



McFarlane Aviation Products

Instructions for Continued Airworthiness
McFarlane Aviation Inc. FAA-PMA Part Number MC0311070
FUEL SELECTOR VALVE ASSEMBLY REPAIR INSTRUCTION
FAA PMA Number: PQ3732CE

Notice: Verify that this document is the latest approved revision before use! Current version can be found at:

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Approved By:


Quality Assurance Manager


Engineering Manager


Production Manager

Revisions

Revision	Date	Summary
Original	08/10/2020	Original release
A	08/10/2021	Revised Title
B	01/17/2023	Removed instances of P/N 1255, <i>SPRING INSERT</i>

List of Effective Pages

Page	Rev/Date
ALL	Original / 08/10/2020
ALL	A / 08/10/2021
ALL	B / 01/17/2023

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INTRODUCTION

This document provides for the continued airworthiness of McFarlane Aviation, Inc. PMA Fuel Selector Valve assembly, P/N: MC0311070. The MC0311070 valve assembly is a direct replacement for the Cessna 0311070 fuel selector valves. Listed below is the fuel selector valve and its associated Cessna aircraft.

McFarlane P/N	Eligible Cessna Aircraft*
MC0311070	190**, 195 (LC-126A,B,C)**, 195A**, 195B**

* Part eligibility presented as reference, consult FAA Part Manufacturer Approvals for specific valve eligibility.

** Indicates partial model eligibility.

SYSTEM DESCRIPTION

A key component of the Cessna 190 series fuel systems is the fuel selector valve. It is a four position, rotating valve that controls fuel flow from the two wing tanks. It is operated by rotating the fuel selector handle to the desired system configuration, e.g. Left, Both, Right, Off. The fuel selector handle, which is connected directly to the cam, rotates and forces the cam lobe to contact one or both of the two internal valves depending on selected configuration. When contacted, each valve is displaced and fuel flow begins.

SPECIAL OPERATING INFORMATION

The control and operation of the fuel selector valve does not change; see the applicable Cessna service manuals for the operational control of this system.

PART REMOVAL, REPLACEMENT, AND SERVICE INFORMATION

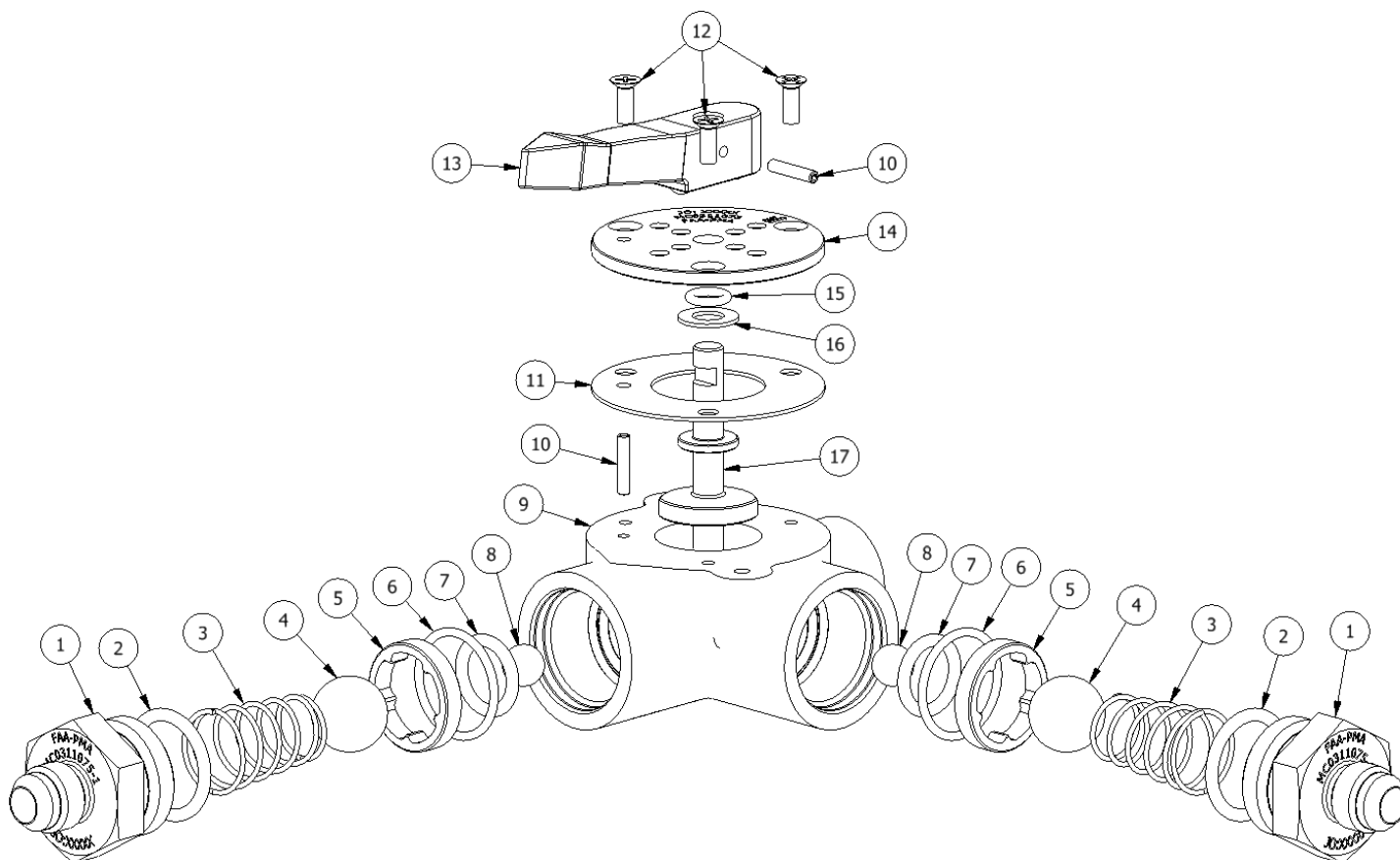
Use the Cessna instructions, per the applicable Cessna service manual, to remove an existing Cessna fuel selector valve and replace it with the McFarlane fuel selector valve. For the initial installation of a McFarlane valve, no flow capacity inspection, rotation sensitivity inspection, or valve leak check is required. This has been done at the McFarlane facility prior to shipping.

