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AIRCRAFT CARBURETOR SERVICE MANUAL

MODELS

MA3A

MA3PA

MA3SPA

MA4SPA

PRECISION
AIRMOTIVE CORPORATION

FSM-OH1
March 30, 1993

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WARNING

WARRANTY AND LIABILITY INFORMATION: The use of parts NOT AUTHORIZED by Precision in Precision Airmotive aviation carburetors constitutes an alteration or modification of the carburetor and voids all warranties. Precision Airmotive will accept no warranty or responsibility/liability for carburetors containing UNAUTHORIZED parts. Any operator and/or overhaul facility responsible for installation of UNAUTHORIZED parts may have the sole and full liability for property damage or injury, including death, arising from any malfunction of the carburetor in which such parts are installed. This manual is not applicable and should not be used for the installation of parts NOT AUTHORIZED by Precision Airmotive.*

*Reference Precision Airmotive Service Bulletin MSA-5 and Service Information Letter 10-21-92.



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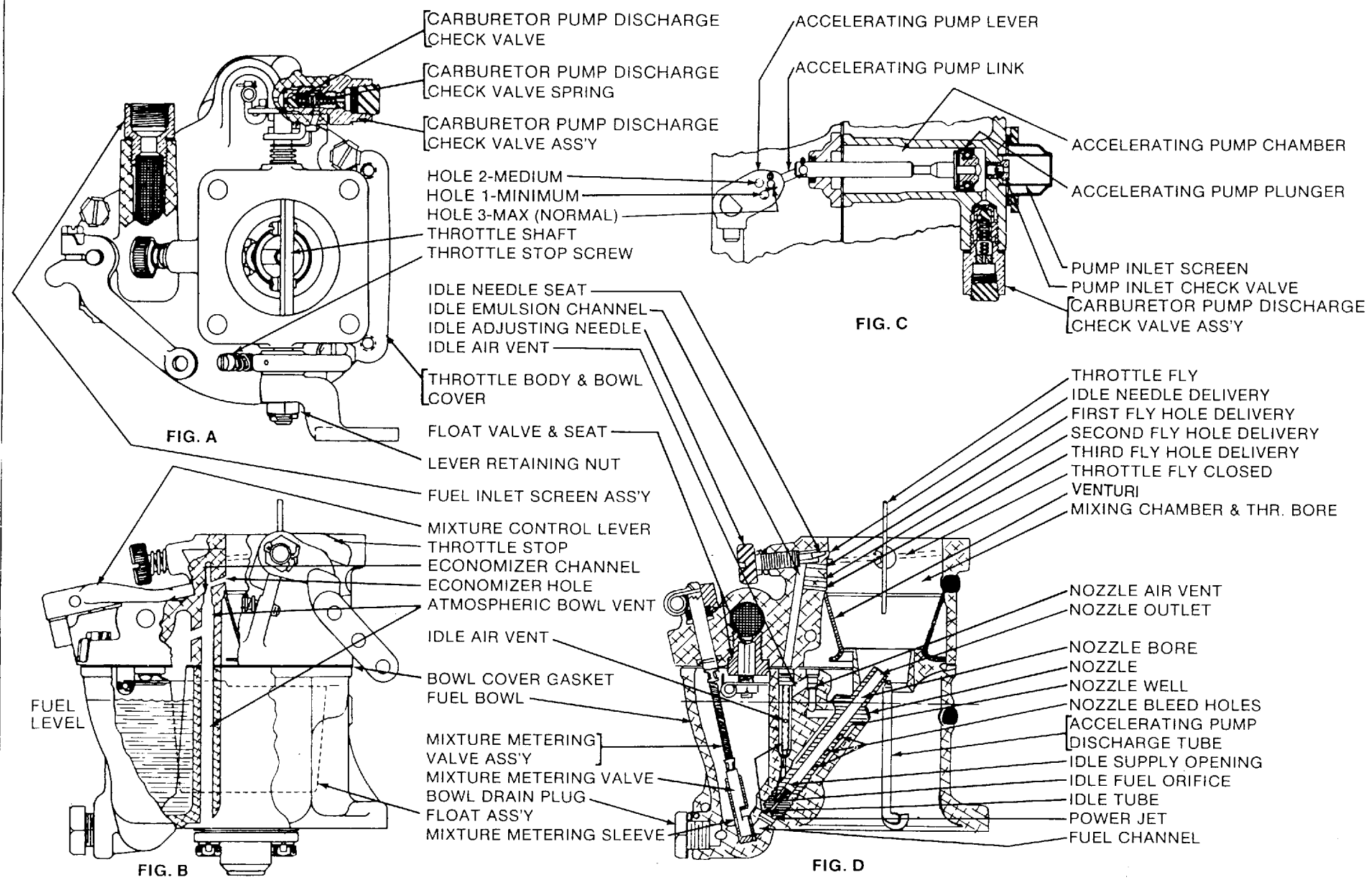
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MODEL MA 4SPA

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NOTE

Models MA 3A, MA 3PA, MA 3SPA, and MA 4SPA are very similar and this overhaul section will apply to all.



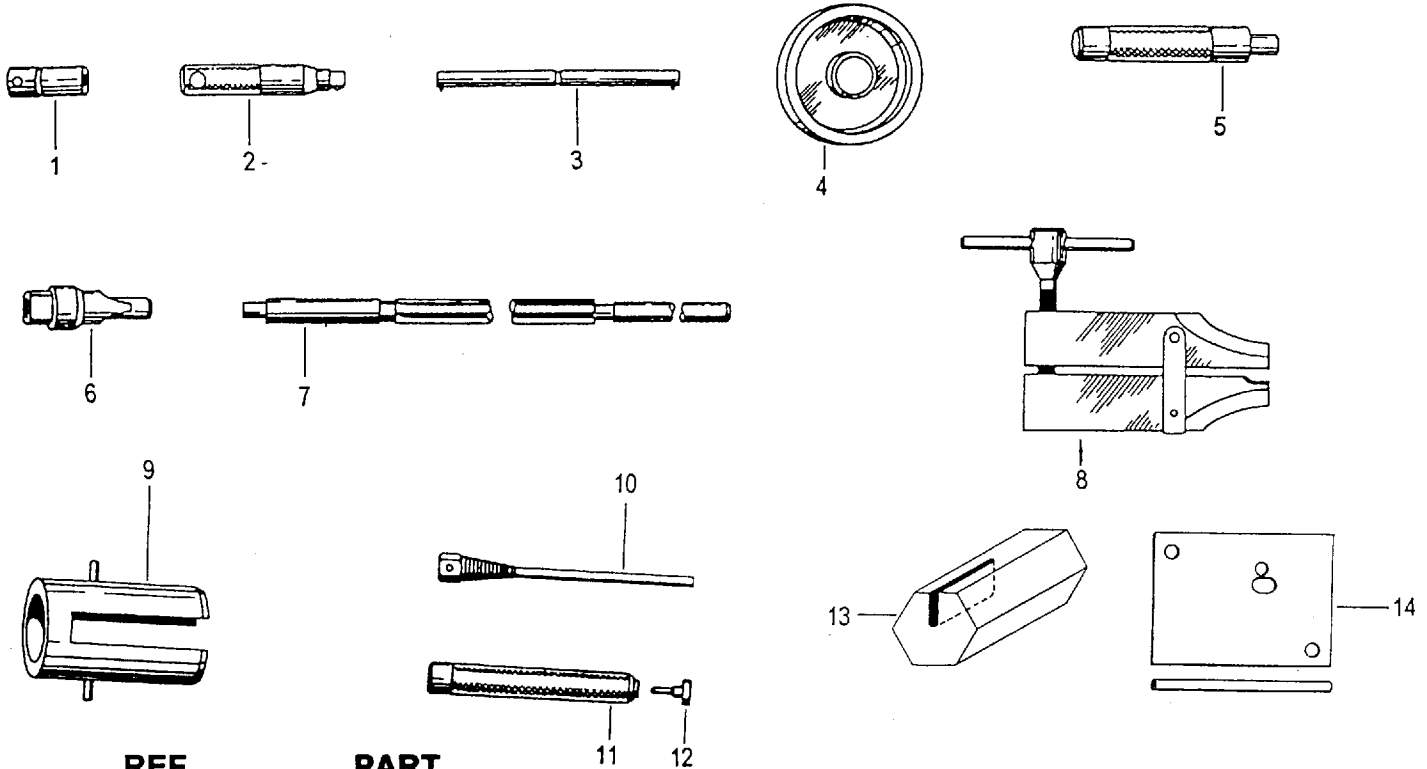
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Model MA 3A does not have an accelerating pump circuit. (Example Part No. A10-3103-1 as used on the Lycoming O-235 C1)

