

**SERVICE INFORMATION DIRECTIVE**

**Compliance Will Enhance Safety, Maintenance or Economy Of Operation**

**SID05-7**

Technical Portions FAA Approved

**SUBJECT: Teledyne Continental Motor's (TCM) Position-Tuned Fuel Injection Nozzles**

**PURPOSE:** To Provide Installation Instructions and Instructions For Continued Airworthiness for TCM Position-Tuned Fuel Injection Nozzles

**COMPLIANCE:** At any time TCM Position-Tuned Fuel Injection Nozzles are initially installed or when removal is required for service procedures or routine cleaning.

**MODELS**

**AFFECTED:** All Fuel Injected Engines

**GENERAL**

TCM fuel nozzles have traditionally been matched to provide equal fuel flow to each cylinder. All nozzles are carefully flow calibrated to give precise metering of fuel flow with respect to fuel pressure. Fuel nozzles are now being produced in additional intermediate sizes, which allow smaller changes to be made in fuel flow. Identification of the new intermediate-flow nozzle is made by combining the flow letter designations of the nozzles one size smaller and one size larger than the new nozzle. (For example: 12D, 12DE, 12E, etc.)

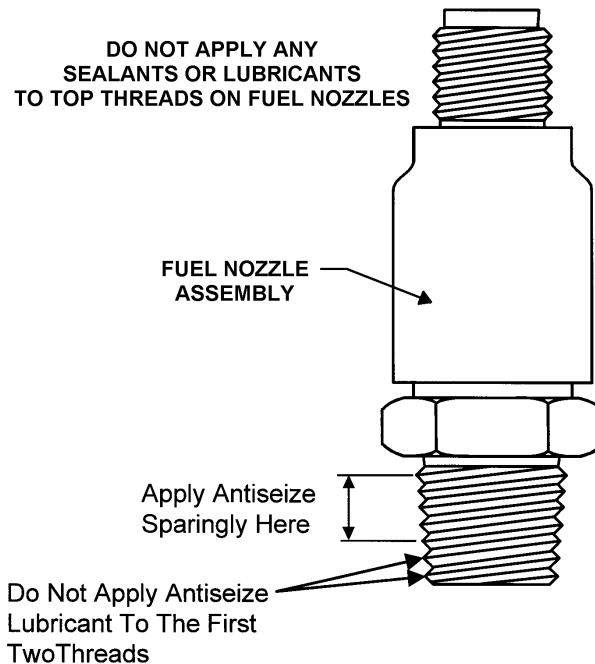
Within the constraints of engine installations and variations in the design of engine induction systems, small differences in airflow can occur within the cylinders on an engine. The variations are small and the resultant changes in air/fuel ratio do not have a significant effect on the power produced in each individual cylinder. TCM's latest engine models, such as the IO-360-ES, IO-550-N, TSIO-520-BE, TSIO-550-B,C and others, feature tuned induction systems which improve the balance of airflow to the cylinders.

The capability exists on ALL engine models to further match the air/fuel ratio between cylinders by carefully modifying the fuel flow between each cylinder in small increments while maintaining the correct total fuel flow. For this purpose TCM has developed "position-tuned" fuel nozzle systems, which match injector flow to each individual cylinder's airflow while maintaining the correct total fuel flow. An automated test method was created to measure and evaluate the fuel flow range between the first and the last cylinder EGT peaks as the mixture was leaned from full rich at cruise operating conditions. Based on the actual fuel flow at each cylinder's peak EGT, individual nozzle flows were changed to *align the peaks*. The process can yield smaller cylinder-to-cylinder air/fuel ratio variations at selected engine settings. This assures that each cylinder is operating at the same air/fuel ratio in cruise conditions while maintaining acceptable air/fuel ratios at other operating points.

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## INSTALLATION INSTRUCTIONS

- 1) In accordance with the airframe manufacturer's instructions, remove cowling and any airframe accessories that may obstruct access to the fuel nozzles.
- 2) Turn the aircraft fuel selector to the off position.
- 3) Loosen and remove the fuel injection lines from the existing fuel nozzles.
- 4) On turbocharged engine models, loosen fuel nozzle sleeve assembly nuts from the upper deck reference tubes and remove the metal washer, the rubber washer and the sleeve assembly from each nozzle. Retain the metal washer and the sleeve assembly for re-use. Discard the rubber washer.
- 5) Loosen and remove the fuel nozzles from each cylinder.

