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## **SECTION 8**

### **AIRPLANE HANDLING, SERVICING AND MAINTENANCE**

#### **8.1 GENERAL**

This section provides general guidelines relating to the handling, servicing and maintenance of the Arrow IV.

Every owner should stay in close contact with his Piper dealer or distributor and Authorized Piper Service Center to obtain the latest information pertaining to his aircraft and to avail himself of the Piper Aircraft Service Back-up.

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent directly to the latest FAA-registered owners in the United States (U.S.) and Piper Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Service Centers.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the Service Letter information.

Service Spares Letters offer improved parts, kits and optional equipment which were not available originally and which may be of interest to the owner.

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from your Piper dealer or distributor. Any correspondence regarding the airplane should include the airplane model and serial number to insure proper response.

### **8.3 AIRPLANE INSPECTION PERIODS**

Piper Aircraft Corporation has developed inspection items and required inspection intervals (i.e.; 50, 100, 500, and 1000 hours) for the specific model aircraft. Appropriate forms are contained in the applicable Piper Service/Maintenance Manual, and should be complied with by a properly trained, knowledgeable, and qualified mechanic at a Piper Authorized Service Center or a reputable repair shop. Piper Aircraft Corporation cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper Aircraft Corporation, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continued airworthiness is maintained. Complete details are available from Piper Aircraft Corporation.

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

A spectrographic analysis of the engine oil is available from several sources. This inspection, if performed properly, provides a good check of the internal condition of the engine. To be accurate, induction air filters must be cleaned or changed regularly, and oil samples must be taken and sent in at regular intervals.

### **8.5 PREVENTIVE MAINTENANCE**

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used in air carrier service. The following is a list of the maintenance which the pilot may perform:

- (a) Repair or change tires and tubes.
- (b) Service landing gear wheel bearings, such as cleaning, greasing or replacing.
- (c) Service landing gear shock struts by adding air, oil or both.
- (d) Replace defective safety wire and cotter keys.
- (e) Lubrication not requiring disassembly other than removal of non-structural items such as cover plates, cowling or fairings.
- (f) Replenish hydraulic fluid in the hydraulic reservoirs.
- (g) Refinish the exterior or interior of the aircraft (excluding balanced control surfaces) when removal or disassembly of any primary structure or operating system is not required.
- (h) Replace side windows and safety belts.

- (i) Replace seats or seat parts with replacement parts approved for the aircraft.
- (j) Replace bulbs, reflectors and lenses of position and landing lights.
- (k) Replace cowling not requiring removal of the propeller.
- (l) Replace, clean or set spark plug clearance.
- (m) Replace any hose connection, except hydraulic connections, with replacement hoses.
- (n) Replace prefabricated fuel lines.
- (o) Replace the battery and check fluid level and specific gravity.

Although the above work is allowed by law, each individual should make a self analysis as to whether he has the ability to perform the work.

If the above work is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

- (a) The date the work was accomplished.
- (b) Description of the work.
- (c) Number of hours on the aircraft.
- (d) The certificate number of pilot performing the work.
- (e) Signature of the individual doing the work.

### **8.7 AIRPLANE ALTERATIONS**

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic air-frame or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

- (a) To be displayed in the aircraft at all times:
  - (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
  - (2) Aircraft Registration Certificate Form FAA-8050-3.
  - (3) Aircraft Radio Station License if transmitters are installed.

- (b) To be carried in the aircraft at all times:
- (1) Pilot's Operating Handbook.
  - (2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable,
  - (3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

## **8.9 GROUND HANDLING**

- (a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the rear baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly. The steering bar is engaged by inserting it into the nose wheel axle.

### *CAUTION*

When towing with power equipment, do not turn the nose gear beyond its steering radius in either direction, as this will result in damage to the nose gear and steering mechanism.

### *CAUTION*

Do not tow the airplane when the controls are secured.

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and/or tail by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures as well as taxi techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following checks should be performed:

- (1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
- (2) Taxi with the propeller set in low pitch, high RPM setting.
- (3) While taxiing, make slight turns to ascertain the effectiveness of the steering.
- (4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
- (5) When taxiing over uneven ground, avoid holes and ruts.
- (6) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that may cause damage to the propeller blades.

(c) Parking

When parking the airplane, be sure that it is sufficiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

- (1) To park the airplane, head it into the wind if possible.
- (2) Set the parking brake by pulling back on the brake lever and depressing the knob on the handle. To release the parking brake, pull back on the handle until the catch disengages; then allow the handle to swing forward.

**CAUTION**

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.



- (3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane:

- (1) Head the airplane into the wind if possible.
- (2) Retract the flaps.
- (3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
- (4) Block the wheels.
- (5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

*CAUTION*

Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.

