

MAINTENANCE MANUAL

FOR

MAULE M-4-180C

Astro Rocket

MAULE AIRCRAFT CORPORATION
MAINTENANCE MANUAL
FOR **M-4-180C**

FOREWARD

Ahead of you are many hours of flying pleasure. The more you fly your M-4 the more you will realize that flying this aircraft is a stimulating sensation that will never grow old.

The Maule M-4 is designed and built to give you the airplane you have always wanted. It is fast, comfortable, and easy to fly, yet no light airplane is safer than the Maule M-4. Its sturdy construction means you will not have to pamper it to enjoy long years of trouble-free service.

Our dealers and distributors are anxious to serve you and will gladly furnish advice as to proper servicing methods. You may also address requests for information on any items not covered in this manual to the Technical Advisor or Service Department of Maule Aircraft. In correspondence, please be certain to give complete information on serial number, engine make and model, etc.

WARRANTY

Maule Aircraft Corp. warrants each new airplane manufactured by it to be free from defects in material and workmanship under normal use and service, provided, however, that this warranty is limited to making good at the Maule factory any part or parts thereof which shall, within ninety (90) days after delivery of such airplane to the original purchaser, be returned to Maule with transportation charges prepaid, and which upon Maule's examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and all other obligations or liabilities on the part of Maule, and Maule neither assumes nor authorizes any other person to assume for it any other liability in connection with the sale of its airplane.

This warranty shall not apply to any airplane which shall have been repaired or altered outside Maule's factory in any way so as, in Maule's judgment, to affect the airplane's stability or reliability, or which airplane has been subject to misuse, negligence or accident.

Certain items of equipment are warranted separately by their manufacturer and they request that warranty claims be made through your nearest authorized Distributor or authorized Service Center. Maule Aircraft will be glad to help you find that facility nearest to you.

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SECTION I

GENERAL DATA

GENERAL DESCRIPTION:

Type: Four place high wing cabin monoplane.

Engine Installation: Single tractor engine in nose of fuselage.

Wing: Strut braced, two spar, metal covered, modified USA 35-B airfoil. Fiberglass wing tips.

Fuselage: Welded steel tube structure.

Fuselage and tail group covered with fiberglass synthetic fabric. Fiberglass engine cowl. Aluminum skin on forward fuselage and doors.

Landing Gear: Main gear split axle type, spring-oil oleo shock absorber. Hydraulic Brakes. Steerable tailwheel (Automatic locking).

Control Systems: Dual controls wheels, rudder pedals and brakes. All controls directly cable driven. Fuel control/shut off valve is at the left lower side panel. Mechanical flap and trim controls are at the center on the floor. All other controls, switches, etc., are instrument panel mounted.

DESIGN SPECIFICATIONS:

Wing Span	29 feet 8 inches
Length	22 feet
Height	6 feet 2½ inches
Gross Weight	2300 lbs.*
Empty Weight	Approx. 1250 lbs.
Wing Loading	13.75 lbs./sq. ft.
Power Loading	12.8 lbs./BHP
Useful Load	Approx. 1050 lbs.
Seats	Four
Flaps	0°, 15°, 35°
Baggage Allowance	250 lb. Structural Limit
Baggage Compartment Dimensions	30H x 26W x 21L
Wings:	
a. Airfoil	Modified USA 35-B
b. Chord	63 inches
c. Incidence	+30 minutes
d. Dihedral	1.2 degrees
e. Sweepback	None

Cont'd

Areas:

a.	Wing, Aileron and Flaps	152.5 sq.ft.
b.	Ailerons (total)	14.5 sq.ft.
c.	Flaps (total)	14.6 sq.ft.
d.	Horizontal Stabilizer	12.6 sq. ft.
e.	Elevators (including tab)	14.0 sq. ft.
f.	Vertical Stabilizer	8.6 sq. ft.
g.	Rudder	7.0 sq. ft.
h.	Elevator Trim tab	1.1 sq. ft.
i.	Rudder Tab	.38 sq. ft.

FLUID CAPACITIES AND SPECIFICATIONS:

- a. Main Fuel Tanks - Inboard - 100 Octane

Right Main Tank	21.5 gallons total
Left Main Tank	21.5 gallons total

Note: 1.5 gallons unusable fuel per main tank

- b. Auxiliary Fuel Tanks - Outboard - 100 Octane

Right Auxiliary Tank	11.5 gallons
Left Auxiliary Tank	11.5 gallons

- c. Engine Oil (SAE 50 above 40°F, SAE 30 or 10W30 below 40°F ambient air temp, at sea level. Refer to Engine Manual for AD Oil grades.)

8.8 quart

- d. Brakes (Texaco Aircraft Hydraulic Oil 15, MIL-H-5606E or equiv.)

1 pint

- e. Landing Gear (New Holland 10W30 No.134 Hydraulic Oil or Ford Tractor ESN-M2C134-D.)

2 pints

SECTION II

GENERAL MAINTENANCE

CLEANING AND CARE OF AIRCRAFT

Keeping the performance, speed and durability that was built into your aircraft at the factory requires more than casual attention. The accumulation of dirt and oil on the outside and debris inside does affect these factors and can be a fire hazard as well. The first step to proper maintenance is a clean aircraft.

EXTERIOR

Frequent washing is good for your aircraft finish, especially during the first few months. Use any quality car wash with a soft cloth or sponge and plenty of clean water - do not use dishwashing detergent. Drying should be done with a chamois. Accumulation of oil, grease and exhaust carbon deposits should be removed frequently by using a soft cloth soaked in mineral spirits or other neutral cleaner.

