CONTINENTAL® AIRCRAFT ENGINE

PERMOLD SERIES ENGINE

MAINTENANCE

AND

OVERHAUL

MANUAL

Technical Portions Accepted by the Federal Aviation Administration
Supersedure Notice

This manual revises information contained in Continental Motors publication M-18, dated 1 September 2014 to support TSIO-550 Permold Series production engines. This revision incorporates cross references to M-0. Previous editions are obsolete upon release of this manual.

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PREFACE

This manual was developed in accordance with Title 14, Code of Federal Regulations (CFR) Part 33, §33.4 as the Instructions for Continued Airworthiness (ICA) for TSIO-550 series engines. Except for authorized owner preventive maintenance, defined in Title 14, Code of Federal Regulations (CFR) Part 43 §§43.3 and 43.13, Continental Motors ICAs are written for exclusive use by FAA (or equivalent authority) licensed mechanics or FAA (or equivalent authority) certified repair station employees. Information and instructions contained in this manual anticipate the user possesses and applies the knowledge, training, and experience commensurate with the requirements to meet the prerequisite FAA license and/or certification requirements. No other use is authorized. It is the responsibility of the owner to verify the person or facility operating, maintaining or servicing the engine uses the most current ICA, including manual change pages, service documents and FAA Airworthiness Directives (ADs), to perform those functions.

Continental Motors provides Instructions for Continued Airworthiness (ICA) based on the design, testing, and certification of engines and parts for which Continental Motors is the holder of the Type Certificate (TC) or Parts Manufacture Approval (PMA) issued by the Federal Aviation Administration (FAA). Instructions in Continental Motors manuals, which include maintenance, repair limits, and overhaul instructions, are applicable only to engines and parts supplied by Continental Motors.

Installation of aftermarket parts on a Continental Motors engine constitutes a deviation from type-design criteria. Continental Motors has not participated in design, test, or certification of any aftermarket parts. Continental Motors does not provide product manufacturing specifications to aftermarket parts manufacturers and accepts no liability for the suitability, durability, longevity, or safety of such parts installed on Continental Motors engines. Installation of aftermarket parts on a Continental Motors engine must be performed using Instructions for Continued Airworthiness prepared by the manufacturer and found acceptable by the FAA for the subject installation. Continental Motors ICAs must not be used for such parts.

WARNING

Ensure you have the latest revision of this manual, any applicable change pages, FAA Airworthiness Directives and CMI service documents prior to commencing engine service, inspection, maintenance, or overhaul.

To facilitate the use of current data, the latest revision of the Instructions for Continued Airworthiness and applicable change pages are available to all registered engine owners at no cost on the Continental Motors web site. The information available includes a listing of the latest manual versions, illustrated parts catalogs, FAA ADs, Service Documents, and other information applicable to the ICAs.

Electronic versions of all current Continental Motors publications are available on the Continental Motors web site to Fixed Base Operators (FBOs), mechanics and others who subscribe to Continental Motors Internet Services. Printed copies of manuals and service subscriptions are also available. Refer to "Publication Access" in Section 1-2.1.
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Chapter 1. Introduction

1-1. Scope and Purpose of This Manual

This manual provides maintenance and overhaul instructions for TSIO-550 Permold series engines, manufactured by Continental Motors. These Instructions for Continued Airworthiness (ICA) are supplied to the owner with the engine. Instructions in this manual are specific to the TSIO-550 Permold Series engines. For information specific to other Continental Motors engine series, accessories, or the airplane, refer to the appropriate manual.

Chapter 2 contains detailed engine model descriptions and specifications. Special tools and consumables such as lubricants, sealants and adhesives are listed in Chapter 3. Airworthiness limitations are in Chapter 4. Chapter 5 provides instructions for engine removal and installation instructions. Chapter 6 contains inspection and service intervals and instructions. Chapter 7 provides supplemental information for the airplane flight manual (AFM) or pilot operating handbook (POH) in regards to specific engine operating procedures. Chapter 8 contains engine troubleshooting instructions. Engine preservation and storage instructions are in Chapter 9. Non-overhaul engine part removal and installation instructions are in Chapter 10. Chapter 11-18 contain engine overhaul instructions. Appendixes A, B, and C cross-references sections of M-0. Appendix D contains engine overhaul dimensional fits and limits.

1-1.1. Instructions for Continued Airworthiness

CMI Part No. M-18, is the principal instruction for continued airworthiness for TSIO-550 Permold Series engines as defined by Title 14 CFR§33.4. This manual and the component manuals (as applicable to engine specification) listed below are delivered to the customer with the engine. Service documents and Airworthiness Directives may also affect ICAs. Refer to Section 1-2.5 for instructions to check current publication status.

<table>
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1-1.2. Effectivity Symbols

Slight variations in TSIO-550 Series engine models require specific instructions or illustrations. When peculiar information pertains to only a specific engine model in the series, an effectivity symbol will accompany the information. Effectivity symbols found in this publication are:

- TSIO-550-B
- TSIO-550-C
- TSIO-550-E
- TSIO-550-G
- TSIO-550-K
- TSIO-550-N
- Energizer Starter
- Iskra Starter
- SkyTec Starter

21 September 2017
1-1.3. Advisories

This manual utilizes three types of advisories; defined as follows:

**WARNING**

*WARNING* emphasizes information which, if disregarded, could result in severe injury to personnel or equipment failure.

**CAUTION:** Emphasizes certain information or instructions, which if disregarded, may result in damage to the engine or accessories.

**NOTE:** Provides special interest information, which may facilitate performance of a procedure or operation of equipment.

Warnings and cautions precede the steps to which they apply; notes are placed in the manner which provides the greatest clarity. Warnings, cautions, and notes do not impose undue restrictions. Failure to heed advisories will likely result in the undesirable or unsafe conditions the advisory was intended to prevent. Advisories are inserted to ensure maximum safety, efficiency, and performance. Abuse, misuse, or neglect of equipment can cause eventual engine malfunction or failure.

1-1.4. Using this Manual

This manual, applicable FAA ADs and CMI service documents, the accessory manuals listed in Table 1-1, and all changes incorporated in the ICAs as revisions constitute the Instructions for Continued Airworthiness (ICAs) prepared by Continental Motors and accepted by the FAA. We prepared this manual in a user-friendly format suited equally for electronic viewing and print. Illustrations in this manual are for reference only, depicting the most prominent configuration in the engine series. Consult the electronic engine parts catalog for engine model-specific illustrated parts breakdowns. The current information available from CMI must be used to perform engine service, repair or overhaul.

Continental Motors provides Instructions for Continued Airworthiness based on the design, testing, and certification of engines and parts for which Continental Motors is the holder of the Type Certificate (TC) or Parts Manufacture Approval (PMA) issued by the Federal Aviation Administration (FAA).

**WARNING**

*Continental Motors Instructions for Continued Airworthiness are applicable only to Continental Motors engines conforming to the approved, type certified engine model configuration.*

*Continental Motors ICAs must not be used for aftermarket parts or products modified by Supplemental Type Certificate.*

Installation of aftermarket parts on a Continental Motors engine constitutes a deviation from type-design criteria. Continental Motors has not participated in design, test, or certification of any aftermarket parts. Continental Motors does not provide product manufacturing specifications to aftermarket parts manufacturers and accepts no liability for the suitability, durability, longevity, or safety of such parts installed on Continental Motors engines. Installation of aftermarket parts on a Continental Motors engine must be performed using Instructions for Continued Airworthiness prepared by the manufacturer.
and approved by the FAA for the subject installation. For work with the engine installed in the aircraft, the aircraft maintenance manual may also be required to gain access to, or install some items. Use only the current information from the aircraft manufacturer.

Exploded assembly illustrations accompany instructions throughout the manual. Parts in illustrations (Figure 1-1) are identified with numerical callouts (indexes). Corresponding parts listings follow the illustrations for reference. The first time instructions refer to an illustration, the figure number is identified in parentheses, followed by the callout. In subsequent parts references, only the callout will be specified unless the referenced illustration changes.

1. Carefully slide the sleeve (Figure 6-15, 13) and drive gear assembly (12) out of the accessory drive adapter through the crankcase magneto pad opening.

2. Remove the nuts (10 & 11), lock washers (8 & 9) and washers (6 & 7). Remove the accessory drive assemblies from the rear of the crankcase. Discard the lock washers (8 & 9).

3. Remove and discard the gasket (1) and residue from the crankcase and the face of the accessory adapter.

4. Repeat steps 1 through 3 for the second accessory drive adapter.

5. Disassemble the accessory drive adapters according to instructions in Chapter 7.

Referenced illustration

Part References by index numbers

Indexed callouts

Illustration Number

Indexed Part names

Figure 1-1. Figure and Index Reference
1-1.5. Compliance

The owner/operator is responsible for ensuring the engine is maintained in an airworthy condition, including compliance with FAA Airworthiness Directives. Engine service life is predicated based on compliance with the aircraft and engine manufacturer’s required instructions, inspections, and maintenance schedule. Failure to comply may void the engine warranty.

WARNING

Prior to authorizing engine maintenance, the owner must ensure the facility or mechanic meets the Federal Aviation Administration (or equivalent authority) regulatory requirements. The engine owner must verify the repair facility or mechanic uses the most current revision, including change pages of the applicable ICA. Use of Instructions for Continued Airworthiness which have been designated as obsolete, superseded, or inactive is prohibited.

Except for Title 14, Code of Federal Regulations (CFR) Part 43 §43.3. “authorized owner preventive maintenance”, Continental Motors ICAs are written for exclusive use by FAA (or equivalent authority) licensed mechanics or FAA (or equivalent authority) certified repair station employees. Information and instructions contained in this manual anticipate the user possesses and applies the knowledge, training, and experience commensurate with the prerequisite FAA license and certification requirements. No other use is authorized.

WARNING

Failure to comply with ICAs may result in personal injury, death and subsequent engine failure. Pursuant to Title 14 CFR Part 43 §43.13(a), each person performing maintenance, alteration or preventive maintenance on an engine or accessory must use methods, techniques and practices set forth in the Instructions for Continued Airworthiness or other methods, techniques, and practices found acceptable to the Administrator.

This manual shall be used in conjunction with the latest revision of FAA Advisory Circular 43.13-1, “Acceptable Methods, Techniques, and Practices” as well as related publications and accessory manufacturer’s instructions. Pursuant to Title 14 CFR Part 43, §43.13(a), each person performing maintenance, alteration, or preventive maintenance on the engine or accessories must use methods, techniques, and practices prescribed in the ICAs or other methods, techniques, and practices found acceptable by the Administrator.
1-1.6. **Order of Precedence**

Continental Motors engine operating instructions are generated prior to and independently of the aircraft operating instructions. Continental Motors operating instructions are developed using factory controlled parameters that are not necessarily the same as those specifications required to satisfy a specific aircraft/engine installation.

**WARNING**

The aircraft operator must use the aircraft manufacturer’s operating instructions found in the Airplane Flight Manual/Pilot’s Operating Handbook (AFM/POH) and applicable Airplane Flight Manual Supplements (AFMS) while operating the engine in the aircraft unless the AFM/POH directs otherwise.

Refer to the AFM/POH published by the aircraft manufacturer for operating instructions and specifications relative to your aircraft.

Prior to commencing engine maintenance, consult the Continental Motors web site to verify the current status of the ICAs relating to the intended procedure.

1-2. **Publications**

This most current approved version of this manual is delivered to the customer at time of purchase. This manual and all subsequent revisions or changes are published in Adobe portable document (pdf) format and available for download on the Continental Motors Internet web site at http://www.continentalmotors.aero.

1-2.1. **Publication Access**

Printed technical publications may be ordered through authorized Continental Motors distributors or via the Internet at http://www.continentalmotors.aero. Contact an authorized Continental Motors distributor to discuss publication or service subscription options and pricing or visit our web site.

1-2.2. **Publication Changes**

**WARNING**

Use only the latest revision of all publications. Using superseded information may jeopardize engine airworthiness. Service documents, published by the manufacturer, or Airworthiness Directives, published by the FAA, may alter or provide supplemental information to the Maintenance and Overhaul Manual. Verify and use only the current versions of all instructions.

The instructions in this manual represent the best and most complete information available at the time of publication. Product or process improvements may trigger changes to existing product design specifications or procedures contained in publications. As new technical information becomes available, Continental Motors will make the information available to the customer.
Continental Motors releases publication changes in the form of either change pages or complete publication revisions, depending upon the extent of change.

Continental Motors issues service documents in the form of Service Bulletins on a wide variety of topics. Some service documents may affect or supplement information in this manual and should be reviewed prior to performing maintenance. All active service documents applicable to the TSIO-550 Permold Series Engine have been incorporated in these instructions as of the date of publication.

1-2.3. Update/Change Distribution

Document updates are available on our website upon notification of FAA document acceptance/approval. Printed publication subscribers receive printed changes and revisions as they are released.

Figure 1-2. Change Page Identification
Document revisions are released if the update changes more than 50% of the contents of a publication. Revisions replace the previous version of a publication from cover to cover. Minor corrections are released as change pages to the original publication, identified with a change number and effective change date in the page footer. Information on the page that changed from the previous edition is identified by a vertical, six-point black line (Figure 1-2), referred to as a “change bar” in the outside margin of the page.

A change page replaces only the previous edition of the affected page. In the event a change page forces repagination, a new page will be inserted with a decimal extension added to the page number. For example, if additional pages are required between pages 1-6 and 1-7, the inserted page numbers will be 1-6.1, 1-6.2, and so on until sufficient pages are added to incorporate the new material.

Page A of the manual contains the original publication date and an itemized list of changes issued for the technical manual (Figure 1-3). If change pages are issued for the manual, the change will be identified, with an effective date under the heading “Effective Changes for This Manual” on Page A. The list of effective pages, itemizes the pages in each section, by change number. Original pages are designated by a 0 in the List of Effective Pages “Change” column.
1-2.4. Service Documents

Continental Motors may issue Service Documents in one of six categories ranging from mandatory (Category 1) to informational (Category 6). Definitions of the categories are listed below:

NOTE: Upon FAA approval, Continental Motors publishes service documents for immediate availability on our web site. The service document cover page indicates the engine models affected by the service document. Service documents may alter or replace the manufacturer’s Instructions for Continued Airworthiness. Insert a copy of applicable Service Documents in affected manuals until the service document instructions are incorporated in the manual, or the service document is canceled or superseded.

Category 1: Mandatory Service Bulletin (MSB)
Used to identify and correct a known or suspected safety hazard which has been incorporated in whole or in part into an Airworthiness Directive (AD) issued by the FAA or have been issued at the direction of the FAA by the manufacturer requiring compliance with an already-issued AD (or an equivalent issued by another country’s airworthiness authority). May contain updates to Instructions for Continued Airworthiness to address a safety issue.

Category 2: Critical Service Bulletin (CSB)
This category identifies a condition that threatens continued safe operation of an aircraft, persons or property on the ground unless some specific action (inspection, repair, replacement, etc.) is taken by the owner or operator. Documents in this category are candidates for incorporation into an FAA Airworthiness Directive. May contain updates to Instructions for Continued Airworthiness to address a safety issue.

Category 3: Service Bulletin (SB)
Information which the product manufacturer believes may improve the inherent safety of an aircraft or aircraft component; this category includes the most recent updates to Instructions for Continued Airworthiness.

Category 4: Service Information Directive (SID)
The manufacturer directs the owner/operator/mechanic in the use of a product to enhance safety, maintenance or economy. May contain updates to Instructions for Continued Airworthiness in the form of maintenance procedures or specifications.

Category 5: Service Information Letter (SIL)
This category includes all information (not included in categories 1 through 4) that may be useful to the owner/operator/technician. May contain updates to Instructions for Continued Airworthiness for optional component installations, which are not covered in the Applicable Operator, Maintenance, or Overhaul Manuals.

Category 6: Special Service Instruction (SSI)
This category is used to address an issue limited to specific model and/or serial number engines. We will distribute SSI notification directly to the affected engine’s owners. SSIs will not be included in the general service document set but will be made available through our Customer Service Department to owners of the affected engines only. An SSI may update the applicable engine’s Instructions for Continued Airworthiness.
1-2.4.1. Service Documents Incorporated in this Manual

Applicable technical information in the service documents listed below, relevant to the engine models covered by this engine manual, have been incorporated in this manual. The full content of active Continental Motors service documents is available at http://www.continentalmotors.aero. Refer to Section 1-3, “Contact Information” for Continental Motors website details.

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1-2.4.2. Service Documents Released After Publication

Continental Motors strives to provide clear, concise, and accurate information and instructions based on best known engineering data at the time of publication. Ongoing process improvements may change a specification or procedure after a manual is released. Service documents, defined in Section 1-2.4, expedite customer notification until the new information is incorporated in the manual text. As service documents are received, note the service document number, release date, title, and applicable section affected by the service document in the blank cells below and insert a copy of the service document behind the last page of this section. Make pen & ink corrections, where appropriate, to the original text in the manual with a citation to the service document; i.e. see SB9X-1. For paragraphs or entire sections, draw an “X” through the affected information in the manual and reference the service document containing the correction.

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1-2.5. Related Publications

The table below lists the publications, source, and accessibility relevant to TSIO-550 Permold Series Engine installation, maintenance & overhaul.

**WARNING**

Use only the latest revision of all publications. Using superseded information jeopardize engine airworthiness.

Table 1-1. Related Publications

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<tr>
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<th>Supplied With Engine</th>
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<td>Yes</td>
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<td>Standard Practice Maintenance Manual (M-0)</td>
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<td>Yes</td>
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<td>Starter Service Instructions (X30592)</td>
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<td>Alternator Service Instructions (X30531)</td>
<td>Yes</td>
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<td>Yes</td>
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<tr>
<td>Magneto Service Manual (X42002)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Installation and Operation Manual (OI-18)</td>
<td>Yes²</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Electronic Engine Product Catalog (by Engine Model and Specification)</td>
<td>No</td>
<td>Yes (view only)</td>
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1. Our web site (continentalmotors.aero) provides daily 24-hour access to engine technical data via the Internet. If you are an Internet service subscriber, you can access our web site to confirm and review the latest revision of this manual. If you have not subscribed to our Internet service and are using printed manuals, contact a service representative using the “Contact Information” in Section 1-3 to confirm you have the latest revision of the manual.

2. The Installation and Operation manual is provided to the aircraft manufacturer as part of the engine interface control documents to aid in development of the Airplane Flight Manual/Pilot’s Operating Handbook with detailed installation instructions and dimensional limits.

1-2.5.1. Suggestions and Corrections

Continental Motors solicits and encourages user comments regarding suggested changes to this manual. Direct recommended changes or questions to the attention of “Publications” at the address listed in Section 1-3, “Contact Information” or send comments via e-mail to CM.techpubs@continentalmotors.aero.

Notify our Customer Service Department immediately, using our toll-free number, if you discover incorrect information which adversely affects safety.
1-3. Contact Information

Continental Motors factory representatives are available to answer technical questions and encourages suggestions regarding products, parts, or service. If customers have an inquiry or require technical assistance, they should contact their local Continental Motors distributor or field representative. To contact a factory representative, refer to the contact information below:

Continental Motors, Inc.
P. O. Box 90
Mobile, AL 36601

Customer Service Department:
Toll free within the Continental United States: 1-888-826-5465
International: 1-251-436-8299

Internet: http://www.continentalmotors.aero.
Chapter 2. Engine Description

2-1. General Engine Description

TSIO-550 Permold Series engines, manufactured by Continental Motors (CM), are six cylinder fuel injected, turbocharged engines with horizontally opposed air cooled cylinders designed for variable-pitch propeller applications. TSIO-550 Permold Series engine models use the cross-flow cylinder design with overhead inclined valves. Downdraft cylinder head intake inlets are cast in the top of the cylinder head; downdraft exhaust outlets exit the bottom of the cylinder.

The 550 cubic inch displacement is achieved using a 5.25 inch diameter cylinder bore and a 4.25 inch piston stroke. TSIO-550 Permold Series engines utilize the Permold crankcase design. Basic engine weights, minus accessories, are listed in Section 2-3. Engine weights vary by model specification, refer to OI-18, TSIO-550 Permold Series Engine Installation and Operation Manual for installed engine weights, including accessories.

The engine is provided with engine mounts designed for a focalized bed mount. A crankcase breather port is located on the oil filler neck on the 2-4-6 side of the crankcase between No. 2 and No. 4 cylinders. A 0.374-24 UNF threaded port is located near the bottom side of the cylinder head to accommodate a bayonet thermocouple.

Engine lubrication is provided by a wet sump, high pressure oil system. The engine lubrication system includes the internal engine-driven pressure oil pump, engine mounted oil cooler, oil sump, full flow oil filter, oil pressure relief valve, and pressure instrumentation. The oil cooler is mounted on the left crankcase half behind the No. 2 cylinder. A vernatherm valve allows oil flow into the engine if an oil restriction occurs in the external oil cooler and during cold starting.

The TSIO-550 Permold Series engines incorporate a downdraft balanced port induction system with an engine mounted throttle body. Engine manifold pressure is controlled by the throttle plate and is measured at the 0.125-27 NPTF port located on the induction manifold near the throttle (see Engine Installation Drawings, Section 5-4).

TSIO-550 Permold Series engines incorporate dual turbochargers and dual intercoolers/aftercoolers. The exhaust bypass for the turbine sections is connected to a single exhaust wastegate that is controlled by a sloped controller.

TSIO-550 Permold Series engines are equipped with a Continuous Flow Fuel Injection system that meters fuel flow as a function of engine speed, throttle angle, mixture control angle, and turbocharger compressor discharge air pressure. The metered fuel is fed to continuous flow air bled injector nozzles located at each cylinder intake port. Fuel drains are provided at the bottom of each cylinder.
Engine Description

Figure 2-1. TSIO-550 Typical Top and Side Views
2-1.1. Engine Model Number Definition

The description of each alphanumeric character in the engine model number is given below for the example engine model TSIO-550-B1B (Figure 2-2).

![Engine Model Definition Diagram]

**Figure 2-2. Engine Model Definition**

2-1.2. Cylinder Number Designations

Refer to Figure 2-3:

- The front of the engine is the end closest to the propeller and the rear of the engine is the accessory end.
- Viewed from the rear of the engine, the left-side cylinders are designated by even numbers 2-4-6, with Cylinder 2 being closest to the rear.
- The right side cylinders have odd number sequential designation 1-3-5, with Cylinder 1 being closest to the rear.
- Firing order of the engine is 1-6-3-2-5-4.

![Cylinder Number Designation Diagram]

**Figure 2-3. Cylinder Number Designation**
2-2. Detailed Engine Description

2-2.1. Crankcase

The crankcase is composed of two aluminum alloy castings joined along the center vertical plane. The individual castings with studs and inserts will be referred to as left and right crankcase halves throughout the manual.

Bosses molded in the castings are line bored in the assembled casting to form bearings for the camshaft and saddles for precision main bearing inserts. Guides are bored through lateral bosses for hydraulic tappets and on the left crankcase half for the governor drive shaft gear. A needle bearing bore is located on the right crankcase half at the rear main bearing saddle for the starter adapter and needle bearing.

Cylinder mounting pads on the left crankcase are farther forward than the corresponding pads on the right crankcase to permit each connecting rod to work on a separate crankpin. There are seven studs and two through-bolts for attaching cylinder base flanges. The propeller governor mount pad is located on the lower front corner of the left crankcase half. An alternator pad is located on the right crankcase forward of the number five cylinder mount pad.

The crankcase interior is ventilated by an integral breather in the oil filler adapter inserted in a machined hole between the number two and four cylinders on the left crankcase half.

Figure 2-4. Permold Crankcase Features
2-2.2. **Engine Drive Train**

When starting the engine, torque is transmitted from the starter through the starter adapter components to the crankshaft gear. As the worm gear in the adapter is turned, the spring mounted on the hub tightens to grip the knurled drum of the shaft gear. After starting, the spring returns to its normal position releasing the shaft gear and disengaging the starter.

Torque is transmitted to the alternator by a face gear mounted on the crankshaft. Crankshaft torque is transmitted by the crankshaft gear directly to the idler gear and the camshaft gear. The idler gear rotates in a counter-clockwise direction to drive the magneto drive gears. Optional accessories mounted on the aft side of the accessory case are driven by the internal splines of the magneto drive gears.

The fuel pump coupling connects directly to the crankshaft gear. The splined end of the oil pump drive gear mates with the internal splines of the camshaft gear and transmits torque to the oil pump driven gear. The governor drive bevel gear is physically attached to the end of the camshaft; it meshes with the governor driven bevel gear to provide power to the propeller governor.

![Engine Drive Train Diagram](image)

*Figure 2-5. Engine Drive Train*
2-2.2.1. Crankshaft

The crankshaft is precision machined aircraft quality steel having five main journals which rotate on bearings in the crankcase. Six rod journals are the connecting points for the connecting rod assemblies.

Counterweights are supplied in matched pairs with the bushings installed; total weight difference between pairs is not to exceed two grams. Counterweight order number designates the vibration order the counterweight is capable of absorbing. A sixth order counterweight is designed to counteract six vibrations per revolution of the crankshaft. Similarly, if a crankshaft produces five vibrations per revolution, a fifth order counterweight is used to offset the vibration. Two sixth order counterweights are installed in the number two crankshaft cheek hangers. On the two No. five crankshaft cheek hangers, one fifth order and one fourth order counterweight is installed.

The crankshaft gear is heated prior to installation to obtain a shrink fit. The gear is positioned on the crankshaft by a dowel pin; it incorporates a square output coupling to drive the fuel pump. The gear also has a machined timing mark to properly position the crankshaft and camshaft angles.

The alternator drive gear is attached by a flange just behind the No. 5 main journal at the front of the crankshaft and secured by four bolts and lock plates. A neoprene oil seal, which is stretched over the crankshaft flange, and a split retainer ring are seated between the crankcase castings in the front crankshaft exit area and is sealed to the crankshaft by a helical spring inside the seal cavity.

![Crankshaft Diagram](image_url)

Figure 2-6. Crankshaft
2-2.2.2. Connecting Rods

The connecting rods halves are machined from a single forging of aircraft quality steel and cut into two pieces, splitting the center of the larger opening of the connecting rod assembly. The resulting pieces, called the rod and cap are fitted with a two piece bearing and attach to the crankpin or rod journal with special bolts and nuts.

The portion of the rod between the rod and the crankpin and piston pin ends is called the “I” beam. A split steel-backed bronze bushing is pressed into the piston pin end and machined for a precision pin-to-bushing fit. Weight variations between opposing crankshaft positions is limited to ½ ounce (14.175 grams).

NOTE: Some older connecting rod assemblies use a castellated nut with a cotter pin to join the connecting rod and cap. Those assemblies are being phased out of current production engines.

![Connecting Rod Diagram](image)
2-2.2.3. Camshaft

The camshaft is forged from aircraft quality steel, machined on four main journals with nine ground and hardened lobes and a gear mounted flange at the rear of the camshaft. The main journals ride within the crankcase camshaft bores. Four unequally spaced bolts attach the gear to the camshaft. Camshaft to crankshaft timing is accomplished by aligning the timing marks of the crankshaft and camshaft gears in the crankcase. As the crankshaft turns the camshaft in the crankcase, hydraulic tappets follow the eccentric lobes of the camshaft in crankshaft tappet bores. Inward and outward movement of the tappets open and close the intake and exhaust valves within the cylinder head by mechanical linkage of the pushrods and rocker arms to the tappets. The exact moment of valves opening and closing is synchronized by the crankshaft to camshaft timing. The camshaft gear incorporates a splined drive for the engine oil pump. A front mounted keyed bevel drive gear provides momentum for the prop governor bevel driven gear.

2-2.2.4. Idler Gear

The idler gear support pin supports the idler gear. A bushing in the crankcase supports the forward part of the idler gear support pin shaft. The crankshaft drives the idler gear directly. In turn, the idler gear drives the left and right magneto accessory drive gears.

2-2.3. Cylinders

TSIO-550 Permold Series engines have six, horizontally-opposed, air cooled cylinders, three on the left side and three on the right side of the engine. The cylinders, pistons and valve drive train provide the momentum to sustain crankshaft movement. Aviation fuel and air, drawn into a cylinder during the intake stroke are compressed by the piston during the compression stroke and then ignited by a high intensity spark from the spark plugs (two per cylinder). As the mixture ignites, expanding gases force the piston toward the crankshaft during the power stroke.

The head and barrel assembly consists of externally finned aluminum alloy head casting and a through-hardened steel, nitrided cylinder barrel for wear resistance. Helicoil thread inserts are installed in upper and lower spark plugs holes. A rotocoil assembly retains two concentric springs surrounding the exhaust valve and is locked to the stem by tapered, semi-circular keys which engage grooves around the valve stems. An outer retainer holds
two concentric springs which surround the intake valve and is locked to the stem by tapered, semi-circular keys which engage grooves on the stem.

TSIO-550 Permold Series engine cylinders use a cross-flow cylinder design. Intake ports are located on top of the cylinder (Figure 2-9) while exhaust ports are located below the cylinder. Separate intake and exhaust valve rocker covers are stamped from zinc-plated sheet steel. This cylinder design is used in conjunction with a Balanced Induction System mounted above the engine.

Figure 2-9. Cross-flow Cylinder Features
Engine Description

2-2.3.1. Pistons

Pistons are aluminum alloy castings with a steel insert cast into the top ring groove. The piston skirts are solid with cylindrical relief cuts at the bottom. Pistons have three ring grooves above the piston pin bore and one ring groove below. Compression rings are installed in the top and second grooves. An oil scraper ring is installed in the groove below the piston pin bore. A center grooved and slotted oil control ring is installed in the third groove which has six oil drain holes to the interior. Pistons are selected in weight matched pairs within opposing cylinders bays. Piston pins are full floating with permanently pressed-in aluminum end plugs.

![Figure 2-10. Piston Features](image)

2-2.3.2. Hydraulic Valve Tappets

The hydraulic valve tappet (lifter) provides an interface between the camshaft lobe and the remaining valve train. Hydraulic valve tappets ride on the eccentric cam lobes, opening and closing the intake and exhaust valves mechanically via push rods and rocker arms. This allows conversion of the cam lobe profile into a linear movement for actuation of the intake and exhaust valves. The hydraulic mechanism inside the tappet maintains zero clearance between the valve and its actuating components. The interface between a cam lobe and tappet is intended to wear to some degree as the engine operates. This is similar to the piston ring to cylinder wall interface that must seat together for proper operation and wear over time.
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![Figure 2-8. Camshaft](image)

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![Piston Features](image)

**Figure 2-10. Piston Features**

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The hydraulic valve tappet (lifter) provides an interface between the camshaft lobe and the remaining valve train. Hydraulic valve tappets ride on the eccentric cam lobes, opening and closing the intake and exhaust valves mechanically via push rods and rocker arms. This allows conversion of the cam lobe profile into a linear movement for actuation of the intake and exhaust valves. The hydraulic mechanism inside the tappet maintains zero clearance between the valve and its actuating components. The interface between a cam lobe and tappet is intended to wear to some degree as the engine operates. This is similar to the piston ring to cylinder wall interface that must seat together for proper operation and wear over time.
Chapter 2. Engine Description

2-1. General Engine Description

TSIO-550 Permold Series engines, manufactured by Continental Motors (CM), are six cylinder fuel injected, turbocharged engines with horizontally opposed air cooled cylinders designed for variable-pitch propeller applications. TSIO-550 Permold Series engine models use the cross-flow cylinder design with overhead inclined valves. Downdraft cylinder head intake inlets are cast in the top of the cylinder head; downdraft exhaust outlets exit the bottom of the cylinder.

The 550 cubic inch displacement is achieved using a 5.25 inch diameter cylinder bore and a 4.25 inch piston stroke. TSIO-550 Permold Series engines utilize the Permold crankcase design. Basic engine weights, minus accessories, are listed in Section 2-3. Engine weights vary by model specification, refer to OI-18, TSIO-550 Permold Series Engine Installation and Operation Manual for installed engine weights, including accessories.

The engine is provided with engine mounts designed for a focalized bed mount. A crankcase breather port is located on the oil filler neck on the 2-4-6 side of the crankcase between No. 2 and No. 4 cylinders. A 0.374-24 UNF threaded port is located near the bottom side of the cylinder head to accommodate a bayonet thermocouple.

Engine lubrication is provided by a wet sump, high pressure oil system. The engine lubrication system includes the internal engine-driven pressure oil pump, engine mounted oil cooler, oil sump, full flow oil filter, oil pressure relief valve, and pressure instrumentation. The oil cooler is mounted on the left crankcase half behind the No. 2 cylinder. A vernatherm valve allows oil flow into the engine if an oil restriction occurs in the external oil cooler and during cold starting.

The TSIO-550 Permold Series engines incorporate a downdraft balanced port induction system with an engine mounted throttle body. Engine manifold pressure is controlled by the throttle plate and is measured at the 0.125-27 NPTF port located on the induction manifold near the throttle (see Engine Installation Drawings, Section 5-4).

TSIO-550 Permold Series engines incorporate dual turbochargers and dual intercoolers/aftercoolers. The exhaust bypass for the turbine sections is connected to a single exhaust wastegate that is controlled by a sloped controller.

TSIO-550 Permold Series engines are equipped with a Continuous Flow Fuel Injection system that meters fuel flow as a function of engine speed, throttle angle, mixture control angle, and turbocharger compressor discharge air pressure. The metered fuel is fed to continuous flow air bled injector nozzles located at each cylinder intake port. Fuel drains are provided at the bottom of each cylinder.
Figure 2-1. TSIO-550 Typical Top and Side Views
2-1.1. **Engine Model Number Definition**

The description of each alphanumeric character in the engine model number is given below for the example engine model TSIO-550-B1B (Figure 2-2).

![Figure 2-2. Engine Model Definition](image)

2-1.2. **Cylinder Number Designations**

Refer to Figure 2-3:

- The front of the engine is the end closest to the propeller and the rear of the engine is the accessory end.
- Viewed from the rear of the engine, the left-side cylinders are designated by even numbers 2-4-6, with Cylinder 2 being closest to the rear.
- The right side cylinders have odd number sequential designation 1-3-5, with Cylinder 1 being closest to the rear.
- Firing order of the engine is 1-6-3-2-5-4.

![Figure 2-3. Cylinder Number Designation](image)
2-2.6. **Starter Assembly**

The Starting System consists of an electric starter motor mounted on a right angle starter drive adapter. Starter motors certified for TSIO-550 Permold Series engines are available from multiple accessory providers.

When the starter motor is electrically energized, the adapter worm shaft and gear engage the starter shaft gear through a spring and clutch assembly by turning the starter worm wheel. As the shaft gear turns, it rotates the crankshaft gear and crankshaft. When the engine starts, electrical energy is removed from the starter motor. The gripping action of the clutch spring is relieved, disengaging the shaft gear from the worm shaft and electric starter motor. The starter shaft gear extends from the rear of the starter adapter.

![Diagram of Starting System](image)

**Figure 2-17. Starting System**

2-2.7. **Alternator**

A gear-driven alternator mounts on the right front crankcase half. The alternator converts mechanical energy from the crankshaft into electrical energy to power aircraft electrical accessories and recharge the aircraft batteries. An elastomer coupling dampens the mechanical interface between the crankshaft face gear and the alternator drive shaft. Approved alternators are available in multiple voltage output options for the engine series to match aircraft circuit requirements. An external voltage regulator is required.

Optional belt-driven or accessory pad mounted gear-driven alternators are available as secondary power sources. If approved for the engine model specification, a split belt drive sheave is sandwiched in the propeller shaft with minimal impact to engine bay requirements. Consult engine model specifications for availability.
2-2.8. Ignition System

TSIO-550 Permold Series Engine Ignition Systems use two separate, independent pressurized magnetos manufactured by either Continental Motors (formerly Bendix) or Champion (formerly Slick) for dual ignition to each cylinder. Continental Motors magneto key features are indicated by the model number (Figure 2-18). Spark plugs are installed in top and bottom bosses in each cylinder head. Magneto pressurization is provided by engine deck pressure.

Magnetos are installed at the rear of the engine, driven by the idler gear. The magnetos may employ impulse couplings or retard breakers for improved engine starting ignition. Impulse couplings, which rotate faster than the engine cranking speed, automatically retard the spark during engine cranking for easier starting. Magnetos fitted with retard breakers boost ignition energy by feeding pulsating battery voltage to the magneto primary circuit during the start sequence and automatically retard the spark during engine cranking. Magnetos may be fitted with a tachometer pickup sensor installed in the flange housing vent. The engine firing order (Figure 2-19 or Figure 2-20) is determined by the crankshaft geometry; magneto firing order is sequential from the number one position and must be synchronized to the crankshaft.

![Figure 2-18. Continental Motors Magneto Model Number Structure](image-url)
Engine Description

Figure 2-19. Continental Motors Ignition System Schematic

Figure 2-20. Champion (Slick) Ignition System Schematic
2-2.9. Engine Cooling

The engine cylinders are cooled by transferring heat from the cylinder barrel and cylinder head cooling fins to the surrounding airflow. The aircraft engine cowling, baffles, and baffle seals direct cooling air (which is ram air-induced by the aircraft’s forward speed) evenly around the cylinders. This airflow is regulated by the size of the cooling air inlets and outlets. Increasing or decreasing outlet size with the use of cowl flaps changes airflow and aids in controlling engine operating temperatures.

**Figure 2-21. Engine Cooling**
2-2.10. Induction System

The Induction System carries induction air to individual cylinder intake ports through a cross-flow cylinder head design. A downdraft-type Induction System is mounted on the top of the cylinder heads, with a balanced intake manifold mounted above the engine crankcase which carries induction air to the individual cylinder intake distribution ports via cylinder induction tubes.

Air from the balanced induction manifold is carried to the intake ports where it mixes with fuel from the injector nozzles. The fuel/air charge then enters the cylinder as a combustible mixture when the intake valve opens.

Figure 2-22. Typical Cross-flow Induction System

2-2.11. Turbocharger and Exhaust System

NOTE: TSIO-550-G aftercoolers and exhaust differ dimensionally but function in the same manner as aftercoolers and exhaust systems on other turbocharged Permold series engines. TSIO-550-K turbocharger mounting brackets and exhaust are different part numbers and the wastegate controller is mounted differently but all TSIO-550 turbocharger and exhaust systems function in the same manner.

The turbocharger and exhaust system contains the following engine components: two turbochargers, intercoolers/aftercoolers, hydraulic controlled exhaust bypass (wastegate), wastegate controller, lubrication plumbing, exhaust collector assembly, and turbocharger tailpipe assemblies. Special lines and fittings are also attached to the upper deck pressure for air reference to the fuel injection system and magneto pressurization.
Engine Description

Exhaust gases exit the cylinder combustion chambers and flow through the exhaust collector to the turbocharger turbine housing inlet. The exhaust gas flow provides turbine wheel rotation and exits through the turbine housing discharge port and tailpipe assembly. The turbine wheel drives the compressor wheel which is connected by a common shaft.

Engine manifold pressure (deck pressure) is maintained within the specified limits by limiting the volume of exhaust gas passing through the turbocharger turbine and out the exhaust. The control device is the wastegate, which is opened and closed hydraulically by the wastegate controller.

![Typical Turbocharger and Exhaust System](image)

Figure 2-23. Typical Turbocharger and Exhaust System
## Engine Description

### 2-3. Engine Specifications

<table>
<thead>
<tr>
<th>Table 2-1. TSIO-550 Series Engine Characteristics</th>
</tr>
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<tbody>
<tr>
<td><strong>General</strong></td>
</tr>
<tr>
<td>FAA Type Certificate</td>
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<td>Installation Drawing Number</td>
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<td>Firing Order</td>
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<td>Stroke</td>
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<td>Piston Displacement</td>
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<td><strong>Ignition</strong></td>
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<tr>
<td>Ignition Timing</td>
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<tr>
<td>Magneto Type</td>
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<tr>
<td>Magneto Coil Temperature Limit, °F (°C)</td>
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<td>Spark Plugs to be used</td>
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<td>Spark Plug Gap</td>
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<td><strong>Exhaust</strong></td>
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<td>Exhaust back pressure, maximum allowable, in. Hg (kPa)</td>
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<td></td>
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<tr>
<td>Maximum Allowable Operational Temperature</td>
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<td></td>
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<tr>
<td>Minimum Take-off Temperature</td>
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</tr>
<tr>
<td><strong>Exhaust Gas-Turbine Inlet Temperature (see Engine Installation Drawings for installed location(s))</strong></td>
</tr>
<tr>
<td>Maximum Continuous Turbine Inlet Temperature (TIT)</td>
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<tr>
<td>Maximum Allowable Operational Temperature (NTE 30 seconds)</td>
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<tr>
<td>Turbine Speed Limit vs. Turbine Inlet Temperature</td>
</tr>
</tbody>
</table>

1. Measured with bayonet thermocouple  
2. Maximum cylinder head temperature for engine operation with ASTM D7592 (UL94) fuel or a mixture of ASTM D7592 and 100 or 100LL.
### Table 2-2. TSIO-550 Performance Specifications

<table>
<thead>
<tr>
<th>Engine Description</th>
<th>Crankshaft Speed, Brake Horsepower &amp; Manifold Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated Maximum Continuous Operation</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td>B 350 bhp -0% +5% @ 2700 rpm @ 38.0 in. Hg</td>
</tr>
<tr>
<td>@ Maximum rated Crankshaft Speed</td>
<td>C 310 bhp -0% +5% @ 2600 rpm @ 35.5 in. Hg</td>
</tr>
<tr>
<td>@ Maximum rated Manifold Pressure</td>
<td>E 350 bhp -0% +5% @ 2700 rpm @ 38.5 in. Hg</td>
</tr>
<tr>
<td></td>
<td>G 310 bhp -0% +5% @ 2700 rpm @ 34.0 in. Hg</td>
</tr>
<tr>
<td></td>
<td>K 315 bhp -0% +5% @ 2500 rpm @ 37.5 in. Hg</td>
</tr>
<tr>
<td></td>
<td>N 315 bhp -0% +5% @ 2500 rpm @ 37.5 in. Hg</td>
</tr>
<tr>
<td><strong>Crankshaft Speed (Maximum rated)</strong></td>
<td>B 2700 rpm</td>
</tr>
<tr>
<td></td>
<td>C 2600 rpm</td>
</tr>
<tr>
<td></td>
<td>E 2700 rpm</td>
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<td>G 2700 rpm</td>
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<td></td>
<td>K 2500 rpm</td>
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<tr>
<td></td>
<td>N 2500 rpm</td>
</tr>
<tr>
<td><strong>Critical Altitude (feet)</strong></td>
<td>B 12000</td>
</tr>
<tr>
<td></td>
<td>C 18000</td>
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<tr>
<td></td>
<td>E 18000 @ 2700 rpm @ 38.5 in. Hg</td>
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<tr>
<td></td>
<td>22000 @ 2500 rpm @ 31.0 in. Hg</td>
</tr>
<tr>
<td></td>
<td>25000 @ 2500 rpm @ 27.5 in. Hg</td>
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<tr>
<td></td>
<td>G 22000</td>
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<td></td>
<td>K 18000</td>
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<td>N 18000</td>
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<tr>
<td><strong>Engine Idle Speed, Minimum</strong></td>
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<tr>
<td><strong>Maximum Recommended Cruise Power</strong></td>
<td>B 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td></td>
<td>C 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td></td>
<td>E 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td></td>
<td>G 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td></td>
<td>K 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td></td>
<td>K 232 bhp @ 2500 rpm @ 27 in. Hg&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>N 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td><strong>Minimum Cruise RPM</strong></td>
<td>2300 RPM</td>
</tr>
</tbody>
</table>

1. Performance is based on sea level, standard day, zero water vapor pressure conditions at the throttle inlet and exhaust exit with no engine accessory load. Standard day conditions are 29.92 in Hg and 59°F. Horsepower will vary approximately 1% for each 6° F (5.6° C) change in compressor inlet air temperature. Correction factors for exhaust back pressure and accessory drive losses is not represented in raw data. Contact a Continental Motors engineering representative for applicable correction factors.

2. Maximum cruise limitation for engine operation with ASTM D7592 (UL94) fuel or a mixture of ASTM D7592 and 100LL or 100 fuels
### Table 2-3. TSIO-550 Lubrication System Specifications

<table>
<thead>
<tr>
<th>Oil</th>
<th>30 to 60 psig</th>
<th>100 psig</th>
<th>10 psig at or below 240°F</th>
<th>240°F</th>
<th>116°C</th>
<th>5.0 qts. (4.7L)</th>
<th>7.5 qts. (5.6L)</th>
<th>4.5 qts. (4.3L)</th>
<th>6.5 qts. (5.6L)</th>
<th>50 or Multi-viscosity</th>
<th>30 or Multi-viscosity</th>
<th>See M-0, Section 3-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Pressure - Normal Operation @ 100° to 240°F (38° to 116°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Allowable Oil Pressure (cold oil)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Oil Pressure @ Idle (600 RPM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Allowable Oil Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Minimum Take-off Oil Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil Sump</td>
<td>C</td>
<td>K</td>
<td>N</td>
<td>B</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fill Capacity</td>
<td>8.0 qts. (7.6L)</td>
<td>12.0 qts. (11.3L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usable Oil - 16° Nose Up (8 qt fill)</td>
<td>5.0 qts. (4.7L)</td>
<td>7.5 qts. (5.8L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usable Oil - 10° Nose Down (8 qt fill)</td>
<td>4.5 qts. (4.3L)</td>
<td>6.5 qts. (5.6L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended Oil Grade, SAE - above 40° F</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended Oil Grade, SAE - below 40° F</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Oil Grade</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CAUTION:** Engine oil must be aviation rated lubricant conforming to SAE J1899 or SAE J1966 specification

### Brake Specific Oil Consumption

Maximum BSOC = 0.006 X (engine rated power) X (% power at which measured/100) X (duration of test in hours)

### Oil Heat Rejection

Maximum Oil Heat Rejection at Full Power | See Figure 2-38

---

1. Oil pressure and temperature are measured at the oil cooler adapter.
<table>
<thead>
<tr>
<th>Fuel System</th>
<th>Continuous Flow Fuel Injection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Certified Fuel Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Minimum Fuel Grade</td>
<td>Refer to M-0, Table 7-1 and Table 7-2 for authorized fuels and applicable engines</td>
</tr>
<tr>
<td><strong>Regional Fuel Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Russian Commonwealth of Independent States</td>
<td>Refer to M-0, Table 7-1 and Table 7-2</td>
</tr>
<tr>
<td>People’s Republic of China</td>
<td>Refer to M-0, Table 7-1 and Table 7-2</td>
</tr>
<tr>
<td><strong>Fuel Injection System Pressure</strong></td>
<td></td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 600 RPM, psig (kPa)</td>
<td>7.0-9.0 (48.3-62.1)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure†, Rated Power, psig (kPa)</td>
<td></td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2700 RPM</td>
<td>B 32.0-36.0 (220.6-248.2)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2600 RPM</td>
<td>C 26.0-29.0 (179.2-199.9)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2700 RPM</td>
<td>E 32.0-36.0 (220.6-248.2)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2500 RPM</td>
<td>G 20.5-23.5 (141.3-162.0)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2500 RPM</td>
<td>K N 20.5-28.5 (141.3-196.5)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure†, psid (kPa)</td>
<td></td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2700 RPM</td>
<td>B 15.3-16.9 (105.5-116.5)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2600 RPM</td>
<td>C 12.7-13.9 (87.6-95.8)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2700 RPM</td>
<td>E 15.3-16.9 (105.5-116.5)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2500 RPM</td>
<td>G 12.4-13.6 (85.5-93.8)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2500 RPM</td>
<td>K N 14.2-14.8 (97.9-102.0)</td>
</tr>
<tr>
<td>Fuel Injection Pump Inlet Pressure: psig (kPa)</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable pressure above 1500 RPM with boost pump off</td>
<td>6.0 (41.4)</td>
</tr>
<tr>
<td>Minimum Pressure at maximum flow condition</td>
<td>-2.0 (-14)</td>
</tr>
<tr>
<td>Recommended flight minimum</td>
<td>-1.0 (-6.9)</td>
</tr>
<tr>
<td>Fuel Vapor Return Outlet, psig (kPa)</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable at maximum flow</td>
<td>3.5 (24.2)</td>
</tr>
<tr>
<td>Recommended flight maximum</td>
<td>2.5 (17.2)</td>
</tr>
</tbody>
</table>

**Fuel Flow**

- Fuel Flow, lb./hr (kg/hr), including return flow: Figure 2-24
- Fuel Flow vs. Brake Horsepower: Figure 2-27
- Fuel Injection System Adjustment Specifications: Refer to M-0, Section 6-4.7
## Table 2-4. TSIO-550 Fuel System Specifications

<table>
<thead>
<tr>
<th>Fuel Vapor Return Outlet Flow, lb/hr (kg/hr):</th>
<th>Maximum @ 23.5 psig pump outlet</th>
<th>51.5 (23.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Flow Transducer (Aircraft):</td>
<td>Maximum Allowable Pressure Drop</td>
<td>5.5 psig @ 295 lb/hr</td>
</tr>
<tr>
<td>Fuel Filter (Aircraft):</td>
<td>Minimum Rating</td>
<td>140 micron</td>
</tr>
</tbody>
</table>

**Fuel Temperature, °F (°C)**

| Maximum temperature rise from fuel tank to pump inlet @ 90-101°F (32-38°C) (Ambient temperature must be minimum standard day at sea level, and temperature rise must be shown at stable operating conditions of idle and maximum performance climb). | 10 (5.6) |

1. FULL POWER unmetered fuel pressure limits are provided for reference only. Use metered fuel pressure specifications for adjustments at full power.
2. The TSIO-550-G engines installed in Mooney aircraft are rated at less than the engine type certificate. Consult the Mooney aircraft maintenance manual for fuel system setup instructions.
3. Use for full power, maximum RPM adjustment only.
4. Metered pressure gauge reference is Upper Deck Pressure.

## Table 2-5. TSIO-550 Fuel Consumption

**CAUTION:** Minimum cruise engine speed is 2300 RPM. Fifty to eighty-five percent cruise power fuel consumption depicts the certified engine fuel consumption during test cell operation.

NOTE: Cruise is calculated at a percentage of rated maximum power. Percentages listed below represent the observations submitted to the FAA for engine model type certification.

<table>
<thead>
<tr>
<th>Power Level</th>
<th>BE</th>
<th>C</th>
<th>G</th>
<th>KN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Power, 100%</td>
<td>BHP (kW)</td>
<td>lbs./hr (max)</td>
<td>BHP (kW)</td>
<td>lbs./hr (max)</td>
</tr>
<tr>
<td>Cruise, 85%</td>
<td>---</td>
<td>---</td>
<td>263.5 (196)</td>
<td>263.5 (196)</td>
</tr>
<tr>
<td>Cruise, 83.5%</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>232.5 (173)</td>
</tr>
<tr>
<td>Cruise, 75%</td>
<td>263 (196)</td>
<td>157</td>
<td>232.5 (173)</td>
<td>232.5 (173)</td>
</tr>
<tr>
<td>Cruise, 65%</td>
<td>225 (170)</td>
<td>125</td>
<td>201.5 (150)</td>
<td>201.5 (150)</td>
</tr>
<tr>
<td>Cruise, 55%</td>
<td>193 (138)</td>
<td>108</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
Table 2-6. Induction

<table>
<thead>
<tr>
<th>Mass Flow</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B  Sea level, standard day conditions, 350 bhp (261 kW)</td>
<td>40.0 lb/min (18.1 kg/min)</td>
</tr>
<tr>
<td>C  Sea level, standard day conditions, 310 bhp (231 kW)</td>
<td>41.0 lb/min (18.6 kg/min)</td>
</tr>
<tr>
<td>E  Sea level, standard day conditions, 350 bhp (261 kW)</td>
<td>50.2 lb/min (22.8 kg/min)</td>
</tr>
<tr>
<td>G  Sea level, standard day conditions, 310 bhp (231 kW)</td>
<td>40.2 lb/min (18.2 kg/min)</td>
</tr>
<tr>
<td>K  Sea level, standard day conditions, 315 bhp (235 kW)</td>
<td>41.5 lb/min (18.8 kg/min)</td>
</tr>
</tbody>
</table>

Induction Manifold Temperature

<table>
<thead>
<tr>
<th>Temperature Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>K Maximum @ rated take-off power (ASTM D7592 only)</td>
<td>130°F (54.4°C)</td>
</tr>
<tr>
<td>K Maximum @ maximum cruise power (ASTM D7592 only)</td>
<td>115°F (46.1°C)</td>
</tr>
</tbody>
</table>

Table 2-7. Propeller

<table>
<thead>
<tr>
<th>Moment of Inertia</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Idle RPM</td>
<td>Minimum (in.-lb.-sec.$^2$)</td>
</tr>
<tr>
<td>800</td>
<td>15</td>
</tr>
<tr>
<td>700</td>
<td>16</td>
</tr>
</tbody>
</table>
Engine Description

Table 2-8. Physical Dimensions and Weight

<table>
<thead>
<tr>
<th>Engine Physical Characteristics</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>G</th>
<th>K</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight, dry, lb. (kg) +/- 2.5%</td>
<td>571 (259)</td>
<td>565 (257)</td>
<td>566 (257)</td>
<td>554 (251)</td>
<td>522.8 (237)</td>
<td>522.8 (237)</td>
</tr>
<tr>
<td>Overall Dimensions, inches (mm)</td>
<td>33.5 (851)</td>
<td>33.5 (851)</td>
<td>33.5 (851)</td>
<td>35.4 (899)</td>
<td>34.0 (864)</td>
<td>28.46 (723)</td>
</tr>
<tr>
<td>Height</td>
<td>42.5 (1080)</td>
<td>42.5 (1080)</td>
<td>42.5 (1080)</td>
<td>35.9 (912)</td>
<td>42.4 (1077)</td>
<td>42.4 (1077)</td>
</tr>
<tr>
<td>Width</td>
<td>42.6 (1082)</td>
<td>42.6 (1082)</td>
<td>42.6 (1082)</td>
<td>40.3 (1023)</td>
<td>39.2 (994)</td>
<td>38.7 (903)</td>
</tr>
<tr>
<td>Length</td>
<td>33.5 (851)</td>
<td>33.5 (851)</td>
<td>33.5 (851)</td>
<td>33.5 (851)</td>
<td>33.5 (851)</td>
<td>33.5 (851)</td>
</tr>
<tr>
<td>Center of Gravity, inches (mm)</td>
<td>11.4 (290)</td>
<td>11.4 (290)</td>
<td>11.4 (290)</td>
<td>11.4 (290)</td>
<td>12.7 (322)</td>
<td>12.7 (322)</td>
</tr>
<tr>
<td>From rear accessory case</td>
<td>1.1 (27)</td>
<td>1.1 (27)</td>
<td>1.1 (27)</td>
<td>1.1 (27)</td>
<td>1.3 (33)</td>
<td>1.3 (33)</td>
</tr>
<tr>
<td>From crankshaft centerline,</td>
<td>0.37 (9)</td>
<td>0.37 (9)</td>
<td>0.37 (9)</td>
<td>0.37 (9)</td>
<td>-0.12 (3)</td>
<td>-0.12 (3)</td>
</tr>
<tr>
<td>below plus (+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to 1-3-5 minus (-), to 2-4-6 plus (+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moment of Inertia, standard acc. package, in·lb·sec² (mm·kg·sec²)</td>
<td>134.3 (946)</td>
<td>134.3 (946)</td>
<td>134.3 (946)</td>
<td>134.3 (946)</td>
<td>134.3 (946)</td>
<td>134.3 (946)</td>
</tr>
<tr>
<td>Roll Longitudinal Axis, (Iy-y)</td>
<td>138.8 (1206)</td>
<td>138.8 (1206)</td>
<td>138.8 (1206)</td>
<td>138.8 (1206)</td>
<td>138.8 (1206)</td>
<td>138.8 (1206)</td>
</tr>
<tr>
<td>Yaw Vertical Axis, (Iz-z)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2-3.1. Accessory Drive Ratios

Accessory drive ratios in Table 2-9 apply to all TSIO-550 engine models.

Table 2-9. Accessory Drive Ratios

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Direction of Rotation¹</th>
<th>Drive Ratio to Crankshaft</th>
<th>Maximum Torque (in. lbs.)</th>
<th>Maximum Overhang Moment, (in. lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cont.</td>
<td>Static</td>
</tr>
<tr>
<td>Optional Tachometer</td>
<td>CCW</td>
<td>0.5:1</td>
<td>7</td>
<td>50</td>
</tr>
<tr>
<td>Magneto</td>
<td>CCW</td>
<td>1.5:1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Starter Motor</td>
<td>CCW</td>
<td>48:1</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Alternator (gear-driven)</td>
<td>CCW</td>
<td>3:1</td>
<td>150</td>
<td>800</td>
</tr>
<tr>
<td>Propeller Governor²</td>
<td>CW</td>
<td>1:1</td>
<td>29</td>
<td>825</td>
</tr>
<tr>
<td>Fuel Pump</td>
<td>CW</td>
<td>1:1</td>
<td>25</td>
<td>680</td>
</tr>
<tr>
<td>AND20000 Pads³</td>
<td>CW</td>
<td>1.5:1</td>
<td>100</td>
<td>800</td>
</tr>
<tr>
<td>Optional Accessory Drive⁴</td>
<td>CCW</td>
<td>3:1</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

1. CW=Clockwise Rotation CCW=Counterclockwise rotation; viewed facing the drive.
2. Drive is a modified AND20010; supplied with a cover.
3. One drive is eligible at 200 in. lbs. continuous torque load providing the other does not exceed 100 in. lbs. continuous torque load. Drive pads conform to AND20000, optionally, per MS3325 modified, and shall be provided with covers.
4. Belt tension 70 lbs. (may be used with appropriate optional equipment kit to drive an aircraft provided refrigerant compressor).

2-3.2. Oil Specifications

A complete listing of approved piston engine aviation oils for engine break-in, normal operation, and corrosion prevention when the engine is in storage may be found in Section 3-1 of M-0, Standard Practice Maintenance Manual.
2-3.3. Performance Data

Refer to the engine Installation Manual (OI-18) for complete engine technical specifications, installation requirements, certification data, and engine test stand performance.

WARNING

The performance charts included in this manual indicate uninstalled engine performance under controlled conditions and will vary from installed performance. The charts are neither intended nor suitable for installed performance specifications or flight planning. Consult the Airplane Flight Manual or Pilot's Operating Handbook for installed aircraft performance specification.
Figure 2-24. TSIO-550-B Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-25. TSIO-550-B Sea Level Performance

HORSEPOWER CORRECTED TO:
- EXHAUST BACK PRESSURE = 29.92 in. Hg
- INDUCTION AIR TEMPERATURE = 60°F FULL RICH FUEL MIXTURE

Recommended Cruise Range

Full Rich Operation Only

2700 RPM
2500 RPM
2300 RPM

Corrected Brake Horsepower

Absolute Dry Manifold Pressure (in. Hg)
Figure 2-26. TSIO-550-B Altitude Performance
2-3.3.2. TSIO-550-C Performance Charts

Figure 2-27. TSIO-550-C Fuel Flow vs. Sea Level Standard Brake Horsepower
Corrected Brake Horsepower vs. Absolute Dry Manifold Pressure (in. Hg)

Figure 2-28. TSIO-550-C Sea Level Performance

Horsepower Corrected To:
- Exhaust Back Pressure = 29.92 in. Hg
- Induction Air Temperature = 60°F
- Full Rich Mixture

Recommended Cruise Range

Full Rich Operation Only
Figure 2-29. TSIO-550-C Altitude Performance
Figure 2-30. TSIO-550-E Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-31. TSIO-550-E Sea Level Performance
Figure 2-32. TSIO-550-E Altitude Performance

**NOTES:**
- Minimum engine
- Full rich fuel settings
- 3 in. H2O pressure
- Cool cylinder heads
- Full rich fuel setting
- 3 in. H2O pressure

**RATED POWER SETTING**
- 2700 RPM, 38.5 in.Hg

**75% POWER SETTING**
- 2500 RPM, 31.5 in.Hg

**100% POWER SETTING, MANIFOLD PRESSURE CRITICAL ALTITUDE**
- 2500 RPM, 31.5 in.Hg

**65% POWER SETTING, MANIFOLD PRESSURE CRITICAL ALTITUDE**
- 2500 RPM, 31.5 in.Hg

**ESTIMATED MAX ENGINE POWER**
- Full rich fuel setting
- Cool cylinder heads

**PRESSURE ALTITUDE (feet)**
- 0 2000 4000 6000 8000 10000 12000 14000 16000 18000 20000 22000 24000 26000 28000

**CORRECTED BRAKE HORSEPOWER**
- 350 345 340 335 330 325 320 315 310 305 300 295 290 285 280 275 270 265 260 255 250 245 240 235 230 225 220 215 210 205 200 195 190 185 180 175 170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0

**Pressure Altitude (feet)**
- 0 2000 4000 6000 8000 10000 12000 14000 16000 18000 20000 22000 24000 26000 28000

**Corrected Brake Horsepower**
- 350 345 340 335 330 325 320 315 310 305 300 295 290 285 280 275 270 265 260 255 250 245 240 235 230 225 220 215 210 205 200 195 190 185 180 175 170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
2-3.3.4. TSIO-550-G Performance Charts

Figure 2-33. TSIO-550-G Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-34. TSIO-550-G Sea Level Performance

Corrected Brake Horsepower

Absolute Dry Manifold Pressure (in Hg)

Minimum Engine, Hot Head [440-460 °F]
Horsepower Corrected to Standard Day
Full Rich Fuel Mixture

100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

2700 2600 2500 2400 2300

Full Rich Operation Only

Recommended Cruise Range
Figure 2-35. TSIO-550-G Altitude Performance
Figure 2-36. TSIO-550-K & N Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-37. TSIO-550-K & N Sea Level Performance

Corrected Brake Horsepower vs. Absolute Dry Manifold Pressure (in.Hg)

- Full Rich Operation Only
- Recommended Cruise Region
2-3.4. TSIO-550 Accessory Performance Charts

Figure 2-38. Oil Cooler Performance

- **Notes:**
  - SAE 50 Oil
  - Effective Flow Area = 0.36 ft²
  - \( \Delta P = 1 \text{ PSI @ 100°F} \)
  - \( 4 \text{ PSI @ 150°F} \)
  - \( 2 \text{ PSI @ 200°F} \)

**Figure 2-38. Oil Cooler Performance**
Figure 2-39. Aftercooler Performance Chart

Corrected Cold Air Pressure Drop (in. H₂O) vs. Hot Air Side Effectiveness

Cold Air Pressure Drop Corrected to 0.0765 lb/ft³
Std. Density
Engine Description

Figure 2-40. Aftercooler Performance Chart

Niagara Thermal Products LLC
Aluminum Aftercooler
NTP P/N 42941A
TCM P/N 657112

Charge Air at 240°F and 18.67 psia

Cooling Air at 100°F and 14.7 psia

Heat Rejection Btu/min/100°F TD

Cooling Air lb/min

Heat Rejection Btu/min/100°F TD

Cooling Air lb/min

Cooling Air Pressure Drop 'H2O

15 lb/min
20 lb/min
25 lb/min
10 lb/min

Cooling Air Pressure Drop

Figure 2-40. Aftercooler Performance Chart
Figure 2-41. Turbine Speed vs. Turbine Inlet Temperature
Engine Description

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Chapter 3. Special Tools and Supplies

3-1. Special Tools

Refer to Section 2-1, “Special Tool”, in M-0, Standard Practice Maintenance Manual.

3-1.1. Vendor Contact Information

Refer to Section 2-1.1, “Vendor Contact Information”, in M-0, Standard Practice Maintenance Manual.

3-1.2. Mechanic’s Tools

Refer to Section 2-2, “Mechanic’s Tools”, in M-0, Standard Practice Maintenance Manual.
3-2. **Lubricants, Sealants and Adhesives**

3-2.1. **Engine Oil Specifications**
Refer to Section 3-1, “Engine Oil Specifications”, in M-0, Standard Practice Maintenance Manual.

3-2.2. **Recommended Oil Grade:**
Refer to Section 3-1, “Engine Oil Specifications”, in M-0, Standard Practice Maintenance Manual.

3-2.3. **Recommended Ashless Dispersant Aviation Engine Oils**
Refer to Section 3-1, “Engine Oil Specifications”, in M-0, Standard Practice Maintenance Manual.

3-2.4. **Oil Change Intervals**
Refer to Section 3-2, “Oil Change Intervals”, in M-0, Standard Practice Maintenance Manual.

3-2.5. **Additives**
Refer to Section 3-3, “Additives”, in M-0, Standard Practice Maintenance Manual.

3-2.6. **Sealants**
Refer to Table 3-4, “Sealants”, in M-0, Standard Practice Maintenance Manual.

3-2.7. **Lubricants**
Refer to Table 3-5, “Lubricants”, in M-0, Standard Practice Maintenance Manual.

3-2.8. **Adhesives**
Refer to Table 3-6, “Adhesives”, in M-0, Standard Practice Maintenance Manual.

3-2.9. **Miscellaneous**
Refer to Table 3-7, “Miscellaneous”, in M-0, Standard Practice Maintenance Manual.
Chapter 4. Airworthiness Limitations

The Airworthiness Limitations Section is FAA approved and specifies maintenance required under §§ 43.16 and 91.403 of the Title 14 Code of Federal Regulations (CFR) unless an alternative program has been FAA approved.

Title 14 CFR §§ 43.16 and 91.403 require owner/operator compliance with all maintenance limitations in this section concerning mandatory replacement times, inspection intervals, and other related procedures that are specific to this engine. Any such limitations listed below are part of the design limits of the engine, which was type certified based upon required owner/operator compliance with the limitations.

4-1. Mandatory Replacement Times

Subject to additional information contained in FAA Airworthiness Directives issued after the date of certification, the engines covered in this manual do not contain any components having mandatory replacement times required by type certification.

4-2. Mandatory Inspection Intervals

Subject to additional information contained in FAA Airworthiness Directives issued after the date of certification, the engines covered in this manual do not require specific intervals of inspection pursuant to type certification.

4-3. Other Related Procedures

Subject to additional information contained in Airworthiness Directives issued after the date of certification, there are no other related procedures required pursuant to the type certification for the engines covered in this manual.

4-4. Distribution of Changes to Airworthiness Limitations

Changes to this Airworthiness Limitations Section constitute changes to the type design of the engines covered in this manual and require FAA approval pursuant to Federal Aviation Regulations. Changes which result in new or more restrictive limits, will be published in FAA Airworthiness Directives.
Airworthiness Limitations

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Chapter 5. Engine Removal & Installation

5-1. Engine Removal

WARNING

Turn the Ignition Switch OFF, disconnect engine electrical power and confirm continuity between the magneto capacitor and aircraft ground before commencing maintenance to avoid an uncommanded engine start. Do not stand or place equipment within the arc of the propeller.

1. Turn off the Ignition Switch and Master Power Switch according to the aircraft manufacturer's instructions. Open the circuit breakers powering the switches according to the aircraft manufacturer's instructions. Turn the fuel selector valve to the OFF position and disconnect engine electrical power according to the aircraft manufacturer's instructions.

2. If the cylinders will be overhauled, perform a “Differential Pressure Test” according to the instructions in Section 6-4.11.2 of M-0, Standard Practice Maintenance Manual and record inspection results on the Cylinder Inspection checklist. If all cylinders will be replaced, proceed to step 3.

3. Remove the engine compartment cowling and aircraft accessories that could obstruct engine removal according to the aircraft manufacturer's instructions.

4. Disconnect the aircraft battery according to the aircraft manufacturer’s instructions.

5. Disconnect the starter cable according to the aircraft manufacturer’s instructions.

6. Remove the propeller, spinner and backplate from the engine according to the aircraft manufacturer's instructions.

7. Remove the aircraft baffling required to avoid contact with the nacelle during removal according to the aircraft manufacturer’s instructions.

8. Remove the oil sump drain plug and gaskets; drain the oil according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

9. Temporarily re-install the oil sump drain plug and gaskets to prevent contamination during transit. The gaskets will be replaced when the oil is serviced.

10. Disconnect and tag the ignition circuit P-leads from the magnetos according to the aircraft manufacturer’s instructions.

11. Disconnect and tag the engine wiring bundles and other connections from the following components according to the aircraft manufacturer's instructions.

   a. Pneumatic, air conditioning, or vacuum pumps

   b. Tachometer drive connection (electrical or mechanical)

   c. Oil temperature and pressure sensor connection(s)

   d. Fuel pressure sensor connection
Engine Removal & Installation

e. Fuel flow sensor connection
f. Alternator
g. Manifold pressure sensor connection
h. Turbine inlet temperature sensor connection(s)
i. Exhaust gas temperature sensor connection(s)
j. Cylinder head temperature connection(s)
k. Aircraft fuel supply hose connections to the engine-driven fuel pump and the engine priming circuit
l. Throttle and mixture control cables
m. Aircraft accessories and instrument connections
n. Propeller governor, hoses, and lines connected to the engine

K & N Remove the hoses from the Wastegate Controller manifold pressure fitting, deck pressure fitting, oil inlet fitting and oil drain fitting. Install protective caps on the fittings; install protective plugs on the hoses.

K & N If the Wastegate Controller could interfere with engine removal, remove it according to the aircraft manufacturer’s instructions.


13. Remove the ignition wiring harness attaching clamps and hardware and remove the ignition wiring harness from the engine.

CAUTION: Do not use tape or makeshift plugs inside open lines or fittings.

14. Properly cap (or plug) off fluid hose and tubing connections to prevent fuel spillage and debris from entering the engine.

15. Ensure all wires, lines, hoses and attachments between the engine and aircraft are disconnected.

16. Disconnect and remove the Turbocharger and Exhaust System from the aircraft according to the “Turbocharger and Exhaust System Removal” instructions in Section 12-8.

CAUTION: Do not allow the chains to become entangled in the engine or its hardware. Ensure the area is clear when lifting the engine. Do not allow the front, rear, sides or bottom of the engine to bump or strike any obstructions to prevent damage to the engine or its components.

17. Attach an engine hoist (min. 800 lbs. static load rated) to the engine lifting eyes (reference Section 5-4).

18. Remove the engine mount isolators and fastening hardware.
19. Relieve the engine weight from the engine mounts and carefully lift the engine slowly out of the aircraft.

20. Place the engine on an engine stand, transport dolly or engine shipping container base.

21. Use a tank sprayer filled with stoddard solvent and soft bristle brush to preclean the engine, followed by a wash with a mild soap and water solution Rinse thoroughly with clean water to minimize contamination before bringing the engine in the shop area for disassembly.

5-2. Engine Installation

5-2.1. Common Tools and Consumable Supplies Required

1. Engine Hoist rated at 800 lbs. minimum static load

   **WARNING**

   Ensure engine slings are designed to support the total weight of the engine including accessories.

   **Use of the engine lifting eye to lift the aircraft is prohibited.**

   *CAUTION: Keep crankshaft axis horizontal during handling operations.*

2. Two engine slings rated for minimum static load

3. Oil conforming to SAE J-1966 (break-in oil, non-dispersant mineral oil) MIL-C-6529 Type II (Fly-away oil)

4. Ashless dispersant oil conforming to SAE J-1899

5. MIL-P-46002A, Grade 1 oil

6. Approved fuel for the engine model as specified in Section 7-2.2 of M-0, Standard Practice Maintenance Manual

7. Spark plugs and new copper gaskets

8. MS20995 Type A Safety Wire (.032”)

9. Cable ties or nylon lacing cord

10. Bladder-type pressure pot (at least one gallon capacity)

11. Type 1 flammable fuel container (at least one gallon capacity)

12. Clean fuel hoses (fuel system setup)

13. AN union fittings (fuel system setup)

14. Rubber grommets (routing fuel hoses through baffling and bulkheads)

15. MS-122AD dry Teflon spray lubricant (procured from Miller-Stephenson)

16. Spark Plug Manufacturer’s recommended spark plug thread lubricant

17. Part No. 646940, Loctite Hydraulic Sealant
Engine Removal & Installation

18. Part No. 646943, Anti-seize Lubricant
19. Loctite Part No. 592 Pipe Sealant
20. Other tools and supplies required by the aircraft manufacturer’s instructions.

5-2.2. Engine Receipt and Handling
Refer to “Engine Receipt and Handling” instructions in Section 5-2.2 of M-0, Standard Practice Maintenance Manual.

5-2.3. Uncrating the Engine
Refer to “Uncrating the Engine” instructions in Section 5-2.3 of M-0, Standard Practice Maintenance Manual.

5-2.4. Crating an Engine for Shipping
Refer to “Crating an Engine for Shipping” instructions in Section 5-2.4 of M-0, Standard Practice Maintenance Manual.

5-2.5. Acceptance Inspection
Refer to “Acceptance Inspection” instructions in Section 5-2.5 of M-0, Standard Practice Maintenance Manual.

5-2.6. Engine Transport
Refer to “Engine Transport” instructions in Section 5-2.6 of M-0, Standard Practice Maintenance Manual.
5-3. Installation Procedures

5-3.1. Prepare the Aircraft for Engine Installation

1. Verify the aircraft fuel filter and fuel boost pump are installed and operate according to the aircraft manufacturer’s instructions.

   **WARNING**

   *Purge the aircraft fuel tanks and lines to remove all contamination prior to connecting the main fuel supply to the fuel pump inlet. Failure to purge contamination may cause erratic fuel injection system operation.*

   *CAUTION: Follow the aircraft manufacturer’s schedule interval for aircraft mounted fuel and oil hoses. Hoses become brittle with age; Continental Motors recommends hose replacement coincident with engine overhaul to avoid immediate contamination or failure at a later date.*

2. Replace all aircraft flexible oil and fuel hoses according to the aircraft manufacturer’s instructions prior to engine installation.

3. Clean the aircraft fuel strainer and allow at least one quart of fuel to flow through the strainer and fuel supply line into a Type 1 fuel container through a paper filter.

4. Inspect the paper filter for contamination; if the fuel supply is free of contamination, proceed with engine installation. If contaminants are found in the fuel supply, isolate and correct the source of contamination prior to connecting the aircraft fuel supply to the engine-driven fuel pump.
5-3.2. Prepare the Engine for Installation

Remove packing material, tags, and the preservative fluid from the sump and fuel injection systems of new, rebuilt, overhauled or stored engines prior to installation.

NOTE: If the engine won’t be installed immediately, refer to the “Engine Preservation and Storage” instructions in Chapter 9 of M-0, Standard Practice Maintenance Manual.

1. Remove the shipping plugs or dehydrator plugs from the spark plug holes.
2. Remove the AN-4060 protectors from the ignition leads.
3. Place a basin under the engine to catch the cylinder preservation oil.
   
   NOTE: A small amount of preservative oil remaining in the cylinder bore is acceptable; it will burn off during the first engine start.

4. Turn the crankshaft through at least two complete revolutions by hand to remove the cylinder preservation oil from the cylinders.

5. Catch the cylinder preservation oil draining out of the lower spark plug holes.
   
   NOTE: If corrosion or abnormal conditions are discovered during the borescope inspection, contact the supplier (If the engine was obtained from Continental Motors, refer to “Contact Information” in Section 1-3) for disposition instructions.

6. Inspect the cylinder bores with a borescope for rust and contamination.

7. Remove the oil sump drain plug and drain the remaining cylinder preservation oil from the oil sump. Drain plug locations are depicted in the “Engine Installation Drawings” in Section 5-4.

8. Install the oil sump drain plug with a new crush washer; torque the drain plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; safety wire the drain plug according to instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

9. Place a catch basin underneath the fuel pump. Remove the shipping cap from the fuel pump inlet fitting. Disconnect the fuel hose from the fuel pump outlet fitting. Allow the preservative fluid to drain from the fuel pump and hoses; reconnect the fuel hose to the fuel pump outlet fitting and torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Re-install the shipping cap on the fuel pump inlet fitting.
   
   NOTE: Remove the turbochargers only if necessary to clear the engine compartment during engine installation. Otherwise, proceed to step 11.

**WARNING**

*Oil pressure is applied to the face of the accessory drive pads. If gasket or accessory covers are not properly installed and torqued to Appendix B specifications, oil leakage will occur.*

10. If engine compartment clearance is required for installation, remove the turbochargers:
Engine Removal & Installation

a. Place an oil drain pan under the turbochargers and wastegate to catch any preservative oil remaining in the lubrication lines.

b. Disconnect and plug the hoses from the wastegate and turbochargers.

c. Install caps on the wastegate and turbocharger fittings to prevent contamination from foreign matter/debris.

d. Remove the v-band clamp from the left turbocharger tailpipe.

e. Remove the tie rod from the right side of the turbo bypass assembly.

f. Remove the following as one assembly:
   1) Left tailpipe
   2) Wastegate
   3) Bypass Assembly

g. Remove two nuts and bolts from the turbocharger mounting brackets.

h. Remove four nuts from the turbocharger mounting flange.

i. Remove both turbochargers from the exhaust system.

11. Remove the shipping plate from the propeller governor pad forward of the No. 6 cylinder.

   CAUTION: Align the governor drive gear spline and ensure the governor is fully seated to the crankcase prior to installing the attaching hardware. Forcing the drive gear over the camshaft will require engine disassembly and repair.

12. Install the propeller governor according to the aircraft manufacturer’s instructions.

   NOTE: Optional accessories such as hydraulic pumps, vacuum pumps, etc. may be installed in the accessory drive pads located on the upper rear portion of the crankcase. Remove the accessory drive covers and install new gaskets. Install accessories in accordance with the aircraft manufacturer’s instructions.

13. Install all aircraft manufacturer-required components according to the aircraft manufacturer’s instructions, including the following:

   a. Cooling baffles
   b. Hoses and fittings
   c. Brackets
   d. Ground straps
   e. Pneumatic or vacuum pumps
   f. Other aircraft manufacturer required item(s)

14. Install the engine in the sequence indicated in Section 5-3.3.
5-3.3. Installation Sequence

**CAUTION:** Do not allow chains to become entangled on the engine or its hardware. Be sure the area is clear when lifting the engine. Do not allow the front, rear, sides, or bottom of the engine to strike any obstructions, as the extreme weight may damage the engine or its components.

1. Install the engine in the aircraft mounts according to the aircraft manufacturer’s instructions. Refer to the “Engine Installation Drawings” in Section 5-4 for engine dimensions, clearances, and connections.

**WARNING**

Oil pressure is applied to the face of the accessory drive pads. If gaskets or accessory covers are not properly installed and torqued to the settings specified in Appendix B, oil leakage will occur.

2. Connect the aircraft fuel supply, fuel vapor return and fuel pump drain connections to the engine-driven fuel pump fittings according to aircraft manufacturer’s instructions.

3. If removed to facilitate installation, install the turbocharger components according to instructions in Section 5-3.3.1.

4. Turn the Ignition Switch to the OFF position.

**WARNING**

Do not install the ignition harness “B” nuts on the spark plugs until the propeller installation and the ignition system operational checkout is complete. Failure to comply can result in bodily injury when the propeller is rotated during installation.

5. Connect the starter and alternator wiring according to aircraft manufacturer’s instructions.

6. Install the propeller according to the aircraft and propeller manufacturer’s instructions.

7. Connect the aircraft ignition switch wiring harness to the P-leads of each magneto and perform a functional check of the circuit to verify the ignition switch properly disables the magnetos.

8. If the magnetos were loosened or rotated during engine installation, adjust magneto to engine timing according to the “Ignition System Maintenance” instructions in Section 6-4.9 of M-0, Standard Practice Maintenance Manual.

9. Install aircraft accessories listed below according to the aircraft manufacturer’s instructions.
   a. Pneumatic or vacuum pumps, or air conditioning compressor
   b. Tachometer (mechanical) drive cable or (electrical) sensor connection
c. Oil temperature sensor and oil pressure sensor connections
d. Fuel pressure sensor and fuel flow sensor connections
e. Exhaust Gas Temperature sensor connection(s)
f. Turbine Inlet Temperature sensor connection(s)
g. Cylinder Head Temperature sensor connection(s)
h. Manifold pressure gauge line
i. Aircraft fuel supply hoses
j. Throttle and mixture control cables
k. Remaining aircraft manufacturer supplied accessories and instrument connections


11. Inspect for and correct engine debris, discrepancies, or damage.

12. Perform an “Installation Inspection” according to instructions in Section 5-3.4.

**WARNING**

Do not operate the engine until all hardware, spark plugs, gaskets, and seals are in place and torqued and the oil sump is properly filled to the specified capacity with oil.

13. Perform the “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.
5-3.3.1. Turbocharger Component Installation

Install the turbocharger components if they were removed to facilitate engine installation. Configurations and installation instructions vary by engine model. Refer to the subsection applicable to the subject engine in Section 5-3.3.1.1 through Section 5-3.3.1.3.

5-3.3.1.1. TSIO-550-B, C, E & G Turbocharger Component Installation

1. Install the left and right turbocharger support brackets (Figure 5-1) (29 & 30) and turbochargers (24) loosely with bolts (31), washers (32), and new lock nuts (33); hardware will be torqued after all components are fitted together.

2. Install the turbochargers (24) on the left and right turbocharger transitions (5 & 6) with new gaskets (23). Hand tighten the fastening bolt (26), washer (27) and lock nut (28). This hardware will be torqued later in this procedure.

3. Apply Part No. 646943 anti-seize compound to the aft exhaust transition (9) and the crossover pipe (8) slip joints. Slide the aft transition (9) and the crossover pipe (8) together to form the bypass assembly and onto the rear ports of the left and right exhaust transitions (5 & 6).

4. Install the wastegate (18) between the tailpipe (14) and transition (9) sandwiched between two gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19), washers (20), and new lock nuts (21). This hardware will be torqued later in this procedure.

5. Place a loosened v-band clamp (16) on each turbine exhaust flange.

6. Push the tailpipe (14) exhaust flange against the left side turbine exhaust flange and position the new clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ the final value for v-band clamps specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and do a final torque of the clamp to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

CAUTION: the exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.
7. Push the tailpipe exhaust flange (15) (or heater (15B)) on some TSIO-550 engine models) against the right side turbine exhaust flange and position the clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ value for V-band clamps specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and do a final torque of the clamp to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to instructions in Figure 5-2 and Appendix C-3 of M-0, Standard Practice Maintenance Manual. Use safety wire pliers to bend the safety wire pigtail close to the bolt.

9. Torque the attaching hardware in the following sequence: (Figure 5-1) 31 & 33; 26 & 28; 19 & 21, to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Secure the bypass assembly (8 & 9) to the exhaust tees (5 & 6) using the tie rod (11) and two each bushings (10), bolts (12) and lock nuts (13).

11. Connect the oil supply hose (36) to the wastegate (18) oil inlet fitting; torque the hose and fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Connect the oil return hose (34) to the wastegate (18) oil outlet fitting.

13. Torque the bolts (12) and lock nuts (13), and oil return hose (34) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Procedure continues after Figure 5-1
Figure 5-1 repeated for reference

Procedure continues on next page
14. Connect the left turbocharger oil supply hose (Figure 5-3) (13) to the fitting (6) on the left turbocharger oil adapter (5); torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Connect the right turbocharger oil supply hose (14) to the fitting (6) on the right turbocharger oil adapter (5); torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Connect the oil return hoses (18 & 19) to the left (4) and right (3) turbocharger oil reservoirs, respectively; torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

17. Check the remaining turbocharger lubrication hose connections for security.

Figure 5-3. Turbocharger Lubrication Hose Routing

1 Right Turbocharger  7 Gasket  13 Hose  19 Hose
2 Left Turbocharger  8 Gasket  14 Hose  20 Hose
3 Right Oil Reservoir  9 Lock Washer  15 Hose  21 Tee Fitting
4 Left Oil Reservoir  10 Bolt  16 Tee Fitting
5 Adapter  11 Lock Washer  17 Check Valve
6 Elbow Fitting  12 Bolt  18 Hose
CAUTION: The tailpipe oil separator vent hose must be of suitable material to withstand exhaust temperatures.

NOTE: If the aircraft manufacturer chooses to use a custom air/oil separator rather than the air/oil separator offered by Continental Motors, refer to the aircraft maintenance instructions for air/oil separator installation and interconnect instructions.

18. Install a hose clamp (Figure 5-4) (6) on the oil separator vent hose (5). Connect the vent hose (5) according to the aircraft manufacturer’s instructions and tighten the clamp (6). Torque the clamp (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 5-4. Crankcase Ventilation Hose Routing

1 Air/Oil Separator Assembly 3 Hose Assembly 5 Hose Assembly 7 Hose
2 90°Elbow Fitting 4 Hose Clamp 6 Hose Clamp
5-3.3.1.2. TSIO-550-K Turbocharger Component Installation

1. Install the left and right turbocharger support brackets (Figure 5-5) (29 & 30) and turbochargers (24) loosely with bolts (31), washers (32), and new lock nuts (33); hardware will be torqued after all components are fitted together.

2. Install the turbochargers (24) on the left and right turbocharger transitions (5 & 6) with new gaskets (23). Hand tighten the fastening bolt (26), washer (27) and lock nut (28). This hardware will be torqued later in this procedure.

3. Apply Part No. 646943 anti-seize compound to the aft exhaust transition (9) and the crossover pipe (8) slip joints. Slide the aft transition (9) and the crossover pipe (8) together to form the bypass assembly and onto the rear ports of the left and right exhaust transitions (5 & 6).

4. Install the wastegate (18) between the tailpipe (14) and transition (9) sandwiched between two gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19), washers (20), and new lock nuts (21). This hardware will be torqued later in this procedure.

5. Place a loosened v-band clamp (16) on each turbine exhaust flange.

6. Push the left tailpipe (14) exhaust flange against the left side turbine exhaust flange and position the new clamp (16) squarely over both flanges. Push the right tailpipe exhaust flange (15) against the right side turbine exhaust flange and position the clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ the final value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and apply the full torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual to the clamp.

7. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to instructions in Figure 5-2 and Appendix C-3 of M-0, Standard Practice Maintenance Manual. Use safety wire pliers to bend the safety wire pigtail close to the bolt.

8. Torque the attaching hardware in the following sequence: (Figure 5-5) 31 & 33; 26 & 28; 19 & 21 to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

CAUTION: the exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.

9. Secure the bypass assembly (8 & 9) to the exhaust tees (5 & 6) using the tie rod (11) and two each: bushings (10), bolts (12) and new lock nuts (13). Torque the bolt and lock nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
10. Push the right tailpipe exhaust flange (15) against the right side turbine exhaust flange and repeat the V-band clamp installation, torque and safety wire instructions in steps 6 and 7.

Figure 5-5. Turbocharger Assembly

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<tbody>
<tr>
<td>1</td>
<td>Elbow Riser</td>
<td>10</td>
<td>Bushing</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>Elbow Riser</td>
<td>11</td>
<td>Tie Rod</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Tee Assembly</td>
<td>12</td>
<td>Bolt</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>Tee Assembly</td>
<td>13</td>
<td>Lock Nut</td>
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Engine Removal & Installation

*CAUTION: The directional arrows on the check valve and the check valve filter assembly must point in the direction of oil flow (away from the oil cooler).*

11. Connect the oil supply hose (Figure 5-6) (15) to the outboard oil cooler supply fitting. Connect the oil filter (22) and check valve (17) to the oil supply hose (15).

12. Connect the female port of the tee (16) to the open end of the check valve (17).

13. Connect the left turbocharger oil supply hose (13) to one of the male ports on the tee fitting (16). Connect the right turbocharger oil supply hose (14) to the remaining port on the tee fitting (16).

14. Connect the left turbocharger oil supply hose (13) to the fitting (6) on the left turbocharger oil adapter (5).

15. Connect the right turbocharger oil supply hose (14) to the fitting (6) on the right turbocharger oil adapter (5).

16. Connect the oil return hoses (18 & 19) to the outlet fittings on the left (4) and right (3) turbocharger oil reservoirs, respectively.

17. Connect the open ends of the oil return hoses (18 & 19) to the in-line ports of the tee fitting (21). Connect the oil scavenge hose (20) between the open port of the tee fitting (21) and the inlet fitting on the scavenge pump.

18. Massage the hoses (13, 14, 15, 18, 19 & 20) and fittings (16 & 21) for best fit and minimal stress according to the instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual. Torque the hoses and fitting to the specifications in Appendix B of M-0, Standard Practice Maintenance Manual.

19. Check the remaining turbocharger lubrication hose connections for security.

*Procedure continues after Figure 5-6*
Procedure continues on next page
20. Connect the wastegate oil supply hose (Figure 5-7) (36) between the inboard oil cooler outlet fitting and wastegate oil inlet fitting.

21. Connect the oil return hose (35) from the wastegate oil outlet fitting and the wastegate controller oil inlet fitting.

22. Connect the wastegate controller oil return hose (34) between the wastegate controller oil drain fitting and the crankcase oil return fitting.

23. Torque hoses (Figure 5-7) (34, 35 & 36) and fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 5-7. Wastegate Control Hose Connections

See Figure 5-5 for parts index

Procedure continues on next page
CAUTION: The tailpipe oil separator vent hose must be of suitable material to withstand exhaust temperatures.

24. Install the air/oil separator (Figure 5-8) (1) according to the aircraft manufacturer’s instructions.

25. Connect the scavenge pump ventilation hose (7) between the air/oil separator drain fitting (2) and the fitting on the top of the scavenge pump.

26. Install two hose clamps (4) on the crankcase breather hose (3). Connect the breather hose (3) between the middle fitting on the air/oil separator (1) and the breather tube on the oil fill assembly. Torque the clamps (4) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

27. Secure the air/oil separator vent hose (5) between the air/oil separator (1) outlet port and the overboard drain according to the aircraft manufacturer’s instructions.
28. Remove the cap from the Wastegate Controller compressor discharge reference (deck pressure) fitting (Figure 5-9) (4). Remove the plug from the deck pressure hose (15). Connect the deck pressure hose (15) to the Wastegate Controller deck pressure fitting (4). Torque the hose and fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

29. Remove the cap from the Wastegate Controller manifold pressure fitting (2). Remove the plug from the manifold pressure hose (14). Connect the manifold pressure hose (14) to the Wastegate Controller manifold pressure fitting (2). Torque the hose and fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 5-9. Wastegate Controller & Hoses](image)
Intentionally Let Blank
5-3.3.1.3. TSIO-550-N Turbocharger Component Installation

NOTE: The turbocharger support brackets (Figure 5-11) (29 & 30) are installed with the engine mounts assemblies.

1. Assemble the 2-4-6 side support rod (Figure 5-11) (43), jam nut (45) and rod end (44). Adjust the 2-4-6 side support rod assembly to the length specified in Figure 5-41. After length adjustment, torque the jam nut (Figure 5-11) (45) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Assemble the 1-3-5 side support rod (42), jam nut (45) and rod end (44). Adjust the 1-3-5 side support rod assembly to the length specified in Figure 5-41. After length adjustment, torque the jam nut (Figure 5-11) (45) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Insert the left support rod (43) through the bottom side of the left turbocharger support bracket (29). Install a bushing (47), washer (48), spring (49), and slotted nut (46) on the support rod. Tighten the slotted nut (46) until a slot aligns with the cotter pin hole. Install a new cotter pin (41) through the slotted nut (46) and support rod (43) according to the instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual.

4. Insert the right support rod (42) through the bottom side of the right turbocharger support bracket (30). Install a bushing (47), washer (48), spring (49), and slotted nut (46) on the support rod. Tighten the slotted nut (46) until a slot aligns with the cotter pin hole. Install a new cotter pin (41) through the slotted nut (46) and support rod (42) according to the instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual.

5. Place the left forward turbocharger bracket (40) on the forward side of the rod end (44). Place the left aft turbocharger bracket (38) on the aft side of the rod end (44). Install a bolt (31) and washer (32) through the forward side of the of the bracket (40), rod end (44) and bracket (38). Secure the assembly with a washer (32) and lock nut (33); torque the lock nut (33) and bolt (31) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Place the right forward turbocharger bracket (39) on the forward side of the rod end (44). Place the right aft turbocharger bracket (37) on the aft side of the rod end (44). Install a bolt (31) and washer (32) through the aft side of the of the bracket (37), rod end (44) and bracket (39). Secure the assembly with a washer (32) and lock nut (33); torque the nut (33) and bolt (31) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

7. Install the turbochargers (24) on the left (6) and right (5) turbocharger transitions with new gaskets (23). Align the turbocharger support brackets (37-40) with the inboard mounting flange bolt holes on both sides of the engine. Secure the assemblies with bolts (26), washers (27) and lock nut (28). This hardware will be torqued later in this procedure.

Procedure continues after Figure 5-10
Figure 5-10. Turbocharger Support Detail

See Figure 5-11 for parts index
8. Apply Part No. 646943 anti-seize compound to the aft exhaust transition (9) and the crossover pipe (8) slip joints. Slide the aft transition (9) and the crossover pipe (8) together to form the bypass assembly and onto the rear ports of the left and right exhaust transitions (6 & 5).

9. Install the wastegate (18) between the tailpipe (14) and transition (9) sandwiched between two gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19), washers (20), and new lock nuts (21). This hardware will be torqued later in this procedure.

10. Place a loosened v-band clamp (16) on each turbine exhaust flange.

11. Push the left tailpipe (14) exhaust flange against the left side turbine exhaust flange and position the new clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ the final value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load and torque the clamp nut to the full value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Push the right tailpipe exhaust flange (15) against the right side turbine exhaust flange and position the clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ the final value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load and torque the clamp nut to the full value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to instructions in Figure 5-2 and Appendix C-3 of M-0, Standard Practice Maintenance Manual. Use safety wire pliers to bend the safety wire pigtail close to the bolt.


    **CAUTION:** the exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.

15. Secure the bypass assembly (8 and 9) to the exhaust tees (5 and 6) using the tie rod (11) and two each: bushings (10), bolts (12) and lock nuts (13). Torque the bolts (12) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

    *Procedure continues after Figure 5-11*
Figure 5-11. Turbocharger and Exhaust Assembly

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Right Turbo Transition
6. Left Turbo Transition
7. Riser
8. Crossover Assembly
9. Transition
10. Bushing
11. Tie Rod
12. Bolt
13. Lock Nut
14. Left Tailpipe
15. Right Tailpipe
16. V-band clamp
17. Gasket
18. Wastegate Assembly
19. Bolt
20. Washer
21. Lock Nut
22. Gasket
23. Gasket
24. Turbocharger Assembly
25. Gasket
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Bolt
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose
37. Turbo Bracket, 1-3-5
38. Turbo Bracket, 2-4-6
39. Turbo Bracket, 1-3-5
40. Turbo Bracket, 2-4-6
41. Cotter Pin
42. Support Rod
43. Support Rod
44. Rod End
45. Nut
46. Slotted Nut
47. Bushing
48. Washer
49. Spring


Engine Removal & Installation

CAUTION: The directional arrows on the check valve and the check valve filter assembly must point in the direction of oil flow (away from the oil cooler)

16. Connect the oil supply hose (Figure 5-12) (15) to the lower port on the oil cooler cross fitting. Connect the oil filter (22) and check valve (17) to the oil supply hose (15).

17. Connect the female port of the tee (16) to the open end of the check valve (17).

18. Connect the left turbocharger oil supply hose (13) to one of the male ports on the tee fitting (16). Connect the right turbocharger oil supply hose (14) to the remaining port on the tee fitting (16).

19. Connect the left turbocharger oil supply hose (13) to the fitting (6) on the left turbocharger oil adapter (5).

20. Connect the right turbocharger oil supply hose (14) to the fitting (6) on the right turbocharger oil adapter (5).

21. Connect the oil return hoses (18 & 19) to the outlet fittings on the left (4) and right (3) turbocharger oil reservoirs, respectively.

22. Connect the open ends of the oil return hoses (18 & 19) to the in-line ports of the tee fitting (21). Connect the oil scavenge hose (20) between the open port of the tee fitting (21) and the inlet fitting on the scavenge pump.

23. Massage the hoses (13, 14, 15, 18, 19 & 20) and fittings (16, 17, 21, 22) for best fit and minimal stress according to the instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual. Torque the hoses and fitting to the specifications in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 5-12. Turbocharger Lubrication Hose Routing

See Figure 5-6 for parts index

24. Check the remaining turbocharger lubrication hose connections for security.
25. Connect the wastegate oil supply hose (Figure 5-13) (36) between the inboard oil cooler outlet fitting and wastegate oil inlet fitting.

26. Connect the oil return hose (35) from the wastegate oil outlet fitting and the wastegate controller oil inlet fitting.

27. Connect the wastegate controller oil return hose (34) between the wastegate controller oil drain fitting and the crankcase oil return fitting.

28. Torque the hoses fittings (34, 35, and 36) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 5-13. Wastegate Control Hose Connections

See Figure 5-11 for parts index
Procedure continues on next page
CAUTION: The tailpipe oil separator vent hose must be of suitable material to withstand exhaust temperatures.

29. Install the air/oil separator (Figure 5-14) (1) according to the aircraft manufacturer’s instructions.

30. Install two hose clamps (6) on the crankcase breather hose (3). Connect the breather hose (3) between the middle fitting on the air/oil separator (1) and the breather tube on the oil fill assembly. Torque the clamp (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

31. Install two hose clamps (6) on the air/oil separator vent hose (5). Connect the vent hose (5) between the upper fitting on the air/oil separator and the aircraft drain manifold and tighten the clamp (6). Torque the clamps (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

32. Remove the cap from the Wastegate Controller compressor discharge reference (deck pressure) fitting (Figure 5-15) (5). Remove the plug from the deck pressure
hose (15). Connect the deck pressure hose (15) to the Wastegate Controller deck pressure fitting (5). Torque the hose fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

33. Remove the cap from the Wastegate Controller manifold pressure fitting (3). Remove the plug from the manifold pressure hose (14). Connect the manifold pressure hose (14) to the Wastegate Controller manifold pressure fitting (3). Torque the hose fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 5-15. Turbocharger Controller and Hoses](image)

1. Controller
2. O-Ring
3. Reducer
4. O-Ring
5. Adapter
6. Adapter Fitting
7. 90° Elbow Fitting
8. Hose Assembly
9. Hose Assembly
10. Bulkhead Union
11. Bulkhead Union
12. Bulkhead Nut
13. Bulkhead Nut
14. Hose Assembly
15. Hose Assembly
16. Hose Assembly
5-3.3.2. Engine Pre-Oiling

Refer to the “Engine Pre-Oiling” instructions in Section 5-2.9 of M-0, Standard Practice Maintenance Manual.

5-3.3.3. Fuel Injection System Purge

Prior to shipping from the factory, the fuel injection system was preserved with MIL-PRF-6081D Grade 1010. The preservative fluid was drained during completion of Section 5-3.2. Flushing the system with aircraft fuel will complete the purge and prime the fuel injection system for operation.

1. Disconnect the fuel supply line at the inlet to the fuel manifold valve.
2. Connect a length of the appropriate size hose to the disconnected fuel manifold supply hose using an AN union fitting. Route the end of the hose to a properly grounded Type 1 flammable fluid container through a paper filter.
   
   **CAUTION:** Ensure the ignition switch is in the OFF position and clear the rotational arc of the propeller before proceeding.

3. Have an assistant turn the aircraft master power switch on.
4. Place the aircraft boost pump switch in the ON position for approximately one minute while cycling the throttle and mixture controls through the full range of travel several times.
5. Turn the aircraft boost pump and Master Power Switches to the OFF positions.
6. Close the mixture and throttle controls.
7. Inspect the paper filter for contamination; isolate and correct the source of contamination and continue flushing until no contamination is present in the paper filter.
8. Remove the extra length of hose and union installed in step 2 from the fuel manifold valve supply hose.
9. Connect the fuel manifold valve fuel supply hose to the inlet fitting on the manifold valve and torque the fuel hose “B” nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
   
   **NOTE:** Place approved containers at the induction system drain locations to collect fuel as it drains overboard.

10. Turn the aircraft Master Power Switch to the ON position.
11. With the Mixture Control in FULL RICH and the Throttle ¼ OPEN, turn the aircraft boost pump to the ON position.
12. Inspect fuel injection system lines, hoses and fitting for evidence of fuel leakage.
13. Place the Mixture Control to IDLE CUT-OFF and CLOSE the Throttle.
14. Turn the aircraft fuel boost pump OFF.
15. Turn the aircraft Master Power Switch OFF.
16. Correct any discrepancies noted.

17. Dispose of the fuel/oil mixture according to local hazardous material regulations.

5-3.4. **Installation Inspection**

Perform a “Visual Inspection” of the engine installation according to instructions in Section 6-3.6 prior to engine start.

5-3.5. **Preflight and Run-up**

Perform an Engine Operational Check after completing the engine installation and before performing the flight check according to the Airplane Flight Manual (AFM) or Pilot Operating Handbook (POH). Perform a flight check before releasing the engine for normal service to ensure the installed engine meets the manufacturer’s performance and operational specifications.

**WARNING**
The fuel system must be adjusted after installation in the aircraft according to the “Engine Operational Check” instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual to ensure proper operation. Correct all discrepancies prior to release for flight.

**TSIO-550 Permold Series engines are neither designed, nor approved, for continuous negative or zero “G” operation.**

**Engine Mount loads shall not exceed FAR 23 utility category load factors.**

*CAUTION: Adhere to the Operating Limits in Section 2-3 during all modes of engine operation, including the Flight Check and Break-In period.*

**NOTE:** Perform a flight check according to instructions in Section 7-2.3 before releasing the engine for normal operations. New and rebuilt engines, and engine with one or more new cylinders or pistons, require a 25-hour break-in. After installation, avoid prolonged ground operation at high power.

1. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

2. Perform a “Post Ground Run Inspection” according to instructions in Section 5-3.5.1.
5-3.5.1. Post Ground Run Inspection

1. Remove engine cowling and perform the following inspections:
   a. Check hoses and fitting connections for oil or fuel leaks.
   b. Inspect cylinder head, rocker covers, and oil sump gaskets for oil leaks.
   c. Inspect oil sump for cracks.
   d. Inspect cylinder head and exhaust risers for evidence of exhaust leaks.
   e. Inspect oil return hoses and air inlet manifold for evidence of chafing from cooling air baffles. Ensure fuel lines and hoses do not rub against air inlet manifold.
   f. Inspect induction air circuit connections for security.
   g. Check control marks between ducts and hoses for movement.
   h. Inspect hose and wire harness clamps for security.

2. After at least 15 minute cool down period, check engine oil level.

3. Correct any discrepancies discovered during inspection according to the instructions in Chapter 8.

4. Perform a “Flight Check” according to instructions in Section 7-2.3 of M-0, Standard Practice Maintenance Manual.
5-4. **Engine Installation Drawings**

Installation drawings are provided to assist the aircraft manufacturer in determining the appropriate fittings and fasteners for aircraft interconnect requirements. Slight variations between the basic and subsequent engine models require separate engine installations. Pay particular attention to the model depicted when referencing drawings for engine installation requirements.

5-4.1. **TSIO-550 Common Installation Drawings**

Exhaust port and propeller dimensions are identical for TSIO-550 Series engines. Specific engine model dimensions follow the common installation drawings.

![Exhaust Port Dimensions Diagram]

Figure 5-16. Exhaust Port Dimensions
Figure 5-17. Propeller Flange Dimensions
Figure 5-18. 24V Gear-Driven Alternator Detail
Figure 5-19. 12V Gear-Driven Alternator

Figure 5-20. Belt-Driven Alternator Detail
5-4.2. TSIO-550-B Engine Installation Drawings

Figure 5-21. TSIO-550-B Installation Drawing 653021 - Sheet 1 of 3
Figure 5-22. TSIO-550-B Installation Drawing 653021 - Sheet 2 of 3
Engine Removal and Installation

Figure 5-23. TSIO-550-B Installation Drawing 653021 - Sheet 3 of 3
5-4.3. TSIO-550-C&E Engine Installation Drawings

Figure 5-24. TSIO-550-C & E Installation Drawing 646618 - Sheet 1 of 3
Figure 5-25. TSIO-550-C & E Installation Drawing 646618 - Sheet 2 of 3
Figure 5-26. TSIO-550-C & E Installation Drawing 646618 - Sheet 3 of 3
Figure 5-27. TSIO-550-C Installation Drawing 656791 - Sheet 1 of 3
Figure 5-28. TSIO-550-C Installation Drawing 656791 - Sheet 2 of 3
Figure 5-29. TSIO-550-C Installation Drawing 656791 - Sheet 3 of 3
5-4.5. TSIO-550-G Engine Installation Drawings

Figure 5-30. TSIO-550-G Installation Drawing 657154 - Sheet 1 of 3
Figure 5-31. TSIO-550-G Installation Drawing 657154 - Sheet 2 of 3
Figure 5-32. TSIO-550-G Installation Drawing 657154 - Sheet 3 of 3
5-4.6. TSIO-550-K Engine Installation Drawings

Figure 5-33. TSIO-550-K Installation Drawing 657645 - Sheet 1 of 4
Figure 5-36. TSIO-550-K Installation Drawing 657645 - Sheet 4 of 4
5-4.7. TSIO-550-N Engine Installation Drawings

Figure 5-37. TSIO-550-N Installation Drawing 658233 - Sheet 1 of 5
Figure 5-38. TSIO-550-N Installation Drawing 658233 - Sheet 2 of 5
Figure 5-39. TSIO-550-N Installation Drawing 658233 - Sheet 3 of 5
Figure 5-41. TSIO-550-N Installation Drawing 658233 - Sheet 5 of 5
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Chapter 6. Engine Inspection and Service

6-1. Inspection Program Introduction

Inspections described in this chapter apply only to the Continental Motors engines covered by this manual. Perform the engine inspections according to the instructions provided. Perform aircraft inspections according to the aircraft manufacturer's instructions. Refer to the following sections:

- Section 6-2, “Inspection and Maintenance Schedule”
- Section 6-3, “Scheduled Inspections”
- Section 6-5, “Inspection Checklists”

Some inspections are at predetermined intervals (scheduled) while others are based on circumstance (unscheduled). Engine servicing is performed at scheduled intervals but may also be performed “on condition.” The first part of this chapter is devoted to scheduled maintenance intervals and associated procedures; unscheduled maintenance instructions follow the scheduled maintenance instructions.

NOTE: Discrepancies discovered by the person conducting the scheduled or unscheduled inspections, even if the discrepancy is not an itemized inspection item, should be corrected upon discovery. Fuel and oil system contamination affects engine performance and service life. If oil or fuel system contamination is discovered, do not limit the correction to the symptom; isolate and correct the source of the contamination, including any residual material left in the engine by the source of the contamination.

6-2. Inspection and Maintenance Schedule

Unless another FAA-approved Inspection Program is established, the Engine Inspection and Maintenance Schedule shows the inspections for the subject engines covered by this manual in their original type design. The inspections described in this chapter apply to the engine and not to the aircraft. Refer to the Aircraft Manufacturer’s manual for aircraft inspection requirements.

The inspections are progressive; commencing from the date the engine is placed in service. The inspection intervals are tracked by Engine Log entries and designated by hours of operation or calendar time, whichever occurs first.

Inspection techniques must be executed consistently for reliability.
### 6-3. Scheduled Inspections

Scheduled inspections are performed at predetermined intervals to verify the system and subsystem integrity; Scheduled inspections and maintenance are intended to enhance serviceability by discovering minor discrepancies and correcting them before the condition degrades. Scheduled inspections are based on calendar days or operating hours or a combination of both. Scheduled maintenance and service tasks are included in the inspections for convenience.

#### 6-3.1. One Time Post-Installation Inspections

Refer to Section 6-4-1 of M-0, Standard Practice Maintenance Manual.

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6-3.2. **25-Hour Initial Operation Inspection**

Refer to the “25-Hour Initial Operation Inspection” in Section 6-4.2 of M-0, Standard Practice Maintenance Manual.

6-3.3. **50-Hour Engine Inspection**

Refer to the “50-Hour Engine Inspection” in Section 6-4.3 of M-0, Standard Practice Maintenance Manual.

6-3.4. **100-Hour (Annual) Engine Inspection**

Refer to the “100-Hour (Annual) Engine Inspection” in Section 6-4.4 of M-0, Standard Practice Maintenance Manual.

In addition to the listed inspections in M-0, perform “Crankcase Inspection with Air Conditioning Compressor” according to the instructions in Section 6-3.12.1 on all engines equipped with an air conditioning compressor until the terminating action listed in the latest revision of SB09-4.

6-3.5. **500-Hour Engine Inspection**

Refer to the “500-Hour Engine Inspection” in Section 6-4.5 of M-0, Standard Practice Maintenance Manual.

6-3.6. **Visual Inspection**

Refer to the “Visual Inspection” instructions in Section 6-4.6 of M-0, Standard Practice Maintenance Manual.

6-3.7. **Engine Operational Check**

Refer to the “Engine Operational Check” instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

6-3.7.1. **Oil Pump Operational Check**

Refer to the “Oil Pump Operational Check” instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

6-3.7.2. **Fuel System Operational Check**

Refer to the “Fuel System Operational Check” instructions in Section 6-4.7.4 of M-0, Standard Practice Maintenance Manual.

6-3.7.3. **Magneto RPM Drop Check**

Refer to the “Magneto RPM Drop Check” instructions in Section 6-4.7.5 of M-0, Standard Practice Maintenance Manual.
6-3.8. Engine Oil Servicing

Refer to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

6-3.9. Ignition System Maintenance

Refer to the “Ignition System Maintenance” instructions in Section 6-4.9 of M-0, Standard Practice Maintenance Manual. Ignition Harness Routing Instructions for TSIO-550 engine models are provided in Figure 6-1 and Figure 6-2.

![Figure 6-1. Champion (Slick) Ignition Harness Routing](image-url)
Figure 6-2. Continental (Bendix) Ignition Harness Routing

ENGINE FIRING ORDER 1-6-3-2-5-4
MAGNETO FIRING ORDER 1-2-3-4-5-6
6-3.10. Engine Adjustments

Refer to the “Engine Adjustments” instructions in Section 6-4.10 of M-0, Standard Practice Maintenance Manual.

6-3.10.1. Belt Tension Check and Adjustment

TSIO-550 engines may be fitted with an optional belt-driven air conditioning compressor or belt-driven alternator. Belt tension is critical to the function of these optional devices however, a new belt will stretch and tension will loosen during the first five hours (break-in) of engine operation after installation. Check the belt tension after the break-in period and during subsequent visual inspections.

Refer to the “Belt Tension Check and Adjustment” instructions in Section 6-4.10.4 of M-0, Standard Practice Maintenance Manual.

6-3.11. Cylinder Inspections

Refer to the “Cylinder Inspections” in Section 6-4.11 of M-0, Standard Practice Maintenance Manual.

6-3.12. Crankcase Inspection

Refer to the “Crankcase Inspection” in Section 6-4.12 of M-0, Standard Practice Maintenance Manual. In addition to the instructions in M-0, perform the inspection in Section 6-3.12.1 on engine models equipped with air conditioning compressors.
6-3.12.1. Crankcase Inspection with Air Conditioning Compressor

1. Inspect the crankcase boss at the forward compressor mounting bracket attach point. Two Permold crankcase rib configurations exist. The first crankcase configuration has a thin rib extending from the forward compressor mounting bracket attach point. The second configuration has a thick rib extending from the forward compressor mounting bracket attach point.

2. Compare the inspection area of your crankcase to Figure 6-3 and Figure 6-4. If your crankcase matches the configuration depicted in Figure 6-3, make a log book entry, indicating inspection compliance and “Thick Rib”; no further action is necessary. If the crankcase configuration matches the “Thin Rib” configuration depicted in Figure 6-4, continue with the visual inspection.

3. Clean the area surrounding the mounting boss with stoddard solvent or mineral spirits.

4. Use a minimum 10X magnifying lens to visually inspect the area depicted in Figure 6-5 and Figure 6-6.
a. Inspect the crankcase rib adjacent to the front air conditioner bracket attach point boss between the right magneto flange and the lower magneto hold down bracket.

b. If no crack, or suspected indication of a crack, is discovered:
   1) Make a log book entry indicating inspection compliance and result and schedule a follow-on inspection at the next 50-Hour inspection interval.
   2) Repeat the special inspection at each 50-hour inspection interval until the old style (Part No. 640767 or 654765) air conditioning compressor mounting bracket is replaced with air conditioning compressor bracket Part No. 657627 (or later) according to instructions in the latest version of SB09-4.

c. If a crack is discovered, or suspected:
   1) Perform a dye penetrant inspection according to the dye penetrant inspection kit manufacturer’s instructions on the suspect area to confirm the crankcase condition and the length of the crack, if one exists.
   2) Use the same crankcase inspection Pass/Fail criteria specified in Section 6-4.12 of M-0, Standard Practice Maintenance Manual.

Figure 6-5. General Inspection Area
Figure 6-6. Suspect Crack Indication
6-3.13. **Engine Mount Inspection**


6-3.14. **Induction System Inspection**

Refer to the “Induction System Inspection” in Section 6-4.14 of M-0, Standard Practice Maintenance Manual.

6-3.15. **Ignition System Inspection**

Refer to the “Ignition System Inspection” in Section 6-4.15 of M-0, Standard Practice Maintenance Manual.

6-3.16. **Engine Gauge Inspection**

Refer to the “Engine Gauge Inspection” in Section 6-4.16 of M-0, Standard Practice Maintenance Manual.

6-3.17. **Fuel System Inspection**

Refer to the “Fuel System Inspection” in Section 6-4.17 of M-0, Standard Practice Maintenance Manual.

6-3.18. **Throttle and Mixture Control Lever Inspection**

Refer to the “Throttle and Control Lever Inspection” in Section 6-4.18 of M-0, Standard Practice Maintenance Manual.

6-3.19. **Engine Control Linkage Inspection**

Refer to the “Engine Control Linkage Inspection” in Section 6-4.19 of M-0, Standard Practice Maintenance Manual.

6-3.20. **Induction System Drain Inspection**

Refer to the “Induction System Drain Inspection” in Section 6-4.20 of M-0, Standard Practice Maintenance Manual.

6-3.21. **Turbocharger and Exhaust System Inspection**

Refer to the “Turbocharger and Exhaust System Inspection” in Section 6-4.21 of M-0, Standard Practice Maintenance Manual.

6-3.22. **Alternator Inspection**

Refer to the “Alternator Inspection” in Section 6-4.22 of M-0, Standard Practice Maintenance Manual. In addition to the instructions in M-0, inspect Hartzell ES10024 and/or ES7024 Series Alternator, if installed, according to the instructions in Section 6-3.22.1 and Section 6-3.22.2.
6-3.22.1. Hartzell (Kelly) ES10024 Series Alternator Inspection

Inspect the alternator brushes at the first 500-Hour Inspection and each subsequent 500-Hour Inspection after being placed in service.

1. Remove the two screws (Figure 6-7) (8) securing the brush holder assembly (8) to the slip ring end housing (9).

   **CAUTION:** Remove the brush holder carefully to avoid damaging or dropping the brushes. If the brush holder assembly is damaged upon removal, all remnants of the previous brush holder must be removed before a new brush holder assembly can be installed. This may require complete alternator disassembly and inspection.

2. Remove the brush assembly (5) from the alternator slip ring end housing (9).

3. Remove the brushes from the brush holder assembly and mark the side to indicate the removed position and orientation in the holder. Serviceable brushes must be reinstalled in the location from which they were removed.

4. Inspect the brushes and brush holder for serviceability.

   a. Inspect the brushes for chipping or physical damage. Inspect the spring, cap and lead wire. If the spring appears damaged or malformed, replace the brushes. If a lead wire is frayed or strands of the lead wire are broken, replace the brush.

   **NOTE:** New brush assemblies are shipped with the brushes installed in the brush holder and retained with an insulated wire as an assembly.
**Engine Inspection and Service**

*CAUTION: Brushes must be replaced in pairs. Single brush replacement is not permitted.*

b. If the brushes appear to be physically intact, measure the brush block length. New brushes measure 0.50 inch in length. If brushes are worn to 0.25 inches in length, or less, replace the brushes.

c. Inspect the brush holder for serviceability. If the brush holder exhibits physical damage or cracks, replace the brush holder.

5. Insert serviceable brushes in the brush holder location from which they were removed. If brushes are to be replaced, insert a new brush in each brush holder slot. Compress the brushes in the brush holder and insert a two-inch long piece of insulated, 22 gauge wire through the hole provided in the side of the brush holder.

6. Install the new or serviceable brush assembly (5) in the alternator with two screws (8). Torque the screws 25-35 in. lbs.

7. Spin the rotor to check for interference between the brush holder and rotor. Remove the retaining wire from the brush holder, allowing the brushes to snap into place.

8. Rotate the alternator shaft and measure resistance between the field (7) and ground (3) terminals with a multimeter. If rotor resistance is not between 7 and 20 ohms, replace the alternator.

9. Return to Section 6-3.22 to complete the alternator inspection.
6-3.22.2. Hartzell ES7024 Belt-Driven Alternator Inspection

Inspect the alternator brushes at the first 500-Hour Inspection and each subsequent 500-Hour Inspection after being placed in service and/or any time alternator brush replacement is necessary.

1. Determine if ES7024 alternator is installed by checking the engine log book or physically inspect the belt-driven alternator data plate.

2. Check the unit time in service and begin inspections with the nearest time interval and associated tasks. If time in service is unknown, perform a 500-Hour Inspection.

3. Disconnect the aircraft battery according to the aircraft manufacturer’s instructions to avoid arcing and possible alternator electrical damage.

4. Loosen the first and second nuts on the battery terminal (red insulator) prior to removing the back cover screws to avoid damaging the alternator.

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**Figure 6-8. ES7024 Alternator Assembly**

1. Alternator Assembly
2. Screw
3. Lock Washer
4. Ground Terminal
5. Battery Terminal
6. Brush Assembly
7. Aux Terminal
8. Field Terminal
9. Back Cover
10. Thru Bolt
11. Slip Ring End Housing
12. Brush Assembly
13. Screw
14. Washer
15. Sea1
Engine Inspection and Service

5. Disconnect the F1 (field) wire by removing the hardware. Remove the three screws (Figure 6-8) (2) and lock washers (3) securing the back cover (9) to the housing. Remove the back cover (9).

   CAUTION: Remove the brush holder carefully to avoid damaging or dropping the brushes. If the brush holder assembly is damaged upon removal, all remnants of the previous brush holder must be removed before a new brush holder assembly can be installed. This may require complete alternator disassembly and inspection.

6. Remove the brush assembly (12) from the alternator slip ring end housing.

7. Remove the brushes from the brush holder assembly and mark the side to indicate the removed position and orientation in the holder. Serviceable brushes must be reinstalled in the location from which they were removed.

8. Inspect the brushes and brush holder for serviceability:

   a. Inspect the brushes for chipping or physical damage. Inspect the spring, cap and lead wire. If the spring appears damaged or malformed, replace the brush assembly. If a lead wire is frayed or strands of the lead wire are broken, replace the brush assembly.

      CAUTION: Brushes must be replaced in pairs. Single brush replacement is not permitted.

      NOTE: New brush assemblies are shipped with the brushes installed in the brush holder and retained with an insulated wire as an assembly.

   b. If the brushes appear to be physically intact, measure the brush block length. New brushes measure 0.50 inch in length. If brushes are worn to 0.25 inch in length, or less, replace the brushes.

   c. Inspect the brush holder for serviceability. If the brush holder exhibits physical damage or cracks, replace the brush holder.

9. Insert serviceable brushes in the brush holder location from which they were removed. If brushes are to be replaced, insert a new brush in each brush holder slot. Compress the brushes in the brush holder and insert a two-inch long piece of insulated, 22 gauge wire through the hole provided in the side of the brush holder.

10. Install the new or serviceable brush assembly (12) in the alternator with two screws (13) and washers (14). Torque the screws 18-20 in. lbs.

11. Spin the rotor to check for interference between the brush holder and rotor. Remove the retaining wire from the brush holder, allowing the brushes to snap into place.

12. Rotate the alternator shaft and measure resistance between the field (8) and ground (4) terminals with a multimeter. If rotor resistance is not between 5.8 and 20 ohms, replace the alternator.

13. Install the back cover with three screws (2) and three new lock washers (3). Torque the screws 20-25 in. lbs.

14. Return to Section 6-3.22 to complete the alternator inspection.
6-4. Unscheduled Maintenance

6-4.1. Propeller Strike
Refer to “Propeller Strike” in Section 6-5.1 of M-0, Standard Practice Maintenance Manual.

6-4.1.1. Propeller Strike Inspection
Refer to “Propeller Strike Inspection” in Section 6-5.1.1 of M-0, Standard Practice Maintenance Manual.

6-4.2. Hydraulic Lock Inspection
Refer to “Hydraulic Lock Inspection” in Section 6-5.2 of M-0, Standard Practice Maintenance Manual.

6-4.3. Engine Overspeed Inspections
Refer to “Engine Overspeed Inspections” in Section 6-5.3 of M-0, Standard Practice Maintenance Manual.

6-4.4. Turbocharger Overboost
Refer to “Turbocharger Overboost” in Section 6-5.4 of M-0, Standard Practice Maintenance Manual.

6-4.5. Lightning Strike Inspection
Refer to “Lightning Strike Inspection” in Section 6-5.5 of M-0, Standard Practice Maintenance Manual.

6-4.6. Contaminated Fuel System Inspection
Refer to “Contaminated Fuel System Inspection” in Section 6-5.6 of M-0, Standard Practice Maintenance Manual.

6-4.7. Foreign Object Contamination Inspection
Refer to “Foreign Object Contamination Inspection” in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.

6-5. Inspection Checklists
Refer to “Inspection Checklists” in Section 6-6 of M-0, Standard Practice Maintenance Manual.
Engine Inspection and Service

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Chapter 7. Engine Operation

7-1. Introduction

This chapter contains the TSIO-550 Permold Series ground engine operating instructions to facilitate maintenance personnel during:
- Normal Engine Operation
- Engine Operation in Abnormal Environments

Instructions in this section apply to Continental Motors TSIO-550 operation with variable pitch propellers conforming to the engine original type design and supplements information in the Airplane Flight Manual (AFM) or Pilot's Operating Handbook (POH) provided by the aircraft manufacturer or supplemental type certificate holder as required by the Federal Aviation Regulations (FAR) for aircraft operating procedures.

NOTE: This section pertains to engine operations under various operating conditions. Normal operating instructions are presented first followed by operation in adverse operating environments.

7-2. Flight Prerequisites

If the engine is newly installed and/or has been repaired/overhauled, perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual prior to releasing the engine for normal operation.

WARNING

The “Engine Operational Check” must be completed on an engine that has been installed, inspected, repaired, or overhauled before the aircraft can be released for normal operation.

DO NOT FLY THE AIRCRAFT UNTIL ALL FLIGHT PREREQUISITES HAVE BEEN MET.

NOTE: Environmental conditions (humidity), seasonal changes, and engine usage influence susceptibility to corrosion. Engines that are flown occasionally (less than one time per week) are more vulnerable to corrosion under these conditions. The best method of reducing the risk of corrosion is to fly the aircraft weekly for at least one hour. The owner/operator is ultimately responsible for recognizing corrosion and taking appropriate corrective action.

After successful completion of the Engine Operational Check, perform a Flight Check according to instructions in Section 7-2.3.2.
7-2.1. Oil Change Interval

NOTE: After the first 25 hours of operation, perform an oil change according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

The Oil Change Interval is specified in Table 6-2, “Engine Inspection and Maintenance Schedule” in M-0, Standard Practice Maintenance Manual.

7-2.2. Engine Fuel Requirements

WARNING

The engine is certified for operation with the aviation fuel listed for each engine model in Section 7-2.2 of M-0, Standard Practice Maintenance Manual. If the minimum fuel grade is not available, use the next higher grade. Never use a lower grade fuel. The use of lower octane fuel may result in damage to, or destruction of, an engine the first time high power is applied.

If the aircraft is inadvertently serviced with the incorrect grade of aviation fuel or jet fuel, the fuel system must be completely drained and the fuel tanks serviced in accordance with the aircraft manufacturer’s recommendations. After the fuel system is decontaminated, inspect the engine according to the “Contaminated Fuel System Inspection” instructions in Section 6-5.6 of M-0, Standard Practice Maintenance Manual.

7-2.3. Flight Check and Break-In

New and factory rebuilt Continental Motors engines are adjusted to meet product specifications in a test cell prior to shipment. A flight check ensures the engine meets operational specifications after installation in the aircraft, prior to release for normal service. The recommended break-in period for Continental Motors engines is 25 hours. Adhere to the following instructions and the “Engine Specifications” in Section 2-3 applicable to the engine model.

Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual and a normal preflight, engine start and ground run-up in accordance with the Airplane Flight Manual or Pilot’s Operating Handbook (AFM/POH) before the A&P mechanic can approve the airplane for a Flight Check. Perform a “Flight Check” according to instructions in Section 7-2.3.2 after engine installation, inspection, repairs, or adjustments. Follow the protocol in Section 7-2.3.1 to complete the recommended break-in period.

WARNING

Avoid long descents at high engine RPM to prevent undesirable engine cooling. If power must be reduced for long periods, adjust the propeller to minimum governing RPM to obtain desired performance levels. If outside air temperature is extremely cold, it may be desirable to increase drag to maintain engine power without gaining excess airspeed. Do not permit cylinder head temperature to drop below 300°F (149°C).
CAUTION: High power ground operation resulting in cylinder and oil temperatures exceeding normal operating limits can be detrimental to cylinders, pistons, valves, and rings.

7-2.3.1. Engine Break-In

1. Conduct a normal engine start, ground run-up and take-off according to the AFM/POH.

2. Monitor a) engine RPM, b) fuel flow and pressure, c) oil pressure and temperature, d) cylinder head temperature, e) exhaust gas temperature, and f) turbine inlet temperature to verify the engine is operating within the parameters specified in Section 2-3.

3. Reduce the engine speed to climb power according to the AFM/POH instructions. Maintain a shallow climb attitude to achieve optimum airspeed and cooling airflow.

4. At cruise altitude:
   a. Maintain level flight cruise at 75% power with best power or richer mixture for the first hour of operation.
      NOTE: Best power mixture setting is 100°-150°F rich of peak exhaust gas temperature. Adjust engine controls or aircraft attitude to maintain indicated engine operation within specifications.

   b. For the second and subsequent hours of flight, alternate cruise power settings between 65% and 75% power with appropriate best power mixture settings.

   WARNING

Avoid long descents at high engine RPM to prevent undesirable engine cooling. If power must be reduced for long periods, adjust the propeller to minimum governing RPM to obtain desired performance levels. If outside air temperature is extremely cold, it may be desirable to increase drag to maintain engine power without gaining excess airspeed. Do not permit cylinder head temperature to drop below 300°F (149°C).

5. Descend at low cruise power settings. Avoid long descents or descents at cruise power RPM with manifold pressure below 18 in. Hg. If necessary, reduce engine RPM to the lower limit of the specified operating range to maintain sufficient manifold pressure. Carefully monitor engine instrumentation to maintain levels above the minimum specified cylinder head temperature and oil temperature.

6. Correct any discrepancies prior to releasing the aircraft for service.
7-2.3.2. Flight Check

NOTE: Accuracy of the tachometer and fuel flow metering device are critical to the outcome of the flight check. Verify equipment accuracy according to the aircraft manufacturer’s instructions prior to performing the flight check.

1. Conduct a normal engine start, ground run-up and take-off according to the AFM/POH.

2. Monitor a) engine RPM, b) fuel flow and pressure, c) oil pressure and temperature, d) cylinder head temperature, e) exhaust gas temperature, and f) turbine inlet temperature to verify the engine is operating within the parameters specified in Section 2-3.

3. Ascend to a safe cruise altitude (>2000' above field elevation) for the vicinity where the flight check may be performed.

4. Verify the engine achieves full throttle, full rich rated RPM at cruise altitude and operates within the limits specified in Section 2-3; if the engine meets full power, rated RPM, proceed to step 5. If the aircraft fails to meet the published limits, repeat the Engine Operational Check and Flight Check.

WARNING
All abnormal conditions must be corrected prior to releasing the aircraft to normal operation.

5. Release the engine to normal service.

7-3. Normal Operation

Information in this section supplements instructions for normal operation found in the AFM/POH. Adhere to the aircraft AFM/POH operating procedures.

WARNING
Before flying the aircraft, ensure all “Flight Prerequisites” in Section 7-2 have been completed, in addition to the aircraft manufacturer’s instructions found in the AFM/POH.

Operation of a malfunctioning engine can result in additional damage to the engine, bodily injury or death.

Supplemental instructions for normal operation in this section are:
• Pre-operational Requirements
• Engine Start
• Engine Ground Run-up
• Engine Shutdown

7-3.1. Pre-operational Requirements

1. Check the engine oil level, and verify quantity is within specified limits.

2. Verify oil fill cap and dipstick are secure.
3. Drain all fuel sumps and strainers in accordance with aircraft manufacturer’s recommendations.

4. Check the fuel system according to the Pilot's Operating Handbook (POH) and verify compliance with “Engine Fuel Requirements” in Section 7-2.2 of M-0, Standard Practice Maintenance Manual.

5. Check propeller and propeller hub for cracks, oil leaks, and security.

6. Check engine nacelle for signs of damage, leaks, and debris.

7. Perform an aircraft preflight inspection according to the AFM/POH.

7-3.2. Engine Start

Refer to the aircraft POH for detailed engine starting procedures. Complete Section 7-3.1, “Pre-operational Requirements” prior to engine start. Be familiar with the quantity and location of the engine fuel system drains.

**WARNING**

*Do not attempt to start an engine with an over-primed or flooded induction system. Starting an engine with a flooded induction system can result in hydraulic lock and subsequent engine malfunction or failure. Allow excess fuel to drain from the intake manifold and/or cylinder prior to attempting to start the engine.*

*CAUTION: Attempting to start an engine with a partially discharged aircraft battery may result in damage to the starter relay or possible engine kick-back resulting in a broken starter adapter clutch spring.*

When starting the engine, ensure the battery is completely charged, especially in sub-freezing temperatures.

Verify the tasks listed in Table 7-2, “Flight Prerequisites,” have been completed in addition to those required by the aircraft POH, aircraft manufacturer, or Supplemental Type Certificate (STC) holder. Note the following:

- If the engine is being started in extreme cold, preheating may be required. Refer to Section 7-4.1, “Engine Operation in Extreme Cold” in M-0, Standard Practice Maintenance Manual.

- If the engine is started in hot weather, refer to Section 7-4.2, “Engine Operation in Hot Weather.”

- If the engine is being started at high altitude, refer to Section 7-4.3, “Ground Operation at High Density Altitude.”

**WARNING**

*Ensure the propeller arc is clear of personnel and obstructions before starting the engine.*

*CAUTION: If the engine is hot, engage starter first, then turn on the auxiliary boost pump as instructed by the aircraft manufacturer.*
**Engine Operation**

NOTE: Check oil pressure frequently. Oil pressure indication must be noted within 30 seconds in normal weather. If no oil pressure is observed, stop the engine and investigate the cause.

1. Propeller ........................................................... Clear

2. Master Switch .................................................. On

3. Ignition Switch ............................................... BOTH

4. Mixture Control ............................................... FULL RICH

5. Propeller Control .............................................. High RPM

6. Auxiliary Boost Pump ..................................... According to AFM/POH

7. Throttle ............................................................. ¼ Open

   **CAUTION:** Release starter switch as soon as engine fires. Never engage the starter while the propeller is still turning.

**EZR SKY** Do not energize the starter for longer than 30 seconds. If the engine does not start after cranking for 30 seconds, release the starter switch and allow the starter motor to cool for 3-5 minutes before another starting attempt.

**ISK** Do not engage the starter for longer than 10 seconds. Allow 20 seconds for the starter to cool after each engagement. If engine start is unsuccessful after six attempts, release the starter switch and allow the starter motor to cool for 30 minutes before another starting attempt is made.

8. Ignition Switch ............................................... Start

   **CAUTION:** If engine kickback is experienced during engine start, inspect the starter adapter and crankshaft gear according to instructions in SB16-6 prior to further flight.

9. Throttle ............................................................. Set to 900 - 1100 RPM

   **CAUTION:** Engine operation without oil pressure will result in engine malfunction and probable failure.

10. Oil Pressure ..................................................... Check

    RESULT: Must have oil pressure indication within 30 seconds.
7-3.2.1. Cold Start

Follow the AFM/POH instructions, using the same procedure as for a normal start. After the engine begins running, it may be necessary to operate the boost pump intermittently to prevent the engine from stalling.

7-3.2.2. Flooded Engine

Excessive priming may cause fuel to accumulate in the induction system or cylinder faster than cylinder drains can evacuate it. If hydraulic lock is suspected, discontinue starting attempts until proper drain operation is verified.

**WARNING**

Do not operate the engine if hydraulic lock is suspected. Engine damage may occur. Perform a “Hydraulic Lock Inspection” according to instructions in Section 6-5.2 of M-0, Standard Practice Maintenance Manual. If no fuel drainage is observed, discontinue starting attempts until the cause is determined. Inspect the cylinder drains for obstructions.

7-3.2.3. Hot Start

Supplement the AFM/POH normal starting instructions with the following:

NOTE: For several minutes after stopping a hot engine, heat soaked fuel injection components, (especially the fuel pump) may cause fuel vaporization resulting in restarting difficulties. To reduce difficulty, perform the following steps:

1. Fuel Selector Valve .......................... ON
2. Throttle .............................................. CLOSED
3. Mixture Control .......................... IDLE CUT-OFF

**CAUTION:** With the mixture control in the IDLE CUT-OFF position, no fuel is supplied to the engine. The fuel manifold valve positively stops fuel flow to the fuel injectors if inlet fuel pressure is less than 1.0 psi. If the boost/prime pump is enabled with the mixture control in IDLE CUT-OFF and the pressure is above the fuel manifold valve nominal shutoff pressure, fuel will be forced past the fuel manifold valve, through the injectors and into the cylinders. Extended operation in this condition is not recommended. Excessive fuel in the cylinder intake will cause an overly rich condition and fuel discharge from the cylinder drains. Refer to AFM/POH for boost pump operational limits.

4. Auxiliary Boost Pump.................. According to AFM/POH
5. Allow fuel to drain from intake prior to engine start; follow AFM/POH starting instructions.
7-3.3. Ground Run-up

CAUTION: DO NOT operate the engine at run-up speeds unless the oil temperature is at least 100°F (38°C) and the oil pressure is within the 30-60 psi range. Operating the engine above idle before reaching minimum oil temperature may cause a loss of oil pressure and engine damage.

1. Maneuver aircraft nose into wind

   CAUTION: Avoid prolonged idle at low RPM to prevent spark plug fouling.

2. Throttle ............................................................. IDLE

3. Propeller Control .............................................. FULL INCREASE

4. Mixture ............................................................. FULL RICH

5. Throttle ............................................................. 900-1000 RPM

6. Maintain engine RPM between 900 and 1000 RPM for at least one minute or until engine oil temperature exceeds 100°F (38°C).

   WARNING

   Absence of RPM drop during the magneto check may be an indication of a faulty ignition circuit resulting in a condition known as “Hot Magneto.” Should the propeller be turned by hand, the engine may inadvertently start and cause personal injury or death. This condition must be corrected prior to continued aircraft operation.

   CAUTION: When operating on single ignition, some RPM drop and slight engine roughness as each magneto is switched off should be noted. Excessive (greater than 150 RPM) RPM drop may indicate a faulty magneto or fouled spark plugs.

   NOTE: If the engine runs roughly after single magneto operation, increase engine speed to 2200 RPM in the BOTH position and lean the mixture control until the RPM peaks for ten seconds before returning to the full rich position to clear the spark plugs and smooth operation before returning to single magneto operation.

Limit ground operation to time necessary to complete engine warm-up and pre-flight checkout.

7. Throttle ............................................................. 1700 RPM

   a. Magneto Check

      1) Ignition Switch .............................................. R

         RESULT: RPM drops 150 RPM or less; record Left Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.
Engine Operation

2) Ignition Switch......................................BOTH
RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position for approximately ten seconds to clear engine roughness.

3) Ignition Switch......................................L
RESULT: RPM drops 150 RPM or less; record Right Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.

4) Ignition Switch......................................BOTH
RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position

b. Propeller Governor Checkout

1) Throttle..................................................1700 RPM

2) Propeller Control....................................Low RPM position
RESULT: Engine RPM decreases to minimum governing speed or as specified by aircraft manufacturer.

3) Propeller Control....................................High RPM position
RESULT: Tachometer drops 400-500 RPM. Cycle the Propeller Governor control 2-3 times to cycle warm oil through the propeller hub.

If equipped:

4) Propeller Control.................................... Feather
RESULT: RPM drops below minimum governing speed.

5) Propeller Control.................................... Full Increase
RESULT: Engine RPM return to 1700 RPM.

8. Throttle...................................................1200 RPM
7-3.4. Engine Shutdown

Supplement the AFM/POH engine shutdown procedures with the following:

1. Auxiliary Boost Pump ........................................ OFF
2. Throttle ............................................................. 1700 RPM

**WARNING**

Absence of RPM drop during the magneto check may be an indication of a faulty ignition circuit resulting in a condition known as “Hot Magneto.” Should the propeller be turned by hand, the engine may inadvertently start and cause personal injury or death. This condition must be corrected prior to continued aircraft operation.

*CAUTION:* When operating on single ignition, some RPM drop should be noted. Normal indications are up to 150 RPM drop and slight engine roughness as each magneto is switched off. RPM drop in excess of 150 RPM may indicate a faulty magneto or fouled spark plugs. Avoid prolonged single magneto operation to preclude spark plug fouling.

NOTE: If the engine runs roughly after single magneto operation, increase engine speed to 2200 RPM in the BOTH position and lean the mixture control until the RPM peaks for ten seconds before returning to the full rich position to clear the spark plugs and restore smooth operation before returning to single magneto operation.

3. Ignition Switch ...................................................... R
   RESULT: RPM drops 150 RPM or less; record Left Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.
4. Ignition Switch ...................................................... BOTH
   RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position for approximately ten seconds to clear engine roughness.
5. Ignition Switch ...................................................... L
   RESULT: RPM drops 150 RPM or less; record Right Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.
6. Ignition Switch ...................................................... BOTH
   RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position.
CAUTION: Turbochargers require a cooling/spin down period before engine shutdown. Failure to allow the turbocharger to cool/spin down will shorten turbocharger service life.

7. Throttle.............................................................IDLE
RESULT: Allow engine to run for five minutes below 900 RPM to allow turbochargers to slow to a lower RPM and cool down.

   NOTE: If RPM is raised above 1200 RPM during the spin-down period, restart the timer and complete five minute cooling/spin-down cycle.

8. Mixture Control ............................................. IDLE CUT-OFF
9. Ignition Switch............................................... OFF
10. Fuel Selector ................................................... OFF (according to AFM/POH)
Engine Operation

7-4. Engine Operation in Abnormal Environments

The anticipated types of abnormal environments are:
- Extreme cold weather
- Extreme hot weather
- High density altitude ground operation

7-4.1. Engine Operation in Extreme Cold

Refer to Engine Operation in Extreme Cold in Section 7-4.1 of M-0, Standard Practice Maintenance Manual.

7-4.2. Engine Operation in Hot Weather

“Hot weather” is defined as ambient temperature exceeding 90°F (32°C). After an engine is shutdown, the temperature of various components will begin to stabilize. The hotter parts such as cylinders and oil will cool, while other parts will begin to heat up due to lack of air flow or heat convection from those engine parts that are cooling. At some point following engine shutdown, the engine temperature will stabilize near ambient temperature. This time period will vary based on outside air temperature, wind conditions, etc. and may take several hours.

Heat soaking occurs thirty minutes to an hour following engine shutdown. During this time, the fuel system will expand, causing the fuel in the pump and fuel lines to vaporize. Starting the engine will be difficult because the fuel pump is trying to pressurize a combination of fuel and fuel vapor causing the fuel delivered to the fuel injection nozzles to be leaner than during an engine start at ambient temperature. Until the vapor is evacuated from the lines and replaced with liquid fuel, expect difficult starting and rough engine operation.

Three hot weather operation situations requiring special instructions are:
- “Cooling an Engine in Hot Weather” (Section 7-4.2.1)
- “Engine Restart in Hot Weather” (Section 7-4.2.2)
- “Take-off and Initial Climb Out in Hot Weather” (Section 7-4.2.3)

Ensure the engine is serviced with the correct viscosity oil specified in Section 2-3.2, “Oil Specifications” prior to starting the engine. In the event of temporary cold weather exposure, store the aircraft in a hangar between flights. Service the oil sump, as required, to maintain the oil capacity specified for the engine model in Section 2-3, “Engine Specifications” according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

Operating Tips
- Inspect the air filter frequently for contamination; clean or replace the filter, if necessary.
- If the aircraft is flown in dusty conditions, more frequent oil changes are recommended
- Use dust covers over openings in the cowling for additional protection.
7-4.2.1. Cooling an Engine in Hot Weather

- Reduce ground operation to a minimum to keep engine temperatures down.
- Open cowl flaps fully while taxiing.
- Face the nose of aircraft into the wind to take advantage of the cooling effect.

7-4.2.2. Engine Restart in Hot Weather

Restarting attempts will be the most difficult thirty to sixty minutes after engine shutdown. Following that interval, fuel vapor will decrease and present less of a restart problem.

**WARNING**

Allow excess fuel to drain from the induction system prior to starting the engine.

1. Fuel selector .................................................... ON
2. Throttle............................................................. CLOSED
3. Mixture Control ............................................. IDLE CUT-OFF
4. Auxiliary Boost Pump................................. ON (according to AFM/POH)
   RESULT: Allow boost pump to run for 15-20 seconds
5. Auxiliary Boost Pump................................. OFF (according to AFM/POH)
6. Follow the “Engine Start” instructions in the AFM/POH and Section 7-3.2.

7-4.2.3. Take-off and Initial Climb Out in Hot Weather

1. Mixture control ................................................. FULL RICH
   
   NOTE: Under extreme conditions, it may be necessary to manually lean the mixture to sustain engine operation at low RPM.

2. Do not operate the engine at maximum power longer than necessary to establish the climb configuration recommended by the aircraft manufacturer.


4. Maintain sufficient airspeed and attitude to provide engine cooling.

5. Cowl flaps ................................................... FULLY OPEN (if equipped)
Engine Operation

7-4.3. **Ground Operation at High Density Altitude**

*CAUTION: Reduced engine power will result from higher density altitude associated with high temperature.*

Idle fuel mixture may be rich during high density altitude conditions. Lean the fuel mixture to sustain operation at low RPM. When practical, operate the engine at higher idle speed.

NOTE: A FULL RICH mixture is required during take-off.

If higher than desired temperatures are experienced during the climb phase, establish a lower angle of attack or higher climb speed, consistent with safe operating practices to provide increased engine cooling.

- Monitor oil and cylinder temperatures closely during taxiing and engine run up.
- Operate with cowl flaps full open.
- Do not operate the engine at high RPM except for necessary operational checks.
- If take-off is not to be made immediately following engine run-up, face the aircraft into the wind with the engine idling between 900-1000 RPM.
Chapter 8. Troubleshooting

Fault isolation paths within this section indicate the most likely causes of given symptoms and corrective action. The fault isolation paths and repair procedures are developed using real world scenarios (log book entries) and best known practices. New symptoms, fault isolation methods, and corrective actions may be added in the future, when warranted.

WARNING

Any attempt by unqualified personnel to adjust, repair, or replace any parts may result in engine malfunction or failure. Continued operation of a malfunctioning engine can cause further damage to a disabled component and possible injury to personnel. Do not return an engine to service unless it functions according to specifications.
Troubleshooting

8-1.  General Troubleshooting
Refer to Section 8-1 of M-0, Standard Practice Maintenance Manual.

8-1.1.  Engine Runs Rough
Refer to Section 8-1.3.2 of M-0, Standard Practice Maintenance Manual.

8-1.2.  Engine Will Not Run
Refer to Section 8-1.4 of M-0, Standard Practice Maintenance Manual.

8-1.3.  Engine Indication Malfunctions
Refer to Section 8-1.5 of M-0, Standard Practice Maintenance Manual.

8-1.4.  Engine Performance Malfunctions
Refer to Section 8-1.5 of M-0, Standard Practice Maintenance Manual.

8-2.  Induction System
Refer to Section 8-2 of M-0, Standard Practice Maintenance Manual.

8-3.  Fuel Injection System
Refer to Section 8-3 of M-0, Standard Practice Maintenance Manual.
8-4. Charging System
Refer to Section 8-4 of M-0, Standard Practice Maintenance Manual.

8-5. Starting System
Refer to Section 8-5 of M-0, Standard Practice Maintenance Manual.

8-6. Ignition System
Refer to Section 8-6 of M-0, Standard Practice Maintenance Manual.

8-7. Lubrication System
Refer to Section 8-7 of M-0, Standard Practice Maintenance Manual.

8-8. Engine Cylinders
Refer to Section 8-8 of M-0, Standard Practice Maintenance Manual.

8-9. Crankcase
Refer to Section 8-9 of M-0, Standard Practice Maintenance Manual.

8-9.1. Excess Crankcase Pressure
Refer to Section 8-9.1 of M-0, Standard Practice Maintenance Manual.

8-10. Turbocharger and Exhaust System
Refer to Section 8-10 of M-0, Standard Practice Maintenance Manual.
Troubleshooting

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Chapter 9. Engine Preservation and Storage

9-1. Preserving and Storing an Engine

Refer to the “Preserving and Storing an Engine” instructions in Section 9-1 of M-0, Standard Practice Maintenance Manual

9-1.1. Engine Preservation Checklist

Make a copy of the “Engine Preservation Checklist” on page 9-5 of M-0, Standard Practice Maintenance Manual and record the serial number, date placed in storage and projected inspection date for each engine placed in storage. The checklist covers a 90-day storage cycle. Complete a new checklist for each 90-day storage cycle and attach to the previous checklist to record inspection until the engine is returned to service.

9-1.2. New or Unused Engine Storage

Refer to the “New or Unused Engine Storage” instructions in Section 9-1.2 of M-0, Standard Practice Maintenance Manual.

9-1.3. Temporary Storage

Refer to the “Temporary Storage” instructions in Section 9-1.3 of M-0, Standard Practice Maintenance Manual.

9-1.4. Indefinite Storage

Refer to the “Indefinite Storage” instructions in Section 9-1.4 of M-0, Standard Practice Maintenance Manual.

9-1.5. Return an Engine to Service after Storage

Refer to the “Return an Engine to Service after Storage” instructions in Section 9-1.5 of M-0, Standard Practice Maintenance Manual.
Engine Preservation and Storage

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Chapter 10. Non-Overhaul Repair and Replacement

10-1. Parts Replacement

Procedures in this section apply to instances outside of overhaul when parts can be repaired or replaced as a maintenance practice; some parts cannot be repaired and must be replaced. Table 10-1, “Non-Overhaul Parts Replacement Reference” indicates items that must be replaced, along with respective references for replacement instructions. Table 10-2, the “Parts Repair Reference” lists items that may be repaired along with corresponding references to the repair instructions. Unless otherwise indicated, instructions are in this chapter.

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

NOTE: When replacing components according to the maintenance procedures in this section, adhere to the service limits, in line with the procedure as a guide for part re-use for each component. Use the overhaul dimensional limits in Appendix D when performing maintenance repairs if service limits are not provided.

