N4099X

AERO COMMANDER

MODELS

100 DARTER AND 100-180 LARK

OVERHAUL AND REPAIR MANUAL

1 800 - 542 - 8565

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North American Rockwell
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NOTE

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SECTION I

GENERAL INFORMATION

INTRODUCTION

The Aero Commander Model 100 Darter and Model 100-180 Lark aircraft are each four-place, high-wing, all-metal aircraft. The Model 100 Darter is powered by a Lycoming O-320-A2B series 150-horsepower engine with a Sensenich Model M74DM-60 fixed-pitch all-metal propeller, and the Model 100-180 Lark is powered by a Lycoming O-360-A2F series 180-horsepower engine with a McCauley 1A170 CFA fixed-pitch all-metal propeller. These engine and propeller combinations provide sufficient power for taking the Model 100 Darter to an absolute ceiling of 11,000 feet and the Model 100-180 Lark to an absolute ceiling of 13,100 feet. Structural integrity, flight safety, and minimum maintenance requirements are assured by the all-metal construction and design of major airframe components. Entrance to the cabin is through doors located on each side of the aircraft, which are equipped with interior locks. The two forward cabin seats are mounted on tracks secured to the cabin floor and may be adjusted for pilot comfort. The wing design and its position in relation to the fuselage provide high lift capability and the aircraft controllability desired for maximum performance, in addition to the capability for short-field operation. The design concept of the aircraft embodies maximum safety, minimum maintenance requirements, and ease of accomplishing necessary maintenance and servicing. Adequate access covers and quick opening engine cowling provide easy access to the engine and aircraft systems and components. Passenger and crew comfort are assured by the design of the seating and interiors, which are completely insulated and upholstered for noise abatement, warmth, and appearance. A separate baggage compartment which will hold 120 pounds is located aft of the aft passenger seats. The baggage compartment is accessible by folding the rear seats forward on the Model 100 Darter, and through an exterior baggage compartment door on the Model 100-180 Lark. The baggage compartment door on the Lark is located on the left side of the fuselage, aft of the rear passenger seats.

FUSELAGE AND WING STATIONS

The station diagrams shown in Figure 1-1 provide a convenient method for identifying and locating reference points on major components of the fuselage and wings. These reference points are numbered in inches. The fuselage station zero reference point is located six inches aft of the engine firewall. Stations forward of fuselage station zero are preceeded by a minus (-) sign indicating the distance or position forward of station zero. Fuselage stations aft of station zero are in plus measurements. Rib stations of the wing are measured along the wing leading edge and outboard from the inboard end of the wing where it attaches to the fuselage.

AIRCRAFT STRUCTURES

The aircraft structure is divided into three main assemblies; the fuselage, wing, and empennage. See Figure 1-2.

FUSELAGE

The fuselage consists of two main sections; the forward fuselage section and aft fuselage section. The forward fuselage is the main structural element of the aircraft and provides the structural framework for the cabin enclosure. The framework, which is constructed of welded steel-alloy tubing, is designed to furnish a rigid cabin structure and provide the necessary strength for supporting the wings, aft fuselage, and engine. The main landing gear is also attached to lower truss members of the welded cabin structure. The forward tubular bulkhead of the forward fuselage steel weldment is designed and stressed to support the engine and the nose landing gear. The aft tubular bulkhead has fixed welded fittings which attach to and support the aft fuselage assembly. The aft fuselage is bolted directly to the fixed welded fittings. The basic structure of the aft fuselage consists of frame bulkheads, stringers, and aluminum skin, to give the aft fuselage the flexibility and strength required. A dorsal fin, which is riveted to the top of the aft fuselage, tapers aft and upward from the forward attachment point to the vertical stabilizer. This surface provides improved stability around the vertical

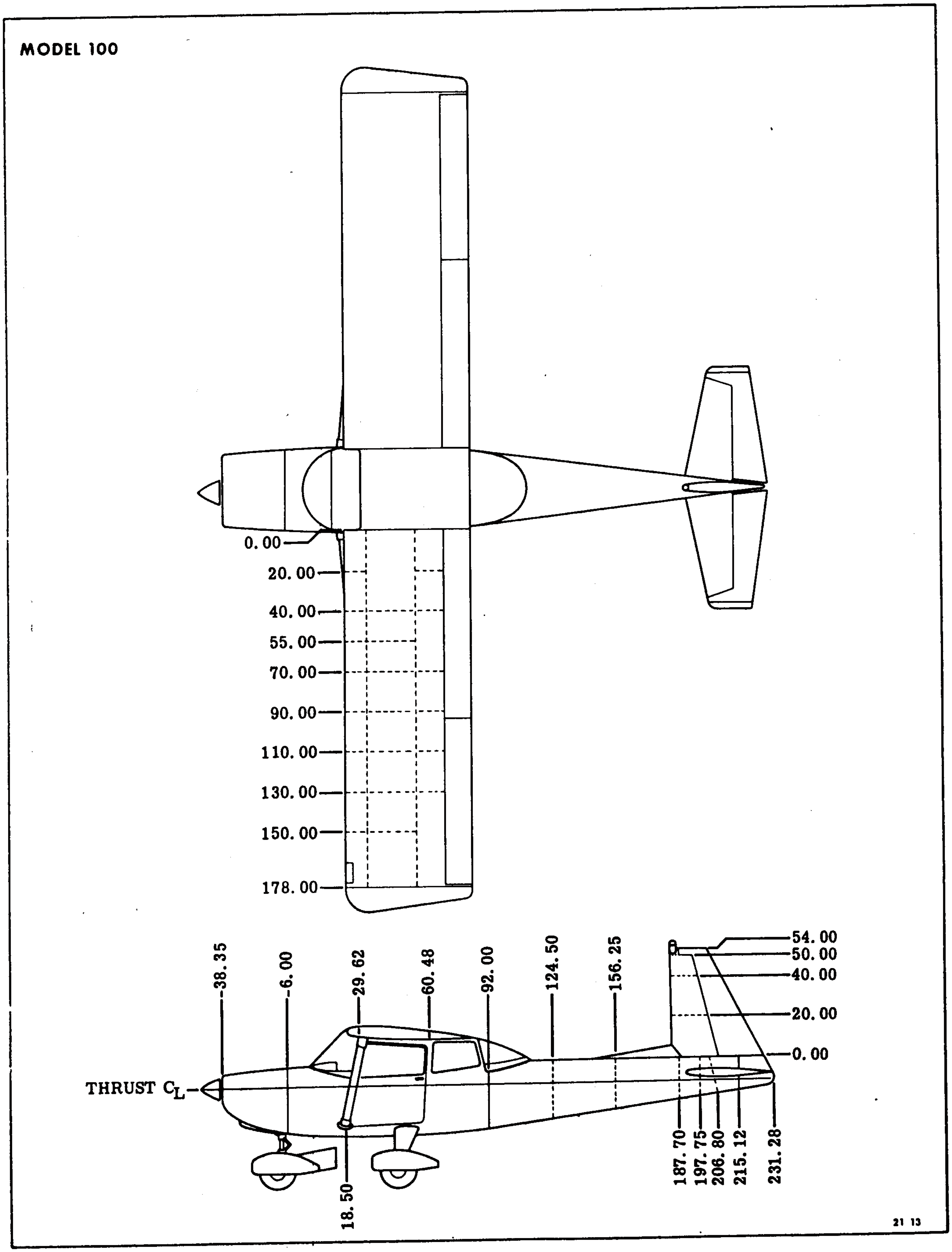


Figure 1-1. Station Diagram (Sheet 1 of 2)

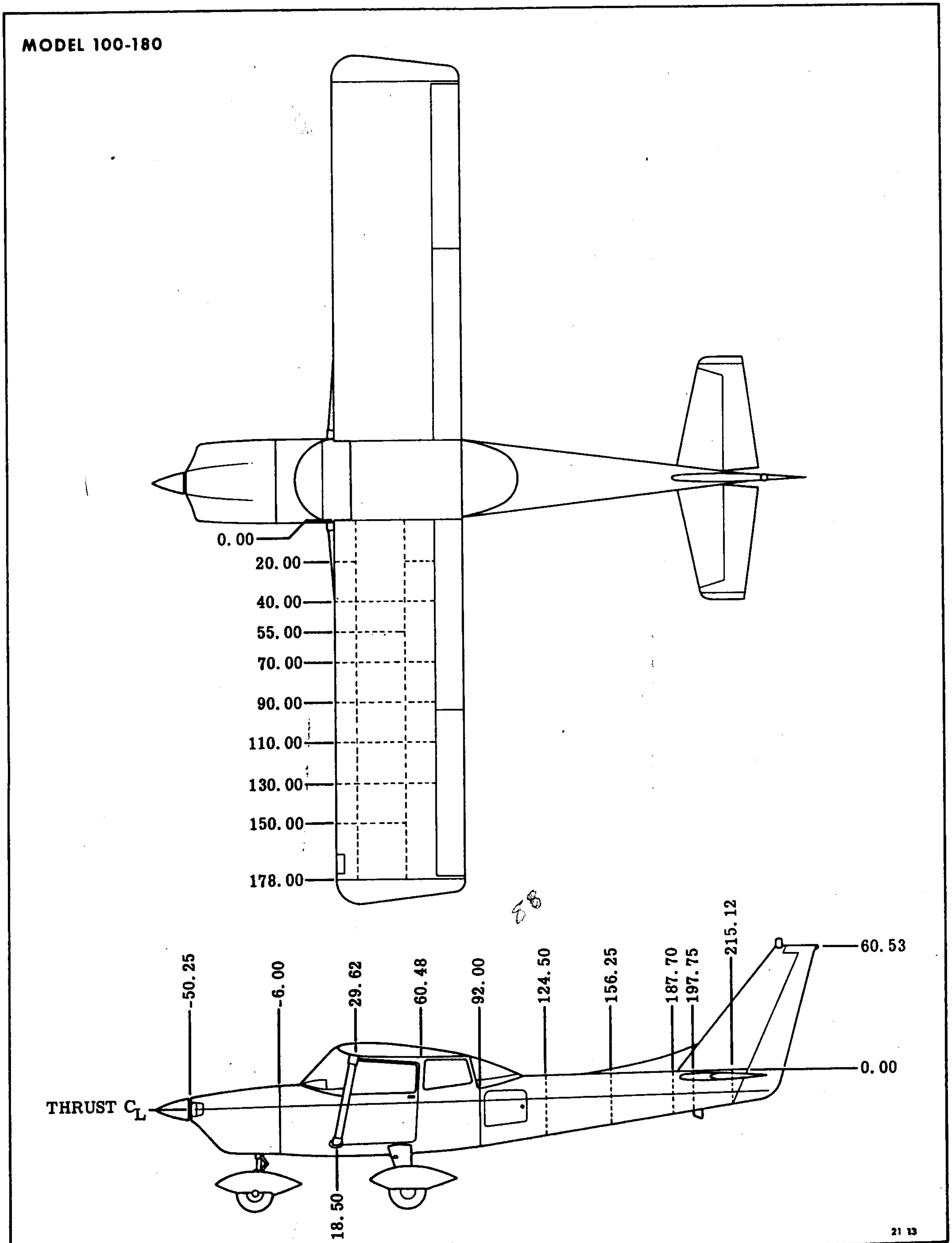


Figure 1-1. Station Diagram (Sheet 2 of 2)

axis of the aircraft in addition to enhancing the streamline effect of the fin. The aft fuselage design provides for installing the vertical and horizontal stabilizers and a tail guard. The end of the aft fuselage on the Model 100 Darter is streamlined by a fiberglass cap which houses the elevator horn and provides for installation of a white navigation light. The elevator, elevator trim tab, and rudder control cables are routed through pulleys and guides in the aft fuselage to assure freedom of control movement and to prevent cabin interference.

WING

The all-metal wing is of conventional design, using a forward and aft spar, ribs, and stringers covered with aluminum skin. Wing attach fittings are bolted to the butt end of each wing spar and mate with two hinge fittings welded to the top frame tube on each side of the cabin. Each wing panel is secured to the aircraft with a steel bolt that passes through both fittings at each attachment point. A single streamlined wing strut attaches between the forward wing spar and the lower cabin frame to complete the wing attachment. The wing flaps are hinge-mounted to the aft inboard section of each wing panel. Hinges also attach the aileron to the aft wing spar. The aileron extends from the outboard end of the wing flap to the end of each wing panel. A removable fiberglass wing tip is attached to each wing panel. Moisture accumulation within each wing panel will flow inboard through the wing rib cutouts and drain through drain holes in the lower wing skin. These drain holes are located immediately outboard of the wing butt rib, forward of the front spar and aft of the rear spar. A metal fuel tank is located between the wing spars immediately outboard of each wing butt. The tanks are filled through a filler neck located on the upper inboard wing surface. A pitot-static tube is installed in the leading edge of the left wing, outboard of the wing strut attach point. The left wing leading edge also includes provisions for the electrical pre-stall warning switch and the optional landing light. Navigation lights are also installed in each wing tip. Access covers are located on the upper and lower surfaces of each wing panel as required for rigging the control surface and inspecting the equipment installed in the wing. Aluminum and fiberglass fairings enclose the area between the wing butt and fuselage. These fairings may be removed to gain access to the wing attachment fittings and fuel line connections.

EMPENNAGE

The all-metal empennage consists of a horizontal stabilizer and vertical stabilizer attached to stub spars on the aft fuselage. The horizontal stabilizer assembly consists of left and right panels which have a full length tapered rear spar that contains three hinge fittings for each elevator. The outboard section of the front spar follows the sweep of the horizontal stabilizer leading edge for approximately half the length of the stabilizer, where it is then secured to the center rib section. The inboard end of the forward spar joins a short spar section which eliminates the sweep angle and allows the stabilizer to fit flush with the taper of the aft fuselage. Inboard and outboard ribs, which complete the internal structure, are covered by formed aluminum sheet riveted to the structure to complete the stressed-skin design of the flight surface. The left stabilizer panel incorporates a housing to accommodate installation of the elevator trim tab actuator assembly. Moisture accumulation in the stabilizer drains through internal openings into the tail cap and out the lower drain holes. The stabilizers are attached to the fuselage stub spars by short bolts that pass through the flanges. The forward spars use two bolts on the upper and lower flanges. The bolts are secured by plate nuts attached to the stub spar. The rear spars are secured by three bolts and self-locking nuts on each of the flanges. The forward and aft spars of the vertical stabilizer attach to stub spars which extend upward from the aft fuselage. Attachment is similar to the horizontal stabilizers, using two bolts in each flange. Three hinge fittings are secured to the aft side of the rear spar and are utilized for attaching the rudder to the stabilizer. The top of the stabilizer is faired and streamlined by a fiberglass tip. An alternate fin tip, designed to house a rotating beacon, may be installed on the Model 100 Darter as optional equipment. A rotating beacon is installed on the tip of the vertical stabilizer as standard equipment on the Model 100-180 Lark. The ribs and spars of the vertical stabilizer are covered with formed aluminum sheet to complete the stressed-skin design. Moisture accumulation within the vertical stabilizer will drain downward through tooling holes and out through drain holes in the lower aft fuselage tail.

AIRCRAFT SYSTEMS

FUEL SYSTEM

The fuel system contains two 22-gallon welded and baffled metal tank assemblies, for a total capacity of 44 gallons. Each tank, which is located at the inboard end of each wing between the forward and aft wing spars, has a useable fuel capacity of 20 gallons. A fuel vent line, which is common to both tanks, is routed from a tee fitting in the upper cabin panel to the left side of the aircraft where it extends overboard through the lower cabin skin. Fuel from each tank flows to the engine through the fuel tank selector valve when the selector is in BOTH tanks position. The fuel selector valve may be positioned to use fuel from either the left or right tank. When the aircraft is parked with one wing low, the fuel selector should be placed to LEFT TANK or RIGHT TANK position to prevent high tank from cross feeding and causing fuel to flow from low tank through the tank vent.

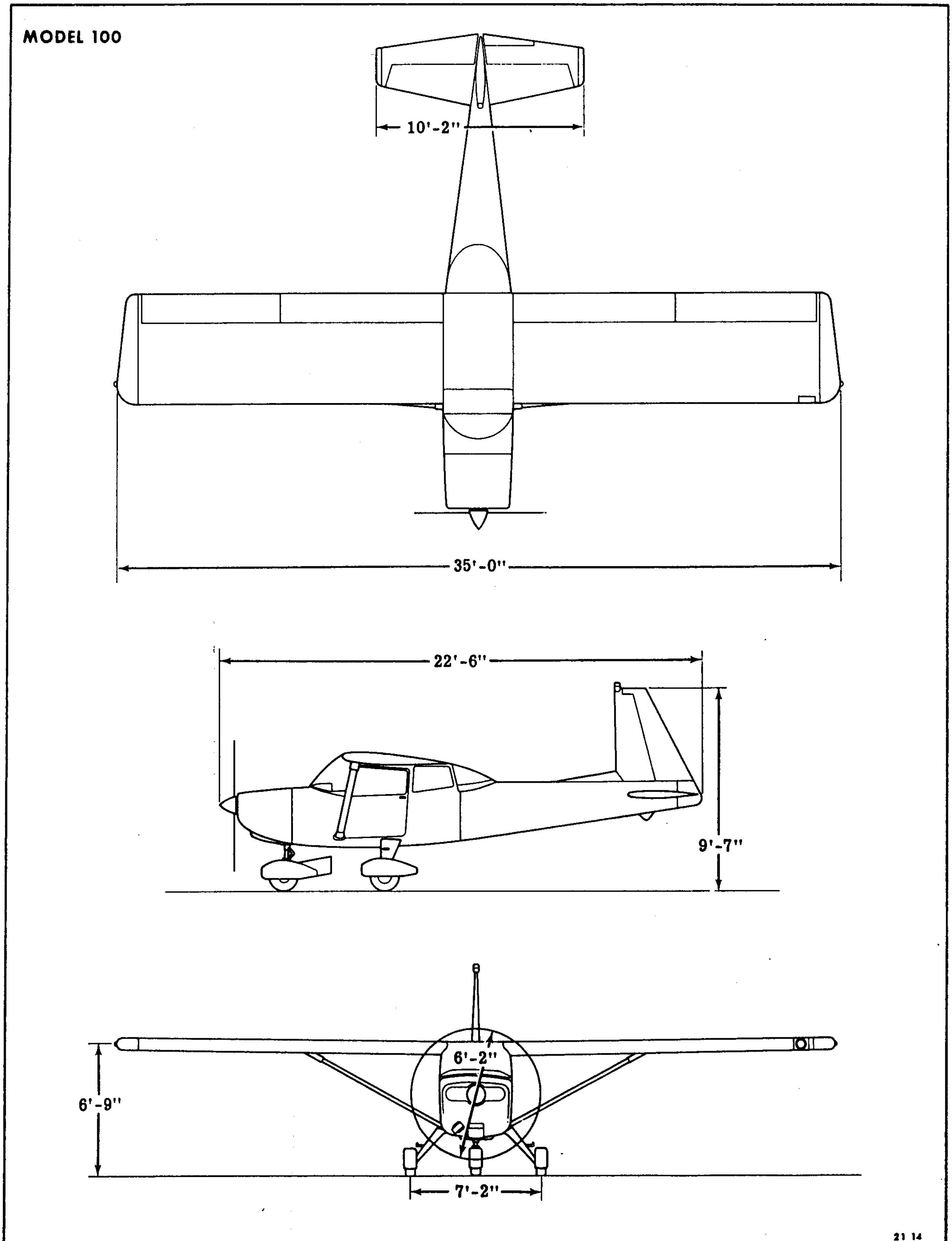


Figure 1-2. General Dimensions (Sheet 1 of 2)

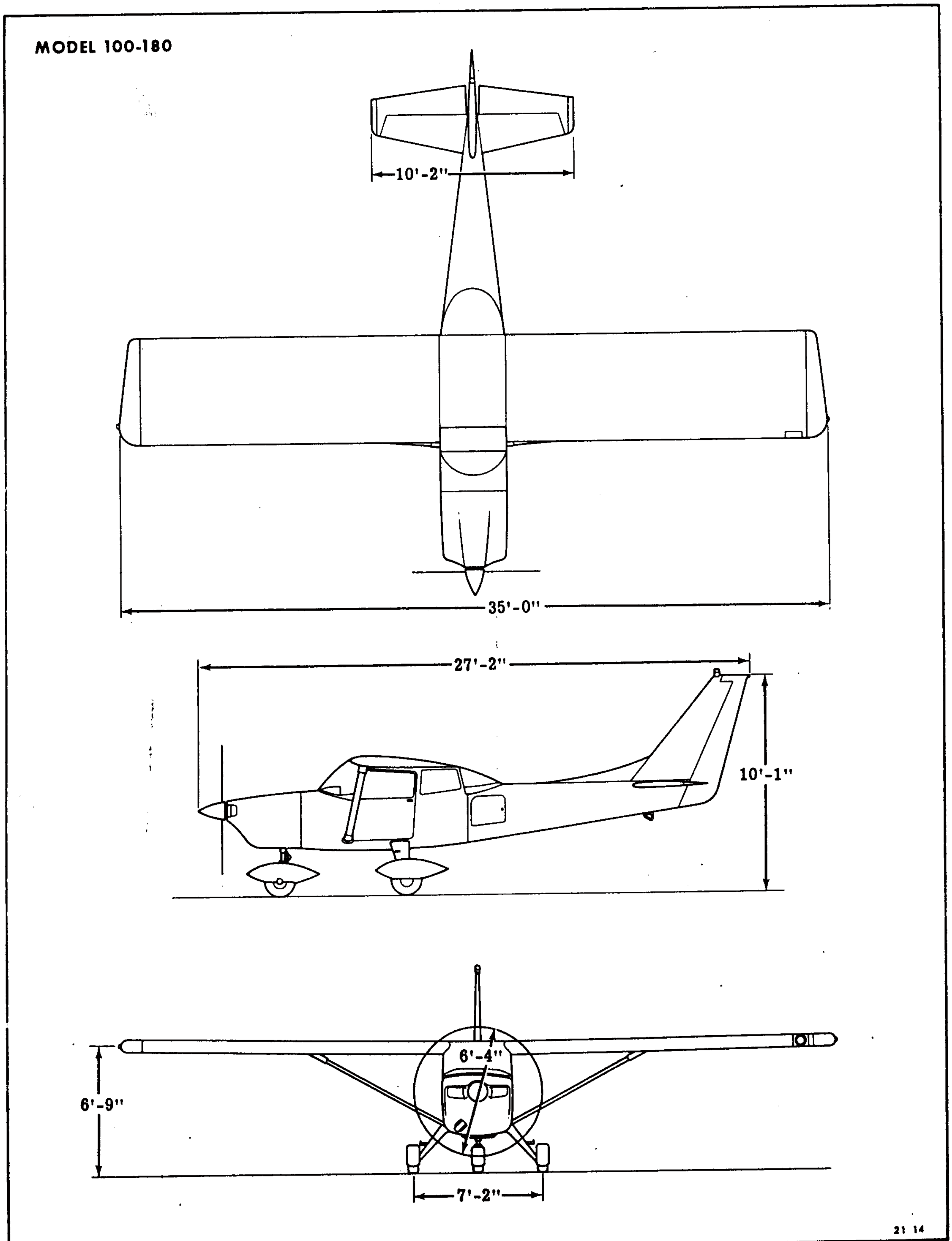


Figure 1-2. General Dimensions (Sheet 2 of 2)

POWER PLANT

The Model 100 Darter is equipped with a Lycoming O-320-A2B engine rated at 150 hp at 2700 rpm, and the Model 100-180 Lark is equipped with a Lycoming O-360-A2F engine rated at 180 hp at 2700 rpm. These engines have their own oil supply and distribution system; therefore, separate airframe-mounted oil tanks and lines are not necessary. The engine on the Model 100 Darter drives a Sensenich Model M74DM-60, fixed-pitch, all-metal propeller, and the engine on the Model 100-180 Lark drives a McCauley 1A170 CFA 7660 fixed-pitch, all-metal propeller. A propeller spinner is attached to the propeller hub to streamline the aircraft and to assure a smooth flow of cooling air into the engine air intake. Dual magnetos are installed on the engine. The left magneto fires the top spark plugs of the left cylinders and the bottom spark plugs of the right cylinders. The right magneto fires the lower plugs on the left cylinders and the top plugs on the right cylinders. This arrangement assures at least one spark plug in each cylinder will fire in event of a magneto failure. A 12-volt generator is installed at the forward lower right side of the engine on the Model 100 Darter serial number 051 thru 226, while a 12-volt, 40-amp alternator is installed at the forward lower right side of the engine on the Model 100 Darter serial number 227 and subsequent and on the Model 100-180 Lark. The starter is installed at the lower forward left side of the engine. The starter drive unit engages a gear which is integral with the aft propeller flange, to provide direct cranking of the engine.

LANDING GEAR, WHEELS, AND BRAKES

All landing gear wheels are equipped with 600 x 6, four-ply tires, which are normally inflated to 28 pounds. An air/oil landing gear strut assembly is used on the nose gear and fiberglass springs are employed on the main gear to absorb landing and taxiing shock loads. The main landing gear wheel inner section for the Model 100 Darter serial numbers 051 thru 120 consists of a brake drum that fits over the wheel brake shoes, which are bolted to a back plate welded to the landing gear strut. The main landing gear wheel inner section for the Model 100 Darter serial numbers 121 and subsequent and all Model 100-180 Lark contains Goodyear wheel brake assemblies, which consists of a brake disc that rotates between a brake anvil and a brake puck. A hydraulic fluid reservoir is installed on the left side of the engine firewall to supply hydraulic fluid to a brake master cylinder. The brake master cylinder for the Model 100 Darter is secured to the fuselage frame forward of the instrument panel, while a brake master cylinder for each wheel is installed forward of the brake pedal on the Model 100-180 Lark. The main landing gear wheel rotates on inner and outer roller bearings, which roll on bearing races that are press-fitted into the wheel body. The nose wheel is attached to the nose wheel fork with an axle shaft, spacers, caps, and an axle rod which passes through the axle shaft.

FLIGHT CONTROLS

The aircraft are equipped with a dual flight control system that utilizes conventional control columns, control wheels, and rudder pedals to operate the primary flight control surfaces. A controllable trim tab is installed on the inboard trailing edge of the left elevator. The trim tab is actuated by rotating the trim tab control wheel, which is located on the left centerline of the forward cabin within easy reach of the pilot, either forward or aft. The wing flaps are mechanically operated by a flap control handle, located between the two forward cabin seats. External control locks may be fabricated and installed on the control surfaces when the aircraft is moored. The forward seat belts may also be used to lock the control surfaces by looping the belts over the control wheels and holding the control wheel in a full aft position.

INSTRUMENTS

The instruments, electrical switches, circuit breakers, radio controls, engine controls, parking brake, and cabin heat controls are located in the instrument panel within easy view or reach of either occupant of the two front seats. Standard instruments include an altimeter, airspeed indicator, engine tachometer, oil pressure gage, oil temperature gage, cylinder head temperature gage, ammeter, and left and right fuel quantity indicators. Optional instruments include a turn and bank indicator, outside air temperature indicator, 8-day clock, directional gyro, and artificial horizon. The directional gyro and artificial horizon require installation of the optional vacuum system, which utilizes an engine-driven vacuum pump.

HEATING AND VENTILATING

The heating system provides warm or hot air from the engine exhaust heat muff assembly into the cabin during flight. Ambient air is directed to the exhaust heat muff assembly and then passes into the hot air duct leading to the cabin heat valve. When the heater control valve is opened the hot air enters the cabin heat outlet assembly. The outlet assembly serves as a plenum chamber and the hot air is forced out into the cabin area to fill the entire cabin with heated air. The amount of hot air entering the cabin is regulated by positioning the heater control. Ventilating air is directed into the cabin through ram air intakes on the inboard leading edge of each wing. This air is directed to separate overhead outlets or vents inside the cabin.

ELECTRICAL SYSTEM

The aircraft utilize a 12-volt dc electrical power system, which consists of an engine-mounted 12-volt generator on the Model 100 through serial number

225 and a 12-volt, 40-amp alternator on 226 and subsequent and on the Model 100-180 Lark. A 12-volt heavy duty 35-amp battery and voltage regulators to control overvoltage and undervoltage conditions are also installed in the electrical system. The lead-acid 12-volt battery provides the power required for engine starting and absorbs any minor surges in power source output.

SECTION II

GROUND HANDLING, SERVICING , AND LUBRICATION

GENERAL

Standard procedures for ground handling, servicing, airframe maintenance, and lubrication are included in this section. Adherence to these procedures on a scheduled basis can save many hours of maintenance and aircraft down time. When a system component requires service or maintenance other than that outlined in this Section, refer to the applicable section of this manual for complete information. Aircraft service schedule data for the Model 100-180 Lark are contained in Section III Servicing and General Maintenance, of the Model 100-180 Lark Owners Manual. Service schedules for the Model 100 Darter are contained in the individual paragraphs of Section III Servicing and General Maintenance, of the Model 100 Owners Manual.

GROUND HANDLING

TOWING

The nose landing gear is equipped with a tow bar attachment fitting. Movement of the aircraft on the ground should be accomplished with the tow-bar installed in the tow links at the base of the nose landing gear strut piston (see Figure 2-1). Tow the aircraft by hand only, as a towing vehicle will place excessive loads on the nose gear strut. Do not turn the nose wheel far enough to forcibly engage the rudder stops as possible damage may occur to the nose gear and steering system. Towing assistance may be provided by pushing on the wing strut at a point near its attachment to the fuselage. When necessary to back the aircraft, use caution to prevent the aft fuselage from dropping down on the tail skid.

TOWING PRECAUTIONS

a. Never push, pull, or lift aircraft by use of control surfaces or propeller.
b. Never use nose gear strut body or tail skid as an attach point for towing.
c. Never place unnecessary strain on aircraft when towing, and avoid jerky motions.
d. Do not use ropes attached to main gear for towing aircraft backwards through mud or snow.

MOORING

The aircraft should be hangared when it is not in use. However, it can be protected from strong or gusty winds by mooring (see Figure 2-2) with a 3/8-inch nylon or manila rope. If manila rope is used for mooring, allow enough slack to compensate for contraction of the rope caused by moisture accumulation. To moore the aircraft proceed as follows:

a. Head aircraft into wind.
b. Place chocks on forward and aft sides of each wheel and tie chocks together.
c. Place rope around nose gear strut, using a halfhitch, and allow ends of rope to extend an equal distance on each side of wheel. Secure rope to tie-down rings or stakes tight enough that nose gear will remain in contact with ground.
d. Place a rope around strut above step and attach to a tie-down ring or stake. The tie-down point should be far enough away from strut to permit attachment of rope at a 45° angle toward nose of aircraft.
e. Attach a rope to tie-down fitting on wing strut attach point, and lash end of rope to a tie-down point that will permit attachment of rope at a 45° angle to the wing surface.
f. Attach a rope to tail skid and secure to a tie-down aft of tail cone.

External control locks should be installed on the control surfaces when the aircraft is moored. The forward seat belts can also be used to lock control surfaces by looping the belts over the control wheels and holding wheel in full aft position. If external control locks are not used, lower wing flaps to 30 degrees. This will prevent wind from buffeting the spring-loaded flap system.

JACKING

The aircraft may be rotated on the main landing gear when it is necessary to change a nose wheel tire or to perform other minor maintenance on the nose wheel. When it is necessary to remove the nose gear strut, the aircraft should be supported on a cradle positioned

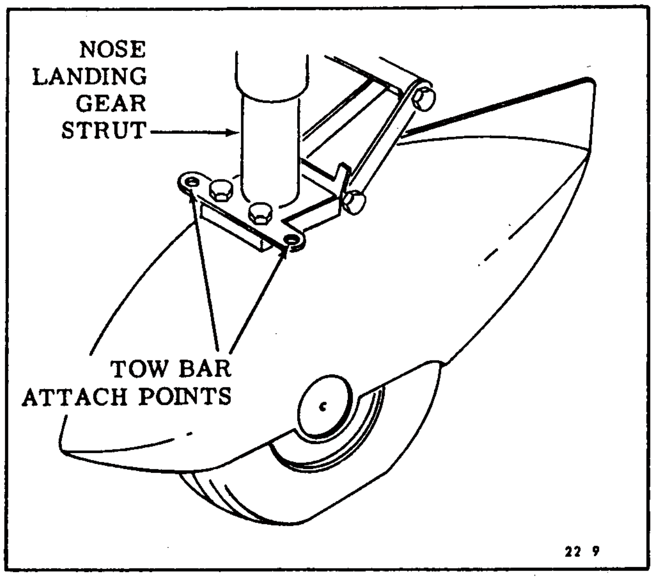


Figure 2-1. Towing

directly below the engine firewall at the forward fuselage bulkhead. To jack the main landing gear (see Figure 2-3) insert a steel bar in the landing gear axle, on the inboard side of the wheel, to serve as a jack point. A regular commerical hydraulic or scissors jack may be used for jacking the aircraft. A chock should be positioned under the opposite tire.

CLEANING

EXTERIOR AND INTERIOR. The exterior of the aircraft has been painted with a high quality synthetic paint that will protect the metal skin and give years of lasting beauty if it is properly cared for. Climate and operating conditions will determine the extent and frequency of cleaning required. The aircraft should be frequently washed when operating near salt water or in alkaline dust, as the salt-laden moisture in the air and the alkaline dust will cause corrosion of the metal surfaces. Wash the aircraft with a mild soap and water solution and rinse thoroughly with clean water. The exterior painted surface should be waxed and polished; however, do not wax the surface until the paint has been allowed to cure for at least 90 days. A window and windshield cleaner should be used for cleaning the cabin windows and windshield. The cleaner, which can be supplied by your Aero Commander dealer, should be especially made for cleaning plastic surfaces. If windshield cleaner is not available, wash the surfaces with clear water, using the hand to dislodge any dirt. Dry the surface with a clean moist chamois. Use care not to scratch the surface of the plastic. Clean the interior of the aircraft frequently with a vacuum cleaner. Use a good grade rug and upholstery cleaner to remove spots and stains from rugs and fabric-covered surfaces. The paneling may be cleaned with a solution of mild soap and water.

ENGINE COMPARTMENT. The engine compartment should be kept clean at all times to: (1) eliminate the obvious fire hazard; (2) assure proper cooling by removing dirt from the cylinder fins, baffles, and oil radiator, which will greatly inhibit the cooling principles designed into the engine; and (3) to make minor discrepancies more apparent. The engine may be washed with one of the many solvent/degreaser solutions available. It should be immediately thoroughly dried before being started. Care should be taken when washing the engine to protect the electrical system and accessories in the engine compartment.

CAUTION

Do not allow cleaning solvents to enter magnetos, starter, generator or alternator, voltage regulator, etc., as the solvents will create electrical shorts and possibly cause deterioration of insulation and sealing gaskets on the accessories.

SERVICING

FUEL SYSTEM

The aircraft fuel supply is contained in two welded and baffled metal tank assemblies, one in the inboard side of each wing. Each tank has a total capacity of 22 gallons; however, only 20 gallons of fuel in each tank is considered useable fuel. A fuel filler cap is located on the top inboard end of each wing (see Figure 2-4). The fuel tanks should be serviced immediately after each flight to eliminate condensation of water in the fuel tanks and lines. The recommended fuel for the Model 100 Darter is 80/87 octane aviation grade fuel and for the Model 100-180 Lark it is 100 octane minimum aviation grade fuel. If the recommended grade fuel is not available, the next higher grade fuel will be a satisfactory substitute. Do not use automobile gasoline or a fuel of a lower octane rating than the octane ratings recommended.

REFUELING. Refuel aircraft with fueling facilities that contain filters for removing moisture content from the fuel. If fueling facilities are not available, filter fuel through a good grade chamois. Fuel tanks should be serviced after the last flight of the day to allow maximum time for entrained moisture to reach the fuel drains prior to next flight.

WARNING

Ground aircraft and fuel servicing equipment to aircraft. Smoking on or around aircraft during refueling operations is prohibited. Fire protection equipment must be immediately available.

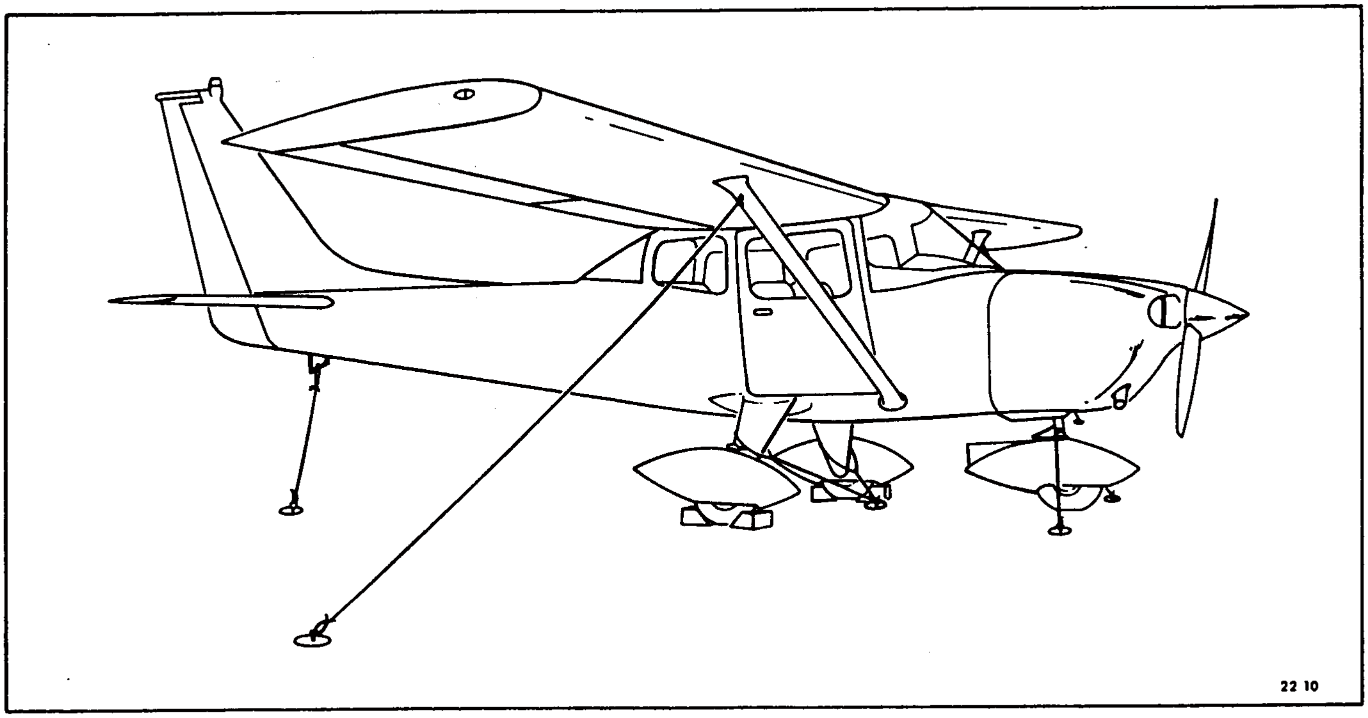


Figure 2-2. Mooring

a. Remove fuel filler cap located on top surface of each wing and fill tanks until fuel level rises to filler neck.

CAUTION

Do not drag refueling hoses over leading edge or other surfaces of wing. This will damage or scuff the wing surface.

b. Replace fuel filler cap and check it for security.
c. Wash spilled fuel from wing surface with clean water.

FUEL DRAIN. A quick drain is provided in the bottom of the fuel filter and drain, which is located on the lower left side of the engine firewall. The fuel drain is readily accessible through the lower opening of the engine cowling and should be drained prior to first flight of the day. On Model 100-180 Lark serial number 5101 and subsequent a fuel drain is also installed on the lower aft inboard end of each tank. This drain may be used for draining fuel from the tanks.

FUEL FILTERS. The fuel filter and drain, which is located on the lower left side of the engine firewall, contains a mesh disc fuel screen (see Figure 2-5). This screen should be removed and cleaned at each 25-hour inspection. An additional fuel filter is installed in the carburetor fuel inlet fitting. This filter should be removed and cleaned at each 100-hour inspection. On the Model 100-180 a fuel filter is also installed in the lower end of the electric fuel pump. This filter should also be removed and cleaned at each 100-hour inspection.

POWER PLANT

A Lycoming O-320 series engine with Sensenich Model M74DM-60 metal fixed-pitch propeller powers the Model 100 Darter, while a Lycoming O-360 series engine with a McCauley Model 1A170 CFA 7660 metal fixed-pitch propeller powers the Model 100-180 Lark. Each engine has its own oil supply and distribution;

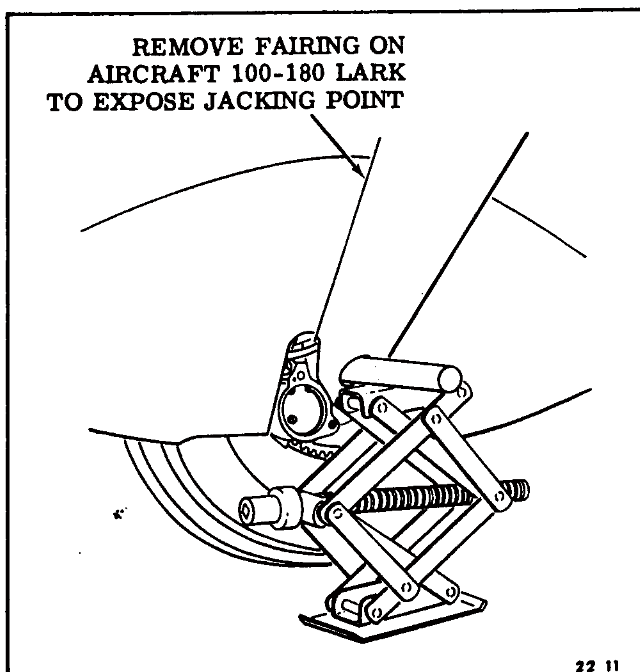
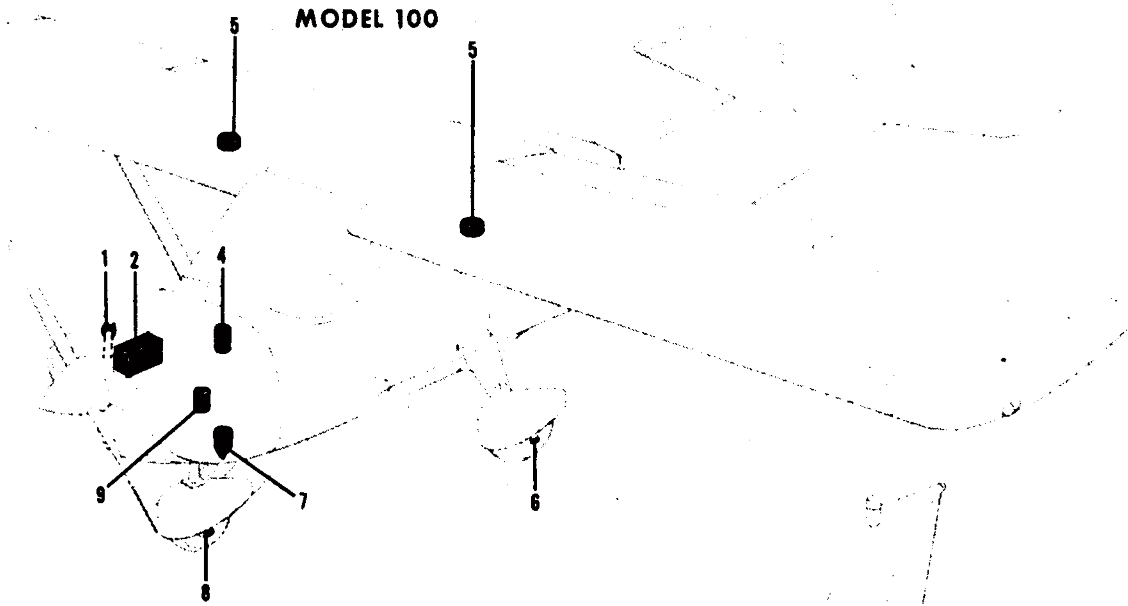
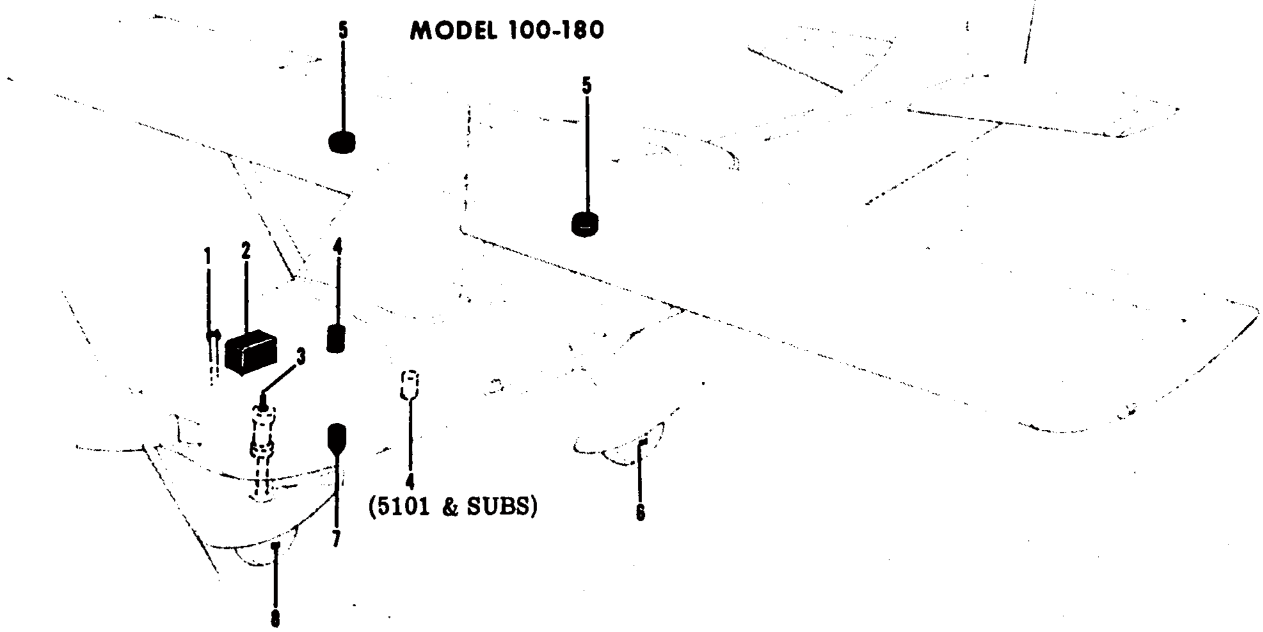


Figure 2-3. Jacking





1. OIL FILLER CAP
2. BATTERY
3. NOSE GEAR STRUT FILLER VALVE
4. HYDRAULIC BRAKE RESERVOIR
5. FUEL TANK FILLER CAP
6. MAIN TIRE INFLATION VALVE
7. FUEL FILTER AND DRAIN
8. NOSE TIRE INFLATION VALVE
9. AIR TANK

22 12

Figure 2-4. Servicing Chart

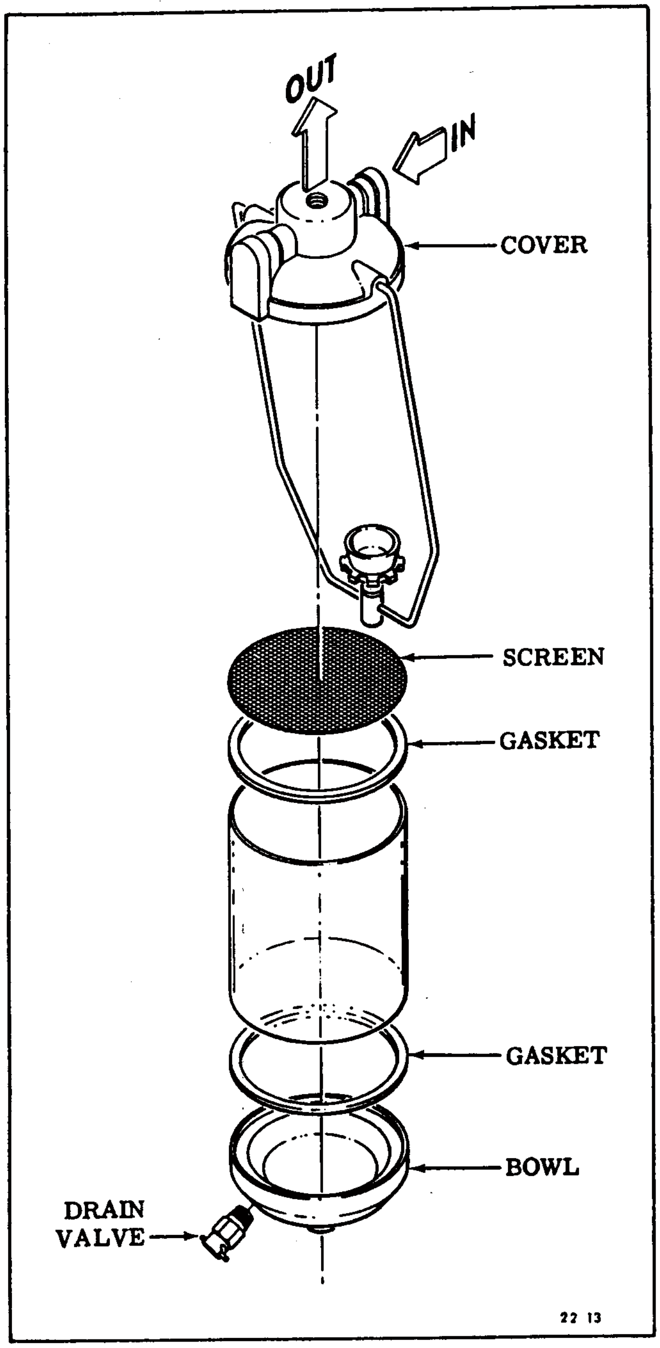


Figure 2-5. Fuel Filter and Drain

therefore a separate airframe-mounted oil tank is not necessary. The engine oil supply and distribution system is integral with the basic engine, except for utilization of an independent oil cooler which is attached to lower side of the front engine baffle.