For any subsequent maintenance or repair of the McFarlane fuel selector valve assembly, use the instructions and special considerations provided in the sections that follow. All inspections listed in this document must be successfully completed prior to returning the McFarlane valve to service.

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MC0311070 FUEL SELECTOR VALVE

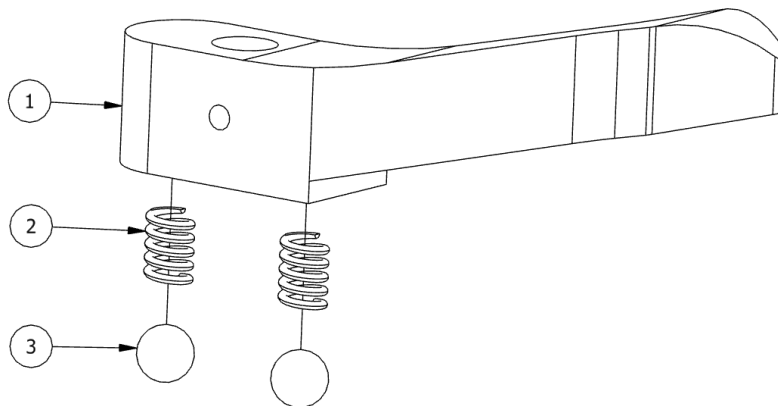
TABLE 1 - FUEL SELECTOR VALVE PART LIST

ITEM	QTY	PART NUMBER	ALTERNATE	DESCRIPTION
1	2	MC0311075	0311075	Retainer, Inlet
2	2	MCM83248/1-116	NAS1593-116	O-Ring (Retainer)
3	2	MC0311079	311079	Spring, Seal
4	2	MCS272-220	S272-220	Ball, Seal
5	2	1244	-	Guide Insert
6	2	MCM83248/1-019	-	O-Ring (Guide Insert)
7	2	MCM83248/1-112	NAS1593-112	O-Ring (Seal)
8	2	MCS272-211	S272-211	Ball, Lifter
9	1	MC0311071	311071	Base, Body
10	2	MS16562-213	-	Roll Pin
11	1	MC0311076	0311076	Gasket
12	3	MS24693S25	-	Screw (Plate)
13	1	MC0311078D	-	Handle Assy, Dual
14	1	MC0311073	0311073	Plate
15	1	MCM83248/1-010	MS29513-10	O-Ring, Cam
16	1	NAS1515H4L NAS1515H4 NAS1515H4H	AN960C416L	Washer
17	1	MC0311072	0311072	Cam, Valve

