TELEDYNE CONTINENTAL ® AIRCRAFT ENGINE

SERVICE BULLETIN

Compliance Will Enhance Safety

CATEGORY 3

SB96-12

FAA APPROVED

Supersedes M89-17

SUBJECT: **CONTINUED AIRWORTHINESS INSTRUCTIONS FOR TCM CYLINDERS.**

PURPOSE: In addition to the instructions provided in TCM Overhaul Manuals, Maintenance Manuals and Service Bulletins, TCM has established the following inspection criteria to assist in achieving the optimum service life from cylinder assemblies. Cylinder cores received from the field often exhibit non-TCM approved repairs, external damage and maintenance neglect which can cause a reduction in service life with possible catastrophic results. Compliance with this Service Bulletin will help identify and prevent conditions, repairs, misuse and damage to cylinders which are known to adversely affect cylinder airworthiness.

This Service Bulletin requires removal from service any cylinder that exhibits unauthorized repairs or types of damage described in this Service Bulletin.

COMPLIANCE: **PART I** - At the next scheduled maintenance interval and then at each subsequent annual inspection thereafter, inspect each cylinder as set forth in PART I.

PART II - Each time a cylinder is removed for engine or cylinder overhaul, the inspection instructions set forth in PART II must be accomplished in addition to the requirements provided in the applicable TCM Service Bulletins, Maintenance and Overhaul Manuals.

MODELS AFFECTED: All TCM engine models.

PART I - ANNUAL INSPECTION REQUIREMENTS.

Each annual inspection must include the following inspection procedures which will help identify internal or external structural discrepancies developing or present in the cylinder assembly. They consist of: (A) VISUAL INSPECTION, (B) COMPRESSION CHECK, and (C) LEAK CHECK.

After inspection is completed and appropriate corrective action (as required) has been accomplished, make a log book entry as to compliance with this Service Bulletin.

A. VISUAL INSPECTION

1. An external inspection of each cylinder assembly will help identify conditions that could progress to the point of adversely affecting the airworthiness of the cylinder. Remove the cowling and inspect the cylinder barrels and cylinder heads as outlined below. It should not be necessary to remove the induction system, exhaust system or inter-cylinder baffles for purposes of this inspection. Prior to any cleaning of the engine, carefully inspect each cylinder assembly as follows:

a. **Cylinder Barrel.** Using an inspection light and mirror, thoroughly inspect the cylinder barrel including the cylinder barrel fins and the areas between and adjacent to the fins for cracks, sharp indentations, chafing damage and pitting. This visual inspection must include a detailed external inspection of the areas of the cylinder barrel which experience the highest operational stresses from the power stroke of the piston. These areas are the 12 o'clock area of the first six fins below the head on one side of the engine, and the 6 o'clock area on the other side as described in Figure 1. In addition, inspect for any signs of leakage of oil, fuel, soot or any condition that could indicate that the integrity of the cylinder or the head-to-barrel junction has been breached. See Table I, item 5 "NOTE" for exception. IF ANY OF THE CONDITIONS DESCRIBED ABOVE ARE FOUND, SEE TABLE I FOR REPAIR OR REPLACEMENT INSTRUCTIONS.

b. **Cylinder Head.** Inspect the external surfaces of the cylinder head including the cylinder head fins, intake and exhaust ports, top and bottom spark plug bosses and fuel nozzle boss. Inspect for cracks, exhaust flange leakage or any signs of leakage of oil, fuel, soot or any conditions that could indicate that structural integrity of the cylinder or the head-to-barrel junction has been breached. IF ANY OF THE CONDITIONS DESCRIBED ABOVE ARE FOUND, SEE TABLE I FOR REPAIR OR REPLACEMENT INSTRUCTIONS.

c. **Inter-cylinder and peripheral baffling.** Carefully inspect all inter-cylinder and peripheral baffling for correct installation, proper positioning, deterioration, chafing and missing or broken sections. CORRECT OR REPLACE ANY DISCREPANT BAFFLING.

d. **Liquid cooled cylinders.** In addition to a, b and c above, as applicable, inspect cylinder head cooling jacket for leaks.

2. Thoroughly wash the entire engine with an approved cleaning solution and repeat the visual inspection outlined above.

WARNING

USE EXTREME CAUTION IN THE PROPELLER AREA WHILE PERFORMING THE FOLLOWING INSPECTION. VERIFY THAT THE MAGNETOS ARE GROUNDED TO PREVENT IGNITION. REMOVE ALL SPARK PLUG LEADS.

B. COMPRESSION CHECK

1. Perform a compression check in accordance with the latest instructions in the TCM Service Bulletin concerning cylinder compression leakage check. This procedure and appropriate follow-up, will help make an early identification of internal conditions which may affect the airworthiness of each cylinder.