SPECIAL TOOLS



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REF NO	PART NO	NOMENCLATURE
1	M-7	Nozzle wrench 1/2 inch (Snap-On No. SF-161)
2	M-12	Socket extension
3	M-13	Socket extension handle
4	M-83	Venturi assembling tool
5	M-86	Throttle shaft bushing driver
6	M-104	Float valve seat remover
7	M-108	Throttle shaft bushing reamer
8	M-109	Throttle valve bolt clincher
9	M-120	Venturi extractor
10	M-122	Throttle shaft bushing remover
11	M-123	Pump stem packing stake punch
12	M-123	Pump stem packing stake pilot
13	M-133	Torque tool for pump discharge tube
14	M-134	Locating tool for pump discharge tube
15	M-510	Float clearance gage (Not shown, Ref. pg 14)

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN ADVERSE CARBURETOR PERFORMANCE AND ENGINE OPERATION.



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STANDARD MA 3 & 4 DISASSEMBLY PROCEDURE

Refer to exploded view, pages 8 & 9 for

Complete Parts Reference Numbers

- 1) Separate the throttle body and bowl by bending tab washers (1) and removing bowl cover screws. (2) Note: Old models may have safety wire and cross hole drilled screws.
- 2) Tap casting lightly with a soft faced hammer to loosen and pull castings apart, being careful not to damage the float.

THROTTLE BODY DISASSEMBLY

- 3) Remove float shaft cotter pin (3), shaft (4), float (5), retraction clip (6), and float valve (7).
- 4) Discard bowl gasket (8).

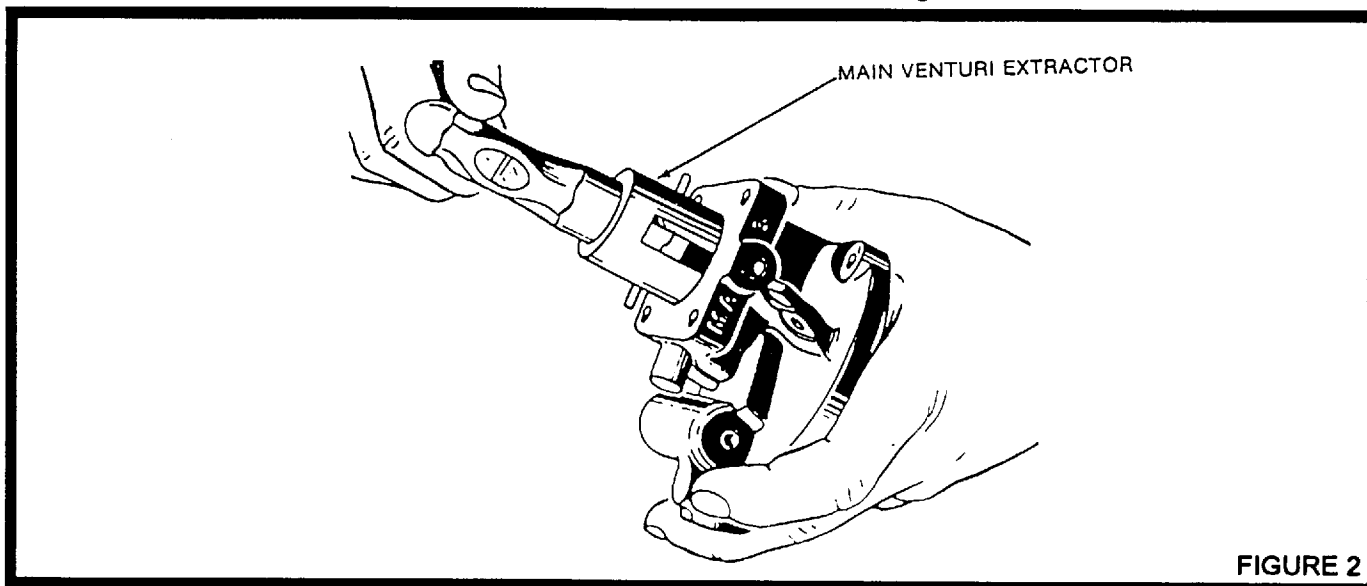
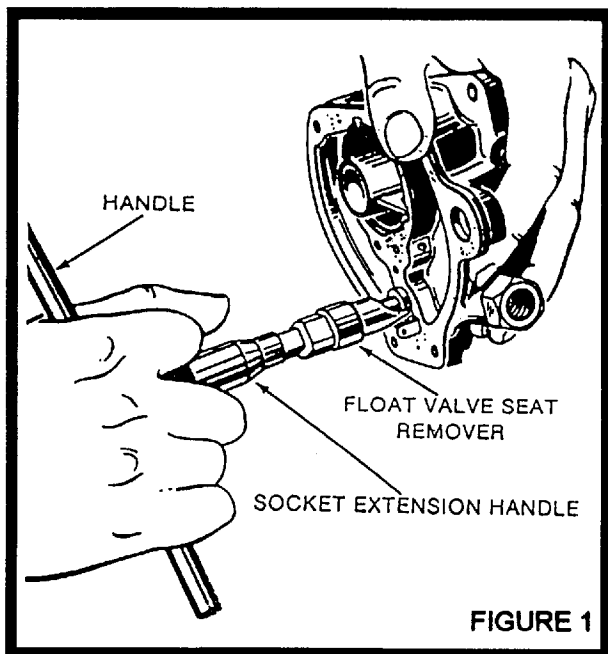
- 5) Remove pump link cotter pins (9), pump link (10), and pump plunger assembly (11). Note hole location of pump link in pump lever (13).
- 6) Remove accelerator pump lever screw (12), lever (13), and throttle opening spring (14).
- 7) Remove pump packing washer (15) and pump packing (16) with a pointed tool or small screw driver.
- 8) Remove mixture control clamp screw (17), and safety washer (18).
- 9) Remove mixture control lever (19), lock wire loop (20), spring (21), thrust washer (22), and packing (23).
- 10) Remove mixture control valve (24), horseshoe washer (25), and gasket (26).
- 11) Remove float valve seat (27) and gasket (28) using tool M-104 or a large screw driver. See Figure 1.
- 12) Make note of throttle lever position before removal. Remove throttle lever cotter pin (29), nut (30), and lever (31).
- 13) Remove throttle valve screws (32), valve (33) and throttle shaft (34).
- 14) Remove throttle adjusting screw (35), and spring (36).
- 15) Remove idle adjusting needle (37), spring (38), and retainer (39). NOTE: some models do not use retainer (39). Refer to appropriate parts list section for proper configuration.
- 16) Venturi (43) seldom needs service, however if necessary, press out the venturi from the throttle valve side using tool M-120 as shown in Figure 2.