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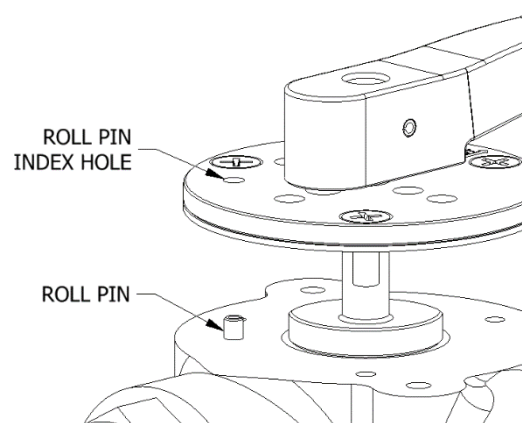
MC0311078D HANDLE ASSY, DUAL

TABLE 2 - DUAL HANDLE ASSY PARTS LIST

ITEM	QTY	PART NUMBER	ALTERNATE	DESCRIPTION
1	1	1345	-	Handle, Dual
2	2	MC0513120-1	0311070-2, 0616052	Positioning Spring
3	2	MCS272-207	S272-207, 16007-7	Ball, Handle

NOTE

The original P/N 0311070 Fuel Valve Assembly can be incorrectly assembled due to the three evenly spaced cover plate attachment holes. McFarlane has reduced the risk of this incorrect assembly in their valves by including a Roll Pin protruding from the Base. This positively clocks the cover plate to the correct orientation upon assembly. If a roll pin is present but there is no roll pin index hole in the gasket or cover plate, the roll pin may be removed and discarded. Failure to correctly install the cover plate will be detected in the functional and valve lift tests. This roll pin and roll pin index hole as found on McFarlane valves can be seen in the image to the right:



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FUEL SELECTOR VALVE DISASSEMBLY INSTRUCTIONS

Prior to disassembly, check valve for solid detent action and free movement of the handle.

Disassemble the McFarlane Fuel selector valve, after it has been removed from the aircraft, in the order described below.

1. Loosen and remove a retainer (Table 1, Item #1) from the base (Table 1, Item #9). Take care to retain and protect the seal spring (Table 1, Item #3), seal ball (Table 1, Item #4), lifter ball (Table 1, Item #8), and guide insert (Table 1, Item #5), all of which are installed under the fitting.
2. Remove retainer o-ring (Table 1, Item #2) from the retainer. Discard the used o-ring.
3. Repeat Steps 2 & 3 for the other retainer.
4. Remove the three plate screws (Table 1, Item #12) that secure the cover plate (Table 1, Item #14) to base.
5. Remove the cam stack, and gasket (Table 1, Item #11). Use caution not to damage the sealing surfaces (plate & base) during removal. Discard used gasket.
6. Remove both internal seal o-rings (Table 1, Item #7) and guide insert o-rings (Table 1, Item #6) from the base. Discard used o-rings.

NOTE: *The edges of the machined o-ring grooves in the valve body are thin and can easily be damaged with the wrong tool. A damaged groove edge may prevent the valve from fully sealing which would render the valve assembly unrepairable. To prevent damage, use a dental pick, or similar sharp and narrow tool, to spear and remove the valve o-ring without contacting the edges of the o-ring grooves.*

7. Use a clamp to relieve the spring pressure between the dual handle (Table 2, Item #1) and the roll pin (Table 1, Item #10). Take care to not scratch or gouge the valve cam (Table 1, Item #17), dual handle, or the plate when clamping these components.
8. Support the dual handle while leaving the roll pin hole exposed on both ends, and drive the roll pin out with .063 roll pin punch.
9. Remove the dual handle from the cam and remove the cam from the plate. Take care to retain the subcomponents of the dual handle: dual handle (Table 2, Item #1), the two positioning springs (Table 2, Item #2), and the two handle balls (Table 2, Item #3).

