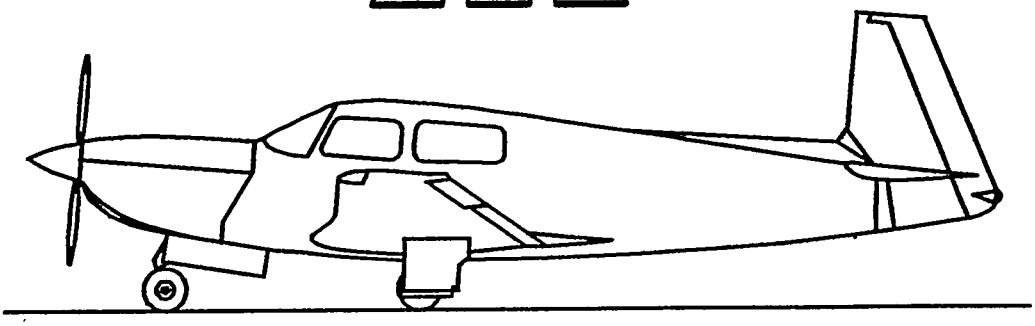
# Mooney M20 L

## SERVICE AND MAINTENANCE MANUAL



MOONEY AIRCRAFT CORPORATION
P.O. BOX 72, KERRVILLE, TEXAS. 78029–0072
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## INTRODUCTION

This manual provides servicing and maintenance information for the Mooney Model M20L, Serial Numbers 26-0001 and ON. Maintenance actions that refer to a limited number of aircraft will be designated by serial number of applicable airplanes.

The format and contents of this manual are prepared in accordance with GENERAL AVIATION MANUFACTURER'S ASSOCIATION (GAMA) Specification No. 2. The manual is supplemented with wiring schematics for the various model year airplanes,as necessary. These are located in envelopes at the back of the manual texts pages.

NOTE

**Revisions or reissues of this manual are not automatically provided to manual holders. Holders of these and other Mooney Technical Publications should complete the information on the YELLOW CARDS located at the front of the Title Page and send to Mooney Aircraft Corporation, P.O. Box 72, Kerrville, TX., 78029-0072, Attn: Service Parts Department.**

Notification is sent to known manual holders when another manual is prepared to replace the subscription and advises that no more revisions will be sent out. The new manual will require a new subscription service. If additional Technical Publications are desired, contact the above department at Mooney Aircraft Corporation at (512) 896-6000.

Correspondence concerning maintenance or part numbers on an airplane should contain the aircraft model number and serial number. The serial number appears on the identification placard located on the aft end, left hand side of the tailcone below the horizontal stabilizer.

## ASSIGNMENT OF SUBJECT MATERIAL

The content of this publication is organized at four levels:

Group
System/Chapter
Subsystem/Section
Unit/Subject

## GROUP

These are primary divisions of the manual that enable broad separation of content, ie., Airframe systems VS Powerplant systems. These groups are identified by tabs.

## SYSTEM/CHAPTER

The various groups contain major systems information such as flight controls, landing gear, etc. The systems are arranged numerically per GAMA recommended number assignment, It is suggested, for example,that "Fuel" be identified with the System/Chapter number "28". The sequence of numbers, 28-00-00, refers to the General information of the Fuel Systems.

## SUB-SYSTEM/SECTION

The major systems of an aircraft are broken down into sub-systems. These sub-systems are identified by the second element of the sequence of numbers, ie., 28-20-00. The element -20- indicates the distribution portion of the fuel system.

## UNIT/SUBJECT

The individual units within a sub-system may be identified by a third element of the sequence of numbers, ie.,28-20-01. This number is assigned by the manufacturer and may or may not be used depending upon the complexity of the maintenance action recommended.

## APPLICATION OF NUMBERING SYSTEM

Mooney Aircraft Corporation is in the process of revising all applicable technical publications to the GAMA format. When this effort is completed any publication concerning maintenance of aircraft will conform to this basic numbering system. Any person wishing information concerning the Fuel Distribution System would refer to the pages identified as ,28-20-00, in any maintenance oriented publication. These pages will be numbered sequentially within each system breakdown in the current Mooney series of aircraft. As Mooney aircraft models become more complex the page numbers may be sequentially numbered within sub-systems.

The table of contents in the front of each System/Chapter will provide a list of sub-systems covered in the Chapter. For example:

| | |
|---|---|
| 28-00 | General |
| 28-10 | Storage (Tanks, vents, repair, etc.) |
| 28-20 | Distribution (Boost pumps, fuel lines, etc.) |

| | | |
|---|---|---|
| 28-40- - | Indicating (Sender Units, quantity gauges, etc.) | If there is a reason to distinguish between LEFT HAND or RIGHT HAND fuel quantity sending units then the number would be expanded to 28-40-01 (Left Hand) and 28-40-02 (Right Hand). This concept will apply to any expanded information throughout the publications. |

## SUPPLEMENTARY PUBLICATIONS

The following list of Manufacturers and/or publications can provide servicing and maintenance information on components of the Mooney-PFM, Model M20L. No avionics equipment Manufacturers or publications are listed due to the many configurations that can be installed in the aircraft. These can be obtained from the repair stations for a particular avionics manufacturer.

Publications available from Mooney Aircraft Corporation are listed in the Parts Price List and are available through any Mooney Marketing/Service Center.

As publications on various components become available, they will be added to the list below.

## VENDOR ADDRESSES or PUBLICATIONS

### ENGINE

Maintenance publications can be obtained through Porsche Aviation Products Inc., Municipal Airport, R.R. # 2, Box 118A, Galesburg, Il.,61401.

### PROPELLER

McCauley Propellers - Obtain publications from McCauley Accessories Division, Cessna Aircraft Company, 3535 McCauley Drive, Vandalia, OH.,45377.

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| | 10 | TIME LIMITS |
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| | 00 | LEVELING |
| 9 | | TOWING AND TAXIING |
| | 00 | GROUND HANDLING |
| | 10 | TOWING |
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| | 30 | ELEVATOR SYSTEM |
| | 40 | STABILIZER TRIM SYSTEM |
| | 50 | WING FLAP SYSTEM |
| | 90 | MISCELLANEOUS |
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| | 20 | DISTRIBUTION |
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# CHAPTER

# 05

# TIME LIMITS/ MAINTENANCE CHECKS

# TIME LIMITS/MAINTENANCE CHECKS

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## 5-00-00 - GENERAL

**AIRCRAFT DESCRIPTION.** The M20L series of aircraft are four place high-performance single-engine low-wing monoplanes. The all-metal airframe has a tubular-steel cabin frame covered with nonstructural aluminum skins, a semi-monocoque tailcone, and a full-cantilever laminar-flow wing. Control surfaces have structural spar construction with stressed skins riveted to the spars and ribs. Dual control wheels accompany the conventional flight controls. The pilot's rudder pedals have toe brakes linked to individual hydraulic cylinders that supply pressure to the hydraulic disc brakes on each main gear wheel. Removable co-pilot rudder pedals are standard equipment. The tricycle landing gear, having a steerable nose wheel controlled by rudder pedal action, is fully retractable. The wide-span trailing-edge wing flaps are electrically operated. For stabilizer trim, the entire empennage pivots vertically about its attaching points.

## 5-00-01 - LANDING GEAR SYSTEM

The electric landing gear system has a steerable nose wheel. Single disc self-adjusting hydraulic brakes are featured on the main gear. Gear position lights, a warning horn and a gear position indicator on the floorboard are standard equipment. Bungee springs assist in preloading the retraction mechanism in an over-center position to lock the gear down. A properly rigged air pressure actuated safety switch in the electrical system prevents electric gear retraction on takeoff until a safe flying speed is attained. A gear warning horn sounds when the power lever is approximately 3/8 to 1/4 inch out from panel while the landing gear is up. The, electric, gear retraction system has a manual extension system connected to the gear actuator which permits manual lowering of the gear in the event of an electrical malfunction.

## 5-00-02 - FLIGHT CONTROL SYSTEMS

Dual flight control systems can be operated from either the pilot or co-pilot seat. All flight controls are conventional in operation, using pushpull tubes to link the control surfaces to the control wheels and rudder pedals. Formica guide blocks maintain control tube alignment and dampen vibration. An interconnect spring mechanism links the aileron and rudder systems to assist in control coordination. The standard co-pilot's rudder pedals are removable. The trim system sets the stabilizer angle of attack.

## 5-00-03 - WING FLAP SYSTEM

Wing flaps are electrically actuated and are controlled by a spring loaded "up-off-down" switch on the center console.

## 5-00-04 - ELECTRIC POWER SYSTEM

1. The master switch and power relay control the electrical power system, comprised of two 70 amp, 28 volt alternators w/ integrated voltage regulators, and two 24 volt 22 AMP HR batteries. The alternator system has an overvoltage protective relay and an overvoltage annunciator light. Circuit breakers or circuit breaker/switches protect the electrical wiring and equipment from overloads. Standard electrical equipment includes: two 100 watt landing lights, two 100 watt taxi lights, navigation lights, interior lights, gear and stall warning system, three electric fuel pumps, an electric starter, an electric gear retraction system with manual extension override and an electric flap system.

## 5-00-05 - INSTRUMENTS

All flight instruments are in the shock-mounted flight panel. Engine instruments are in the pilot's panel. The pitot system provides air pressure to operate the airspeed indicator. The instrument static pressure system has two static air pickup ports (one on each side of the tailcone) that open to the atmosphere. An alternate static source control is provided on the center console. The instrument panel lights come on when the Navigation lights are turned on. Dimming is controled by switches located on the center console. They are momentary type switches; push top of switch and hold until the desired illumination is obtained, then release. Push bottom of switch and the lights will dim.

## 5-00-06 - CABIN HEATING & VENTILATING SYSTEMS

The heater muff encasing the exhaust system is the cabin heat source. Hot air from the heater muff mixed with ambient air controls cabin temperature. Air routed from the main heater duct system to nozzles at the windshield base defrosts the windshield.

## 5-00-07 - FUEL SYSTEM

The fuel system has sealed, integral wing tanks in the forward, inboard section of each wing. Vents at the aft, outboard top corner of each tank vent through the lower wing surface. Fuel sump drains are at the lowest point in each tank. The three electric fuel pumps are located in the belly below the cabin. Access is gained by removing the fiberglass belly fairing. Two fuel quantity transmitters in each tank are wired in series to fuel quantity gauges (L & R) in the engine gauges.

The Battery switches (L & R), left side of pilot's panel, activate all circuity to start the aircraft engine; however no instrumentation indication will be activated except tachometer, fuel flow and power meters.

The Master Switch, left side of the pilot's panel between the two Battery Switches, turns on the fuel quantity indicating systems.
Optional visual sight gauges are available for partial fueling of wing tanks on aircraft.

A low fuel warning annunciator light for each tank is activated when usable fuel quantity goes below 2 1/2 gallons.

## 5-10-00 - TIME LIMIT COMPONENTS

It is recommended that overhaul or replacement of components should be a accomplished not later than the specified period of operation for that component or in accordance with manufactures service data or airworthiness directives.
The specified overhaul time limits, if applicable to a component, do not constitute a guarantee that the component will reach that time limit without requiring maintenance.

**NOTE**
**"ON CONDITION" items are to be repaired, replaced or overhauled when inspection or performance reveals an unserviceable condition.**

5-10-01

## - OVERHAUL AND REPLACEMENT SCHEDULE

| ITEM | RECOMMENDED OVERHAUL OR REPLACE TIME LIMITS |
|---|---|
| **Landing Gear** | |
| Actuator No-Back Spring (Avionics Products) | 1000 Hours |
| All other Components | On Condition |
| **Powerplant** | |
| Engine | 2000 Hours |
| Torsional coupling | 1000 Hrs |
| Cylinder Heads | 1000 Hrs |
| V-Belts | 3 Yrs. or 2000 Hrs |
| Propeller | 1500 Flight Hrs. - Retire Blades |
| Induction Air Filter | 500 Hours or 5 Years |
| All other Components | On Condition |
| **Fuel & Oil System** | |
| Fuel Pumps | 2000 Hrs |
| Fuel Filter | 100 Hrs |
| Oil Filter | 100 Hrs |
| Engine Oil | 100 Hrs (API SF/CC or SF/CD) |
| All other Components | On Condition |
| **Instruments** | |
| All Components | On condition |
| **Electrical System** | |
| Voltage Regulators | 1000 Hrs |
| All other Components | On Condition |
| **Flight Controls** | |
| All Components | On Condition |
| **Miscellaneous Systems** | |
| E.L.T. Battery | 2 Years or 1 Hour Total Use |
| Oxygen Cylinder | 15 Yrs or 10,000 recharge.cycles |
| All Other Components (Excluding Avionics) | On Condition |
| Avionics | Refer to Manufacturers Publications |

**NOTE**

**Components should be inspected and serviced at regular intervals per the servicing, lubrication and inspection chart of this manual.**

## 5-20-00 - SCHEDULED MAINTENANCE CHECKS

Inspection Intervals. Perform 25, 50, or 100-hour inspections of the aircraft and engine at recommended intervals as outlined in the following paragraphs.

## 5-20-01 - INSPECTION CHECK POINTS

The general points to be covered during inspection are grouped in accordance with the nature and function of the items discussed.

1. Moving Parts shall be inspected and checked as applicable for: proper operation, security of attachment, sealing, cleanliness, lubrication, servicing, safetying, adjustment, tension, travel, condition of hinges, binding, excessive wear, cracking, corrosion, deformation, and any other apparent damage.

2. Metal Parts shall be inspected and checked as applicable for: security of attachment, condition of finish and sealant, distortion, fatigue cracks, welding cracks, corrosion, and any other apparent damage.

3. Fuel, air, oil and hydraulic oil lines and hoses shall be inspected as applicable for: cracks, dents, kinks, deterioration, obstruction, chaffing, improper bend radius, and insecure installation. Replace or correct if any of these conditions exist. Hose clamp installations on fuel and hydraulic systems between systems or between systems and the engine shall be torqued to 25 inch pounds. Hose clamp installations on blast tubes, air ducts, drain and vent lines shall be torqued to 15 inch pounds.

4. Pipe Threads - Tightening and torque procedures. Lubricate pipe threads as follows:
Oxygen Lines - Use only MIL-T-5542 thread compound or Teflon thread seal tape on threads of valves, connectors, fittings, parts or assemblies which might come in contact with oxygen. The thread compound must be applied sparingly to the first three threads of the mail fitting only. No compound is to be used on the coupling sleeves or on the outside of the tube flares. Extreme care should be exercised to prevent the contamination of the thread compound or teflon tape with oil, grease or other lubricant.

Fuel, Hydraulic, Air, Oil Lines - Use "Parker Thread Lube" or equivalent on male fittings only. Apply lubricant, omitting the first two threads, sparingly and carefully.
Engine Fittings - Use only aircraft engine oil to lubricate fittings threaded directly to engine.
Tapered Threads - Use Teflon Threadseal Tape.

(1) Continue to tighten until fitting is correctly positioned but do not overrun or backoff.

(2) If leaks are detected, tighten one full turn more.

(3) If leaks persist, the parts should be disconnected and ; rejected; replace with new components.

FLARE NUT TORQUE VALUES - Tighten to minimum torque value for appropriate size as shown (Figure 5-1).

| FITTING SIZE | ALUMINUM TUBING | | STEEL TUBING | |
|---|---|---|---|---|
| | TORQUE - IN. LBS. | | | |
| | MINIMUM | MAXIMUM | MINIMUM | MAXIMUM |
| -3 | | | 30 | 70 |
| -4 | 40 | 65 | 50 | 90 |
| -5 | 60 | 80 | 70 | 120 |
| -6 | 75 | 125 | 90 | 150 |
| -8 | 150 | 250 | 155 | 250 |
| -10 | 200 | 350 | 300 | 400 |
| -12 | 300 | 500 | 430 | 575 |
| -16 | 500 | 700 | 550 | 750 |
| -20 | 600 | 900 | | |
| -24 | 600 | 900 | | |

FLARE NUT TORQUE
FIGURE 5-1

5. Electrical wiring shall be checked as applicable for: loose, corroded, or broken terminals; chaffed, broken, or worn insulation; insecure installation; heat deterioration; and any other apparent damage.

6. Bolts and nuts in critical areas shall be checked for: fretting, wear, damage, stretch, proper torque, (Figure 5-2) and safetying.

7. Filters and screens shall be removed, cleaned and inspected for contamination or damage that would require replacement.

**CAUTION**

**These torque values are derived from oil-free cadmium-plated threads.**

## BOLT -NUT TORQUE VALUES

### METRIC BOLTS, SCREWS & NUTS

Failure of threaded fasteners due to over-tightening can occur by bolt shank fracture or by stripping of the nut and/or bolts thread. A bolt or screw assembled with a nut of the appropriate class is intended to provide an assembly capable of being tightened to the bolt proof load without thread stripping occurring.

The torque value to be set for a particular size of screw is dependent upon:

1) Material of the screw.
2) Parent material (steel, non-ferrous metal or plastic).
3) Whether the screw is untreated or plated.
4) Whether the screw is dry or lubricated.
5) The depth of the thread.

**TIGHTENING TORQUES** - Untreated Screw(Black Finish) *Friction Coeficient 0.14*

| NOMINAL DIAMETER (Coarse Thread) | PROPERTY CLASS | | | |
|---|---|---|---|---|
| | 5.6 | 8.8 | 10.9 | 12.9 |
| | TORQUE Mg | | | |
| | Nm/ft.lb. | Nm/ft.lb. | Nm/ft.lb. | Nm/ft.lb. |
| M 3 | 0.60/0.44 | 1.37/1.01 | 1.92/1.42 | 2.30/1.70 |
| M 4 | 1.37/1.01 | 3.10/2.29 | 4.40/3.25 | 5.25/3.87 |
| M 5 | 2.70/1.99 | 6.15/4.54 | 8.65/6.38 | 10.4/7.6 |
| M 6 | 4.6/3.3 | 10.5/7.7 | 15/11 | 18/13 |
| M7 | 7.6/5.6 | 17.5/12.9 | 25/18.4 | 29/21.3 |
| M8 | 11/8.1 | 26/19 | 36/26 | 43/31 |
| M10 | 22/16 | 51/37 | 72/53 | 87/64 |
| M12 | 39/28 | 89/65 | 125/92 | 150/110 |
| M14 | 62/45 | 141/103 | 198/146 | 240/177 |
| M16 | 95/70 | 215/158 | 305/224 | 365/269 |
| M18 | 130/95 | 295/217 | 420/309 | 500/368 |
| M20 | 184/135 | 420/309 | 590/435 | 710/523 |
| M22 | 250/184 | 570/420 | 800/590 | 960/708 |
| M24 | 315/232 | 725/534 | 1020/752 | 1220/899 |
| M27 | 470/346 | 1070/789 | 1510/1113 | 1810/1334 |
| M30 | 635/468 | 1450/1069 | 2050/1511 | 2450/1806 |
| M33 | 865/637 | 1970/1452 | 2770/2042 | 3330/2455 |
| M36 | 1111/819 | 2530/1865 | 3560/2625 | 4280/3156 |
| M39 | 1440/1062 | 3290/2426 | 4620/3407 | 5550/4093 |

(METRIC TORQUE TABLES CONTINUED ON NEXT PAGE)

Metric Torque Tables (Cont.)

| NOMINAL DIAMETER (Fine Thread) | PROPERTY CLASS 8.8 TORQUE Ma Nm/ft.lb. | 10.9 Nm/ft.lb. | 12.9 Nm/ft.lb. |
|---|---|---|---|
| M8 x 1 | 27/19 | 38/28 | 45/33 |
| M10 x 1.25 | 52/38 | 73/53 | 88/64 |
| M12 x 1.25 | 95/70 | 135/99 | 160/118 |
| M14 x 1.5 | 150/110 | 210/154 | 250/184 |
| M16 x 1.5 | 225/165 | 315/232 | 380/280 |
| M18 x 1.5 | 325/239 | 460/339 | 550/405 |
| M20 x 1.5 | 460/339 | 640/472 | 770/567 |
| M22 x 1.5 | 610/449 | 860/634 | 1050/774 |
| M24 x 2 | 780/575 | 1100/811 | 1300/958 |

**TIGHTENING TORQUES** - Electrically Zinc Plated *Friction Coeficient 0.125*

| DIAMETER (Coarse Thread) | 5.6 | PROPERTY CLASS 8.8 TORQUE Ma | 10.9 | 12.9 |
|---|---|---|---|---|
| | Nm/ft.lb. | Nm/ft.lb. | Nm/ft.lb. | Nm/ft.lb. |
| M3 | 0.56/0.41 | 1.28/0.94 | 1.80/1.33 | 2.15/1.59 |
| M4 | 1.28/0.94 | 2.90/2.14 | 4.10/3.02 | 4.95/3.65 |
| M5 | 2.50/1.84 | 5.75/4.24 | 8.10/5.97 | 9.70/7.15 |
| M6 | 4.3/3.1 | 9.9/7.3 | 14/10.3 | 16.5/12.1 |
| M7 | 7.1/5.2 | 16.5/12.1 | 23/16.9 | 27/19.9 |
| M8 | 10.5/7.7 | 24/17.7 | 34/25 | 40/29 |
| M10 | 21/15 | 48/35 | 67/49 | 81/59 |
| M12 | 36/26 | 83/61 | 117/86.2 | 140/103 |
| M14 | 58/42 | 132/97 | 185/136 | 220/162 |
| M16 | 88/64 | 200/147 | 285/210 | 340/250 |
| M18 | 121/89 | 25/202 | 390/287 | 470/346 |
| M20 | 171/126 | 390/287 | 550/405 | 660/486 |
| M22 | 230/169 | 530/390 | 745/549 | 890/656 |
| M24 | 295/217 | 675/497 | 960/708 | 1140\840 |
| M27 | 435/320 | 995/733 | 1400/1032 | 1680/1239 |
| M30 | 590/435 | 1350/995 | 1900/1401 | 2280/1681 |
| M33 | 800/590 | 1830/1349 | 2580/1902 | 3090/2278 |
| M36 | 1030/759 | 2360/1740 | 3310/2441 | 3980/2935 |
| M39 | 1340/988 | 3050/2249 | 4290/3163 | 5150/3798 |

METRIC TORQUE TABLES CONTINUED ON NEXT PAGE

Metric Torque Tables (Cont.)

| NOMINAL DIAMETER (Fine Thread) | PROPERTY CLASS | | |
|---|---|---|---|
| | 8.8 | 10.9 | 12.9 |
| | TORQUE Ma | | |
| | Nm/ft.lb. | Nm/ft.lb. | Nm/ft.lb. |
| M8 x 1 | 25/18 | 35/25 | 42/30 |
| M10 x 1.25 | 49/36 | 68/50 | 82/60 |
| M12 x 1.25 | 88/64 | 125/92 | 150/110 |
| M14 x 1.25 | 140/103 | 195/143 | 235/173 |
| M16 x 1.5 | 210/154 | 295/217 | 350/258 |
| M18 x 1.5 | 305/224 | 425/313 | 510/376 |
| M20 x 1.5 | 425/313 | 600/442 | 720/531 |
| M22 x 1.5 | 570/420 | 800/590 | 960/708 |
| M24 x 2 | 720/531 | 1000/737 | 1200/885 |

METRIC CONVERSION FACTOR: One Nm(Newton Meter) = .7375 Foot Pound;
One Foot Pound = 1.355818 Nm

## AN/MS STANDARD BOLTS, NUTS TORQUE TABLES

### FINE - THREAD SERIES

| NUT-- BOLT SIZE | TENSION-type AN( )BOLTS; AN-365/AN-310 NUTS | SHEAR-type AN()BOLTS;AN-365/AN310 NUTS | TENSION-type NAS( ) BOLTS AN-364/AN320 NUTS | SHEAR-type NAS( ) BOLTS; AN-364/AN320 NUTS |
|---|---|---|---|---|
| 8-36 | 12-15 | 7-9 | | |
| 10-32 | 20-25 | 12-15 | 25-30 | 15-20 |
| 1/4-28 | 50-70 | 30-40 | 80-100 | 50-60 |
| 5/16-24 | 100-140 | 60-85 | 120-145 | 70-90 |
| 3/8-24 | 160-190 | 95-110 | 200-250 | 120-150 |
| 7/16-20 | 450-500 | 270-300 | 520-630 | 300-400 |
| 1/2-20 | 480-690 | 290-410 | 770-950 | 450-550 |
| 9/16-18 | 800-1000 | 480-600 | 1100-1300 | 650-800 |
| 5/8-18 | 1100-1300 | 600-780 | 1250-1550 | 750-950 |
| 3/4-16 | 2300-2500 | 1300-1500 | 2650-3200 | 1600-1900 |
| 7/8-14 | 2500-3000 | 1500-1800 | 3550-4350 | 2100-2600 |
| 1-14 | 3700-5500 | 2200-3300 | 4500-5500 | 2700-3300 |
| 1 1/8-12 | 5000-7000 | 8000-4200 | 6000-7300 | 3600-4400 |
| 1 1/4-12 | 9000-11000 | 5400-6600 | 11000-13000 | 6600-8000 |

| | | |
|---|---|---|
| 8-32 | 12-15 | 7-9 |
| 10-24 | 20-25 | 12-15 |
| 1/4-20 | 40-50 | 25-30 |
| 5/16-18 | 80-90 | 48-55 |
| 3/8-16 | 160-185 | 95-100 |
| 7/16-14 | 235-255 | 140-155 |
| 1/2-13 | 400-480 | 240-290 |
| 9/16-12 | 500-700 | 300-420 |
| 5/8-11 | 700-900 | 420-540 |
| 3/4-10 | 1150-1600 | 700-950 |
| 7/8-9 | 2200-3000 | 1300-1800 |

TORQUE VALUES
(Units are Inch-pounds)
Figure 5-2

Reference: Federal Aviation Agency Advisory Circular No. 43.13-1A, p. 118

Recommended Torque Values for Nut-Bolt combination

1. Be sure nut and/or bolt threads are clean and dry(unless Mfg. states otherwise.

2. Run bolt down near contact with washer or bearing surface and check "friction drag torque" required to turn bolt/nut.

3. Add "friction drag torque" to the recommended torque value from Figure 5-2. This value is considered "Final Torque Value".

(FRICTION DRAG TORQUE + REC'MD TORQUE = FINAL TORQUE).

CAUTION

**DO NOT REUSE LOCKNUTS IF THEY CAN BE RUN UP FINGER TIGHT.**

## 5-20-02 - AIRCRAFT FILE INSPECTION

Aircraft 100-hour and annual inspections cover, in addition to examining the aircraft proper, a review of the status of compliance with current Federal Aviation Regulations. This review includes inspection of the Airplane Flight Manual, Aircraft Log Book, Engine Log Book, Registration Certificate, Airworthiness Certificate, Weight & Balance Record, Porsche Service Information, Aircraft Radio Station License (if applicable), FAA Airworthiness Directives, and Mooney serivce documents.

## 5-20-03 - ENGINE FUNCTIONAL CHECK

Prior to a scheduled 100-hour or annual inspection, and/or 25 hours after installation of new or overhauled engine, wash down the engine and engine components. Then perform an engine runup in accord with procedure recommended in the Airplane Flight Manual. Make a record of all malfunctions and abnormalities.

## 5-20-04 - FIRST 25-HOUR INSPECTION

The 25-hour inspection consists of a visual inspection of the propeller, engine, and aircraft general condition, including a preflight inspection as outlined in the Airplane Flight Manual. The inspection does not require removal of all access panels or disassembly of components; however, it should include completion of all lubrication & service requirements. The inspection should be extensive enough to detect any damage or maladjustment which might jeopardize flight safety.

1. Visually inspect propeller, spinner, and engine cowling; remove cowling.

2. Inspect and clean induction air filter if aircraft has been operating under dusty conditions. Check operation and condition of alternate air door and components.

3. Inspect engine compartment for evidence of fuel, oil or exhaust leaks.

4. Check security and condition of equipment installed on engine.

5. Inspect fuselage, wing and empennage for external evidence of damage. Pay particular attention to scratches or dents.

6. Inspect windshields and windows for crazing, cracks, or scratches.

7. Check control systems for binding, excessive freeplay, or damage.

8. Check pitot and static systems for possible obstructions.

9. Inspect Landing Gear Assemblies for damage and security.

10. Inspect aircraft exterior for security of bolts, screws, etc.

11. Check and service battery.

## 5-20-05 - 50-HOUR INSPECTION

The 50-hour inspection includes all requirements for the 25-hour inspection, plus the necessary removal of inspection doors, panels, or fairings.

A. Inspect engine intake, exhaust and muffler systems for evidence of leakage or looseness.

B. Check spark plug elbows and shielding nuts for security.

C. Check cooling fan shroud and belts for security.

D. Check baffles for security and freedom from cracks.

E. Check engine control for operation, full travel, freedom of movement, and security.

F. Visually check fuel and oil lines for security of connections and evidence of leakage or damage.

G. Visually inspect induction air system; check operation of alternate-air door (refer to paragraph 71-62-00).

2. Propeller.

A. Check propeller and spinner for general condition, looseness, and oil leakage.

B. Inspect blades for nicks and cracks. Repair prior to next flight.

3. Cabin.

A. Check brake and parking brake control systems for proper operation and fluid level.

B. Check trim system and indicator for operation and travel (Manually and electrically).

C. Check cabin and baggage doors for damage, proper operation, and sealing.

D. Check cabin, instrument, position, anticollision, and landing light (Illumination and extension/retraction cycle).

E. Check fuel selector valve, gascolator, and Main, Boost and Emergency fuel pumps for proper operation.

F. Check oxygen system (if installed).

4. Landing Gear.

A. Check tires for cuts, blisters, worn areas, and proper inflation.

B. Check shock discs for proper extension at aircraft static weight.

C. Check hydraulic brakes for wear, warpage and proper installation.

5. Wings.

A. Check surfaces and tips for damage.

B. Check ailerons, aileron attachments, and bellcranks for damage and proper operation.

C. Check flaps and attachments for damage and proper operation.

D. Lubricate controls and flight surface pivot points if necessary (refer to Lubrication Chart/Diagram at the end of this Section.

6. Fuselage and Empennage.

A. Check stabilizer, elevators, fin, and rudder for damage and proper attachment.

B. Lubricate controls and flight surface pivot points if necessary.

7. See Section 5-20-07 for repetitive 50 hr. inspection and service components.

## 5-20-06 - 100-HOUR INSPECTION (or ANNUAL) (Refer to Fig. 5-3)

The 100-hour (or annual) inspection is a thorough, searching inspection of the entire aircraft. Preparation for the inspection includes the removal of the fuselage, wing, and empennage inspection doors, cover plates, and fairings at all systems attach, hinge, and bearing locations (including wing and empennage to fuselage mating points). Operating limit replacement and special testing of components is to be included at this interval when applicable. Comply with applicable FAA Directives, AD Notes, and applicable Mooney or Vendor Service Bulletins or Instructions. Check for aircraft conformance to FAA Aircraft Specification No. 2A3 (current revision). Recommended 100-hour and special inspection requirements are outlined in the following paragraphs.

1. **ENGINE INSPECTION.** Prior to the inspection, remove engine cowling and propeller spinner. Wash down the engine and engine compartment. Perform an engine runup in accord with the procedure recommended in the Porsche Engine Maintenance and Operators Manual. To verify correction of malfunctions and abnormalities, perform a second runup and fight test after the 100-hour inspection engine set-up.

A. Complete a differential (hot engine) compression check. Clean and gap or replace spark plugs if necessary. If Gap on most worn plug exceeds .047 in., since last 100 hr. inspection and gapping, the associated ignition system needs to be checked for proper operation. Refer to Porsche Engine Maintenance Manual.

B. Check Valve clearance.
Refer to Porsche Engine Maintenane Manual for specific steps to accomplish.

C. Check backlash on Propshaft. Verify Propeller shaft bolts are torqued to 800 in.lbs. Gently move propeller blade to check for gear backlash. The backlash should not exceed .39 inches at the tip.

D. Gear Box and Torsional Coupling inspection. Remove cooling duct from the right side of the propeller gear box. While rotating the propeller, use a flashlight to visually inspect fly wheel gear surface for wear and/or damage and check the torsional coupler for any signs of ply separation or undue wear.

E. Inspect engine for evidence of fuel and oil leakage. Inspect oil cooler. Inspect oil & fuel hoses for condition & security.

F. Drain oil from tank and engine; reinstall drains and safety. Remove full-flow oil filter cartridge; replace with new cartridge and safety. Check oil tank breather line for obstruction.

G. Service engine oil tank & gear box(if drained) with the proper type, grade, and quantity of lubricating oil.(REF. Porsche Operators Manual) Run engine for 3.0 minutes to fill all areas of engine and gear box(if drained). THEN refill oil tank to proper level for operation. DO NOT USE AVIATION GRADE OIL.

H. Inspect fuel injector and all fuel line connections for security and condition. Inspect fuel pump connections inside shroud, under floorboard, and fuel supply line where it penetrates the firewall.

I. Remove Fuel Filter. Remove fuel lines from each end of filter; remove fittings from filter. Release retaining ring from filter and remove from aircraft. Using new gaskets, install fittings on new filter.

Install new filter and secure retaining ring. Be sure to observe the flow direction. Turn Battery Switch and Main/Boost fuel pump ON and verify that fuel pressure light goes out. Check fuel lines and filter for any leaks.

J. Remove and inspect gascolator strainer, clean & reinstall strainer. Remove and replace 2 micron fuel strainers on the firewall. Inspect fuel lines and connections:pressure check fuel system with Main/Boost fuel pump **ON , engine OFF.**

K. Remove Air Filter cartridge, check suction opening for dirt and clean if needed. Use compressed air(no more than 60 PSI) to blow out cartridge from inside/out. Re-install filter cartridge; replace with new filter after 5 years or 500 Hours.

L. Inspect air ducting and connections in the heating and induction air systems for leaks. Remove and clean induction air filter(replace at 5 Yrs. or 500 Hrs). Leak check all exhaust/manifold connections, engine exhaust manifold and muffler areas.

M. Examine V-Belts (2 ea.) on cooling fan for damage, cuts, breaks and wear. Check belt tension by pushing on the belts in the middle of the belt span using a force of 22.5 Lbs. The belt deviation from static position should be between .31 and .39 inches. Replace the belts in pairs if either one does not meet the above test.

N. Alternator backlash inspection: Use finger to gently move the alternator fan blade. Check to see if the play at fan blade tip is no more than .080 in. If it exceeds this tolerance Refer to Porsche Engine Maintenance Manual.

O. Check distributors for condition (500 hrs). Repair or replace components,if required,.

. Check baffles for security, cracks, holes, deformation, and for fit around cylinders. Check baffle sealant.

Q. Check engine controls for operation, proper lubrication, full travel, and security of attachment.

R. Inspect engine mount for cracks; check all bolts and rubber mounts for security and condition.

S. Check battery cables, electrical wiring, and ignition harness for condition, security, loose terminals, and burned or chaffed insulation.

T. Check fuel pumps operation & pressures. (See Porsche Engine Maintenance Manual information and Section 71-00-50).

U. Inspect batteries and vent systems for condition and corrosion. Check blast tubes for obstruction. Flush battery mount area and battery cases if necessary with soda solution to neutralize corrosive action. Check batteries for proper charge status.

V. Inspect accessory case, starter, alternators, distributors, hoses, firewall and fittings for security or damage.

W. ENGINE OPERATIONAL CHECK
With the cowling removed start the engine and observe the following:

(1) Oil pressue gauge should show a reading and the low oil pressure light should go off within 5 seconds.

(2) Both alternators should be producing an output.

(3) Power lever and propeller governor interact properly.

(4) Both ignition systems function independently.

(5) All fuel pumps operate and supply fuel to the engine.

(6) Fuel pressure is within limits.

(7) Slowly increase power lever to full power and verify that the propeller speed does not exceed 2343 RPM.

(8) Shut down engine and check for any leaks, loose fittings, etc.

X. Inspect and reinstall cowling.

2. **PROPELLER INSPECTION.**

A. Remove spinner (if not already removed).

B. Check security of propeller installation.

C. Check hub bolts for security and damage.

D. Inspect hub parts and blades for cracks and nicks. Repair prior to next flight.

F. Check high and low blade angles. Refer to appropriate POH/AFM for correct blade angles.

G. Inspect spinner and bulkhead for cracks and condition.

H. Check spinner bulkhead for correct interference fit with prop cylinder. (Use Teflon Tape to obtain correct fit.)

3. **LANDING GEAR and RETRACTION SYSTEM INSPECTION.**

A. Check tires for proper inflation, cuts, blisters, slippage, or excessive wear. Replace with new approved tire if necessary.

CAUTION
**Always run at least 5 Landing Gear Retraction Cycle checks after any tire has been removed and/or replaced before flying the aircraft.**

B. Check wheels for cracks, distortion, misalignment, corrosion, bolt failure. Check condition of felt seals and bearings; repack bearings at 250 hour intervals.

C. Check brakes for warping, wear or corrosion.

D. Check hydraulic reservoir for proper fluid level.

E. Check hydraulic brake lines and hoses for leakage, dents, cracks chafing, kinks, and security of anchorage.

F. Check parking brake system for proper engagement and release.

G. Jack aircraft as recommended in paragraph 7-10-00.

H. Check nose gear for cleanliness and damage. Check nose gear retraction tube bungees for sheared or broken roll pins.

NOTE
**Maximum allowable towing damage on leg assembly is 1/32 inch dent. No repair allowed on Heat Treated Landing Gear components.**

I. Check nose wheel steering mechanism for adjustment, alignment, corrosion, and lubrication.

J. Check main gear for cleanliness or damage.

K. Check landing gear retraction linkage, bellcranks, pivots, and bearings for wear, damage, distortion, misalignment, corrosion, cleanliness, and lubrication.

L. Check the landing gear actuator for security of mounting, cleanliness, and indication of overheating or damage.

M. Perform landing gear operational check per Section 32-30-01.

4. **FUEL SYSTEM INSPECTION.**

A. Inspect each fuel tank exterior for evidence of fuel seepage and stain.

B. Drain tank and inspect tank interior when seepage is evident.

C. Check fuel tank drains for leakage, sediment, or water contamination.

D. Check fuel-tank vents for obstruction.

E. Check fuel selector valve for proper tank selection, smooth operation, and leakage in **OFF** position.

F. Check fuel pumps for leaks, security of mounting, adequate fuel pressure, switch operation, and condition of wiring and electrical connections. **Verify proper operation of all fuel pumps.**

G. Check fuel quantity gages and transmitters for security of mounting, condition of wiring and electrical connections.

H. Check fuel tank filler ports for cleanliness, cap security, and condition of servicing placards.

I. Check fuel filler cap O'rings for condition and replace if needed (Ref. Section 28-00-01).

5. **EXTERIOR INSPECTION.**

A. Inspect fuselage exterior surfaces for corrosion, damage, loose or popped rivets, dents, cans(stretched skin), scratches, cracks, and deteriorated paint.

B. Inspect windshields and windows for cracks, crazing, scratches, condition of seals, and security of installation.

C. Inspect wings, flaps, and ailerons for corrosion, damage, loose or popped rivets, dents, scratches, cracks, condition of attaching points, lubrication, freedom of operation, free-play, travel, and balance weight attachment.

D. Inspect empennage for corrosion, damage, loose or popped rivets, free-play, dents, scratches, cracks, condition and lubrication of hinge points, attachment of balance weights, and freedom of operation.

E. Inspect cabin door and door frames for damage, corrosion, nicks, dents, hinge security, and lubrication.

F. Inspect cabin door lock mechanism for lubrication and proper engagement. See Section 52-11-00 for rigging procedures.

G. Inspect the baggage door and baggage compartment for damage, corrosion, warpage, hinge security, condition to door frame and door seals, condition and operation of door locking mechanism, and condition of cargo tiedowns.

H. Inspect ventilating system drain line for obstruction.

I. Inspect landing light for security ,operation and condition.

6. **INTERIOR INSPECTION.**

A. Inspect seats, seat tracks, and upholstery for cleanliness and mounting security; check seats for condition and operation of position locks; inspect seat structure for cracks, deformation, corrosion, and mechanism lubrication.

B. Inspect safety belts and attaching brackets for cleanliness, condition, latch operation, and security of attachment.

7. **INTERNAL INSPECTION.**

A. Open access covers, panels, inspection doors, and remove fairings as required.

B. Inspect forward side of firewall for damage.

C. Inspect steel fuselage tubular structure for corrosion or damage (interior panels will require removal)(Ref. Mooney Service Bulletin M20-208A).

D. Inspect wing attaching bolts for proper torque, safetying and evidence of damage or corrosion.

E. Inspect wing ribs and stringers for cracks and evidence of damage or corrosion.

F. Check spars for damage, distortion, cracks, or corrosion.

G. Check wing interior for foreign material, corrosion, and evidence of fuel leakage.

H. Check wire harnesses, lines, and ducts for security, damage, interference, chafling, and bonding.

8. **FLIGHT CONTROL INSPECTION.**

A. Inspect control column and control wheels for full travel, proper rigging, free-play, binding, security of mounting, proper lubrication, and direction of control surface movement with relation to control movement.

**CAUTION**

**All flight control components should be checked to verify that all moisture drain holes are free of obstructions.**

B. Inspect elevator system linkage for rigging, travel, stop adjustment, condition of bear-

ings and bellcranks, wear on downspring eyes, cable pulley and fittings, security of mounting, damage, corrosion, proper lubrication and proper relations to control movement.

C. Inspect aileron system linkage for damage, corrosion, lubrication, rigging, travel, stop adjustment, condition of bellcranks, pivots and rod end bearings, and link bolt security.

D. Inspect rudder system linkage for damage, corrosion, lubrication, security of link bolts and rod end bearings; check for free movement of toe-brake pedals and proper rudder and nose wheel travel.

E. Inspect stabilizer trim control system for security and proper adjustment, shaft and stop nuts for proper rigging, trim control wheel for smooth operation, universal joints for free-play and good working order, actuator threads for lubrication, linkage for corrosion, and guide blocks for looseness or excessive wear.

F. Inspect flap system for rigging, travel, and stop adjustment; flap rods, interconnects, and bellcranks for corrosion, security, and lubrication.

**NOTE**

**All control rigging checks should be made with the aircraft jacked and leveled and with the landing gear retracted.**

**NOTE**

**Some elevator trim tubes have poly tape wrapped at bulkhead penetrations. If tape shows signs of wear, rerap (1/2 lap) tube with 2" wide Y9265 polyurethane tape. Trim tubes, without tape, which show signs of abrading grommet should be wrapped. See SB M20-185. MAX. TUBE WEAR - .007 in. per wall or .014 in. diameter reduction.**

9. **INSTRUMENT INSPECTION.**

A. Inspect all instrument wiring and plumbing for condition and proper connections.

B. Inspect all instruments for proper pointer indication, range and limit markings, condition of indicator markings, cracked or loose glass, slippage marks, and security of installation.

C. Check compass for proper lighting, compensation, security of mounting, liquid leakage, and discoloration. Swing compass at annual inspection and after any new equipment has been installed.

D. Inspect altimeter for scale error, discolored markings, proper pointer readings, setting knob freedom, and syncronization of barometric scale with reference markers.

E. Inspect flight panel for security of mounting, condition of shock mounts, freedom from interference with structure, and condition of ground straps.

F. Inspect pitot head for port obstruction; check lines for cracks, dents, kinks, proper bend radius, and security of attachment. Drain system and check for leaks.

G. Inspect static ports for obstruction and aerodynamic smoothness at port installations. Inspect lines for bends, cracks, dents, kinks, and security of attachment. Drain system and check for leaks. Check alternate static pressure source located on center console.

10. **ELECTRICAL FUNCTIONAL TEST.**

A. Check operation of navigation lights.

B. Check operation of landing light.

C. Check operation of dome lights and cigar lighter.

D. Check operation of anticollision lights.

E. Check operation of instrument and placard lights..

F. Check operation of pitot head heater.

G. Check operation of engine gauge.

H. Check operation of fuel gauges.

I. Check operation of annunciator light-press-to-test switch.

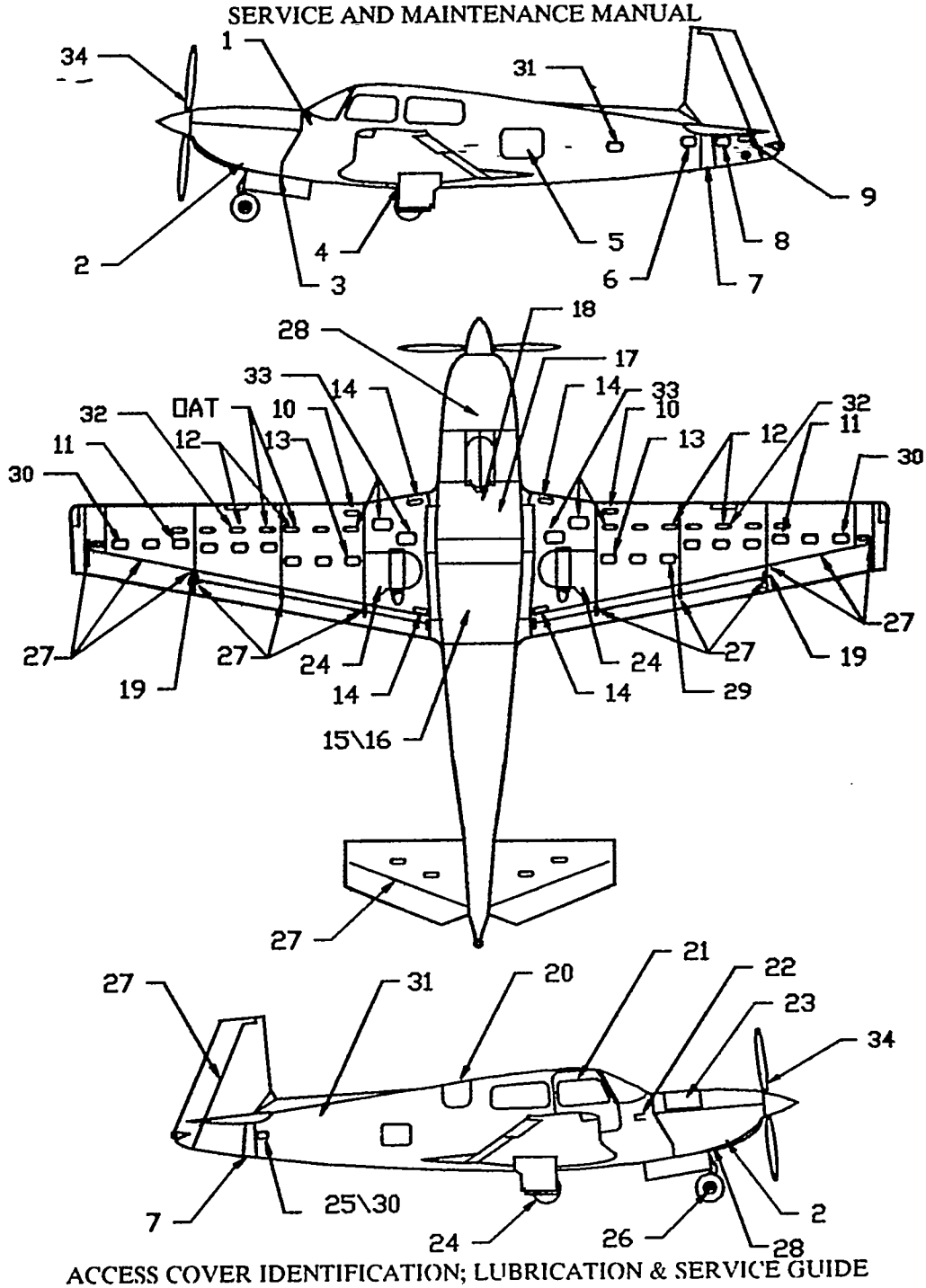
J. Check operation of ignition switch, and starter solenoid.

K. Flight check operation of landing gear position lights and warning horn.

L. Flight check operation of stall warning horn.

M. Check operation of "Prop De-Ice" (if installed).

11. **POST INSPECTION FLIGHT TEST..** Flight test the aircraft to verify correction of all malfunctions and abnormalities. Make proper entries in aircraft log book.




ACCESS COVER IDENTIFICATION; LUBRICATION & SERVICE GUIDE

FIGURE 5-3

Wing access covers may vary to some degree between model year aircraft. Component locations remain basically unchanged.

NOTE

**Access covers riveted in place during production need not be removed for routine inspections.**

## - ACCESS COVER IDENTIFICATION, LUBRICATION AND SERVICE GUIDE

| ITEM NO. | ITEM DESCRIPTION | LUBRICATION SYMBOL* | INTERVAL (HRS) |
|---|---|---|---|
| 1 | Flight Instruments | | |
| | Turn Coordinator | | |
| | Control System Adjustments: | | |
| | Control Column Bearing Ball | ψ | 100 |
| | Rod End Bearings | ψ | 100 |
| | Universal Joints | Σ | 100 |
| | Bellcranks | Σ | 100 |
| 2 | Engine Cowling | ∂ | |
| 3 | Nose Gear Grease Fittings | Ω | 100 |
| | Retraction Tube Rod End Bearings | ψ | 100 |
| | Bellcranks | Σ | 100 |
| | Bungees | ψ | 100 |
| | Gear Door Rod End Bearings | ψ | 50 |
| 4 | Main Gear Grease Fittings | Ω | 100 |
| | Retraction Tube Rod End Bearings | ψ | 100 |
| | Bellcranks | Σ | 100 |
| | Bungees | Σ | 100 |
| | Gear Door Rod End Bearings | ψ | 50 |
| | Electric Gear Actuator Gear Box | Ω | AR |
| | Electric Gear Actuator Ball Screw | ♥ | 1000 |
| 5 | Elevator & Rudder Controls: | | |
| | Control Tube Rod End Bearings | ψ | 100 |
| | Bellcranks | Σ | 100 |
| | Battery | | |
| | Stabilizer Trim Control Shaft: | | |
| | Universal Joints | Σ | 100 |
| | Guide Blocks | ◇ | 100 |
| | Hydraulic Reservoir | β | 50 |
| | Oxygen, High Pressure Fittings | ⊗ | 50 |
| 6 | Elevator & Rudder Controls: | | |
| | Control Tube Rod End Bearings | ψ | 100 |
| | Bellcranks | Σ | 100 |
| | Stabilizer Trim Jack Screw/Actuator Brgs. | ◆ | 100 |
| | Variable Downspring System | ψ | 100 |
| | Tail Strobe Light Power Supply | | |

* See last page of section for lubrication symbol legend.

| | | | | |
|---|---|---|---|---|
| 7 | Empennage Attach Points | ∂ | 100 |
| | Stabilizer Trim Attach Point | ∂ | 100 |
| 8 | Elevator & Rudder controls: | | |
| | Control Tube Rod End Bearings | ψ | 100 |
| 9 | Elevator & Rudder Controls: | | |
| | Control Tube Rod End Bearings | ψ | 100 |
| 10 | Aileron Control Tube Guide Blocks | ◇ | 100 |
| 11 | Aileron Controls: | | |
| | Control Tube Rod End Bearings | ψ | 100 |
| | Bellcranks | Σ | 100 |
| 12 | Aileron Control Tube Guide Blocks | ◇ | 100 |
| 13 | Main Gear Retraction Bellcranks | Σ | 100 |
| 14 | Wing Points | ∂ | 100 |
| | Control Tube Guide Blocks | ◇ | 100 |
| 15 | Stabilizer Trim Screw & Stops | ♦ | 100 |
| | Trim Indicator Potientiometer | | |
| | Stabilizer Trim Chain & Gear | ◇ | 100 |
| 16 | Elevator & Rudder Controls: | | |
| | Control Tube Rod End Bearings | ψ | 100 |
| | Bellcranks | Σ | 100 |
| | Guide Blocks | ◇ | 100 |
| | Flap Actuator Gear Box | Ω | 500 |
| | Flap Actuator Ball Screw | ♥ | 100 |
| 17 | Electric Fuel Pumps | | |
| | Gascolator | Σ | 50 |
| 18 | Control Systems: | | |
| | Control Tube Rod End Bearings | ψ | 100 |
| | Control Yoke (Lower Section) | Σ | 100 |
| | Nose Gear Steering Link Rod End Bearings | ψ | 100 |
| | Rudder Pedal Cross Shaft | Σ | 100 |
| | Rudder-Aileron Bungee | Σ | 100 |
| | Hydraulic Brake Cylinder Pedal Linkage | Σ | 100 |
| 19 | Aileron Control Tube Rod End Bearings | ψ | 100 |
| | Outboard Flap Stops | | |
| 20 | Baggage Compartment Door: | | |
| | Hinges | Σ | 100 |
| | Latches | ♣ | 100 |
| | Seals | ♠ | 100 |
| 21 | Cabin Door: | | |
| | Hinges | Σ | 100 |

| | | | |
|---|---|---|---|
| | Latches | ♣ | .100 |
| | Seals | ♠ | .100 |
| | Hold-Open Arm | Ψ | .100 |
| 22 | Engine Instruments<br>Radios | | |
| 23 | Engine Compartment Access Door<br>Oil Dip Stick, Oil Filler Tube | ⊕ | .AR |
| 24 | Wheels & Brakes:<br>Wheel Bearings | Ψ | . 50 |
| | Brake Pressure Plates Anchor Bolts & Guide Pins | ψ | . 50 |
| 25 | Elevator & Rudder Control Stops | | |
| 26 | Nose Wheel:<br>Wheel Bearings | Ψ | .250 |
| 27 | Control Surface Hinges | Σ | .100 |
| 28 | Air Induction Filter | ∂ | . 50 |
| 29 | Remote Compass Flux Valve | | |
| 30 | Strobelight Power Supply | | |
| 31 | ELT | | |
| 32. | Landing/Taxi Light Adjust. | | |
| 33. | Fuel Tank | | |
| 34. | Propeller | Φ | . 100 |

## LUBRICATION SYMBOL LEGEND

| SYMBOL | MIL. SPEC. NO. | DESCRIPTION |
|---|---|---|
| Σ | MIL-L-7870 | Low Temperature Oil (General Purpose) |
| Ω | MIL-G-7711 or MIL-G-81322 | Grease |
| Ψ | MIL-L-3545 | Grease (High Temperature) |
| β | MIL-H-5606 | Hydraulic Fluid (Red) |
| ◇ | Graphite & MIL-G-3278 Grease or MIL-G-23827 | |
| ∇ | | Powdered Graphite |
| Σ | | Teflon Spray (Tri-flow) |
| ♣ | | Stick Lubricant (Door Ease or Equivalent) |
| ♦ | | Aeroshell Grease NO. 7 (On jackscrew and inside Actuator Bearing Housing) |
| ♥ | | Lubriplate 630AA |
| | | (10% by Volume Molybdenum Disulfide Mixture Permissible) |
| ♠ | | Seal Dressing |
| ∂ | | Inspect |
| ⊗ | (MIL-T-27730) | Tape, Tetrafluoroethylene Permacel Tape Corp., New Brunswick, NJ |
| ⊕ | | PORSCHE Oper. Man. |
| ∅ | | Dow Corning No. 4 |
| Φ | | MIL-G-23827,MIL-G-81322 or MIL-G-3545 |

**Viscosity Requirements:**

Refer to Porsche Engine Service Manual. Only SAE multirange oils conforming to American Petroleum Institute (API) specification of SF/CC or SF/CD and approved by Porsche are allowed for the PFM 3200 NO3 engine, ie. automotive type, Mobil 1 synthetic.

NOTE

**Mooney M20L Aircraft are delivered with the proper oil. This oil should be changed, after 100 hours of operation with oil conforming to PORSCHE Specifications .**

# CHAPTER 06

# DIMENSIONS AND AREAS

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## 6-00-00 - DIMENSIONS AND AREAS

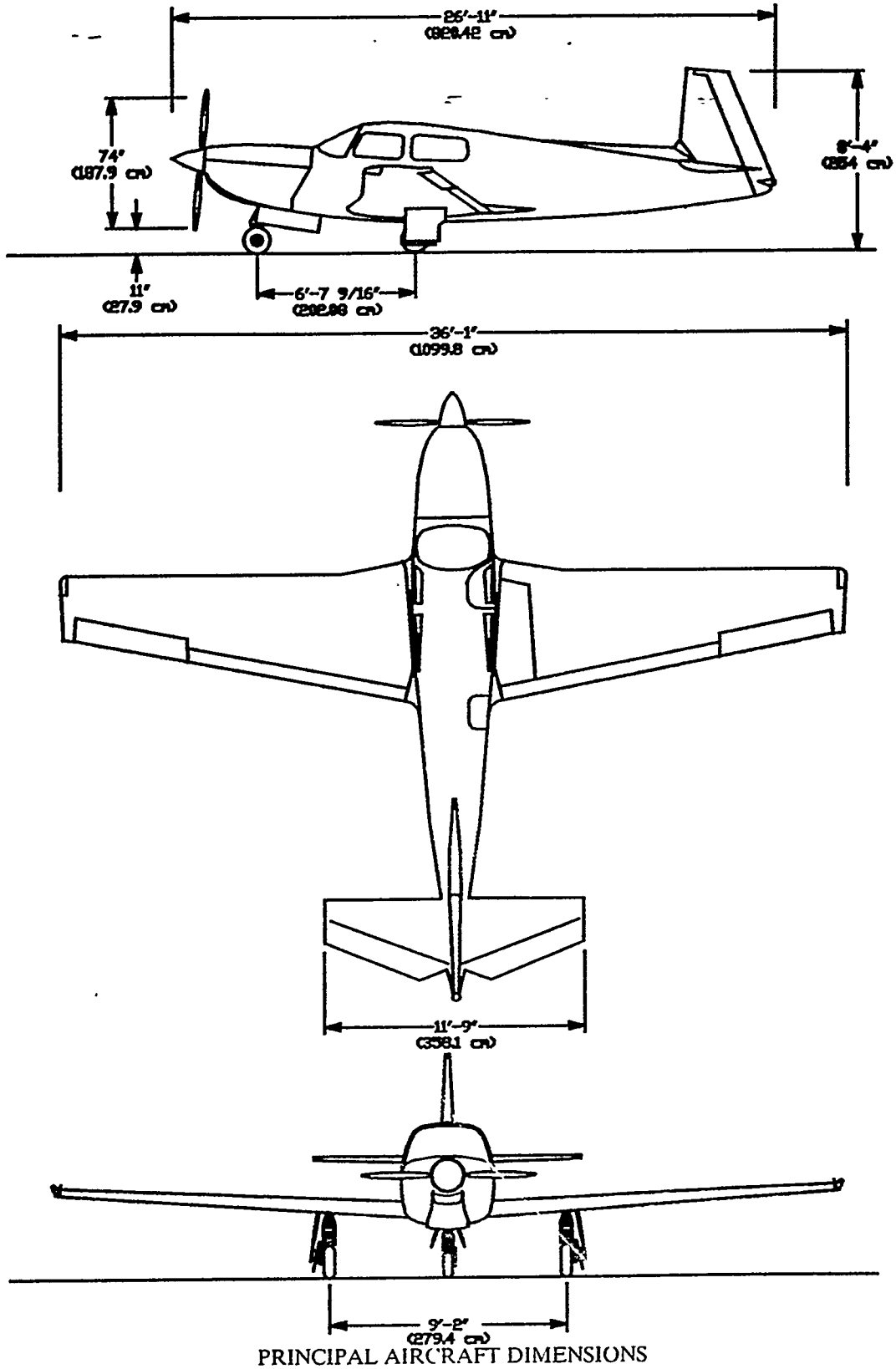
## 6-00-01 - AIRCRAFT SPECIFICATIONS

| | STANDARD | METRIC/OPT/MISC. |
|---|---|---|
| **ENGINE** | | |
| Engine Manufacturer | Porsche | |
| Engine Model | PFM 3200 NO3 | |
| No. Cylinders | 6 | |
| Rated Horsepower | 217 HP | |
| RPM | 2343 (5300 engine RPM) | |
| Min. Fuel Octane | 100 LL. only | |
| Fuel Capacity | | |
| Total | 66.5 U.S. Gal. | 252.7 Liters |
| Useable | 60.5 U.S. Gal. | 230 Liters |
| Oil Specification | API - SF/CD | (ie. Mobile 1) |
| Oil Grade Above $23^0$ F ($-5^0$ C) | SAE 15W-50 | Ref. Porsche Spec. |
| Below $23^0$ F. | SAE 5W-30. | Ref. Porsche Spec. |
| Oil Capacity | 13.5 Qts. | 12.7 Liters |
| Oil Tank Capacity(Full) | 7.0 Qts.(6.7 liters) | |
| (Minimum for Flight) | 5.5 Qts.(5.23 liters) | |
| Oil Pressure | | |
| Normal Operation | 29-116 P.S.I. | |
| Idle, Minimum- | 4.4 P.S.I. | |
| Max. Allowable (cold oil) | | |
| Ground Running | 116 P.S.I. | |
| Oil Temperature | | |
| Max. Allowable | $120^0$ C. | $248^0$ F |
| Recommended Takeoff-Min | $40^0$ C. | $104^0$ F. |
| **PROPELLER** | | |
| Propeller Mfg. | Hartzell | |
| Type | Constant Speed | |
| Model/Blade | BHC-J2YF-1C | |
| Pitch Angle (HIGH) @ 30 in. Sta. | 40 (+/-) 1 Deg | |
| Pitch Angle (LOW) @ 30 in. Sta. | 15.3 (+/-).1 Deg | |
| Diameter | Max. 74.0 Inches<br>Min. 74.0 Inches | |
| Governor | Woodward | P/N A210778 |

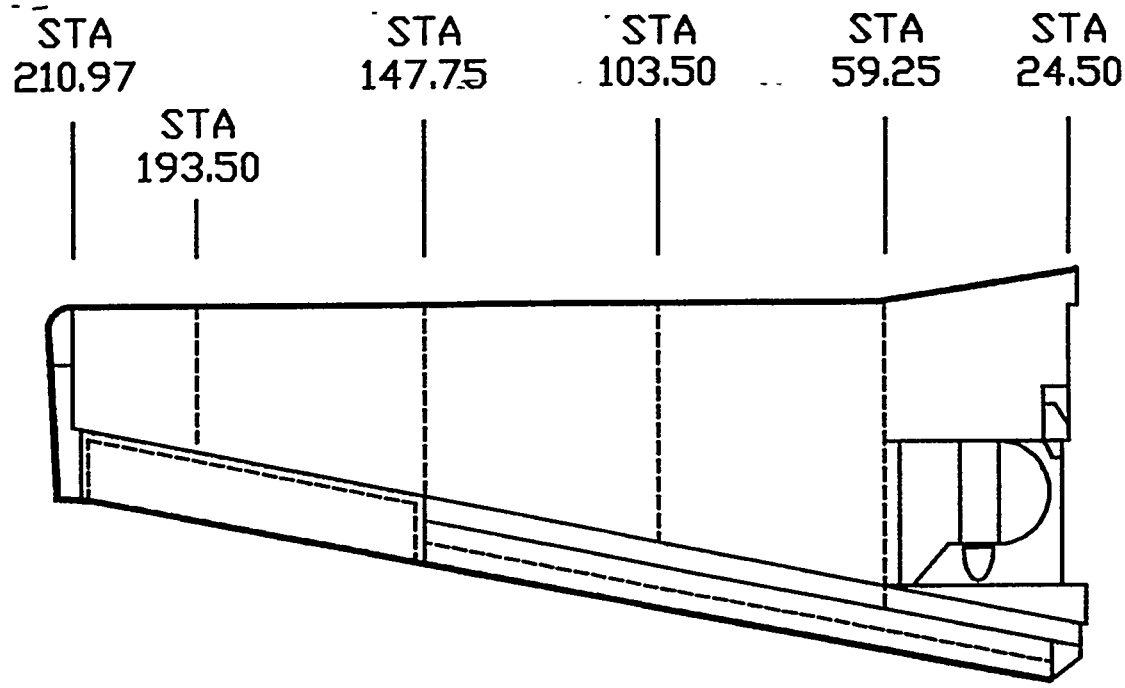
| (CONT.) | STANDARD | METRIC/OPT/MISC |
|---|---|---|
| **AIRFRAME** | | |
| **WEIGHTS & LOADINGS:** | | |
| A. Approximate Empty Weight | 1800 lb. | 793.79 kg. |
| B. Gross Weight | 2900 lb. | 1315.42 kg. |
| C. Useful Load | 1100 lb. | 521.63 kg. |
| D. Wing Loading | 16.59 P/SF | 80.99 kg/sq meter |
| E. Power Loading | 13.36 lb/hp | 6.06 kg/hp |
| WINGS: | | |
| A. Airfoil At Wing Root | NACA $63_2$ 215 | |
| B. Airfoil At Wing Tip | NACA $64_1$ 412 | |
| C. Mean Aerodynamic Chord At Wing Sta.94.848 | 61 inches | 154.94 cm |
| D. Center-of-Gravity Range | 43.5 to 49.3 | |
| E. Geometric Twist (DEG) | 1.5 Degree | |
| F. Incidence Angle (DEG) From Sta 20. to Wing Tip | 2.5 Degree | |
| G. Dehedral angle (DEG) | 5.5 Degree | |
| H. Aspect Ratio | 7.448 | |
| I. Taper Ratio (CS/CT) | 2.271 | |
| **FUSELAGE:** | | |
| A. Cabin Dimensions: | | |
| (1) Height | 44.5" | 113.03 cm |
| (2) Width | 43.5" | 110.49 cm |
| (3) Length | 114" | 289.56 cm |
| (4) Cabin Door Width | 29" | 73.66 cm |
| (5) Cabin Door Height | 35" | 88.9 cm |
| B. Baggage Campartment: | | |
| (1) MAX.Loading | 120 lbs | 54.43 kg |
| (2) Baggage Space | 17.0 Cu. Ft. | 0.476 Cu. M. |
| (3) Baggage Door Width | 17" | 43.18 cm |
| (4) Baggage Door Height | 20.5" | 52.07 cm |
| (5) Hat Rack/Rear Shelf Capacity | 10 lbs | 4.54 kg |
| C. Landing Gear: | | |
| (1) Type | Tricycle Retractable | |
| (2) Operation | Electrical | |
| (3) Wheel Track | 9' 3/4" | 276.23 cm |
| (4) Wheel Base | 6' 7 9/16" | 198.91 cm |
| (5) Tire Size--Nose | (6-Ply Rating) 5.00x5 | |
| (6) Tire Size--Main | (6-Ply Rating) 6.00x6 | |
| (7) Tire Pressure--Nose | 49 lbs/sq. in. | |
| (8) Tire Pressure--Main | 42 lbs/sq. in. | |

## 6-00-02 - AIRCRAFT DIMENSIONS

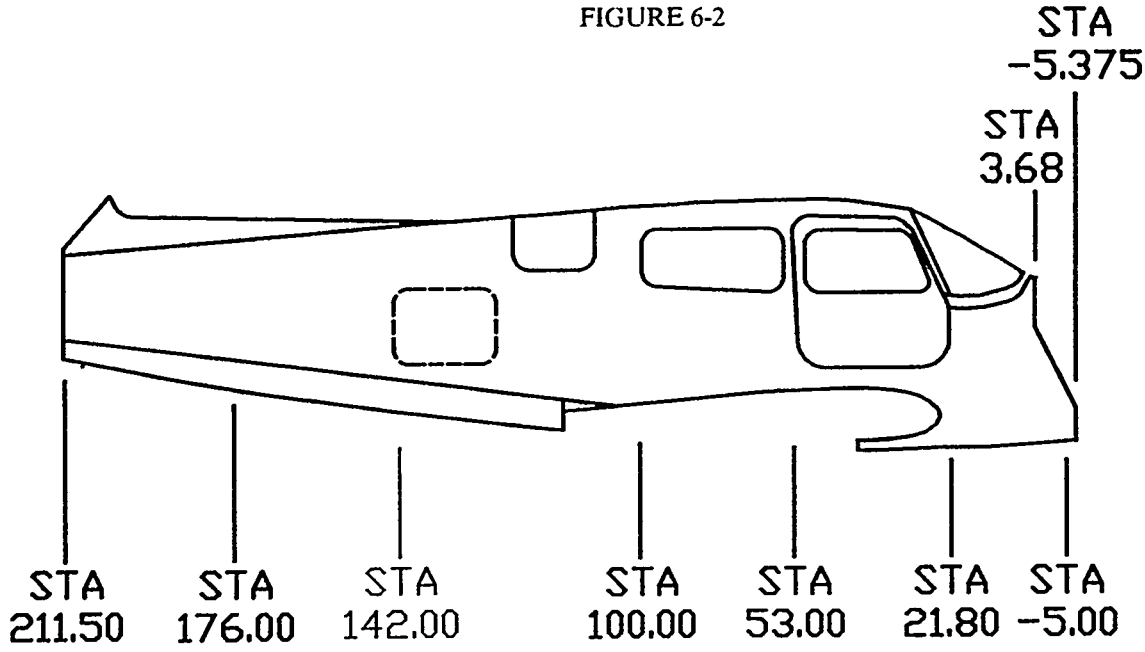
| | | |
|---|---|---|
| DIMENSIONS: | | |
| A. Wing Span | 36'1" | 10.998 meters |
| B. Fuselage Length | 26'11" | 8.075 meters |
| C. Tail Height | 8'4" | 1.321 meters |
| D. Stabilizer Span | 11'9" | 3.581 meters |
| AREAS: | | |
| A. Wing | 174.786 sq. ft. | 16.238 sq. meters |
| B. Ailerons | 11.4 sq. ft. | 1.059 sq. meters |
| C. Flaps | 17.9 sq. ft. | 1.663 sq. meters |
| D. Vertical Fin | 7.8 sq. ft. | 0.725 sq. meters |
| E. Rudder | 6.25 sq. ft. | 0.518 sq. meters |
| F. Horizontal Stabilizer | 21.42 sq. ft. | 1.900 sq. meters |
| G. Elevators | 13.0 sq. ft. | 1.208 sq. meters |




PRINCIPAL AIRCRAFT DIMENSIONS
FIGURE 6-1



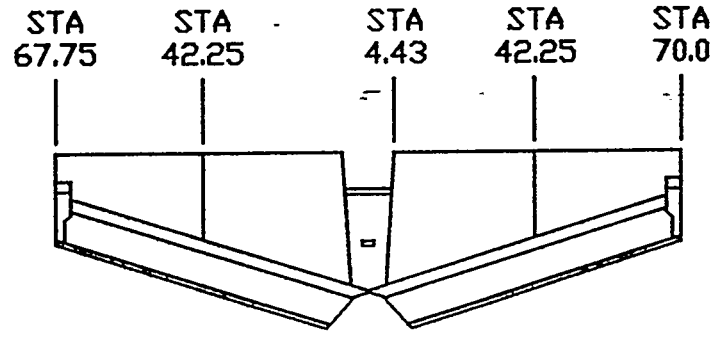

WING STATION RIBS
FIGURE 6-2

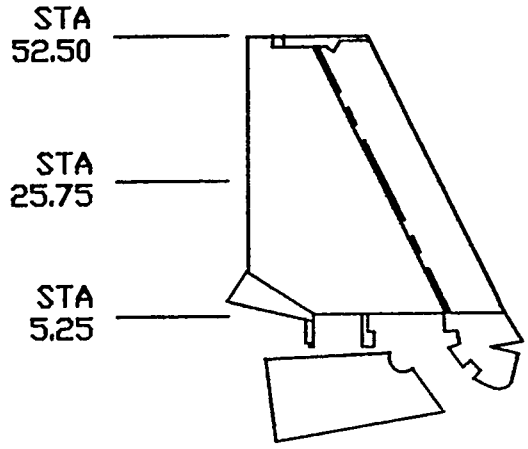



FUSELAGE STATIONS
FIGURE 6-3

NOTE
**The datum line station 0.0 is 13 inches aft of the nose gear trunion pivot point. (Reference Figure 8-2.)**

EMPENNAGE STATIONS




EMPENNAGE STATIONS
FIGURE 6-4

# CHAPTER

# 07

# LIFTING AND SHORING

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## 7-10-00 - JACKING

When it is necessary to raise the aircraft off the ground:

CAUTION
**Do not raise the aircraft on jacks out of doors when wind velocity is over 10 MPH. Jacks should be on hard surface.**

CAUTION
**Do not place jack directly on propeller.**

1. Install jack points in tiedown mounting holes outboard of each main gear.
2. Use standard aircraft jacks at both wing hoist points (wing tiedown eyebolt receptacles) outboard of the main gears. While holding jack point in place, raise jack to firmly contact jack point.
3. Use standard aircraft jack at the nose jacking point,(Sta. -10.96) (-27.8 cm). While holding jack point in place, raise jack to firmly contact jack point.
4. Raise aircraft, keeping wings as nearly level as possible.
5. Secure safety locks on each jack.

CAUTION
**When lowering aircraft on jacks, bleed off pressure on all jacks simultaneously and evenly to keep aircraft level as it is lowered.**

CAUTION
**Individual wheels may be raised without raising the entire aircraft. Wheels not being raised should be chocked fore and aft.**

NOTE
**It is not recommended to use tail-tie down fitting during jacking process to lift nose wheel off ground.**

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# CHAPTER

# 08

# LEVELING AND WEIGHING

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| 8-00-00 | Leveling | 3 |
| 8-00-01 | Weight and Balance | 3 |

## 8-00-00 - LEVELING

Place a spirit level on the leveling screws above the tailcone access door when leveling the aircraft longitudinally. Level the aircraft by increasing or decreasing air pressure in the nose wheel tire. Front seats must be in the full forward position when weighing. (See Figure 8-2 for leveling screws above tailcone avionics access door)

## 8-00-01 - WEIGHT AND BALANCE

To weigh the aircraft select a level and draft free work area, then:

1. Check for installation of all equipment as listed in the Weight and Balance Record.

**NOTE**
**See Pilot's Operating Handbook for Weight and Balance reference data.**

2. Ground aircraft and drain fuel tanks per Section 12-10-02, 2.

3. Add unusable fuel to each tank, (see Pilot's Operating Handbook/Airplane Flight Manual for aircraft being serviced for proper quantity of unusable fuel).

4. Fill oil tank to capacity (7 quarts). Total 13.5 quarts in engine and oil tank.

5. Position a 2000-pound capacity scale under each of the three wheels.

6. Level aircraft as described in Section 8-00-00 and center nose wheel.

7. Weigh the aircraft.

8. Find reference point by dropping a plumb-bob from center of nose gear trunion (retracting pivot axis) to the floor. Mark the point of intersection.

9. Locate centerline of the main wheel axles in the same manner.

10. Measure the horizontal distance from the reference point to main wheel axle center line. Measure horizontal distance from center line of nose wheel axle to center line of main wheel axles.

11. Record weights and measurements, and compute basic weight and CG as follows:

$LC/G = L_{M/R} - 13 - L_M$

a. CG Forward of Main Wheels

| _____ LBS | X | _____ IN. | ÷ | _____ LBS. | = | _____ IN. |
|---|---|---|---|---|---|---|
| Weight of Nose Main and Nose Wheel ($W_N$) | | Distance Between Aircraft ($L_{M/N}$) | | Total Weight of Wheels ($W_T$) | | CG Forward of ($L_M$) |

b. CG Aft of Datum (Station 0).

| _____ IN. | - | 13 IN. | - | _____ IN. | = | _____ IN. |
|---|---|---|---|---|---|---|
| Distance from center Nose Gear Trunnion to Center of Main Wheel Axles (Horizontal) ($L_{M/R}$) | | Distance from Nose Gear Trunnion to Datum (CONSTANT) | | Result of computation Above (a.) ($L_M$) | | CG (FUS STA) Distance Aft of Datum (Empty Weight CG) ($L_{C/G}$) |

NOTE: Empty weight includes unusable fuel and full oil (13.5 Qts.) and is computed with gear down and flaps up.

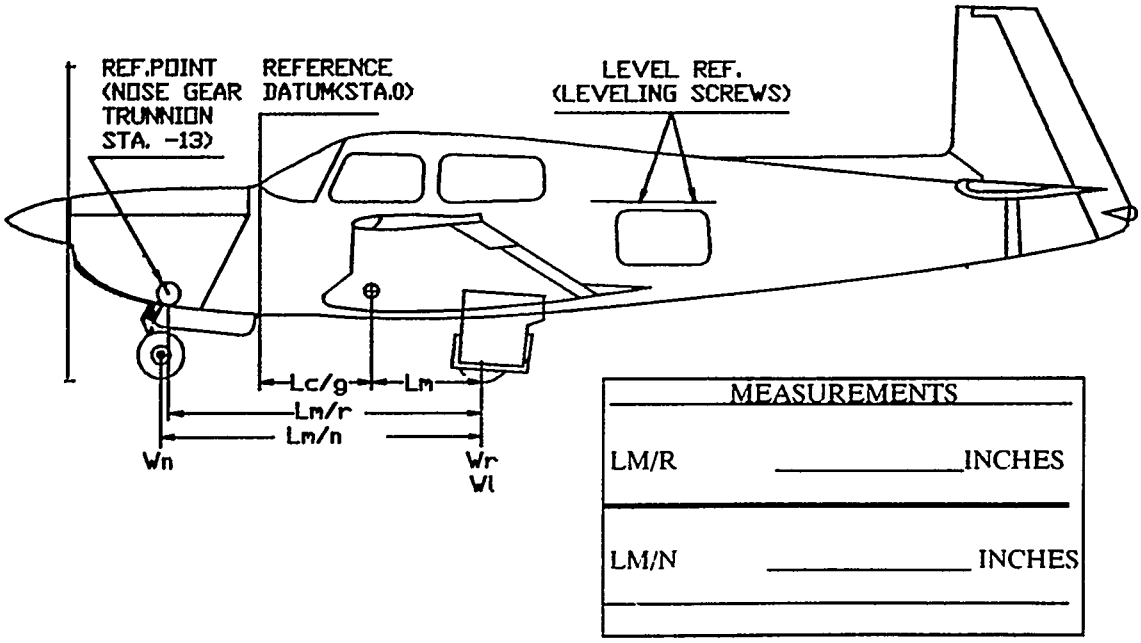



FIGURE 8-1
WEIGHT AND BALANCE DIAGRAM

# CHAPTER

# 09

# TOWING AND TAXIING

# TOWING AND TAXIING

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| 9-20-00 | Taxiing | 3 |
| 9-30-00 | Emergency Procedures | 3 |

## 9-00-00 - GROUND HANDLING

### 9-10-00 - TOWING

Use a towbar for moving the aircraft. The towbar attaches to the nose gear crossbar. One man can move the aircraft providing the ground surface is relatively smooth and the tires are properly inflated. When no towbar is available, or when assistance in moving the aircraft is required, push by hand: (1) on the wing leading edges, and (2) on the wing tips. Towing by tractor or other powered equipment is NOT RECOMMENDED.

**CAUTION**

**Exercise care not to turn the nose wheel past its normal swivel angle of 11° Left or 13° Right of center. Exceeding the turn limits shown on the turn indicator may cause structural damage.**

**Maximum allowable damage to hose gear leg assembly is 1/32 inch dent. No repair is authorized for these or other heat treated landing gear components.**

### 9-20-00 - WARMUP AND TAXIING

Before attempting to warmup or taxi the aircraft, ground personnel should be checked out by qualified pilots or other responsible personnel.

