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CONTINENTAL® AIRCRAFT ENGINE

PERMOLD SERIES ENGINE

MAINTENANCE AND OVERHAUL MANUAL

Technical Portions Accepted by the Federal Aviation Administration

Publication M-18

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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.

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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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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.

Part No.	Title	Applicability
M-18	Maintenance and Overhaul Manual	TSIO-550 engines
M-0	Maintenance and Overhaul Manual	Various
X30592	Starter Service Instructions	CMI Energizer® starters
X30531	Alternator Service Instructions	CMI alternators
X42002	S-20/S-200 Magneto Service Manual	Various

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 **B**	TSIO-550-C **C**	TSIO-550-E **E**
TSIO-550-G **G**	TSIO-550-K **K**	TSIO-550-N **N**
Energizer Starter **EZR**	Iskra Starter **ISK**	SkyTec Starter **SKY**

1-1.3. Advisories

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

WARNING

A 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.

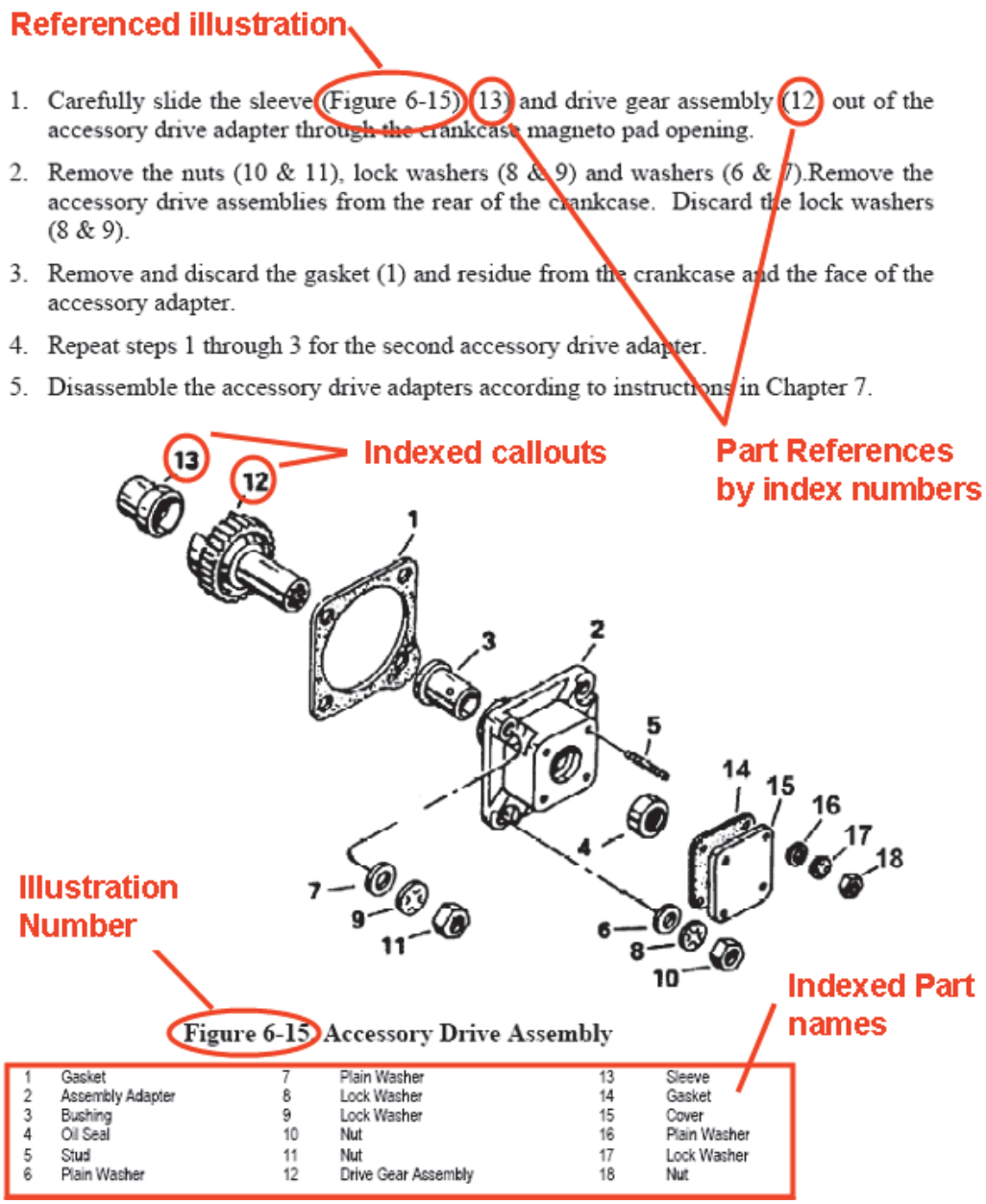


Figure 1-1. Figure and Index Reference

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 web site upon notification of FAA document acceptance/approval. Printed publication subscribers receive printed changes and revisions as they are released.

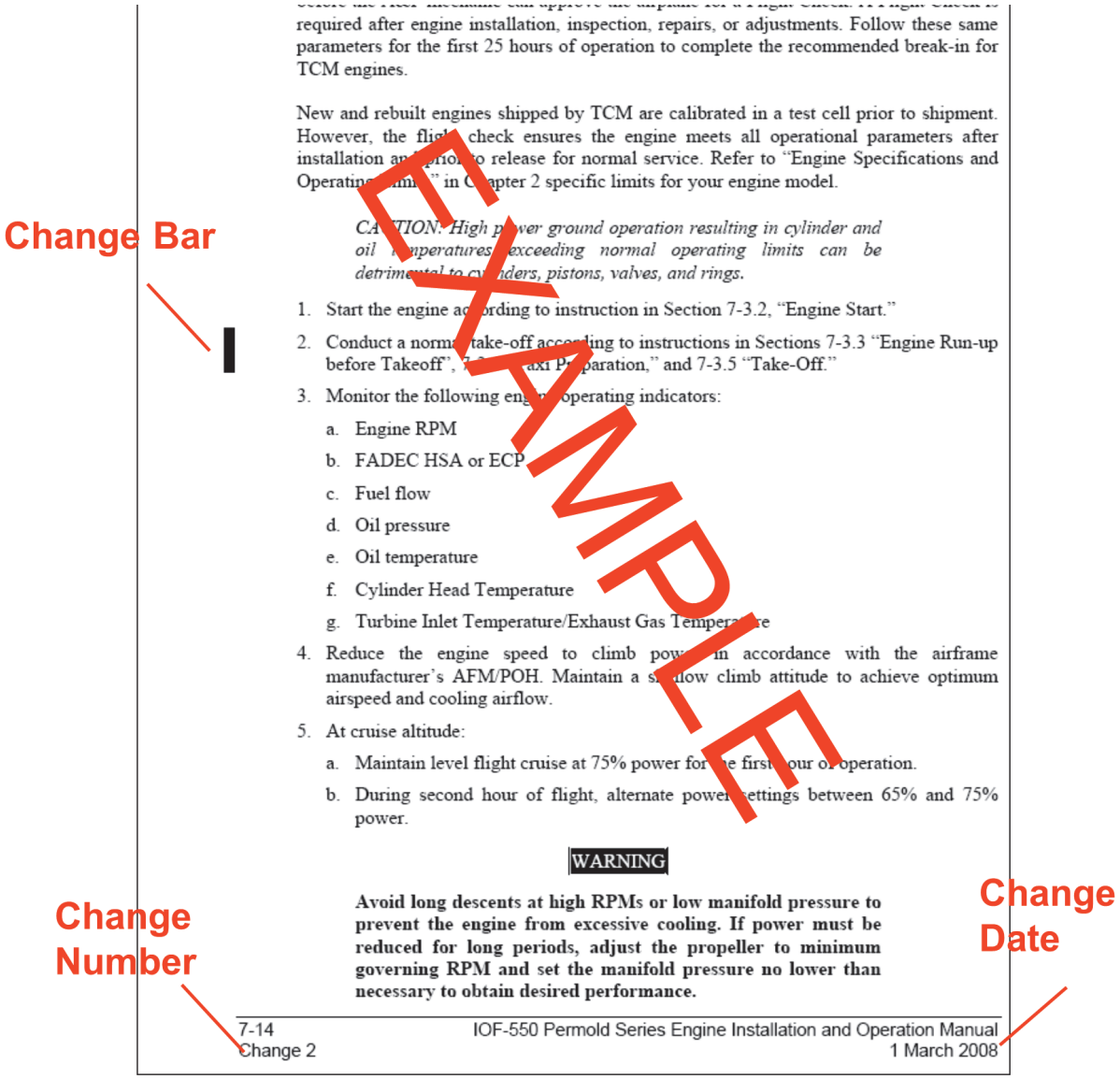
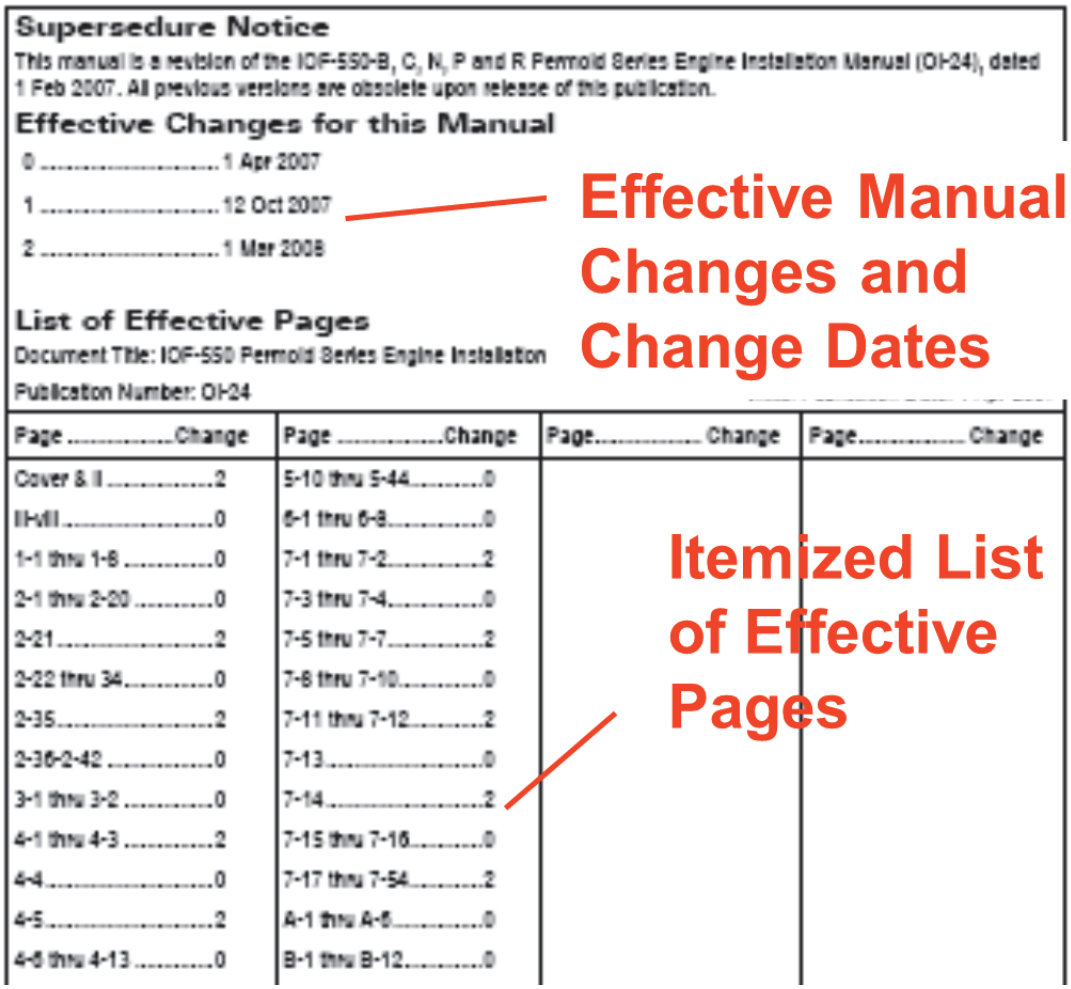


Figure 1-2. Change Page Identification

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.



Supersedure Notice

This manual is a revision of the IOF-550-B, C, N, P and R Permold Series Engine Installation Manual (OI-24), dated 1 Feb 2007. All previous versions are obsolete upon release of this publication.

Effective Changes for this Manual

0 ..... 1 Apr 2007
1 ..... 12 Oct 2007
2 ..... 1 Mar 2008

Effective Manual Changes and Change Dates

List of Effective Pages

Document Title: IOF-550 Permold Series Engine Installation
Publication Number: OI-24

Page ..... Change	Page ..... Change	Page ..... Change	Page ..... Change
Cover & II 2	5-10 thru 5-44 0		
II-Hdl 0	6-1 thru 6-8 0		
1-1 thru 1-8 0	7-1 thru 7-2 2		
2-1 thru 2-20 0	7-3 thru 7-4 0		
2-21 2	7-5 thru 7-7 2		
2-22 thru 34 0	7-8 thru 7-10 0		
2-35 2	7-11 thru 7-12 2		
2-36-2-42 0	7-13 0		
3-1 thru 3-2 0	7-14 2		
4-1 thru 4-3 2	7-15 thru 7-16 0		
4-4 0	7-17 thru 7-54 2		
4-5 2	A-1 thru A-6 0		
4-6 thru 4-13 0	B-1 thru B-12 0		

Itemized List of Effective Pages

Figure 1-3. 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.

Service Document	Subject	Affected Chapter
CSB668, Inspection of Ignition Harness Attachment Plate	Magneto or Ignition Harness Maintenance	6, 10, 16
SB669, Magneto Distribution Gear Block	Magneto Inspection and Maintenance	6
M67-12, Overboost of Turbocharged Engines	Unscheduled Maintenance	6 & 7
M72-17R1, Maximum Weight Difference Between Connecting Rods and Pistons in the Same Engine	Parts Replacement	M-0
M76-4, Propeller Shaft or Crankshaft Oil Seal Replacement	Unscheduled Maintenance	M-0
M85-14, Magneto Pressurization Filter	Magneto Inspection	6, 10, 15
M86-13R1, Camshaft Plug Inspection and Overhaul Revision	Camshaft Inspection and Replacement	13
M87-15, Alternator Ground Strap	Alternator Replacement	10, 15, 17
M88-9, Lightning Strikes	Unscheduled Maintenance	M-0
M88-10, Contaminated Fuels	Unscheduled Maintenance	M-0
M89-7R1, Engine Operation after Cylinder Replacement and/or Major Overhaul	Engine Operation/Post Overhaul Testing	M-0
M89-9, Excessive Crankcase Pressure	Unscheduled Maintenance	M-0
M89-18, Exhaust Gas Temperature (EGT) Recommendations for Standard Engines	Engine Operation	7
M93-4, Crankshaft Counterweights	Crankshaft Repair	M-0
M93-8, Rocker Arm to Rotocoil Clearance	Rocker Arm Installation	10, 16
SIL93-11B, Service Document Format	Service Documents	1
SIL93-14, CFC Compliance	N/A	N/A
SIL93-15, General Practices for Installation of Lock Wire, Tab Washers, and Cotter Pins	Standard Practices	M-0
SB94-2, Oil Filter mounting Stud	Service	10 & 15
MSB94-8D, Magneto to Engine Timing	Service	M-0
SIL94-5, Mobil AV-1 Oil	Authorized Lubricants	M-0
SB95-2, Inspection and Maintenance of Engine Control Cables and Linkage	Inspection	M-0
SIL95-5, Hose and Tubing Installation	Hose and tubing installation	M-0, Appendix C
SB95-7A, Manifold Valve Cover Inspection	Fuel system maintenance	6, 8, 10
SB96-3C, Crankshaft Gear Bolt Inspection	Crankshaft Assembly	16
SB96-7D, Torque Limits	Fastener torque	M-0, Appendix B
MSB96-10B, Crankshaft Ultrasonic Inspection	Crankshaft Removal & Replacement	15
SB96-11B, Propeller Strikes and Hydraulic Lock	Scheduled Inspection	6
SB96-12, Cylinder Continued Airworthiness	Scheduled Inspection	6 & 10
SIL97-1, Airworthiness Limitations	Airworthiness Limitations	4

Service Document	Subject	Affected Chapter
SID97-2B, Design, Operation Maintenance and Warranty of Cylinders	N/A	N/A
SID97-3G, Continuous Flow Fuel Injection Systems Adjustment Specifications and Instructions	Operational Checks and Adjustments	M-0
SID97-4F, Cylinder Bore and Piston Fit Specifications	Overhaul & Service Limits	10 & Appendix D, M-0
SB97-6B, Mandatory Replacement Parts	Engine Inspection & Assembly	M-0, Appendix C
CSB97-10B, Piston Pin Plug Wear	Service Limits	10
SIL97-12, Installation of Starter Adapter Shaft Seal	Starter Adapter Assembly	12, 16
CSB98-1C, Intake and Exhaust Valve Inspection	Service Limits	10 & 15
SIL98-3B, Production Release of New Intake and Exhaust Valve Springs	Cylinder Assembly	10 & 15
SIL98-5, Production Release of P/N 654837A1 Camshaft Assembly	Camshaft Replacement	15
SIL98-9E, Time Between Overhaul Periods	Engine Specifications, Scheduled Maintenance	M-0
SIL99-1, Engine Preservation for Active and Stored Aircraft	Engine preservation and returning an engine to service after storage	M-0
SIL99-2C, Sealants, Lubricants and Adhesives Authorized by CMI	Materials	M-0
SB99-8B, Engine Fuel Injection System Preservation	Fuel Injection system preservation	5
SB00-3A, Crankshaft, Counterweight and Connecting Rod Repair Information	Repair Specifications	10
SB00-4A, Australian AVGAS Contamination	Inspection and Operation	6
MSB00-6C, Slick Service Bulletin SB1-00C	Slick magnetos	2, 6, 10, 12, 17
SIL00-7A, Oil Gauge Rod Application	Oil Servicing	6
SIL00-9A, Engine Data Plates	N/A	N/A
SB00-10, Fuel Pump Seal	Fuel Pump Installation	10 & 17
SIL00-11B, Release of new Cylinder Induction Port Drain Connector	Cylinder Assembly	10 & 17
SB01-3A, P/N649304A1 and 649305A1 Gear-driven Alternators	Alternator overhaul	6, 10 & 15
SIL02-4, Production Release of New Lightweight Starter Motors	Starter replacement	10, 15 & 17
SIL02-6A, Production Release of Optional Intake And Exhaust Valves	Cylinder Assembly	10 & 15
SIL03-1, Cold Weather Operation – Engine Preheating	Preheating procedures	7
SIL03-2C, Currently Active Approved Spark Plug Application	Spark plugs	2 & 6
SIL03-3, Differential Pressure Test and Borescope Inspection	Inspection Criteria	6
SIL04-2A, Cylinder Barrel Ultrasonic Inspection	N/A	M-0
CSB04-5A, Ignition Systems CSB665A	Magneto Service	10
CSB04-6B, Inspection of TSIO-550 and TSIOL-550 Engines with P/N 654867 Pistons Installed	Engine Inspection	6
SB04-10, Piston Pin Marking	Overhaul Repairs	10 & 15
SB04-11, Valve Guide Application, Installation and Reaming	Valve Guide Repairs	10 & 15

Service Document	Subject	Affected Chapter
SIL04-12A, Authorized Engine Adjustments, Component Replacement and Repositioning	Engine Specification	M-0
SID05-1B, Inspection Guidelines for Camshafts and Hydraulic Lifters	Inspection Criteria	15 & Appendix D
SB05-2, Overspeed Limitations	Unscheduled Maintenance	M-0
SIL05-3A, Engine Specification Numbers	Engine Specification	2
MSB05-8B, Improved Camshaft Gear	Camshaft Gear Replacement and Overhaul	13, 15 & 17
SB06-1A, Fuel Injection Nozzle Inspection & Replacement	Injector Nozzle Installation	6, 10 & 16
SIL06-3, Crankshaft Gear Retaining Screw	Engine Assembly	16
SB07-1, Connecting Rod Piston Pin Bushing Inspection	Inspection	15
MSB07-4, Kelly Aerospace Power Systems Turbocharger Replacement	Turbocharger Inspection	6, 10 & 15
CSB08-3C, Throttle & Mixture Control Levers	Fuel Injection System Assembly	5, 6, 10 & 17
SB08-4A, Fuel Injection System Contamination	Fuel Injection Service	M-0
SB08-8, Slick Service Bulletin SB2-08	Magneto Inspection	6, 15
SB08-9A, Slick Service Bulletin SB3-08A	Magneto Inspection	6, 15
SB08-13, Induction System Hose and Clamp Installation	Induction System Inspection & Assembly	6, 10 & 17
SB09-4B, Crankcase Inspection for Permold Engines Equipped with Air Conditioner Systems from 1998 to present	Scheduled Inspections	6
SB09-7, Potential Pushrod Seal Leakage	Engine Inspections	5, 6, 9, 10
MSB09-8A, Inspection and Removal of Certain Hydraulic Lifters	Engine Inspection	6, 10, 13, 15 & 16
SB09-14, Crankshaft Corrosion Treatment	Engine Inspection	6, 10, 12, 15, 16
CSB09-11A, Minimum Cruise RPM Limits	Engine Operation	2 & 7
SB10-1A, Exhaust and Turbocharger System Inspection	Turbocharger Inspection	M-0
MSB10-3, KAES SB039 Turbine Wheel Replacement	Turbocharger Inspection	6, 10, 17
SIL10-6A, Oil Cooler and Vernatherm Valve for Certain Engines Experiencing Low Oil Temperatures	Engine Operation	7, 10
SB10-8A, KAES SB040A Turbocharger Center Housing Rotating Assembly Inspection	Turbocharger Inspection	6, 10, 17
SB11-1A, Hartzell Engine Technologies, SIL A-138	Alternator Inspection	N/A
SB11-2, Continued Airworthiness Instructions Part No. 656802 Alternator	Alternator Service	6, 10
SB11-3, Alternator and Drive Coupling Installation	Alternator Replacement	6, 10, 12, 13, 15, 16, 17
CSB12-1, P/N 641909 Lock Plate Inspection	Engine Assembly	15, 16, 17
SIL13-2A, Alternator Instructions for Continued Airworthiness	Alternator Replacement	6, 10, 12, 13, 15, 16, 17
SB13-4C, Aneroid Equipped Fuel Pumps	Scheduled Maintenance	6
SB13-6A, Crankshaft Gear Replacement	Engine Disassembly	13
SB13-8, Hartzell Engine Technologies SIL A-137	Alternator Service	6
SIL14-4B, 24V/70 Amp Belt-driven Alternator Brace Alignment	Alternator Service	10, 17, M-0
SB14-5A, Hartzell Engine Technologies SB 059	Alternator Inspection	6
SB14-8, Exhaust Flange to Cylinder Installation	Exhaust System Installation	M-0

Service Document	Subject	Affected Chapter
SIL14-9, Fuel Pump Mixture Control Lever Configuration	Fuel Pump Configuration	6
SB15-1, Continental Motors Ignition System Service Bulletin SB669	Magneto Inspection	6
CSB15-2C, Oil Cooler Cross Fitting Replacement	Engine Assembly	5, 13, 16
SB15-3A, Oil Sump Assembly Inspection	Scheduled Maintenance	6
SB15-5, Champion Aerospace Slick Service Letter SL4300/6300-74-20-001	Ignition Timing	6, M-0
SB15-6A, NIC3 Cylinder Assemblies	Optional Cylinder Assemblies	7, 10, Appendix D
CSB15-7B, TSIO-550-K Oil Cooler Cross Fitting Replacement	Engine Assembly	5, 13, 16
SIL16-1, Optional 24V Starters	Starter Replacement	10, 17
SIL16-2, M-0, Standard Practice Maintenance Manual Release	Multiple	Throughout
SB16-3, Turbocharger Check Valve Inspection	Scheduled Maintenance	M-0
SB16-4, Incorrectly Identified Control Levers	Scheduled Maintenance	6
SB16-6, Engine Damage Due to Kickback	Engine Operation	7
SB16-8, Turbo Exhaust Transition 657631	Exhaust System Maintenance	6, 10
SB16-9, Hartzell Engine Technologies (HET) SB No. 066	Alternator Maintenance	6

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

Publication	Supplied With Engine	Internet via CMI web site[1]	Printed Manual Available for Purchase
Instructions for Continued Airworthiness			
TSIO-550 Permold Series Engine Maintenance and Overhaul Manual (M-18) (this manual)	Yes	Yes	Yes
Standard Practice Maintenance Manual (M-0)	Yes	Yes	Yes
Starter Service Instructions (X30592)	Yes	Yes	Yes
Alternator Service Instructions (X30531)	Yes	Yes	Yes
Magneto Service Manual (X42002)	Yes	Yes	Yes
Engine Installation Manual			
Installation and Operation Manual (OI-18)	Yes[2]	Yes	Yes
Illustrated Parts Catalogs			
Electronic Engine Product Catalog (by Engine Model and Specification)	No	Yes (view only)	No

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.

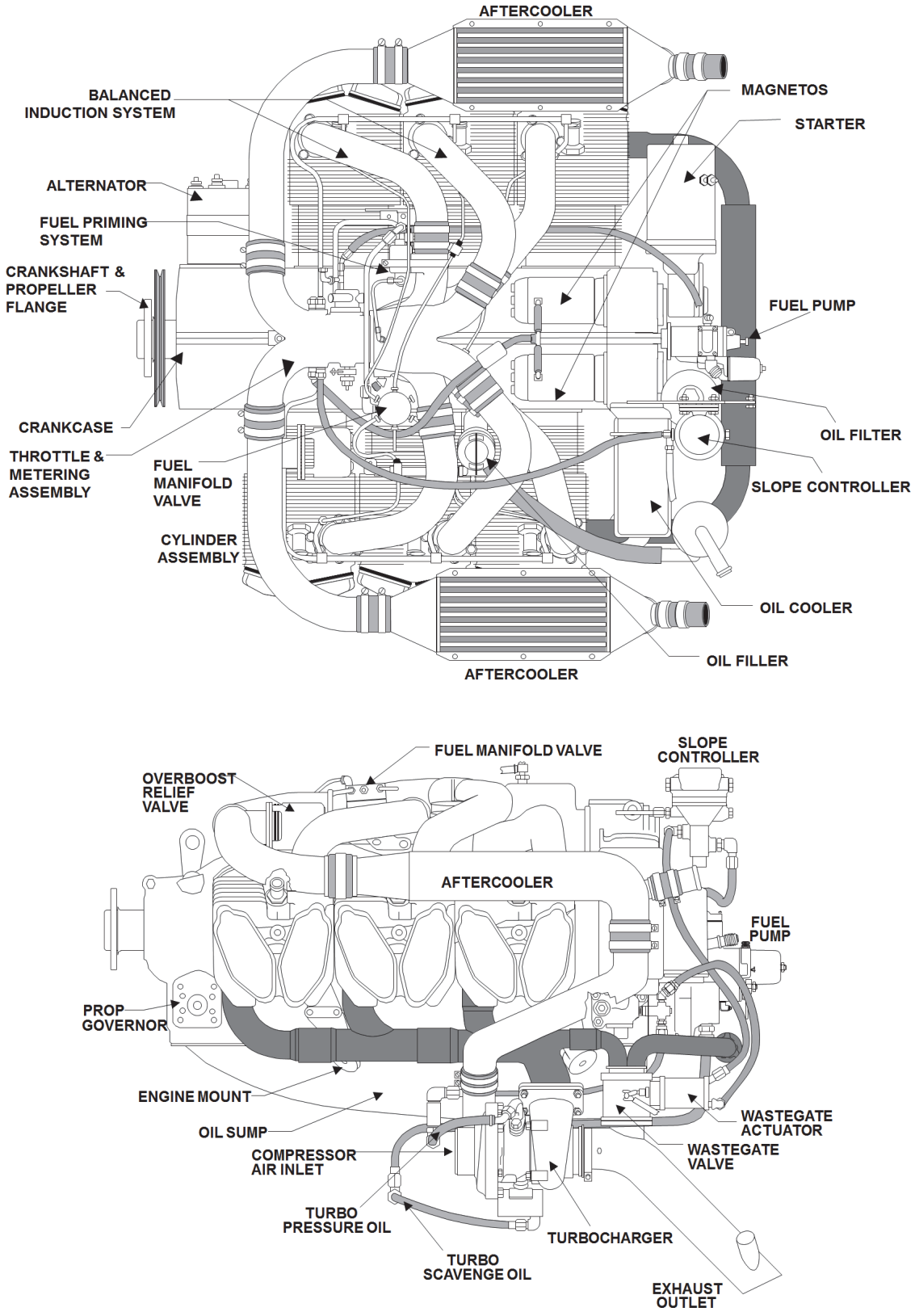

Figure 2-1. TSIO-550 Typical Top and Side Views

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).

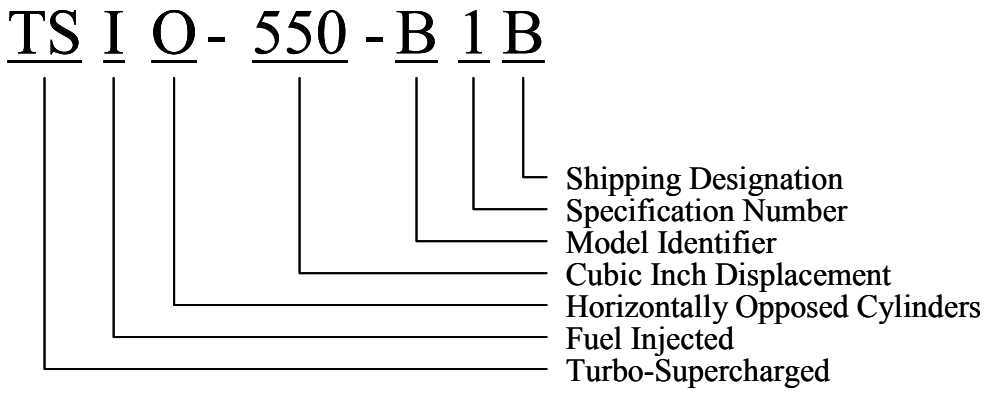

Figure 2-2. Engine Model Definition

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.

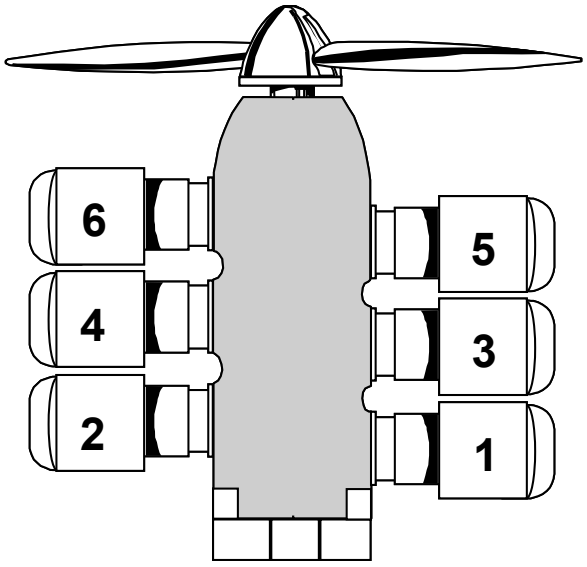

Figure 2-3. Cylinder Number Designation

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.

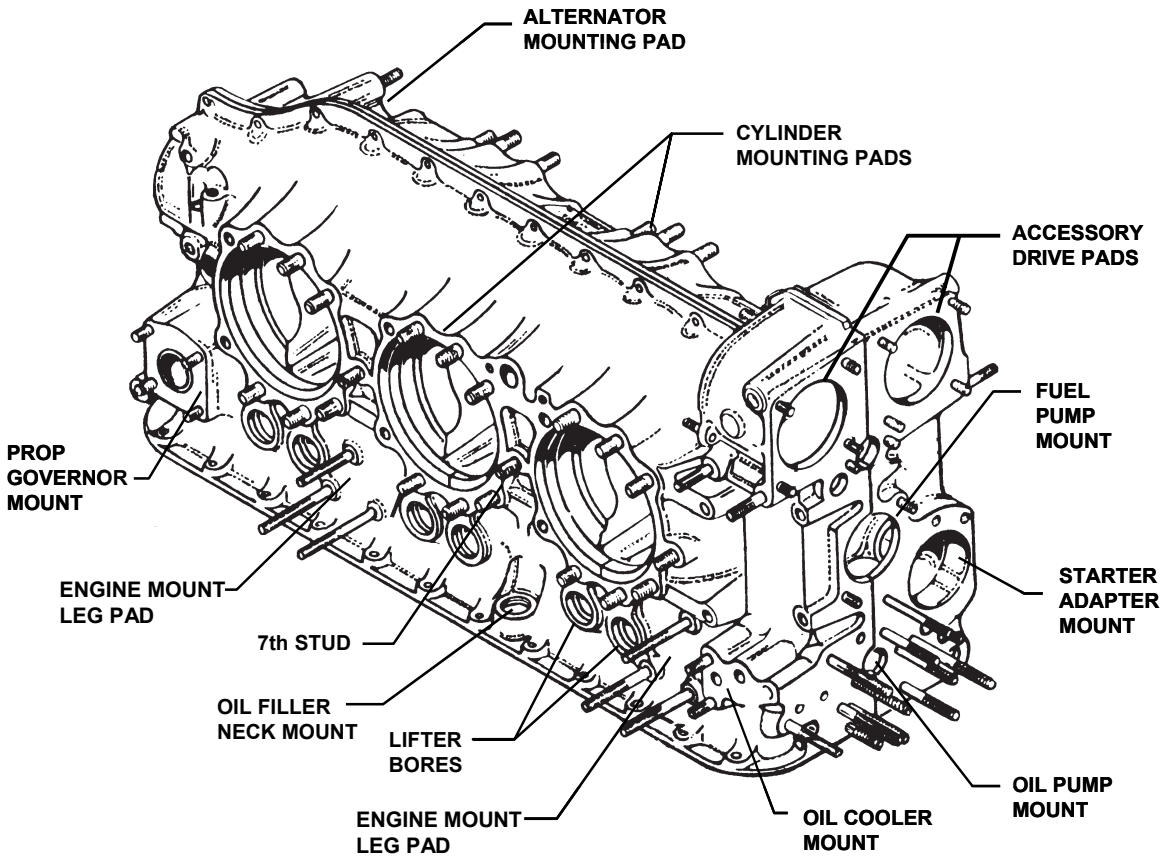

Figure 2-4. Permold Crankcase Features

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.

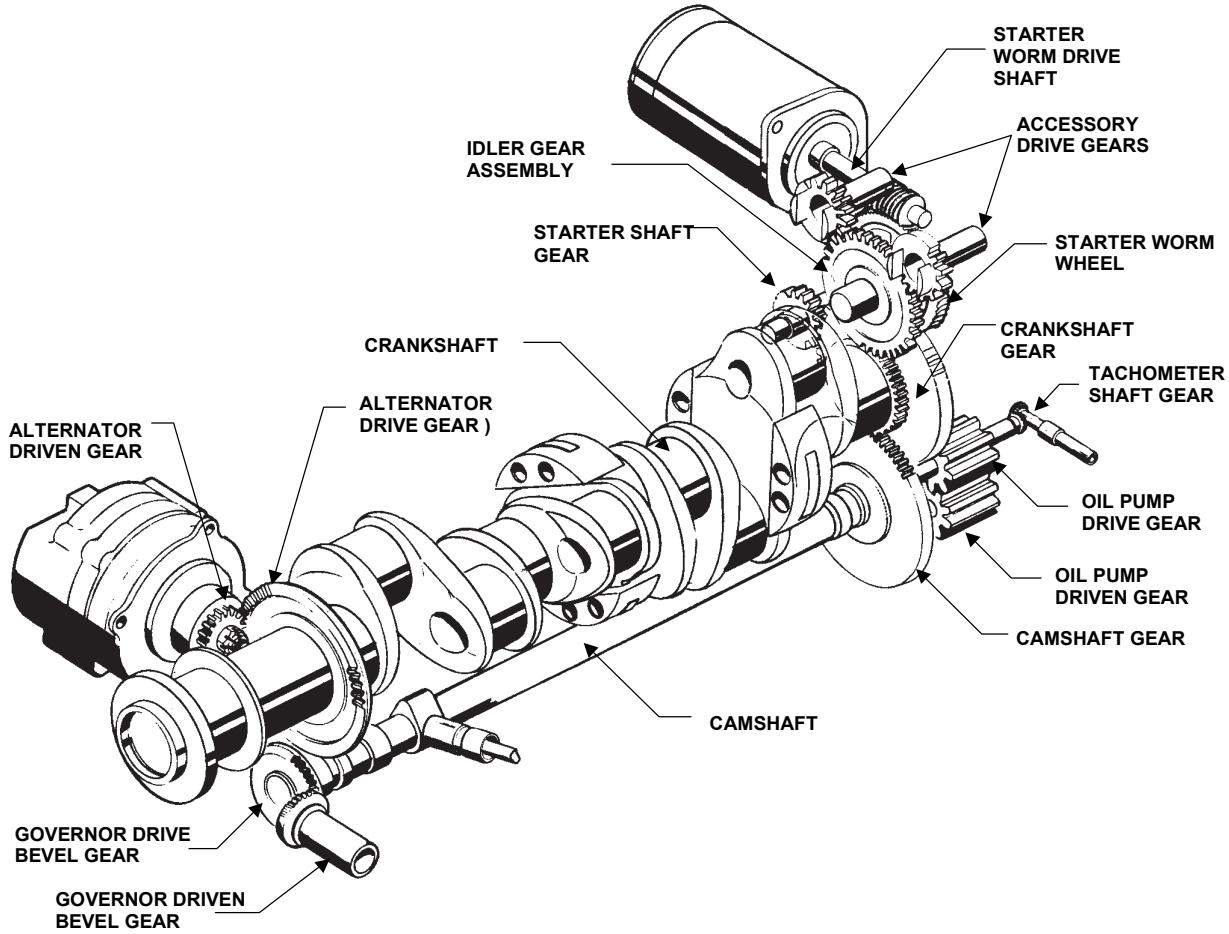

Figure 2-5. Engine Drive Train

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.

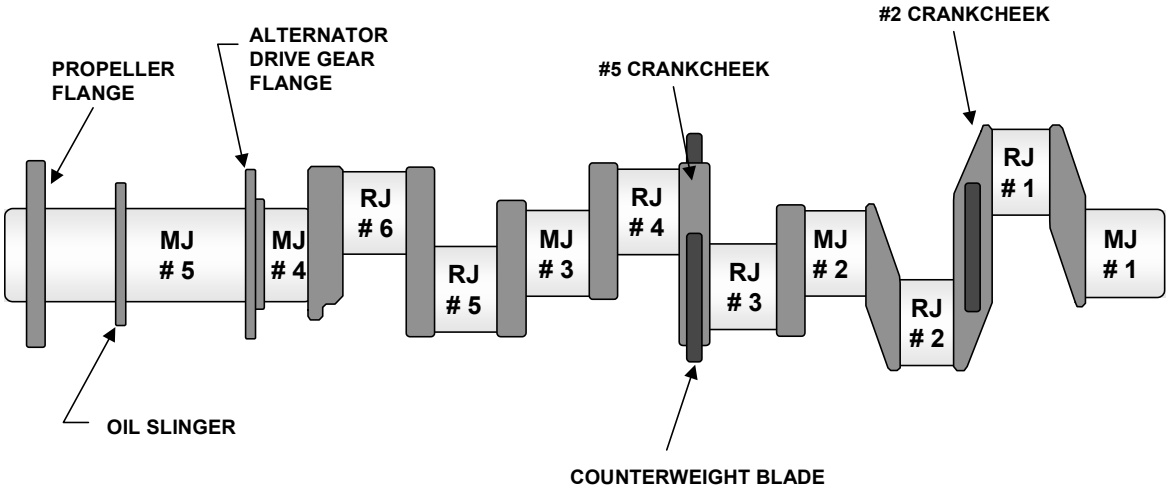

Figure 2-6. Crankshaft

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.

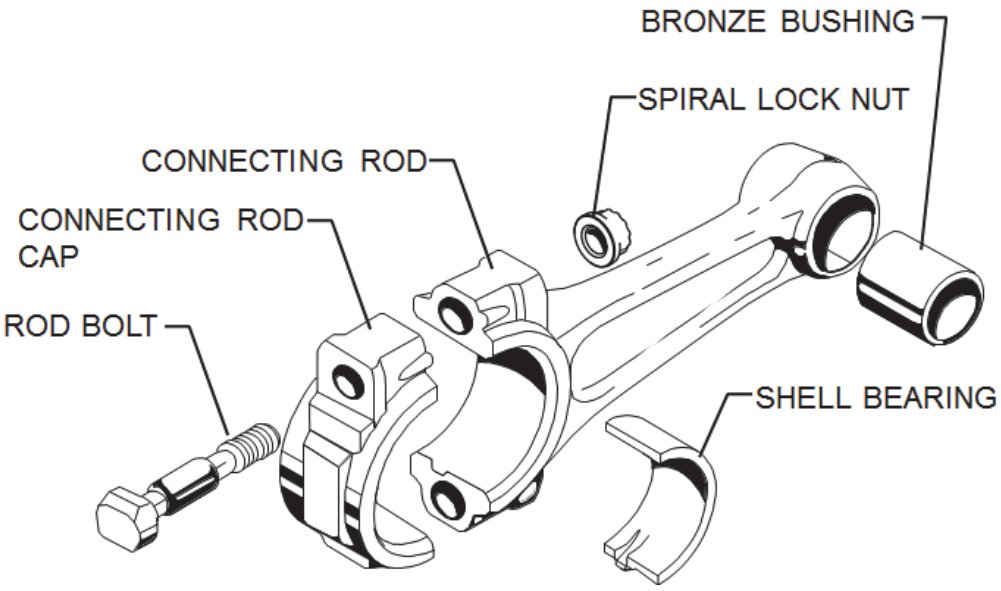

Figure 2-7. Connecting Rod

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.

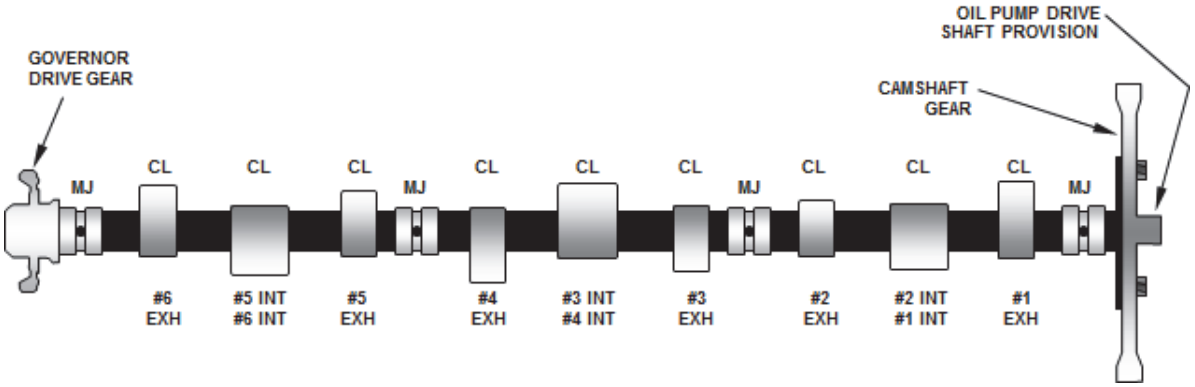

Figure 2-8. Camshaft

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.

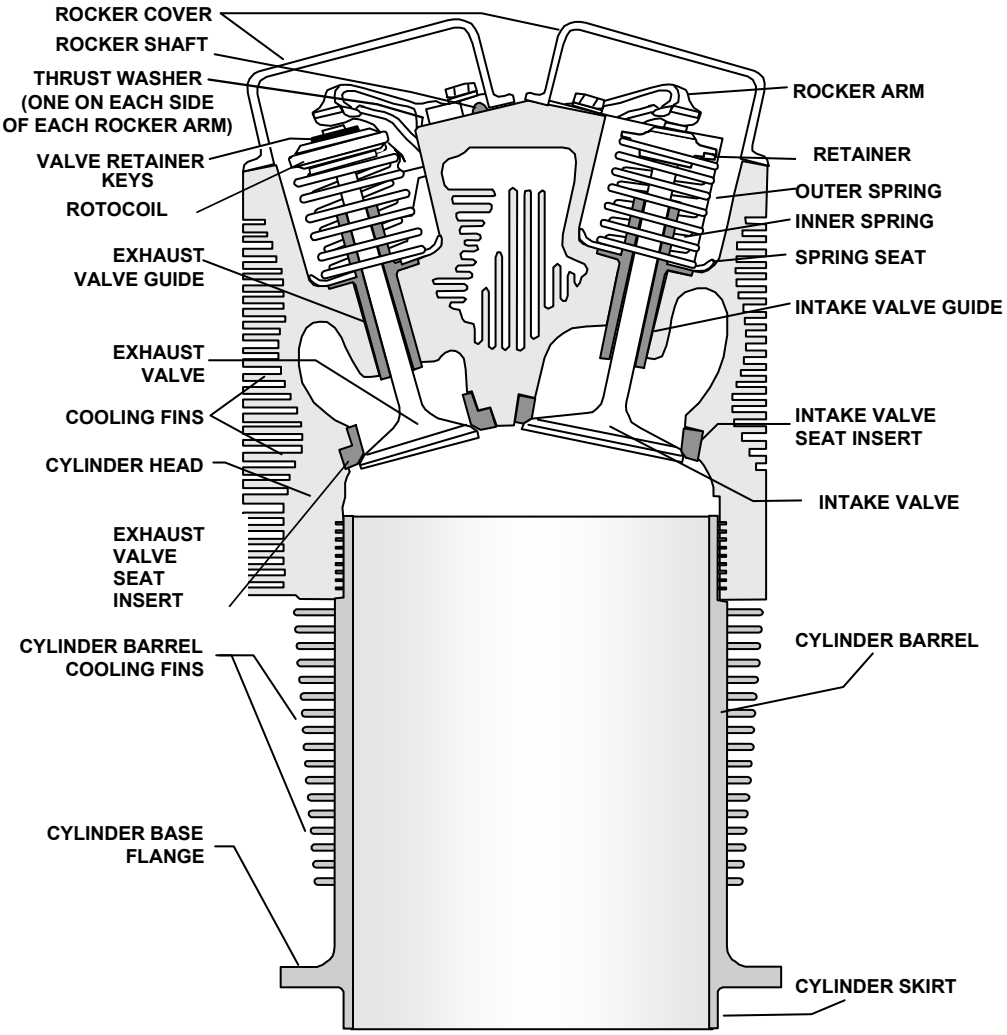

Figure 2-9. Cross-flow Cylinder Features

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.

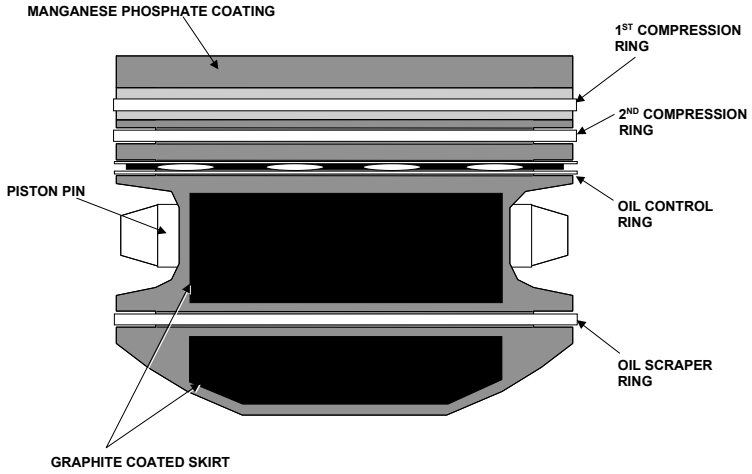

Figure 2-10. Piston Features

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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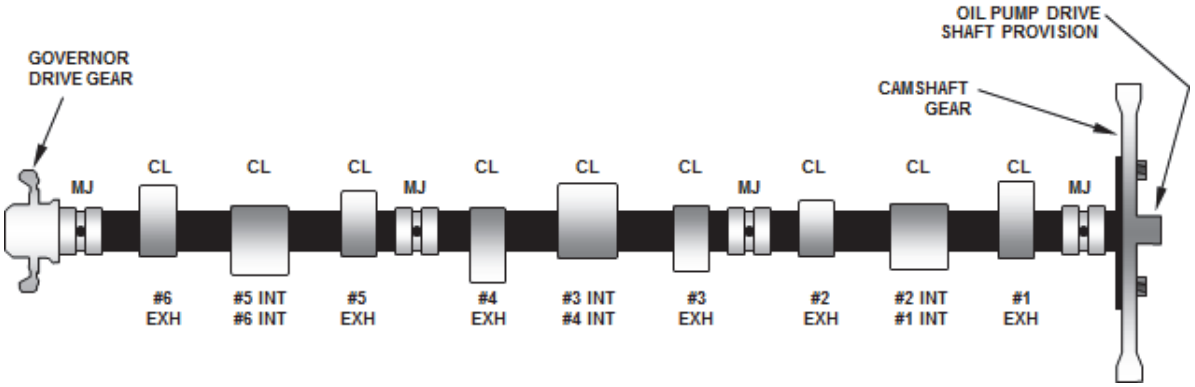
The camshaft is forged from aircraft quality steel, machined on four main journals with nine ground and hardened lobes and a gear mounted flange at the rear of the camshaft. The main journals ride within the crankcase camshaft bores. Four unequally spaced bolts attach the gear to the camshaft. Camshaft 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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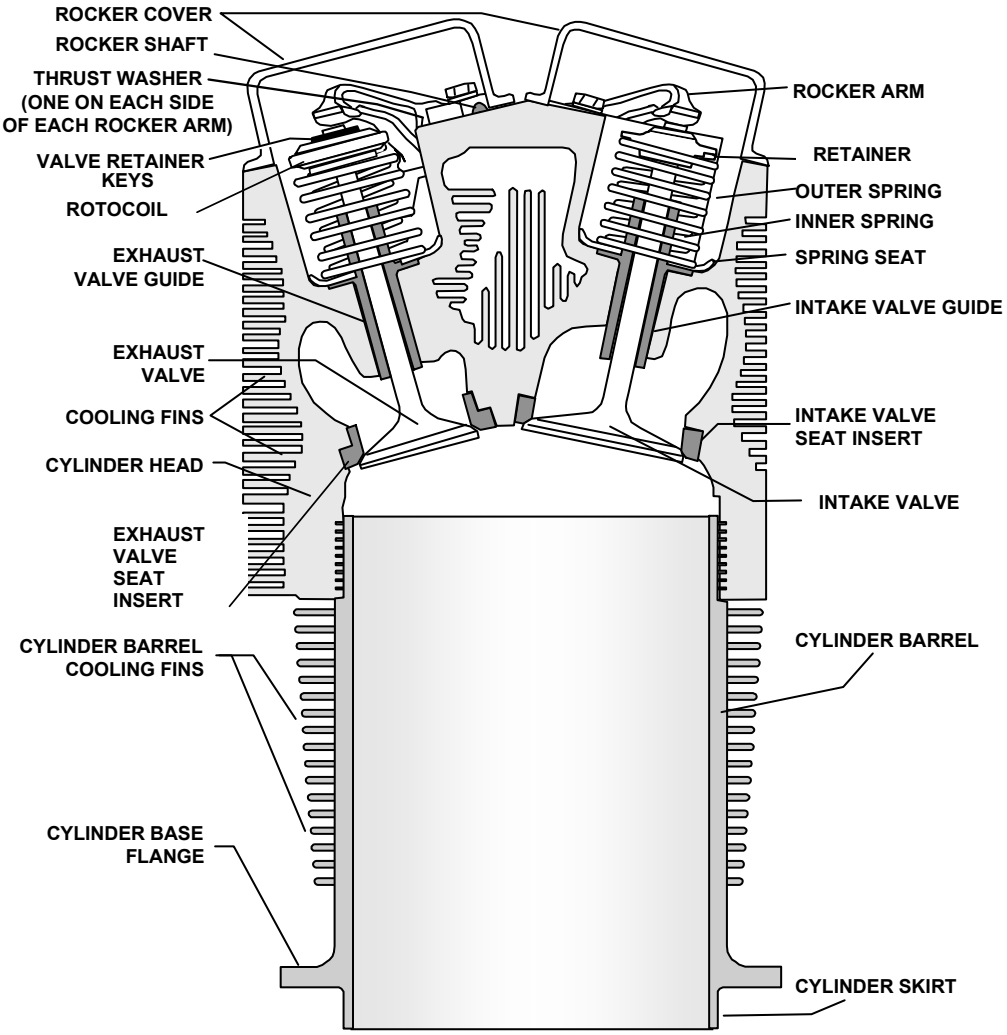

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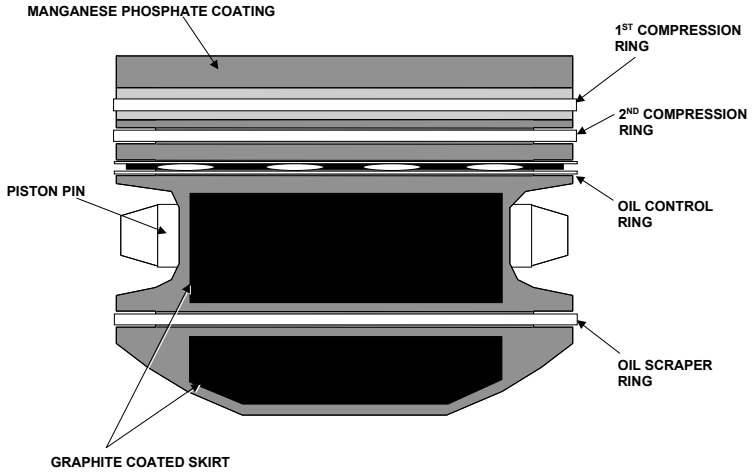

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The TSIO-550 Permold Series engines incorporate a downdraft balanced port induction system with an engine mounted throttle body. Engine manifold pressure is controlled by the throttle plate and is measured at the 0.125-27 NPTF port located on the induction 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.

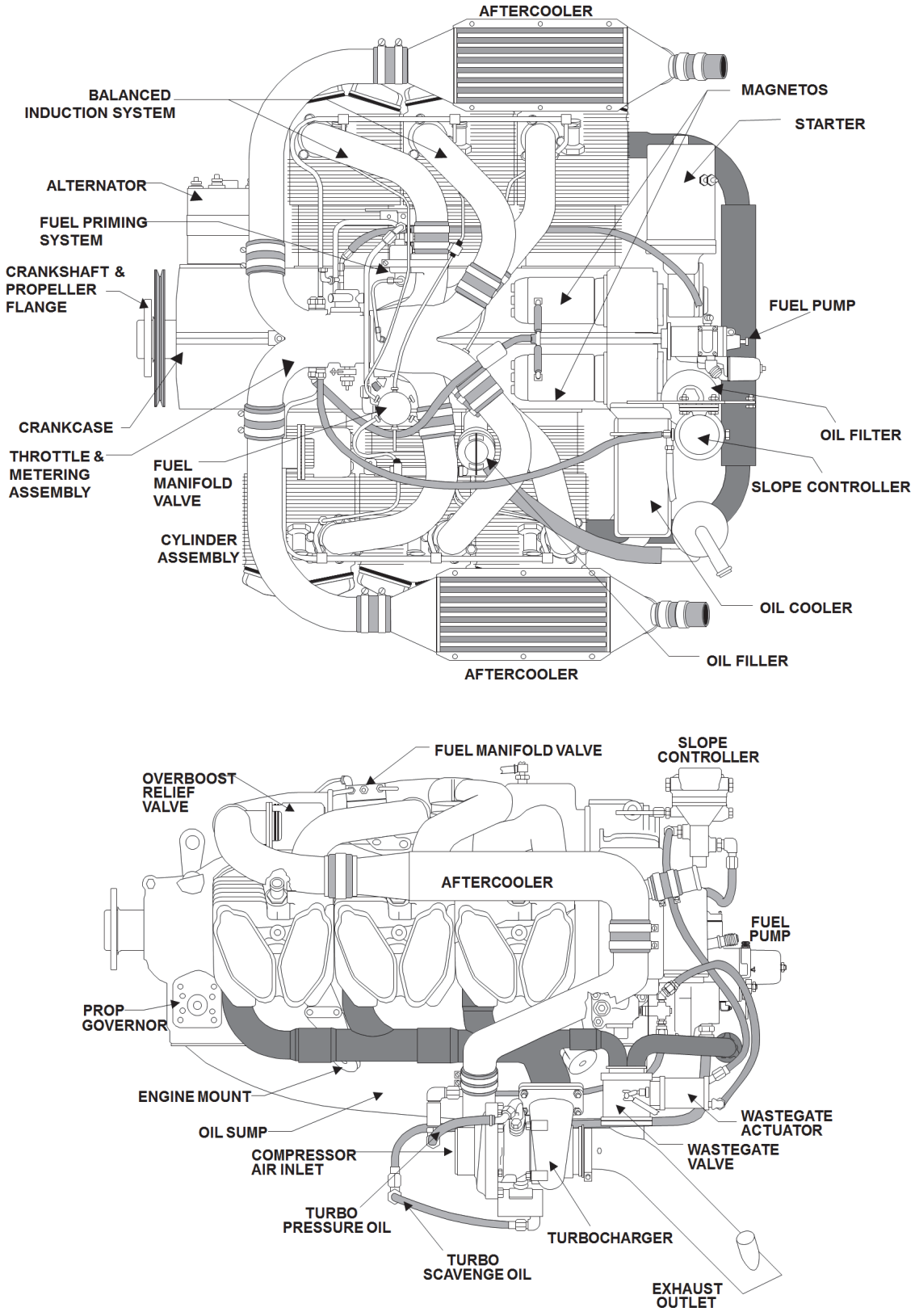

Figure 2-1. TSIO-550 Typical Top and Side Views

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).

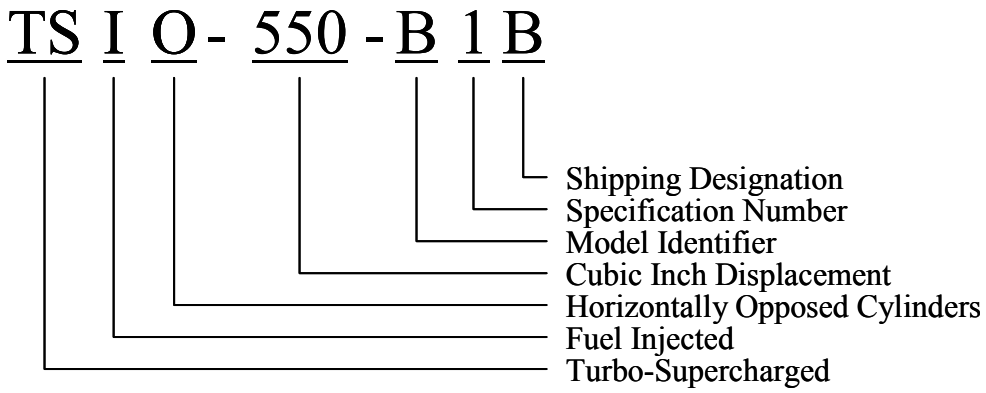

Figure 2-2. Engine Model Definition

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.

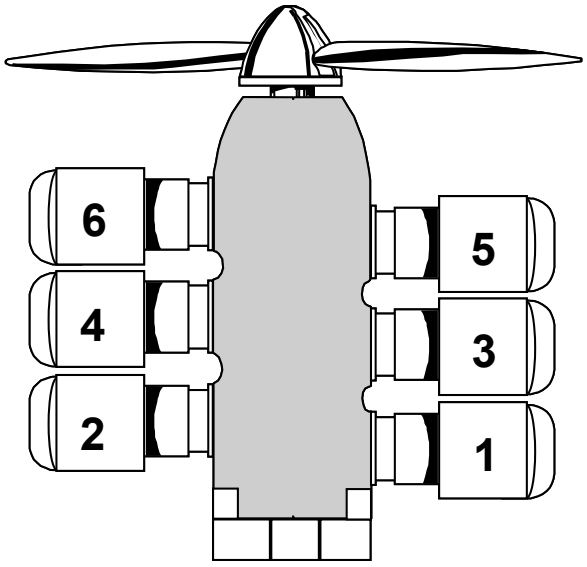

Figure 2-3. Cylinder Number Designation

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.

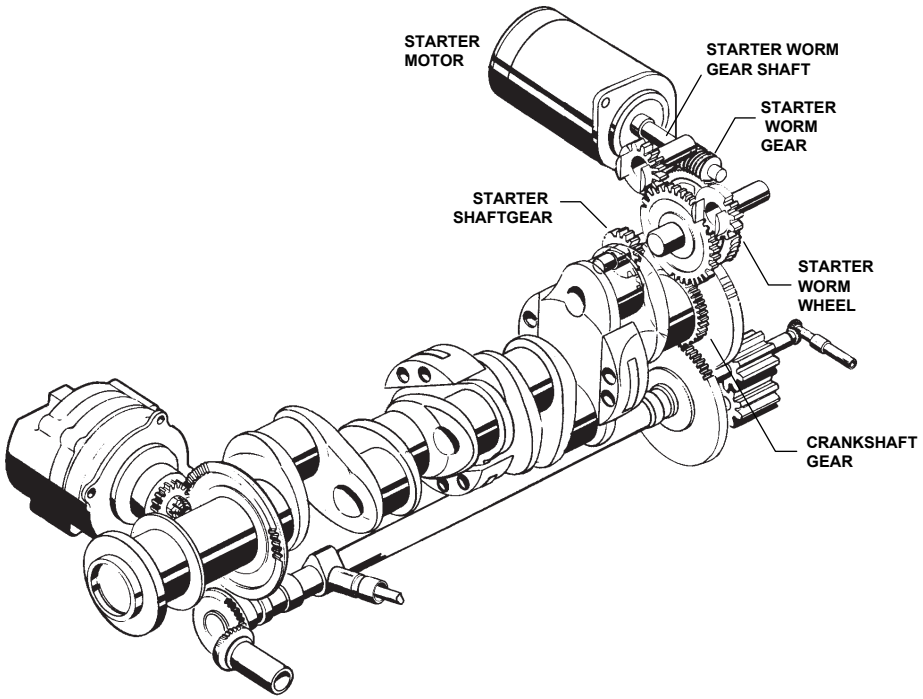

Figure 2-17. Starting System

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.

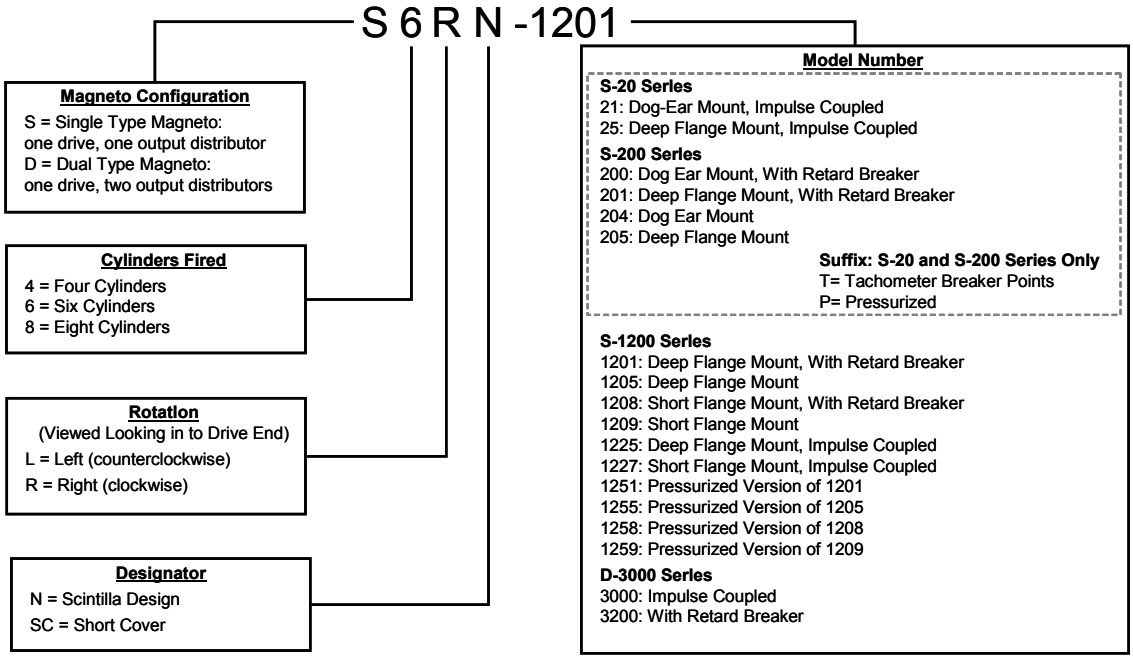

Figure 2-18. Continental Motors Magneto Model Number Structure

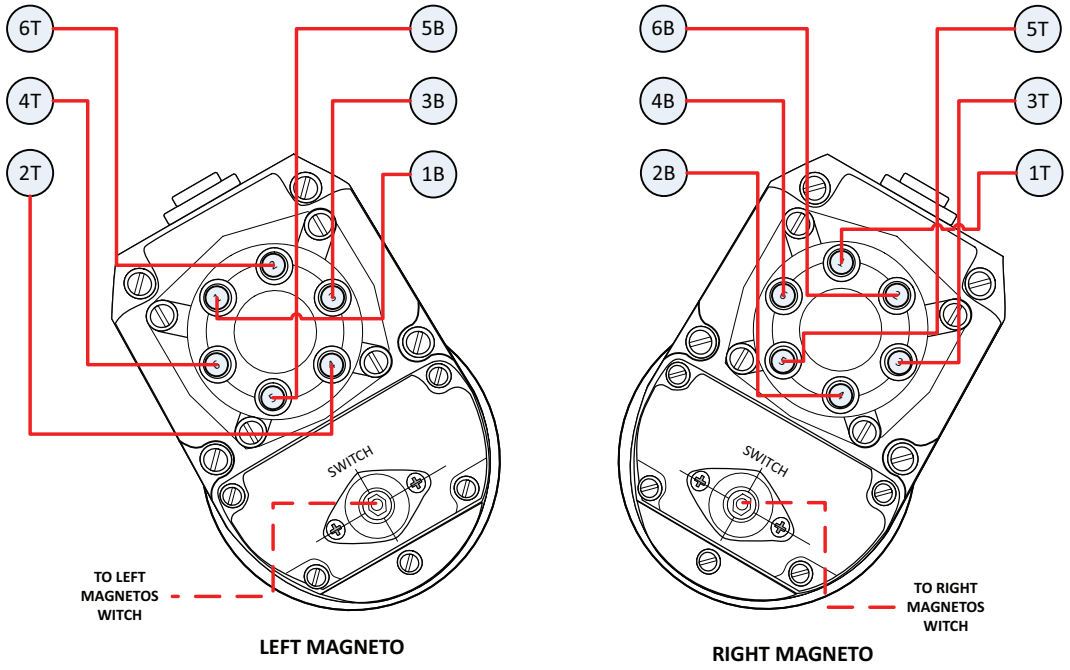

Figure 2-19. Continental Motors Ignition System Schematic

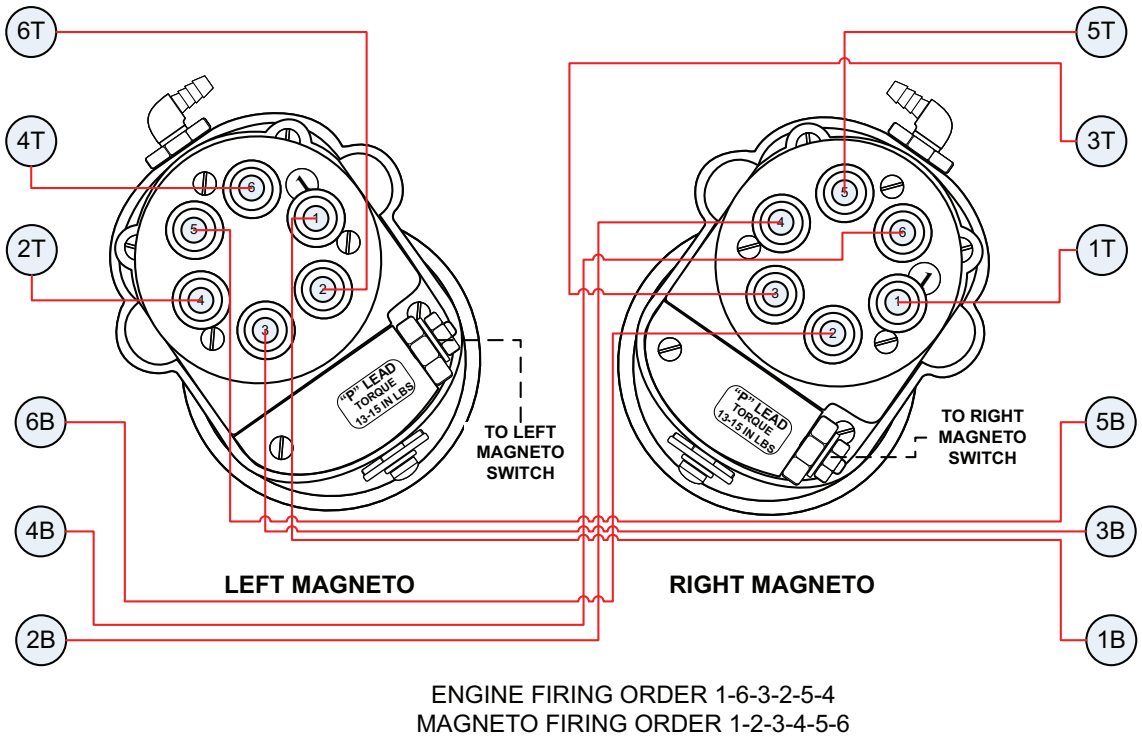

Figure 2-20. Champion (Slick) Ignition System Schematic

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.