For general polishing, apply a good quality car polish or wax according to instructions. Clean Plexiglas with plenty of soap and water using grit free soft cloth, chamois or sponge. Use of a dry cloth on Plexiglas will not only cause scratches but will also build up an electrostatic field which will attract dust to the surface. Blotting with a clean damp chamois will remove the charge and the dust. After cleaning, polishing with a good Plexiglas cleaning product such as "Mirror Glaze" will keep the glass clean and help polish out minor scratches.

INTERIOR

Floorboards should be vacuumed frequently and can be cleaned with any good rug cleaner.

Care should be taken in the disposal of candy wrappers, paper scraps, cigarette butts, etc. These can work their way under the floorboards and become a fire hazard, moisture trap and could jam the control cables.

NOTE: While washing the aircraft, ascertain that all drain holes are open. Clean out any debris blocking them. Accumulated water can be dangerous, so check behind the baggage compartment frequently.

Textile upholstery may be cleaned using a vacuum cleaner. Grease and oil spots on the upholstery should be treated with a spot remover or dry cleaning fluid. Do not use soap and water on textile materials.

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Vinyl upholstery may be cleaned using soft whiskbroom or suds of any mild soap (castile or olive oil base) in lukewarm water. Use water sparingly as the upholstery otherwise requires a long time to dry if water trickles through the seam stitches.

For best results, stains, especially those caused by grease or paint, should be removed from upholstery as soon as possible or they may become "set" and hard or impossible to remove. "Set" stains should be removed carefully with a clean cloth dampened in denatured alcohol. Stains caused by shoe polish can best be removed with turpentine. However, such cleaning agents are liable to affect the dust-repellent finish of the vinyl if used in excess of the actual requirements. Never use volatile solvents such as lacquer thinner, acetone, etc. on upholstery.

The cleaning should be completed by wiping the surface of the vinyl dry with a clean cloth, particularly in the seam. No attempt should be made to apply preservatives such as wax, polish, or varnishes, as these will not be absorbed by vinyl, but will merely collect dust. There are protective treatments made especially for vinyl that are commercially available and quite satisfactory.

INSPECTION GUIDES

At **25 Hour Total Time**:

Perform **50 Hour** Inspection as described below.

At **50 Hour Total Time** and every **50 hours** thereafter:

A. POWER PLANT

1. Perform appropriate inspection as called for in the engine manufacturer's Operator's Manual.

NOTE: Check rocker box cover retaining screws for tightness and security.

2. Perform appropriate inspection as called for in the propeller manufacturer's Installation, Operation and Service Manual.
3. Remove the outer muffers from the mufflers and inspect the mufflers and tubes for cracks. Inspect muffers for cracks before reinstalling.
4. Inspect gascolator, clean if necessary.
5. Inspect engine controls for security and proper operation.
6. Clean or replace air filter. (See page 24 for Bracket air filter)
7. Inspect all engine and engine mount attach bolts.
8. Inspect all engine fuel and oil lines for general condition and security.
9. Check all engine compartment electrical connections and wires for security and chafing.

B. AIRCRAFT

1. Check battery for general condition and electrolyte level, (in wet batteries only).
2. Check all main electrical connections.
3. Check fluid level in brake reservoirs.
4. Check the entire fuselage, tail surfaces and wing skins for cracks, security of fairings and general condition.

Cont'd

CAUTION: If airplane is or has been subject to excessive stress, i.e., heavy loads, adverse wind conditions, rough landings, etc., take special care in examining wing skins for any cracks. If any are found, repair before further flight in accordance with AC 43:13 and factory drawings. (Do not replace any countersunk rivets with buttonhead rivets in wing because it is not approved.)

5. Check aileron and flap skins for cracks.
6. Check the security, operation and general condition of all control surfaces.
7. Check main landing gear oleo struts for oil leaks.
8. Check general condition of tailwheel, leaf springs and spring attachment. Leaf springs should have 45° angle with no weight on the wheel. Check all bolts and nuts holding the tail springs to the fuselage. Tighten nuts, if needed, so that there is no play or side movement in the springs or their attachment.
9. Drain sumps of fuel tanks.

CAUTION: Quick drains are required in all fuel tanks and if not installed, comply with Maule Service Letter No. 32 and Service Bulletin No. 5.

10. Check tires for inflation and cuts.

At **100 Hours Total Time** and **every 100 Hours** thereafter, perform the **50-hour** inspection plus the following:

A. POWER PLANT

1. Perform appropriate inspection as called for in the engine manufacturer's Operator's Manual.
2. Perform appropriate inspection as called for in the propeller manufacturer's Installation, Operation and Service Manual.
3. Clean the engine with any good engine cleaner (Gunk, etc.) Be sure to protect magneto from getting wet.
4. Examine baffles and baffle extensions for security and cracking.
5. Clean gascolator screen.
6. Retorque bolts attaching engine mount-to-fuselage and engine-to-engine mount. Visually inspect mount structure for condition. See "Engine Mount" under "Power Plant System".

Cont'd

7. Inspect induction system and airbox for cracks and security.

B. AIRCRAFT

1. Remove right and left kick panels in cockpit, windshield side post covers and panels below seat fronts.

CAUTION: If backside of kick panel shows evidence of rudder cable rub and tape has not been placed, comply with Maule Service Bulletins No.14 and No. 17.

Examine protective rudder cable guide tubes, (located behind kick panels), if installed per Service Bulletins No.17, and attaching clamps, bolts and nuts for security and general condition.