*Service limits* in this section apply only to maintenance procedures and in many cases are not identical to the overhaul limits in Appendix D.
### Table 10-1. Non-Overhaul Parts Replacement Reference

<table>
<thead>
<tr>
<th>Replaceable Item</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternator</td>
<td>Section 10-5, “Alternator Replacement”</td>
</tr>
<tr>
<td>Camshaft Plugs</td>
<td>Section 13-10.1, “Camshaft Disassembly”</td>
</tr>
<tr>
<td></td>
<td>Section 16-10.1, “Camshaft Assembly”</td>
</tr>
<tr>
<td>Crankcase Studs</td>
<td>Section 15-8.10.5, “Crankcase Cylinder Deck Stud Replacement”</td>
</tr>
<tr>
<td>Crankcase Helical Coils</td>
<td>Section 15-8.10.4, “Crankcase Cylinder Deck Stud Helical Coil Installation”</td>
</tr>
<tr>
<td>Crankshaft Nose Oil Seal</td>
<td>Section 10-9, “Crankshaft Nose Oil Seal Replacement”</td>
</tr>
<tr>
<td>Engine Cylinder - Individual</td>
<td>Section 10-8, “Engine Cylinder Maintenance”</td>
</tr>
<tr>
<td></td>
<td>Section 16-9, “Engine and Turbocharger Mount Installation”</td>
</tr>
<tr>
<td>Fuel Injector Nozzles</td>
<td>Table 10-3 and Section 10-3, “Fuel Injector Replacement”</td>
</tr>
<tr>
<td>Fuel Manifold Valve</td>
<td>Section 12-5, “Fuel Injection System Removal”</td>
</tr>
<tr>
<td></td>
<td>Section 17-11, “Fuel Injection System Installation”</td>
</tr>
<tr>
<td>Fuel Pump</td>
<td>Section 10-2, “Fuel Pump Replacement”</td>
</tr>
<tr>
<td>Hydraulic Tappets</td>
<td>Section 10-8.2, “Hydraulic Tappet Removal” and</td>
</tr>
<tr>
<td></td>
<td>Section 10-8.7, “Hydraulic Tappet Installation”</td>
</tr>
<tr>
<td>Magneto</td>
<td>Section 10-6, “Magneto Replacement”</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td>Section 10-7.4, “Oil Cooler Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Filter</td>
<td>Section 6-3.8, “Engine Oil Servicing”</td>
</tr>
<tr>
<td>Oil Filter Adapter Stud</td>
<td>Section 10-7.1, “Oil Filter Adapter Stud Replacement”</td>
</tr>
<tr>
<td>Oil Pressure Relief Valve</td>
<td>Section 10-7.5, “Oil Pressure Relief Valve Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Pump</td>
<td>Section 10-7.2, “Oil Pump or Tachometer Drive Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Sump or Oil Suction Tube</td>
<td>Section 10-7.3, “Oil Sump and Oil Suction Tube Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Temperature Control Valve</td>
<td>Section 10-7.6, “Oil Temperature Control Valve Inspection and Replacement”</td>
</tr>
<tr>
<td>Starter Adapter</td>
<td>Section 10-4, “Starter Motor and Adapter Replacement”</td>
</tr>
<tr>
<td>Starter Motor</td>
<td>Section 10-4, “Starter Motor and Adapter Replacement”</td>
</tr>
<tr>
<td>Starter Needle Bearing</td>
<td>Section 10-4, “Starter Motor and Adapter Replacement”</td>
</tr>
<tr>
<td></td>
<td>Section 13-6, “Starter and Starter Adapter Disassembly”</td>
</tr>
<tr>
<td></td>
<td>Section 13-9.2, “Crankcase Studding Disassembly”</td>
</tr>
<tr>
<td></td>
<td>Section 15-8.5.1, “Starter Adapter Housing Worm Shaft Needle Bearing</td>
</tr>
<tr>
<td></td>
<td>Replacement”</td>
</tr>
<tr>
<td></td>
<td>Section 16-4, “Starter &amp; Starter Adapter Assembly”</td>
</tr>
<tr>
<td>Throttle Body</td>
<td>Section 12-5, “Fuel Injection System Removal”</td>
</tr>
<tr>
<td></td>
<td>Section 17-11, “Fuel Injection System Installation”</td>
</tr>
<tr>
<td>Turbocharger</td>
<td>Section 10-11.1.1, “Turbocharger Replacement”</td>
</tr>
<tr>
<td>Wastegate</td>
<td>Section 12-8, “Turbocharger and Exhaust System Removal”</td>
</tr>
<tr>
<td></td>
<td>Section 17-10, “Turbocharger and Exhaust System Installation”</td>
</tr>
<tr>
<td>Wastegate Controller</td>
<td>Section 12-4, “Wastegate Controller Removal”</td>
</tr>
<tr>
<td></td>
<td>Section 17-12, “Wastegate Controller Installation”</td>
</tr>
</tbody>
</table>
### Table 10-2. Parts Repair Reference

<table>
<thead>
<tr>
<th>Repairable Item</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankcase Cracks</td>
<td>Section 15-8.10, “Crankcase Overhaul Repair”</td>
</tr>
<tr>
<td>Engine Cylinder</td>
<td>Section 10-8, “Engine Cylinder Maintenance”</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td>Section 10-7.4, “Oil Cooler Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Pressure Relief Valve</td>
<td>Section 10-7.5, “Oil Pressure Relief Valve Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Pump</td>
<td>Section 10-7.2, “Oil Pump or Tachometer Drive Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Sump and Oil Suction Tube</td>
<td>Section 10-7.3, “Oil Sump and Oil Suction Tube Repair and Replacement”</td>
</tr>
<tr>
<td>Starter Motor</td>
<td>Section 10-4, “Starter Motor and Adapter Replacement”</td>
</tr>
</tbody>
</table>

### Table 10-3. Parts Handling Guidelines

<table>
<thead>
<tr>
<th>Parts/Components</th>
<th>Handling Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrapped new or rebuilt parts</td>
<td>Parts that require protection from atmospheric dust and moisture should be wrapped or boxed after acceptance inspection and remain wrapped until time of installation</td>
</tr>
<tr>
<td>Spark plugs</td>
<td>Handle spark plugs with clean, dry hands. Avoid dropping a spark plug. If a spark plug is either dropped or damaged, discard it. Do not install any spark plug that has been dropped or damaged.</td>
</tr>
</tbody>
</table>
10-2. Fuel Pump Replacement

Continental Motors offers new and rebuilt fuel pumps for the TSIO-550 Permold series engines. Fuel pumps may be repaired by FAA Part 145 Authorized Repair Stations. Continental Motors does not control Repair Station certification; verify the Repair Station possesses the proper certification before contracting repairs.

10-2.1. Fuel Pump Removal

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the ignition switch to the OFF position and disconnect engine electrical power.

   **NOTE:** Mark or tag hose connections as they are removed to eliminate confusion during installation.

   ![Figure 10-1. Fuel Pump Adjustments & Fittings (typical)](image)

<table>
<thead>
<tr>
<th>Fittings</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Fuel Inlet</td>
<td>1 Low Pressure Relief Valve</td>
</tr>
<tr>
<td>B Fuel Outlet (Unmetered Pressure)</td>
<td>CW = INCREASE</td>
</tr>
<tr>
<td>C Fuel Return</td>
<td>2 Aneroid Adjustment</td>
</tr>
<tr>
<td>D Fuel Vapor Return</td>
<td>CCW = INCREASE</td>
</tr>
<tr>
<td>E Drain</td>
<td>3 Mixture Control</td>
</tr>
<tr>
<td>F Ambient (or Deck) Pressure Reference</td>
<td>CCW = INCREASE</td>
</tr>
</tbody>
</table>

2. Disconnect the hoses from and place protective caps on the fuel pump inlet fitting (Figure 10-1) (A), fuel pump outlet fitting (B), fuel pump vapor return fitting (D),
upper deck pressure reference ($F^1$ or $F^2$, depending on engine model), and fuel pump drain fitting (E).

3. Remove the nuts (Figure 10-2) (6), lock washers (5), and hold-down washers (4), from the base of the fuel pump (1); discard the lock washers (5). Remove the fuel pump (1) from the crankcase. Remove and discard the gasket (3).

4. Clean the gasket residue from the crankcase flange.

5. Remove the fuel pump drive coupling (2) from the pump shaft. Inspect the drive coupling for evidence of excessive wear or damage. Inspect the fuel pump drive coupling according to the service limits in Table 10-4 and Figure 10-3.

![Figure 10-2. Fuel Pump Assembly](image)

<table>
<thead>
<tr>
<th>1</th>
<th>Fuel Pump Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Coupling, Fuel Pump Drive</td>
</tr>
<tr>
<td>3</td>
<td>Fuel Pump Gasket</td>
</tr>
<tr>
<td>4</td>
<td>Hold Down Washer</td>
</tr>
<tr>
<td>5</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>6</td>
<td>Nut</td>
</tr>
</tbody>
</table>
10-2.2. Fuel Pump Service Limits

**Figure 10-3. Fuel Pump Drive Coupling Fits and Limits**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuel pump drive coupling to crankshaft gear...</td>
<td>Clearance:</td>
<td>0.0095L</td>
<td>0.0155L</td>
</tr>
<tr>
<td>2</td>
<td>Fuel pump drive coupling to fuel pump.........</td>
<td>Clearance:</td>
<td>0.0030L</td>
<td>0.0090L</td>
</tr>
</tbody>
</table>

T= Tight    L=Loose

10-2.3. Fuel Pump Installation

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Remove aircraft cowling, as required, to access the fuel pump.
3. Apply Molyshield Grease to the fuel pump drive coupling (Figure 10-2) (2).
4. Install the fuel pump drive coupling (2) in the fuel pump (1).
5. Apply Gasket Sealant (Part No. 642188) to both sides of the new gasket and install the new gasket (3) on the fuel pump (1).
6. Lubricate the fuel pump cavity with clean 50 weight aviation engine oil.
7. Install the fuel pump on the crankcase with hold down washers (4), new lock washers (5) and nuts (6). Torque the nuts according to Appendix B.

**CAUTION:** Fuel system contamination may lead to component damage, erratic engine operation, loss of power, or engine shutdown. Flush new fuel system parts, hoses and test equipment prior to connection to the system.
Non-Overhaul Repair and Replacement

8. Flush the fuel pump and all connecting hoses according to the “Fuel System Purge” instructions in Section C-8.1 of M-0, Standard Practice Maintenance Manual to prevent fuel system contamination prior to connecting the parts with the aircraft fuel system.

9. Connect the appropriate hoses to the fuel pump inlet fitting (Figure 10-1) (A), fuel pump outlet fitting (B), fuel vapor return fitting (D), fuel drain fitting (E), and upper deck pressure reference fitting (F^1 or F^2, depending on engine model) according to “Hose and Tubing Installation” instructions in Section C-11 of M-0, Standard Practice Maintenance Manual. Torque the hoses to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Perform a static leak check of the fuel system
   a. Position the Ignition Switch to OFF
   b. Turn on the fuel supply and boost pump according to the AFM/POH
   c. Position the throttle to WIDE OPEN
   d. Position the mixture control to FULL RICH
   e. Check the fuel lines for leaks from the fuel pump inlet to the manifold valve and correct any leaks if detected
   f. Turn the boost pump and fuel supply OFF
   g. Position the throttle to CLOSED
   h. Position the mixture control to IDLE/CUTOFF
   i. Install any aircraft components removed to facilitate repairs

11. Perform an “Engine Operational Check” according to the instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

Figure 10-2 repeated for reference
10-3. Fuel Injector Replacement

NOTE: Continental Motors tests newly manufactured fuel injector nozzles and manifold valves as a set during the assembly process. Individual fuel injector nozzles may be replaced if unserviceable but we recommend replacement of injectors as a complete set to ensure proper distribution of fuel mixture to all cylinders and optimum engine performance.

10-4. Starter Motor and Adapter Replacement

Repair or replace the starter motor if it will not turn the starter adapter. Repair the Energizer starter motor according to the Starter Service Instructions (X30592). Engines originally configured with ISKRA starters may be converted to Energizer or Skytec starters at overhaul or when ISKRA starter replacement is necessary. No field repair is authorized for the Skytec starter; replacement is the only remedy for Skytec starter motor failure.

Repair or replace the starter adapter if the starter motor turns but the starter adapter does not engage the engine or the starter adapter malfunctions.

NOTE: Depending on the aircraft application, it may be necessary to lift the engine off the engine mounts to remove the starter or starter adapter.
10-4.1. Starter Motor Removal

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position.
2. Disconnect the aircraft battery and electrical cable from the starter motor according to the aircraft manufacturer’s instructions.
3. Remove the two nuts (Figure 10-4) (3) and washers (4) from the starter motor mounting studs.
4. Carefully remove the starter motor assembly (1) without damaging the mounting stud threads.
5. Remove and discard the O-ring (5).
6. Repair or replace the starter motor according appropriate starter manufacturer’s instructions.
### Figure 10-4. Starter Motor and Starter Adapter

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Starter Motor</td>
<td>5</td>
<td>O-ring</td>
<td>9</td>
<td>Gasket</td>
<td>13</td>
<td>Spacer</td>
</tr>
<tr>
<td>2</td>
<td>Starter Adapter</td>
<td>6</td>
<td>Washer</td>
<td>10</td>
<td>Washer</td>
<td>14</td>
<td>Lock Nut</td>
</tr>
<tr>
<td>3</td>
<td>Nut</td>
<td>7</td>
<td>Lock washer</td>
<td>11</td>
<td>O-ring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Washer</td>
<td>8</td>
<td>Nut</td>
<td>12</td>
<td>Sleeve</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scavenge Pump with PTO Option
Non-Overhaul Repair and Replacement

10-4.2 Starter Adapter Removal

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Remove the starter motor according to the “Starter Motor Removal” instructions in Section 10-4.1.

2. Disconnect the turbocharger lubrication hoses from the starter adapter fittings; plug the lubrication hoses to prevent contamination.

3. Remove the four sets of nuts (Figure 10-4) (8), lock washers (7), and washers (6 & 10) (two on the outside of the crankcase between Cylinder 1 and the starter, and two on the cover assembly).

4. Remove the starter adapter assembly (2) from the crankcase; discard the lock washers (7).

5. Remove and discard the starter adapter gasket (9). Clean the gasket residue from the crankcase mating surface.

6. Place the starter adapter on a sturdy work surface. Rotate the starter shaft gear in a clockwise direction by hand.
   a. Ensure the clutch spring is not binding on the shaft.
   b. Observe smooth operation in the shaft bearing surface.

7. Disassemble the starter adapter (if condition warrants, or starter adapter was removed to correct a malfunction) according to the instructions in Section 13-6.

8. Inspect the starter and starter adapter parts using to the service limits in Section 10-4.3. Repair or replace parts which fail to meet the dimensional inspection criteria.

WARNING

If damage is discovered in step 9 or 10, perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-4.7.

9. Perform a “Gear Tooth Inspection” on the starter shaft gear according to the instruction in Section 11-1.1 of M-0, Standard Practice Maintenance Manual. If the gear teeth are chipped, broken, or otherwise damaged, inspect the starter adapter according to instructions in Section 15-7.4 using the service limits in Section 10-4.3, perform the necessary starter adapter repairs according to instructions in Section 15-8.5 and perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.

10. Perform a “Gear Tooth Inspection” on the crankshaft gear according to instruction in Section 11-1.1 of M-0, Standard Practice Maintenance Manual. If the gear teeth are
chipped, broken, or otherwise damaged, disassemble the engine and replace the crankshaft gear.

11. Assemble the starter adapter (if previously disassembled) according to the instructions in Section 16-4.

12. Visually inspect the starter needle bearing in crankcase for debris or damage. Inspect the needle bearing dimensionally according to the “Starter and Starter Adapter Service Limits” in Section 10-4.3.

13. Install the starter adapter according to instructions in Section 10-4.4.

Figure 10-4 repeated for reference
10-4.3. Starter and Starter Adapter Service Limits

Starters and starter adapter service limits are in Table 10-5. Index numbers in the first column correspond to the numbers in Figure 10-5. Service limits for the worm wheel drum (Figure 10-6) and shaft gear drum (Figure 10-7) are shown in Table 10-6 and Table 10-7, respectively.

Table 10-5. Starter and Starter Adapter Service Limits

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Starter shaft gear needle bearing hole crankcase .................................. diameter: ---</td>
<td>0.9990</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Starter shaft gear front (bearing) journal ............................................. diameter: 0.7480</td>
<td>0.7495</td>
<td>0.7500</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Starter shaft gear in clutch drum bearing ............................................. diameter: 1.0000</td>
<td>0.9995</td>
<td>1.0000L</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Clutch spring sleeve in starter adapter .............................................. diametric clearance:</td>
<td>0.0050T</td>
<td>0.0030T</td>
<td>0.0050T</td>
</tr>
<tr>
<td>5</td>
<td>Starter shaft gear in ball bearing ..................................................... diametric clearance:</td>
<td>0.0007L</td>
<td>0.0001T</td>
<td>0.0005L</td>
</tr>
<tr>
<td>6</td>
<td>Bearing in starter adapter cover ...................................................... diametric clearance:</td>
<td>0.0010L</td>
<td>0.0001T</td>
<td>0.0010L</td>
</tr>
<tr>
<td>7</td>
<td>Worm wheel gear ................................................................................... end clearance:</td>
<td>0.0250</td>
<td>0.0016</td>
<td>0.0166</td>
</tr>
<tr>
<td>8</td>
<td>Worm wheel drum .................................................................................... diameter: Figure 10-6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Starter shaft gear drum .......................................................................... diameter: Figure 10-7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Clutch spring in clutch spring sleeve † .................................................. diametric clearance:</td>
<td>0.030T</td>
<td>0.0310T</td>
<td>0.0380T</td>
</tr>
<tr>
<td>11</td>
<td>Center of worm gear shaft to starter adapter thrust pads distance .............</td>
<td>0.2520</td>
<td>0.2450</td>
<td>0.2490</td>
</tr>
<tr>
<td>12</td>
<td>Needle bearing hole starter adapter ..................................................... diameter: 0.7495</td>
<td>0.7485</td>
<td>0.7495</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Ball bearing in starter adapter ............................................................ diametric clearance:</td>
<td>0.0013L</td>
<td>0.0001T</td>
<td>0.0013L</td>
</tr>
<tr>
<td>14</td>
<td>Worm gear shaft in needle bearing area .................................................. diameter: 0.5600</td>
<td>0.5615</td>
<td>0.5625</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Worm gear shaft in ball bearing ............................................................. diametric clearance:</td>
<td>0.0007T</td>
<td>0.0001L</td>
<td>0.0007T</td>
</tr>
<tr>
<td>16</td>
<td>Starter worm gear on shaft ...................................................................... diametric clearance:</td>
<td>0.0040</td>
<td>0.0005L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>17</td>
<td>Starter spring on worm drive shaft ....................................................... diametric clearance:</td>
<td>0.0250L</td>
<td>0.0050L</td>
<td>0.0250L</td>
</tr>
<tr>
<td>18</td>
<td>Starter pilot to starter drive adapter .................................................. diametric clearance:</td>
<td>0.0070L</td>
<td>0.0010L</td>
<td>0.0070L</td>
</tr>
<tr>
<td>19</td>
<td>Scavenge pump driven gear on shaft ...................................................... diametric clearance:</td>
<td>0.0040L</td>
<td>0.0005L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>20</td>
<td>Scavenge pump driver and driven gear in body ......................................... end clearance:</td>
<td>0.0060L</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>21</td>
<td>Scavenge pump driver and driven gear in body ......................................... diametric clearance:</td>
<td>0.0160L</td>
<td>0.0118L</td>
<td>0.0143L</td>
</tr>
<tr>
<td>22</td>
<td>Bushing in scavenge pump driven gear ................................................... diametric clearance:</td>
<td>---</td>
<td>0.0035T</td>
<td>0.0060T</td>
</tr>
<tr>
<td>23</td>
<td>Scavenge pump driver and driven gear ................................................... backlash:</td>
<td>---</td>
<td>0.0035</td>
<td>0.0050</td>
</tr>
<tr>
<td>24</td>
<td>Starter worm wheel gear and worm gear ................................................ backlash:</td>
<td>0.0200</td>
<td>0.0090</td>
<td>0.0110</td>
</tr>
</tbody>
</table>

T = Tight and L = Loose

1. When the sandblasted diameter finish is smoother than 125 RMS, replace the sleeve
Figure 10-5. Starter and Starter Adapter Dimensions
Non-Overhaul Repair and Replacement

Table 10-6. Worm Wheel Drum Dimensions

<table>
<thead>
<tr>
<th>Part</th>
<th>“A” Diameter (inches)</th>
<th>“B” Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>New Worm Wheel Drum</td>
<td>1.931</td>
<td>1.932</td>
</tr>
<tr>
<td>0.015 Undersize</td>
<td>1.916</td>
<td>1.917</td>
</tr>
</tbody>
</table>

NOTE: Inspect the starter adapter sleeve. The outside diameter should be 0.812 to 0.814 inches.

Table 10-7. Shaft Gear Drum Service Limits

<table>
<thead>
<tr>
<th>Part</th>
<th>“A” Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>New Shaft Gear Drum Dimensions</td>
<td>1.931</td>
</tr>
<tr>
<td>0.015 Undersize</td>
<td>1.916</td>
</tr>
</tbody>
</table>

NOTE: Inspect the starter adapter sleeve. The outside diameter should be 0.812 to 0.814 inches.
10-4.4. Starter Adapter Installation

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

**CAUTION:** Fittings (or plugs) installed in the starter adapter with accessory drive assembly are critical to engine function. Failure to install fittings (or plugs) and reconnect accessory hoses will result in loss of engine oil and catastrophic engine failure.

**CAUTION:** Exercise care when cleaning the residue from the mounting flange; mask the crankcase opening to avoid contaminating the engine oil supply.

1. Thoroughly clean the crankcase mounting surface to remove any gasket residue.

![Figure 10-4 repeated for reference](image)
Non-Overhaul Repair and Replacement

2. Visually inspect the starter needle bearing in crankcase for debris or damage. Inspect the needle bearing dimensionally according to the “Starter and Starter Adapter Service Limits” in Section 10-4.3.

3. Apply a translucent coat of Gasket Maker (Part No. 646942) to only the crankcase mating surface of the starter adapter gasket only according to the “Gasket Maker® Application” instructions in Appendix C-9 of M-0, Standard Practice Maintenance Manual.

4. Install the new gasket (Figure 10-4) (9) on the crankcase.

5. Lubricate the starter shaft gear teeth with clean 50-weight aviation engine oil.

6. Mesh the teeth with the crankshaft gear while placing the starter adapter in position.

7. Seat the starter adapter against the gasket.

8. Secure the starter adapter assembly to the crankcase with washers (6, 10), new lock washers (7) and nuts (8). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Connect the turbocharger lubrication hoses to the starter adapter fittings from which they were removed according to the “Hose and Tubing Installation” instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual. Torque the hoses and fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Install the starter motor according to the “Starter Motor Installation” instructions in Section 10-4.5.

11. Perform an “Engine Start” according to the instructions in Section 7-3.2 to verify starter operation.

10-4.5. Starter Motor Installation

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

2. Inspect a new O-ring (Figure 10-4) (5) for the starter motor and verify the O-ring is free of cracks and is not deformed or brittle. Do not install a deformed, brittle, or cracked O-ring.

3. Coat the new O-ring with clean 50-weight aviation engine oil and install the O-ring on the starter motor flange.

4. Apply Molyshield Grease to the starter motor drive lug.
5. Verify the integrity of the starter motor mounting studs; if studs are loose, bent or the threads are damaged, replace the studs according to instructions in Appendix C-6 of M-0, Standard Practice Maintenance Manual.

6. Install the starter motor on the mounting studs; ensure the drive lug aligns with the slot. Secure the starter motor with two sets of washers (4) and nuts (3).

7. Torque the mounting nuts (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Verify the integrity of the electrical cable; replace frayed or cracked wiring.

9. Reconnect the electrical cable and aircraft battery according to the aircraft manufacturer’s instructions.

10. Perform an “Engine Start” according to the instructions in Section 7-3.2 to verify starter operation.

Figure 10-4 repeated for reference
10-5. Alternator Replacement

Refer to the “Alternator Replacement” instructions in Section 10-4 of M-0, Standard Practice Maintenance Manual.

10-6. Magneto Replacement

**WARNING**

- Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections.
- Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance.
- Do not stand or place equipment within the arc of the propeller.

10-6.1. Continental Motors Magneto Removal

Refer to the “Continental Motors Magneto Removal” instructions in Section 10-5.2 of M-0, Standard Practice Maintenance Manual.

10-6.2. Champion (Slick) Magneto Removal

Refer to the “Champion (Slick) Magneto Removal” instructions in Section 10-5.3 of M-0, Standard Practice Maintenance Manual.
10-6.3. Ignition System Service Limits

The ignition system component service limits are shown in Table 10-8. Index numbers in the first column correspond to the numbers in Figure 10-8.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bushing in magneto and accessory diametric clearance: drive adapter</td>
<td>0.0040T</td>
<td>0.0010T</td>
<td>0.0040T</td>
</tr>
<tr>
<td>2</td>
<td>Magneto and accessory drive gear diametric clearance: adapter bushing</td>
<td>0.0050L</td>
<td>0.0015L</td>
<td>0.0035L</td>
</tr>
<tr>
<td>3</td>
<td>Oil seal in adapter diametric clearance:</td>
<td>0.0070T</td>
<td>0.0010T</td>
<td>0.0070T</td>
</tr>
<tr>
<td>4</td>
<td>Sleeve in magneto and accessory drive gear diametric clearance:</td>
<td>0.0040T</td>
<td>0.0010T</td>
<td>0.0070T</td>
</tr>
<tr>
<td>5</td>
<td>Magneto coupling retainer on drive diametric clearance: gear sleeve</td>
<td>0.0550L</td>
<td>0.025L</td>
<td>0.040L</td>
</tr>
<tr>
<td>6</td>
<td>Magneto and accessory drive gear end clearance:</td>
<td>0.0770L</td>
<td>0.0110L</td>
<td>0.0770L</td>
</tr>
<tr>
<td>7</td>
<td>Magneto coupling retainer in drive slot side clearance:</td>
<td>0.040L</td>
<td>0.0020L</td>
<td>0.0280T</td>
</tr>
<tr>
<td>8</td>
<td>Magneto coupling rubber bushings on drive lugs side clearance:</td>
<td>0.0140L</td>
<td>0.014L</td>
<td>0.052T</td>
</tr>
<tr>
<td>9</td>
<td>Magneto pilot in crankcase diametric clearance:</td>
<td>0.0050L</td>
<td>0.001L</td>
<td>0.005L</td>
</tr>
</tbody>
</table>

T = Tight and L = Loose

Figure 10-8. Accessory Drive Adapter Dimensions
10-6.4. Continental Motors Magneto Installation

Refer to the “Continental Motors Magneto Installation” instructions in Section 10-5.2 of M-0, Standard Practice Maintenance Manual.

10-6.5. Champion (Slick) Magneto Installation

Refer to the “Champion (Slick) Magneto Installation” instructions in Section 10-5.4 of M-0, Standard Practice Maintenance Manual.

10-6.6. Magneto Filter Replacement

Pressurized magnetos incorporate a desiccant filter to trap moisture that could cause arcing at higher altitudes. Serviceable desiccant material in the filters is white in color; replace the filter when the desiccant material turns dark. If the filter requires replacement, inspect the internal magneto components for moisture and corrosion.

10-6.6.1. Continental Motors Magneto Filter Replacement

1. Inspect the magneto housing for cracks according to the appropriate Magneto Service Instructions (Section 1-2.5, “Related Publications”). Inspect the magneto internal parts for evidence of moisture or corrosion according to the Magneto Service Instructions.

2. Remove the bolt (Figure 10-9) (21) and washer (22) securing the cushion clamp (20) to the baffle support.

3. Loosen hose clamps (16) and remove the filter (12), hoses (14, 15, 17) and clamps (16).

4. Remove the cushion clamp (20) from the filter (12); retain the cushion clamp; discard the filter (12)

5. Inspect the hoses (14, 15 & 17) for cracks or dry rot. Discard unserviceable hoses.

   NOTE: A filter kit is available to replace the entire magneto filter assembly and hoses at overhaul. For continued service, replace hoses on condition; replace the assembly at overhaul.

Complete filter assembly replacement instructions are provided, perform applicable steps required to return the ignition system to service.

6. Install a new filter kit:

   a. Install serviceable hoses (14) between the tee and the elbow fittings (18 & 19); secure the hoses (14) with clamps (16).

   b. Connect a serviceable hose (18) on the open side of the tee and secure with a clamp (16).

   c. Connect a serviceable hose (17) to the upper deck reference pressure fitting on the intake manifold and secure with a clamp (16).
d. Remove the shipping plugs and inspect the new filter (12) for cracks. Verify the reducer/drain plug (13) is installed in the filter (12) drain hole.

e. Loosen two clamps (16) and place them on the open ends of hoses (15 & 17). Connect the new filter assembly (12) to the hoses (15 & 17) with the arrow on the filter pointing toward the magnetos and the drain pointing down.

f. Adjust hoses (14, 15 & 17) to minimize twisting stress and torque clamps (16) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Non-Overhaul Repair and Replacement

10-6.6.2. Champion (Slick) Magneto Filter Replacement

1. Inspect the magneto housing for cracks according to the appropriate Magneto Service Instructions (Section 1-2.5, “Related Publications”). Inspect the magneto internal parts for evidence of moisture or corrosion according to the Magneto Service Instructions.

2. Loosen hose clamps (Figure 10-10) (11) from the hoses (8 & 9) at each end of the filter (13); remove the filter (13) from assembly hoses (8 & 9) and clamps (11);

3. Inspect the hoses (8, 9 & 10) and fittings (12, 15 & 21) for security and serviceability. Replace cracked or brittle hoses.

   NOTE: A filter kit is available to replace the entire magneto filter assembly and hoses at overhaul. For continued service, replace hoses on condition; replace the assembly at overhaul.

   Complete filter assembly replacement instructions are provided, perform applicable steps required to return the ignition system to service.

4. Install new filter kit (22):

   g. Remove the shipping plugs and inspect the new filter assembly (13) for cracks. Verify the reducer/drain plug (14) is installed in the filter drain hole.

   a. Connect serviceable hoses (10) to the tee (12) fitting 180° apart and secure with hose clamps (11). Connect the open ends of the hoses (10) to the 90° fittings (15) and secure with clamps (11). Connect a serviceable hose (8) to the remaining fitting on the tee (12) and secure with a clamp (11).

   b. Connect the short end of a serviceable 90° hose (9) to the upper deck reference pressure fitting on the intake manifold and secure with a clamp (11).

   c. Insert the new filter assembly (13) in the cushion clamp (20) with the arrow pointing toward the magnetos and the drain tube pointing downward. Secure the cushion clamp (20) to the bracket (16) with a screw (17), washers (19) and new lock nut (18); tighten and torque the fasteners (17 & 18) to the value specified in M-0, Standard Practice Maintenance Manual.

   d. Connect the hoses (8 & 9) to the new filter; secure the hoses (8 & 9) to the filter with clamps (11).

   e. Adjust hoses (8, 9 & 10) to minimize twisting stress and torque clamps (11) to the value specified in M-0, Standard Practice Maintenance Manual.
Figure 10-10. Champion (Slick) Ignition System

1 Magneto  7 Spark Plug Assembly  13 Magneto Filter Assembly  19 Washer
2 Ignition Harness  8 Hose Assembly  14 Drain, Filter Reducer  20 Cushion Clamp
3 Gasket  9 Hose Assembly  15 Elbow Fitting  21 Reducer Fitting
5 Lock Washer  11 Hose Assembly  17 Screw  22 Magneto Filter Kit
6 Mag Hold Washer  12 Hose Clamp  18 Lock Nut  23 Magneto Tachometer Sensor

- Nut  10 Hose Assembly  16 Bracket
10-6.7. Accessory Drive Adapter Removal

1. Disconnect the aircraft accessory connected to the accessory drive according to the aircraft manufacturer’s instructions.

2. Remove the Accessory Drive Adapter according to instructions in Section 12-3.

3. Disassemble the accessory drive adapter according to instructions in Section 13-8. Inspect the following items using the “Ignition System Service Limits” in Section 10-6.3; replace components on condition:
   a. Rubber drive bushing(s) and retainer: if the rubber bushings are torn or exhibit missing material perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.
   b. Oil seal
   c. Bushing: may be smoothly worn; no gouges or pitting permitted; may be reamed within service limits.
   d. Drive Gear Assembly: if the gear assembly exhibits uneven wear or broken teeth, perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.
   e. Mounting studs: studs should be straight, securely installed in the housing with clean, well defined threads. Replace loose, bent or deformed studs.

4. Install the serviceable Accessory Drive Adapter according to instructions in Section 17-15.1.

5. Start the engine according to the “Engine Start” instructions in Section 7-3.2 instructions. Allow the engine to run at idle for approximately ten minutes. Shut the engine down according to Section 7-3.4 and inspect the area surrounding the accessory drive for leaks.
### Figure 10-11. Accessory Drive Adapter Assembly

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Rubber Bushing</td>
</tr>
<tr>
<td>102</td>
<td>Retainer-Mag Coupling</td>
</tr>
<tr>
<td>103</td>
<td>Magneto Drive Gear</td>
</tr>
<tr>
<td>104</td>
<td>Gasket</td>
</tr>
<tr>
<td>105</td>
<td>Magneto Adapter Assembly</td>
</tr>
<tr>
<td>106</td>
<td>Bushing</td>
</tr>
<tr>
<td>107</td>
<td>Part of 106</td>
</tr>
<tr>
<td>108</td>
<td>Stud</td>
</tr>
<tr>
<td>109</td>
<td>Oil Seal</td>
</tr>
<tr>
<td>110</td>
<td>Accessory Drive Gasket</td>
</tr>
<tr>
<td>111</td>
<td>Accessory Cover</td>
</tr>
<tr>
<td>112</td>
<td>Plain Washer</td>
</tr>
<tr>
<td>113</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>114</td>
<td>Nut</td>
</tr>
<tr>
<td>115</td>
<td>Nut</td>
</tr>
<tr>
<td>116</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>117</td>
<td>Plain Washer</td>
</tr>
<tr>
<td>118</td>
<td>Nut</td>
</tr>
<tr>
<td>119</td>
<td>Nut</td>
</tr>
</tbody>
</table>

*NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.*
10-7. Lubrication System Repair

10-7.1. Oil Filter Adapter Stud Replacement

If the threads on the oil filter adapter stud are worn or damaged, replace the stud:

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Drain the oil and remove the oil filter according to the “Oil Change” instructions in Section 6-4.8.2 of M-0, Standard Practice Maintenance Manual but do not refill the oil at this time. Replace the oil filter adapter stud according to the instructions in Section 15-8.8.3. When stud replacement is complete, return to Section 6-4.8.2 of M-0 to complete the oil change.
3. Perform the “Oil Pump Operational Check” according to instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

10-7.2. Oil Pump or Tachometer Drive Repair and Replacement

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Remove malfunctioning oil pump according to the “Oil Pump Removal” instructions in Section 12-10.
3. Inspect the oil pump components according to the Lubrication System Service Limits in Table 10-9. Replace parts that do not meet the service limits.
4. Install the new oil pump according to the “Oil Pump Installation” instructions in Section 17-5.

**NOTE:** Repairs other than smoothing nicks on parting surfaces, replacing studs and worn parts, and refacing the oil pressure relief valve seat on the oil pump housing are prohibited. The pump driven gear shaft is pressed into the pump housing and is not field replaceable. The pump gear chamber must not be enlarged. If it becomes scored or enlarged, discard and replace the pump housing. Scoring on the gear contact area of the oil pump cover renders it unserviceable unless the parting surfaces can be lapped smooth and perfectly flat.
5. Perform the “Oil Pump Operational Check” according to instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual, as required.

10-7.3. Oil Sump and Oil Suction Tube Repair and Replacement

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

NOTE: For most engine installations, the engine must be removed from the aircraft to remove the oil sump. Follow appropriate engine removal instructions in Chapter 5.

2. Remove the oil sump and suction tube according to the “Oil Sump Removal” instructions in Section 12-14. Install a new oil sump or suction tube according to the “Oil Sump & Suction Tube Installation” instructions in Section 17-4.

3. Perform the “Oil Pump Operational Check” according instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

10-7.4. Oil Cooler Repair and Replacement

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

NOTE: For TSIO550C engine models installed in Cessna Corvalis 400 experiencing low oil temperature, an optional oil cooler and oil temperature control valve is available, refer to CMI SIL10-6.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

2. Remove the oil cooler according to the “Oil Cooler Removal” instructions in Section 12-9.

3. Send the oil cooler to an appropriately rated FAA Part 145 repair station. No structural repairs are allowed on the oil cooler.

4. Replace any oil cooler exhibiting structural damage, i.e. bent/broken or cracked cooling fins, with a new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange must be accomplished by an appropriately FAA Part 145 repair station.

5. Install the serviceable oil cooler according to the “Oil Cooler Installation” instructions in Section 17-6.
6. Perform a normal “Engine Start” (Section 7-3.2) and “Ground Run-up” (Section 7-3.3) according to instructions in Chapter 7 to verify the lubrication system operates within the engine specifications in Section 2-3.

10-7.5. Oil Pressure Relief Valve Repair and Replacement

WARNING
Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Cut, remove, and discard the safety wire from the oil pressure relief valve housing located at the rear of the engine (Figure 10-12).
3. Unscrew and remove the oil pressure relief valve from the oil pump housing.

Figure 10-12. Rear View of Engine

procedure continues on next page
4. Inspect the oil pressure relief valve plunger (Figure 10-13) and valve seat face in the oil pump housing (Figure 10-14) for scoring, nicks, and rough spots.

5. Check the oil pressure relief valve service limits listed in Table 10-9. If the valve has exceeds the service limits, replace the valve.

6. If the plunger has scoring, nicks, or roughening, replace the oil pressure relief valve plunger.

7. If the valve seat face in the oil pump housing is nicked or the surface is rough, reface the valve seat according to instructions in Section 15-8.8.2.

Figure 10-13. Oil Pressure Relief Valve

Figure 10-14. Valve Seat in the Oil Pump Housing
8. Turn the adjusting screw on the oil pressure relief valve housing (Figure 10-15) inward about halfway. Final adjustment will be accomplished during the operational test.

9. Install a new copper washer (with the split line against the housing, see Appendix C-10.1 in M-0, Standard Practice Maintenance Manual) and nut.

10. Apply Part No. 646943 to the threads of the valve as shown in Figure 10-15.

![Figure 10-15. Oil Pump and Oil Pressure Relief Valve](image)

11. Assemble the plunger, spring, and seat of the oil pressure relief valve (Figure 10-15) and slide it into the oil pump housing pressure relief valve cavity.

12. Ensure that oil pressure relief valve components are aligned and install them in the oil pump housing.

13. Torque the oil pressure relief valve housing to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Safety wire the oil pressure relief valve housing according to the “Safety Wiring Hardware” instructions in Section C-3 of M-0, Standard Practice Maintenance Manual.

15. Perform an “Oil Pump Operational Check” according instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.
10-7.6. Oil Temperature Control Valve Inspection and Replacement

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Cut, remove, and discard the safety wire from the oil temperature control valve housing located on the oil cooler.
3. Remove the oil temperature control valve.
4. Inspect the conical valve seat (Figure 10-16) of the oil temperature control valve for scoring and nicks. If these valves are nicked or scored, replace the valve.
5. Visually inspect the seat in the oil cooler.
6. Apply Part No. 646943 to the threads on the oil temperature control valve where shown in Figure 10-16.
7. Install the oil temperature control valve with a new washer and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
8. Safety wire the oil temperature control valve housing according to the instructions in Section C-3 of M-0, Standard Practice Maintenance Manual.

![Figure 10-16. Oil Temperature Control Valve](image-url)
### 10-7.7. Lubrication Component Service Limits

The lubrication system component service limits are shown in Table 10-9. Index numbers in the first column correspond to the item numbers in Figure 10-17.

#### Table 10-9. Lubrication System Component Service Limits

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Service</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oil Pressure Relief Valve Assembly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Oil pressure relief valve adjusting screw ....... diametric clearance: in plunger</td>
<td>0.0070L</td>
<td>0.0030</td>
<td>0.0070</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Oil pressure relief valve seat in housing ......................... depth:</td>
<td>1.060</td>
<td>0.750</td>
<td>1.060</td>
<td></td>
</tr>
<tr>
<td><strong>Oil Pump Assembly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Oil pump driver gear in pump housing ................................. body</td>
<td>0.0065L</td>
<td>0.0040L</td>
<td>0.0060L</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Oil pump driver gear shaft in pump housing ... diametric clearance:</td>
<td>0.0045L</td>
<td>0.0015T</td>
<td>0.0030L</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Oil pump driven gear to driven gear shaft ...... diametric clearance:</td>
<td>0.0040L</td>
<td>0.0005L</td>
<td>0.0025L</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Oil pump driver gear in pump housing ..................... end clearance:</td>
<td>0.0050</td>
<td>0.0016L</td>
<td>0.0041</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Oil pump driven gear in pump housing .................... end clearance:</td>
<td>0.0050</td>
<td>0.0016L</td>
<td>0.0041</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Oil pump driver gear shaft in tach ...................... diametric clearance: drive housing</td>
<td>---</td>
<td>0.0015L</td>
<td>0.0030L</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Oil pump driver gear shaft pin in bevel gear .. diametric clearance:</td>
<td>---</td>
<td>0.0005L</td>
<td>0.0025L</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Oil pump driven gear in housing ...................... diametric clearance:</td>
<td>0.0065L</td>
<td>0.0040L</td>
<td>0.0060L</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Tachometer drive shaft in tach drive housing diametric clearance:</td>
<td>---</td>
<td>0.0015L</td>
<td>0.0030L</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Oil seal in mechanical tach drive housing...... diametric clearance:</td>
<td>---</td>
<td>0.003T</td>
<td>0.005T</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Oil seal in electrical tach drive housing........ diametric clearance:</td>
<td>---</td>
<td>0.0015T</td>
<td>0.0065T</td>
<td></td>
</tr>
<tr>
<td><strong>Gear Backlash</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Oil pump driver and driven gears ................................. backlash:</td>
<td>0.0160</td>
<td>0.0090</td>
<td>0.0130</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Tach drive and driven bevel gears ............................... backlash:</td>
<td>---</td>
<td>0.0040</td>
<td>0.0080</td>
<td></td>
</tr>
<tr>
<td><strong>Spring Test Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Oil pressure relief valve spring compressed to 1.25 inch length load:</td>
<td>30 lbs.</td>
<td>32 lbs.</td>
<td>37 lbs.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Oil temperature control valve 0.090” minimum travel ...................... at oil temperature:</td>
<td>---</td>
<td>120°F</td>
<td>170°F</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Oil temperature control valve must close between ........................ oil temperature:</td>
<td>---</td>
<td>168°F</td>
<td>172°F</td>
<td></td>
</tr>
</tbody>
</table>

T= Tight  L=Loose
Figure 10-17. Lubrication System Service Limits
10-8. Engine Cylinder Maintenance

Procedures in this section apply to engine cylinder repair, service, or replacement on condition as a maintenance item and not for engine overhaul. These instructions may be used to replace one or more cylinders as a service action. Refer to instructions in Chapters 12 through 17 for multiple engine cylinder replacement during overhaul.

**WARNING**

*Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.*

Prior to any cylinder maintenance, perform the following:

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Position the fuel shutoff valve to the CLOSED position.
3. Disconnect the battery according to the aircraft manufacturer's instructions.
4. Remove cowling and any aircraft supplied accessories that interfere with cylinder removal according to the aircraft manufacturer’s instructions.
5. Disconnect the ignition harness from the spark plugs on all cylinders.
6. Remove at least one spark plug from each cylinder to avoid developing compression during crankshaft rotation.

10-8.1. Rocker Arm Removal

1. Perform the preliminary steps in Section 10-8 prior to rocker arm removal.
2. Remove the screws (Figure 10-18) (32), lock washers (31), washers (30) and rocker covers (29) from the cylinder; discard the lock washers (31).
3. Remove and discard the rocker cover gaskets (28).
4. Position the crankshaft so the piston is at top dead center and both intake and exhaust valves of the rocker arms to be removed are closed.
5. Bleed the hydraulic valve tappets (54 & 55) down by applying steady pressure to the pushrod end of the rocker arm; pressure relief should be obvious.
6. Bend the tab washers (26) down and remove the screws (27), tab washers (26) and retainers (25). Discard the tab washers (26).
7. Remove the rocker arms (19 & 20), rocker shafts (24), and thrust washers (23) from the cylinder.
8. Withdraw the pushrods (40) from the pushrod housings (35). Mark the location and position of removal to ensure installation in the same position and location.
9. Inspect the rocker assemblies and pushrods according to the instructions in Section 10-8.4.
**Figure 10-18. Engine Cylinder**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cylinder Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Spark Plug Insert</td>
</tr>
<tr>
<td>3</td>
<td>Intake Valve Guide</td>
</tr>
<tr>
<td>4</td>
<td>Exhaust Valve Guide</td>
</tr>
<tr>
<td>5</td>
<td>Stud</td>
</tr>
<tr>
<td>6</td>
<td>Stud</td>
</tr>
<tr>
<td>7</td>
<td>Exhaust Stud</td>
</tr>
<tr>
<td>8</td>
<td>Helicoil Insert</td>
</tr>
<tr>
<td>9</td>
<td>Intake Valve Seat Insert</td>
</tr>
<tr>
<td>10</td>
<td>Exhaust Valve Seat Insert</td>
</tr>
<tr>
<td>11</td>
<td>Intake Valve</td>
</tr>
<tr>
<td>12</td>
<td>Exhaust Valve</td>
</tr>
<tr>
<td>13</td>
<td>Inner Spring</td>
</tr>
<tr>
<td>14</td>
<td>Outer Spring</td>
</tr>
<tr>
<td>15</td>
<td>Drain Fitting</td>
</tr>
<tr>
<td>16</td>
<td>Inner Retainer</td>
</tr>
<tr>
<td>17</td>
<td>Retainer Key</td>
</tr>
<tr>
<td>18</td>
<td>Rotocool</td>
</tr>
<tr>
<td>19</td>
<td>Intake Rocker Arm Assembly</td>
</tr>
<tr>
<td>20</td>
<td>Exhaust Rocker Arm Assembly</td>
</tr>
<tr>
<td>21</td>
<td>Rocker Arm Bushing</td>
</tr>
<tr>
<td>22</td>
<td>Drive Screw</td>
</tr>
<tr>
<td>23</td>
<td>Thrust Washer</td>
</tr>
<tr>
<td>24</td>
<td>Rocker Arm Shaft</td>
</tr>
<tr>
<td>25</td>
<td>Retainer</td>
</tr>
<tr>
<td>26</td>
<td>Tab Washers</td>
</tr>
<tr>
<td>27</td>
<td>Screw</td>
</tr>
<tr>
<td>28</td>
<td>Rocker Cover Gasket</td>
</tr>
<tr>
<td>29</td>
<td>Rocker Cover</td>
</tr>
<tr>
<td>30</td>
<td>Washer</td>
</tr>
<tr>
<td>31</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>32</td>
<td>Screw</td>
</tr>
<tr>
<td>33</td>
<td>Exhaust Flange Gasket</td>
</tr>
<tr>
<td>34</td>
<td>Lock Nut</td>
</tr>
<tr>
<td>35</td>
<td>Pushrod Housing</td>
</tr>
<tr>
<td>36</td>
<td>Washer</td>
</tr>
<tr>
<td>37</td>
<td>O-ring Seal</td>
</tr>
<tr>
<td>38</td>
<td>Pushrod Housing Packing</td>
</tr>
<tr>
<td>39</td>
<td>Pushrod Housing Spring</td>
</tr>
<tr>
<td>40</td>
<td>Pushrod Assembly</td>
</tr>
<tr>
<td>41</td>
<td>Flange Nut</td>
</tr>
<tr>
<td>42</td>
<td>Flange Nut</td>
</tr>
<tr>
<td>43</td>
<td>Baffle</td>
</tr>
<tr>
<td>44</td>
<td>Spring</td>
</tr>
<tr>
<td>45</td>
<td>Drain Tube</td>
</tr>
<tr>
<td>46</td>
<td>Drain Tube Seal</td>
</tr>
<tr>
<td>47</td>
<td>7th Stud Bracket</td>
</tr>
<tr>
<td>48</td>
<td>7th Stud Bracket</td>
</tr>
<tr>
<td>49</td>
<td>Flange Nut</td>
</tr>
<tr>
<td>50</td>
<td>Cylinder Base O-ring</td>
</tr>
<tr>
<td>51</td>
<td>Intake Valve Seal</td>
</tr>
<tr>
<td>52</td>
<td>Check Valve</td>
</tr>
<tr>
<td>53</td>
<td>Valve Spring Retainer</td>
</tr>
<tr>
<td>54</td>
<td>Hydraulic Exhaust Tappet</td>
</tr>
<tr>
<td>55</td>
<td>Hydraulic Intake Tappet</td>
</tr>
</tbody>
</table>
10-8.2. Hydraulic Tappet Removal

1. Remove the rocker arm assemblies and pushrods according to instructions in Section 10-8.1.

2. Remove the hydraulic tappets (Figure 10-18) (54 & 55) from the crankcase bores.
   a. Identify the location from which the tappets are removed, they must be installed (if serviceable) in the same location from which they were removed.
   b. Inspect the hydraulic tappets, lifter bores and cam lobes for nicks, scratches, gouging, spalling or galling using the inspection guidance in Chapter 15. Replace hydraulic tappets which exhibit face or body wear exceeding 10% of the surface area. If hydraulic tappets require replacement, inspect the cam lobes of the associated valve for abnormal wear.

3. Inspect the hydraulic tappet retaining rings and pushrod cups. If the spring is collapsed or the spring will not compress, replace the hydraulic tappet. Replace hydraulic tappets which exhibit faulty retaining rings, damaged pushrod cups, or appear to have collapsed or stuck spring mechanisms.

Figure 10-18 repeated for reference
10-8.3. Engine Cylinder Removal

**WARNING**

*Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Do not stand or place equipment within the arc of the propeller.*

1. Perform the steps in Section 10-8 and remove the rocker arms according Section 10-8.1 to prior to cylinder removal.

2. Remove Induction System components from each cylinder to be removed according to instructions in Section 12-5.

3. Remove exhaust system components from each cylinder to be removed according to the instructions in Section 12-8.

4. Remove the fuel injector nozzle(s) from the cylinder to be removed according to the instructions in Section 10-2 of M-0, Standard Practice Maintenance Manual.

5. Remove the rocker covers, rocker arms, and pushrods according to the “Rocker Arm Removal” instructions in Section 10-8.1.

6. Remove the pushrod tubes and hydraulic valve tappets according to the instructions in Section 10-8.2.

---

**Figure 10-18 repeated for reference**
7. Remove the inter-cylinder baffles according to instructions in Section 12-15.

8. Loosen and remove cylinder drain tubes (Figure 10-18) (45) from each cylinder to be removed.

9. Remove and discard the drain tube seals (46) from each cylinder to be removed.

10. Remove the cylinder drain fitting (15).

11. While removing an engine cylinder, inspect components for wear and conformance to dimensional criteria. Replace any component based on the following:
   a. Only parts that meet service limits may remain in service or be re-used.
   b. If a part fails to meet a service limit tolerance, replace it with a part that meets the specified service limits.

12. Using the appropriate wrenches, carefully remove the flange nuts (41, 42, and 49) from the cylinder base flange and seventh stud locations.

13. Remove the 7th stud brackets (47 and 48).

14. As the last pieces of fastening hardware are removed, cradle the cylinder in your arm for support.

   **CAUTION:** The piston will be damaged if allowed to drop as the cylinder is withdrawn.

15. While supporting the cylinder, carefully pull the cylinder outward in a straight plane with one hand, keeping the other hand free to catch the piston as the cylinder is withdrawn to prevent damage to the crankcase or cylinder.

16. Remove the piston pin (Figure 10-20) (6) and piston (1) from the connecting rod. Inspect the piston pin (6). Remove and discard the piston rings (2 through 5).

**Figure 10-19. Cylinder Base O-Ring Used to Secure the Connecting Rods**

17. Remove the cylinder base O-ring (Figure 10-18) (50). Install the old O-ring in a figure 8 (Figure 10-19) pattern to support the connecting rod.
18. Repeat steps 11 through 17 for each cylinder to be removed.

19. Disassemble the cylinder necessary to complete repairs according to instructions in Section 13-7.
   a. Clean the cylinder according to the “Cylinder Cleaning” instructions in Section 12-1.1 of M-0, Standard Practice Maintenance Manual.
   b. Clean the cylinder according to the “Piston Cleaning” instructions in Section 12-1.2 of M-0, Standard Practice Maintenance Manual.

   **CAUTION:** Do not use automotive-type piston scrapers to clean piston ring lands.

   c. Perform “Fluorescent Penetrant Inspection” and “Magnetic Particle Inspection” according to instructions in Chapter 11 of M-0, Standard Practice Maintenance Manual.

   d. Perform a dimensional inspection on the cylinder, the piston, and components according to the “Engine Cylinder Dimensional Inspection” instructions in Section 15-7.3, using the “Cylinder Service Limits” in Section 10-8.4.1.

20. Remove the hydraulic tappets according to instructions in Section 10-8.7.

21. Perform a static leak check to confirm the cylinder static seal (Figure 10-21).
   a. Place a fiber drift on the rocker arm directly over the valve stem.
**CAUTION:** Do not allow the fiber drift to contact the valve spring retainer or rotocoil.

b. Tap the drift several times with a hammer to dislodge any debris that may be between the valve face and seat.

c. Invert the removed cylinder with the spark plugs installed.

d. Fill the inverted cylinder bore with nonflammable solvent.

e. Look for leaks in the static seal area of the cylinder. Pay particular attention to the barrel to cylinder head junction. If the cylinder head and barrel seal is leaking, discard the cylinder. If the intake or exhaust seat seals or the spark plug seals are leaking, note the discrepancy and perform the appropriate repairs in Chapter 15.

![Figure 10-21. Cylinder Static Seal](image)

22. Assemble serviceable cylinders according to the “Engine Cylinder Assembly” instructions in Section 16-7 and install the cylinder according to the “Cylinder Installation” instructions in Section 10-8.5.

**10-8.4. Engine Repair Cylinder Dimensional Inspection**

1. Inspect the “power stroke stress areas” of the crankcase according to instructions in Section 6-4.12 of M-0, Standard Practice Maintenance Manual.

2. Inspect cylinder bore dimensions according to the specifications in Section 10-8.4.1. Grind cylinder bores that do not conform to the standard size dimensions to the next oversize dimension up to 0.015 inch oversize maximum. (Refer to “Cylinder Bore Honing” in Section 15-8.9.7 for cylinder barrel grinding and honing instructions.)
3. Inspect the cylinder base flanges for flatness with a straightedge and a feeler gauge. If a flange exceeds 0.001 inches out of flat, replace the cylinder.

4. Inspect the intake and exhaust flange studs and rocker hold down fastener threads using a thread gauge. If studs are loose or bent, or if the threads are damaged or disfigured, determine the appropriate oversize stud and replace according to instructions in Appendix C-6 of M-0, Standard Practice Maintenance Manual.

5. Inspect the inside diameter of the valve guides using the “Cylinder Service Limits” in Section 10-8.4.1. Replace cracked, eroded, burned, or pitted valve guides or valve guides which fail to meet service limits.

6. Inspect the valve seats for indications of burning, pitting erosion, or cracks. Check the valve seat dimensions according to the “Cylinder Service Limits” in Section 10-8.4.1. Replace valve seats that are cracked, eroded, burned or pitted or valve seats that are not within the service limits according to instructions in Section 15-8.9.

   NOTE: A two-dimensional illustration of the intake and exhaust valve is provided in Figure 10-27.

7. Perform a visual inspection on the intake and exhaust valves; if the valve face is mushroomed, or if the valve face exhibits seat pounding (face angle is concave), or the valve exhibits burns, cracks, pitting, erosion, or corrosion, replace the valves.

8. Using a V-block with a surface plate and a dial indicator, inspect each intake and exhaust valve face for runout (eccentricity). Discard valves if they exceed “Cylinder Service Limits” in Section 10-8.4.1 run-out specifications.

9. Inspect the outside diameter of the intake and exhaust valve stems using a micrometer and the “Cylinder Service Limits” in Section 10-8.4.1. Replace the valve if the outside diameter of the valve stem measures less than the service limits.

10. Inspect the intake and exhaust valve head gauge line diameter using a micrometer and the “Cylinder Service Limits” in Section 10-8.4.1. Replace the valve if the gauge line diameter measure less than the service limit.

11. Perform a dimensional inspection on the intake and exhaust valves using the service limits in Section 10-8.4.1. Replace the valve if they fail to meet the service limits or cannot be restored to service limits by grinding.

   a. Clean the valves with mineral spirits and allow to dry.

   b. Use a precision valve grinding machine to restore the valve contact seat dimensions and geometry to the service limits specified in Section 10-8.4.1.

      1) Thickness from the gauge line to the bottom of the valve and gauge line outer diameter must not be less than the specified service limit. Discard valves if the overall length (stem to gauge line plus gauge line to bottom) is less than the service limit or if the outer diameter of the valve at the gauge line is less than the minimum specified.

      2) After grinding the face, measure from the gauge line to the tip of the valve stem. If the valve exceeds the service limit, grind material from the tip to meet the service limit stem to gauge line and overall lengths.
3) Clean the valves with mineral spirits and allow to dry to remove grinding residue.

c. Inspect the valve contact seat angle with an optical comparator after grinding; if the angles fail to meet the service limits, repeat the grinding process.

d. Inspect the surface finish of the valves with a profilometer; polish as required to meet the service limits.

e. Perform a “Magnetic Particle Inspection” (Section 11-3 of M-0, Standard Practice Maintenance Manual) on the intake and exhaust valves. Discard any valve with cracks or indications of cracks.

12. Clean the valves using mineral spirits and air dry. When valves have dried, coat all valve surfaces thoroughly with clean 50-weight aviation engine oil.

13. Measure the diameter of the removed piston pin at three equally spaced points along the length of the piston pin in comparison to the dimensions specified in “Cylinder Service Limits” in Section 10-8.4.1. Rotate the piston pin 90° and repeat the measurements. The piston pin must meet the dimensional limits at each point, out of round is limited to 0.0002 inches. Discard piston pins exceeding the dimensional limits or out of round tolerance.

14. Measure the piston pin bore inside diameter to verify it meets Table 10-10 dimensions. Insert the piston pin in the piston bore to verify the fit meets Table 10-10 specifications.

15. Insert the piston rings in the cylinder, individually, with the ring part number to the top of the cylinder. Use the piston to position the ring to the depth specified for ring gap measurement in Table 10-10.

16. Remove the piston from the cylinder and measure the ring gap at the specified depth in the cylinder. Measure the ring gap using the specifications in Table 10-10.

Figure 10-22. Piston, Piston Pin, and Piston Ring Detail
17. If the piston ring meets the specified gap, proceed to the next ring measurement. If piston ring gap is less than the specified amount, mount a fine toothed flat file in a vise. Hold the ring ends firmly and squarely against the file. In a deliberate back and forth motion, remove small amounts of material. Recheck the end gap in the cylinder until the ring meets the specified measurement.

18. After filing, deburr the ring ends using crocus cloth and thoroughly clean the piston ring with mineral spirits and air dry.

19. Install the new piston rings (Figure 10-20) (2-5) with the part number facing toward the top of the piston using a ring expander.
   a. Install a new expander ring in the new oil control ring groove so the expander gap is 180° away from the oil control ring gap.
   b. Install a new #3 piston ring in the #3 ring groove of the piston with the oil control ring gap at the 12 O’clock (referenced to the piston’s installed position in the cylinder) position.
   c. Install a new second compression ring (3) into the #2 ring groove with the ring gap at the 3 O’clock position.
   d. Install a new top compression ring (2) into the #1 ring groove with the ring gap at the 9 O’clock position.
   e. Install a new oil scraper ring (5) into the fourth ring groove with the ring gap at the 6 O’clock position.

20. Lubricate the piston pin with clean 50-weight aviation engine oil.

21. Match the new piston and ring assembly with the cylinder assembly for which it was measured and gapped. Insert the piston pin in the piston pin bore. The piston pin must slide freely in the piston pin bore.

22. Using a ring compressor, install each piston into its cylinder with top three rings in the cylinder barrel and the piston pin accessible for connecting rod installation.

23. Inspect connecting rod piston pin bushings for excessive wear or missing material. Verify the bushing split line is no closer than 40 degrees to the connecting rod centerline; replace piston pin bushings that fail to meet service limit specifications.

24. Inspect the pushrods for cracks, nicks, burrs, pitting or corrosion. Inspect the rod caps for cracks or erosion. Inspect the pushrods using “Cylinder Service Limits” in Section 10-8.4.1. Verify the rod cap oil passages are clear and the bores meet service limits. Inspect the pushrods length and cap diameter with a micrometer. Rotate the pushrods on a surface plate to inspect for bends. The total runout service limit is 0.003” over the length of the pushrods.
25. Inspect pushrod housings for cracks, dents, bending or chafing damage; discard pushrod housings exhibiting these conditions. Inspect pushrod housings for rust, pitting or missing cadmium plating; discard pushrod housings exhibiting these conditions.

26. Dry fit the rocker arms in the rocker arm boss to dimensionally inspect the rocker arm thrust width using “Cylinder Service Limits” in Section 10-8.4.1 specifications; replace rocker arms if they cannot be ground and polished to meet service limits.
   a. Inspect the rocker arm foot contact area for wear, galling, spalling, scoring, or grooves; discard rocker arms exhibiting these conditions.
   b. Inspect the rocker arm ball seat for wear and smoothness; discard rocker arms with gouged, scratched, etched, pitted or mushroomed ball seats.
   c. Inspect the thrust surfaces of the rocker arm shaft bore for displaced metal, spalling, or galling; discard rocker arms exhibiting these conditions if they cannot be smoothed to service limits.
   d. Inspect rocker arm exhibiting peeling copper plating, which can be a source of contamination in oil and spectrographic oil analysis. Use a scotch-brite pad to remove loose copper plating material.
   e. Inspect for and discard rocker arms with loose or missing oil passage drive screws or rivets. Inspect rocker arm oil passages for obstructions. Use an oil squirt bottle with clean 50 weight aviation engine oil to check oil passages for free flow. Discard rocker arms if oil passages cannot be cleared with solvent.

27. Inspect the Intake and Exhaust Valve Springs according to the service limits in Section 10-8.4.1. Replace valve springs which fail the dimensional inspection or exhibit cracks, abnormal curvature or excessive wear.

28. Perform a dimensional inspection on the connecting rod(s), if removed, according to the instructions in Section 15-7.2.1 using the service limits in Section 10-8.4.1.
10-8.4.1. Cylinder Service Limits

Refer to the “Cylinder Assembly Service Limits” in Table 10-10 and corresponding Figure 10-24. Clean and dry the parts thoroughly according to “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual. Remove oil and preservative material before performing the dimensional inspection. Discard and replace parts that do not conform to the specified tolerances.

WARNING

Use only parts that meet the specified service limits.

Table 10-10. Cylinder Assembly Service Limits

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cylinder bore (lower 4-1/4 inch of barrel)</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cylinder bore (5.75 inch into barrel)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cylinder bore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cylinder bore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cylinder bore surface (Nitrided Barrels)</td>
<td>22° - 32°</td>
<td>22° - 32°</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cylinder barrel in crankcase</td>
<td>0.013L</td>
<td>0.0040L</td>
<td>0.0100L</td>
</tr>
<tr>
<td>7</td>
<td>Intake valve seat insert in cylinder head</td>
<td>0.001T</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>8</td>
<td>Intake valve guide in cylinder head</td>
<td>0.001T</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>9</td>
<td>Exhaust valve guide in cylinder head</td>
<td>0.001T</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>10</td>
<td>Exhaust valve seat insert in cylinder head</td>
<td>0.007T</td>
<td>0.0070T</td>
<td>0.0100T</td>
</tr>
<tr>
<td>11</td>
<td>Intake valve seat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Exhaust valve seat</td>
<td></td>
<td>Figure 10-25</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Exhaust valve seat-to-valve guide</td>
<td>45° 00'</td>
<td>44° 30'</td>
<td>45° 00'</td>
</tr>
<tr>
<td>14</td>
<td>Intake valve seat-to-valve guide</td>
<td>60° 15'</td>
<td>59° 30'</td>
<td>60° 00'</td>
</tr>
</tbody>
</table>

Rocker Arms and Shafts

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Rocker shaft in cylinder head bosses</td>
<td>0.0031L</td>
<td>0.0005L</td>
<td>0.0031L</td>
</tr>
<tr>
<td>14</td>
<td>Rocker arm bushing</td>
<td>0.8755</td>
<td>0.875</td>
<td>0.8755</td>
</tr>
<tr>
<td>15</td>
<td>Rocker arm</td>
<td>0.0150L</td>
<td>0.0020</td>
<td>0.0150</td>
</tr>
<tr>
<td>16</td>
<td>Intake valve guide</td>
<td>0.4350</td>
<td>0.4362</td>
<td>0.4362</td>
</tr>
<tr>
<td>17</td>
<td>Exhaust valve guide</td>
<td>0.0062L</td>
<td>0.4370</td>
<td>0.4380</td>
</tr>
<tr>
<td>18</td>
<td>Intake valve face-to-stem</td>
<td>60°15'</td>
<td>60°00'</td>
<td>60°15'</td>
</tr>
<tr>
<td>19</td>
<td>Exhaust valve face-to-stem</td>
<td>45°15'</td>
<td>45°00'</td>
<td>45°15'</td>
</tr>
<tr>
<td>20</td>
<td>Intake valve gauge line-to-stem</td>
<td>Figure 10-27</td>
<td>Replace 100%</td>
<td>Replace 100%</td>
</tr>
<tr>
<td>21</td>
<td>Exhaust valve gauge line-to-stem</td>
<td>Figure 10-27</td>
<td>Replace 100%</td>
<td>Replace 100%</td>
</tr>
<tr>
<td>22</td>
<td>Intake &amp; Exhaust valve face-to-stem</td>
<td>0.0015</td>
<td>0.0000</td>
<td>0.0015</td>
</tr>
<tr>
<td>23</td>
<td>Rocker arm foot to valve stem (dry valve)</td>
<td>0.060-0.200</td>
<td>0.060</td>
<td>0.200</td>
</tr>
</tbody>
</table>
### Non-Overhaul Repair and Replacement

#### Pistons, Rings, and Pins

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Piston, non-coated in cylinder(^1) diametric clearance:</td>
<td>0.011L(^2) 0.010L(^3)</td>
<td>0.008L(^2) 0.007L(^3)</td>
<td>0.011L(^2) 0.010L(^3)</td>
</tr>
<tr>
<td></td>
<td>Piston, manganese phosphate coated in cylinder(^1) diametric clearance:</td>
<td>0.012L(^2) 0.011L(^3)</td>
<td>0.009L(^2) 0.008L(^3)</td>
<td>0.012L(^2) 0.011L(^3)</td>
</tr>
<tr>
<td>25</td>
<td>Top piston ring in groove side clearance:</td>
<td>0.006L</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>26</td>
<td>Second piston ring in groove side clearance:</td>
<td>0.006L</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>27</td>
<td>Third piston ring in groove side clearance:</td>
<td>0.0075L</td>
<td>0.0035</td>
<td>0.0055</td>
</tr>
<tr>
<td>28</td>
<td>Fourth piston ring in groove side clearance:</td>
<td>0.0100L</td>
<td>0.0060</td>
<td>0.0080</td>
</tr>
</tbody>
</table>

#### Dimensions for Items 29A -32A Apply Only to Post-Gold Standard Cylinders (5.251-5.253 Dia. Cylinder Bore)

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>29A</td>
<td>Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel)</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
</tr>
<tr>
<td>30A</td>
<td>Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)(^4)</td>
<td>Gap:</td>
</tr>
<tr>
<td>31A</td>
<td>Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel)</td>
<td>Gap:</td>
</tr>
<tr>
<td>32A</td>
<td>Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel)</td>
<td>Gap:</td>
</tr>
</tbody>
</table>

#### Dimensions for Items 29B -32B Apply Only to Pre-Gold Standard Cylinders (5.252-5.254 Dia. Cylinder Bore)

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>29B</td>
<td>Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel)</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
</tr>
<tr>
<td>30B</td>
<td>Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)(^4)</td>
<td>Gap:</td>
</tr>
<tr>
<td>31B</td>
<td>Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel)</td>
<td>Gap:</td>
</tr>
<tr>
<td>32B</td>
<td>Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel)</td>
<td>Gap:</td>
</tr>
</tbody>
</table>

### Spring Test Data

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Inner valve spring 654442 compressed to 1.230(^\circ)</td>
<td>67 Lbs. 70.3 Lbs. 77.3 Lbs.</td>
</tr>
<tr>
<td></td>
<td>Inner valve spring 654442 compressed to 1.745(^\circ)</td>
<td>31 Lbs. 32.1 Lbs. 38.1 Lbs.</td>
</tr>
<tr>
<td>44</td>
<td>Outer valve spring 654441 compressed to 1.275(^\circ)</td>
<td>98 Lbs. 101.8 Lbs. 111.4 Lbs.</td>
</tr>
<tr>
<td></td>
<td>Outer valve spring 654441 compressed to 1.790(^\circ)</td>
<td>46 Lbs. 49.1 Lbs. 55.1 Lbs.</td>
</tr>
</tbody>
</table>

### Installed outer valve spring height:

1. Measured below fourth ring groove, perpendicular to piston pin bore
2. Pre-Gold Standard Dimension
3. Post-Gold Standard Dimension
4. Second ring gap is nominally 0.006” larger than the top ring

---

1. T = Tight and L = Loose

---

1. Measured below fourth ring groove, perpendicular to piston pin bore
2. Pre-Gold Standard Dimension
3. Post-Gold Standard Dimension
4. Second ring gap is nominally 0.006” larger than the top ring
Figure 10-24. Cylinder Assembly Service Limits
Non-Overhaul Repair and Replacement

NOTE: See Section D-6 for Intake and Exhaust Valve Seat Machining Dimensions.

Figure 10-25. Intake Valve Seat Dimensions

Figure 10-26. Exhaust Valve Seat Dimensions
Non-Overhaul Repair and Replacement

Figure 10-27. Valve Service Limits

Intake Valve

Exhaust Valve
Non-Overhaul Repair and Replacement

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10-8.5. Cylinder Installation

Replace worn or out of tolerance components based on the following criteria:

- Only parts that meet service limits may remain in service.
- If a part has reached a service limit tolerance, it must be replaced with a part that conforms to the specified new part tolerances or service limits.
- Clean the cylinders according to “Cylinder Cleaning” instructions in Section 12-1.1 of M-0, Standard Practice Maintenance Manual.
- Clean pistons according to “Piston Cleaning” instructions in Section 12-1.1 of M-0, Standard Practice Maintenance Manual.
- Perform fluorescent penetrant, magnetic particle, and dimensional inspections on specified cylinder and piston parts according to instructions in Chapter 15.
- Install serviceable hydraulic tappets in the same location from which they were removed.
- Assemble cylinders which meet the inspection criteria and service limits according to Section 16-7, “Engine Cylinder Assembly” instructions with serviceable pistons and new piston rings.

**WARNING**

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Inspect a new cylinder base O-ring (Figure 10-18) (50) for cracks or deformities. Lubricate the serviceable, new cylinder base O-ring (50) with clean 50-weight aviation engine oil.
3. Install the new cylinder base O-ring (50), lubricated with clean 50-weight aviation engine oil on the cylinder base flange; verify the O-ring is not twisted on the cylinder base flange after installation.
4. Clean the cylinder deck and stud threads with Stoddard solvent; use a narrow brush to clean threaded holes; deck and stud holes must be free of dirt and debris.

5. Lubricate cylinder through-bolt and deck stud threads using clean 50 weight aviation engine oil.

6. Install a conforming piston (Figure 10-20) (1) with new piston rings (2 through 5) partially in the cylinder bore.

7. When installing the piston on the connecting rod, use care not to drop the connecting rod on the cylinder deck to avoid damaging the crankcase cylinder deck. Carefully rotate the crankshaft, placing the connecting rod of the cylinder being installed in the outermost position. Remove the O-ring (Figure 10-19) that was installed for connecting rod support.

8. Back the piston (Figure 10-20) (1) out far enough to allow the piston pin (6) to be installed on the connecting rod. Place the cylinder assembly and piston on the connecting rod.

9. Line the piston (1) up with the connecting rod and slide the piston pin (6) into the connecting rod.
10. Using a ring compressor, compress the fourth piston ring and push the cylinder until the fourth piston ring is positioned inside the cylinder barrel.

11. Remove the ring compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.

12. While supporting the cylinder, install, but do not torque, the cylinder flange nuts (Figure 10-18) (41 and 42).

13. Install the 7th stud brackets (47 and 48) and flange nut (49). The 7th stud nuts have a conical seat.

14. For single cylinder replacement, torque the cylinder fastening hardware according to the “Cylinder Torque” instructions in Section 10-8.6. For multiple cylinder replacement, torque the cylinder fastening hardware for each cylinder being installed according to the “Cylinder Torque” instructions in Section 10-8.6, steps 1 & 2. When all cylinders are installed, torque all cylinder and crankcase fasteners according to the instructions in Section 17-3.1. If re-torquing fasteners that were not removed during this maintenance action, apply torque to the specified torque value.

15. Rotate the crankshaft through multiple revolutions to verify smooth rotation of the crankshaft. If rotation is not smooth or binding is evident, disassemble the engine to determine the cause. Verify crankshaft end play (end clearance) is within the tolerance specified in Table D-13. If no end play is present, disassemble the engine to determine the cause.

16. Install the hydraulic tappets and pushrod housings according to instructions in Section 10-8.7.

17. Install the valve train according to instructions in Section 10-8.8.

18. Install the Inter-Cylinder Baffles according to instructions in Section 17-3.2.

19. Install the drain tube fittings (Figure 10-18) (15) and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

20. Install new drain tube seals (46) and the cylinder drain tubes (45). Torque the “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

21. Install the spark plugs and ignition harness according to the “Ignition System Maintenance” instructions in Section 6-4.9 of M-0, Standard Practice Maintenance Manual.

22. Install the Exhaust System according to instructions in Section 17-12.1.

23. Install the fuel injector nozzles according to instructions in Section 10-2.3 of M-0, Standard Practice Maintenance Manual.

24. Install the Induction System components according to instructions in Section 17-12.1.

25. Set the aircraft Fuel Selector Valve to the ON position and activate the fuel boost pump to leak check the fuel delivery system, including fuel lines and fittings.
Non-Overhaul Repair and Replacement

CAUTION: Service the engine with SAE J1966 mineral oil for engine break-in.

26. Service the engine with mineral oil according to instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

27. Install the any aircraft-supplied accessories (removed to facilitate engine maintenance) and aircraft cowling according to the aircraft manufacturer’s instructions.

28. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

29. Perform the “25-Hour Initial Operation Inspection” in Section 6-3.2 after the first 25 hours of engine operation. When oil consumption has stabilized, replace the mineral oil with ashless dispersant aviation engine oil according to Section 6-4.8 of M-0, Standard Practice Maintenance Manual.
10-8.6. Cylinder Torque

CAUTION: This cylinder torque procedure is for single cylinder installation. For complete engine assembly and torque, refer to instructions in Chapter 17.

Proper cylinder installation requires adherence to the torque sequence listed below using two people:

1. Lubricate the cylinder base stud threads, through-bolt threads and nut threads on BOTH sides of the engine with clean, 50-weight aviation oil.

   **WARNING**

   Failure to torque through-bolt nuts on both sides of the engine may result in a loss of main bearing crush, main bearing shift, crankshaft fracture, and engine failure.

2. Install and torque the through-bolt nuts and cylinder base nuts in the sequence shown in Figure 10-28 to one half (1/2) of the final torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Torque the through-bolt nuts and cylinder base nuts in the sequence shown in Figure 10-28 to the full final torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Torque the through-bolt nuts on both sides of the engine (even if only one cylinder is being installed).

![Figure 10-28. Single Cylinder Torque Sequence](image)
Non-Overhaul Repair and Replacement

10-8.7. Hydraulic Tappet Installation

1. Perform the dimensional inspection listed in Section 10-8.4 that apply to the hydraulic tappets (lifters) and pushrod tubes. Replace parts which fail to meet the service limits.

2. Gather the replacement parts necessary to comply with “100% Parts Replacement Requirements” criteria in Section C-2.3 of M-0, Standard Practice Maintenance Manual.

3. Lubricate all tappet faces using Dow Corning® G-N Paste, or equivalent. Lubricate the tappets with clean 50-weight aviation engine oil.

4. Install the serviceable hydraulic valve tappets in the bores from which they were removed. Install new hydraulic tappets to replace those which failed inspection.

5. Install new hydraulic exhaust tappets (wide groove on the tappet body) into the aft tappet guides in cylinders on the 1-3-5 side of the crankcase and in the forward tappet guides for cylinders on the 2-4-6 side of the crankcase.

6. Install new hydraulic intake tappets (narrow groove on the tappet body) into the forward tappet guides in cylinders on the 1-3-5 side of the crankcase and in the aft tappet guides for cylinders on the 2-4-6 side of the crankcase.

   NOTE: Install the pushrod housings nearest to engine mount brackets first. The Pushrod Spring Compressor Tool must lie close to horizontal to clear the crankcase flange.

7. Using a Kent-Moore Part No. 68-3 Pushrod Spring Compressor (Section 2-1, “Special Tools” in M-0, Standard Practice Maintenance Manual) or equivalent, compress the pushrod housing spring (Figure 10-18) (39).

8. Place a new packing (38) between the two steel washers (36), and install on the crankcase end of the pushrod housing (35).

9. Position the pushrod housings (35) into respective crankcase tappet bores.

10. While the spring (39) is compressed insert the crankcase end of the pushrod housing (35) in the crankcase bore and slide a new O-ring seal (37) on the cylinder end of the pushrod housing.

11. Guide the cylinder end of the pushrod housing (35) into the cylinder head bore while releasing the tension on the pushrod spring (39) with the Pushrod Spring Compressor Tool.

12. Remove the Pushrod Spring Compressor Tool from the pushrod and verify the O-ring seal (37), packing (38), and washers (36) are properly positioned.

13. Install the pushrods, rocker arms, and rocker covers according to instruction in Section 10-8.8.

14. Install any aircraft equipment, accessories, and cowlings removed to facilitate hydraulic tappet replacement according to the aircraft manufacturer’s instructions.
15. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

10-8.8. Rocker Arm Installation

NOTE: In 2016, exhaust rocker arms were redesigned to increase lubricant flow volume to the valve train. The bottom of the improved exhaust rocker arms have two oil feed holes; intake rocker arms have only one oil feed hole.

1. With the engine upright, lubricate the pushrods (Figure 10-18) (40) with clean 50-weight aviation engine oil and install the pushrods through the cylinder openings into the pushrod housings (35).

2. Before installing the valve actuating parts on each cylinder, turn the crankshaft until the pushrods are at their lowest position in the cylinder.

3. Lubricate the intake and exhaust rocker arms (19 & 20), new thrust washers (23) and new rocker shafts (24) with clean 50-weight aviation engine oil.

4. Slide the shaft (24) into the rocker arm assembly with a new thrust washer on each side of the rocker shaft.

   CAUTION: Ensure the intake and exhaust rocker arms are installed on the correct intake and exhaust valve positions.

5. Install the rocker and shaft assemblies on the rocker arm boss with retainers (25), new tab washers (26) and screws (27). Verify clearance of 0.020 inches between the rocker arm (Figure 10-29) and rotocoil/retainer. The underside of the rocker arm may be smoothly ground to attain the 0.020-inch minimum clearance using “Rocker Arm-to-Retainer Clearance” instructions in Section 15-8.9.19.

   ![](Figure_10-29. Rocker_Arm_to_Retainer_C clearance.png)

6. Check the side clearance (Figure 10-30) between the retainers and rocker arms with a feeler gauge; the side clearance must be 0.002 - 0.015 inches. If side clearance exceeds the allowable amount, replace the thrust washers with a thicker (oversize) thrust washer to reduce side clearance to the proper tolerance.
Figure 10-30. Rocker Arm Side Clearance

7. Torque the screws (Figure 10-18) (27) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   CAUTION: Do not over- or under-torque bolts to align tab washers; replace the bolt and re-torque to obtain proper alignment.

8. Secure the rocker assembly to the cylinder with a new tab washers (26) according to “Tab Washer Installation” instructions in Appendix C-4 of M-0, Standard Practice Maintenance Manual. Do not re-align the screw head to the tab washer.

9. Measure the dry valve lash at valve tip-to-rocker foot with the piston at top dead center; compare with limits in Section 10-8.4.1. Replace the pushrods with authorized over size pushrods (P030) if the dry valve lash exceeds the maximum limit.

10. Install the rocker covers (29) with a new rocker cover gaskets (28) (beaded side of the gasket toward the rocker cover); secure the rocker covers with screws (32), new lock washers (31) and washers (30). Torque the rocker cover screws (32) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

12. Install the aircraft cowling according to the aircraft manufacturer’s instructions.
10-9. Crankshaft Nose Oil Seal Replacement

Refer to the “Crankcase Nose Oil Seal Replacement” instructions in Section 10-10 of M-0, Standard Practice Maintenance Manual.

10-10. Crankcase Repair

See Section 15-8.10, “Crankcase Overhaul Repair.”
10-11. Turbocharger and Exhaust System Repairs

A mandatory one time inspection (Ref: MSB07-4) is required for engine serial numbers listed in Table 10-11 or engines with turbochargers replaced between March and July 2007. Consult the engine log book to verify compliance with MSB07-4 if your engine serial number is listed in Table 10-11. If the engine log book contains no record of compliance with MSB07-4, discontinue flight until the inspection is complied with.

Table 10-11. Engine Model and Serial Numbers Affected by MSB07-4

<table>
<thead>
<tr>
<th>Engine Model</th>
<th>Serial Number</th>
<th>Engine Model</th>
<th>Serial Number</th>
<th>Engine Model</th>
<th>Serial Number</th>
</tr>
</thead>
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<tr>
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<td>915041</td>
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<td>802877</td>
<td>TSIO550G</td>
<td>915044</td>
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<td>802878</td>
<td>TSIO550G</td>
<td>915046</td>
</tr>
<tr>
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<td>802861</td>
<td>TSIO550C</td>
<td>802881</td>
<td>TSIO550G</td>
<td>915048</td>
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<td>TSIO550C</td>
<td>802882</td>
<td>TSIO550G</td>
<td>915050</td>
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<td>802866</td>
<td>TSIO550G</td>
<td>915040</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**

Turbocharger and exhaust system weld repairs may only be performed by an FAA Part 145 authorized repair station certified to perform the specific repairs.

Refer to Section 12-8 for complete Turbocharger and Exhaust System removal instructions and Section 17-12.1 for Turbocharger and Exhaust System installation instructions.

10-11.1. Turbocharger Replacement

Instructions for turbocharger replacement are different, depending on engine model. Refer to the instructions in Section 10-11.1.1 or Section 10-11.1.2 applicable to the subject engine model.
10-11.1.1. TSIO-550-B, C, E, G & K Turbocharger Replacement

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Loosen the hose clamp and disconnect the induction tube from the compressor inlet.
3. Disconnect the air duct from the compressor housing according to the aircraft manufacturer’s instructions.
4. Place a suitable oil receptacle below the turbocharger oil reservoir. Disconnect the turbocharger oil supply and return hoses from the turbocharger oil inlet adapter and the turbocharger oil reservoir.
5. Remove the exhaust tailpipe according to instructions in Section 10-11.2.
6. Remove four lock nuts (Figure 10-34) (28), washers (27) and bolts (26) from the mounting turbo transition (5 or 6) and turbocharger (24) mounting flanges; discard the lock nuts (28).
7. Remove and discard the gasket (23).

**NOTE:** TSIO-550-B, C, E, G & K turbochargers (Figure 10-34) (24) are mounted to brackets (29 and 30) in specific orientations, based on the installed position, as shown in Figure 10-34, remove only the turbocharger mounting bolts necessary to facilitate turbocharger replacement.

<table>
<thead>
<tr>
<th>To remove the left side (2-4-6) turbocharger:</th>
<th>To remove the right side (1-3-5) turbocharger:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove bolts 3 and 4 (Figure 10-31).</td>
<td>Remove bolts 1 and 2 (Figure 10-31).</td>
</tr>
</tbody>
</table>

**Figure 10-31. Turbocharger Bracket Orientation**
Non-Overhaul Repair and Replacement

NOTE: The turbocharger support bracket is shaped differently on the TSIO-550-K model engine but the installation instructions are the same.

8. Orient the turbocharger to the bracket (Figure 10-31) on the correct side of the engine.

9. Install the bolts and new locking tab washers; torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Secure the tab washers according to instructions in Appendix C-4 of M-0, Standard Practice Maintenance Manual.

10. Install the new turbocharger on the turbocharger transition (Figure 10-32) (5 or 6) with a new gasket (23). Secure the turbocharger to the turbocharger transition with bolts (26), washers (27), and new lock nuts (28); torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Install the exhaust tailpipe according to instructions in Section 10-11.2.

12. Pre-oil the turbocharger before starting the engine according to the instructions in Section 10-11.1.3.

13. Connect the air duct to the compressor housing according to the aircraft manufacturer’s instructions.

14. Perform a ground engine run after turbocharger replacement; monitor the turbocharger oil fittings for leaks.
Figure 10-32. Turbocharger Installation Detail

see Figure 10-34 for index
10-11.1.2. TSIO-550-N Turbocharger Replacement

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Loosen the hose clamp and disconnect the induction tube from the compressor inlet.
3. Disconnect the air duct from the compressor housing according to the aircraft manufacturer’s instructions.
4. Place a suitable oil receptacle below the turbocharger oil reservoir. Disconnect the turbocharger oil supply and return hoses from the turbocharger oil inlet adapter and the turbocharger oil reservoir.
5. Remove the exhaust tailpipe according to instructions in Section 10-11.2.
   NOTE: Leave the turbocharger support bracket assembly intact for turbocharger replacement.
6. Remove four lock nuts (Figure 10-33) (28), washers (27) and bolts (26) from the turbo transition (5 or 6) and turbocharger (24) mounting flanges and support bracket (29 or 30); discard the lock nuts (28).
7. Remove and discard the gasket (23).
8. Install the new turbocharger on the turbocharger transition (5 or 6) with a new gasket (23). Secure the turbocharger to the turbocharger transition with bolts (26), washers (27), and new lock nuts (28); torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
9. Install the exhaust tailpipe according to instructions in Section 10-11.2.
10. Pre-oil the turbocharger before starting the engine according to the instructions in Section 10-11.1.3.
11. Connect the air duct to the compressor housing according to the aircraft manufacturer’s instructions.
12. Perform a ground engine run after turbocharger replacement; monitor the turbocharger oil fittings for leaks.
Figure 10-33. Turbocharger Installation Detail
10-11.1.3. Turbocharger Pre-Oiling

1. Temporarily connect a length of clear hose to the oil reservoir return fitting and direct the open end of the hose into the oil receptacle.

2. Using a funnel and suitable hose, add clean 50-weight aviation engine oil to the turbocharger oil inlet fitting until oil flows steadily from the turbocharger oil reservoir fitting. Raise the open end of the clear hose above the turbocharger oil inlet fitting to stop the flow of oil.

3. Manually turn the compressor wheel to distribute oil through the turbocharger.

4. Connect the turbocharger oil supply hose to the turbocharger oil inlet adapter.

5. Disconnect the clear hose from the turbocharger oil reservoir return fitting and connect the turbocharger oil return hose to the turbocharger oil reservoir fitting.


7. Place the mixture control in the IDLE CUT-OFF position and close the throttle.

8. Temporarily install jumper wires between the magneto P-leads and aircraft ground to disable the ignition.

9. Engage the starter two to three times, not to exceed 10 seconds per engagement, to force any remaining air from the lubrication system. Remove the temporary jumper wires from the magneto P-leads.

10. Service the engine oil according to the instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

11. Return to the turbocharger installation instructions to complete the procedure.
Non-Overhaul Repair and Replacement

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10-11.2. Exhaust Tailpipe or Heater Muff Replacement

The optional heater muff replaces the right tailpipe. The heater muff cannot be repaired or removed from the tailpipe since it is an integral part of the tailpipe. Replace a heater muff/tailpipe exhibiting signs of cracking, corrosion or erosion.

**WARNING**

Turbocharger and exhaust system weld repairs may only be performed by an FAA Part 145 authorized repair station certified to perform the specific repairs.

10-11.2.1. Exhaust Tailpipe or Heater Muff Removal

1. Allow the engine (and exhaust system) to cool prior to commencing exhaust system removal to avoid burn injuries.

   **WARNING**

   Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

   *CAUTION:* Stretching the V-band clamp excessively will cause undue stress on the outer band and lead to premature V-band clamp failure.

2. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

3. If the left tailpipe is to be removed, remove the four bolts (Figure 10-34) (19), washers (20), and lock nuts (21) connecting the tailpipe to the wastegate (18). Remove the gasket (17); discard the gasket and lock nuts (21).

4. Remove the safety wire and nut from the V-band clamp. Gently spread the V-band clamp and work the edges away from the turbocharger flange, onto the heater muff/tailpipe flange. Remove the heater muff/tailpipe (14 or 15).
Figure 10-34. Composite Turbocharger and Exhaust System

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Elbow Riser</td>
<td>11</td>
<td>Tie Rod</td>
<td>18</td>
<td>Wastegate Assembly</td>
<td>30</td>
<td>Bracket</td>
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<td>Bolt</td>
<td>19</td>
<td>Bolt</td>
<td>31</td>
<td>Screw</td>
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<td>3</td>
<td>Tee Assembly</td>
<td>13</td>
<td>Lock Nut</td>
<td>20</td>
<td>Washer</td>
<td>32</td>
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<td>4</td>
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<td>14</td>
<td>Contoured Tailpipe</td>
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<td>Lock Nut</td>
<td>33</td>
<td>Lock Nut</td>
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<td>5</td>
<td>Turbo Transition</td>
<td>14A</td>
<td>Straight Tailpipe</td>
<td>22</td>
<td>Controller</td>
<td>34</td>
<td>Hose</td>
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<td>Turbo Transition</td>
<td>14B</td>
<td>Inverse Tailpipe Option</td>
<td>23</td>
<td>Gasket</td>
<td>35</td>
<td>Hose</td>
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<tr>
<td>7</td>
<td>Riser</td>
<td>15</td>
<td>Contoured Tailpipe</td>
<td>24</td>
<td>Turbocharger Assembly</td>
<td>36</td>
<td>Hose</td>
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<td>8</td>
<td>Crossover Assembly</td>
<td>15A</td>
<td>Straight Tailpipe</td>
<td>25</td>
<td>Gasket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8A</td>
<td>Crossover Assy with Heater Shroud Option</td>
<td>15B</td>
<td>Heater</td>
<td>26</td>
<td>Bolt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Transition</td>
<td>16</td>
<td>V-band clamp</td>
<td>27</td>
<td>Washer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Bushing</td>
<td>17</td>
<td>Gasket</td>
<td>28</td>
<td>Lock Nut</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
10-11.2.2. Exhaust Tailpipe or Heater Muff Installation

1. Inspect the heater muff/tailpipe according to applicable steps in Section 6-4.21 of M-0, Standard Practice Maintenance Manual. Gently spread a serviceable V-band clamp over the heater muff/tailpipe (Figure 10-35) (14 or 15) flange in a twisting motion. Continue to spread and twist the V-band clamp over the flange to allow the clamp to rest just behind the flange.

2. If the left tailpipe/heater is being installed, place a new gasket between the tailpipe and wastegate flanges and secure the tailpipe to the wastegate with four bolts (19), washers (20), and new lock nuts (21).

   **CAUTION:** Do not use the V-Band clamp to align the turbocharger and tailpipe flanges. Align the flanges before attempting to tighten the clamp.

3. Install a new heater muff/tailpipe (14 or 15) by pushing the tailpipe exhaust flange against the turbine exhaust flange. Verify the tailpipe and turbocharger flanges mate squarely and secure the assembly according to instructions in Section 10-11.3, “Multi-Segment V-Band Clamp Replacement.”

---

**Figure 10-35. Tailpipe and V-Band Clamp Detail**

*See Figure 10-34 for Index*
10-11.3. Multi-Segment V-Band Clamp Replacement

10-11.3.1. Multi-Segment V-Band Clamp Removal

1. Remove the exhaust tailpipe (or heater muff) according to instructions in Section 10-11.2.1, “Exhaust Tailpipe or Heater Muff Removal.”

2. Gently spread the V-band clamp over the removed exhaust flange; inspect the clamp according to the applicable steps in Section 6-4.21 of M-0, Standard Practice Maintenance Manual. Replace the clamp if it fails to meet the inspection criteria.

10-11.3.2. Multi-Segment V-Band Clamp Installation

1. Clean the new multi-segment V-band clamps outer band using crocus cloth.

2. Spread the V-band clamp over the face of the first flange in a twisting motion.

3. Mate the exhaust tailpipe (or heater muff) and turbocharger flanges.

4. Gently spread the V-band clamp over the face of the tailpipe/heater muff flange in a twisting motion to center the V-band clamp evenly over the turbocharger and exhaust tailpipe flanges. Initially torque the clamp nut to half the amount specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Use a rawhide or plastic mallet to lightly tap the outer edge of the clamp to distribute the load. Align the flanges and torque the clamp to the final torque value for the clamp specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed t-bolt threads according to instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual and Figure 10-37.

Figure 10-36. V-Band Clamp Inspection Criteria
6. Inspect the installed V-band clamp as follows:

   **CAUTION:** If the V-band clamp exhibits physical damage or fails any of the listed inspection criteria, discard the V-band clamp and obtain a new or serviceable V-band clamp replacement.

   a. Inspect the inner segment spacing. The inner segments must not contact after the clamp is installed.

   b. Verify 100% contact between the inner segment and outer band

   c. Inspect the corner radii of the clamp inner segments for cracks using a flashlight and mirror.

   d. Using a straight edge, inspect the clamp outer band for flatness, especially within 2 inches of spot-weld tabs that retain the T-bolt fastener - clearance must be less than 0.062 inches. If clearance exceeds 0.062 inches, replace the clamp.

   e. Verify the safety wire is securely installed and the pigtail is folded back closely to the bolt.

   NOTE: The TSIO-550-G V-band clamps are riveted instead of welded.

   ![V-Band Clamp Safety Wire](image)

   Torque nut to specification plus nut running torque and secure V-Band clamp fastener with Ø .032 safety wire.

   **Figure 10-37. V-Band Clamp Safety Wire**

**10-12. Engine Preservation and Storage**

“Engine Preservation and Storage” instructions are in Chapter 9 of M-0, Standard Practice Maintenance Manual.
Chapter 11. Engine Overhaul Introduction

11-1. Engine Overhaul

During overhaul, all engine parts and accessories are removed and inspected. Specified parts are replaced while others may be restored to a condition equal to new product specifications. All engine parts and accessories must conform with the engine and accessory manufacturer's specifications prior to being re-installed on the engine. The intent of overhaul is to restore the engine to an airworthy condition. To be considered “airworthy,” the engine must conform to its type certificate and be in a condition for safe operation.

Information in this manual defines practices for overhauling engines. Chapters are arranged in sequential order of tasks to be performed during overhaul starting with engine removal and disassembly, followed by component disassembly, cleaning, inspection and repair, component assembly, engine assembly and installation, and post-overhaul testing.

Overhaul procedures in this manual apply only to the engines for which it is written and not the aircraft. Overhaul procedures described herein must be complied with in addition to all aircraft manufacturer and accessory manufacturer overhaul requirements.

New part limits essential to performing an engine overhaul applicable to engines covered in this manual are provided in Appendix D. Torque Specifications for all fasteners on the engine are located in Appendix B of M-0, Standard Practice Maintenance Manual. Appendix C of M-0, Standard Practice Maintenance Manual contains standard repairs and instructions for recurring common procedures, like cotter pin and safety wire installation, and heli-coil replacement. Appendix C also contains details regarding mandatory replacement parts disposition during maintenance and overhaul. These sections will be referred to often throughout the procedures. Refer to the aircraft manufacturer’s manual for instructions pertaining to mandatory replacement items during engine replacement or engine overhaul.

This manual does not contain overhaul requirements for engines modified by installation of components or systems under supplemental type certificate.

11-2. Overhaul Schedule

Engine time between overhaul (TBO) is determined by the engine model certification data submitted to and approved by the FAA. Refer to “Time Between Overhaul” in Section 6-3 of M-0, Standard Practice Maintenance Manual to determine when to overhaul your engine model.
# Overhaul Sequence

Perform engine overhaul in the sequence described in Table 11-1.

<table>
<thead>
<tr>
<th>Action</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Remove the engine from the aircraft.</td>
<td>Section 5-1, “Engine Removal”</td>
</tr>
<tr>
<td>2. Disassemble the engine.</td>
<td>Chapter 12, “Engine Disassembly”</td>
</tr>
<tr>
<td>6. Repair or replace unserviceable parts or parts identified as 100% replacement parts or mandatory overhaul replacement parts.</td>
<td>Repair or replace parts specified in Section 15-8, “Overhaul Repair”</td>
</tr>
<tr>
<td>8. Assemble the engine components.</td>
<td>Chapter 16, “Component Assembly”</td>
</tr>
<tr>
<td>10. Install the engine in the aircraft.</td>
<td>“Section 5-2, “Engine Installation”</td>
</tr>
<tr>
<td>11. Test the overhauled engine.</td>
<td>Chapter 18, “Post-Overhaul Test and Adjustments”</td>
</tr>
</tbody>
</table>
11-4. Overhaul Checklists

Overhaul Checklists serve as guides during the overhaul process of disassembly, inspection, mandatory component replacement, refurbishing and assembly. Checklists provide a comprehensive record of the overhaul procedures:

- “Engine Removal and Disassembly Checklist”, Table 11-2
- “Engine Overhaul Visual Inspection Checklist”, Table 11-3
- “Fluorescent Penetrant Inspection Checklist”, Table 11-4
- “Magnetic Particle Inspection Checklist”, Table 11-5
- “Ultrasonic Inspection Checklist”, Table 11-6
- “Dimensional Inspection Checklist”, Table 11-7
- “Engine Cylinder Overhaul Inspection Checklist”, Table 11-8
- “Engine Drive Train Inspection Checklist”, Table 11-9
- “Replacement Parts Inventory”, Table 11-10

Overhaul inspection items listed in the checklists contain references to the procedures containing the overhaul actions required when overhauling engines covered by this manual. For convenient reference, make a copy of the checklists and complete them during engine overhaul.

Perform items listed in the checklists, according the referenced procedures to remove, disassemble, and repair components on an engine which has reached Time Between Overhaul (TBO):

Section 5-1, “Engine Removal”
Section 12, “Engine Disassembly”
Section 13, “Component Disassembly”
Section 12, “Engine Cleaning” in M-0, Standard Practice Maintenance Manual
Section 15, “Overhaul Inspection and Repair”

During the overhaul process, assemble, install, and test the overhauled engine according to instruction in the following chapters:

- Section 16, “Component Assembly”
- Section 17, “Engine Assembly”
- Section 5-2, “Engine Installation”
- Section 18, “Post-Overhaul Test and Adjustments”
Table 11-2. Engine Removal and Disassembly Checklist

<table>
<thead>
<tr>
<th>Overhaul Step</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete a Cylinder Visual Inspection (Section 6-4.11.1 of M-0, Standard Practice Maintenance Manual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete a Cylinder Differential Pressure Test. (Section 6-4.11.2 of M-0, Standard Practice Maintenance Manual)</td>
<td></td>
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</tr>
<tr>
<td>Remove the engine from the aircraft (Section 5-1).</td>
<td></td>
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</tr>
<tr>
<td>Remove the Ignition System (Section 12-2).</td>
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<tr>
<td>Remove the Accessory Drive Adapters (Section 12-3).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Wastegate Controller (Section 12-4.1).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Induction System (Section 12-5).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Fuel Injection System (Section 12-5).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Air/Oil Separator (Section 12-7).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Turbocharger &amp; Exhaust System (Section 12-8).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Oil Cooler (Section 12-9).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Oil Pump (Section 12-10).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Alternator(s) (Section 12-11).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Starter Adapter Assembly (Section 12-13).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Oil Sump (Section 12-14).</td>
<td></td>
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</tr>
<tr>
<td>Remove the Engine Cylinders and Pistons (Section 12-16).</td>
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<tr>
<td>Disassemble the Ignition System (Section 13-1).</td>
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<tr>
<td>Disassemble the Fuel Injection System (Section 13-2).</td>
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<tr>
<td>Disassemble the Starter and Starter Adapter (Section 13-6).</td>
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<tr>
<td>Disassemble the Engine Cylinders (Section 13-7).</td>
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<tr>
<td>Disassemble the Accessory Drive Adapters (Section 13-8).</td>
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<tr>
<td>Disassemble the Crankcase (Section 13-9).</td>
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<tr>
<td>Disassemble the Drive Train (Section 13-10).</td>
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<tr>
<td>Disassemble the Compressor Mount (Section 13-11).</td>
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</tr>
<tr>
<td>Perform a visual inspection prior to cleaning the engine parts (Section 11-1 of M-0, Standard Practice Maintenance Manual).</td>
<td></td>
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<tr>
<td>Clean engine parts (Chapter 12 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Perform detailed visual parts inspection (Section 11-1 of M-0, Standard Practice Maintenance Manual).</td>
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<td></td>
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<tr>
<td>Perform Fluorescent Penetrant Inspections (Section 11-2 of M-0, Standard Practice Maintenance Manual).</td>
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</tbody>
</table>
### Table 11-2. Engine Removal and Disassembly Checklist

<table>
<thead>
<tr>
<th>Overhaul Step</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform Magnetic Particle Inspections (Section 11-3 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Perform Ultrasonic Inspections (Section 11-4 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Perform Dimensional Inspections (Section 15-7).</td>
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<tr>
<td>Perform overhaul repairs (Section 15-8).</td>
<td></td>
<td></td>
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<tr>
<td>Assemble engine components (Chapter 16).</td>
<td></td>
<td></td>
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<tr>
<td>Assemble the engine (Chapter 17).</td>
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<tr>
<td>Install the engine in the aircraft (Section 5-2).</td>
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<tr>
<td>Complete Post-Overhaul Test and Adjustments (Chapter 18).</td>
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</tbody>
</table>
Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete the cursory visual inspection according to Section 11-1 of M-0, Standard Practice Maintenance Manual during disassembly to avoid cleaning parts which ultimately will be replaced. Collect faulty part (not required overhaul replacements) information at the end of each subsystem for a replacement parts list.</td>
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</tbody>
</table>

**Fuel Injection System**

- Inspect the fuel injection system plumbing for cracks, dents, chafing, flared end erosion, and deformation.
- Inspect fittings and hardware on the fuel injection system for damaged threads or stripped heads.
- Inspect fuel injection system brackets for cracks, dents, or wear.
- Inspect replacement fuel injection parts for serviceability.
- Inspect tapped holes and helical coils on the fuel injection system for distorted or stripped threads, cracks or dents.

**Replacement Part Description**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reason</th>
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</tbody>
</table>
## Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Induction System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect induction tubes, risers, and intake manifold for cracks, dents, and chafing.</td>
<td></td>
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</tr>
<tr>
<td>Check tube ends and flanges on the surface plate for warpage or deformities.</td>
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</tr>
<tr>
<td>Inspect fittings and hardware on the induction system for damaged threads or stripped heads.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect tapped holes and helical coils on the induction system (including aftercooler) for distorted or stripped threads, cracks or dents.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the induction brackets, manifold, throttle, and induction tubes with a 10X magnifying glass.</td>
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<tr>
<td><strong>Replacement Part Description</strong></td>
<td>Part Number</td>
<td>Reason</td>
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</tbody>
</table>

**Alternator** | | |
| Perform a visual inspection on alternator components. | | |
| Inspect fasteners for damaged or stripped heads. | | |
| Check the alternator drive hub per instructions in “Alternator Drive Hub Slippage Inspection” in Section 10-4.1.4 of M-0, Standard Practice Maintenance Manual. | | |
| Inspect the alternator parts, housing and brackets with a 10X magnifying glass. | | |
| **Replacement Part Description** | Part Number | Reason |
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Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starter/Starter Adapter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform a visual inspection of the starter and starter adapter components.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the exterior of the starter adapter housing and cover for cracks with a 10X magnifying glass.</td>
<td></td>
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</tr>
<tr>
<td>Inspect the starter adapter housing and accessory drive adapter housing studs for distorted or stripped threads, corrosion, or pitting, or looseness.</td>
<td></td>
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<tr>
<td>Check the shaft gears, worm wheel gears, worm gear, or worm gear shafts for cracks.</td>
<td></td>
<td></td>
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<tr>
<td>Check for damaged or loose studs on the starter and accessory drive adapter.</td>
<td></td>
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<tr>
<td><strong>Replacement Part Description</strong></td>
<td><strong>Part Number</strong></td>
<td><strong>Reason</strong></td>
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<tr>
<td><strong>Lubrication System</strong></td>
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<tr>
<td>Inspect the exterior and cavity of the oil pump housing with a 10X magnifying glass.</td>
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<tr>
<td>Inspect the oil pump cover, tach drive housing, and oil filter adapter with a 10X magnifying glass.</td>
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<tr>
<td>Inspect the oil pump cover for scoring at gear contact surfaces.</td>
<td></td>
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<tr>
<td>Using a flashlight and 10X magnifying glass, inspect all remaining Lubrication System components.</td>
<td></td>
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<tr>
<td>Inspect all oil passages, especially in the oil pump housing and tach drive housings, for flow restrictions.</td>
<td></td>
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<tr>
<td>Inspect the oil pump housing gear shaft for security and scoring.</td>
<td></td>
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<tr>
<td>Inspect the oil pressure relief valve plunger for scoring and nicks and the face for roughness.</td>
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<tr>
<td>Check the oil pump drive gear shaft and shaft splines for wear or damage.</td>
<td></td>
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<tr>
<td>Inspect the oil sump and sump bolt holes.</td>
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</tbody>
</table>
Engine Overhaul Introduction

Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect the oil drain plug boss and drain plug for damaged threads and damaged wrench flats.</td>
<td></td>
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<tr>
<td>Inspect the oil suction tube assembly for dents, cracks, distorted or restricted openings.</td>
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<tr>
<td>Inspect the oil pump housing and tach drive housing studs for distorted or stripped threads.</td>
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<tr>
<td>Inspect the lubrication system fastening studs.</td>
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</table>

<table>
<thead>
<tr>
<th>Replacement Part Description</th>
<th>Part Number</th>
<th>Reason</th>
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</table>

Engine Cylinders

- Inspect for obvious cracks, missing or bent fins. Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness.
- Inspect the cylinders using Table 11-8, “Engine Cylinder Overhaul Inspection Checklist”.

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<thead>
<tr>
<th>Replacement Part Description</th>
<th>Part Number</th>
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</table>
### Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
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</thead>
<tbody>
<tr>
<td><strong>Crankcase</strong></td>
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<tr>
<td>Inspect for obvious cracks, missing or bent hardware.</td>
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<tr>
<td>Inspect fasteners for loose or bent studs and damaged threads</td>
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<tr>
<td>Inspect interior after disassembly for worn, scored, or otherwise damaged journals.</td>
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<tr>
<th>Replacement Part Description</th>
<th>Part Number</th>
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**Engine Drive Train**

Inspect the drive train components using the "Engine Drive Train Inspection Checklist" (Section 11-9)

<table>
<thead>
<tr>
<th>Replacement Part Description</th>
<th>Part Number</th>
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</table>
## Engine Overhaul Introduction

### Air Conditioning Compressor (Optional Part) Mounting Kit

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect the air conditioning compressor mounting brackets for cracks and elongated holes.</td>
<td></td>
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</tr>
<tr>
<td>Inspect the idler sheave for warpage, cracks, and wear in belt grooves and bearing seats.</td>
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<tr>
<td>Check the mounting bracket flange for wear; place it on a surface plate and check for warpage.</td>
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<tr>
<td>Inspect the idler sheave support bolt for wear on the support shank.</td>
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<tr>
<td>Inspect the hardware for distorted or stripped threads.</td>
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</table>

### Replacement Part Description

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<th>Part Number</th>
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</table>
## Table 11-4. Fluorescent Penetrant Inspection Checklist

Inspect clean, aluminum or non-ferrous metal parts according to the “Fluorescent Penetrant Inspection” instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Focus</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Pay particular attention to:</td>
<td></td>
</tr>
<tr>
<td>Look for discontinuities such as:</td>
<td>• Bearing bosses.</td>
<td></td>
</tr>
<tr>
<td>• Fatigue cracks</td>
<td>• Mounting flanges.</td>
<td></td>
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<tr>
<td>• Grinding</td>
<td>• Shaft bores.</td>
<td></td>
</tr>
<tr>
<td>• Cracks from heat treatment or brittleness</td>
<td>• Mating surfaces where hardware has been previously torqued.</td>
<td></td>
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<tr>
<td>• Seams</td>
<td>• Areas where oil seals or bushings are pressed in or seated.</td>
<td></td>
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<tr>
<td>• Laps or ruptures</td>
<td>• Look for indications of weakness in corners, edges, holes, or fillets.</td>
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<tr>
<td></td>
<td>• Identify parts that contain linear indications that cannot be reworked.</td>
<td></td>
</tr>
<tr>
<td><strong>Cylinder heads</strong></td>
<td>Pay particular attention to:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Rocker boss areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Valve seat insert areas</td>
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<tr>
<td></td>
<td>• Valve guide areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Intake and exhaust flanges</td>
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<tr>
<td></td>
<td>• Intake and exhaust ports</td>
<td></td>
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<tr>
<td></td>
<td>• Between cylinder head cooling fins</td>
<td></td>
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<tr>
<td></td>
<td>• Cylinder-to-barrel mating area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td><strong>Aluminum alloy fuel injection components</strong></td>
<td>• Fuel manifold valve body</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Covers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Flanges</td>
<td></td>
</tr>
<tr>
<td><strong>Aluminum air conditioning compressor mounting components</strong></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bolt holes</td>
<td></td>
</tr>
<tr>
<td><strong>Starter Adapter housing</strong></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bolt holes</td>
<td></td>
</tr>
<tr>
<td><strong>Alternator housing</strong></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bolt holes</td>
<td></td>
</tr>
<tr>
<td><strong>Crankcase halves</strong></td>
<td>Pay particular attention to:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cylinder-to-barrel mating area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bearing bosses</td>
<td></td>
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<tr>
<td></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Shaft bores</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Through-bolt hole areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Crankcase/crankshaft exit area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oil seals or bushing seats</td>
<td></td>
</tr>
<tr>
<td><strong>Aluminum alloy brackets</strong></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bolt holes</td>
<td></td>
</tr>
<tr>
<td><strong>Aluminum alloy Induction System components</strong></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bolt holes</td>
<td></td>
</tr>
<tr>
<td><strong>Scavenge pump body and adapter covers</strong></td>
<td>• Oil cavity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oil seal or bushing seats</td>
<td></td>
</tr>
<tr>
<td><strong>Oil pump housing</strong></td>
<td>• Bearing bosses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oil pump cavity area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oil seal or bushing seats</td>
<td></td>
</tr>
</tbody>
</table>
Table 11-4. Fluorescent Penetrant Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Focus</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil pump cover</td>
<td>Oil pump cavity area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mounting flanges</td>
<td></td>
</tr>
<tr>
<td>Oil filter adapter</td>
<td>Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oil seal or bushing seats</td>
<td></td>
</tr>
<tr>
<td>Cast aluminum oil sump</td>
<td>Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt holes</td>
<td></td>
</tr>
</tbody>
</table>

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.

Table 11-5. Magnetic Particle Inspection Checklist

Use the fluorescent method wet continuous procedure on all ferrous parts according to the “Magnetic Particle Inspection” instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Inspector Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Journals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fillets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Oil holes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Thrust flanges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Prop flange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder Barrels:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fin tips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fin roots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lobes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Journals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Drilled hole edges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocker arms:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Socket under side arms and boss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler sheave support bolt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter Adapter:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Shaft gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Worm shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Worm gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubrication System:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Oil pump gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bevel gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Tach drive shaft</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Engine Overhaul Introduction

### Table 11-5. Magnetic Particle Inspection Checklist

Use the fluorescent method wet continuous procedure on all ferrous parts according to the “Magnetic Particle Inspection” instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Inspector Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counterweights (after bushings installed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight hanger blade (after bushing installed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor drive gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting rods (Section 11-3.1 of M-0, Standard Practice Maintenance Manual)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.

### Table 11-6. Ultrasonic Inspection Checklist

Only certified, trained personnel can perform this inspection Ref: “Crankshaft Ultrasonic Inspection” instructions in Section 11-4.1 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Result</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft (Section 15-6.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibroetch Passing Crankshaft with Inspection Results</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.
### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crankcase (Section 15-7)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through-bolt in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support in crankcase (front) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support in crankcase (rear) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil pump housing pilot in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear end clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear in support bushing (front) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear in support bushing (rear) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magneto pilot in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter shaft gear roller bearing hole diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor drive shaft in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankcase (each half) width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankcase (cylinder deck-to-cylinder deck) width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessory drive adapter pilot in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor Drive Gear Backlash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Journal Bore diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft Journal Bore Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tappet Guides Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor Driven Gear Bearing Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter Shaft Needle Bearing Hole Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support pin front cc diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support pin rear cc diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 4</td>
<td></td>
<td></td>
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</tbody>
</table>
### Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake valve tappets OD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust valve tappets OD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drive Train (Section 15-7)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft front journal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft rear journal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #2 journal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #3 journal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #4 journal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #5 journal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crank pins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Counterweight hanger blade bushing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft main bearings diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crank pins out-of-round</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main journals out-of-round</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft front journal diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft rear journal diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #2 journal diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #3 journal diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #4 journal diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #5 journal diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crank pin diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft run-out at center main journals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft run-out at propeller flange pilot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft run-out at propeller flange face</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Crankshaft Counterweights (Section 10-9.1 of M-0, Standard Practice Maintenance Manual)

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Damper pin bushing in crank cheek ext. diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damper pin bushing in counterweight diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damper pin in counterweight end clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternator gear on crankshaft diameter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft gear on crankshaft diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft in thrust bearing end clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor oil transfer collar on crankshaft diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journals in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Camshaft in crankcase end clearance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft run-out at center journals (shaft support at end journals) full indicator reading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft gear on camshaft flange diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushing in connecting rod diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolt in connecting rod diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting rod bearing on crank pin diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting rod on crank pin end clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting rod bearing and bushing twist or convergence per inch of length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft gear and camshaft gear backlash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft gear and idler gear backlash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear and accessory drive gear (right and left) backlash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter shaft gear and crankshaft gear backlash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight 4th order pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight 5th order pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight 6th order pins (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight 6th order pins (2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 11-7. Dimensional Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Counterweight bushing bore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight bushing ID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight hanger blade bushing ID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight hanger blade bore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting Rods (Section 10-9.4.1 in M-0)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Bushing bore diameter (bushing installed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushing center to crank pin center</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Cylinders (Section 15-7.3)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cylinder bore (lower 4-1/4 inch of barrel) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder bore choke (at 5.75 inch from open end of barrel) taper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder bore out-of-round</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder bore – allowable oversize</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder bore surface (Nitrided Barrels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross hatch angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finish in micro-inches Ra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder barrel in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake valve seat insert in cylinder head diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake valve guide in cylinder head diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust valve guide in cylinder head diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust valve seat insert in cylinder head diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New intake valve seat width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New exhaust valve seat width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocker shaft in cylinder head bosses diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocker arm bushing bore diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocker arm bushing inside diameter – finish bore</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Cylinders (cont.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rocker arm side clearance</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake valve guide inside diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake valve in guide diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust valve guide inside diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust valve in guide diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocker arm foot to valve stem (dry valve gear lash)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piston, moly coated (bottom of skirt) in cylinder diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
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### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

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<tr>
<th>Inspection Item</th>
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<td>Piston diameter at bottom</td>
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<td>Piston fourth ring groove width</td>
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<td>Rocker arm thrust width</td>
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<td><strong>Starter Adapter (Section 15-7.4)</strong></td>
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<tr>
<td>Starter shaft gear needle bearing hole crankcase diameter</td>
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<td>Starter shaft gear front (bearing) journal diameter</td>
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<tr>
<td>Starter shaft gear in clutch drum bearing diameter</td>
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### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

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<th>Inspection Item</th>
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<td><strong>Starter Adapter (cont.)</strong></td>
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<td>Clutch spring sleeve in starter adapter diameter</td>
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<td>Starter shaft gear in ball bearing diameter</td>
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<tr>
<td>Bearing in starter adapter cover diameter</td>
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<tr>
<td>Worm wheel gear end clearance</td>
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<tr>
<td>Worm wheel drum diameter</td>
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<tr>
<td>Starter shaft gear drum diameter</td>
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<tr>
<td>Clutch spring in clutch spring sleeve diameter</td>
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<tr>
<td>From center line of worm gear shaft to starter adapter thrust pads</td>
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<tr>
<td>Needle bearing hole starter adapter diameter</td>
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<tr>
<td>Ball bearing in starter adapter diameter</td>
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<tr>
<td>Worm gear shaft in needle bearing area diameter</td>
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<td>Worm gear shaft in ball bearing diameter</td>
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<td>Starter worm gear on shaft diameter</td>
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<tr>
<td>Starter spring on worm drive shaft diameter</td>
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<tr>
<td>Starter pilot to starter drive adapter diameter</td>
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<tr>
<td>Scavenge pump driven gear on shaft diameter</td>
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<tr>
<td>Scavenge pump driver and driven gear in body end clearance</td>
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<tr>
<td>Scavenge pump driver and driven gear in body diameter</td>
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<tr>
<td>Bushing in scavenge pump driven gear diameter</td>
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<tr>
<td>Scavenge pump driver and driven gear backlash</td>
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<tr>
<td>Starter worm wheel gear and worm gear backlash</td>
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<tr>
<td>Worm wheel drum A dimension</td>
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# Engine Overhaul Introduction

## Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

<table>
<thead>
<tr>
<th>Inspection Item</th>
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<td>0.015 Undersize worm wheel drum A dimension</td>
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<td>Worm wheel drum B dimension</td>
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<tr>
<td>0.015 Undersize worm wheel drum B dimension</td>
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<td>Shaft Gear Drum dimension</td>
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<td>0.015 Undersize Shaft Gear Drum dimension</td>
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### Lubrication System (Section 15-7.5)

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<td>Oil pump drive gear hole diameter</td>
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<td>Oil pump gear chamber depth</td>
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<td>Oil pump drive gear shaft diameter</td>
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<tr>
<td>Oil pump driven gear shaft diameter</td>
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<tr>
<td>Oil pressure relief valve adjusting screw in plunger diameter</td>
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<td>Oil pressure relief valve seat in housing depth</td>
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<td>Oil pump driver gear in pump housing diameter</td>
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<tr>
<td>Oil pump driver gear shaft in pump housing diameter</td>
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<tr>
<td>Oil pump driven gear to driven gear shaft diameter</td>
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<td>Oil pump driver gear in pump housing end clearance</td>
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<tr>
<td>Oil pump driven gear in pump housing end clearance</td>
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<tr>
<td>Oil pump driver gear shaft in oil pump cover diameter</td>
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<tr>
<td>Oil pump driven gear in housing diameter</td>
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<tr>
<td>Oil pump drive and driven gears’ backlash</td>
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<tr>
<td>Oil pressure relief valve spring compressed to 1.25 inch length load</td>
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<tr>
<td>Oil temp. control valve 0.090 inches minimum travel at oil temperature</td>
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<tr>
<td>Oil temperature control valve must close between</td>
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Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

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<tr>
<th>Inspection Item</th>
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<tr>
<td>Alternator (Section 15-7.6)</td>
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<td>Stud Height Settings (Section 15-7.9)</td>
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<td>Starter Adapter</td>
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<tr>
<td>Starter Adapter to Crankcase (1)</td>
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<td>Starter Adapter to Crankcase (2)</td>
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<td>Cover, Scavenge Body to Adapter</td>
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<td>Cover to Scavenge Body (1)</td>
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<td>Cover to Scavenge Body (2)</td>
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<td>Cover to Scavenge Body (4)</td>
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<td>Oil Pump Cover to Housing (1)</td>
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<td>Oil Pump Cover to Housing (2)</td>
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<td>Intake flange stud (2)</td>
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<td>Intake flange stud (3)</td>
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<td>Oil Control collar dowel (2)</td>
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<tr>
<td>Install crankcase studs according to Section 15-7.9 and App. D.</td>
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Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.
### Engine Overhaul Introduction

**Table 11-8. Engine Cylinder Overhaul Inspection Checklist**

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<tr>
<td>Perform the inspection according to the “Fluorescent Penetrant Inspection” instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.</td>
<td>Cylinder Heads</td>
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<td>Cylinder Heads after Valve Seat or Valve Guide Installation</td>
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<table>
<thead>
<tr>
<th><strong>Magnetic Particle Inspection (on all ferrous parts)</strong></th>
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<tbody>
<tr>
<td>Use the fluorescent wet continuous method according to the “Magnetic Particle Inspection” instructions in of M-0, Standard Practice Maintenance Manual.</td>
<td>Engine cylinder barrel inner and outer surfaces using the close coil shot method</td>
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<tr>
<td></td>
<td>Engine cylinder intake valve, and rocker arms using circular and longitudinal magnetization</td>
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<table>
<thead>
<tr>
<th><strong>Dimensional Inspection</strong></th>
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<tbody>
<tr>
<td>Refer to the Section 15-7, “Dimensional Inspection” and Appendix D</td>
<td>Cylinders</td>
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<tr>
<td></td>
<td>Cylinder Components</td>
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<tr>
<td>Item to Check</td>
<td>Initials</td>
<td>Action</td>
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<tr>
<td>Inspect the crankshaft, camshaft, connecting rods, and engine drive train components for rusting, pitting, and cracks.</td>
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<tr>
<td>Using a 10X magnifying glass, inspect the camshaft journals and lobes for scoring, pitting, corrosion, or any other indication of wear.</td>
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<tr>
<td>Inspect the camshaft gear splines for wear.</td>
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<tr>
<td>Inspect the camshaft gear flange for nicks, peening, and other irregularities. (This flange must be smooth to align gears.)</td>
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<tr>
<td>Inspect the bolt holes on the camshaft gear flange for distorted or stripped threads.</td>
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<tr>
<td>Using Borroughs 8087A polishing tool or equivalent, rotate the crankshaft in a lathe and polish the mains and crank pins to a finish of 8 $R_a$ maximum. Inspect the finish using a profilometer. Perform a dimensional inspection on the crankshaft mains and crankshaft pins according to the “Drive Train Dimensional Inspection” in Section 15-7.2.</td>
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<tr>
<td>Inspect the crankshaft main journals, crank pins, and oil seal area for scoring and burning.</td>
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<tr>
<td>Inspect the crankshaft gear bolt holes for distorted or stripped threads.</td>
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<tr>
<td>Check the oil passages on the crankshaft for obstruction or loose oil tubes.</td>
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<tr>
<td>Check the gear dowel for the desired snug fit.</td>
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<tr>
<td>Inspect the oil control plug for obstructions in the oil hole and loose fit.</td>
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<tr>
<td>Inspect the crankshaft and counterweights for cracks, nicks, or evidence of contact between the bottom of the counterweight and the crankshaft according to: Section 15-7.2, “Drive Train Dimensional Inspection” and “Crankshaft Counterweight Inspection” in Section 10-9.1 of M-0, Standard Practice Maintenance Manual. Use tags to identify parts. Do not use a scribe or punch to identify the parts.</td>
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<tr>
<td>Using a 10X magnifying glass, inspect the crankshaft gear and idler gear drive teeth for signs of overheating or wear according to the “Gear Tooth Inspection” instructions in Section 11-1.1. Normal wear produces a fine polish on the tooth thrust faces.</td>
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<tr>
<td>Verify the crankshaft connecting rod and cap mate marks are adjacent to each other and the position numbers are stamped on or adjacent to the bolt boss match.</td>
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</table>
## Engine Overhaul Introduction

### Table 11-9. Engine Drive Train Inspection Checklist

<table>
<thead>
<tr>
<th>Item to Check</th>
<th>Initials</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect the connecting rod for corrosion, pitting, rust, discoloration (blue), galling, impact damage, nicks, bending, or twisting.</td>
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<tr>
<td>Remove the nuts and bolts from the connecting rod and separate the rod and the cap (accomplished during disassembly). Inspect the connecting rod and cap parting surface. Contact signatures resulting from assembly forces are normal and acceptable. Fretting signatures resulting in the loss of metal indicated by removal of original machining marks are not acceptable.</td>
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<tr>
<td>Inspect the connecting rod nut seat area for loss of material or edge loading signatures. Inspect dowel surfaces at the connecting rod and cap bolt holes for distortion or scoring.</td>
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<tr>
<td>Assemble the connecting rod and caps by installing one bolt through the cap and rod. Verify the mate marks align. With the cap seated firmly against the connecting rod, a bolt should be easily installed using hand pressure.</td>
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<tr>
<td>Inspect the oil transfer collar assembly for cracks and scoring.</td>
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<tr>
<td>Verify the tin plating on the oil control collar is intact.</td>
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<tr>
<td>Inspect studs on the oil control collar for corrosion, pitting, incomplete threads, or looseness.</td>
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<tr>
<td>Check the stud height and dowel settings on the oil control collar according to Section 15-7.9, “Stud Height Dimensional Inspection.”</td>
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<tr>
<td>Inspect the connecting rods according to the “ Connecting Rod Dimensional Inspection.” instructions in Section 10-9.4.1 of M-0, Standard Practice Maintenance Manual.</td>
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<tr>
<td>Remove the piston pin bushing from the connecting rod; inspect the piston pin bushing bore and surrounding area for nicks, gouges and mechanical damage.</td>
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<tr>
<td>Inspect the rod channel rails for nicks, gouges or mechanical damage.</td>
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</table>
Table 11-10. Replacement Parts Inventory

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Part Number</th>
<th>Reason/Comment</th>
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### Table 11-10. Replacement Parts Inventory

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Engine Overhaul Introduction

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Chapter 12. Engine Disassembly

12-1. Engine Disassembly Sequence

Disassemble the engine following the procedures in the sequential steps listed below. Once the engine is disassembled as described herein, disassemble components, clean, and inspect them as described in subsequent chapters. Refer to the corresponding sections in this chapter for detailed instructions for each step:

1. Ignition System Removal
2. Accessory Drive Adapter Removal
3. Wastegate Controller Removal
4. Induction System Removal
5. Fuel Injection System Removal
6. Air/Oil Separator Removal
7. Turbocharger and Exhaust System Removal
8. Oil Cooler Removal
9. Oil Pump Removal
10. Alternator Removal (and optional alternator bracket assembly)
11. Starter and Starter Adapter Removal
12. Oil Sump Removal
13. Engine Cylinder and Piston Removal
12-2. Ignition System Removal and Disassembly

Ignition systems may be Champion (Slick) 6320 or Continental Motors S6RSC-25P series, impulse coupled magnetos. Magnetos may be fitted with a tachometer drive sensor. Removal and installation procedures are similar, with only minor differences. Separate instructions are provided for Continental and Champion (Slick) Magnetos.

12-2.1. Continental Motors Ignition System Removal

1. Remove the ignition lead from each spark plug (Figure 12-1) (3). Remove and discard cable ties and clamps.
   a. On each magneto, remove four screws (4) from the cable outlet plate; remove the cable outlet plates from magnetos (1).
   b. Remove clamps and ignition harness assembly (3) from engine and discard.
2. Remove clamp (16) and disconnect hose (14) at 90° fitting (19) from magneto.
3. Remove clamps (16) from filter (12) and tee (18). Remove hoses (14, 15 and 17). Discard the filter (12) and hoses (14, 15 and 17).
4. Remove nuts (5), lock washers (6), and magneto retainers (7) from either side of magneto.
5. Disconnect the magneto sensor (2), if equipped, from bottom of magneto. Inspect the magneto sensor for cracks or physical damage; verify the vent hole is open and free of obstructions; replace on condition.
   CAUTION: The rubber bushings (Figure 12-3) (101) may fall out of the retainer (102) when the magneto is removed from the crankcase. If the bushings fall in the crankcase, retrieve and remove them before advancing to the next step.
6. Carefully remove the magneto (Figure 12-1) (1) from the crankcase, disengaging the drive coupling lugs from the drive bushings. Remove and discard gasket (24).
7. Overhaul the magnetos according to instructions the Ignition System Master Service Manual (X40000) or order replacement magnetos.
Figure 12-1. Continental Motors Ignition System

1 Magneto
2 Magneto Tachometer Sensor
3 Ignition Harness
4 Screw Assembly
5 Nut
6 Lock Washer
7 Mag Hold Washer
8 Nut
9 Lock Washer
10 Gasket
11 Spark Plug Assembly
12 Magneto Filter Assembly
13 Drain, Filter Reducer
14 Hose
15 Hose
16 Hose Clamp
17 Hose
18 Tee
19 Elbow Fitting
20 Clamp
21 Bolt
22 Washer
23 Lock Nut
24 Gasket
25 Bracket
26 Bracket
27 Clamp
12-2.2. Champion (Slick) Ignition System Removal

1. Remove three screws (Figure 12-2) (part of ignition harness) from the cable outlet plate. Remove and discard gasket (not shown).

2. Remove clamps and cable ties and discard the ignition harness (2).

3. Remove clamp (11) and disconnect hose (10) at 90° fitting (15) from magneto.

4. Remove clamps (11) from filter (13) and tee (12). Remove and discard hoses (8, 9, and 10) and the filter (13).

5. Remove nuts (4), lock washers (5), and magneto retainers (6) from either side of magneto.

6. Disconnect magneto sensor (23). Inspect the magneto sensor for cracks or physical damage; verify the vent hole open and free of obstructions; replace on condition.

   CAUTION: The rubber bushings (Figure 12-3) (101) may fall out of the retainer (102) when the magneto is removed from the crankcase. If the bushings fall in the crankcase, retrieve and remove them before advancing to the next step.

7. Carefully remove the magneto (Figure 12-2) (1) from the crankcase, disengaging the drive coupling lugs from the drive bushings.

8. Remove and discard the magneto gasket (3).

9. Replace the magneto with a new magneto or a magneto overhauled according to FAA approved procedures.
Figure 12-2. Champion (Slick) Ignition System

1  Magneto  
2  Ignition Harness  
3  Gasket  
4  Nut  
5  Lock Washer  
6  Mag Hold Washer  
7  Spark Plug Assembly  
8  Hose Assembly  
9  Hose Assembly  
10  Hose Assembly  
11  Hose Assembly  
12  Hose Clamp  
13  Magneto Filter Assembly  
14  Drain, Filter Reducer  
15  Elbow Fitting  
16  Bracket  
17  Screw  
18  Lock Nut  
19  Washer  
20  Cushion Clamp  
21  Reducer Fitting  
22  Magneto Filter Kit  
23  Magneto Tachometer Sensor
12-3. **Accessory Drive Adapter Removal**

1. Carefully slide the drive gear assembly (Figure 12-3) (103), retainer (102), and rubber bushings (101) out of the accessory drive adapter through the crankcase magneto pad opening. Remove and discard the rubber bushings (101).

2. Remove the nuts (115 & 118), lock washers (116 & 119) and washers (117). Remove the accessory drive assemblies (105) from the rear of the crankcase. Discard the lock washers (116 & 119).

3. Remove and discard the gasket (104) and residue from the crankcase and the face of the accessory adapter.

4. Repeat steps 1 through 3 for the second accessory drive adapter.

5. Disassemble the accessory drive adapters according to instructions in Chapter 13.
### Figure 12-3. Accessory Drive Adapter Assembly

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>101</td>
<td>Rubber Bushing</td>
</tr>
<tr>
<td>102</td>
<td>Retainer-Mag Coupling</td>
</tr>
<tr>
<td>103</td>
<td>Magneto Drive Gear</td>
</tr>
<tr>
<td>104</td>
<td>Gasket</td>
</tr>
<tr>
<td>105</td>
<td>Magneto Adapter Assembly</td>
</tr>
<tr>
<td>106</td>
<td>Bushing</td>
</tr>
<tr>
<td>107</td>
<td>Part of 106</td>
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<tr>
<td>108</td>
<td>Stud</td>
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<tr>
<td>109</td>
<td>Oil Seal</td>
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<tr>
<td>110</td>
<td>Accessory Drive Gasket</td>
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<tr>
<td>111</td>
<td>Accessory Cover</td>
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<tr>
<td>112</td>
<td>Plain Washer</td>
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<tr>
<td>113</td>
<td>Lock Washer</td>
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<tr>
<td>114</td>
<td>Nut</td>
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<tr>
<td>115</td>
<td>Nut</td>
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<tr>
<td>116</td>
<td>Lock Washer</td>
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<tr>
<td>117</td>
<td>Plain Washer</td>
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<tr>
<td>118</td>
<td>Nut</td>
</tr>
<tr>
<td>119</td>
<td>Lock Washer</td>
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</tbody>
</table>

*NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.*
12-4. Wastegate Controller Removal

12-4.1. TSIO-550-B, C, E & G Wastegate Controller Removal

1. Disconnect the oil supply hose (Figure 12-4) (36) from the inboard oil cooler fitting and the wastegate (18) oil inlet fitting.

2. Disconnect the oil return hose (35) from between the wastegate (18) oil outlet fitting and the wastegate controller (22) oil inlet fitting.

3. Disconnect the oil return hose (34) from wastegate controller (22) oil drain fitting and the fitting on the rear of the crankcase.

4. Remove and discard the deck pressure hose (Figure 12-5) (11) between the throttle body and the controller.

5. Remove the lock nut (23), washers (22) and bolt (21) securing the mixture support bracket (20), if used, to the bracket (8); discard the lock nut.
6. Remove the manifold pressure tube assembly (10) between the induction manifold and the controller. Place protective plugs in the manifold pressure tube assembly (10) fittings to prevent contamination.

7. Remove the lock nuts (19) and washers (16); Discard the lock nuts (19).

8. Remove the bolts (13) and washers (14) from the controller and remove the controller from the bracket.

9. Remove the bolts (15) from the controller bracket (9) and bracket (8). Remove the grommets (17), spacers (18), and washers (16); discard the grommets (17).

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**Figure 12-5. Wastegate Controller Assembly Detail**

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<td>Controller</td>
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<td>2</td>
<td>Reducer</td>
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<td>3</td>
<td>O-Ring</td>
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<td>Adapter</td>
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<td>5</td>
<td>O-Ring</td>
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<td>Adapter Fitting</td>
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12-4.2. TSIO-550-K Wastegate Controller Removal

NOTE: The TSIO-550-K Wastegate Controller is aircraft mounted. The controller should be removed from the aircraft prior to engine removal. If the wastegate controller was not disconnected and removed prior to engine removal, disconnect and remove it now.

1. Disconnect the oil supply hose (Figure 12-6) (36) from the inboard oil cooler fitting and the wastegate (18) oil inlet fitting.

2. Disconnect the oil return hose (35) from between the wastegate (18) oil outlet fitting and the wastegate controller (22) oil inlet fitting.

3. Disconnect the oil return hose (34) from wastegate controller (22) oil drain fitting and the fitting on the rear of the crankcase.

Figure 12-6. Wastegate Controller Lubrication

NOTE: See Figure 12-20 for legend
4. Discard the hoses (34, 35 & 36).

5. Remove and discard the deck pressure hose assemblies (Figure 12-7) (8 & 15) between the throttle body, bulkhead fittings, and controller.

6. Remove and discard the manifold pressure hose assemblies (9 & 14) between the induction manifold, bulkhead fittings, and the controller.

7. Remove the controller (22) from the aircraft according to the aircraft manufacturer’s instructions.

8. Disassemble the wastegate controller according to instructions in Section 13-4.

Figure 12-7. Wastegate Controller Assembly

12-4.3. TSIO-550-N Wastegate Controller Removal

NOTE: The TSIO-550-N Wastegate Controller is aircraft mounted. The controller should be removed from the aircraft prior to engine removal. If the wastegate controller was not disconnected and removed prior to engine removal, disconnect and remove it now.

1. Disconnect the oil supply hose (Figure 12-8) (36) from the inboard oil cooler fitting and the wastegate (18) oil inlet fitting.

2. Disconnect the oil return hose (35) from between the wastegate (18) oil outlet fitting and the wastegate controller (22) oil inlet fitting.

3. Disconnect the oil return hose (34) from wastegate controller (22) oil drain fitting and the fitting on the rear of the crankcase.

![Diagram of Wastegate Controller Lubrication](image)

**Figure 12-8. Wastegate Controller Lubrication**

See Figure 12-20 for legend
4. Discard the hoses (34, 35 & 36).

5. Remove and discard the deck pressure hose assemblies (Figure 12-9) (8 & 15) between the throttle body, bulkhead fittings, and controller.

6. Remove and discard the manifold pressure hose assemblies (9 & 14) between the induction manifold, bulkhead fittings, and the controller.

7. Remove the controller (22) from the aircraft according to the aircraft manufacturer’s instructions.

8. Disassemble the Wastegate controller according to instructions in Section 13-4.
12-5. Fuel Injection System Removal

Refer to the removal instructions applicable to the subject engine model.

12-5.1. TSIO-550-B, C & E Fuel Injection System Removal

**WARNING**

Prohibit ignition sources within the work area when fuel lines are open. Work with clean hands, tools, and shop towels.

1. Tag the corresponding cylinder number on each respective fuel injection tube (Figure 12-10) (11 through 16) to ensure correct identification and connection to the appropriate cylinder.

2. Remove the tube clamp assemblies (Figure 12-16) (25 & 28) from the brackets (26 & 27) holding the fuel tubes (Figure 12-10) (11 through 16).

**WARNING**

Fuel injection lines must not be bent or deformed. Discard and replace bent, chafed, or deformed fuel injection lines.

3. Place a wrench on the fuel injector body to hold the injector in place. Loosen the fuel tube (11 through 16) “B” nuts from each fuel injector (17A-F) to disconnect the fuel line from the fuel injector nozzle.

   NOTE: Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

4. Place a small container beneath the fuel line to collect fuel; disconnect the fuel lines (11 through 16) from the manifold valve assembly (4).

5. Disconnect and remove the fuel hose (9) between the fuel pump (3) outlet fitting and throttle and metering assembly inlet fitting; discard the fuel hose (9).

6. Remove the nuts (6), washers (5), and hold down washers (7) from the fuel pump (3).

7. Remove the fuel pump (3) and fuel pump gasket (20); discard the fuel pump gasket (20).

8. Remove crankshaft drive coupling (2) from the fuel pump.

*Procedure continues after Figure 12-10 and index*
Figure 12-10. Fuel Injection System

1. Fuel Injection Kit
2. Crankshaft Gear Coupling
3. Fuel Pump Assembly
5. Lock Washer
6. Nut
7. Hold Down Washer
8. Throttle & Metering Assembly
9. Hose Assembly
10. Hose Assembly
11. Fuel Inj. Tube Assembly #1
12. Fuel Inj. Tube Assembly #2
13. Fuel Inj. Tube Assembly #3
14. Fuel Inj. Tube Assembly #4
15. Fuel Inj. Tube Assembly #5
16. Fuel Inj. Tube Assembly #6
17A. Injector Nozzle #1
17B. Injector Nozzle #2
17C. Injector Nozzle #3
17D. Injector Nozzle #4
17E. Injector Nozzle #5
17F. Injector Nozzle #6
17G. Injector Nozzle Kit
18. Washer
19. O-Ring
20. Fuel Pump Adapter Gasket
9. Disconnect the air reference lines (Figure 12-11) (16, 17 & 18) from the throttle body fittings.

10. Loosen the “B” nut and separate the left side air reference tubes (16 and 18). Discard the compression seal (46). Place protective caps on the open ends of the fuel injection tube assemblies (Figure 12-10)(11 through 16).

11. Loosen air reference sleeve “B” nuts and slide reference sleeves (Figure 12-11) (21) off the injector nozzles (Figure 12-10) (17).

12. Remove compression seals (Figure 12-11) (24) and washers (22 and 23) from air reference sleeves (21) and discard the seals (24) and washers (22 and 23). Inspect the reference sleeves for physical damage; note replacement requirements on the overhaul checklist.

13. Inspect the fuel injection tubes (Figure 12-10) (11 through 16) for deformities, bends or chafing. Discard deformed, bent, or chafed tubing and note replacement requirements on the Engine Overhaul Inspection Checklist.

WARNING
When removing the fuel injector in the next step, use great care to avoid introducing contaminants into the fuel system.

14. Remove the fuel injector nozzles (17A-F) from the cylinders with Ideal Aviation Part No. 8167-IA Injector Nozzle Removal/Installation Tool. Discard all fuel injector nozzles (Figure 12-10) (17A-F) - they will be replaced during engine assembly.
NOTE: Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

15. Disconnect the primer tube assembly (Figure 12-12) (8) from the elbow on top of the induction manifold and the elbow (7) on the diverter valve.

16. Disconnect the fuel inlet tube (Figure 12-12) (5) from the fuel manifold valve inlet fitting and the diverter valve outlet fitting (4).

17. Remove the metering unit tube (3) from the throttle fuel metering unit and the fitting (2) on the bottom of the diverter valve (1). Loosen the clamp (9) securing the diverter valve (1) and discard and diverter valve.

Figure 12-12. Fuel Priming System

1 Diverter Valve
2 Street Elbow
3 Metering Unit Tube
4 Elbow
5 Manifold Valve Inlet Tube
6 Reducer Bushing
7 Elbow
8 Primer Tube Assembly
9 Hose Clamp
12-5.2. TSIO-550-G Fuel Injection System Removal

**WARNING**

Prohibit ignition sources within the work area when fuel lines are open. Work with clean hands, tools, and shop towels.

1. Tag the corresponding cylinder number on each respective fuel injection tube (Figure 12-14) (11 through 16) to ensure correct identification and connection to the appropriate cylinder.

2. Remove the tube clamp assemblies (Figure 12-15) (25 & 28) from the brackets (26 & 27) holding the fuel tubes (Figure 12-14) (11 through 16).

3. Place a wrench on the fuel injector body to hold the injector in place. Loosen the injection tube assembly (11 through 16) “B” nuts from each fuel injector (17A through 17F); disconnect the fuel tubes from the fuel injector nozzles.

4. Place a small container beneath the fuel line to collect fuel; disconnect the injection tube assemblies (11 through 16) from the manifold valve assembly (4).

5. Disconnect the air reference lines (Figure 12-11) (16, 17 & 18) from the throttle body fittings.

6. Loosen the “B” nut and separate the left side air reference tubes (16 & 18). Discard the compression seal (46). Place protective caps on the open ends of the fuel injection tube assemblies (11 through 16).

7. Loosen the air reference sleeve “B” nuts and slide the air reference sleeves (21) off the injector nozzles (Figure 12-14) (17 A-F).

8. Remove compression seals (Figure 12-11) (24) and washers (22 & 23) from air reference sleeves (21) and discard the seals (24) and washers (22 & 23). Inspect the reference sleeves for physical damage; note replacement requirements on the overhaul checklist.

![Figure 12-11 repeated for reference](image)
9. Inspect the fuel injection tubes (Figure 12-13) (11 through 16) for deformities, bends or chafing. Discard deformed, bent, or chafed tubing and note replacement requirements on the Engine Overhaul Inspection Checklist.

10. Remove the fuel injector nozzles (17A-F) from the cylinders with Ideal Aviation Part No. 8167-1A Injector Nozzle Removal/Installation Tool. Discard all fuel injector nozzles (17A-F) - they will be replaced during overhaul.
NOTE: Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

11. Disconnect the tube assembly (21) connected between the fuel manifold valve assembly (4) and the throttle and metering assembly (8).

12. Remove and discard the fuel hose (9) between the throttle and metering assembly (8) fuel inlet fitting and the fuel pump (3) fuel outlet fitting.

13. Disconnect and discard the air reference hose (10) between the fuel pump air reference input fitting (3) and the 1-3-5 side of the throttle and metering assembly (8).

14. Remove the nuts (6), washers (5), and hold down washers (7) from the fuel pump (3).

15. Remove the fuel pump (3) and fuel pump gasket (20). Discard the fuel pump gasket (22).

16. Remove and discard the crankshaft drive coupling (2) from the fuel pump.
Figure 12-13 repeated for reference
12-5.3. TSIO-550-K & N Fuel Injection System Removal

**WARNING**

Prohibit ignition sources within the work area when fuel lines are open. Work with clean hands, tools, and shop towels.

1. Tag the corresponding cylinder number on each respective fuel injection tube (Figure 12-14) (11 through 16) to ensure correct identification and connection to the appropriate cylinder.

2. Remove the tube clamp assemblies (Figure 12-16) (25 & 28) from the brackets (26 & 27) holding the fuel tubes (Figure 12-14) (11 through 16).

3. Place a wrench on the fuel injector body to hold the injector in place. Loosen the injection tube assembly (11 through 16) “B” nuts from each fuel injector (17A through 17F); disconnect the fuel tube assembly from the fuel injector nozzle.

4. Place a small container beneath the fuel line to collect fuel; disconnect the injection tube assemblies (11 through 16) from the manifold valve assembly (4).

5. Disconnect the air reference lines (Figure 12-11) (16, 17 & 18) from the throttle body fittings.

6. Loosen the “B” nut and separate the left side air reference tubes (16 and 18). Discard the compression seal (46). Place protective caps on the open ends of the fuel injection tube assemblies (11 through 16).

7. Loosen the air reference sleeve “B” nuts and slide the air reference sleeves (21) off the injector nozzles (Figure 12-14) (17 A-F).

8. Remove compression seals (Figure 12-11) (24) and washers (22 and 23) from air reference sleeves (21) and discard the seals (24) and washers (22 and 23). Inspect the reference sleeves for physical damage; note replacement requirements on the overhaul checklist.
9. Inspect the fuel injection tubes (Figure 12-14) (11 through 16) for deformities, bends or chafing. Discard deformed, bent, or chafed tubing and note replacement requirements on the Engine Overhaul Inspection Checklist.

10. Remove the fuel injector nozzles (17A-F) from the cylinders with Ideal Aviation Part No. 8167-IA Injector Nozzle Removal/Installation Tool. Discard all fuel injector nozzles (17A-F) - they will be replaced during overhaul.
NOTE: Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

11. Disconnect the tube assembly (21) connected between the throttle and metering assembly (8) fuel outlet fitting and fuel manifold valve (4) inlet fitting.

12. Remove and discard the fuel hoses (9, 27 & 29) between the throttle and metering assembly (8) inlet fitting and the fuel pump (3) outlet fitting.

13. Disconnect and discard the air reference hoses (10 & 22) between the fuel pump (3) air reference input fitting and the 1-3-5 side of the throttle and metering assembly (8)

14. Remove the nuts (6), washers (5), and hold down washers (7) from the fuel pump (3).

15. Remove the fuel pump (3) and fuel pump gasket (20) from the crankcase; discard the fuel pump gasket (20).

16. Remove and discard the crankshaft drive coupling (2) from the fuel pump.
Figure 12-14 repeated for reference
12-6. Induction System Removal

1. Loosen the clamps (Figure 12-15 & Figure 12-16) (42) and disconnect hoses (40) from the throttle body and aftercoolers (34). Remove the FWD induction tubes (38 and 39); discard hoses (40).

2. Loosen clamps (43) and disconnect the hoses (41) from aftercoolers (34) and turbochargers. Remove the AFT induction tubes (44 & 45); discard hoses (41).

3. Remove the aftercoolers (34) from the engine.

4. Remove (four each) screws (19), lock washers (14) and washers (13) connecting the throttle body to the manifold (1); discard the lock washers (14) and gasket (2).

5. Remove the nuts (15), lock washers (14) and washers (13) from the induction manifold flanges (12) on all cylinders; discard the lock washers (14).

6. Disconnect the throttle body from the crankcase backbone and remove the throttle body from the engine.

7. Lift and remove the induction manifold (1) with induction tubes (3-8) from the engine.

Figure 12-15. Induction Assembly

---

Engine Disassembly

12-6. Induction System Removal

1. Loosen the clamps (Figure 12-15 & Figure 12-16) (42) and disconnect hoses (40) from the throttle body and aftercoolers (34). Remove the FWD induction tubes (38 and 39); discard hoses (40).

2. Loosen clamps (43) and disconnect the hoses (41) from aftercoolers (34) and turbochargers. Remove the AFT induction tubes (44 & 45); discard hoses (41).

3. Remove the aftercoolers (34) from the engine.

4. Remove (four each) screws (19), lock washers (14) and washers (13) connecting the throttle body to the manifold (1); discard the lock washers (14) and gasket (2).

5. Remove the nuts (15), lock washers (14) and washers (13) from the induction manifold flanges (12) on all cylinders; discard the lock washers (14).

6. Disconnect the throttle body from the crankcase backbone and remove the throttle body from the engine.

7. Lift and remove the induction manifold (1) with induction tubes (3-8) from the engine.

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8. Remove and discard the gaskets (11) from the cylinder intake manifold flanges.

9. Disassemble the Induction System according to instructions in Section 13-3.

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**Figure 12-16. Induction System**

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12-7. Air/Oil Separator Removal

NOTE: An air/oil separator is required for crankcase ventilation. In some instances, the air/oil separator is provided by the aircraft manufacturer. Refer to the aircraft manufacturer’s instructions for air/oil separator removal instructions in those instances.

Figure 12-17 and Figure 12-18 depicts the overboard drain hose connected to the left tailpipe. Some aircraft route the drain to a drain manifold instead of the tailpipe. Refer to the “Engine Installation Drawings” in Section 5-4 or the aircraft maintenance manual to determine proper hose routing.

1. Loosen and remove the hose (Figure 12-17 or Figure 12-18) (7) between the air/oil separator and oil scavenge pump. Discard the hose (7).
2. Remove four hose clamps (4 & 6).
3. Remove the breather hose (3) and drain hose (5) and discard.
4. Remove the air/oil separator (1) from the aircraft bracket according to the aircraft manufacturer's instructions.
Figure 12-18. Crankcase Ventilation Hose Routing

1. Air/Oil Separator Assembly
2. 90°Elbow Fitting
3. Hose Assembly
4. Hose Clamp
5. Hose Assembly
6. Hose Clamp
7. Hose
12-8. Turbocharger and Exhaust System Removal
12-8.1. TSIO-550-B, C, E, & G Turbocharger and Exhaust System Removal

1. Loosen, remove, and discard the hose (Figure 12-19) (13) between the left turbocharger (2) and the tee (16).

2. Loosen and remove the tee (16), check valve (17), and hose (15). Discard the check valve (17) and hose (15).

3. Disconnect the hose (14) from the right turbocharger (1). Discard the hose (14).

4. Loosen and separate the tee (21) from the hoses (18, 19, and 20).

5. Disconnect the hoses (18 and 19) from the left and right oil reservoirs (3 and 4). Discard the hoses (18, 19, and 20).
6. Remove the V-band clamps (Figure 12-20) (16) from the tailpipe (14 or 15) (or optional heater, if so equipped). Discard the v-band clamps (16).