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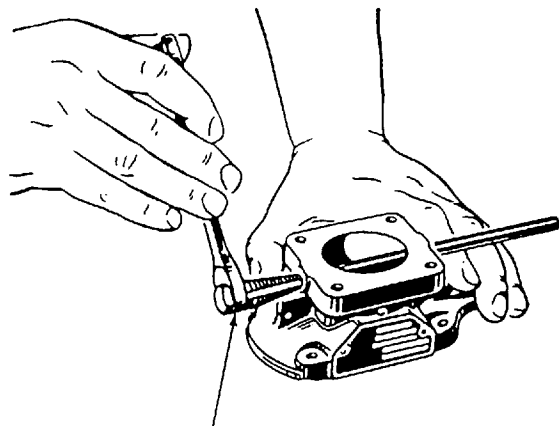


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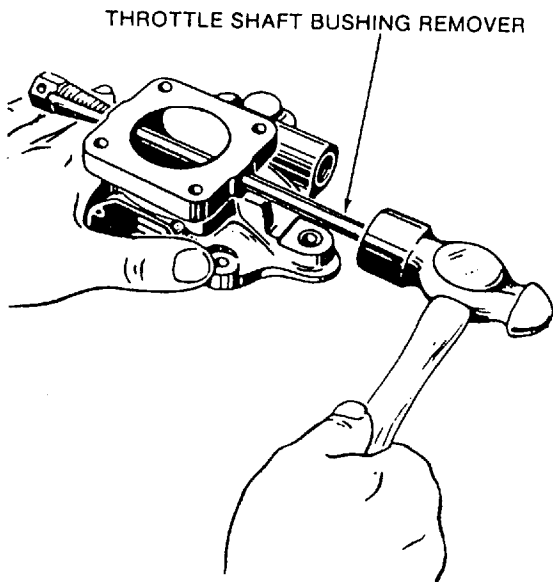
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- 17) Remove throttle shaft bushings (44) using tool M-122 or any standard bushing removal tool. See Figures 3 and 4.
- 18) Remove economizer jet (45) if used, vent screen (42) if used, and idle drill plug (66) if used. Note: Heating may ease removal of idle drill plug. If lead ball is used in place of idle drill plug, **DO NOT REMOVE**.



THROTTLE SHAFT BUSHING REMOVER

FIGURE 3



THROTTLE SHAFT BUSHING REMOVER

FIGURE 4

- 19) Remove fuel inlet strainer assembly (46) and gasket (47). Remove float bracket screws (63), and bracket (64).

FUEL BOWL DISASSEMBLY

- 20) Remove idle tube (48) and drain plug (49).
- 21) Remove nozzle (50), safety washer (51), and nozzle gasket (52). See Figure 5.
Note: Occasionally the nozzle gasket will stay in the casting when nozzle is removed. **Make sure it is removed.**
- 22) Remove pump discharge check valve assembly (53), safety washer (54), and gasket (55). NOTE: Do not disassemble the pump discharge valve (53).
- 23) Remove pump inlet retainer screws (56), safety washers (57), retainer flange (58), strainer housing (59), gasket (60), screen (61), and inlet check valve assembly (62). Pump discharge tube (Figure 5) seldom needs service or removal. If it is damaged or loose pull it carefully out of its casting counter bore and discard.

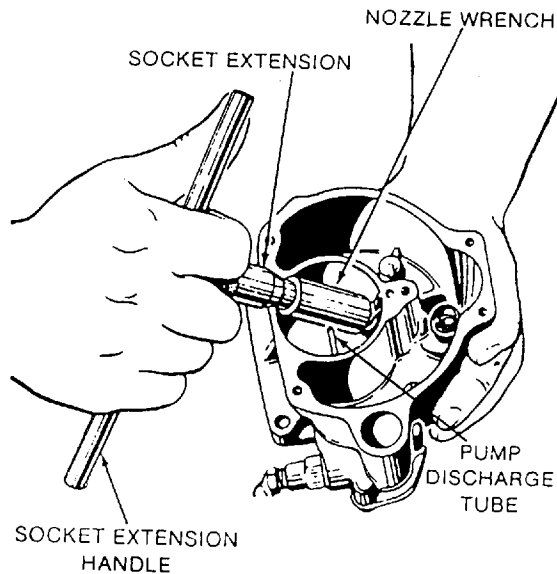


FIGURE 5



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CLEANING AND INSPECTION



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Cleaning Process

- 24) Use a recommended carburetor cleaner and the cleaner manufacturer's procedure to soak, rinse, and blow out to assure complete cleaning. Only metal parts are to be placed in carburetor cleaner. Do not expose non metal parts to carburetor cleaner.
- 25) Carburetors have by design requirements very small passages, channels, and orifices. These are quite difficult to inspect using the naked eye. Using equipment such as an Otoscope or other magnifying device will enable you to see these difficult places.

IMPORTANT: Do not clean passages in castings or calibrated parts (nozzle, idle tube, etc.) with wire or small drills. Compressed air, carburetor cleaner, and a small, soft bristle brush work quite well.

WEAR LIMITS FOR MA-3 AND MA-4SPA CARBURETORS

INDEX NO.	DESCRIPTION	PERMISSIBLE WORN DIM.	PERMISSIBLE WORN CLEARANCE
T-Body	Mixture control hole in body	.222	
24	Mixture control valve (Top)	.215	.007
T-Body	Accelerator pump hole in T-body	.225	
24	Mixture control valve (Bottom)	.2480	.002
Bowl	Mixture control sleeve	.2500	
64	Float shaft bracket	.100	.008
4	Float shaft	.092	
4	Float shaft	.092	.008
5	Float lever pivot	.100	
T-Body	Throttle shaft bushing holes	.3775	.002
	Throttle shaft bushing O.D.	.3750	
	Throttle shaft bushing I.D.	.3135	.005
34	Throttle shaft	.3085	
13	Accelerator pump lever holes	.132	.008
10	Accelerator pump link	.122	
5	Float adjustment tab	wear spot = .100 dia.	-
Bowl	Accelerator pump cylinder	.630	-
T-Body	Throttle stop pad on T-body	wear spot = .010 deep	-

TABLE I

Inspection

- 26) The following parts should always be replaced during carburetor overhaul:
 - All gaskets
 - Seals and packing
 - Throttle shaft bushings
 - Retainers
 - Float valve and seat assembly
 - Accelerator pump
 - Float shaft

NOTE: Fuel inlet strainer assembly should be replaced if the strainer screen is broken at any place or cannot be satisfactorily cleaned.