1. Examine all front cockpit electrical connections and wires, fuel lines and fittings, control cables attachments and pulleys for security, leaks, chafing, etc.
2. Remove rear seat, rear floorboard and panel behind baggage compartment.
3. Inspect all control cables, pulleys, fairings and electrical connections and wires for security and chafing.
4. Open zippers in headliner and inspect all control cables, pulleys, fairleads and electrical connections and wires for security and chafing.
6. Remove wing root fairings and inspect control cables, fairleads, fuel lines and connections, and electrical wires and connections for security, chafing and leaks.
7. Remove wing strut fairings, top and bottom, and inspect attaching fittings and bolts for security, corrosion and cracks. Carefully inspect both sides of lift struts for abrasion, corrosion, pin holes and punctures. Any paint loss or minor corrosion should be sanded down to bare metal with fine sandpaper and metal primer should be applied. After the primer is dried, a finish coat of the desired color may be added. Powder coating is recommended if complete strut is being refinished.

WARNING: Any unrepairable dents or punctures in strut are cause for replacement of the strut.

CAUTION: If aircraft has unsealed struts, comply with Maule Service Bulletin No. 11 (AD# 98-15-18) as required, (new sealed struts are identified by two weld spots located at upper end. Removal of the upper cuff is needed to locate the weld spots). Also, do not replace lift struts with older M-4 (145 hp) struts with the 7/16" dia. lower fork thread. 1/2" dia. is required for later models.

CAUTION: Item (a)(4) of AD# 98-15-18 is very misleading as Maule never drills holes in struts to attach cuffs, door clips or any hardware and it is illegal to do so since there are no approved holes in the wing struts under the TC data. If aircraft has a modification added requiring a drilled hole in strut under a #337, refer to AD for inspection re-

quirements at the 24-month intervals. Also, inspect the area around the holes(s) frequently for corrosion or cracking (ref. Maule Service Letter #58).

8. Remove wheels and inspect wheels, tires, brake disc, bearings, brake lines and brake pad for wear, cuts, chafing, leaks and general condition. Repack wheel bearings.
9. Remove landing gear top fairings and inspect attaching fittings and bolts for security, corrosion and cracks and inspect brake hose for security, chafing and leaks. Check oleo attach bolts for bending or shearing.
10. The oleo springs occasionally become overstressed and weak due to hard usage, and if so should be replaced. This can usually be detected if the airplane sits wing low on a level surface or if the wheel camber is negative.

CAUTION: Check fluid level in the landing gear oleo struts. Fill to overflowing (no air).

CAUTION: Use Steps 9 and 10 above as a guide for inspection after an unusually hard landing or any time there is concern about the condition of the main landing gears or their attachments.

11. Remove all inspection covers/plates and inspect all visible control cables, pulleys, bellcranks, electrical wires and connections, fuel lines and fittings, nuts, bolts, etc. for security, chafing, leaks, etc.
12. CAUTION: At inspection hole in tail, visually check the pivoting action at the control cable attachment points over the full range of rudder and elevator travel. This action should be such that there are no bending loads imparted to the turnbuckles, (which are designed for straight tension load only). Any binding which causes bending of the turnbuckles should be removed. Any cable attachment parts which display appreciable corrosion must be replaced before further flight. NOTE: Pivot points must be cleaned and lubricated with any lightweight lubricating oil. Following lubrication, the cable attachments, including the turnbuckles, must be heavily coated with a good preservative such as:

Black Bear Paralketone Preventative
Black Bear Co. (preferred)
Long Island City, NY

LPS 3, Heavy Duty Rust Inhibitor
LPS Laboratories, Inc.
Tucker, GA

NOTE: Maule Service Bulletin No. 9 covers corrosion resistant parts replacement and is particularly recommended for airplanes operating in a potentially corrosive environment. Compliance to this Service Bulletin provides for larger stainless steel turnbuckles and corrosion resistant steel fasteners and attachment details for the elevator cables.

Cont'd

13. Lubricate all chains and points of rotation on sprockets, pulleys and bellcranks,

14. Inspect and lubricate all control surface hinges and control horn connections.
15. Inspect and lubricate door hinges and latches and seat tracks.

CAUTION: Carefully inspect all door hinge bolts and nuts for condition and security. If using elastic nuts on door hinges, they must be replaced with castle nuts and cotter pins. Refer to Maule Service Letter No. 61.

16. Lubricate rudder pedals and rudder bar points of rotation.
17. Check control rigging and cable tensions.
18. Check and clean vacuum system regulator valve filter and intake filter.
19. Check the pitot static system for leaks.
20. Ensure that all applicable Airworthiness Directives and Maule Service Letters and Bulletins that are mandatory have been complied with.

RIGGING PROCEDURES

1. LEVELING:

Laterally: The airplane can be accurately leveled laterally using the front spar attach bolts. Turn these two bolts so that a flat on the head is "up". Fabricate two equal length spacers (1½ inch minimum length) which can be placed on the

bolt heads. Place a 48 inch level across the two spacers and block under the landing gear to center the bubble.

Longitudinally: Using a level thirty-six (36) inches long or longer, place it on the leveling lug and leveling mark thirty-one (31) inches to the rear of the leveling lug on the bottom of the right wing root. Raise the tail to bring bubble to center.

2. DIHEDRAL ANGLE:

To check dihedral angle at the front spar, remove both top wing root fairings to expose the front spar attach bolts. Stretch a string along the top of the wing above the front spar from wingtip to wingtip and draw it tight. The end of the string can be attached to tie down fittings underneath the wing to hold tautness. Be careful to protect the edges of the wingtips from string chafing.