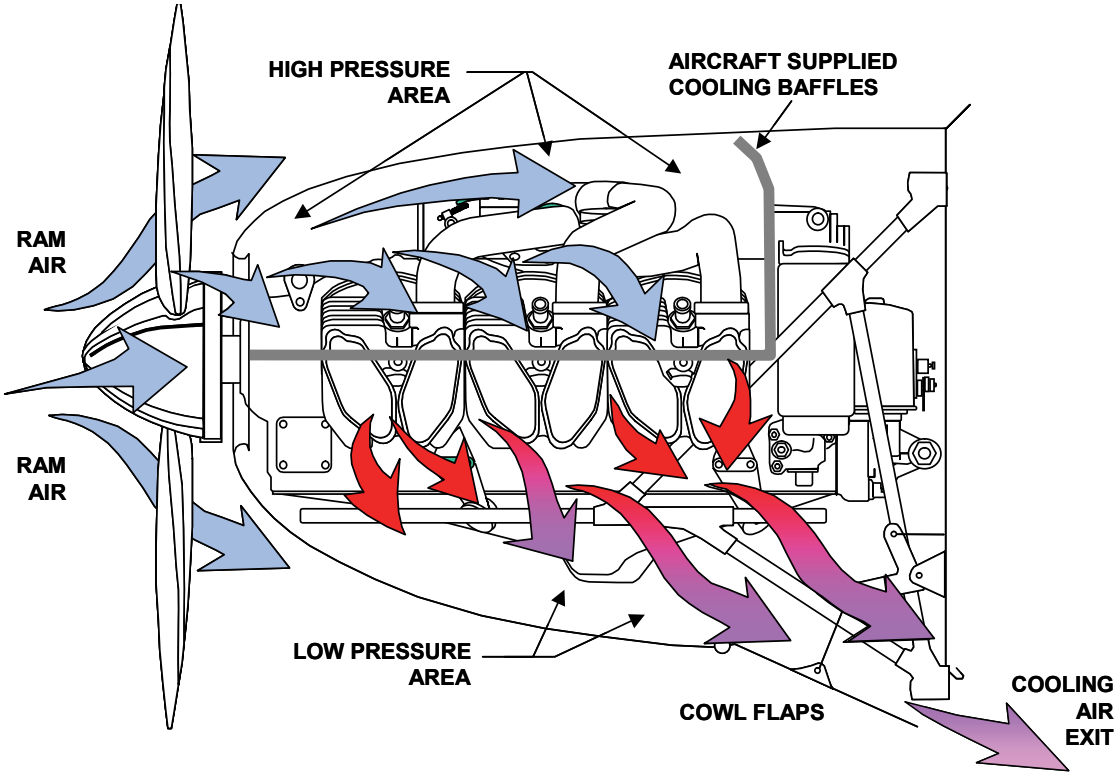

Figure 2-21. Engine Cooling

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.

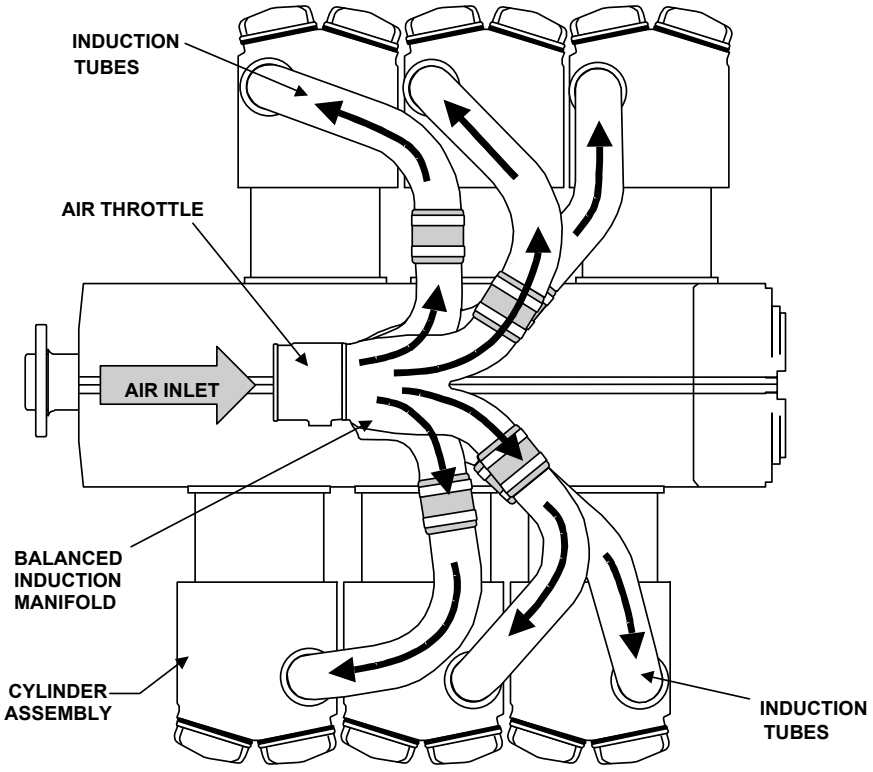

Figure 2-22. Typical Cross-flow Induction System

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.

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.

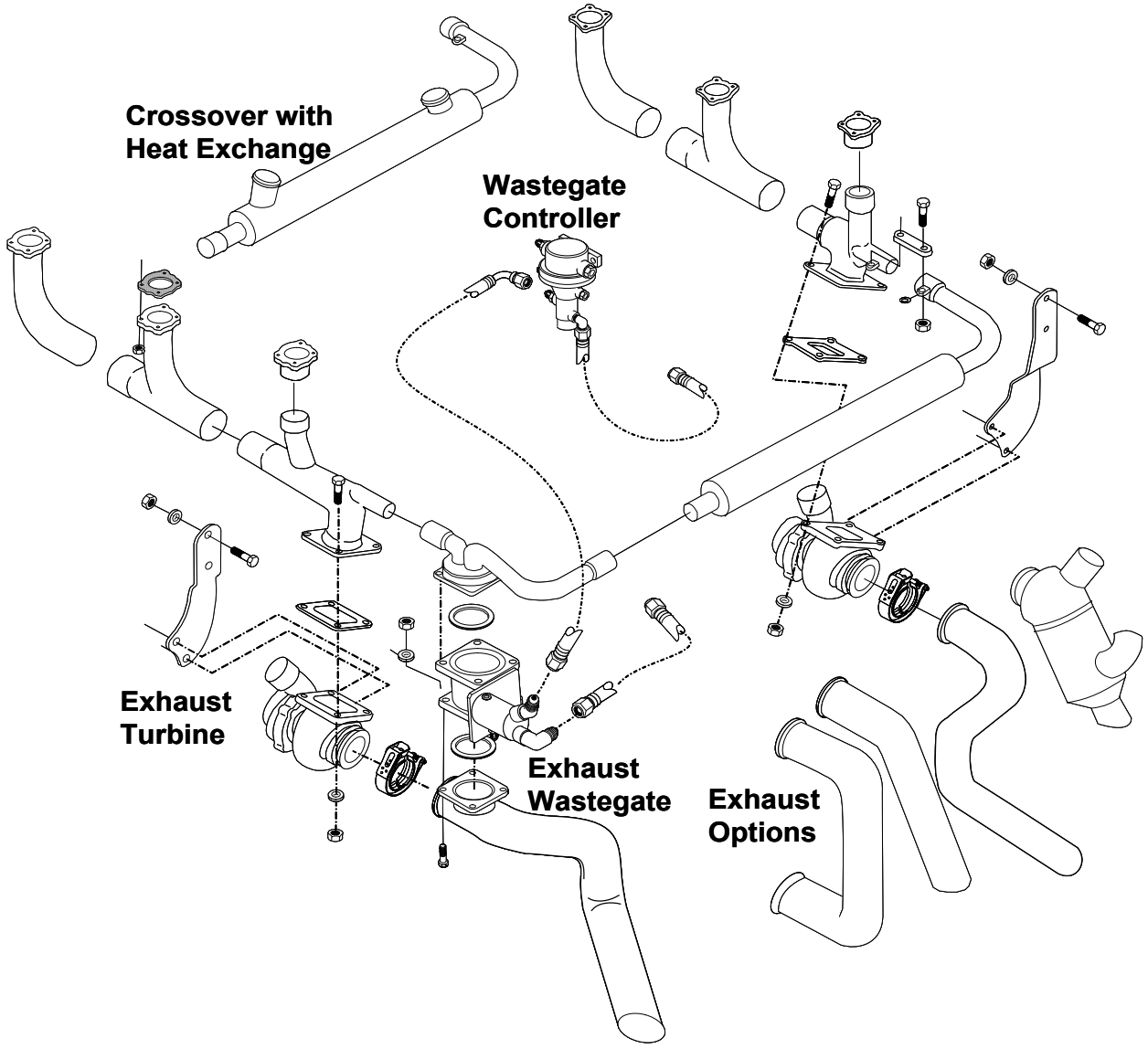

Figure 2-23. Typical Turbocharger and Exhaust System

2-3. Engine Specifications

Table 2-1. TSIO-550 Series Engine Characteristics

General		
FAA Type Certificate	E5S0	
Installation Drawing Number	(B) 653021 (C) 646618 & 656791 (E) 646618 (G) 657154 (K) 657645 (N) 658233	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	7.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Time Between Overhaul (TBO)	Refer to M-0, Section 6-3	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	552 cubic inches	9.05 L
Ignition		
Ignition Timing	24° BTC ± 1°	
Magneto Type	(B) (C) (E) Champion (Slick) 6320 (two) (G) CMI S6RSC-25P (two) (K) (N) 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) (N) 2.5 (8.46)	
Cylinder Head Temperature		
Maximum Cruise Operational Temperature[1]	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
	(K) 420°F[2]	215°C[2]
Minimum Take-off Temperature	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

Crankshaft Speed, Brake Horsepower & Manifold Pressure	
Rated Maximum Continuous Operation[1] @ Maximum rated Crankshaft Speed @ Maximum rated Manifold Pressure	**B** 350 bhp -0% +5% @2700 rpm@ 38.0 in. Hg **C** 310 bhp -0% +5% @2600 rpm@ 35.5 in. Hg **E** 350 bhp -0% +5% @2700 rpm@ 38.5 in. Hg **G** 310 bhp -0% +5% @2700 rpm@ 34.0 in. Hg **K** 315 bhp -0% +5% @2500 rpm@ 37.5 in. Hg **N** 315 bhp -0% +5% @2500 rpm@ 37.5 in. Hg
Crankshaft Speed (Maximum rated)	**B** 2700 rpm **C** 2600 rpm **E** 2700 rpm **G** 2700 rpm **K** 2500 rpm **N** 2500 rpm
Critical Altitude (feet)	**B** 12000 **C** 18000 **E** 18000 @ 2700 rpm @ 38.5 in. Hg 22000 @ 2500 rpm @ 31.0 in. Hg 25000 @ 2500 rpm @ 27.5 in. Hg **G** 22000 **K** 18000 **N** 18000
Engine Idle Speed, Minimum	600 rpm
Maximum Recommended Cruise Power	**B** 262 bhp @ 2500 rpm @ 30.5 in. Hg **C** 262 bhp @ 2500 rpm @ 30.5 in. Hg **E** 262 bhp @ 2500 rpm @ 30.5 in. Hg **G** 262 bhp @ 2500 rpm @ 30.5 in. Hg **K** 262 bhp @ 2500 rpm @ 30.5 in. Hg **K** 232 bhp @ 2500 rpm @ 27 in. Hg[2] **N** 262 bhp @ 2500 rpm @ 30.5 in. Hg
Minimum Cruise RPM	2300 RPM

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

Oil		
Oil Pressure - Normal Operation @ 100° to 240°F (38° to 116°C)[1]	30 to 60 psig	
Maximum Allowable Oil Pressure (cold oil)[1]	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[1]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[1]	240°F	116°C
Minimum Take-off Oil Temperature[1]	100°F	38°C
Oil Sump	C G K N	B E
Fill Capacity	8.0 qts. (7.6L)	12.0 qts. (11.3L)
Usable Oil - 16° Nose Up (8 qt fill), 20° Nose Up (12 qt fill)	5.0 qts. (4.7L)	7.5 qts. (5.8L)
Usable Oil - 10° Nose Down (8 qt fill), 14.5° Nose Down (12 qt fill)	4.5 qts. (4.3L)	6.5 qts. (5.6L)
Recommended Oil Grade, SAE - above 40° F	50 or Multi-viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi-viscosity	
Oil Grade	See M-0, Section 3-1	
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

Fuel System	
Fuel Control System	Continuous Flow Fuel Injection
Certified Fuel Specifications	
Minimum Fuel Grade	Refer to M-0, Table 7-1 and Table 7-2 for authorized fuels and applicable engines
Regional Fuel Specifications	
Russian Commonwealth of Independent States	Refer to M-0, Table 7-1 and Table 7-2
People's Republic of China	Refer to M-0, Table 7-1 and Table 7-2
Fuel Injection System Pressure	
Unmetered Fuel Pressure, 600 RPM, psig (kPa)	7.0-9.0 (48.3-62.1)
Unmetered Fuel Pressure[1], Rated Power, psig (kPa)	
Unmetered Fuel Pressure, 2700 RPM	B 32.0-36.0 (220.6-248.2)
Unmetered Fuel Pressure, 2600 RPM	C 26.0-29.0 (179.2-199.9)
Unmetered Fuel Pressure, 2700 RPM	E 32.0-36.0 (220.6-248.2)
Unmetered Fuel Pressure, 2500 RPM	G 20.5-23.5 (141.3-162.0) [2]
Unmetered Fuel Pressure, 2500 RPM	K N 20.5-28.5 (141.3-196.5)
Metered Nozzle Pressure[3] [4], psid (kPa)	
Metered Nozzle Pressure, 2700 RPM	B 15.3-16.9 (105.5-116.5)
Metered Nozzle Pressure, 2600 RPM	C 12.7-13.9 (87.6-95.8)
Metered Nozzle Pressure, 2700 RPM	E 15.3-16.9 (105.5-116.5)
Metered Nozzle Pressure, 2500 RPM	G 12.4-13.6 (85.5-93.8)[2]
Metered Nozzle Pressure, 2500 RPM	K N 14.2-14.8 (97.9-102.0)
Fuel Injection Pump Inlet Pressure: psig (kPa) Maximum allowable pressure above 1500 RPM with boost pump off Minimum Pressure at maximum flow condition Recommended flight minimum	 6.0 (41.4) -2.0 (-14) -1.0 (-6.9)
Fuel Vapor Return Outlet, psig (kPa) Maximum allowable at maximum flow Recommended flight maximum	 3.5 (24.2) 2.5 (17.2)
Fuel Flow	
Fuel Flow, lb./hr (kg/hr), including return flow: Fuel Flow vs. Brake Horsepower	B Figure 2-24 C Figure 2-27 E Figure 2-30 G Figure 2-33 K Figure 2-36 N Figure 2-36
Fuel Injection System Adjustment Specifications:	Refer to M-0, Section 6-4.7

Table 2-4. TSIO-550 Fuel System Specifications

Fuel Vapor Return Outlet Flow, lb/hr (kg/hr): Maximum @ 23.5 psig pump outlet [5]	K 51.5 (23.4)
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. TheTSIO-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
5. May be determined using a calibrated in-line flow measuring device. Otherwise use metered fuel pressure specifications. Refer to aircraft manufacturer's maintenance manual for method of verifying accuracy of fuel flow indicator.

Table 2-5. TSIO-550 Fuel Consumption

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.

	B E		C		G		K N	
Power Level	BHP (kW)	lbs./hr (max)	BHP (kW)	lbs./hr (max)	BHP (kW)	lbs./hr (max)	BHP (kW)	lbs./hr (max)
Rated Power, 100%	350 (261)	255	310 (231)	224	310 (231)	210	315 (235)	220
Cruise, 85%	---	---	263.5 (196)	162	263.5 (196)	155	---	---
Cruise, 83.5%	---	---	---	---	---	---	262 (195)	143
Cruise, 75%	263 (196)	157	232.5 (173)	143	232.5 (173)	128	236 (176)	128
Cruise, 65%	228 (170)	125	201.5 (150)	126	201.5 (150)	102	205 (153)	110
Cruise, 55%	193 (138)	108	---	---	---	---	---	---

Table 2-6. Induction

Mass Flow	
B Sea level, standard day conditions, 350 bhp (261 kW)	40.0 lb/min (18.1 kg/min)
C Sea level, standard day conditions, 310 bhp (231 kW)	41.0 lb/min (18.6 kg/min)
E Sea level, standard day conditions, 350 bhp (261 kW)	50.2 lb/min (22.8 kg/min)
G Sea level, standard day conditions, 310 bhp (231 kW)	40.2 lb/min (18.2 kg/min)
K N Sea level, standard day conditions, 315 bhp (235 kW)	41.5 lb/min (18.8 kg/min)
Induction Manifold Temperature	
K Maximum @ rated take-off power (ASTM D7592 only)	130°F (54.4°C)
K Maximum @ maximum cruise power (ASTM D7592 only)	115°F (46.1°C)

Table 2-7. Propeller

Moment of Inertia	
Engine Idle RPM	**Minimum (in.·lb.·sec.^{2})**
800	15
700	16

Table 2-8. Physical Dimensions and Weight

Engine Physical Characteristics						
	B	C	E	G	K	N
Weight, dry, lb. (kg) +/- 2.5%	571 (259)	565 (257)	566 (257)	554 (251)	522.8 (237)	522.8 (237)
Overall Dimensions, inches (mm)						
Height	33.5 (851)	33.5 (851)	33.5 (851)	35.4 (899)	34.0 (864)	28.46 (723)
Width	42.5 (1080)	42.5 (1080)	42.5 (1080)	35.9 (912)	42.4 (1077)	42.4 (1077)
Length	42.6 (1082)	42.6 (1082)	42.6 (1082)	40.3 (1023)	39.2 (994)	38.7 (903)
Center of Gravity, inches (mm)						
From rear accessory case	11.4 (290)	11.4 (290)	11.4 (290)	11.4 (290)	12.7 (322)	12.7 (322)
From crankshaft centerline, below plus (+)	1.1 (27)	1.1 (27)	1.1 (27)	1.1 (27)	1.3 (33)	1.3 (33)
From crankshaft centerline, to 1-3-5 minus (-), to 2-4-6 plus (+)	0.37 (9)	0.37 (9)	0.37 (9)	0.37 (9)	-0.12 (3)	-0.12 (3)
Moment of Inertia, standard acc. package, in·lb·sec^2 (mm·kg·sec^2)						
Roll Longitudinal Axis, (Iy-y)	134.3 (946)	134.3 (946)	134.3 (946)	134.3 (946)	134.3 (946)	134.3 (946)
Pitch Lateral Axis, (Ix-x)	138.8 (1206)	138.8 (1206)	138.8 (1206)	138.8 (1206)	138.8 (1206)	138.8 (1206)
Yaw Vertical Axis, (Iz-z)	218.9 (1976)	218.9 (1976)	218.9 (1976)	218.9 (1976)	218.9 (1976)	218.9 (1976)

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

Accessory	Direction of Rotation[1]	Drive Ratio to Crankshaft	Maximum Torque (in. lbs.)		Maximum Overhang Moment, (in. lbs.)
			Cont.	Static	
Optional Tachometer	CCW	0.5:1	7	50	25
Magneto	CCW	1.5:1	-	-	-
Starter Motor	CCW	48:1	200	400	60
Alternator (gear-driven)	CCW	3:1	150	800	150
Propeller Governor[2]	CW	1:1	29	825	50
Fuel Pump	CW	1:1	25	680	60
AND20000 Pads[3]	CW	1.5:1	100	800	40
Optional Accessory Drive[4]	CCW	3:1	100	500	N/A
Oil Cooler	---	---	---	---	55 wet

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.