OIL. The engine oil level should be checked prior to each flight and changed at least every 50 hours flying time. Oil should be added if the oil level is below the ADD line (minimum for flight). Oil of the same grade and weight should be added to the FULL mark on the dipstick if sustained flight of the aircraft is expected. Oil that becomes dirty and contains sludge deposits should be changed regardless of time since last oil change. Capacity of the oil sump is 8 quarts. Recommended grades of oil to be used are as follows: SAE 50 when air temperature is above 60°F; SAE 40 when air temperature is 30 to 90°F; SAE 30 when air temperature is 0 - 70°F; and SAE 20 when air temperature is below 10°F. Reference should be made to Lycoming Service Instructions No. 1014C "Lubricating Oil Recommendations" for determining types and grade of oil to use when adding or changing oil. The engine oil screen should be removed and washed in solvent and allowed to dry each time engine oil is changed.

INDUCTION AIR FILTER. The induction air or carburetor air filter removes dust, which is the primary cause of premature engine wear, that has entered the engine intake system. The filter should be checked at each preflight inspection and removed and serviced every 25 hours or as required (see Figure 2-6). Operation during dusty conditions will require that the filter be serviced more often, perhaps daily. Extra filters should be available for installation, so that time will not be lost waiting for oil to drain from a serviced filter. The filter is removed and serviced as follows:

a. Model 100-180: Remove top engine cowling, remove top plate from induction air box on left aft side of engine, and lift filter from air box.
Model 100: Remove airlock studs from induction air filter box on lower side of engine and remove filter from air box.
b. Wash filter in P-S-661 solvent or equivalent.
c. Drain filter until dry then dip filter in engine oil and allow excess oil to drain from filter.
d. Clean induction air box then replace filter with airflow arrow pointing in the correct direction and install the air box cover.
e. On Model 100-180: Install top engine cowling.

PROPELLER. The propeller should be cleaned frequently with a shop towel dampened in carbon tetrachloride, and then a thin coat of engine oil applied to the blades to prevent corrosion. Sharp nicks should be smoothed out with a quarter-round file and then polished with crocus cloth.

BATTERY

A 12-volt battery is installed in a frame support attached to the right forward side of the engine firewall. The battery area should be kept clean at all times to prevent an accumulation of foreign material which would absorb electrolyte. Battery cell filler caps must be tight at all times except when battery is being recharged. Terminal posts should be kept clean and lubricated to prevent corrosion. Inspect battery for electrolyte level at least every 50 hours. Distilled water should be added to bring electrolyte up to proper level. Use a solution of baking soda and water to neutralize electrolyte that may have spilled from battery, or corrosion that has formed around battery, then flush area with clear water.

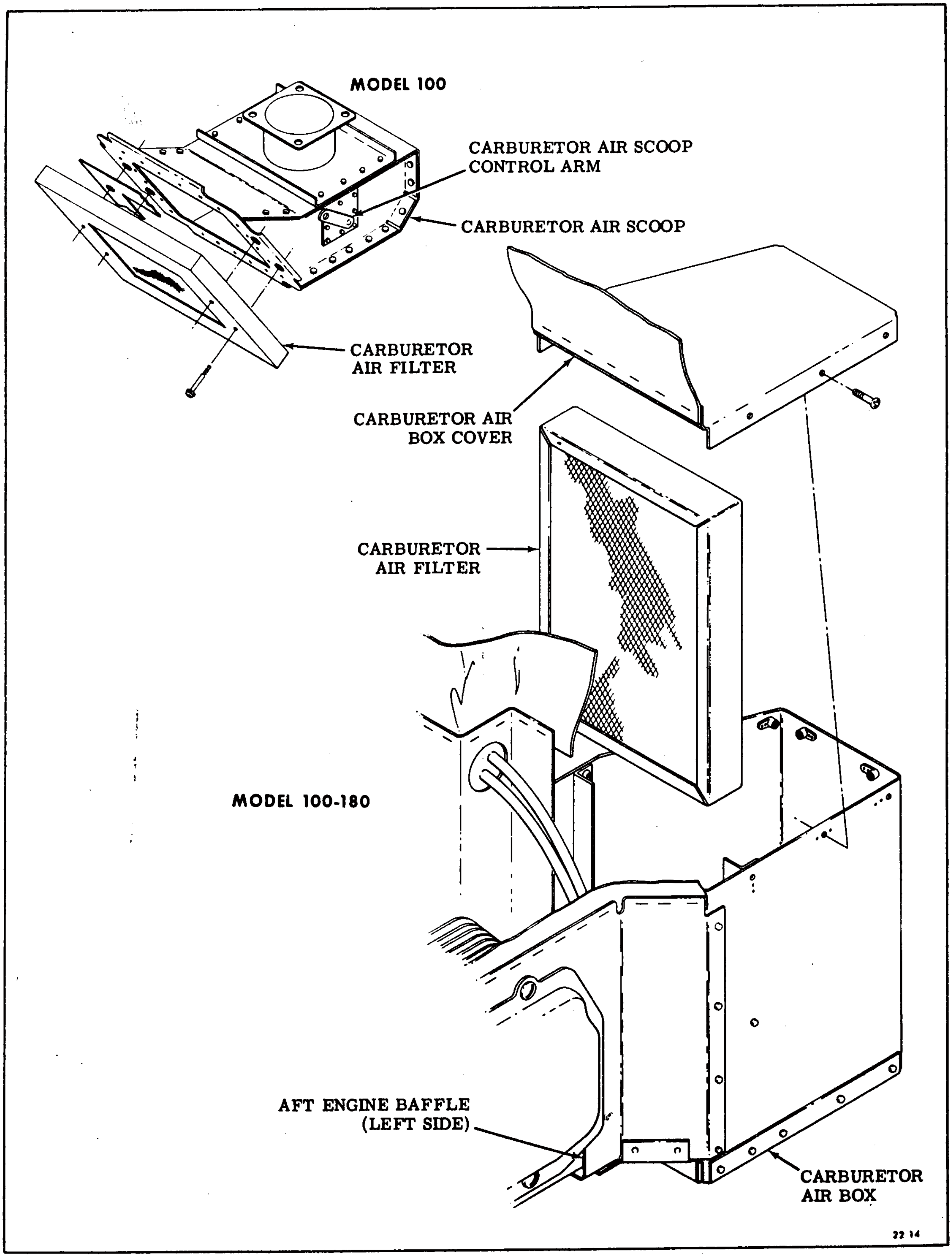


Figure 2-6. Carburetor Air Filter

HYDRAULIC BRAKE SYSTEM

The hydraulic fluid reservoir is installed on the forward left side of the engine firewall and supplies hydraulic fluid to the brake master cylinder. The reservoir is serviced with Mil-H-5606 hydraulic fluid and should be filled to within 0.5-inch below the lip of the filler port. However, before removing the hydraulic fluid reservoir filler cap, wipe filler neck and cap with a shop towel to remove dirt that could fall into reservoir. Never allow reservoir to remain uncapped longer than necessary. If reservoir is low and hydraulic fluid is not immediately available reinstall filler cap while fluid is being obtained.

TIRES, NOSE STRUT, AND SHIMMY DAMPER

TIRES. Maximum service from the landing gear tires may be obtained only through proper tire inflation and tire maintenance. The main landing gear tires as well as the nose landing gear tire should be inflated to a pressure of 28 psi. The tires should be periodically inspected for breaks, cuts, flat spots, exposed chord, and proper inflation. Replace tires if there is a question of reliability. Tire pressure will change with changes in temperature, therefore, the pressure should be checked outside of the hangar at the temperature the aircraft will be operating in. Tires should be cleaned with soap and water. If aircraft is out of service, the tires should be rotated every seven days.

NOSE STRUT. Model 100 Darter serial number 051 thru 250. The principle of operation of the nose gear oleo utilizes a conventional air/oil shock absorber action with an internal spring to absorb taxi loads. The air tank is charged to 40 psi. To service the nose gear strut, proceed as follows:

a. Weight tail of aircraft until nose gear is fully extended and tire clears the ground.
b. Open air filler cap on top of air tank and bleed air pressure from tank.
c. Remove air line and elbow from air pressure port at top of strut.
d. Fill strut to top of strut with Mil-H-5606 hydraulic fluid.
e. Install elbow in top of strut and install air line on elbow.
f. Close air filler cap.
g. Lower nose of aircraft until nose gear tire is touching ground.
h. Charge air tank to 40 psi with dry filtered air.
i. Check air filler valve and cap for possible leaks.

Model 100 Darter and Model 100-180 Lark serial number 251 and subsequent. The principle of operation of the nose gear strut utilizes the conventional air/oil shock absorber action for absorbing landing and taxi loads. A hole or orifice in the top of the piston controls the flow of oil from the cylinder assembly through the piston, allowing the piston to move through the oil with a resistance to the shock loads. As the strut starts to extend the oil above the piston is forced back into the piston through the hole in the top of the piston. This slows the movement of the piston extension to a minimum to control strut rebound. To service the nose gear strut, proceed as follows:

a. Open high pressure air valve on top of strut and bleed air from strut.
b. Remove high pressure air valve body from top of strut.
c. Completely compress strut.
d. Fill strut to overflowing with Mil-H-5606 hydraulic fluid.
e. Install high pressure air valve body and charge strut with compressed air or nitrogen until strut extends 2.75 inches with aircraft empty. If aircraft is at full gross weight strut should extend 2.0 inches.

SHIMMY DAMPER. The shimmy damper is installed on a bracket welded to a diagonal member of the engine mount. A clevis on the inboard end of the shimmy damper piston rod is attached to an arm on top of the nose gear strut. On Model 100 Darter serial number 026 thru 088 the shimmy damper should be checked at each 100-hour inspection, or at any time shimmy is detected in the nose wheel. Remove the filler plug on top of the shimmy damper and fill with SAE 40 engine oil. Reinstall and safety wire the filler plug. On Model 100 Darter and 100-180 Lark serial number 089 and subsequent, the shimmy damper is a sealed unit; therefore if shimmy is detected in the nose wheel, remove and replace the shimmy damper.

LUBRICATION

Lubrication requirements are shown in the Lubrication Chart (see Figure 2-7). Before lubricating zerk fittings, wipe dirt from fittings with a shop towel, then lubricate fittings and wipe off excess grease. Lubricate all hinges with a squirt can or a brush dipped lightly in oil. Wipe excess oil from surfaces to prevent accumulation of dirt and grit.

STORAGE

The aircraft is constructed of corrosion resistant alclad aluminum; however aluminum is subject to oxidation and must be inspected periodically for signs of corrosion. The first indication of corrosion is the formation of white deposits or spots on unpainted surfaces. Painted surfaces will blister or become discolored. The aircraft should be stored in a dry hangar for best preservation during long term storage.

28 DAYS OR LESS

Special preservation measures are not required for airframe and airframe components when the aircraft is to be stored for 28 days or less. However, the

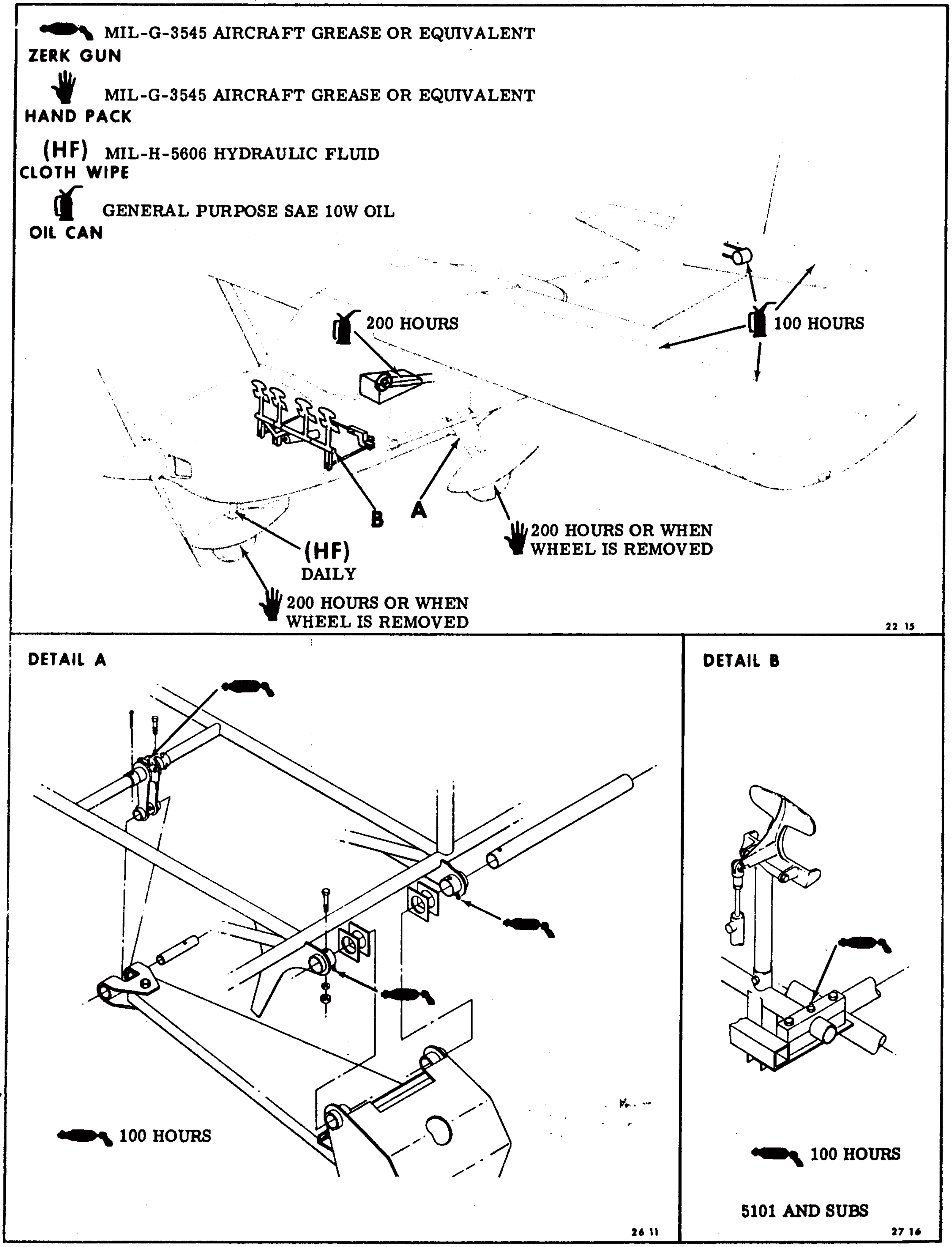


Figure 2-7. Lubrication Chart

GENERAL TUBE AND HOSE FITTINGS							
STD DASH NO'S	O. D. OF TUBE	ALUMINUM ALLOY TUBING (5052 or 2024)		STEEL TUBING		HOSE END FITTINGS & ASSEMBLIES	
		MIN	MAX.	MIN.	MAX.	MIN.	MAX.
-2	1/8	10	16	-	-	-	-
-3	3/16	-	-	90	100	70	100
-4	1/4	40	65	135	150	70	120
-5	5/16	60	80	180	200	85	180
-6	3/8	75	125	270	300	100	250
-8	1/2	150	250	450	500	210	420
-10	5/8	200	350	650	700	300	480
-12	3/4	300	500	900	1000	500	850
-16	1	500	700	1200	1400	700	1150
-20	1-1/4	600	900	-	-	-	-
-24	1-1/2	600	900	-	-	-	-

NOTE: All torque figures are in inch-pounds.

STRUCTURAL NUTS			
THREAD SIZE	AN TYPE BOLTS	TORQUE IN INCH-POUNDS Tension Type Nuts MS20365 & AN 310	Shear Type Nuts MS20364 & AN 320
8-32	AN2	12-15	7-9
10-32	AN3	20-25	12-15
1/4-28	AN4	50-70	30-40
5/16-24	AN5	100-140	60-85
3/8-24	AN6	160-190	95-110
7/16-20	AN7	450-500	270-300
1/2-20	AN8	480-690	-
9/16-18	AN9	800-1000	-

Figure 2-8. Torque Values

following procedures should be accomplished before aircraft is placed in storage.

a. Service fuel, oil, and hydraulic brake systems.
b. Place fuel tank selector to OFF position.
c. Place all electrical switches to OFF position.
d. Install pitot covers and gust locks, and moor aircraft securely in a level position if stored in an open area.
e. Clean and rotate tires regularly.
f. Remove and store battery during cold weather.
g. Rotate propeller through several revolutions once every seven days.
h. Start engine and run up to operating temperature every 14 days.

28 DAYS OR MORE

When the aircraft is to be stored for periods greater than 28 days, perform the following preservation and storage procedures:

a. Clean and polish aircraft.
b. Operate engine until oil temperature reaches normal. Shutdown engine, completely drain engine oil sump, and install drain plugs.
c. Fill sump with eight quarts of preservative oil (Socony's Avrex 901, or equivalent) which has been preheated to 225°F.
d. Operate engine to a maximum of 1800 rpm for four minutes. Closely observe cylinder head temperature. Temperature shall not exceed 232°C.
e. Stop engine and drain preservative oil from engine sump. Drained oil may be reused for engine cylinder preservation.

CAUTION

Corrosion preventative properties of this lubricant are harmful to paint, and should be wiped from painted surfaces immediately.

f. Disconnect ignition harness and remove all spark plugs. Spray each cylinder through spark plug holes with two ounces of preservative oil while engine is being turned five full revolutions for each cylinder.

NOTE

Preheat preservative oil to 200°F to 220°F for all spraying operations.

g. Spray each cylinder through spark plug holes with preservative oil without rotating engine and install cylinder dehydrator plugs in spark plug holes.
h. Cover all engine and accessory vents and openings with a vapor-proof covering material.
i. Attach a warning placard, "ENGINE LUBRICATING OIL DRAINED" on throttle control. Attach a placard to propeller "ENGINE IN STORAGE - DO NOT ROTATE PROPELLER".
j. Remove battery and store in a cool dry area.
k. Clean oil from engine area and tires.

RETURN AIRCRAFT TO SERVICE

If proper procedures have been followed during storage, very little preparation will be required to return aircraft to service. Install fully charged battery and perform a thorough inspection and preflight check. If engine has been preserved for storage, perform the following:

a. Remove engine oil drain plug and allow engine to completely drain.
b. Remove dehydrator plugs from spark plug holes and rotate propeller by hand to remove preservative oil from cylinders.
c. Install spark plugs and ignition harness.
d. Remove plugs and covering from all engine vents and openings.
e. Install oil drain plug and fill crankcase with approved quantity and weight engine oil.
f. Remove warning placards from propeller and throttle control.

SECTION III

FUSELAGE AND AIRFRAME

FUSELAGE

Structural framework of the forward fuselage consists of welded steel-alloy tubing covered with aluminum skin to provide for a rigid cabin structure. This design also provides the necessary strength for supporting the wings, aft fuselage, and engine. The structural framework of the aft fuselage consists of standard frame bulkheads and stringers covered with aluminum skin to give the aft fuselage the flexibility and strength required. The forward tubular structure of the forward fuselage supports the engine and nose landing gear. Welding repairs to the forward fuselage structure shall be made in accordance with the Federal Aviation Agency Advisory Circular AC No: 43.13-1, Chapter 2, Section 2. Structural repair of the fuselage, including the aft fuselage shall be made in accordance with Chapter 2, Section 3 of AC No: 43.13-1. Windshield and window repairs shall be made in accordance with Chapter 9, Section 1 of AC No: 43.13-1.

NOSE SECTION

ENGINE MOUNT. The engine mount is fabricated from tubular steel and attaches to four mounting bosses on the forward fuselage frame. See Figure 4-2. The nose landing gear outer strut body is permanently welded into the engine mounting structure. The engine is attached to the engine mount at four positions; two of which are provided on the upper aft part of the engine accessory drive housing and two on the lower aft section of the engine. Vibration isolators are used at the four engine attach points. Structural repairs to the engine mount shall be made in accordance with AC No: 43.13-1. If damage to the engine mount cannot be repaired in accordance with the referenced advisory circular, the mount shall be replaced.

ENGINE COWLING AND ENGINE CYLINDER BAFFLES. Engine cowling, cowling support frames, and engine cylinder baffles are designed to direct the propeller air blast and inflight ram air into the air intake and around the engine cylinder cooling fins to cool the engine. The cowling consists of an upper and lower fiberglass section with stiffeners and other supports molded into the fiberglass cowling. Repair to the fiberglass cowling shall be made in accordance with the procedure established in AC No: 43.13-1.

FORWARD FUSELAGE

The forward fuselage consists of the structure from the engine firewall aft to the aft cabin bulkhead (forward frame of the aft fuselage). This area includes the windshield and windows, pilots and passenger seats, cabin doors, and cabin upholstery.

WINDSHIELD AND WINDOWS. The windshield and windows are made from plastic. Plastics lack the hardness of glass, therefore, care must be exercised while servicing the aircraft to prevent scratching or otherwise damaging the surfaces. The plastic shall be cleaned by washing with water and mild soap, using a clean and soft grit-free cloth, sponge, or bare hands.

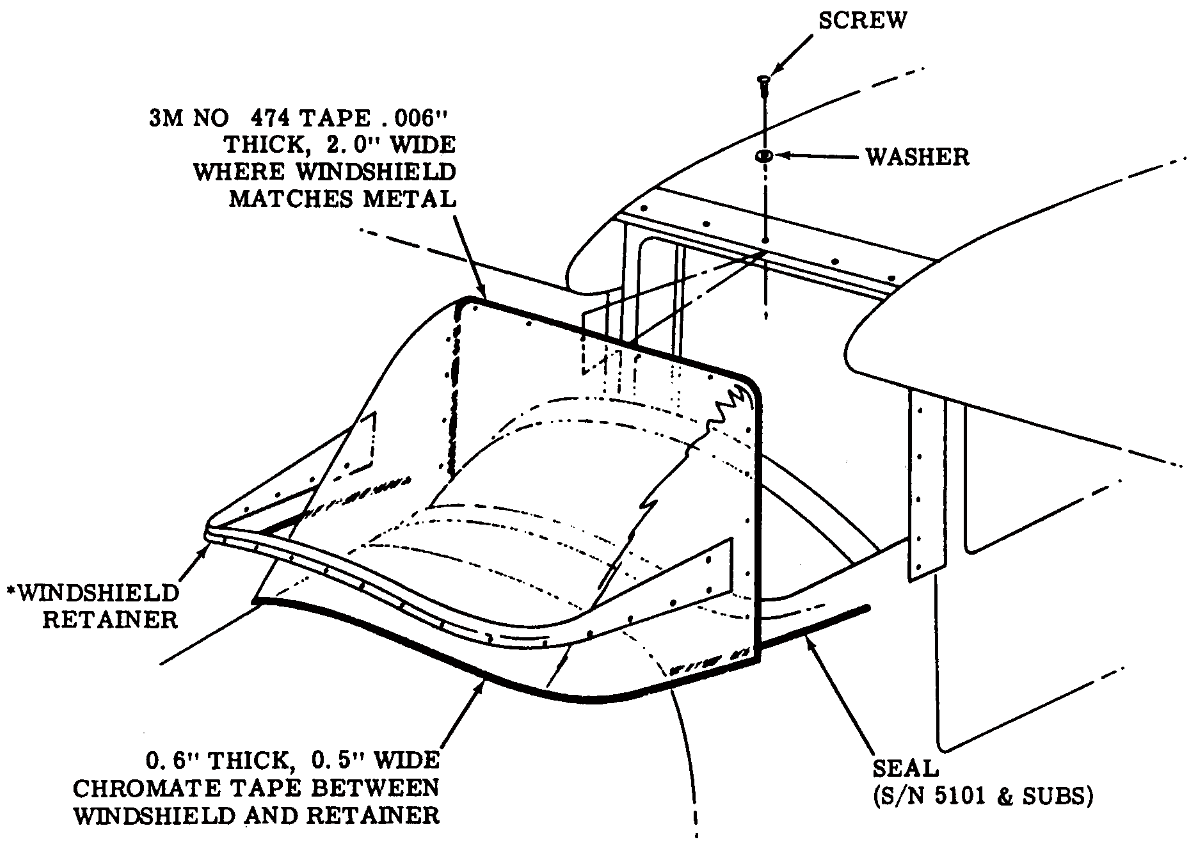
CAUTION

Do not use gasoline, alcohol, benzene, acetone, carbon tetrachloride, fire extinguishing or deicer thinners, or window cleaning sprays, as they will soften the plastic and cause crazing.

Rubbing the windshield or windows with a dry cloth will possibly cause scratches and build up electrostatic charges that attract dust particles to the plastic surfaces. If scratching is visible after removing dirt or grease, finish the plastic with a good grade of commercial wax. Apply the wax in a thin even coat and bring to a high polish by rubbing lightly with a soft cloth. Do not hand polish or buff the surface until the surface is clean. A soft cotton or flannel buffing wheel is recommended. Minor scratches may be removed by rubbing the affected area vigorously with a soft clean cloth dampened with a mixture of turpentine and chalk, or an automobile cleanser applied with a damp cloth. Remove the cleanser and polish with a soft dry cloth. Do not buff or polish area too long in one spot as heat generated may soften the surface. This will produce visual distortion, which is to be guarded against.

Repair of Windshield and Windows

Windshields and windows that are extensively damaged should be replaced rather than repaired, since a carefully patched area will not be as acceptable as a new



NOTE

INSTALL KYPALON CHAULK NO 35034 (CHEMICAL COATING & ENGINEERING CO.) ON FAYING SURFACE OF WINDSHIELD TO SEAL OUTSIDE SURFACE OF WINDSHIELD

*WINDSHIELD RETAINER INSTALLED WITH CR163 RIVETS ON AIRCRAFT THRU SERIAL NUMBER 5100. WINDSHIELD RETAINER INSTALLED WITH AN526-832R8 SCREW, AN960-8 WASHER, AND MS20365-1032 NUT ON AIRCRAFT SERIAL NUMBER 5101 AND SUBSEQUENT.

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Figure 3-1. Windshield Installation

structure, either optically or structurally. Surface patches or plug patches may be made to the windshields or windows. These patches shall be made in accordance with FAA Advisory Circular AC No: 43.13-1, Section 9, Plastic Windshields and Enclosures.

WINDSHIELD REMOVAL AND INSTALLATION. To remove the forward or rear windshield, (see Figure 3-1) proceed as follows:

a. Remove screws retaining windshield at top of wing.
b. Remove screws from windshield side panel retainers.
c. Remove screws from wing fuselage fairings and remove fairings.
d. Drill out rivets retaining lower forward windshield retainer and carefully remove retainer.

NOTE

On Model 100-180 Lark serial numbers 5101 and subsequent screws are used to install the lower forward windshield retainer.

e. On Model 100-180 Lark, remove the sunvisor support and sunvisor bracket assembly from the forward windshield.
f. Pull windshield straight forward, out of the side panel retainers.

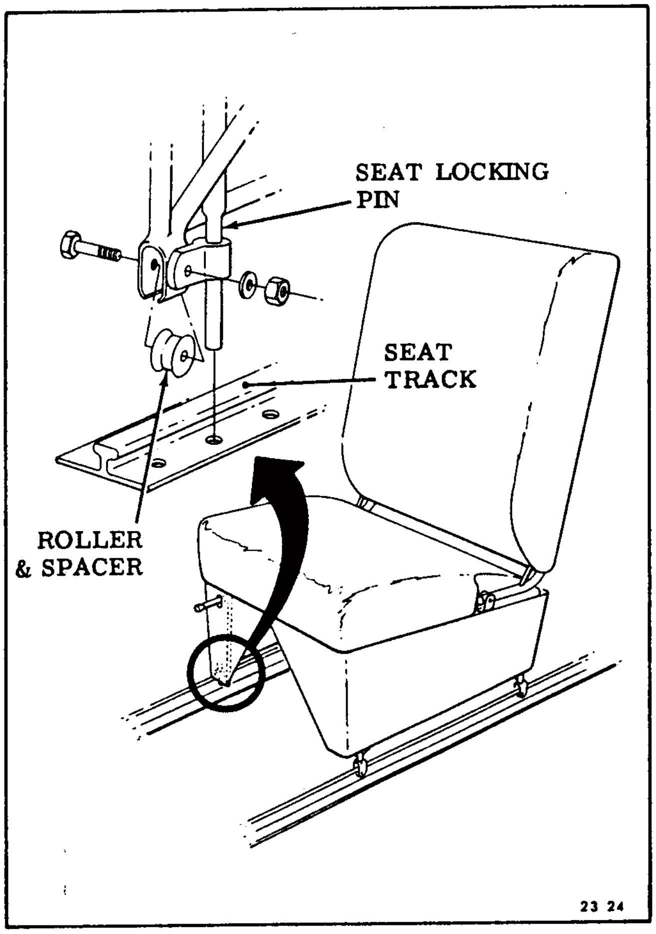


Figure 3-2. Pilots Seat Installation

To install the windshield, proceed as follows:

a. Apply Russtite 590. 5 or equivalent sealing tape to all edges of windshield to seal windshield.
b. Lift windshield and fit into place in side panel retainers.
c. Check fit of a new windshield and carefully grind plastic to fit. Use care not to overstress the windshield and cause it to crack.
d. Apply a fillet of Dow Corning Aviation or equivalent adhesive to both interior and exterior edges of windshield.
e. Install lower forward windshield retainer with CH162 cherry rivets.
f. Install screws that retain windshield at top of wing.
g. Install screws in windshield side panel retainers.
h. On Model 100-180 Lark, install sunvisor support and bracket assembly on forward windshield.

WINDOW REMOVAL AND INSTALLATION. To remove a window, proceed as follows:

a. Remove screws holding molding and remove molding from window.
c. Apply a slight amount of pressure on outside of plastic window and press inward.

To install a window, proceed as follows:

a. Apply a fillet of Dow Corning Aviation or equivalent adhesive to interior and exterior edges of window and fit window into frame.
b. Install window molding over window.
c. Install interior molding retainer.

CABIN DOOR REMOVAL AND INSTALLATION. The cabin doors are removed by removing the hinge with the door still attached. The hinge may be removed by removing the screws which hold the hinge. These screws are forward of each door and are held in place with nutplates. When removing these screws, the door shall be supported until all screws are removed. The hinge may then be pulled aft, releasing it from the forward door facing. When installing the door the hinge should be inserted under the skin on the forward door facing prior to inserting the screws holding the door hinge. The door hinge has slotted screw holes for adjusting the position of the door prior to tightening the screws holding the hinge. The weatherstrip around the door should be replaced as necessary, to maintain a good seal between the door and door frame.

PILOTS SEATS. Individual fully upholstered bucket seats are installed for the pilot and copilot. These seats are fully adjustable in the fore and aft position for the comfort of the pilots. The seats set on four rollers which are attached to seat tracks and held in position by pins that slide into holes in the seat track, locking the seat in desired positions (see Figure 3-2). The seats may be removed from the track by removing the stop screw from the aft end of the track and sliding the seat off the aft end of track. The seat track should be lubricated with parafin or wax to make positioning of the seats easier.

REAR SEAT. A fully upholstered seat is installed for two passengers aft of the pilots seats. Framework for the seat is made from tubular steel and covered with foam rubber and a fabric covering. The seat back will fold forward allowing the area immediately aft of the seat to be utilized for baggage. The seat, which is mounted to brackets on the floor, may be removed by first removing the attaching bolts for the seat back and removing the seat back, then removing the attaching bolts for the seat and removing the seat. When removing the seat back and seat, care should be exercised not to damage the side panels and aircraft upholstery.

UPHOLSTERY. The cabin and baggage compartment are completely upholstered and covered with Royalite, fabric, and carpets. Fiberglass is utilized to insulate and soundproof the cabin. The Royalite panels are held in place with screws, metal fasteners, and windlace. The carpet is retained with a cement, metal retainers, and upholstery fasteners and screws. The upholstery and carpet should be cleaned regularly, to be retained in a new condition. A good grade cleaner should be used when cleaning the interior of the cabin and baggage compartment.

AFT FUSELAGE

The aft fuselage is all-metal semi-monocoque in construction, utilizing frame bulkheads, stringers, and skin to give it the strength, flexibility, and durability desired. The aft fuselage also supports the empennage section. A dorsal fin riveted to the top of the aft fuselage tapers upward from the forward attachment point to the vertical stabilizer. This surface provides improved lateral stability around the vertical axis of the aircraft. The aft end of the aft fuselage on the Model 100 Darter is streamlined by a fiberglass cap which houses the elevator horn and provides for installation of a navigation warning light. The elevator, elevator trim tab, and rudder control cables are routed through pulleys and guides in the aft fuselage to prevent control cable interference and assure freedom of control movement. A baggage compartment door is installed on the Model 100-180 Lark which opens into a baggage compartment that is separated from the cabin. This compartment is carpeted and upholstered and has a baggage capacity of 120 pounds. The aft fuselage is bolted directly to the cabin section of the forward fuselage at five attach fittings. Repairs to the structure of the aft baggage compartment shall be made in accordance with the Federal Aviation Agency Advisory Circular AC No: 43.13-1, Chapter 2, Section 3.

WINGS

The wings are of all-metal conventional design, utilizing a forward and aft spar, ribs, and stringers covered with aluminum skin. Wing attach fittings are bolted to the butt end of each wing spar and mate with two hinge fittings, welded to the top frame tube, on each side of the cabin (see Figure 3-3). Each wing panel is secured to the fuselage with a steel bolt that passes through both hinge fittings at each attachment point. A solid streamlined wing strut attaches between the forward wing spar and the lower cabin frame to complete the wing attachment. A removable wing tip is attached to each wing panel. Moisture accumulation within each wing will flow inboard and pass through the rib cutouts, and drain through the lower wing skin. These drain holes are located in each wing, immediately outboard of the wing butt rib, one forward of the front spar and one aft of the rear spar. A metal fuel tank is installed between the wing spars immediately outboard of each wing root. A fuel filler neck is installed from the tanks, upward through the upper forward inboard wing surface. Each wing panel contains access panels on both the upper and lower surfaces of the wing. An aluminum fairing encloses the space between the wing butt and the fuselage. This fairing may be removed to gain access to the wing attach fittings and fuel line connections.

WING REMOVAL

A proper support or cradle should be provided for each wing as they are removed from the aircraft. When one wing is removed an adequate support should be provided for the opposite wing.

a. Defuel aircraft, including fuel lines, valves, and sumps.
b. Remove wing butt fairings, all inboard wing access plates, upper and lower wing strut cuffs, and fuselage access plates located at strut attach points.
c. Disconnect fuel lines at fuel tank fittings and fuel vent hose connections near top of forward wing spars.
d. Disconnect pitot tube hose at left wing.
e. Disconnect springs that attach windshield fillets.
f. Disconnect wing flap control cables from wing flap bellcrank.
g. Disconnect aileron control cables at turnbarrels in each wing.

NOTE

The turnbarrels are accessible through the inboard inspection plate on top of each wing panel.

h. Disconnect all electrical wiring.
i. Remove nuts from front and rear spar attach bolts, and from upper and lower strut attach bolts.
j. Make final inspection to assure that all electrical connections, hoses, and lines are disconnected.
k. Support wing near the tip and remove bolt from outboard strut fitting. Lower strut a few inches and support strut with a stand, or tie strut to fuselage with safety wire.
l. Remove the two (2) wing spar attach bolts and lift wing straight outward until wing is clear of fuselage. Place wing on a padded stand.

NOTE

Note quantity and location of shim washers.

m. Cap all open lines.
n. Note position of eccentric bushings in fuselage rear wing fittings.
o. Remove lower strut bolt and remove strut.

WING INSTALLATION

The wing panel should be handled with care when fitting the wing to the attach points.

a. Raise wing, protecting wing tip as necessary, and align attachment lugs with fittings on upper cabin truss tube.

NOTE

Eccentric bushing shall be installed in the same position as when removed.

b. Install wing to fuselage attaching hardware and tighten nuts until snug.
c. Attach lower end of wing strut to lower fuselage fitting.
d. Raise wing upward until best position is obtained for connecting fuel line and fuel tank vent lines at fuselage wing butt, and connect these lines.

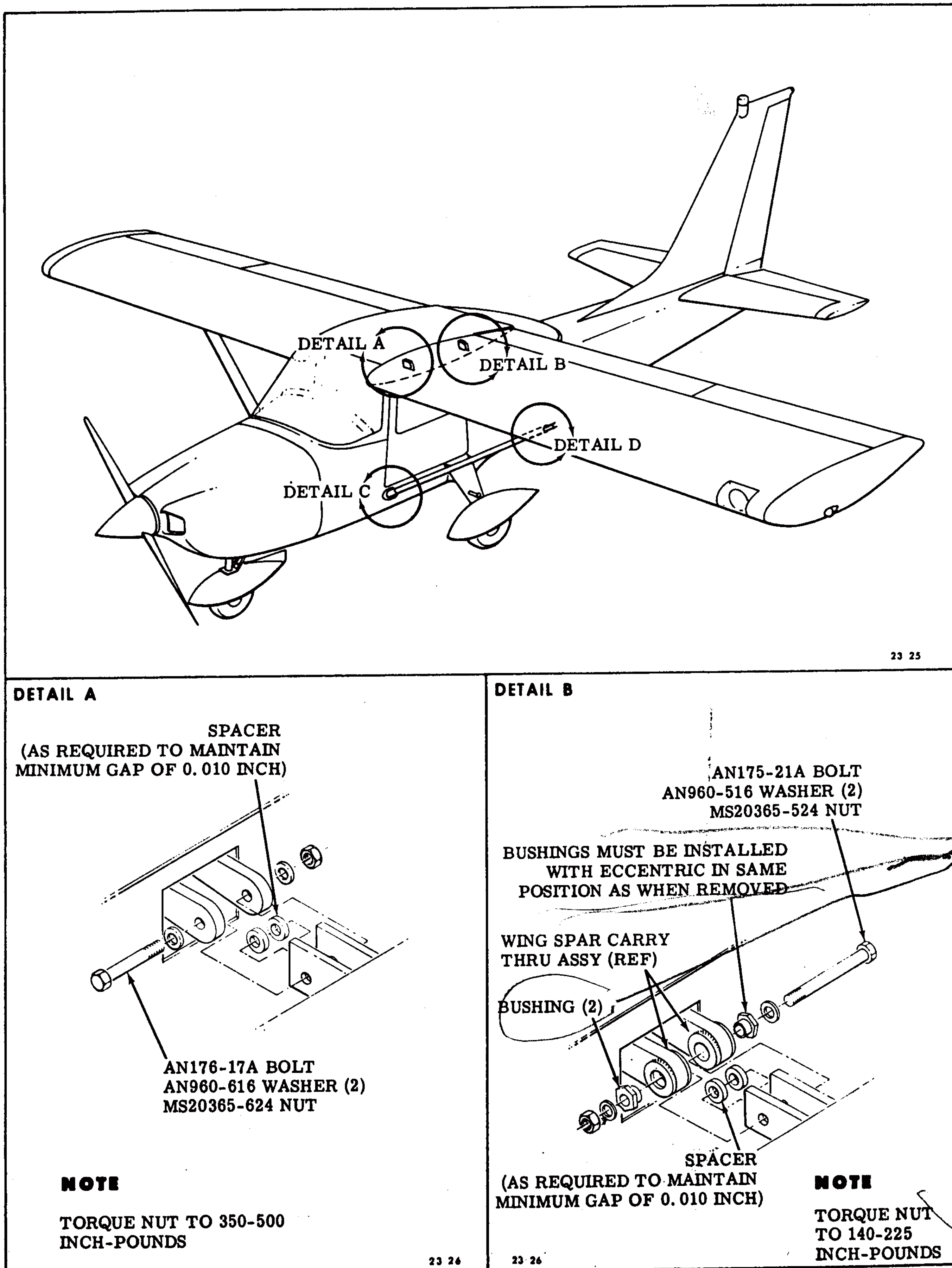
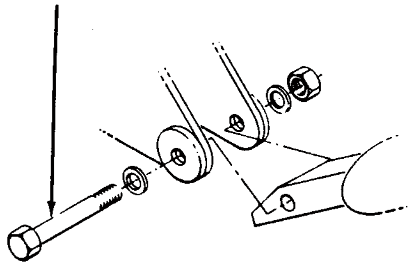


Figure 3-3. Wing Installation (Sheet 1 of 2)

DETAIL C

AN176-17A BOLT
AN960-616 WASHER (2)
MS20365-624 NUT



NOTE

TORQUE NUT TO 190-390
INCH-POUNDS

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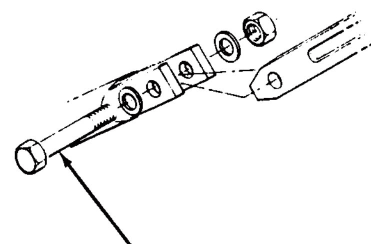
DETAIL D

NOTE

TORQUE NUT TO 190-330
INCH-POUNDS



AN176-32A BOLT
AN960-616 WASHER (2)
MS20365-624 NUT

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Figure 3-3. Wing Installation (Sheet 2 of 2)

CAUTION

DO NOT lower wing after fuel lines are attached.

e. Raise wing strut and position wing so that hinge fitting on wing mates with strut attach fitting, and install attaching hardware. Torque upper and lower wing strut attach bolts to 190-350 inch-pounds. Also torque forward wing attach bolt to 350-500 inch-pounds, and aft wing attach bolt to 140-225 inch-pounds.
f. Connect aileron control cables and balance cables at turnbarrels.
g. Attach wing flap cables at turnbarrels inboard of wing butt.
h. Connect all electrical wiring (see Section X).
i. Rig wing flaps in accordance with Section VII.
j. Rig aileron in accordance with Section VII.
k. Check wing flap and aileron surface travels and control cable tension in accordance with Section VII.
l. After wing flaps and ailerons have been rigged, install access doors, wing and fuselage fairings, and other parts from aircraft interior that may have been removed during wing removal and installation.

EMPENNAGE

VERTICAL STABILIZER

The vertical stabilizer is of standard stressed skin design with forward and aft spars and ribs covered with formed aluminum sheet. The forward and aft spars on the Model 100 Darter nest within channel beams that extend upward from the aft fuselage. The spars are attached to the channel beams with bolts. See Figure 3-4. The forward spar on the Model 100-180 Lark is attached to top of the bulkhead assembly and fitting at fuselage station 197.75, while the aft spar extends to the bottom of the bulkhead assembly at fuselage station 214.00. The aft spar is bolted to the bulkhead assembly at the top and bottom of the assembly, to give the vertical stability necessary. Three hinge fittings for attaching the rudder to the vertical stabilizer are secured to the aft spar of the stabilizer tip. Moisture accumulation within the vertical stabilizer will drain downward through tooling holes and out through drain holes in the tail cone.

VERTICAL STABILIZER REMOVAL. The rudder and vertical stabilizer should be handled with care and properly placed in cradles when removed. To remove the vertical stabilizer from the Model 100 Darter, proceed as follows:

a. Disconnect electrical wire from light in tail cone.
b. Remove 8 screws attaching tail cone and remove tail cone.
c. Disconnect rudder control cables from rudder control horn.
d. Remove rudder hinge bolts and remove rudder.
e. Disconnect electrical wire to rotating beacon in top of vertical stabilizer.
f. Remove bolts attaching forward and aft spars of stabilizer to fuselage and remove vertical stabilizer.

To remove the vertical stabilizer from the Model 100-180 Lark, proceed as follows:

a. Remove screws attaching side fairings at base of vertical stabilizer and remove fairings.
b. Remove screws attaching fairings to base of rudder and remove fairing.
c. Remove screws attaching fairing around rudder horn bracket and remove fairing.
d. Disconnect rudder control cables from rudder control horn.