*NOTE*

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

- (6) Install a pitot head cover if available. Be sure to remove the pitot head cover before flight.
- (7) Cabin and baggage doors should be locked when the airplane is unattended.

### **8.11 ENGINE AIR FILTER**

(a) Removing Engine Air Filter

- (1) Remove the upper cowl.
- (2) Remove the wing nuts securing the filter box cover. Remove the filter.

(b) Cleaning Engine Air Filter

The induction air filter must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

To clean the filter:

- (1) Tap the filter gently to remove dirt particles, being careful not to damage the filter. DO NOT wash the filter in any liquid. DO NOT attempt to blow out dirt with compressed air.
- (2) If the filter is excessively dirty or shows any damage, replace it immediately.
- (3) Wipe the filter housing with a clean cloth soaked in unleaded gasoline. When the housing is clean and dry, install the filter.

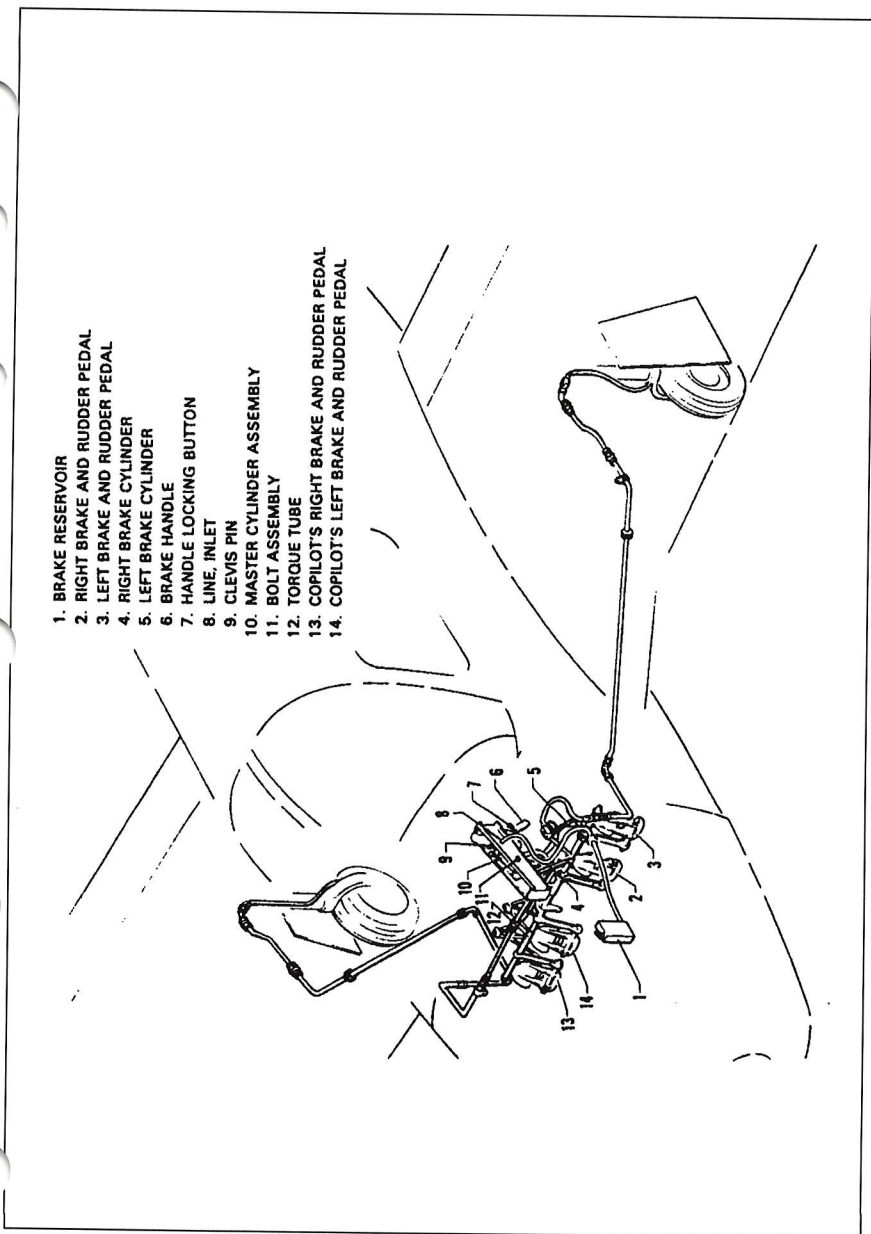
(c) Installation of Engine Air Filter

After cleaning or when replacing the filter, install the filter in the reverse order of removal.