2-3.3.1. TSIO-550-B Performance Charts

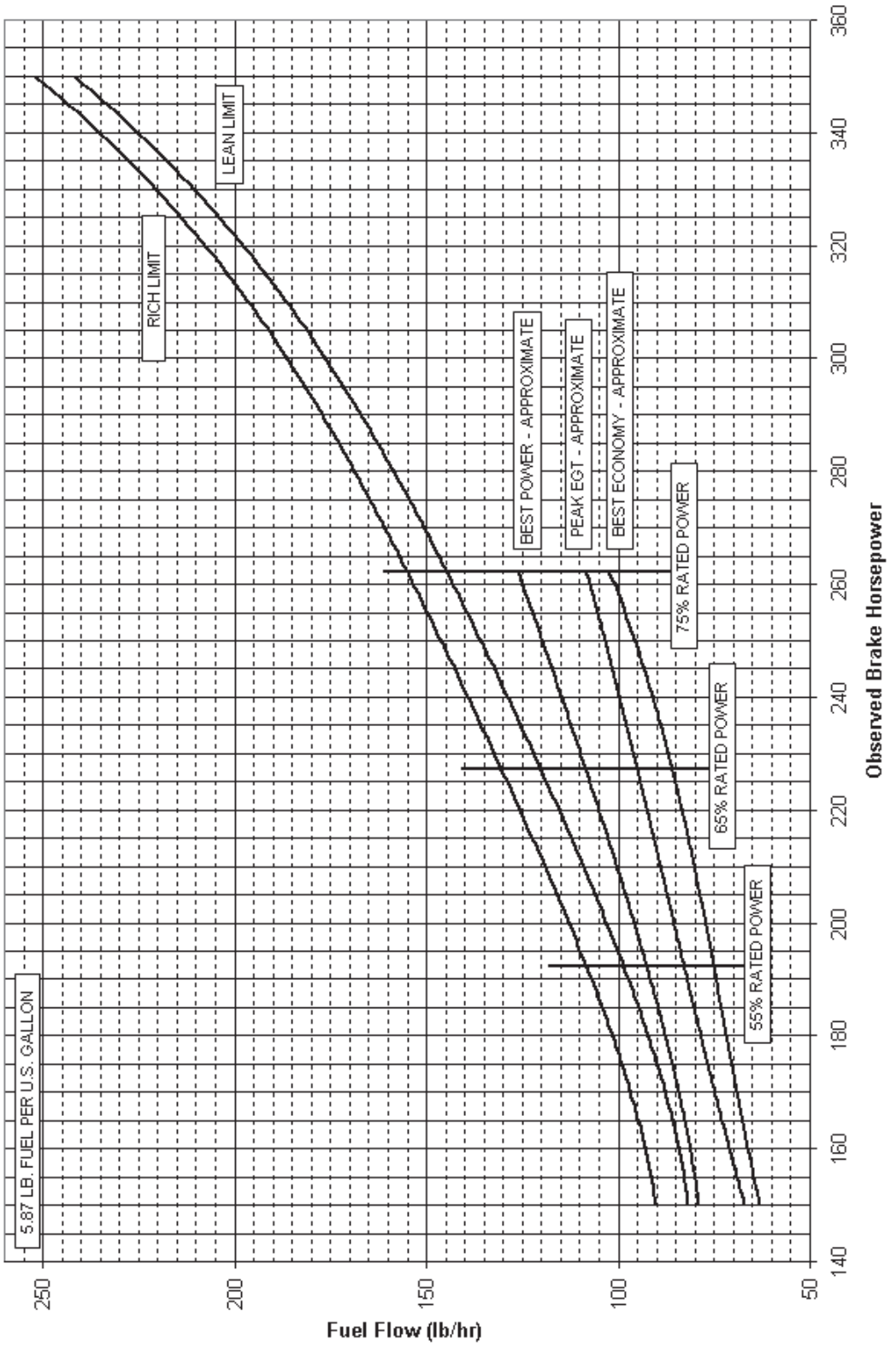

Figure 2-24. TSIO-550-B Fuel Flow vs. Sea Level Standard Brake Horsepower

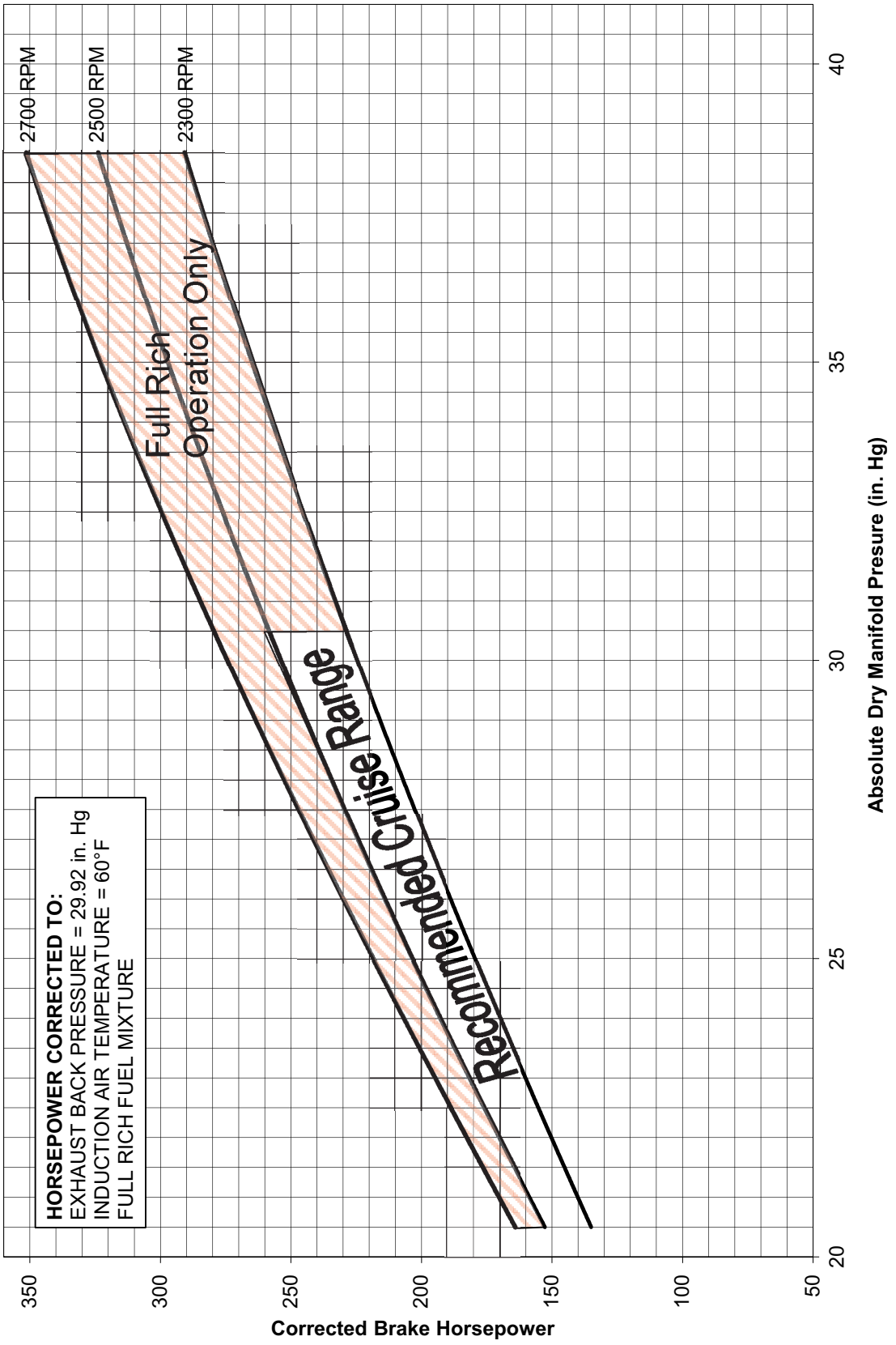

Figure 2-25. TSIO-550-B Sea Level Performance

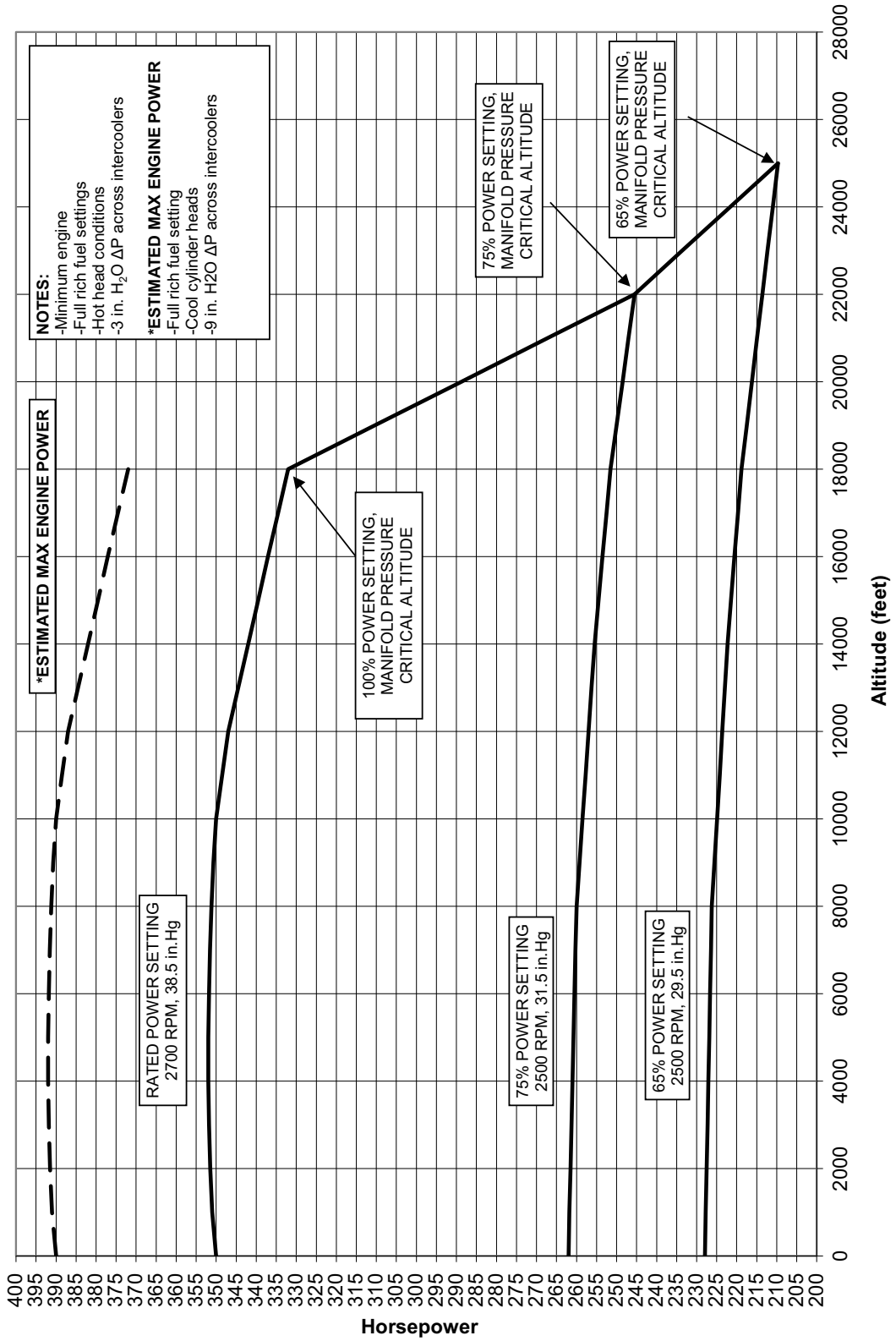

Figure 2-26. TSIO-550-B Altitude Performance

2-3.3.2. TSIO-550-C Performance Charts

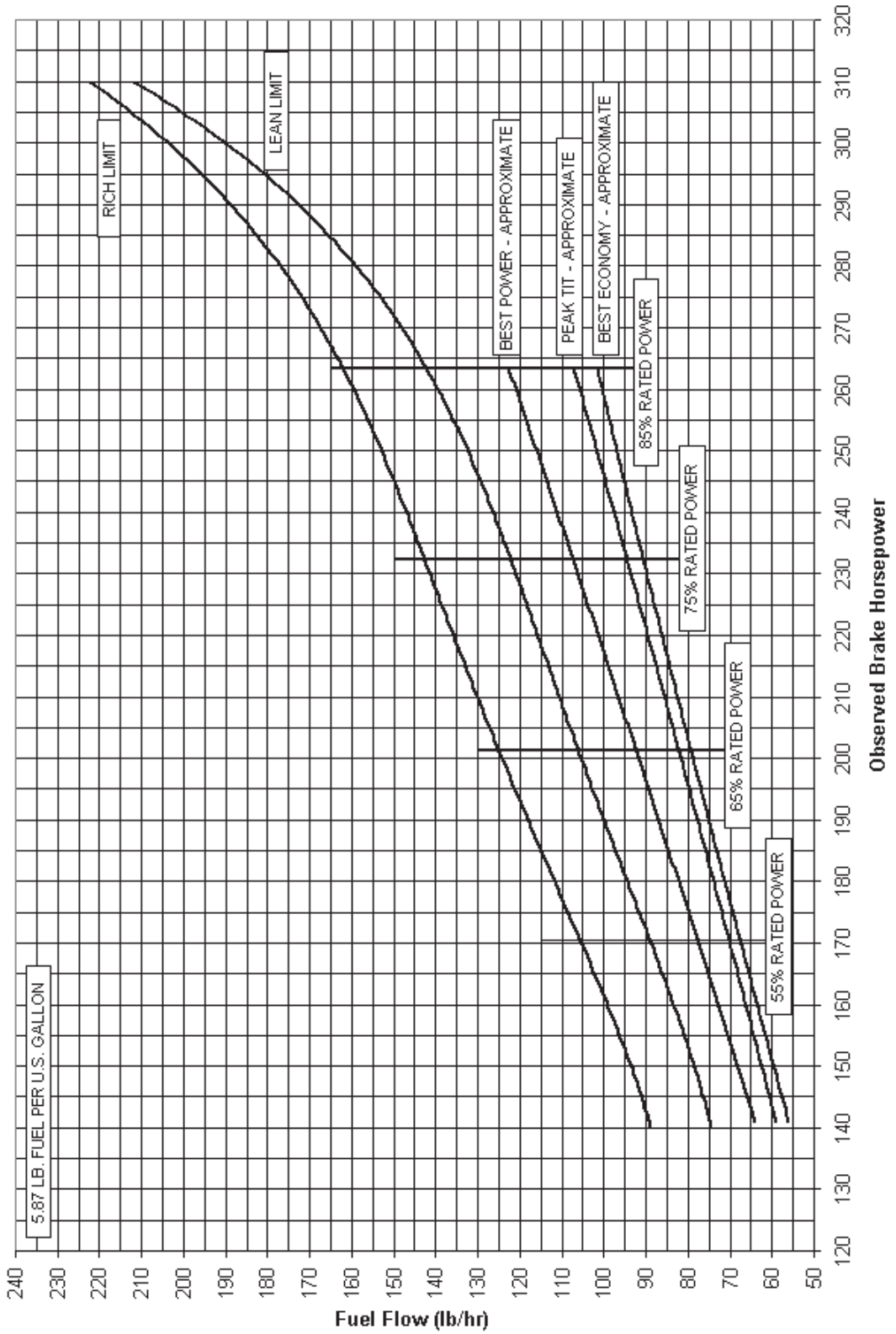

Figure 2-27. TSIO-550-C Fuel Flow vs. Sea Level Standard Brake Horsepower

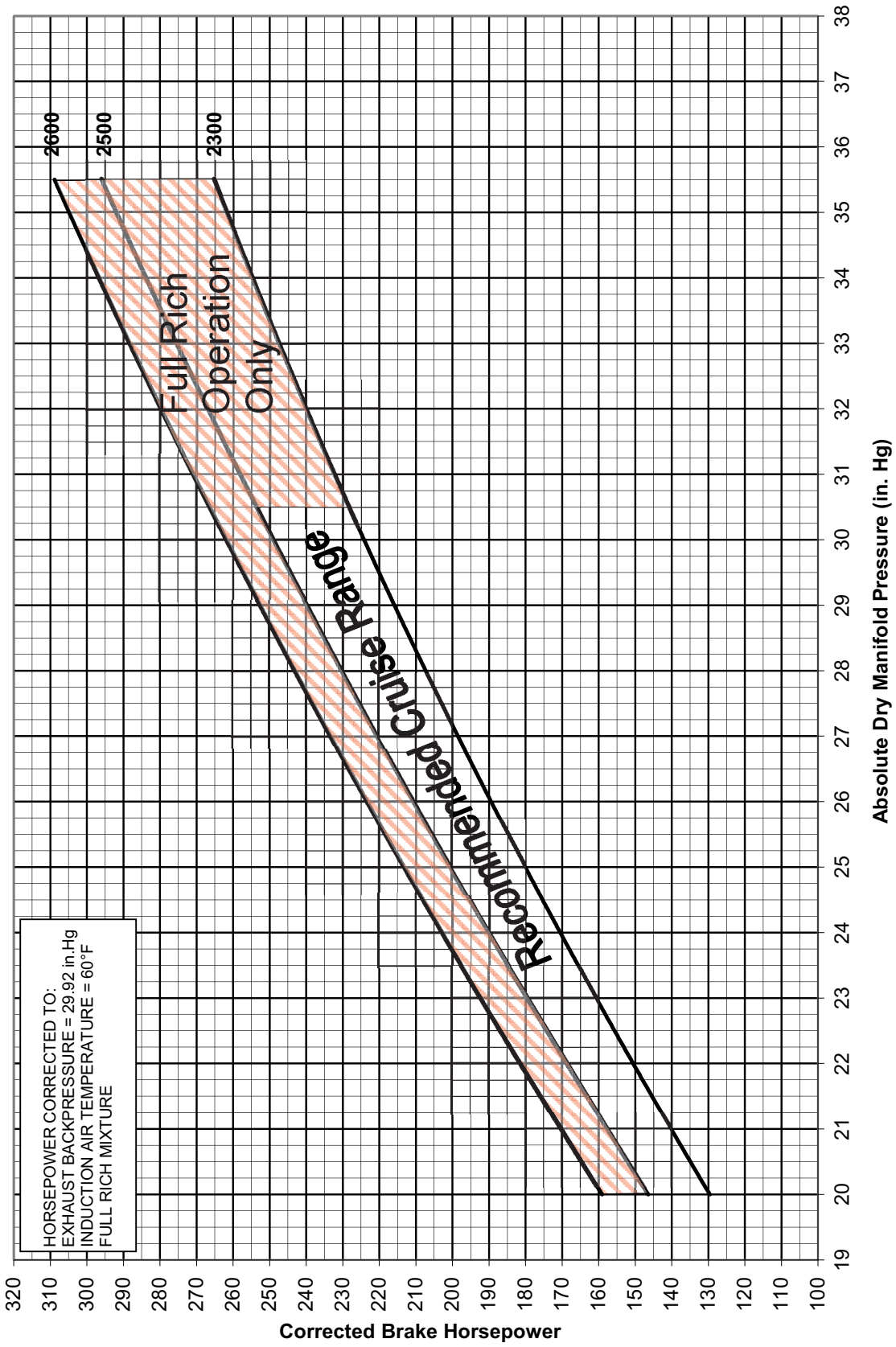

Figure 2-28. TSIO-550-C Sea Level Performance

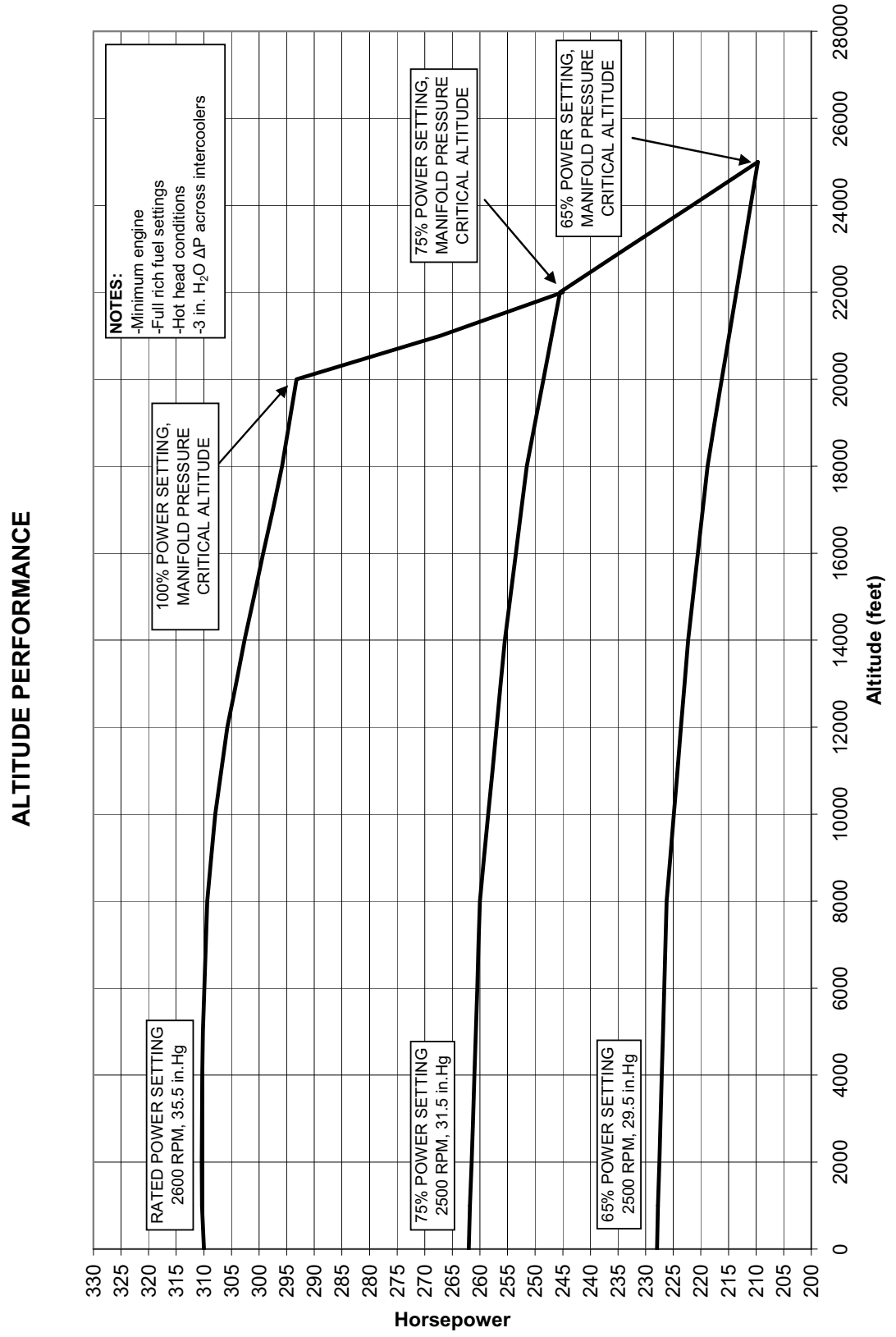

Figure 2-29. TSIO-550-C Altitude Performance

2-3.3.3. TSIO-550-E Performance Charts

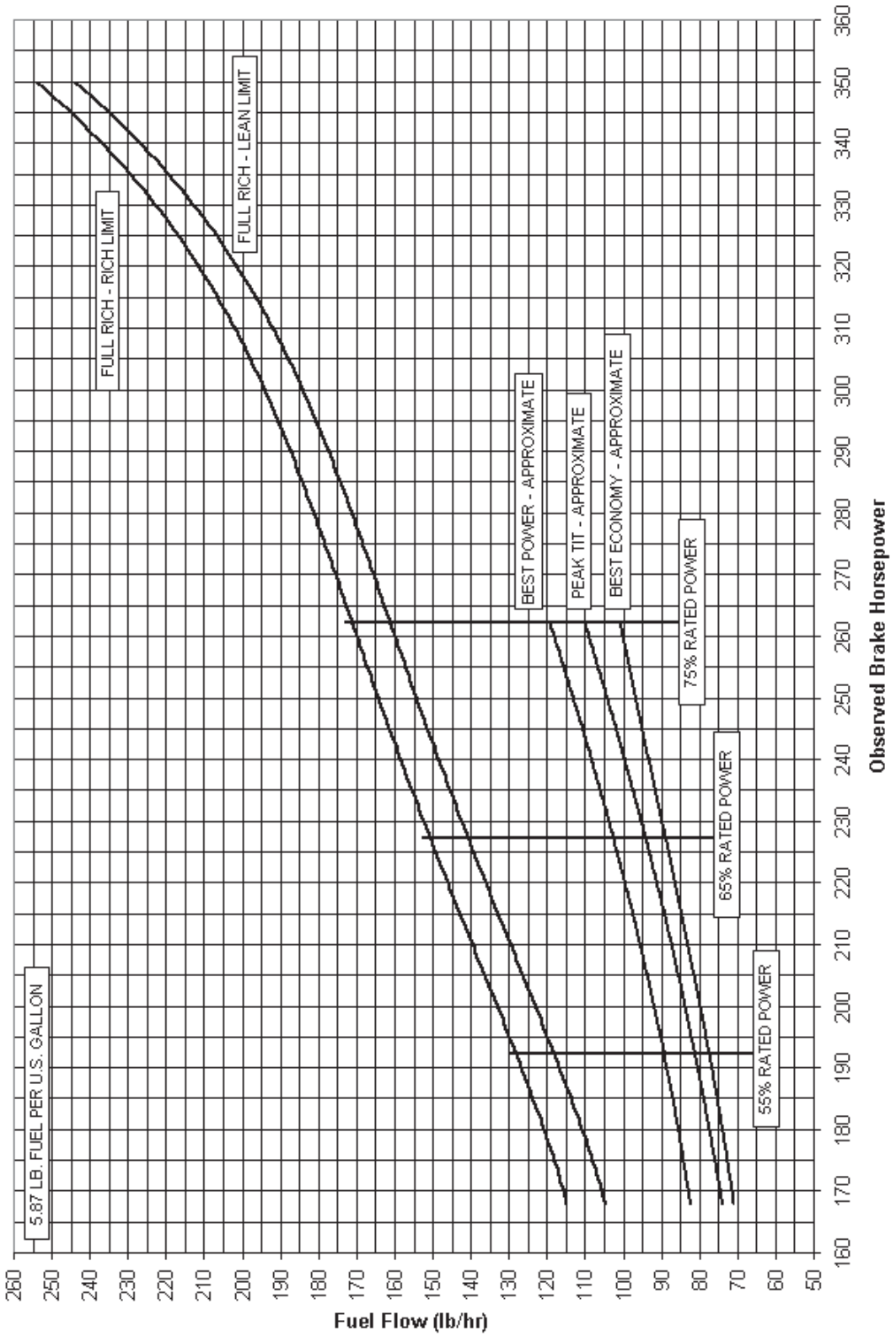

Figure 2-30. TSIO-550-E Fuel Flow vs. Sea Level Standard Brake Horsepower

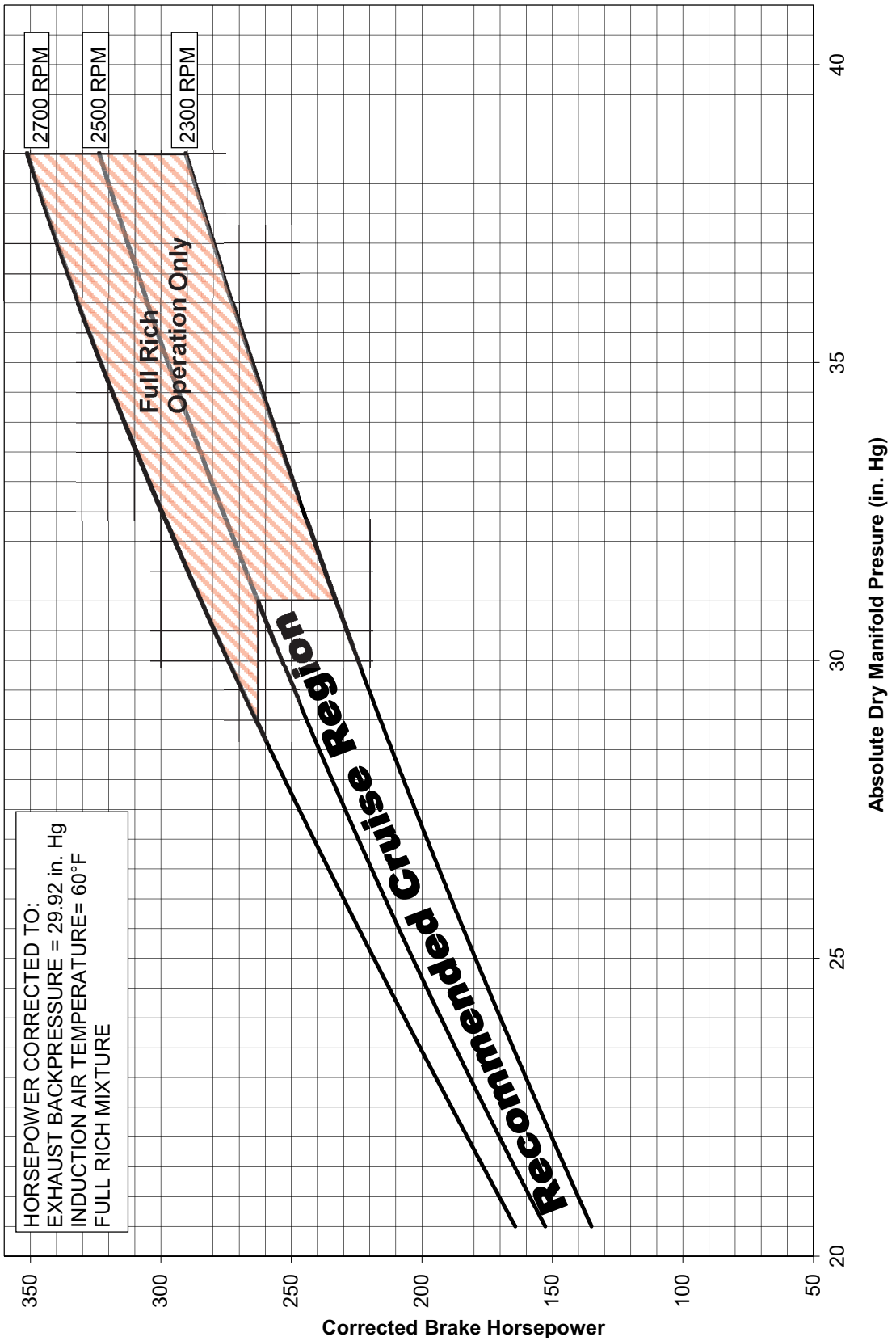

Figure 2-31. TSIO-550-E Sea Level Performance

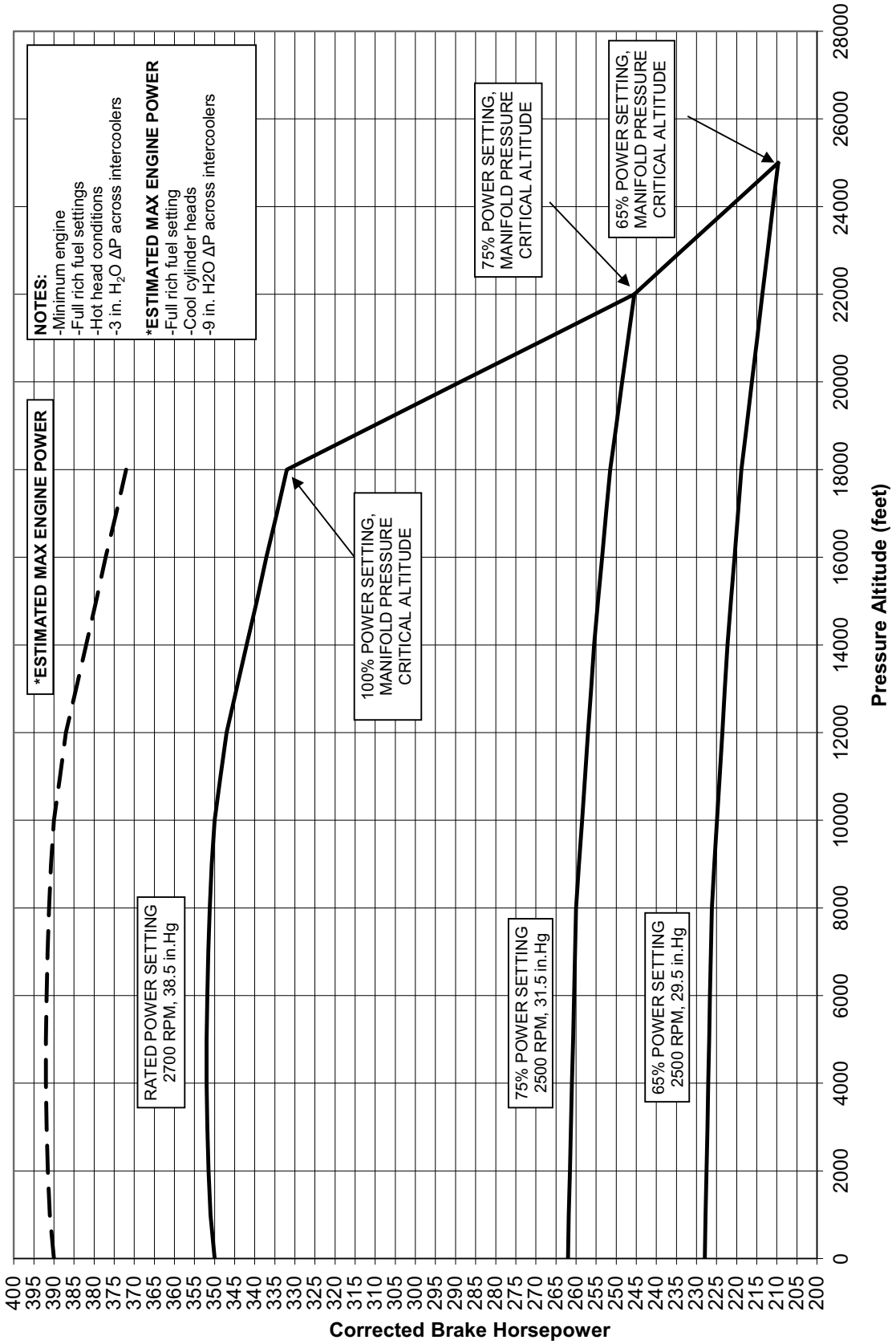

Figure 2-32. TSIO-550-E Altitude Performance

2-3.3.4. TSIO-550-G Performance Charts

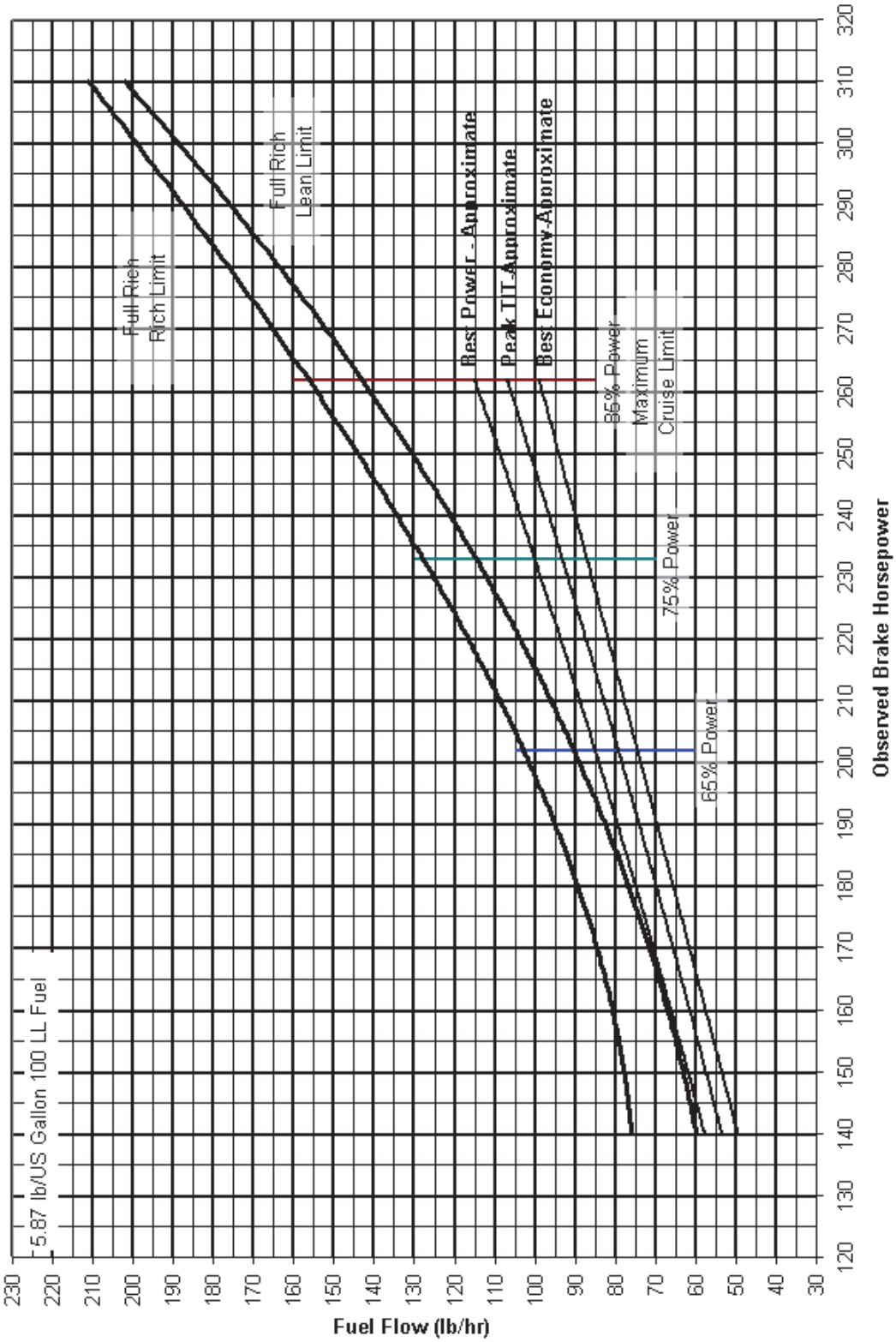

Figure 2-33. TSIO-550-G Fuel Flow vs. Sea Level Standard Brake Horsepower

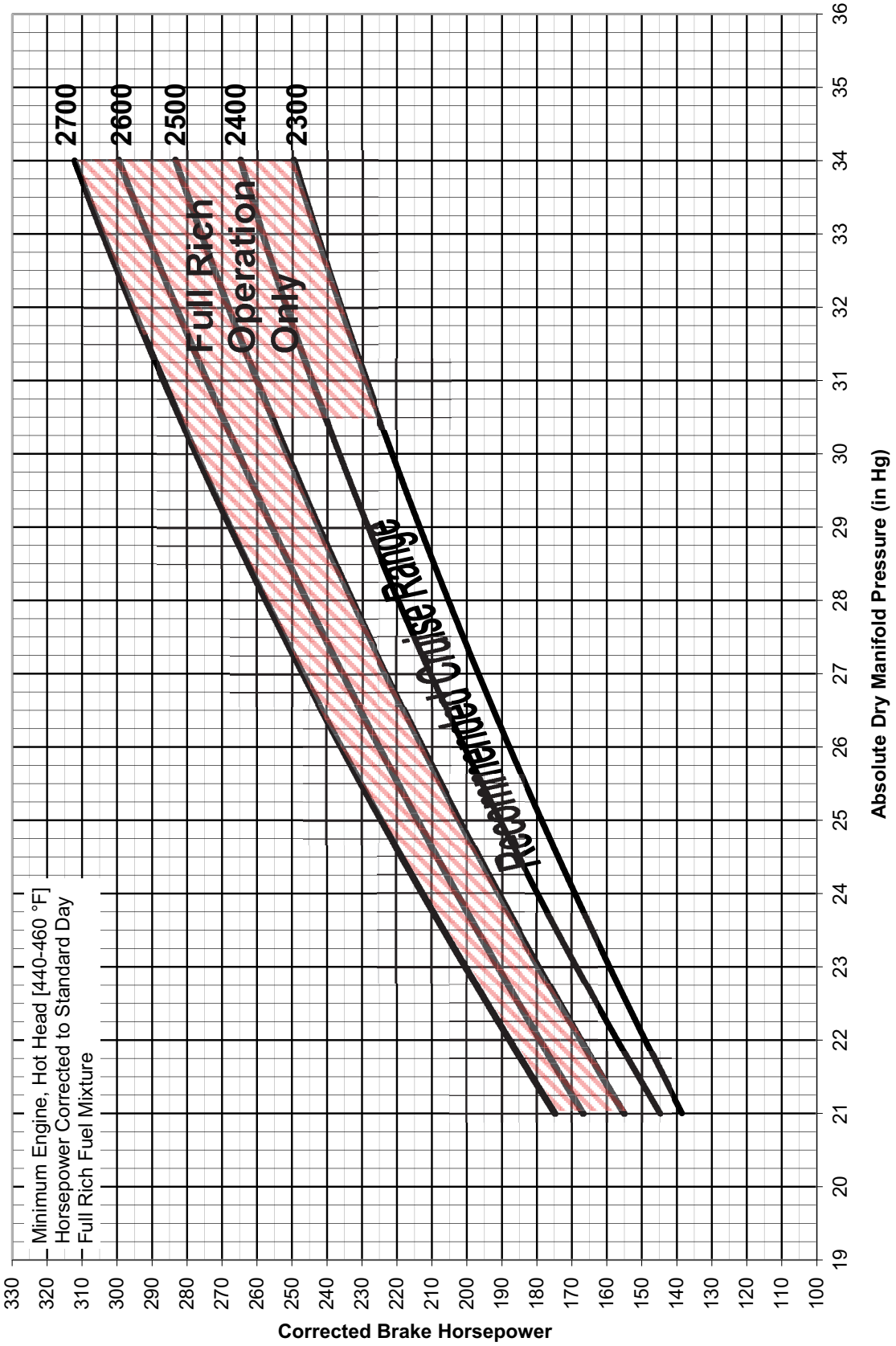

Figure 2-34. TSIO-550-G Sea Level Performance

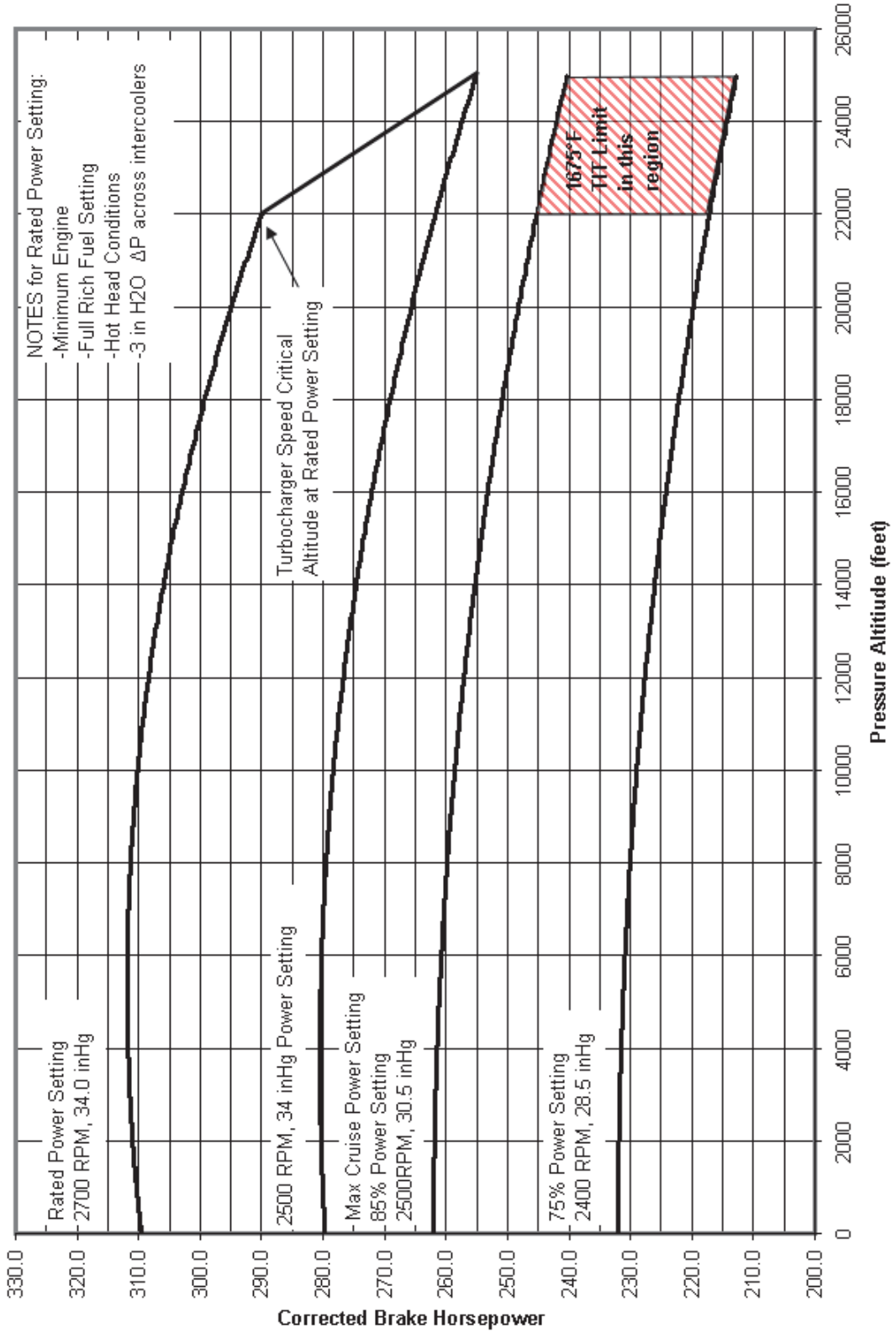

Figure 2-35. TSIO-550-G Altitude Performance

2-3.3.5. TSIO-550-K & N Performance Charts

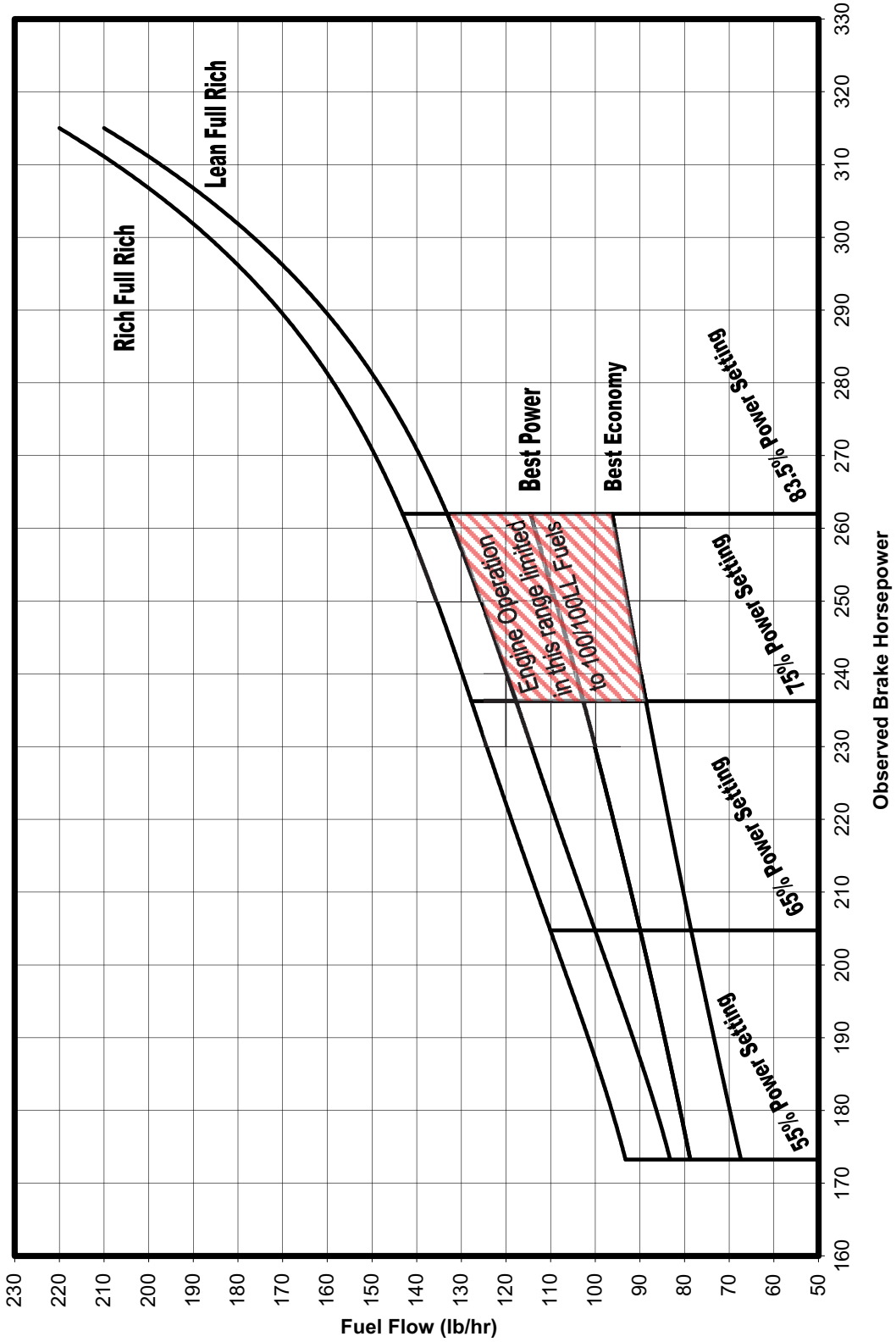

Figure 2-36. TSIO-550-K & N Fuel Flow vs. Sea Level Standard Brake Horsepower

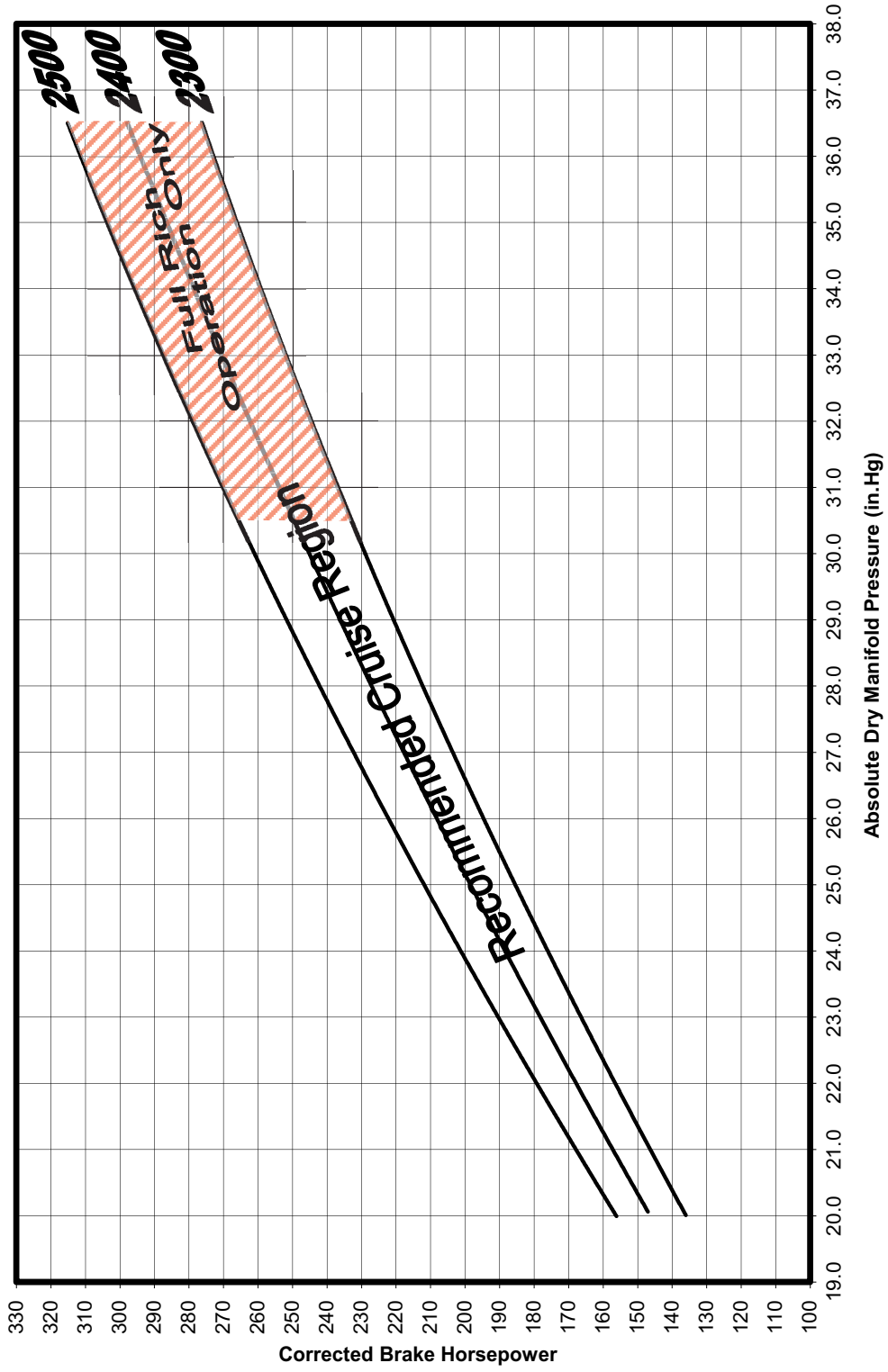

Figure 2-37. TSIO-550-K & N Sea Level Performance

2-3.4. TSIO-550 Accessory Performance Charts

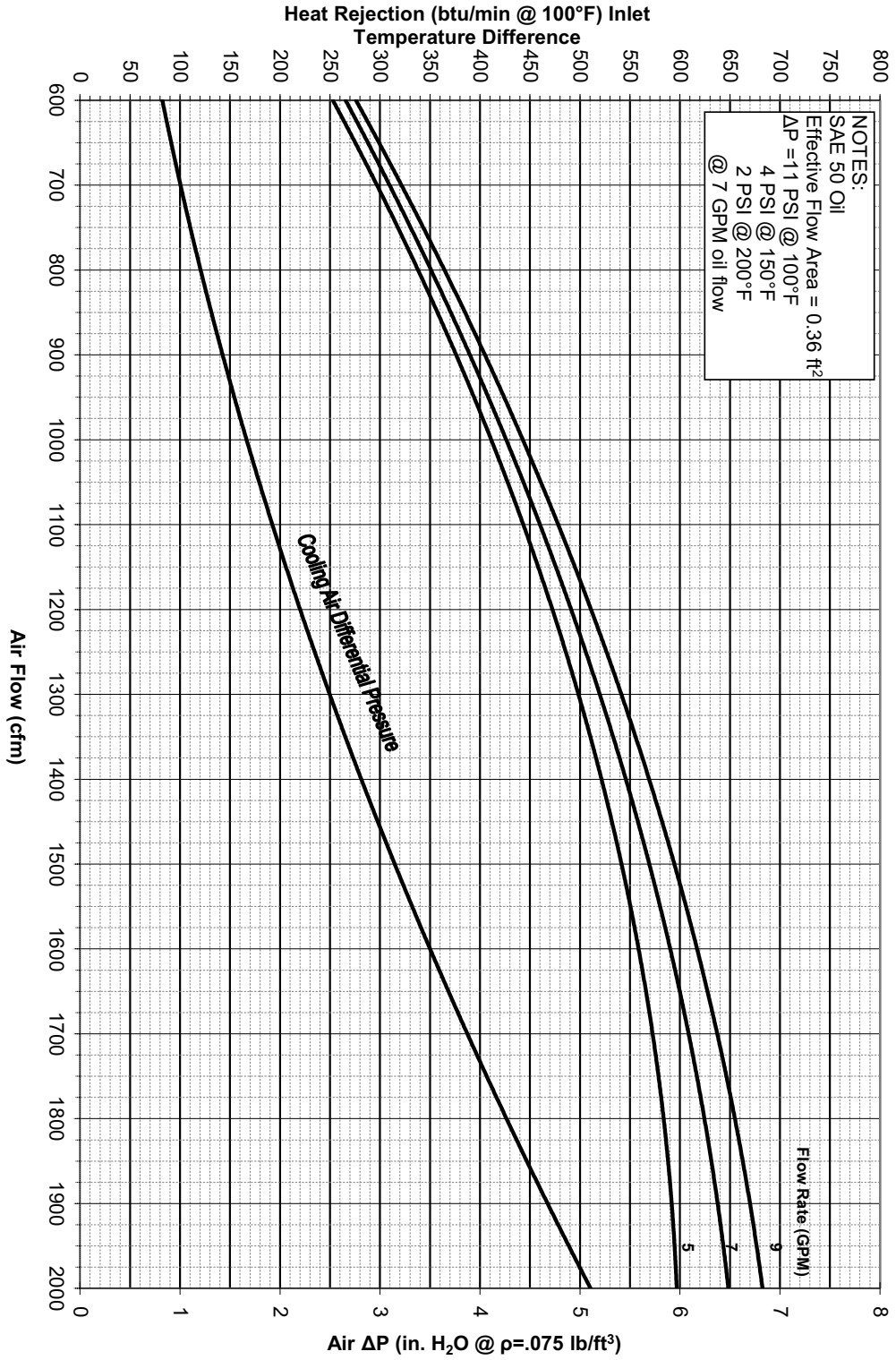

Figure 2-38. Oil Cooler Performance

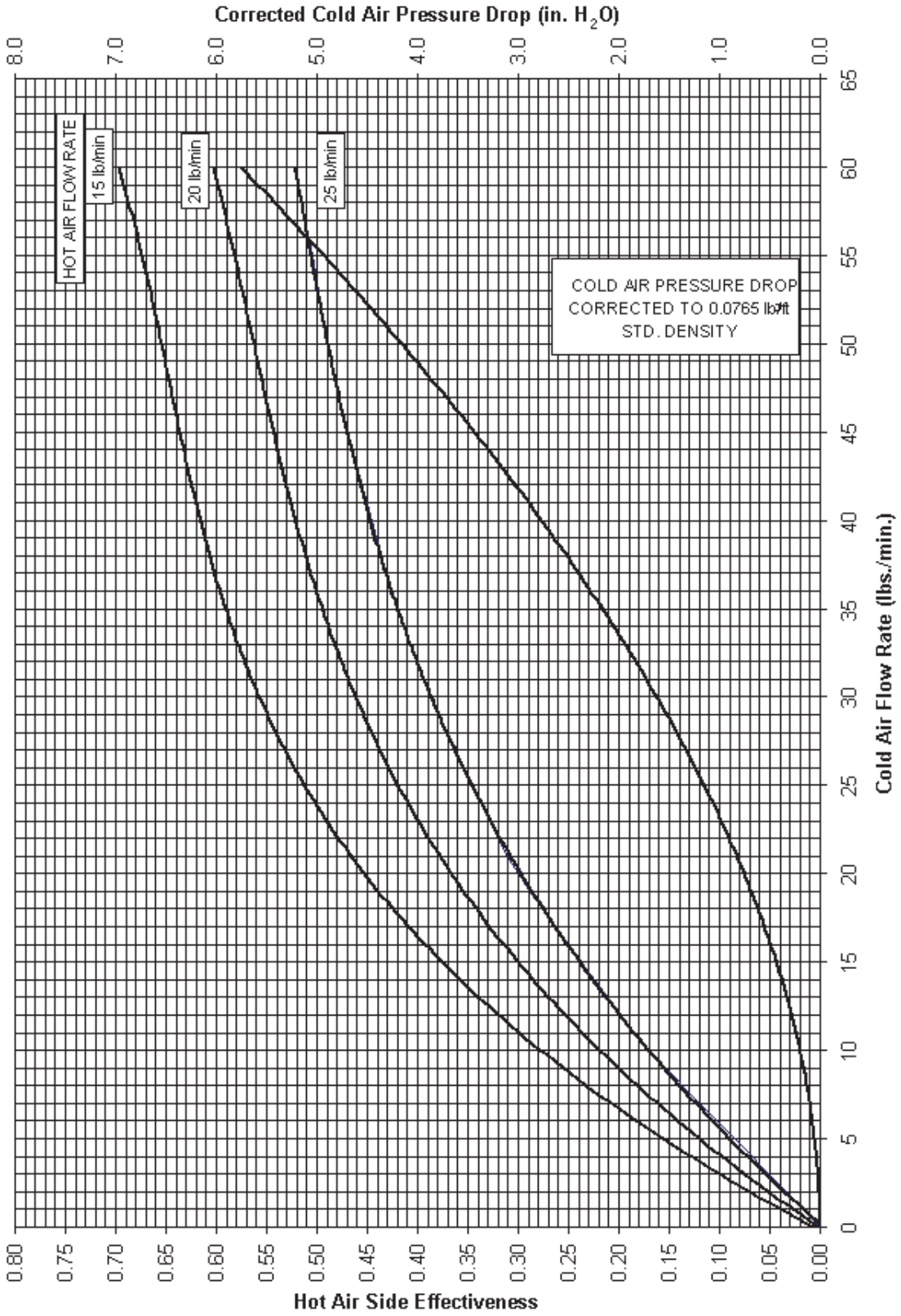

Figure 2-39. Aftercooler Performance Chart B C E K N

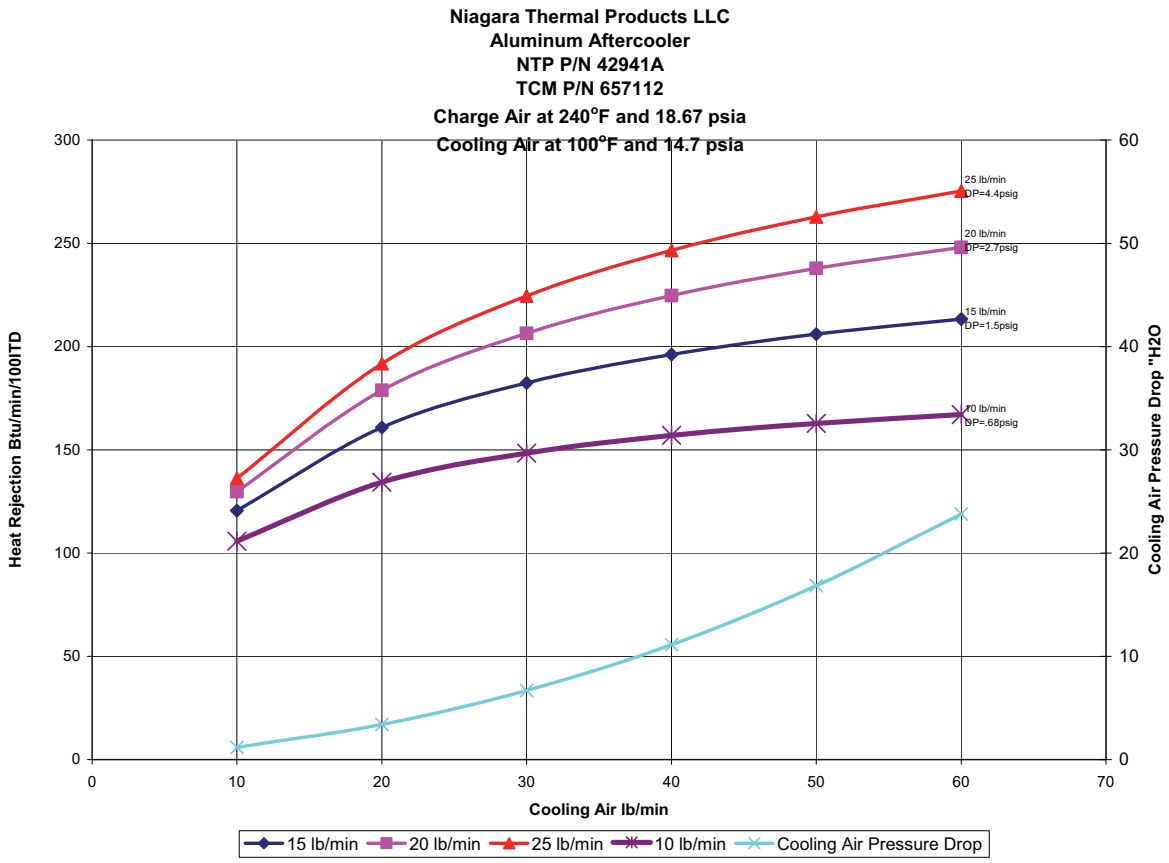

Figure 2-40. Aftercooler Performance Chart G

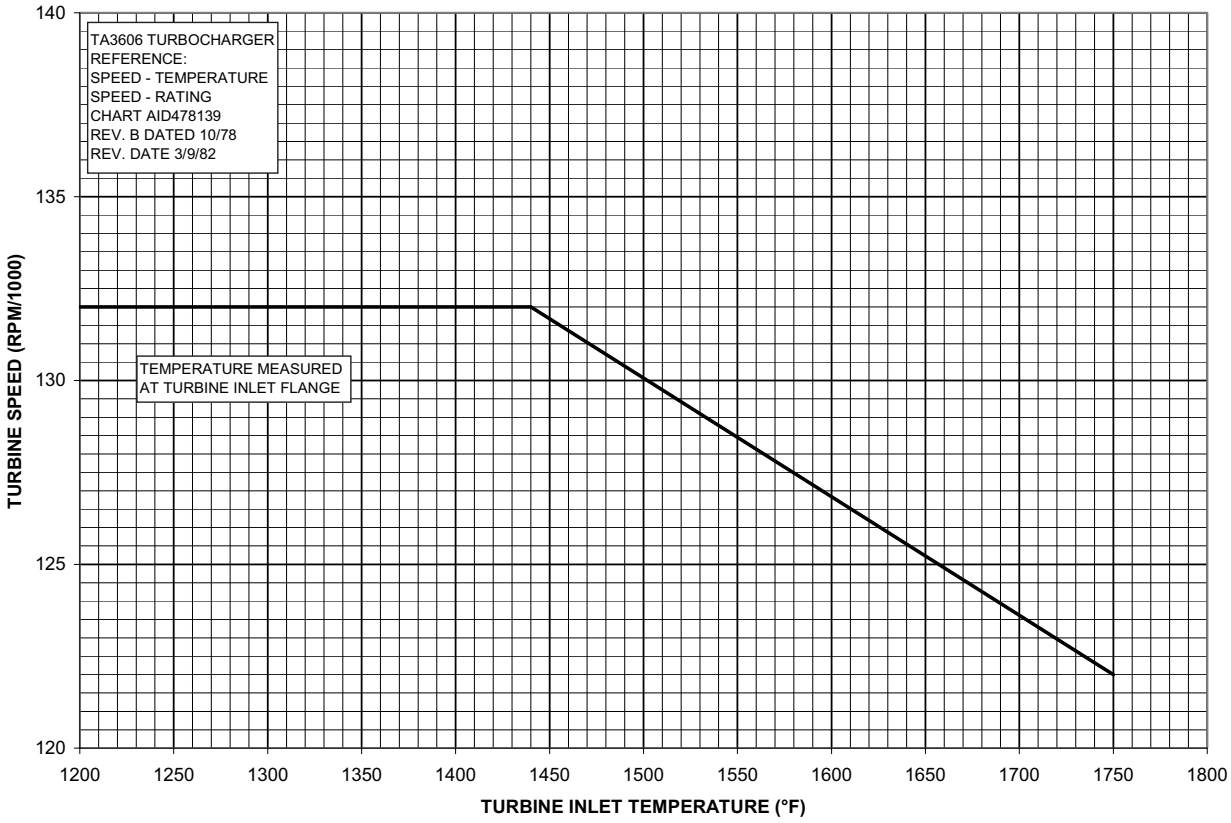

Figure 2-41. Turbine Speed vs. Turbine Inlet Temperature

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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.

3-2. Lubricants, Sealants and Adhesives

Refer to Chapter 3, “Lubricants, Sealants, and Adhesives”, in M-0, Standard Practice Maintenance Manual.

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

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.

12. Disconnect the Ignition Harness according to instructions in "Ignition System Maintenance" in Section 6-4.9 of M-0, Standard Practice Maintenance Manual.

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

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:

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

10. Perform the "Engine Pre-Oiling" procedure according to Section 5-2.9 of M-0, Standard Practice Maintenance Manual.

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.

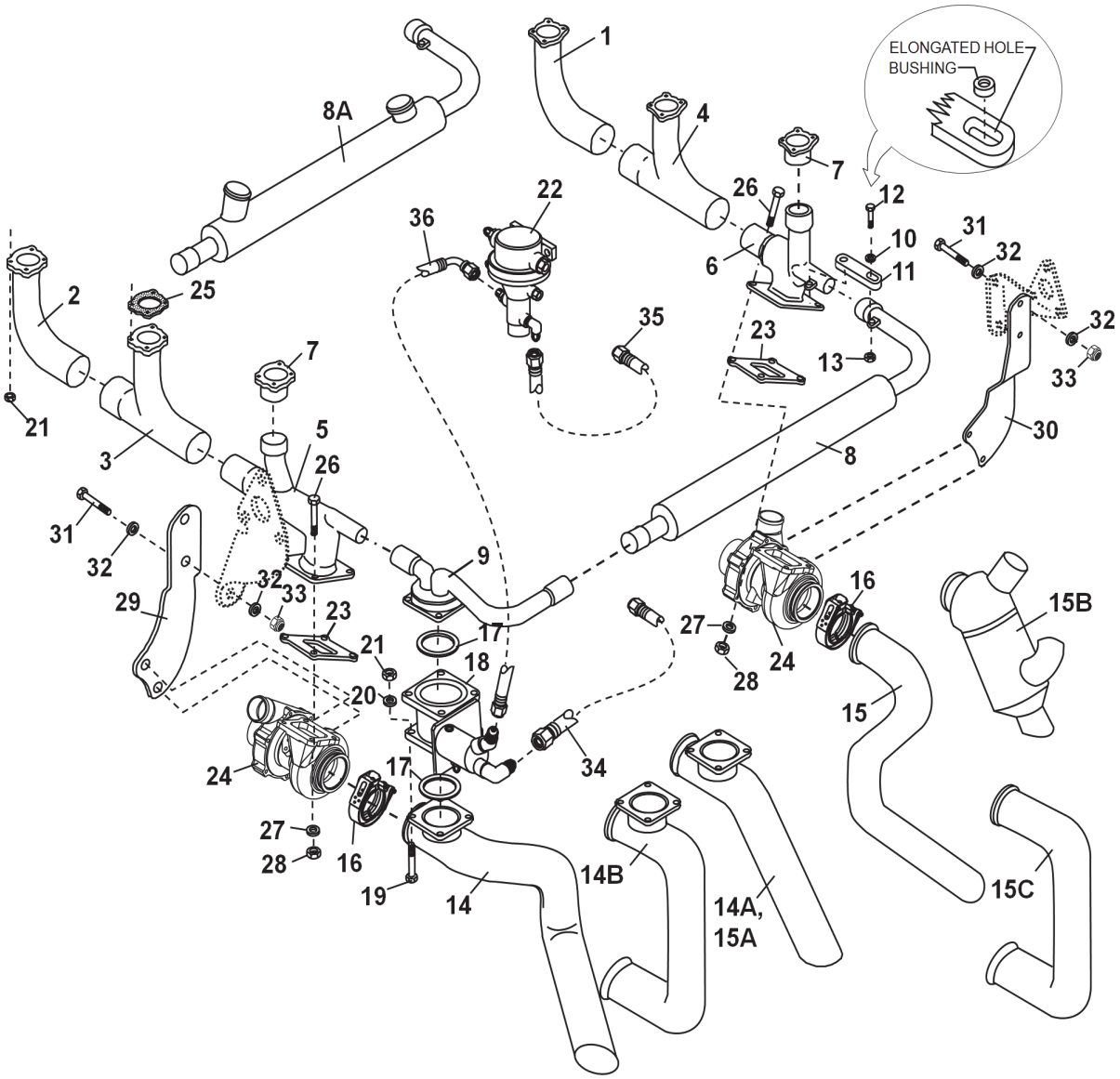


Figure 5-1. Turbocharger and Exhaust System B C E G

1	Elbow Riser	11	Tie Rod	18	Wastegate Assembly	30	Bracket
2	Elbow Riser	12	Bolt	19	Bolt	31	Bolt
3	Tee Assembly	13	Lock Nut	20	Washer	32	Washer
4	Tee Assembly	14	Contoured Tailpipe	21	Lock Nut	33	Lock Nut
5	Turbo Transition	14A	Straight Tailpipe	22	Controller	34	Hose
6	Turbo Transition	14B	Inverse Tailpipe Option	23	Gasket	35	Hose
7	Riser	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
8	Crossover Assembly	15A	Straight Tailpipe	25	Gasket		
8A	Crossover Assy with Heater Shroud Option	15B	Heater	26	Bolt		
		15C	Inverse Tailpipe Option	27	Washer		
9	Transition	16	V-band clamp	28	Lock Nut		
10	Bushing	17	Gasket	29	Bracket		

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.

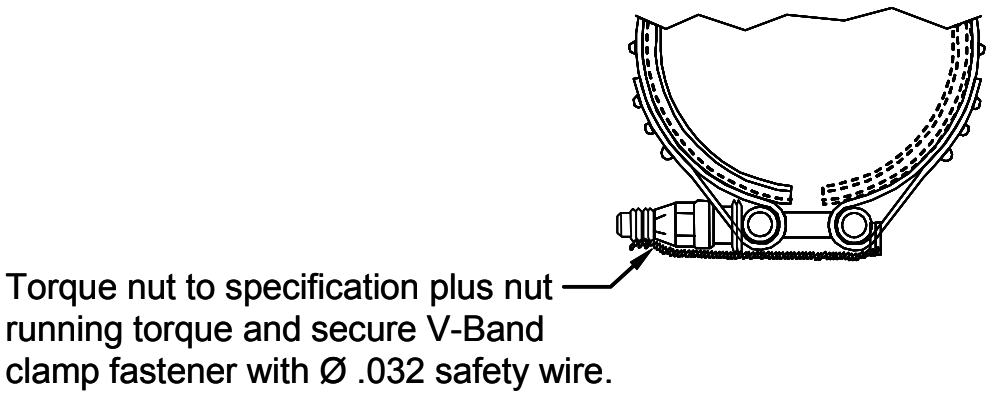


Figure 5-2. V-band Clamp Safety Wire

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

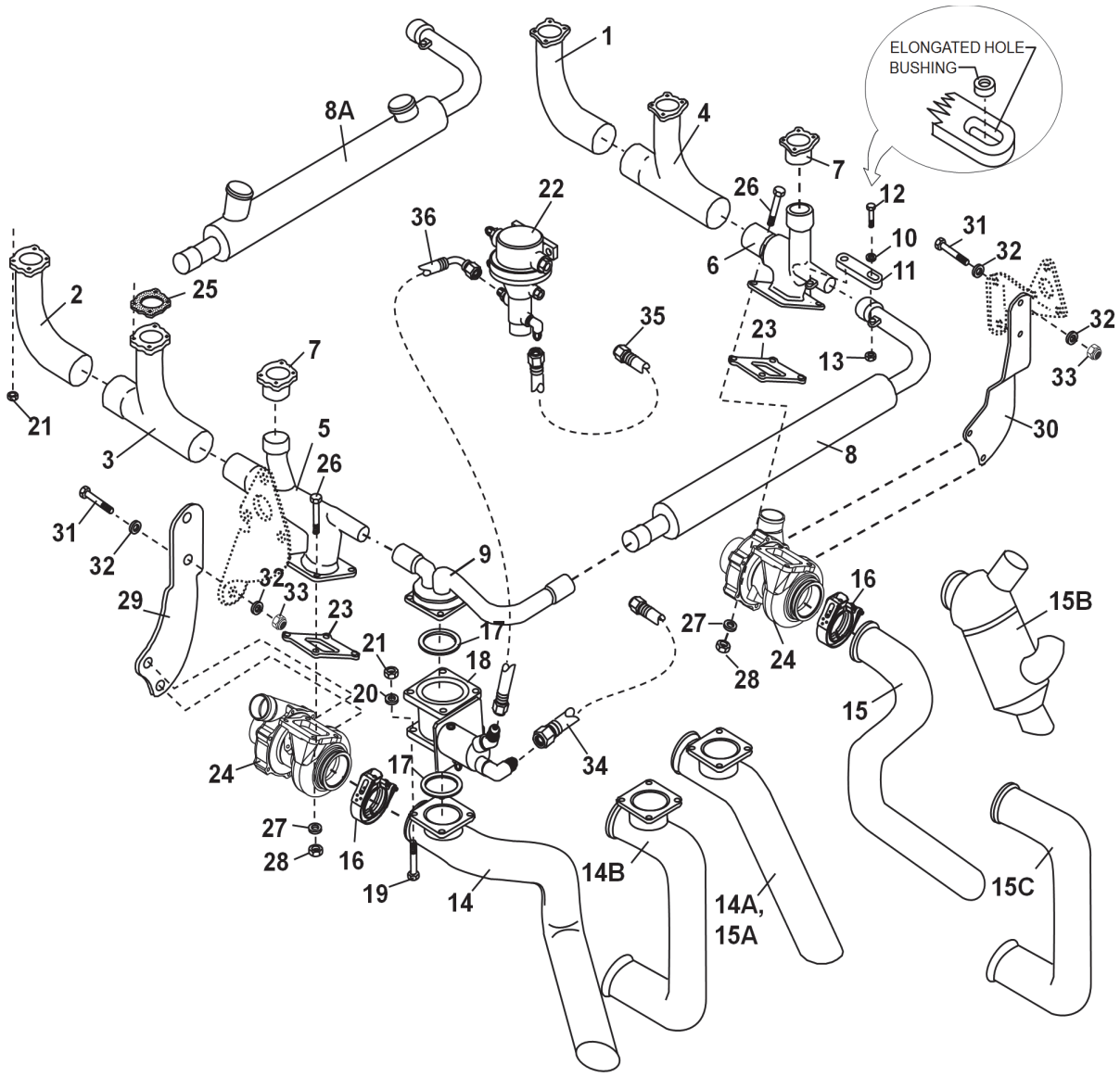


Figure 5-1 repeated for reference

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.

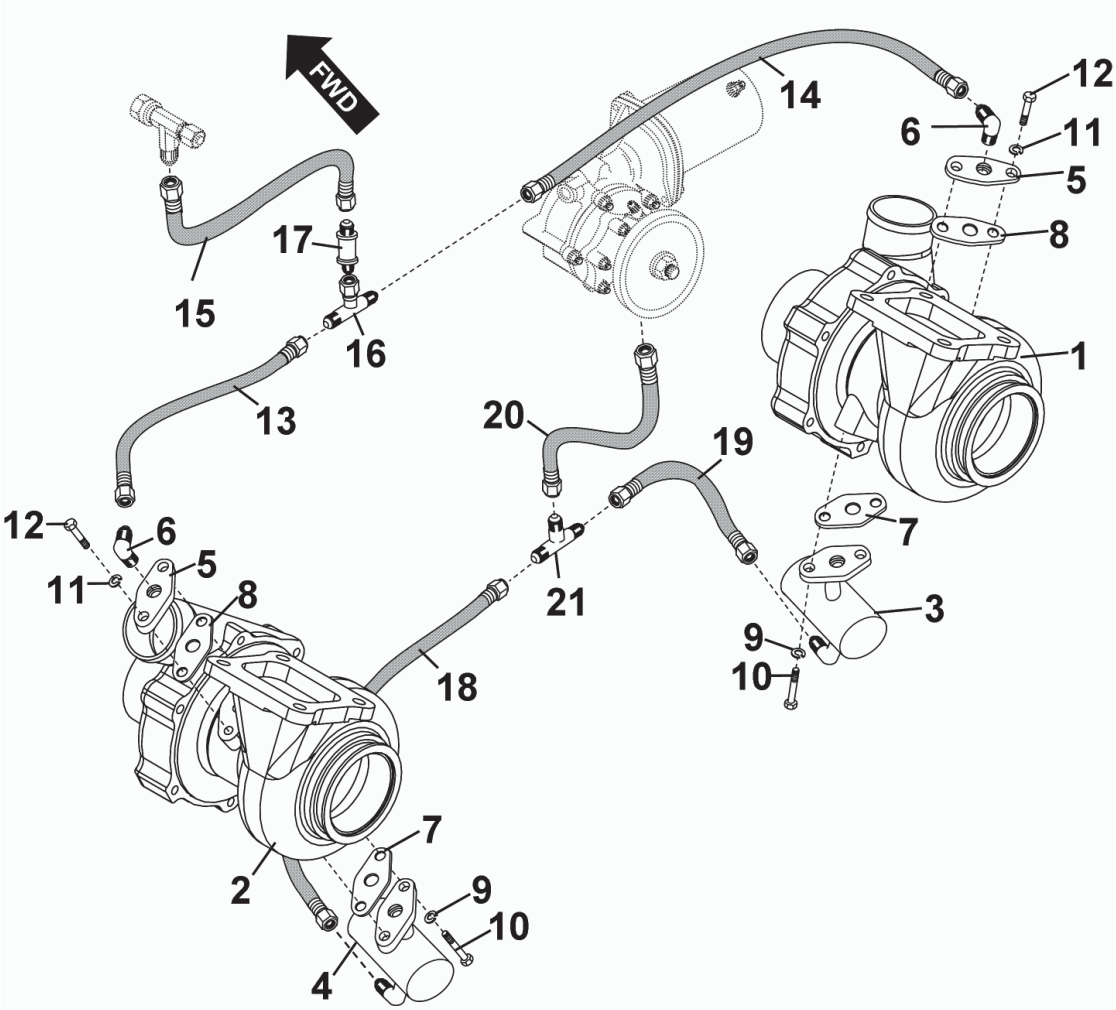


Figure 5-3. Turbocharger Lubrication Hose Routing B C E G

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.

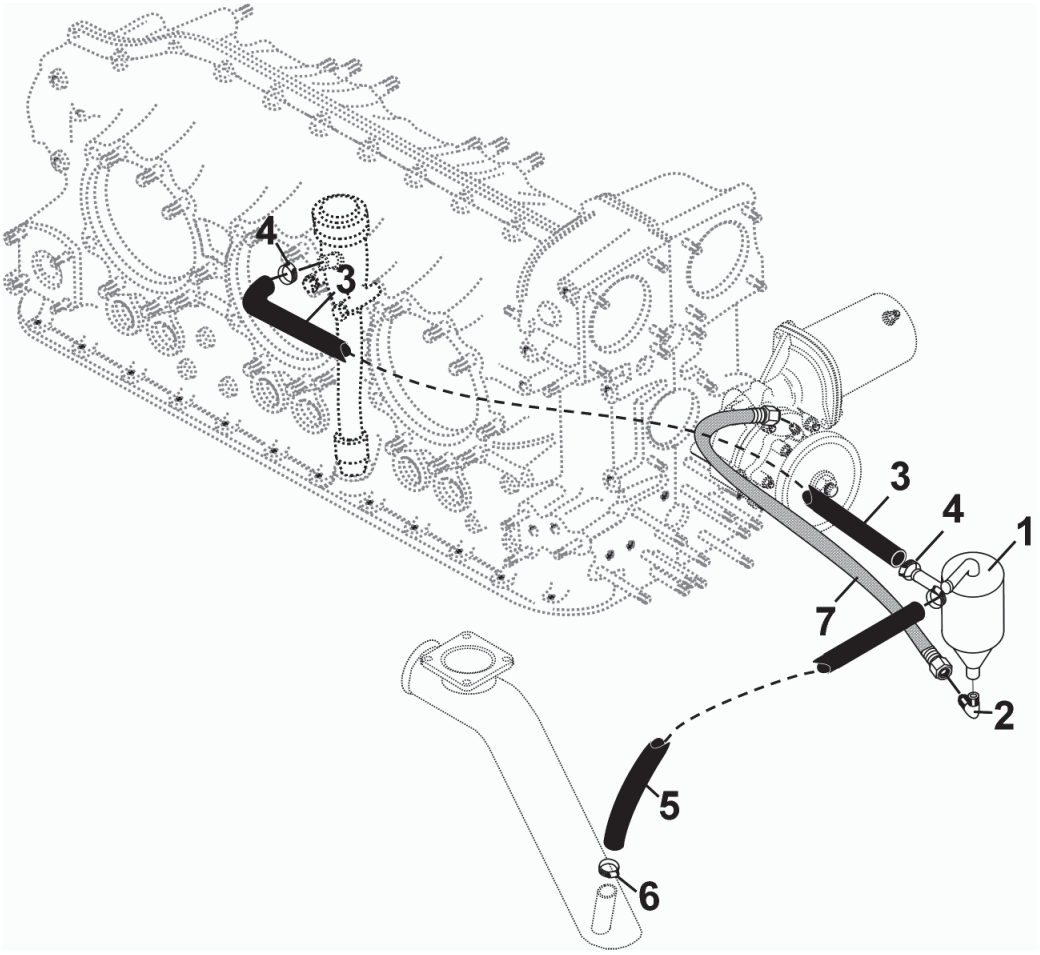


Figure 5-4. Crankcase Ventilation Hose Routing B C E G

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.

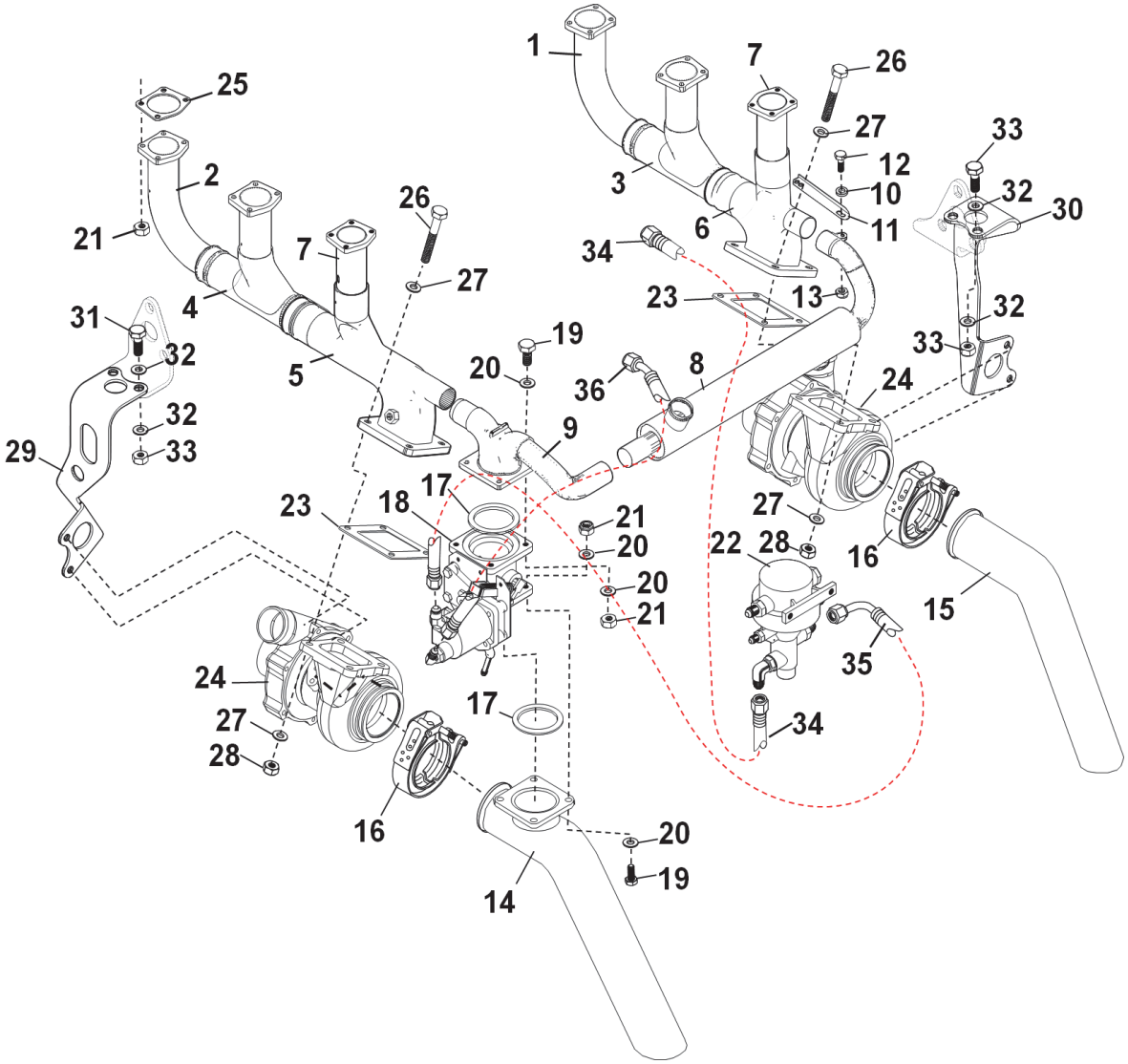


Figure 5-5. Turbocharger Assembly K

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	Bolt
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

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

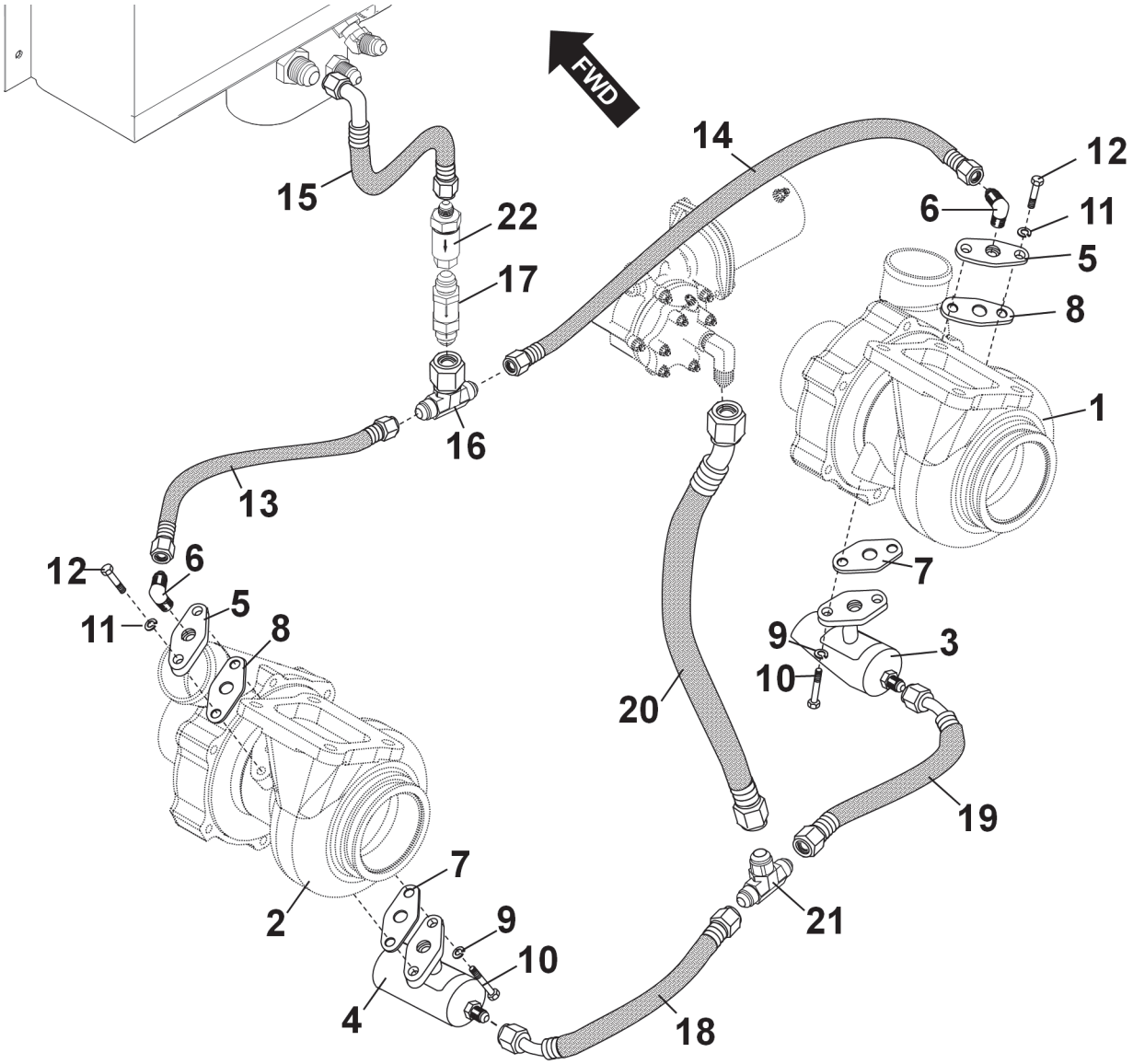


Figure 5-6. Turbocharger Lubrication Hose Routing K

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	22	Check Valve Filter Assy
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.

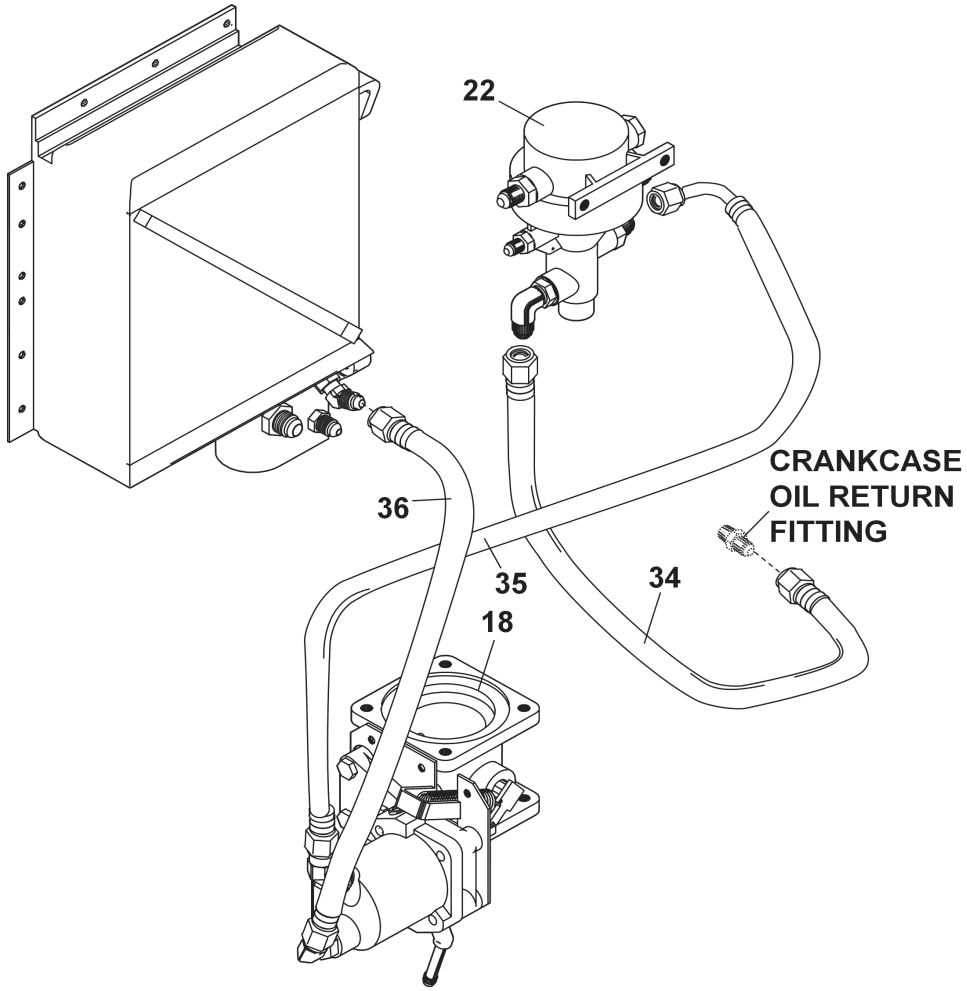


Figure 5-7. Wastegate Control Hose Connections K

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.

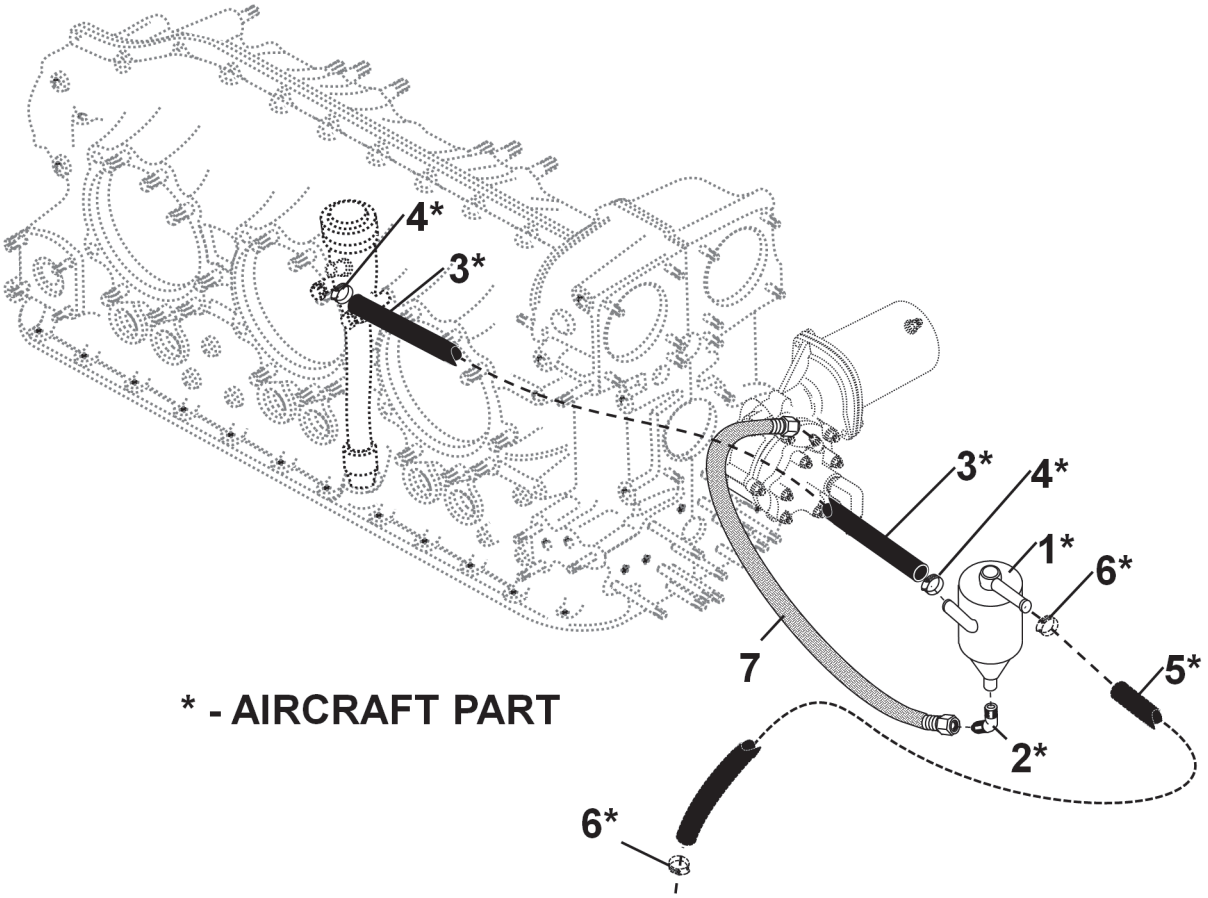


Figure 5-8. Crankcase Ventilation Hose Routing K

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.

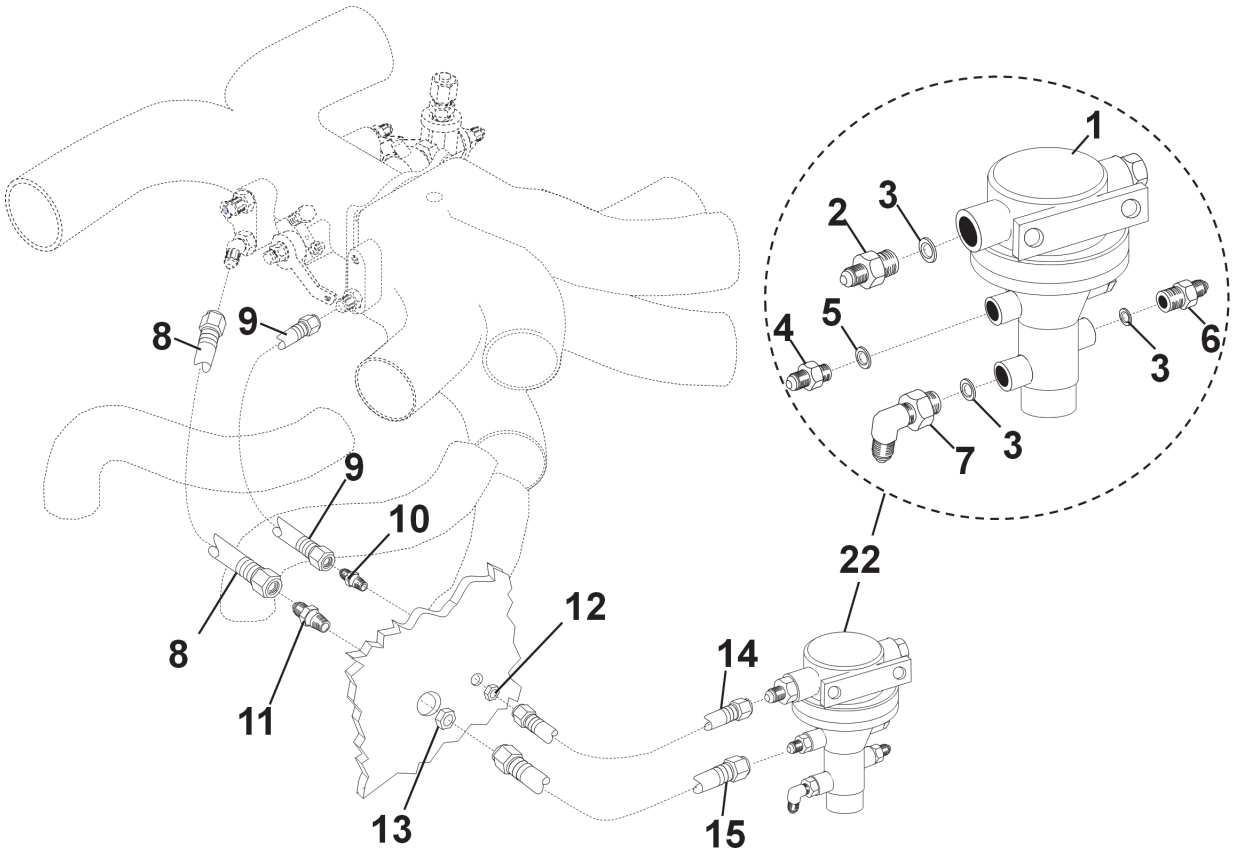


Figure 5-9. Wastegate Controller & Hoses K

1	Controller	5	O-Ring	9	Hose Assembly	13	Bulkhead Nut
2	Reducer	6	Adapter Fitting	10	Bulkhead Union	14	Hose Assembly
3	O-Ring	7	90° Elbow Fitting	11	Bulkhead Union	15	Hose Assembly
4	Adapter	8	Hose Assembly	12	Bulkhead Nut	22	Wastegate Controller Assy

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

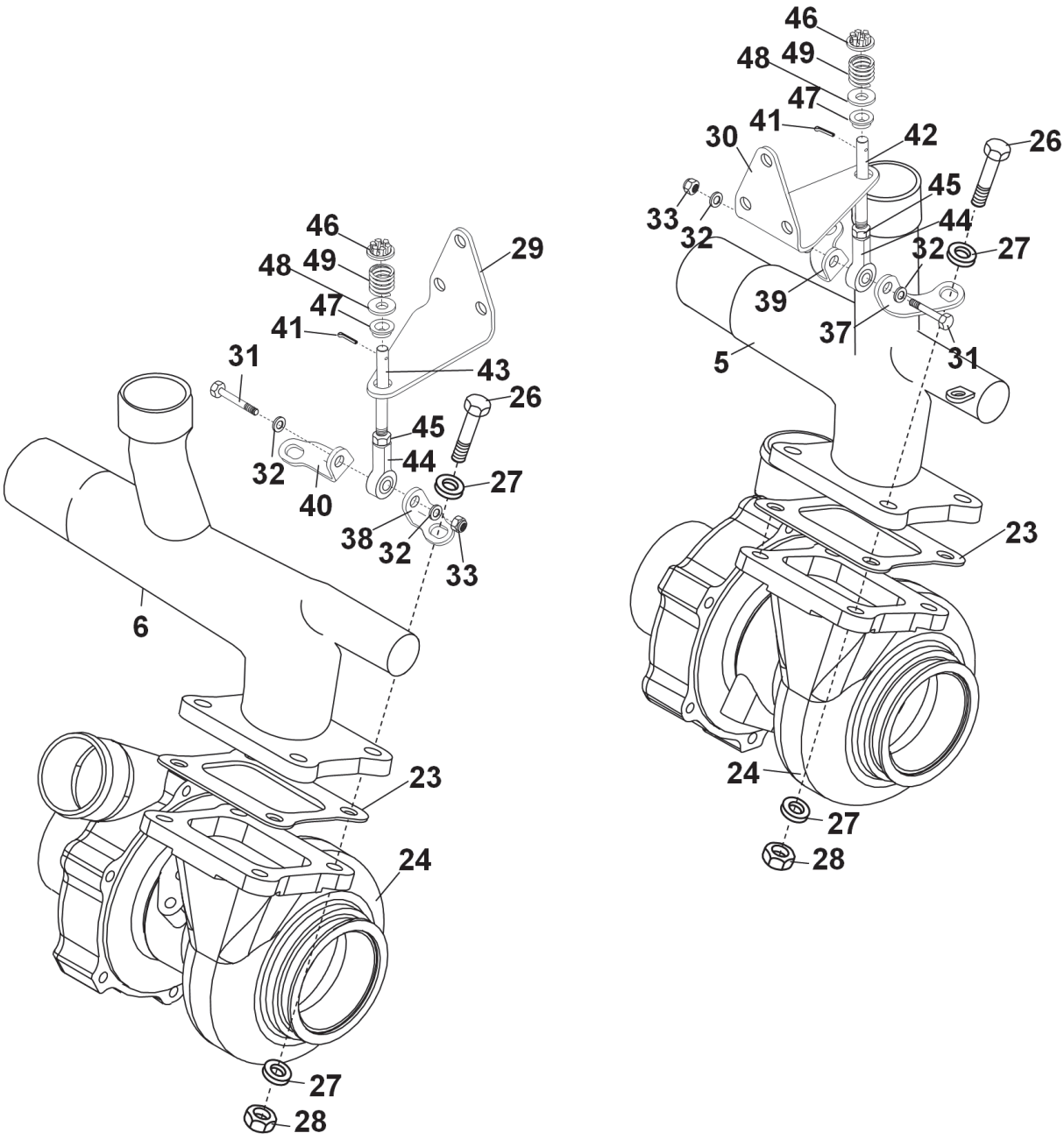


Figure 5-10. Turbocharger Support Detail N

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.
14. Torque the attaching hardware to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual in the following sequence: 26 & 28; 19 & 21.

    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

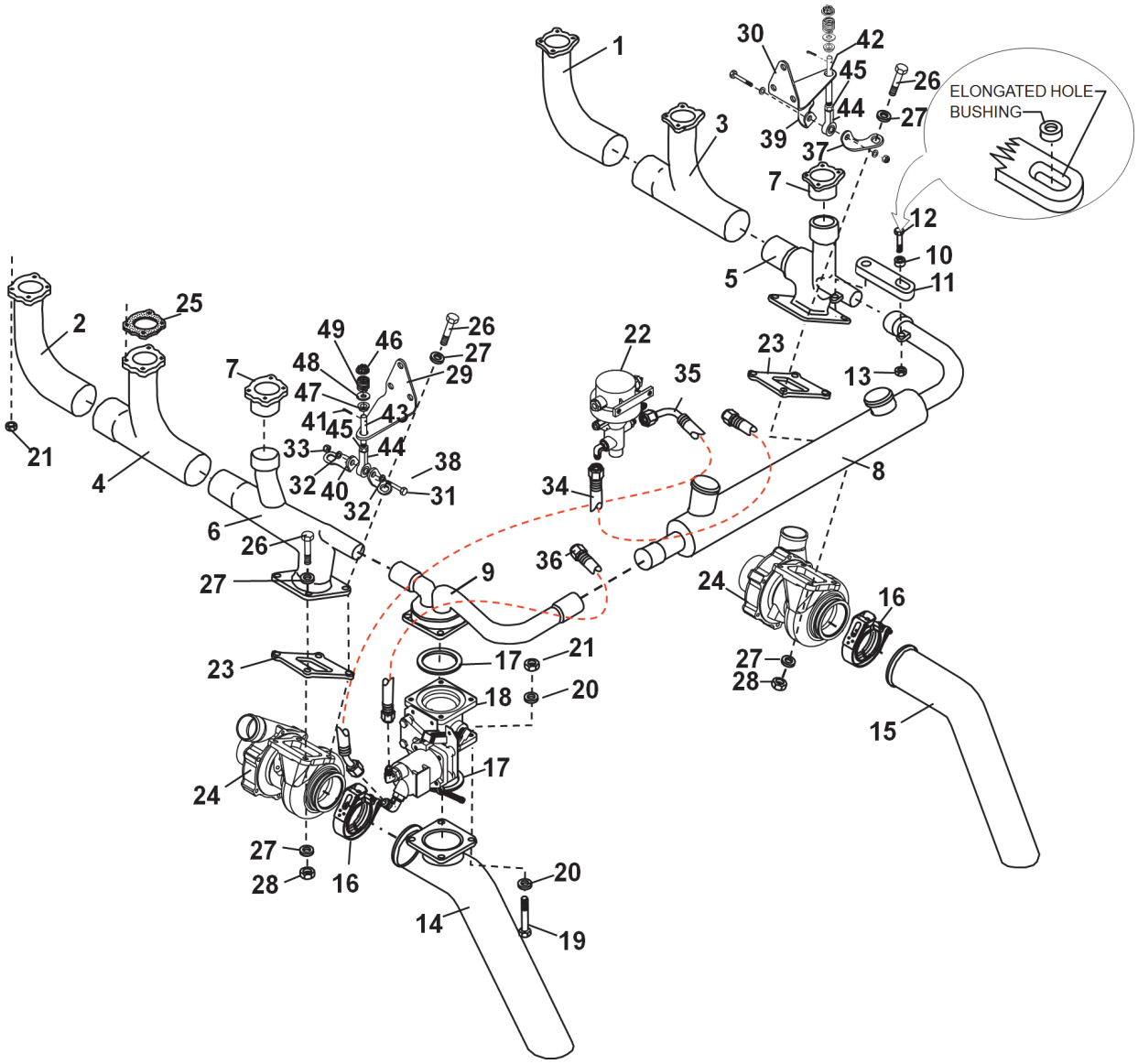


Figure 5-11. Turbocharger and Exhaust Assembly N

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

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.