Find the row of flush rivets on the top of the wing from wingtip to wingtip at the front spar location. Then find the perpendicular row of round head rivets running from the leading edge to the front spar located at 127.5 inches outboard from the fuselage attach bolts for both left and right wings (where the leading edge wing skins overlap). Using masking tape or equivalent, tape the string down at the intersection of these two rivet lines.

At the inboard end of the front spar, measure the distance from the top rear edge of the spar cap to the spring for both wings. Adjust the front wing struts so as to have a measurement of 2 3/4 inches on each wing (plus or minus 1/8 inch) at this location. It is recommended that the rear struts be removed while adjusting dihedral. The wing must be supported while the front strut is being adjusted. For rear strut adjustment, see section on Washout.

CAUTION: Be sure that the strut fork is not extended more than 1 inch of threads from the strut end to the end of the fork threads (not including the jam nut). There must be at least 1 3/8 inch of thread engagement into the strut.

3. WASHOUT:

To adjust the washout in the wings, proceed as follows:

Put a leveling protractor chordwise on the underside of the wing root and adjust it to a zero degree reading. Now put the protractor chordwise just inboard of the wing tip and adjust the rear strut to give 1/2° trailing edge up, difference from the wing root angle.

4. TAIL ASSEMBLY:

With the airplane in level position, the stabilizers should be leveled at their rear spars. The hinge line should be straight from tip to tip. The vertical stabilizer should be plumb at the hinge.

5. AILERONS:

Adjust the ailerons to streamline position by placing a straight edge on the bottom of the wing, chordwise, at the inboard end of the aileron. Then adjust the turnbuckles in the aileron system so the control wheels are centered and there is a gap of zero to ¼ inch between the straight edge and the trailing edge of the aileron.

Check the aileron travel for $20^{\circ} \pm 1^{\circ}$ up and $20^{\circ} \pm 1^{\circ}$ down. Adjust turnbuckles to stay within these limits. Proper cable tension is 15 to 25 lbs.

6. FLAPS:

Correct flap operation is dependent upon correct cable tension which is controlled by the spring on the bellcrank in the wing. If the spring tension has diminished due to use or over extension, this will reduce the degree of flap extension due to air loads on the flaps. If springs appear weak, remove and check the spring tension. One inch of travel should yield a force of twelve (12) to fifteen (15) pounds. If the tension is less than above, replace both springs with new springs.

After verifying acceptable spring tension, check cable adjustment. Changes can be made to flap retract cable via the turnbuckle located behind the rear cabin bulkhead cover. Adjust retract cable as tight as possible without moving flap from its 0° position.

A limit cable is installed at the inboard flap hinge, which should be adjusted so that the flaps will not hit the rear windows. The cable must allow the correct full flap angle (35°).

The bellcrank in each wing should rest against the cork pad glued to the rear wing spar while in the retracted position. While the bellcrank is in the retracted position the flaps should be set to 0° plus or minus one half ($1/2$) degree using the push rod located on each flap.

To adjust the balance cable turnbuckle located above the headliner above the aileron turnbuckles, slowly extend the flaps while watching both left and right flaps. They should initially extend evenly and together. If on the initial extension, the flaps do not extend symmetrically, tighten or loosen the turnbuckle as required.

After the above adjustments have been made you should check for proper deflections: 15° first notch and 35° second notch $\pm 3^{\circ}$.

7. RUDDER:

Check the rudder travel for $21^{\circ} \pm 1^{\circ}$ right and left. Adjust the rudder travel by backing off on the locknuts on the rudder stops located on fuselage frame and screwing stop screw in or out, whichever is needed.

8. ELEVATORS:

Elevator control movements are up $25^{\circ} \pm 2^{\circ}$, down $21^{\circ} \pm 1^{\circ}$. Stops are located on the vertical tail rear spar just inside the inspection plate. Proper cable tension is 25 to 40 lbs.

9. ELEVATOR TRIM TAB:

Elevator trim tab movement is $11^{\circ} \pm 3^{\circ}$ up, $25^{\circ} \pm 1^{\circ}$ down. If adjustment is needed, it may be done at the turnbuckles located just aft of the trim control. Proper cable tension is 15 to 25 lbs.

10. RUDDER TAB:

This tab is interconnected with the aileron system to automatically coordinate aileron and rudder controls for simplified handling in the air. (It may be used as a rudder trim tab to make the airplane trim in cruise.) This tab may be ground adjusted by changing to the position of the tab cables where they attach to the aileron cables located just over the front doors on the inside of the airplane. Normally, the tab should be streamlined with the rudder when the aileron and rudder controls are centered.

The tab travel is $48^{\circ} \pm 4^{\circ}$ right or left. Proper cable tension is 5 to 10 lbs.

CAUTION: Make sure tab is free at extreme aileron travel.

NOTE: The "Rudder Trim Control" on the instrument panel pulls on a spring attached to the right rudder pedal. It is not connected to the tab on the rudder.

LUBRICATION

1. Main wheel bearings - Use good quality wheel bearing grease.
2. Oleo shock struts – Use New Holland No. 134 hydraulic oil or Ford Tractor No. ESN-M2C134-D. 10W30 engine oil may also be used.
3. Landing gear hinges – Use engine oil.

4. Control Column - Apply light coat of graphite base lubricant to aileron balance chain, torque tube and control guide. Use lightweight lubricating oil on all other bearings.
5. Control pulley bearings and control surface hinges - Use lightweight lubricating oil.
6. Flap bellcrank and mechanism - Use lightweight lubrication oil.
7. Aileron and flap hinge - Use lightweight lubricating oil.
8. Elevator and trim tab - Use lightweight lubricating oil.
9. Tailwheel - Good quality wheel bearing grease to tailwheel bearings through zerk fitting. Same for fork spindle roller bearings, if necessary. See tailwheel maintenance section under "Landing Gear, Wheels and Brakes".