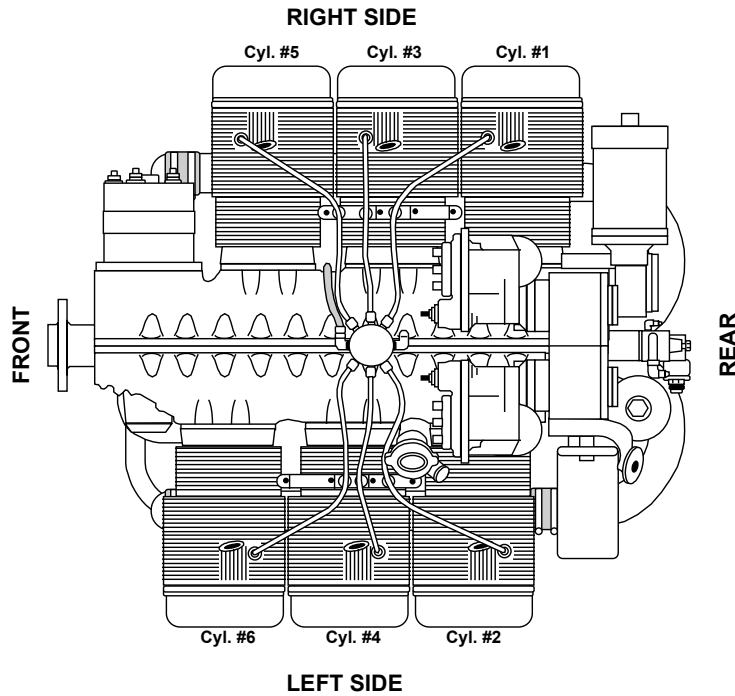


**CAUTION . . .** Never use teflon tape on fluid fittings or fuel nozzles.

**Figure 1. General Antiseize Lubricant Application Typical Fuel Nozzle Shown**

- 6) Remove the TCM Position-Tuned Fuel Nozzles from their packages. Inspect each nozzle for debris to avoid possible nozzle restriction after installation. Visually inspect each nozzle jet orifice to verify that it is open and contains no restriction. If cleaning is required, the Maintenance Instructions contained in this bulletin must be followed.
- 7) Apply a thin film of anti-seize compound, TCM P/N 646943 or Loctite 76732, to the large threaded end of each nozzle assembly. Reference Figure 1 for proper installation of the anti-seize compound to the nozzle assembly.
- 8) Each TCM Position Tuned nozzle is identified as to cylinder position and nozzle size, reference Figure 2 for cylinder arrangement on the engine crankcase and Figure 3 for nozzle position marking.

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**Figure 2. Cylinder arrangement as installed on the engine.**



**Figure 3. Nozzle Position Marking**

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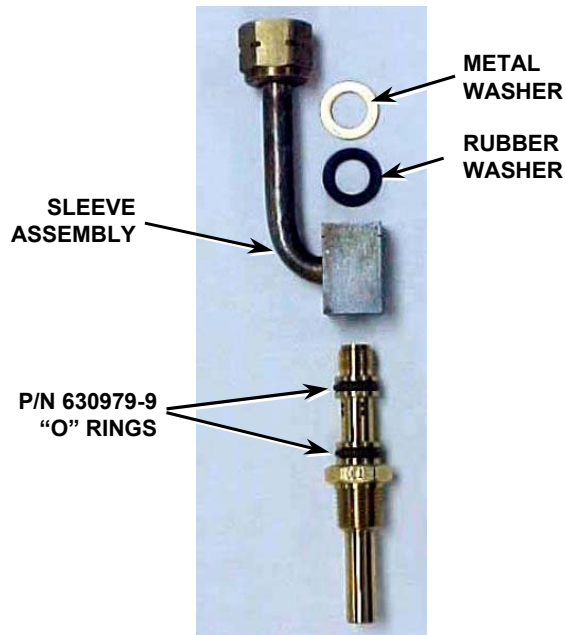