![Composite Turbocharger and Exhaust Diagram]

**Figure 12-20. Composite Turbocharger and Exhaust**

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<td>Bracket</td>
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</table>
Engine Disassembly

NOTE: The Oil Supply Hose (36) was removed and discarded in Section 12-4.1 or Section 12-4.2.

7. Disconnect, remove and discard the hoses (34 & 36).

8. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and left tailpipe (14); discard the lock nuts (21). Separate the left tailpipe (14) from the wastegate assembly (18) and discard the gasket (17).

9. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and transition (9); discard the lock nuts (21).

10. Remove the bolt (12), lock nut (13), and bushing (10) from the tie rod (11). Discard the lock nut (13). Remove the transition (9) and crossover pipe (8) from the transitions (5 & 6).

11. Remove the bolts (31), washers (32) and lock nuts (33) from the turbo support brackets (29 & 30).

12. Remove the bolts (26), washers (27), and lock nuts (28) from the turbochargers (24) and transitions (5 & 6). Separate the turbochargers from the transition tubes (5 & 6); remove and discard the gaskets (23).

13. Remove and discard the lock nuts (21) from each exhaust flange.

14. Remove elbows (1 & 2), tees (3 & 4), transitions (5 & 6), risers (7) and turbochargers (24) from the cylinders.

15. Remove and discard the exhaust flange gasket (25) from each cylinder.

16. Store the Turbocharger and Exhaust System in a clean location until disassembly in Section 13-4.
Figure 12-20 repeated for reference
12-8.2. TSIO-550-K Turbocharger and Exhaust System Removal

1. Loosen, remove, and discard the hose (Figure 12-21) (13) between the left turbocharger and the tee (16).

2. Loosen and remove the tee (16), filter assembly (22), check valve (17), and hose (14). Discard the check valve (17), filter assembly (22), and hose (17).

3. Disconnect the hose (14) from the right turbocharger (1). Discard the hose (14).

4. Loosen and separate the tee (21) from the hoses (18, 19, and 20).

5. Disconnect the hoses (19 and 15) from the left and right oil reservoirs (8 and 9). Discard the hoses (15, 19, and 21).

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**Figure 12-21. Turbocharger Lubrication Hose Routing**

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<td>Bolt</td>
</tr>
<tr>
<td>11</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>12</td>
<td>Elbow Fitting</td>
</tr>
<tr>
<td>13</td>
<td>Hose</td>
</tr>
<tr>
<td>14</td>
<td>Hose</td>
</tr>
<tr>
<td>15</td>
<td>Hose</td>
</tr>
<tr>
<td>16</td>
<td>Tee Fitting</td>
</tr>
<tr>
<td>17</td>
<td>Check Valve</td>
</tr>
<tr>
<td>18</td>
<td>Hose</td>
</tr>
<tr>
<td>19</td>
<td>Hose</td>
</tr>
<tr>
<td>20</td>
<td>Hose</td>
</tr>
<tr>
<td>21</td>
<td>Tee Fitting</td>
</tr>
<tr>
<td>22</td>
<td>Check Valve Filter Assy</td>
</tr>
</tbody>
</table>
6. Remove the V-band clamps (Figure 12-22) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).

7. Disconnect, remove and discard the oil supply and return hoses (34, 35 & 36).

NOTE: The Wastegate Controller Oil Supply and Return Hoses (34 & 35) was removed and discarded in Section 12-4.2.
Engine Disassembly

8. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and left tailpipe (14); discard the lock nuts (21). Separate the left tailpipe (14) from the wastegate assembly (18) and discard the gasket (17).

9. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and transition (9); discard the lock nuts (21).

10. Remove the bolt (12), lock nut (13), and bushing (10) from the tie rod (11). Discard the lock nut (13). Remove the transition (9) and crossover pipe (8) from the transitions (5 & 6).

11. Remove the screws (31), washer (32) and lock nuts (33) from the turbo support brackets (29 & 30).

12. Remove the bolts (26), washers (27), and lock nuts (28) from the turbochargers (24) and transitions (5 & 6). Separate the turbochargers from the transition tubes (5 & 6); remove and discard the gaskets (23).

13. Remove and discard the lock nuts (21) from each exhaust flange.

14. Remove elbows (1 & 2), tees (3 & 4), transitions (5 & 6), risers (7) and turbochargers (24) from the cylinders.

15. Remove and discard the exhaust flange gasket (25) from each cylinder.

16. Store the Turbocharger and Exhaust System in a clean location until disassembly in Section 13-4.
Figure 12-22 repeated for reference
Engine Disassembly

12-8.3. TSIO-550-N Turbocharger and Exhaust System Removal

1. Loosen, remove, and discard the hose (Figure 12-23) (13) between the left turbocharger and the tee (16).

2. Loosen and remove the tee (16), check valve (17), filter (22) and hose (15). Discard the check valve (17), filter (22), and hose (15).

3. Disconnect the hose (14) from the right turbocharger (1). Discard the hose (14).

4. Loosen and separate the tee (21) from the hoses (18, 19, and 20).

5. Disconnect the hoses (18 and 19) from the left and right oil reservoirs (3 and 4). Discard the hoses (18, 19, and 20).

See Figure 12-21 for parts index
6. Remove the V-band clamps (Figure 12-24) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).
Engine Disassembly

NOTE: The Wastegate Controller Oil Supply and Return Hoses (34 & 35) was removed and discarded in Section 12-4.2.

7. Disconnect, remove and discard the oil supply and return hoses (34, 35 & 36).

8. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and left tailpipe (14); discard the lock nuts (21). Separate the left tailpipe (14) from the wastegate assembly (18) and discard the gasket (17).

9. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and transition (9); discard the lock nuts (21).

10. Remove the bolt (12), lock nut (13), and bushing (10) from the tie rod (11). Discard the lock nut (13). Remove the transition (9) and crossover pipe (8) from the transitions (5 & 6).

11. Remove the bolts (31), washers (32) and lock nuts (33) from the turbo support brackets (29 & 30).

12. Remove four lock nuts (28), washers (27) and bolts (26) from the left turbo transition (5 or 6) and turbocharger (24) mounting flanges and support bracket (29 or 30); discard the lock nuts (28).

13. Remove and discard the lock nuts (21) from each exhaust flange.

14. Remove elbows (1 & 2), tees (3 & 4), transitions (5 & 6), risers (7) and turbochargers (24) from the cylinders.

15. Remove and discard the exhaust flange gasket (25) from each cylinder.

16. Store the Turbocharger and Exhaust System in a clean location until disassembly in Section 13-4.
Figure 12-24 repeated for reference
Engine Disassembly

12-9. Oil Cooler Removal

NOTE: The oil cooler is to be disassembled, cleaned, overhauled, and re-assembled by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station). No structural repairs are allowed on the oil cooler. Replace any cooler that has structural damage or bent, broken, or cracked cooling fins with a new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange are permitted only by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station).

NOTE: The TSIO-550-C oil cooler fittings may be configured as depicted in Figure 12-25 or Figure 12-26. Consult the engine illustrated parts catalog to determine the appropriate configuration of the engine model specification and follow the applicable disassembly instructions.

12-9.1. TSIO-550-B, C, E & G Oil Cooler Removal

1. Remove the flanged nuts (Figure 12-25) (13) and lock washers (12) from the lower forward crankcase studs. Discard the lock washers (12).

2. Remove the nut (9) lock washer (8) and washer (7) from the lower aft studs. Discard the lock washer (8).

3. Remove the nut (11) washer (10) and gaskets (4) from the upper studs; discard the gaskets (4).

4. Remove the oil cooler (1) from the crankcase.

5. Remove the bracket (shadowed) from the crankcase studs.

6. Remove the gaskets (2) and spacer (3); discard the gaskets (2).

7. Remove the reducer bushing (18), adapter fitting (19), tee (20), and cap (19) from the outboard port at the aft side of the oil cooler.

8. Remove the elbow fitting (17) and adapter fitting (21) from the upper inboard port at the aft side of the oil cooler.

9. Remove the plug (5) from the port adjacent to the oil temperature control valve (14).

   CAUTION: Oil temperature control valve specifications differ based on the end application. Note the part number of the oil temperature control valve at the time of removal and verify using the illustrated parts catalog to ensure proper replacement part.

10. Remove the oil temperature control valve (14) and gasket (15); discard the gasket (15).

11. Place the oil cooler in a clean, protected area until it is overhauled.
Figure 12-25. Oil Cooler

1 Oil Cooler Assembly
2 Gasket
3 Spacer
4 Gasket-Washer
5 Plug
6 Baffle
7 Washer
8 Lock Washer
9 Nut
10 Washer
11 Nut
12 Lock Washer
13 Flanged Nut
14 Oil Temp. Control Valve
15 Gasket
16 Adapter
17 Elbow Fitting
18 Reducer Bushing
19 Adapter Fitting
20 Tee Fitting
21 Cap
22 Stud

*ITEM 14 INCLUDES ITEM 15*
12-9.1.1. TSIO-550-C Oil Cooler Removal

**WARNING**

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent and oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

NOTE: The TSIO-550-C5, C7, C9, C10, C11, C12, C13, C17, C18, C19, C20 and C21 engine model specifications used a cross fitting and various adapter fittings of differing sizes to mate with accessories and sensors.

1. Remove the flanged nuts (Figure 12-26) (13) and lock washers (12) from the lower forward crankcase studs. Discard the lock washers (12).
2. Remove the nut (9) lock washer (8) and washer (7) from the lower aft studs. Discard the lock washer (8).
3. Remove the nut (11) washer (10) and gaskets (4) from the upper studs; discard the gaskets (4).
4. Remove the oil cooler (1) from the crankcase.
5. Remove the bracket (phantom part) from the crankcase studs.
6. Remove the gaskets (2) and spacer (3); discard the gaskets (2).
   NOTE: Consult the engine illustrated parts catalog to determine the most appropriate configuration of the engine model specification and adjust the disassembly instructions accordingly.
7. If CSB15-2 was previously complied with proceed to the next step.
   a. Remove and discard the cross fitting (21), pipe nipple fitting (19) and pipe bushing (18), flared nipple (22) and, if used, bushings (23) from the outboard port at the aft side of the oil cooler. The oil cooler fittings will be reconfigured at overhaul.
   b. Obtain a new cross fitting (27), 45 degree street elbow fitting (24), and flared nipple fitting (28).
8. Remove the 45° elbow fitting (17) and adapter fitting (16) from the upper inboard port at the aft side of the oil cooler.
9. Remove the plug (5) from the port adjacent to the oil temperature control valve (vernatherm) (14).
10. Remove the plug (20) from the lower pressure port.

   **CAUTION:** Oil temperature control valve specifications differ based on the end application. Note the part number of the oil temperature
control valve at the time of removal and verify using the illustrated parts catalog to ensure proper replacement part.

11. Remove the oil temperature control valve (14) and gasket (15); discard the gasket (15).

12. Place the oil cooler in a clean, protected area until it is overhauled.
12-9.2. TSIO-550-K Oil Cooler Removal

WARNING
The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. The TSIO-550-K oil cooler fittings have been reconfigured twice since 2015. Consult the latest revision of CSB15-7 for required corrective action.

1. Remove the (Figure 12-27) screw (22) and washer (23) from the baffle assembly (21). Remove the baffle assembly from the engine and set it aside.

2. Remove the flanged nuts (7) and lock washers (6) from the lower front crankcase studs. Discard the lock washers (6).

3. Remove the nut (10) lock washer (9) and washer (8) from the lower rear stud. Discard the lock washer (9).

4. Remove the nut (12) washer (11) and gaskets (4) from the upper studs. Discard the gaskets (4).

5. Remove the oil cooler (1) from the crankcase.

6. Remove the gasket (3) and any residue from the crankcase flange; discard the gasket (3).

7. If the oil cooler has been reconfigured to omit the cross fitting (24), proceed to step 8. If the oil cooler configuration includes a cross fitting, continue with the next step.
   a. Remove the nipple (25) from the lower port on the cross fitting (24).
   b. Remove the 45 degree fitting (26) and plug (27) from the upper port on the cross fitting (24).
   c. Remove the plug (27) from the aft port on the cross fitting (24).
   d. Discard the cross fitting (24), 45 degree elbow fitting (26), and plugs (27). The oil cooler will be reconfigured at assembly.

8. Remove the reducer (15) and elbow (16) from the inboard oil cooler port.

9. Remove the adapter (17) and cap (18) from the lower port at the rear of the oil cooler.

10. Remove the nipple fitting (19) from the lower oil cooler pressure port.

11. Remove the plug (20) adjacent to the oil temperature control valve (vernatherm) (13).

12. Remove the oil temperature control valve (13) and gasket (14) from the oil cooler; discard the gasket (14).

13. Place the oil cooler in a clean, protected area until it is overhauled.
**Figure 12-27. Oil Cooler**

1. Oil Cooler
2. Baffle
3. Oil Cooler Gasket
4. Gasket-Washer
5. Stud
6. Lock Washer
7. Flanged Nut
8. Washer
9. Lock Washer
10. Nut
11. Washer
12. Oil Cooler Gasket
13. Oil Temp. Control Valve
14. Gasket
15. Adapter Fitting
16. Elbow Fitting
17. Adapter Fitting
18. Cap Assembly
19. Flared Nipple Fitting
20. Plug
21. Baffle Assembly
22. Screw
23. Washer
24. Cross Fitting
25. Flared Nipple Fitting
26. 45° Elbow Fitting
27. Plug

* ITEM 13 INCLUDES ITEM 14
12-9.3. TSIO-550-N Oil Cooler Removal

WARNING

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

1. Remove the (Figure 12-28) screw (24) and washer (25) from the baffle assembly (23). Remove the baffle assembly from the engine and set it aside.
2. Remove the flanged nuts (7) and lock washers (6) from the lower front crankcase studs. Discard the lock washers (6).
3. Remove the nut (10) lock washer (9) and washer (8) from the lower rear stud. Discard the lock washer (9).
4. Remove the nut (12) washer (11) and gaskets (4) from the upper studs. Discard the gaskets (4).
5. Remove the oil cooler (1) from the crankcase.
6. Remove the gasket (3) and any residue from the crankcase flange; discard the gasket (3).
7. If the oil cooler has been reconfigured to omit the cross fitting (19), proceed to step 8. If the oil cooler configuration includes a cross fitting, continue with the next step.
   a. Remove the nipple (20) from the lower port on the cross fitting (19).
   b. Remove the 45 degree fitting (21 and plug (5) from the upper port on the cross fitting (19).
   c. Remove the plug (5) from the aft port on the cross fitting (19).
   d. Discard the cross fitting (19), reducer bushing (17), and adapter (18). The oil cooler will be reconfigured at assembly.
8. Remove the reducer (15) and elbow (16) from the inboard oil cooler port.
9. Remove the plug (5) from the lower pressure oil cooler port.
10. Remove the plug (22) adjacent to the oil temperature control valve (vernatherm) (13).
11. Remove the oil temperature control valve (13) and gasket (14) from the oil cooler; discard the gasket (14).
12. Place the oil cooler in a clean, protected area until it is overhauled.
**Engine Disassembly**

**Figure 12-28. Oil Cooler**

1. Oil Cooler
2. Baffle
3. Oil Cooler Gasket
4. Gasket-Washer
5. Plug
6. Lock Washer
7. Nut
8. Washer
9. Lock Washer
10. Nut
11. Washer
12. Oil Temp. Control Valve
13. Oil Temp. Control Valve
14. Gasket
15. Adapter Fitting
16. Elbow Fitting
17. Pipe Bushing
18. Pipe Nipple Fitting
19. Cross Fitting
20. Flared Nipple Fitting
21. 45° Street Elbow Fitting
22. Plug
23. Baffle Assembly
24. Screw
25. Washer
26. Cross Fitting
27. Stud
12-10. Oil Pump Removal

1. Remove and discard the oil filter (Figure 12-29) (11).

2. Remove the three sets of nuts (8), lock washers (7), and washers (6) from studs securing the oil filter adapter (13).

3. Separate the oil filter adapter (13) and the gasket (12) from the oil pump housing (1).

4. Discard the lock washers (7) and gasket (12).

5. Remove and discard the safety wire from the plug (9). Remove the plug (9) and crush washer (10) from the top of the oil suction tube; discard the crush washer (10).

6. Remove the nuts (5), lock washers (4) and washers (3) from the oil pump assembly cover (1) except at the 6 and 12 o’clock positions; discard the lock washers (3).

7. Remove the oil pump assembly (1) from the crankcase studs.

8. Remove and discard the gasket (2).

9. Store the oil pump in a clean location until disassembly in Section 13-5.

Figure 12-29. Oil Pump

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil Pump Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Oil Pump Gasket</td>
</tr>
<tr>
<td>3</td>
<td>Washer</td>
</tr>
<tr>
<td>4</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>5</td>
<td>Nut</td>
</tr>
<tr>
<td>6</td>
<td>Washer</td>
</tr>
<tr>
<td>7</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>8</td>
<td>Nut</td>
</tr>
<tr>
<td>9</td>
<td>Plug</td>
</tr>
<tr>
<td>10</td>
<td>Gasket</td>
</tr>
<tr>
<td>11</td>
<td>Oil Filter</td>
</tr>
<tr>
<td>12</td>
<td>Gasket</td>
</tr>
<tr>
<td>13</td>
<td>Oil Filter Adapter</td>
</tr>
<tr>
<td>14</td>
<td>Coupling Nut</td>
</tr>
</tbody>
</table>
12-11. Alternator Removal

A direct drive alternator is mounted in the crankcase, forward of the No. 5 cylinder. The engine may also be equipped with a belt-driven alternator, mounted on the front of the 2-4-6 side of the engine. Depending on model specification, a belt-driven alternator may also be installed. Remove the gear driven alternator(s) according to instructions in Section 10-4 of M-0, Standard Practice Maintenance Manual. Instructions to remove the belt-driven alternator are provided in Section 12-11.1.
12-11.1. Belt-Driven Alternator Removal

NOTE: Disconnect the electrical connections from the alternator according to the aircraft manufacturer’s instruction.

1. Remove the safety wire from the pivot screw (Figure 12-30) (4). Loosen the pivot screw (4), upper alternator mounting bolt (9) and the screw (7) securing the alternator (19) to the adjustable brace (15).

2. Remove and discard the V-belt (20) from the alternator sheave (10).

3. Remove the screw (7), lock washer (5) and washer (8) from the alternator and adjustable brace; discard the lock washer (5). Retain shims (27), if used.
4. Remove the nut (2) and washer (3) from the bolt (9). Support the weight of the alternator and remove the upper mounting bolt (9) from the alternator and bracket. Retain shims, if used.

12-11.2. Belt-Driven Alternator Bracket and Drive Sheave Removal

1. Remove the belt-driven alternator according to instructions in Section 12-11.1.

2. Remove the screw (Figure 12-31) (4), lock washer (5), washer (6), adjustable brace (15); discard the lock washer (5).

   **NOTE:** Shims (24) are installed to align the bracket with the contour of the crankcase; the number of shims may be more or less than illustrated.

3. Remove the bolt (21), spacer (23), shims (24), lock washer (25), washers (22), and nut (26). Discard the lock washer (25).

4. Remove the nuts (16) and washers (17) from the crankcase through-bolts.

5. Remove the bracket (1) and spacers (18) from the crankcase through-bolts.

![Figure 12-31. Optional 70 Amp Alternator Bracket Assembly](image)

See Figure 12-30 for index

6. Remove the six bolts (Figure 12-30) (13), washers (14), and nuts (12) from the front drive sheave (10) and adapters (11). Remove the drive sheave (10) and split sheave adapters (11) from the crankshaft.
**12-12. Compressor Mounting Assembly (Optional) Removal**

1. Follow the aircraft manufacturer’s instructions to remove the air conditioning compressor.
2. Turn the tensioning bolt (Figure 12-32) (10) counter-clockwise and relieve belt tension.
3. Remove and discard the compressor drive belt (17).
4. Remove three each bolts and washers (15 and 16).
5. Remove the compressor mounting bracket from the crankcase and set it aside until disassembly in Section 13-11.

---

**Figure 12-32. Optional Air Conditioning Compressor Mount Assembly**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mounting Bracket Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Mounting Bracket</td>
</tr>
<tr>
<td>3</td>
<td>Idler Sheave</td>
</tr>
<tr>
<td>3.01</td>
<td>Ball Bearing</td>
</tr>
<tr>
<td>3.02</td>
<td>Retaining Ring</td>
</tr>
<tr>
<td>4</td>
<td>Block Assembly</td>
</tr>
<tr>
<td>5</td>
<td>Sheave Support Bolt</td>
</tr>
<tr>
<td>6</td>
<td>Spacer</td>
</tr>
<tr>
<td>7</td>
<td>Bolt</td>
</tr>
<tr>
<td>8</td>
<td>Special Washer</td>
</tr>
<tr>
<td>9</td>
<td>Tensioning Bolt</td>
</tr>
<tr>
<td>10</td>
<td>Jam Nut</td>
</tr>
<tr>
<td>11</td>
<td>Rectangular Nut</td>
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<tr>
<td>12</td>
<td>Lock Nut</td>
</tr>
<tr>
<td>13</td>
<td>Plain Washer</td>
</tr>
<tr>
<td>14</td>
<td>Bolt</td>
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<tr>
<td>15</td>
<td>Bolt</td>
</tr>
<tr>
<td>16</td>
<td>Washer</td>
</tr>
<tr>
<td>17</td>
<td>Drive Belt</td>
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<tr>
<td>18</td>
<td>Driver Sheave</td>
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<td>Shim</td>
</tr>
<tr>
<td>20</td>
<td>Shim</td>
</tr>
<tr>
<td>21</td>
<td>Compressor</td>
</tr>
</tbody>
</table>
12-13. Starter and Adapter Removal

1. Remove two nuts (Figure 12-33) (8), lock washers (7) and washers (6) from the crankcase studs at 7 and 11 o’clock (inboard) positions just aft of the #1 cylinder adjacent to the starter mounting flange; discard the lock washers (7).

2. Remove the nuts (8), lock washers (7), washer (6 & 10) from the starter adapter cover at 7 and 9 o’clock positions. Discard the lock washers (7).

3. Remove the starter and starter adapter assembly from the crankcase; discard the gasket (9)

4. Set the starter and starter adapter aside until disassembly in Section 13-6.

---

**Figure 12-33. Starter and Adapter**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th></th>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Starter Motor</td>
<td>5</td>
<td>O-ring</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>Starter Adapter</td>
<td>6</td>
<td>Washer</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Nut</td>
<td>7</td>
<td>Lock washer</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>Washer</td>
<td>8</td>
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</tbody>
</table>

Scavenge Pump with PTO Option
12-14. Oil Sump Removal

NOTE: The oil should have been drained prior to engine removal. The safety wire should have been removed and discarded, and the oil drain plug (8) and copper gaskets (6, 7) were removed with the oil pump. Discard the copper gasket (6, 7).

1. Remove the bolts (Figure 12-34, Figure 12-35 or Figure 12-36) (13 & 15), lock washers (12), and washers (11); discard the lock washers (12).

2. Remove the bracket (15) from the sump rail.

3. Do not pry the oil sump (10) away from the crankcase. Lightly tap the oil sump with a rubber mallet to loosen it from the crankcase; remove the oil sump from the crankcase.

4. Remove and discard the gasket (9) and residue.

5. Remove the nut (5), washers (3 & 4) and bolt (2).

6. Remove the oil suction tube (1) assembly from the crankcase.

7. Remove and discard the copper gaskets (6, 7 & 14).

---

Figure 12-34. Oil Sump

- 1 Oil Suction Tube Assy
- 2 Bolt
- 3 Washer
- 4 Washer
- 5 Nut
- 6 Copper Gasket
- 7 Copper Gasket
- 8 Plug
- 9 Oil Sump Gasket
- 10 Oil Sump
- 11 Washer
- 12 Lock Washer
- 13 Bolt
- 14 Copper Gasket
- 15 Bracket
- 15 Bolt
- 16 Oil Coupling
Figure 12-35. Oil Sump

Figure 12-36. Oil Sump
12-15. Inter-Cylinder Baffle Removal

1. Remove and discard the baffle tie springs (Figure 12-37) (10), if used.

2. Place a hand below the lower baffle assemblies (3 & 5, 3 & 6, 4 & 5) as the bolts are removed from the baffle supports (1 & 2) to avoid damage to the assemblies during disassembly. Remove the bolts (9), washers (7) and baffle supports (1 & 2) from the top of the cylinder baffle assemblies. Remove the lower baffle assemblies (3 & 5, 3 & 6, 4 & 5) as the bolts are removed from the corresponding baffle supports (1 & 2).

3. Remove the screws (8) and washers (7) from the cylinder base baffles (3 & 4) and separate the cylinder base baffles (3 & 4) from the baffle assemblies (5 & 6).

4. Remove the grommet (11), if used.
Figure 12-37. Inter-Cylinder Baffle Assembly

1  Baffle Support
2  Baffle Support
3  Cylinder Base Baffle
4  Cylinder Base Baffle
5  Baffle Assembly
6  Baffle Assembly
7  Washer
8  Screw
9  Bolt
10 Baffle Tie Spring
11 Grommet
Engine Disassembly

12-16. Engine Cylinder Removal

1. Remove the Inter-Cylinder Baffles adjacent to the cylinder being removed according to instructions in Section 12-15.

2. Loosen and remove the cylinder drain tubes (Figure 12-39)(45).

3. Remove the drain tube fitting (16) and drain tube seal (46); discard the drain tube seal (46). SIL00-11 announced a redesigned cylinder drain tube fitting to replace drain tube fitting P/N 632068 for improved cold weather starting characteristics. Verify the tapered end of the drain tube has a nozzle (Figure 12-38) extending into the cylinder. If the cylinder drain terminates at the taper, replace the fittings with the improved nozzle, regardless of condition.

![Figure 12-38. Cylinder Drain Tube Fitting](image)

4. Remove the screws (Figure 12-39) (32), lock washers (31), and washers (30), and rocker covers (29) from all six cylinders; discard the lock washers (31).

5. Remove and discard the six rocker cover gaskets (28).

6. Position the crankshaft so the piston is at top dead center and both intake and exhaust valves of the cylinder to be removed are closed.

7. Bend the tab on the tab washers (26) down and remove the screws (27), tab washers (26) and retainers (25). Discard the tab washers (26).

   **NOTE:** The exhaust rocker arms were modified in 2016 to add additional oil feed hole. If the exhaust rocker arms exhibit only one oil feed hole, discard the exhaust rocker arms and replace with the current design.

8. Remove the intake and exhaust rocker arms (19 & 20), rocker shaft (24), thrust washers (23) and retainer (25) from the cylinder. Discard the rocker shafts (24) and thrust washers (23).

9. Withdraw all of the push rod assemblies (40) from their respective housings (35).

10. Repeat steps 6-9 for the remaining cylinders.

11. Grasp each push rod housing (35) and push it inward toward the crankcase, compressing the push rod housing spring (39); lower the outboard end of the pushrod housing away from the cylinder and remove the push rod housing (35), push rod housing springs (39), washers (36), O-ring seals (37), and packing (38). Discard the O-ring seals (37), packing (38), and springs (39). Repeat this step for the remaining push rod housings.

12. Rotate the engine stand to invert the engine.
13. Remove the hydraulic tappets (54 & 55) by rotating the camshaft to push (use either your finger or a non-ferrous metal (copper, brass) wire) the hydraulic tappets above the crankcase tappet bores. Discard the hydraulic tappets.

14. Rotate the crankshaft until the piston in the cylinder to be removed is at the top dead center position.

15. Using the appropriate wrenches, carefully remove flange nuts (41, 42, & 49) from the cylinder base flange and seventh stud locations.
16. As the last pieces of fastening hardware are being removed, cradle the cylinder in your arm to support the cylinder.

17. Remove the 7th stud brackets (47 & 48). Note that the piston can drop and damage the crankcase if care is not used in step 18 when the cylinder is withdrawn.

18. While supporting the cylinder, carefully and slowly pull the cylinder outward in a straight plane while keeping your other hand free to catch the piston as the cylinder is withdrawn to prevent piston or crankcase damage.

19. Remove and discard the piston pin & plug assembly (Figure 12-40) (6), piston (1) and piston rings (2 through 5).

![Diagram of piston, piston pin, and rings]

Figure 12-40. Piston, Piston Pin and Rings

1 Piston 3 Compression Ring 5 Scraper Ring
2 Compression Ring 4 Oil Control Ring 6 Piston Pin

Procedure continues on next page...
20. Remove the cylinder base O-ring (Figure 12-39) (50).

21. Install the cylinder base O-ring (50) in a figure “8” pattern (Figure 12-41) around the cylinder deck studs and connecting rod for support.

![Figure 12-41. Cylinder Base O-Ring used to Support the Connecting Rods](image)

22. Place the cylinder upright on a work bench.

23. Repeat steps 17 through 22 to remove and prepare the remaining cylinders for overhaul.

24. Place the cylinders in a clean, protected area until disassembly in Section 13-7.
Engine Disassembly

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Chapter 13. Component Disassembly

13-1. Ignition System

At engine overhaul, magnetos must be replaced with new units or units overhauled according to FAA approved procedures. For Continental (Bendix) magnetos, refer to the S-20/S-200 Series Magneto Service Support Manual (X42002) for applicable overhaul instructions. Replace non-Continental magnetos during overhaul.
Component Disassembly

13-2. Fuel Injection System

Continental Motors does not provide overhaul instructions for the fuel pump, manifold valve, throttle or mixture control assembly due to the precise calibration requirements after assembly. We offer new and rebuilt fuel pump assemblies, manifold valves, throttle assemblies and mixture control assemblies, or the assemblies may be rebuilt by an FAA Part 145 Repair Station authorized to overhaul the assemblies. Check for evidence of leakage or wear; clean, inspect, and replace the remaining fuel injection system parts according to the overhaul instructions in this and subsequent chapters of this manual.

NOTE: New and factory rebuilt and fuel injection system components which meet new part specifications are available from Continental Motors. Continental Motors does not control FAA Part 145 Repair Station activities; verify the repair station qualifications before contracting fuel injection system overhaul. Fuel injection system overhaul must be accomplished under carefully controlled conditions per approved procedures in compliance with FAA regulations.

Fittings selection and orientation differs significantly between engine model specifications for fuel pumps, manifold valves, throttle bodies, mixture control assemblies and priming assemblies. Using the illustration in Figure 13-1 as a guide, record the orientation of the fitting in relationship to the bore prior to removal. Refer to the recorded fitting orientation during assembly.
Second Fitting Orientation
When first fitting is straight, first fitting orientation applies to the second fitting

Figure 13-1. Fitting Orientation Guide
13-3. Induction System Disassembly

1. Remove and discard the hose clamp assemblies (Figure 13-2 or Figure 13-3) (10), and hoses (20) from the induction tubes (3 through 8) and manifold (1).

2. Loosen hose clamps (37); remove venturi nozzles (35) and hoses (36). Discard hoses (36) and clamps (37).

3. Remove the bolts (31), lock nuts (33) and washers (32) from the induction tube; discard the lock nuts (33). Remove the overboost valve (29) and o-ring (30); discard the o-ring (30).

NOTE: Aftercoolers must be disassembled, cleaned, overhauled, and assembled by an appropriately rated FAA Part 145 approved repair station (or foreign government equivalent). No aftercooler structural repairs are permitted. Replace any aftercooler exhibiting structural damage, bent/broken, or cracked cooling fins. Weld repairs to the aftercooler mounting flange are permitted only by an appropriately rated FAA Part 145 approved repair station.

Figure 13-2. Induction System
## Component Disassembly

**Figure 13-3. Induction System**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manifold &amp; Fitting Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Gasket</td>
</tr>
<tr>
<td>3</td>
<td>Tube</td>
</tr>
<tr>
<td>4</td>
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<td>Tube</td>
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<tr>
<td>9</td>
<td>Hose</td>
</tr>
<tr>
<td>10</td>
<td>Hose Clamp</td>
</tr>
<tr>
<td>11</td>
<td>Intake Manifold Gasket</td>
</tr>
<tr>
<td>12</td>
<td>Flange</td>
</tr>
</tbody>
</table>

37 | Clamp |
38 | 1-3-5 FWD Induction Tube |
39 | 2-4-6 FWD Induction Tube |
40 | Hose |
41 | Hose |
42 | Clamp Assembly |
43 | Clamp Assembly |
44 | 1-3-5 AFT Induction Tube |
45 | 2-4-6 AFT Induction Tube |
46 | Compression Seal |
Component Disassembly

NOTE: Take a photograph or make a sketch the induction manifold fitting location and orientation using the illustration in Figure 13-1 and Figure 13-4 as guides, prior to manifold disassembly. Refer to the recorded fitting orientation during component assembly.

4. Remove the fittings (Figure 13-5) (3 through 6 and 10 through 12, as applicable) from the induction manifold (1) ports (Figure 13-4) (A through F).

5. Remove, examine, clean, inspect, repair/replace aircraft-supplied induction parts according to the aircraft manufacturer's instructions.

6. Remove the bolts (Figure 13-5) (9), washers (7), and spacers (8) from the 2-4-6 side of the bracket and induction manifold (1). Remove the fuel manifold valve and bracket assembly from the 2-4-6 side of the induction manifold. Prepare the fuel manifold valve for core return or overhaul by a Part 145 Repair Station.

---

**Figure 13-4. Induction Manifold Port Detail**
Figure 13-5. Induction Manifold
13-4. Turbocharger and Exhaust System Disassembly

1. Remove the fittings (Figure 13-6) (3, 5, 6 & 7) and O-rings (2 & 4) from the wastegate controller (1); discard the O-rings (2 & 4).

2. Remove the plug (Figure 13-7) (7), fittings (2, 3 & 4) and O-rings (5 & 6) from the wastegate (1); discard the O-rings (5 & 6).
Figure 13-7. Wastegate Fittings
3. Remove the bolts (Figure 13-8 or Figure 13-9) (10 & 12) and lock washers (9 & 11) from the adapters (5) and oil reservoirs (3 & 4). Discard the lock washers (9 & 11).

4. Remove the gaskets (7 & 8) and gasket residue from the turbocharger hub, adapters (5), and oil reservoirs (3 & 4).

5. Place protective plugs in the wastegate, wastegate controller and turbocharger oil fittings to prevent contamination. Place protective covers over the turbocharger and wastegate flanges to prevent contamination. Store the wastegate, wastegate controller and turbocharger until transport to an FAA Part 145 Repair Station or Continental Motors as a core return.
NOTE: The TSIO-550-N turbocharger lubrication parts the same as the TSIO-550-K except the supply fittings at the oil cooler is different.

Figure 13-9. Turbocharger Lubrication

See Figure 13-8 for parts index
13-5. Oil Pump Disassembly

1. Cut and remove the safety wire (Figure 13-10) (31) from the oil pressure relief valve assembly. Remove the lock nut (14) and copper washer (13) from the adjustment screw (9); discard the lock nut (14) and copper washer (13).

2. Unscrew the oil pressure relief valve assembly housing (11) from the oil pump housing (2). Remove and discard the gasket (10).

3. Remove the seat (8), spring (7), and plunger (6) from the oil pump housing (2) if they remain after removing the oil pressure relief valve assembly from the oil pump housing (2).

4. Discard the gasket (10).

5. Remove the nuts (20), lock washers (19), and washers (18) from the studs at 6 and 12 o'clock. Remove the oil pump cover (16) from oil pump housing (2). Discard the lock washers (19).

6. Remove the drive gear (15) and driven gear assemblies (4) from the oil pump housing (2).
13-6. Starter and Starter Adapter Disassembly

TSIO-550 starter adapters are fitted with a scavenge pump. Some engine models use a scavenge pump with a drive sheave for an external accessory drive, others do not have a drive sheave. Field repairs/overhaul on starter adapters with a scavenge pump and no accessory (PTO) drive shaft are prohibited. Instructions in this section apply only to the starter adapter with accessory drive sheave. If the starter adapter has no drive sheave, it must be replaced at overhaul.
Component Disassembly

13-6.1. Starter Adapter with Scavenge Pump and Accessory Drive Disassembly

NOTE: If the starter adapter has no PTO drive shaft extending outside the scavenge pump housing, starter adapter overhaul is prohibited; starter adapters with no PTO drive shaft must be replaced at overhaul.

1. Remove the retaining ring (Figure 13-11) (9) from the starter adapter housing with retaining ring pliers; discard the retaining ring (9).

2. Clamp the starter shaft gear (16) teeth in shielded vise jaws to prevent the worm drive assembly from turning.

   CAUTION: Do not clamp the starter adapter housing (1) in a vise.

3. Insert a Worm Shaft Tool (illustrated in “Special Tools” section of Chapter 2 of M-0, Standard Practice Maintenance Manual) into the slot of the worm drive shaft (4). Rotate the worm drive shaft (4) counter-clockwise to dislodge the bearing (8) from the adapter housing (1). (An arbor press may be required to remove the bearing (8) from the worm drive shaft (4)).

4. If possible, remove the entire shaft assembly (4, 5, 6, 7, & 8) from the adapter housing (1). Otherwise, remove components after removing the shaft (4). Separate the worm gear (7), spring (6), woodruff key (5), and shaft (4). Discard the bearing (8), woodruff key (5), and spring (6).

5. Use a 12-point deep socket, remove and discard the self-locking 12-point nut (49).

6. Remove the nut (42), lock washer (41), and seal retainer clip (39) from the top hole in the scavenge pump housing (35).

7. Remove the spacer or sheave (48), sleeve (47) and O-ring (46). Remove and discard the oil seal (45) and bearing (44). Remove the spacer (43) from the scavenge pump housing (35).

8. Remove the five remaining nuts (42), lock washers (41) and washers (40) from the scavenge pump housing (35); discard the lock washers (41).

9. Use a rawhide or plastic mallet to gently tap the scavenge pump housing (35) loose; remove the scavenge pump housing (35), driver gear (32), driven gear (34) and bushing (33), discard the bushing (33).

10. Remove the nuts (31) and washers (30) from the perimeter of the starter adapter cover (24); use an inertia puller or other suitable tool to detach the cover (24).

11. Remove and discard the O-ring (23) from the starter adapter cover (24).

12. Remove and discard the clutch spring retaining screw (21) and tab washer (20).

13. Place the starter shaft gear (16) in a shielded vise. Insert the Starter Adapter Disassembly Tool (“Special Tools” in Chapter 2 of M-0, Standard Practice Maintenance Manual) in the worm wheel gear holes; rotate the starter assembly gear in a driving direction to wind the clutch spring (17) while simultaneously pulling axially to release the clutch spring (17) from the clutch spring sleeve (2).

14. Separate the clutch spring (17) from starter shaft gear (16).
15. Remove the roller bearing (18), worm wheel gear (19), and bearing (22) from starter shaft gear (16). Discard the roller bearing (18) and bearing (22).

Figure 13-11. Starter and Adapter Assembly with Accessory Drive

<table>
<thead>
<tr>
<th>Component</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter Adapter Housing</td>
<td>1</td>
</tr>
<tr>
<td>Sleeve, Clutch Spring</td>
<td>2</td>
</tr>
<tr>
<td>Needle Bearing</td>
<td>3</td>
</tr>
<tr>
<td>Worm Drive Shaft</td>
<td>4</td>
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<tr>
<td>Woodruff Key</td>
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<tr>
<td>Starter Worm Gear</td>
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<tr>
<td>Radial Ball Bearing</td>
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<tr>
<td>Internal Retaining Ring</td>
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</tr>
<tr>
<td>Dowel</td>
<td>15</td>
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<tr>
<td>Starter Shaft Gear</td>
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</tr>
<tr>
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<td>17</td>
</tr>
<tr>
<td>Roller Bearing</td>
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<td>Cover Assembly</td>
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<tr>
<td>Starter Shaft Spacer</td>
<td>48</td>
</tr>
<tr>
<td>Flanged Nut</td>
<td>49</td>
</tr>
</tbody>
</table>

Procedure continues on next page
Component Disassembly

16. Remove the needle bearing (3) from the starter adapter housing (1) with an arbor press or a slide hammer/blind bearing removal tool; discard the needle bearing (3).

17. Remove the fittings (36, 37 & 38) from the scavenge pump housing (35).

18. Clean, inspect and repair the starter and starter adapter according to the instructions in Chapters 14, 15 and Appendix D.

Figure 13-11 repeated for reference
Intentionally Left Blank
Component Disassembly

13-7. Engine Cylinder Disassembly

CAUTION: To prevent damage to the engine cylinder, take precautions when removing studs as directed in “Replacing Rosan-Ring-locked Studs” in Appendix C.

1. Place the cylinder assembly (Figure 13-12) on a cylindrical block of wood anchored to a workbench.

2. Use a Valve Spring Compressor Tool (Section 2-1 of M-0, Standard Practice Maintenance Manual) to carefully compress the valve springs. Do not cock the rotocoil (retainer) (Figure 13-12) (18 & 53) which could score the valve stem.

3. Use needle nose pliers to remove and discard the retainer keys (17).

4. Remove and discard the rotocoil (18).

5. Remove and discard the following:
   a. Intake valve retainer (53)
   b. Outer springs (14)
   c. Inner springs (13)

6. Remove the lower retainers (16).

7. Remove and discard the intake valve guide seal (51)

8. Hold the valve stems while lifting the cylinder from its support and place the cylinder on its side.

9. Remove any nicks on the intake valve stem using an emery stone or cloth.

10. Remove and discard the exhaust valves (12).

11. Remove and discard the cylinder exhaust flange studs, regardless of condition, according to the instructions in Section C-2 of M-0, Standard Practice Maintenance Manual.

12. Support the intake and exhaust rocker arms (19 & 20) on a ring or vise to allow the old bushings to pass.

13. Press the worn rocker arm bushings (21) out using the proper size arbor tool. Discard the rocker arm bushings (21).

14. Remove the baffle (43). Inspect each cylinder baffle and repair or replace, if necessary, during overhaul.

15. Remove and discard the baffle spring (44).

16. Perform the “Visual Inspection” according to instructions in Section 11-1 of M-0, Standard Practice Maintenance Manual to determine if the cylinder may be a candidate for overhaul inspection and repair.
Component Disassembly

Figure 13-12. Cylinder Assembly

1 Cylinder Assembly
2 Spark Plug Insert
3 Intake Valve Guide
4 Exhaust Valve Guide
5 Stud
6 Stud
7 Exhaust Stud
8 Helicoil Insert
9 Intake Valve Seat Insert
10 Exhaust Valve Seat Insert
11 Intake Valve
12 Exhaust Valve
13 Inner Spring
14 Outer Spring
15 Drain Fitting
16 Inner Retainer
17 Retainer Key
18 Rotocoil
19 Intake Rocker Arm Assembly
20 Exhaust Rocker Arm Assembly
21 Rocker Arm Bushing
22 Drive Screw
23 Thrust Washer
24 Rocker Arm Shaft
25 Retainer
26 Tab Washers
27 Screw
28 Rocker Cover Gasket
29 Rocker Cover
30 Washer
31 Lock Washer
32 Screw
33 Exhaust Flange Gasket
34 Lock Nut
35 Pushrod Housing
36 Washer
37 O-ring Seal
38 Pushrod Housing Packing
39 Pushrod Housing Spring
40 Pushrod Assembly
41 Flange Nut
42 Flange Nut
43 Baffle
44 Spring
45 Drain Tube
46 Drain Tube Seal
47 7th Stud Bracket
48 7th Stud Bracket
49 Flange Nut
50 Cylinder Base O-ring
51 Intake Valve Seat
52 Check Valve
53 Valve Spring Retainer
54 Hydraulic Exhaust Tappet
55 Hydraulic Intake Tappet
13-8. Accessory Drive Pad Disassembly

1. Remove the nuts (Figure 13-13) (114), lock washers (113), and washers (112) from the four corners of the accessory pad cover (111). Remove the cover (111) and gasket (110). Discard the gasket (110) and lock washers (113).

2. Remove and discard the oil seal (109).

3. Use an arbor press to remove the bushing (106); discard the bushing (106).

4. Place the accessory drive components in a clean, storage area until overhaul inspection and repair in Chapter 15.

* NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.

Figure 13-13. Accessory Drive Assembly
13-9. Crankcase Disassembly

13-9.1. Miscellaneous Crankcase Accessory Removal

1. Remove two sets of nuts (Figure 13-14) (11), lock washers (10), and washers (9); discard the lock washers (9). Remove the camshaft cover (7) and gasket (8); discard the gasket (8).

2. Remove the nuts (18) and lock washers (17) from the idler gear support pin (14); discard the lock washers (17).

3. Remove the idler gear support pin (14), flange gasket (15), and idler gear bushing (16). Discard the flange gasket (15) and idler gear bushing (16).

4. Remove the oil gauge rod (21) from the oil filler assembly (19); remove and discard the gasket (22) from the oil gauge rod (21). Remove the screws (26), lock washers (27), and washers (28) from the oil filler assembly (19). Remove the oil filler assembly (19) from the crankcase. Remove and discard the oil breather gasket (20). Remove the oil filler adapter (24) from the crankcase; remove and discard the O-rings (23 & 25) from the oil filler adapter (19).

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**Figure 13-14. Miscellaneous Crankcase Hardware**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>Cover</td>
<td>Gasket</td>
<td>Spacer</td>
<td>Washer</td>
<td>Lock Washer</td>
<td>Nut</td>
<td>Camshaft Cover</td>
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<tr>
<td>Camshaft Cover Gasket</td>
<td>Washer</td>
<td>Lock Washer</td>
<td>Nut</td>
<td>Gasket</td>
<td>Screw</td>
<td>Idler Gear Support Pin</td>
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<tr>
<td>Idler Pin Cover Gasket</td>
<td>Idler Gear Bushing</td>
<td>Lock Washer</td>
<td>Nut</td>
<td>Oil Filler Assembly</td>
<td>Gasket</td>
<td>Oil Gauge &amp; Cap Assembly</td>
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<tr>
<td>22</td>
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<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
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<tr>
<td>Oil Filler Gasket</td>
<td>O-ring</td>
<td>Adapter</td>
<td>O-ring</td>
<td>Screw</td>
<td>Lock Washer</td>
<td>Washer</td>
</tr>
</tbody>
</table>
5. Remove the bolts (Figure 13-14) (13) and oil seal retainer plates (12) from the crankcase halves.

6. Remove the nuts (6), lock washers (5), washers (4) and spacers (3) from the governor drive (or cover (1)). Remove the cover (1) and gasket (2) from the crankcase and discard the gasket (2).

7. Remove the nuts and washers holding the rear lifting eye. Remove the lifting eye from the crankcase.

NOTE: Reference the locations in Figure 13-15 for fastener removal. Due to lack of clearance, do not attempt to remove the bolt and washer adjacent to the right accessory drive stud.
Component Disassembly

8. Remove the 0.31” bolts, nuts and washers along the crankcase backbone (55-63 and 65-68).

9. Remove the lifting eye (63), throttle bracket (61) and fuel manifold valve bracket (55).

10. Remove the fastening hardware at locations 45 and 46. Using a soft mallet, tap out and discard the through-bolts.

11. Remove the three bolts and washers from positions 69, 70 and 71.

12. Remove nuts, and washers from eight 10.75” through-bolts in position 37-44. Tap the through-bolts out with a mallet and discard the through-bolts. Remove and discard the O-rings from each through-bolt.

13. Remove the baffle supports from 42R; 43 and 44L.

14. Remove the fastening hardware (64) and O-ring; tap the through-bolt out with a mallet and discard the through-bolt and O-ring.

15. Rotate the engine stand to invert the engine.

16. Remove the six 0.25” screws (positions 77-82) from the crankcase belly.

17. Remove the 0.31” fasteners (positions 73-76) below the camshaft journal.

18. Rotate the engine stand placing the left crankcase half downward. Support the engine under the left crankcase half.

19. Disconnect the right crankcase engine mounts from the engine stand and carefully lift the right crankcase half from the left crankcase half to support the connecting rods to prevent them from hitting the cylinder decks.

20. Check and record the gear backlash according to the specifications in Appendix D before proceeding to the next step.

21. Remove the crankshaft assembly (Figure 13-22) from the crankcase and place it in a holding fixture for inspection.

22. Remove the idler gear (3) from the crankcase.

23. Remove and discard the crankshaft bearings (2) and thrust washers (1).

24. Remove the camshaft assembly (Figure 13-21) (1) and governor driven gear (7) from the crankcase.
Component Disassembly

13-9.2. Crankcase Studding Disassembly

1. Remove starter shaft gear roller bearing (Figure D-23)(1) from the crankcase with a slide hammer and blind bearing remover; discard the starter shaft gear roller bearing.

   NOTE: Tag removed crankcase plugs with a label to identify removed location. During crankcase assembly, all plugs must installed same crankcase location from which they were removed to prevent oil pressure loss.

   CAUTION: Do not attempt to remove the crankcase oil squirt nozzles, field replacement is not possible.

2. Use a Crankcase Through-Bolt Remover Tool (Section 2-1 in M-0, Standard Practice Maintenance Manual), remove the applicable crankcase hardware and plugs listed in Section D-9.6 to allow pressure flushing the crankcase. Inspect plugs for wear; replace worn plugs. Tag plugs to identify the respective locations for accurate identification during assembly.

3. Inspect crankcase studs for serviceability and proper extension (length) according to instructions in Section 15-7.1.

4. Examine the components for evidence of leakage or wear according to the instructions in Chapter 15. Clean the components according to instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual. Perform the non-destructive inspections and repairs according to the instructions in Chapter 11 of M-0, Standard Practice Maintenance Manual.
13-9.3. Engine and Turbocharger Mount Disassembly

Engine mounting brackets vary by engine model. Refer to the instructions applicable to the engine model in Section 13-9.3.1 through Section 13-9.3.4.

13-9.3.1. TSIO-550-B, C, & E Engine and Turbocharger Mount Disassembly

1. Remove the nuts (Figure 13-16) (6) and washers (5) from the crankcase studs.
2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).

![Figure 13-16. Engine and Turbocharger Mounting Brackets B C E](image)

1 Fwd Engine Mount 4 Right Turbo Support Bracket 7 Washer
2 Aft Engine Mount 5 Washer 8 Spacer
3 Left Turbo Support Bracket 6 Nut 9 Helical Coil Insert
13-9.3.2. TSIO-550-G Engine and Turbocharger Mount Disassembly

1. Remove the nuts (Figure 13-17) (6) and washers (5) from the crankcase studs.

2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).

![Figure 13-17. Engine and Turbocharger Mounting Brackets](image-url)
13-9.3.3. TSIO-550-K Engine and Turbocharger Mount Disassembly

1. Remove the nuts (Figure 13-18) (6) and washers (5) from the crankcase studs.
2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).

![Diagram of engine and turbocharger mounting brackets]

**Figure 13-18. Engine and Turbocharger Mounting Brackets**

1. Fwd Engine Mount
2. Aft Engine Mount
3. Left Turbo Support Bracket
4. Right Turbo Support Bracket
5. Washer
6. Nut
7. Washer
8. Spacer
9. Helical Coil Insert
13-9.3.4. TSIO-550-N Engine and Turbocharger Mount Disassembly

1. Remove the nuts (Figure 13-19) (6) and washers (5) from the crankcase studs.

2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).

Figure 13-19. Engine and Turbocharger Mounting Brackets

1 Fwd Engine Mount 4 Right Turbo Support Bracket 7 Washer
2 Aft Engine Mount 5 Washer 8 Spacer
3 Left Turbo Support Bracket 6 Nut 9 Helical Coil Insert
13-10. Engine Drive Train Disassembly

The engine drive train consists of the camshaft and crankshaft.

13-10.1. Camshaft Disassembly

1. Remove the governor drive gear (Figure 13-21)(6). Inspect the mating surfaces of the camshaft and governor drive gear: if the end of the camshaft and bore of the governor drive gear are smooth (Figure 13-20), and secured with a woodruff key (6), discard the obsolete governor drive gear (7), woodruff key (6) and the camshaft; obtain the replacement camshaft assembly depicted in Figure 13-21.

![Figure 13-20. Keyed Camshaft](image)

2. Cut and remove the safety wire from the bolts (Figure 13-21) (5). Remove the four bolts (5) and the camshaft gear (4). Discard the bolts (5).

CAUTION: Camshaft assemblies may feature pressed-in plugs, threaded plugs or a combination of both. Threaded plugs are easily identified by their hex socket head. Do not remove the pressed-in plugs. Replace camshaft assemblies exhibiting pressed-in plugs with the replacement camshaft featuring threaded bores and a splined drive shaft at overhaul.

3. Remove the front and rear threaded, hex drive camshaft plugs (2 and 3).

![Figure 13-21. Camshaft Assembly](image)
13-10.2. Crankshaft Disassembly

CAUTION: When disassembling the crankshaft, do not scribe or punch the counterweights and crankshaft to identify locations. Use only tags or ink to identify locations.

1. Place wooden support blocks under the crankshaft front and rear main journals.

2. Remove and discard all spiral lock nuts (Figure 13-22) (4) and connecting rod bolts (5). Separate the connecting rod caps (6) from the connecting rod (7) with their position numbers matched.

3. Remove and discard the connecting rod bearing inserts (8).

   NOTE: Leave the counterweights intact. Detailed counterweight removal and disassembly instructions are included in Section 10-9.1 of M-0, Standard Practice Maintenance Manual.

4. Remove the two lock nuts (17) securing the oil transfer collar. Separate the oil transfer collar assembly (18 through 21) from the crankshaft. Discard the lock nuts (17), dowel pin (18), and O-ring (21).

   CAUTION: The correct crankshaft gear screws have safety wire holes drilled in all sides. If the removed screws are drilled in only two sides, replace the crankshaft gear screws, regardless of condition.

5. Cut, remove and discard the safety wire; remove and discard the six drilled head screws (22).

6. Remove the large and small gears (24 and 23) by tapping the circumference of the gears using a rawhide mallet.

7. Inspect the large crankshaft gear (23) for part number and revision. If the crankshaft gear is identified with Part No. 656991 Rev B or earlier, discard the gear, regardless of condition (Ref: SB13-6). Part No. 656991 Rev B or earlier, is easily identified by the copper plating on the surface of the gear where it mates with the crankshaft. Later revisions of the part are not copper plated in this area.

   NOTE: The dowel (32) is installed with an interference fit. If repeated efforts to remove the dowel with a slide hammer are unsuccessful, it may be necessary to weld a nut on the end of the dowel to increase gripping force.

8. Remove the dowel (32) from the crankshaft with a slide hammer fitted with an adjustable chuck; discard the dowel.

9. Drive the ears of the tab lock plate (26) flat with a drift. Remove the four bolts (25), tab lock plates (26), and alternator face gear (27). Discard the tab lock plates (26) and bolts (25).

   CAUTION: Do not scratch, mar, or damage the crankshaft or crankcase while removing the crankshaft nose oil seal.
10. Twist and remove the split reinforcing ring (29) from the crankshaft nose oil seal (30). Discard the reinforcing ring (29).

11. Work the oil seal spring (28) from the oil seal groove and detach it from the oil seal (30). Unhook the spring ends using an unwinding motion and discard the oil seal spring (28).

12. Twist and remove the crankshaft nose oil seal (30) from the crankshaft. Gentle prying may be required to extract the seal from the counterbore. Discard the crankshaft nose oil seal.

13. Clean the Gasket Maker residue from the crankshaft according to the instructions in Section 10-10 of M-0, Standard Practice Maintenance Manual.
Component Disassembly

13-10.2.1. Crankshaft Counterweight Removal

Equipment Required
- Snap ring pliers with 90° bend
- Borroughs Part No. 4965A Crankshaft Hanger Blade Bushing Removal/Installation Tool (Section 2-1 of M-0, Standard Practice Maintenance Manual), or equivalent

2. Inspect the Crankshaft Counterweights according to the instructions in Section 10-9.1.3 and Section 10-9.1.4 of M-0, Standard Practice Maintenance Manual.
3. Inspect the Crankshaft Counterweight Hanger Blade according to the instructions in Section 10-9.1.6 of M-0, Standard Practice Maintenance Manual.
4. Perform the Crankshaft Dimensional Inspections in Section 15-7.2 to determine if the crankshaft can be overhauled.

13-11. Compressor Mounting Kit Disassembly

1. Remove the sheave support bolt (Figure 13-23) (5), sheave assembly (3, 3.01 & 3.02), shims (19), and spacer (6) from the block assembly (4). Discard the spacer and shims.
2. Remove the retaining ring (3.02) from the idler sheave (3) with snap ring pliers; discard the retaining ring.
3. Support the idler sheave (3), face down on a 1" diameter cylindrical block centered under an arbor press. Press the bearing (3.01) out of the idler sheave (3) and discard the bearing.
4. Remove the bolt (7) and washer (8) from the block (4).
5. Remove the compressor mounting hardware (12, 13, and 14) from the mounting bracket (2). Discard the self-locking nuts (12).
6. Remove the adjusting bolt (9); jam nut (10), washer (13), and rectangular nut (11) from the mounting bracket (2).

   NOTE: The self-locking nut is part of the starter adapter assembly. The drive sheave (11) may be provided by the aircraft manufacturer, part of the optional compressor bracket kit, or delivered with the engine, depending on the engine model specification.
7. Remove the self-locking 12-point nut (part of starter adapter, see Figure 13-11), sheave (18) and shims (20) from the starter adapter PTO shaft; discard the self-locking 12-point nut.
8. Remove three bolts (15), washers (16), and spacer (22) securing the bracket (2) to the aft 1-3-5 side of the crankcase. Remove the bracket (2) from the crankcase and set it aside for overhaul inspection and repair.
Figure 13-23. Freon Compressor Mounting Kit

1 Mounting Bracket Assembly  5 Sheave Support Bolt  11 Rectangular Nut  17 Drive Belt  18 Driver Sheave
2 Mounting Bracket  6 Spacer  12 Lock Nut  19 Shim  20 Shim
3 Idler Sheave  7 Bolt  13 Plain Washer  14 Bolt  21 Compressor
3.01 Ball Bearing  8 Special Washer  15 Bolt  22 Spacer
3.02 Retaining Ring  9 Tensioning Bolt  16 Washer
4 Block Assembly  10 Jam Nut
Component Disassembly

Intentionally Left Blank
Chapter 14. Engine Cleaning

Refer to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual.
Chapter 15. Overhaul Inspection and Repair

15-1. Engine Overhaul Inspection Program

The Engine Overhaul Inspection Program consists of inspection procedures cited in this chapter. The inspections apply only to the engines covered in this manual and is intended to support the continued airworthiness of the engine.

15-2. Engine Overhaul Inspection Checklists

Use the Engine Overhaul Inspection Checklists in Chapter 11 as guides for performing the inspections required during engine overhaul. Print a copy of the checklist to record inspection progress and document actions taken during overhaul.

Perform the items on the checklists (in the order listed) on an engine which has been removed from the aircraft, disassembled, and cleaned according to the instructions provided.

15-3. Visual Inspection

Perform visual inspections according to the instructions in Section 11-1 of M-0, Standard Practice Maintenance Manual.

15-3.1. Gear Tooth Inspection

Inspect the gear teeth according to the instructions in Section 11-1.1 of M-0, Standard Practice Maintenance Manual.

15-4. Fluorescent Penetrant Inspection

1. Perform a Fluorescent Penetrant Inspection on all cleaned, aluminum or non-ferrous metal parts according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.

2. Record inspection findings on the “Fluorescent Penetrant Inspection Checklist.”

15-5. Magnetic Particle Inspection

1. Perform Magnetic Particle Inspection according to the instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

2. Record repair or replacement requirements on the Engine Overhaul Inspection Checklist.

15-5.1. Connecting Rod Magnetic Particle Inspection

1. Perform Connecting Rod Magnetic Particle Inspection according to the instructions in Section 11-3.1 of M-0, Standard Practice Maintenance Manual.

2. Record inspection findings on the “Magnetic Particle Inspection Checklist.”
15-6. **Ultrasonic Inspections**

The inspections must be performed by technicians possessing inspection certification credentials. Refer to Ultrasonic Inspection in Section 11-4 of M-0, Standard Practice Maintenance Manual.

15-6.1. **Crankshaft Ultrasonic Inspection**

The crankshaft requires an Ultrasonic Inspection to determine if it is a candidate for overhaul. Refer to the Crankshaft Ultrasonic Inspection instructions in Section 11-4.2 of M-0 of M-0, Standard Practice Maintenance Manual.
15-7. Dimensional Inspection

Continental Motors uses new parts dimensions and assembly clearances for engine overhaul. New part dimensions listed in Appendix D are based on product engineering drawings in effect at the time of publication.

Clearances in the new part limits apply to mating parts.

CAUTION: Prior to dimensional inspection, ensure the part conforms to all Visual, Fluorescent Penetrant, Magnetic Particle, and Ultrasonic Inspection requirements.

Ensure the parts have been thoroughly cleaned and dried according to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual.

1. Measure part dimensions in comparison to the dimensional limits specified in Appendix D. Record the measurements on the “Dimensional Inspection Checklist” (Table 11-7).

2. If the part dimension fits within the minimum and maximum range specified in Appendix D, the part may be re-used during overhaul provided it meets all other inspection requirements.

WARNING

Use only the Appendix D dimensions during engine overhaul.

3. Label each part’s inspection status and required action.

4. Record inspection results on the Engine Overhaul Inspection Checklist.
15-7.1. Crankcase Dimensional Inspection

This inspection verifies the crankcase structural and dimensional integrity.

**Equipment Required**
- Mechanic’s hand tools and calibrated torque wrench
- Inspection light
- Mirror

1. Inspect the exterior of the crankcase halves for cracks. Carefully inspect the entire external surface of the crankcase using an inspection light and mirror. Pay particular attention to areas adjacent to the cylinder mount flanges, tappet guides, case flange, nose seal land and bearing bosses.

2. Look for scoring on the old crankshaft bearings, tappet guides, and camshaft bearings and journals.

3. Inspect the main bearing boss parting surfaces for fretting.

4. Inspect the bearing saddles for elongation of the bearing lock slot or for any indication of bearing movement.

5. Inspect all machined surfaces for nicks and roughness.

6. Inspect the crankcase for cracks and the progression of any cracks crankcase according to the instructions in Section 6-4.12 of M-0, Standard Practice Maintenance Manual.

7. Inspect the breather for cracks and dents. Inspect tube ends for scoring and out of roundness that may cause a bad seal and oil leakage. Discard and replace components with any of these indications.

8. Inspect engine mount pads and brackets for cracks, dents and wear. Inspect hardware for distorted or stripped threads and damaged wrench flats. Discard and replace any components exhibiting these indications.

9. Inspect all crankcase helical coils and studs for stripped or distorted threads. Inspect studs for corrosion, rusting, pitting, incomplete threads and looseness.

10. Inspect crankcase studs with a tool maker’s square for alignment. Check studs for looseness. Check crankcase stud height settings versus Appendix D specifications. Remove, discard, and replace non-conforming studs with new studs.

11. Inspect the number one, two and three main bearing oil feed passages to determine if they conform to the crankcase main bearing oil feed hole specifications in Figure D-13. The subject passages are located in the left (2-4-6) case half and begin in the rear main bearing saddle, counting forward. Proper main bearing oil feed hole chamfers are required to prevent cracks from forming in the area.

**Prerequisites**
Prior to the completing the dimensional inspections of the crankcase, crankshaft, and camshaft bores, temporarily assemble and torque the crankcase specifically for this inspection using the torque sequence shown in Figure 15-1.
12. For the preliminary torque, torque the crankcase fasteners in Figure 15-1 to \( \frac{1}{2} \) the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Repeat the torque sequence in Figure 15-1 using the full value for the fastener indicated in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 15-1. Crankcase Dimensional Inspection Torque Sequence](image)

14. Measure dimensional clearances for the assembled crankcase in Appendix D, inside and outside dimensions, with bearings out and repeat with bearings installed to check running clearance.

NOTE: The keyed camshaft gear (Part No. 656031) was superseded (Reference: SB05-8) and is no longer available. The new camshaft gear and camshaft are splined; the new gear is 0.060” wider than the previous gear. The crankshaft starter adapter bearing boss must be machined with a radius cut to provide clearance for the new camshaft gear.

15. Inspect the starter adapter shaft bore for compliance with SB05-8; to accommodate the new camshaft gear. Refer to Section 15-8.10.1 for crankcase machining requirements.

16. Record inspection results on “Dimensional Inspection Checklist” (Table 11-7).
15-7.2. Drive Train Dimensional Inspection

**Equipment required**
- A surface plate
- Metalworking lathe or two matched V-blocks
- Dial indicator
- Two blocks of ground flat steel stock of equal height
- Leaf-type feeler gauge
- 8-inch long arbors

**NOTE:** Precise setup is critical for the crankshaft and camshaft dimensional inspections. Pass/fail criteria is measured in thousandths of an inch (.001”).

1. Center the crankshaft between the headstock and tailstock of a lathe (or place the crankshaft on matched V-blocks, mounted on a surface plate, supporting the front and rear main journals). Check the parallelism at the front and rear main journals with the dial indicator before inspecting runout.

2. Inspect the crankshaft journal and crankpin diameter compared to the new part dimensions in Appendix D. Inspect the circumference of the crankshaft journals and crankpins to ensure the out of round limits in Appendix D are not exceeded.

3. Rotate the crankshaft under a dial indicator placed on the center main journal to detect bending (run out).

4. Rotate the crankshaft propeller flange under a dial indicator to detect runout (bending) (see Figure 15-2).

5. Inspect the crankshaft hanger blade bushing bore diameter and finish; bushing bores must be smooth and cylindrical. Discard crankshafts with worn, pitted, fretted, or out-of-round bushing bores. Verify the bushing bores meet Section D-8.3 dimensional specifications.

6. Mount the camshaft front and rear main journals on matched V-blocks.

7. Rotate the camshaft under a dial indicator placed on the center main journal to detect bending (run out).

![Figure 15-2. Crankshaft Journals](image-url)
15-7.2.1. Connecting Rod Dimensional Inspection

Refer to the “Connecting Rod Dimensional Inspection” instructions in Section 10-9.4.1 of M-0, Standard Practice Maintenance Manual.

15-7.2.2. Crankshaft Counterweight Inspection

Refer to the “Crankshaft Counterweight Inspection” instructions in Section 10-9.1.3 of M-0, Standard Practice Maintenance Manual.

15-7.2.2.1. Crankshaft Counterweight Bushing Bore Inspection

15-7.3. Engine Cylinder Dimensional Inspection

Refer to Appendix D-6 for cylinder dimensional limits.

1. Perform the “Cylinder Visual Inspection” according to instructions in Section 6-4.11.1 of M-0, Standard Practice Maintenance Manual. Replace cylinders that fail the inspection criteria.

2. Inspect cylinder bore dimensions using the appropriate illustrations and tables in the Appendix D-6. Cylinders may be honed (see Section 15-8.9.7, “Cylinder Bore Honing”) from the standard size dimensions in Appendix D to the next authorized oversize dimension.

3. Inspect the cylinder base flanges for flatness. If a flange exceeds 0.001 inches out-of-flat, replace the cylinder.

4. Dimensionally inspect the intake flange studs, cylinder exhaust flange studs, and rocker hold down stud bores using a thread gauge. Determine the appropriate oversize stud if replacement is required.

5. If the intake flange studs have been removed, dimensionally inspect the stud holes using a thread gauge. Determine the appropriate oversize stud for replacement.

6. Dimensionally inspect the inside diameter and geometry of the of the valve guides. Valve guide dimensions must be within specifications the entire length of the guide. Replace worn or non-conforming guides.

7. Inspect the intake and exhaust valve seats for indication of burning, pitting erosion, or cracks. Check the valve seat dimensions according to Appendix D specifications. Regrind or replace valve seats which fail to conform to Appendix D specifications or if the valve seat is cracked, eroded, burned or pitted.

8. Inspect the pushrods for cracks, nicks, burrs, pitting or corrosion. Inspect the pushrod caps for cracks or erosion. Verify the pushrod cap oil passages are clear and the bores meet Appendix D specifications. Dimensionally inspect the pushrods length and pushrod cap diameter with a micrometer and Appendix D specifications. Inspect runout with V-blocks and an air gauge according to Appendix D specifications.

9. Inspect pushrod housings for cracks, dents, bends or chafing damage; discard pushrod housings exhibiting these conditions. Inspect pushrod housings for rust, pitting or missing cadmium plating; discard pushrod tubes exhibiting these conditions.

10. Dry fit the rocker arms in the rocker arm boss to dimensionally inspect the rocker arm thrust width. Refer to the overhaul tolerances in Appendix D and verify that the thrust width specified for the engine being overhauled conforms to Appendix D specifications.

   a. Inspect the rocker arm foot contact area for wear, galling, spalling, scoring, or grooves; discard rocker arms exhibiting these conditions.
b. Inspect the rocker arm ball seats for wear and smoothness; discard rocker arms with gouged, scratched, etched, pitted or mushroomed ball seats.

c. Inspect the thrust surfaces of the rocker arm shaft bore for displaced metal, spalling, or galling; discard rocker arms exhibiting these conditions.

d. Inspect rocker arm exhibiting peeling copper plating, which can be a source of contamination in oil and spectrographic oil analysis. Use a scotch-brite pad to remove loose copper plating material.

e. Inspect for and discard rocker arms with loose or missing oil passage drive screws. Inspect oil passages for obstructions. Use an oil squirt bottle with clean 50 weight aviation engine oil to check oil passages for free flow. Discard rocker arms with blocked oil passages which cannot be cleared with solvent.

11. Record inspection results on the “Engine Cylinder Overhaul Inspection Checklist.”
15-7.4. Starter Adapter Dimensional Inspection

Inspect the starter adapter parts for wear or damage; replace worn or damaged parts in addition to the “Mandatory Overhaul Replacement Parts” in Appendix C-2.4.

1. Perform a “Gear Tooth Inspection” on the worm gear, starter shaft gear and starter gear assembly, according to Section 11-1.1 of M-0, Standard Practice Maintenance Manual. If the teeth are worn, broken or show evidence of excessive wear, replace the non-conforming gear.

2. Inspect the surface of the gear and shaft assembly for corrosion, nicks, gouges, or pitting. Inspect the inner and outer retaining ring grooves for gouges or worn edges. If any of these conditions exist, replace the gear and shaft assembly.

3. Inspect the starter adapter housing, shaft adapter sleeve, shafts and gear assemblies using the “Starter and Starter Adapter” dimensional limits in Appendix D-3.

4. Record inspection results on a copy of the “Dimensional Inspection Checklist.”

15-7.5. Lubrication System Dimensional Inspection

1. Perform a “Gear Tooth Inspection” according to Section 11-1.1 of M-0, Standard Practice Maintenance Manual on the oil pump gears for damage or wear; replace worn or damaged gears.

2. Inspect the lubrication system components according to the dimensional specifications in Appendix D-5 Test the oil pressure relief and oil temperature relief valve springs for proper tension according to Appendix D-5.

3. Record inspection results a copy of the “Dimensional Inspection Checklist.”

15-7.6. Alternator Drive Hub Slippage Inspection

1. Perform an “Alternator Drive Hub Slippage Inspection” according to the instructions in Section 10-4.1.4 of M-0, Standard Practice Maintenance Manual.

2. Record inspection results on the “Engine Overhaul Visual Inspection Checklist.”

15-7.7. Throttle and Mixture Control Lever Inspection

Refer to the “Throttle and Mixture Control Lever Inspection” instructions in Section 6-4.18 of M-0, Standard Practice Maintenance Manual
15-7.8. Exhaust System Inspection

NOTE: Clean parts prior to the visual inspection.

1. Visually inspect the exhaust system components.
2. Record inspection results on the “Engine Overhaul Visual Inspection Checklist.”

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Inspection Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stacks</td>
<td>Check parts for:</td>
</tr>
<tr>
<td></td>
<td>• Burned areas</td>
</tr>
<tr>
<td></td>
<td>• Cracks</td>
</tr>
<tr>
<td></td>
<td>• Loose parts/hardware</td>
</tr>
<tr>
<td></td>
<td>• Inspect welds and seams for cracks</td>
</tr>
<tr>
<td></td>
<td>• Replace worn, cracked or burned parts</td>
</tr>
<tr>
<td>Risers</td>
<td></td>
</tr>
<tr>
<td>Elbows</td>
<td></td>
</tr>
<tr>
<td>Slip joints</td>
<td>Inspect for bulges or cracks</td>
</tr>
<tr>
<td>Multi-segment V-band clamps</td>
<td>Replace at overhaul</td>
</tr>
</tbody>
</table>

15-7.9. Stud Height Dimensional Inspection

1. Inspect studs listed in Table 15-1 for damage, corrosion and security. Measure stud heights using the measurements in Appendix D-9. Replace studs that fail the inspection criteria.
2. Record inspection results on the “Dimensional Inspection Checklist.”

Table 15-1. Stud Height Settings

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Inspect for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter Adapter</td>
<td>• Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness.</td>
</tr>
<tr>
<td>Accessory Drive Adapter</td>
<td>• Check the stud alignment using a tool maker's square.</td>
</tr>
<tr>
<td>Lubrication System</td>
<td>• Studs should measure within the limits provided in Appendix D-9.</td>
</tr>
<tr>
<td>Oil Control Collar</td>
<td>• Replace unserviceable studs according to instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual.</td>
</tr>
<tr>
<td>Crankcase</td>
<td>• If studs installed in helical coil inserts are loose, the helical coil insert may require replacement according to instructions in Appendix C-6of M-0, Standard Practice Maintenance Manual.</td>
</tr>
<tr>
<td>Cylinder</td>
<td></td>
</tr>
</tbody>
</table>
15-7.10. Air Conditioning Compressor Dimensional Inspection

NOTE: The belt sheave inspection dimensions in Figure 15-3 apply only to Continental Motors belt sheaves. Refer to the manufacturer's instructions for air conditioning kits obtained from other sources.

1. Inspect the belt sheaves (Figure 15-3) for corrosion, physical damage, nicks, warpage, wear, or missing material. The drive belt channel must be free of nicks or sharp edges with a surface finish of 63 Ra. Replace the idler sheave bearing.

   a. The sheave belt channel inside dimension, measured at the apex must be not exceed 0.508" wide.

   b. The angle of the sheave belt channel should be 36° ±30'.

   c. After installation, inspect both sheaves for runout at the face with a dial indicator. Runout at the sheave face must not exceed 0.005 of an inch.

![Figure 15-3. Air Conditioning Compressor Sheave](image_url)
15-8. Overhaul Repair

15-8.1. Fuel Injection System Overhaul Repair

NOTE: Continental Motors fuel injection system parts overhaul procedures require specialized test equipment beyond the scope of this manual. Continental Motors offers new and rebuilt fuel pumps, fuel manifold valves and mixture controls which meet new part specifications. Continental Motors does not control FAR Part 145 Repair Station activities; verify the Repair Station qualifications before contracting fuel injection system parts overhaul. Fuel injection system parts overhaul must be accomplished in compliance with FAA approved procedures.

1. Collect the fuel injection system parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for fuel injection system assembly.

2. Inspect the fuel injection system parts intended for reuse to determine condition:
   a. Inspect rigid fuel injection tubes, including the flared ends for leaks or physical damage. Inspect the length of the tubes for sharp bends, cracks, dents, gouges, chafing or corrosion which may lead to fuel leaks. Discard and replace fuel injection tubes exhibiting any of these conditions.
   b. Inspection the condition of the fuel injection tube B-nuts. The B-nut shoulders must be intact, not worn or stripped. Wrenches must fit snugly on the nut for proper torque. B-nut threads must be clearly defined; stripped threads can lead to fuel leaks. Discard and replace fuel injection tubes exhibiting damaged B-nuts.
   c. Check the condition and placement of fuel injection line protectors, if included in the engine model configuration. Line protectors align with the tube clamps to inhibit friction at the attaching points. Reposition or replace damaged line protectors on rigid fuel injection tubes.
   d. Clean all serviceable fuel injection system components intended for reuse according to the instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual to remove debris and prevent fuel injection system contamination.

3. Replace the bronze throttle control lever or mixture control lever with the newer stainless steel versions.

15-8.2. Induction System Overhaul Repair

1. Collect the induction system parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for induction system assembly.

2. Replace the throttle control lever if it is not stainless steel or if the lever fails the dimensional inspection.
15-8.3. Air Conditioning Compressor Mount Bracket Overhaul Repair

Collect the air conditioning compressor mounting bracket assembly overhaul parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”
15-8.4. Alternator Overhaul

1. Overhaul Continental Motors alternators according to the latest revision of the Alternator Service Manual (Table 1-1 in Section 1-2.5). Replace aftermarket, or third-party alternators with a new unit or a unit which has been overhauled according to FAA approved procedures.

2. Collect the alternator parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for alternator (and alternator bracket, if equipped) assembly.

3. If the engine is equipped with an alternator bracket, collect the necessary parts specified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

15-8.5. Starter and Starter Adapter Overhaul Repair

NOTE: 12V and 24V lightweight starters, manufactured by ISKRA have been discontinued. Consult the engine model illustrated parts catalog for the applicable replacement starter.

1. Overhaul Continental Motors starter motors according to instructions in the Starter Service Instructions (X30592). Replace aftermarket, or third-party starter motors with a new unit or a unit which has been overhauled according to FAA approved procedures.

2. During overhaul, replace the parts specified below:
   a. Starter adapter housing worm shaft needle bearing according to instructions in Section 15-8.5.1.
   b. Shaft gears, worm wheel gears, worm gears or worm gear shafts exhibiting wear, cracks, or missing material.
   c. Worn scavenge pump covers and bushings on the starter/starter adapter assembly.
   d. Collect the necessary starter and starter adapter parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” and Continental Motors Starter Service Instructions (X30592) to prepare for starter and starter adapter assembly.
15-8.5.1. Starter Adapter Housing Worm Shaft Needle Bearing Replacement

Press the new needle bearing (Figure 15-4) (3) in position until it is thirty thousandths (0.030) of an inch below the inner surface using the Needle Bearing Installer Tool or equivalent. (Refer to Section 2-1, of M-0, Standard Practice Maintenance Manual.)
15-8.6. Ignition System Overhaul

Overhaul magnetos according to the magneto manufacturer's instructions.

15-8.6.1. Accessory Drive Adapter Overhaul Repair

During engine overhaul, collect the new parts required according to the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.” Install new bushings and oil seals in the accessory (magneto) drive adapters.

**Equipment Required**

- Arbor Press
- Heavy Duty Drill Press
- Adjustable Blade Reamer Size Range (25132-27132), adjusted to 0.8150 diameter

1. Plug the accessory adapter oil passages with beeswax to protect them from flying debris contamination during the reaming process.

2. Place the accessory drive adapter, tapered side up, on an arbor press. Support the adapter drive pad on a flat, parallel block thick enough to raise the studs off the arbor press bed.

3. Apply a liberal coating of clean, 50-weight aviation engine oil to the outer perimeter of the bushing. Align the bushing and accessory drive adapter bushing bore oil holes and press the bushing in the accessory drive adapter.

![Figure 15-5. Accessory Drive Adapter Bushing Installation Detail](image_url)
4. Ream the installed bushing to 0.8145-0.8155” diameter using the specified reamer and heavy duty drill press. The bushing bore surface finish must be 32 Ra when complete.

5. Face the bushing flange until it projects forward 1.454-1.458” from the adapter parting surface. The flange face surface finish must be 32 Ra when complete.

6. Chamfer the bore at the flange end 0.06" deep on a 45° angle, and slightly break sharp edges at both ends. The bushing bore must be concentric with the adapter pilot shoulder within 0.002" per inch of length. The flange thrust face must be parallel to the parting surface within 0.002" (full indicator reading).

7. Repeat the previous steps for new bushings in the remaining magneto adapter.

8. Clean the accessory drive adapters according to the cleaning instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual to remove reaming debris and beeswax; oil passages must be clear after cleaning.

9. Place the accessory drive adapter over on the arbor press with the studs on top. Support the edges of the accessory drive adapter to raise the bushing off the bed of the arbor press.

10. Coat the periphery of a new oil seal with a thin translucent coat of Gasket Maker. Insert the oil seal in the center of the accessory drive adapter flange. Press the new oil seal into the accessory drive adapter using a 1-3/8 inch diameter by 1-1/4 inch long flat end block or the Oil Seal Tool (Part No. MT500260 in Chapter 2 of M-0, Standard Practice Maintenance Manual) until it bottoms out in the adapter. Do not crush the oil seal. Wipe excess adhesive from the perimeter of the seal.

11. Perform a “Fluorescent Penetrant Inspection” on the accessory drive adapters according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual after bushing and oil seal installation to ensure the accessory drive adapter assembly is free of cracks.
15-8.7. Turbocharger and Exhaust System Overhaul Repair

Collect the exhaust and turbocharger system parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.” Gather replacement exhaust manifold gaskets and nuts for overhaul assembly.

**WARNING**

Turbocharger and exhaust system weld repairs may only be performed by an FAA Part 145 authorized repair station certified to perform the specific repairs.

15-8.7.1. Turbocharger Overhaul

1. Replace the turbochargers, wastegate, wastegate controller and overboost valve at engine overhaul with new units or units which have been overhauled according to FAA approved procedures.

2. Inspect the turbocharger oil reservoirs for cracks, leaks, and physical damage; replace on condition.

15-8.7.2. Air/Oil Separator Overhaul

Collect the air/oil separator parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.” Flush the air/oil separator thoroughly with mineral spirits to remove residual oil deposits. Upon completion, clean mineral spirits poured through the air/oil separator into a paper filter will be clean and free of debris; if particles continue to flow from the cleaned separator, replace the air/oil separator.

15-8.8. Lubrication System Overhaul

**NOTE:** The oil cooler must be cleaned by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station). No structural repairs are allowed on the oil cooler. Replace an oil cooler that has structural damage, bent/broken or cracked cooling fins with a new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange are permitted only by an appropriately rated repair station (i.e., FAA-approved Part 145 repair station).

Reface the oil pressure relief valve according to instructions in Section 15-8.8.2.

Collect the lubrication system parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for lubrication system assembly.

15-8.8.1. Oil Cooler Overhaul Repair

The oil cooler must be cleaned and overhauled by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station). No structural repairs are allowed on the oil cooler. Replace any cooler that has structural damage, bent/broken or cracked cooling fins with a
new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange are permitted only by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station).

**15-8.8.2. Oil Pressure Relief Valve Seat Repair**

Reface the oil pump housing oil pressure relief valve seat by applying light finger pressure with an 8048 Oil Pressure Relief Valve Spot Facer (see Section 2-1 of M-0, Standard Practice Maintenance Manual). Do not exceed the 1.060 depth limit on the valve seat (Figure 15-6).

Clean the oil pump housing after refacing the oil pressure relief valve seat according to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual. No debris is permitted in the oil pump housing at assembly.

![Figure 15-6. Oil Pressure Relief Valve](image)

**15-8.8.3. Oil Filter Adapter Stud Replacement**

NOTE: This procedure applies only to screw-on type oil filters.

If the oil filter adapter stud is a plain steel color and is 1.440 inches long and/or if the stud is below the height specified in Figure 15-7, replace the oil filter adapter stud:

1. Remove the oil filter adapter stud.
2. Inspect the adapter housing threads for damage or cracks. If thread damage or cracks are evident, replace the adapter housing.
3. Clean the adapter housing threads thoroughly to remove all adhesive or oil residue.
4. Temporarily install the new oil filter adapter stud in the oil filter adapter to check fit.
5. Verify the incomplete thread of the new stud stops at the first thread in the adapter housing and does not extend below 0.500-inch (12.7 mm) into the housing. If the stud extends deeper than 0.500-inch in the housing, replace the adapter housing.
6. Remove the oil filter adapter stud from the adapter housing.
7. Clean the adapter housing and stud threads with Part No. 653693 primer (Loctite 7471) and allow to dry.
8. Apply a line of Part No. 646941 (Loctite 271) along the large threads (0.8125-16 end) of the oil filter adapter stud and torque the stud to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Confirm the installed stud matches the illustration in Figure 15-7.

10. Allow the parts to cure at least 30 minutes prior to oil filter installation. Curing times may vary depending on ambient temperature. Consult the Loctite instructions.

11. Stamp a 0.125-inch high letter “S” in the adapter housing, as shown in Figure 15-8, to indicate a new oil filter adapter stud has been installed in the adapter housing.

Figure 15-7. Oil Filter Adapter Stud

Figure 15-8. Identification of Oil Filter Adapter Stud Modification
15-8.9. Engine Cylinder Overhaul Repair

This procedure applies to overhauling all engine cylinders at the same time while the engine is disassembled and removed from the aircraft. Engine cylinders must be leak checked, removed, cleaned and inspected.

Before performing any cylinder overhaul repair, establish a baseline inspection point for cylinder head-to-barrel movement and inspect the baseline throughout cylinder rework procedures to verify joint integrity is not compromised.

1. Mask off a ¼-inch wide X 1-inch high area across the cylinder head to the barrel junction on the intake port side of the cylinder.

2. Apply a heavy coat of high temperature paint.

3. Allow the paint to dry thoroughly.

4. Remove the masking material.

**WARNING**

*Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.*

5. Heat soak the cylinder assembly via a uniform heating method to 450°F (232°C) for one hour.

6. Verify no cylinder head-to-barrel movement by referring to the baseline inspection point. Discard cylinder assemblies exhibiting head-to-barrel movement.
### 15-8.9.1. Cylinder Repair versus Replacement Guidelines

Table 15-2 indicates possible cylinder symptoms and appropriate corrective actions.

#### Table 15-2. Cylinder Repair vs. Replacement Guidelines

<table>
<thead>
<tr>
<th>Condition</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder with radial fin crack extending to the root of a fin</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Broken, bent (or straightened), or pitted cylinder head or barrel fins</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Power stroke stress on cylinder barrel; heavy rust or pitting, indentation; chafing or cracks on cylinder barrel</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Cracks in cylinder head structure</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Cracked or eroded valve seat bore</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Broken, bent (or straightened), or pitted cylinder head or barrel fins</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Power stroke stress on cylinder barrel; heavy rust or pitting, indentation; chafing or cracks on cylinder barrel</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Cracks in cylinder head structure</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Cracked or eroded valve seat bore</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Static seal leakage or leakage from head to barrel seal or crack in head or barrel</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Discolored/burned paint, Piston pin scoring or damage to the cylinder bore (usually due to overheating)</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Blistered paint on the cylinder barrel</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Cylinder head-to-barrel junction movement</td>
<td>Replace¹ the cylinder</td>
</tr>
<tr>
<td>Low differential pressure coupled with excessive oil consumption</td>
<td>Repair or replace³ the cylinder</td>
</tr>
<tr>
<td>Scratches in the honed surface of the cylinder wall or cylinder bore</td>
<td>Repair the cylinder</td>
</tr>
<tr>
<td>Pitting, sharp dents or chafing in fin tips less than 0.050 inches (1.3 mm) deep</td>
<td>Repair the cylinder</td>
</tr>
</tbody>
</table>

1. Replacement cylinders are available in several configurations, starting with a basic assembly and progressing to cylinders with more components installed:
   - Cylinder and Valve Assembly (includes the Basic Cylinder Assembly plus valve components).
   - Loaded Cylinder and Valve Assembly (Cylinder and Valve Assembly plus rocker shaft, piston, piston rings, and gasket set).
   - Consult Continental Motors’ web site for the latest parts information.

2. Do not attempt to remove overheating damage by grinding the cylinder bore to the next allowable oversize. Cylinder barrel overheating destroys material strength.

3. If the cylinder is otherwise acceptable on inspection and the fits and clearances provide enough tolerance that the cylinder can be ground and honed, repair the cylinder; otherwise replace the cylinder.
15-8.9.2. Engine Overhaul Replacement Parts

Replace the items listed in Table 15-3 during engine overhaul:

Table 15-3. Mandatory Cylinder Overhaul Replacement Parts

| Baffle (new or repaired)               | Pushrod Tube Compression Springs |
| Baffle Retainer Spring                | Pushrod Tube Packing             |
| Cylinder Deck Stud Nuts and Through-Bolts | Retainer Keys                  |
| Cylinder Exhaust Flange Studs         | Rocker Arm Bushings             |
| Exhaust Flange Gaskets                | Rocker Cover Gaskets            |
| Exhaust Manifold Nuts                 | Rocker Shafts                   |
| Exhaust Valves                        | Rockocoils                      |
| Intake Valves                         | Seals, O-rings, Gaskets         |
| Intake and Exhaust Valve Tappets      | Springs                         |
| Lock Washers                          | Tab Washers                     |
| Pistons & Piston Rings                | Thrust Washers                  |
| Piston Pin                            | Valve Spring Retainers          |

15-8.9.3. New Cylinder Position Numbers

Original cylinders have a position number stamped on the edge of the base flange. New cylinders must have a position number stamped in the location shown in Figure 15-9.

CAUTION: Do not metal stamp or etch the piston.

NOTE: Pistons are not stamped with position numbers.

Figure 15-9. Cylinder Position Number
15-8.9.4. Cylinder Head Repair

Replace cracked or damaged cylinders. Do not attempt to repair a cracked cylinder head.

**WARNING**

Do not perform any structural weld repairs on the cylinder head. Welding the cylinder head structure can destroy the assembly preloads and casting strength resulting in cylinder assembly failure.

15-8.9.5. Cylinder Fin Tip Repair

*CAUTION: Do not attempt to straighten bent cylinder fins.*

15-8.9.6. Cylinder Barrel Repair

**WARNING**

*Cylinder Barrel Repair requires FAA certification. If you are not certified, do not attempt to repair the cylinder barrel.*

If the cylinder passes the visual inspection and static leak check at the cylinder head to barrel junction, the cylinder barrel may be ground to the next authorized oversize dimension by an FAA Part 145 Repair Stations certified to grind engine cylinders. These facilities grind and hone the cylinder bore using a cam-controlled grinder to grind the cylinder barrel to the next larger authorized oversize dimension specified in Appendix D.

After grinding the cylinder barrel to the next authorized oversize dimensions, perform a Magnetic Particle Inspection on the cylinder bore and identify the cylinder with the correct bore size by steel-stamping the barrel flange with the appropriate oversize designation as depicted in Figure 15-9.

*CAUTION: Replace the engine cylinder if the barrel fins exhibit pitting, sharp indentation, or chafing damage. Do NOT weld cylinder barrel fins or cylinder barrels.*

If a cylinder has been ground, the cylinder bore must be honed according to instructions in Section 15-8.9.7, “Cylinder Bore Honing.”
Overhaul Inspection and Repair

15-8.9.7. Cylinder Bore Honing

Perform this procedure under any of the following circumstances:
- after grinding a cylinder barrel
- when replacing piston rings
- to restore the cylinder bore cross hatch pattern

1. Hone the cylinder bore using a wet honing process and hone stones that will produce a surface finish as specified in Table D-9.

2. Inspect the cylinder barrel wall for corrosion, pitting and scoring. Discard any cylinder exhibiting any of these unacceptable, non-conforming conditions.

3. Measure the surface finish using a contact profilometer.

4. After wet honing, the bore finish must show a cross hatch pattern. The included angle of the cross hatch measured perpendicular to the axis of the cylinder is 22°-32°. Inspect the hone pattern taken at 100X magnification. An acceptable cross hatch pattern must be cleanly cut and free of torn and folded metal.
   NOTE: Honed turnaround areas up to 0.5 inch from the skirt and barrel stop are exempt from cross hatch angle requirements.

5. After honing, clean the cylinder thoroughly using hot soapy water and a stiff bristled scrub brush to remove all honing material from the cylinder.

6. Rinse the cylinder with hot water to remove soap residue.

7. Dry the cylinder completely; repeat step 2 to verify cylinder serviceability. If the honed cylinder passes inspection, thoroughly coat the cylinder bare steel surfaces with clean 50 weight aviation engine oil.

8. The surface finish of the cylinder barrel bore must conform to the specifications listed in Table D-9.
15-8.9.8. Valve Seat Removal

**Equipment Required**

- Borroughs Part No. 8086, Valve Seat Insert Remover and Replacer Tool, or equivalent
- Borroughs Part No. 5221B, Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-13A, Holding Fixture Adapter, or equivalent
- Borroughs Part No. 8122A, Common Drive Handle, or equivalent
- Valve stem or valve guide hole pilot of correct size
- Valve seat boss cutter equal in size to the new valve seat outside diameter
- Universal Drive from Borroughs Part No. 8116 common parts kit or equivalent
- Heavy duty drill press

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.

**WARNING**

*Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.*

2. Heat soak the cylinder assembly via a uniform heating method up to 450°F (232°C) for one hour.

3. Using the correct special tool, remove the worn valve seats.

4. Allow the heated cylinder to cool to room temperature.

5. Inspect the seat bore for cracks and erosion. Discard any cylinder with a cracked valve seat bore or a valve seat bore that has eroded beyond the allowable valve seat oversize bore repair.

6. Select the proper size valve seat bore cutter based on the new valve seat insert outside diameter See Section D-6.

7. Install the cylinder in the Cylinder Holding Fixture.

8. Using the specified special tools, machine the valve seat bore(s) to the correct diameter. Do not exceed the new part (overhaul) tolerances specified in Appendix D for the respective intake and/or exhaust valve seat illustrations, as applicable.

9. Deburr the valve seat bore and clean the cylinder, removing all debris created during the machining procedure.

10. Inspect and record the valve seat bore inside diameter and new valve seat outside diameter on the “Engine Cylinder Overhaul Inspection Checklist”(Table 11-8). Refer to Appendix D for the valve seat dimensional limits.

11. Install a new valve seat according to Section 15-8.9.9, “Valve Seat Installation.”
15-8.9.9. Valve Seat Installation

WARNING

Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.

2. While the cylinder is hot, install the valve seat firmly against the bottom of the valve seat bore using the required special tools.

   WARNING

   Misaligned or improperly installed valve seat(s) will cause valve leakage and burning.

3. Install new valve guides according to instructions in Section 15-8.9.10 and Section 15-8.9.11 followed by a “Fluorescent Penetrant Inspection” according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual on the newly installed valve seat(s) and valve guide(s).
15-8.9.10. Valve Guide Removal

**Equipment Required**

- Borroughs Part No. 5221B, Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-15A, Holding Fixture Adapter, or equivalent
- Borroughs Part No. 4981, Valve Guide Remover, or equivalent
- Borroughs Part No. 8116-1R through 15R Reamer
- Borroughs Part No. 8116-1 through 16, Expanding guide bores
- Proper size morse adapter
- Borroughs Part No. 3170, Floating Holder, or equivalent
- Heavy duty drill press

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.
2. Install proper size head on Valve Guide Remover and attach the assembly to a cold water supply.
3. Heat the cylinder assembly via a uniform heating method to 350°F (177°C) maximum and heat soak the cylinder assembly for 10 minutes.

**WARNING**

*Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.*

4. Install the cylinder in the holding fixture.
5. Install the pilot into the valve guide.
6. Hold the Valve Guide Remover down firmly pressed into guide bore with one hand and the other hand on the water release mechanism.
7. Release the water and drive out the valve guide while water is running.
8. Remove the other valve guide.
9. Allow the cylinder to cool to room temperature.
10. Measure the cylinder head valve guide bore and select the proper size reamer.

**CAUTION:** Always ream the guide bore to the proper oversize.

11. Ream the cylinder head valve guide bore to the required size.
12. The guide bore must be free of grooves.
13. Deburr the valve guide bore and clean the cylinder; remove all machining debris.
15-8.9.11. Valve Guide Installation

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.

2. Apply a small amount of LUBRIPLATE® 930AA to the outside diameter of the valve guide to prevent binding during installation.

   **WARNING**
   Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.

3. Heat soak the cylinder assembly via a uniform heating method to 350°F (177°C) for 10 minutes.

4. While the cylinder is hot, install the new valve guides:
   
   **CAUTION:** The intake and exhaust valve guides are different and must be installed in the correct positions.

   *Never install an oversize valve guide in a standard size valve guide bore.*

   a. Install the exhaust valve guide in the side of the cylinder with the smaller diameter valve seat.

   b. Install the intake valve guide in the side of the cylinder with the larger diameter valve seat.

5. Hang the cylinder with the flange up; allow the cylinder to stabilize to room temperature. Inspect the valve guide inside diameter.

6. Ream the valve guides according to the “Valve Guide Bore Reaming” instructions in Section 15-8.9.12.

7. After reaming the valve guide to the proper inside dimension, perform a “Fluorescent Penetrant Inspection” (according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual) on the cylinder head in the area surrounding the new valve guide and the valve seat.

**Equipment Required:**
- Borroughs Part No. 5221B Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-15A Holding Fixture Adapter, or equivalent
- Borroughs Part No. 8116-1R through 15R Reamers, or equivalent
- Heavy duty drill press

*CAUTION: Do not attempt reaming the valve guide bore with a hand held power tool.*

1. Install the Cylinder Holding Fixture into a drill press.
2. Index the Cylinder Holding Fixture to the proper angle and install the cylinder in the fixture.
3. Zero in the valve guide with the dial indicator.
4. Using the proper size reamer tool bit, ream the valve guides while applying generous amounts of lubricant at 400 RPM for high speed steel reamers and 700 RPM for carbide tip reamers.
5. Inspect the finished bore size using Appendix D specifications for the valve stem bore inside diameter. The valve guide finish must be 63 Ra finish measured with a profilometer.

15-8.9.13. Valve Seat Machining

**Equipment Required**
- Borroughs Part No. 5221B, Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-13A, Holding Fixture Adapter, or equivalent
- Sioux Brand Valve Seat Grinder Set No. 1675 or equivalent.
- Valve Seat Grinder Pilot 0.437 diameter check inside diameter of valve guide for proper size.
- Grinding stones:
  - K106 roughening for intake valve seats
  - K46 finishing for intake valve seats
  - K95 roughening for exhaust valve seats
  - K25 finishing for exhaust valve seats.

*NOTE: Valve seats and valves may be lapped after refacing, if desired. Lapping compounds are extremely abrasive, be sure to completely remove compound residue from the valves, valve seats and cylinder by thorough cleansing with hot soapy water and a stiff bristled scrub brush. Rinse the cylinder thoroughly with hot water to remove soap residue.*

1. Reface the valve seats according to the specifications in Appendix D using the valve seat grinder. Wash the cylinder with soapy water and rinse thoroughly.
2. Dry the cylinder completely.
3. Coat all bare steel surfaces thoroughly with clean 50 weight aviation engine oil.

**Equipment Required**
- Stanley Heli-Coil Extracting Tool
- Stanley Heli-Coil Installation Tool
- Stanley Heli-Coil No. 520-2 Expanding Tool

1. Before attempting to remove a damaged helical coil insert, use a sharp pointed tool to pry the teeth at the outer Heli-Coil end away from the cylinder head metal.
2. Tap the Heli-Coil Extracting Tool into the insert until firmly seated; remove the Heli-Coil.
3. Using the proper size mandrel on the Heli-Coil Installation Tool, place a new stainless steel helical coil in the cutout side of the Heli-Coil Installation Tool and engage the driving tang toward the threaded end.
4. Engage the tang with the slotted end of the driving mandrel and wind the insert into the sleeve thread, compressing the insert.
5. Hold the sleeve so the Heli-Coil can be seen through the slot in the threaded end.
6. Turn the mandrel crank until the insert starts into the cylinder head hole. If the sleeve is not in contact with the head surface, grip the sleeve and mandrel and turn until the sleeve touches lightly.

**WARNING**

The Heli-Coil insert end must not protrude into the combustion chamber after it has been installed.

7. Wind the Heli-Coil into the cylinder head until its toothed end lies within the first full thread. The teeth should be in position to enter the depressions made by the original insert. If driven too far, the insert will emerge in the combustion chamber and will have to be wound through and removed.
8. When the Heli-Coil is in the correct position, use long-nose pliers to bend the driving tang back and forth across the hole until it breaks off at the notch.
9. Coat the threaded end of the No. 520-2 Expanding Tool with Alcoa thread lube or a mixture of white lead and oil.
10. Screw the No. 520-2 Expanding Tool into the new insert until its final thread forces the teeth firmly into the cylinder head metal.
15-8.9.15. Cylinder Stud Installation

Replace exhaust manifold studs, regardless of condition, replace studs that are loose or fail to meet Appendix D specifications according to the “Stud Installation” instructions in Appendix C-6.2 of M-0, Standard Practice Maintenance Manual. Install the new studs to the specified heights listed in Appendix D. Check the stud alignment using a tool maker's square.

Install the appropriate oversize new exhaust flange studs, rocker shaft hold down studs, and intake flange studs according to the “Engine Cylinder Dimensional Inspection” in Section 15-7.3 and Appendix D.

15-8.9.16. Piston Ring Replacement

Install new pistons and piston rings on each engine cylinder during engine assembly.

NOTE: Whenever piston rings are replaced in an engine cylinder, hone the cylinder bore prior to assembly according to “Cylinder Bore Honing” in Section 15-8.9.7.

15-8.9.17. Cylinder Protective Coatings

1. Clean the exterior cylinder head surface.

2. Apply a protective coating of Alodine on the cylinder surface according to instructions in Section 12-4 of M-0, Standard Practice Maintenance Manual.

3. Thoroughly clean the entire cylinder with mineral spirits and air dry.
   
   CAUTION: Do not paint the cylinder flange nut seats, skirt, or flange-to-crankcase mating surface.

4. Mask the cylinder flange nut seat contact surfaces, cylinder skirt and flange-to-crankcase mating surfaces.

5. Apply a protective coating of specified enamel paint or equivalent (Table 3-7 of M-0, Standard Practice Maintenance Manual) to the cylinder barrel according to instructions in Section 12-4 of M-0, Standard Practice Maintenance Manual.

6. After the paint dries completely, remove all masking materials.

7. Coat all bare steel surfaces with clean 50 weight aviation engine oil.

8. Store the cylinder assembly in a clean protected area until cylinder assembly.
15-8.9.18. Rocker Arm Bushing Replacement

**Equipment Required**
- Borroughs Part No. 8118 Rocker Arm Bushing Remover/Installer
- Borroughs Part No. 8116-1R through 15R Reamers, or equivalent
- Arbor Press

1. Plug the oil passages on the rocker arm with beeswax.
2. Remove the old bushings from the rocker arm(s).
3. Measure the rocker arm bushing bore inner and outer diameter; verify it conforms to the Appendix D dimensional specifications.
4. Verify the bushing oil passages are positioned as illustrated in Figure 15-10.

**WARNING**

Incorrectly positioned bushing oil passages will result in a loss of rocker arm shaft lubrication, severe wear of the rocker arm bushing, shaft, and valve guide and possible engine failure.

5. Lubricate the new bushings with clean 50 weight aviation engine oil.
6. Using the Borroughs Part No 8118 Rocker Arm Bushing Remover/Installer, or equivalent and an arbor press, carefully press the bushing into the rocker arm bushing bore. The bushing must be installed flush to 0.020 below surface (Figure 15-10).
7. Plug the bushing oil holes with beeswax to prevent debris from entering the oil passages.
8. Ream the bushing inner diameter to 0.7505 - 0.7515 inches with a surface finish of 32 RMS (Figure 15-10).
9. Inspect the bushing bore and surface finish to verify it meets Appendix D specifications.
10. After reaming, clean and flush the oil passages with clean mineral spirits to remove the beeswax; ensure the oil passages are clean and free of debris.
11. Clean obstructed oil passages in rocker arms or pushrods by soaking the parts in clean mineral spirits and blowing compressed air through them. Discard rocker arms or pushrods with clogged oil passages.
12. Perform Visual and Magnetic Particle Inspections of the rocker arm assembly according to instructions in Sections 11-1 and 11-3 of M-0, Standard Practice Maintenance Manual.
Bush O. D. must maintain a 0.0020-0.0065 Press Fit in a 0.8755-0.8725 Rocker Arm Bushing Bore.

INSTALL BUSHING FLUSH TO 0.020 BELOW SURFACE

Bush must have a surface finish of 32 rms after reaming. These surfaces must be square within the center line of the bushing bore within 0.002 inch full indicator reading.

Figure 15-10. Rocker Arm Bushing Replacement
15-8.9.19. Rocker Arm-to-Retainer Clearance

Maintain a minimum clearance of 0.020 inches (0.508 mm) between the rocker arm and valve spring retainer. If 0.020 inches (0.508 mm) clearance is not met, proceed as follows.

**WARNING**

Grinding marks or cracks in the rocker arm may cause the rocker arm to fail.

1. Temporarily install the rocker arm on the cylinder to verify rocker arm to retainer clearance.

2. Smoothly grind across the forging flash line on the underside of the rocker arm to attain the specified 0.020-inch clearance. The grind must be smooth and uniform. Cover the rocker arm bushing bore and oil passage to prevent contamination.

3. Smoothly grind across the forging flash line on the underside of the rocker arm to obtain the specified clearance. The grind must be smooth and uniform and must not exceed the width illustrated in Figure 15-11. If the required clearance cannot be met without exceeding the grind width, discard and replace the rocker arm.

4. Polish the entire ground surface to remove grinding marks.

5. Remove the protective coverings from the rocker arm and clean thoroughly.

6. Perform a “Magnetic Particle Inspection” (Section 15-4 of M-0, Standard Practice Maintenance Manual) on the polished rocker arm to inspect for cracks.

7. Remove and thoroughly clean the rocker arm(s) before final engine assembly.

![Figure 15-11. Rocker Arm to Retainer Clearance](image)
15-8.10. Crankcase Overhaul Repair

1. Collect the crankcase replacement parts specified in the following sections of M-0, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

2. Replace any crankcase or associated part worn beyond the overhaul limits in Appendix D or failing to meet inspection criteria. Discard and replace all non-conforming components.

3. Inspect the outer diameter of the starter adapter bearing boss to determine if the boss has been modified (Figure 15-12) to provide clearance for the new camshaft gear. If the radius cut is absent, perform the modification according to Section 15-8.10.1.
15-8.10.1. Crankcase Modification after Camshaft Gear Replacement

CAUTION: Crankcase machining should be accomplished only by an FAA Part 145 Approved Repair Station.

Camshaft gear Part Nos. 631845, 655430, 655516 and 656031 has been superseded (Reference: MSB05-8) and is no longer available. The replacement gear is 0.060" wider than the earlier gears. The crankcase starter adapter bearing boss must be machined with a radius cut to provide clearance for the wider replacement camshaft gear.

CAUTION: Installing the new camshaft gear in an unmodified crankcase will result in damage to the gear and the crankcase.

1. Measure 3.0935" - 3.0985" from the camshaft bore centerline to the center of the starter drive bearing boss (Figure 15-12).

2. Cut a 0.005-0.015” radius in the outside edge of the starter drive bearing boss at a depth of 2.100-2.110” (Figure 15-13) from the accessory face in step 1.
15-8.10.2. Oil Filler Overhaul

Collect the replacement parts specified in the following sections of M-0, Standard Practice Maintenance Manual: Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

15-8.10.3. Crankcase Welding

**WARNING**

No weld repairs are permitted in the critical (non-shaded) areas of the crankcase or the bearing support structures. An FAA-approved repair facility is the only facility authorized to perform a crankcase weld repair.

Welding is only permitted on non-critical areas of the crankcase identified in Section 6-4.12 of M-0, Standard Practice Maintenance Manual. Only an FAA-certified weld repair facility for specialized crankcase repairs may complete the weld repair. The dimensional integrity of the crankcase must be maintained.

15-8.10.4. Crankcase Cylinder Deck Stud Helical Coil Installation

Install helical coils in crankcase cylinder deck stud holes according to instructions in Appendix C of M-0, Standard Practice Maintenance Manual according to specifications in Figure 15-14.

**WARNING**

Repair of the 2 or 4 o'clock crankcase cylinder deck stud positions by installing helical coil inserts is prohibited.

![Figure 15-14. Crankcase Cylinder Deck Stud Repair Specifications](image-url)
15-8.10.5. Crankcase Cylinder Deck Stud Replacement

Replace crankcase studs which fail to meet Appendix D stud height specifications according to stud replacement instructions in Appendix C of M-0, Standard Practice Maintenance Manual. Refer to the crankcase figures in Appendix D for the proper stud height settings.

**WARNING**

*Do not attempt to repair the 2 and 4 o'clock crankcase cylinder deck stud positions by installing helical coil inserts.*

1. Verify the studs, threads tapped holes are free of damage and are clean and dry.
2. Apply Part No. 653693 Primer to the stud and cylinder deck threads and allow appropriate drying time according to manufacturer's recommendations.
3. Apply Part No. 646941 High Strength Adhesive to the stud and the cylinder deck tapped hole threads.
4. Install the studs to the appropriate cylinder stud height setting in Appendix D.
5. Wipe excess adhesive from the cylinder deck.
6. After two hours minimum cure time, test the installed stud breakaway torque. Studs must resist movement with a torque load of 100 in-lbs. If studs break away, replace with a new stud.

15-8.10.6. Crankcase Line Boring

Either discard or line-bore crankcases with crankshaft or camshaft bearing bores that exceed the Appendix D specifications. Only a certified repair facility for specialized crankcase repairs is authorized to perform line bore repairs. Only a certified repair station for specialized crankcase repairs is authorized to perform line bore repairs. Refer to Appendix D for overhaul limits and Section 15-7.1, “Crankcase Dimensional Inspection” for information on performing a crankshaft and camshaft bore dimensional inspection.

15-8.10.7. Crankcase Machining

Discard and replace or machine crankcases exhibiting fretting. Crankcase machining is only permitted at a certified crankcase repair facility. The crankcase cylinder deck dimensions are listed in Appendix D. After machining, the cylinder deck height must meet Appendix D specifications. Discard crankcase halves failing to meet this dimension.

**CAUTION:** Gear backlashes must not be less than the specified minimum after machining.

The crankcase half-parting line surface must be flat within 0.005 inches (true indicator reading). The sum total of the parting line surface for both crankcase halves must not exceed 0.008 (true indicator reading). Discard crankcase halves that exceed these dimensions. After all machining is complete, perform a “Fluorescent Penetrant Inspection” on the crankcase halves according to instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.
**15-8.11. Engine Drive Train Overhaul**

*CAUTION: Engine Drive Train Overhaul is beyond the scope of field repairs. Special fixtures, special tools and air gauges are required to inspect the components for serviceability after repairs are accomplished. Overhaul repairs to the camshaft, crankshaft and connecting rods may only be performed by an FAA Part 145 Repair Station using FAA approved repair procedures.*

1. The engine drive train consists of the camshaft assembly and crankshaft assembly, including counterweights, gears and connecting rods. Overhauling the engine drive train entails disassembling, verifying the integrity of parts, replacing parts, and re-assembling these components as instructed in the subsection herein. Replace any parts worn beyond Appendix D limits or parts which do not meet inspection criteria.

2. Collect the engine drive train replacement parts specified in the following sections of M-0, Standard Practice Maintenance Manual: Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

3. Refer to the appropriate subsections to accomplish camshaft and crankshaft repairs.

**Table 15-4. Engine Drive Train Parts Replacement**

<table>
<thead>
<tr>
<th>Part to Consider for Replacement</th>
<th>Discard and Replace Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td></td>
</tr>
<tr>
<td>Crankshaft</td>
<td>Discard/replace a crankshaft with any of the following conditions:</td>
</tr>
<tr>
<td></td>
<td>• Worn, pitted, fretted, or out-of-round counterweight bushing bores</td>
</tr>
<tr>
<td></td>
<td>• Worn counterweight bushing bores</td>
</tr>
<tr>
<td></td>
<td>• Cracked counterweight hanger blades</td>
</tr>
<tr>
<td></td>
<td>• Cracks, rust or pitting on crankshaft</td>
</tr>
<tr>
<td>Camshaft</td>
<td>Discard/replace a camshaft with any of the following conditions:</td>
</tr>
<tr>
<td></td>
<td>• cracks, scoring, galling corrosion pitting or other physical damage</td>
</tr>
<tr>
<td></td>
<td>• Worn bearing surfaces</td>
</tr>
<tr>
<td></td>
<td>• If a hydraulic tappet has been rejected for spalling, inspect the corresponding cam lobe; any indication of stress, surface irregularity or feathering at the edge of the cam lobe indicates a reject condition.</td>
</tr>
</tbody>
</table>
Overhaul Inspection and Repair

Table 15-4. Engine Drive Train Parts Replacement

<table>
<thead>
<tr>
<th>Part to Consider for Replacement</th>
<th>Discard and Replace Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td></td>
</tr>
<tr>
<td>Counterweight bushings and counterweight bushing retainer plates require an interference fit. Replace counterweight bushings or counterweight bushing retainer plates if insertion in the bushing bore is possible without resistance.</td>
<td></td>
</tr>
<tr>
<td>Crankshaft Counterweight¹</td>
<td>Discard any counterweight that is:</td>
</tr>
<tr>
<td></td>
<td>• Cracked</td>
</tr>
<tr>
<td></td>
<td>• Worn, pitted, fretted, or out of round bushing bores</td>
</tr>
<tr>
<td></td>
<td>• Worn or has distortions in the retaining ring groove that can affect the retaining ring seating</td>
</tr>
<tr>
<td>Oil Control Plugs</td>
<td>Discard/replace loose or leaking oil plugs</td>
</tr>
<tr>
<td>Connecting Rods</td>
<td>Discard/replace any connecting rod:</td>
</tr>
<tr>
<td></td>
<td>• With a bore exhibiting nicks or gouges</td>
</tr>
<tr>
<td></td>
<td>• If the rod and cap do not align properly</td>
</tr>
</tbody>
</table>

¹ Replace both counterweights in the matched pair, even if only one counterweight is unserviceable

15-8.11.1. Camshaft Repair

**WARNING**

Camshafts may only be repaired by an approved FAA Part 145 Repair Stations. Do not attempt camshaft repair without the proper tooling and FAA required certification.

Camshaft overhaul repairs must be performed by an FAA Part 145 Repair Station certified to perform camshaft repair using methods approved by the Federal Aviation Administration. Camshaft grinding is limited to 0.020 inch authorized undersize. Undersize camshafts require line boring of the crankcase journals. The repaired camshaft must meet the dimensional limits specified in Appendix D. Perform a “Magnetic Particle Inspection” (Section 11-3 of M-0, Standard Practice Maintenance Manual) on the camshaft after rework.
15-8.11.2. Crankshaft Repair

**WARNING**

Crankshafts may only be repaired by an approved FAA Part 145 Repair Stations. Do not attempt crankshaft repair without the required FAA certification.

*CAUTION:* Do not attempt to repair a scored or overheated crankshaft. Discard and replace scored or scorched crankshafts.

*CAUTION:* If a crankshaft is repaired by an FAA Repair Station, the nitride treatment must be restored.

Crankshaft overhaul repairs must be performed by an FAA Part 145 Repair Station certified to perform crankshaft repair using methods approved by the Federal Aviation Administration. The repaired crankshaft must meet the dimensional limits specified in Appendix D.

1. Install the Crankshaft Oil Control Plug according to Section 15-8.11.2.1, “Oil Control Plug Replacement.”

2. Install new crankshaft counterweight bushings according to Section 15-8.11.2.2, “Crankshaft Counterweight Bushing Replacement.”

3. Install new crankshaft hanger blade bushings according to Section 15-8.11.2.3, “Crankshaft Hanger Blade Bushing Replacement.”

4. After the crankshaft hanger blade bushings, counterweight bushings are installed, and the oil control plug are installed, perform a “Magnetic Particle Inspection” on the crankshaft and counterweights and a “Crankshaft Ultrasonic Inspection” according to the instructions in Chapter 11 of M-0, Standard Practice Maintenance Manual to ensure no cracks developed during the bushing or plug installation process.
15-8.11.2.1. Oil Control Plug Replacement

**Equipment Required**

- Oil Plug Leak Test Fixture (Chapter 2 of M-0, Standard Practice Maintenance Manual)
- Oil Control Plug Installation Tool (Chapter 2 of M-0, Standard Practice Maintenance Manual)

  NOTE: The 2.375-inch diameter collar at the rear of the Oil Control Plug Installation Tool prevents driving the oil control plug beyond the specified depth of 4.71 to 4.73 inches. **Do not** use makeshift tools to install the oil control plug.

1. Remove the crankshaft oil control plug using a 0.4375-20 diameter bolt approximately 8 inches long with 0.4375 -20NF threads and a slide hammer.

2. Inspect the inside diameter of the crankshaft for rust or pitting. Discard crankshafts exhibiting rust or pitting. Clean the bore of the crankshaft using a pneumatic drill and a two inch Merrit Wheel. The inside diameter of the crankshaft must be clean and free of any sludge residue prior to installing a new oil control plug.

3. Two special tools (Oil Control Plug Installation Tool and Oil Control Plug Leak Test Fixture (Chapter 2 of M-0, Standard Practice Maintenance Manual)) are required to perform this procedure. The tools are designed especially for this application. The 2.375-inch diameter collar at the rear of the Oil Control Plug Installation Tool prevents driving the oil control plug beyond the specified depth of 4.69 to 4.75 inches.

  **CAUTION:** Do not use makeshift tools to perform this procedure. **Non-conforming tools can damage components, rendering them unusable.**

4. Carefully drive in the new oil control plug into the crankshaft using an air impact tool and the Oil Control Plug Installation Tool.

5. Leak test the oil control plug and pressure test the crankshaft by connecting the Oil Control Plug Leak Test Fixture to the crankshaft using a C-clamp with neoprene rubber pads as shown in Figure 15-15. Apply 70-80 psi air pressure and close the air supply. Monitor the pressure gauge for 15 seconds; allowable pressure loss is not to exceed 2 psi.

6. After all crankshaft repairs have been completed, restore the helix pattern to the exposed portion of the crankshaft according to instructions in Section 15-8.11.2.4, “Crankshaft Plating Overhaul.”
Figure 15-15. Oil Control Plug/Crankshaft Pressure Test

"C" CLAMP
NOTE: NEOPRENE RUBBER PADS MUST BE INSTALLED BETWEEN "C" CLAMP SPINDLES AND CRANKSHAFT

OIL CONTROL PLUG LEAK TEST FIXTURE

CRANKSHAFT

NEOPRENE RUBBER PADS

NEOPRENE RUBBER PAD

APPLY 70-80 PSI AIR PRESSURE AND CLOSE CIRCUIT. LEAKAGE SHALL NOT EXCEED 2 PSI IN 15 SECONDS.

NOTE: FIXTURE MUST BE INSTALLED CAREFULLY TO PREVENT CRANKSHAFT DAMAGE
15-8.11.2.2. Crankshaft Counterweight Bushing Replacement
Replace all crankshaft counterweight bushings at overhaul according to the instructions in Section 10-9.1.5 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.3. Crankshaft Hanger Blade Bushing Replacement
Replace all crankshaft hanger blade bushings at overhaul according to the instructions in Section 10-9.1.6 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.4. Crankshaft Plating Overhaul
Prepare the exposed end of the crankshaft and propeller flange and apply protective coating according to the instructions in Section 10-9.3 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.5. Connecting Rod Piston Pin Bushing Replacement
Replace all connecting rod piston pin bushings at overhaul according to the instructions in Section 10-9.4.2 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.6. Piston Pin Bushing Boring
After new connecting rod bushings are installed, bore the bushing to the correct inside diameter according to the instructions in Section 10-9.4.3 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.7. Connecting Rod Replacement
Connecting rod assemblies are selected in pairs with a maximum weight variation not to exceed ½ ounce in opposing bays. Connecting rods are supplied only in matched sets; replace connecting rods only in pairs.

WARNING
Never remove material from a connecting rod. Removing material from a connecting rod will destroy the shot peen treatment and may cause stress risers.
Chapter 16. Component Assembly

Instructions in this section depend on compliance with and completion of the preliminary steps detailed in earlier chapters. Parts must be properly removed, cleaned, inspected and repaired according to the instructions in previous chapters prior to assembly. Adhere to the component assembly instructions in this chapter. Prior to assembling components, refer to the following sections of M-0, Standard Practice Maintenance Manual:

- Appendix C-1, “Handling Parts”
- Appendix C-2.2, “Acceptable Replacement Parts”
- Appendix C-2.3, “100% Parts Replacement Requirements”

NOTE: The definition of “replace” in this manual is removal and disposal of the original part and subsequent installation of a new part with the same form, fit and function as the original part when it was new.

16-1. Fuel Injection System Assembly

16-1.1. Fuel Injection System Subassembly

NOTE: Before re-installation of fuel system component fittings ensure they are free of debris by screwing them into the proper size holes of a soft wood block and thoroughly flushing them with an approved solvent.

The fuel pump, throttle/metering unit and fuel manifold valve must be new, factory rebuilt, or field overhauled and tested by an authorized FAA Part 145 Repair Station.
Component Assembly

16-1.2. Fuel Injector Nozzles

1. Prepare six new fuel injector nozzles matching the flow characteristics of those removed during disassembly. Position-tuned nozzles must be installed in the appropriate cylinder location for optimum performance.

2. Apply a light coating of clean 50 weight aviation engine oil to the injector O-rings seats and the injector nut seat. Install a new washer (Figure 17-34) (19) below the nut seat of the fuel injector nozzle. Install new O-rings (18) in the grooves above the nut seat.

3. Cap the ends of the new injector nozzles; mark them for the respective cylinders and place them in a clean storage container until ready for use.

Figure 16-1. Fuel Injector Nozzle Identification

4. Sparingly apply CMI Part No. 646943 anti-seize lubricant to the fuel injector male threads as shown in Figure 16-2.

CAUTION: Apply Anti-seize lubricant to the male fitting threads. Never use Teflon tape on Fuel Injection System fittings or components.

Figure 16-2. Apply Anti-Seize to Fuel Injector Threads
16-1.3. Fuel Pump Assembly

NOTE: This procedure only applies if the fuel pump is field overhauled. New and factory rebuilt fuel pumps are shipped with fittings installed.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to all except the first two male fitting threads and install the fuel pump fittings in the same locations (Figure 16-4) they were removed from, oriented (clocked) to the same angles as when disassembled.

Figure 16-3. Fuel Injection Fitting F/I Sealant Application

2. Torque the fittings to the value specified in M-0, Standard Practice Maintenance Manual following Appendix C (in M-0) hose and fitting installation instructions.

NOTE: Fuel pump fittings vary by engine model specification. Illustration depicts the purpose of the connections relative to fuel flow through the fuel system.

Figure 16-4. Fuel Pump Assembly with Fittings

1 Low Pressure Relief Valve Adjustment
2 Variable Orifice Adjustment (N/A)
3 Mixture Control
4 Aneroid Adjustment
A Pump Inlet
B Pump Outlet
C Fuel Return
D Vapor Return
E Drain
F Deck Pressure Reference
16-1.4. Diverter Valve Assembly

NOTE: the diverter valve is only used on TSIO-550-B, C & E engine model fuel systems.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to the male fitting threads; install the fittings (Figure 16-5) (2, 4, 6, and 7) in the new diverter valve, clocked according to the illustration drawn or the photograph taken at the time of disassembly.

2. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 16-5. Fuel Priming System](image-url)
Figure 16-6. Diverter Valve Fitting Detail
Component Assembly

16-1.5. Fuel Manifold Valve Assembly

The fuel manifold valve must be replaced as an assembly at engine overhaul. Assembly instructions are limited to verification of the assembled components and minor parts replacement. Internal fuel manifold valve assembly and flow verification instructions are beyond the scope of this manual and are not provided. When the fuel manifold valve is ordered as an assembly, steps to install the fittings in the fuel manifold valve are not necessary; the fuel manifold valve is shipped with the fittings installed to comply with the engine model configuration.

Prior to disassembly, the mechanic should have taken a photograph or sketched the assembly for fitting installed location and orientation. Refer to the photograph or sketch for assembly.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to all except the first two male fitting threads and install the fuel manifold valve fittings in the same locations from which they were removed. Torque the fittings to the value specified in M-0, Standard Practice Maintenance Manual.

2. Place the fuel manifold valve (Figure 16-7) (1) on a flat surface. Invert the bracket (2) and insert a screw (3) with a washer (4) through each of the mounting holes in the bracket. Place another washer (4) on each of the screws after the screw is in the bracket. Align the bracket (2) with the manifold valve mounting holes and thread each screw in to the fuel manifold valve cover. When all the screws are hand tight, torque the screws (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Component Assembly

Figure 16-7. Fuel Manifold Valve Assembly

1. Manifold Valve
2. Bracket
3. Fillister Head Screw
4. Washer
5. Adapter
6. 90° Elbow
7. 45° Elbow
8. Flare Tube Cap
9. Elbow
16-1.6. TSIO-550-B, C, E & G Throttle Assembly

The throttle and metering assembly must be replaced as an assembly at engine overhaul. Assembly instructions are limited to verification of the assembled components and minor parts replacement. Internal throttle assembly and flow verification instructions are beyond the scope of this manual and are not provided. When the throttle is ordered as an assembly, steps to install the fittings are not necessary.

Prior to disassembly, the mechanic should have taken a photograph or sketched the assembly for fitting installed location and orientation. Refer to the photograph or sketch for assembly.

1. Apply a small amount of CMI Part No. 646940 sealant (Figure 16-3) to all except the first two male fitting threads and install the throttle fittings (10-19) in the same locations from which they were removed. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Install the bracket (Figure 16-8 or Figure 16-9) (20) on the throttle body with a bolt (21), followed by a washer (24), washer (23), bracket (20) washer (23) and spacer (22) in the boss on the bottom of the throttle body. Torque the bolt (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 16-8. Throttle Assembly

![Throttle Assembly Diagram]
3. The throttle lever (3) and lock nut (4) ship loose with the throttle assembly. Install the lever according the engine installation drawings in Section 5-4.

**Figure 16-9. Throttle Assembly**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Throttle Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Lever</td>
</tr>
<tr>
<td>3</td>
<td>Throttle &amp; Mixture Control Lever</td>
</tr>
<tr>
<td>4</td>
<td>Lock Nut</td>
</tr>
<tr>
<td>5</td>
<td>Adjustment Screw</td>
</tr>
<tr>
<td>6</td>
<td>Spring</td>
</tr>
<tr>
<td>7</td>
<td>Pin</td>
</tr>
<tr>
<td>8</td>
<td>Nut</td>
</tr>
<tr>
<td>9</td>
<td>Set Screw</td>
</tr>
<tr>
<td>10</td>
<td>Reducer Bushing</td>
</tr>
<tr>
<td>11</td>
<td>Connector Fitting</td>
</tr>
<tr>
<td>12</td>
<td>Adapter Assembly</td>
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<tr>
<td>13</td>
<td>Flex Connector</td>
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<tr>
<td>14</td>
<td>Plug</td>
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<tr>
<td>15</td>
<td>Tee</td>
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<tr>
<td>16</td>
<td>45° Elbow or Connector Fitting</td>
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<td>17</td>
<td>90° Elbow or Orifice Fitting Adapter</td>
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<td>18</td>
<td>Cap</td>
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<td>19</td>
<td>90° Elbow</td>
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<td>Bracket</td>
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<td>21</td>
<td>Bolt</td>
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<td>22</td>
<td>Sleeve</td>
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<tr>
<td>23</td>
<td>Screw</td>
</tr>
<tr>
<td>24</td>
<td>Washer</td>
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</tbody>
</table>
16-1.7. TSIO-550-K & N Throttle Assembly

The throttle and metering assembly must be replaced as an assembly at engine overhaul. Assembly instructions are limited to verification of the assembled components and minor parts replacement. Internal throttle assembly and flow verification instructions are beyond the scope of this manual and are not provided. When the throttle is ordered as an assembly, steps to install the fittings are not necessary.

Prior to disassembly, the mechanic should have taken a photograph or sketched the assembly for fitting installed location and orientation. Refer to the photograph or sketch for assembly.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to all except the first two male fitting threads and install the throttle fittings (10-20) in the same locations from which they were removed. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Install the bracket (Figure 16-10 or Figure 16-11) (25) on the throttle body with a bolt (21), followed by a washer (24), washer (23), bracket (25) washer (23) and spacer (22) in the boss on the bottom of the throttle body. Torque the bolt (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. The throttle lever (3) and lock nut (4) ship loose with the throttle assembly. Install the lever according the engine installation drawings in Section 5-4.

![Figure 16-10. Throttle Assembly](image-url)
Figure 16-11. Throttle Assembly

1. Throttle Assembly
2. Lever
3. Throttle & Mixture Control Lever
4. Lock Nut
5. Adjustment Screw
6. Spring
7. Set Screw
8. Nut
9. Pin
10. Reducer Bushing
11. Connector Fitting
12. Adapter Assembly
13. Flex Connector
14. Plug
15. Tee
16. Connector Fitting
17. Orifice Fitting Adapter
18. Cap
19. 90° Elbow
20. 45° Elbow Fitting
21. Bolt
22. Sleeve
23. Washer
24. Washer
25. Throttle Body Bracket
Component Assembly

16-2. Induction System Assembly

1. Install a new felt bumper pad (Figure 16-13) (2) on the bottom of the induction manifold with CMI Part No. 655700 adhesive.

2. Install the fuel manifold valve and bracket assembly on the 2-4-6 side of the induction manifold (1) with new bolts (9), washers (7) and spacers (8); torque the bolts (9) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to the male fitting threads and install plugs (Figure 16-13) (3) in the 1-3-5 side FWD (Figure 16-12) (F) (if the manifold is drilled and tapped for a fitting) and lower induction manifold ports (D & E); torque the plugs (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to the male fitting threads and install the remaining induction manifold fittings in the induction

---

**Figure 16-12. Induction Manifold Port Detail**

4. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to the male fitting threads and install the remaining induction manifold fittings in the induction
manifold ports (Figure 16-12)(A, B & C) based on the requirements of the engine model configuration; example configurations are provided in Figure 16-13.

![Component Assembly](Image)

**Figure 16-13. Composite Induction Manifold**

1. Induction Manifold
2. Felt Bumper Pad
3. Plug
4. Adapter Assembly
5. Nipple Connector
6. 90° Elbow
7. Washer
8. Spacer
9. Bolt
10. 45° Elbow
11. 45° Street Elbow
12. Plug
16-2.1. Induction Tube Assembly

1. Lubricate a new O-ring (30) with Grade 50 aviation engine oil and install the new O-ring on the 2-4-6 forward induction tube (39) flange.

2. Install the overboost valve (29) with bolts (31), washers (32) and new lock nuts (33). Torque the fasteners to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Do not torque the induction tube clamps until final installation on the engine.

3. Loosely assemble the 1-3-5 side aftercooler (34) and induction tubes (39 & 45) with new hoses (40 & 41) and clamp assemblies (42 & 43).

4. Loosely assemble the 2-4-6 side aftercooler (34) and induction tubes (38 & 44) with new hoses (40 & 41) and clamp assemblies (42 & 43).

![Induction System Diagram](image)

**Figure 16-14. Induction System**

NOTE: WD-40 or a mild, soapy water solution may be applied to the inside of the hoses the ease assembly of the induction spider.

3. Loosely assemble the 1-3-5 side aftercooler (34) and induction tubes (39 & 45) with new hoses (40 & 41) and clamp assemblies (42 & 43).

4. Loosely assemble the 2-4-6 side aftercooler (34) and induction tubes (38 & 44) with new hoses (40 & 41) and clamp assemblies (42 & 43).
5. Install the venturi nozzle (35) with new hoses (36) and new clamps (37).

6. Loosely assemble the induction spider (1 & 3-8) with new hoses (9) and clamps (10) at each induction joint. Do not torque the clamps at this time.

Figure 16-15. Induction System

1 Induction Manifold 13 Washer 25 Clamp Assembly
2 Gasket 14 Lock Washer 26 Fuel Distribution Tube Bracket
3 Intake Tube, #1 Cylinder 15 Nut 27 Fuel Injection Line Bracket
4 Intake Tube, #2 Cylinder 16 Tube Assembly 28 Tube Clamp
5 Intake Tube, #3 Cylinder 17 Tube Assembly, Right 29 Overboost Valve
6 Intake Tube, #4 Cylinder 18 Tube Assembly, Left 30 O-Ring Seal
7 Intake Tube, #5 Cylinder 19 Screw 31 Bolt
8 Intake Tube, #6 Cylinder 20 Hose 32 Washer
9 Hose 21 Sleeve Assembly 33 Lock Nut
10 Hose Clamp 22 Washer 34 Aftercooler Assembly
11 Gasket 23 Washer 35 Sonic Venturi Nozzle
12 Intake Manifold Tube Flange 24 Compression Seal 36 Hose
37 Clamp
38 Induction Tube, 1-3-5 FWD
39 Induction Tube, 1-3-5 FWD
40 Intake Hose
41 Hose
42 Clamp Assembly
43 Clamp Assembly
44 Induction Tube, 1-3-5 AFT
45 Induction Tube, 1-3-5 AFT
46 Compression Seal
Component Assembly

16-3. Alternator Assembly

Refer to the “Gear Driven Alternator Replacement” instructions in Section 10-4.1 of M-0, Standard Practice Maintenance Manual.
Component Assembly

16-4. Starter & Starter Adapter Assembly

The starter adapter features a scavenge pump driven to circulate the turbocharger oil supply. Overhaul is only permitted on the starter adapter with a PTO drive shaft. Replace the starter adapter without PTO drive shaft at overhaul.

16-4.1. Starter Adapter with Scavenge Pump and Accessory Drive Assembly

1. Lubricate the inside diameter of a new bearing (Figure 16-17) (8) and the end of the worm drive shaft (4) with Molyshield grease. Press the new bearing (8) onto the worm drive shaft (4) until it rests on the shoulder of the worm drive shaft (4).

2. Lubricate the inside diameter of the worm gear (7) and the worm drive shaft (4) with Molyshield grease. Install a new woodruff key (5) in the slot of the worm drive shaft (4). Install a new spring (6) on the worm drive shaft (4), followed by the worm gear (7).

3. Lubricate the inside of the starter adapter housing (1) and the worm gear (7) drive teeth with Molyshield grease. Insert the assembled worm drive (4, 5, 6, 7 & 8) in the starter adapter housing (1) so the end of the worm drive shaft (4) is inside the new roller bearing (3). Use snap ring pliers to secure the assembly with a new retaining ring (9) in the starter adapter housing (1) flange. Verify the retaining ring (9) is properly seated in the starter adapter housing (1) flange.

4. Lubricate a roller bearing (18) with Molyshield grease and install the roller bearing (18) in the worm wheel gear (19) using the Bearing Installation Tool (Figure 16-16 and Chapter 2 of M-0, Standard Practice Maintenance Manual) and an arbor press.

5. Lubricate the inside diameter of the clutch spring (Figure 16-17) (17) liberally with clean 50 weight aviation engine oil.
Figure 16-17. Starter and Adapter with Scavenge Pump and Accessory Drive

1 Starter Adapter Housing 14 Stud 27 Stud
2 Sleeve, Clutch Spring 15 Dowel 28 Stud
3 Needle Bearing 16 Starter Shaft Gear 29 Dowel
4 Worm Drive Shaft 17 Clutch Spring 30 Washer
5 Woodruff Key 18 Roller Bearing 31 Nut
6 Starter Spring 19 Starter Worm Gear 32 Scav. Pump Driven Gear
7 Starter Worm Gear 20 Tab Washer 33 Bushing
8 Radial Ball Bearing 21 Screw 34 Scav. Pump Driver Gear
9 Internal Retaining Ring 22 Ball Bearing 35 Scav. Pump Body
10 Stud 23 O-Ring 36 90° Street Elbow
11 Stud 24 Cover Assembly 37 45° Elbow
12 Stud 25 Plug 38 90° Elbow
13 Stud 26 Stud 39 Seal Retainer Clip
14 Stud 27 Stud 40 Washer
15 Dowel 28 Stud 41 Lock Washer
16 Starter Shaft Gear 29 Dowel 42 Nut
17 Clutch Spring 30 Washer 43 Spacer
18 Roller Bearing 31 Nut 44 Bearing
19 Starter Worm Gear 32 Scav. Pump Driven Gear 45 Starter Shaft Seal
20 Tab Washer 33 Bushing 46 O-ring Seal
21 Screw 34 Scav. Pump Driver Gear 47 Starter Shaft Sleeve
22 Ball Bearing 35 Scav. Pump Body 48 Starter Shaft Spacer
23 O-Ring 36 90° Street Elbow 49 Flanged Nut
24 Cover Assembly 37 45° Elbow
25 Plug 38 90° Elbow
26 Stud 39 Seal Retainer Clip
Component Assembly

6. Twist the new clutch spring clockwise on to the back side of the worm wheel gear assembly (50) until the offset end drops into the gear land. Position the clutch spring (17) on the worm wheel gear (19) so the tang aligns with the screw hole in the gear web.

7. Install a screw (21) with a new tab washer (20) in the threaded screw hole in the worm wheel gear assembly (50) web. Torque the screw (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual and bend the tab washer (20) up to the wrench flat of the screw head with a brass drift to secure the screw.

8. Lubricate the starter shaft gear (16) collar and inside diameter of the clutch spring (17) liberally with clean 50 weight aviation engine oil.

9. Twist the assembled worm wheel gear (19) and clutch spring (17) clockwise on the starter shaft gear (16) until the starter shaft gear (16) meets the roller bearing (18).

10. Lubricate the worm wheel gear teeth with Molyshield grease. Insert the starter shaft gear and worm wheel assembly in to the starter adapter housing (1). Align the teeth of the worm gear (7) and worm wheel gear (16) as the assembly enters starter adapter housing (1).

11. Lubricate a new bearing (22) with Molyshield grease and press the bearing into the flange on the inside of the housing cover (24) using an arbor press. The ball bearing (22) should be seated against the inside flange of the housing cover (24).

12. Lubricate a new O-ring (23) with 50 weight aviation engine oil; install the new O-ring (23) on the starter adapter housing cover (24) flange.

13. Align the starter adapter housing cover (24) with the starter adapter studs. Secure the cover with washers (30) and nuts (31); torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Insert the blade of a large common screwdriver in the driver slot of the worm drive shaft (4) and turn the worm drive shaft clockwise. The shaft should rotate smoothly, with minimal resistance. If the assembly doesn’t rotate or it exhibits binding, disassemble the starter adapter to determine the cause of the malfunction.

15. Lubricate the inside diameter and gear teeth of the scavenge pump driver gear (32) with Molyshield grease and install the gear on the end of the starter shaft gear (16).

16. Apply Loctite 592 to the fitting threads and install the fittings (36, 37 & 38) in the scavenge pump housing (35). Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

17. Lubricate the shaft inside the scavenge pump housing (35) and the inside diameter of the bushing (33) and scavenge pump driven gear (34) with Molyshield Grease. Press the new bushing (33) in the scavenge pump driven gear (34). Install the drive gear, with new bushing on the shaft. Wipe any Molyshield grease residue from the scavenge pump housing parting flange.

18. Lightly coat the parting flange of the scavenge pump housing (35) with Part No. 654663 sealant; Allow the Part No. 654663 sealant to cure until it is slightly tacky.
19. Apply a single line of Grade 3 Silk Thread over the Part No. 654663 surface of the pump body following the dotted line pattern in Figure 16-18.

![Figure 16-18. Scavenge Pump Body Silk Thread Pattern](image)

20. Install the scavenge pump housing (Figure 16-17) (35) on the starter adapter housing cover (24). Secure the scavenge pump housing with five sets of nuts (42), new lock washers (41) and washers (40). Do not install any hardware on the stud adjacent to the starter shaft seal bore. This hardware and seal retainer clip (39) will be installed after the starter shaft seal (45) and sleeve (47) are installed. Torque the nuts (42) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: The bearing (44) has an open cage on one side and a closed cage (labeled “thrust” on the cage) on the other. The bearing must be installed with the “thrust” side toward the front of the engine.

21. Install a new spacer (43) and new bearing (44) over the starter shaft gear (16) in the scavenge pump housing (35).

22. Lubricate the inside diameter of the starter shaft sleeve (47) with 50 weight aviation engine oil. Lubricate a new O-ring (46) with 50 weight aviation engine oil and install the new O-ring (46) in the starter shaft sleeve (47). Install the assembly (46 & 47), O-ring first on the starter shaft gear (16).

   Procedure continues on following page...
23. Lubricate the perimeter of the starter shaft seal (45) and the inside diameter of the scavenge pump housing seal bore and the starter shaft sleeve (47). Work the starter shaft seal (45) into position in the seal bore with an O-ring installation tool. The starter shaft seal (45) must be installed flush within 0.030 inches (Figure 16-19).

![Figure 16-19. Scavenge Pump Oil Seal Position](image)

24. Install a washer (40), oil seal retainer clip (Figure 16-17), (39), and nut (42) on the top stud of the scavenge pump housing (See Figure 16-20); torque the nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

25. Install the spacer (Figure 16-17) (48) or sheave on the starter shaft gear (16).
   a. If an air conditioning compressor drive sheave is required for the installation, lubricate the shaft threads with clean 50 weight aviation engine oil and install the air conditioning compressor drive sheave (48) and a new lock nut (49) on the end of the shaft (16). Do not torque the lock nut (49) until the sheave alignment is verified in Section 17-14, “Compressor (Optional) Mount Installation.”
   b. If a no air conditioning compressor drive sheave is required for the installation, lubricate the shaft threads with clean 50 weight aviation engine oil and install the spacer (48) and a new lock nut (49) on the end of the shaft (16); torque the lock nut (49) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

26. Insert the blade of a large common screwdriver in the driver slot of the worm drive shaft (4) and turn the worm drive shaft clockwise for a final check of the assembly. The shaft should rotate smoothly, with minimal resistance. If the assembly doesn’t rotate or it exhibits binding, disassemble the starter adapter to determine the cause of the malfunction.

27. Install the assembled adapter securely in a fixture. Apply counterclockwise force to the adapter input shaft with a torque wrench set to 300 in. lbs. No slippage is allowed.
28. Lubricate a new O-ring (Figure 16-21) (5) with clean 50 weight aviation engine oil and install it on the starter assembly (1) flange.

29. Align the driver slot of the worm drive shaft (Figure 16-17) (4) with the starter drive tang. Mount the starter motor (Figure 16-21) (2) on the starter adapter studs using two sets of nuts (3) and washers (4). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
NOTE: This section does not apply to the TSIO-550-N turbocharger assemblies.

On TSIO-550-B, C, E, G & K engines, turbochargers are fastened to the respective support brackets in a specific orientation, as shown in Figure 16-22, remove only the bolts necessary to facilitate turbocharger replacement:

- To assemble the left side (2-4-6) turbocharger, align the turbocharger bolt holes with the support bracket at bolt positions 3 and 4.
- To assemble the right side (1-3-5) turbocharger, align the turbocharger bolt holes with the support bracket at bolt positions 3 and 4.

If a new, rebuilt or overhauled turbocharger is being installed on the support bracket, refer to Figure 16-17 for the proper alignment and orientation of the turbocharger and support bracket:

1. Verify the side of the engine the turbocharger is being configured for.
2. Align the turbocharger bolt holes with the support bracket.
3. Install bolts with new tab washers.
5. Bend the tabs up against the bolt heads with a drift.

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**Figure 16-22. Turbocharger Bracket Orientation**

![Diagram of Turbocharger Bracket Orientation](image)
16-5.2. Turbocharger Component Assembly

NOTE: Refer to “Hose and Tubing Installation” in Appendix C-11 for important instructions about tightening fittings and hoses.

Lubricate the adapters, fittings, reducer, and O-rings with 50 weight aviation engine oil before installation to prevent damage to the O-rings and ensure proper torque application.

1. Install the left oil reservoir (Figure 16-23) (4) and adapter (5) on the left turbocharger (2) with new gaskets (7 & 8), bolts (10 & 12) and new lock washers (9 & 11).

2. Install the right oil reservoir (3) and adapter (5) on the right turbocharger (1) with new gaskets (7 & 8), bolts (10 & 12) and new lock washers (9 & 11); torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
3. Install the adapter (Figure 16-25) (4) with new O-ring (5) in the controller (1) compressor discharge reference port; torque the adapter (4) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Install an elbow (7) with a new O-ring (3) in the controller (1) oil drain port; torque the elbow (7) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Install the reducer (2) with new O-ring (3) in the controller (1) manifold pressure port or alternate manifold pressure port; torque the reducer (2) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Install the fitting adapter (6) with a new O-ring (3) in the controller (1) oil inlet port; torque the fitting adapter (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 16-25. Wastegate Controller Fitting Detail
7. Install the 45° (K N 90°) elbow (Figure 16-26) (2) with a new O-ring (5) in the wastegate (1) oil supply port (from oil cooler); torque the fitting (2) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Install the 45° (N 90°) elbow (3) with a new O-ring (6) in the wastegate (1) oil outlet port (to controller); torque the fitting (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Apply Loctite 592 to the plug (7) threads and install the plug (7) in the wastegate (1) upper drain port; torque the plug (7) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: The lower wastegate drain B C E G fitting is defined and provided by the aircraft manufacturer. Consult aircraft maintenance manual for instructions.

10. Apply Loctite 592 to the drain (4) fitting threads and install the drain fitting (4) in the wastegate (1) lower drain port; torque the drain fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 16-26. Wastegate Fitting Detail
16-6. Lubrication System Assembly

CAUTION: Never use Teflon tape on Lubrication System fittings.

16-6.1. Oil Pump Assembly

1. Lightly coat the parting surface of the oil pump body (Figure 16-27) with Part No. 654663 sealant and allow to cure until it is slightly tacky.

2. Apply a single line of Grade 3 Silk Thread in the Part No. 654663 sealant bed, inward to the split line toward the oil pump bore.

3. Apply Part No. 654663 to the perimeter of the oil pump cover (Figure 16-28)(16) where it mates with the oil pump housing.

![Figure 16-27. Oil Pump Housing Silk Thread Pattern](image)

4. Install the oil pump housing (2) in a suitable fixture and lubricate the cavity, gear contact areas, the gear and bushing (4), and the shaft gear assembly (15) with Part No. 656817 Molyshield Grease.

5. Assemble the oil pressure relief valve plunger (6) with spring (7), and seat (8) on the adjusting screw (9). Install a new gasket (10) on the oil pressure relief valve housing (11). Thread the adjusting screw (9) into the oil pressure relief valve housing (11) approximately half the full length of travel on the threads. Verify the relief valve components are aligned.

6. Apply Part No. 646943 Anti-Seize Lubricant to all except the first two male threads of the oil pressure relief valve housing. Torque the oil pressure relief valve housing (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil pressure relief valve housing (11) according to instructions in Appendix C of M-0, Standard Practice Maintenance Manual.

7. Install the copper washer (13) over the adjusting screw protruding from the base of the oil pressure relief valve housing and secure with the self-locking nut (14).
Torque the self-locking nut (14) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Lubricate the oil pump gear cavity, gear contact area, gears (15 and 4) and bushing (5) with Molyshield grease. Install the shaft (driving) gear (15), bushing (5) and (driven) gear (4), in the oil pump housing (2).

9. Install the cover (16) and secure with two sets of washers (18) and nuts (20) at 6 and 12 o’clock positions. Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Cover the assembly and store in a clean location until final assembly. The oil pump, filter adapter and oil filter will be installed during engine assembly.

### Figure 16-28. Oil Pump Assembly

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Component Assembly

16-6.2. Oil Cooler Assembly

The oil cooler must be cleaned, overhauled, tested and assembled by an appropriately rated repair station (i.e., FAA-approved Part 145 repair station) or replaced with a new oil cooler assembly. The oil temperature control valve, any special plugs, new gaskets, new O-rings, and new lock washers will be installed on the oil cooler during engine assembly.
16-7. Engine Cylinder Assembly

1. Install a new (or repaired) cylinder baffle (Figure 16-31) (43) on the lower side of each cylinder below the pushrod tube passages to close the gap outboard of the lower spark plug hole as illustrated in Figure 16-29.

2. Insert the hooked end of a new spring (44) through the baffle as depicted in Figure 16-30. Use a spring hook to extend and latch the end of the spring (44) over a cylinder fin on the opposite side of the cylinder from the baffle.
Figure 16-31. Cylinder Assembly

1 Cylinder Assembly 15 Drain Fitting 29 Rocker Cover 43 Baffle
2 Spark Plug Insert 16 Inner Retainer 30 Washer 44 Spring
3 Intake Valve Guide 17 Retainer Key 31 Lock Washer 45 Drain Tube
4 Exhaust Valve Guide 18 Rotocoil 32 Screw 46 Drain Tube Seal
5 Stud 19 Intake Rocker Arm Assembly 33 Exhaust Flange Gasket 47 7th Stud Bracket
6 Stud 20 Exhaust Rocker Arm Assembly 34 Lock Nut 48 7th Stud Bracket
7 Exhaust Stud 21 Rocker Arm Bushing 35 Pushrod Housing 49 Flange Nut
8 Helicoil Insert 22 Drive Screw 36 Washer 50 Cylinder Base O-ring
9 Intake Valve Seat Insert 23 Thrust Washer 37 O-ring Seal 51 Intake Valve Seat
10 Exhaust Valve Seat Insert 24 Rocker Arm Shaft 38 Pushrod Housing Packing 52 Check Valve
11 Intake Valve 25 Retainer 39 Pushrod Housing Spring 53 Valve Spring Retainer
12 Exhaust Valve 26 Tab Washers 40 Pushrod Assembly 54 Hydraulic Exhaust Tappet
13 Inner Spring 27 Screw 41 Flange Nut 55 Hydraulic Intake Tappet
14 Outer Spring 28 Rocker Cover Gasket 42 Flange Nut
**WARNING**

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

3. Spread a film of Molyshield grease on the intake valve (Figure 16-31) (11) and the new exhaust valve (12) stems.

   NOTE: If the intake and exhaust valves were lapped, install the valves into the corresponding cylinder lapped positions.