FABRIC REPAIRS:

(Applicable to polyurethane paint on Ceconite fabric only)

(This installation is approved for retrofitting-no M-4-180C's were originally manufactured with this paint/covering)

REPAIRS:

1. Small holes and damaged areas can easily be repaired without removing the existing paint topcoat.

2. Trim the damaged area to a rectangular or circular shape.
3. Lightly scuff sand with #320 or #400 wet/dry sandpaper approximately 2 inches around the repair area.
4. Mix one part gray urethane primer catalyst with two (2) parts gray urethane primer (2:1 ratio - 2 parts paint/1 part catalyst), mixing a very small amount only for coating the sanded area around the repair.
5. Apply one coat (this may be brushed) to the sanded area slightly larger than the size of the patch to be applied. This application aids in total adhesion to the topcoat and offers a fresh chemical adhesion base for the repair patch.
6. Allow prime to dry for 4 hours.
7. Apply a coat of urethane adhesive (thinned one to one (1:1) with urethane adhesive thinner by volume) to the primed area slightly larger than the repair patch size. Allow this to dry for approximately 15 minutes.
8. Apply a second coat of the thinned urethane adhesive and lay the patch in the wet bed of adhesive, smoothing the edges while applying a topcoat of the thinned urethane adhesive, working the edges down. Allow to dry at least 8 hours prior to any shrinkage.

SHRINKING THE REPAIR AREA:

1. When using an iron to shrink the patch, always use a piece of aluminum foil over the area to be tautened and the surrounding undamaged topcoat. This is to prevent any scorching of the topcoat. Follow the procedure previously mentioned (primer and finish coat application). Take care to feather sand as required during primer procedure to feather the repair patch and blend in prior to topcoat spraying.

SPECIAL PRECAUTIONS:

1. For any repair or damaged area refer to FAA AC 43.13 1B, paragraph 169. Only use equal or next heavier weight fabric for repair patch. Do not substitute any other products or brands in this procedure.

SECTION III

MAJOR COMPONENT PARTS

WINGS:

The complete wing is of metal construction (2024-T3 aluminum) with a fiberglass wing tip.

Spar root end strut fittings are made of (2024-T4 aluminum).

LIFT STRUTS:

The lift struts are streamlined tubes attached to the wing and fuselage by means of steel bolts. When inspecting the struts, check for nicks and dents and see that all bolts are snug (not tight).

In handling the airplane on the ground, care should be taken to prevent damage to the lift struts by pushing or lifting in the middle of the strut. Frequent inspection of the struts should be made and any paint loss or minor corrosion should be sanded down to bare metal with fine sandpaper and metal primer should be applied. After the primer is dried, a finish coat of the desired color may be added. Powder coating is recommended if complete strut is being refinished.

WARNING: Any unreparable dents or punctures are cause for replacement of the strut. If airplane has original unsealed struts, insure compliance with AD No. 98-15-18 (Maule SB No. 11) (See also page 7, item 7.)

FUSELAGE:

The fuselage is a welded truss type structure having an integral vertical tail fin. Chrome molybdenum steel (4130) is used for all tube members, control fittings, floor supports and seat members. Door frames and other nonstructural parts are made of cold rolled steel (1008 to 1015).

If it becomes necessary to replace any fuselage members, sleeve type splices should be made in accordance with practices outlined in FAA AC 43.13-1B, Aircraft Inspection and Repair.

The forward fuselage section is aluminum covered (5052-H34 or 2024-T3). The firewall and bottom fuselage just aft of the cooling air egress are made of .018 CRS (1008) and is cadmium plated or primed with zinc chromate or are made of .018 galvanized sheet steel.

The aft fuselage section is covered with fiberglass fabric and standard dope and paint finish. This covering is the Razorback method as per Instruction Manual No. 39-5 by Planters, Inc. Blytheville, AR. This fabric need not be pulled or punch tested.

SURFACES AND CONTROLS

AILERONS AND FLAPS:

The ailerons and flaps are aluminum alloy structures covered with 2024-T3 skin.

The aileron control system consists of a chain drive connecting the two control wheels and is attached to the necessary cables which are routed over pulleys through the fuselage and into the wing section to the aileron horns.

The flap control system consists of a control lever, which has two active positions, 15° and 35°. This is connected to the control cables which are routed to the flap through the fuselage and wing to the flap bellcrank which operates the flap by means of a push-pull rod attached to the inboard hinge fitting.

ELEVATORS:

The elevator has chrome molybdenum (4130) internal structure covered with fiberglass fabric. Inspect for corrosion. Drain grommets should be kept open. The hinge attachments should be lubricated with light engine oil. Accumulations of dust and dirt on hinges should be removed.

STABILIZERS:

The stabilizers have chrome molybdenum steel (4130) internal structures covered with fiberglass fabric. Inspect for corrosion including elevator hinges and struts.

Steel tie rods brace the stabilizers to the vertical stabilizer and fuselage. These tie rods should not be rigged tighter than necessary so high loads may be imposed on other parts of the tail surfaces or fuselage. In adjusting the tension of the tie rods, care should be taken so that marring the rods will not result. The threads at each end of the tie rods must close the inspection holes in the end fittings. An inspection of the tie rods and fitting should be made to check cotter pins, lock nuts, and to see if they have been damaged in any way.

RUDDER:

The rudder structure is very similar to the elevators. No maintenance other than inspection for corrosion is needed. The hinges should be cleaned and lubricated with light engine oil at frequent intervals. The cable attachment points should be checked for wear and corrosion.