NOTE: *Check the cam for burrs, especially around the roll pin notch, before removing it from the cover plate. An excessive burr can damage the cover plate during removal.*

10. Remove the washer (Table 1, Item #16) and cam o-ring (Table 1, Item #15) from the cam. Discard the used o-ring.

VALVE POST TEARDOWN CLEANING AND INSPECTION

Clean and inspect the disassembled McFarlane Fuel selector valve components as described below. Replace any parts that are worn or damaged before reassembling the valve.

1. Inspect the dual handle (Table 2, Item #1) for the following:
 - a. Wear, deformation, and corrosion.
 - b. Ensure that the roll pin area is free of damage.
 - c. Check the fitment (free play or wear) of the roll pin hole in the handle - a new roll pin must be tight in the handle.
2. Check that the handle springs (Table 2, Item #2) are free of corrosion or other defects.
3. Check that the handle bearing balls (Table 2, Item #3) are free of any deep scratches, flats, and/or corrosion.
4. Check the plate (Table 1, Item #14) for the following:
 - a. Check the top and bottom faces for smoothness, pitting, or other defects that could affect valve action.
 - b. Check for corrosion.
 - c. Inspect the four, inner detent holes for excessive wear. Handle ball must engage and be stable with each detent hole.
Minor grooving between the holes is acceptable as long as handle locking action is acceptable.
5. Inspect the cam (Table 1, Item #17), and the washer (Table 1, Item #16) for the following:
 - a. Check the cam faces for smoothness, anodize defects, pitting, or other defects that could affect valve action.
 - b. Inspect the top groove, where the roll pin contact occurs, for wear, burrs, corrosion or other defects.
 - c. Inspect the washer for any gouges, scratches, burrs, or defects that could affect its function.

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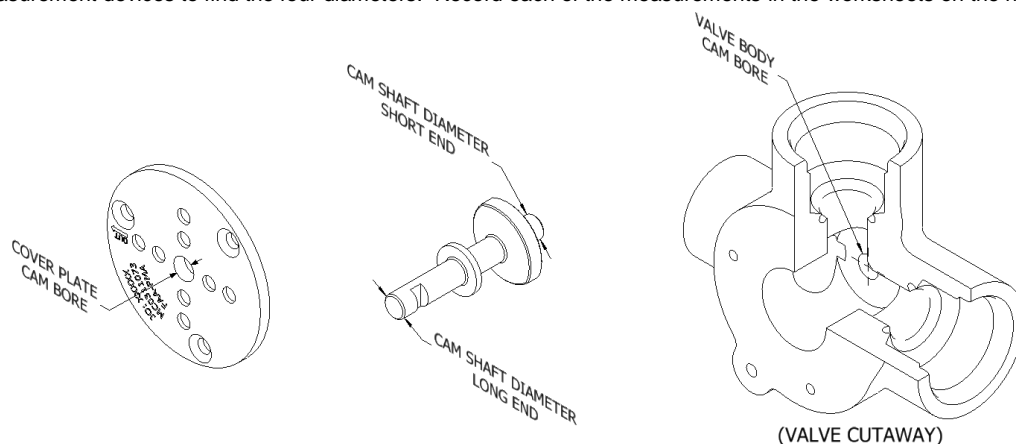
VALVE POST TEARDOWN CLEANING AND INSPECTION (Continued.)

6. Check that the seal bearing balls (Table 1, Item #4) and lifter bearing balls (Table 1, Item #8) are free of any deep scratches, flats, and/or corrosion.
7. Inspect the Guide Inserts (Table 1, Item #5) for the following:
 - a. Guides are free of corrosion or other defects.
 - b. Inner diameter is no greater than .658". (Suggested use of a .658+ as a NOT-GO gauge)
8. Check that the seal springs (Table 1, Item #3) are free of corrosion or other defects.
9. Inspect the base (Table 1, Item #9) for the following:
 - a. O-ring seats for smoothness, pitting or other defects that could affect sealing.
 - b. Inlet and Outlet threads for wear, burrs, corrosion or other defects.
 - c. Inlet/Outlet line mating surfaces for any gouges, scratches, burrs, or defects that could affect proper sealing.
 - d. Valve half mating surface for corrosion, smoothness, anodize defects, pitting, or other defects that could affect proper sealing.
 - e. Ensure that the roll pin area is free of damage.
 - f. Check the fitment (free play or wear) of the roll pin hole in the base.
10. Check retainers (Table 1, Item #1) for damage, wear, and corrosion.