- 27) Normal aircraft quality inspection techniques can determine reusability of carburetor components. Abnormal wear, cracks, warping, or damage are, of course, just cause for rejection. Wear beyond the limits shown in TABLE I is also just cause for rejection:

NOTE: Late model aircraft are all equipped with soft engine mounts. This has created a more severe vibration environment, causing different wear characteristics in different aircraft. **Careful inspection is required.**



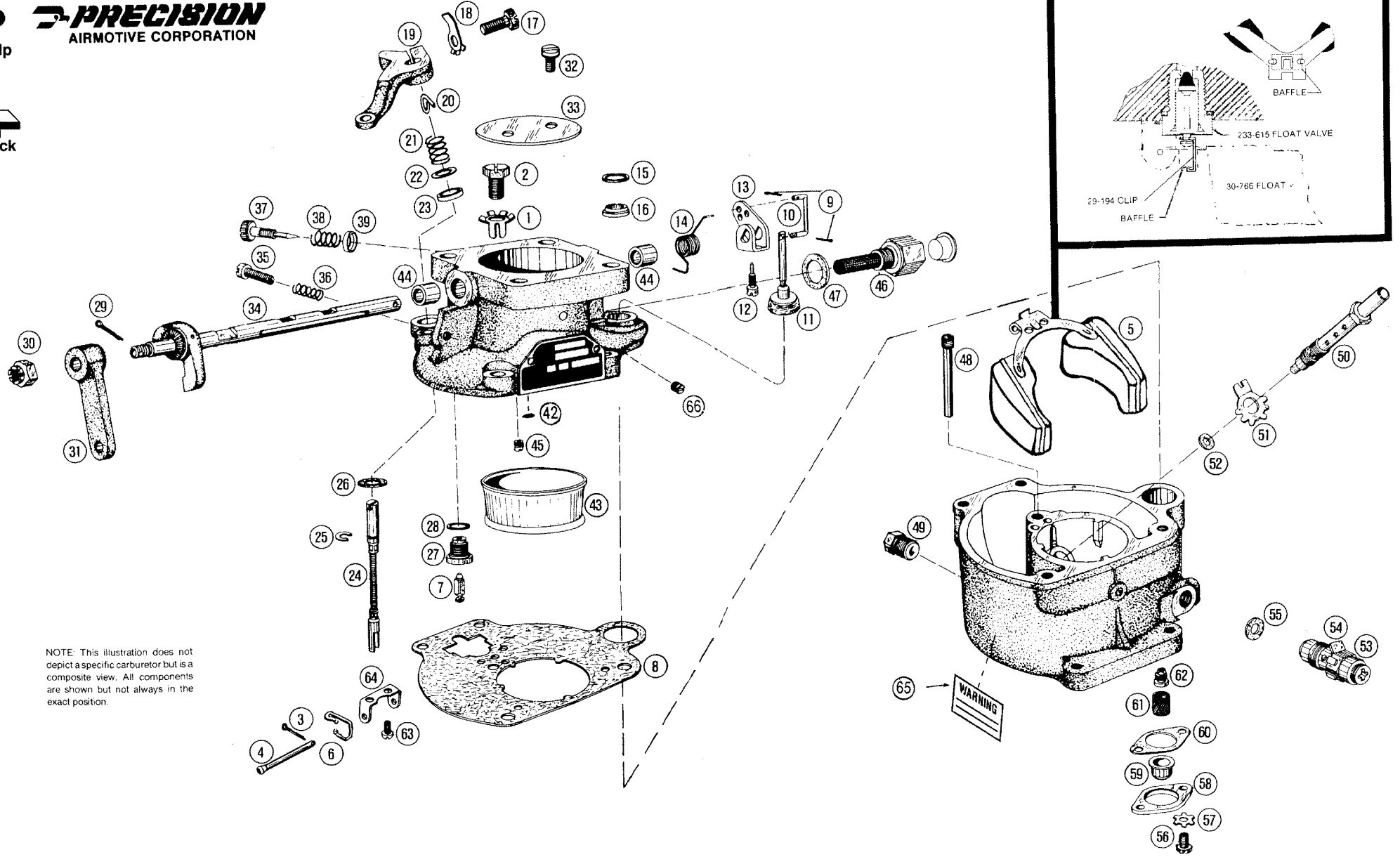
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NOTE: This illustration does not depict a specific carburetor but is a composite view. All components are shown but not always in the exact position.



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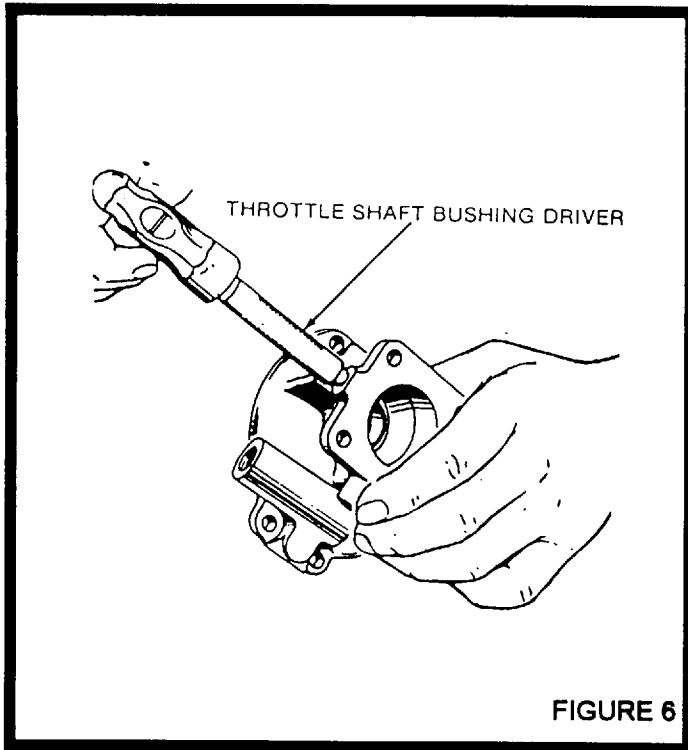
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MODEL MA 3 & 4 ASSEMBLY PROCEDURE THROTTLE BODY

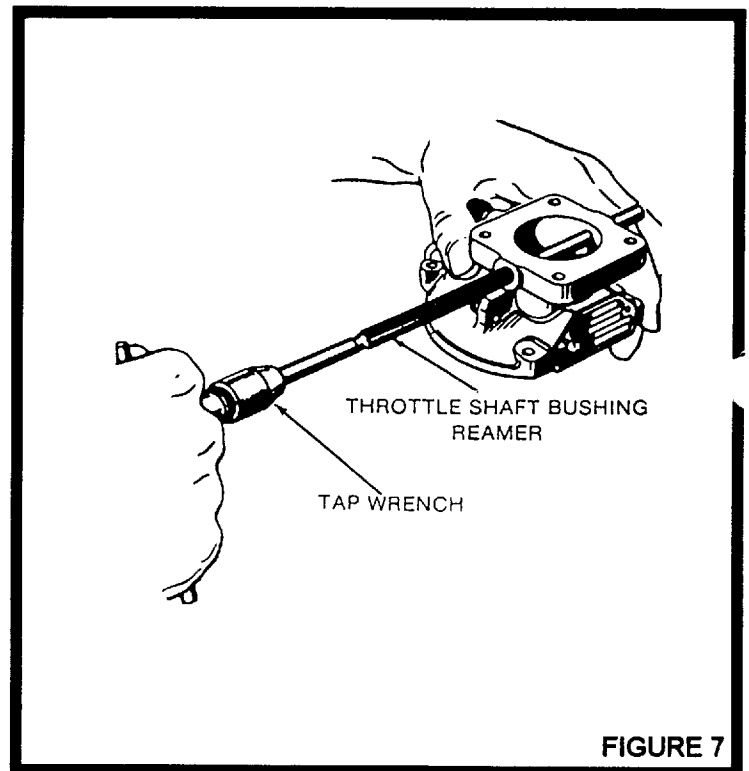
- 28) Lightly coat the bushing with Loctite RC-680 per Loctite's recommended instructions. Install throttle shaft bushings using tool M-86 bushing driver. Place bushing (44) on driver and tap into place, repeat on opposite side. See Figure 6. Cure in location from two to four hours. Heat not to exceed 110°F may be used to speed curing.



NOTE: Repeated rebushing of older models with the old style steel bushings may have enlarged the bore with resultant loss of press fit. Make sure in this case that the loose bushings are in location.

- 29) Line ream the bushings with tool No. M-108. See Figure 7.

- 30) Install pump stem packing (16) and retainer (15) using tools M-123 and M-123A. Place tool M-123A packing pilot in place on the bottom side of throttle body; slip packing (16) in the cavity on top side. Place retainer (15) over packing and stake in place with tool M-123. Remove pilot.
- 31) Install venturi (43) using tool M-83. Place the venturi in position so that the notch in the side of the venturi will be in alignment with the nozzle and the legs engaged in the grooves in the throttle bore.