TRIM AND RUDDER TABS:

These surfaces have low carbon steel frames with aluminum alloy skin (2024-T3).

These surfaces need no maintenance other than inspection for corrosion. The hinges should be lubricated at frequent intervals using light engine oil.

LANDING GEAR, WHEELS AND BRAKES

MAIN LANDING GEAR:

TOE-IN:

If ground handling of the airplane makes toe-in suspect, inspect main landing gear as follows:

1. With airplane unloaded, jack-up airplane on one side and spin tire. If center groove runs true, do same on other side. If not, mark tire, or both tires as needed, while spinning, with black marker pen.
2. Support tail to level (flight attitude) with main tires on floor. Measure from the floor to centerline of axle and using that dimension, measure up from floor on front of tire in center and on back of tire and mark. Do same on other side.
3. Measure between grooves and/or mark(s) at height marks, across front and then rear. The difference should be 0" to 1/4" toe-in for 7:00 tires and 0" to 3/8" toe-in for 8:50 tires.

LANDING GEAR SHOCK ABSORBER:

This gear is supported by two spring oil type oleo struts which must be full of oil at all times. The oil may be checked by removing a 1/8" pipe plug at the top end of the strut. If oil is needed, use New Holland No. 134 hydraulic oil or Ford Tractor No. ESN-M2C134-D. 10W30 engine oil may also be used.

DISASSEMBLY OF OLEO STRUT:

1. To remove the strut, the weight must be taken off of the gear. The bolt at the top and bottom can then be removed, freeing the strut. Higher strength top bolts are available to eliminate bending from hard landings.
2. Remove four (4) bolts at top of strut.
3. Remove oil filter plug.
4. Pull out cylinder head and spring assembly.
5. To remove spring, take all nuts off of strut shaft and press piston upward to free bolts for removal. Remove bolts, and piston will come out of end of shaft.
6. Replace worn parts, weak spring, etc. New replacement springs are stronger than the original springs. The "O" ring on the strut shaft and on the cylinder head should be replaced at this time also.

ASSEMBLY OF OLEO STRUT:

1. Reassembly is the reverse of steps 5 and 6.
2. Fill cylinder 1/2 full of hydraulic oil.
3. Align cylinder head bolt holes with cylinder bolt holes and insert spring assembly.
4. Install cylinder head bolts, filler plug and safety.
5. Reinstall strut on airplane being careful to get the spacers in at the top attaching bolt.
6. Work airplane up and down on strut and check for oil leaks.

7. Recheck and fill to top.

LANDING GEAR LEGS AND AXLE:

The landing gear is made of chrome molybdenum steel (4130) and has an aluminum skin (2024-T3).

These need no maintenance other than inspection for corrosion. The hinges should be lubricated every hundred hours using a light engine oil.

MAIN WHEELS AND BRAKES:

See Equipment Lists for items installed and options.

To change a tire, follow these steps:

1. Chock opposite main wheel and tailwheel.
2. Raise wheel with a light scissors or a small bottle jack placed about 2" inboard of brake mount plate.
3. Remove brake calipers by removing two (2) brake bolts.
4. Remove hub cap, cotter pin and retainer nut.
5. Remove wheel.
6. Deflate tire by removing valve core.

WARNING: Failure to fully deflate the tire prior to separating the wheel halves (Step 8) may result in personal injury.

7. Break tire bead on both rim halves.
8. Remove wheel rim through-bolts.

Cont'd

9. Clean rims thoroughly.
10. Remove bearings and check for scoring, galling and corrosion. Replace as required.
11. Regrease and assemble. (Tire and wheel rims are prebalanced. Balance points are usually marked by a colored dot.)
12. Lightly inflate to prevent pinching of tube when tightening through-bolts.
13. Inflate tire to 35 psi to seat tire on rims and back off to 25-26 psi normal pressure. (16-18 psi for oversize tires.)

14. Thoroughly inspect landing gear and axle; check that axle attach bolts are torqued.
15. Reinstall wheel, tighten retaining nut until all play is removed, back off nut to first available cotter pin hole, and install new cotter pin.
16. Inspect brake pads. Replace if necessary.
17. Replace brake calipers and hub cap.

BRAKE CYLINDERS:

The hydraulic brakes are actuated by two (2) master cylinders on the left side and two (2) slave cylinders on the right side.

Check hydraulic oil level in master brake cylinder reservoirs. Proper level is 1/4 inch from top of cylinder.

Bleeding brake system may be done as follows:

1. Fill reservoir if necessary.
2. Replace plug in reservoir.
3. Connect a clear plastic tube to the bleeder valve on the wheel brake cylinder with the free end of the tube in a container of hydraulic brake fluid.
4. Actuate brake pedal full stroke with the bleeder valve open which will force fluid into the receptacle where a check can be made for escaping air bubbles. Continue to actuate pedal until no more air bubbles are observed.
5. When no bubbles are observed, close the bleeder valve after pedal has returned to "off" position. Remove the plastic tube.
6. Recheck reservoir level and fill as necessary.