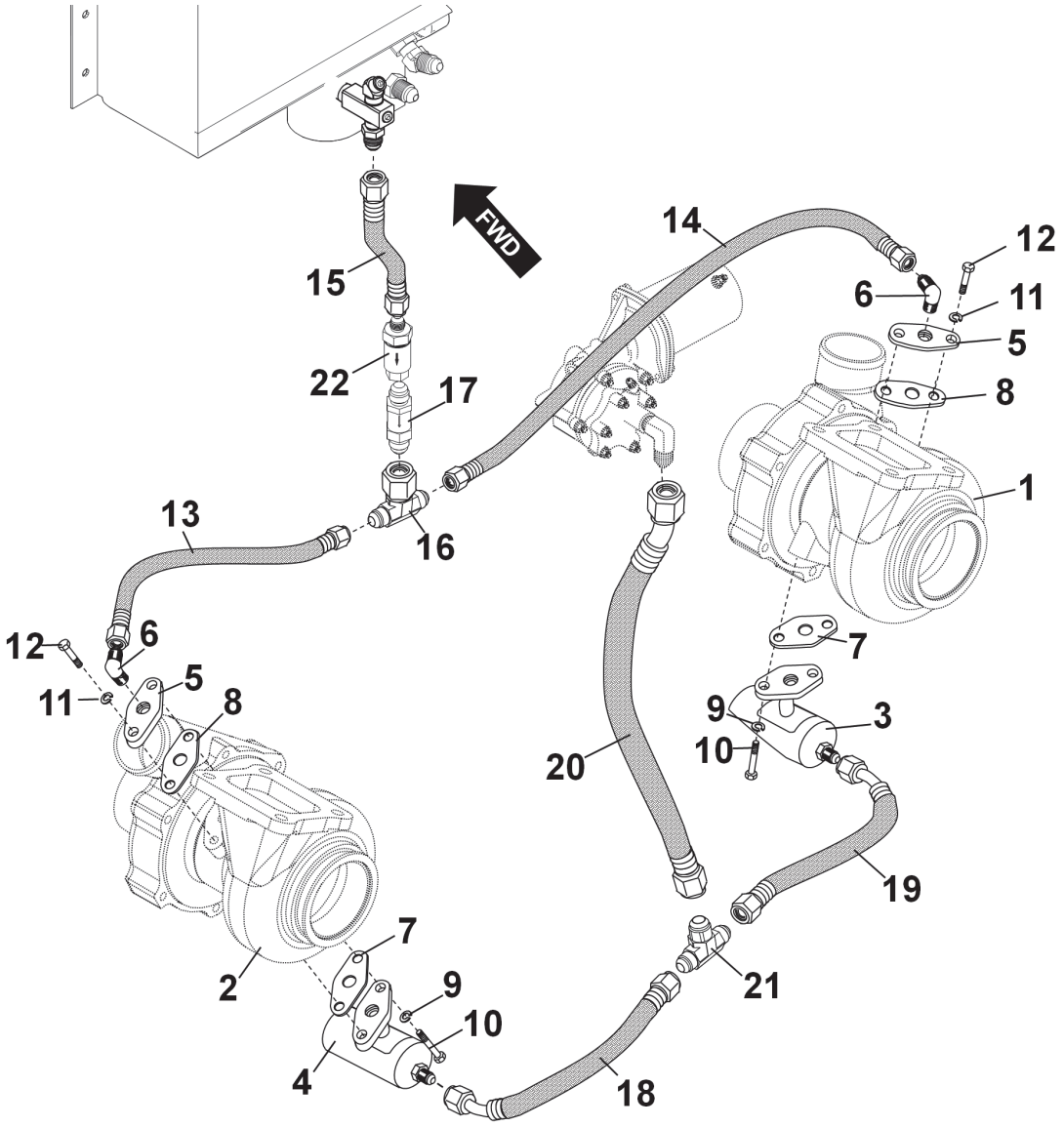


Figure 5-12. Turbocharger Lubrication Hose Routing N

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

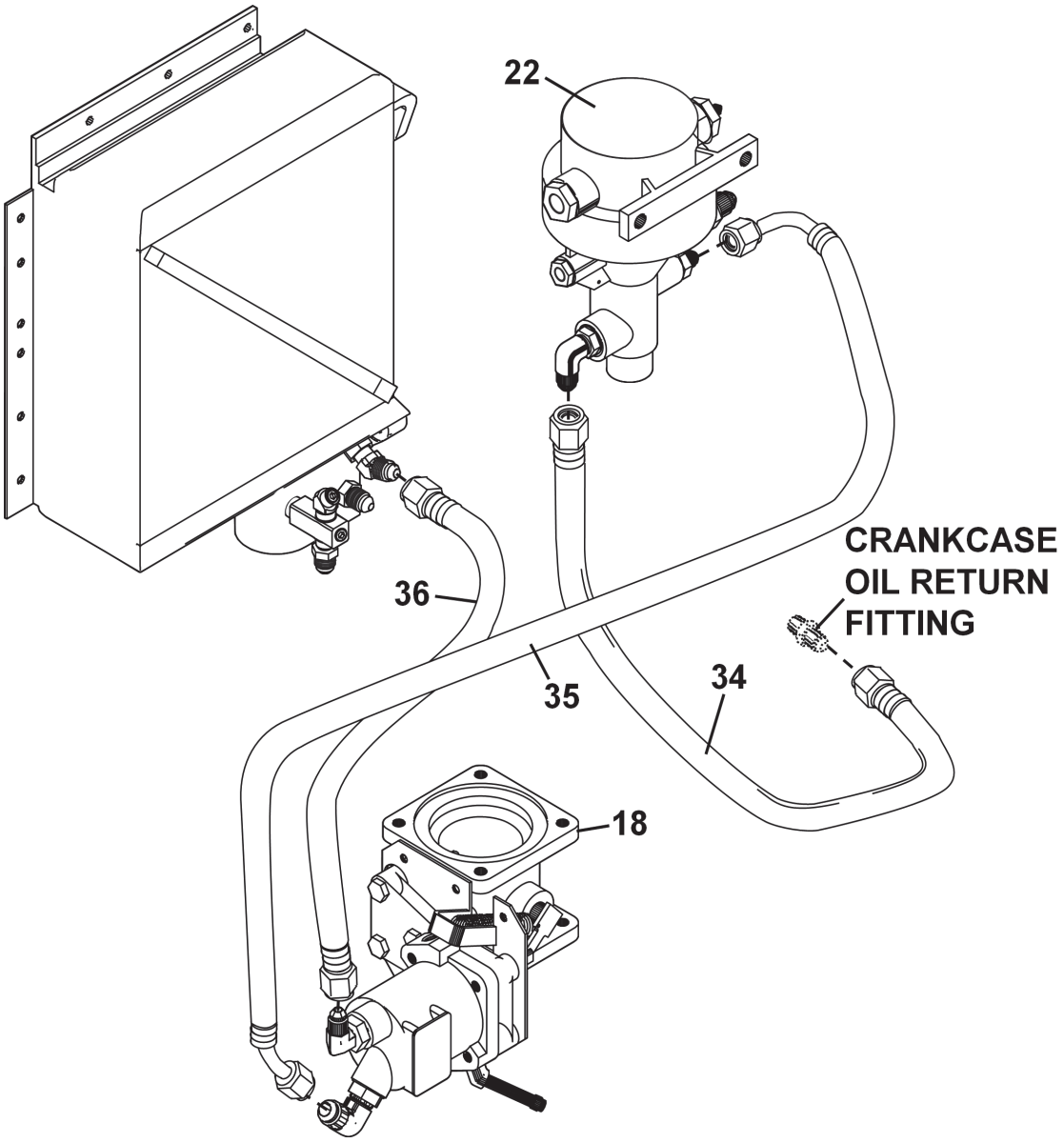


Figure 5-13. Wastegate Control Hose Connections N

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.

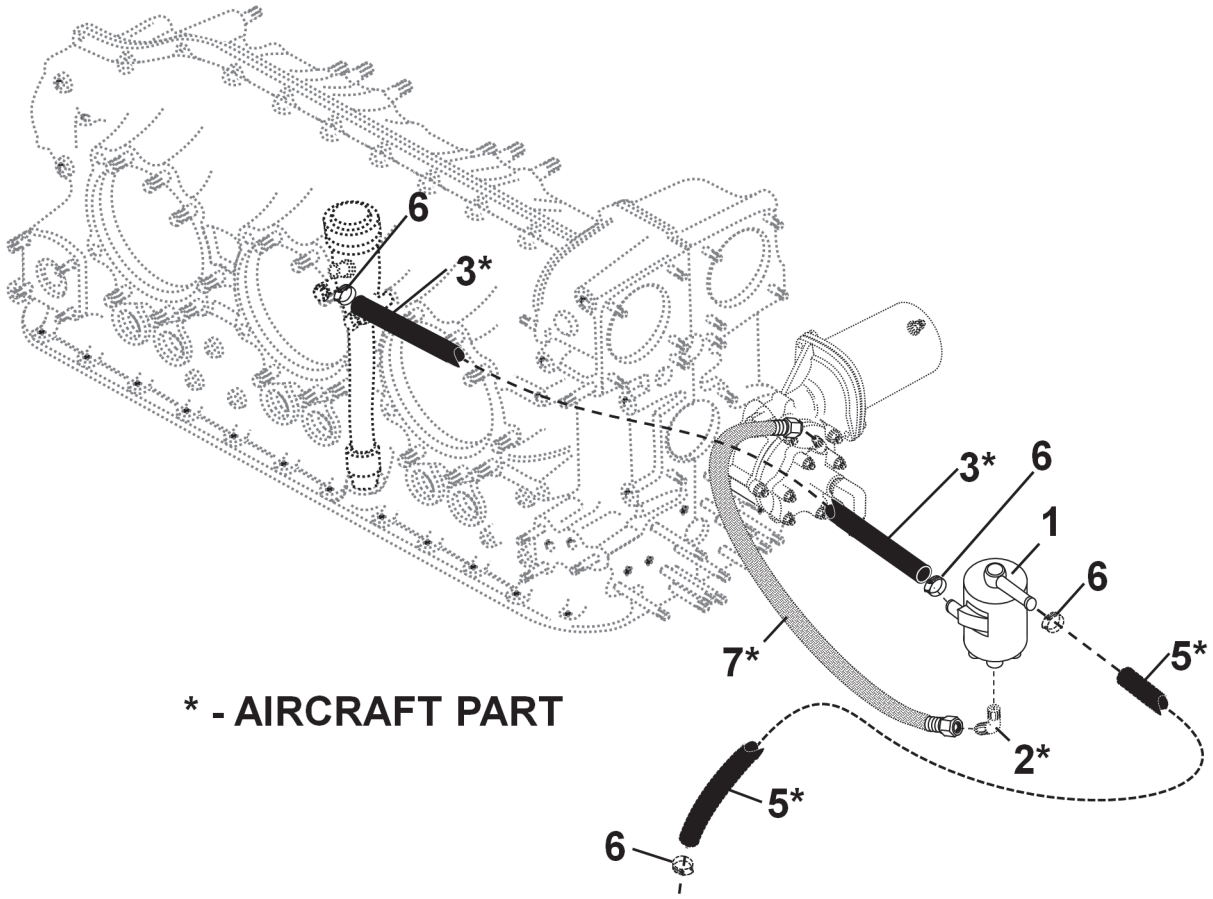


Figure 5-14. Air/Oil Separator N

1	Air/Oil Separator Assembly	3	Hose Assembly	5	Hose Assembly	7	Hose
2	Elbow Fitting	4	Hose Clamp	6	Hose Clamp		

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.

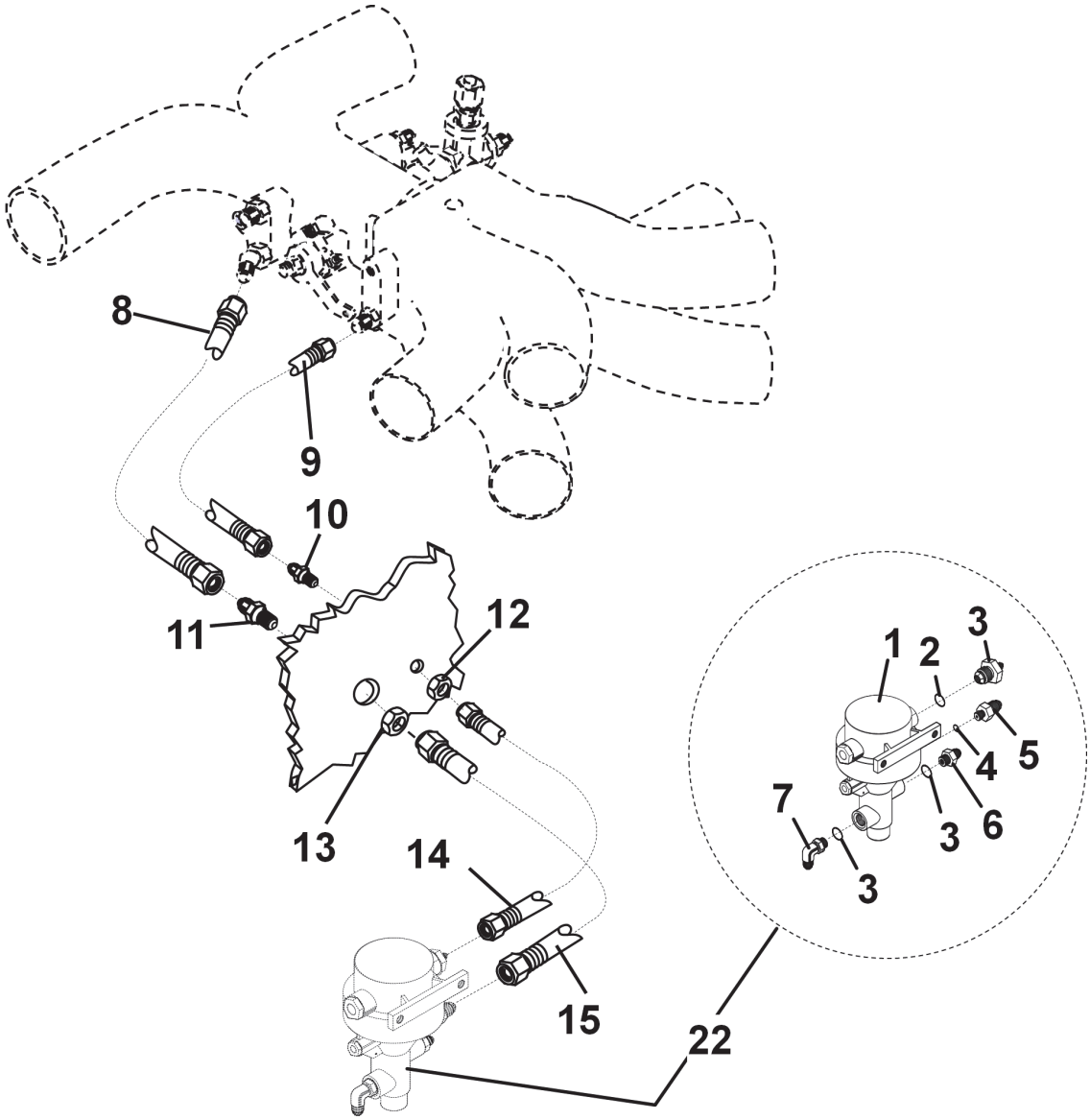


Figure 5-15. Turbocharger Controller and Hoses N

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

Intentionally Left Blank

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 colling 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.

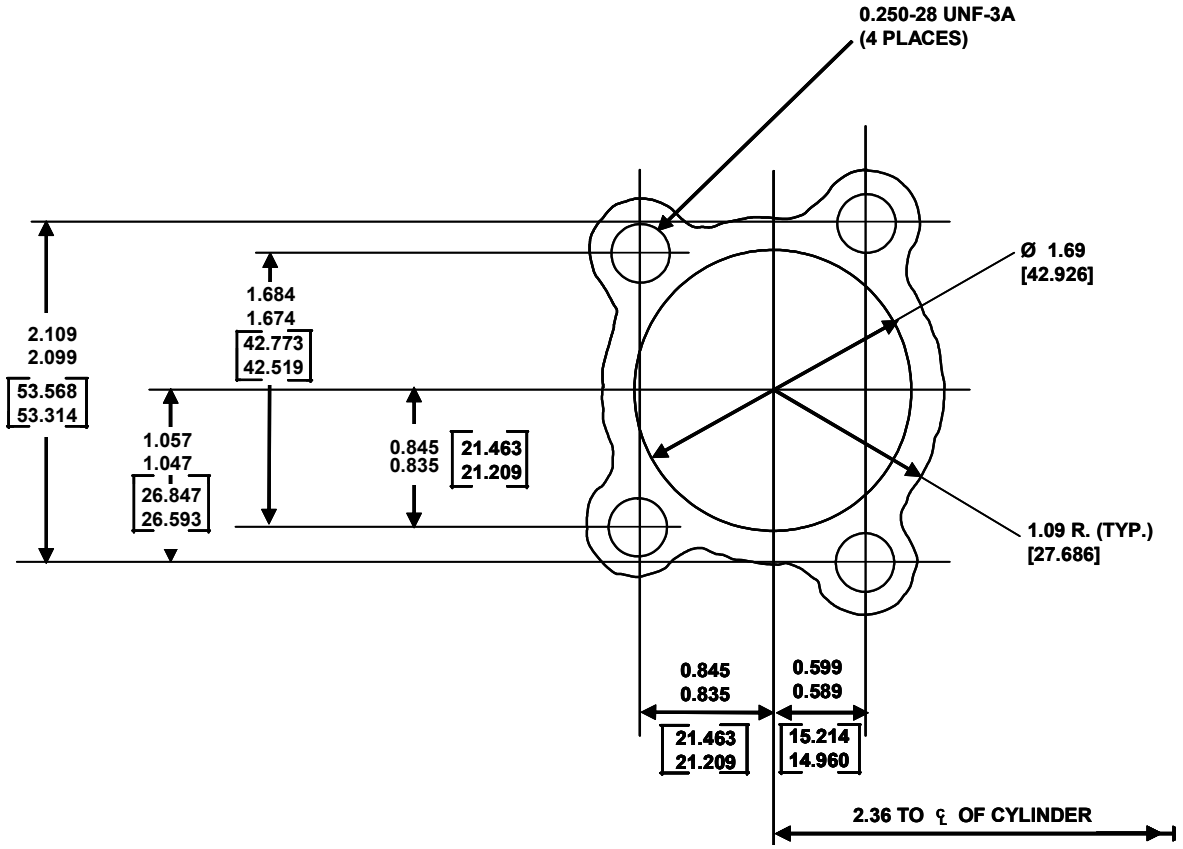


Figure 5-16. Exhaust Port Dimensions

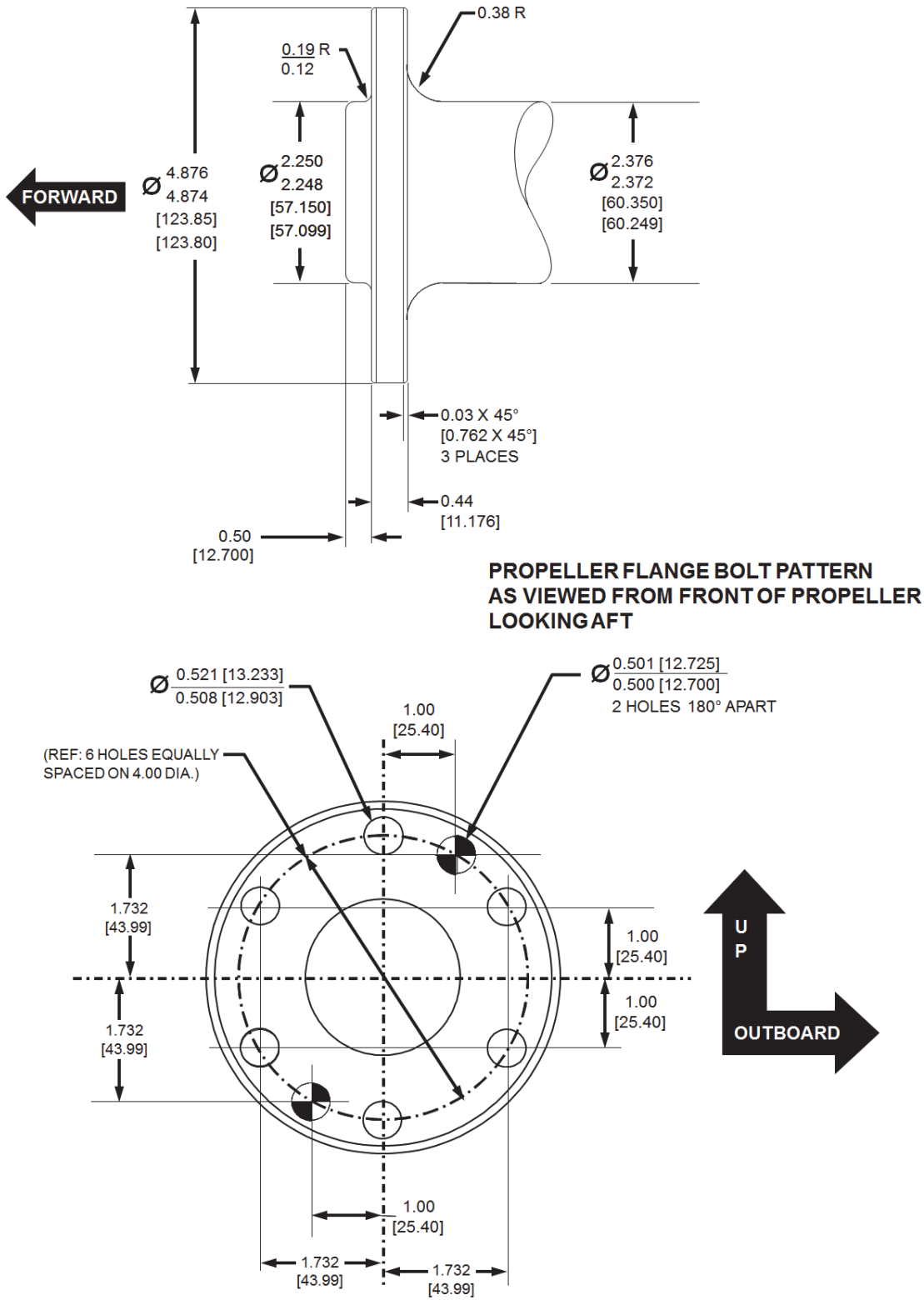


Figure 5-17. Propeller Flange Dimensions

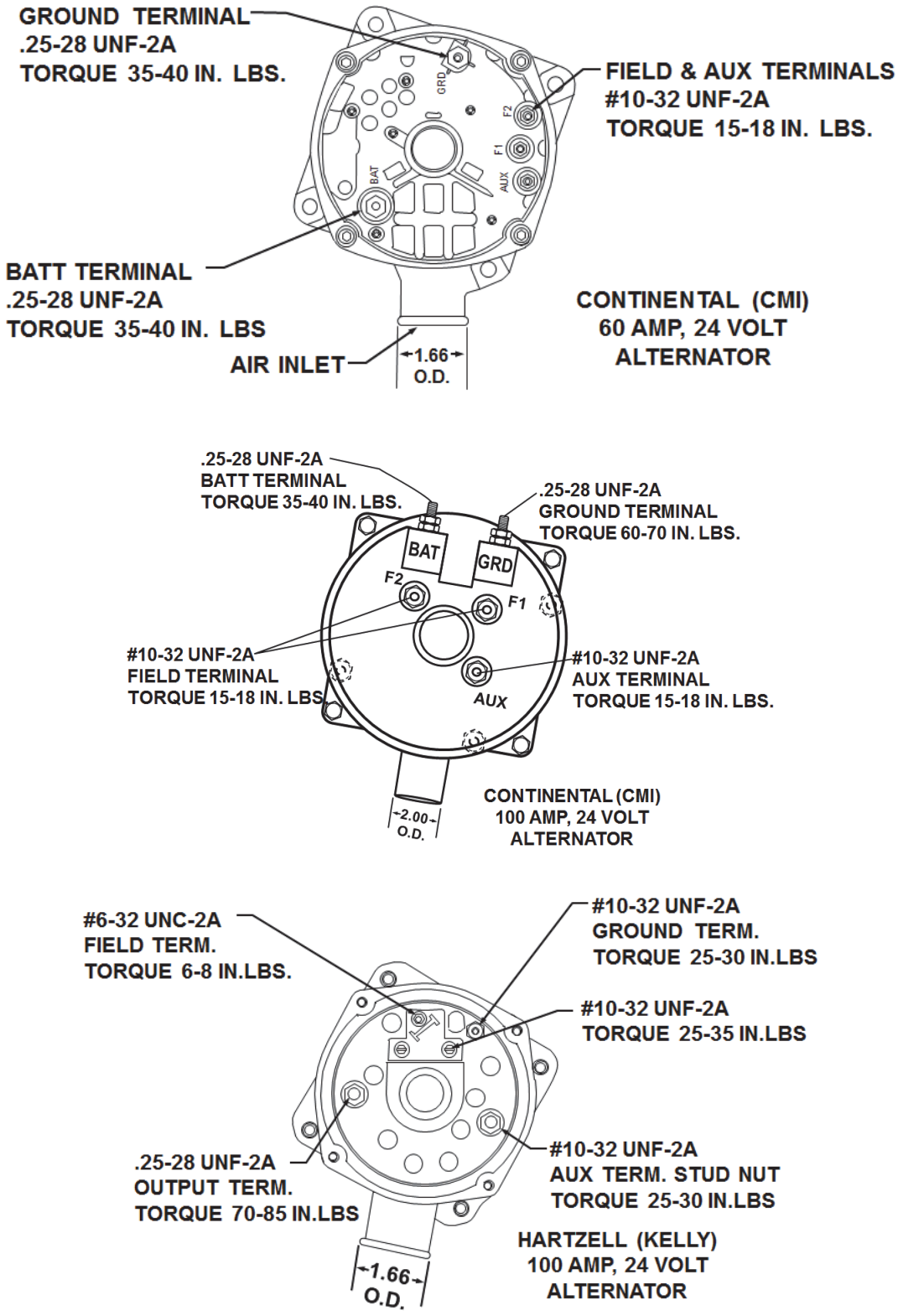


Figure 5-18. 24V Gear-Driven Alternator Detail

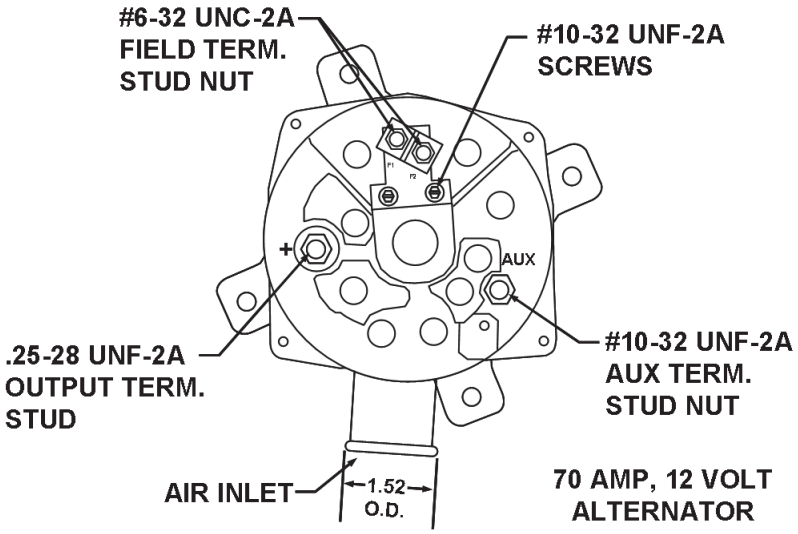


Figure 5-19. 12V Gear-Driven Alternator

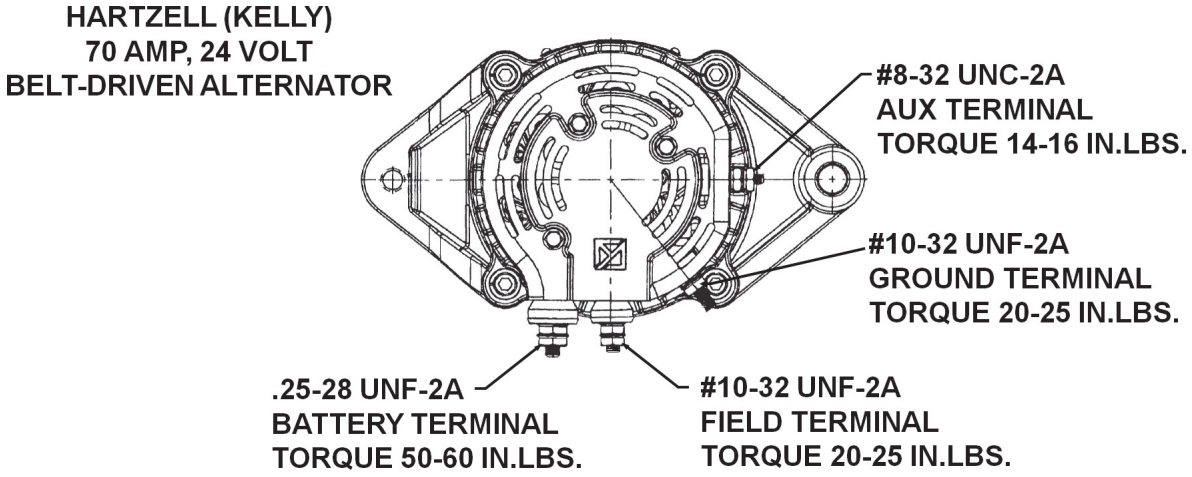


Figure 5-20. Belt-Driven Alternator Detail

5-4.2. TSIO-550-B Engine Installation Drawings

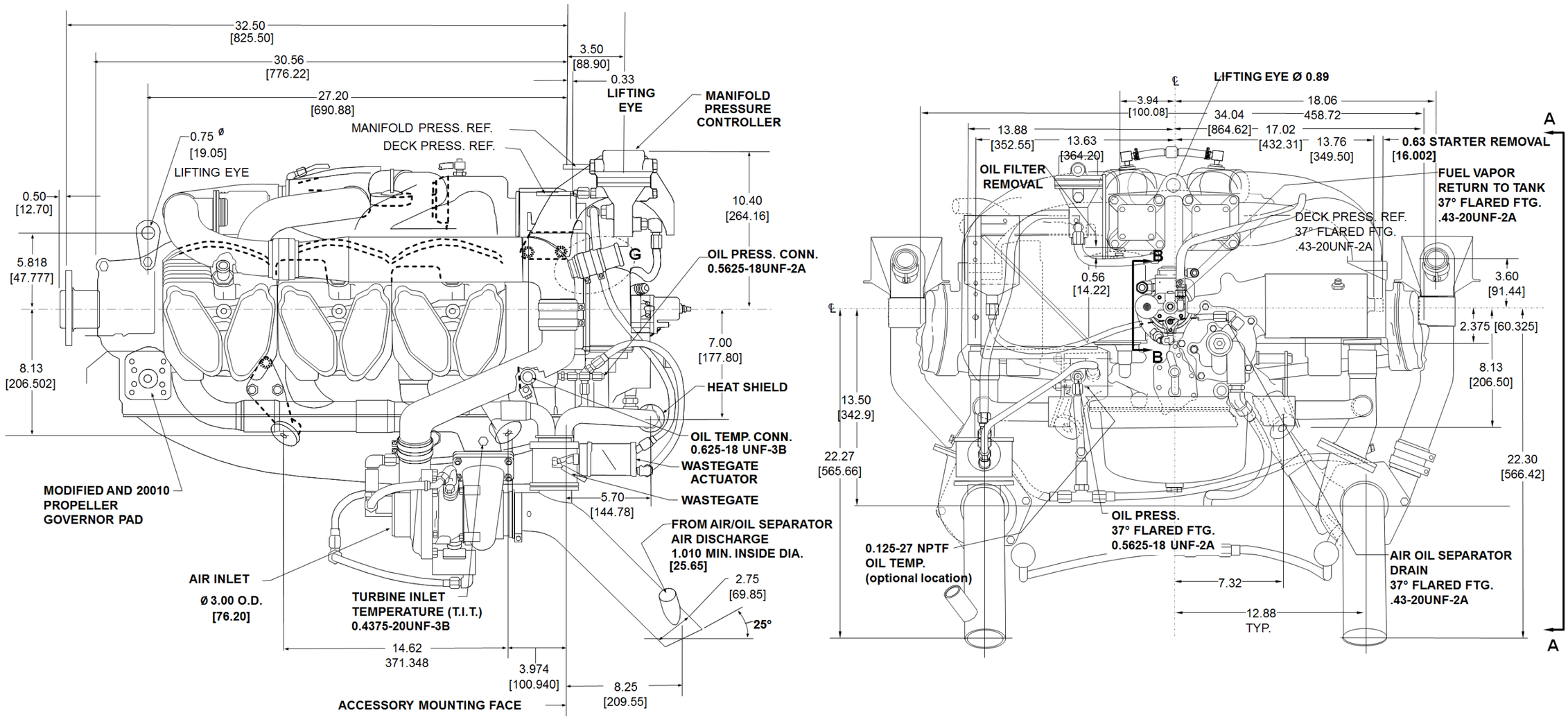


Figure 5-21. TSIO-550-B Installation Drawing 653021 - Sheet 1 of 3

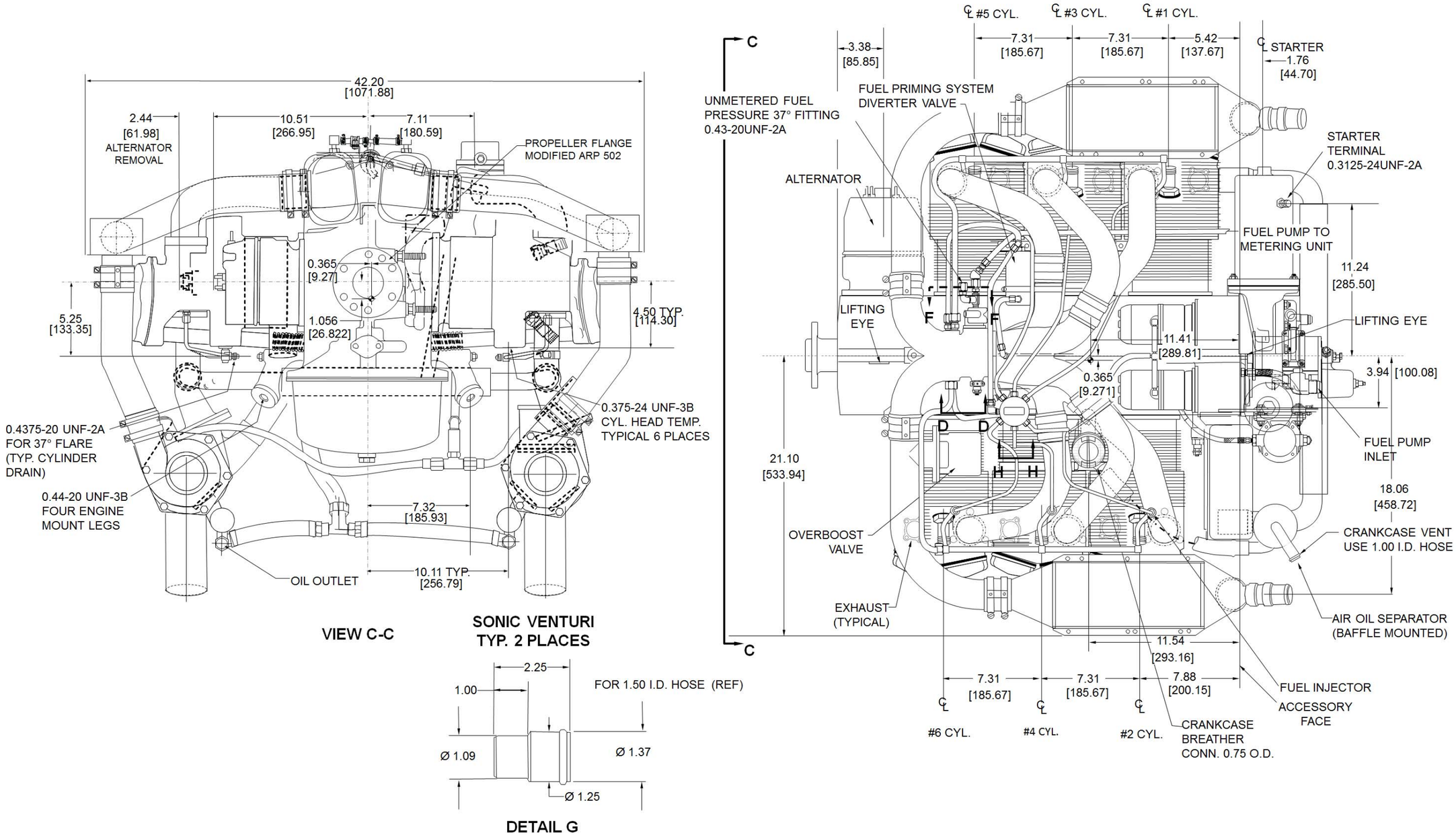
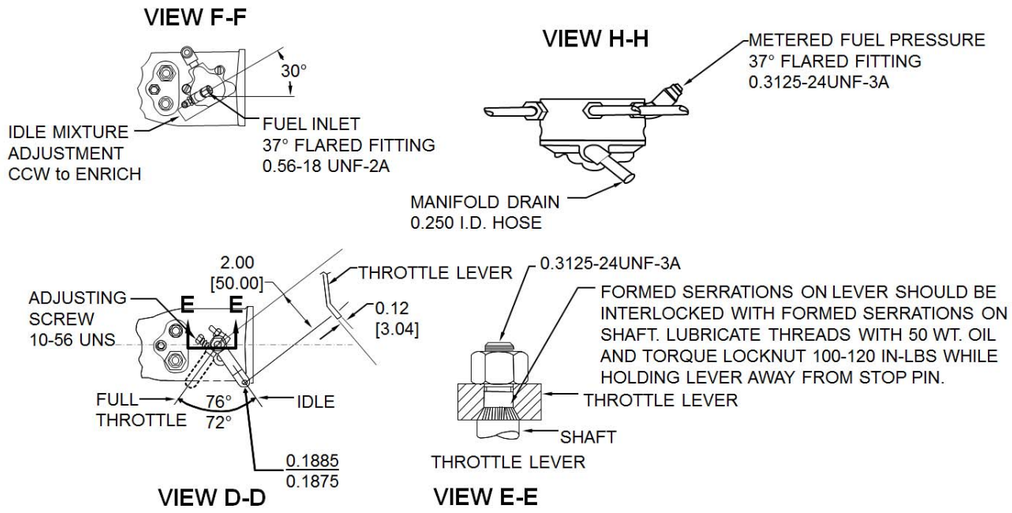


Figure 5-22. TSIO-550-B Installation Drawing 653021 - Sheet 2 of 3



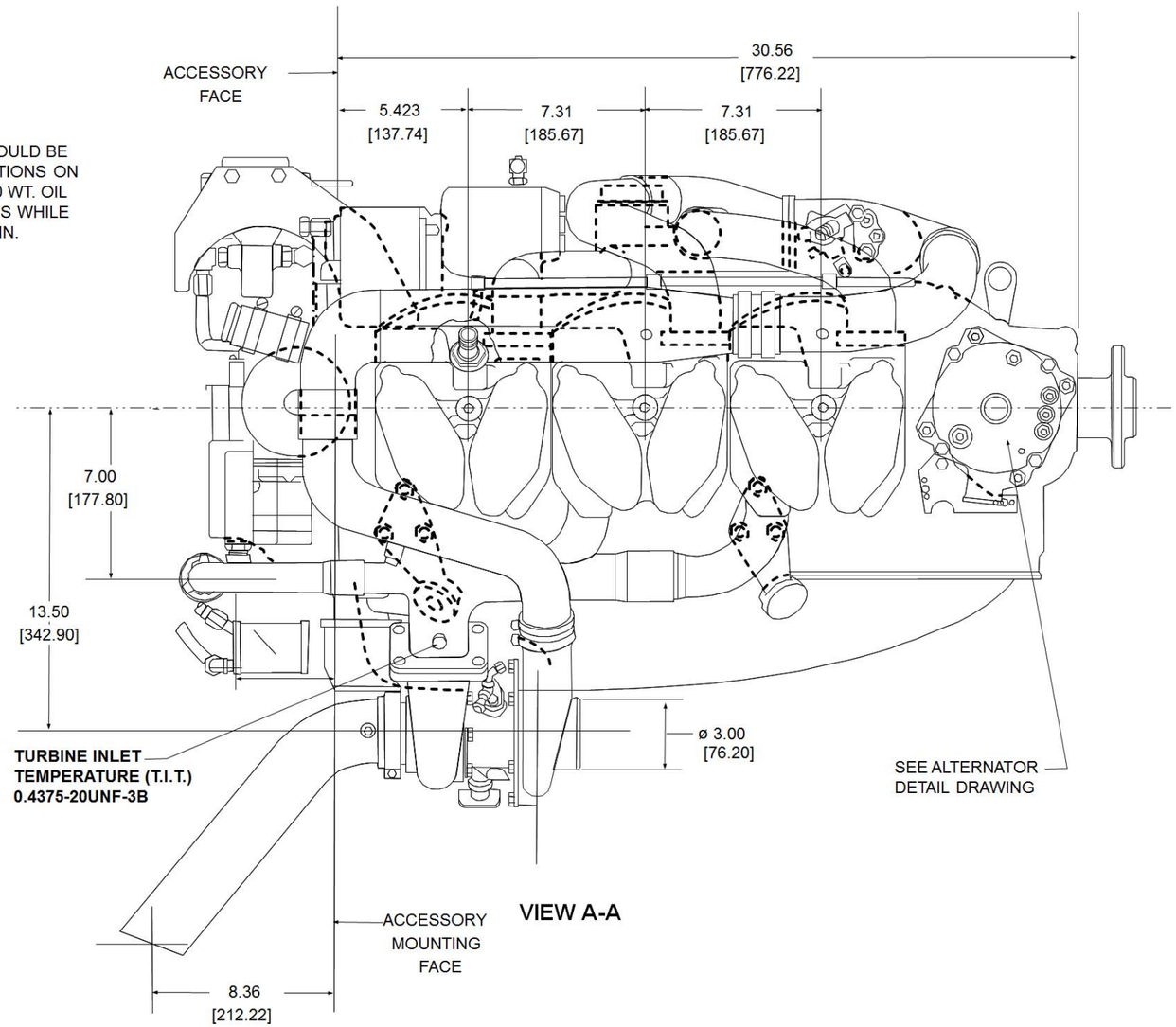


Figure 5-23. TSIO-550-B Installation Drawing 653021 - Sheet 3 of 3

5-4.3. TSIO-550-C&E Engine Installation Drawings

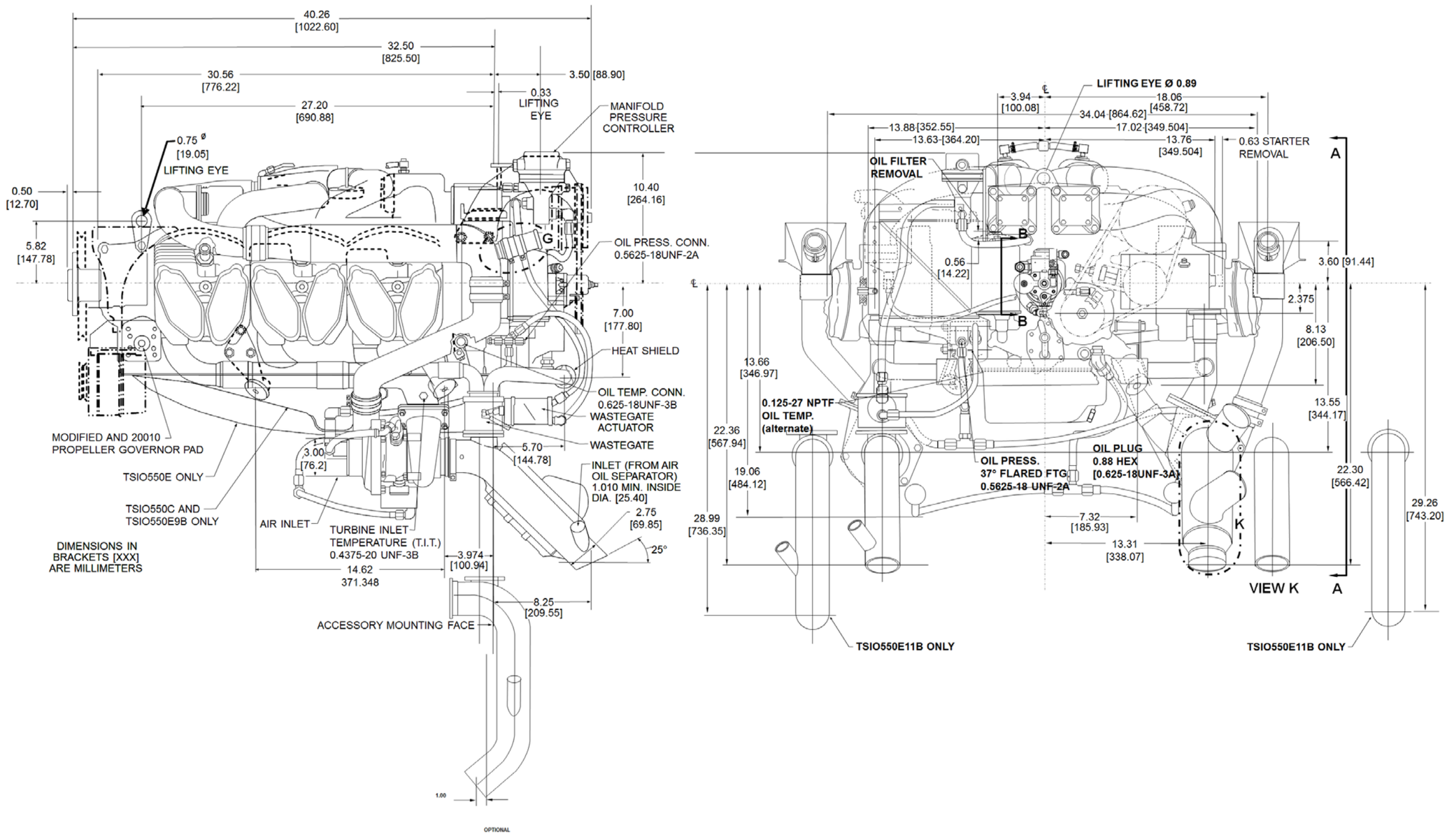


Figure 5-24. TSIO-550-C & E Installation Drawing 646618 - Sheet 1 of 3

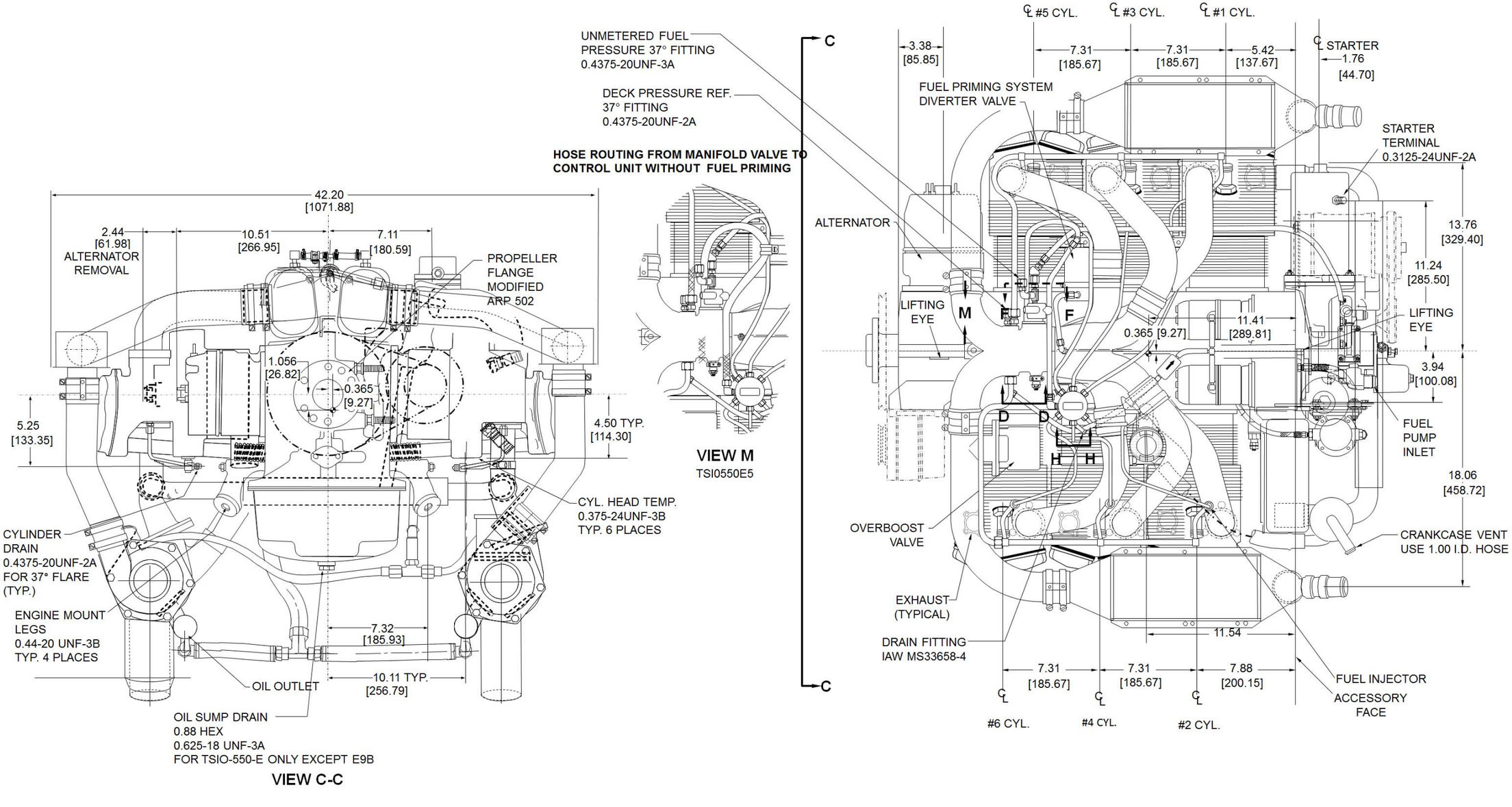


Figure 5-25. TSIO-550-C & E Installation Drawing 646618 - Sheet 2 of 3

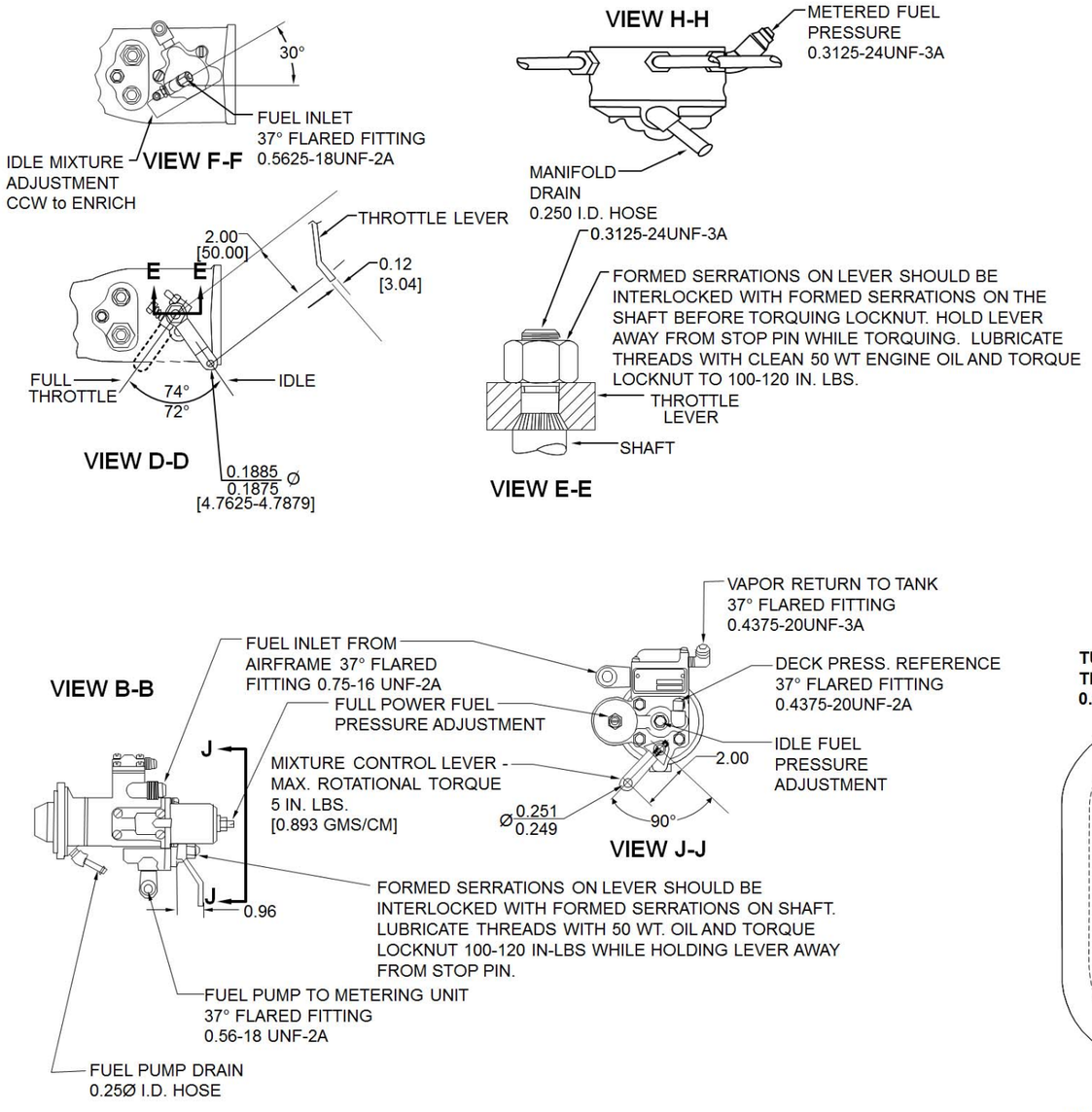


Figure 5-26. TSIO-550-C & E Installation Drawing 646618 - Sheet 3 of 3

5-4.4. TSIO-550-C Engine Installation Drawings

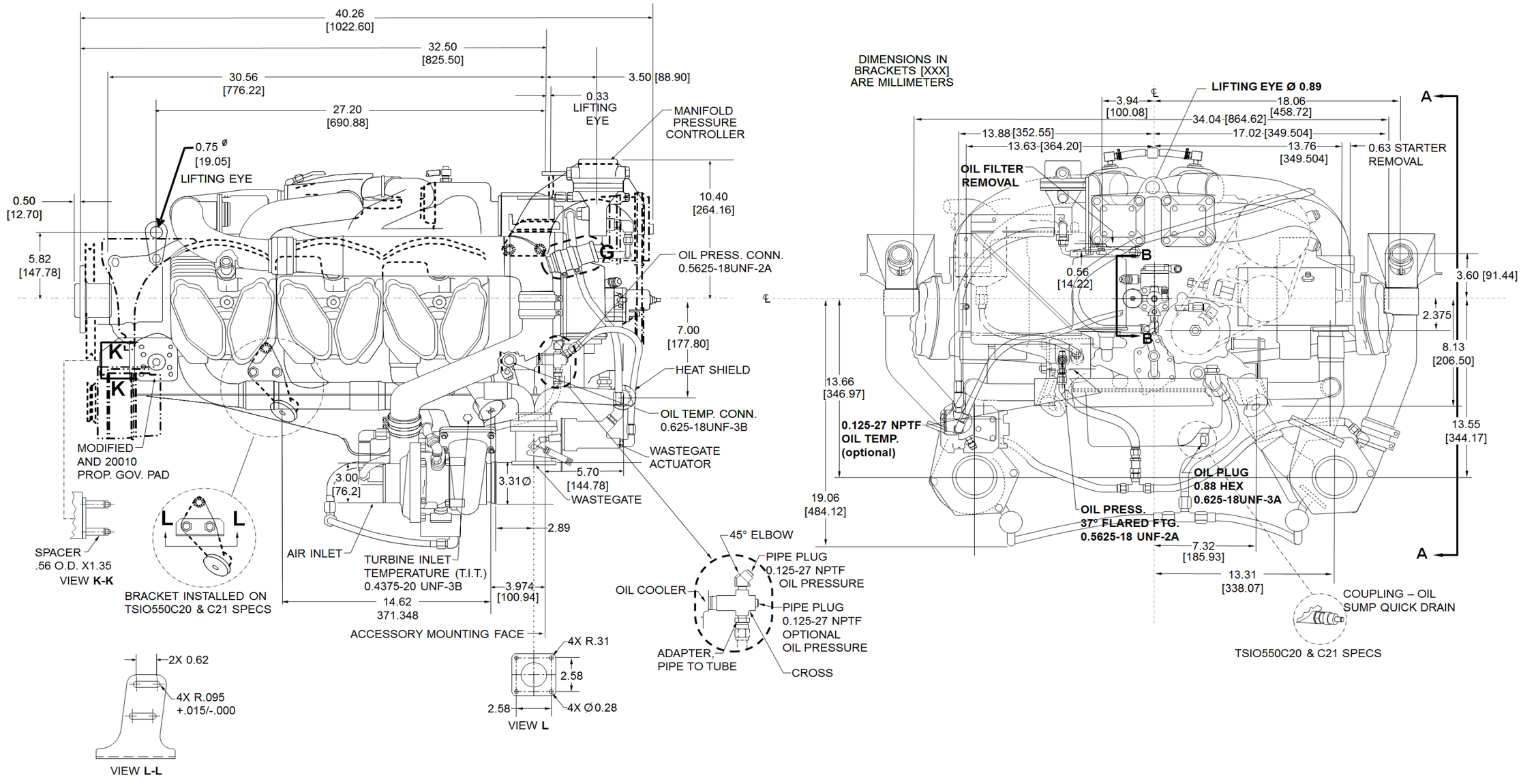


Figure 5-27. TSIO-550-C Installation Drawing 656791 - Sheet 1 of 3

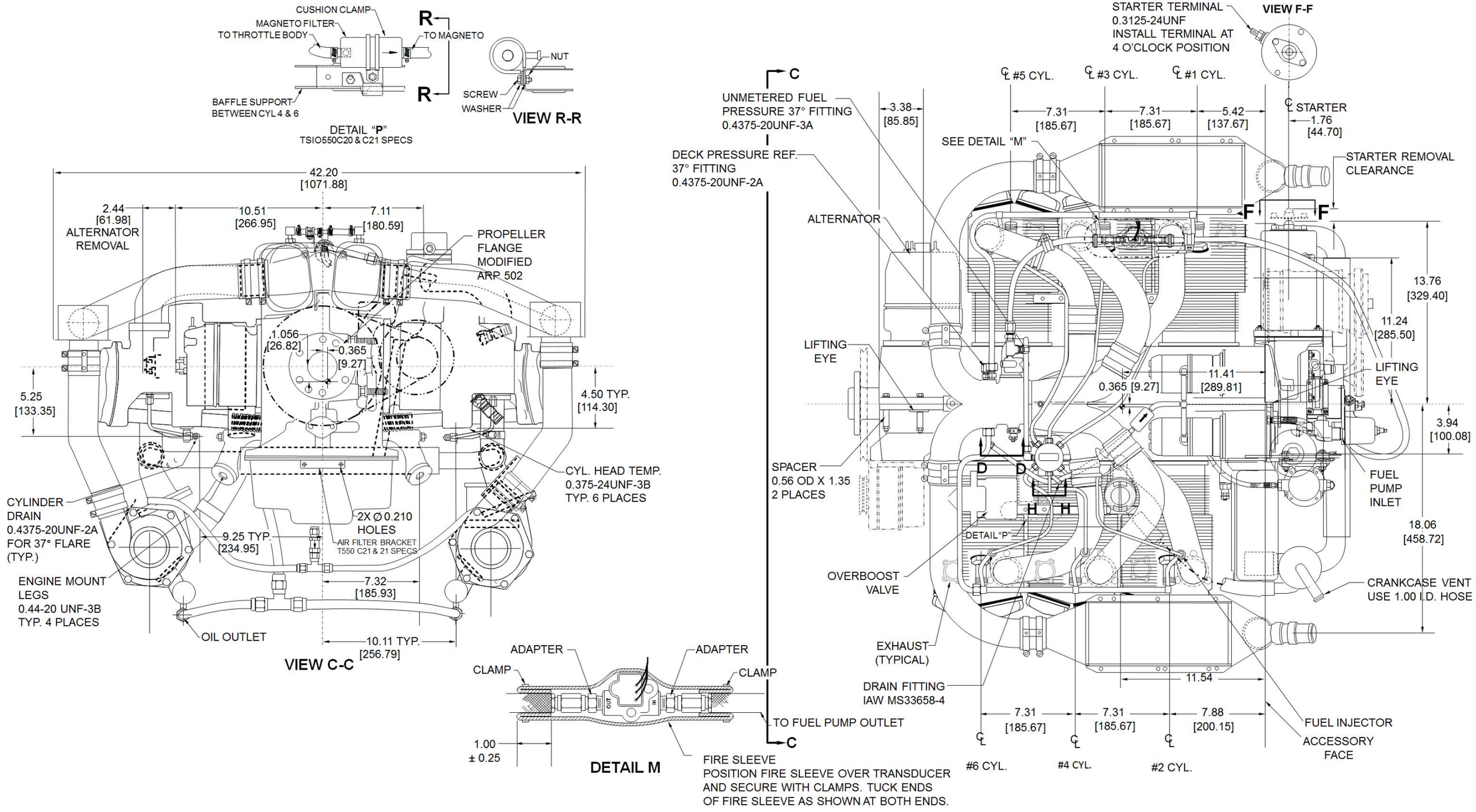
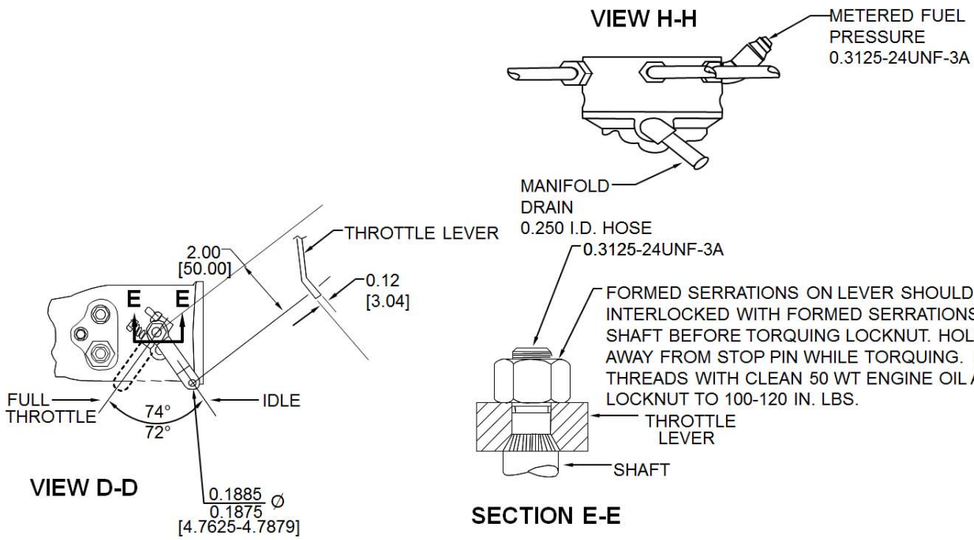
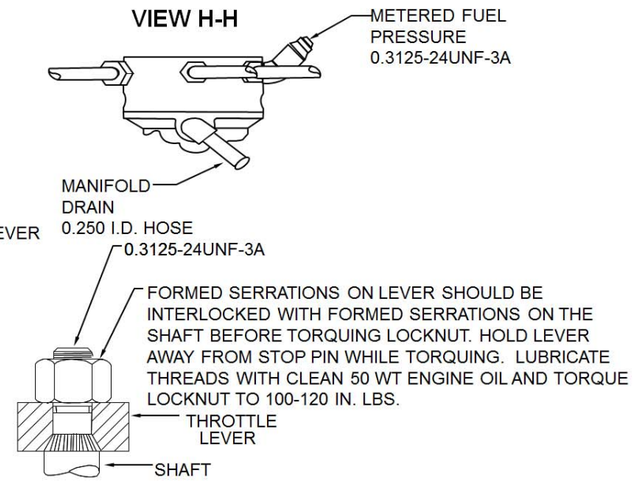


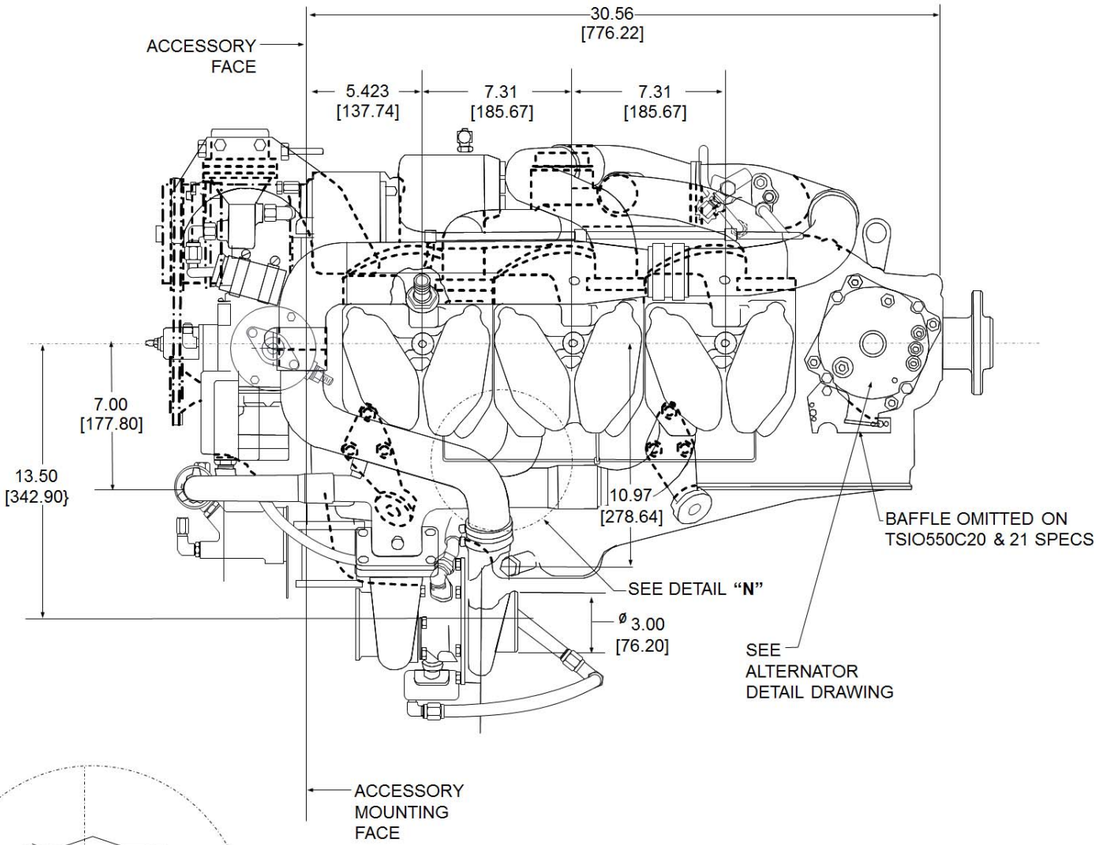
Figure 5-28. TSIO-550-C Installation Drawing 656791 - Sheet 2 of 3