1. Start and warmup engine. (Refer to POH/AFM Manual.)
2. Taxi forward a few feet and check brake effectiveness.
3. While taxiing, make shallow turns to test nose gear steering.
4. Check operation of gyro instruments and turn coordinator during turns.
5. Check engine instruments for sluggish response to engine control movements.

## 9-30-00 - EMERGENCY PROCEDURES

1. Engine Fire During Starting.
   A. Continue cranking engine with starter.
   B. Set POWER LEVER at OFF.
   C. Turn fuel selector handle to OFF.
   D. Open throttle to FULL.
   E. Turn Battery Switches OFF
   F. Push cabin heat control to OFF.
   G. If fire is not extinguished, proceed as follows:
      (1) Turn electrical switches OFF.
      (2) Discharge fire extinguisher into engine compartment through nose cowl openings.
      (3) Call for fire-fighting equipment.
2. Fuselage or Wheel Well Fire. In case of fire in wheel well (or in the cabin or fuselage area), turn all fuel, electrical, and ignition controls to the OFF position before evacuating the aircraft to extinguish the flames.
3. Electrical Fire. Circuit breakers (or circuit-breaker switches), that automatically interrupt the flow of power when an overload or short circuit occurs, protect all electrical circuits (except the ignition-starter circuits). In the event of an electrical fire, immediately turn OFF the battery switches. Make sure that only a fire extinguisher approved for electrical fires is used.

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# CHAPTER

# 10

# PARKING, MOORING, STORAGE, RTN TO SVC.

# SECTION 10
# PARKING AND MOORING

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| 10-10-03 | Return to Service | 3 |
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## 10-00-00 - GENERAL

The parking brakes are set by applying the brakes and pulling out on the parking brake knob. Release the brakes by pushing in on the parking brake control knob.

NOTE
**There is no need to depress the brake pedals to relieve the pressure in the lines during release of parking brake control.**

There are three tiedown points on the aircraft, one on each wing outboard of main gear (tiedown rings are to be threaded into built in receptacles) and the tail skid/tiedown fitting on the aft end of the tailcone.

## 10-10-00 - PARKING

When parking the aircraft, place wheel chocks fore and aft of the main wheels. The parking brakes may be used for short-duration parking.

CAUTION
**Do not set parking brakes when they are overheated or when cold weather could freeze moisture and slush accumulation in the brake mechanism. Do not set parking brakes when aircraft is tied down. For maximum protection, hangar the aircraft during severe weather and high winds.**

## 10-10-01 - STORAGE (FLYABLE)

Outdoor storage requires adequate mooring and tiedown facilities. The following precautionary measures are recommended for keeping the aircraft serviceable and ready-to-fly.

1. Refer to paragraph 10-20-00 for mooring instructions.
2. Ignition switches.....OFF
3. Power Lever.....CLOSED
4. Keep fuel tanks filled at least one-half full to minimize moisture condensation. Keep battery fully charged.
5. Install protective covers over pitot head, engine cowl openings, static ports, etc.
6. Maintain a good wax finish on all exterior surfaces after 90 days.

## 10-10-02 - STORAGE (PROLONGED)

If the aircraft is to be stored for an extended period of time, the following steps are recommended for protection:

1. Refer to paragraph 10-20-00 for mooring instructions.
2. Tape or cover all openings.
3. Remove battery, charge fully, and store in a cool place.
4. Raise aircraft to remove weight from the tires, and block up the wheels.

CAUTION
**If weight is not removed from tires, rotate wheels to a new position at least once each 30 days to prevent flat-spotting the tires.**

5. See appropriate Porsche Service Data for engine preservation. Attach warning placards if preservation procedures make engine inoperable.

## 10-10-03 - RETURNING TO SERVICE

If the aircraft has been stored for an extended period of time, it is advisable to perform a 50-hour periodic inspection after completion of the following preliminary steps:

1. Remove blocks from wheels. Check tire inflation.
2. Check and install batteries.
3. Remove tape and covers from ALL openings.
4. Remove warning placards (if any).
5. Replace engine oil filter.
6. Fill engine tank with proper grade of lubricating oil.
7. Clean and reinstall engine air-inlet filter.
8. Check fuel tank vents for obstruction, and drain sumps to remove moisture and sediment.
9. Complete 50-hour and preflight inspections.
10. See appropriate Porsche Service Data for servicing of the engine.

## 10-20-00 - MOORING

When mooring the aircraft out of doors:

1. Head aircraft into the wind.
2. Place chocks fore and aft of each main wheel.
3. Drive stakes in ground approximately three feet outboard of each main gear and to either side of tailskid.
4. Install tiedown rings in wing receptacles outboard of each main gear. Tie a 600-pound tensile strength rope to each wing tiedown ring and anchor to ground stake. Allow a little slack in each tiedown rope.
5. Tie the center of a rope to tail skid tiedown ring and anchor rope ends to ground stakes at either side of tail.
6. For additional security, attach a rope to the nose gear and anchor to a ground stake.
7. Lock controls by looping right front seat safety belt through the control wheel and drawing belt snug.

# CHAPTER

# 11

# PLACARDS AND MARKINGS

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## 11-00-00 - GENERAL

FAA required placards and markings.

**NOTE**

**All placards should be inspected for proper location, readability and security during maintenance actions. When an airplane has been painted inspect all placards to assure that they are not obscured by paint.**

## 11-10-00 - MARKINGS

The exterior paint schemes for the various model year aircraft are depicted in the M20L Illustrated Parts Catalog.

## 11-20/30-00 - PLACARDS, EXTERIOR/INTERIOR

All required placards and their locations, both interior and exterior, are listed in Section II of the FAA Approved Airplane Flight Manual and Pilot's Operating Handbook.

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# CHAPTER

# 12

# SERVICING

# SERVICING

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| 12-20-06 | Cleaning | .6 |

## 12-00-00 - SERVICING

### 12-00-01 - SERVICING INTERVALS

The specified intervals (refer to Chapter 5) are considered adequate to meet average requirements under normal operating conditions. It is advisable, however, to shorten service and maintenance intervals when operating under abnormal environmental conditions, such as extreme temperature ranges, dusty atmospheric conditions, high humidity and moisture, unimproved airport facilities, or unusual operating requirements.

### 12-10-00 - REPLENISHING

### 12-10-01 - FUEL TANKS

Keep fuel tanks at least half filled to minimize condensation and moisture accumulation in tanks. (Fuel capacity is given in Chapter 6.)

WARNING

**Ground the aircraft and fuel service vehicle. Ground servicing nozzle to wing. Permit no smoking or open flame within 50 feet of aircraft or vehicle.**

WARNING

**Each fuel tank is vented to the atmosphere at its outboard aft corner; vent openings are on the lower wing surface. Check vents for obstruction before each flight.**

### 12-10-02 - FUEL DRAINS

A fuel-drain valve is located in the aft inboard corner of each tank to provide for drainage of moisture and sediment. Use the small plastic cup furnished with the flyaway kit to drain the fuel sumps. Drain wing tank sumps and gascolator before the first flight of the day and after each fuel service to inspect for water and/or contamination. Continue draining until free of water or contamination.

WARNING

**After servicing the aircraft with fuel, wait at least five minutes for moisture and sediment to settle before draining and checking both the fuel tank sumps and the fuel selector valve drain.**

1. Fuel Selector Drain. The fuel gascolator is at the lowest point in the fuel system and has a drain valve operated by a control on the floor in the cabin. To drain the fuel selector valve:

A. Switch fuel selector valve handle to L and pull fuel drain valve control ring for 10 seconds.

B. Switch fuel selector valve handle to R and pull fuel drain valve control ring for 10 seconds.

C. After draining, be sure fuel drain valve control is returned to the closed position and the valve is not leaking outside the aircraft.

WARNING

**During cold weather operation, frequently check fuel selector drain for ice formation by repeating procedures 1., A, B and C above.**

NOTE

**If conditions conducive to fuel system icing exist Isopropyl Alcohol may be added to fuel tanks. It is extremely important to thoroughly BLEND the isopropyl alcohol in with the fuel supply in quantities not to exceed 1% of the total by volume.**

2. Defueling. Fuel tanks may be drained by pumping fuel out with the electric fuel pumps, siphoning fuel through the filler ports, or removing tank quick drain valves.

WARNING

**Allow no smoking or open flame within 50 feet of the defueling area. Ground the aircraft and fuel container during all defueling operations.**

A. To defuel the aircraft using fuel pump:

(1) Disconnect fuel line from electric fuel pump outlet at the fitting forward of the firewall.

(2) Connect to output fitting a flexible line that will reach fuel receptacle.

(3) Turn fuel selector valve to the tank to be drained, and remove filler cap from fuel filler port.

(4) Turn on either fuel pump until tank is empty. Repeat steps (3) and (4) to drain other tank.

(5) To completely drain fuel system also drain wing sumps and the fuel gascolator valve sump until fuel stops running.

NOTE

**When defueling using removable tank quick drains it is only necessary to remove the drains and to operate the gascolator drain.**

## 12-10-03 - ENGINE OIL

The oil access door is located on the right hand side of the cowling. Check engine oil either before first engine start when engine is cold or with a completely warm engine (oil temperature above 40$^0$C, engine shutdown). Approved engine oil and oil viscosity requirements are shown in Chapter 5-20-07.

The aircraft is delivered from Mooney with proper oil.

OIL FILTER - The oil filter should be changed at 100 hour intervals using Porsche filter or approved equivalent.

## 12-10-04 - OXYGEN SYSTEM (OPTIONAL)

The oxygen cylinder, when fully charged, contains approximately 76, 77 or 115 cubic feet of aviators breathing oxygen (Specifications No. MIL-O-27210). Recharging of this oxygen cylinder should be accomplished by using the appropriate Scott recharging fittings to the pressure shown on (Figure 12-1), Pressure vs Temperature Table.

WARNING

**Oil, grease or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided when handling oxygen equipment.**

| AMBIENT TEMPERATURE F DEGREES | FILLING PRESSURE PSIG | AMBIENT TEMPERATURE F DEGREES | FILLING PRESSURE PSIG |
|---|---|---|---|
| 0 | 1650 | 50 | 1875 |
| 10 | 1700 | 60 | 1925 |
| 20 | 1725 | 70 | 1975 |
| 30 | 1775 | 80 | 2000 |
| 40 | 1825 | 90 | 2050 |

OXYGEN PRESSURE VS TEMPERATURE TABLE
FIGURE 12-1

NOTE

**The oxygen cylinder should not be run down to less than 100 p.s.i. Below this pressure atmospheric contamination of the cylinder may occur, requiring valve removal and cylinder cleaning and inspection at an FAA approved repair stations.**

NOTE

**Refer to Section 35-00-00 for periodic bottle pressure check.**

Any time fittings are disconnected on the oxygen system the threads should be treated with tetrafluoroethylene tape (MIL-T-17720). Prior to reconnection the system should be checked for leaks with leak testing compound (MIL-L-25567). If no leaks are found wipe the system clean and dry.

## 12-20-00 - SCHEDULED SERVICING

### 12-20-01 - INDUCTION AIR FILTER

The importance of keeping the induction air filter clean cannot be overemphasized. A clean filter promotes fuel economy and longer engine life. The dry-type filter can be cleaned five (5) times within 500 hours.

To clean the dry-type induction air filter:

1. Remove filter element.
2. Direct a jet of air against down or clean side of filter (opposite to normal airflow). Keep air nozzle at least two inches from filter element. Direct a jet of air from inside of filter out. Cover entire filter area with air jet.

CAUTION

**Do not use a compressor unit with a nozzle pressure greater than 60 p.s.i.**

3. After cleaning, inspect filter and/or gasket for damage. Discard a ruptured filter or broken gasket.

4. Reinstall filter in aircraft making sure of proper sealing and security.

### 12-20-02 - BATTERIES

Service the batteries with distilled water to maintain electrolyte above plates. After adding water in freezing weather, charge battery long enough to mix electrolyte and water. Keep battery electrolyte above a specific gravity of 1.225 to avoid freezing. To service the battery:

1. Remove battery compartment access cover. Check electrolyte and service battery as required.

CAUTION
**Battery gases may be explosive.**

2. Check battery area for corrosion and spilled electrolyte. To clean cables, terminals, and battery box, use a solution of bicarbonate of soda and clean water to neutralize corrosion and spilled electrolyte.

CAUTION
**When cleaning, do not allow bicarbonate of soda to enter battery cells - permanent damage will result if soda mixes with electrolyte.**

3. Rinse battery with clean water, and wipe clean with a dry cloth.

4. To retard corrosion, coat terminals with petroleum jelly after cleaning and tightening them.

5. Check battery vents for obstruction, line kinks, etc.

### 12-20-03 - TIRES AND WHEELS

Keep the tires at recommended air pressure. (Refer to Chapter 6-00-01.

1. Check tires for wear, cuts, and bruises.

2. Check valve stems for evidence of tire slippage or pulling.

3. Check wheels for damage.

4. Check wheel bearings for condition and lubrication.

### 12-20-04 - BRAKE RESERVOIR

Frequently check the brake reservoir for proper fluid level. See Chapter 12-20-05 for locations.

CAUTION
**Do not fill reservoir while parking brake is set.**

Use only hydraulic fluid (red), per specification MIL-H-5606. Do not fill reservoir above two inches below filler port.

### 12-20-05 - HYDRAULIC BRAKE (Bleeding)

CAUTION
**Fluid in the wheel cylinders may be under high pressure due to expansion. Therefore, be sure parking brakes are released prior to beginning hydraulic system servicing.**

For best results, use a hydraulic pressure service unit (pressure pot) to back bleed the system through the wheel cylinder bleeder valves.

1. Remove hydraulic fluid reservoir filler plug, and install a suitable fitting for attaching a flexible drain line to a filler port.

2. Immerse open end of drain line in a hydraulic fluid container.

3. Attach pressurized hydraulic fluid service unit to wheel cylinder bleeder valve and open valve. Hydraulic service unit should be free of air prior to servicing aircraft system.

4. Feed fluid from service unit into brake system. Check for air bubbles at end of drain line immersed in fluid.

5. When fluid flow is clear of air bubbles, close wheel cylinder bleeder valve and remove service line.

NOTE
**Brake pedal may need to be pulled back in order for fluid to bleed back into reservoir.**

6. To bleed opposite brake, repeat steps 3 through 5.

7. Remove drain line from reservoir.

8. Lower fluid level in reservoir to two inches below filler port.

9. Reinstall filler plug.

10. Check brake linings for excessive wear and proper installation. Refer to Section 32-40-04 for Brake Removal and Inspection Procedures.

11. Depress brake pedals to check for sponginess. Resistance should be solid and even when brake pedals are depressed.

## 12-20-06 - CLEANING

Cleanliness is a major prerequisite to adequate inspection and maintenance of an aircraft. Cleanliness enhances the appearance of an aircraft and reduces the probability of corrosion.

1. EXTERIOR

A. Before washing aircraft exterior, cover brake discs, pitot head, and static ports.

B. Flush away loose dirt and mud.

C. Wash exterior with a mild aircraft detergent in cool water, and a soft cleaning cloth or chamois. Rinse away soap film.

CAUTION

**Do not use so called "mild" household detergents to wash aircraft exterior. Such detergents may damage finish and corrode aluminum components.**

CAUTION

**Do not apply wax or use pre-wax cleaners during initial paint curing period. Use only mild aircraft detergent and cool water when washing exterior during the first 90 days after repainting.**

D. To remove heavy oxidation film, use a pre-wax cleaner.

E. Apply an exterior-finish wax recommended for protection of urethane enamel. Apply a heavy coating of wax to leading edges of wings, empennage, and nose section to reduce drag and abrasion.

CAUTION

**When fuel, hydraulic fluid, or other fluid containing dye is spilled on painted surfaces, remove it at once to prevent staining. Flush away spilled battery electrolyte immediately with water. Treat the area with bicarbonate of soda solution followed by thorough washing with a mild aircraft detergent solution.**

2. WINDSHIELDS, WINDOWS AND DOORS

A. Flush windshield and windows with water prior to wiping. Never wipe while dry.

B. Remove grease or oil with a soft cloth saturated in kerosene.

CAUTION

**Never use gasoline, benezene, carbon tetrachloride, acetone, fire extinguisher fluid, de-icer fluid, lacquer thinner, or household window cleaning sprays on windows or windshields. Such solvents will soften or craze the plexiglas surface.**

C. Clean windows and windshields with an antistatic plexiglas cleaner.

D. Check door seals for damage that could cause leakage.

E. Check cabin and baggage door mechanism for good working order.

NOTE

**Minor scratches or abrasions may be polished out by using plexiglas resurfacing kits, ie, Micro-Mesh, available from aircraft accessory suppliers.**

3. ENGINE COMPARTMENT Accumulation of dirt and oil within the engine compartment creates a fire hazard and hampers inspection.

A. Wash down engine cowling and engine compartment using a nonflammable solvent.

B. Dry engine cowling and engine compartment after washing.

4. CABIN INTERIOR Use normal household cleaning practices for routine interior care.

A. Frequently vacuum seats, rugs, upholstery panels, and headliners to remove surface dust and dirt.

B. Clean leather or vinyl upholstery and panels with a mild aircraft detergent. Clean with a slight damp cloth, and dry with a soft cloth.

NOTE

**Foam-type shampoos and cleaners for vinyl, leather, and plastic materials can be used to remove stains and to condition the entire interior. Spray-on dry cleaners are also recommended.**

CAUTION

**Never apply furniture polish to interior furnishings. Most polishes contain solvents harmful to vinyl. Do not use alcohol or strong solvents on interior plastics. When using commercial cleaning and finishing compounds, carefully follow the manufacturer's instructions. Never saturate fabrics with solution which could damage the backing and padding materials. To minimize wetting of carpets, keep foam as dry as possible and rub in circles. Use a vacuum cleaner to remove foam. Do not allow carpets to remain damp; dry them thoroughly.**

# CHAPTER

# 20

# STANDARD PRACTICES (AIRFRAME)

SECTION 20
STANDARD PRACTICES - AIRFRAME

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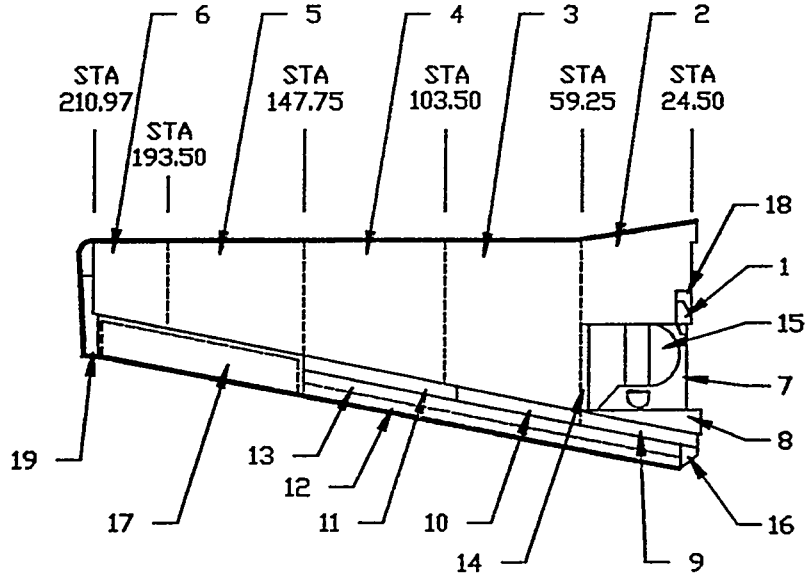

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| 20-00-02 | Corrosion Detection and Prevention | 5 |
| 20-00-03 | Painting | 7 |

## 20-00-00 - GENERAL

This chapter of the manual discusses treatment of metal surfaces for corrosion control and the identification of skin panels for replacement purposes. Those who inspect or repair aircraft should consult FAR 43, Maintenance, Preventive Maintenance, Rebuilding and Alteration and Sub Parts A, D and E of FAR 65, Certification. Advisory Circular 43.13-1( ) outlines inspection and repair practices acceptable to the F.A.A. Administrator.

## 20-00-01 - SKIN SPECIFICATIONS

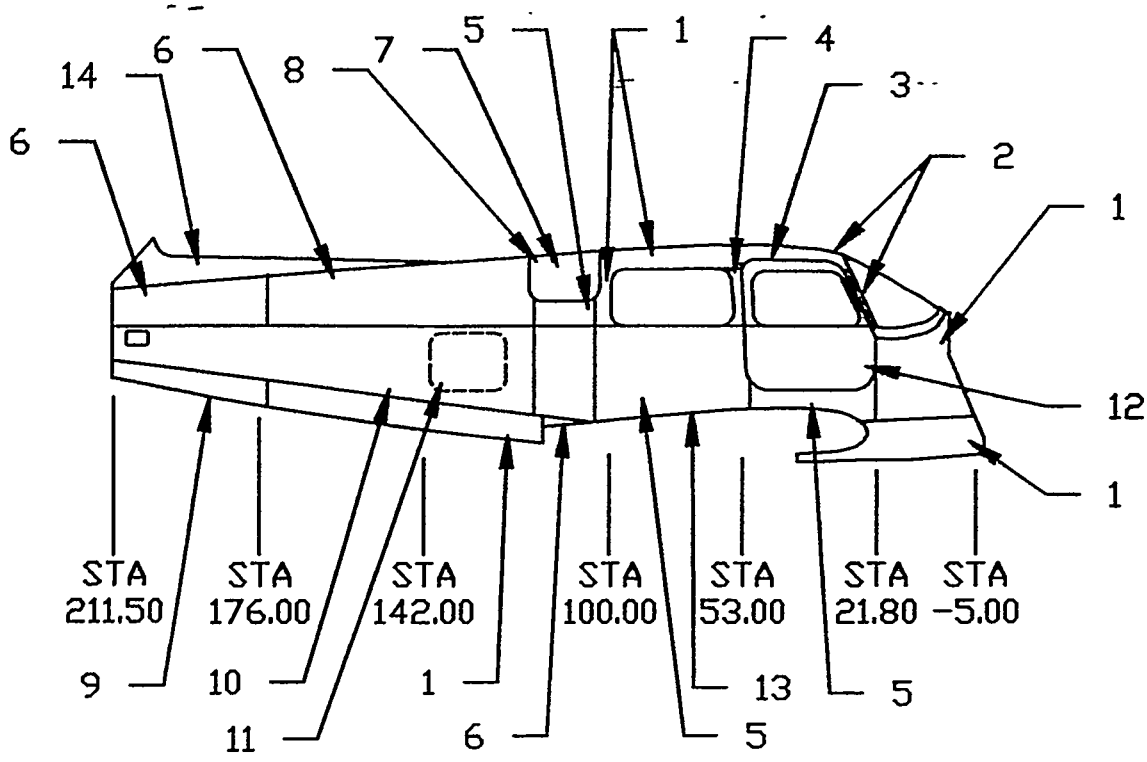



WING SKIN PANELS

| INDEX NO. | SKIN THICKNESS | MATERIAL | INDEX NO. | SKIN THICKNESS | MATERIAL |
|---|---|---|---|---|---|
| 1. | 0.063 | 2024 T-3 CLAD | 12. | 0.025(c) | 2024 T-3 CLAD |
| 2. | 0.050 | 2024 T-3 CLAD | 13. | 0.020(a) | 2024 T-3 CLAD |
| 3 . | 0.040 | 2024 T-3 CLAD | 14. | 0.032 | 2024 T-3 CLAD |
| 4. | 0.032 | 2024 T-3 CLAD | 15. | 0.040(b) | 2024 T-3 CLAD |
| 5. | 0.025 | 2024 T-3 CLAD | 16. | 0.040(d) | 2024 T-3 CLAD |
| 6. | 0.025 | 2024 T-3 CLAD | 17. | 0.016(a) | 2024 T-3 CLAD |
| 7. | 0.032 | 2024 T-3 CLAD | 18. | 0.050(b) | 2024 T-3 CLAD |
| 8. | 0.040 | 2024 T-3 CLAD | 19. | Polyester Glass-Fiber Reinforced | |
| 9. | 0.025 | 2024 T-3 CLAD | | | |
| 10. | 0.025 | 2024 T-3 CLAD | | | |
| 11. | 0.025 | 2024 T-3 CLAD | | | |

LEGEND
(a) Same thickness on top and bottom.
(b) Top of wing only.
(c) Top aft flap skin (hat section).
(d) Top inboard flap skin.

WING SKIN PANELS
FIGURE 20-1



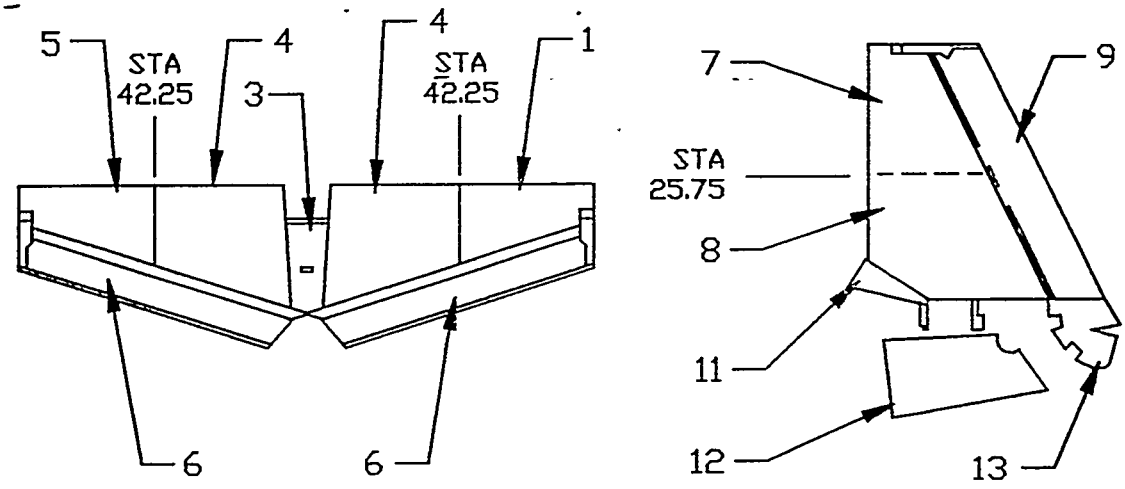

FUSELAGE SKIN PANELS

| INDEX NO. | SKIN THICKNESS | MATERIAL | INDEX NO. | SKIN THICKNESS | MATERIAL |
|---|---|---|---|---|---|
| 1. | 0.025 | 2024 T-3 CLAD | 10. | 0.032 | 2024 T-3 CLAD |
| 2. | 0.040(d) | 2024 -0 CLAD | 11. | 0.032(a) | 2024 T-3 CLAD |
| 3. | 0.025(c)(b) | 2024 T-4 CLAD | 12. | 0.032 | 2024 T-3 CLAD |
| 4. | 0.025 | 2024 T-3 CLAD | 13. | 0.025(a) | 2024 T-3 CLAD |
| 5. | 0.025(b) | 2024 T-3 CLAD | 14. | Polyester Glass-Fiber Reinforced | |
| 6. | 0.020 | 2024 T-3 CLAD | | | |
| 7. | 0.025 | 2024 T-3 CLAD | | | |
| 8. | 0.032(d)(e) | 2024 -0 CLAD | | | |
| 9. | 0.025 | 2024 T-3 CLAD | | | |

LEGEND

(a) Left side only.
(b) Right side only.
(c) 0.032 can be used.
(d) Heat treated to T-42 condition after forming.
(e) Shell.

FUSELAGE SKIN PANELS
FIGURE 20-2




EMPENNAGE SKIN PANELS

| INDEX NO. | SKIN THICKNESS | MATERIAL | INDEX NO. | SKIN THICKNESS | MATERIAL |
|---|---|---|---|---|---|
| 1. | 0.025 | 2024 T-3 CLAD | 8. | 0.025 | 2024 T-3 CLAD |
| 2. | 0.025 | 2024 T-3 CLAD | 9. | 0.020 | 2024 T-3 CLAD |
| 3. | 0.025 | 2024 T-3 CLAD | 10. | 0.032 | 2024 T-3 CLAD |
| 4. | 0.025 | 2024 T-3 CLAD | 11. | Polyester Glass-Fiber Reinforced. | |
| 5. | 0.025 | 2024 T-3 CLAD | 12. | 0.020 | 2024 T-3 CLAD |
| 6. | 0.020 | 2024 T-3 CLAD | 13. | 0.025(a) | 2024 T-3 CLAD |
| 7. | 0.025 | 2024 T-3 CLAD | | | |

(a) Heat treated to T-42 condition.

EMPENNAGE SKIN PANELS
FIGURE 20-3

**20-00-02 - CORROSION DETECTION & PREVENTION**

Most metallic fabrication materials are susceptible to corrosion. Corrosion may occur on aircraft in any climate, but it will be a problem more often in climates where the aircraft is exposed to salt air or high humidity, or where there are industrial contaminants in the atmosphere. The aircraft should be inspected frequently to detect and correct corrosion before serious damage occurs.

Any form of corrosion should be removed at once. If it is necessary to remove paint, only an approved aircraft paint remover such as Eldorado PR-3400, (Eldorado Chemical Co., Inc., 6700 Lookout Road, P.O. Box 32101, San Antonio, TX. 78216) should be used. Paint removing substances left in metal crevices will cause further corrosion. Turco 2662C or 3002 will remove corrosion from aluminum and treat the metal surface in one application. This paragraph discusses corrosion types and their prevention along with suggested procedures for zinc chromating internal airframe surfaces.

1. Types of Corrosion - Aluminum

Corrosion normally appears in one or more of four forms. Each type of corrosion can be

precluded or controlled by a preventative maintenance program.

A. Chemical Corrosion.

Chemical corrosion normally occurs where battery acid or exhaust gases come in contact with metal surfaces. A few simple precautions will prevent chemical corrosion.

(1) Be sure battery vents are free from obstruction at all times.

(2) Repaint all scratches and worn spots found in areas painted with acid-resistant paint.

(3) If acid is spilled on metal surfaces, flush entire area with sodium bicarbonate and water. The solution should be rinsed away at once and the area dried by driving all water from crevices with an air hose before wiping surface dry with a clean cloth.

(4) Frequently clean exhaust gas deposits from metal surfaces.

B. Local-Cell Corrosion.

On bare metal surfaces, in an early stage development, local-cell corrosion appears as a light, whitish powder deposit. Surface pits warn of advanced local-cell corrosion. On painted surfaces, the first indication of corrosion will be evidenced by paint blistering.

(1) Intergranular Corrosion - Selective attack along grain boundaries of metal alloys is referred to as intergranular corrosion. Aluminum alloys 2024 and 7075 are vulnerable to this type of attack. Aluminum extrusions may contain nonuniform areas, which in turn may result in galvanic attack along grain boundaries. This type of corrosion is difficult to detect in its original stages. When the attack is well advanced, the metal is usually blistered or delaminated. This is referred to as "exfoliation". It is very difficult to completely remove and stop this type of corrosion, and replacement of the affected part is recommended wherever possible.

C. Concentration Cell Corrosion

Corrosion forming under rivet heads, along faying surfaces, at skin to longeron contact surfaces and other similar areas is called concentration cell corrosion. Detection requires close inspection. Rivets must be removed and skin laps must be separated to remove concentration cell corrosion. Use aluminum wool soaked in solvent such as methyl-ethyl-ketone to scour corrosion deposits from the surface before painting both faying surfaces with zinc chromate primer and reassembling.

D. Galvanic Corrosion

Dissimilar metals, such as stainless steel and aluminum, in contact with each other sometimes develop galvanic corrosions. To remedy this form of corosion, separate the parts, remove the corrosion, and paint both surfaces with Zinc Chromate or epoxy-polymide primer before reassembling.

2. Corrosion Prevention

A. Thoroughly examine unpainted metal surfaces at inspections, and check corrosion when found. Carefully examine seams, lap joints, and crevices where moisture or dirt can collect. Areas exposed to exhaust gases require frequent inspection and cleaning.

B. Corrosion may attack metal even though the surface is painted. Inspect painted areas for a blistered or scaly appearance that warns of corrosion below the paint layer.

C. Use only liquid (non-alkaline) soap to wash the exterior airframe. Cover vent scoops when the aircraft is being washed. Rinse aircraft exterior after exposure to salt air or industrial fallout.

D. Since moisture promotes corrosion, thoroughly and frequently inspect areas where water is apt to collect. Use an air hose to drive water from crevices before wiping the exterior surface dry after washdown.

E. Hangar the aircraft when not in use.

F. If battery acid is spilled on any part of the aircraft, immediately wash the area with a solution of sodium bicarbonate in water. Rinse with water and dry with clean towels.

**NOTE**
**FAA Advisory Circular 43-4 addresses corrosion problems.**

3. Zinc Chromating.

Zinc chromating of internal airframe surfaces will not eliminate the necessity for periodic inspections. The most likely areas for corrosion to begin are in hidden crevices such as skin laps, under rivet heads or any opening where moisture can collect. Periodic inspection of these areas is most important so that any corrosion which may be present can be detected and treated in its very earliest stages.

When corrosion is detected, it should be treated as follows:

A. Remove all corrosion product (usually white or grey-white powder on aluminum) from the corroded area down to sound metal.

(1) If the base metal is aluminum, clean off the corrosion product by scrubbing with aluminum wool or a nonmetallic scouring pad such as the nylon pads made by the Carborundum Company, P.O. Box 277, Niagara Falls, N.Y. 14302.

(2) If the base metal is steel, remove the corrosion product with emery cloth (320 grit or finer) or steel wool.

(3) If the corrosion is too advanced to remove by the light mechanical cleaning methods of (1) and (2), refer to Advisory Circulars 43.13-1( ) and/or 43-4 for alternate methods of cleanup and repair.

(4) Chemical cleaning solutions should be used with extreme caution on both aluminum and steel parts. Such solutions are not recommended for use in areas where they cannot be easily and completely neutralized.

B. Wash all areas to be zinc chromated with a cleaning solvent such as methyl ethyl ketone (MEK), Turco T-657 (Turco Products, Inc., 6135 South Central Ave., Los Angeles, California), lacquer thinner, #3094 wash thinner (Pratt & Lambert, Inc., 25th and N.Y. Avenue, Wichita, Kansas) or similar solvents.

(1) To get a good clean surface for zinc chromate priming use a clean cloth or piece of cheesecloth and apply one of the solvents noted above. The surface should be wiped dry with a second piece of clean cloth. Do not allow the solvent to dry on the cleaned area as it will redeposit dissolved soil and grime upon evaporation.

CAUTION

**Wipe solvents are generally flammable and toxic and should not be used without adequate ventilation and fire precautions.**

C. Apply zinc chromate primer to cleaned area by spray or brush. Area needs to be painted within 24 hours of zinc chromate primer coat.

## 20-00-03 - PAINTING

The exterior is painted with urethane enamel. When exposed to humid salt air or to an atmosphere having corrosive fallout, the aircraft should be hangared when not in use.

1. Paint Repairs.

A. Materials.

(1) Aluminum wool, nylon scouring pads, 320 grit or finer emery cloth or steel wool.

(2) Tack rags.

(3) Wipe solvents such as: methyl ethyl ketone, T-657 ---(Turco Products, Inc.); #3094 wash thinner ---(Pratt & Lambert, Inc.); lacquer thinner or equivalent solvents.

(4) Body putty or aerodynamic filler such as: Flex-Bond ---(Taylor & Art Plastics); Flex ---(3M Co.):or Cuz polyester body filler #6372 --- (NAPA [Martin Senour Paints]).

(5) Compatible paints for the item (such as steel tubular structure or exterior skin) and for the year and model being repainted. (Refer to Mooney Parts Manual).

(6) Thinners which are compatible with the paints being used both for paint thinning and for burn-down thinners.

B. Cleaning Procedures.

NOTE

**Fiberglass components are attacked and deteriorated by products containing the following chemicals: Ketone, aliphatic esters, chlorinated hydrocarbons and slightly softened by aromatic hydrocarbons.**

Fuel Servicing Decal Removal:

1. Cover the decal with a hot, wet towel for approximately 2 minutes.
2. Lift one corner of the decal and slowly remove.

(1) Remove all old loose paint by one of the following methods:

(a) On aluminum - for uniformity of finish appearance, the entire skin panel should be prepared for repainting. If the paint is in very bad condition or if a filler is to be used, remove all of the paint by use of lacquer thinner, MEK or similar solvent. Careful application of paint stripper is acceptable. The solvent should be wiped on and wiped off before it evaporates. If the solvent is allowed to evaporate, it will redeposit the soils and paint that were being carried. Any scouring required should be done at this point. Scouring with nylon pads or aluminum wool may be done dry or wet with one of the wipe solvents listed above. After the old paint, grime, etc. has been loosened and removed, the scoured area should be wiped with a tack rag, and again cleaned

with fresh wipe solvent. The part should now be ready for priming and painting.

(b) On steel - Remove all grease, grime, loose paint, etc. by wiping with a wipe solvent and rags. Do not allow the wipe solvent to evaporate. Wipe it dry! Steel parts may be cleaned to bare metal by sanding with emery cloth or steel wool. If the parts are removable, they can be cleaned by sandblasting. Regardless of the scouring method, all parts should be wiped with a tack rag and cleaned with fresh wipe solvent. The part should now be ready for priming and painting.

C. Priming and Painting.

(1) On aluminum - Cleaned and dried surfaces to be painted should be coated with a wash primer conforming to MIL-C-8514 or MIL-P-15328. Read and follow the manufacturer's instructions carefully. The wash primer should be applied to attain a dry film thickness of 0.3 to 0.4 mils (a transparent film). A good wash primer coating is a must since the top coating can be only as good as the primer coat. As a general rule the wash primer should dry from .05 to 1.5 hours but not more than 2 hours before application of the top or intermediate primer coat. When an intermediate epoxy primer coat is applied, it should be mixed very carefully per the manufacturer's instructions. It should be thinned per manufacturer's instructions and applied to a dry film thickness of 0.8 to 1.0 MILS. The intermediate primer should be allowed to dry a minimum of 0.5 to 1.5 hours depending upon the application temperature and relative humidity. Follow manufacturer's instructions. The intermediate primer coat can be dry-scuffed lightly with No. 400 to No. 600 sandpaper prior to top coat application and give a higher gloss finish. As many coats of paint as desired may be applied. A higher gloss will be attained if the surface is scuffed lightly and tack rag cleaned between each coat.

(2) On steel - The same general procedure used on aluminum can be applied to steel. However, MIL-P-8585 primer or epoxy primer is recommended for the steel coat. If epoxy primer is used, it should have a wash primer (MIL-C-8514) pre-treatment.

D. Painting.

(1) Apply three coats of white base and/or color finish allowing three to five minutes between coats depending upon weather conditions. Allow five to ten minutes between coats in cold, dry weather; in humid weather, allow fifteen minutes between coats.

(2) Use a small round watercolor brush trimmed to a point for application of undiluted touch-up paint to small scratches and bare spots. Do not thin acid resistant black paint or exterior finish touch-up paint for brush-on application.

NOTE

**M20L aircraft are painted with Enflex III urethane enamel. Inquiries concerning application of this finish should be directed to: Pratt & Lambert, P.O. Box 2153, Wichita, KS. 67201.**

CAUTION

**Any flight control surface that is to be repainted should be stripped of all paint prior to repainting. It is required that repainted control surfaces be removed and rebalanced prior to flight per paragraph 27-91-00.**

NOTE

**Never use abrasive polish compounds or harsh soaps and detergents on ureathane finishes. Once the surface gloss is damaged it cannot be restored by polishing.**

# CHAPTER

# 21

# AIR CONDITIONING

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## 21-00-00 - CABIN VENTILATION SYSTEM

The cabin environmental system consist of three ventilating systems that supply heated or fresh air as the pilot or passengers prefer. CABIN AIR, CABIN HEAT and OVERHEAD VENTILATION. The cabin air and heat system controls and vents are located on the console between the pilot and co-pilot seats. Individual fresh air outlets are located on each side of the cabin side panels just forward of the pilots and co-pilots knees. The overhead ventilation system consists of individual outlets (Wemac valves) located between each seat position. All aircraft have a airflow regulator system with the control knob located overhead between the pilot and co-pilot. The systems are basically trouble free but inspection should be made at regular intervals to ensure proper operation.

## 21-40-00 - HEATING

Heat is supplied to the cabin through flexible hoses connected to a heat distribution box assembly and shroud assemblies located on the exhaust manifold on the engine. It is recommended that the condition of these items be checked each time the cowling is removed. This will provide a continuing check for the prevention of carbon monoxide in the cabin. Any deteriorated flexible ducts should be replaced. Heat shrouds should be inspected for cracks or other deteriorations and repaired or replaced promptly. Inspect the exhaust system for any leaks or cracks and replace or repair as needed.

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# CHAPTER

# 24

# ELECTRICAL POWER

# ELECTRICAL POWER

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## 24-00-00 - GENERAL

Two 28 volt, 70 AMP alternators, utilizing a transistorized voltage regulator and over voltage control, supply electrical power. Two 24-volt, 22 AMP HR storage batteries are installed in the tailcone. The alternators, during normal operation, supply power in conjuction with the battery when the master switch and battery switches are ON. The circuit breaker panel is on the right subpanel. The electrical system is capable of supplying current for simultaneous operation of multiple radios, anticollision lights, navigation lights and other equipment. A shunt type combination gauge gives alternator output and line load in % of rated capacity, plus bus voltage.

## 24-30-00 - D.C. GENERATION

## 24-31-01 - ALTERNATOR CHARGING SYSTEM MAINTENANCE

1. Alternator System Servicing.

When the loadmeter shows a higher percentage than the alternators output (at higher RPM), a charging system component is malfunctioning. On-the-plane testing should indicate which component is faulty and needs to be removed from the aircraft for bench testing and repair or replacement.

The alternator charging system requires no special attention; however, improper maintenance procedures can damage the alternator or wiring. There are several precautions that must be observed when servicing an alternator system:

A. Be sure the battery switches are OFF when repairing an alternator or voltage regulator.

B. When auxiliary power or a booster battery is used, be sure the cables are connected correctly--positive to positive and negative to negative. DO NOT by-pass the battery when using Auxiliary Power Source.

NOTE

**It is recommended that the approved Auxiliary Power Cable be connected to the booster battery and then the plug inserted into the auxiliary power receptacle.**

C. When the battery is removed from the aircraft for charging, be sure that the charger is correctly connected. Use the correct charging rate when charging battery, refer to Manufacturers procedures. It is possible to reverse the polarity of a battery by connecting a charger backwards.

D. Be sure to check battery polarity by using a voltmeter prior to reinstallation in the aircraft.

E. Do not leave the battery switches ON when the aircraft is parked.

F. Use an auxiliary ground power unit when trouble shooting electrical accessory equipment or when performing electrical landing gear maintenance and retraction system testing.

2. Alternator System Inspection.

A. Check alternator circuit breaker on the main circuit breaker panel. Reset breaker if open.

B. Check alternator field circuit breaker on main circuit breaker panel. Reset if open.

C. Inspect battery for corroded cable connections; remove and clean cable if corrosion is found.

D. Check charging system wiring connectors to be sure they are clean and tight.

E. Inspect alternator and wiring for damage.

CAUTION

**DO NOT ATTEMPT TO POLARIZE ALTERNATOR. Alternator is polarized every time master switch is turned on.**

## 24-31-02 - VOLTAGE REGULATOR MAINTENANCE

The battery charging rate depends upon the battery condition and the voltage regulator setting. With all equipment turned off and the engine running at 2000 RPM or faster, the normal battery charging rate will be 5 to 35 amperes.

1. Excessively High Charging Rate. Check the following:

A. Fly aircraft for 15 to 20 minutes; charging rate should slowly drop to 10 amperes or less. A very low battery will take longer to show a drop in charging current.

B. Measure voltage with a voltmeter connected to the bus. At 80 degree F., voltage should be 27.5 to 28.0 volts). An excessively high voltage regulator setting will cause excessive battery heating and water loss.

2. Excessively Low Charging Rate. Check battery charging rate (normal rate is not to exceed four amperes). The regulator should not

be considered defective because of a low charing rate until:

A. A voltmeter check indicates that voltage at the bus is below requirements.

B. A battery hydrometer check indicates that battery is not fully charged.

3. Hydrometer Reading. If battery electrolyte temperature is below 80 degree F., subtract four points from hydrometer reading for every 10 degree F. below 80 degree F. If battery acid temperature is above 80 degrees F., add four points to hydrometer reading for every 10 F. above 80 degrees F.

EXAMPLE:
Hydrometer reading = 1.260
Battery electrolyte temperature = 30 degree F.
80 degree - 30 degree = 50 degree
5 x 4 = 20 points
Corrected reading 1.260 - 20 = 1.240

| HYDROMETER READING..... | .....PERCENT OF CHARGE |
|---|---|
| 1.280 | 100 |
| 1.250 | 75 |
| 1.220 | 50 |
| 1.190 | 25 |
| 1.130 or below | Very little useful capacity---discharged |

"Hi" or Overvolt Adjustment.
Refer to Porsche Engine Service manual for repairs.

-- Regulator Adjustment --
No adjustment of regulator can be made.

## 24-32-00 - BATTERY MAINTENANCE

CAUTION
**Battery gases are explosive.**

1. Battery Removal.
   A. Turn master switch off.
   B. Remove tailcone access cover.
   C. Disconnect battery cables, negative lead first, remove battery from aircraft.
   D. Install battery in reverse sequence of removal. **Use a voltmeter to check battery polarity before installation.**
2. Battery Cleaning and Corrosion Removal.
   A. Mix one pound of baking soda in one gallon of water.
   B. Wash battery area and flush battery with the mixture. Do not allow soda water to enter battery cells; permanent damage will result if soda mixes with electrolyte.
   C. Rinse thoroughly with clear water and dry the area.
   D. Test each cell with a temperature corrected hydrometer. Specific gravity should be 1.265 to 1.280 for a fully charged battery.
   E. Check electrolyte level and maintain at split ring.
   F. Clean battery terminals with emery cloth, reinstall and tighten cables. Coat terminals and connectors with petroleum jelly to retard corrosion.

## 24-33-00 - WARNING CIRCUITS

1. Landing gear position lights and warning horn. Red and green landing gear position lights are in the annunciator panel. The gear-down limit switch controls the green gear-down light. Both limit switches control the red gear unsafe light. The power lever operates landing gear warning horn (intermittent tone) when the throttle is retarded and the landing gear is still in the UP position. Check gear warning system during flight periodically for proper operation.

2. Prestall Warning Circuit. The prestall warning horn has a high frequency continuous tone that sounds when airspeed drops to 5 to 10 KIAS above stalling speed. A vane in the left wing leading edge actuates the prestall warning horn switch. (This vane is made of heat treated steel, and any attempt to adjust switch operation by bending the vane will damage the switch). Refer to Section 27-93-00 for adjustment procedures.

3. Low Fuel Warning Circuit. The low fuel indicators will illuminate when a minimum of 2 1/2 gallons usable fuel remains in either left or right hand tank. When it becomes necessary to replace the annunciator panel for any reason other than "low fuel" warning malfunction, the following procedure should be used to set the "low fuel" warning circuits.

A. Calibration Check.

The LOW FUEL Warning circuitry is calibrated by the vendor and controlled by a computer with in the Annunciator unit.

Verify both LEFT and RIGHT FUEL QTY LOW annunciators illuminate when fuel quantity is less than 21/2 to 3 gallons of fuel for each tank.

4. Alternate Air Light Warning Circuit - Annunciator Panel. The light illuminates on the annunciator panel when the alternate air door has opened for any reason.

5. Hi/Low Voltage Warning Circuit - Annunciator Panel. Remove annunciator top cover. Connect a voltmeter to the Aircraft Buss (LEFT). Start engine and run at idle. Add load to bus until "Low Volt" light starts to flash. Adjust RPM to obtain a bus voltage of 26.5 volts. Adjust trim pot (located at center, rear of circuit board) until flashing light just comes on. Repeat for Engine Buss (RIGHT).

**NOTE**

**It may be necessary to adjust trim pot to turn out light at 26.5 volts first. Increase RPM until light goes out and note voltage. Decrease RPM until light flashes on and note voltage. Light should come on at a voltage between 26.4 and 26.6 volts.**

## 24-34-00 - POWER PLANT CIRCUITS

1. Starter-Ignition Circuit. The starter-ignition switch has five positions: OFF, R (right), L (left), BOTH, and START. At the BOTH position the ignition system is on. Turning the ignition switch to START and pushing in, closes both starter solenoids and engages the starter. The starter-ignition switch is spring loaded to return from START to the BOTH position when released.

**CAUTION**

**Do not operate the starter in excess of 15 seconds or re-engage the starter without allowing it to cool for 3 minutes.**

**A. Low Battery Starting Procedures.**

Batteries that have been discharged to the point where they will not turn the engine but have sufficient power remaining for other equipment; should NOT be jumped with another power source for two major reasons:

(1) The discharged aircraft battery is not airworthy because it will not have the necessary reserve capacity required to operate the aircraft electrical system and avionics in the event of the failure of the generating system during flight.

(2) Active material on the positive plate expands when the battery is discharged and the fast recharge from the higher potential source, battery, alternator, rectifier, etc., will severely damage the battery. A slow charge is recommended prior to flight.

2. Oil and Cylinder Head Temperature Gauge Circuits. Both the oil and cylinder head temperature indicators operate electrically. The oil temperature gauge circuit has a resistance bulb on the accessory case. Changes in resistance caused by changes in oil temperature alter current flow rate, thereby varying the magnetic field in the indicator coils. The cylinder head temperature indicator connects to tip sensitive resistance bulbs in all cylinder heads. An increase or decrease in temperature causes an increase or decrease in bulb resistance, varying the magnetic field in the indicator coils.

3. The oil pressure instrument circuit contains an electrical instrument used as a monitor, and a transducer which varies voltage output with pressure changes.

4. The Fuel Flow indicator receives its signal from a potentiometer located at the K-Jetronic Metering unit. Refer to Porsche Engine Service Manual for any maintenance action required.

## 24-35-00 - LIGHTING CIRCUITS

1. Navigation Lights. A circuit breaker switch on the flight panel controls the navigation lights.

2. Landing/Taxi Lights. Two sets of split switches on the flight panel controls illumination of the landing lights and taxi lights . The landing/taxi lights are located in the leading edge of both wings.

3. Cabin Lights (FWD & AFT). Two three-position (Bright, Off, Dim) rocker switches in the headliner controls the two cabin lights.

CAUTION

**The Cabin Light switches are connected directly to the battery and will illuminate either light with the Master switch OFF. Care must be exercised to prevent leaving switch ON and discharging battery.**

4. Anti-Collision Lights. A circuit breaker switch controls the three white anti-collision strobe lights, one located on each wing tip and one on the rudder.

5. Instrument and Radio Lights. These lights are turned on when the NAV light switch is pushed ON. Dimming of these lights are controlled by individual switches located on the console. The instrument light switch controls the compass light. Pushing on the top of each switch brightens the selected set of lights; pushing on the bottom of the switch dims selected set of lights.

CAUTION

**Care must be exercised to prevent shorting light wires when installing or replacing instruments. Shorted wires will cause blown fuses or burned out transistors in the control box.**

6. Map Lights. A push button switch on top of each control wheel center section controls the map lights. .

## 24-36-00 - LANDING GEAR CIRCUITS

1. Limit switches and relays operate the landing gear actuator, 24 volt reversible motor. A landing gear air pressure safety switch, actuated by pitot air pressure prevents landing gear retraction until a safe flying speed is attained. The landing gear control switch operates the actuator motor through the safety switch and relays. When the landing gear control switch is up and a safe flying speed has been attained, the safety switch closes to activate the control relay starting the actuator. As the gear reaches the up and locked position, a mechanical stop opens the limit switch and the actuator stops. When the landing gear control switch is placed in the down position, the gear motor down-relay closes and the actuator starts. When the gear reaches the down-and-locked position, the mechanical stop opens the limit switch and the actuator stops. The gear-up limit switch controls the landing gear un-safe light. The red light comes on when the gear is in transit. The green light comes on when the gear reaches the down-and-locked position; the gear-down limit switch controls the green gear-down light.

2. Gear Safety By-Pass Switch. The gear will not retract if airspeed above the set limit has not been attained when the gear handle is placed in the up position. A warning horn will sound and both "GEAR DOWN" and " GEAR UNSFE" lights will illuminate. Push and hold the red button switch beside the landing gear handle until the gear is up and both lights go out. Pull the circuit breaker "GEAR CONT" or "GEAR RELAY " to stop warning horn. Reset circuit breaker prior to extending gear.

## 24-37-00 - FUEL SYSTEM CIRCUITS

The fuel system has three electric fuel pumps. The fuel quantity indicating system is comprised of two transmitters in each fuel tank and two fuel quantity gauges in the instrument panel.

1. Fuel Pump Circuits. The Main & Boost fuel pumps are controlled by a split switch located on the pilots instrument panel. The Emergency fuel pump is controlled by a separate switch. These switches have a protective cover over them and MUST be in place for proper operation.

2. Fuel Quantity Gauge Circuits. Changes in fuel level varies the resistance in fuel quantity transmitters that send a signal to the fuel quantity gauges. The master and battery switches activate the fuel quantity indicating system. Refer to Section 28-43-00 for Adjustment Procedures.

**24-38-00 - MISCELLANEOUS CIRCUITS.**

1. All flight instruments operate from electrical power or pitot/static source.
2. Heated Pitot Tube. A circuit breaker switch controls the pitot tube heater.
3. Hour Meter (Optional). The hour meter operates from the tachometer. A Hobbs meter may be installed as an option.
4. Cigar Lighter. A cigar lighter is mounted in the right instrument panel.

**24-39-00 - TROUBLE SHOOTING CHARTS**

**24-39-01 - ALTERNATOR TROUBLE SHOOTING**

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Alternator over-charges battery; battery uses excessive water. | Regulator faulty. | Check bus voltage with engine running. Observe aircraft alternator output indicator. Indicator should indicate near zero after ten minutes of engine operation with no aircraft load. Replace alternator if voltage regulator is defective. |
| ALT FIELD circuit breaker trips. | Circuit shorted in wiring. | If circuit breaker trips, check wiring. Repair as required per alternator maintenance information available from Porsche. |
| ALT circuit breaker trips. | Short circuit in wiring. | Disconnect lead from + post of alternator, and reset ALT circuit breaker. If circuit breaker trips, check wiring between alternator and circuit breaker. |
| | Short circuit in alternator. | Reconnect lead to + post of alternator. Rotate propeller by hand to rotate alternator through 360 degrees of travel. If circuit breaker trips replace alternator. |

| | | |
|---|---|---|
| Alternator will not keep battery charged. | Battery malfunction. | 1. Start engine and adjust for 1500 RPM. Alternator Output indicator should indicate a heavy charge rate with all electrical equipment turned off. Rate should taper off in 1 - 3 minutes. The voltmeter should indicate a reading of 28 volts. If charge rate tapers off very quickly and voltage is normal, check battery for malfunction. If alternator output indicator shows a low charge rate and voltage is low, proceed to step 3. |
| | Regulator faulty. | 3. Replace alternator or repair according to alternator maintenance manual available through Porsche. |
| | Defective alternator. | 4. Repair or replace alternator. |

**24-39-02 - RESERVED**

**24-39-03 - BATTERY TROUBLE SHOOTING**

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Discharged battery. | Battery worn out. | Replace battery. |
| | Excessive discharging. | Turn off some equipment when alternator is not charging. |

| | | |
|---|---|---|
| | | Decrease starter usage by using external power whenever possible. |
| | Standing too long. | Remove and recharge battery. |
| | Equipment accidentally left on. | Remove and recharge battery |
| | Impure electrolyte. | Replace battery. |
| | Short circuit (ground) in wiring. | Check wiring. |
| | Low charging rate. | Replace voltage regulator. |
| Cracked cell jars. | Loose hold-down bracket. | Replace battery and secure firmly. |
| | Frozen battery. | Replace battery. |
| Compound on top of battery melts. | Charging rate too high. | Replace voltage regulator. |
| Electrolyte runs out of vent plugs. | Too much water added to battery and charging rate too high. | Drain battery and keep at proper level; replace voltage regulator. |
| Excessive corrosion inside container. | Spillage from overfilling. | Flush container with baking soda solution. |
| | Leaking/clogged vent lines. | Repair/clean vent lines. |
| | Charging rate too high. | Replace voltage regulator. |
| Battery freezes. | Discharged battery. | Replace battery. |
| | Water added and battery not charged immediately. | Always recharge battery for 1/2 hour following addition of water in freezing weather. |
| Leaking battery case. | Frozen electrolyte. | Replace battery. |
| Reversed battery polarity. | Cables connected backwards on battery or charger. | Battery should be slowly discharged completely, then charged correctly and tested. |

| | | |
|---|---|---|
| Excessive water consumption in all cells. | Charging rate too high. | Correct charging rate. |
| Excessive water consumption in one cell only. | Cracked jar. | Replace battery. |

## 24-39-04 - STARTER TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Motor does not operate. | Low battery. | Check and recharge battery if necessary. |
| | Defective, improper, or loose wire connections. | Refer to electrical wiring diagram and check all wiring. |
| | Binding, worn improperly seated brushes; brushes have excessive side play. | Brushes should fit free in brush boxes without excessive side play. Clean binding brushes and brush boxes with a Varsol moistened cloth. A new brush assembly should be run-in until at least 50 percent seated; however, if facilities are not available for running in brushes, seat brush by inserting a strip of No. .0000 sandpaper between brush and commutator with sanded side next to brush. Pull sandpaper in direction of rotation, being careful to keep it in same contours as commutator. |

**CAUTION: Do not use coarse sandpaper or emery cloth.**

| | | |
|---|---|---|
| | | After seating, thoroughly clean brushes and commutator to prevent excessive wear. Keep motor bearing free from sand or metal particles. |
| | Dirty commutator. | If commutator is rough or dirty, smooth and polish with No. 0000 sandpaper. |

| | | |
|---|---|---|
| | | If too rough and pitted, remove commutator and turn down. Blow out all foreign material. |
| | Shorted, grounded, or open armature. | Remove and replace with an armature known to be in good working order. |
| | Grounded or open field circuit. | Test and repair circuit if possible or replace with new parts. |
| Slow cranking speed. | Worn, rough, or improperly lubricated motor or starter. | Disassemble, clean, inspect, and relubricate components, replacing ball bearing if worn. |
| | Same causes as listed with "Motor fails to operate." | Same remedies. |
| Excessive motor brush arcing. | Binding, worn, or improperly seated brush or brushes have excessive side play. | Repair as outlined above. |
| | Dirty, rough, pitted, or scored commutator. | Clean as outlined. |
| Excessive motor brush wear and arcing. | Rough or scored commutator. | Remove and turn down commutator on lathe. |
| | Armature assembly not concentric. | Reface commutator. |

24-39-05

## ANNUNCIATOR TROUBLE SHOOTING

The annunciator on the Mooney M20L is manufactured by International Avionics, Incororated (IAI). When any portion of the annunciator malfunctions IAI should be contacted at the following address: International Avionics, Incorporated, 1611 No. I-35, Suite 428, Carrollton, Tx. 75006; telephone No. (214) 446-1185. Trouble shooting data has been requested and when received will be incorporated into this Service and Maintenance Manual.

## 24-50-00 - ELECTRICAL LOAD DISTRIBUTION

## 24-51-00 - POWER DISTRIBUTION SYSTEM

The power bus distributes direct current power to the electrical system from the alternator and from the battery through the battery relay.

The negative battery lead attaches to a structural ground on the airframe. The battery switches "ON" closes the relay and supplies power to the aircraft electrical system.

CAUTION

**Do not reset a circuit breaker after it has tripped a second time. If necessary to do so to locate the malfunction, be alert for a possible electrical fire. Breakers are "Trip Free" type and cannot be held in the closed position.**

# CHAPTER

# 27

# FLIGHT CONTROLS

# FLIGHT CONTROLS

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## 27-00-00 - GENERAL

The aircraft has dual flight controls and can be flown from either the pilot or co-pilot seat. Dual pairs of foot pedals control the rudder and nose wheel steering mechanisms. The co-pilot pedals are removable if dual brakes are not installed. Push pull tubes actuate the all-metal flight control surfaces. Rod-end bearings are used throughout the flight control systems. These bearings are simple and require little maintenance other than occasional lubrication. Specially designed aluminum-alloy extrusions, that permit flush skin attachment, form the leading edges of the rudder and elevators. Electrically actuated wing flap systems are installed on all models. Longitudinal pitch trim is achieved through a trim control system that pivots the entire empennage around the tail-cone attachment points.

## 27-10-00 - AILERON SYSTEM

1. Ailerons. The ailerons are of all-metal construction with beveled trailing edges. Three hinges of machined, extruded aluminum attach the ailerons to the aft wing spar outboard of the wing flaps. The ailerons link to the control wheel through push-pull tubes and bellcranks. Lead counter-weights static balance the ailerons.

2. Aileron Removal and Installation.

A. Remove control tube attaching bolt, nut, and washer at aileron horn.

B. Remove bolts, nuts, and washers from the three attaching hinges.

C. Remove aileron by pulling it straight aft until hinges are clear; rotate inboard portion down and forward to allow aileron balance weights to clear wing tip.

D. Reinstall aileron in reverse sequence of removal.

E. Recheck bolts for security and safety.

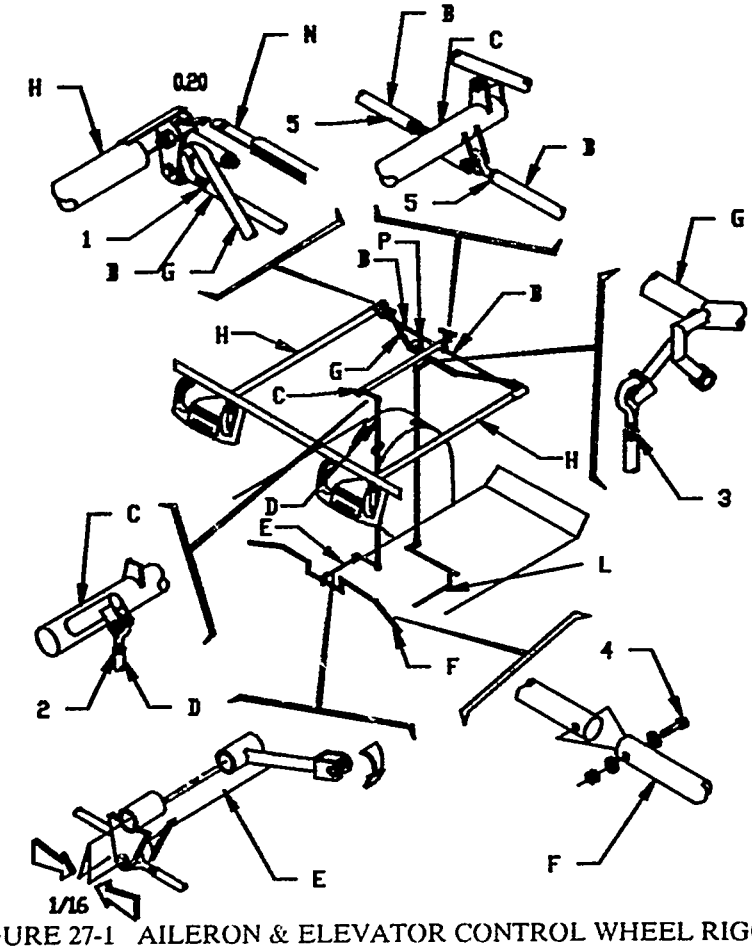



FIGURE 27-1 AILERON & ELEVATOR CONTROL WHEEL RIGGING

3. Aileron Rigging

A. Level control wheels using straight edge(Reference 27-1) and in accordance with step B.

B. Adjust control tube (B) linding control wheel shaft (C) at rod ends (5). Clamp or otherwise secure control wheels in the level position until steps C thru E are completed.

C. Adjust control tube (D) at rod end (2) so aileron bellcrank is 1/16 in. left of center facing forward(Fig.27-1).

D. Adjust aileron control tubes (F) by removing bolt, nut and washer (4)(Fig. 27-1) and loosening locknut (6)(Fig 27-2). The aileron control tube (F) can then be rotated clockwise or counterclockwise so the center of outboard bolt (K) is 4.3 in. from spar web (M). Replace bolt, nut and washer (4)(Fig 27-1), and recheck 4.3 in. dimension.

Adjust aileron push-pull tube (J)(Fig 27-2) at rod end (7) so aileron(in neutral position) is $0^{o}$ to $-2^{o}$ down (with no additional tolerances) as measured with travel board at wing station indicated on travel board P/N GSE 030003.

---
NOTE |
---

**Wing station 147.75 is located at skin splice line between flap outboard end and aileron inboard end**

F. Remove clamps from control wheels, then adjust aileron stops (8)(Fig 27-2) so the DOWN travel is $8^{o}$+/-$1^{o}$. Aileron UP travel may vary from 12-1/2° to 14-1/2° (with no additional tolerance).

---
| NOTE |
---

**The above aileron rigging and adjustment instructions apply to both left and right ailerons.**

G. Rotate the left control wheel clockwise until the ailerons contact the aileron stops (8)(Fig 27-2). Adjust control tube (B) at rod ends (1) & (5)(Fig 27-1) by loosening the lock nut and turning tube clockwise or counteclockwise to attain .020 maximum clearance using feeler (N). Secure locknuts (1) & (5) and recheck .020 dimension. Repeat operation on right control wheel by turning wheel counterclockwise until ailerons contact stops, then proceed as described for the left control wheel. Rigging is now COMPLETE.

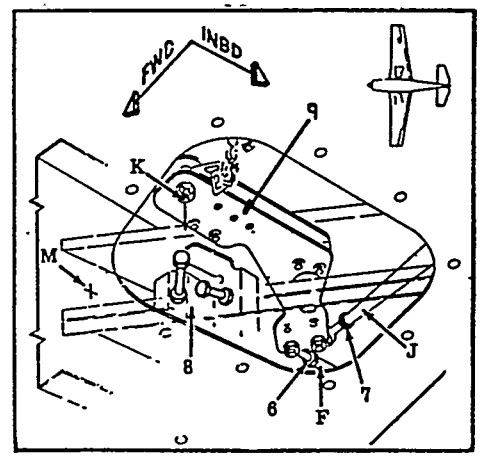



FIGURE 27-2 AILERON STOP ADJUSTMENTS

## 27-20-00 - RUDDER AND STEERING SYSTEM

1. Rudder. The rudder attaches to the aft vertical fin spar at four hinge points. Push-pull tubes and bellcranks link the rudder to the rudder pedals.

2. Rudder Removal and Installation.

A. Detach rudder push-pull tube from rudder horn.

B. Remove attaching hardware at rudder hinges.

C. Remove rudder by pulling straight aft.

D. Install rudder in reverse sequence of removal. Recheck attaching bolts for security and safety.

3. Rudder Rigging and Adjustment.

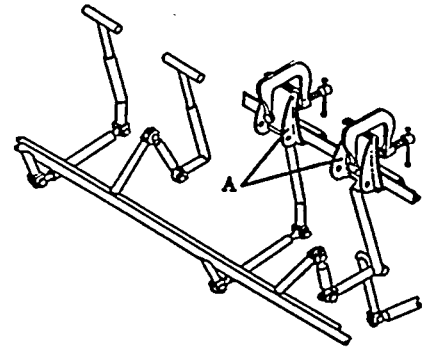



FIGURE 27-3 RUDDER PEDAL ADJUSTMENT

A. Raise aircraft nose. Place approved jack at nose jacking point (See Section 7).

B. Set stabilizer trim control in neutral position (stabilizer parallel with aircraft center line).

C. Clamp pilots rudder pedals (A), (Figure 27-3), in neutral position.

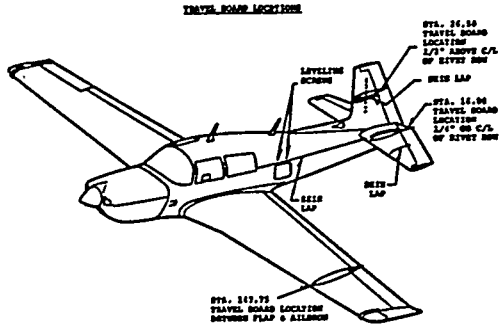


FIGURE 27-3A TRAVEL BOARD LOCATIONS

D. Center nose wheel by removing nut, washer & bolt (1), (Figure 27-4), and adjusting steering linkage at (2). Bolt, nut and washer (5) and (6) must be installed as shown from rear to front.

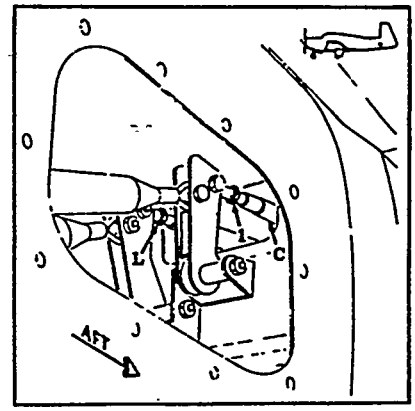


FIGURE 27-5 RUDDER & ELEVATOR TRAVEL ADJUSTMENT

**NOTE**
**Steering stops (3) should be adjusted so .020 clearance exists between adjustment stop (3) and gear truss assembly (4) (Figure 27-4) when rudder is at extreme left and right travel position.**

H. After setting stops, retighten all jam nuts, bolts and secure; recheck all travel limits.

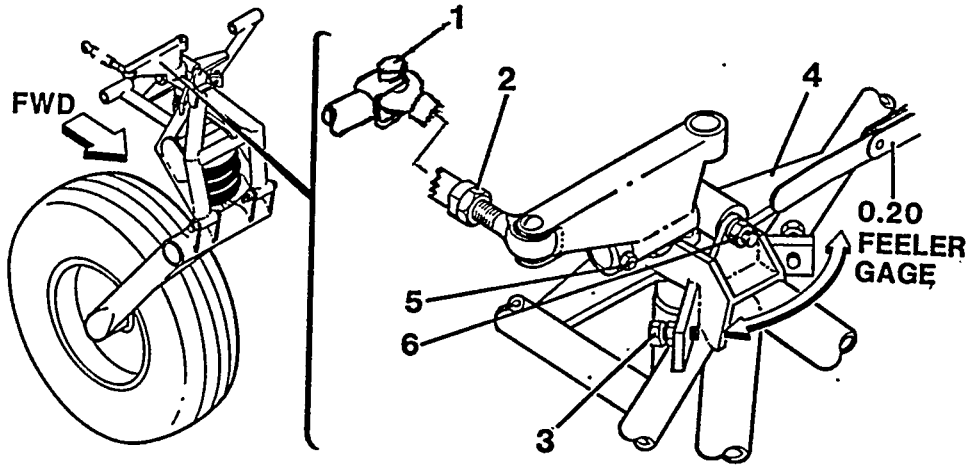



FIGURE 27-4 NOSE GEAR STEERING LINKAGE ADJUSTMENT

E. Adjust control tube (C) at rear tail-cone bulkhead bellcrank, (Figure 27-5), and set rudder by adjusting control tube (D), (Figure 27-6), at rod end bearing (2) 1 degree to the right.

F. Unclamp rudder pedals.

G. Adjust rudder stops (M), (Figure 27-8), so that rudder travel is 23 degrees (+1/-0 degrees) right and left.

**NOTE**
**Measure rudder travel with travel board on rivet line at station indicated on travel board GSE 030005, and with longitudinal trim (stabilizer) set in the 0 degree position. Sta. 26.50 is located 3/4 in. above skin splice on vertical fin.**

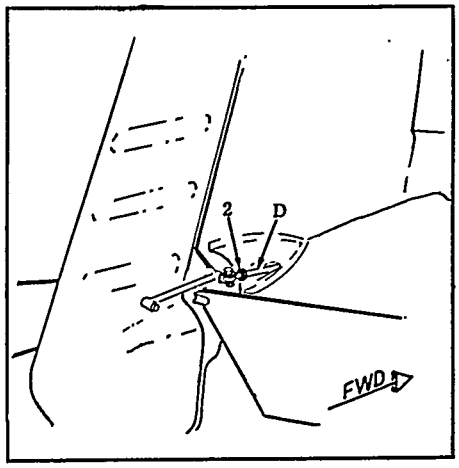



FIGURE 27-6 - RUDDER HORN ADJUSTMENT

4. Allowable Free-Play Limits.

A. Vertical movement at rudder trailing edge - .08 inches.

(1) If excessive free-play exists check the following areas for wear:

(a) Trim screw jackshaft.

(b) Trim link connecting empennage to trimscrew.

(c) Bolts and brackets attaching empennage to tailcone.

5. Rudder Torque Tube Removal. The rudder torque tube should be inspected thoroughly and replaced if any damage is found. Remove shield from front of cabin floorboard that covers torque tube. Remove attaching hardware from hinges and rudder pedal control rods. Carefully remove torque tube by sliding out toward the right side of cabin and through cabin door.

NOTE

**Control tube wear allowables. If any portion of the control tube exceeds .007 wear per wall or .014 in reduction in diameter, the tube must be replaced.**

## 27-30-00 - ELEVATOR SYSTEM

1. Elevators. Elevator construction is essentially the same as that of the ailerons. Both elevators attach to the stabilizer at four hinge points. Push-pull tubes and bellcranks link the elevators to the control yoke. Lead counterweights static balance the elevators. A lead bob-weight under the instrument panel refines aircraft handling in flight.

2. Elevator Removal and Installation.

A. Remove push-pull control tube by taking off all attaching bolts, nuts, and washer.

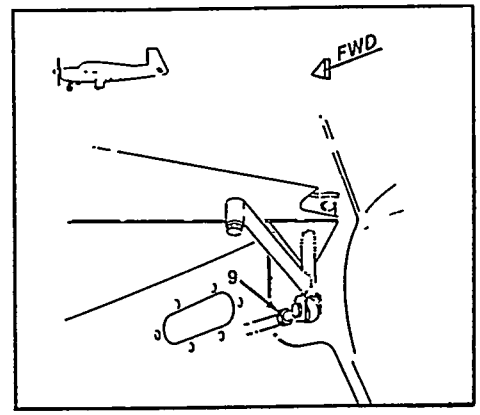



FIGURE 27-7 ELEVATOR HORN ADJUSTMENT

B. Remove bolts, nuts, and washers from the four attaching hinges.

C. Remove elevator to the rear.

D. Install elevators in reverse sequence of removal. Recheck attaching bolts for security and safety.

3. Elevator Rigging and Adjustment

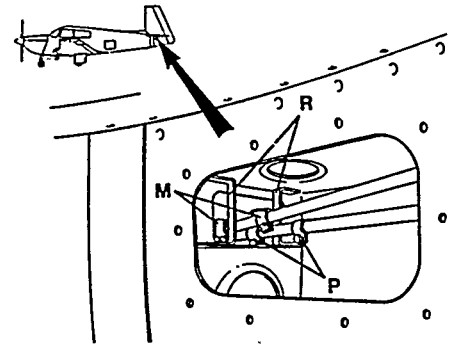



FIGURE 27-8 RUDDER & ELEVATOR STOP ADJUSTMENT

A. Adjust rod end bearing (3), (Figure 27-1), at control yoke (G) for control shaft (H) clearance from firewall and control yoke and bob weight (P) clearance from fuselage structure.

B. Level aircraft (Section 8-00-00) and set control column in neutral with stabilizer parallel to center line of aircraft (use travel board,P/N GSE 030004-503, and bubble protractor to level stabilizer with aircraft reference.

**NOTE**
**Measure elevator travel from 0 degrees stabilizer thrust line with travel board positioned at stabilizer station 16.00 as indicated on travel board P/N GSE 030004 and with stabilizer at 0 degrees. (See Figure 27-11 and Figure 27-3A for travel board placement.**

C. Set stops (P), (Figure 27-8), in empennage stinger for elevator uptravel and downtravel of 20 degrees to 22 degrees.

**NOTE**
**Adjust rod end bearings of control tube (L), (Figure 27-5), at rear tailcone bulkhead, at elevator horn rod end (9), (Figure 27-7) or as last resort at main spar adjustable rod end bearing to obtain additional elevator travel.**

D. After stops are set rotate elevators thru full range of travel to assure solid contact with stops and that nuts and bolt heads clear stop limiter. Stop limiter may be bent to obtain clearances and contact (R), (Figure 27-8).

E. Rotate trim full down to check clearance of bellcrank at wing rear spar. Adjust rod end bearing at rear tailcone bulkhead if needed for clearance. Recheck elevator up and down travel.

F. Rotate trim full up to check that up stop makes solid contact on stop limiter.

G. Retighten all jam nuts, attach bolts and secure as necessary; recheck all control tube clearances and travel limits.

## 27-31-00 - VARIABLE DOWNSPRING SYSTEM

A spring hooked into the elevator control system in the tailcone refines the feel of the elevator in flight. A bellcrank and cable tailors the spring tension appropriate to the trimmed position of the stabilizer.

**NOTE**
**Negative stabilizer (- degrees) settings mean that stabilizer leading edge is moved down relative to the thrust line.**

A. Set stabilizer to -7 degrees position and elevators full down.

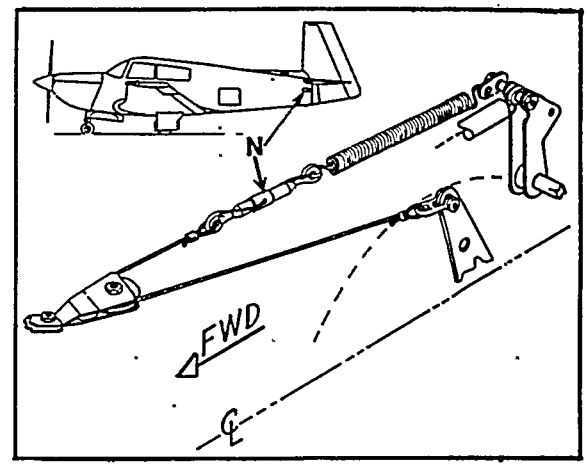



FIGURE 27-9 VARIABLE DOWNSPRING

B. Adjust turn buckle (N) to 2.5 to 3.5 lb. tensionmeter reading on cable, (Figure 27-9).

C. Retrim to maximum positive setting and check for clearance between cable end and pulley sheave. Tensionmeter reading should be 20 lb. maximum.

## 27-40-00 - STABILIZER TRIM SYSTEM

To provide pitch trim control, the entire empennage pivots around its main hinge points. The system consists of a manually operated actuator that operates a series of torque tubes and universal joints connected to a jack screw on the aft tailcone bulkhead.

1. Nose Down Stabilizer Trim Control Rigging and Adjustment. Level aircraft per Section 8-00-00.

A. Loosen setscrew in stop (A) (Figure 27-10) and turn stop (A) clockwise or counterclockwise to align aft edge of stop (A) with last thread of trimscrew (C) (Figure 27-10). Tighten setscrew and turn trim control wheel to full NOSE DOWN position (trim screw nut (F) against stop (A).