MODEL 100

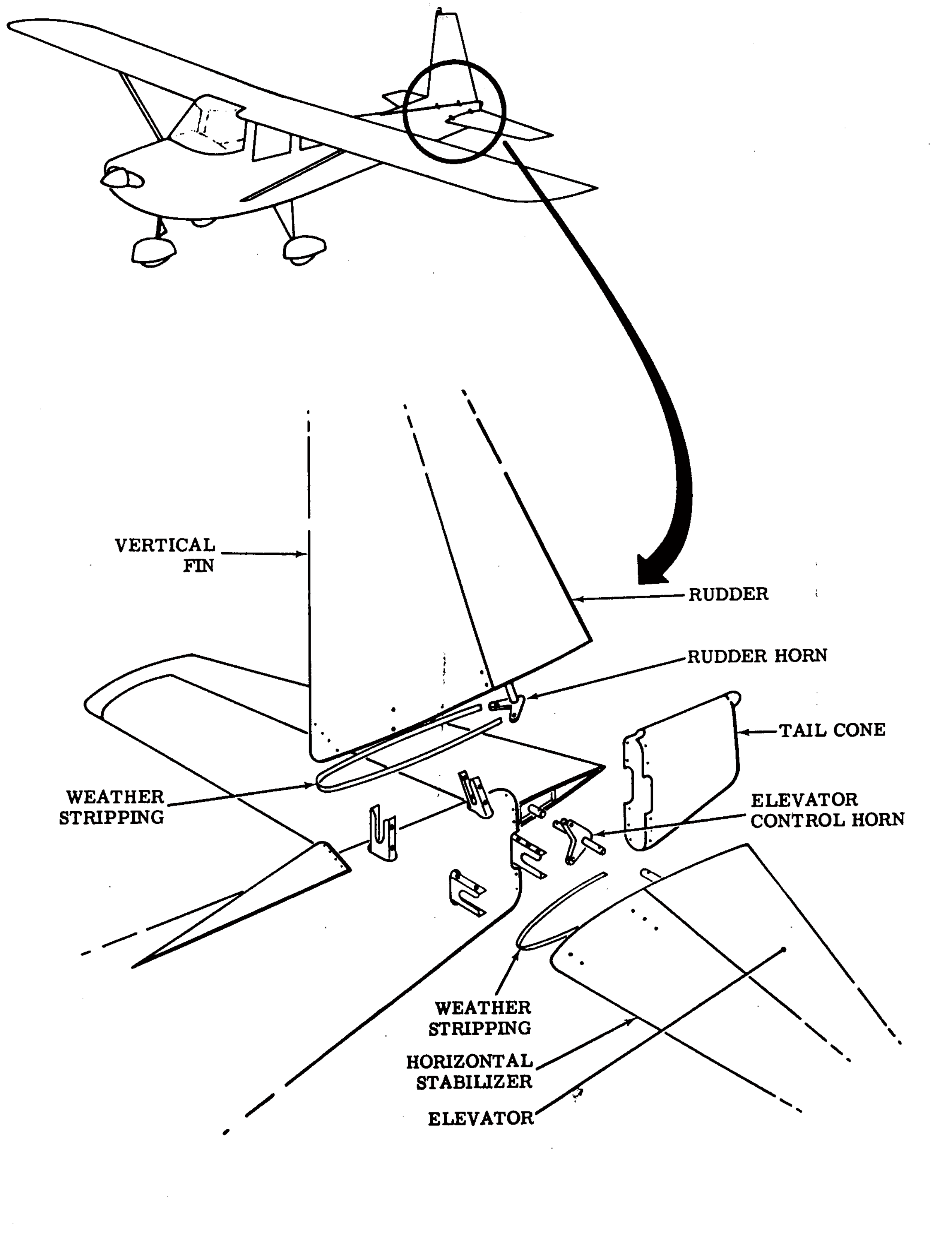


Figure 3-4. Vertical and Horizontal Stabilizer Installation (Sheet 1 of 2)

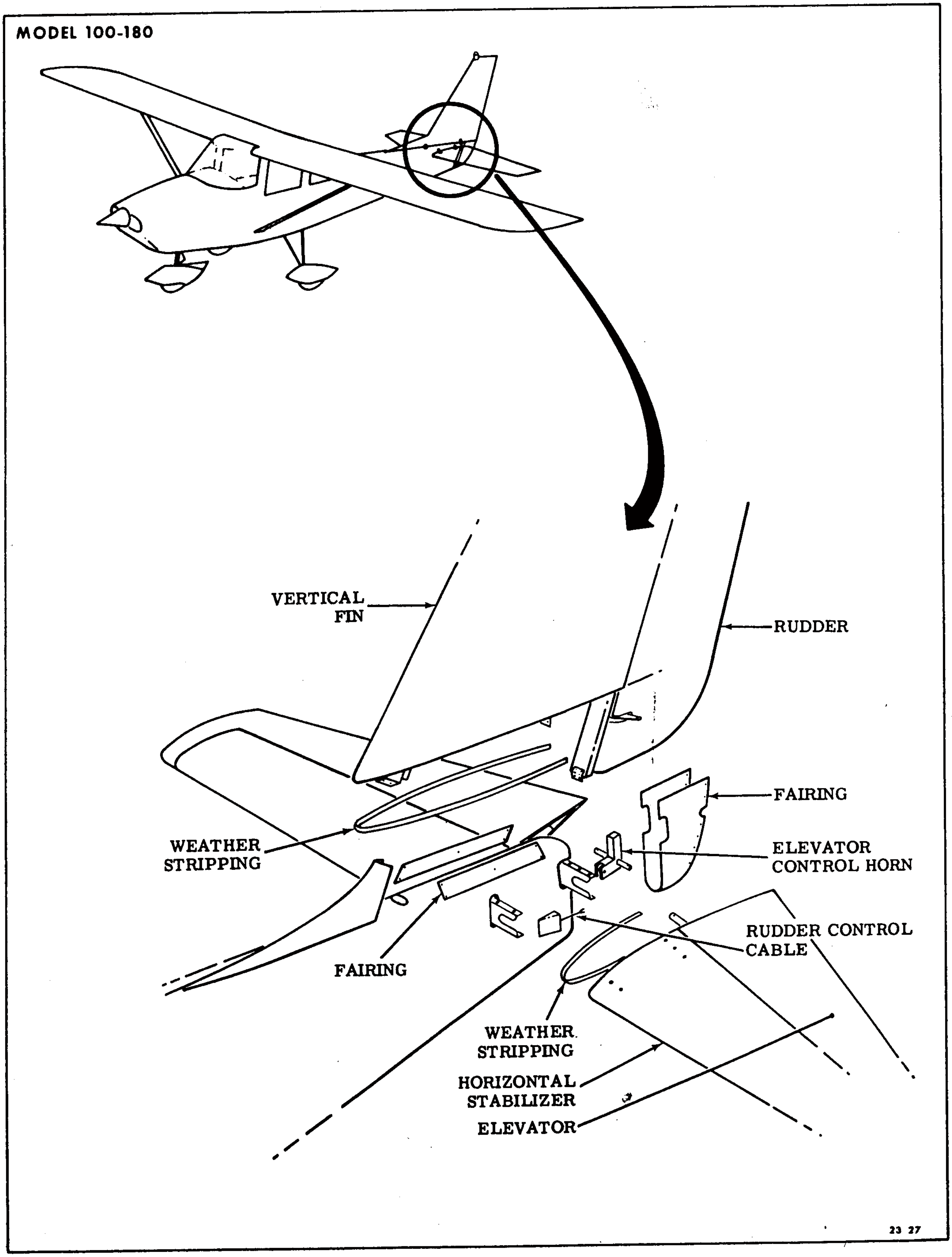


Figure 3-4. Vertical and Horizontal Stabilizer Installation (Sheet 2 of 2)

e. Remove rudder hinge bolts and remove rudder.
f. Disconnect electrical wire from beacon in top of vertical stabilizer.
g. Remove bolts from clip attaching lower rib of vertical stabilizer to aft fuselage.
h. Remove bolts attaching forward spar to aft fuselage and bolts attaching aft spar to the aft bulkhead assembly at fuselage station 214.00 and remove vertical stabilizer from aft fuselage.

VERTICAL STABILIZER INSTALLATION. The Model 100 Darter or Model 100-180 Lark Illustrated Parts Catalog should be referred to, to determine the attaching hardware, when installing the vertical stabilizer. To install the vertical stabilizer on the Model 100 Darter, proceed as follows:

a. Align forward and aft vertical stabilizer spars with forward and aft fitting assemblies, and install attaching bolts, washers, and nuts.

NOTE

The rubber sealing strip or weather-strip between the vertical stabilizer and fuselage shall make a good seal between the stabilizer and fuselage.

b. Connect electrical wiring to beacon on top of vertical stabilizer.
c. Install rudder to vertical stabilizer.
d. Connect rudder control cables to rudder control horn.
e. Connect electrical wire to light in tail cone and install tail cone.
f. Rig rudder control cables in accordance with instructions contained in Section VII.

To install the vertical stabilizer on the Model 100-180 Lark, proceed as follows:

a. Align vertical stabilizer spars with forward and aft attach points and install attaching bolts, washers, and nuts.
b. Connect electrical wiring to rotating beacon.
c. Align rudder with rudder hinges on vertical stabilizer and install bolts.
d. Connect electrical wiring to light in top of rudder.
e. Connect rudder control cables to rudder control horn and rig rudder control cables in accordance with instructions contained in Section VII.
f. Install stabilizer side fairings, rudder fairing, and rudder horn bracket fairing.

HORIZONTAL STABILIZER

The horizontal stabilizer assembly is of standard stressed skin design with forward and aft spars and ribs covered with formed aluminum sheet. The assembly consists of a left and right panel. Each panel has a full length tapered aft spar which mounts the three elevator assembly hinge fittings. The forward spar follows the sweep of the horizontal stabilizer leading edge from the inboard rib to the center rib. The inboard end of the forward spar is formed to eliminate the sweep angle of the leading edge and allow the stabilizer to fit flush with the taper of the aft fuselage. An outboard rib completes the structure of the stabilizer. See Figure 3-4. The horizontal stabilizer does not employ a tip fairing since the configuration of the elevator utilizes a faired tip that extends forward of the elevator to the forward edge of the horizontal stabilizer. The elevator trim tab actuator is installed on the forward side of the aft spar of the left horizontal stabilizer. Moisture accumulation in the stabilizer will drain through internal openings into the tail cone, and out through a drain hole. The forward and aft spar of each stabilizer panel extend inboard from the stabilizer butt rib to allow the spar to nest within the bulkhead fitting assemblies, or stub spars, that extend outboard from the aft fuselage. The stabilizer spars are attached to the bulkhead fitting assemblies with three bolts that pass through both the spar and fitting assembly flanges on both the upper and lower flanges.

HORIZONTAL STABILIZER REMOVAL. The elevator and horizontal stabilizer should be handled with care and properly placed in cradles when removed. To remove the horizontal stabilizer, proceed as follows:

a. Disconnect electrical wire to light in tail cone on Model 100 Darter.
b. Remove screws attaching tail cone on Model 100 Darter and remove tail cone.
c. Remove screws attaching fairings on Model 100-180 Lark at base of vertical stabilizer, at base of rudder, and around rudder horn bracket, and remove fairings.
d. Disconnect elevator control cables from elevator control horn on Model 100 Darter, or push-pull rod to elevator control horn on Model 100-180 Lark.
e. Remove nuts from elevator hinge bolts.
f. Remove clevis pin from elevator trim tab actuator control rod (left elevator only).
g. Remove elevator hinge bolts and remove elevator.
h. Remove access plate from lower side of left stabilizer.
i. Remove bolts attaching elevator trim tab actuator to stabilizer rear spar (left stabilizer only).
j. Remove pin from actuator chain and trim tab control cable, remove chain from actuator, and remove actuator through access opening.
k. Remove bolts attaching the forward and aft spars to bulkhead fittings, or stub spars, and slide stabilizer outward.
l. Place stabilizer on a padded support.

HORIZONTAL STABILIZER INSTALLATION. The Model 100 Darter or Model 100-180 Lark Illustrated Parts Catalog should be referred to, to determine the attaching parts, when installing the horizontal stabilizer. To install the horizontal stabilizer, proceed as follows:

a. Align forward and aft spars of horizontal stabilizer with horizontal stabilizer forward and aft bulkhead fittings, or stub spars, and install attaching bolts, washers, and nuts.

NOTE

The rubber sealing strip between the stabilizer and fuselage shall make a good seal between the stabilizer and fuselage.

b. Place elevator trim tab actuator through access opening in left stabilizer, place chain over actuator, and install pin through actuator control cable and actuator chain.

c. Install trim tab actuator to horizontal stabilizer aft spar.

d. Install elevator to horizontal stabilizer. When installing left elevator, connect the elevator trim tab to the elevator trim tab actuator control rod with a clevis pin before installing the elevator hinge bolts.

e. Connect elevator control cables to elevator control horn.

f. Connect electrical wire to light in tail cone on Model 100 Darter.

g. Rig elevator and elevator trim tab in accordance with instructions contained in Section VII.

h. Install access plate and fairings.

SECTION IV

POWER PLANT

ENGINE

A Lycoming O-320-A2B four-cylinder engine rated at 150 hp at 2700 rpm is installed on the Model 100 Darter, and a Lycoming O-360-A2F four-cylinder engine rated at 180 hp at 2700 rpm is installed on the Model 100-180 Lark. These engines are wet sump engines with an internal oil distribution system. The cylinders are numbered from front to rear with odd numbers on the right side and even numbers on the left side. The direction of rotation of the crankshaft as viewed from the rear is clockwise, and the direction of rotation for accessory drives is determined with the observer facing the drive pad. Accessories installed on the engines include magnetos, carburetor, generator or alternator, starter, and an optional vacuum pump. The engines are attached to the engine mount by four mounts, two on the upper aft side of the engine and two on the lower aft side of the engine.

ENGINE COWLING

Engine cowling, engine cylinder baffles, and cowling support frames direct the propeller air blast and ram air around the engine cylinder cooling fins to cool the engine. The engine cowling consists of upper and lower fiberglass sections. Cutouts are provided in the cowling sections to accommodate engine cooling inlet air, exhaust outlet, and to "fair-in" the nose landing gear strut. A cutout is also provided on the Model 100 Darter lower cowling section for the carburetor air filter inlet air. An access cover is provided in the upper right side of the top engine cowling to provide for access to the oil filler cap and dipstick. The cowling is attached together and to the cowling support frames by camloc fasteners. See Figure 4-1. Each section of the cowling may be quickly removed to expose the engine and all engine and aircraft components forward of the engine firewall.

EXHAUST SYSTEM

Stainless steel exhaust pipes are flange mounted to each cylinder exhaust port and individually connected to the muffler/heater assembly, which is installed at the bottom of the engine. An exhaust outlet is welded to the muffler/heater assembly and extended through the lower engine cowling, directs the engine exhaust overboard. Components of the exhaust system that fail should be replaced. However, the components may be repaired in accordance with the Federal Aviation Agency Advisory Circular AC No: 43.13-1, Section 3, Exhaust Systems. Inspect the exhaust system frequently for possible leaks and to ascertain complete integrity. Inspect the exhaust system as follows:

CAUTION

Never use lead pencils, grease pencils, etc., to mark exhaust system parts. Carbon deposited by these tools will cause cracks from heat concentration and carbonization of the metal. Mark on exhaust system parts only with chalk, Prussion blue, or India ink that is carbon free.

a. Remove engine cowling and examine cowling and areas adjacent to exhaust system components for signs of exhaust gas soot, indicating possible leakage points.
b. Check that no part of the exhaust system is being chafed by cowling, engine control cables, or other components. Ignition leads, hoses, fuel lines, and flexible air ducts shall be protected from the exhaust system by adequate clearance from the exhaust components.
c. Remove or loosen the carburetor heat muff and muffler/heater assembly and inspect the assemblies for cracks, distortion, or missing parts.
d. Clean and inspect all external surfaces of the exhaust system for cracks, dents, and missing parts, paying particular attention to welds, clamps, supports, couplings, gaskets, etc. Examine the heal of each bend, area adjacent to welds, any dented areas, and low spots in the system for thinning and pitting due to internal erosion by combustion or accumulated moisture. An ice pick or similar pointed instrument is useful in probing suspected areas. Disassemble the muffler/heater assembly as necessary to inspect internal baffles or diffusers.

ENGINE MOUNT

The engine mount is fabricated from welded tubular steel and attached to four mounting bosses on the for-

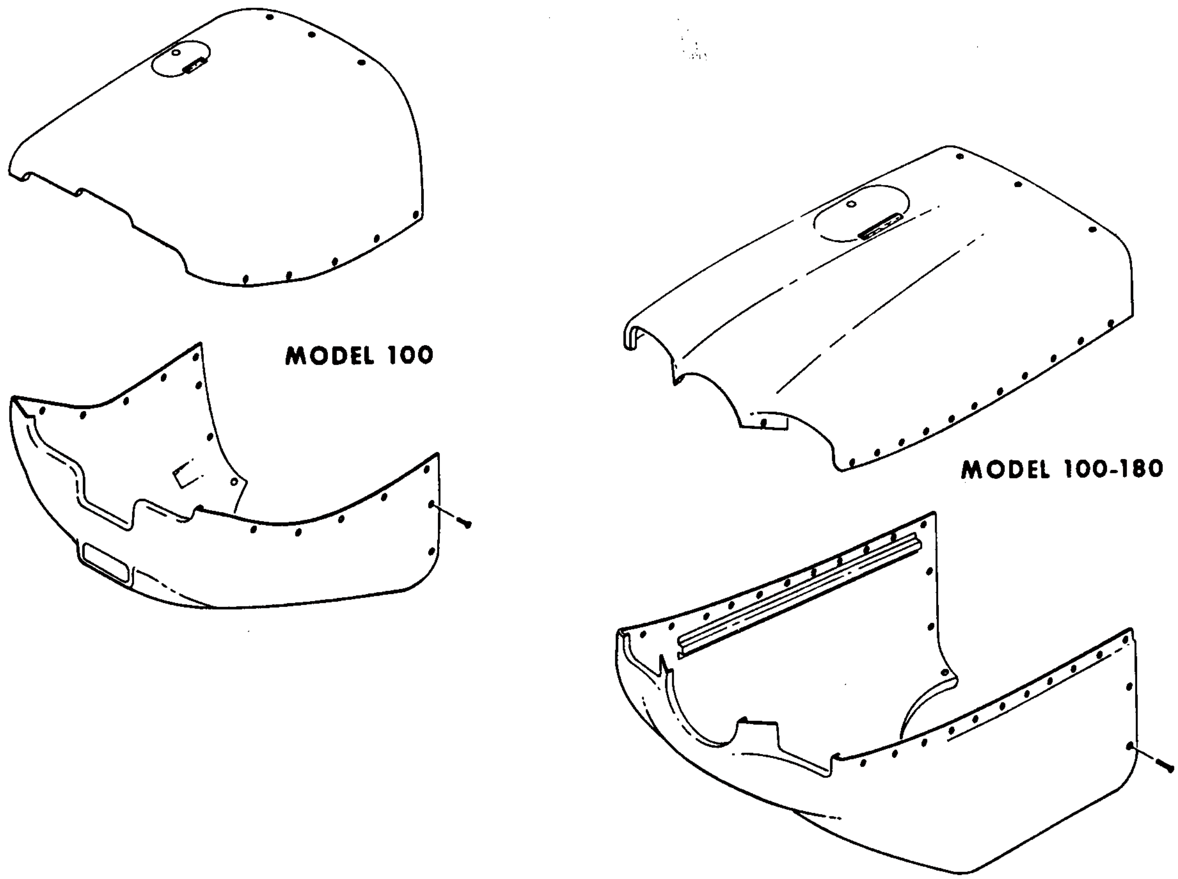


Figure 4-1. Engine Cowling

ward fuselage. See Figure 4-2. The nose landing gear outer strut body is permanently welded into the engine mounting structure. The engine is attached to the engine mount at four positions; two of which are provided on the upper aft part of the engine and two on the lower aft section of the engine. Vibration isolators are used at the four engine attach points.

ENGINE MOUNT REMOVAL. The engine mount may be removed with the engine or the engine may be removed from the mount and then the engine mount removed. The following procedure is for removing the engine from the engine mount prior to removing the engine mount from the aircraft. To remove the engine mount, proceed as follows:

a. Remove upper and lower engine cowling.
b. Remove propeller from engine.
c. Remove engine from engine mount.
d. Disconnect all lines and wiring from engine mount.
e. Remove cotter pins and nuts from engine mount attach bolts at firewall fittings, and remove bolts from mount, and remove mount from aircraft.

CAUTION

The nose gear is attached to the engine mount; therefore, the engine and nose gear shall be supported when the mount bolts are removed.

ENGINE MOUNT INSTALLATION. To install the engine mount (see Figure 4-2), proceed as follows:

a. Position engine mount to firewall fittings and install an AN6-37 bolt through the top fittings and install an AN960-616 washer and AN310-6 nut on each bolt.
b. Install an AN8-40 bolt through each lower fitting and install an AN960-816 washer and AN310-8 nut on the bolt.
c. Torque the AN310-6 nuts on the top fitting bolts to 190 to 390 inch-pounds and install an MS24665-283 cotter pin on Model 100-180 Lark and AN380-3-3 cotter pin on Model 100 Darter.

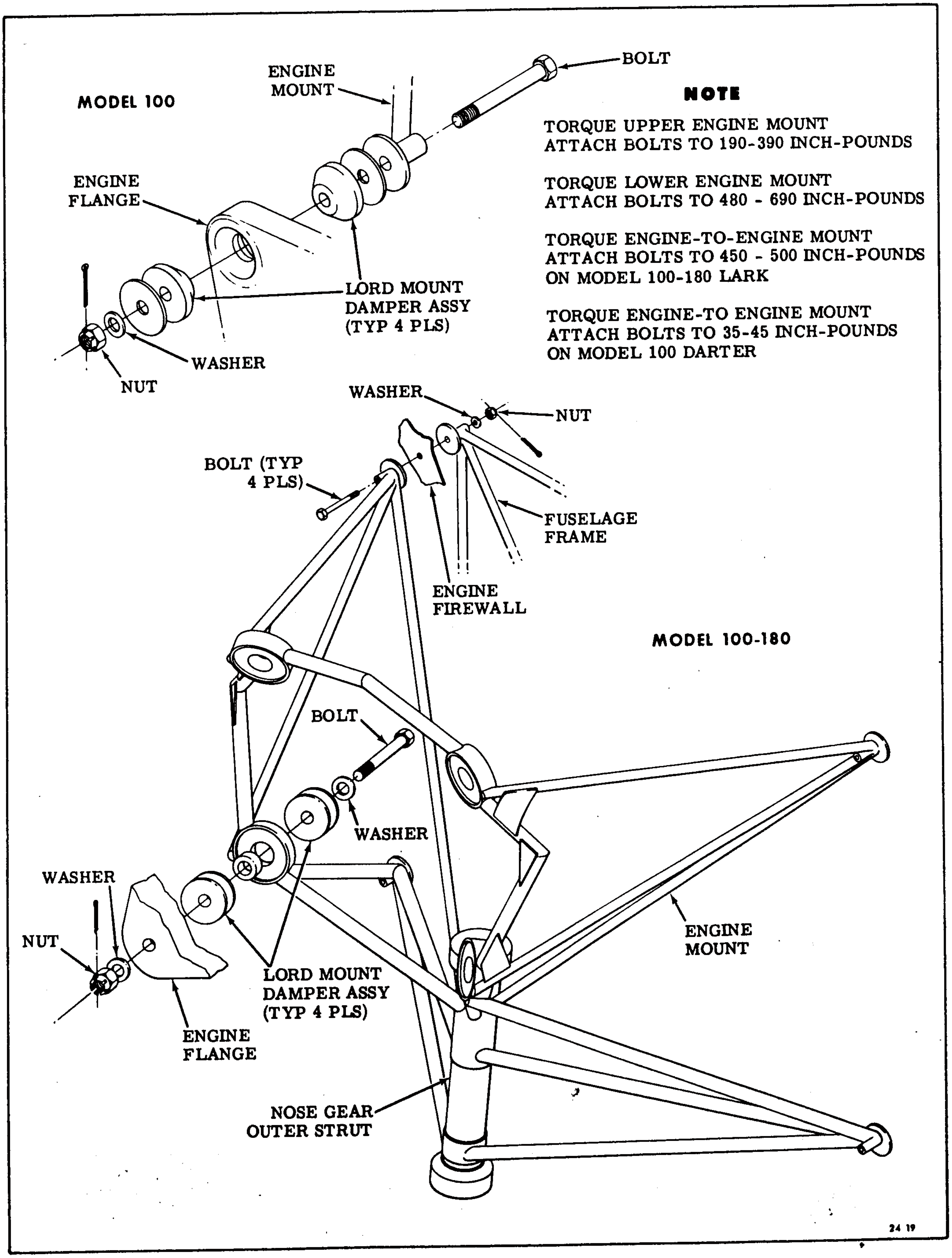


Figure 4-2. Engine Mount Installation

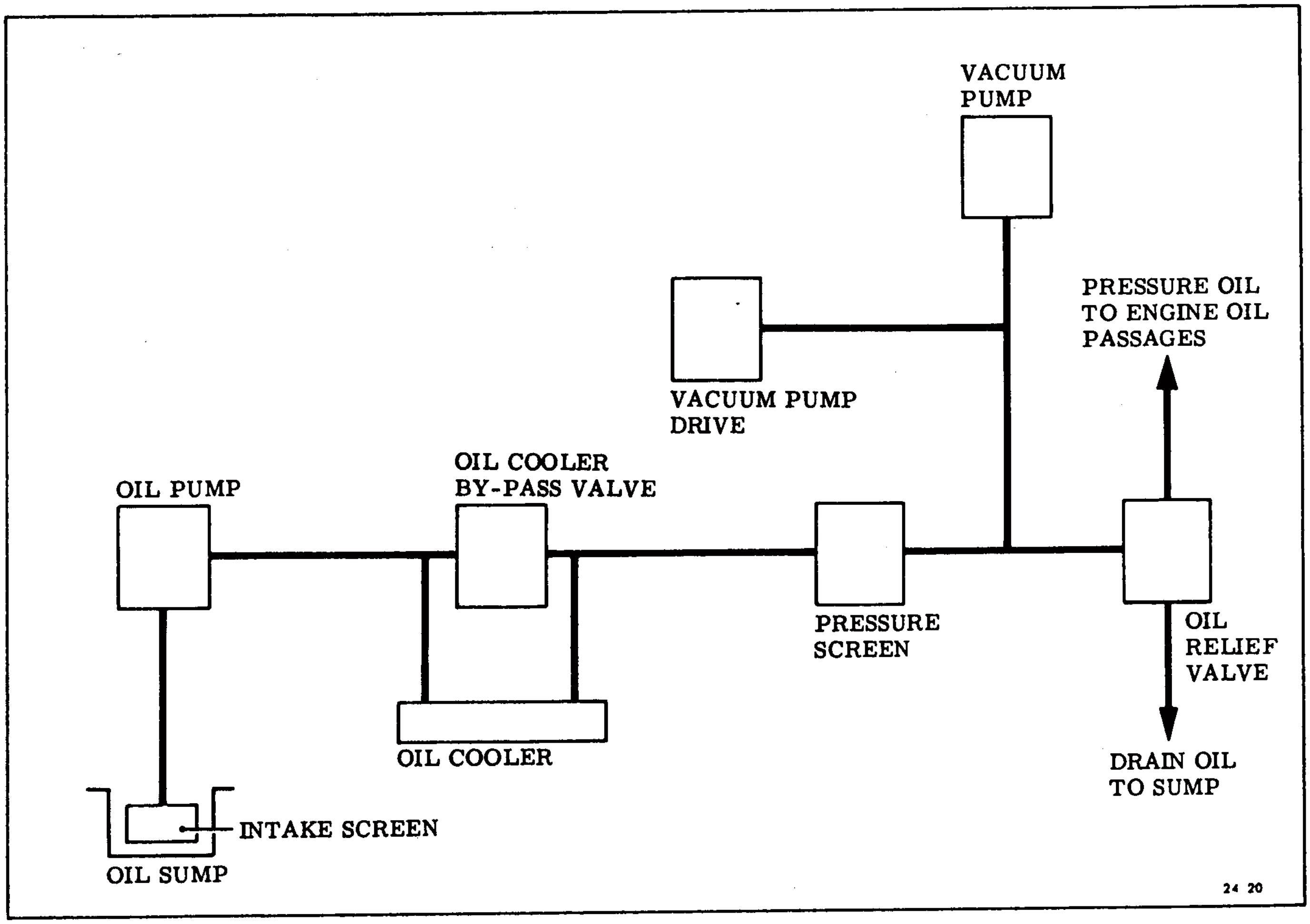


Figure 4-3. Engine Lubrication System

d. Torque the AN8-40 nuts on the lower fittings to 480-690 inch-pounds and install an MS24665-304 cotter pin on the Model 100-180 Lark and AN380-3-3 cotter pin on the Model 100 Darter.
e. Connect all lines and wiring removed when engine mount was removed.
f. Install engine to engine mount.
g. Install propeller to engine.
h. Install engine cowling.

ENGINE MOUNT REPAIRS. Cracked or damaged engine mounts may be repaired in accordance with The Federal Aviation Agency Advisory Circular AC No: 43-13-1, Section 2, Welding. Engine mounts that cannot be repaired in accordance with AC No: 43-13-1 shall be replaced with new mounts.

ENGINE LUBRICATION SYSTEM

The engine oil supply and distribution system is integral with the basic engine except for the utilization of an independent oil cooler, which is attached to the lower forward end of the engine on the Model 100 Darter, and on the left forward side of the engine on the Model 100-180 Lark. Inlet air intakes in the forward engine cowling directs air through the cooling cores of the oil cooler. Oil is circulated within the radiator cavity and cooled when passing through the cooling cores. The amount of oil passing through the oil cooler is regulated by a thermostatic flow control valve that assures a constant oil temperature relative to engine heat and ambient air temperatures. The engine oil sump, which is the engine oil reservoir, is attached to lower engine crankcase. Oil filler cap is attached to a dipstick and located on the upper right rear section of the engine. Oil sump capacity is 8 quarts. The engine is internally lubricated through internal cored passages by oil pump pressure and by means of oil collectors and oil mist. See Figure 4-3. The oil pump draws oil through the oil sump screen and directs it to the oil cooler through drilled passages and a flexible line to the oil cooler. The cooled oil passes from the oil cooler to the oil pressure screen installed in a housing attached to the engine accessory section. After being filtered through the oil pressure screen the oil is routed through drilled passages to the oil pressure relief valve, which is installed in the upper right side of the crankcase forward of the accessory housing.

OIL PRESSURE RELIEF VALVE (NON-ADJUSTABLE). The oil pressure relief valve, which is installed in the upper right side of the crankcase forward of the

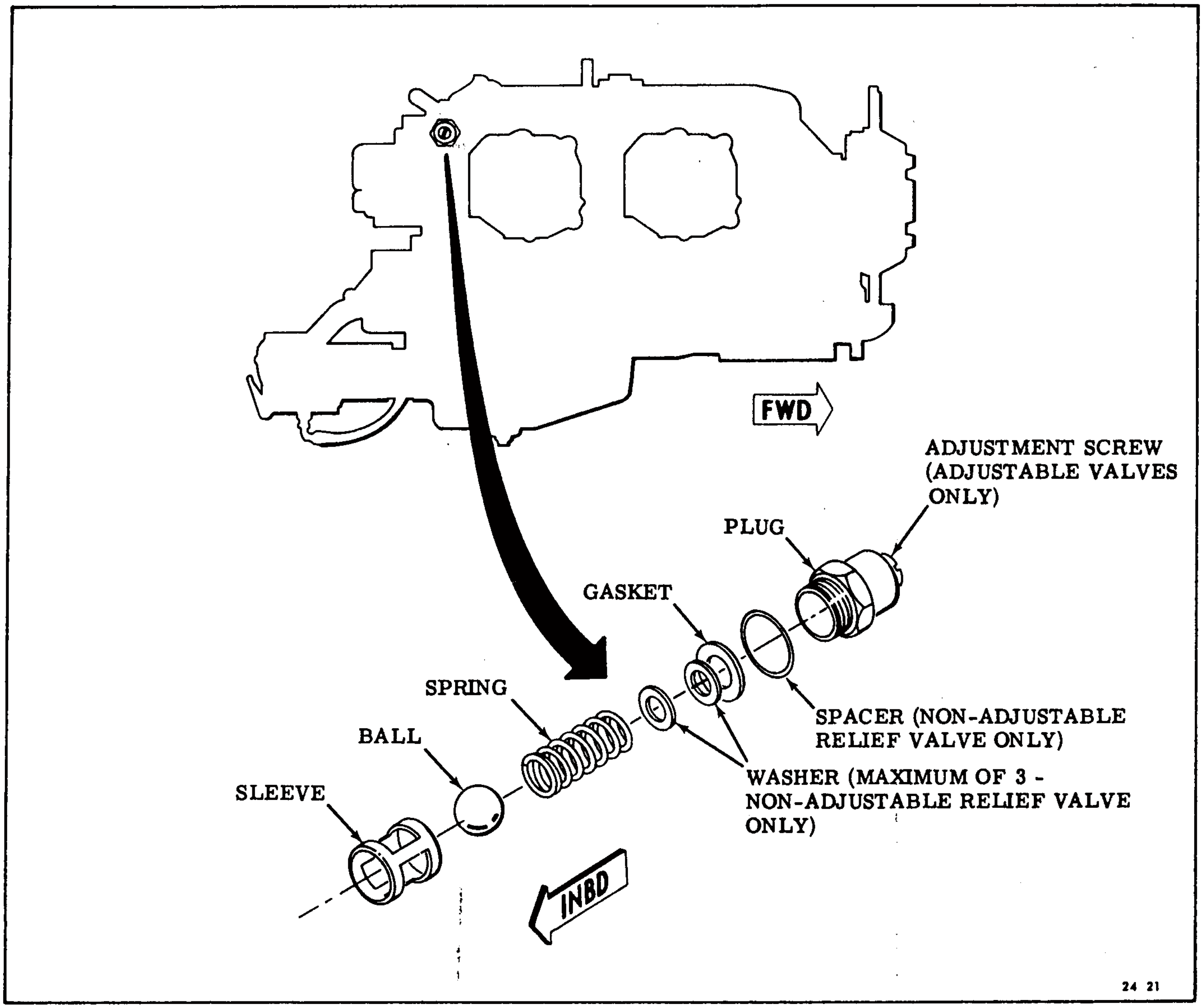


Figure 4-4. Oil Pressure Relief Valve

accessory housing, is factory adjusted on the earlier model engines to provide a normal oil pressure of 60 to 85 psi on the O-320-A2B engine and a normal oil pressure of 60 to 90 psi on the O-360-A2F engine. See Figure 4-4. The valve regulates the oil pressure by returning excess oil directly to the oil sump. The remainder of the pressure oil passes to the internal parts of the engine. The oil pressure relief valve is not adjustable; however, the oil pressure may be controlled by installing a maximum of three STD-425 washers under the cap of the relief valve to increase oil pressure. A spacer (Lyc P/N 73629 or 73630) may be installed under the cap to decrease oil pressure. A calibrated pressure gage should be used to determine the oil pressure when installing washers or spacers to determine that pressures are within recommended tolerances. Particles of metal or other foreign material lodged between the ball and seat of the relief valve will cause a drop in oil pressure. Therefore, it is advisable to disassemble, inspect, and clean the relief valve if excessive pressure fluctuations are noted.

NOTE

Do not confuse the oil pressure relief valve with the oil cooler bypass valve which is located in a housing installed on the center aft side of the accessory housing.

OIL PRESSURE RELIEF VALVE (ADJUSTABLE). The adjustable oil pressure relief valve on the later model engines has replaced the non-adjustable relief valve installed on the earlier engines. See Figure 4-4. The adjustable pressure relief valve enables the operator to maintain engine oil pressure within the 60 to 90 psi limits during normal operation. The valve is installed on the upper right side of the crankcase forward of the accessory housing. If the pressure should consistently exceed 90 psi or run less than 60 psi during normal operation of the engine, the valve should be adjusted as follows:

NOTE

A calibrated pressure gage may be connected to the oil pressure line to obtain a correct oil pressure reading.

a. Operate engine until thoroughly warmed up, then operate engine at 2200 rpm. The oil pressure shall not exceed 90 psi.
b. If oil pressure exceeds 90 psi, stop engine, loosen adjusting locknut, and turn adjusting screw 1 to 2 turns counterclockwise. Tighten locknut and retest oil pressure system.
c. If oil pressure is less than 60 psi, stop engine, turn adjusting screw clockwise into the relief valve plug, increasing tension on the relief valve spring.
d. When the relief valve has been satisfactorily adjusted, tighten the locknut and lockwire the crown nut to the drilled ear projecting from the valve mounting boss.

ENGINE OIL COOLER. A fin and plate oil cooler, which is installed in the engine baffles on the upper left side of the engine, receives its cooling air from the forward air intake on the engine. Oil under pressure from the oil pump enters one side of the oil cooler, passes through the cooler and back to the oil pressure screen on the accessory section of the engine where it is filtered and directed on through the engine. A thermostatic oil cooler bypass valve installed in a housing on the aft center accessory section causes oil to bypass the cooler if the oil is cold and congealed or if the cooler is obstructed. The bypass valve passes the oil directly to the oil pressure screen until the oil reaches a predetermined temperature. The oil is then directed through the cooler to the pressure screen.

ENGINE OIL SCREENS. An engine oil suction screen is installed in the oil sump to filter any sizeable metal particles or heavy sludge from the oil before it goes through the oil pump. An oil pressure screen is installed in the thermostatic and oil pressure screen housing located on the upper center section of the accessory section. The oil pressure screen filters any small solid particles that may have passed through the oil suction screen to the oil sump. The oil suction screen and oil pressure screens should be removed, inspected for metal objects, and cleaned at each 50-hour inspection. The engine oil suction screen may be removed after the oil is drained from the engine. The oil pressure screen may be removed when the engine is not operating and the engine oil has drained back into the crankcase. To remove and inspect the oil pressure screen, proceed as follows:

a. Remove electrical lead from oil temperature bulb.
b. Remove oil cooler bypass valve from valve and oil pressure screen housing.
c. Remove four bolts attaching valve and oil pressure screen housing to accessory case and remove housing.
d. Remove oil pressure screen from housing.
e. Inspect oil pressure screen for small metallic particles.
f. Clean oil pressure screen and housing in unleaded gasoline or a suitable cleaning solvent and dry with dehydrated compressed air.

To install the oil pressure screen and housing, proceed as follows:

a. Install oil pressure screen in housing and using a new gasket install housing to accessory section.
b. Tighten housing retaining bolts to 70-80 inch-pounds.
c. Install oil temperature electrical connection.

OIL TEMPERATURE INDICATOR. The oil temperature indicator is electrically connected to a temperature sensing bulb installed on the housing for the oil pressure screen and oil cooler bypass valve. Changes in oil temperature are sensed by the bulb and transmitted to the oil temperature indicator. These temperature changes are registered in variations of electrical current flow to the indicator, which are governed by the temperature sensing bulb. Normal oil temperature is 125°F to 245°F, which is indicated by a green arc on the indicator. The indicator is redlined at 245°F.

OIL PRESSURE GAGE. The oil pressure gage is a direct reading instrument. A small oil line is connected on one end to an engine oil pressure outlet on the right side of the engine accessory section, above the magneto drive pad. The other end of the oil line is connected to the rear case of the oil pressure gage. Normal oil pressure is 60 to 85 psi, which is indicated by a green arc on the indicator, for the Model 100 Darter, and normal oil pressure is 60 to 90 psi on the Model 100-180 Lark. Oil pressure fluctuations are usually caused by air trapped in the oil pressure gage line. This can be corrected by using an instrument line bleeding gun or by disconnecting the line from the gage and motoring the engine for a short time. Catch the oil from the gage line in a small container.

ENGINE IGNITION SYSTEM

Dual ignition is furnished by one Scintilla S4LN-20 magneto and one Scintilla S4LN-21 on the Model 100 Darter engine; and by one Scintilla S4LN-1227 and one Scintilla S4LN-1209 on the Model 100-180 Lark. The S4LN-20 and S4LN-1209 are installed on the upper right side of the accessory drive housing and the S4LN-21 and S4LN-1227 are installed on the upper left side of the accessory drive housing of their respective engines. The left magneto incorporates an impulse coupling. The shielded ignition wiring is arranged so that the left magneto fires the top spark plugs in the left cylinders and bottom spark plugs in the right cylinders, while the right magneto fires the bottom spark plugs in the left cylinders and the top

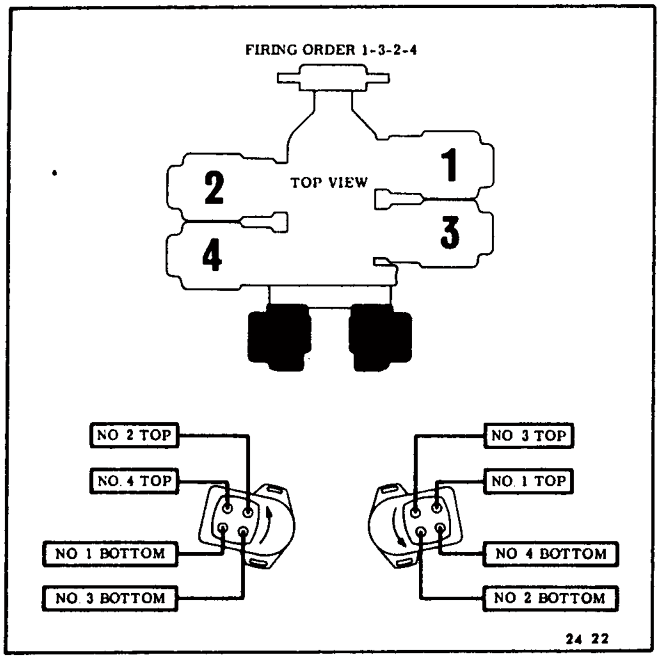


Figure 4-5. Ignition Wiring Diagram

spark plugs in the right cylinders. This arrangement assures consistant dropoff when switching from both magnetos to either right or left magneto.

MAGNETOS. The magnetos contain a rotating magnet, which turns on two ball bearings, one located at the breaker end and one bearing located at the opposite end of the magneto. A two-lobe cam is secured to the breaker end of the magneto. The small distributor gear, located on the rotating magnet shaft drives the large distributor gear and distributor electrode at one-half engine speed. The ratio between these two gears is such that the high tension current from the coil is conducted by means of a carbon brush to the distributor electrode and from there to the high tension contact springs in the distributor block; then through the high tension cables to the spark plug at the correct firing interval of the engine. An impulse coupling consisting of a body, a spring, and a cam assembly is installed on the left magneto (S4LN-21 and S4LN-1227). A stop pin(s) in the magneto flange engages the flyweights, which when tripped actuate the impulse coupling. The impulse coupling rotates the magnet between impulse trips faster than the engine cranking speed, thus generating a stronger spark for starting. The coupling also automatically retards the spark when starting the engine. When the engine is running, the impulse coupling acts as a drive coupling for the magneto.

Magneto Removal

To remove the complete magneto from the engine, proceed as follows:

a. Remove upper cowling from engine.

b. Remove screws retaining high tension outlet plate and remove outlet plate.

NOTE

High-tension outlet plate may be left attached to the ignition harness.

c. Remove the screws and washers from the studs holding magneto, and remove magneto.

The condenser or breaker assemblies may be replaced by removing the breaker cover. However it is recommended that the magneto be removed for replacement of the condenser or breaker assemblies and for internally timing the magneto.

CAUTION

Do not remove the screws fastening the two halves of the magneto together, as this will disengage the distributor gears, causing loss of internal timing.

If it is necessary to overhaul or internally time the magneto it should be sent to an authorized magneto repair station.

Magneto Installation

To install a magneto on the engine, proceed as follows:

a. Install a Woodruff key in keyway of right (direct drive) magneto shaft and assemble magneto gear in place on shaft.
b. Place a spacer over magneto shaft and install a castellated nut on shaft and install a cotter pin.
c. Turn magneto rotor until marked tooth of timing gear is in line with pointer. This is observed through small window on magneto.
d. Turn engine propeller opposite to normal rotation until it is approximately 35° before top center (BTC) on the compression stroke of No. 1 cylinder.
e. Clamp an ignition timing pointer (Lycoming P/N 64697) to the crankcase and rotate the engine until the pointer aligns with the 25° BTC mark (when the Lycoming Tool P/N 64697 is not available, the above can be accomplished by aligning the 25° BTC mark with the top parting surfaces of the crankcase using a straight edge) or if the front cowling will permit, the 25° BTC can be determined by aligning 25° mark on the front face of the ring gear with the drilled hole on the front surface of the starter housing.

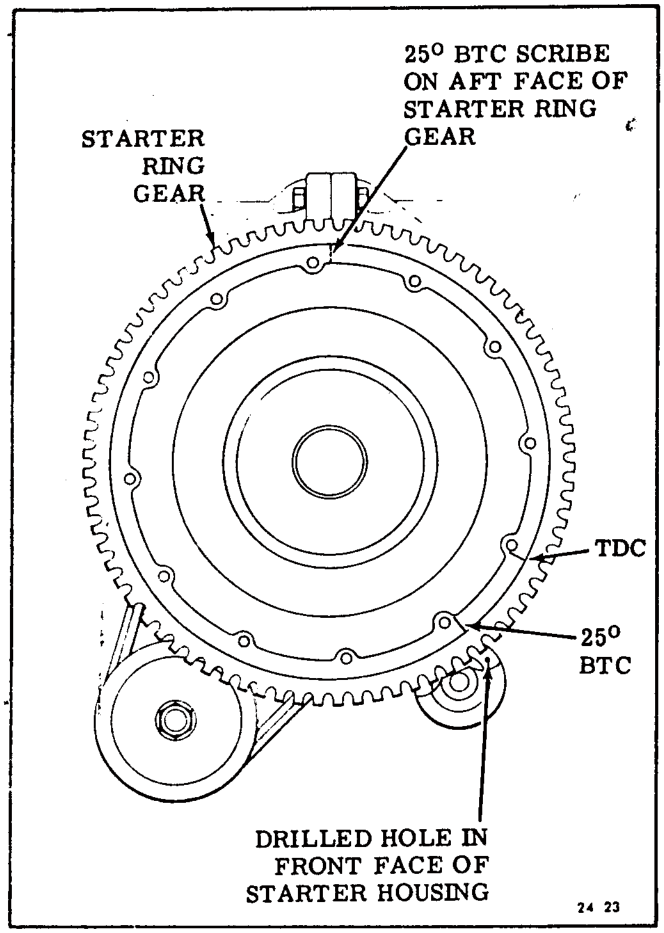


Figure 4-6. 25-Degree Timing Mark

NOTE

In this position both valves on No. 1 cylinder (see Figure 4-5) should be closed. If exhaust valve should be open, engine is on exhaust stroke of No. 1 cylinder, and the crankshaft must be turned one complete revolution before it is in proper position to install the magnetos. Leave propeller and crankshaft in this position until left magneto is installed in place on the engine.

f. Install magneto and gaskets and secure nuts only finger tight.
g. Attach positive lead of an electric timing light to a suitable terminal connected to ground terminal of magneto, and negative lead to any unpainted portion of engine.
h. Rotate magneto in mounting flange until light illuminates, then slowly turn magneto in opposite direction until light extinguishes. Turn magneto back slowly until light just illuminates, then tighten nuts on studs holding magneto.
i. Install impulse coupling magneto adapter and gasket on left magneto mounting pad of the accessory housing.

CAUTION

Impulse coupling magneto may be used only on left side of engine or accessory housing.

j. Remove inspection plug and turn impulse coupling on left magneto until white beveled tooth on magneto gear aligns with timing pointer.
k. Without allowing magneto gear to turn from this position, install the left magneto to the accessory housing and install washers and nuts. Tighten the nuts only finger tight.

NOTE

Depress panel on impulse coupling with finger to turn shaft on impulse coupler.

l. Connect other positive wire of timing light to a suitable terminal connected to ground terminal connection of left magneto.
m. Repeat step h. for left magneto.
n. After both magnetos have been timed, rotate propeller or crankshaft backwards a few degrees, until timing light extinguishes.

NOTE

The crankshaft should not be rotated more than 10 degrees in direction opposite to normal rotation, since the pawl on the impulse coupling of the left magneto will engage with the stop pin and late timing will be indicated through the impulse coupling mechanism. If this should occur, rotate engine in normal direction until a sharp click is heard. This will indicate that impulse coupling has passed through firing mechanism. Turn crankshaft in direction opposite normal rotation to approximately 35 degrees BTC and continue with timing check.

o. Slowly rotate propeller or crankshaft forward in direction of normal rotation until timing mark and hole in starter housing are in alignment. At this point, both timing lights should illuminate simultaneously. If breaker points open too early loosen mounting nuts and rotate magneto clockwise; if breaker points open too soon rotate magneto counterclockwise.
p. Torque magneto mounting nuts to 150 inch-pounds.
q. Install timing inspection plug, breaker compartment cover, and magneto switch primary lead.
r. Install magneto high-tension outlet plate.