### **8.13 BRAKE SERVICE**

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. The fluid level should be checked periodically or at every 100-hour inspection and replenished when necessary. The brake reservoir is located on the left side of the fire wall in the engine compartment. If the entire system must be refilled, fill with fluid under pressure from the brake end of the system. This will eliminate air from the system.

No adjustment of the brake clearances is necessary. If after extended service brake blocks become excessively worn, they should be replaced with new segments.



**BRAKE SYSTEM**

Figure 8-1

### **8.15 LANDING GEAR SERVICE**

The main landing gear uses 6.00 x 6 wheels with 6.00 x 6, six-ply rating tires and tubes. The nose wheel uses a 5.00 x 5 wheel with a 5.00 x 5 four-ply rating, type III tire and tube. (Refer to Paragraph 8.23.)

Wheels are removed by taking off the hub cap, cotter pin, axle nut, and the two bolts holding the brake segment in place. Mark tire and wheel for reinstallation; then dismount by deflating the tire, removing the three through-bolts from the wheel and separating the wheel halves.

Landing gear oleos on the Arrow IV should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until  $2.5 \pm .25$  inches of oleo piston tube is exposed, and the nose gear should show  $2.75 \pm .25$  inches. To add air to the oleo struts, attach a strut pump to the valve assembly near the top of the oleo strut housing and pump the oleo to the desired position. To add oil, jack the aircraft, release the air pressure in the strut, remove the valve core and add oil through this opening with the strut extended. After the strut is full, compress it slowly and fully to allow excess air and oil to escape. With the strut still compressed reinsert the valve stem and pump up the strut as above.

In jacking the aircraft for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 250 pounds of ballast should be placed on the base of the tail stand before the airplane is jacked up. The hydraulic jacks should be placed under the jack points on the bottom of the wing and the airplane jacked up until the tail skid is at the right height to attach the tail stand. After the tail stand is attached and the ballast added, jacking may be continued until the airplane is at the height desired.

The steering arms from the rudder pedals to the nose wheel are adjusted at the rudder pedals or at the nose wheel by turning the threaded rod end bearings in or out. Adjustment is normally accomplished at the forward end of the rods and should be done in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals and rudder are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the plane follows a perfectly straight line. The turning arc of the nose wheel is  $30^\circ$  in either direction and is factory adjusted at stops on the bottom of the forging.

### **8.17 PROPELLER SERVICE**

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, and corrosion. If found, they should be repaired as soon as possible by a rated mechanic, since a nick or scratch causes an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, the surface should be cleaned and waxed periodically.

### **8.19 OIL REQUIREMENTS**

The oil capacity of the Lycoming IO-360 series engine is 8 quarts, and the minimum safe quantity is 2 quarts. It is recommended that the oil be changed every 50 hours (not to exceed each 4 months\*) and sooner under unfavorable operating conditions. The following grades are recommended for the specified temperatures:

Average Ambient Air Temperature For Starting	Single Viscosity Grade	Multi-Viscosity Grades
Above 60°F	SAE 50	SAE 40 or SAE 50
30° to 90°F	SAE 40	SAE 40
0° to 70°F	SAE 30	SAE 40 or 20W-30
Below 10°F	SAE 20	SAE 20W-30

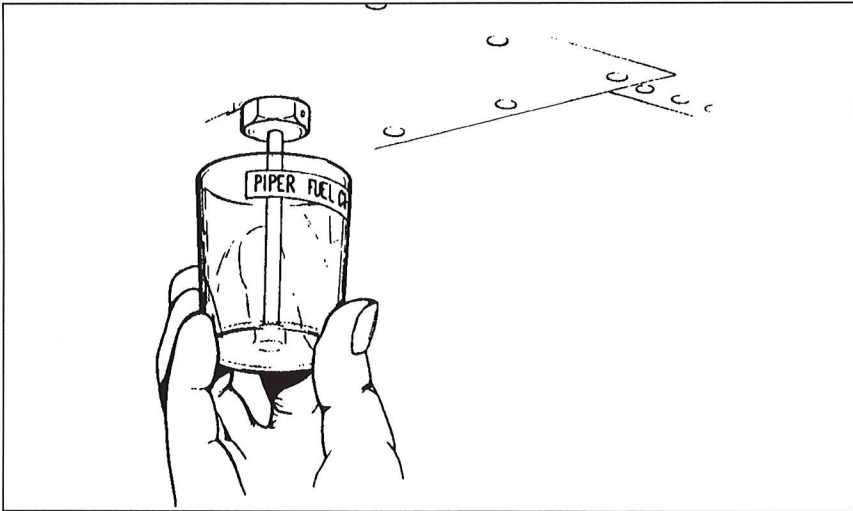
Use of ashless dispersant oil (MIL-L-22851) is recommended after the initial break-in period of 25 to 50 hours.\*

\* Refer to the latest revision of Lycoming Service Bulletin 480 for details.