B. Disconnect torque shaft (B) from trim screw (C), (Figure 27-10).

C. Turn disconnected torque shaft (B) clockwise or counterclockwise until horizontal

stabilizer, as measured using the travel board, P/N GSE 030004-503, and bubble protractor, as shown by (Figure 27-11), is within the following limits ( $+3.8^{\circ}$ to $+4.2^{\circ}$.

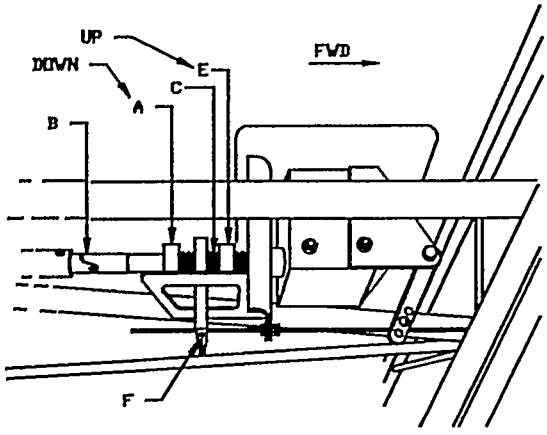



FIGURE 27-10 TRIM CONTROL ACTUATOR RIGGING

**NOTE**
**Positive (+ degrees) stabilizer degrees mean that stabilizer leading edge is moved up relative to thrust line.**

D. Connect torque shaft (B) to trim screw (C) (Figure 27-10). NOSE DOWN stabilizer trim control rigging is now complete.

2. Nose Up Stabilizer Trim Control Rigging and Adjustment.

A. Loosen setscrew in stop (E) (Fig. 27-10) and turn stop on threaded shaft to move it toward the trim screw gear box. Turn trim control wheel toward NOSE UP position until horizontal stabilizer is within the following limits: -6.5 degrees to -7.0 degrees.

**NOTE**
**Negative stabilizer (-degree) settings mean that stabilizer leading edge is moved down relative to thrust line.**

B. Rotate stop (E), (Figure 27-10) clockwise or counterclockwise to make contact with trim screw nut (F). Tighten setscrew. NOSE UP stabilizer trim control rigging is now complete.

3. Stabilizer Trim Indicator Rigging.

The indicator is connected to the trim control wheel via a potentiometer and electrical wires and indicates stabilizer position relative to the aircraft thrust line. Set horizontal stabilizer to full nose down position. loosen two set screws on arm assy on potentiometer shaft. Rotate shaft of potentiometer to achieve 100 Ohms. Tighten the two set screws and recheck resistance for 95 to 105 Ohms. Indicator should read full nose down. Indicator is programmed to read resistance change of potentiometer & indicate T/O & NOSE UP position.

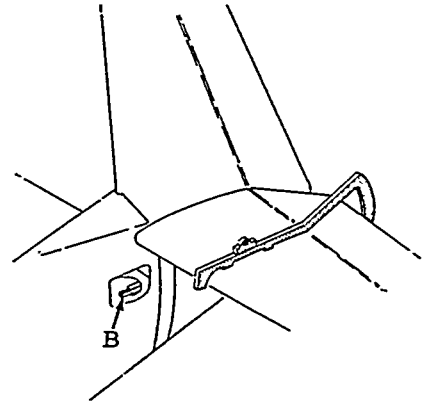



FIGURE 27-11 STABILIZER TRIM ADJUSTMENT

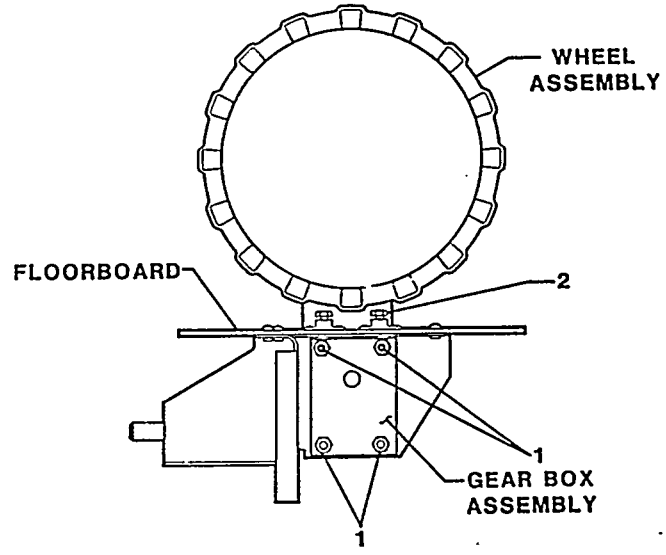



FIGURE 27-12 STABILIZER TRIM CHAIN

A. **Stabilizer Free Play Limits**

(1) Fore and aft movement at stabilizer tip - .12 inches.

(2) Vertical movement at stabilizer tip - .10 inches.

**NOTE**
**When removing trim screw from empennage use a block of wood cut to fit opening between tailcone and empennage to prop empennage up when trim screw is removed.**

4. Electric Trim.

A. The clutch torque for the electric trim system should be adjusted by qualified Avionics shop for the following settings to operate the autopilot systems properly:

(1) KFC 200 - 21 +/- 2 inch lbs.
(2) KAP 100 - 21 +/- 2 inch lbs.
(3) KFC 150 - 21 +/- 2 inch lbs.
(4) EDO AIRE - 18 inch lbs.
(5) S-TEC - 30 inch lbs.

5. Stabilizer Trim Chain Adjustment. (Reference Figure 27-12).

A. With the four mounting bolts (1) slack, adjust the two NAS428-3-4 bolts (2) to obtain maximum tension on chain without causing binding.

**27-40-01 - Trim System Troubleshooting**

| | |
|---|---|
| BINDING | Check control tubes at bulkhead grommets for rub marks. |
| | Check Trim Actuator threads for galling or not lubricated,lube per Sect. 5. |
| ELECTRIC CLUTCH SLIPPING | Check BINDING symptoms above.<br>Check for proper clutch settings.<br>Confirm full bus voltage is available at trim motor. |

**NOTE**
**Maximum wear on trim tube, where it passes thru bulkhead grommets, is .007 inch per wall or .014 inch diameter.**

Lubricate the actuator gear box and ball screw at intervals with lubricants prescribed in Chapter 5.

2. Wing Flap Removal and Installation.

## 27-50-00 - WING FLAP SYSTEM

1. Push-pull tubes and bellcranks interconnect the flaps. The flaps are operated by an electrical motor driven actuator (1) connected to a jack shaft (2). The jack shaft is connected to actuator bracket (3) (Figure 27-13) on each flap just outboard of hinges (4) by a push-pull rod end bearing (5) and hardware. Each flap pivots about four hinges. Travel is controlled by limit switches (6) and (7) and UP stops located at outboard hinges). Flap position is indicated in the cockpit through a potentiometer system (8) connected to the jack shaft via linkage arms (9).

The flap switch is self centering from the down position and located on the console. The flaps can be retracted completely by placing the switch in the up position or to any setting between 0 and 33 degrees by holding in up position to setting desired and then centering to stop the actuator.

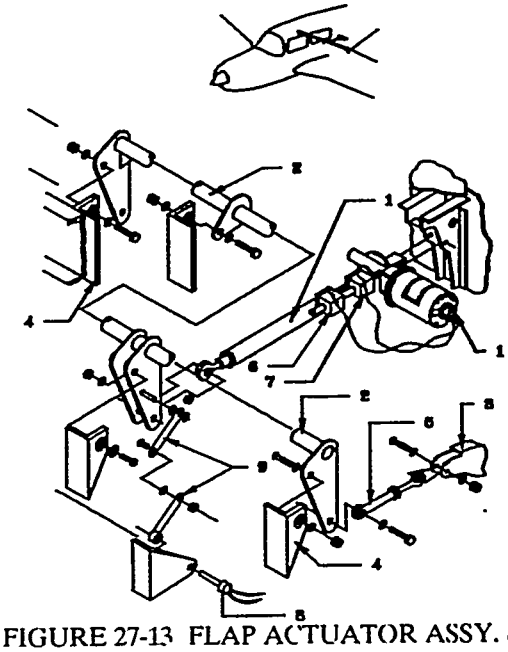


FIGURE 27-13 FLAP ACTUATOR ASSY. & INSTL.

A. Remove wing flap hinge fairing to expose flap push-pull tube.

B. Remove bolt, nut, and washer from flap-actuating attachment.

C. Remove bolts, nuts, and washers at flap hinge points.

D. Remove flap by pulling down and aft.

E. Install wing flaps in reverse sequence of removal. Recheck security and safety of attaching bolts.

3. Wing Flap Rigging and Adjustment.

**NOTE**

**Flap deflections are to be measured with travel board GSE 030003 at the station indicated on the travel board. (See Section 27-20-00,Fig. 27-3A)**

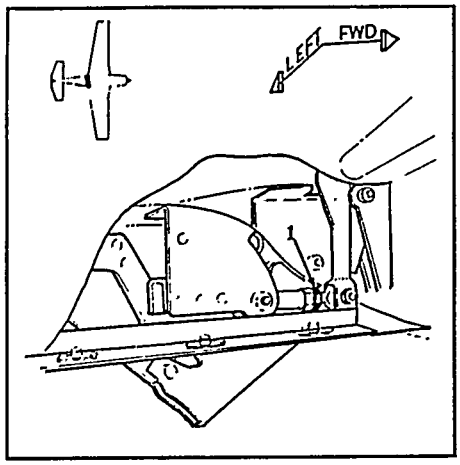



FIGURE 27-14 - WING FLAP ADJUSTMENT

A. Adjust right and left inboard linkage at rod end bearing (1), (Figure 27-14) to obtain a flap deflection of 33 degrees (+0 degree/-2 degrees). Retract flaps to 0 degree (+/-2 degrees); set flap outboard travel stops (not illustrated) so that flaps align with ailerons in neutral position.

B. Flap Indicator Rigging.

Set flaps to full down position (33 deg.), loosen two set screws on arm assembly (1) attached to potentiometer shaft (2). Rotate shaft of potentiometer to obtain 100 Ohms. Tighten the two set screws; recheck potentiometer resistance for 95 to 105 Ohms (Figure 27-15). The flap indicator should depict full down position. Indicator is programmed to depict T/O or Full UP position from resistance changes of potentiometer.

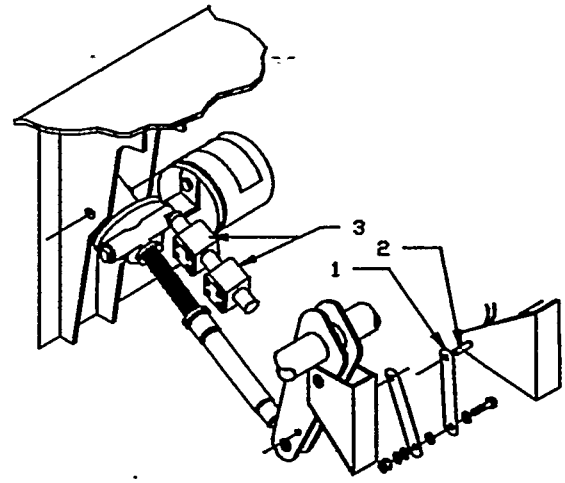



FIGURE 27-15 WING FLAP IND. ADJ.

C. The limit switches, (3), (Figure 27-15) should be adjusted so that under flight loads the actuator over run will not allow the flaps to exceed either up or down positions.

## 27-60-00 - AILERON/RUDDER INTERCONNECT SYSTEM.

1. With controls in neutral position, locate 110002-101 bracket, on aileron control tube, so that the end of 110002-005 bellcrank assembly will be 2.25 inl AFT of 310020 fuselage former.

2. Holding controls in neutral position, install springs on -005 bellcrank & 110002-025 & -027 brackets & position -025 & -027 brackets on rudder control tube so the installed length of each spring is 4.90 in.

3. Make sure PK screws are in place to secure all three brackets.

## 27-90-00 - MISCELLANEOUS

## 27-91-00 - CONTROL SURFACE STATIC BALANCING

When repairing or repainting the control surfaces they must be rebalanced according to the following procedures.

**CAUTION**

**All control surfaces should be stripped prior to repainting.**

**NOTE**

**Maximum and minimum static unbalance moments apply only to ailerons that have been painted.**

## 27-92-00 - EQUIPMENT AND MATERIALS - STATIC BALANCING

The design of the balancing fixture is not critical providing the requirements of this section are met.

Obtain or otherwise fabricate two (2) knife edges and supports approximately one (1) foot in height such that they can be placed on a table and be stabilized to prevent tipping (See Fig. 27-16).

Fabricate or otherwise obtain a "control weight" and hanging string (Fig.27-16,item A) such that the total weight of the string and weight agrees exactly with the values listed for the control surface to be balanced.

**NOTE**

**Accurate weight measurements can be obtained at any United States Post Office.**

1. ELEVATOR: 3.50 LBS. (6.000 Arm)
2. RUDDER: 3.00 LBS. (5.8125 Arm)
3. AILERON: 2.00 LBS. (5.625 Arm)

Fabricate or otherwise obtain a "gauge weight", item B, Fig.27-16, of exactly 12 oz. (.75 lb.) such that all three dimensions are approximately equal (cube, cylinder or pyramid). The size of the gauge weight is not critical as long as its weight in oz. is accurately known. However, if a 12 oz. gauge weight is used, computation of moments will not be necessary and the dimensions in Table 27-18 may be used.

## 27-93-00 - GENERAL PROCEDURES - STATIC BALANCING

1. A line drawn through the hinge line support points must be level and perpendicular to the supporting knife edges.

2. The supporting knife edges must be horizontal and parallel to each other within the requirements of step 1. above.

3. The control surface must be supported in normal flight attitude with the hinge line level (except as specified in 27-93-01. 2.)

4. The area in which balancing operations are performed must be free of drafts or other air movement which might affect the balancing operation.

5. The balancing device must include a means to accurately measure the distance of the gauge weight from the hinge line.

6. Control surfaces must be rechecked for balance after any painting, stripping, repairs or alterations to any control surface.

## 27-93-01 - DETAIL PROCEDURES - STATIC BALANCING

1. Devise a bearing surface for supporting the control surface hinge line on the knife edges providing a friction free support.

2. Place surface on knife edges and level hinge line (ailerons should be balanced inverted for greater sensitivity). Rest trailing edge on aft support and adjust aft support to put the surface in its normal (0 degree) chordwise flight attitude.

3. Place gauge weight (B) on top and near the trailing edge of the surface to hold surface down.

4. Suspend the control weight (A) from the balance horn in the following positions:

A. Rudder & Elevator: Suspend weight at the seam formed by the balance weight and balance horn ribs (See Figure 27-17).

B. Aileron: Loosen forward most balance weight bolt and suspend weight from shank of bolt (See Figure 27-17).

5. Gradually move gauge weight forward toward hinge line until the point is reached where the trailing edge tends to leave the trailing edge support.

6. Accurately measure and record the distance "X" perpendicular from the hinge line to the center of the gauge weight. The gauge weight distance must be within the limits provided (Table 27-18).

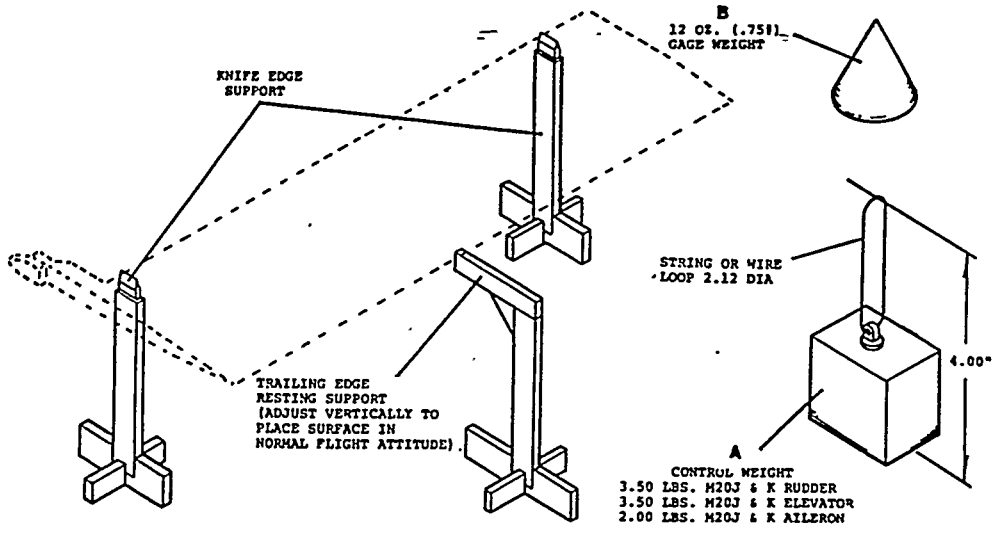



FIGURE 27-16 - CONTROL SURFACE STATIC BALANCE DIAGRAM

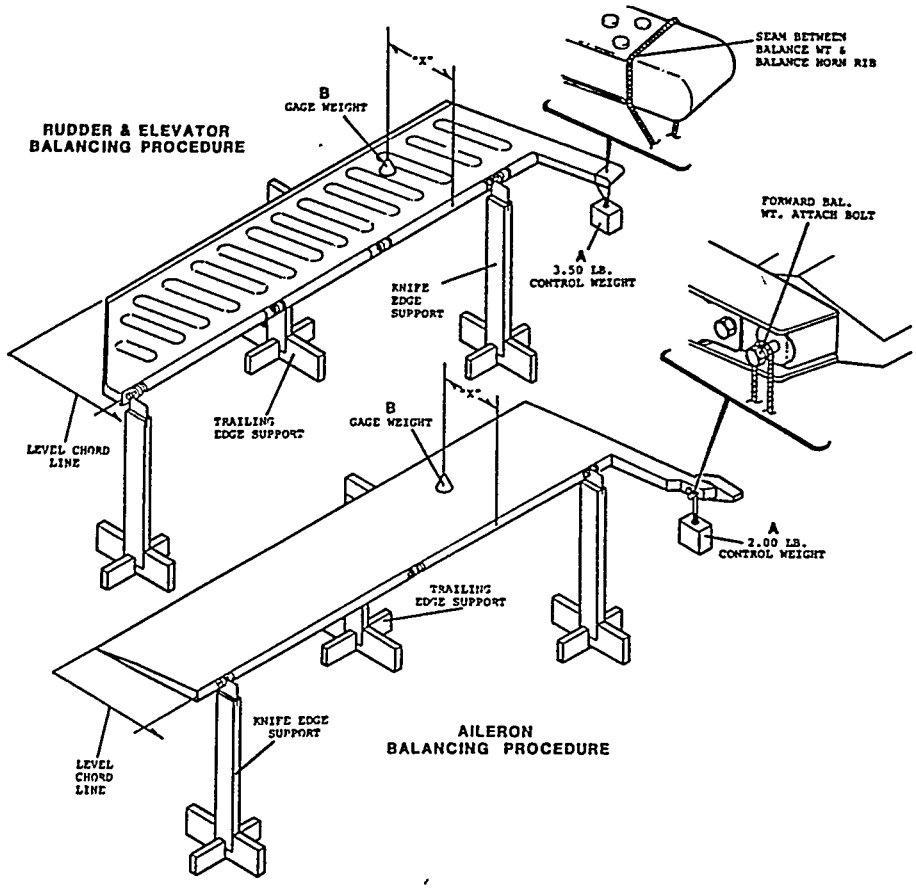



FIGURE 27-17 FLIGHT CONTROL BALANCING PROCEDURES

7. If the gauge weight is forward of the distance limit the surface is under balanced and weight must be added, and the balance rechecked.

8. If the gauge weight is aft of the distance limit the surface is overbalanced and weight must be removed, and the balance rechecked.

9. Table 27-19 provides the absolute balance limits used in developing the "X" distance limits.

NOTE

**The "absolute limits" must be satisfied if a different balance procedure is used requiring calculation of balancing moments.**

| CONTROL SURFACE | CONTROL WEIGHT | LIMIT DESCRIPTION | GAUGE WEIGHT (12 oz) DISTANCE LIMITS -Note 2 |
|---|---|---|---|
| Elevators 430026-505 & -506 | 3.50 LB. | Underbalance<br><br>Overbalance | +9.08 in.<br>to<br>+16.79 in. |
| Rudder 460043-505 | 3.00 LB. | Underbalance<br><br>Overbalaance | +6.78 in.<br>to<br>+16.78 in. |
| Aileron 230015-505 & -506 | 2.00 LB. | Underbalance<br><br>Overbalance | +12.68 in.<br>to<br>+14.90 in. Note 3 |

GAUGE WEIGHT DISTANCE LIMITS
(for balancing with specified control weight)
TABLE 27-18

NOTE: 1. (+) Positive dimension indicates distance aft of hinge line.

2. Values in this column only applicable for 12 oz. gauge weight used in combination with specified control weight.

3. Value for aileron distance limit adjusted for C.G. of gauge weight on inclined surface (6.8 degree) maximum error when measuring top point of "cubic proportioned - right circular cone" gauge weight.

| CONTROL SURFACE | ELEVATOR | RUDDER. | AILERON |
|---|---|---|---|
| ABSOLUTE BALANCE LIMITS- Note 1 | +15.00 In-# to +9.22 In-# | +12.50In-# to +5.00In-# | +6.23 In-# to +0.00 In-# |
| CONTROL WEIGHT MOMENT - Note 2 | 3.50 # @ -6.2322 In. Effective Arm = -21.8127 In-# | 3.00#@-5.8627In. EffectiveArm =-17.588In-# | 2.00 # @ -5.5902 In. Effective Arm = -11.1804 In-# |
| BALANCE LIMITS WITH CONTROL WEIGHT | -6.8127 In-# to -12.5927 In-# | -5.088In-# to -12.588In-# | -9.512 In-# to -11.1804 In-# |
| DISTANCE LIMITS (Divide by .75 LB) | +9.08 In-# to +16.79 In-# | +6.78In. to +16.78In. | +12.68 In. to +14.90 In. |

COMPUTATION FIELD BALANCE LIMITS
TABLE 27-19

NOTES:1. Type design data requirements.
2. Effective arm determined by balance test with calibrated gauge and control weights.
3. (+) Positive moments indicate T.E. Heavy condition.
4. (+) Positive dimensions indicate distance aft of hinge line.

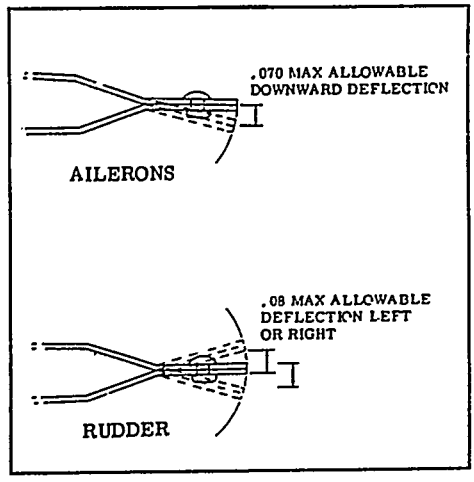
NOTE

**If balance limits cannot be met with existing weight on any control surface a lighter or heavier weight can be obtained through a Mooney Service Center. This approach should be examined before reworking any repair or restripping and repainting the affected control surface.**

## 27-94-00 - CONTROL SURFACE - TRAILING EDGE

**NOTE**
**Verify flight control rigging is correct before bending trailing edge.**

1. Trimming. A special pair of widenose vicegrip pliers are to be used to bend the trailing edges as necessary (See Figure 27-20).




TRAILING EDGE TRIMMING - FIGURE 27-20

**NOTE**
**The aileron trailing edge MUST NOT BE BENT UP under any circumstance. Any deformed rivets must be replaced after trimming aileron or rudder trailing edge.**

A. Aileron. To correct for a left wing-heavy condition, bend right aileron trailing edge down; to correct for a right wing-heavy condition, bend left aileron trailing edge down.

B. Rudder. The rudder trailing edge may be trimmed right or left as required.

C. Elevator. A full span tab is built into each elevator trailing edge and is fixed 7 degrees (+/-) 1/2 degree trailing edge down. No further tolerance is allowed.

## 27-95-00 - STALL WARNING - MAINTENANCE PRACTICES

1. Stall Warning Switch Removal.

A. Remove the screws or rivets attaching the access cover aft of the switch on the lower wing surface.

B. Remove the two adjustment screws which hold the switch to the wing leading edge.

C. Disconnect the two wires from the switch.

2. Stall Warning Switch Installation.

A. Connect the electrical wires to the switch.

B. Position the switch in the opening of the lower wing leading edge, install the two adjustment screws.

C. Replace the access cover securely.

D. Adjust the switch. See STALL WARNING INDICATION SYSTEM ADJUSTMENT.

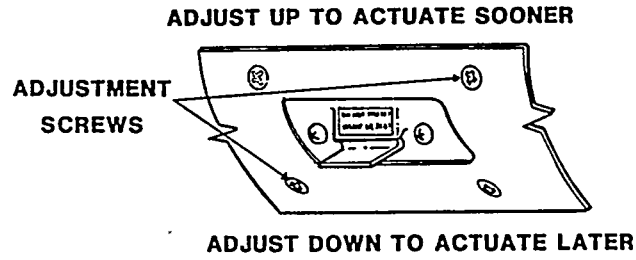
3. Stall Warning Indicating System Adjustment (Figure 27-21). The stall warning switch is adjusted when the airplane is test flown at the factory. Should it require readjusting, proceed as follows: Locate the switch installation on the under surface of the left wing leading edge and loosen the two phillips head screws, one on either side of the vane. If the stall warning has been activating too early, pull the vane back and down. If the stall warning has been activating too late, push the vane up and forward. Moving the vane with the phillips head screws loosened moves the entire unit up or down inside the wing, causing the switch to be closed earlier or later. Retighten the screws after making each adjustment.

**NOTE**
**NEVER TRY TO ADJUST THE SWITCH BY BENDING THE VANE. This part has been heat treated and cannot be bent without damaging or breaking the vane or switch.**

As a rule of thumb, moving the vane tip 1/4 inch will change the time the stall warning actuates by about 5 mph of indicated air speed. The only way to test the accuracy of the setting is to fly the airplane into a stall, noting the speed at which the warning horn comes on and the speed at which the full stall occurs. The stall must be made in various configurations, clean, gear and flaps down and power on and power off. It may be necessary to make several alter-

nate adjustments and test flights before the desired setting can be reached.

The stall warning should actuate at no less than 5 KTS. nor more than 10 KTS. preceding the stall and shall continue until the stall occurs in power off configuration. The rate of speed reduction shall not exceed one knot per second with the airplane trimmed to 1.5 times the stall speed. The switch setting should be checked and adjusted as necessary whenever a wing or wing leading edge is replaced or extensively repaired, or if a new switch is installed. The switch should require no adjustment in normal service.




STALL VANE ADJUSTMENT - FIGURE 27-21

## 27-95-01 - TROUBLE SHOOTING - STALL WARNING SYSTEM

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Warning system inoperative. | Warning circuit breaker tripped. | If circuit breaker persist in tripping, check for grounded circuit. |
| | Open circuit. | Check for continuity. |
| | Defective warning horn switch. | Replace switch. |
| | Defective warning horn. | Replace horn. |
| Horn continues to blow. | Defective warning horn switch. | Replace switch. |

# CHAPTER

# 28

# FUEL

# FUEL

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## 28-00-00 - GENERAL

Internally sealed, integral fuel tanks are in the forward inboard sections of the wings. Fuel feeds from either tank to a selector valve thru a gascolator, with a low-point drain, through the fuel pumps to the fuel injector system on the engine. Fuel quantity indicators are electrically operated with 2 transmitters located in each tank. Visual fuel level indicators at the 25-gallon level in each tank, can be seen through the filler ports. Optional visual fuel quantity gauges are located on the wing and may be used for partial fuel loads as necessary.

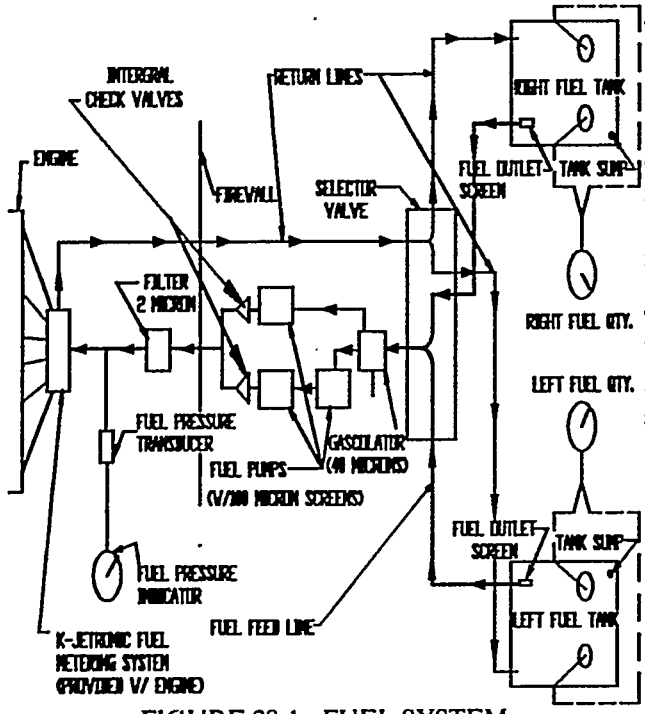



FIGURE 28-1 FUEL SYSTEM

## 28-00-01 - FUEL FILLER CAP ASSEMBLY MAINTENANCE

Fuel filler port cap assemblies should be checked periodically for proper sealing and should be serviced occasionally to prevent hard to open or close conditions.

1. The o'ring seal (1) (Figure 28-2) around the cap assembly should be kept clean and free of dirt or grit that might cause abrasive action on seal or mating flange. Occasional lubrication with petroleum jelly or Tri-Flow will keep the o'ring soft and pliable.

2. The shaft (2) running through the center of the cap housing, that actuates the rotating lock plate (3) should be lubricated occasionally with Tri-Flow, or equivalent, to prevent binding while opening or closing the cap assembly. This should also lubricate the o'ring (4) that seals this shaft.

**WARNING**
**Water can enter the fuel tank through a loose fitting cap, deteriorated O'rings or damaged cap. This should be corrected as soon as possible.**

3. The sealing capability of each cap assembly should be checked periodically and at each annual inspection. This can be accomplished per the following procedures:

A. Remove cap assembly from wing filler port and inspect o'ring (1) for any damage, cracks or brittleness. Remove and replace if necessary.

B. Adjust tension of shaft (2) and rotating lock plate (3) by removing cotter pin (5) from nut (6) on threaded portion of shaft (2). Tighten nut (6) so cap assembly handle (7) can be opened, turned and shut with hand pressure and still provide the necessary seal of cap assembly to keep water from entering fuel tank.

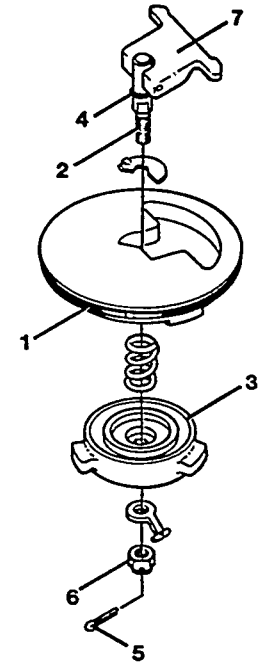



FIGURE 28-2 FUEL FILLER CAP MAINT.

NOTE
**Fuel selector should be in the OFF position before proceeding with paragraph C. to pressurize the fuel tanks.**

C. Connect rubber hose to each tank's vent line. Apply only one-half pound (1/2 lb.) air pressure. Check for fuel cap leaks by soaping circumference of filler cap assembly and observing bubbles. Replace o'ring if bubbles are observed and adjustment of the nut does not stop the leak.

CAUTION
**Use only one-half (1/2) pound of air pressure in tank.**

## 28-10-00 - STORAGE

## 28-11-00 - FUEL TANK FIELD REPAIR

This paragraph outlines the procedures recommended for repair of the integral fuel tanks. Tank repairs should not be attempted until these instructions are fully understood. Refer to Service Bulletin M20-230 during resealing of the tanks for drain holes to be left open.

1. Approved Materials.
   A. Sealants.

WARNING
**Sealants are safe only when handled with reasonable care. Avoid ingestion and all contact with the body, especially with open breaks in the skin. Wash hands before eating or smoking. If accelerator contacts the skin, flush area with warm water.**

(1) Brush sealant - PR1422-A-1/2 or A-2 or CS3204 A-1/2, A-2 (MIL-S-8802D Class A).

(2) Filleting Compound - PR1422 B-1/2, B-2 or CS3204 B-1/2, B-2 (MIL-S-8802D Class B).

(3) Removable access panel sealant - PR1403-G-B2.

(4) Protective sealant - PR1005-L (MIL-S-4383B).

B. Gloves -- Polyethylene.

C. Metal cleaning solvent - Turco 657 wipe solvent.

D. Cheese cloth.

E. Turco leak detector or bubble fluid.

F. Methyl ethyl keytone (MEK) (thinner for PR 1005-L).

NOTE
**Approved materials may be obtained from your local Mooney Marketing or Service Center. Sealants may also be obtained from Products Research Co., 5454 San Fernando Road, Glendale, CA 91209; or Chem Seal Corp., 11120 Sherman Way, Sun Valley, CA 91352.**

2. Handling and Mixing Sealants.
   A. Sealant Material Characteristics.

(1) Application life is the time that the mixed compound remains suitable for application. Application life ratings are always based on standard conditions of 75 degrees F. and 50 percent relative humidity. For every 10 degree F. rise in temperature, application life and cure time is reduced by half; for every 10 degree F. drop in temperature, application life and cure time is doubled. High humidity at the time of mixing slightly reduces the sealant application life.

(2) Maximum unopened container life, with sealant at 80 degree F., is six months.

(3) Sealant application life, tack-free curing time, and curing rates are as follows:

(a) PR1422 or CS3204 Brush Sealant

| Class A | Tack-Free Time (HOURS) | Cure Rate (HOURS) | Application Life (HOURS) |
|---|---|---|---|
| PR1422 A-1/2 | 10 | 30 | 1/2 |
| PR1422 A-2 | 36 | 72 | 2 |
| CS3204 A-1/2 | 8 | 30 | 1/2 |
| CS3204 A-2 | 24 | 72 | 2 |

(b) PR1422 or CS3204 Filleting Compound (and on wing walk access panel)

| Class B | Tack-Free Time (HOURS) | Cure Rate (HOURS) | Application Life (HOURS) |
|---|---|---|---|
| PR1422 B-1/2 | 10 | 45 | 1/2 |
| PR1422 B-2 | 36 | 72 | 2 |
| CS3204 B-1/2 | 8 | 30 | 1/2 |
| CS3204 B-2 | 24 | 72 | 2 |
| CS3204 B-4 | 36 | 76 | 4 |

Follow procedures accompaning sealant to properly seal fuel tanks.

(c) PR1403-G-B2 Access Door Sealant (except on wing walk access panel)

| Class B | Tack-Free Time (HOURS) | Cure Rate (HOURS) | Application Life (HOURS) |
|---|---|---|---|
| B-2 | 10 | 48 | 2 |

(d) PR1005L Top Coat Protective Sealant

Allow 24 hours cure time prior to refueling tanks.

B. Sealant Mixing

(1) For best results, use kits with proper proportions of base compound and accelerator.

(2) To avoid excessive air entrapment, slowly stir accelerator into base compound. Continue mixing for SEVEN to TEN MINUTES. Scrape sides and bottom of container to include all compound in mixture and to insure uniform blending. Scrape mixing paddle on edge of container to remove unmixed compound. Be sure to use all of the accelerator.

(3) Place a small amount of mixture on a clean strip of aluminum and spread sealant. Visually examine sealant film to determine whether accelerator is visible in particle form. If particles of accelerator are visible, continue mixing operation. If course particles of accelerator persist after mixing thoroughly, reject the mixed batch.

**NOTE**

**Sealant in tube form have mixing instructions on each tube. Read and comply with these mixing instructions prior to sealant application.**

3. Cleaning Surfaces to be Sealed.

A. Clean metal surfaces to be sealed with Turco 657 Wipe Solvent or Methyl Ethyl Ketone. Wipe surface dry with a clean cloth. Do not allow solvent to evaporate.

B. Allow cleaned surface to dry five to ten minutes before sealant application.

**NOTE**

**Apply sealant as soon as possible after cleaning. Store and handle parts in a manner that will prevent finger prints, dust, dirt, or other foreign substances from accumulating on surfaces to be sealed.**

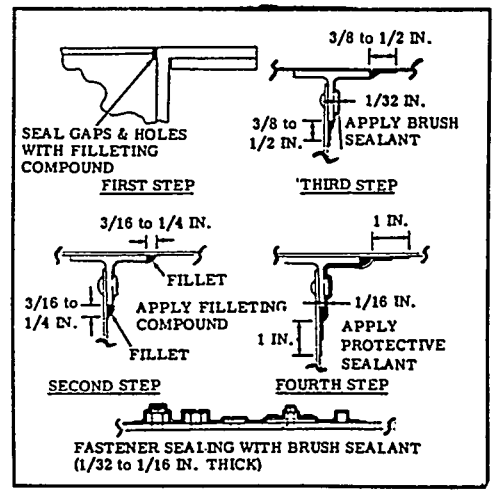



FIGURE 28-3 FUEL TANK SEALING

**NOTE**

**Refer to Mooney SB M20-230A for sealant application and drain holes to be left open.**

4. Sealant Application. Old sealant must be removed. Use a sharp non-metallic scraper (formica or lexan). When sealant has been removed, clean area thoroughly and reseal tank as follows:

A. Fillet Sealing.

(1) Be certain that the surface to be sealed is totally clean and free from oil, grime, finger prints, etc.

(2) Refer to (Figure 28-3) for typical fillet size.

(3) Join fillets laid on intersection joints to produce a continuous fillet.

(4) Seal all difficult and hard-to-reach areas first to preclude the possibility of their being overlooked or improperly sealed.

B. Filleting Compound Application - (PR1422 B-2)

(1) Use a spatula or an extrusion gun with a 1/8 - to 1/4 - inch nozzle opening for laying fillets at edges of all seams. When using an extrusion gun, hold gun perpendicular to seam so that extruded sealant will pack tightly.

(2) Use a spatula to pack sealant firmly in place while working out air pockets. Shape each fillet evenly.

C. Brush Sealing.

(1) Brush sealant (PR1422-A-1/2, A-2 or CS3204 A-1/2, A-(2) over all seams, rivets, nuts, and bolts. A one inch stiffbristle brush is recommended for sealant application. Force sealant into all gaps with brush strokes parallel to seams. Use a circular brush action to deposit an even coating of sealant around rivets, nuts, and bolts. Coating should be approximately 1/32-inch thick. Use considerable brush action to force sealant into all small crevices and to obtain good adhesion. Air pockets under the sealant, that will open up in the form of holes or voids soon after application, will result from improper application. To repair holes or voids, press sealant in place using a spatula.

(2) When the edge of a flange protrudes 0.040 inch or less, or where the seam cannot be clearly defined, apply two 1/32-inch brush coats. Allow the first coat to cure about four hours or until it becomes rubbery before applying the second coat. The second coat should overlap the edges of the first coat by about 1/4 inch.

D. Protective Sealant.

(1) Using short, even strokes, brush on a smooth and continuous coat of PR1005-L over sealant. The protective sealant coat should extend one inch beyond edge of the filleting compound.

(2) Allow the first protective coat to cure 20 minutes at 75 degree F., or until tack-free; then apply a second brush coat of PR1005-L. Make every effort to obtain a completely bubble-free, continuous top coat. DO NOT REBRUSH over areas, as doing so will only cause dragging and will break coating continuity.

E. Upper Wing Tank Access Panel Sealing.

(1) Apply a coat of access door sealant (PR1403-G-B2) to either faying surface using a short stiff bristle brush, spatula, or extrusion gun. If an extrusion gun is used, smooth the sealant with a brush or spatula. Cover the entire faying surface with a sealant coat of sufficient thickness (1/32 to 1/16 inch) to assure extrusion along the edges of the faying surface when the mating parts are assembled. Access panels in wing walk area should be sealed with PR1422, Class B filleting compound.

(2) Assemble parts immediately after application of sealant and tighten screws to ob-

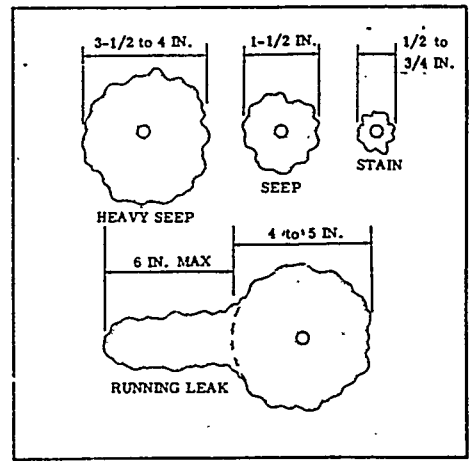



FIGURE 28-4 FUEL LEAK CLASSIFICATION

tain as near as possible a metal-to-metal contact.

(3) Remove the extruded sealant from the wing surface after installing the fasteners.

## 28-12-00 - FUEL TANK LEAK REPAIR

1. Leak Description. It is necessary to periodically inspect the fuel tanks. Inspection is particularly important in confined areas of the aircraft that are not exposed to the airstream. Identification and classification of fuel leaks that occur in both confined and open areas is necessary to differentiate between those leaks that require repair before flight and those which do not constitute a flight hazard. The size of the wetted area around a leak is an indication of the leak intensity. All fuel leaks must be recorded by describing the location and intensity of the leak in the aircraft log book.

2. Classification of leaks as to Intensity and Location. (Refer to Figure 28-4).

A. Intensity Classification.

(1) Stain--A slow fuel leak that tends to evaporate as soon as it is exposed to air.

(2) Seep--A fuel leak that reappears shortly after area is wiped clean.

(3) Heavy Seep--A fuel leak that reappears immediately after area is wiped clean.

(4) Running Leak--A fuel leak that flows steadily.

B. Location Classification.

(1) Slow-to-heavy seeps occuring in open areas, such as wing surfaces exposed to the airstream, are leaks which do not constitute a flight hazard and need not be repaired prior to flight, providing the condition causing the leak cannot result in a leak of greater intensity during flight. Seeps considered permissible for flight must be frequently inspected to insure that no increase in intensity has occured.

(2) A running leak and any leak in a confined area that is not exposed to the airstream should be repaired before the next flight.

3. Leak Detection.

A. External Leak Detection After Refueling. To be able to trace a leak from where it appears on an outer tank or wing skin to its true source inside the tank, the exact point where fuel is escaping from tank, must be determined.

(1) Use compressed air to blow and evaporate fuel from seams and crevices of leak area. Attempt to define exact point where fuel is escaping from tank.

(2) Small seep leaks can be traced with raw edges of torn paper. The fuzzy edge absorbs fluid and gives a good visual indication of fuel presence when brought in contact with suspected leak points.

(3) After tracing leak to its exterior source, mark location and drain fuel tank.

B. Internal Leak Detection. To make a permanent repair, it is mandatory that the true source of the interior leak be located. The fuel tank is a network of seams, and fuel may flow through or along a seam or from one seam to another. Fuel may channel a few inches or several feet to where it appears on external skin surface.

(1) Enter tank through inspection access panels and inspect sealant in general area of outside leak point. Look first for bare seams, rivets, and bolts in difficult-to-seal areas. Inspect sealant for blisters, pin holes, cracks, splits, and loss of adhesion. Mark all suspected flaws with masking tape.

(2) Test each suspected flaw from inside tank using compressed filtered air at 20 to 30 PSI. Hold air nozzle against flaw and closely check outside leak point for evidence of fuel.

(3) After testing each suspected flaw from inside tank as outlined above, and if no leak source can be discovered, apply soapless bubble fluid to exterior and again apply air pressure to flaws from inside tank.

(4) If above tests fail to locate leak source, apply air pressure (10 PSI MAX) to external leak point after removing all traces of fuel from tank and applying soapless bubble fluid to tank interior seams per Section 28-13-00.

4. Leak Repair.

A. Temporary Repair of Fastener Leaks. Generally, all leaks in enclosed areas and running leaks in open areas constitute a flight hazard. Fastener leaks of this category may be temporarily repaired by applying a sealant fillet over fastener head on fuel tank exterior. For a temporary repair to be satisfactory, structural integrity must be retained in leak area. To make a temporary fastener-leak repair:

(1) Remove enough fuel from tank to drop fuel level below leaking fasteners.

(2) Clean fastener head and adjacent surface with Turco 657 Wipe Solvent or MEK

and dry thoroughly. Fastener head and adjacent metal must be entirely free from paint, dirt, and oil.

(3) Apply a 1/8 inch thick coat of PR1422 (or CS3204) B-1/2 or B-2 over head and around fastener.

(4) Allow sealant to cure until firm and rubbery.

(5) Refill tank and examine repair periodically. If leak recurs, sealant must be removed and area recleaned prior to making another temporary repair.

B. Permanent Leak repair. If leak source is found to be around a rivet or threaded fastener the repair procedure shall be to restrike rivet or retorque fastener to maximum permitted torque value. ANY ONE RIVET MAY BE RESTRUCK ONLY ONE TIME. If leak continues, replace the rivet.

(1) Repair any sealant damage due to restriking or retorqueing a fastener.

(2) Remove sealant in immediate area of leak source using a sharp, non-metallic tool. A chisel-shaped formica tool is recommended. Scarf or taper ends of existing sealant so that new sealant can form a continuous and smooth overlap.

(3) Thoroughly clean repair area using Turco 657 Wipe Solvent or MEK. Wash one small area at a time. To prevent redeposit of oil and dirt on surface, dry with a clean cloth before solvent evaporates.

NOTE

**Always pour solvent onto wash cloth to prevent contamination of solvent supply; do not dip cloth into solvent.**

(4) Thoroughly dry clean area by flowing filtered air over immediate area until there is no possibility of solvent or fuel entrapment under adjacent sealant.

(5) Apply sealant as required for repair (See Figure 28-3). Repaired fillets must be blended into existing fillets with a spatula or an appropriate tool.

(6) Allow all repaired sealant to cure tack-free and apply two brush coats of PR1005-L to repair area (Refer to paragraph 28-11-00,4.D.).

## 28-13-00 - SOAPLESS BUBBLE FLUID FORMULA PREPARATION FOR LEAK CHECK

1. Materials.

A. Three ounces of either sodium bichromate, potassium chromate, or potassium dichromate.

B. Three and one-quarter ounces Thickening Wax (Carbo Wax 1500).

C. Thirteen ounces Alkaryl Sufonate wetting agent.

D. Distilled water.

2. Solution Preparation.

A. Mix one of the compounds listed in item (A) above with one cup distilled water.

B. Mix item (B) above with one cup distilled water.

C. Mix item (C) above with four to four and one half gallons distilled water until wetting agent dissolves completely.

D. Mix the three ingredients (A), (B) and (C) together and add enough distilled water to make five gallons of solution.

NOTE

**Amount of each ingredient may be reduced for a smaller quantity of solution. Solution life is about one week.**

CAUTION

**Soapless bubble fluid is slightly corrosive and must be completely removed by washing freely with water followed by scrubbing.**

CAUTION

**When removing lower inboard access panels, caution should be exercised during removal so fuel outlet tubes will not be damaged or bent.**

## 28-14-00 - FUEL ADDITIVES

Under certain conditions of temperature and humidity, water can be present in the fuel in sufficient quantities to create ice formations within the fuel system. To prevent this, add ISO-PROPYL Alcohol to the fuel supply in quantities not to exceed 1% of total fuel volume per tank.

CAUTION

**Ethylene glycol monomethyl ether (EGME) or other additives are not recommended due to potential deteriorating effects within the fuel system.**

## 28-20-00 - DISTRIBUTION

The fuel system is comprised of three electric fuel pumps and the related hardware, hoses,

valves and drains necessary.

The Main and Boost fuel pumps are required to be ON during normal flight operations(Main/Boost are on split switch). The Emergency fuel pump can be turned ON in the event of Main/Boost fuel pump failure.

The fuel pumps are connected to rocker switches on the instrument panel.

### 28-21-00 - FUEL PUMP(S) REMOVAL AND INSTALLATION

1. Electric Fuel Pump(s) Removal.
   A. Remove FWD lower belly fairing.
   B. Remove lower exhaust cavity skin.
      (1) Left - MAIN or EMER pump
      (2) Right - BOOST pump
   C. Remove fuel pump shroud.
      (1) Emergency pump - outboard.
      (2) Main pump - inboard.
   D. Remove electrical leads.
   E. Turn fuel selector valve OFF.
   F. Disconnect inlet and outlet fuel lines.
   G. Remove fuel pump(s).

2. Reverse the removal procedure for reinstallation.

A. When installing fuel pump shrouds, ensure that all mating surfaces are completely sealed with PR1422-B2 sealant.

**CAUTION**
**Do not run pump dry for more than 15 seconds.**
**CAUTION**
**Do not operate fuel pumps with the fuel selector in the OFF position.**

### 28-22-00 - SELECTOR VALVE GASCOLATOR AND FUEL FILTER SCREEN CLEANING

Fuel gascolator screen should be cleaned every 50 hours. The valve is safety wired, (notice should be taken of exact wiring technique before removal) and upon completion, rewiring should be identical to original installation.

1. Gascolator screen removal and cleaning: Remove belly skin just aft of nose wheelwell; turn selector valve to off position; remove safety wire on bottom nut and remove nut; remove sump and screen by pulling down: clean screen and reverse process to reinstall (take care not to damage O-rings); lubricate O-rings with clean engine oil before installing. Torque 15 to 20 inch pounds.

### 28-22-10 - FUEL FILTER

A two micron fuel filter is installed down stream of the fuel pumps and just prior to the fuel metering housing. This filter is mounted on the L/H firewall. This fuel filter is a sealed disposable unit which must be replaced after every 100 hours of service.

REMOVAL

1. Remove upper and lower cowling.
2. Disconnect the inlet and outlet fuel lines.
3. Unclamp filter from the bracket.
4. Remove and replace filter.

INSTALLATION

1. Reverse order for installation of filter. USE NEW GASKETS.
2. Pressure check system prior to installation of cowling.
3. Install bottom and top cowling.

### 28-23-00 - FUEL INJECTION SYSTEM

The K-Jetronic system measures the volume of air drawn into the engine by means of a baffle-plate airflow meter. The control pressure regulator measures density and generates a control pressure which acts in the opposite sense to airflow pressure. The baffle plate pivots in the airflow to the angle permitted by the opposing control pressure. This angular movement is transmitted to the control plunger in the volumetric fuel distributor. The slots in this device are shaped to provide the appropriate metered flow of fuel to the engine's cylinders. Pressure drop at the control slots in the flow distribiutor is kept cnstant by means of a differential pressure regulator. The injectors, one in each inlet port, are therefore not required to control the injected volume of fuel. The control pressure regulator compensates for unavoidable air volume measuring error, which has physical causes. It also varies injection system output to provide "best power" or "best economy" as appropriate. During the flight regardless of altitude, the engine is always supplied with the correct volume of fuel for maximum economy at the selected power output..

### 28-24-00 - ENGINE PRIMING

Engine priming is not required. However engine should be started with enrich switch ON or OFF depending on the following conditions:

ON when CHT is BELOW $25^{O}$C.
OFF when CHT is ABOVE $25^{O}$C.

Should the engine not start within the first 5 seconds of cranking, move the enrich switch to the opposite position and continue cranking. Cranking should be limited to 30 seconds, and several minutes allowed between cranking periods to permit the starter to cool.

Engine priming is accomplished by the use of a separate fuel injection nozzle called the Cold Start Valve. This solenoid operated valve is designed to flow fuel into the intake manifold when the enrich switch is in the ON position and the starter switch is engaged.

### 28-25-00 - FUEL SELECTOR VALVE REMOVAL & INSTALLATION

1. The fuel selector valve is located aft of the center console, below the floorboard.

A. Drain both fuel tanks.

B. Disconnect right and left inlet lines at valve body.

C. Disconnect outlet line at valve body.

D. Remove handle above floorboard in fuel selector pan.

E. Remove screws mounting valve to the tubular structure.

F. Remove valve.

G. Reverse the selector valve removal procedure for reinstallation. Pressure check fuel system for leaks after installation.

### 28-30-00 - DUMP

The fuel tanks can be emptied for maintenance purposes by:

(1) removing the sump drains in the lower panel of each fuel tank and allowing fuel to drain into suitable container or

(2) disconnect the fuel line at union just past the firewall and use fuel pump to transfer fuel from both tanks into a suitable storage container.

### 28-31-00 - FUEL SYSTEM DRAINS

Fuel drains are installed in the inboard corners of the wing tanks and at the gascolator, the lowest point in the fuel system. Tank drains are recessed and spring loaded. An O-ring at the lower flange seals the valve seat.

### 28-32-00 - FUEL VENTS

The fuel tanks are vented from the outboard upper edge. This vent is routed outboard and is vented overboard through a NACA vent on lower wing surface.

To check fuel tank vents:

1. Block entire fuel tank vent by slipping a short length of rubber hose over tube and projecting below wing lower surface.

2. Remove fuel tank filler cap; blow gently into rubber hose. Air should be felt coming out of filler port.

3. If stoppage is found, clear vent prior to flight since fuel starvation could result from vent stoppage.

NOTE

**It is important that the fuel tank vent tube protrude only enough to be flush with lower wing skins.**

### 28-40-00 - INDICATING

### 28-41-00 - FUEL QUANTITY INDICATING TRANSMITTERS

The fuel quantity indicating system has two fuel quantity transmitters in each wing tank. The transmitters are electrically connected to the fuel gauges and work in series with each other.

1. Fuel Quantity Transmitter Removal.

A. Drain fuel from tank.

B. Remove transmitter wires.

C. Remove the six screws attaching transmitter to doubler.

D. Remove transmitter.

2. For reinstallation, reverse the fuel quantity transmitter removal procedure.

A. Make certain wire from outboard transmitter goes under head of insulating sleeve against the inboard transmitter flange and not under the mounting screw head.

### 28-42-00 - FUEL QUANTITY INDICATOR

Two fuel quantity gauges are in the instrument panel. These gauges show gallons of fuel remaining. Each gauge operates by the change in resistance of two transmitters located in the fuel tanks.

### 28-43-00 - FUEL QUANTITY ADJUSTMENT PROCEDURE

### 28-43-01 - FUEL TANK TRANSMITTER/ INDICATOR ADJUSTMENT

--AIRCRAFT MUST BE LEVEL--

--TO CALIBRATE FUEL GAUGES--

1. Fuel tanks empty.

2. Indicator will be out of instrument panel to accomplish this adjustment.

3. Take case off the indicator by removing 6 Phillips head screws from the sides of indicator.

4. Locate the four adjustment potentiometers on the left hand side of the indicator looking from front (SEE Figure 28-5).

5. Connect indicator to the EMIS system in the aircraft (a patch cord (P/N GSE030031-501) will be needed).

6. Add unuseable fuel (3.0 gals./tank) to left tank; then add one additional gallon.

7. Power up indicator and select the left fuel quantity on the digital display (to obtain digital readout of fuel qty).

8. Adjust the left zero or left null potentiometer until the digital display shows "one gallon".

9. The analog display should also read approximately one gallon.

10. Add 31 additional gallons fuel to left tank to bring to total usable fuel (32 gals). Add 1 to 2 gallons slowly and note when FUEL LOW light goes OFF; then add rest of fuel.

**NOTE**

**The left FUEL LOW annunciator light should be ON. This warning light should illuminate at 2 1/2 to 3 gallons, going down scale.**

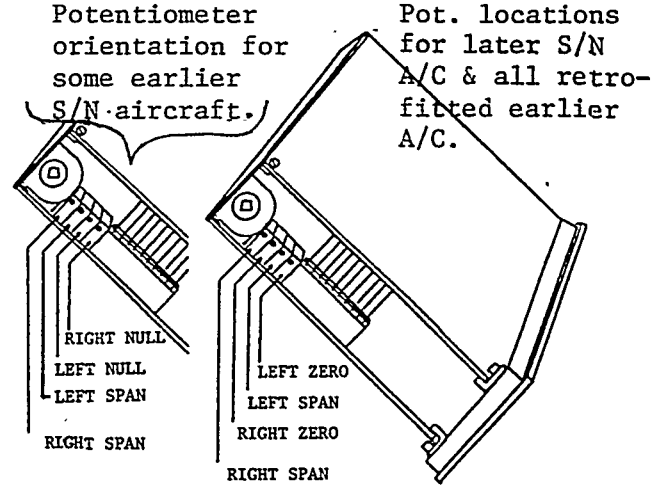



FIGURE 28-5 FUEL QTY. IND. ADJUST.

11. Adjust left span potentiometer until digital display reads 32 gallons. The analog display should also read approximately 32 gallons.

12. Repeat steps 6 through 11 for the right fuel tank.

13. Power down system. Disconnect Fuel Quantity gauge.

14. Put Glyptal (torque seal) on the potentiometers calibrated so they will not move.

15. Reinstall case on the indicator securely and install indicator into the instrument panel.

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**28-90-00 - MISCELLANEOUS**

**28-91-00 - TROUBLE SHOOTING**

When trouble shooting, check from the power supply to the suspect item. If trouble is not located, proceed to check the item itself. If necessary, remove the item and install an identical unit tested and known to be in good operational condition.

---

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Fuel gauge not indicating. | Broken wire. | Check and Repair. |
| | Faulty transmitting unit. | Replace. |
| | Open circuit breaker. | Check and reset. |
| Fuel gauge indicates full when tanks are not full | Incomplete ground. | Check ground connection at transmitter. |
| | Broken wire. | Check and repair. |
| No fuel pressure indication (with calibrated gauges) | Tank empty. | Check and service tank. |
| | Defective fuel pump. | Check pump for proper pressure buildup. |

| | | |
|---|---|---|
| | | Check for obstruction in boost pump screen. Check fuel pumps and check valves. |
| | Open fuel line. | Repair or replace line. |
| | Fuel selector in OFF position. | Select proper position. |
| Fuel pressure low or surging (calibrated test gauges connected.) | Obstruction in inlet side of pump. Faulty fuel pump. | Check and clear fuel lines. Replace pump. Check fuel lines and connection for leakage or damage. |
| | Fuel selector not in proper position. | Select proper position. |
| | Air leak in system. | Repair leak. |

## 28-92-00 - FLARED FITTINGS

When installing flared fittings and hoses, make sure the threads are properly lubricated with VV-P-236 petrolatum per (Figure 28-6). When previously installed fittings are removed, they should be wiped clean and relubricated before they are reinstalled. Torque all fittings in accordance with flare fitting torque chart, Chapter 5, Figure 5-1.

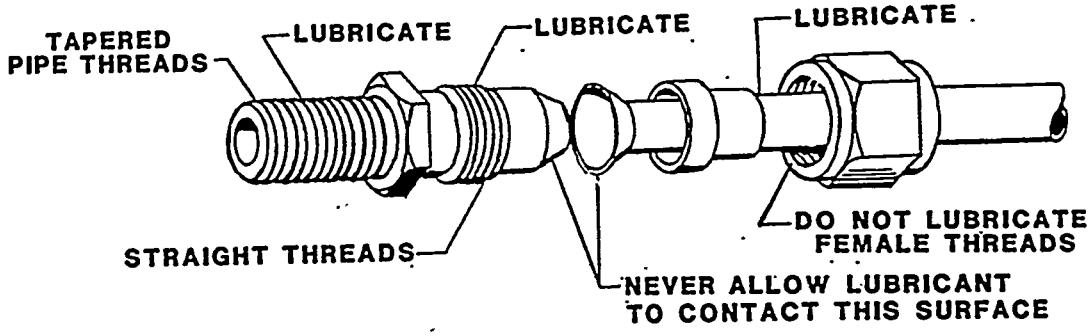



FIGURE 28-6 - LUBRICATION OF FLARED FITTINGS

# CHAPTER

# 30

# ICE AND RAIN PROTECTION

# ICE PROTECTION

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## 30-00-00 - GENERAL

The M20L aircraft incorporates an alternate air system that is designed to open automatically any time the air intake system becomes blocked. This system should be inspected to assure that no heated air is entering the induction system during routine engine operation. (See Porsche Service Manual).

This aircraft includes as standard equipment a heated pitot tube assembly.

An optional electrically operated propeller de-ice system may be available in the future

## 30-30-00 - PITOT, DESCRIPTION AND OPERATION

A standard heated pitot tube is located on the left wing at Wing Station No. 145. The pitot heat circuit breaker switch located on the panel in front of the pilots right knee supplies power to the pitot tube heating element. When Pitot Heat is ON, annunciator light "PITOT HEAT" will be illuminated.

## 30-50-00 - PROPELLERS, DESCRIPTION AND OPERATION

## 30-60-01 - PROPELLER DE-ICE

RESERVED

## 30-61-00 - SERVICE GUIDE

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# CHAPTER

# 32

# LANDING GEAR

MOONEY AIRCRAFT CORPORATION
MODEL M20L
SERVICE AND MAINTENANCE MANUAL
CHAPTER 32

# LANDING GEAR

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## 32-00-00 - GENERAL

The landing gear is operated by an electrical motor driven actuator. The travel during the extend and retract cycle is controlled by down and up limit switches located beneath the floorboard under the pilots seat. Power is supplied to the actuator through a set of relays actuated by the gear selection switch. The gear selection switch is located at the top of the instrument panel in front of the pilot. The actuator worm gear ball nut is connected to the retract bellcrank which is connected to push-pull retract tubes and bellcranks throughout the entire retraction system. An airspeed safety switch is mounted on the cockpit sideskin above pilots left knee and incorporated into the landing gear electrical circuit to prevent landing gear retraction while on the ground until a safe takeoff speed is reached. A by-pass switch is installed adjacent to the gear selection switch in order to override the safety switch circuitry if the gear does not retract.

The gear legs are constructed of welded chrome-molybdenum tubular steel, heat treated for greater strength and wear resistance. Main gear attaching points have bushings installed in the gear mounting box attached to the wing spar. The steerable nose gear mounts to the cabin tubular steel frame.

**NOTE**
**Heat treated components should NOT be repaired; replace them.**

The main gear wheels have hydraulic disc brakes with a parking brake valve incorporated into the system.

Rubber discs in the gear leg assemblies absorb the shock of landing and taxiing.

MANUAL-EMERGENCY LANDING GEAR SYSTEM.

Emergency gear extension is available through a manual override system. This system is built into the actuator unit. The disengage controls are located aft and between the front seats under the interior trim cover.

LANDING GEAR WARNING SYSTEM.

The landing gear warning system provides the pilot with an audible warning that the landing gear is not down and locked when the power lever is retarded to a pre set position. When the landing gear is down and locked the electrical circuit is opened and the intermittent horn is stopped. This warning switch is mounted in the power lever housing. It can be adjusted for the proper setting by loosening two screws on the striker plate from beneath power lever housing & repositioning striker plate assembly so gear warning horn sounds when power lever is between 1/4 to 3/8 in. from closed position.

BRAKE SYSTEM.

The brake system is hydraulically operated by depressing the brake pedals mounted on the pilots rudder pedals. (Dual brake system is optional for co-pilots). Individual wheel brakes are available by depressing either left or right pedal. Parking brakes are actuated by depressing both brake pedals and pulling the parking brake control cable knob. This cable actuates a lever on the parking brake valve and traps the hydraulic fluid from the valve to the wheel cylinders thus holding the pucks to the discs. Release the parking brakes by pushing the parking brake knob in. This releases hydraulic pressure at the wheel cylinders and therefore releases the brake discs.

## 32-10-00 - MAIN LANDING GEAR AND DOORS

### 32-10-01 - MAIN GEAR REMOVAL

1. Raise aircraft on jacks.
2. Partially retract gear as described in Section 32-60-01, para. 1.
3. Disconnect gear door links and brake lines. Cap all lines and fittings.
4. Remove gear door (if desired).
5. Detach main gear retracting tube (F), (Figure 32-9) from retracting truss (G), and remove bolts (H) from retracting truss mounting block.

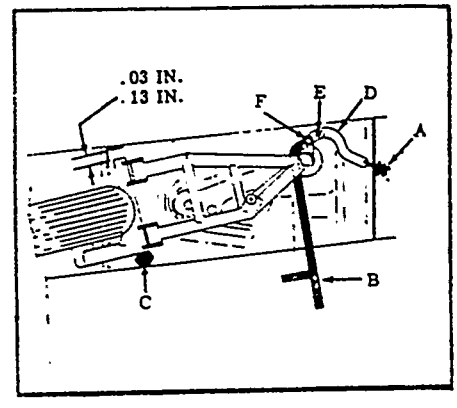



FIGURE 32-1 RETRACT SPRING REMOVAL

6. Remove grease fittings from forward gear support trunnion-shaft bearing.

7. Retract the gear until a 2 inch thick wood block (C), (Figure 32-1), can be inserted, as shown, to hold gear in retracted position.

A. Remove cotter key and nut at spring connecting link (F), (Figure 32-1).

B. Remove gear retraction spring (A) at (F), (Figure 32-1), by attaching spring installation tool (B), P/N GSE 030012, (old P/N was 8186) using an AN3-12A bolt (E). Remove grease fitting prior to using tool.

8. Extend gear three to four inches from down-lock position and secure.

9. Remove six mounting bolts from rear gear trunnion shaft mounting block assembly at stub spar.

10. Slide out aft bearing block.

11. Slide front bearing block aft and remove.

12. Slide gear assembly aft until clear of front bearing, and carefully remove gear assembly from wing.

13. Identify all components removed, and DO NOT intermix right and left gear components.

14. DO NOT attempt to repair any heat treated component of main landing gear assembly.

## 32-10-02 - MAIN GEAR INSTALLATION

1. Lubricate wheel bearings, retraction linkage, and fore and aft trunnion bearings prior to installation (refer to Section 5-20-07 for recommended lubricants).

2. Installation of main gear is the exact reversal of the main gear removal procedure.

3. Check fore and aft movement of gear in bearing blocks. Maximum allowable movement is .020. Shim excess by inserting shims at rear block.

4. Temporarily attach gear door link rods to gear leg brackets.

5. Retract gear while checking for binding in door linkage and proper contact of gear door edges with wing. DO NOT make final gear door adjustments until gear has been rigged (Ref. 32-30-02).

## 32-10-03 - MAIN GEAR DOOR RIGGING

1. Raise aircraft on jacks.

**NOTE**

**Gear system must be properly rigged prior to gear door rigging, see Section 32-30-01.**

2. Check main gear up against bumper pads.

3. Normally once the doors are installed at the factory no further adjustment should be required. However, should the inboard doors be removed for any reason the following rigging procedure should be used when reinstalling them:

A. Disconnect outboard gear doors at the forward and aft linkages (B)(Fig. 32-2).

B. Raise gear electrically to the full up position.

C. Forward leading edge and aft trailing edge of inboard gear door should be tight against the wing skin and fair with the aft bubble fairing. Spacers (A) (Figure 32-2) should be added or removed as required to obtain a good fit with no binding or distortion with the gear in the UP position. AN960-10 washers may be used as spacers.

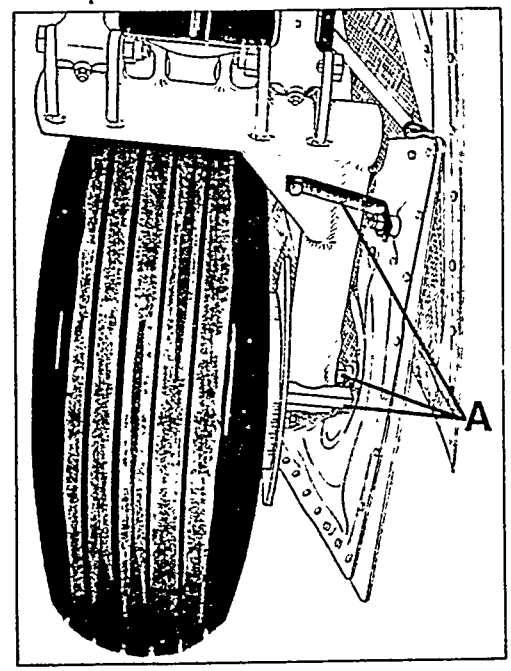



FIGURE 32-2 INBOARD-GEAR DOOR ADJUSTMENT POINTS

4. Reconnect outboard gear doors and check that the forward edge of outboard gear doors are faired with wing skin/wheel well opening and that there is no binding or distortion where links attach to door.

5. If adjustments are required, adjust outboard gear door rod ends(B)(Fig.32-2) at for-

ward or aft linkages as required. Extend gear to adjust links, then retract to check adjustment.

## 32-20-00 - NOSE GEAR AND DOORS

## 32-20-01 - NOSE GEAR REMOVAL.

1. Raise aircraft on jacks.
2. Remove exhaust cavity fairings.
3. Partially retract gear as described by Section 32-60-01.
4. Remove firewall nose gear box (if needed) to gain access to bolts.
5. Disconnect link (A) on nose gear truss assy. (Figure 32-3).
6. Disconnect nose gear steering horn link (B) (Figure 32-3).
7. Remove left and right gear mounting bolts (D) and (E) (Figure 32-3) from tubular structure and nose gear truss assembly.
8. Carefully remove nose gear assembly.
9. DO NOT attempt to repair heat treated components of nose landing gear assembly.

## 32-20-02 - NOSE GEAR INSTALLATION

1. Lubricate wheel bearings, retraction linkage and left and right mount bearings.
2. Install gear in reverse order of removal procedure.

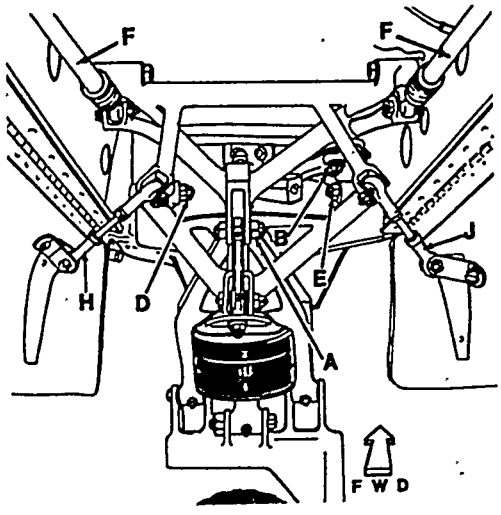



FIGURE 32-3 NOSE GEAR RETRACT TUBE BASIC ADJUSTMENT POINTS

## 32-20-03 - NOSE GEAR DOOR RIGGING

1. Raise aircraft on jacks. (Refer to Section 7-10-00.)

**NOTE**
**Gear system must be properly rigged prior to gear door rigging, see Section 32-30-01.**

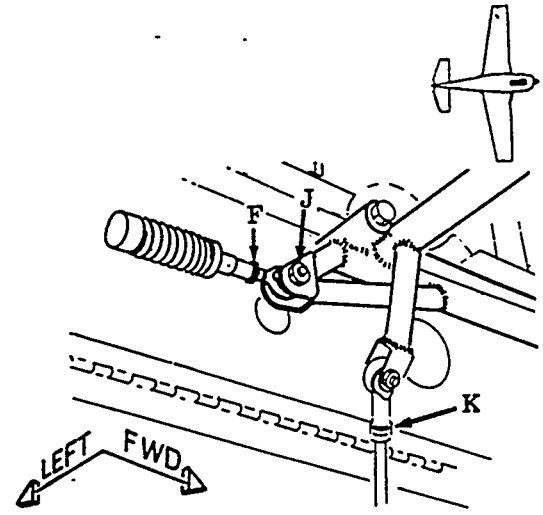



FIGURE 32-4 NOSE GEAR & DOOR ADJUSTMENT POINTS (FINE)

2. Adjust gear door link rods (H and J Figure 32-3) to obtain proper door fit when closed.
3. To increase or decrease nose gear-up travel in wheel well, adjust eccentrics on trunnion bearings (J), (Figure 32-4) as required.

**CAUTION**
**Nose gear overcenter preload must be rechecked after any adjustment to nose wheel eccentrics.**

4. Readjust nose gear door linkage as required after eccentrics have been moved. (Figure 32-4, K.)

## 32-30-00 - EXTENSION AND RETRACTION

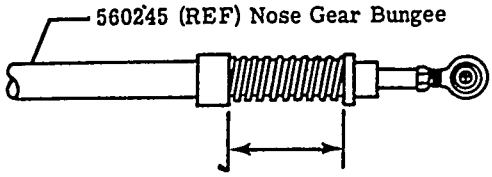
## 32-30-01 - GEAR SYSTEM OPERATIONAL CHECK

1. Raise aircraft on jacks. (See Section 7-10-00).

2. With master switch ON and gear switch in UP position apply pressure to pitot tube (see Section 32-60-01). Verify gear retraction occurs at (65 +7/-4 KIAS). Allow gear to raise completely. Check for any tire interference as tire enters wheelwell.

3. Close throttle and confirm gear horn sounds.

4. Inspect gear doors for proper closing: lower gear.




Deflection of spring from static length to rigged position to be .030 to .070 in.

Figure 32-5 - NOSE GEAR BUNGEE SPRING

5. With zero airspeed place gear switch in UP position. Gear horn should sound regardless of throttle position, both gear position lights and safety bypass switch will illuminate.

6. Push RED gear safety bypass switch and hold in to partially retract gear. Pull "GEAR ACT" circuit breaker.

7. Check nose gear overcenter preload.

A. Measure nose gear bungees (Figure 32-5).

B. Extend gear manually (See Section 32-30-06) stopping extension the moment the green Gear Down Light comes on. Gear switch in DOWN position.

C. Measure nose gear bungee springs. Deflection from zero load condition in (A) above must be .030 to .070 inches for each bungee.

D. If spring deflection is not within prescribed limits, adjust tube rod ends (Figure 32-4 (F)) in increments of 1/2 turns as required.

8. Check main gear overcenter preload.

A. Place rigging tool (T) P/N GSE 030007 (Figure 32-9) on retraction truss. Hold the tool stationary by placing thumb on rear end of tool (S) and press forward.

B. Hold 10" torque wrench (R) and place thumb on wing bottom; apply force until joint (4) breaks open slightly, insert shim stock (.005 .008 in. thickness) between link and truss at (P). Release force on wrench.

C. With fingers on torque wrench and thumb on wing bottom apply force on wrench while maintaining a pulling force on shim stock. Read torque value on wrench at the exact moment the shim stock pulls loose. Torque value should be 250 to 280 inch pounds.

D. Repeat on other main gear.

E. If preload is not within prescribed limits adjust retract tube (L) at rod ends (E)(Figure 32-6) as required. No other adjustment is available.

F. If main gear preload needs readjusting the nose gear bungees should be rechecked per 7. (C) above.

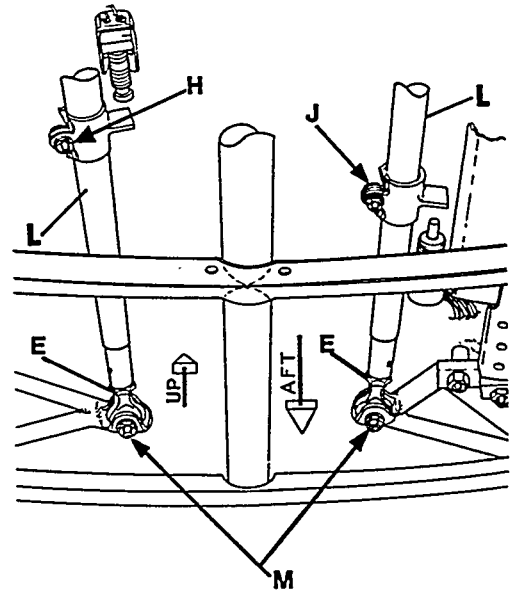



FIGURE 32-6 MAIN GEAR RETRACT TUBE ADJUSTMENT POINTS

**NOTE**

**When gear overcenter preload check is completed, electrically extend the gear and check the nose gear tube bungee springs to assure they have not compressed completely resulting in no remaining deflection. This would indicate excessive preload or weak bungees.**

## 32-30-02 - MAIN LANDING GEAR SYSTEM RIGGING

1. Raise aircraft on jacks and remove the three piece belly access fairings.

2. Disconnect main gear retraction tubes (L) (Figure 32-6) at inboard bellcranks (M). Loosen locknuts (E). Disconnect nose gear retraction tubes (F) (Figure 32-3) at main retraction bellcrank (A) (Figure 32-10). Loosen locknuts (F) (Figure 32-4). Disconnect actuator rod end at (N) from bellcrank (A) Fig. 32-10. Disconnect nose gear and main gear door links. Check gear for binding at pivot points while moving gear legs by hand. Lubricate retraction system as indicated in SECTION 5-20-07.

3. Position retraction bellcrank (A) Figure 32-10, so that center of forward hole in left outboard arm of the bellcrank is 1.56 IN. (approximately) from forward face of truss at Fuselage Station 33. (See Figure 32-10.)

**NOTE**

**This is a starting point only. This dimension may vary to permit retraction tubes to connect with zero preload.**

4. With the bellcrank (A), Figure 32-10, in position, turn ball nut (D) on actuator until Heim rodend aligns with hole in bellcrank at (N). Install connection bolt.

5. With bellcrank in position and all gears fully extended, adjust main and nose gear retraction tubes so that tubes can be slipped in place with zero preload.

6. Disconnect electrical power from landing gear actuator by pulling actuator circuit breaker. Make sure landing gear warning light circuit breaker is pushed in.

7. With bellcrank, retraction tubes, and the gear positioned as indicated in step 4, set down-limit switch striker arm so that gear down limit switch is just closed and green gear-down light is on. Secure striker arm in position.

8. Reset actuator circuit breaker and partially retract the gear (use master switch to control motor). Screw rod end, on aft end of each main gear retracting tube, OUT two (2) full turns, screw IN each nose gear retraction tube rod end one (1) full turn, then slip attaching bolts back in place.

9. Check nose and main gear overcenter preload described in Section 32-30-01, steps 7 and 8. Adjust as instructed.

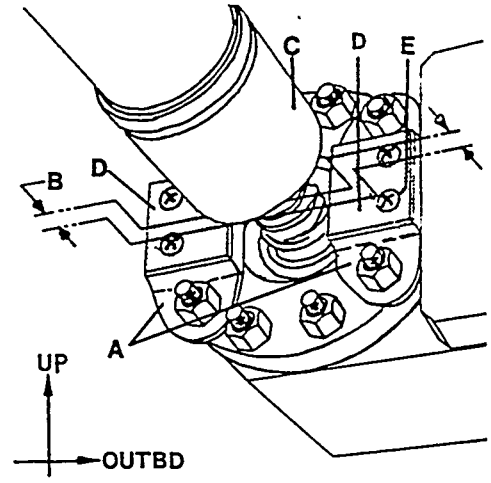



FIGURE 32-7 MECHANICAL DOWN STOP

10. Complete operational check described in 32-30-01 steps 2, 3, 5 and 6.

11. When step 10 is complete, the retraction system is rigged for the gear-down-and-locked position with allowance for actuator overrun after cutoff.