FUEL SELECTOR VALVE ASSEMBLY INSTRUCTIONS

Assemble the McFarlane Fuel selector valve components as described below.

1. Check Clearances
 - a. Measure the diameters of the fuel selector cam, valve body bore, and the cover plate bore that are shown in the figure below. Use appropriate measurement devices to find the four diameters. Record each of the measurements in the worksheets on the next page.



- b. Calculate the cover plate clearance by subtracting the long end cam shaft diameter from the cover plate cam bore diameter.

COVER PLATE CLEARANCE	
<div style="border: 1px solid black; width: 100px; height: 30px; margin: 0 auto;"></div>	COVER PLATE CAM BORE DIAMETER (in)
-	<div style="border: 1px solid black; width: 100px; height: 30px; margin: 0 auto;"></div>
	CAM SHAFT DIAMETER, LONG END (in)
<div style="border-top: 1px solid black; width: 100%; margin-top: 10px;"></div>	
Clearance must be between .001 to .007 in.	

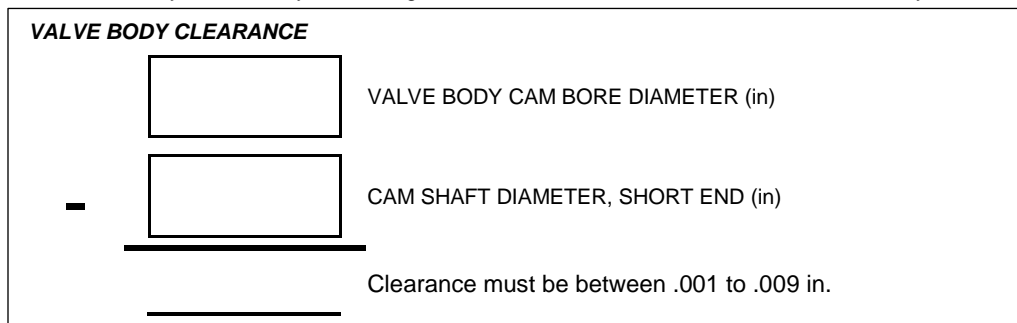
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FUEL SELECTOR VALVE ASSEMBLY INSTRUCTIONS (Continued)

- c. Determine the valve body clearance by subtracting the short end cam shaft diameter from the valve body cam bore diameter.



- d. The calculated valve clearances must both be within the limits shown. If one, or both, are outside of limits, replace and re-measure affected parts until acceptable clearances are achieved.
2. Ensure Roll Pin (Table 1, Item #10) is installed in the base (Table 1, Item #9).
3. Install Valve O-rings
- a. Lubricate the two seal o-rings (Table 1, Item #7) with Windex®. Lubricate guide insert o-rings (Table 1, Item #6) with aviation motor oil (SAE Standard J1899 oil or equivalent).
- NOTE: NON-FUEL SOLUBLE LUBRICANTS MUST NEVER BE USED AS EXCESS LUBRICANT COULD CIRCULATE THROUGH THE FUEL SYSTEM AND FOWL SENSITIVE FUEL SYSTEM COMPONENTS. LUBRICANTS USED MUST BE FUEL SOLUBLE.**
- b. Turn valve base (Table 1, Item #9), so that one of the two inlet passages faces up.
- c. Set seal o-ring into valve body o-ring groove and the guide insert o-ring into the outer machined groove.
- d. Use the McFarlane o-ring tool (P/N: 740), or a blunt dull tool, to gently press the o-rings completely down and out into their grooves.
- NOTE: THERE MUST BE SOME RESISTANCE TO THE SEAL O-RING ENTERING ITS GROOVE; THIS INDICATES THAT GROOVE AND O-RING ARE PROPERLY SIZED. ONCE SEATED, O-RING MUST LAY FREE WITH NO BINDING AFTER INSTALLATION.**
- e. Rotate valve body around to bring the other inlet up, and repeat the process to install the remaining o-rings.
4. Prepare Fuel Selector Cam
- a. Lubricate the cam o-ring (Table 1, Item #15) and the o-ring seal area with McFarlane Pulley Oil or aviation motor oil (SAE Standard J1899 or equivalent).
- b. Slide the washer (Table 1, Item #16), down the long end of the fuel selector cam (Table 1, Item #17) until it contacts the cam shoulder.
- c. Follow the washer with the cam o-ring, down the fuel selector cam until it contacts the washer.
5. Create Cam and Cover Plate Subassembly
- a. Insert prepared cam through cam mounting hole in center of cover plate (Table 1, Item #14) until the cam o-ring just contacts the edges of cover plate. Cam can only be inserted from the underside of cover plate (this is the side with the o-ring gland and washer step).
- b. Carefully press the cam o-ring into o-ring gland until the seated into the cover plate gland. Take care to NOT PINCH OR GOUGE o-ring when pressing. **NOTE: IMMEDIATELY REPLACE O-RING IF DAMAGED DURING INSTALLATION.**
- c. Hold, or clamp, cam and cover plate assembly together to ensure that the o-ring remains seated.
- d. Place a small amount of grease on end of the positioning springs (Table 2, Item #2), and insert them into the spring bore of the dual handle (Table 2, Item #1). *The grease compound will help retain handle springs when the handle is turned over.*
- e. Do the same for the other side of the positioning springs.
- f. Hold the cam and cover plate subassembly level and facing up (the cover plate is facing up when the face with the detent holes is pointing up.)
- g. Place the handle balls (Table 2, Item #3) in two opposing inner detent holes.
- h. Capture the handle balls with the dual handle and springs as they are slid over the end of the fuel selector cam.
- i. Press the dual handle on to the cover plate to compress the positioning springs until the notch in the end of the cam shaft is visible through the roll pin mounting hole. **NOTE: ROTATE CAM AS REQUIRED TO ALIGN NOTCH AND ROLL PIN MOUNTING HOLE.**
- j. Temporarily lock assembly together by carefully sliding a 3/32" roll pin punch, or similarly sized tool, into the roll pin hole.