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- 32) Install the economizer jet (45) if used. Exercise caution, so as not to damage or burr this jet since this can cause a change in flow. Install vent screen (42) if used.
- 33) Install idle drill plug (66) to 12-16 inch pounds with Loctite 222 or equivalent mild threadlock.
- 34) Install throttle shaft (34), throttle valve (33), and throttle valve screws (32). Run screws lightly into place, rotate the shaft to the closed position and tap the valve lightly with the screw driver blade to seat the valve in throttle bore. Hold the throttle valve closed and tighten the screws. Torque screw (32) to 10-15 inch pounds.
- 35) Safety the throttle valve screws in place with clinching tool M-109. See Figure 8. Carefully installed, the shaft will rotate freely from fully closed to wide open. Note: Certain carburetors do not use a wide open valve and you may notice that the valve is limited up to 15° from the fully open position. This is normal and an important part of the full throttle requirements.
DO NOT CHANGE.
- 36) Install throttle adjusting screw (35), and spring (36).
- 37) Install retainer (39), spring (38), and idle needle (37). Approximate setting 1-1/2 to 2 turns from seat. NOTE: Some models do not use retainer (39). Refer to appropriate parts list section for proper configuration.
- 38) Place horseshoe washer (25) in its groove on mixture control valve (24). Place washer (26) over valve head and insert into casting from the bottom.
- 39) Slide packing (23), washer (22), and spring (21) over valve head. Place tip of the lock wire loop (20) into its hole in valve head. Align lever (19) with wire loop and push down to compress spring (21). Assure that the loop of the lock wire is toward the valve.
- 40) Install clamp screw (17) through safety washer (18), lever (19) and lock wire (20) and bend safety tab washer to secure. Torque screw to 20-28 inch pounds.
- 41) Install float bracket (64) with screws (63) torque to 8-11 inch pounds. NOTE: Screw (63) should be replaced if nylon long-loc is missing or ineffective.
- 42) Slide throttle opening spring (14) (if used) over the end of shaft (34) and insert the end through the hole in casting web. Install accelerating pump lever (13) and secure in place with screw (12). Torque screw (12) to 8-11 inch pounds. Insert the throttle opening spring end through the cross hole drilled screw (12) to safety and bend the end of the spring over to secure. If model does not incorporate spring use safety wire to safety screw (12). Place throttle lever (31) at proper angle location on throttle shaft and secure with retaining nut (30). Torque nut (30) to 20-60 inch pounds. Install cotter pin and bend. NOTE: Carburetor without the throttle lever locknut retaining feature on the end of the throttle shaft must have the throttle lever safety wired as shown in Figure 9.
- 43) Insert the pump (11) carefully through the packing and install pump link (10) and cotter pins (9).
- 44) Note: The accelerating pump lever has three holes into which the upper end of the pump connecting rod can be installed.

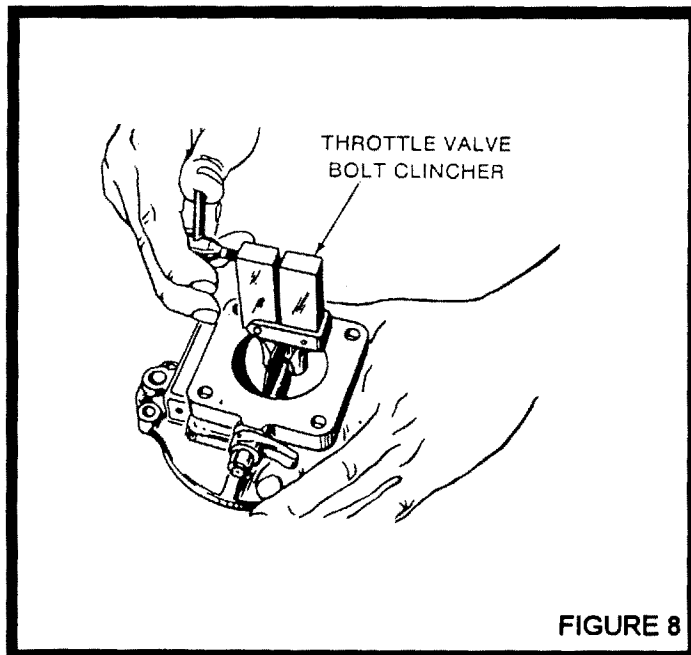


FIGURE 8



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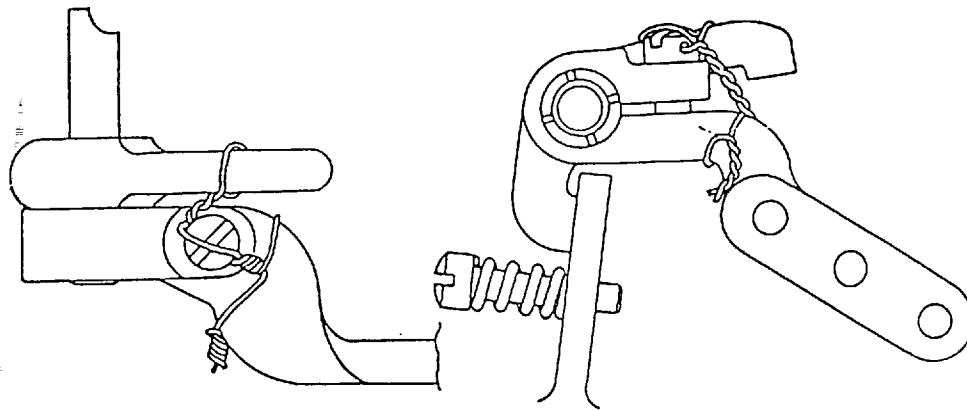


FIGURE 9

- 45) The outer hole, known as the No. 3 hole, is approximately midway in height between the upper and lower holes. The No. 3 hole provides the longest stroke for delivery of maximum amount of accelerating fuel. The lower hole is known as the No. 1 hole and produces the shortest stroke. The middle hole, or No. 2 hole, produces a medium supply of accelerating fuel. Refer to FIG C, Page 2.
- 46) Note: Some models have a pump plunger assembly which incorporates a collapsing feature to prolong the pump stroke.
- 47) Assemble this type in accordance with this special section and Figure 10.
- Hold a spring seat (12) against each end of the spring (13) and slide the pump plunger and stem assembly (16) through the spring.
 - Slide the pump plunger rod (11) over the end of the pump plunger stem (11) so that the hole at the lower end will be in alignment with the slot in the stem. Apply finger pressure
- 48) against the top spring seat (12) to compress the spring (13) far enough to permit insertion of the spring seat locating pin (10). After the pin (10) is in place, release pressure on the spring (13) to hold the pin securely in position. Press down against the top of the pump plunger rod assembly (11) to make certain that the stem on the pump plunger and stem assembly (16) will slide freely in the end of the stem.
- 49) If the pump leather expanding spring (17) was removed, install it carefully under the pump leather.
- 50) Install fuel inlet fitting-strainer assembly (46), and gasket (47). Torque fitting (46) to 10-12 foot pounds.
- 51) Install float valve seat (27), and gasket (28) using tool No. M-104. See Figure 11. Torque to 10-12 foot pounds.
- CAUTION:** Exercise care during the following operations to prevent damage to the float.