12. Reset landing gear system circuit breaker and disengage manual system.

13. Leave all gear doors disconnected, and run gear-up electrically until main gears are .03 inches minimum from bumper pads. Position gear-up limit switch striker arm so that switch is just closed, and RED gear unsafe light is OFF. Secure striker arm in position. The gear is now properly rigged in the gear-up position with allowance for actuator overrun after cutoff.

14. Electrically extend gear to down-and-locked position. Adjust gear doors (refer to Main Door and Nose Gear Door Rigging Procedures in Section 32-10-03,Main, and 32-20-03, Nose).

15. Adjust the mechanical down stop and up stop on actuator housing per the following instructions and Figure 32-7.

A. 560252-1 Fixed Stops — Use one DOWN
560252-3 Fixed Stops — STOP on each side as



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560252-5 Fixed Stops
560252-7 Fixed Stops
560252-9 Adjustable Stop (use -11 shims)

required (Pick up existing hdw).

B. With gear fully extended, select down stop of proper thickness to give .050 - .100 clearance between down-stop and end of ball nut. (Figure 32-7).

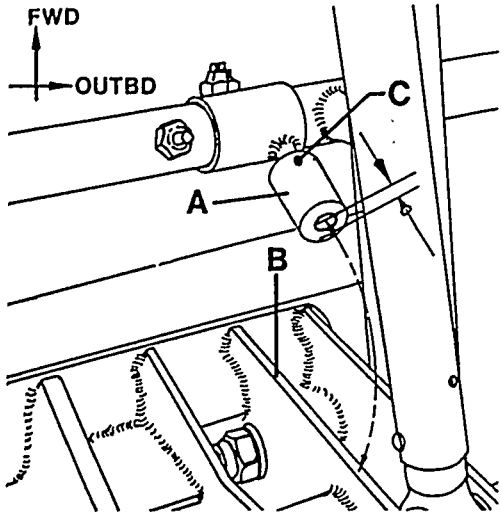



FIGURE 32-8 MECHANICAL UP STOP

NOTE

**Use 1 to 4 560252-11 shims with 560252-9 stop to achieve proper clearance as an alternate for 560252-1, -3, -5, or -7.**

C. Actuator ball nut.

D. 560252-11 shim (use with 560252-9 only, maximum of 4).

E. AN515-6R screw*
AN936A6 Lock Washer
(Typ. 2 plc.) (use with 560252-9 only).

*Use .063 longer screws with each additional shim. (Secure screw with Blue Locktite #83-31 grade C).

With gear fully retracted, adjust stop for .050 - .070 clearance between up stop (A) and retracting truss (B), then tighten set screw (C) (Figure 32-8).

NOTE

**The main gear preload torque should not exceed 325 inch lb. using the torque wrench/shim stock procedure after electrical extension.**

RUN THE GEAR DOWN ELECTRICALLY AND CHECK THAT TORQUE VALUES DO NOT EXCEED 325 INCH POUNDS USING THE TORQUE WRENCH/SHIM STOCK METHOD.

The main landing gear system is now rigged for the gear down and locked condition.

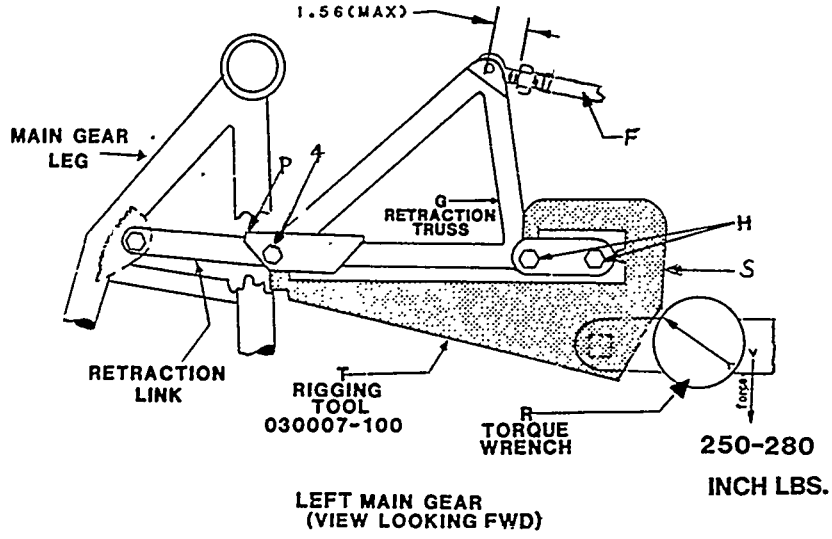



FIGURE 32-9 MAIN GEAR RIGGING TOOL APPLICATION

FINAL CHECKS

1. Raise and lower the landing gear through five complete cycles, pausing after each cycle to check required tolerances and dimensions, and annunciator light indications. Make certain that no bungee springs are compressed to solid height, and that the nose gear tire clears the top of the wheel well a minimum of .25 in. when the landing gear is retracted. Make adjustments per the above procedures as required to correct any deficiencies.
2. Retorque all jam nuts.
3. Reattach the main and nose landing gear door links. Check to see that nose and main landing gear doors are still rigged per paragraph 32-10-03.

## 32-30-04 - EMERGENCY GEAR EXTENSION SYSTEM RIGGING.

Disengage rigging:

1. Insert cable thru hole in actuator disengage arm, (B) (Figure 32-10).
2. With red lever (1) (Fig. 32-11) in full disengaged position (down and latched) push actuator disengage arm (B) (FIG.32-10) to full forward position and apply approximately 5 lbs. pull to cable to remove slack.
3. Install D222 wire stop, (C) tighten nut and connect spring (E) to clevis pin, (D).

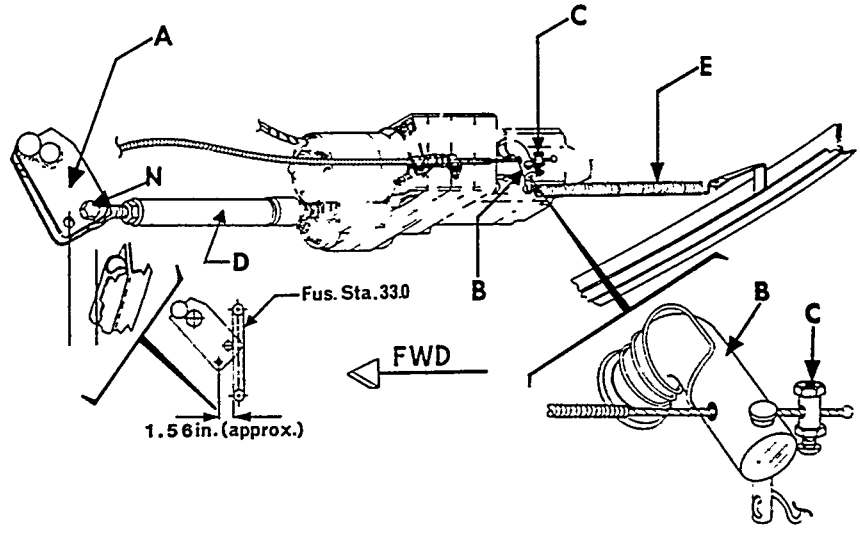



FIGURE 32-10 LANDING GEAR ACTUATOR ADJUSTMENTS

4. Lift cover then red lever and pull "T" handle (2) (Fig. 32-11) aside: re-engage red lever. Check manual extension system to verify that it is fully disengaged by pulling "T" handle: no resistance should be felt. Check cable routing through pulleys 3 and 4 (Fig. 32-11) if a resistance is felt to verify if it is cable routing or actuator resistance.
5. Move red lever to full UP position: pull "T" handle slowly to verify manual extension system is engaged. Resistance should be felt at once.
6. Replace "T" handle under red lever and return red lever to disengage position, (down and latched). Manual extension system is now rigged.



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NOTE

**Plessey actuators should be lubricated every: 2000 cycles with MIL-G- 81322 grease. Run actuator to mechanical extended position. Fill tube cavity with grease via MS15001-1 grease fitting until old grease is purged from screw assembly; remove old grease from and relubricate exposed screw. Run actuator to approximately 0.5 in. or mechanical retract and remove the major excess grease extruded from the ball nut assembly.**

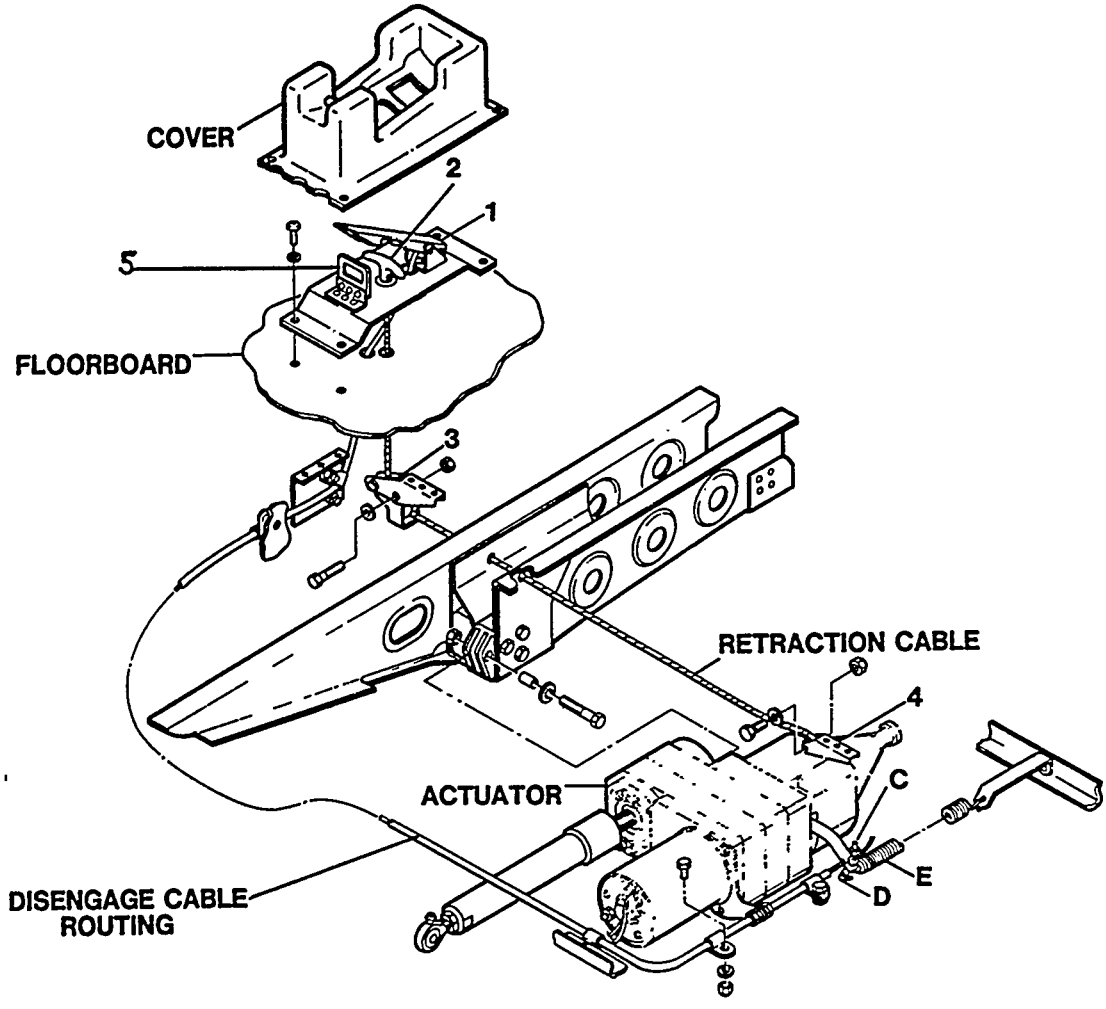



FIGURE 32-11 EMERGENCY GEAR SYSTEM

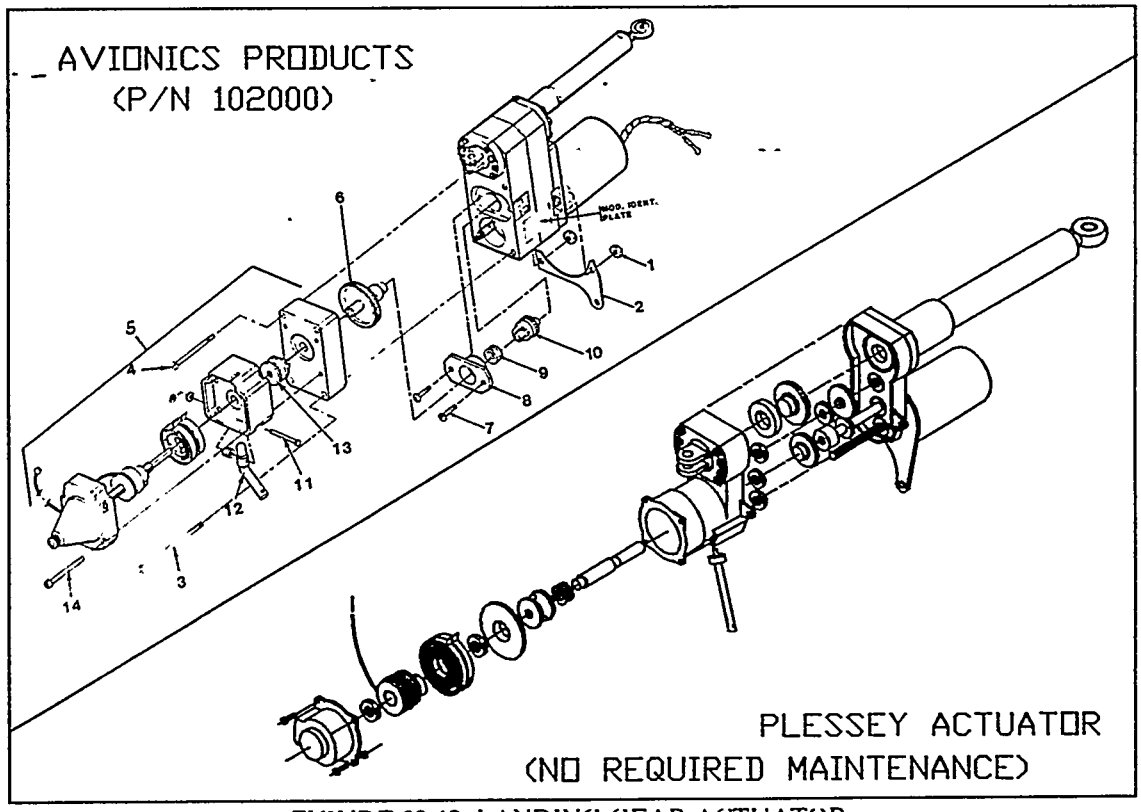



FIGURE 32-12 LANDING GEAR ACTUATOR

### 32-30-05 - LANDING GEAR ACTUATOR, P/N 102000, CLUTCH SPRING REPLACEMENT, --KIT #A10-85.

Landing gear actuator clutch spring replacement is mandatory at each 1000 hours of aircraft operation. (Reference S.I. M20-52.)

DISASSEMBLY

1. Remove two nuts, item 1. Note position of cable support bracket, item 2, and remove (Figure 32-12).
2. Remove manual extension system disengage cable from actuator disengage arm.
3. Remove two long screws, item 3.
4. Remove two short screws, item 4.
5. Remove recoiler assembly, item 5.
6. Remove gear assembly, item 6, from clutch housing, item 8, by rotating gear and pulling with slight to moderate pressure.
7. Remove two screws, item 7, and remove housing, item 8, spring, item 9, and gear assembly, item 10 from actuator body.
8. Remove clutch spring, item 9, from housing using gear assembly, item 6, as removal tool. Insert, item 6, into spring from flanged end of housing, and rotate CCW and pull slightly.

CAUTION

**Use extreme care to prevent ball bearing from dropping out of recoiler assembly, avoid damage to gear and do not allow dirt to enter clutch housing bore.**

After disassembly, clean clutch gear thoroughly. Discard removed screws (3) & (4).

9. See 32-30-06 procedure prior to reassembly if additional maintenance is necessary.

ASSEMBLY

1. Lubricate gear and new clutch spring thoroughly with lube (MIL-G-81322) poly-tube.
2. Using gear to rotate spring, insert clutch spring into bore until fully seated.

NOTE

**Be sure spring is all the way in and seated around cam.**

3. Reinstall recoiler assembly making sure to fully seat gear, bearing, and gear tang into manual drive slot of recoiler assembly.

supplied and install taking care to use the two longest screws in the bottom holes of item 5.

NOTE
**Torque to approximately 10 - 12 inch pounds.**

5. Reinstall cable support bracket and retaining nuts.

6. Retest unit for proper electrical and mechanical operation.

7. Install modification plate adjacent to I.D. plate (first 1000 hours only). Mark the first block of modification plate with the figure "1" using metal stamp or etching tool. Mark plate at each succeeding clutch spring replacement with the next consecutive number.

## 32-30-06 - LANDING GEAR ACTUATOR, P/N 102000-1, RECOILER SPRINGS/CABLE AND DRUM ASSEMBLY REPLACEMENT

1. Carefully separate the pulley housing from the recoiler assembly (5) by removing screws (14).

2. Slide the pulley drum and cable off shaft.

3. Remove the two (2) recoiler springs, and two (2) of the three (3) spring spacers leaving the third spacer in housing. Be certain that spacer is in place before installation of two (2) new recoiler springs and previously removed spacers.

4. Install new recoiler springs placing a spacer between each spring and over top spring. IMPORTANT - Recheck proper installation of springs.

NOTE
**When looking at recoiler assembly with pulley shaft end toward you, the spring tabs in the housing slot should curve to the right as shown (Figure 32-12).**

5. Inspect cable for sheathing damage. Replace cable if sheathing is cut or stripped. Measure overall cable length prior to reassembly, Cable length should be 31 1/2" +/- 1/2" long.

6. Slide drum onto shaft and be certain that spring detent on drum engages both recoiler springs by slightly rocking drum end.

7. When full engagement is obtained, wrap cable around drum in a clockwise direction-leaving 2" to 5" of cable free of drum.

8. Align slot in pulley housing with cable and slide pulley housing over cable and drum assembly.

9. Holding the housings together, pull properly aligned cable several times to ensure the absence of binding conditions. Measure cable length from side of housing. At full extend, the length of cable should be 29" minimum. In retracted position, cable length should be 5" to 8" long.

NOTE
Cable length in retract position may be adjusted shorter or longer by holding clutch with the finger of one hand (to prevent shaft rotation), and then with the other hand, rotating pulley housing one (1) full turn CW (to shorten) or CCW (to lengthen). Retention of clutch with finger will not allow pretensioning of springs. Slight spring tension should be noted starting at 8" to 10".

10. Bronze clutch (13) should be inspected for damage or wear at slot where gear assemble engages during manual extension of the landing gear.

11. If damaged or worn, remove pin (11) from disengage arm (12) and slide disengage arm out so bronze clutch (13) can be pulled from its driveshaft.

12. Replace bronze clutch and reassemble disengage arm into recoiler assembly.

13. Attach clutch recoiler assembly to actuator gear housing with the four (4) screws removed in 32-30-05 (supplied in clutch spring kit).

## 32-30-07 - EMERGENCY GEAR EXTENSION OPERATION

The manual emergency gear extension override system is used to extend the gear only. The controls are in the floorboard aft and between the front seats. To manually extend the gear:

1. Pull landing gear actuator circuit breaker.

2. Move landing gear control switch to DOWN position.

3. Push latch forward with right thumb.

4. Pull lever back and upward (engaging manual extension system).

5. Pull "T" handle up and return to original position and continue until green gear-down indicator light is on and/or the lines on the visual gear position indicator on floor aft of console are aligned when viewed from directly above the indicator (12 to 20 pulls).

**CAUTION**
**DO NOT operate landing gear electrically with manual extension system engaged.**

**CAUTION**
**DO NOT continue to pull T-Handle after GEAR DOWN light is ON. Actuator will bind on Down Stops.**

## 32-31-00 - TROUBLE SHOOTING - LANDING GEAR SYSTEM

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Incomplete retraction. Gear retracts to an intermediate position and stops short. | Bind in gear retraction system because gear is out of rig. Malfunction in gear electrical circuit, inoperative actuating motor, or weak battery. | Refer to landing gear rigging procedure. Examine all movable parts for proper lubrication and freedom from binding.<br><br>Check for actuator worm gear binding and lubricate as needed. Any malfunction can cause the landing gear circuit breaker to trip: therefore check electric circuit for loose connection, broken wires or defective relay switches. Recharge battery if necessary. |
| | Oversized/Stretched tire will not go into wheelwell properly. | Replace tire with smaller diameter tire. |
| Gear will not retract at 61 to 70 KIAS. | Insufficient airspeed, pressure switch inoperative, circuit breaker tripped or actuator ball nut binding on mechanical DOWN STOPS. | Check pitot tube and line for obstructions. Examine pressure switch for proper adjustment and operation. Reset circuit breaker.<br><br>Does gear retract using override - check system operation.<br><br>Gear may have been extended manually & ball nut is jammed tight against STOPS on |

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| | | motor; use wrench on ball nut flat to move off STOPS. |
| Aircraft does not track or steer properly. | Nose wheel location improper. | See Section 32-50-02. |
| Gear will extend; green indicator-light (press-to-test) will not illuminate. | Lamp burned out in green indicator-light circuit. Down-limit switch is inoperative. | Replace burned out lamp. Check indicator-light circuit and/or down-limit switch. |
| Actuating motor extends gear to an intermediate position. | Same causes as listed with "Incomplete Retraction" above. | Same remedies as listed with "Incomplete Retraction" above. |
| Gear will extend manually, but green indicator light will not illuminate. | Gear switch is not in DOWN position. Lamp burned out in green indicator light. | Place gear switch in DOWN position. Replace burned out lamp. |
| | Down limit internal switches not in proper sequence. | Reposition wires so internal switches work in opposite sequence per paragraph 32-60-04 |
| Manual system will not lower gear. | Actuator internal clutch spring broken. | Replace spring. |
| | Manual engage arm improperly rigged. | Rig manual engage arm. |

## 32-40-00 - WHEELS AND BRAKES

### 32-40-01 - MAIN WHEELS

The main wheels have standard brand, 6:00 x 6, six-ply rated tires with standard tubes. To remove main wheels:

1. Remove IB gear door.
2. Detach dust shield. Remove three screws and washers.
3. Remove 2 bolts from brake caliper.
4. Remove wheel by removing cotter key and nut from axle. (See Figure 32-13.)
5. Slide wheel off axle.

### 32-40-02 - MAIN WHEEL DISASSEMBLY/ASSEMBLY

1. Remove snap ring, (10) grease seal rings, (8) and felt seals (9), (See Figure 32-14).
2. Remove bearings (7).
3. Completely deflate tire.

**WARNING**
**Do not loosen wheel half retaining nuts before tire is completely deflated. Failure to observe this warning may result in bodily injury.**

4. Remove nuts, washers, and wheel half retaining bolts, (5); separate halves, (3, 4) and remove tire and tube.

**NOTE**
**Bearing cups are shrink fitted: do not remove them unless necessary for replacement.**

5. Clean all wheel parts thoroughly in cleaning fluid (Federal Specification PS-661). Exercise special care in cleaning bearing cones and felt rings to insure thorough cleaning.
6. Inspect all parts for cracks, corrosion, or evidence or wear.

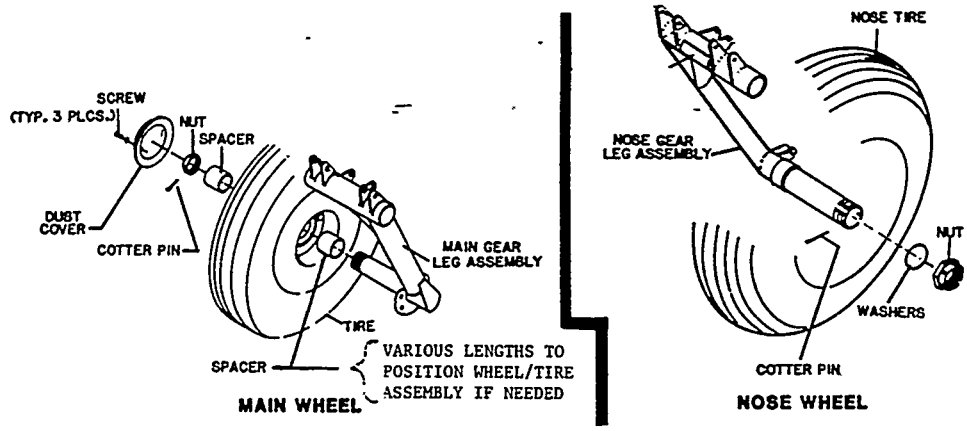



FIGURE 32-13 - LANDING GEAR WHEEL REMOVAL

7. Inspect bearing cups and replace if cups are damaged or worn. If necessary to remove bearing cups, heat wheel in boiling water for at least 30 minutes. Then remove cup by tapping evenly. To install cup, heat wheel half again and then cool cup with dry ice. Position cup and tap lightly to insure proper seating.

8. Polish small burrs or nicks out of wheel halves with No. 400 grit sandpaper, clean thoroughly, and refinish protective coating as required.

9. Replace bearing cones that show signs of wear or bearing fretting.

10. Repack wheel bearings and lubricate seals with grease. Install bearings, grease seal rings, and felt seals in wheel halves. Secure with snap rings.

11. Position tire & tube on one wheel half; then position other wheel half in tire.

12. Install brake disc (2),Fig.32-14, and wheel half retaining bolts, washers and nuts.

13. Tighten nuts evenly and torque to 150 inch pounds.

CAUTION
**Uneven or improper torque may cause bolt or wheel failure.**

14. Inflate tire to 42 PSI.

15. Install wheel assembly, washer, and axle nut. Tighten axle nut until bearing binds slightly, back nut off to nearest castellation, and install cotter pin.

NOTE
**When properly installed, the wheel will turn with a slight resistance.**

16. Install dust shield and IB gear door.

17. Reinstall brake caliper & safety.

NOTE
**Conduct a retraction/extension check (5 cycles) to verify tire enters and exits wheelwell without interference. [Ref. AC 43.13-1A, Chap.8, para. 332, a. (9)]**

18. Remove aircraft from jacks.

## 32-40-03 - NOSE WHEEL DISASSEMBLY/ASSEMBLY

The standard brand, tube-type, 5:00 x 5 (TYPE III)nose wheel tire is six-ply rated.

1. Nose wheel removal.

A. Remove cotter key, nut, and washer from axle. (Figure 32-13).

B. Remove nose wheel.

2. Installation is in reverse sequence of removal.

3. Nose wheel disassembly.

A. Completely deflate tire by removing valve core.

B. Remove nuts, washers, and wheel half retaining bolts (15), Fig. 32-14.

C. Separate wheel halves, (13 and 14) and remove tire and tube. Refer to Section 32-40-02 steps 5 thru 10 for wheel inspection.

D. Reassemble nose wheel in reverse sequence of removal. Tighten wheel half retain-

ing bolt nuts evenly and torque to 90 inch-

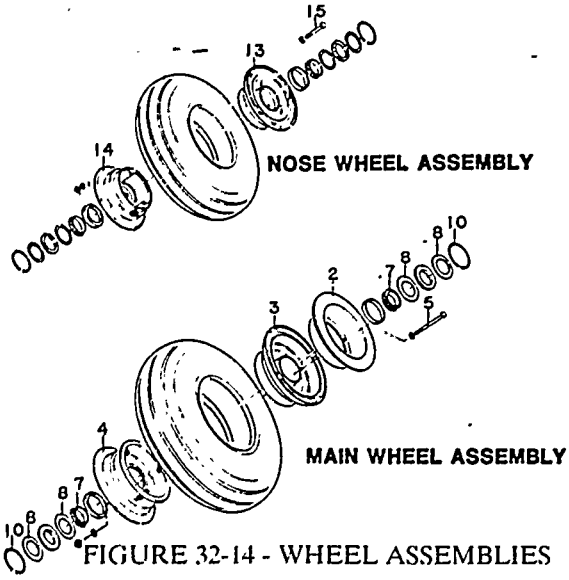



FIGURE 32-14 - WHEEL ASSEMBLIES

pounds. Inflate tire to 49 PSI.

### 32-40-04 - BRAKE SYSTEM

1. Brake removal and installation: Lining inspection and/or replacement or cylinder repair.

A. Place aircraft on jacks.

B. Remove inboard gear doors. Remove safety wire and two AN4H17A bolts (1) attaching back lining plate assembly (2) to brake cylinder assembly (Figure 32-15).

C. Visually inspect linings for wear and

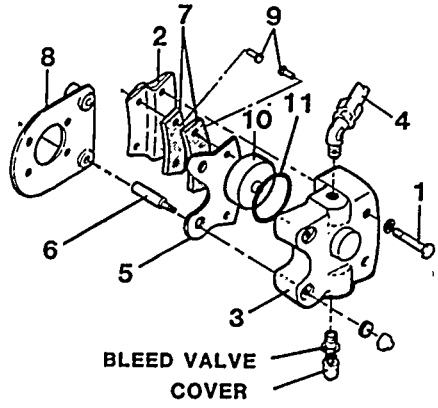



FIGURE 32-15 - BRAKE ASSEMBLY

brake disc for warpage. Brake linings should be replaced when they are worn to a minimum thickness of 1/8 inch. If lining replacement is necessary proceed with steps D thru O. Otherwise reassemble in reverse sequence of disassembly.

**CAUTION**
**Brake disc should be replaced if width is .205 in. or less.**

D. Disconnect and cap hydraulic line (4) at brake cylinder assembly. Remove nuts from anchor bolts.

E. Remove pressure plate assembly (Figure 32-15) (5) sliding it off the anchor bolts (6). Note the condition of the anchor bolts. If they are nicked or gouged they should be sanded smooth to prevent binding with the pressure plate (5) or torque plate (8). When the anchor bolts are replaced they should be pressed out. New ones can be installed by tapping them in place with a soft hammer.

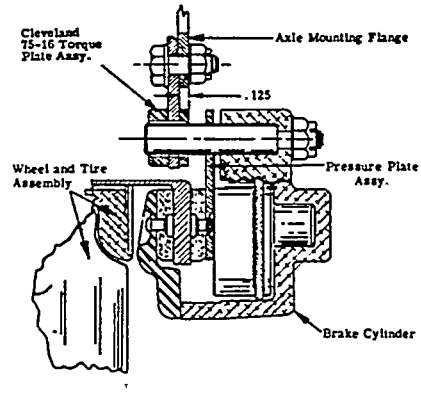



FIGURE 32-16 TORQUE PLATE ASSY CORRECTLY INSTALLED

F. Drill out rivets (9) attaching linings (7) to back lining plate (2) and the pressure plate (5). Remove piston assembly (10) and "O" ring (11). It is permissible to use compressed air applied to the brake line fitting to remove the piston (10) from the brake cylinder.

G. Clean parts in cleaning solvent (Federal Specification PS-661 or equivalent) and dry with oil-free compressed air.

H. Replace linings with Cleveland 66-30 linings using Cleveland #561-2 rivets. Rivets must be rolled to obtain proper fit between rivet shank and hole.

I. Inspect brake cylinder bore for scoring. A scored cylinder may cause the "O" ring to leak or cause rapid wear of the "O" ring. A scored brake cylinder should be replaced.

J. Replace AN6230-2 "O" ring (11) with a new one. Do not reuse the old "O" ring.

K. Lubricate cylinder and piston with MIL-H-5606 red hydraulic fluid and assemble components with care to prevent damage to the "O" ring.

L. Service and inspect main wheels as described in Section 32-40-02. Inspect torque plate assembly making sure the .125 thickness is toward brake cylinder assembly (outboard). If thicker .250 protrusion is outboard, remove torque plate from axle mounting flange and install as shown (Figure 32-16).

M. Reassembly brake cylinder assembly and back lining plate assembly onto the airplane in the reverse sequence of disassembly.

N. Bleed hydraulic system as described in Section 12-20-05.

O. Remove aircraft from jacks.

2. Brake System Conditioning

**NOTE**

**Brake pad conditioning is required to properly cure the resins binding the asbestos lining composition together. Excessive heat created prior to conditioning will carburize the lining material and prevent the attainment of maximum braking coefficient. Proper conditioning may be accomplished as follows:**

A. Perform a minimum of six (6) light pedal effort braking applications and two (2) hard stops from 21 to 35 KIAS. Allow the brake discs to partially cool between stops. The procedure will generate sufficient heat to cure the resins in the lining, but will not cause the material to become carburized due to excessive heat.

3. Master cylinder removal and disassembly.

A. Remove left hand exhaust cavity.

B. Disconnect hydraulic cylinder from pedal linkage.

C. Disconnect and cap hydraulic lines.

D. Disconnect hydraulic cylinder from bracket and remove cylinder.

E. To disassemble master cylinder: (Gerdes or Parker-Hannifin) (Refer Figure 32-17).

(1) Unscrew and remove rod end clevis and nut from piston rod (9).

(2) Remove snap ring (13) and lift out complete piston rod assembly, item 3 thru 12.

(3) Remove spacer (11) and O-ring packings, (10 and 12) from piston and assembly.

(4) Disassemble piston rod assembly by removing roll pin (4), (spring guide (3) will be pushed out by spring (5) when roll pin is removed), spring (5) and piston (7).

(5) Remove O-ring packing (6) from piston.

(6) Remove stat-o-seal (8) from piston rod.

(7) Clean all parts with cleaning solvent (Federal Specification No. PS-661).

(8) Inspect cylinder for cracks, scoring, or grooves in bore.

(9) Inspect piston (7) for damage, check for nicks and scratches

(10) Inspect valve for damage.

(11) Inspect push rod for scoring, grooves, nicks and scratches.

(12) Inspect piston return springs (2) for permanent set and proper length (3.670 in. min., 4.05 in. max.).

(13) Replace all faulty parts and all O-rings.

(14) Reassemble in reverse sequence of disassembly. Immerse all parts in hydraulic brake fluid prior to reassembly.

F. Reinstall master cylinder in reverse sequence of removal.

G. Bleed brake system (refer to Section 12-20-05).

4. Parking brake valve removal and disassembly.

A. Remove left hand exhaust cavity.

B. Disconnect parking brake control at parking brake valve arm.

C. Disconnect and cap hydraulic lines.

D. Remove parking brake valve.

E. Disassemble parking brake valve: (Refer Figure 32-18).

(1) Remove both fittings (1) from valve housing (7), springs (8) will come out with the fittings.

(2) Remove poppet valves (2) and pins (3), from housing by bumping on table top.

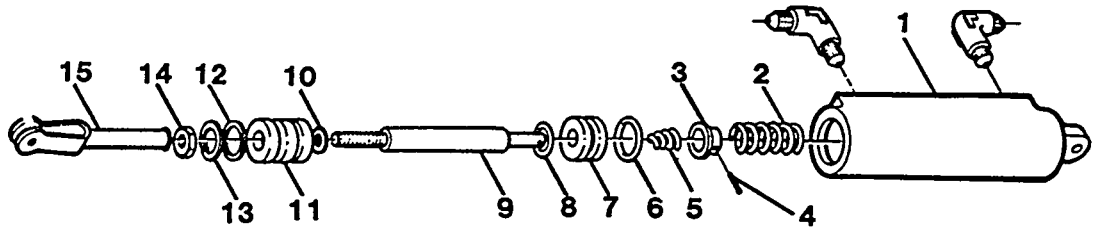



FIGURE 32-17 MASTER BRAKE CYLINDER

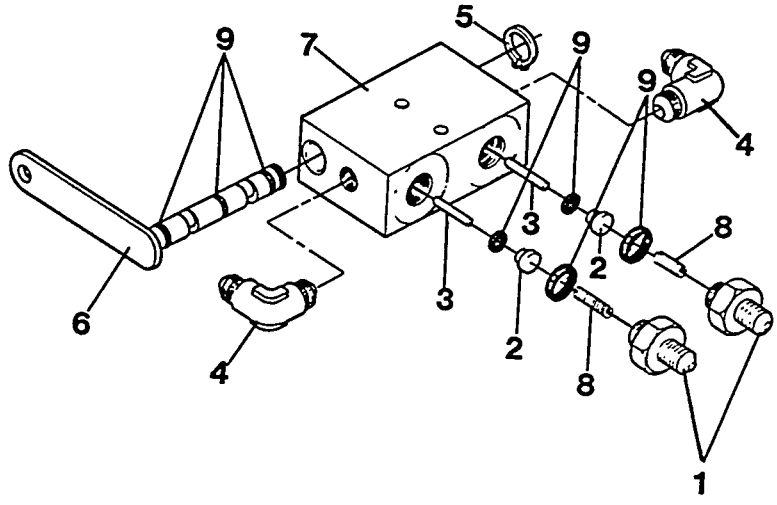



FIGURE 32-18 PARKING BRAKE VALVE

(3) Remove both fittings (4) from end of housing.

(4) Remove snap ring (5) from end of camshaft assembly (6).

(5) Carefully remove camshaft assembly (6) from housing.

(6) Inspect all components for damage, nicks, grooves, etc.

(7) Clean all parts with cleaning solvent (Federal Specification No. PS-661).

(8) Replace all O-rings (9).

(9) Reassemble brake valve in reverse sequence of disassembly.

(10) Connect valve assembly to the hydraulic lines.

(11) Bleed system and service hydraulic reservoir with hydraulic fluid as described in Section 12-20-05.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Solid pedal and no brakes. | Brake lining worn beyond allowable limit. | Replace lining. |
| Spongy brake. | Air in system. | Bleed brake system |
| Pressure will not hold. | Leak in brake system. | Visually check entire system for evidence of leaks. |
| Parking brake will not hold. | Air in system or leak in system (downstream of parking brake valve). | See remedies above. |
| | Defective parking brake valve. | Repair or replace the valve. |
| Brake grabs. | Warped or bent disc. | Replace disc |
| | Foreign matter locking disc. | Clean disc and lining. |
| Brake pedal will not return to neutral position. | Master cylinder shaft or other linkage misaligned. | Check that shaft travels in straight line and not binding in linkage. |

## 32-50-00 - STEERING

### 32-50-01 - NOSE GEAR STEERING SYSTEM

The nose gear steering system consists of a steering horn on the gear leg linked to the rudder pedals by push-pull tubes and bellcranks. Gear retraction automatically disengages the steering mechanism from the nose wheel. (Section 27-20-00 outlines the nose gear steering rigging.) A centering cam aligns the nose wheel for entry into the wheel well.

**NOTE**
**Check nose gear leg assy. for towing damage. Replace if any dent exceeds 1/32 inch.**

**NOTE**
**All aircraft have twin limiter pads and adjustable stops (7),Fig. 32-19, installed on the nose gear leg assembly (A) that will help to prevent towing/turning damage to the leg assembly.**

1. Every 100 hours remove cotter pin (1) (Figure 32-19) and retorque nut (2) to 450-500 inch lbs. Check holes in leg assembly where pivot bolt (3) is located for any wear. If holes are worn, replace the leg assembly.

**CAUTION**
**Bolt, washer, nut (9) and (10) (Figure 32-19) must be installed as shown, from rear to front.**

2. Rod end bearing (4) (Figure 32-19) should be inspected at least every 100 hours for any damage or bending.
3. Check the steering horn assembly (5) collars and spacers for looseness. Replace any bushings or spacers that are worn.
4. Adjust turn limiter stop bolts (7) to contact cross member (8) of truss assembly (.020 gap permissible) when rudder is at its extreme left and right travel position.

### 32-50-02 - NOSE GEAR STEERING AND TRACKING

1. Level aircraft as described in Chapter 5.
2. Center nose wheel.

3. Place plumb line over and forward of nose gear trunnion (see Figure 32-20) part number 540001-503.

4. Measure forward from aft edge of plumb line to axle center line. Modification relocating nose wheel should be accomplished if axle position, forward of plumb line, exceeds .06.

5. Add SB M20-202-3 spacer under collar to reposition the axle if required.

NOTE

**Some collars have holes drilled off center and may be turned over to change axle position.**

6. Run gear through up/down cycle. Check nose gear door and wheel well tire clearances. Re-rig if required.

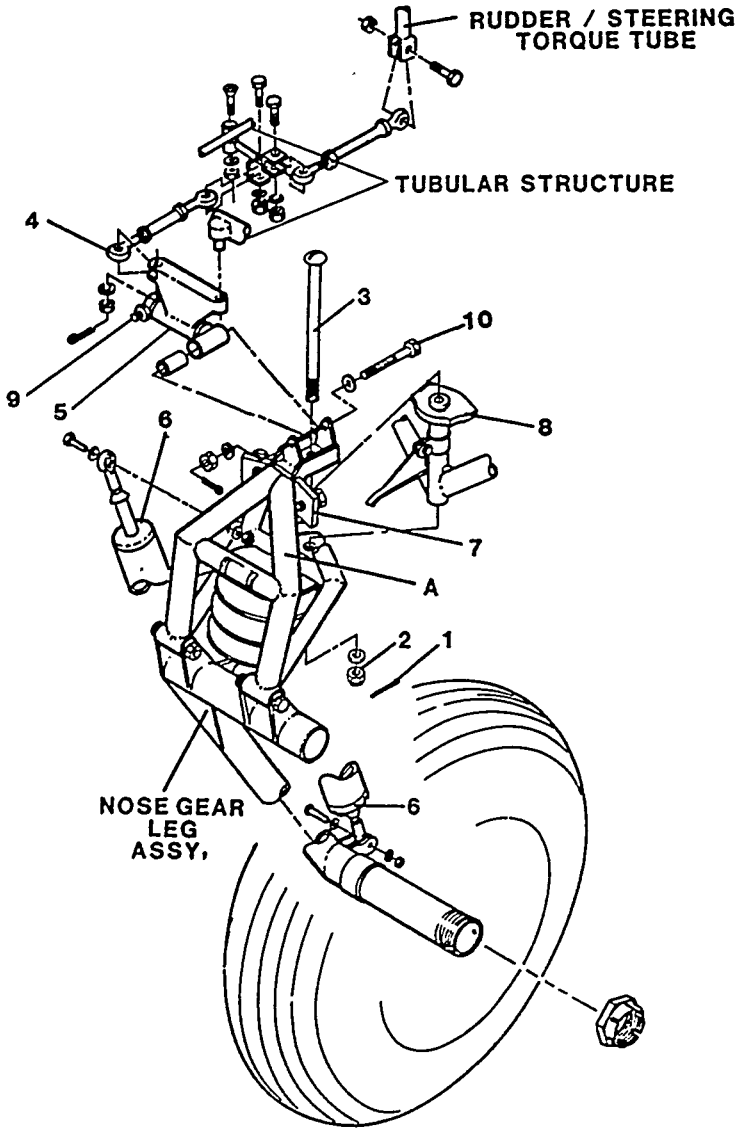



FIGURE 32-19 NOSE WHEEL STEERING

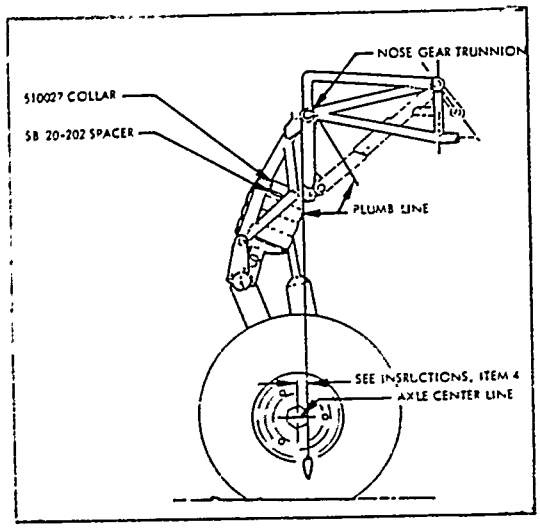



FIGURE 32-20 CORRECT NOSE WHEEL LOCATION

## 32-60-01 - ELECTRIC GEAR SAFETY DEVICES

The gear switch operates the landing gear actuator relay. Pulling the wheel-shaped knob out and moving it to the upper detent raises the gear. However, an airspeed safety switch, is incorporated in the electrical system to prevent landing gear retraction while on the ground. To allow gear retraction with the aircraft on jacks; attach a 12-inch length of 3/8 inch pliable rubber hose (surgical tubing) over the pitot head, and pinch the open end with a larger cotter pin; roll the tubing with the cotter pin until the compressed air within the twisted tube actuates the airspeed pressure switch. Maintain pressure on the switch until retraction is complete. To adjust the airspeed switch refer to paragraph 32-60-03.

The up-limit switch will stop the gear in its retracted position. Moving the control knob to its lower detent lowers the gear. The down limit switch will stop the gear actuating motor when the proper force is exerted to hold the gears in the down-and-locked position. Refer to Section 32-30-02.7, for proper limit switch rigging. The gear down-and-locked position is indicated by:

1. Illumination of the green gear down annunciator light and visual indicator lights

2. The warning horn will not sound with the throttle retarded to a pre-set position.

3. The indicator marks will be aligned on the visual gear-position indicator.

**CAUTION**

**When running gear up or down electrically DO NOT use circuit breaker as a switch. Partial retraction or extension may be accomplished electrically as follows:**

1. Place master switch in OFF position.

2. Move gear switch to GEAR UP or GEAR DOWN as desired.

3. Momentarily actuate master switch until gear is in desired position.

## 32-60-02 - LANDING GEAR WARNING SYSTEM

The landing gear warning system consists of:

1. Landing gear position lights: (GEAR DOWN-white indicator light on floor and green light on annunciator; GEAR IN TRANSIT - up or down - red unsafe on annunciator; GEAR UP - no lights.)

2. A warning horn in cabin is actuated by the throttle control when the gear control switch handle is up and the throttle is retarded to a pre-set position. Check warning horn for volume in flight periodically. Horn will sound if gear is not DOWN and LOCKED even if switch is in DOWN position or if airspeed is below 65 KIAS & gear switch is in UP position.

## 32-60-03 - AIRSPEED SAFETY SWITCH ADJUSTMENT

The airspeed safety switch, located inside the cabin, is mounted behind the airspeed indicator. The airspeed safety switch is incorporated into the electrical system to prevent landing gear retraction while on the ground and at airspeeds below 65 −7 -4 KTS. Additionally the red gear unsafe light comes on and the warning horn is sounded when the gear control handle is placed in the gear - up position below 65 −7 -4 KTS.

**NOTE**

**Warning Horn also sounds through cabin speaker and headset.**

**Whitman-General switches can be adjusted using the following procedures:**

1. Using a water manometer to measure pressure, gradually apply air pressure to inlet at cap.



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2. Connect an ohmmeter between microswitch leads.

3. Graduallly increase the pressure to 2.775 inches of water until diaphram movement closes microswitch.

4. Slowly decrease pressure until microswitch opens.

5. Adjust knurled body until switch closes at an increasing pressure of 2.775 + .384 - .359 in. water 65 +7/-4 KTS.

6. Secure set screw and repeat step (5) five times as specified.

V.E.P. manufactured switches are field adjustable. They should close at 2.8 +/- .4 inches water. Adjust slotted screw head on center of switch to obtain correct settings.

CAUTION

**The airspeed safety switch is designed to operate within a specified range during increasing airspeed only. Due to hysteresis of the switch/diaphram assembly the switch MAY NOT deactivate the landing gear circuitry until approximately 49.5 KIAS. This could allow the landing gear to retract if the gear switch is inadvertently placed in the UP position during the landing roll.**

NOTE

**Refer to proper electrical schematic when replacing with switches from another manufacturer.**

## 32-60-04 DOWN LIMIT SWITCH WIRING

Some occurences of the Gear Actuator stopping before the "DOWN" light illuminating can be corrrected by changing the wiring connections so the two internal switches will operate different circuits and therefore the "DOWN" light will illuminate a fraction of a second prior to the gear being down and locked. The procedures are as follows:

1. Place aircraft on jacks.

2. Remove belly panel for access to gear actuator and limit switches.

3. Locate "DOWN" limit switch wires (6 ea.) and determine most accessible area in wire harness.

(Wires are numbered 20-1 thru 20-6)

4. Locate wire numbers 20-1 and 20-4, cut both at same location. Splice 1 to 4 and 4 to 1.

5. Move approximately 1 inch along wire bundle. Cut and splice numbers 2 and 5 in same manner.

6. Move again and cut and splice numbers 3 and 6 in a like manner.

7. Retract and extend gear to verify proper operation of the warning lights.

## 32-80-00 - MISCELLANEOUS

## 32-81-00 - LANDING GEAR SHOCK DISC INSPECTION

1. Aircraft with full fuel load and weight on landing gear.

A. Main gear shock discs.

(1) Check gap between retaining collar (A) (Figure 32-21) and top retaining plate (B). Allowable gap is 0.00 to 0.60 inches.

(2) Replace discs when gap exceeds the allowable tolerance. Use a shock disc replacement tool (C), P/N GSE 030011, (old P/N ME 121), to remove and install main gear shock discs. Use removable pad from tool as a guide on top of shock link to align discs as they are being compressed.

(3) Careful application of the shock disc replacement tool is recommended during replacement of main gear shock disc to keep from damaging grease fittings.

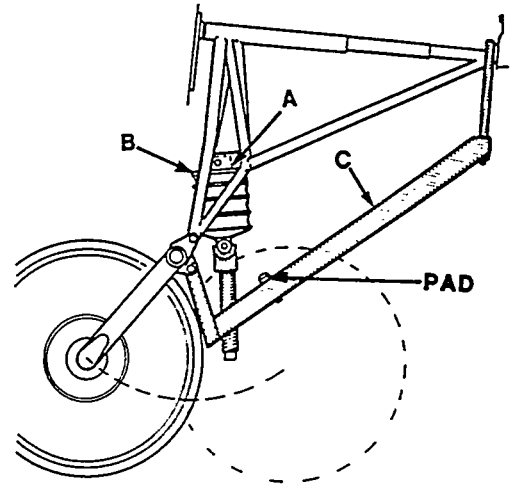



FIGURE 32-21 MLG SHOCK DISC REPLACEMENT TOOL APPLICATION

NOTE

**Shock disc retention collar should be installed with the chamfer facing down and forward.**

B. Nose Gear Shock Discs.

(1) Check for gap between retaining collar (D), (Figure 32-22) and top retaining

plate (E). Top retaining plate must be in contact with retaining collar.

(2) Replace shock discs if gap is found. Use shock disc replacement tool (F), P/N GSE 030010, (old P/N ME120), to remove and install nose gear shock discs. Use removable pad from tool as a guide on top of shock link to align discs as they are being compressed.

NOTE

**Dimension (T), (Figure 32-22), is critical to properly locate nose wheel position. The leg assemblies can vary, due to manufacturers tolerances, where the position for proper nose wheel rigging cannot be met without additional spacers (S) being used. The dimension (T) in a no load fully extended position should be a nominal 3.0 inches. Add spacers to either top or bottom of the shock discs as needed. See (Figure 32-20), paragraph 30-50-02, for proper steering/tracking rigging.**

2. Raise aircraft on jacks - shocks fully extended.

A. Inspect nose and main gear shocks for evidence of gap between retaining collar and retaining plate. The disc preload must be great enough to maintain complete wheel extension during retraction.

B. Replace shock discs that have lost resilience.

C. Inspect retaining collar and bolt for deformation, wear, and cracks.

D. Replace defective bolt and collar.

CAUTION

**Both collar and bolt must be replaced when one or the other is defective.**

E. Inspect nose gear snubber for proper shock absorbing action. Replace snubber when effectiveness is impaired--the unit is sealed and cannot be repaired.

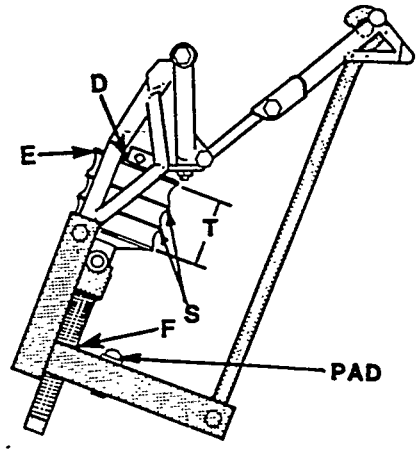



FIGURE 32-22 - NOSE GEAR SHOCK DISC REPLACEMENT

NOTE

**For Nose Gear Steering/Tracking see Section 32-50-02, (Figure 32-20).**

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# CHAPTER 33

# LIGHTS

# LIGHTS

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# LIGHTS

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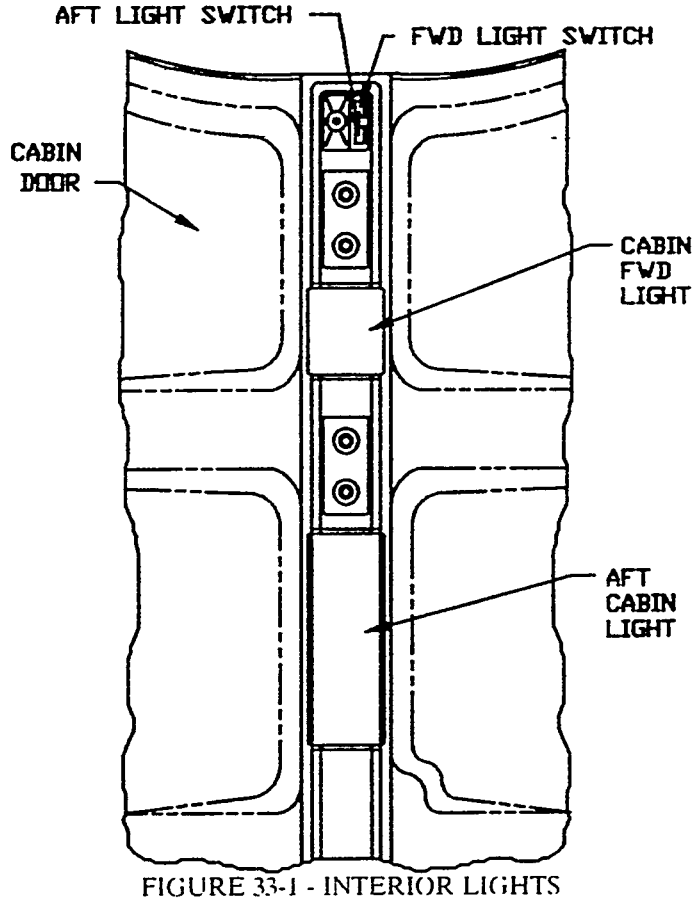



FIGURE 33-1 - INTERIOR LIGHTS

## 33-00-00 - GENERAL - DESCRIPTION AND OPERATION

High intensity strobe lights are standard equipment on M20L aircraft. The lights are located adjacent to the wing tip navigation lights and incorporated in the taillight assembly. Separate power supplies are utilized for each strobe light and are located in each wing outboard section, mounted on inspection cover, and inside the tailcone adjacent to the left rear inspection cover. The system is actuated by a 10 amp circuit breaker/switch located on the instrument panel in front of the pilot.

Navigation lights (red or green) are located on each wing tip forward section; aft facing navigation lights (clear) are located on each wing tip trailing edge. The lights are activated by a 7.5 amp circuit breaker/switch located on the instrument panel in front of the pilot.

The landing/taxi lights are located in leading edge of both wings. Two 110,000 candle power sealed beam bulbs are incorporated in both wings. The lights are activated by two 25 amp circuit breaker/switches (landing & taxi) located on the instrument panel in front of the pilot. The switches are used to illuminate both landing & taxi or either one, as needed.

Two sets of interior lights are located on the overhead panel. The forward cabin overhead lights are located between the pilot and co-pilot seats and are actuated by a three position switch, (dim, off, bright) located forward of overhead air vents on overhead panel. The passenger compartment lights are located above the rear seats in the overhead panel and are activated by a similar three position switch located adjacent and aft of forward cabin light switch.

CAUTION

**These cabin lights are connected directly to the battery through their switches and will illuminate without the master switch ON.**



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| APPLICATIONS | BULB PART NUMBER |
|---|---|
| Glareshield Lights | GE 327 |
| Post Lights | GE 327 |
| Map Light | GE 327 |
| Cabin Interior Lights | GE 1818 |
| Trim & Flap Indicator | GE 327 |
| Gear Down Light (Floorboard Indicator) | GE 327 |
| Tail Position Light (WHELEN) | A508-14W1290 |
| Wing Tip Position Light (GRIMES) | W1290 |
| Landing Light (GE) | GE 4596 |

## 33-20-00 - INTERIOR LIGHTS - MAINTENANCE PRACTICES

## 33-21-00 - CABIN LIGHTS - OVERHEAD LIGHTS

### 33-21-01 - LIGHT BULB REPLACEMENT

1. Remove the light cover panel (2) (Figure 33-1) from the headliner assembly (1) by removing screws (3).

NOTE
**The front and rear light bulbs are replaced in the same manner.**

2. Remove and replace the bulbs and check for proper operation.

### 33-21-02 - CABIN LIGHT SWITCH REPLACEMENT

1. Remove the cover (4) from headliner assembly (1) by removing the screws (3) holding panel in place (Figure 33-1).

NOTE
**The aircraft overhead ventilation system has a butterfly shut-off valve that must be freed from the panel prior to removal.**

2. The switch (5) is a press and snap in fit and may require the bending of spring tabs to release for removal.

3. Disconnect wire connections and replace with new switch. Check for proper operation.

4. Reassemble the panels, and ventilation control if applicable, to the headliner.

### 33-22-00 - INSTRUMENT/FLIGHT PANEL AND GLARESHIELD LIGHTS

### 33-22-01 - LIGHT BULB REPLACEMENT

1. Instrument panel lights.

A. Internally lit instruments are not being considered in this information.

B. Post light bulbs are replaced by pulling hood straight out from post light base and then pulling bulb from this hooded portion.

C. Insert new bulb into hood and push hood back onto post light base.

D. Check for proper operation and hood orientation.

2. Glareshield lights.

A. Remove outer housing by unscrewing from light assembly base.

B. Remove bulb and insert new bulb.

C. Screw outer housing back onto base.

D. Check for proper operation.

3. Trim Indicator Light.

A. LCD indicator; remove and replace.

4. Flap indicator light.

A. LCD indicator; rmove and replace.

5. Map Light

A. Place wrench on flat of exposed metal housing on bulb assembly from receptacle.

B. Screw on new bulb assembly and tighten.

**Figures 33-2 & 33-3 are reserved.**

### 33-23-00 - GEAR DOWN INDICATOR LIGHT (FLOORBOARD)

### 33-23-01 - LIGHT BULB REPLACEMENT

1. Remove lower belly panel to gain access to light assembly.

2. Remove and replace bulb.

3. Check for proper operation.

4. Reinstall belly panel.

## 33-40-00 - EXTERIOR LIGHTS - MAINTENANCE PRACTICES

## 33-40-01 - TROUBLE SHOOTING EXTERIOR LIGHTS

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| | **STROBE LIGHTS** | |
| Lights inoperative. | Circuit breaker/switch tripped. | Check for short circuit. Reset circuit breaker. |
| | Loose connection. | Check and tighten electrical connections. |
| | Battery defective. | Replace battery or use external power. |
| | Circuit breaker switch defective. | Check continuity through switch; replace if necessary. |
| | Faulty power supply. | Disconnect synch wires to identify faulty power supply. |
| One bulb does not light. | Bulb burned out. | Replace bulb. |
| | Power supply inoperative. | Replace. |
| | Fixture not grounded. | Check for good bonding between fixture and structure. Tighten mounting screws. |
| | Loose connection. | Check all connections in circuit. |
| | Defective fixture | Replace fixture. |
| | **LANDING/TAXI LIGHTS, NAVIGATION LIGHTS AND TAILLIGHT** | |
| Lamp fails to light. | Circuit breaker/switch tripped. | Check for short circuit. Reset circuit breaker. |
| | Lamp burned out. | Replace lamp. |
| | Loose connection or defective wire. | Tighten connections and check wire circuit continuity. Replace or repair wire if necessary. |
| | Circuit breaker/switch defective. | Check continuity through switch. Replace if necessary. |

## 33-41-00 - STROBE LIGHTS - MAINTENANCE

The strobe light power supply requires a 28 VDC input across the red and black wires. Red is positive and black is negative, or common. The voltage for the strobe light is supplied through Pin 1 and 3 of the power supply connector with Pin 2 as the trigger pulse. The strobe light assembly is a potted assembly and cannot be repaired.

### TROUBLE SHOOTING AIDS

**When no lights are flashing:**

1. Check circuit breaker/switch.

2. To determine power supply or flashtube problems, first check the input voltage to the power supply. The red and black line should have 28 VDC. If no voltage is present check for shorted power leads or tripped circuit breaker.

**When one light not flashing:**

1. To determine power supply or flashtube problems, first check the input voltage to the power supply. The red and black line should have 28 VDC. If no voltage is present then check for shorted power leads, blown inline fuses, or circuit breaker. If input voltage is present, then disconnect the connector to the flashtube. 400-500VDC should be present across Pin 1 and 3 of the power supply. If not, the power supply has no output and is defective. Turn off master switch.

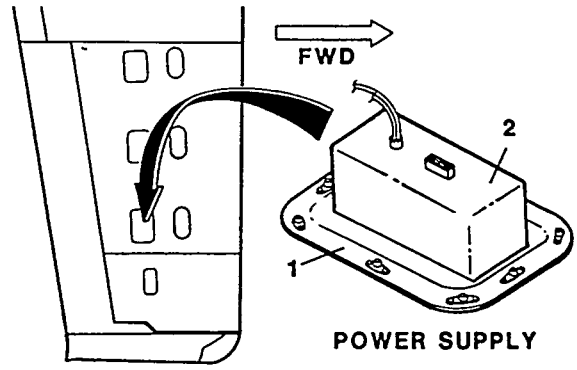
2. If voltage is present across Pin 1 and 3 of the power supply, connect a known good flashtube to the power supply. If good flashtube fails to operate, power supply is defective. If good flashtube operates, the flashtube is defective. Replace flashtube.

## 33-41-01 - POWER SUPPLY UNIT - REMOVAL OR REPLACEMENT

1. Wing tip strobe power supply.

A. Gain access to wing tip power supply through bottom inspection cover (1) near wing tip (See Figure 33-4). Power supply (2) is physically attached to this inspection cover.

B. Disconnect wiring connections between switch and power supply.




**VIEW LOOKING UP - LEFT WING**
INSPECTION COVER-TYPICAL LOCATION-RIGHT WING

FIGURE 33-4 - STROBE LIGHT POWER SUPPLY

**WARNING**
**High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 20 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.**

C. Disconnect wiring harness between power supply and strobe light. (See warning above).

D. Remove the screws securing the power supply to the inspection panel and remove the unit.

2. Tail strobe light power supply.

A. Gain access to this unit through the inspection cover on the aft, left hand side of the tailcone. The power supply is physically mounted to this inspection cover.

B. Disconnect the wiring connections between the switch and the power supply.

C. Steps B thru D, and Warning of paragraph 33-41-01, 1, apply for removal of this power supply unit.

## 33-41-02 - POWER SUPPLY UNIT -INSTALLATION

The installation of any of the power supplies is a reverse sequence of the removal procedures.

**CAUTION**

**STROBE LIGHT WIRING - An incorrect hook-up of the wires at either the power input or between the strobe light assemblies and the power supply unit will cause a reversal of polarity that results in serious component damage and failure. Care must be taken to ensure that the red wire is connected to positive power and the black wire to ground.**

## 33-41-03 - STROBE LIGHT REPLACEMENT

1. Wing tip strobe light.

A. Remove the wing tip lens (1) (Figure 33-5) to gain access to malfunctioning strobe light.

B. Remove screws (2) holding the navigation/position light lens and the screw (3) below the flashtube assembly. This will allow the light assembly (4) and mounting plate (5) to be pulled away from tip rib.

C. Remove the two screws (6) from the back side of the mounting plate.

**WARNING**

**High voltage is involved in the circuit between the power supply and strobe light assemblies. Although a bleed-off resistor is incorporated in the power supply circuit, turn the control switch for the strobe lights OFF and allow at least 20 minutes to elapse prior to disconnecting the cables at the power supply or strobe light assemblies and before handling either of these units in any way. Failure to observe these precautions may result in physical injury from electrical shock.**

D. Disconnect the wiring harness plug and remove the flashtube assembly.

E. The flashtube assembly must be replaced if determined to be bad; the flashtube is soldered in place and is not readily removeable from the assembly.

F. If required, the clear lens can be removed from the flashtube assembly by removing the two lens retaining screws (7), Fig. 33-5, and pulling the lens free for replacement or cleaning.

G. Install the new strobe light assembly in reverse sequence of removal.

2. Tail strobe light removal.

A. To gain access to the wire harness and connections from the power supply rotate the round access cover (1) on the lower left side of the empennage stinger (Figure 33-6).

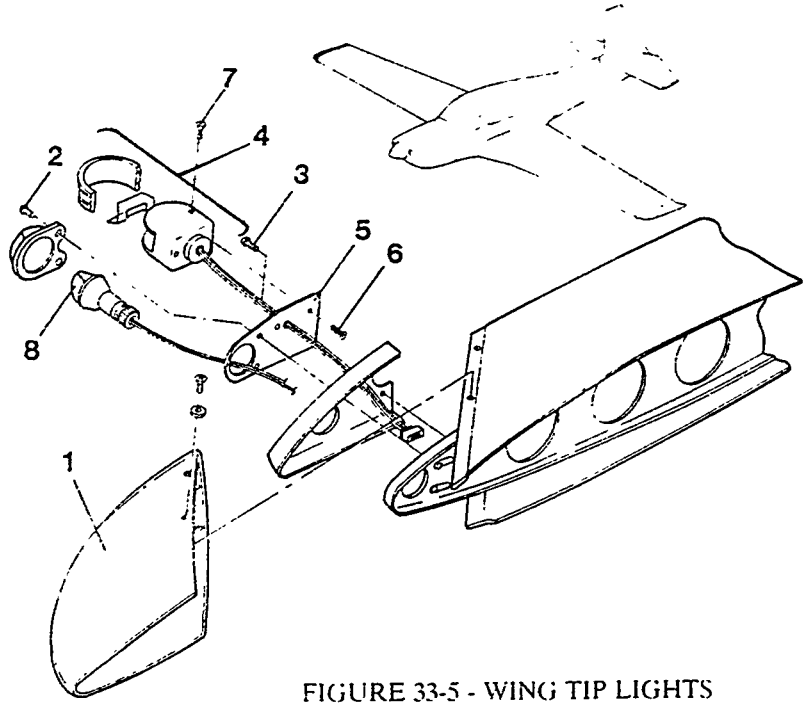



FIGURE 33-5 - WING TIP LIGHTS

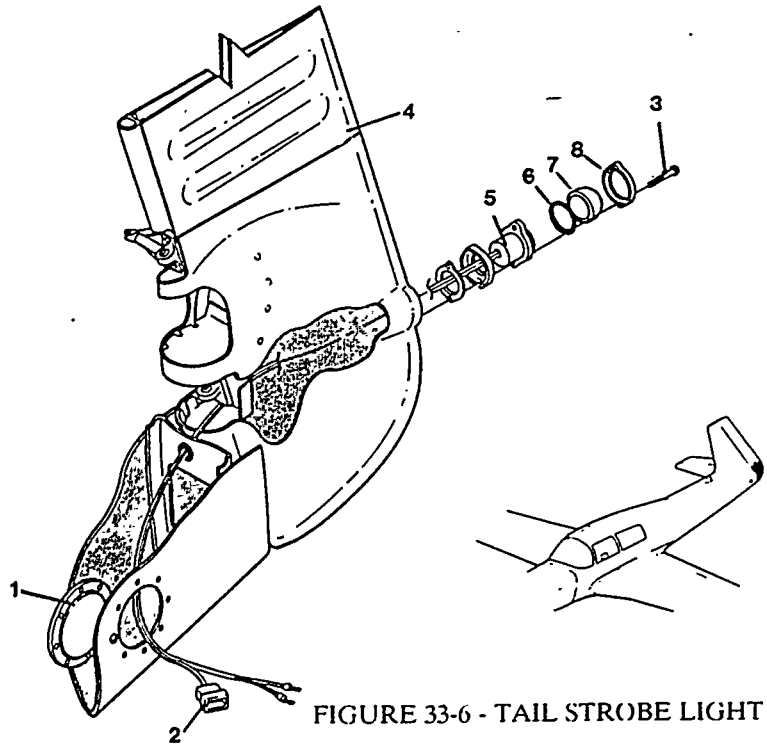



FIGURE 33-6 - TAIL STROBE LIGHT ASSY.

B. Disconnect strobe wiring harness connector from strobe power supply harness.

C. Remove the connector plug (2) from the strobe light wiring harness leaving the pins connected to the individual wires.

D. Tie and tape a strong, small diameter cord, 4 to 5 feet long, to the entire wire harness after plug has been removed.

E. Remove the two screws (3) that secure the strobe/tail light assembly to the rudder (4) and pull the light assembly out so it clears the mounting hole.

F. Carefully begin working the wire harness through the empennage and rudder bulkheads until the wire harness can be pulled through the light mounting hole in the rudder. The rubber grommets at each bulkhead will require removal from bulkhead but leave attached to wire harness. See (Figure 33-6) for this detail.

G. Pull light assembly and entire wire harness through mounting hole in rudder. **DO NOT PULL THE STRONG CORD ALL THE WAY THROUGH ACCESS PANEL HOLE.** You will need this to pull the new wire harness back in place during installation. Remove cord from wire harness.

H. Replace complete flashtube assembly (5) if strobe light portion is malfunctioning. The flashtube is not a repairable component.

I. Place bulkhead grommets at relative positions on new harness, after plug (2) is removed from new harness.

J. Tie and tape cord to new harness and carefully begin to feed wire and grommets back to their positions.

K. Place all grommets in the bulkheads. Reinstall plug (2) on new harness and secure the strobe light assembly to the rudder after proper positioning of gasket(6), lens(7) and retainer(8).

L. Connect the completed harness and plug from the strobe light assembly to the harness socket from the strobe power supply.

M. Check for proper operation.

N. There is sufficient wire available to pull this strobe light assembly out the rudder attach hole.

A. Remove the wing tip lens (1) (Figure 33-5).

B. Remove the two screws (2) holding the position light lens in place.

C. Pull the lens (red or green) from mounting plate (5) and remove the lamp (8).

D. Install new lamp into base.

E. Reassemble the light assembly in reverse sequence.

2. Aft Position Light

A. Remove two screws that secure aluminum cover (1) to wing tip (2).

B. Remove clear lens (3) & gasket to gain access to light bulb (4).

C. Pull light bulb (with special puller if needed).

D. Replace with new lamp & reassemble light assembly in reverse sequence of removal.

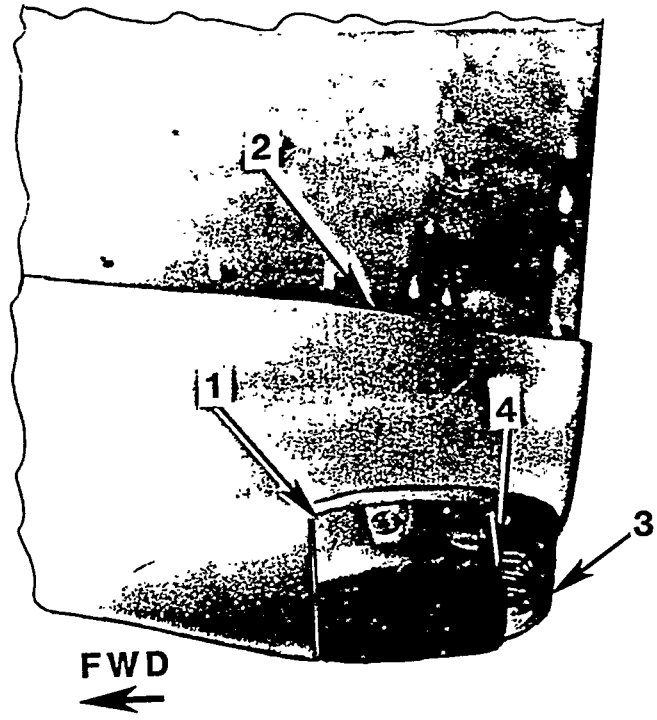



FIGURE 33-7 - AFT POSITION LIGHT

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# CHAPTER

# 34

# NAVIGATION

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## 34-00-00 - GENERAL

All flight instruments are grouped on the shock mounted panel directly in front of the pilot. Flight instruments are operated by: (1) barometric pressure or barometric impact air pressure differences. (2) variations in electric current due to mechanically varied resistance. (3) reference to the earths magnetic field or (4) aircraft electrical power.

The glareshield must be removed and wiring or plumbing disconnected on many of the flight instruments before they can be removed. Remove glareshield attaching screws, center post cover screws and carefully lift center post cover and glareshield from the panel. Disconnect the glareshield lights. Reinstall the glareshield in reverse sequence.

## 34-10-00 - PITOT & STATIC AIR PRESSURE SYSTEM

Static pressure instruments are extremely sensitive to pressure changes; therefore, the pitot and static system must be kept free from moisture and obstructions. Drain the pitot and static systems after humid or wet weather. If instrument operation is erratic or inoperative after draining, perform the following:

1. Pitot system leak test. (Make sure Master switch is OFF and Gear Control is in DOWN position.)

A. Slip end of a short rubber hose over pitot tube.

B. Close open end of hose; slowly roll up hose until airspeed indicator reads 150 KIAS.

C. Clamp hose and hold for one minute.

D. If airspeed indicator falls more than 10 KIAS, within one minute, check system for leaks and tighten line fittings.

E. Repeat steps B, C, and D until obtaining less than a 10 KIAS indicator reading drop.

CAUTION

**Release the air pressure slowly by unrolling the rubber tubing, a sudden release of the air pressure may damage the airspeed indicator.**

2. Pitot system hose inspections. After the pitot system is checked for leaks, inspect the hose sections for signs of deterioration. Check all tubing for brittleness, checks or cracks particularly at the bends or connecting points. When new hose is installed, recheck the system for leaks using the PITOT SYSTEM LEAK TEST procedure above.

3. Static system cleaning. Blow low air pressure (10-25 PSI), through the lines from the disconnected line at the airspeed indicator to the static ports. Cover each static port separately when blowing to insure that each line is clear. Instrument error or possible damage may result if even one port is clogged with dirt or foreign matter.

CAUTION

**NEVER BLOW AIR through the line TOWARD the INSTRUMENT panel; to do so will seriously damage the instruments. When blowing back through the line from the instrument panel, make sure that no air is blown into the instruments.**

4. Static system leak test. The static system should be checked for leaks in accordance with the instructions in Federal Aviation Regulation 91.171.

CAUTION

**To avoid damaging either the airspeed indicator or the landing gear airspeed safety switch an equal pressure should be applied to the pitot side of the indicator while leak testing the static system.**

5. Alternate static source. An alternate static source valve is provided to change the static air source from outside the aircraft to inside the cabin. The valve is located on the lower panel immediately to the left of the pilots control column. Airspeed indicator and altimeter readings will be slightly affected when using the alternate static source.

34-10-01

## - HEATED PITOT TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Tube does not heat or clear itself of ice with switch on. | Switch circuit breaker tripped. | Reset circuit breaker. |
| | Open circuit. | Repair. |
| | Excessive voltage drop between battery and pitot head. | Check voltage at pitot head. |
| | Heating element burned out. | Replace pitot head. |

## 34-11-00 - AIRSPEED INDICATOR

Registers airspeed in knots. Air pressure difference between impact air, pitot tube, and static air (static ports on each side of the aircraft tailcone) operates the airspeed indicator. An electrically heated pitot head prevents ice obstruction in flight.

The airspeed indicator dial markings are as follows:

Radial Red Line ..... 195 KIAS
Yellow Arc ..... 174-195 KIAS
Green Arc ..... 64-174 KIAS
White Arc ..... 57-110 KIAS

NOTE
**See Section 27-95-00 for stall warning systems.**

## 34-11-01 - AIRSPEED INDICATOR TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Instrument pointer does not indicate properly. | Leak in instrument | Check for leak and seal case or in static lines lines. |
| | Obstruction in pitot tube. | Clean out obstruction. |
| Instrument pointer oscillates. | Leak in instrument case or in pitot lines. | Check for leak and seal lines. |

## 34-12-00 - VERTICAL SPEED INDICATOR

Converts barometric pressure changes within the static port lines to aircraft ascent or descent rate; readings are in feet per minute.

This instrument has a single needle and two adjoining scales that read from 0 to 2000 feet per minute, top side for ascent rate and bottom side for descent rate. The recessed, slotted screw at the lower left of the instrument case is used to "zero" the indicator when the aircraft is on the ground.

34-12-01

**- RATE-OF-CLIMB INDICATOR TROUBLE SHOOTING. (VERTICAL SPEED INDICATOR).**

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Pointer does not set on zero. | Aging of diaphragm. | Turn setting screw to reset pointer at zero. Tap instrument while resetting. |
| Pointer fails to respond. | Obstruction in static line. (Includes water) | Disconnect static line from instruments. Apply low pressure air (10-25 PSI max.) to instrument end of static line. Check both static ports for air flow. Depress static drain valve and check for water. Keep depressed until air is free of moisture. Reconnect static line to instruments and leak check. |
| Pointer oscillates. | Leaks in static line. | Disconnect all instruments connected to the static line. Check individual instruments and test installation for leaks. |
| | Defective mechanism. | Replace instrument. |

**34-13-00 - ALTIMETER**

The altimeter operates by absolute pressure, and converts barometric pressure to altitude; reading is in feet above mean sea level. The altimeter has a fixed dial with three pointers to indicate hundreds, thousands, and tens of thousands of feet. Barometric pressure is sensed through the static vents. A knob adjusts a movable dial behind a small window in the face of the main dial to indicate local barometric pressure. This corrects the altimeter reading for prevailing conditions.

**34-13-01 - ALTIMETER TROUBLE SHOOTING**

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Excess scale error. | Improper calibration adjustment. | Replace instrument. |
| Excessive pointer oscillation. | Defective mechanism. | Replace instrument. |
| High reading. | Static pressure system leak. | Eliminate leak in static pressure system. |
| Setting knob is hard to turn. | Wrong lubricant or lack of lubrication. | Replace instrument. |

ALTIMETER TROUBLESHOOTING (CONT)

| | | |
|---|---|---|
| Inner reference marker fails to move when setting knob is rotated. | Marker out of engagement. | Replace instrument. |
| Setting knob set-screw is loose or missing. | Excessive vibration. | Tighten instrument screw if loose. Replace instrument if screw is missing. |
| Cracked or loose cover glass. | Excessive vibration. | Replace instrument. |
| Dull or discolored luminous markings. | Age. | Replace instrument. |
| Barometric scale and reference markers are out of synchronization with pointers. | Shift in mechanism. | Reset pointers. |
| Barometric scale and reference markers are out of synchronization. | Slippage of mating parts. | Replace instrument. |

## 34-20-00 - DIRECTIONAL GYRO COMPASS

This electrically driven instrument indicates the heading reference. The knob is used to reset basic directional heading. (See Trouble Shooting Chart, for maintenance instructions.)