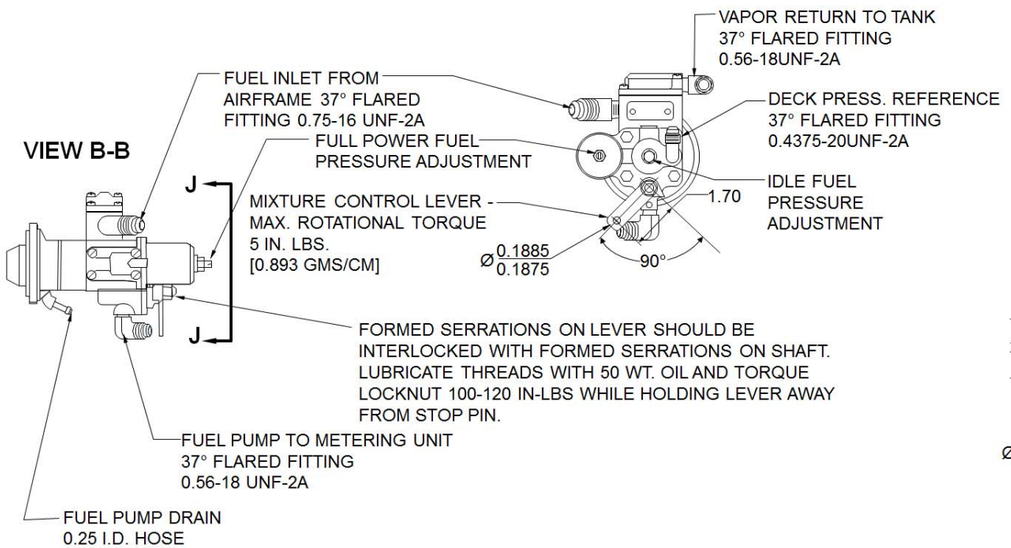
VIEW D-D

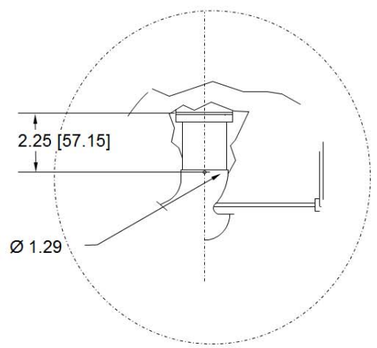


SECTION E-E



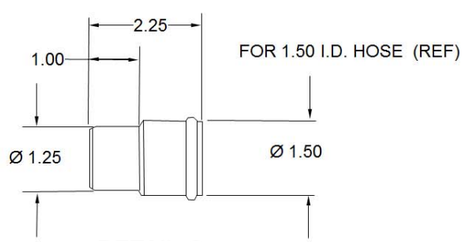
VIEW A-A





DETAIL "N"
EGT PROBE (EXHAUST)
TYPICAL 6 PLACES

SONIC VENTURI
TYP. 2 PLACES



DETAIL G

Figure 5-29. TSIO-550-C Installation Drawing 656791 - Sheet 3 of 3

5-4.5. TSIO-550-G Engine Installation Drawings

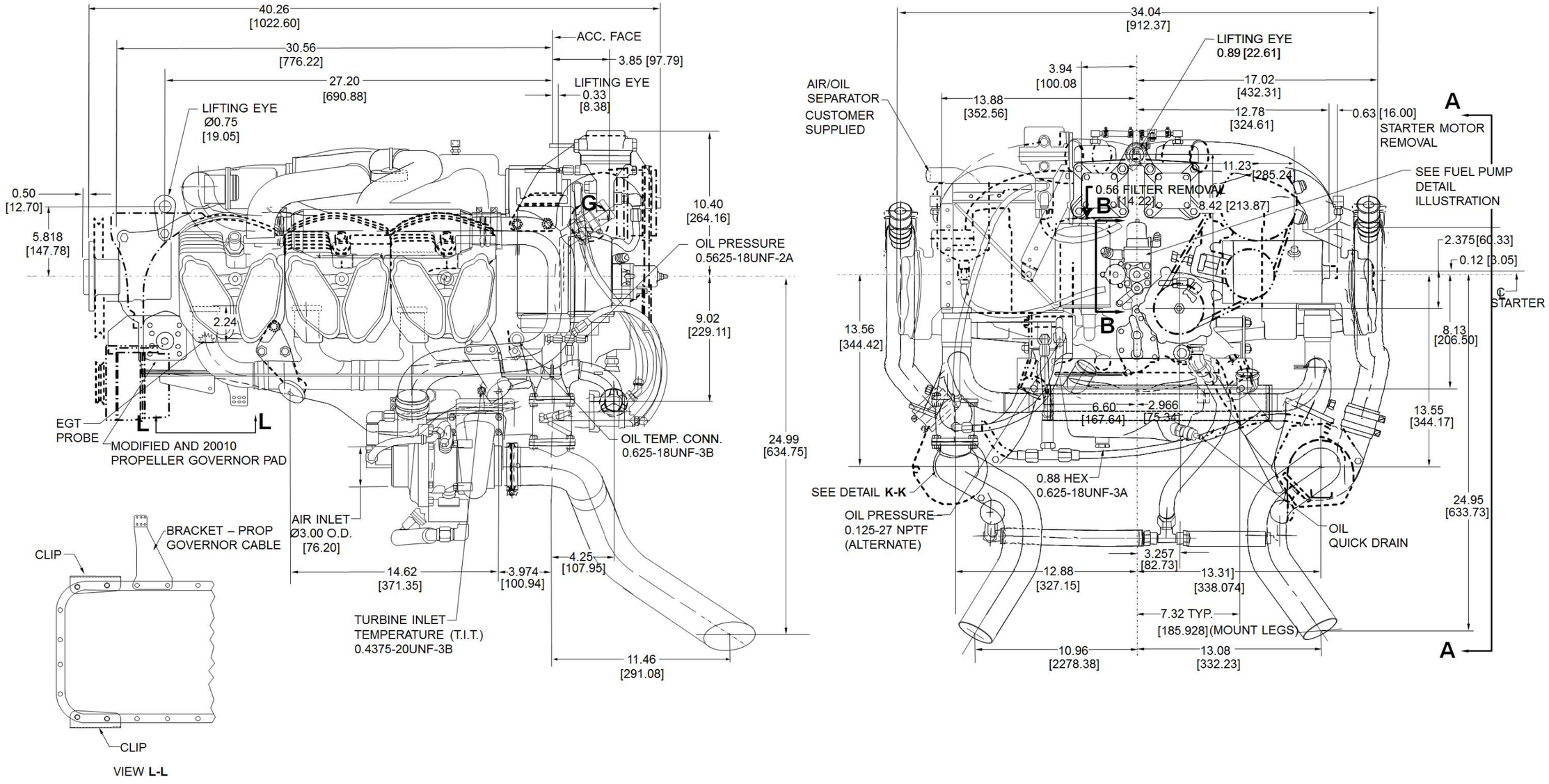


Figure 5-30. TSIO-550-G Installation Drawing 657154 - Sheet 1 of 3

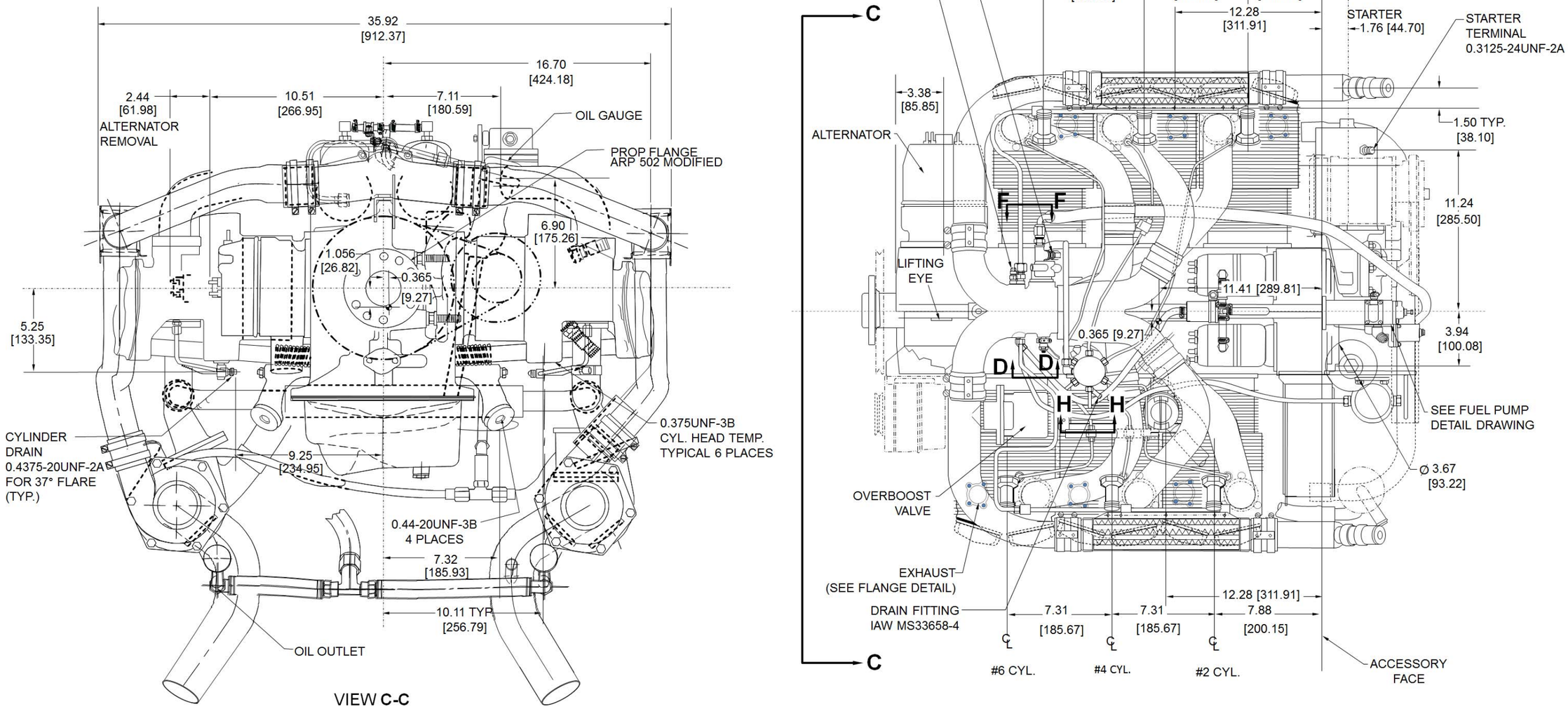


Figure 5-31. TSIO-550-G Installation Drawing 657154 - Sheet 2 of 3

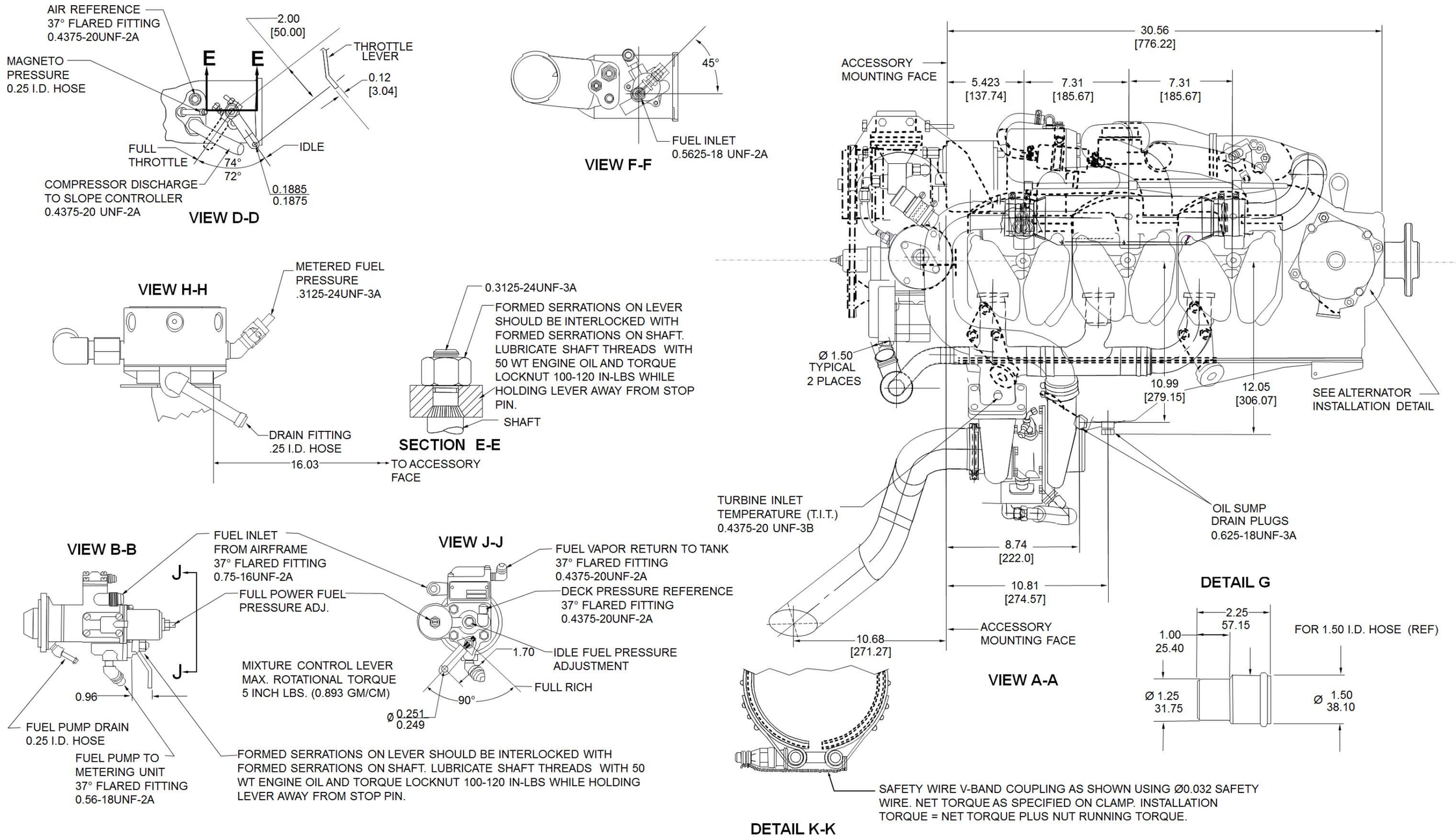


Figure 5-32. TSIO-550-G Installation Drawing 657154 - Sheet 3 of 3

5-4.6. TSIO-550-K Engine Installation Drawings

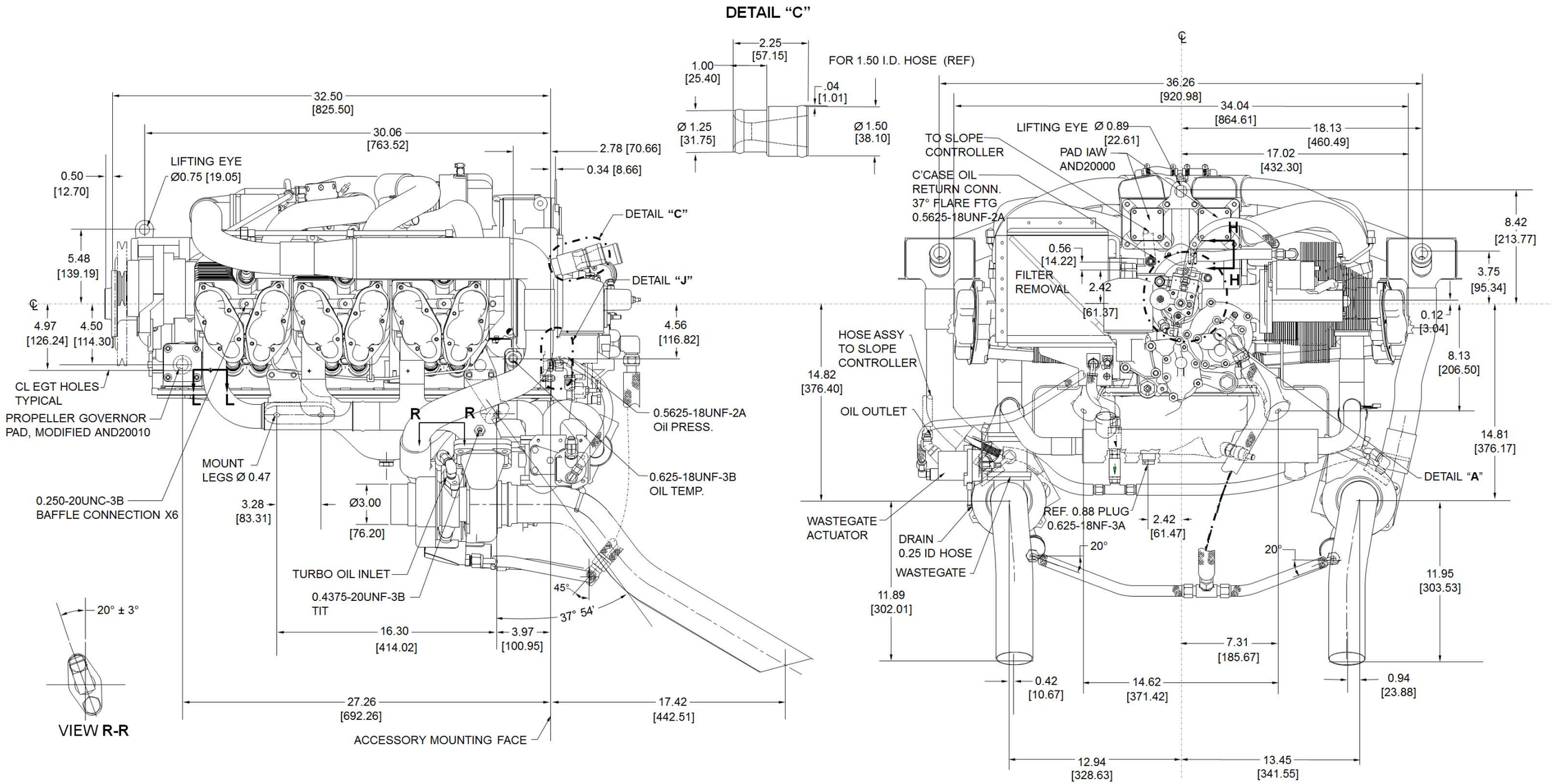


Figure 5-33. TSIO-550-K Installation Drawing 657645 - Sheet 1 of 4

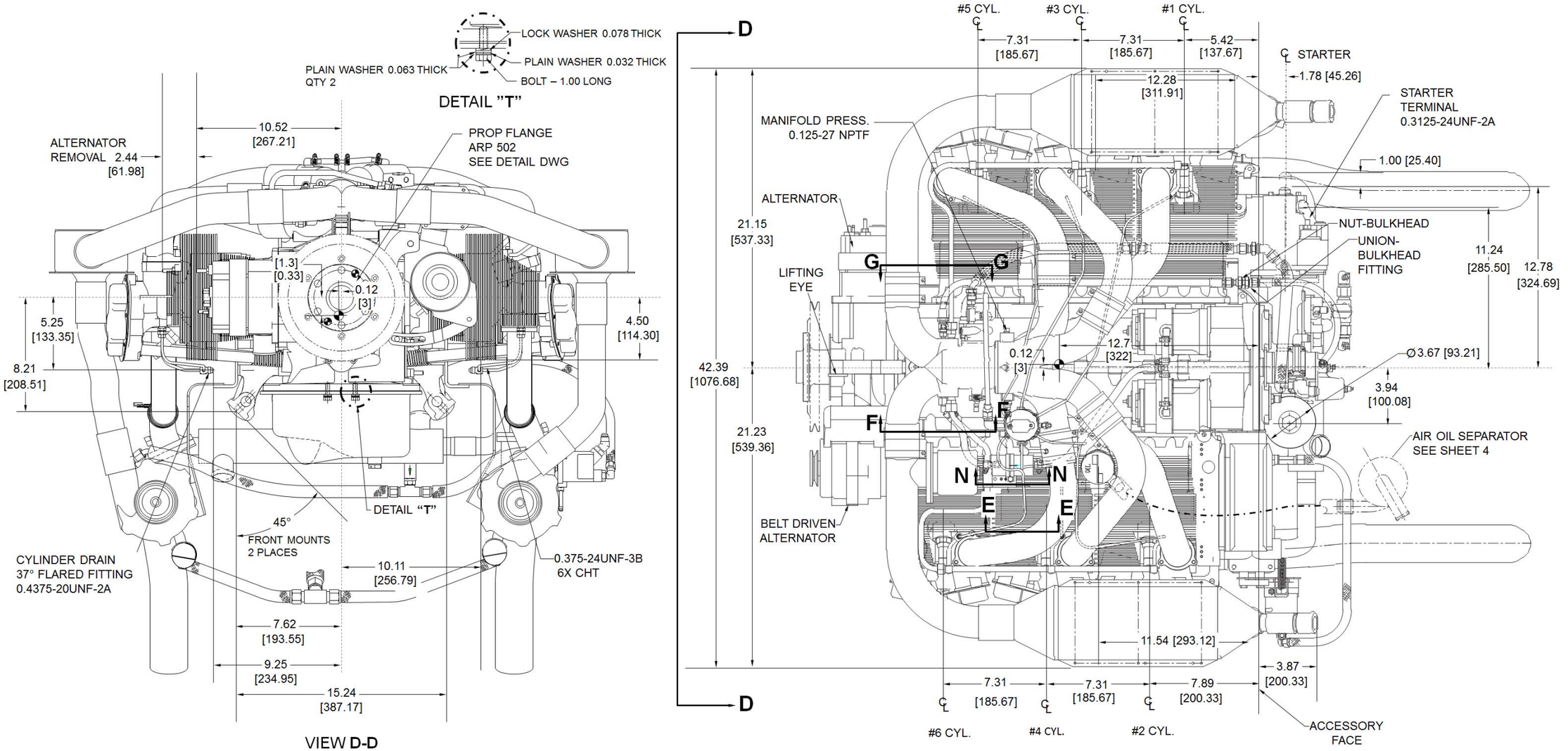


Figure 5-34. TSIO-550-K Installation Drawing 657645 - Sheet 2 of 4

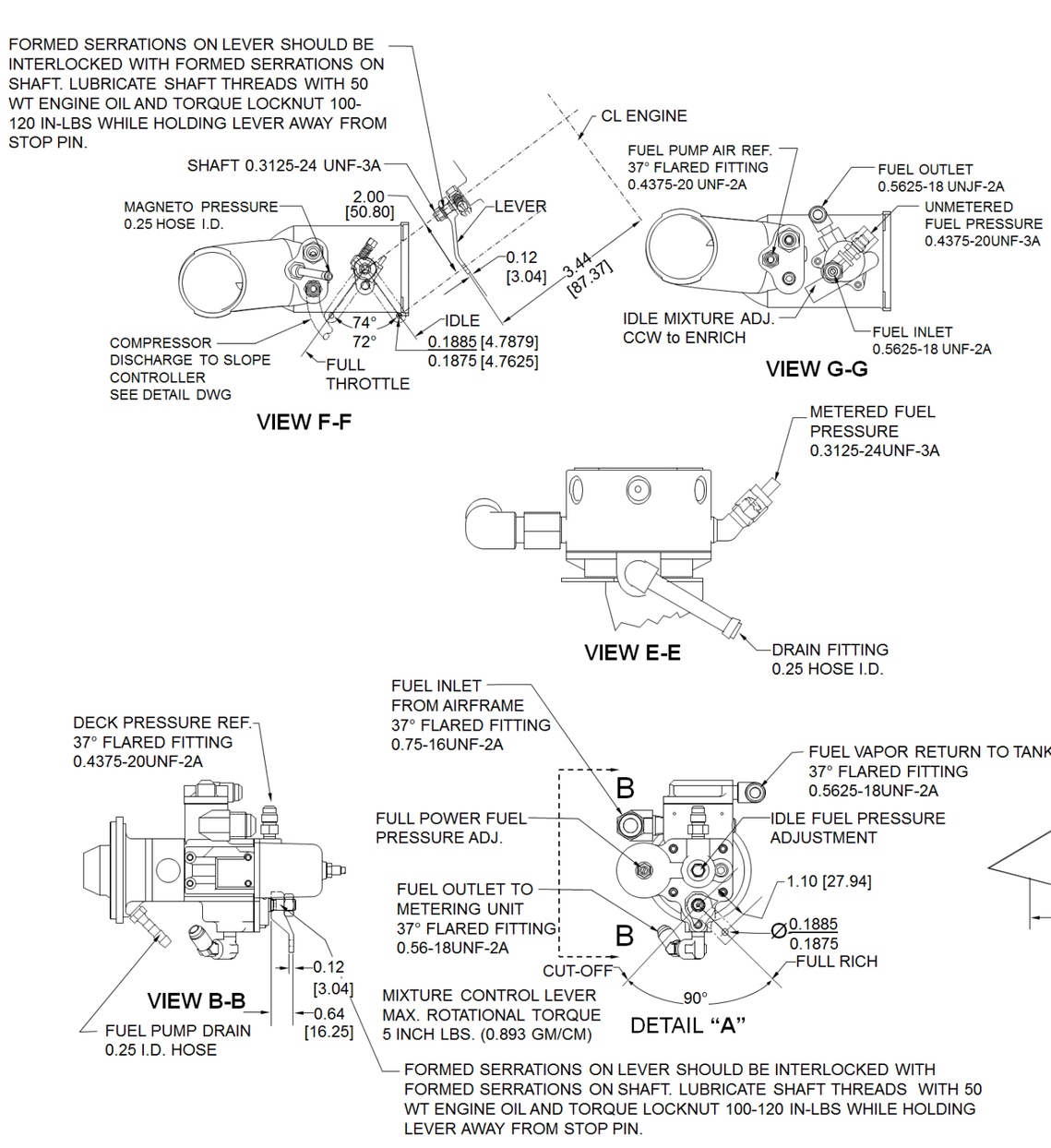
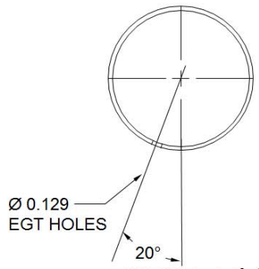
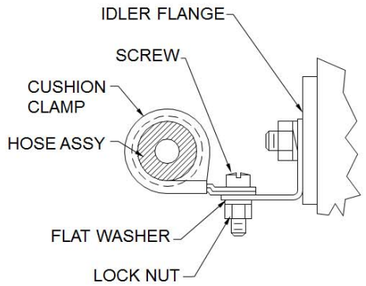


Figure 5-35. TSIO-550-K Installation Drawing 657645 - Sheet 3 of 4

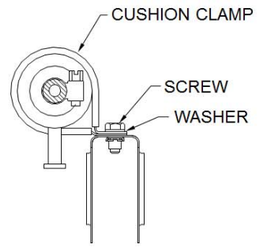


VIEW L-L 1-3-5 CYLINDERS

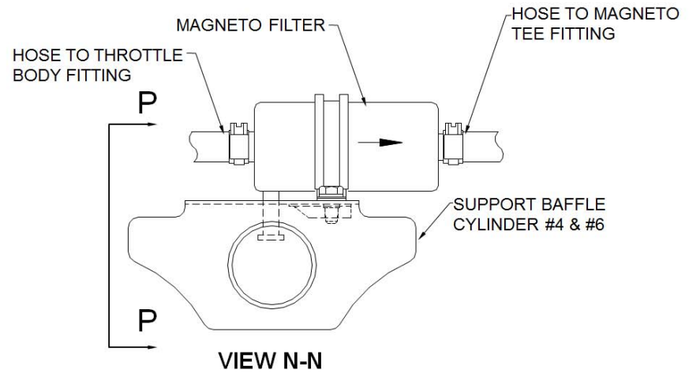
VIEW M-M 2-4-6 CYLINDERS



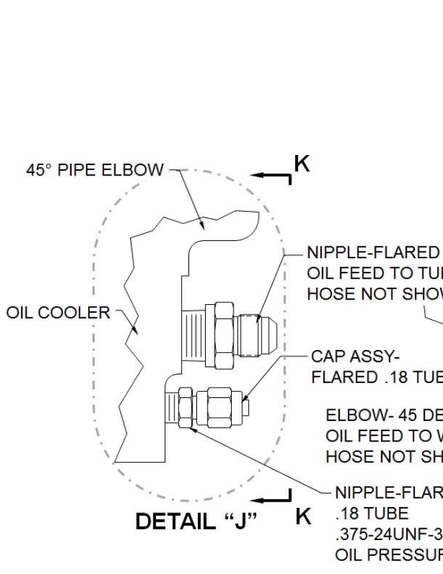
VIEW H-H



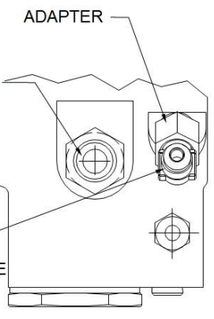
VIEW P-P



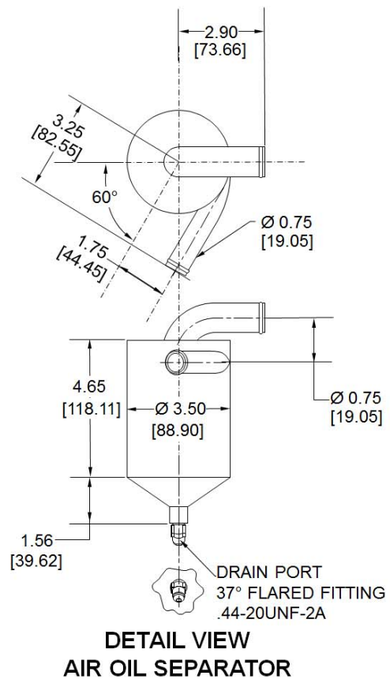
VIEW N-N



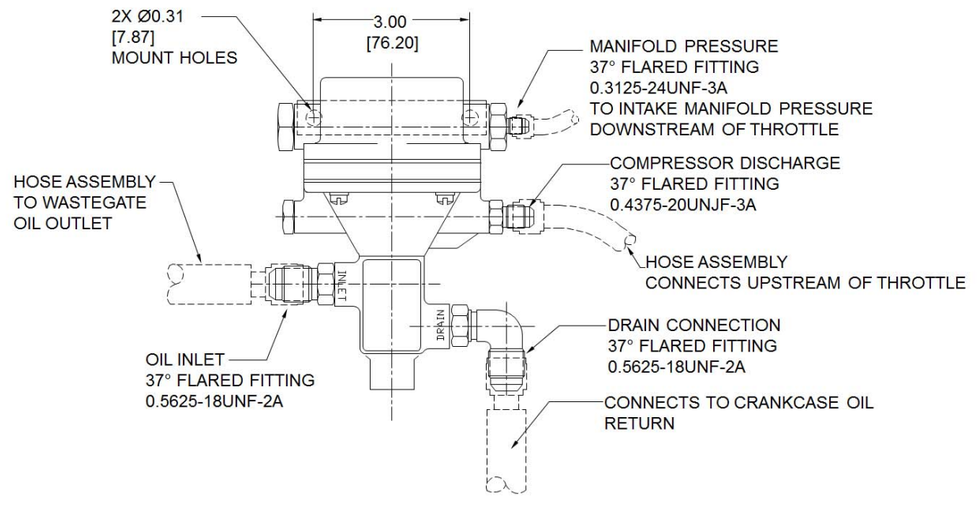
DETAIL "J"



VIEW K-K



DETAIL VIEW
AIR OIL SEPARATOR



DETAIL VIEW
AIRFRAME MOUNTED
SLOPE CONTROLLER

Figure 5-36. TSIO-550-K Installation Drawing 657645 - Sheet 4 of 4

5-4.7. TSIO-550-N Engine Installation Drawings

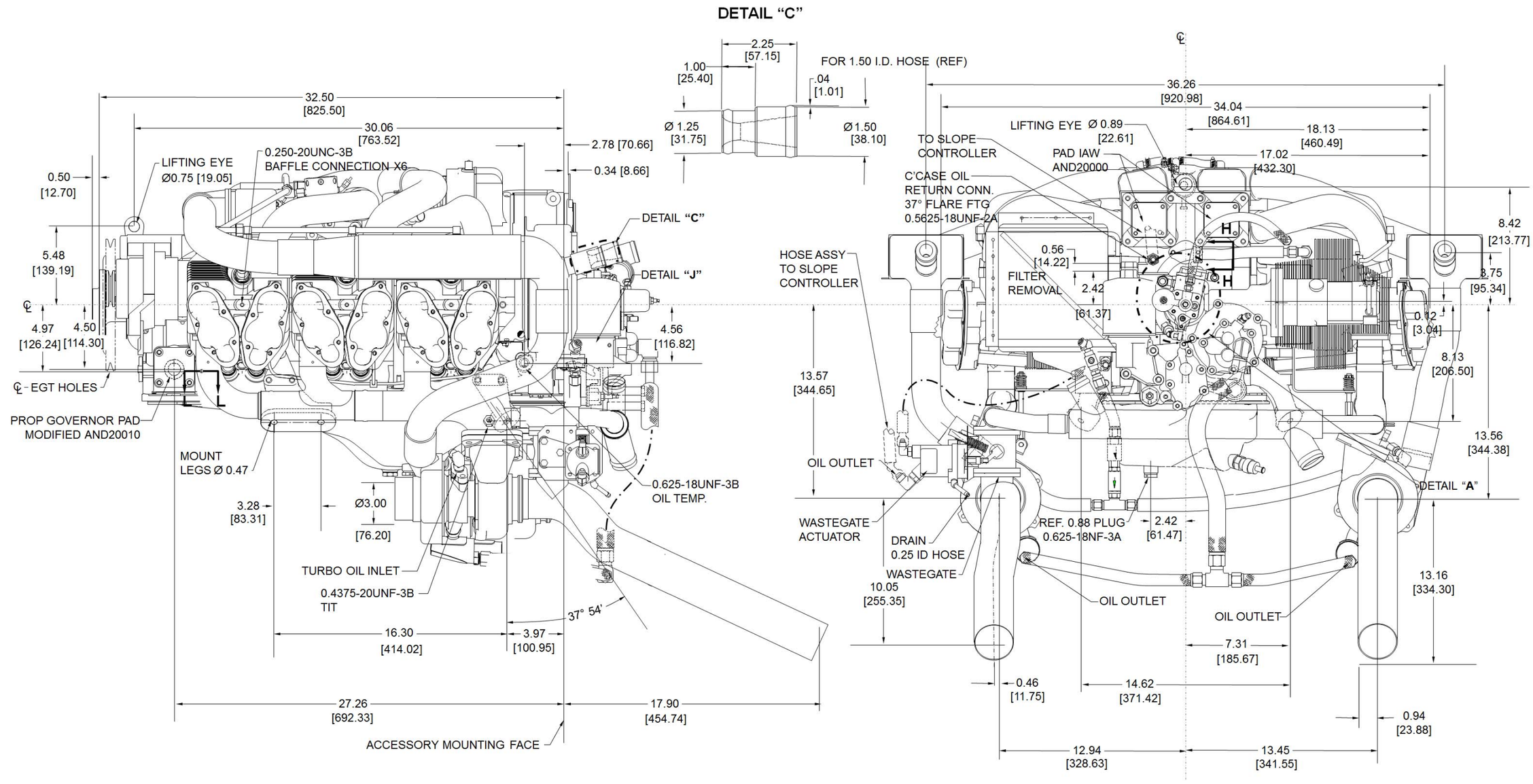


Figure 5-37. TSIO-550-N Installation Drawing 658233 - Sheet 1 of 5

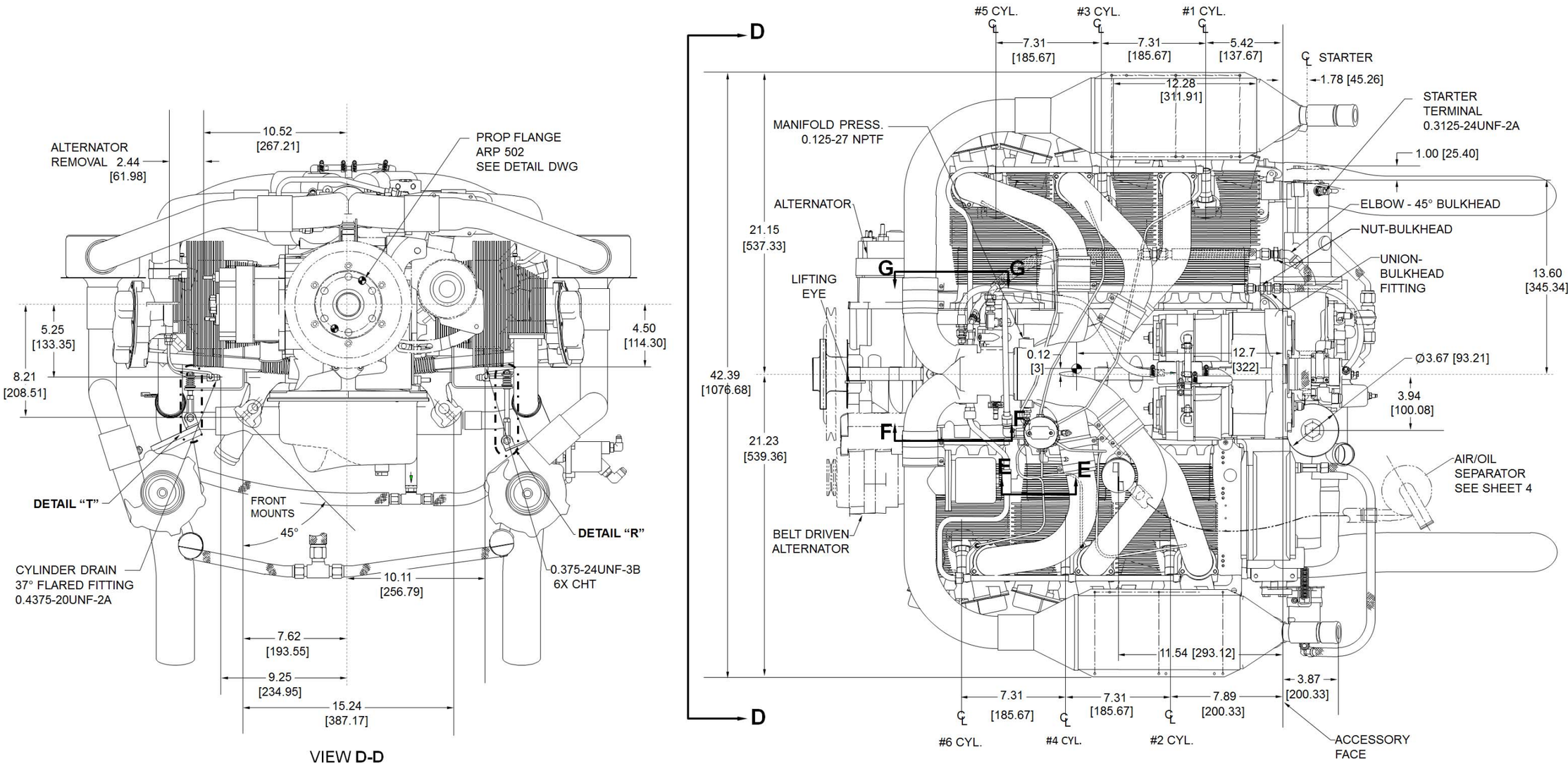


Figure 5-38. TSIO-550-N Installation Drawing 658233 - Sheet 2 of 5

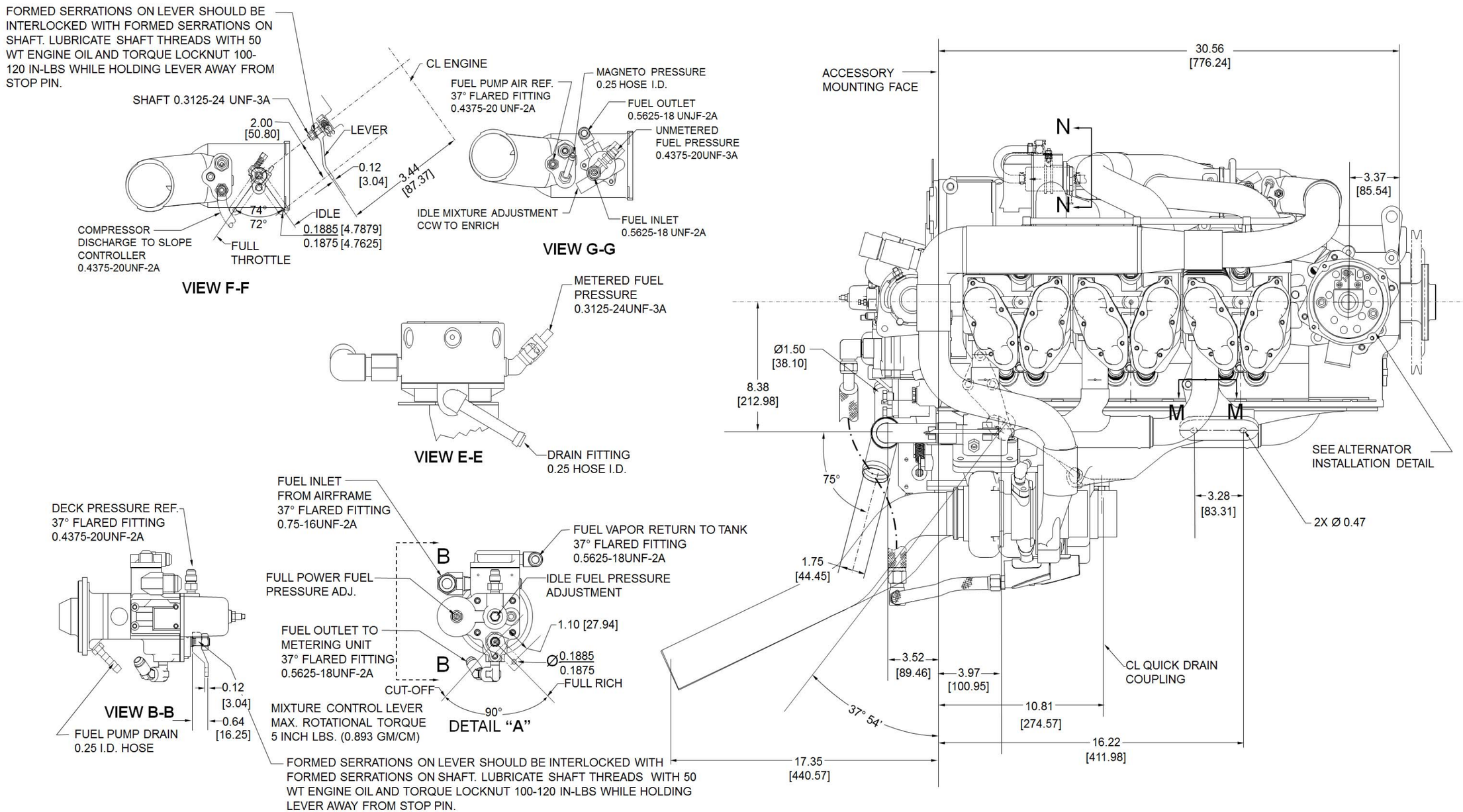
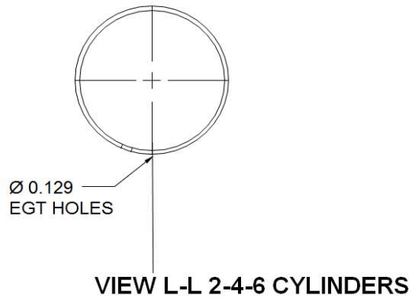
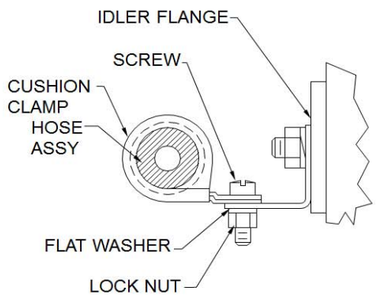


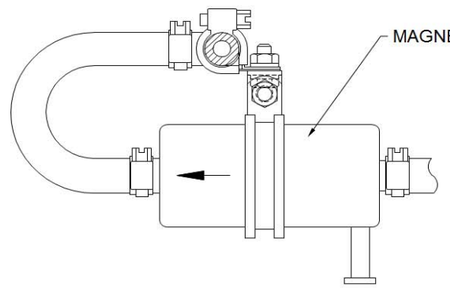
Figure 5-39. TSIO-550-N Installation Drawing 658233 - Sheet 3 of 5



VIEW L-L 2-4-6 CYLINDERS
VIEW M-M 1-3-5 CYLINDERS



VIEW H-H



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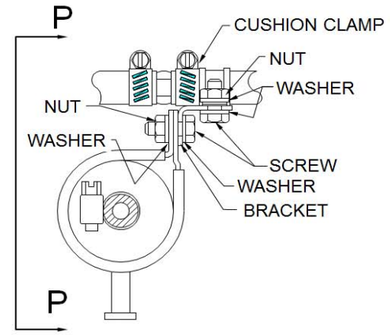
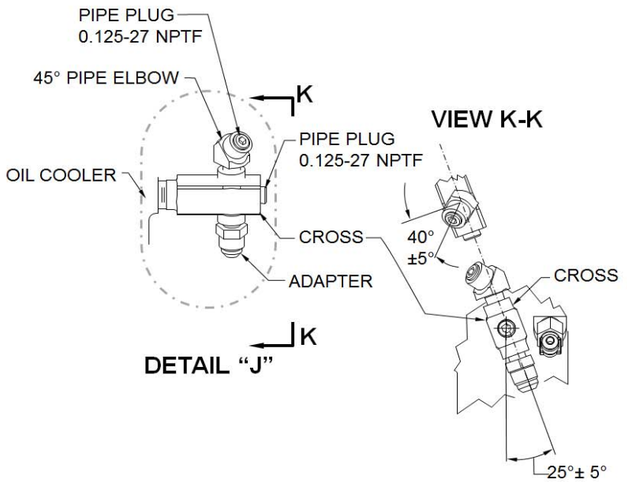
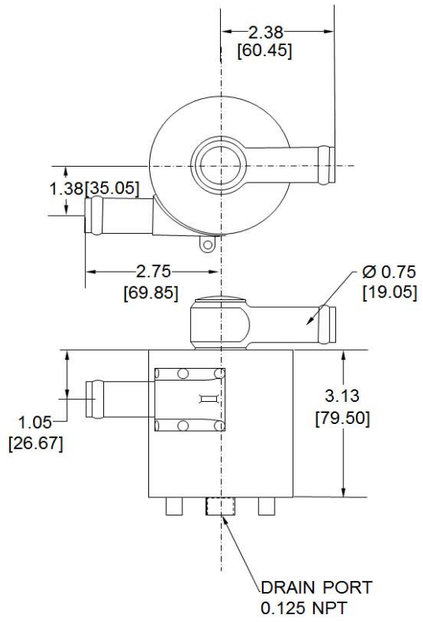
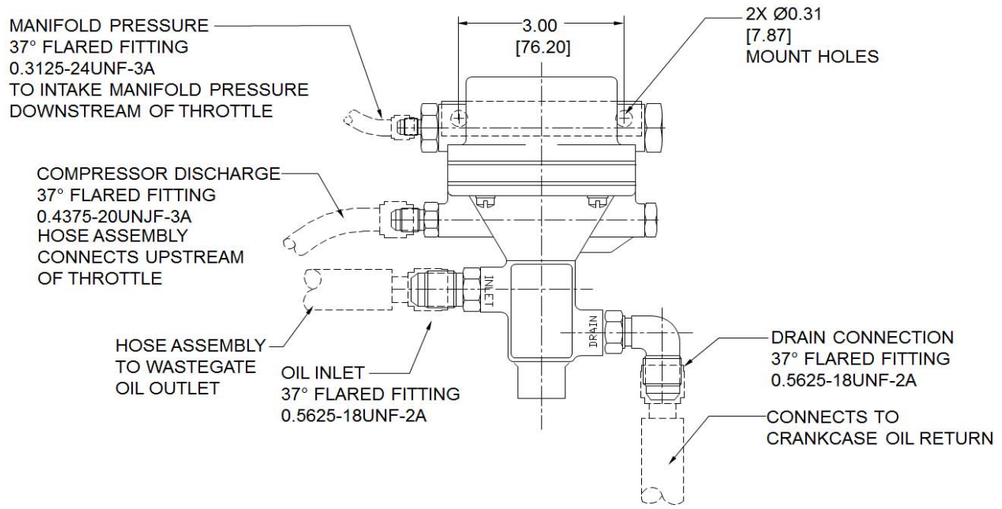


VIEW N-N



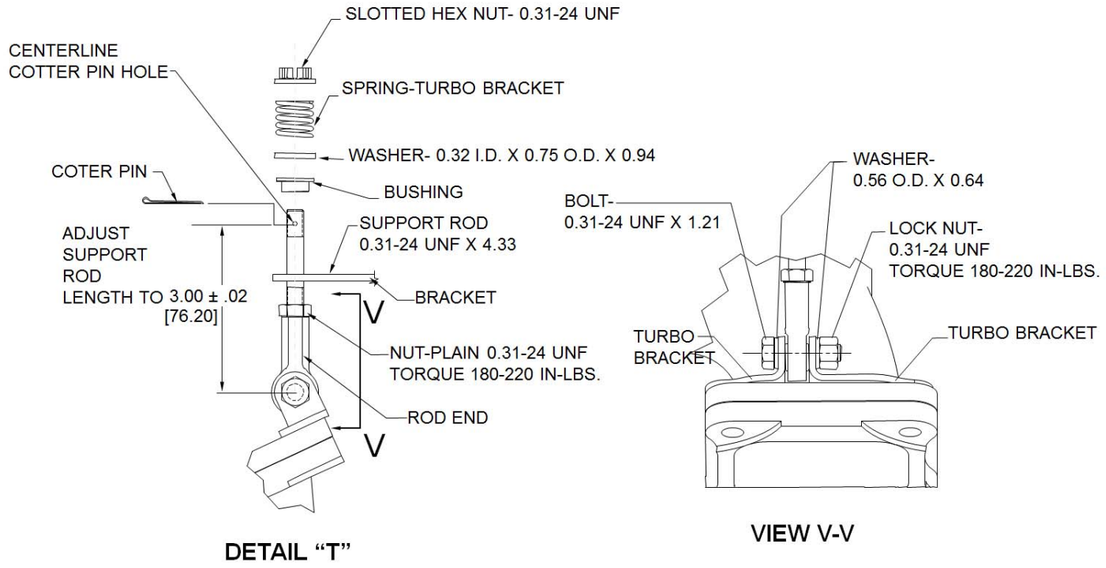


DETAIL VIEW
AIR OIL SEPARATOR

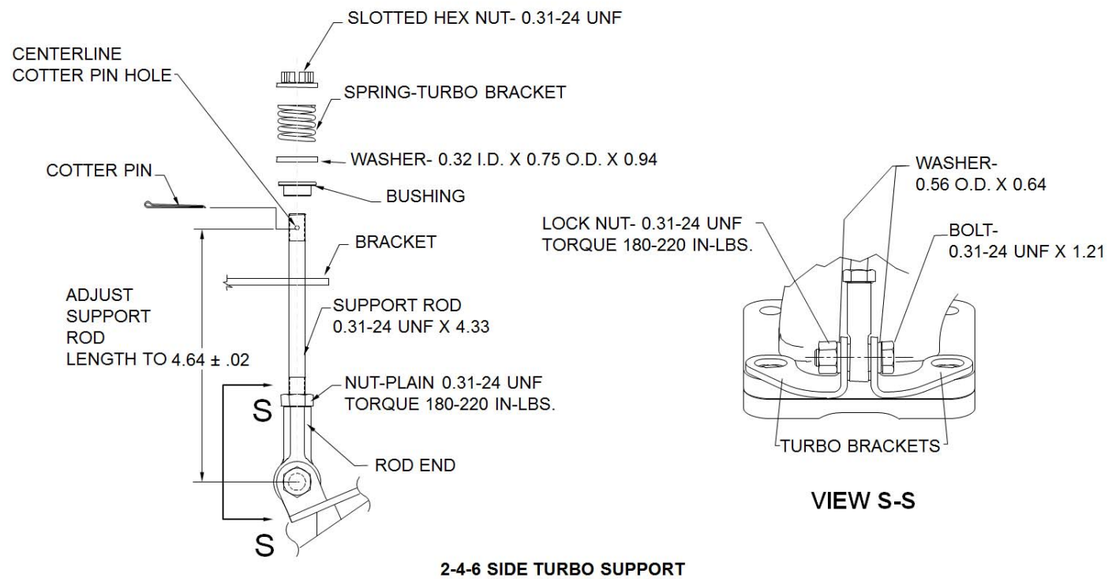


DETAIL VIEW
AIRFRAME MOUNTED
SLOPE CONTROLLER

Figure 5-40. TSIO-550-N Installation Drawing 658233 - Sheet 4 of 5



1-3-5 SIDE TURBO SUPPORT



2-4-6 SIDE TURBO SUPPORT

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.

Table 6-1. Engine Inspection and Maintenance Schedule

Interval		Task	Reference
Cumulative Operating Hours	**Calendar**		
See Table 6-2 in M-0, Standard Practice Maintenance Manual		Drive Belt (optional equipment) Tension Check	Section 6-3.1
		Hartzell Alternator Initial Inspection (One Time)	Section 6-3.1
		Initial operation inspection after placing a new, rebuilt, or overhauled engine in service, including cylinder replacement. Repeat this inspection after each 25 hours of operation until oil consumption stabilizes.	Section 6-3.2
		Oil Change (with integral oil screen)	Section 6-3.8
		50-Hour engine inspection and service	Section 6-3.3
		100-Hour engine inspection and service	Section 6-3.4
		Clean fuel injector nozzles	Section 6-3.4
		Magneto inspection	Section 6-3.4
		500-Hour inspection and service	Section 6-3.5

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.

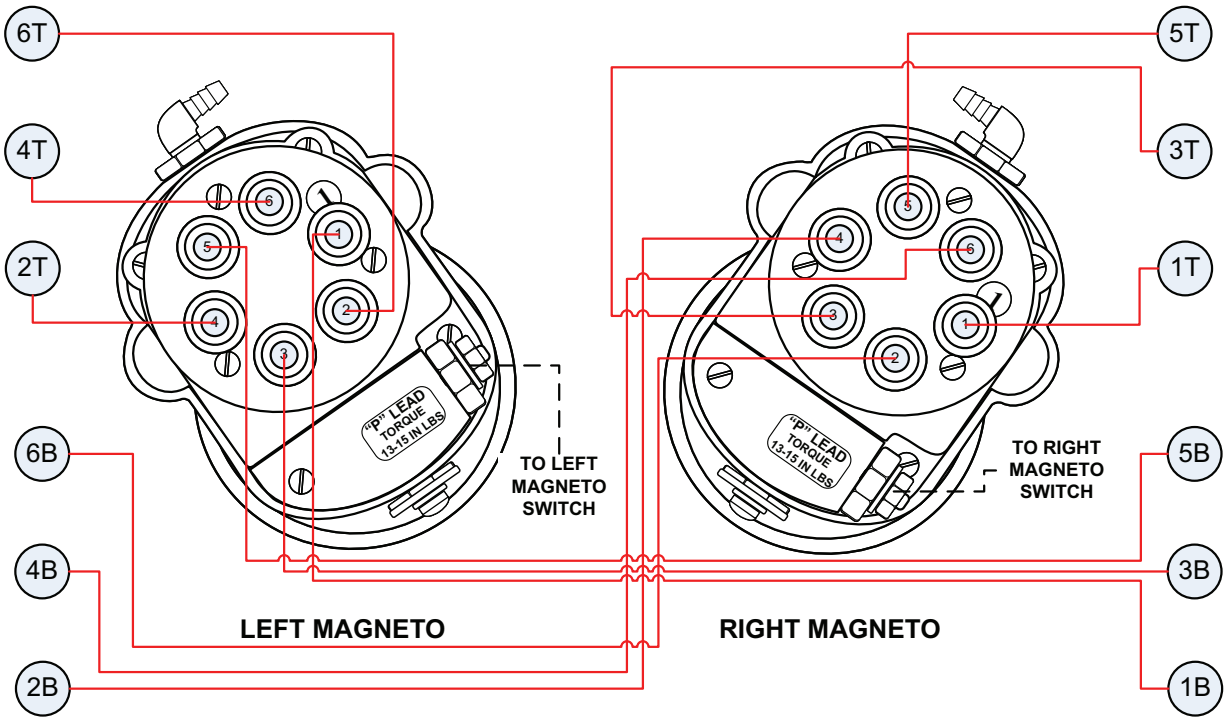

Figure 6-1. Champion (Slick) Ignition Harness Routing

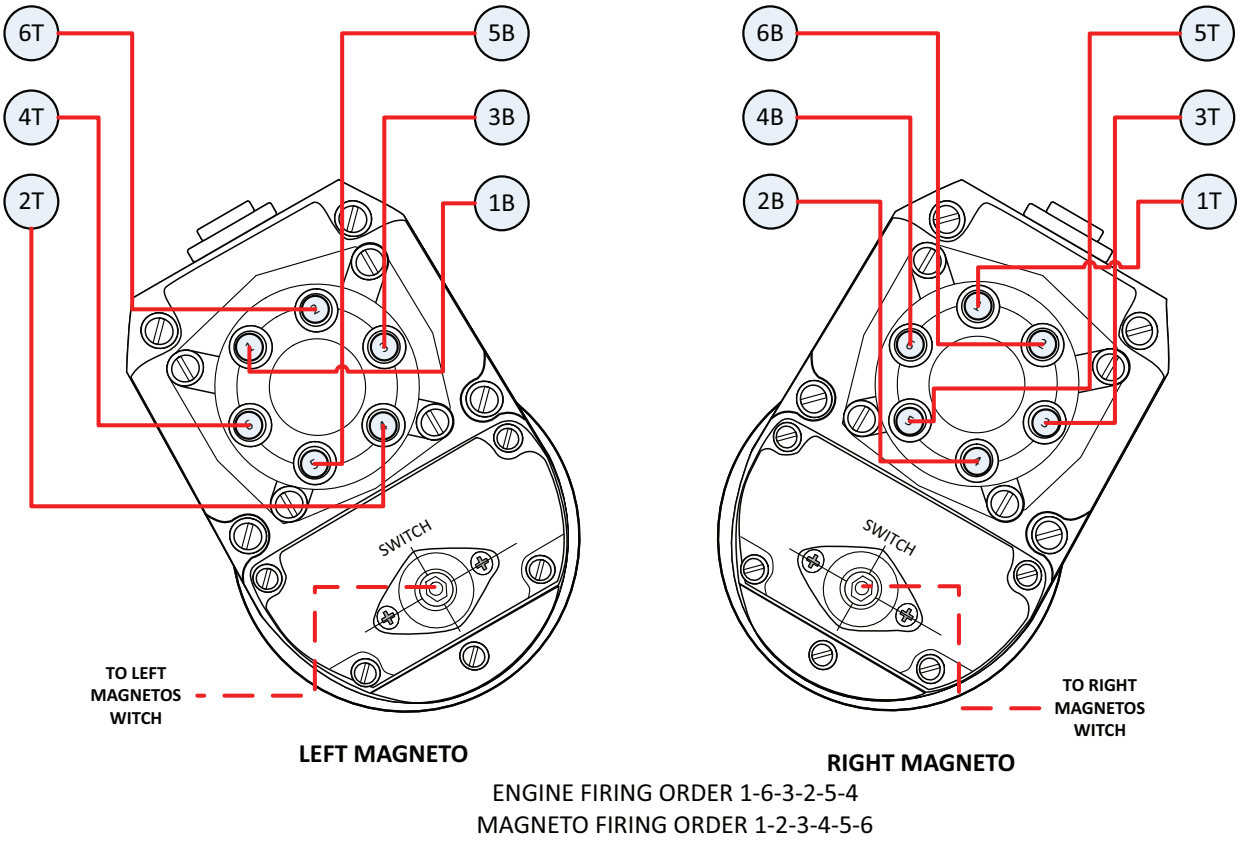

Figure 6-2. Continental (Bendix) Ignition Harness Routing

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.

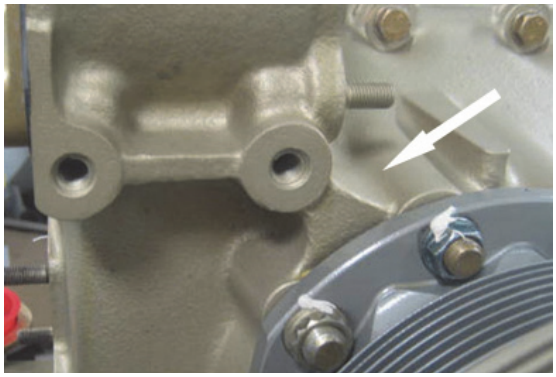

Figure 6-3. Mount Boss with Thick Rib

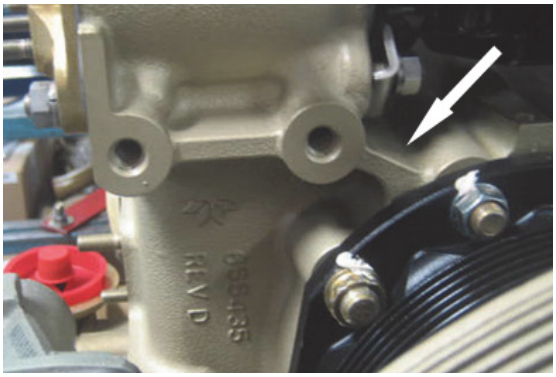

Figure 6-4. Mount Boss with Thin Rib

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.

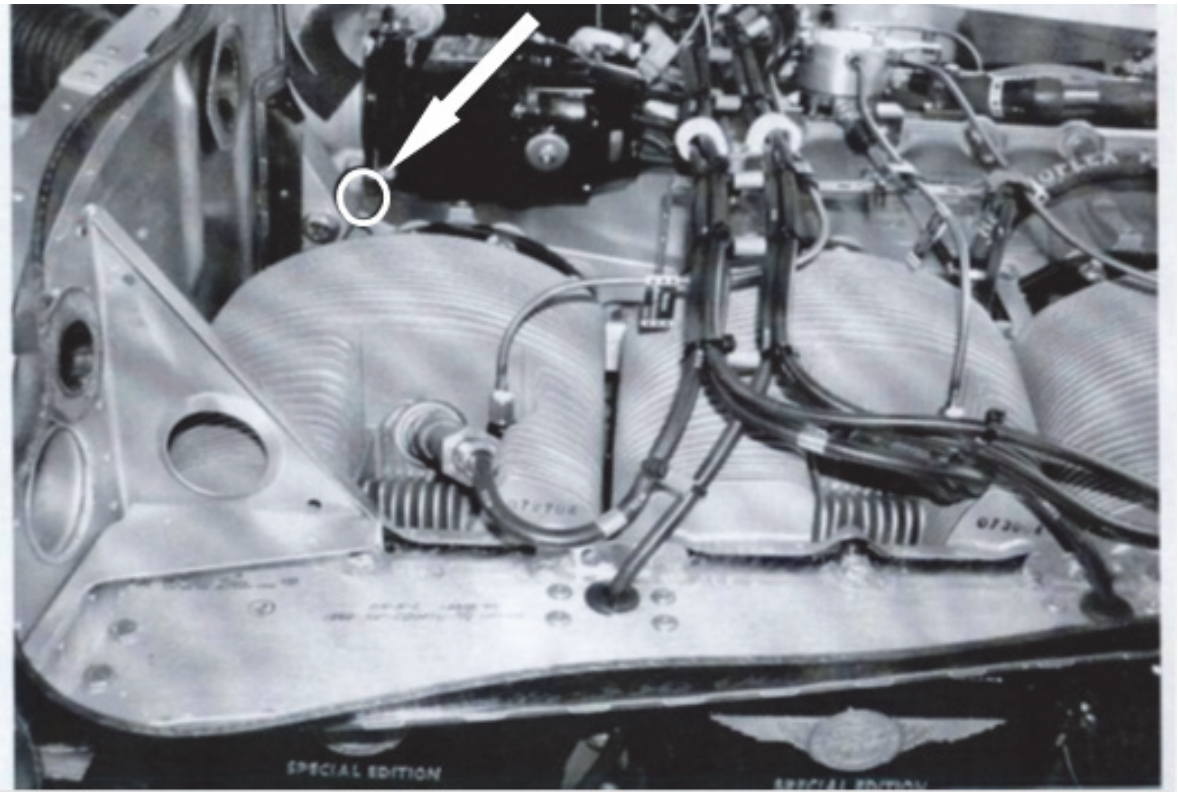

Figure 6-5. General Inspection Area

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

Refer to the "Engine Mount Inspection" in Section 6-4.13 of M-0, Standard Practice Maintenance Manual.

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.

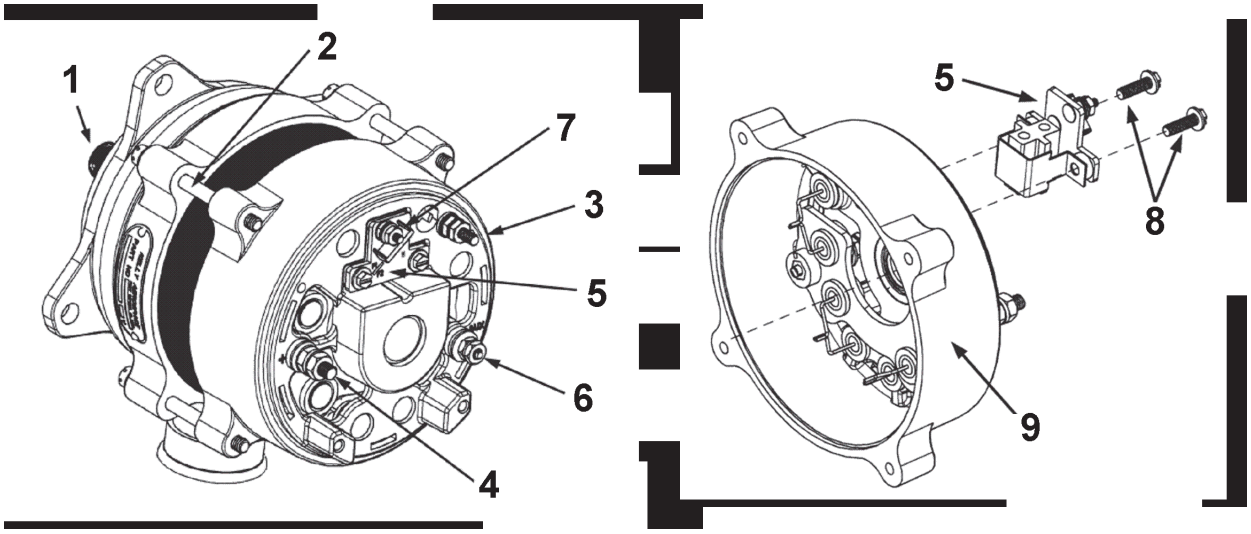

Figure 6-7. ES10024 Alternator

1	Output Shaft	4	Battery Terminal	6	Aux Terminal	8	Screws
2	Thru Bolts	5	Brush Assembly	7	Field Terminal	9	Slip Ring End Housing
3	Ground Terminal						

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.

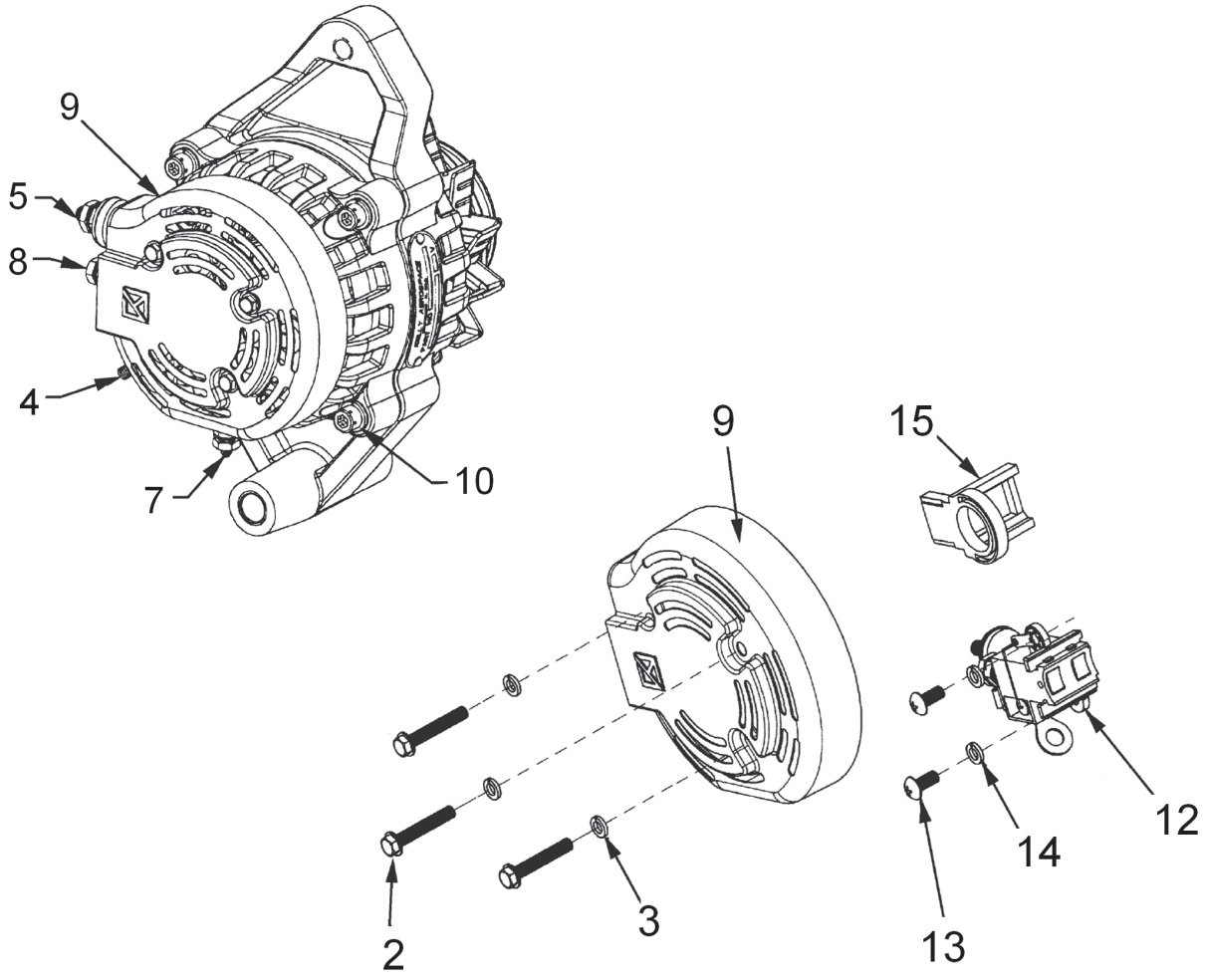

Figure 6-8. ES7024 Alternator Assembly

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

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.

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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.

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.

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.

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.
3. Monitor temperatures closely.
4. Maintain sufficient airspeed and attitude to provide engine cooling.
5. Cowl flaps ..... FULLY OPEN (if equipped)

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.