4. Grasp the valve stems and install the cylinder on a cylindrical block of wood anchored to a work bench.

5. Reapply Molyshield grease to the valve stems.

6. Place the new valve spring lower retainers (16) over the valve guides (3 and 4), cupped side up.

7. Coat the sealing surface of a new intake valve guide seal (51) with clean 50-weight aviation engine oil.

8. Install the new intake valve guide seal (51) by hand. Tap the new seal onto the guide with a “Valve Guide Seal Installation Tool” (Chapter 2, Special Tools in M-0, Standard Practice Maintenance Manual) and a plastic mallet until it is firmly seated.

9. Install new inner and outer springs (13 and 14) and a new rotocoil (18) on the exhaust valve springs and the new retainer (53) on the intake valve springs. The valve springs must be installed with the closed coils toward the cylinder head as shown in Figure 16-32.

![Figure 16-32. Valve Spring Installation](image-url)
WARNING
Contact with the retainer will damage the valve stems. Before releasing pressure on the springs, ensure the keys are properly seated in the valve stem grooves.

10. Compress the valve springs with the Valve Spring Compressor Tool and insert the new valve stem retainer keys (Figure 16-31) (17). Depress the springs only enough to allow the keys to seat into the valve stem grooves. If the keys drop, they may damage the valve stem when the springs are released.

11. Remove the cylinder from the fixture and place it upright on a workbench.

12. Place a plastic mallet squarely on the end of the valve stem and strike the plastic mallet sharply with a rawhide mallet to seat the valve spring retainer keys. DO NOT STRIKE THE RETAINER.

13. Verify the valve spring retainer keys are properly positioned, with two keys on each valve stem as illustrated in Figure 16-33.

14. Invert the cylinder assembly on the bench with the cylinder bore facing upward and the cylinder resting on the rocker shaft mounting bosses.

15. Coat the cylinder barrel wall thoroughly with clean 50-weight aviation engine oil.

16. Ensure the new pistons and new piston rings are the correct size for the cylinder bore size. Inspect the piston-to-cylinder clearance of each matching piston and cylinder. Refer to Section 10-8 of M-0 for information regarding piston weights now used to identify pistons (in lieu of piston position markings).

17. Inspect each piston ring for the proper gap in the cylinder bore in which it will be assembled.

18. Insert one piston ring at a time into the cylinder bore and use the piston to push the piston ring to the position specified in Appendix D.
19. Remove the piston and inspect the ring gap using a leaf type feeler gauge.
   
a. If the ring gap is smaller than specified, record the actual gap size and remove the ring from the cylinder bore.

b. Mount a fine toothed flat file in a vise. While holding the ring ends firmly and squarely against the file, remove the desired amount of material.

c. To attain the correct ring gap, deburr the ring gap ends using crocus cloth.

d. Thoroughly clean the piston ring with mineral spirits and air dry.

e. Install the new piston ring in the cylinder bore to the correct position and inspect the ring gap again. Repeat the tasks in this step until all piston ring gaps meet the required specification.

f. Discard piston rings that exceed the specified piston ring gap dimensions.

![Figure 16-34. Piston Ring Installation Order](image)

20. Install the new piston rings (Figure 16-35) (2 thru 5) on the new pistons with the part number facing toward the top of the piston using a ring expander.
   
a. Install a new expander ring in the new oil control ring groove so the expander gap is 180° away from the oil control ring gap.

b. Install a new #3 piston ring in the #3 ring groove of the piston with the oil control ring gap at the 12 O’clock (referenced to the piston’s installed position in the cylinder) position.

c. Install a new second compression ring (3) into the #2 ring groove with the ring gap at the 3 O’clock position.

d. Install a new top compression ring (2) into the #1 ring groove with the ring gap at the 9 O’clock position.

e. Install a new oil scraper ring (5) into the fourth ring groove with the ring gap at the 6 O’clock position.

21. Inspect all ring side clearances with the ring edge flush with the piston outside diameter. All ring side clearances must conform to Appendix D dimensional limits.
Component Assembly

22. Lubricate the piston pin and piston and ring assemblies with clean 50-weight aviation engine oil.

NOTE: The weight of opposing bay piston pairs varies no more than 1/2 ounce or 14.175 grams.

![Figure 16-35. Piston, Piston Pin and Rings](image)

23. Place the new piston and ring assembly with the cylinder assembly for which it was previously sized and gapped. Install new piston pins (6) in the piston pin bores. Piston pins must slide freely in the piston pin bores.

24. Using a ring compressor, install each piston into its cylinder with top three rings in the cylinder barrel and the piston pin accessible for connecting rod installation.

25. Install a new O-ring seal (Figure 16-36) (37) on the cylinder end of the pushrod housings (35). Place two each, pushrod housings, new springs (39), washers (36), new packing (38), and second washer (36) with each cylinder on the bench.

![Figure 16-36. Pushrod Tube Assembly](image)
16-8. Crankcase Assembly

1. Install new pipe plugs.
   a. Apply Loctite 592 Teflon PS/T Pipe Sealant sparingly on the pipe plug male threads.
   b. Install the crankcase pipe plugs removed during disassembly in the locations indicated on the tags. Install new plugs according to the “Crankcase Plugs” instructions in Appendix D-9.6. The plugs must be installed in all of the corresponding locations to prevent oil leakage or pressure loss. Torque the plugs to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Install the starter adapter shaft gear bearing using the following steps:
   a. Stand the 1-3-5 crankcase on its nose end and place the new starter shaft gear needle bearing with its part number facing outward into the bearing bore.
   b. Install the needle bearing using an arbor press and a “Permold Crankcase Needle Bearing Installation Tool” (Chapter 2 of M-0, Standard Practice Maintenance Manual) or equivalent.
   c. Press the bearing into the crankcase until it bottoms out in the bore.
16-9. Engine and Turbocharger Mount Installation

NOTE: TSIO-550-K & N model turbocharger mounting brackets vary significantly in appearance from the remaining engine models but instructions are the same for all engine models.

1. Install the forward engine mounts (Figure 16-37) (1) on the crankcase studs and secure with washers (5) and nuts (6). Torque the nuts (6) to Appendix B specifications.

2. Install the aft engine mounts (2) on the crankcase studs. Install washers (5 (top) & 7 (bottom)) on the protruding studs, followed by two spacers (8) on the top stud. Install the turbocharger mounting brackets (3 & 4) on the studs and secure with washers (5) and nuts (6) on all three studs. Torque the nuts (6) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 16-38. Engine and Turbocharger Mounting Brackets

Figure 16-39. Engine and Turbocharger Mounting Brackets
Component Assembly

16-10. Engine Drive Train Assembly

16-10.1. Camshaft Assembly

Camshafts have the same rear plugs but the front plugs may be threaded with a hex head or a Hubbard, press type plug. If press type (Hubbard) plugs are installed in the camshaft, or the camshaft is otherwise unserviceable, replace the camshaft.

**WARNING**

Failure to install camshaft plugs before the camshaft is assembled in the engine will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.

NOTE: Continental Motors no longer manufactures camshafts for the TSIO-550 engine with pressed in (Hubbard) plugs. Reliable replacement of pressed in plugs cannot be performed in the field. If a pressed in plug is present in either the front or rear of the camshaft, replace the camshaft.

1. Install the camshaft (Figure 16-40) in a suitable holding fixture. Apply Loctite 592 Pipe Sealant to the threads of the 0.25”-18 camshaft plugs (2 & 3); install the plugs (2 & 3) in each end of the camshaft. Torque the plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual and repeat the Camshaft “Magnetic Particle Inspection” according to instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

2. Coat the gears and camshaft spline with 50-weight aviation engine oil.

3. Align the splines and install the governor drive gear (6) onto the camshaft.

   NOTE: The camshaft gear (4) bolt holes are offset to allow only one correct installed position for the engine timing mark.

4. Install the camshaft gear (4) on the camshaft assembly (1).

5. Install four new bolts (5) and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Safety wire the bolt heads according to the “Safety Wiring Hardware” instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

7. Coat the camshaft with 50-weight aviation engine oil.
Figure 16-40. Camshaft Assembly

1 Camshaft Assembly 3 Plug 5 Bolt 7 Governor Driven Gear
2 Plug 4 Camshaft Gear 6 Governor Drive Gear
16-10.2. Crankshaft Assembly

**WARNING**

Do not assemble and install the crankshaft if the VAR stamp is absent from the propeller flange.

1. Place the crankshaft on a bench with a notched wooden block under the front and rear main journals.

   *CAUTION: Do not heat the gear cluster more than 10 minutes.*

2. Install a new dowel (Figure 16-41) (32) in the crankshaft dowel bore. The dowel bore is smooth, not threaded and a smaller diameter than the bolt holes. Drive the
Component Assembly

dowel with a hammer and brass drift until only 0.20 ±0.010” extends from the crankshaft flange.

3. Using a uniform heating method (not a torch), heat the small crankshaft gear (24) to 300°F (149°C) for 5 to 10 minutes. Heating the gear is necessary for a shrink fit installation.

4. While the gear is still hot, align the gear dowel hole with the crankshaft dowel and install the small crankshaft gear on the crankshaft.

5. Attach the large crankshaft gear (23) to the small crankshaft gear (24) using six new drilled head screws (22). Torque the screws in a crisscross pattern to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. The crankshaft gear incorporates a square drive hole for the square drive fuel pump coupling. The gear also has a timing mark to align the crankshaft to camshaft timing.

7. Safety wire the drilled head screws (22) according to the “Safety Wiring Hardware” instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

8. Install the alternator face gear (27) over the propeller flange.

9. With the holes aligned, install new tab lock plates (26) and four new bolts (25). Torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Do not over-torque the bolts to line up the bolt wrench flat with the lock tab. If the bolt head flat does not line with the lock tab, replace the bolt.

10. Secure the tab lock plates against the bolt wrench flats with a brass drift.

11. Lubricate the oil transfer collar halves (19 and 20) with clean 50-weight aviation engine oil. Install the collar halves on the crankshaft using new dowel pins (18) and secure the installation with new lock nuts (17).

12. Confirm running clearance (Table D-13) between the collar and crankshaft for propeller oil pressure.

13. Alternately torque the lock nuts (17) in 20 inch-pound increments according to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. The collar must rotate freely to prevent friction.

14. Install the counterweights (Figure 16-41).

   a. Attach two 6th order counterweights (15) to crank cheek No. 2 hanger blade with new 6th order counterweight pins (12).

   NOTE: Counterweight pins are identified by a three-digit dash number stamped on one end (see Section 10-9.1 of M-0, Standard Practice Maintenance Manual). The pin diameter determines the counterweight order; it is imperative the correct pin be installed in the counterweight (as instructed in subsequent steps). Table 10-30 in M-0 indicates the counterweight order and outer diameter dimension.

   CAUTION: Replacement counterweight pins must be designated for the same order of magnitude as the removed counterweight pin to ensure proper operation.
b. Install new counterweight plates (11) with the sharp edge (flat surface) outboard as shown in Figure 16-42 and new retaining rings (10).

\textit{CAUTION: The minimum gap between the retaining ring ears must be 0.179 inches (0.454 cm) for proper seating.}

Counterweight plates have a small extruded point which provides an interference fit of 0.001 to 0.007 inches. Check for the interference fit of the counterweight plates in the bushing bore during installation. Do not install loose fitting counterweight plates. Do not install retainer plates on counterweights that have a loose fit between the retainer plate and the counterweight.

c. Attach one 4th order and one 5th order counterweight on either side of the No. 5 crank cheeks.

d. Install two new 4th order counterweight pins (Figure 16-41) (13) in the 4th order counterweights (38).

e. Install two new 5th order counterweight pins (14) in the 5th order counterweights (38).

f. Install new counterweight plates and retaining rings and (11 and 10) with the sharp edge (flat surface) outboard as shown in Figure 16-42.

15. Install the connecting rod (Figure 16-41) (7) and new connecting rod bearings (8) on the crankshaft according to instructions in Section 16-10.3.
16-10.3. Connecting Rod and Bearing Assembly

1. Place a sheet of crocus cloth on a flat surface plate and dampen the cloth with solvent.

2. Lightly rub the parting surface of the cap and rod across the crocus cloth to remove any burrs or nicks. Inspect the parting surfaces, bolt holes and bolt hole edges to ensure there are no nicks, burrs, or sharp edges.

3. Original connecting rods have a position number stamped on the end cap and rod bolt boss. Check that the new connecting rod has the correct position number, 1 through 6 as applicable, vibro-etched in the location shown in Figure 16-43 that corresponds to the connecting rod being replaced. Replacement connecting rods must match the position of the connecting rod being replaced.
4. Install a new connecting rod bearing (Figure 16-41) (8) in each connecting rod cap (6) and rod (7). Ensure that the bearing ends project the same distance even with the parting surface and they are properly seated.

5. Look closely for any metal that may have shaved from the bearing back onto the parting surface during installation. Remove the metal shavings.

6. Lubricate each connecting rod cap and bearing with 50 wt aviation engine oil and install each rod, cap and bearing assembly at the correct position on the crankshaft. Install the connecting rod and cap with the position numbers on top when odd number rods are extended to the right and even number rods are to the left when viewing the crankshaft from the rear (gear end) forward.

7. Lubricate the threads of the new connecting rod bolt (5) and new spiral lock nut (4) using clean 50 weight aviation engine oil. Note different part numbers are available for connecting rod bolt and nut pairs - do not intermingle bolt and nut pairs; only the specified bolt and nut in the pair are to be installed. If new connecting rod fasteners are required, bolt and nut sets must match.

8. Secure rods and caps using the new connecting rod bolt (5) and new spiral lock nut (4). Torque the fasteners to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Check connecting rod to crankshaft pin end clearance according to Appendix D specifications.
16-10.4. Crankshaft Nose Oil Seal Assembly

Install the Crankshaft Nose Oil Seal according to the “Split Type Nose Oil Seal Installation” instructions in Section 10-10.4 of M-0, Standard Practice Maintenance Manual.
Component Assembly

16-11. Compressor Mounting Kit Assembly

1. Install a new bearing (Figure 16-44) (3.01) into the idler sheave (3). Secure the new bearing (3.01) with a new retaining ring (3.02).

   NOTE: Shims (19 & 20) are used to align the driven sheave (18), idler sheave (3) and the starter adapter PTO drive sheave. Add or subtract shims, as required, to align the three sheaves during air conditioning compressor installation.

2. Install the idler sheave (3) on the block assembly (4) with the sheave support bolt (5), shims (19), and spacer (6). Do not torque the sheave support bolt at this time.

3. Loosely assemble the tensioning hardware (9, 10, 13, 11, and 4) on the mounting bracket (2).

4. Install the idler sheave (3) and block assembly (4) on the mounting bracket (1) using a bolt (7) and washer (8) through the block assembly, secured with a washer (13) and nut (12). Do not torque the hardware at this time.
Figure 16-44. Air Conditioning Compressor Mounting Assembly

ITEMS 2 THRU 14 INCLUDED IN ITEM 1

1 Mounting Bracket Assembly
2 Mounting Bracket
3 Idler Sheave
3.01 Ball Bearing
3.02 Retaining Ring
4 Block Assembly
5 Sheave Support Bolt
6 Spacer
7 Bolt
8 Special Washer
9 Tensioning Bolt
10 Jam Nut
11 Rectangular Nut
12 Lock Nut
13 Plain Washer
14 Bolt
15 Bolt
16 Washer
17 Drive Belt
18 Driver Sheave
19 Shim
20 Shim
21 Compressor
22 Spacer
Component Assembly

Intentionally Left Blank
Chapter 17. Engine Assembly

17-1. Engine Assembly Sequence

Assemble the engine in the sequential steps listed below, referring to corresponding sections in this chapter (and specified references) for detailed instructions:

1. Lubricate the engine components
2. Assemble the crankcase
3. Install the engine cylinders, inter-cylinder baffles and drain tubes
4. Torque the engine cylinders and crankcase
5. Install the hydraulic tappets and pushrods and lower baffle bases
6. Install the rocker arms
7. Install the oil suction tube and oil sump
8. Install the oil pump
9. Install the oil cooler
10. Install the alternator (and optional alternator bracket assembly)
11. Install the starter and starter adapter assembly
12. Install the induction system
13. Install the turbochargers and exhaust system
14. Install the fuel injection system
15. Install the air/oil Separator
16. Install the optional air conditioning compressor mount assembly
17. Install the ignition system
18. Install the engine in the aircraft according to instructions in Section 5-2

17-1.1. Component Lubrication

Prior to engine assembly, apply clean 50-weight aviation engine oil liberally to bare steel surfaces, journals, and bushings, except where special lubricants are required. A comprehensive list of authorized lubricants, sealants and adhesives is provided in Chapter 3 of M-0, Standard Practice Maintenance Manual.

**WARNING**

Lubricate hardware according to instructions in Chapter 3 and Appendix B of M-0, Standard Practice Maintenance Manual. Inspect fasteners for proper plating and thread form. Verify fastener serviceability and correctly lubricate the fastener for proper fastener pre-loading and torque application.
**17-2. Crankcase Assembly**

**17-2.1. Drive Train Installation**

*CAUTION: All parts must be clean and free of debris before the crankcase can be assembled. Perform the assembly in a clean, dry, dust-free environment.*

1. Install the left (2-4-6) crankcase half on the engine stand with the open side up. Place the right (1-3-5) crankcase half on a workbench with the open side up.

2. Seal and thread the crankcase according to the instructions in Section 3-3.1.2 of M-0, Standard Practice Maintenance Manual.

   *CAUTION: Do not apply engine oil on the crankshaft bearing saddles. Bearing saddles must be dry when installing the crankshaft main bearings.*

**WARNING**

*Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, cylinder fastener threads or crankcase main bearing bosses. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.*

3. Install new crankshaft main bearings (Figure 17-1) (2 & 39) in the bearing saddles on both crankcase halves. Do not lubricate the crankshaft bearing saddles, lubricate only the crankshaft side of the main bearings with clean 50-weight aviation engine oil.

4. Apply clean 50-weight aviation engine oil to the thrust washer lands in the crankcase to prevent the thrust washer halves from falling out during final assembly. Lubricate bearings with clean 50-weight aviation engine oil.

5. Install a new O-ring (21) in the oil transfer 2-4-6 side collar (20). Lubricate the O-ring (21) and oil transfer 2-4-6 side collar (20) area and bearing surface thoroughly with clean 50-weight aviation oil.

6. With the aid of an assistant, lift the crankshaft assembly by the No. 1 connecting rod and propeller flange.

7. Have the assistant hold the numbers 3 and 5 connecting rods upward while carefully lowering the crankshaft assembly into position. Guide the oil transfer collar into position.

8. Install new thrust washer halves (1).
9. Ensure the bearing and thrust washer ends project equally in the crankcase halves.

10. Verify the new O-ring (21), new crankshaft main bearings (2 & 39), and new thrust washers (1) are seated properly.

11. Connecting rod position numbers, if properly installed, will be toward the upper case flange. Carefully place the odd-numbered connecting rods on the upper case flange.

**Figure 17-1. Crankshaft Assembly**

**WARNING**

Failure to install plugs before the camshaft is assembled in the engine will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.
12. Apply clean, 50-weight aviation engine oil to the governor driven gear (Figure 17-2) (7) and camshaft assembly (1).

13. Install the governor-driven gear (7) in the crankcase bore.

14. Install the assembled camshaft assembly (1) into the crankcase.

15. Ensure the timing marks (Figure 17-3) on the camshaft and crankshaft align as the gears mesh.

16. The No. 1 connecting rod on the crankshaft should be in its fully extended (top dead center (TDC) position. The governor-driven gear may have to be turned slightly to allow the camshaft to seat in its bearings properly.

17. Compare the governor-driven gear backlash to Appendix D specifications. If the crankcase has been machined, the gear backlash must not be less than the specified minimum. (If the gear backlash is not within tolerance, inspect the gear, camshaft, and crankcase to determine the cause of non-conformance).

18. Measure the crankshaft end clearance using a dial indicator set at zero against the propeller flange; end clearance must conform to Appendix D specifications.

19. Measure the camshaft end clearance at both ends of the rear main bearing to ensure it falls within the range specified in Appendix D.
20. Install a new idler gear bushing (Figure 17-4) (16) on the dowel at the rear of the 2-4-6 side of the crankcase.

21. Lubricate the idler gear (Figure 17-1) (3) with clean 50-weight aviation engine oil.

22. Install the idler gear in the crankcase with the idler gear thrust flange to the rear and the support pin, eccentric shoulder away from the crankshaft.

23. Coat both sides of a new idler pin gasket (17) with Part No. 642188 sealant (CRC Copper Coat) and align the gasket with the idler gear support pin (18).

24. Temporarily secure the idler gear with the idler gear support pin (Figure 17-4) (14) lubricated with clean, 50-weight aviation engine oil. The idler gear support pin will be torqued later.

25. Using a dial indicator, check the idler, camshaft and crankshaft gear backlash according to Appendix D specifications.

27. Have an assistant balance and guide the odd numbered connecting rods straight up (Figure 17-5) through the 1-3-5 cylinder bores in the crankcase as the crankshaft assembly is installed.

**WARNING**

Failure to lubricate designated fasteners may result in damage to the crankcase bearing bore, crankshaft bearing or crankshaft and lead to engine malfunction or failure.
28. Back the idler gear support pin (Figure 17-4) (14) partially out to clear the studs.
29. Place the 1-3-5 (right) crankcase half on the 2-4-6 (left) case half.
30. Push the idler gear support pin (14) back onto the studs.
31. Secure the idler gear support pin with new lock washers (17) and nuts (18) but do not torque it at this time.
32. Verify the thrust washer (Figure 17-1) (1) halves and crankshaft main bearings (2) remain in place.

   **CAUTION:** *If the connecting rods are not secured with the old cylinder base O-rings (Figure 17-6) the connecting rods or the cylinder mounting deck could be damaged.*

33. Use the old cylinder base O-rings (Figure 17-6) to immobilize the connecting rods until the cylinders are installed.
17-2.2. Crankcase Hardware Installation

17-2.2.1. Crankcase Assembly

1. Lubricate all studs and crankcase through-bolts with approved lubricants specified in Appendix B and Chapter 3 of M-0, Standard Practice Maintenance Manual.
WARNING

Lubricate fasteners and apply torque to the crankcase hardware in the proper sequence. Failure to do so may result in crankcase damage or engine failure.

NOTE: Positions cited in this procedure refer to Figure 17-7.

2. Using an O-ring Installation Tool (“Special Tools” in Chapter 2 of M-0, Standard Practice Maintenance Manual), install eight new 0.5” x 10.75” through-bolts (Figure 17-8)(46) with new o-rings (47) in positions 37 through 44 with baffle supports at position 43L and 44L (89) and 42R (88). If necessary, use a mallet to tap the through-bolts into position.

3. Install three new 0.3125” x 4.00” tie bolts (62) with washers (32) in positions 70, 71 and 72; tighten, but do not torque the tie bolts (62).

4. Install a new 0.4375” x 7.58” through-bolt (40) with new O-rings (47) in position 45. Install the crankcase through-bolt spacer (43) on the 2-4-6 side; install a 0.45 ID X.08 flat washer (42) on the 1-3-5 side. Secure the hardware on the 1-3-5 side with a 0.4375”-20 UNF-3B flange nut (44) and a 0.43”-20 hex nut (45) on the 2-4-6 side.
Engine Assembly

5. Install a new 0.4375” x 6.74” through-bolt (40) in position 46 with a mallet. Install the flat washer on the 1-3-5 side and install the crankcase through-bolt spacer (43) on the 2-4-6 side. Secure the hardware on the 1-3-5 side with a 0.4375”-20 UNF-3B flange nut (44) and a 0.43”-20 hex nut (45) on the 2-4-6 side.

6. Install a 0.3125” x 1.12” screw in position 54 and a 0.3125” x 1.38” screw in position 53.

7. Install a 0.38” x 11.67” through-bolt (50) with two new o-rings (51) in position 64, with a spacer (52) on the 1-3-5 side, washers (53), and nuts (54).

8. Install a new 0.3125” x 1.47” bolt (31) in position 67, with two 0.3125” x 0.063” flat washers (32) and 0.3125”-24 nut (56), and snug the nut.

9. Rotate engine stand to place engine in upright position. With connecting rods supported by old cylinder o-rings, secure 1-3-5 side engine mounts to engine stand.
NOTE: The aft lifting eye (65) is installed with the accessory drive adapters; baffle supports (88 & 89) are installed after the cylinders and the 0.31" bolt at position 70 is installed with the oil cooler.

10. Install the forward lifting eye (66) at position 65 on the 2-4-6 side of the crankcase backbone and secure with 0.3125"-24 x 1.72" bolt (64), washer (32) & nut (56).

   NOTE: The manifold locator bracket and the throttle support bracket may be installed during crankcase assembly or during the induction system installation. If bracket installation is deferred until induction system assembly, the fasteners at position 55 and 63 must be removed, installed and re-torqued.

11. Install the manifold locator bracket with the open end to the aft of the engine at position 55. Insert a 0.3125" x 1.59" bolt (68) with a flat washer (32) through the 1-3-5 side of the bracket. Secure with a flat washer (32) and nut (56). Snug the nut.

12. Insert a 0.3125" x 1.34" bolt (67) and nut (56) through the 1-3-5 side of the crankcase at position 68; secure with a 0.31" x 0.032" washer (32) and nut (56). Snug the nut.

13. Install the throttle support bracket with a 0.03125" x 1.72" bolt (64) and washer (32) inserted from the 1-3-5 side of the engine at position 63; secure with a washer (32) and nut (56).

14. Install remaining 0.3125" x 1.47" bolts (31), washers (32) & nuts (56) at positions 56, 57, 59, 61, 62 and 66; tighten, but do not torque the fasteners at this time.

15. At the cam journal bosses below the camshaft, insert 0.3125” bolts (55) with washers (32) in positions 73, 74 & 75 from the 1-3-5 side and secure with washers (32) and nuts (56) on the 2-4-6 side of the engine; tighten, but do not torque at this time.

16. Install six 0.25" bolts (57) in positions 77-82 with washers (58) and nuts (59); tighten, but do not torque at this time.

17-3. Cylinder Installation

WARNING

Do not install a cylinder that does not conform to the Appendix D overhaul or new dimensional inspection criteria cited in Chapter 15, Inspection and Repair. Ensure each cylinder has the required new parts and the cylinder barrel is clean, free of cracks, nicks, scratches, pitting, and rust before installation.

1. Lubricate all cylinder through-bolt and deck stud threads with clean 50-weight aviation engine oil.

2. Carefully rotate the crankshaft to position the connecting rod of the cylinder being installed in the outer most position.

   WARNING

   Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring.
or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

3. Lubricate a new cylinder base O-ring (Figure 17-10) (52) with 50 weight engine oil and install the cylinder base O-ring on the cylinder skirt against the base flange. Ensure the new cylinder base O-ring (52) is not twisted.

![Figure 17-9. Piston, Piston Pin and Rings](image)

4. Back the new piston pin (Figure 17-9) (6) out far enough to allow the new piston (1) to be installed on the connecting rod.

5. Align the cylinder and piston (1) with the connecting rod piston pin bore and slide the piston pin (6) into the connecting rod.

6. Compress the fourth piston ring (5) with a ring compressor and push the cylinder until the fourth piston ring is positioned inside the cylinder barrel.

7. Remove the Ring Compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.

8. While supporting the cylinder, install, but do not torque, the cylinder flange nuts (Figure 17-10) (41 and 42).

*CAUTION: Ensure the correct nut is installed on the seventh stud.
An incorrect nut can damage the flange brackets.*
9. Install the 7th stud brackets (47 and 48) and nuts (49) on the studs between Cylinders 1-3, 3-5, 2-4 and 4-6, flat side against the cylinder flange. The 7th stud nuts have a conical seat.

10. Repeat steps 1-9 for the remaining cylinders.

11. Proceed to Section 17-3.1, “Cylinder and Crankcase Torque.”

Figure 17-10. Cross-flow Cylinder Assembly
17-3.1. Cylinder and Crankcase Torque

Before torquing the crankcase, use a straight edge to confirm that the rear crankcase half ends are flush with each other. Do not proceed with final torque unless the crankcase halves are flush.

NOTE: Crankcase and cylinder torque requires two people; the torque is applied in two stages: first in a preliminary torque sequence, followed by a final torque sequence.

WARNING

Torque values specified for engine assembly are for use with clean nuts, bolts and studs with threads that are free of damage, distortion which have been pre-lubricated with clean 50-weight aviation engine oil prior to assembly. The torque wrench must be currently calibrated and traceable to the National Bureau of Standards. Incorrect through-bolt and deck stud torque may result in subsequent engine malfunction and failure.

1. After cylinders and hardware is installed, have an assistant hold the fastener on the opposite side of crankcase and simultaneously torque the crankcase fasteners in the sequence shown in Figure 17-7. Torque all the fasteners to ½ the value listed in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Filled circles in Figure 17-7 indicate through-bolt positions.

2. Using the torquing sequence shown in Figure 17-7, torque nuts at positions (1 through 82) to the final torque values listed in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-7 repeated for reference
17-3.2. Inter-Cylinder Baffle Installation

1. Assemble two cylinder base baffles (Figure 17-11) (3) and baffle assemblies (6) and secure with a screw (8) and washer (7). Assemble one cylinder base baffle (3) and baffle assembly (5) and secure with a screw (8) and washer (7). Assemble one cylinder base baffle (4) and baffle assembly (5) and secure with a screw (8) and washer (7). Torque the screws to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Place baffle supports (1) on the top of the engine straddling cylinder fin positions 3 and 9 between cylinders 1 & 3, 3 & 5, and 4 & 6.

3. Place the baffle support (2) on the top of the engine straddling cylinder fin positions 3 and 9 between cylinders 2 & 4.

4. Align the 2-4 cylinder baffle assembly (4 & 5) bolt hole with the baffle support (2) bolt hole and secure with a bolt (9) and washer (7).

5. Align the 3-5 cylinder baffle assembly (3 & 5) with the baffle support (1) bolt hole and secure with a bolt (9) and washer (7).

6. Align the 1-3 and 4-6 cylinder baffle assemblies (3 & 6) bolt holes with the baffle support (1) bolt holes and secure with bolts (9) and washers (7); torque the bolts (9) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 17-11. Inter-Cylinder Baffle Assembly

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Baffle Support</td>
</tr>
<tr>
<td>2</td>
<td>Baffle Support</td>
</tr>
<tr>
<td>3</td>
<td>Cylinder Base Baffle</td>
</tr>
<tr>
<td>4</td>
<td>Cylinder Base Baffle</td>
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<tr>
<td>5</td>
<td>Baffle Assembly</td>
</tr>
<tr>
<td>6</td>
<td>Baffle Assembly</td>
</tr>
<tr>
<td>7</td>
<td>Washer</td>
</tr>
<tr>
<td>8</td>
<td>Screw</td>
</tr>
<tr>
<td>9</td>
<td>Bolt</td>
</tr>
<tr>
<td>10</td>
<td>Baffle Tie Spring</td>
</tr>
<tr>
<td>11</td>
<td>Grommet</td>
</tr>
</tbody>
</table>
17-3.3. Cylinder Drain Tube Installation

1. Coat the male tapered threads of the drain tube fittings (Figure 17-10) (16) with Loctite 592 Teflon PS/T Pipe Sealant. Coat the male tapered threads only.

2. Install the drain tube fittings (16) in the cylinders and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Install the cylinder drain tube (45) on the cylinders with new seals (46).


5. Install the drain valve assemblies in accordance with the aircraft manufacturer's instructions.
17-3.4. Crankcase Miscellaneous Hardware Installation

1. Lightly coat new O-rings (Figure 17-4) (23 & 25) with clean 50-weight aviation engine oil; install the O-rings (23 & 25) on the oil filler adapter (24).

2. Install the oil filler adapter (3) into the left crankcase half. Ensure the O-rings (1 & 2) are not pinched or twisted.

3. Insert the oil filler assembly (19) into the oil filler adapter (24). Do not displace the O-ring (23).

4. Install a new breather gasket (20) and secure the oil filler assembly to the left crankcase case half with screws (26), new lock washers (27) and washers (28). Torque the bolts (26) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Install a new oil filler gasket (22) on the cap assembly (21).

6. Coat both sides of a new cam cover gasket (8) with Part No. 642188 Gasket Sealant. Align the gasket with the bolt holes in the cam hole cover.

7. Install a new cam cover gasket (Figure 17-4) (8) and camshaft cover (7) on the crankcase with the beaded side of the gasket facing the cover. Secure with two flat washers (9), two new lock washers (10), and two nuts (11).

8. Remove the idler gear support pin (14) which was temporarily installed during crankcase assembly. Clean the idler gear support pin flange with mineral spirits and allow to dry.

9. Coat both sides of a new idler gear support pin flange gasket (15) with Part No. 642188 Gasket Sealant; install the gasket on the idler gear support pin flange.

10. Lubricate the idler gear support pin (14) with clean, 50 weight aviation engine oil and install the idler gear support pin (14) in the crankcase with a new flange gasket (15). Secure the idler gear support pin with new lock washers (17) and nuts (18) and torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

WARNING

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

CAUTION: Use care to prevent displacement or damage to the crankshaft nose seal and silk thread.
11. Spray Loctite LocQuic Primer 7649 on the oil seal counterbore and allow it to dry for 1 to 2 minutes.

12. Apply a thin translucent coat of Gasket Maker to the wall of the oil seal counterbore according to instructions in Appendix C of M-0, Standard Practice Maintenance Manual.

13. Use thumb pressure to work the crankshaft nose oil seal into the crankcase counterbore. After the seal is in place, wipe any remaining oil from the seal and crankshaft.

14. Apply Loctite 271 to the bolt (13) threads. Apply Primer 7471 to the bolt holes; install the oil seal retainer plates (12) with bolts (13); torque the bolts (13) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Install the propeller governor pad cover (1) with a new gasket (2). Secure the cover (1) with spacers (3), washers (4), new lock washers (5) and nuts (6). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 17-4 repeated for reference
17-3.5. Hydraulic Tappet and Pushrod Installation

During overhaul, new hydraulic exhaust and intake tappets (Figure 17-10) (54 and 55) must be installed with each engine cylinder.

1. Lubricate all hydraulic tappet faces with Dow Corning® G-N Paste or equivalent.
2. Lubricate the crankcase tappet bores with clean 50-weight aviation engine oil.
3. Install new hydraulic exhaust tappets (53) (wide groove on the tappet body) into the aft tappet guides in cylinders on the 1-3-5 side of the crankcase and in the forward tappet guides for cylinders on the 2-4-6 side of the crankcase.
4. Install new hydraulic intake tappets (54) (narrow groove on the tappet body) into the forward tappet guides in cylinders on the 1-3-5 side of the crankcase and in the aft tappet guides for cylinders on the 2-4-6 side of the crankcase.
5. Install the pushrod housings (35).
   a. Using a Burroughs Part No. 68-3 Pushrod Spring Compressor (Figure 17-12) or equivalent, compress a new spring (Figure 17-10) (39).
   b. Place a new packing (38) between the two steel washers (36), and install on the crankcase end of the pushrod housing (35).
   c. Position the pushrod housings (35) into respective crankcase tappet bores.
   d. While the spring (39) is compressed insert the crankcase end of the pushrod housing (35) in the crankcase bore and slide a new O-ring seal (37) on the cylinder end of the pushrod housing.
   e. Guide the cylinder end of the pushrod housing (35) into the cylinder head bore while releasing the tension on the pushrod spring (39) with the Pushrod Spring Compressor Tool.
   f. Remove the Pushrod Spring Compressor Tool from the pushrod and verify the O-ring seal (37), packing (38), and washers (36) are properly positioned.

Figure 17-12. Pushrod Spring Compressor

6. Rotate the engine to the upright position on the stand.
7. Lubricate the pushrods (40) with clean 50-weight aviation engine oil and install the pushrods through the cylinder openings into the pushrod housings (35).

Figure 17-10 repeated for reference
17-3.6. Rocker Arm Installation

1. Before installing the rocker arms on each cylinder, turn the crankshaft until the pushrods are at their lowest position in the cylinder.

2. Lubricate the intake and exhaust rocker arms (Figure 17-10) (19 & 20), new thrust washers (23) and new rocker shafts (24) with clean 50-weight aviation engine oil. The flat side of the rocker shaft (24) must be installed against the cylinder base.

3. Slide the shaft (24) into the rocker arm assembly. Place a thrust washer (23) on the outboard of each side of the rocker arm.

4. Install the rocker arms and shaft assemblies, in the correct intake (19) and exhaust (20) positions, on the engine cylinder rocker arm boss.

5. Secure the rocker arm to the cylinder with retainers (25), new tab washers (26) and screws (27).

6. Using a feeler gauge, check the side clearance between the retainers and rocker arms as illustrated in Figure 17-13; side clearance must be 0.002 - 0.015 inches. If side clearance exceeds the allowable amount, replace the thrust washers with a thicker (oversize) thrust washer to reduce side clearance to the proper tolerance.

7. Measure the exhaust rocker arm-to-retainer clearance according to the illustration in Figure 17-14. If the clearance is less than 0.020”, grind the underside of the rocker arm according to the instructions in Section 15-8.9.19.

8. Measure the dry valve lash at valve tip-to-rocker foot with the piston at top dead center while applying pressure on the rocker arm at the ball (pushrod) end. Verify the dry valve lash does not exceed the overhaul limits in Appendix D. Replace pushrods with authorized over-sized (AO) pushrods if dry valve lash exceeds the limit.

9. If all measurements and clearances are correct, torque the screws (Figure 17-10) (27) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
10. Secure the rocker assembly to the cylinder by bending the new tab washers (26) flat up against the head of the screws (27) according to the “Tab Washer Installation” instructions in Appendix C-4 of M-0, Standard Practice Maintenance Manual. Do not re-align the screw head to the tab washer.

![Figure 17-14. Rocker Arm to Retainer Clearance](image)

**Figure 17-14. Rocker Arm to Retainer Clearance**

*CAUTION: Do not over- or under-torque bolts to align tab washers; replace the bolt and re-torque to obtain proper alignment.*

11. Repeat steps 1-10 for remaining cylinders.

12. Install new rocker cover gaskets (28) (with the beaded side of the gasket toward the rocker cover) and the rocker covers (29); secure them with screws (32), new lock washers (31) and washers (30).

13. Torque the rocker cover screws evenly to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 17-10 repeated for reference](image)
17-4. **Oil Sump & Suction Tube Installation**

1. Invert the engine on the stand; verify crankcase belly bolts are installed and torqued to Appendix B (of M-0) specifications and no foreign objects are in the engine or oil sump.

2. Install a new copper gasket (Figure 17-15 or Figure 17-16) (6) on the oil suction tube (1) with the split line facing outward toward the crankcase.

   NOTE: The copper gasket (7) and plug (8) will be installed on the engine after the oil pump.

3. Attach the oil suction tube bracket to the crankcase:
   
   a. Insert the bolt (C (Figure 17-15) or G (Figure 17-17) (2) with a washer (4) through the bracket and the crankcase. Insert washers (3) inboard of both sides of the bracket. Secure the bracket with a washer (4) and nut (5); torque the nut (2) and bolt (5) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   b. Insert a bolt (Figure 17-16) (3) with a washer (2) through the bracket and the crankcase. Secure the bracket with a washer (4) and nut (5); torque the bolt and nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

---

**Figure 17-15. Oil Sump**

1. Oil Suction Tube Assy  
2. Bolt  
3. Washer  
4. Washer  
5. Nut  
6. Copper Gasket  
7. Copper Gasket  
8. Plug  
9. Oil Sump Gasket  
10. Oil Sump  
11. Washer  
12. Lock Washer  
13. Bolt  
14. Copper Gasket  
15. Bracket
Figure 17-16. Oil Sump B E

Figure 17-17. Oil Sump G K N
4. Install the oil sump drain plug (Figure 17-15, Figure 17-16, Figure 17-17) (8) with new copper gasket (14) (split line toward the oil sump) in the oil sump (10). Torque the drain plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; safety wire the drain plug according to safety wiring instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

5. Apply a bead of Gasket Maker to the oil sump flange; do not allow silk thread on the crankcase split line to protrude beyond the mating surface for the oil sump gasket. Refer to Appendix C-9 of M-0, Standard Practice Maintenance Manual for Gasket Maker application instructions.

6. Install a new oil sump gasket (9) on the oil sump (10) flange with the beaded side of the gasket facing the oil sump.

7. Install the oil sump on the crankcase:
   a. Align the oil sump gasket and oil sump assembly with the crankcase oil sump rail. Install the bracket (Figure 17-16) (15) in the fifth bolt hole from the front on the 2-4-6 side of the sump with a bolt (13), new lock washer (12) and washer (11). Install bolts (13), new lock washers (12) and washers (11) in the remaining bolt holes in the sump rail.
   b. Align the oil sump gasket and oil sump assembly with the crankcase oil sump rail. Secure the oil sump to the crankcase with bolts (Figure 17-15) (13), new lock washers (12), and washers (11).
   c. Align the oil sump gasket and oil sump assembly with the crankcase oil sump rail. Install bolts (Figure 17-17) (16), new lock washers (12), and washers (11) in the two forward holes on the 2-4-6 side of the sump and in the four forward holes on the 1-3-5 side of the sump.
   d. Install bolts (13), new lock washers (12), and washers (11) in the remaining oil sump rail bolt holes.
   e. Install a new coupling (15) with a new copper gasket (14) (split line toward the oil sump) in the oil sump and torque the coupling to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
   f. Torque the oil sump bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual in the sequence shown in (Figure 17-18).
Figure 17-18. Oil Sump Torque Sequence
17-5. **Oil Pump Installation**

1. Lubricate both sides of a new gasket (Figure 17-19) (2) with Part No. 642188 (Copper Coat) Gasket Sealant and install the oil pump gasket on the crankcase studs.

2. Install the assembled oil pump on the crankcase studs.

3. Secure the oil pump assembly to the crankcase with washers (3), and new lock washers (4), and nuts (5). Torque the nuts (5) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Lubricate both sides of a new gasket (12) with Part No. 642188 (Copper Coat) Gasket Sealant.

   **NOTE:** For installations using coupling nuts to support aircraft control cable brackets, replace then plain nuts at the five and six o’clock positions of the oil pump with coupling nuts (14).

5. Align the new gasket (12) with the oil filter adapter (13) flange and install the oil filter adapter (13) and new gasket (12) on the oil pump housing studs. Fasten the oil filter adapter to the oil pump housing with three sets of washers (6), new lock washers (7) and nuts (8). Torque the nuts (8) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Install the plug (9) and the new gasket (10) in the end of the oil suction tube extending through the crankcase. Torque the plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual and safety wire the plug according to instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

   **CAUTION:** Refer to the label on the oil filter for installation instructions. Tempest began producing oil filters in 2017 with a special graphite coating on the gasket. These filters are installed dry, with no lubricant. Application of DC-4 to the graphite coated filter gasket will defeat the properties of the graphite coating.

7. Read the installation instructions on the oil filter before applying lubricant to the gasket.

   a. For oil filters with dry seal gaskets, install the new oil filter (11) on the oil filter adapter stud and tighten by hand.

   b. For oil filters without graphite coated gaskets, apply a thin coat of Dow Corning No. 4 to the oil filter gasket and install a new oil filter (11) and tighten by hand.

   c. Torque the oil filter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
17-6. Oil Cooler Installation

TSIO-550-K & N and certain TSIO-550-C model specification’s oil cooler assemblies differs from the configuration of the remaining TSIO-550 Series engines. Oil cooler installation instructions for the TSIO-550-K, N engines may be found in Section 17-6.4. For TSIO-550-C engine models with cross fittings on the oil outlet port, proceed to Section 17-6.2. For all other TSIO-550 engine models, proceed to Section 17-6.1.

NOTE: The oil cooler must be disassembled, cleaned, overhauled, and assembled by an appropriately rated repair station, i.e. FAA approved Part 145 repair station before installation. No structural repairs are allowed on the oil cooler. Replace any cooler that has structural damage, bent/broken or cracked cooling fins, with a new or serviceable oil cooler. Oil cooler weld repairs are permitted only on the mounting flange, by an appropriately rated repair station, i.e. FAA approved Part 145 repair station.
17-6.1. TSIO-550-B, C & E Oil Cooler Installation

NOTE: Instructions in this section apply only to engines using a tee fitting to supply oil to the turbochargers. If the oil cooler uses a cross fitting to supply oil to the turbochargers, proceed to Section 17-6.2.

1. Position the oil cooler baffle (6) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler. Secure the oil cooler baffle (6) to the oil cooler fins with four equally-spaced staples.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

2. Apply Loctite 592 Teflon PS/T Pipe Sealant to the pipe plug (5) threads and install the pipe plug (5) in the bottom pressure port. Torque the pipe plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Coat the oil cooler pad stud threads with Part No. 646943 Anti-Seize lubricant.

4. Install the spacer (3), sandwiched between two new gaskets (2) on the lower crankcase studs.

5. Install the wastegate controller bracket (phantom in illustration), with the arm extending aft of the engine and two washers (4) on the upper crankcase studs. Secure the oil cooler to the crankcase with two washers (10) and nuts (11) on the studs at the top of the oil cooler. Torque the nuts (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

6. Install a washer (7), new lock washer (8), and nut (9) on the lower aft crankcase stud; install new lock washers (12), and flanged nuts (13) on the two forward studs at the bottom of the oil cooler. Torque the nuts (9 & 13) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

7. Install the adapter (16) in the inboard pressure port; torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Install the elbow fitting (17) in the adapter (16). Use a backup wrench to torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.


10. Install the connector fitting (19) into the reducer bushing (16). Use a backup wrench to torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Connect the tee fitting (20) to the connector fitting (19); secure the connector fitting (19) with a backup wrench and torque the tee fitting (20) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
12. Install the cap (21) on the top outlet of the tee fitting (20). Use a backup wrench to torque the cap to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (14). Install the oil temperature control valve with a new gasket (15) in the oil temperature control valve port on the bottom of the oil cooler and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.

Figure 17-20. Oil Cooler

1 Oil Cooler Assembly 7 Washer
2 Gasket 8 Lock Washer
3 Spacer 9 Nut
4 Gasket-Washer 10 Washer
5 Plug 11 Nut
6 Baffle

13 Flanged Nut 14 Oil Temp. Control Valve
15 Gasket 16 Adapter
17 45° Elbow Fitting 18 Reducer Bushing
19 Connector Fitting 20 Tee Fitting
21 Cap 22 Stud


17-6.2. TSIO-550-C Oil Cooler Installation

WARNING

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

NOTE: The TSIO-550-C5, C7, C9, C10, C11, C12, C13, C17, C18, C19, C20 and C21 engine model specifications used a cross fitting and various adapter fittings of differing sizes to mate with accessories and sensors.

1. Position the oil cooler baffle (6) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler. Secure the oil cooler baffle (6) to the oil cooler fins with four equally-spaced staples.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

   NOTE: The lower pressure port is only present on oil coolers using the large diameter (See Section 17-21) oil temperature control valve (vernatherm).

2. Apply Loctite 592 Teflon PS/T Pipe Sealant to the pipe plug (5 & 18 (where applicable)) threads and install the pipe plugs in the oil cooler bottom and lower inboard pressure port. Torque the pipe plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Coat the oil cooler pad stud threads with Part No. 646943 Anti-Seize lubricant.

4. Install the spacer (3), sandwiched between two new gaskets (2) on the lower crankcase studs.

5. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

6. Install the wastegate controller bracket (phantom in illustration), with the arm extending aft from the engine, with two washers (4) on the upper crankcase studs. Secure the oil cooler to the crankcase with two washers (10) and nuts (11) on the studs at the top of the oil cooler; torque nuts (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Remove the feeler stock from the sump rail. Remove the feeler stock from the oil sump rail.

7. Install a washer (7), new lock washer (8), and nut (9) on the lower aft crankcase stud; install new lock washers (12), and flanged nuts (13) on the two forward studs at the bottom of the oil cooler. Torque the nuts (9 & 13) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Verify 0.010” clearance between the top of the oil sump rail and the bottom of the oil cooler.
NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

9. Install an adapter (16) in the inboard pressure port; torque the adapter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Engine Assembly

NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

10. Install the elbow fitting (17) in the adapter (16). Use a backup wrench to torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Install a cross fitting (19) in the outboard oil cooler port; torque the cross fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual, mindful of the clocking required by the installation drawing.

NOTE: Consult the engine illustrated parts catalog to determine the appropriate configuration of the engine model specification and adjust the assembly instructions accordingly.

12. Install a 45° street elbow (20) in upper port of the cross fitting (19); torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install plugs (22) in street elbow (20) the aft end of the cross fitting (19); secure the fittings (19 & 20) with a backup wrench and torque the plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Install a flared nipple fitting (21) in the lower port of the cross fitting (19); secure the cross fitting (19) with a backup wrench and torque the flared nipple fitting (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Install a cap (24) on the flared nipple fitting (21); secure the flared nipple fitting (21) with a backup wrench and torque the cap (24) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (14). Install the valve with a new gasket (15) in the port on the bottom of the oil cooler; Torque the valve to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
Figure 17-21 repeated for reference

* ITEM 14 INCLUDES ITEM 15

C20 & C21 ONLY

LARGE DIA. VERNATHERM
17-6.3. TSIO-550-G Oil Cooler Installation

1. Position the oil cooler baffle (6) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler fins with four equally-spaced staples.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

2. Apply Loctite 592 Teflon PS/T Pipe Sealant to the pipe plug (5 & 22) threads and install the pipe plugs in the oil cooler bottom and lower aft pressure ports. Torque the pipe plugs to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Coat the oil cooler pad stud threads with Part No. 646943 Anti-Seize lubricant.

4. Install the spacer (3), sandwiched between two new gaskets (2) on the lower crankcase studs.

5. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

6. Install the wastegate controller bracket (phantom in illustration), with the arm extending aft of the engine and two gasket washers (4) on the upper crankcase studs. Secure the oil cooler to the upper crankcase studs with two washers (10) and nuts (11). Torque the nuts (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; remove the feeler stock from the sump rail.

7. Install a washer (7), new lock washer (8), and nut (9) on the lower aft crankcase stud; install new lock washers (12), and flanged nuts (13) on the two forward studs at the bottom of the oil cooler. Torque the nuts (9 & 13) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Verify 0.010” clearance between the oil sump rail and the bottom of the oil cooler.

9. Install an adapter (21) in the inboard pressure port; torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

10. Install an elbow fitting (17) in the adapter (21). Secure the adapter with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.


12. Install the connector fitting (20) into the reducer bushing (16). Secure the bushing with a backup wrench and torque the connector fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Connect the tee fitting (18) to the connector fitting (20); secure the connector fitting with a backup wrench and torque the tee fitting (18) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
14. Install the cap (19) on the top outlet of the tee fitting (18). Use a backup wrench to secure the tee fitting and torque the cap to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (14). Install the oil temperature control valve with a new gasket (15) in the oil temperature control valve port on the bottom of the oil cooler and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
Engine Assembly

17-6.4. TSIO-550-K Oil Cooler Installation

**WARNING**
The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-7 for required corrective action.

1. Position the oil cooler baffle (Figure 17-23) (2) 1.5 inches above the oil cooler flange and align the baffle with the oil cooler; secure the baffle to the forward side of the oil cooler (2) with four equally-spaced staples.

2. In the upper rear on the oil cooler pad, coat the stud threads with Part No. 646943 Anti-Seize lubricant.

   **NOTE:** Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

3. Apply Loctite 592 Teflon PS/T Pipe Sealant to the threads of the pipe plug (20). Install the pipe plug in the bottom pressure port. Torque the pipe plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Apply Loctite 592 Teflon PS/T Pipe Sealant to the threads of a flared nipple fitting (17). Install the nipple fitting in the lower aft pressure port. Torque the pipe plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Place a new gasket (3) on the lower crankcase studs.

6. Place two new gasket washers (4) on the upper crankcase studs.

7. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

8. Align the oil cooler with the crankcase upper and lower studs and secure with washers (11) and nuts (12) on the two studs near the top of the oil cooler. Torque the nuts (12) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; remove the feeler stock from the top of the sump rail.

9. Install a washer (8), new lock washer (9), and nut (10) on the lower aft crankcase stud; install new lock washers (6), and flanged nuts (7) on the two forward studs at the bottom of the oil cooler. Torque the nuts (7 & 10) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Verify 0.010” clearance between the oil sump rail and the bottom of the oil cooler.

11. Align the horizontal baffle (21) with the lower flange of the oil cooler. Align the hole in the baffle inboard nut plate below the 2-4-6 side lower aft baffle support bracket. Insert the screw (22) and washer (23) through the baffle support bracket and the baffle (23) nut plate. Tighten the screw to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-23. Oil Cooler

1 Oil Cooler 7 Nut 13 Oil Temp. Control Valve 19 Flared Nipple Fitting
2 Baffle 8 Washer 14 Gasket 20 Plug
3 Oil Cooler Gasket 9 Lock Washer 15 Adapter Fitting 21 Baffle Assembly
4 Gasket-Washer 10 Nut 16 Elbow Fitting 22 Screw
5 Plug 11 Washer 17 Flared Nipple Fitting 23 Washer
6 Lock Washer 12 Nut 18 Cap

* ITEM 13 INCLUDES ITEM 14

procedure continues on next page...
Engine Assembly

NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

12. Install an adapter (15) in the inboard pressure port; torque the adapter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install an elbow fitting (16) in the adapter (15). Secure the adapter with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.


15. Install a cap (18) on the adapter fitting (17). Use a backup wrench to secure the adapter fitting and torque the cap the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (13). Install the valve with a new gasket (14) in the port on the bottom of the oil cooler and torque the oil temperature control valve to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
* ITEM 13 INCLUDES ITEM 14

Figure 17-23 repeated for reference
17-6.5. TSIO-550-N Oil Cooler Installation

**WARNING**

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent and oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

1. Position the oil cooler baffle (2) 1.5 inches above the oil cooler flange and align the baffle with the oil cooler; secure the baffle to the forward side of the oil cooler (2) with four equally-spaced staples.

2. In the upper rear on the oil cooler pad, coat the stud threads with Part No. 646943 Anti-Seize lubricant.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

3. Apply Loctite 592 Teflon PS/T Pipe Sealant to the threads of a new pipe plugs (5 & 15). Install the pipe plugs (5 & 15) in the lower aft and bottom pressure ports. Torque the pipe plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Place a new gasket (3) on the lower crankcase studs.

5. Place two new gasket washers (4) on the upper crankcase studs.

6. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

7. Align the oil cooler with the crankcase upper and lower studs and secure with washers (11) and nuts (12) on the two studs near the top of the oil cooler. Torque the nuts (12) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; remove the feeler stock from the top of the sump rail.

8. Install a washer (8), new lock washer (9), and nut (10) on the lower aft crankcase stud; install new lock washers (6), and flanged nuts (7) on the two forward studs at the bottom of the oil cooler. Torque the nuts (7 & 10) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Verify 0.010” clearance between the oil sump rail and the bottom of the oil cooler.

10. Align the horizontal baffle (21) with the lower flange of the oil cooler. Align the hole in the baffle inboard nut plate below the 2-4-6 side lower aft baffle support bracket. Insert the screw (22) and washer (23) through the baffle support bracket and the baffle (23) nut plate. Tighten the screw to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-24. Oil Cooler

1 Oil Cooler Assembly 7 Flanged Nut 13 Oil Temp. Control Valve 19 45° Street Elbow
2 Baffle 8 Washer 14 Gasket 20 Flared Nipple Fitting 21 Baffle
3 Gasket 9 Lock Washer 15 Plug 21 Baffle 22 Screw
4 Gasket-Washer 10 Nut 16 Adapter Fitting 23 Washer
5 Plug 11 Washer 17 45° Elbow Fitting 24 Stud
6 Lock Washer 12 Nut 18 Cross Fitting

* ITEM 13 INCLUDES ITEM 14

procedure continues on next page...
NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

11. Install an adapter (16) in the inboard pressure port; torque the adapter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Install the elbow fitting (117) in the adapter (16). Secure the adapter with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install a cross fitting (18) in the upper outboard pressure port; torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Install a 45° street elbow (19) in upper port of the cross fitting (18); Secure the cross fitting with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual

15. Install plugs (5) in street elbow (19) the aft end of the cross fitting (18); secure the fittings (18 & 19) with a backup wrench and torque the plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Install a flared nipple fitting (20) in the lower port of the cross fitting (18); secure the cross fitting (18) with a backup wrench and torque the flared nipple fitting (20) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

17. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (13). Install the valve with a new gasket (14) in the port on the bottom of the oil cooler and torque the oil temperature control valve to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
Figure 17-24 repeated for reference
Engine Assembly

17-7. Alternator Installation

The basic engine is fitted with a direct drive alternator. A belt drive alternator is an available option.

17-7.1. Direct Drive Alternator Installation

Refer to the “Gear Driven Alternator Replacement, Forward Mount” instructions in Section 10-4-1 of M-0, Standard Practice Maintenance Manual to install the gear driven alternator.
17-7.2. Optional Belt-Driven Alternator Assembly Installation

NOTE: The through-bolt nuts at the mounting location must be removed to install the mounting bracket.

The drive sheave, split sheave adapters and the propeller must be installed at the same time. If the propeller is not available at the time of assembly, defer installation until propeller is installed in aircraft.

1. Install the propeller according to the propeller manufacturer’s instructions.

2. Align the holes on the drive sheave (10) (Figure 17-25) with the propeller flange holes. Align the split sheave adapter (11) bolt holes with those in the drive sheave.

3. Install six bolts (13) with washers (14) through the front of the drive sheave (10) and split sheave adapter (11) bolt holes. Install a lock nut (12) on each of the six bolts. Torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Install the bracket assembly (1) on the 2-4-6 side of the crankcase with the following hardware

   a. Add the spacers (18) to the exposed ends of the 2-4-6 crankcase through-bolts at the propeller flange. Secure the bracket to the through-bolts with washers (17) and nuts (16). Do not torque the bracket fasteners at this time.

   b. If a standard length bolt was installed in crankcase backbone position #3 during crankcase assembly, remove and discard the bolt.

   NOTE: Inserting an incorrect combination of shims (24) at the upper mounting location may hinder proper alignment of the bracket to the engine crankshaft.

   c. Align the throttle assembly bracket and two washers, with the crankcase bolt hole; Insert a bolt (21), with washer (22), through the 1-3-5 side of the throttle body bracket.

   d. Place a spacer (23) on the 2-4-6 side of the bolt (21). Add a combination of shims (24), as required, to fill the space between the spacer and the bracket and

   e. Align the bracket assembly (1) with the crankcase assembly and upper and lower through-bolts. Secure the bracket assembly to the crankcase with a washer (22), lock washer (25), and nut (26).

5. Torque the nuts (26) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Torque the crankcase through-bolt nuts (16) according to the “Cylinder and Crankcase Torque” instructions in Section 17-3.1.

6. Align the alternator (19) upper mounting boss with the mounting bracket assembly (1). Insert a bolt (9) through the bracket and the alternator and secure with a washer (2), and nut (3). Do not torque at this time.

7. Check the alignment of the alternator sheave to the drive sheave (10) with a Part No. 80821A, or equivalent, Pulley Alignment Tool (Chapter 2 M-0, Standard Practice Maintenance Manual.).
Engine Assembly

a. Place the alignment tool in the center of the alternator drive sheave and lower the opposite end of the alignment tool into the channel of the propeller drive sheave - true alignment must be within 0.016 inch.

![Figure 17-25. Belt-Driven Alternator Assembly (Optional)]

NOTE: Each shim will move the alternator sheave approximately 0.032” aft.

b. If misalignment is greater than 0.016 inch, the alternator is not properly aligned. Align the two sheaves by first removing the lock nut (3) and washer (2) from the bolt (9) and insert shims (27) between the forward boss of the mounting bracket (1) and the upper alternator (19) mounting boss to align the two sheaves. Torque...
the fasteners (3 & 9) to 250 in. lbs. to seat the alternator bracket bushing then
back-off nut (3) one full-turn counter-clockwise.

8. Align the slotted hole in the adjustable brace (15) with the threaded lower boss on
the bracket assembly (1) and install a screw (4), new lock washer (5) and washer (6)
through the brace and the threaded lower bolt hole in the bracket assembly (1).

9. Raise the adjustable brace (15) to align the round bolt hole with outboard alternator
(19) mounting boss and temporarily torque the screw (4) to 150 in. lbs.

   **CAUTION:** No gap is permitted between the alternator brace and the mounting boss. If the gap is between 0.001” and 0.031”, add a
   shim to fill the void.

10. Measure the distance between the alternator mounting boss and the lower brace
(Figure 17-26) to determine the number of shims (Figure 17-25) (27) to completely
fill the gap between the brace and the alternator mounting boss. Each shim measures
0.032”. No gap is permitted between the two surfaces; the thickness of the shims to
fill the gap may exceed the distance between the brace and alternator by up to
0.031”.

![Figure 17-26. Alternator Brace Shim Location](image)

11. Loosen the screw (4) and insert shims (27) to completely fill the gap between the
adjustable brace and the alternator mounting boss. Install the screw (7), new lock
washer (5) and washer (8) through the shims and adjustable brace (15) and into the
threaded outboard alternator mounting boss.

12. Install a new V-belt (20) and adjust the belt tension according to instructions in
Section 6-4.10.4.3 of M-0, Standard Practice Maintenance Manual.

13. Torque the fasteners (3, 4 and 7) after belt adjustment to the value specified in

14. Safety wire the screw (4) to a nearby through-bolt according to the “Safety Wiring
Hardware” instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.
17-8. **Starter and Starter Adapter Installation**

1. Apply Part No. 642188 Gasket Sealant to both sides of the new gasket (Figure 17-27) (9) and apply the new gasket (9) to the crankcase surface.

2. Lubricate the starter shaftgear teeth with clean 50 weight aviation engine oil.

3. Mesh the shaftgear teeth with the crankshaft gear as starter adapter is placed in position. Align the starter adapter holes with the crankcase studs protruding from the rear of the engine and apply pressure to the starter adapter cover to seat the adapter assembly against gasket (9).

4. Install washers (6), new lock washers (7) and nuts (8) on the inboard side of the starter at the 7 and 11 o’clock positions. Install a washer (10), lock washer (7) and nuts (8) at the 7 o’clock position and washer (6), new lock washers (7) and nuts (8) at the 9 o’clock position on the aft studs to mount the starter and adapter assembly. Torque the nuts (8) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-27. Starter and Adapter Assembly

1 Starter Motor
2 Starter Adapter
3 Nut
4 Washer
5 O-ring
6 Washer
7 Lock washer
8 Nut
9 Gasket
10 Washer
11 O-ring
12 Sleeve
13 Spacer
14 Lock Nut
17-9. **Induction System Installation**

NOTE: Depending upon the size and type of aircraft installation and engine cradle clearance, it may not be possible to install the turbocharger and exhaust system until the engine is installed in the aircraft.

1. Carefully position the preassembled induction spider (1, 3-15) over the engine with the rubber bumper pad resting on the manifold locator bracket (47).

2. Install a new gasket (Figure 17-28) (2) on the throttle body.

3. Position the assembled throttle body and bracket on the crankcase backbone using the crankcase backbone bolt (Figure 17-8) (64), washer (32) and nut (56) at (Figure 17-7) position 63 and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Align the throttle body with the induction manifold and install four each: screws (Figure 17-28) (19), washers (13), and new lock washers (14); torque the fasteners to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Install new gaskets (11) on all cylinder intake flanges.
   
   NOTE: Do not torque induction or exhaust connections until all tubing is installed.

6. Fit the induction tubes (3 through 8) over the cylinder intake flange studs. Use care not to allow foreign material to fall into the cylinder intake flange. Connect the intake tubes to the cylinder intake manifolds using lubricated washers (13), new lock washers (14) and nuts (15).
   
   NOTE: The TSIO-550-G induction system is identical to the TSIO-550-B, C, E, K & N except the aftercoolers dimensions differ.

7. Torque the intake flange nuts (Figure 17-28) (15) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-28. Induction System B C E K N

1. Manifold & Fitting Assembly
2. Gasket
3. Tube
4. Tube
5. Tube
6. Tube
7. Tube
8. Tube
9. Hose
10. Hose Clamp
11. Intake Manifold Gasket
12. Flange
13. Washer
14. Lock Washer
15. Nut
16. Air Manifold Tube Assembly
17. Right Air Reference Tube
18. Left Air Reference Tube
19. Screw
20. Hose
21. Sleeve Assembly
22. Washer
23. Washer
24. Compression Seal
25. Clamp Assembly
26. Fuel Dist. Tube Bracket
27. Fuel Inj. Line Bracket
28. Tube Clamp
29. Overboost Valve
30. O-ring
31. Bolt
32. Washer
33. Lock Nut
34. Aftercooler Assembly
35. Sonic Venturi Nozzle
36. Hose
37. Clamp
38. 1-3-5 FWD Induction Tube
39. 2-4-6 FWD Induction Tube
40. Hose
41. Hose
42. Clamp Assembly
43. Clamp Assembly
44. 1-3-5 AFT Induction Tube
45. 2-4-6 AFT Induction Tube
46. Compression Seal
47. Manifold Locator Bracket
48. Bumper
17-10. Turbocharger and Exhaust System Installation

17-10.1. TSIO-550-B, C, E & G Turbocharger and Exhaust System Installation

1. Apply Part No. 646943 anti-seize compound to the exhaust slip joints (Figure 17-29)(1-9) prior to assembly.

2. Install risers (7) on the exhaust tees (5 and 6).

3. Slide the riser/tee assemblies (2, 3, 5, and 7) together to make up the 2-4-6 side collector assembly.

4. Slide the riser/tee assemblies (1, 4, 6, and 7) together to make up the 1-3-5 side collector assembly.

5. With the engine in the inverted position, install a new exhaust flange gasket (25) on each cylinder.

6. Carefully install the left and right side collectors on the cylinder exhaust ports; position the collector so the flanges mate with the risers and seat squarely on the ports; lubricate and install new lock nuts (21) on each cylinder flange- do not torque.

7. Install the turbochargers (24), mounted on the support brackets (29 and 30) on the turbo mount brackets (phantom parts in Figure 17-29) with bolts (31), washers (32) and new lock nuts (33). This hardware will be torqued later in this procedure.

8. Install a new gasket (23) between the transitions (5 and 6) and the turbochargers (24). Hand-tighten the bolts and washers (26 and 27) with new lock nuts (28). This hardware will be torqued later in this procedure.

9. Install the wastegate (18) between the left tailpipe (14) and bypass assembly (8 and 9) sandwiched between two new gaskets (15) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of fastening hardware (17 and 18) with new lock nuts (19). This hardware will be torqued later in this procedure.

10. Torque the support bracket screws (31) and nuts (33), turbocharger riser bolts (26) and lock nuts (28), exhaust flange nuts (Figure 17-29) (25) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   CAUTION: The exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.

   NOTE: Installation of the remaining exhaust system and turbocharger components may be delayed until after the engine is installed in the aircraft.

11. Secure the bypass assembly (8 & 9) on the transition (6) using the tie rod (11), bushing (10), nut (13) and bolt (12). Torque the assembly to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Check the installed assembly for freedom of movement.
Figure 17-29. Composite Turbocharger and Exhaust System

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Turbo Transition
6. Turbo Transition
7. Riser
8. Crossover Assembly
8A. Crossover Assy with
Heater Shroud Option
9. Transition
10. Bushing
11. Tie Rod
12. Bolt
13. Lock Nut
14. Contoured Tailpipe
14C. Inverse Tailpipe Option
15. Contoured Tailpipe
15A. Straight Tailpipe
15B. Heater
15C. Inverse Tailpipe Option
16. V-band clamp
17. Gasket
18. Wastegate Assembly
19. Bolt
20. Lock Nut
21. Lock Nut
22. Controller
23. Gasket
24. Turbocharger Assembly
25. Heater
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Screw
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose

Engine Assembly
12. Place a new v-band clamp (16) halfway on each turbine exhaust flange. Slide the transition (9) and crossover pipe (8) together to form the bypass assembly. Install the bypass assembly on the end of the exhaust tees (5 and 6).

13. Install the tailpipe (14) exhaust flange inside the clamp (16) mounted on the left side turbine exhaust flange.

14. Install the tailpipe (or heater) exhaust flange (15) inside the clamp (16) mounted on the right side turbine exhaust flange.

15. Initially torque the clamps to \( \frac{1}{2} \) the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and torque the clamp to the full torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to “Safety Wiring Hardware” instructions in Section C-3 of M-0, Standard Practice Maintenance Manual and Figure 17-30. Use safety wire pliers to bend the safety wire pigtail close to the bolt.

NOTE: Connect the oil supply hoses to the fittings according to the “Hose and Tubing Installation” instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual.

17. Connect the turbocharger oil supply hose (Figure 17-31) (15) to the outboard oil cooler tee or cross fitting (Figure 17-20) (20) or Figure 17-21) (19). Install a new check valve (17), with the arrow pointing away from the oil cooler, to the open end of the supply hose. Connect the female end of the tee (16) to the check valve (17).

18. Install the connecting tee (21) in line with the new hoses (18 and 19). Install a new hose (20) on the right angle fitting of the tee (21). Connect the other end of the hose (19) to the fitting on the right turbocharger oil reservoir (3). Connect hose (18) to the left reservoir fitting.

19. Connect oil supply hoses (13 and 14) to the open ends of the connecting tee (16). Connect the open end of hose (14) to the right oil inlet fitting (6); connect the open end of hose (13) the left oil inlet fitting (6).
20. Torque the hoses and fitting connections to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Diagram of Turbocharger Lubrication](image)

**Figure 17-31. Turbocharger Lubrication**

1. Left Turbocharger
2. Right Turbocharger
3. Gasket
4. Adapter
5. Lock Washer
6. Bolt
7. Gasket
8. Left Oil Reservoir
9. Right Oil Reservoir
10. Lock Washer
11. Bolt
12. Adapter
13. Tee
14. Check Valve
15. Hose
16. Hose
17. Hose
18. Tee
19. Hose
20. Hose
21. Hose
17-10.2. TSIO-550-K Turbocharger and Exhaust System Installation

1. Apply Part No. 646943 anti-seize compound to the exhaust slip joints (Figure 17-32)(1-9) prior to assembly.

2. Install risers (7) on the exhaust tees (5 and 6).

3. Slide the riser/tee assemblies (2, 4 5, and 7) together to make up the 2-4-6 side collector assembly.

4. Slide the riser/tee assemblies (1, 3, 6, and 7) together to make up the 1-3-5 side collector assembly.

5. With the engine in the inverted position, install a new exhaust flange gasket (25) on each cylinder.

6. Carefully install the left and right side collectors on the cylinder exhaust ports; position the collector so the flanges mate with the risers and seat squarely on the ports; lubricate and install new lock nuts (21) on each cylinder flange- do not torque.

7. Install the turbochargers (24), mounted on the support brackets (29 and 30) on the turbo mount brackets (phantomed in Figure 17-32) with bolts (31), washers (32) and new lock nuts (33). This hardware will be torqued later in this procedure.

8. Install a new gasket (23) between the transitions (5 and 6) on the turbochargers (24). Hand-tighten the bolts and washers (26 and 27) with new lock nuts (28). This hardware will be torqued later in this procedure.

9. Install the wastegate (18) between the tailpipe (14) and bypass assembly (8 and 9) sandwiched between two new gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19, washers (20) and new lock nuts (21). This hardware will be torqued later in this procedure.

10. Torque the support bracket screws (31) and nuts (33), turbocharger riser bolts (26) and lock nuts (28), and exhaust flange nuts (Figure 17-32) (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

NOTE: The remaining exhaust system and turbocharger components will be installed after the engine is installed in the aircraft.
Figure 17-32. Turbocharger and Exhaust System

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Right Turbo Transition
6. Left Turbo Transition
7. Riser
8. Crossover Assembly
9. Transition
10. Bushing
11. Tie Rod
12. Bolt
13. Lock Nut
14. Left Tailpipe
15. Right Tailpipe
16. V-band clamp
17. Gasket
18. Wastgate Assembly
19. Bolt
20. Washer
21. Lock Nut
22. Wastegate Controller
23. Gasket
24. Turbocharger Assembly
25. Gasket
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Screw
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose
17-10.3. TSIO-550-N Turbocharger and Exhaust System Installation

1. Apply Part No. 646943 anti-seize compound to the exhaust slip joints (Figure 17-33)(1-9) prior to assembly.

2. Install risers (7) on the exhaust tees (5 and 6).

3. Slide the riser/tee assemblies (2, 4, 6, and 7) together to make up the 2-4-6 side collector assembly.

4. Slide the riser/tee assemblies (1, 3, 5, and 7) together to make up the 1-3-5 side collector assembly.

5. With the engine in the inverted position, install a new exhaust flange gasket (25) on each cylinder.

6. Carefully install the left and right side collectors on the cylinder exhaust ports; position the collector so the flanges mate with the risers and seat squarely on the ports; lubricate and install new lock nuts (21) on each cylinder flange- do not torque at this time.

   NOTE: The remaining exhaust system and turbocharger components will be installed after the engine is installed in the aircraft.
Figure 17-33. Turbocharger and Exhaust System

1 Elbow Riser
2 Elbow Riser
3 Tee Assembly
4 Tee Assembly
5 Turbo Transition
6 Turbo Transition
7 Riser
8 Crossover Assembly
8A Crossover Assy with
Heater Shroud Option
9 Transition
10 Bushing
11 Tie Rod
12 Bolt
13 Lock Nut
14 Contoured Tailpipe
14C Inverse Tailpipe Option
15 Contoured Tailpipe
15A Straight Tailpipe
15B Heater
15C Inverse Tailpipe Option
16 V-band clamp
17 Gasket
18 Wastegate Assembly
19 Bolt
20 Washer
21 Lock Nut
22 Controller
23 Gasket
24 Turbocharger Assembly
25 Gasket
26 Bolt
27 Washer
28 Lock Nut
29 Bracket
30 Bracket
31 Screw
32 Washer
33 Lock Nut
34 Hose
35 Hose
36 Hose
17-11. Fuel Injection System Installation

TSIO-550-B, C & E engine models utilize a diverter valve priming system to ease engine starting; TSIO-550-G & K engine models do not. Refer to the appropriate section that applies to the engine model being assembled for instructions.

17-11.1. TSIO-550-B, C & E Fuel Injection System Installation

WARNING

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.

1. Liberally coat a new drive coupling (Figure 17-34) (2) with Molyshield Grease.
2. Install the new lubricated drive coupling (2) in the fuel pump (3) drive hub.
3. Lubricate both faces of a new fuel pump gasket with Part No. 642188 Gasket Sealant and install the new gasket (2) on the fuel pump.
4. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil.
5. Install the fuel pump (3) on the crankcase using hold down washers (7), washers (5), and nuts (6); torque the nuts (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
6. Purge the new fuel hoses (9 & 10) and fuel tubes (11-16) with Stoddard solvent through a white paper filter into a suitable fuel container. Continue to flush the fuel hoses with the Stoddard solvent until no particle residue is evident on the filter.

Procedure continues after Figure 17-34
Figure 17-34. Fuel Injection System

1. Fuel Injection Kit
2. Crankshaft Gear Coupling
3. Fuel Pump Assembly
5. Lock Washer
6. Nut
7. Hold Down Washer
8. Throttle & Metering Assembly
9. Hose Assembly
10. Hose Assembly
11. Fuel Inj. Tube Assembly #1
12. Fuel Inj. Tube Assembly #2
13. Fuel Inj. Tube Assembly #3
14. Fuel Inj. Tube Assembly #4
15. Fuel Inj. Tube Assembly #5
16. Fuel Inj. Tube Assembly #6
17A. Injector Nozzle #1
17B. Injector Nozzle #2
17C. Injector Nozzle #3
17D. Injector Nozzle #4
17E. Injector Nozzle #5
17F. Injector Nozzle #6
17A. Injector Nozzle Kit
18. Washer
19. O-Ring
20. Fuel Pump Adapter Gasket
Engine Assembly

7. Position the new diverter valve (Figure 17-35) (1) with fittings on the forward side of the Number 5 cylinder induction port on the manifold and secure with a new wraplock band clamp (9). Conform the clamp to the shape of the diverter valve and induction manifold and torque the band clamp to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 17-35. Fuel Priming System](image)

8. Install a new flushed fuel tube (5) between the fuel manifold valve inlet fitting and the diverter valve (Figure 17-35) (1) outlet fitting (4).

![Figure 17-36. Anti-Seize Lubricant Application on the Fuel Injector](image)
9. Install a new flushed tube (3) between the throttle body outlet fitting and the elbow (Figure 17-35) (2) on the bottom of the diverter valve (1).

10. Connect the flushed fuel tube (8) to the elbow (7) on the top of the diverter valve (1) and the fitting (A in Figure 16-12) on top of the induction manifold.

11. Thread the new injector nozzles (Figure 17-34) (17 A-F), prepared in Section 16-1.2 with new O-rings (18) and washers (19), into the cylinder head by hand. Use an 8167-1A Injector Nozzle Removal/Installation Tool to torque the fuel injector to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Install a cleaned sleeve assembly (Figure 17-37) (21) over each injector with new washers (23 and 22). Install a new compression seal (24) on the flared tube and install the cleaned air reference tubes (16, 17 & 18) on top of the sleeves. Torque the air reference tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Connect the air reference lines (17 & 18), with new compression seals (46) to the flex connector fittings on the throttle body, forward of the metering unit.

**WARNING**

Replacement of the fuel pump, fuel manifold valve, diverter valve, throttle or fuel injectors requires an “Engine Operational Check” to verify fuel system operation and adjustment.

14. Install the respective fuel tubes (Figure 17-34) (11 through 16) between the fuel manifold valve (4) and the corresponding cylinder number fuel injector nozzles. (These fuel lines were identified during engine disassembly); torque the fuel tube (11 through 16) “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 17-37. Air Reference Tubes

See Figure 17-28 for index
17-11.2. TSIO-550-G Fuel Injection System Installation

WARNING

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.

1. Liberally coat a new drive coupling (Figure 17-38) (2) with Molyshield Grease.
2. Install the new lubricated drive coupling (2) in the fuel pump (3) drive hub.
3. Apply Part No. 642188 Gasket Sealant to both sides of the new gasket (20) and install the new gasket (20) on the fuel pump.
4. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil.
5. Install the fuel pump (3) on the crankcase with hold down washers (7), new lock washers (5) and nuts (6). Torque the nuts (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
6. Purge the new fuel hoses (9 & 10) and fuel tubes (11-16) with Stoddard solvent through a white paper filter into a suitable fuel container. Continue to flush the fuel hoses with the Stoddard solvent until no particle residue is evident on the filter.
7. Install a new flushed fuel hose (21) between the fuel manifold valve (4) inlet and the throttle body (8) fuel inlet fitting; torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 17-36 repeated for reference
8. Thread the new injector nozzles (Figure 17-38) (17 A-F), prepared in Section 16-1.2 with new O-rings (18) and washers (19), into the cylinder head by hand. Use an 8167-IA Injector Nozzle Removal/Installation Tool to torque the fuel injector nozzles to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
9. Install a cleaned sleeve assembly (Figure 17-37) (21) over each injector with new washers (23 and 22). Install a new compression seal (41) on the flared tube and install the cleaned air reference tubes (16, 17 & 18) on top of the sleeves. Torque the air reference tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Connect the air reference lines (Figure 17-38) (17 & 18), with new compression seals (46) to the flex connector fittings on the throttle body, forward of the metering unit.

**WARNING**

Replacement of the fuel pump, fuel manifold valve, diverter valve, throttle or fuel injectors requires an “Engine Operational Check” according to instructions in Section 6-3.7 to verify fuel system operation and adjustment.

11. Install the respective fuel tubes (11 through 16) between the fuel manifold valve (4) and the corresponding cylinder number fuel injector nozzles. (These fuel lines were identified during engine disassembly); torque the fuel tube (11 through 16) “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-38 repeated for reference
17-11.3. TSIO-550-K & N Fuel Injection System Installation

**WARNING**

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

*CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.*

**WARNING**

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

*CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.*

1. Liberally coat a new drive coupling (Figure 17-39) (2) with Molyshield Grease.
2. Install the new lubricated drive coupling (2) in the fuel pump (3) drive hub.
3. Apply Part No. 642188 Gasket Sealant to both sides of the new gasket (20) and install the new gasket (20) on the fuel pump.
4. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil.
5. Install the fuel pump (3) on the crankcase with hold down washers (7), new lock washers (5) and nuts (6). Torque the nuts (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
6. Purge the new fuel hoses (9, 10 & 22, 27, 29) and fuel tubes (11-16, 21) with Stoddard solvent through a white paper filter into a suitable fuel container. Continue to flush the fuel hoses with the Stoddard solvent until no particle residue is evident on the filter.
7. Install a new flushed fuel tube (21) between the fuel manifold valve (4) inlet fitting and the throttle body (8) fuel outlet fitting; torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
8. Install clean bulkhead fittings (23 & 25) through the aircraft bulkhead and secure with bulkhead jam nuts (24 & 26); torque the jam nuts to aircraft manufacturer’s specifications.
9. Connect new, flushed fuel supply hose (29) to new flushed fuel supply hose (27) with a clean union (28).
10. Connect the supply hose assembly (27, 28 & 29) to the throttle fuel inlet fitting and the 45° bulkhead elbow fitting (25). Connect the fuel supply hose (9) to the fuel pump outlet fitting and the open end of the 45° bulkhead fitting (25); torque the hose and fitting connections to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
11. Connect the deck pressure reference hose segment (10) between fuel pump pressure reference fitting and the bulkhead nipple fitting (23). Connect deck pressure reference hose segment (22) between the open end of the bulkhead nipple fitting (23) and deck pressure reference on the 1-3-5 side of the throttle body forward of the throttle plate. Torque the hose and fitting connections to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
12. Thread the new injector nozzles (Figure 17-39) (17A-F), prepared in Section 16-1.2 with new O-rings (18) and new washers (19), into the cylinder head by hand. Use an 8167-IA Injector Nozzle Removal/Installation Tool to torque the fuel injector according to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install a cleaned sleeve assembly (Figure 17-37) (21) over each injector with new washers (23 and 22). Install a new compression seal (24) on the flared tube and install the cleaned air reference tubes (16 & 17) on top of the sleeve assemblies. Torque the air reference tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Connect the air reference tubes (16, 17 & 18), with new compression seals (46) to the flex connector fittings on the throttle body, forward of the metering unit.

**WARNING**

Replacement of the fuel pump, fuel manifold valve, diverter valve, throttle or fuel injectors requires an “Engine Operational Check” according to instructions in Section 6-3.7 to verify fuel system operation and adjustment.

15. Install the respective fuel tubes (Figure 17-39) (11 through 16) between the fuel manifold valve (4) and the corresponding cylinder number fuel injector nozzles. (These fuel lines were identified during engine disassembly); torque the fuel tube (11 through 16) “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-37 repeated for reference

Figure 17-39 repeated for reference
17-12. Wastegate Controller Installation

17-12.1. TSIO-550-B, C, E & G Wastegate Controller Installation

1. Insert bolts (Figure 17-40) (13) with washers (14) through the bracket (9). Place a second washer (14) on the bolt (13) and fasten the bracket (9) to the new or overhauled wastegate controller. Torque the bolts (13) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Place washers (16), grommets (17) and spacers (18) on two bolts (15). Insert the assembled fasteners through the 1-3-5 side of the bracket (8) and place a washer (16), spacer (18) and grommet (17) on the bolts, followed by the controller/bracket assembly. Secure the assembly with washers (16) and new lock nuts (19); torque the hardware to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Install the manifold pressure line (10) with a new line protector (12) between the upper fitting on the wastegate controller and the manifold pressure fitting on the induction manifold.

Figure 17-40. Wastegate Controller

<p>| | | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
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<tr>
<td>2</td>
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<td>3</td>
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<td>9</td>
<td>Bracket</td>
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<td>4</td>
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</tr>
<tr>
<td>5</td>
<td>O-Ring</td>
<td>11</td>
<td>Hose Assembly</td>
</tr>
<tr>
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<td>12</td>
<td>Line Protector</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>13</td>
<td>Bolt</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>14</td>
<td>Washer</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>15</td>
<td>Bolt</td>
</tr>
<tr>
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<td></td>
<td>16</td>
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</tr>
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</tr>
<tr>
<td>16</td>
<td></td>
<td>22</td>
<td>Washer</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>23</td>
<td>Lock Nut</td>
</tr>
</tbody>
</table>
4. Install a new deck pressure hose (11) to the fitting on the left side of the throttle body and the middle fitting on the front of the wastegate controller.

5. Install the mixture support bracket (20), if used, to the bracket with two bolts (21), four washers (22) and two new lock nuts (23).

6. Connect a new controller oil supply hose (35) between the wastegate oil outlet fitting and the controller (Figure 17-41) oil inlet fitting.

7. Connect a new oil return hose (34) between the controller oil drain fitting and the oil return fitting at the rear of the crankcase.

Figure 17-41. Wastegate Controller Lubrication
17-12.2. TSIO-550-K Wastegate Controller Hose Installation

1. Connect a new deck pressure hose (Figure 17-42) (8) to the deck pressure fitting on the throttle body. Install a plug in the open end of the deck pressure hose (8).

2. Connect a new manifold pressure hose (9) to the induction manifold pressure fitting. Install a plug in the open end of the new manifold pressure hose (9).

3. Place protective caps on the wastegate controller fittings and set the wastegate controller aside until the engine is installed in the aircraft.

4. Connect the new oil return hose (Figure 17-43) (34) to the oil return fitting at the rear of the crankcase. Install a plug on the wastegate controller end of the hose.

Figure 17-42. Wastegate Controller Hydraulic Hose Installation

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<td>4</td>
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<tr>
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<td>14</td>
<td>Hose Assembly</td>
<td>15</td>
<td>Hose Assembly</td>
</tr>
</tbody>
</table>
5. Connect a new wastegate controller oil supply hose (36) to the wastegate oil outlet fitting (Figure 17-29). Plug the open end of the oil supply hose until engine installation.

Figure 17-43. Wastegate Controller Lubrication
17-12.3. TSIO-550-N Wastegate Controller Hose Installation

1. Connect a new deck pressure hose (Figure 17-44) (8) to the deck pressure fitting on the throttle body. Install a plug in the open end of the deck pressure hose (8).

2. Connect a new manifold pressure hose (9) to the induction manifold pressure fitting. Install a plug in the open end of the new manifold pressure hose (9).

3. Place protective caps on the wastegate controller fittings and set the wastegate controller aside until engine installation.

4. Connect the new oil return hose (Figure 17-45) (34) to the oil return fitting at the rear of the crankcase. Install a plug on the wastegate controller end of the hose (34).
5. Connect a new wastegate controller oil supply hose (35) to the wastegate oil outlet fitting (Figure 17-29). Plug the open end of the oil supply hose until engine installation.

6. Place protective caps on the wastegate controller fittings and set the wastegate controller aside until engine installation.
17-13. Air/Oil Separator Installation

NOTE: The air/oil separator is aircraft mounted. Connections cannot be completed until the engine is installed in the aircraft.

NOTE: If the aircraft manufacturer chooses to use a custom air/oil separator rather than the air/oil separator offered by Continental Motors, refer to the aircraft maintenance instructions for air/oil separator installation and interconnect instructions.

1. Mount the air/oil separator (Figure 17-46) (1) according to the aircraft manufacturer's instructions.

2. Install the fitting (2) in the bottom of the air/oil separator.

3. Position two new hose clamps (4) loosely on each of the separator air hoses (3 & 5).

4. Connect a new separator-to-breather hose (3) and new separator-to-overboard drain hose (5) on the air oil/separator; Locate the hose clamp inboard of the air oil separator port “beads.”
5. Connect a new separator-to-scavenge pump hose (7) to the fitting (2) on the bottom of the air/oil separator and the upper (inlet) scavenge pump fitting on the starter adapter.

6. Connect the turbocharger oil scavenge hose (Figure 17-31) (21) to the elbow at the bottom or rear of the starter scavenge pump.

7. Connect the hoses according to the “Hose and Tubing Installation” instructions in Section C-11 of M-0, Standard Practice Maintenance Manual and torque all hose connections to the value specified in Appendix B of M-0.

Figure 17-47. Air/Oil Separator

<table>
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<tr>
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<td>1</td>
<td>Air/Oil Separator Assembly</td>
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<td>2</td>
<td>Elbow Fitting</td>
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<td>3</td>
<td>Hose Assembly</td>
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<tr>
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<td>Hose Clamp</td>
</tr>
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<td>5</td>
<td>Hose Assembly</td>
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<tr>
<td>6</td>
<td>Hose Clamp</td>
</tr>
<tr>
<td>7</td>
<td>Hose</td>
</tr>
</tbody>
</table>
17-14. **Compressor (Optional) Mount Installation**

1. Remove the self-locking 12-point nut (Figure 17-48) (item 14 in Figure 17-27) and spacer (13) from the starter adapter PTO shaft.

2. Discard the spacer (Figure 17-27) (13) and install a drive sheave (Figure 17-48) (18) in place of the spacer.

3. Temporarily secure the drive sheave (19) with a new self-locking 12-point nut (item 14 in Figure 17-27). Do not torque at this time.

4. Remove the nut (Figure 17-8) (54) and washer (53) on the 1-3-5 side of the crankcase.

5. Discard the O-ring (51) and install a new O-ring (51).

6. Install the mounting bracket (Figure 17-48) (1) on the crankcase upper hole to the through-bolt.

7. Loosely install washer (Figure 17-8) (53) and nut (54).

8. Align the lower bracket bolt holes with the crankcase bolt bosses.

9. Lubricate the bolt threads (Figure 17-48) (16) with 50 weight aviation engine oil and install the bolts (16) with washers (17) in the mount (1) and crankcase.

10. In a counterclockwise sequence starting with the through-bolt nut (Figure 17-8) (50), torque the nut and bolts (Figure 17-48) (16) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
11. Install the customer-supplied air conditioning compressor using kit supplied bolts (Figure 17-48)(14), plain washer (13) and nuts (12). Torque the nuts (12) and bolts (14) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Proceed with the remaining freon compressor installation according to the aircraft manufacturer's instructions.

12. Rotate the faces of the installed drive sheaves (2 & 19) under a dial indicator to check for runout. If runout exceeds 0.005”, replace or rework nonconforming sheave. Excessive idler sheave runout may be caused by an improperly installed bearing, check bearing installation.
Engine Assembly

13. With components installed, check the alignment of the starter adapter and idler sheaves with a calibrated Alignment Tool (Ideal Aviation Part No. 8082IA or equivalent (see Special Tools in Chapter 2 of M-0, Standard Practice Maintenance Manual) according to instructions in Figure 17-50.

![Diagram of Starter Adapter Belt Sheave Alignment]

**Figure 17-49. Starter Adapter Belt Sheave Alignment**

14. Check the tool flatness (calibration) by laying it on a surface table. Place the alignment tool around the drive sheave, resting in the valley of the compressor sheave.

15. If the alignment is correct, the extended end of the alignment tool will rest within 0.020 inch (Figure 17-50) of the center of the sheave.

16. Repeat the procedure used in step 15 to check the idler sheave, except the extended end of alignment tool will rest in the lower portion of the compressor sheave.

17. If either the drive or idler sheave is misaligned, install up to five 0.020-inch shims (Figure 17-48)(21 or 22) to align the sheaves. Do not install more than five shims in either location (Figure 17-49).

18. Lubricate the sheave support bolt (Figure 17-48) (5) with clean, 50-weight aviation engine oil. The sheave support bolt must extend beyond the threads of the block assembly.
19. When the idler sheave is aligned, prevent the engine from turning and torque the sheave support bolt (Figure 17-48) (5) and new 12-point self locking nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

20. Install a new drive belt (17). Loosen the jam nut (10) and unscrew the adjusting bolt (9) far enough to install the new drive belt.

21. Slide the idler sheave (3) snugly against the new drive belt (17) and tighten the tensioning bolt (9) finger-tight into its socket. In this position, the idler sheave (3) should rotate by hand under the belt.

22. Tighten the tensioning bolt (9) two full turns and check the drive belt for 50-70 lbs. of tension using one of the following methods:

   a. Use a direct reading Belt Tension Gage (such as Ideal Aviation Part No. BT-33-73FIA).

   b. Measure the belt deflection under a 5-pound load at the center of the longest belt span (Figure 17-51). Acceptable deflection is 0.30 to 0.40 inches.

   NOTE: One full turn of the adjusting screw will yield approximately 10 pounds change in belt tension.

**Figure 17-50. Sheave Alignment**
23. Adjust the bolt to the proper tension and tighten the jam nut (Figure 17-48) (10). Torque the tensioning bolt jam nut (10) and the idler sheave bracket slide bolt (9) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

24. After approximately 5 hours of operation, check the belt tension and adjust as required to maintain 50 to 70 pounds of belt tension.
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17-15. Ignition System Installation

CAUTION: The magnetos must be replaced or overhauled according to the manufacturer's instruction prior to installation.

17-15.1. Accessory Drive Adapter Installation

1. Apply Part No. 642188 Gasket Adhesive to both sides of new gaskets (Figure 17-52) (104) and apply the new gaskets to the accessory drive adapters (107).

2. Install the accessory drive adapter assemblies (107) with new gaskets (104) on the mounting studs on the rear of the crankcase.

3. Install the rear engine lifting eye on the two top inside accessory drive adapter studs.

4. Lubricate the accessory drive adapter fastener threads with 50 weight aviation engine oil. Secure the accessory drive adapters and lifting eye with washers (117), new lock washers (116 and 119), and nuts (115 & 118). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Apply Part No. 642188 Gasket Adhesive to both sides of new gaskets (110) and apply the new gaskets to the accessory drive covers (111).

6. Install the covers (111) with a new gaskets (110) on the accessory drive adapter studs with washers (112), new lock washers (113), and nuts (1114). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

7. Liberally lubricate the retainer (102) and new rubber bushings (101) with Molyshield grease. Insert the retainer, followed by the rubber bushings in the drive gear (103).

8. Lubricate the drive gear assembly (103) shaft, shaft splines and gear teeth with Molyshield grease and insert through the crankcase into the tapered side of the accessory drive adapter.
Figure 17-52. Accessory Drive Adapter

101 Rubber Bushing 106 Bushing 111 Accessory Cover 116 Lock Washer
102 Retainer-Mag Coupling 107 Part of 106 112 Plain Washer 117 Plain Washer
103 Magneto Drive Gear 108 Stud 113 Lock Washer 118 Nut
104 Gasket 109 Oil Seal 114 Nut 119 Lock Washer
105 Magneto Adapter Assembly 110 Accessory Drive Gasket 115 Nut

* NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.
17-15.2. Continental Motors Ignition System Installation

1. Install the magnetos in the crankcase according to the “Magneto Installation Instructions” in Section 10-5 of M-0, Standard Practice Maintenance Manual.

2. Apply Part No. 649366 (Loctite 242) adhesive to the threads of the new 90° fittings (Figure 17-53) (19) and install the fitting in the magneto housing. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Loosely install two hose clamps (16) on each new hose segment (14, 15, and 17).

4. Connect a hose (14) to each magneto 90° fittings (19) and join the hoses with the tee (18); secure with clamps (16) at each connection. Connect the hose (14) to the tee (18) and secure with clamps (16).

   NOTE: The magneto pressurization hose for the TSIO-550-N is on the 1-3-5 side of the throttle body unlike the other TSIO-550 engine models.

5. Verify the drain reducer (13) is present in the new filter. Connect a new filter (12) between hoses (15 & 16). Connect the free end of the hose (17) to the flex fitting on the throttle body for pressurization. Secure the filter to the engine according to the engine installation drawings. Simple illustrations are provided in Figure 17-53.

6. Connect magneto sensor, if equipped, (2) to bottom of one of the magnetos (determined by the aircraft manufacturer's instructions). Torque the magneto tachometer sensor to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-53. Continental Motors Ignition

1 Magneto 8 Nut 15 Hose
2 Magneto Tachometer Sensor 9 Lock Washer 16 Hose Clamp
3 Ignition Harness 10 Gasket 17 Hose
4 Screw Assembly 11 Spark Plug Assembly 18 Tee
5 Nut 12 Magneto Filter Assembly 19 Elbow Fitting
6 Lock Washer 13 Drain, Filter Reducer 20 Clamp
7 Mag Hold Washer 14 Hose 21 Bolt
8 Washer 22 Lock Nut
9 Gasket 23 Nut
10 Lock Washer 24 Gasket
11 Spark Plug Assembly 25 Bracket
12 Magneto Filter Assembly 26 Bracket
13 Drain, Filter Reducer 27 Clamp
14 Hose
15 Hose Clamp
16 Hose
17 Hose
18 Tee
19 Elbow Fitting
20 Clamp
21 Bolt
22 Washer
23 Lock Nut
24 Gasket
25 Bracket
26 Bracket
27 Clamp
17-15.3. Champion (Slick) Ignition System Installation

1. Install the magnetos in the crankcase according to the “Magneto Installation Instructions” in Section 10-5 of M-0, Standard Practice Maintenance Manual.

2. Apply Part No. 649366 (Loctite 242) adhesive to the threads of the new vent bushings (Figure 17-54)(21) and 90° pressurization fittings (15); Install the vent bushings (21) in each magneto and torque the vent bushings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Install 90° pressurization fittings (15) in the vent bushings; and torque the fittings (15) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Loosely install two hose clamps (11) on each new hose segment (8, 9, and 10).

4. Connect a hose (10) to each magneto 90° fittings (15) and join the hoses with the tee (12); secure with clamps (11) at each connection. Connect the hose (8) to the tee and secure with clamps (11).

5. Verify the drain reducer (14) is present in the new filter. Connect the filter (13) between hoses (8 and 9). Connect the free end of the hose (9) to the flex fitting on the throttle body for pressurization.


7. Connect magneto sensor (23) to the bottom of one of the magnetos (determined by aircraft manufacturer's instructions). Torque the magneto tachometer sensor to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-54. Champion (Slick) Ignition System

1  Magneto
2  Ignition Harness
3  Gasket
   Nut
5  Lock Washer
6  Mag Hold Washer
7  Spark Plug Assembly
8  Hose Assembly
9  Hose Assembly
10 Hose Assembly
11 Hose Assembly
12 Hose Clamp
13 Magneto Filter Assembly
14 Drain, Filter Reducer
15 Elbow Fitting
16 Bracket
17 Screw
18 Lock Nut
19 Washer
20 Cushion Clamp
21 Reducer Fitting
22 Magneto Filter Kit
23 Magneto Tachometer Sensor
Chapter 18. Post-Overhaul Test and Adjustments

18-1. Introduction

Specific procedures listed in sections of this chapter must be completed after engine overhaul before the aircraft can be released for normal flight operations.

**WARNING**

The tasks listed in the Engine Operation Prerequisite Table must be completed in the order listed on an engine before the aircraft is authorized for flight.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Requirement</th>
<th>Section References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prepare the Engine for Operation</td>
<td>“Maintenance Preflight Inspection” in Section 6-4.7.2 of M-0, Standard Practice Maintenance Manual</td>
</tr>
<tr>
<td>2</td>
<td>Maintenance Test Run</td>
<td>“Standard Acceptance Test” in Section 18-4</td>
</tr>
<tr>
<td>3</td>
<td>Complete Operational Checklist</td>
<td>“Engine Operational Checklist” in Section 6-6 of M-0, Standard Practice Maintenance Manual</td>
</tr>
<tr>
<td>4</td>
<td>Perform Flight Check</td>
<td>“Flight Check” instructions in Section 7-2.3^1</td>
</tr>
</tbody>
</table>

1. And in accordance with the Pilot’s Operating Handbook (POH).

18-2. Post-Overhaul Testing Prerequisites

Install the engine in the aircraft or an engine test stand (per the applicable test stand or aircraft manufacturer’s instructions). The following will be required to conduct post-overhaul testing:

- Fill the engine with oil according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.
  
  NOTE: A removable oil transfer tube conducts oil under pressure from the front main bearing through the crankshaft to the propeller hub. Crankshafts are equipped with an oil transfer collar to supply the governor-controlled oil to the crankshaft for use with an oil controlled propeller. When a test club or fixed pitch propeller is used for testing, the governor pad cover must have an internal grooved surface to allow the circulating oil to lubricate the oil transfer collar. The governor pad cover is not needed if a propeller governor is installed.

- Install the engine on a test stand (test cell) or the aircraft. A test stand is the preferred method of testing.
  
  A test club or flight propeller mated to the propeller flange, meeting the minimum moment of inertia specified for the engine propeller in Section 2-3 to absorb the brake horsepower (BHP) at the RPM specified in the test operating limits. Use the test club or flight propeller in combination with the cell, test stand, cooling apparatus, and operating limits for which it is calibrated.
Post-Overhaul Test and Adjustments

- A cooling air scoop designed to fit over the tops of all cylinders, with padded seals for rear cylinders and valve rocker covers, to direct an adequate flow of air downward through the cylinder fins.
- Vanes to direct cooling air to the center cylinder and the oil cooler.
- An air duct to the alternator vent tube.
- An air filter and housing attached to the air throttle inlet flange. The filter area must be sufficient to avoid air flow restrictions. Clean the filter before each test. Calculations of filter area should be based on approximately 389 cubic feet per minute (CFM) of air required by the engine at full throttle and on the filter capacity per unit of area. Increase the calculated area of a clean filter by at least 50% to allow for dirt accumulation.
- A flight propeller (if the engine is installed in the aircraft and cowling is in place)
  - The aircraft configured with a flight propeller may be considered a suitable test stand for Post-Overhaul engine testing contingent on the following:
    - The flight propeller may be used contingent upon cautious observation of engine cylinder head temperature.
    - The aircraft instruments must be calibrated prior to initiation of the Post-Overhaul engine testing
    - Each cylinder should be fitted with a cylinder head temperature (CHT) sensing device. If the aircraft instruments monitor only one cylinder, CHT must not exceed 400°F and oil temperature must not exceed 200°F throughout all phases of engine testing.
    - Position the nose of the aircraft into prevailing winds.
  - A throttle control capable of operating the throttle shaft through its complete range and a five position (OFF/R/L/BOTH/START) Ignition Switch connecting the engine with the aircraft electrical system.
  - A storage battery must be connected by a No. 0 stranded copper cable from its positive terminal to the power terminal of the starter through a starter solenoid. The battery negative terminal must be connected to the engine or both battery terminal and engine may be grounded. A small insulated wire should connect the starter solenoid coil terminal to a 5 ampere push-button switch. The other switch terminal must be connected to the engine or both to common ground.
  - Control panel equipped with the following calibrated engine instruments:
    - An oil pressure gauge and tube connection
    - An oil temperature gauge and capillary assembly
    - A water manometer with rubber hose connection to the vacuum pump oil return hole at the rear of the crankcase
    - An ammeter connected in the generator or alternator circuit
    - A manifold air pressure gauge connected to the deck pressure fitting on the fuel pump
    - A turbine inlet temperature gauge connected to a temperature probe fitted to an exhaust manifold temperature probe boss
Post-Overhaul Test and Adjustments

- A cylinder head temperature gauge connected to a temperature probe installed in bayonet fitting on the lower side of each cylinder
- A fuel flow gauge
- A clean, substantial hose of 3/4 inch inner diameter must be installed on the crankcase breather elbow and supported so it leads to a point above and to the rear of engine
- Fuel system with an auxiliary pump capable of sustained fuel pressure of 25 psi indication on fuel pressure gauge.

Make fuel line connections as follows:
1. Connect the fuel supply line to the fuel pump inlet.
2. Connect the fuel vapor return line (if equipped) to the upper elbow projecting from the right side of the fuel pump.
3. Connect a fuel pressure gauge in line with the fuel manifold valve fuel outlet.

18-3. Post-Overhaul Test Operating Limits

Post-overhaul test limits are the same as the “Engine Specifications” found in Section 2-3.

18-4. Standard Acceptance Test

Perform a standard acceptance test according to the protocol listed in Table 18-2.

Table 18-2. Standard Acceptance Test Requirements

<table>
<thead>
<tr>
<th>Engine Run Period</th>
<th>Oil (F°) Minimum</th>
<th>CHT (F°) Minimum</th>
<th>Duration (Minutes)</th>
<th>Engine RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120</td>
<td>175</td>
<td>N/A</td>
<td>1200 ± 25 RPM</td>
</tr>
<tr>
<td>2</td>
<td>150</td>
<td>225</td>
<td>N/A</td>
<td>1700 ± 25 RPM</td>
</tr>
<tr>
<td>3</td>
<td>165</td>
<td>250</td>
<td>N/A</td>
<td>2300 ± 25 RPM</td>
</tr>
<tr>
<td>4</td>
<td>180</td>
<td>250</td>
<td>10</td>
<td>Rated Power RPM</td>
</tr>
<tr>
<td>5</td>
<td>180</td>
<td>250</td>
<td>10</td>
<td>75% Power RPM. Check Fuel and Oil Pressures. Check Temperatures.</td>
</tr>
<tr>
<td>6</td>
<td>180</td>
<td>250</td>
<td>5</td>
<td>Idle RPM (cooling period -300° Max. CHT at shut down.)</td>
</tr>
<tr>
<td>7</td>
<td>N/A</td>
<td>N/A</td>
<td>---</td>
<td>Stop engine and perform leak check.</td>
</tr>
<tr>
<td>8</td>
<td>180</td>
<td>250</td>
<td>10</td>
<td>75% Power RPM</td>
</tr>
<tr>
<td>9</td>
<td>180</td>
<td>250</td>
<td>5</td>
<td>Idle RPM (cooling period)</td>
</tr>
</tbody>
</table>

1. Operate engine at specified RPM until engine has stabilized for one minute above minimum temperatures.
2. Do not run the engine above 1800 RPM until oil temperature has reached 160°F (71°C) and cylinder head temperatures have reached 200°F (93°C).
3. Make one check on performance of each magneto channel alone at 1700 RPM. Clear the spark plugs by operating with both magnetos on for a few seconds between checks.
4. Do not shut engine down until oil temperature is below 200°F (93°C) and cylinder temperatures are below 300°F (149°C).
5. Fuel and oil leaks are not acceptable.
Post-Overhaul Test and Adjustments

Engines failing the acceptance test for high oil consumption, major oil leaks, low power, damaged components, excessive noise, excessive roughness, low oil pressure, excessive oil filter contamination require further investigation. Correct discrepancies and repeat the Standard Acceptance Test.

18-5. Oil Consumption Test

If oil consumption is abnormal during the Standard Acceptance Test, perform an Oil Consumption Test to assess the extent of oil consumption over a longer period of operation. Use Table 18-3 to complete the oil consumption test.

Table 18-3. Oil Consumption Test Requirements

<table>
<thead>
<tr>
<th>Engine Run Period</th>
<th>Time Duration (Minutes)</th>
<th>Engine RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>1200 ± 25 RPM</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>1600 ± 25 RPM</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>2450 ± 25 RPM¹</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>Rated Power RPM²</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>75% Power RPM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check Fuel and Oil Pressures. Check Temperatures.</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>Idle RPM (cooling period 300°F (149°C) maximum at shutdown)³</td>
</tr>
</tbody>
</table>

Stop engine, drain and weigh oil for oil consumption determination⁴

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>5</td>
<td>Warm up to rated RPM</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>Rated Power Take engine readings every 10 minutes⁴</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>Idle RPM (cooling period 300° Max. CHT at shutdown.)³ ⁴ ⁵</td>
</tr>
</tbody>
</table>

1. Do not run the engine above 1800 RPM until oil temperature has reached 160°F (71°C) and cylinder head temperatures have reached 200°F (93°C).
2. Make one check on performance of each magneto alone at 1700 RPM. Clear spark plugs by operating with both magnetos on for a few seconds between checks.
3. Do not shut the engine down until the oil temperature is below 200°F (93°C) and cylinder temperatures are below 300°F (149°C).
4. Oil consumption of 1 lb. is considered acceptable for this test. One repeat of this test run is acceptable. If oil consumption is in excess of 1.0 pound, return the engine to the overhaul shop for a complete inspection.
5. Fuel and oil leaks are not acceptable.

Engines failing to pass the acceptance test for high oil consumption, major oil leaks, low power, damaged components, excessive noise, excessive roughness, low oil pressure, excessive oil filter contamination require further investigation. Correct discrepancies and repeat the Oil Consumption Test. Refer to troubleshooting instructions in Chapter 8 for remedial action, if necessary.

18-6. Drive Belt Tension Check

After approximately 5 hours of engine operation, check the belt tension of newly installed drive belts according to the “Belt Tension Check and Adjustment” instructions in Section 6-3.10.1.
Appendix A. Glossary

A-1. Acronyms

Refer to Appendix A-1 in M-0, Standard Practice Maintenance Manual.

A-2. Terms and Definitions

Refer to Appendix A-2 in M-0, Standard Practice Maintenance Manual.
Appendix B. Torque Specifications

Refer to the “Torque Specifications” in Appendix B of M-0, Standard Practice Maintenance Manual
Torque Specifications

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Appendix C. Standard Practices

C-1. Handling Parts
Refer to Appendix C-1 of M-0, Standard Practice Maintenance Manual.

C-2. Replacement Parts
Refer to Appendix C-2 of M-0, Standard Practice Maintenance Manual.

C-2.1. Background
Refer to Appendix C-2.1 of M-0, Standard Practice Maintenance Manual.

C-2.2. Acceptable Replacement Parts
Refer to Appendix C-2.2 of M-0, Standard Practice Maintenance Manual.

C-2.2.1. Know Your Supplier
Refer to Appendix C-2.2.1 of M-0, Standard Practice Maintenance Manual.

C-2.3. 100% Parts Replacement Requirements
Refer to Appendix C-2.3 of M-0, Standard Practice Maintenance Manual.

C-2.4. Mandatory Overhaul Replacement Parts
Refer to Appendix C-2.4 of M-0, Standard Practice Maintenance Manual.

C-2.5. Authorized Oversize/Undersize Parts
Refer to Appendix C-2.5 of M-0, Standard Practice Maintenance Manual.

C-3. Safety Wiring Hardware
Refer to Appendix C-3 of M-0, Standard Practice Maintenance Manual.

C-4. Tab Washer Installation
Refer to Appendix C-4 of M-0, Standard Practice Maintenance Manual.

C-5. Heli-Coil® Insert Replacement
Refer to Appendix C-5 of M-0, Standard Practice Maintenance Manual.

C-5.1. Heli-Coil® Removal
Refer to Appendix C-5.1 of M-0, Standard Practice Maintenance Manual.

C-5.2. Heli-Coil® Insertion
Refer to Appendix C-5.2 of M-0, Standard Practice Maintenance Manual.

C-6. Stud Replacement
Refer to Appendix C-6 of M-0, Standard Practice Maintenance Manual.

C-6.1. Stud Removal
Refer to Appendix C-6.1 of M-0, Standard Practice Maintenance Manual.
Standard Practices

C-6.1.1. Size-on-Size Rosan® Stud Removal
   Refer to Appendix C-6.1.1 of M-0, Standard Practice Maintenance Manual.

C-6.1.2. Step-Type Rosan® Stud Removal
   Refer to Appendix C-6.1.2 of M-0, Standard Practice Maintenance Manual.

C-6.1.2.1. Step-Type Rosan® Stud Removal Method 1
   Refer to Appendix C-6.1.2.1 of M-0, Standard Practice Maintenance Manual.

C-6.1.2.2. Step Type Rosan Stud Removal Method 2
   Refer to Appendix C-6.1.2.2 of M-0, Standard Practice Maintenance Manual.

C-6.2. Stud Installation
   Refer to Appendix C-6.2 of M-0, Standard Practice Maintenance Manual.

C-6.2.1. Rosan® Stud Installation
   Refer to Appendix C-6.2.1 of M-0, Standard Practice Maintenance Manual.

C-7. Cotter Pin Installation
   Refer to Appendix C-7 of M-0, Standard Practice Maintenance Manual.

C-8. Fuel System Service
   Refer to Appendix C-8 of M-0, Standard Practice Maintenance Manual.

C-8.1. Fuel System Purge
   Refer to Appendix C-8.1 of M-0, Standard Practice Maintenance Manual.

C-9. Gasket Maker® Application
   Refer to Appendix C-9 of M-0, Standard Practice Maintenance Manual.

C-10. Gasket Installation
   Refer to Appendix C-10 of M-0, Standard Practice Maintenance Manual.

C-11. Hose and Tubing Installation
   Refer to Appendix C-11 of M-0, Standard Practice Maintenance Manual.

C-12. Harness Routing
   Refer to Appendix C-12 of M-0, Standard Practice Maintenance Manual.
Appendix D. Overhaul Dimensional Limits

D-1. Overhaul Dimensional Limits=New Part Dimensions

New part dimensions are used for the Overhaul Dimensional Inspection. Overhaul tolerances are not the same as the service limits used for maintenance in Chapter 10. New parts dimensions are based on production drawings in effect at the time of publication.

WARNING

Use only new part dimensional limits during engine overhaul.
D-2. Fuel Injection System

Refer to Figure D-1 and Table D-1 for the fuel pump drive coupling dimensional limits. The Index numbers in the first column of Table D-1 correspond to the numbered items in Figure D-1.

Clean and dry parts thoroughly according to the Engine Cleaning instructions Chapter 12 of M-0, Standard Practice Maintenance Manual. Discard and replace any parts that do not conform to the specified new part dimensional specifications.

![Figure D-1. Fuel Pump Drive Coupling Fits & Limits](image)

**Table D-1. Fuel Pump Drive Coupling Dimensions**

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fuel pump drive coupling to crankshaft gear</td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>clearance:</td>
<td>0.0095L</td>
</tr>
<tr>
<td>1</td>
<td>Fuel pump drive coupling to fuel pump</td>
<td>clearance:</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.0030L</td>
</tr>
</tbody>
</table>

T= Tight  L= Loose
D-2.1. Throttle Lever

Refer to Figure D-2 for throttle and mixture control lever dimensional limits. Figure D-2 is specifically for stainless steel throttle levers.

NOTE: If the throttle lever bore is out of tolerance, replace the entire throttle lever. Do not attempt to install a bushing in the throttle lever.

Figure D-2. Throttle Lever Dimensions
Overhaul Dimensional Limits

D-3. Starter and Starter Adapter

Refer to Figure D-3 and Table D-2 for starter and starter adapter dimensional limits. Index numbers in Table D-2 correspond with the numbers in Figure D-3. Discard and replace any parts that do not conform to the new part dimensions. Figure D-4 and Table D-3 contain worm wheel drum dimensions and limits. Figure D-5 and Table D-4 contain shaft gear drum dimensions and limits.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual. Discard and replace any parts which do not conform to the new part tolerances.

Figure D-3. Starter and Starter Adapter with Scavenge Pump Dimensions
<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Starter shaft gear needle bearing bore in crankcase</td>
<td>0.9990</td>
</tr>
<tr>
<td>2</td>
<td>Starter shaft gear front (bearing) journal</td>
<td>0.7495</td>
</tr>
<tr>
<td>3</td>
<td>Starter shaft gear in clutch drum bearing</td>
<td>0.9995</td>
</tr>
<tr>
<td>4</td>
<td>Clutch spring sleeve in starter adapter</td>
<td>0.0030T</td>
</tr>
<tr>
<td>5</td>
<td>Starter shaft gear in ball bearing</td>
<td>0.00001T</td>
</tr>
<tr>
<td>6</td>
<td>Bearing in starter adapter cover</td>
<td>0.0001T</td>
</tr>
<tr>
<td>7</td>
<td>Worm wheel gear</td>
<td>0.0016</td>
</tr>
<tr>
<td>8</td>
<td>Worm wheel drum</td>
<td>See Figure D-4</td>
</tr>
<tr>
<td>9</td>
<td>Starter shaft gear drum</td>
<td>See Figure D-5</td>
</tr>
<tr>
<td>10</td>
<td>Clutch spring in clutch spring sleeve</td>
<td>0.0310T</td>
</tr>
<tr>
<td>11</td>
<td>Center line of worm gear shaft to starter adapter thrust pads</td>
<td>0.2450</td>
</tr>
<tr>
<td>12</td>
<td>Needle bearing bore starter adapter</td>
<td>0.7485</td>
</tr>
<tr>
<td>13</td>
<td>Ball bearing in starter adapter</td>
<td>0.00001T</td>
</tr>
<tr>
<td>14</td>
<td>Worm gear shaft in needle bearing area</td>
<td>0.5615</td>
</tr>
<tr>
<td>15</td>
<td>Worm gear shaft in ball bearing</td>
<td>0.0001L</td>
</tr>
<tr>
<td>16</td>
<td>Starter worm gear on shaft</td>
<td>0.0005L</td>
</tr>
<tr>
<td>17</td>
<td>Starter spring on worm drive shaft</td>
<td>0.0050L</td>
</tr>
<tr>
<td>18</td>
<td>Starter pilot to starter drive adapter</td>
<td>0.0010L</td>
</tr>
<tr>
<td>19</td>
<td>Scavenge pump driven gear on shaft</td>
<td>0.0005L</td>
</tr>
<tr>
<td>20</td>
<td>Scavenge pump driver and driven gear in body</td>
<td>0.0015</td>
</tr>
<tr>
<td>21</td>
<td>Scavenge pump driver gear in body</td>
<td>0.0118L</td>
</tr>
<tr>
<td>22</td>
<td>Bushing in scavenge pump driven gear</td>
<td>0.0035T</td>
</tr>
<tr>
<td>23</td>
<td>Scavenge pump driven gear</td>
<td>0.0035</td>
</tr>
<tr>
<td>24</td>
<td>Starter worm wheel gear and worm gear</td>
<td>0.0090</td>
</tr>
</tbody>
</table>

T= Tight  L= Loose

1. When the sandblasted finish is smoother than 125 RMS, replace the sleeve.
Overhaul Dimensional Limits

**Figure D-4. Worm Wheel Drum Dimensions**

<table>
<thead>
<tr>
<th>Part</th>
<th>“A” Diameter (inches)</th>
<th>“B” Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worm Wheel Drum</td>
<td>1.931 - 1.932</td>
<td>1.955 - 1.960</td>
</tr>
<tr>
<td>0.015 Undersize Worm Wheel Drum</td>
<td>1.916 - 1.917</td>
<td>1.940 - 1.945</td>
</tr>
</tbody>
</table>

**Figure D-5. Shaft Gear Drum Dimensions**

<table>
<thead>
<tr>
<th>Part</th>
<th>“A” Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft Gear Drum</td>
<td>1.931 - 1.932</td>
</tr>
<tr>
<td>0.015 Undersize Shaft Gear Drum</td>
<td>1.916 - 1.917</td>
</tr>
</tbody>
</table>
D-4. Ignition System

NOTE: For Continental Motors magneto overhaul limits, refer to the applicable Magneto Service Manual.

Refer to Figure D-6 and Table D-5 for the accessory drive adapter overhaul limits (new part tolerances). The numbers in the Ref. No. column of Table D-5 correspond to the numbered items in Figure D-6.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the magneto and accessory drive dimensional inspection. Discard and replace any parts that do not conform to the specified new part tolerances.

Table D-5. Ignition System Dimensional

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bushing in magneto and accessory drive adapter..........................</td>
<td>Minimum: 0.0010T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.0040T</td>
</tr>
<tr>
<td>2</td>
<td>Magneto and accessory drive gear in adapter..............................</td>
<td>Minimum: 0.0015L</td>
</tr>
<tr>
<td></td>
<td>bushing ..................................................................................</td>
<td>Maximum: 0.0035L</td>
</tr>
<tr>
<td>3</td>
<td>Oil seal in adapter ..................................................................</td>
<td>Minimum: 0.0010T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.0070T</td>
</tr>
<tr>
<td>4</td>
<td>Sleeve in magneto and accessory drive gear...............................</td>
<td>Minimum: 0.0010T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.0070T</td>
</tr>
<tr>
<td>5</td>
<td>Coupling retainer on drive gear sleeve....................................</td>
<td>Minimum: 0.0250L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.040L</td>
</tr>
<tr>
<td>6</td>
<td>Magneto and accessory drive gear............................................</td>
<td>Minimum: 0.0110L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.0770L</td>
</tr>
<tr>
<td>7</td>
<td>Magneto coupling retainer in magneto drive gear slot..................</td>
<td>Minimum: 0.0020T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.0280T</td>
</tr>
<tr>
<td>8</td>
<td>Magneto coupling rubber bushings on drive lugs.........................</td>
<td>Minimum: 0.014L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.052T</td>
</tr>
<tr>
<td>9</td>
<td>Magneto pilot in crankcase .................................................</td>
<td>Minimum: 0.001L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.005L</td>
</tr>
</tbody>
</table>

T= Tight  L= Loose
D-5. Lubrication System

Refer to Figure D-7 and Table D-6 for lubrication system dimensions. Numbers in the index column of Table D-6 correspond to the numbered items in Figure D-7. Additional lubrication system dimensions are listed in Table D-7.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection on the oil pump and tach drive. Discard and replace any parts that do not conform to the specified new part tolerances.

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oil Pressure Relief Valve Assembly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Oil pressure relief valve adjusting screw</td>
<td>diameter: 0.0030</td>
<td>0.0070</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Oil pressure relief valve seat in housing</td>
<td>depth: 0.750</td>
<td>1.060</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oil Pump Assembly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Oil pump driver gear in pump housing</td>
<td>diametric clearance:</td>
<td>0.0040L</td>
<td>0.0060L</td>
</tr>
<tr>
<td>4</td>
<td>Oil pump driver gear shaft in pump housing</td>
<td>diametric clearance:</td>
<td>0.0015T</td>
<td>0.0030L</td>
</tr>
<tr>
<td>5</td>
<td>Oil pump driven gear to driven gear shaft</td>
<td>diametric clearance:</td>
<td>0.0005L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>6</td>
<td>Oil pump driven gear in pump housing</td>
<td>end clearance:</td>
<td>0.0016L</td>
<td>0.0041</td>
</tr>
<tr>
<td>7</td>
<td>Oil pump driven gear in pump housing</td>
<td>end clearance:</td>
<td>0.0016L</td>
<td>0.0041</td>
</tr>
<tr>
<td>8</td>
<td>Oil pump driven gear shaft in oil pump cover</td>
<td>diametric clearance:</td>
<td>0.0015L</td>
<td>0.0030L</td>
</tr>
<tr>
<td>9</td>
<td>Oil pump driven gear in housing</td>
<td>diametric clearance:</td>
<td>0.0040L</td>
<td>0.0060L</td>
</tr>
<tr>
<td>10</td>
<td>Oil pump driver and driven gears</td>
<td>backlash:</td>
<td>0.0090</td>
<td>0.0130</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Oil press. relief valve spring compressed to 1.25 inch length</td>
<td>load: 32 lbs.</td>
<td>37 lbs.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Oil temp. control valve 0.090 inches minimum travel</td>
<td>at oil temperature:</td>
<td>120°F</td>
<td>170°F</td>
</tr>
<tr>
<td></td>
<td>Oil temperature must close between</td>
<td>oil temperature:</td>
<td>168°F</td>
<td>172°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T= Tight</td>
<td>L= Loose</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Inspection Item</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Pump Housing and Shaft Assembly</td>
<td>Driven Gear Shaft</td>
<td>0.5640 0.5650</td>
</tr>
<tr>
<td></td>
<td>Driver Gear Shaft Hole</td>
<td>0.5620 0.5630</td>
</tr>
<tr>
<td></td>
<td>Gear Chamber</td>
<td>1.9985 2.0000</td>
</tr>
<tr>
<td>Oil Pump Driver Gear</td>
<td>Shaft</td>
<td>0.0040L 0.0060L</td>
</tr>
<tr>
<td>Oil Pump Driven Gear</td>
<td>Bushing</td>
<td>0.0015L 0.0030</td>
</tr>
</tbody>
</table>

Table D-7. Lubrication System Components Dimensions
Not shown in Figure D-7
Figure D-7. Oil Pump Dimensions
Overhaul Dimensional Limits

**D-6. Engine Cylinders**

Refer to Figure D-8 and Table D-9 for cylinder dimensional limits. The numbers in the index column of table correspond to the numbered items in the illustrations. Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection. Discard and replace parts that do not conform to the dimensional specifications in the tables.

Table D-8. Cylinder Assembly Dimensions
Not illustrated in Figure D-8

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Inspection Item</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocker Arm Bushings</td>
<td>Inside Diameter</td>
<td>Minimum 0.7505</td>
</tr>
<tr>
<td>Valance Rocker Shaft</td>
<td>Outside Diameter</td>
<td>Maximum 0.7515</td>
</tr>
<tr>
<td>Intake Valve</td>
<td>Stem Diameter</td>
<td>Minimum 0.4334</td>
</tr>
<tr>
<td>Exhaust Valve</td>
<td>Stem Diameter</td>
<td>Maximum 0.4340</td>
</tr>
<tr>
<td>Piston (Standard)</td>
<td>Diameter at Top(^1)</td>
<td>Minimum 5.2126</td>
</tr>
<tr>
<td></td>
<td>Diameter Below 1st Groove(^1)</td>
<td>Maximum 5.2166</td>
</tr>
<tr>
<td></td>
<td>Diameter at Bottom(^2)</td>
<td>Minimum 5.2414</td>
</tr>
<tr>
<td></td>
<td>Pin Bore Diameter</td>
<td>Maximum 5.2424</td>
</tr>
<tr>
<td></td>
<td>Third Ring Groove Width</td>
<td>Minimum 0.1910</td>
</tr>
<tr>
<td></td>
<td>Fourth Ring Groove Width</td>
<td>Maximum 0.1920</td>
</tr>
<tr>
<td></td>
<td>Piston Pin to Top of Dome Height</td>
<td>Minimum 1.652</td>
</tr>
<tr>
<td>Pin Assembly</td>
<td>Length (Including plugs)</td>
<td>Maximum 1.656</td>
</tr>
<tr>
<td>Rocker Arm</td>
<td>Thrust Width</td>
<td>Minimum 0.937</td>
</tr>
</tbody>
</table>

1. Measure Piston Diameter at right angles to piston pin bore
2. Measurement must be made at 0.165 inches from the bottom of the piston.
Figure D-8. Cylinder Assembly Dimensions
## Table D-9. Engine Cylinder Assembly Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part Description</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cylinders</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cylinder bore (lower 4-1/2 inch of barrel)</td>
<td>diameter: See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cylinder bore choke (at 5.75 inch from open end of barrel)</td>
<td>taper:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cylinder bore</td>
<td>out-of-round:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cylinder bore</td>
<td>allowable oversize</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cylinder bore surface (Nitrided Barrels)</td>
<td>Cross hatch angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finish in micro-inches Ra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cylinder barrel in crankcase</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Intake valve seat insert in cylinder head</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Intake valve guide in cylinder head</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Exhaust valve guide in cylinder head</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Exhaust valve seat insert in cylinder head</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Intake valve seat</td>
<td>width: Figure D-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Exhaust valve seat</td>
<td>width: Figure D-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rocker Arms and Shafts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Rocker shaft in cylinder head boss</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Rocker arm bushing bore</td>
<td>diameter:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Rocker arm</td>
<td>side clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Intake valve guide</td>
<td>inside diameter:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Exhaust valve guide</td>
<td>inside diameter:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Intake valve face-to-stem</td>
<td>axis angle:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Exhaust valve face-to-stem</td>
<td>axis angle:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Intake valve gauge line-to-stem</td>
<td>length: Figure D-11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Exhaust valve gauge line-to-stem</td>
<td>length: Figure D-12 (Replace 100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Intake &amp; Exhaust valve face-to-stem</td>
<td>runout:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Rocker arm foot to valve stem (dry valve)</td>
<td>valve lash:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pistons, Rings, and Pins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Piston, non-coated in cylinder</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Piston, manganese phosphate coated in cylinder</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Top piston ring in groove</td>
<td>side clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Second piston ring in groove</td>
<td>side clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Third piston ring in groove</td>
<td>side clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Fourth piston ring in groove</td>
<td>side clearance:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensions for items 29A -32A apply only to Post-Gold Standard Cylinders (5.251-5.253 Dia. Cylinder Bore)

29A Top ring | gap: See Section 10-6.9 in M-0, Standard Practice Maintenance Manual |

30A Second ring | gap: |

31A Oil control ring | gap: |

32A Fourth ring | gap: |
### Table D-9. Engine Cylinder Assembly Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>29B</td>
<td>Top ring</td>
<td>gap: See Section 10-6.9 in M-0, Standard Practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30B</td>
<td>Second ring</td>
<td>gap: Maintenance Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31B</td>
<td>Oil control ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32B</td>
<td>Fourth ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Piston pin in piston</td>
<td>diametric clearance: 0.0001 0.0007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Piston Pin</td>
<td>diameter: 1.1243 1.1293</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Piston Pin (0.005 oversize)</td>
<td>diameter: 1.1245 1.1295</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Piston pin in cylinder</td>
<td>end clearance: 0.0310 0.0480</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Piston pin in connecting rod bushing</td>
<td>diametric clearance: 0.0022 0.0026</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Bushing in connecting rod</td>
<td>diametric clearance: 0.0025 0.0050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Bolt in connecting rod</td>
<td>diametric clearance: 0.0000 0.0018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Connecting rod bearing on crankpin</td>
<td>diametric clearance: 0.0009 0.0034</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Connecting rod on crankpin</td>
<td>end clearance: 0.0060 0.0110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Connecting rod bushing</td>
<td>twist (convergence) per inch of length: See M-0, Section 10-9.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Hydraulic tappet in crankcase</td>
<td>diametric clearance: 0.0010 0.0025</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Spring Test Data

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Load (Lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Inner valve spring 654442</td>
<td>70.3, 77.3</td>
</tr>
<tr>
<td></td>
<td>Inner valve spring 654442 compressed to 1.230 in. length</td>
<td>32.1, 38.1</td>
</tr>
<tr>
<td>44</td>
<td>Outer valve spring 654441 compressed to 1.275 in. length</td>
<td>101.8, 111.4</td>
</tr>
<tr>
<td></td>
<td>Outer valve spring 654441</td>
<td>49.1, 55.1</td>
</tr>
<tr>
<td>45</td>
<td>Installed outer valve spring</td>
<td>1.791 inches</td>
</tr>
</tbody>
</table>

1. Measured below fourth ring groove
2. Pre-Gold Standard Dimension
3. Post-Gold Standard Dimension
Overhaul Dimensional Limits

![Intake Valve Seat Dimensions Diagram](Image)

**INTAKE SEAT INSERT DIMENSIONS**

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DIA. B</th>
<th>DIA. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD</td>
<td>2.2790-2.2800</td>
<td>2.2770-2.2780</td>
</tr>
<tr>
<td>.002</td>
<td>2.2810-2.2820</td>
<td>2.2790-2.2800</td>
</tr>
<tr>
<td>.005</td>
<td>2.2840-2.2850</td>
<td>2.2820-2.2830</td>
</tr>
<tr>
<td>.010</td>
<td>2.2890-2.2900</td>
<td>2.2870-2.2880</td>
</tr>
<tr>
<td>.020</td>
<td>2.2990-2.3000</td>
<td>2.2970-2.2980</td>
</tr>
<tr>
<td>.030</td>
<td>2.3090-2.3100</td>
<td>2.3070-2.3080</td>
</tr>
</tbody>
</table>

**Figure D-9. Intake Valve Seat Dimensions**
Figure D-10. Exhaust Valve Seat Dimensions

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DIA. B</th>
<th>DIA. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD</td>
<td>1.796-1.797</td>
<td>1.794-1.795</td>
</tr>
<tr>
<td>.002</td>
<td>1.798-1.799</td>
<td>1.796-1.797</td>
</tr>
<tr>
<td>.005</td>
<td>1.801-1.802</td>
<td>1.799-1.800</td>
</tr>
<tr>
<td>.010</td>
<td>1.806-1.807</td>
<td>1.804-1.805</td>
</tr>
<tr>
<td>.020</td>
<td>1.816-1.817</td>
<td>1.814-1.815</td>
</tr>
<tr>
<td>.030</td>
<td>1.826-1.827</td>
<td>1.824-1.825</td>
</tr>
</tbody>
</table>
Overhaul Dimensional Limits

Figure D-11. Intake Valve Dimensions  
Figure D-12. Exhaust Valve Dimensions
D-7. Crankcase

Refer to Figure D-14 and Table D-11 for crankcase dimensional limits. Index numbers in the first column of Table D-11 correspond to the numbered items in Figure D-14. For items not illustrated in Figure D-14, refer to Table D-10.

Clean and dry parts thoroughly according to the Engine Cleaning’ instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection. Discard and replace any parts that do not conform to the specified new part tolerances.

Table D-10. Additional Crankcase Dimensions

<table>
<thead>
<tr>
<th>Part Name/Feature</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft Journal Bore (Rear &amp; Intermediate)</td>
<td>diameter</td>
<td>2.816</td>
<td>2.817</td>
</tr>
<tr>
<td>Crankshaft Main Journals (MJ #4 &amp; #5)</td>
<td>diameter</td>
<td>2.5625</td>
<td>2.5635</td>
</tr>
<tr>
<td>Camshaft Journal Bore</td>
<td>diameter</td>
<td>1.0000</td>
<td>1.0010</td>
</tr>
<tr>
<td>Crankcase Tappet Guides</td>
<td>diameter</td>
<td>1.0005</td>
<td>1.0015</td>
</tr>
<tr>
<td>Governor Driven Gear Bearing</td>
<td>diameter</td>
<td>0.8750</td>
<td>0.8760</td>
</tr>
<tr>
<td>Starter Shaft Needle Bearing Hole</td>
<td>diameter</td>
<td>0.9990</td>
<td>1.0000</td>
</tr>
<tr>
<td>Crankcase Idler Gear Support (front)</td>
<td>diameter:</td>
<td>0.9990</td>
<td>1.0000</td>
</tr>
<tr>
<td>Crankcase Idler Gear Support (rear)</td>
<td>diameter:</td>
<td>1.062</td>
<td>1.063</td>
</tr>
<tr>
<td>Camshaft Journal (4)</td>
<td>diameter</td>
<td>0.9980</td>
<td>0.9990</td>
</tr>
<tr>
<td>Valve Tappets</td>
<td>diameter</td>
<td>0.9990</td>
<td>0.9995</td>
</tr>
</tbody>
</table>

Figure D-13. Crankcase Main Bearing Oil Feed Hole Chamfer
### Figure D-14. Crankcase Dimensions

#### Table D-11. Crankcase Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Through-bolt in crankcase</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>Idler gear support in crankcase (front)</td>
<td>0.0005L</td>
</tr>
<tr>
<td>3</td>
<td>Idler gear support in crankcase (rear)</td>
<td>0.0015L</td>
</tr>
<tr>
<td>4</td>
<td>Oil pump housing pilot in crankcase</td>
<td>0.0010L</td>
</tr>
<tr>
<td>5</td>
<td>Idler gear</td>
<td>0.0300</td>
</tr>
<tr>
<td>6</td>
<td>Idler gear in support bushing (front)</td>
<td>0.0010L</td>
</tr>
<tr>
<td>7</td>
<td>Idler gear in support bushing (rear)</td>
<td>0.0010L</td>
</tr>
<tr>
<td>8</td>
<td>Magneto pilot in crankcase</td>
<td>0.0015L</td>
</tr>
<tr>
<td>9</td>
<td>Starter shaft gear roller bearing hole</td>
<td>0.9995</td>
</tr>
<tr>
<td>10</td>
<td>Governor drive shaft in crankcase</td>
<td>0.0014L</td>
</tr>
<tr>
<td>11</td>
<td>Crankcase deck height (each half)</td>
<td>4.560</td>
</tr>
<tr>
<td>12</td>
<td>Crankcase (cylinder deck-to-cylinder deck)</td>
<td>9.12</td>
</tr>
<tr>
<td>13</td>
<td>Accessory drive adapter pilot in crankcase</td>
<td>0.0000T</td>
</tr>
</tbody>
</table>

T= Tight  L= Loose
# D-8. Engine Drive Train

Refer to Figure D-15 and Table D-13 for engine drive train dimensional limits. Index numbers in the first column of Table D-13 correspond to the numbered items in Figure D-15. Additional dimensions are listed in Table D-12.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection. Discard and replace parts that do not meet the specified dimensions.
### Table D-12. Engine Drive Train Dimensions not depicted in Figure D-15

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Feature</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft Ctrwt. Hanger</td>
<td>Blade Bushing .................. Inside Diameter</td>
<td>See M-0, Section 10-9.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft</td>
<td>Journal......................... Diameter</td>
<td>0.9980</td>
<td>0.9990</td>
<td></td>
</tr>
</tbody>
</table>

### Table D-13. Engine Drive Train Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crankshaft in main bearing..........................</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crank pins</td>
<td>diametric clearance:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>out-of-round:</td>
<td>0.0000L</td>
<td>0.0040L</td>
</tr>
<tr>
<td>3</td>
<td>Main journals</td>
<td>out-of-round:</td>
<td>0.0000</td>
<td>0.0005</td>
</tr>
<tr>
<td>4</td>
<td>Crankshaft</td>
<td>diameter:</td>
<td>2.372</td>
<td>2.376</td>
</tr>
<tr>
<td></td>
<td>Front Journal</td>
<td>diameter:</td>
<td>2.374</td>
<td>2.375</td>
</tr>
<tr>
<td>4B</td>
<td>#4 &amp; #5 Main Journal</td>
<td>diameter:</td>
<td>2.624</td>
<td>2.625</td>
</tr>
<tr>
<td></td>
<td>Rear &amp; Intermediate Journals</td>
<td>diameter:</td>
<td>2.249</td>
<td>2.250</td>
</tr>
<tr>
<td>5</td>
<td>Crank pin</td>
<td>diameter:</td>
<td>2.374</td>
<td>2.375</td>
</tr>
<tr>
<td></td>
<td>Crankshaft</td>
<td>runout:</td>
<td>0.00000</td>
<td>0.0070</td>
</tr>
<tr>
<td>7</td>
<td>Propeller Flange</td>
<td>runout:</td>
<td>0.000</td>
<td>0.003</td>
</tr>
<tr>
<td>8</td>
<td>Damper pin bushing in crank cheek</td>
<td>diametric clearance:</td>
<td>0.0015T</td>
<td>0.0030T</td>
</tr>
<tr>
<td>9</td>
<td>Damper pin bushing in counterweight</td>
<td>diametric clearance:</td>
<td>0.0015T</td>
<td>0.0030T</td>
</tr>
<tr>
<td>10</td>
<td>Damper pin in counterweight</td>
<td>end clearance:</td>
<td>0.0090L</td>
<td>0.0390L</td>
</tr>
<tr>
<td>11</td>
<td>Alternator gear on crankshaft</td>
<td>diametric clearance:</td>
<td>0.0005T</td>
<td>0.0035T</td>
</tr>
<tr>
<td>12</td>
<td>Crankshaft gear on crankshaft</td>
<td>diametric clearance:</td>
<td>0.0000</td>
<td>0.0020T</td>
</tr>
<tr>
<td>13</td>
<td>Crankshaft in thrust bearing</td>
<td>end clearance:</td>
<td>0.004</td>
<td>0.016</td>
</tr>
<tr>
<td>14</td>
<td>Governor oil transfer collar on crankshaft</td>
<td>diametric clearance:</td>
<td>0.0005L</td>
<td>0.0018L</td>
</tr>
<tr>
<td>15</td>
<td>Camshaft journals in crankcase</td>
<td>diametric clearance:</td>
<td>0.0010L</td>
<td>0.0030L</td>
</tr>
<tr>
<td>16</td>
<td>Camshaft in crankcase</td>
<td>end clearance:</td>
<td>0.008</td>
<td>0.012</td>
</tr>
<tr>
<td>17</td>
<td>Camshaft</td>
<td>run-out:</td>
<td>0.00000</td>
<td>0.0010</td>
</tr>
<tr>
<td>18</td>
<td>Camshaft gear on camshaft flange</td>
<td>diametric clearance:</td>
<td>0.0005T</td>
<td>0.0015T</td>
</tr>
</tbody>
</table>

### Connecting Rod

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Bushing in connecting rod</td>
<td>diametric clearance:</td>
<td>0.0025T</td>
<td>0.0050T</td>
</tr>
<tr>
<td>20</td>
<td>Bolt in connecting rod</td>
<td>diametric clearance:</td>
<td>0.0000</td>
<td>0.0018L</td>
</tr>
<tr>
<td>21</td>
<td>Connecting rod bearing on crank pin</td>
<td>diametric clearance:</td>
<td>0.0009L</td>
<td>0.0034L</td>
</tr>
<tr>
<td>22</td>
<td>Connecting rod on crank pin</td>
<td>end clearance:</td>
<td>0.0060</td>
<td>0.0113</td>
</tr>
<tr>
<td>23</td>
<td>Connecting rod bushing twist (convergence) per inch of length</td>
<td>See M-0, Section 10-9.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Connecting rod bushing bore</td>
<td>See M-0, Section 10-9.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Bushing center to crankpin center</td>
<td>See M-0, Section 10-9.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. If the crankshaft is worn beyond limits, the crankshaft may be repaired by grinding the crank pins and journals to 0.010" under new shaft limits and re-nitriding. Crankshaft machining must be accomplished by a repair station certified to perform crankshaft repair by the FAA or equivalent government airworthiness authority.
Table D-14. Crankshaft, Camshaft, and Idler Gear Backlash

<table>
<thead>
<tr>
<th>Index</th>
<th>Part (See Figure D-16)</th>
<th>Dimensions (inches)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crankshaft gear and camshaft gear................................. backlash</td>
<td>0.0080</td>
<td>0.0120</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Crankshaft gear and idler gear.................................................. backlash</td>
<td>0.0080</td>
<td>0.0120</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Idler gear and magneto drive gear (right and left).................... backlash</td>
<td>0.0080</td>
<td>0.0120</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Starter shaft gear and crankshaft gear................................. backlash</td>
<td>0.0080</td>
<td>0.0120</td>
<td></td>
</tr>
</tbody>
</table>

Figure D-16. Crankshaft, Camshaft, and Idler Gear Backlash

Figure D-17. Pushrod Dimensions
Overhaul Dimensional Limits

D-8.1. Crankshaft Counterweight Assemblies


D-8.2. Counterweight Pins

Refer to “Crankshaft Assemblies” in Table 10-30 of M-0, Standard Practice Maintenance Manual for crankshaft counterweight pin part numbers and dimensions.

D-8.3. Crankshaft Hanger Blade and Counterweight Bushing Dimensions


D-8.4. Connecting Rod Dimensions

Refer to Connecting Rod Dimensional Inspection in Section 10-9.4.1 and Figure 10-42 in M-0, Standard Practice Maintenance Manual.
D-9. Stud Height Settings

D-9.1. Starter Adapter Stud Height Settings

Refer to Figure D-18 and Table D-15 for stud settings for the starter and accessory drive adapters. Index numbers in the accompanying tables match the callouts in the illustrations.

Figure D-18. Starter Adapter with Scavenge Pump
Overhaul Dimensional Limits

Table D-15. Starter Adapter with Scavenge Pump Stud Heights

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stud, Starter Adapter to Crankcase</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.32</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Stud, Starter Adapter to Crankcase</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.09</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Stud, Cover to Adapter</td>
<td>0.3125-18 X 0.3125-24</td>
<td>0.67</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Stud, Cover &amp; Scavenge Body to Adapter</td>
<td>0.38-16 X 0.38-24</td>
<td>2.13</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Stud, Starter Motor to Adapter</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.00</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Stud, Cover to Scavenge Body</td>
<td>0.3125-18 X 0.3125-24</td>
<td>2.25</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Stud, Cover to Scavenge Body</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.31</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Stud, Cover to Scavenge Body</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.55</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Dowel, Cover to Scavenge Body</td>
<td>0.45 X 0.625</td>
<td>0.15</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Stud, Cover to Housing</td>
<td>0.25-20 X 0.25 - 28</td>
<td>0.65</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Stud, Oil Filter To Adapter</td>
<td>0.75-16 X 0.8125-16</td>
<td>0.500-0.700</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Entries below only apply to oil pumps with a tachometer drive adapter

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Stud, Throttle Support</td>
<td>0.25-20 X 0.25 - 28</td>
<td>0.44</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Stud, Cover to Housing</td>
<td>0.25-20 X 0.25 - 28</td>
<td>0.75</td>
<td>4</td>
</tr>
</tbody>
</table>

D-9.2. Lubrication System Stud Height Settings

Figure D-19 and the accompanying table show stud settings on the oil pump housing, oil filter adapter and associated parts. Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness. Check the stud alignment using a tool maker’s square. No stud should exceed the specified settings.
D-9.3. Accessory Drive Adapter Stud Height

Figure D-20 is and the table below it indicate stud heights for the accessory drive adapter. For the accessory drive adapter mounting studs, refer to the crankcase stud height settings.

<table>
<thead>
<tr>
<th>Item</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stud, Accessory to Adapter</td>
<td>0.25-20X 0.25-28</td>
<td>0.87-0.90</td>
<td>4</td>
</tr>
</tbody>
</table>
D-9.4. Cylinder Stud Height Settings

Figure D-21 and Table D-16 show cylinder head stud height settings for the two cylinder configurations. Check stud alignment using a tool maker’s square.

![Figure D-21. Cylinder Stud Heights](image)

**Table D-16. Cylinder Stud Heights**

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exhaust flange stud (ring-locked)</td>
<td>1/4-20 x 1/4-28</td>
<td>0.865-0895</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Exhaust flange stud (ring-locked)</td>
<td>1/4-20 x 1/4-28</td>
<td>0.865-0895</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Intake flange stud</td>
<td>1/4-20 x 1/4-28</td>
<td>1.00</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Intake flange stud</td>
<td>1/4-20 x 1/4-28</td>
<td>0.78</td>
<td>2</td>
</tr>
</tbody>
</table>
D-9.5. Oil Control Collar Stud Height Settings

Figure D-22 shows the stud and dowel height settings on the oil control collar. Check that the studs are secure and aligned using a tool maker’s square. No stud height should exceed the listed stud height in Figure D-22.

![Figure D-22. Oil Control Collar Stud Height Settings]

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil Control Collar Stud</td>
<td>1/4X1-1/4 LG</td>
<td>0.94</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Dowel (Ferrule)</td>
<td>1/8X 7/16 LG</td>
<td>0.15</td>
<td>2</td>
</tr>
</tbody>
</table>

D-9.6. Crankcase Plugs

Refer to Table D-17 to determine the plugs that need to be removed to allow pressure flushing of the crankcase. Tag the removed plugs for re-installation reference. Numbers in parentheses refer to illustration Figure D-23.

![Table D-17. Crankcase Plugs]

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plug (14)</td>
</tr>
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## D-9.7. Crankcase Stud Height Settings

### Table D-18. Crankcase Stud Height Settings

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Figure D-23. Crankcase Stud Detail
### Table D-19. Crankcase Stud Height Settings

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Overhaul Dimensional Limits

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Supersedure Notice
This manual revises information contained in Continental Motors publication M-18, dated 1 September 2014 to support TSIO-550 Permold Series production engines. This revision incorporates cross references to M-0. Previous editions are obsolete upon release of this manual.

Effective Changes for this Manual

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PREFACE

This manual was developed in accordance with Title 14, Code of Federal Regulations (CFR) Part 33, §33.4 as the Instructions for Continued Airworthiness (ICA) for TSIO-550 series engines. Except for authorized owner preventive maintenance, defined in Title 14, Code of Federal Regulations (CFR) Part 43 §§43.3 and 43.13, Continental Motors ICAs are written for exclusive use by FAA (or equivalent authority) licensed mechanics or FAA (or equivalent authority) certified repair station employees. Information and instructions contained in this manual anticipate the user possesses and applies the knowledge, training, and experience commensurate with the requirements to meet the prerequisite FAA license and/or certification requirements. No other use is authorized. It is the responsibility of the owner to verify the person or facility operating, maintaining or servicing the engine uses the most current ICA, including manual change pages, service documents and FAA Airworthiness Directives (ADs), to perform those functions.

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Chapter 1. Introduction

1-1. Scope and Purpose of This Manual

This manual provides maintenance and overhaul instructions for TSIO-550 Permold series engines, manufactured by Continental Motors. These Instructions for Continued Airworthiness (ICA) are supplied to the owner with the engine. Instructions in this manual are specific to the TSIO-550 Permold Series engines. For information specific to other Continental Motors engine series, accessories, or the airplane, refer to the appropriate manual.