MAINTENANCE HINTS ON HYDRAULIC BRAKES:

Excessive pedal travel:

Probable cause

Corrective Action

- | | |
|--------------------------------------|--|
| 1. Normal wear of brake pad at wheel | 1. If pad is worn thin, replace with new pad. |
| 2. Leak in system | 2. Inspect all attachments and fittings in brake system. |

- | | |
|---|--|
| 3. Air in system | 3. A springy, soft action of the pedal indicates air in the system. An excessive amount of air in system will allow the pedal to continue traveling under normal pressure. In either case, the system should be bled and refilled. |
| 4. Lack of fluid in reservoir | 4. Air will enter system if the reservoir runs dry. Inspect at regular intervals and keep reservoir full at all times. |
| 5. Vent plug stopped up | 5. If vent hole in reservoir plug becomes stopped, there is a possibility that a partial vacuum will be created in the system, which will interrupt the fluid flow in the system. Clear vent hole. |
| 6. Improper bleeding - air mixed with fluid | 6. Bleed brakes. |
| 7. Master cylinder cup or "O" ring wear | 7. Replace brake cylinder cups and "O" rings. |
| 8. Wheel cylinder leakage | 8. Replace wheel cylinder seals. |

DRAGGING BRAKES:

NOTE: These disc brakes have no spring return of the pads and thus will always drag slightly. Do not be concerned unless this drag is noticeable while taxiing.

Probable Cause

Corrective Action

- | | |
|-----------------------------|--|
| 1. Foreign matter in system | 1. If dirt is found in the system, the master cylinder and brake assemblies must be dismantled and parts cleaned with alcohol and reinstalled. Flush system and install new brake fluid. |
|-----------------------------|--|

Cont'd

- | | |
|----------------------------|--|
| 2. Binding of brake piston | 2. Dust or dirt mixing with brake fluid at the brake may become gummy and cause sticking of the brake piston. Remove parts and clean and fill system with new fluid. |
| 3. Use of improper fluid | 3. Improper fluid may destroy the seal and packings. Use only the recommended hydraulic fluid. |

MAULE TAILWHEEL

The tailwheel assembly consists of a Maule SFS-P8 full swivel, steerable tailwheel and a leaf type spring mounting. This unit should be lubricated as noted in the inspection guide in the manual. Keep air pressure at 40 psi. If tailwheel is a Maule SFS-P8B and if shimmy of the tailwheel becomes a problem, it should be lubricated and adjusted as follows: (See Fig. 1 for detailed breakdown.)

A. DISASSEMBLY

1. Remove cap (74B) - may be pried off with flat side of a screwdriver.
2. Hold the fork (69B) and loosen the nut (A1).
3. With the nut removed, carefully remove the fork spindle from the rest of the assembly. Slowly rotate the fork back and forth while withdrawing it and collect the loose parts.
4. Clean all of the metal parts in solvent. Inspect all parts and replace any parts that exhibit excessive wear.

B. SHIM SELECTION

1. Position the bearings (A5) in bracket (71B) and slide the fork (69B) through the bearings. Do not install any of the other parts at this time.
2. Slide lock ring (73B) over the threaded end of the fork spindle and run nut (A1) down until it bottoms on the lock ring.
3. Tighten the nut moderately and note whether or not there is any end play in the bearings. If there is no end play and no excessive rotational drag, shimming will not be required. If there is any bearing end play, remove the nut and spindle and install one (1) shim (83B) on the spindle and repeat the check. Normally only one (1) or two (2) shims will be required to remove any bearing clearance. Too many shims will cause the bearings to drag when the nut is tightened.

FIGURE 1

C. ASSEMBLY

1. Grease pack roller bearings (A5) and lock pin (13AB) with wheel bearing grease. Grease the parts adjacent to lock pin. Do Not grease friction washer (72B-4) or the parts adjacent to it.
2. Place the roller bearings (A5) in their races, the felt seals (78B-2) on the bearings, and the three (3) springs (76B) in the three deeper holes in bracket (71B). Place friction ring assembly (72B-3) over the springs with the pin in the shallow hole in bracket (71B). Grease may be used to hold the foregoing parts in place. Do not allow any grease on the friction washer surface of the friction ring assembly (72B-3).
3. Place shim(s) (83B) on lower shoulder of the spindle on fork (69B). Place the friction washer (72B-4) on the large diameter friction surface of the fork.

4. Carefully slide the fork spindle through the friction ring and bearings until the friction washer is bottomed against the springs. Make sure that all parts stay in place.
5. Assemble lock ring (73B), arm (6) (with lock pin (13AB) and spring (14) installed), shield (36), and pins (60AB) together as a unit. Make sure that the key end of lock pin 13AB) is properly aligned with the slot in lock ring (73B).
6. Slide the lock pin subassembly over the threaded end of the fork spindle being careful to keep the parts together. It will be necessary to retract lock pin (13AB) slightly to clear wear plate (75B) as the assemblies are brought together.
7. Thread on nut (A1) and torque to 15-20 foot pounds. Fork should rotate by hand, but with some drag, which is normal and caused by the friction washer.
8. Install cap (74B) with soft mallet. Check wheel rotation. There must be no play in the bearings. Wheel should rotate with a slight drag.

D. TAILWHEEL INSTALLATION

1. Check all bolts and nuts holding the tail springs to the fuselage. They must be tight so that there is no play or side movement in the springs or their attachment.
2. Tighten the bracket bolt and back off enough to install the cotter pin. There must be no looseness or play between the bracket (71B) and the spring.
3. Install the connector springs, using the heavier spring on the right side. Install the springs so that the light spring is compressed approximately 1/2 to 3/4 inch.
4. Inflate the tire to approximately 45 psi.

POWER PLANT SYSTEM

The power plant system consists of the engine, engine mount, propeller, cowl, engine controls, exhaust, air intake system and fuel system.

ENGINE:

Engine instructions covering the care and operation are covered in the engine manufacturer's Operator's Manual.

ENGINE MOUNT:

The engine mount is a welded structure of chrome molybdenum steel (4130) tubing. The engine is attached to the mount by means of four point suspension to four (4) mounting pads on the engine case. Each leg attachment incorporates a shock mount designed to absorb torsional fluctuation and vibrations of the engine. The engine mount assembly is bolted at the firewall to the fuselage structure by means of four (4) 3/8" attaching bolts, (requiring a torque of 13.3-15.8 ft. lbs.) which should be checked for tightness periodically.