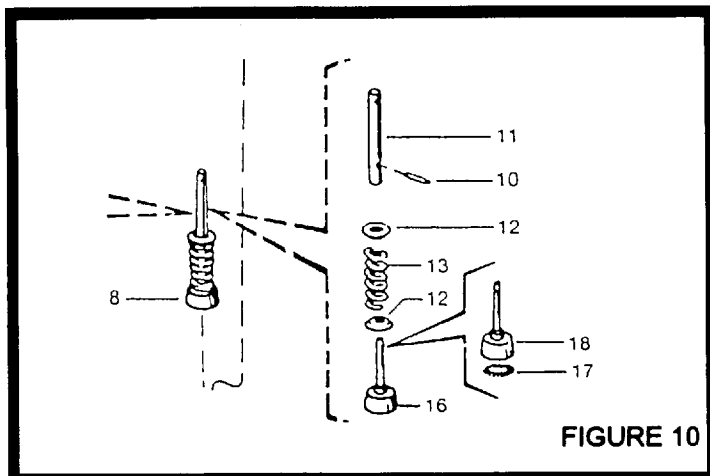


FIGURE 10

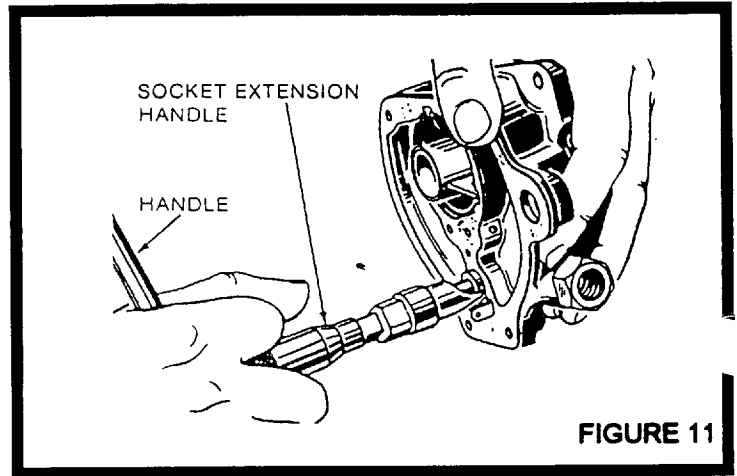


FIGURE 11



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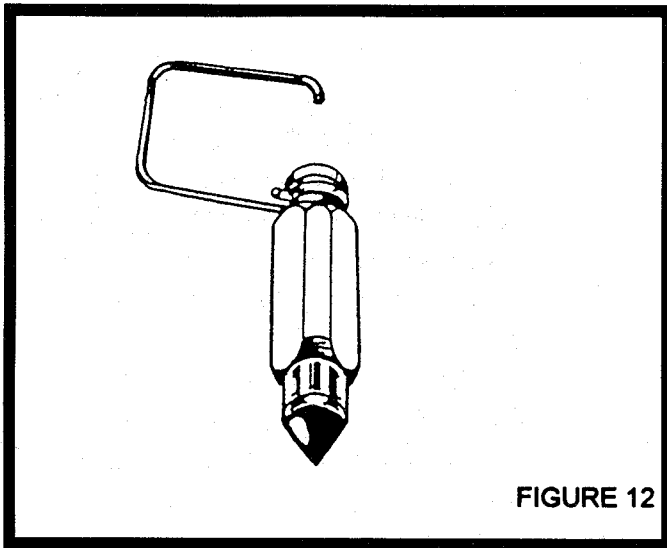


FIGURE 12

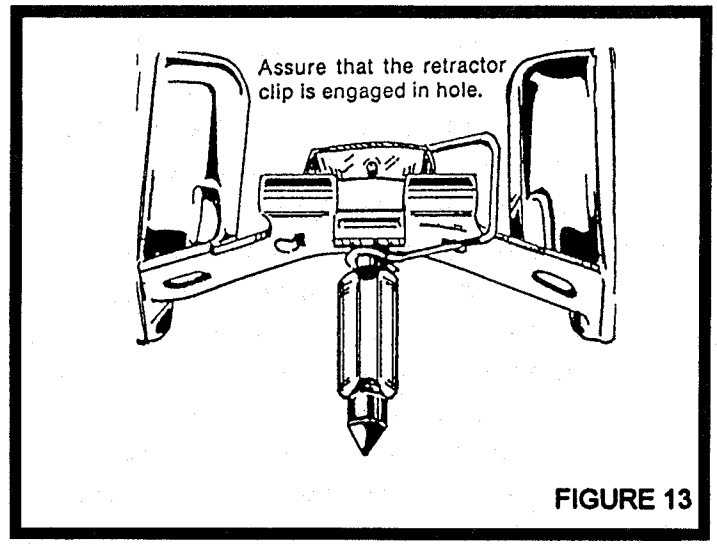


FIGURE 13

- 52) To install the float, place the throttle body with the mounting flange down and install the proper throttle body to bowl gasket (8).
- 53) Place the float valve retractor clip (6) on the float valve (7) as illustrated in Figure 12. Place the float valve and retractor clip on the float (5) as illustrated in Figure 13.
- 54) Make sure the float valve is centered on the adjustment tab on the float. The float valve retractor clip should not hold the float valve tight against the float lever but have approximately .005" clearance when viewed as in Figure 13.
- 55) Place the float, valve, and clip assembly into the float bracket (64) with the valve (7) in the float valve seat (27) (Reference Figure 15).

- 56) Insert the float lever shaft (4) through the float bracket and float lever hinge and safety in place with cotter pin (3). Bend the ends of the pin all the way back.
- 57) **CAUTION:** Insure that the float shaft is free to rotate and that the float and valve movement is not restricted between the fully open and fully closed position of the float valve. This is approximately 1/2-inch of float travel measured at outer end of float. The float setting is established as shown in Figure 14 with 7/32" clearance between the float and gasket measured near the outer end of each float.
- 58) If adjustment is required, bend the float lever adjustment tab, located over the float valve, to achieve the 7/32" setting. A small screwdriver bent 30 degrees approximately 1/4-inch from its tip is a useful tool for setting the float.