## 34-20-01 - DIRECTIONAL GYRO TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Instrument does not indicate. | No electrical power to instrument. | Check Power On flag. Check to see if power is getting to Instrument. Correct electrical problem. Replace if necessary. |
| | Excessive vibration. | Test with vibrometer. If vibration amplitude is more than .004 inch, examine shock mountings to see if connections are restricting instrument. |
| Instrument is sluggish. | Defective mechanism (worn or dirty pivots and bearings.) | Replace instrument. |
| Dial spins continuously in one direction. | Operating limits have been exceeded | Reset the instrument with the aircraft in level flight. |
| | Defective mechanism. | Replace instrument. |

## 34-21-00 - TURN COORDINATOR

A gyro instrument that indicates control coordination and rate of turn. This instrument is electrically driven.

## 34-21-01 - TURN COORDINATOR TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Pointer fails to respond. | Foreign matter lodged in instrument. | Replace instrument. |
| | No electric current. | Check voltage at instrument. |
| Bar does not set level. | Gimbal and rotor assembly out of balance. | Replace instrument. |
| | Pitted or worn pivots or bearings. | Replace instrument. |
| In low temperature, bar fails to respond or responds sluggishly and with insufficient deflection. | Oil has become too thick. | Replace instrument. |
| | Insufficient bearing clearance. | Replace instrument. |
| Bar sluggish in returning to level and does not set on level when stationary. | Oil or dirt between damping pistons and cylinders. | Replace instrument. |
| | Excessive clearance between rotor and rotor pivots. | Replace instrument. |

## 34-22-00 - MAGNETIC COMPASS

The magnetic compass dial, graduated in five-degree increments, is encased in a liquid filled glass and metal case. The unit mounts on the stainless steel windshield center post above the glareshield. The compass should be swung and compensated at each annual inspection and whenever new equipment is installed. To compensate for N-S deviation, adjust left screw; to compensate for E-W deviation, adjust right screw.

Degausing of the tubular structure may be required if compass cannot be compensated within limits. Carefully go over the entire steel structure with degauser to remove residual magnetism. Recommend Armature Growler to degause steel structure.

NOTE

**Refer to S.B. M20-150A, Instruction III, for degausing procedures.**

NOTE

**Check for outside magnetic influences if excessive compensation is required.**

34-22-01

## -MAGNETIC COMPASS TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Excessive card error. | Compass not properly compensated. | Compensate instrument. |
| | External magnetic interference. | Locate magnetic interference and eliminate if possible. |
| | | Excessive card oscillation. |
| | Improper instrument mounting. | Align instrument. |
| | Insufficient liquid. | Replace instrument. |
| Sluggish card. | Weak card magnets. | Replace instrument. |
| | Excessive pivot friction or broken jewel. | Replace instrument. |
| | Instrument too heavily compensated. | Correct excess compensation. |
| Liquid leakage. | Loose bezel screws. | Tighten screws. |
| | Broken cover glass. | Replace instrument. |
| | Defective sealing gaskets. | Replace instrument. |
| Discolored luminous markings or discolored damping liquid. | Age | Replace instrument. |
| Defective light. | Burned out lamp or broken circuit. | Check lamp or wiring continuity. |

## 34-23-00 - ARTIFICIAL HORIZON

The electrically-powered artificial horizon gyro indicates aircraft attitude relative to straight and level flight. Maintenance is similar to that required for the directional gyro compass

34-23-01

## - GYRO-HORIZON TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Horizon bar does not respond. | No electrical power to instrument. | Check Power On flag. Correct electrical problem. Replace instrument if necessary. |

GYRO-HORIZON TROUBLE SHOOTING (CONT)

| | | |
|---|---|---|
| | Defective Mechanism. | Replace instrument. |
| Horizon bar does not settle. | Defective mechanism. | Replace instrument |
| | Excessive vibration. | Test with vibrometer. If amplitude is more than .004 inch, examine installation to determine whether connections are restricting movement of instrument. Examine shock mountings and replace if necessary |
| Horizon bar oscillates or vibrates excessively | Defective mechanism | Replace instrument. |
| | Excessive vibration. | Test with vibrometer. If amplitude is more than .004 inch, examine installation to determine whether connections are restricting movement of instrument. |
| | Shock mounted panel is contacting structure (inadequate clearance). | Examine shock mountings and replace if necessary. |

## 34-90-00 - MISCELLANEOUS INSTRUMENTS

### 34-90-01 - CLOCK

Various clock options are available. The standard clock is mounted in the left side of the instrument panel.

### 34-90-02 - OUTSIDE AIR TEMPERATURE

Provides the pilot with the free stream outside air temperature in degrees centigrade.



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# CHAPTER 35

# OXYGEN

# OXYGEN

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## 35-00-00 - GENERAL

The oxygen system is an optional installation for serial number 20-0001 and ON. The system consists of a 76, 77.1 or 115.7 cubic ft. cylinder located in the tailcone immediately aft of the baggage compartment bulkhead. A reducing valve and an altitude compensating valve are connected to the cylinder to regulate the oxygen flow for a given altitude. Lines connected to the altitude compensating valve distribute aviators oxygen to the pilot and passengers. The system is activated by the control knob rotated to open the reducing valve. A gauge, located on the pilots arm rest adjacent to the control, indicates the pressure of the cylinder. When the cylinder is full the pressure will indicate 1850 P.S.I. at 21 degree C. (70 degree F.). The system is serviced through an access opening located aft of the baggage compartment door. Standard refill fittings are required to fill the cylinder with aviators oxygen. (Spec. No. MIL-O-27210).

**WARNING**

**Proper safety measures must be employed while oxygen system maintenance is being performed or a serious fire hazard will be created. Avoid making sparks and keep all burning cigarettes or fire away from the vicinity of oxygen. Make sure that your hands, tools, and clothing are clean, particularly with respect to oil or grease, for these WILL IGNITE upon contact with pure oxygen under pressure.**

## 35-00-01 - RECHARGING PROCEDURES

**WARNING**

**Oil, grease or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided when handling oxygen equipment.**

**WARNING**

**NO SMOKING when refilling oxygen cylinder.**

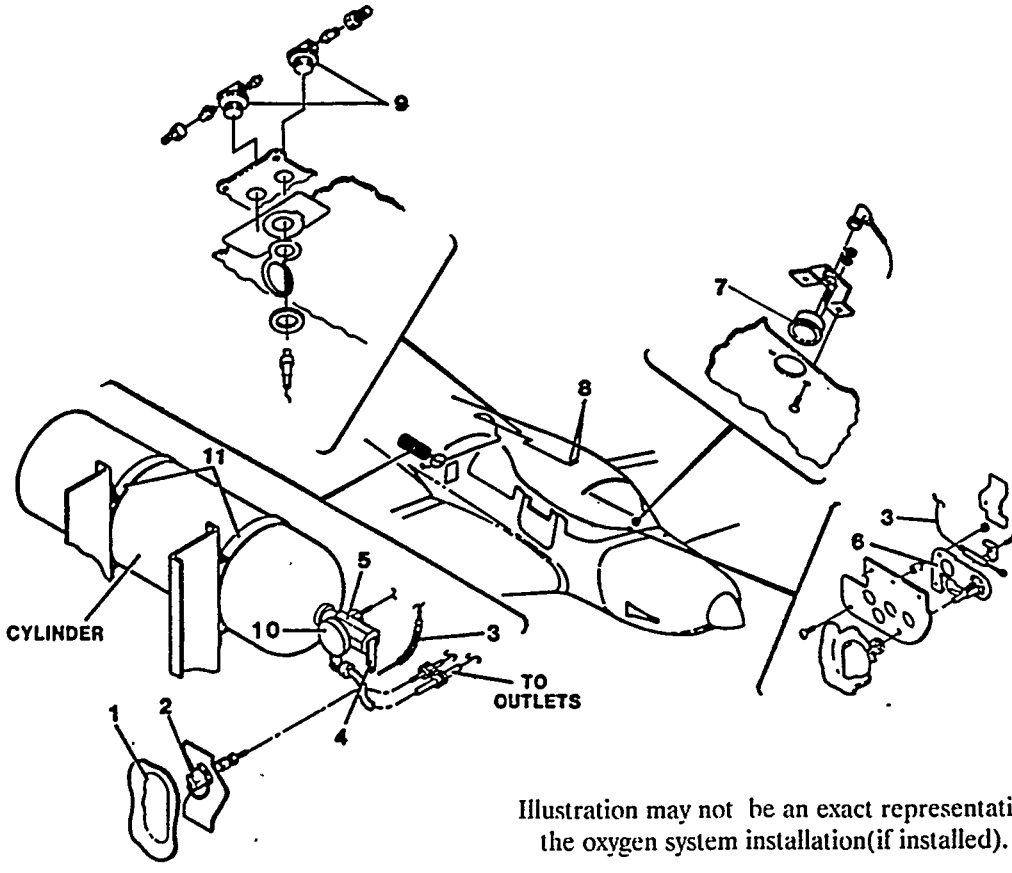



Illustration may not be an exact representation of the oxygen system installation(if installed).

FIGURE 35-1 - OXYGEN SYSTEM

1.The oxygen cylinder should not be used to less than 100 P.S.I.: contamination may occur to the cylinder and valve. The valve must be removed and the cylinder cleaned and inspected if this happens.

2. Refill the cylinder with aviators oxygen Specification No. MIL-O-27210. through the Oxygen Servicing Access Door (1) (Figure 35-1). No special fittings are required for this servicing, however several types of standard oxygen fittings are in use and a compatible fitting for the Scott Recharging Valve (2) must be used. Mooney P/N 870025-501 oxygen recharge hose assembly is recommended.

3. The cylinder contains 1850 P.S.I. at 21 degrees C. (70 degrees F.) when fully charged. Temperature has an affect on the correct charging pressure: See Section 12-10-04 and (Figure 12-1) for pressure vs. temperature charging pressure.

## 35-00-02 - MAINTENANCE PRACTICES (Ref: AC 43.13-1A,chap. 8, para. 363)

1. The control cable (3) (Fig. 35-1) is attached to an actuating arm (4) on reducing valve (5). This cable is routed through various bulkheads along the left side panel to the control (6) at pilots position. The control is a push-pull cable assembly that is activated by a rotating knob assembly. The supply gauge (7) located adjacent to this control indicates the pressure of oxygen available in the system.

2. The pilots & co-pilots outlet (8) and rear passenger outlets (9) should be inspected for damage and cleanliness during servicing.

3. Inspect the individual oxygen masks, and fittings for damage.

4. Oxygen system test procedures. Remove oxygen line from the regulator and plug the line. Cap open regulator port with a clean plastic cap to prevent contamination of the regulator. Conduct the low pressure system leak test using a 70 +/- 10 PSI oxygen supply plugged into one of the cabin outlets and a test gauge plugged into another outlet. Apply 70 +/- 10 PSI to the system, allow 2 minutes for the system to stabilize, remove oxygen supply. The drop in pressure after 15 minutes shall not exceed five PSIG. Remove temporary plug and ensure that the cylinder is charged to capacity. Conduct high pressure test using cylinder pressure. Using the supply gauge on the pilot's side wall, note cylinder pressure. There shall be no pressure loss after 30 minutes. If leakage exists apply MIL-L-25567, leak test solution to suspected areas. After test, wipe clean and dry. Make necessary repairs and retest.

5. Oxygen system purging. Offensive odors may be removed from the oxygen system by purging. The system should also be purged any time the lines are left open and subject to contamination. Purging is accomplished by connecting a recharging cart into the system and permitting oxygen to flow through the lines and outlets until any offensive odors have been carried away.

**WARNING**

**Avoid making sparks and keep all burning cigarettes or fire away from the vicinity of the airplane when the outlets are in use. Inspect the filler connection for cleanliness before attaching it to the filler valve. Make sure that your hands, tools, and clothing are clean, particularly from grease and oil stains, for these contaminants will IGNITE upon contact with oxygen.**

The following procedures are recommended to purge the system:

A. Connect a recharge cart to the filler valve. Set the cart pressure regulator to deliver 50 PSI to the system.

B. Plug in an oxygen mask at each outlet in the cabin.

C. Open the cabin door and place the control knob in the half open position.

D. Allow the system to purge for one hour. If an offensive odor still lingers, continue purging the system for an additional hour. If such odors still remain, replace the supply cylinder. After the system has been adequately purged, remove the masks from the outlets, turn the control knob to the closed position and service the system as described in 35-00-01.

6. Oxygen cylinder removal. The oxygen cylinder is located in the tailcone aft of the baggage compartment bulkhead. Access to the cylinder is obtained thru the radio compartment access door on the left side of the aircraft behind left wing post.

WARNING

**Keep fire, cigarettes and sparks away from the vicinity of the oxygen cylinder. Oil and grease will IGNITE upon contact with oxygen under pressure.**

A. Place pilots knob to the closed position.

B. Gain access to the cylinder through the large radio compartment door.

C. Slowly loosen the supply line fittings at the cylinder valves, (reference Figure 35-1), to relieve any pressure that may exist in the supply lines. After pressure is relieved, remove the lines.

D. Disconnect the control cable (3) from the arm (4) on reducing valve (5).

E. Cap all open lines and regulator openings with clean metal caps.

F. Note relative position of regulator valves and control arm prior to removal.

G. Loosen the clamps (11) retaining the cylinder, while supporting the cylinder, and carefully remove cylinder and regulators from its position.

7. Oxygen cylinder installation.

A. Place new cylinder and regulators into position in clamps and secure. The new cylinder should be positioned with regulator valves and control arm in the same position as the removed cylinder assembly components.

B. Remove caps from lines and carefully inspect all connections for damage or any foreign substance before connection to the new cylinder and valves.

C. Connect all lines to proper fitting and connect the control cable (3) to the arm (4) on reducer valve (5).

D. Charge the cylinder, if required, to the correct pressure, see recharging table on (Figure 35-2).

E. Place the pilots contol lever/knob to the open position and plug oxygen mask into the pilots outlet to check for proper system operation.

F. Repeat this checkout procedure for all outlets.

G. Test the system for leaks per leak test check, paragraph 35-00-02, D.

H. Reinstall the radio compartment access door.

NOTE

**Oxygen cylinders must be hydrostatic tested every 3 years in accordance with DOT Code of Federal Regulations,Title 49,chap. 1, para. 173.34.**

NOTE

**Maximum life for composite oxygen cylinders is 15 years.**

NOTE

**Maximum life for light weight steel oxygen cylinders is 24 years.**

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# CHAPTER

# 37

# VACUUM

# CHAPTER 37

# VACUUM

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## 37-00-00 - GENERAL

The Mooney M20L (Mooney-PFM) does not have a vacuum system installation. All instrumentation is electrically driven, directly or indirectly, or activated by pitot/static air.

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# CHAPTER

# 39

# CHAPTER 39

# ELECTRICAL PANELS AND COMPONENTS

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# ELECTRICAL PANELS AND COMPONENTS

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## 39-00-00 - GENERAL

The instrument panel is divided into three basic groupings: (1) Flight/Engine Instruments, (2) Avionics/Radio Panel and (3) Circuit Breaker Panel. The flight instrument panel is shock mounted. The radio/avionics panel generally, has individual racks for the components and are of the quick removal type. The circuit breaker panel is located in a relatively quick removal panel which is located to the right of the co-pilot.

The circuit breaker/switches for the standard and/or optional accessories and equipment are located at the bottom of the flight instrument panel on the right side of the pilots control column.

The engine gauges are located on the upper right side of the flight instrument panel.

The annunciator is located at the top of the avionics panel.

The electrical power meters are located at the top of the right radio panel.

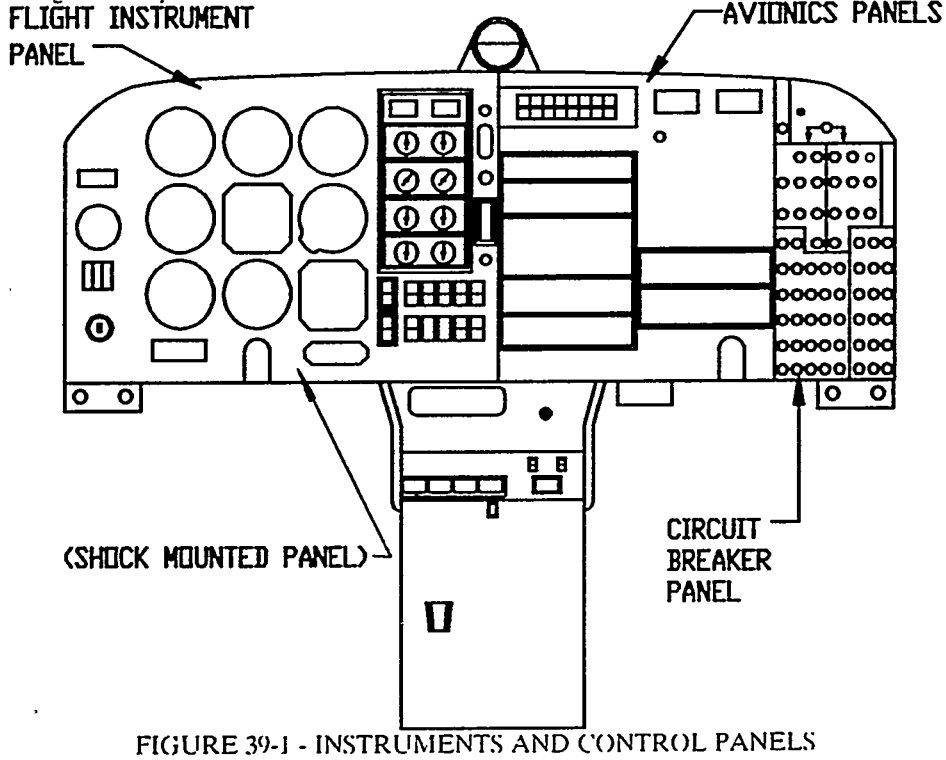



FIGURE 39-1 - INSTRUMENTS AND CONTROL PANELS

The panel illustration depicted in Figure 39-1 shows phantom lines for some installations. Model year improvements, technical improvements or various avionics installations dictate which instrument will be installed in a given location.

See Section 91 for Electrical System Hardware Charts and Schematics.

## 39-10-00 - INSTRUMENT AND CONTROL PANELS

### 39-10-01 - FLIGHT INSTRUMENTS

1. Removal.

A. Remove the screws attaching the glareshield; carefully lift glareshield to expose disconnects for the glareshield lights. Disconnect wires and lift the glareshield OFF.

B. Disconnect plumbing and/or electrical connections from flight instruments to be removed.

C. Remove the mounting screws securing the instrument to the panel.

D. Remove the instrument by sliding it forward from the panel.

2. Installation.

A. Place instrument into the proper location on panel.

B. Insert and secure mounting screws to hold instrument to panel.

C. Connect all plumbing and/or electrical connections to the instrument; perform pitot-static leak check.

D. Position the glareshield so electrical connections can be made and secured.

E. Secure glareshield with screws.

### 39-10-02 - AVIONICS EQUIPMENT

Each avionics package installed is basically a customized package to meet the requirements of the customer. Wiring harness, any associated plumbing or mechanical mechanisms required for a particular avionics installation are well secured to prevent any interference with other components. Removal of these avionics components will require evaluation of each installation to determine the proper procedure or sequence to follow.

1. Removal.

Most individual avionics components are mounted in slide out chassis racks. Loosen the screw on the face of the component and slide the unit straight aft to remove.

Some components are not mounted in slide out chassis. Removal of these units will require the same sequence as removal of flight instruments in Section 39-10-01.

CAUTION
**Radio panel must be stacked from the bottom to the top.**

2. Installation. Install the repaired or new unit in reverse sequence of removal.

### 39-10-03 - CIRCUIT BREAKERS

The circuit breaker panel is an assembly that can be pulled out as a unit for removal of any circuit breaker.

1. Removal.

A. Remove the glareshield - refer to Section 39-10-01.

B. Remove two flat head screws on outside of the airplane (B) (Fig. 39-2). These are located forward of the cabin door hinge and above the cabin air inlet scoop approximately 4 inches below the windshield.

C. Remove two screws from the face of the panel at the upper contour (C) (Figure 39-2).

D. Remove two screws (D) from underneath, near the edge of the panel face.

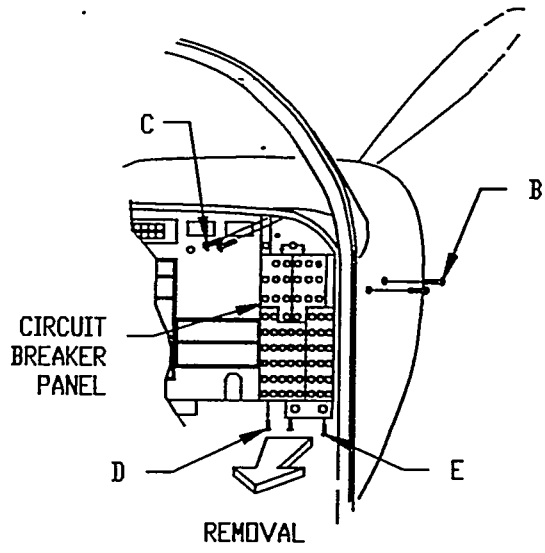



FIGURE 39-2 CIRCUIT BREAKER PANEL

E. Remove the NAS21919DG clamp (E) from the steel structure cross brace, underneath the panel, forward section, see (Figure 39-2).

F. The panel should now be free to slide aft approximately 4-5 inches. This will allow access to the electrical connections.

G. Remove the electrical connections from the circuit breaker that will be removed.

H. Remove thin lexan glass insulation strip, if required, when removing circuit breakers.

I. Remove the circuit breakers by unscrewing nut from stem on each circuit breaker and push the breaker through the panel.

2. Installation.

A. Installation of new circuit breaker into the panel is accomplished in reverse sequence of removal.

B. Insert the lexan insulator sheet in proper location to prevent any short circuits.

### 39-11-00 - FLIGHT INSTRUMENT PANEL

The flight instrument panel is a shock mounted panel containing various flight instruments for a particular installation group. These instruments vary depending upon the avionics package installed. The panel contains a row of circuit breaker/switches, along with the master switch, which control most of the systems of the airplane. Refer to Figure 39-3).

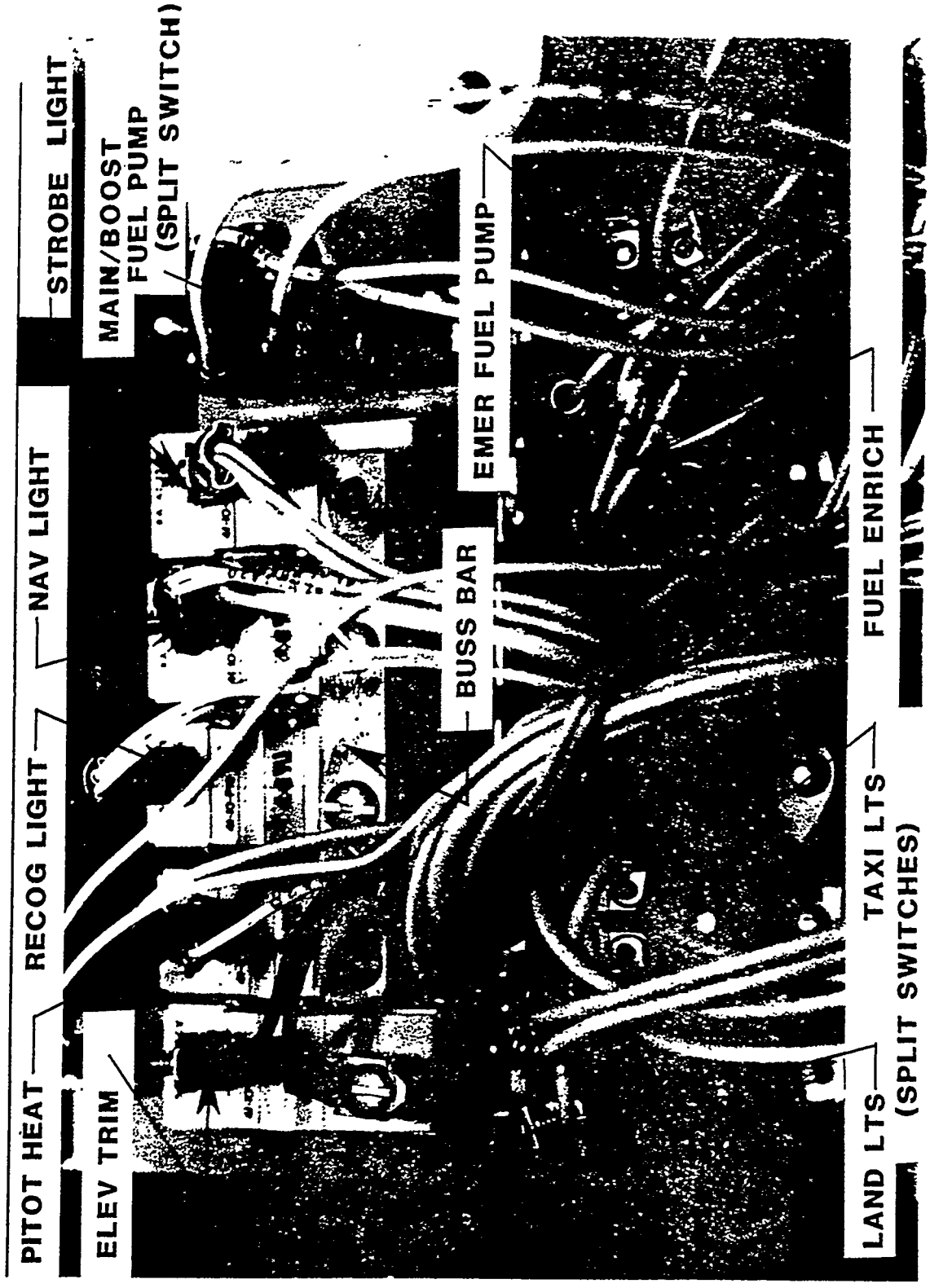



FIGURE 39-3 - ROCKER SWITCHES/CIRCUIT BREAKERS & BUS BARS

Access for maintenance of the switches or related wiring is obtained by removing the two attachment screws and pushing the switch through the panel. There is a common bus bar on some of the switches that will require loosening or removal for switch replacement.

**CAUTION**

**Care should be exercised when replacing wiring or switches to ensure proper alignment of terminal connections to prevent shorting between switches.**

## 39-11-01 - ENGINE - MODULE GAUGES

The engine - module gauges are located at the right of the flight panel. Access is obtained by removing the glareshield per section 39-10-01. These gauges have the capability of individual dual module replacement. Each dual module gauge will require removal and replacement when inoperative. To remove the dual module gauge the wiring harness can be disconnected at connector on back of each dual module. Remove and replace the defective module.

RESERVED FOR FUTURE ILLUSTRATION

FIGURE 39-4 - RESERVED

## 39-11-02 - ENGINE MODULE SYSTEM

### CHECK

1. DUAL ANALOG MODULES

A. Power Up

When power is applied to the Engine Monitoring Instrumentation System (EMIS) all instruments will respond within (3) seconds and seek to register their respective parameters. The Dual Digital Display will post the current RPM reading on the Left Digital Display and the Fuel Flow on the right. Both the RPM and Fuel Flow green "select" lights will be illuminated indicating that they are the currently selected units. All other "SELECT" lights will be off. All red alarm lights will reflect any individual analog reading condition.

B. SELECT

Each module in the EMIS has an external "SELECT" pushbutton (switch) located to the outside of each module instrument (left or right side). In the dual analog instruments they serve two functions: SELECT and SELF-TEST. The Select function is invoked by a momentary depression of the pushbutton adjacent to the instrument desired, and Self-Test is entered if either pushbutton is held depressed for approximately 1.5 seconds. Selection of a particular instrument is verified by the illumination of its associated green light. Only one left and one right instrument can be selected at a time, and will be automatically deselected upon the selection of a different instrument. If two left or right select pushbuttons are depressed simultaneously, selection is determined by the last released pushbutton. The selected instrument's engine parameters will be continuously transmitted to its associated left or right display in the Dual Digital Display Module.

C. SELF-TEST

This function is a confidence test to insure that all instruments are functioning correctly. Each of the Dual Analog Modules may be entered into the Test Mode independently by depressing and holding either of the modules select pushbuttons.

Self-test may be requested at any time and will remain active until the pushbutton is released. The test is common to both instruments in the module and will result in the following: (1) Both green select and red alarm lights are illuminated and the external alarm circuits are asserted. (2) Both analog pointers will display full scale readings. Upon release of the select pushbutton both instruments will seek to display their current engine parameters and all lights will return to their previous status.

If either or both instruments were "SELECTED" when self-test was invoked, the associated dual digital display will track to full scale along with the analog display.

A complete module system self-test may be initiated by depressing the "PRESS TO TEST" pushbutton switch located near the bottom right of the instrument panel.

2. DUAL DIGITAL DISPLAY

A. POWER-UP

When the Dual Digital Display Module receives power, it will immediately respond by selecting the RPM & Fuel Flow engine parameters. The select lights of these instruments will be illuminated, and corresponding data will be received and displayed appropriately.

B. DISPLAY

The displays of this module may be turned OFF, if so desired, by a momentary depression of either left or right pushbuttons. They will remain in the OFF (Blank) state until one of the analog indicators is re-selected.

C. SELF-TEST

This test is initiated and sustained as long as the "PRESS TO TEST" pushbutton switch is depressed. The module will respond by posting 8's on both displays and transmitting a system self-test command to all the connected analog modules. Each analog module will respond by performing its self-test.

| TROUBLE | PROBABLE CAUSE |
|---|---|
| No response from one or more instruments but self-test functions correctly. | Cable loose, disconnected or broken. |
| RPM/FF not automatically selected on power up, all other functions operable. | Dual Digital Display failure , cable loose or broken. |
| Unable to select an instrument for Digital Display but self-test works. | Dual Digital Display failure , cable loose or broken. |
| Unable to select or enter self-test and analog functions are operable. | Pushbutton failure. |
| Selected analog reading does not correspond to digital display. | Intermodule communication failure (does Digital Display operate correctly when other units are selected). |
| More than one module on either the right or left side is "SELECTED" (Green LED lit up). | Intermodule communication failure. |
| TEST drives pointers to full scale but not all LED's light. | LED failure. |
| SELF-TEST moves pointers but not to full scale. | Module's synchro motor/electronics failure. |
| Pointer does not reflect changes in measured engine parameter. | Open or shorted sensing element module failure. |

NOTE

**If any pickup or cable is disconnected or shorted to ground, the analog pointer will point full downscale. The exception to this is a grounded input to the oil temperature gauge which will depict full upscale.**

## 39-12-00 - LANDING GEAR SYSTEM

### 39-12-01 - LANDING GEAR SWITCH

The landing gear switch is a two position switch located at the top right side of the flight instrument panel. The wheel shaped knob must be pulled aft prior to raising or lowering the switch to activate the landing gear actuator.

1. The glareshield will require removal to gain access to switch for maintenance action (refer to Section 39-10-01).
2. Remove the wire connections from the back of the landing gear switch.
3. Turn the wheel shaped knob counterclockwise to remove from stem.
4. Remove the nut and washer from the face of the switch and push switch through the panel.

### 39-12-02 - LANDING GEAR SAFETY OVERRIDE SWITCH

The landing gear safety override switch is located adjacent to the landing gear switch. Proper operation of the landing gear safety system will not allow the gear to retract below 65 +7/-4 KIAS.

CAUTION

**Activation of the gear safety override switch while the aircraft is on the ground may cause the landing gear to retract.**

1. The landing gear switch or engine module will require removal to gain access for the removal of the override switch.
2. Disconnect wire connectors, approximately 6 inches from the switch, by cutting with wire cutters or opening the knife disconnects.
3. Loosen the nut on the stem and hold the nut located inside the mounting bracket. The red lens may need to be removed to fully remove the switch from the panel and bracket.
4. The light bulb (GE 327) can be replaced after the glareshield is removed by bending a nail or similar rod (approximately 3/32" diameter) and pushing the red lens off to the front of the panel. Use a small vacuum tube

puller or soft nosed instrument to pull the bulb from the socket.

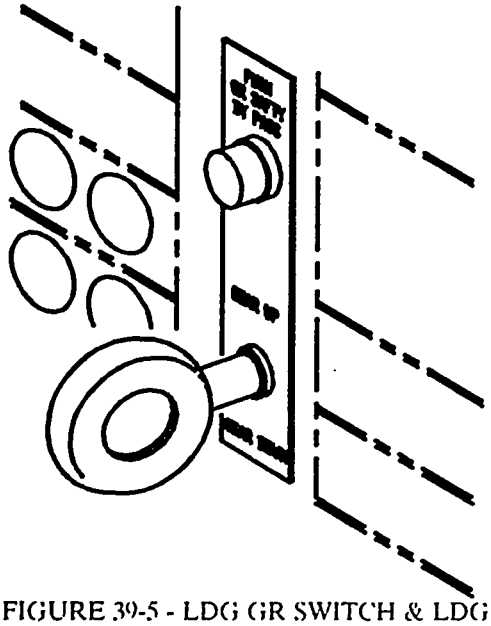


FIGURE 39-5 - LDG GR SWITCH & LDG GR SAFETY OVERRIDE SWITCH

### 39-13-00 - AVIONICS/RADIO PANEL

The avionics/radio panel contains equipment installed per sales order by Mooney Aircraft and other equipment installed by other sources as the owner desires. The maintenance information contained in this Service and Maintenance Manual describes the Mooney factory installation only.

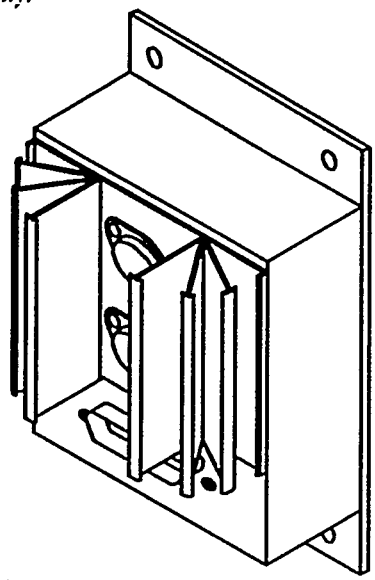


FIGURE 39-6 - INSTRUMENT, RADIO & GLARESHIELD LIGHT CONTROL

The avionics/radio components are removed and installed according to Section 39-10-02, 1 and 2.

### 39-13-01 - ANNUNCIATOR PANEL

The annunciator panel is located at the top of the center-most avionics/radio panel and is not mounted with a slide in type chassis. Remove this component by removing the screws holding glareshield in position. Remove the glareshield and disconnect the electrical harness from back side of the unit. Remove the screws holding unit in place on the panel and remove from the back side of the panel.

LOW FUEL WARNING CIRCUIT CALIBRATION. Refer to Section 24-33-00 paragraph 4.

### 39-13-02 - EMERGENCY LOCATOR TRANSMITTER (ELT) SWITCH

The remote ELT switch is located at the top left of the flight panel. The ELT is located in the tailcone and is accessible by removing the small access panel on the left side of the aircraft fuselage. The ELT antenna is located on top of the tailcone underneath the fiberglass dorsal fin.

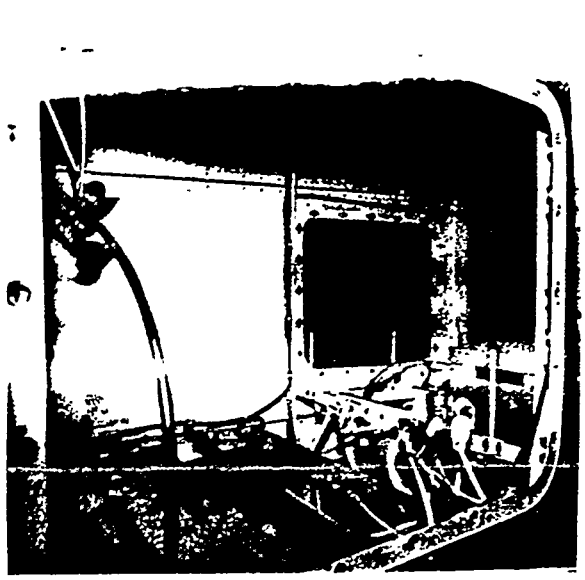
NOTE
**The dorsal fin must be removed to gain access to the ELT antenna for removal.**

The unit has a three position switch "ON", "OFF" and "ARM". The correct position of this switch is "ARM". The remote switch is connected in parallel to the ELT circuit and will operate correctly either in the "ARM" mode or the "ON" mode. Normal operation is in the "ARM" position. Place the remote switch in the "ON" position and tune the communication radio to 121.5 Mhz to verify that a warbling tone is heard. Place the remote switch back to "ARM" position for normal operation.

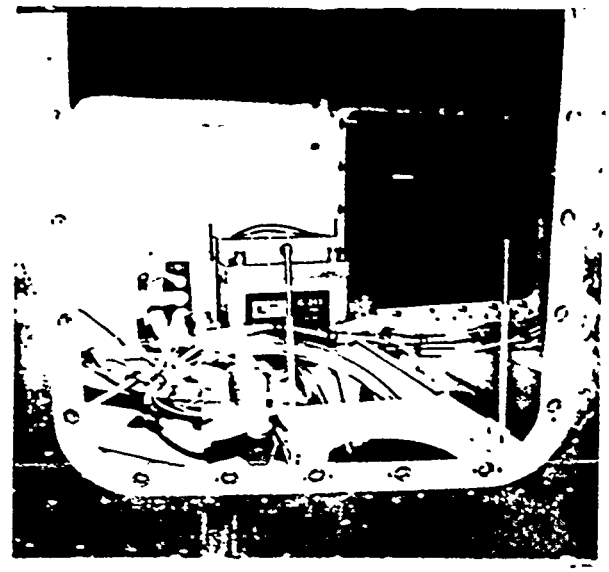
CAUTION
**Testing of ELT should be conducted only during the first five (5) minutes after any hour and no longer than three (3) audible sweeps.**

1. If the warbling tone is not heard replacement of the ELT battery or the unit may be necessary. Follow ELT manufactures instructions for battery replacement.

2. If ELT unit is found to be operating properly and the system still will not work correctly through the remote ELT switch, repair or



LEFT SIDE TAILCONE



RIGHT SIDE TAILCONE

FIGURE 39-7 - ELECTRICAL/ELECTRONICS EQUIPMENT RACK

replacement of the switch or wiring will be required.

A. To gain access to the remote switch and wiring the glareshield will require removal (refer to section 39-10-01).

B. Remove the switch retaining nut and washer and push switch through face of panel. Disconnect wires, remove and replace defective switch.

C. Reconnect wires and test switch for proper operation.

D. Reinstall glareshield.

**NOTE**
**Other switches located in the ELT placard area of avionics panel can be removed and replaced in similar manner.**

### 39-13-03 - INSTRUMENT/RADIO LIGHT & GLARESHIELD DIMMER CONTROLS

The dimmer controls for the instrument, radio and glareshield lights consists of two switches located on the lower console,top. Push the top of the switch to increase illumination of either light group and push bottom of switch to decrease illumination. The dimming function takes place in a control box located in the tailcone on aft cabin bulkhead.(See Figure 39-6). Test malfunction of either switch with a multimeter and replace as needed. Replace control box if malfunctioning.

### 39-13-04 - CIGAR LIGHTER

The cigar lighter is located at the bottom of the radio panel immediately to the right of the co-pilots control column shaft. It is a standard cigar lighter similar to automotive type.

### 39-20-00 - ELECTRICAL/ELECTRONIC EQUIPMENT RACK

The electrical equipment rack for the M20L aircraft is located in the tailcone just aft of the baggage compartment bulkhead. Access is gained through the large access door in the tailcone aft of the left wing trailing edge. The various avionics black boxes are mounted on the electrical equipment rack. (See Figure 39-7). The batteries and auxiliary power plug receptacle (if installed), are located just aft of this equipment rack and access is through either access door on the left or right side of the tailcone. The ELT is mounted on an accessory rack further aft in the tailcone and accessible through the smaller access door on the left side of the tailcone.



ORIGINAL
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ATP

# CHAPTER 51

# STANDARD PRACTICES-STRUCTURES

# CHAPTER 51

# STRUCTURES

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# STRUCTURES

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## 51-00-00 - GENERAL

The Mooney M20L is an all metal, low wing airplane. The fuselage cabin area is constructed of a welded 4130 chrome-molybdenum steel tubular structure. The steel tubular structure is covered with non-structural aluminum skins fastened to the tubular structure by rivets, bolts and screws.

The tailcone is of semi-monocoque type construction and is fastened to the tubular structure with structural bolts at five hard points plus bonded and riveted overlapping aluminum skins.

The wing is a tapered, laminar flow, one piece wing. It is constructed with a one piece, full length main spar. The spar is constructed from tapered cap strips (7075 aluminum) bolted (huck bolts) to webs (2024 aluminum). Aluminum ribs connect the main spar to the aft stub spar and the rear spar. Extruded stringers run the full length of the wing, spaced chordwise for strength and skin reinforcement. The skins are stretch formed, wrap around, 2024-T3 aluminum ranging in thickness from .025 at the tip to .050 at the fuel tanks.

The completed wing assembly is mated to the fuselage tubular structure during final assembly at the Mooney facility. Removal of the wing from the fuselage structure is required for most over land type transportation.

The empennage is of similar construction to the wing. A main spar spans the length of the stabilizer. Ribs connect the main spar to the stub and rear spar. A stretch formed skin wraps around the leading edge ribs and attaches to the rear spar on top and bottom. The elevators are constructed of formed aluminum skins fastened to a spar extrusion at the leading edge and riveted together at the trailing edge.

The vertical stabilizer is constructed around a fabricated main spar assembly with ribs connecting the main and rear spar. A stretch formed, aluminum skin wraps around the leading edge ribs and is riveted to the rear spar on both sides.

The rudder is constructed of formed aluminum skins fastened to a spar extrusion at the leading edge and riveted together at the trailing edge.

The aircraft has a three piece composite belly skin that covers the underside of the aircraft from the exhaust cavity aft to the tailcone.

The front seats are installed on rails which are attached to the floorboard and structure beneath the floorboard.

The rear seats, 2 passengers, are built into the top of the wing center section from the main spar aft to the rear spar. They are split type seats, using seat cushion's in molded wells over the wing spars and individually reclining rear seat backs.

## 51-10-00 - STRUCTURAL REPAIR - GENERAL

This section outlines structural repair procedures for the M20L airplane. It is intended to supplement FAA Advisory AC 43.13-1A by showing repair methods specific to Mooney Airplanes.

All structural repair must be: in compliance with AC 43.13-1A, or in accordance with Mooney factory recommendations, or with the specific approval of a Federal Aviation Administration representative which is the final authority in all repairs. This manual is for general guidance and has no authorized approval status. The Customer Service Department, Mooney Aircraft Corporation, Kerrville, Texas, should be consulted for special repair procedures when repair of damaged structure is not covered by published instructions.

## 51-10-01 - FASTENER REPLACEMENT

1. HUCKBOLT INSTALLATION. The Huck Lockbolt is an interference fit fastener used in a rigid joint structure. A loose or slip fit Huckbolt is unacceptable. The recommended limits for Huckbolt holes are:

| Huck Fastener | Pre-Drill Size | Drill Size | Hole Limits |
|---|---|---|---|
| 2LPH-T5 | No. 26 (.147 IN.) | No. 20 (.161 IN.) | .161 to .1635 IN. |
| ALPPH-T6 | No. 18 (.1695 IN.) | No. 13 (.185 IN.) | .185 to .187 IN. |
| R3001-T6 | No. 18 (.1695 IN.) | No. 13 (.185 IN.) | .185 to .187 IN. |
| 2L426H-T5 | No. 26 (.147 IN.) | No. 20 (.161 IN.) | .161 to .1635 IN. |
| R3007-T6 | 3/16 (.187 IN.) | No. 7 (.201 IN.) | .2005 to .2025 IN |

When the Huckbolt is enlarged beyond the above limits but is straight and round, the hole may be considered acceptable, provided that the Huckbolt cannot be pressed into the hole, with normal hand pressure, to a depth more than 50 percent of the heaviest material being secured. Check enlarged hole size at both ends. Select-fit Huckbolts to the oversize holes.

Oversize Huckbolt holes may be repaired by replacing 2LPH-T5 Huckbolts with ALPPH-T6 Huckbolts or NAS 623-2 screws and NAS 1021 No. 8 Hex-lock nuts (or equivalent), provided the pitch distance is greater than .56 inches and the edge distance is greater than .33 inches. Huckbolts ALPPH-T6 and R3001-T6 may be replaced with R3007-T6 Huckbolts as necessary. Consult the Customer Service Department, Mooney Aircraft, Inc., Kerrville, Texas, for factory recommendations when the preceding instructions are inadequate to accomplish the repair.

To compensate for material thickness tolerances, Huckbolt length may be increased by one dash number from the prescribed length. When a Huckbolt pin of the proper length is not available, use a pin of the next longer length. To adjust the grip length, install a cadmium-plated steel washer .065 inch thick (or a combination of not more than two washers .065 inch and .032 inch thick) under the Huckbolt collar. The combined thickness of any two washers shall not exceed .098 inch. Huckbolts or conical Keystone Lock blind rivet heads may be cocked no more than .004 inch. Not more than 20 percent of the fasteners in any pattern, nor more than three fasteners in succession, may be cocked.

**NOTE**
**Where access is limited or for replacement/repair the following substitution is permissible.**

| HUCKBOLT P/N | SUBSTITUTE P/N (VENDOR) | DESCRIPTION |
|---|---|---|
| NAS 1465 or R3001-T5 | HL20-5 Pin (Hi-Shear) HL86-5 Collar | Pin-Protruding Tension 160 KSI Ftu |
| NAS 1466 or R3001-T6 | HL20-6 Pin (Hi-Shear) HL86-6 Collar | Pin-Protruding Tension 160 KSI Ftu |
| NAS 1475 or R3014-T5 | HL19-5 Pin (Hi-Shear) HL94-5 Collar | Pin-100 D. Flush Shear - 95 KSI Fsu |
| NAS 1476 or R3014-T6 | HL19-6 Pin (Hi-Shear) HL94-5 Collar | Pin-100 D. Flush Shear - 95 KSI Fsu |

PART NUMBER CODE

HL20 - 5 - 8

| | |
|---|---|
| | Grip in 1/16ths" (8/16 = .500) MAX |
| | Nominal Dia. in 1/32nds" (5/32 = .156) |
| | Pin Part Number |

2. RIVET REMOVAL AND REPLACEMENT.

A. REPLACEMENT-STANDARD SIZE RIVETS, HOLE OVERSIZE. This repair applies only to original aluminum alloy, steel, or monel rivets of 1/16, 3/32, 1/8, and 5/32 inch diameters. Such rivets may be replaced as noted and limited below and in the General Limitations, when the hole only is oversize.

(1) Protruding Head Joint. If the edge distance is a minimum of two times the diameter of the original rivet, it will be permissible to drill for and install the next standard size larger diameter rivet of the same type and material as the original rivet.

(2) Machine Countersink Joint, Method I. If the edge distance is a minimum of two times the diameter of the next standard size larger diameter rivet and the sheet thicknesses

involved are within the limits specified for machine-countersinking for the next standard size larger diameter rivet, it will be permissible to drill and countersink for and install the next size rivet of the same type and material as the original rivet. The following are limits for machine countersinking:

| RIVET SIZE | MIN. GAUGE |
|---|---|
| 3/32 | .025 |
| 1/8 | .032 |
| 5/32 | .040 |

(3) Machine Countersink Joint, Method II. If the edge distance is a minimum of two times the diameter of the original rivet, it will be permissible to drill for and install the next standard size larger diameter rivet of the same type and material as the original rivet. Do not remachine the countersink. After installation, mill the excess head height flush with the surface.

(4) Dimpled Joint. If the edge distance is a minimum of two times the diameter of the original rivet, it will be permissible to drill for and install the next standard size larger diameter rivet of the same type and material as the original rivet. Do not redimple. After installation, mill the excess head height flush with the surface. This method is subject to the same limitations as paragraph 2, A (3).

B. REPLACEMENT-STANDARD SIZE RIVETS, HOLE AND COUNTERSINK OR DIMPLE OVERSIZE. This repair applies only to original countersunk head aluminum alloy rivets of 1/16, 3/32, 1/8, and 5/32 inch diameters. Such rivets may be replaced (as noted and limited below) when the hole and countersink or dimple is oversize.

---

(1) Machine Countersink Joint. If the edge distance is a minimum of two times the diameter of the next standard size larger diameter rivet and the countersink depth is not beyond the thickness of the countersunk sheet, it will be permissible to rework according to paragraph 2, A (3).

(2) Dimpled Joint. If the edge distance is a minimum of two times the diameter of the next standard size diameter rivet and all the parts are dimpled, it will be permissible to rework the smaller dimples to a size to match the oversize dimple and install Dimples in 7075-T6 must be hot formed when reworked.

(3) Combined Countersink and Dimpled Joint. If the edge distance is a minimum of two times the diameter of the next standard size larger diameter rivet, it will be permissible to rework the smaller countersink or dimple to a size to match the oversize dimple or countersink and install the next standard size larger rivet according to paragraph 2, A (4). Dimples in 7075-T6 must be hot formed when reworked.

C. RIVET HEAD TOLERANCE.

(1) A rivet head will be considered open if .001 feeler gauge can be inserted between the head of the flush or protruding head rivet and the top skin. The top of a flush head rivet must not be below the skin in which it is installed by a dimension of more than .004.

D. RIVET HOLE TOLERANCE.

(1) An enlarged hole is defined as having an internal diametric dimension in any direction which exceeds the sum of the drill diameter normally used plus ten percent of the diameter of the rivet shank.

(2) The following table specifies the maximum acceptable diametric dimensions for the various rivet sizes that occur in multiple layer assemblies which are "drilled on assembly".

| RIVET SIZE | NOMINAL DRILL SIZE | MAX. ACCEPTABLE DIAMETRIC DIMENSION |
|---|---|---|
| AN470AD3 or AN426AD3 | #40 (.098 dia.) | .108 in. |
| AN470AD4 or AN426AD4 | #30 (.1285 dia.) | .141 in. |

(3) When a hole becomes enlarged beyond the acceptble diametric limit and the prescribed rivet cannot be used, the next larger diameter rivet may be used if (a) four-diameter (4D) rivet spacing is maintained and if (b) two-diameter (2D) edge distance is maintained.

3. BLIND RIVET INSTALLATION. Ordinarily, where rivet bucking is impossible,

Cherrylock (CR-2248 and CR-2249) rivets may be substituted for AD rivets to repair skins and structural members. However, consult the Customer Service Department or a representative of the Federal Aviation Administration before using blind-type or hollow rivets in primary structure.

Check existing rivet hole size before installing blind rivets. When hole is marginal, use the next larger size rivet to assure firm attachment.

4. "AN"- BOLT, NUT AND WASHER INSTALLATION. To compensate for material thickness tolerances, the length of AN bolts may be increased or decreased by one dash number from prescribed length. AN960 regular washers and AN960L thin washers may be used interchangeably for proper bolt and nut installation. One regular washer or one thin washer may be added to any bolt installation. Washers may be used under the bolthead and/or under the nut. AN365 and AN363 nuts may be used interchangeably. The AN363 nut is acceptable for higher operating temperature installations.

5. HI-SHEAR RIVET INSTALLATION. When a hi-shear rivet pin of the prescribed length is not available, the next longer length pin may be used with cadmium-plated steel washers to adjust the pin grip length. The combined washer thickness shall not exceed .096 inch.

## 51-11-00 - RESERVED

## 51-12-00 - FUSELAGE REPAIR

### 51-12-01 - TUBULAR STRUCTURE REPAIR

Check tubular structure annually for corrosion and damage.

Interior panels may require removal to gain access to areas which are difficult to inspect.

Refer to AC 43.13-1A for tubular frame repair procedures. Warped or bent tube members can often be straightened; however, all surrounding welds should be dye checked for cracks after tube straightening.

Use proper material when making weld repairs. Welding rod, meeting the requirement of specification MIL-R-5632, class 2, is recommended for oxyacetylene welding. Electrodes meeting the requirement of specification MIL-F-5632-A, class 2, or AWS A5.18-69, class E705-2 are recommended for inert-gas shielded-arc welding (Heliarc). Use AISI 4130 condition N steel for replacement and repair of tubes, and for making repair sleeves. Replacing a member or subassembly is often advantageous and more feasible than repair. All detail tubes or assemblies needed for replacement can be purchased from Service Parts Department, Mooney Aircraft Corporation, P.O. Box 72, Kerrville, Texas 78029-0072.

1. WELDED PATCH REPAIR OF LOCAL DAMAGE. Use a welded patch to repair dents, small holes, and cracks no longer than the outside diameter of the tube and covering a maximum of 1/4 of the tube circumference. Drill out the crack, smooth the hole edges, weld the hole or dent, and file the repaired surface smooth. Form a patch that will cover twice the diameter of the tube around the edge of the damaged area and twice the circumferential area of damage as shown in (Figure 51-1). Weld patch in place.

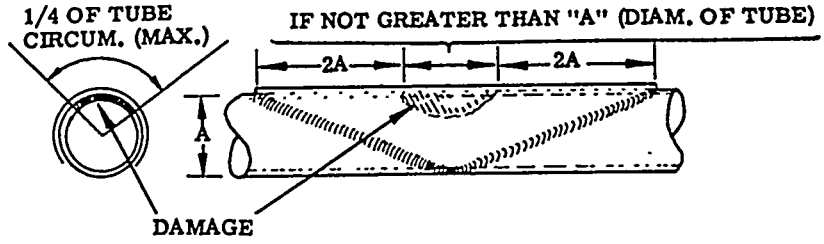



FIG. 51-1 WELDED PATCH-LOCAL DAMAGE REPAIR

2. INNER SLEEVE SPLICING. Use an inner sleeve splice to partially replace a tube without increasing the outside diameter (see Figure 51-2).

A. Make a 30-degree cut to remove the damaged portion of the tube; then, remove the burr from the remaining end.

B. Cut a replacement tube of the same material (AISI 4130 steel, condition N), same

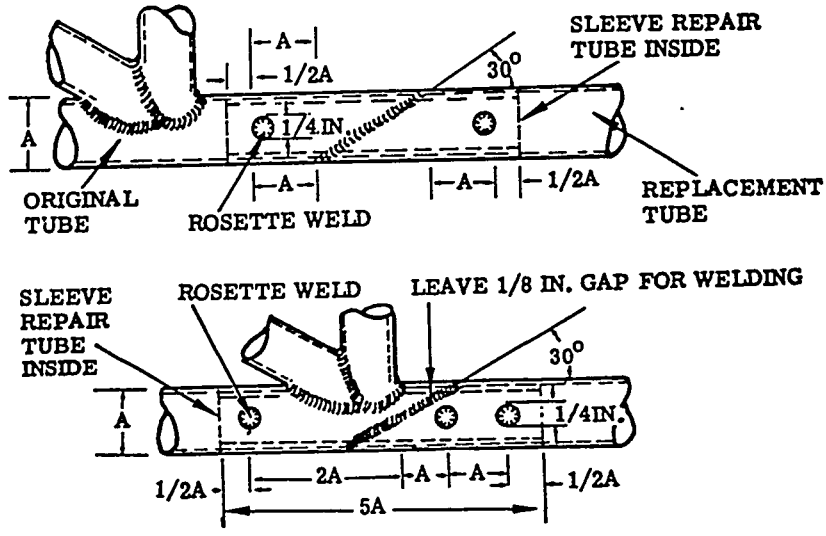



FIGURE 51-2 INNER SLEEVE SPLICING

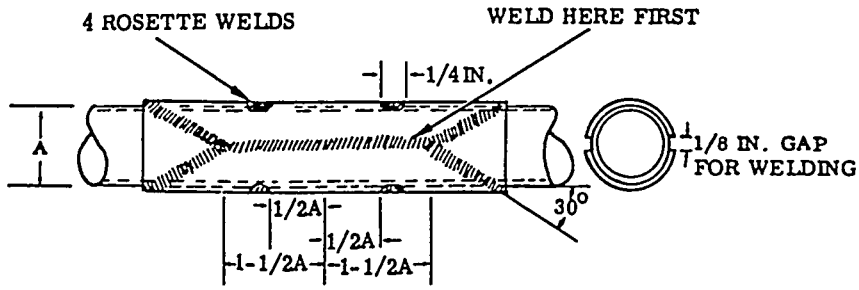



FIG 51-3 SPLIT SLEEVE SPLICE

diameter and the same wall thickness as the original tube.

C. Select a tube with an outer diameter equal to the inner diameter of the tube to be repaired and with the same wall thickness.

D. Cut tube to a length five times the outer diameter of the tube to be spliced.

E. Install inner sleeve in tube to be repaired so that its outer end is one and one-half of the original tube diameter from the nearest end of the diagonal cut; secure in position with a rosette weld on each side at one-half the original tube diameter from the inner-sleeve end.

F. Install replacement tube over the inner sleeve allowing a 1/8 inch gap for welding between the original and replacement tubes.

G. Weld the inner sleeve to the tube stubs through the 1/8 inch gap, forming an overlayed bead across the gap.

H. Rosette weld the replacement tube to the inner sleeve in two or more places.

3. SPLIT-SLEEVE SPLICING. Use the split-sleeve splice to repair a damaged tube when the parts on each side of the damage cannot be spearated to insert an inner sleeve (see Figure 51-3).

A. Form the split sleeve from steel tube or sheet steel when outside diameter of original tube is less than one inch.

B. Form the split sleeve from sheet steel when outside diameter of the original tube is one inch or more.

C. Form the split sleeve from the same material (AISI 4130 steel, condition N) with at least the same gauge as the original tube.

D. Allow a 1/8 inch gap between sleeve halves for welding.

E. Weld parallel edges of sleeve to original tube through 1/8 inch gaps.

F. Weld center of each sleeve half to original tube with two rosette welds spaced one original tube diameter apart.

4. TENSION FITTING REPLACEMENT (see Figure 51-4).

A. Cut A and B tubes loose from tension fitting 340034-7, -8 at welds.

B. Cut C tube at a 30 degree angle seven inches from bottom of tension fitting.

C. Cut a replacement C tube at a 30 degree angle and at an appropriate length to position the tension fitting. Weld tension fitting in proper position.

D. Drill four 1/4 inch holes for rosette welds 1.9 inches from center of 30 degree cut.

E. Make an inner sleeve five inches long from 4130 steel tube, condition N, with outside diameter to match inside diameter of tube C and with a .085 inch wall thickness.

F. Insert the inner sleeve in C tube and weld in place as shown (Figure 51-4).

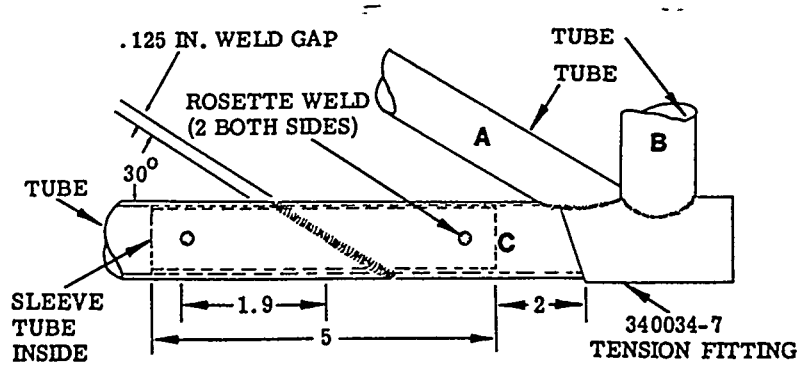



FIG 51-4 TENSION FITTING REPLACEMENT (REF AC 43.13-1A)

5. REPAIRS FOR WELDED ASSEMBLIES - General. This section does not apply to any control system tubing or assemblies, engine mounts or heat treated steel components (except as stated below).

A. Small holes up to a #20 drill may be closed by welding with the inert gas shielded arc method.

B. Nicks and drill marks that are no longer than 1/8" and do not exceed four percent of wall thickness in depth after cleanup may be smoothed out and reprimed. Nicks, holes, and cracks that will clean up with a #20 drill may be drilled and repaired per item A.

C. The repair of weld beads on heat-treated assemblies may be accomplished without reheat treatment within the following limits.

(1) The repair bead will not exceed .375 in length or 1/3 of total length of weld, whichever is the lesser.

(2) Only one repair per weld bead is allowed.

6. REPAIR OF SPOT WELDS. Failed spot welds on aluminum may be repaired by installing an AD470-4 rivet through the weld if the damaged area will clean up with a #30 drill.

7. DENTS. Small dents which do not exceed five percent of the diameter of the tube in depth and are no longer than one-half the tube diameter are acceptable.

## 51-12-02 - TAILCONE REPAIRS

1. LONGERON SPLICING. Use procedure outlined in AC 43.13-1A for repairing and splicing tailcone longerons. (Figure 51-5) shows acceptable methods for splicing longerons. Consult AC 43.13-1A, figures 2.28, 2.29 and 2.30 for fastener requirements.

2. TAILCONE STRUCTURAL SKIN REPAIR. Repair minor tailcone skin damage as shown in AC 43.13-1A, Figure 2.24. The rivet pattern for stressed skin repairs shall be the same as the rivet pattern in the skin joint immediately forward of the damaged area. Replace severely damaged structural skin panels. Install new skin panels to exactly match the original skin installation.

3. NONSTRUCTURAL SKIN REPAIR. The skin covering the M20L aircraft tubular fuselage structure is considered nonstructural. Patches in nonstructural skin are not restricted as to size or shape; however, appearance and possible vibration damage should be considered. Either a flush patch, a plate patch, or a plug patch may be used.

## 51-12-03 - LANDING GEAR & RETACTION SYSTEM REPAIR

Replace any damaged landing gear or retraction system component with a new part. Repairing landing gear or retraction system components is not recommended. After installing new components, check gear and retraction

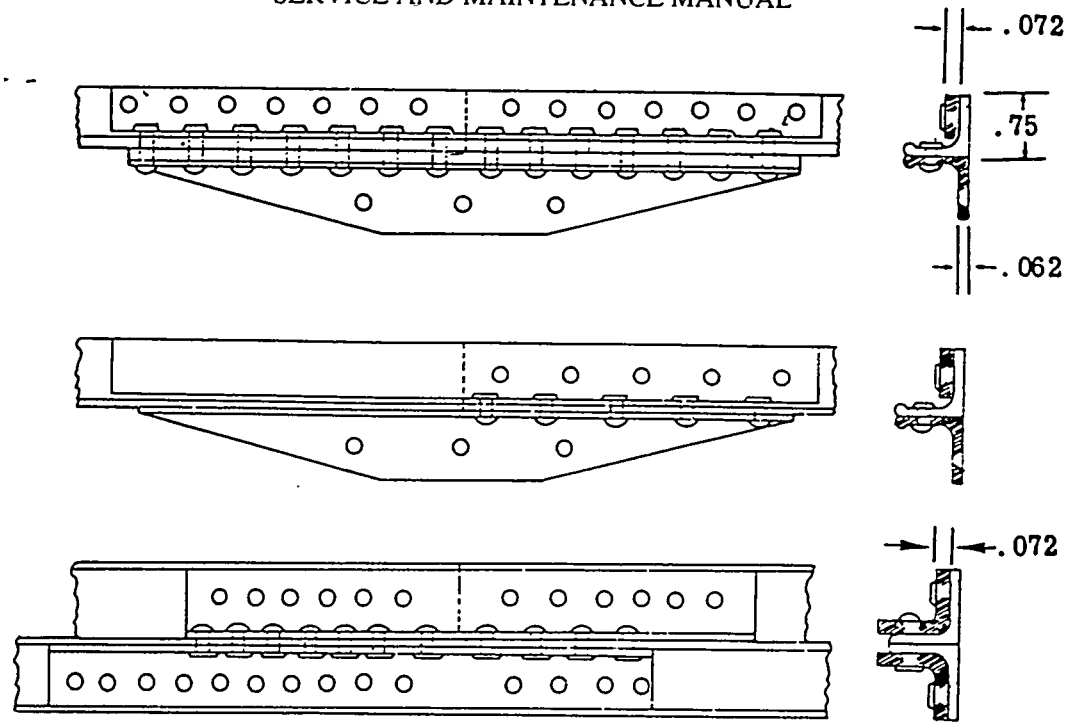



FIG 51-5 LONGERON SPLICING (REF AC 43.13-1A)

system rigging as outlined in Section 32-20-02. Before returning the aircraft to service, perform a retraction test and operational check of the landing gear and retraction system per Section 32-30-01.

### 51-12-04 - FLIGHT CONTROL SYSTEM REPAIR

Replace any damaged primary control system component with a new part. Repairing primary control system components is not recommended. Use only new hardware when installing new parts. After installation of new parts, check control system travel and rigging as outlined in Chapter 27. Before returning the aircraft to service, flight test the aircraft for proper control system rigging.

### 51-13-00 - WING REPAIR

### 51-13-01 - STRINGER REPAIR

Stringer splicing may require drilling new holes and adding rivets between existing rivets to obtain the required total number of rivets. Add extra rivets where the distance between existing rivets is the greatest. The pitch and edge distance must conform to AC 43.13-1A requirements (see Figure 51-6 below).

### 51-13-02 - MAIN SPAR REPAIR

The spar caps inboard of STA 103 are made of 7075 T6 high-strength material. Replacement of the spar cap is preferable to repair. However, if a spar cap repair is thought necessary, an exact description of the damage showing location and extent should be sent to the Customer Service Department, Mooney Aircraft Corporation, to obtain factory recommendations prior to beginning the repair.

1. SPAR CAP REPLACEMENT. To replace a spar cap, remove the skin covering the area to be repaired. Before removing a large area of wing skin, attach temporary jigs or holding fixtures to the wing to prevent wing warpage. When attaching a new spar cap, assure proper interference fit of the replaced huckbolts. During installation of the new spar cap, all holes damaged by improper drilling or reaming should be reamed to the hole size recommended for oversize huckbolt installation. When installing oversize huckbolts, consult the Huck Fastener Standards Manual for proper tolerances. Use proper length huckbolts. If the bolt is too long, the collar will not swage properly; if the bolt is too short, the shank will not completely fill the hole.

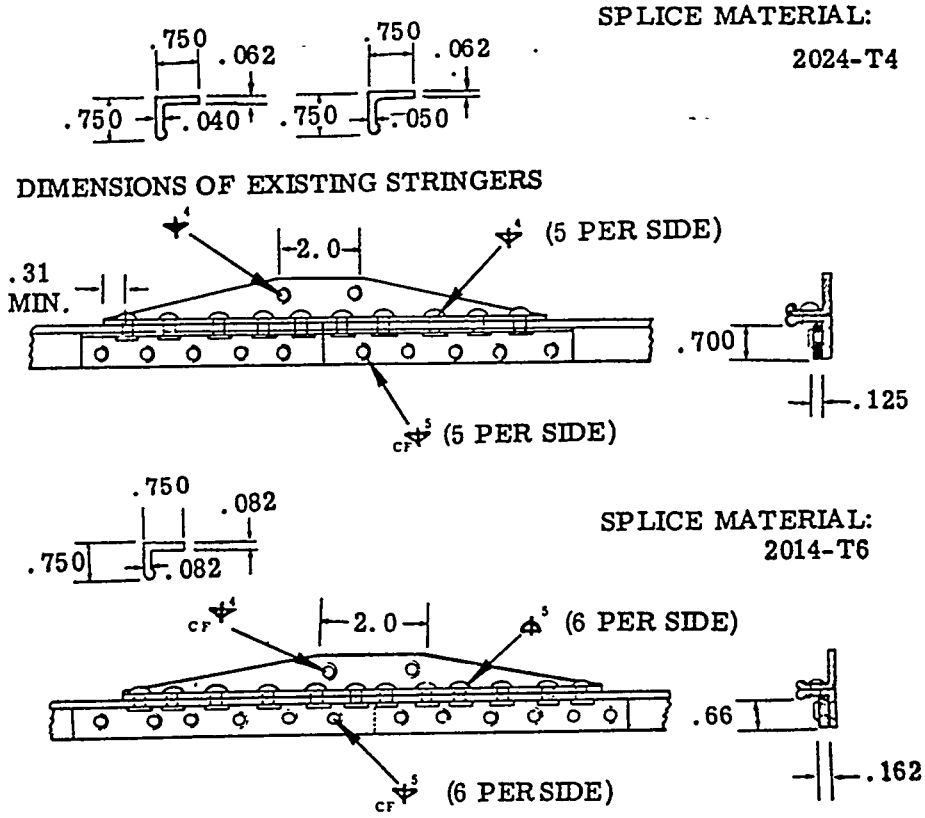



FIG 51-6 STRINGER REPAIR

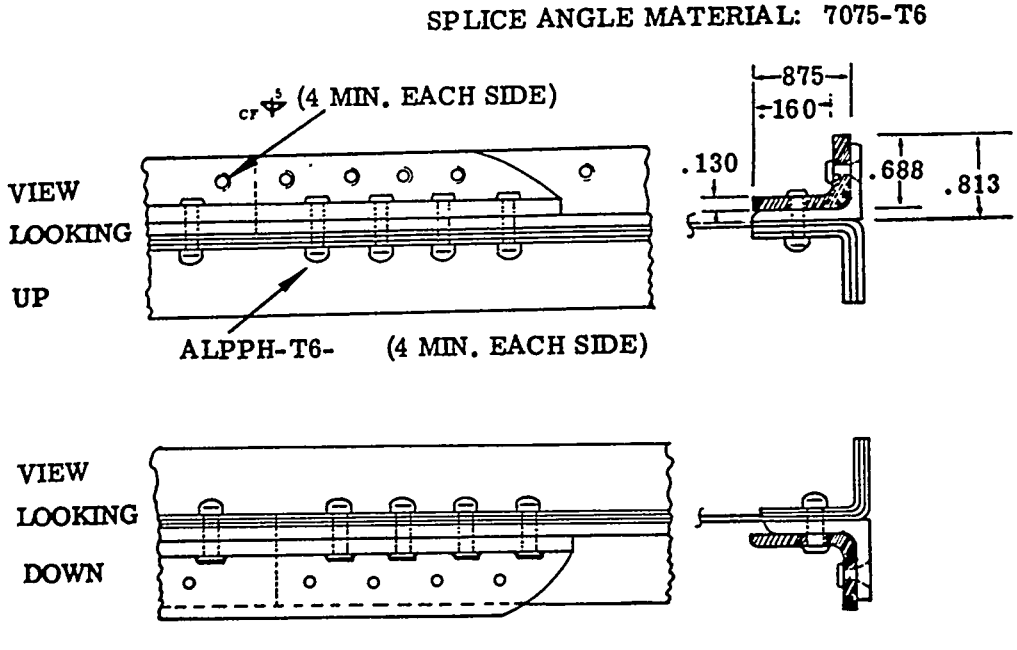



FIG 51-7 SPAR CAP REPAIR

Repair scratches on spar caps that are not deeper than .003 inch by sanding with No. 400 abrasive paper. Remove no more than .005 inch of material. Inspect the sanded area; use dye penetrant to be sure that the scratch is completely removed. Clean and prime area where the protective coating has been removed.

2. SPAR CAP REPAIR. Spar caps outboard of STA 103 consist of sheet metal angles backed up with aluminum extrusions from STA 103 to near STA 150. Replace or repair damaged extrusions.

Do not allow splices in a repaired extrusion to coincide with a spar-web splice when avoidable. Splice sheet-metal angles with an extrusion of equal area, picking up existing fasteners. Add extra fasteners to bring the minimum number of fasteners to six AD-5 rivets per side in the vertical flange, and nine AD-4 (or six AD-5) rivets per side in the horizontal flange. (See Figure 51-7).

RIVET CODE FOR STRUCTURAL REPAIRS

| | |
|---|---|
| 4 | MS20470AD4-xx |
| 5 | MS20470AD5-xx |
| 4 | MS20426AD4-xx |
| 5 | MS20426AD5-xx |
| BP | CR516-xx |

3. SPAR WEB REPAIR. Repair all damage to spar webs in accordance with AC 43.13-1A. If there is extensive damage to a web that cannot be repaired as outlined in AC 43.13-1A, consult the Customer Service Department giving exact location and extent of damage.

## 51-13-03 - STUB SPAR REPAIR

(Stub spar splice at wing STA 34.5 +/- 3.0) (See Figure 51-8).

1. Cut the stub spar halfway between existing rivets as required by the damage incurred.

2. Smooth all rough or sharp edges, and prime area to be spliced.

3. Locate new outboard section and trim splice to fit with a maximum gap of .020 inch.

4. Fabricate -501 angles to pick up 30 existing fastener holes (30 recommended, but 22 minimum), -503 angles to pick up 15 existing fastener holes (12 minimum), and -505 plate and -507 spacer. (See Figure 51-8). Prime angles, plate, and spacer. Rivet parts together using wet primer on all rivets.

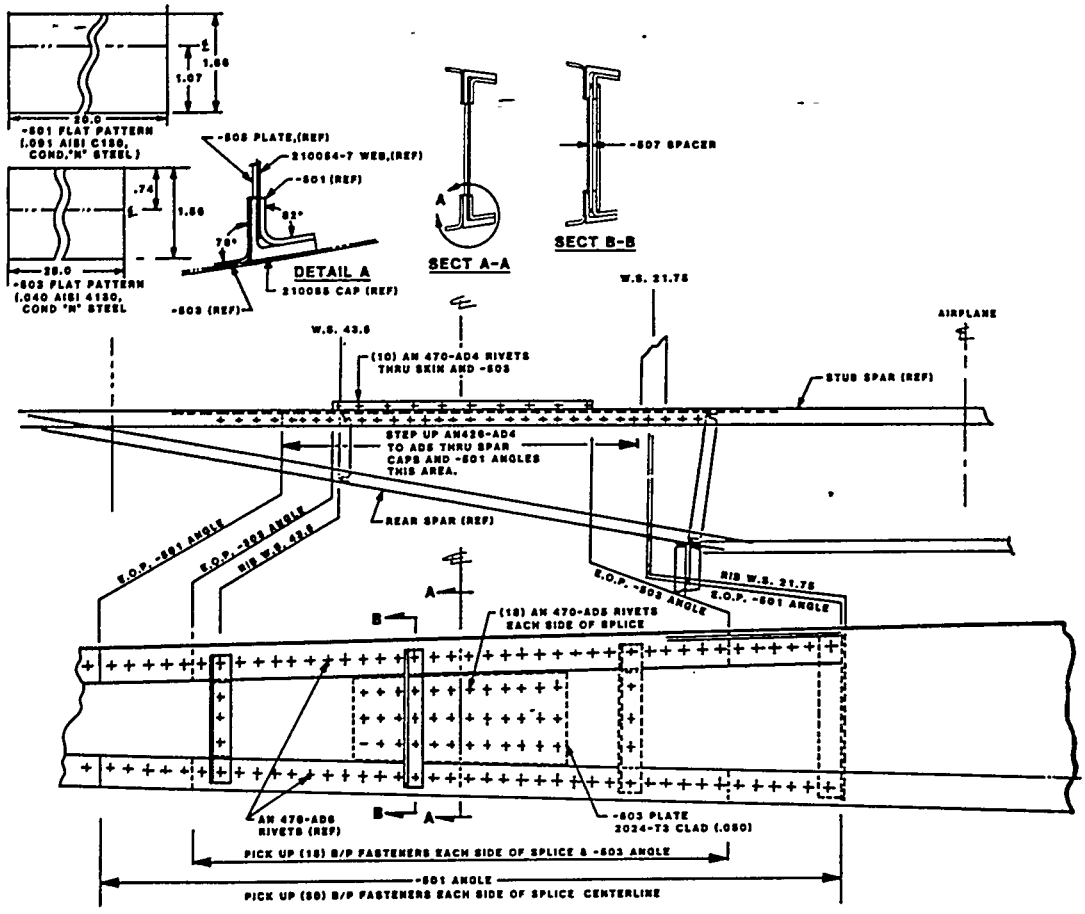



FIG 51-8 STUB SPAR REPAIR (REF AC 43.13-1A)

## 51-13-04 - REAR SPAR REPAIR

The rear spar may be spliced between ribs in accordance with AC 43.13-1A (see Figure 51-9).

## 51-13-05 - RIB REPAIR

Replace ribs that are severely damaged. Minor damage may be repaired as shown (Figure 51-10).

## 51-13-06 - WING TIP REPAIR

To repair severe damage to the wing tip outboard of STA 193.5, it is advisable to replace the entire tip skin and rib.

1. Locate the new tip rib in the exact original tip rib position to prevent wing tip twisting. Use a temporary support or locator pins to maintain correct wing tip position.
2. Rivet new tip rib to main and rear spars.
3. Locate new skin, and drill rivet holes through skin to match existing holes in ribs and stringers.
4. Rivet skin to rib at STA 193.5.
5. Roll skin back on lower wing surface to gain access to stringers for rivet bucking. Rivet skin to upper stringers.
6. Rivet skin to tip rib starting at leading edge. Buck rivets as far back as possible.
7. Install cherrylock (CR-2248) blind rivets in places inaccessable for rivet bucking. Add one extra countersunk blind rivet between every other pair of cherrylock rivets.

## 51-13-07 - WING SKIN PANEL REPAIR

Repair wing skin panels as prescribed in AC 43.13-1A, unless an entire skin panel is to be replaced. Install new skin panels to exactly match the original skin installation. Preformed skin panels may be obtained from the Mooney Service and Marketing Centers.

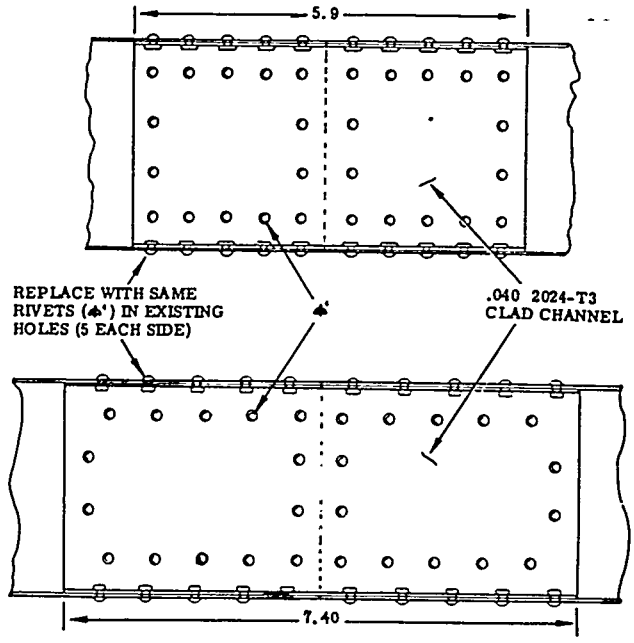



FIG 51-9 REAR SPAR REPAIR (REF AC 43.13-1A)

1. Damaged Dimple Repair Around Inspection Holes. Repair damaged dimples around inspection holes when (a) there are three or

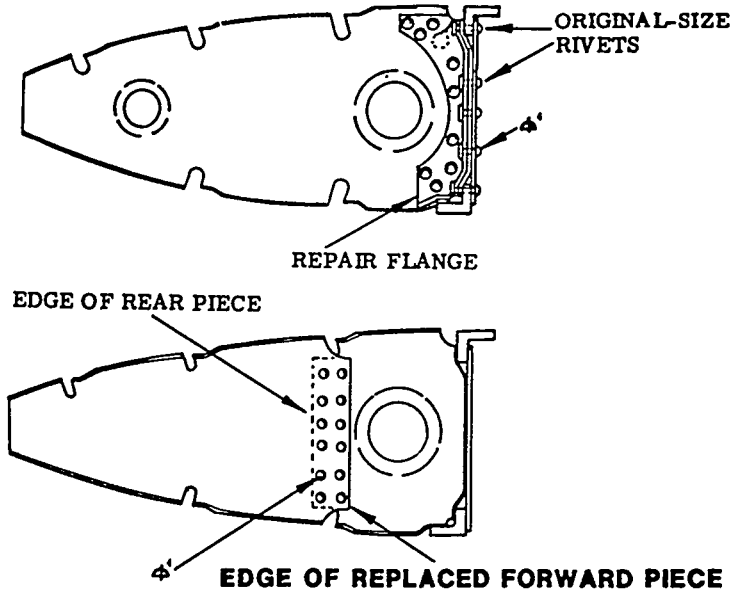



FIG 51-10 RIB REPAIR (REF AC 43.13-1A)

more cracked adjacent dimples, (b) the crack in one or more of the dimples extends beyond the radius of the dimple into the skin, and (c) when there are four or more cracked dimples around an inspection hole (see Figure 51-11).

