of fuel and anti-ice additive.

(4) During defueling, ensure anti-ice additive blended fuel and unblended fuel are not mixed.

4. Anti-Ice Additive as a Biocide

A. In addition to preventing icing in fuel tanks, anti-ice additive effectively controls the growth of bacterial and fungal microorganisms which can form in fuel storage tanks.

(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.

5. Aviation Fuel Additive

A. When servicing fuel with anti-icing additives containing ethylene glycol monomethyl ether (EGME, MIL-I-27686) or diethylene glycol monomethyl ether (DiEGME, MIL-I-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 neplyotoxin 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 should 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.

6. Fuel Loading

CAUTION: ENSURE THE PROPER GRADE AND TYPE OF FUEL IS USED TO SERVICE THE AIRPLANE. REFER TO FAA APPROVED AIRPLANE FLIGHT MANUAL FOR A LIST OF APPROVED FUELS.

A. Approved fuels for the Model 500 airplane may or may not contain an anti-ice additive. The additive incorporates a biocidal chemical which inhibits growth of fungal and bacterial organisms in fuel storage reservoirs. 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 (PRB 101), 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 as described in paragraph 6.C.

WARNING: ANTI-ICING ADDITIVES CONTAINING EGME OR DIEGME ARE HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH THE SKIN AND WILL CAUSE EYE IRRITATION. EGME IS ALSO COMBUSTIBLE. BEFORE USING THIS MATERIAL, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.

CAUTION: ENSURE THAT ADDITIVE IS DIRECTED INTO FLOWING FUEL STREAM AND ADDITIVE FLOW IS STARTED AFTER FUEL FLOW STARTS AND IS STOPPED BEFORE FUEL FLOW STOPS. DO NOT ALLOW CONCENTRATED ADDITIVE TO CONTACT COATED INTERIOR OF FUEL TANK OR AIRPLANE PAINTED SURFACE.

(b) Start refueling; then, direct the fuel additive into the fuel stream so as to blend the additive simultaneously with the fuel as it fills the tank. The additive concentration range shall be maintained in accordance with instructions in the FAA Approved Airplane Flight Manual.

C. Overwing Tank Filling Procedures.

WARNING: PERFORM FUEL LOADING IN AREAS WHICH PERMIT FREE MOVEMENT OF FIRE EQUIPMENT.

WARNING: ENSURE THAT FUEL SUPPLY UNIT IS GROUNDED AND GROUND TO AIRPLANE IS CONNECTED.

(1)Connect fueling nozzle ground to the airplanes grounding receptacle, located on the lower side of the wing outboard of the filler cap.
(2)Place a protective pad on the wing adjacent to the fuel filler and remove the filler cap.

NOTE: Due to the position of the key holes, lock freezing may be encountered on airplanes with locking-type filler caps. Heating the key prior to inserting it in the lock will normally thaw the lock; however, putting jet fuel, anti-ice spray or liquid into the lock during inclement weather can reduce the freezing possibilities.

(3)Service as follows:
(a) If the turbine fuel has 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 and Equipment, and add as described by the inhibitor manufacturer or in accordance with Mixing Icing Inhibitor Procedures.

CAUTION: ENSURE FILLER CAP IS SECURED.

4) Remove fuel nozzle and protective pad; disconnect fueling nozzle ground and install fuel filler cap.

7. Checking Fuel in Wing Tank

A. Fuel Samples.
(1)The main functions of the poppet-type drain valves installed on the lower side of the fuel tank are to sample fuel and to check for and drain sediments in the tanks. 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. The end of the poppet allows for screwdriver operation. Depress and rotate to lock the valve to the open position, using applicable screwdriver. To close valve depress, rotate and release, using applicable screwdriver.

NOTE: There are two types of fuel drain valves used on Model 500 airplanes. One type has a slot head for flat screwdriver drain cup and the other has a phillips head for phillips screwdriver drain cup. Refer to 500 Series Tools and Equipment for applicable drain cup.

(3)During cold weather, if more than one hour elapses between removal from a heated shelter and takeoff, all fuel sumps should be drained through the drain valves during the preflight inspection. Enough fuel should be drained from each drain point to ensure that the fuel is free from water and/or other contaminants. At least 30 minutes should elapse between fueling and checking for contamination. The fuel should 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-I-27686 Anti-Ice Additive Concentration Check using CJMD128-002 Anti-Ice Concentration test kit.

NOTE: Refer to Tools and Equipment for test kit.

NOTE: When adding 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 FAA Approved Airplane Flight Manual, perform the following check.

(1) Obtain a vial of the fuel to be tested.
(2) Fill a beaker with approximately 250 ml of water (tap water is acceptable). Place 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 vial.
(5) Transfer 10 ml of the fuel test sample to the vial with the 10 ml of water.
(6) Screw the cap on the vial and shake the tube for two minutes (use the timer).

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

(7) Allow the vial 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 AMPULES ARE A STRONG ACID. DO NOT ALLOW TO COME IN CONTACT WITH SKIN. WASH WITH RUNNING WATER FOR 15 MINUTES AND OBTAIN IMMEDIATE MEDICAL ATTENTION.

(8) Snap off the top of the glass ampule and empty the potassium dichromate/sulfuric acid solution into a clean vial. Do not discard the empty ampule.
(9) With a clean pipet, add a few drops (not over 2 ml) of distilled water to the ampule. Empty the rinse solution into the vial containing the acid. Discard the empty ampule.
(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 vial of fuel and water. Ensure that none of the fuel phase is transferred.
(12) Empty the pipet containing the water/anti-ice additive into the vial containing the potassium dichromate/sulfuric acid solution.
(13) Thoroughly mix the acid-water solution by swirling carefully. Do not cap the vial.
(14) Immediately place the vial 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, which will create erroneously high results.