Magneto Inspection and Maintenance

The ball bearings of the magneto are packed in grease and require no lubrication except when magneto is disassembled for overhaul. At routine inspection intervals, remove the breaker cover and inspect the breaker as follows:

a. Turn engine until timing marks line up correctly.
b. When timing marks are lined up, the breaker should be just starting to open.
c. If points are not open when timing marks are lined up, loosen screw in slotted hole of breaker assembly and shift breaker slightly so that points just break contact when timing marks are aligned.
d. Clean points with clear gasoline.
e. If breaker points are burned or excessively worn, install a new set of breaker points.

SPARK PLUGS. Two 18-mm short reach spark plugs are installed in each cylinder and screw into heli-coil inserts. The spark plugs are shielded to prevent spark plug noise in the radio and have an internal resistor to provide longer terminal life. Operating conditions will determine the average service life of the spark plugs. A spark plug that is kept clean and properly gapped will give better and longer service than one that is allowed to collect deposits and become improperly gapped. The spark plug gap should be set in accordance with the engine manufacturer's (Lycoming) latest publication of Service Instruction 1042. The spark plugs should be torqued to 360 to 420 inch-pounds.

ENGINE ACCESSORIES

STARTER. A bendix drive starter is installed on the lower left side of the front of the engine. The starter drive pinion engages the engine flywheel ring gear, which is integral with aft propeller flange, to provide direct cranking of the engine. The pinion disengages from the ring gear when the engine starts. A starter switch relay, installed on the right side of the firewall, is engaged by a key operated spring-loaded start and ignition switch on the left side of the instrument panel. When starting the engine, the starter should never be operated for more than 30 seconds without allowing starter to cool for two minutes.

Trouble Shooting The Starting Circuit

Before removing any unit in a starting circuit it should first be determined that the unit is faulty. Check that the battery is fully charged and inspect the wiring for possible damage. Inspect all connections to the starter solenoid, ignition switch, and battery, including all ground connections. Clean and tighten all connections as required. Inspect all switches to determine their condition. Connect a jumper lead around any switch suspected of being defective. If the starting system functions properly using a jumper, repair or replace the bypassed switch. If the battery, wiring, and switches are satisfactory and the engine is known to be functioning properly, remove the starter and send to an authorized repair station for repair.

Starter Removal

To remove the starter from the engine, proceed as follows:

a. Remove upper and lower engine cowling.
b. Disconnect electrical lead from starter terminal.
c. Remove bolt attaching generator support strut to starter.
d. Remove nuts and washers from studs holding starter mounting flange.
e. Remove aft inboard and forward outboard studs from starter mounting flange.

Installation of the starter is the reverse of the removal.

GENERATOR. A 12-volt, 35-amp generator is installed on the forward lower right side of the engine on Model 100 Darters through serial number 225. A ram air blast tube extending from the aft generator cap to the forward engine baffle supplies cooling air to the generator. The armature turns on sealed ball bearings which are lubricated for the life of the bearing. A belt from the generator pulley to a pulley which is integral with the aft propeller flange drives the generator at 1.910 times the speed of the engine. Generator belt tension should be maintained to provide a midpoint depression of 1/4 to 3/8 inch when pressed inward with thumb pressure. Generator belt tension is adjusted by loosening the generator attaching bolts, pulling the generator outward until proper belt tension is obtained, and then tightening the generator attaching bolts.

Polarizing Generator

After a new or repaired generator has been installed on the engine it must be polarized so it will have the correct polarity with respect to the battery polarity. Failure to polarize the generator may result in burned or stuck relay contacts in the regulator and damage to the wiring and generator windings. Polarizing the generator allows a surge of current to flow through the generator field windings, which assures that polarity of the generator will match polarity of the battery. To polarize the generator, disconnect the lead from the regulator F (FIELD) terminal and momentarily touch the lead of the regulator B (BATTERY) terminal. The generator should be polarized after all other leads have been connected and before the engine is started.

ALTERNATOR. A 12-volt, 40-amp alternator is installed on the forward lower right side of the engine on Model 100 Darters on serial numbers 226 and subsequent and on Model 100-180 Larks. The alternator employs a 3-phase stator winding in which the phase windings are electrically 120 degrees apart. The rotor consists of a field coil encased between two 4-poled interleaved sections producing an 8-pole magnetic field with alternate North and South poles. When the rotor rotates inside the stator, an alternating current is induced in the stator windings. This ac current is rectified, i.e. changed to dc, by silicon diode rectifiers and delivered to the output terminal of the alternator. A ram air blast tube extending from the slip ring end cover of the alternator to the forward engine baffle supplies cooling air to the alternator. A belt from the alternator pulley to a pulley which is integral with the aft propeller flange drives the alternator at 3.250 times the speed of the engine.

Alternator belt tension should be maintained to provide a midpoint depression of 1/4 to 3/8 inch when pressed inward with thumb pressure.

ENGINE FUEL SYSTEM

The engine fuel system consists primarily of the air induction system and the carburation system. Fuel is metered through the carburetor into the air induction system where it is mixed with air and directed to each cylinder.

AIR INDUCTION SYSTEM. Particularly good distribution of the fuel-air mixture from the carburetor to each cylinder is obtained through the center zone induction system, which is integral with the oil sump. The center induction system tubes consist of tubes cast together and attached to the bottom of the sump where the carburetor is attached. Intake pipes are then attached between the induction system tubes and the intake on each cylinder. The center zone induction air tubes are submerged in the oil which heats the fuel-air mixture to assure a more uniform vaporization of fuel and to aid in cooling the oil in the sump.

CARBURETOR AIR FILTER. An Air Maze flock-coated screen wire filter, is installed in the front of the carburetor air scoop on the Model 100 Darter, and in the upper left aft engine baffle on the Model 100-180 Lark. The filter (see Figure 2-6), which is coated with oil, is one of the most efficient filters available. Dust in the air entering the carburetor is filtered from the air. The filter should be removed and cleaned at each 25-hours flying time. However, the filter should be cleaned or changed any time it appears to be dirty. This could be as often as twice a day when the aircraft is operating under dusty or dirty conditions. To clean the air filter, proceed as follows:

a. Remove air filter from carburetor air scoop on Model 100 Darter or from upper left aft engine baffle on Model 100-180 Lark.
b. Thoroughly wash filter in PS-661 cleaning solvent or equivalent.
c. Allow filter to drain dry.
d. Dip filter in engine oil, then stand on end and allow to drain for 8 hours.

NOTE

Extra air filters should be retained so that a clean, oil filter will be readily available.

e. Clean all foreign material from air scoop or filter frame.
f. Install filter in carburetor air scoop or engine baffle filter frame with arrow pointing in direction of air flow.

FUEL FILTER. The fuel filter and drain assembly, which is installed on the lower left side of the engine firewall, contains a mesh disc fuel screen. This screen should be removed and cleaned at each 25-hour inspection. An additional fuel filter is installed in the carburetor fuel inlet fitting. This filter should be removed and cleaned at each 100-hour inspection. On the Model 100-180 Lark a fuel filter is also installed in the lower end of the electric fuel pump. This filter should also be removed and cleaned at each 100-hour inspection.

CARBURETOR ADJUSTMENT. Idle speed and mixture are the only adjustments to be made to the carburetor (see Figure 4-7). When the engine exceeds the idle speed range the fuel/air mixture is controlled by fixed fuel jets and air passages within the carburetor. Adjustment of the carburetor should not be attempted on an engine that is out of time or has faulty spark plugs; therefore, before making any adjustment to the carburetor, warm up the engine and perform a magneto check to assure that the ignition system is functioning properly. After the engine is sufficiently warmed and the ignition system is functioning properly, proceed as follows:

a. Adjust idle speed stop screw to obtain an idle speed of 550 rpm.
b. Turn idle mixture adjusting screw toward rich position until engine begins to run rough and rpm decreases, and then gradually turn mixture adjusting screw toward lean position.
c. Continue turning mixture adjusting screw toward lean position until maximum idle rpm is reached.
d. Operate engine at 2000 rpm for a short period of time and return throttle to IDLE position.
e. Reset idle stop screw to obtain an idle speed of 550 rpm.

STARTING ENGINE

Before starting engine the engine should be inspected to determine that oil quantity is 6 to 8 quarts, carburetor air filter is unobstructed, fuel filter and drain assembly is drained, that all oil and fuel lines are secure, and that engine cowling is secure. After the engine prestart check has been made start the engine as follows:

a. Master switch - ON.
b. Electrical accessory switches - OFF.
c. Carburetor heat - COLD.
d. Mixture control - RICH.
e. Throttle - OPEN (1/10 of travel).
f. Primer - NORMAL (as required).
g. Electric fuel pump - ON (if applicable).
h. Ignition switch - START (release when engine fires).

CAUTION

Limit starter operation to 12 seconds in every 5-minute period.

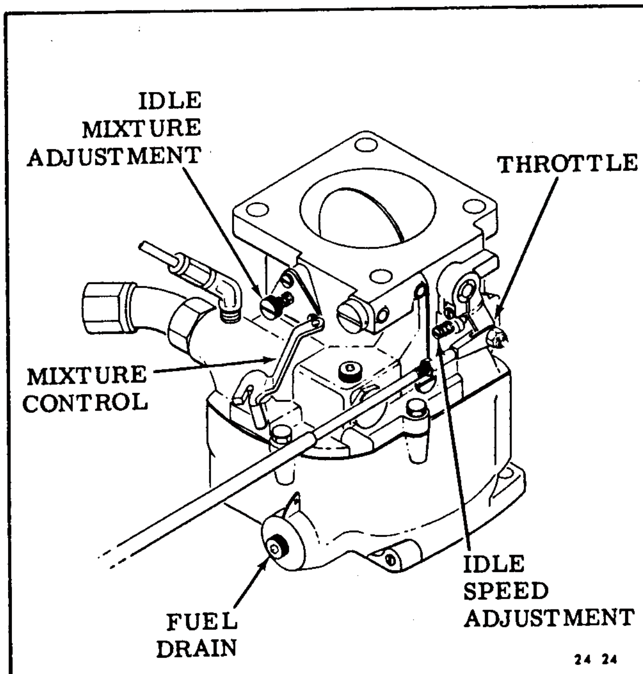


Figure 4-7. Carburetor

i. Electric fuel pump - OFF (to determine that engine-driven pump is operating) - if applicable.
j. Check oil pressure gage. If minimum oil pressure is not indicated within 30 seconds, stop engine and determine trouble.

During extreme cold weather it may be necessary to preheat the engine or oil before starting. If engine fails to start at the first attempt, a second attempt should be made without priming. If engine still does not start, turn ignition switch to OFF position, open throttle slowly, and turn the engine over approximately 10 revolutions. Prime engine with half the original prime and repeat starting procedure.

ENGINE REMOVAL

Installation of various lines, hoses, engine controls, etc., may vary between the Model 100 Darter and 100-180 Lark; however, the removal of these components will be essentially the same. When removing the components from the engine it will be advisable to tag the parts when removed. These tags will then facilitate installation of the component. To remove the engine, proceed as follows:

a. Remove upper and lower engine cowling.
b. Remove propeller spinner and propeller.
c. Remove spark plug leads from upper and lower spark plugs in each cylinder.
d. Remove oil cooler lines from accessory housing.
e. Remove fuel and drain line from fuel pump.
f. Remove crankcase breather line.
g. Remove tachometer cable from tachometer drive on accessory housing.
h. Remove oil temperature lead from thermometer well on accessory housing.
i. Remove "P" leads from mangetos.
j. Remove throttle, mixture, and carburetor air cables from carburetor.
k. Remove primer line from carburetor.
l. Remove cabin heat duct from heat exchanger and cabin air inlet.
m. Remove vacuum pump from accessory housing.
n. Remove left and right magnetos from accessory housing.

NOTE

> Vacuum pump and magnetos must be removed to remove engine from engine mount.

o. Remove bonding strap from engine mount and firewall.
p. Remove alternator and starter electrical leads.
q. Remove fuel primer line from tee on accessory housing.
r. Remove oil pressure line from accessory housing.
s. Connect cable or chain hoist to lifting eye on engine.
t. Install a support under tail of aircraft.
u. Hoist weight of engine from engine mounts and remove engine mount bolts (4).
v. Slip engine forward until engine clears engine mount then hoist engine from engine mount.

ENGINE INSTALLATION

Engine installation is essentially the reverse of the removal instructions. The engine may be "build up" prior to installation on the aircraft. However, the magnetos and vacuum pump shall not be installed on the engine until the engine is attached to the engine mounts. To install the engine, proceed as follows:

a. Hoist engine and slip accessory section of engine through engine mount; align engine with engine mounts and install engine mount attaching parts. On Model 100 Darter, torque the engine mount bolts to 35 to 40-inch-pounds; on the Model 100-180 Lark, torque the engine mount bolts to 450-500 inch-pounds.
b. Install magnetos (see Magneto Installation in this Section) and vacuum pump.
c. Install components removed during engine removal and connect all lines, hoses, and wiring removed.
d. Connect throttle, mixture, and carburetor air control cables to carburetor (see Carburetor Adjustment in this Section).
e. Install propeller and spinner (see Propeller Installation in this Section).
f. Install engine cowling.

	O-320-A2B	O-360-A2F
Takeoff HP @ 2700 RPM	150	180
Bore, Inches	5.125	5.125
Stroke, Inches	3.875	4.375
Displacement, Cubic Inches	319.8	361.0
Compression Ratio	7.00:1	8.5:1
Oil Sump Capacity, Quarts	8.0	8.0
Fuel, Aviation Grade, Octane	80/87	100 Minimum
Magneto Drive, Ratio to Crankshaft	1.00:1	1.500:1
Rotation	Clockwise	Clockwise
Tachometer Drive, Ratio to Crankshaft	0.500:1	0.500:1
Rotation	Clockwise	Clockwise
Starter Drive, Ratio to Crankshaft	13.556:1	16.556:1
Rotation	C-Clockwise	C-Clockwise
Firing Order	1-3-2-4	1-3-2-4
Spark Plug Gap, Inches	See Lycoming Service Instruction No. 1042 (Latest Revision)	
Propeller Drive Ratio	1:1	1:1

Figure 4-8. Detail Engine Specifications

PROPELLER

GENERAL DESCRIPTION

The Model 100 Darter is equipped with a Sensenich, M74DM-60 fixed-pitch metal propeller, and the Model 100-180 Lark is equipped with a McCauley 1A170 CFA 7660 fixed-pitch metal propeller. A propeller spinner is attached to the propeller hub to streamline the aircraft and to direct a smooth flow of cooling air into the engine air intake. On the Model 100-180 Lark a spacer approximately four inches long is installed between the aft propeller bulkhead and the starter ring gear support assembly.

PROPELLER REMOVAL

The propeller spinner must be removed before removing the propeller. Also the position of the propeller with respect to the 25° timing mark on the starter ring gear should be noted. To remove the propeller, proceed as follows:

a. Remove screws attaching propeller spinner to propeller bulkheads and remove spinner.
b. Remove safety wire and remove bolts attaching propeller to engine, and pull propeller forward to remove.

CAUTION

Support propeller as bolts are removed to keep propeller from dropping or striking metal objects as it is removed from the engine.

c. On Model 100-180 Lark, remove spacer with propeller.

PROPELLER INSTALLATION

Before installing the propeller, the surfaces of the starter ring gear support and the pilot stub, as well as the rear face of the propeller hub boss and pilot

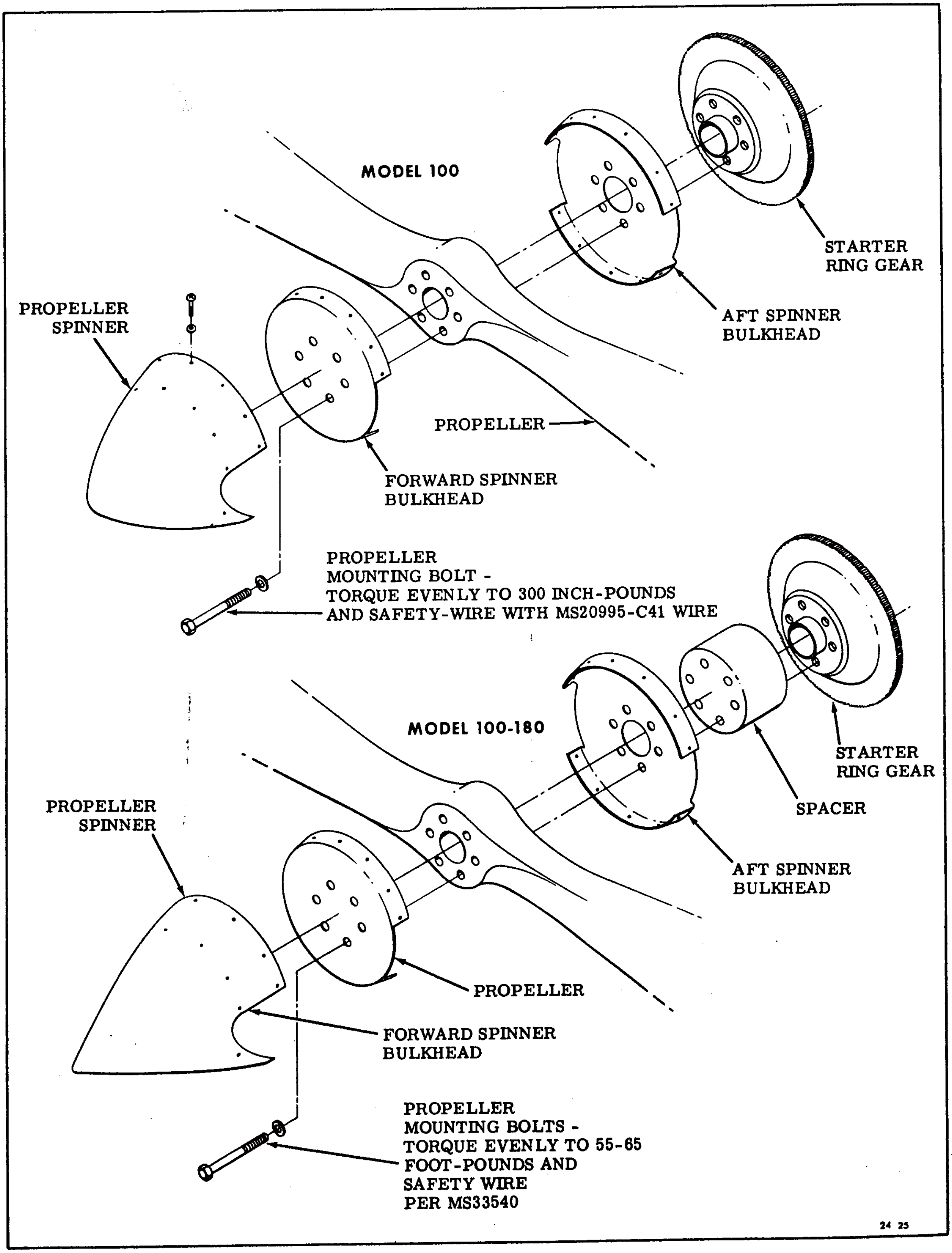


Figure 4-9. Propeller Installation

bore should be cleaned. They should be examined carefully for nicks or burrs, especially the end of the pilot stub. Any nicks or burrs should be stoned until smooth. Particular care should be taken to avoid cocking the propeller when starting it on the pilot stub. Do not force the propeller back against the ring gear support or spacer. The propeller spacer on the Model 100-180 Lark must be installed between the aft propeller bulkhead and the starter ring gear support when the propeller is installed. To install the propeller proceed as follows:

a. Align 25° timing mark on starter ring gear with top center of engine.
b. Install bolts through forward propeller bulkhead, propeller, and aft propeller bulkhead and install propeller horizontally on engine. On Model 100-180 Lark install spacer between aft propeller bulkhead and starter ring gear.
c. Torque propeller attach bolts on Model 100 Darter evenly to 300 inch-pounds; torque propeller attach bolts on Model 100-180 Lark to 55 to 65 foot-pounds.
d. Install propeller spinner.

PROPELLER REPAIR

Safe propeller blade repairs should be made to hold reductions from the original blade dimensions to a minimum, and to remove any "V" notch damage as promptly as possible by rounding out, fairing, and polishing the area of damage. The methods, techniques, and practices of FAA Advisory Circular No: 43.13-1 shall be followed when repairing the propeller.

SECTION V

FUEL SYSTEM

GENERAL DESCRIPTION

The aircraft fuel supply is contained in two welded metal tank assemblies. Each tank, which is located in the inboard end of each wing between the forward and aft wing spars, has a total capacity of 22 gallons; however, two gallons of fuel in each tank is not considered useable fuel. The filler neck and cap is located at the upper forward edge of each tank and is flush with the upper wing skin. A fuel vent that is common to both tanks extends overboard through the lower fuselage to vent the tanks. Fuel from each tank is routed to the carburetor through a fuel tank selector valve and to the fuel filter and drain assembly. The fuel is then directed through the electric fuel pump and the engine-driven pump to the carburetor on the Model 100-180 Lark. However, fuel is directed from the fuel filter and drain assembly directly to the carburetor on the Model 100 Darter. An electric-driven fuel pump, which is activated by a switch on the instrument panel, is installed between the fuel filter and drain and the engine-driven pump on the Model 100-180 Lark. An engine fuel primer installed on the instrument panel is connected between the fuel filter and drain and cylinders 1, 2, and 3, and is used for priming the engine during starts. A fuel pressure indicator, which indicates pressure of fuel to the carburetor, is installed on the instrument panel on the Model 100-180 Lark. A fuel quantity system, consisting of two transmitters and two indicators is installed for indicating the amount of useable fuel remaining in each fuel tank. See Figure 5-1.

FUEL TANKS

The all-metal fuel tanks are installed between the forward and aft wing spars on the inboard end of each wing. The fuel tanks each contain a total capacity of 22 gallons, however only 20 gallons are considered useable. This gives the total fuel system 40 gallons of useable fuel. A vent line, which is welded into the forward outboard side of the tank, extends inboard and connects to a fitting from the fuel vent from the opposite tank. A line is then connected to the fitting and routed overboard to vent both fuel tanks. Two baffles are installed in a fore and aft position in the tanks to keep the fuel from sloshing or moving too fast within the tank. The fuel quantity transmitters are installed through an access opening on the inboard end of each tank. Fuel flows through fuel lines installed on the forward and aft inboard sides of each tank to the fuel selector valve, installed on the floor between the pilot and copilot seats. On the Model 100 Darter and Model 100-180 Lark serial number 5001 through 5075 the wing must be removed prior to removing the fuel tank. However, on the Model 100-180 Lark serial number 5076 and subs, the fuel tank may be removed through an access door on top of the wing. A fuel drain is installed on the Model 100-180 Lark serial number 5101 and subs, on the lower aft inboard end of each tank. This drain may be used for draining fuel from the tanks. The fuel tanks should be pressure tested to a maximum of 1.5 psi after repair, to determine that they do not leak.

FUEL SYSTEM COMPONENTS

FUEL TANK SELECTOR VALVE

A fuel tank selector valve is installed on the cabin floor between the two forward seats. The tank selector valve has four positions: OFF, LEFT TANK, RIGHT TANK, and BOTH. When the selector is in LEFT TANK position fuel flows through the selector from the left tank only; fuel will flow through the selector from the right tank only when the selector is in RIGHT TANK position; and from both tanks when selector is in BOTH position. Fuel will not flow through the selector when the selector is in OFF position. However, fuel will flow through the selector from either wing tank to the other wing tank if one wing is higher when selector is in OFF position.

NOTE

> When the aircraft is parked with one wing low the fuel tank selector should be placed to right or left tank to prevent high tank from cross feeding and causing fuel to flow from tank vent.

When the fuel tank selector is in the BOTH position fuel is used at an equal rate from each tank. Since the fuel system is basically a gravity feed fuel system the fuel tank selector valve should be placed in the OFF position when the engine is not operating.

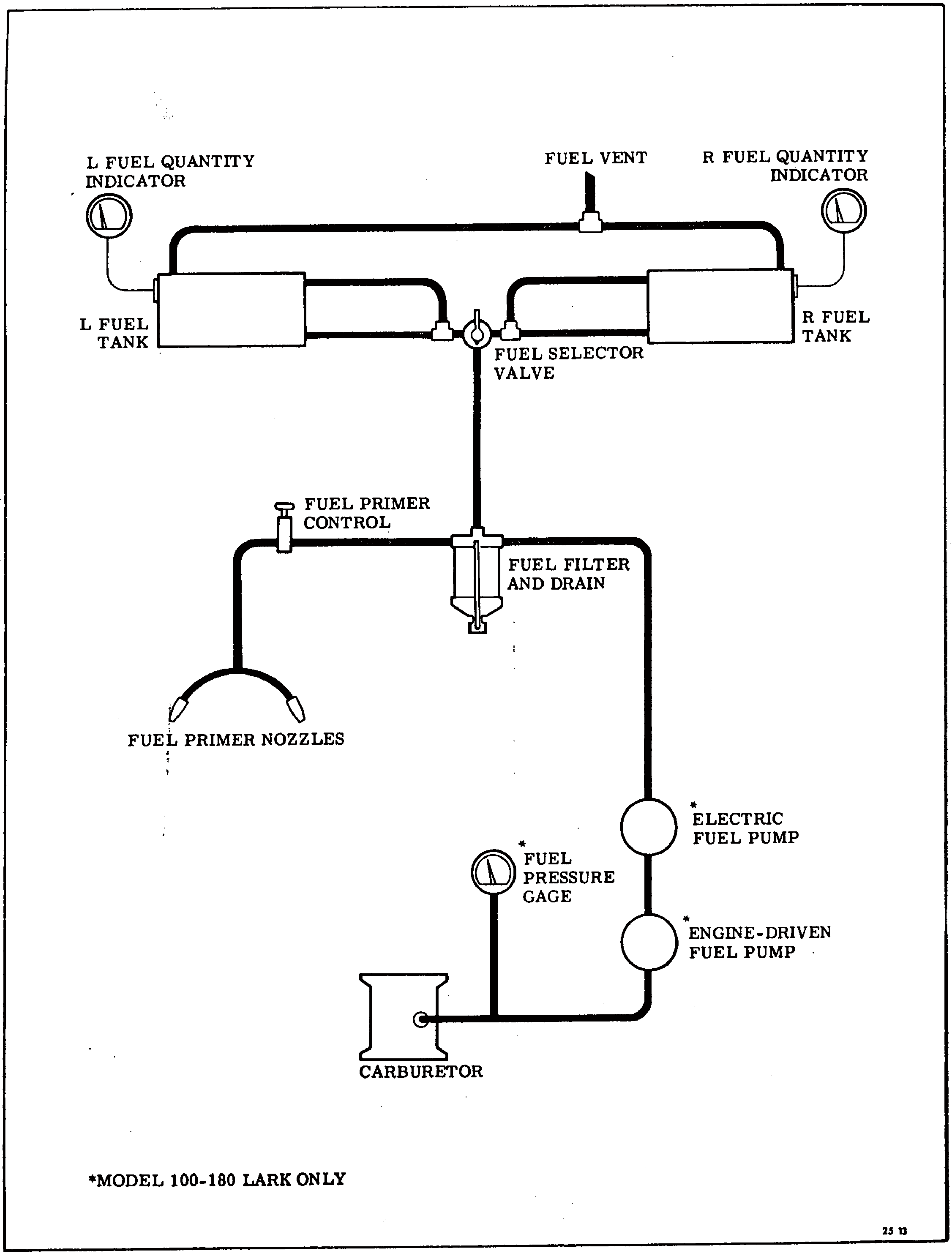


Figure 5-1. Fuel System Schematic

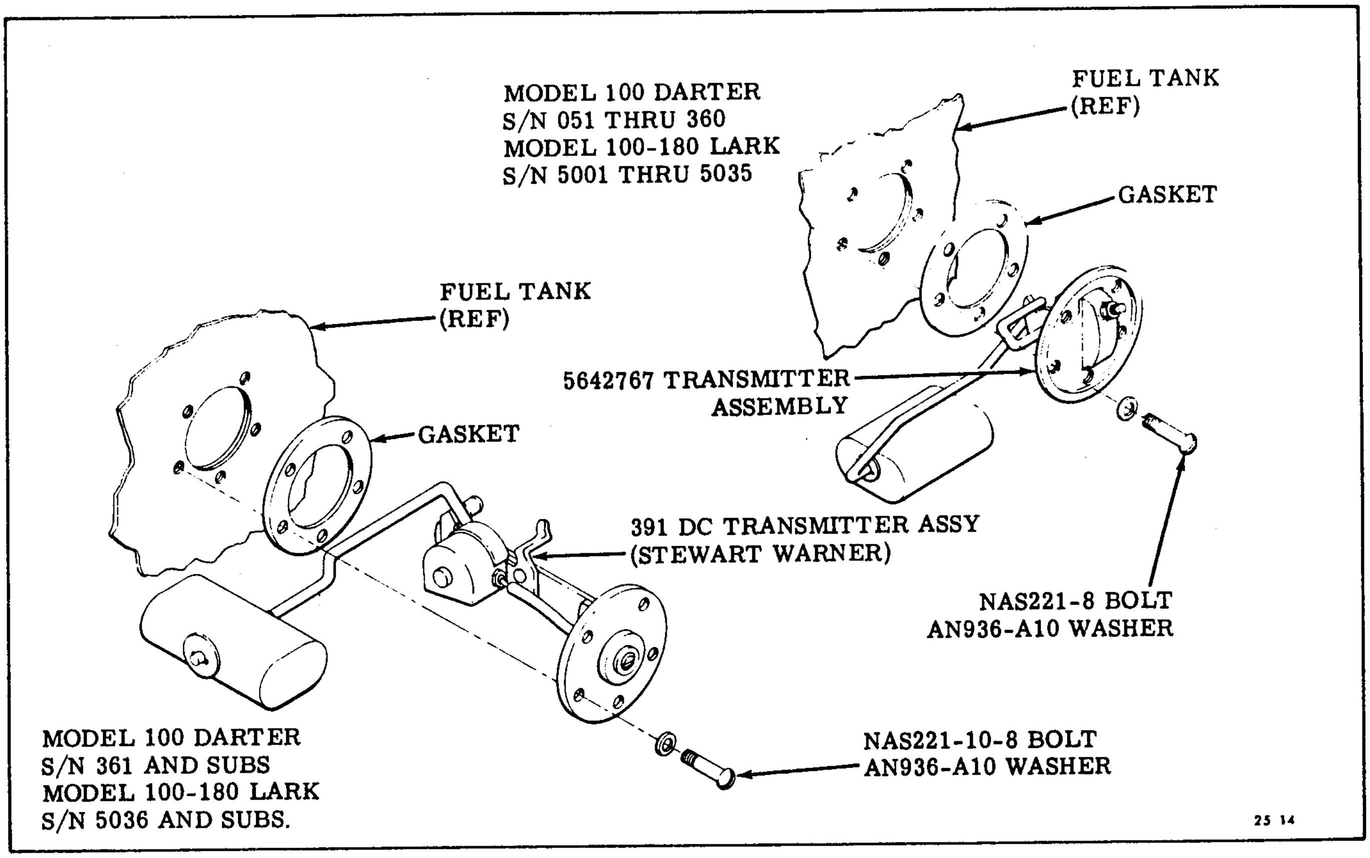


Figure 5-2. Fuel Quantity Transmitter Installation

FUEL TANK SELECTOR VALVE REMOVAL AND INSTALLATION. Prior to removing the selector valve, remove the carpeting from around the valve and gain access to the fuel lines to the valve. To remove the fuel tank selector valve, proceed as follows:

a. Completely drain all fuel from fuel tanks and fuel lines to selector valve.
b. Disconnect fuel lines from tee on each side of valve and from elbow on forward side of valve, and cap or plug fuel lines.
c. Remove selector valve handle and selector plate.
d. Remove two bolts, washers, and nuts attaching valve and remove valve.

To install the fuel tank selector valve, reverse the above steps. See Figure 5-3.

FUEL FILTER AND DRAIN

The fuel filter and drain assembly is installed on the forward lower left side of the engine firewall. It consists primarily of a filter screen, a sediment bowl, and a fuel drain. The filter and drain assembly is located in the lowest part of the fuel system to trap any moisture or foreign material in the fuel. Fuel enters and exists from the fuel filter through the filter top casting. The drain is incorporated in the base of the filter to drain moisture that may accumulate in the filter. See Figure 2-5.

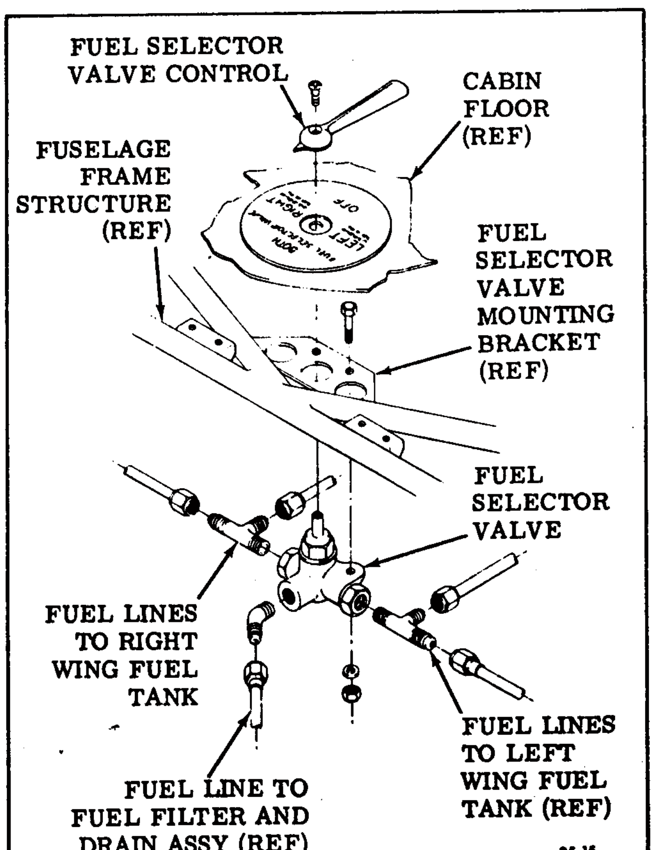


Figure 5-3. Fuel Tank Selector Valve

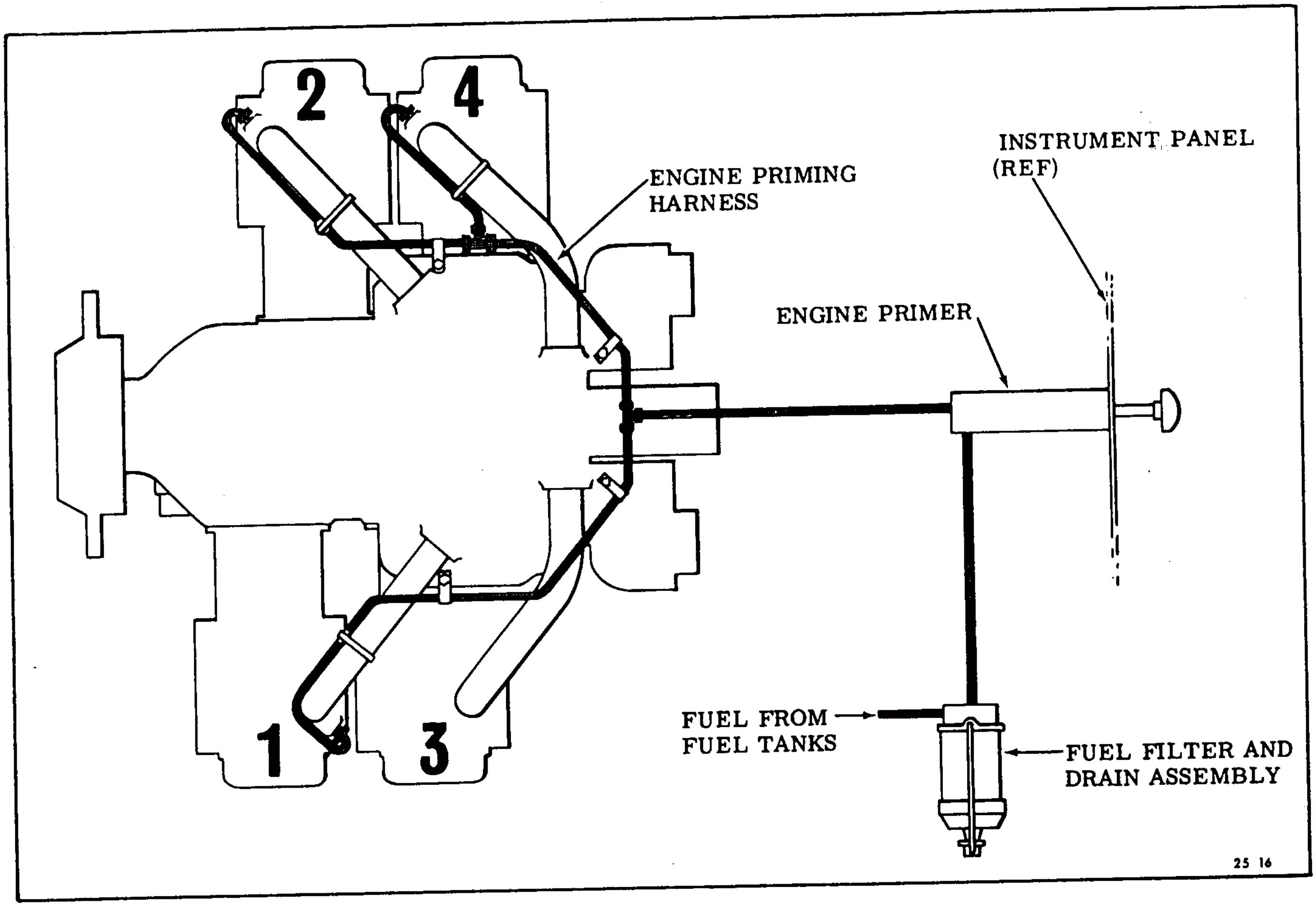


Figure 5-4. Fuel Primer System

FUEL FILTER AND DRAIN REMOVAL AND INSTALLATION. To remove the fuel filter and drain assembly, proceed as follows:

a. Loosen screw on lower portion of fuel filter and drain and slip retainer from top of assembly.
b. Remove gaskets, glass, drain, and screen filter from assembly.
c. Clean parts in gasoline or solvent and dry.

To install the fuel filter and drain, reverse the removal procedure.

ENGINE FUEL PRIMER

The engine fuel primer is installed in the lower center instrument panel and is utilized to prime the engine during cold weather. The fuel primer is connected between the engine fuel filter and drain assembly and cylinders 1, 2, and 4. The primer should be used approximately three or four times during extreme cold weather operation. If the engine fails to start on the first attempt another attempt should be made without priming. If this fails it is possible that the engine is overprimed, and the primer should be turned and locked in the OFF position, the throttle opened slowly, and the engine turned over approximately 10 revolutions. The engine should then be primed with half the original prime and the starting procedure repeated. See Figure 5-4

ENGINE DRIVEN FUEL PUMP (Model 100-180 Lark Only)

An engine-driven fuel pump is installed on the lower left side of the engine accessory section. This installation provides a 3 to 5 psi fuel pressure from the engine-driven fuel pump to the carburetor, assuring that the carburetor is obtaining fuel under pressure. The fuel pump is actuated by the fuel pump plunger which is in turn actuated by the cam on the crankshaft idler gear. The fuel pump makes one stroke each two times the crankshaft is rotated.

ELECTRIC FUEL PUMP (Model 100-180 Lark Only)

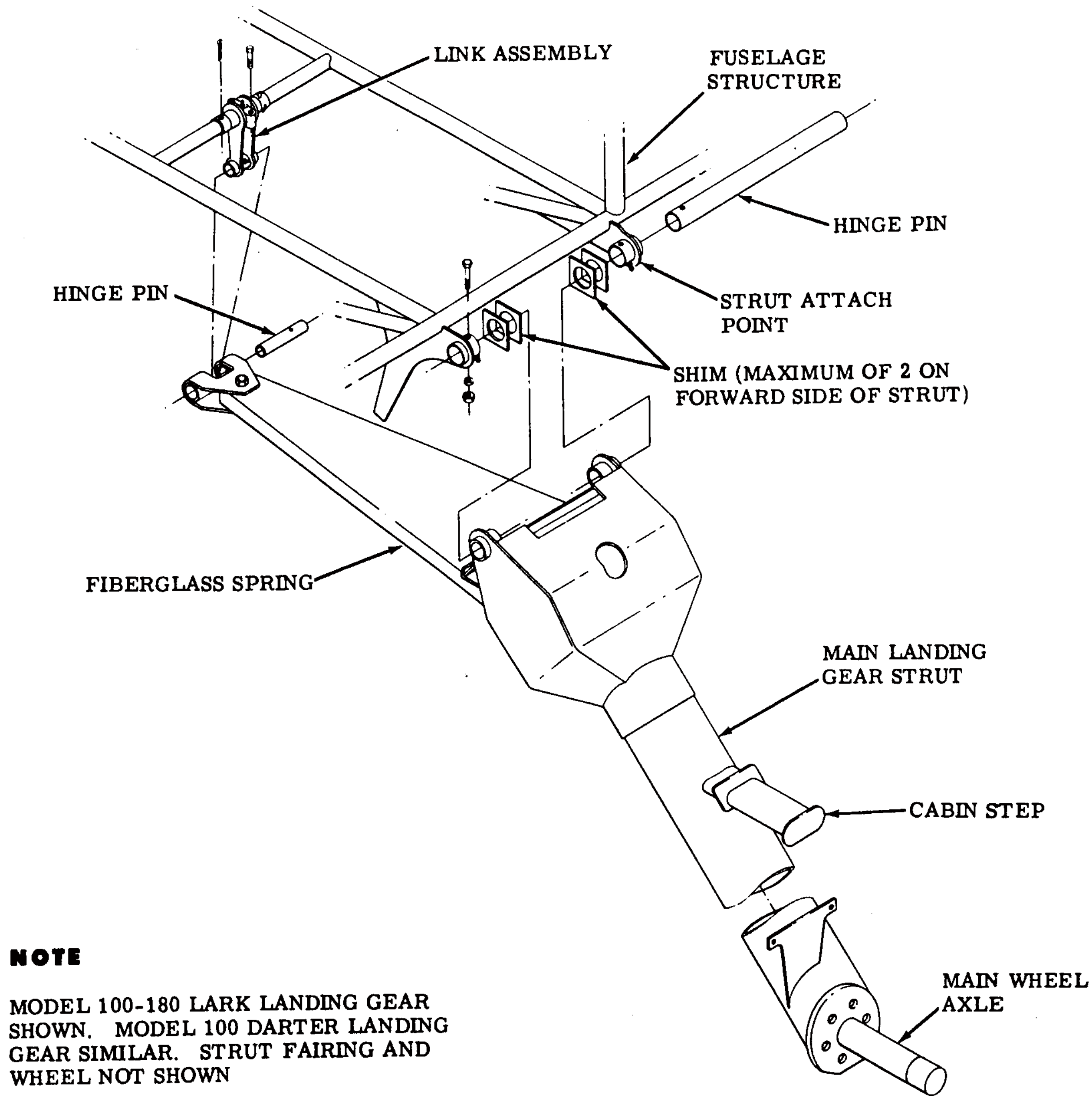
An electric fuel pump is installed on the left side of the engine firewall above and left of the fuel filter and drain assembly. The pump is connected between the fuel filter and drain assembly and the engine-driven fuel pump, and is utilized for supplying fuel to the engine-driven fuel pump for starting, takeoff, and landing. The electric fuel pump may also be used as an alternate means of pumping fuel to the carburetor in the event the engine-driven fuel pump should fail. The switch for activating the electric fuel pump is located on the lower left side of the pilots instrument panel. The electric pump delivers fuel to the engine-driven pump at a flow rate of 4.5 (+0.25, -0.50) psi.

ELECTRIC FUEL PUMP SCREEN FILTER. The electric fuel pump contains a screen filter and magnet in the lower end of the pump assembly. The screen filter and magnet should be cleaned every 100 hours of operation. To remove and clean the screen filter and magnet proceed as follows:

a. Turn fuel selector to OFF position.
b. Loosen nut on bottom of filter and twist bottom cover by hand to release cover from bayonet fittings and remove cover from pump.
c. Carefully remove filter screen and wash in clean solvent. Replace screen if distorted.
d. Clean magnet in center of cover and check condition of cover gasket. Replace cover gasket if deteriorated.

To install the screen filter, proceed as follows:

a. Place filter screen around magnet in bottom of cover.
b. Twist cover with fingers and carefully guide screen around the plunger spring cup. The screen must fit snugly without pinching or distorting.
c. Tighten bolt holding bottom cover to pump.
d. Turn fuel selector to ON position.
e. Check that fuel does not leak around fuel filter cover.



NOTE

MODEL 100-180 LARK LANDING GEAR SHOWN. MODEL 100 DARTER LANDING GEAR SIMILAR. STRUT FAIRING AND WHEEL NOT SHOWN

Figure 6-1. Main Landing Gear

MAIN WHEEL DISASSEMBLY (Aircraft 121 and Subsequent). The following procedure is for disassembly of Goodyear wheels. To disassemble the main wheel, proceed as follows:

a. Break tire beads away from wheel flanges with hands or by carefully stepping on tire while wheel lies flat.

CAUTION

Do not use tire tools. They may damage wheel flanges or tire beads.

b. Remove self-locking nuts and washers from wheel bolts.

c. Separate wheel halves and remove tire and tube.

NOTE

Bearing cups are shrink fitted into wheel halves and should not be removed unless replacement is necessary.

CLEANING, INSPECTION, AND REPAIR

a. Clean all metal parts in PS-661 cleaning solvent and wipe dry with a clean lint-free cloth.

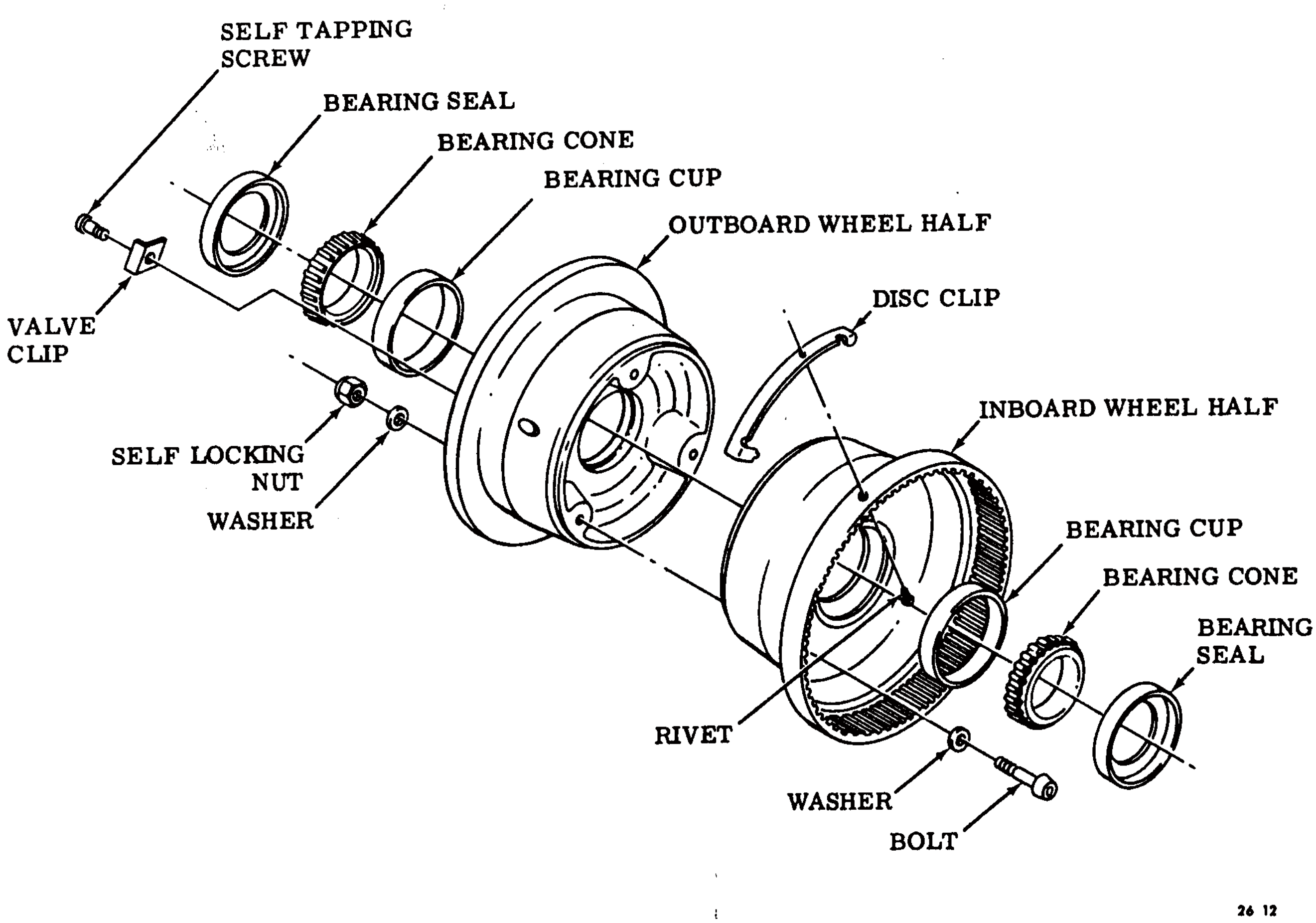


Figure 6-2. Main Landing Wheels (Aircraft 121 and Subs)

b. Wash bearings in clean solvent and dry with compressed air. However, do not allow compressed air to spin the bearings.