FIGURE 4. Typical Turbo-Charged Injector Installation

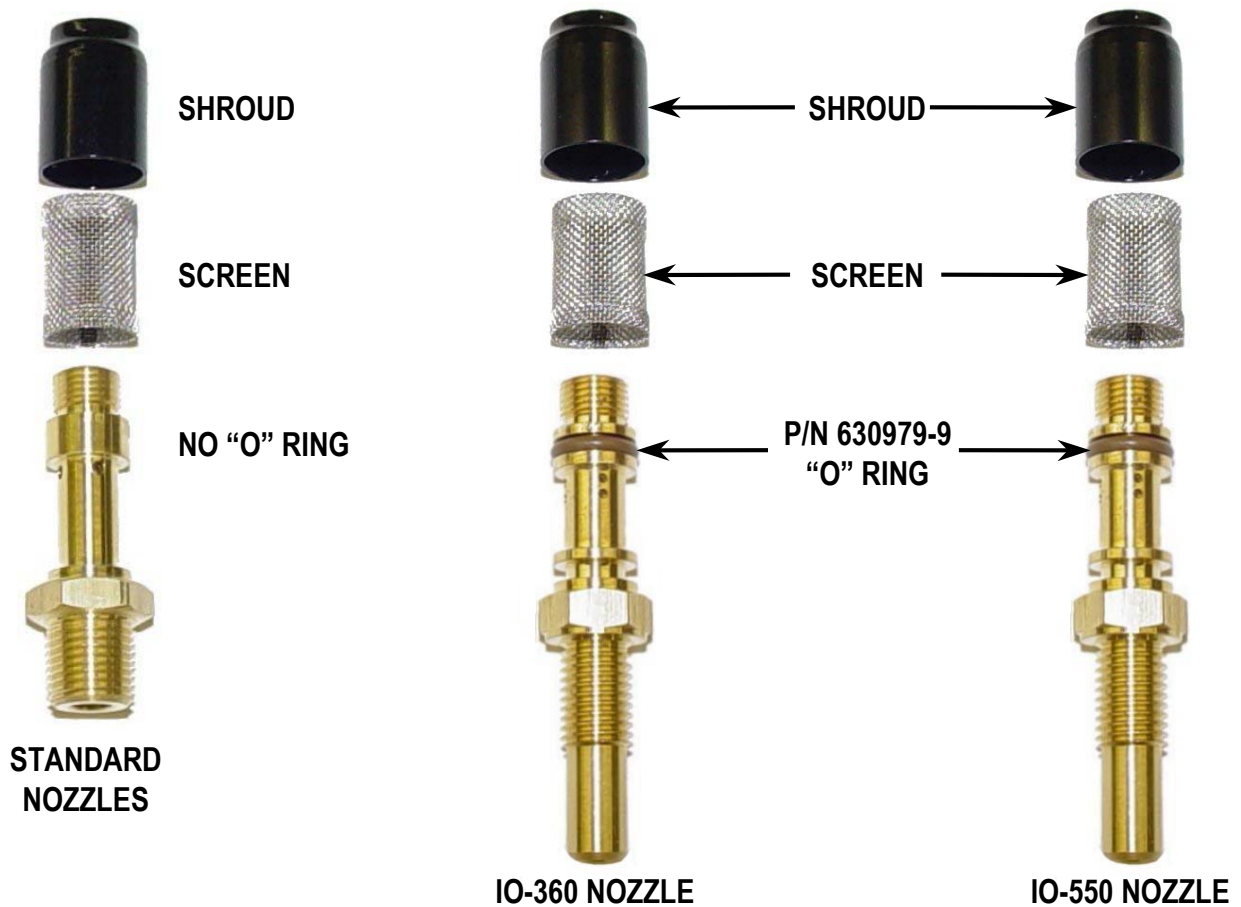


Figure 5. Typical Nozzle Assemblies For Normally-Aspirated Engines

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- 9) Install each nozzle in the fuel nozzle port of the appropriate cylinder finger tight to insure that it does not cross-thread.
- 10) Torque each nozzle to 55-65 inch pounds using a properly calibrated torque wrench.
- 11) For turbo-charged engine models, reinstall nozzle sleeve assemblies ensuring new P/N 630979-9 O-rings are used. Tighten the nut to the upper deck reference tube finger tight to set the seal between the nut and the male connector, then tighten an additional 3/4 to 1 turn. Install a new P/N 640612 rubber washer and the previously retained metal washer on each nozzle, reference figure 4.
- 12) Reinstall each fuel injection line to the appropriate nozzle and tighten to a torque value of 40-45 inch pounds using a properly calibrated torque wrench.