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FUEL SELECTOR VALVE ASSEMBLY INSTRUCTIONS (Continued)

- k. Measure the gap between the dual handle (Table 2, Item #1) and the cover plate (Table 1, Item #14). Use appropriate measurement devices to measure the distance. Record the measurement in the table below:

HANDLE CLEARANCE

Spacing must be between .015 to .050 in.

- l. The spacing above must be within the limits shown. If outside of limits, replace the cam washer (Table 1, Item #16) with the appropriately sized washer (See Table 1) until acceptable spacing is achieved.
- m. Replace 3/32" roll pin punch with 1/16" roll pin punch for the next step.
- n. Properly support the cam, cover plate, and dual handle to prevent assembly forces from being transferred to the cam shaft. Carefully drive the roll pin (Table 1, Item #10) into dual handle. *Remove roll pin punch as the roll pin is inserted.*
6. Install Cover Plate Assembly
- a. Align holes in fuel selector valve gasket (Table 1, Item #11) with the three tapped mounting holes, the cam bore, and the indexing roll pin (Table 1, Item #10) on the top side of the valve base. Set gasket on valve base when aligned.
- b. Hold cover plate assembly over valve base, and align with the cover mounting holes, the cam bore, and the indexing roll pin. When positioned properly, capture gasket and hold.
- c. Coat the threads of the three mounting screws (Table 1, Item #12) with Loctite 7471 Primer and let dry. Follow up with Loctite 242 threadlocker. Install screws to secure cover plate assembly. Torque the three 6-32 screws to 7 - 8 in-lbs.
7. Install Retainers
- a. Lubricate both retainer o-rings (Table 1, Item #1) with McFarlane Pulley Oil or aviation motor oil (SAE Standard J1899 or equivalent).
- b. Slide retainer o-ring (Table 1, Item #2) around the large threaded end of the retainer until making contact with the wrench flats. Do this for both retainers.
- c. Set valve base with one of the two inlet passages facing up.
- d. Inside the inlet passage, set the lifter ball (Table 1, Item #8) into the lift ball bore.
- e. Verify that the cam lobe is visually centered in the lifter ball bore.
- f. Verify that lifter ball will remain in contact with the cam surface when the ball is moved around the extents of the lift ball bore.
- g. Insert Guide Insert (Table 1, Item #5) and sealing ball (Table 1, Item #4) into inlet passage, ensuring that the Guide Insert is set back flush against the Guide Insert O-ring (Table 1, Item #6).
- h. Follow with the seal spring (Table 1, Item #3). **NOTE: THE SMALL END OF THE SEAL SPRING SHOULD BE INSTALLED CONTACTING THE SEALING BALL; THE LARGE END OF THE SPRING SHOULD NEST INSIDE FITTING.**
- i. Mix anti-seize compound by volume 25 parts aviation motor oil (SAE Standard J1899 or equivalent) with one part TS-001 Moly powder, Technical grade, from T.S. Moly Lubricants, or equivalent molybdenum disulfide powder (particle size = 3.0 to 4.0μ Fischer Scale).
- j. Lubricate the larger threads on the retainer (Table 1, Item #1) with the mixed anti-seize compound.
- k. Capture the three valve components (sealing spring, lifter ball, and seal ball) in valve body with the retainer. Thread the retainer into valve body and tighten until sealed. Torque the fitting to 20-25 ft-lbs.
- l. Rotate valve assembly to bring the other inlet face up, and repeat steps to complete installation of the retainers.
8. Fuel Selector Valve assembly testing & finishing
- a. Complete the Flow Capacity, Rotation Sensitivity, and Leak Check Inspections as detailed in the following sections.
- b. Upon successful completion of inspections, secure roll pin (Table 1, Item #10) into the dual handle (Table 2, Item #1) with .032" stainless steel safety wire.
- c. Apply inspection lacquer across screws and retainers.