NOTE

Wash bearing cones last to keep solution clean. Place all parts in a clean place to avoid picking up foreign material.

c. Clean bearing seals in denatured alcohol and dry.
d. Inspect wheel halves for possible damage or cracks. If a casting is cracked or shows excessive corrosion, it should be replaced. Small nicks or gouges in the casting should be blended out and polished with fine (400 grit) sandpaper. Areas where protective coating has been removed or which show slight corrosion, should be thoroughly cleaned and repainted with two coats of zinc chromate primer and two coats of aluminum lacquer.
e. Inspect disc drive teeth of wheel half for damage or wear. If three or more teeth are worn to a thickness of 0.070-inch at a point 0.100-inch from top of tooth, replace the wheel half. A gauge can be fabricated to check tooth dimensions accurately (see Figure 6-3).
f. Inspect bearing cups for damage or wear. Do not remove bearing cups unless replacement is necessary.
g. Inspect bearing cones for possible damage or wear and then coat cones with clean bearing grease.
h. Inspect bearing seals for nicks, distortion, or damage that may affect the sealing qualities. Replace bearing seals if damaged.
i. Inspect wheel bolts for deformation or cracks at the head junction and at the first two threads adjacent to shank. Replace bolts if necessary.
j. Inspect self-locking nuts for locking condition. If nut can be turned past end of bolt threads with fingers replace nut. Nuts should be replaced after being removed 10 times.

MAIN WHEEL REASSEMBLY AND INSTALLATION. Prior to reassembly of the main wheel the bearing cones, the surface of the bearing cups, and the contacting edges of the bearing seals shall be lubricated with Mil-G-5345 bearing grease or equivalent. To reassemble the main wheel, proceed as follows:

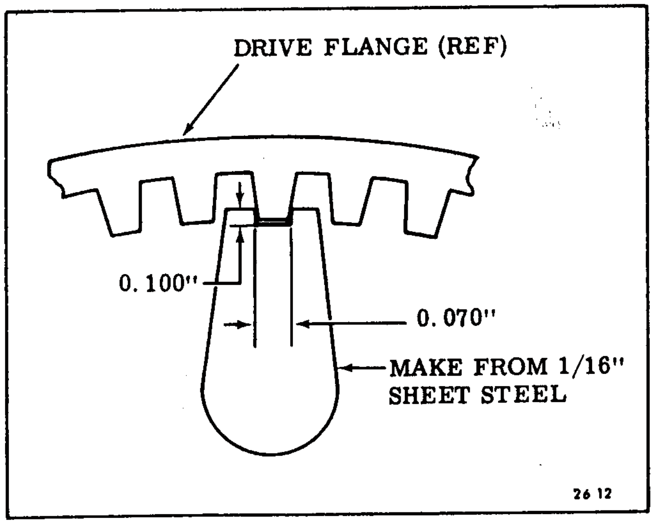


Figure 6-3. Disc Drive Teeth Dimension Gauge

a. If bearing cups have been removed install them as follows:
   1. Heat wheel half in boiling water or an oven for 30 minutes not to exceed 149°C (300°F) and chill cups with dry ice.
   2. Remove wheel half from heat and immediately install chilled cup and seal.

b. Inflate inner tube until just rounded out and install in tire with yellow stripe on base of inner tube aligned with red dot on tire.

c. Install tire and tube on outboard wheel half and position valve stem in valve stem hole.

d. Place inboard wheel half in tire and align bolt holes.

e. Place countersunk washers on bolts with countersink facing bolt head, and install bolt through inboard and outboard wheel halves and secure with plain washers and self-locking nuts.

f. Torque self-locking nuts evenly to 83 inch-pounds.

g. Inflate tire just enough to seat the beads then completely deflate.

h. Install valve core and inflate tire.

i. Pack bearing cones with clean Mil-G-5345 bearing grease and lubricate lips of bearing seals.

j. Install bearing seal and cone on axle then install wheel and tire, outboard bearing cone, and outer bearing seal.

CAUTION

The wheel must be positioned so that the three wide slots between the teeth of the rotating discs are in alignment with the three clips. The three disc clips must be pried upward and retained in that position with wooden wedges until wheel is installed.

k. Install axle washer and nut. Tighten axle nut until bearings bind slightly, then back axle nut off to nearest castellation and install cotter pin.

NOTE

Rotate the wheel while adjusting the axle nut to assure proper seating, and check that there is no side motion in wheel.

l. Inflate tire to 28 pounds and install valve cap.

NOSE LANDING GEAR

The nose landing gear strut outer body is welded to and becomes a part of the engine mount assembly. The nose landing gear cylinder and piston fits upward through the strut outer body. An upper and lower strut bearing fits between the strut outer body and the strut cylinder, permitting the strut cylinder to rotate within the outer body. A shimmy damper collar or bracket assembly is secured to the upper end of the strut by a through bolt, and a shim separates the collar from the upper strut bearing. An air port or an air valve in the top of the cylinder is utilized for servicing the cylinder with hydraulic fluid and supplying air pressure to the strut. The lower strut bearing fits over the strut cylinder to ride against a machined collar on the cylinder. The cylinder is pulled up against this bearing to mate with the lower outer body sleeve, and the entire assembly is held in place by the upper shimmy damper collar and through bolt. On the Model 100 Darter serial number 051 thru 250 the upper strut cylinder contains a coil spring, which is held in place by the lower cylinder nut, to aid in absorbing the minor shock forces incurred during taxi (see Figure 6-4). On Model 100 Darter serial number 251 and subs and on all Model 100-180 Larks the compression of air and metering of oil through a hole in the top of the piston controls the flow of the oil from the cylinder assembly through the piston, allowing the piston to move through the oil with a resistance to the shock loads (see Figure 6-4). The strut cylinder is joined to the landing gear fork boss by the upper and lower scissors links. Bolts and accompanying hardware secure the towing arm and nose wheel fork to the fork boss. The nose wheel fairing is attached to the nose wheel fork with bolts, and the nose wheel is attached to the nose wheel fork with an axle, axle rod, spacers, end caps, and cotter pins.

NOSE LANDING GEAR WHEELS

The nose landing gear wheel is equipped with a 600 x 6, four-ply tube tire, which is normally inflated to 28 pounds. The wheel halves are divided and held together with bolts and secured with washers and self-locking nuts. The nose wheel is secured to the nose gear fork assembly with an axle rod, axle, spacers, axle end caps, and cotter pins. The wheel is supported with two tapered roller bearings, seated in hardened cups in the wheel hub, protected by special rubber grease seals to prevent loss of lubricant and to keep foreign material from the bearings.

MODEL 100 (051 Thru 250)

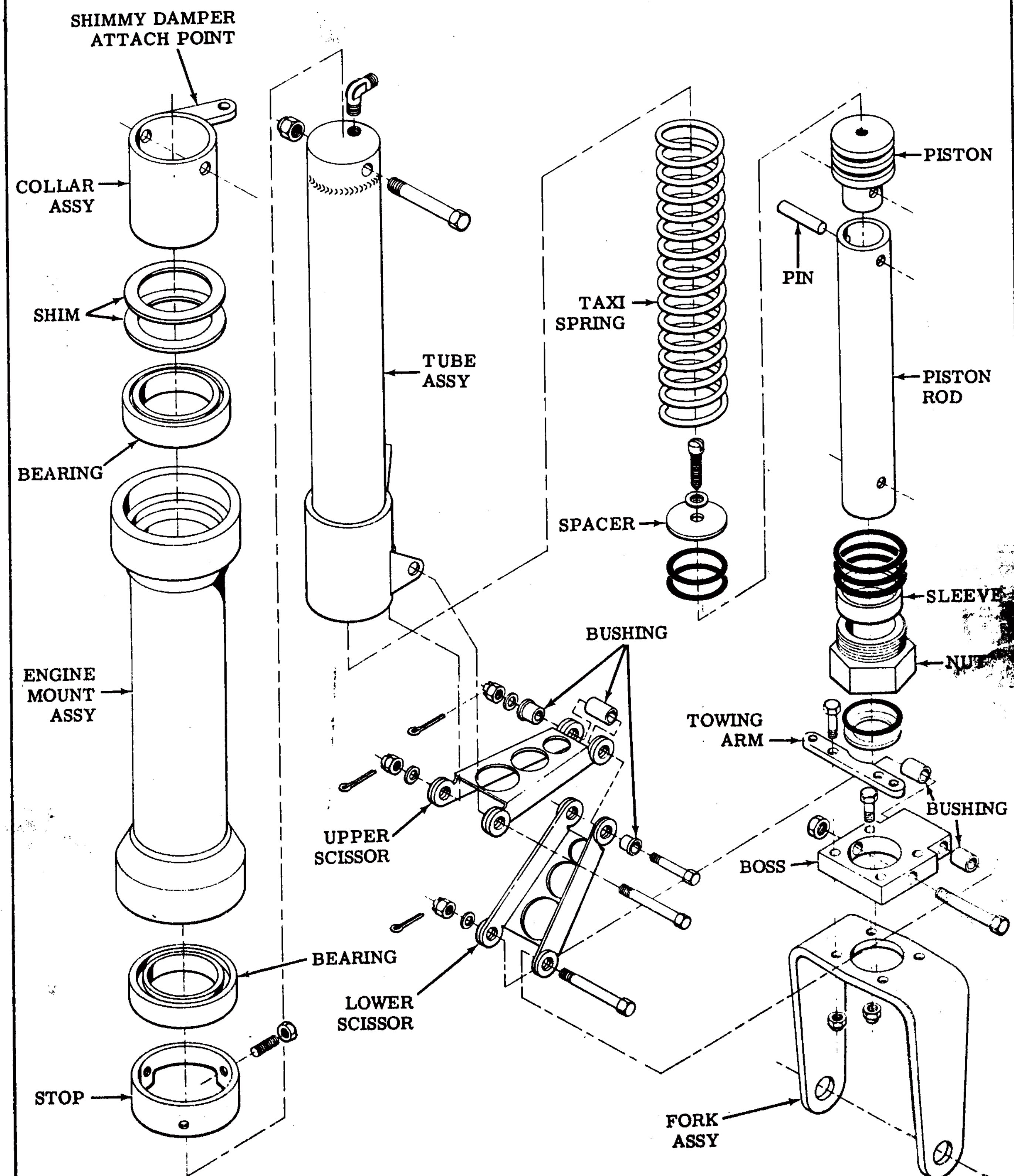


Figure 6-4. Nose Landing Gear (Sheet 1 of 2)

SECTION VI

LANDING GEAR AND BRAKES

GENERAL DESCRIPTION

The aircraft is equipped with a fixed tricycle landing gear. Four-ply 600 x 6 tires are installed on all three landing gear wheels. Fiberglass springs are employed on the main gears and an air/oil landing gear strut assembly is used on the nose gear to absorb landing and taxiing shock loads. The main landing gear wheels are equipped with hydraulic brakes, and a nose wheel steering assembly is installed on the nose wheel. A nose wheel shimmy damper is also secured between the nose wheel and the engine mount.

MAIN LANDING GEAR

The main landing gear strut for the Model 100 Darter is made from two sections of sheet steel patterned and formed to make an elliptical cone, while the main landing gear strut for the Model 100-180 Lark is made from tubular steel. See Figure 6-1. A weld assembly is inserted into the upper end of the strut and welded to the strut body, to provide the attachment fittings and bushing housing. The strut is then attached to trunnion fittings welded to the lower cabin frame tube, immediately forward of the aft door tubular bulkhead. Hinge pins are inserted through the landing gear trunnion fittings and strut attachment bushings to attach the strut and wheel assembly to the aircraft. A fiberglass spring leaf that is attached to a link rod below the center cabin floor, extends outboard to steel mounting plates in the upper strut attachment structure of each strut. The connecting link rod for each fiberglass spring is attached to a longitudinal tube that is welded to the cabin truss tubes, slightly outboard of the aircraft centerline. The lower part of the link rod is attached to a hinge pin connection on the fiberglass spring leaf attachment plate. The main landing gear strut is attached to the fuselage at an angle that allows the strut to rotate on the hinge pins when landing or taxiing shock loads are placed on the landing gear. These shock loads increase the angle between the landing gear wheel and the fuselage, and cause the fiberglass spring to depress downward and pull the connecting link assembly toward the vertical position. This dampens the forces causing the landing gear to deflect. As these forces diminish the fiberglass spring returns toward the neutral position and repositions the connecting link assembly. The upper and lower ends of each link rod and the landing gear strut hinges contain grease fittings. Grease fittings on the link rods are accessible through an inspection plate located on the cabin floor, and the grease fittings on the strut hinges are accessible by removing the fairing cap on top of the landing gear strut.

MAIN LANDING GEAR WHEELS

All landing gear wheels are equipped with 600 x 6, four-ply tube tires, which are normally inflated to 28 pounds. On the Model 100 Darter serial number 051 thru 120 the main landing gear wheel inner section consists of a brake drum that fits over the wheel brake shoes bolted to a back plate that is welded to the landing gear strut. On Model 100 Darter serial number 121 and subsequent and all Model 100-180 Larks the wheel halves are divided and held together with bolts and secured with washers and self-locking nuts. See Figure 6-2. Each wheel has two tapered roller bearings, seated in hardened cups in the wheel hubs, protected by special rubber grease seals to prevent loss of lubricant and to keep foreign material from the bearings.

MAIN WHEEL REMOVAL (Aircraft 121 and Subsequent). The procedure for removing the main wheels is for aircraft with Goodyear landing gear and brakes installed. To remove the main wheel, proceed as follows:

a. Jack aircraft in accordance with instructions contained in Section II of this manual.
b. Remove bolts, washers, and nuts attaching main landing gear fairing and remove fairing from wheel.
c. Remove valve core and deflate tire.
d. Remove cotter pin from axle nut and remove axle nut.
e. Pry the three disc clips up and retain in that position with wooden wedges until wheel is removed.
f. Remove wheel from axle.

CAUTION

When removing wheel be careful not to drop or damage bearing seals or bearing cones.

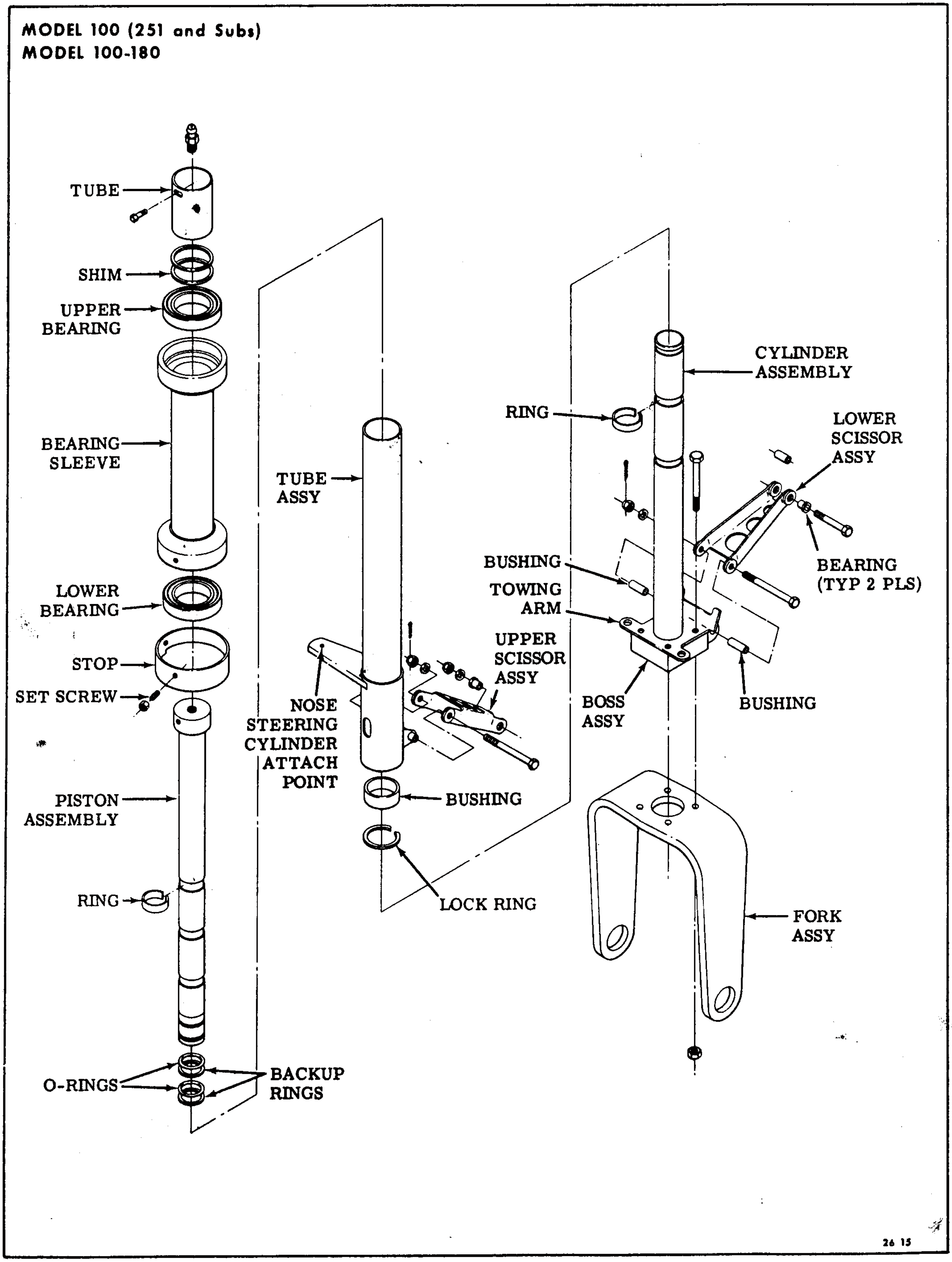


Figure 6-4. Nose Landing Gear (Sheet 2 of 2)

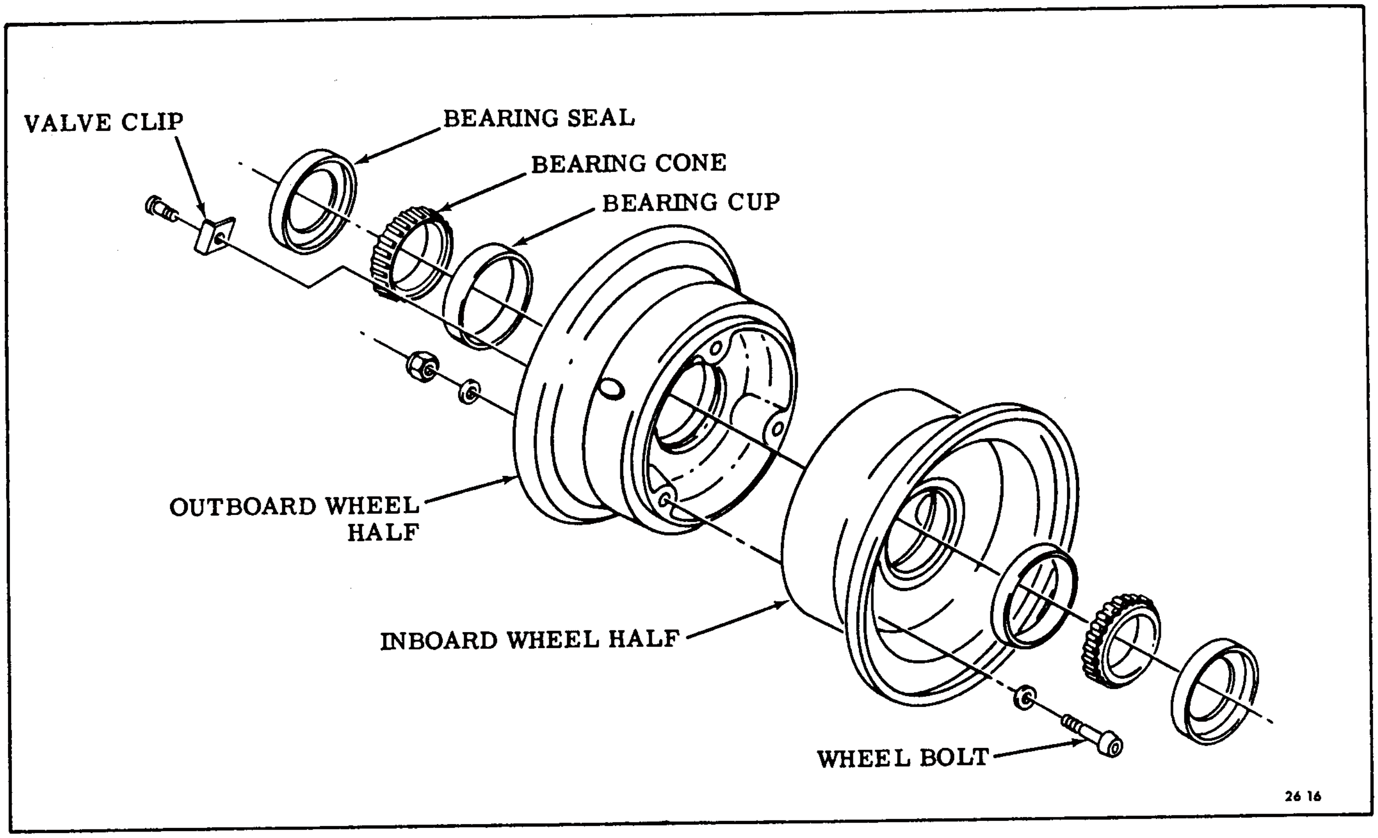


Figure 6-5. Nose Wheel Assembly (Aircraft 121 and Subs)

NOSE WHEEL REMOVAL (Aircraft 121 and Subsequent). The procedure for removing the nose wheel is for aircraft with Goodyear wheels installed. To remove the nose wheel, proceed as follows:

a. Weight tail of aircraft until nose gear is fully extended and tire clears the ground.
b. Remove bolts attaching wheel fairing to nose gear fork assembly and raise wheel fairing.
c. Remove cotter pin and remove end cap from axle.
d. Remove axle rod, axle, and spacer from wheel and remove wheel from fork assembly.

CAUTION

When removing wheel be careful not to drop or damage bearing seals or bearing cone.

NOSE WHEEL DISASSEMBLY (Aircraft 121 and Subsequent). The following procedure is for disassembly of the Goodyear nose wheel. See Figure 6-5. To disassemble the nose wheel, proceed as follows:

a. Remove valve core and deflate tire.
b. Break tire beads away from wheel flanges with hands or by carefully stepping on tire while wheel lies flat.

CAUTION

Do not use tire tools. They may damage wheel flanges or tire beads.

c. Remove self-locking nuts and washers from wheel bolts.
d. Separate wheel halves and remove tire and tube.

NOTE

Bearing cups are shrink fitted into wheel halves and should not be removed unless replacement is necessary.

CLEANING, INSPECTION AND REPAIR

a. Clean all metal parts in PS-661 cleaning solvent and wipe dry with a clean lint-free cloth.
b. Wash bearings in clean solvent and dry with compressed air. However, do not allow compressed air to spin the bearing.

NOTE

Wash bearing cones last to keep solution clean. Place all parts in a clean place to avoid picking up foreign material.

c. Clean bearing seals in denatured alcohol and dry.
d. Inspect wheel halves for possible damage or cracks. If a casting is cracked or shows excessive corrosion, it should be replaced. Small nicks or gouges in the castings should be blended out and polished with fine (400 grit) sandpaper. Areas where protective coating has been removed or which show slight corrosion, should be thoroughly cleaned and repainted with two coats of zinc chromate primer and two coats of aluminum lacquer.
e. Inspect bearing cups for damage or wear. Do not remove bearing cups unless replacement is necessary.
f. Inspect bearing cones for possible damage or wear and then coat with bearing grease.
g. Inspect bearing seals for nicks, distortion, or damage that may affect their sealing qualities. Replace bearing seals if damaged.
h. Inspect wheel bolts for deformation or cracks at head junction and at first two threads adjacent to shank. Replace bolts if necessary.
i. Inspect self-locking nuts for locking condition. If nut can be turned past ends of bolt threads with fingers replace nut. Nuts should be replaced after being removed 10 times.

NOSE WHEEL REASSEMBLY AND INSTALLATION. Prior to reassembly of the nose wheel the bearing cones, the surface of the bearing cups, and the contacting edges of the bearing seals shall be lubricated with Mil-G-5345 bearing grease or equivalent. To reassemble the nose wheel, proceed as follows:

a. If bearing cups have been removed install them as follows:
    1. Heat wheel half in boiling water or an oven for 30 minutes not to exceed 149°C (300°F) and chill cups with dry ice.
    2. Remove wheel half from heat and immediately install chilled cup and seal.
b. Inflate inner tube until just rounded out and install in tire with yellow stripe on base of inner tube aligned with red balance dot on tire.
c. Install tire and inner tube on outboard wheel half and position valve stem in valve stem hole.
d. Place inboard wheel half in tire and align bolt holes.
e. Place countersunk washers on bolts with countersink facing bolt head, and install bolt through inboard and outboard wheel halves and secure with plain washers and self-locking nuts.
f. Torque self-locking nuts evenly to 83 inch-pounds.
g. Inflate tire just enough to seat the beads then completely deflate.
h. Install valve core and inflate tire.
i. Pack bearing cones with clean Mil-G-5345 bearing grease and lubricate lips of bearing seals.
j. Install bearing seal and cone on axle then install wheel and tire, other bearing cone, and seal.
k. Install axle washer and nut. Tighten axle nut until bearings bind slightly, then back axle nut off to nearest castellation and install cotter pin.

NOTE

Rotate the wheel while adjusting the axle nut to assure proper seating, and check that there is no side motion in wheel.

l. Inflate tire to 28 pounds and install valve cap.

The nose wheel and tire are balanced assemblies and the red dot on the tire must align with the valve stem. If nose wheel shimmy is encountered during takeoff or landing and the shimmy damper is properly serviced, the nose wheel and tire should be balanced with automotive balancing equipment.

SHIMMY DAMPER

The shimmy damper is installed on a bracket welded to a diagonal member of the engine mount. A clevis on the inboard end of the shimmy damper piston rod is attached to an arm on top of the nose landing gear strut. On aircraft serial number 026 through 088 the shimmy damper should be checked at each 100-hour inspection, or at any time shimmy is detected in the nose wheel. Remove the filler plug on top of the shimmy damper and fill with SAE 40 engine oil. Reinstall and safety wire the filler plug. On aircraft serial number 089 and subsequent, the shimmy damper is a sealed unit; therefore, if shimmy is detected in the nose wheel, remove and replace the shimmy damper.

BRAKES

The main landing gear wheels are equipped with hydraulic brakes. A hydraulic fluid reservoir is installed on the left forward side of the engine firewall. On the Model 100 Darter hydraulic fluid is supplied from the reservoir to a brake master cylinder, which is secured to the fuselage frame forward of the instrument panel. On the Model 100-180 Lark hydraulic fluid is supplied to two individual master cylinders, which are installed forward of the pilots rudder-brake pedals. The brake master cylinder on the Model 100 Darter is linked to the brake handle by a push-pull tube. The brake handle, which extends aft from below the instrument panel just to the right of aircraft centerline, is positioned by a brake handle pivot bracket supported to the aircraft frame by a mounting secured to the aircraft frame. When the brake handle is pulled aft the piston of the brake master cylinder moves forward, forcing brake fluid to each individual wheel brake cylinder. On Model 100 Darter serial number 051 through 120 the wheel brake cylinders expand and move the brake shoes out against the brake drum to provide the braking force. On Model 100 Darter serial number 121 and subsequent the wheel brake cylinders move a piston lining against a brake disc to provide the braking force (see Figure 6-7).

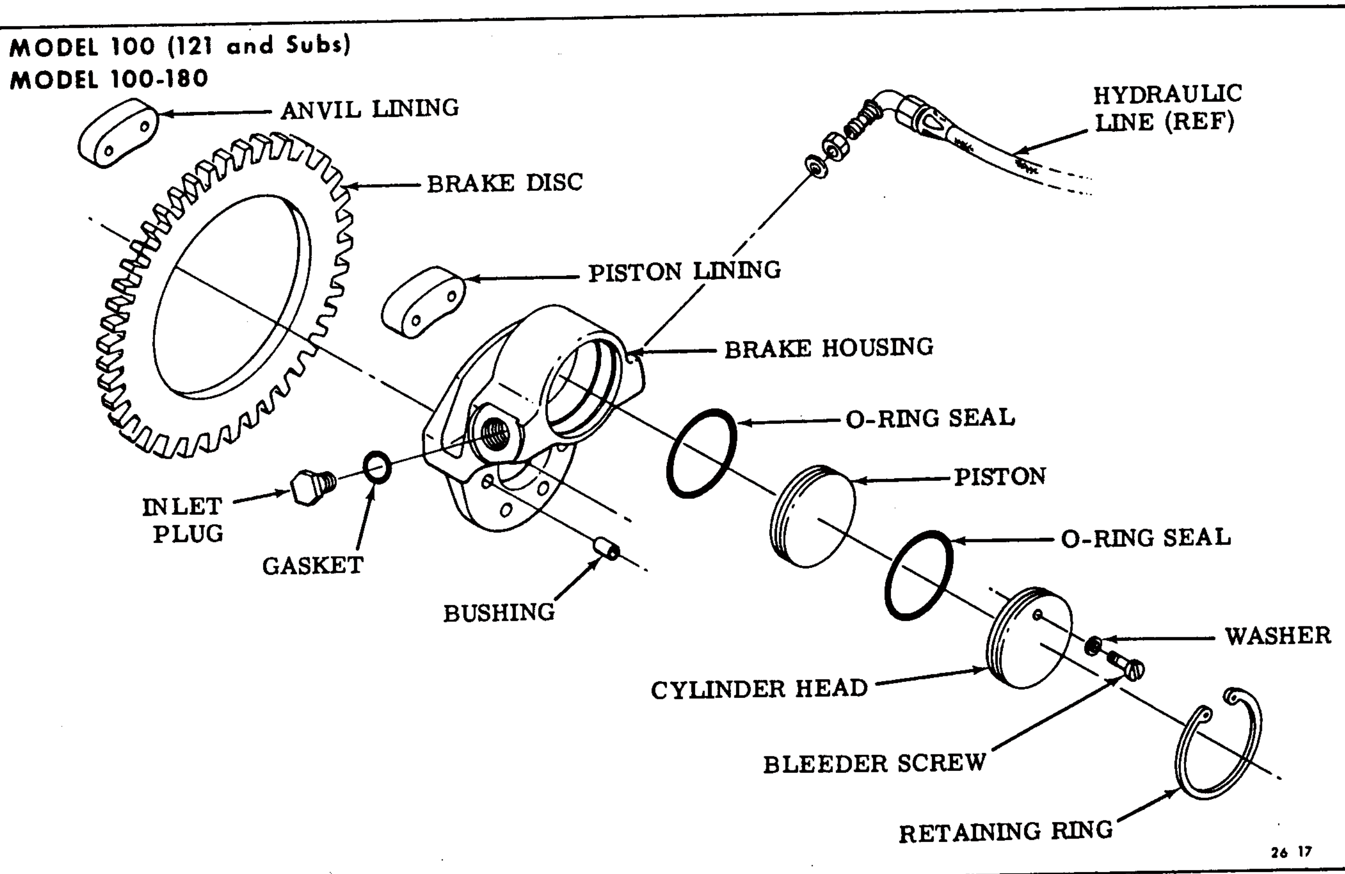


Figure 6-6. Brake Assembly (Aircraft 121 and Subs)

The brake master cylinder for the Model 100 Darter has provisions for locking the brake master cylinder in the brake pressure position to provide a parking brake. The parking brake control is attached to the master cylinder and controlled by a flexible cable and control knob, which is secured to the instrument panel immediately to the right of the mixture control. On the Model 100-180 Lark hydraulic fluid is directed to each wheel brake cylinder by the individual brake master cylinders installed just forward of the pilots rudder-brake pedal. When the rudder-brake pedals are pressed hydraulic fluid is forced through the respective brake master cylinders to each individual wheel cylinder. The wheel brake cylinders move a piston lining against a brake disc to provide a braking force. A parking brake control valve is installed on the aft side of the forward cabin bulkhead and is actuated by a parking brake control installed in the instrument panel. The parking brakes may be applied by actuating the rudder-brake pedals and pulling the parking brake control. On the Model 100 Darter a single hydraulic line extends under the cabin floor down the right side of the fuselage from the brake master cylinder to a tee fitting where a line is routed to each wheel brake cylinder. On the Model 100-180 Lark a line is routed under the cabin floor from each master cylinder to each individual wheel brake cylinder.

BRAKE ASSEMBLY

The wheel brake assembly consists primarily of a wheel brake housing, a rotating brake disc, an anvil lining, and a piston lining (see Figure 6-6). Braking action is produced by hydraulically clamping the rotating brake disc between the piston and anvil linings, which are retained in recesses provided in the brake housing and piston. To assure equal pressure from the entire surface of both brake linings, the rotating brake disc is geared to rotate with the wheel and to permit it to "float" sideways, allowing the brake disc to rotate free of the linings when the brakes are not applied. Inlet ports are provided on each side of the brake housing, so it can be installed on either wheel of the aircraft.

BRAKE LINING WEAR. Brake linings may be checked to determine the amount of wear and their serviceability without disassembly of the brake. To check the brake lining wear, proceed as follows:

a. Depress rudder-brake pedals and set parking brake.
b. Measure distance between rotating disc and flat surface of brake housing near center of disc face as shown in Figure 6-7.
c. Replace linings if space between rotating disc

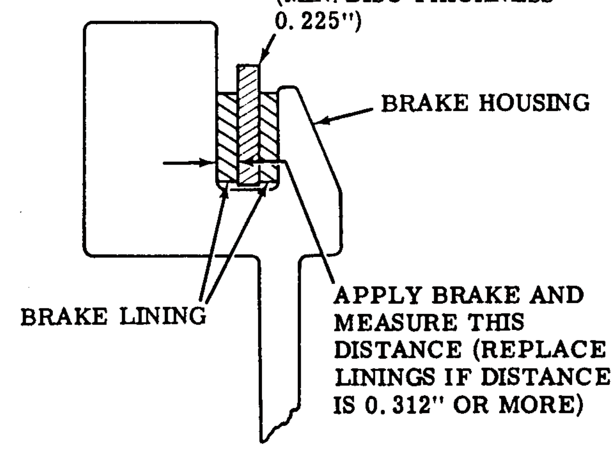


Figure 6-7. Brake Lining Wear

and flat surface of brake housing is or exceeds 0.312-inch.

BRAKE LINING REPLACEMENT. When the space between the rotating disc and flat surface of brake housing is or exceeds 0.312-inch the brake line shall be replaced. To replace the brake lining, proceed as follows:

a. Jack aircraft and remove main wheel.
b. Remove brake disc as far out of brake as possible.
c. Insert a flat screwdriver between the brake linings and force linings to a complete "brake off" position.
d. Remove worn brake linings from brake.

CAUTION

Never mix new and used brake linings. If necessary to reinstall worn linings, replace them in their original positions.

e. Install thicker brake lining on piston side of brake housing with part number facing piston so that smooth side of lining will be in contact with rotating disc.
f. Install thinner brake lining on anvil side of brake housing with part number facing anvil so that smooth side of lining is in contact with rotating disc.
g. Position rotating disc between linings and install wheel on axle.
 1. Position wheel with three wide slots between the teeth of the rotating disc in alignment with the clips.
 2. Remove wedges from clips after wheel is in position and clips are on disc.
h. Rotate wheel and ascertain that all clips are properly installed and do not rub against brake.
i. Apply brakes several times to seat the anvils with the rotating disc.
j. Release brakes and check that wheel rotates freely and does not rub against brake.

BLEEDING BRAKES. To obtain correct operation of the brakes it is necessary to have a direct transfer of hydraulic pressure throughout the entire brake system. Since air is compressible, it must be removed from the brake system by bleeding the air from the brakes. The following procedure should be adhered to when bleeding air from the brakes.

a. Fill hydraulic reservoir with clean hydraulic fluid and keep reservoir filled throughout the procedure, to prevent air from entering the system.
b. Remove bleeder screw and washer from cylinder head of brake housing and install an adapter and bleeder hose in the cylinder head.
c. Place free end of hose in a clean glass receptacle containing enough hydraulic fluid to cover end of hose.

CAUTION

End of bleeder hose must be kept under the fluid at all times to properly check for air bubbles and to prevent air from entering hydraulic system.

d. When fluid starts to flow from bleeder hose, apply and hold brake pressure to slowly force out fluid. Crimp hose before allowing pedal to return to "brakes off" position.
e. Repeat step d. until no more air bubbles are emitted from bleeder hose.
f. Remove hose and install bleeder screw and washer, taking care to prevent excessive loss of fluid.
g. Fill hydraulic reservoir as required.

PARKING BRAKES

On the Model 100 Darter the brake master cylinder has provisions for locking the cylinder in the "brake on" position to provide for a parking brake. The parking brake control is attached to the brake master cylinder and controlled by a flexible cable and control knob, which is secured to the instrument panel immediately to the right of the mixture control. On the Model 100-180 Lark a parking control valve is installed on the aft side of the engine firewall and is supplied hydraulic fluid directly from the reservoir. Fluid then flows from the control valve through a T-fitting to each brake master cylinder. The parking brake control is attached to the parking brake control valve. Therefore, when the parking brake control is pulled out the valve is actuated, trapping all hydraulic fluid in the brake lines. The parking brakes may be set by depressing the brake pedals and pulling outward on the parking brake control.

SECTION VII

FLIGHT CONTROLS

GENERAL DESCRIPTION

The aircraft is equipped with all-metal flight control surfaces, which include the ailerons, elevators, rudder, and wing flaps. Dual controls are provided for the ailerons, rudder, and elevators. A single control handle, which is easily reached from either front seat, controls the position of the wing flaps. A movable trim tab is installed on the left elevator and controlled by a trim tab control wheel installed on the floor between the two front seats. A fixed ground-adjustable trim tab is installed on the left aileron, and a fixed ground-adjustable trim tab is installed on the rudder of the Model 100 Darter only. The control column, control wheel, and rudder pedals at the pilots and copilots positions are mechanically interconnected to push-pull rods, bellcranks, and cables to operate the primary flight controls. All control surfaces are balanced to prevent surface flutter and provide the best possible aircraft control characteristics throughout the complete range of normal flight speeds. Control cable pulley brackets are provided with guards to prevent the control cables from jumping from the pulley grooves. The all-metal flaps provide additional lift for shorter takeoff distances and slower landing speeds. The wing flaps may be positioned at various settings between UP and DOWN by placing the flap control in the various detents on the flap control bracket.

MAINTENANCE OF FLIGHT CONTROLS

Special care must be exercised when performing control system maintenance. All components and assemblies shall be securely installed, rod ends must be in correct alignment with cables, correct hardware shall be free of kinks, pulleys must be aligned with the cables, and cable guards must be installed at the pulleys. Inspect the work area for possible mislaid tools or parts, which could foul the controls, and perform an operational check of the control system prior to replacing access covers. A flight test should be performed before the aircraft is released for routine operation after a control system component has been replaced or aircraft rigging has been altered. It will seldom be necessary to rerig the control system if correct maintenance techniques are employed when system components are removed and replaced. Do not disturb position of rod end fittings when control system components are removed, unless absolutely necessary. When necessary to change position of rod end fittings record the amount of change required so that fittings may be returned to the original position when maintenance or repairs is completed. When control system components are being removed, carefully note location and position of attaching parts and hardware and return to original location or position when installing new components or attaching parts. Rigging instructions are provided in this section for each flight control system. Read these instructions carefully before starting the rigging operation. Select and accomplish only those rigging steps applicable to the job requirement. Cable tensions and control surface travel measurements are contained in rigging instructions. Ambient temperature and buildup within the airframe structure affect cable tension and must be given proper consideration when rigging control surfaces. The following procedures should be followed when rigging control cables:

a. Rigging should be accomplished in a hangar. When necessary to rig aircraft in the open it should be accomplished during coolest part of the day with tail of aircraft pointing toward sun. If aircraft is moved into a hangar for rigging, allow 90 minutes for control cables to adjust to hangar temperature.

b. Control cable tension readings should be taken near the midpoint of the cable and never closer than six inches to a cable terminal or within 18 inches of a pulley or fairlead. All control surfaces must be in the streamlined position when cable tension is taken. Cable tension must be compensated for ambient temperature. Carefully follow instructions provided with the tensiometer.

CONTROL SURFACE BALANCING

The aileron, elevator, and rudder are balanced to provide the best possible aircraft control characteristics throughout the full range of normal flight speeds. Control surface balance should be checked after painting, repair, or other maintenance actions that will alter the weight or weight distribution of the control surface. A balancing fixture similar to that shown in Figure 7-1, should be used for balancing a control surface. The control surface must be in the "flyaway" condition when balanced; i.e. surfaces must be

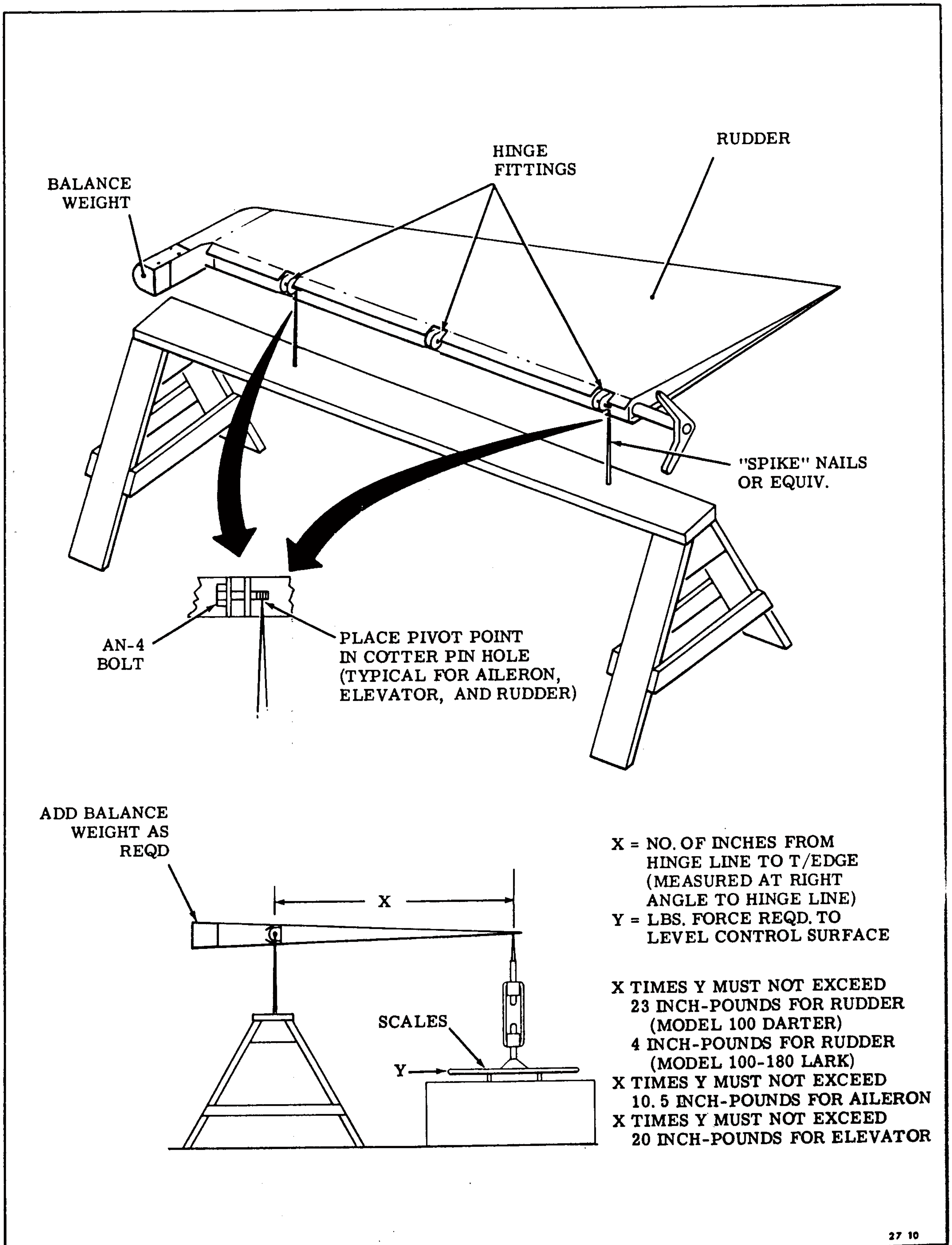
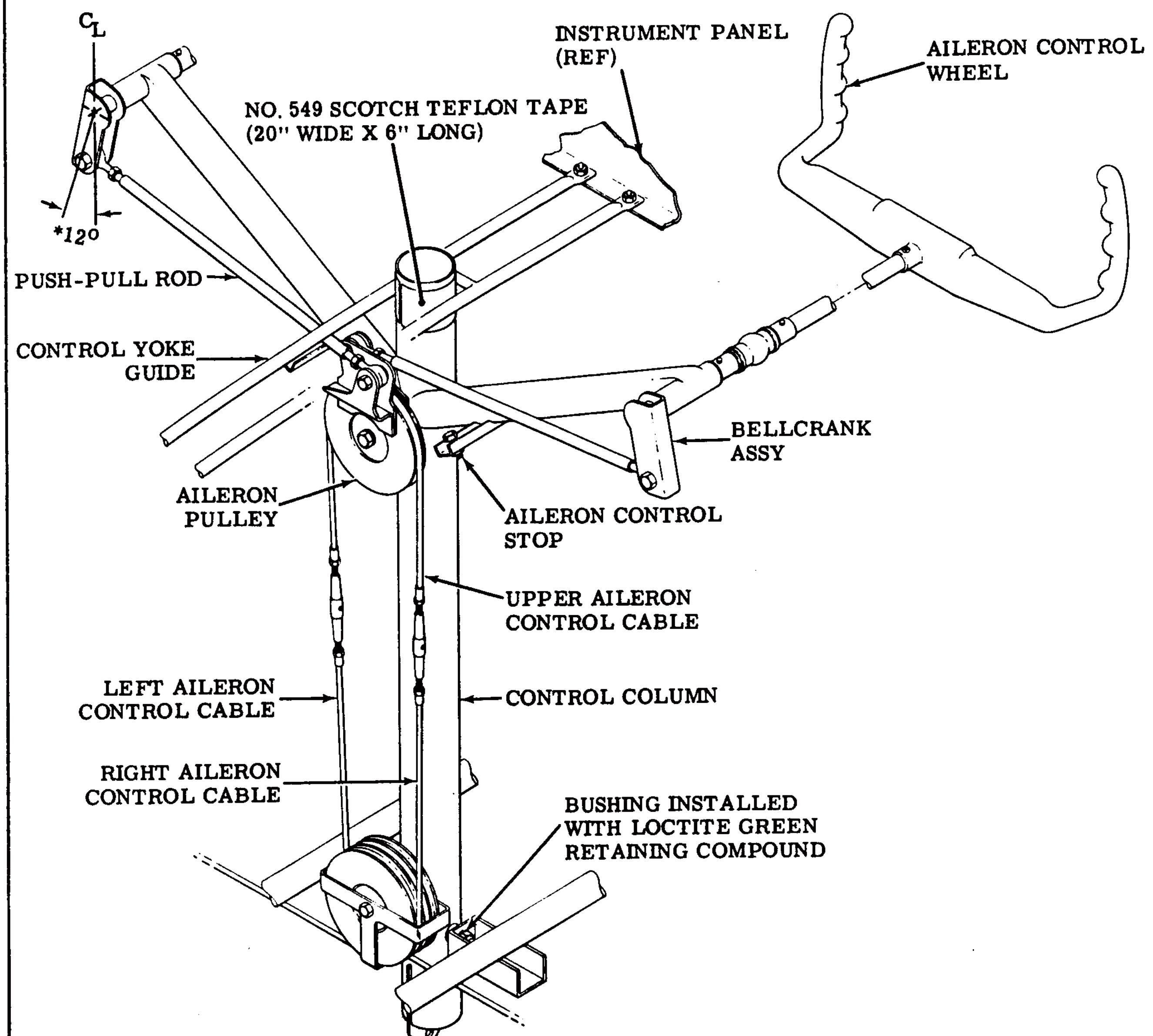


Figure 7-1. Control Surface Balancing



NOTE

*ADJUST PUSH-PULL ROD TO OBTAIN 12° BETWEEN CENTER LINE OF BELLCRANK AND VERTICAL CENTER LINE AS SHOWN (TYP BOTH SIDES)

Figure 7-2. Control Column Installation

painted and trim tabs and hardware in place. The static moment of the rudder assembly shall not exceed 23.0 inch-pounds about the hinge line with the rudder in the horizontal plane for the Model 100 Darter or 4.0 inch-pounds for the Model 100-180 Lark; the static moment of the aileron assembly shall not exceed 10.5 inch-pounds about the hinge line with aileron surface in the horizontal plane; and the static moment of each elevator assembly shall not exceed 20.0 inch-pounds about the hinge line with the elevator in the horizontal plane. If the static moment of a control surface exceeds the maximum static moment for the control surface, weight must be added forward of the hinge line as required to bring the control surface within the maximum limits. Weight may be added to the rudder for the Model 100 Darter as shown in Figure 7-1. The tip of the elevator must be removed to add weight to the elevator doubler. Weight may be added to the aileron balance weight assembly at the outboard leading edge of the aileron.