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.

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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.

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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.

S*ervice 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

Replaceable Item	Reference
Alternator	Section 10-5, “Alternator Replacement”
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”
Engine Mounts	Section 13-9.3, “Engine and Turbocharger Mount Disassembly” 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” and 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

Repairable Item	Reference
Crankcase Cracks	Section 15-8.10, “Crankcase Overhaul Repair”
Engine Cylinder	Section 10-8, “Engine Cylinder Maintenance”
Oil Cooler	Section 10-7.4, “Oil Cooler Repair and 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 and Oil Suction Tube	Section 10-7.3, “Oil Sump and Oil Suction Tube Repair and Replacement”
Starter Motor	Section 10-4, “Starter Motor and Adapter Replacement”

Table 10-3. Parts Handling Guidelines

Parts/Components	Handling Instructions
Wrapped new or rebuilt parts	Parts that require protection from atmospheric dust and moisture should be wrapped or boxed after acceptance inspection and remain wrapped until time of installation
Spark plugs	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.

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.

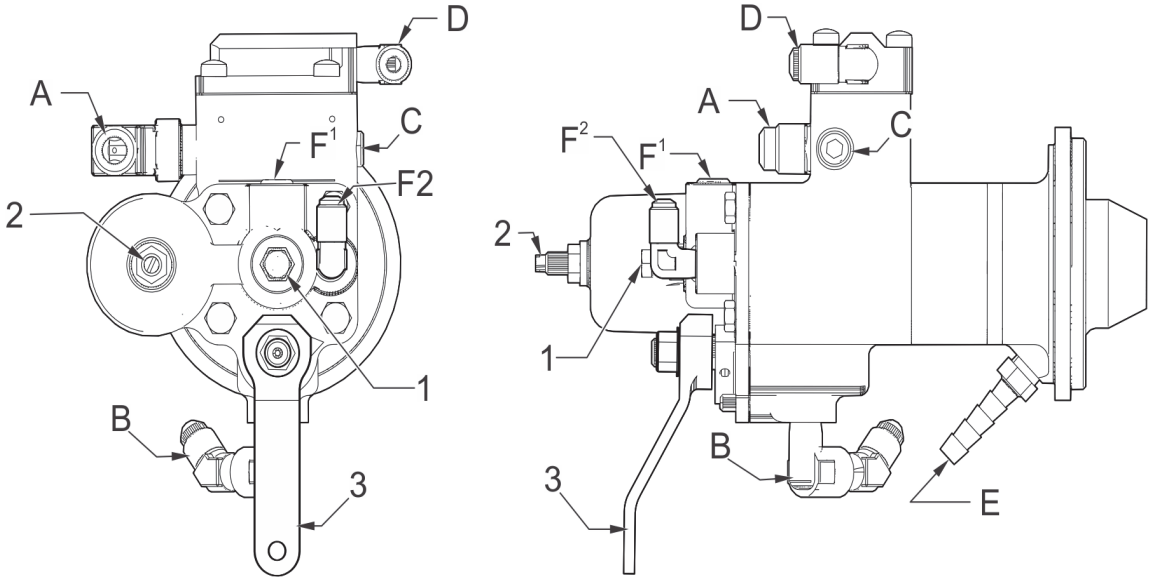

Figure 10-1. Fuel Pump Adjustments & Fittings (typical)

Fittings	
A	Fuel Inlet
B	Fuel Outlet (Unmetered Pressure)
C	Fuel Return
D	Fuel Vapor Return
E	Drain
F	Ambient (or Deck) Pressure Reference

Adjustments	
1	Low Pressure Relief Valve CW = INCREASE
2	Aneroid Adjustment CCW = INCREASE
3	Mixture Control 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.

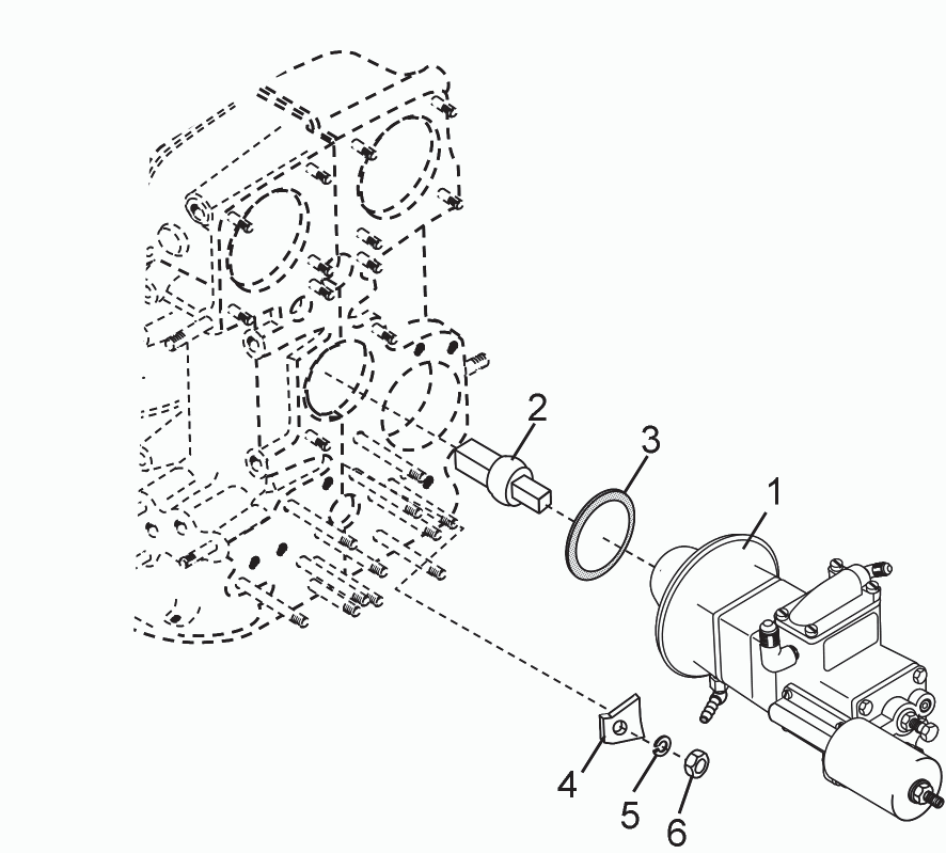

Figure 10-2. Fuel Pump Assembly

1	Fuel Pump Assembly	4	Hold Down Washer
2	Coupling, Fuel Pump Drive	5	Lock Washer
3	Fuel Pump Gasket	6	Nut

10-2.2. Fuel Pump Service Limits

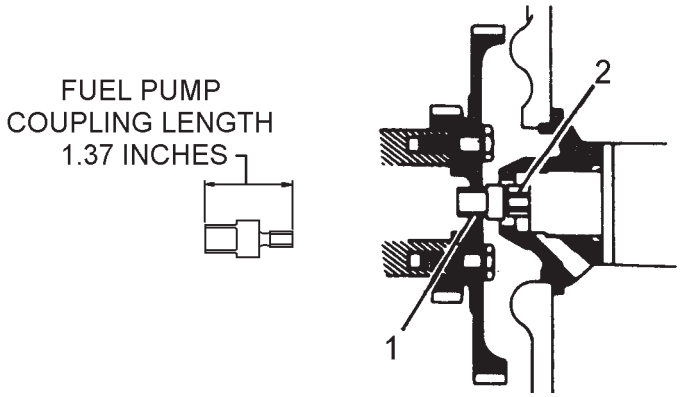

Figure 10-3. Fuel Pump Drive Coupling Fits and Limits

Table 10-4. Fuel Pump Drive Coupling Dimensions

Ref. No.	Part	Dimensions (inches)	
		Minimum	Maximum
1	Fuel pump drive coupling to crankshaft gear ..... Clearance:	0.0095L	0.0155L
2	Fuel pump drive coupling to fuel pump ..... Clearance:	0.0030L	0.0090L
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 (F^1 or F^2,depending on engine model) according to "Hose and Tubing Installation" instructions in Section C-11of 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.

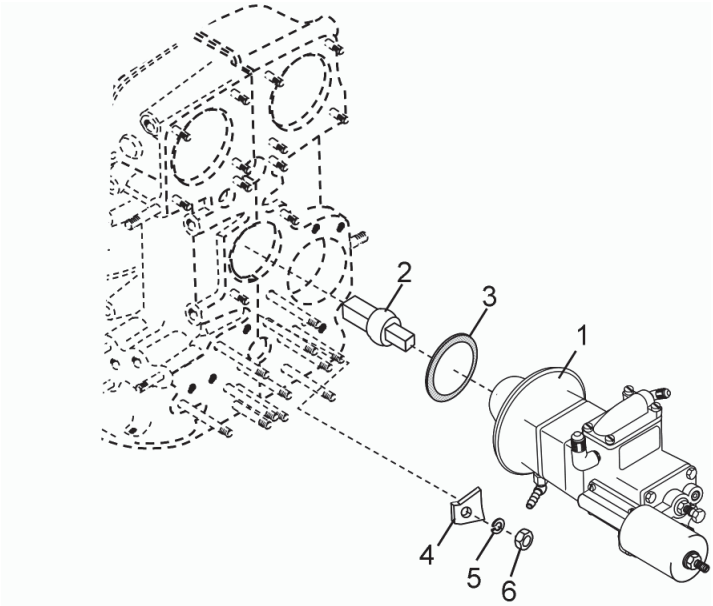

Figure 10-2 repeated for reference

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.

Refer to "Fuel Injector Replacement" in Section 10-2 of M-0, Standard Practice Maintenance Manual.

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.

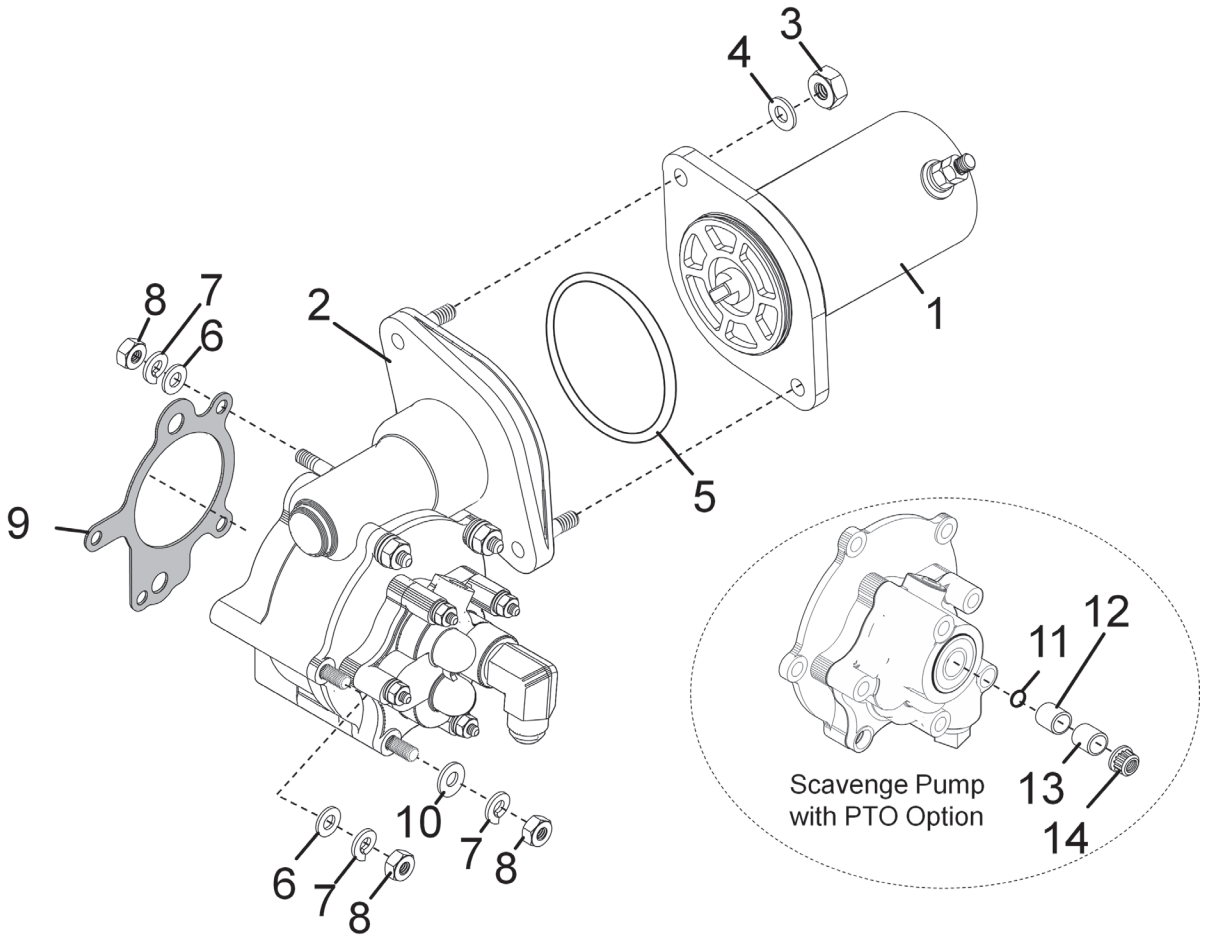

Figure 10-4. Starter Motor and Starter Adapter

1	Starter Motor	5	O-ring	9	Gasket	13	Spacer
2	Starter Adapter	6	Washer	10	Washer	14	Lock Nut
3	Nut	7	Lock washer	11	O-ring		
4	Washer	8	Nut	12	Sleeve		

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.

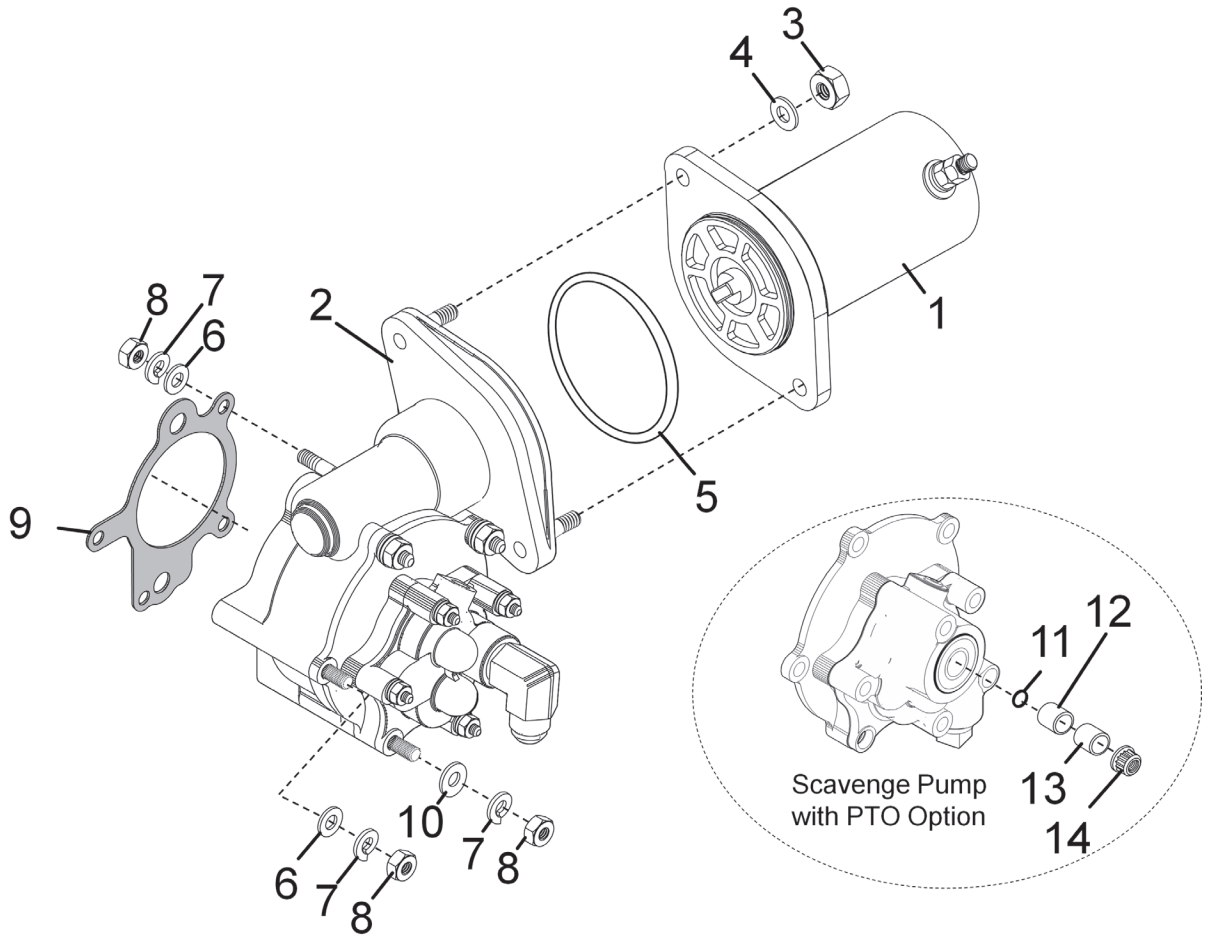

Figure 10-4 repeated for reference

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

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

1. When the sandblasted diameter finish is smoother than 125 RMS, replace the sleeve

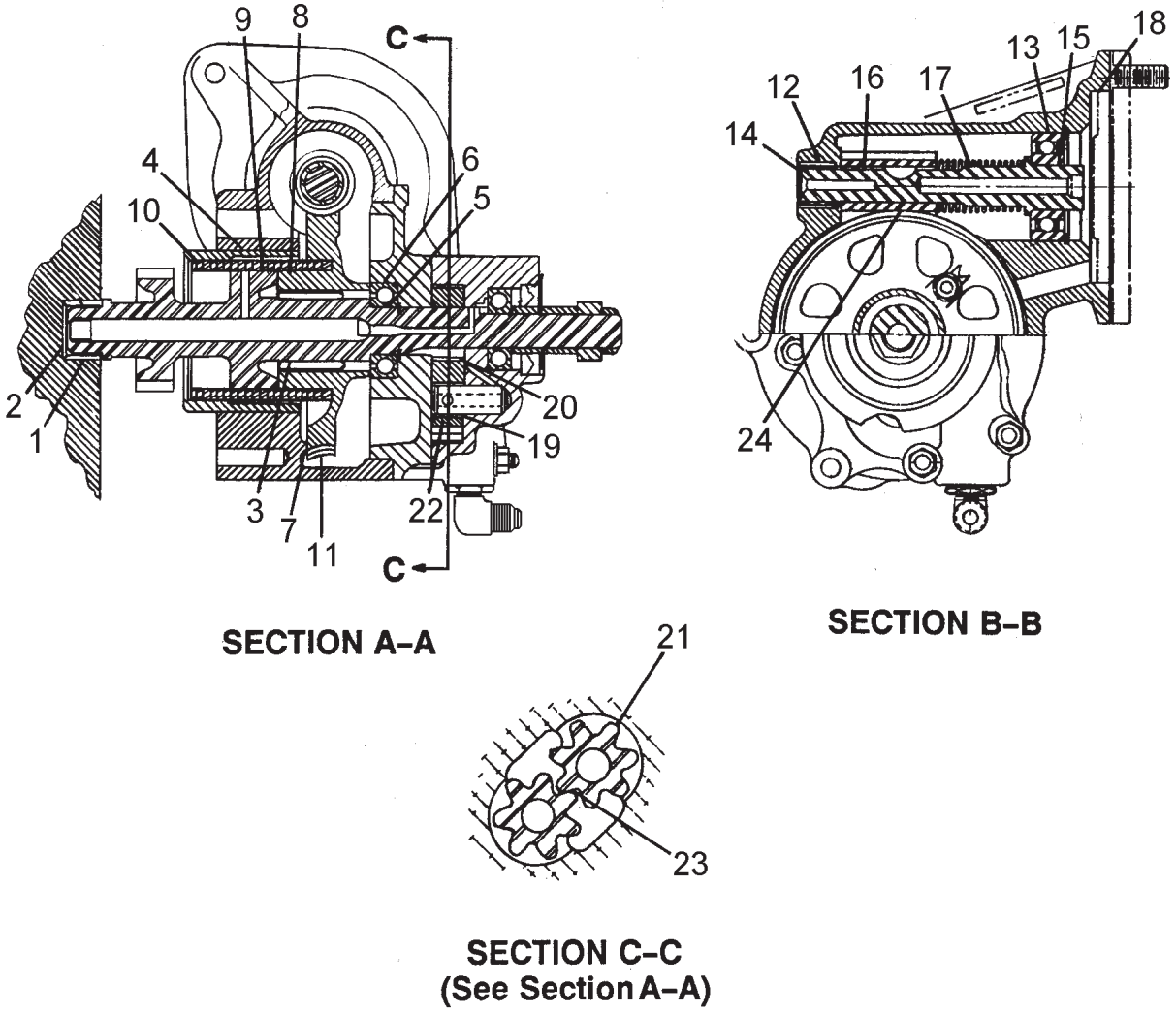

Figure 10-5. Starter and Starter Adapter Dimensions

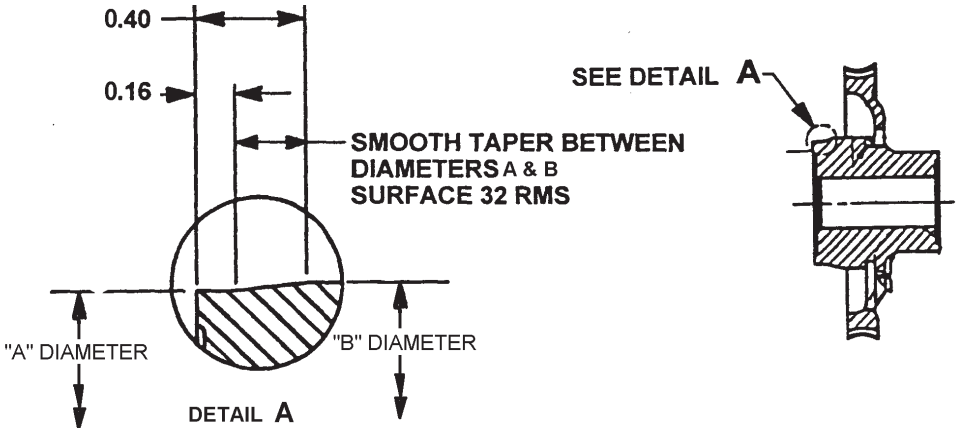

Figure 10-6. Worm Wheel Drum Dimensions

Table 10-6. Worm Wheel Drum Dimensions

Part	"A" Diameter (inches)		"B" Diameter (inches)	
	Minimum	Maximum	Minimum	Maximum
New Worm Wheel Drum	1.931	1.932	1.955	1.960
0.015 Undersize	1.916	1.917	1.940	1.945

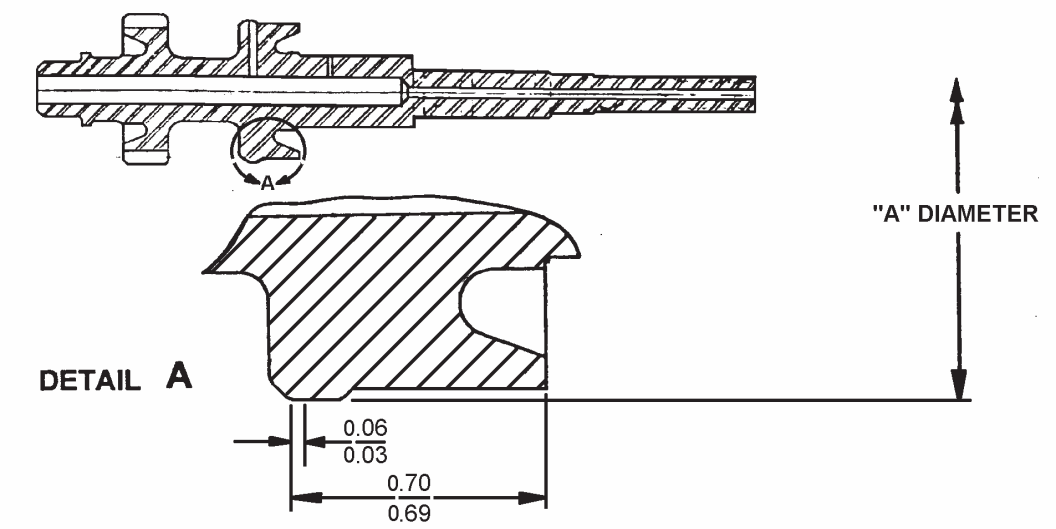

Figure 10-7. Shaft Gear Drum Dimensions

Table 10-7. Shaft Gear Drum Service Limits

Part	"A" Diameter (inches)	
	Minimum	Maximum
New Shaft Gear Drum Dimensions	1.931	1.932
0.015 Undersize	1.916	1.917
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.

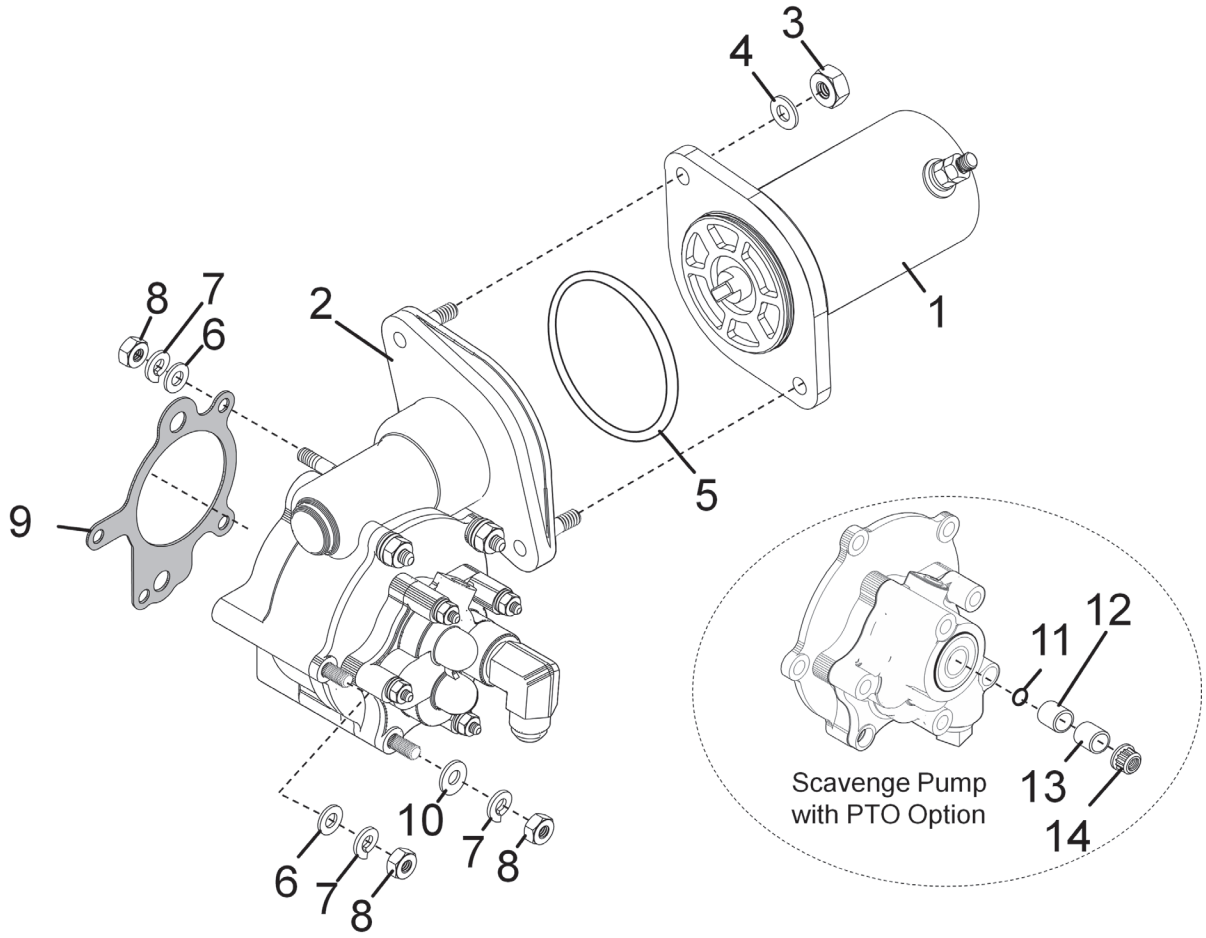

Figure 10-4 repeated for reference

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.

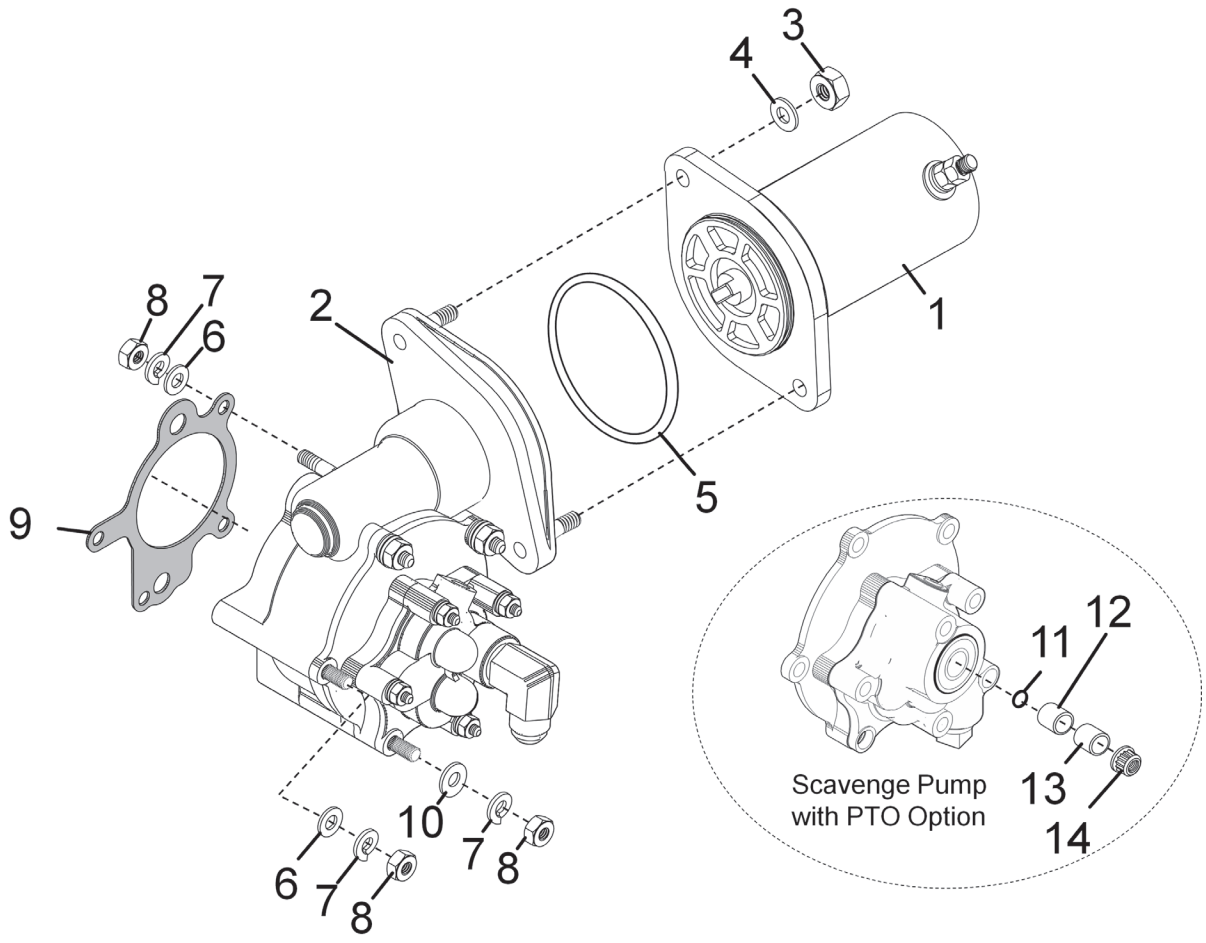

Figure 10-4 repeated for reference

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

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

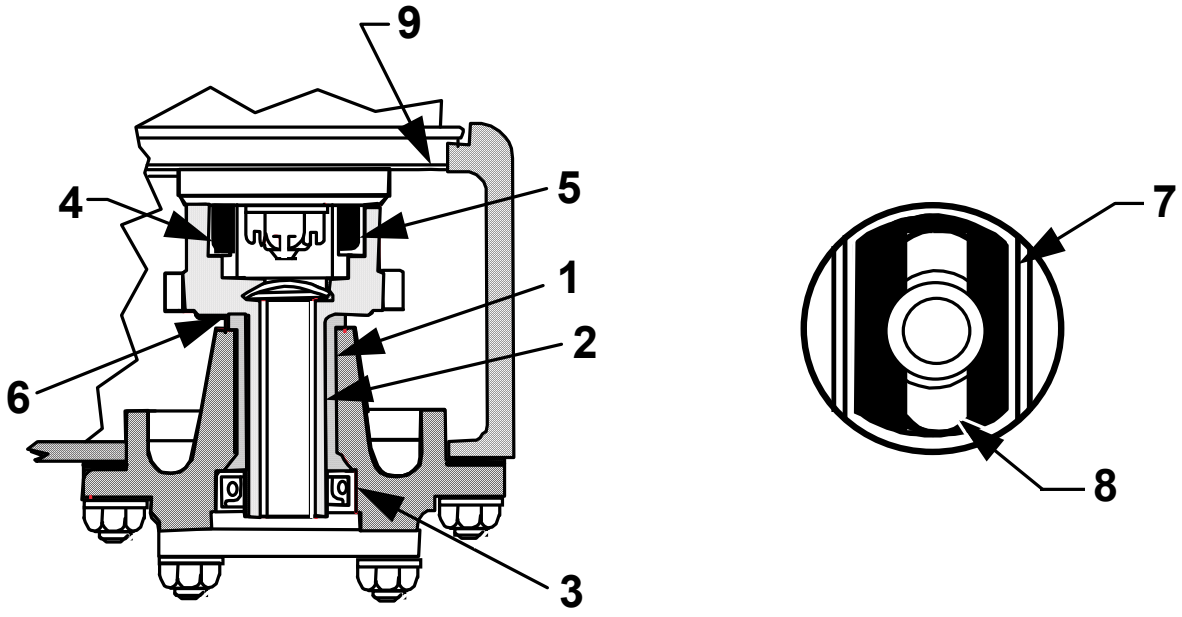

Figure 10-8. Accessory Drive Adapter Dimensions

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.

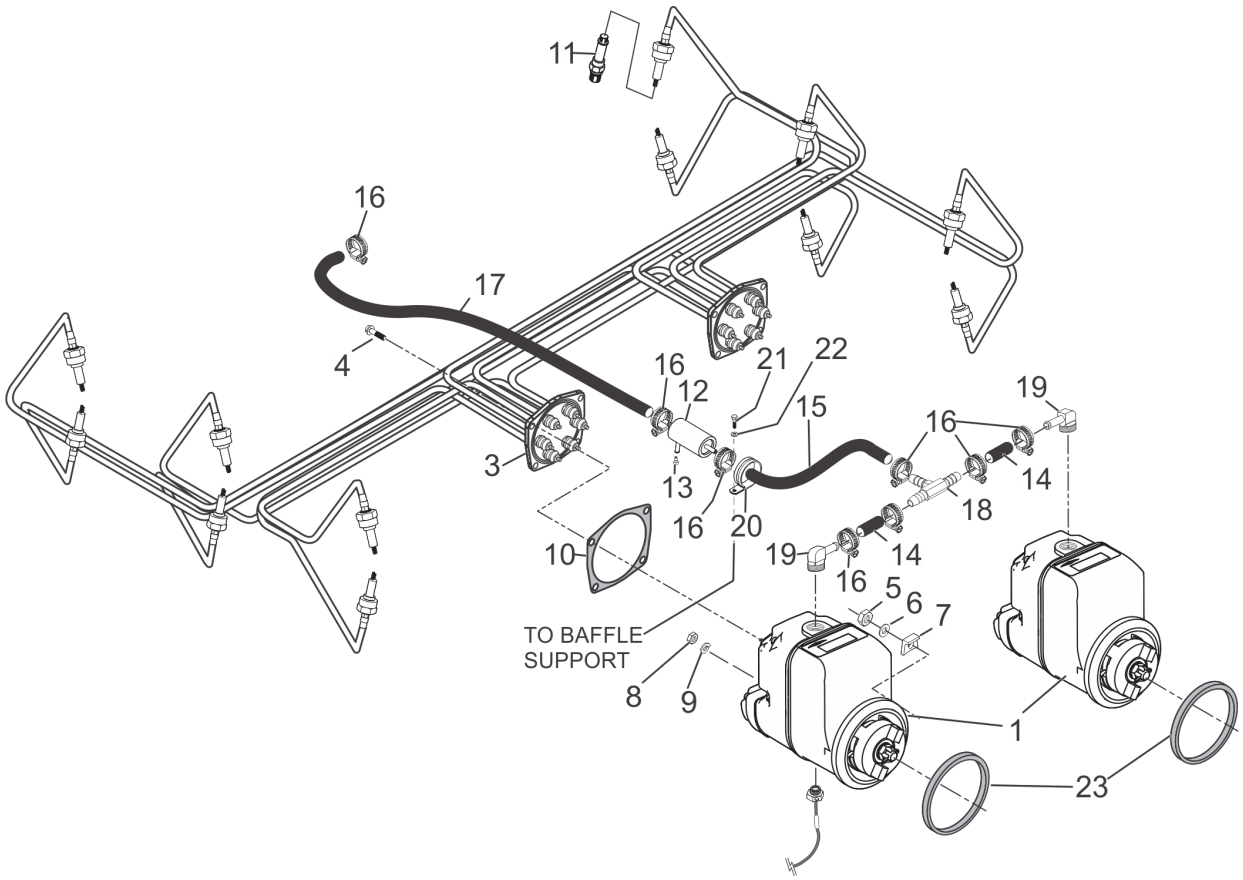

Figure 10-9. Continental Motors Ignition System

1	Magneto	7	Mag Hold Washer	13	Drain, Filter Reducer	19	Elbow Fitting
2	Magneto Tachometer Sensor	8	Nut	14	Hose	20	Clamp
3	Ignition Harness	9	Lock Washer	15	Hose	21	Bolt
4	Screw Assembly	10	Gasket	16	Hose Clamp	22	Washer
5	Nut	11	Spark Plug Assembly	17	Hose	23	Gasket
6	Lock Washer	12	Magneto Filter Assembly	18	Tee		

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.

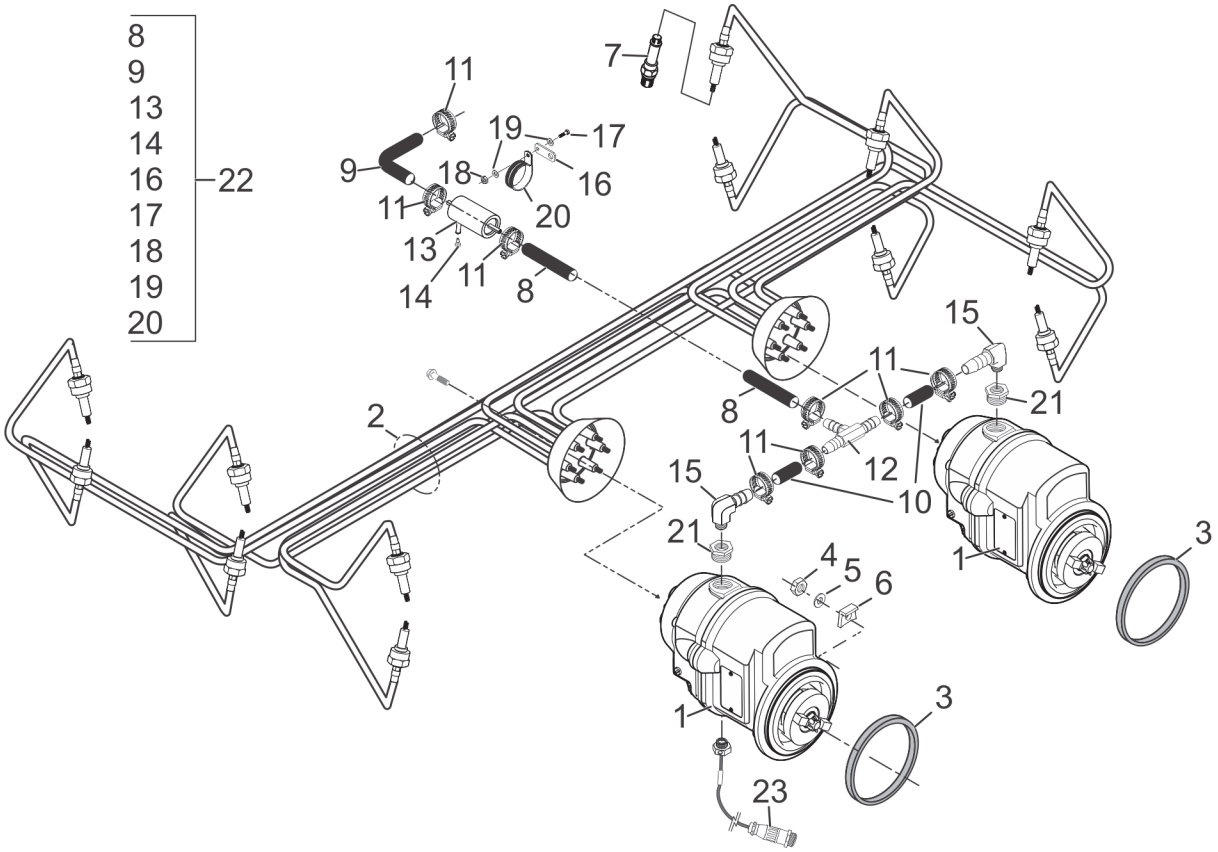

Figure 10-10. Champion (Slick) Ignition System

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
	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 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.

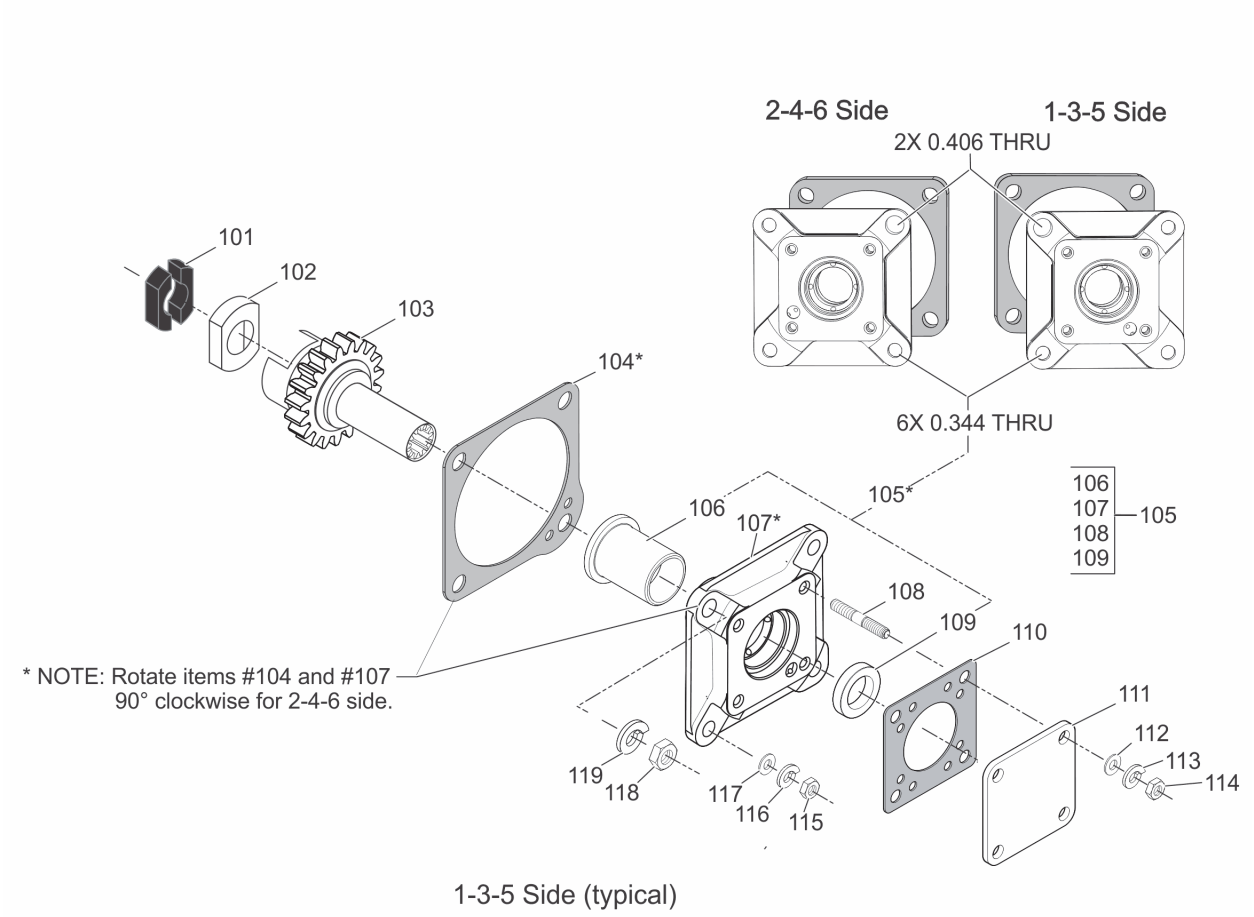

Figure 10-11. Accessory Drive Adapter Assembly

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		

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.

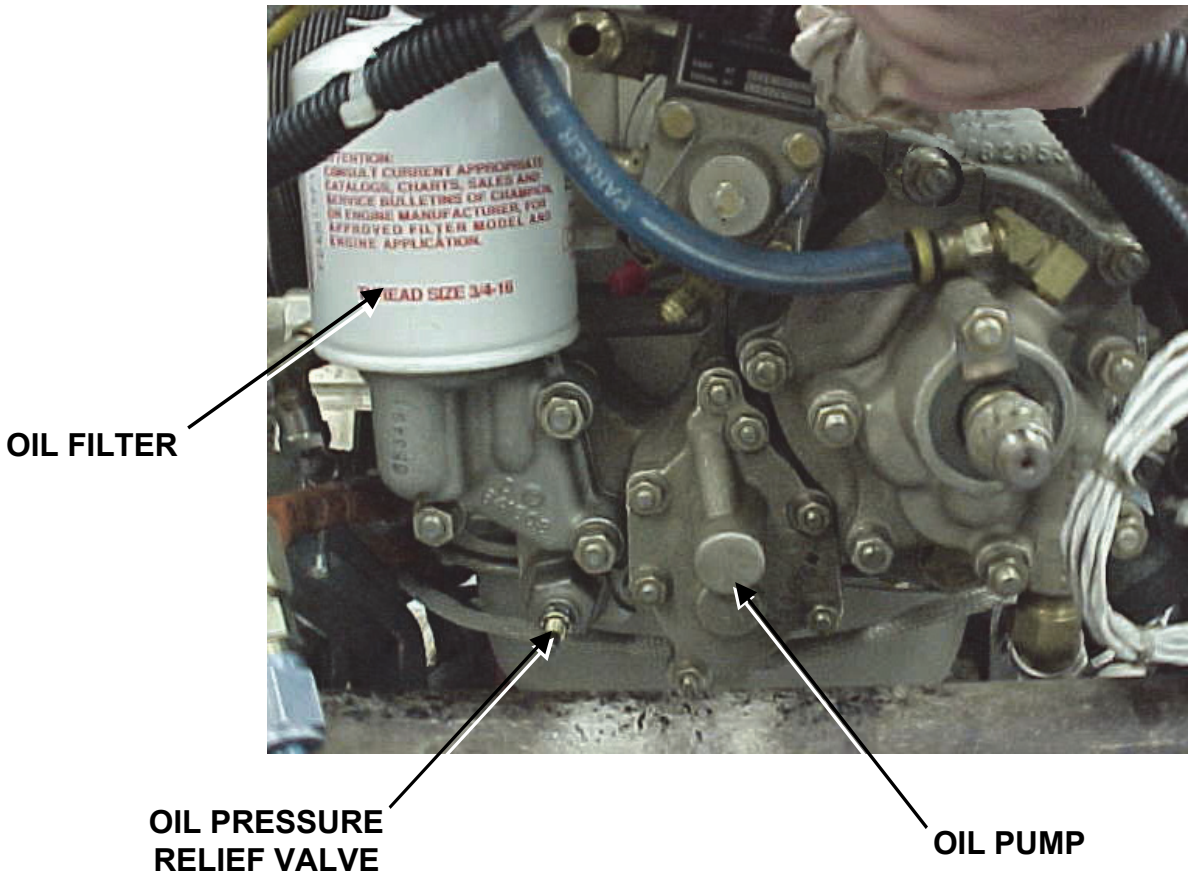

Figure 10-12. Rear View of Engine

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

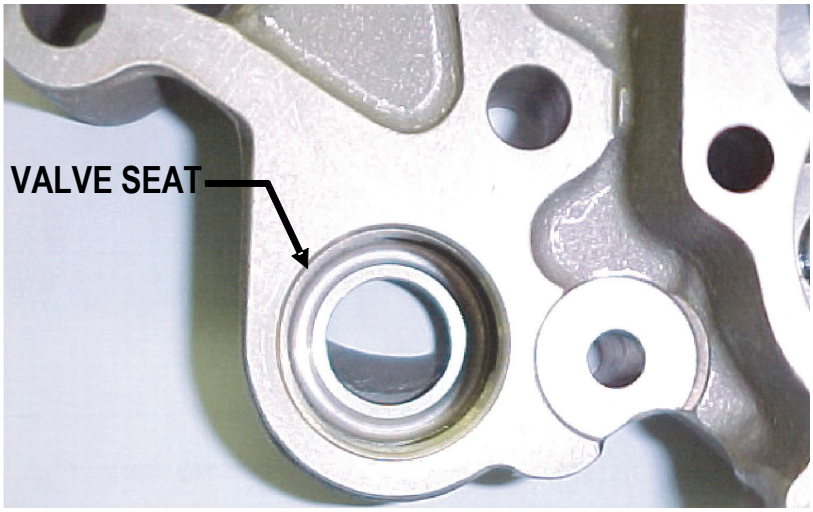

Figure 10-14. Valve Seat in the Oil Pump Housing

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.

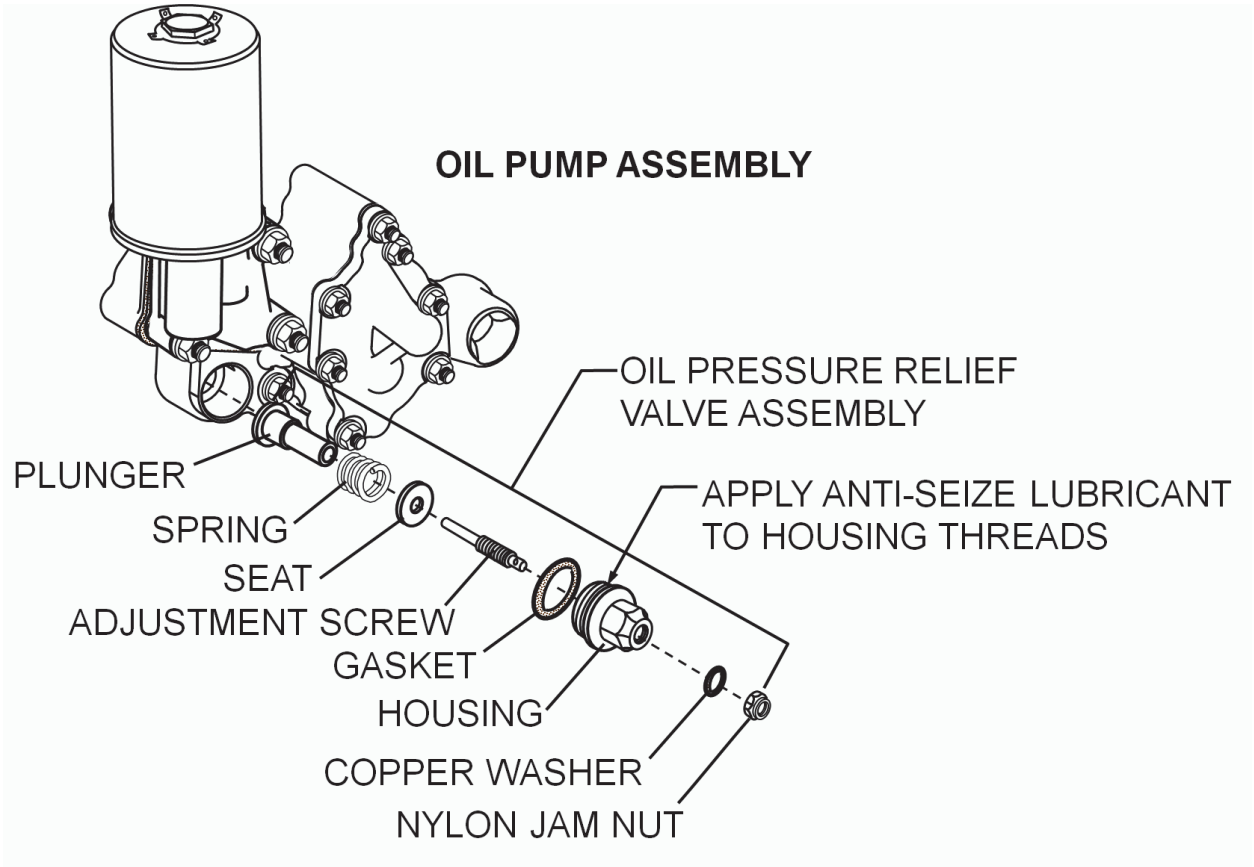

Figure 10-15. Oil Pump and Oil Pressure Relief Valve

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.
9. Perform an "Oil Pump Operational Check" according instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

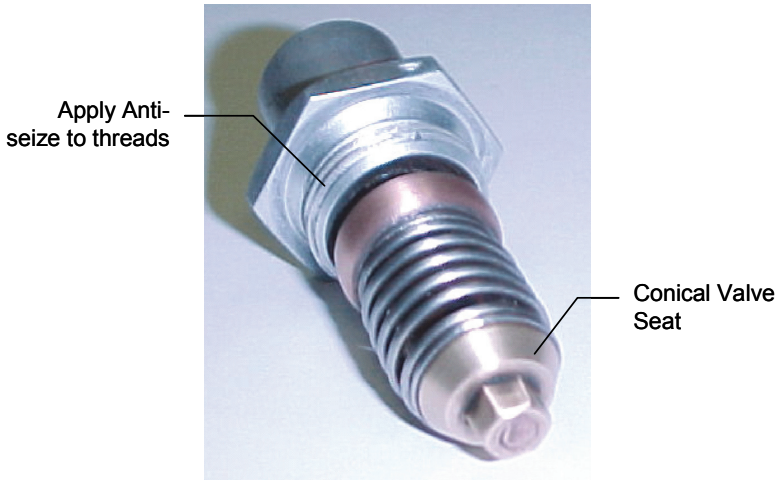

Figure 10-16. Oil Temperature Control Valve

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

Index	Part		Dimensions (inches)	
		Service	Minimum	Maximum
Oil Pressure Relief Valve Assembly				
1	Oil pressure relief valve adjusting screw ..... diametric clearance: in plunger	0.0070L	0.0030	0.0070
2	Oil pressure relief valve seat in housing ..... depth:	1.060	0.750	1.060
Oil Pump Assembly				
3	Oil pump driver gear in pump housing .....body	0.0065L	0.0040L	0.0060L
4	Oil pump driver gear shaft in pump housing .. diametric clearance:	0.0045L	0.0015T	0.0030L
5	Oil pump driven gear to driven gear shaft ..... diametric clearance:	0.0040L	0.0005L	0.0025L
6	Oil pump driver gear in pump housing .....end clearance:	0.0050	0.0016L	0.0041
7	Oil pump driven gear in pump housing .....end clearance:	0.0050	0.0016L	0.0041
8	Oil pump driver gear shaft in tach ..... diametric clearance: drive housing	---	0.0015L	0.0030L
9	Oil pump driver gear shaft pin in bevel gear .. diametric clearance:	---	0.0005L	0.0025L
10	Oil pump driven gear in housing ..... diametric clearance:	0.0065L	0.0040L	0.0060L
11	Tachometer drive shaft in tach drive housing diametric clearance:	---	0.0015L	0.0030L
12	Oil seal in mechanical tach drive housing..... diametric clearance:	---	0.003T	0.005T
13	Oil seal in electrical tach drive housing..... diametric clearance:	---	0.0015T	0.0065T
Gear Backlash				
14	Oil pump driver and driven gears ..... backlash:	0.0160	0.0090	0.0130
15	Tach drive and driven bevel gears ..... backlash:	---	0.0040	0.0080
Spring Test Data				
16	Oil pressure relief valve spring compressed to 1.25 inch length load:	30 lbs.	32 lbs.	37 lbs.
17	Oil temperature control valve 0.090” minimum travel ..... at oil temperature:	---	120°F	170°F
18	Oil temperature control valve must close between ..... oil temperature:	---	168°F	172°F
T= Tight L=Loose				

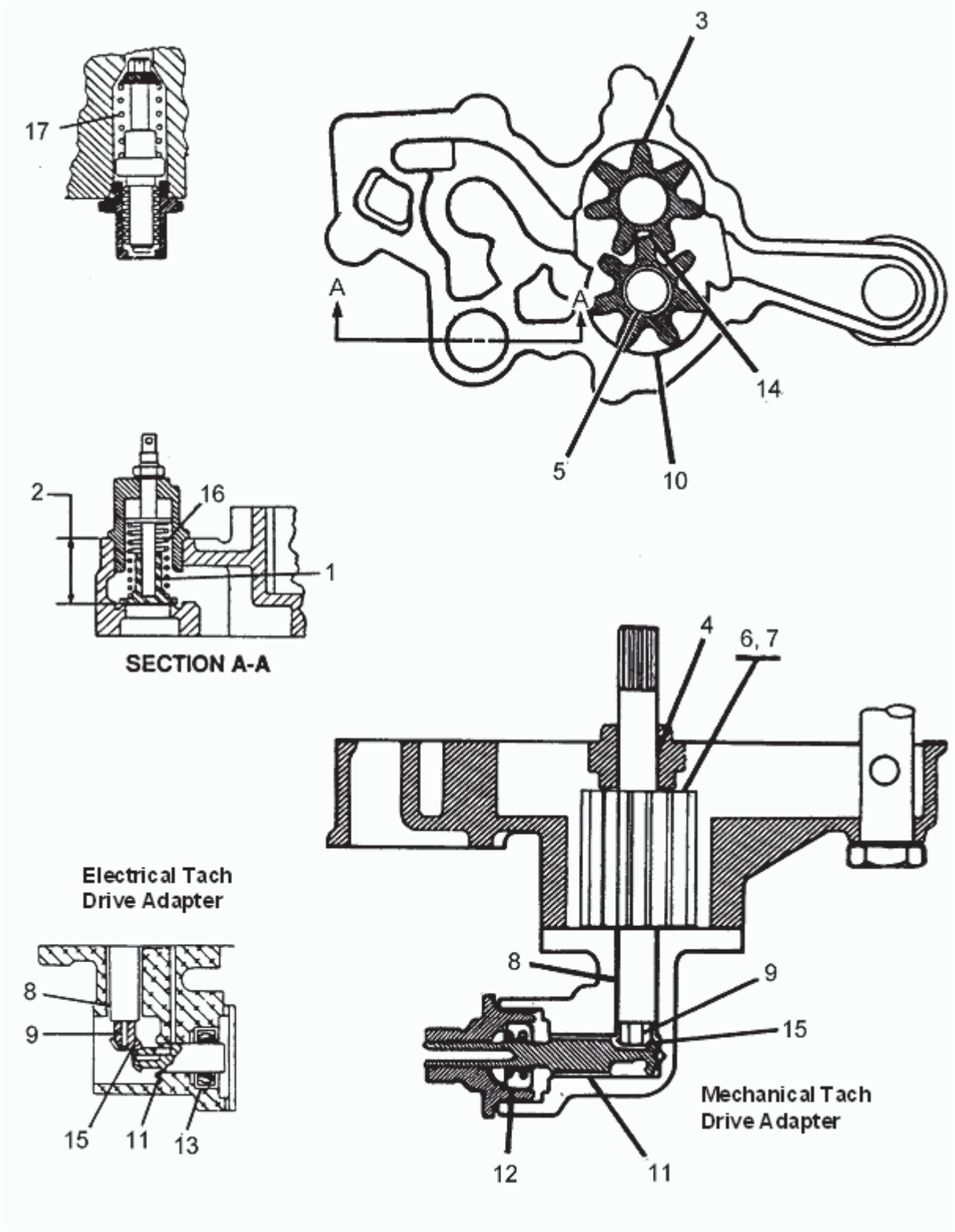

Figure 10-17. Lubrication System Service Limits

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.

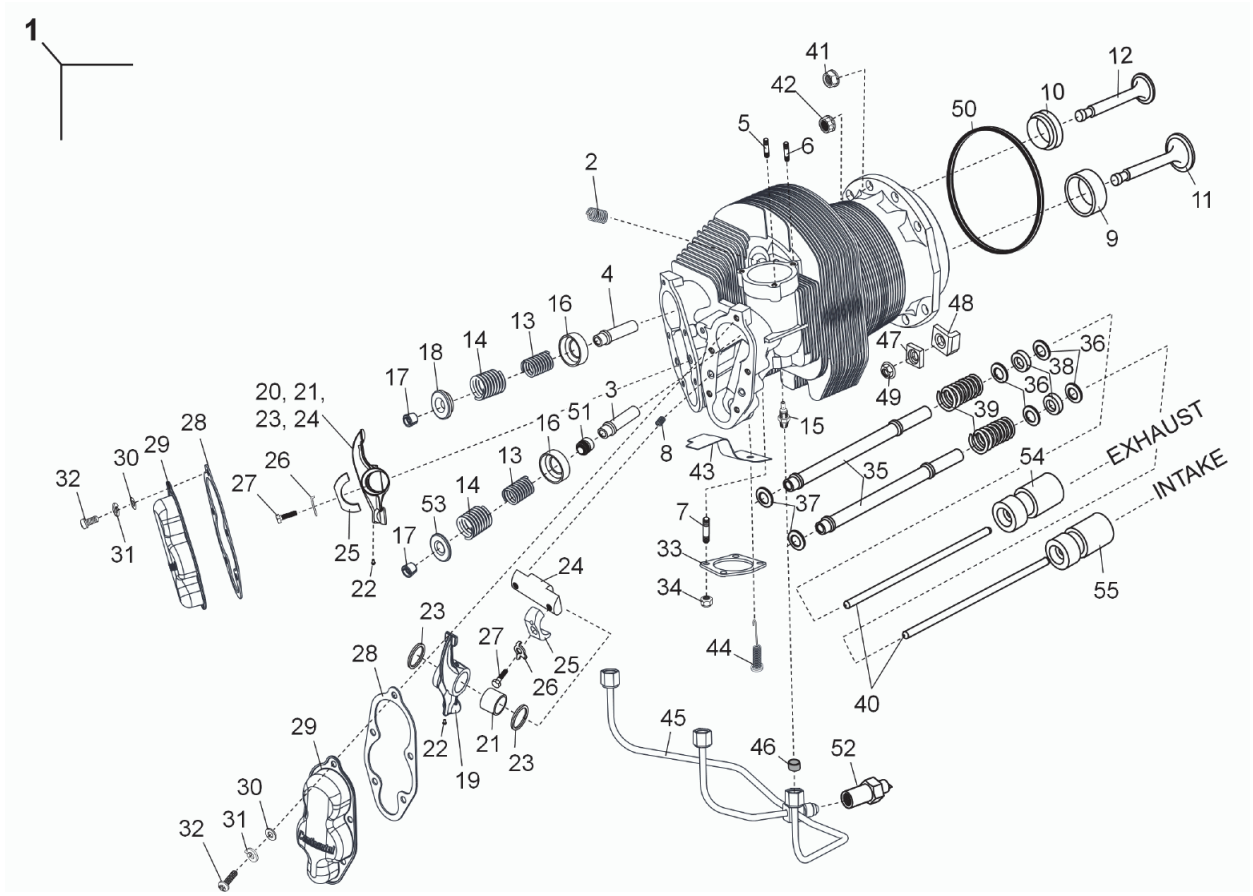

Figure 10-18. Engine Cylinder

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.

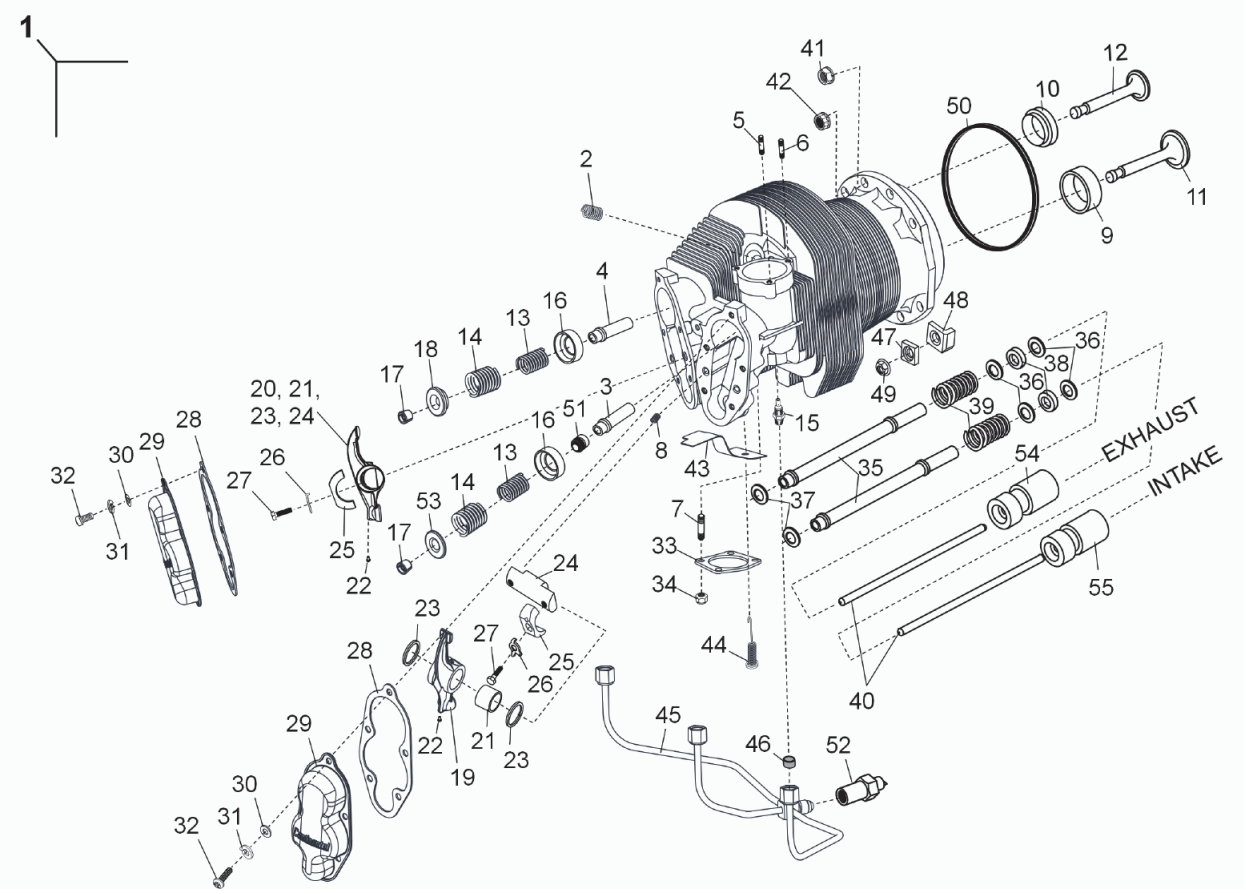

Figure 10-18 repeated for reference

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.