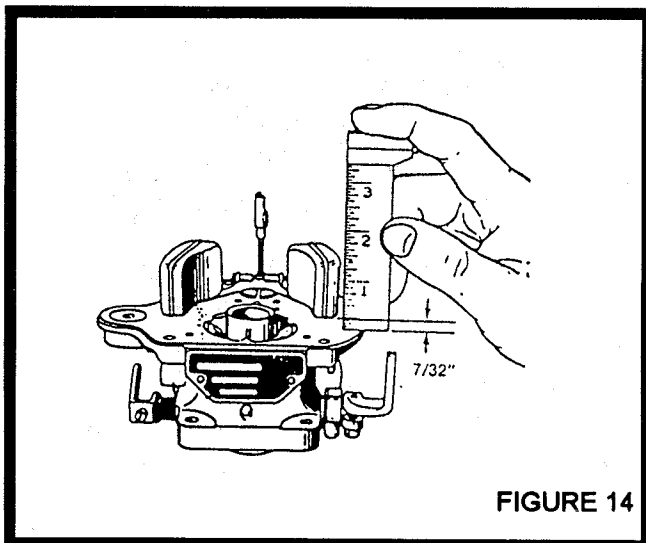


FIGURE 14

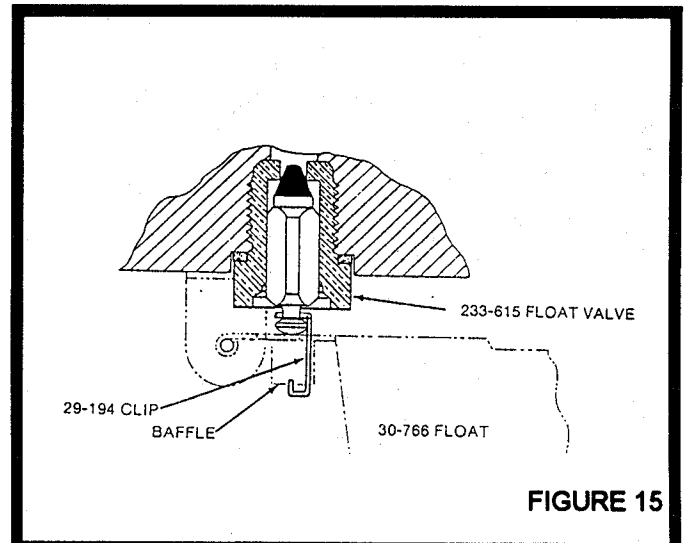


FIGURE 15



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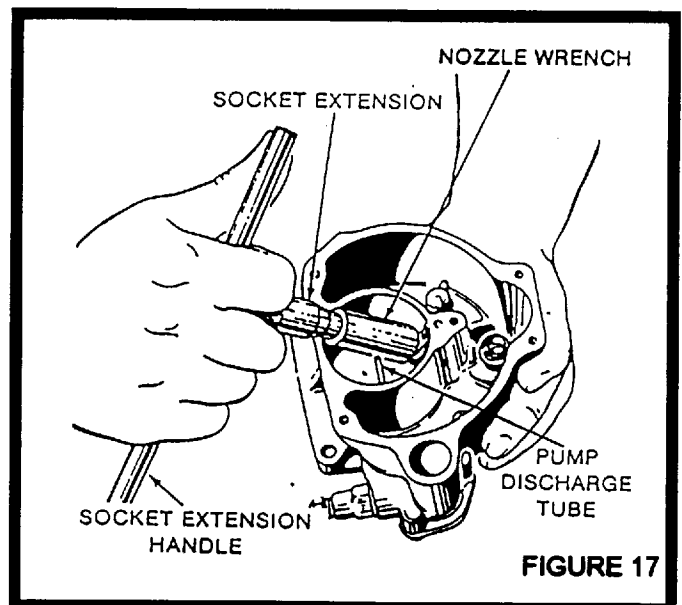
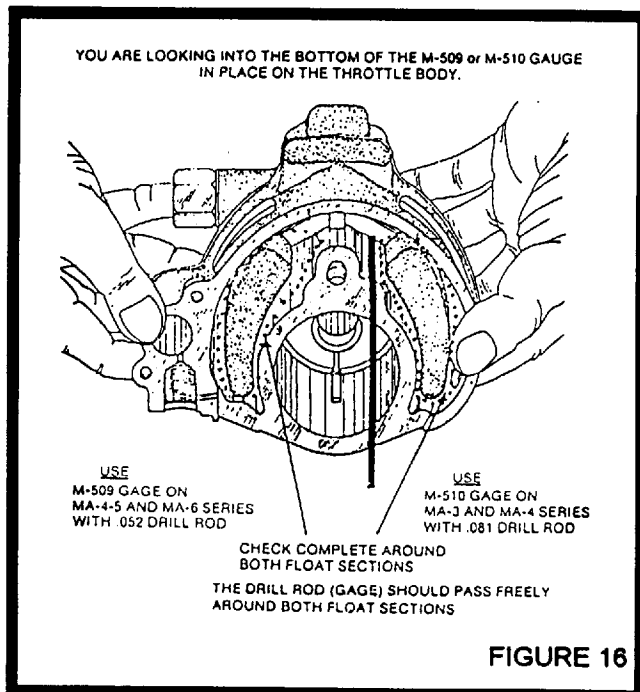
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- 59) **CAUTION:** Both float pontoons must be at the same height above the gasket.
- 60) **CAUTION:** DO NOT APPLY PRESSURE TO THE VALVE AND SEAT DURING ADJUSTMENT BENDING.
- 61) Use tool No. M-510 as a clearance gauge to check float before assembly in accordance with Figure 16. The float may be repositioned laterally by loosening the float bracket screws (63), moving the bracket slightly, and retightening screws. Set throttle body aside in a clean area while completing bowl assembly.
- 62) **CAUTION:** To prevent possible damage to the float do not blow on or into the carburetor assembly with compressed air. Failure to follow these instructions may result in adverse carburetor performance and engine operation.

FUEL BOWL ASSEMBLY

- 63) Install idle tube (48) in casting exercising care not to damage the tube. Torque idle tube (48) to 3-5 inch pounds.
- 64) Install pump discharge check valve assembly (53), gasket (55), and safety washer (54). Torque valve assembly (53) to 50-70 inch pounds. Bend tabs to safety.
- 65) **NOTE:** Do not disassemble the pump discharge valve (53). It is factory preset. If it has been disassembled, it must be replaced.

- 66) Install pump inlet check valve assembly (62), inlet screen (61), gasket (60), housing(59), and flange (58) (chamfered side toward casting), and secure with screws (56) and safety washers (57). Bend tabs to secure. Torque check valve assembly (62) to 8-12 inch pounds and screws (56) to 14-18 inch pounds.
- 67) Install drain plug (49) with a small amount of thread lube. Torque drain plug (49) to 25-30 inch pounds. (**CAUTION-**Make sure no thread lube can be put in ahead of the plug).
- 68) Place power jet gasket (52) on shoulder of power jet in the base of nozzle and insert nozzle through gasket safety washer (51), and install nozzle firmly into the bowl casting. See Figure 17. **NOTE:** It is best to install nozzle with bowl inverted to insure that the power jet gasket does not fall into well and block power jet.
- 69) Bend ALL tabs in washer (51) to secure.
- 70) The pump discharge tube seldom needs service. However, if it needs to be replaced, it is installed with Loctite mounting compound and cured in place, in accordance with the following instructions:





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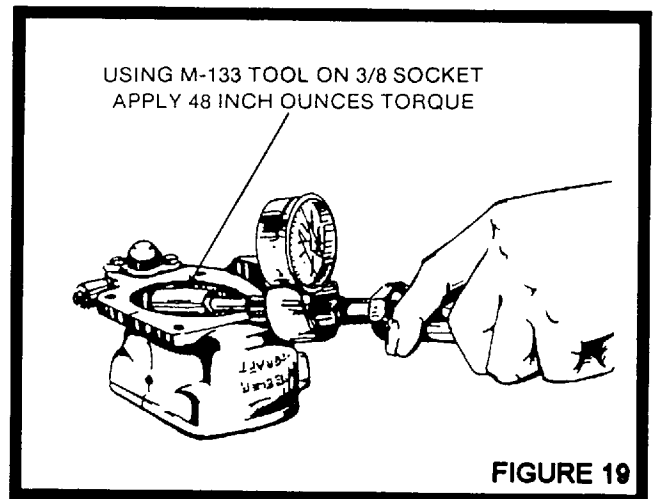
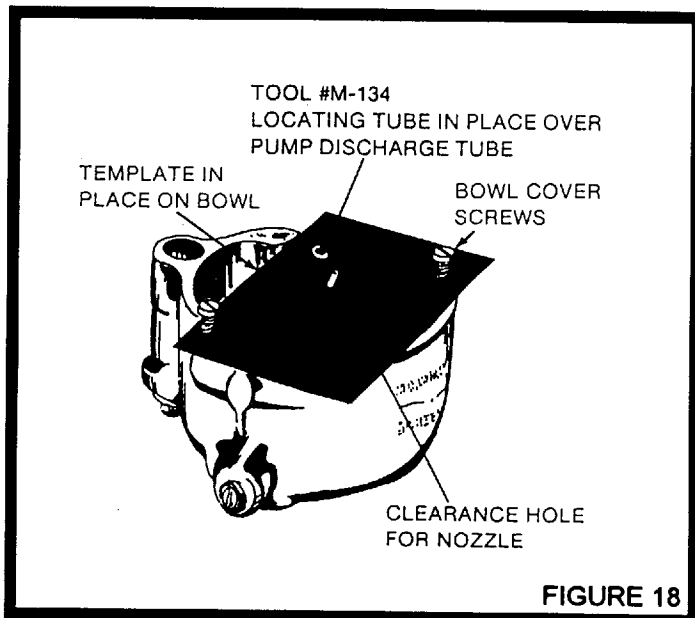