CONTROL CABLE REMOVAL AND INSTALLATION

The removal and installation of control cables may be facilitated by attaching a lead line or cord to the smallest end fitting of the control cable being removed and pulling the control cable through the pulleys and fairleads. The lead line or cord will follow the same route as the cable being removed. After control cable is removed, attach lead line or cord to replacement cable and thread cable back through same route by pulling on the lead line. When replacement cable is properly routed tighten all turnbarrels and rig system as noted in rigging instructions for each system.

FLIGHT CONTROL SYSTEMS

CONTROL COLUMN

The control column is of the typical "Y" construction. A shaft, which extends aft from the top of each side of the control column and through the instrument panel directly in front of each pilots seat, mounts the aileron control wheels. The control column pivots in the fore and aft direction on brackets mounted to the floor structure. The lower section of the control column that extends below the floor is attached to the elevator push-pull tube which is also connected to the elevator bellcrank. See Figure 7-2. An aileron bellcrank is attached to the top of the control column. Push-pull tubes are then connected between the bellcrank and arms on the ends of each aileron control shaft. Two pulleys mounted on the lower section of the control column route the aileron control cables outboard from the control column. Aileron stops are installed on the arms that extend outboard from the control column to the aileron control shafts. The aft aileron bellcrank strikes the stops to limit the travel of the aileron control wheel.

AILERON

The ailerons extend from the outboard end of the wing flaps to the wing tip, and are attached to the aft wing spar by four sections of continuous hinge. One hinge is installed at the center of the aileron. The inboard and outboard hinges are positioned so that the center of the hinge is aligned with first aileron rib inboard of the end ribs. A fourth hinge is installed at the outboard end of the aileron to provide greater security of the aileron where the aileron balance weight is installed. The ailerons are formed by 12 ribs that furnish the structural members for attaching the outer aluminum skin. Ribs close both ends of the aileron, and an aileron closure strip is riveted to each rib butt and the aileron skin to close the front of the aileron and provide strength to the aileron structure. A balance weight assembly, incorporated in the outboard end of each aileron, aids in movement of the aileron by reducing the hinge forces.

AILERON CONTROL SYSTEM

The ailerons are controlled by rotating the control wheels, which are synchronized by the aileron control wheel shafts, a set of push-pull tubes, and a bellcrank pulley. The push-pull tubes are connected between the aileron bellcrank pulley and a short bellcrank attached to the ends of the control wheel shafts, so that as the control wheels are turned the aileron bellcrank pulley also turns. The aileron control cables are attached to the aileron bellcrank pulley and routed through a dual pulley assembly at the bottom of the control column. The cables are then routed through a system of pulleys and guides to the aileron bellcranks installed in the trailing edges of the wings. An adjustable rod connects the aileron bellcranks to the aileron control horns. A balance cable connected between the aileron bellcranks completes the aileron control system. See Figure 7-3.

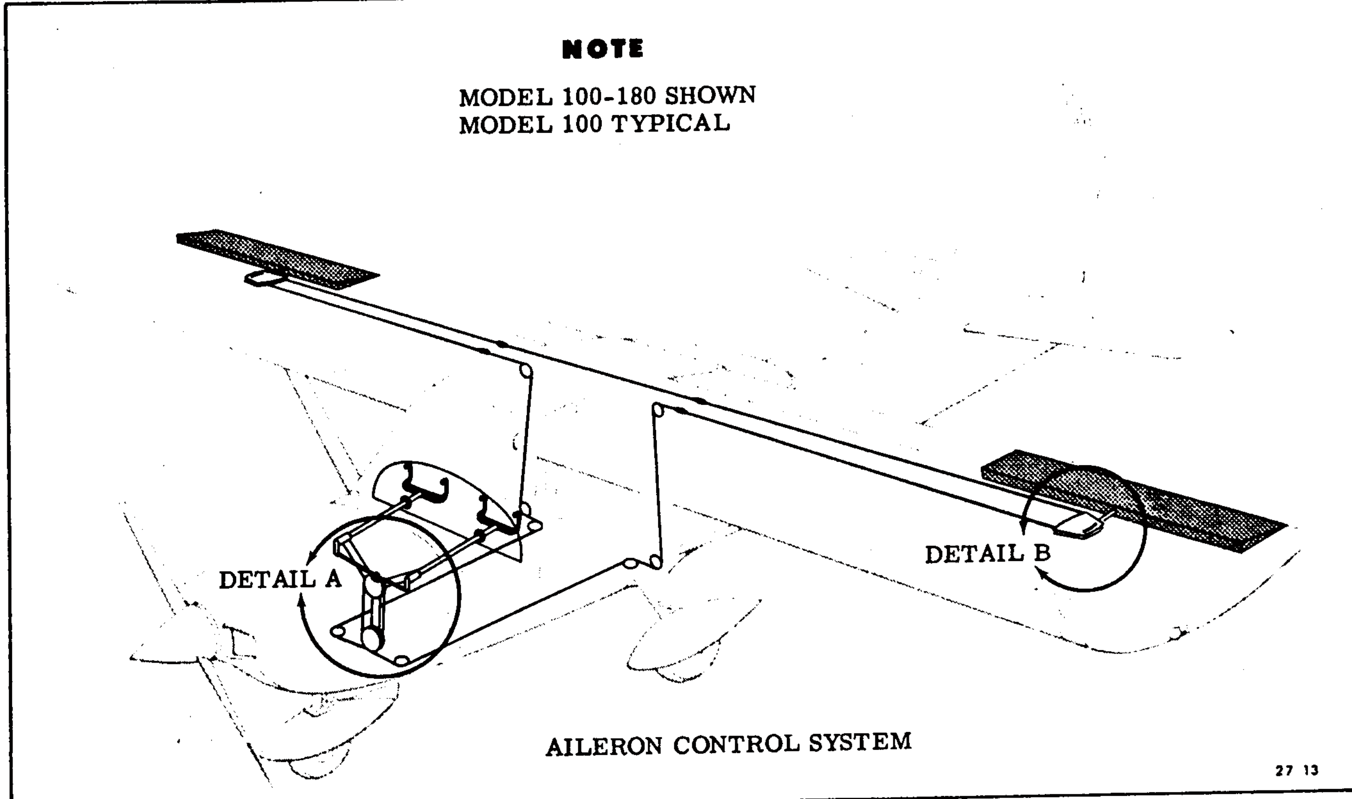
AILERON REMOVAL AND INSTALLATION. To remove the aileron, proceed as follows:

a. Disconnect aileron push-pull rod from aileron horn. Do not change position of rod end on push-pull rod.
b. Remove aileron hinge pins from hinges.
c. Remove aileron.

Installation of the aileron is the reverse of the removal procedure. In the event push-pull rod length has been changed, streamline trailing edge of opposite aileron with trailing edge of wing and outboard flap and secure with a temporary lock. Adjust push-pull rod length to align attaching bolt hole with hole in aileron horn when aileron is in neutral position.

NOTE

Aileron controls must be rigged as outlined in subsequent paragraph if aileron control wheels are not aligned horizontally when ailerons are neutral.



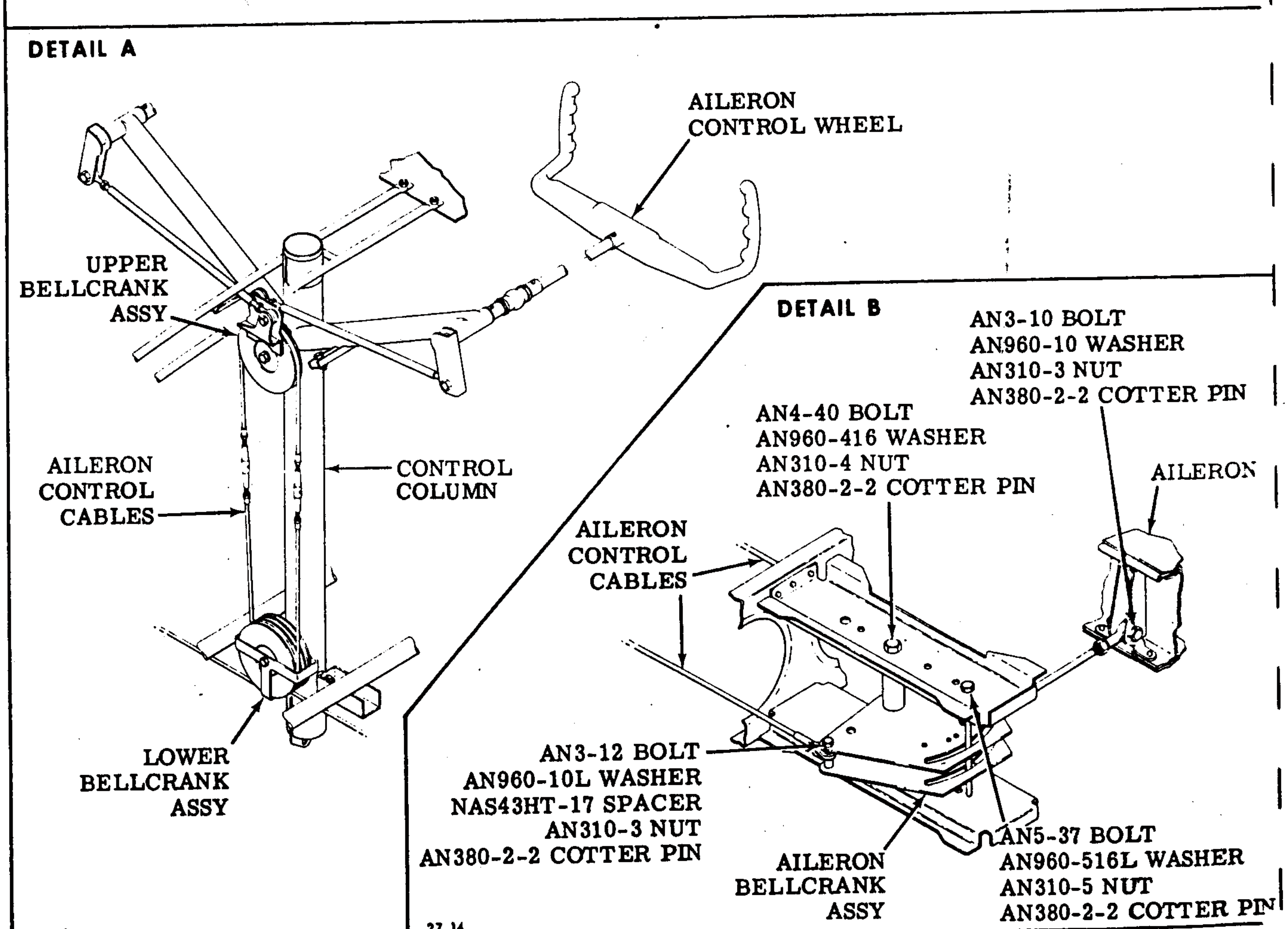


Figure 7-3. Aileron Control System

AILERON CONTROL SYSTEM RIGGING. Aileron travel is 19 (± 2)° UP and 17 (± 2)° DOWN. Aileron control cable tension is 40 (± 5) pounds tension. Cable tension is adjusted at the forward and aft turnbarrels in the wings immediately outboard of the fuselage. To rig the aileron control cables proceed as follows:

a. Remove aileron bellcrank inspection doors from wing.
b. Rotate left aileron bellcrank forward until aft end of slot in bellcrank contacts stop bolt.
c. Adjust push-pull rod until aileron down travel is 15°. Bend in push-pull rod must be in horizontal plane with bends outboard.
d. Repeat steps b. and c. for right aileron.
e. Secure ailerons and aileron control wheels in neutral position.
f. Adjust all control cable turnbarrels until no more than three (3) threads are exposed.
g. Tighten control cable turnbarrels equally until cable tension is 40 (± 5) pounds tension.
h. Aileron travel shall be 19 (± 2)° UP and 17 (± 2)° DOWN.
i. Ailerons shall align with flaps in neutral position within ± 1/8 inch at trailing edge.
j. Minor adjustment may be made on the turnbarrels to obtain requirements of steps h. and i.
k. Adjust bellcrank stops on control column to provide 0.12-inch clearance between the stops and bellcrank with ailerons at their UP and DOWN positions.

ELEVATOR

Fabrication of the elevators is the typical spar, rib, and stressed skin construction used for the control surfaces. The outboard end of each elevator extends beyond the outboard end of the horizontal stabilizer and forms the horizontal stabilizer tip when the elevator is streamlined. The outboard end acts as a servo for moving the elevators without sacrificing any lift or stabilizing characteristics of the elevator and stabilizer. Three hinges on the horizontal stabilizer mate with hinge brackets secured to the front spar of the elevator. A torque tube is secured to the inboard end of each elevator and attached to the elevator control horn. The control horn is installed on the aft fuselage structure in line with the centerline of the fuselage. The control horn joins the two elevators together, forming a single control surface controlled by a single control horn.

ELEVATOR CONTROL SYSTEM

The elevators are controlled by fore and aft movement of the control column. The elevator control column pivots between two pivot fittings secured to the cabin floor structure. This allows the control column to be moved fore and aft around the pivot fittings, which are located above the lower end of the column. The distance between the control column pivot point and the top of the control column provides a mechanical advantage, which assures smooth and easy movement of the elevators. A push-pull rod is connected between the lower end of the control column and the elevator bellcrank assembly installed below the cabin floor under the aft passenger seats on the Model 100 Darter. Control cables are then routed from the elevator bellcrank assembly aft through pulleys to the bellcrank attached to the elevator torque tube. On the Model 100-180 Lark control cables are routed from the elevator bellcrank assembly to an additional bellcrank installed on the aft side of the frame assembly at fuselage station 187.00. A push-pull rod is then installed between the aft bellcrank assembly and the rudder control horn installed on the elevator torque tube. See Figure 7-4. Elevator mechanical stops are installed on the bracket installed on the aft frame at fuselage station 214.00.

ELEVATOR REMOVAL AND INSTALLATION. To remove the elevator, proceed as follows:

a. Remove screws attaching tail cone on Model 100 Darter and remove tail cone.
b. Remove screws attaching fairings on Model 100-180 Lark at base of rudder and around rudder horn bracket and remove fairings.
c. Remove bolts attaching elevator control to elevator torque tube.
d. Remove clevis pin from elevator trim tab actuator control rod (left elevator only).
e. Remove nuts from elevator hinge bolts and remove hinge bolts and elevator.

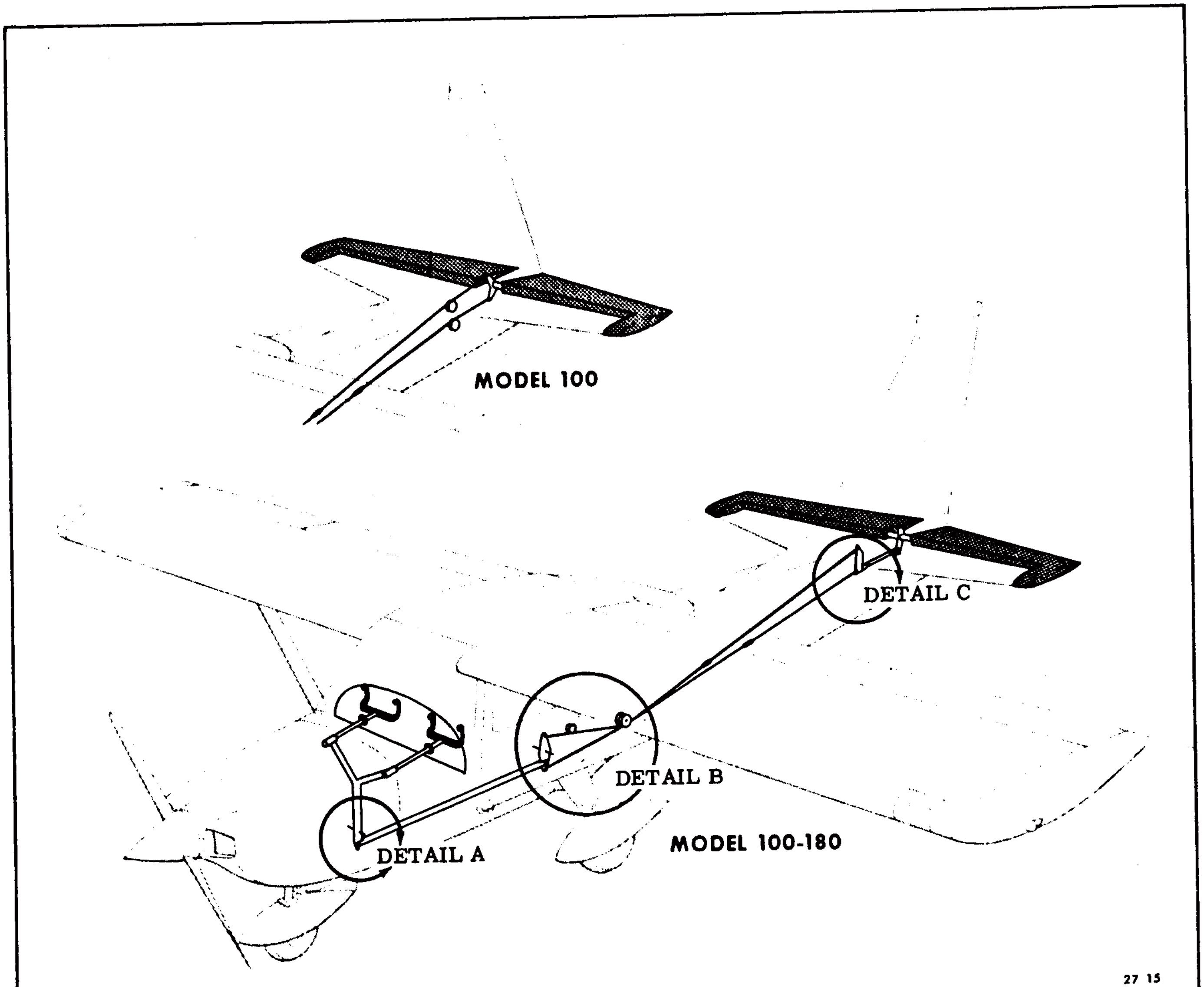
NOTE

When removing the left elevator, the elevator should be slipped aft and outboard to slide the torque tube from the control horn and to slide the trim tab actuator arm from the elevator.

The installation of the elevator is the reverse of the removal.

ELEVATOR CONTROL SYSTEM RIGGING. Elevator travel is 25 (± 2)° UP and 20 (± 2)° DOWN. Elevator control cable tension is 40 (± 5) pounds tension. Cable tension is adjusted with the turnbarrels in the aft fuselage. The turnbarrels are accessible through the baggage compartment door on the Model 100-180 Lark. However, the aft panel of the baggage compartment must also be removed. On the Model 100 Darter the turnbarrels are accessible by removing the aft passenger seat. To rig the elevator control system, proceed as follows:

a. Level aircraft.
b. Place control column 12 (± 1)° forward of vertical position.
c. Rig cables to position elevator control surface in a neutral position.
d. Tighten control cable turnbarrels equally until cable tension is 40 (± 5) pounds tension.
e. Elevator travel shall be 25 (± 2)° UP and 20 (± 2)° DOWN.



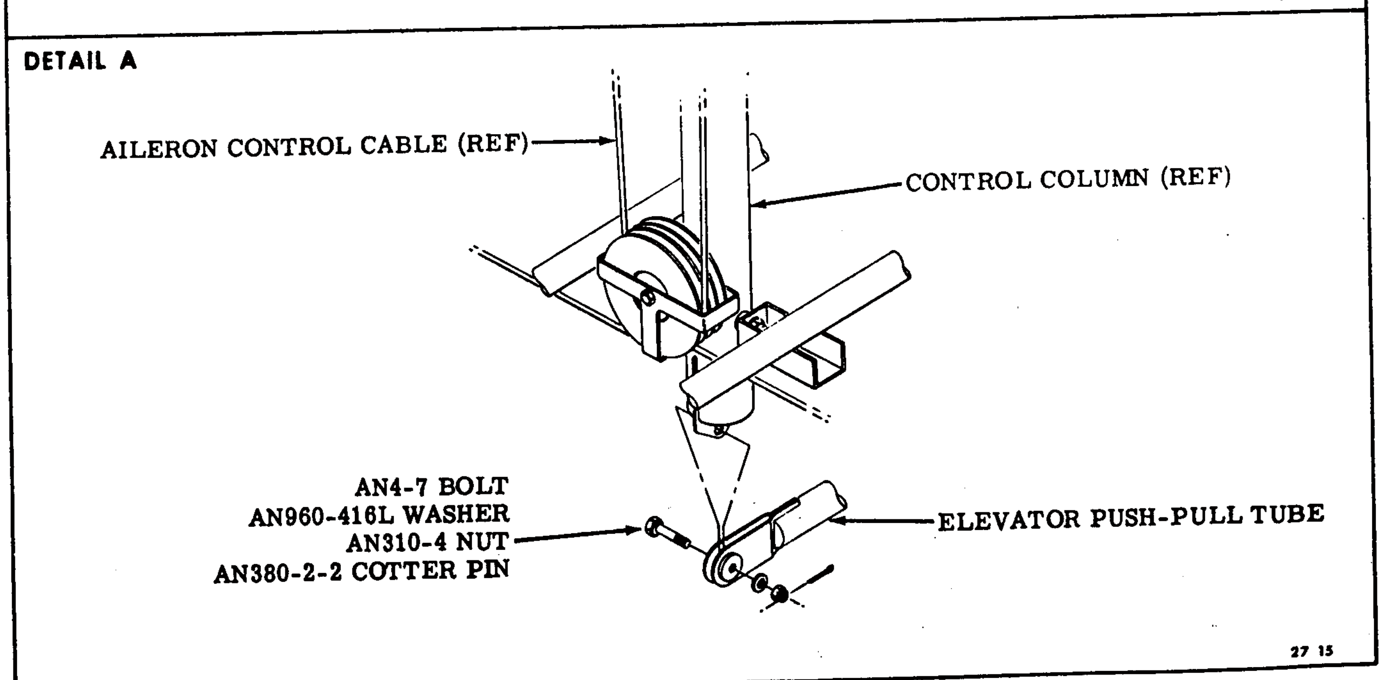
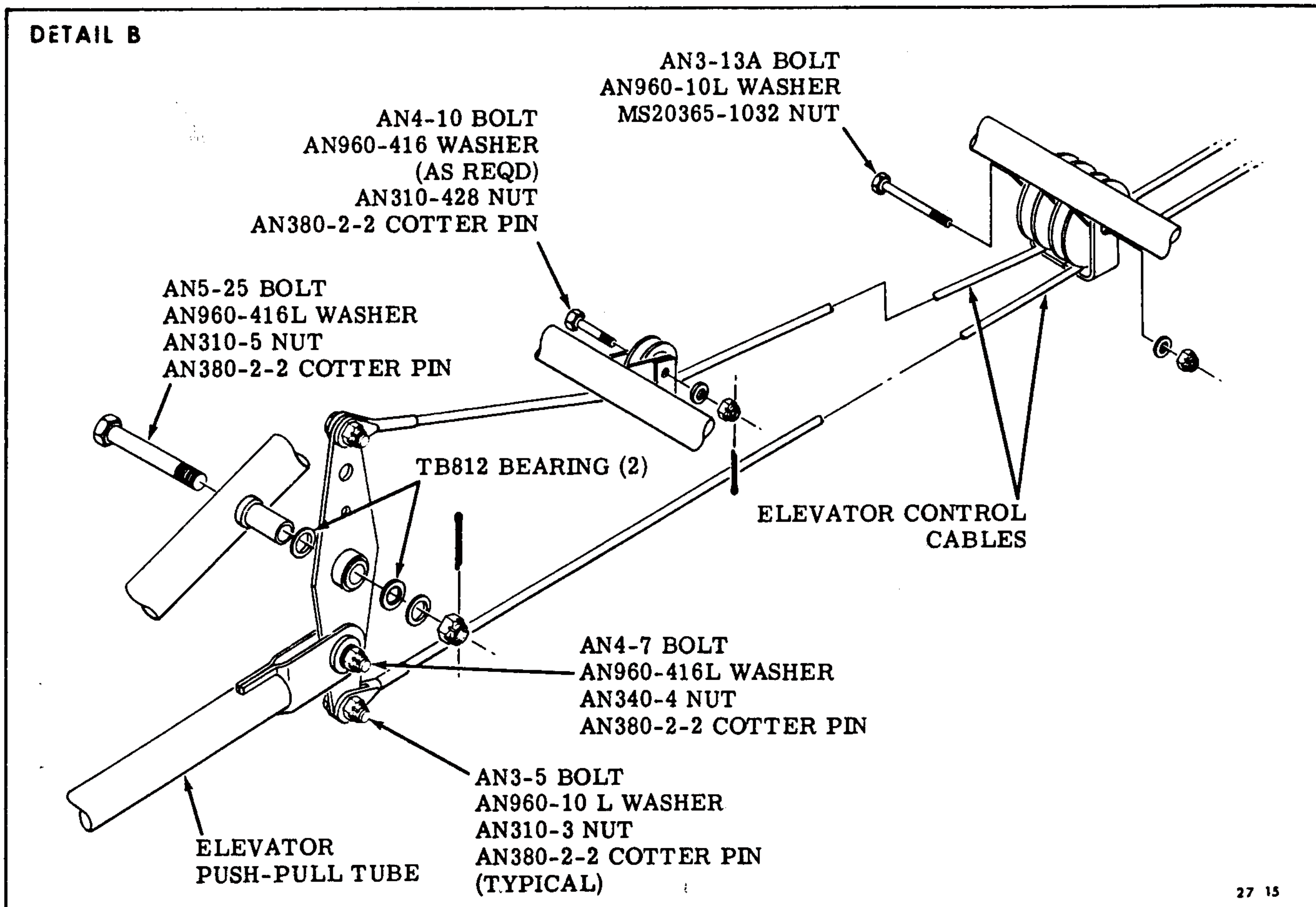


Figure 7-4. Elevator Control System (Sheet 1 of 2)



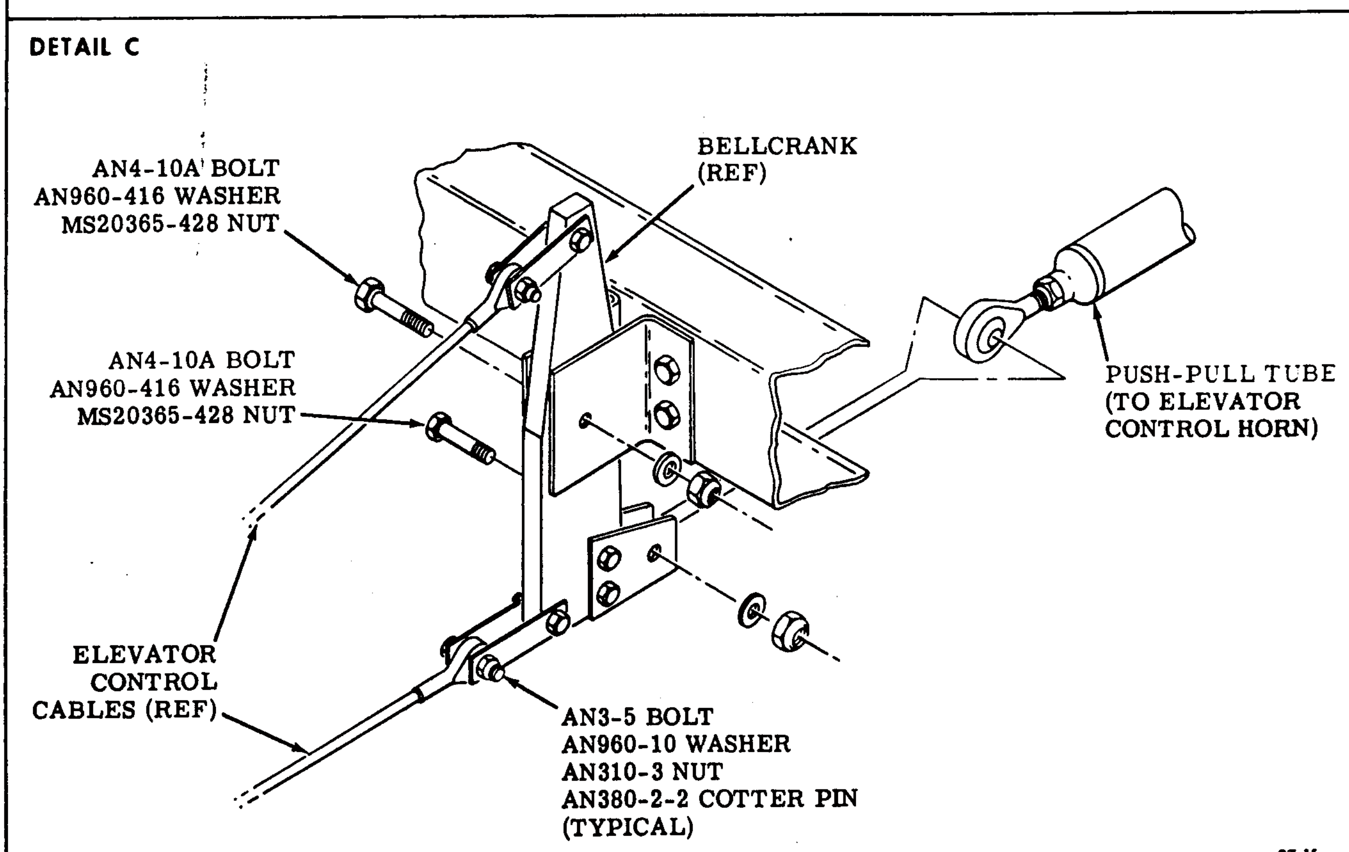


Figure 7-4. Elevator Control System (Sheet 2 of 2)

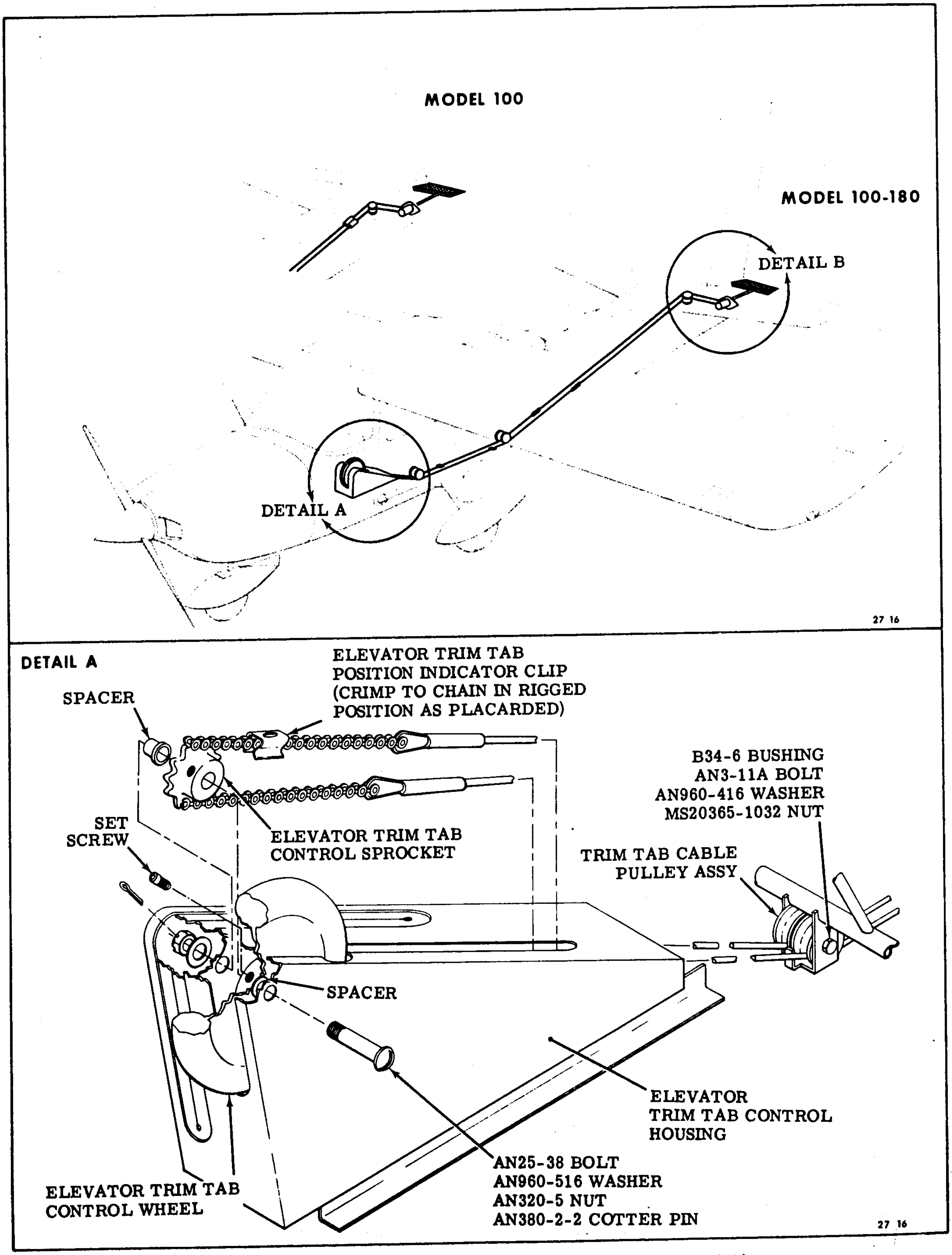


Figure 7-5. Elevator Trim Tab Control System (Sheet 1 of 2)

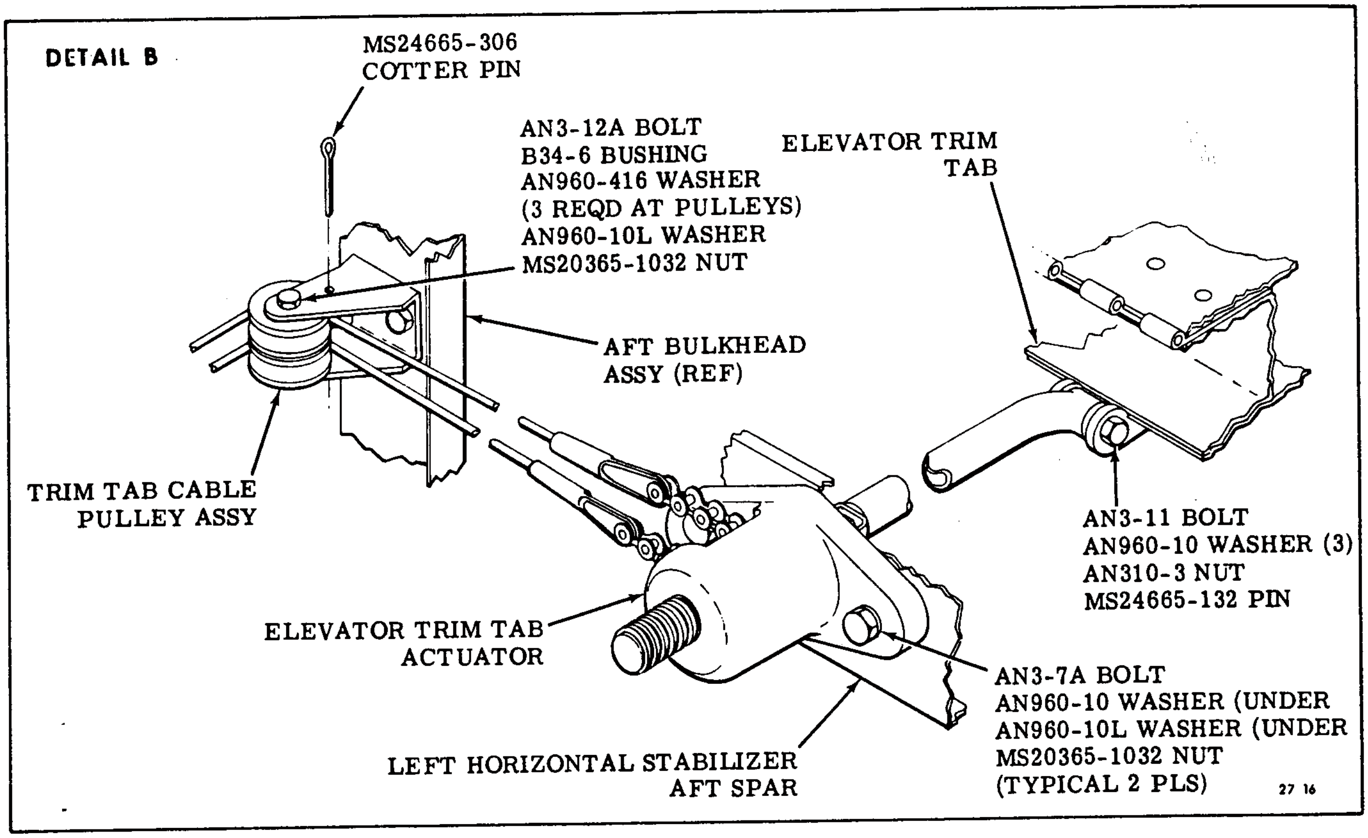


Figure 7-5. Elevator Trim Tab Control System (Sheet 2 of 2)

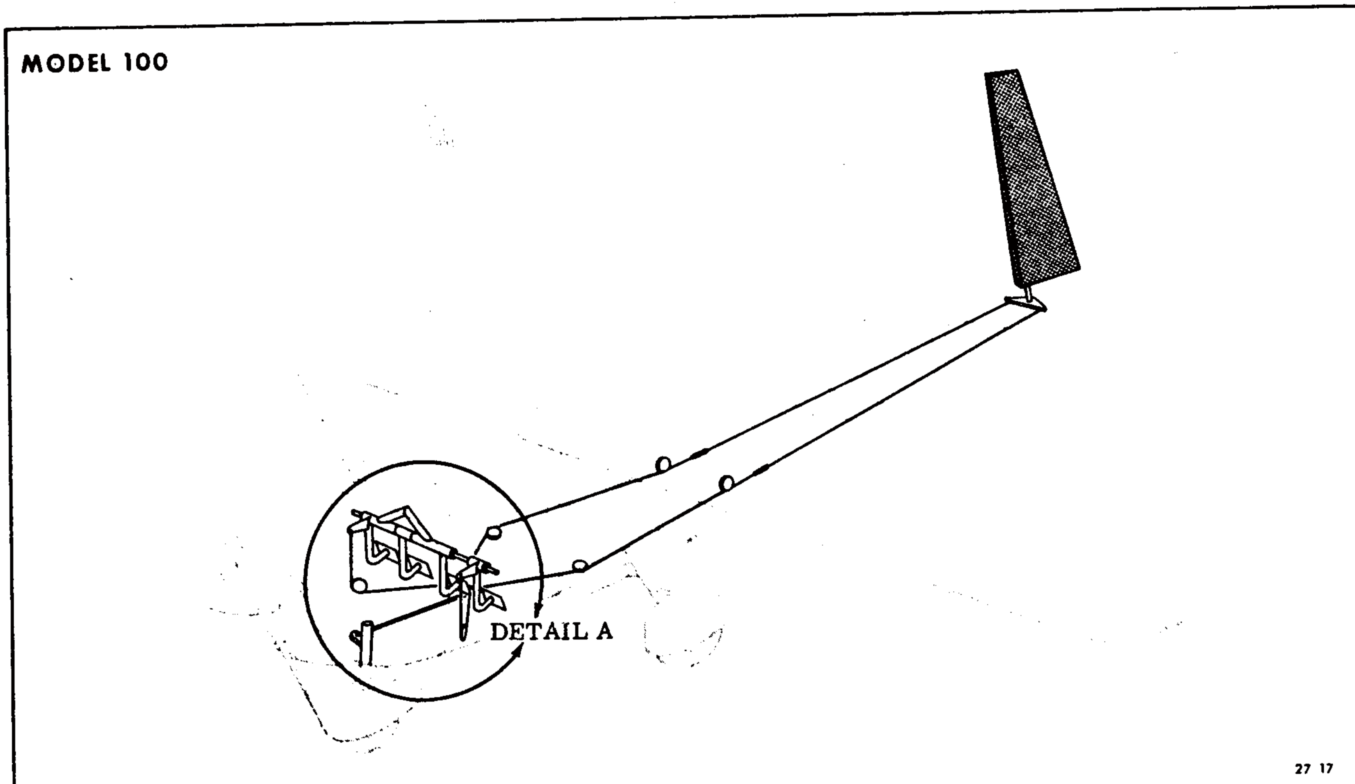
ELEVATOR TRIM TAB SYSTEM. A controllable trim tab is installed on the inboard trailing edge of the left elevator and hinged to the upper side of a short stringer on the elevator. The trim tab actuator assembly is installed within the horizontal stabilizer and connected to the trim tab horn by a link rod. A trim tab control wheel, secured within a housing on the left centerline of the cabin floor just forward of the pilots seats, controls the position of the trim tab. The trim tab is actuated by rotating the trim tab control wheel forward or aft. Forward movement of the wheel causes the trim tab to move upwards and consequently lower the nose of the aircraft. See Figure 7-5. Aft movement of the trim tab control wheel causes the trim tab to move downward, raising the nose of the aircraft. The elevator trim tab is actuated by cables which have sprocket chains attached to each end. One chain operates in a sprocket wheel attached to the trim tab control wheel, and the other chain rotates a sprocket wheel on the trim tab actuator. Trim tab cables are routed from the trim tab control wheel aft through pulleys and cable guides to pulleys parallel to the aft edge of the horizontal stabilizer. The cables are routed through these pulleys and outboard of the sprocket chain on the trim tab actuator. Cable stops are clamped on the right hand control cable between cable pulleys below the cabin floor. These stops strike against the pulley cable guard pins to limit movement of the trim tab control wheel. Elevator trim tab travel is 20 (± 2)° UP and 20 (± 2)° DOWN, and the cable tension is 8 to 15 pounds.

RUDDER

Fabrication of the rudder is the typical spar, rib, and stressed skin construction used for the control surfaces. The rudder tip extends above the top of the vertical stabilizer and forward to provide a servo action for movement of the rudder. The forward spar of the rudder is enclosed by a leading edge, which fairs the rudder with the aft edge of the vertical stabilizer, forming the smooth aerodynamic lines of the rudder. Rudder hinge brackets, riveted to the rudder spar at three cutouts in the rudder leading edge, mate with hinge fittings installed on the aft spar of the vertical stabilizer. A torque tube attached to the lower end of the rudder spar is attached to the rudder control horn. Rudder control cables are attached to each side of the rudder horn. On the Model 100 Darter a fixed trim tab may be installed on the rudder trailing edge. Adjustment of the tab may be made by bending the tab, between two blocks of wood, in the direction opposite to the direction of trim desired.