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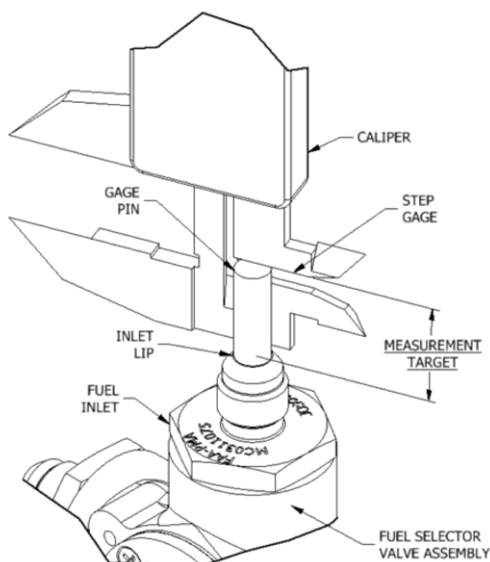
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FLOW CAPACITY INSPECTION

Prior to returning the fuel selector valve to service, inspect it for proper ball lift (valve deflection). This must be checked for each inlet in both single and combined fuel source settings. Due to the valve design, these settings must be checked in both clockwise *and* counter-clockwise rotation directions. McFarlane valves have a *minimum* deflection requirement of .062", where deflection is equal to lifted height ("LEFT/BOTH/RIGHT") minus seated height ("OFF"). A typical setup is seen below with a caliper/step gage and a tight-fitting gauge pin being used to measure ball height.

NOTE: FUEL FLOW THROUGH THE SELECTOR VALVE IS DIRECTLY RELATED TO VALVE LIFT.



TYPICAL VALVE DEFLECTION MEASUREMENT

The gauge pin must have flat-ends for accurate readings. In order to reduce inaccuracy of measurements, the suggested pin gauge size is .421+.

ACCEPTANCE: To accept the fuel selector assembly as airworthy, all valve deflections must meet or exceed the minimum valve deflection of .062 inches. If the fuel selector valve and the cam fail to meet the minimum valve deflection, repeat steps 1 through 11, and re-measure and compare valve deflection results.

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ROTATION SENSITIVITY INSPECTION

Check the rotational sensitivity of the McFarlane Fuel selector valve by manipulating it through the process described below.

RIGHT Position Check

1. Turn the valve control turned to the RIGHT detent position.
2. Insert a gage pin (use the same tool as was used in the flow capacity inspection) into the RIGHT inlet.
3. Apply and maintain gentle pressure to the exposed end of gage pin.
4. Slowly rotate the valve control to the CLOSED position. Note the location of the balls in relation to the detent pockets when gage pin first moves; this indicates the valve is beginning to close.

LEFT Position Check

1. Turn the valve control turned to the LEFT detent position.
2. Insert a gage pin into the LEFT inlet.
3. Apply and maintain gentle pressure to the exposed end of gage pin.
4. Slowly rotate the valve control to the CLOSED position. Note the location of the balls in relation to the detent pockets when gage pin first moves; this indicates the valve is beginning to close.