Chapter 2 contains detailed engine model descriptions and specifications. Special tools and consumables such as lubricants, sealants and adhesives are listed in Chapter 3. Airworthiness limitations are in Chapter 4. Chapter 5 provides instructions for engine removal and installation instructions. Chapter 6 contains inspection and service intervals and instructions. Chapter 7 provides supplemental information for the airplane flight manual (AFM) or pilot operating handbook (POH) in regards to specific engine operating procedures. Chapter 8 contains engine troubleshooting instructions. Engine preservation and storage instructions are in Chapter 9. Non-overhaul engine part removal and installation instructions are in Chapter 10. Chapter 11-18 contain engine overhaul instructions. Appendixes A, B, and C cross-references sections of M-0. Appendix D contains engine overhaul dimensional fits and limits.

1-1.1. Instructions for Continued Airworthiness

CMI Part No. M-18, is the principal instruction for continued airworthiness for TSIO-550 Permold Series engines as defined by Title 14 CFR§33.4. This manual and the component manuals (as applicable to engine specification) listed below are delivered to the customer with the engine. Service documents and Airworthiness Directives may also affect ICAs. Refer to Section 1-2.5 for instructions to check current publication status.

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<td>TSIO-550 engines</td>
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<tr>
<td>M-0</td>
<td>Maintenance and Overhaul Manual</td>
<td>Various</td>
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<td>Starter Service Instructions</td>
<td>CMI Energizer® starters</td>
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<td>Alternator Service Instructions</td>
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<tr>
<td>X42002</td>
<td>S-20/S-200 Magneto Service Manual</td>
<td>Various</td>
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1-1.2. Effectivity Symbols

Slight variations in TSIO-550 Series engine models require specific instructions or illustrations. When peculiar information pertains to only a specific engine model in the series, an effectivity symbol will accompany the information. Effectivity symbols found in this publication are:

- **TSIO-550-B**  
- **TSIO-550-C**  
- **TSIO-550-E**  
- **TSIO-550-G**  
- **TSIO-550-K**  
- **TSIO-550-N**  
- **EZR** Energizer Starter
- **ISK** Iskra Starter
- **SkyTec Starter**
Introduction

1-1.3. Advisories

This manual utilizes three types of advisories; defined as follows:

**WARNING**

*WARNING* Emphasizes information which, if disregarded, could result in severe injury to personnel or equipment failure.

*CAUTION:* Emphasizes certain information or instructions, which if disregarded, may result in damage to the engine or accessories.

*NOTE:* Provides special interest information, which may facilitate performance of a procedure or operation of equipment.

Warnings and cautions precede the steps to which they apply; notes are placed in the manner which provides the greatest clarity. Warnings, cautions, and notes do not impose undue restrictions. Failure to heed advisories will likely result in the undesirable or unsafe conditions the advisory was intended to prevent. Advisories are inserted to ensure maximum safety, efficiency, and performance. Abuse, misuse, or neglect of equipment can cause eventual engine malfunction or failure.

1-1.4. Using this Manual

This manual, applicable FAA ADs and CMI service documents, the accessory manuals listed in Table 1-1, and all changes incorporated in the ICAs as revisions constitute the Instructions for Continued Airworthiness (ICAs) prepared by Continental Motors and accepted by the FAA. We prepared this manual in a user-friendly format suited equally for electronic viewing and print. Illustrations in this manual are for reference only, depicting the most prominent configuration in the engine series. Consult the electronic engine parts catalog for engine model-specific illustrated parts breakdowns. The current information available from CMI must be used to perform engine service, repair or overhaul.

Continental Motors provides Instructions for Continued Airworthiness based on the design, testing, and certification of engines and parts for which Continental Motors is the holder of the Type Certificate (TC) or Parts Manufacture Approval (PMA) issued by the Federal Aviation Administration (FAA).

**WARNING**

*Continental Motors Instructions for Continued Airworthiness are applicable only to Continental Motors engines conforming to the approved, type certified engine model configuration.*

*Continental Motors ICAs must not be used for aftermarket parts or products modified by Supplemental Type Certificate.*

Installation of aftermarket parts on a Continental Motors engine constitutes a deviation from type-design criteria. Continental Motors has not participated in design, test, or certification of any aftermarket parts. Continental Motors does not provide product manufacturing specifications to aftermarket parts manufacturers and accepts no liability for the suitability, durability, longevity, or safety of such parts installed on Continental Motors engines. Installation of aftermarket parts on a Continental Motors engine must be performed using Instructions for Continued Airworthiness prepared by the manufacturer.
and approved by the FAA for the subject installation. For work with the engine installed in the aircraft, the aircraft maintenance manual may also be required to gain access to, or install some items. Use only the current information from the aircraft manufacturer.

Exploded assembly illustrations accompany instructions throughout the manual. Parts in illustrations (Figure 1-1) are identified with numerical callouts (indexes). Corresponding parts listings follow the illustrations for reference. The first time instructions refer to an illustration, the figure number is identified in parentheses, followed by the callout. In subsequent parts references, only the callout will be specified unless the referenced illustration changes.

1. Carefully slide the sleeve (Figure 6-15), 13 and drive gear assembly 12 out of the accessory drive adapter through the crankcase magnet pad opening.
2. Remove the nuts (10 & 11), lock washers (8 & 9) and washers (6 & 7). Remove the accessory drive assemblies from the rear of the crankcase. Discard the lock washers (8 & 9).
3. Remove and discard the gasket (1) and residue from the crankcase and the face of the accessory adapter.
4. Repeat steps 1 through 3 for the second accessory drive adapter.
5. Disassemble the accessory drive adapters according to instructions in Chapter 7.
1-1.5. Compliance

The owner/operator is responsible for ensuring the engine is maintained in an airworthy condition, including compliance with FAA Airworthiness Directives. Engine service life is predicated based on compliance with the aircraft and engine manufacturer’s required instructions, inspections, and maintenance schedule. Failure to comply may void the engine warranty.

WARNING

Prior to authorizing engine maintenance, the owner must ensure the facility or mechanic meets the Federal Aviation Administration (or equivalent authority) regulatory requirements. The engine owner must verify the repair facility or mechanic uses the most current revision, including change pages of the applicable ICA. Use of Instructions for Continued Airworthiness which have been designated as obsolete, superseded, or inactive is prohibited.

Except for Title 14, Code of Federal Regulations (CFR) Part 43 §43.3. “authorized owner preventive maintenance”, Continental Motors ICAs are written for exclusive use by FAA (or equivalent authority) licensed mechanics or FAA (or equivalent authority) certified repair station employees. Information and instructions contained in this manual anticipate the user possesses and applies the knowledge, training, and experience commensurate with the prerequisite FAA license and certification requirements. No other use is authorized.

WARNING

Failure to comply with ICAs may result in personal injury, death and subsequent engine failure. Pursuant to Title 14 CFR Part 43 §43.13(a), each person performing maintenance, alteration or preventive maintenance on an engine or accessory must use methods, techniques and practices set forth in the Instructions for Continued Airworthiness or other methods, techniques, and practices found acceptable to the Administrator.

This manual shall be used in conjunction with the latest revision of FAA Advisory Circular 43.13-1, “Acceptable Methods, Techniques, and Practices” as well as related publications and accessory manufacturer’s instructions. Pursuant to Title 14 CFR Part 43, §43.13(a), each person performing maintenance, alteration, or preventive maintenance on the engine or accessories must use methods, techniques, and practices prescribed in the ICAs or other methods, techniques, and practices found acceptable by the Administrator.
1-1.6. Order of Precedence

Continental Motors engine operating instructions are generated prior to and independently of the aircraft operating instructions. Continental Motors operating instructions are developed using factory controlled parameters that are not necessarily the same as those specifications required to satisfy a specific aircraft/engine installation.

WARNING

The aircraft operator must use the aircraft manufacturer’s operating instructions found in the Airplane Flight Manual/Pilot’s Operating Handbook (AFM/POH) and applicable Airplane Flight Manual Supplements (AFMS) while operating the engine in the aircraft unless the AFM/POH directs otherwise.

Refer to the AFM/POH published by the aircraft manufacturer for operating instructions and specifications relative to your aircraft.

Prior to commencing engine maintenance, consult the Continental Motors web site to verify the current status of the ICAs relating to the intended procedure.

1-2. Publications

This most current approved version of this manual is delivered to the customer at time of purchase. This manual and all subsequent revisions or changes are published in Adobe portable document (pdf) format and available for download on the Continental Motors Internet web site at http://www.continentalmotors.aero.

1-2.1. Publication Access

Printed technical publications may be ordered through authorized Continental Motors distributors or via the Internet at http://www.continentalmotors.aero. Contact an authorized Continental Motors distributor to discuss publication or service subscription options and pricing or visit our web site.

1-2.2. Publication Changes

WARNING

Use only the latest revision of all publications. Using superseded information may jeopardize engine airworthiness. Service documents, published by the manufacturer, or Airworthiness Directives, published by the FAA, may alter or provide supplemental information to the Maintenance and Overhaul Manual. Verify and use only the current versions of all instructions.

The instructions in this manual represent the best and most complete information available at the time of publication. Product or process improvements may trigger changes to existing product design specifications or procedures contained in publications. As new technical information becomes available, Continental Motors will make the information available to the customer.
Introduction

Continental Motors releases publication changes in the form of either change pages or complete publication revisions, depending upon the extent of change.

Continental Motors issues service documents in the form of Service Bulletins on a wide variety of topics. Some service documents may affect or supplement information in this manual and should be reviewed prior to performing maintenance. All active service documents applicable to the TSIO-550 Permold Series Engine have been incorporated in these instructions as of the date of publication.

1-2.3. Update/Change Distribution

Document updates are available on our website upon notification of FAA document acceptance/approval. Printed publication subscribers receive printed changes and revisions as they are released.

Figure 1-2. Change Page Identification
Document revisions are released if the update changes more than 50% of the contents of a publication. Revisions replace the previous version of a publication from cover to cover. Minor corrections are released as change pages to the original publication, identified with a change number and effective change date in the page footer. Information on the page that changed from the previous edition is identified by a vertical, six-point black line (Figure 1-2), referred to as a “change bar” in the outside margin of the page.

A change page replaces only the previous edition of the affected page. In the event a change page forces repagination, a new page will be inserted with a decimal extension added to the page number. For example, if additional pages are required between pages 1-6 and 1-7, the inserted page numbers will be 1-6.1, 1-6.2, and so on until sufficient pages are added to incorporate the new material.

Page A of the manual contains the original publication date and an itemized list of changes issued for the technical manual (Figure 1-3). If change pages are issued for the manual, the change will be identified, with an effective date under the heading “Effective Changes for This Manual” on Page A. The list of effective pages, itemizes the pages in each section, by change number. Original pages are designated by a 0 in the List of Effective Pages “Change” column.

![Figure 1-3. List of Effective Pages](image)

**Effective Manual Changes and Change Dates**

**Itemized List of Effective Pages**
1-2.4. Service Documents

Continental Motors may issue Service Documents in one of six categories ranging from mandatory (Category 1) to informational (Category 6). Definitions of the categories are listed below:

NOTE: Upon FAA approval, Continental Motors publishes service documents for immediate availability on our web site. The service document cover page indicates the engine models affected by the service document. Service documents may alter or replace the manufacturer’s Instructions for Continued Airworthiness. Insert a copy of applicable Service Documents in affected manuals until the service document instructions are incorporated in the manual, or the service document is canceled or superseded.

Category 1: Mandatory Service Bulletin (MSB)
Used to identify and correct a known or suspected safety hazard which has been incorporated in whole or in part into an Airworthiness Directive (AD) issued by the FAA or have been issued at the direction of the FAA by the manufacturer requiring compliance with an already-issued AD (or an equivalent issued by another country’s airworthiness authority). May contain updates to Instructions for Continued Airworthiness to address a safety issue.

Category 2: Critical Service Bulletin (CSB)
This category identifies a condition that threatens continued safe operation of an aircraft, persons or property on the ground unless some specific action (inspection, repair, replacement, etc.) is taken by the owner or operator. Documents in this category are candidates for incorporation into an FAA Airworthiness Directive. May contain updates to Instructions for Continued Airworthiness to address a safety issue.

Category 3: Service Bulletin (SB)
Information which the product manufacturer believes may improve the inherent safety of an aircraft or aircraft component; this category includes the most recent updates to Instructions for Continued Airworthiness.

Category 4: Service Information Directive (SID)
The manufacturer directs the owner/operator/mechanic in the use of a product to enhance safety, maintenance or economy. May contain updates to Instructions for Continued Airworthiness in the form of maintenance procedures or specifications.

Category 5: Service Information Letter (SIL)
This category includes all information (not included in categories 1 through 4) that may be useful to the owner/operator/technician. May contain updates to Instructions for Continued Airworthiness for optional component installations, which are not covered in the Applicable Operator, Maintenance, or Overhaul Manuals.

Category 6: Special Service Instruction (SSI)
This category is used to address an issue limited to specific model and/or serial number engines. We will distribute SSI notification directly to the affected engine’s owners. SSIs will not be included in the general service document set but will be made available through our Customer Service Department to owners of the affected engines only. An SSI may update the applicable engine’s Instructions for Continued Airworthiness.
## 1-2.4.1. Service Documents Incorporated in this Manual

Applicable technical information in the service documents listed below, relevant to the engine models covered by this engine manual, have been incorporated in this manual. The full content of active Continental Motors service documents is available at http://www.continentalmotors.aero. Refer to Section 1-3, “Contact Information” for Continental Motors web site details.

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1-2.4.2. Service Documents Released After Publication

Continental Motors strives to provide clear, concise, and accurate information and instructions based on best known engineering data at the time of publication. Ongoing process improvements may change a specification or procedure after a manual is released. Service documents, defined in Section 1-2.4, expedite customer notification until the new information is incorporated in the manual text. As service documents are received, note the service document number, release date, title, and applicable section affected by the service document in the blank cells below and insert a copy of the service document behind the last page of this section. Make pen & ink corrections, where appropriate, to the original text in the manual with a citation to the service document; i.e. see SB9X-1. For paragraphs or entire sections, draw an “X” through the affected information in the manual and reference the service document containing the correction.

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Service Documents Release After This Manual
1-2.5. Related Publications

The table below lists the publications, source, and accessibility relevant to TSIO-550 Permold Series Engine installation, maintenance & overhaul.

**WARNING**
Use only the latest revision of all publications. Using superseded information jeopardize engine airworthiness.

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1. Our web site (continentalmotors.aero) provides daily 24-hour access to engine technical data via the Internet. If you are an Internet service subscriber, you can access our web site to confirm and review the latest revision of this manual. If you have not subscribed to our Internet service and are using printed manuals, contact a service representative using the “Contact Information” in Section 1-3 to confirm you have the latest revision of the manual.

2. The Installation and Operation manual is provided to the aircraft manufacturer as part of the engine interface control documents to aid in development of the Airplane Flight Manual/Pilot’s Operating Handbook with detailed installation instructions and dimensional limits.

1-2.5.1. Suggestions and Corrections

Continental Motors solicits and encourages user comments regarding suggested changes to this manual. Direct recommended changes or questions to the attention of “Publications” at the address listed in Section 1-3, “Contact Information” or send comments via e-mail to CM.techpubs@continentalmotors.aero.

Notify our Customer Service Department immediately, using our toll-free number, if you discover incorrect information which adversely affects safety.
Introduction

1-3. Contact Information

Continental Motors factory representatives are available to answer technical questions and encourages suggestions regarding products, parts, or service. If customers have an inquiry or require technical assistance, they should contact their local Continental Motors distributor or field representative. To contact a factory representative, refer to the contact information below:

Continental Motors, Inc.
P. O. Box 90
Mobile, AL 36601

Customer Service Department:
Toll free within the Continental United States: 1-888-826-5465
International: 1-251-436-8299

Internet: http://www.continentalmotors.aero.
Chapter 2. Engine Description

2-1. General Engine Description

TSIO-550 Permold Series engines, manufactured by Continental Motors (CM), are six cylinder fuel injected, turbocharged engines with horizontally opposed air cooled cylinders designed for variable-pitch propeller applications. TSIO-550 Permold Series engine models use the cross-flow cylinder design with overhead inclined valves. Downdraft cylinder head intake inlets are cast in the top of the cylinder head; downdraft exhaust outlets exit the bottom of the cylinder.

The 550 cubic inch displacement is achieved using a 5.25 inch diameter cylinder bore and a 4.25 inch piston stroke. TSIO-550 Permold Series engines utilize the Permold crankcase design. Basic engine weights, minus accessories, are listed in Section 2-3. Engine weights vary by model specification, refer to OI-18, TSIO-550 Permold Series Engine Installation and Operation Manual for installed engine weights, including accessories.

The engine is provided with engine mounts designed for a focalized bed mount. A crankcase breather port is located on the oil filler neck on the 2-4-6 side of the crankcase between No. 2 and No. 4 cylinders. A 0.374-24 UNF threaded port is located near the bottom side of the cylinder head to accommodate a bayonet thermocouple.

Engine lubrication is provided by a wet sump, high pressure oil system. The engine lubrication system includes the internal engine-driven pressure oil pump, engine mounted oil cooler, oil sump, full flow oil filter, oil pressure relief valve, and pressure instrumentation. The oil cooler is mounted on the left crankcase half behind the No. 2 cylinder. A vernatherm valve allows oil flow into the engine if an oil restriction occurs in the external oil cooler and during cold starting.

The TSIO-550 Permold Series engines incorporate a downdraft balanced port induction system with an engine mounted throttle body. Engine manifold pressure is controlled by the throttle plate and is measured at the 0.125-27 NPTF port located on the induction manifold near the throttle (see Engine Installation Drawings, Section 5-4).

TSIO-550 Permold Series engines incorporate dual turbochargers and dual intercoolers/aftercoolers. The exhaust bypass for the turbine sections is connected to a single exhaust wastegate that is controlled by a sloped controller.

TSIO-550 Permold Series engines are equipped with a Continuous Flow Fuel Injection system that meters fuel flow as a function of engine speed, throttle angle, mixture control angle, and turbocharger compressor discharge air pressure. The metered fuel is fed to continuous flow air bled injector nozzles located at each cylinder intake port. Fuel drains are provided at the bottom of each cylinder.
2-1.1. **Engine Model Number Definition**

The description of each alphanumeric character in the engine model number is given below for the example engine model TSIO-550-B1B (Figure 2-2).

![Engine Model Definition Diagram](image)

**Figure 2-2. Engine Model Definition**

2-1.2. **Cylinder Number Designations**

Refer to Figure 2-3:

- The front of the engine is the end closest to the propeller and the rear of the engine is the accessory end.
- Viewed from the rear of the engine, the left-side cylinders are designated by even numbers 2-4-6, with Cylinder 2 being closest to the rear.
- The right side cylinders have odd number sequential designation 1-3-5, with Cylinder 1 being closest to the rear.
- Firing order of the engine is 1-6-3-2-5-4.

![Cylinder Number Designation Diagram](image)

**Figure 2-3. Cylinder Number Designation**
2-2. Detailed Engine Description

2-2.1. Crankcase

The crankcase is composed of two aluminum alloy castings joined along the center vertical plane. The individual castings with studs and inserts will be referred to as left and right crankcase halves throughout the manual.

Bosses molded in the castings are line bored in the assembled casting to form bearings for the camshaft and saddles for precision main bearing inserts. Guides are bored through lateral bosses for hydraulic tappets and on the left crankcase half for the governor drive shaft gear. A needle bearing bore is located on the right crankcase half at the rear main bearing saddle for the starter adapter and needle bearing.

Cylinder mounting pads on the left crankcase are farther forward than the corresponding pads on the right crankcase to permit each connecting rod to work on a separate crankpin. There are seven studs and two through-bolts for attaching cylinder base flanges. The propeller governor mount pad is located on the lower front corner of the left crankcase half. An alternator pad is located on the right crankcase forward of the number five cylinder mount pad.

The crankcase interior is ventilated by an integral breather in the oil filler adapter inserted in a machined hole between the number two and four cylinders on the left crankcase half.

![Figure 2-4. Permold Crankcase Features](image-url)
2-2.2. Engine Drive Train

When starting the engine, torque is transmitted from the starter through the starter adapter components to the crankshaft gear. As the worm gear in the adapter is turned, the spring mounted on the hub tightens to grip the knurled drum of the shaft gear. After starting, the spring returns to its normal position releasing the shaft gear and disengaging the starter.

Torque is transmitted to the alternator by a face gear mounted on the crankshaft. Crankshaft torque is transmitted by the crankshaft gear directly to the idler gear and the camshaft gear. The idler gear rotates in a counter-clockwise direction to drive the magneto drive gears. Optional accessories mounted on the aft side of the accessory case are driven by the internal splines of the magneto drive gears.

The fuel pump coupling connects directly to the crankshaft gear. The splined end of the oil pump drive gear mates with the internal splines of the camshaft gear and transmits torque to the oil pump driven gear. The governor drive bevel gear is physically attached to the end of the camshaft; it meshes with the governor driven bevel gear to provide power to the propeller governor.

![Figure 2-5. Engine Drive Train](image-url)
2-2.2.1. Crankshaft

The crankshaft is precision machined aircraft quality steel having five main journals which rotate on bearings in the crankcase. Six rod journals are the connecting points for the connecting rod assemblies.

Counterweights are supplied in matched pairs with the bushings installed; total weight difference between pairs is not to exceed two grams. Counterweight order number designates the vibration order the counterweight is capable of absorbing. A sixth order counterweight is designed to counteract six vibrations per revolution of the crankshaft. Similarly, if a crankshaft produces five vibrations per revolution, a fifth order counterweight is used to offset the vibration. Two sixth order counterweights are installed in the number two crankshaft cheek hangers. On the two No. five crankshaft cheek hangers, one fifth order and one fourth order counterweight is installed.

The crankshaft gear is heated prior to installation to obtain a shrink fit. The gear is positioned on the crankshaft by a dowel pin; it incorporates a square output coupling to drive the fuel pump. The gear also has a machined timing mark to properly position the crankshaft and camshaft angles.

The alternator drive gear is attached by a flange just behind the No. 5 main journal at the front of the crankshaft and secured by four bolts and lock plates. A neoprene oil seal, which is stretched over the crankshaft flange, and a split retainer ring are seated between the crankcase castings in the front crankshaft exit area and is sealed to the crankshaft by a helical spring inside the seal cavity.

![Figure 2-6. Crankshaft](image-url)
2-2.2.2. Connecting Rods

The connecting rods halves are machined from a single forging of aircraft quality steel and cut into two pieces, splitting the center of the larger opening of the connecting rod assembly. The resulting pieces, called the rod and cap are fitted with a two piece bearing and attach to the crankpin or rod journal with special bolts and nuts.

The portion of the rod between the rod and the crankpin and piston pin ends is called the “I” beam. A split steel-backed bronze bushing is pressed into the piston pin end and machined for a precision pin-to-bushing fit. Weight variations between opposing crankshaft positions is limited to ½ ounce (14.175 grams).

NOTE: Some older connecting rod assemblies use a castellated nut with a cotter pin to join the connecting rod and cap. Those assemblies are being phased out of current production engines.
2-2.2.3. Camshaft

The camshaft is forged from aircraft quality steel, machined on four main journals with nine ground and hardened lobes and a gear mounted flange at the rear of the camshaft. The main journals ride within the crankcase camshaft bores. Four unequally spaced bolts attach the gear to the camshaft. Camshaft to crankshaft timing is accomplished by aligning the timing marks of the crankshaft and camshaft gears in the crankcase. As the crankshaft turns the camshaft in the crankcase, hydraulic tappets follow the eccentric lobes of the camshaft in crankshaft tappet bores. Inward and outward movement of the tappets open and close the intake and exhaust valves within the cylinder head by mechanical linkage of the pushrods and rocker arms to the tappets. The exact moment of valves opening and closing is synchronized by the crankshaft to camshaft timing. The camshaft gear incorporates a splined drive for the engine oil pump. A front mounted keyed bevel drive gear provides momentum for the prop governor bevel driven gear.

![Figure 2-8. Camshaft](image)

2-2.2.4. Idler Gear

The idler gear support pin supports the idler gear. A bushing in the crankcase supports the forward part of the idler gear support pin shaft. The crankshaft drives the idler gear directly. In turn, the idler gear drives the left and right magneto accessory drive gears.

2-2.3. Cylinders

TSIO-550 Permold Series engines have six, horizontally-opposed, air cooled cylinders, three on the left side and three on the right side of the engine. The cylinders, pistons and valve drive train provide the momentum to sustain crankshaft movement. Aviation fuel and air, drawn into a cylinder during the intake stroke are compressed by the piston during the compression stroke and then ignited by a high intensity spark from the spark plugs (two per cylinder). As the mixture ignites, expanding gases force the piston toward the crankshaft during the power stroke.

The head and barrel assembly consists of externally finned aluminum alloy head casting and a through-hardened steel, nitrided cylinder barrel for wear resistance. Helicoil thread inserts are installed in upper and lower spark plugs holes. A rotocoil assembly retains two concentric springs surrounding the exhaust valve and is locked to the stem by tapered, semi-circular keys which engage grooves around the valve stems. An outer retainer holds
two concentric springs which surround the intake valve and is locked to the stem by tapered, semi-circular keys which engage grooves on the stem.

TSIO-550 Permold Series engine cylinders use a cross-flow cylinder design. Intake ports are located on top of the cylinder (Figure 2-9) while exhaust ports are located below the cylinder. Separate intake and exhaust valve rocker covers are stamped from zinc-plated sheet steel. This cylinder design is used in conjunction with a Balanced Induction System mounted above the engine.

Figure 2-9. Cross-flow Cylinder Features
2-2.3.1. Pistons

Pistons are aluminum alloy castings with a steel insert cast into the top ring groove. The piston skirts are solid with cylindrical relief cuts at the bottom. Pistons have three ring grooves above the piston pin bore and one ring groove below. Compression rings are installed in the top and second grooves. An oil scraper ring is installed in the groove below the piston pin bore. A center grooved and slotted oil control ring is installed in the third groove which has six oil drain holes to the interior. Pistons are selected in weight matched pairs within opposing cylinders bays. Piston pins are full floating with permanently pressed-in aluminum end plugs.

![Piston Features](image)

Figure 2-10. Piston Features

2-2.3.2. Hydraulic Valve Tappets

The hydraulic valve tappet (lifter) provides an interface between the camshaft lobe and the remaining valve train. Hydraulic valve tappets ride on the eccentric cam lobes, opening and closing the intake and exhaust valves mechanically via push rods and rocker arms. This allows conversion of the cam lobe profile into a linear movement for actuation of the intake and exhaust valves. The hydraulic mechanism inside the tappet maintains zero clearance between the valve and its actuating components. The interface between a cam lobe and tappet is intended to wear to some degree as the engine operates. This is similar to the piston ring to cylinder wall interface that must seat together for proper operation and wear over time.
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The camshaft is forged from aircraft quality steel, machined on four main journals with nine ground and hardened lobes and a gear mounted flange at the rear of the camshaft. The main journals ride within the crankcase camshaft bores. Four unequally spaced bolts attach the gear to the camshaft. Camshaft to crankshaft timing is accomplished by aligning the timing marks of the crankshaft and camshaft gears in the crankcase. As the crankshaft turns the camshaft in the crankcase, hydraulic tappets follow the eccentric lobes of the camshaft in crankshaft tappet bores. Inward and outward movement of the tappets open and close the intake and exhaust valves within the cylinder head by mechanical linkage of the pushrods and rocker arms to the tappets. The exact moment of valves opening and closing is synchronized by the crankshaft to camshaft timing. The camshaft gear incorporates a splined drive for the engine oil pump. A front mounted keyed bevel drive gear provides momentum for the prop governor bevel driven gear.

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![Piston Features](image)

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Chapter 2. Engine Description

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The 550 cubic inch displacement is achieved using a 5.25 inch diameter cylinder bore and a 4.25 inch piston stroke. TSIO-550 Permold Series engines utilize the Permold crankcase design. Basic engine weights, minus accessories, are listed in Section 2-3. Engine weights vary by model specification, refer to OI-18, TSIO-550 Permold Series Engine Installation and Operation Manual for installed engine weights, including accessories.

The engine is provided with engine mounts designed for a focalized bed mount. A crankcase breather port is located on the oil filler neck on the 2-4-6 side of the crankcase between No. 2 and No. 4 cylinders. A 0.374-24 UNF threaded port is located near the bottom side of the cylinder head to accommodate a bayonet thermocouple.

Engine lubrication is provided by a wet sump, high pressure oil system. The engine lubrication system includes the internal engine-driven pressure oil pump, engine mounted oil cooler, oil sump, full flow oil filter, oil pressure relief valve, and pressure instrumentation. The oil cooler is mounted on the left crankcase half behind the No. 2 cylinder. A vernatherm valve allows oil flow into the engine if an oil restriction occurs in the external oil cooler and during cold starting.

The TSIO-550 Permold Series engines incorporate a downdraft balanced port induction system with an engine mounted throttle body. Engine manifold pressure is controlled by the throttle plate and is measured at the 0.125-27 NPTF port located on the induction manifold near the throttle (see Engine Installation Drawings, Section 5-4).

TSIO-550 Permold Series engines incorporate dual turbochargers and dual intercoolers/aftercoolers. The exhaust bypass for the turbine sections is connected to a single exhaust wastegate that is controlled by a sloped controller.

TSIO-550 Permold Series engines are equipped with a Continuous Flow Fuel Injection system that meters fuel flow as a function of engine speed, throttle angle, mixture control angle, and turbocharger compressor discharge air pressure. The metered fuel is fed to continuous flow air bled injector nozzles located at each cylinder intake port. Fuel drains are provided at the bottom of each cylinder.
Figure 2-1. TSIO-550 Typical Top and Side Views
2-1.1. **Engine Model Number Definition**

The description of each alphanumeric character in the engine model number is given below for the example engine model TSIO-550-B1B (Figure 2-2).

![Figure 2-2. Engine Model Definition](image)

**TS I O - 550 - B 1 B**

- Shipping Designation
- Specification Number
- Model Identifier
- Cubic Inch Displacement
- Horizontally Opposed Cylinders
- Fuel Injected
- Turbo-Supercharged

2-1.2. **Cylinder Number Designations**

Refer to Figure 2-3:

- The front of the engine is the end closest to the propeller and the rear of the engine is the accessory end.
- Viewed from the rear of the engine, the left-side cylinders are designated by even numbers 2-4-6, with Cylinder 2 being closest to the rear.
- The right side cylinders have odd number sequential designation 1-3-5, with Cylinder 1 being closest to the rear.
- Firing order of the engine is 1-6-3-2-5-4.

![Figure 2-3. Cylinder Number Designation](image)
2-2.6. Starter Assembly

The Starting System consists of an electric starter motor mounted on a right angle starter drive adapter. Starter motors certified for TSIO-550 Permold Series engines are available from multiple accessory providers.

When the starter motor is electrically energized, the adapter worm shaft and gear engage the starter shaft gear through a spring and clutch assembly by turning the starter worm wheel. As the shaft gear turns, it rotates the crankshaft gear and crankshaft. When the engine starts, electrical energy is removed from the starter motor. The gripping action of the clutch spring is relieved, disengaging the shaft gear from the worm shaft and electric starter motor. The starter shaft gear extends from the rear of the starter adapter.

![Diagram of Starting System]

Figure 2-17. Starting System

2-2.7. Alternator

A gear-driven alternator mounts on the right front crankcase half. The alternator converts mechanical energy from the crankshaft into electrical energy to power aircraft electrical accessories and recharge the aircraft batteries. An elastomer coupling dampens the mechanical interface between the crankshaft face gear and the alternator drive shaft. Approved alternators are available in multiple voltage output options for the engine series to match aircraft circuit requirements. An external voltage regulator is required.

Optional belt-driven or accessory pad mounted gear-driven alternators are available as secondary power sources. If approved for the engine model specification, a split belt drive sheave is sandwiched in the propeller shaft with minimal impact to engine bay requirements. Consult engine model specifications for availability.
2-2.8. Ignition System

TSIO-550 Permold Series Engine Ignition Systems use two separate, independent pressurized magnetos manufactured by either Continental Motors (formerly Bendix) or Champion (formerly Slick) for dual ignition to each cylinder. Continental Motors magneto key features are indicated by the model number (Figure 2-18). Spark plugs are installed in top and bottom bosses in each cylinder head. Magneto pressurization is provided by engine deck pressure.

Magneto pressurization is provided by engine deck pressure. Magnetos are installed at the rear of the engine, driven by the idler gear. The magnetos may employ impulse couplings or retard breakers for improved engine starting ignition. Impulse couplings, which rotate faster than the engine cranking speed, automatically retard the spark during engine cranking for easier starting. Magnetos fitted with retard breakers boost ignition energy by feeding pulsating battery voltage to the magneto primary circuit during the start sequence and automatically retard the spark during engine cranking. Magnetos may be fitted with a tachometer pickup sensor installed in the flange housing vent. The engine firing order (Figure 2-19 or Figure 2-20) is determined by the crankshaft geometry; magneto firing order is sequential from the number one position and must be synchronized to the crankshaft.

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**Figure 2-18. Continental Motors Magneto Model Number Structure**
Engine Description

Figure 2-19. Continental Motors Ignition System Schematic

Figure 2-20. Champion (Slick) Ignition System Schematic
2-2.9. **Engine Cooling**

The engine cylinders are cooled by transferring heat from the cylinder barrel and cylinder head cooling fins to the surrounding airflow. The aircraft engine cowling, baffles, and baffle seals direct cooling air (which is ram air-induced by the aircraft’s forward speed) evenly around the cylinders. This airflow is regulated by the size of the cooling air inlets and outlets. Increasing or decreasing outlet size with the use of cowl flaps changes airflow and aids in controlling engine operating temperatures.

![Engine Cooling Diagram](image-url)

**Figure 2-21. Engine Cooling**
2-2.10. Induction System

The Induction System carries induction air to individual cylinder intake ports through a cross-flow cylinder head design. A downdraft-type Induction System is mounted on the top of the cylinder heads, with a balanced intake manifold mounted above the engine crankcase which carries induction air to the individual cylinder intake distribution ports via cylinder induction tubes.

Air from the balanced induction manifold is carried to the intake ports where it mixes with fuel from the injector nozzles. The fuel/air charge then enters the cylinder as a combustible mixture when the intake valve opens.

![Typical Cross-flow Induction System](image)

**Figure 2-22. Typical Cross-flow Induction System**

2-2.11. Turbocharger and Exhaust System

NOTE: TSIO-550-G aftercoolers and exhaust differ dimensionally but function in the same manner as aftercoolers and exhaust systems on other turbocharged Permold series engines. TSIO-550-K turbocharger mounting brackets and exhaust are different part numbers and the wastegate controller is mounted differently but all TSIO-550 turbocharger and exhaust systems function in the same manner.

The turbocharger and exhaust system contains the following engine components: two turbochargers, intercoolers/aftercoolers, hydraulic controlled exhaust bypass (wastegate), wastegate controller, lubrication plumbing, exhaust collector assembly, and turbocharger tailpipe assemblies. Special lines and fittings are also attached to the upper deck pressure for air reference to the fuel injection system and magneto pressurization.
Exhaust gases exit the cylinder combustion chambers and flow through the exhaust collector to the turbocharger turbine housing inlet. The exhaust gas flow provides turbine wheel rotation and exits through the turbine housing discharge port and tailpipe assembly. The turbine wheel drives the compressor wheel which is connected by a common shaft.

Engine manifold pressure (deck pressure) is maintained within the specified limits by limiting the volume of exhaust gas passing through the turbocharger turbine and out the exhaust. The control device is the wastegate, which is opened and closed hydraulically by the wastegate controller.
## 2-3. Engine Specifications

Table 2-1. TSIO-550 Series Engine Characteristics

<table>
<thead>
<tr>
<th>General</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FAA Type Certificate</td>
<td>E5S0</td>
</tr>
<tr>
<td>Installation Drawing Number</td>
<td>B 653021</td>
</tr>
<tr>
<td></td>
<td>C 646618 &amp; 656791</td>
</tr>
<tr>
<td></td>
<td>E 646618</td>
</tr>
<tr>
<td></td>
<td>G 657154</td>
</tr>
<tr>
<td></td>
<td>K 657645</td>
</tr>
<tr>
<td></td>
<td>N 658233</td>
</tr>
<tr>
<td>Arrangement</td>
<td>Individual cylinders, horizontally opposed</td>
</tr>
<tr>
<td>Compression Ratio</td>
<td>7.5:1</td>
</tr>
<tr>
<td>Number of Cylinders</td>
<td>6</td>
</tr>
<tr>
<td>Firing Order</td>
<td>1-6-3-2-5-4</td>
</tr>
<tr>
<td>Time Between Overhaul (TBO)</td>
<td>Refer to M-0, Section 6-3</td>
</tr>
<tr>
<td>Bore</td>
<td>5.25 in. 13.335 cm</td>
</tr>
<tr>
<td>Stroke</td>
<td>4.25 in. 10.795 cm</td>
</tr>
<tr>
<td>Piston Displacement</td>
<td>552 cubic inches 9.05 L</td>
</tr>
</tbody>
</table>

### Ignition

| Ignition Timing                              | 24° BTC ± 1° |
| Magneto Type                                 | B Champion (Slick) 6320 (two) |
|                                               | C CMI S6RSC-25P (two) |
|                                               | E CMI S6RSC-25P (two), or Champion (Slick) 6220 (two), or CM S6RN-201 (one) and S6RN-205 (one) |
| Magneto Coil Temperature Limit, °F (°C)      | 225 (107) |
| Spark Plugs to be used                       | Refer to M-0, Section 6-4.9.2 |
| Spark Plug Gap                               | Spark plug manufacturer’s specified gap |

### Exhaust

| Exhaust back pressure, maximum allowable, in. Hg (kPa) | B C E G 2.0 (6.78) |
|                                                       | K 2.5 (8.46) |

### Cylinder Head Temperature

| Maximum Cruise Operational Temperature¹         | 420°F 215°C |
| Maximum Allowable Operational Temperature      | 460°F 238°C |
| Minimum Take-off Temperature                   | K 420°F² 215°C² |
|                                               | 240°F 116°C |

### Exhaust Gas-Turbine Inlet Temperature (see Engine Installation Drawings for installed location(s))

| Maximum Continuous Turbine Inlet Temperature (TIT) | 1750°F 954°C |
| Maximum Allowable Operational Temperature (NTE 30 seconds) | 1850°F 1010°C |
| Turbine Speed Limit vs. Turbine Inlet Temperature | See Figure 2-41 |

1. Measured with bayonet thermocouple
2. Maximum cylinder head temperature for engine operation with ASTM D7592 (UL94) fuel or a mixture of ASTM D7592 and 100 or 100LL.
Table 2-2. TSIO-550 Performance Specifications

<table>
<thead>
<tr>
<th>Crankshaft Speed, Brake Horsepower &amp; Manifold Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Maximum Continuous Operation¹</td>
</tr>
<tr>
<td>@ Maximum rated Crankshaft Speed</td>
</tr>
<tr>
<td>@ Maximum rated Manifold Pressure</td>
</tr>
<tr>
<td>B 350 bhp -0% +5% @2700 rpm @ 38.0 in. Hg</td>
</tr>
<tr>
<td>C 310 bhp -0% +5% @2600 rpm @ 35.5 in. Hg</td>
</tr>
<tr>
<td>E 350 bhp -0% +5% @2700 rpm @ 38.5 in. Hg</td>
</tr>
<tr>
<td>G 310 bhp -0% +5% @2700 rpm @ 34.0 in. Hg</td>
</tr>
<tr>
<td>K 315 bhp -0% +5% @2500 rpm @ 37.5 in. Hg</td>
</tr>
<tr>
<td>N 315 bhp -0% +5% @2500 rpm @ 37.5 in. Hg</td>
</tr>
<tr>
<td>Crankshaft Speed (Maximum rated)</td>
</tr>
<tr>
<td>B 2700 rpm</td>
</tr>
<tr>
<td>C 2600 rpm</td>
</tr>
<tr>
<td>E 2700 rpm</td>
</tr>
<tr>
<td>G 2700 rpm</td>
</tr>
<tr>
<td>K 2500 rpm</td>
</tr>
<tr>
<td>N 2500 rpm</td>
</tr>
<tr>
<td>Critical Altitude (feet)</td>
</tr>
<tr>
<td>B 12000</td>
</tr>
<tr>
<td>C 18000</td>
</tr>
<tr>
<td>E 18000 @ 2700 rpm @ 38.5 in. Hg</td>
</tr>
<tr>
<td>22000 @ 2500 rpm @ 31.0 in. Hg</td>
</tr>
<tr>
<td>25000 @ 2500 rpm @ 27.5 in. Hg</td>
</tr>
<tr>
<td>G 22000</td>
</tr>
<tr>
<td>K 18000</td>
</tr>
<tr>
<td>N 18000</td>
</tr>
<tr>
<td>Engine Idle Speed, Minimum</td>
</tr>
<tr>
<td>600 rpm</td>
</tr>
<tr>
<td>Maximum Recommended Cruise Power</td>
</tr>
<tr>
<td>B 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td>C 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td>E 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td>G 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td>K 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td>N 262 bhp @ 2500 rpm @ 30.5 in. Hg</td>
</tr>
<tr>
<td>Minimum Cruise RPM</td>
</tr>
<tr>
<td>2300 RPM</td>
</tr>
</tbody>
</table>

1. Performance is based on sea level, standard day, zero water vapor pressure conditions at the throttle inlet and exhaust exit with no engine accessory load. Standard day conditions are 29.92 in Hg and 59°F. Horsepower will vary approximately 1% for each 6°F (5.6°C) change in compressor inlet air temperature. Correction factors for exhaust back pressure and accessory drive losses is not represented in raw data. Contact a Continental Motors engineering representative for applicable correction factors.

2. Maximum cruise limitation for engine operation with ASTM D7592 (UL94) fuel or a mixture of ASTM D7592 and 100LL or 100 fuels
Table 2-3. TSIO-550 Lubrication System Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Pressure - Normal Operation @ 100° to 240°F (38° to 116°C)</td>
<td>Oil Pressure - Normal Operation @ 100° to 240°F (38° to 116°C)</td>
<td>30 to 60 psig</td>
</tr>
<tr>
<td>Maximum Allowable Oil Pressure (cold oil)</td>
<td>Maximum Allowable Oil Pressure (cold oil)</td>
<td>100 psig</td>
</tr>
<tr>
<td>Minimum Oil Pressure @ Idle (600 RPM)</td>
<td>Minimum Oil Pressure @ Idle (600 RPM)</td>
<td>10 psig at or below 240°F</td>
</tr>
<tr>
<td>Maximum Allowable Oil Temperature</td>
<td>Maximum Allowable Oil Temperature</td>
<td>240°F 116°C</td>
</tr>
<tr>
<td>Minimum Take-off Oil Temperature</td>
<td>Minimum Take-off Oil Temperature</td>
<td>100°F 38°C</td>
</tr>
<tr>
<td>Oil Sump</td>
<td>Oil Sump</td>
<td></td>
</tr>
<tr>
<td>Fill Capacity</td>
<td>Fill Capacity</td>
<td>8.0 qts. (7.6L) 12.0 qts. (11.3L)</td>
</tr>
<tr>
<td>Usable Oil - 16° Nose Up (8 qt fill), 20° Nose Up (12 qt fill)</td>
<td>Usable Oil - 16° Nose Up (8 qt fill), 20° Nose Up (12 qt fill)</td>
<td>5.0 qts. (4.7L) 7.5 qts. (5.8L)</td>
</tr>
<tr>
<td>Usable Oil - 10° Nose Down (8 qt fill), 14.5° Nose Down (12 qt fill)</td>
<td>Usable Oil - 10° Nose Down (8 qt fill), 14.5° Nose Down (12 qt fill)</td>
<td>4.5 qts. (4.3L) 6.5 qts. (5.6L)</td>
</tr>
<tr>
<td>Recommended Oil Grade, SAE - above 40°F</td>
<td>Recommended Oil Grade, SAE - above 40°F</td>
<td>50 or Multi-viscosity</td>
</tr>
<tr>
<td>Recommended Oil Grade, SAE - below 40°F</td>
<td>Recommended Oil Grade, SAE - below 40°F</td>
<td>30 or Multi-viscosity</td>
</tr>
<tr>
<td>Oil Grade</td>
<td>Oil Grade</td>
<td>See M-0, Section 3-1</td>
</tr>
</tbody>
</table>

**CAUTION:** Engine oil must be aviation rated lubricant conforming to SAE J1899 or SAE J1966 specification

**Brake Specific Oil Consumption**

Maximum BSOC = 0.006 X (engine rated power) X (% power at which measured/100) X (duration of test in hours)

**Oil Heat Rejection**

Maximum Oil Heat Rejection at Full Power | See Figure 2-38

1. Oil pressure and temperature are measured at the oil cooler adapter.
## Table 2-4. TSIO-550 Fuel System Specifications

<table>
<thead>
<tr>
<th>Fuel System</th>
<th>Continuous Flow Fuel Injection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Certified Fuel Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Minimum Fuel Grade</td>
<td>Refer to M-0, Table 7-1 and Table 7-2 for authorized fuels and applicable engines</td>
</tr>
<tr>
<td><strong>Regional Fuel Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Russian Commonwealth of Independent States</td>
<td>Refer to M-0, Table 7-1 and Table 7-2</td>
</tr>
<tr>
<td>People’s Republic of China</td>
<td>Refer to M-0, Table 7-1 and Table 7-2</td>
</tr>
<tr>
<td><strong>Fuel Injection System Pressure</strong></td>
<td></td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 600 RPM, psig (kPa)</td>
<td>7.0-9.0 (48.3-62.1)</td>
</tr>
<tr>
<td><strong>Unmetered Fuel Pressure</strong>, Rated Power, psig (kPa)</td>
<td></td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2700 RPM</td>
<td>B 32.0-36.0 (220.6-248.2)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2600 RPM</td>
<td>C 26.0-29.0 (179.2-199.9)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2700 RPM</td>
<td>E 32.0-36.0 (220.6-248.2)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2500 RPM</td>
<td>G 20.5-23.5 (141.3-162.0)</td>
</tr>
<tr>
<td>Unmetered Fuel Pressure, 2500 RPM</td>
<td>20.5-28.5 (141.3-196.5)</td>
</tr>
<tr>
<td><strong>Metered Nozzle Pressure</strong>, psid (kPa)</td>
<td></td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2700 RPM</td>
<td>B 15.3-16.9 (105.5-116.5)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2600 RPM</td>
<td>C 12.7-13.9 (87.6-95.8)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2700 RPM</td>
<td>E 15.3-16.9 (105.5-116.5)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2500 RPM</td>
<td>G 12.4-13.6 (85.5-93.8)</td>
</tr>
<tr>
<td>Metered Nozzle Pressure, 2500 RPM</td>
<td>14.2-14.8 (97.9-102.0)</td>
</tr>
<tr>
<td>Fuel Injection Pump Inlet Pressure: psig (kPa)</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable pressure above 1500 RPM with boost pump off</td>
<td>6.0 (41.4)</td>
</tr>
<tr>
<td>Minimum Pressure at maximum flow condition</td>
<td>-2.0 (-14)</td>
</tr>
<tr>
<td>Recommended flight minimum</td>
<td>-1.0 (-6.9)</td>
</tr>
<tr>
<td>Fuel Vapor Return Outlet, psig (kPa)</td>
<td></td>
</tr>
<tr>
<td>Maximum allowable at maximum flow</td>
<td>3.5 (24.2)</td>
</tr>
<tr>
<td>Recommended flight maximum</td>
<td>2.5 (17.2)</td>
</tr>
</tbody>
</table>

## Fuel Flow

<table>
<thead>
<tr>
<th>Fuel Flow, lb./hr (kg/hr), including return flow:</th>
<th>Figure 2-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Flow vs. Brake Horsepower</td>
<td>Figure 2-27</td>
</tr>
<tr>
<td>Fuel Injection System Adjustment Specifications:</td>
<td>Refer to M-0, Section 6-4.7</td>
</tr>
</tbody>
</table>
**Engine Description**

<table>
<thead>
<tr>
<th>Fuel Vapor Return Outlet Flow, lb/hr (kg/hr):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum @ 23.5 psig pump outlet</td>
</tr>
</tbody>
</table>

**Fuel Flow Transducer (Aircraft):**
- Maximum Allowable Pressure Drop: 5.5 psig @ 295 lb/hr

**Fuel Filter (Aircraft):**
- Minimum Rating: 140 micron

**Fuel Temperature, F° (C°):**
- Maximum temperature rise from fuel tank to pump inlet @ 90-101°F (32-38°C)
  - (Ambient temperature must be minimum standard day at sea level, and temperature rise must be shown at stable operating conditions of idle and maximum performance climb).
  - 10 (5.6)

1. FULL POWER unmetered fuel pressure limits are provided for reference only. Use metered fuel pressure specifications for adjustments at full power.
2. The TSIO-550-G engines installed in Mooney aircraft are rated at less than the engine type certificate. Consult the Mooney aircraft maintenance manual for fuel system setup instructions.
3. Use for full power, maximum RPM adjustment only
4. Metered pressure gauge reference is Upper Deck Pressure

### Table 2-4. TSIO-550 Fuel System Specifications

<table>
<thead>
<tr>
<th>Power Level</th>
<th>BHP (kW)</th>
<th>lbs./hr (max)</th>
<th>BHP (kW)</th>
<th>lbs./hr (max)</th>
<th>BHP (kW)</th>
<th>lbs./hr (max)</th>
<th>BHP (kW)</th>
<th>lbs./hr (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Power, 100%</td>
<td>350 (261)</td>
<td>255</td>
<td>310 (231)</td>
<td>224</td>
<td>310 (231)</td>
<td>210</td>
<td>315 (235)</td>
<td>220</td>
</tr>
<tr>
<td>Cruise, 85%</td>
<td>---</td>
<td>---</td>
<td>263.5 (196)</td>
<td>162</td>
<td>263.5 (196)</td>
<td>155</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Cruise, 83.5%</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>262 (195)</td>
<td>143</td>
</tr>
<tr>
<td>Cruise, 75%</td>
<td>263 (196)</td>
<td>157</td>
<td>232.5 (173)</td>
<td>143</td>
<td>232.5 (173)</td>
<td>128</td>
<td>236 (176)</td>
<td>128</td>
</tr>
<tr>
<td>Cruise, 65%</td>
<td>226 (170)</td>
<td>125</td>
<td>201.5 (150)</td>
<td>126</td>
<td>201.5 (150)</td>
<td>102</td>
<td>205 (153)</td>
<td>110</td>
</tr>
<tr>
<td>Cruise, 55%</td>
<td>193 (138)</td>
<td>108</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

### Table 2-5. TSIO-550 Fuel Consumption

**CAUTION:** Minimum cruise engine speed is 2300 RPM. Fifty five to eighty five percent cruise power fuel consumption depicts the certified engine fuel consumption during test cell operation.

**NOTE:** Cruise is calculated at a percentage of rated maximum power. Percentages listed below represent the observations submitted to the FAA for engine model type certification.
### Table 2-6. Induction

<table>
<thead>
<tr>
<th>Mass Flow</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea level, standard day conditions, 350 bhp (261 kW)</td>
<td>40.0 lb/min (18.1 kg/min)</td>
</tr>
<tr>
<td>Sea level, standard day conditions, 310 bhp (231 kW)</td>
<td>41.0 lb/min (18.6 kg/min)</td>
</tr>
<tr>
<td>Sea level, standard day conditions, 350 bhp (261 kW)</td>
<td>50.2 lb/min (22.8 kg/min)</td>
</tr>
<tr>
<td>Sea level, standard day conditions, 310 bhp (231 kW)</td>
<td>40.2 lb/min (18.2 kg/min)</td>
</tr>
<tr>
<td>Sea level, standard day conditions, 315 bhp (235 kW)</td>
<td>41.5 lb/min (18.8 kg/min)</td>
</tr>
</tbody>
</table>

#### Induction Manifold Temperature

| Maximum @ rated take-off power (ASTM D7592 only)                         | 130°F (54.4°C)   |
| Maximum @ maximum cruise power (ASTM D7592 only)                         | 115°F (46.1°C)   |

### Table 2-7. Propeller

<table>
<thead>
<tr>
<th>Engine Idle RPM</th>
<th>Minimum (in.-lb.-sec.²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>15</td>
</tr>
<tr>
<td>700</td>
<td>16</td>
</tr>
</tbody>
</table>
2-3.1. Accessory Drive Ratios

Accessory drive ratios in Table 2-9 apply to all TSIO-550 engine models.

### Table 2-9. Accessory Drive Ratios

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Direction of Rotation¹</th>
<th>Drive Ratio to Crankshaft</th>
<th>Maximum Torque (in. lbs.)</th>
<th>Maximum Overhang Moment, (in. lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional Tachometer</td>
<td>CCW</td>
<td>0.5:1</td>
<td>7</td>
<td>50</td>
</tr>
<tr>
<td>Magneto</td>
<td>CCW</td>
<td>1.5:1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Starter Motor</td>
<td>CCW</td>
<td>48:1</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Alternator (gear-driven)</td>
<td>CCW</td>
<td>3:1</td>
<td>150</td>
<td>800</td>
</tr>
<tr>
<td>Propeller Governor²</td>
<td>CW</td>
<td>1:1</td>
<td>29</td>
<td>825</td>
</tr>
<tr>
<td>Fuel Pump</td>
<td>CW</td>
<td>1:1</td>
<td>25</td>
<td>680</td>
</tr>
<tr>
<td>AND20000 Pads³</td>
<td>CW</td>
<td>1.5:1</td>
<td>100</td>
<td>800</td>
</tr>
<tr>
<td>Optional Accessory Drive⁴</td>
<td>CCW</td>
<td>3:1</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

1. CW=Clockwise Rotation  CCW=Counterclockwise rotation; viewed facing the drive.
2. Drive is a modified AND20010; supplied with a cover.
3. One drive is eligible at 200 in. lbs. continuous torque load providing the other does not exceed 100 in. lbs. continuous torque load. Drive pads conform to AND20000, optionally, per MS3325 modified, and shall be provided with covers.
4. Belt tension 70 lbs. (may be used with appropriate optional equipment kit to drive an aircraft provided refrigerant compressor).

2-3.2. Oil Specifications

A complete listing of approved piston engine aviation oils for engine break-in, normal operation, and corrosion prevention when the engine is in storage may be found in Section 3-1 of M-0, Standard Practice Maintenance Manual.
2-3.3. Performance Data

Refer to the engine Installation Manual (OI-18) for complete engine technical specifications, installation requirements, certification data, and engine test stand performance.

WARNING

The performance charts included in this manual indicate uninstalled engine performance under controlled conditions and will vary from installed performance. The charts are neither intended nor suitable for installed performance specifications or flight planning. Consult the Airplane Flight Manual or Pilot's Operating Handbook for installed aircraft performance specification.
Figure 2-24. TSIO-550-B Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-25. TSIO-550-B Sea Level Performance

HORSEPOWER CORRECTED TO:
- EXHAUST BACK PRESSURE = 29.92 in. Hg
- INDUCTION AIR TEMPERATURE = 60°F
- FULL RICH FUEL MIXTURE

Recommended Cruise Range

Corrected Brake Horsepower

Absolute Dry Manifold Pressure (in. Hg)
Figure 2-26. TSIO-550-B Altitude Performance

NOTES:
- Minimum engine
- Oil pressure
- Oil temperature
- Cool cylinder heads
- Cool HDP
- Full rich fuel setting
- 3 in. H.O. D.P. across intercoolers

RATED POWER SETTING
2700 RPM, 38.5 in. Hg

75% POWER SETTING,
CRITICAL ALTITUDE
2500 RPM, 31.5 in. Hg

65% POWER SETTING,
CRITICAL ALTITUDE
2500 RPM, 29.5 in. Hg

*ESTIMATED MAX ENGINE POWER
- Full rich fuel setting
- Cool cylinder heads
- Cool HDP
- 9 in. H.O. D.P. across intercoolers

Horsepower

Altitude (feet)

0 2000 4000 6000 8000 10000 12000 14000 16000 18000 20000 22000 24000 26000 28000
2-3.3.2. TSIO-550-C Performance Charts

Figure 2-27. TSIO-550-C Fuel Flow vs. Sea Level Standard Brake Horsepower
Engine Description

Figure 2-28. TSIO-550-C Sea Level Performance

Horsepower Corrected to:
- Exhaust Back Pressure = 29.92 in. Hg
- Induction Air Temperature = 60°F
- Full Rich Mixture

Recommended Cruise Range

Full Rich Operation Only
Figure 2-29. TSIO-550-C Altitude Performance

**RATED POWER SETTING**
- 2600 RPM, 35.5 in.Hg

**75% POWER SETTING**
- 2500 RPM, 31.5 in.Hg

**65% POWER SETTING**
- 2500 RPM, 29.5 in.Hg

**CRITICAL ALTITUDE**
- 100% POWER SETTING, MANIFOLD PRESSURE
- 75% POWER SETTING, MANIFOLD PRESSURE
- 65% POWER SETTING, MANIFOLD PRESSURE

NOTES:
- Minimum engine
- Full rich fuel settings
- Hot head conditions
- 3 in. H2O across intercoolers

Altitude (feet) vs. Horsepower

Altitude: 0, 2000, 4000, 6000, 8000, 10000, 12000, 14000, 16000, 18000, 20000, 22000, 24000, 26000, 28000

Figure 2-30. TSIO-550-E Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-31. TSIO-550-E Sea Level Performance
Engine Description

Figure 2-32. TSIO-550-E Altitude Performance

- RATED POWER SETTING: 2700 RPM, 38.5 in.Hg
- 75% POWER SETTING: 2500 RPM, 31.5 in.Hg
- 65% POWER SETTING: 2250 RPM, 29.5 in.Hg

**NOTES:**
- Minimum engine
- Full rich fuel settings
- Cool cylinder heads

**ESTIMATED MAX ENGINE POWER**
- 100% POWER SETTING, MANIFOLD PRESSURE CRITICAL ALTITUDE
- 75% POWER SETTING, MANIFOLD PRESSURE CRITICAL ALTITUDE
- 65% POWER SETTING, MANIFOLD PRESSURE CRITICAL ALTITUDE

**Pressure Altitude (feet)**
0 2000 4000 6000 8000 10000 12000 14000 16000 18000 20000 22000 24000 26000

**Corrected Brake Horsepower**
Figure 2-33. TSIO-550-G Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-34. TSIO-550-G Sea Level Performance
Figure 2-35. TSIO-550-G Altitude Performance
Figure 2-36. TSIO-550-K & N Fuel Flow vs. Sea Level Standard Brake Horsepower
Figure 2-37. TSIO-550-K & N Sea Level Performance
Engine Description

2-3.4. TSIO-550 Accessory Performance Charts

![Figure 2-38. Oil Cooler Performance](image)

**NOTES:**
- SAE 50 Oil
- Effective Flow Area = 0.36 ft²
- ΔP = 11 PSI @ 100°F
- 4 PSI @ 200°F
- @ 7 GPM oil flow

**Figure 2-38. Oil Cooler Performance**
Figure 2-39. Aftercooler Performance Chart

- HOT AIR FLOW RATE
- COLD AIR PRESSURE DROP
- CORRECTED TO 0.0765 lb/ft³
- STD. DENSITY

Engine Description
Niagara Thermal Products LLC
Aluminum Aftercooler
NTP P/N 42941A
TCM P/N 657112

Charge Air at 240°F and 18.67 psia
Cooling Air at 100°F and 14.7 psia

Heat Rejection Btu/min/100°F

Cooling Air lb/min

 Cooling Air Pressure Drop "H2O

25 lb/min
DP=4.4 psig

20 lb/min
DP=2.7 psig

15 lb/min
DP=1.5 psig

10 lb/min
DP=.68 psig

Figure 2-40. Aftercooler Performance Chart
Figure 2-41. Turbine Speed vs. Turbine Inlet Temperature
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Chapter 3. Special Tools and Supplies

3-1. Special Tools

Refer to Section 2-1, “Special Tool”, in M-0, Standard Practice Maintenance Manual.

3-1.1. Vendor Contact Information

Refer to Section 2-1.1, “Vendor Contact Information”, in M-0, Standard Practice Maintenance Manual.

3-1.2. Mechanic’s Tools

Refer to Section 2-2, “Mechanic’s Tools”, in M-0, Standard Practice Maintenance Manual.
Special Tools and Supplies

3-2. Lubricants, Sealants and Adhesives

3-2.1. Engine Oil Specifications
Refer to Section 3-1, “Engine Oil Specifications”, in M-0, Standard Practice Maintenance Manual.

3-2.2. Recommended Oil Grade:
Refer to Section 3-1, “Engine Oil Specifications”, in M-0, Standard Practice Maintenance Manual.

3-2.3. Recommended Ashless Dispersant Aviation Engine Oils
Refer to Section 3-1, “Engine Oil Specifications”, in M-0, Standard Practice Maintenance Manual.

3-2.4. Oil Change Intervals
Refer to Section 3-2, “Oil Change Intervals”, in M-0, Standard Practice Maintenance Manual.

3-2.5. Additives
Refer to Section 3-3, “Additives”, in M-0, Standard Practice Maintenance Manual.

3-2.6. Sealants
Refer to Table 3-4, “Sealants”, in M-0, Standard Practice Maintenance Manual.

3-2.7. Lubricants
Refer to Table 3-5, “Lubricants”, in M-0, Standard Practice Maintenance Manual.

3-2.8. Adhesives
Refer to Table 3-6, “Adhesives”, in M-0, Standard Practice Maintenance Manual.

3-2.9. Miscellaneous
Refer to Table 3-7, “Miscellaneous”, in M-0, Standard Practice Maintenance Manual.
Chapter 4. Airworthiness Limitations

The Airworthiness Limitations Section is FAA approved and specifies maintenance required under §§ 43.16 and 91.403 of the Title 14 Code of Federal Regulations (CFR) unless an alternative program has been FAA approved.

Title 14 CFR §§ 43.16 and 91.403 require owner/operator compliance with all maintenance limitations in this section concerning mandatory replacement times, inspection intervals, and other related procedures that are specific to this engine. Any such limitations listed below are part of the design limits of the engine, which was type certified based upon required owner/operator compliance with the limitations.

4-1. Mandatory Replacement Times

Subject to additional information contained in FAA Airworthiness Directives issued after the date of certification, the engines covered in this manual do not contain any components having mandatory replacement times required by type certification.

4-2. Mandatory Inspection Intervals

Subject to additional information contained in FAA Airworthiness Directives issued after the date of certification, the engines covered in this manual do not require specific intervals of inspection pursuant to type certification.

4-3. Other Related Procedures

Subject to additional information contained in Airworthiness Directives issued after the date of certification, there are no other related procedures required pursuant to the type certification for the engines covered in this manual.

4-4. Distribution of Changes to Airworthiness Limitations

Changes to this Airworthiness Limitations Section constitute changes to the type design of the engines covered in this manual and require FAA approval pursuant to Federal Aviation Regulations. Changes which result in new or more restrictive limits, will be published in FAA Airworthiness Directives.
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Chapter 5. Engine Removal & Installation

5-1. Engine Removal

WARNING

Turn the Ignition Switch OFF, disconnect engine electrical power and confirm continuity between the magneto capacitor and aircraft ground before commencing maintenance to avoid an uncommanded engine start. Do not stand or place equipment within the arc of the propeller.

1. Turn off the Ignition Switch and Master Power Switch according to the aircraft manufacturer's instructions. Open the circuit breakers powering the switches according to the aircraft manufacturer's instructions. Turn the fuel selector valve to the OFF position and disconnect engine electrical power according to the aircraft manufacturer's instructions.

2. If the cylinders will be overhauled, perform a “Differential Pressure Test” according to the instructions in Section 6-4.11.2 of M-0, Standard Practice Maintenance Manual and record inspection results on the Cylinder Inspection checklist. If all cylinders will be replaced, proceed to step 3.

3. Remove the engine compartment cowling and aircraft accessories that could obstruct engine removal according to the aircraft manufacturer's instructions.

4. Disconnect the aircraft battery according to the aircraft manufacturer’s instructions.

5. Disconnect the starter cable according to the aircraft manufacturer’s instructions.

6. Remove the propeller, spinner and backplate from the engine according to the aircraft manufacturer's instructions.

7. Remove the aircraft baffling required to avoid contact with the nacelle during removal according to the aircraft manufacturer’s instructions.

8. Remove the oil sump drain plug and gaskets; drain the oil according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

9. Temporarily re-install the oil sump drain plug and gaskets to prevent contamination during transit. The gaskets will be replaced when the oil is serviced.

10. Disconnect and tag the ignition circuit P-leads from the magnetos according to the aircraft manufacturer’s instructions.

11. Disconnect and tag the engine wiring bundles and other connections from the following components according to the aircraft manufacturer's instructions.
   a. Pneumatic, air conditioning, or vacuum pumps
   b. Tachometer drive connection (electrical or mechanical)
   c. Oil temperature and pressure sensor connection(s)
   d. Fuel pressure sensor connection
Engine Removal & Installation

e. Fuel flow sensor connection
f. Alternator
g. Manifold pressure sensor connection
h. Turbine inlet temperature sensor connection(s)
i. Exhaust gas temperature sensor connection(s)
j. Cylinder head temperature connection(s)
k. Aircraft fuel supply hose connections to the engine-driven fuel pump and the engine priming circuit
l. Throttle and mixture control cables
m. Aircraft accessories and instrument connections
n. Propeller governor, hoses, and lines connected to the engine

o. **K & N** Remove the hoses from the Wastegate Controller manifold pressure fitting, deck pressure fitting, oil inlet fitting and oil drain fitting. Install protective caps on the fittings; install protective plugs on the hoses.

p. **K & N** If the Wastegate Controller could interfere with engine removal, remove it according to the aircraft manufacturer’s instructions.


13. Remove the ignition wiring harness attaching clamps and hardware and remove the ignition wiring harness from the engine.

   **CAUTION:** Do not use tape or makeshift plugs inside open lines or fittings.

14. Properly cap (or plug) off fluid hose and tubing connections to prevent fuel spillage and debris from entering the engine.

15. Ensure all wires, lines, hoses and attachments between the engine and aircraft are disconnected.

16. Disconnect and remove the Turbocharger and Exhaust System from the aircraft according to the “Turbocharger and Exhaust System Removal” instructions in Section 12-8.

   **CAUTION:** Do not allow the chains to become entangled in the engine or its hardware. Ensure the area is clear when lifting the engine. Do not allow the front, rear, sides or bottom of the engine to bump or strike any obstructions to prevent damage to the engine or its components.

17. Attach an engine hoist (min. 800 lbs. static load rated) to the engine lifting eyes (reference Section 5-4).

18. Remove the engine mount isolators and fastening hardware.
19. Relieve the engine weight from the engine mounts and carefully lift the engine slowly out of the aircraft.

20. Place the engine on an engine stand, transport dolly or engine shipping container base.

21. Use a tank sprayer filled with stoddard solvent and soft bristle brush to preclean the engine, followed by a wash with a mild soap and water solution. Rinse thoroughly with clean water to minimize contamination before bringing the engine in the shop area for disassembly.

**5-2. Engine Installation**

5-2.1. Common Tools and Consumable Supplies Required

1. Engine Hoist rated at 800 lbs. minimum static load

   **WARNING**

   Ensure engine slings are designed to support the total weight of the engine including accessories.

   **Use of the engine lifting eye to lift the aircraft is prohibited.**

   *CAUTION: Keep crankshaft axis horizontal during handling operations.*

2. Two engine slings rated for minimum static load

3. Oil conforming to SAE J-1966 (break-in oil, non-dispersant mineral oil) MIL-C-6529 Type II (Fly-away oil)

4. Ashless dispersant oil conforming to SAE J-1899

5. MIL-P-46002A, Grade 1 oil

6. Approved fuel for the engine model as specified in Section 7-2.2 of M-0, Standard Practice Maintenance Manual

7. Spark plugs and new copper gaskets

8. MS20995 Type A Safety Wire (.032”)

9. Cable ties or nylon lacing cord

10. Bladder-type pressure pot (at least one gallon capacity)

11. Type 1 flammable fuel container (at least one gallon capacity)

12. Clean fuel hoses (fuel system setup)

13. AN union fittings (fuel system setup)

14. Rubber grommets (routing fuel hoses through baffling and bulkheads)

15. MS-122AD dry Teflon spray lubricant (procured from Miller-Stephenson)

16. Spark Plug Manufacturer’s recommended spark plug thread lubricant

17. Part No. 646940, Loctite Hydraulic Sealant
Engine Removal & Installation

18. Part No. 646943, Anti-seize Lubricant
19. Loctite Part No. 592 Pipe Sealant
20. Other tools and supplies required by the aircraft manufacturer’s instructions.

5-2.2. **Engine Receipt and Handling**
Refer to “Engine Receipt and Handling” instructions in Section 5-2.2 of M-0, Standard Practice Maintenance Manual.

5-2.3. **Uncrating the Engine**
Refer to “Uncrating the Engine” instructions in Section 5-2.3 of M-0, Standard Practice Maintenance Manual.

5-2.4. **Crating an Engine for Shipping**
Refer to “Crating an Engine for Shipping” instructions in Section 5-2.4 of M-0, Standard Practice Maintenance Manual.

5-2.5. **Acceptance Inspection**
Refer to “Acceptance Inspection” instructions in Section 5-2.5 of M-0, Standard Practice Maintenance Manual.

5-2.6. **Engine Transport**
Refer to “Engine Transport” instructions in Section 5-2.6 of M-0, Standard Practice Maintenance Manual.
5-3. Installation Procedures

5-3.1. Prepare the Aircraft for Engine Installation

1. Verify the aircraft fuel filter and fuel boost pump are installed and operate according to the aircraft manufacturer’s instructions.

   **WARNING**

   Purge the aircraft fuel tanks and lines to remove all contamination prior to connecting the main fuel supply to the fuel pump inlet. Failure to purge contamination may cause erratic fuel injection system operation.

   **CAUTION:** Follow the aircraft manufacturer’s schedule interval for aircraft mounted fuel and oil hoses. Hoses become brittle with age; Continental Motors recommends hose replacement coincident with engine overhaul to avoid immediate contamination or failure at a later date.

2. Replace all aircraft flexible oil and fuel hoses according to the aircraft manufacturer’s instructions prior to engine installation.

3. Clean the aircraft fuel strainer and allow at least one quart of fuel to flow through the strainer and fuel supply line into a Type 1 fuel container through a paper filter.

4. Inspect the paper filter for contamination; if the fuel supply is free of contamination, proceed with engine installation. If contaminants are found in the fuel supply, isolate and correct the source of contamination prior to connecting the aircraft fuel supply to the engine-driven fuel pump.
5-3.2. Prepare the Engine for Installation

Remove packing material, tags, and the preservative fluid from the sump and fuel injection systems of new, rebuilt, overhauled or stored engines prior to installation.

NOTE: If the engine won’t be installed immediately, refer to the “Engine Preservation and Storage” instructions in Chapter 9 of M-0, Standard Practice Maintenance Manual.

1. Remove the shipping plugs or dehydrator plugs from the spark plug holes.

2. Remove the AN-4060 protectors from the ignition leads.

3. Place a basin under the engine to catch the cylinder preservation oil.
   NOTE: A small amount of preservative oil remaining in the cylinder bore is acceptable; it will burn off during the first engine start.

4. Turn the crankshaft through at least two complete revolutions by hand to remove the cylinder preservation oil from the cylinders.

5. Catch the cylinder preservation oil draining out of the lower spark plug holes.
   NOTE: If corrosion or abnormal conditions are discovered during the borescope inspection, contact the supplier (If the engine was obtained from Continental Motors, refer to “Contact Information” in Section 1-3) for disposition instructions.

6. Inspect the cylinder bores with a borescope for rust and contamination.

7. Remove the oil sump drain plug and drain the remaining cylinder preservation oil from the oil sump. Drain plug locations are depicted in the “Engine Installation Drawings” in Section 5-4.

8. Install the oil sump drain plug with a new crush washer; torque the drain plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; safety wire the drain plug according to instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

9. Place a catch basin underneath the fuel pump. Remove the shipping cap from the fuel pump inlet fitting. Disconnect the fuel hose from the fuel pump outlet fitting. Allow the preservative fluid to drain from the fuel pump and hoses; reconnect the fuel hose to the fuel pump outlet fitting and torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Re-install the shipping cap on the fuel pump inlet fitting.
   NOTE: Remove the turbochargers only if necessary to clear the engine compartment during engine installation. Otherwise, proceed to step 11.

   WARNING
   Oil pressure is applied to the face of the accessory drive pads. If gasket or accessory covers are not properly installed and torqued to Appendix B specifications, oil leakage will occur.

10. If engine compartment clearance is required for installation, remove the turbochargers:
Engine Removal & Installation

a. Place an oil drain pan under the turbochargers and wastegate to catch any preservative oil remaining in the lubrication lines.

b. Disconnect and plug the hoses from the wastegate and turbochargers.

c. Install caps on the wastegate and turbocharger fittings to prevent contamination from foreign matter/debris.

d. Remove the v-band clamp from the left turbocharger tailpipe.

e. Remove the tie rod from the right side of the turbo bypass assembly.

f. Remove the following as one assembly:
   1) Left tailpipe
   2) Wastegate
   3) Bypass Assembly

g. Remove two nuts and bolts from the turbocharger mounting brackets.

h. Remove four nuts from the turbocharger mounting flange.

i. Remove both turbochargers from the exhaust system.

11. Remove the shipping plate from the propeller governor pad forward of the No. 6 cylinder.

   CAUTION: Align the governor drive gear spline and ensure the governor is fully seated to the crankcase prior to installing the attaching hardware. Forcing the drive gear over the camshaft will require engine disassembly and repair.

12. Install the propeller governor according to the aircraft manufacturer’s instructions.

   NOTE: Optional accessories such as hydraulic pumps, vacuum pumps, etc. may be installed in the accessory drive pads located on the upper rear portion of the crankcase. Remove the accessory drive covers and install new gaskets. Install accessories in accordance with the aircraft manufacturer’s instructions.

13. Install all aircraft manufacturer-required components according to the aircraft manufacturer’s instructions, including the following:

   a. Cooling baffles
   b. Hoses and fittings
   c. Brackets
   d. Ground straps
   e. Pneumatic or vacuum pumps
   f. Other aircraft manufacturer required item(s)

14. Install the engine in the sequence indicated in Section 5-3.3.
Engine Removal & Installation

5-3.3. Installation Sequence

**CAUTION**: Do not allow chains to become entangled on the engine or its hardware. Be sure the area is clear when lifting the engine. Do not allow the front, rear, sides, or bottom of the engine to strike any obstructions, as the extreme weight may damage the engine or its components.

1. Install the engine in the aircraft mounts according to the aircraft manufacturer’s instructions. Refer to the “Engine Installation Drawings” in Section 5-4 for engine dimensions, clearances, and connections.

   **WARNING**
   
   Oil pressure is applied to the face of the accessory drive pads. If gaskets or accessory covers are not properly installed and torqued to the settings specified in Appendix B, oil leakage will occur.

2. Connect the aircraft fuel supply, fuel vapor return and fuel pump drain connections to the engine-driven fuel pump fittings according to aircraft manufacturer’s instructions.

3. If removed to facilitate installation, install the turbocharger components according to instructions in Section 5-3.3.1.

4. Turn the Ignition Switch to the OFF position.

   **WARNING**
   
   Do not install the ignition harness “B” nuts on the spark plugs until the propeller installation and the ignition system operational checkout is complete. Failure to comply can result in bodily injury when the propeller is rotated during installation.

5. Connect the starter and alternator wiring according to aircraft manufacturer’s instructions.

6. Install the propeller according to the aircraft and propeller manufacturer’s instructions.

7. Connect the aircraft ignition switch wiring harness to the P-leads of each magneto and perform a functional check of the circuit to verify the ignition switch properly disables the magnetos.

8. If the magnetos were loosened or rotated during engine installation, adjust magneto to engine timing according to the “Ignition System Maintenance” instructions in Section 6-4.9 of M-0, Standard Practice Maintenance Manual.

9. Install aircraft accessories listed below according to the aircraft manufacturer’s instructions.
   a. Pneumatic or vacuum pumps, or air conditioning compressor
   b. Tachometer (mechanical) drive cable or (electrical) sensor connection
Engine Removal & Installation

c. Oil temperature sensor and oil pressure sensor connections
d. Fuel pressure sensor and fuel flow sensor connections
e. Exhaust Gas Temperature sensor connection(s)
f. Turbine Inlet Temperature sensor connection(s)
g. Cylinder Head Temperature sensor connection(s)
h. Manifold pressure gauge line
i. Aircraft fuel supply hoses
j. Throttle and mixture control cables
k. Remaining aircraft manufacturer supplied accessories and instrument connections


11. Inspect for and correct engine debris, discrepancies, or damage.

12. Perform an “Installation Inspection” according to instructions in Section 5-3.4.

**WARNING**

Do not operate the engine until all hardware, spark plugs, gaskets, and seals are in place and torqued and the oil sump is properly filled to the specified capacity with oil.

13. Perform the “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.
**5-3.3.1. Turbocharger Component Installation**

Install the turbocharger components if they were removed to facilitate engine installation. Configurations and installation instructions vary by engine model. Refer to the subsection applicable to the subject engine in Section 5-3.3.1.1 through Section 5-3.3.1.3.

**5-3.3.1.1. TSIO-550-B, C, E & G Turbocharger Component Installation**

1. Install the left and right turbocharger support brackets (Figure 5-1) (29 & 30) and turbochargers (24) loosely with bolts (31), washers (32), and new lock nuts (33); hardware will be torqued after all components are fitted together.

2. Install the turbochargers (24) on the left and right turbocharger transitions (5 & 6) with new gaskets (23). Hand tighten the fastening bolt (26), washer (27) and lock nut (28). This hardware will be torqued later in this procedure.

3. Apply Part No. 646943 anti-seize compound to the aft exhaust transition (9) and the crossover pipe (8) slip joints. Slide the aft transition (9) and the crossover pipe (8) together to form the bypass assembly and onto the rear ports of the left and right exhaust transitions (5 & 6).

4. Install the wastegate (18) between the tailpipe (14) and transition (9) sandwiched between two gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19), washers (20), and new lock nuts (21). This hardware will be torqued later in this procedure.

5. Place a loosened v-band clamp (16) on each turbine exhaust flange.

6. Push the tailpipe (14) exhaust flange against the left side turbine exhaust flange and position the new clamp (16) squarely over both flanges. Initially torque the clamp nut to $\frac{1}{2}$ the final value for v-band clamps specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and do a final torque of the clamp to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

*CAUTION: the exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.*
7. Push the tailpipe exhaust flange (15) (or heater (15B)) on some TSIO-550 engine models) against the right side turbine exhaust flange and position the clamp (16) squarely over both flanges. Initially torque the clamp nut to \( \frac{1}{2} \) value for V-band clamps specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and do a final torque of the clamp to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to instructions in Figure 5-2 and Appendix C-3 of M-0, Standard Practice Maintenance Manual. Use safety wire pliers to bend the safety wire pigtail close to the bolt.

9. Torque the attaching hardware in the following sequence: (Figure 5-1) 31 & 33; 26 & 28; 19 & 21, to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Secure the bypass assembly (8 & 9) to the exhaust tees (5 & 6) using the tie rod (11) and two each bushings (10), bolts (12) and lock nuts (13).

11. Connect the oil supply hose (36) to the wastegate (18) oil inlet fitting; torque the hose and fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Connect the oil return hose (34) to the wastegate (18) oil outlet fitting.

13. Torque the bolts (12) and lock nuts (13), and oil return hose (34) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

*Procedure continues after Figure 5-1*
Figure 5-1 repeated for reference

Procedure continues on next page
14. Connect the left turbocharger oil supply hose (Figure 5-3) (13) to the fitting (6) on the left turbocharger oil adapter (5); torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Connect the right turbocharger oil supply hose (14) to the fitting (6) on the right turbocharger oil adapter (5); torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Connect the oil return hoses (18 & 19) to the left (4) and right (3) turbocharger oil reservoirs, respectively; torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

17. Check the remaining turbocharger lubrication hose connections for security.

![Figure 5-3. Turbocharger Lubrication Hose Routing](image)
CAUTION: The tailpipe oil separator vent hose must be of suitable material to withstand exhaust temperatures.

NOTE: If the aircraft manufacturer chooses to use a custom air/oil separator rather than the air/oil separator offered by Continental Motors, refer to the aircraft maintenance instructions for air/oil separator installation and interconnect instructions.

18. Install a hose clamp (Figure 5-4) (6) on the oil separator vent hose (5). Connect the vent hose (5) according to the aircraft manufacturer’s instructions and tighten the clamp (6). Torque the clamp (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 5-4. Crankcase Ventilation Hose Routing

1 Air/Oil Separator Assembly 3 Hose Assembly 5 Hose Assembly 7 Hose
2 90°Elbow Fitting 4 Hose Clamp 6 Hose Clamp
5.3.1.2. TSIO-550-K Turbocharger Component Installation

1. Install the left and right turbocharger support brackets (Figure 5-5) (29 & 30) and turbochargers (24) loosely with bolts (31), washers (32), and new lock nuts (33); hardware will be torqued after all components are fitted together.

2. Install the turbochargers (24) on the left and right turbocharger transitions (5 & 6) with new gaskets (23). Hand tighten the fastening bolt (26), washer (27) and lock nut (28). This hardware will be torqued later in this procedure.

3. Apply Part No. 646943 anti-seize compound to the aft exhaust transition (9) and the crossover pipe (8) slip joints. Slide the aft transition (9) and the crossover pipe (8) together to form the bypass assembly and onto the rear ports of the left and right exhaust transitions (5 & 6).

4. Install the wastegate (18) between the tailpipe (14) and transition (9) sandwiched between two gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19), washers (20), and new lock nuts (21). This hardware will be torqued later in this procedure.

5. Place a loosened v-band clamp (16) on each turbine exhaust flange.

6. Push the left tailpipe (14) exhaust flange against the left side turbine exhaust flange and position the new clamp (16) squarely over both flanges. Push the right tailpipe exhaust flange (15) against the right side turbine exhaust flange and position the clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ the final value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and apply the full torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual to the clamp.

7. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to instructions in Figure 5-2 and Appendix C-3 of M-0, Standard Practice Maintenance Manual. Use safety wire pliers to bend the safety wire pigtail close to the bolt.

8. Torque the attaching hardware in the following sequence: (Figure 5-5) 31 & 33; 26 & 28; 19 & 21 to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   CAUTION: the exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.

9. Secure the bypass assembly (8 & 9) to the exhaust tees (5 & 6) using the tie rod (11) and two each: bushings (10), bolts (12) and new lock nuts (13). Torque the bolt and lock nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
10. Push the right tailpipe exhaust flange (15) against the right side turbine exhaust flange and repeat the V-band clamp installation, torque and safety wire instructions in steps 6 and 7.

**Figure 5-5. Turbocharger Assembly**

| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Elbow Riser | Elbow Riser | Tee Assembly | Tee Assembly | Right Turbo Transition | Left Turbo Transition | Riser | Crossover Assembly | Transition | Bushing | Tie Rod | Bolt | Lock Nut | Elbow Riser | Left Tailpipe | Right Turbo Transition | Left Turbo Transition | Riser | V-band clamp | Gasket | Wastegate Assembly | Bolt | Washer | Lock Nut | Bracket | Bracket | Bolt | Washer | Turbocharger Assembly | Gasket | Lock Nut | Hose | Hose | Hose | Hose |
CAUTION: The directional arrows on the check valve and the check valve filter assembly must point in the direction of oil flow (away from the oil cooler).

11. Connect the oil supply hose (Figure 5-6) (15) to the outboard oil cooler supply fitting. Connect the oil filter (22) and check valve (17) to the oil supply hose (15).

12. Connect the female port of the tee (16) to the open end of the check valve (17).

13. Connect the left turbocharger oil supply hose (13) to one of the male ports on the tee fitting (16). Connect the right turbocharger oil supply hose (14) to the remaining port on the tee fitting (16).

14. Connect the left turbocharger oil supply hose (13) to the fitting (6) on the left turbocharger oil adapter (5).

15. Connect the right turbocharger oil supply hose (14) to the fitting (6) on the right turbocharger oil adapter (5).

16. Connect the oil return hoses (18 & 19) to the outlet fittings on the left (4) and right (3) turbocharger oil reservoirs, respectively.

17. Connect the open ends of the oil return hoses (18 & 19) to the in-line ports of the tee fitting (21). Connect the oil scavenge hose (20) between the open port of the tee fitting (21) and the inlet fitting on the scavenge pump.

18. Massage the hoses (13, 14, 15, 18, 19 & 20) and fittings (16 & 21) for best fit and minimal stress according to the instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual. Torque the hoses and fittings to the specifications in Appendix B of M-0, Standard Practice Maintenance Manual.

19. Check the remaining turbocharger lubrication hose connections for security.

Procedure continues after Figure 5-6
Figure 5-6. Turbocharger Lubrication Hose Routing

1 Right Turbocharger    7 Gasket    13 Hose    19 Hose
2 Left Turbocharger    8 Gasket    14 Hose    20 Hose
3 Right Oil Reservoir  9 Lock Washer 15 Hose    21 Tee Fitting
4 Left Oil Reservoir   10 Bolt     16 Tee Fitting
5 Adapter              11 Lock Washer 17 Check Valve
6 Elbow Fitting        12 Bolt     18 Hose

Procedure continues on next page
20. Connect the wastegate oil supply hose (Figure 5-7) (36) between the inboard oil cooler outlet fitting and wastegate oil inlet fitting.

21. Connect the oil return hose (35) from the wastegate oil outlet fitting and the wastegate controller oil inlet fitting.

22. Connect the wastegate controller oil return hose (34) between the wastegate controller oil drain fitting and the crankcase oil return fitting.

23. Torque hoses (Figure 5-7) (34, 35 & 36) and fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 5-7. Wastegate Control Hose Connections

See Figure 5-5 for parts index

Procedure continues on next page
CAUTION: The tailpipe oil separator vent hose must be of suitable material to withstand exhaust temperatures.

24. Install the air/oil separator (Figure 5-8) (1) according to the aircraft manufacturer’s instructions.

25. Connect the scavenge pump ventilation hose (7) between the air/oil separator drain fitting (2) and the fitting on the top of the scavenge pump.

26. Install two hose clamps (4) on the crankcase breather hose (3). Connect the breather hose (3) between the middle fitting on the air/oil separator (1) and the breather tube on the oil fill assembly. Torque the clamps (4) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

27. Secure the air/oil separator vent hose (5) between the air/oil separator (1) outlet port and the overboard drain according to the aircraft manufacturer’s instructions.

Figure 5-8. Crankcase Ventilation Hose Routing

1 Air/Oil Separator Assembly 3 Hose Assembly 5 Hose Assembly 7 Hose
2 Elbow Fitting 4 Hose Clamp 6 Hose Clamp
28. Remove the cap from the Wastegate Controller compressor discharge reference (deck pressure) fitting (Figure 5-9) (4). Remove the plug from the deck pressure hose (15). Connect the deck pressure hose (15) to the Wastegate Controller deck pressure fitting (4). Torque the hose and fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

29. Remove the cap from the Wastegate Controller manifold pressure fitting (2). Remove the plug from the manifold pressure hose (14). Connect the manifold pressure hose (14) to the Wastegate Controller manifold pressure fitting (2). Torque the hose and fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 5-9. Wastegate Controller & Hoses

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<td>1</td>
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<td>O-Ring</td>
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<tr>
<td>2</td>
<td>Reducer</td>
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5-3.3.1.3. TSIO-550-N Turbocharger Component Installation

NOTE: The turbocharger support brackets (Figure 5-11) (29 & 30) are installed with the engine mounts assemblies.

1. Assemble the 2-4-6 side support rod (Figure 5-11) (43), jam nut (45) and rod end (44). Adjust the 2-4-6 side support rod assembly to the length specified in Figure 5-41. After length adjustment, torque the jam nut (Figure 5-11) (45) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Assemble the 1-3-5 side support rod (42), jam nut (45) and rod end (44). Adjust the 1-3-5 side support rod assembly to the length specified in Figure 5-41. After length adjustment, torque the jam nut (Figure 5-11) (45) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Insert the left support rod (43) through the bottom side of the left turbocharger support bracket (29). Install a bushing (47), washer (48), spring (49), and slotted nut (46) on the support rod. Tighten the slotted nut (46) until a slot aligns with the cotter pin hole. Install a new cotter pin (41) through the slotted nut (46) and support rod (43) according to the instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual.

4. Insert the right support rod (42) through the bottom side of the right turbocharger support bracket (30). Install a bushing (47), washer (48), spring (49), and slotted nut (46) on the support rod. Tighten the slotted nut (46) until a slot aligns with the cotter pin hole. Install a new cotter pin (41) through the slotted nut (46) and support rod (42) according to the instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual.

5. Place the left forward turbocharger bracket (40) on the forward side of the rod end (44). Place the left aft turbocharger bracket (38) on the aft side of the rod end (44). Install a bolt (31) and washer (32) through the forward side of the of the bracket (40), rod end (44) and bracket (38). Secure the assembly with a washer (32) and lock nut (33); torque the lock nut (33) and bolt (31) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Place the right forward turbocharger bracket (39) on the forward side of the rod end (44). Place the right aft turbocharger bracket (37) on the aft side of the rod end (44). Install a bolt (31) and washer (32) through the aft side of the of the bracket (37), rod end (44) and bracket (39). Secure the assembly with a washer (32) and lock nut (33); torque the nut (33) and bolt (31) to the standard torque value in Appendix B of M-0, Standard Practice Maintenance Manual.

7. Install the turbochargers (24) on the left (6) and right (5) turbocharger transitions with new gaskets (23). Align the turbocharger support brackets (37-40) with the inboard mounting flange bolt holes on both sides of the engine. Secure the assemblies with bolts (26), washers (27) and lock nut (28). This hardware will be torqued later in this procedure.

Procedure continues after Figure 5-10
Figure 5-10. Turbocharger Support Detail

See Figure 5-11 for parts index
Engine Removal & Installation

8. Apply Part No. 646943 anti-seize compound to the aft exhaust transition (9) and the crossover pipe (8) slip joints. Slide the aft transition (9) and the crossover pipe (8) together to form the bypass assembly and onto the rear ports of the left and right exhaust transitions (6 & 5).

9. Install the wastegate (18) between the tailpipe (14) and transition (9) sandwiched between two gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19), washers (20), and new lock nuts (21). This hardware will be torqued later in this procedure.

10. Place a loosened v-band clamp (16) on each turbine exhaust flange.

11. Push the left tailpipe (14) exhaust flange against the left side turbine exhaust flange and position the new clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ the final value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load and torque the clamp nut to the full value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Push the right tailpipe exhaust flange (15) against the right side turbine exhaust flange and position the clamp (16) squarely over both flanges. Initially torque the clamp nut to ½ the final value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load and torque the clamp nut to the full value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to instructions in Figure 5-2 and Appendix C-3 of M-0, Standard Practice Maintenance Manual. Use safety wire pliers to bend the safety wire pigtail close to the bolt.


    CAUTION: the exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.

15. Secure the bypass assembly (8 and 9) to the exhaust tees (5 and 6) using the tie rod (11) and two each: bushings (10), bolts (12) and lock nuts (13). Torque the bolts (12) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

     Procedure continues after Figure 5-11
Figure 5-11. Turbocharger and Exhaust Assembly

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Right Turbo Transition
6. Left Turbo Transition
7. Riser
8. Crossover Assembly
9. Transition
10. Bushing
11. Tie Rod
12. Bolt
13. Lock Nut
14. Left Tailpipe
15. Right Tailpipe
16. V-band clamp
17. Gasket
18. Wastegate Assembly
19. Bolt
20. Washer
21. Lock Nut
22. Gasket
23. Gasket
24. Turbocharger Assembly
25. Gasket
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Bolt
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose
37. Turbo Bracket, 1-3-5
38. Turbo Bracket, 2-4-6
39. Turbo Bracket, 1-3-5
40. Turbo Bracket, 2-4-6
41. Cotter Pin
42. Support Rod
43. Support Rod
44. Rod End
45. Nut
46. Slotted Nut
47. Bushing
48. Washer
49. Spring
Engine Removal & Installation

CAUTION: The directional arrows on the check valve and the check valve filter assembly must point in the direction of oil flow (away from the oil cooler)

16. Connect the oil supply hose (Figure 5-12) (15) to the lower port on the oil cooler cross fitting. Connect the oil filter (22) and check valve (17) to the oil supply hose (15).

17. Connect the female port of the tee (16) to the open end of the check valve (17).

18. Connect the left turbocharger oil supply hose (13) to one of the male ports on the tee fitting (16). Connect the right turbocharger oil supply hose (14) to the remaining port on the tee fitting (16).

19. Connect the left turbocharger oil supply hose (13) to the fitting (6) on the left turbocharger oil adapter (5).

20. Connect the right turbocharger oil supply hose (14) to the fitting (6) on the right turbocharger oil adapter (5).

21. Connect the oil return hoses (18 & 19) to the outlet fittings on the left (4) and right (3) turbocharger oil reservoirs, respectively.

22. Connect the open ends of the oil return hoses (18 & 19) to the in-line ports of the tee fitting (21). Connect the oil scavenge hose (20) between the open port of the tee fitting (21) and the inlet fitting on the scavenge pump.

23. Massage the hoses (13, 14, 15, 18, 19 & 20) and fittings (16, 17, 21, 22) for best fit and minimal stress according to the instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual. Torque the hoses and fitting to the specifications in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 5-12. Turbocharger Lubrication Hose Routing

See Figure 5-6 for parts index

24. Check the remaining turbocharger lubrication hose connections for security.
25. Connect the wastegate oil supply hose (Figure 5-13) (36) between the inboard oil cooler outlet fitting and wastegate oil inlet fitting.

26. Connect the oil return hose (35) from the wastegate oil outlet fitting and the wastegate controller oil inlet fitting.

27. Connect the wastegate controller oil return hose (34) between the wastegate controller oil drain fitting and the crankcase oil return fitting.

28. Torque the hoses fittings (34, 35, and 36) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual
CAUTION: The tailpipe oil separator vent hose must be of suitable material to withstand exhaust temperatures.

29. Install the air/oil separator (Figure 5-14) (1) according to the aircraft manufacturer’s instructions.

30. Install two hose clamps (6) on the crankcase breather hose (3). Connect the breather hose (3) between the middle fitting on the air/oil separator (1) and the breather tube on the oil fill assembly. Torque the clamp (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

31. Install two hose clamps (6) on the air/oil separator vent hose (5). Connect the vent hose (5) between the upper fitting on the air/oil separator and the aircraft drain manifold and tighten the clamp (6). Torque the clamps (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

32. Remove the cap from the Wastegate Controller compressor discharge reference (deck pressure) fitting (Figure 5-15) (5). Remove the plug from the deck pressure
hose (15). Connect the deck pressure hose (15) to the Wastegate Controller deck pressure fitting (5). Torque the hose fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

33. Remove the cap from the Wastegate Controller manifold pressure fitting (3). Remove the plug from the manifold pressure hose (14). Connect the manifold pressure hose (14) to the Wastegate Controller manifold pressure fitting (3). Torque the hose fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 5-15. Turbocharger Controller and Hoses

1 Controller 5 Adapter 9 Hose Assembly 13 Bulkhead Nut
2 O-Ring 6 Adapter Fitting 10 Bulkhead Union 14 Hose Assembly
3 Reducer 7 90° Elbow Fitting 11 Bulkhead Union 15 Hose Assembly
4 O-Ring 8 Hose Assembly 12 Bulkhead Nut 22 Wastegate Controller Assy
5-3.3.2. Engine Pre-Oiling

Refer to the “Engine Pre-Oiling” instructions in Section 5-2.9 of M-0, Standard Practice Maintenance Manual.

5-3.3.3. Fuel Injection System Purge

Prior to shipping from the factory, the fuel injection system was preserved with MIL-PRF-6081D Grade 1010. The preservative fluid was drained during completion of Section 5-3.2. Flushing the system with aircraft fuel will complete the purge and prime the fuel injection system for operation.

1. Disconnect the fuel supply line at the inlet to the fuel manifold valve.
2. Connect a length of the appropriate size hose to the disconnected fuel manifold supply hose using an AN union fitting. Route the end of the hose to a properly grounded Type 1 flammable fluid container through a paper filter.

   CAUTION: Ensure the ignition switch is in the OFF position and clear the rotational arc of the propeller before proceeding.

3. Have an assistant turn the aircraft master power switch on.
4. Place the aircraft boost pump switch in the ON position for approximately one minute while cycling the throttle and mixture controls through the full range of travel several times.
5. Turn the aircraft boost pump and Master Power Switches to the OFF positions.
6. Close the mixture and throttle controls.
7. Inspect the paper filter for contamination; isolate and correct the source of contamination and continue flushing until no contamination is present in the paper filter.
8. Remove the extra length of hose and union installed in step 2 from the fuel manifold valve supply hose.
9. Connect the fuel manifold valve fuel supply hose to the inlet fitting on the manifold valve and torque the fuel hose “B” nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Place approved containers at the induction system drain locations to collect fuel as it drains overboard.
10. Turn the aircraft Master Power Switch to the ON position.
11. With the Mixture Control in FULL RICH and the Throttle ¼ OPEN, turn the aircraft boost pump to the ON position.
12. Inspect fuel injection system lines, hoses and fitting for evidence of fuel leakage.
13. Place the Mixture Control to IDLE CUT-OFF and CLOSE the Throttle.
14. Turn the aircraft fuel boost pump OFF.
15. Turn the aircraft Master Power Switch OFF.
16. Correct any discrepancies noted.

17. Dispose of the fuel/oil mixture according to local hazardous material regulations.

5-3.4. Installation Inspection

Perform a “Visual Inspection” of the engine installation according to instructions in Section 6-3.6 prior to engine start.

5-3.5. Preflight and Run-up

Perform an Engine Operational Check after completing the engine installation and before performing the flight check according to the Airplane Flight Manual (AFM) or Pilot Operating Handbook (POH). Perform a flight check before releasing the engine for normal service to ensure the installed engine meets the manufacturer’s performance and operational specifications.

WARNING

The fuel system must be adjusted after installation in the aircraft according to the “Engine Operational Check” instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual to ensure proper operation. Correct all discrepancies prior to release for flight.

TSIO-550 Permold Series engines are neither designed, nor approved, for continuous negative or zero “G” operation. Engine Mount loads shall not exceed FAR 23 utility category load factors.

CAUTION: Adhere to the Operating Limits in Section 2-3 during all modes of engine operation, including the Flight Check and Break-In period.

NOTE: Perform a flight check according to instructions in Section 7-2.3 before releasing the engine for normal operations. New and rebuilt engines, and engine with one or more new cylinders or pistons, require a 25-hour break-in. After installation, avoid prolonged ground operation at high power.

1. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

2. Perform a “Post Ground Run Inspection” according to instructions in Section 5-3.5.1.
5-3.5.1. Post Ground Run Inspection

1. Remove engine cowling and perform the following inspections:
   a. Check hoses and fitting connections for oil or fuel leaks.
   b. Inspect cylinder head, rocker covers, and oil sump gaskets for oil leaks.
   c. Inspect oil sump for cracks.
   d. Inspect cylinder head and exhaust risers for evidence of exhaust leaks.
   e. Inspect oil return hoses and air inlet manifold for evidence of chafing from cooling air baffles. Ensure fuel lines and hoses do not rub against air inlet manifold.
   f. Inspect induction air circuit connections for security.
   g. Check control marks between ducts and hoses for movement.
   h. Inspect hose and wire harness clamps for security.

2. After at least 15 minute cool down period, check engine oil level.

3. Correct any discrepancies discovered during inspection according to the instructions in Chapter 8.

4. Perform a “Flight Check” according to instructions in Section 7-2.3 of M-0, Standard Practice Maintenance Manual.
5-4. Engine Installation Drawings

Installation drawings are provided to assist the aircraft manufacturer in determining the appropriate fittings and fasteners for aircraft interconnect requirements. Slight variations between the basic and subsequent engine models require separate engine installations. Pay particular attention to the model depicted when referencing drawings for engine installation requirements.

5-4.1. TSIO-550 Common Installation Drawings

Exhaust port and propeller dimensions are identical for TSIO-550 Series engines. Specific engine model dimensions follow the common installation drawings.

Figure 5-16. Exhaust Port Dimensions
Figure 5-17. Propeller Flange Dimensions
Figure 5-18. 24V Gear-Driven Alternator Detail
Engine Removal & Installation

Figure 5-19. 12V Gear-Driven Alternator

Figure 5-20. Belt-Driven Alternator Detail
5-4.2. TSIO-550-B Engine Installation Drawings

Figure 5-21. TSIO-550-B Installation Drawing 653021 - Sheet 1 of 3
Figure 5-22. TSIO-550-B Installation Drawing 653021 - Sheet 2 of 3
Figure 5-23. TSIO-550-B Installation Drawing 653021 - Sheet 3 of 3
5-4.3. TSIO-550-C&E Engine Installation Drawings

Figure 5-24. TSIO-550-C & E Installation Drawing 646618 - Sheet 1 of 3
Figure 5-25. TSIO-550-C & E Installation Drawing 646618 - Sheet 2 of 3
Figure 5-26. TSIO-550-C & E Installation Drawing 646618 - Sheet 3 of 3
5-4.4. TSIO-550-C Engine Installation Drawings

Figure 5-27. TSIO-550-C Installation Drawing 656791 - Sheet 1 of 3
Figure 5-28. TSIO-550-C Installation Drawing 656791 - Sheet 2 of 3
Figure 5-29. TSIO-550-C Installation Drawing 656791 - Sheet 3 of 3
Engine Removal and Installation

5-4.5. TSIO-550-G Engine Installation Drawings

Figure 5-30. TSIO-550-G Installation Drawing 657154 - Sheet 1 of 3
Figure 5-31. TSIO-550-G Installation Drawing 657154 - Sheet 2 of 3
Figure 5-32. TSIO-550-G Installation Drawing 657154 - Sheet 3 of 3
5-4.6. TSIO-550-K Engine Installation Drawings

Figure 5-33. TSIO-550-K Installation Drawing 657645 - Sheet 1 of 4
Figure 5-34. TSIO-550-K Installation Drawing 657645 - Sheet 2 of 4
Figure 5-35. TSIO-550-K Installation Drawing 657645 - Sheet 3 of 4
Figure 5-36. TSIO-550-K Installation Drawing 657645 - Sheet 4 of 4
5-4.7. TSIO-550-N Engine Installation Drawings

Figure 5-37. TSIO-550-N Installation Drawing 658233 - Sheet 1 of 5
Figure 5-38. TSIO-550-N Installation Drawing 658233 - Sheet 2 of 5
Engine Removal and Installation

Figure 5-39. TSIO-550-N Installation Drawing 658233 - Sheet 3 of 5
Engine Removal and Installation

Figure 5-41. TSIO-550-N Installation Drawing 658233 - Sheet 5 of 5
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Chapter 6. Engine Inspection and Service

6-1. Inspection Program Introduction

Inspections described in this chapter apply only to the Continental Motors engines covered by this manual. Perform the engine inspections according to the instructions provided. Perform aircraft inspections according to the aircraft manufacturer's instructions. Perform aircraft inspections according to the aircraft manufacturer's instructions. Refer to the following sections:

- Section 6-2, “Inspection and Maintenance Schedule”
- Section 6-3, “Scheduled Inspections”
- Section 6-5, “Inspection Checklists”

Some inspections are at predetermined intervals (scheduled) while others are based on circumstance (unscheduled). Engine servicing is performed at scheduled intervals but may also be performed “on condition.” The first part of this chapter is devoted to scheduled maintenance intervals and associated procedures; unscheduled maintenance instructions follow the scheduled maintenance instructions.

NOTE: Discrepancies discovered by the person conducting the scheduled or unscheduled inspections, even if the discrepancy is not an itemized inspection item, should be corrected upon discovery. Fuel and oil system contamination affects engine performance and service life. If oil or fuel system contamination is discovered, do not limit the correction to the symptom; isolate and correct the source of the contamination, including any residual material left in the engine by the source of the contamination.

6-2. Inspection and Maintenance Schedule

Unless another FAA-approved Inspection Program is established, the Engine Inspection and Maintenance Schedule shows the inspections for the subject engines covered by this manual in their original type design. The inspections described in this chapter apply to the engine and not to the aircraft. Refer to the Aircraft Manufacturer’s manual for aircraft inspection requirements.

The inspections are progressive; commencing from the date the engine is placed in service. The inspection intervals are tracked by Engine Log entries and designated by hours of operation or calendar time, whichever occurs first.

Inspection techniques must be executed consistently for reliability.
Engine Inspection and Service

6-3. Scheduled Inspections

Scheduled inspections are performed at predetermined intervals to verify the system and subsystem integrity; Scheduled inspections and maintenance are intended to enhance serviceability by discovering minor discrepancies and correcting them before the condition degrades. Scheduled inspections are based on calendar days or operating hours or a combination of both. Scheduled maintenance and service tasks are included in the inspections for convenience.

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<td>Drive Belt (optional equipment) Tension Check</td>
<td>Section 6-3.1</td>
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<td></td>
<td>Hartzell Alternator Initial Inspection (One Time)</td>
<td>Section 6-3.1</td>
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<td>Initial operation inspection after placing a new, rebuilt, or</td>
<td>Section 6-3.2</td>
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<td>overhauled engine in service, including cylinder replacement.</td>
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<td>Repeat this inspection after each 25 hours of operation until oil</td>
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<td>consumption stabilizes.</td>
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<td>Oil Change (with integral oil screen)</td>
<td>Section 6-3.8</td>
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<td>100-Hour engine inspection and service</td>
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<td>500-Hour inspection and service</td>
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6-3.1. One Time Post-Installation Inspections

Refer to Section 6-4-1 of M-0, Standard Practice Maintenance Manual.
6-3.2. 25-Hour Initial Operation Inspection
Refer to the “25-Hour Initial Operation Inspection” in Section 6-4.2 of M-0, Standard Practice Maintenance Manual.

6-3.3. 50-Hour Engine Inspection
Refer to the “50-Hour Engine Inspection” in Section 6-4.3 of M-0, Standard Practice Maintenance Manual.

6-3.4. 100-Hour (Annual) Engine Inspection
Refer to the “100-Hour (Annual) Engine Inspection” in Section 6-4.4 of M-0, Standard Practice Maintenance Manual.
In addition to the listed inspections in M-0, perform “Crankcase Inspection with Air Conditioning Compressor” according to the instructions in Section 6-3.12.1 on all engines equipped with an air conditioning compressor until the terminating action listed in the latest revision of SB09-4.

6-3.5. 500-Hour Engine Inspection
Refer to the “500-Hour Engine Inspection” in Section 6-4.5 of M-0, Standard Practice Maintenance Manual.

6-3.6. Visual Inspection
Refer to the “Visual Inspection” instructions in Section 6-4.6 of M-0, Standard Practice Maintenance Manual.

6-3.7. Engine Operational Check
Refer to the “Engine Operational Check” instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

6-3.7.1. Oil Pump Operational Check
Refer to the “Oil Pump Operational Check” instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

6-3.7.2. Fuel System Operational Check
Refer to the “Fuel System Operational Check” instructions in Section 6-4.7.4 of M-0, Standard Practice Maintenance Manual.

6-3.7.3. Magneto RPM Drop Check
Refer to the “Magneto RPM Drop Check” instructions in Section 6-4.7.5 of M-0, Standard Practice Maintenance Manual.
6-3.8. **Engine Oil Servicing**

Refer to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

6-3.9. **Ignition System Maintenance**

Refer to the “Ignition System Maintenance” instructions in Section 6-4.9 of M-0, Standard Practice Maintenance Manual. Ignition Harness Routing Instructions for TSIO-550 engine models are provided in Figure 6-1 and Figure 6-2.

![Ignition Harness Routing Diagram](image-url)

**Figure 6-1. Champion (Slick) Ignition Harness Routing**

- Engine Firing Order: 1-6-3-2-5-4
- Magneto Firing Order (1T, 2T, 3T, 4T, 5T, 6T)
- Magneto Switch Routing

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**Figure 6-1. Champion (Slick) Ignition Harness Routing**
Figure 6-2. Continental (Bendix) Ignition Harness Routing
6-3.10. Engine Adjustments

Refer to the “Engine Adjustments” instructions in Section 6-4.10 of M-0, Standard Practice Maintenance Manual.

6-3.10.1. Belt Tension Check and Adjustment

TSIO-550 engines may be fitted with an optional belt-driven air conditioning compressor or belt-driven alternator. Belt tension is critical to the function of these optional devices however, a new belt will stretch and tension will loosen during the first five hours (break-in) of engine operation after installation. Check the belt tension after the break-in period and during subsequent visual inspections.

Refer to the “Belt Tension Check and Adjustment” instructions in Section 6-4.10.4 of M-0, Standard Practice Maintenance Manual.

6-3.11. Cylinder Inspections

Refer to the “Cylinder Inspections” in Section 6-4.11 of M-0, Standard Practice Maintenance Manual.

6-3.12. Crankcase Inspection

Refer to the “Crankcase Inspection” in Section 6-4.12 of M-0, Standard Practice Maintenance Manual. In addition to the instructions in M-0, perform the inspection in Section 6-3.12.1 on engine models equipped with air conditioning compressors.
6-3.12.1. Crankcase Inspection with Air Conditioning Compressor

1. Inspect the crankcase boss at the forward compressor mounting bracket attach point. Two Permold crankcase rib configurations exist. The first crankcase configuration has a thin rib extending from the forward compressor mounting bracket attach point. The second configuration has a thick rib extending from the forward compressor mounting bracket attach point.

2. Compare the inspection area of your crankcase to Figure 6-3 and Figure 6-4. If your crankcase matches the configuration depicted in Figure 6-3, make a log book entry, indicating inspection compliance and “Thick Rib”; no further action is necessary. If the crankcase configuration matches the “Thin Rib” configuration depicted in Figure 6-4, continue with the visual inspection.

3. Clean the area surrounding the mounting boss with stoddard solvent or mineral spirits.

4. Use a minimum 10X magnifying lens to visually inspect the area depicted in Figure 6-5 and Figure 6-6.
Figure 6-5. General Inspection Area

a. Inspect the crankcase rib adjacent to the front air conditioner bracket attach point boss between the right magneto flange and the lower magneto hold down bracket.

b. If no crack, or suspected indication of a crack, is discovered:
   1) Make a log book entry indicating inspection compliance and result and schedule a follow-on inspection at the next 50-Hour inspection interval.
   2) Repeat the special inspection at each 50-hour inspection interval until the old style (Part No. 640767 or 654765) air conditioning compressor mounting bracket is replaced with air conditioning compressor bracket Part No. 657627 (or later) according to instructions in the latest version of SB09-4.

c. If a crack is discovered, or suspected:
   1) Perform a dye penetrant inspection according to the dye penetrant inspection kit manufacturer’s instructions on the suspect area to confirm the crankcase condition and the length of the crack, if one exists.
   2) Use the same crankcase inspection Pass/Fail criteria specified in Section 6-4.12 of M-0, Standard Practice Maintenance Manual.
Figure 6-6. Suspect Crack Indication
6-3.13. **Engine Mount Inspection**


6-3.14. **Induction System Inspection**

Refer to the “Induction System Inspection” in Section 6-4.14 of M-0, Standard Practice Maintenance Manual.

6-3.15. **Ignition System Inspection**

Refer to the “Ignition System Inspection” in Section 6-4.15 of M-0, Standard Practice Maintenance Manual.

6-3.16. **Engine Gauge Inspection**

Refer to the “Engine Gauge Inspection” in Section 6-4.16 of M-0, Standard Practice Maintenance Manual.

6-3.17. **Fuel System Inspection**

Refer to the “Fuel System Inspection” in Section 6-4.17 of M-0, Standard Practice Maintenance Manual.

6-3.18. **Throttle and Mixture Control Lever Inspection**

Refer to the “Throttle and Control Lever Inspection” in Section 6-4.18 of M-0, Standard Practice Maintenance Manual.

6-3.19. **Engine Control Linkage Inspection**

Refer to the “Engine Control Linkage Inspection” in Section 6-4.19 of M-0, Standard Practice Maintenance Manual.

6-3.20. **Induction System Drain Inspection**

Refer to the “Induction System Drain Inspection” in Section 6-4.20 of M-0, Standard Practice Maintenance Manual.

6-3.21. **Turbocharger and Exhaust System Inspection**

Refer to the “Turbocharger and Exhaust System Inspection” in Section 6-4.21 of M-0, Standard Practice Maintenance Manual.

6-3.22. **Alternator Inspection**

Refer to the “Alternator Inspection” in Section 6-4.22 of M-0, Standard Practice Maintenance Manual. In addition to the instructions in M-0, inspect Hartzell ES10024 and/or ES7024 Series Alternator, if installed, according to the instructions in Section 6-3.22.1 and Section 6-3.22.2.
6-3.22.1. Hartzell (Kelly) ES10024 Series Alternator Inspection

Inspect the alternator brushes at the first 500-Hour Inspection and each subsequent 500-Hour Inspection after being placed in service.

1. Remove the two screws (Figure 6-7) (8) securing the brush holder assembly (8) to the slip ring end housing (9).

   **CAUTION:** Remove the brush holder carefully to avoid damaging or dropping the brushes. If the brush holder assembly is damaged upon removal, all remnants of the previous brush holder must be removed before a new brush holder assembly can be installed. This may require complete alternator disassembly and inspection.

2. Remove the brush assembly (5) from the alternator slip ring end housing (9).

3. Remove the brushes from the brush holder assembly and mark the side to indicate the removed position and orientation in the holder. Serviceable brushes must be reinstalled in the location from which they were removed.

4. Inspect the brushes and brush holder for serviceability.
   
   a. Inspect the brushes for chipping or physical damage. Inspect the spring, cap and lead wire. If the spring appears damaged or malformed, replace the brushes. If a lead wire is frayed or strands of the lead wire are broken, replace the brush.

   **NOTE:** New brush assemblies are shipped with the brushes installed in the brush holder and retained with an insulated wire as an assembly.

   **Figure 6-7. ES10024 Alternator**

   1. Output Shaft  
   2. Thru Bolts  
   3. Ground Terminal  
   4. Battery Terminal  
   5. Brush Assembly  
   6. Aux Terminal  
   7. Field Terminal  
   8. Screws  
   9. Slip Ring End Housing
Engine Inspection and Service

CAUTION: Brushes must be replaced in pairs. Single brush replacement is not permitted.

b. If the brushes appear to be physically intact, measure the brush block length. New brushes measure 0.50 inch in length. If brushes are worn to 0.25 inches in length, or less, replace the brushes.

c. Inspect the brush holder for serviceability. If the brush holder exhibits physical damage or cracks, replace the brush holder.

5. Insert serviceable brushes in the brush holder location from which they were removed. If brushes are to be replaced, insert a new brush in each brush holder slot. Compress the brushes in the brush holder and insert a two-inch long piece of insulated, 22 gauge wire through the hole provided in the side of the brush holder.

6. Install the new or serviceable brush assembly (5) in the alternator with two screws (8). Torque the screws 25-35 in. lbs.

7. Spin the rotor to check for interference between the brush holder and rotor. Remove the retaining wire from the brush holder, allowing the brushes to snap into place.

8. Rotate the alternator shaft and measure resistance between the field (7) and ground (3) terminals with a multimeter. If rotor resistance is not between 7 and 20 ohms, replace the alternator.

9. Return to Section 6-3.22 to complete the alternator inspection.
6-3.22.2. Hartzell ES7024 Belt-Driven Alternator Inspection

Inspect the alternator brushes at the first 500-Hour Inspection and each subsequent 500-Hour Inspection after being placed in service and/or any time alternator brush replacement is necessary.

1. Determine if ES7024 alternator is installed by checking the engine log book or physically inspect the belt-driven alternator data plate.

2. Check the unit time in service and begin inspections with the nearest time interval and associated tasks. If time in service is unknown, perform a 500-Hour Inspection.

3. Disconnect the aircraft battery according to the aircraft manufacturer’s instructions to avoid arcing and possible alternator electrical damage.

4. Loosen the first and second nuts on the battery terminal (red insulator) prior to removing the back cover screws to avoid damaging the alternator.

Figure 6-8. ES7024 Alternator Assembly
Engine Inspection and Service

5. Disconnect the F1 (field) wire by removing the hardware. Remove the three screws (Figure 6-8) (2) and lock washers (3) securing the back cover (9) to the housing. Remove the back cover (9).

   **CAUTION:** Remove the brush holder carefully to avoid damaging or dropping the brushes. If the brush holder assembly is damaged upon removal, all remnants of the previous brush holder must be removed before a new brush holder assembly can be installed. This may require complete alternator disassembly and inspection.

6. Remove the brush assembly (12) from the alternator slip ring end housing.

7. Remove the brushes from the brush holder assembly and mark the side to indicate the removed position and orientation in the holder. Serviceable brushes must be reinstalled in the location from which they were removed.

8. Inspect the brushes and brush holder for serviceability:
   a. Inspect the brushes for chipping or physical damage. Inspect the spring, cap and lead wire. If the spring appears damaged or malformed, replace the brush assembly. If a lead wire is frayed or strands of the lead wire are broken, replace the brush assembly.

   **CAUTION:** Brushes must be replaced in pairs. Single brush replacement is not permitted.

   NOTE: New brush assemblies are shipped with the brushes installed in the brush holder and retained with an insulated wire as an assembly.

   b. If the brushes appear to be physically intact, measure the brush block length. New brushes measure 0.50 inch in length. If brushes are worn to 0.25 inch in length, or less, replace the brushes.

   c. Inspect the brush holder for serviceability. If the brush holder exhibits physical damage or cracks, replace the brush holder.

9. Insert serviceable brushes in the brush holder location from which they were removed. If brushes are to be replaced, insert a new brush in each brush holder slot. Compress the brushes in the brush holder and insert a two-inch long piece of insulated, 22 gauge wire through the hole provided in the side of the brush holder.

10. Install the new or serviceable brush assembly (12) in the alternator with two screws (13) and washers (14). Torque the screws 18-20 in. lbs.

11. Spin the rotor to check for interference between the brush holder and rotor. Remove the retaining wire from the brush holder, allowing the brushes to snap into place.

12. Rotate the alternator shaft and measure resistance between the field (8) and ground (4) terminals with a multimeter. If rotor resistance is not between 5.8 and 20 ohms, replace the alternator.

13. Install the back cover with three screws (2) and three new lock washers (3). Torque the screws 20-25 in. lbs.

14. Return to Section 6-3.22 to complete the alternator inspection.
6-4. **Unscheduled Maintenance**

6-4.1. **Propeller Strike**

Refer to “Propeller Strike” in Section 6-5.1 of M-0, Standard Practice Maintenance Manual.

6-4.1.1. **Propeller Strike Inspection**

Refer to “Propeller Strike Inspection” in Section 6-5.1.1 of M-0, Standard Practice Maintenance Manual.

6-4.2. **Hydraulic Lock Inspection**

Refer to “Hydraulic Lock Inspection” in Section 6-5.2 of M-0, Standard Practice Maintenance Manual.

6-4.3. **Engine Overspeed Inspections**

Refer to “Engine Overspeed Inspections” in Section 6-5.3 of M-0, Standard Practice Maintenance Manual.

6-4.4. **Turbocharger Overboost**

Refer to “Turbocharger Overboost” in Section 6-5.4 of M-0, Standard Practice Maintenance Manual.

6-4.5. **Lightning Strike Inspection**

Refer to “Lightning Strike Inspection” in Section 6-5.5 of M-0, Standard Practice Maintenance Manual.

6-4.6. **Contaminated Fuel System Inspection**

Refer to “Contaminated Fuel System Inspection” in Section 6-5.6 of M-0, Standard Practice Maintenance Manual.

6-4.7. **Foreign Object Contamination Inspection**

Refer to “Foreign Object Contamination Inspection” in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.

6-5. **Inspection Checklists**

Refer to “Inspection Checklists” in Section 6-6 of M-0, Standard Practice Maintenance Manual.
Chapter 7. Engine Operation

7-1. Introduction

This chapter contains the TSIO-550 Permold Series ground engine operating instructions to facilitate maintenance personnel during:

- Normal Engine Operation
- Engine Operation in Abnormal Environments

Instructions in this section apply to Continental Motors TSIO-550 operation with variable pitch propellers conforming to the engine original type design and supplements information in the Airplane Flight Manual (AFM) or Pilot's Operating Handbook (POH) provided by the aircraft manufacturer or supplemental type certificate holder as required by the Federal Aviation Regulations (FAR) for aircraft operating procedures.

NOTE: This section pertains to engine operations under various operating conditions. Normal operating instructions are presented first followed by operation in adverse operating environments.

7-2. Flight Prerequisites

If the engine is newly installed and/or has been repaired/overhauled, perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual prior to releasing the engine for normal operation.

WARNING

The “Engine Operational Check” must be completed on an engine that has been installed, inspected, repaired, or overhauled before the aircraft can be released for normal operation.

DO NOT FLY THE AIRCRAFT UNTIL ALL FLIGHT PREREQUISITES HAVE BEEN MET.

NOTE: Environmental conditions (humidity), seasonal changes, and engine usage influence susceptibility to corrosion. Engines that are flown occasionally (less than one time per week) are more vulnerable to corrosion under these conditions. The best method of reducing the risk of corrosion is to fly the aircraft weekly for at least one hour. The owner/operator is ultimately responsible for recognizing corrosion and taking appropriate corrective action.

After successful completion of the Engine Operational Check, perform a Flight Check according to instructions in Section 7-2.3.2.
7-2.1. Oil Change Interval

NOTE: After the first 25 hours of operation, perform an oil change according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

The Oil Change Interval is specified in Table 6-2, “Engine Inspection and Maintenance Schedule” in M-0, Standard Practice Maintenance Manual.

7-2.2. Engine Fuel Requirements

WARNING

The engine is certified for operation with the aviation fuel listed for each engine model in Section 7-2.2 of M-0, Standard Practice Maintenance Manual. If the minimum fuel grade is not available, use the next higher grade. Never use a lower grade fuel. The use of lower octane fuel may result in damage to, or destruction of, an engine the first time high power is applied.

If the aircraft is inadvertently serviced with the incorrect grade of aviation fuel or jet fuel, the fuel system must be completely drained and the fuel tanks serviced in accordance with the aircraft manufacturer’s recommendations. After the fuel system is decontaminated, inspect the engine according to the “Contaminated Fuel System Inspection” instructions in Section 6-5.6 of M-0, Standard Practice Maintenance Manual.

7-2.3. Flight Check and Break-In

New and factory rebuilt Continental Motors engines are adjusted to meet product specifications in a test cell prior to shipment. A flight check ensures the engine meets operational specifications after installation in the aircraft, prior to release for normal service. The recommended break-in period for Continental Motors engines is 25 hours. Adhere to the following instructions and the “Engine Specifications” in Section 2-3 applicable to the engine model.

Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual and a normal preflight, engine start and ground run-up in accordance with the Airplane Flight Manual or Pilot’s Operating Handbook (AFM/POH) before the A&P mechanic can approve the airplane for a Flight Check. Perform a “Flight Check” according to instructions in Section 7-2.3.2 after engine installation, inspection, repairs, or adjustments. Follow the protocol in Section 7-2.3.1 to complete the recommended break-in period.

WARNING

Avoid long descents at high engine RPM to prevent undesirable engine cooling. If power must be reduced for long periods, adjust the propeller to minimum governing RPM to obtain desired performance levels. If outside air temperature is extremely cold, it may be desirable to increase drag to maintain engine power without gaining excess airspeed. Do not permit cylinder head temperature to drop below 300°F (149°C).
CAUTION: High power ground operation resulting in cylinder and oil temperatures exceeding normal operating limits can be detrimental to cylinders, pistons, valves, and rings.

7-2.3.1. Engine Break-In

1. Conduct a normal engine start, ground run-up and take-off according to the AFM/POH.

2. Monitor a) engine RPM, b) fuel flow and pressure, c) oil pressure and temperature, d) cylinder head temperature, e) exhaust gas temperature, and f) turbine inlet temperature to verify the engine is operating within the parameters specified in Section 2-3.

3. Reduce the engine speed to climb power according to the AFM/POH instructions. Maintain a shallow climb attitude to achieve optimum airspeed and cooling airflow.

4. At cruise altitude:
   a. Maintain level flight cruise at 75% power with best power or richer mixture for the first hour of operation.

      NOTE: Best power mixture setting is 100°-150°F rich of peak exhaust gas temperature. Adjust engine controls or aircraft attitude to maintain indicated engine operation within specifications.

   b. For the second and subsequent hours of flight, alternate cruise power settings between 65% and 75% power with appropriate best power mixture settings.

WARNING

Avoid long descents at high engine RPM to prevent undesirable engine cooling. If power must be reduced for long periods, adjust the propeller to minimum governing RPM to obtain desired performance levels. If outside air temperature is extremely cold, it may be desirable to increase drag to maintain engine power without gaining excess airspeed. Do not permit cylinder head temperature to drop below 300°F (149°C).

5. Descend at low cruise power settings. Avoid long descents or descents at cruise power RPM with manifold pressure below 18 in. Hg. If necessary, reduce engine RPM to the lower limit of the specified operating range to maintain sufficient manifold pressure. Carefully monitor engine instrumentation to maintain levels above the minimum specified cylinder head temperature and oil temperature.

6. Correct any discrepancies prior to releasing the aircraft for service.
7-3. Normal Operation

Information in this section supplements instructions for normal operation found in the AFM/POH. Adhere to the aircraft AFM/POH operating procedures.

WARNING

Before flying the aircraft, ensure all “Flight Prerequisites” in Section 7-2 have been completed, in addition to the aircraft manufacturer’s instructions found in the AFM/POH.

Operation of a malfunctioning engine can result in additional damage to the engine, bodily injury or death.

Supplemental instructions for normal operation in this section are:

- Pre-operational Requirements
- Engine Start
- Engine Ground Run-up
- Engine Shutdown

7-3.1. Pre-operational Requirements

1. Check the engine oil level, and verify quantity is within specified limits.
2. Verify oil fill cap and dipstick are secure.
3. Drain all fuel sumps and strainers in accordance with aircraft manufacturer’s recommendations.

4. Check the fuel system according to the Pilot's Operating Handbook (POH) and verify compliance with “Engine Fuel Requirements” in Section 7-2.2 of M-0, Standard Practice Maintenance Manual.

5. Check propeller and propeller hub for cracks, oil leaks, and security.

6. Check engine nacelle for signs of damage, leaks, and debris.

7. Perform an aircraft preflight inspection according to the AFM/POH.

**7-3.2. Engine Start**

Refer to the aircraft POH for detailed engine starting procedures. Complete Section 7-3.1, “Pre-operational Requirements” prior to engine start. Be familiar with the quantity and location of the engine fuel system drains.

**WARNING**

Do not attempt to start an engine with an over-primed or flooded induction system. Starting an engine with a flooded induction system can result in hydraulic lock and subsequent engine malfunction or failure. Allow excess fuel to drain from the intake manifold and/or cylinder prior to attempting to start the engine.

*CAUTION: Attempting to start an engine with a partially discharged aircraft battery may result in damage to the starter relay or possible engine kick-back resulting in a broken starter adapter clutch spring.*

When starting the engine, ensure the battery is completely charged, especially in sub-freezing temperatures.

Verify the tasks listed in Table 7-2, “Flight Prerequisites,” have been completed in addition to those required by the aircraft POH, aircraft manufacturer, or Supplemental Type Certificate (STC) holder. Note the following:

- If the engine is being started in extreme cold, preheating may be required. Refer to Section 7-4.1, “Engine Operation in Extreme Cold” in M-0, Standard Practice Maintenance Manual.
- If the engine is started in hot weather, refer to Section 7-4.2, “Engine Operation in Hot Weather.”
- If the engine is being started at high altitude, refer to Section 7-4.3, “Ground Operation at High Density Altitude.”

**WARNING**

Ensure the propeller arc is clear of personnel and obstructions before starting the engine.

*CAUTION: If the engine is hot, engage starter first, then turn on the auxiliary boost pump as instructed by the aircraft manufacturer.*
**Engine Operation**

NOTE: Check oil pressure frequently. Oil pressure indication must be noted within 30 seconds in normal weather. If no oil pressure is observed, stop the engine and investigate the cause.

1. Propeller........................................................... Clear
2. Master Switch .................................................. On
3. Ignition Switch............................................... BOTH
4. Mixture Control ............................................. FULL RICH
5. Propeller Control.......................................... High RPM
6. Auxiliary Boost Pump .................................. According to AFM/POH
7. Throttle....................................................... ¼ Open

**CAUTION:** Release starter switch as soon as engine fires. Never engage the starter while the propeller is still turning.

**EZR ISK** Do not energize the starter for longer than 30 seconds. If the engine does not start after cranking for 30 seconds, release the starter switch and allow the starter motor to cool for 3-5 minutes before another starting attempt.

**SKY** Do not engage the starter for longer than 10 seconds. Allow 20 seconds for the starter to cool after each engagement. If engine start is unsuccessful after six attempts, release the starter switch and allow the starter motor to cool for 30 minutes before another starting attempt is made.

8. Ignition Switch.............................................. Start

**CAUTION:** If engine kickback is experienced during engine start, inspect the starter adapter and crankshaft gear according to instructions in SB16-6 prior to further flight.

9. Throttle....................................................... Set to 900 - 1100 RPM

**CAUTION:** Engine operation without oil pressure will result in engine malfunction and probable failure.

10. Oil Pressure.................................................. Check

RESULT: Must have oil pressure indication within 30 seconds.
7-3.2.1. Cold Start

Follow the AFM/POH instructions, using the same procedure as for a normal start. After the engine begins running, it may be necessary to operate the boost pump intermittently to prevent the engine from stalling.

7-3.2.2. Flooded Engine

Excessive priming may cause fuel to accumulate in the induction system or cylinder faster than cylinder drains can evacuate it. If hydraulic lock is suspected, discontinue starting attempts until proper drain operation is verified.

WARNING
Do not operate the engine if hydraulic lock is suspected. Engine damage may occur. Perform a “Hydraulic Lock Inspection” according to instructions in Section 6-5.2 of M-0, Standard Practice Maintenance Manual. If no fuel drainage is observed, discontinue starting attempts until the cause is determined. Inspect the cylinder drains for obstructions.

7-3.2.3. Hot Start

Supplement the AFM/POH normal starting instructions with the following:

NOTE: For several minutes after stopping a hot engine, heat soaked fuel injection components, (especially the fuel pump) may cause fuel vaporization resulting in restarting difficulties. To reduce difficulty, perform the following steps:

1. Fuel Selector Valve ......................................... ON
2. Throttle............................................................. CLOSED
3. Mixture Control ............................................... IDLE CUT-OFF

CAUTION: With the mixture control in the IDLE CUT-OFF position, no fuel is supplied to the engine. The fuel manifold valve positively stops fuel flow to the fuel injectors if inlet fuel pressure is less than 1.0 psi. If the boost/prime pump is enabled with the mixture control in IDLE CUT-OFF and the pressure is above the fuel manifold valve nominal shutoff pressure, fuel will be forced past the fuel manifold valve, through the injectors and into the cylinders. Extended operation in this condition is not recommended. Excessive fuel in the cylinder intake will cause an overly rich condition and fuel discharge from the cylinder drains. Refer to AFM/POH for boost pump operational limits.

4. Auxiliary Boost Pump...................................... According to AFM/POH
5. Allow fuel to drain from intake prior to engine start; follow AFM/POH starting instructions.
CAUTION: DO NOT operate the engine at run-up speeds unless the oil temperature is at least 100°F (38°C) and the oil pressure is within the 30-60 psi range. Operating the engine above idle before reaching minimum oil temperature may cause a loss of oil pressure and engine damage.

1. Maneuver aircraft nose into wind

CAUTION: Avoid prolonged idle at low RPM to prevent spark plug fouling.

2. Throttle............................................................. IDLE

3. Propeller Control.............................................. FULL INCREASE

4. Mixture............................................................. FULL RICH

5. Throttle............................................................. 900-1000 RPM

6. Maintain engine RPM between 900 and 1000 RPM for at least one minute or until engine oil temperature exceeds 100°F (38°C).

WARNING

Absence of RPM drop during the magneto check may be an indication of a faulty ignition circuit resulting in a condition known as “Hot Magneto.” Should the propeller be turned by hand, the engine may inadvertently start and cause personal injury or death. This condition must be corrected prior to continued aircraft operation.

CAUTION: When operating on single ignition, some RPM drop and slight engine roughness as each magneto is switched off should be noted. Excessive (greater than 150 RPM) RPM drop may indicate a faulty magneto or fouled spark plugs.

NOTE: If the engine runs roughly after single magneto operation, increase engine speed to 2200 RPM in the BOTH position and lean the mixture control until the RPM peaks for ten seconds before returning to the full rich position to clear the spark plugs and smooth operation before returning to single magneto operation.

Limit ground operation to time necessary to complete engine warm-up and pre-flight checkout.

7. Throttle............................................................. 1700 RPM

a. Magneto Check

1) Ignition Switch.............................................. R
RESULT: RPM drops 150 RPM or less; record Left Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.
2) Ignition Switch................................. BOTH
RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position for approximately ten seconds to clear engine roughness.

3) Ignition Switch................................. L
RESULT: RPM drops 150 RPM or less; record Right Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.

4) Ignition Switch................................. BOTH
RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position

b. Propeller Governor Checkout

1) Throttle........................................... 1700 RPM

2) Propeller Control............................. Low RPM position
RESULT: Engine RPM decreases to minimum governing speed or as specified by aircraft manufacturer.

3) Propeller Control............................. High RPM position
RESULT: Tachometer drops 400-500 RPM. Cycle the Propeller Governor control 2-3 times to cycle warm oil through the propeller hub.

If equipped:

4) Propeller Control............................. Feather
RESULT: RPM drops below minimum governing speed.

5) Propeller Control............................. Full Increase
RESULT: Engine RPM return to 1700 RPM.

8. Throttle............................................ 1200 RPM
7-3.4. Engine Shutdown

Supplement the AFM/POH engine shutdown procedures with the following:

1. Auxiliary Boost Pump ........................................ OFF
2. Throttle.............................................................. 1700 RPM

**WARNING**

Absence of RPM drop during the magneto check may be an indication of a faulty ignition circuit resulting in a condition known as “Hot Magneto.” Should the propeller be turned by hand, the engine may inadvertently start and cause personal injury or death. This condition must be corrected prior to continued aircraft operation.

**CAUTION:** When operating on single ignition, some RPM drop should be noted. Normal indications are up to 150 RPM drop and slight engine roughness as each magneto is switched off. RPM drop in excess of 150 RPM may indicate a faulty magneto or fouled spark plugs. Avoid prolonged single magneto operation to preclude spark plug fouling.

NOTE: If the engine runs roughly after single magneto operation, increase engine speed to 2200 RPM in the BOTH position and lean the mixture control until the RPM peaks for ten seconds before returning to the full rich position to clear the spark plugs and restore smooth operation before returning to single magneto operation.

3. Ignition Switch......................................................... R
   RESULT: RPM drops 150 RPM or less; record Left Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.

4. Ignition Switch......................................................... BOTH
   RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position for approximately ten seconds to clear engine roughness.

5. Ignition Switch......................................................... L
   RESULT: RPM drops 150 RPM or less; record Right Magneto channel drop results. Maximum allowable RPM drop spread between magneto channels is 50 RPM.

6. Ignition Switch......................................................... BOTH
   RESULT: Engine RPM returns to approximately 1700 RPM. Allow ignition switch to remain in the BOTH position.
CAUTION: Turbochargers require a cooling/spin down period before engine shutdown. Failure to allow the turbocharger to cool/spin down will shorten turbocharger service life.

7. Throttle.............................................................IDLE
RESULT: Allow engine to run for five minutes below 900 RPM to allow turbochargers to slow to a lower RPM and cool down.

    NOTE: If RPM is raised above 1200 RPM during the spin-down period, restart the timer and complete five minute cooling/spin-down cycle.

8. Mixture Control .............................................IDLE CUT-OFF
9. Ignition Switch...............................................OFF
10. Fuel Selector ....................................................OFF (according to AFM/POH)
7-4. Engine Operation in Abnormal Environments

The anticipated types of abnormal environments are:
- Extreme cold weather
- Extreme hot weather
- High density altitude ground operation

7-4.1. Engine Operation in Extreme Cold

Refer to Engine Operation in Extreme Cold in Section 7-4.1 of M-0, Standard Practice Maintenance Manual.

7-4.2. Engine Operation in Hot Weather

“Hot weather” is defined as ambient temperature exceeding 90°F (32°C). After an engine is shutdown, the temperature of various components will begin to stabilize. The hotter parts such as cylinders and oil will cool, while other parts will begin to heat up due to lack of air flow or heat convection from those engine parts that are cooling. At some point following engine shutdown, the engine temperature will stabilize near ambient temperature. This time period will vary based on outside air temperature, wind conditions, etc. and may take several hours.

Heat soaking occurs thirty minutes to an hour following engine shutdown. During this time, the fuel system will expand, causing the fuel in the pump and fuel lines to vaporize. Starting the engine will be difficult because the fuel pump is trying to pressurize a combination of fuel and fuel vapor causing the fuel delivered to the fuel injection nozzles to be leaner than during an engine start at ambient temperature. Until the vapor is evacuated from the lines and replaced with liquid fuel, expect difficult starting and rough engine operation.

Three hot weather operation situations requiring special instructions are:
- “Cooling an Engine in Hot Weather” (Section 7-4.2.1)
- “Engine Restart in Hot Weather” (Section 7-4.2.2)
- “Take-off and Initial Climb Out in Hot Weather” (Section 7-4.2.3)

Ensure the engine is serviced with the correct viscosity oil specified in Section 2-3.2, “Oil Specifications” prior to starting the engine. In the event of temporary cold weather exposure, store the aircraft in a hangar between flights. Service the oil sump, as required, to maintain the oil capacity specified for the engine model in Section 2-3, “Engine Specifications” according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

Operating Tips
- Inspect the air filter frequently for contamination; clean or replace the filter, if necessary.
- If the aircraft is flown in dusty conditions, more frequent oil changes are recommended
- Use dust covers over openings in the cowling for additional protection.
7-4.2.1. Cooling an Engine in Hot Weather

- Reduce ground operation to a minimum to keep engine temperatures down.
- Open cowl flaps fully while taxiing.
- Face the nose of aircraft into the wind to take advantage of the cooling effect.

7-4.2.2. Engine Restart in Hot Weather

Restarting attempts will be the most difficult thirty to sixty minutes after engine shutdown. Following that interval, fuel vapor will decrease and present less of a restart problem.

**WARNING**

*Allow excess fuel to drain from the induction system prior to starting the engine.*

1. Fuel selector .................................................... ON
2. Throttle.................................................................. CLOSED
3. Mixture Control .................................................. IDLE CUT-OFF
4. Auxiliary Boost Pump........................................... ON (according to AFM/POH)
   RESULT: Allow boost pump to run for 15-20 seconds
5. Auxiliary Boost Pump........................................... OFF (according to AFM/POH)
6. Follow the “Engine Start” instructions in the AFM/POH and Section 7-3.2.

7-4.2.3. Take-off and Initial Climb Out in Hot Weather

1. Mixture control .................................................. FULL RICH
   NOTE: Under extreme conditions, it may be necessary to manually lean the mixture to sustain engine operation at low RPM.
2. Do not operate the engine at maximum power longer than necessary to establish the climb configuration recommended by the aircraft manufacturer.
4. Maintain sufficient airspeed and attitude to provide engine cooling.
5. Cowl flaps.......................................................... FULLY OPEN (if equipped)
Engine Operation

7-4.3. Ground Operation at High Density Altitude

CAUTION: Reduced engine power will result from higher density altitude associated with high temperature.

Idle fuel mixture may be rich during high density altitude conditions. Lean the fuel mixture to sustain operation at low RPM. When practical, operate the engine at higher idle speed.

NOTE: A FULL RICH mixture is required during take-off.

If higher than desired temperatures are experienced during the climb phase, establish a lower angle of attack or higher climb speed, consistent with safe operating practices to provide increased engine cooling.

- Monitor oil and cylinder temperatures closely during taxiing and engine run up.
- Operate with cowl flaps full open.
- Do not operate the engine at high RPM except for necessary operational checks.
- If take-off is not to be made immediately following engine run-up, face the aircraft into the wind with the engine idling between 900-1000 RPM.
Chapter 8. Troubleshooting

Fault isolation paths within this section indicate the most likely causes of given symptoms and corrective action. The fault isolation paths and repair procedures are developed using real world scenarios (log book entries) and best known practices. New symptoms, fault isolation methods, and corrective actions may be added in the future, when warranted.

**WARNING**

Any attempt by unqualified personnel to adjust, repair, or replace any parts may result in engine malfunction or failure. Continued operation of a malfunctioning engine can cause further damage to a disabled component and possible injury to personnel. Do not return an engine to service unless it functions according to specifications.
 Troubleshooting

8-1. General Troubleshooting
Refer to Section 8-1 of M-0, Standard Practice Maintenance Manual.

8-1.1. Engine Runs Rough
Refer to Section 8-1.3.2 of M-0, Standard Practice Maintenance Manual.

8-1.2. Engine Will Not Run
Refer to Section 8-1.4 of M-0, Standard Practice Maintenance Manual.

8-1.3. Engine Indication Malfunctions
Refer to Section 8-1.5 of M-0, Standard Practice Maintenance Manual.

8-1.4. Engine Performance Malfunctions
Refer to Section 8-1.5 of M-0, Standard Practice Maintenance Manual.

8-2. Induction System
Refer to Section 8-2 of M-0, Standard Practice Maintenance Manual.

8-3. Fuel Injection System
Refer to Section 8-3 of M-0, Standard Practice Maintenance Manual.
8-4. Charging System
Refer to Section 8-4 of M-0, Standard Practice Maintenance Manual.

8-5. Starting System
Refer to Section 8-5 of M-0, Standard Practice Maintenance Manual.

8-6. Ignition System
Refer to Section 8-6 of M-0, Standard Practice Maintenance Manual.

8-7. Lubrication System
Refer to Section 8-7 of M-0, Standard Practice Maintenance Manual.

8-8. Engine Cylinders
Refer to Section 8-8 of M-0, Standard Practice Maintenance Manual.

8-9. Crankcase
Refer to Section 8-9 of M-0, Standard Practice Maintenance Manual.

8-9.1. Excess Crankcase Pressure
Refer to Section 8-9.1 of M-0, Standard Practice Maintenance Manual.

8-10. Turbocharger and Exhaust System
Refer to Section 8-10 of M-0, Standard Practice Maintenance Manual.
Troubleshooting

*Intentionally Left Blank*
Chapter 9. Engine Preservation and Storage

9-1. Preserving and Storing an Engine

Refer to the “Preserving and Storing an Engine” instructions in Section 9-1 of M-0, Standard Practice Maintenance Manual

9-1.1. Engine Preservation Checklist

Make a copy of the “Engine Preservation Checklist” on page 9-5 of M-0, Standard Practice Maintenance Manual and record the serial number, date placed in storage and projected inspection date for each engine placed in storage. The checklist covers a 90-day storage cycle. Complete a new checklist for each 90-day storage cycle and attach to the previous checklist to record inspection until the engine is returned to service.

9-1.2. New or Unused Engine Storage

Refer to the “New or Unused Engine Storage” instructions in Section 9-1.2 of M-0, Standard Practice Maintenance Manual.

9-1.3. Temporary Storage

Refer to the “Temporary Storage” instructions in Section 9-1.3 of M-0, Standard Practice Maintenance Manual.

9-1.4. Indefinite Storage

Refer to the “Indefinite Storage” instructions in Section 9-1.4 of M-0, Standard Practice Maintenance Manual.

9-1.5. Return an Engine to Service after Storage

Refer to the “Return an Engine to Service after Storage” instructions in Section 9-1.5 of M-0, Standard Practice Maintenance Manual.
Chapter 10. Non-Overhaul Repair and Replacement

10-1. Parts Replacement

Procedures in this section apply to instances outside of overhaul when parts can be repaired or replaced as a maintenance practice; some parts cannot be repaired and must be replaced. Table 10-1, “Non-Overhaul Parts Replacement Reference” indicates items that must be replaced, along with respective references for replacement instructions. Table 10-2, the “Parts Repair Reference” lists items that may be repaired along with corresponding references to the repair instructions. Unless otherwise indicated, instructions are in this chapter.

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

NOTE: When replacing components according to the maintenance procedures in this section, adhere to the service limits, in line with the procedure as a guide for part re-use for each component. Use the overhaul dimensional limits in Appendix D when performing maintenance repairs if service limits are not provided.

Service limits in this section apply only to maintenance procedures and in many cases are not identical to the overhaul limits in Appendix D.
## Table 10-1. Non-Overhaul Parts Replacement Reference

<table>
<thead>
<tr>
<th>Replaceable Item</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternator</td>
<td>Section 10-5, “Alternator Replacement”</td>
</tr>
</tbody>
</table>
| Camshaft Plugs   | Section 13-10.1, “Camshaft Disassembly”  
                     Section 16-10.1, “Camshaft Assembly” |
| Crankcase Studs  | Section 15-8.10.5, “Crankcase Cylinder Deck Stud Replacement” |
| Crankcase Helical Coils | Section 15-8.10.4, “Crankcase Cylinder Deck Stud Helical Coil Installation” |
| Crankshaft Nose Oil Seal | Section 10-9, “Crankshaft Nose Oil Seal Replacement” |
| Engine Cylinder - Individual | Section 10-8, “Engine Cylinder Maintenance” |
                     Section 16-9, “Engine and Turbocharger Mount Installation” |
| Fuel Injector Nozzles | Table 10-3 and Section 10-3, “Fuel Injector Replacement” |
| Fuel Manifold Valve | Section 12-5, “Fuel Injection System Removal”  
                     Section 17-11, “Fuel Injection System Installation” |
| Fuel Pump        | Section 10-2, “Fuel Pump Replacement” |
| Hydraulic Tappets | Section 10-8.2, “Hydraulic Tappet Removal”  
                     Section 10-8.7, “Hydraulic Tappet Installation” |
| Magneto          | Section 10-6, “Magneto Replacement” |
| Oil Cooler       | Section 10-7.4, “Oil Cooler Repair and Replacement” |
| Oil Filter       | Section 6-3.8, “Engine Oil Servicing” |
| Oil Filter Adapter Stud | Section 10-7.1, “Oil Filter Adapter Stud Replacement” |
| Oil Pressure Relief Valve | Section 10-7.5, “Oil Pressure Relief Valve Repair and Replacement” |
| Oil Pump         | Section 10-7.2, “Oil Pump or Tachometer Drive Repair and Replacement” |
| Oil Sump or Oil Suction Tube | Section 10-7.3, “Oil Sump and Oil Suction Tube Repair and Replacement” |
| Oil Temperature Control Valve | Section 10-7.6, “Oil Temperature Control Valve Inspection and Replacement” |
| Starter Adapter  | Section 10-4, “Starter Motor and Adapter Replacement” |
| Starter Motor    | Section 10-4, “Starter Motor and Adapter Replacement” |
| Starter Needle Bearing | Section 10-4, “Starter Motor and Adapter Replacement”  
                     Section 13-6, “Starter and Starter Adapter Disassembly”  
                     Section 13-9.2, “Crankcase Studding Disassembly”  
                     Section 15-8.5.1, “Starter Adapter Housing Worm Shaft Needle Bearing Replacement”  
                     Section 16-4, “Starter & Starter Adapter Assembly” |
| Throttle Body    | Section 12-5, “Fuel Injection System Removal”  
                     Section 17-11, “Fuel Injection System Installation” |
| Turbocharger     | Section 10-11.1, “Turbocharger Replacement” |
| Wastegate        | Section 12-8, “Turbocharger and Exhaust System Removal”  
                     Section 17-10, “Turbocharger and Exhaust System Installation” |
| Wastegate Controller | Section 12-4, “Wastegate Controller Removal”  
                     Section 17-12, “Wastegate Controller Installation” |
### Table 10-2. Parts Repair Reference

<table>
<thead>
<tr>
<th>Repairable Item</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankcase Cracks</td>
<td>Section 15-8.10, “Crankcase Overhaul Repair”</td>
</tr>
<tr>
<td>Engine Cylinder</td>
<td>Section 10-8, “Engine Cylinder Maintenance”</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td>Section 10-7.4, “Oil Cooler Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Pressure Relief Valve</td>
<td>Section 10-7.5, “Oil Pressure Relief Valve Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Pump</td>
<td>Section 10-7.2, “Oil Pump or Tachometer Drive Repair and Replacement”</td>
</tr>
<tr>
<td>Oil Sump and Oil Suction Tube</td>
<td>Section 10-7.3, “Oil Sump and Oil Suction Tube Repair and Replacement”</td>
</tr>
<tr>
<td>Starter Motor</td>
<td>Section 10-4, “Starter Motor and Adapter Replacement”</td>
</tr>
</tbody>
</table>

### Table 10-3. Parts Handling Guidelines

<table>
<thead>
<tr>
<th>Parts/Components</th>
<th>Handling Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrapped new or rebuilt parts</td>
<td>Parts that require protection from atmospheric dust and moisture should be wrapped or boxed after acceptance inspection and remain wrapped until time of installation</td>
</tr>
<tr>
<td>Spark plugs</td>
<td>Handle spark plugs with clean, dry hands. Avoid dropping a spark plug. If a spark plug is either dropped or damaged, discard it. Do not install any spark plug that has been dropped or damaged.</td>
</tr>
</tbody>
</table>
10-2. Fuel Pump Replacement

Continental Motors offers new and rebuilt fuel pumps for the TSIO-550 Permold series engines. Fuel pumps may be repaired by FAA Part 145 Authorized Repair Stations. Continental Motors does not control Repair Station certification; verify the Repair Station possesses the proper certification before contracting repairs.