To repair damaged dimples (a) cut a doubler from the same material and gauge as the skin to be repaired, (b) drill and countersink 100-degree fastener holes in the doubler to match dimpled fastener holes in skin, and (c) install doubler around inspection hole. Use AN426-AD4 rivets when material is .040 inch thick or greater. Drill holes using a No. 30 (.128 IN.) drill as shown in the above illustration. Use AN426-AD3 rivets when material is .032 inch thick or less. Drill holes using a No. 40 (.098 IN.) drill.

2. Repair of Cracks Wholly Within Dimple Radius. Surface cracks on inside (bearing) face of a dimple that do not extend through the material can be repaired by sanding out the crack. Cracks in dimples which do not extend beyond the dimple radius can be repaired by (a) stop drilling the crack with a No. 60 drill and (b) by adding rivets, the same size as those in the original pattern, to each side of the cracked dimple. Maintain four-diameter (4D) spacing and two-diameter(2D) edge distances. When original rivet pattern has rivets on only one or two sides of a dimple, only one or two rivets need be added (see Figure 51-12).

3. Repair of Cracks Extending Beyond Dimple Radius. Cracks that extend through the face of the dimple into the surrounding skin can be repaired as follows: (see Figure 51-13).

A. Stop drill crack with No. 60 bit.

B. Cut a doubler from the same material as the skin to be repaired. Allow for six rivets at four-diameter rivet spacings with two-diameter edge distances in a circular pattern around the cracked dimple.

C. Round the corners of the doubler, and scarf the sandwiched edges to about .010 inch by .250 inch.

D. Drill holes for six rivets (same size as those in the original rivet pattern), and drill and countersink 100 degree dimples in doubler.

E. Prime area to be repaired and install doubler with wet primer.

4. Repair of Circumferentially Cracked Dimples. Circumferentially cracked dimples (dimples with cracks that appear as an annular

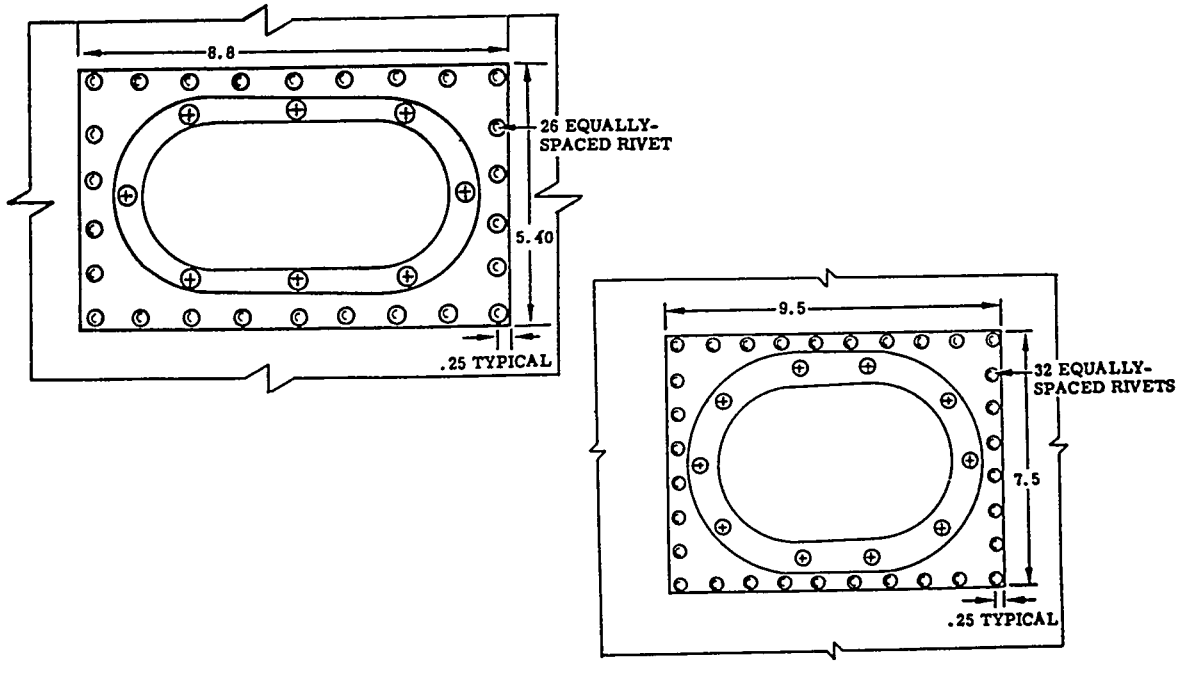



FIG 51-11 ACCESS COVER REPAIR

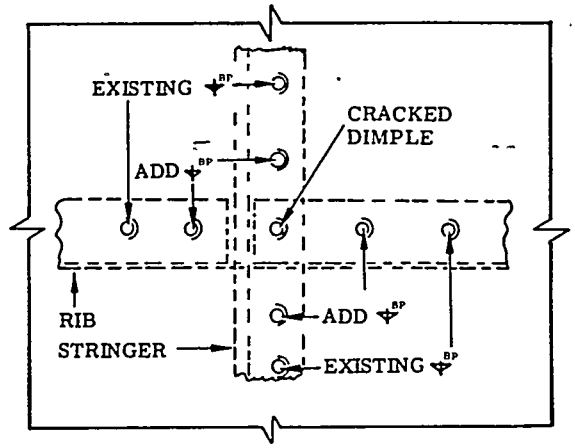



FIGURE 51-12 - DIMPLE CRACKS - REPAIR

mark around the dimple) can be repaired by installing a conical washer.

A. Drill through dimple using a drill large enough to remove the damaged area.

B. Install doubler as shown in Figure 51-14. Wet prime prior to assembly.

C. Countersink dimple hole in skin allowing the countersink to extend into substructure.

D. Install conical washer, use next oversize rivet size. Wet prime washer and adjacent skin and doubler surfaces prior to assembly.

E. Drill remainder of the hole to allow installation of next larger diameter rivet than the rivets in the original pattern.

## 51-14-00 - HORIZONTAL STABILIZER & VERTICAL FIN REPAIR

### 51-14-01 - LEADING EDGE SKIN REPAIR

The horizontal stabilizer and vertical fin leading edge interiors are inaccessable near the tailcone. To repair damage in these areas, cut a standard (3.0 inches by 6.5 inches) access hole in the lower side of the stabilizer leading edge and close the access hole by installing inspection cover P/N 913000-501.

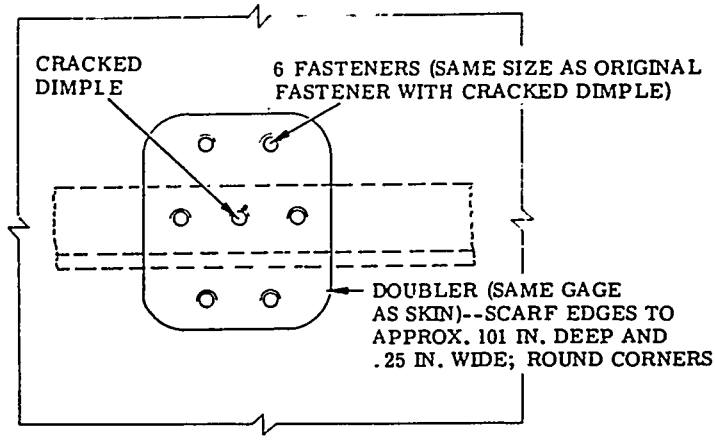



FIGURE 51-13 DIMPLE CRACKS - REPAIR

## 51-14-02 - MAIN SPAR REPAIR OUTBOARD OF STA. 9.00

Repair damage to the horizontal stabilizer main spar by straightening the damaged area and inspecting it carefully for cracks. If cracks are formed, stop drill or remove cracked area.

1. Repair damage between STA 9.00 and STA 34.0 on the spar upper flange, and between STA 9.00 and STA 40.0 on the spar lower flange with a splice angle formed from .070 AISI 4130 steel, condition N. The splice angle flanges must be as wide as the original spar flanges. The splice angle must be long enough to install 11 AD4 rivets through the skin and 11 rivets through the spar web on each side of the damaged area (see Figure 51-15).

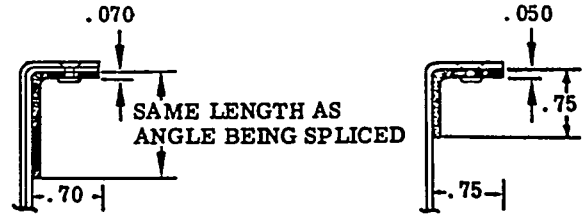



FIGURE 51-15 SPAR REPAIR(STA. 9.0 & OUTBD)

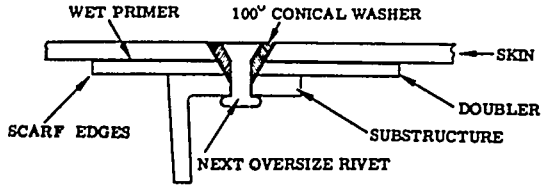



FIGURE 51-14 - OVERSIZE HOLE REPAIR

Prime splice angle before riveting it to spar. Pick up five existing rivet holes and drill six new holes between existing rivet holes in the skin at each side of the damaged area. Install 22 AD4 rivets through splice angle and skin, and 22 AD4 rivets through splice angle and spar web. (See Figure 51-15).

2. Repair main spar cap damage between STA 34 and STA 48.5 by forming a splice angle from 3/4 inch by 3/4 inch .050 2024-T3 sheet aluminum. Pick up five existing holes and drill six new rivet holes between existing holes in the skin on each side of damaged area.

Install 11 AD4 rivets through angle and skin and 10 AD4 rivets through angle and web on each side of the damaged area. (See Figure 51-15).

3. Repair main spar damage from STA 48.5 outboard by installing splice angles made from .040 2024-T3 material on both side of web using 12 AD4 rivets (6 through skin and 6 through web on each side of damaged area). Pick up three existing holes and drill three new holes between existing holes on each side of damaged area. (See Figure 51-16).

4. Repair main spar web damage outboard of STA 34.0, top flange, and STA 48.5, lower flange by forming a splice angle from .050 2024-T3 aluminum. The splice angle web flange should be cut to allow sufficient coverage of the damaged area of existing web and long enough to install 6 AD4 rivets on the flange on each side of the damaged area.

Pick up 3 existing rivet holes on flange of spar and drill 3 new rivet holes between existing holes.

Drill 10 rivet holes through splice angle and web on each side of the damaged web area. The damaged web should be stop drilled or cracked area removed prior to splice angle installation. Prime splice angle and deburr spar web and flange before installing splice (see Figure 51-17).

5. Spar webs outboard of STA 48.5 cracked more than 50% of the web height may be repaired (see Figure 51-18). Form a splice plate from .050 2024-T3 aluminum to fit the in-

side dimensions of the web and flange at the damaged area.

Pick up 3 existing rivet holes on top and bottom flange on each side of damaged area and drill 2 new AD4 rivet holes between these existing holes.

Pick up all rivet holes on web under splice plate and drill new rivet holes on equal spacing around the damaged area similar to that on Figure 51-18 rivets on each side of damaged area.

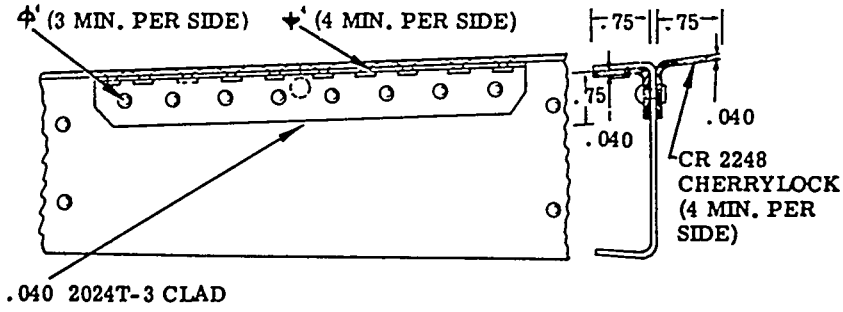



FIGURE 51-16 - SPAR REPAIR-STA. 48.5 APPROX.

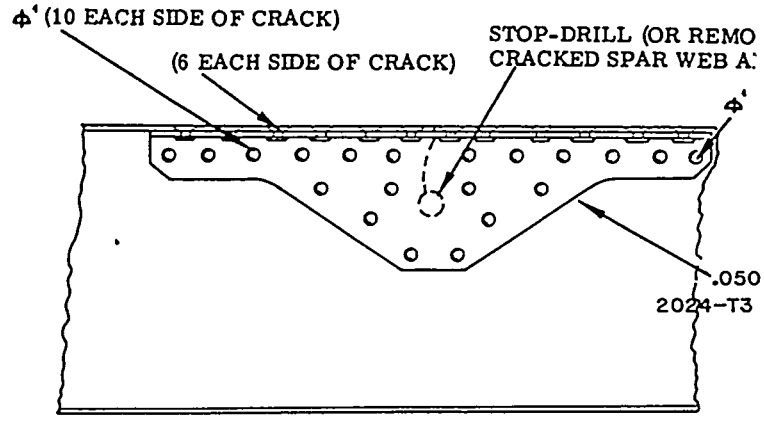



FIGURE 51-17 SPAR REPAIR(OUTBD of Sta. 34.0

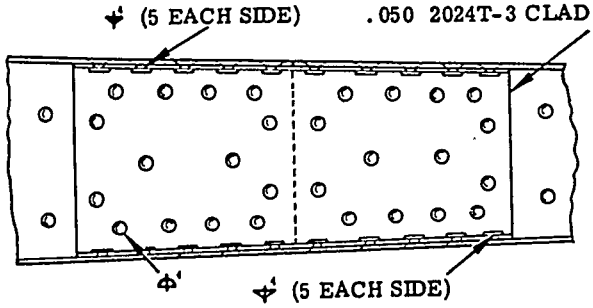



FIGURE 51-18 SPAR REPAIR

### 51-14-03 - RIB REPAIR

The repair of damaged stabilizer and fin ribs is not feasible in most cases. Damaged ribs should be replaced with new parts.

### 51-14-04 - REMATING HORIZONTAL STABILIZER TO STINGER

When stabilizer repair necessitates removal from the stinger, remating can be facilitated by using huckbolt substitution information contained in Section 51-10-01. When mating stabilizer to stinger use bent rivet swage set #5 (see Figure 51-19).

### 51-15-00 - FIBERGLASS LAMINATES, REPAIR PROCEDURES

Despite the fact that fiberglass laminates are designed to withstand considerable abuse, occasional repairs will be necessary. It is difficult to cover all the various repair techniques due to such limiting factors as accessibility and the extent of damage. The following outlines those steps which are used to make repairs of the more common type damage to a fiberglass laminate.

1. Materials used for repairs shall be as specified and compatible with the basic resin used in the fiberglass laminate.

**Resin** -Aerospace Adhesive EA934 Part A
Hysol Division
The Dexter Corporation

Catalyst-Aerospace Adhesive EA934 Part B
Hysol Division
The Dexter Corporation

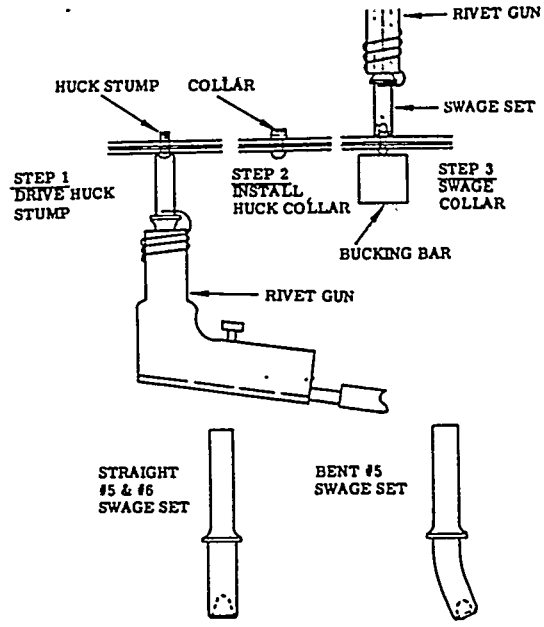



FIG 51-19 - REMATING HORIZONTAL STABILIZER TO STRINGER

Alternates:

**Resin**-Epoxical #606 Patching Adhesive Resin
United States Gypsum

Catalyst -Epoxical #606 Patching Adhesive Hardner
United States Gypsum

OR

**Resin** -Ren Epoxy CG 1304
Ren Plastics Co.
Lansing, Michigan

**Catalyst** -Ren Hardener CG 1304
Ren Plastics Co.
Lansing, Michigan

**Fire retardation** - Antimony Trioxide for fire retardation, 5% minimum; 10% maximum by Weight of Resin Content. Must be added to the base resin (cowling and air intake assembly only).

The manufacturer's bulletins shall be followed for all mixing ratios and preparation prior to application.

2. General.

A. The configuration of repairs are shown for flat surface areas; for simplicity; however, the same techniques can be used for contoured surfaces. Contoured repairs will require additional considerations and the proper

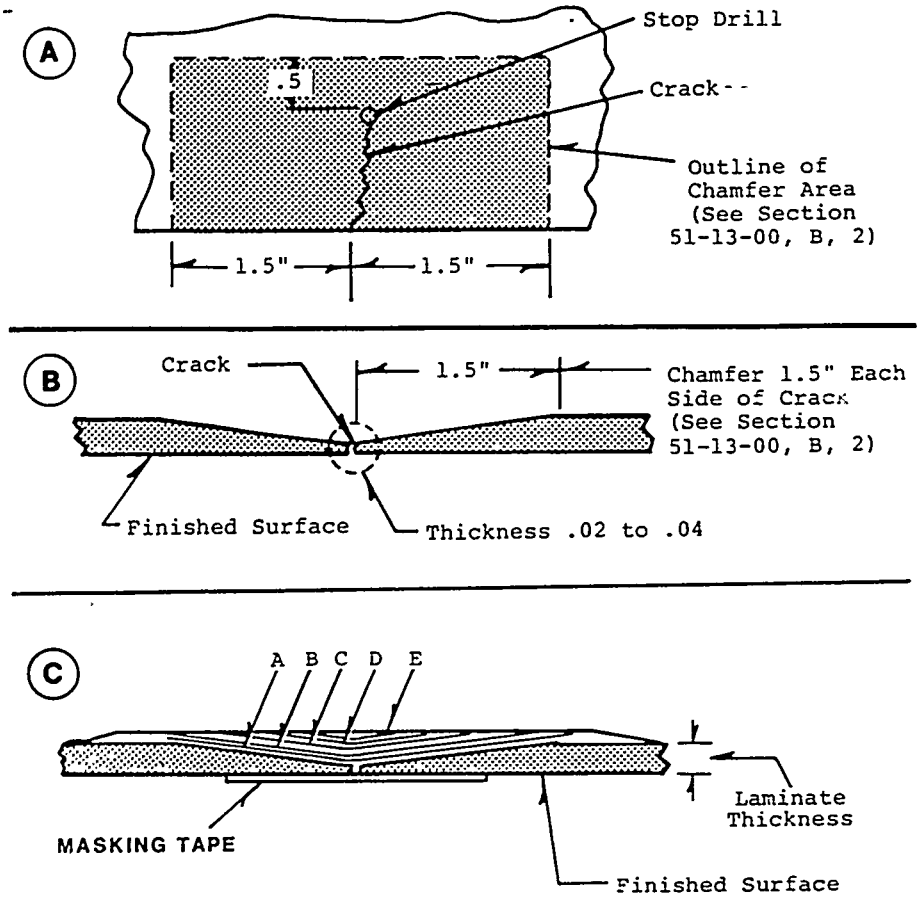



FIGURE 51-20 - NON-STRUCTURAL REPAIR

shaping of the backup plates used for clamping the laminates together during the curing cycle.

B. The degree of laminate chamfer and size will vary based on accessibility, shape of part and the extent of damage.

## 51-15-01 - CRACKS, IN SURFACE AREAS

1. Stop drill all cracks per standard aircraft procedure.

2. Remove any loose particles and frayed fiberglass strands from the cracked portion.

3. Prepare surface for repair as shown in (Figure 51-20, Figure 51-21, and Figure 51-22).

4. Prior to continuing the repair, all surfaces in the area of the repair must be cleaned of all contaminates by wiping the area with a clean cloth saturated with Methyl-Ethyl Ketone.

**CAUTION**
**Methyl Ethyl Ketone (M.E.K.) is a flammable liquid and should be used with proper ventilation and the prescribed safety equipment.**

**CAUTION**
**Fiberglass components are attacked and deteriorated by the following products: Ketone, aliphatic esters, chlorinated hydrocarbons, and slightly softened by aromatic hydrocarbons.**

## 51-15-02 - NON-STRUCTURAL REPAIR

1. Apply masking tape over crack on finished surface side.

2. Apply wet coat of catalyzed epoxy resin to chamfered surface.

3. Apply one layer of #181 fiberglass cloth saturated with catalyzed epoxy resin.

4. Add additional plys of #181 fiberglass cloth, saturated with epoxy resin to attain original laminate thickness.

5. Apply one additional ply of #181 cloth bridging the total repaired area and bond in place.

## 51-15-03 - COMMON STRUCTURAL LAMINATE REPAIR (METAL INSERT)

5. Place rigid aluminum plates on both sides of repair area and clamp into place with "C" clamps. Permit laminated repair to cure.

6. After the fiberglass repair has cured, remove the clamps and install #3 AN426A rivets. Flush head to be on the finished surface side. The number of rivets and spacing will be determined by the size of the repair.

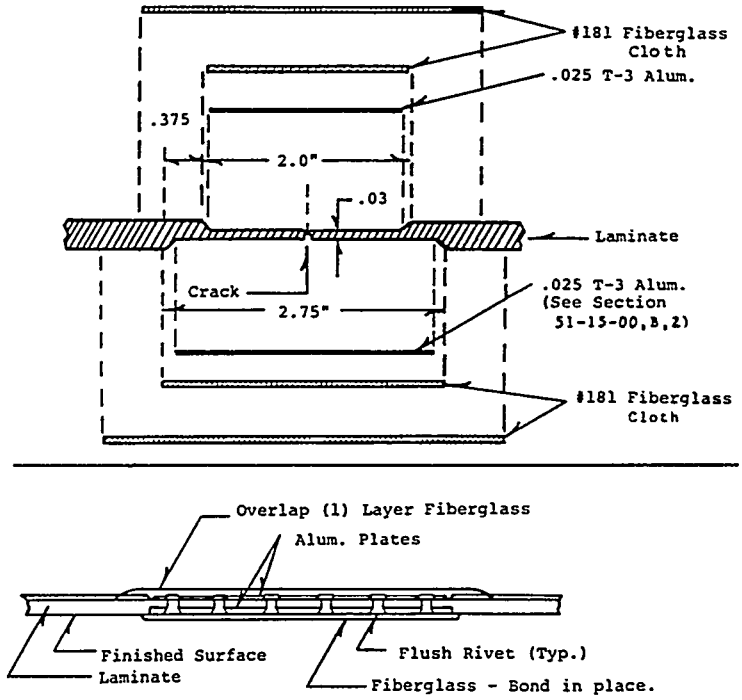



FIGURE 51-21 - COMMON STRUCT.LAMINATE REPAIR -(METAL INSERT)

1. Cut away laminate per sketch, roughen repair area with 240 sandpaper, clean repair area with M.E.K. - apply a wet coat of catalyzed epoxy resin to surfaces. Then IMMEDIATELY proceed with steps 2 thru 5.

2. Install chemically cleaned .025 T-3 aluminum straps, perforated with #40 holes approximately .35 on center all directions.

3. Apply wet coat of epoxy resin to aluminum straps and apply one or more layers of resin saturated #181 fiberglass cloth to equal the thickness of the original laminate.

4. Lay wax paper over both sides of the repaired area while still wet. This prevents adhesion to the pressure clamp application (paragraph 5).

7. Apply one additional overlapping layer of #181 fiberglass cloth on the non-finished surface and bond in place. Should the opposite side be a non-finished surface, an additional layer of fiberglass should be applied to this side.

8. Upon completion of steps 1 thru 7, permit the repair to cure before attempting further treatment of appearance surfaces, if required.

9. Appearance surfaces will normally require the application of a filler-sealer coating. The appearance area is to be wiped clean, using a clean cloth saturated with M.E.K. prior to applying a filler-sealer coating.

10. Mix epoxy resin and catalyst per manufacturers specifications and apply to the appearance surface area. Care should be taken to

assure as smooth as possible surface in this particular operation.

Permit this surfacing coat to cure prior to any additional applications or further rework.

11. Using #240 sandpaper, sand and blend the repaired area to match the surrounding surface. Steps 10 and 11 may be repeated to acquire a satisfactory surface finish.

## 51-15-04 - COMMON STRUCTURAL LAMINATE REPAIR (FIBERGLASS-RESIN COMBINATION)

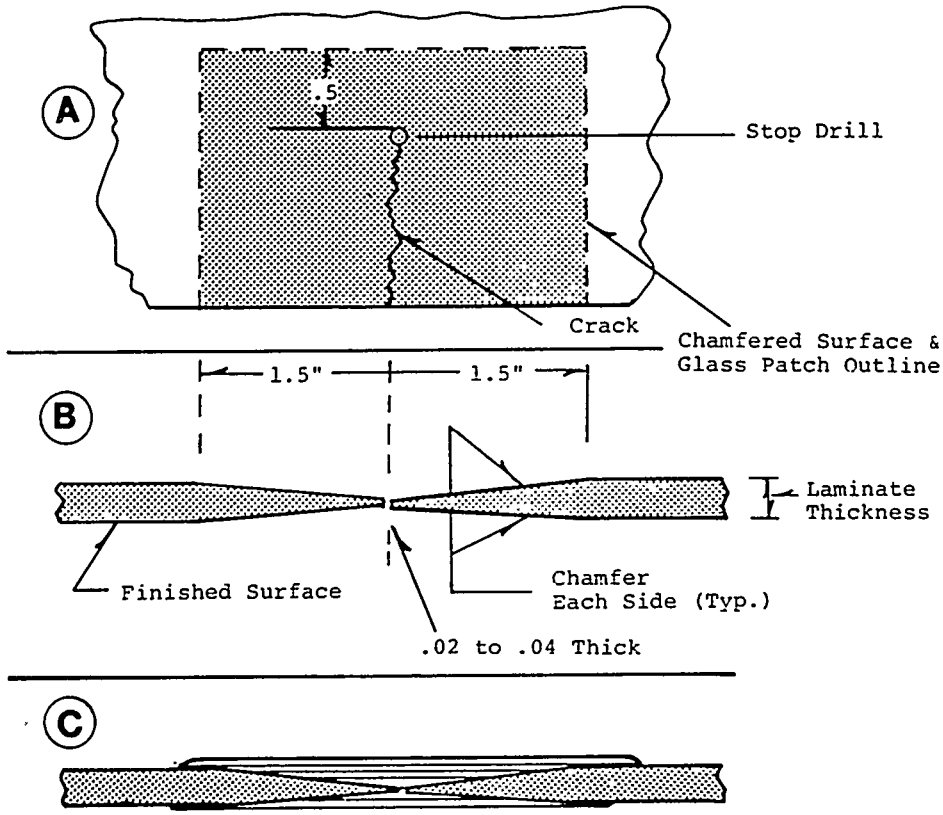



FIG 51-22 COMMON STRUCTRUAL LAMINATE REPAIR-FIBERGLASS/RESIN

1. Apply wet coat of catalyzed epoxy resin to chamfered surface.

2. Apply one layer of #181 fiberglass cloth saturated with catalyzed epoxy resin.

3. Add additional plys of #181 fiberglass cloth saturated with epoxy resin to attain original laminate thickness.

4. Apply one layer of #181 fiberglass cloth to the non-finished side of laminate, extending 1/2" each side of the chamfer and bond in place.

5. Lay wax paper over both sides of the repaired-area while still wet. This prevents adhesion to the pressure clamp application (paragraph 6).

6. Place rigid aluminum plates on both sides of repair area and clamp into place with "C" clamps. Permit laminate repair to cure.

7. After fiberglass repair has cured, remove clamps and install #3 AN426 rivets. Flush head to be on finished surface side. The number of rivets and spacing will be determined by the size of the repair.

8. Upon completion of steps 1 thru 7, allow the repair to cure before attempting further treatment of the appearance surface.

9. Appearance surfaces will normally require the application of a filler-sealer coating. The appearance area is to be wiped clean, using a clean cloth saturated with M.E.K. prior to applying a filler-sealer coating.

10. Mix epoxy resin and catalyst per manufacturer's specifications and apply to the appearance surface area. Care should be taken to assure as smooth as possible surface in this particular operation. Permit this surfacing coat to cure prior to any additional application or further rework.

11. Using #240 sandpaper, sand and blend repaired area to match surrounding surface. Steps 10 and 11 may be repeated to acquire a satisfactory surface finish.

## 51-15-05 - FIBERGLASS DELAMINATION REPAIR

1. Delamination or ply separation of a fiberglass product is usually a result of poor bonding of fiberglass layers. Generally, this condition is localized and can be readily repaired by carefully spreading apart the plys in the delamination, and removing loose particles by blowing clean compressed air into damaged area.

2. Proceed by inserting catalyzed epoxy resin into the delamination and then immediately clamp the delamination together. Permit the repair to cure a minimum of 8 hours before removing clamps.

3. Extensive delamination of a part will be reason for total rejection of the part and shall be scrapped per standard practices.

## 51-16-00 - MISCELLANEOUS

1. Protective Coatings.

A. Parts with protective coatings (such as Conversion Coated -or zinc primer) on which the coating is scratched, spotfaced, drilled, or in any way removed must be recoated with zinc chromate primer. EXAMPLE: Part is Conversion Coated as detail part. During replacement the part is spotfaced to receive bolt and washer. This part must be primed after spotfacing.

2. Low Pressure, Plastic, or Rubber Line Splices. Static system lines may be lengthened, shortened, or spliced to allow the replacement of sections of damaged lines. The fittings are called out in the Parts Catalog text pages following the illustration depicting the assembly or component in question.

If splices are made, the system must be checked for leaks.

3. Shortening and Lengthening of Tubing, Hoses, and Flexible Ducting. Mooney manufactured assemblies of plumbing, tubing, hoses, and flexible ducting may be modified to allow the use of longer parts of the same size and material to be cut and used as replacements. When the manufactured ends of flexible ducting are removed, the raw edge must be taped with 3M aluminum foil tape.

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# CHAPTER 52

# DOORS

# SECTION 52

# DOOR

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| 52-31-00 | Baggage Compartment Door--Latching Mechanism | .7 |

## 52-00-00 - GENERAL

The cabin door is constructed of an inner and outer aluminum shell fastened together by rivets. It is provided with a dual latching mechanism, 1) a lock pin extends into a mating receptacle in the lower door frame and 2) a jaw type latch clamps a special designed nut in the upper door frame to hold door securely in place. The door is hinged at the forward edge by an extruded aluminum hinge. The inner handle and the outer handle are interconnected by adjustable push pull tubes. This mechanism is spring loaded to an over center position in the latched position for positive security. Adjustment for each push pull tube is provided to accurately rig the latching pin and the jaw type latch. Adjustment to the special nut at the top of the door frame can be made for proper closure.

The baggage compartment door is constructed of an inner and outer aluminum shell fastened together by rivets. It has dual pin latches that extend into receptacle fittings on both sides of the door frame when the exterior handle is closed properly.

The auxiliary exit handle is located on the inside of the baggage door. This handle can be operated only from the inside even if the outer handle is locked. A cam mechanism allows a clevis pin to bypass the outer handle latch groove and open the two latching pins which hold the baggage door closed. (Refer to POH/AFM Section III for specific procedures to operate auxiliary exit handle.) This door is hinged at the top with an extruded piano type hinge.

A hold open arm is attached on both doors to assist in holding the door open when desired.

A door lock is provided for both doors. A single key will operate either door lock. The interior panels require removal if the door locks are to be removed and replaced.

## 52-10-00 - CABIN DOOR - MAINTENANCE PRACTICES

1. Removal. The cabin door may be removed to replace or repair the door or to replace a damaged hinge.

A. Remove the interior panel around the door frame.

B. Remove the hold open arm at the door frame. Remove the cotter pin and washers from the hold open arm shaft. Pull the shaft up from the doubler plate and clear of the door frame.

C. Remove the eight (8) screws from outside the airplane that hold the front portion of the hinge in place. There are also three (3) flush rivets that will require removal at this location.

D. Carefully drill center of rivet head with a 1/8th inch drill bit until head pops off and rivet stem can be punched out.

The original door assembly, with hinge attached, is assembled to the door frame prior to installation of the outer skin. The door is placed into position and the hinge held in place on its mounting plate by sealant and locator rivets. (The number of locator rivets may vary). These rivets will be underneath the outer skin. After removal of the outer rivets and screws work a putty knife or a thin piece of aluminum between the outer skin and the hinge and between the hinge and the mounting plate from the inside in order to break the sealant bond. During this procedure determination can be made where the locator rivets are positioned. Locate these rivets from the inside and drill the bucked head carefully. **DO NOT DRILL THROUGH THE OUTER SKIN.** Attempt to move the door and hinge aft and away from the attach point after each rivet stem is drilled out. The door and hinge should come free when all sealant bond and rivets are removed.

2. Door Repair.

A. The door should be repaired, if applicable, according to standard procedures in AC 43.13-1( ).

B. Remove the interior door panel if necessary to repair the door assembly.

3. Installation. The old door can be relocated by using the existing holes. The mounting plate should be thoroughly cleaned of all sealant and foreign material before reinstallation of the door.

A new door or hinge will require proper positioning of the door to obtain proper sealing.

A. Place door, with new hinge installed, into position between the outer skin and the mounting plate.

B. When door is properly positioned mark the new hinge for mounting using existing holes, either from the outer skin locations or from the hinge mounting plate inside the cabin.

C. Drill the new holes in hinge carefully while door is securely in place.

D. Remove the door - deburr holes and clean the shavings from the area.

NOTE
**The rivets and rivet holes originally used as locators do not have to be utilized when installing a new door or hinge if proper alignment can be obtained using another method.**

E. Apply sealant, PR1403-G-B2, or equivalent, between outer skin and hinge support plate on tubular structure.

F. Reinstall door hinge to mounting plate using the eight (8) flat head screws removed earlier and three (3) flat head AD4 standard (AD5 oversize) rivets.

G. Adjust door latching mechanism so door closes and seals during flight. (See door rigging procedures paragraph 52-11-00).

H. Reinstall the hold open arm with new cotter pin.

I. Reinstall interior panels and interior trim to door and cabin.

J. Paint door to match airplane.

## 52-11-00 - CABIN DOOR RIGGING/ADJUSTMENT PROCEDURES

The cabin door latching mechanism has several adjustment points that may be utilized to obtain proper rigging. (See Figure 52-1). Removal of the interior door panel will be required to gain access to the adjustment points.

1. Adjust cabin door linkage to satisfy requirements listed below.

A. Latching pin must contact striker plate on door frame the full circumference of pin when mechanism is in full latched position.

B. Latching pin must clear striker plate when opening or closing the door with latching mechanism in full open position.

C. As the lower link (1) and bellcrank arm (2), (Fig. 52-1) travel over center, the spring (3), is to be compressed to 1.000 +/- .030.

NOTE
**Washers may be added between spring and link or 310294-501 housing assembly (4) to comply with items B and C, (Figure 52-1).**

D. The lower link (1) and bellcrank arm (2), in full locked position, should be overcenter a minimum of .3 inches. (Figure 52-1).

NOTE
**It is not necessary that the lower link (1) contact the upper link (5), (Figure 52-1).**

E. The outside handle is to be flush with outside skin when mechanism is in full latched position.

F. In full latched position, the upper latch jaws (6) must be closed and the latch slide cam (7) at the end of its full travel. See adjustment points (8) and (9), (Figure 52-1).

G. In full open position the upper latch jaws must be open and slide cam at the end of its full travel.

NOTE
**Slide cam (7) moves 1.13 in. from the full latched to full open position.**

## 52-12-00 - CABIN DOOR SEAL

The cabin door seal is an extruded rubber seal filled with a soft foam. Unless deformed or torn, the seal will provide adequate sealing around the periphery of the door during flight conditions.

1. Cabin door seal replacement.

A. The seal is held to inner door frame with adhesive.

B. Remove the door inner trim panel to gain access to the door seal.

C. Pull the seal from the door frame.

D. Clean the area with lacquer thinner to help soften the remaining adhesive. Remove excess adhesive.

CAUTION
**Care should be exercised to keep the lacquer thinner from dripping on the wing or any other portion of the airplane.**

E. Coat cleaned door frame with adhesive (St. Clair #4587).

F. Coat bond area of new seal with adhesive (St. Clair #4587).

G. Let both applications dry until tacky.

H. Carefully place end of seal into position at bottom of door and continue around the door until the seal is firmly attached. Do not pull tight around corners. Cut off any excess seal.

I. When seal is properly attached the door should close with little effort.

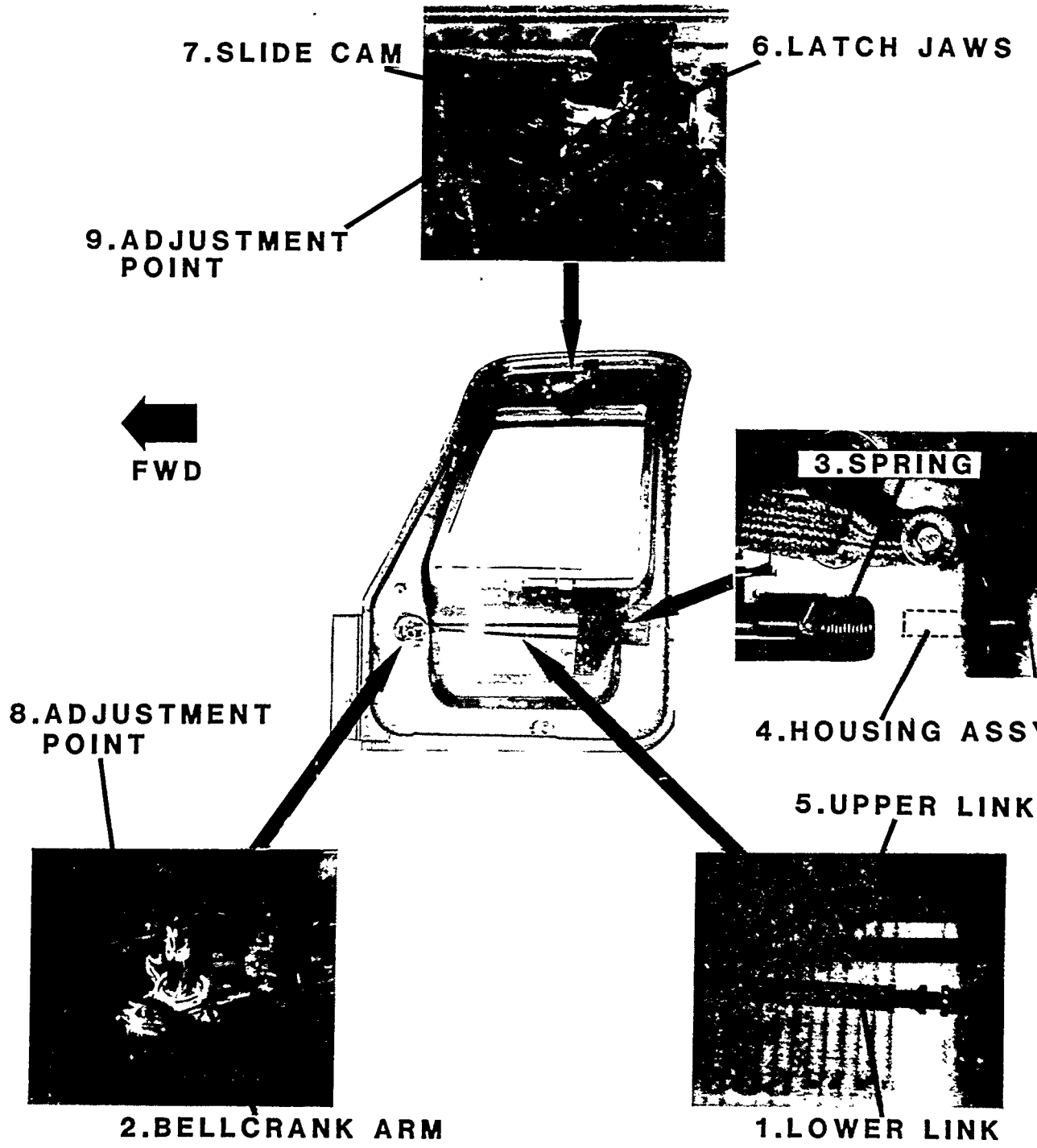



FIGURE 52-1 - CABIN DOOR - RIGGING/ADJUSTMENT

NOTE
**Door contour can be altered slightly to conform with cabin contour, if needed, for proper fit and sealing.**

## 52-30-00 - BAGGAGE COMPARTMENT DOOR - MAINTENANCE PRACTICES

1. **Removal.** The baggage compartment door may be removed to replace or repair the door or to replace a damaged hinge.

A. Remove the coat hanger and headliner panel located inside and directly under the baggage door hinge area.

B. Pull insulation back to clear rivet shanks.

C. Center punch rivet heads holding the hinge half to the fuselage.

D. Carefully drill rivet heads and punch rivets from holes.

E. Work a putty knife or thin piece of aluminum between outer skin and hinge and inner skin frame and hinge to break sealant bond.

F. Remove hinge and baggage door assembly carefully.

G. Clean hinge and hinge mounting area thoroughly of all sealant or foreign material.

2. **Repair.** The baggage door may be repaired per standard repair procedures in accordance with AC 43.13-1A. Repairs may be made to the baggage door on the airplane if feasible.

NOTE
**If repairs are to be made the interior trim panel may require removal.**

3. **Installation.**

OLD HINGE

A. Place repaired baggage door with old hinge into position and cleco securely to assure fit of door; check latching operations.

B. Remove door

- assure attachment area is clean of old sealant.

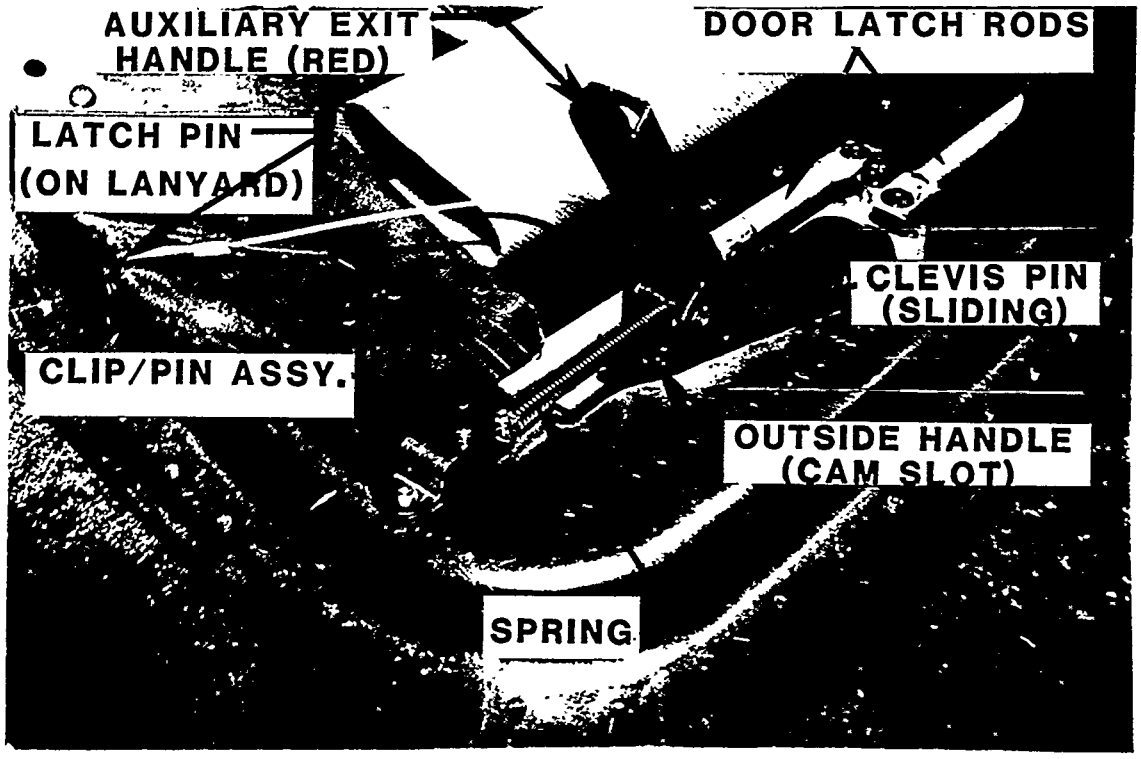



FIGURE 52-2 - BAGGAGE DOOR LATCH MECHANISM

C. Apply sealant, PR 1403-G-B2 or equivalent, to hinge attachment area between outer skin and inner frame.

D. Reinstall door assembly with old hinge and cleco hinge for proper placement.

E. Install rivets (AD4 standard, AD5 oversize) in all holes.

NEW HINGE

A. Place old door assembly with new hinge or new door assembly and new hinge into position and latch the door in place.

NOTE
**Hinge mounting area should be clean of old sealant and debris.**

B. Push in on door assembly at top, while door is in the latched position to properly locate the door and seal in the door frame.

C. While door is held in place mark holes in new hinge using holes in outer skin as locators.

D. Verify correct position of door prior to drilling holes in hinge.

E. Center punch all holes and carefully drill the two end holes. Fasten clecoes in these and recheck door assembly fit, if satisfactory continue drilling all holes.

F. Remove door assembly. Deburr and clean the area completely prior to reinstallation of door assembly.

G. Apply sealant (PR 1403-G-B2 or equivalent) to hinge mounting ar between outer skin and door frame.

H. Reinstall door assembly and cleco securely in place.

I. Install rivets, (AD4 standard, AD5 oversize) in all holes. Remove clecoes as rivets are being installed to keep door aligned.

## 52-31-00 - BAGGAGE COMPARTMENT DOOR - LATCHING MECHANISM

The baggage compartment door has a direct non-adjustable latching linkage that inserts two pins into hard points in the door frame. This latching mechanism can be locked from the outside. An auxiliary exit mechanism is incorporated into this latching mechanism which allows the door to be opened, in an emergency, from the inside even if outside handle is locked. The outside handle has to be unlatched and fully opened to correctly re-engage the latching mechanism after use of the inside auxiliary exit handle. (See Figure 52-2).

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A spring attached to the clevis pin to assist in the re-engagement of the latch pin linkage has been incorporated. This ensures a positive re-engagement of the clevis pin into the cam slot of outside handle for proper actuation of the outside latching mechanism (see Figure 52-2).

NOTE
**Follow the procedures in the Pilots Operating Handbook / Airplane Flight Manual (POH/AFM) for re-engagement of the mechanism for proper outside handle operation.**

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# CHAPTER

# 53

# FUSELAGE

# SECTION 53

# FUSELAGE

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## 53-00-00 GENERAL

The Mooney M20L forward fuselage is constructed from 4130 chrome molybdenum tubular steel and covered with aluminum skin attached to the tubular steel structure.

The tubular steel sub-assemblies are heliarc welded in fixtures, inspected and then assembled into the main cabin fixture and heliarc welded into a cabin enclosure. The assembled steel structure is sand blasted and coated with epoxy primer for corrosion protection.

The tailcone bulkheads, formers, etc., are formed from sheet aluminum on a hydro press or drop hammer at Mooney Aircraft Corporation.

These components, along with stringers, clips, brackets, etc., are assembled together on a fixture and built into the aft fuselage assembly.

All air ducts, control brackets, electrical harnesses and antennas are assembled into the tailcone during this manufacturing stage.

The forward cabin enclosure and the tailcone are mated into the fuselage assembly and this fuselage assembly advances down the production line to the station for mating with the wing assembly.

## 53-10-00 - MAIN FRAME

## 53-10-01 - TUBULAR STRUCTURE FRAME

The basic cabin enclosure is shown in (Figure 53-1).

## 53-10-02 - TAILCONE STRUCTURE

The tailcone is of semi-monocoque construction. The internal structure is shown on (Figure 53-2). The forward cabin structure (1) is bolted to the tailcone with structural bolts. The tailcone skin (2) is an integral load bearing portion of the assembly. The avionics equipment shelf (3) spans the tailcone width to provide rigidity and space for avionics components.

The battery shelfs (5) and batteries are located in this area also. The hat rack shelf (4) provides rigidity as well as storage space.

The empennage attach points (6) are attached to the rear bulkhead (7) with tabs (8) extended forward and attached to the tailcone structure.

## 53-30-00 - PLATES/SKINS

The fuselage tubular structure is covered with aluminum skins after mating to the tailcone. The skins are riveted and bolted to support angles, formers and brackets. These skins are non structural coverings to form the outside contour of the forward fuselage section.

The skins covering the tailcone are an integral part of the structure. Repair or replacement of these skins should be according to AC 43.13-1A section 3.

The fuselage assembly and tailcone have panels, covers or doors at various locations to provide access to the interior for inspection or maintenance purposes. (See Figure 53-3).

The one piece belly fairing is removable to provide access to all components and control systems located below the floorboard. See (Figure 53-3) and table following for component location and identification.

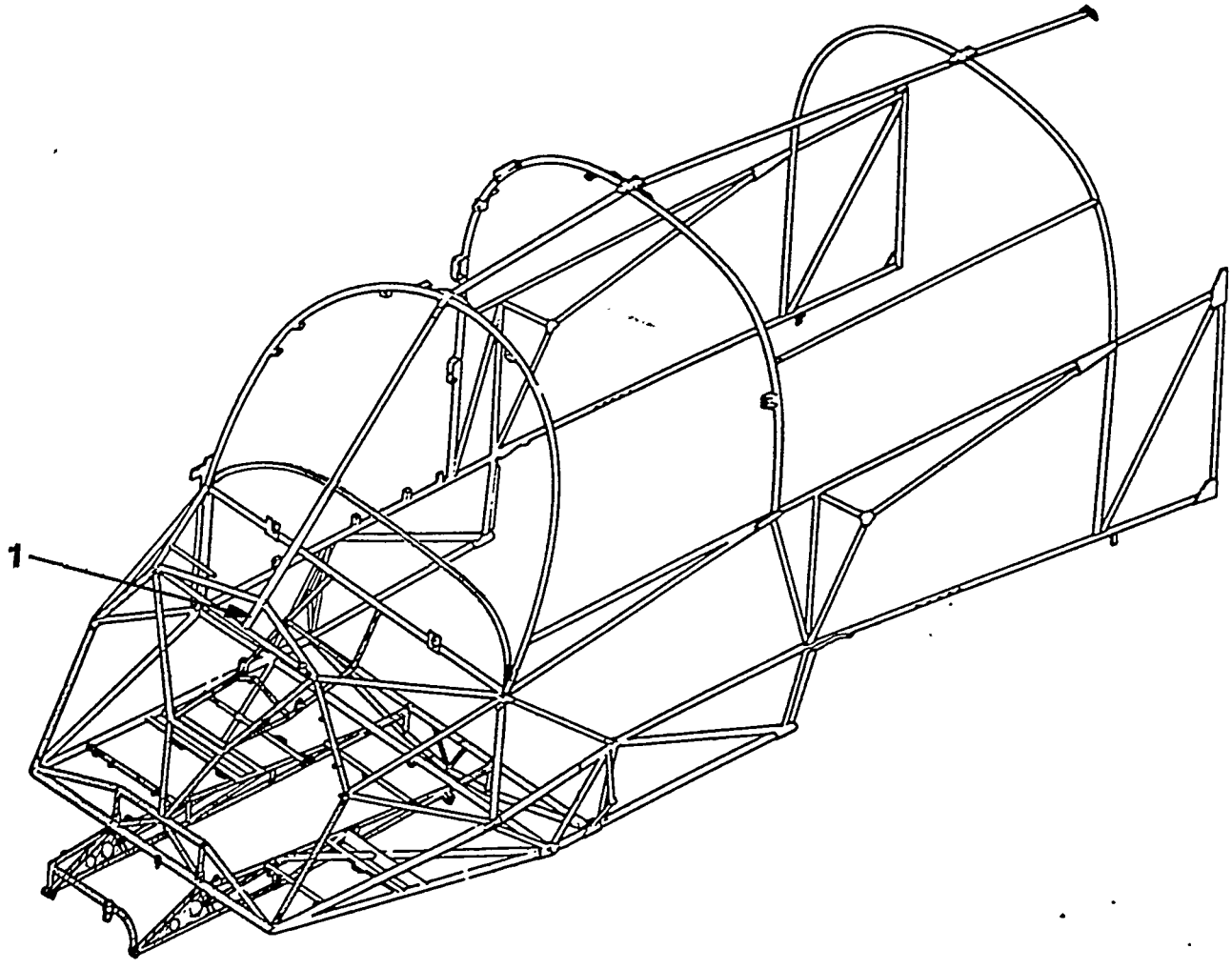



FIGURE 53-1 - TUBULAR STRUCTURE FRAME

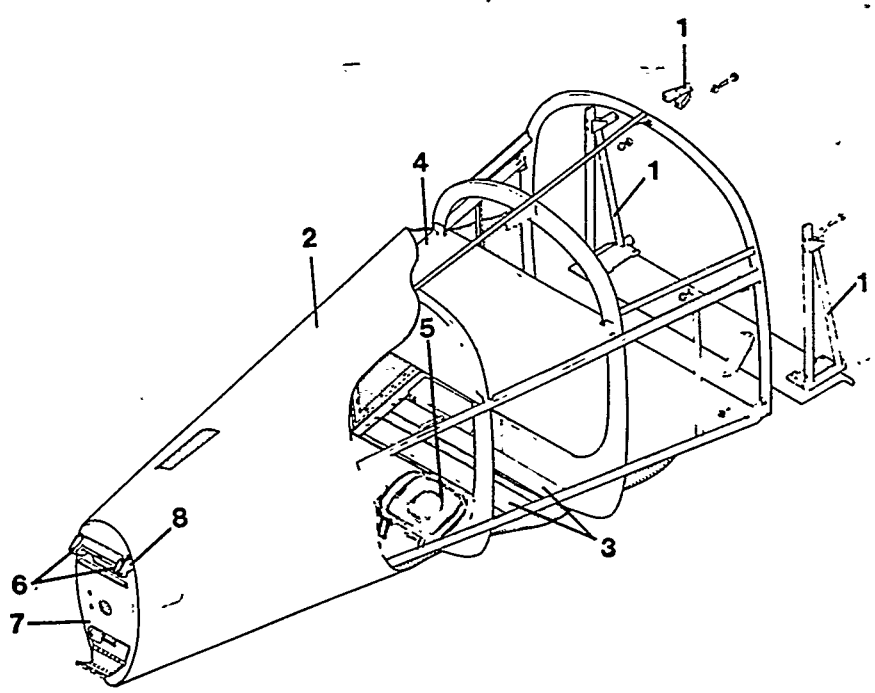
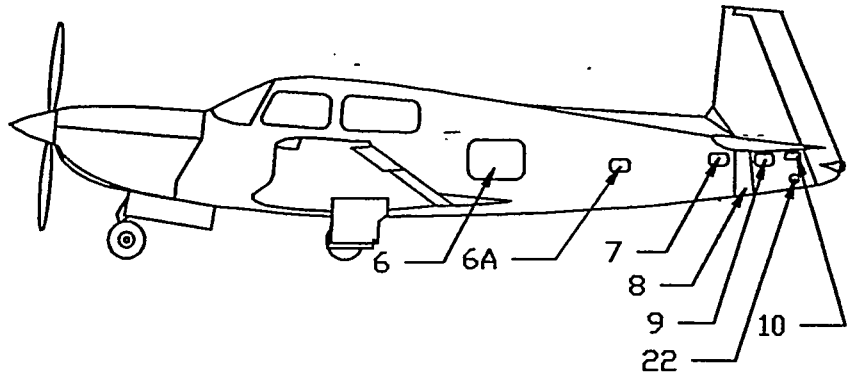
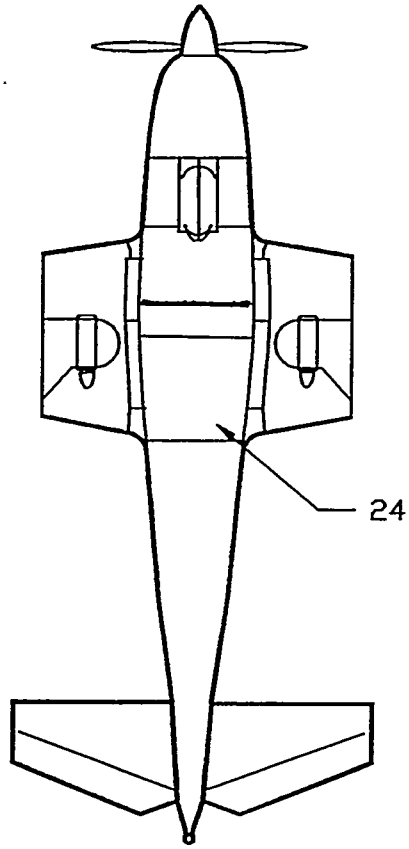



FIGURE 53-2 TAILCONE STRUCTURE

TABLE FOR FIGURE 53-3 - COMPONENT IDENTIFICATION

| | |
|---|---|
| 1. Cabin Door. | 12. Landing Gear Actuator, Gascolator, Fuel Selector Valve. |
| 2. Engine Compartment, Turbocharger | 13. Landing Gear Retract Tubes, Flap Indicator Cable. |
| 3. Baggage Door. | 14. Electric Flap Actuator. |
| 4. Elevator/Rudder Control Stops. | 15. Stabilizer Trim Screw and Stops. |
| 5. Empennage Attachment. | 16, 17, 18. Elevator/Rudder/Aileron Control System, Bellcranks, Rod End Bearings. |
| 6. Avionics Blackboxes, Batteries. | 19. Nose Wheel Steering System, Cowl Flap Controls. |
| 6A E.L.T. access. | 20. Rudder Torque Tube. |
| 7. Stabilizer Trim Jack Screw. | 21. Landing Gear Retraction Tubes. |
| 8. Empennage Attachment. | 22. Tail-Light Harness Connections. |
| 9. Elevator/Rudder Controls, Rod End Bearings & Travel Stops. | 23. Empennage Attachment, Trim Jack Screw. |
| 10. Rudder Controls, Elevators & Rudder Bellcranks. | 24. All components (12-18, 21). |
| 11. Brake Master Cylinders, Rudder Torque Tube, Electric Fuel Pump. | 25.Oil access |



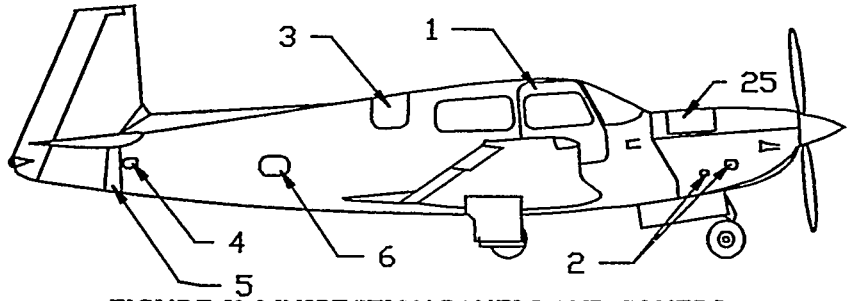




FIGURE 53-3 INSPECTION PANELS AND COVERS

## 53-40-00 - ATTACH FITTINGS

Various type of fittings (3) are used to properly distribute the load between the wing and the fuselage.

## 53-40-01 - WING ATTACH FITTINGS

The wing assembly (1) is attached to the fuselage assembly (2) using structural hardware (4); (see Figure 53-4 for locations).

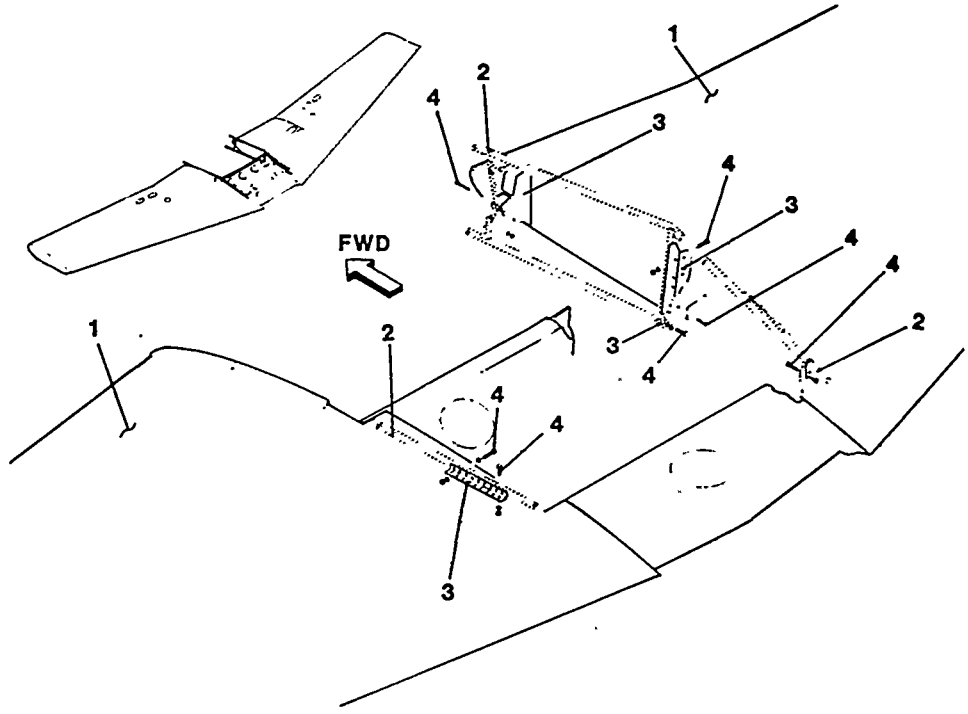



FIGURE 53-4 WING/FUSELAGE ATTACH FITTINGS

## 53-40-02 - EMPENNAGE ATTACH FITTINGS

The empennage assembly is manufactured as a unit (1), (Figure 53-5) with the vertical fin and the horizontal stabilizer using common components. This unit attaches to the tailcone empennage attach points (1) (Figure 53-6), using two structural bolts (2) (Figure 53-5) passing through two top hinges (3) (Figure 53-5).

The bottom attach point (4) (Figure 53-5) on the empennage assembly secures the stabilizer trim jack screw (5) (Figure 53-5) and (4) (Figure 53-6). Lateral stability of the empennage assembly is controlled with an articulated hinge assembly (2) (Figure 53-6) attached to the rear bulkhead (3) (Figure 53-6) of the tailcone. The hinge attach pin (6) (Figure 53-5) is held in place with a cotter pin at each end.

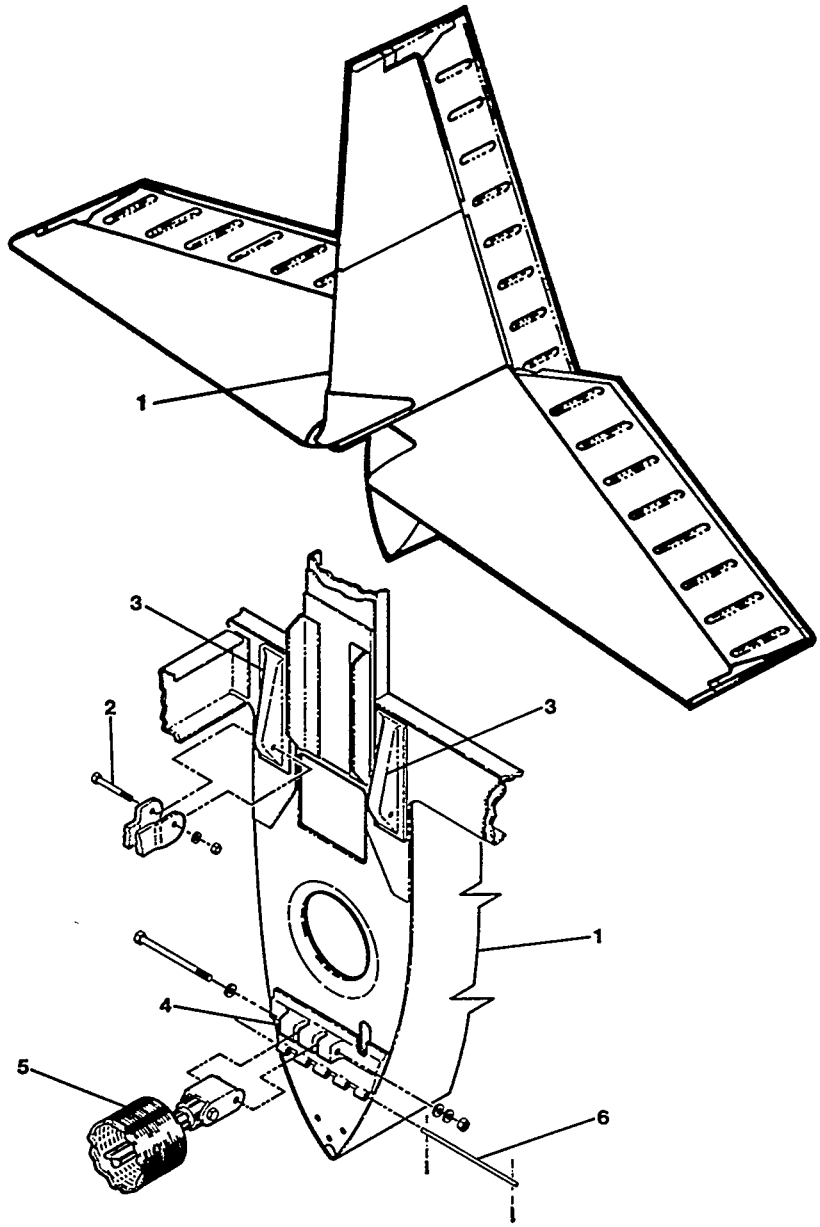



FIGURE 53-5 EMPENNAGE ASSEMBLY ATTACH FITTINGS

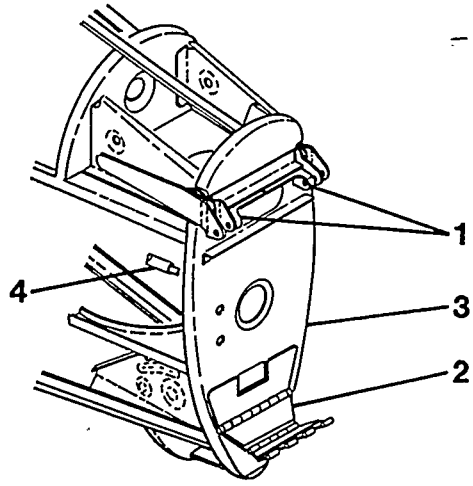



FIGURE 53-6 TAILCONE/EMPENNAGE ATTACH POINTS

### 53-40-03 - MAIN LANDING GEAR ATTACH POINTS

The main landing gear assembly is a welded heat treated 4130 chrome molybdenum steel assembly. The leg assembly (1).Fig. 53-7, is supported at the forward end by the tension strap fitting (2) attached to the wing main spar assembly (3) (Figure 53-7 insert) and provides one of the hard points for the main landing gear assembly. The leg assembly (1) is supported at the rear by a bracket (4) attached to the stub spar assembly (5). This is the rear hard point. The main landing gear truss assembly (6) also attaches to the tension strap fitting (2) on the main spar. The brass bearing (7) (insert) should be inspected at any scheduled maintenance action for wear. Grease fittings (8) are installed at pivot points of the main landing gear assembly for lubrication per Section 5. (Reference Figure 53-7).

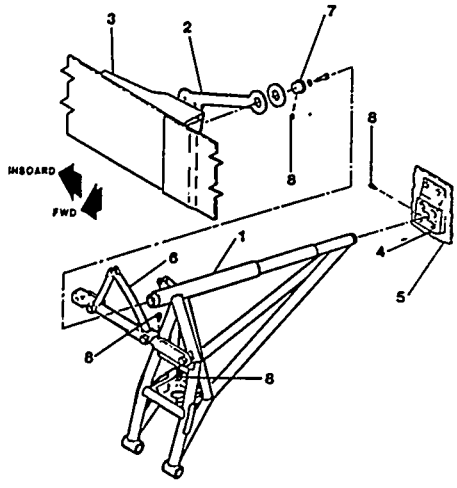



FIGURE 53-7 - MAIN LANDING GEAR ASSEMBLY ATTACH POINTS

**CAUTION**

**Heat treated assemblies are not considered to be repairable. Welding or heating will change the heat treat characteristics and it takes special precautions to obtain the original hardness and strength.**

### 53-40-04 - ENGINE MOUNT ATTACH POINTS

The engine mount is attached to hard points built into the forward portion of the tubular structure.

The upper hard points (1) (Figure 53-8) & lower hard points (2) are for NAS1304 bolts installed for tension loads. The lower hard points (2) are for AN3 bolts.

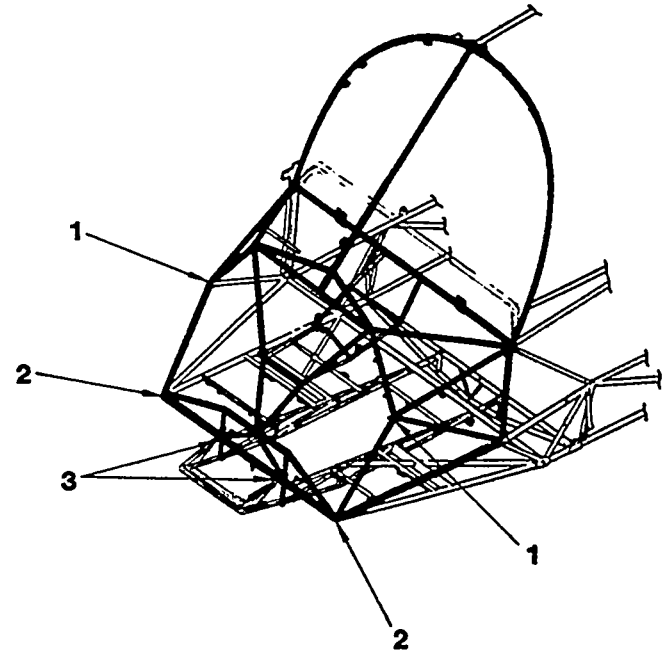



FIGURE 53-8 - ENGINE MOUNT ATTACH POINTS

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# CHAPTER

# 55

# STABILIZERS

SECTION 55

STABILIZERS

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## 55-00-00 - GENERAL

The M20L empennage assembly is a variable incidence tail-plane consisting of a horizontal and vertical stabilizer built as a unit. (Refer to Chapter 53 for the attachment of the empennage to the fuselage.)

The horizontal and vertical stabilizer are constructed of formed sheet metal ribs attached to a forward and aft spar assembly covered with stretch formed skins. The horizontal stabilizer has a stub spar that spans a portion of the stabilizer.

The elevator and rudder are constructed from an extruded leading edge spar assembly covered with formed skins. The elevators have a fixed tab between the skins that run the full length of the trailing edge.

The elevators and the rudder have balance weights permanently installed for stabilization during flight.

## 55-10-00 - HORIZONTAL STABILIZER

The main spar assembly (1) (Ref. Fig. 55-1) is formed from aluminum sheet into a channel. Angle doublers (2, 3 and 4) are formed and riveted to the spar through the web section. The stub spar (5) is a channel formed from aluminum sheet reinforced with a joggled channel (6) at the center section. The rear spar (7) is an extrusion attaching to the aft end of the ribs and contains the hinge fittings (8) for the elevators.

The ribs (9) are assembled in sections to the front and rear face of each spar assembly to form the air foil. Stretch formed skins (10) are fastened to the ribs, spars and doublers to form the complete horizontal stabilizer structure.

The aft vertical fin spar (11) is attached to the horizontal stabilizer structure through a bracket (12) which is fastened securely to the stabilizer rear spar assembly (7). (Reference Figure 55-1).

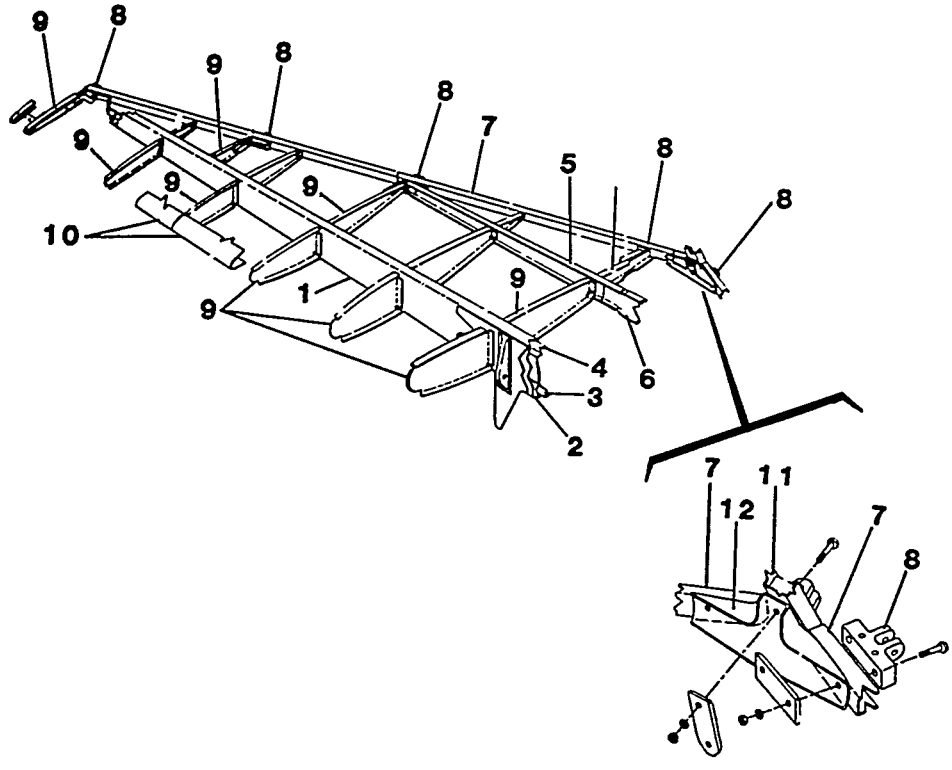



FIGURE 55-1 - HORIZONTAL STABILIZER

## 55-10-01 - HORIZONTAL STABILIZER - REMOVAL

The fairing located on the tailcone, covering the gap between the tailcone and empennage assembly, will require removal to gain access to empennage attaching hardware. Section 53-40-02 describes the attaching points for the empennage assembly. Refer to this section for the removal of the empennage assembly from the airplane.

## 55-10-02 - HORIZONTAL STABILIZER - INSTALLATION

Refer to Section 53-40-02 for installation.

## 55-20-00 - ELEVATOR

The elevators on the M20L consist of a left and right hand assembly attached through ball bearing fittings (1) to the rear spar of the horizontal stabilizer (reference Figure 55-2).

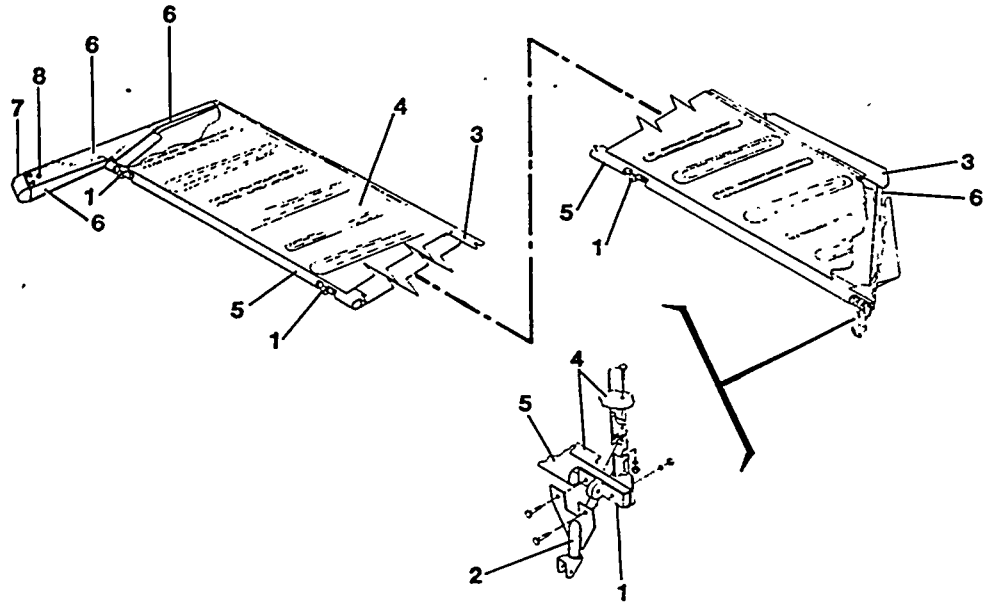



FIGURE 55-2 - ELEVATOR

The elevator control horn (2) is connected to the inboard leading edge of each elevator (R.H. and L.H.). Both control horns are then connected to the elevator flight control bellcrank. The full length trim tab (3) may not be adjusted from the factory installed configuration. This is factory set at 7 degrees down.

The elevator skins (4) are stretch formed for the upper and lower surface of the elevator. There are no ribs in the elevator between the inboard and the outboard ribs. The skins are attached to the leading edge extrusion (5) and the ribs (6) with blind rivets. Each formed corrogation is matched on top and bottom skins and rivets are installed for strength and rigidity through each corrogation.