(15) Remove the vial from the bath and allow to cool gradually to room temperature.
(16) Transfer the reaction solution from the vial 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 back plate of the optical comparator directly toward any indirect outdoor (natural) lighting (northern exposure is best). Take care that no shadows fall on the back plate, 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 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 and Equipment for 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 by the FAA Approved Airplane Flight Manual.

8. Defueling

A. Two methods of defueling suitable for all airplanes are discussed; alternate methods are suitable. For partial defueling of one wing tank, the condition may exist to transfer fuel from one wing tank to the other wing tank. To transfer fuel from one wing tank to the other wing tank, refer to Transfer Method of Defueling (One Tank at a Time).

B. Force Method of Defueling.

NOTE: Observe safety precautions.

(1)Remove lower engine cowl. Refer to Chapter 71, Engine Cowling - Removal/Installation.

(2) Disconnect the fuel supply line at the engine fuel control.
Refer to Chapter 73, Engine Fuel Distribution - Maintenance Practices.
(3) Attach suction line; select one of the following:

NOTE: If both wing tanks are to be defueled simultaneously, provide sufficient equipment.

(a) Attach suction line (from fueling/defueling unit) to fuel supply line.
(b) Place container (five-gallon can) below engine; attach one end of a line to the fuel supply line and place the other end into the container. Place the suction line (from fueling/defueling unit) into the container.
(4) Apply external electrical power to the airplane and operate the fuel boost pump. Refer to Chapter 28, Fuel Distribution - Description and Operation.
(5) Operate suction line pump in defueling unit and airplane fuel boost pump until wing tank(s) are empty.

CAUTION: TO PREVENT POSSIBLE DAMAGE TO THE FUEL BOOST PUMP, DO NOT OPERATE THE FUEL BOOST PUMP AFTER THE LOW FUEL PRESSURE ANNUNCIATOR ILLUMINATES.

NOTE: Do not rely on fuel boost pump sound to determine cavitation, as the sound varies with fuel depth. The fuel boost pump must be submerged in fuel during operation to ensure adequate cooling and lubrication.

(6) Drain residual fuel from the tank by the wing tank poppet-type drain valves.
(7) Remove suction line (from defueling unit), remove line attached to fuel supply line and remove line from containers. Connect fuel supply line to engine fuel control. Refer to Chapter 73, Engine Fuel Distribution - Maintenance Practices. Install lower cowl. Refer to Chapter 71, Engine Cowling - Removal/Installation.

C. Suction Method of Defueling.

NOTE: Observe safety precautions.

(1) Remove fuel filler cap.
(2) Insert suction line from the defueling unit into fuel filler.

NOTE: The suction line shall be of sufficient length to have the open end of the hose worked toward the fuel tank sump area.

(3) When defueling flow stops, complete the defueling operation by the forced defueling method; transfer fuel from one wing to the opposite wing, or drain remaining fuel hrough the poppet-type drains.

D. Transfer Method of Defueling (One Tank at a Time).

NOTE: Determine if space is available in the left or right fuel tank (as applicable) to accept the quantity of fuel to be transferred (defueled). The fuel is transferred through the crossfeed fuel system.

(1) To defuel (transfer) the left tank to the right tank, accomplish the following:
(a) Connect external electrical power to airplane.
(b) With both boost pump switches in NORMAL position and both throttle levers in CUT OFF, select crossfeed LH TANK to RH ENG; both crossfeed valves will open and the left electric boost pump will energize automatically.

CAUTION: TO PREVENT POSSIBLE DAMAGE TO THE FUEL BOOST PUMP, DO NOT OPERATE THE FUEL BOOST PUMP AFTER THE LOW FUEL PRESSURE ANNUNCIATOR ILLUMINATES.

NOTE: Do not rely on fuel boost pump sound to determine cavitation, as the sound varies with fuel depth. The fuel boost pump must be submerged in fuel during operation to ensure adequate cooling and lubrication.

(c) Operate the left boost pump until the left engine low pressure light illuminates.
(d) Select crossfeed to OFF; both crossfeed valves will close within approximately 5 seconds and the boost pump will deenergize automatically. Place boost pumps to OFF position.
(e) Disconnect external electrical power from airplane.
(f) Drain residual fuel from the left tank by the wing tank poppet-type drain valves.

(2) To defuel (transfer) the right tank to the left tank, accomplish (a) through (d) above, except reverse nomenclature to "right tank to left tank".

9. Purging

A. The following purging procedure is recommended when it is necessary to house an airplane in buildings unapproved for previously fueled airplanes.

CAUTION: THIS PROCEDURE WILL RENDER THE FUEL TANKS SAFE FOR 10 to 15 DAYS. THE AIRPLANE MAY BE RETURNED TO SERVICE BY FUELING AND PURGING THE AIR FROM THE FUEL LINES TO THE ENGINE.

(1) Defuel airplane.
(2) Drain residual fuel at poppet-type drain valves; include filter drain.
(3) Fill airplane fuel tanks with purging fluid MIL-F-38299 (JP-5 fuel may be used as an alternate purging fluid); let purging fluid remain in the tanks for 15 minutes.
(4) Defuel airplane per steps (1) and (2). Reconnect fuel lines broken during defueling.
(5) Airplane is now ready to hangar.