C. LEAK CHECK

Many repair stations have already made this simple test part of their routine cylinder compression check. This check serves as an identifier for conditions which may not be detectable by visual inspection and also serves as a back-up for conditions which maybe difficult to detect because of visual limitations. It can be accomplished in a relatively short amount of time and can identify conditions affecting airworthiness.

1. With the compression tester connected, apply 5 PSI to the cylinder.

2. Position the piston as close to bottom dead center on the compression stroke as possible, ensuring that the intake valve remains closed to allow the cylinder to hold pressure.

WARNING

IT WILL BE NECESSARY TO HOLD THE PROPELLER STATIONARY WHILE PRESSURE IS APPLIED TO THE CYLINDER. USE EXTREME CAUTION TO PREVENT INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT.

3. Increase the pressure slowly to a maximum value of 80 PSI. Saturate the entire cylinder assembly with a soap and water solution.

4. Inspect the complete cylinder for leakage. Leakage will be indicated by an accumulation of bubbles.

5. After complete cylinder inspection, relieve cylinder pressure and remove compression tester.

6. Perform this inspection on each cylinder.

ANY CYLINDER THAT EXHIBITS EXTERNAL LEAKAGE FROM THE HEAD OR BARREL STRUCTURE MUST BE REPLACED PRIOR TO FURTHER ENGINE OPERATION.

PART II - INSPECTION REQUIREMENTS FOR CYLINDERS REMOVED FROM THE ENGINE FOR OVERHAUL.

In addition to the instructions set forth in the applicable TCM Overhaul Manual, and those set forth in PART I,A and PART I,C of this Service Bulletin, perform the following inspections as set forth below. The leak check (PART I,C) may be performed prior to removal of the cylinder(s) if desired.

A. MAGNETIC PARTICLE AND FLUORESCENT PENETRANT INSPECTION

1. Clean the cylinder assembly thoroughly in accordance with the applicable TCM Overhaul Manual.

WARNING

BLASTING TECHNIQUES CAN BE EMPLOYED TO REMOVE HARD CARBON DEPOSITS IF SUITABLE EQUIPMENT IS AVAILABLE. SUITABLE TYPES OF GRIT FOR DRY BLASTING ARE PLASTIC PELLETS AND PROCESSED NATURAL MATERIALS, SUCH AS WHEAT GRAINS AND CRUSHED FRUIT PITS OR SHELLS. AIR PRESSURE SHOULD BE THE LOWEST THAT WILL PRODUCE THE DESIRED CLEANING ACTION. SMALL HOLES AND FINISHED SURFACES, WHICH DO NOT REQUIRE CLEANING, SHOULD BE PROTECTED FROM THE BLAST BY SEALS AND COVERS, PARTICULARLY IF THE GRIT IS SHARP. SAND, GLASS, SHOT AND METAL GRIT ARE TOO ABRASIVE AND TOO HEAVY FOR USE ON SOFT METALS LIKE ALUMINUM, AND MUST NOT BE USED. AFTER ANY BLASTING PROCESS, BLOW OFF ALL DUST WITH DRY COMPRESSED AIR AND MAKE SURE THAT NO GRIT HAS LODGED IN CREVICES, RECESSES AND HOLES. PARTS MAY ALSO BE CLEANED WITH HOT SOAPY WATER, THEN AIR DRIED WITH DRY COMPRESSED AIR. FAILURE TO CLEAN THE CYLINDER IN THIS MANNER COULD RESULT IN CYLINDER BORE DAMAGE DUE TO CONTAMINATION.

2. Perform a magnetic particle inspection of the inner and outer surfaces of the cylinder barrel using circular and longitudinal magnetization. This inspection must be performed in accordance with ASTM Standards pertaining to non-destructive testing by a certified technician.

3. Perform a fluorescent penetrant inspection of the cylinder head in accordance with ASTM Standards pertaining to non-destructive testing by a certified technician.

NOTE: Applicable ASTM Standards may be obtained from:

American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103-1187
Telephone: (215) 299-5400
Fax: (215) 977-9679

4. Repair or replace any cylinder that exhibits damage in accordance with the instructions set forth in TABLE I.

TABLE I - REPAIR AND REPLACEMENT INSTRUCTIONS

After performing the inspection requirements set forth in PART I or PART II (as applicable), any cylinder found to exhibit the following conditions must be repaired or replaced in accordance with the following instructions:

LOCATION	TYPE OF DAMAGE AND CORRECTIVE ACTION
1. Power Stroke Stress Area of the Cylinder Barrel - See Figure 1.	(a) Cracks, broken or bent fins, (including bent fins that have been straightened) pitting, sharp indentations and chafing damage that alter the original barrel surface contour or reduce the thickness of the barrel fins - CYLINDER REPLACEMENT IS REQUIRED, unless damage can be repaired as described in Item 2 (a) below.
2. Remaining Cylinder Barrel Fin Areas.	(a) Fin tips - Pitting, sharp indentations or chafing damage in the fin tip LESS than .050 inch deep - Remove only enough material to eliminate the damage with a small hand-held grinder and fine grit disk or stone, or by turning the cylinder on a lathe. PRECAUTIONS MUST BE TAKEN TO PREVENT DAMAGE TO ADJACENT FINS AND LOCALIZED FIN HEATING DURING THE MATERIAL REMOVAL PROCESS. Blend the area smooth so that no sharp edges remain and ensure that original fin contours remain. Inspect the area for cracks and if none are present, clean the surface and apply a protective coating of specified TCM enamel paint or equivalent.

WARNING

DAMAGE OR REMOVAL OF EXTERNAL BARREL MATERIAL THAT RESULTS IN A REDUCTION OF THE BARREL WALL THICKNESS IS STRICTLY PROHIBITED REGARDLESS OF LOCATION AND REQUIRES CYLINDER REPLACEMENT.

LOCATION	TYPE OF DAMAGE AND CORRECTIVE ACTION
Remaining Cylinder Barrel Fin Areas. (continued)	(b) Bent fins - Cylinder may continue in use, provided that the fin is not bent more than one-half of the distance to the next fin and that no attempt is, or has been made to straighten the bent fin. If the bending is more than the distance indicated, or if an attempt has been made to straighten the bent fin, or it is not possible to determine that neither of these conditions has occurred, the cylinder must be removed for magnetic particle inspection.
3. All External Surfaces of the Cylinder Barrel.	(a) ELECTRICAL ARC PITTING OR WELD REPAIRS OF ANY SURFACE ON THE CYLINDER BARREL (INCLUDING THE FIN TIPS) IS STRICTLY PROHIBITED. If such conditions are present - CYLINDER REPLACEMENT IS REQUIRED.
	(b) Discolored or burnt paint - Will require removal of the cylinder for inspection. This could indicate piston and piston pin scoring of the cylinder bore produced by an overheating condition and will require cylinder repair or replacement.
	(c) Surface corrosion and missing paint - Surface corrosion can in some cases lead to conditions which may be detrimental to cylinder service life. Exterior cylinder surfaces should be maintained in a condition free of surface corrosion. If surface corrosion is present it should be removed by polishing the affected surfaces to a smooth finish and a coating of the specified TCM paint (or equivalent) must be applied.

WARNING

DO NOT PAINT THE CYLINDER FLANGE NUT SEATS, SKIRT OR FLANGE TO CRANKCASE MATING SURFACE.

4. Cylinder Head	(a) Except as noted in paragraph (c) below, any crack, other than minor cooling fin cracks that do not extend into the cylinder head structure, or heat checks in the exhaust port less than 1/8" in length - CYLINDER REPLACEMENT REQUIRED.
	(b) Exhaust flange leakage - Replace exhaust flange gasket. If damage to the exhaust system or cylinder flange is found, repair or replace the damaged component prior to further engine operation.
	(c) Weld repair - Only minor non-structural weld repairs are permitted. TCM allows welding repairs of the intake and exhaust port flanges, rocker cover flange and threaded holes (other than spark plug) and requires that these repairs be performed under carefully controlled conditions. NO STRUCTURAL WELD REPAIRS ARE ALLOWED. TCM does not allow weld repairs to the combustion chamber, head structure and rocker shaft bosses - ANY CYLINDER HEAD THAT IS CRACKED OR DAMAGED in a structural area must be replaced.

LOCATION	TYPE OF DAMAGE AND CORRECTIVE ACTION
Cylinder Head (continued)	(d) Damaged studs - Replace studs in accordance with the applicable TCM Overhaul Manual.
	(e) Damage to threaded bores - Repair threaded bores in accordance with the applicable TCM Overhaul Manual.
	(f) Cracked cooling jacket (liquid cooled cylinder) - CYLINDER REPLACEMENT IS REQUIRED.
5. Head to Barrel Junction	(a) Air, fuel or oil leakage - CYLINDER REPLACEMENT IS REQUIRED. See Section C, LEAK CHECK.
	NOTE: During assembly of the cylinder head to barrel, a thread lubricant is used. This lubricant will normally leave a dark stain of dry/hard material and is not cause for cylinder replacement. However, if this stain is noted, the cylinder must be leak checked in accordance with section C to verify that the head to barrel junction has not been breached.