10-2.1. Fuel Pump Removal

**WARNING**

*Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.*

1. Turn the ignition switch to the OFF position and disconnect engine electrical power.

   **NOTE:** Mark or tag hose connections as they are removed to eliminate confusion during installation.

   ![Figure 10-1. Fuel Pump Adjustments & Fittings (typical)](image)

   **Table 10-1. Fuel Pump Adjustments & Fittings (typical)**

<table>
<thead>
<tr>
<th><strong>Fittings</strong></th>
<th><strong>Adjustments</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fuel Inlet</td>
</tr>
<tr>
<td>B</td>
<td>Fuel Outlet (Unmetered Pressure)</td>
</tr>
<tr>
<td>C</td>
<td>Fuel Return</td>
</tr>
<tr>
<td>D</td>
<td>Fuel Vapor Return</td>
</tr>
<tr>
<td>E</td>
<td>Drain</td>
</tr>
<tr>
<td>F</td>
<td>Ambient (or Deck) Pressure Reference</td>
</tr>
</tbody>
</table>

   | | 1 | Low Pressure Relief Valve |
   | 1 | CW = INCREASE |
   | 2 | 2 | Aneroid Adjustment |
   | 2 | CCW = INCREASE |
   | 3 | 3 | Mixture Control |
   | 3 | CCW = INCREASE |

2. Disconnect the hoses from and place protective caps on the fuel pump inlet fitting (Figure 10-1) (A), fuel pump outlet fitting (B), fuel pump vapor return fitting (D),
upper deck pressure reference ($F^1$ or $F^2$, depending on engine model), and fuel pump drain fitting (E).

3. Remove the nuts (Figure 10-2) (6), lock washers (5), and hold-down washers (4), from the base of the fuel pump (1); discard the lock washers (5). Remove the fuel pump (1) from the crankcase. Remove and discard the gasket (3).

4. Clean the gasket residue from the crankcase flange.

5. Remove the fuel pump drive coupling (2) from the pump shaft. Inspect the drive coupling for evidence of excessive wear or damage. Inspect the fuel pump drive coupling according to the service limits in Table 10-4 and Figure 10-3.

![Figure 10-2. Fuel Pump Assembly](image)

<table>
<thead>
<tr>
<th>1</th>
<th>Fuel Pump Assembly</th>
<th>4</th>
<th>Hold Down Washer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Coupling, Fuel Pump Drive</td>
<td>5</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>3</td>
<td>Fuel Pump Gasket</td>
<td>6</td>
<td>Nut</td>
</tr>
</tbody>
</table>

Non-Overhaul Repair and Replacement
10-2.2. Fuel Pump Service Limits

**Figure 10-3. Fuel Pump Drive Coupling Fits and Limits**

**Table 10-4. Fuel Pump Drive Coupling Dimensions**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Fuel pump drive coupling to crankshaft gear</td>
<td>0.0095L</td>
</tr>
<tr>
<td>2</td>
<td>Fuel pump drive coupling to fuel pump</td>
<td>0.0030L</td>
</tr>
</tbody>
</table>

T= Tight L=Loose

10-2.3. Fuel Pump Installation

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Remove aircraft cowling, as required, to access the fuel pump.
3. Apply Molyshield Grease to the fuel pump drive coupling (Figure 10-2) (2).
4. Install the fuel pump drive coupling (2) in the fuel pump (1).
5. Apply Gasket Sealant (Part No. 642188) to both sides of the new gasket and install the new gasket (3) on the fuel pump (1).
6. Lubricate the fuel pump cavity with clean 50 weight aviation engine oil.
7. Install the fuel pump on the crankcase with hold down washers (4), new lock washers (5) and nuts (6). Torque the nuts according to Appendix B.

**CAUTION:** Fuel system contamination may lead to component damage, erratic engine operation, loss of power, or engine shutdown. Flush new fuel system parts, hoses and test equipment prior to connection to the system.
8. Flush the fuel pump and all connecting hoses according to the “Fuel System Purge”
instructions in Section C-8.1 of M-0, Standard Practice Maintenance Manual to
prevent fuel system contamination prior to connecting the parts with the aircraft fuel
system.

9. Connect the appropriate hoses to the fuel pump inlet fitting (Figure 10-1) (A), fuel
pump outlet fitting (B), fuel vapor return fitting (D), fuel drain fitting (E), and upper
deck pressure reference fitting (F₁ or F₂, depending on engine model) according to
“Hose and Tubing Installation” instructions in Section C-11 of M-0, Standard
Practice Maintenance Manual. Torque the hoses to the value specified in Appendix

10. Perform a static leak check of the fuel system
   a. Position the Ignition Switch to OFF
   b. Turn on the fuel supply and boost pump according to the AFM/POH
   c. Position the throttle to WIDE OPEN
   d. Position the mixture control to FULL RICH
   e. Check the fuel lines for leaks from the fuel pump inlet to the manifold valve and
correct any leaks if detected
   f. Turn the boost pump and fuel supply OFF
   g. Position the throttle to CLOSED
   h. Position the mixture control to IDLE/CUTOFF
   i. Install any aircraft components removed to facilitate repairs

11. Perform an “Engine Operational Check” according to the instructions in Section 6-
4.7 of M-0, Standard Practice Maintenance Manual.

Figure 10-2 repeated for reference
10-3. Fuel Injector Replacement

NOTE: Continental Motors tests newly manufactured fuel injector nozzles and manifold valves as a set during the assembly process. Individual fuel injector nozzles may be replaced if unserviceable but we recommend replacement of injectors as a complete set to ensure proper distribution of fuel mixture to all cylinders and optimum engine performance.

10-4. Starter Motor and Adapter Replacement

Repair or replace the starter motor if it will not turn the starter adapter. Repair the Energizer starter motor according to the Starter Service Instructions (X30592). Engines originally configured with ISKRA starters may be converted to Energizer or Skytec starters at overhaul or when ISKRA starter replacement is necessary. No field repair is authorized for the Skytec starter; replacement is the only remedy for Skytec starter motor failure.

Repair or replace the starter adapter if the starter motor turns but the starter adapter does not engage the engine or the starter adapter malfunctions.

NOTE: Depending on the aircraft application, it may be necessary to lift the engine off the engine mounts to remove the starter or starter adapter.
10-4.1. Starter Motor Removal

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position.
2. Disconnect the aircraft battery and electrical cable from the starter motor according to the aircraft manufacturer’s instructions.
3. Remove the two nuts (Figure 10-4) (3) and washers (4) from the starter motor mounting studs.
4. Carefully remove the starter motor assembly (1) without damaging the mounting stud threads.
5. Remove and discard the O-ring (5).
6. Repair or replace the starter motor according appropriate starter manufacturer’s instructions.
Figure 10-4. Starter Motor and Starter Adapter

1. Starter Motor
2. Starter Adapter
3. Nut
4. Washer
5. O-ring
6. Washer
7. Lock washer
8. Nut
9. Gasket
10. Washer
11. O-ring
12. Sleeve
13. Spacer
14. Lock Nut
10-4.2. Starter Adapter Removal

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Remove the starter motor according to the “Starter Motor Removal” instructions in Section 10-4.1.
2. Disconnect the turbocharger lubrication hoses from the starter adapter fittings; plug the lubrication hoses to prevent contamination.
3. Remove the four sets of nuts (Figure 10-4) (8), lock washers (7), and washers (6 & 10) (two on the outside of the crankcase between Cylinder 1 and the starter, and two on the cover assembly).
4. Remove the starter adapter assembly (2) from the crankcase; discard the lock washers (7).
5. Remove and discard the starter adapter gasket (9). Clean the gasket residue from the crankcase mating surface.
6. Place the starter adapter on a sturdy work surface. Rotate the starter shaft gear in a clockwise direction by hand.
   a. Ensure the clutch spring is not binding on the shaft.
   b. Observe smooth operation in the shaft bearing surface.
7. Disassemble the starter adapter (if condition warrants, or starter adapter was removed to correct a malfunction) according to the instructions in Section 13-6.
8. Inspect the starter and starter adapter parts using to the service limits in Section 10-4.3. Repair or replace parts which fail to meet the dimensional inspection criteria.

**WARNING**

If damage is discovered in step 9 or 10, perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-4.7.

9. Perform a “Gear Tooth Inspection” on the starter shaft gear according to the instruction in Section 11-1.1 of M-0, Standard Practice Maintenance Manual. If the gear teeth are chipped, broken, or otherwise damaged, inspect the starter adapter according to instructions in Section 15-7.4 using the service limits in Section 10-4.3, perform the necessary starter adapter repairs according to instructions in Section 15-8.5 and perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.
10. Perform a “Gear Tooth Inspection” on the crankshaft gear according to instruction in Section 11-1.1 of M-0, Standard Practice Maintenance Manual. If the gear teeth are...
chipped, broken, or otherwise damaged, disassemble the engine and replace the crankshaft gear.

11. Assemble the starter adapter (if previously disassembled) according to the instructions in Section 16-4.

12. Visually inspect the starter needle bearing in crankcase for debris or damage. Inspect the needle bearing dimensionally according to the “Starter and Starter Adapter Service Limits” in Section 10-4.3.

13. Install the starter adapter according to instructions in Section 10-4.4.

Figure 10-4 repeated for reference
10-4.3. Starter and Starter Adapter Service Limits

Starters and starter adapter service limits are in Table 10-5. Index numbers in the first column correspond to the numbers in Figure 10-5. Service limits for the worm wheel drum (Figure 10-6) and shaft gear drum (Figure 10-7) are shown in Table 10-6 and Table 10-7, respectively.

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Starter shaft gear needle bearing hole crankcase ......... diameter:</td>
<td>---</td>
<td>0.9990</td>
<td>1.0000</td>
</tr>
<tr>
<td>2</td>
<td>Starter shaft gear front (bearing) journal ....................</td>
<td>0.7480</td>
<td>0.7495</td>
<td>0.7500</td>
</tr>
<tr>
<td>3</td>
<td>Starter shaft gear in clutch drum bearing .....................</td>
<td>1.0000</td>
<td>0.9995</td>
<td>1.0000L</td>
</tr>
<tr>
<td>4</td>
<td>Clutch spring sleeve in starter adapter ............. diameter: diametric clearance:</td>
<td>0.0050T</td>
<td>0.0030T</td>
<td>0.0050T</td>
</tr>
<tr>
<td>5</td>
<td>Starter shaft gear in ball bearing ......................... diametric clearance:</td>
<td>0.0007L</td>
<td>0.0001T</td>
<td>0.0005L</td>
</tr>
<tr>
<td>6</td>
<td>Bearing in starter adapter cover ......................... diametric clearance:</td>
<td>0.0010L</td>
<td>0.0001T</td>
<td>0.0010L</td>
</tr>
<tr>
<td>7</td>
<td>Worm wheel gear .............................................. diametric clearance:</td>
<td>0.0250</td>
<td>0.0016</td>
<td>0.0166</td>
</tr>
<tr>
<td>8</td>
<td>Worm wheel drum ................................................ diametric clearance:</td>
<td>Figure 10-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Starter shaft gear drum ........................................ diametric clearance:</td>
<td>Figure 10-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Clutch spring in clutch spring sleeve ‡ ..................... diametric clearance:</td>
<td>0.030T</td>
<td>0.0310T</td>
<td>0.0380T</td>
</tr>
<tr>
<td>11</td>
<td>Center of worm gear shaft to starter adapter thrust pads distance:</td>
<td>0.2520</td>
<td>0.2450</td>
<td>0.2490</td>
</tr>
<tr>
<td>12</td>
<td>Needle bearing hole starter adapter ......................... diameter:</td>
<td>0.7495</td>
<td>0.7485</td>
<td>0.7495</td>
</tr>
<tr>
<td>13</td>
<td>Ball bearing in starter adapter ......................... diametric clearance:</td>
<td>0.0013L</td>
<td>0.0001T</td>
<td>0.0013L</td>
</tr>
<tr>
<td>14</td>
<td>Worm gear shaft in needle bearing area ..................... diameter:</td>
<td>0.5600</td>
<td>0.5615</td>
<td>0.5625</td>
</tr>
<tr>
<td>15</td>
<td>Worm gear shaft in ball bearing ................................ diametric clearance:</td>
<td>0.0007T</td>
<td>0.0001L</td>
<td>0.0007T</td>
</tr>
<tr>
<td>16</td>
<td>Starter worm gear on shaft .................................. diametric clearance:</td>
<td>0.0040</td>
<td>0.0005L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>17</td>
<td>Starter spring on worm drive shaft ....................... diametric clearance:</td>
<td>0.0250L</td>
<td>0.0050L</td>
<td>0.0250L</td>
</tr>
<tr>
<td>18</td>
<td>Starter pilot to starter drive adapter ...................... diametric clearance:</td>
<td>0.0070L</td>
<td>0.0010L</td>
<td>0.0070L</td>
</tr>
<tr>
<td>19</td>
<td>Scavenge pump driven gear on shaft ...................... diametric clearance:</td>
<td>0.0040L</td>
<td>0.0005L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>20</td>
<td>Scavenge pump driver and driven gear in body ......... diametric clearance:</td>
<td>0.0060L</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>21</td>
<td>Scavenge pump driver and driven gear in body ............ diametric clearance:</td>
<td>0.0160L</td>
<td>0.0118L</td>
<td>0.0143L</td>
</tr>
<tr>
<td>22</td>
<td>Bushing in scavenge pump driven gear ..................... diametric clearance:</td>
<td>---</td>
<td>0.0035</td>
<td>0.0060T</td>
</tr>
<tr>
<td>23</td>
<td>Scavenge pump driver and driven gear ..................... backlash:</td>
<td>0.0035</td>
<td>0.0050</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Starter worm wheel gear and worm gear .................... backlash:</td>
<td>0.0200</td>
<td>0.0090</td>
<td>0.0110</td>
</tr>
</tbody>
</table>

T = Tight and L = Loose

1. When the sandblasted diameter finish is smoother than 125 RMS, replace the sleeve
Figure 10-5. Starter and Starter Adapter Dimensions
Table 10-6. Worm Wheel Drum Dimensions

<table>
<thead>
<tr>
<th>Part</th>
<th>“A” Diameter (inches)</th>
<th>“B” Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>New Worm Wheel Drum</td>
<td>1.931</td>
<td>1.932</td>
</tr>
<tr>
<td>0.015 Undersize</td>
<td>1.916</td>
<td>1.917</td>
</tr>
</tbody>
</table>

NOTE: Inspect the starter adapter sleeve. The outside diameter should be 0.812 to 0.814 inches.
10-4.4. Starter Adapter Installation

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

**CAUTION:** Fittings (or plugs) installed in the starter adapter with accessory drive assembly are critical to engine function. Failure to install fittings (or plugs) and reconnect accessory hoses will result in loss of engine oil and catastrophic engine failure.

**CAUTION:** Exercise care when cleaning the residue from the mounting flange; mask the crankcase opening to avoid contaminating the engine oil supply.

1. Thoroughly clean the crankcase mounting surface to remove any gasket residue.

*Figure 10-4 repeated for reference*
2. Visually inspect the starter needle bearing in crankcase for debris or damage. Inspect the needle bearing dimensionally according to the “Starter and Starter Adapter Service Limits” in Section 10-4.3.

3. Apply a translucent coat of Gasket Maker (Part No. 646942) to only the crankcase mating surface of the starter adapter gasket only according to the “Gasket Maker® Application” instructions in Appendix C-9 of M-0, Standard Practice Maintenance Manual.

4. Install the new gasket (Figure 10-4) (9) on the crankcase.

5. Lubricate the starter shaft gear teeth with clean 50-weight aviation engine oil.

6. Mesh the teeth with the crankshaft gear while placing the starter adapter in position.

7. Seat the starter adapter against the gasket.

8. Secure the starter adapter assembly to the crankcase with washers (6, 10), new lock washers (7) and nuts (8). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Connect the turbocharger lubrication hoses to the starter adapter fittings from which they were removed according to the “Hose and Tubing Installation” instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual. Torque the hoses and fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Install the starter motor according to the “Starter Motor Installation” instructions in Section 10-4.5.

11. Perform an “Engine Start” according to the instructions in Section 7-3.2 to verify starter operation.

10-4.5. Starter Motor Installation

**WARNING**

*Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.*

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

2. Inspect a new O-ring (Figure 10-4) (5) for the starter motor and verify the O-ring is free of cracks and is not deformed or brittle. Do not install a deformed, brittle, or cracked O-ring.

3. Coat the new O-ring with clean 50-weight aviation engine oil and install the O-ring on the starter motor flange.

4. Apply Molyshield Grease to the starter motor drive lug.
5. Verify the integrity of the starter motor mounting studs; if studs are loose, bent or the threads are damaged, replace the studs according to instructions in Appendix C-6 of M-0, Standard Practice Maintenance Manual.

6. Install the starter motor on the mounting studs; ensure the drive lug aligns with the slot. Secure the starter motor with two sets of washers (4) and nuts (3).

7. Torque the mounting nuts (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Verify the integrity of the electrical cable; replace frayed or cracked wiring.

9. Reconnect the electrical cable and aircraft battery according to the aircraft manufacturer’s instructions.

10. Perform an “Engine Start” according to the instructions in Section 7-3.2 to verify starter operation.

Figure 10-4 repeated for reference
10-5. Alternator Replacement

Refer to the “Alternator Replacement” instructions in Section 10-4 of M-0, Standard Practice Maintenance Manual.

10-6. Magneto Replacement

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

10-6.1. Continental Motors Magneto Removal

Refer to the “Continental Motors Magneto Removal” instructions in Section 10-5.2 of M-0, Standard Practice Maintenance Manual.

10-6.2. Champion (Slick) Magneto Removal

Refer to the “Champion (Slick) Magneto Removal” instructions in Section 10-5.3 of M-0, Standard Practice Maintenance Manual.
10-6.3. Ignition System Service Limits

The ignition system component service limits are shown in Table 10-8. Index numbers in the first column correspond to the numbers in Figure 10-8.

Table 10-8. Ignition System Service Limits

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bushing in magneto and accessory drive adapter</td>
<td>0.0040T</td>
<td>0.0010T</td>
<td>0.0040T</td>
</tr>
<tr>
<td>2</td>
<td>Magneto and accessory drive gear in adapter bushing</td>
<td>0.0050L</td>
<td>0.0015L</td>
<td>0.0035L</td>
</tr>
<tr>
<td>3</td>
<td>Oil seal in adapter</td>
<td>0.0070T</td>
<td>0.0010T</td>
<td>0.0070T</td>
</tr>
<tr>
<td>4</td>
<td>Sleeve in magneto and accessory drive gear</td>
<td>0.0040T</td>
<td>0.0010T</td>
<td>0.0070T</td>
</tr>
<tr>
<td>5</td>
<td>Magneto coupling retainer on drive gear sleeve</td>
<td>0.0550L</td>
<td>0.025L</td>
<td>0.040L</td>
</tr>
<tr>
<td>6</td>
<td>Magneto and accessory drive gear end clearance</td>
<td>0.0770L</td>
<td>0.0110L</td>
<td>0.0770L</td>
</tr>
<tr>
<td>7</td>
<td>Magneto coupling retainer in drive slot side clearance</td>
<td>0.040L</td>
<td>0.0020T</td>
<td>0.0280T</td>
</tr>
<tr>
<td>8</td>
<td>Magneto coupling rubber bushings on drive lugs side clearance</td>
<td>0.0140L</td>
<td>0.014L</td>
<td>0.052T</td>
</tr>
<tr>
<td>9</td>
<td>Magneto pilot in crankcase</td>
<td>0.0050L</td>
<td>0.001L</td>
<td>0.005L</td>
</tr>
</tbody>
</table>

T = Tight and L = Loose

Figure 10-8. Accessory Drive Adapter Dimensions
10-6.4. Continental Motors Magneto Installation

Refer to the “Continental Motors Magneto Installation” instructions in Section 10-5.2 of M-0, Standard Practice Maintenance Manual.

10-6.5. Champion (Slick) Magneto Installation

Refer to the “Champion (Slick) Magneto Installation” instructions in Section 10-5.4 of M-0, Standard Practice Maintenance Manual.

10-6.6. Magneto Filter Replacement

Pressurized magnetos incorporate a desiccant filter to trap moisture that could cause arcing at higher altitudes. Serviceable desiccant material in the filters is white in color; replace the filter when the desiccant material turns dark. If the filter requires replacement, inspect the internal magneto components for moisture and corrosion.

10-6.6.1. Continental Motors Magneto Filter Replacement

1. Inspect the magneto housing for cracks according to the appropriate Magneto Service Instructions (Section 1-2.5, “Related Publications”). Inspect the magneto internal parts for evidence of moisture or corrosion according to the Magneto Service Instructions.

2. Remove the bolt (Figure 10-9) (21) and washer (22) securing the cushion clamp (20) to the baffle support.

3. Loosen hose clamps (16) and remove the filter (12), hoses (14, 15, 17) and clamps (16).

4. Remove the cushion clamp (20) from the filter (12); retain the cushion clamp; discard the filter (12).

5. Inspect the hoses (14, 15 & 17) for cracks or dry rot. Discard unserviceable hoses. NOTE: A filter kit is available to replace the entire magneto filter assembly and hoses at overhaul. For continued service, replace hoses on condition; replace the assembly at overhaul.

Complete filter assembly replacement instructions are provided, perform applicable steps required to return the ignition system to service.

6. Install a new filter kit:

   a. Install serviceable hoses (14) between the tee and the elbow fittings (18 & 19); secure the hoses (14) with clamps (16).

   b. Connect a serviceable hose (18) on the open side of the tee and secure with a clamp (16).

   c. Connect a serviceable hose (17) to the upper deck reference pressure fitting on the intake manifold and secure with a clamp (16).
d. Remove the shipping plugs and inspect the new filter (12) for cracks. Verify the reducer/drain plug (13) is installed in the filter (12) drain hole.

e. Loosen two clamps (16) and place them on the open ends of hoses (15 & 17). Connect the new filter assembly (12) to the hoses (15 & 17) with the arrow on the filter pointing toward the magnetos and the drain pointing down.

f. Adjust hoses (14, 15 & 17) to minimize twisting stress and torque clamps (16) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
10-6.6.2. Champion (Slick) Magneto Filter Replacement

1. Inspect the magneto housing for cracks according to the appropriate Magneto Service Instructions (Section 1-2.5, “Related Publications”). Inspect the magneto internal parts for evidence of moisture or corrosion according to the Magneto Service Instructions.

2. Loosen hose clamps (Figure 10-10) (11) from the hoses (8 & 9) at each end of the filter (13); remove the filter (13) from assembly hoses (8 & 9) and clamps (11);

3. Inspect the hoses (8, 9 & 10) and fittings (12, 15 & 21) for security and serviceability. Replace cracked or brittle hoses.

   NOTE: A filter kit is available to replace the entire magneto filter assembly and hoses at overhaul. For continued service, replace hoses on condition; replace the assembly at overhaul.

   Complete filter assembly replacement instructions are provided, perform applicable steps required to return the ignition system to service.

4. Install new filter kit (22):

   g. Remove the shipping plugs and inspect the new filter assembly (13) for cracks. Verify the reducer/drain plug (14) is installed in the filter drain hole.

   a. Connect serviceable hoses (10) to the tee (12) fitting 180° apart and secure with hose clamps (11). Connect the open ends of the hoses (10) to the 90° fittings (15) and secure with clamps (11). Connect a serviceable hose (8) to the remaining fitting on the tee (12) and secure with a clamp (11).

   b. Connect the short end of a serviceable 90° hose (9) to the upper deck reference pressure fitting on the intake manifold and secure with a clamp (11).

   c. Insert the new filter assembly (13) in the cushion clamp (20) with the arrow pointing toward the magnetos and the drain tube pointing downward. Secure the cushion clamp (20) to the bracket (16) with a screw (17), washers (19) and new lock nut (18); tighten and torque the fasteners (17 & 18) to the value specified in M-0, Standard Practice Maintenance Manual.

   d. Connect the hoses (8 & 9) to the new filter; secure the hoses (8 & 9) to the filter with clamps (11).

   e. Adjust hoses (8, 9 & 10) to minimize twisting stress and torque clamps (11) to the value specified in M-0, Standard Practice Maintenance Manual.
Figure 10-10. Champion (Slick) Ignition System

1 Magneto 7 Spark Plug Assembly 13 Magneto Filter Assembly 19 Washer
2 Ignition Harness 8 Hose Assembly 14 Drain, Filter Reducer 20 Cushion Clamp
3 Gasket 9 Hose Assembly 15 Elbow Fitting 21 Reducer Fitting
4 Nut 10 Hose Assembly 16 Bracket 22 Magneto Filter Kit
5 Lock Washer 11 Hose Assembly 17 Screw 23 Magneto Tachometer Sensor
6 Mag Hold Washer 12 Hose Clamp 18 Lock Nut
10-6.7. Accessory Drive Adapter Removal

1. Disconnect the aircraft accessory connected to the accessory drive according to the aircraft manufacturer’s instructions.

2. Remove the Accessory Drive Adapter according to instructions in Section 12-3.

3. Disassemble the accessory drive adapter according to instructions in Section 12-3. Inspect the following items using the “Ignition System Service Limits” in Section 10-6.3; replace components on condition:
   a. Rubber drive bushing(s) and retainer: if the rubber bushings are torn or exhibit missing material perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.
   b. Oil seal
   c. Bushing: may be smoothly worn; no gouges or pitting permitted; may be reamed within service limits.
   d. Drive Gear Assembly: if the gear assembly exhibits uneven wear or broken teeth, perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-5.7 of M-0, Standard Practice Maintenance Manual.
   e. Mounting studs: studs should be straight, securely installed in the housing with clean, well defined threads. Replace loose, bent or deformed studs.

4. Install the serviceable Accessory Drive Adapter according to instructions in Section 17-15.1.

5. Start the engine according to the “Engine Start” instructions in Section 7-3.2 instructions. Allow the engine to run at idle for approximately ten minutes. Shut the engine down according to Section 7-3.4 and inspect the area surrounding the accessory drive for leaks.
Figure 10-11. Accessory Drive Adapter Assembly

101 Rubber Bushing
102 Retainer-Mag Coupling
103 Magneto Drive Gear
104 Gasket
105 Magneto Adapter Assembly
106 Bushing
107 Part of 106
108 Stud
109 Oil Seal
110 Accessory Drive Gasket
111 Accessory Cover
112 Plain Washer
113 Lock Washer
114 Nut
115 Nut
116 Lock Washer
117 Plain Washer
118 Nut
119 Lock Washer

* NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.
10-7. Lubrication System Repair

10-7.1. Oil Filter Adapter Stud Replacement

If the threads on the oil filter adapter stud are worn or damaged, replace the stud:

**WARNING**

**Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.**

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

2. Drain the oil and remove the oil filter according to the “Oil Change” instructions in Section 6-4.8.2 of M-0, Standard Practice Maintenance Manual but do not refill the oil at this time. Replace the oil filter adapter stud according to the instructions in Section 15-8.8.3. When stud replacement is complete, return to Section 6-4.8.2 of M-0 to complete the oil change.

3. Perform the “Oil Pump Operational Check” according to instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

10-7.2. Oil Pump or Tachometer Drive Repair and Replacement

**WARNING**

**Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.**

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

2. Remove malfunctioning oil pump according to the “Oil Pump Removal” instructions in Section 12-10.

3. Inspect the oil pump components according to the Lubrication System Service Limits in Table 10-9. Replace parts that do not meet the service limits.

4. Install the new oil pump according to the “Oil Pump Installation” instructions in Section 17-5.

**NOTE:** Repairs other than smoothing nicks on parting surfaces, replacing studs and worn parts, and refacing the oil pressure relief valve seat on the oil pump housing are prohibited. The pump driven gear shaft is pressed into the pump housing and is not field replaceable. The pump gear chamber must not be enlarged. If it becomes scored or enlarged, discard and replace the pump housing. Scoring on the gear contact area of the oil pump cover renders it unserviceable unless the parting surfaces can be lapped smooth and perfectly flat.
5. Perform the “Oil Pump Operational Check” according to instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual, as required.

10-7.3. Oil Sump and Oil Suction Tube Repair and Replacement

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

   NOTE: For most engine installations, the engine must be removed from the aircraft to remove the oil sump. Follow appropriate engine removal instructions in Chapter 5.

2. Remove the oil sump and suction tube according to the “Oil Sump Removal” instructions in Section 12-14. Install a new oil sump or suction tube according to the “Oil Sump & Suction Tube Installation” instructions in Section 17-4.

3. Perform the “Oil Pump Operational Check” according instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

10-7.4. Oil Cooler Repair and Replacement

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

**NOTE:** For TSIO550C engine models installed in Cessna Corvalis 400 experiencing low oil temperature, an optional oil cooler and oil temperature control valve is available, refer to CMI SIL10-6.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

2. Remove the oil cooler according to the “Oil Cooler Removal” instructions in Section 12-9.

3. Send the oil cooler to an appropriately rated FAA Part 145 repair station. No structural repairs are allowed on the oil cooler.

4. Replace any oil cooler exhibiting structural damage, i.e. bent/broken or cracked cooling fins, with a new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange must be accomplished by an appropriately FAA Part 145 repair station.

5. Install the serviceable oil cooler according to the “Oil Cooler Installation” instructions in Section 17-6.
6. Perform a normal “Engine Start” (Section 7-3.2) and “Ground Run-up” (Section 7-3.3) according to instructions in Chapter 7 to verify the lubrication system operates within the engine specifications in Section 2-3.

10-7.5. Oil Pressure Relief Valve Repair and Replacement

WARNING

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Cut, remove, and discard the safety wire from the oil pressure relief valve housing located at the rear of the engine (Figure 10-12).
3. Unscrew and remove the oil pressure relief valve from the oil pump housing.

Figure 10-12. Rear View of Engine

procedure continues on next page
4. Inspect the oil pressure relief valve plunger (Figure 10-13) and valve seat face in the oil pump housing (Figure 10-14) for scoring, nicks, and rough spots.

5. Check the oil pressure relief valve service limits listed in Table 10-9. If the valve has exceeds the service limits, replace the valve.

6. If the plunger has scoring, nicks, or roughening, replace the oil pressure relief valve plunger.

7. If the valve seat face in the oil pump housing is nicked or the surface is rough, reface the valve seat according to instructions in Section 15-8.8.2.

Figure 10-13. Oil Pressure Relief Valve

Figure 10-14. Valve Seat in the Oil Pump Housing
8. Turn the adjusting screw on the oil pressure relief valve housing (Figure 10-15) inward about halfway. Final adjustment will be accomplished during the operational test.

9. Install a new copper washer (with the split line against the housing, see Appendix C-10.1 in M-0, Standard Practice Maintenance Manual) and nut.

10. Apply Part No. 646943 to the threads of the valve as shown in Figure 10-15.

11. Assemble the plunger, spring, and seat of the oil pressure relief valve (Figure 10-15) and slide it into the oil pump housing pressure relief valve cavity.

12. Ensure that oil pressure relief valve components are aligned and install them in the oil pump housing.

13. Torque the oil pressure relief valve housing to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Safety wire the oil pressure relief valve housing according to the “Safety Wiring Hardware” instructions in Section C-3 of M-0, Standard Practice Maintenance Manual.

15. Perform an “Oil Pump Operational Check” according instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.
10-7.6. Oil Temperature Control Valve Inspection and Replacement

**WARNING**

*Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections.*

*Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance.*

*Do not stand or place equipment within the arc of the propeller.*

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Cut, remove, and discard the safety wire from the oil temperature control valve housing located on the oil cooler.
3. Remove the oil temperature control valve.
4. Inspect the conical valve seat (Figure 10-16) of the oil temperature control valve for scoring and nicks. If these valves are nicked or scored, replace the valve.
5. Visually inspect the seat in the oil cooler.
6. Apply Part No. 646943 to the threads on the oil temperature control valve where shown in Figure 10-16.
7. Install the oil temperature control valve with a new washer and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
8. Safety wire the oil temperature control valve housing according to the instructions in Section C-3 of M-0, Standard Practice Maintenance Manual.

![Figure 10-16. Oil Temperature Control Valve](image-url)
10-7.7. Lubrication Component Service Limits

The lubrication system component service limits are shown in Table 10-9. Index numbers in the first column correspond to the item numbers in Figure 10-17.

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Service</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil Pressure Relief Valve Assembly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Oil pressure relief valve adjusting screw ........ diametrical clearance: in plunger</td>
<td></td>
<td>0.0070L</td>
<td>0.0030</td>
<td>0.0070</td>
</tr>
<tr>
<td>2</td>
<td>Oil pressure relief valve seat in housing .............. depth:</td>
<td></td>
<td>1.060</td>
<td>0.750</td>
<td>1.060</td>
</tr>
<tr>
<td><strong>Oil Pump Assembly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Oil pump driver gear in pump housing .......................body</td>
<td></td>
<td>0.0065L</td>
<td>0.0040L</td>
<td>0.0060L</td>
</tr>
<tr>
<td>4</td>
<td>Oil pump driver gear shaft in pump housing ...... diametrical clearance:</td>
<td></td>
<td>0.0045L</td>
<td>0.0015T</td>
<td>0.0030L</td>
</tr>
<tr>
<td>5</td>
<td>Oil pump driven gear to driven gear shaft ...... diametrical clearance:</td>
<td></td>
<td>0.0040L</td>
<td>0.0005L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>6</td>
<td>Oil pump driven gear in pump housing ....................end clearance:</td>
<td></td>
<td>0.0050</td>
<td>0.0016L</td>
<td>0.0041</td>
</tr>
<tr>
<td>7</td>
<td>Oil pump driven gear in pump housing ....................end clearance:</td>
<td></td>
<td>0.0050</td>
<td>0.0016L</td>
<td>0.0041</td>
</tr>
<tr>
<td>8</td>
<td>Oil pump driver gear shaft in tach .................. diametrical clearance: drive housing</td>
<td></td>
<td>---</td>
<td>0.0015L</td>
<td>0.0030L</td>
</tr>
<tr>
<td>9</td>
<td>Oil pump driver gear shaft pin in bevel gear ...... diametrical clearance:</td>
<td></td>
<td>---</td>
<td>0.0005L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>10</td>
<td>Oil pump driven gear in housing ....................... diametrical clearance:</td>
<td></td>
<td>0.0065L</td>
<td>0.0040L</td>
<td>0.0060L</td>
</tr>
<tr>
<td>11</td>
<td>Tachometer drive shaft in tach drive housing diametrical clearance:</td>
<td></td>
<td>---</td>
<td>0.0015L</td>
<td>0.0030L</td>
</tr>
<tr>
<td>12</td>
<td>Oil seal in mechanical tach drive housing ...... diametrical clearance:</td>
<td></td>
<td>---</td>
<td>0.003T</td>
<td>0.005T</td>
</tr>
<tr>
<td>13</td>
<td>Oil seal in electrical tach drive housing ........ diametrical clearance:</td>
<td></td>
<td>---</td>
<td>0.0015T</td>
<td>0.0065T</td>
</tr>
<tr>
<td><strong>Gear Backlash</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Oil pump driver and driven gears ................... backlash:</td>
<td></td>
<td>0.0160</td>
<td>0.0090</td>
<td>0.0130</td>
</tr>
<tr>
<td>15</td>
<td>Tach drive and driven bevel gears ..................... backlash:</td>
<td></td>
<td>---</td>
<td>0.0040</td>
<td>0.0080</td>
</tr>
<tr>
<td><strong>Spring Test Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Oil pressure relief valve spring compressed to 1.25 inch length load:</td>
<td></td>
<td>30 lbs.</td>
<td>32 lbs.</td>
<td>37 lbs.</td>
</tr>
<tr>
<td>17</td>
<td>Oil temperature control valve 0.090” minimum travel ...................... at oil temperature:</td>
<td></td>
<td>---</td>
<td>120°F</td>
<td>170°F</td>
</tr>
<tr>
<td>18</td>
<td>Oil temperature control valve must close between ...................... oil temperature:</td>
<td></td>
<td>---</td>
<td>168°F</td>
<td>172°F</td>
</tr>
</tbody>
</table>

T=Tight    L=Loose
Figure 10-17. Lubrication System Service Limits
10-8. Engine Cylinder Maintenance

Procedures in this section apply to engine cylinder repair, service, or replacement on condition as a maintenance item and not for engine overhaul. These instructions may be used to replace one or more cylinders as a service action. Refer to instructions in Chapters 12 through 17 for multiple engine cylinder replacement during overhaul.

**WARNING**

*Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.*

Prior to any cylinder maintenance, perform the following:

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Position the fuel shutoff valve to the CLOSED position.
3. Disconnect the battery according to the aircraft manufacturer's instructions.
4. Remove cowling and any aircraft supplied accessories that interfere with cylinder removal according to the aircraft manufacturer’s instructions.
5. Disconnect the ignition harness from the spark plugs on all cylinders.
6. Remove at least one spark plug from each cylinder to avoid developing compression during crankshaft rotation.

10-8.1. Rocker Arm Removal

1. Perform the preliminary steps in Section 10-8 prior to rocker arm removal.
2. Remove the screws (Figure 10-18) (32), lock washers (31), washers (30) and rocker covers (29) from the cylinder; discard the lock washers (31).
3. Remove and discard the rocker cover gaskets (28).
4. Position the crankshaft so the piston is at top dead center and both intake and exhaust valves of the rocker arms to be removed are closed.
5. Bleed the hydraulic valve tappets (54 & 55) down by applying steady pressure to the pushrod end of the rocker arm; pressure relief should be obvious.
6. Bend the tab washers (26) down and remove the screws (27), tab washers (26) and retainers (25). Discard the tab washers (26).
7. Remove the rocker arms (19 & 20), rocker shafts (24), and thrust washers (23) from the cylinder.
8. Withdraw the pushrods (40) from the pushrod housings (35). Mark the location and position of removal to ensure installation in the same position and location.
9. Inspect the rocker assemblies and pushrods according to the instructions in Section 10-8.4.
Figure 10-18. Engine Cylinder

1 Cylinder Assembly 15 Drain Fitting 29 Rocker Cover 43 Baffle
2 Spark Plug Insert 16 Inner Retainer 30 Washer 44 Spring
3 Intake Valve Guide 17 Retainer Key 31 Lock Washer 45 Drain Tube
4 Exhaust Valve Guide 18 Rotocoil 32 Screw 46 Drain Tube Seal
5 Stud 19 Intake Rocker Arm Assembly 33 Exhaust Flange Gasket 47 7th Stud Bracket
6 Stud 20 Exhaust Rocker Arm Assembly 34 Lock Nut 48 7th Stud Bracket
7 Exhaust Stud 21 Rocker Arm Bushing 35 Pushrod Housing 49 Flange Nut
8 Helicoil Insert 22 Drive Screw 36 Washer 50 Cylinder Base O-ring
9 Intake Valve Seat Insert 23 Thrust Washer 37 O-ring Seal 51 Intake Valve Seal
10 Exhaust Valve Seat Insert 24 Rocker Arm Shaft 38 Pushrod Housing Packing 52 Check Valve
11 Intake Valve 25 Retainer 39 Pushrod Housing Spring 53 Valve Spring Retainer
12 Exhaust Valve 26 Tab Washers 40 Pushrod Assembly 54 Hydraulic Exhaust Tappet
13 Inner Spring 27 Screw 41 Flange Nut 55 Hydraulic Intake Tappet
14 Outer Spring 28 Rocker Cover Gasket 42 Flange Nut
10-8.2. Hydraulic Tappet Removal

1. Remove the rocker arm assemblies and pushrods according to instructions in Section 10-8.1.

2. Remove the hydraulic tappets (Figure 10-18) (54 & 55) from the crankcase bores.
   a. Identify the location from which the tappets are removed, they must be installed (if serviceable) in the same location from which they were removed.
   b. Inspect the hydraulic tappets, lifter bores and cam lobes for nicks, scratches, gouging, spalling or galling using the inspection guidance in Chapter 15. Replace hydraulic tappets which exhibit face or body wear exceeding 10% of the surface area. If hydraulic tappets require replacement, inspect the cam lobes of the associated valve for abnormal wear.

3. Inspect the hydraulic tappet retaining rings and pushrod cups. If the spring is collapsed or the spring will not compress, replace the hydraulic tappet. Replace hydraulic tappets which exhibit faulty retaining rings, damaged pushrod cups, or appear to have collapsed or stuck spring mechanisms.

Figure 10-18 repeated for reference
10-8.3. Engine Cylinder Removal

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Do not stand or place equipment within the arc of the propeller.

1. Perform the steps in Section 10-8 and remove the rocker arms according Section 10-8.1 to prior to cylinder removal.

2. Remove Induction System components from each cylinder to be removed according to instructions in Section 12-5.

3. Remove exhaust system components from each cylinder to be removed according to the instructions in Section 12-8.

4. Remove the fuel injector nozzle(s) from the cylinder to be removed according to the instructions in Section 10-2 of M-0, Standard Practice Maintenance Manual.

5. Remove the rocker covers, rocker arms, and pushrods according to the “Rocker Arm Removal” instructions in Section 10-8.1.

6. Remove the pushrod tubes and hydraulic valve tappets according to the instructions in Section 10-8.2.

![Figure 10-18 repeated for reference](image)
Non-Overhaul Repair and Replacement

7. Remove the inter-cylinder baffles according to instructions in Section 12-15.

8. Loosen and remove cylinder drain tubes (Figure 10-18) (45) from each cylinder to be removed.

9. Remove and discard the drain tube seals (46) from each cylinder to be removed.

10. Remove the cylinder drain fitting (15).

11. While removing an engine cylinder, inspect components for wear and conformance to dimensional criteria. Replace any component based on the following:
   a. Only parts that meet service limits may remain in service or be re-used.
   b. If a part fails to meet a service limit tolerance, replace it with a part that meets the specified service limits.

12. Using the appropriate wrenches, carefully remove the flange nuts (41, 42, and 49) from the cylinder base flange and seventh stud locations.

13. Remove the 7th stud brackets (47 and 48).

14. As the last pieces of fastening hardware are removed, cradle the cylinder in your arm for support.

   CAUTION: The piston will be damaged if allowed to drop as the cylinder is withdrawn.

15. While supporting the cylinder, carefully pull the cylinder outward in a straight plane with one hand, keeping the other hand free to catch the piston as the cylinder is withdrawn to prevent damage to the crankcase or cylinder.

16. Remove the piston pin (Figure 10-20) (6) and piston (1) from the connecting rod. Inspect the piston pin (6). Remove and discard the piston rings (2 through 5).

![Figure 10-19. Cylinder Base O-Ring Used to Secure the Connecting Rods](image)

17. Remove the cylinder base O-ring (Figure 10-18) (50). Install the old O-ring in a figure 8 (Figure 10-19) pattern to support the connecting rod.
18. Repeat steps 11 through 17 for each cylinder to be removed.

19. Disassemble the cylinder necessary to complete repairs according to instructions in Section 13-7.

   a. Clean the cylinder according to the “Cylinder Cleaning” instructions in Section 12-1.1 of M-0, Standard Practice Maintenance Manual.

   b. Clean the cylinder according to the “Piston Cleaning” instructions in Section 12-1.2 of M-0, Standard Practice Maintenance Manual.

      **CAUTION:** Do not use automotive-type piston scrapers to clean piston ring lands.

   c. Perform “Fluorescent Penetrant Inspection” and “Magnetic Particle Inspection” according to instructions in Chapter 11 of M-0, Standard Practice Maintenance Manual.

   d. Perform a dimensional inspection on the cylinder, the piston, and components according to the “Engine Cylinder Dimensional Inspection” instructions in Section 15-7.3, using the “Cylinder Service Limits” in Section 10-8.4.1.

20. Remove the hydraulic tappets according to instructions in Section 10-8.7.

21. Perform a static leak check to confirm the cylinder static seal (Figure 10-21).

   a. Place a fiber drift on the rocker arm directly over the valve stem.
Non-Overhaul Repair and Replacement

**CAUTION:** Do not allow the fiber drift to contact the valve spring retainer or rotocoil.

b. Tap the drift several times with a hammer to dislodge any debris that may be between the valve face and seat.

c. Invert the removed cylinder with the spark plugs installed.

d. Fill the inverted cylinder bore with nonflammable solvent.

e. Look for leaks in the static seal area of the cylinder. Pay particular attention to the barrel to cylinder head junction. If the cylinder head and barrel seal is leaking, discard the cylinder. If the intake or exhaust seat seals or the spark plug seals are leaking, note the discrepancy and perform the appropriate repairs in Chapter 15.

![Cylinder Static Seal](image)

**Figure 10-21. Cylinder Static Seal**

22. Assemble serviceable cylinders according to the “Engine Cylinder Assembly” instructions in Section 16-7 and install the cylinder according to the “Cylinder Installation” instructions in Section 10-8.5.

**10-8.4. Engine Repair Cylinder Dimensional Inspection**

1. Inspect the “power stroke stress areas” of the crankcase according to instructions in Section 6-4.12 of M-0, Standard Practice Maintenance Manual.

2. Inspect cylinder bore dimensions according to the specifications in Section 10-8.4.1. Grind cylinder bores that do not conform to the standard size dimensions to the next oversize dimension up to 0.015 inch oversize maximum. (Refer to “Cylinder Bore Honing” in Section 15-8.9.7 for cylinder barrel grinding and honing instructions.)
3. Inspect the cylinder base flanges for flatness with a straightedge and a feeler gauge. If a flange exceeds 0.001 inches out of flat, replace the cylinder.

4. Inspect the intake and exhaust flange studs and rocker hold down fastener threads using a thread gauge. If studs are loose or bent, or if the threads are damaged or disfigured, determine the appropriate oversize stud and replace according to instructions in Appendix C-6 of M-0, Standard Practice Maintenance Manual.

5. Inspect the inside diameter of the valve guides using the “Cylinder Service Limits” in Section 10-8.4.1. Replace cracked, eroded, burned, or pitted valve guides or valve guides which fail to meet service limits.

6. Inspect the valve seats for indications of burning, pitting erosion, or cracks. Check the valve seat dimensions according to the “Cylinder Service Limits” in Section 10-8.4.1. Replace valve seats that are cracked, eroded, burned or pitted or valve seats that are not within the service limits according to instructions in Section 15-8.9.

   NOTE: A two-dimensional illustration of the intake and exhaust valve is provided in Figure 10-27.

7. Perform a visual inspection on the intake and exhaust valves; if the valve face is mushroomed, or if the valve face exhibits seat pounding (face angle is concave), or the valve exhibits burns, cracks, pitting, erosion, or corrosion, replace the valves.

8. Using a V-block with a surface plate and a dial indicator, inspect each intake and exhaust valve face for runout (eccentricity). Discard valves if they exceed “Cylinder Service Limits” in Section 10-8.4.1 run-out specifications.

9. Inspect the outside diameter of the intake and exhaust valve stems using a micrometer and the “Cylinder Service Limits” in Section 10-8.4.1. Replace the valve if the outside diameter of the valve stem measures less than the service limits.

10. Inspect the intake and exhaust valve head gauge line diameter using a micrometer and the “Cylinder Service Limits” in Section 10-8.4.1. Replace the valve if the gauge line diameter measure less than the service limit.

11. Perform a dimensional inspection on the intake and exhaust valves using the service limits in Section 10-8.4.1. Replace the valve if they fail to meet the service limits or cannot be restored to service limits by grinding.
   a. Clean the valves with mineral spirits and allow to dry.
   b. Use a precision valve grinding machine to restore the valve contact seat dimensions and geometry to the service limits specified in Section 10-8.4.1.
      1) Thickness from the gauge line to the bottom of the valve and gauge line outer diameter must not be less than the specified service limit. Discard valves if the overall length (stem to gauge line plus gauge line to bottom) is less than the service limit or if the outer diameter of the valve at the gauge line is less than the minimum specified.
      2) After grinding the face, measure from the gauge line to the tip of the valve stem. If the valve exceeds the service limit, grind material from the tip to meet the service limit stem to gauge line and overall lengths.
3) Clean the valves with mineral spirits and allow to dry to remove grinding residue.

c. Inspect the valve contact seat angle with an optical comparator after grinding; if the angles fail to meet the service limits, repeat the grinding process.

d. Inspect the surface finish of the valves with a profilometer; polish as required to meet the service limits.

e. Perform a “Magnetic Particle Inspection” (Section 11-3 of M-0, Standard Practice Maintenance Manual) on the intake and exhaust valves. Discard any valve with cracks or indications of cracks.

12. Clean the valves using mineral spirits and air dry. When valves have dried, coat all valve surfaces thoroughly with clean 50-weight aviation engine oil.

13. Measure the diameter of the removed piston pin at three equally spaced points along the length of the piston pin in comparison to the dimensions specified in “Cylinder Service Limits” in Section 10-8.4.1. Rotate the piston pin 90° and repeat the measurements. The piston pin must meet the dimensional limits at each point, out of round is limited to 0.0002 inches. Discard piston pins exceeding the dimensional limits or out of round tolerance.

14. Measure the piston pin bore inside diameter to verify it meets Table 10-10 dimensions. Insert the piston pin in the piston bore to verify the fit meets Table 10-10 specifications.

15. Insert the piston rings in the cylinder, individually, with the ring part number to the top of the cylinder, Use the piston to position the ring to the depth specified for ring gap measurement in Table 10-10.

Figure 10-22. Piston, Piston Pin, and Piston Ring Detail

16. Remove the piston from the cylinder and measure the ring gap at the specified depth in the cylinder. Measure the ring gap using the specifications in Table 10-10.
17. If the piston ring meets the specified gap, proceed to the next ring measurement. If piston ring gap is less than the specified amount, mount a fine toothed flat file in a vise. Hold the ring ends firmly and squarely against the file. In a deliberate back and forth motion, remove small amounts of material. Recheck the end gap in the cylinder until the ring meets the specified measurement.

18. After filing, deburr the ring ends using crocus cloth and thoroughly clean the piston ring with mineral spirits and air dry.

19. Install the new piston rings (Figure 10-20) (2-5) with the part number facing toward the top of the piston using a ring expander.
   a. Install a new expander ring in the new oil control ring groove so the expander gap is 180° away from the oil control ring gap.
   b. Install a new #3 piston ring in the #3 ring groove of the piston with the oil control ring gap at the 12 O’clock (referenced to the piston’s installed position in the cylinder) position.
   c. Install a new second compression ring (3) into the #2 ring groove with the ring gap at the 3 O’clock position.
   d. Install a new top compression ring (2) into the #1 ring groove with the ring gap at the 9 O’clock position.
   e. Install a new oil scraper ring (5) into the fourth ring groove with the ring gap at the 6 O’clock position.

20. Lubricate the piston pin with clean 50-weight aviation engine oil.

21. Match the new piston and ring assembly with the cylinder assembly for which it was measured and gapped. Insert the piston pin in the piston pin bore. The piston pin must slide freely in the piston pin bore.

22. Using a ring compressor, install each piston into its cylinder with top three rings in the cylinder barrel and the piston pin accessible for connecting rod installation.

23. Inspect connecting rod piston pin bushings for excessive wear or missing material. Verify the bushing split line is no closer than 40 degrees to the connecting rod centerline; replace piston pin bushings that fail to meet service limit specifications.

24. Inspect the pushrods for cracks, nicks, burrs, pitting or corrosion. Inspect the rod caps for cracks or erosion. Inspect the pushrods using “Cylinder Service Limits” in Section 10-8.4.1. Verify the rod cap oil passages are clear and the bores meet service limits. Inspect the pushrods length and cap diameter with a micrometer. Rotate the pushrods on a surface plate to inspect for bends. The total runout service limit is 0.003” over the length of the pushrods.
25. Inspect pushrod housings for cracks, dents, bending or chafing damage; discard pushrod housings exhibiting these conditions. Inspect pushrod housings for rust, pitting or missing cadmium plating; discard pushrod housings exhibiting these conditions.

26. Dry fit the rocker arms in the rocker arm boss to dimensionally inspect the rocker arm thrust width using “Cylinder Service Limits” in Section 10-8.4.1 specifications; replace rocker arms if they cannot be ground and polished to meet service limits.
   a. Inspect the rocker arm foot contact area for wear, galling, spalling, scoring, or grooves; discard rocker arms exhibiting these conditions.
   b. Inspect the rocker arm ball seat for wear and smoothness; discard rocker arms with gouged, scratched, etched, pitted or mushroomed ball seats.
   c. Inspect the thrust surfaces of the rocker arm shaft bore for displaced metal, spalling, or galling; discard rocker arms exhibiting these conditions if they cannot be smoothed to service limits.
   d. Inspect rocker arm exhibiting peeling copper plating, which can be a source of contamination in oil and spectrographic oil analysis. Use a scotch-brite pad to remove loose copper plating material.
   e. Inspect for and discard rocker arms with loose or missing oil passage drive screws or rivets. Inspect rocker arm oil passages for obstructions. Use an oil squirt bottle with clean 50 weight aviation engine oil to check oil passages for free flow. Discard rocker arms if oil passages cannot be cleared with solvent.

27. Inspect the Intake and Exhaust Valve Springs according to the service limits in Section 10-8.4.1. Replace valve springs which fail the dimensional inspection or exhibit cracks, abnormal curvature or excessive wear.

28. Perform a dimensional inspection on the connecting rod(s), if removed, according to the instructions in Section 15-7.2.1 using the service limits in Section 10-8.4.1.
10-8.4.1. Cylinder Service Limits

Refer to the “Cylinder Assembly Service Limits” in Table 10-10 and corresponding Figure 10-24. Clean and dry the parts thoroughly according to “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual. Remove oil and preservative material before performing the dimensional inspection. Discard and replace parts that do not conform to the specified tolerances.

**WARNING**

Use only parts that meet the specified service limits.

**Table 10-10. Cylinder Assembly Service Limits**

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cylinder bore (lower 4-1/4 inch of barrel)</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cylinder bore (5.75 inch into barrel)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cylinder bore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cylinder bore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cylinder bore surface (Nitrided Barrels)</td>
<td>22° - 32°</td>
<td>22° - 32°</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Cross hatch angle:</td>
<td>35-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Finish in micro-inches $R_a$:</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cylinder barrel in crankcase</td>
<td>0.013L</td>
<td>0.0040L</td>
<td>0.0100L</td>
</tr>
<tr>
<td>7</td>
<td>Intake valve seat insert in cylinder head</td>
<td>0.0001T</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>8</td>
<td>Intake valve guide in cylinder head</td>
<td>0.0001T</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>9</td>
<td>Exhaust valve guide in cylinder head</td>
<td>0.001T</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>10</td>
<td>Exhaust valve seat insert in cylinder head</td>
<td>0.0007T</td>
<td>0.00070T</td>
<td>0.0100T</td>
</tr>
<tr>
<td>11</td>
<td>Intake valve seat</td>
<td>Figure 10-25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Exhaust valve seat</td>
<td>Figure 10-26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exhaust valve seat-to-valve guide</td>
<td>45° 00'</td>
<td>44° 30'</td>
<td>45° 00'</td>
</tr>
<tr>
<td></td>
<td>Intake valve seat-to-valve guide</td>
<td>60° 15'</td>
<td>59° 30'</td>
<td>60° 00'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Rocker shaft in cylinder head bosses</td>
<td>0.0031L</td>
<td>0.0005L</td>
<td>0.0031L</td>
</tr>
<tr>
<td>14</td>
<td>Rocker arm bushing bore</td>
<td>0.8755</td>
<td>0.8725</td>
<td>0.8755</td>
</tr>
<tr>
<td>15</td>
<td>Rocker arm</td>
<td>0.0150L</td>
<td>0.0020</td>
<td>0.0150</td>
</tr>
<tr>
<td>16</td>
<td>Intake valve guide</td>
<td>0.0050L</td>
<td>0.4350</td>
<td>0.4362</td>
</tr>
<tr>
<td>17</td>
<td>Exhaust valve guide</td>
<td>0.0062L</td>
<td>0.4370</td>
<td>0.4380</td>
</tr>
<tr>
<td>18</td>
<td>Intake valve face-to-stem</td>
<td>60° 15'</td>
<td>60° 00'</td>
<td>60° 15'</td>
</tr>
<tr>
<td>19</td>
<td>Exhaust valve face-to-stem</td>
<td>45° 15'</td>
<td>45° 00'</td>
<td>45° 15'</td>
</tr>
<tr>
<td>20</td>
<td>Intake valve gauge line-to-stem</td>
<td>Figure 10-27</td>
<td>Replace 100%</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Exhaust valve gauge line-to-stem</td>
<td>Figure 10-27</td>
<td>Replace 100%</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Intake &amp; Exhaust valve face-to-stem</td>
<td>0.0015</td>
<td>0.0000</td>
<td>0.0015</td>
</tr>
<tr>
<td>23</td>
<td>Rocker arm foot to valve stem (dry valve)</td>
<td>0.060 - 0.200</td>
<td>0.060</td>
<td>0.200</td>
</tr>
</tbody>
</table>
## Table 10-10. Cylinder Assembly Service Limits

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Service Limit</th>
<th>New Part Minimum (inches)</th>
<th>New Part Maximum (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pistons, Rings, and Pins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Piston, non-coated in cylinder(^1)..............diametric clearance:</td>
<td>0.011L(^2) 0.010L(^3)</td>
<td>0.008L(^2) 0.007L(^3)</td>
<td>0.011L(^2) 0.010L(^3)</td>
</tr>
<tr>
<td></td>
<td>Piston, manganese phosphate......................diametric clearance:</td>
<td>0.012L(^2) 0.011L(^3)</td>
<td>0.009L(^2) 0.008L(^3)</td>
<td>0.012L(^2) 0.011L(^3)</td>
</tr>
<tr>
<td>25</td>
<td>Top piston ring in groove .......................side clearance:</td>
<td>0.006L</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>26</td>
<td>Second piston ring in groove ....................side clearance:</td>
<td>0.006L</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>27</td>
<td>Third piston ring in groove .....................side clearance:</td>
<td>0.0075L</td>
<td>0.0035</td>
<td>0.0055</td>
</tr>
<tr>
<td>28</td>
<td>Fourth piston ring in groove ....................side clearance:</td>
<td>0.0100L</td>
<td>0.0060</td>
<td>0.0080</td>
</tr>
<tr>
<td></td>
<td>Dimensions for items 29A -32A apply only to Post-Gold Standard Cylinders (5.251-5.253 Dia. Cylinder Bore)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29A</td>
<td>Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel)........gap:</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30A</td>
<td>Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)(^4)....gap:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31A</td>
<td>Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel)........gap:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32A</td>
<td>Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel)........gap:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dimensions for items 29B -32B apply only to Pre-Gold Standard Cylinders (5.252-5.254 Dia. Cylinder Bore)</td>
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<td></td>
</tr>
<tr>
<td>29B</td>
<td>Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel)........gap:</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30B</td>
<td>Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)(^4)....gap:</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>31B</td>
<td>Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel)........gap:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32B</td>
<td>Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel)........gap:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Piston pin in piston ................................diametric clearance:</td>
<td>0.0013L</td>
<td>0.0001L</td>
<td>0.0007L</td>
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<tr>
<td>34</td>
<td>Piston pin ............................................diameter:</td>
<td>1.1243</td>
<td>1.1243</td>
<td>1.1245</td>
</tr>
<tr>
<td>35</td>
<td>Piston pin in cylinder ................................end clearance:</td>
<td>0.0480L</td>
<td>0.0100L</td>
<td>0.0340L</td>
</tr>
<tr>
<td>36</td>
<td>Piston pin in connecting rod bushing ..............diametric clearance:</td>
<td>0.0040L</td>
<td>0.0012L</td>
<td>0.0018L</td>
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<tr>
<td>37</td>
<td>Bushing in connecting rod ..........................diametric clearance:</td>
<td>0.0050T</td>
<td>0.0025T</td>
<td>0.0050T</td>
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<tr>
<td>38</td>
<td>Bolt in connecting rod ..............................diametric clearance:</td>
<td>0.0023L</td>
<td>0.0000L</td>
<td>0.0018L</td>
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<tr>
<td>39</td>
<td>Connecting rod bearing on crankpin...............diametric clearance:</td>
<td>0.0034L</td>
<td>0.0009L</td>
<td>0.0034L</td>
</tr>
<tr>
<td>40</td>
<td>Connecting rod on crankpin ......................end clearance:</td>
<td>0.0160</td>
<td>0.0060</td>
<td>0.0110</td>
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<tr>
<td>41</td>
<td>Connecting rod bearing and bushing twist ......per inch of length:</td>
<td>See M-0, Section 10-9.4</td>
<td></td>
<td></td>
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<tr>
<td>42</td>
<td>Hydraulic tappet in crankcase ..................diametric clearance:</td>
<td>0.0035L</td>
<td>0.0010L</td>
<td>0.0025L</td>
</tr>
<tr>
<td>43</td>
<td>Inner valve spring 654442 compressed to 1.230(^\circ)</td>
<td>67 Lbs.</td>
<td>70.3 Lbs.</td>
<td>77.3 Lbs.</td>
</tr>
<tr>
<td>44</td>
<td>Outer valve spring 654441 compressed to 1.725(^\circ)</td>
<td>98 Lbs.</td>
<td>101.8 Lbs.</td>
<td>111.4 Lbs.</td>
</tr>
<tr>
<td>45</td>
<td>Installed outer valve spring ....................height:</td>
<td>1.791 inches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** T = Tight and L = Loose

1. Measured below fourth ring groove, perpendicular to piston pin bore
2. Pre-Gold Standard Dimension
3. Post-Gold Standard Dimension
4. Second ring gap is nominally 0.006" larger than the top ring
Figure 10-24. Cylinder Assembly Service Limits
Non-Overhaul Repair and Replacement

NOTE: See Section D-6 for Intake and Exhaust Valve Seat Machining Dimensions.

Figure 10-25. Intake Valve Seat Dimensions

Figure 10-26. Exhaust Valve Seat Dimensions
Non-Overhaul Repair and Replacement

Figure 10-27. Valve Service Limits
10-8.5. Cylinder Installation

Replace worn or out of tolerance components based on the following criteria:

- Only parts that meet *service limits* may remain in service.
- If a part has reached a service limit tolerance, it must be replaced with a part that conforms to the specified new part tolerances or service limits.
- Clean the cylinders according to “Cylinder Cleaning” instructions in Section 12-1.1 of M-0, Standard Practice Maintenance Manual.
- Clean pistons according to “Piston Cleaning” instructions in Section 12-1.1 of M-0, Standard Practice Maintenance Manual.
- Perform fluorescent penetrant, magnetic particle, and dimensional inspections on specified cylinder and piston parts according to instructions in Chapter 15.
- Install serviceable hydraulic tappets in the same location from which they were removed.
- Assemble cylinders which meet the inspection criteria and service limits according to Section 16-7, “Engine Cylinder Assembly” instructions with serviceable pistons and new piston rings.

**WARNING**

*Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads.* The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. **USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.**

**Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections.** Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. **Do not stand or place equipment within the arc of the propeller.**

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Inspect a new cylinder base O-ring (Figure 10-18) (50) for cracks or deformities. Lubricate the serviceable, new cylinder base O-ring (50) with clean 50-weight aviation engine oil.
3. Install the new cylinder base O-ring (50), lubricated with clean 50-weight aviation engine oil on the cylinder base flange; verify the O-ring is not twisted on the cylinder base flange after installation.
4. Clean the cylinder deck and stud threads with Stoddard solvent; use a narrow brush to clean threaded holes; deck and stud holes must be free of dirt and debris.

5. Lubricate cylinder through-bolt and deck stud threads using clean 50 weight aviation engine oil.

6. Install a conforming piston (Figure 10-20) (1) with new piston rings (2 through 5) partially in the cylinder bore.

7. When installing the piston on the connecting rod, use care not to drop the connecting rod on the cylinder deck to avoid damaging the crankcase cylinder deck. Carefully rotate the crankshaft, placing the connecting rod of the cylinder being installed in the outermost position. Remove the O-ring (Figure 10-19) that was installed for connecting rod support.

8. Back the piston (Figure 10-20) (1) out far enough to allow the piston pin (6) to be installed on the connecting rod. Place the cylinder assembly and piston on the connecting rod.

9. Line the piston (1) up with the connecting rod and slide the piston pin (6) into the connecting rod.
10. Using a ring compressor, compress the fourth piston ring and push the cylinder until the fourth piston ring is positioned inside the cylinder barrel.

11. Remove the ring compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.

12. While supporting the cylinder, install, but do not torque, the cylinder flange nuts (Figure 10-18) (41 and 42).

13. Install the 7th stud brackets (47 and 48) and flange nut (49). The 7th stud nuts have a conical seat.

14. For single cylinder replacement, torque the cylinder fastening hardware according to the “Cylinder Torque” instructions in Section 10-8.6. For multiple cylinder replacement, torque the cylinder fastening hardware for each cylinder being installed according to the “Cylinder Torque” instructions in Section 10-8.6, steps 1 & 2. When all cylinders are installed, torque all cylinder and crankcase fasteners according to the instructions in Section 17-3.1. If re-torquing fasteners that were not removed during this maintenance action, apply torque to the specified torque value.

15. Rotate the crankshaft through multiple revolutions to verify smooth rotation of the crankshaft. If rotation is not smooth or binding is evident, disassemble the engine to determine the cause. Verify crankshaft end play (end clearance) is within the tolerance specified in Table D-13. If no end play is present, disassemble the engine to determine the cause.

16. Install the hydraulic tappets and pushrod housings according to instructions in Section 10-8.7.

17. Install the valve train according to instructions in Section 10-8.8.

18. Install the Inter-Cylinder Baffles according to instructions in Section 17-3.2.

19. Install the drain tube fittings (Figure 10-18) (15) and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

20. Install new drain tube seals (46) and the cylinder drain tubes (45). Torque the “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

21. Install the spark plugs and ignition harness according to the “Ignition System Maintenance” instructions in Section 6-4.9 of M-0, Standard Practice Maintenance Manual.

22. Install the Exhaust System according to instructions in Section 17-12.1.

23. Install the fuel injector nozzles according to instructions in Section 10-2.3 of M-0, Standard Practice Maintenance Manual.

24. Install the Induction System components according to instructions in Section 17-12.1.

25. Set the aircraft Fuel Selector Valve to the ON position and activate the fuel boost pump to leak check the fuel delivery system, including fuel lines and fittings.
Non-Overhaul Repair and Replacement

*CAUTION:* Service the engine with SAE J1966 mineral oil for engine break-in.

26. Service the engine with mineral oil according to instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

27. Install the any aircraft-supplied accessories (removed to facilitate engine maintenance) and aircraft cowling according to the aircraft manufacturer’s instructions.

28. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

29. Perform the “25-Hour Initial Operation Inspection” in Section 6-3.2 after the first 25 hours of engine operation. When oil consumption has stabilized, replace the mineral oil with ashless dispersant aviation engine oil according to Section 6-4.8 of M-0, Standard Practice Maintenance Manual.
10-8.6. Cylinder Torque

CAUTION: This cylinder torque procedure is for single cylinder installation. For complete engine assembly and torque, refer to instructions in Chapter 17.

Proper cylinder installation requires adherence to the torque sequence listed below using two people:

1. Lubricate the cylinder base stud threads, through-bolt threads and nut threads on **BOTH sides** of the engine with clean, 50-weight aviation oil.

   **WARNING**

   Failure to torque through-bolt nuts on both sides of the engine may result in a loss of main bearing crush, main bearing shift, crankshaft fracture, and engine failure.

2. Install and torque the through-bolt nuts and cylinder base nuts in the sequence shown in Figure 10-28 to one half (1/2) of the final torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Torque the through-bolt nuts and cylinder base nuts in the sequence shown in Figure 10-28 to the full final torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Torque the through-bolt nuts on both sides of the engine (even if only one cylinder is being installed).

Figure 10-28. Single Cylinder Torque Sequence
10-8.7. Hydraulic Tappet Installation

1. Perform the dimensional inspection listed in Section 10-8.4 that apply to the hydraulic tappets (lifters) and pushrod tubes. Replace parts which fail to meet the service limits.

2. Gather the replacement parts necessary to comply with “100% Parts Replacement Requirements” criteria in Section C-2.3 of M-0, Standard Practice Maintenance Manual.

3. Lubricate all tappet faces using Dow Corning® G-N Paste, or equivalent. Lubricate the tappets with clean 50-weight aviation engine oil.

4. Install the serviceable hydraulic valve tappets in the bores from which they were removed. Install new hydraulic tappets to replace those which failed inspection.

5. Install new hydraulic exhaust tappets (wide groove on the tappet body) into the aft tappet guides in cylinders on the 1-3-5 side of the crankcase and in the forward tappet guides for cylinders on the 2-4-6 side of the crankcase.

6. Install new hydraulic intake tappets (narrow groove on the tappet body) into the forward tappet guides in cylinders on the 1-3-5 side of the crankcase and in the aft tappet guides for cylinders on the 2-4-6 side of the crankcase.

    NOTE: Install the pushrod housings nearest to engine mount brackets first. The Pushrod Spring Compressor Tool must lie close to horizontal to clear the crankcase flange.

7. Using a Kent-Moore Part No. 68-3 Pushrod Spring Compressor (Section 2-1, “Special Tools” in M-0, Standard Practice Maintenance Manual) or equivalent, compress the pushrod housing spring (Figure 10-18) (39).

8. Place a new packing (38) between the two steel washers (36), and install on the crankcase end of the pushrod housing (35).

9. Position the pushrod housings (35) into respective crankcase tappet bores.

10. While the spring (39) is compressed insert the crankcase end of the pushrod housing (35) in the crankcase bore and slide a new O-ring seal (37) on the cylinder end of the pushrod housing.

11. Guide the cylinder end of the pushrod housing (35) into the cylinder head bore while releasing the tension on the pushrod spring (39) with the Pushrod Spring Compressor Tool.

12. Remove the Pushrod Spring Compressor Tool from the pushrod and verify the O-ring seal (37), packing (38), and washers (36) are properly positioned.

13. Install the pushrods, rocker arms, and rocker covers according to instruction in Section 10-8.8.

14. Install any aircraft equipment, accessories, and cowling removed to facilitate hydraulic tappet replacement according to the aircraft manufacturer’s instructions.
15. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

10-8.8. Rocker Arm Installation

NOTE: In 2016, exhaust rocker arms were redesigned to increase lubricant flow volume to the valve train. The bottom of the improved exhaust rocker arms have two oil feed holes; intake rocker arms have only one oil feed hole.

1. With the engine upright, lubricate the pushrods (Figure 10-18) (40) with clean 50-weight aviation engine oil and install the pushrods through the cylinder openings into the pushrod housings (35).

2. Before installing the valve actuating parts on each cylinder, turn the crankshaft until the pushrods are at their lowest position in the cylinder.

3. Lubricate the intake and exhaust rocker arms (19 & 20), new thrust washers (23) and new rocker shafts (24) with clean 50-weight aviation engine oil.

4. Slide the shaft (24) into the rocker arm assembly with a new thrust washer on each side of the rocker shaft.

   CAUTION: Ensure the intake and exhaust rocker arms are installed on the correct intake and exhaust valve positions.

5. Install the rocker and shaft assemblies on the rocker arm boss with retainers (25), new tab washers (26) and screws (27). Verify clearance of 0.020 inches between the rocker arm (Figure 10-29) and rotocoil/retainer. The underside of the rocker arm may be smoothly ground to attain the 0.020-inch minimum clearance using “Rocker Arm-to-Retainer Clearance” instructions in Section 15-8.9.19.

6. Check the side clearance (Figure 10-30) between the retainers and rocker arms with a feeler gauge; the side clearance must be 0.002 - 0.015 inches. If side clearance exceeds the allowable amount, replace the thrust washers with a thicker (oversize) thrust washer to reduce side clearance to the proper tolerance.

*Figure 10-29. Rocker Arm to Retainer Clearance*
Non-Overhaul Repair and Replacement

Figure 10-30. Rocker Arm Side Clearance

7. Torque the screws (Figure 10-18) (27) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   CAUTION: Do not over- or under-torque bolts to align tab washers; replace the bolt and re-torque to obtain proper alignment.

8. Secure the rocker assembly to the cylinder with a new tab washers (26) according to “Tab Washer Installation” instructions in Appendix C-4 of M-0, Standard Practice Maintenance Manual. Do not re-align the screw head to the tab washer.

9. Measure the dry valve lash at valve tip-to-rocker foot with the piston at top dead center; compare with limits in Section 10-8.4.1. Replace the pushrods with authorized over size pushrods (P030) if the dry valve lash exceeds the maximum limit.

10. Install the rocker covers (29) with a new rocker cover gaskets (28) (beaded side of the gasket toward the rocker cover); secure the rocker covers with screws (32), new lock washers (31) and washers (30). Torque the rocker cover screws (32) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Perform an “Engine Operational Check” according to instructions in Section 6-4.7 of M-0, Standard Practice Maintenance Manual.

12. Install the aircraft cowling according to the aircraft manufacturer’s instructions.
10-9. Crankshaft Nose Oil Seal Replacement

Refer to the “Crankcase Nose Oil Seal Replacement” instructions in Section 10-10 of M-0, Standard Practice Maintenance Manual.

10-10. Crankcase Repair

See Section 15-8.10, “Crankcase Overhaul Repair.”
10-11. Turbocharger and Exhaust System Repairs

A mandatory one time inspection (Ref: MSB07-4) is required for engine serial numbers listed in Table 10-11 or engines with turbochargers replaced between March and July 2007. Consult the engine log book to verify compliance with MSB07-4 if your engine serial number is listed in Table 10-11. If the engine log book contains no record of compliance with MSB07-4, discontinue flight until the inspection is complied with.

### Table 10-11. Engine Model and Serial Numbers Affected by MSB07-4

<table>
<thead>
<tr>
<th>Engine Model</th>
<th>Serial Number</th>
<th>Engine Model</th>
<th>Serial Number</th>
<th>Engine Model</th>
<th>Serial Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSIO550C</td>
<td>802854</td>
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<td>802867</td>
<td>TSIO550G</td>
<td>915041</td>
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<td>TSIO550G</td>
<td>915040</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**

Turbocharger and exhaust system weld repairs may only be performed by an FAA Part 145 authorized repair station certified to perform the specific repairs.

Refer to Section 12-8 for complete Turbocharger and Exhaust System removal instructions and Section 17-12.1 for Turbocharger and Exhaust System installation instructions.

### 10-11.1. Turbocharger Replacement

Instructions for turbocharger replacement are different, depending on engine model. Refer to the instructions in Section 10-11.1.1 or Section 10-11.1.2 applicable to the subject engine model.
10-11.1.1. TSIO-550-B, C, E, G & K Turbocharger Replacement

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Loosen the hose clamp and disconnect the induction tube from the compressor inlet.
3. Disconnect the air duct from the compressor housing according to the aircraft manufacturer’s instructions.
4. Place a suitable oil receptacle below the turbocharger oil reservoir. Disconnect the turbocharger oil supply and return hoses from the turbocharger oil inlet adapter and the turbocharger oil reservoir.
5. Remove the exhaust tailpipe according to instructions in Section 10-11.2.
6. Remove four lock nuts (Figure 10-34) (28), washers (27) and bolts (26) from the mounting turbo transition (5 or 6) and turbocharger (24) mounting flanges; discard the lock nuts (28).
7. Remove and discard the gasket (23).

**NOTE:** TSIO-550-B, C, E, G & K turbochargers (Figure 10-34) (24) are mounted to brackets (29 and 30) in specific orientations, based on the installed position, as shown in Figure 10-34, remove only the turbocharger mounting bolts necessary to facilitate turbocharger replacement.

<table>
<thead>
<tr>
<th>To remove the left side (2-4-6) turbocharger:</th>
<th>To remove the right side (1-3-5) turbocharger:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove bolts 3 and 4 (Figure 10-31).</td>
<td>Remove bolts 1 and 2 (Figure 10-31).</td>
</tr>
</tbody>
</table>

![Figure 10-31. Turbocharger Bracket Orientation](image)
Non-Overhaul Repair and Replacement

NOTE: The turbocharger support bracket is shaped differently on the TSIO-550-K model engine but the installation instructions are the same.

8. Orient the turbocharger to the bracket (Figure 10-31) on the correct side of the engine.

9. Install the bolts and new locking tab washers; torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Secure the tab washers according to instructions in Appendix C-4 of M-0, Standard Practice Maintenance Manual.

10. Install the new turbocharger on the turbocharger transition (Figure 10-32) (5 or 6) with a new gasket (23). Secure the turbocharger to the turbocharger transition with bolts (26), washers (27), and new lock nuts (28); torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Install the exhaust tailpipe according to instructions in Section 10-11.2.

12. Pre-oil the turbocharger before starting the engine according to the instructions in Section 10-11.1.3.

13. Connect the air duct to the compressor housing according to the aircraft manufacturer’s instructions.

14. Perform a ground engine run after turbocharger replacement; monitor the turbocharger oil fittings for leaks.
Figure 10-32. Turbocharger Installation Detail

see Figure 10-34 for index
10-11.1.2. TSIO-550-N Turbocharger Replacement

1. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.
2. Loosen the hose clamp and disconnect the induction tube from the compressor inlet.
3. Disconnect the air duct from the compressor housing according to the aircraft manufacturer’s instructions.
4. Place a suitable oil receptacle below the turbocharger oil reservoir. Disconnect the turbocharger oil supply and return hoses from the turbocharger oil inlet adapter and the turbocharger oil reservoir.
5. Remove the exhaust tailpipe according to instructions in Section 10-11.2.
   NOTE: Leave the turbocharger support bracket assembly intact for turbocharger replacement.
6. Remove four lock nuts (Figure 10-33) (28), washers (27) and bolts (26) from the turbo transition (5 or 6) and turbocharger (24) mounting flanges and support bracket (29 or 30); discard the lock nuts (28).
7. Remove and discard the gasket (23).
8. Install the new turbocharger on the turbocharger transition (5 or 6) with a new gasket (23). Secure the turbocharger to the turbocharger transition with bolts (26), washers (27), and new lock nuts (28); torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
9. Install the exhaust tailpipe according to instructions in Section 10-11.2.
10. Pre-oil the turbocharger before starting the engine according to the instructions in Section 10-11.1.3.
11. Connect the air duct to the compressor housing according to the aircraft manufacturer’s instructions.
12. Perform a ground engine run after turbocharger replacement; monitor the turbocharger oil fittings for leaks.
Figure 10-33. Turbocharger Installation Detail
10-11.1.3. Turbocharger Pre-Oiling

1. Temporarily connect a length of clear hose to the oil reservoir return fitting and direct the open end of the hose into the oil receptacle.

2. Using a funnel and suitable hose, add clean 50-weight aviation engine oil to the turbocharger oil inlet fitting until oil flows steadily from the turbocharger oil reservoir fitting. Raise the open end of the clear hose above the turbocharger oil inlet fitting to stop the flow of oil.

3. Manually turn the compressor wheel to distribute oil through the turbocharger.

4. Connect the turbocharger oil supply hose to the turbocharger oil inlet adapter.

5. Disconnect the clear hose from the turbocharger oil reservoir return fitting and connect the turbocharger oil return hose to the turbocharger oil reservoir fitting.


7. Place the mixture control in the IDLE CUT-OFF position and close the throttle.

8. Temporarily install jumper wires between the magneto P-leads and aircraft ground to disable the ignition.

9. Engage the starter two to three times, not to exceed 10 seconds per engagement, to force any remaining air from the lubrication system. Remove the temporary jumper wires from the magneto P-leads.

10. Service the engine oil according to the instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.

11. Return to the turbocharger installation instructions to complete the procedure.
Intentionally Left Blank
10-11.2. Exhaust Tailpipe or Heater Muff Replacement

The optional heater muff replaces the right tailpipe. The heater muff cannot be repaired or removed from the tailpipe since it is an integral part of the tailpipe. Replace a heater muff/tailpipe exhibiting signs of cracking, corrosion or erosion.

**WARNING**

Turbocharger and exhaust system weld repairs may only be performed by an FAA Part 145 authorized repair station certified to perform the specific repairs.

10-11.2.1. Exhaust Tailpipe or Heater Muff Removal

1. Allow the engine (and exhaust system) to cool prior to commencing exhaust system removal to avoid burn injuries.

**WARNING**

Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.

*CAUTION: Stretching the V-band clamp excessively will cause undue stress on the outer band and lead to premature V-band clamp failure.*

2. Turn the Ignition Switch to the OFF position and disconnect engine electrical power.

3. If the left tailpipe is to be removed, remove the four bolts (Figure 10-34) (19), washers (20), and lock nuts (21) connecting the tailpipe to the wastegate (18). Remove the gasket (17); discard the gasket and lock nuts (21).

4. Remove the safety wire and nut from the V-band clamp. Gently spread the V-band clamp and work the edges away from the turbocharger flange, onto the heater muff/tailpipe flange. Remove the heater muff/tailpipe (14 or 15).
Figure 10-34. Composite Turbocharger and Exhaust System

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Turbo Transition
6. Turbo Transition
7. Riser
8. Crossover Assembly
9. Transition
10. Bushing
11. Tie Rod
12. Bolt
13. Lock Nut
14. Contoured Tailpipe
14A. Straight Tailpipe
14B. Inverse Tailpipe Option
15. Contoured Tailpipe
15A. Straight Tailpipe
15B. Inverse Tailpipe Option
15C. Heater Shroud Option
16. V-band clamp
17. Gasket
18. Wastegate Assembly
19. Bolt
20. Washer
21. Lock Nut
22. Controller
23. Gasket
24. Turbocharger Assembly
25. Gasket
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Screw
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose
10-11.2.2. Exhaust Tailpipe or Heater Muff Installation

1. Inspect the heater muff/tailpipe according to applicable steps in Section 6-4.21 of M-0, Standard Practice Maintenance Manual. Gently spread a serviceable V-band clamp over the heater muff/tailpipe (Figure 10-35) (14 or 15) flange in a twisting motion. Continue to spread and twist the V-band clamp over the flange to allow the clamp to rest just behind the flange.

2. If the left tailpipe/heater is being installed, place a new gasket between the tailpipe and wastegate flanges and secure the tailpipe to the wastegate with four bolts (19), washers (20), and new lock nuts (21).

   **CAUTION:** Do not use the V-Band clamp to align the turbocharger and tailpipe flanges. Align the flanges before attempting to tighten the clamp.

3. Install a new heater muff/tailpipe (14 or 15) by pushing the tailpipe exhaust flange against the turbine exhaust flange. Verify the tailpipe and turbocharger flanges mate squarely and secure the assembly according to instructions in Section 10-11.3, “Multi-Segment V-Band Clamp Replacement.”

---

**Figure 10-35. Tailpipe and V-Band Clamp Detail**

*See Figure 10-34 for Index*
10-11.3. Multi-Segment V-Band Clamp Replacement

10-11.3.1. Multi-Segment V-Band Clamp Removal

1. Remove the exhaust tailpipe (or heater muff) according to instructions in Section 10-11.2.1, “Exhaust Tailpipe or Heater Muff Removal.”

2. Gently spread the V-band clamp over the removed exhaust flange; inspect the clamp according to the applicable steps in Section 6-4.21 of M-0, Standard Practice Maintenance Manual. Replace the clamp if it fails to meet the inspection criteria.

10-11.3.2. Multi-Segment V-Band Clamp Installation

1. Clean the new multi-segment V-band clamp outer band using crocus cloth.

2. Spread the V-band clamp over the face of the first flange in a twisting motion.

3. Mate the exhaust tailpipe (or heater muff) and turbocharger flanges.

4. Gently spread the V-band clamp over the face of the tailpipe/ heater muff flange in a twisting motion to center the V-band clamp evenly over the turbocharger and exhaust tailpipe flanges. Initially torque the clamp nut to half the amount specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Use a rawhide or plastic mallet to lightly tap the outer edge of the clamp to distribute the load. Align the flanges and torque the clamp to the final torque value for the clamp specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed t-bolt threads according to instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual and Figure 10-37.

![Figure 10-36. V-Band Clamp Inspection Criteria](image-url)
6. Inspect the installed V-band clamp as follows:

   _CAUTION: If the V-band clamp exhibits physical damage or fails any of the listed inspection criteria, discard the V-band clamp and obtain a new or serviceable V-band clamp replacement._

   a. Inspect the inner segment spacing. The inner segments must not contact after the clamp is installed.

   b. Verify 100% contact between the inner segment and outer band

   c. Inspect the corner radii of the clamp inner segments for cracks using a flashlight and mirror.

   d. Using a straight edge, inspect the clamp outer band for flatness, especially within 2 inches of spot-weld tabs that retain the T-bolt fastener - clearance must be less than 0.062 inches. If clearance exceeds 0.062 inches, replace the clamp.

   e. Verify the safety wire is securely installed and the pigtail is folded back closely to the bolt.

   NOTE: The TSIO-550-G V-band clamps are riveted instead of welded.

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**Figure 10-37. V-Band Clamp Safety Wire**

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10-12. Engine Preservation and Storage

   “Engine Preservation and Storage” instructions are in Chapter 9 of M-0, Standard Practice Maintenance Manual.
Chapter 11. Engine Overhaul Introduction

11-1. Engine Overhaul

During overhaul, all engine parts and accessories are removed and inspected. Specified parts are replaced while others may be restored to a condition equal to new product specifications. All engine parts and accessories must conform with the engine and accessory manufacturer's specifications prior to being re-installed on the engine. The intent of overhaul is to restore the engine to an airworthy condition. To be considered “airworthy,” the engine must conform to its type certificate and be in a condition for safe operation.

Information in this manual defines practices for overhauling engines. Chapters are arranged in sequential order of tasks to be performed during overhaul starting with engine removal and disassembly, followed by component disassembly, cleaning, inspection and repair, component assembly, engine assembly and installation, and post-overhaul testing.

Overhaul procedures in this manual apply only to the engines for which it is written and not the aircraft. Overhaul procedures described herein must be complied with in addition to all aircraft manufacturer and accessory manufacturer overhaul requirements.

New part limits essential to performing an engine overhaul applicable to engines covered in this manual are provided in Appendix D. Torque Specifications for all fasteners on the engine are located in Appendix B of M-0, Standard Practice Maintenance Manual. Appendix C of M-0, Standard Practice Maintenance Manual contains standard repairs and instructions for recurring common procedures, like cotter pin and safety wire installation, and heli-coil replacement. Appendix C also contains details regarding mandatory replacement parts disposition during maintenance and overhaul. These sections will be referred to often throughout the procedures. Refer to the aircraft manufacturer’s manual for instructions pertaining to mandatory replacement items during engine replacement or engine overhaul.

This manual does not contain overhaul requirements for engines modified by installation of components or systems under supplemental type certificate.

11-2. Overhaul Schedule

Engine time between overhaul (TBO) is determined by the engine model certification data submitted to and approved by the FAA. Refer to “Time Between Overhaul” in Section 6-3 of M-0, Standard Practice Maintenance Manual to determine when to overhaul your engine model.
11-3. Overhaul Sequence

Perform engine overhaul in the sequence described in Table 11-1.

<table>
<thead>
<tr>
<th>Action</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Remove the engine from the aircraft.</td>
<td>Section 5-1, “Engine Removal”</td>
</tr>
<tr>
<td>2. Disassemble the engine.</td>
<td>Chapter 12, “Engine Disassembly”</td>
</tr>
<tr>
<td>5. Inspect engine parts for serviceability.</td>
<td>Perform inspections and complete the Overhaul Inspection Checklist:</td>
</tr>
<tr>
<td></td>
<td>Chapter 15, “Overhaul Inspection and Repair”</td>
</tr>
<tr>
<td></td>
<td>Appendix D, “Overhaul Dimensional Limits”</td>
</tr>
<tr>
<td>6. Repair or replace unserviceable parts or</td>
<td>Repair or replace parts specified in Section 15-8, “Overhaul Repair”</td>
</tr>
<tr>
<td>parts identified as 100% replacement parts or</td>
<td></td>
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<tr>
<td>mandatory overhaul replacement parts.</td>
<td></td>
</tr>
<tr>
<td>8. Assemble the engine components.</td>
<td>Chapter 16, “Component Assembly”</td>
</tr>
<tr>
<td>10. Install the engine in the aircraft.</td>
<td>“Section 5-2, “Engine Installation”</td>
</tr>
<tr>
<td>11. Test the overhauled engine.</td>
<td>Chapter 18, “Post-Overhaul Test and Adjustments”</td>
</tr>
</tbody>
</table>
11-4. Overhaul Checklists

Overhaul Checklists serve as guides during the overhaul process of disassembly, inspection, mandatory component replacement, refurbishing and assembly. Checklists provide a comprehensive record of the overhaul procedures:

- “Engine Removal and Disassembly Checklist”, Table 11-2
- “Engine Overhaul Visual Inspection Checklist”, Table 11-3
- “Fluorescent Penetrant Inspection Checklist”, Table 11-4
- “Magnetic Particle Inspection Checklist”, Table 11-5
- “Ultrasonic Inspection Checklist”, Table 11-6
- “Dimensional Inspection Checklist”, Table 11-7
- “Engine Cylinder Overhaul Inspection Checklist”, Table 11-8
- “Engine Drive Train Inspection Checklist”, Table 11-9
- “Replacement Parts Inventory”, Table 11-10

Overhaul inspection items listed in the checklists contain references to the procedures containing the overhaul actions required when overhauling engines covered by this manual. For convenient reference, make a copy of the checklists and complete them during engine overhaul.

Perform items listed in the checklists, according the referenced procedures to remove, disassemble, and repair components on an engine which has reached Time Between Overhaul (TBO):

Section 5-1, “Engine Removal”
Section 12, “Engine Disassembly”
Section 13, “Component Disassembly”
Section 12, “Engine Cleaning” in M-0, Standard Practice Maintenance Manual
Section 15, “Overhaul Inspection and Repair”

During the overhaul process, assemble, install, and test the overhauled engine according to instruction in the following chapters:

- Section 16, “Component Assembly”
- Section 17, “Engine Assembly”
- Section 5-2, “Engine Installation”
- Section 18, “Post-Overhaul Test and Adjustments”
### Engine Overhaul Introduction

#### Table 11-2. Engine Removal and Disassembly Checklist

<table>
<thead>
<tr>
<th>Overhaul Step</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete a Cylinder Visual Inspection (Section 6-4.11.1 of M-0, Standard Practice Maintenance Manual)</td>
<td></td>
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<tr>
<td>Complete a Cylinder Differential Pressure Test. (Section 6-4.11.2 of M-0, Standard Practice Maintenance Manual)</td>
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<tr>
<td>Remove the engine from the aircraft (Section 5-1).</td>
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<tr>
<td>Remove the Ignition System (Section 12-2).</td>
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<tr>
<td>Remove the Accessory Drive Adapters (Section 12-3).</td>
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<tr>
<td>Remove the Wastegate Controller (Section 12-4.1).</td>
<td></td>
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<tr>
<td>Remove the Induction System (Section 12-5).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the Fuel Injection System (Section 12-5).</td>
<td></td>
<td></td>
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<tr>
<td>Remove the Air/Oil Separator (Section 12-7).</td>
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<tr>
<td>Remove the Turbocharger &amp; Exhaust System (Section 12-8).</td>
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<tr>
<td>Remove the Oil Cooler (Section 12-9).</td>
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<tr>
<td>Remove the Oil Pump (Section 12-10).</td>
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<tr>
<td>Remove the Alternator(s) (Section 12-11).</td>
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<tr>
<td>Remove the Starter Adapter Assembly (Section 12-13).</td>
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<tr>
<td>Remove the Oil Sump (Section 12-14).</td>
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<tr>
<td>Remove the Engine Cylinders and Pistons (Section 12-16).</td>
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<tr>
<td>Disassemble the Ignition System (Section 13-1).</td>
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<tr>
<td>Disassemble the Fuel Injection System (Section 13-2).</td>
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<tr>
<td>Disassemble the Starter and Starter Adapter (Section 13-6).</td>
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<tr>
<td>Disassemble the Engine Cylinders (Section 13-7).</td>
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<tr>
<td>Disassemble the Accessory Drive Adapters (Section 13-8).</td>
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<tr>
<td>Disassemble the Crankcase (Section 13-9).</td>
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<tr>
<td>Disassemble the Drive Train (Section 13-10).</td>
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<tr>
<td>Disassemble the Compressor Mount (Section 13-11).</td>
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<tr>
<td>Perform a visual inspection prior to cleaning the engine parts (Section 11-1 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Clean engine parts (Chapter 12 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Perform detailed visual parts inspection (Section 11-1 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Perform Fluorescent Penetrant Inspections (Section 11-2 of M-0, Standard Practice Maintenance Manual).</td>
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</tbody>
</table>
### Table 11-2. Engine Removal and Disassembly Checklist

<table>
<thead>
<tr>
<th>Overhaul Step</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform Magnetic Particle Inspections (Section 11-3 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Perform Ultrasonic Inspections (Section 11-4 of M-0, Standard Practice Maintenance Manual).</td>
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<tr>
<td>Perform Dimensional Inspections (Section 15-7).</td>
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</tr>
<tr>
<td>Perform overhaul repairs (Section 15-8).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assemble engine components (Chapter 16).</td>
<td></td>
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<tr>
<td>Assemble the engine (Chapter 17).</td>
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<tr>
<td>Install the engine in the aircraft (Section 5-2).</td>
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<tr>
<td>Complete Post-Overhaul Test and Adjustments (Chapter 18).</td>
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</tbody>
</table>
Engine Overhaul Introduction

Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete the cursory visual inspection according to Section 11-1 of M-0, Standard Practice Maintenance Manual during disassembly to avoid cleaning parts which ultimately will be replaced. Collect faulty part (not required overhaul replacements) information at the end of each subsystem for a replacement parts list.</td>
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**Fuel Injection System**

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect the fuel injection system plumbing for cracks, dents, chafing, flared end erosion, and deformation.</td>
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<tr>
<td>Inspect fittings and hardware on the fuel injection system for damaged threads or stripped heads.</td>
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<tr>
<td>Inspect fuel injection system brackets for cracks, dents, or wear.</td>
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<tr>
<td>Inspect replacement fuel injection parts for serviceability.</td>
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<tr>
<td>Inspect tapped holes and helical coils on the fuel injection system for distorted or stripped threads, cracks or dents.</td>
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**Replacement Part Description**

<table>
<thead>
<tr>
<th>Replacement Part Description</th>
<th>Part Number</th>
<th>Reason</th>
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</tbody>
</table>
## Engine Overhaul Introduction

### Induction System

- Inspect induction tubes, risers, and intake manifold for cracks, dents, and chafing.
- Check tube ends and flanges on the surface plate for warpage or deformities.
- Inspect fittings and hardware on the induction system for damaged threads or stripped heads.
- Inspect tapped holes and helical coils on the induction system (including aftercooler) for distorted or stripped threads, cracks or dents.
- Inspect the induction brackets, manifold, throttle, and induction tubes with a 10X magnifying glass.

### Replacement Part Description

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reason</th>
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</table>

### Alternator

- Perform a visual inspection on alternator components.
- Inspect fasteners for damaged or stripped heads.
- Check the alternator drive hub per instructions in “Alternator Drive Hub Slippage Inspection” in Section 10-4.1.4 of M-0, Standard Practice Maintenance Manual.
- Inspect the alternator parts, housing and brackets with a 10X magnifying glass.

### Replacement Part Description

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reason</th>
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</tbody>
</table>

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### Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect induction tubes, risers, and intake manifold for cracks, dents, and chafing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check tube ends and flanges on the surface plate for warpage or deformities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect fittings and hardware on the induction system for damaged threads or stripped heads.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect tapped holes and helical coils on the induction system (including aftercooler) for distorted or stripped threads, cracks or dents.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the induction brackets, manifold, throttle, and induction tubes with a 10X magnifying glass.</td>
<td></td>
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</tr>
</tbody>
</table>
### Engine Overhaul Introduction

#### Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starter/Starter Adapter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform a visual inspection of the starter and starter adapter components.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the exterior of the starter adapter housing and cover for cracks with a 10X magnifying glass.</td>
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</tr>
<tr>
<td>Inspect the starter adapter housing and accessory drive adapter housing studs for distorted or stripped threads, corrosion, or pitting, or looseness.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the shaft gears, worm wheel gears, worm gear, or worm gear shafts for cracks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for damaged or loose studs on the starter and accessory drive adapter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Replacement Part Description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Part Number</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reason</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lubrication System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the exterior and cavity of the oil pump housing with a 10X magnifying glass.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil pump cover, tach drive housing, and oil filter adapter with a 10X magnifying glass.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil pump cover for scoring at gear contact surfaces.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using a flashlight and 10X magnifying glass, inspect all remaining Lubrication System components.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect all oil passages, especially in the oil pump housing and tach drive housings, for flow restrictions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil pump housing gear shaft for security and scoring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil pressure relief valve plunger for scoring and nicks and the face for roughness.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the oil pump drive gear shaft and shaft splines for wear or damage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil sump and sump bolt holes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Engine Overhaul Introduction

Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect the oil drain plug boss and drain plug for damaged threads and damaged wrench flats.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil suction tube assembly for dents, cracks, distorted or restricted openings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil pump housing and tach drive housing studs for distorted or stripped threads.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the lubrication system fastening studs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Replacement Part Description

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>

Engine Cylinders

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect for obvious cracks, missing or bent fins. Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the cylinders using Table 11-8, &quot;Engine Cylinder Overhaul Inspection Checklist&quot;.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Replacement Part Description

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>


## Engine Overhaul Introduction

### Crankcase
- Inspect for obvious cracks, missing or bent hardware.
- Inspect fasteners for loose or bent studs and damaged threads.
- Inspect interior after disassembly for worn, scored, or otherwise damaged journals.

### Engine Drive Train
- Inspect the drive train components using the "Engine Drive Train Inspection Checklist" (Section 11-9)

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankcase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect for obvious cracks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect fasteners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect interior</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Replacement Part Description</th>
<th>Part Number</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Engine Drive Train</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect drive train components</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Replacement Part Description</th>
<th>Part Number</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
### Engine Overhaul Introduction

#### Air Conditioning Compressor (Optional Part) Mounting Kit

- Inspect the air conditioning compressor mounting brackets for cracks and elongated holes.
- Inspect the idler sheave for warpage, cracks, and wear in belt grooves and bearing seats.
- Check the mounting bracket flange for wear; place it on a surface plate and check for warpage.
- Inspect the idler sheave support bolt for wear on the support shank.
- Inspect the hardware for distorted or stripped threads.

### Replacement Part Description

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Table 11-3. Engine Overhaul Visual Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioning Compressor (Optional Part) Mounting Kit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the air conditioning compressor mounting brackets for cracks and elongated holes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the idler sheave for warpage, cracks, and wear in belt grooves and bearing seats.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the mounting bracket flange for wear; place it on a surface plate and check for warpage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the idler sheave support bolt for wear on the support shank.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the hardware for distorted or stripped threads.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 11-4. Fluorescent Penetrant Inspection Checklist

Inspect clean, aluminum or non-ferrous metal parts according to the “Fluorescent Penetrant Inspection” instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Focus</th>
<th>Initials</th>
</tr>
</thead>
</table>
| **General**     | Look for discontinuities such as:  
• Fatigue cracks  
• Grinding  
• Cracks from heat treatment or brittleness  
• Seams  
• Laps or ruptures  
Pay particular attention to:  
• Bearing bosses  
• Mounting flanges  
• Shaft bores  
• Mating surfaces where hardware has been previously torqued  
• Areas where oil seals or bushings are pressed in or seated  
• Look for indications of weakness in corners, edges, holes, or fillets. Identify parts that contain linear indications that cannot be reworked. | |
| **Cylinder heads** | Pay particular attention to:  
• Rocker boss areas  
• Valve seat insert areas  
• Valve guide areas  
• Intake and exhaust flanges  
• Intake and exhaust ports  
• Between cylinder head cooling fins  
• Cylinder-to-barrel mating area  
• Mounting flanges | |
| **Aluminum alloy fuel injection components** | • Fuel manifold valve body  
• Covers  
• Flanges | |
| **Aluminum air conditioning compressor mounting components** | • Mounting flanges  
• Bolt holes | |
| **Starter Adapter housing** | • Mounting flanges  
• Bolt holes | |
| **Alternator housing** | • Mounting flanges  
• Bolt holes | |
| **Crankcase halves** | Pay particular attention to:  
• Cylinder-to-barrel mating area  
• Bearing bosses  
• Mounting flanges  
• Shaft bores  
• Through-bolt hole areas  
• Crankcase/crankshaft exit area  
• Oil seals or bushing seats | |
| **Aluminum alloy brackets** | • Mounting flanges  
• Bolt holes | |
| **Aluminum alloy Induction System components** | • Mounting flanges  
• Bolt holes | |
| **Scavenge pump body and adapter covers** | • Oil cavity  
• Mounting flanges  
• Oil seal or bushing seats | |
| **Oil pump housing** | • Bearing bosses  
• Oil pump cavity area  
• Mounting flanges  
• Oil seal or bushing seats | |
### Table 11-4. Fluorescent Penetrant Inspection Checklist

Inspect clean, aluminum or non-ferrous metal parts according to the “Fluorescent Penetrant Inspection” instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Focus</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil pump cover</td>
<td>• Oil pump cavity area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td>Oil filter adapter</td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oil seal or bushing seats</td>
<td></td>
</tr>
<tr>
<td>Cast aluminum oil sump</td>
<td>• Mounting flanges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bolt holes</td>
<td></td>
</tr>
</tbody>
</table>

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.

### Table 11-5. Magnetic Particle Inspection Checklist

Use the fluorescent method wet continuous procedure on all ferrous parts according to the “Magnetic Particle Inspection” instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Inspector Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Journals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fillets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Oil holes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Thrust flanges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Prop flange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder Barrels:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fin tips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fin roots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lobes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Journals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Drilled hole edges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocker arms:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Socket under side arms and boss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler sheave support bolt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter Adapter:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Shaft gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Worm shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Worm gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubrication System:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Oil pump gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bevel gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Tach drive shaft</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Engine Overhaul Introduction

#### Counterweights
- Counterweights (after bushings installed)
- Counterweight hanger blade (after bushing installed)

#### Gear Components
- Crankshaft gears
- Camshaft gear
- Idler gear
- Governor drive gear

#### Connecting Rods
- Connecting rods (Section 11-3.1 of M-0, Standard Practice Maintenance Manual)

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.

### Table 11-5. Magnetic Particle Inspection Checklist

Use the fluorescent method wet continuous procedure on all ferrous parts according to the “Magnetic Particle Inspection” instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Initials</th>
<th>Inspector Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counterweights (after bushings installed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterweight hanger blade (after bushing installed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft gears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor drive gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting rods (Section 11-3.1 of M-0, Standard Practice Maintenance Manual)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.

### Table 11-6. Ultrasonic Inspection Checklist

Only certified, trained personnel can perform this inspection Ref: “Crankshaft Ultrasonic Inspection” instructions in Section 11-4.1 of M-0, Standard Practice Maintenance Manual.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Result</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft (Section 15-6.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Main Journal #5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibroetch Passing Crankshaft with Inspection Results</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.
### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crankcase (Section 15-7)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through-bolt in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support in crankcase (front) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support in crankcase (rear) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil pump housing pilot in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear end clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear in support bushing (front) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear in support bushing (rear) diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magneto pilot in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor drive shaft in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankcase (each half) width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankcase (cylinder deck-to-cylinder deck) width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessory drive adapter pilot in crankcase diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor Drive Gear Backlash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft Journal Bore diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft Journal Bore Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tappet Guides Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governor Driven Gear Bearing Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starter Shaft Needle Bearing Hole Diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support pin front cc diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idler gear support pin rear cc diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 11-7. Dimensional Inspection Checklist

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake valve tappets OD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust valve tappets OD</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drive Train (Section 15-7)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft front journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft rear journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #2 journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #3 journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #4 journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft #5 journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crank pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Counterweight hanger blade bushing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft journal diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft main bearings diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crank pins out-of-round</td>
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Table 11-7. Dimensional Inspection Checklist

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### Table 11-7. Dimensional Inspection Checklist

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### Table 11-7. Dimensional Inspection Checklist

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### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

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### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

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### Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

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<tr>
<td>0.015 Undersize worm wheel drum B dimension</td>
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<tr>
<td>Shaft Gear Drum dimension</td>
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<tr>
<td>0.015 Undersize Shaft Gear Drum dimension</td>
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**Lubrication System (Section 15-7.5)**

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Dimension</th>
<th>Initials</th>
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<tbody>
<tr>
<td>Oil pump driven gear shaft diameter</td>
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<tr>
<td>Oil pump drive gear hole diameter</td>
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<tr>
<td>Oil pump gear chamber depth</td>
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<tr>
<td>Oil pump drive gear shaft diameter</td>
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<tr>
<td>Oil pump driven gear shaft diameter</td>
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<td>Oil pressure relief valve adjusting screw in plunger diameter</td>
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<tr>
<td>Oil pressure relief valve seat in housing depth</td>
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<tr>
<td>Oil pump driver gear in pump housing diameter</td>
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<tr>
<td>Oil pump driver gear shaft in pump housing diameter</td>
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<tr>
<td>Oil pump driven gear to driven gear shaft diameter</td>
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<tr>
<td>Oil pump driver gear in pump housing end clearance</td>
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<tr>
<td>Oil pump driven gear in pump housing end clearance</td>
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<tr>
<td>Oil pump driver gear shaft in oil pump cover diameter</td>
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<tr>
<td>Oil pump driven gear in housing diameter</td>
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<tr>
<td>Oil pump drive and driven gears' backlash</td>
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<tr>
<td>Oil pressure relief valve spring compressed to 1.25 inch length load</td>
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<tr>
<td>Oil temp. control valve 0.090 inches minimum travel at oil temperature</td>
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<tr>
<td>Oil temperature control valve must close between</td>
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</table>
### Engine Overhaul Introduction

- Alternator (Section 15-7.6) Overhaul according to manufacturer’s instructions
- Stud Height Settings (Section 15-7.9)
  - Starter Adapter
  - Starter Adapter to Crankcase (1)
  - Starter Adapter to Crankcase (2)
  - Cover to Adapter (1)
  - Cover to Adapter (2)
  - Cover to Adapter (3)
  - Cover, Scavenge Body to Adapter
  - Starter Motor to Adapter (1)
  - Starter Motor to Adapter (2)
  - Cover to Scavenge Body (1)
  - Cover to Scavenge Body (2)
  - Cover to Scavenge Body (3)
  - Cover to Scavenge Body (4)
- Oil Pump
  - Oil Pump Cover to Housing (1)
  - Oil Pump Cover to Housing (2)
  - Oil Filter To Adapter
- Cylinder
  - Exhaust flange stud (1)
  - Exhaust flange stud (2)
  - Exhaust flange stud (3)
  - Exhaust flange stud (4)
  - Intake flange stud (1)
  - Intake flange stud (2)
  - Intake flange stud (3)
  - Oil Control Collar Stud (1)
  - Oil Control Collar Stud (2)
  - Oil Control collar dowel (1)
  - Oil Control collar dowel (2)
  - Install crankcase studs according to Section 15-7.9 and App. D.

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Dimension</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternator</td>
<td>Overhaul according to manufacturer’s instructions</td>
<td></td>
</tr>
</tbody>
</table>

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D

Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory” for an accurate inventory of required parts to overhaul. Mark the faulty parts as defective and discard.
**Engine Overhaul Introduction**

**Table 11-8. Engine Cylinder Overhaul Inspection Checklist**

<table>
<thead>
<tr>
<th>Fluorescent Penetrant Inspection (on all non-ferrous metal parts)</th>
<th>Perform the inspection according to the “Fluorescent Penetrant Inspection” instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder Heads</td>
<td>1</td>
</tr>
<tr>
<td>Cylinder Heads after Valve Seat or Valve Guide Installation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Magnetic Particle Inspection (on all ferrous parts)</th>
<th>Use the fluorescent wet continuous method according to the “Magnetic Particle Inspection” instructions in of M-0, Standard Practice Maintenance Manual.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine cylinder barrel inner and outer surfaces using the close coil shot method</td>
<td></td>
</tr>
<tr>
<td>Engine cylinder intake valve, and rocker arms using circular and longitudinal magnetization</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensional Inspection</th>
<th>Refer to the Section 15-7, “Dimensional Inspection” and Appendix D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinders</td>
<td></td>
</tr>
<tr>
<td>Cylinder Components</td>
<td></td>
</tr>
</tbody>
</table>
## Table 11-9. Engine Drive Train Inspection Checklist

<table>
<thead>
<tr>
<th>Item to Check</th>
<th>Initials</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect the crankshaft, camshaft, connecting rods, and engine drive train components for rusting, pitting, and cracks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using a 10X magnifying glass, inspect the camshaft journals and lobes for scoring, pitting, corrosion, or any other indication of wear.</td>
<td></td>
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</tr>
<tr>
<td>Inspect the camshaft gear splines for wear.</td>
<td></td>
<td></td>
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<tr>
<td>Inspect the camshaft gear flange for nicks, peening, and other irregularities. (This flange must be smooth to align gears.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the bolt holes on the camshaft gear flange for distorted or stripped threads.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Borroughs 8087A polishing tool or equivalent, rotate the crankshaft in a lathe and polish the mains and crank pins to a finish of 8 R₉₉ maximum. Inspect the finish using a profilometer. Perform a dimensional inspection on the crankshaft mains and crankshaft pins according to the “Drive Train Dimensional Inspection” in Section 15-7.2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the crankshaft main journals, crank pins, and oil seal area for scoring and burning.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the crankshaft gear bolt holes for distorted or stripped threads.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the oil passages on the crankshaft for obstruction or loose oil tubes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check the gear dowel for the desired snug fit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the oil control plug for obstructions in the oil hole and loose fit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect the crankshaft and counterweights for cracks, nicks, or evidence of contact between the bottom of the counterweight and the crankshaft according to: Section 15-7.2, “Drive Train Dimensional Inspection” and “Crankshaft Counterweight Inspection” in Section 10-9.1 of M-0, Standard Practice Maintenance Manual. Use tags to identify parts. Do not use a scribe or punch to identify the parts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using a 10X magnifying glass, inspect the crankshaft gear and idler gear drive teeth for signs of overheating or wear according to the “Gear Tooth Inspection” instructions in Section 11-1.1. Normal wear produces a fine polish on the tooth thrust faces.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify the crankshaft connecting rod and cap mate marks are adjacent to each other and the position numbers are stamped on or adjacent to the bolt boss match.</td>
<td></td>
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</tr>
</tbody>
</table>
### Table 11-9. Engine Drive Train Inspection Checklist

<table>
<thead>
<tr>
<th>Item to Check</th>
<th>Initials</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect the connecting rod for corrosion, pitting, rust, discoloration (blue), galling, impact damage, nicks, bending, or twisting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the nuts and bolts from the connecting rod and separate the rod and the cap (accomplished during disassembly). Inspect the connecting rod and cap parting surface. Contact signatures resulting from assembly forces are normal and acceptable. Fretting signatures resulting in the loss of metal indicated by removal of original machining marks are not acceptable.</td>
<td></td>
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<tr>
<td>Inspect the connecting rod nut seat area for loss of material or edge loading signatures. Inspect dowel surfaces at the connecting rod and cap bolt holes for distortion or scoring.</td>
<td></td>
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</tr>
<tr>
<td>Assemble the connecting rod and caps by installing one bolt through the cap and rod. Verify the mate marks align. With the cap seated firmly against the connecting rod, a bolt should be easily installed using hand pressure.</td>
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</tr>
<tr>
<td>Inspect the oil transfer collar assembly for cracks and scoring.</td>
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<tr>
<td>Verify the tin plating on the oil control collar is intact.</td>
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<tr>
<td>Inspect studs on the oil control collar for corrosion, pitting, incomplete threads, or looseness.</td>
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</tr>
<tr>
<td>Check the stud height and dowel settings on the oil control collar according to Section 15-7.9, “Stud Height Dimensional Inspection.”</td>
<td></td>
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<tr>
<td>Inspect the connecting rods according to the “Connecting Rod Dimensional Inspection.” instructions in Section 10-9.4.1 of M-0, Standard Practice Maintenance Manual.</td>
<td></td>
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<tr>
<td>Remove the piston pin bushing from the connecting rod; inspect the piston pin bushing bore and surrounding area for nicks, gouges and mechanical damage.</td>
<td></td>
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<tr>
<td>Inspect the rod channel rails for nicks, gouges or mechanical damage.</td>
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Table 11-10. Replacement Parts Inventory

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Part Number</th>
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## Table 11-10. Replacement Parts Inventory

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Table 11-10. Replacement Parts Inventory

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Chapter 12. Engine Disassembly

12-1. Engine Disassembly Sequence

Disassemble the engine following the procedures in the sequential steps listed below. Once the engine is disassembled as described herein, disassemble components, clean, and inspect them as described in subsequent chapters. Refer to the corresponding sections in this chapter for detailed instructions for each step:

1. Ignition System Removal
2. Accessory Drive Adapter Removal
3. Wastegate Controller Removal
4. Induction System Removal
5. Fuel Injection System Removal
6. Air/Oil Separator Removal
7. Turbocharger and Exhaust System Removal
8. Oil Cooler Removal
9. Oil Pump Removal
10. Alternator Removal (and optional alternator bracket assembly)
11. Starter and Starter Adapter Removal
12. Oil Sump Removal
13. Engine Cylinder and Piston Removal
12-2. Ignition System Removal and Disassembly

Ignition systems may be Champion (Slick) 6320 or Continental Motors S6RSC-25P series, impulse coupled magnetos. Magnetos may be fitted with a tachometer drive sensor. Removal and installation procedures are similar, with only minor differences. Separate instructions are provided for Continental and Champion (Slick) Magnetos.

12-2.1. Continental Motors Ignition System Removal

1. Remove the ignition lead from each spark plug (Figure 12-1) (3). Remove and discard cable ties and clamps.
   a. On each magneto, remove four screws (4) from the cable outlet plate; remove the cable outlet plates from magnetos (1).
   b. Remove clamps and ignition harness assembly (3) from engine and discard.
2. Remove clamp (16) and disconnect hose (14) at 90° fitting (19) from magneto.
3. Remove clamps (16) from filter (12) and tee (18). Remove hoses (14, 15 and 17). Discard the filter (12) and hoses (14, 15 and 17).
4. Remove nuts (5), lock washers (6), and magneto retainers (7) from either side of magneto.
5. Disconnect the magneto sensor (2), if equipped, from bottom of magneto. Inspect the magneto sensor for cracks or physical damage; verify the vent hole is open and free of obstructions; replace on condition.
   CAUTION: The rubber bushings (Figure 12-3) (101) may fall out of the retainer (102) when the magneto is removed from the crankcase. If the bushings fall in the crankcase, retrieve and remove them before advancing to the next step.
6. Carefully remove the magneto (Figure 12-1) (1) from the crankcase, disengaging the drive coupling lugs from the drive bushings. Remove and discard gasket (24).
7. Overhaul the magnetos according to instructions the Ignition System Master Service Manual (X40000) or order replacement magnetos.
Figure 12-1. Continental Motors Ignition System

1 Magneto 8 Nut 15 Hose 22 Washer
2 Magneto Tachometer Sensor 9 Lock Washer 16 Hose Clamp 23 Lock Nut
3 Ignition Harness 10 Gasket 17 Hose 24 Gasket
4 Screw Assembly 11 Spark Plug Assembly 18 Tee 25 Bracket
5 Nut 12 Magneto Filter Assembly 19 Elbow Fitting 26 Bracket
6 Lock Washer 13 Drain, Filter Reducer 20 Clamp 27 Clamp
7 Mag Hold Washer 14 Hose 21 Bolt

TSIO550C ONLY

TSIO550K
TSIO550C20 & 21 ONLY

TSIO550N ONLY

TSIO550G
Engine Disassembly

12-2.2. Champion (Slick) Ignition System Removal

1. Remove three screws (Figure 12-2) (part of ignition harness) from the cable outlet plate. Remove and discard gasket (not shown).

2. Remove clamps and cable ties and discard the ignition harness (2).

3. Remove clamp (11) and disconnect hose (10) at 90° fitting (15) from magneto.

4. Remove clamps (11) from filter (13) and tee (12). Remove and discard hoses (8, 9, and 10) and the filter (13).

5. Remove nuts (4), lock washers (5), and magneto retainers (6) from either side of magneto.

6. Disconnect magneto sensor (23). Inspect the magneto sensor for cracks or physical damage; verify the vent hole open and free of obstructions; replace on condition.

   **CAUTION:** The rubber bushings (Figure 12-3) (101) may fall out of the retainer (102) when the magneto is removed from the crankcase. If the bushings fall in the crankcase, retrieve and remove them before advancing to the next step.

7. Carefully remove the magneto (Figure 12-2) (1) from the crankcase, disengaging the drive coupling lugs from the drive bushings.

8. Remove and discard the magneto gasket (3).

9. Replace the magneto with a new magneto or a magneto overhauled according to FAA approved procedures.
Figure 12-2. Champion (Slick) Ignition System

1 Magneto 7 Spark Plug Assembly 13 Magneto Filter Assembly 19 Washer
2 Ignition Harness 8 Hose Assembly 14 Drain, Filter Reducer 20 Cushion Clamp
3 Gasket 9 Hose Assembly 15 Elbow Fitting 21 Reducer Fitting
4 Nut 10 Hose Assembly 16 Bracket 22 Magneto Filter Kit
5 Lock Washer 11 Hose Assembly 17 Screw 23 Magneto Tachometer Sensor
6 Mag Hold Washer 12 Hose Clamp 18 Lock Nut
12-3. Accessory Drive Adapter Removal

1. Carefully slide the drive gear assembly (Figure 12-3) (103), retainer (102), and rubber bushings (101) out of the accessory drive adapter through the crankcase magneto pad opening. Remove and discard the rubber bushings (101).

2. Remove the nuts (115 & 118), lock washers (116 & 119) and washers (117). Remove the accessory drive assemblies (105) from the rear of the crankcase. Discard the lock washers (116 & 119).

3. Remove and discard the gasket (104) and residue from the crankcase and the face of the accessory adapter.

4. Repeat steps 1 through 3 for the second accessory drive adapter.

5. Disassemble the accessory drive adapters according to instructions in Chapter 13.
**Figure 12-3. Accessory Drive Adapter Assembly**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Rubber Bushing</td>
</tr>
<tr>
<td>102</td>
<td>Retainer-Mag Coupling</td>
</tr>
<tr>
<td>103</td>
<td>Magneto Drive Gear</td>
</tr>
<tr>
<td>104</td>
<td>Gasket</td>
</tr>
<tr>
<td>105</td>
<td>Magneto Adapter Assembly</td>
</tr>
<tr>
<td>106</td>
<td>Bushing</td>
</tr>
<tr>
<td>107</td>
<td>Part of 106</td>
</tr>
<tr>
<td>108</td>
<td>Stud</td>
</tr>
<tr>
<td>109</td>
<td>Oil Seal</td>
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<tr>
<td>110</td>
<td>Accessory Drive Gasket</td>
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<tr>
<td>111</td>
<td>Accessory Cover</td>
</tr>
<tr>
<td>112</td>
<td>Plain Washer</td>
</tr>
<tr>
<td>113</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>114</td>
<td>Nut</td>
</tr>
<tr>
<td>115</td>
<td>Nut</td>
</tr>
<tr>
<td>116</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>117</td>
<td>Plain Washer</td>
</tr>
<tr>
<td>118</td>
<td>Nut</td>
</tr>
<tr>
<td>119</td>
<td>Lock Washer</td>
</tr>
</tbody>
</table>

*NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.*
12-4. Wastegate Controller Removal

12-4.1. TSIO-550-B, C, E & G Wastegate Controller Removal

1. Disconnect the oil supply hose (Figure 12-4) (36) from the inboard oil cooler fitting and the wastegate (18) oil inlet fitting.

2. Disconnect the oil return hose (35) from between the wastegate (18) oil outlet fitting and the wastegate controller (22) oil inlet fitting.

3. Disconnect the oil return hose (34) from wastegate controller (22) oil drain fitting and the fitting on the rear of the crankcase.

4. Remove and discard the deck pressure hose (Figure 12-5) (11) between the throttle body and the controller.

5. Remove the lock nut (23), washers (22) and bolt (21) securing the mixture support bracket (20), if used, to the bracket (8); discard the lock nut.

Figure 12-4. Wastegate Controller Lubrication

NOTE: See Figure 12-20 for legend
6. Remove the manifold pressure tube assembly (10) between the induction manifold and the controller. Place protective plugs in the manifold pressure tube assembly (10) fittings to prevent contamination.

7. Remove the lock nuts (19) and washers (16); Discard the lock nuts (19).

8. Remove the bolts (13) and washers (14) from the controller and remove the controller from the bracket.

9. Remove the bolts (15) from the controller bracket (9) and bracket (8). Remove the grommets (17), spacers (18), and washers (16); discard the grommets (17).

Figure 12-5. Wastegate Controller Assembly Detail

| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Controller | Reducer | O-Ring | Adapter | O-Ring | Adapter Fitting | 90° Elbow Fitting | Bracket | Bracket | Tube Assembly | Hose Assembly | Line Protector | Bolt | Washer | Bolt | Grommet | Washer | Spacer | Lock Nut | Bracket | Bolt | Washer | Lock Nut |

19 | 20 | 21 | 22 | 23 |
12-4.2. TSIO-550-K Wastegate Controller Removal

NOTE: The TSIO-550-K Wastegate Controller is aircraft mounted. The controller should be removed from the aircraft prior to engine removal. If the wastegate controller was not disconnected and removed prior to engine removal, disconnect and remove it now.

1. Disconnect the oil supply hose (Figure 12-6) (36) from the inboard oil cooler fitting and the wastegate (18) oil inlet fitting.

2. Disconnect the oil return hose (35) from between the wastegate (18) oil outlet fitting and the wastegate controller (22) oil inlet fitting.

3. Disconnect the oil return hose (34) from wastegate controller (22) oil drain fitting and the fitting on the rear of the crankcase.

Figure 12-6. Wastegate Controller Lubrication

NOTE: See Figure 12-20 for legend.
4. Discard the hoses (34, 35 & 36).

5. Remove and discard the deck pressure hose assemblies (Figure 12-7) (8 & 15) between the throttle body, bulkhead fittings, and controller.

6. Remove and discard the manifold pressure hose assemblies (9 & 14) between the induction manifold, bulkhead fittings, and the controller.

7. Remove the controller (22) from the aircraft according to the aircraft manufacturer’s instructions.

8. Disassemble the wastegate controller according to instructions in Section 13-4.

---

**Figure 12-7. Wastegate Controller Assembly**

1. Controller  
2. Reducer  
3. O-Ring Seal  
4. #4 Tube Adapter  
5. O-Ring Seal  
6. Adapter Fitting  
7. Elbow  
8. Hose Assembly  
9. Hose Assembly  
10. Bulkhead Union  
11. Bulkhead Union  
12. Bulkhead Nut  
13. Bulkhead Nut  
14. Hose Assembly  
15. Hose Assembly
12-4.3. TSIO-550-N Wastegate Controller Removal

NOTE: The TSIO-550-N Wastegate Controller is aircraft mounted. The controller should be removed from the aircraft prior to engine removal. If the wastegate controller was not disconnected and removed prior to engine removal, disconnect and remove it now.

1. Disconnect the oil supply hose (Figure 12-8) (36) from the inboard oil cooler fitting and the wastegate (18) oil inlet fitting.

2. Disconnect the oil return hose (35) from between the wastegate (18) oil outlet fitting and the wastegate controller (22) oil inlet fitting.

3. Disconnect the oil return hose (34) from wastegate controller (22) oil drain fitting and the fitting on the rear of the crankcase.

Figure 12-8. Wastegate Controller Lubrication

See Figure 12-20 for legend
4. Discard the hoses (34, 35 & 36).

5. Remove and discard the deck pressure hose assemblies (Figure 12-9) (8 & 15) between the throttle body, bulkhead fittings, and controller.

6. Remove and discard the manifold pressure hose assemblies (9 & 14) between the induction manifold, bulkhead fittings, and the controller.

7. Remove the controller (22) from the aircraft according to the aircraft manufacturer’s instructions.

8. Disassemble the Wastegate controller according to instructions in Section 13-4.
12-5. Fuel Injection System Removal

Refer to the removal instructions applicable to the subject engine model.

12-5.1. TSIO-550-B, C & E Fuel Injection System Removal

**WARNING**

Prohibit ignition sources within the work area when fuel lines are open. Work with clean hands, tools, and shop towels.

1. Tag the corresponding cylinder number on each respective fuel injection tube (Figure 12-10) (11 through 16) to ensure correct identification and connection to the appropriate cylinder.

2. Remove the tube clamp assemblies (Figure 12-16) (25 & 28) from the brackets (26 & 27) holding the fuel tubes (Figure 12-10) (11 through 16).

**WARNING**

Fuel injection lines must not be bent or deformed. Discard and replace bent, chafed, or deformed fuel injection lines.

3. Place a wrench on the fuel injector body to hold the injector in place. Loosen the fuel tube (11 through 16) “B” nuts from each fuel injector (17A-F) to disconnect the fuel line from the fuel injector nozzle.

   **NOTE:** Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

4. Place a small container beneath the fuel line to collect fuel; disconnect the fuel lines (11 through 16) from the manifold valve assembly (4).

5. Disconnect and remove the fuel hose (9) between the fuel pump (3) outlet fitting and throttle and metering assembly inlet fitting; discard the fuel hose (9).

6. Remove the nuts (6), washers (5), and hold down washers (7) from the fuel pump (3).

7. Remove the fuel pump (3) and fuel pump gasket (20); discard the fuel pump gasket (20).

8. Remove crankshaft drive coupling (2) from the fuel pump.

*Procedure continues after Figure 12-10 and index*
Figure 12-10. Fuel Injection System

1  Fuel Injection Kit  8  Throttle & Metering Assembly  15  Fuel Inj. Tube Assembly #5  17E  Injector Nozzle #5
2  Crankshaft Gear Coupling  9  Hose Assembly  16  Fuel Inj. Tube Assembly #6  17F  Injector Nozzle #6
3  Fuel Pump Assembly  10  Hose Assembly  17  Injector Nozzle Kit  18  Washer
4  Fuel Manifold Valve Assy.  11  Fuel Inj. Tube Assembly #1  17A  Injector Nozzle #1  19  O-Ring
5  Lock Washer  12  Fuel Inj. Tube Assembly #2  17B  Injector Nozzle #2  20  Fuel Pump Adapter Gasket
6  Nut  13  Fuel Inj. Tube Assembly #3  17C  Injector Nozzle #3
7  Hold Down Washer  14  Fuel Inj. Tube Assembly #4  17D  Injector Nozzle #4

17 = 17A THRU 17F
9. Disconnect the air reference lines (Figure 12-11) (16, 17 & 18) from the throttle body fittings.

10. Loosen the “B” nut and separate the left side air reference tubes (16 and 18). Discard the compression seal (46). Place protective caps on the open ends of the fuel injection tube assemblies (Figure 12-10)(11 through 16).

11. Loosen air reference sleeve “B” nuts and slide reference sleeves (Figure 12-11) (21) off the injector nozzles (Figure 12-10) (17).

12. Remove compression seals (Figure 12-11) (24) and washers (22 and 23) from air reference sleeves (21) and discard the seals (24) and washers (22 and 23). Inspect the reference sleeves for physical damage; note replacement requirements on the overhaul checklist.

Figure 12-11. Air Reference Tubes

NOTE: See Figure 12-15 or Figure 12-16 for legend

13. Inspect the fuel injection tubes (Figure 12-10) (11 through 16) for deformities, bends or chafing. Discard deformed, bent, or chafed tubing and note replacement requirements on the Engine Overhaul Inspection Checklist.

WARNING

When removing the fuel injector in the next step, use great care to avoid introducing contaminants into the fuel system.

14. Remove the fuel injector nozzles (17A-F) from the cylinders with Ideal Aviation Part No. 8167-IA Injector Nozzle Removal/Installation Tool. Discard all fuel injector nozzles (Figure 12-10) (17A-F) - they will be replaced during engine assembly.
NOTE: Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

15. Disconnect the primer tube assembly (Figure 12-12) (8) from the elbow on top of the induction manifold and the elbow (7) on the diverter valve.

16. Disconnect the fuel inlet tube (Figure 12-12) (5) from the fuel manifold valve inlet fitting and the diverter valve outlet fitting (4).

17. Remove the metering unit tube (3) from the throttle fuel metering unit and the fitting (2) on the bottom of the diverter valve (1). Loosen the clamp (9) securing the diverter valve (1) and discard and diverter valve.

**Figure 12-12. Fuel Priming System**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diverter Valve</td>
</tr>
<tr>
<td>2</td>
<td>Street Elbow</td>
</tr>
<tr>
<td>3</td>
<td>Metering Unit Tube</td>
</tr>
<tr>
<td>4</td>
<td>Elbow</td>
</tr>
<tr>
<td>5</td>
<td>Manifold Valve Inlet Tube</td>
</tr>
<tr>
<td>6</td>
<td>Reducer Bushing</td>
</tr>
<tr>
<td>7</td>
<td>Elbow</td>
</tr>
<tr>
<td>8</td>
<td>Primer Tube Assembly</td>
</tr>
<tr>
<td>9</td>
<td>Hose Clamp</td>
</tr>
</tbody>
</table>
12-5.2. TSIO-550-G Fuel Injection System Removal

**WARNING**
Prohibit ignition sources within the work area when fuel lines are open. Work with clean hands, tools, and shop towels.

1. Tag the corresponding cylinder number on each respective fuel injection tube (Figure 12-14) (11 through 16) to ensure correct identification and connection to the appropriate cylinder.

2. Remove the tube clamp assemblies (Figure 12-15) (25 & 28) from the brackets (26 & 27) holding the fuel tubes (Figure 12-14) (11 through 16).

3. Place a wrench on the fuel injector body to hold the injector in place. Loosen the injection tube assembly (11 through 16) “B” nuts from each fuel injector (17A through 17F); disconnect the fuel tubes from the fuel injector nozzles.

4. Place a small container beneath the fuel line to collect fuel; disconnect the injection tube assemblies (11 through 16) from the manifold valve assembly (4).

5. Disconnect the air reference lines (Figure 12-11) (16, 17 & 18) from the throttle body fittings.

6. Loosen the “B” nut and separate the left side air reference tubes (16 & 18). Discard the compression seal (46). Place protective caps on the open ends of the fuel injection tube assemblies (11 through 16).

7. Loosen the air reference sleeve “B” nuts and slide the air reference sleeves (21) off the injector nozzles (Figure 12-14) (17 A-F).

8. Remove compression seals (Figure 12-11) (24) and washers (22 & 23) from air reference sleeves (21) and discard the seals (24) and washers (22 & 23). Inspect the reference sleeves for physical damage; note replacement requirements on the overhaul checklist.

---

**Figure 12-11 repeated for reference**
9. Inspect the fuel injection tubes (Figure 12-13) (11 through 16) for deformities, bends or chafing. Discard deformed, bent, or chafed tubing and note replacement requirements on the Engine Overhaul Inspection Checklist.

10. Remove the fuel injector nozzles (17A-F) from the cylinders with Ideal Aviation Part No. 8167-1A Injector Nozzle Removal/Installation Tool. Discard all fuel injector nozzles (17A-F) - they will be replaced during overhaul.
Engine Disassembly

NOTE: Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

11. Disconnect the tube assembly (21) connected between the fuel manifold valve assembly (4) and the throttle and metering assembly (8).

12. Remove and discard the fuel hose (9) between the throttle and metering assembly (8) fuel inlet fitting and the fuel pump (3) fuel outlet fitting.

13. Disconnect and discard the air reference hose (10) between the fuel pump air reference input fitting (3) and the 1-3-5 side of the throttle and metering assembly (8).

14. Remove the nuts (6), washers (5), and hold down washers (7) from the fuel pump (3).

15. Remove the fuel pump (3) and fuel pump gasket (20). Discard the fuel pump gasket (22).

16. Remove and discard the crankshaft drive coupling (2) from the fuel pump.
Figure 12-13 repeated for reference
12-5.3. TSIO-550-K & N Fuel Injection System Removal

**WARNING**

Prohibit ignition sources within the work area when fuel lines are open. Work with clean hands, tools, and shop towels.

1. Tag the corresponding cylinder number on each respective fuel injection tube (Figure 12-14) (11 through 16) to ensure correct identification and connection to the appropriate cylinder.

2. Remove the tube clamp assemblies (Figure 12-16) (25 & 28) from the brackets (26 & 27) holding the fuel tubes (Figure 12-14) (11 through 16).

3. Place a wrench on the fuel injector body to hold the injector in place. Loosen the injection tube assembly (11 through 16) “B” nuts from each fuel injector (17A through 17F); disconnect the fuel tube assembly from the fuel injector nozzle.

4. Place a small container beneath the fuel line to collect fuel; disconnect the injection tube assemblies (11 through 16) from the manifold valve assembly (4).

5. Disconnect the air reference lines (Figure 12-11) (16, 17 & 18) from the throttle body fittings.

6. Loosen the “B” nut and separate the left side air reference tubes (16 and 18). Discard the compression seal (46). Place protective caps on the open ends of the fuel injection tube assemblies (11 through 16).

7. Loosen the air reference sleeve “B” nuts and slide the air reference sleeves (21) off the injector nozzles (Figure 12-14) (17 A-F).

8. Remove compression seals (Figure 12-11) (24) and washers (22 and 23) from air reference sleeves (21) and discard the seals (24) and washers (22 and 23). Inspect the reference sleeves for physical damage; note replacement requirements on the overhaul checklist.

---

**Figure 12-11 repeated for reference**
9. Inspect the fuel injection tubes (Figure 12-14) (11 through 16) for deformities, bends or chafing. Discard deformed, bent, or chafed tubing and note replacement requirements on the Engine Overhaul Inspection Checklist.

10. Remove the fuel injector nozzles (17A-F) from the cylinders with Ideal Aviation Part No. 8167-IA Injector Nozzle Removal/Installation Tool. Discard all fuel injector nozzles (17A-F) - they will be replaced during overhaul.
Engine Disassembly

NOTE: Before removing the fuel pump, diverter valve, throttle and metering assembly, or fuel manifold valve, either take a photograph or draw a sketch of the fuel injection fitting locations, position, and connections for reference during assembly.

11. Disconnect the tube assembly (21) connected between the throttle and metering assembly (8) fuel outlet fitting and fuel manifold valve (4) inlet fitting.

12. Remove and discard the fuel hoses (9, 27 & 29) between the throttle and metering assembly (8) inlet fitting and the fuel pump (3) outlet fitting.

13. Disconnect and discard the air reference hoses (10 & 22) between the fuel pump (3) air reference input fitting and the 1-3-5 side of the throttle and metering assembly (8).

14. Remove the nuts (6), washers (5), and hold down washers (7) from the fuel pump (3).

15. Remove the fuel pump (3) and fuel pump gasket (20) from the crankcase; discard the fuel pump gasket (20).

16. Remove and discard the crankshaft drive coupling (2) from the fuel pump.
Figure 12-14 repeated for reference
12-6. Induction System Removal

1. Loosen the clamps (Figure 12-15 & Figure 12-16) (42) and disconnect hoses (40) from the throttle body and aftercoolers (34). Remove the FWD induction tubes (38 and 39); discard hoses (40).

2. Loosen clamps (43) and disconnect the hoses (41) from aftercoolers (34) and turbochargers. Remove the AFT induction tubes (44 & 45); discard hoses (41).

3. Remove the aftercoolers (34) from the engine.

4. Remove (four each) screws (19), lock washers (14) and washers (13) connecting the throttle body to the manifold (1); discard the lock washers (14) and gasket (2).

5. Remove the nuts (15), lock washers (14) and washers (13) from the induction manifold flanges (12) on all cylinders; discard the lock washers (14).

6. Disconnect the throttle body from the crankcase backbone and remove the throttle body from the engine.

7. Lift and remove the induction manifold (1) with induction tubes (3-8) from the engine.

Figure 12-15. Induction Assembly

6. Disconnect the throttle body from the crankcase backbone and remove the throttle body from the engine.

7. Lift and remove the induction manifold (1) with induction tubes (3-8) from the engine.
8. Remove and discard the gaskets (11) from the cylinder intake manifold flanges.
9. Disassemble the Induction System according to instructions in Section 13-3.
12-7. Air/Oil Separator Removal

NOTE: An air/oil separator is required for crankcase ventilation. In some instances, the air/oil separator is provided by the aircraft manufacturer. Refer to the aircraft manufacturer’s instructions for air/oil separator removal instructions in those instances.

Figure 12-17 and Figure 12-18 depict the overboard drain hose connected to the left tailpipe. Some aircraft route the drain to a drain manifold instead of the tailpipe. Refer to the “Engine Installation Drawings” in Section 5-4 or the aircraft maintenance manual to determine proper hose routing.

1. Loosen and remove the hose (Figure 12-17 or Figure 12-18) (7) between the air/oil separator and oil scavenge pump. Discard the hose (7).
2. Remove four hose clamps (4 & 6).
3. Remove the breather hose (3) and drain hose (5) and discard.
4. Remove the air/oil separator (1) from the aircraft bracket according to the aircraft manufacturer's instructions.
Figure 12-18. Crankcase Ventilation Hose Routing

1. Air/Oil Separator Assembly
2. 90°Elbow Fitting
3. Hose Assembly
4. Hose Clamp
5. Hose Assembly
6. Hose Clamp
7. Hose
12-8. Turbocharger and Exhaust System Removal

12-8.1. TSIO-550-B, C, E, & G Turbocharger and Exhaust System Removal

1. Loosen, remove, and discard the hose (Figure 12-19) (13) between the left turbocharger (2) and the tee (16).

2. Loosen and remove the tee (16), check valve (17), and hose (15). Discard the check valve (17) and hose (15).

3. Disconnect the hose (14) from the right turbocharger (1). Discard the hose (14).

4. Loosen and separate the tee (21) from the hoses (18, 19, and 20).

5. Disconnect the hoses (18 and 19) from the left and right oil reservoirs (3 and 4). Discard the hoses (18, 19, and 20).
6. Remove the V-band clamps (Figure 12-20) (16) from the tailpipe (14 or 15) (or optional heater, if so equipped). Discard the v-band clamps (16).
Engine Disassembly

NOTE: The Oil Supply Hose (36) was removed and discarded in Section 12-4.1 or Section 12-4.2.

7. Disconnect, remove and discard the hoses (34 & 36).

8. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and left tailpipe (14); discard the lock nuts (21). Separate the left tailpipe (14) from the wastegate assembly (18) and discard the gasket (17).

9. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and transition (9); discard the lock nuts (21).

10. Remove the bolt (12), lock nut (13), and bushing (10) from the tie rod (11). Discard the lock nut (13). Remove the transition (9) and crossover pipe (8) from the transitions (5 & 6).

11. Remove the bolts (31), washers (32) and lock nuts (33) from the turbo support brackets (29 & 30).

12. Remove the bolts (26), washers (27), and lock nuts (28) from the turbochargers (24) and transitions (5 & 6). Separate the turbochargers from the transition tubes (5 & 6); remove and discard the gaskets (23).

13. Remove and discard the lock nuts (21) from each exhaust flange.

14. Remove elbows (1 & 2), tees (3 & 4), transitions (5 & 6), risers (7) and turbochargers (24) from the cylinders.

15. Remove and discard the exhaust flange gasket (25) from each cylinder.

16. Store the Turbocharger and Exhaust System in a clean location until disassembly in Section 13-4.
Figure 12-20 repeated for reference
12-8.2. TSIO-550-K Turbocharger and Exhaust System Removal

1. Loosen, remove, and discard the hose (Figure 12-21) (13) between the left turbocharger and the tee (16).

2. Loosen and remove the tee (16), filter assembly (22), check valve (17), and hose (14). Discard the check valve (17), filter assembly (22), and hose (17).

3. Disconnect the hose (14) from the right turbocharger (1). Discard the hose (14).

4. Loosen and separate the tee (21) from the hoses (18, 19, and 20).

5. Disconnect the hoses (19 and 15) from the left and right oil reservoirs (8 and 9). Discard the hoses (15, 19, and 21).

![Figure 12-21. Turbocharger Lubrication Hose Routing](image-url)
6. Remove the V-band clamps (Figure 12-22) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).

7. Disconnect, remove and discard the oil supply and return hoses (34, 35 & 36).

NOTE: The Wastegate Controller Oil Supply and Return Hoses (34 & 35) was removed and discarded in Section 12-4.2.
Engine Disassembly

8. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and left tailpipe (14); discard the lock nuts (21). Separate the left tailpipe (14) from the wastegate assembly (18) and discard the gasket (17).

9. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and transition (9); discard the lock nuts (21).

10. Remove the bolt (12), lock nut (13), and bushing (10) from the tie rod (11). Discard the lock nut (13). Remove the transition (9) and crossover pipe (8) from the transitions (5 & 6).

11. Remove the screws (31), washer (32) and lock nuts (33) from the turbo support brackets (29 & 30).

12. Remove the bolts (26), washers (27), and lock nuts (28) from the turbochargers (24) and transitions (5 & 6). Separate the turbochargers from the transition tubes (5 & 6); remove and discard the gaskets (23).

13. Remove and discard the lock nuts (21) from each exhaust flange.

14. Remove elbows (1 & 2), tees (3 & 4), transitions (5 & 6), risers (7) and turbochargers (24) from the cylinders.

15. Remove and discard the exhaust flange gasket (25) from each cylinder.

16. Store the Turbocharger and Exhaust System in a clean location until disassembly in Section 13-4.
Figure 12-22 repeated for reference
12-8.3. TSIO-550-N Turbocharger and Exhaust System Removal

1. Loosen, remove, and discard the hose (Figure 12-23) (13) between the left turbocharger and the tee (16).

2. Loosen and remove the tee (16), check valve (17), filter (22) and hose (15). Discard the check valve (17), filter (22), and hose (15).

3. Disconnect the hose (14) from the right turbocharger (1). Discard the hose (14).

4. Loosen and separate the tee (21) from the hoses (18, 19, and 20).

5. Disconnect the hoses (18 and 19) from the left and right oil reservoirs (3 and 4). Discard the hoses (18, 19, and 20).

See Figure 12-21 for parts index.
6. Remove the V-band clamps (Figure 12-24) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).

---

**Figure 12-24. Turbocharger and Exhaust Assembly**

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Right Turbo Transition
6. Left Turbo Transition
7. Riser
8. Crossover Assembly
9. Transition
10. Bushing
11. Tie Rod
12. Bolt
13. Lock Nut
14. Left Tailpipe
15. Right Tailpipe
16. V-band clamp
17. Gasket
18. Wastegate Assembly
19. Bolt
20. Washer
21. Lock Nut
22. Wastegate Controller
23. Gasket
24. Turbocharger Assembly
25. Gasket
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Screw
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose
37. Turbo Bracket, 1-3-5
38. Turbo Bracket, 2-4-6
39. Turbo Bracket, 1-3-5
40. Turbo Bracket, 2-4-6
41. Cotter Pin
42. Support Rod
43. Support Rod
44. Rod End
45. Nut
46. Slotted Nut
47. Bushing
48. Washer
49. Spring
Engine Disassembly

NOTE: The Wastegate Controller Oil Supply and Return Hoses (34 & 35) was removed and discarded in Section 12-4.2.

7. Disconnect, remove and discard the oil supply and return hoses (34, 35 & 36).

8. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and left tailpipe (14); discard the lock nuts (21). Separate the left tailpipe (14) from the wastegate assembly (18) and discard the gasket (17).

9. Remove four sets of bolts (19), lock nuts (21), and washers (20) from the wastegate assembly (18) and transition (9); discard the lock nuts (21).

10. Remove the bolt (12), lock nut (13), and bushing (10) from the tie rod (11). Discard the lock nut (13). Remove the transition (9) and crossover pipe (8) from the transitions (5 & 6).

11. Remove the bolts (31), washers (32) and lock nuts (33) from the turbo support brackets (29 & 30).

12. Remove four lock nuts (28), washers (27) and bolts (26) from the left turbo transition (5 or 6) and turbocharger (24) mounting flanges and support bracket (29 or 30); discard the lock nuts (28).

13. Remove and discard the lock nuts (21) from each exhaust flange.

14. Remove elbows (1 & 2), tees (3 & 4), transitions (5 & 6), risers (7) and turbochargers (24) from the cylinders.

15. Remove and discard the exhaust flange gasket (25) from each cylinder.

16. Store the Turbocharger and Exhaust System in a clean location until disassembly in Section 13-4.
Figure 12-24 repeated for reference
12-9. Oil Cooler Removal

NOTE: The oil cooler is to be disassembled, cleaned, overhauled, and re-assembled by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station). No structural repairs are allowed on the oil cooler. Replace any cooler that has structural damage or bent, broken, or cracked cooling fins with a new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange are permitted only by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station).

NOTE: The TSIO-550-C oil cooler fittings may be configured as depicted in Figure 12-25 or Figure 12-26. Consult the engine illustrated parts catalog to determine the appropriate configuration of the engine model specification and follow the applicable disassembly instructions.

12-9.1. TSIO-550-B, C, E & G Oil Cooler Removal

1. Remove the flanged nuts (Figure 12-25) (13) and lock washers (12) from the lower forward crankcase studs. Discard the lock washers (12).
2. Remove the nut (9) lock washer (8) and washer (7) from the lower aft studs. Discard the lock washer (8).
3. Remove the nut (11) washer (10) and gaskets (4) from the upper studs; discard the gaskets (4).
4. Remove the oil cooler (1) from the crankcase.
5. Remove the bracket (shadowed) from the crankcase studs.
6. Remove the gaskets (2) and spacer (3); discard the gaskets (2).
7. Remove the reducer bushing (18), adapter fitting (19), tee (20), and cap (19) from the outboard port at the aft side of the oil cooler.
8. Remove the elbow fitting (17) and adapter fitting (21) from the upper inboard port at the aft side of the oil cooler.
9. Remove the plug (5) from the port adjacent to the oil temperature control valve (14).

CAUTION: Oil temperature control valve specifications differ based on the end application. Note the part number of the oil temperature control valve at the time of removal and verify using the illustrated parts catalog to ensure proper replacement part.

10. Remove the oil temperature control valve (14) and gasket (15); discard the gasket (15).
11. Place the oil cooler in a clean, protected area until it is overhauled.
Figure 12-25. Oil Cooler

1 Oil Cooler Assembly
2 Gasket
3 Spacer
4 Gasket-Washer
5 Plug
6 Baffle
7 Washer
8 Lock Washer
9 Nut
10 Washer
11 Nut
12 Lock Washer
13 Flanged Nut
14 Oil Temp. Control Valve
15 Gasket
16 Adapter
17 Elbow Fitting
18 Reducer Bushing
19 Adapter Fitting
20 Tee Fitting
21 Cap
22 Stud

* ITEM 14 INCLUDES ITEM 15
12-9.1.1. TSIO-550-C Oil Cooler Removal

WARNING

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

NOTE: The TSIO-550-C5, C7, C9, C10, C11, C12, C13, C17, C18, C19, C20 and C21 engine model specifications used a cross fitting and various adapter fittings of differing sizes to mate with accessories and sensors.

1. Remove the flanged nuts (Figure 12-26) (13) and lock washers (12) from the lower forward crankcase studs. Discard the lock washers (12).
2. Remove the nut (9) lock washer (8) and washer (7) from the lower aft studs. Discard the lock washer (8).
3. Remove the nut (11) washer (10) and gaskets (4) from the upper studs; discard the gaskets (4).
4. Remove the oil cooler (1) from the crankcase.
5. Remove the bracket (phantom part) from the crankcase studs.
6. Remove the gaskets (2) and spacer (3); discard the gaskets (2).

NOTE: Consult the engine illustrated parts catalog to determine the most appropriate configuration of the engine model specification and adjust the disassembly instructions accordingly.

7. If CSB15-2 was previously complied with proceed to the next step.
   a. Remove and discard the cross fitting (21), pipe nipple fitting (19) and pipe bushing (18), flared nipple (22) and, if used, bushings (23) from the outboard port at the aft side of the oil cooler. The oil cooler fittings will be reconfigured at overhaul.
   b. Obtain a new cross fitting (27), 45 degree street elbow fitting (24), and flared nipple fitting (28).
8. Remove the 45° elbow fitting (17) and adapter fitting (16) from the upper inboard port at the aft side of the oil cooler.
9. Remove the plug (5) from the port adjacent to the oil temperature control valve (vernatherm) (14).
10. Remove the plug (20) from the lower pressure port.

CAUTION: Oil temperature control valve specifications differ based on the end application. Note the part number of the oil temperature control valve.
control valve at the time of removal and verify using the illustrated parts catalog to ensure proper replacement part.