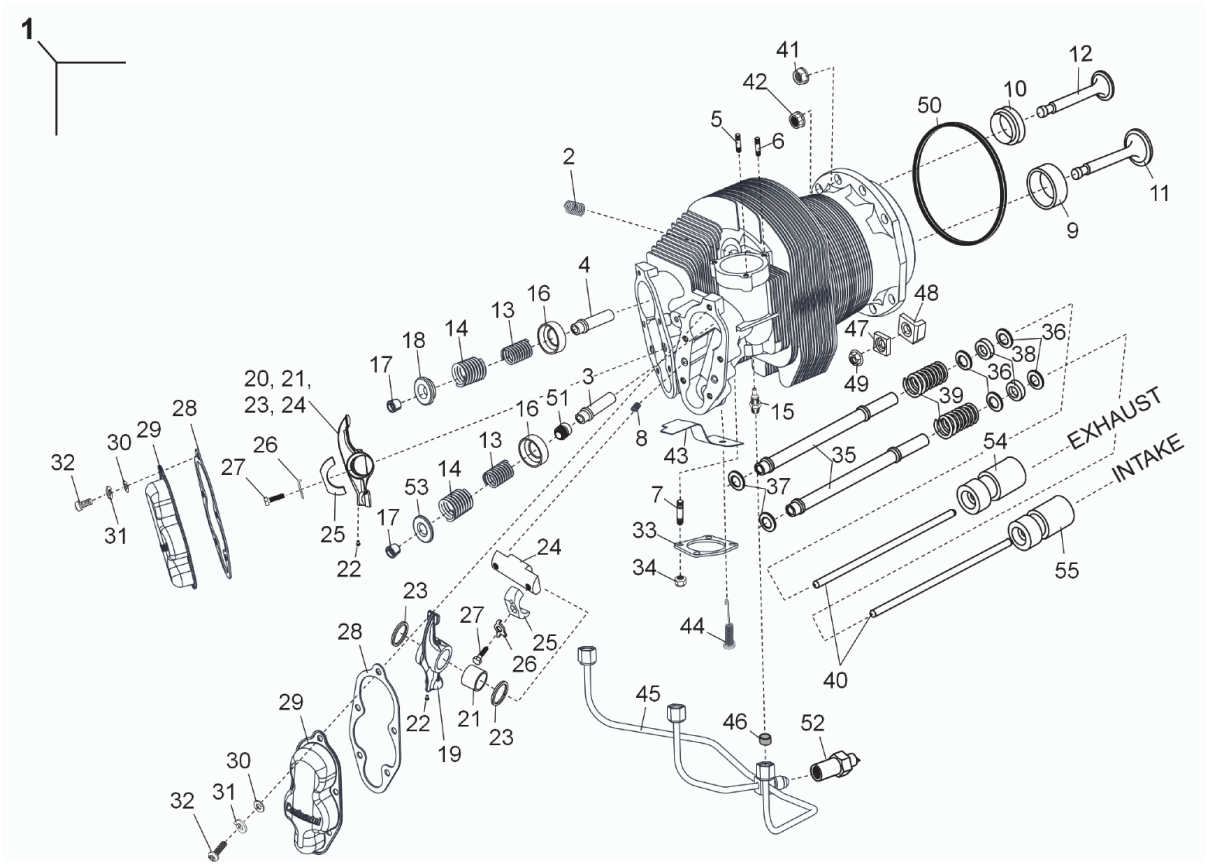

Figure 10-18 repeated for reference

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).

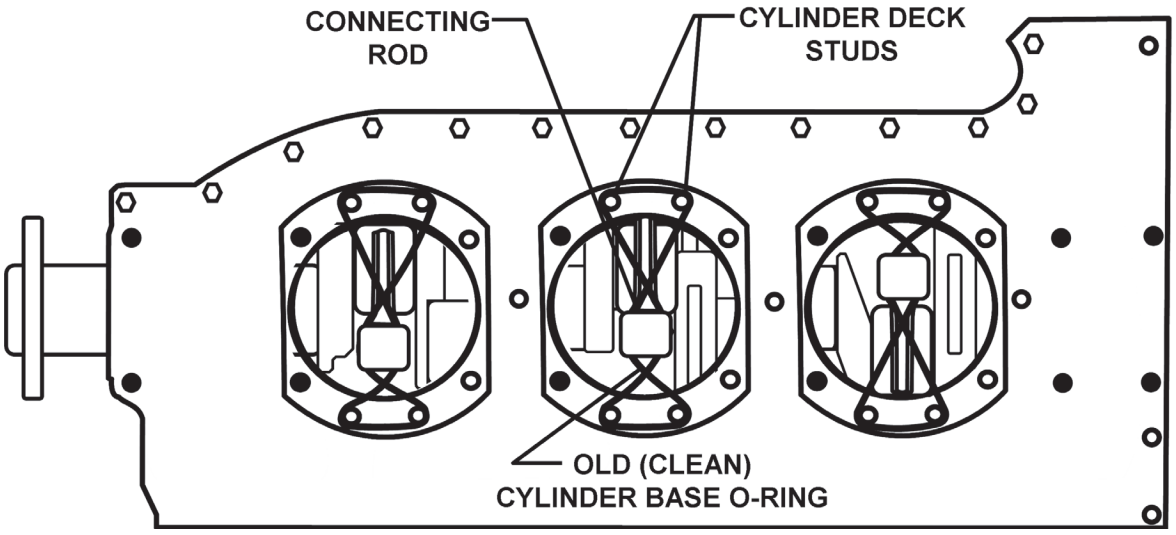

Figure 10-19. Cylinder Base O-Ring Used to Secure the Connecting Rods

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.

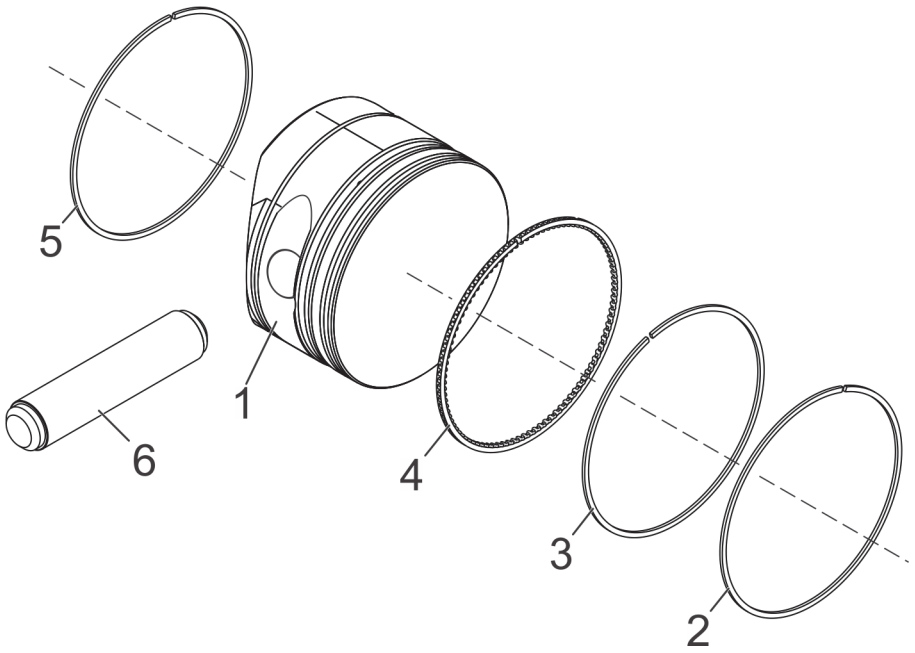

Figure 10-20. Piston, Piston Pin and Rings

1	Piston	3	Compression Ring	5	Scraper Ring
2	Compression Ring	4	Oil Control Ring	6	Piston Pin

18. Repeat steps 11 through 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.

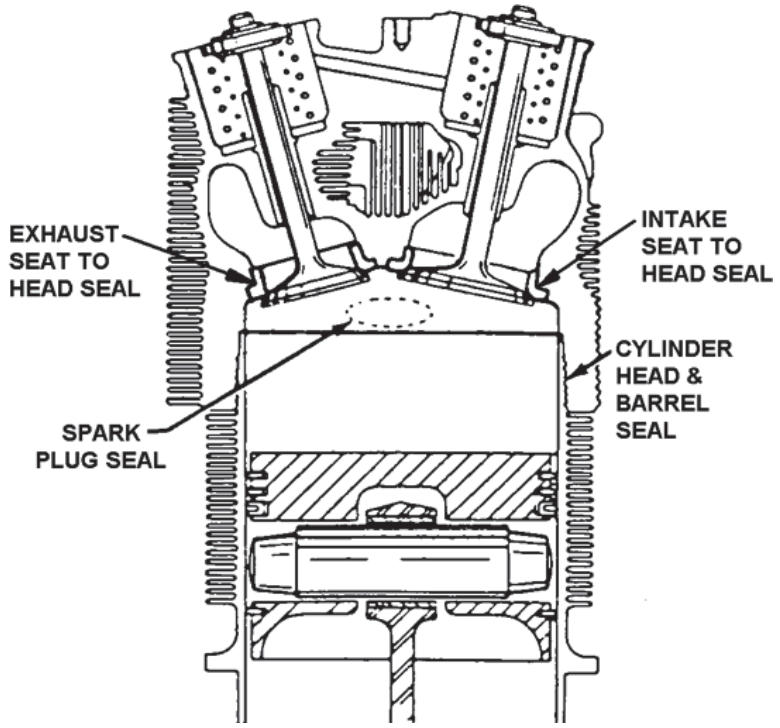

Figure 10-21. Cylinder Static Seal

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.

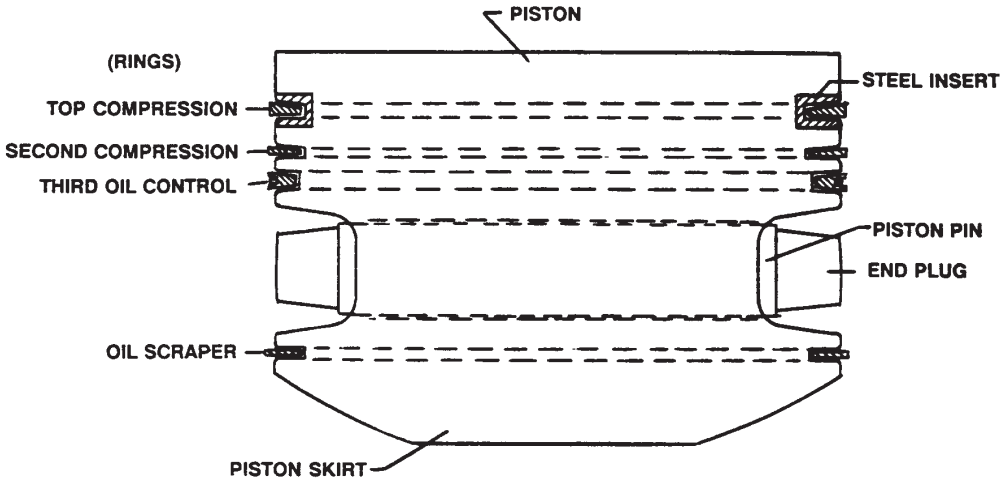

Figure 10-22. Piston, Piston Pin, and Piston Ring Detail

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.

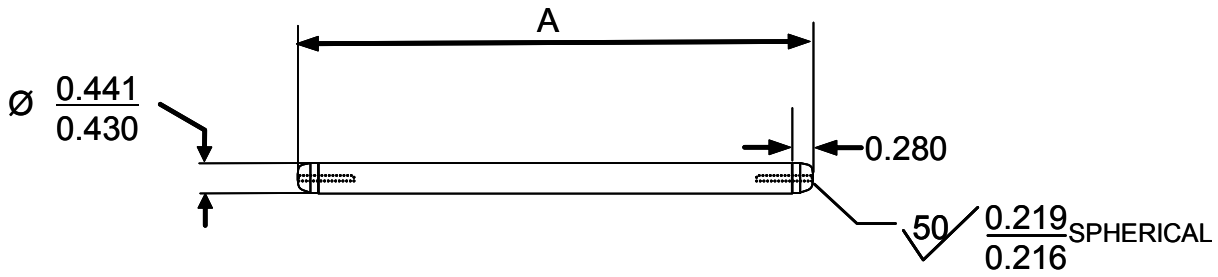

Figure 10-23. Pushrod Dimensions

"A" dimension	Min	Max
Standard	13.632	13.662
P030 Oversize	13.662	13.692

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

Index	Description	Service Limit	New Part Minimum (inches)	New Part Maximum (inches)
Cylinder Assembly				
1	Cylinder bore (lower 4-1/4 inch of barrel) .....diameter:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual		
2	Cylinder bore (5.75 inch into barrel) ..... choke:			
3	Cylinder bore ..... out-of-round:			
4	Cylinder bore .....allowable oversize:			
5	Cylinder bore surface (Nitrided Barrels) .....Cross hatch angle:	22° - 32°	22° - 32°	—
	.....Finish in micro-inches R_a:	35-60	35	60
6	Cylinder barrel in crankcase.....diametric clearance:	0.013L	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head .....diametric clearance:	0.007T	0.007T	0.010T
8	Intake valve guide in cylinder head .....diametric clearance:	0.001T	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head .....diametric clearance:	0.001T	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head .....diametric clearance:	0.007T	0.0070T	0.0100T
11	Intake valve seat .....width:	Figure 10-25		
12	Exhaust valve seat .....width:	Figure 10-26		
	Exhaust valve seat-to-valve guide .....axis angle:	45° 00'	44° 30'	45° 00'
	Intake valve seat-to-valve guide .....axis angle:	60° 15'	59° 30'	60° 00'
Rocker Arms and Shafts				
13	Rocker shaft in cylinder head bosses.....diametric clearance:	0.0031L	0.0005L	0.0031L
	Rocker shaft in rocker arm bushing.....diametric clearance:	0.0040L	0.0005L	0.0031L
14	Rocker arm bushing bore .....diameter: Rocker arm bushing (finish bore) .....inside diameter:	0.8755 0.7515	0.8725 0.7505	0.8755 0.7515
15	Rocker arm .....side clearance:	0.0150L	0.0020	0.0150
16	Intake valve guide .....inside diameter: Intake valve in guide .....diametric clearance:	 0.0050L	0.4350 0.0010L	0.4362 0.0032L
17	Exhaust valve guide .....inside diameter: Exhaust valve in guide .....diametric clearance:	 0.0062L	0.4370 0.0029L	0.4380 0.0046L
18	Intake valve face-to-stem .....axis angle:	60°15'	60°00'	60°15'
19	Exhaust valve face-to-stem .....axis angle:	45°15'	45°00'	45°15'
20	Intake valve gauge line-to-stem .....length:	Figure 10-27	Replace 100%	
21	Exhaust valve gauge line-to-stem .....length:	Figure 10-27	Replace 100%	
22	Intake & Exhaust valve face-to-stem .....runout:	0.0015	0.0000	0.0015
23	Rocker arm foot to valve stem (dry valve) .....valve lash:	0.060- 0.200	0.060	0.200

Table 10-10. Cylinder Assembly Service Limits

Index	Description	Service Limit	New Part Minimum (inches)	New Part Maximum (inches)
Pistons, Rings, and Pins				
24	Piston, non-coated in cylinder[1] ..... diametric clearance:	0.011L[2] 0.010L[3]	0.008L[2] 0.007L[3]	0.011L[2] 0.010L[3]
	Piston, manganese phosphate coated in cylinder[1] ..... diametric clearance:	0.012L[2] 0.011L[3]	0.009L[2] 0.008L[3]	0.012L[2] 0.011L[3]
25	Top piston ring in groove ..... side clearance:	0.006L	0.0015	0.0040
26	Second piston ring in groove ..... side clearance:	0.006L	0.0015	0.0040
27	Third piston ring in groove ..... side clearance:	0.0075L	0.0035	0.0055
28	Fourth piston ring in groove ..... side clearance:	0.0100L	0.0060	0.0080
Dimensions for items 29A -32A apply only to Post-Gold Standard Cylinders (5.251-5.253 Dia. Cylinder Bore)				
29A	Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual		
30A	Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)[4] ..... gap:			
31A	Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:			
32A	Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:			
Dimensions for items 29B -32B apply only to Pre-Gold Standard Cylinders (5.252-5.254 Dia. Cylinder Bore)				
29B	Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual		
30B	Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)[4] ..... gap:			
31B	Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel)[1] ..... gap:			
32B	Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:			
33	Piston pin in piston ..... diametric clearance:	0.0013L	0.0001L	0.0007L
34	Piston pin ..... diameter:	1.1243	1.1243	1.1245
35	Piston pin in cylinder ..... end clearance:	0.0480L	0.0100L	0.0340L
36	Piston pin in connecting rod bushing ..... diametric clearance:	0.0040L	0.0012L	0.0018L
37	Bushing in connecting rod ..... diametric clearance:	0.0050T	0.0025T	0.0050T
38	Bolt in connecting rod ..... diametric clearance:	0.0023L	0.0000L	0.0018L
39	Connecting rod bearing on crankpin ..... diametric clearance:	0.0034L	0.0009L	0.0034L
40	Connecting rod on crankpin ..... end clearance:	0.0160	0.0060	0.0110
41	Connecting rod bearing and bushing twist ..... per inch of length:	See **M-0, Section 10-9.4**		
42	Hydraulic tappet in crankcase ..... diametric clearance:	0.0035L	0.0010L	0.0025L
Spring Test Data				
43	Inner valve spring 654442 compressed to 1.230"	67 Lbs.	70.3 Lbs.	77.3 Lbs.
	Inner valve spring 654442 compressed to 1.745"	31 Lbs.	32.1 Lbs.	38.1 Lbs.
44	Outer valve spring 654441 compressed to 1.275"	98 Lbs.	101.8 Lbs.	111.4 Lbs.
	Outer valve spring 654441 compressed to 1.790"	46 Lbs.	49.1 Lbs.	55.1 Lbs.
45	Installed outer valve spring ..... height:	1.791 inches		
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

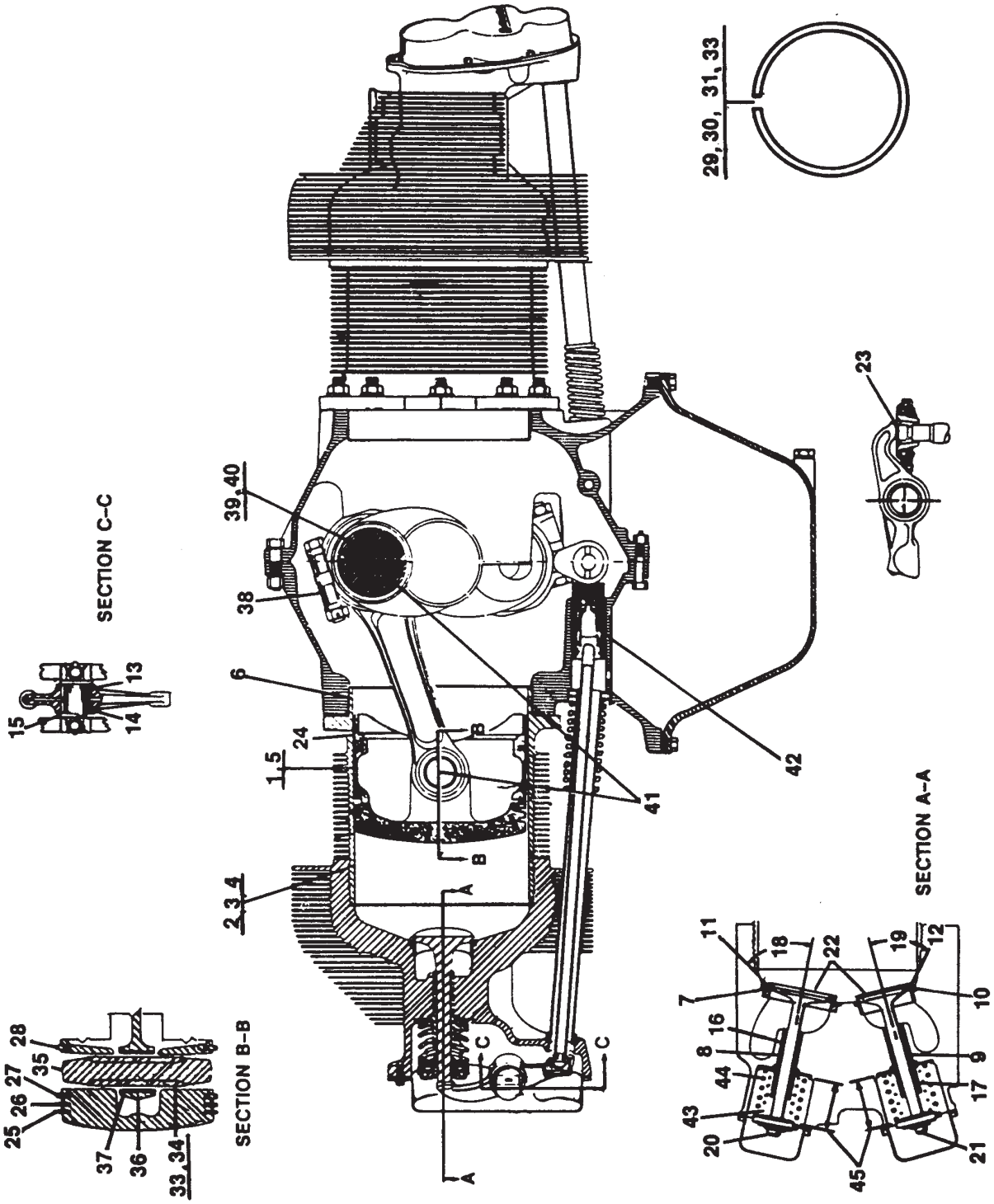

Figure 10-24. Cylinder Assembly Service Limits

NOTE: See Section D-6 for Intake and Exhaust Valve Seat Machining Dimensions.

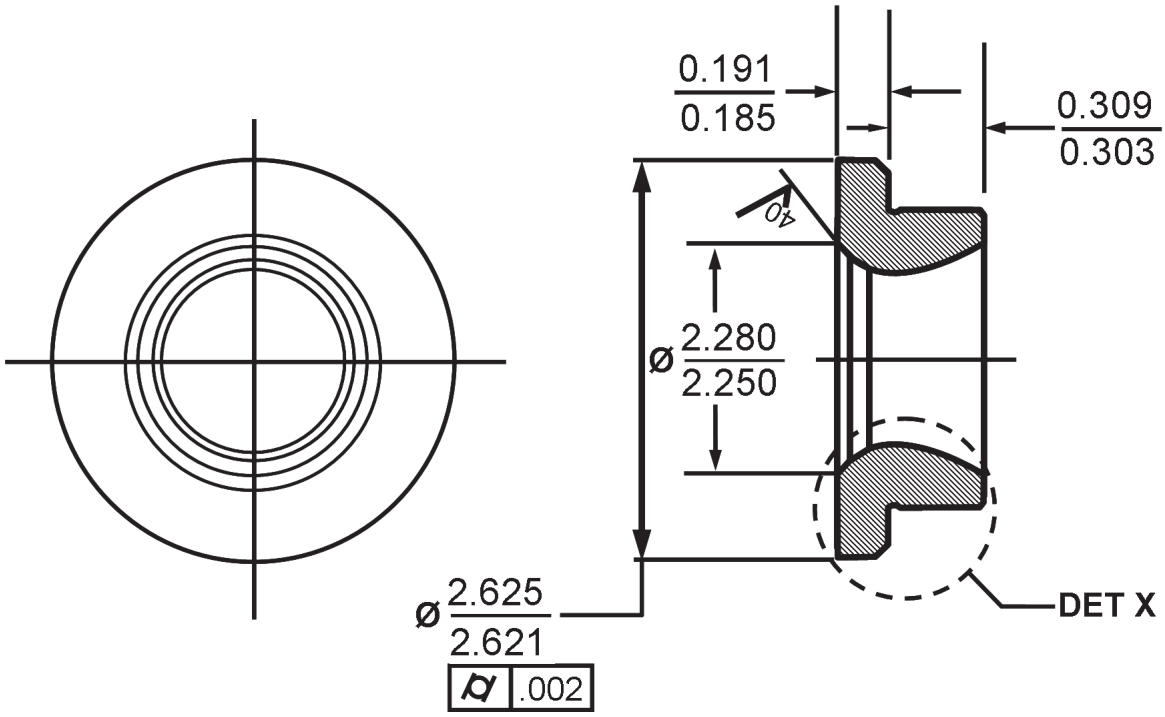

Figure 10-25. Intake Valve Seat Dimensions

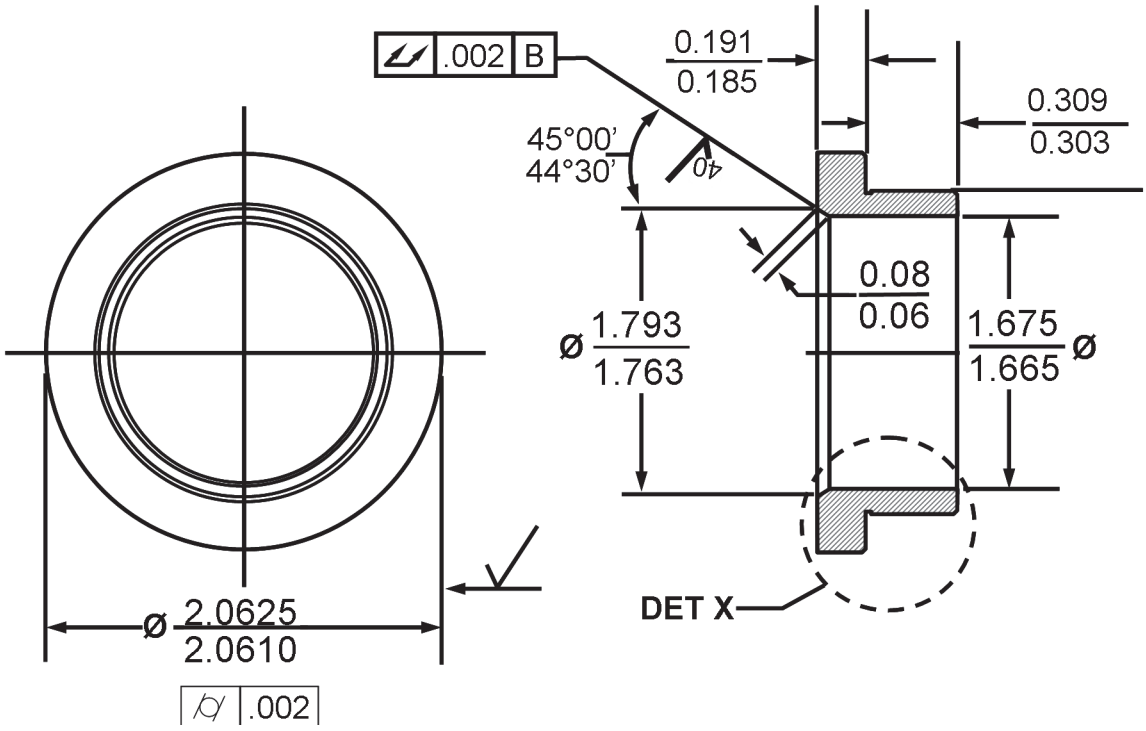

Figure 10-26. Exhaust Valve Seat Dimensions

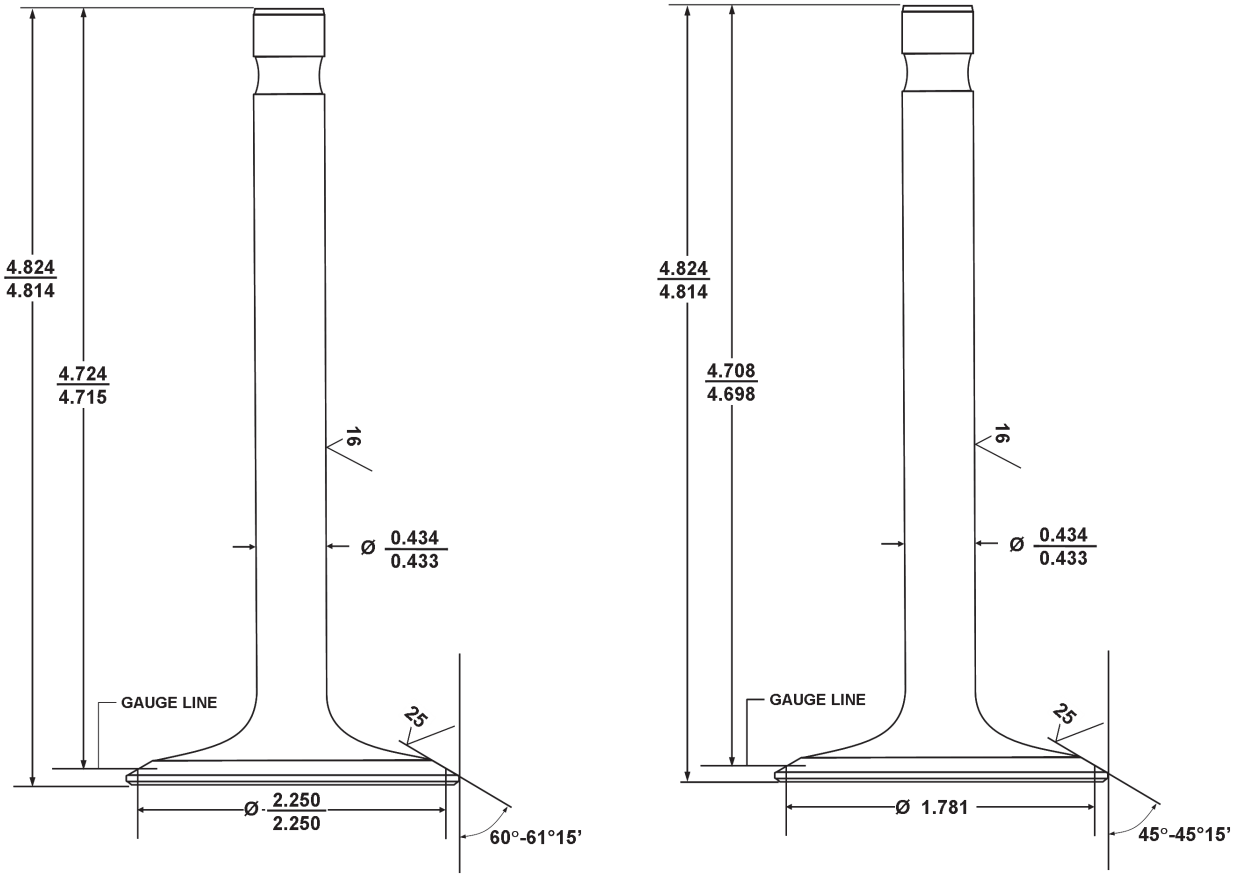

Figure 10-27. Valve Service Limits

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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 <u>any</u> 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 <u>any</u> 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.

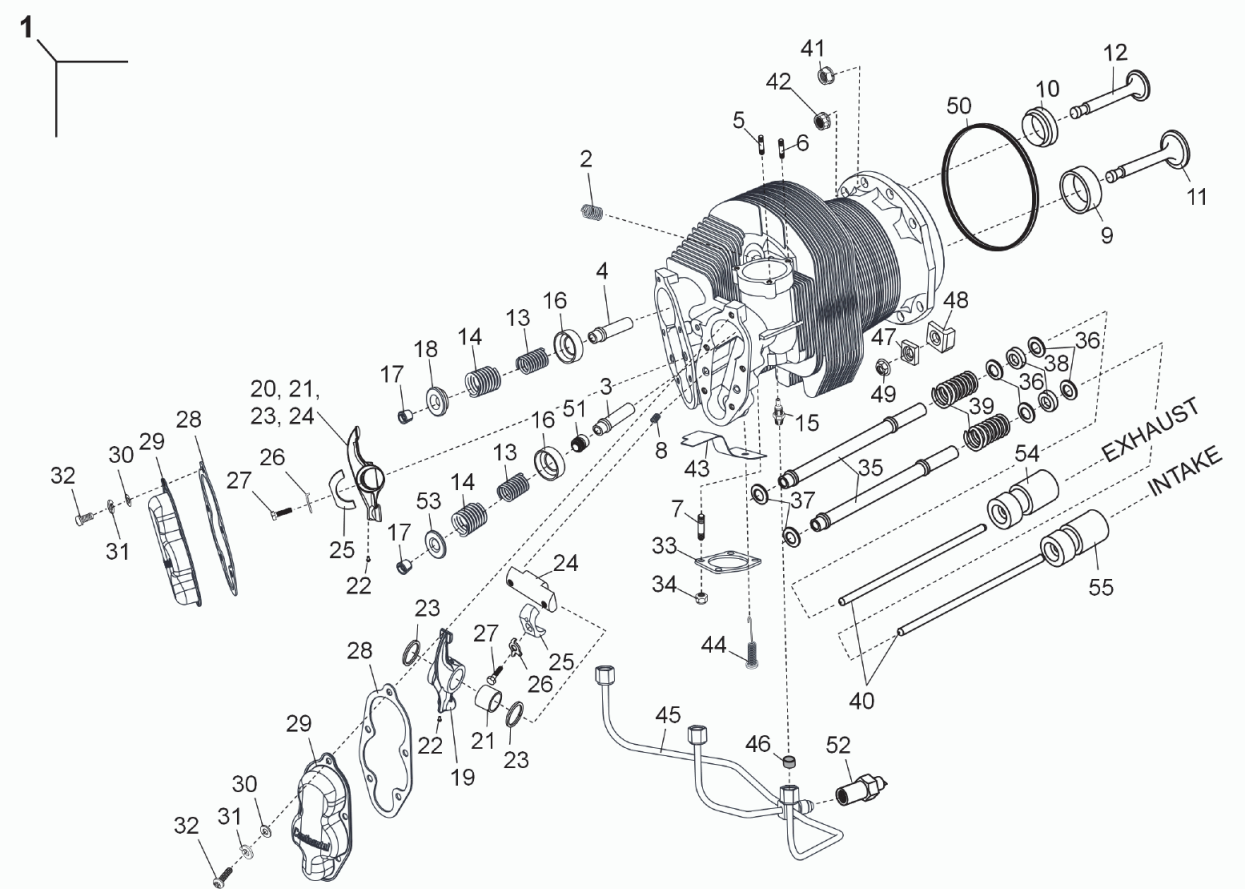

Figure 10-18 repeated for reference

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.

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 n 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).

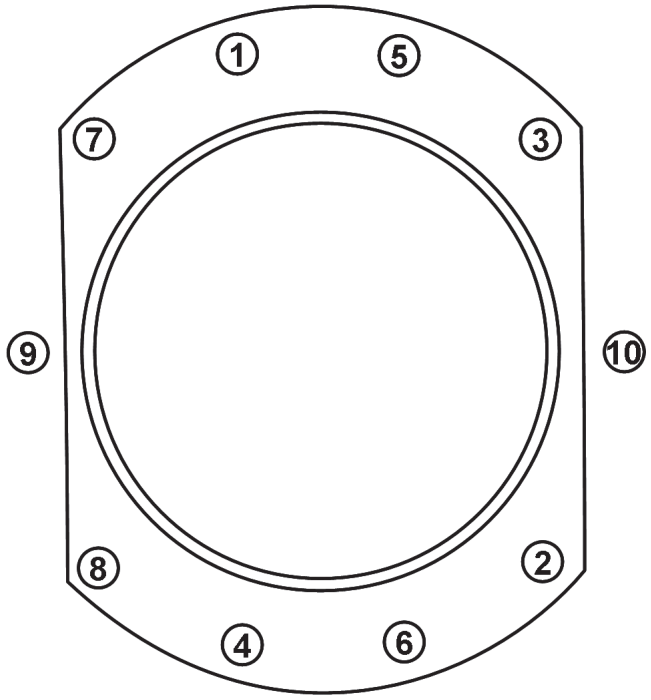

Figure 10-28. Single Cylinder Torque Sequence

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.

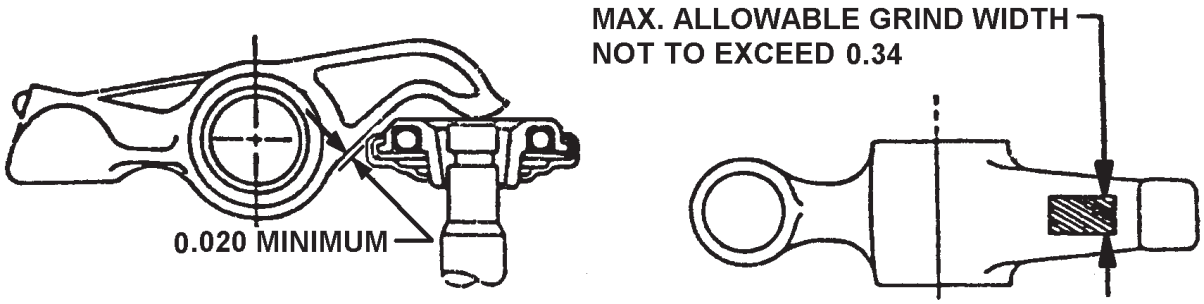

Figure 10-29. Rocker Arm to Retainer Clearance

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.

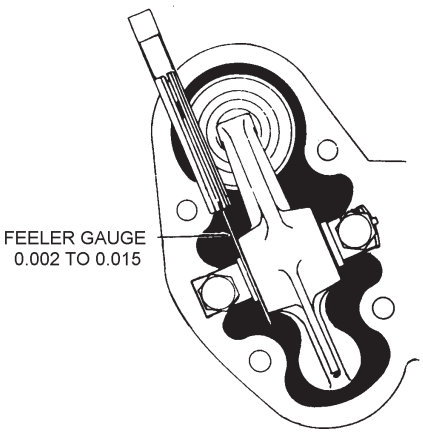

Figure 10-30. Rocker Arm Side Clearance

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

Engine Model	Serial Number	Engine Model	Serial Number	Engine Model	Serial Number
TSIO550C	802854	TSIO550C	802867	TSIO550G	915041
TSIO550C	802855	TSIO550C	802868	TSIO550G	915042
TSIO550C	802856	TSIO550C	802876	TSIO550G	915043
TSIO550C	802859	TSIO550C	802877	TSIO550G	915044
TSIO550C	802860	TSIO550C	802878	TSIO550G	915046
TSIO550C	802861	TSIO550C	802881	TSIO550G	915048
TSIO550C	802862	TSIO550C	802882	TSIO550G	915050
TSIO550C	802863	TSIO550C	814585	TSIO550G	915061
TSIO550C	802864	TSIO550G	915033	TSIO550G	905062
TSIO550C	802865	TSIO550G	815039		
TSIO550C	802866	TSIO550G	915040		

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 B C E G K

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.

To remove the left side (2-4-6) turbocharger:	**To remove the right side (1-3-5) turbocharger:**
Remove bolts 3 and 4 (Figure 10-31).	Remove bolts 1 and 2 (Figure 10-31).

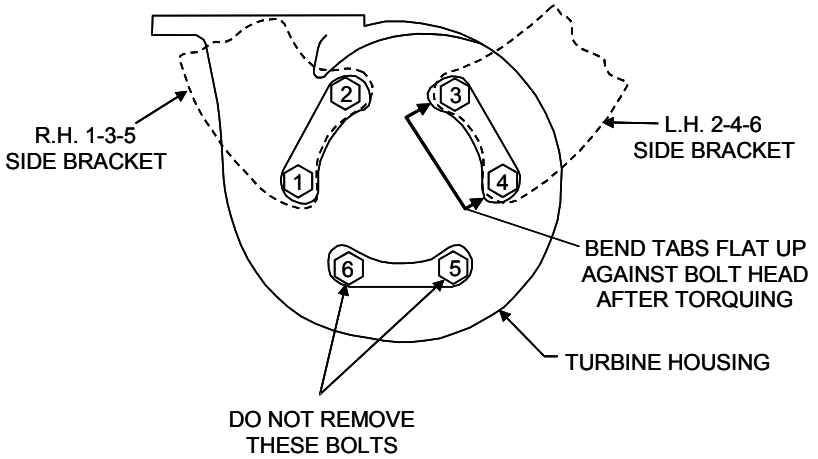

Figure 10-31. Turbocharger Bracket Orientation

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.

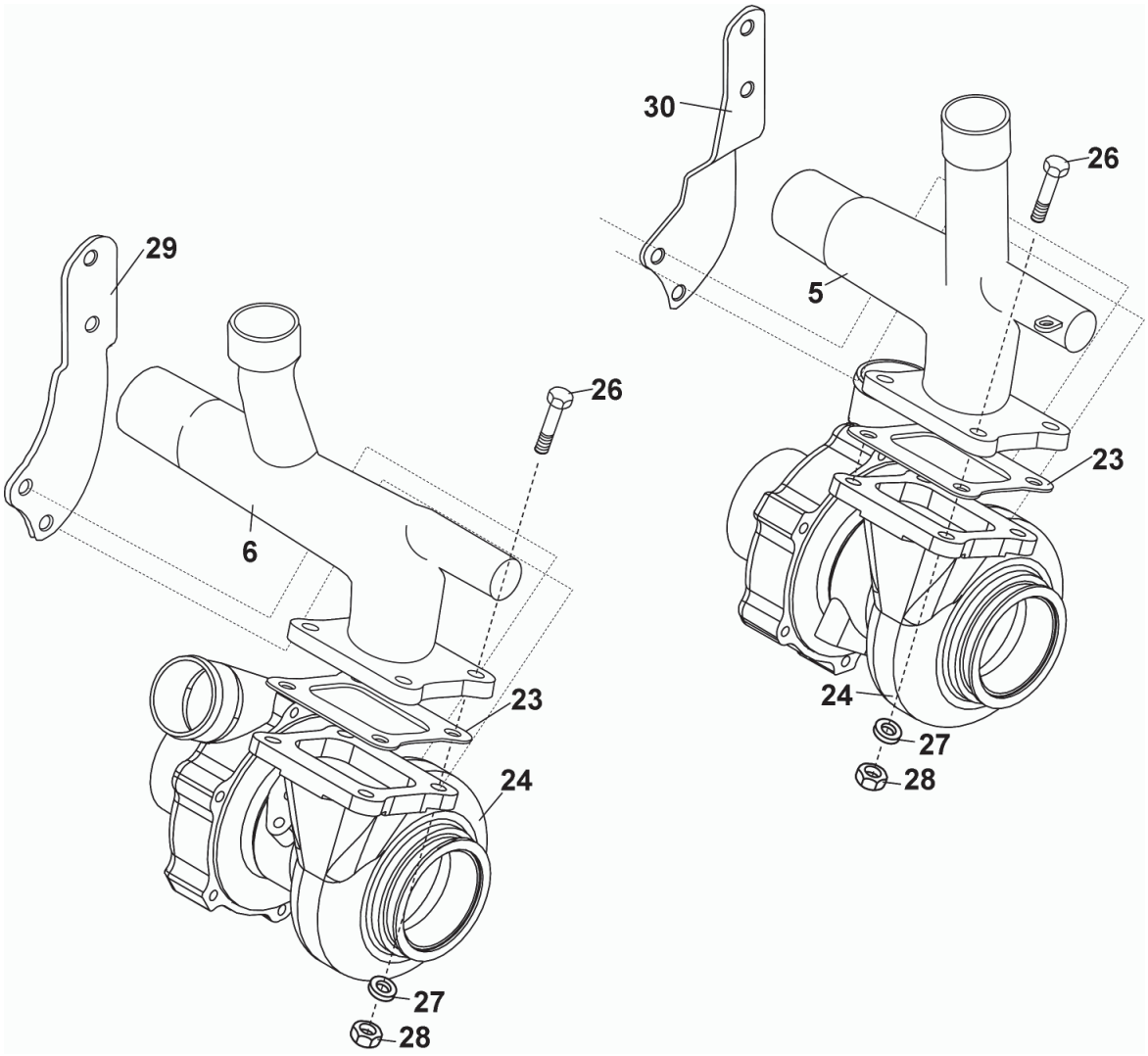

Figure 10-32. Turbocharger Installation Detail B C E G

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.

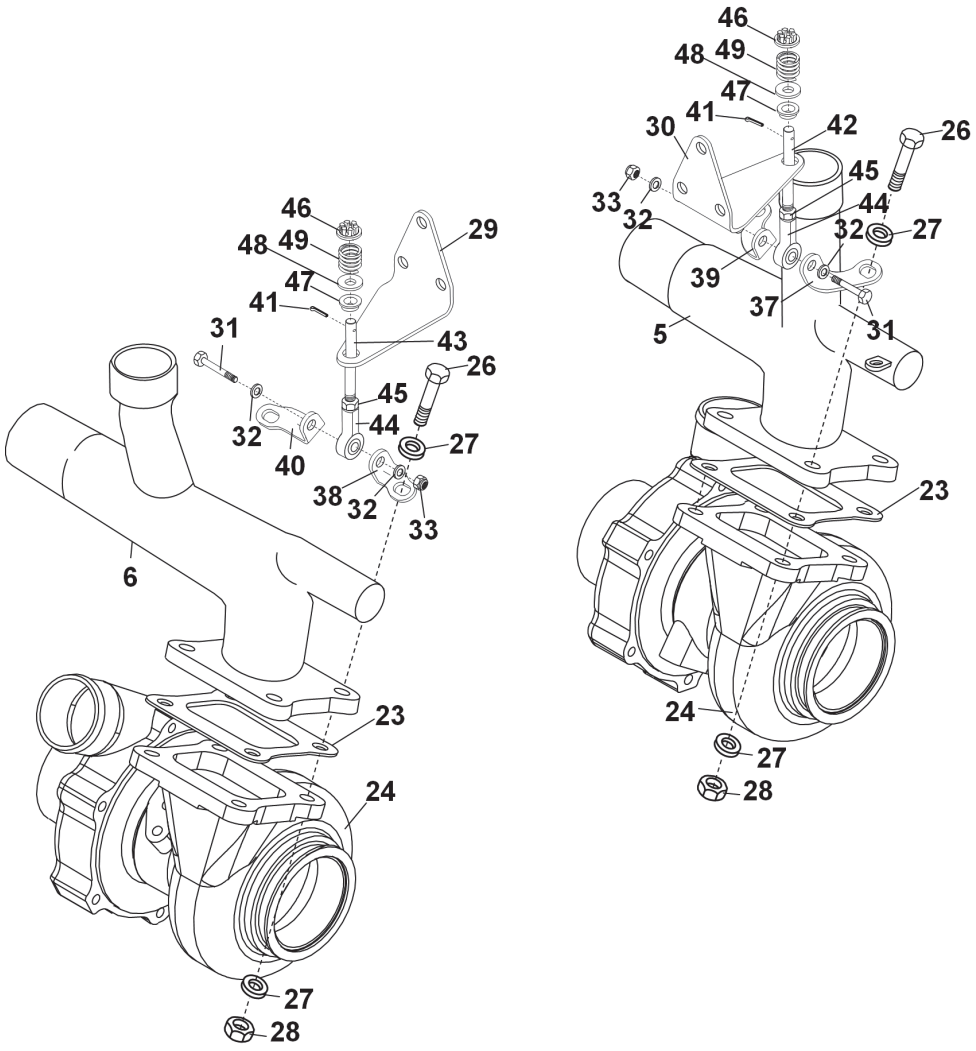

Figure 10-33. Turbocharger Installation Detail N

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.
6. Torque the oil supply and return hoses and fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual using the "Hose and Tubing Installation" instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual.
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.

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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 is 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).

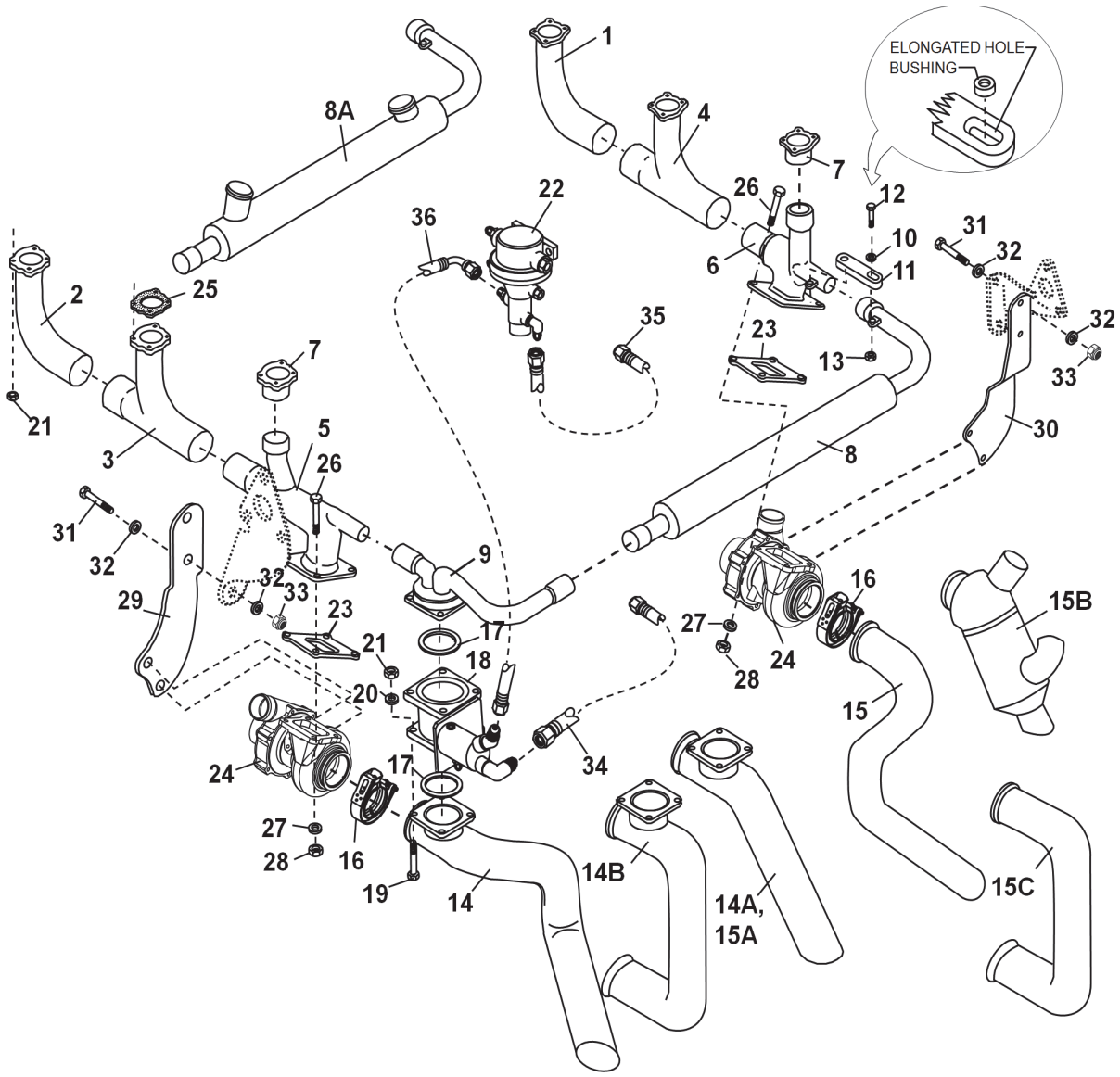

Figure 10-34. Composite Turbocharger and Exhaust System

1	Elbow Riser	11	Tie Rod	18	Wastegate Assembly	30	Bracket
2	Elbow Riser	12	Bolt	19	Bolt	31	Screw
3	Tee Assembly	13	Lock Nut	20	Washer	32	Washer
4	Tee Assembly	14	Contoured Tailpipe	21	Lock Nut	33	Lock Nut
5	Turbo Transition	14A	Straight Tailpipe	22	Controller	34	Hose
6	Turbo Transition	14B	Inverse Tailpipe Option	23	Gasket	35	Hose
7	Riser	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
8	Crossover Assembly	15A	Straight Tailpipe	25	Gasket		
8A	Crossover Assy with Heater Shroud Option	15B	Heater	26	Bolt		
		15C	Inverse Tailpipe Option	27	Washer		
9	Transition	16	V-band clamp	28	Lock Nut		
10	Bushing	17	Gasket	29	Bracket		

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."

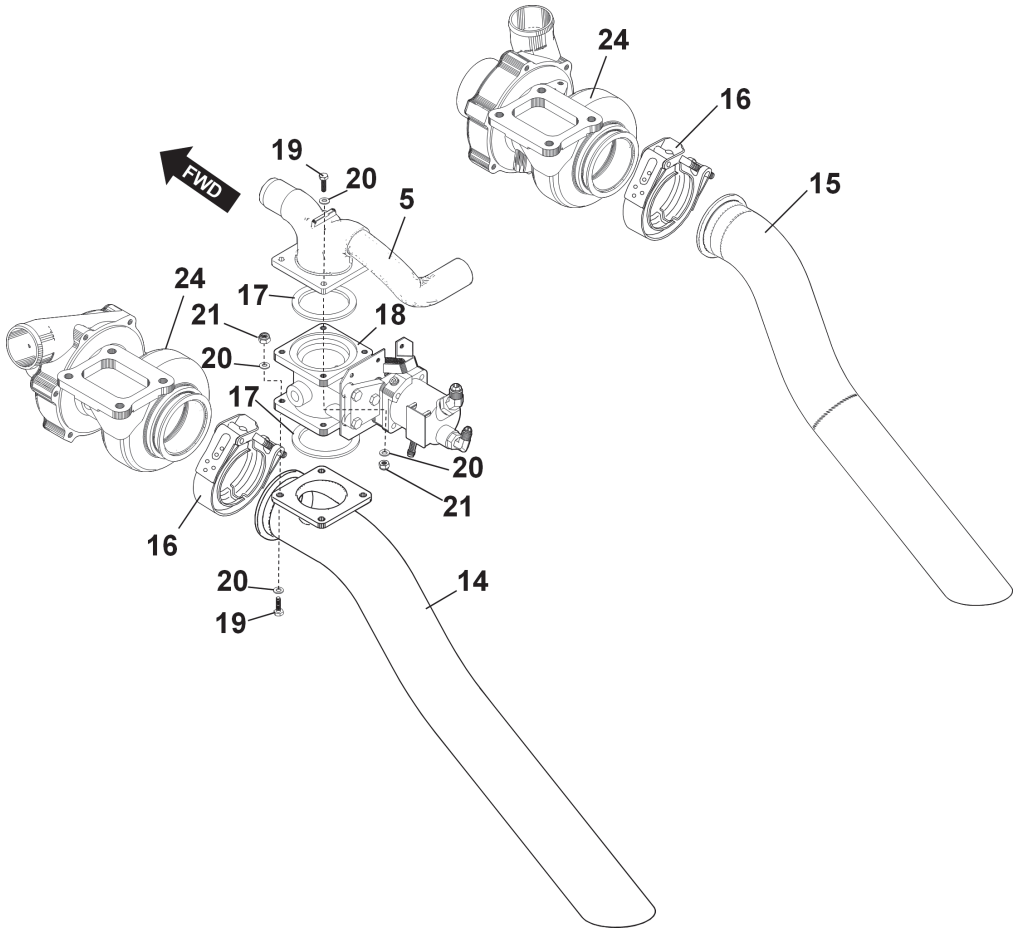

Figure 10-35. Tailpipe and V-Band Clamp Detail

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.

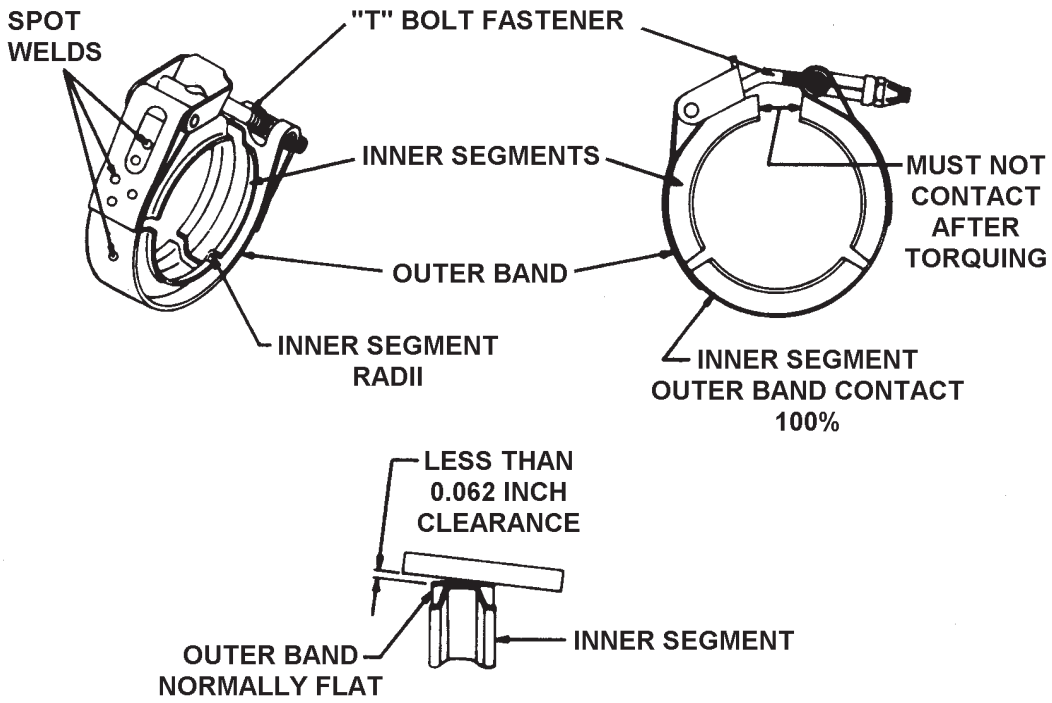

Figure 10-36. V-Band Clamp Inspection Criteria

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.

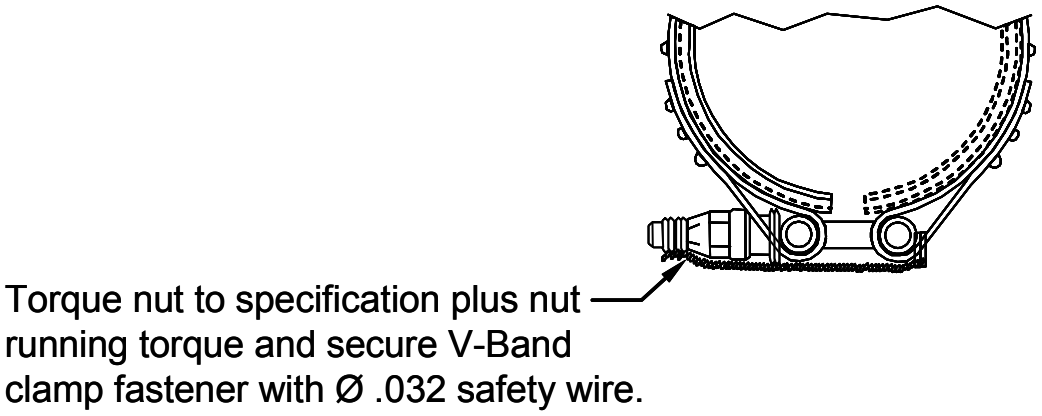

Figure 10-37. V-Band Clamp Safety Wire

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.

11-3. Overhaul Sequence

Perform engine overhaul in the sequence described in Table 11-1.

Table 11-1. Overhaul Sequence

Action	Reference
1. Remove the engine from the aircraft.	Section 5-1, “Engine Removal”
2. Disassemble the engine.	Chapter 12, “Engine Disassembly”
3. Disassemble engine components.	Chapter 13, “Component Disassembly”
4. Clean engine parts.	Chapter 14, “Engine Cleaning”
5. Inspect engine parts for serviceability.	Perform inspections and complete the Overhaul Inspection Checklist: Chapter 15, “Overhaul Inspection and Repair” Appendix D, “Overhaul Dimensional Limits”
6. Repair or replace unserviceable parts or parts identified as 100% replacement parts or mandatory overhaul replacement parts.	Repair or replace parts specified in Section 15-8, “Overhaul Repair”
7. Apply protective coating to engine parts.	“Protective Coatings” in Chapter 12 of M-0, Standard Practice Maintenance Manual
8. Assemble the engine components.	Chapter 16, “Component Assembly”
9. Assemble the engine.	Chapter 17, “Engine Assembly”
10. Install the engine in the aircraft.	“Section 5-2, “Engine Installation”
11. Test the overhauled engine.	Chapter 18, “Post-Overhaul Test and Adjustments”

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

Overhaul Step	Initials	Findings
Complete a Cylinder Visual Inspection (Section 6-4.11.1 of M-0, Standard Practice Maintenance Manual)		
Complete a Cylinder Differential Pressure Test. (Section 6-4.11.2 of M-0, Standard Practice Maintenance Manual)		
Remove the engine from the aircraft (Section 5-1).		
Remove the Ignition System (Section 12-2).		
Remove the Accessory Drive Adapters (Section 12-3).		
Remove the Wastegate Controller (Section 12-4.1).		
Remove the Induction System (Section 12-5).		
Remove the Fuel Injection System (Section 12-5).		
Remove the Air/Oil Separator (Section 12-7).		
Remove the Turbocharger & Exhaust System (Section 12-8).		
Remove the Oil Cooler (Section 12-9).		
Remove the Oil Pump (Section 12-10).		
Remove the Alternator(s) (Section 12-11).		
Remove the Starter Adapter Assembly (Section 12-13).		
Remove the Oil Sump (Section 12-14).		
Remove the Engine Cylinders and Pistons (Section 12-16).		
Disassemble the Ignition System (Section 13-1).		
Disassemble the Fuel Injection System (Section 13-2).		
Disassemble the Starter and Starter Adapter (Section 13-6).		
Disassemble the Engine Cylinders (Section 13-7).		
Disassemble the Accessory Drive Adapters (Section 13-8).		
Disassemble the Crankcase (Section 13-9).		
Disassemble the Drive Train (Section 13-10).		
Disassemble the Compressor Mount (Section 13-11).		
Perform a visual inspection prior to cleaning the engine parts (Section 11-1 of M-0, Standard Practice Maintenance Manual).		
Clean engine parts (Chapter 12 of M-0, Standard Practice Maintenance Manual).		
Perform detailed visual parts inspection (Section 11-1 of M-0, Standard Practice Maintenance Manual).		
Perform Fluorescent Penetrant Inspections (Section 11-2 of M-0, Standard Practice Maintenance Manual).		

Table 11-2. Engine Removal and Disassembly Checklist

Overhaul Step	Initials	Findings
Perform Magnetic Particle Inspections (Section 11-3 of M-0, Standard Practice Maintenance Manual).		
Perform Ultrasonic Inspections (Section 11-4 of M-0, Standard Practice Maintenance Manual).		
Perform Dimensional Inspections (Section 15-7).		
Perform overhaul repairs (Section 15-8).		
Assemble engine components (Chapter 16).		
Assemble the engine (Chapter 17).		
Install the engine in the aircraft (Section 5-2).		
Complete Post-Overhaul Test and Adjustments (Chapter 18).		

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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.		
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	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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	**Part Number**	**Reason**
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**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
Starter/Starter Adapter		
Perform a visual inspection of the starter and starter adapter components.		
Inspect the exterior of the starter adapter housing and cover for cracks with a 10X magnifying glass.		
Inspect the starter adapter housing and accessory drive adapter housing studs for distorted or stripped threads, corrosion, or pitting, or looseness.		
Check the shaft gears, worm wheel gears, worm gear, or worm gear shafts for cracks.		
Check for damaged or loose studs on the starter and accessory drive adapter.		
Replacement Part Description	**Part Number**	**Reason**
Lubrication System		
Inspect the exterior and cavity of the oil pump housing with a 10X magnifying glass.		
Inspect the oil pump cover, tach drive housing, and oil filter adapter with a 10X magnifying glass.		
Inspect the oil pump cover for scoring at gear contact surfaces.		
Using a flashlight and 10X magnifying glass, inspect all remaining Lubrication System components.		
Inspect all oil passages, especially in the oil pump housing and tach drive housings, for flow restrictions.		
Inspect the oil pump housing gear shaft for security and scoring.		
Inspect the oil pump pressure relief valve plunger for scoring and nicks and the face for roughness.		
Check the oil pump drive gear shaft and shaft splines for wear or damage.		
Inspect the oil sump and sump bolt holes.		