RUDDER CONTROL SYSTEM

A dual set of rudder pedals are installed on a rudder bar assembly located immediately forward of the two front cabin seats. Each outboard end of the rudder bar assembly rotates on a bearing installed in a bracket, which is bolted to a fuselage truss member on



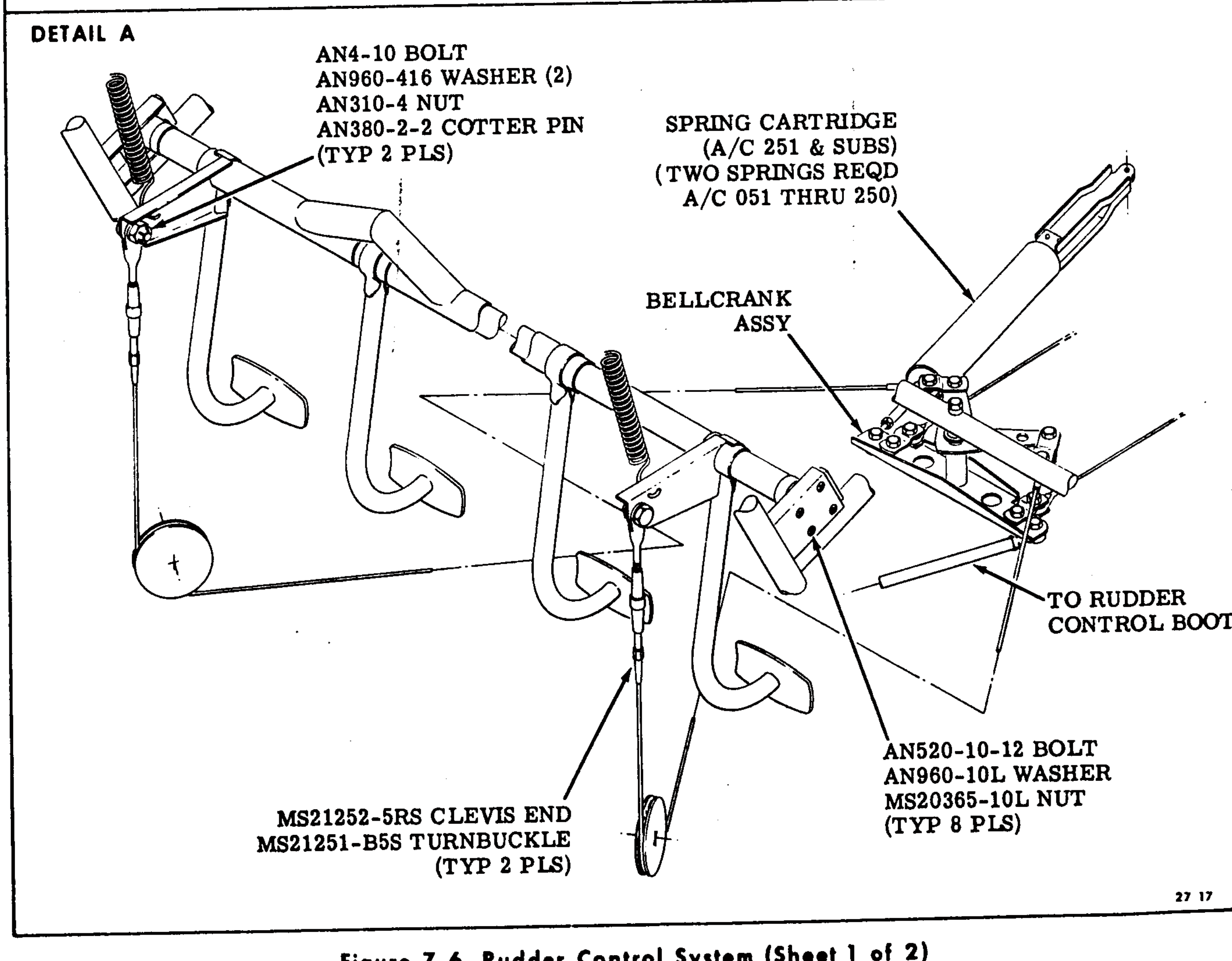
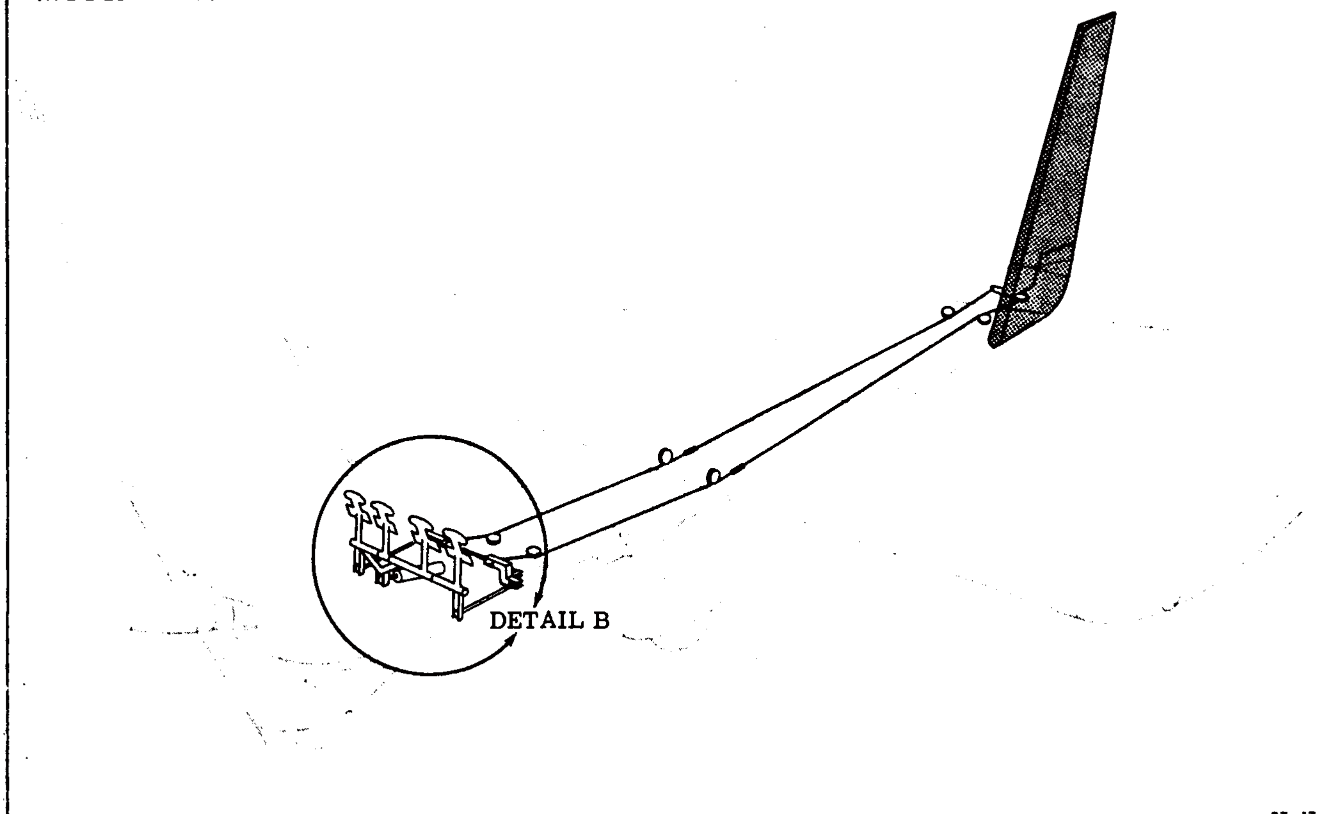


Figure 7-6. Rudder Control System (Sheet 1 of 2)



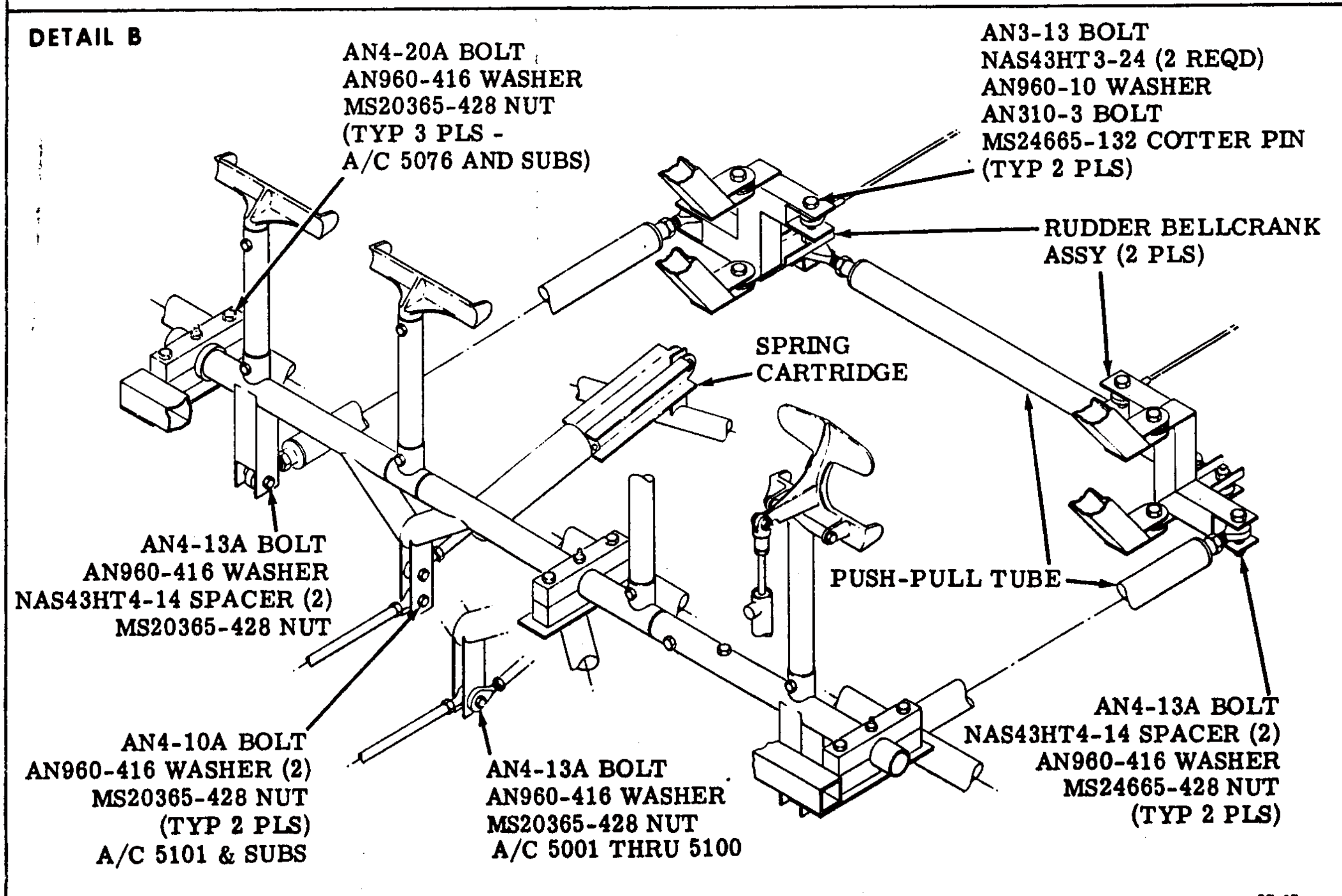


Figure 7-6. Rudder Control System (Sheet 2 of 2)

each side of the cabin. On the Model 100 Darter control cables extend from the pilots left rudder pedal horn and the copilots right rudder pedal horn downward through pulleys beneath the cabin floor, then aft and inboard to a bellcrank assembly located approximately 12 inches aft of the rudder pedals. See Figure 7-6. Rudder control cables then extend aft from the rudder bellcrank assembly through pulleys and guides to the rudder control horn. On the Model 100-180 Lark push-pull tubes extend aft from the pilots left rudder pedal horn and the copilots right rudder horn to welded steel bellcranks located under the cabin floor just forward of the pilot seats. The two bellcranks are synchronized by a transverse rod that connects to parallel arms welded onto the lower body of each of the actuating bellcranks. Rudder control cables then extend aft from the actuating bellcranks through pulleys and guides to the rudder control horn. The rudder control horn then positions the rudder when the rudder pedals are moved. Nose wheel steering is also controlled by rudder pedal movement. A rudder centering device is connected to the rudder bar and extends aft to attachment lugs on the cabin truss tubes. Mechanical stops located on the aft side of the aft frame at station 214.00 limit rudder travel in both directions.

RUDDER REMOVAL AND INSTALLATION. To remove the rudder, proceed as follows:

a. On Model 100 Darter disconnect electrical wire to light in tail cone, remove screws attaching tail cone, and remove tail cone.
b. On Model 100-180 Lark remove screws attaching lower tail cone from rudder and remove tail cone.
c. On Model 100-180 Lark remove screws attaching aft fairing and remove fairing, exposing rudder control horn.
d. On Model 100-180 Lark disconnect electrical wiring to light in top of rudder.
e. Disconnect cables from rudder control horn.
f. Remove rudder hinge bolts and remove rudder.

The installation of the rudder is the reverse of the removal.

RUDDER CONTROL SYSTEM RIGGING. Rudder travel for the Model 100 Darter is 25 ($\pm$ 2)$^{\circ}$ left and right, and rudder travel for the Model 100-180 Lark is 20 ($\pm$ 2)$^{\circ}$ left and right. Rudder control cable tension is 20 ($\pm$ 5) pounds tension. Cable tension is adjusted with the turnbarrels in the aft fuselage. The turnbarrels are accessible through the baggage compartment door on the Model 100-180 Lark. However, the aft panel of the baggage compartment must also be removed. On the Model 100 Darter the turnbarrels are accessible by removing the aft seat. Mechanical stops just above lower rudder hinge limit rudder travel in both directions. To rig the rudder control system, proceed as follows:

a. Align nose wheel with centerline of aircraft and secure rudder in neutral position with a control surface clamp.
b. Align the four rudder pedals.
c. Tighten control cable turnbarrels equally until cable tension is 20 ($\pm$ 5) pounds tension.
d. Adjust rudder control stops just above lower rudder hinge on Model 100-180 Lark to obtain a rudder travel of 20 ($\pm$ 2)$^{\circ}$ left and right. Rudder travel stops on Model 100 Darter are also located just above lower rudder hinge. However, they are fixed stops to give a rudder travel of 25 ($\pm$ 2)$^{\circ}$.

WING FLAPS

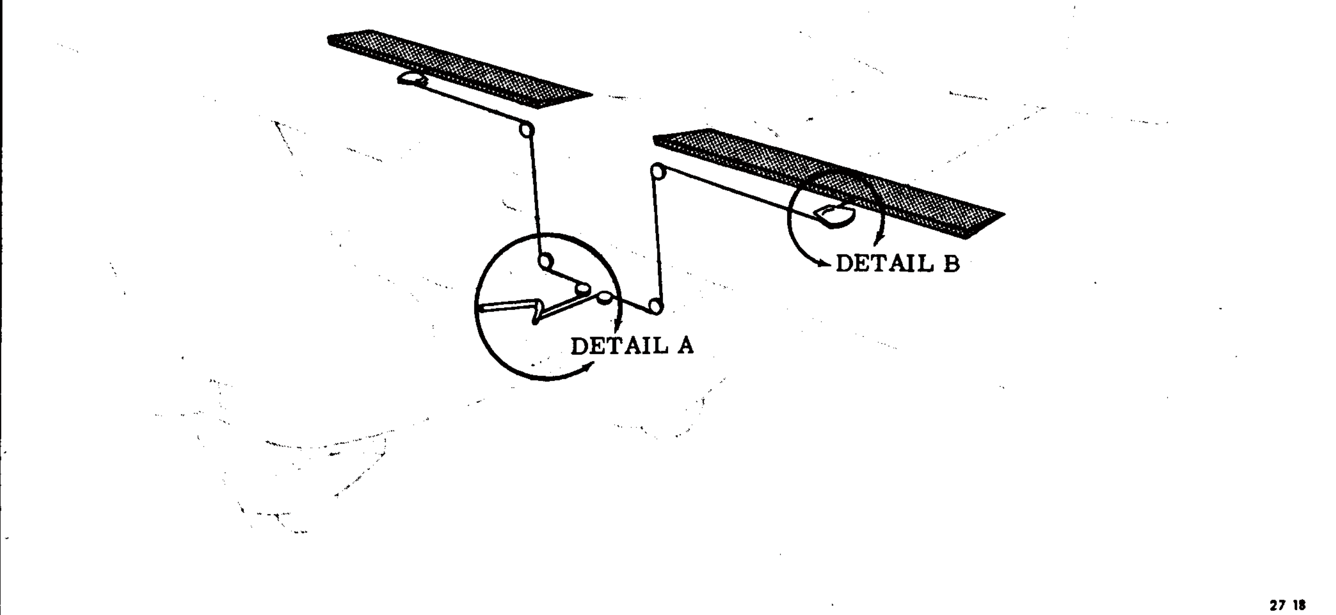
The left and right wing flaps, which are identical in construction, are formed by nine ribs that furnish the structural members for attaching the outer aluminum skin. The ribs in the center section of the flap are spaced more closely than ribs in the outer sections to give the added strength necessary for attaching and operating the wing flap control horn. Ribs close both ends of each wing flap. The flap skins are formed from a single sheet of aluminum so that the ribs fit flush within the envelope formed by the skin. A continuous strip of flanged aluminum butts with the forward ends of the ribs and fits between the upper and lower wing flap skin, which extends forward of the rib ends. This closure closes the front of the flap and provides additional strength to the flap structure. The wing flap extends outboard from the fuselage to the inboard side of the aileron. It is attached to the lower edge of the aft wing spar by three sections of continuous hinge, located at the center and the inboard and outboard ends of the flaps.

WING FLAP CONTROL SYSTEM

The wing flaps are mechanically operated by a flap control handle installed between the pilots seats. The flap control handle has four positions; full up, full down, and two intermediate positions. See Figure 7-7. The flaps are streamlined with the wing in the full up position. The flaps are positioned 10° DOWN when the wing flap control handle is in the first intermediate position. The second intermediate position of the flap control handle extends the flaps to 20 degrees, and the full down position extends the flaps to 30 degrees. The flap control handle is attached to the flap control cables, which are routed through pulleys attached to the fuselage truss members and out through the wing. The cables extend through the forward side of the aft wing spar to each wing flap bellcrank. The bellcrank, which is connected to the flaps horn located at the center flap rib, actuates the flaps when the flap control handle is moved. Return springs are attached between the aft wing spar and the wing flap bellcrank to assist in returning the flaps to the up position.

WING FLAP REMOVAL AND INSTALLATION. To remove a wing flap, proceed as follows:

a. Disconnect wing flap push-pull rod from flap horn. Do not change position of rod end on push-pull rod.
b. Remove flap hinge pins from flap hinges.
c. Remove flap.



DETAIL A

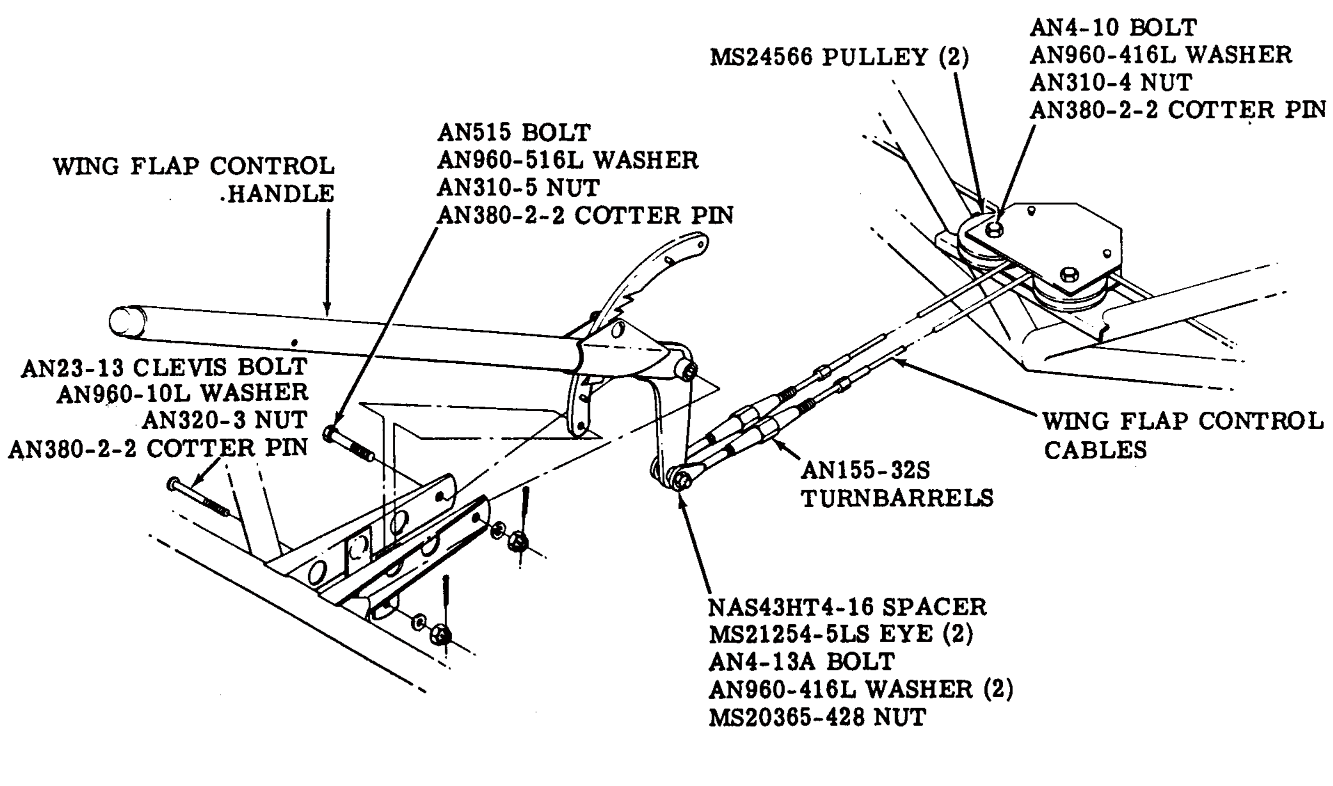


Figure 7-7. Wing Flap Control System (Sheet 1 of 2)

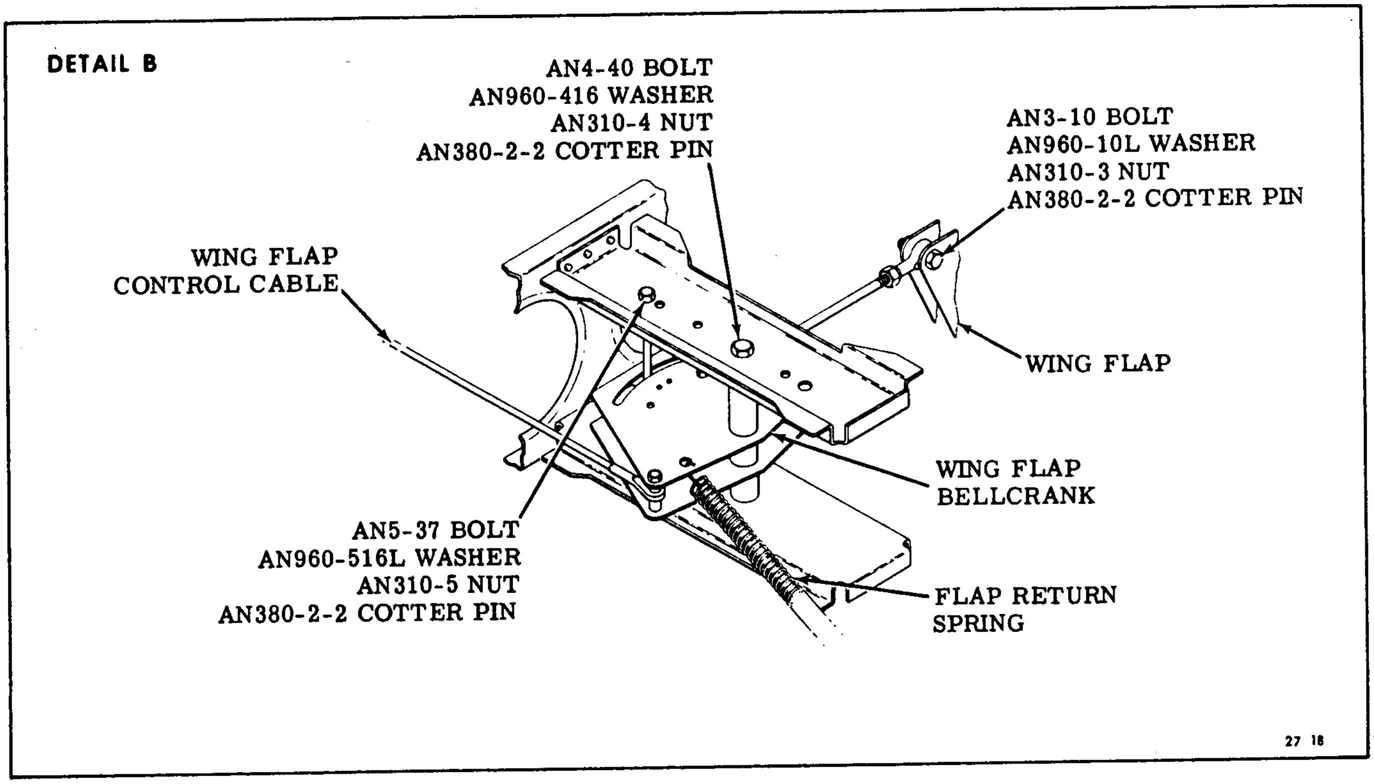


Figure 7-7. Wing Flap Control System (Sheet 2 of 2)

Installation of the wing flap is the reverse of the removal procedure. In the event push-pull rod length has been changed, streamline trailing edge of flap with trailing edge of aileron with aileron in a neutral position. Secure flap and aileron with a temporary lock and adjust wing flap push-pull rod length to align attaching bolt hole in rod end with hole in wing flap horn.

WING FLAP RIGGING. Wing flap cable tension is adjusted at the turnbarrels immediately aft of the flap control handle under the floor. Full travel of the flap in full down position is 30 (± 2)°. To rig the flaps, proceed as follows:

NOTE

Use a standard protractor to measure flap travel. Zero-degree flap angle will be when upper surface of flap is streamlined with upper surface of wing.

a. Tighten wing flap control cables to 3 (± 2) pounds tension with flaps in full up position.
b. Adjust wing flap push-pull rod to obtain zero-degree flap angle.
c. Both flaps operate simultaneously when flap handle is pulled upward.
d. Flap travel will be as follows:
   1. First notch in wing flap control 10 (± 2)°.
   2. Second notch in wing flap control 20 (± 2)°.
   3. Third notch in wing flap control 30 (± 2)°.
   4. Flap neutral setting is 0 (± 2)°.

STRUCTURAL REPAIR

Repair of the structure of the flight control surfaces shall be accomplished in accordance with Federal Aviation Administration Advisory Circular AC No: 43.13-1, Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair.

SECTION VIII

INSTRUMENTS

GENERAL DESCRIPTION

The instrument panels for the aircraft are basically the same. The flight instruments for the Model 100-180 Lark are installed in a shock-mounted sub panel installed on the standard instrument panel, while the flight instruments for the Model 100 Darter are installed in the standard instrument panel. Instruments installed in the instrument panels are basically the same. However, location of the instruments within the panel will vary slightly (see Figure 8-1). The standard instrument installation provides all instruments for safe and efficient operation of the aircraft. Optional instrument installations are available to satisfy particular operational needs and to augment the standard instruments to meet individual preferences. With the exception of the magnetic compass and free air temperature indicator, all instruments are installed in the instrument panel and are grouped according to function and necessity for surveillance. Instruments are divided into three groups; Flight Instruments, Engine Instruments, and Miscellaneous Instruments. All engine and flight instruments are installed on the left side of the panel directly forward of the pilot, while the center and right side of the panel is used for installing various radio installations. A circuit breaker panel for the Model 100 Darter is installed on the lower left side of the instrument panel, while two circuit breaker panels are installed on the lower right half of the instrument panel for the Model 100-180 Lark. The engine controls and parking brake control are installed in the lower center section of the instrument panel, between the two control wheels.

INSTRUMENT SYSTEM MAINTENANCE

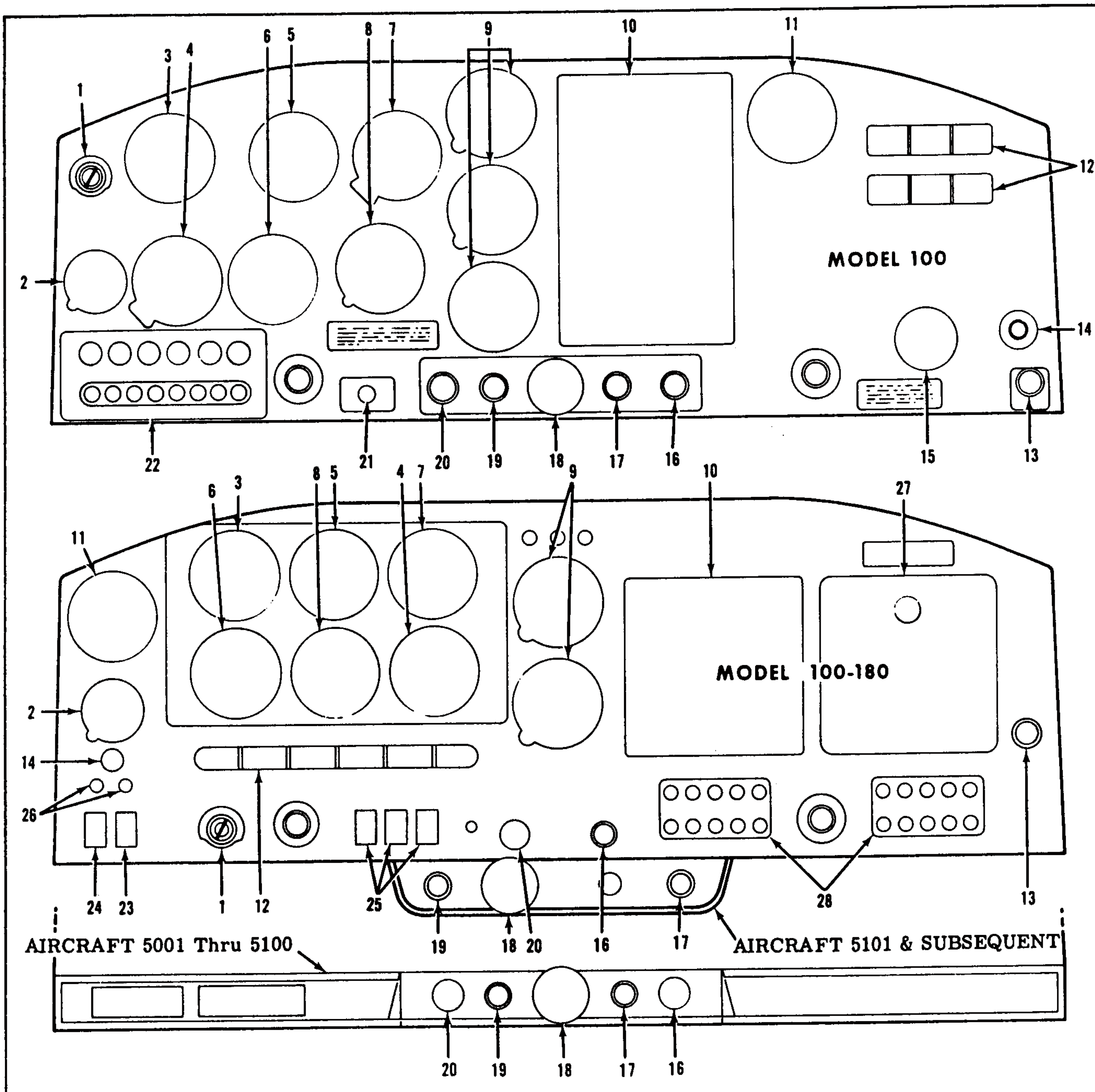
Unless otherwise specified, field maintenance of instrument systems is limited to removal and replacement of defective instruments, transmitters, and probes; authorized in-service adjustment of transmitters and instruments; replacement of indicator lamps; and repair of instrument systems between the instrument and signal source. Reliability of the various instruments and related systems can be sustained by routine inspection of the electrical wiring for chafing, and electrical connections for security. All fluid pressure, pitot pressure, and static line connections must be tight at all times. Lines must be correctly routed and secured. Instrument ports and lines disconnected during system maintenance must be capped or plugged immediately to prevent the entrance of foreign material and consequent instrument malfunction. Maintenance procedures pertaining to a specific instrument or system are contained in subsequent paragraphs. As a general rule it is recommended that the instrument signal source and means of transmission to the instrument be "wrung out" before changing the instrument.

FLIGHT INSTRUMENTS

The flight instruments indicate the aircraft heading, aircraft altitude, airspeed, degree of turn and bank, aircraft attitude, and rate of aircraft ascent or descent. However, the turn-and-bank indicator, directional gyro, and attitude gyro are installations that are optional. A magnetic compass is installed on top center of the instrument panel; just aft of the glareshield. All flight instruments are operated by the pitot-static or instrument vacuum systems, except the electric turn-and-bank indicator. The pitot-static system furnishes pitot (impact) and static (atmospheric) air pressure to the airspeed indicator, and static air pressure to the altimeter and rate-of-climb indicator. The artificial horizon and directional gyros are air-driven gyros, operated by the instrument vacuum system. The gyros are driven by ambient air rushing into the instrument case to replace the air evacuated by the vacuum system. The air used for driving the gyros is filtered through an instrument vacuum air filter.

PITOT-STATIC SYSTEM

The pitot-static system provides impact pressure for operation of the airspeed indicator and static (atmospheric) air-pressure for operation of the airspeed indicator, rate-of-climb indicator, and altimeter. See Figure 8-2. Pitot pressure is provided by a pitot tube installed in the leading edge of the left wing. The piping for the pitot system extends from the pitot tube through the leading edge of the left wing to the fuselage where it is then routed down the left windshield post and inboard to the airspeed indicator. A



1. IGNITION SWITCH
2. CLOCK
3. AIRSPEED INDICATOR
4. VERTICAL SPEED INDICATOR
5. ARTIFICIAL HORIZON
6. TURN AND SLIP INDICATOR
7. ALTIMETER
8. DIRECTIONAL GYRO
9. OMNI AND ADF (OPTIONAL)
10. NAV-COMM (OPTIONAL)
11. TACHOMETER
12. ENGINE INSTRUMENT CLUSTER (FUEL QUANTITY INDICATORS, CYLINDER HEAD TEMP INDICATOR, OIL TEMP INDICATOR, OIL PRESSURE GAGE AND AMMETER)
13. CABIN HEAT CONTROL
14. STALL WARNING LIGHT
15. VACUUM GAGE (OPTIONAL)
16. PARKING BRAKE CONTROL
17. MIXTURE CONTROL
18. THROTTLE
19. CARBURETOR HEAT CONTROL
20. ENGINE PRIMER
21. INSTRUMENT LIGHT DIMMER SWITCH
22. SWITCH AND FUSE PANEL
23. FUEL PUMP SWITCH
24. MASTER SWITCH
25. EXTERIOR LIGHTS SWITCHES
26. VACUUM PRESSURE LIGHTS
27. GLOVE BOX
28. CIRCUIT BREAKER PANELS

Figure 8-1. Instrument Panel

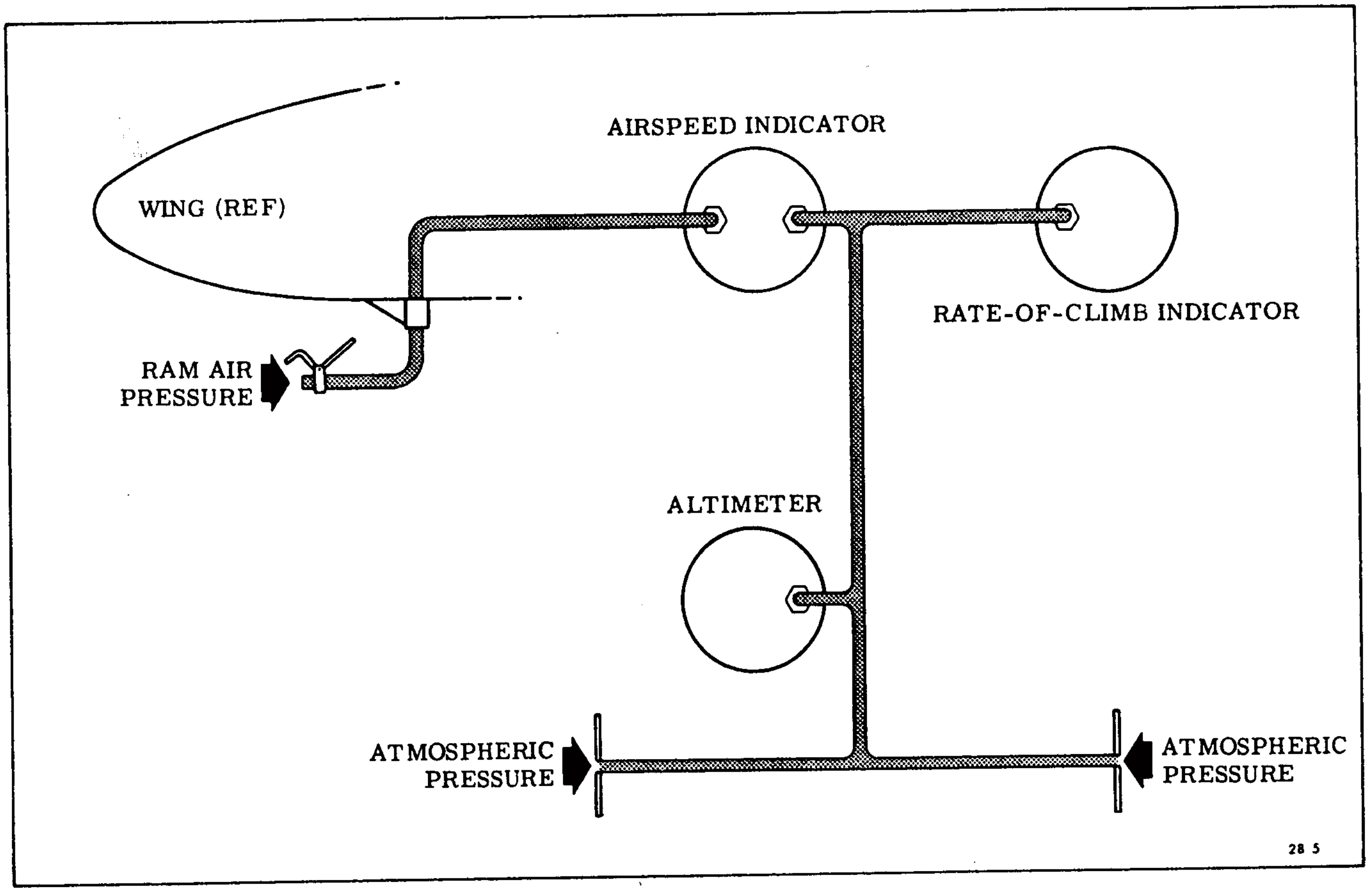


Figure 8-2. Pitot-Static System

static port is installed on each side of the aircraft forward of each door. The two static ports are interconnected by a tee fitting. A single line extends from the tee fitting to a tee fitting on the aft side of the altimeter. A line is then routed from the tee fitting to the airspeed indicator and rate-of-climb indicator.

MAINTENANCE. Flight instruments which utilize pitot-static pressures are very sensitive to pressure variations. Therefore, all piping and hose connections must be absolutely air tight. Moisture drains for the pitot-static system are unnecessary because of the pitot tube and static port design and position of lines from the pitot and static source. However, if moisture should accidently get into the lines, the static line may be purged by disconnecting the static line from the altimeter and applying 2-4 psi pressure to the static line. The pitot pressure line may be purged by disconnecting the pitot line from the airspeed indicator and applying 2-4 psi pressure to the pitot line.

WARNING

Be sure that air pressure is directed toward the pitot or static ports and not toward the instruments.

If the altimeter and rate-of-climb indicators are both erratic, check for an obstruction or open static line between the static ports and the instruments. When only one of these two instruments is indicating incorrectly, the trouble may be caused by a leak or an obstruction in the static line between the instrument and its connection to the static source. If the altimeter and rate-of-climb indicators continue to operate erratically after the static lines have been purged and checked for obstructions, the erratic instrument should be replaced. Faulty operation of the airspeed indicator may be caused by trouble in the static system. However, erratic readings of the other instruments using the static source will usually be evident. Malfunction of the airspeed indicator may also be caused by a leak in the pitot pressure lines. To check the pitot pressure line and airspeed indicator for leakage proceed as follows:

a. Slip ends of a 6-foot length of surgical hose over tip of pitot tube. Make certain hose is tight on the tube.
b. While observing airspeed indicator slowly double hose until airspeed indicator registers 150 mph. Crimp hose tightly and hold for one minute.
c. If airspeed indicator reading decreases more than 10 mph during the one-minute period, check all fittings and connections in pitot pressure system for tightness and repeat step b.
d. If indicator continues to show a decrease in

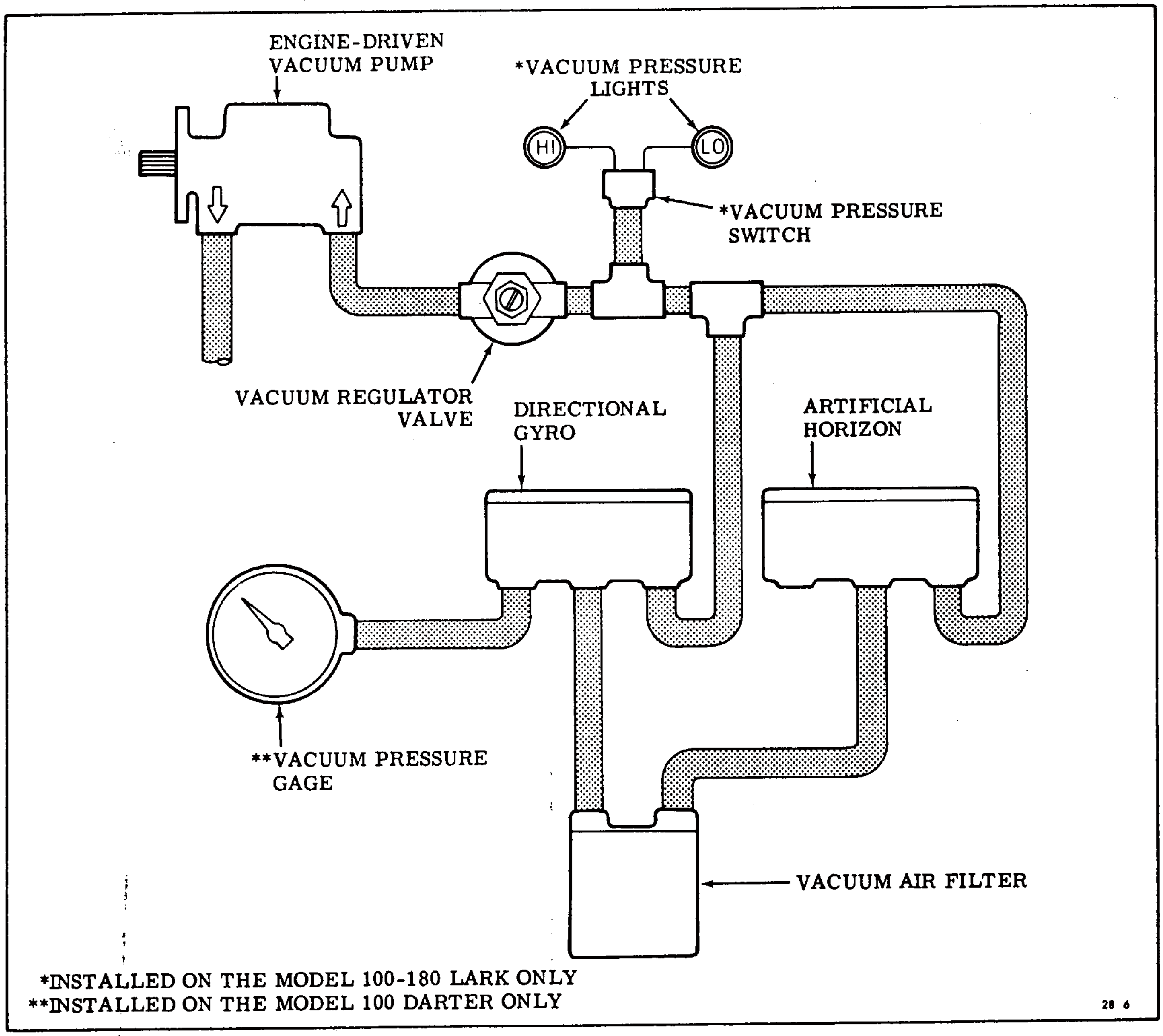


Figure 8-3. Instrument Vacuum System

airspeed, instrument case is leaking and indicator must be replaced.

INSTRUMENT VACUUM SYSTEM (OPTIONAL)

An instrument vacuum system may be installed on the aircraft as optional equipment for operation of a vacuum-driven artificial horizon indicator and a directional gyro. The vacuum system consists of an engine-driven pump, a vacuum regulator, an air filter, and interconnecting vacuum lines (see Figure 8-2). On the Model 100 Darter an instrument vacuum gage is installed in the instrument panel and connected by a tube to a fitting on the directional gyro. On the Model 100-180 Lark a vacuum switch is installed between the regulator and instruments. A HI vacuum light and a LOW vacuum light are installed on the left side of the instrument panel and are connected to the vacuum switch. The HI light illuminates when the vacuum is above 5.2 inches Hg and the LO light illuminates when vacuum is below 4.8 inches Hg. Normal vacuum pressure is indicated when neither light is illuminated. The vacuum gage on the Model 100 Darter is marked at 4.8 and 5.2 inches Hg. A vacuum reducing valve on the vacuum regulator is utilized to manually regulate the vacuum between 4.8 and 5.2 inches Hg. The vacuum regulator also incorporates an air filter screen (see Figure 8-3), which should be removed and cleaned on a scheduled basis. The hose connections and line fittings must be tight to assure correct operation of the vacuum system. All connections must be checked for possible leaks prior to adjusting the vacuum regulator for correct operation. A correct setting of the vacuum instrument system and periodical cleaning of the instrument air filter is necessary for proper operation of the instrument vacuum system.

VACUUM REGULATOR ADJUSTMENT. When adjusting the vacuum regulator a vacuum gage of known accuracy may be installed in the vacuum line between the vacuum regulator and the tee fitting forward of the instrument panel. This gage shall be used for adjusting the vacuum regulator. To adjust the vacuum regulator, proceed as follows:

a. Install a vacuum gage of known accuracy between vacuum regulator and tee fitting in vacuum line.
b. Start and operate engine at 800 rpm.
c. Adjust vacuum at vacuum regulator to obtain 4.8 inches Hg on vacuum gage.
d. Remove vacuum gage and connect vacuum line between vacuum regulator and tee fitting in vacuum line.
e. Operate engine at 2000 rpm. The vacuum gage on the Model 100 Darter shall not indicate more than 5.2 inches Hg. The vacuum lights on the Model 100-180 Lark shall not illuminate.

AIRSPEED INDICATOR

The airspeed indicator registers airspeed in miles-per-hour. The indicator is operated by the pressure differential between impact air pressure from the pitot tube and barometric pressure sensed through the static system. The following markings are on the airspeed indicator for the Model 100 Darter: A white arc from 48 to 105 mph indicates the speed range in which the flaps may be safely lowered. A green arc from 52 to 138 mph indicates the normal operating speed. A yellow arc from 138 to 170 mph indicates the caution range in which all operations must be conducted with care, and then only in smooth air. A red radial line at 170 mph indicates the maximum speed at which the aircraft may be safely flown. The marking on the airspeed indicator for the Model 100-180 Lark are as follows: a white arc from 60 to 105 mph indicates the speed range in which the flaps may be safely lowered. A green arc from 63 to 140 mph indicates the normal operating speed. A yellow arc from 140 to 176 mph indicates the caution range in which all operations must be conducted with care, and then only in smooth air. A red radial line at 176 mph indicates the maximum speed at which the aircraft may be safely flown.

TURN-AND-SLIP INDICATOR

The turn-and-slip indicator installed on the instrument panel is an electrically operated instrument. The instrument is utilized as a visual reference for the purpose of making smooth coordinated turns during flight. The instrument is powered by the aircraft electrical system, and therefore, operates only when the aircraft master switch is turned on. The circuit to the indicator is protected by a 5-ampere circuit breaker.

TURN COORDINATOR (OPTIONAL)

The turn coordinator is installed as an optional instrument, replacing the turn and bank indicator. The turn coordinator is an electrically operated instrument, connected to the aircraft main dc bus, and therefore, operates only when the aircraft master switch is turned on. The turn coordinator indicates an anticipatory visual display of the turn rate, indicating what the aircraft is doing. This display presents an indication of the movement of the aircraft on the roll axis that is proportional to the roll rate. When the roll rate is reduced to zero, the instrument provides an indication of the turn rate. The circuit to the indicator is protected by a 5-ampere circuit breaker.

DIRECTIONAL GYRO (OPTIONAL)

The directional gyro is operated from the instrument vacuum system. The air-driven gyro rotates with its spin axis horizontal. Due to gyroscopic inertia, the spin axis of the gyro remains constant, even though the aircraft direction is changed; therefore the relative motion between the gyro and instrument case is indicated on the face of the instrument in degrees. A knob extending from the instrument is used for directional heading adjustments and caging of the gyro. The directional gyro is primarily a navigational instrument; therefore, it should be maintained in an operational condition. The vacuum lines to the back of the instrument must be unobstructed and there shall be no leakage on the vacuum lines to the indicator.