11. Remove the oil temperature control valve (14) and gasket (15); discard the gasket (15).

12. Place the oil cooler in a clean, protected area until it is overhauled.

---

**Figure 12-26. Oil Cooler**

1 Oil Cooler Assembly  
2 Gasket  
3 Spacer  
4 Gasket-Washer  
5 Plug  
6 Baffle  
7 Washer  
8 Lock Washer  
9 Nut  
10 Washer  
11 Nut  
12 Lock Washer  
13 Flanged Nut  
14 Oil Temp. Control Valve  
15 Gasket  
16 Adapter Fitting  
17 45° Elbow Fitting  
18 Pipe Bushing  
19 Pipe Nipple Fitting  
20 Plug  
21 Cross Fitting  
22 Flared Nipple Fitting  
23 Pipe Bushing  
24 45° Street Elbow  
25 Plug  
26 Stud  
27 Cross Fitting  
28 Flared Nipple Fitting
12-9.2. TSIO-550-K Oil Cooler Removal

**WARNING**

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. The TSIO-550-K oil cooler fittings have been reconfigured twice since 2015. Consult the latest revision of CSB15-7 for required corrective action.

1. Remove the (Figure 12-27) screw (22) and washer (23) from the baffle assembly (21). Remove the baffle assembly from the engine and set it aside.

2. Remove the flanged nuts (7) and lock washers (6) from the lower front crankcase studs. Discard the lock washers (6).

3. Remove the nut (10) lock washer (9) and washer (8) from the lower rear stud. Discard the lock washer (9).

4. Remove the nut (12) washer (11) and gaskets (4) from the upper studs. Discard the gaskets (4).

5. Remove the oil cooler (1) from the crankcase.

6. Remove the gasket (3) and any residue from the crankcase flange; discard the gasket (3).

7. If the oil cooler has been reconfigured to omit the cross fitting (24), proceed to step 8. If the oil cooler configuration includes a cross fitting, continue with the next step.
   a. Remove the nipple (25) from the lower port on the cross fitting (24).
   b. Remove the 45 degree fitting (26) and plug (27) from the upper port on the cross fitting (24).
   c. Remove the plug (27) from the aft port on the cross fitting (24).
   d. Discard the cross fitting (24), 45 degree elbow fitting (26), and plugs (27). The oil cooler will be reconfigured at assembly.

8. Remove the reducer (15) and elbow (16) from the inboard oil cooler port.

9. Remove the adapter (17) and cap (18) from the lower port at the rear of the oil cooler.

10. Remove the nipple fitting (19) from the lower oil cooler pressure port.

11. Remove the plug (20) adjacent to the oil temperature control valve (vernatherm) (13).

12. Remove the oil temperature control valve (13) and gasket (14) from the oil cooler; discard the gasket (14).

13. Place the oil cooler in a clean, protected area until it is overhauled.
Figure 12-27. Oil Cooler

1 Oil Cooler
2 Baffle
3 Oil Cooler Gasket
4 Gasket-Washer
5 Stud
6 Lock Washer
7 Flanged Nut
8 Washer
9 Lock Washer
10 Nut
11 Washer
12 Nut
13 Oil Temp. Control Valve
14 Gasket
15 Adapter Fitting
16 Elbow Fitting
17 Adapter Fitting
18 Cap Assembly
19 Flared Nipple Fitting
20 Plug
21 Baffle Assembly
22 Screw
23 Washer
24 Cross Fitting
25 Flared Nipple Fitting
26 45° Elbow Fitting
27 Plug

* ITEM 13 INCLUDES ITEM 14
12-9.3. TSIO-550-N Oil Cooler Removal

WARNING
The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

1. Remove the (Figure 12-28) screw (24) and washer (25) from the baffle assembly (23). Remove the baffle assembly from the engine and set it aside.
2. Remove the flanged nuts (7) and lock washers (6) from the lower front crankcase studs. Discard the lock washers (6).
3. Remove the nut (10) lock washer (9) and washer (8) from the lower rear stud. Discard the lock washer (9).
4. Remove the nut (12) washer (11) and gaskets (4) from the upper studs. Discard the gaskets (4).
5. Remove the oil cooler (1) from the crankcase.
6. Remove the gasket (3) and any residue from the crankcase flange; discard the gasket (3).
7. If the oil cooler has been reconfigured to omit the cross fitting (19), proceed to step 8. If the oil cooler configuration includes a cross fitting, continue with the next step.
   a. Remove the nipple (20) from the lower port on the cross fitting (19).
   b. Remove the 45 degree fitting (21 and plug (5) from the upper port on the cross fitting (19).
   c. Remove the plug (5) from the aft port on the cross fitting (19).
   d. Discard the cross fitting (19), reducer bushing (17), and adapter (18). The oil cooler will be reconfigured at assembly.
8. Remove the reducer (15) and elbow (16) from the inboard oil cooler port.
9. Remove the plug (5) from the lower pressure oil cooler port.
10. Remove the plug (22) adjacent to the oil temperature control valve (vernatherm) (13).
11. Remove the oil temperature control valve (13) and gasket (14) from the oil cooler; discard the gasket (14).
12. Place the oil cooler in a clean, protected area until it is overhauled.
**Figure 12-28. Oil Cooler**

1. Oil Cooler
2. Baffle
3. Oil Cooler Gasket
4. Gasket - Washer
5. Plug
6. Lock Washer
7. Nut
8. Washer
9. Lock Washer
10. Nut
11. Washer
12. Nut
13. Oil Temp. Control Valve
14. Gasket
15. Adapter Fitting
16. Elbow Fitting
17. Pipe Bushing
18. Pipe Nipple Fitting
19. Cross Fitting
20. Flared Nipple Fitting
21. 45° Street Elbow Fitting
22. Plug
23. Baffle Assembly
24. Screw
25. Washer
26. Cross Fitting
27. Stud
12-10. Oil Pump Removal

1. Remove and discard the oil filter (Figure 12-29) (11).

2. Remove the three sets of nuts (8), lock washers (7), and washers (6) from studs securing the oil filter adapter (13).

3. Separate the oil filter adapter (13) and the gasket (12) from the oil pump housing (1).

4. Discard the lock washers (7) and gasket (12).

5. Remove and discard the safety wire from the plug (9). Remove the plug (9) and crush washer (10) from the top of the oil suction tube; discard the crush washer (10).

6. Remove the nuts (5), lock washers (4) and washers (3) from the oil pump assembly cover (1) except at the 6 and 12 o’clock positions; discard the lock washers (3).

7. Remove the oil pump assembly (1) from the crankcase studs.

8. Remove and discard the gasket (2).

9. Store the oil pump in a clean location until disassembly in Section 13-5.

---

**Figure 12-29. Oil Pump**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Oil Pump Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Oil Pump Gasket</td>
</tr>
<tr>
<td>3</td>
<td>Washer</td>
</tr>
<tr>
<td>4</td>
<td>Lock Washer</td>
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<tr>
<td>5</td>
<td>Nut</td>
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<td>6</td>
<td>Washer</td>
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<tr>
<td>7</td>
<td>Lock Washer</td>
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<tr>
<td>8</td>
<td>Nut</td>
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<tr>
<td>9</td>
<td>Plug</td>
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<tr>
<td>10</td>
<td>Gasket</td>
</tr>
<tr>
<td>11</td>
<td>Oil Filter</td>
</tr>
<tr>
<td>12</td>
<td>Gasket</td>
</tr>
<tr>
<td>13</td>
<td>Oil Filter Adapter</td>
</tr>
<tr>
<td>14</td>
<td>Coupling Nut</td>
</tr>
</tbody>
</table>
12-11. Alternator Removal

A direct drive alternator is mounted in the crankcase, forward of the No. 5 cylinder. The engine may also be equipped with a belt-driven alternator, mounted on the front of the 2-4-6 side of the engine. Depending on model specification, a belt-driven alternator may also be installed. Remove the gear driven alternator(s) according to instructions in Section 10-4 of M-0, Standard Practice Maintenance Manual. Instructions to remove the belt-driven alternator are provided in Section 12-11.1.
12-11.1. Belt-Driven Alternator Removal

NOTE: Disconnect the electrical connections from the alternator according to the aircraft manufacturer's instruction.

1. Remove the safety wire from the pivot screw (Figure 12-30) (4). Loosen the pivot screw (4), upper alternator mounting bolt (9) and the screw (7) securing the alternator (19) to the adjustable brace (15).

2. Remove and discard the V-belt (20) from the alternator sheave (10).

3. Remove the screw (7), lock washer (5) and washer (8) from the alternator and adjustable brace; discard the lock washer (5). Retain shims (27), if used.
4. Remove the nut (2) and washer (3) from the bolt (9). Support the weight of the alternator and remove the upper mounting bolt (9) from the alternator and bracket. Retain shims, if used.

12-11.2. Belt-Driven Alternator Bracket and Drive Sheave Removal

1. Remove the belt-driven alternator according to instructions in Section 12-11.1.
2. Remove the screw (Figure 12-31) (4), lock washer (5), washer (6), adjustable brace (15); discard the lock washer (5).
   
   NOTE: Shims (24) are installed to align the bracket with the contour of the crankcase; the number of shims may be more or less than illustrated.
3. Remove the bolt (21), spacer (23), shims (24), lock washer (25), washers (22), and nut (26). Discard the lock washer (25).
4. Remove the nuts (16) and washers (17) from the crankcase through-bolts.
5. Remove the bracket (1) and spacers (18) from the crankcase through-bolts.

See Figure 12-30 for index

6. Remove the six bolts (Figure 12-30) (13), washers (14), and nuts (12) from the front drive sheave (10) and adapters (11). Remove the drive sheave (10) and split sheave adapters (11) from the crankshaft.
**12-12. Compressor Mounting Assembly (Optional) Removal**

1. Follow the aircraft manufacturer’s instructions to remove the air conditioning compressor.
2. Turn the tensioning bolt (Figure 12-32) (10) counter-clockwise and relieve belt tension.
3. Remove and discard the compressor drive belt (17).
4. Remove three each bolts and washers (15 and 16).
5. Remove the compressor mounting bracket from the crankcase and set it aside until disassembly in Section 13-11.

![Figure 12-32. Optional Air Conditioning Compressor Mount Assembly](image-url)
12-13. Starter and Adapter Removal

1. Remove two nuts (Figure 12-33) (8), lock washers (7) and washers (6) from the crankcase studs at 7 and 11 o’clock (inboard) positions just aft of the #1 cylinder adjacent to the starter mounting flange; discard the lock washers (7).

2. Remove the nuts (8), lock washers (7), washer (6 & 10) from the starter adapter cover at 7 and 9 o’clock positions. Discard the lock washers (7).

3. Remove the starter and starter adapter assembly from the crankcase; discard the gasket (9)

4. Set the starter and starter adapter aside until disassembly in Section 13-6.

![Figure 12-33. Starter and Adapter](image-url)

<table>
<thead>
<tr>
<th>Number</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Starter Motor</td>
</tr>
<tr>
<td>2</td>
<td>Starter Adapter</td>
</tr>
<tr>
<td>3</td>
<td>Nut</td>
</tr>
<tr>
<td>4</td>
<td>Washer</td>
</tr>
<tr>
<td>5</td>
<td>O-ring</td>
</tr>
<tr>
<td>6</td>
<td>Washer</td>
</tr>
<tr>
<td>7</td>
<td>Lock washer</td>
</tr>
<tr>
<td>8</td>
<td>Nut</td>
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<tr>
<td>9</td>
<td>Gasket</td>
</tr>
<tr>
<td>10</td>
<td>Washer</td>
</tr>
<tr>
<td>11</td>
<td>O-ring</td>
</tr>
<tr>
<td>12</td>
<td>Sleeve</td>
</tr>
<tr>
<td>13</td>
<td>Spacer</td>
</tr>
<tr>
<td>14</td>
<td>Lock Nut</td>
</tr>
</tbody>
</table>
12-14. Oil Sump Removal

NOTE: The oil should have been drained prior to engine removal. The safety wire should have been removed and discarded, and the oil drain plug (8) and copper gaskets (6, 7) were removed with the oil pump. Discard the copper gasket (6, 7).

1. Remove the bolts (Figure 12-34, Figure 12-35 or Figure 12-36) (13 & 15), lock washers (12), and washers (11); discard the lock washers (12).

2. Remove the bracket (15) from the sump rail.

3. Do not pry the oil sump (10) away from the crankcase. Lightly tap the oil sump with a rubber mallet to loosen it from the crankcase; remove the oil sump from the crankcase.

4. Remove and discard the gasket (9) and residue.

5. Remove the nut (5), washers (3 & 4) and bolt (2).

6. Remove the oil suction tube (1) assembly from the crankcase.

7. Remove and discard the copper gaskets (6, 7 & 14).

---

Figure 12-34. Oil Sump

1 Oil Suction Tube Assy 6 Copper Gasket 11 Washer 15 Bracket
2 Bolt 7 Copper Gasket 12 Lock Washer 15 Bolt
3 Washer 8 Plug 13 Bolt 16 Oil Coupling
4 Washer 9 Oil Sump Gasket 14 Copper Gasket
5 Nut 10 Oil Sump
Engine Disassembly

Figure 12-35. Oil Sump

Figure 12-36. Oil Sump
12-15. **Inter-Cylinder Baffle Removal**

1. Remove and discard the baffle tie springs (Figure 12-37) (10), if used.

2. Place a hand below the lower baffle assemblies (3 & 5, 3 & 6, 4 & 5) as the bolts are removed from the baffle supports (1 & 2) to avoid damage to the assemblies during disassembly. Remove the bolts (9), washers (7) and baffle supports (1 & 2) from the top of the cylinder baffle assemblies. Remove the lower baffle assemblies (3 & 5, 3 & 6, 4 & 5) as the bolts are removed from the corresponding baffle supports (1 & 2).

3. Remove the screws (8) and washers (7) from the cylinder base baffles (3 & 4) and separate the cylinder base baffles (3 & 4) from the baffle assemblies (5 & 6).

4. Remove the grommet (11), if used.
Figure 12-37. Inter-Cylinder Baffle Assembly

1 \hspace{0.2cm} \text{Baffle Support} \hspace{1cm} 4 \hspace{0.2cm} \text{Cylinder Base Baffle} \hspace{1cm} 7 \hspace{0.2cm} \text{Washer} \hspace{1cm} 10 \hspace{0.2cm} \text{Baffle Tie Spring}

2 \hspace{0.2cm} \text{Baffle Support} \hspace{1cm} 5 \hspace{0.2cm} \text{Baffle Assembly} \hspace{1cm} 8 \hspace{0.2cm} \text{Screw} \hspace{1cm} 11 \hspace{0.2cm} \text{Grommet}

3 \hspace{0.2cm} \text{Cylinder Base Baffle} \hspace{1cm} 6 \hspace{0.2cm} \text{Baffle Assembly} \hspace{1cm} 9 \hspace{0.2cm} \text{Bolt}
12-16. Engine Cylinder Removal

1. Remove the Inter-Cylinder Baffles adjacent to the cylinder being removed according to instructions in Section 12-15.

2. Loosen and remove the cylinder drain tubes (Figure 12-39)(45).

3. Remove the drain tube fitting (16) and drain tube seal (46); discard the drain tube seal (46). SIL00-11 announced a redesigned cylinder drain tube fitting to replace drain tube fitting P/N 632068 for improved cold weather starting characteristics. Verify the tapered end of the drain tube has a nozzle (Figure 12-38) extending into the cylinder. If the cylinder drain terminates at the taper, replace the fittings with the improved nozzle, regardless of condition.

![Figure 12-38. Cylinder Drain Tube Fitting](image)

4. Remove the screws (Figure 12-39) (32), lock washers (31), and washers (30), and rocker covers (29) from all six cylinders; discard the lock washers (31).

5. Remove and discard the six rocker cover gaskets (28).

6. Position the crankshaft so the piston is at top dead center and both intake and exhaust valves of the cylinder to be removed are closed.

7. Bend the tab on the tab washers (26) down and remove the screws (27), tab washers (26) and retainers (25). Discard the tab washers (26).

   NOTE: The exhaust rocker arms were modified in 2016 to add additional oil feed hole. If the exhaust rocker arms exhibit only one oil feed hole, discard the exhaust rocker arms and replace with the current design.

8. Remove the intake and exhaust rocker arms (19 & 20), rocker shaft (24), thrust washers (23) and retainer (25) from the cylinder. Discard the rocker shafts (24) and thrust washers (23).

9. Withdraw all of the push rod assemblies (40) from their respective housings (35).

10. Repeat steps 6-9 for the remaining cylinders.

11. Grasp each push rod housing (35) and push it inward toward the crankcase, compressing the push rod housing spring (39); lower the outboard end of the pushrod housing away from the cylinder and remove the push rod housing (35), push rod housing springs (39), washers (36), O-ring seals (37), and packing (38). Discard the O-ring seals (37), packing (38), and springs (39). Repeat this step for the remaining push rod housings.

12. Rotate the engine stand to invert the engine.
13. Remove the hydraulic tappets (54 & 55) by rotating the camshaft to push (use either your finger or a non-ferrous metal (copper, brass) wire) the hydraulic tappets above the crankcase tappet bores. Discard the hydraulic tappets.

14. Rotate the crankshaft until the piston in the cylinder to be removed is at the top dead center position.

15. Using the appropriate wrenches, carefully remove flange nuts (41, 42, & 49) from the cylinder base flange and seventh stud locations.
16. As the last pieces of fastening hardware are being removed, cradle the cylinder in your arm to support the cylinder.

17. Remove the 7th stud brackets (47 & 48). Note that the piston can drop and damage the crankcase if care is not used in step 18 when the cylinder is withdrawn.

18. While supporting the cylinder, carefully and slowly pull the cylinder outward in a straight plane while keeping your other hand free to catch the piston as the cylinder is withdrawn to prevent piston or crankcase damage.

19. Remove and discard the piston pin & plug assembly (Figure 12-40) (6), piston (1) and piston rings (2 through 5).

Figure 12-40. Piston, Piston Pin and Rings

1 Piston 3 Compression Ring 5 Scraper Ring
2 Compression Ring 4 Oil Control Ring 6 Piston Pin

Procedure continues on next page...
20. Remove the cylinder base O-ring (Figure 12-39) (50).

21. Install the cylinder base O-ring (50) in a figure “8” pattern (Figure 12-41) around the cylinder deck studs and connecting rod for support.

22. Place the cylinder upright on a work bench.

23. Repeat steps 17 through 22 to remove and prepare the remaining cylinders for overhaul.

24. Place the cylinders in a clean, protected area until disassembly in Section 13-7.
Engine Disassembly

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Chapter 13. Component Disassembly

13-1. Ignition System

At engine overhaul, magnetos must be replaced with new units or units overhauled according to FAA approved procedures. For Continental (Bendix) magnetos, refer to the S-20/S-200 Series Magneto Service Support Manual (X42002) for applicable overhaul instructions. Replace non-Continental magnetos during overhaul.
13-2. Fuel Injection System

Continental Motors does not provide overhaul instructions for the fuel pump, manifold valve, throttle or mixture control assembly due to the precise calibration requirements after assembly. We offer new and rebuilt fuel pump assemblies, manifold valves, throttle assemblies and mixture control assemblies, or the assemblies may be rebuilt by an FAA Part 145 Repair Station authorized to overhaul the assemblies. Check for evidence of leakage or wear; clean, inspect, and replace the remaining fuel injection system parts according to the overhaul instructions in this and subsequent chapters of this manual.

NOTE: New and factory rebuilt and fuel injection system components which meet new part specifications are available from Continental Motors. Continental Motors does not control FAA Part 145 Repair Station activities; verify the repair station qualifications before contracting fuel injection system overhaul. Fuel injection system overhaul must be accomplished under carefully controlled conditions per approved procedures in compliance with FAA regulations.

Fittings selection and orientation differs significantly between engine model specifications for fuel pumps, manifold valves, throttle bodies, mixture control assemblies and priming assemblies. Using the illustration in Figure 13-1 as a guide, record the orientation of the fitting in relationship to the bore prior to removal. Refer to the recorded fitting orientation during assembly.
Second Fitting Orientation
When first fitting is straight, first fitting orientation applies to the second fitting

Figure 13-1. Fitting Orientation Guide
13-3. Induction System Disassembly

1. Remove and discard the hose clamp assemblies (Figure 13-2 or Figure 13-3) (10), and hoses (20) from the induction tubes (3 through 8) and manifold (1).

2. Loosen hose clamps (37); remove venturi nozzles (35) and hoses (36). Discard hoses (36) and clamps (37).

3. Remove the bolts (31), lock nuts (33) and washers (32) from the induction tube; discard the lock nuts (33). Remove the overboost valve (29) and o-ring (30); discard the o-ring (30).

NOTE: Aftercoolers must be disassembled, cleaned, overhauled, and assembled by an appropriately rated FAA Part 145 approved repair station (or foreign government equivalent). No aftercooler structural repairs are permitted. Replace any aftercooler exhibiting structural damage, bent/broken, or cracked cooling fins. Weld repairs to the aftercooler mounting flange are permitted only by an appropriately rated FAA Part 145 approved repair station.
Component Disassembly

Figure 13-3. Induction System

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th></th>
<th>Description</th>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manifold &amp; Fitting Assembly</td>
<td>13</td>
<td>Washer</td>
<td>25</td>
<td>Clamp Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Gasket</td>
<td>14</td>
<td>Lock Washer</td>
<td>26</td>
<td>Fuel Dist. Tube Bracket</td>
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<tr>
<td>3</td>
<td>Tube</td>
<td>15</td>
<td>Nut</td>
<td>27</td>
<td>Fuel Inj. Line Bracket</td>
</tr>
<tr>
<td>4</td>
<td>Tube</td>
<td>16</td>
<td>Air Manifold Tube Assembly</td>
<td>28</td>
<td>Tube Clamp</td>
</tr>
<tr>
<td>5</td>
<td>Tube</td>
<td>17</td>
<td>Right Air Reference Tube</td>
<td>29</td>
<td>Overboost Valve</td>
</tr>
<tr>
<td>6</td>
<td>Tube</td>
<td>18</td>
<td>Left Air Reference Tube</td>
<td>30</td>
<td>O-ring</td>
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<tr>
<td>7</td>
<td>Tube</td>
<td>19</td>
<td>Screw</td>
<td>31</td>
<td>Bolt</td>
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<td>Tube</td>
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<td>Hose</td>
<td>32</td>
<td>Washer</td>
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<td>9</td>
<td>Hose</td>
<td>21</td>
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<td>33</td>
<td>Lock Nut</td>
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<tr>
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<td>Washer</td>
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<td>Aftercooler Assembly</td>
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<tr>
<td>11</td>
<td>Intake Manifold Gasket</td>
<td>23</td>
<td>Washer</td>
<td>35</td>
<td>Sonic Venturi Nozzle</td>
</tr>
<tr>
<td>12</td>
<td>Flange</td>
<td>24</td>
<td>Compression Seal</td>
<td>36</td>
<td>Hose</td>
</tr>
</tbody>
</table>

1 clamp, 2 gasket, 3 tube, 4 tube, 5 tube, 6 tube, 7 tube, 8 tube, 9 hose, 10 hose clamp, 11 intake manifold gasket, 12 flange.
Component Disassembly

NOTE: Take a photograph or make a sketch the induction manifold fitting location and orientation using the illustration in Figure 13-1 and Figure 13-4 as guides, prior to manifold disassembly. Refer to the recorded fitting orientation during component assembly.

4. Remove the fittings (Figure 13-5) (3 through 6 and 10 through 12, as applicable) from the induction manifold (1) ports (Figure 13-4) (A through F).

5. Remove, examine, clean, inspect, repair/replace aircraft-supplied induction parts according to the aircraft manufacturer's instructions.

6. Remove the bolts (Figure 13-5) (9), washers (7), and spacers (8) from the 2-4-6 side of the bracket and induction manifold (1). Remove the fuel manifold valve and bracket assembly from the 2-4-6 side of the induction manifold. Prepare the fuel manifold valve for core return or overhaul by a Part 145 Repair Station.

Figure 13-4. Induction Manifold Port Detail
Figure 13-5. Induction Manifold
13-4. Turbocharger and Exhaust System Disassembly

1. Remove the fittings (Figure 13-6) (3, 5, 6 & 7) and O-rings (2 & 4) from the wastegate controller (1); discard the O-rings (2 & 4).

![](image)

**Figure 13-6. Wastegate Controller Fittings**

2. Remove the plug (Figure 13-7) (7), fittings (2, 3 & 4) and O-rings (5 & 6) from the wastegate (1); discard the O-rings (5 & 6).
Figure 13-7. Wastegate Fittings
Component Disassembly

3. Remove the bolts (Figure 13-8 or Figure 13-9) (10 & 12) and lock washers (9 & 11) from the adapters (5) and oil reservoirs (3 & 4). Discard the lock washers (9 & 11).

4. Remove the gaskets (7 & 8) and gasket residue from the turbocharger hub, adapters (5), and oil reservoirs (3 & 4).

5. Place protective plugs in the wastegate, wastegate controller and turbocharger oil fittings to prevent contamination. Place protective covers over the turbocharger and wastegate flanges to prevent contamination. Store the wastegate, wastegate controller and turbocharger until transport to an FAA Part 145 Repair Station or Continental Motors as a core return.

Figure 13-8. Turbocharger Lubrication

5. Adapter 11. Lock Washer 17. Check Valve
NOTE: The TSIO-550-N turbocharger lubrication parts the same as the TSIO-550-K except the supply fittings at the oil cooler is different.

Figure 13-9. Turbocharger Lubrication

See Figure 13-8 for parts index
13-5. Oil Pump Disassembly

1. Cut and remove the safety wire (Figure 13-10) (31) from the oil pressure relief valve assembly. Remove the lock nut (14) and copper washer (13) from the adjustment screw (9); discard the lock nut (14) and copper washer (13).

2. Unscrew the oil pressure relief valve assembly housing (11) from the oil pump housing (2). Remove and discard the gasket (10).

3. Remove the seat (8), spring (7), and plunger (6) from the oil pump housing (2) if they remain after removing the oil pressure relief valve assembly from the oil pump housing (2).

4. Discard the gasket (10).

5. Remove the nuts (20), lock washers (19), and washers (18) from the studs at 6 and 12 o'clock. Remove the oil pump cover (16) from oil pump housing (2). Discard the lock washers (19).

6. Remove the drive gear (15) and driven gear assemblies (4) from the oil pump housing (2).
13-6. Starter and Starter Adapter Disassembly

TSIO-550 starter adapters are fitted with a scavenge pump. Some engine models use a scavenge pump with a drive sheave for an external accessory drive, others do not have a drive sheave. Field repairs/overhaul on starter adapters with a scavenge pump and no accessory (PTO) drive shaft are prohibited. Instructions in this section apply only to the starter adapter with accessory drive sheave. If the starter adapter has no drive sheave, it must be replaced at overhaul.
Component Disassembly

13-6.1. Starter Adapter with Scavenge Pump and Accessory Drive Disassembly

NOTE: If the starter adapter has no PTO drive shaft extending outside the scavenge pump housing, starter adapter overhaul is prohibited; starter adapters with no PTO drive shaft must be replaced at overhaul.

1. Remove the retaining ring (Figure 13-11) (9) from the starter adapter housing with retaining ring pliers; discard the retaining ring (9).

2. Clamp the starter shaft gear (16) teeth in shielded vise jaws to prevent the worm drive assembly from turning.

   CAUTION: Do not clamp the starter adapter housing (1) in a vise.

3. Insert a Worm Shaft Tool (illustrated in “Special Tools” section of Chapter 2 of M-0, Standard Practice Maintenance Manual) into the slot of the worm drive shaft (4). Rotate the worm drive shaft (4) counter-clockwise to dislodge the bearing (8) from the adapter housing (1). (An arbor press may be required to remove the bearing (8) from the worm drive shaft (4)).

4. If possible, remove the entire shaft assembly (4, 5, 6, 7, & 8) from the adapter housing (1). Otherwise, remove components after removing the shaft (4). Separate the worm gear (7), spring (6), woodruff key (5), and shaft (4). Discard the bearing (8), woodruff key (5), and spring (6).

5. Use a 12-point deep socket, remove and discard the self-locking 12-point nut (49).

6. Remove the nut (42), lock washer (41), and seal retainer clip (39) from the top hole in the scavenge pump housing (35).

7. Remove the spacer or sheave (48), sleeve (47) and O-ring (46). Remove and discard the oil seal (45) and bearing (44). Remove the spacer (43) from the scavenge pump housing (35).

8. Remove the five remaining nuts (42), lock washers (41) and washers (40) from the scavenge pump housing (35); discard the lock washers (41).

9. Use a rawhide or plastic mallet to gently tap the scavenge pump housing (35) loose; remove the scavenge pump housing (35), driver gear (32), driven gear (34) and bushing (33), discard the bushing (33).

10. Remove the nuts (31) and washers (30) from the perimeter of the starter adapter cover (24); use an inertia puller or other suitable tool to detach the cover (24).

11. Remove and discard the O-ring (23) from the starter adapter cover (24).

12. Remove and discard the clutch spring retaining screw (21) and tab washer (20)

13. Place the starter shaft gear (16) in a shielded vise. Insert the Starter Adapter Disassembly Tool (“Special Tools” in Chapter 2 of M-0, Standard Practice Maintenance Manual) in the worm wheel gear holes; rotate the starter assembly gear in a driving direction to wind the clutch spring (17) while simultaneously pulling axially to release the clutch spring (17) from the clutch spring sleeve (2).

14. Separate the clutch spring (17) from starter shaft gear (16).
15. Remove the roller bearing (18), worm wheel gear (19), and bearing (22) from starter shaft gear (16). Discard the roller bearing (18) and bearing (22).

![Component Disassembly](image_url)

**Figure 13-11. Starter and Adapter Assembly with Accessory Drive**

<table>
<thead>
<tr>
<th>Component</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Starter Adapter Housing</td>
<td>14</td>
</tr>
<tr>
<td>2. Sleeve, Clutch Spring</td>
<td>15</td>
</tr>
<tr>
<td>3. Needle Bearing</td>
<td>16</td>
</tr>
<tr>
<td>4. Worm Drive Shaft</td>
<td>17</td>
</tr>
<tr>
<td>5. Woodruff Key</td>
<td>18</td>
</tr>
<tr>
<td>6. Starter Spring</td>
<td>19</td>
</tr>
<tr>
<td>7. Starter Worm Gear</td>
<td>20</td>
</tr>
<tr>
<td>8. Radial Ball Bearing</td>
<td>21</td>
</tr>
<tr>
<td>9. Internal Retaining Ring</td>
<td>22</td>
</tr>
<tr>
<td>10. Stud</td>
<td>23</td>
</tr>
<tr>
<td>11. Stud</td>
<td>24</td>
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<tr>
<td>12. Stud</td>
<td>25</td>
</tr>
<tr>
<td>13. Stud</td>
<td>26</td>
</tr>
<tr>
<td>14. Stud</td>
<td>27</td>
</tr>
<tr>
<td>15. Dowel</td>
<td>28</td>
</tr>
<tr>
<td>16. Starter Shaft Gear</td>
<td>29</td>
</tr>
<tr>
<td>17. Clutch Spring</td>
<td>30</td>
</tr>
<tr>
<td>18. Roller Bearing</td>
<td>31</td>
</tr>
<tr>
<td>19. Starter Worm Gear</td>
<td>32</td>
</tr>
<tr>
<td>20. Tab Washer</td>
<td>33</td>
</tr>
<tr>
<td>21. Screw</td>
<td>34</td>
</tr>
<tr>
<td>22. Ball Bearing</td>
<td>35</td>
</tr>
<tr>
<td>23. O-Ring</td>
<td>36</td>
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<tr>
<td>24. Cover Assembly</td>
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<td>25. Plug</td>
<td>38</td>
</tr>
<tr>
<td>26. Stud</td>
<td>39</td>
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<tr>
<td>27. Stud</td>
<td>40</td>
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<td>28. Stud</td>
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<tr>
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<td>42</td>
</tr>
<tr>
<td>30. Washer</td>
<td>43</td>
</tr>
<tr>
<td>31. Nut</td>
<td>44</td>
</tr>
<tr>
<td>32. Scav. Pump Driven Gear</td>
<td>45</td>
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<tr>
<td>33. Bushing</td>
<td>46</td>
</tr>
<tr>
<td>34. Scav. Pump Driver Gear</td>
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</tr>
<tr>
<td>35. Scav. Pump Body</td>
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<tr>
<td>36. 90° Street Elbow</td>
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<tr>
<td>37. 45° Elbow</td>
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</tr>
<tr>
<td>38. 90° Elbow</td>
<td></td>
</tr>
<tr>
<td>39. Seal Retainer Clip</td>
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</tr>
<tr>
<td>40. Washer</td>
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</tr>
<tr>
<td>41. Lock Washer</td>
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</tr>
<tr>
<td>42. Nut</td>
<td></td>
</tr>
<tr>
<td>43. Spacer</td>
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</tr>
<tr>
<td>44. Bearing</td>
<td></td>
</tr>
<tr>
<td>45. Starter Shaft Seal</td>
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</tr>
<tr>
<td>46. O-ring Seal</td>
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</tr>
<tr>
<td>47. Starter Shaft Sleeve</td>
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<tr>
<td>48. Starter Shaft Spacer</td>
<td></td>
</tr>
<tr>
<td>49. Flanged Nut</td>
<td></td>
</tr>
</tbody>
</table>

*Procedure continues on next page*
Component Disassembly

16. Remove the needle bearing (3) from the starter adapter housing (1) with an arbor press or a slide hammer/blind bearing removal tool; discard the needle bearing (3).

17. Remove the fittings (36, 37 & 38) from the scavenge pump housing (35).

18. Clean, inspect and repair the starter and starter adapter according to the instructions in Chapters 14, 15 and Appendix D.

Figure 13-11 repeated for reference
13-7. Engine Cylinder Disassembly

CAUTION: To prevent damage to the engine cylinder, take precautions when removing studs as directed in “Replacing Rosan-Ring-locked Studs” in Appendix C.

1. Place the cylinder assembly (Figure 13-12) on a cylindrical block of wood anchored to a workbench.

2. Use a Valve Spring Compressor Tool (Section 2-1 of M-0, Standard Practice Maintenance Manual) to carefully compress the valve springs. Do not cock the rotocoil (retainer) (Figure 13-12) (18 & 53) which could score the valve stem.

3. Use needle nose pliers to remove and discard the retainer keys (17).

4. Remove and discard the rotocoil (18).

5. Remove and discard the following:
   a. Intake valve retainer (53)
   b. Outer springs (14)
   c. Inner springs (13)

6. Remove the lower retainers (16).

7. Remove and discard the intake valve guide seal (51)

8. Hold the valve stems while lifting the cylinder from its support and place the cylinder on its side.

9. Remove any nicks on the intake valve stem using an emery stone or cloth.

10. Remove and discard the exhaust valves (12).

11. Remove and discard the cylinder exhaust flange studs, regardless of condition, according to the instructions in Section C-2 of M-0, Standard Practice Maintenance Manual.

12. Support the intake and exhaust rocker arms (19 & 20) on a ring or vise to allow the old bushings to pass.

13. Press the worn rocker arm bushings (21) out using the proper size arbor tool. Discard the rocker arm bushings (21).

14. Remove the baffle (43). Inspect each cylinder baffle and repair or replace, if necessary, during overhaul.

15. Remove and discard the baffle spring (44).

16. Perform the “Visual Inspection” according to instructions in Section 11-1 of M-0, Standard Practice Maintenance Manual to determine if the cylinder may be a candidate for overhaul inspection and repair.
Figure 13-12. Cylinder Assembly
13-8. Accessory Drive Pad Disassembly

1. Remove the nuts (Figure 13-13) (114), lock washers (113), and washers (112) from the four corners of the accessory pad cover (111). Remove the cover (111) and gasket (110). Discard the gasket (110) and lock washers (113).

2. Remove and discard the oil seal (109).

3. Use an arbor press to remove the bushing (106); discard the bushing (106).

4. Place the accessory drive components in a clean, storage area until overhaul inspection and repair in Chapter 15.

*NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.

Figure 13-13. Accessory Drive Assembly
13-9. Crankcase Disassembly

13-9.1. Miscellaneous Crankcase Accessory Removal

1. Remove two sets of nuts (Figure 13-14) (11), lock washers (10), and washers (9); discard the lock washers (9). Remove the camshaft cover (7) and gasket (8); discard the gasket (8).

2. Remove the nuts (18) and lock washers (17) from the idler gear support pin (14); discard the lock washers (17).

3. Remove the idler gear support pin (14), flange gasket (15), and idler gear bushing (16). Discard the flange gasket (15) and idler gear bushing (16).

4. Remove the oil gauge rod (21) from the oil filler assembly (19); remove and discard the gasket (22) from the oil gauge rod (21). Remove the screws (26), lock washers (27), and washers (28) from the oil filler assembly (19). Remove the oil filler assembly (19) from the crankcase. Remove and discard the oil breather gasket (20). Remove the oil filler adapter (24) from the crankcase; remove and discard the O-rings (23 & 25) from the oil filler adapter (19).

![Figure 13-14. Miscellaneous Crankcase Hardware](image)
5. Remove the bolts (Figure 13-14) (13) and oil seal retainer plates (12) from the crankcase halves.

6. Remove the nuts (6), lock washers (5), washers (4) and spacers (3) from the governor drive (or cover (1)). Remove the cover (1) and gasket (2) from the crankcase and discard the gasket (2).

7. Remove the nuts and washers holding the rear lifting eye. Remove the lifting eye from the crankcase.

Figure 13-14 repeated for reference

7. Remove the nuts and washers holding the rear lifting eye. Remove the lifting eye from the crankcase.

Figure 13-15. Crankcase Fastener Locations

NOTE: Reference the locations in Figure 13-15 for fastener removal. Due to lack of clearance, do not attempt to remove the bolt and washer adjacent to the right accessory drive stud.
8. Remove the 0.31” bolts, nuts and washers along the crankcase backbone (55-63 and 65-68).

9. Remove the lifting eye (63), throttle bracket (61) and fuel manifold valve bracket (55).

10. Remove the fastening hardware at locations 45 and 46. Using a soft mallet, tap out and discard the through-bolts.

11. Remove the three bolts and washers from positions 69, 70 and 71.

12. Remove nuts, and washers from eight 10.75” through-bolts in position 37-44. Tap the through-bolts out with a mallet and discard the through-bolts. Remove and discard the O-rings from each through-bolt.

13. Remove the baffle supports from 42R; 43 and 44L.

14. Remove the fastening hardware (64) and O-ring; tap the through-bolt out with a mallet and discard the through-bolt and O-ring.

15. Rotate the engine stand to invert the engine.

16. Remove the six 0.25” screws (positions 77-82) from the crankcase belly.

17. Remove the 0.31” fasteners (positions 73-76) below the camshaft journal.

18. Rotate the engine stand placing the left crankcase half downward. Support the engine under the left crankcase half.

19. Disconnect the right crankcase engine mounts from the engine stand and carefully lift the right crankcase half from the left crankcase half to support the connecting rods to prevent them from hitting the cylinder decks.

20. Check and record the gear backlash according to the specifications in Appendix D before proceeding to the next step.

21. Remove the crankshaft assembly (Figure 13-22) from the crankcase and place it in a holding fixture for inspection.

22. Remove the idler gear (3) from the crankcase.

23. Remove and discard the crankshaft bearings (2) and thrust washers (1).

24. Remove the camshaft assembly (Figure 13-21) (1) and governor driven gear (7) from the crankcase.
Component Disassembly

13-9.2. Crankcase Studding Disassembly

1. Remove starter shaft gear roller bearing (Figure D-23)(1) from the crankcase with a slide hammer and blind bearing remover; discard the starter shaft gear roller bearing.

   NOTE: Tag removed crankcase plugs with a label to identify removed location. During crankcase assembly, all plugs must installed same crankcase location from which they were removed to prevent oil pressure loss.

   CAUTION: Do not attempt to remove the crankcase oil squirt nozzles, field replacement is not possible.

2. Use a Crankcase Through-Bolt Remover Tool (Section 2-1 in M-0, Standard Practice Maintenance Manual), remove the applicable crankcase hardware and plugs listed in Section D-9.6 to allow pressure flushing the crankcase. Inspect plugs for wear; replace worn plugs. Tag plugs to identify the respective locations for accurate identification during assembly.

3. Inspect crankcase studs for serviceability and proper extension (length) according to instructions in Section 15-7.1.

4. Examine the components for evidence of leakage or wear according to the instructions in Chapter 15. Clean the components according to instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual. Perform the non-destructive inspections and repairs according to the instructions in Chapter 11 of M-0, Standard Practice Maintenance Manual.
13-9.3. Engine and Turbocharger Mount Disassembly

Engine mounting brackets vary by engine model. Refer to the instructions applicable to the engine model in Section 13-9.3.1 through Section 13-9.3.4.

13-9.3.1. TSIO-550-B, C, & E Engine and Turbocharger Mount Disassembly

1. Remove the nuts (Figure 13-16) (6) and washers (5) from the crankcase studs.
2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).

![Figure 13-16. Engine and Turbocharger Mounting Brackets B C E](image)

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fwd Engine Mount</td>
</tr>
<tr>
<td>2</td>
<td>Aft Engine Mount</td>
</tr>
<tr>
<td>3</td>
<td>Left Turbo Support Bracket</td>
</tr>
<tr>
<td>4</td>
<td>Right Turbo Support Bracket</td>
</tr>
<tr>
<td>5</td>
<td>Washer</td>
</tr>
<tr>
<td>6</td>
<td>Nut</td>
</tr>
<tr>
<td>7</td>
<td>Washer</td>
</tr>
<tr>
<td>8</td>
<td>Spacer</td>
</tr>
<tr>
<td>9</td>
<td>Helical Coil Insert</td>
</tr>
</tbody>
</table>
1. Remove the nuts (Figure 13-17) (6) and washers (5) from the crankcase studs.

2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).

Figure 13-17. Engine and Turbocharger Mounting Brackets

1 Fwd Engine Mount 4 Right Turbo Support Bracket 7 Washer
2 Aft Engine Mount 5 Washer 8 Spacer
3 Left Turbo Support Bracket 6 Nut 9 Helical Coil Insert
13-9.3.3. TSIO-550-K Engine and Turbocharger Mount Disassembly

1. Remove the nuts (Figure 13-18) (6) and washers (5) from the crankcase studs.
2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).

Figure 13-18. Engine and Turbocharger Mounting Brackets

<p>| | | | | | | | | |</p>
<table>
<thead>
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</tr>
</thead>
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<td>1</td>
<td>Fwd Engine Mount</td>
<td>4</td>
<td>Right Turbo Support Bracket</td>
<td>7</td>
<td>Washer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Aft Engine Mount</td>
<td>5</td>
<td>Washer</td>
<td>8</td>
<td>Spacer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Left Turbo Support Bracket</td>
<td>6</td>
<td>Nut</td>
<td>9</td>
<td>Helical Coil Insert</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13-9.3.4. TSIO-550-N Engine and Turbocharger Mount Disassembly

1. Remove the nuts (Figure 13-19) (6) and washers (5) from the crankcase studs.
2. Remove the turbocharger brackets (3 & 4), washers (7), spacers (8), and engine mounts (1 & 2).
13-10. Engine Drive Train Disassembly

The engine drive train consists of the camshaft and crankshaft.

13-10.1. Camshaft Disassembly

1. Remove the governor drive gear (Figure 13-21)(6). Inspect the mating surfaces of the camshaft and governor drive gear: if the end of the camshaft and bore of the governor drive gear are smooth (Figure 13-20), and secured with a woodruff key (6), discard the obsolete governor drive gear (7), woodruff key (6) and the camshaft; obtain the replacement camshaft assembly depicted in Figure 13-21.

2. Cut and remove the safety wire from the bolts (Figure 13-21) (5). Remove the four bolts (5) and the camshaft gear (4). Discard the bolts (5).

   CAUTION: Camshaft assemblies may feature pressed-in plugs, threaded plugs or a combination of both. Threaded plugs are easily identified by their hex socket head. Do not remove the pressed-in plugs. Replace camshaft assemblies exhibiting pressed-in plugs with the replacement camshaft featuring threaded bores and a splined drive shaft at overhaul.

3. Remove the front and rear threaded, hex drive camshaft plugs (2 and 3).
13-10.2. Crankshaft Disassembly

CAUTION: When disassembling the crankshaft, do not scribe or punch the counterweights and crankshaft to identify locations. Use only tags or ink to identify locations.

1. Place wooden support blocks under the crankshaft front and rear main journals.

2. Remove and discard all spiral lock nuts (Figure 13-22) (4) and connecting rod bolts (5). Separate the connecting rod caps (6) from the connecting rod (7) with their position numbers matched.

3. Remove and discard the connecting rod bearing inserts (8).

   NOTE: Leave the counterweights intact. Detailed counterweight removal and disassembly instructions are included in Section 10-9.1 of M-0, Standard Practice Maintenance Manual.

4. Remove the two lock nuts (17) securing the oil transfer collar. Separate the oil transfer collar assembly (18 through 21) from the crankshaft. Discard the lock nuts (17), dowel pin (18), and O-ring (21).

   CAUTION: The correct crankshaft gear screws have safety wire holes drilled in all sides. If the removed screws are drilled in only two sides, replace the crankshaft gear screws, regardless of condition.

5. Cut, remove and discard the safety wire; remove and discard the six drilled head screws (22).

6. Remove the large and small gears (24 and 23) by tapping the circumference of the gears using a rawhide mallet.

7. Inspect the large crankshaft gear (23) for part number and revision. If the crankshaft gear is identified with Part No. 656991 Rev B or earlier, discard the gear, regardless of condition (Ref: SB13-6). Part No. 656991 Rev B or earlier, is easily identified by the copper plating on the surface of the gear where it mates with the crankshaft. Later revisions of the part are not copper plated in this area.

   NOTE: The dowel (32) is installed with an interference fit. If repeated efforts to remove the dowel with a slide hammer are unsuccessful, it may be necessary to weld a nut on the end of the dowel to increase gripping force.

8. Remove the dowel (32) from the crankshaft with a slide hammer fitted with an adjustable chuck; discard the dowel.

9. Drive the ears of the tab lock plate (26) flat with a drift. Remove the four bolts (25), tab lock plates (26), and alternator face gear (27). Discard the tab lock plates (26) and bolts (25).

   CAUTION: Do not scratch, mar, or damage the crankshaft or crankcase while removing the crankshaft nose oil seal.
10. Twist and remove the split reinforcing ring (29) from the crankshaft nose oil seal (30). Discard the reinforcing ring (29).

11. Work the oil seal spring (28) from the oil seal groove and detach it from the oil seal (30). Unhook the spring ends using an unwinding motion and discard the oil seal spring (28).

12. Twist and remove the crankshaft nose oil seal (30) from the crankshaft. Gentle prying may be required to extract the seal from the counterbore. Discard the crankshaft nose oil seal.

13. Clean the Gasket Maker residue from the crankshaft according to the instructions in Section 10-10 of M-0, Standard Practice Maintenance Manual.
13-10.2.1. Crankshaft Counterweight Removal

**Equipment Required**
- Snap ring pliers with 90° bend
- Borroughs Part No. 4965A Crankshaft Hanger Blade Bushing Removal/Installation Tool (Section 2-1 of M-0, Standard Practice Maintenance Manual), or equivalent

2. Inspect the Crankshaft Counterweights according to the instructions in Section 10-9.1.3 and Section 10-9.1.4 of M-0, Standard Practice Maintenance Manual.
3. Inspect the Crankshaft Counterweight Hanger Blade according to the instructions in Section 10-9.1.6 of M-0, Standard Practice Maintenance Manual.
4. Perform the Crankshaft Dimensional Inspections in Section 15-7.2 to determine if the crankshaft can be overhauled.

13-11. Compressor Mounting Kit Disassembly

1. Remove the sheave support bolt (Figure 13-23) (5), sheave assembly (3, 3.01 & 3.02), shims (19), and spacer (6) from the block assembly (4). Discard the spacer and shims.
2. Remove the retaining ring (3.02) from the idler sheave (3) with snap ring pliers; discard the retaining ring.
3. Support the idler sheave (3), face down on a 1" diameter cylindrical block centered under an arbor press. Press the bearing (3.01) out of the idler sheave (3) and discard the bearing.
4. Remove the bolt (7) and washer (8) from the block (4).
5. Remove the compressor mounting hardware (12, 13, and 14) from the mounting bracket (2). Discard the self-locking nuts (12).
6. Remove the adjusting bolt (9); jam nut (10), washer (13), and rectangular nut (11) from the mounting bracket (2).

   **NOTE:** The self-locking nut is part of the starter adapter assembly. The drive sheave (11) may be provided by the aircraft manufacturer, part of the optional compressor bracket kit, or delivered with the engine, depending on the engine model specification.

7. Remove the self-locking 12-point nut (part of starter adapter, see Figure 13-11), sheave (18) and shims (20) from the starter adapter PTO shaft; discard the self-locking 12-point nut.
8. Remove three bolts (15), washers (16), and spacer (22) securing the bracket (2) to the aft 1-3-5 side of the crankcase. Remove the bracket (2) from the crankcase and set it aside for overhaul inspection and repair.
Figure 13-23. Freon Compressor Mounting Kit

 ITEMS 2 THRU 14 INCLUDED IN ITEM 1

1 Mounting Bracket Assembly 5 Sheave Support Bolt 11 Rectangular Nut 17 Drive Belt
2 Mounting Bracket 6 Spacer 12 Lock Nut 18 Driver Sheave
3 Idler Sheave 7 Bolt 13 Plain Washer 19 Shim
3.01 Ball Bearing 8 Special Washer 14 Bolt 20 Shim
3.02 Retaining Ring 9 Tensioning Bolt 15 Bolt 21 Compressor
4 Block Assembly 10 Jam Nut 16 Washer 22 Spacer
Chapter 14. Engine Cleaning

Refer to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual.
Engine Cleaning

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Chapter 15. Overhaul Inspection and Repair

15-1. Engine Overhaul Inspection Program

The Engine Overhaul Inspection Program consists of inspection procedures cited in this chapter. The inspections apply only to the engines covered in this manual and is intended to support the continued airworthiness of the engine.

15-2. Engine Overhaul Inspection Checklists

Use the Engine Overhaul Inspection Checklists in Chapter 11 as guides for performing the inspections required during engine overhaul. Print a copy of the checklist to record inspection progress and document actions taken during overhaul.

Perform the items on the checklists (in the order listed) on an engine which has been removed from the aircraft, disassembled, and cleaned according to the instructions provided.

15-3. Visual Inspection

Perform visual inspections according to the instructions in Section 11-1 of M-0, Standard Practice Maintenance Manual.

15-3.1. Gear Tooth Inspection

Inspect the gear teeth according to the instructions in Section 11-1.1 of M-0, Standard Practice Maintenance Manual.

15-4. Fluorescent Penetrant Inspection

1. Perform a Fluorescent Penetrant Inspection on all cleaned, aluminum or non-ferrous metal parts according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.

2. Record inspection findings on the “Fluorescent Penetrant Inspection Checklist.”

15-5. Magnetic Particle Inspection

1. Perform Magnetic Particle Inspection according to the instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

2. Record repair or replacement requirements on the Engine Overhaul Inspection Checklist.

15-5.1. Connecting Rod Magnetic Particle Inspection

1. Perform Connecting Rod Magnetic Particle Inspection according to the instructions in Section 11-3.1 of M-0, Standard Practice Maintenance Manual.

2. Record inspection findings on the “Magnetic Particle Inspection Checklist.”
15-6. Ultrasonic Inspections

The inspections must be performed by technicians possessing inspection certification credentials. Refer to Ultrasonic Inspection in Section 11-4 of M-0, Standard Practice Maintenance Manual.

15-6.1. Crankshaft Ultrasonic Inspection

The crankshaft requires an Ultrasonic Inspection to determine if it is a candidate for overhaul. Refer to the Crankshaft Ultrasonic Inspection instructions in Section 11-4.2 of M-0 of M-0, Standard Practice Maintenance Manual.
15-7. Dimensional Inspection

Continental Motors uses new parts dimensions and assembly clearances for engine overhaul. New part dimensions listed in Appendix D are based on product engineering drawings in effect at the time of publication.

Clearances in the new part limits apply to mating parts.

**CAUTION:** Prior to dimensional inspection, ensure the part conforms to all Visual, Fluorescent Penetrant, Magnetic Particle, and Ultrasonic Inspection requirements.

*Ensure the parts have been thoroughly cleaned and dried according to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual.*

1. Measure part dimensions in comparison to the dimensional limits specified in Appendix D. Record the measurements on the “Dimensional Inspection Checklist” (Table 11-7).

2. If the part dimension fits within the minimum and maximum range specified in Appendix D, the part may be re-used during overhaul provided it meets all other inspection requirements.

**WARNING**

*Use only the Appendix D dimensions during engine overhaul.*

3. Label each part’s inspection status and required action.

4. Record inspection results on the Engine Overhaul Inspection Checklist.
15-7.1 Crankcase Dimensional Inspection

This inspection verifies the crankcase structural and dimensional integrity.

**Equipment Required**
- Mechanic’s hand tools and calibrated torque wrench
- Inspection light
- Mirror

1. Inspect the exterior of the crankcase halves for cracks. Carefully inspect the entire external surface of the crankcase using an inspection light and mirror. Pay particular attention to areas adjacent to the cylinder mount flanges, tappet guides, case flange, nose seal land and bearing bosses.

2. Look for scoring on the old crankshaft bearings, tappet guides, and camshaft bearings and journals.

3. Inspect the main bearing boss parting surfaces for fretting.

4. Inspect the bearing saddles for elongation of the bearing lock slot or for any indication of bearing movement.

5. Inspect all machined surfaces for nicks and roughness.

6. Inspect the crankcase for cracks and the progression of any cracks crankcase according to the instructions in Section 6-4.12 of M-0, Standard Practice Maintenance Manual.

7. Inspect the breather for cracks and dents. Inspect tube ends for scoring and out of roundness that may cause a bad seal and oil leakage. Discard and replace components with any of these indications.

8. Inspect engine mount pads and brackets for cracks, dents and wear. Inspect hardware for distorted or stripped threads and damaged wrench flats. Discard and replace any components exhibiting these indications.

9. Inspect all crankcase helical coils and studs for stripped or distorted threads. Inspect studs for corrosion, rusting, pitting, incomplete threads and looseness.

10. Inspect crankcase studs with a tool maker’s square for alignment. Check studs for looseness. Check crankcase stud height settings versus Appendix D specifications. Remove, discard, and replace non-conforming studs with new studs.

11. Inspect the number one, two and three main bearing oil feed passages to determine if they conform to the crankcase main bearing oil feed hole specifications in Figure D-13. The subject passages are located in the left (2-4-6) case half and begin in the rear main bearing saddle, counting forward. Proper main bearing oil feed hole chamfers are required to prevent cracks from forming in the area.

**Prerequisites**

Prior to completing the dimensional inspections of the crankcase, crankshaft, and camshaft bores, temporarily assemble and torque the crankcase specifically for this inspection using the torque sequence shown in Figure 15-1.
12. For the preliminary torque, torque the crankcase fasteners in Figure 15-1 to $\frac{1}{2}$ the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Repeat the torque sequence in Figure 15-1 using the full value for the fastener indicated in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 15-1. Crankcase Dimensional Inspection Torque Sequence](image)

14. Measure dimensional clearances for the assembled crankcase in Appendix D, inside and outside dimensions, with bearings out and repeat with bearings installed to check running clearance.

   NOTE: The keyed camshaft gear (Part No. 656031) was superseded (Reference: SB05-8) and is no longer available. The new camshaft gear and camshaft are splined; the new gear is 0.060” wider than the previous gear. The crankshaft starter adapter bearing boss must be machined with a radius cut to provide clearance for the new camshaft gear.

15. Inspect the starter adapter shaft bore for compliance with SB05-8; to accommodate the new camshaft gear. Refer to Section 15-8.10.1 for crankcase machining requirements.

16. Record inspection results on “Dimensional Inspection Checklist” (Table 11-7).
15-7.2. Drive Train Dimensional Inspection

**Equipment required**
- A surface plate
- Metalworking lathe or two matched V-blocks
- Dial indicator
- Two blocks of ground flat steel stock of equal height
- Leaf-type feeler gauge
- 8-inch long arbors

NOTE: Precise setup is critical for the crankshaft and camshaft dimensional inspections. Pass/fail criteria is measured in thousandths of an inch (.001").

1. Center the crankshaft between the headstock and tailstock of a lathe (or place the crankshaft on matched V-blocks, mounted on a surface plate, supporting the front and rear main journals). Check the parallelism at the front and rear main journals with the dial indicator before inspecting runout.

2. Inspect the crankshaft journal and crankpin diameter compared to the new part dimensions in Appendix D. Inspect the circumference of the crankshaft journals and crankpins to ensure the out of round limits in Appendix D are not exceeded.

3. Rotate the crankshaft under a dial indicator placed on the center main journal to detect bending (run out).

4. Rotate the crankshaft propeller flange under a dial indicator to detect runout (bending) (see Figure 15-2).

5. Inspect the crankshaft hanger blade bushing bore diameter and finish; bushing bores must be smooth and cylindrical. Discard crankshafts with worn, pitted, fretted, or out-of-round bushing bores. Verify the bushing bores meet Section D-8.3 dimensional specifications.

6. Mount the camshaft front and rear main journals on matched V-blocks.

7. Rotate the camshaft under a dial indicator placed on the center main journal to detect bending (run out).

---

*Figure 15-2. Crankshaft Journals*
15-7.2.1. Connecting Rod Dimensional Inspection

Refer to the “Connecting Rod Dimensional Inspection” instructions in Section 10-9.4.1 of M-0, Standard Practice Maintenance Manual.

15-7.2.2. Crankshaft Counterweight Inspection

Refer to the “Crankshaft Counterweight Inspection” instructions in Section 10-9.1.3 of M-0, Standard Practice Maintenance Manual.

15-7.2.2.1. Crankshaft Counterweight Bushing Bore Inspection

15-7.3. Engine Cylinder Dimensional Inspection

Refer to Appendix D-6 for cylinder dimensional limits.

1. Perform the “Cylinder Visual Inspection” according to instructions in Section 6-4.11.1 of M-0, Standard Practice Maintenance Manual. Replace cylinders that fail the inspection criteria.

2. Inspect cylinder bore dimensions using the appropriate illustrations and tables in the Appendix D-6. Cylinders may be honed (see Section 15-8.9.7, “Cylinder Bore Honing”) from the standard size dimensions in Appendix D to the next authorized oversize dimension.

3. Inspect the cylinder base flanges for flatness. If a flange exceeds 0.001 inches out-of-flat, replace the cylinder.

4. Dimensionally inspect the intake flange studs, cylinder exhaust flange studs, and rocker hold down stud bores using a thread gauge. Determine the appropriate oversize stud if replacement is required.

5. If the intake flange studs have been removed, dimensionally inspect the stud holes using a thread gauge. Determine the appropriate oversize stud for replacement.

6. Dimensionally inspect the inside diameter and geometry of the of the valve guides. Valve guide dimensions must be within specifications the entire length of the guide. Replace worn or non-conforming guides.

7. Inspect the intake and exhaust valve seats for indication of burning, pitting erosion, or cracks. Check the valve seat dimensions according to Appendix D specifications. Regrind or replace valve seats which fail to conform to Appendix D specifications or if the valve seat is cracked, eroded, burned or pitted.

8. Inspect the pushrods for cracks, nicks, burrs, pitting or corrosion. Inspect the pushrod caps for cracks or erosion. Verify the pushrod cap oil passages are clear and the bores meet Appendix D specifications. Dimensionally inspect the pushrods length and pushrod cap diameter with a micrometer and Appendix D specifications. Inspect runout with V-blocks and an air gauge according to Appendix D specifications.

9. Inspect pushrod housings for cracks, dents, bends or chafing damage; discard pushrod housings exhibiting these conditions. Inspect pushrod housings for rust, pitting or missing cadmium plating; discard pushrod tubes exhibiting these conditions.

10. Dry fit the rocker arms in the rocker arm boss to dimensionally inspect the rocker arm thrust width. Refer to the overhaul tolerances in Appendix D and verify that the thrust width specified for the engine being overhauled conforms to Appendix D specifications.

   a. Inspect the rocker arm foot contact area for wear, galling, spalling, scoring, or grooves; discard rocker arms exhibiting these conditions.
b. Inspect the rocker arm ball seats for wear and smoothness; discard rocker arms with gouged, scratched, etched, pitted or mushroomed ball seats.

c. Inspect the thrust surfaces of the rocker arm shaft bore for displaced metal, spalling, or galling; discard rocker arms exhibiting these conditions.

d. Inspect rocker arm exhibiting peeling copper plating, which can be a source of contamination in oil and spectrographic oil analysis. Use a scotch-brite pad to remove loose copper plating material.

e. Inspect for and discard rocker arms with loose or missing oil passage drive screws. Inspect oil passages for obstructions. Use an oil squirt bottle with clean 50 weight aviation engine oil to check oil passages for free flow. Discard rocker arms with blocked oil passages which cannot be cleared with solvent.

11. Record inspection results on the “Engine Cylinder Overhaul Inspection Checklist.”
15-7.4. Starter Adapter Dimensional Inspection

Inspect the starter adapter parts for wear or damage; replace worn or damaged parts in addition to the “Mandatory Overhaul Replacement Parts” in Appendix C-2.4.

1. Perform a “Gear Tooth Inspection” on the worm gear, starter shaft gear and starter gear assembly, according to Section 11-1.1 of M-0, Standard Practice Maintenance Manual. If the teeth are worn, broken or show evidence of excessive wear, replace the non-conforming gear.

2. Inspect the surface of the gear and shaft assembly for corrosion, nicks, gouges, or pitting. Inspect the inner and outer retaining ring grooves for gouges or worn edges. If any of these conditions exist, replace the gear and shaft assembly.

3. Inspect the starter adapter housing, shaft adapter sleeve, shafts and gear assemblies using the “Starter and Starter Adapter” dimensional limits in Appendix D-3.

4. Record inspection results on a copy of the “Dimensional Inspection Checklist.”

15-7.5. Lubrication System Dimensional Inspection

1. Perform a “Gear Tooth Inspection” according to Section 11-1.1 of M-0, Standard Practice Maintenance Manual on the oil pump gears for damage or wear; replace worn or damaged gears.

2. Inspect the lubrication system components according to the dimensional specifications in Appendix D-5 Test the oil pressure relief and oil temperature relief valve springs for proper tension according to Appendix D-5.

3. Record inspection results a copy of the “Dimensional Inspection Checklist.”

15-7.6. Alternator Drive Hub Slippage Inspection

1. Perform an “Alternator Drive Hub Slippage Inspection” according to the instructions in Section 10-4.1.4 of M-0, Standard Practice Maintenance Manual.

2. Record inspection results on the “Engine Overhaul Visual Inspection Checklist.”

15-7.7. Throttle and Mixture Control Lever Inspection

Refer to the “Throttle and Mixture Control Lever Inspection” instructions in Section 6-4.18 of M-0, Standard Practice Maintenance Manual
15-7.8. Exhaust System Inspection

NOTE: Clean parts prior to the visual inspection.

1. Visually inspect the exhaust system components.

2. Record inspection results on the “Engine Overhaul Visual Inspection Checklist.”

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Inspection Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stacks</td>
<td>Check parts for: • Burned areas • Cracks • Loose parts/hardware • Inspect welds and seams for cracks • Replace worn, cracked or burned parts</td>
</tr>
<tr>
<td>Risers</td>
<td></td>
</tr>
<tr>
<td>Elbows</td>
<td></td>
</tr>
<tr>
<td>Slip joints</td>
<td>Inspect for bulges or cracks</td>
</tr>
<tr>
<td>Multi-segment V-band clamps</td>
<td>Replace at overhaul</td>
</tr>
</tbody>
</table>

15-7.9. Stud Height Dimensional Inspection

1. Inspect studs listed in Table 15-1 for damage, corrosion and security. Measure stud heights using the measurements in Appendix D-9. Replace studs that fail the inspection criteria.

2. Record inspection results on the “Dimensional Inspection Checklist.”

Table 15-1. Stud Height Settings

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Inspect for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter Adapter</td>
<td>• Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness.</td>
</tr>
<tr>
<td>Accessory Drive Adapter</td>
<td>• Check the stud alignment using a tool maker's square.</td>
</tr>
<tr>
<td>Lubrication System</td>
<td>• Studs should measure within the limits provided in Appendix D-9.</td>
</tr>
<tr>
<td>Oil Control Collar</td>
<td>• Replace unserviceable studs according to instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual.</td>
</tr>
<tr>
<td>Crankcase</td>
<td>• If studs installed in helical coil inserts are loose, the helical coil insert may require replacement according to instructions in Appendix C-6 of M-0, Standard Practice Maintenance Manual.</td>
</tr>
<tr>
<td>Cylinder</td>
<td></td>
</tr>
</tbody>
</table>
15-7.10. Air Conditioning Compressor Dimensional Inspection

NOTE: The belt sheave inspection dimensions in Figure 15-3 apply only to Continental Motors belt sheaves. Refer to the manufacturer's instructions for air conditioning kits obtained from other sources.

1. Inspect the belt sheaves (Figure 15-3) for corrosion, physical damage, nicks, warpage, wear, or missing material. The drive belt channel must be free of nicks or sharp edges with a surface finish of 63 Ra. Replace the idler sheave bearing.

a. The sheave belt channel inside dimension, measured at the apex must be not exceed 0.508" wide.

b. The angle of the sheave belt channel should be 36° ±30'.

c. After installation, inspect both sheaves for runout at the face with a dial indicator. Runout at the sheave face must not exceed 0.005 of an inch.

Figure 15-3. Air Conditioning Compressor Sheave

NOTE: IDLER SHEAVE DEPICTED. DRIVE SHEAVE CENTER HUB IS OFFSET BUT TOLERANCES ARE IDENTICAL TO IDLER SHEAVE.


15-8. Overhaul Repair

15-8.1. Fuel Injection System Overhaul Repair

NOTE: Continental Motors fuel injection system parts overhaul procedures require specialized test equipment beyond the scope of this manual. Continental Motors offers new and rebuilt fuel pumps, fuel manifold valves and mixture controls which meet new part specifications. Continental Motors does not control FAR Part 145 Repair Station activities; verify the Repair Station qualifications before contracting fuel injection system parts overhaul. Fuel injection system parts overhaul must be accomplished in compliance with FAA approved procedures.

1. Collect the fuel injection system parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for fuel injection system assembly.

2. Inspect the fuel injection system parts intended for reuse to determine condition:
   a. Inspect rigid fuel injection tubes, including the flared ends for leaks or physical damage. Inspect the length of the tubes for sharp bends, cracks, dents, gouges, chafing or corrosion which may lead to fuel leaks. Discard and replace fuel injection tubes exhibiting any of these conditions.
   b. Inspection the condition of the fuel injection tube B-nuts. The B-nut shoulders must be intact, not worn or stripped. Wrenches must fit snugly on the nut for proper torque. B-nut threads must be clearly defined; stripped threads can lead to fuel leaks. Discard and replace fuel injection tubes exhibiting damaged B-nuts.
   c. Check the condition and placement of fuel injection line protectors, if included in the engine model configuration. Line protectors align with the tube clamps to inhibit friction at the attaching points. Reposition or replace damaged line protectors on rigid fuel injection tubes.
   d. Clean all serviceable fuel injection system components intended for reuse according to the instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual to remove debris and prevent fuel injection system contamination.

3. Replace the bronze throttle control lever or mixture control lever with the newer stainless steel versions.

15-8.2. Induction System Overhaul Repair

1. Collect the induction system parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for induction system assembly.

2. Replace the throttle control lever if it is not stainless steel or if the lever fails the dimensional inspection.
Overhaul Inspection and Repair

15-8.3. Air Conditioning Compressor Mount Bracket Overhaul Repair

Collect the air conditioning compressor mounting bracket assembly overhaul parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”
15-8.4. Alternator Overhaul

1. Overhaul Continental Motors alternators according to the latest revision of the Alternator Service Manual (Table 1-1 in Section 1-2.5). Replace aftermarket, or third-party alternators with a new unit or a unit which has been overhauled according to FAA approved procedures.

2. Collect the alternator parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for alternator (and alternator bracket, if equipped) assembly.

3. If the engine is equipped with an alternator bracket, collect the necessary parts specified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

15-8.5. Starter and Starter Adapter Overhaul Repair

NOTE: 12V and 24V lightweight starters, manufactured by ISKRA have been discontinued. Consult the engine model illustrated parts catalog for the applicable replacement starter.

1. Overhaul Continental Motors starter motors according to instructions in the Starter Service Instructions (X30592). Replace aftermarket, or third-party starter motors with a new unit or a unit which has been overhauled according to FAA approved procedures.

2. During overhaul, replace the parts specified below:
   a. Starter adapter housing worm shaft needle bearing according to instructions in Section 15-8.5.1.
   b. Shaft gears, worm wheel gears, worm gears or worm gear shafts exhibiting wear, cracks, or missing material.
   c. Worn scavenge pump covers and bushings on the starter/starter adapter assembly.
   d. Collect the necessary starter and starter adapter parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” and Continental Motors Starter Service Instructions (X30592) to prepare for starter and starter adapter assembly.
15-8.5.1. Starter Adapter Housing Worm Shaft Needle Bearing Replacement

Press the new needle bearing (Figure 15-4) (3) in position until it is thirty thousandths (0.030) of an inch below the inner surface using the Needle Bearing Installer Tool or equivalent. (Refer to Section 2-1, of M-0, Standard Practice Maintenance Manual.)
15-8.6. Ignition System Overhaul

Overhaul magnetos according to the magneto manufacturer's instructions.

15-8.6.1. Accessory Drive Adapter Overhaul Repair

During engine overhaul, collect the new parts required according to the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.” Install new bushings and oil seals in the accessory (magneto) drive adapters.

**Equipment Required**
- Arbor Press
- Heavy Duty Drill Press
- Adjustable Blade Reamer Size Range (25132-27132), adjusted to 0.8150 diameter

1. Plug the accessory adapter oil passages with beeswax to protect them from flying debris contamination during the reaming process.

2. Place the accessory drive adapter, tapered side up, on an arbor press. Support the adapter drive pad on a flat, parallel block thick enough to raise the studs off the arbor press bed.

3. Apply a liberal coating of clean, 50-weight aviation engine oil to the outer perimeter of the bushing. Align the bushing and accessory drive adapter bushing bore oil holes and press the bushing in the accessory drive adapter.

![Figure 15-5. Accessory Drive Adapter Bushing Installation Detail](image-url)
4. Ream the installed bushing to 0.8145-0.8155” diameter using the specified reamer and heavy duty drill press. The bushing bore surface finish must be 32 Ra when complete.

5. Face the bushing flange until it projects forward 1.454-1.458” from the adapter parting surface. The flange face surface finish must be 32 Ra when complete.

6. Chamfer the bore at the flange end 0.06” deep on a 45° angle, and slightly break sharp edges at both ends. The bushing bore must be concentric with the adapter pilot shoulder within 0.002” per inch of length. The flange thrust face must be parallel to the parting surface within 0.002” (full indicator reading).

7. Repeat the previous steps for new bushings in the remaining magneto adapter.

8. Clean the accessory drive adapters according to the cleaning instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual to remove reaming debris and beeswax; oil passages must be clear after cleaning.

9. Place the accessory drive adapter over on the arbor press with the studs on top. Support the edges of the accessory drive adapter to raise the bushing off the bed of the arbor press.

10. Coat the periphery of a new oil seal with a thin translucent coat of Gasket Maker. Insert the oil seal in the center of the accessory drive adapter flange. Press the new oil seal into the accessory drive adapter using a 1-3/8 inch diameter by 1-1/4 inch long flat end block or the Oil Seal Tool (Part No. MT500260 in Chapter 2 of M-0, Standard Practice Maintenance Manual) until it bottoms out in the adapter. Do not crush the oil seal. Wipe excess adhesive from the perimeter of the seal.

11. Perform a “Fluorescent Penetrant Inspection” on the accessory drive adapters according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual after bushing and oil seal installation to ensure the accessory drive adapter assembly is free of cracks.
15-8.7. Turbocharger and Exhaust System Overhaul Repair

Collect the exhaust and turbocharger system parts identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.” Gather replacement exhaust manifold gaskets and nuts for overhaul assembly.

**WARNING**

Turbocharger and exhaust system weld repairs may only be performed by an FAA Part 145 authorized repair station certified to perform the specific repairs.

15-8.7.1. Turbocharger Overhaul

1. Replace the turbochargers, wastegate, wastegate controller and overboost valve at engine overhaul with new units or units which have been overhauled according to FAA approved procedures.

2. Inspect the turbocharger oil reservoirs for cracks, leaks, and physical damage; replace on condition.

15-8.7.2. Air/Oil Separator Overhaul

Collect the air/oil separator parts identified in identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.” Flush the air/oil separator thoroughly with mineral spirits to remove residual oil deposits. Upon completion, clean mineral spirits poured through the air/oil separator into a paper filter will be clean and free of debris; if particles continue to flow from the cleaned separator, replace the air/oil separator.

15-8.8. Lubrication System Overhaul

NOTE: The oil cooler must be cleaned by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station). No structural repairs are allowed on the oil cooler. Replace an oil cooler that has structural damage, bent/broken or cracked cooling fins with a new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange are permitted only by an appropriately rated repair station (i.e., FAA-approved Part 145 repair station).

Reface the oil pressure relief valve according to instructions in Section 15-8.8.2.

Collect the lubrication system parts identified in identified in the following sections of M-2, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts” to prepare for lubrication system assembly.

15-8.8.1. Oil Cooler Overhaul Repair

The oil cooler must be cleaned and overhauled by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station). No structural repairs are allowed on the oil cooler. Replace any cooler that has structural damage, bent/broken or cracked cooling fins with a
new or serviceable oil cooler. Weld repairs to the oil cooler mounting flange are permitted only by an appropriately rated repair station (i.e. FAA-approved Part 145 repair station).

15-8.8.2. Oil Pressure Relief Valve Seat Repair

Reface the oil pump housing oil pressure relief valve seat by applying light finger pressure with an 8048 Oil Pressure Relief Valve Spot Facer (see Section 2-1 of M-0, Standard Practice Maintenance Manual). Do not exceed the 1.060 depth limit on the valve seat (Figure 15-6).

Clean the oil pump housing after refacing the oil pressure relief valve seat according to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual. No debris is permitted in the oil pump housing at assembly.

![Figure 15-6. Oil Pressure Relief Valve](image)

15-8.8.3. Oil Filter Adapter Stud Replacement

NOTE: This procedure applies only to screw-on type oil filters.

If the oil filter adapter stud is a plain steel color and is 1.440 inches long and/or if the stud is below the height specified in Figure 15-7, replace the oil filter adapter stud:

1. Remove the oil filter adapter stud.
2. Inspect the adapter housing threads for damage or cracks. If thread damage or cracks are evident, replace the adapter housing.
3. Clean the adapter housing threads thoroughly to remove all adhesive or oil residue.
4. Temporarily install the new oil filter adapter stud in the oil filter adapter to check fit.
5. Verify the incomplete thread of the new stud stops at the first thread in the adapter housing and does not extend below 0.500-inch (12.7 mm) into the housing. If the stud extends deeper than 0.500-inch in the housing, replace the adapter housing.
6. Remove the oil filter adapter stud from the adapter housing.
7. Clean the adapter housing and stud threads with Part No. 653693 primer (Loctite 7471) and allow to dry.
8. Apply a line of Part No. 646941 (Loctite 271) along the large threads (0.8125-16 end) of the oil filter adapter stud and torque the stud to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Confirm the installed stud matches the illustration in Figure 15-7.

10. Allow the parts to cure at least 30 minutes prior to oil filter installation. Curing times may vary depending on ambient temperature. Consult the Loctite instructions.

11. Stamp a 0.125-inch high letter “S” in the adapter housing, as shown in Figure 15-8, to indicate a new oil filter adapter stud has been installed in the adapter housing.

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**Figure 15-7. Oil Filter Adapter Stud**

**Figure 15-8. Identification of Oil Filter Adapter Stud Modification**
Overhaul Inspection and Repair

15-8.9. Engine Cylinder Overhaul Repair

This procedure applies to overhauling all engine cylinders at the same time while the engine is disassembled and removed from the aircraft. Engine cylinders must be leak checked, removed, cleaned and inspected.

Before performing any cylinder overhaul repair, establish a baseline inspection point for cylinder head-to-barrel movement and inspect the baseline throughout cylinder rework procedures to verify joint integrity is not compromised.

1. Mask off a ¼-inch wide X 1-inch high area across the cylinder head to the barrel junction on the intake port side of the cylinder.
2. Apply a heavy coat of high temperature paint.
3. Allow the paint to dry thoroughly.
4. Remove the masking material.

**WARNING**

Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.

5. Heat soak the cylinder assembly via a uniform heating method to 450°F (232°C) for one hour.
6. Verify no cylinder head-to-barrel movement by referring to the baseline inspection point. Discard cylinder assemblies exhibiting head-to-barrel movement.
15-8.9.1. Cylinder Repair versus Replacement Guidelines

Table 15-2 indicates possible cylinder symptoms and appropriate corrective actions.

**Table 15-2. Cylinder Repair vs. Replacement Guidelines**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder with radial fin crack extending to the root of a fin</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Broken, bent (or straightened), or pitted cylinder head or barrel fins</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Power stroke stress on cylinder barrel; heavy rust or pitting, indentation; chafing or cracks on cylinder barrel</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Cracks in cylinder head structure</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Cracked or eroded valve seat bore</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Static seal leakage or leakage from head to barrel seal or crack in head or barrel</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Discolored/burned paint, Piston pin scoring or damage to the cylinder bore (usually due to overheating)</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Blistered paint on the cylinder barrel</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Cylinder head-to-barrel junction movement</td>
<td>Replace the cylinder</td>
</tr>
<tr>
<td>Low differential pressure coupled with excessive oil consumption</td>
<td>Repair or replace the cylinder</td>
</tr>
<tr>
<td>Scratches in the honed surface of the cylinder wall or cylinder bore</td>
<td>Repair the cylinder</td>
</tr>
<tr>
<td>Pitting, sharp dents or chafing in fin tips less than 0.050 inches (1.3 mm) deep</td>
<td>Repair the cylinder</td>
</tr>
</tbody>
</table>

1. Replacement cylinders are available in several configurations, starting with a basic assembly and progressing to cylinders with more components installed:
   - Cylinder and Valve Assembly (includes the Basic Cylinder Assembly plus valve components).
   - Loaded Cylinder and Valve Assembly (Cylinder and Valve Assembly plus rocker shaft, piston, piston rings, and gasket set).
   - Consult Continental Motors’ web site for the latest parts information.

2. Do not attempt to remove overheating damage by grinding the cylinder bore to the next allowable oversize. Cylinder barrel overheating destroys material strength.

3. If the cylinder is otherwise acceptable on inspection and the fits and clearances provide enough tolerance that the cylinder can be ground and honed, repair the cylinder; otherwise replace the cylinder.
15-8.9.2. Engine Overhaul Replacement Parts

Replace the items listed in Table 15-3 during engine overhaul:

Table 15-3. Mandatory Cylinder Overhaul Replacement Parts

<table>
<thead>
<tr>
<th>Baffle (new or repaired)</th>
<th>Pushrod Tube Compression Springs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baffle Retainer Spring</td>
<td>Pushrod Tube Packing</td>
</tr>
<tr>
<td>Cylinder Deck Stud Nuts and Through-Bolts</td>
<td>Retainer Keys</td>
</tr>
<tr>
<td>Cylinder Exhaust Flange Studs</td>
<td>Rocker Arm Bushings</td>
</tr>
<tr>
<td>Exhaust Flange Gaskets</td>
<td>Rocker Cover Gaskets</td>
</tr>
<tr>
<td>Exhaust Manifold Nuts</td>
<td>Rocker Shafts</td>
</tr>
<tr>
<td>Exhaust Valves</td>
<td>Rotocoils</td>
</tr>
<tr>
<td>Intake Valves</td>
<td>Seals, O-rings, Gaskets</td>
</tr>
<tr>
<td>Intake and Exhaust Valve Tappets</td>
<td>Springs</td>
</tr>
<tr>
<td>Lock Washers</td>
<td>Tab Washers</td>
</tr>
<tr>
<td>Pistons &amp; Piston Rings</td>
<td>Thrust Washers</td>
</tr>
<tr>
<td>Piston Pin</td>
<td>Valve Spring Retainers</td>
</tr>
</tbody>
</table>

15-8.9.3. New Cylinder Position Numbers

Original cylinders have a position number stamped on the edge of the base flange. New cylinders must have a position number stamped in the location shown in Figure 15-9.

*CAUTION: Do not metal stamp or etch the piston.*

*NOTE: Pistons are not stamped with position numbers.*

![Figure 15-9. Cylinder Position Number](image)
15-8.9.4. Cylinder Head Repair

Replace cracked or damaged cylinders. Do not attempt to repair a cracked cylinder head.

**WARNING**

Do not perform any structural weld repairs on the cylinder head. Welding the cylinder head structure can destroy the assembly preloads and casting strength resulting in cylinder assembly failure.

15-8.9.5. Cylinder Fin Tip Repair

**CAUTION:** Do not attempt to straighten bent cylinder fins.

15-8.9.6. Cylinder Barrel Repair

**WARNING**

Cylinder Barrel Repair requires FAA certification. If you are not certified, do not attempt to repair the cylinder barrel.

If the cylinder passes the visual inspection and static leak check at the cylinder head to barrel junction, the cylinder barrel may be ground to the next authorized oversize dimension by an FAA Part 145 Repair Stations certified to grind engine cylinders. These facilities grind and hone the cylinder bore using a cam-controlled grinder to grind the cylinder barrel to the next larger authorized oversize dimension specified in Appendix D.

After grinding the cylinder barrel to the next authorized oversize dimensions, perform a Magnetic Particle Inspection on the cylinder bore and identify the cylinder with the correct bore size by steel-stamping the barrel flange with the appropriate oversize designation as depicted in Figure 15-9.

**CAUTION:** Replace the engine cylinder if the barrel fins exhibit pitting, sharp indentation, or chafing damage. Do NOT weld cylinder barrel fins or cylinder barrels.

If a cylinder has been ground, the cylinder bore must be honed according to instructions in Section 15-8.9.7, “Cylinder Bore Honing.”
15-8.9.7. Cylinder Bore Honing

Perform this procedure under any of the following circumstances:

- after grinding a cylinder barrel
- when replacing piston rings
- to restore the cylinder bore cross hatch pattern

1. Hone the cylinder bore using a wet honing process and hone stones that will produce a surface finish as specified in Table D-9.

2. Inspect the cylinder barrel wall for corrosion, pitting and scoring. Discard any cylinder exhibiting any of these unacceptable, non-conforming conditions.

3. Measure the surface finish using a contact profilometer.

4. After wet honing, the bore finish must show a cross hatch pattern. The included angle of the cross hatch measured perpendicular to the axis of the cylinder is 22°-32°. Inspect the hone pattern taken at 100X magnification. An acceptable cross hatch pattern must be cleanly cut and free of torn and folded metal.

   NOTE: Honed turnaround areas up to 0.5 inch from the skirt and barrel stop are exempt from cross hatch angle requirements.

5. After honing, clean the cylinder thoroughly using hot soapy water and a stiff bristled scrub brush to remove all honing material from the cylinder.

6. Rinse the cylinder with hot water to remove soap residue.

7. Dry the cylinder completely; repeat step 2 to verify cylinder serviceability. If the honed cylinder passes inspection, thoroughly coat the cylinder bare steel surfaces with clean 50 weight aviation engine oil.

8. The surface finish of the cylinder barrel bore must conform to the specifications listed in Table D-9.
15-8.9.8. Valve Seat Removal

**Equipment Required**
- Borroughs Part No. 8086, Valve Seat Insert Remover and Replacer Tool, or equivalent
- Borroughs Part No. 5221B, Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-13A, Holding Fixture Adapter, or equivalent
- Borroughs Part No. 8122A, Common Drive Handle, or equivalent
- Valve stem or valve guide hole pilot of correct size
- Valve seat boss cutter equal in size to the new valve seat outside diameter
- Universal Drive from Borroughs Part No. 8116 common parts kit or equivalent
- Heavy duty drill press

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.

**WARNING**
Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.

2. Heat soak the cylinder assembly via a uniform heating method up to 450°F (232°C) for one hour.

3. Using the correct special tool, remove the worn valve seats.

4. Allow the heated cylinder to cool to room temperature.

5. Inspect the seat bore for cracks and erosion. Discard any cylinder with a cracked valve seat bore or a valve seat bore that has eroded beyond the allowable valve seat oversize bore repair.

6. Select the proper size valve seat bore cutter based on the new valve seat insert outside diameter See Section D-6.

7. Install the cylinder in the Cylinder Holding Fixture.

8. Using the specified special tools, machine the valve seat bore(s) to the correct diameter. Do not exceed the new part (overhaul) tolerances specified in Appendix D for the respective intake and/or exhaust valve seat illustrations, as applicable.

9. Deburr the valve seat bore and clean the cylinder, removing all debris created during the machining procedure.

10. Inspect and record the valve seat bore inside diameter and new valve seat outside diameter on the “Engine Cylinder Overhaul Inspection Checklist” (Table 11-8). Refer to Appendix D for the valve seat dimensional limits.

11. Install a new valve seat according to Section 15-8.9.9, “Valve Seat Installation.”
WARNING

Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.

2. While the cylinder is hot, install the valve seat firmly against the bottom of the valve seat bore using the required special tools.

WARNING

Misaligned or improperly installed valve seat(s) will cause valve leakage and burning.

3. Install new valve guides according to instructions in Section 15-8.9.10 and Section 15-8.9.11 followed by a “Fluorescent Penetrant Inspection” according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual on the newly installed valve seat(s) and valve guide(s).
15-8.9.10. Valve Guide Removal

**Equipment Required**

- Borroughs Part No. 5221B, Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-15A, Holding Fixture Adapter, or equivalent
- Borroughs Part No. 4981, Valve Guide Remover, or equivalent
- Borroughs Part No. 8116-1R through 15R Reamer
- Borroughs Part No. 8116-1 through 16, Expanding guide bores
- Proper size morse adapter
- Borroughs Part No. 3170, Floating Holder, or equivalent
- Heavy duty drill press

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.
2. Install proper size head on Valve Guide Remover and attach the assembly to a cold water supply.
3. Heat the cylinder assembly via a uniform heating method to 350°F (177°C) maximum and heat soak the cylinder assembly for 10 minutes.

**WARNING**

*Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.*

4. Install the cylinder in the holding fixture.
5. Install the pilot into the valve guide.
6. Hold the Valve Guide Remover down firmly pressed into guide bore with one hand and the other hand on the water release mechanism.
7. Release the water and drive out the valve guide while water is running.
8. Remove the other valve guide.
9. Allow the cylinder to cool to room temperature.
10. Measure the cylinder head valve guide bore and select the proper size reamer.

**CAUTION:** *Always ream the guide bore to the proper oversize.*

11. Ream the cylinder head valve guide bore to the required size.
12. The guide bore must be free of grooves.
13. Deburr the valve guide bore and clean the cylinder; remove all machining debris.
15-8.9.11. Valve Guide Installation

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.

2. Apply a small amount of LUBRIPLATE® 930AA to the outside diameter of the valve guide to prevent binding during installation.

   **WARNING**

   *Do not use a torch to heat the cylinder assembly. Heat the cylinder using uniform heating methods only. After heating the cylinder assembly, do not bump the head or barrel which could cause movement in this area. Inspect the cylinder assembly to ensure the cylinder head did not turn in relation to the barrel. Movement of the cylinder head in relation to the barrel destroys the assembly preload; discard the cylinder.*

3. Heat soak the cylinder assembly via a uniform heating method to 350°F (177°C) for 10 minutes.

4. While the cylinder is hot, install the new valve guides:

   **CAUTION:** The intake and exhaust valve guides are different and must be installed in the correct positions.

   *Never install an oversize valve guide in a standard size valve guide bore.*

   a. Install the exhaust valve guide in the side of the cylinder with the smaller diameter valve seat.

   b. Install the intake valve guide in the side of the cylinder with the larger diameter valve seat.

5. Hang the cylinder with the flange up; allow the cylinder to stabilize to room temperature. Inspect the valve guide inside diameter.

6. Ream the valve guides according to the “Valve Guide Bore Reaming” instructions in Section 15-8.9.12.

7. After reaming the valve guide to the proper inside dimension, perform a “Fluorescent Penetrant Inspection” (according to the instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual) on the cylinder head in the area surrounding the new valve guide and the valve seat.

**Equipment Required:**
- Borroughs Part No. 5221B Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-15A Holding Fixture Adapter, or equivalent
- Borroughs Part No. 8116-1R through 15R Reamers, or equivalent
- Heavy duty drill press

*CAUTION: Do not attempt reaming the valve guide bore with a hand held power tool.*

1. Install the Cylinder Holding Fixture into a drill press.
2. Index the Cylinder Holding Fixture to the proper angle and install the cylinder in the fixture.
3. Zero in the valve guide with the dial indicator.
4. Using the proper size reamer tool bit, ream the valve guides while applying generous amounts of lubricant at 400 RPM for high speed steel reamers and 700 RPM for carbide tip reamers.
5. Inspect the finished bore size using Appendix D specifications for the valve stem bore inside diameter. The valve guide finish must be 63 Ra finish measured with a profilometer.

15-8.9.13. Valve Seat Machining

**Equipment Required**
- Borroughs Part No. 5221B, Cylinder Holding Fixture, or equivalent
- Borroughs Part No. 5221-13A, Holding Fixture Adapter, or equivalent
- Sioux Brand Valve Seat Grinder Set No. 1675 or equivalent.
- Valve Seat Grinder Pilot 0.437 diameter check inside diameter of valve guide for proper size.
- Grinding stones:
  - K106 roughening for intake valve seats
  - K46 finishing for intake valve seats
  - K95 roughening for exhaust valve seats
  - K25 finishing for exhaust valve seats.

*NOTE: Valve seats and valves may be lapped after refacing, if desired. Lapping compounds are extremely abrasive, be sure to completely remove compound residue from the valves, valve seats and cylinder by thorough cleansing with hot soapy water and a stiff bristled scrub brush. Rinse the cylinder thoroughly with hot water to remove soap residue.*

1. Reface the valve seats according to the specifications in Appendix D using the valve seat grinder. Wash the cylinder with soapy water and rinse thoroughly.
2. Dry the cylinder completely.
3. Coat all bare steel surfaces thoroughly with clean 50 weight aviation engine oil.
Overhaul Inspection and Repair


**Equipment Required**
- Stanley Heli-Coil Extracting Tool
- Stanley Heli-Coil Installation Tool
- Stanley Heli-Coil No. 520-2 Expanding Tool

1. Before attempting to remove a damaged helical coil insert, use a sharp pointed tool to pry the teeth at the outer Heli-Coil end away from the cylinder head metal.

2. Tap the Heli-Coil Extracting Tool into the insert until firmly seated; remove the Heli-Coil.

3. Using the proper size mandrel on the Heli-Coil Installation Tool, place a new stainless steel helical coil in the cutout side of the Heli-Coil Installation Tool and engage the driving tang toward the threaded end.

4. Engage the tang with the slotted end of the driving mandrel and wind the insert into the sleeve thread, compressing the insert.

5. Hold the sleeve so the Heli-Coil can be seen through the slot in the threaded end.

6. Turn the mandrel crank until the insert starts into the cylinder head hole. If the sleeve is not in contact with the head surface, grip the sleeve and mandrel and turn until the sleeve touches lightly.

**WARNING**

_The Heli-Coil insert end must not protrude into the combustion chamber after it has been installed._

7. Wind the Heli-Coil into the cylinder head until its toothed end lies within the first full thread. The teeth should be in position to enter the depressions made by the original insert. If driven too far, the insert will emerge in the combustion chamber and will have to be wound through and removed.

8. When the Heli-Coil is in the correct position, use long-nose pliers to bend the driving tang back and forth across the hole until it breaks off at the notch.

9. Coat the threaded end of the No. 520-2 Expanding Tool with Alcoa thread lube or a mixture of white lead and oil.

10. Screw the No. 520-2 Expanding Tool into the new insert until its final thread forces the teeth firmly into the cylinder head metal.
15-8.9.15. Cylinder Stud Installation

Replace exhaust manifold studs, regardless of condition, replace studs that are loose or fail to meet Appendix D specifications according to the “Stud Installation” instructions in Appendix C-6.2 of M-0, Standard Practice Maintenance Manual. Install the new studs to the specified heights listed in Appendix D. Check the stud alignment using a tool maker's square.

Install the appropriate oversize new exhaust flange studs, rocker shaft hold down studs, and intake flange studs according to the “Engine Cylinder Dimensional Inspection” in Section 15-7.3 and Appendix D.

15-8.9.16. Piston Ring Replacement

Install new pistons and piston rings on each engine cylinder during engine assembly.

NOTE: Whenever piston rings are replaced in an engine cylinder, hone the cylinder bore prior to assembly according to “Cylinder Bore Honing” in Section 15-8.9.7.

15-8.9.17. Cylinder Protective Coatings

1. Clean the exterior cylinder head surface.

2. Apply a protective coating of Alodine on the cylinder surface according to instructions in Section 12-4 of M-0, Standard Practice Maintenance Manual.

3. Thoroughly clean the entire cylinder with mineral spirits and air dry.

   CAUTION: Do not paint the cylinder flange nut seats, skirt, or flange-to-crankcase mating surface.

4. Mask the cylinder flange nut seat contact surfaces, cylinder skirt and flange-to-crankcase mating surfaces.

5. Apply a protective coating of specified enamel paint or equivalent (Table 3-7 of M-0, Standard Practice Maintenance Manual) to the cylinder barrel according to instructions in Section 12-4 of M-0, Standard Practice Maintenance Manual.

6. After the paint dries completely, remove all masking materials.

7. Coat all bare steel surfaces with clean 50 weight aviation engine oil.

8. Store the cylinder assembly in a clean protected area until cylinder assembly.
15-8.9.18. Rocker Arm Bushing Replacement

Equipment Required
- Borroughs Part No. 8118 Rocker Arm Bushing Remover/Installer
- Borroughs Part No. 8116-1R through 15R Reamers, or equivalent
- Arbor Press

1. Plug the oil passages on the rocker arm with beeswax.
2. Remove the old bushings from the rocker arm(s).
3. Measure the rocker arm bushing bore inner and outer diameter; verify it conforms to the Appendix D dimensional specifications.
4. Verify the bushing oil passages are positioned as illustrated in Figure 15-10.

**WARNING**

Incorrectly positioned bushing oil passages will result in a loss of rocker arm shaft lubrication, severe wear of the rocker arm bushing, shaft, and valve guide and possible engine failure.

5. Lubricate the new bushings with clean 50 weight aviation engine oil.
6. Using the Borroughs Part No 8118 Rocker Arm Bushing Remover/Installer, or equivalent and an arbor press, carefully press the bushing into the rocker arm bushing bore. The bushing must be installed flush to 0.020 below surface (Figure 15-10).
7. Plug the bushing oil holes with beeswax to prevent debris from entering the oil passages.
8. Ream the bushing inner diameter to 0.7505 - 0.7515 inches with a surface finish of 32 RMS (Figure 15-10).
9. Inspect the bushing bore and surface finish to verify it meets Appendix D specifications.
10. After reaming, clean and flush the oil passages with clean mineral spirits to remove the beeswax; ensure the oil passages are clean and free of debris.
11. Clean obstructed oil passages in rocker arms or pushrods by soaking the parts in clean mineral spirits and blowing compressed air through them. Discard rocker arms or pushrods with clogged oil passages.
12. Perform Visual and Magnetic Particle Inspections of the rocker arm assembly according to instructions in Sections 11-1 and 11-3 of M-0, Standard Practice Maintenance Manual.
**Bushings O. D. must maintain a** 0.0020-0.0065 **Press Fit in a** 0.8755-0.8725 **Rocker Arm Bushing Bore.**

Bushings must have a surface finish of 32 rms after reaming.

These surfaces must be square within the center line of the bushing bore within 0.002 inch full indicator reading.

*Figure 15-10. Rocker Arm Bushing Replacement*
15-8.9.19. Rocker Arm-to-Retainer Clearance

Maintain a minimum clearance of 0.020 inches (0.508 mm) between the rocker arm and valve spring retainer. If 0.020 inches (0.508 mm) clearance is not met, proceed as follows.

**WARNING**

*Grinding marks or cracks in the rocker arm may cause the rocker arm to fail.*

1. Temporarily install the rocker arm on the cylinder to verify rocker arm to retainer clearance.

2. Smoothly grind across the forging flash line on the underside of the rocker arm to attain the specified 0.020-inch clearance. The grind must be smooth and uniform. Cover the rocker arm bushing bore and oil passage to prevent contamination.

3. Smoothly grind across the forging flash line on the underside of the rocker arm to obtain the specified clearance. The grind must be smooth and uniform and must not exceed the width illustrated in Figure 15-11. If the required clearance cannot be met without exceeding the grind width, discard and replace the rocker arm.

4. Polish the entire ground surface to remove grinding marks.

5. Remove the protective coverings from the rocker arm and clean thoroughly.

6. Perform a “Magnetic Particle Inspection” (Section 15-4 of M-0, Standard Practice Maintenance Manual) on the polished rocker arm to inspect for cracks.

7. Remove and thoroughly clean the rocker arm(s) before final engine assembly.

---

**Figure 15-11. Rocker Arm to Retainer Clearance**
15-8.10. Crankcase Overhaul Repair

1. Collect the crankcase replacement parts specified in the following sections of M-0, Standard Practice Maintenance Manual: Section C-2, “Replacement Parts”, Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

2. Replace any crankcase or associated part worn beyond the overhaul limits in Appendix D or failing to meet inspection criteria. Discard and replace all non-conforming components.

3. Inspect the outer diameter of the starter adapter bearing boss to determine if the boss has been modified (Figure 15-12) to provide clearance for the new camshaft gear. If the radius cut is absent, perform the modification according to Section 15-8.10.1.
15-8.10.1. Crankcase Modification after Camshaft Gear Replacement

**CAUTION:** Crankcase machining should be accomplished only by an FAA Part 145 Approved Repair Station.

Camshaft gear Part Nos. 631845, 655430, 655516 and 656031 has been superseded (Reference: MSB05-8) and is no longer available. The replacement gear is 0.060" wider than the earlier gears. The crankcase starter adapter bearing boss must be machined with a radius cut to provide clearance for the wider replacement camshaft gear.

**CAUTION:** Installing the new camshaft gear in an unmodified crankcase will result in damage to the gear and the crankcase.

1. Measure 3.0935" - 3.0985" from the camshaft bore centerline to the center of the starter drive bearing boss (Figure 15-12).

2. Cut a 0.005-0.015” radius in the outside edge of the starter drive bearing boss at a depth of 2.100-2.110” (Figure 15-13) from the accessory face in step 1.

![Figure 15-12. Radius Cut Distance from Camshaft Centerline](image1)

![Figure 15-13. Overhead View of Radius Cut Depth](image2)
15-8.10.2. Oil Filler Overhaul

Collect the replacement parts specified in the following sections of M-0, Standard Practice Maintenance Manual: Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

15-8.10.3. Crankcase Welding

**WARNING**

No weld repairs are permitted in the critical (non-shaded) areas of the crankcase or the bearing support structures. An FAA-approved repair facility is the only facility authorized to perform a crankcase weld repair.

Welding is only permitted on non-critical areas of the crankcase identified in Section 6-4.12 of M-0, Standard Practice Maintenance Manual. Only an FAA-certified weld repair facility for specialized crankcase repairs may complete the weld repair. The dimensional integrity of the crankcase must be maintained.

15-8.10.4. Crankcase Cylinder Deck Stud Helical Coil Installation

Install helical coils in crankcase cylinder deck stud holes according to instructions in Appendix C of M-0, Standard Practice Maintenance Manual according to specifications in Figure 15-14.

**WARNING**

Repair of the 2 or 4 o'clock crankcase cylinder deck stud positions by installing helical coil inserts is prohibited.
15-8.10.5. Crankcase Cylinder Deck Stud Replacement

Replace crankcase studs which fail to meet Appendix D stud height specifications according to stud replacement instructions in Appendix C of M-0, Standard Practice Maintenance Manual. Refer to the crankcase figures in Appendix D for the proper stud height settings.

**WARNING**

*Do not attempt to repair the 2 and 4 o'clock crankcase cylinder deck stud positions by installing helical coil inserts.*

1. Verify the studs, threads tapped holes are free of damage and are clean and dry.
2. Apply Part No. 653693 Primer to the stud and cylinder deck threads and allow appropriate drying time according to manufacturer's recommendations.
3. Apply Part No. 646941 High Strength Adhesive to the stud and the cylinder deck tapped hole threads.
4. Install the studs to the appropriate cylinder stud height setting in Appendix D.
5. Wipe excess adhesive from the cylinder deck.
6. After two hours minimum cure time, test the installed stud breakaway torque. Studs must resist movement with a torque load of 100 in-lbs. If studs break away, replace with a new stud.

15-8.10.6. Crankcase Line Boring

Either discard or line-bore crankcases with crankshaft or camshaft bearing bores that exceed the Appendix D specifications. Only a certified repair facility for specialized crankcase repairs is authorized to perform line bore repairs. Only a certified repair station for specialized crankcase repairs is authorized to perform line bore repairs. Refer to Appendix D for overhaul limits and Section 15-7.1, “Crankcase Dimensional Inspection” for information on performing a crankshaft and camshaft bore dimensional inspection.

15-8.10.7. Crankcase Machining

Discard and replace or machine crankcases exhibiting fretting. Crankcase machining is only permitted at a certified crankcase repair facility. The crankcase cylinder deck dimensions are listed in Appendix D. After machining, the cylinder deck height must meet Appendix D specifications. Discard crankcase halves failing to meet this dimension.

**CAUTION:** Gear backlashes must not be less than the specified minimum after machining.

The crankcase half-parting line surface must be flat within 0.005 inches (true indicator reading). The sum total of the parting line surface for both crankcase halves must not exceed 0.008 (true indicator reading). Discard crankcase halves that exceed these dimensions. After all machining is complete, perform a “Fluorescent Penetrant Inspection” on the crankcase halves according to instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.
15-8.11. Engine Drive Train Overhaul

**CAUTION:** Engine Drive Train Overhaul is beyond the scope of field repairs. Special fixtures, special tools and air gauges are required to inspect the components for serviceability after repairs are accomplished. Overhaul repairs to the camshaft, crankshaft and connecting rods may only be performed by an FAA Part 145 Repair Station using FAA approved repair procedures.

1. The engine drive train consists of the camshaft assembly and crankshaft assembly, including counterweights, gears and connecting rods. Overhauling the engine drive train entails disassembling, verifying the integrity of parts, replacing parts, and reassembling these components as instructed in the subsection herein. Replace any parts worn beyond Appendix D limits or parts which do not meet inspection criteria.

2. Collect the engine drive train replacement parts specified in the following sections of M-0, Standard Practice Maintenance Manual: Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

3. Refer to the appropriate subsections to accomplish camshaft and crankshaft repairs.

<table>
<thead>
<tr>
<th>Part to Consider for Replacement</th>
<th>Discard and Replace Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td>Discard/replace a crankshaft with any of the following conditions:</td>
</tr>
<tr>
<td></td>
<td>• Worn, pitted, fretted, or out-of-round counterweight bushing bores</td>
</tr>
<tr>
<td></td>
<td>• Worn counterweight bushing bores</td>
</tr>
<tr>
<td></td>
<td>• Cracked counterweight hanger blades</td>
</tr>
<tr>
<td></td>
<td>• Cracks, rust or pitting on crankshaft</td>
</tr>
<tr>
<td>Crankshaft</td>
<td>Discard/replace a camshaft with any of the following conditions:</td>
</tr>
<tr>
<td></td>
<td>• cracks, scoring, galling corrosion pitting or other physical damage</td>
</tr>
<tr>
<td></td>
<td>• Worn bearing surfaces</td>
</tr>
<tr>
<td></td>
<td>• If a hydraulic tappet has been rejected for spalling, inspect the corresponding cam lobe; any indication of stress, surface irregularity or feathering at the edge of the cam lobe indicates a reject condition.</td>
</tr>
</tbody>
</table>

Table 15-4. Engine Drive Train Parts Replacement
15-8.11.1. Camshaft Repair

**WARNING**

Camshafts may only be repaired by an approved FAA Part 145 Repair Stations. Do not attempt camshaft repair without the proper tooling and FAA required certification.

Camshaft overhaul repairs must be performed by an FAA Part 145 Repair Station certified to perform camshaft repair using methods approved by the Federal Aviation Administration. Camshaft grinding is limited to 0.020 inch authorized undersize. Undersize camshafts require line boring of the crankcase journals. The repaired camshaft must meet the dimensional limits specified in Appendix D. Perform a “Magnetic Particle Inspection” (Section 11-3 of M-0, Standard Practice Maintenance Manual) on the camshaft after rework.

---

### Table 15-4. Engine Drive Train Parts Replacement

<table>
<thead>
<tr>
<th>Part to Consider for Replacement</th>
<th>Discard and Replace Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td></td>
</tr>
<tr>
<td>Counterweight bushings and counterweight bushing retainer plates require an interference fit. Replace counterweight bushings or counterweight bushing retainer plates if insertion in the bushing bore is possible without resistance.</td>
<td></td>
</tr>
<tr>
<td>Crankshaft Counterweight¹</td>
<td>Discard any counterweight that is:</td>
</tr>
<tr>
<td></td>
<td>• Cracked</td>
</tr>
<tr>
<td></td>
<td>• Worn, pitted, fretted, or out of round bushing bores</td>
</tr>
<tr>
<td></td>
<td>• Worn or has distortions in the retaining ring groove that can affect the retaining ring seating</td>
</tr>
<tr>
<td>Oil Control Plugs</td>
<td>Discard/replace loose or leaking oil plugs</td>
</tr>
<tr>
<td>Connecting Rods</td>
<td>Discard/replace any connecting rods:</td>
</tr>
<tr>
<td></td>
<td>• With a bore exhibiting nicks or gouges</td>
</tr>
<tr>
<td></td>
<td>• If the rod and cap do not align properly</td>
</tr>
</tbody>
</table>

¹. Replace both counterweights in the matched pair, even if only one counterweight is unserviceable
15-8.11.2. Crankshaft Repair

**WARNING**

Crankshafts may only be repaired by an approved FAA Part 145 Repair Stations. Do not attempt crankshaft repair without the required FAA certification.

*CAUTION:* Do not attempt to repair a scored or overheated crankshaft. Discard and replace scored or scorched crankshafts.

*CAUTION:* If a crankshaft is repaired by an FAA Repair Station, the nitride treatment must be restored.

Crankshaft overhaul repairs must be performed by an FAA Part 145 Repair Station certified to perform crankshaft repair using methods approved by the Federal Aviation Administration. The repaired crankshaft must meet the dimensional limits specified in Appendix D.

1. Install the Crankshaft Oil Control Plug according to Section 15-8.11.2.1, “Oil Control Plug Replacement.”

2. Install new crankshaft counterweight bushings according to Section 15-8.11.2.2, “Crankshaft Counterweight Bushing Replacement.”

3. Install new crankshaft hanger blade bushings according to Section 15-8.11.2.3, “Crankshaft Hanger Blade Bushing Replacement.”

4. After the crankshaft hanger blade bushings, counterweight bushings are installed, and the oil control plug are installed, perform a “Magnetic Particle Inspection” on the crankshaft and counterweights and a “Crankshaft Ultrasonic Inspection” according to the instructions in Chapter 11 of M-0, Standard Practice Maintenance Manual to ensure no cracks developed during the bushing or plug installation process.
15-8.11.2.1. Oil Control Plug Replacement

**Equipment Required**

- Oil Plug Leak Test Fixture (Chapter 2 of M-0, Standard Practice Maintenance Manual)
- Oil Control Plug Installation Tool (Chapter 2 of M-0, Standard Practice Maintenance Manual)

  NOTE: The 2.375-inch diameter collar at the rear of the Oil Control Plug Installation Tool prevents driving the oil control plug beyond the specified depth of 4.71 to 4.73 inches. *Do not* use makeshift tools to install the oil control plug.

1. Remove the crankshaft oil control plug using a 0.4375-20 diameter bolt approximately 8 inches long with 0.4375-20NF threads and a slide hammer.

2. Inspect the inside diameter of the crankshaft for rust or pitting. Discard crankshafts exhibiting rust or pitting. Clean the bore of the crankshaft using a pneumatic drill and a two inch Merrit Wheel. The inside diameter of the crankshaft must be clean and free of any sludge residue prior to installing a new oil control plug.

3. Two special tools (Oil Control Plug Installation Tool and Oil Control Plug Leak Test Fixture (Chapter 2 of M-0, Standard Practice Maintenance Manual)) are required to perform this procedure. The tools are designed especially for this application. The 2.375-inch diameter collar at the rear of the Oil Control Plug Installation Tool prevents driving the oil control plug beyond the specified depth of 4.69 to 4.75 inches.

  *CAUTION: Do not use makeshift tools to perform this procedure. Non-conforming tools can damage components, rendering them unusable.*

4. Carefully drive in the new oil control plug into the crankshaft using an air impact tool and the Oil Control Plug Installation Tool.

5. Leak test the oil control plug and pressure test the crankshaft by connecting the Oil Control Plug Leak Test Fixture to the crankshaft using a C-clamp with neoprene rubber pads as shown in Figure 15-15. Apply 70-80 psi air pressure and close the air supply. Monitor the pressure gauge for 15 seconds; allowable pressure loss is not to exceed 2 psi.

6. After all crankshaft repairs have been completed, restore the helix pattern to the exposed portion of the crankshaft according to instructions in Section 15-8.11.2.4, “Crankshaft Plating Overhaul.”
"C" CLAMP
NOTE: NEOPRENE RUBBER PADS MUST BE INSTALLED BETWEEN "C" CLAMP SPINDLES AND CRANKSHAFT

OIL CONTROL PLUG
LEAK TEST FIXTURE

CRANKSHAFT

NEOPRENE RUBBER
PADS

APPLY 70-80 PSI AIR PRESSURE AND CLOSE CIRCUIT. LEAKAGE SHALL NOT EXCEED 2 PSI IN 15 SECONDS.

NOTE: FIXTURE MUST BE INSTALLED CAREFULLY TO PREVENT CRANKSHAFT DAMAGE

Figure 15-15. Oil Control Plug/Crankshaft Pressure Test
15-8.11.2.2. Crankshaft Counterweight Bushing Replacement

Replace all crankshaft counterweight bushings at overhaul according to the instructions in Section 10-9.1.5 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.3. Crankshaft Hanger Blade Bushing Replacement

Replace all crankshaft hanger blade bushings at overhaul according to the instructions in Section 10-9.1.6 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.4. Crankshaft Plating Overhaul

Prepare the exposed end of the crankshaft and propeller flange and apply protective coating according to the instructions in Section 10-9.3 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.5. Connecting Rod Piston Pin Bushing Replacement

Replace all connecting rod piston pin bushings at overhaul according to the instructions in Section 10-9.4.2 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.6. Piston Pin Bushing Boring

After new connecting rod bushings are installed, bore the bushing to the correct inside diameter according to the instructions in Section 10-9.4.3 of M-0, Standard Practice Maintenance Manual.

15-8.11.2.7. Connecting Rod Replacement

Connecting rod assemblies are selected in pairs with a maximum weight variation not to exceed ½ ounce in opposing bays. Connecting rods are supplied only in matched sets; replace connecting rods only in pairs.

WARNING

Never remove material from a connecting rod. Removing material from a connecting rod will destroy the shot peen treatment and may cause stress risers.
Chapter 16. Component Assembly

Instructions in this section depend on compliance with and completion of the preliminary steps detailed in earlier chapters. Parts must be properly removed, cleaned, inspected and repaired according to the instructions in previous chapters prior to assembly. Adhere to the component assembly instructions in this chapter. Prior to assembling components, refer to the following sections of M-0, Standard Practice Maintenance Manual:

- Appendix C-1, “Handling Parts”
- Appendix C-2.2, “Acceptable Replacement Parts”
- Appendix C-2.3, “100% Parts Replacement Requirements”

NOTE: The definition of “replace” in this manual is removal and disposal of the original part and subsequent installation of a new part with the same form, fit and function as the original part when it was new.

16-1. Fuel Injection System Assembly

16-1.1. Fuel Injection System Subassembly

NOTE: Before re-installation of fuel system component fittings ensure they are free of debris by screwing them into the proper size holes of a soft wood block and thoroughly flushing them with an approved solvent.

The fuel pump, throttle/metering unit and fuel manifold valve must be new, factory rebuilt, or field overhauled and tested by an authorized FAA Part 145 Repair Station.
16-1.2. Fuel Injector Nozzles

1. Prepare six new fuel injector nozzles matching the flow characteristics of those removed during disassembly. Position-tuned nozzles must be installed in the appropriate cylinder location for optimum performance.

2. Apply a light coating of clean 50 weight aviation engine oil to the injector O-rings seats and the injector nut seat. Install a new washer (Figure 17-34) (19) below the nut seat of the fuel injector nozzle. Install new O-rings (18) in the grooves above the nut seat.

3. Cap the ends of the new injector nozzles; mark them for the respective cylinders and place them in a clean storage container until ready for use.

4. Sparingly apply CMI Part No. 646943 anti-seize lubricant to the fuel injector male threads as shown in Figure 16-2.

   **CAUTION**: Apply Anti-seize lubricant to the male fitting threads. Never use Teflon tape on Fuel Injection System fittings or components.

![Fuel Injector Nozzle Identification](image)

![Apply Anti-Seize to Fuel Injector Threads](image)
16-1.3. Fuel Pump Assembly

NOTE: This procedure only applies if the fuel pump is field overhauled. New and factory rebuilt fuel pumps are shipped with fittings installed.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to all except the first two male fitting threads and install the fuel pump fittings in the same locations (Figure 16-4) they were removed from, oriented (clocked) to the same angles as when disassembled.

![Figure 16-3. Fuel Injection Fitting F/I Sealant Application](image)

2. Torque the fittings to the value specified in M-0, Standard Practice Maintenance Manual following Appendix C (in M-0) hose and fitting installation instructions.

NOTE: Fuel pump fittings vary by engine model specification. Illustration depicts the purpose of the connections relative to fuel flow through the fuel system.

![Figure 16-4. Fuel Pump Assembly with Fittings](image)

1 Low Pressure Relief Valve Adjustment  
2 Variable Orifice Adjustment (N/A)  
3 Mixture Control  
4 Aneroid Adjustment  
A Pump Inlet  
B Pump Outlet  
C Fuel Return  
D Vapor Return  
E Drain  
F Deck Pressure Reference
16-1.4. Diverter Valve Assembly

NOTE: The diverter valve is only used on TSIO-550-B, C & E engine model fuel systems.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to the male fitting threads; install the fittings (Figure 16-5) (2, 4, 6, and 7) in the new diverter valve, clocked according to the illustration drawn or the photograph taken at the time of disassembly.

2. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 16-5. Fuel Priming System

1 Diverter Valve 4 Swivel Elbow 7 90° Elbow
2 90° Elbow 5 Manifold Valve Inlet Tube 8 Primer Tube Assembly
3 Metering Unit Tube 6 Reducer Bushing 9 Hose Clamp
Figure 16-6. Diverter Valve Fitting Detail
16-1.5. Fuel Manifold Valve Assembly

The fuel manifold valve must be replaced as an assembly at engine overhaul. Assembly instructions are limited to verification of the assembled components and minor parts replacement. Internal fuel manifold valve assembly and flow verification instructions are beyond the scope of this manual and are not provided. When the fuel manifold valve is ordered as an assembly, steps to install the fittings in the fuel manifold valve are not necessary; the fuel manifold valve is shipped with the fittings installed to comply with the engine model configuration.

Prior to disassembly, the mechanic should have taken a photograph or sketched the assembly for fitting installed location and orientation. Refer to the photograph or sketch for assembly.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to all except the first two male fitting threads and install the fuel manifold valve fittings in the same locations from which they were removed. Torque the fittings to the value specified in M-0, Standard Practice Maintenance Manual.

2. Place the fuel manifold valve (Figure 16-7) (1) on a flat surface. Invert the bracket (2) and insert a screw (3) with a washer (4) through each of the mounting holes in the bracket. Place another washer (4) on each of the screws after the screw is in the bracket. Align the bracket (2) with the manifold valve mounting holes and thread each screw into the fuel manifold valve cover. When all the screws are hand tight, torque the screws (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 16-7. Fuel Manifold Valve Assembly

1. Manifold Valve
2. Bracket
3. Fillister Head Screw
4. Washer
5. Adapter
6. 90° Elbow
7. 45° Elbow
8. Flare Tube Cap
9. Elbow
16-1.6. TSIO-550-B, C, E & G Throttle Assembly

The throttle and metering assembly must be replaced as an assembly at engine overhaul. Assembly instructions are limited to verification of the assembled components and minor parts replacement. Internal throttle assembly and flow verification instructions are beyond the scope of this manual and are not provided. When the throttle is ordered as an assembly, steps to install the fittings are not necessary.

Prior to disassembly, the mechanic should have taken a photograph or sketched the assembly for fitting installed location and orientation. Refer to the photograph or sketch for assembly.

1. Apply a small amount of CMI Part No. 646940 sealant (Figure 16-3) to all except the first two male fitting threads and install the throttle fittings (10-19) in the same locations from which they were removed. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Install the bracket (Figure 16-8 or Figure 16-9) (20) on the throttle body with a bolt (21), followed by a washer (24), washer (23), bracket (20) washer (23) and spacer (22) in the boss on the bottom of the throttle body. Torque the bolt (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 16-8. Throttle Assembly
3. The throttle lever (3) and lock nut (4) ship loose with the throttle assembly. Install the lever according the engine installation drawings in Section 5-4.

Figure 16-9. Throttle Assembly

1. Throttle Assembly
2. Lever
3. Throttle & Mixture Control Lever
4. Lock Nut
5. Adjustment Screw
6. Spring
7. Pin
8. Nut
9. Set Screw
10. Reducer Bushing
11. Connector Fitting
12. Adapter Assembly
13. Flex Connector
14. Plug
15. Tee
16. 45° Elbow or Connector Fitting
17. 90° Elbow or Orifice Fitting Adapter
18. Cap
19. 90° Elbow
20. Bracket
21. Bolt
22. Sleeve
23. Washer
24. Washer
16-1.7. TSIO-550-K & N Throttle Assembly

The throttle and metering assembly must be replaced as an assembly at engine overhaul. Assembly instructions are limited to verification of the assembled components and minor parts replacement. Internal throttle assembly and flow verification instructions are beyond the scope of this manual and are not provided. When the throttle is ordered as an assembly, steps to install the fittings are not necessary.

Prior to disassembly, the mechanic should have taken a photograph or sketched the assembly for fitting installed location and orientation. Refer to the photograph or sketch for assembly.

1. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to all except the first two male fitting threads and install the throttle fittings (10-20) in the same locations from which they were removed. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Install the bracket (Figure 16-10 or Figure 16-11) (25) on the throttle body with a bolt (21), followed by a washer (24), washer (23), bracket (25) washer (23) and spacer (22) in the boss on the bottom of the throttle body. Torque the bolt (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. The throttle lever (3) and lock nut (4) ship loose with the throttle assembly. Install the lever according the engine installation drawings in Section 5-4.
### Component Assembly

**Figure 16-11. Throttle Assembly**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Throttle Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Lever</td>
</tr>
<tr>
<td>3</td>
<td>Throttle &amp; Mixture Control Lever</td>
</tr>
<tr>
<td>4</td>
<td>Lock Nut</td>
</tr>
<tr>
<td>5</td>
<td>Adjustment Screw</td>
</tr>
<tr>
<td>6</td>
<td>Spring</td>
</tr>
<tr>
<td>7</td>
<td>Set Screw</td>
</tr>
<tr>
<td>8</td>
<td>Nut</td>
</tr>
<tr>
<td>9</td>
<td>Pin</td>
</tr>
<tr>
<td>10</td>
<td>Reducer Bushing</td>
</tr>
<tr>
<td>11</td>
<td>Connector Fitting</td>
</tr>
<tr>
<td>12</td>
<td>Adapter Assembly</td>
</tr>
<tr>
<td>13</td>
<td>Flex Connector</td>
</tr>
<tr>
<td>14</td>
<td>Plug</td>
</tr>
<tr>
<td>15</td>
<td>Tee</td>
</tr>
<tr>
<td>16</td>
<td>Connector Fitting</td>
</tr>
<tr>
<td>17</td>
<td>Orifice Fitting Adapter</td>
</tr>
<tr>
<td>18</td>
<td>Cap</td>
</tr>
<tr>
<td>19</td>
<td>90° Elbow</td>
</tr>
<tr>
<td>20</td>
<td>45° Elbow Fitting</td>
</tr>
<tr>
<td>21</td>
<td>Bolt</td>
</tr>
<tr>
<td>22</td>
<td>Sleeve</td>
</tr>
<tr>
<td>23</td>
<td>Washer</td>
</tr>
<tr>
<td>24</td>
<td>Washer</td>
</tr>
<tr>
<td>25</td>
<td>Throttle Body Bracket</td>
</tr>
</tbody>
</table>
16-2. Induction System Assembly

1. Install a new felt bumper pad (Figure 16-13) (2) on the bottom of the induction manifold with CMI Part No. 655700 adhesive.

2. Install the fuel manifold valve and bracket assembly on the 2-4-6 side of the induction manifold (1) with new bolts (9), washers (7) and spacers (8); torque the bolts (9) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to the male fitting threads and install plugs (Figure 16-13) (3) in the 1-3-5 side FWD (Figure 16-12) (F) (if the manifold is drilled and tapped for a fitting) and lower induction manifold ports (D & E); torque the plugs (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Apply a small amount of CMI Part No. 646940 F/I sealant (Figure 16-3) to the male fitting threads and install the remaining induction manifold fittings in the induction manifold.
manifold ports (Figure 16-12)(A, B & C) based on the requirements of the engine model configuration; example configurations are provided in Figure 16-13.

![Composite Induction Manifold Diagram](image)

**Figure 16-13. Composite Induction Manifold**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Induction Manifold</td>
</tr>
<tr>
<td>2</td>
<td>Felt Bumper Pad</td>
</tr>
<tr>
<td>3</td>
<td>Plug</td>
</tr>
<tr>
<td>4</td>
<td>Adapter Assembly</td>
</tr>
<tr>
<td>5</td>
<td>Nipple Connector</td>
</tr>
<tr>
<td>6</td>
<td>90° Elbow</td>
</tr>
<tr>
<td>7</td>
<td>Washer</td>
</tr>
<tr>
<td>8</td>
<td>Spacer</td>
</tr>
<tr>
<td>9</td>
<td>Bolt</td>
</tr>
<tr>
<td>10</td>
<td>45° Elbow</td>
</tr>
<tr>
<td>11</td>
<td>45° Street Elbow</td>
</tr>
<tr>
<td>12</td>
<td>Plug</td>
</tr>
</tbody>
</table>
16-2.1. Induction Tube Assembly

1. Lubricate a new O-ring (30) with Grade 50 aviation engine oil and install the new O-ring on the 2-4-6 forward induction tube (39) flange.

2. Install the overboost valve (29) with bolts (31), washers (32) and new lock nuts (33). Torque the fasteners to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Do not torque the induction tube clamps until final installation on the engine.

3. Loosely assemble the 1-3-5 side aftercooler (34) and induction tubes (39 & 45) with new hoses (40 & 41) and clamp assemblies (42 & 43).

4. Loosely assemble the 2-4-6 side aftercooler (34) and induction tubes (38 & 44) with new hoses (40 & 41) and clamp assemblies (42 & 43).

Figure 16-14. Induction System

NOTE: WD-40 or a mild, soapy water solution may be applied to the inside of the hoses the ease assembly of the induction spider.
5. Install the venturi nozzle (35) with new hoses (36) and new clamps (37).

6. Loosely assemble the induction spider (1 & 3-8) with new hoses (9) and clamps (10) at each induction joint. Do not torque the clamps at this time.
16-3. Alternator Assembly

Refer to the “Gear Driven Alternator Replacement” instructions in Section 10-4.1 of M-0, Standard Practice Maintenance Manual.
16-4. Starter & Starter Adapter Assembly

The starter adapter features a scavenge pump driven to circulate the turbocharger oil supply. Overhaul is only permitted on the starter adapter with a PTO drive shaft. Replace the starter adapter without PTO drive shaft at overhaul.

16-4.1. Starter Adapter with Scavenge Pump and Accessory Drive Assembly

1. Lubricate the inside diameter of a new bearing (Figure 16-17) (8) and the end of the worm drive shaft (4) with Molyshield grease. Press the new bearing (8) onto the worm drive shaft (4) until it rests on the shoulder of the worm drive shaft (4).

2. Lubricate the inside diameter of the worm gear (7) and the worm drive shaft (4) with Molyshield grease. Install a new woodruff key (5) in the slot of the worm drive shaft (4). Install a new spring (6) on the worm drive shaft (4), followed by the worm gear (7).

3. Lubricate the inside of the starter adapter housing (1) and the worm gear (7) drive teeth with Molyshield grease. Insert the assembled worm drive (4, 5, 6, 7 & 8) in the starter adapter housing (1) so the end of the worm drive shaft (4) is inside the new roller bearing (3). Use snap ring pliers to secure the assembly with a new retaining ring (9) in the starter adapter housing (1) flange. Verify the retaining ring (9) is properly seated in the starter adapter housing (1) flange.

4. Lubricate a roller bearing (18) with Molyshield grease and install the roller bearing (18) in the worm wheel gear (19) using the Bearing Installation Tool (Figure 16-16 and Chapter 2 of M-0, Standard Practice Maintenance Manual) and an arbor press.

5. Lubricate the inside diameter of the clutch spring (Figure 16-17) (17) liberally with clean 50 weight aviation engine oil.
### Figure 16-17. Starter and Adapter with Scavenge Pump and Accessory Drive

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Number</th>
<th>Description</th>
<th>Number</th>
<th>Description</th>
<th>Number</th>
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<tbody>
<tr>
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<td>Starter Adapter Housing</td>
<td>14</td>
<td>Stud</td>
<td>27</td>
<td>Stud</td>
<td>40</td>
<td>Washer</td>
</tr>
<tr>
<td>2</td>
<td>Sleeve, Clutch Spring</td>
<td>15</td>
<td>Dowel</td>
<td>28</td>
<td>Stud</td>
<td>41</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>3</td>
<td>Needle Bearing</td>
<td>16</td>
<td>Starter Shaft Gear</td>
<td>29</td>
<td>Dowel</td>
<td>42</td>
<td>Nut</td>
</tr>
<tr>
<td>4</td>
<td>Worm Drive Shaft</td>
<td>17</td>
<td>Clutch Spring</td>
<td>30</td>
<td>Washer</td>
<td>43</td>
<td>Spacer</td>
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<tr>
<td>5</td>
<td>Woodruff Key</td>
<td>18</td>
<td>Roller Bearing</td>
<td>31</td>
<td>Nut</td>
<td>44</td>
<td>Bearing</td>
</tr>
<tr>
<td>6</td>
<td>Starter Spring</td>
<td>19</td>
<td>Starter Worm Gear</td>
<td>32</td>
<td>Scav. Pump Driven Gear</td>
<td>45</td>
<td>Starter Shaft Seal</td>
</tr>
<tr>
<td>7</td>
<td>Starter Worm Gear</td>
<td>20</td>
<td>Tab Washer</td>
<td>33</td>
<td>Bushing</td>
<td>46</td>
<td>O-ring Seal</td>
</tr>
<tr>
<td>8</td>
<td>Radial Ball Bearing</td>
<td>21</td>
<td>Screw</td>
<td>34</td>
<td>Scav. Pump Driver Gear</td>
<td>47</td>
<td>Starter Shaft Sleeve</td>
</tr>
<tr>
<td>9</td>
<td>Internal Retaining Ring</td>
<td>22</td>
<td>Ball Bearing</td>
<td>35</td>
<td>Scav. Pump Body</td>
<td>48</td>
<td>Starter Shaft Spacer</td>
</tr>
<tr>
<td>10</td>
<td>Stud</td>
<td>23</td>
<td>O-Ring</td>
<td>36</td>
<td>90° Street Elbow</td>
<td>49</td>
<td>Flanged Nut</td>
</tr>
<tr>
<td>11</td>
<td>Stud</td>
<td>24</td>
<td>Cover Assembly</td>
<td>37</td>
<td>45° Elbow</td>
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<td></td>
</tr>
<tr>
<td>12</td>
<td>Stud</td>
<td>25</td>
<td>Plug</td>
<td>38</td>
<td>90° Elbow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Stud</td>
<td>26</td>
<td>Stud</td>
<td>39</td>
<td>Seal Retainer Clip</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- **Stud:** 
- **Dowel:** 
- **Washer:** 
- **Nut:** 
- **Spacer:** 
- **Bearing:** 
- **Washer:** 
- **Lock Washer:** 
- **Nut:** 
- **O-ring Seal:** 
- **Flanged Nut:**
Component Assembly

6. Twist the new clutch spring clockwise on to the back side of the worm wheel gear assembly (50) until the offset end drops into the gear land. Position the clutch spring (17) on the worm wheel gear (19) so the tang aligns with the screw hole in the gear web.

7. Install a screw (21) with a new tab washer (20) in the threaded screw hole in the worm wheel gear assembly (50) web. Torque the screw (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual and bend the tab washer (20) up to the wrench flat of the screw head with a brass drift to secure the screw.

8. Lubricate the starter shaft gear (16) collar and inside diameter of the clutch spring (17) liberally with clean 50 weight aviation engine oil.

9. Twist the assembled worm wheel gear (19) and clutch spring (17) clockwise on the starter shaft gear (16) until the starter shaft gear (16) meets the roller bearing (18).

10. Lubricate the worm wheel gear teeth with Molyshield grease. Insert the starter shaft gear and worm wheel assembly in to the starter adapter housing (1). Align the teeth of the worm gear (7) and worm wheel gear (16) as the assembly enters starter adapter housing (1).

11. Lubricate a new bearing (22) with Molyshield grease and press the bearing into the flange on the inside of the housing cover (24) using an arbor press. The ball bearing (22) should be seated against the inside flange of the housing cover (24).

12. Lubricate a new O-ring (23) with 50 weight aviation engine oil; install the new O-ring (23) on the starter adapter housing cover (24) flange.

13. Align the starter adapter housing cover (24) with the starter adapter studs. Secure the cover with washers (30) and nuts (31); torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Insert the blade of a large common screwdriver in the driver slot of the worm drive shaft (4) and turn the worm drive shaft clockwise. The shaft should rotate smoothly, with minimal resistance. If the assembly doesn’t rotate or it exhibits binding, disassemble the starter adapter to determine the cause of the malfunction.

15. Lubricate the inside diameter and gear teeth of the scavenge pump driver gear (32) with Molyshield grease and install the gear on the end of the starter shaft gear (16).

16. Apply Loctite 592 to the fitting threads and install the fittings (36, 37 & 38) in the scavenge pump housing (35). Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

17. Lubricate the shaft inside the scavenge pump housing (35) and the inside diameter of the bushing (33) and scavenge pump driven gear (34) with Molyshield Grease. Press the new bushing (33) in the scavenge pump driven gear (34). Install the drive gear, with new bushing on the shaft. Wipe any Molyshield grease residue from the scavenge pump housing parting flange.

18. Lightly coat the parting flange of the scavenge pump housing (35) with Part No. 654663 sealant; Allow the Part No. 654663 sealant to cure until it is slightly tacky.
19. Apply a single line of Grade 3 Silk Thread over the Part No. 654663 surface of the pump body following the dotted line pattern in Figure 16-18.

![Figure 16-18. Scavenge Pump Body Silk Thread Pattern](image)

20. Install the scavenge pump housing (Figure 16-17) (35) on the starter adapter housing cover (24). Secure the scavenge pump housing with five sets of nuts (42), new lock washers (41) and washers (40). Do not install any hardware on the stud adjacent to the starter shaft seal bore. This hardware and seal retainer clip (39) will be installed after the starter shaft seal (45) and sleeve (47) are installed. Torque the nuts (42) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: The bearing (44) has an open cage on one side and a closed cage (labeled “thrust” on the cage) on the other. The bearing must be installed with the “thrust” side toward the front of the engine.

21. Install a new spacer (43) and new bearing (44) over the starter shaft gear (16) in the scavenge pump housing (35).

22. Lubricate the inside diameter of the starter shaft sleeve (47) with 50 weight aviation engine oil. Lubricate a new O-ring (46) with 50 weight aviation engine oil and install the new O-ring (46) in the starter shaft sleeve (47). Install the assembly (46 & 47), O-ring first on the starter shaft gear (16).

   Procedure continues on following page...
23. Lubricate the perimeter of the starter shaft seal (45) and the inside diameter of the scavenge pump housing seal bore and the starter shaft sleeve (47). Work the starter shaft seal (45) into position in the seal bore with an O-ring installation tool. The starter shaft seal (45) must be installed flush within 0.030 inches (Figure 16-19).

![Figure 16-19. Scavenge Pump Oil Seal Position](image)

24. Install a washer (40), oil seal retainer clip (Figure 16-17), (39), and nut (42) on the top stud of the scavenge pump housing (See Figure 16-20); torque the nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

25. Install the spacer (Figure 16-17) (48) or sheave on the starter shaft gear (16).
   a. If an air conditioning compressor drive sheave is required for the installation, lubricate the shaft threads with clean 50 weight aviation engine oil and install the air conditioning compressor drive sheave (48) and a new lock nut (49) on the end of the shaft (16). Do not torque the lock nut (49) until the sheave alignment is verified in Section 17-14, “Compressor (Optional) Mount Installation.”
   b. If a no air conditioning compressor drive sheave is required for the installation, lubricate the shaft threads with clean 50 weight aviation engine oil and install the spacer (48) and a new lock nut (49) on the end of the shaft (16); torque the lock nut (49) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

26. Insert the blade of a large common screwdriver in the driver slot of the worm drive shaft (4) and turn the worm drive shaft clockwise for a final check of the assembly. The shaft should rotate smoothly, with minimal resistance. If the assembly doesn’t rotate or it exhibits binding, disassemble the starter adapter to determine the cause of the malfunction.

27. Install the assembled adapter securely in a fixture. Apply counterclockwise force to the adapter input shaft with a torque wrench set to 300 in. lbs. No slippage is allowed.
28. Lubricate a new O-ring (Figure 16-21) (5) with clean 50 weight aviation engine oil and install it on the starter assembly (1) flange.

29. Align the driver slot of the worm drive shaft (Figure 16-17) (4) with the starter drive tang. Mount the starter motor (Figure 16-21) (2) on the starter adapter studs using two sets of nuts (3) and washers (4). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
16-5. Turbocharger and Exhaust System Assembly

16-5.1. Turbocharger and Bracket Assembly

NOTE: This section does not apply to the TSIO-550-N turbocharger assemblies.

On TSIO-550-B, C, E, G & K engines, turbochargers are fastened to the respective support brackets in a specific orientation, as shown in Figure 16-22, remove only the bolts necessary to facilitate turbocharger replacement:
- To assemble the left side (2-4-6) turbocharger, align the turbocharger bolt holes with the support bracket at bolt positions 3 and 4.
- To assemble the right side (1-3-5) turbocharger, align the turbocharger bolt holes with the support bracket at bolt positions 3 and 4.

If a new, rebuilt or overhauled turbocharger is being installed on the support bracket, refer to Figure 16-17 for the proper alignment and orientation of the turbocharger and support bracket:

1. Verify the side of the engine the turbocharger is being configured for.
2. Align the turbocharger bolt holes with the support bracket.
3. Install bolts with new tab washers.
5. Bend the tabs up against the bolt heads with a drift.

Figure 16-22. Turbocharger Bracket Orientation

<table>
<thead>
<tr>
<th>R.H. 1-3-5 SIDE BRACKET</th>
<th>L.H. 2-4-6 SIDE BRACKET</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEND TABS FLAT UP AGAINST BOLT HEAD AFTER TORQUING</td>
<td></td>
</tr>
<tr>
<td>TURBINE HOUSING</td>
<td></td>
</tr>
<tr>
<td>DO NOT REMOVE THESE BOLTS</td>
<td></td>
</tr>
</tbody>
</table>

B C E G K
16-5.2. Turbocharger Component Assembly

NOTE: Refer to “Hose and Tubing Installation” in Appendix C-11 for important instructions about tightening fittings and hoses.

Lubricate the adapters, fittings, reducer, and O-rings with 50 weight aviation engine oil before installation to prevent damage to the O-rings and ensure proper torque application.

1. Install the left oil reservoir (Figure 16-23) (4) and adapter (5) on the left turbocharger (2) with new gaskets (7 & 8), bolts (10 & 12) and new lock washers (9 & 11).

2. Install the right oil reservoir (3) and adapter (5) on the right turbocharger (1) with new gaskets (7 & 8), bolts (10 & 12) and new lock washers (9 & 11); torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 16-23. Turbocharger Lubrication

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Left Turbocharger</td>
</tr>
<tr>
<td>2</td>
<td>Right Turbocharger</td>
</tr>
<tr>
<td>3</td>
<td>Gasket</td>
</tr>
<tr>
<td>4</td>
<td>Adapter</td>
</tr>
<tr>
<td>5</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>6</td>
<td>Bolt</td>
</tr>
<tr>
<td>7</td>
<td>Gasket</td>
</tr>
<tr>
<td>8</td>
<td>Left Oil Reservoir</td>
</tr>
<tr>
<td>9</td>
<td>Right Oil Reservoir</td>
</tr>
<tr>
<td>10</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>11</td>
<td>Bolt</td>
</tr>
<tr>
<td>12</td>
<td>Adapter</td>
</tr>
<tr>
<td>13</td>
<td>Tee</td>
</tr>
<tr>
<td>14</td>
<td>Check Valve</td>
</tr>
<tr>
<td>15</td>
<td>Hose</td>
</tr>
<tr>
<td>16</td>
<td>Hose</td>
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<tr>
<td>17</td>
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<td>20</td>
<td>Hose</td>
</tr>
<tr>
<td>21</td>
<td>Hose</td>
</tr>
</tbody>
</table>
Figure 16-24. Wastegate Controller Ports

3. Install the adapter (Figure 16-25) (4) with new O-ring (5) in the controller (1) compressor discharge reference port; torque the adapter (4) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Install an elbow (7) with a new O-ring (3) in the controller (1) oil drain port; torque the elbow (7) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Install the reducer (2) with new O-ring (3) in the controller (1) manifold pressure port or alternate manifold pressure port; torque the reducer (2) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Install the fitting adapter (6) with a new O-ring (3) in the controller (1) oil inlet port; torque the fitting adapter (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 16-25. Wastegate Controller Fitting Detail
Component Assembly

7. Install the 45° (\(90^\circ\)) elbow (Figure 16-26) (2) with a new O-ring (5) in the wastegate (1) oil supply port (from oil cooler); torque the fitting (2) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Install the 45° (\(90^\circ\)) elbow (3) with a new O-ring (6) in the wastegate (1) oil outlet port (to controller); torque the fitting (3) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Apply Loctite 592 to the plug (7) threads and install the plug (7) in the wastegate (1) upper drain port; torque the plug (7) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: The lower wastegate drain B C E G fitting is defined and provided by the aircraft manufacturer. Consult aircraft maintenance manual for instructions.

10. Apply Loctite 592 to the drain (4) fitting threads and install the drain fitting (4) in the wastegate (1) lower drain port; torque the drain fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 16-26. Wastegate Fitting Detail
16-6. Lubrication System Assembly

*CAUTION:* Never use Teflon tape on Lubrication System fittings.

16-6.1. Oil Pump Assembly

1. Lightly coat the parting surface of the oil pump body (Figure 16-27) with Part No. 654663 sealant and allow to cure until it is slightly tacky.

2. Apply a single line of Grade 3 Silk Thread in the Part No. 654663 sealant bed, inward to the split line toward the oil pump bore.

3. Apply Part No. 654663 to the perimeter of the oil pump cover (Figure 16-28)(16) where it mates with the oil pump housing.

![Figure 16-27. Oil Pump Housing Silk Thread Pattern](image)

4. Install the oil pump housing (2) in a suitable fixture and lubricate the cavity, gear contact areas, the gear and bushing (4), and the shaft gear assembly (15) with Part No. 656817 Molyshield Grease.

5. Assemble the oil pressure relief valve plunger (6) with spring (7), and seat (8) on the adjusting screw (9). Install a new gasket (10) on the oil pressure relief valve housing (11). Thread the adjusting screw (9) into the oil pressure relief valve housing (11) approximately half the full length of travel on the threads. Verify the relief valve components are aligned.

6. Apply Part No. 646943 Anti-Seize Lubricant to all except the first two male threads of the oil pressure relief valve housing. Torque the oil pressure relief valve housing (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil pressure relief valve housing (11) according to instructions in Appendix C of M-0, Standard Practice Maintenance Manual.

7. Install the copper washer (13) over the adjusting screw protruding from the base of the oil pressure relief valve housing and secure with the self-locking nut (14).
Component Assembly

Torque the self-locking nut (14) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Lubricate the oil pump gear cavity, gear contact area, gears (15 and 4) and bushing (5) with Molyshield grease. Install the shaft (driving) gear (15), bushing (5) and (driven) gear (4), in the oil pump housing (2).

9. Install the cover (16) and secure with two sets of washers (18) and nuts (20) at 6 and 12 o’clock positions. Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Cover the assembly and store in a clean location until final assembly. The oil pump, filter adapter and oil filter will be installed during engine assembly.

![Figure 16-28. Oil Pump Assembly](image-url)

1 Oil Pump 9 Screw 17 Gasket 25 Lock Washer
2 Oil Pump Housing 10 Gasket 18 Washer 26 Nut
3 Stud 11 Housing 19 Lock Washer 27 Gasket
4 Gear 12 Helical Coil 20 Nut 28 Plug
5 Bushing 13 Copper Washer 21 Gasket 29 Stud
6 Plunger 14 Lock Nut 22 Oil Filter 30 Silk Thread
7 Spring 15 Gear 23 Oil Filter Adapter 31 Safety Wire
8 Seat 16 Cover 24 Washer

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Component Assembly

16-6.2. Oil Cooler Assembly

The oil cooler must be cleaned, overhauled, tested and assembled by an appropriately rated repair station (i.e., FAA-approved Part 145 repair station) or replaced with a new oil cooler assembly. The oil temperature control valve, any special plugs, new gaskets, new O-rings, and new lock washers will be installed on the oil cooler during engine assembly.
16-7. Engine Cylinder Assembly

1. Install a new (or repaired) cylinder baffle (Figure 16-31) (43) on the lower side of each cylinder below the pushrod tube passages to close the gap outboard of the lower spark plug hole as illustrated in Figure 16-29.

2. Insert the hooked end of a new spring (44) through the baffle as depicted in Figure 16-30. Use a spring hook to extend and latch the end of the spring (44) over a cylinder fin on the opposite side of the cylinder from the baffle.
Figure 16-31. Cylinder Assembly

1 Cylinder Assembly  15 Drain Fitting  29 Rocker Cover  43 Baffle
2 Spark Plug Insert  16 Inner Retainer  30 Washer  44 Spring
3 Intake Valve Guide  17 Retainer Key  31 Lock Washer  45 Drain Tube
4 Exhaust Valve Guide  18 Rotocoil  32 Screw  46 Drain Tube Seal
5 Stud  19 Intake Rocker Arm Assembly  33 Exhaust Flange Gasket  47 7th Stud Bracket
6 Stud  20 Exhaust Rocker Arm Assembly  34 Lock Nut  48 7th Stud Bracket
7 Exhaust Stud  21 Rocker Arm Bushing  35 Pushrod Housing  49 Flange Nut
8 Helicoil Insert  22 Drive Screw  36 Washer  50 Cylinder Base O-ring
9 Intake Valve Seat Insert  23 Thrust Washer  37 O-ring Seal  51 Intake Valve Seal
10 Exhaust Valve Seat Insert  24 Rocker Arm Shaft  38 Pushrod Housing Packing  52 Check Valve
11 Intake Valve  25 Retainer  39 Pushrod Housing Spring  53 Valve Spring Retainer
12 Exhaust Valve  26 Tab Washers  40 Pushrod Assembly  54 Hydraulic Exhaust Tappet
13 Inner Spring  27 Screw  41 Flange Nut  55 Hydraulic Intake Tappet
14 Outer Spring  28 Rocker Cover Gasket  42 Flange Nut
**WARNING**

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

3. Spread a film of Molyshield grease on the intake valve (Figure 16-31) (11) and the new exhaust valve (12) stems.

   NOTE: If the intake and exhaust valves were lapped, install the valves into the corresponding cylinder lapped positions.

4. Grasp the valve stems and install the cylinder on a cylindrical block of wood anchored to a work bench.

5. Reapply Molyshield grease to the valve stems.

6. Place the new valve spring lower retainers (16) over the valve guides (3 and 4), cupped side up.

7. Coat the sealing surface of a new intake valve guide seal (51) with clean 50-weight aviation engine oil.

8. Install the new intake valve guide seal (51) by hand. Tap the new seal onto the guide with a “Valve Guide Seal Installation Tool” (Chapter 2, Special Tools in M-0, Standard Practice Maintenance Manual) and a plastic mallet until it is firmly seated.

9. Install new inner and outer springs (13 and 14) and a new rotocoil (18) on the exhaust valve springs and the new retainer (53) on the intake valve springs. The valve springs must be installed with the closed coils toward the cylinder head as shown in Figure 16-32.

![Figure 16-32. Valve Spring Installation](image)

NOTE: INNER AND OUTER SPRINGS MUST BE INSTALLED AS SHOWN, WITH CLOSED COILS TOWARD CYLINDER HEAD.
Component Assembly

WARNING

Contact with the retainer will damage the valve stems. Before releasing pressure on the springs, ensure the keys are properly seated in the valve stem grooves.

10. Compress the valve springs with the Valve Spring Compressor Tool and insert the new valve stem retainer keys (Figure 16-31) (17). Depress the springs only enough to allow the keys to seat into the valve stem grooves. If the keys drop, they may damage the valve stem when the springs are released.

11. Remove the cylinder from the fixture and place it upright on a workbench.

12. Place a plastic mallet squarely on the end of the valve stem and strike the plastic mallet sharply with a rawhide mallet to seat the valve spring retainer keys. DO NOT STRIKE THE RETAINER.

13. Verify the valve spring retainer keys are properly positioned, with two keys on each valve stem as illustrated in Figure 16-33.

Figure 16-33. Valve Retainer Key Installation

14. Invert the cylinder assembly on the bench with the cylinder bore facing upward and the cylinder resting on the rocker shaft mounting bosses.

15. Coat the cylinder barrel wall thoroughly with clean 50-weight aviation engine oil.

16. Ensure the new pistons and new piston rings are the correct size for the cylinder bore size. Inspect the piston-to-cylinder clearance of each matching piston and cylinder. Refer to Section 10-8 of M-0 for information regarding piston weights now used to identify pistons (in lieu of piston position markings).

17. Inspect each piston ring for the proper gap in the cylinder bore in which it will be assembled.

18. Insert one piston ring at a time into the cylinder bore and use the piston to push the piston ring to the position specified in Appendix D.
19. Remove the piston and inspect the ring gap using a leaf type feeler gauge.
   a. If the ring gap is smaller than specified, record the actual gap size and remove the ring from the cylinder bore.
   b. Mount a fine toothed flat file in a vise. While holding the ring ends firmly and squarely against the file, remove the desired amount of material.
   c. To attain the correct ring gap, deburr the ring gap ends using crocus cloth.
   d. Thoroughly clean the piston ring with mineral spirits and air dry.
   e. Install the new piston ring in the cylinder bore to the correct position and inspect the ring gap again. Repeat the tasks in this step until all piston ring gaps meet the required specification.
   f. Discard piston rings that exceed the specified piston ring gap dimensions.

20. Install the new piston rings (Figure 16-35) (2 thru 5) on the new pistons with the part number facing toward the top of the piston using a ring expander.
   a. Install a new expander ring in the new oil control ring groove so the expander gap is 180° away from the oil control ring gap.
   b. Install a new #3 piston ring in the #3 ring groove of the piston with the oil control ring gap at the 12 O’clock (referenced to the piston’s installed position in the cylinder) position.
   c. Install a new second compression ring (3) into the #2 ring groove with the ring gap at the 3 O’clock position.
   d. Install a new top compression ring (2) into the #1 ring groove with the ring gap at the 9 O’clock position.
   e. Install a new oil scraper ring (5) into the fourth ring groove with the ring gap at the 6 O’clock position.

21. Inspect all ring side clearances with the ring edge flush with the piston outside diameter. All ring side clearances must conform to Appendix D dimensional limits.
22. Lubricate the piston pin and piston and ring assemblies with clean 50-weight aviation engine oil.

NOTE: The weight of opposing bay piston pairs varies no more than 1/2 ounce or 14.175 grams.

![Figure 16-35. Piston, Piston Pin and Rings](image)

23. Place the new piston and ring assembly with the cylinder assembly for which it was previously sized and gapped. Install new piston pins (6) in the piston pin bores. Piston pins must slide freely in the piston pin bores.

24. Using a ring compressor, install each piston into its cylinder with top three rings in the cylinder barrel and the piston pin accessible for connecting rod installation.