An extremely close visual inspection of the engine mount should be made to periodically check for cracks, dents, weld failures, etc., of the mount tubular members as well as the general condition of the rubber mounts. At regular intervals, the attaching bolts at the engine should be checked for tightness (required torque value of 20 +2 in. lb.) (using AN310 castle nuts). The rubber engine mounts should be carefully inspected and replaced if necessary at each 100 hour inspection. Excessive engine vibration at various RPM ranges should also prompt their inspection. Care should be exercised to prevent the rubber mount's contact with oil as this may result in their premature deterioration. CAUTION: When torquing any engine or mount bolts, precaution should be taken against any over-tightening, as this also may cause early failure.

PROPELLER:

The propeller manufacturer's Installation, Operation and Service manual contains information on the proper use and care of the propeller.

COWLING AND BAFFLING:

The cowling consists of an upper and lower section. Removal is accomplished by unlocking the dzus fasteners and removing the AN526 screws.

A periodic inspection of the cowling should be made checking for cracks, chafing, security of attachment, etc.

Baffling should be checked for security and the rubber sealing extensions should be checked for wear and security. When the cowl is installed, these sealing extensions should lay up, forward or inboard, and provide a good seal against the cowl.

AIR FILTER:

Visually inspect at each periodic maintenance. Follow cleaning instructions as printed on air filter. Clean periodically as determined by environmental conditions encountered. Replace filter when cleaning no longer services unit.

BRACKETT AIR FILTER:

Service by replacement of element only when:

- a) Every 12 months regardless of hours used,
- b) or, every 100 hours use,
- c) or, when operating in extremely dusty conditions, change frequently; use your good judgment.

Special instructions for new element: Squeeze out all excess wettant in element prior to installation. And DO NOT WASH OUT wettant as this will destroy some of the filter's efficiency. Be sure safety pin is in place after installing.

CAUTION: When replacing Brackett Air Filter, insure compliance with AD# 96-09-06.

EXHAUST SYSTEM:

Check mufflers and tailpipes for cracks. Check attachments for security. Note that the tailpipe clamps and the muffler-to header attachments should not be tightened to the point of rigidity, but should be loose enough to be moved easily by hand.

Check the heater shell retaining screws for security and ensure that hot air hoses are clamped tightly and are not worn or chafed.

FUEL SYSTEM

Two (2) 21.5 gallon main fuel tanks, mounted in the inboard end of the wings, have front and rear outlets.

The fuel lines running from these tanks terminate at the fuel selector valve on the left side kick panel. The fuel then runs through the firewall to the fuel gascolator. Fuel runs from the gascolator to the electric fuel boost pump, to the engine driven fuel pump, and then to the carburetor.

If installed, two (2) auxiliary wing tip fuel tanks, eleven and one-half (11.5) gallon capacity, are mounted in the second from the outboard wing bay. They are fuel transfer tanks and simply supply fuel to the main tank through a small vibrator pump.

CAUTION: Main and Auxiliary fuel tanks must have quick drains installed in each sump, (ref. Maule Service Letter No. 32 and AD #84-09-07).

Cont'd

The fuel lines should be checked for cracks and chafing every 100 hours or annually and the gascolator should be cleaned at the same time. (Always safety wire the nut under bowl upon reassembly.) The auxiliary tank transfer pump strainers should be cleaned at the same interval. This is done by removing the pump bottom with a wrench. The pump is on the rear spar, inboard of the auxiliary tank, and the bottom is exposed.

ELECTRICAL SYSTEM

The electrical system is a 14-volt, 50 amp, direct current, single wire circuit using the airplane structure as a ground return to the battery. All wiring in the airplane is fabricated into harnesses, which are groups of related wires tied together. Most of the harnesses originate at circuit breakers on the main bus (left side of instrument panel) and terminate at the load (light, pump motor, etc.) A wiring diagram is shown at the end of this manual.

CAUTION: Addition(s) of electrical equipment must not cause the total load to exceed 50 amperes. A 50 amp circuit breaker is installed in aircraft.

BATTERY:

A lead plate type storage battery rated at 12 volts is installed in the battery box attached to the forward left side of firewall. The battery supplies current for the airplane electrical system when the master switch is in the "ON" position only. A heavy-duty battery solenoid switch is installed next to the battery box and is controlled from the Instrument panel by a master switch.

The battery is the sealed type, with the base being integrally vented. Tubes attached to the case vent the battery below the fuselage through the lower engine cowling egress. Battery caps should be kept tight to prevent electrolyte spillage. If spillage does occur, the affected area should be cleaned with a liberal application of an acid neutralizing solution such as baking soda and water.

This battery is considered fully charged at a hydrometer specific gravity reading of 1.280. A low charge would be 1.240 or lower. Operating with a low charge will shorten the life of the battery and can be prevented by recharging or operating with the electrical equipment turned off until the battery has been sufficiently recharged.

GENERATOR or ALTERNATOR AND REGULATOR:

To protect the generator or alternator and battery from an overcharge, the voltage regulator should be checked for a charging voltage of 13.7 to a maximum of 14.0 volts with the engine operating at high speed.

Electric Schematic

The wire numbering system has been designed to ease tracing a faulty wire. The code is as shown below the schematic. Wires are plainly labeled near each end.

14 Volt

MAULE AIRCRAFT CORPORATION
MAINTENANCE MANUAL
*FOR **M-4-180C***