ATTITUDE GYRO (OPTIONAL)

The attitude gyro indicator provides a visual reference of the aircraft attitude relative to the pitch and roll axis of the gyro indicator. The indicator, which is air-driven by the vacuum system, is installed in the instrument panel directly in front of the pilot. A correct setting of the vacuum instrument system and periodical cleaning of the instrument is necessary for accurate operation of this instrument.

ALTIMETER

The altimeter is an absolute pressure instrument that converts atmospheric pressure to altitude, using sea level as a reference base. As atmospheric pressure varies with changes in altitude the change in pressure is shown on the instrument dial in feet above sea level. The altimeter has a fixed dial and is equipped with three concentrically arranged pointers with a range to 50,000 feet. The long pointer registers in 100-foot increments, the short pointer registers in 10,000-foot increments, and the remaining pointer registers in 1000-foot increments. A movable barometric scale, visable through a small window in the main dial, indicates the barometric pressure in inches of Hg. An adjusting knob provides a means of adjusting the three pointers and barometric scale simultaneously to correct for changes in atmospheric pressure and to establish the proper reference to sea level. Barometric pressure is sensed through the instrument static system.

RATE-OF-CLIMB INDICATOR

The rate-of-climb indicator converts changes in barometric pressure to a rate of aircraft ascent or descent in feet-per-minute. Barometric pressure is sensed through the instrument static system. The indicator has a single needle and two adjoining scales, ranging from zero to 6,000 feet-per-minute, to indicate rate of climb or descent from a common zero point. The first 1000 feet on both scales is divided into 100-foot increments. A recessed slotted screw in the lower left corner is used to zero the indicator when the aircraft is on the ground.

POWER PLANT INSTRUMENTS

To afford maximum visibility to the pilot, power plant instruments are grouped together in the instrument panel. The power plant instruments provide the means for monitoring the operation and condition of the engine and include the cylinder head temperature indicator, oil temperature indicator, and oil pressure indicator. On the Model 100 Darter these instruments are installed in a cluster above the right control wheel, while on the Model 100-180 Lark these instruments are installed on a panel directly in front of the pilot. The engine tachometer for the Model 100 Darter is also installed in the instrument panel above the right control wheel, while on the Model 100-180 Lark the engine tachometer is installed on the upper left side of the instrument panel.

CYLINDER HEAD TEMPERATURE INDICATOR

The cylinder head temperature indicator is calibrated in degrees centigrade. The indicator is controlled by a temperature sensitive resistance probe installed in a cavity below the lower spark plug on the number four engine cylinder. This temperature sensing probe regulates current supplied from the aircraft battery through the temperature probe to operate the cylinder head temperature indicator. As the No. 4 cylinder head temperature increases a higher electrical potential is created within the temperature probe causing the indicator pointer to indicate a higher temperature reading. A red radial line at 475°F marks the maximum allowable engine operating temperature. A green arc from 100°F to 475°F indicates the normal temperature range.

OIL TEMPERATURE INDICATOR

The oil temperature indicator is controlled by a temperature bulb installed in the engine high pressure oil screen housing. As the oil temperature increases, the increased resistance of the bulb unbalances the current in the indicator circuit causing the indicator pointer to deflect toward a higher temperature reading. A red radial line at 245°F marks the maximum allowable oil temperature. A green arc from 125°F to 245°F indicates the safe oil temperature range.

OIL PRESSURE INDICATOR

The oil pressure indicator is a direct reading instrument. A small oil line is connected to an engine oil pressure outlet on the right side of the engine accessory section forward of the magneto drive pad. The other end of the oil line is connected to the rear case of the oil pressure gage. Allowable operating oil pressures are marked at 25 psi for the minimum pressure and at 85 psi for the Model 100 Darter and 90 psi for the Model 100-180 Lark for the maximum oil pressures. Oil pressure fluctuations are usually caused by air trapped in the oil line. Air in the oil line can be removed by disconnecting the line from the indicator and motoring the engine for a short time. Catch the oil from the indicator line in a small container.

TACHOMETER

The engine tachometer is a direct reading instrument which is driven by a flexible shaft attached to the engine tachometer drive unit. A red radial line at 2700 rpm indicates the maximum operating rpm. Fluctuations of the tachometer indicator needle are usually caused by the drive shaft whipping within the cable house. A small amount of graphite dust from a "puff" applicator blown into the indicator end of the shaft housing will correct this condition.

FUEL PRESSURE INDICATOR (MODEL 100-180)

The fuel pressure indicator is a direct reading instrument. A small fuel line is connected between a fuel pressure outlet on the carburetor and the fuel pressure indicator. A green arc between 0.5 psi and 8.0 psi indicates the allowable fuel pressure. Red lines at 0.5 and 8.0 indicate the minimum and maximum allowable fuel pressures. Fuel pressure fluctuations are usually caused by air trapped in the fuel pressure line to the fuel pressure indicator. Air in the fuel pressure line can be removed by disconnecting the line from the indicator and operating the electric fuel pump for a short time. Catch the fuel from the fuel pressure indicator line in a small container.

MISCELLANEOUS INSTRUMENTS

Miscellaneous instruments includes those instruments that are not specifically classified as flight nor power plant instruments. The miscellaneous instruments include the fuel quantity indicating system, ammeter, outside air temperature indicator, and stall warning system.

FUEL QUANTITY INDICATING SYSTEM

FUEL QUANTITY INDICATOR. Two fuel quantity indicators are installed in the instrument panels, one for the left fuel tank and one for the right fuel tank. These indicators are electrically connected to the fuel quantity transmitters. The indicator registers E, 1/4, 1/2, 3/4 and F. The fuel tank contains 22 gallons of fuel; however, two gallons remain in the tank when the indicator registers empty. This two gallons of fuel is not considered useable fuel.

FUEL QUANTITY TRANSMITTER. The fuel quantity transmitters, which are actuated by a fuel float and arm assembly installed within the fuel tanks, consist of a potentiometer that is actuated by the float and arm assembly to vary the resistance in the potentiometer windings. This resistance in the windings is transmitted to the fuel quantity indicator to register the amount of fuel in the fuel tanks.

OUTSIDE AIR TEMPERATURE INDICATOR

The outside air temperature indicator, which is installed in the right corner of the windshield, registers ambient temperature from -50°C to 60°C (-58°F to 140°F). A brass sunshield is utilized to reduce the effect of direct sunlight on the temperature readings. The temperature sensing element protrudes through the windshield with the head of the instrument inside the cockpit.

AMMETER

The ammeter, which is grouped with the engine instruments, indicates the amperage or current flowing to or from the battery. The ammeter, which indicates from 0 to 60 amperes and from 0 to -60 amperes, is connected between the main bus and the battery solenoid. When the battery solenoid is actuated the ammeter is then connected between the main bus and the battery, allowing current flow from the battery to the bus. When the generator is operating current then flows from the generator to the bus and from the bus through the ammeter to the battery.

STALL WARNING SYSTEM

The stall warning system utilizes a vane-actuated switch installed in the leading edge of the left wing to energize a red warning light and an audible stall warning horn located in the instrument panel. The stall warning switch is adjusted to operate at 5-10 mph above the actual stall speed. The vane of the switch is installed in a position which causes the switch to close when the angle of attack approaches the maximum lift angle of the wing and airflow over the wing tends to burble.

SECTION IX

HEATING AND VENTILATING

GENERAL DESCRIPTION

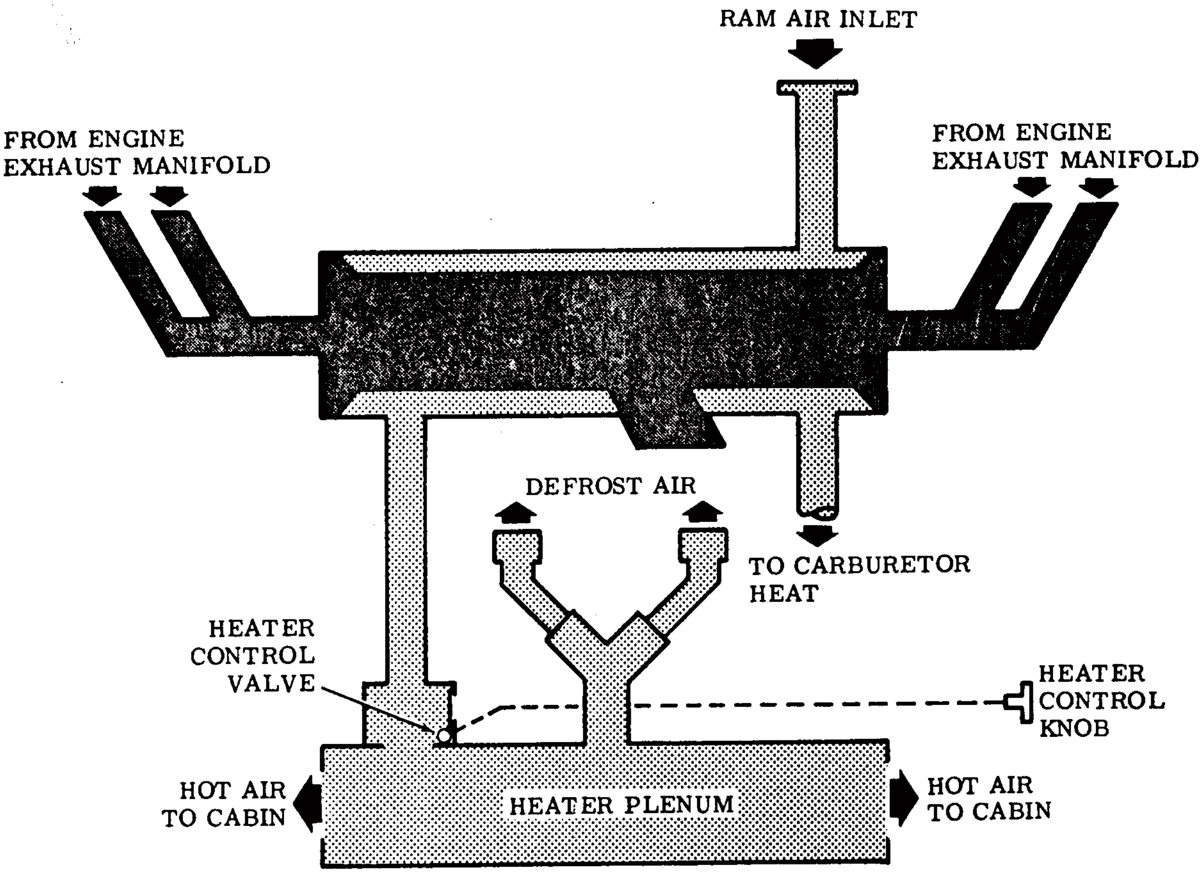
Heating and ventilation is provided by ram air. Ram air is directed through the engine exhaust heat muff assembly, which acts as a heat exchanger, and through ducting to the cabin heater and defroster outlets. The entry of heated air into the cockpit is controlled by the cabin heat control on the right side of the instrument panel. Ventilating air is directed into the cabin by ram air inlets in the inboard leading edge of each wing. Ventilating air into the cabin is controlled by positioning the ventilating air outlets in the cabin.

HEATING SYSTEM

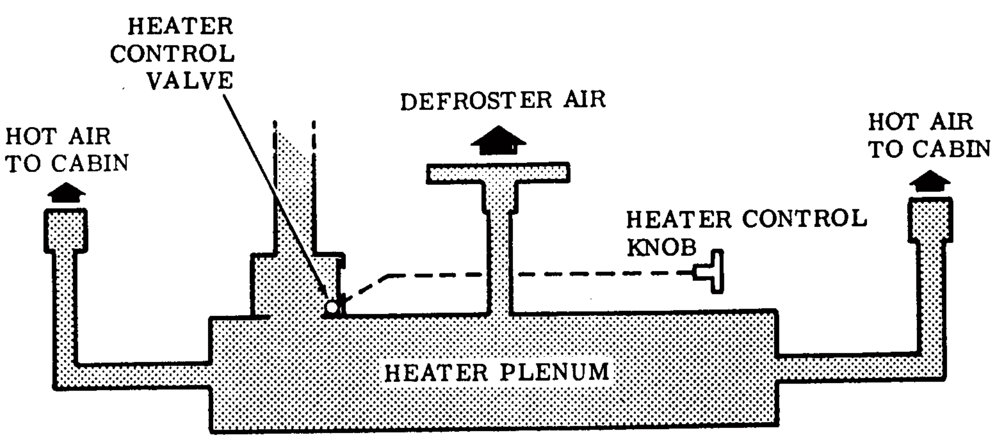
The heater consists of a heat muff which surrounds the engine exhaust stacks where they come together below the engine. The heat from the exhaust is transmitted to the air in the heat muff. Ram air through the ram air inlet is directed into the heat muff to force the heated air through the heater ducting to the heater outlets in the cabin (see Figure 9-1). The cabin heat control on the right side of the instrument panel is connected to the cabin heat valve on the lower forward side of the engine firewall. When the cabin heat control is pulled out the control flexible shaft opens the cabin heat valve to admit heated air to the cabin heat outlet assembly. The heater outlet assembly serves as a plenum chamber and directs the heated air into the forward cabin area and through the windshield defroster outlets. The defroster outlets each consists of a Wemac outlet under each windshield. Heated air is then available to the windshield when the cabin heat control is pulled out and the Wemac outlets are open. The heat will all be directed into the cabin through the heater outlet assembly when the defroster outlets are closed.

VENTILATING SYSTEM

Ventilating air is directed into the cabin through two ventilating air outlets on each side of the aircraft ceiling. An air outlet is installed over each seat in the aircraft (see Figure 9-2). Ventilating air inlets are installed in the inboard leading edge of each wing. These inlets direct the air inboard and aft to an air distribution box. The ventilating air outlets are then connected to the air distribution box with flexible ducting and may be opened or closed to obtain ventilating air as necessary. Some early Model 100 Darters were equipped with cowl vents, located on the fuselage just forward of the cabin door posts. These were replaced with adjustable vents in the windshield and utilized until air inlets were installed in the leading edge of the wings.



MODEL 100 AND 100-180 LARK A/C 5001 THRU 5100



MODEL 100/180 A/C 5101 AND SUBS

Figure 9-1. Cabin Heating System

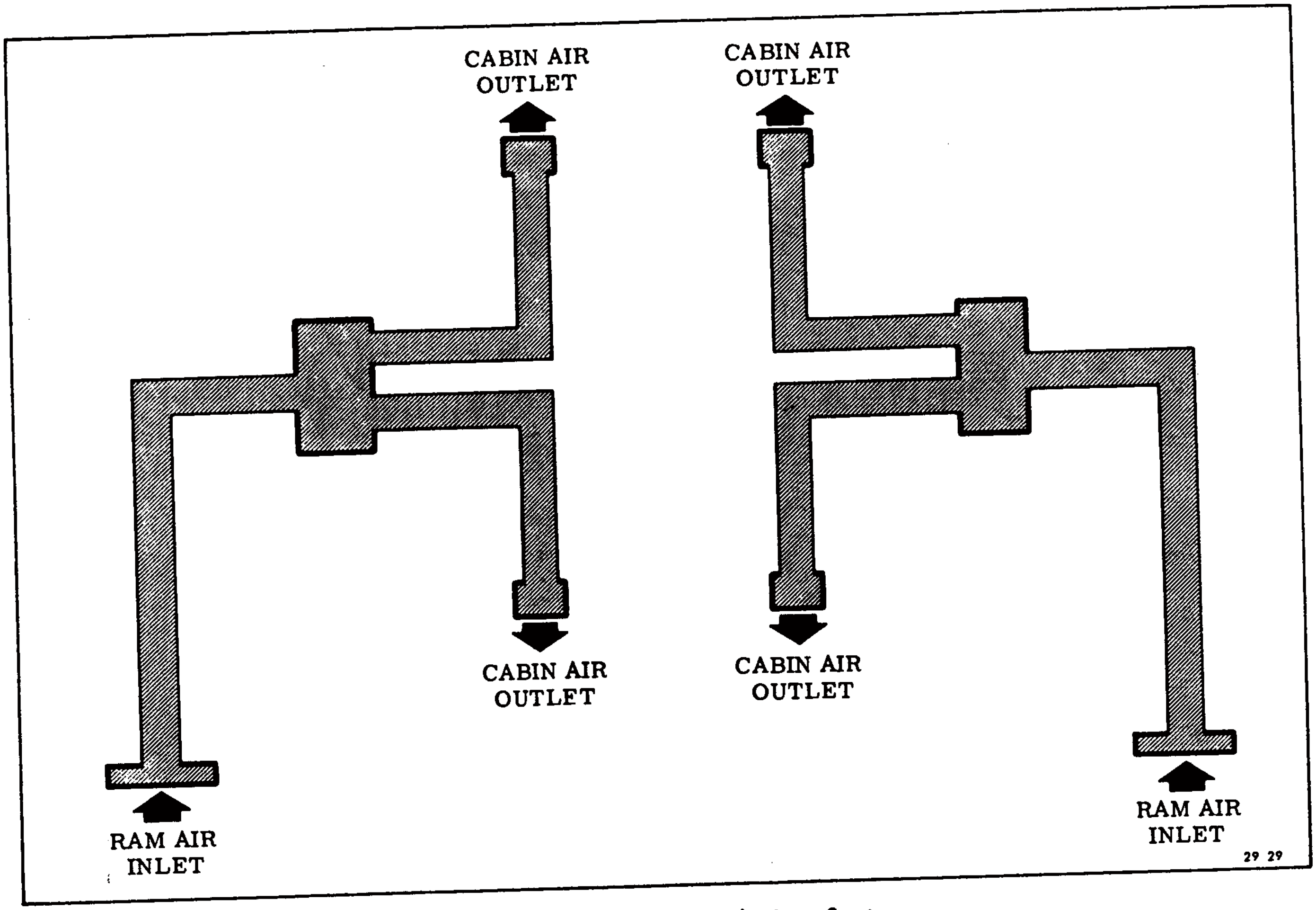


Figure 9-2. Cabin Ventilating System

SECTION X

ELECTRICAL SYSTEM

GENERAL DESCRIPTION

The aircraft are equipped with a 12-volt dc electrical system. A 12-volt wet cell storage battery provides electrical power for engine starting and a reserve source of electrical power in the event of a generator or alternator failure. A 12-volt, 35-ampere dc generator is installed on the Model 100 Darter serial number 051 thru 225, and a 12-volt, 40-ampere alternator is installed on Model 100 Darter serial number 226 and subsequent and on all Model 100-180 Larks. The generator or alternator supplies the primary source of electrical power to the main dc bus. The electrical system is protected by voltage regulators and overload circuit breakers on the Model 100 Darter serial number 051 thru 225. An overvoltage control relay protects the load circuit from an overvoltage condition by automatically opening the field circuit of the alternator on the Model 100 Darter serial number 226 and subsequent and on all Model 100-180 Larks. If generator output voltage is below battery or bus voltage, a cutout relay in the generator voltage regulator will automatically disconnect the generator from the dc bus. An ammeter installed in the instrument panel indicates the amperage or current flowing from or to the battery. All electrical circuits on the Model 100 Darter except the starting circuit are individually protected by circuit breaker switches or fuses, and all circuits on the Model 100-180 Lark except the starting circuit are individually protected by push-pull circuit breakers. Each electrical system component, therefore, is protected so that a failure within a particular circuit will not affect the operation of components in the other circuits. Switches and circuit breakers required for operation of the electrical system are installed in the instrument panel. A description of each circuit with necessary maintenance data is included with the information pertaining to the associated aircraft system.

POWER DISTRIBUTION

Electrical power to the dc bus depends upon the battery and the generator. When the engine is not operating electrical power is connected to the battery bus by placing the master switch to ON position. This energizes the battery relay, which connects the battery to the bus. When the engine is operating and the generator voltage exceeds battery voltage, electrical power from the generators is directed through the regulator to the bus on Model 100 Darter serial number 051 thru 225. On Model 100 Darter serial number 226 and subsequent and on all Model 100-180 Larks electrical power from the alternator is directed through the regulator and overvoltage relay through the master switch to the bus. Electrical power is then directed from the bus to the individual circuits connected to the bus.

BATTERY

A 12-volt dc battery, installed in a frame support on the right forward side of the engine firewall, provides power to the dc bus through the battery relay. The relay is controlled by a 2-position (BATTERY-OFF) master switch installed in the instrument panel. Placing the master switch to OFF position de-energizes the battery switch, disconnecting the battery from the dc bus.

BATTERY SERVICING. Inspect battery for general cleanliness, security of mounting, and electrolyte level at every 50 hours flight time. Inspect battery for any signs of spilling, boiling over, or other possible damage. If considerable wetting of battery area is evident and electrolyte cannot be seen in the battery cells, electrolyte shall be added to the cells. If electrolyte is not available add distilled water to the low cells and note which cells had low level of electrolyte. The addition of water may result in more than a 15 point spread of the specific gravity between these and adjacent cells. If the specific gravity is more than a 15 point spread between the cells electrolyte should be added to the original low level cells when all cells need leveling. If frequent addition of water is necessary, the battery is probably being overcharged because of improper voltage regulation. Remove spilled electrolyte from battery and battery area with weak ammonia or a solution of baking soda and water mixed at one pound baking soda per one gallon of water. Rinse affected area with clear water.

CAUTION

Do not allow ammonia or soda water to enter battery. The electrolyte will be neutralized and battery will be permanently damaged.

Electrolyte does not evaporate and does not ordinarily need replacing unless spilled. An electrolyte specific gravity reading of 1.265 - 1.285 for all cells indicates a fully charged battery. If the specific gravity reading is below 1.200, the battery must be recharged at a rate not exceeding 3 amperes for the Model 100-180 Lark nor 2 amperes for the Model 100 Darter.

WARNING

Do not allow open flame in vicinity of battery gases. Battery gases produced by chemical reaction are explosive.

Check battery with a hydrometer when it will no longer take a charge. The reading should be 1.265 to 1.285 at 70°-80°F. Battery voltage should be 14.4 volts with no load. Charge may also be terminated if specific gravity of any one cell does not rise during four successive hourly readings corrected to 80°F.

BATTERY REMOVAL AND INSTALLATION. To remove the battery, remove the top engine cowling and proceed as follows:

a. Remove wing nuts from battery posts and remove battery cables.
b. Remove vent tube from battery vent.
c. Remove nuts from battery holddown assembly and remove battery holddown.
d. Lift battery from battery cradle.

Installation of the battery is the reverse of the removal.

GENERATOR SYSTEM (Model 100 Darter, Serial No. 051 thru 225)

The dc power generating system consists primarily of a 12-volt, 35-amp dc generator, a 3-unit voltage regulator, an ammeter, the battery, and the master switch. A description of the generator is included in Section IV, Power Plant. The generator supplies the voltage and current to the voltage regulator, which regulates the voltage and current and connects the generator to the battery bus when the generator voltage exceeds the battery voltage. If the generator fails or battery voltage exceeds the generator voltage, the cutout relay in the voltage regulator disconnects the generator from the battery bus. This prevents the battery or bus voltage from motoring the generator and creating excessive drain on the electrical system. The generator circuit is protected by an overload circuit breaker switch on the instrument panel. Inspection of the generator is limited mostly to visual checks for loose mounting bolts, a loose drive belt, damaged wiring, and worn commutator brushes. All mounting bolts should be kept tight, and the belt tension should be properly adjusted. Wiring with frayed insulation should be replaced and all connections checked to assure that they are tight and clean. If generator brushes are worn to less than half their original length, they should be replaced.

VOLTAGE REGULATORS. The voltage regulator, which incorporates a current regulator, a voltage regulator, and a cutout relay, is mounted on vibration isolators attached on the upper center of the forward side of the engine firewall. The current regulator unit in the voltage regulator is a current-limiting device that limits the generator output. The cutout relay closes the generator-to-battery circuit when the generator voltage is sufficient to charge the battery, and it opens the circuit when generator voltage is less than the battery. The voltage regulator unit limits the voltage through the regulator and prevents the system voltage from exceeding the rated voltage of the generator, thereby protecting the battery and other voltage-sensitive equipment from an overvoltage condition.

GENERATOR FIELD FLASHING. After a new or repaired generator or voltage regulator has been installed on the aircraft the generator and voltage regulator must be polarized so they will have correct polarity with the battery. Failure to polarize the system may result in burned or stuck relay contacts in the voltage regulator and possible damage to the wiring and generator windings. Polarizing the generator allows a surge of current to flow through the generator field windings, which assures that polarity of the generator and voltage regulator will match polarity of the battery. Reversed polarity may be eliminated by polarizing the generator as follows:

a. Turn MASTER switch to ON position.
b. Remove lead from regulator F (FIELD) terminal and momentarily touch lead to regulator B (BATTERY) terminal.
c. Reconnect lead to regulator F (FIELD) terminal.
d. Start engine and assure that ammeter in aircraft indicates a positive amperage output of the generator.

ALTERNATOR SYSTEM (Model 100 Darter, Serial No. 226 and Subs and All Model 100-180 Larks)

The alternator charging circuit consists of the alternator, a solid state voltage regulator, the master switch, an overvoltage relay, an ammeter, and the battery. A description of the alternator is included in Section IV, Power Plant. The alternator has self-limiting current characteristics, therefore, a current limiting unit in the regulator is not necessary. The solid state voltage regulator contains a voltage adjustment on top of the regulator. This adjustment can be turned left or right to adjust the voltage output of the alternator through the regulator. The normal voltage through the regulator with the engine operating at 1500 rpm is 14 volts. The alternator circuit is protected by a 40-ampere circuit breaker switch on the instrument panel. Inspection of the alternator system is limited mostly to visual checks for loose mounting bolts, a loose drive belt, and damaged wiring. All mounting bolts should be kept tight, and belt tension should be properly adjusted. Wiring with frayed insulation shall be replaced and all connections checked to assure that they are clean and tight.

VOLTAGE REGULATOR. The voltage regulator, installed on the upper center engine firewall, limits the alternator output voltage to 14.2 volts by controlling the alternator field current. The output voltage of the alternator is determined by the adjustment of the voltage regulator. Once adjusted the alternator voltage remains practically unchanged, since the regulator is unaffected by the length of service, changes in temperature, or by changes in alternator output and speed. After a voltage regulator has been replaced it will not be necessary to polarize the alternator. Therefore, never connect a ground, even momentarily, to either the regulator F (FIELD) terminal or to the alternator F (FIELD) terminal. Also do not interchange the leads to the regulator, as this will damage the regulator.

Voltage Regulator Adjustment (Model 100 Darter, Serial No. 226 thru 250)

When a voltage regulator has been replaced on the aircraft, the regulator may be adjusted as follows:

a. Connect a voltmeter to the leads of the voltage regulator. The + lead of the voltmeter shall be connected with the positive lead to the regulator, and the - lead of the voltmeter shall be connected to the negative lead of the regulator.
b. Turn all switches off.
c. Start and operate engine at approximately 1000 rpm for a minimum of one minute. The alternator output should be 30 amperes.
d. Remove plug from top of regulator and turn slotted adjusting button to obtain a voltage reading between 13.2 and 14.0 volts.

Voltage Regulator Adjustment (Model 100 Darter, Serial Number 251 and Subsequent, and all Model 100-180 Larks).

When a voltage regulator has been replaced on the aircraft, the regulator may be adjusted as follows:

a. Connect a test voltmeter between terminal "I" and ground on the voltage regulator. The + lead of the voltmeter shall be connected to the "I" lead of regulator and the - lead of the voltmeter shall be connected to the "G" (ground) terminal of the regulator.
b. Start engine and operate at approximately 1000 rpm for a minimum of one minute.
c. Turn accessory switches on as necessary to establish a 10 to 15 ampere electrical load.
d. Remove plastic plug from top of regulator and adjust the voltage to obtain a voltage reading of 13.2 volts at an engine speed of 400 rpm and 14.1 (± 0.1) volts at an engine speed of 1550 rpm.

ALTERNATOR SYSTEM GENERAL NOTES

To avoid possible damage to the alternator system the following notes should be adhered to when performing maintenance on the electrical system.

1. Disconnect the battery ground cable at the battery before connecting or disconnecting a test ammeter or other equipment or before making wiring changes in the electrical system.
2. Exercise caution when connecting and disconnecting a voltmeter to the voltage regulator.
3. Install battery with negative terminal in position to connect battery ground terminal to negative terminal.
4. It is not necessary to polarize the alternator; therefore, never connect ground, even momentarily, to either the regulator field terminal or to the alternator field terminal. Do not interchange leads to the regulator, or the regulator will be damaged.
5. The alternator drive belt must be properly adjusted, to prevent slippage.
6. The battery should always be in good condition in order to maintain a full charge.

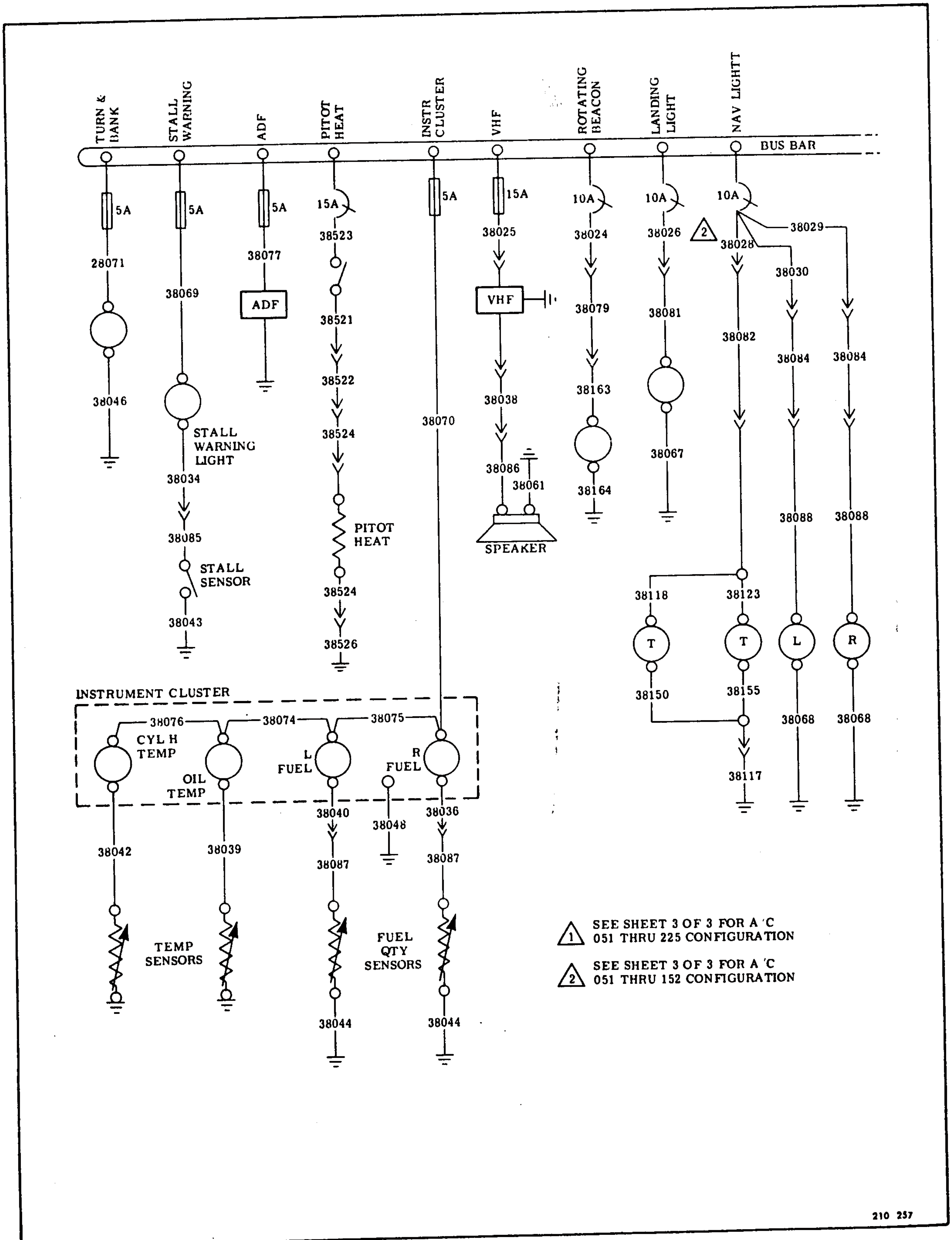


Figure 10-1. Electrical System - Model 100 (Sheet 1 of 3)

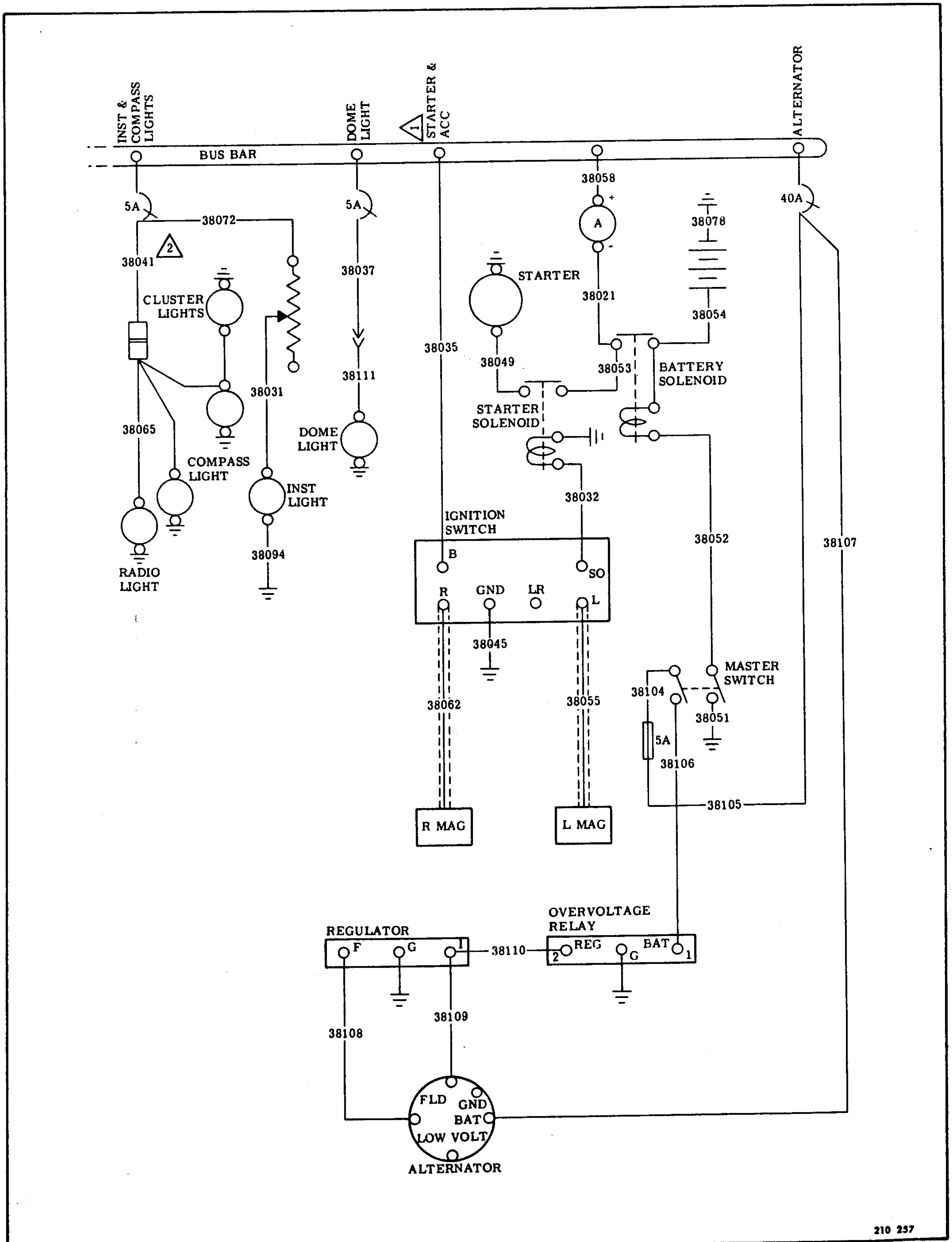


Figure 10-1. Electrical System - Model 100 (Sheet 2 of 3)

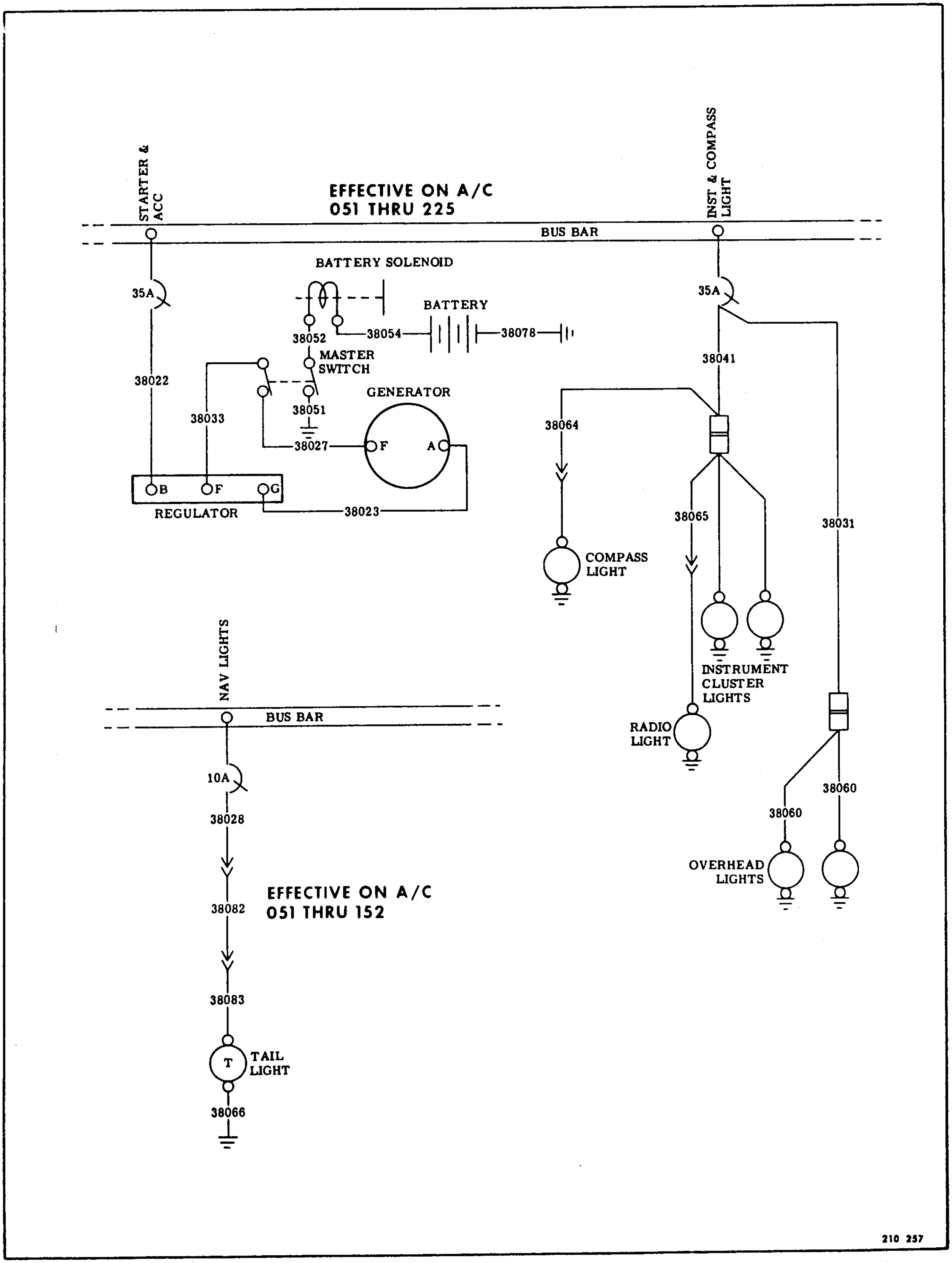


Figure 10-1. Electrical System - Model 100 (Sheet 3 of 3)

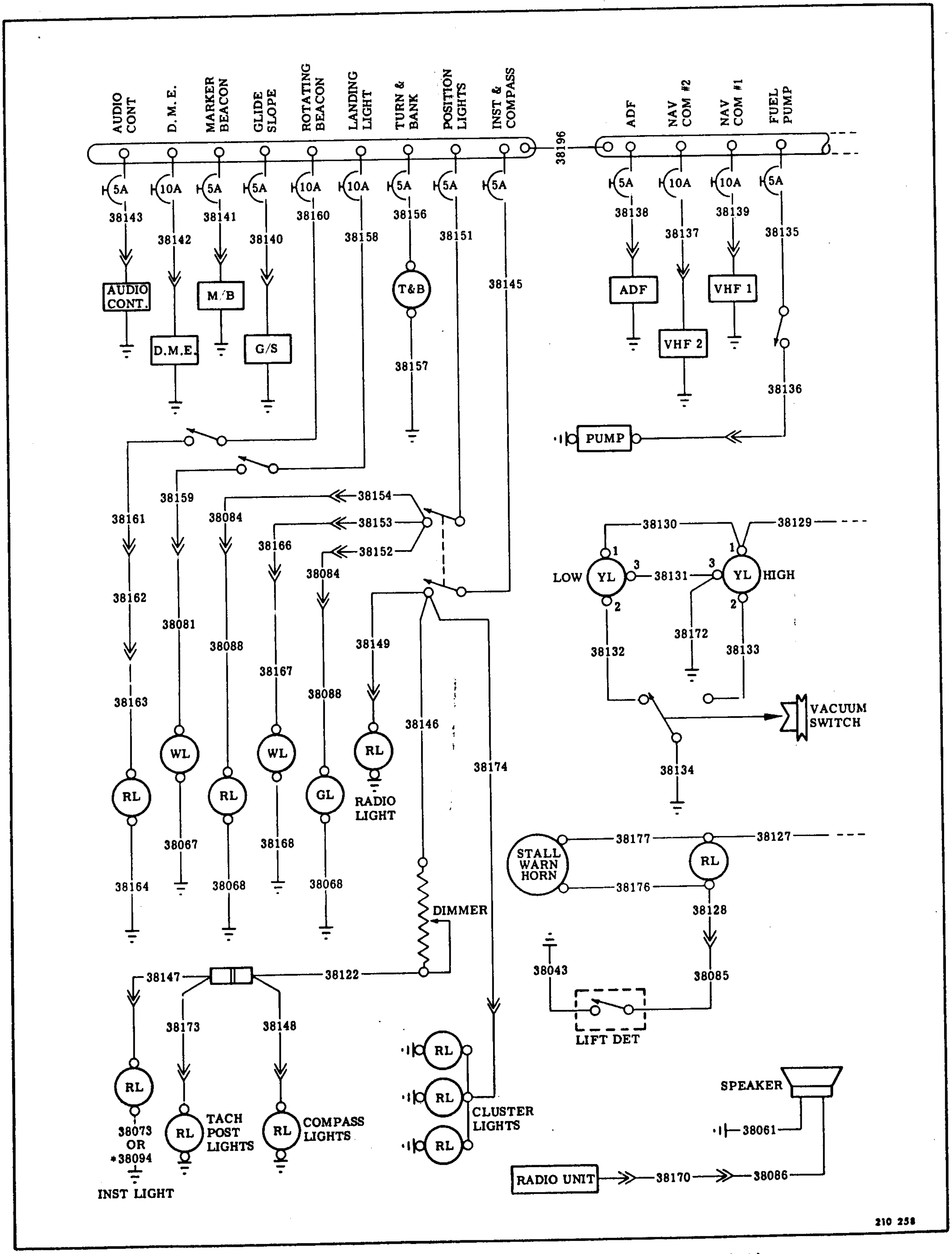


Figure 10-2. Electrical System - Model 100-180 (Sheet 1 of 2)

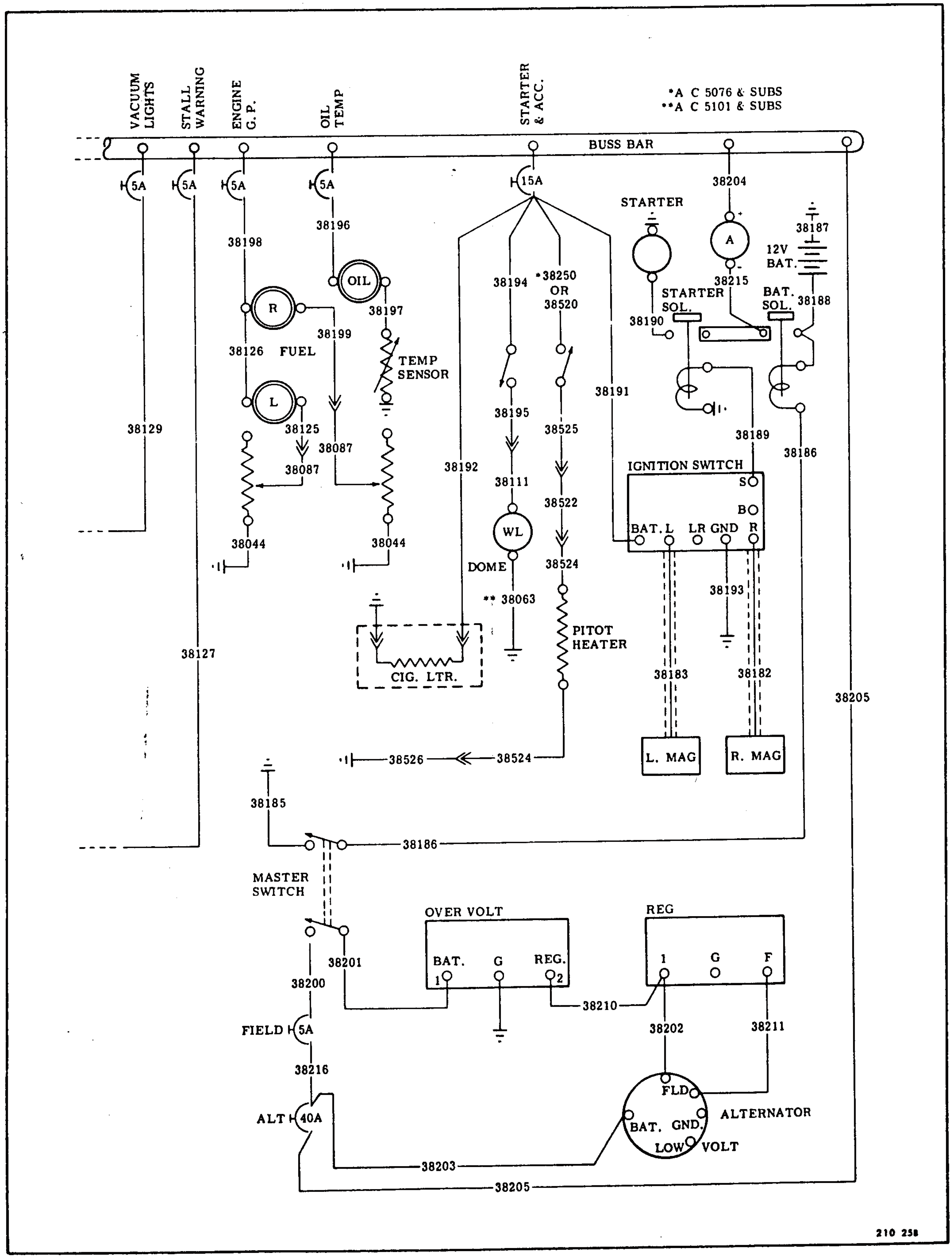


Figure 10-2. Electrical System - Model 100-180 (Sheet 2 of 2)