A lead balance weight (7) is installed in each elevator tip with iron rivets (8). (Reference Figure 55-2). See Section 27-91-00 for balancing procedures on the elevators.

## 55-20-01 - ELEVATOR - REMOVAL

Remove the AN3 bolts from each control horn and push-pull tube bearing, then remove the AN3 bolts and hardware from each hinge fitting on both elevators.

## 55-20-02 - ELEVATOR - INSTALLATION

**CAUTION**
**Each new, repaired or repainted elevator should be checked for balance per Section 27-91-00.**

The elevators are installed in reverse order of removal. Nominal torque values for AN3 bolts

are to be used (see section 5-20-01 for torque table.)

### 55-30-00 - VERTICAL STABILIZER

The main spar assembly (1) (Ref. Fig. 55-3) is formed from aluminum sheet. Formed angle doublers (2) are nested inside the main spar channel and riveted to the web. The rear spar (3) is an extrusion used to attach the aft end of the sectioned ribs (4). The stub spar (5) is also formed from sheet aluminum. A doubler channel (6) is attached to the vertical stabilizer stub and the stub spar of the horizontal stabilizer.

This attach channel is securely bolted to stinger bulkhead brackets. The main spar doublers and angles 7, 8 and 9 provide attach points for the stinger and the horizontal stabilizer spar. (Refer to Figure 55-3).

The skins (10) are stretch formed in 2 sections and riveted to the ribs and spar.

The rudder attach fittings (11) are mounted to the rear spar extrusion.

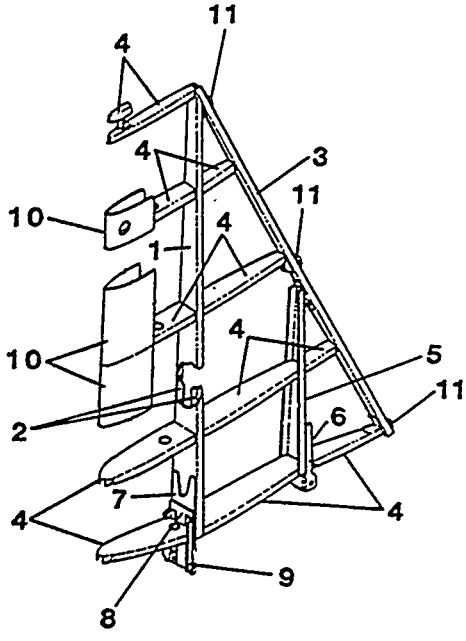



FIGURE 55-3 - VERTICAL STABILIZER ASSEMBLY

### 55-30-01 - VERTICAL STABILIZER - REMOVAL

The vertical and horizontal stabilizer are removed as a unit with the stinger assembly. Remove the fairing located on the tailcone which covers the gap between tailcone and empennage. Section 53-40-02 describes the attaching points for the complete empennage assembly. Refer to this section for removal of the empennage assembly from the airplane.

### 55-30-02 - VERTICAL STABILIZER - INSTALLATION

Refer to Section 53-40-02 for installation.

### 55-40-00 - RUDDER

The rudder on the M20L is constructed the same as the elevator with stretch formed skins (1) (Ref. Fig. 55-4) riveted to an extruded leading edge (2) and riveted together at the trailing edge.

The rudder lower skins (3) are drop hammer formed left and right halves riveted to the upper skins, a rib assembly (4) and at the leading and trailing edge. A stiffener (5) is to support the lower rudder ball bearing hinge fitting (6). A weather seal (7) is included in the assembly.

The rudder control horn (8) is attached with the center hinge fitting (9) to the rear flange of the front spar at the junction of the lower rib assembly (10). A brace arm on the horn assembly is attached to a fitting (11) on the lower rib (10).

The upper hinge fitting (12) is attached to the rear flange of the front spar just under the top rib assembly (13) and the balance weight (14). (refer to Figure 55-4).

The balance weight (14) is installed with four iron rivets (15). See section 27-91-00 for balancing procedures on the rudder.

### 55-40-01 - RUDDER - REMOVAL

Remove the AN3 bolt from the control horn and push-pull tube bearing, then remove the three AN3 bolts and hardware from each hinge fitting. Disconnect electrical connections per paragraph 33-41-03,2.A thru E.

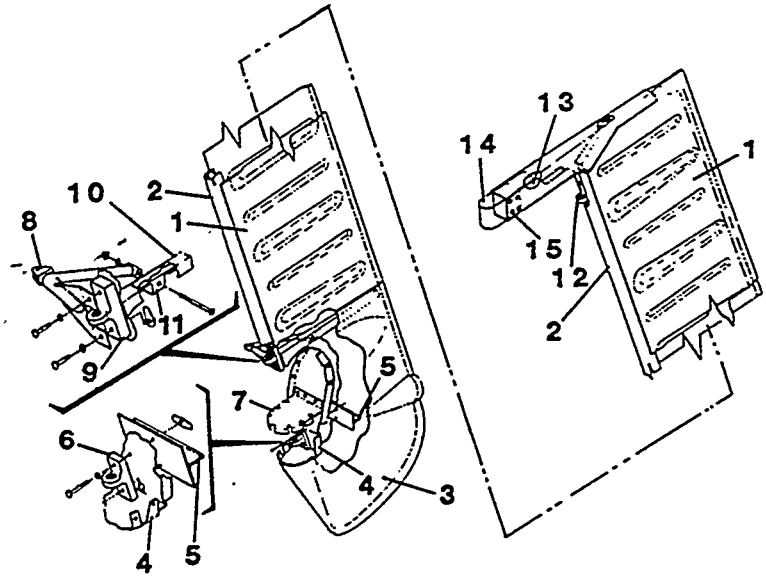



FIGURE 55-4 - RUDDER ASSEMBLY

## 55-40-02 - RUDDER INSTALLATION

CAUTION
**Each new, repaired or repainted rudder should be checked for balance per section 27-91-00 prior to installation.**

The rudder is installed in reverse order of removal. Nominal torque valves for AN3 bolts are to be used. (See Section 5-20-01 for torque table).

# CHAPTER

# 56

# WINDOWS

# SECTION 56
# WINDOWS

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## 56-00-00 - GENERAL

The windshield for the M20L is .187 inch thick acrylic heat formed to contour. The pilots side window is also .187 inch thick acrylic with a hole cut out to accommodate the .312 inch thick storm window. The storm window is milled to fit the hole and to be flush with outside of pilots window surface when closed. The other three side windows are .125 inch thick acrylic.

All the windows are heated in an auto-clave to approximately 300° F and placed on a plaster mold to cool while maintaining the correct shape.

The windows are tinted for visual comfort, ultra-violet filteration and cooling effect for the cabin.

The windows are sealed to the outside skin. Retainers and clips are used on the frame to hold the windows in place.

## 56-00-01 - CLEANING ACRYLIC

A commercial cleaning solution manufactured for acrylic may be used to clean routine grit and grime from the windows. Follow the instructions on the commercial cleaner used.

If no commercial cleaner is available these procedures should be followed:

1. Flush windows with water prior to wiping with a clean, soft cloth soaked in kerosene.

CAUTION
**Never wipe windows when dry.**

2. Flush with water after cleaning with kerosene.

CAUTION
**Never use gasoline, benezene, carbon tetrachloride, acetone, lacquer thinner, deicer fluid, house hold cleaning fluid or any other questionable fluid to clean acrylic windows. These solvents will soften or craze the surface.**

NOTE
**Minor scratches or abrasions may be polished out by using acrylic resurfacing kits, ie., Micro-Mesh, available from aviation accessory suppliers.**

## 56-20-00 - WINDSHIELD AND CABIN WINDOWS

The removal and installation of windshield and windows are accomplished in the following paragraphs.

## 56-21-00 - WINDSHIELD

## 56-21-01 - WINDSHIELD - REMOVAL

The aluminum retainer (1) at bottom of windshield (2) must be removed by drilling out the rivets attaching it to the cowl deck (3), (reference Figure 56-1).

A putty knife or thin aluminum strip will be necessary to work underneath the top skin (4) and the side post skin (5) to break the sealant bond between the acrylic and the skins.

CAUTION
**Exercise care during this operation to avoid scratching the acrylic. Considerable effort may be required to break the bond.**

Carefully pull the windshield away from its location starting at the lower portion and work it loose as the sealant bond is broken around the edge of acrylic.

When windshield is removed all residual sealant must be removed prior to installation of the replacement windshield. Careful scrapeing with putty knife and the application of M.E.K. will assist in removing the excess sealant.

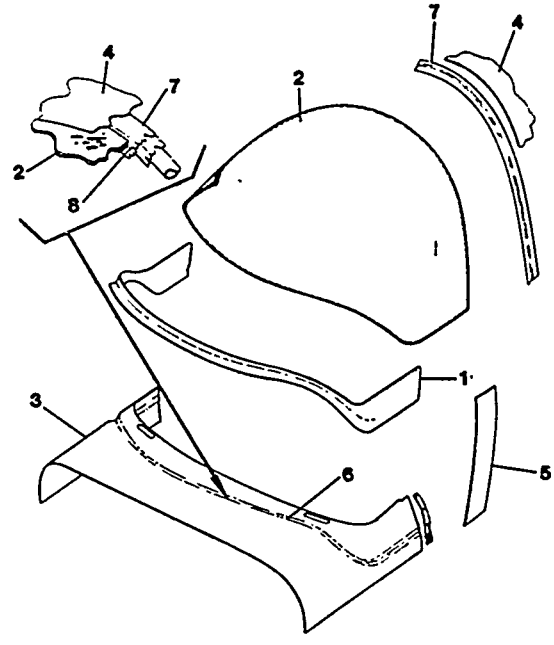



FIGURE 56-1 - WINDSHIELD INSTALLATION

## 56-21-02 - WINDSHIELD-INSTALLATION

When old sealant is removed brush M.E.K. or equivalent cleaning solvent in the cavity (8) where new windshield will be located (refer to Fig.

**NOTE**
**Exercise care with application of these solvents. Damage may result if drops of solvents come in contact with either the exterior paint, interior trim or plexiglass.**

Apply sealant, PR1403-G-B2 or PRC1321-B-2, into the cavity (8) until approximately half filled. Apply a bead of sealant along the recessed joggle (6) of the cowl deck (3), (reference Figure 56-1).

The new windshield being forced into the cavity between the outer skin (4) and the interior retainer (7) will extrude excess sealant. After the windshield is in place wipe the excess sealant off with a damp clean cloth.

Prior to riveting the aluminum retainer (1) into position coat retainer with a uniform thickness of either sealant. A positive bond will be made as the retainer is riveted into place. Use CR1312-5-2 cherry rivets to reattach the retainer (1) to cowl deck (3), (reference Figure 56-1).

After the sealant cures the excess may be removed with a sharp razor knife.

Check for water leaks.

Repaint retainer and rivets to match aircraft.

## 56-22-00 - CABIN WINDOWS

## 56-22-01 - CABIN WINDOWS - REMOVAL

Remove interior trim from the window (1) to be replaced. Remove the retainers (2) or clips (3) which hold the window in position from the inside. (reference Figure 56-2).

**NOTE**
**Some retainers are held in place with screws (4) and some with rivets. Drill out rivets carefully.**

The window will be bonded to the outside skin with sealant. Considerable effort may be required to break the bond between the acrylic

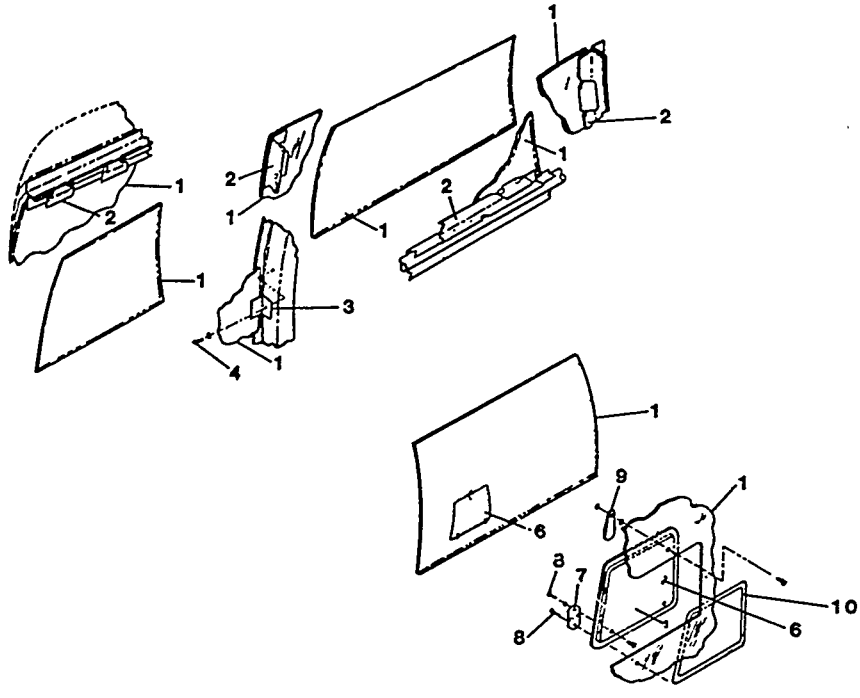



FIGURE 56-2 - WINDOW INSTALLATION

and the outer skin. Care should be exercised to keep window from twisting and possibly cracking.

Remove the window and clean all remaining sealant from the skin. Use M.E.K. and a scraper to remove the sealant.

### 56-22-02 - CABIN WINDOWS - INSTALLATION

Remove all old sealant and clean skin area with M.E.K.

Place window (1) into position to assure proper fit. Trim if necessary (See Figure 56-2).

Apply a thick, uniform thickness of PR1403-G-B2 or PRC1321-B-2 sealant to both window and skin areas where window (1) will be located. Sufficient sealant should be used so excess sealant is extruded from all edges of windows, both inside and outside, (approximately 5 ,3.5 oz. tubes for 4 windows).

NOTE

**It is recommended that five (5) tubes of sealant be used for the windows to properly seal all areas to keep water from entering the interior and causing corrosion of the steel tubular structure.**

Force window (1) into place with retainers (2) or clips (3) and secure with Avex 1601-410 blind rivets or existing screws and hardware (4). The sealant will be forced out and seal the window to the outside skin. Carefully wipe excess sealant off acrylic before it sets up. After sealant cures the excess can be cut off with a sharp razor knife, (reference Figure 56-2).

Check replaced window for leaks.

Reinstall interior trim panels.

### 56-23-00 - STORM WINDOW

The storm window (6) is mounted with two aluminum hinges (7), attaching hardware (8) and held closed by a latch (9). A gasket (10) is bonded to the storm window for sealing purposes when closed, (reference Figure 56-2).

### 56-50-00 - ACRYLIC DRILLING

Drill bits for acrylic should be ground per (Figure 56-3). A slow turning drill bit with light pressures is desirable.

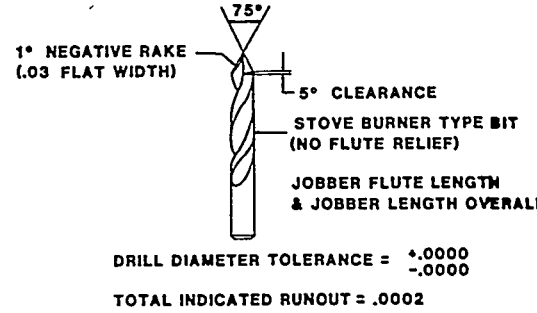



FIGURE 56-3 - ACRYLIC PLASTIC DRILL BIT

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# CHAPTER

# 57

# WINGS

SECTION 57

WINGS

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## 57-00-00 - GENERAL

The all metal wing is a one piece assembly attached to the fuselage at structural hard points with structural hardware. (See section 53-40-01). The full span main spar assembly is connected to the stub spar and rear spar assembly by ribs, doublers and skins. The main landing gear forward attach assembly is an integral part of the main spar and the rear fitting is bolted to the stub spar assembly. The spar caps are 7075-T6 aluminum and the webs, ribs and doublers are 2024-T3, T4 or T42 aluminum. Repair of these components is covered in Section 51-13-00.

The wing tips are fabricated from fiberglass and house the navigation and strobe lights.

The fuel is contained in wet wing type fuel cells between the main spar and baffles forward of the spar. The tanks are sealed during manufacturing with current technology sealant. (See section 28 for fuel system details).

## 57-00-01 - WING REMOVAL AND INSTALLATION

The major subassemblies of the wing may be removed individually, or the wing may be removed as a unit. To remove a wing, a fuselage supporting cradle is needed.

1. Wing removal:

A. Remove wing-root fairings and bottom fuselage access panels.

B. Drain all fuel from tanks.

C. Drain brake lines and reservoir. Disconnect hydraulic lines at wing main spar.

D. Remove front and rear seats. Remove the two inspection plates under rear seat area.

E. Jack aircraft per Section 7-10-00.

F. Disconnect or remove the following:

(a) Two landing gear assist springs.

(b) Aileron control tubes at inboard bellcranks.

(c) Trim control tube at station 59.3 and 94.5.

(d) Main gear retraction tubes.

(e) Rudder control tubes.

(f) Elevator control tube.

(g) Elevator and rudder push-pull tubes.

(h) Floorboards at rear attach points.

(i) Belly skin stringer splice angles.

(j) Airspeed indicator line, pitot lines, and pitot heater wires (if installed).

(k) Hardware shown in (Figure 57-1).

**CAUTION**
**Have a suitable cradle ready to carry the fuselage before removing all mating hardware.**

2. Wing installation: Installation of the wing assembly is direct reversal of removal.

## 57-00-02 - STALL STRIPS - INSTALLATION

1. Adjust stall strips so that during stall recovery normal use of controls would prevent:

A. More than 15 degree roll.

B. More than 15 degree yaw.

C. More than 30 degree pitch below flight level.

2. Place stall strips on leading edge at stations shown on Figure 57-2, attach securely with duct tape for test flights. Adjust stall strips until aircraft flies to criteria in paragraph 57-00-02, 1, A, B and C. Secure each stall strip per installation instructions in (Figure 57-2).

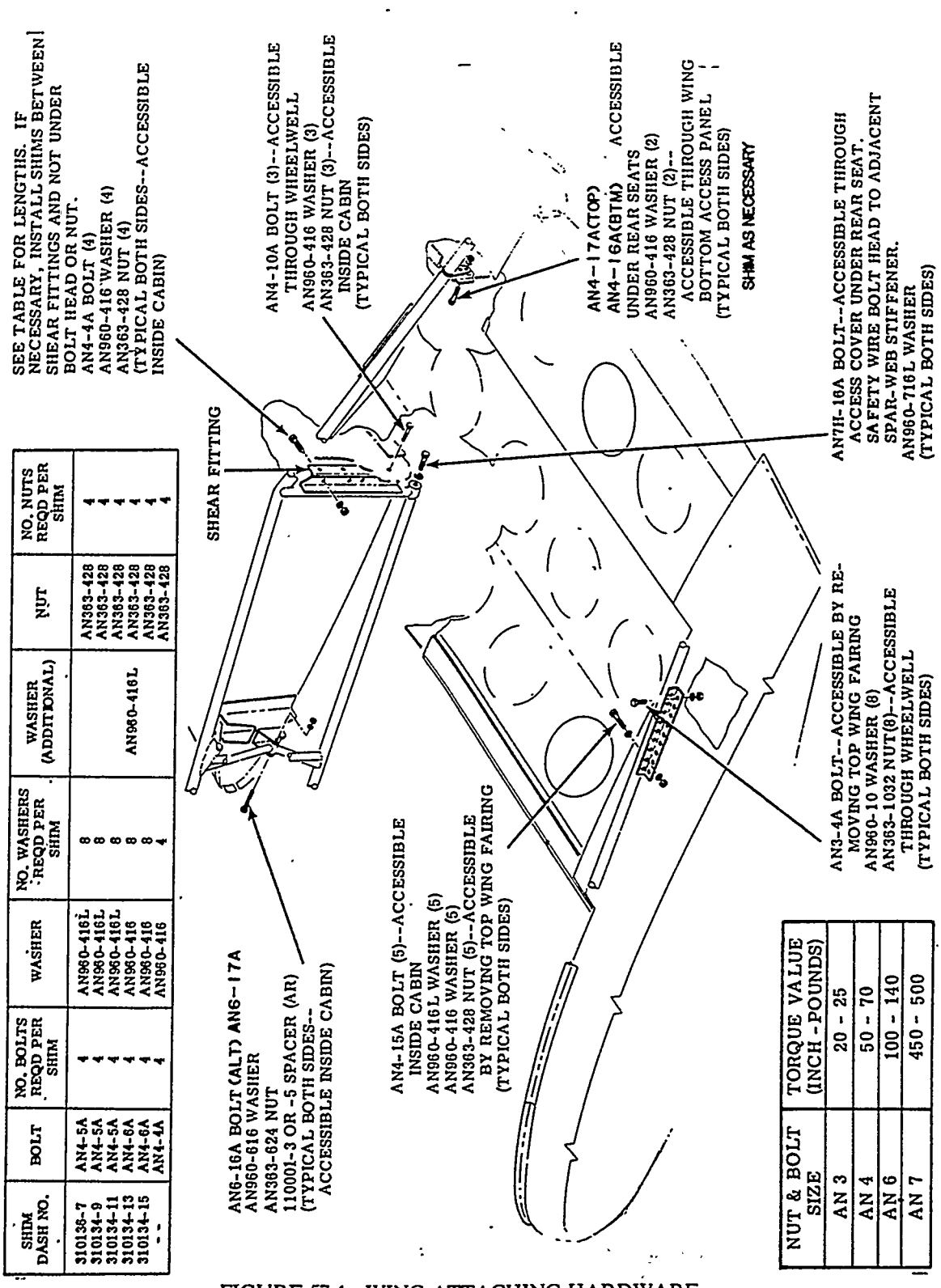
## 57-10-00 - MAIN FRAME

The integral fuel cells, shaded area (1) start at wing station 24.5 and continue to the rib at station 74.0 on both wings. (Reference Figure 57-3). Sealer is applied to all joints on ribs, spar and baffle plates. (See section 28 for resealing procedures).

The wing is manufactured in three sections: the center section (2), the left outboard section (3) and an opposite right outboard section (not shown) (Figure 57-3). These three sections are then assembled into one full span wing assembly as the skins are installed.

A spares wing tip assembly is available which includes completed section from wing station 118.25 and outboard. The assembly includes the stringers (4) required to complete the splice to the old center section. A spar splice plate is required to reinforce the spar (5) at it's attachment location. These components, with instructions, are available through your Mooney Marketing/Service Centers.

| SHIM DASH NO. | BOLT | NO. BOLTS REQD PER SHIM | WASHER | NO. WASHERS REQD PER SHIM | WASHER (ADDITIONAL) | NUT | NO. NUTS REQD PER SHIM |
|---|---|---|---|---|---|---|---|
| 310136-7 | AN4-5A | 4 | AN960-416L | 8 | AN960-416L | AN363-428 | 4 |
| 310134-9 | AN4-5A | 4 | AN960-416L | 8 | | AN363-428 | 4 |
| 310134-11 | AN4-5A | 4 | AN960-416L | 8 | | AN363-428 | 4 |
| 310134-13 | AN4-6A | 4 | AN960-416 | 8 | | AN363-428 | 4 |
| 310134-15 | AN4-6A | 4 | AN960-416 | 8 | | AN363-428 | 4 |
| - - | AN4-4A | 4 | AN960-416 | 4 | | AN363-428 | 4 |




| NUT & BOLT SIZE | TORQUE VALUE (INCH-POUNDS) |
|---|---|
| AN 3 | 20 - 25 |
| AN 4 | 50 - 70 |
| AN 6 | 100 - 140 |
| AN 7 | 450 - 500 |

FIGURE 57-1 - WING ATTACHING HARDWARE

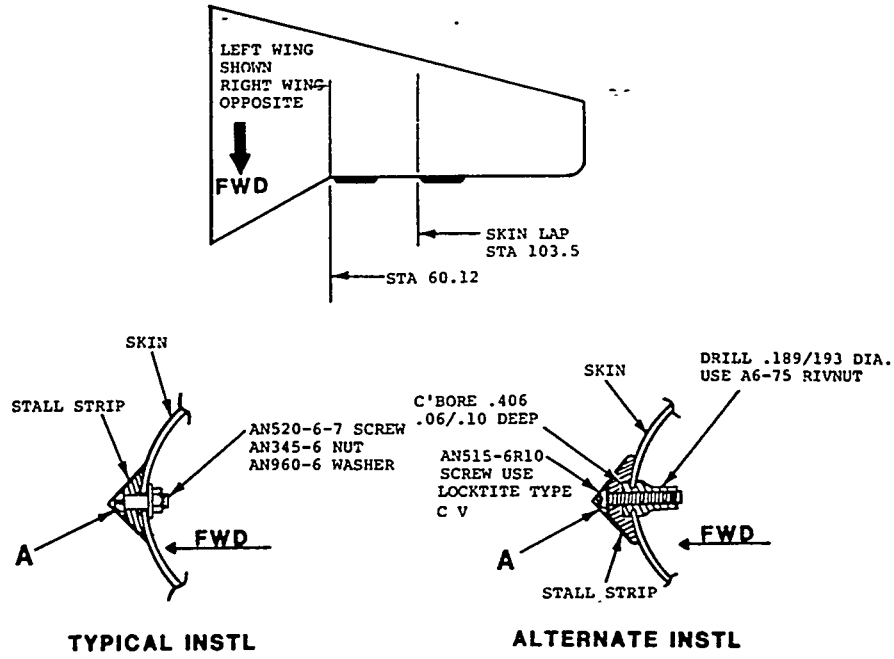



FIGURE 57-2 - STALL STRIP INSTALLATION

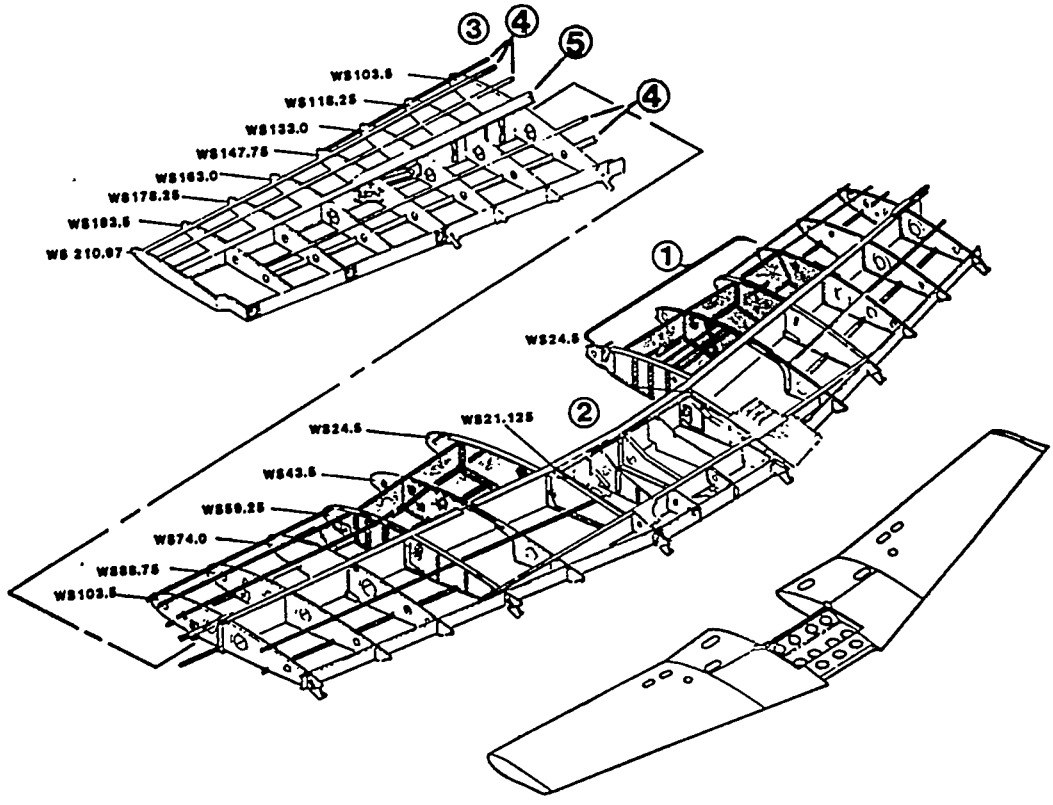



FIGURE 57-3 - WING STRUCTURE

## 57-20-00 - AUXILIARY STRUCTURES

### 57-20-01 - JACK POINTS

The jack points are located on the under side of the wing. The threaded wing tie down eyebolt fittings are designed to accept the non threaded jack points. These are located outboard of each main gear. See Section 7-10-00 for complete jacking procedures.

### 57-20-02 - WING TIPS

The M20L wing tips are non-structural fiberglass components. They are riveted to the upper and lower wing skins during final assembly of the wing structure.

1. Wing tip removal.

A. Remove the navigation strobe light lens (1) by removing 4 screws and washers (2) that retain the lens to wing tip (3). Disconnect aft position light connections. Refer to Figure 57-4).

B. Drill out rivets (4) holding tip to upper and lower wing skins (5). Remove all rivet shanks with a punch.

C. Carefully pull wing tip away from wing rib (6) and skins (5). Disconnect the strobe and navigation light harnesses at the quick disconnect plug (8) prior to completely removing the tip.

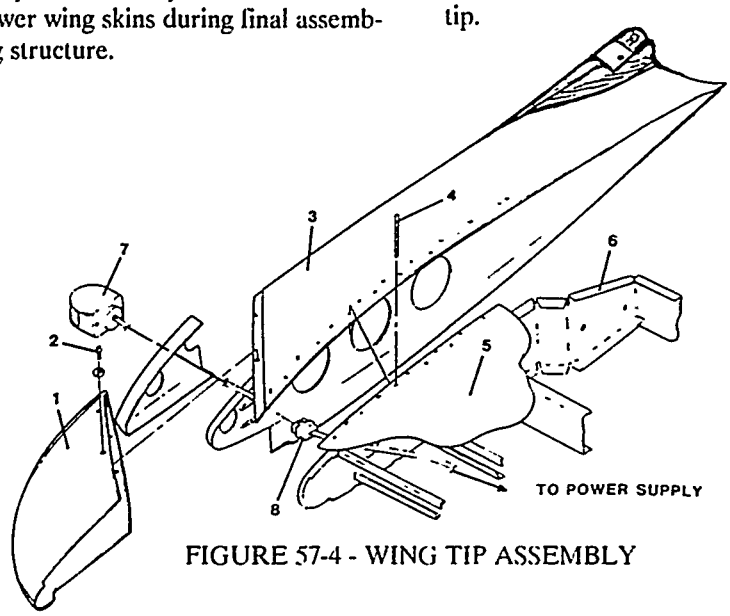



FIGURE 57-4 - WING TIP ASSEMBLY

**NOTE**
**The strobe or navigation lights can be removed from wing tip either before or after its removal from wing.**

2. Wing tip installation.

A. Place the new or repaired wing tip in place.

**CAUTION**
**Be sure aileron and aileron balance weights are not restricted in movement either direction.**

B. Secure wing tip and drill holes to match wing skins. Cleco as holes are drilled into tip. When all holes are drilled remove wing tip assembly and deburr.

**NOTE**
**Connect strobe and navigation light connectors prior to final attachment of the tip.**

C. Use Avex 1604-0412 blind rivets to attach the wing tip to the top and bottom skins.

D. Repaint to match the aircraft.

### 57-30-00 - PLATES - SKIN

The wing access and inspection covers shown in (Figure 57-5) provide maintenance access to components, plumbing and control bellcranks enclosed within the wing.

They are flush mounted covers and when installed continue the aerodynamic contour of the wing. The aircraft has a one piece fiberglass skin that can be removed to gain access to components located in that area.

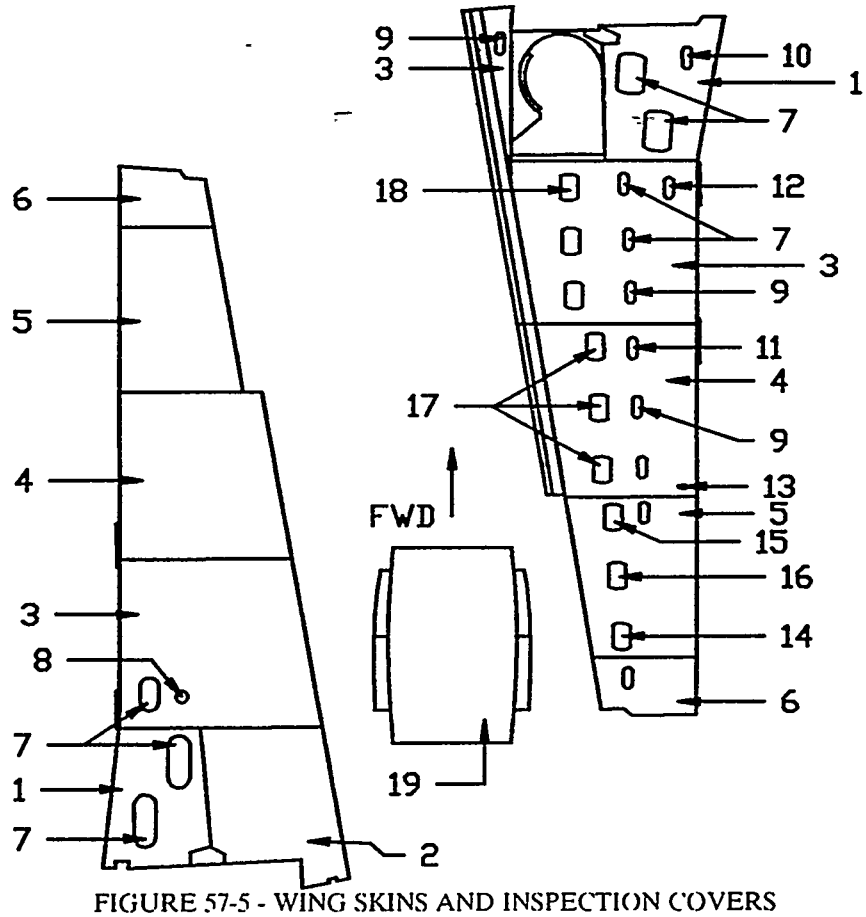



FIGURE 57-5 - WING SKINS AND INSPECTION COVERS

LEGEND FOR FIGURE 57-5.

1. Wing skin - .050 thickness.
2. Wing skin - .040 thickness.
3. Wing skin - .040 thickness.
4. Wing skin - .032 thickness.
5. Wing skin - .025 thickness.
6. Wing skin - .025 thickness.
7. Fuel tank access.
8. Fuel tank filler.
9. Control tube guide blocks.
10. Wing - fuselage attach points.
11. OAT probe, right wing only.
12. Control tube guide blocks and flight timer.
13. Pitot post - left wing only.
14. Strobe light power supply.
15. Aileron bellcrank and control rods.
16. Auto pilot servos.
17. Gyro compass flux valve (one of these, depending on installed equipment), (left wing only).
18. Main landing gear retraction spring.
19. Elevator and rudder controls - rod end bearings, bellcranks.

**NOTE**

**Access covers on bottom of wing that require removal for inspection intervals are secured with screws. Any access covers that are riveted in place are required for manufacturing only and NOT for routine inspections.**

## 57-40-00 - ATTACH FITTINGS

Refer to Section 57-00-01 for wing fuselage attachment.

## 57-50-00 - FLIGHT SURFACES

Refer to Section 27-90-00 for flight control surfaces balancing procedures.

### 57-50-10 - FLAPS

Refer to Section 27-50-00 for maintenance and rigging procedures.

The flap actuator jack shaft is connected by a push-pull rod end bearing to the actuator bracket (1) (Figure 57-6) located just inboard of the inboard hinge (2). All four hinges (2) and (3) are faired (4) to reduce drag.

The internal structure of the flaps consists of a leading edge extrusion (5) trailing edge stiffener (6), ribs (7) and top and bottom skins (8). These components are riveted together into a left hand and right hand assembly.

### 57-50-11 - FLAP REMOVAL AND INSTALLATION

Refer to Section 27-50-00 for removal and installation procedures.

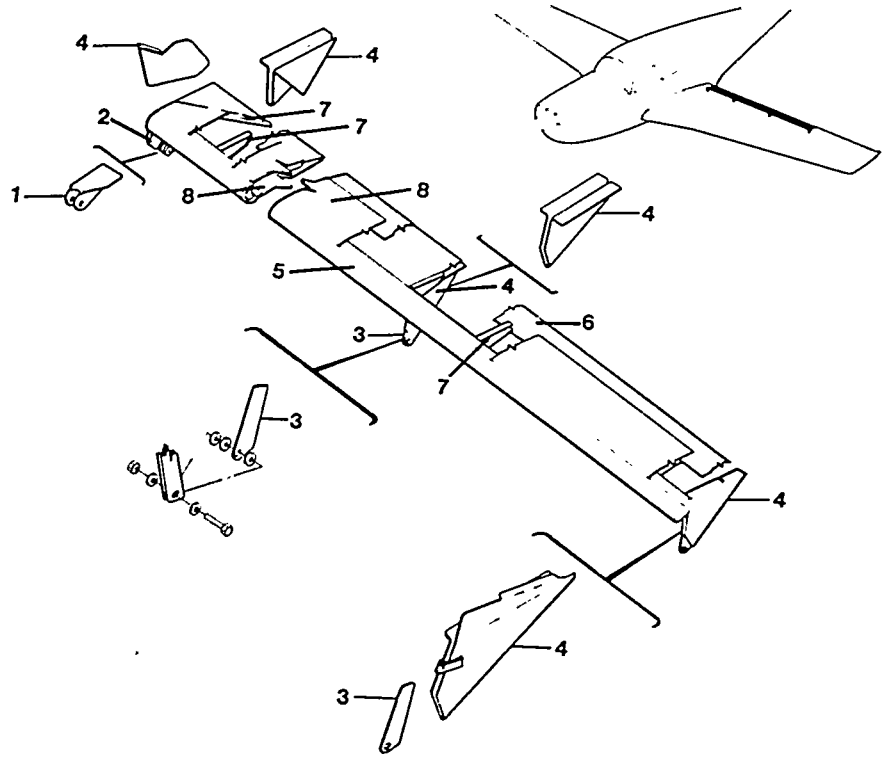



FIGURE 57-6 - FLAP ASSEMBLY

### 57-50-20 - AILERONS

Refer to Section 27-10-00 for maintenance and rigging procedures.

The ailerons are of all metal construction. The main spar (1), (Figure 57-7), is attached to the rear spar (2) through ribs (3). These components are riveted together and a top and bottom skin (4) and (5) riveted to this sub-assembly.

To complete the control surface, hinges (6) and balance weights (7) are installed. The weights (7) are bolted (10) through an outboard rib (8) and bracket (9) on each aileron assembly.

### 57-50-21 - AILERON REMOVAL AND INSTALLATION

Refer to Section 27-10-00 for removal and installation procedures.

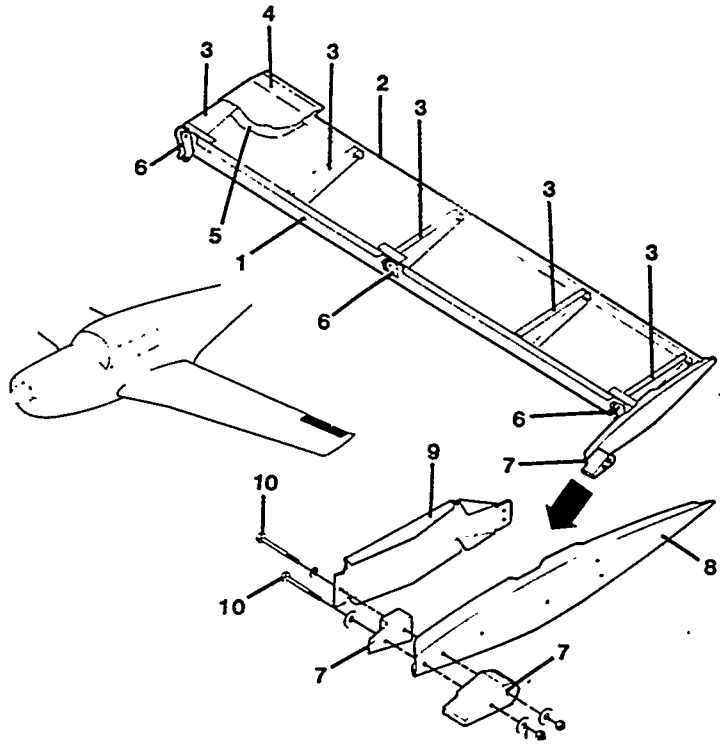



FIG 57-7 AILERON ASSEMBLY

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# 60

# STANDARD PRACTICES (PROP/ROTOR)

# SECTION 60

# STANDARD PRACTICES-PROPELLER

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## 60-00-00 - GENERAL

The standard M20L aircraft has a Hartzell Propeller, controlled by a power control system for proper RPM settings.

Repairs may be made as specified by Hartzell maintenance publications or in accordance with AC 43.13-1A Chapter 12 and in conjunction with the definitions of FAR 43.

**CAUTION**

**Refer to Porsche maintenance publications for engine inspection procedures after a propeller strike.**

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# CHAPTER

# 61

# PROPELLERS/ PROPULSORS

# SECTION 61

# PROPELLERS

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## 61-00-00 - GENERAL

The propeller is a constant speed type which operates by hydraulic pressure opposing the natural centrifugal twisting moment of the rotating blade and the force of a spring to obtain the correct pitch for the engine load. Engine lubricating oil is supplied to the power piston in the propeller hub through the propeller shaft. The amount and pressure of the oil supplied (0-300 PSI) is controlled by an engine driven governor. Increasing engine speed will cause oil to be admitted to the piston, thereby increasing propeller pitch. Conversely decreasing engine speed will result in oil leaving the piston, therefore decreasing propeller pitch.

Propeller overhaul shall coincide with engine overhaul, but interval between overhauls shall not exceed 1500 flight hours,at which time the blades MUST be retired. Refer to propeller manufacturers' overhaul manual for complete maintenance action.

**NOTE**

**Approved propeller shops ONLY are authorized for overhaul or major repairs to these propellers. Refer to Federal Aviation Regulations, Part 43, (FAR 43) and Federal Aviation Agency Advisory Circular No. 43.13-1A (AC 43.13-1A) for the definition of major or minor repairs or alternations and who may accomplish them.**

## 61-00-10 - SPINNER DOME AND PROPELLER REMOVAL

1. Spinner dome removal (if necessary).

**NOTE**

**It is not necessary to remove spinner when removing propeller assembly.**

A. Remove 12 screws and fiber washers from aft spinner bulkhead assembly and screws from each doubler plate . (Reference Figure 61-1).

B. Pull doubler plates from behind propeller.

C. Carefully pull spinner dome forward to clear propeller and hub.

**NOTE**

**Forward spinner bulkhead is attached to spinner dome and need not be removed except for repair of spinner or bulkhead.**

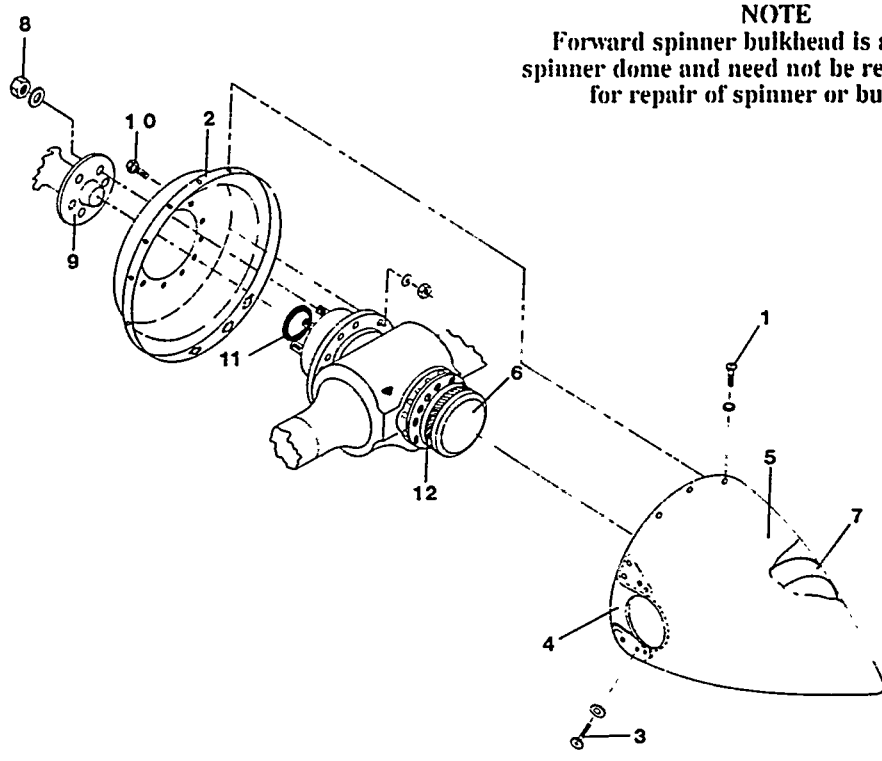



FIGURE 61-1 - SPINNER DOME AND PROPELLER REMOVAL

2. Propeller removal.

A. Loosen nuts (6 ea.) attaching propeller to engine gearbox propeller flange about 1/4 inch and pull propeller forward.

NOTE
**Nuts (6) will have to be backed off evenly so that the propeller may be pulled forward (approximately 1/4 inch at a time until all nuts are disengaged from the propeller studs. As the propeller is separated from the engine crankshaft, oil will drain from the propeller and engine crankshaft cavities.**

B. Pull propeller from engine crankshaft (9). Use clean rags to cover cavity in crankshaft and hub.

C. If necessary to remove the aft spinner bulkhead (2) (Figure 61-1), the spinner dome (5) must be removed, refer to 61-00-10 (1). Remove bolts, washers and nuts (10) which attach bulkhead to propeller hub flange. Remove aft bulkhead from propeller flange.

## 61-00-20 - PROPELLER INSTALLATION

1. If aft spinner bulkhead was removed, reinstall, using bolts, nuts and washers in the reverse order of removal.

2. Clean propeller hub cavity and mating surfaces of propeller hub.

3. Lightly lubricate a new O-Ring (11), (Figure 61-1), and the crankshaft pilot with clean engine oil and install O-Ring in the propeller hub.

CAUTION
**Remove all rags or plugs placed in crankshaft or hub during propeller removal.**

4. Align propeller mounting studs with proper holes in engine crankshaft flange and slide propeller carefully over crankshaft pilot until nuts (8) can be started on propeller studs.

NOTE
**The guide pins in the propeller hub must be aligned with respective holes in the crankshaft flange.**

5. Tighten nuts (8) evenly and work propeller aft on crankshaft flange. Tighten bolts to 60-70 ft. pounds on Hartzell propeller.

6. Install spinner dome making sure fiber washers are installed under all screw heads (1).

NOTE
**Teflon tape may be used if excessive clearance exist between spinner bulkhead ,inside diameter, and propeller hub. The teflon tape on hub (if used) should be checked for smoothness of tape layers and that inner bulkhead fits snug as spinner dome is being installed.**

7. Conduct operational and leak check on propeller installation prior to flight.

## 61-10-00 - PROPELLER ASSEMBLY

No external lubrication is required on the M20L propeller.

Preflight inspection should be accomplished prior to each flight to determine:--if blades have been damaged, if any abnormal looseness is evident between hub and blades or if there is any evidence of oil leakage.

## 61-10-10 - MINOR PROPELLER BLADE REPAIR

1. Minor nicks, dents and gouges may be repaired by approved personnel. Refer to Hartzell Propeller repair manual for any maintenance actions. Repaint area to reduce any deteriation action.

## 61-20-00 - PROPELLER CONTROLLING

## 61-20-10 - PROPELLER GOVERNOR CONTROL RIGGING

1. Reference Engine rigging procedure in Chapter 71.

CAUTION
**Recheck security and thread engagement on all engine controls after adjustment rigging or assembly.**

## 61-20-90 - PROPELLER GOVERNOR TROUBLE SHOOTING

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Leakage:Between control shaft and head. | Damaged O-Ring. | Replace with new O-Ring. |
| Between head and body. | Damaged head and body gasket. | Replace gasket. |
| Between relief valve plug and body. | Damaged relief valve plug gasket. | Replace gasket. |
| Between body and base. | Damaged body and base gasket. | Replace gasket. |
| Between governor base and engine mounting pad. | Damaged governor mounting gasket. | Replace gasket. |
| | Loose governor attaching nuts. | Retighten nuts. |
| | Warped engine mounting pad. | Consult engine manual. |
| Inability to attain takeoff RPM during flight. | Wrong high-RPM governor setting. | Reset governor external high RPM adjustment screw. |
| | Incorrect system rigging. | Adjust control system. |
| | Low engine power. | Consult engine manual. |
| | Erroneous reading tachometer. | Calibrate or replace instrument. |
| **NOTE**<br>**Maximum RPM (2343) may vary +/-1%.** | | |
| | Sticky pilot valve. | Remove head and clean pilot valve with crocus cloth. Maintain sharp pilot valve land corners. Check for straightness of pilot valve; if bent, replace valve. |
| RPM fluctuates. The RPM can fluctuate +/-30 RPM. | Sludge in governor pilot valve or relief valve. | Disassemble and clean. |
| | Burrs on pilot valve lands. | Disassemble and clean with crocus cloth. |

PROPELLER TROUBLE SHOOTING (CONT)

| | | |
|---|---|---|
| | Backlash in governor control system. | Rerig or adjust control system. |
| | Sticky relief valve. | Inspect for burrs, and clean. |
| | Erroneous reading tachometer. | Calibrate or replace instrument. |
| | Excessive oil leakage in propeller shaft transfer bearing. | Refer to engine manual. |
| | High propeller friction. | Refer to propeller overhaul manual. |
| | Governor function upset by malfunctioning engine. | Repair engine for smooth operation. |
| | Air trapped in propeller. | Cycle Power Lever from MIN to MAX several times to purge air. |
| | Sticky pilot valve. | Remove head and pilot valve. Clean away sludge and varnish. Check speeder spring ends for proper settings. |
| | Bent pilot valve. | Remove head and replace pilot valve. |
| | Excesive internal leakage in governor. | Check rigging and make necessary part replacements. |
| Excessive over-speeding: | Wrong governor setting. | Reset governor. Use test rig if available. |
| | Damaged or wrong gasket between governor base and engine mounting pad. | Install correct new gasket. |
| | Sticky governor pilot or relief valve. | Disassemble, clean, and check for burrs.Replace bent pilot valves. |
| | Erroneous reading tachometer. | Calibrate or replace instrument. |

| | | |
|---|---|---|
| Inability to attain positive high RPM: | High-RPM screw adjusted too far IN, causing restricted arm travel. | Remove control arm and rotate one serration clockwise. Back out high-RPM screw to required maximum RPM.(One turn equals 27 RPM.) |
| Surging: | Excessive propeller bladeseat friction. | Examine propeller hub for cause of friction. |

## 61-30-00 - PROPELLER LUBRICATION PROCEDURES

1. At each 100 hour inspection grease hub through zerk fittings on hub. Pump approximately two ounces of grease into each lubricator fitting provided. To avoid hub pressurization, remove one of the fittings provided in each blade position during lubrication process.

---
| NOTE |
---

**Be sure all lubricator fittings are serviced.**

Refer to Section 5, Lubrication/Service Guide, for Grease Specifications approved to service the propeller.

Refer to Hartzell Propeller Owner's Manual, No. 115N, for complete inspection and servicing procedures.

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# CHAPTER

# 71

# POWERPLANT

MOONEY AIRCRAFT CORPORATION
MODEL M20L
SERVICE AND MAINTENANCE MANUAL

CHAPTER 71

POWERPLANT

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## 71-00-00 - GENERAL

The M20L (S/N 26-0001 thru 26-TBA) is equippd with a PFM 3200 NO3 engine. This engine is manufactured by Porsche A. G. of West Germany. The PFM 3200 NO3 engine is a six cylinder, horizontally opposed, normally aspirated, fuel injected, fan air cooled reciprocating aircraft engine with a gear driven propeller.

## 71-00-10 - ENGINE REMOVAL

To assist in installation, identify and tag each part as it is removed. Plug or cap all lines, hoses, and fittings as they are disconnected.

1. Make sure that all cockpit switches are OFF.
2. Turn fuel selector valve OFF.

NOTE
**Fuel Selector MUST be turned to either L or R tank before either fuel pump is turned ON.**

3. Remove engine cowling and baffles (See Section 71-10).
4. Disconnect batteries ground cables.
5. Remove propeller (refer to section 61-00-10).
6. Drain engine sump and oil tank.
7. Disconnect the following:
   A. Cabin heat ducts (at engine).
   B. Fuel supply and return lines (at engine).
   C. Oil supply line (at check valve).
   D. Oil return line (at union).
   E. Oil breather (at engine).
   F. Manifold pressure sense line (at engine).
8. Disconnect the following control linkage:
   A. Power Lever linkage.
   B. Propeller governor control.
9. Disconnect ignition wires from coil to distrubutor (at distributor).
10. Disconnect electrical harnesses from firewall and unclamp from engine mount.
11. Disconnect engine grounding strap.
12. Disconnect alternator and starter wires.
13. Engine may be removed at this time per steps 14 thru 17, however it would be easier to remove the following components.
   A. Exhaust muffler.
   B. Exhaust manifold.
   C. Oil cooler, associated bracket and lines.
   D. Engine baffles.
14. Relieve nose wheel weight if mount is to be removed with engine; shore up fuselage at tail skid using shoring stand to prevent tail from dropping after engine is removed.
15. Attach hoist to thru tube on forward engine mount holding isolator and rear engine mount bracket hoist holes. Slightly lift engine to relieve weight from engine mounts. Remove engine mounting bolts.
18. Slowly lower engine. Be sure that all lines, hoses, and wires are free.

## 71-00-20 - ENGINE INSPECTION & REPAIR

For specific engine inspection and overhaul instructions, consult engine manufacturer's overhaul manual and/or service instructions.

## 71-00-30 - ENGINE INSTALLATION

Reverse the engine removal procedure for installation.

1. Engine installation torque values are as follows:
   A. Spark plugs - 250 inch lbs.
   B. Hose clamps - 15 to 25 inch lbs.
   C. Engine isolator center bolts - 120 to 145 inch lbs.
   D. Upper and lower outboard engine mount bolts - 80 to 100 inch lbs.
   E. Inner lower engine mount - 20 to 25 inch lbs.

NOTE
**Due to characteristics of the elastomer to acquire a set condition, isolators should not be reinstalled once removed.**

2. Ensure that all fuel and oil lines have been purged and are clean prior to installation.
3. Re-inspect to see that:
   A. Propeller and spinner are properly torqued.
   B. Engine mounting bolts are properly torqued.
   C. Engine controls are properly rigged and safetied. (Recheck rod-ends for proper threadgrip length.)
   D. Oil drain plugs are tightened and safetied.
   E. Oil tank is filled with 7.0 quarts of proper oil.

F. Spark plugs are tight and ignition harness is properly installed.

G. Propeller gear box is filled with oil.

H. Oil temperature bulb is tight.

I. Cylinder head temperature connections are secure.

K. Starter cable connection is secure.

L. Alternator wiring is secure.

M. Exhaust system is secure.

N. Fuel connections are tight and pressure checked.

O. Oil lines are tight.

NOTE

**All oil supply lines from the oil tank to the engine inlet port are to be filled with the appropriate oil prior to engine start to prime the system.**

P. Manifold pressure sense line is tight.

Q. Oil pressure lines are tight and pressure checked.

R. Fuel injection lines are tight.

S. Oil filter is installed and secure.

T. Induction manifolds are secure.

U. All lines, hoses, and wires are properly secured.

V. Induction air filter is installed and secure.

W. Baffles are secure.

X. Engine area is free of loose objects, tools, etc.

Y. Cowling is installed and secure (See Section 71-11).

## 71-00-40 - ENGINE GROUND OPERATION CHECKOUT

1. Prime the oil supply lines from the oil tank to the engine inlet port with the appropriate oil.

2. Prestarting procedure (with aircraft headed into wind):

A. Turn Ignition/Starter switch OFF.

B. Battery switches & Master switch OFF.

C. Check engine oil level.

D. Check fuel quantity.

E. Verify fuel selector is in either LEFT or RIGHT TANK position. NOT IN OFF position.

F. Drain fuel sumps and gascolator; check for sediment and water.

F. Operate all controls through full range to check for freedom of movement.

G. Check baffles and cowling for security

H. Place wheel chocks and set parking brake.

I. Disconnect wires at coils from the ignition boxes (both coils).

J. Use the starter to turn engine over 5 to 10 seconds to start oil flowing in the engine.

K. Reconnect wires at both coils.

3. Starting procedure:

A. Fuel selector on LEFT or RIGHT tank.

B. Power Control Lever in IDLE position.

C. Master and Battery Switches ON.

D. Main/Boost Fuel Pump ON (fuel pressure 58 - 80 PSI).

E. Clear propeller area.

F. Start engine. If no oil pressure is indicated within 5 seconds, shutdown engine and trouble shoot oil system. Refer to Porsche maintenance publications for procedures.

G. If oil pressure is OK, continue running engine for approximately 2-3 minutes at low RPM (500 to 1000).

H. Shut engine down and check oil quantity in oil tank. Refill as necessary to obtain 7.0 quarts. The total oil capacity is approximately 13.5 quarts. Check engine exterior for oil or fuel leaks.

4. Ground run and warmup. Always head the aircraft into the wind during warmup.

A. After verification all conditions are OK, restart engine per steps A thru F.

B. Warm engine until temperatures are in the green.

C. Complete an ignition system check. RPM set at 1100 with switch on BOTH. Select RIGHT, minimum 50/maximum 150 RPM drop. Repeat for LEFT. Refer to Section 74 for detail procedures.

NOTE

**If RPM is unstable at low RPM, has a high RPM drop during ignition check and at approximately 1800 RPM exhibits large power fluctuations, check manifold pressure sense line for leaks.**

D. Complete a full power static run up. Check maximum RPM to be approximately 2343 (to be verified in flight).

E. Electrical Power output - CHECK: (1) VDC (L & R)(Min. 26.5 V); (2) Alternator % (L & R) must be equal or greater than % Load.

N. Ensure engine is properly rigged per Section 71-00-50

### 71-00-50 - ENGINE SET UP PROCEDURE

It is recommended that the PFM 3200 NO3 engine installed on Mooney M20L aircraft be set up according to instructions in Porsche's Service Manual and appropriate Service Bulletins.

**NOTE**
**The engine must be THOROUGHLY WARMED up for all tests.**

**CAUTION**
**Watch for rotating propeller during adjustment.**

1. CHECK and/or ADJUST ENGINE CONTROL RIGGING per Chapter 76.

### 71-00-60 - FUEL INJECTION SYSTEM MAINTENANCE

For specific injection system inspection and overhaul instructions, consult engine manufacturer's overhaul manual and service instructions.

### 71-00-70 - STARTER SYSTEM MAINTENANCE

Inspect and service starter per Porsche Service Instructions.

**CAUTION**
**Do not operate starter in excess of 30 seconds; allow cooling time before re-engaging.**

### 71-00-80 - ENGINE MIXTURE CONTROL RIGGING

1. NOT APPLICABLE TO M20L AIRCRAFT. Refer to Chapter 76 for engine controls rigging.

### 71-00-90 - STARTER TROUBLE SHOOTING

See Section 24-39-04 for procedures. Porsche's MAINTENANCE AND OPERATORS MANUAL should be consulted.

### 71-10-00 - COWLING REMOVAL

### 71-10-01 - TOP COWLING

1. Unlatch eight camlocks(right) and nine(left) on cowling sides.
2. Unlatch engine compartment access door on right side of cowling.
3. Unlatch seven camlocks on the aft edge of the top cowling just ahead of windshield.
4. Carefully lift top cowling off.

### 71-10-02 - BOTTOM COWLING

1. Disconnect induction duct to air filter housing on left hand side.
2. Unlatch 17 camlocks on bottom cowling while supporting the cowl.
3. Carefully lower cowling clear of spinner and remove from aircraft.

### 71-11-00 - COWLING INSTALLATION

1. Check condition of tape on firewall flange where cowling will rest. A polyethylene tape, P/N 5421(UHMW) (3M) 1 in. wide is recommended. This will decrease streaking during wet weather operations.

### 71-11-01 - BOTTOM COWLING

1. The bottom cowling is installed "first" in reverse sequence of removal.

### 71-11-02 - TOP COWLING

1. The top cowling is installed, after the bottom cowling is in place, in reverse sequence of removal.
2. Caution should be taken not to damage the cowling, propeller or spinner during installation.

### 71-20-00 - ENGINE MOUNTS

The M20L engine mount is a welded, suspension, mount assembly of chrome-moly, 4130 steel.
The engine is installed to hang within the mount so the center of gravity is located between the isolators. The forward isolator is designed to take the thrust loads while the rear isolators take the torque loads.

### 71-30-00 - FIRESEALS

Firewall firesеals and grommets, if removed and replaced for any reason, should be sealed after routing the cable or wire assembly from the engine compartment into the cockpit area. After installation cover cable or wire and grommet underneath the fireseal with Coast Pro-Seal 700 on engine side of firewall.

### 71-60-00 - AIR INTAKES

The engine cooling air intakes and exits are calculated for optimum operating requirements

and minimum drag. Normal engine operating temperatures are at the optimum to facilitate engine efficiency.

The engine induction air intake is a fiberglass/carbon NACA duct that picks up impact air at the left hand air intake and routes it through the air filter to the engine induction system.

The air intake system includes an alternate air intake system that is automatically operated.

## 71-61-00 - AIR INTAKE DUCT TUBE REPLACEMENT

Inspect the air intake duct tube or clamps for damage. When the tube must be replaced it is essential that it be positioned exactly as the original installation to prevent any interference with the cowling or the engine.

## 71-62-00 - ALTERNATE AIR DOOR RIGGING

Refer to Porsche Service Manual for rigging procedures.

# CHAPTER

# 72

# ENGINES

# SECTION 72

# ENGINE

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## 72-00-00 - GENERAL

Refer to Porsche Engine Operators Manual and Overhaul and Maintenance Manual for detailed information.
Technical assistance and Technical Publications may be obtained from Porsche Aviation Products, Inc., Municipal Airport, RR #2, Box 118A, Galesburg, IL., 61401.

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# CHAPTER

# 73

# ENGINE FUEL AND CONTROL

SECTION 73

ENGINE FUEL SYSTEMS

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### 73-00-00 - GENERAL

The engine and its accessories are certificated under Porsche Type Certificate. Refer to Porsche Operators or Overhaul Manual for specific instructions.

### 73-30-00 - INDICATING

The aircraft has a combinaton analog/digital readout style fuel flow indicator. The digital indication is called up as desired by the pilot by pushing the button located adjacent to each analog instrument. The digital readout will appear above all the analog instruments. When any of the analog instruments read below a pre-set value the digital gauge will show this number and flash to indicate that special attention should be taken to correct the situation.

### 73-31-00 - FUEL FLOW SYSTEM - GENERAL SYSTEM DESCRIPTION

The fuel flow indicator receives its signal from a potentiometer located at the K-Jetronic metering unit. This potentiometer is operated by the movement of the baffle plate and reads the position of the metering pin. The position of this pin relates directly to the amount of fuel flowing to the engine. As the fuel flow increases the potentiometer acts as a voltage divider network increasing the voltage ratio. Wiring from the potentiometer runs directly to the indicating gauge.

### 73-31-01 - PANEL MOUNTED INSTRUMENT

The panel mounted instrument contains all system electronics and may be divided into groups. Fuel flow, fuel pressure and fuel quantity are located in this group.

### 73-31-03 - GENERAL OPERATING PROCEDURES

No special procedures are necessary.

### 73-31-04 - TEST FUNCTION

The gauges may be tested by pushing the instrument test display button-gauges should indicate full scale.

### 73-31-05 - TROUBLESHOOTING FUEL MANAGEMENT SYSTEM

Check wiring. Refer to the Engine Maintenance Manual for repair of the potentiometer.

If after making these checks you still do not isolate the problem or do not find a problem, contact the Customer Service Department of Mooney Aircraft Company for further assistance.

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# CHAPTER

# 74

# IGNITION

SECTION 74

IGNITION

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## 74-00-00 - GENERAL

The engine has two independently operating ignition systems. Each system fires one of the two spark plugs in each cylinder. The ignition system is comprised of an ignition box located under the rear seat, a coil located in the engine compartment on the footwells, a distributor located on the engine and spark plugs in the cylinders. The ignition control boxs receive three signals, top dead center, engine speed and intake manifold pressure. These inputs are analized to give precise ignition timing, in all flight conditions.

## 74-10-00 - ELECTRICAL POWER

Electrical power for each ignition system is supplied by an independent 24 volt/70 ampre altenator coupled with a 22 ampre hour battery. Each systems electrical source is independent and redundant.

## 74-10-01 - IGNITION SYSTEM TROUBLE SHOOTING

| TROUBLE | SYMPTOM | REMEDY |
|---|---|---|
| Erratic RPM | Check Electrical connectors. Check ignition box sensors. | Remove and replace as required. |
| Engine runs rough at low RPM.<br>RPM surges at approx. 1800 RPM.<br>Runs fairly smooth at high RPM | Check manifold pressure line to ignition boxes for leaks. | Remove and replace as required. |
| Ignition system inoperative. | Check electrical system wiring.<br>Check ignition components. | Remove and replace as required. |

## 74-20-00 - ENGINE FIRING ORDER

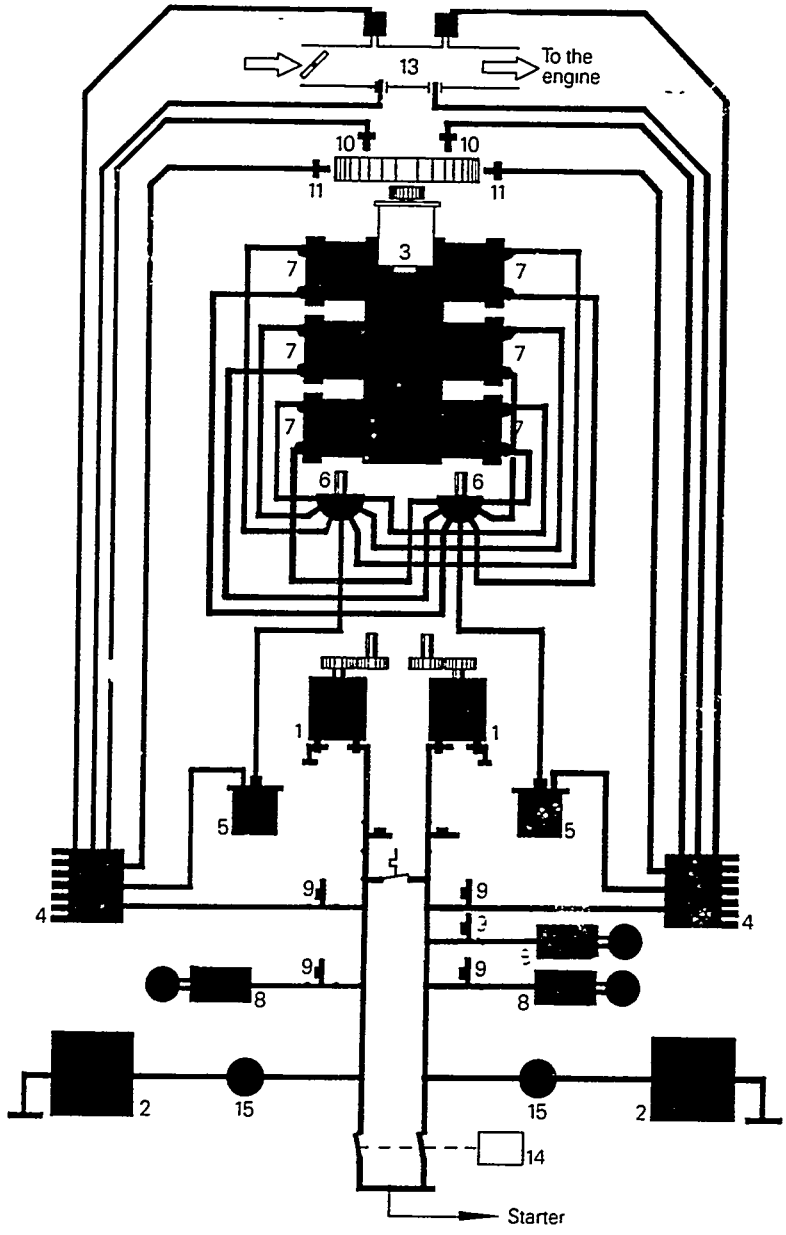
The engine firing order is 1-6-2-4-3-5.

**NOTE**

**It is recommended all spark plugs be removed, inspected, cleaned, reagapped and reinstalled in the same cylinder but in a different spark plug hole every 100 hrs. Replace the spark plugs after 300 Hrs. of operation.**

## 74-30-00 - SWITCHING

Ignition switching can be found on the left hand lower instrument panel. This switch incorporates a LEFT ignition position, a RIGHT ignition position, a BOTH ignition position and a PUSH TO START position. Normal operation is in the BOTH position. A drop of 50 - 150-RPM should be noted when the ignition switch is selected from the BOTH position to either LEFT or RIGHT. This check should be accomplished at 1100 RPM.




1 Alternator
2 Battery
3 Starter
4 Ignition Box
5 Coil
6 Distributor
7 Spark Plug
8 Electric Fuel Pump
9 Circuit Breaker
10 TDC Sensor
11 RPM Sensor
12 NOT USED
13 Manifold Pressure Sensor
14 Starter Relay
15 Amp-Meter

FIGURE 74-1 - IGNITION SYSTEM - PFM 3200 NO3

# CHAPTER

# 76

# ENGINE CONTROLS

# SECTION 76

# ENGINE CONTROLS

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## 76-00-00 - GENERAL

The power control system of this engine is unique from the systems which are presently-utilized in the general aviation aircraft of today. Present aircraft of this category utilize three individual levers for operation: (1) throttle (Manifold Pressure), (2) engine or propeller governor (RPM) and (3) fuel metering unit (Mixture). The PFM 3200 NO3 engine requires only one control lever (power lever) to operate these respective components. There are specific rigging requirements to make all of these work together properly and these will be covered later in this Section.

## 76-10-00 - POWER LEVER

The single lever control operates in the following manner:

When the power lever is located in the aft or idle position the throttle plate is almost closed and the propeller governor arm is located to govern at approximately 600 RPM. As the power control is moved forward the throttle plate is opened and the governor arm begins to move at approximately 1100 RPM. At approximately 1800 RPM the throttle plate is full open. Further forward movements of the power control only increases the RPM by moving the governor's arm until it reaches the high RPM stop, which is set to 2343 +/-23 RPM. At this point the power control is fully forward and the engine is developing its rated 217 BHP.

An additional feature of this power control is that as is moved past the 2300 RPM position, a micro-switch is activated to activate a solenoid in the K-Jetronic fuel control system. This solenoid engages a fuel regulator to change the fuel metering to Best Power.

The throttle and propeller governor cables are connected to one Power Lever in the cockpit.

## 76-10-01 - PROPELLER SPEED CONTROL SYSTEM

The RPM control operates in a conventional manner. A propeller governor, hydraulically operated, controls the RPM of the engine. This is done by controlling the oil pressure in the propeller hub which adjusts the propeller blade angles that in turn controls the RPM.

The propeller governing system operates in the following manner:

When the power control is in the aft position the governor is set to operate at approximately 600 RPM. Due to low oil pressure the governor is unable to govern and the blade angles are in low pitch. As the power control is moved forward the RPM rises, increasing the oil pressure. As oil pressure becomes available the blades are moved to a high pitch setting (low RPM). Further forward movements of the power control lever increases the governing RPM, decreasing the blade angles until a low pitch angle (high RPM) is reached for takeoff power.

## 76-10-02 - FUEL METERING SYSTEM

The fuel metering system is unique from that which is found in the present general aviation engine industry. A K-Jetronic fuel metering system is utilized. This system automatically regulates the correct amount of fuel required by the engine. See Section 73, Fuel System, for a description of the K-Jetronic fuel injection system.

All metering to the engine is controlled by a standard throttle metering plate. This plate is linked by an arm to a cable which is then routed to the cockpit and the single lever control. The fuel metering system is completely automated in the engine except for two switches which perform the same function of changing the fuel metering from best economy to best power.

As a result of the inter-action of these components only one engine control lever is required.

## 76-11-00 - ENGINE POWER CONTROL RIGGING PROCEDURES

This procedure is to be used to rig the engine controls and adjust the fuel metering for the M20L aircraft, S/N 26-0001 thru 26-TBA, using the Porsche PFM 3200 NO3 engine. The fuel adjustment need only be done once (at the Mooney factory) provided there are no component changes to the K-Jetronic automatic fuel metering unit on the engine.

## 76-11-01 - EQUIPMENT REQUIRED

| ITEM | QTY | PARTNUMBER | DESCRIPTION |
|---|---|---|---|
| 1. | 2 | 3/8in. | Wrench |
| 2. | 1 | 4516 | Adjustment Tool * |
| 3. | 1 | Common | Screwdriver |
| 4. | 1 | CrossHead | Screwdriver |
| 5. | 1 | SGA9000 | Exhaust Gas Analyzer ** |
| 6. | 1 | Vu-Thru | Tachometer *** |

* The 4516 adjustment tool is manufactured by Hazet of West Germany and may be purchased through MAC Tools. A 3mm allen wrench may be substituted.

** The SGA 9000 Exhaust Gas Analyzer may be purchased from SUN ELECTRIC CORPORATION, Crystal Lake, Il.

*** The DAS tachometer installed in the M20L (if calibrated) may be used for adjustments specified in the procedure in lieu of the Vu-Thru tachometer.

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## 76-11-02 - ENGINE POWER LEVER RIGGING PROCEDURE - PFM 3200 NO3

1. Ensure that all cable assemblies are installed in their nominal positions and are disconnected from the throttle and governor arms.

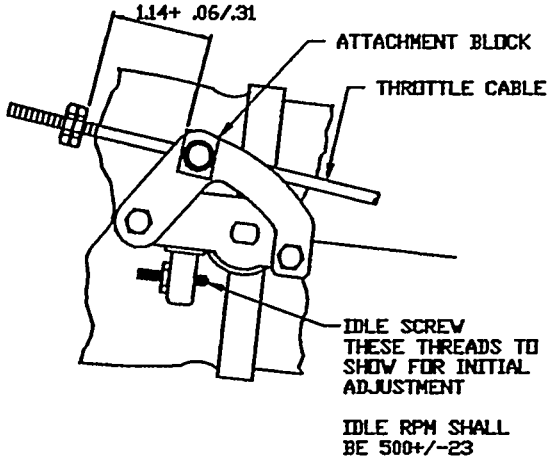



FIGURE 76-1 THROTTLE LINKAGE/FULL POWER POSITION

2. Push the power control lever full forward. Re-position the power control lever .125 (+.06/-.03) aft of the full forward position.

3. Attach the governor cable assembly so that the arm contacts the low pitch (high RPM) stop. (Ref. Fig 76-3).

NOTE

**Additional adjustment other than that found in the cable assembly and rod end bearing may be found by loosening the six screws around the aft outer bezel and rotating the center housing until the high RPM stop contacts the governor arm. Re-tighten screws and safety.**

4. Install the throttle cable assembly so that the distance between the attachment block and check nut is 1.14(+.06/-.31). Shim, as required, between the cable assembly mounting bracket and the mounting boss to maintain this dimension.

5. Adjust idle screw so that three (3) threads show on the throttle lever side of the screw (Ref. Figure 76-1). This is for initial setup and will vary depending on the position required for 500 RPM.

6. Re-position the power control .06(+/-.03) aft of the full power position and adjust the enrich micro switch striker plate so that the micro switch is just activating.

7. Place the power control in the full aft position (idle). Ensure that the throttle plate is fully against the idle stop. Note that the governor arm is not full against the high pitch (low RPM) stop. This is considered normal.

8. Re-position the power control .31(+/-.06) forward of the full aft (idle) position. Adjust the gear warning micro switch striker plate so that the micro switch is just activating.