RELATED SERVICE BULLETINS

The latest revision of the following TCM Service Bulletins contain information concerning cylinder inspection and must be referenced to determine compliance requirements:

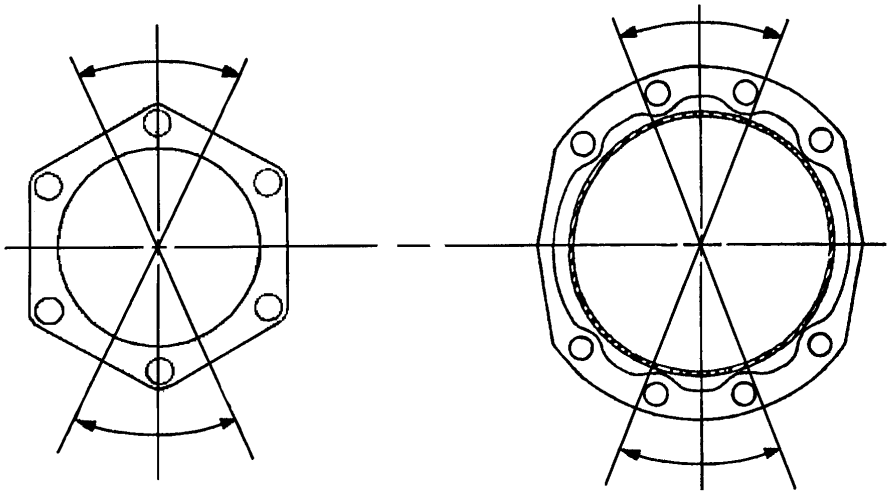
M92-11	LIQUID COOLED CYLINDER ASSEMBLY SPARK PLUG AND SPARK PLUG HELI-COIL.
M92-8	APPLICATION OF 4-1/16 INCH DIAMETER CYLINDER ASSEMBLIES.
M92-6	ROCKER SHAFT RETENTION IMPROVEMENT FOR INCLINED VALVE CYLINDER.
M92-4R1	IO & L/TSIO-360 ROCKER SHAFT STUD INSPECTION.
M91-7	CYLINDER BARREL ULTRASONIC INSPECTION.
M91-6	CYLINDER BARREL INSPECTION.
M90-5R1	CYLINDER BORE DIMENSIONS FOR 5 INCH AND 5-1/4 INCH CYLINDERS.
M84-15	CYLINDER COMPRESSION LEAKAGE CHECK.
M73-13	ROCKER SHAFT BOSSES.
M73-2	CYLINDER, NON-H FAA AD #72-20-02.

Also reference all TCM Service Bulletins issued after the original publication date of this bulletin for additional information concerning cylinder inspection.

AFFECTED PUBLICATIONS: Insert a copy of this Service Bulletin into the appropriate section of all TCM engine model Overhaul and Maintenance Manuals.

POWER STROKE STRESS AREA ON THE 1-3-5 CYLINDERS OF RIGHT HAND ROTATING ENGINES (EXCEPT GTSIO-520) AND ON THE 2-4-6 CYLINDERS OF ALL LTSIO-360, LTSIO-520 AND GTSIO-520 ENGINES.

TOP 12 O' CLOCK POSITION
(as mounted on crankcase)



BOTTOM 6 O' CLOCK POSITION
(as mounted on crankcase)

POWER STROKE STRESS AREA ON THE 2-4-6 CYLINDERS OF RIGHT HAND ROTATING ENGINES (EXCEPT GTSIO-520) AND ON THE 1-3-5 CYLINDERS OF ALL LTSIO-360, LTSIO-520 AND GTSIO-520 ENGINES.

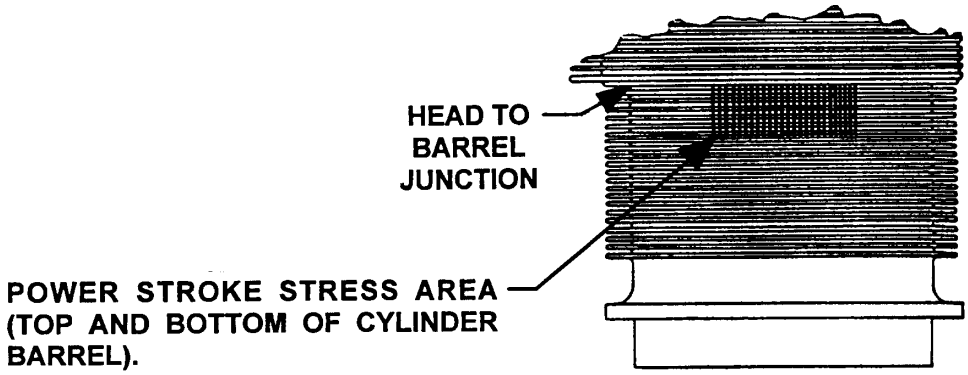


FIGURE 1