**CAUTION...** Do not apply any type of thread lubricant or sealant to the fuel injection line to nozzle junction.

- 13) Clean each fuel injection line at the location of the identification label application with acetone, reference figure 6. With this area clean and dry, apply an identification label P/N 655303 to each fuel injection line and wrap the label around the fuel injection line to form a flag as indicated in figure 6. An identification label may also be applied to the valve rocker cover in a conspicuous location in addition to the fuel injection line.



**Figure 6. Label Application**

- 14) Turn the aircraft fuel selector to the "ON" position.
- 15) Perform a complete fuel system leak check in accordance with aircraft manufacturer's maintenance instructions prior to engine operation.

**WARNING**

**Over priming can cause a flooded intake resulting in a hydraulic lock condition and subsequent engine damage or failure. If the engine is over primed, or flooded, make sure that all fuel has drained from the intake and cylinders prior to attempting engine start.**

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- 16) Perform the engine fuel system verification in accordance with the latest revision of SID97-3.
- 17) Reinstall all airframe-supplied accessories and cowlings in accordance with the airframe manufacturer's instructions.

## **MAINTENANCE INSTRUCTIONS**

NOTE . . . This bulletin contains the Manufacturer's Instructions for Continued Airworthiness for Position Tuned Nozzle Assemblies as required by FAR43.13.

All fuel nozzles must be removed annually or every 300 hours, whichever occurs first, for inspection and cleaning as follows:

- 1) In accordance with the airframe manufacturer's instructions, remove cowling and any airframe accessories that may obstruct access to the fuel nozzles.
- 2) Turn the aircraft fuel selector to the off position.
- 3) Loosen and remove the fuel injection lines from the fuel nozzles.
- 4) On turbo-charged engine models, loosen fuel nozzle sleeve assembly nuts from the upper deck reference tubes and remove the metal washer, the rubber washer and the sleeve assembly from each nozzle. Retain the metal washer and the sleeve assembly for re-use. Discard the rubber washer.
- 5) Loosen and remove the fuel nozzles from each cylinder.
- 6) Clean each nozzle by soaking in lacquer thinner, MEK or acetone for several hours. Wipe clean the exterior of the nozzle with a lint-free cloth. Dry the nozzle interior with dry compressed air. Visually inspect the nozzle jet orifice to verify that it is open with no obstructions.
- 7) If the nozzle jet orifice is obstructed and cannot be cleaned by solvent action as noted in step 6 above, the nozzle must be replaced.

***CAUTION . . . Never attempt to clear or clean a nozzle jet orifice restriction by mechanical means. This can damage the orifice and affect the flow rate of the nozzle. Any nozzle which has been cleaned by mechanical means must be replaced.***

- 8) Once each nozzle has been cleaned and inspected, they should be reinstalled in accordance with the following:
- 9) Apply a thin film of anti-seize compound, TCM P/N 646943 or Loctite 76732, to the large threaded end of each nozzle assembly. Reference Figure 1 for proper installation of the anti-seize compound to the nozzle assembly.
- 10) Each TCM Position Tuned nozzle is identified as to cylinder position and nozzle size, reference Figure 2 for cylinder arrangement on the engine crankcase and figure 3 for nozzle position marking.

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- 11) Install each nozzle in the fuel nozzle port of the appropriate cylinder finger tight to insure that it does not cross-thread.
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**CAUTION...** *Do not apply any type of thread lubricant or sealant to the fuel injection line to nozzle junction.*

- 15) Turn the aircraft fuel selector to the "ON" position.
- 16) Perform a complete fuel system leak check in accordance with aircraft manufacturer's maintenance instructions prior to engine operation.

**WARNING**

**Over priming can cause a flooded intake resulting in a hydraulic lock condition and subsequent engine damage or failure. If the engine is over primed, or flooded, make sure that all fuel has drained from the intake and cylinders prior to attempting engine start.**

- 17) Perform the engine fuel system verification in accordance with the latest revision of SID97-3.
- 18) Reinstall all airframe-supplied accessories and cowlings in accordance with the airframe manufacturer's instructions.

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