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PROCEDURE TO ASSEMBLE ACCELERATOR DISCHARGE TUBE IN MA 3 AND MA 4 BOWLS

- 71) Clean and roughen longitudinally (not radially) with #320 emery cloth approximately 1/2 inch length of the end of the accelerator discharge tube which is inserted into the bowl discharge port. Thoroughly clean both surfaces with Loctite safety solvent. Clean surfaces insure consistent bonding results. After applying safety solvent to accelerator discharge port in casting, swab with CLEAN pipe cleaner to remove residual contamination. After applying safety solvent to accelerator discharge tube, wipe with a CLEAN tissue to remove residual contamination. **DO NOT BLOW WITH COMPRESSED AIR AFTER APPLYING SAFETY SOLVENT**-moisture and oil in the air may recontaminate the surfaces.
- 72) Apply Locquic Primer T or Primer N to both surfaces. Allow primer to visibly dry (2-5 minutes) before applying retaining compound. Apply primer to accelerator discharge port in casting with a pipe cleaner wetted (not saturated) with primer. Apply primer to discharge tube by wiping.
- 73) Apply Loctite Retaining Compound RC-680 to the accelerator pump discharge tube brushing or wiping on approximately one-half inch length of the tube end which is inserted into the accelerator discharge port approximately 1/16 inch from the end of tube. **DO NOT ALLOW RC-680 TO ENTER TUBE.**

- 74) With template M-134 in place, assemble discharge tube into discharge port with a rotating motion to spread retaining compound. Parts may be repositioned up to one minute after assembly. After inserting pump discharge tube in place, place locating tube part of tool, M-134 thru the hole as indicated and down over the pump discharge tube and allow to cure in place. See Figure 18. If Primer T is used parts must be joined within four minutes after RC-680 is applied. If Primer N is used, parts must be joined within ten minutes after RC-680 is applied.
- 75) Allow to cure at room temperature. With Primer T fixturing occurs within five minutes with full cure in six hours. With Primer N fixturing occurs in 15-30 minutes and full cure in 12 hours.
- 76) After full cure - the Loctite joint must be able to withstand 48 inch ounces of torque applied at the rotational axis of the discharge tube entering the discharge port without movement of the discharge tube. See Figure #19.





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THROTTLE BODY AND BOWL ASSEMBLY

- 77) Carefully assemble the castings together by inserting the pump plunger into its cavity in the bowl (extreme care should be exercised to keep from damaging the pump leather), carefully guide the mixture metering valve (24) into its seat in bowl. Assure that the accelerator pump discharge tube is located inside the center ring of the venturi. Install bowl cover screws (2) and safety washers (1) and torque in place 35-45 inch pounds. Bend up a minimum of two tabs on all safety washers.

INSTALLATION OF WARNING LABEL

- 78) Clean the side of the carburetor body using acetone or equivalent degreasing solvent. Allow the surface to dry completely. Remove the peel-off backing from the warning label (65) and attach the label to the carburetor body.

TEST PROCEDURE

GENERAL

- 79) After the carburetors have been overhauled and the checks performed as specified throughout the overhaul procedures, the carburetors should be equal to new units. Final adjustments should be made at the time the carburetor is installed on the engine.

FLOAT VALVE AND SEAT TEST

(See Figure 20)

- 80) A. Connect the inlet fitting of the carburetor to a fuel pressure supply of 0.4 psi.
- B. Remove the bowl drain plug and connect a fitting, rubber hose, and glass tube to the carburetor drain connection. The glass tubing should be positioned vertically beside the carburetor.

C. Allow the fuel pressure at 0.4 psi to remain for a period of at least 15 minutes and then raise the fuel pressure to 6.0 psi. (There will be a slight rise in fuel level as the pressure is increased.) Allow the 6.0 psi pressure to remain for at least five minutes after the fuel level has stabilized.

D. If the fuel rises to the level of the parting surface of the castings or runs out of the nozzle, the bowl and throttle body must be separated and the float valve and seat cleaned or replaced. CAUTION: Under no circumstances change the float level from the established setting to correct flooding or to change fuel level.

E. With fuel supplied to the carburetor as shown in Figure 20, operate the throttle lever for several strokes to fill the accelerating pump and passages. Then close the throttle, open it fully again, and hold it for a few seconds. If the accelerating pump is operating correctly, a solid stream of fuel will be discharged from the accelerating pump discharge tube or jet and will gradually die away after the spring on the pump plunger reaches its limit.

WARNING: DO NOT STAND DIRECTLY OVER THE CARBURETOR FLANGE AS FUEL WILL BE DIRECTED INTO THE FACE OF THE OPERATOR.

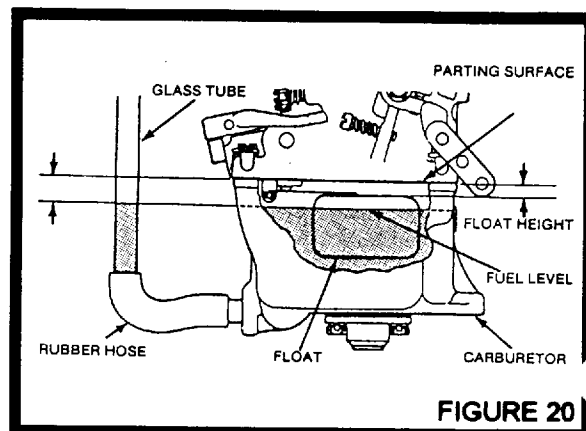


FIGURE 20



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F. If the fuel discharge from the discharge tube is weak, or if air is dispelled, it is an indication that the pump plunger, pump discharge or inlet check valve are not functioning properly. Disassemble the carburetor and make necessary repairs.

G. Remove the sight tube fixture and allow the fuel to drain out. Operate the pump to clear the fuel out of the pump cylinder and passages. Reinstall and safety drain plug.

PRESERVATIVE TREATMENT

- 81) If the carburetor is to be placed in storage after overhaul, the bowl drain plug should be removed and the carburetor flushed internally with soluble corrosion preventive oil, Military Specification MIL-C-4339. After draining the surplus oil from the carburetor, enough will cling to the parts to provide internal protection during storage. Replace the bowl drain plug.

TORQUE SETTINGS FOR MA-3 AND MA-4SPA CARBURETORS

Screw - Throttle valve	10 - 15 in·lbs
Screw - Mixture control lever	15 - 20 in·lbs
Screw - Throttle lever clamp	20 - 28 in·lbs
Screw - Pump inlet strainer housing	14 - 18 in·lbs
Screw - Float bracket	8 - 11 in·lbs
Screw - Idle drill plug	12 -16 in·lbs + Thread lock
Screw - Pump lever pin	8 - 11 in·lbs
Screw - Throttle body to bowl	35 - 45 in·lbs
Valve assy. - Pump inlet	8 - 12 in·lbs
Valve assy. - Pump discharge	50 - 70 in·lbs
Nozzle	45 - 60 in·lbs
Nut - Throttle lever	20 - 60 in·lbs
Fuel inlet and strainer assy.	10 - 12 ft·lbs
Plug - Bowl drain	25 - 30 in·lbs
Idle tube	3 - 5 in·lbs
Float valve seat	10 - 12 ft·lbs

TABLE II