25. Install a new O-ring seal (Figure 16-36) (37) on the cylinder end of the pushrod housings (35). Place two each, pushrod housings, new springs (39), washers (36), new packing (38), and second washer (36) with each cylinder on the bench.

![Figure 16-36. Pushrod Tube Assembly](image)
16-8. Crankcase Assembly

1. Install new pipe plugs.
   a. Apply Loctite 592 Teflon PS/T Pipe Sealant sparingly on the pipe plug male threads.
   b. Install the crankcase pipe plugs removed during disassembly in the locations indicated on the tags. Install new plugs according to the “Crankcase Plugs” instructions in Appendix D-9.6. The plugs must be installed in all of the corresponding locations to prevent oil leakage or pressure loss. Torque the plugs to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Install the starter adapter shaft gear bearing using the following steps:
   a. Stand the 1-3-5 crankcase on its nose end and place the new starter shaft gear needle bearing with its part number facing outward into the bearing bore.
   b. Install the needle bearing using an arbor press and a “Permold Crankcase Needle Bearing Installation Tool” (Chapter 2 of M-0, Standard Practice Maintenance Manual) or equivalent.
   c. Press the bearing into the crankcase until it bottoms out in the bore.
16-9. Engine and Turbocharger Mount Installation

NOTE: TSIO-550-K & N model turbocharger mounting brackets vary significantly in appearance from the remaining engine models but instructions are the same for all engine models.

1. Install the forward engine mounts (Figure 16-37) (1) on the crankcase studs and secure with washers (5) and nuts (6). Torque the nuts (6) to Appendix B specifications.

2. Install the aft engine mounts (2) on the crankcase studs. Install washers (5 (top) & 7 (bottom)) on the protruding studs, followed by two spacers (8) on the top stud. Install the turbocharger mounting brackets (3 & 4) on the studs and secure with washers (5) and nuts (6) on all three studs. Torque the nuts (6) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 16-37. Engine and Turbocharger Mounting Brackets B C E G

1  Fwd Engine Mount
2  Aft Engine Mount
3  Left Turbo Support Bracket
4  Right Turbo Support Bracket
5  Washer
6  Nut
7  Washer
8  Spacer
9  Heli-Coil Insert
Figure 16-38. Engine and Turbocharger Mounting Brackets

Figure 16-39. Engine and Turbocharger Mounting Brackets
16-10. Engine Drive Train Assembly

16-10.1. Camshaft Assembly

Camshafts have the same rear plugs but the front plugs may be threaded with a hex head or a Hubbard, press type plug. If press type (Hubbard) plugs are installed in the camshaft, or the camshaft is otherwise unserviceable, replace the camshaft.

**WARNING**

*Failure to install camshaft plugs before the camshaft is assembled in the engine will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.*

NOTE: Continental Motors no longer manufactures camshafts for the TSIO-550 engine with pressed in (Hubbard) plugs. Reliable replacement of pressed in plugs cannot be performed in the field. If a pressed in plug is present in either the front or rear of the camshaft, replace the camshaft.

1. Install the camshaft (Figure 16-40) in a suitable holding fixture. Apply Loctite 592 Pipe Sealant to the threads of the 0.25”-18 camshaft plugs (2 & 3); install the plugs (2 & 3) in each end of the camshaft. Torque the plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual and repeat the Camshaft “Magnetic Particle Inspection” according to instructions in Section 11-3 of M-0, Standard Practice Maintenance Manual.

2. Coat the gears and camshaft spline with 50-weight aviation engine oil.

3. Align the splines and install the governor drive gear (6) onto the camshaft.

   NOTE: The camshaft gear (4) bolt holes are offset to allow only one correct installed position for the engine timing mark.

4. Install the camshaft gear (4) on the camshaft assembly (1).

5. Install four new bolts (5) and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Safety wire the bolt heads according to the “Safety Wiring Hardware” instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

7. Coat the camshaft with 50-weight aviation engine oil.
Figure 16-40. Camshaft Assembly

1 Camshaft Assembly 3 Plug 5 Bolt 7 Governor Driven Gear
2 Plug 4 Camshaft Gear 6 Governor Drive Gear
16-10.2. Crankshaft Assembly

**WARNING**
Do not assemble and install the crankshaft if the VAR stamp is absent from the propeller flange.

1. Place the crankshaft on a bench with a notched wooden block under the front and rear main journals.

   *CAUTION: Do not heat the gear cluster more than 10 minutes.*

2. Install a new dowel (Figure 16-41) (32) in the crankshaft dowel bore. The dowel bore is smooth, not threaded and a smaller diameter than the bolt holes. Drive the
dowel with a hammer and brass drift until only 0.20 ±0.010” extends from the crankshaft flange.

3. Using a uniform heating method (not a torch), heat the small crankshaft gear (24) to 300°F (149°C) for 5 to 10 minutes. Heating the gear is necessary for a shrink fit installation.

4. While the gear is still hot, align the gear dowel hole with the crankshaft dowel and install the small crankshaft gear on the crankshaft.

5. Attach the large crankshaft gear (23) to the small crankshaft gear (24) using six new drilled head screws (22). Torque the screws in a crisscross pattern to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. The crankshaft gear incorporates a square drive hole for the square drive fuel pump coupling. The gear also has a timing mark to align the crankshaft to camshaft timing.

7. Safety wire the drilled head screws (22) according to the “Safety Wiring Hardware” instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

8. Install the alternator face gear (27) over the propeller flange.

9. With the holes aligned, install new tab lock plates (26) and four new bolts (25). Torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Do not over-torque the bolts to line up the bolt wrench flat with the lock tab. If the bolt head flat does not line with the lock tab, replace the bolt.

10. Secure the tab lock plates against the bolt wrench flats with a brass drift.

11. Lubricate the oil transfer collar halves (19 and 20) with clean 50-weight aviation engine oil. Install the collar halves on the crankshaft using new dowel pins (18) and secure the installation with new lock nuts (17).

12. Confirm running clearance (Table D-13) between the collar and crankshaft for propeller oil pressure.

13. Alternately torque the lock nuts (17) in 20 inch-pound increments according to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. The collar must rotate freely to prevent friction.

14. Install the counterweights (Figure 16-41).

a. Attach two 6th order counterweights (15) to crank cheek No. 2 hanger blade with new 6th order counterweight pins (12).

NOTE: Counterweight pins are identified by a three-digit dash number stamped on one end (see Section 10-9.1 of M-0, Standard Practice Maintenance Manual). The pin diameter determines the counterweight order; it is imperative the correct pin be installed in the counterweight (as instructed in subsequent steps). Table 10-30 in M-0 indicates the counterweight order and outer diameter dimension.

CAUTION: Replacement counterweight pins must be designated for the same order of magnitude as the removed counterweight pin to ensure proper operation.
b. Install new counterweight plates (11) with the sharp edge (flat surface) outboard as shown in Figure 16-42 and new retaining rings (10).

**CAUTION:** The minimum gap between the retaining ring ears must be 0.179 inches (0.454 cm) for proper seating.

Counterweight plates have a small extruded point which provides an interference fit of 0.001 to 0.007 inches. Check for the interference fit of the counterweight plates in the bushing bore during installation. Do not install loose fitting counterweight plates. Do not install retainer plates on counterweights that have a loose fit between the retainer plate and the counterweight.

c. Attach one 4th order and one 5th order counterweight on either side of the No. 5 crank cheeks.

d. Install two new 4th order counterweight pins (Figure 16-41) (13) in the 4th order counterweights (38).

e. Install two new 5th order counterweight pins (14) in the 5th order counterweights (38).

f. Install new counterweight plates and retaining rings and (11 and 10) with the sharp edge (flat surface) outboard as shown in Figure 16-42.

15. Install the connecting rod (Figure 16-41) (7) and new connecting rod bearings (8) on the crankshaft according to instructions in Section 16-10.3.
16-10.3. Connecting Rod and Bearing Assembly

1. Place a sheet of crocus cloth on a flat surface plate and dampen the cloth with solvent.

2. Lightly rub the parting surface of the cap and rod across the crocus cloth to remove any burrs or nicks. Inspect the parting surfaces, bolt holes and bolt hole edges to ensure there are no nicks, burrs, or sharp edges.

3. Original connecting rods have a position number stamped on the end cap and rod bolt boss. Check that the new connecting rod has the correct position number, 1 through 6 as applicable, vibro-etched in the location shown in Figure 16-43 that corresponds to the connecting rod being replaced. Replacement connecting rods must match the position of the connecting rod being replaced.
Component Assembly

Figure 16-43. Connecting Rod Position Number

4. Install a new connecting rod bearing (Figure 16-41) (8) in each connecting rod cap (6) and rod (7). Ensure that the bearing ends project the same distance even with the parting surface and they are properly seated.

5. Look closely for any metal that may have shaved from the bearing back onto the parting surface during installation. Remove the metal shavings.

6. Lubricate each connecting rod cap and bearing with 50 wt aviation engine oil and install each rod, cap and bearing assembly at the correct position on the crankshaft. Install the connecting rod and cap with the position numbers on top when odd number rods are extended to the right and even number rods are to the left when viewing the crankshaft from the rear (gear end) forward.

7. Lubricate the threads of the new connecting rod bolt (5) and new spiral lock nut (4) using clean 50 weight aviation engine oil. Note different part numbers are available for connecting rod bolt and nut pairs - do not intermingle bolt and nut pairs; only the specified bolt and nut in the pair are to be installed. If new connecting rod fasteners are required, bolt and nut sets must match.

8. Secure rods and caps using the new connecting rod bolt (5) and new spiral lock nut (4). Torque the fasteners to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Check connecting rod to crankshaft pin end clearance according to Appendix D specifications.
16-10.4. **Crankshaft Nose Oil Seal Assembly**

Install the Crankshaft Nose Oil Seal according to the “Split Type Nose Oil Seal Installation” instructions in Section 10-10.4 of M-0, Standard Practice Maintenance Manual.
16-11. Compressor Mounting Kit Assembly

1. Install a new bearing (Figure 16-44) (3.01) into the idler sheave (3). Secure the new bearing (3.01) with a new retaining ring (3.02).
   
   NOTE: Shims (19 & 20) are used to align the driven sheave (18), idler sheave (3) and the starter adapter PTO drive sheave. Add or subtract shims, as required, to align the three sheaves during air conditioning compressor installation.

2. Install the idler sheave (3) on the block assembly (4) with the sheave support bolt (5), shims (19), and spacer (6). Do not torque the sheave support bolt at this time.

3. Loosely assemble the tensioning hardware (9, 10, 13, 11, and 4) on the mounting bracket (2).

4. Install the idler sheave (3) and block assembly (4) on the mounting bracket (1) using a bolt (7) and washer (8) through the block assembly, secured with a washer (13) and nut (12). Do not torque the hardware at this time.
Figure 16-44. Air Conditioning Compressor Mounting Assembly

1 Mounting Bracket Assembly 5 Sheave Support Bolt 11 Rectangular Nut 17 Drive Belt
2 Mounting Bracket 6 Spacer 12 Lock Nut 18 Driver Sheave
3 Idler Sheave 7 Bolt 13 Plain Washer 19 Shim
3.01 Ball Bearing 8 Special Washer 14 Bolt 20 Shim
3.02 Retaining Ring 9 Tensioning Bolt 15 Bolt 21 Compressor
4 Block Assembly 10 Jam Nut 16 Washer 22 Spacer

ITEMS 2 THRU 14 INCLUDED IN ITEM 1
Chapter 17. Engine Assembly

17-1. Engine Assembly Sequence

Assemble the engine in the sequential steps listed below, referring to corresponding sections in this chapter (and specified references) for detailed instructions:

1. Lubricate the engine components
2. Assemble the crankcase
3. Install the engine cylinders, inter-cylinder baffles and drain tubes
4. Torque the engine cylinders and crankcase
5. Install the hydraulic tappets and pushrods and lower baffle bases
6. Install the rocker arms
7. Install the oil suction tube and oil sump
8. Install the oil pump
9. Install the oil cooler
10. Install the alternator (and optional alternator bracket assembly)
11. Install the starter and starter adapter assembly
12. Install the induction system
13. Install the turbochargers and exhaust system
14. Install the fuel injection system
15. Install the air/oil Separator
16. Install the optional air conditioning compressor mount assembly
17. Install the ignition system
18. Install the engine in the aircraft according to instructions in Section 5-2

17-1.1. Component Lubrication

Prior to engine assembly, apply clean 50-weight aviation engine oil liberally to bare steel surfaces, journals, and bushings, except where special lubricants are required. A comprehensive list of authorized lubricants, sealants and adhesives is provided in Chapter 3 of M-0, Standard Practice Maintenance Manual.

**WARNING**

Lubricate hardware according to instructions in Chapter 3 and Appendix B of M-0, Standard Practice Maintenance Manual. Inspect fasteners for proper plating and thread form. Verify fastener serviceability and correctly lubricate the fastener for proper fastener pre-loading and torque application.
17-2. Crankcase Assembly

17-2.1. Drive Train Installation

**CAUTION:** All parts must be clean and free of debris before the crankcase can be assembled. Perform the assembly in a clean, dry, dust-free environment.

1. Install the left (2-4-6) crankcase half on the engine stand with the open side up. Place the right (1-3-5) crankcase half on a workbench with the open side up.

2. Seal and thread the crankcase according to the instructions in Section 3-3.1.2 of M-0, Standard Practice Maintenance Manual.

**CAUTION:** Do not apply engine oil on the crankshaft bearing saddles. Bearing saddles must be dry when installing the crankshaft main bearings.

**WARNING**

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, cylinder fastener threads or crankcase main bearing bosses. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

3. Install new crankshaft main bearings (Figure 17-1) (2 & 39) in the bearing saddles on both crankcase halves. Do not lubricate the crankshaft bearing saddles, lubricate only the crankshaft side of the main bearings with clean 50-weight aviation engine oil.

4. Apply clean 50-weight aviation engine oil to the thrust washer lands in the crankcase to prevent the thrust washer halves from falling out during final assembly. Lubricate bearings with clean 50-weight aviation engine oil.

5. Install a new O-ring (21) in the oil transfer 2-4-6 side collar (20). Lubricate the O-ring (21) and oil transfer 2-4-6 side collar (20) area and bearing surface thoroughly with clean 50-weight aviation oil.

6. With the aid of an assistant, lift the crankshaft assembly by the No. 1 connecting rod and propeller flange.

7. Have the assistant hold the numbers 3 and 5 connecting rods upward while carefully lowering the crankshaft assembly into position. Guide the oil transfer collar into position.

8. Install new thrust washer halves (1).
9. Ensure the bearing and thrust washer ends project equally in the crankcase halves.

10. Verify the new O-ring (21), new crankshaft main bearings (2 & 39), and new thrust washers (1) are seated properly.

11. Connecting rod position numbers, if properly installed, will be toward the upper case flange. Carefully place the odd-numbered connecting rods on the upper case flange.

**Figure 17-1. Crankshaft Assembly**

1. Thrust Washer  
2. C’shaft Main Bearing, 4 & 5  
3. Idler Gear  
4. Spiral Lock Nut  
5. Connecting Rod Bolt  
6. Connecting Rod Cap  
7. Connecting Rod  
8. Connecting Rod Bearing  
9. Piston Pin Bushing  
10. Retaining Ring  
11. Counterweight Plate  
12. 6th Order Counterweight Pin  
13. 4th Order Counterweight Pin  
14. 5th Order Counterweight Pin  
15. Counterweight Assembly  
16. Counterweight Bushing  
17. Lock Nut  
18. Dowel Pin  
19. 1-3-5 Side Collar  
20. 2-4-6 Side Collar  
21. O-ring  
22. Drilled Head Screw  
23. Large Gear Cluster  
24. Small Gear Cluster  
25. Bolt  
26. Tab Lock Plate  
27. Alternator Drive Gear  
28. Spring  
29. Reinforcing Ring  
30. Oil Seal  
31. Counterweight Bushing  
32. Crankshaft Dowel  
33. Crankshaft  
34. Stud  
35. Oil Transfer Plug  
36. Idler Gear Bushing  
37. Dowel Pin  
38. Counterweight Assembly  
39. C’shaft Main Bearing, Rear & Intermediate

**WARNING**

Failure to install plugs before the camshaft is assembled in the engine will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.
12. Apply clean, 50-weight aviation engine oil to the governor driven gear (Figure 17-2) (7) and camshaft assembly (1).

13. Install the governor-driven gear (7) in the crankcase bore.

14. Install the assembled camshaft assembly (1) into the crankcase.

15. Ensure the timing marks (Figure 17-3) on the camshaft and crankshaft align as the gears mesh.

16. The No. 1 connecting rod on the crankshaft should be in its fully extended (top dead center (TDC) position. The governor-driven gear may have to be turned slightly to allow the camshaft to seat in its bearings properly.

17. Compare the governor-driven gear backlash to Appendix D specifications. If the crankcase has been machined, the gear backlash must not be less than the specified minimum. (If the gear backlash is not within tolerance, inspect the gear, camshaft, and crankcase to determine the cause of non-conformance).

18. Measure the crankshaft end clearance using a dial indicator set at zero against the propeller flange; end clearance must conform to Appendix D specifications.

19. Measure the camshaft end clearance at both ends of the rear main bearing to ensure it falls within the range specified in Appendix D.
20. Install a new idler gear bushing (Figure 17-4) (16) on the dowel at the rear of the 2-4-6 side of the crankcase.

21. Lubricate the idler gear (Figure 17-1) (3) with clean 50-weight aviation engine oil.

22. Install the idler gear in the crankcase with the idler gear thrust flange to the rear and the support pin, eccentric shoulder away from the crankshaft.

23. Coat both sides of a new idler pin gasket (17) with Part No. 642188 sealant (CRC Copper Coat) and align the gasket with the idler gear support pin (18).

24. Temporarily secure the idler gear with the idler gear support pin (Figure 17-4) (14) lubricated with clean, 50-weight aviation engine oil. The idler gear support pin will be torqued later.

25. Using a dial indicator, check the idler, camshaft and crankshaft gear backlash according to Appendix D specifications.

27. Have an assistant balance and guide the odd numbered connecting rods straight up (Figure 17-5) through the 1-3-5 cylinder bores in the crankcase as the crankshaft assembly is installed.

**WARNING**

Failure to lubricate designated fasteners may result in damage to the crankcase bearing bore, crankshaft bearing or crankshaft and lead to engine malfunction or failure.
28. Back the idler gear support pin (Figure 17-4) (14) partially out to clear the studs.

29. Place the 1-3-5 (right) crankcase half on the 2-4-6 (left) case half.

30. Push the idler gear support pin (14) back onto the studs.

31. Secure the idler gear support pin with new lock washers (17) and nuts (18) but do not torque it at this time.

32. Verify the thrust washer (Figure 17-1) (1) halves and crankshaft main bearings (2) remain in place.

   CAUTION: If the connecting rods are not secured with the old cylinder base O-rings (Figure 17-6) the connecting rods or the cylinder mounting deck could be damaged.

33. Use the old cylinder base O-rings (Figure 17-6) to immobilize the connecting rods until the cylinders are installed.
17-2.2. Crankcase Hardware Installation
17-2.2.1. Crankcase Assembly

1. Lubricate all studs and crankcase through-bolts with approved lubricants specified in Appendix B and Chapter 3 of M-0, Standard Practice Maintenance Manual.
WARNING

Lubricate fasteners and apply torque to the crankcase hardware in the proper sequence. Failure to do so may result in crankcase damage or engine failure.

NOTE: Positions cited in this procedure refer to Figure 17-7.

Figure 17-7. Crankcase Fastener Locations

2. Using an O-ring Installation Tool (“Special Tools” in Chapter 2 of M-0, Standard Practice Maintenance Manual), install eight new 0.5” x 10.75” through-bolts (Figure 17-8)(46) with new o-rings (47) in positions 37 through 44 with baffle supports at position 43L and 44L (89) and 42R (88). If necessary, use a mallet to tap the through-bolts into position.

3. Install three new 0.3125” x 4.00” tie bolts (62) with washers (32) in positions 70, 71 and 72; tighten, but do not torque the tie bolts (62).

4. Install a new 0.4375” x 7.58” through-bolt (40) with new O-rings (47) in position 45. Install the crankcase through-bolt spacer (43) on the 2-4-6 side; install a 0.45 ID X.08 flat washer (42) on the 1-3-5 side. Secure the hardware on the 1-3-5 side with a 0.4375”-20 UNF-3B flange nut (44) and a 0.43”-20 hex nut (45) on the 2-4-6 side.
5. Install a new 0.4375” x 6.74” through-bolt (40) in position 46 with a mallet. Install the flat washer on the 1-3-5 side and install the crankcase through-bolt spacer (43) on the 2-4-6 side. Secure the hardware on the 1-3-5 side with a 0.4375”-20 UNF-3B flange nut (44) and a 0.43”-20 hex nut (45) on the 2-4-6 side.

6. Install a 0.3125” x 1.12” screw in position 54 and a 0.3125” x 1.38” screw in position 53.

7. Install a 0.38” x 11.67” through-bolt (50) with two new o-rings (51) in position 64, with a spacer (52) on the 1-3-5 side, washers (53), and nuts (54).

8. Install a new 0.3125” x 1.47” bolt (31) in position 67, with two 0.3125” x 0.063” flat washers (32) and 0.3125”-24 nut (56), and snug the nut.

9. Rotate engine stand to place engine in upright position. With connecting rods supported by old cylinder o-rings, secure 1-3-5 side engine mounts to engine stand.
NOTE: The aft lifting eye (65) is installed with the accessory drive adapters; baffle supports (88 & 89) are installed after the cylinders and the 0.31" bolt at position 70 is installed with the oil cooler.

10. Install the forward lifting eye (66) at position 65 on the 2-4-6 side of the crankcase backbone and secure with 0.3125"-24 x 1.72" bolt (64), washer (32) & nut (56).

   NOTE: The manifold locator bracket and the throttle support bracket may be installed during crankcase assembly or during the induction system installation. If bracket installation is deferred until induction system assembly, the fasteners at position 55 and 63 must be removed, installed and re-torqued.

11. Install the manifold locator bracket with the open end to the aft of the engine at position 55. Insert a 0.3125" x 1.59" bolt (68) with a flat washer (32) through the 1-3-5 side of the bracket. Secure with a flat washer (32) and nut (56). Snug the nut.

12. Insert a 0.3125" x 1.34" bolt (67) and nut (56) through the 1-3-5 side of the crankcase at position 68; secure with a 0.31" x 0.032" washer (32) and nut (56). Snug the nut.

13. Install the throttle support bracket with a 0.03125" x 1.72" bolt (64) and washer (32) inserted from the 1-3-5 side of the engine at position 63; secure with a washer (32) and nut (56).

14. Install remaining 0.3125" x 1.47" bolts (31), washers (32) & nuts (56) at positions 56, 57, 59, 61, 62 and 66; tighten, but do not torque the fasteners at this time.

15. At the cam journal bosses below the camshaft, insert 0.3125" bolts (55) with washers (32) in positions 73, 74 & 75 from the 1-3-5 side and secure with washers (32) and nuts (56) on the 2-4-6 side of the engine; tighten, but do not torque at this time.

16. Install six 0.25" bolts (57) in positions 77-82 with washers (58) and nuts (59); tighten, but do not torque at this time.

17-3. Cylinder Installation

**WARNING**

Do not install a cylinder that does not conform to the Appendix D overhaul or new dimensional inspection criteria cited in Chapter 15, Inspection and Repair. Ensure each cylinder has the required new parts and the cylinder barrel is clean, free of cracks, nicks, scratches, pitting, and rust before installation.

1. Lubricate all cylinder through-bolt and deck stud threads with clean 50-weight aviation engine oil.

2. Carefully rotate the crankshaft to position the connecting rod of the cylinder being installed in the outer most position.

**WARNING**

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring.
or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

3. Lubricate a new cylinder base O-ring (Figure 17-10) (52) with 50 weight engine oil and install the cylinder base O-ring on the cylinder skirt against the base flange. Ensure the new cylinder base O-ring (52) is not twisted.

4. Back the new piston pin (Figure 17-9) (6) out far enough to allow the new piston (1) to be installed on the connecting rod.

5. Align the cylinder and piston (1) with the connecting rod piston pin bore and slide the piston pin (6) into the connecting rod.

6. Compress the fourth piston ring (5) with a ring compressor and push the cylinder until the fourth piston ring is positioned inside the cylinder barrel.

7. Remove the Ring Compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.

8. While supporting the cylinder, install, but do not torque, the cylinder flange nuts (Figure 17-10) (41 and 42).

CAUTION: Ensure the correct nut is installed on the seventh stud. An incorrect nut can damage the flange brackets.
9. Install the 7th stud brackets (47 and 48) and nuts (49) on the studs between Cylinders 1-3, 3-5, 2-4 and 4-6, flat side against the cylinder flange. The 7th stud nuts have a conical seat.

10. Repeat steps 1-9 for the remaining cylinders.

11. Proceed to Section 17-3.1, “Cylinder and Crankcase Torque.”

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**Figure 17-10. Cross-flow Cylinder Assembly**

1. Cylinder Assembly
2. Spark Plug Insert
3. Intake Valve Guide
4. Exhaust Valve Guide
5. Stud
6. Stud
7. Exhaust Stud
8. Helicoil Insert
9. Intake Valve Seat Insert
10. Exhaust Valve Seat Insert
11. Intake Valve
12. Exhaust Valve
13. Inner Spring
14. Outer Spring
15. Drain Fitting
16. Inner Retainer
17. Retainer Key
18. Rotocool
19. Intake Rocker Arm Assembly
20. Exhaust Rocker Arm Assembly
21. Rocker Arm Bushing
22. Drive Screw
23. Thrust Washer
24. Rocker Arm Shaft
25. Retainer
26. Tab Washers
27. Screw
28. Rocker Cover Gasket
29. Rocker Cover
30. Washer
31. Lock Washer
32. Screw
33. Exhaust Flange Gasket
34. Lock Nut
35. Pushrod Housing
36. Washer
37. O-ring Seal
38. Pushrod Housing Packing
39. Pushrod Housing Spring
40. Pushrod Assembly
41. Flange Nut
42. Flange Nut
43. Baffle
44. Spring
45. Drain Tube
46. Drain Tube Seal
47. 7th Stud Bracket
48. 7th Stud Bracket
49. Flange Nut
50. Cylinder Base O-ring
51. Intake Valve Seat
52. Check Valve
53. Valve Spring Retainer
54. Hydraulic Exhaust Tappet
55. Hydraulic Intake Tappet
17-3.1. Cylinder and Crankcase Torque

Before torquing the crankcase, use a straight edge to confirm that the rear crankcase half ends are flush with each other. Do not proceed with final torque unless the crankcase halves are flush.

NOTE: Crankcase and cylinder torque requires two people; the torque is applied in two stages: first in a preliminary torque sequence, followed by a final torque sequence.

WARNING

Torque values specified for engine assembly are for use with clean nuts, bolts and studs with threads that are free of damage, distortion which have been pre-lubricated with clean 50-weight aviation engine oil prior to assembly. The torque wrench must be currently calibrated and traceable to the National Bureau of Standards. Incorrect through-bolt and deck stud torque may result in subsequent engine malfunction and failure.

1. After cylinders and hardware is installed, have an assistant hold the fastener on the opposite side of crankcase and simultaneously torque the crankcase fasteners in the sequence shown in Figure 17-7. Torque all the fasteners to ½ the value listed in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Filled circles in Figure 17-7 indicate through-bolt positions.

2. Using the torquing sequence shown in Figure 17-7, torque nuts at positions (1 through 82) to the final torque values listed in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-7 repeated for reference
17-3.2. Inter-Cylinder Baffle Installation

1. Assemble two cylinder base baffles (Figure 17-11) (3) and baffle assemblies (6) and secure with a screw (8) and washer (7). Assemble one cylinder base baffle (3) and baffle assembly (5) and secure with a screw (8) and washer (7). Assemble one cylinder base baffle (4) and baffle assembly (5) and secure with a screw (8) and washer (7). Torque the screws to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Place baffle supports (1) on the top of the engine straddling cylinder fin positions 3 and 9 between cylinders 1 & 3, 3 & 5, and 4 & 6.

3. Place the baffle support (2) on the top of the engine straddling cylinder fin positions 3 and 9 between cylinders 2 & 4.

4. Align the 2-4 cylinder baffle assembly (4 & 5) bolt hole with the baffle support (2) bolt hole and secure with a bolt (9) and washer (7).

5. Align the 3-5 cylinder baffle assembly (3 & 5) with the baffle support (1) bolt hole and secure with a bolt (9) and washer (7).

6. Align the 1-3 and 4-6 cylinder baffle assemblies (3 & 6) bolt holes with the baffle support (1) bolt holes and secure with bolts (9) and washers (7); torque the bolts (9) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

**Figure 17-11. Inter-Cylinder Baffle Assembly**
17-3.3. Cylinder Drain Tube Installation

1. Coat the male tapered threads of the drain tube fittings (Figure 17-10) (16) with Loctite 592 Teflon PS/T Pipe Sealant. Coat the male tapered threads only.

2. Install the drain tube fittings (16) in the cylinders and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Install the cylinder drain tube (45) on the cylinders with new seals (46).


5. Install the drain valve assemblies in accordance with the aircraft manufacturer's instructions.
17-3.4. Crankcase Miscellaneous Hardware Installation

1. Lightly coat new O-rings (Figure 17-4) (23 & 25) with clean 50-weight aviation engine oil; install the O-rings (23 & 25) on the oil filler adapter (24).

2. Install the oil filler adapter (3) into the left crankcase half. Ensure the O-rings (1 & 2) are not pinched or twisted.

3. Insert the oil filler assembly (19) into the oil filler adapter (24). Do not displace the O-ring (23).

4. Install a new breather gasket (20) and secure the oil filler assembly to the left crankcase case half with screws (26), new lock washers (27) and washers (28). Torque the bolts (26) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Install a new oil filler gasket (22) on the cap assembly (21).

6. Coat both sides of a new cam cover gasket (8) with Part No. 642188 Gasket Sealant. Align the gasket with the bolt holes in the cam hole cover.

7. Install a new cam cover gasket (Figure 17-4) (8) and camshaft cover (7) on the crankcase with the beaded side of the gasket facing the cover. Secure with two flat washers (9), two new lock washers (10), and two nuts (11).

8. Remove the idler gear support pin (14) which was temporarily installed during crankcase assembly. Clean the idler gear support pin flange with mineral spirits and allow to dry.

9. Coat both sides of a new idler gear support pin flange gasket (15) with Part No. 642188 Gasket Sealant; install the gasket on the idler gear support pin flange.

10. Lubricate the idler gear support pin (14) with clean, 50 weight aviation engine oil and install the idler gear support pin (14) in the crankcase with a new flange gasket (15). Secure the idler gear support pin with new lock washers (17) and nuts (18) and torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

**WARNING**

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

**CAUTION:** Use care to prevent displacement or damage to the crankshaft nose seal and silk thread.
11. Spray Loctite LocQuic Primer 7649 on the oil seal counterbore and allow it to dry for 1 to 2 minutes.

12. Apply a thin translucent coat of Gasket Maker to the wall of the oil seal counterbore according to instructions in Appendix C of M-0, Standard Practice Maintenance Manual.

13. Use thumb pressure to work the crankshaft nose oil seal into the crankcase counterbore. After the seal is in place, wipe any remaining oil from the seal and crankshaft.

14. Apply Loctite 271 to the bolt (13) threads. Apply Primer 7471 to the bolt holes; install the oil seal retainer plates (12) with bolts (13); torque the bolts (13) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Install the propeller governor pad cover (1) with a new gasket (2). Secure the cover (1) with spacers (3), washers (4), new lock washers (5) and nuts (6). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 17-4 repeated for reference
Engine Assembly

17-3.5. Hydraulic Tappet and Pushrod Installation

During overhaul, new hydraulic exhaust and intake tappets (Figure 17-10) (54 and 55) must be installed with each engine cylinder.

1. Lubricate all hydraulic tappet faces with Dow Corning® G-N Paste or equivalent.
2. Lubricate the crankcase tappet bores with clean 50-weight aviation engine oil.
3. Install new hydraulic **exhaust** tappets (53) (wide groove on the tappet body) into the **aft** tappet guides in cylinders on the 1-3-5 side of the crankcase and in the **forward** tappet guides for cylinders on the 2-4-6 side of the crankcase.
4. Install new hydraulic **intake** tappets (54) (narrow groove on the tappet body) into the **forward** tappet guides in cylinders on the 1-3-5 side of the crankcase and in the **aft** tappet guides for cylinders on the 2-4-6 side of the crankcase.
5. Install the pushrod housings (35).
   a. Using a Burroughs Part No. 68-3 Pushrod Spring Compressor (Figure 17-12) or equivalent, compress a new spring (Figure 17-10) (39).
   b. Place a new packing (38) between the two steel washers (36), and install on the **crankcase** end of the pushrod housing (35).
   c. Position the pushrod housings (35) into respective crankcase tappet bores.
   d. While the spring (39) is compressed insert the **crankcase** end of the pushrod housing (35) in the crankcase bore and slide a new O-ring seal (37) on the **cylinder** end of the pushrod housing.
   e. Guide the **cylinder** end of the pushrod housing (35) into the cylinder head bore while releasing the tension on the pushrod spring (39) with the Pushrod Spring Compressor Tool.
   f. Remove the Pushrod Spring Compressor Tool from the pushrod and verify the O-ring seal (37), packing (38), and washers (36) are properly positioned.

6. Rotate the engine to the upright position on the stand.

![Figure 17-12. Pushrod Spring Compressor](image-url)
7. Lubricate the pushrods (40) with clean 50-weight aviation engine oil and install the pushrods through the cylinder openings into the pushrod housings (35).

Figure 17-10 repeated for reference
17-3.6. Rocker Arm Installation

1. Before installing the rocker arms on each cylinder, turn the crankshaft until the pushrods are at their lowest position in the cylinder.

2. Lubricate the intake and exhaust rocker arms (Figure 17-10) (19 & 20), new thrust washers (23) and new rocker shafts (24) with clean 50-weight aviation engine oil. The flat side of the rocker shaft (24) must be installed against the cylinder base.

3. Slide the shaft (24) into the rocker arm assembly. Place a thrust washer (23) on the outboard of each side of the rocker arm.

4. Install the rocker arms and shaft assemblies, in the correct intake (19) and exhaust (20) positions, on the engine cylinder rocker arm boss.

5. Secure the rocker arm to the cylinder with retainers (25), new tab washers (26) and screws (27).

6. Using a feeler gauge, check the side clearance between the retainers and rocker arms as illustrated in Figure 17-13; side clearance must be 0.002 - 0.015 inches. If side clearance exceeds the allowable amount, replace the thrust washers with a thicker (oversize) thrust washer to reduce side clearance to the proper tolerance.

7. Measure the exhaust rocker arm-to-retainer clearance according to the illustration in Figure 17-14. If the clearance is less than 0.020”, grind the underside of the rocker arm according to the instructions in Section 15-8.9.19.

8. Measure the dry valve lash at valve tip-to-rocker foot with the piston at top dead center while applying pressure on the rocker arm at the ball (pushrod) end. Verify the dry valve lash does not exceed the overhaul limits in Appendix D. Replace pushrods with authorized over-sized (AO) pushrods if dry valve lash exceeds the limit.

9. If all measurements and clearances are correct, torque the screws (Figure 17-10) (27) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
10. Secure the rocker assembly to the cylinder by bending the new tab washers (26) flat up against the head of the screws (27) according to the “Tab Washer Installation” instructions in Appendix C-4 of M-0, Standard Practice Maintenance Manual. Do not re-align the screw head to the tab washer.

![Figure 17-14. Rocker Arm to Retainer Clearance](image)

**Figure 17-14. Rocker Arm to Retainer Clearance**

*CAUTION: Do not over- or under-torque bolts to align tab washers; replace the bolt and re-torque to obtain proper alignment.*

11. Repeat steps 1-10 for remaining cylinders.

12. Install new rocker cover gaskets (28) (with the beaded side of the gasket toward the rocker cover) and the rocker covers (29); secure them with screws (32), new lock washers (31) and washers (30).

13. Torque the rocker cover screws evenly to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 17-10 repeated for reference](image)
17-4. **Oil Sump & Suction Tube Installation**

1. Invert the engine on the stand; verify crankcase belly bolts are installed and torqued to Appendix B (of M-0) specifications and no foreign objects are in the engine or oil sump.

2. Install a new copper gasket (Figure 17-15 or Figure 17-16) (6) on the oil suction tube (1) with the split line facing outward toward the crankcase.

   NOTE: The copper gasket (7) and plug (8) will be installed on the engine after the oil pump.

3. Attach the oil suction tube bracket to the crankcase:

   a. **C G K N** Insert the bolt (C (Figure 17-15) or G K N (Figure 17-17) (2) with a washer (4) through the bracket and the crankcase. Insert washers (3) inboard of both sides of the bracket. Secure the bracket with a washer (4) and nut (5); torque the nut (2) and bolt (5) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   b. **B E** Insert a bolt (Figure 17-16) (3) with a washer (2) through the bracket and the crankcase. Secure the bracket with a washer (4) and nut (5); torque the bolt and nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 17-15. Oil Sump](image)
4. Install the oil sump drain plug (Figure 17-15, Figure 17-16, Figure 17-17) (8) with new copper gasket (14) (split line toward the oil sump) in the oil sump (10). Torque the drain plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; safety wire the drain plug according to safety wiring instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

5. Apply a bead of Gasket Maker to the oil sump flange; do not allow silk thread on the crankcase split line to protrude beyond the mating surface for the oil sump gasket. Refer to Appendix C-9 of M-0, Standard Practice Maintenance Manual for Gasket Maker application instructions.

6. Install a new oil sump gasket (9) on the oil sump (10) flange with the beaded side of the gasket facing the oil sump.

7. Install the oil sump on the crankcase:
   a. Align the oil sump gasket and oil sump assembly with the crankcase oil sump rail. Install the bracket (Figure 17-16) (15) in the fifth bolt hole from the front on the 2-4-6 side of the sump with a bolt (13), new lock washer (12) and washer (11). Install bolts (13), new lock washers (12) and washers (11) in the remaining bolt holes in the sump rail.
   b. Align the oil sump gasket and oil sump assembly with the crankcase oil sump rail. Secure the oil sump to the crankcase with bolts (Figure 17-15) (13), new lock washers (12), and washers (11).
   c. Align the oil sump gasket and oil sump assembly with the crankcase oil sump rail. Install bolts (Figure 17-17) (16), new lock washers (12), and washers (11) in the two forward holes on the 2-4-6 side of the sump and in the four forward holes on the 1-3-5 side of the sump.
   d. Install bolts (13), new lock washers (12), and washers (11) in the remaining oil sump rail bolt holes.
   e. Install a new coupling (15) with a new copper gasket (14) (split line toward the oil sump) in the oil sump and torque the coupling to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
   f. Torque the oil sump bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual in the sequence shown in (Figure 17-18).
Figure 17-18. Oil Sump Torque Sequence
Engine Assembly

17-5. Oil Pump Installation

1. Lubricate both sides of a new gasket (Figure 17-19) (2) with Part No. 642188 (Copper Coat) Gasket Sealant and install the oil pump gasket on the crankcase studs.

2. Install the assembled oil pump on the crankcase studs.

3. Secure the oil pump assembly to the crankcase with washers (3), and new lock washers (4), and nuts (5). Torque the nuts (5) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Lubricate both sides of a new gasket (12) with Part No. 642188 (Copper Coat) Gasket Sealant.

   NOTE: For installations using coupling nuts to support aircraft control cable brackets, replace then plain nuts at the five and six o’clock positions of the oil pump with coupling nuts (14).

5. Align the new gasket (12) with the oil filter adapter (13) flange and install the oil filter adapter (13) and new gasket (12) on the oil pump housing studs. Fasten the oil filter adapter to the oil pump housing with three sets of washers (6), new lock washers (7) and nuts (8). Torque the nuts (8) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Install the plug (9) and the new gasket (10) in the end of the oil suction tube extending through the crankcase. Torque the plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual and safety wire the plug according to instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.

   CAUTION: Refer to the label on the oil filter for installation instructions. Tempest began producing oil filters in 2017 with a special graphite coating on the gasket. These filters are installed dry, with no lubricant. Application of DC-4 to the graphite coated filter gasket will defeat the properties of the graphite coating.

7. Read the installation instructions on the oil filter before applying lubricant to the gasket.

   a. For oil filters with dry seal gaskets, install the new oil filter (11) on the oil filter adapter stud and tighten by hand.

   b. For oil filters without graphite coated gaskets, apply a thin coat of Dow Corning No. 4 to the oil filter gasket and install a new oil filter (11) and tighten by hand.

   c. Torque the oil filter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.


**17-6. Oil Cooler Installation**

TSIO-550-K & N and certain TSIO-550-C model specification’s oil cooler assemblies differ from the configuration of the remaining TSIO-550 Series engines. Oil cooler installation instructions for the TSIO-550-K, N engines may be found in Section 17-6.4. For TSIO-550-C engine models with cross fittings on the oil outlet port, proceed to Section 17-6.2. For all other TSIO-550 engine models, proceed to Section 17-6.1.

NOTE: The oil cooler must be disassembled, cleaned, overhauled, and assembled by an appropriately rated repair station, i.e. FAA approved Part 145 repair station before installation. No structural repairs are allowed on the oil cooler. Replace any cooler that has structural damage, bent/broken or cracked cooling fins, with a new or serviceable oil cooler. Oil cooler weld repairs are permitted only on the mounting flange, by an appropriately rated repair station, i.e. FAA approved Part 145 repair station.
17-6.1. TSIO-550-B, C & E Oil Cooler Installation

NOTE: Instructions in this section apply only to engines using a tee fitting to supply oil to the turbochargers. If the oil cooler uses a cross fitting to supply oil to the turbochargers, proceed to Section 17-6.2.

1. Position the oil cooler baffle (6) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler. Secure the oil cooler baffle (6) to the oil cooler fins with four equally-spaced staples.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

2. Apply Loctite 592 Teflon PS/T Pipe Sealant to the pipe plug (5) threads and install the pipe plug (5) in the bottom pressure port. Torque the pipe plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Coat the oil cooler pad stud threads with Part No. 646943 Anti-Seize lubricant.

4. Install the spacer (3), sandwiched between two new gaskets (2) on the lower crankcase studs.

5. Install the wastegate controller bracket (phantom in illustration), with the arm extending aft of the engine and two washers (4) on the upper crankcase studs. Secure the oil cooler to the crankcase with two washers (10) and nuts (11) on the studs at the top of the oil cooler. Torque the nuts (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

6. Install a washer (7), new lock washer (8), and nut (9) on the lower aft crankcase stud; install new lock washers (12), and flanged nuts (13) on the two forward studs at the bottom of the oil cooler. Torque the nuts (9 & 13) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

7. Install the adapter (16) in the inboard pressure port; torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Install the elbow fitting (17) in the adapter (16). Use a backup wrench to torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.


10. Install the connector fitting (19) into the reducer bushing (16). Use a backup wrench to torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Connect the tee fitting (20) to the connector fitting (19); secure the connector fitting (19) with a backup wrench and torque the tee fitting (20) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
12. Install the cap (21) on the top outlet of the tee fitting (20). Use a backup wrench to torque the cap to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (14). Install the oil temperature control valve with a new gasket (15) in the oil temperature control valve port on the bottom of the oil cooler and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
17-6.2. TSIO-550-C Oil Cooler Installation

WARNING

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent and oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

NOTE: The TSIO-550-C5, C7, C9, C10, C11, C12, C13, C17, C18, C19, C20 and C21 engine model specifications used a cross fitting and various adapter fittings of differing sizes to mate with accessories and sensors.

1. Position the oil cooler baffle (6) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler. Secure the oil cooler baffle (6) to the oil cooler fins with four equally-spaced staples.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

   NOTE: The lower pressure port is only present on oil coolers using the large diameter (See Section 17-21) oil temperature control valve (vernatherm).

2. Apply Loctite 592 Teflon PS/T Pipe Sealant to the pipe plug (5 & 18 (where applicable)) threads and install the pipe plugs in the oil cooler bottom and lower inboard pressure port. Torque the pipe plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Coat the oil cooler pad stud threads with Part No. 646943 Anti-Seize lubricant.

4. Install the spacer (3), sandwiched between two new gaskets (2) on the lower crankcase studs.

5. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

6. Install the wastegate controller bracket (phantom in illustration), with the arm extending aft from the engine, with two washers (4) on the upper crankcase studs. Secure the oil cooler to the crankcase with two washers (10) and nuts (11) on the studs at the top of the oil cooler; torque nuts (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Remove the feeler stock from the sump rail. Remove the feeler stock from the oil sump rail.

7. Install a washer (7), new lock washer (8), and nut (9) on the lower aft crankcase stud; install new lock washers (12), and flanged nuts (13) on the two forward studs at the bottom of the oil cooler. Torque the nuts (9 & 13) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Verify 0.010” clearance between the top of the oil sump rail and the bottom of the oil cooler.
NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

9. Install an adapter (16) in the inboard pressure port; torque the adapter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

procedure continues on next page...
Engine Assembly

NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

10. Install the elbow fitting (17) in the adapter (16). Use a backup wrench to torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

11. Install a cross fitting (19) in the outboard oil cooler port; torque the cross fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual, mindful of the clocking required by the installation drawing.

   NOTE: Consult the engine illustrated parts catalog to determine the appropriate configuration of the engine model specification and adjust the assembly instructions accordingly.

12. Install a 45° street elbow (20) in upper port of the cross fitting (19); torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install plugs (22) in street elbow (20) the aft end of the cross fitting (19); secure the fittings (19 & 20) with a backup wrench and torque the plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Install a flared nipple fitting (21) in the lower port of the cross fitting (19); secure the cross fitting (19) with a backup wrench and torque the flared nipple fitting (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Install a cap (24) on the flared nipple fitting (21); secure the flared nipple fitting (21) with a backup wrench and torque the cap (24) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (14). Install the valve with a new gasket (15) in the port on the bottom of the oil cooler; Torque the valve to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
Figure 17-21 repeated for reference

* ITEM 14 INCLUDES ITEM 15
Engine Assembly

17-6.3. TSIO-550-G Oil Cooler Installation

1. Position the oil cooler baffle (6) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler fins with four equally-spaced staples.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

2. Apply Loctite 592 Teflon PS/T Pipe Sealant to the pipe plug (5 & 22) threads and install the pipe plugs in the oil cooler bottom and lower aft pressure ports. Torque the pipe plugs to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Coat the oil cooler pad stud threads with Part No. 646943 Anti-Seize lubricant.

4. Install the spacer (3), sandwiched between two new gaskets (2) on the lower crankcase studs.

5. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

6. Install the wastegate controller bracket (phantom in illustration), with the arm extending aft of the engine and two gasket washers (4) on the upper crankcase studs. Secure the oil cooler to the upper crankcase studs with two washers (10) and nuts (11). Torque the nuts (11) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; remove the feeler stock from the sump rail.

7. Install a washer (7), new lock washer (8), and nut (9) on the lower aft crankcase stud; install new lock washers (12), and flanged nuts (13) on the two forward studs at the bottom of the oil cooler. Torque the nuts (9 & 13) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

8. Verify 0.010” clearance between the oil sump rail and the bottom of the oil cooler.

9. Install an adapter (21) in the inboard pressure port; torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

10. Install an elbow fitting (17) in the adapter (21). Secure the adapter with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.


12. Install the connector fitting (20) into the reducer bushing (16). Secure the bushing with a backup wrench and torque the connector fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Connect the tee fitting (18) to the connector fitting (20); secure the connector fitting with a backup wrench and torque the tee fitting (18) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
14. Install the cap (19) on the top outlet of the tee fitting (18). Use a backup wrench to secure the tee fitting and torque the cap to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (14). Install the oil temperature control valve with a new gasket (15) in the oil temperature control valve port on the bottom of the oil cooler and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.

**Figure 17-22. Oil Cooler**

1. Oil Cooler Assembly
2. Gasket
3. Spacer
4. Gasket-Washer
5. Plug
6. Baffle
7. Washer
8. Lock Washer
9. Nut
10. Washer
11. Nut
12. Lock Washer
13. Flanged Nut
14. Oil Temp. Control Valve
15. Gasket
16. Reducer Bushing
17. 45° Elbow Fitting
18. Tee Fitting
19. Cap
20. Connector Fitting
21. Adapter
22. Aircraft Part
23. Stud
17-6.4. TSIO-550-K Oil Cooler Installation

WARNING

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-7 for required corrective action.

1. Position the oil cooler baffle (Figure 17-23) (2) 1.5 inches above the oil cooler flange and align the baffle with the oil cooler; secure the baffle to the forward side of the oil cooler (2) with four equally-spaced staples.

2. In the upper rear on the oil cooler pad, coat the stud threads with Part No. 646943 Anti-Seize lubricant.

   NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

3. Apply Loctite 592 Teflon PS/T Pipe Sealant to the threads of the pipe plug (20). Install the pipe plug in the bottom pressure port. Torque the pipe plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Apply Loctite 592 Teflon PS/T Pipe Sealant to the threads of a flared nipple fitting (17). Install the nipple fitting in the lower aft pressure port. Torque the pipe plug to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Place a new gasket (3) on the lower crankcase studs.

6. Place two new gasket washers (4) on the upper crankcase studs.

7. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

8. Align the oil cooler with the crankcase upper and lower studs and secure with washers (11) and nuts (12) on the two studs near the top of the oil cooler. Torque the nuts (12) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; remove the feeler stock from the top of the sump rail.

9. Install a washer (8), new lock washer (9), and nut (10) on the lower aft crankcase stud; install new lock washers (6), and flanged nuts (7) on the two forward studs at the bottom of the oil cooler. Torque the nuts (7 & 10) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Verify 0.010” clearance between the oil sump rail and the bottom of the oil cooler.

11. Align the horizontal baffle (21) with the lower flange of the oil cooler. Align the hole in the baffle inboard nut plate below the 2-4-6 side lower aft baffle support bracket. Insert the screw (22) and washer (23) through the baffle support bracket and the baffle (23) nut plate. Tighten the screw to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-23. Oil Cooler

1 Oil Cooler 7 Nut 13 Oil Temp. Control Valve
2 Baffle 8 Washer 14 Gasket
3 Oil Cooler Gasket 9 Lock Washer 15 Adapter Fitting
4 Gasket-Washer 10 Nut 16 Elbow Fitting
5 Plug 11 Washer 17 Flared Nipple Fitting
6 Lock Washer 12 Nut 18 Cap

* ITEM 13 INCLUDES ITEM 14

procedure continues on next page...
NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

12. Install an adapter (15) in the inboard pressure port; torque the adapter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install an elbow fitting (16) in the adapter (15). Secure the adapter with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.


15. Install a cap (18) on the adapter fitting (17). Use a backup wrench to secure the adapter fitting and torque the cap the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (13). Install the valve with a new gasket (14) in the port on the bottom of the oil cooler and torque the oil temperature control valve to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
* ITEM 13 INCLUDES ITEM 14

Figure 17-23 repeated for reference
17-6.5. TSIO-550-N Oil Cooler Installation

**WARNING**

The combination of various adapter fittings and cross fitting in earlier oil cooler configurations caused stress at the oil cooler that could cause fractured fittings and subsequent oil loss. Engine models configured with cross fittings Part No. AN918-1J or AN918-2J must be reconfigured to omit the AN918 cross fittings. Consult the latest revision of CSB15-2 for required corrective action.

1. Position the oil cooler baffle (2) 1.5 inches above the oil cooler flange and align the baffle with the oil cooler; secure the baffle to the forward side of the oil cooler (2) with four equally-spaced staples.

2. In the upper rear on the oil cooler pad, coat the stud threads with Part No. 646943 Anti-Seize lubricant.

   **NOTE:** Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

3. Apply Loctite 592 Teflon PS/T Pipe Sealant to the threads of a new pipe plugs (5 & 15). Install the pipe plugs (5 & 15) in the lower aft and bottom pressure ports. Torque the pipe plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Place a new gasket (3) on the lower crankcase studs.

5. Place two new gasket washers (4) on the upper crankcase studs.

6. Place a piece of 0.010” feeler stock on the sump rail to provide clearance between the bottom of the oil cooler and the crankcase.

7. Align the oil cooler with the crankcase upper and lower studs and secure with washers (11) and nuts (12) on the two studs near the top of the oil cooler. Torque the nuts (12) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual; remove the feeler stock from the top of the sump rail.

8. Install a washer (8), new lock washer (9), and nut (10) on the lower aft crankcase stud; install new lock washers (6), and flanged nuts (7) on the two forward studs at the bottom of the oil cooler. Torque the nuts (7 & 10) to the values specified in Appendix B of M-0, Standard Practice Maintenance Manual.

9. Verify 0.010” clearance between the oil sump rail and the bottom of the oil cooler.

10. Align the horizontal baffle (21) with the lower flange of the oil cooler. Align the hole in the baffle inboard nut plate below the 2-4-6 side lower aft baffle support bracket. Insert the screw (22) and washer (23) through the baffle support bracket and the baffle (23) nut plate. Tighten the screw to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-24. Oil Cooler

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil Cooler Assembly</td>
</tr>
<tr>
<td>2</td>
<td>Baffle</td>
</tr>
<tr>
<td>3</td>
<td>Gasket</td>
</tr>
<tr>
<td>4</td>
<td>Gasket-Washer</td>
</tr>
<tr>
<td>5</td>
<td>Plug</td>
</tr>
<tr>
<td>6</td>
<td>Lock Washer</td>
</tr>
<tr>
<td>7</td>
<td>Flanged Nut</td>
</tr>
<tr>
<td>8</td>
<td>Washer</td>
</tr>
<tr>
<td>9</td>
<td>Lock Washer</td>
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<tr>
<td>10</td>
<td>Washer</td>
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<tr>
<td>11</td>
<td>Washer</td>
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<tr>
<td>12</td>
<td>Nut</td>
</tr>
<tr>
<td>13</td>
<td>Oil Temp. Control Valve</td>
</tr>
<tr>
<td>14</td>
<td>Gasket</td>
</tr>
<tr>
<td>15</td>
<td>Plug</td>
</tr>
<tr>
<td>16</td>
<td>Adapter Fitting</td>
</tr>
<tr>
<td>17</td>
<td>45° Elbow Fitting</td>
</tr>
<tr>
<td>18</td>
<td>Cross Fitting</td>
</tr>
<tr>
<td>19</td>
<td>45° Street Elbow</td>
</tr>
<tr>
<td>20</td>
<td>Flared Nipple Fitting</td>
</tr>
<tr>
<td>21</td>
<td>Baffle</td>
</tr>
<tr>
<td>22</td>
<td>Screw</td>
</tr>
<tr>
<td>23</td>
<td>Washer</td>
</tr>
<tr>
<td>24</td>
<td>Stud</td>
</tr>
</tbody>
</table>

* ITEM 13 INCLUDES ITEM 14

procedure continues on next page...
Engine Assembly

NOTE: Apply Loctite 592 Pipe Sealant to the threads of all pipe fitting prior to installation.

11. Install an adapter (16) in the inboard pressure port; torque the adapter to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Install the elbow fitting (117) in the adapter (16). Secure the adapter with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install a cross fitting (18) in the upper outboard pressure port; torque the fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Install a 45° street elbow (19) in upper port of the cross fitting (18); Secure the cross fitting with a backup wrench and torque the elbow fitting to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

15. Install plugs (5) in street elbow (19) the aft end of the cross fitting (18); secure the fittings (18 & 19) with a backup wrench and torque the plugs to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Install a flared nipple fitting (20) in the lower port of the cross fitting (18); secure the cross fitting (18) with a backup wrench and torque the flared nipple fitting (20) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

17. Apply Part No. 646943 anti-seize lubricant to the threads of the oil temperature control valve (13). Install the valve with a new gasket (14) in the port on the bottom of the oil cooler and torque the oil temperature control valve to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Safety wire the oil temperature control valve to an adjacent fastener according to the instructions in Appendix C of M-0, Standard Practice Maintenance Manual.
Engine Assembly

Figure 17-24 repeated for reference

* ITEM 13 INCLUDES ITEM 14
17-7. **Alternator Installation**

The basic engine is fitted with a direct drive alternator. A belt drive alternator is an available option.

17-7.1. **Direct Drive Alternator Installation**

Refer to the “Gear Driven Alternator Replacement, Forward Mount” instructions in Section 10-4-1 of M-0, Standard Practice Maintenance Manual to install the gear driven alternator.
17-7.2. Optional Belt-Driven Alternator Assembly Installation

NOTE: The through-bolt nuts at the mounting location must be removed to install the mounting bracket.

The drive sheave, split sheave adapters and the propeller must be installed at the same time. If the propeller is not available at the time of assembly, defer installation until propeller is installed in aircraft.

1. Install the propeller according to the propeller manufacturer’s instructions.

2. Align the holes on the drive sheave (10) (Figure 17-25) with the propeller flange holes. Align the split sheave adapter (11) bolt holes with those in the drive sheave.

3. Install six bolts (13) with washers (14) through the front of the drive sheave (10) and split sheave adapter (11) bolt holes. Install a lock nut (12) on each of the six bolts. Torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Install the bracket assembly (1) on the 2-4-6 side of the crankcase with the following hardware
   a. Add the spacers (18) to the exposed ends of the 2-4-6 crankcase through-bolts at the propeller flange. Secure the bracket to the through-bolts with washers (17) and nuts (16). Do not torque the bracket fasteners at this time.
   b. If a standard length bolt was installed in crankcase backbone position #3 during crankcase assembly, remove and discard the bolt.
      NOTE: Inserting an incorrect combination of shims (24) at the upper mounting location may hinder proper alignment of the bracket to the engine crankshaft.
   c. Align the throttle assembly bracket and two washers, with the crankcase bolt hole; Insert a bolt (21), with washer (22), through the 1-3-5 side of the throttle body bracket.
   d. Place a spacer (23) on the 2-4-6 side of the bolt (21). Add a combination of shims (24), as required, to fill the space between the spacer and the bracket and
   e. Align the bracket assembly (1) with the crankcase assembly and upper and lower through-bolts. Secure the bracket assembly to the crankcase with a washer (22), lock washer (25), and nut (26).

5. Torque the nuts (26) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Torque the crankcase through-bolt nuts (16) according to the “Cylinder and Crankcase Torque” instructions in Section 17-3.1.

6. Align the alternator (19) upper mounting boss with the mounting bracket assembly (1). Insert a bolt (9) through the bracket and the alternator and secure with a washer (2), and nut (3). Do not torque at this time.

7. Check the alignment of the alternator sheave to the drive sheave (10) with a Part No. 80821A, or equivalent, Pulley Alignment Tool (Chapter 2 M-0, Standard Practice Maintenance Manual.).
a. Place the alignment tool in the center of the alternator drive sheave and lower the opposite end of the alignment tool into the channel of the propeller drive sheave - true alignment must be within 0.016 inch.

![Diagram of Belt-Driven Alternator Assembly (Optional)](image)

NOTE: Each shim will move the alternator sheave approximately 0.032” aft.

b. If misalignment is greater than 0.016 inch, the alternator is not properly aligned. Align the two sheaves by first removing the lock nut (3) and washer (2) from the bolt (9) and insert shims (27) between the forward boss of the mounting bracket (1) and the upper alternator (19) mounting boss to align the two sheaves. Torque
the fasteners (3 & 9) to 250 in. lbs. to seat the alternator bracket bushing then back-off nut (3) one full-turn counter-clockwise.

8. Align the slotted hole in the adjustable brace (15) with the threaded lower boss on the bracket assembly (1) and install a screw (4), new lock washer (5) and washer (6) through the brace and the threaded lower bolt hole in the bracket assembly (1).

9. Raise the adjustable brace (15) to align the round bolt hole with outboard alternator (19) mounting boss and temporarily torque the screw (4) to 150 in. lbs.

   CAUTION: No gap is permitted between the alternator brace and the mounting boss. If the gap is between 0.001” and 0.031”, add a shim to fill the void.

10. Measure the distance between the alternator mounting boss and the lower brace (Figure 17-26) to determine the number of shims (Figure 17-25) (27) to completely fill the gap between the brace and the alternator mounting boss. Each shim measures 0.032”. No gap is permitted between the two surfaces; the thickness of the shims to fill the gap may exceed the distance between the brace and alternator by up to 0.031”.

![Figure 17-26. Alternator Brace Shim Location](image)

11. Loosen the screw (4) and insert shims (27) to completely fill the gap between the adjustable brace and the alternator mounting boss. Install the screw (7), new lock washer (5) and washer (8) through the shims and adjustable brace (15) and into the threaded outboard alternator mounting boss.

12. Install a new V-belt (20) and adjust the belt tension according to instructions in Section 6-4.10.4.3 of M-0, Standard Practice Maintenance Manual.

13. Torque the fasteners (3, 4 and 7) after belt adjustment to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Safety wire the screw (4) to a nearby through-bolt according to the “Safety Wiring Hardware” instructions in Appendix C-3 of M-0, Standard Practice Maintenance Manual.
17-8. **Starter and Starter Adapter Installation**

1. Apply Part No. 642188 Gasket Sealant to both sides of the new gasket (Figure 17-27) (9) and apply the new gasket (9) to the crankcase surface.

2. Lubricate the starter shaftgear teeth with clean 50 weight aviation engine oil.

3. Mesh the shaftgear teeth with the crankshaft gear as starter adapter is placed in position. Align the starter adapter holes with the crankcase studs protruding from the rear of the engine and apply pressure to the starter adapter cover to seat the adapter assembly against gasket (9).

4. Install washers (6), new lock washers (7) and nuts (8) on the inboard side of the starter at the 7 and 11 o’clock positions. Install a washer (10), lock washer (7) and nuts (8) at the 7 o’clock position and washer (6), new lock washers (7) and nuts (8) at the 9 o’clock position on the aft studs to mount the starter and adapter assembly. Torque the nuts (8) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-27. Starter and Adapter Assembly

1. Starter Motor
2. Starter Adapter
3. Nut
4. Washer
5. O-ring
6. Washer
7. Lock washer
8. Nut
9. Gasket
10. Washer
11. O-ring
12. Sleeve
13. Spacer
14. Lock Nut
Engine Assembly

17-9. Induction System Installation

NOTE: Depending upon the size and type of aircraft installation and engine cradle clearance, it may not be possible to install the turbocharger and exhaust system until the engine is installed in the aircraft.

1. Carefully position the preassembled induction spider (1, 3-15) over the engine with the rubber bumper pad resting on the manifold locator bracket (47).

2. Install a new gasket (Figure 17-28) (2) on the throttle body.

3. Position the assembled throttle body and bracket on the crankcase backbone using the crankcase backbone bolt (Figure 17-8) (64), washer (32) and nut (56) at (Figure 17-7) position 63 and torque to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

4. Align the throttle body with the induction manifold and install four each: screws (Figure 17-28) (19), washers (13), and new lock washers (14); torque the fasteners to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Install new gaskets (11) on all cylinder intake flanges.

NOTE: Do not torque induction or exhaust connections until all tubing is installed.

6. Fit the induction tubes (3 through 8) over the cylinder intake flange studs. Use care not to allow foreign material to fall into the cylinder intake flange. Connect the intake tubes to the cylinder intake manifolds using lubricated washers (13), new lock washers (14) and nuts (15).

NOTE: The TSIO-550-G induction system is identical to the TSIO-550-B, C, E, K & N except the aftercoolers dimensions differ.

7. Torque the intake flange nuts (Figure 17-28) (15) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-28. Induction System

1 Manifold & Fitting Assembly
2 Gasket
3 Tube
4 Tube
5 Tube
6 Tube
7 Tube
8 Tube
9 Hose
10 Hose Clamp
11 Intake Manifold Gasket
12 Flange
13 Washer
14 Lock Washer
15 Nut
16 Air Manifold Tube Assembly
17 Right Air Reference Tube
18 Left Air Reference Tube
19 Screw
20 Hose
21 Sleeve Assembly
22 Washer
23 Washer
24 Compression Seal
25 Clamp Assembly
26 Fuel Dist. Tube Bracket
27 Fuel Inj. Line Bracket
28 Tube Clamp
29 Overboost Valve
30 O-ring
31 Bolt
32 Washer
33 Lock Nut
34 Aftercooler Assembly
35 Sonic Venturi Nozzle
36 Hose
37 Clamp
38 1-3-5 FWD Induction Tube
39 2-4-6 FWD Induction Tube
40 Hose
41 Hose
42 Clamp Assembly
43 Clamp Assembly
44 1-3-5 AFT Induction Tube
45 2-4-6 AFT Induction Tube
46 Compression Seal
47 Manifold Locator Bracket
48 Bumper
17-10. Turbocharger and Exhaust System Installation

17-10.1. TSIO-550-B, C, E & G Turbocharger and Exhaust System Installation

1. Apply Part No. 646943 anti-seize compound to the exhaust slip joints (Figure 17-29)(1-9) prior to assembly.

2. Install risers (7) on the exhaust tees (5 and 6).

3. Slide the riser/tee assemblies (2, 3, 5, and 7) together to make up the 2-4-6 side collector assembly.

4. Slide the riser/tee assemblies (1, 4, 6, and 7) together to make up the 1-3-5 side collector assembly.

5. With the engine in the inverted position, install a new exhaust flange gasket (25) on each cylinder.

6. Carefully install the left and right side collectors on the cylinder exhaust ports; position the collector so the flanges mate with the risers and seat squarely on the ports; lubricate and install new lock nuts (21) on each cylinder flange do not torque.

7. Install the turbochargers (24), mounted on the support brackets (29 and 30) on the turbo mount brackets (phantom parts in Figure 17-29) with bolts (31), washers (32) and new lock nuts (33). This hardware will be torqued later in this procedure.

8. Install a new gasket (23) between the transitions (5 and 6) and the turbochargers (24). Hand-tighten the bolts and washers (26 and 27) with new lock nuts (28). This hardware will be torqued later in this procedure.

9. Install the wastegate (18) between the left tailpipe (14) and bypass assembly (8 and 9) sandwiched between two new gaskets (15) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of fastening hardware (17 and 18) with new lock nuts (19). This hardware will be torqued later in this procedure.

10. Torque the support bracket screws (31) and nuts (33), turbocharger riser bolts (26) and lock nuts (28), exhaust flange nuts (Figure 17-29) (25) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

   **CAUTION:** The exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion and the exhaust system parts have adequate clearance from surrounding objects after installation.

   **NOTE:** Installation of the remaining exhaust system and turbocharger components may be delayed until after the engine is installed in the aircraft.

11. Secure the bypass assembly (8 & 9) on the transition (6) using the tie rod (11), bushing (10), nut (13) and bolt (12). Torque the assembly to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Check the installed assembly for freedom of movement.
Figure 17-29. Composite Turbocharger and Exhaust System

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Turbo Transition
6. Turbo Transition
7. Riser
8. Crossover Assembly
8A. Crossover Assy with Heater Shroud Option
9. Transition
10. Bushing
11. Tie Rod
12. Bolt
13. Lock Nut
14. Contoured Tailpipe
14C. Inverse Tailpipe Option
15. Contoured Tailpipe
15A. Straight Tailpipe
15B. Heater
15C. Inverse Tailpipe Option
16. V-band clamp
17. Gasket
18. Wastegate Assembly
19. Bolt
20. Lock Nut
21. Washer
22. Controller
23. Gasket
24. Turbocharger Assembly
25. Heater
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Screw
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose

Additional Details:
- ELONGATED HOLE BUSHING
- 15B Heater
- 15C Inverse Tailpipe Option

Engine Assembly
12. Place a new v-band clamp (16) halfway on each turbine exhaust flange. Slide the transition (9) and crossover pipe (8) together to form the bypass assembly. Install the bypass assembly on the end of the exhaust tees (5 and 6).

13. Install the tailpipe (14) exhaust flange inside the clamp (16) mounted on the left side turbine exhaust flange.

14. Install the tailpipe (or heater) exhaust flange (15) inside the clamp (16) mounted on the right side turbine exhaust flange.

15. Initially torque the clamps to ½ the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Lightly tap the outer edge of the clamp to distribute the load. Align the flanges and torque the clamp to the full torque value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

16. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed T-bolt threads according to “Safety Wiring Hardware” instructions in Section C-3 of M-0, Standard Practice Maintenance Manual and Figure 17-30. Use safety wire pliers to bend the safety wire pigtail close to the bolt.

NOTE: Connect the oil supply hoses to the fittings according to the “Hose and Tubing Installation” instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual.

17. Connect the turbocharger oil supply hose (Figure 17-31) (15) to the outboard oil cooler tee or cross fitting (Figure 17-20) (20) or Figure 17-21) (19). Install a new check valve (17), with the arrow pointing away from the oil cooler, to the open end of the supply hose. Connect the female end of the tee (16) to the check valve (17).

18. Install the connecting tee (21) in line with the new hoses (18 and 19). Install a new hose (20) on the right angle fitting of the tee (21). Connect the other end of the hose (19) to the fitting on the right turbocharger oil reservoir (3). Connect hose (18) to the left reservoir fitting.

19. Connect oil supply hoses (13 and 14) to the open ends of the connecting tee (16). Connect the open end of hose (14) to the right oil inlet fitting (6); connect the open end of hose (13) the left oil inlet fitting (6).
20. Torque the hoses and fitting connections to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

Figure 17-31. Turbocharger Lubrication

1. Left Turbocharger
2. Right Turbocharger
3. Gasket
4. Adapter
5. Lock Washer
6. Bolt
7. Gasket
8. Left Oil Reservoir
9. Right Oil Reservoir
10. Lock Washer
11. Bolt
12. Adapter
13. Tee
14. Check Valve
15. Hose
16. Hose
17. Hose
18. Tee
19. Hose
20. Hose
21. Hose

Engine Assembly
17-10.2. TSIO-550-K Turbocharger and Exhaust System Installation

1. Apply Part No. 646943 anti-seize compound to the exhaust slip joints (Figure 17-32)(1-9) prior to assembly.

2. Install risers (7) on the exhaust tees (5 and 6).

3. Slide the riser/tee assemblies (2, 4 5, and 7) together to make up the 2-4-6 side collector assembly.

4. Slide the riser/tee assemblies (1, 3, 6, and 7) together to make up the 1-3-5 side collector assembly.

5. With the engine in the inverted position, install a new exhaust flange gasket (25) on each cylinder.

6. Carefully install the left and right side collectors on the cylinder exhaust ports; position the collector so the flanges mate with the risers and seat squarely on the ports; lubricate and install new lock nuts (21) on each cylinder flange- do not torque.

7. Install the turbochargers (24), mounted on the support brackets (29 and 30) on the turbo mount brackets (phantomed in Figure 17-32) with bolts (31), washers (32) and new lock nuts (33). This hardware will be torqued later in this procedure.

8. Install a new gasket (23) between the transitions (5 and 6) on the turbochargers (24). Hand-tighten the bolts and washers (26 and 27) with new lock nuts (28). This hardware will be torqued later in this procedure.

9. Install the wastegate (18) between the tailpipe (14) and bypass assembly (8 and 9) sandwiched between two new gaskets (17) (one gasket on top of the wastegate and one on tailpipe flange) using eight sets of bolts (19, washers (20) and new lock nuts (21). This hardware will be torqued later in this procedure.

10. Torque the support bracket screws (31) and nuts (33), turbocharger riser bolts (26) and lock nuts (28), and exhaust flange nuts (Figure 17-32) (21) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

NOTE: The remaining exhaust system and turbocharger components will be installed after the engine is installed in the aircraft.
Figure 17-32. Turbocharger and Exhaust System

1 Elbow Riser 10 Bushing 19 Bolt 28 Lock Nut
2 Elbow Riser 11 Tie Rod 20 Washer 29 Bracket
3 Tee Assembly 12 Bolt 21 Lock Nut 30 Bracket
4 Tee Assembly 13 Lock Nut 22 Wastegate Controller 31 Screw
5 Right Turbo Transition 14 Left Tailpipe 23 Gasket 32 Washer
6 Left Turbo Transition 15 Right Tailpipe 24 Turbocharger Assembly 33 Lock Nut
7 Riser 16 V-band clamp 25 Gasket 34 Hose
8 Crossover Assembly 17 Gasket 26 Bolt 35 Hose
9 Transition 18 Wastegate Assembly 27 Washer 36 Hose
17-10.3. TSIO-550-N Turbocharger and Exhaust System Installation

1. Apply Part No. 646943 anti-seize compound to the exhaust slip joints (Figure 17-33)(1-9) prior to assembly.

2. Install risers (7) on the exhaust tees (5 and 6).

3. Slide the riser/tee assemblies (2, 4, 6, and 7) together to make up the 2-4-6 side collector assembly.

4. Slide the riser/tee assemblies (1, 3, 5, and 7) together to make up the 1-3-5 side collector assembly.

5. With the engine in the inverted position, install a new exhaust flange gasket (25) on each cylinder.

6. Carefully install the left and right side collectors on the cylinder exhaust ports; position the collector so the flanges mate with the risers and seat squarely on the ports; lubricate and install new lock nuts (21) on each cylinder flange- do not torque at this time.

   NOTE: The remaining exhaust system and turbocharger components will be installed after the engine is installed in the aircraft.
Figure 17-33. Turbocharger and Exhaust System

1. Elbow Riser
2. Elbow Riser
3. Tee Assembly
4. Tee Assembly
5. Turbo Transition
6. Turbo Transition
7. Riser
8. Crossover Assembly
8A. Crossover Assy with
9. Transition
10. Bushing

11. Tie Rod
12. Bolt
13. Lock Nut
14. Contoured Tailpipe
14C. Inverse Tailpipe Option
15. Contoured Tailpipe
15A. Straight Tailpipe
15B. Heater
15C. Inverse Tailpipe Option
16. Gasket
16A. Crossover Assy with
17. Gasket
18. Wastegate Assembly
19. Bolt
20. Washer
21. Lock Nut
22. Controller
23. Gasket
24. Turbocharger Assembly
25. Gasket
26. Bolt
27. Washer
28. Lock Nut
29. Bracket
30. Bracket
31. Screw
32. Washer
33. Lock Nut
34. Hose
35. Hose
36. Hose
Engine Assembly

17-11. Fuel Injection System Installation

TSIO-550-B, C & E engine models utilize a diverter valve priming system to ease engine starting; TSIO-550-G & K engine models do not. Refer to the appropriate section that applies to the engine model being assembled for instructions.

17-11.1. TSIO-550-B, C & E Fuel Injection System Installation

WARNING

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.

1. Liberally coat a new drive coupling (Figure 17-34) (2) with Molyshield Grease.
2. Install the new lubricated drive coupling (2) in the fuel pump (3) drive hub.
3. Lubricate both faces of a new fuel pump gasket with Part No. 642188 Gasket Sealant and install the new gasket (2) on the fuel pump.
4. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil.
5. Install the fuel pump (3) on the crankcase using hold down washers (7), washers (5), and nuts (6); torque the nuts (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
6. Purge the new fuel hoses (9 & 10) and fuel tubes (11-16) with Stoddard solvent through a white paper filter into a suitable fuel container. Continue to flush the fuel hoses with the Stoddard solvent until no particle residue is evident on the filter.

Procedure continues after Figure 17-34
Figure 17-34. Fuel Injection System

1. Fuel Injection Kit
2. Crankshaft Gear Coupling
3. Fuel Pump Assembly
5. Lock Washer
6. Nut
7. Hold Down Washer
8. Throttle & Metering Assembly
9. Hose Assembly
10. Hose Assembly
11. Fuel Inj. Tube Assembly #1
12. Fuel Inj. Tube Assembly #2
13. Fuel Inj. Tube Assembly #3
14. Fuel Inj. Tube Assembly #4
15. Fuel Inj. Tube Assembly #5
16. Fuel Inj. Tube Assembly #6
17. Injector Nozzle Kit
18. Injector Nozzle #1
19. Injector Nozzle #2
20. Injector Nozzle #3
21. Injector Nozzle #4
22. Injector Nozzle #5
23. Injector Nozzle #6
24. Washer
25. O-Ring
26. Fuel Pump Adapter Gasket
7. Position the new diverter valve (Figure 17-35) (1) with fittings on the forward side of the Number 5 cylinder induction port on the manifold and secure with a new wraplock band clamp (9). Conform the clamp to the shape of the diverter valve and induction manifold and torque the band clamp to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 17-35. Fuel Priming System](image)

8. Install a new flushed fuel tube (5) between the fuel manifold valve inlet fitting and the diverter valve (Figure 17-35) (1) outlet fitting (4).

![Figure 17-36. Anti-Seize Lubricant Application on the Fuel Injector](image)
9. Install a new flushed tube (3) between the throttle body outlet fitting and the elbow (Figure 17-35) (2) on the bottom of the diverter valve (1).

10. Connect the flushed fuel tube (8) to the elbow (7) on the top of the diverter valve (1) and the fitting (A in Figure 16-12) on top of the induction manifold.

11. Thread the new injector nozzles (Figure 17-34) (17 A-F), prepared in Section 16-1.2 with new O-rings (18) and washers (19), into the cylinder head by hand. Use an 8167-1A Injector Nozzle Removal/Installation Tool to torque the fuel injector to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

12. Install a cleaned sleeve assembly (Figure 17-37) (21) over each injector with new washers (23 and 22). Install a new compression seal (24) on the flared tube and install the cleaned air reference tubes (16, 17 & 18) on top of the sleeves. Torque the air reference tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Connect the air reference lines (17 & 18), with new compression seals (46) to the flex connector fittings on the throttle body, forward of the metering unit.

**WARNING**

*Replacement of the fuel pump, fuel manifold valve, diverter valve, throttle or fuel injectors requires an “Engine Operational Check” to verify fuel system operation and adjustment.*

14. Install the respective fuel tubes (Figure 17-34) (11 through 16) between the fuel manifold valve (4) and the corresponding cylinder number fuel injector nozzles. (These fuel lines were identified during engine disassembly); torque the fuel tube (11 through 16) “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

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**Figure 17-37. Air Reference Tubes**

See Figure 17-28 for index
17-11.2. TSIO-550-G Fuel Injection System Installation

**WARNING**

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

*CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.*

1. Liberally coat a new drive coupling (Figure 17-38) (2) with Molyshield Grease.
2. Install the new lubricated drive coupling (2) in the fuel pump (3) drive hub.
3. Apply Part No. 642188 Gasket Sealant to both sides of the new gasket (20) and install the new gasket (20) on the fuel pump.
4. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil.
5. Install the fuel pump (3) on the crankcase with hold down washers (7), new lock washers (5) and nuts (6). Torque the nuts (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
6. Purge the new fuel hoses (9 & 10) and fuel tubes (11-16) with Stoddard solvent through a white paper filter into a suitable fuel container. Continue to flush the fuel hoses with the Stoddard solvent until no particle residue is evident on the filter.
7. Install a new flushed fuel hose (21) between the fuel manifold valve (4) inlet and the throttle body (8) fuel inlet fitting; torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

**Figure 17-36 repeated for reference**
8. Thread the new injector nozzles (Figure 17-38) (17 A-F), prepared in Section 16-1.2 with new O-rings (18) and washers (19), into the cylinder head by hand. Use an 8167-IA Injector Nozzle Removal/Installation Tool to torque the fuel injector nozzles to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
9. Install a cleaned sleeve assembly (Figure 17-37) (21) over each injector with new washers (23 and 22). Install a new compression seal (41) on the flared tube and install the cleaned air reference tubes (16, 17 & 18) on top of the sleeves. Torque the air reference tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

10. Connect the air reference lines (Figure 17-38) (17 & 18), with new compression seals (46) to the flex connector fittings on the throttle body, forward of the metering unit.

**WARNING**

*Replacement of the fuel pump, fuel manifold valve, diverter valve, throttle or fuel injectors requires an “Engine Operational Check” according to instructions in Section 6-3.7 to verify fuel system operation and adjustment.*

11. Install the respective fuel tubes (11 through 16) between the fuel manifold valve (4) and the corresponding cylinder number fuel injector nozzles. (These fuel lines were identified during engine disassembly); torque the fuel tube (11 through 16) “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

*Figure 17-37 repeated for reference*
WARNING

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.

WARNING

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

CAUTION: Avoid introducing contaminants into the fuel injectors. Work with clean hands, tools, and shop towels. Place protective caps on the fuel injectors anytime the fuel line is not connected. Never insert an object into either end of a fuel injector.

1. Liberally coat a new drive coupling (Figure 17-39) (2) with Molyshield Grease.
2. Install the new lubricated drive coupling (2) in the fuel pump (3) drive hub.
3. Apply Part No. 642188 Gasket Sealant to both sides of the new gasket (20) and install the new gasket (20) on the fuel pump.
4. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil.
5. Install the fuel pump (3) on the crankcase with hold down washers (7), new lock washers (5) and nuts (6). Torque the nuts (6) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
6. Purge the new fuel hoses (9, 10 & 22, 27, 29) and fuel tubes (11-16, 21) with Stoddard solvent through a white paper filter into a suitable fuel container. Continue to flush the fuel hoses with the Stoddard solvent until no particle residue is evident on the filter.
7. Install a new flushed fuel tube (21) between the fuel manifold valve (4) inlet fitting and the throttle body (8) fuel outlet fitting; torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
8. Install clean bulkhead fittings (23 & 25) through the aircraft bulkhead and secure with bulkhead jam nuts (24 & 26); torque the jam nuts to aircraft manufacturer’s specifications.
9. Connect new, flushed fuel supply hose (29) to new flushed fuel supply hose (27) with a clean union (28).
10. Connect the supply hose assembly (27, 28 & 29) to the throttle fuel inlet fitting and the 45° bulkhead elbow fitting (25). Connect the fuel supply hose (9) to the fuel pump outlet fitting and the open end of the 45° bulkhead fitting (25); torque the hose and fitting connections to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
11. Connect the deck pressure reference hose segment (10) between fuel pump pressure reference fitting and the bulkhead nipple fitting (23). Connect deck pressure reference hose segment (22) between the open end of the bulkhead nipple fitting (23) and deck pressure reference on the 1-3-5 side of the throttle body forward of the throttle plate. Torque the hose and fitting connections to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

![Figure 17-39. Fuel Injection System](image-url)
12. Thread the new injector nozzles (Figure 17-39) (17A-F), prepared in Section 16-1.2 with new O-rings (18) and new washers (19), into the cylinder head by hand. Use an 8167-IA Injector Nozzle Removal/Installation Tool to torque the fuel injector according to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

13. Install a cleaned sleeve assembly (Figure 17-37) (21) over each injector with new washers (23 and 22). Install a new compression seal (24) on the flared tube and install the cleaned air reference tubes (16 & 17) on top of the sleeve assemblies. Torque the air reference tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

14. Connect the air reference tubes (16, 17 & 18), with new compression seals (46) to the flex connector fittings on the throttle body, forward of the metering unit.

**WARNING**

Replacement of the fuel pump, fuel manifold valve, diverter valve, throttle or fuel injectors requires an “Engine Operational Check” according to instructions in Section 6-3.7 to verify fuel system operation and adjustment.

15. Install the respective fuel tubes (Figure 17-39) (11 through 16) between the fuel manifold valve (4) and the corresponding cylinder number fuel injector nozzles. (These fuel lines were identified during engine disassembly); torque the fuel tube (11 through 16) “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-37 repeated for reference

Figure 17-39 repeated for reference
17-12. Wastegate Controller Installation

17-12.1. TSIO-550-B, C, E & G Wastegate Controller Installation

1. Insert bolts (Figure 17-40) (13) with washers (14) through the bracket (9). Place a second washer (14) on the bolt (13) and fasten the bracket (9) to the new or overhauled wastegate controller. Torque the bolts (13) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

2. Place washers (16), grommets (17) and spacers (18) on two bolts (15). Insert the assembled fasteners through the 1-3-5 side of the bracket (8) and place a washer (16), spacer (18) and grommet (17) on the bolts, followed by the controller/bracket assembly. Secure the assembly with washers (16) and new lock nuts (19); torque the hardware to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Install the manifold pressure line (10) with a new line protector (12) between the upper fitting on the wastegate controller and the manifold pressure fitting on the induction manifold.
4. Install a new deck pressure hose (11) to the fitting on the left side of the throttle body and the middle fitting on the front of the wastegate controller.

5. Install the mixture support bracket (20), if used, to the bracket with two bolts (21), four washers (22) and two new lock nuts (23).

6. Connect a new controller oil supply hose (35) between the wastegate oil outlet fitting and the controller (Figure 17-41) oil inlet fitting.

7. Connect a new oil return hose (34) between the controller oil drain fitting and the oil return fitting at the rear of the crankcase.

Figure 17-41. Wastegate Controller Lubrication
17-12.2. TSIO-550-K Wastegate Controller Hose Installation

1. Connect a new deck pressure hose (Figure 17-42) (8) to the deck pressure fitting on the throttle body. Install a plug in the open end of the deck pressure hose (8).

2. Connect a new manifold pressure hose (9) to the induction manifold pressure fitting. Install a plug in the open end of the new manifold pressure hose (9).

3. Place protective caps on the wastegate controller fittings and set the wastegate controller aside until the engine is installed in the aircraft.

4. Connect the new oil return hose (Figure 17-43) (34) to the oil return fitting at the rear of the crankcase. Install a plug on the wastegate controller end of the hose.
5. Connect a new wastegate controller oil supply hose (36) to the wastegate oil outlet fitting (Figure 17-29). Plug the open end of the oil supply hose until engine installation.

Figure 17-43. Wastegate Controller Lubrication
Engine Assembly

17-12.3. TSIO-550-N Wastegate Controller Hose Installation

1. Connect a new deck pressure hose (Figure 17-44) (8) to the deck pressure fitting on the throttle body. Install a plug in the open end of the deck pressure hose (8).

2. Connect a new manifold pressure hose (9) to the induction manifold pressure fitting. Install a plug in the open end of the new manifold pressure hose (9).

3. Place protective caps on the wastegate controller fittings and set the wastegate controller aside until engine installation.

4. Connect the new oil return hose (Figure 17-45) (34) to the oil return fitting at the rear of the crankcase. Install a plug on the wastegate controller end of the hose (34).

Figure 17-44. Wastegate Controller Hydraulic Hose Installation

3. Place protective caps on the wastegate controller fittings and set the wastegate controller aside until engine installation.

4. Connect the new oil return hose (Figure 17-45) (34) to the oil return fitting at the rear of the crankcase. Install a plug on the wastegate controller end of the hose (34).
5. Connect a new wastegate controller oil supply hose (35) to the wastegate oil outlet fitting (Figure 17-29). Plug the open end of the oil supply hose until engine installation.

6. Place protective caps on the wastegate controller fittings and set the wastegate controller aside until engine installation.

Figure 17-45. Wastegate Controller Lubrication

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**Engine Assembly**

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17-13. Air/Oil Separator Installation

NOTE: The air/oil separator is aircraft mounted. Connections cannot be completed until the engine is installed in the aircraft.

NOTE: If the aircraft manufacturer chooses to use a custom air/oil separator rather than the air/oil separator offered by Continental Motors, refer to the aircraft maintenance instructions for air/oil separator installation and interconnect instructions.

1. Mount the air/oil separator (Figure 17-46) (1) according to the aircraft manufacturer's instructions.

2. Install the fitting (2) in the bottom of the air/oil separator.

3. Position two new hose clamps (4) loosely on each of the separator air hoses (3 & 5).

4. Connect a new separator-to-breather hose (3) and new separator-to-overboard drain hose (5) on the air oil/separator; Locate the hose clamp inboard of the air oil separator port “beads.”
5. Connect a new separator-to-scavenge pump hose (7) to the fitting (2) on the bottom of the air/oil separator and the upper (inlet) scavenge pump fitting on the starter adapter.

6. Connect the turbocharger oil scavenge hose (Figure 17-31) (21) to the elbow at the bottom or rear of the starter scavenge pump.

7. Connect the hoses according to the “Hose and Tubing Installation” instructions in Section C-11 of M-0, Standard Practice Maintenance Manual and torque all hose connections to the value specified in Appendix B of M-0.
Engine Assembly

17-14. **Compressor (Optional) Mount Installation**

1. Remove the self-locking 12-point nut (Figure 17-48) (item 14 in Figure 17-27) and spacer (13) from the starter adapter PTO shaft.

2. Discard the spacer (Figure 17-27) (13) and install a drive sheave (Figure 17-48) (18) in place of the spacer.

3. Temporarily secure the drive sheave (19) with a new self-locking 12-point nut (item 14 in Figure 17-27). Do not torque at this time.

4. Remove the nut (Figure 17-8) (54) and washer (53) on the 1-3-5 side of the crankcase.

5. Discard the O-ring (51) and install a new O-ring (51).

6. Install the mounting bracket (Figure 17-48) (1) on the crankcase upper hole to the through-bolt.

7. Loosely install washer (Figure 17-8) (53) and nut (54).

8. Align the lower bracket bolt holes with the crankcase bolt bosses.

9. Lubricate the bolt threads (Figure 17-48) (16) with 50 weight aviation engine oil and install the bolts (16) with washers (17) in the mount (1) and crankcase.

10. In a counterclockwise sequence starting with the through-bolt nut (Figure 17-8) (50), torque the nut and bolts (Figure 17-48) (16) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
11. Install the customer-supplied air conditioning compressor using kit supplied bolts (Figure 17-48)(14), plain washer (13) and nuts (12). Torque the nuts (12) and bolts (14) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Proceed with the remaining freon compressor installation according to the aircraft manufacturer's instructions.

![Figure 17-48. Air Conditioning Compressor Mounting Assembly](image)

12. Rotate the faces of the installed drive sheaves (2 & 19) under a dial indicator to check for runout. If runout exceeds 0.005”, replace or rework nonconforming sheave. Excessive idler sheave runout may be caused by an improperly installed bearing, check bearing installation.
Engine Assembly

13. With components installed, check the alignment of the starter adapter and idler sheaves with a calibrated Alignment Tool (Ideal Aviation Part No. 80821A or equivalent (see Special Tools in Chapter 2 of M-0, Standard Practice Maintenance Manual) according to instructions in Figure 17-50.

14. Check the tool flatness (calibration) by laying it on a surface table. Place the alignment tool around the drive sheave, resting in the valley of the compressor sheave.

15. If the alignment is correct, the extended end of the alignment tool will rest within 0.020 inch (Figure 17-50) of the center of the sheave.

16. Repeat the procedure used in step 15 to check the idler sheave, except the extended end of alignment tool will rest in the lower portion of the compressor sheave.

17. If either the drive or idler sheave is misaligned, install up to five 0.020-inch shims (Figure 17-48)(21 or 22) to align the sheaves. Do not install more than five shims in either location (Figure 17-49).

18. Lubricate the sheave support bolt (Figure 17-48) (5) with clean, 50-weight aviation engine oil. The sheave support bolt must extend beyond the threads of the block assembly.

Figure 17-49. Starter Adapter Belt Sheave Alignment
Figure 17-50. Sheave Alignment

19. When the idler sheave is aligned, prevent the engine from turning and torque the sheave support bolt (Figure 17-48) (5) and new 12-point self locking nut to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

20. Install a new drive belt (17). Loosen the jam nut (10) and unscrew the adjusting bolt (9) far enough to install the new drive belt.

21. Slide the idler sheave (3) snugly against the new drive belt (17) and tighten the tensioning bolt (9) finger-tight into its socket. In this position, the idler sheave (3) should rotate by hand under the belt.

22. Tighten the tensioning bolt (9) two full turns and check the drive belt for 50-70 lbs. of tension using one of the following methods:

   a. Use a direct reading Belt Tension Gage (such as Ideal Aviation Part No. BT-33-73FIA).

   b. Measure the belt deflection under a 5-pound load at the center of the longest belt span (Figure 17-51). Acceptable deflection is 0.30 to 0.40 inches.

   NOTE: One full turn of the adjusting screw will yield approximately 10 pounds change in belt tension.
23. Adjust the bolt to the proper tension and tighten the jam nut (Figure 17-48) (10). Torque the tensioning bolt jam nut (10) and the idler sheave bracket slide bolt (9) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

24. After approximately 5 hours of operation, check the belt tension and adjust as required to maintain 50 to 70 pounds of belt tension.
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17-15. Ignition System Installation

*CAUTION: The magnetos must be replaced or overhauled according to the manufacturer's instruction prior to installation.*

17-15.1. Accessory Drive Adapter Installation

1. Apply Part No. 642188 Gasket Adhesive to both sides of new gaskets (Figure 17-52) (104) and apply the new gaskets to the accessory drive adapters (107).

2. Install the accessory drive adapter assemblies (107) with new gaskets (104) on the mounting studs on the rear of the crankcase.

3. Install the rear engine lifting eye on the two top inside accessory drive adapter studs.

4. Lubricate the accessory drive adapter fastener threads with 50 weight aviation engine oil. Secure the accessory drive adapters and lifting eye with washers (117), new lock washers (116 and 119), and nuts (115 & 118). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

5. Apply Part No. 642188 Gasket Adhesive to both sides of new gaskets (110) and apply the new gaskets to the accessory drive covers (111).

6. Install the covers (111) with a new gaskets (110) on the accessory drive adapter studs with washers (112), new lock washers (113), and nuts (1114). Torque the nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

7. Liberally lubricate the retainer (102) and new rubber bushings (101) with Molyshield grease. Insert the retainer, followed by the rubber bushings in the drive gear (103).

8. Lubricate the drive gear assembly (103) shaft, shaft splines and gear teeth with Molyshield grease and insert through the crankcase into the tapered side of the accessory drive adapter.
Figure 17-52. Accessory Drive Adapter

101 Rubber Bushing
102 Retainer-Mag Coupling
103 Magnet Drive Gear
104 Gasket
105 Magnet Adapter Assembly
106 Bushing
107 Part of 106
108 Stud
109 Oil Seal
110 Accessory Drive Gasket
101 Rubber Bushing
102 Retainer-Mag Coupling
103 Magnet Drive Gear
104 Gasket
105 Magnet Adapter Assembly
106 Bushing
107 Part of 106
108 Stud
109 Oil Seal
110 Accessory Drive Gasket
111 Accessory Cover
112 Plain Washer
113 Lock Washer
114 Nut
115 Nut
116 Lock Washer
117 Plain Washer
118 Nut
119 Lock Washer

* NOTE: Rotate items #104 and #107 90° clockwise for 2-4-6 side.
17-15.2. Continental Motors Ignition System Installation

1. Install the magnetos in the crankcase according to the “Magneto Installation Instructions” in Section 10-5 of M-0, Standard Practice Maintenance Manual.

2. Apply Part No. 649366 (Loctite 242) adhesive to the threads of the new 90° fittings (Figure 17-53) (19) and install the fitting in the magneto housing. Torque the fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Loosely install two hose clamps (16) on each new hose segment (14, 15, and 17).

4. Connect a hose (14) to each magneto 90° fittings (19) and join the hoses with the tee (18); secure with clamps (16) at each connection. Connect the hose (14) to the tee (18) and secure with clamps (16).

   NOTE: The magneto pressurization hose for the TSIO-550-N is on the 1-3-5 side of the throttle body unlike the other TSIO-550 engine models.

5. Verify the drain reducer (13) is present in the new filter. Connect a new filter (12) between hoses (15 & 16). Connect the free end of the hose (17) to the flex fitting on the throttle body for pressurization. Secure the filter to the engine according to the engine installation drawings. Simple illustrations are provided in Figure 17-53.

6. Connect magneto sensor, if equipped, (2) to bottom of one of the magnetos (determined by the aircraft manufacturer's instructions). Torque the magneto tachometer sensor to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-53. Continental Motors Ignition

1. Magneto
2. Magneto Tachometer Sensor
3. Ignition Harness
4. Screw Assembly
5. Nut
6. Lock Washer
7. Mag Hold Washer
8. Nut
9. Lock Washer
10. Gasket
11. Spark Plug Assembly
12. Magneto Filter Assembly
13. Drain, Filter Reducer
14. Hose
15. Hose
16. Hose Clamp
17. Hose
18. Tee
19. Elbow Fitting
20. Clamp
21. Bolt
22. Washer
23. Lock Nut
24. Gasket
25. Bracket
26. Bracket
27. Clamp
17-15.3. Champion (Slick) Ignition System Installation

1. Install the magnetos in the crankcase according to the “Magneto Installation Instructions” in Section 10-5 of M-0, Standard Practice Maintenance Manual.

2. Apply Part No. 649366 (Loctite 242) adhesive to the threads of the new vent bushings (Figure 17-54)(21) and 90° pressurization fittings (15); Install the vent bushings (21) in each magneto and torque the vent bushings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual. Install 90° pressurization fittings (15) in the vent bushings; and torque the fittings (15) to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.

3. Loosely install two hose clamps (11) on each new hose segment (8, 9, and 10).

4. Connect a hose (10) to each magneto 90° fittings (15) and join the hoses with the tee (12); secure with clamps (11) at each connection. Connect the hose (8) to the tee and secure with clamps (11).

5. Verify the drain reducer (14) is present in the new filter. Connect the filter (13) between hoses (8 and 9). Connect the free end of the hose (9) to the flex fitting on the throttle body for pressurization.


7. Connect magneto sensor (23) to the bottom of one of the magnetos (determined by aircraft manufacturer's instructions). Torque the magneto tachometer sensor to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
Figure 17-54. Champion (Slick) Ignition System

1 Magneto 7 Spark Plug Assembly 13 Magneto Filter Assembly 19 Washer
2 Ignition Harness 8 Hose Assembly 14 Drain, Filter Reducer 20 Cushion Clamp
3 Gasket 9 Hose Assembly 15 Elbow Fitting 21 Reducer Fitting
4 Nut 10 Hose Assembly 16 Bracket 22 Magneto Filter Kit
5 Lock Washer 11 Hose Assembly 17 Screw 23 Magneto Tachometer Sensor
6 Mag Hold Washer 12 Hose Clamp 18 Lock Nut
Chapter 18. Post-Overhaul Test and Adjustments

18-1. Introduction

Specific procedures listed in sections of this chapter must be completed after engine overhaul before the aircraft can be released for normal flight operations.

WARNING

The tasks listed in the Engine Operation Prerequisite Table must be completed in the order listed on an engine before the aircraft is authorized for flight.

Table 18-1. Engine Operation Prerequisites

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Requirement</th>
<th>Section References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prepare the Engine for Operation</td>
<td>“Maintenance Preflight Inspection” in Section 6-4.7.2 of M-0, Standard Practice Maintenance Manual</td>
</tr>
<tr>
<td>2</td>
<td>Maintenance Test Run</td>
<td>“Standard Acceptance Test” in Section 18-4</td>
</tr>
<tr>
<td>3</td>
<td>Complete Operational Checklist</td>
<td>“Engine Operational Checklist” in Section 6-6 of M-0, Standard Practice Maintenance Manual</td>
</tr>
<tr>
<td>4</td>
<td>Perform Flight Check</td>
<td>“Flight Check” instructions in Section 7-2.3(^1)</td>
</tr>
</tbody>
</table>

1. And in accordance with the Pilot’s Operating Handbook (POH).

18-2. Post-Overhaul Testing Prerequisites

Install the engine in the aircraft or an engine test stand (per the applicable test stand or aircraft manufacturer’s instructions). The following will be required to conduct post-overhaul testing:

- Fill the engine with oil according to the “Engine Oil Servicing” instructions in Section 6-4.8 of M-0, Standard Practice Maintenance Manual.
  
  NOTE: A removable oil transfer tube conducts oil under pressure from the front main bearing through the crankshaft to the propeller hub. Crankshafts are equipped with an oil transfer collar to supply the governor-controlled oil to the crankshaft for use with an oil controlled propeller. When a test club or fixed pitch propeller is used for testing, the governor pad cover must have an internal grooved surface to allow the circulating oil to lubricate the oil transfer collar. The governor pad cover is not needed if a propeller governor is installed.

- Install the engine on a test stand (test cell) or the aircraft. A test stand is the preferred method of testing.

- A test club or flight propeller mated to the propeller flange, meeting the minimum moment of inertia specified for the engine propeller in Section 2-3 to absorb the brake horsepower (BHP) at the RPM specified in the test operating limits. Use the test club or flight propeller in combination with the cell, test stand, cooling apparatus, and operating limits for which it is calibrated.
Post-Overhaul Test and Adjustments

- A cooling air scoop designed to fit over the tops of all cylinders, with padded seals for rear cylinders and valve rocker covers, to direct an adequate flow of air downward through the cylinder fins.
- Vanes to direct cooling air to the center cylinder and the oil cooler.
- An air duct to the alternator vent tube.
- An air filter and housing attached to the air throttle inlet flange. The filter area must be sufficient to avoid air flow restrictions. Clean the filter before each test. Calculations of filter area should be based on approximately 389 cubic feet per minute (CFM) of air required by the engine at full throttle and on the filter capacity per unit of area. Increase the calculated area of a clean filter by at least 50% to allow for dirt accumulation.
- A flight propeller (if the engine is installed in the aircraft and cowling is in place)
  - The aircraft configured with a flight propeller may be considered a suitable test stand for Post-Overhaul engine testing contingent on the following:
    - The flight propeller may be used contingent upon cautious observation of engine cylinder head temperature.
    - The aircraft instruments must be calibrated prior to initiation of the Post-Overhaul engine testing
    - Each cylinder should be fitted with a cylinder head temperature (CHT) sensing device. If the aircraft instruments monitor only one cylinder, CHT must not exceed 400°F and oil temperature must not exceed 200°F throughout all phases of engine testing.
    - Position the nose of the aircraft into prevailing winds.
  - A throttle control capable of operating the throttle shaft through its complete range and a five position (OFF/R/L/BOTH/START) Ignition Switch connecting the engine with the aircraft electrical system.
  - A storage battery must be connected by a No. 0 stranded copper cable from its positive terminal to the power terminal of the starter through a starter solenoid. The battery negative terminal must be connected to the engine or both battery terminal and engine may be grounded. A small insulated wire should connect the starter solenoid coil terminal to a 5 ampere push-button switch. The other switch terminal must be connected to the engine or both to common ground.
  - Control panel equipped with the following calibrated engine instruments:
    - An oil pressure gauge and tube connection
    - An oil temperature gauge and capillary assembly
    - A water manometer with rubber hose connection to the vacuum pump oil return hole at the rear of the crankcase
    - An ammeter connected in the generator or alternator circuit
    - A manifold air pressure gauge connected to the deck pressure fitting on the fuel pump
    - A turbine inlet temperature gauge connected to a temperature probe fitted to an exhaust manifold temperature probe boss
A cylinder head temperature gauge connected to a temperature probe installed in bayonet fitting on the lower side of each cylinder

A fuel flow gauge

A clean, substantial hose of 3/4 inch inner diameter must be installed on the crankcase breather elbow and supported so it leads to a point above and to the rear of engine

Fuel system with an auxiliary pump capable of sustained fuel pressure of 25 psi indication on fuel pressure gauge.

Make fuel line connections as follows:

1. Connect the fuel supply line to the fuel pump inlet.
2. Connect the fuel vapor return line (if equipped) to the upper elbow projecting from the right side of the fuel pump.
3. Connect a fuel pressure gauge in line with the fuel manifold valve fuel outlet.

### 18-3. Post-Overhaul Test Operating Limits

Post-overhaul test limits are the same as the “Engine Specifications” found in Section 2-3.

### 18-4. Standard Acceptance Test

Perform a standard acceptance test according to the protocol listed in Table 18-2.

<table>
<thead>
<tr>
<th>Engine Run</th>
<th>Oil (°F) Minimum</th>
<th>CHT (°F) Minimum</th>
<th>Duration (Minutes)</th>
<th>Engine RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120</td>
<td>175</td>
<td>N/A</td>
<td>1200 ± 25 RPM</td>
</tr>
<tr>
<td>2</td>
<td>150</td>
<td>225</td>
<td>N/A</td>
<td>1700 ± 25 RPM</td>
</tr>
<tr>
<td>3</td>
<td>165</td>
<td>250</td>
<td>N/A</td>
<td>2300 ± 25 RPM²</td>
</tr>
<tr>
<td>4</td>
<td>180</td>
<td>250</td>
<td>10</td>
<td>Rated Power RPM³</td>
</tr>
<tr>
<td>5</td>
<td>180</td>
<td>250</td>
<td>10</td>
<td>75% Power RPM Check Fuel and Oil Pressures. Check Temperatures.</td>
</tr>
<tr>
<td>6</td>
<td>180</td>
<td>250</td>
<td>5</td>
<td>Idle RPM (cooling period -300° Max. CHT at shut down.)⁴</td>
</tr>
<tr>
<td>7</td>
<td>N/A</td>
<td>N/A</td>
<td>---</td>
<td>Stop engine and perform leak check.⁵</td>
</tr>
<tr>
<td>8</td>
<td>180</td>
<td>250</td>
<td>10</td>
<td>75% Power RPM</td>
</tr>
<tr>
<td>9</td>
<td>180</td>
<td>250</td>
<td>5</td>
<td>Idle RPM (cooling period)⁴ ⁵</td>
</tr>
</tbody>
</table>

1. Operate engine at specified RPM until engine has stabilized for one minute above minimum temperatures.
2. Do not run the engine above 1800 RPM until oil temperature has reached 160°F (71°C) and cylinder head temperatures have reached 200°F (93°C).
3. Make one check on performance of each magneto channel alone at 1700 RPM. Clear the spark plugs by operating with both magnetos on for a few seconds between checks.
4. Do not shut engine down until oil temperature is below 200°F (93°C) and cylinder temperatures are below 300°F (149°C).
5. Fuel and oil leaks are not acceptable.
Post-Overhaul Test and Adjustments

Engines failing the acceptance test for high oil consumption, major oil leaks, low power, damaged components, excessive noise, excessive roughness, low oil pressure, excessive oil filter contamination require further investigation. Correct discrepancies and repeat the Standard Acceptance Test.

18-5. Oil Consumption Test

If oil consumption is abnormal during the Standard Acceptance Test, perform an Oil Consumption Test to assess the extent of oil consumption over a longer period of operation. Use Table 18-3 to complete the oil consumption test.

<table>
<thead>
<tr>
<th>Engine Run Period</th>
<th>Time Duration (Minutes)</th>
<th>Engine RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>1200 ± 25 RPM</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>1600 ± 25 RPM</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>2450 ± 25 RPM</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>Rated Power RPM</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>75% Power RPM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check Fuel and Oil Pressures. Check Temperatures.</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>Idle RPM (cooling period 300°F (149°C) maximum at shutdown)</td>
</tr>
</tbody>
</table>

Stop engine, drain and weigh oil for oil consumption determination

<table>
<thead>
<tr>
<th>Engine Run Period</th>
<th>Time Duration (Minutes)</th>
<th>Engine RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>5</td>
<td>Warm up to rated RPM</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>Rated Power Take engine readings every 10 minutes</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>Idle RPM (cooling period 300°F Max. CHT at shutdown)</td>
</tr>
</tbody>
</table>

1. Do not run the engine above 1800 RPM until oil temperature has reached 160°F (71°C) and cylinder head temperatures have reached 200°F (93°C).
2. Make one check on performance of each magneto alone at 1700 RPM. Clear spark plugs by operating with both magnetos on for a few seconds between checks.
3. Do not shut the engine down until the oil temperature is below 200°F (93°C) and cylinder temperatures are below 300°F (149°C).
4. Oil consumption of 1 lb. is considered acceptable for this test. One repeat of this test run is acceptable. If oil consumption is in excess of 1.0 pound, return the engine to the overhaul shop for a complete inspection.
5. Fuel and oil leaks are not acceptable.

Engines failing to pass the acceptance test for high oil consumption, major oil leaks, low power, damaged components, excessive noise, excessive roughness, low oil pressure, excessive oil filter contamination require further investigation. Correct discrepancies and repeat the Oil Consumption Test. Refer to troubleshooting instructions in Chapter 8 for remedial action, if necessary.

18-6. Drive Belt Tension Check

After approximately 5 hours of engine operation, check the belt tension of newly installed drive belts according to the “Belt Tension Check and Adjustment” instructions in Section 6-3.10.1.
Appendix A. Glossary

A-1. Acronyms

Refer to Appendix A-1 in M-0, Standard Practice Maintenance Manual.

A-2. Terms and Definitions

Refer to Appendix A-2 in M-0, Standard Practice Maintenance Manual.
Glossary

*Intentionally Left Blank*
Appendix B. Torque Specifications

Refer to the “Torque Specifications” in Appendix B of M-0, Standard Practice Maintenance Manual
Torque Specifications

Intentionally Left Blank
Appendix C. Standard Practices

C-1. Handling Parts
Refer to Appendix C-1 of M-0, Standard Practice Maintenance Manual.

C-2. Replacement Parts
Refer to Appendix C-2 of M-0, Standard Practice Maintenance Manual.

C-2.1. Background
Refer to Appendix C-2.1 of M-0, Standard Practice Maintenance Manual.

C-2.2. Acceptable Replacement Parts
Refer to Appendix C-2.2 of M-0, Standard Practice Maintenance Manual.

C-2.2.1. Know Your Supplier
Refer to Appendix C-2.2.1 of M-0, Standard Practice Maintenance Manual.

C-2.3. 100% Parts Replacement Requirements
Refer to Appendix C-2.3 of M-0, Standard Practice Maintenance Manual.

C-2.4. Mandatory Overhaul Replacement Parts
Refer to Appendix C-2.4 of M-0, Standard Practice Maintenance Manual.

C-2.5. Authorized Oversize/Undersize Parts
Refer to Appendix C-2.5 of M-0, Standard Practice Maintenance Manual.

C-3. Safety Wiring Hardware
Refer to Appendix C-3 of M-0, Standard Practice Maintenance Manual.

C-4. Tab Washer Installation
Refer to Appendix C-4 of M-0, Standard Practice Maintenance Manual.

C-5. Heli-Coil® Insert Replacement
Refer to Appendix C-5 of M-0, Standard Practice Maintenance Manual.

C-5.1. Heli-Coil® Removal
Refer to Appendix C-5.1 of M-0, Standard Practice Maintenance Manual.

C-5.2. Heli-Coil® Insertion
Refer to Appendix C-5.2 of M-0, Standard Practice Maintenance Manual.

C-6. Stud Replacement
Refer to Appendix C-6 of M-0, Standard Practice Maintenance Manual.

C-6.1. Stud Removal
Refer to Appendix C-6.1 of M-0, Standard Practice Maintenance Manual.
Standard Practices

C-6.1.1. Size-on-Size Rosan® Stud Removal
   Refer to Appendix C-6.1.1 of M-0, Standard Practice Maintenance Manual.

C-6.1.2. Step-Type Rosan® Stud Removal
   Refer to Appendix C-6.1.2 of M-0, Standard Practice Maintenance Manual.

C-6.1.2.1. Step-Type Rosan® Stud Removal Method 1
   Refer to Appendix C-6.1.2.1 of M-0, Standard Practice Maintenance Manual.

C-6.1.2.2. Step Type Rosan Stud Removal Method 2
   Refer to Appendix C-6.1.2.2 of M-0, Standard Practice Maintenance Manual.

C-6.2. Stud Installation
   Refer to Appendix C-6.2 of M-0, Standard Practice Maintenance Manual.

C-6.2.1. Rosan® Stud Installation
   Refer to Appendix C-6.2.1 of M-0, Standard Practice Maintenance Manual.

C-7. Cotter Pin Installation
   Refer to Appendix C-7 of M-0, Standard Practice Maintenance Manual.

C-8. Fuel System Service
   Refer to Appendix C-8 of M-0, Standard Practice Maintenance Manual.

C-8.1. Fuel System Purge
   Refer to Appendix C-8.1 of M-0, Standard Practice Maintenance Manual.

C-9. Gasket Maker® Application
   Refer to Appendix C-9 of M-0, Standard Practice Maintenance Manual.

C-10. Gasket Installation
   Refer to Appendix C-10 of M-0, Standard Practice Maintenance Manual.

C-11. Hose and Tubing Installation
   Refer to Appendix C-11 of M-0, Standard Practice Maintenance Manual.

C-12. Harness Routing
   Refer to Appendix C-12 of M-0, Standard Practice Maintenance Manual.
Appendix D. Overhaul Dimensional Limits

D-1. Overhaul Dimensional Limits=New Part Dimensions

New part dimensions are used for the Overhaul Dimensional Inspection. Overhaul tolerances are not the same as the service limits used for maintenance in Chapter 10. New parts dimensions are based on production drawings in effect at the time of publication.

WARNING

Use only new part dimensional limits during engine overhaul.
D-2. Fuel Injection System

Refer to Figure D-1 and Table D-1 for the fuel pump drive coupling dimensional limits. The Index numbers in the first column of Table D-1 correspond to the numbered items in Figure D-1.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual. Discard and replace any parts that do not conform to the specified new part dimensional specifications.

Table D-1. Fuel Pump Drive Coupling Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Fuel pump drive coupling to crankshaft gear</td>
<td>0.0095L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0.0155L</td>
</tr>
<tr>
<td>2</td>
<td>Fuel pump drive coupling to fuel pump</td>
<td>0.0030L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.0090L</td>
</tr>
<tr>
<td>T=</td>
<td>Tight</td>
<td></td>
</tr>
<tr>
<td>L=</td>
<td>Loose</td>
<td></td>
</tr>
</tbody>
</table>

Figure D-1. Fuel Pump Drive Coupling Fits & Limits
D-2.1. Throttle Lever

Refer to Figure D-2 for throttle and mixture control lever dimensional limits. Figure D-2 is specifically for stainless steel throttle levers.

NOTE: If the throttle lever bore is out of tolerance, replace the entire throttle lever. Do not attempt to install a bushing in the throttle lever.

Figure D-2. Throttle Lever Dimensions
D-3.  Starter and Starter Adapter

Refer to Figure D-3 and Table D-2 for starter and starter adapter dimensional limits. Index numbers in Table D-2 correspond with the numbers in Figure D-3. Discard and replace any parts that do not conform to the new part dimensions. Figure D-4 and Table D-3 contain worm wheel drum dimensions and limits. Figure D-5 and Table D-4 contain shaft gear drum dimensions and limits.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual. Discard and replace any parts which do not conform to the new part tolerances.

Figure D-3. Starter and Starter Adapter with Scavenge Pump Dimensions
Table D-2. Starter/Starter Adapter with Scavenge Pump Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Starter shaft gear needle bearing bore in crankcase</td>
<td>0.9990</td>
</tr>
<tr>
<td>2</td>
<td>Starter shaft gear front (bearing) journal</td>
<td>0.7495</td>
</tr>
<tr>
<td>3</td>
<td>Starter shaft gear in clutch drum bearing</td>
<td>0.9995</td>
</tr>
<tr>
<td>4</td>
<td>Clutch spring sleeve in starter adapter</td>
<td>0.0030T</td>
</tr>
<tr>
<td>5</td>
<td>Starter shaft gear in ball bearing</td>
<td>0.0001T</td>
</tr>
<tr>
<td>6</td>
<td>Bearing in starter adapter cover</td>
<td>0.0001T</td>
</tr>
<tr>
<td>7</td>
<td>Worm wheel gear cover</td>
<td>0.0016</td>
</tr>
<tr>
<td>8</td>
<td>Worm wheel drum</td>
<td>See Figure D-4</td>
</tr>
<tr>
<td>9</td>
<td>Starter shaft gear drum</td>
<td>See Figure D-5</td>
</tr>
<tr>
<td>10</td>
<td>Clutch spring in clutch spring sleeve</td>
<td>0.0310T</td>
</tr>
<tr>
<td>11</td>
<td>Center line of worm gear shaft to starter adapter thrust pads</td>
<td>0.2450</td>
</tr>
<tr>
<td>12</td>
<td>Needle bearing bore starter adapter</td>
<td>0.7485</td>
</tr>
<tr>
<td>13</td>
<td>Ball bearing in starter adapter</td>
<td>0.0001T</td>
</tr>
<tr>
<td>14</td>
<td>Worm gear shaft in needle bearing area</td>
<td>0.5615</td>
</tr>
<tr>
<td>15</td>
<td>Worm gear shaft in ball bearing</td>
<td>0.0001L</td>
</tr>
<tr>
<td>16</td>
<td>Starter worm gear on shaft</td>
<td>0.0005L</td>
</tr>
<tr>
<td>17</td>
<td>Starter spring on worm drive shaft</td>
<td>0.0050L</td>
</tr>
<tr>
<td>18</td>
<td>Starter pilot to starter drive adapter</td>
<td>0.0010L</td>
</tr>
<tr>
<td>19</td>
<td>Scavenge pump driven gear on shaft</td>
<td>0.0005L</td>
</tr>
<tr>
<td>20</td>
<td>Scavenge pump driver and driven gear in body</td>
<td>0.0015</td>
</tr>
<tr>
<td>21</td>
<td>Scavenge pump driver gear in body</td>
<td>0.0118L</td>
</tr>
<tr>
<td>22</td>
<td>Bushing in scavenge pump driven gear</td>
<td>0.0035T</td>
</tr>
<tr>
<td>23</td>
<td>Scavenge pump driver and driven gear backslash</td>
<td>0.0035</td>
</tr>
<tr>
<td>24</td>
<td>Starter worm wheel gear and worm gear</td>
<td>0.0090</td>
</tr>
</tbody>
</table>

T= Tight  L= Loose

1. When the sandblasted finish is smoother than 125 RMS, replace the sleeve
### Overhaul Dimensional Limits

#### Figure D-4. Worm Wheel Drum Dimensions

**Table D-3. Worm Wheel Drum Dimensions**

<table>
<thead>
<tr>
<th>Part</th>
<th>“A” Diameter (inches)</th>
<th>“B” Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worm Wheel Drum ................................</td>
<td>Minimum 1.931</td>
<td>Maximum 1.960</td>
</tr>
<tr>
<td>0.015 Undersize Worm Wheel Drum ..........</td>
<td>Minimum 1.916</td>
<td>Maximum 1.945</td>
</tr>
</tbody>
</table>

#### Figure D-5. Shaft Gear Drum Dimensions

**Table D-4. Shaft Gear Drum Fits & Limits**

<table>
<thead>
<tr>
<th>Part</th>
<th>“A” Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft Gear Drum ................................</td>
<td>Minimum 1.931</td>
</tr>
<tr>
<td>0.015 Undersize Shaft Gear Drum ............</td>
<td>Minimum 1.916</td>
</tr>
</tbody>
</table>
D-4. Ignition System

NOTE: For Continental Motors magneto overhaul limits, refer to the applicable Magneto Service Manual.

Refer to Figure D-6 and Table D-5 for the accessory drive adapter overhaul limits (new part tolerances). The numbers in the Ref. No. column of Table D-5 correspond to the numbered items in Figure D-6.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the magneto and accessory drive dimensional inspection. Discard and replace any parts that do not conform to the specified new part tolerances.

Table D-5. Ignition System Dimensional

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Bushing in magneto and accessory drive adapter... diametric clearance:</td>
<td>0.0010T</td>
</tr>
<tr>
<td>2</td>
<td>Magneto and accessory drive gear in adapter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>bushing</td>
<td>0.0015L</td>
</tr>
<tr>
<td>3</td>
<td>Oil seal in adapter</td>
<td>0.0010T</td>
</tr>
<tr>
<td>4</td>
<td>Sleeve in magneto and accessory drive gear... diametric clearance:</td>
<td>0.0010T</td>
</tr>
<tr>
<td>5</td>
<td>Coupling retainer on drive gear sleeve</td>
<td>0.0250L</td>
</tr>
<tr>
<td>6</td>
<td>Magneto and accessory drive gear</td>
<td>0.0110L</td>
</tr>
<tr>
<td>7</td>
<td>Magneto coupling retainer in magneto drive gear slot... side clearance:</td>
<td>0.0020T</td>
</tr>
<tr>
<td>8</td>
<td>Magneto coupling rubber bushings on drive lugs</td>
<td>0.014L</td>
</tr>
<tr>
<td>9</td>
<td>Magneto pilot in crankcase</td>
<td>0.001L</td>
</tr>
</tbody>
</table>

T= Tight   L= Loose

Figure D-6. Accessory Drive Adapter Dimensions
D-5. Lubrication System

Refer to Figure D-7 and Table D-6 for lubrication system dimensions. Numbers in the index column of Table D-6 correspond to the numbered items in Figure D-7. Additional lubrication system dimensions are listed in Table D-7.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection on the oil pump and tach drive. Discard and replace any parts that do not conform to the specified new part tolerances.

<table>
<thead>
<tr>
<th>Table D-6. Lubrication System Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Oil Pressure Relief Valve Assembly</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>Oil Pump Assembly</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>Spring Test Data</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

T = Tight  L = Loose

<table>
<thead>
<tr>
<th>Table D-7. Lubrication System Components Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Name</td>
</tr>
<tr>
<td>Inspection Item</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Oil Pump Housing and Shaft Assembly</td>
</tr>
<tr>
<td>Driven Gear Shaft</td>
</tr>
<tr>
<td>Driver Gear Shaft Hole</td>
</tr>
<tr>
<td>Gear Chamber</td>
</tr>
<tr>
<td>Oil Pump Driver Gear</td>
</tr>
<tr>
<td>Shaft</td>
</tr>
<tr>
<td>Oil Pump Driven Gear</td>
</tr>
<tr>
<td>Bushing</td>
</tr>
</tbody>
</table>
Figure D-7. Oil Pump Dimensions
Overhaul Dimensional Limits

**D-6. Engine Cylinders**

Refer to **Figure D-8** and **Table D-9** for cylinder dimensional limits. The numbers in the index column of table correspond to the numbered items in the illustrations. Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection. Discard and replace parts that do not conform to the dimensional specifications in the tables.

**Table D-8. Cylinder Assembly Dimensions**

*Not illustrated in Figure D-8*

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Inspection Item</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocker Arm Bushings</td>
<td>Inside Diameter</td>
<td>Minimum: 0.7505</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.7515</td>
</tr>
<tr>
<td>Valve Rocker Shaft</td>
<td>Outside Diameter</td>
<td>Minimum: 0.7482</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.7500</td>
</tr>
<tr>
<td>Intake Valve</td>
<td>Stem Diameter</td>
<td>Minimum: 0.4334</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.4340</td>
</tr>
<tr>
<td>Exhaust Valve</td>
<td>Stem Diameter</td>
<td>Minimum: 0.4333</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.4340</td>
</tr>
<tr>
<td>Piston (Standard)</td>
<td>Diameter at Top(^1)</td>
<td>Minimum: 5.2126</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 5.2166</td>
</tr>
<tr>
<td></td>
<td>Diameter Below 1st Groove(^1)</td>
<td>Minimum: 5.2157</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 5.2197</td>
</tr>
<tr>
<td></td>
<td>Diameter at Bottom(^1,2)</td>
<td>Minimum: 5.2414</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 5.2424</td>
</tr>
<tr>
<td></td>
<td>Pin Bore Diameter</td>
<td>Minimum: 1.1246</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 1.1250</td>
</tr>
<tr>
<td></td>
<td>Third Ring Groove Width</td>
<td>Minimum: 0.1910</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.1920</td>
</tr>
<tr>
<td></td>
<td>Fourth Ring Groove Width</td>
<td>Minimum: 0.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.1010</td>
</tr>
<tr>
<td></td>
<td>Piston Pin to Top of Dome Height</td>
<td>Minimum: 1.652</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 1.656</td>
</tr>
<tr>
<td>Piston Pin Assembly</td>
<td>Length (including plugs)</td>
<td>Minimum: 5.220</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 5.242</td>
</tr>
<tr>
<td>Rocker Arm</td>
<td>Thrust Width</td>
<td>Minimum: 0.937</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum: 0.940</td>
</tr>
</tbody>
</table>

1. Measure Piston Diameter at right angles to piston pin bore
2. Measurement must be made at 0.165 inches from the bottom of the piston.
Figure D-8. Cylinder Assembly Dimensions
### Overhaul Dimensional Limits

#### Table D-9. Engine Cylinder Assembly Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cylinders</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cylinder bore (lower 4-1/2 inch of barrel)</td>
<td>diameter:</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cylinder bore choke (at 5.75 inch from open end of barrel)</td>
<td>taper:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cylinder bore</td>
<td>out-of-round:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cylinder bore</td>
<td>allowable oversize</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cylinder bore surface (Nitrided Barrels)</td>
<td>Cross hatch angle</td>
<td>Finish in micro-inches Ra</td>
<td>22° - 32°</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>6</td>
<td>Cylinder barrel in crankcase</td>
<td>diametric clearance:</td>
<td>0.0040L</td>
<td>0.0100L</td>
</tr>
<tr>
<td>7</td>
<td>Intake valve seat insert in cylinder head</td>
<td>diametric clearance:</td>
<td>0.0070T</td>
<td>0.0100T</td>
</tr>
<tr>
<td>8</td>
<td>Intake valve guide in cylinder head</td>
<td>diametric clearance:</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>9</td>
<td>Exhaust valve guide in cylinder head</td>
<td>diametric clearance:</td>
<td>0.0010T</td>
<td>0.0025T</td>
</tr>
<tr>
<td>10</td>
<td>Exhaust valve seat insert in cylinder head</td>
<td>diametric clearance:</td>
<td>0.0070T</td>
<td>0.0100T</td>
</tr>
<tr>
<td>11</td>
<td>Intake valve seat</td>
<td>width:</td>
<td>Figure D-9</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Exhaust valve seat</td>
<td>width:</td>
<td>Figure D-10</td>
<td></td>
</tr>
<tr>
<td><strong>Rocker Arms and Shafts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Rocker shaft in cylinder head boss</td>
<td>diametric clearance:</td>
<td>0.0005L</td>
<td>0.0033L</td>
</tr>
<tr>
<td></td>
<td>Rocker shaft in rocker arm bushing</td>
<td>diametric clearance:</td>
<td>0.0005L</td>
<td>0.0033L</td>
</tr>
<tr>
<td>14</td>
<td>Rocker arm bushing bore</td>
<td>diameter:</td>
<td>0.8725</td>
<td>0.8755</td>
</tr>
<tr>
<td></td>
<td>Rocker arm bushing – finish bore</td>
<td>inside diameter:</td>
<td>0.7505</td>
<td>0.7515</td>
</tr>
<tr>
<td>15</td>
<td>Rocker arm</td>
<td>side clearance:</td>
<td>0.0020L</td>
<td>0.0150L</td>
</tr>
<tr>
<td>16</td>
<td>Intake valve guide</td>
<td>inside diameter:</td>
<td>0.4350L</td>
<td>0.4377L</td>
</tr>
<tr>
<td></td>
<td>Intake valve in guide</td>
<td>diametric clearance:</td>
<td>0.0010L</td>
<td>0.0042L</td>
</tr>
<tr>
<td>17</td>
<td>Exhaust valve guide</td>
<td>inside diameter:</td>
<td>0.4375L</td>
<td>0.4395L</td>
</tr>
<tr>
<td></td>
<td>Exhaust valve in guide</td>
<td>diametric clearance:</td>
<td>0.0035L</td>
<td>0.0062L</td>
</tr>
<tr>
<td>18</td>
<td>Intake valve face-to-stem</td>
<td>axis angle:</td>
<td>60°00'</td>
<td>60°15'</td>
</tr>
<tr>
<td>19</td>
<td>Exhaust valve face-to-stem</td>
<td>axis angle:</td>
<td>45°00'</td>
<td>45°15'</td>
</tr>
<tr>
<td>20</td>
<td>Intake valve gauge line-to-stem</td>
<td>length:</td>
<td>Figure D-11</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Exhaust valve gauge line-to-stem</td>
<td>length:</td>
<td>Figure D-12 (Replace 100%)</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Intake &amp; Exhaust valve face-to-stem</td>
<td>runout:</td>
<td>0.060</td>
<td>0.200</td>
</tr>
<tr>
<td>23</td>
<td>Rocker arm foot to valve stem (dry valve)</td>
<td>valve lash:</td>
<td>0.060</td>
<td>0.200</td>
</tr>
<tr>
<td><strong>Pistons, Rings, and Pins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Piston, non-coated in cylinder</td>
<td>diametric clearance:</td>
<td>0.008L2</td>
<td>0.011L2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.007L3</td>
<td>0.010L3</td>
</tr>
<tr>
<td></td>
<td>Piston, manganese phosphate coated in cylinder</td>
<td>diametric clearance:</td>
<td>0.009L2</td>
<td>0.012L2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.008L3</td>
<td>0.011L3</td>
</tr>
<tr>
<td>25</td>
<td>Top piston ring in groove</td>
<td>side clearance:</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>26</td>
<td>Second piston ring in groove</td>
<td>side clearance:</td>
<td>0.0015</td>
<td>0.0040</td>
</tr>
<tr>
<td>27</td>
<td>Third piston ring in groove</td>
<td>side clearance:</td>
<td>0.0035</td>
<td>0.0055</td>
</tr>
<tr>
<td>28</td>
<td>Fourth piston ring in groove</td>
<td>side clearance:</td>
<td>0.0060</td>
<td>0.0080</td>
</tr>
<tr>
<td><strong>Dimensions for items 29A-32A apply only to Post-Gold Standard Cylinders (5.251-5.253 Dia. Cylinder Bore)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29A</td>
<td>Top ring</td>
<td>gap:</td>
<td>See Section 10-6.9 in M-0, Standard Practice Maintenance Manual</td>
<td></td>
</tr>
<tr>
<td>30A</td>
<td>Second ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31A</td>
<td>Oil control ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32A</td>
<td>Fourth ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Overhaul Dimensional Limits

**Dimensions for items 29B-32B apply only to Pre-Gold Standard Cylinders (5.252-5.254 Dia. Cylinder Bore)**

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
<th>minimum</th>
<th>maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>29B</td>
<td>Top ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30B</td>
<td>Second ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31B</td>
<td>Oil control ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32B</td>
<td>Fourth ring</td>
<td>gap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Piston pin in piston</td>
<td>diametric clearance:</td>
<td>0.0001L</td>
<td>0.0007L</td>
</tr>
<tr>
<td>34</td>
<td>Piston Pin</td>
<td>diameter:</td>
<td>1.1243</td>
<td>1.1245</td>
</tr>
<tr>
<td>35</td>
<td>Piston pin in cylinder</td>
<td>end clearance:</td>
<td>0.0310L</td>
<td>0.0480L</td>
</tr>
<tr>
<td>36</td>
<td>Piston pin in connecting rod bushing</td>
<td>diametric clearance:</td>
<td>0.0022L</td>
<td>0.0026L</td>
</tr>
<tr>
<td>37</td>
<td>Bushing in connecting rod</td>
<td>diametric clearance:</td>
<td>0.00251</td>
<td>0.00501</td>
</tr>
<tr>
<td>38</td>
<td>Bolt in connecting rod</td>
<td>diametric clearance:</td>
<td>0.0000L</td>
<td>0.0018L</td>
</tr>
<tr>
<td>39</td>
<td>Connecting rod bearing on crankpin</td>
<td>diametric clearance:</td>
<td>0.0009L</td>
<td>0.0034L</td>
</tr>
<tr>
<td>40</td>
<td>Connecting rod on crankpin</td>
<td>end clearance:</td>
<td>0.0060</td>
<td>0.0110L</td>
</tr>
<tr>
<td>41</td>
<td>Connecting rod bushing</td>
<td>twist (convergence) per inch of length</td>
<td>See M-0, Section 10-9.4</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Hydraulic tappet in crankcase</td>
<td>diametric clearance:</td>
<td>0.0010L</td>
<td>0.0025L</td>
</tr>
</tbody>
</table>

### Spring Test Data

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Inner valve spring 654442 compressed to 1.230 in. length</td>
<td>70.3 Lbs.</td>
</tr>
<tr>
<td>44</td>
<td>Outer valve spring 654441 compressed to 1.275 in. length</td>
<td>101.8 Lbs.</td>
</tr>
<tr>
<td>45</td>
<td>Installed outer valve spring</td>
<td>height:</td>
</tr>
</tbody>
</table>

1. Measured below fourth ring groove
2. Pre-Gold Standard Dimension
3. Post-Gold Standard Dimension
INTAKE SEAT INSERT DIMENSIONS

<table>
<thead>
<tr>
<th>SIZE</th>
<th>DIA. B</th>
<th>DIA. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD</td>
<td>2.2790-2.2800</td>
<td>2.2770-2.2780</td>
</tr>
<tr>
<td>.002</td>
<td>2.2810-2.2820</td>
<td>2.2790-2.2800</td>
</tr>
<tr>
<td>.005</td>
<td>2.2840-2.2850</td>
<td>2.2820-2.2830</td>
</tr>
<tr>
<td>.010</td>
<td>2.2890-2.2900</td>
<td>2.2870-2.2880</td>
</tr>
<tr>
<td>.020</td>
<td>2.2990-2.3000</td>
<td>2.2970-2.2980</td>
</tr>
<tr>
<td>.030</td>
<td>2.3090-2.3100</td>
<td>2.3070-2.3080</td>
</tr>
</tbody>
</table>

Figure D-9. Intake Valve Seat Dimensions
Figure D-10. Exhaust Valve Seat Dimensions
Figure D-11. Intake Valve Dimensions

Figure D-12. Exhaust Valve Dimensions
D-7. Crankcase

Refer to Figure D-14 and Table D-11 for crankcase dimensional limits. Index numbers in the first column of Table D-11 correspond to the numbered items in Figure D-14. For items not illustrated in Figure D-14, refer to Table D-10.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection. Discard and replace any parts that do not conform to the specified new part tolerances.

Table D-10. Additional Crankcase Dimensions
Not depicted in Figure D-14

<table>
<thead>
<tr>
<th>Part Name/Feature</th>
<th>Dimensions (inches)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft Journal Bore (Rear &amp; Intermediate)</td>
<td>diameter</td>
<td>2.816</td>
<td>2.817</td>
</tr>
<tr>
<td>Crankshaft Main Journals (MJ #4 &amp; #5)</td>
<td>diameter</td>
<td>2.5625</td>
<td>2.5635</td>
</tr>
<tr>
<td>Camshaft Journal Bore</td>
<td>diameter</td>
<td>1.0000</td>
<td>1.0010</td>
</tr>
<tr>
<td>Crankcase Tappet Guides</td>
<td>diameter</td>
<td>1.0005</td>
<td>1.0015</td>
</tr>
<tr>
<td>Governor Driven Gear Bearing</td>
<td>diameter</td>
<td>0.8750</td>
<td>0.8760</td>
</tr>
<tr>
<td>Starter Shaft Needle Bearing Hole</td>
<td>diameter</td>
<td>0.9990</td>
<td>1.0000</td>
</tr>
<tr>
<td>Crankcase Idler Gear Support (front)</td>
<td>diameter</td>
<td>0.9990</td>
<td>1.0000</td>
</tr>
<tr>
<td>Crankcase Idler Gear Support (rear)</td>
<td>diameter</td>
<td>1.062</td>
<td>1.063</td>
</tr>
<tr>
<td>Camshaft Journal (4)</td>
<td>diameter</td>
<td>0.9980</td>
<td>0.9990</td>
</tr>
<tr>
<td>Valve Tappets</td>
<td>diameter</td>
<td>0.9990</td>
<td>0.9995</td>
</tr>
</tbody>
</table>

Figure D-13. Crankcase Main Bearing Oil Feed Hole Chamfer
Overhaul Dimensional Limits

Table D-11. Crankcase Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Through-bolt in crankcase</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>Idler gear support in crankcase (front)</td>
<td>0.0005L</td>
</tr>
<tr>
<td>3</td>
<td>Idler gear support in crankcase (rear)</td>
<td>0.0015L</td>
</tr>
<tr>
<td>4</td>
<td>Oil pump housing pilot in crankcase</td>
<td>0.0010L</td>
</tr>
<tr>
<td>5</td>
<td>Idler gear</td>
<td>0.0300</td>
</tr>
<tr>
<td>6</td>
<td>Idler gear in support bushing (front)</td>
<td>0.0010L</td>
</tr>
<tr>
<td>7</td>
<td>Idler gear in support bushing (rear)</td>
<td>0.0010L</td>
</tr>
<tr>
<td>8</td>
<td>Magneto pilot in crankcase</td>
<td>0.0015L</td>
</tr>
<tr>
<td>9</td>
<td>Starter shaft gear roller bearing hole</td>
<td>0.9995</td>
</tr>
<tr>
<td>10</td>
<td>Governor drive shaft in crankcase</td>
<td>0.0014L</td>
</tr>
<tr>
<td>11</td>
<td>Crankcase deck height (each half)</td>
<td>4.560</td>
</tr>
<tr>
<td>12</td>
<td>Crankcase (cylinder deck-to-cylinder deck)</td>
<td>9.12</td>
</tr>
<tr>
<td>13</td>
<td>Accessory drive adapter pilot in crankcase</td>
<td>0.0000T</td>
</tr>
</tbody>
</table>

T= Tight     L= Loose
D-8. Engine Drive Train

Refer to Figure D-15 and Table D-13 for engine drive train dimensional limits. Index numbers in the first column of Table D-13 correspond to the numbered items in Figure D-15. Additional dimensions are listed in Table D-12.

Clean and dry parts thoroughly according to the Engine Cleaning” instructions Chapter 12 of M-0, Standard Practice Maintenance Manual before performing the dimensional inspection. Discard and replace parts that do not meet the specified dimensions.

Figure D-15. Engine Drive Train Dimensions
## Overhaul Dimensional Limits

### Table D-12. Engine Drive Train Dimensions not depicted in Figure D-15

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Feature</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft Ctrwt. Hanger</td>
<td>Blade Bushing</td>
<td>Inside Diameter</td>
</tr>
<tr>
<td>Camshaft</td>
<td>Journal</td>
<td>Diameter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Feature</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft Ctrwt. Hanger</td>
<td>Blade Bushing</td>
<td>Inside Diameter</td>
</tr>
<tr>
<td>Camshaft</td>
<td>Journal</td>
<td>Diameter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Feature</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft Ctrwt. Hanger</td>
<td>Blade Bushing</td>
<td>Inside Diameter</td>
</tr>
<tr>
<td>Camshaft</td>
<td>Journal</td>
<td>Diameter</td>
</tr>
</tbody>
</table>

### Table D-13. Engine Drive Train Dimensions

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crankshaft in main bearing</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0010L 0.0040L</td>
</tr>
<tr>
<td></td>
<td>Crank pins</td>
<td>out-of-round:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000 0.0005</td>
</tr>
<tr>
<td></td>
<td>Main journals</td>
<td>out-of-round:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000 0.0005</td>
</tr>
<tr>
<td></td>
<td>Crankshaft</td>
<td>diameter:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.372 2.376</td>
</tr>
<tr>
<td></td>
<td>Front Journal</td>
<td>diameter:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.374 2.375</td>
</tr>
<tr>
<td></td>
<td>#4 &amp; #5 Main Journal</td>
<td>diameter:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.624 2.625</td>
</tr>
<tr>
<td></td>
<td>Rear &amp; Intermediate Journals</td>
<td>diameter:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.249 2.250</td>
</tr>
<tr>
<td></td>
<td>Crankshaft</td>
<td>runout:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000 0.0070</td>
</tr>
<tr>
<td></td>
<td>Propeller Flange</td>
<td>runout:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.000 0.003</td>
</tr>
<tr>
<td></td>
<td>Damper pin bushing in crank cheek</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0015T 0.0030T</td>
</tr>
<tr>
<td></td>
<td>Damper pin bushing in counterweight</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0015T 0.0030T</td>
</tr>
<tr>
<td></td>
<td>Damper pin in counterweight</td>
<td>end clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0090L 0.0390L</td>
</tr>
<tr>
<td></td>
<td>Alternator gear on crankshaft</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0005T 0.0035T</td>
</tr>
<tr>
<td></td>
<td>Crankshaft gear on crankshaft</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000 0.0020T</td>
</tr>
<tr>
<td></td>
<td>Crankshaft in thrust bearing</td>
<td>end clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.004 0.016</td>
</tr>
<tr>
<td></td>
<td>Governor oil transfer collar on crankshaft</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0005L 0.0018L</td>
</tr>
</tbody>
</table>

### Camshaft

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Camshaft journals in crankcase</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0010L 0.0030L</td>
</tr>
<tr>
<td></td>
<td>Camshaft in crankcase</td>
<td>end clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.008 0.012</td>
</tr>
<tr>
<td></td>
<td>Camshaft</td>
<td>run-out:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000 0.0010</td>
</tr>
<tr>
<td></td>
<td>Camshaft gear on camshaft flange</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0005T 0.0015T</td>
</tr>
</tbody>
</table>

### Connecting Rod

<table>
<thead>
<tr>
<th>Index</th>
<th>Part</th>
<th>Dimensions (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bushing in connecting rod</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0025T 0.0050T</td>
</tr>
<tr>
<td></td>
<td>Bolt in connecting rod</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000 0.0018L</td>
</tr>
<tr>
<td></td>
<td>Connecting rod bearing on crank pin</td>
<td>diametric clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0009L 0.0034L</td>
</tr>
<tr>
<td></td>
<td>Connecting rod on crank pin</td>
<td>end clearance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0060 0.0113</td>
</tr>
<tr>
<td></td>
<td>Connecting rod bushing twist</td>
<td>See M-0, Section 10-9.4</td>
</tr>
<tr>
<td></td>
<td>(convergence) per inch of length</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connecting rod bushing bore</td>
<td>See M-0, Section 10-9.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. If the crankshaft is worn beyond limits, the crankshaft may be repaired by grinding the crank pins and journals to 0.010" under new shaft limits and re-nitriding. Crankshaft machining must be accomplished by a repair station certified to perform crankshaft repair by the FAA or equivalent government airworthiness authority.
Table D-14. Crankshaft, Camshaft, and Idler Gear Backlash

<table>
<thead>
<tr>
<th>Index</th>
<th>Part (See Figure D-16)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crankshaft gear and camshaft gear ..............................................................................</td>
<td>0.0080</td>
<td>0.0120</td>
</tr>
<tr>
<td>2</td>
<td>Crankshaft gear and idler gear ....................................................................................</td>
<td>0.0080</td>
<td>0.0120</td>
</tr>
<tr>
<td>3</td>
<td>Idler gear and magneto drive gear (right and left) .....................................................</td>
<td>0.0080</td>
<td>0.0120</td>
</tr>
<tr>
<td>4</td>
<td>Starter shaft gear and crankshaft gear .........................................................................</td>
<td>0.0080</td>
<td>0.0120</td>
</tr>
</tbody>
</table>

Figure D-16. Crankshaft, Camshaft, and Idler Gear Backlash

Figure D-17. Pushrod Dimensions

<table>
<thead>
<tr>
<th>“A” dimension</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>13.632</td>
<td>13.662</td>
</tr>
<tr>
<td>P030 Oversize</td>
<td>13.662</td>
<td>13.692</td>
</tr>
</tbody>
</table>
Overhaul Dimensional Limits

D-8.1. Crankshaft Counterweight Assemblies

D-8.2. Counterweight Pins
Refer to “Crankshaft Assemblies” in Table 10-30 of M-0, Standard Practice Maintenance Manual for crankshaft counterweight pin part numbers and dimensions.

D-8.3. Crankshaft Hanger Blade and Counterweight Bushing Dimensions

D-8.4. Connecting Rod Dimensions
Refer to Connecting Rod Dimensional Inspection in Section 10-9.4.1 and Figure 10-42 in M-0, Standard Practice Maintenance Manual.
D-9. Stud Height Settings

D-9.1. Starter Adapter Stud Height Settings

Refer to Figure D-18 and Table D-15 for stud settings for the starter and accessory drive adapters. Index numbers in the accompanying tables match the callouts in the illustrations.

![Starter Adapter with Scavenge Pump](image)

Figure D-18. Starter Adapter with Scavenge Pump
Overhaul Dimensional Limits

Table D-15. Starter Adapter with Scavenge Pump Stud Heights

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stud, Starter Adapter to Crankcase</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.32</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Stud, Starter Adapter to Crankcase</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.09</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Stud, Cover to Adapter</td>
<td>0.3125-18 X 0.3125-24</td>
<td>0.67</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Stud, Cover &amp; Scavenge Body to Adapter</td>
<td>0.38-16 X 0.38-24</td>
<td>2.13</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Stud, Starter Motor to Adapter</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.00</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Stud, Cover to Scavenge Body</td>
<td>0.3125-18 X 0.3125-24</td>
<td>2.25</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Stud, Cover to Scavenge Body</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.31</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Stud, Cover to Scavenge Body</td>
<td>0.3125-18 X 0.3125-24</td>
<td>1.55</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Dowel, Cover to Scavenge Body</td>
<td>0.45 X 0.625</td>
<td>0.15</td>
<td>1</td>
</tr>
</tbody>
</table>

D-9.2. Lubrication System Stud Height Settings

Figure D-19 and the accompanying table show stud settings on the oil pump housing, oil filter adapter and associated parts. Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness. Check the stud alignment using a tool maker’s square. No stud should exceed the specified settings.

Figure D-19. Lubrication System Stud Height Settings

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stud, Cover to Housing</td>
<td>0.25-20 X 0.25 - 28</td>
<td>0.65</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Stud, Oil Filter To Adapter</td>
<td>0.75-16 X 0.8125-16</td>
<td>0.500-0.700</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Stud, Throttle Support</td>
<td>0.25-20 X 0.25 - 28</td>
<td>0.44</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Stud, Cover to Housing</td>
<td>0.25-20 X 0.25 - 28</td>
<td>0.75</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: Entries below only apply to oil pumps with a tachometer drive adapter.
D-9.3. Accessory Drive Adapter Stud Height

Figure D-20 is and the table below it indicate stud heights for the accessory drive adapter. For the accessory drive adapter mounting studs, refer to the crankcase stud height settings.

![Figure D-20. Accessory Drive Adapter](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stud, Accessory to Adapter</td>
<td>0.25-20X 0.25-28</td>
<td>0.87-0.90</td>
<td>4</td>
</tr>
</tbody>
</table>
D-9.4. Cylinder Stud Height Settings

Figure D-21 and Table D-16 show cylinder head stud height settings for the two cylinder configurations. Check stud alignment using a tool maker’s square.

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exhaust flange stud (ring-locked)</td>
<td>1/4-20 x 1/4-28</td>
<td>0.865-0895</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Exhaust flange stud (ring-locked)</td>
<td>1/4-20 x 1/4-28</td>
<td>0.865-0895</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Intake flange stud</td>
<td>1/4-20 x 1/4-28</td>
<td>1.00</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Intake flange stud</td>
<td>1/4-20 x 1/4-28</td>
<td>0.78</td>
<td>2</td>
</tr>
</tbody>
</table>
D-9.5. Oil Control Collar Stud Height Settings

Figure D-22 shows the stud and dowel height settings on the oil control collar. Check that the studs are secure and aligned using a tool maker’s square. No stud height should exceed the listed stud height in Figure D-22.

Figure D-22. Oil Control Collar Stud Height Settings

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Stud Height (inches)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil Control Collar Stud</td>
<td>1/4X1-1/4 LG</td>
<td>0.94</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Dowel (Ferrule)</td>
<td>1/8X 7/16 LG</td>
<td>0.15</td>
<td>2</td>
</tr>
</tbody>
</table>

D-9.6. Crankcase Plugs

Refer to Table D-17 to determine the plugs that need to be removed to allow pressure flushing of the crankcase. Tag the removed plugs for re-installation reference. Numbers in parentheses refer to illustration Figure D-23.

Table D-17. Crankcase Plugs

| Plug (14) |
| Plug (17) |
| Plug (18) |
| Plug (19) |
| Plug (21) |
| Plug (24) |
| Plug (29) |
### D-9.7. Crankcase Stud Height Settings

#### Table D-18. Crankcase Stud Height Settings

<table>
<thead>
<tr>
<th>Index</th>
<th>Location</th>
<th>Thread Size</th>
<th>Setting Height</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crankcase Assembly with Studs</td>
<td>---</td>
<td>Figure D-23</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Helical Coil</td>
<td>0.31-18</td>
<td>Install per Appendix C</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Helical Coil</td>
<td>0.31-18</td>
<td>Install per Appendix C</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Pin, Dowel</td>
<td>3/16X 0.50 LG</td>
<td>0.17 - 0.19</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Stud, Thread</td>
<td>5/16X18-24</td>
<td>0.98</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Magneto Mount Pad</td>
<td>5/16X18-24</td>
<td>0.72</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Accessory Pad</td>
<td>3/8X16-24</td>
<td>0.97</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Accessory Pad</td>
<td>5/16X18-24</td>
<td>0.98</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Idler Pin Pad</td>
<td>1/4X20-28</td>
<td>0.56</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Fuel Pump Pad</td>
<td>5/16X18-24</td>
<td>0.75</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Starter Adapter Pad</td>
<td>5/16X18-24</td>
<td>3.69</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Oil Pump Pad</td>
<td>1/4X20-28</td>
<td>3.38</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Plug</td>
<td>3/8 X18</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Oil Pump Pad</td>
<td>3/8X16-24</td>
<td>2.94</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Oil Pump Pad</td>
<td>1/4X20-28</td>
<td>1.77</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Oil Pump Pad</td>
<td>5/16X18-24</td>
<td>4.27</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Plug</td>
<td>1/8X27</td>
<td>---</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>Plug</td>
<td>1/16X27</td>
<td>---</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>Plug</td>
<td>1/8X27</td>
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Figure D-24. Crankcase Stud Detail
Overhaul Dimensional Limits

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