BOTH Position Check

1. Turn the valve control to the BOTH position.
2. Insert the gage pin into the RIGHT inlet.
3. Apply and maintain gentle pressure to the exposed end of gage pin.
4. Slowly rotate the valve control to the LEFT position. Note the location of the balls in relation to the detent pockets when gage pin first moves; this indicates the right side is beginning to close.
5. Return the valve control in the BOTH position, insert the gage pin into the LEFT inlet.
6. Slowly rotate the valve control to the RIGHT position. Note the location of the balls in relation to the detent pockets when gage pin first moves; this indicates the left side is beginning to close.

ACCEPTANCE: In each of the four required inspection rotations, the balls must be clear of the detent pockets before a notable change in pin position is observed.

LEAK CHECK INSPECTION

A functioning fuel selector valve must not leak in the OFF position. If a leak is found, disassemble valve as required and repair. When corrected, repeat the leak check procedure.

NOTE: THE FOLLOWING PROCEDURE IS DESIGNED TO IDENTIFY LEAKS IN THE FUEL SELECTOR VALVE. THIS IS CONDUCTED AT A STANDARD PRESSURE.

LEAK CHECK - OUTLET PRESSURE CHECK

1. Turn the fuel selector valve to the OFF position.
2. Attach an air source to the fuel outlet fitting. Apply 2.0 to 3.0 psig of regulated dry air to the outlet.
3. Submerge pressurized valve in clean Stoddard solvent or clean mineral spirits.
4. Check for leakage out of the left or right inlet fittings and at any o-ring or gasket locations - Leaks are typified by small streams of bubbles rising to the surface from the leaking location. Though, any bubbles coming out of the valve indicates leakage.
5. Remove valve from solvent.
6. Rotate the valve counter-clockwise to RIGHT and back to the OFF position.
7. Re-submerge the pressurized valve into the solvent.
8. Check for leakage out of the left or right inlet fittings and at any o-ring or gasket locations.
9. Remove valve from solvent.
10. Rotate the valve clockwise to LEFT
11. and back to the OFF position.
12. Re-submerge the pressurized valve into the solvent.
13. Check for leakage out of the left or right inlet fittings and at any o-ring or gasket locations.
14. Remove valve from solvent and wipe off any remaining solvent.

ACCEPTANCE: The functioning fuel selector valve must not leak in the "off" valve position.

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FUEL SELECTOR VALVE COMPLIANCE

COMPLIANCE: The fuel selector valve must pass the **Flow Capacity Inspection**, the **Rotation Sensitivity Inspection**, and the **Valve Leak Check** prior to being returned to service. If inspections cannot be completed successfully after attempting repairs, the fuel selector valve assembly is not airworthy. Please contact McFarlane Aviation Engineering group for additional support.

You can contact us via email: engineering@mcfarlaneaviation.com or phone: 1-785-594-2741.

CAUTION: DO NOT REMOVE P/N 1345, HANDLE, DUAL, AFTER ASSEMBLY. IF THE HANDLE IS REMOVED, THE VALVE MUST BE DISASSEMBLED AND INSPECTED BEFORE REASSEMBLY.

TROUBLESHOOTING

Refer to the applicable Cessna 100 Series Service Manual for troubleshooting instructions.

PLACARDS

None applicable

DATA

All information to support the continued airworthiness of this replacement part is as defined herein and contained in:

- Relevant Cessna 100 Series Service Manuals.
- Relevant Cessna 100 Series Illustrated Parts Catalog.

INSPECTION

Follow all inspections listed in this document and those mandated by Cessna for the fuel selector valve assembly, P/N: 0311070-1.

RECOMMENDED OVERHAUL PERIODS

No additional overhaul time limitations exist with the use of these parts.

AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is FAA approved and specifies maintenance required under Sec. 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved. No additional airworthiness limitations exist.

ASSISTANCE & REVISIONS

ICA revisions shall be made available on the McFarlane website, www.mcfarlaneaviation.com/ICA. For questions or assistance regarding these Instructions for Continued Airworthiness (ICA), contact McFarlane Aviation, Inc via email or phone. Email: engineering@mcfarlaneaviation.com Phone: 1-800-544-8594 (within the US) or 1-785-594-2741.