### **8.21 FUEL SYSTEM**

#### **(a) Servicing Fuel System**

At every 50-hour inspection, the fuel screen in the strainer must be cleaned. The fuel strainer is located on the forward left lower side of the fire wall. It is accessible by removing the lower cowling. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.



**FUEL DRAIN**  
Figure 8-3

(b) Fuel Requirements

Aviation grade fuel with a minimum octane of 100/130 is specified for this airplane. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes. Refer to latest issue of Lycoming Service Instruction 1070 for approved alternate grade fuels.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 38.5 U.S. gallons. When using less than the standard 77 gallon capacity, fuel should be distributed equally between each side.

(d) Draining Fuel System, Sumps and Lines

The fuel strainer, located on the lower left side of the fire wall, is provided with a quick drain which should be drained before the first flight of the day or after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each fuel tank is provided with a fuel quick drain to check for contamination. Each tank should be checked for contamination in accordance with the above procedure.

(e) Draining Fuel System

The bulk of the fuel may be drained from the fuel cells by the use of a siphon hose placed in the cell or tank through the filler neck. The remainder of the fuel may be drained by opening all the drain valves.

*CAUTION*

When draining fuel, be sure that no fire hazard exists before starting the engine.

**8.23 TIRE INFLATION**

For maximum service from the tires, keep them inflated to the proper pressure of 27 psi for nose tire and 30 psi for main tires. All wheels and tires are balanced before original installation, and the relationship of tire, tube and wheel should be maintained upon reinstallation. In the installation of new components, it may be necessary to rebalance the wheels with the tires mounted. Unbalanced wheels can cause extreme vibration in the landing gear. When checking tire pressure, examine the tires for wear, cuts, bruises, and slippage.

### **8.25 BATTERY SERVICE**

Access to the 12-volt battery is gained by removing the upper cowl. It is mounted to the forward right side on the face of the fire wall. The battery container has a plastic drain tube which is normally closed off with a cap. The cap should be opened periodically to remove battery acid which may have collected in the tube.

The battery fluid level must not be brought above the baffle plates. It should be checked every 30 days to determine that the fluid level is proper and the connections are tight and free of corrosion. Do not fill the battery with acid – use water only.

If the battery is not properly charged, recharge it starting with a rate of four amperes and finishing with a rate of two amperes. The battery should be removed from the airplane for charging, and quick charges are not recommended.

The external power receptacle, if installed, is located on the right side of the fuselage just aft of the fire wall.

Refer to the Arrow IV Service Manual for battery servicing procedure.

### **8.27 CLEANING**

#### **(a) Cleaning Engine Compartment**

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

- (1) Place a large pan under the engine to catch waste.
- (2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

#### *CAUTION*

Do not spray solvent into the alternator, vacuum pump, starter, or air intakes.



- (3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

*CAUTION*

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

- (4) Remove the protective tape from the magnetos.
- (5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

- (1) Place a pan under the gear to catch waste.
- (2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.
- (3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
- (4) Remove the cover from the wheel and remove the catch pan.
- (5) Lubricate the gear in accordance with the Lubrication Chart.
- (6) Caution: Do not brush the micro switches.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

- (1) Flush away loose dirt with water.
- (2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
- (3) To remove exhaust stains, allow the solution to remain on the surface longer.

- (4) To remove stubborn oil and grease, use a cloth dampened with naphtha.
- (5) Rinse all surfaces thoroughly.
- (6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

- (1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
- (2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.
- (3) Remove oil and grease with a cloth moistened with kerosene.

*CAUTION*

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

- (4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
- (5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

- (1) Clean headliner, side panels, and seats with a stiff bristle brush, and vacuum where necessary.
- (2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Carefully follow the manufacturer's instructions. Avoid soaking or harsh rubbing.

*CAUTION*

Solvent cleaners require adequate ventilation.

(3) Leather should be cleaned with saddle soap or a mild hand soap and water.

(f) **Cleaning Carpets**

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a noninflammable dry cleaning fluid. Floor carpets may be cleaned like any household carpet.

**8.29 WINTERIZATION**

For winter operation a winterization kit is installed on the inlet opening of the oil cooler outboard chamber of the plenum chamber. This kit should be installed whenever the ambient temperature is 50° F or less. When the kit is not being used it can be stowed on the bracket provided for this purpose on the top side of the oil cooler plenum chamber.