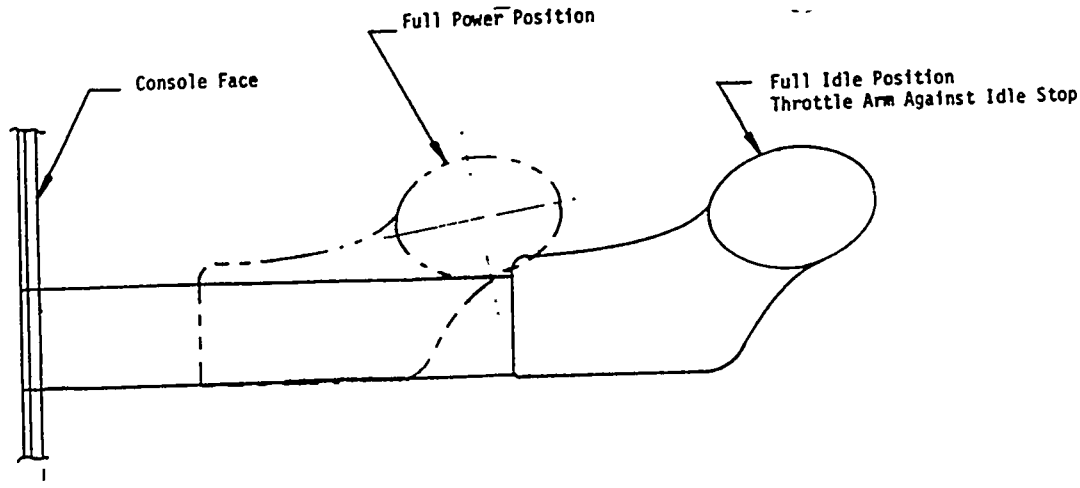



FIGURE 76-2 POWER CONTROL ASSEMBLY

9. Operate the engine and allow engine temperatures to stabilize within the GREEN (normal) operating ranges.

10. Check idle RPM and adjust as required to obtain 500 +/-23 RPM as indicated on the ship's RPM gauge.

11. Increase power to full throttle and verify that the RPM is 2343 +23/-(see note below). Adjust as necessary.

NOTE
**It is possible that due to the engine characteristics the in flight RPM will be higher than the static RPM. As a result the static RPM may be adjusted lower to ensure an in flight maximum RPM of 2343 +/-23.**

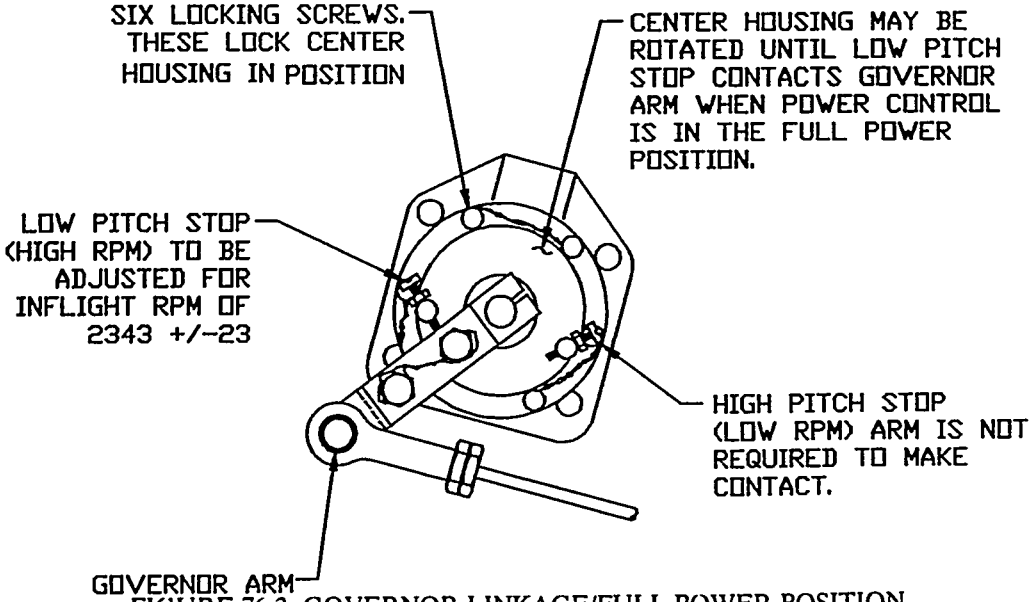



FIGURE 76-3 GOVERNOR LINKAGE/FULL POWER POSITION

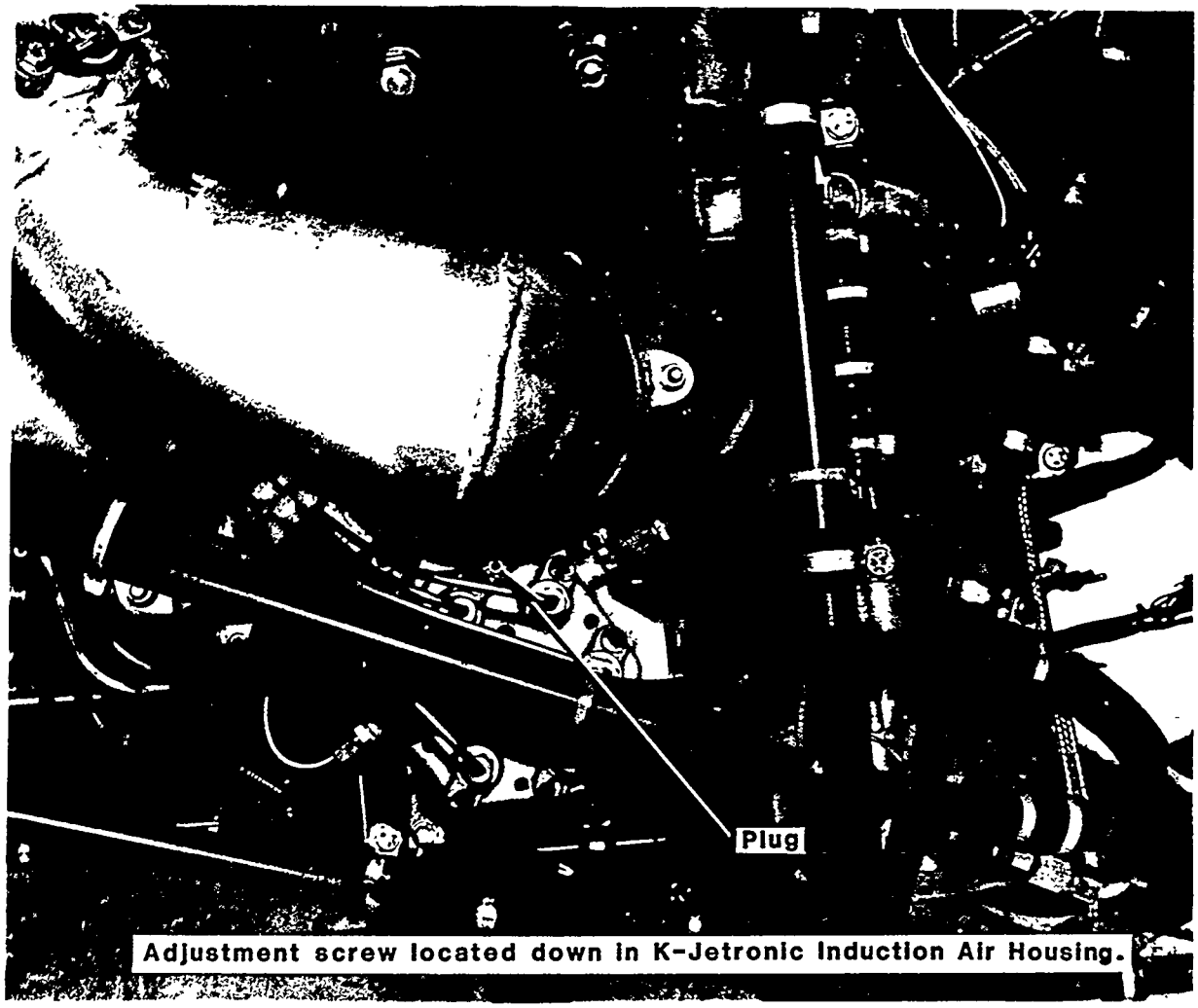



FIGURE 76-4 K-JETRONIC FUEL METERING UNIT/ADJUSTMENT SCREW

13. Check that the enrichment is activated by the power control above 2300 RPM. Adjust as required.

### 76-11-03 - FUEL METERING ADJUSTMENT

1. Operate the SGA 9000 Exhaust Gas Analyzer in accord with the Operator's Manual. Literature Kit No. 119-235.

2. With the engine OFF, place the exhaust sampling probe approximately 12 inches into the tail pipe and secure.

3. Remove the plug screw on the K-Jetronic fuel distributing unit (Ref. Figure 76-4).

4. Start the engine and warm engine until the oil temperature has reached 80$^{O}$C.

5. Once temperatures have been reached (80$^{O}$ C) adjust engine idle to 500 +23/-10 RPM.

6. Using the 4516 adjustment tool adjust the fuel metering screw until the CO reading on the SGA 9000 reads between 1.0 and 2.0. The other three gas parameters are not required for engine set-up.

7. Stop engine, remove the exhaust gas probe and reinstall the plug screw.

NOTE

**The SGA 9000 Exhaust Gas Analyzer should be calibrated as specified by the Manufacturer prior to any engine set-up or adjustment.**

8. Check engine controls, bolts, etc. for security, safety wired, torqued, etc. prior to replacing cowling.

# CHAPTER

# 77

# ENGINE INDICATING

SECTION 77

ENGINE INDICATING

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## 77-00-00 - GENERAL

Engine indicating instruments and their sending units, transducers, probes, etc., must be operating properly to prevent engine damage.

It is recommended that all engine indicating components be checked at each 100 hour or annual inspection to verify proper operation. Calibrated instruments may be Tee'd into the particular systems for a comparison check between them and the aircraft's instruments.

## 77-00-01 - RANGES

Power plant instruments operate electrically through variations in resistance caused by pressure or temperature changes, by variations in current output caused by varying engine RPM or alternator output, or by pressure from engine induction system.

1. **Fuel Flow**
   - A. Green arc--2 to 20 GPH
   - B. Yellow arc--N/A
   - C. Red line--N/A
2. **Fuel Pressure**
   - A. RED LINE Minimum --58 PSI
   - B. Green arc--58 to 80 PSI
   - C. Yellow arc--N/A
   - D. Red line--80 PSI
3. **Oil temperature**
   - A. Green arc--40 to 120 deg. C
   - B. Yellow arc--0 to 40 deg. C.

C. Red line--120 degrees C.

4. **Oil Pressure**
   - A. Minimum Limit--4.4 PSI (IDLE)
   - B. Green arc--29 to 116 PSI
   - C. Yellow arc--4.4 to 29 PSI
   - D. Red line--116 PSI
5. **Tachometer.**
   - A. Green arc--485 to 2343 RPM.
   - B. Yellow arc--N/A
   - C. Red line--2343 RPM
6. **Cylinder head temperature (CHT)**

S/N 26-0002 thru 26-TBA

- A. Green arc--110 to 275 degrees C
- B. Yellow arc--0 to 110 degrees C
- C. Red line--275 degrees C

## 77-10-00 - POWER INDICATING

## 77-10-01 - TACHOMETER

The electric tachometer counts pulses from the RPM sensor to indicate propeller speed in revolutions per minute (RPM). The tachometer is connected to the "D" & "E" terminals on both electronic ignition control units and senses the impulses through these wire connections.

The tachometer indicating system is a fully solid state electronic system that senses propeller RPM. Power requirement is 28 VDC with a typical current drain requirement of 100 milliamps.

TACHOMETER TROUBLE SHOOTING.

| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| No permanent or intermittent indicator reading. | C/B out (IGNITION) | Reset C/B. |
| | Broken wire | Check & repair wiring. |
| | Faulty instrument. | Replace instrument. |

### 77-10-02 - MANIFOLD PRESSURE

This aircraft does not require a Manifold Pressure Indicating system. The Porsche engine fuel control system monitors and controls the fuel flow, power setting and propeller RPM.

### 77-10-03 - FUEL FLOW INDICATING SYSTEM

Refer to Section 73-30-00 for this data.

### 77-20-00 - TEMPERATURE INDICATING

### 77-20-02 - CYLINDER HEAD TEMPERATURE

The cylinder head temperature (CHT) instrument provides the operator with an indication of how hot or cool the cylinders are operating during flight. Resistance type temperature probes are installed in all 6 cylinders. This system provides monitoring of each cylinder's temperature.

# CHAPTER



# OIL

# SECTION 79

# OIL

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## 79-00-00 - GENERAL

The PFM 3200 NO3 engine is a dry sump type engine with an external 7.0 quart (U.S.)capacity oil tank mounted on the engine. Hot oil is picked up in the engine's sump and pumped through an oil-to-air heat exchanger mounted below the propeller gear box. The oil temperature is regulated by a vernatherm mounted in the oil cooler. From the oil cooler the oil flows into the oil tank. Cool oil is sucked from the tank, passes through a flow check valve and into the high pressure pump for distribution inside the engine. The flow-check valve retains oil in the tank after the engine has stopped for the purpose of providing a means to check oil quantity.

Servicing of the oil quantity is provided through an access door located on top,right hand side of engine cowling.

Check engine oil either before first engine start when engine is cold or with a completely warm engine (oil temperature above $40^{0}$C. with engine shutdown).

The aircraft is delivered with the proper SAE multi-range oil meeting American Petroleum Institute (API) specifications of SF/CC or SF/CD and approved by Porsche. The routine oil change interval is 100 hours. however if operating in a dusty environment the interval should be more often.

**NOTE**
**Refer to Section 5-20-07 or to Porsche's Operator's Manual for approved oil products.**

## 79-00-01 - OIL FILTER REMOVAL

The engine oil filter, should be replaced each 100 hours at every oil change.

1. Remove top and bottom cowling (see Section 71-10-00).
2. Cut and remove safety wire on filter.
3. Loosen the spin off oil filter and remove.

## 79-00-02 - OIL FILTER INSTALLATION

1. Position new filter on adapter.
2. Tighten per instructions on filter.
3. Safety wire filter.
4. Perform leak check prior to flight.
5. Avoid oil spillage on electrical components; clean up if spilled on alternators.
6. Reinstall lower and upper cowling (see Section 71-11-00).
7. Connect and secure all electrical and mechanical connections.

## 79-20-00 - DISTRIBUTION

Reference Porsche Operators Manual for internal engine oil distribution.

## 79-30-00 - INDICATING

## 79-30-01 - OIL PRESSURE

Oil pressure indicating is provided through a strain gauge transducer plumbed into the engine oil system. see (Figure 79-1). Pressure variations change the voltage output of the transducer and this signal drives the oil pressure gauge located on the right of the flight panel.

## 79-30-02 - OIL TEMPERATURE

The oil temperature gauge is an electric unit receiving its signal from a temperature bulb in the engine case. located on the aft R/H side of the case just to the right and below the fan housing.. The probe resistance changes as the oil temperature changes and this varies the readout on the instrument.

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# CHAPTER 80

# STARTING

# SECTION 80

# STARTING

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## 80-00-00 - GENERAL

The airplane is equipped with a 24 volt starter supplied with the engine package. The starter is located on the right hand side of the propeller gear box case at the front of the engine.
When the ignition switch is placed in the "start" position, current is supplied through the main bus to energize the starter solenoid which in turn connects the battery to the starter.

## 80-00-01 - STARTER TROUBLESHOOTING

1. Refer to Section 24-39-04 and Porsche Maintenance Manual.

## 80-00-02 - STARTER MAINTENANCE

1. Inspect and service starter per Porsche Service Instructions or Overhaul Manual.

2. Lubrication - No lubrication is required on the starter motor except at overhaul.

**CAUTION**
**Do not clean the starter in any degreasing tank or grease dissolving solvents. Avoid excessive lubrication. Use only kerosene or Varsol.**

## 80-00-03 - STARTER REMOVAL

1. Remove upper cowling (and lower if desired),(See Section 71-10).

2. Disconnect electrical wiring from starter terminals.

3. Remove nut and washer from studs on mounting pad.

4. Remove starter from adapter.

## 80-00-04 - STARTER INSTALLATION

1. Before installation, clean any rust corrosion or dirt from the mounting surface of the starter motor.

2. Check all ground straps connections for tightness.

3. Position starter on mounting pad.

4. Install attaching nuts and washers.

5. Torque nuts according to torque chart in Chapter 5-20-01.

6. Connect electrical wiring to starter terminals.

8. Check starter mounting flange for oil leakage before cowling is installed.

9. Install cowling.

## 80-00-05 - STARTER BRUSHES

Inspect and replace starter brushes per Porsche Maintenance Manual and Service Information.

## 80-10-00 - CRANKING

The starter solenoids are located on the cabin side of the firewall. Both solenoids are energized by placing the ignition switch in the start position. Battery current is then directed to the starter. The aircraft is equipped with a "START POWER ON" annunciator light. This light illuminates when the starter switch is in start position or when the starter switch or starter solenoids have malfunctioned and the starter is engaged while the engine is running. This malfunction should be corrected before the engine is started again.

---
| NOTE |
---

**Limit starter operation to 15 second intervals with a 3 minute cool down between attempts.**

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# CHAPTER

# 91

# CHARTS

# SECTION 91

# ELECTRICAL WIRING DIAGRAMS

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## 91-00-00 - GENERAL

The electrical system hardware lists and related schematics are sequenced in this section by serial number effectivity. The chapter is divided into the following sections:

-Electrical Systems Schematic Notes
-Wiring Identification System
-Electrical System Hardware Charts
-Electrical Schematics

## 91-00-01 - ELECTRICAL SYSTEMS SCHEMATICS NOTES

1. All electrical wiring, assemblies, and installtions must be in accord with FAR 43 and AC 43.13-1.

2. All splices must be "AMP" disconnect or equivalent.

3. All circuit breakers are trip-free.

4. All terminals are to Specification MS25036 (or equivalent) or they must be soldered.

5. All terminals must be pre-insulated or must be insulated with "Ampsulation" (or equivalent).

6. Wires without dash numbers are furnished by the manufacturer and are included with the equipment.

7. The symbol "->->" indicates a knife disconnect.

8. Optional equipment may be installed as required.

9. Wires denoted by = = = = = = = = = symbols to be twisted counter clockwise with a minimum of three (3) wraps per foot.

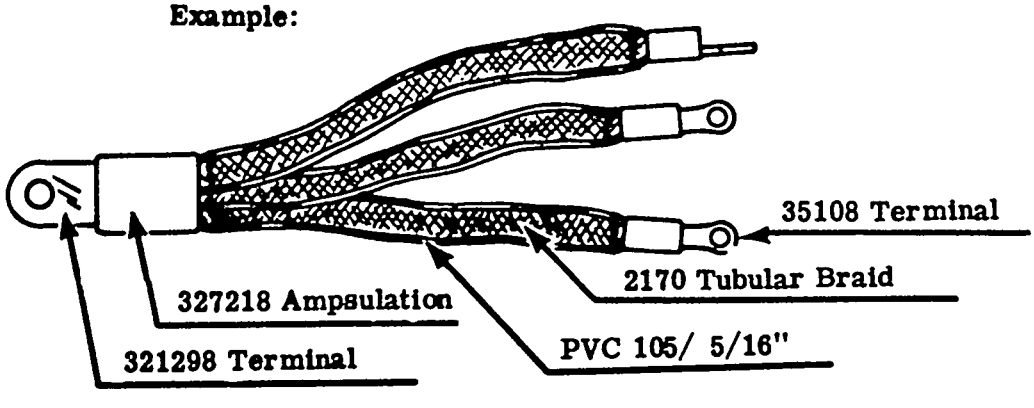
10. "F" denotes ground through frame (no wires).

11. All knife disconnect splices to be insulated with PVC105 and securely string tied with airtex no. 417 cord.

12. All wire sizes are minimum sizes acceptable.

13. Use 913127 bus bars as necessary for various configuration changes and manufacture interconnecting bus using no. 2170 tubular braid covered with PVC105/5/16" (both Alpha Wire Co.) and terminated with AMP terminals of appropriate sizes.

**Example:**




- EXAMPLE -

## 91-00-02 - WIRING IDENTIFICATION SYSTEM

Under the Mooney wiring system, a typical Wire Identification Number is JKLPA03A18. This 10-character number is composed of five functional groups, each of which communicates certain specific information. These functional groups are as follows:

JKL or -KL or J-L or --L , first three letters - Aircraft Type
JKL - indicates the wire or component is common to the M20J, M20K and M20L aircraft.
-KL - indicates the wire or component is common to the M20K and M20L aircraft.
J-L - indicates the wire or component is common to the M20J and M20L aircraft.
--L - indicates the wire or component is used on the M20L aircraft only

PA - second set of letters - Circuit Function

03 - first set of numerals - Wire Sequence

A- single letter in the series - Configuration

18 - last two numerals in the series - Wire Size

- LEGEND -

CB Defroster Blower
CC Cowl Flaps
CD PC Dump
CF Wing Flaps - Electric
CT Trim
CV Stand-by Vacuum

DA Instruments - Ammeter
DB Instruments - Turn Coordinator
DC Instruments - Cylinder Head Temperature
DD Instruments - Outside Air Temperature
DE Instruments - Carburetor Air Temperature
DF Instruments - Fuel Quantity
DG Instruments - Cluster Gauge
DH Instruments - Oil Temperature
DJ Instruments - Oil Pressure
DK Instruments - Fuel Pressure
DL Instruments - Tachometer
DM Instruments - Hour Meter
DN Instruments - Pressurization
DP Instruments - Pitot Heat
DR Instruments - Turbine Inlet Temperature
DS Instruments - Compressor Discharge Temperature
DT Instruments - Exhaust Gas Temperature
DU Instruments - Manifold Pressure
DV Fuel Flow

EG Electric Gear - Gear Controls
EL Lighting - Electroluminescence
ELT Emergency Locator Transmitter

FON Phones

JM Ignition - Magneto
JV Ignition - Vibrator

LB Lighting - Rotating Beacon (Anticollision Light)
LC Lighting - Cabin Lights
LL Lighting - Landing Lights
LN Lighting - Navigation Lights
LP Lighting - Instrument & Placard Lights
LS Lighting - Instrument & Strobe Lights
LT Lighting - Taxi Lights

MA Miscellaneous - Auxiliary Power Plug
MB Miscellaneous - Radio Circuits
MC Miscellaneous - Cigar Lighter
MD Miscellaneous - Clock Light
ME Miscellaneous - Electric Clock
MIC Miscellaneous - Microphone
MM Miscellaneous - Marker Beacon
MP Miscellaneous - Propeller De-Ice
MS Miscellaneous - Radio Speaker
MW Miscellaneous - Radio Warning

NF Fuel - Fuel Pump
NP Fuel - Primer

PA Power - Alternator (output & Control)
PB Power - Battery (Output & Control)
PG Power - Generator (Output & Control)
PS Power - Starter (Input & Control)

SPK Speaker

VB Vent Air Blower

WA Warning System - Alternator - Voltage Warning
WB Warning - Engine Boost
WE Warning System - Gear Position Warning (Electric)
WF Warning System - Fuel Pressure
WL Warning System - Landing Light
WM Warning System - Gear Position Warning (Manual)
WN Warning System - Pressurization
WS Warning System - Stall Warning
WT Warning System - Press-to-Test
WV Warning System - Vacuum Warning
WW Warning System - Alternate Air
WD Warning System - Starter Power

## 91-00-03 - ABBREVIATIONS - EQUIPMENT LIST

The abbreviations to the electrical system hardware charts are necessary due to space limitations in the fields of the computer.

Airspeed - A/S
Alternate - Altn
Circuit Breaker - Ckt. Bkr. or C/B
Console - Cnsl
Control - Cntrl
Coordinator - Coordtr
Cylinder - Cyl
Down - Dn
Electric - Elec
Flight - Flt
Glareshield - Glrshld
Landing - Ldg
Left - L
Lights - Lts
Panel - Pnl
Pilot - Plt
Placard - Plcd
Radio - Rad
Receptacle - Recpt
Regulator - Regltr
Remote - Rem
Resistor - Res
Rheostat - Rheo
Right - R
Safety - Sfty
Selector - Sel
Supply - Sply
Switch - Sw
Transducer - XDCR
Transmitter - XMTR
Transistor - XSTR
Warning - Wrn

## 91-20-00 - ELECTRICAL SYSTEM HARDWARE CHARTS - GENERAL

Refer to the Electrical Schematic (located in the envelopes at the back of this manual) that depicts the Serial Number configuration of the aircraft being serviced. The S/N vs. schematic is shown below:

| A/C SERIAL NUMBER | DRAWING / SCHEMATIC NUMBER |
|---|---|
| 26-0001 thru 26-TBA | 800350 / L1 (4 SHEETS) |

The correct Vendor and Part Number will be depicted where the applicable electrical equipment identifier is shown on the following hardware chart.

91-20-01 **ELECTRICAL SYSTEM HARDWARE CHART**

**SERIAL NUMBER 26-0001 thru 26- TBA, MOONEY DRAWING NO. 800350**

| CODE | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|
| JKL -CB101A | C/B DEFROSTER BLOWER | KLIXON | 7277-2-2 |
| JKL -CB102A | SWITCH, DEFROST BLOWER | CHERRY | E51-508 |
| JKL -CB103A | MOTOR, DEFROSTER BLOWER | MOONEY | 640317-501 |
| JKL -CB104A | RECPT, DEFROSTER BLOWER | AMP | 1-408319-0 |
| --- ------- | PINS | AMP | 60620-1 |
| JKL -CB105A | PLUG, DEFROSTER BLOWER | AMP | 1-480318-0 |
| --- ------- | PINS | AMP | 60619-1 |
| JKL -CF101A | C/B FLAP ACT | KLIXON | 7277-2-5 |
| JKL -CF102A | SWITCH, FLAP | CUTLER-HAMMER | 8906K3149 |
| JKL -CF103A | SWITCH, UP LIMIT | MICRO | V3-1 |
| --- ------- | ACTUATOR | MICRO | JV-5 |
| JKL -CF104A | SWITCH, DOWN LIMIT | MICRO | V-3 |
| --- ------- | ACTUATOR | MICRO | JV-5 |
| JKL -CF105A | ACTUATOR, FLAP | MOONEY | 750105-501 |
| --L -CF150A | C/B TRIM/FLAP IND | KLIXON | 7277-2-1 |
| --L -CF151A | INDICATOR,TRIM/FLAP | PENN AIRBORNE | 9A1590 |
| --L -CF152A | PLUG, TRIM/FLAP IND | ITT CANNON | DA15S |
| --- ------- | CLAMP | ITT CANNON | DA51210-1 |
| --- ------- | LOCK RETAINER | ITT CANNON | DA51220-1 |
| --L -CF153A | PLUG,FLAP POSITION, 4 PIN | AMP | 206060-1 |
| --- ------- | CLAMP | AMP | 206062-1 |
| --L -CF154A | RECPT,FLAP POSITION, 4 PIN | AMP | 206153-1 |
| --- ------- | CLAMP | AMP | 206062-1 |
| --L -CF155A | POTENTIOMETER, FLAP POSITION | ALLEN-BRADLEY | WA2-G056S502AU |
| JKL -CT101A | C/B ELECTRIC TRIM | KLIXON | 7277-2-3* |
| JKL -CT101A | C/B ELECTRIC TRIM | KLIXON | 7277-2-5* |
| --- ------- | | * VARIES WITH A/P SYSTEMS | |
| --L -CT150A | POTENIOMETER, TRIM POSITION | ALLEN-BRADLEY | WA2-G056S502AU |
| --L -CT151A | PLUG, TRIM POSITION, 4 PIN | AMP | 206060-1 |
| --- ------- | CLAMP | AMP | 206062-1 |
| --L -CT152A | RECPT,TRIM POSITION, 4 PIN | AMP | 206153-1 |
| --- ------- | CLAMP | AMP | 206062-1 |
| --L -DA150A | C/B VOLT/AMP IND, LT | KLIXON | 7277-2-1 |
| --L -DA151A | C/B VOLT/AMP IND, RT | KLIXON | 7277-2-1 |
| --L -DA152A | INDICATOR, VOLT/AMP, RT | PENN AIRBORNE | 9A1570 |
| --L -DA153A | PLUG, VOLT/AMP IND | ITT CANNON | DA15S |
| --- ------- | CLAMP | ITT CANNON | DA51210 |
| --- ------- | LOCK RETAINER | ITT CANNON | DA51220-1 |
| --L -DA154A | INDICATOR, VOLT/AMP, RT | PENN AIRBORNE | 9A1570 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --L | -DA155A | PLUG, VOLT/AMP IND | ITT CANNON | DA15S |
| --- | ------- | CLAMP | ITT CANNON | DA51210 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DA51220-1 |
| --L | -DA156A | SHUNT, LEFT LOAD | EMPRO | MLA-105A50MV |
| --L | -DA157A | SHUNT, LEFT ALTERNATOR | EMPRO | MLA-70A-50MV |
| --L | -DA158A | SHUNT, RIGHT LOAD | EMPRO | MLA-105A50MV |
| --L | -DA159A | SHUNT, RIGHT ALTERNATOR | EMPRO | MLA-70A-50MV |
| JKL | -DB101A | C/B TURN COORD | KLIXON | 7277-2-2 |
| JKL | -DB103A | PLUG, TURN COORD | | MS3106A-10SL-3S |
| --- | ------- | CABLE CLAMP | | MS3507-4A or-4B |
| --L | -DB150A | TURN COORDINATOR | UNITED INST | 9551B |
| --L | -DC150A | C/B OIL TEMP/CHT | KLIXON | 7277-2-1 |
| --L | -DC151A | CHT/OIL TEMP IND | PENN AIRBORNE | 9A1630 |
| --L | -DC152A | PLUG, CHT/OIL TEMP | ITT CANNON | DB25S |
| --- | ------- | CLAMP | ITT CANNON | DB51212 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| --L | -DC153A | SWITCH, CHT | GRAY HILL | 71AD30-02-2-AJN |
| --- | ------- | KNOB | RAYTHEON | 50-3-1G |
| --L | -DC154A | PLUG, CHT, 16 PIN | AMP | 206037-1 |
| --- | ------- | CLAMP | AMP | 206070-1 |
| --L | -DC155A | RECPT, CHT, 16 PIN | AMP | 206036-3 |
| --- | ------- | CLAMP | AMP | 206070-1 |
| --L | -DC156A | PROBE, CHT-CYL #1 | | MS24482-1 ** |
| --L | -DC157A | PROBE, CHT-CYL #2 | | MS24482-1 ** |
| --L | -DC158A | PROBE, CHT-CYL #3 | | MS24482-1 ** |
| --L | -DC159A | PROBE, CHT-CYL #4 | | MS24482-1 ** |
| --L | -DC160A | PROBE, CHT-CYL #5 | | MS24482-1 ** |
| --L | -DC161A | PROBE, CHT-CYL #6 | | MS24482-1 ** |
| --- | ------- | ** AN5546-1 (ALT) -EITHER REQUIRES AN4076-1 ADAPTER | | |
| JKL | -DD104A | PROBE, OAT | MOONEY | 880004-501 |
| --L | -DD150A | C/B OAT IND | KLIXON | 7277-2-1 |
| --L | -DD151A | INDICATOR, OAT | PENN AIRBORNE | 9A1580 |
| --L | -DD152A | PLUG, OAT | ITT CANNON | DA15S |
| --- | ------- | CLAMP | ITT CANNON | DA51210 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DA51220-1 |
| -KL | -DF102A | TRANSMITTER, FUEL QTY, O/B, LT | MOONEY | 610243-003 |
| JKL | -DF104A | TRANSMITTER, FUEL QTY, O/B, RT | MOONEY | 610243-001 |
| -KL | -DF105A | TRANSMITTER, FUEL QTY, I/B, LT | MOONEY | 610242-003 |
| -KL | -DF106A | TRANSMITTER, FUEL QTY, I/B, RT | MOONEY | 610242-003 |
| --L | -DF150A | C/B FUEL QTY, LH/RH | KLIXON | 7277-2-1 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --L | -DF151A | FUEL QTY IND. L/R | PENN AIRBORNE | 9A1620 |
| --L | -DF152A | PLUG, FUEL QTY, L/R | ITT CANNON | DB25S |
| --- | ------- | CLAMP | ITT CANNON | DB51212 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| --L | -DG150A | C/B INSTRUMENT DISPLAY | KLIXON | 7277-2-1 |
| --L | -DG151A | INSTRUMENT DISPLAY | PENN AIRBORNE | 9A1600 |
| --L | -DG152A | PLUG, INSTR. DISPLAY | ITT CANNON | DB25S |
| --- | ------- | CLAMP | ITT CANNON | DB51212 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| --L | -DG153A | C/B INSTRUMENT PTT | KLIXON | 7277-2-1 |
| --L | -DG154A | SWITCH, INSTRUMENT PTT | ALCOSWITCH | MPE106F |
| --- | ------- | CAP, BLACK | ALCOSWITCH | C-22 |
| --L | -DG155A | PLUG, INSTR. PTT | AMP | 206708-1 |
| --- | ------- | CLAMP | AMP | 206966-1 |
| --L | -DG156A | RECPT. INSTR. PTT, 9 PIN | AMP | 206705-2 |
| --- | ------- | CLAMP | AMP | 206966-1 |
| --L | -DG157A | PLUG, GRND #7, 28 PIN | AMP | 205839-3 |
| --- | ------- | CLAMP | AMP | 206070-1 |
| --L | -DG158A | RECPT. GRND #7, 28 PIN | AMP | 206152-1 |
| --- | ------- | CLAMP | AMP | 206070-1 |
| --L | -DH150A | PROBE, OIL TEMP | PORSCHE | 933.606.002.00 |
| --L | -DJ150A | XDUCER, OIL PRESS | DRUCK | PDCR 821-0662 (100 PSIG) |
| --L | -DJ151A | PLUG, OIL PRESS, 4 PIN | AMP | 206060-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -DJ152A | RECPT. OIL PRESS, 4 PIN | AMP | 206153-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -DK150A | C/B FUEL/OIL PRESSURE | KLIXON | 7277-2-1 |
| --L | -DK151A | INDICATOR, FUEL/OIL PRESS | PENN AIRBORNE | 9A1640 |
| --L | -DK152A | PLUG, FUEL/OIL PRESS | ITT CANNON | DB25S |
| --- | ------- | CLAMP | ITT CANNON | DB51212-1 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| --L | -DK153A | XDUCER, FUEL PRESS | DRUCK | PDCR 821-0062 (100 PSIG) |
| --L | -DK154A | PLUG, FUEL PRESS, 4 PIN | AMP | 206060-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -DK155A | RECPT, FUEL PRESS, 4 PIN | AMP | 206153-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -DL150A | DIODE, RPM/FUEL FLOW, LT | | 1N2483 |
| --L | -DL151A | DIODE, RPM/FUEL FLOW, RT | | 1N2483 |
| --L | -DL152A | INDICATOR, RPM/FUEL FLOW | PENN AIRBORNE | 9A1610 |
| --L | -DL153A | PLUG, RPM/FUEL FLOW | ITT CANNON | DB25S |
| --- | ------- | CLAMP | ITT CANNON | DB51212 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --- | ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| --L | -DL157A | SENSOR, RPM #2, RT | PORSCHE | 933.602.002.01 |
| --L | -DL158A | SENSOR, RPM #1, LT | PORSCHE | 933.602.002.01 |
| --L | -DM150A | HOUR METER | AIRPAX | K4205 *** |
| | | | *** K4207 or KF4207 (ALT) | |
| --L | -DM151A | RECPT, HOUR METER, 4 PIN | AMP | 206153-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -DM152A | PLUG, HOUR METER, 4 PIN | AMP | 206060-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| JKL | -DP101A | C/B PITOT HEAT | MOONEY | 930023-205 |
| JKL | -DP102A | PITOT, HEATED | AERO INST | PH502-24 **** |
| | | | **** AN5812-1 (ALT) | |
| JKL | -DP103A | PLUG, PITOT HEAT | | AN3115-1 |
| --- | ------- | SOCKETS | | AN3116-1 |
| --L | -DP150A | BOX, CURRENT DETECTOR RELAY | MOONEY | 800221-501 |
| --L | -DP151A | PLUG, CUR/DECT RELAY | AMP | 206060-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -DV150A | XDUCER, FUEL FLOW | PORSCHE | 933-110-377-02 (FUEL CONTROL) |
| --L | -DW150A | INDICATOR, VERTICAL SPEED | UNITED INST | 7201-2 |
| --L | -DW151A | PLUG, VSI, 3 PIN | BENDIX | PT06E-8-3S |
| --L | -DW151A | PLUG, V/S (ALT) | CANNON | KPT06E-8-3S |
| --L | -DW151A | PLUG, VSI (ALT) | | MS3116-8-3S |
| --- | ------- | CLAMP | | MS3057-3A or -3B |
| JKL | -EG101A | C/B GEAR RELAY | KLIXON | 7277-2-5 |
| JKL | -EG102A | SWITCH, GEAR UP/DN | CUTLER-HAMMER | 8906K2875 |
| JKL | -EG103A | SWITCH, GEAR OVERIDE | CUTLER-HAMMER | SBIDDX492-2 |
| --- | ------- | LOCKING RING | CUTLER-HAMMER | 29-761 |
| --- | ------- | LOCK WASHER | CUTLER-HAMMER | 16-886 |
| --- | ------- | HEX NUT (2 EA) | CUTLER-HAMMER | 15-966-6 |
| --- | ------- | LAMP (28 V) | GE | 388 |
| JKL | -EG104A | SWITCH, GEAR SAFE (AIRSPEED) | MOONEY | 880013-507 |
| JKL | -EG105A | C/B GEAR ACTUATOR | KLIXON | 7277-2-15 |
| JKL | -EG106A | SWITCH, GEAR UP LIMIT | MICRO SWITCH | DT-2R-A7 |
| --- | ------- | ACTUATOR | MICRO SWITCH | MCD-2711 |
| JKL | -EG107A | SWITCH, GEAR DN LIMIT | MICRO SWITCH | ICHI-6 |
| JKL | -EG107A | SWITCH, GEAR DN LIMIT (ALT) | SAINT SWITCH,INC | ML1116 |
| JKL | -EG108A | RELAY, GEAR UP | CUTLER-HAMMER | 604IH-220 |
| JKL | -EG109A | RELAY, GEAR DOWN | CUTLER-HAMMER | 604IH-220 |
| JKL | -EG110A | ACTUATOR, LANDING GEAR | MOONEY | 560254-503 |
| JKL | -EG110A | ACTUATOR, LDG. GR (ALT) | MOONEY | 880037-507 |
| JKL | -EG111A | DIODE,GEAR UP RELAY | | 1N2483 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --- | ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| JKL | -EG112A | DIODE, GEAR DOWN RELAY | | 1N2483 |
| JKL | -ELT101A | SWITCH, REMOTE ELT | DORNE&MARGOLIN | DM-U65-1 |
| JKL | -ELT101A | SWITCH,REMOTE ELT (ALT) | C & K | 7101K |
| JKL | -ELT102A | ELT TRANSMITTER | DORNE&MARGOLIN | DM-ELT-8 |
| --L | -ELT150A | PLUG, ELT | AMP | 206060-1 |
| --- | -------- | CLAMP | AMP | 206062-1 |
| --L | -ELT151A | RECPT, ELT | AMP | 206153-1 |
| --- | -------- | CLAMP | AMP | 206062-1 |
| --L | -JE150B | C/B IGNITION, LT | KLIXON | 7277-2-7.5 |
| --L | -JE151B | C/B IGNITION, RT | KLIXON | 7277-2-7.5 |
| --L | -JE152B | IGNITION BOX, LT | PORSCHE | 933.602.007.07 |
| --L | -JE153B | IGNITION BOX, RT | PORSCHE | 933.602.007.07 |
| --L | -JE154B | PLUG, IGN BOX, LT | CANNON | CA3106A-20A-48S-B-03 |
| --L | -JE154B | PLUG, IGN BOX, LT (ALT) | CANNON-GERMANY | CA3106A-20A-48S-B-15 |
| --L | -JE154B | PLUG, IGN BOX, LT (ALT) | PORSCHE | 933.612.440.00 |
| --- | ------- | TINEL-LOCK ADAPTER | RAYCHEM | TXR18AB45-C2012AI |
| --- | ------- | BOOT | RAYCHEM | 202C621-51/164 |
| --- | ------- | SHIELD | RAYCHEM | QQB575R36T500 |
| --- | ------- | TINEL LOCK RING | RAYCHEM | TR*** |
| --L | -JE155B | PLUG, IGN BOX, RT | CANNON | CA3106A-20AL-48P-B-03 |
| --L | -JE155B | PLUG, IGN BOX, RT (ALT) | CANNON-GERMANY | CA3106A-20A-48S-B-15 |
| --L | -JE155B | PLUG, IGN BOX, RT (ALT) | PORSCHE | 933.612.440.00 |
| --- | ------- | TINEL-LOCK ADAPTER | RAYCHEM | TXR18AB45-C2012AI |
| --- | ------- | SHIELD | RAYCHEM | QQB575R36T500 |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | TR*** |
| --L | -JE156B | PLUG, IGN BOX COIL, LT | CANNON | CA3106E-10SL-3P-B-02 |
| --L | -JE156B | PLUG, IGN BOX COIL, LT (ALT) | CANNON-GERMANY | CA3106E-10SL-3P-B-14 |
| --L | -JE156B | PLUG, IGN BOX COIL, LT (ALT) | PORSCHE | 933.612.409.00 |
| --- | ------- | TINEL-LOCK ADAPTER | RAYCHEM | TXR18AB00-C1104AI |
| --- | ------- | SHIELD | RAYCHEM | QQB575R36T203 |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | TR*** |
| --L | -JE157B | PLUG, IGN BOX COIL, RT | CANNON | CA3106E10SL3PB-02 |
| --L | -JE157B | PLUG, IGN BOX COIL, RT (ALT) | CANNON-GERMANY | CA3106E-10SL-3P-B-14 |
| --L | -JE157B | PLUG, IGN BOX COIL, RT (ALT) | PORSCHE | 933.612.409.00 |
| --- | ------- | TINEL-LOCK ADAPTER | RAYCHEM | TXR18AB00-C1104AI |
| --- | ------- | SHIELD | RAYCHEM | QQB575R36T203 |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | TR*** |
| --L | -JE162B | PLUG, IGN COIL, LT | CANNON | CA3106E-10SL-4S-B-02 |
| --L | -JE162B | PLUG, IGN COIL, LT | CANNON-GERMANY | CA3106E-10SL-4S-B-14 |
| --L | -JE162B | PLUG, IGN COIL, LT | PORSCHE | 933.612.407.00 |
| --- | ------- | TINEL-LOCK ADAPTER | RAYCHEM | TXR18AB00-C1104AI |
| --- | ------- | SHIELD | RAYCHEM | QQB575R36T203 |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | TR*** |
| --L | -JE163B | PLUG, IGN. COIL, RT | CANNON | CA3106E-10SL-4S-B-02 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --L | -JE163B | PLUG, IGN COIL, RT | CANNON-GERMANY | CA3106E-10SL-4S-B-14 |
| --L | -JE163B | PLUG, IGN COIL, RT | PORSCHE | 933.612.407.00 |
| --- | ------- | TINEL-LOCK ADAPTER | RAYCHEM | TXR18AB00-C1104AI |
| --- | ------- | SHIELD | RAYCHEM | QQB575R36T203 |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | TR*** |
| --L | -JE164A | IGNITION COIL, LT | PORSCHE | |
| --L | -JE165A | IGNITION COIL, RT | PORSCHE | |
| --L | -JE168A | SENSOR, TDC #1 | PORSCHE | |
| --L | -JE169A | SENSOR, TDC #2 | PORSCHE | |
| --L | -JE172B | RECEPT, IGN, COIL, LT, 4 PIN | | MS3100K-14S-2P |
| --- | ------- | ADAPTER | RAYCHEM | TXR18AB000-C1404AI |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | |
| --L | -JE173B | PLUG, IGN, COIL, LT, 4 PIN | | MS3106A-14S-2S |
| --L | -JE173B | PLUG, (ALT) | | MS3106E-14S-2S |
| --- | ------- | ADAPTER | RAYCHEM | TXR18AB000-C1404AI |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | |
| --L | -JE176B | RECPT, IGN. COIL, RT, 4 PIN | | MS3100K-14S-2P |
| --- | ------- | ADAPTER | RAYCHEM | TXR18AB000-C1404AI |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | |
| --L | -JE177B | PLUG, IGN. COIL, RT, 4 PIN | | MS3106A-14S-2S |
| --L | -JE177B | PLUG, (ALT) | | MS3106E-14S-2S |
| --- | ------- | ADAPTER | RAYCHEM | TXR18AB000-C1404AI |
| --- | ------- | TINEL-LOCK RING | RAYCHEM | |
| --L | -JE179A | RECPT, C/B, 3 PIN | AMP | 1-480305-0 |
| --- | ------- | PINS | AMP | 60620-1 |
| --L | -JE181A | RECPT, C/B, 2 PIN | AMP | 1-480319-0 |
| --- | ------- | PINS | AMP | 60620-1 |
| --L | -JE182A | PLUG, TACH/FUEL FLOW | AMP | 1-480318-0 |
| --- | ------- | SOCKET | AMP | 60619-1 |
| --L | -JE183A | RECPT, TACH/FUEL FLOW | AMP | 1-480319-0 |
| --- | ------- | PINS | AMP | 60620-1 |
| JKL | -JM101A | SWITCH, IGNITION | BENDIX SCINTILLA | 10-357210-9 |
| --- | ------- | PLACARD | BENDIS SCINTILLA | 10-187-468 |
| JKL | -LC101A | FUSEHOLDER, CLOCK, 5AMP | LITTEL FUSE | 155020/155120 |
| --- | ------- | FUSE,(5A-3AG-SLO-BLO) | LITTEL FUSE | 313005 |
| JKL | -LC102A | SWITCH, CABIN LIGHT, FWD | CARLING | TILC64-IS-WH-FN |
| JKL | -LC103A | RESISTOR, CABIN LIGHT, FWD | DALE | RH-10-20 OHM |
| JKL | -LC104A | LIGHT, CABIN, FWD, LT | H.H. SMITH | 1930 |
| --- | ------- | LAMP | GE | 1818 |
| JKL | -LC105A | LIGHT, CABIN, FWD, RT | H.H. SMITH | 1930 |
| --- | ------- | LAMP | GE | 1818 |
| JKL | -LC106 | LIGHT, CABIN, FWD, LT | H.H. SMITH | 1930 |
| --- | ------ | LAMP | GE | 1818 |
| JKL | -LC107A | LIGHT, CABIN, FWD, RT | H.H. SMITH | 1930 |
| --- | ------ | LAMP | GE | 1818 |

| CODE | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|
| JKL -LC108A | SWITCH, CABIN LIGHT, REAR | CARLING | TILC64-' WH-FN |
| JKL -LC109A | RESISTOR, CABIN LIGHT SW | DALE | RH-10-20 OHM |
| JKL -LC110A | LIGHT, CABIN, REAR, LT | H.H. SMITH | 1930 |
| --- ------ | LAMP | GE | 1818 |
| JKL -LC111A | LIGHT, CABIN, REAR, RT | H.H. SMITH | 1930 |
| --- ------ | LAMP | GE | 1818 |
| JKL -LC112A | LIGHT, CABIN, REAR, LT | H.H. SMITH | 1930 |
| --- ------ | LAMP | GE | 1818 |
| JKL -LC113A | LIGHT, CABIN, REAR, RT | H.H. SMITH | 1930 |
| --- ------ | LAMP | GE | 1818 |
| --L -LC114A | LIGHT, CABIN, REAR, LT | H.H. SMITH | 1930 |
| --- ------ | LAMP | GE | 1818 |
| --L -LC115A | LIGHT, CABIN, REAR, RT | H.H. SMITH | 1930 |
| --- ------ | LAMP | GE | 1818 |
| | | | |
| --L -LL150A | C/B LANDING LIGHT, LEFT | KLIXON | 7277-2-20 |
| --L -LL151A | C/B LANDING LIGHT, RIGHT | KLIXON | 7277-2-20 |
| --L -LL152A | SWITCH, LANDING LIGHT | CUTLER-HAMMER | 8162-K22-E13-M50 |
| --L -LL154A | LANDING LIGHT-RT WING | GE | 4596 |
| --L -LL155A | TAXI LIGHT-RT WING | GE | 4596 |
| --L -LL156A | SWITCH, TAXI LIGHT | CUTLER-HAMMER | 8162-K22-E13-M50 |
| --L -LL157A | TAXI LIGHT, LEFT WING | GE | 4596 |
| --L -LL158A | LANDING LIGHT, LEFT WING | GE | 4596 |
| | | | |
| JKL -LN101A | C/B NAV LIGHTS | MOONEY | 930023-201 |
| JKL -LN102A | LIGHT, TAIL, LT WING | MOONEY | 800051-501 |
| JKL -LN103A | LIGHT, TAIL RT WING | MOONEY | 800051-501 |
| JKL -LN104A | PLUG, TAIL LIGHT, RT WING | AMP | 1-480318-0 |
| --- ------- | SOCKETS | AMP | 60619-1 |
| JKL -LN105A | RECPT, TAIL LIGHT RT WING | AMP | 1-480319-0 |
| --- ------- | PINS | AMP | 60620-1 |
| JKL -LN106A | PLUG, TAIL NAV LIGHT | AMP | 1-480318-0 |
| --- ------- | SOCKETS | AMP | 60619-1 |
| JKL -LN107A | RECPT, TAIL NAV LIGHT | AMP | 1-480319-1 |
| --- ------- | PINS | AMP | 60620-1 |
| | | | |
| JKL -LP101A | C/B PANEL LIGHTS | KLIXON | 7277-2-5 |
| JKL -LP102A | C/B GLARESHIELD LIGHTS | KLIXON | 7277-2-5 |
| JKL -LP103A | LAMP, COMPASS LIGHT | GE | AVIATION RED 327 or 327 |
| JKL -LP105A | PLUG, COMPASS LIGHT | DEANS | DEA90020FEMALE |
| JKL -LP106A | LAMP, GLARESHIELD LIGHTS | GE | 327 |
| --L -LP150A | DIMMER CONTROL BOX | IAI | 950D0307-000 |
| --L -LP151A | PLUG, DIMMER CONTROL BOX | ITT CANNON | DBM17W2S |
| --- ------- | CLAMP | ITT CANNON | DB51212 |
| --- ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| --- ------- | RECPT (2 EA) | ITT CANNON | DM53744-7 |
| --L -LP152A | SWITCH, PANEL LIGHTS, DIMR | C & K | 7105-J1-Z-Q |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --L | -LP153A | SWITCH, GLARESHIELD LIGHTS, DIMMER | C & K | 7105-J1-Z-Q |
| --L | -LP154A | LIGHT, FLAP SWITCH | MOONEY | 130285-003 |
| --- | ------- | LAMP | GE | 327 |
| --L | -LP155A | LIGHT, CONSOLE SWITCH, RT | MOONEY | 130285-003 |
| --- | ------- | LAMP | GE | 327 |
| --L | -LP158A | LIGHT, CONSOLE SWITCH, LT | MOONEY | 130285-003 |
| --- | ------- | LAMP | GE | 327 |
| --L | -LP159A | PLUG, 16 PIN | AMP | 206037-1 |
| --- | ------- | CLAMP | AMP | 206070-1 |
| --L | -LP160A | RECEPT, DIMMER CONTROL BOX | | AMP206036-3 |
| --- | ------- | CLAMP | AMP | 206070-1 |
| JKL | -LR101A | C/B RECOGNITION LIGHTS | MOONEY | 930023-231 |
| JKL | -LR102A | RECOGNITION LIGHT, LT WG | MOONEY | 880049-501 |
| JKL | -LR103A | PLUG, RECOG. LIGHT, LT WG | AMP | 1-480318-0 |
| --- | ------- | SOCKETS | AMP | 60619-1 |
| JKL | -LR104A | RECOGNITION LIGHT, RT | MOONEY | 880049-501 |
| JKL | -LR105A | PLUG, RECOG. LIGHT, RT | AMP | 1-480318-0 |
| --- | ------- | SOCKETS | AMP | 60619-1 |
| JKL | -LR106A | RECPT, RECOG.LIGHT, LEFT | AMP | 1-480319-0 |
| --- | ------- | PINS | AMP | 60620-1 |
| JKL | -LR107A | PLUG, RECOG. LIGHT, LEFT | AMP | 1-480318-0 |
| --- | ------- | SOCKETS | AMP | 60619-1 |
| JKL | -LR108A | RESISTOR, RECOG. LIGHT, LEFT | DALE | RH-50-7.5 OHMS |
| JKL | -LR109A | RECPT, RECOG. LIGHT, RT | AMP | 1-480319-0 |
| --- | ------- | PINS | AMP | 60620-1 |
| JKL | -LR110A | PLUG, RECOG. LIGHT, RT | AMP | 1-480318-0 |
| --- | ------- | SOCKETS | AMP | 60619-1 |
| JKL | -LR111A | RESISTOR, RECOG. LIGHT, RT | DALE | RH-50-7.5 OHMS |
| JKL | -LS101A | C/B STROBE LIGHTS | MOONEY | 930023-207 |
| JKL | -LS101A | C/B STROPE LIGHTS (ALT) | MOONEY | 930023-237 |
| JKL | -LS102A | POWER SUPPLY, STROBE, LT WG | WHELEN | 01-0770329-00 |
| JKL | -LS103A | RECPT, STROBE PWR SUPPLY, LT WG | AMP | 1-480305-0 |
| JKL | -LS104A | RECPT, STROBE PWR SUPPLY,LT WG | AMP | 1-480305-0 |
| JKL | -LS105A | PLUG, NAV/STROBE, LT WG | AMP | 1-480303-0 |
| JKL | -LS106A | LIGHT, NAV/STROBE, LT WG | WHELEN | A650-PR-D-M |
| JKL | -LS107A | STROBE PWR SUPPLY, RT WG | WHELEN | 01-0770329-00 |
| JKL | -LS108A | RECPT, STROBE PWR SUPPLY, RT | AMP | 1-480305-0 |
| JKL | -LS109A | RECPT,STROBE LIGHT PWR SUPPLY, RT | AMP | 1-480305-0 |
| JKL | -LS110A | PLUG,STROBE LIGHT, RT | AMP | 1-480303-0 |
| JKL | -LS111A | NAV/STROBE LIGHT RT. WING | WHELEN | A650-PG-D-M |
| JKL | -LS112A | POWER SUPPLY, TAIL STROBE | WHELEN | 01-0770329-00 |

| CODE | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|
| JKL -LS113A | RECPT, TAIL STROBE PWR SUPPLY | AMP | 1-480305-0 |
| JKL -LS114A | RECPT, TAIL STROBE PWR SUPPLY | AMP | 1-480305-0 |
| JKL -LS115A | PLUG, TAIL STROBE | AMP | 206060-1 |
| --- ------- | CLAMP | AMP | 206062-1 |
| JKL -LS116A | RECPT, TAIL STROBE | AMP | 206153-1 |
| --- ------- | CLAMP | AMP | 206062-1 |
| JKL -LS117A | PLUG, TAIL STROBE | AMP | 1-480303-0 |
| JKL -LS118A | STROBE LIGHT, TAIL | MOONEY | 470013-501 |
| JKL -MA101A | AUX. PWR. RECEPTACLE | | AN2552-3A |
| JKL -MA102A | RELAY, AUX. PWR | CUTLER-HAMMER | 6041H-202 or 202A |
| JKL -MA103A | DIODE, AUX PWR RELAY | SARKES TARZIAN | 10H3P |
| JKL -MB101A | AVIONICS CONTROL RELAY | MAGNACRAFT | W67CSX-3 |
| --- ------- | BASE | MAGNACRAFT | 70-303 |
| JKL -MB103A | DIODE | | 1N2483 |
| JKL -MB107A | SWITCH, AVIONICS MASTER | C & K | 7101K |
| JKL -MB109A | C/B HSI | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB110A | C/B COM1 | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB111A | C/B NAV1 | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB112A | C/B AUDIO | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB113A | C/B PHONE | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB114A | C/B ADF | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB115A | C/B COM2 | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB116A | C/B NAV2 | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB117A | C/B TRANSPONDER | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB118A | C/B ENCODER | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB119A | C/B AUTOPILOT/TRIM | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB121A | C/B DME | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB122A | C/B LORAN | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB123A | C/B STORMSCOPE | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB125A | C/B RMI | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB126A | C/B R/NAV | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB128A | C/B STEREO | KLIXON | 7277-2-XX(VARIES) |
| JKL -MB135A | C/B YAW DAMP | KLIXON | 7277-2-7.5 |
| JKL -MB137A | C/B ARTIFICIAL HORIZ | KLIXON | 7277-2-5 |
| --L -MB150A | AVIONICS BUS BAR #1 | MOONEY | 913127-003 |
| --L -MB151A | AVIONICS BUS BAR #2 | MOONEY | 913127-003 |
| --L -MB152A | AVIONICS BUS BAR #3 | MOONEY | 913127-003 |
| --L -MB153A | AVIONICS BUS BAR #4 | MOONEY | 913127-003 |
| --L -MB154A | AVIONICS BUS BAR #5 | MOONEY | 913127-003 |
| --L -MB155A | AVIONICS BUS BAR #6 | MOONEY | 913127-003 |
| --L -MB157A | SHUNT | MOONEY | 913127-049 |
| --L -MB158A | AVIONICS MASTER RELAY | AROMAT | HG4-DC24V |
| --- ------- | RECEPTACLE | AROMAT | HG4-SF |
| --L -MB159A | DIODE | | 1N2483 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --L | -MB162A | DIODE, STARTER SOLENOID, LT | | 1N2483 |
| --L | -MB163A | DIODE, STARTER SOLENOID | | 1N2483 |
| --L | -MB164A | ARTIFICIAL HORIZ | CASTLEBERRY | 300-2BL |
| --L | -MB165A | PLUG, ART.HORIZ | AMPHENOL | 126-222 |
| JKL | -MC101A | CIGAR LIGHTER | MOONEY | 800336-505 |
| --L | -MC150A | C/B CIGAR LIGHTER | KLIXON | 7277-2-10 |
| --L | -ME150A | CLOCK, (ALT) | IAI | 950D0312.000 |
| --L | -ME150B | CLOCK, CONTROL WHEEL | PORSCHE | 944.641.213.00 |
| --L | -ME151A | RECPT, CONTROL WHEEL | AMP | 206153-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -ME152A | PLUG, CONTROL WHEEL | AMP | 206060-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -NE150A | C/B FUEL ENRICH | KLIXON | 7277-2-1 |
| --L | -NE151A | SWITCH, ENRICHMENT | MICRO SWITCH | 1SE1-T |
| --- | ------- | ACTUATOR | MICRO SWITCH | JE-5 |
| --L | -NE153A | VALVE, SOLENOID, MIXTURE ENRICHMENT | PORSCHE | 933.606.012.00 |
| --L | -NE154A | DIODE, ENRICH SW. | | 1N2483 |
| --L | -NF150A | C/B FUEL PUMP, MAIN | KLIXON | 7277-2-10 |
| --L | -NF151A | C/B FUEL PUMP, EMERGENCY | KLIXON | 7277-2-10 |
| --L | -NF152A | SWITCH,FUELPUMP,MAIN/BOOST | CUTLER-HAMMER | 8162-K22-E13-M50 |
| --- | ------- | GUARD | MOONEY | 930028-501 |
| --L | -NF153A | SWITCH,FUEL PUMP, EMER. | CUTLER-HAMMER | 8142-K21-E7-T50 |
| --- | ------- | GUARD | MOONEY | 930028-501 |
| --L | -NF154A | RECPT, FUEL PUMP | AMP | 206060-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -NF155A | RECPT, FUEL PUMP | AMP | 206153-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -NF160A | FUEL PUMP, MAIN | PORSCHE | 933.620.001.00 |
| --L | -NF161A | FUEL PUMP, EMERGENCY | PORSCHE | 933.620.001.00 |
| --L | -NF162A | C/B FUEL PUMP, BOOST | KLIXON | 7277-2-10 |
| --L | -NF163A | FUEL PUMP, BOOST | PORSCHE | 933.620.001.00 |
| --L | -NS150A | SWITCH, COLD START/ENRICH | MOONEY | 880052-511 |
| --L | -NS151A | NOZZLE, COLD START | PORSCHE | 933.612.401.00 |
| --- | ------- | PLUG | PORSCHE | 933.615.032.40 |
| --- | ------- | CLAMP | PORSCHE | 999.615.032.40 |
| --- | ------- | BOOT | PORSCHE | 944.612.128.00 |
| --- | ------- | CONTACTS | PORSCHE | 999.652.456.22 |
| --L | -NS153A | DIODE, COLD START SW | | 1N2483 |
| JKL | -PA102A | C/B ALTERNATOR FIELD, LT | KLIXON | 7277-2-5 |
| JKL | -PA108A | FILTER | MOONEY | 880014-501 |
| JKL | -PA109A | CAPACITOR | MALLORY | CGS302U-050R2C |

| CODE | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|
| JKL -PA111A | C/B ALTERNATOR FIELD, RT | KLIXON | 7277-2-5 |
| JKL -PA116A | FILTER | MOONEY | 880014-501 |
| JKL -PA117A | CAPACITOR | MALLORY | CGS302U-050R2C |
| --L -PA150A | ALTERNATOR, LT | PORSCHE | 933.603.004.00 |
| --L -PA151A | ALTERNATOR, RT | PORSCHE | 933.603.004.00 |
| --L -PA152A | OVERVOLTAGE CONTROL, LT | ELECTRO DELTA | OS-400 |
| --L -PA153A | PLUG, OVERVOLTAGE CONTROL, LT | AMP | 206708-1 |
| --- ------- | CLAMP | AMP | 206966-1 |
| --L -PA154A | OVERVOLTAGE CONTROL, RT | ELECTRO DELTA | OS-400 |
| --L -PA155A | PLUG, OVERVOLTAGE CONTROL, RT | AMP | 206708-1 |
| --- ------- | CLAMP | AMP | 206966-1 |
| --L -PA156A | SWITCH, OVERVOLTAGE RESET, LT | CUTLER-HAMMER | SB1DDX492-2 |
| --- ------- | LOCKING RING | CUTLER-HAMMER | 29-761 |
| --- ------- | LOCKING WASHER | CUTLER-HAMMER | 16-886 |
| --- ------- | NUT, HEX (2 ea) | CUTLER-HAMMER | 15-966-6 |
| --- ------- | LAMP | GE | 388 |
| --L -PA157A | SWITCH, OVERVOLTAGE RESET, RT | CUTLER-HAMMER | SB1DDX492-2 |
| --- ------- | LOCKING RING | CUTLER-HAMMER | 29-761 |
| --- ------- | LOCKING WASHER | CUTLER-HAMMER | 16-886 |
| --- ------- | NUT, HEX (2 ea) | CUTLER-HAMMER | 15-966-6 |
| --- ------- | LAMP | GE | 388 |
| --L -PA158A | C/B ALTERNATOR, LT | ETA | 41-3-S14-LN2-70A |
| --L -PA158A | C/B ALTERNATOR, LT (ALT) | ETA | 41-3-S34-LN2-70A |
| --L -PA159A | C/B ALTERNATOR, RT | ETA | 41-3-S14-LN2-70A |
| --L -PA159A | C/B ALTERNATOR, RT (ALT) | ETA | 41-3-S34-LN2-70A |
| --L -PA160A | RECPT, OVERVOLTAGE CONTROL, LT | AMP | 206705-2 |
| --- ------- | CLAMP | AMP | 206966-1 |
| --L -PA161A | RECPT, OVERVOLTAGE CONTROL, RT | AMP | 206705-1 |
| --- ------- | CLAMP | AMP | 206996-1 |
| JKL -PB102A | RELAY,MASTER,BATTERY,LEFT | CUTLER-HAMMER | 604IH-202 or -202A |
| JKL -PB103A | DIODE,LEFT BATTERY RELAY | | 1N2483 |
| JKL -PB105A | C/B BATTERY, LT | ETA | 41-3-S14-LN2-70A |
| JKL -PB105A | C/B BATTERY, LT (ALT) | ETA | 41-3-S34-LN2-70A |
| JKL -PB106A | C/B BUS, FLIGHT PNL SWITCH | ETA | 41-3-S14-LN2-70A |
| JKL -PB106A | C/B BUS, FLT PNL SW (ALT) | ETA | 41-3-S34-LN2-70A |
| --L -PB150A | BATTERY, RIGHT | GILL | G-243 |
| --L -PB151A | RELAY, BATTERY, RT | CUTLER-HAMMER | 6041H-202 or -202A |
| --L -PB152A | DIODE, BATTERY RELAY, RT | | 1N2483 |
| --L -PB153A | SWITCH, BATTERY, LT | MOONEY | 880052-507 |
| --L -PB154A | SWITCH, BATTERY, RT | MOONEY | 880052-509 |
| --L -PB155A | C/B BATTERY, RT | ETA | 41-3-S14-LN2-70A |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --L | -PB155A | C/B BATTERY, RT (ALT) | ETA | 41-3-S34-LN2-70A |
| --L | -PB161A | BUS BAR #6 | MOONEY | 913127-19 |
| --L | -PB162A | BUS BAR #7 | MOONEY | 913127-19 |
| --L | -PB163A | BUS BAR #8 | MOONEY | 913127-19 |
| --L | -PB164A | BUS BAR #9 | MOONEY | 913127-53 |
| --L | -PB166A | BUS BAR #11 | MOONEY | 913127-53 |
| --L | -PB168A | C/B EMERGENCY CROSSOVER | ETA | 41-3-S14-LN2-50A |
| --L | -PB168A | C/B EMERGENCY CROSSOVER (ALT) | ETA | 41-3-S34-LN2-50A |
| --- | ------- | C/B COVER PLACARD | MOONEY | 150080-802 |
| --- | ------- | GUARD | MOONEY | 800232-503 |
| --L | -PB169A | SHUNT, AVIONICS RELAY | MOONEY | 913127-047 |
| --L | -PB170A | BATTERY, LEFT | GILL | G-243 |
| --L | -PB171A | C/B LOAD, A/C, LT | ETA | 41-3-S14-LN2-60A |
| --L | -PB171A | C/B LOAD, A/C, LT (ALT) | ETA | 41-3-S34-LN2=60A |
| --L | -PB172A | C/B LOAD, A/C, RT | ETA | 41-3-S14-LN2-60A |
| --L | -PB172A | C/B LOAD, A/C RT (ALT) | ETA | 41-3-S34-LN2=60A |
| --L | -PB174A | BUS BAR #14 | MOONEY | 913127-57 |
| --L | -PB175A | BUS BAR #15 | MOONEY | 913127-57 |
| --L | -PB176A | BUS BAR #16 | MOONEY | 913127-59 |
| --L | -PB177A | BUS BAR #17 | MOONEY | 913127-59 |
| --L | -PB178A | BUS BAR #18 | MOONEY | 913127-61 |
| --L | -PB179A | BUS BAR #19 | MOONEY | 913127-19 |
| --L | -PB180A | FUSEHOLDER, LEFT MASTER | LITTEL FUSE | 155020 or 155120 |
| --- | -PB180A | FUSE 5AMP | LITTEL FUSE | 313005 |
| --L | -PB181A | MASTER RELAY | CUTLER-HAMMER | 6041H-202 or 202A |
| --L | -PB182A | DIODE | | 1N2483 |
| --L | -PB183A | MASTER SWITCH | MOONEY | 880052-501 |
| --L | -PB184A | RELAY, A/H PWR | MAGNACRAFT | W389CX-3 |
| --L | -PB185A | DIODE | | 1N2483 |
| --L | -PB186A | FUSEHOLDER, A/H, RT | LITTEL FUSE | 155020 or 155120 |
| --- | -PB186A | FUSE, 5AMP | LITTEL FUSE | 313005 |
| --L | -PB187A | FUSEHOLDER, MASTER, RT | LITTEL FUSE | 155020 or 155120 |
| --- | -PB187A | FUSE, 5AMP | LITTEL FUSE | 313005 |
| --L | -PB188A | MASTER RELAY, ENGINE BUS, RT | CUTLER-HAMMER | 6041H-202 or -202A |
| --L | -PB189A | DIODE | | 1N2483 |
| --L | -PB190A | MASTER SWITCH (OPT) | CUTLER-HAMMER | 8133K-21-E13-T52 |
| --L | -PB191A | GRND/DIMMER BOX | MOONEY | 800228-501 |
| JKL | -PL01A | PLUG, C/B PANEL #1, 37 PIN | AMP | 206150-1 |
| --- | ------ | CLAMP | AMP | 206138-1 |
| JKL | -PL02B | PLUG, CONSOLE #1, 28 PIN | AMP | 205839-3 |
| --- | ------ | CLAMP | AMP | 206070-1 |
| JKL | -PL03B | PLUG, LEFT SIDE PANEL, 26 PIN | MOONEY | 930021-505 |
| JKL | -PL04A | PLUG, FLT PNL #1, 26 PIN | MOONEY | 930021-505 |
| JKL | -PL05A | PLUG, A/S SWITCH #1, 4 PIN | AMP | 206060-1 |
| --- | ------ | CLAMP | AMP | 206062-1 |

| CODE | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|
| JKL -PL06A | PLUG, AUTOPILOT POWER, 16 PIN | AMP | 206037-1 |
| --- ------ | CLAMP | AMP | 202070-1 |
| JKL -PL08A | PLUG, FIREWALL #1, 19 PIN | | MS3106A-22-14S |
| --- ------ | CLAMP | | MS3057-12B |
| JKL -PL09B | PLUG, RT. WING, 20 PIN | MOONEY | 930021-501 |
| JKL -PL10A | PLUG, RT. WING STUB, 14 PIN | MOONEY | 930021-001 |
| JKL -PL11B | PLUG, LEFT WING, 14 PIN | MOONEY | 930021-001 |
| JKL -PL12B | PLUG, FIREWALL #2, 19 PIN | | MS3106A22-14S |
| --- ------ | CLAMP | | MS3057-12B |
| JKL -PL13B | PLUG, AVIONICS MASTER, 4 PIN | AMP | 206060-1 |
| --- ------ | CLAMP | AMP | 206062-1 |
| JKL -PL15A | PLUG, LEFT WING STUB, 14 PIN | MOONEY | 930021-001 |
| JKL -PL16A | PLUG, GEAR CONTROL, 9 PIN | AMP | 206708-1 |
| --- ------ | CLAMP | AMP | 206966-1 |
| JKL -PL17A | PLUG, ELECTRIC GEAR, 14 PIN | MOONEY | 930021-001 |
| JKL -PL19A | PLUG, A/S SWITCH #2, 4 PIN | AMP | 206060-1 |
| --- ------ | CLAMP | AMP | 206062-1 |
| JKL -PL20A | PLUG, TAILCONE, 16 PIN | AMP | 206037-1 |
| --- ------ | CLAMP | AMP | 206070-1 |
| JKL -PL23A | PLUG, GRND #1, 16 PIN | AMP | 206037-1 |
| --- ------ | CLAMP | AMP | 206070-1 |
| JKL -PL24A | PLUG, GRND #2, 16 PIN | AMP | 206037-1 |
| --- ------ | CLAMP | AMP | 206070-1 |
| JKL -PL26A | PLUG, COMPASS LIGHT HARNESS, 4 PIN | AMP | 206060-1 |
| --- ------ | CLAMP | AMP | 206062-1 |
| JKL -PL27B | RECPT,FLT PNL #2, 20 PIN | MOONEY | 930021-501 |
| JKL -PL28A | PLUG,AVIONICS POWER, 20 PIN | MOONEY | 930021-501 |
| JKL -PL32A | PLUG,GEAR SWITCH, 4 PIN | AMP | 206060-1 |
| --- ------ | CLAMP | AMP | 206062-1 |
| JKL -PL34A | PLUG, GRND #3, 9 PIN | AMP | 206708-1 |
| --- ------ | CLAMP | AMP | 206966-1 |
| JKL -PL50A | PLUG, C/B PNL #2, 37 PIN | AMP | 206150-1 |
| --- ------ | FLANGE | AMP | 207299-4 |
| JKL -PL51A | RECPT, IGNITION SWITCH,26 PIN | MOONEY | 930021-505 |
| JKL -PL52A | PLUG, ALT/STARTER, F/W | CANNON | MS3106A2B-22S |
| --- ------ | CLAMP | | MS3057-16 |
| --L -PL152A | PLUG, GR/STALL WARN HARNESS, 4 PIN | AMP | 206060-1 |
| --- ------ | CLAMP | AMP | 206062-1 |
| JKL -PS102A | SOLENOID, STARTER,LT | CUTLER-HAMMER | 6041H-202 or -202A |
| JKL -PS107A | DIODE, STARTER SOLENOID,LT | | 1N2483 |
| --L -PS150A | DIODE, PWR START,LT | | 1N2483 |
| --L -PS151A | DIODE, PWR START,RT | | 1N2483 |
| --L -PS152A | SOLENOID, STARTER, RT | CUTLER-HAMMER | 6041H-202 or -202A |
| --L -PS153A | DIODE, STARTER SOLENOID | | 1N2483 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --L | -PS154A | STARTER | PORSCHE | 933.602.007.03 |
| JKL | -RB101A | C/B RADIO BLOWER | KLIXON | 7277-2-2 |
| JKL | -RB102A | RADIO BLOWER | TRW | 19A2790 |
| JKL | -RB103A | FILTER ,RADIO BLOWER | ARCHER | 273-103 |
| JKL | -RB103A | FILTER, RAD. BLWR, (ALT) | SPRAGUE | 5JX5104A |
| JKL | -RC01A | RECPT, C/B PNL #1 | AMP | 206151-2 |
| JKL | -RC02B | RECPT, CONSOLE #1 | AMP | 206152-1 |
| --- | ------ | CLAMP | AMP | 206070-1 |
| JKL | -RC03B | RECPT, LEFT SIDE PANEL | MOONEY | 930021-506 |
| JKL | -RC04A | RECPT, FLT PNL #1 | MOONEY | 930021-506 |
| JKL | -RC05A | RECPT, A/S SWITCH #1 | AMP | 206153-1 |
| --- | ------ | CLAMP | AMP | 206062-1 |
| JKL | -RC08A | RECPT, FIREWALL #1 | | MS3100A22-14P |
| --- | ------ | CLAMP | | MS3057-12B |
| JKL | -RC09B | RECPT, RT WING | MOONEY | 930021-502 |
| JKL | -RC10A | RECPT, RT. WING STUB | MOONEY | 930021-2 |
| JKL | -RC11B | RECPT, LT. WG. | MOONEY | 930021-002 |
| JKL | -RC12B | RECPT, FIREWALL #2 | | MS3100K-22-14P or MS3100KE-22-14P |
| --- | ------ | CLAMP | MS3057-12B or -12A | |
| JKL | -RC13B | RECPT, AVIONICS MASTER | AMP | 206153-1 |
| --- | ------ | CLAMP | AMP | 206062-1 |
| JKL | -RC15A | RECPT, LEFT WING STUB | MOONEY | 930021-002 |
| JKL | -RC16A | RECPT, GEAR CONTROL | AMP | 206705-2 |
| --- | ------ | CLAMP | AMP | 206966-1 |
| JKL | -RC17A | RECPT, ELECTRIC GEAR | MOONEY | 930021-002 |
| --L | -RC18B | RECPT, PNL LIGHT DIMMER #1 | AMP | 206044-1 |
| --- | ------ | CLAMP | AMP | 206070-1 |
| JKL | -RC19A | RECPT, A/S SWITCH #2 | AMP | 206153-1 |
| --- | ------ | CLAMP | AMP | 206062-1 |
| JKL | -RC20A | RECPT, TAILCONE | AMP | 206036-3 |
| --- | ------ | CLAMP | AMP | 206070-1 |
| JKL | -RC26A | RECPT, COMPASS LIGHT HARNESS | AMP | 206153-1 |
| --- | ------ | CLAMP | AMP | 206062-1 |
| JKL | -RC27B | RECPT, FLT PNL #2 | MOONEY | 930021-502 |
| JKL | -RC32A | RECPT, GEAR RELAY | AMP | 206153-1 |
| --- | ------ | CLAMP | AMP | 206062-1 |
| JKL | -RC50A | RECPT, C/B PNL #2 | AMP | 206151-2 |
| --- | ------ | CLAMP | AMP | 206138-1 |
| JKL | -RC51A | RECPT, IGNITION SWITCH | MOONEY | 930021-506 |
| JKL | -RC52A | RECPT, ALT/STARTER | CANNON | MS3100K28-2P orMS3100KE28-2P |
| --L | -RC58B | RECPY, PNL LIGHT DIMMER #2 | AMP | 206044-1 |
| --- | ------ | CLAMP | AMP | 206070-1 |
| --L | -RC150A | RECPT, ENGINE HARNESS, LT | CANNON-GERMANY | CA121006-518 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --- | ------- | CLAMP | CANNON-GERMANY | 057-8557-000 |
| --- | ------- | FERRULE END RING | CANNON-GERMANY | 304-8553-000 |
| --L | -RC150A | RECPT, ENGINE HARNESS, LT (ALT) | PORSCHE | 933.612.415.00 |
| --- | ------- | CLAMP * | PORSCHE | 933.612.417.00 |
| --- | ------- | ENDBELL * | PORSCHE | 933.612.425.00 |
| --- | ------- | (SEE NOTE BELOW FOR HIGH TEMP. COMPONENTS) | | |
| --L | -RC151A | RECPT, ENGINE HARNESS, RT | CANNON-GERMANY | CA121006-518 |
| --- | ------- | CLAMP * | CANNON-GERMANY | 057-8557-000 |
| --- | ------- | FERRULE END RING * | CANNON-GERMANY | 304-8553-000 |
| --L | -RC151A | RECPT, ENGINE HARNESS, RT | PORSCHE | 933.612.415.00 |
| --- | ------- | CLAMP * | PORSCHE | 933.612.417.00 |
| --- | ------- | ENDBELL * | PORSCHE | 933.612.425.00 |
| --- | * NOTE: | ALTERNATE HIGH TEMPERATURE COMPONENTS FOR ITEMS: | | |
| --- | ------- | CLAMP | CANNON | 057-8670-010 |
| --- | ------- | CLAMP | PORSCHE | 933.612.421.00 |
| --- | ------- | FERRULE ENDRING | CANNON | 304-8526-006 |
| --- | ------- | FERRULE ENDRING | PORSCHE | 933.612.417.00 |
| --L | -RC152A | RECPT, GR/STALL WARN HARNESS | AMP | 206153-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| JKL | -SB101A | C/B SPEED BRAKE | KLIXON | 7277-2-2 |
| --L | -WD150A | FUSEHOLDER, STARTER SOLENOID | LITTEL FUSE | 155020 or 155120 |
| --- | -WD150A | FUSE, 1AMP | LITTEL FUSE | 313001 |
| JKL | -WE101A | C/B GEAR WARN HORN | KLIXON | 7277-2-2 |
| JKL | -WE102A | LIGHT, GEAR DOWN | SLOAN | 855S-O-U |
| JKL | -WE105A | DIODE | | 1N2483 |
| JKL | -WE106A | DIODE | | 1M2483 |
| --L | -WE150A | SWITCH, THROTTLE | MICRO-SWITCH | 1S1-T |
| --- | ------- | ACTUATOR | MICRO-SWITCH | JE-5 |
| --L | -WE151A | PLUG, 4 PIN | AMP | 206060-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -WE152A | RECPT, 4 PIN | AMP | 206153-1 |
| --- | ------- | CLAMP | AMP | 206062-1 |
| JKL | -WS101A | C/B STALL WARN HORN | KLIXON | 7277-2-2 |
| JKL | -WS103A | SWITCH, STALL WARN | SAFE FLIGHT | C46001 |
| --L | -WS150A | ALERT, GR/STALL WARNING | IAI | 950D-0309-000 |
| --L | -WS151A | PLUG, GR/STALL WARN ALERT | ITT CANNON | DB25S |
| --- | ------- | CLAMP | ITT CANNON | DB51212 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DB1212-1 |
| --L | -WS152A | SPEAKER, GR/STALL WARN | ARCHER | 40-1333C |
| --L | -WS153A | PLUG, INTER PHONE | AMP | 206060-1 |

| CODE | | DESCRIPTION | VENDOR | PART NO. |
|---|---|---|---|---|
| --- | ------- | CLAMP | AMP | 206062-1 |
| --L | -WS154A | PLUG, MATE N LOCK | AMP | 1-480318-0 |
| --- | ------- | SOCKETS | AMP | 60619-1 |
| --L | -WS155A | RECPT, MATE N LOCK | AMP | 1-480319-0 |
| --- | ------- | PINS | AMP | 60620-1 |
| --L | -WT150A | C/B ANNUNCIATOR, LT | KLIXON | 7277-2-1 |
| --L | -WT151A | C/B ANNUNCIATOR, RT | KLIXON | 7277-2-1 |
| --L | -WT153A | ANNUNCIATOR | IAI | 950D0308-000 |
| --- | ------- | LAMPS | CHICAGO MINATURE | CM7327 |
| --L | -WT154A | PLUG, ANNUNCIATOR | ITT CANNON | DB25S |
| --- | ------- | CLAMP | ITT CANNON | DB51212-1 |
| --- | ------- | LOCK RETAINER | ITT CANNON | DB51221-1 |
| -LL | -WW150A | SWITCH, ALTERNATE AIR | CHERRY | E51-508 |

91-30-00

## - ELECTRICAL SYSTEM SCHEMATICS

( SEE NEXT PAGE )

# ELECTRICAL SCHEMATICS

| SCHEMATIC | M20L EFFECTIVITY | BLOW-UP FICHE NO. | ITEM NO. |
|---|---|---|---|
| 800350L1 | 26-0001 & ON | AMOB327 | A, E |