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
Inspect the oil drain plug boss and drain plug for damaged threads and damaged wrench flats.		
Inspect the oil suction tube assembly for dents, cracks, distorted or restricted openings.		
Inspect the oil pump housing and tach drive housing studs for distorted or stripped threads.		
Inspect the lubrication system fastening studs.		
Replacement Part Description	**Part Number**	**Reason**
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”.		
Replacement Part Description	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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.		
Replacement Part Description	**Part Number**	**Reason**
Engine Drive Train		
Inspect the drive train components using the “Engine Drive Train Inspection Checklist”(Section 11-9)		
Replacement Part Description	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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	**Part Number**	**Reason**

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.		
Inspection Item	**Focus**	**Initials**
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.		
Inspection Item	**Focus**	**Initials**
Oil pump cover	•Oil pump cavity area •Mounting flanges	
Oil filter adapter	•Mounting flanges •Oil seal or bushing seats	
Cast aluminum oil sump	•Mounting flanges •Bolt holes	
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.		
Inspection Item	**Initials**	**Inspector Notes**
Crankshaft: •Journals •Fillets •Oil holes •Thrust flanges •Prop flange		
Cylinder Barrels: •Fin tips •Fin roots		
Camshaft: •Lobes •Journals •Drilled hole edges		
Rocker arms: •Pad •Socket under side arms and boss		
Idler sheave support bolt		
Starter Adapter: •Shaft gear •Worm shaft •Worm gear		
Lubrication System: •Oil pump gears •Bevel gears •Tach drive shaft		

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.		
Inspection Item	**Initials**	**Inspector Notes**
•Counterweights (after bushings installed) •Counterweight hanger blade (after bushing installed) •Crankshaft gears •Camshaft gear •Idler gear •Governor drive gear		
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 11-6. 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		
Inspection Item	**Result**	**Remedy**
Crankshaft (Section 15-6.1)		
Crankshaft Main Journal #1		
Crankshaft Main Journal #2		
Crankshaft Main Journal #3		
Crankshaft Main Journal #4		
Crankshaft Main Journal #5		
Vibroetch Passing Crankshaft with Inspection Results		
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		
Inspection Item	**Dimension**	**Initials**
Crankcase (Section 15-7)		
Through-bolt in crankcase diameter		
Idler gear support in crankcase (front) diameter		
Idler gear support in crankcase (rear) diameter		
Oil pump housing pilot in crankcase diameter		
Idler gear end clearance		
Idler gear in support bushing (front) diameter		
Idler gear in support bushing (rear) diameter		
Magneto pilot in crankcase diameter		
Starter shaft gear roller bearing hole diameter		
Governor drive shaft in crankcase diameter		
Crankcase (each half) width		
Crankcase (cylinder deck-to-cylinder deck) width		
Accessory drive adapter pilot in crankcase diameter		
Governor Drive Gear Backlash		
Crankshaft Journal Bore diameter		
Camshaft Journal Bore Diameter		
Tappet Guides Diameter		
Governor Driven Gear Bearing Diameter		
Starter Shaft Needle Bearing Hole Diameter		
Idler gear support pin front cc diameter		
Idler gear support pin rear cc diameter		
Camshaft journal diameter 1		
Camshaft journal diameter 2		
Camshaft journal diameter 3		
Camshaft journal diameter 4		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Intake valve tappets OD							
Exhaust valve tappets OD							
Drive Train (Section 15-7)							
Crankshaft front journal							
Crankshaft rear journal							
Crankshaft #2 journal							
Crankshaft #3 journal							
Crankshaft #4 journal							
Crankshaft #5 journal							
Crank pins							
Counterweight hanger blade bushing							
Camshaft journal diameter							
Crankshaft main bearings diameter							
Crank pins out-of-round							
Main journals out-of-round							
Crankshaft front journal diameter							
Crankshaft rear journal diameter							
Crankshaft #2 journal diameter							
Crankshaft #3 journal diameter							
Crankshaft #4 journal diameter							
Crankshaft #5 journal diameter							
Crank pin diameter							
Crankshaft run-out at center main journals							
Crankshaft run-out at propeller flange pilot							
Crankshaft run-out at propeller flange face							
Crankshaft Counterweights (Section 10-9.1 of M-0, Standard Practice Maintenance Manual)							
Damper pin bushing in crank cheek ext. diameter							
Damper pin bushing in counterweight diameter							
Damper pin in counterweight end clearance							
Alternator gear on crankshaft diameter							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D		
Inspection Item	**Dimension**	**Initials**
Crankshaft gear on crankshaft diameter		
Crankshaft in thrust bearing end clearance		
Governor oil transfer collar on crankshaft diameter		
Camshaft journals in crankcase diameter		
Camshaft in crankcase end clearance		
Camshaft run-out at center journals (shaft support at end journals) full indicator reading		
Camshaft gear on camshaft flange diameter		
Bushing in connecting rod diameter		
Bolt in connecting rod diameter		
Connecting rod bearing on crank pin diameter		
Connecting rod on crank pin end clearance		
Connecting rod bearing and bushing twist or convergence per inch of length		
Crankshaft gear and camshaft gear backlash		
Crankshaft gear and idler gear backlash		
Idler gear and accessory drive gear (right and left) backlash		
Starter shaft gear and crankshaft gear backlash		
Counterweight 4^{th} order pins		
Counterweight 5^{th} order pins		
Counterweight 6^{th} order pins (1)		
Counterweight 6^{th} order pins (2)		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Journal	**1**	**2**	**3**	**4**			
Counterweight bushing bore							
Counterweight bushing ID							
Counterweight hanger blade bushing ID							
Counterweight hanger blade bore							
Connecting Rods (Section 10-9.4.1 in M-0)	**1**	**2**	**3**	**4**	**5**	**6**	
Bushing bore diameter (bushing installed)							
Bushing center to crank pin center							
Engine Cylinders (Section 15-7.3)	**1**	**2**	**3**	**4**	**5**	**6**	
Cylinder bore (lower 4-1/4 inch of barrel) diameter							
Cylinder bore choke (at 5.75 inch from open end of barrel) taper							
Cylinder bore out-of-round							
Cylinder bore – allowable oversize							
Cylinder bore surface (Nitrided Barrels) Cross hatch angle Finish in micro-inches R_a							
Cylinder barrel in crankcase diameter							
Intake valve seat insert in cylinder head diameter							
Intake valve guide in cylinder head diameter							
Exhaust valve guide in cylinder head diameter							
Exhaust valve seat insert in cylinder head diameter							
New intake valve seat width							
New exhaust valve seat width							
Rocker shaft in cylinder head bosses diameter							
Rocker arm bushing bore diameter							
Rocker arm bushing inside diameter – finish bore							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Engine Cylinders (cont.)	**1**	**2**	**3**	**4**	**5**	**6**	
Rocker arm side clearance							
Intake valve guide inside diameter							
Intake valve in guide diameter							
Exhaust valve guide inside diameter							
Exhaust valve in guide diameter							
Rocker arm foot to valve stem (dry valve gear lash)							
Piston, moly coated (bottom of skirt) in cylinder diameter							
Top piston ring in groove side clearance							
Second piston ring in groove side clearance							
Third piston ring in groove side clearance							
Fourth piston ring in groove side clearance							
Top ring gap							
Second ring gap							
Third ring gap							
Fourth ring gap							
Piston pin in piston diameter							
Piston Pin diameter							
Piston pin in cylinder end clearance							
Piston pin in connecting rod bushing diameter							
Bushing in connecting rod diameter							
Connecting rod bearing on crankpin diameter							
Connecting rod on crankpin end clearance							
Connecting rod bearing and bushing twist or convergence per inch of length							
Hydraulic tappet in crankcase diameter							
Inner valve spring 654442 compressed to 1.230 in. length load							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Engine Cylinders (cont.)	**1**	**2**	**3**	**4**	**5**	**6**	
Inner valve spring 654442 compressed to 1.745 in. length load							
Outer valve spring 654441 compressed to 1.275 in. length load							
Outer valve spring 654441 compressed to 1.790 in. length load							
Installed outer valve spring height							
Cylinder assembly intake valve guide bore							
Cylinder assembly exhaust valve guide bore							
Rocker arm bushings inside diameter							
Valve rocker shaft outside diameter							
Intake valve stem diameter							
Exhaust valve stem diameter							
Piston diameter at top							
Piston diameter below 1st groove							
Piston diameter at bottom							
Piston pin bore diameter							
Piston third ring groove width							
Piston fourth ring groove width							
Piston pin length w/plugs							
Rocker arm thrust width							
Cylinder dimension STD D							
Cylinder dimension 0.005 D							
Cylinder dimension STD X							
Cylinder dimension 0.005 X							
Cylinder dimension STD Y							
Cylinder dimension 0.005 Y							
Starter Adapter (Section 15-7.4)							
Starter shaft gear needle bearing hole crankcase diameter							
Starter shaft gear front (bearing) journal diameter							
Starter shaft gear in clutch drum bearing diameter							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D		
Inspection Item	**Dimension**	**Initials**
Starter Adapter (cont.)		
Clutch spring sleeve in starter adapter diameter		
Starter shaft gear in ball bearing diameter		
Bearing in starter adapter cover diameter		
Worm wheel gear end clearance		
Worm wheel drum diameter		
Starter shaft gear drum diameter		
Clutch spring in clutch spring sleeve diameter		
From center line of worm gear shaft to starter adapter thrust pads		
Needle bearing hole starter adapter diameter		
Ball bearing in starter adapter diameter		
Worm gear shaft in needle bearing area diameter		
Worm gear shaft in ball bearing diameter		
Starter worm gear on shaft diameter		
Starter spring on worm drive shaft diameter		
Starter pilot to starter drive adapter diameter		
Scavenge pump driven gear on shaft diameter		
Scavenge pump driver and driven gear in body end clearance		
Scavenge pump driver and driven gear in body diameter		
Bushing in scavenge pump driven gear diameter		
Scavenge pump driver and driven gear backlash		
Starter worm wheel gear and worm gear backlash		
Worm wheel drum A dimension		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D		
Inspection Item	**Dimension**	**Initials**
0.015 Undersize worm wheel drum A dimension		
Worm wheel drum B dimension		
0.015 Undersize worm wheel drum B dimension		
Shaft Gear Drum dimension		
0.015 Undersize Shaft Gear Drum dimension		
Lubrication System (Section 15-7.5)		
Oil pump driven gear shaft diameter		
Oil pump drive gear hole diameter		
Oil pump gear chamber depth		
Oil pump drive gear shaft diameter		
Oil pump driven gear shaft diameter		
Oil pressure relief valve adjusting screw in plunger diameter		
Oil pressure relief valve seat in housing depth		
Oil pump driver gear in pump housing diameter		
Oil pump driver gear shaft in pump housing diameter		
Oil pump driven gear to driven gear shaft diameter		
Oil pump driver gear in pump housing end clearance		
Oil pump driven gear in pump housing end clearance		
Oil pump driver gear shaft in oil pump cover diameter		
Oil pump driven gear in housing diameter		
Oil pump drive and driven gears' backlash		
Oil pressure relief valve spring compressed to 1.25 inch length load		
Oil temp. control valve 0.090 inches minimum travel at oil temperature		
Oil temperature control valve must close between		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
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	**1**	**2**	**3**	**4**	**5**	**6**	
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.							
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 11-8. Engine Cylinder Overhaul Inspection Checklist

Fluorescent Penetrant Inspection (on all non-ferrous metal parts) Perform the inspection according to the "Fluorescent Penetrant Inspection" instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.						
Cylinder	**1**	**2**	**3**	**4**	**5**	**6**
Cylinder Heads						
Cylinder Heads after Valve Seat or Valve Guide Installation						
Magnetic Particle Inspection (on all ferrous parts) Use the fluorescent wet continuous method according to the "Magnetic Particle Inspection" instructions in of M-0, Standard Practice Maintenance Manual.						
Engine cylinder barrel inner and outer surfaces using the close coil shot method						
Engine cylinder intake valve, and rocker arms using circular and longitudinal magnetization						
Dimensional Inspection Refer to the Section 15-7, "Dimensional Inspection" and Appendix D						
Cylinders						
Cylinder Components						

Table 11-9. Engine Drive Train Inspection Checklist

Item to Check	Initials	Action
Inspect the crankshaft, camshaft, connecting rods, and engine drive train components for rusting, pitting, and cracks.		
Using a 10X magnifying glass, inspect the camshaft journals and lobes for scoring, pitting, corrosion, or any other indication of wear.		
Inspect the camshaft gear splines for wear.		
Inspect the camshaft gear flange for nicks, peening, and other irregularities. (This flange must be smooth to align gears.)		
Inspect the bolt holes on the camshaft gear flange for distorted or stripped threads.		
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.		
Inspect the crankshaft main journals, crank pins, and oil seal area for scoring and burning.		
Inspect the crankshaft gear bolt holes for distorted or stripped threads.		
Check the oil passages on the crankshaft for obstruction or loose oil tubes.		
Check the gear dowel for the desired snug fit.		
Inspect the oil control plug for obstructions in the oil hole and loose fit.		
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.		
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.		
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.		

Table 11-9. Engine Drive Train Inspection Checklist

Item to Check	Initials	Action
Inspect the connecting rod for corrosion, pitting, rust, discoloration (blue), galling, impact damage, nicks, bending, or twisting.		
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.		
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.		
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.		
Inspect the oil transfer collar assembly for cracks and scoring.		
Verify the tin plating on the oil control collar is intact.		
Inspect studs on the oil control collar for corrosion, pitting, incomplete threads, or looseness.		
Check the stud height and dowel settings on the oil control collar according to Section 15-7.9, “Stud Height Dimensional Inspection.”		
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.		
Remove the piston pin bushing from the connecting rod; inspect the piston pin bushing bore and surrounding area for nicks, gouges and mechanical damage.		
Inspect the rod channel rails for nicks, gouges or mechanical damage.		

Table 11-10. Replacement Parts Inventory

Part Description	Part Number	Reason/Comment

Table 11-10. Replacement Parts Inventory

Part Description	Part Number	Reason/Comment

Table 11-10. Replacement Parts Inventory

Part Description	Part Number	Reason/Comment

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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.

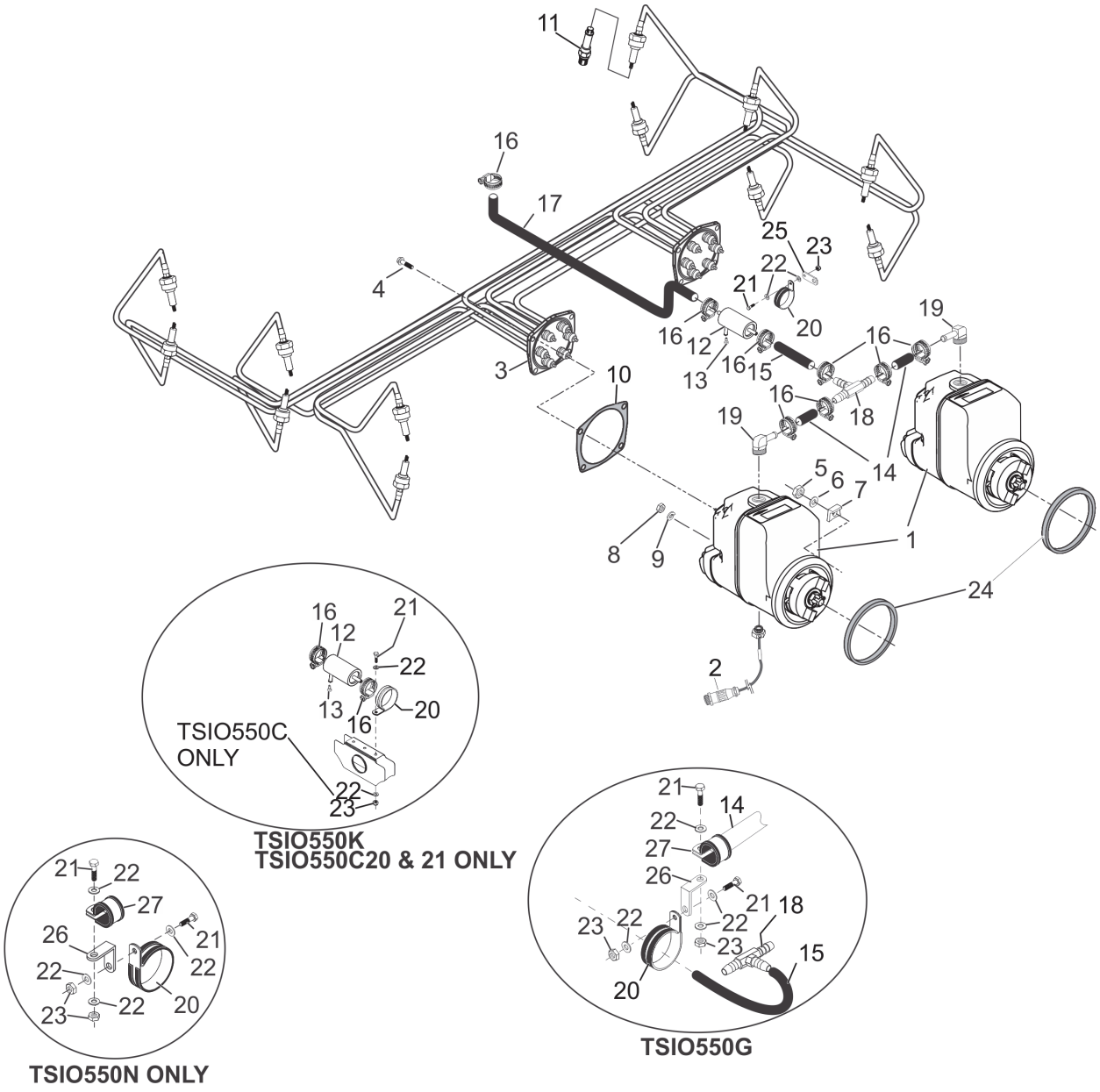


Figure 12-1. Continental Motors Ignition System

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		

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.

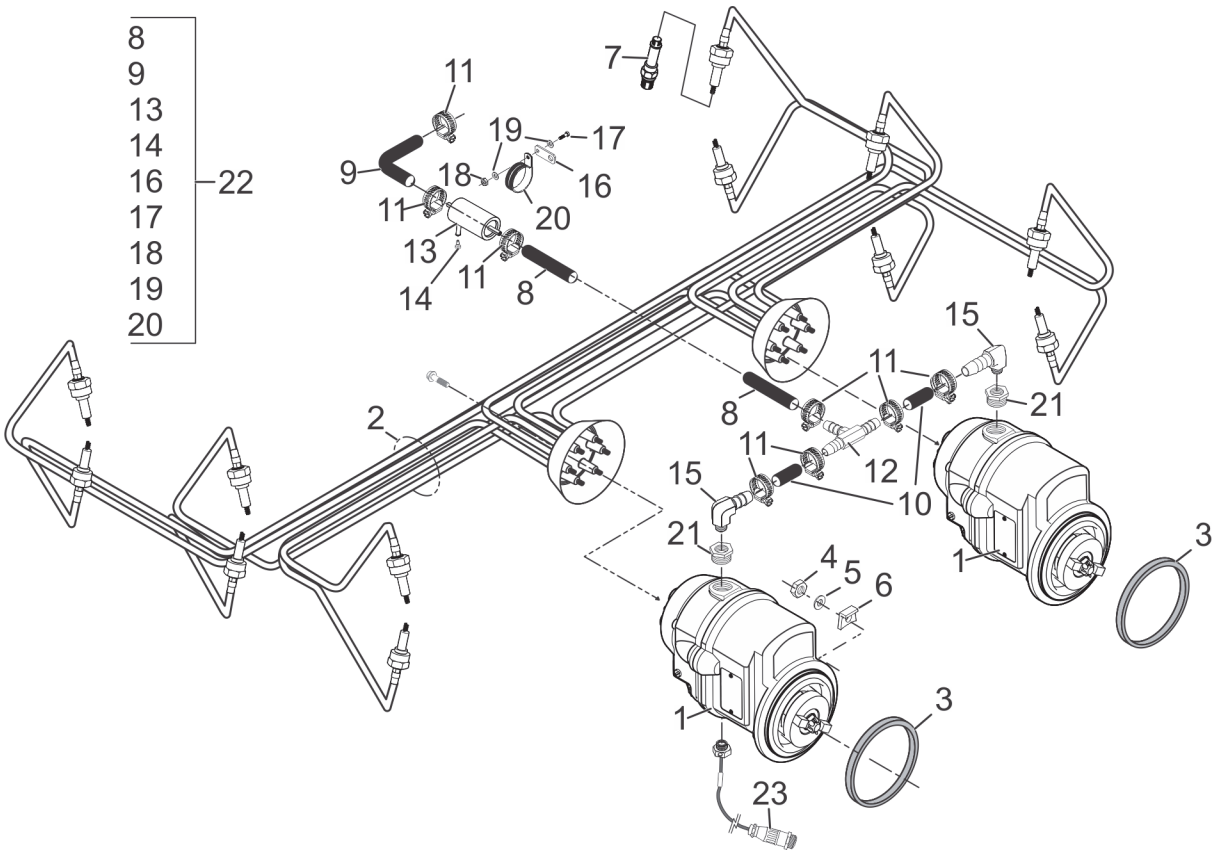


Figure 12-2. Champion (Slick) Ignition System

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
	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.

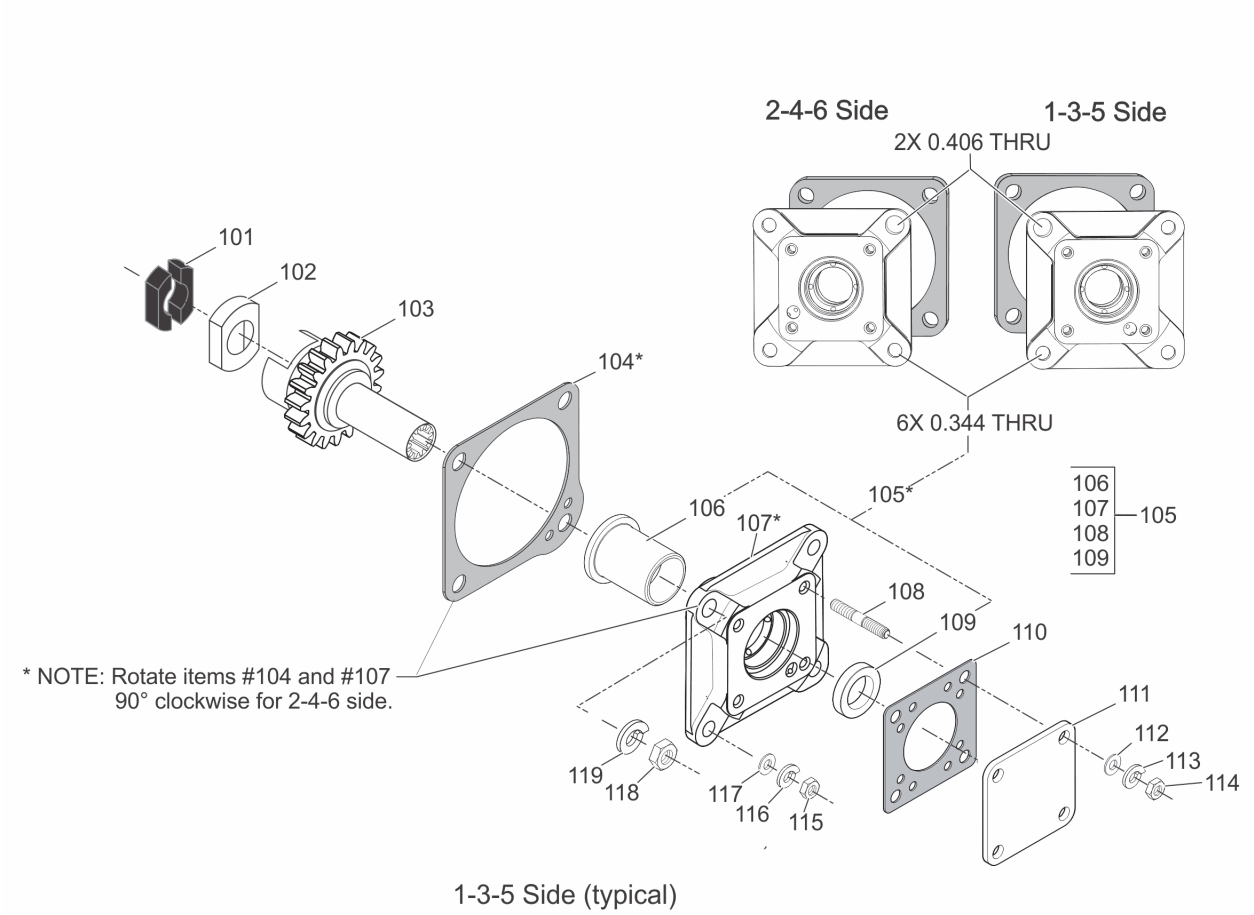


Figure 12-3. Accessory Drive Adapter Assembly

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		

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.

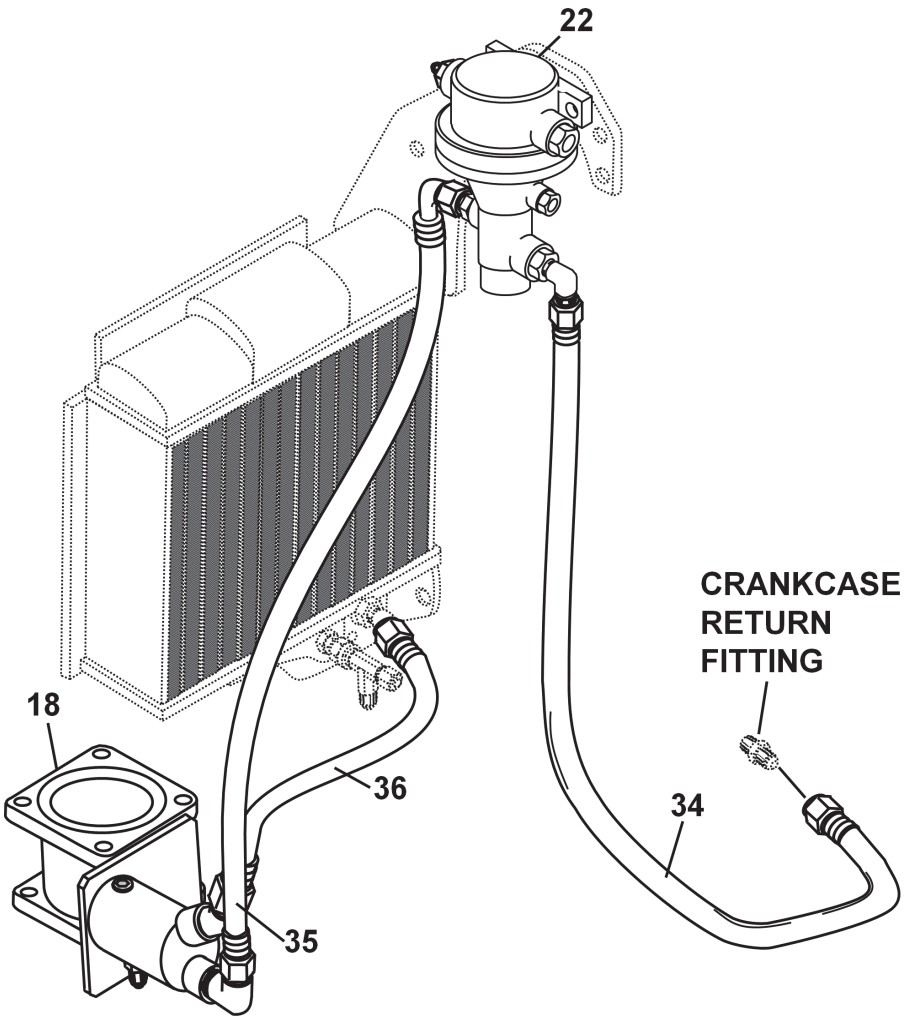


Figure 12-4. Wastegate Controller Lubrication B C E G

NOTE: See Figure 12-20 for legend

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).

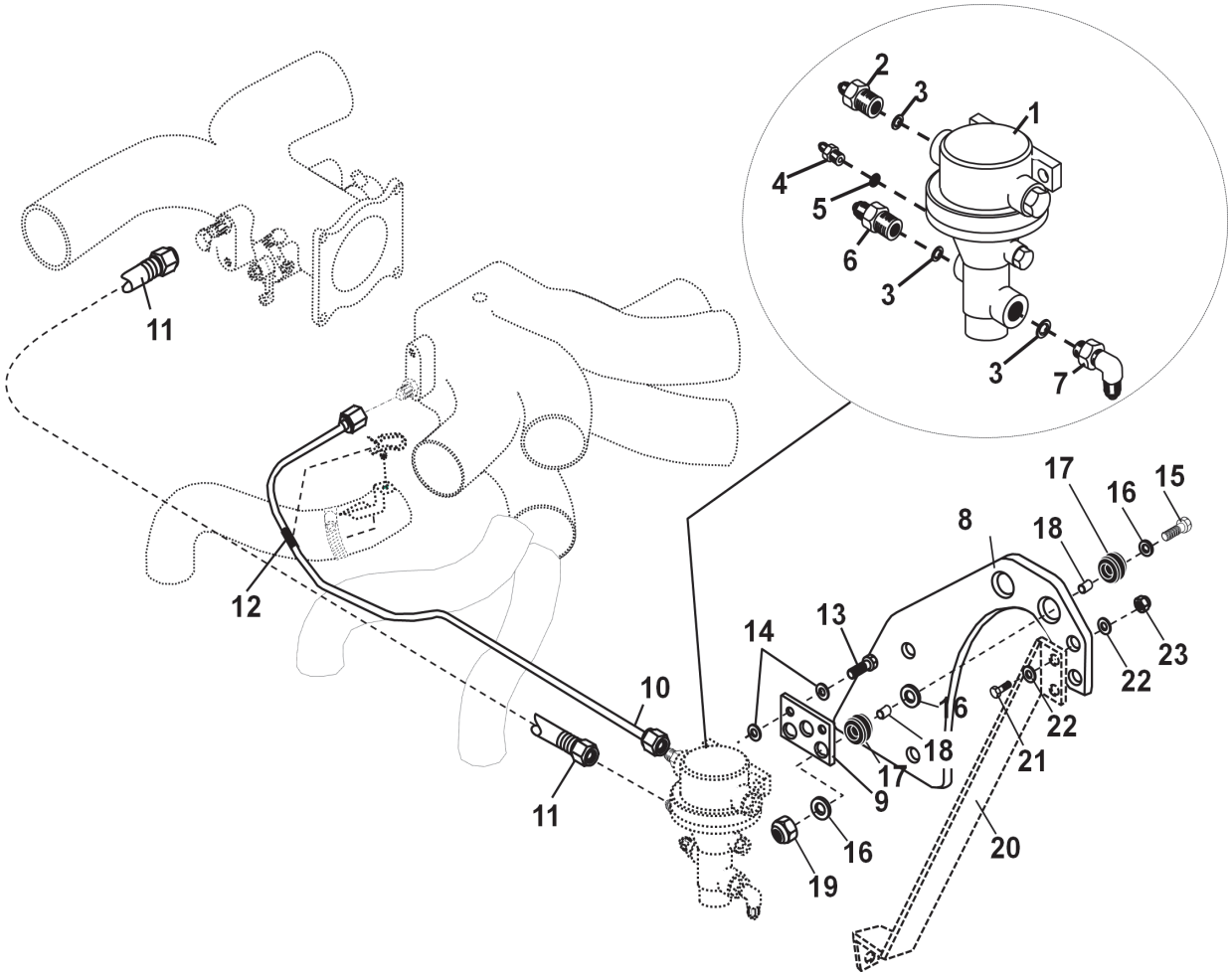


Figure 12-5. Wastegate Controller Assembly Detail B C E G

1	Controller	7	90° Elbow Fitting	13	Bolt	19	Lock Nut
2	Reducer	8	Bracket	14	Washer	20	Bracket
3	O-Ring	9	Bracket	15	Bolt	21	Bolt
4	Adapter	10	Tube Assembly	16	Washer	22	Washer
5	O-Ring	11	Hose Assembly	17	Grommet	23	Lock Nut
6	Adapter Fitting	12	Line Protector	18	Spacer		

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.

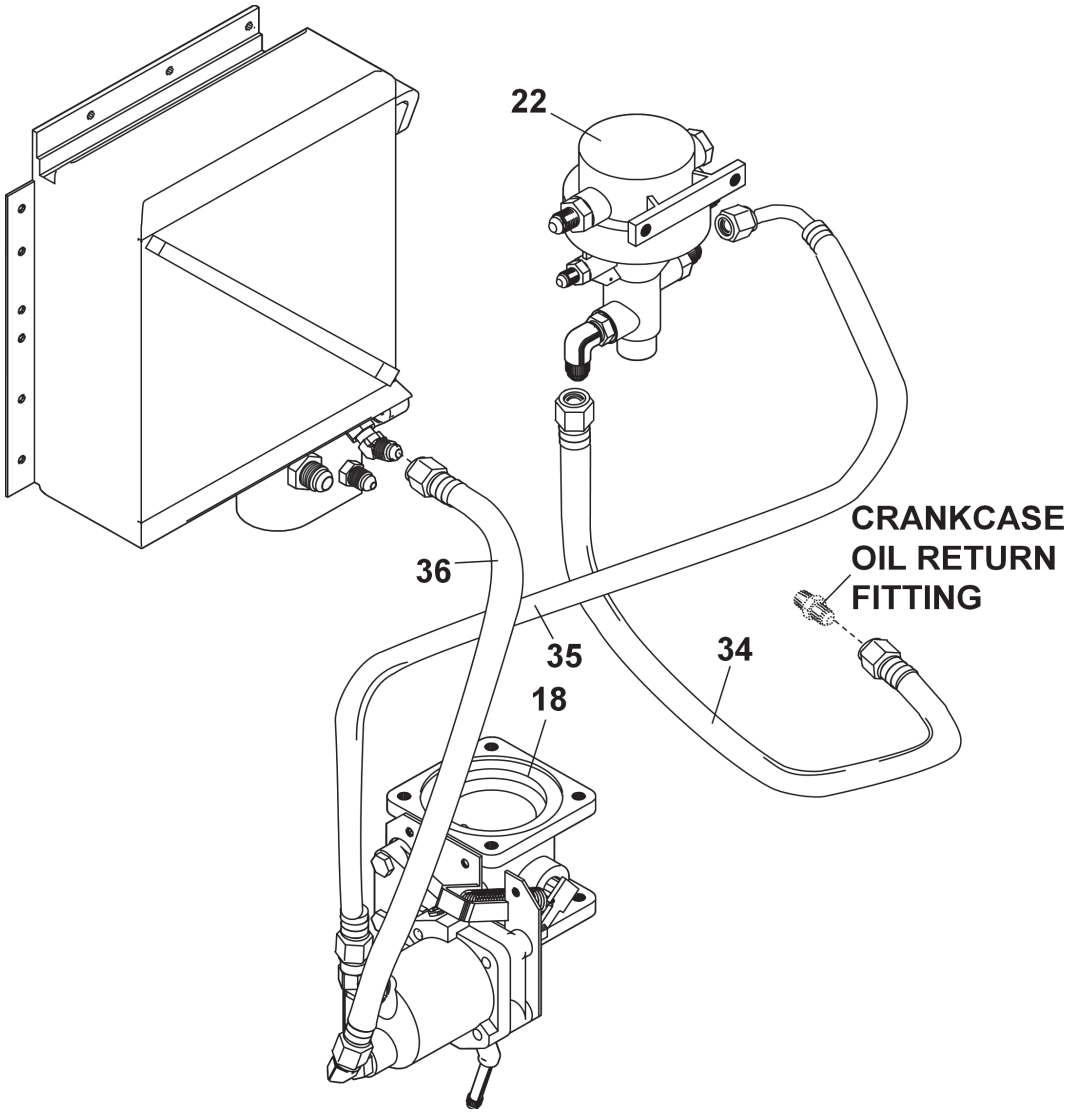


Figure 12-6. Wastegate Controller Lubrication K

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.

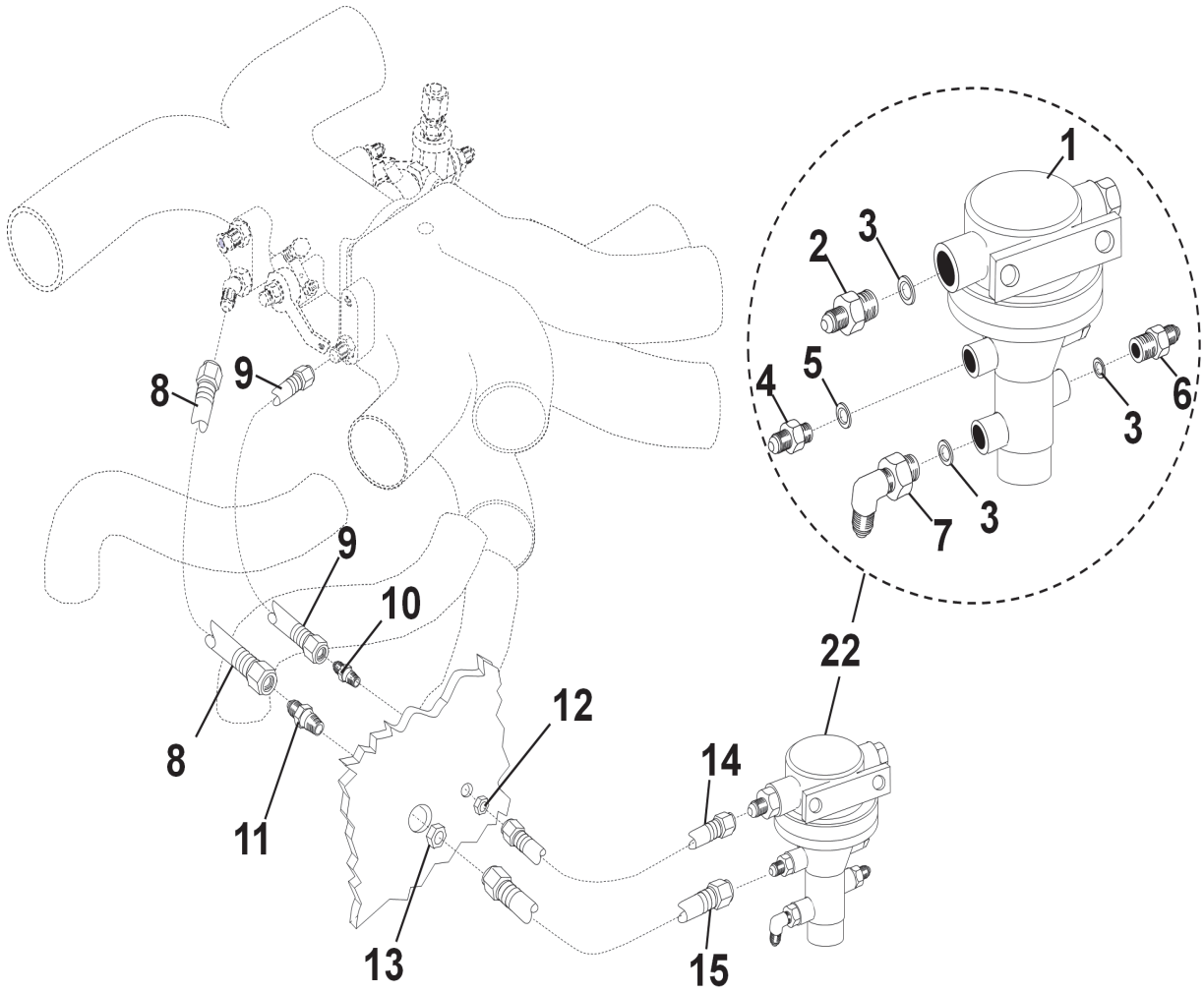


Figure 12-7. Wastegate Controller Assembly K

1	Controller	5	O-Ring Seal	9	Hose Assembly	13	Bulkhead Nut
2	Reducer	6	Adapter Fitting	10	Bulkhead Union	14	Hose Assembly
3	O-Ring Seal	7	Elbow	11	Bulkhead Union	15	Hose Assembly
4	#4 Tube Adapter	8	Hose Assembly	12	Bulkhead Nut		

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.

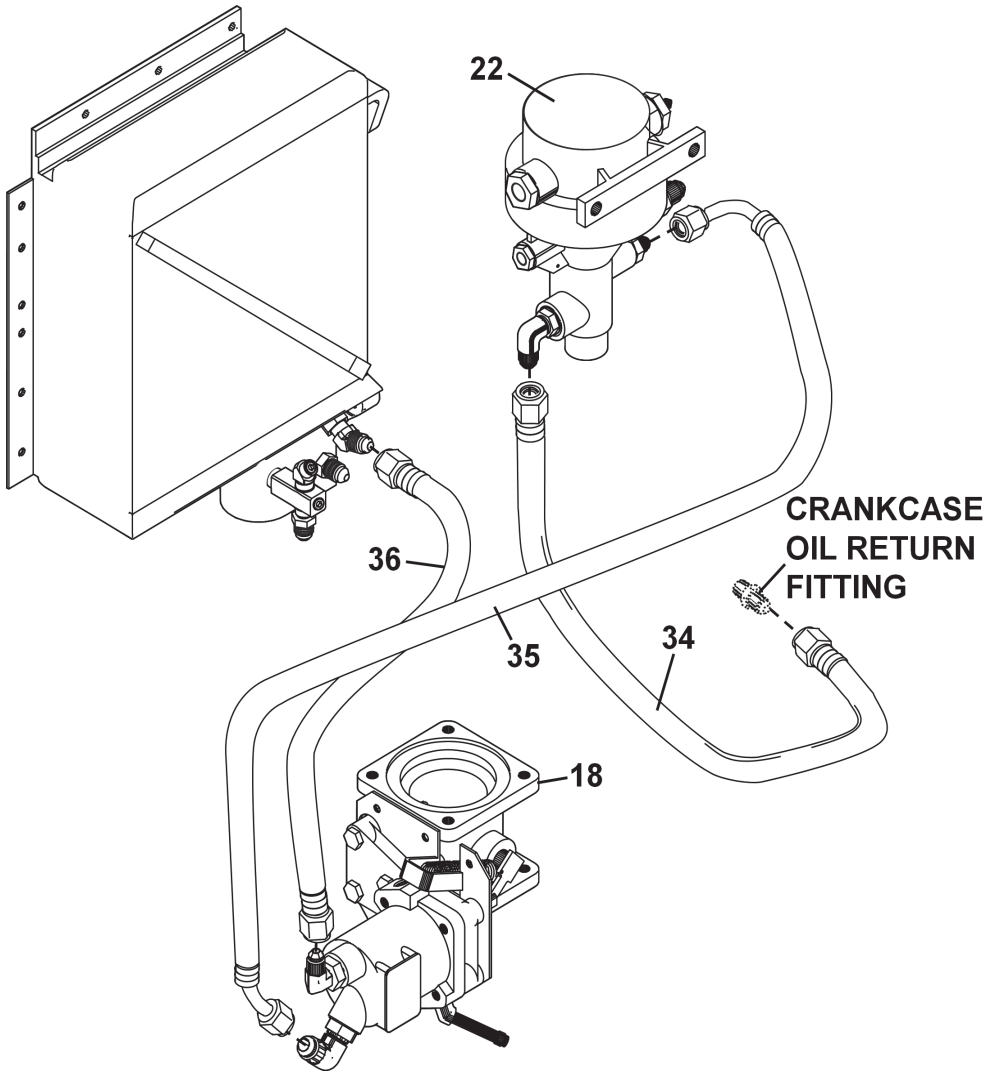


Figure 12-8. Wastegate Controller Lubrication N
See Figure 12-20 for legend

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.

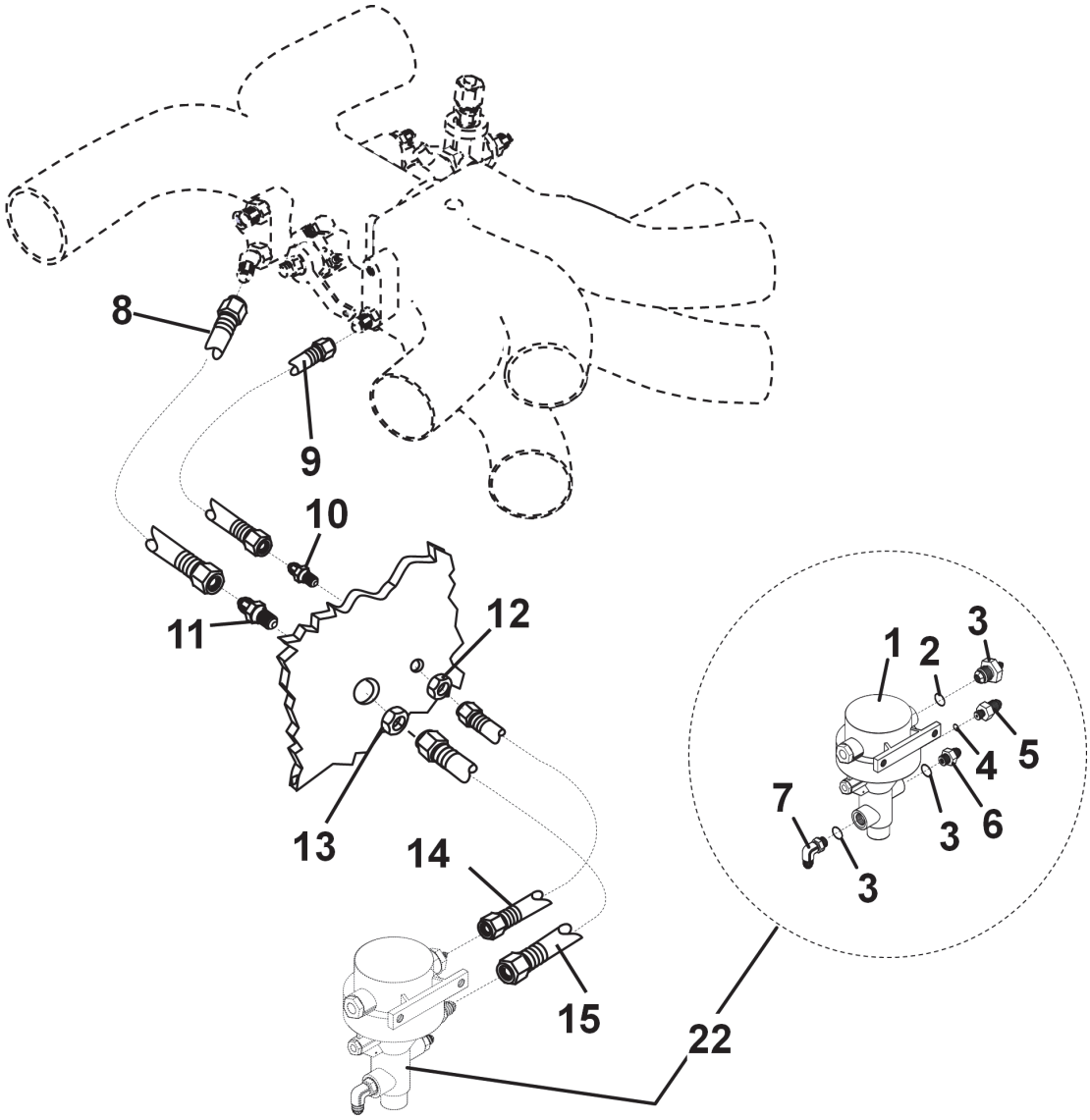


Figure 12-9. Turbocharger Controller and Hoses N

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

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

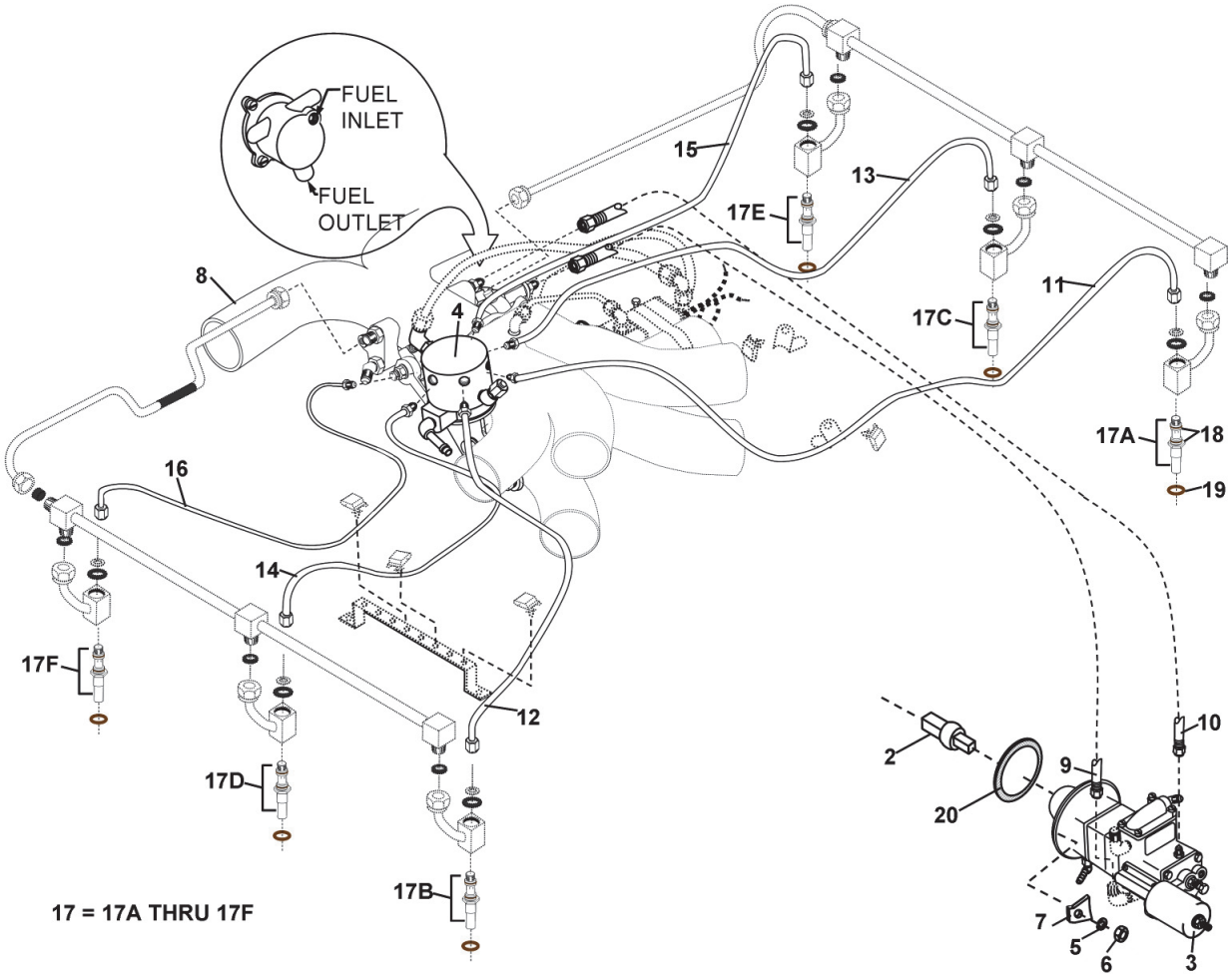


Figure 12-10. Fuel Injection System B C E

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		

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.

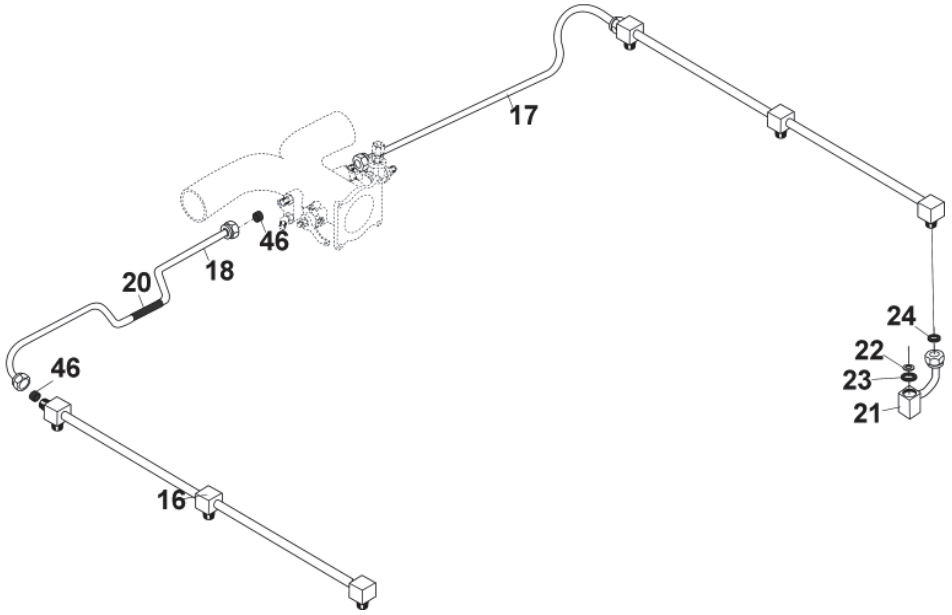


Figure 12-11. Air Reference Tubes

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.

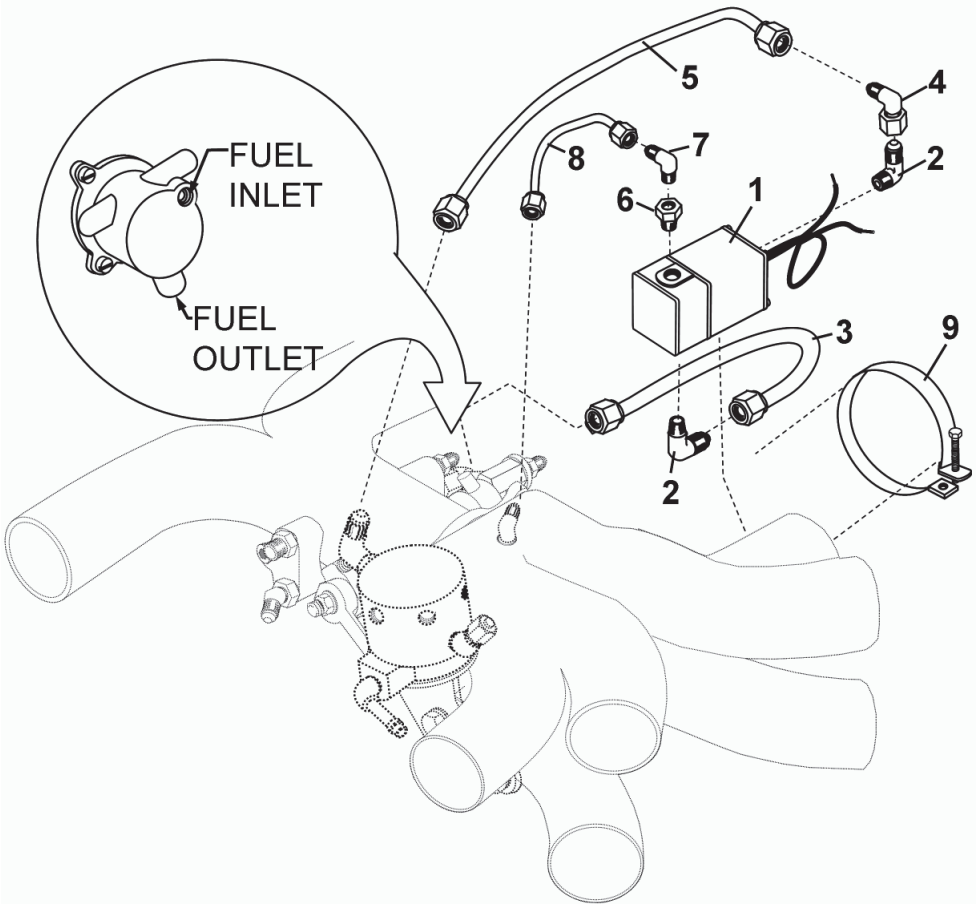


Figure 12-12. Fuel Priming System B C E

1	Diverter Valve	3	Metering Unit Tube	5	Manifold Valve Inlet Tube	7	Elbow
2	Street Elbow	4	Elbow	6	Reducer Bushing	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.

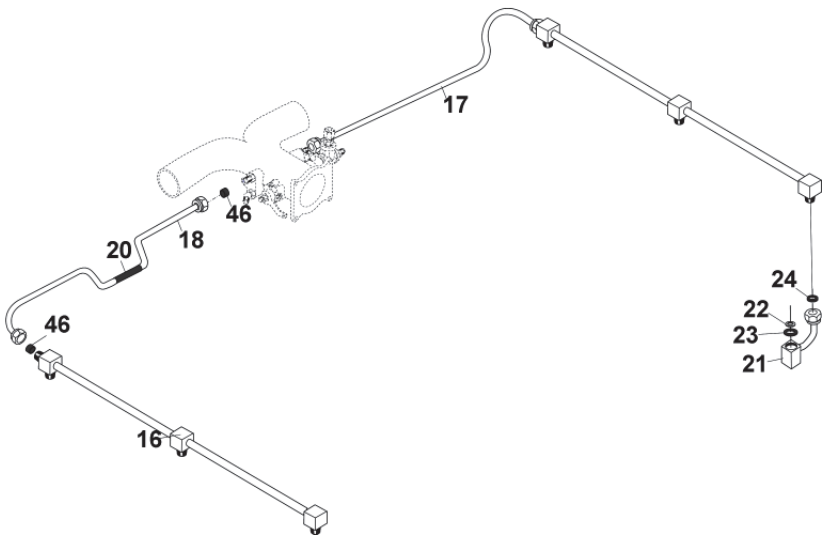


Figure 12-11 repeated for reference

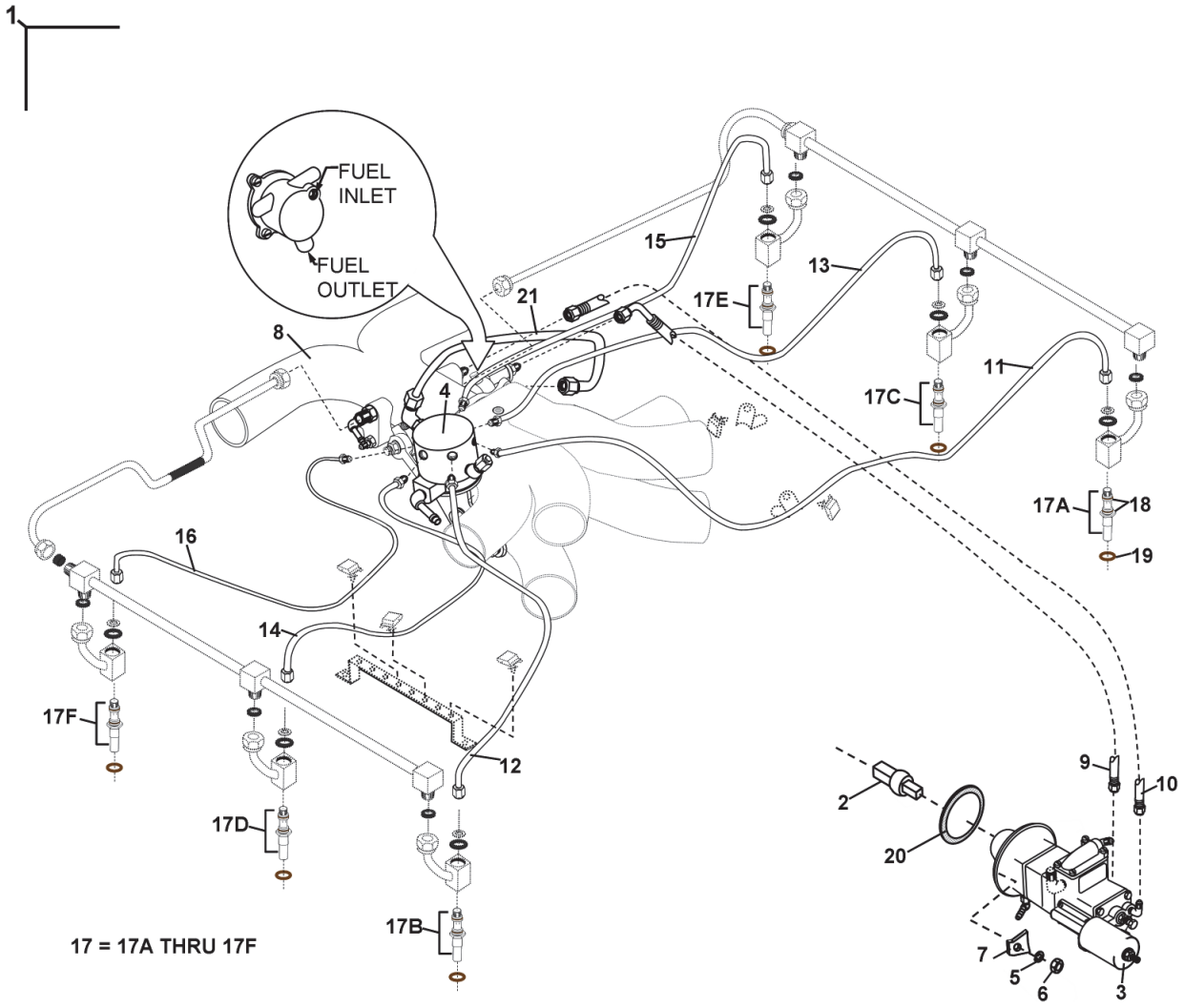


Figure 12-13. Fuel Injection System G

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		

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-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 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.

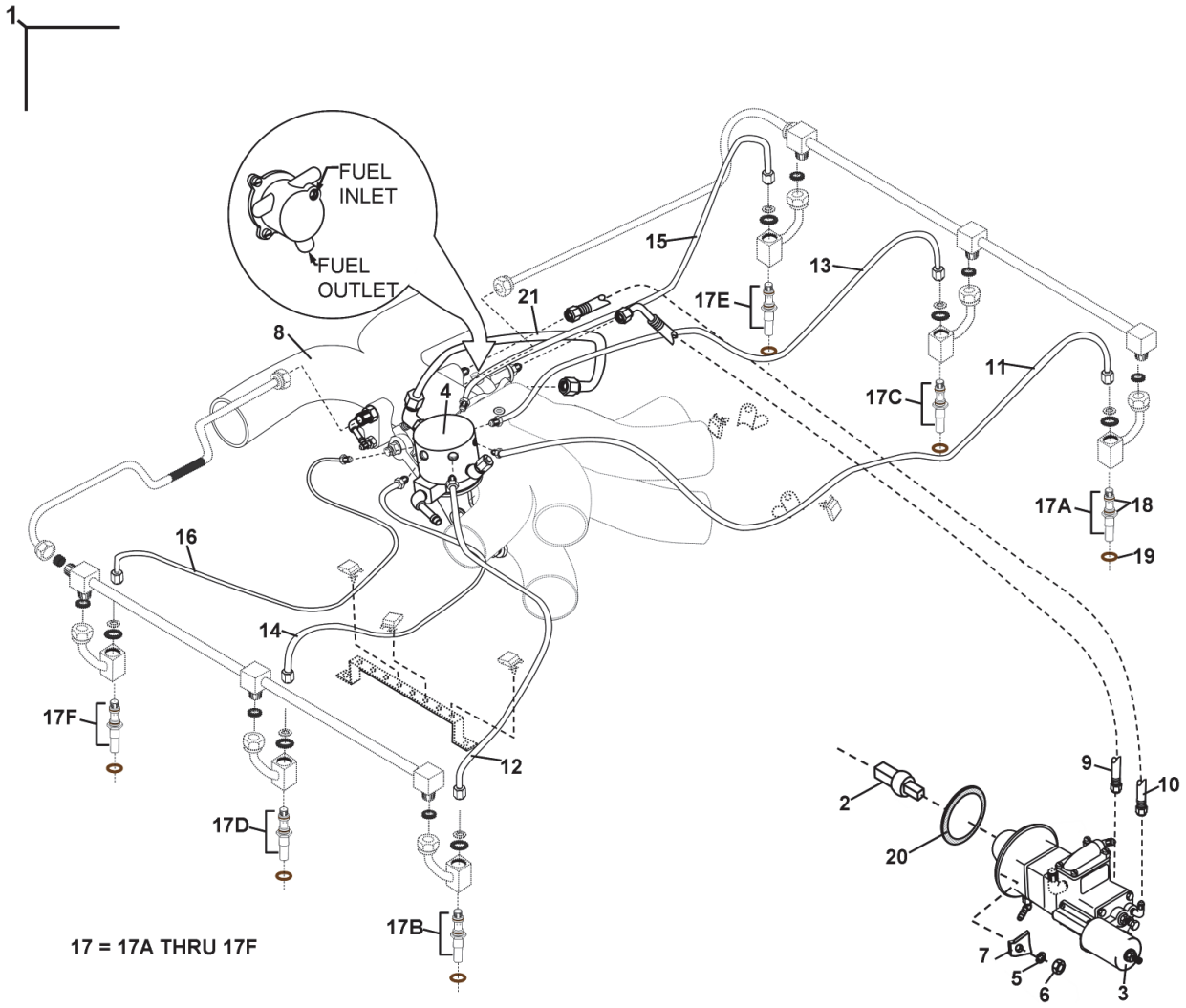


Figure 12-13 repeated for reference

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.

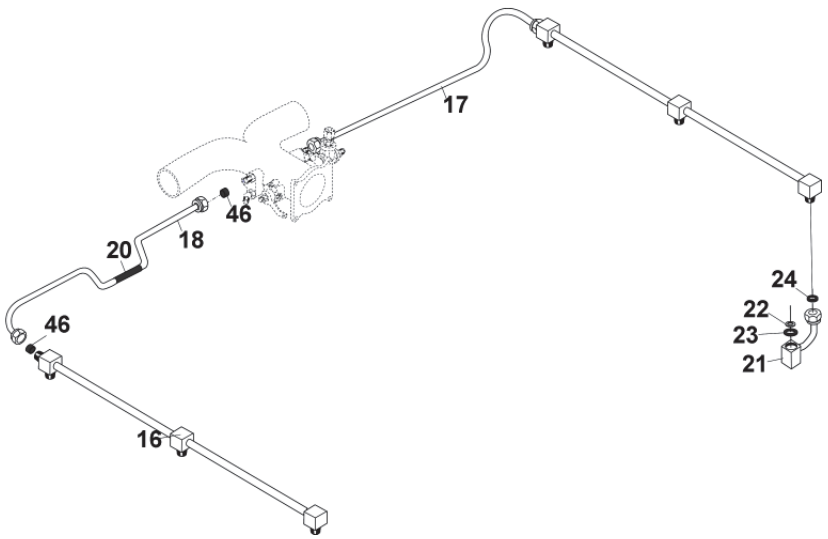


Figure 12-11 repeated for reference

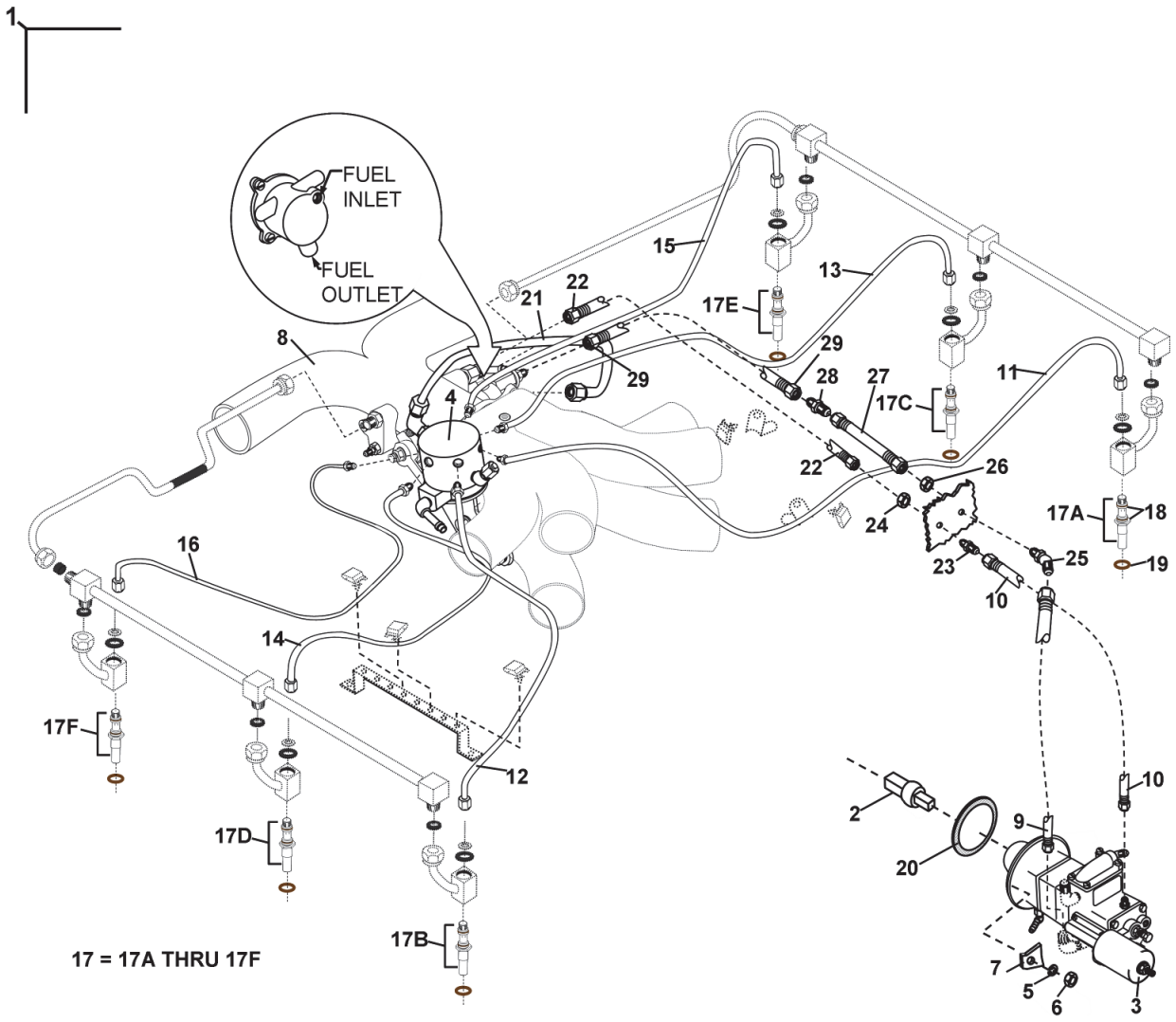


Figure 12-14. Fuel Injection System K N

1	Fuel Injection Kit	10	Hose Assembly	17B	Injector Nozzle #2	22	Hose Assembly
2	Crankshaft Gear Coupling	11	Fuel Inj. Tube Assembly #1	17C	Injector Nozzle #3	23	Bulkhead Union
3	Fuel Pump Assembly	12	Fuel Inj. Tube Assembly #2	17D	Injector Nozzle #4	24	Bulkhead Nut
4	Fuel Manifold Valve Assy.	13	Fuel Inj. Tube Assembly #3	17E	Injector Nozzle #5	25	Bulkhead 45° Fitting
5	Lock Washer	14	Fuel Inj. Tube Assembly #4	17F	Injector Nozzle #6	26	Bulkhead Nut
6	Nut	15	Fuel Inj. Tube Assembly #5	18	Washer	27	Hose Assembly
7	Hold Down Washer	16	Fuel Inj. Tube Assembly #6	19	O-Ring	28	Bulkhead Union
8	Throttle & Metering Assembly	17	Injector Nozzle Kit	20	Fuel Pump Adapter Gasket	29	Hose Assembly
9	Hose Assembly	17A	Injector Nozzle #1	21	Fuel Tube		

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.

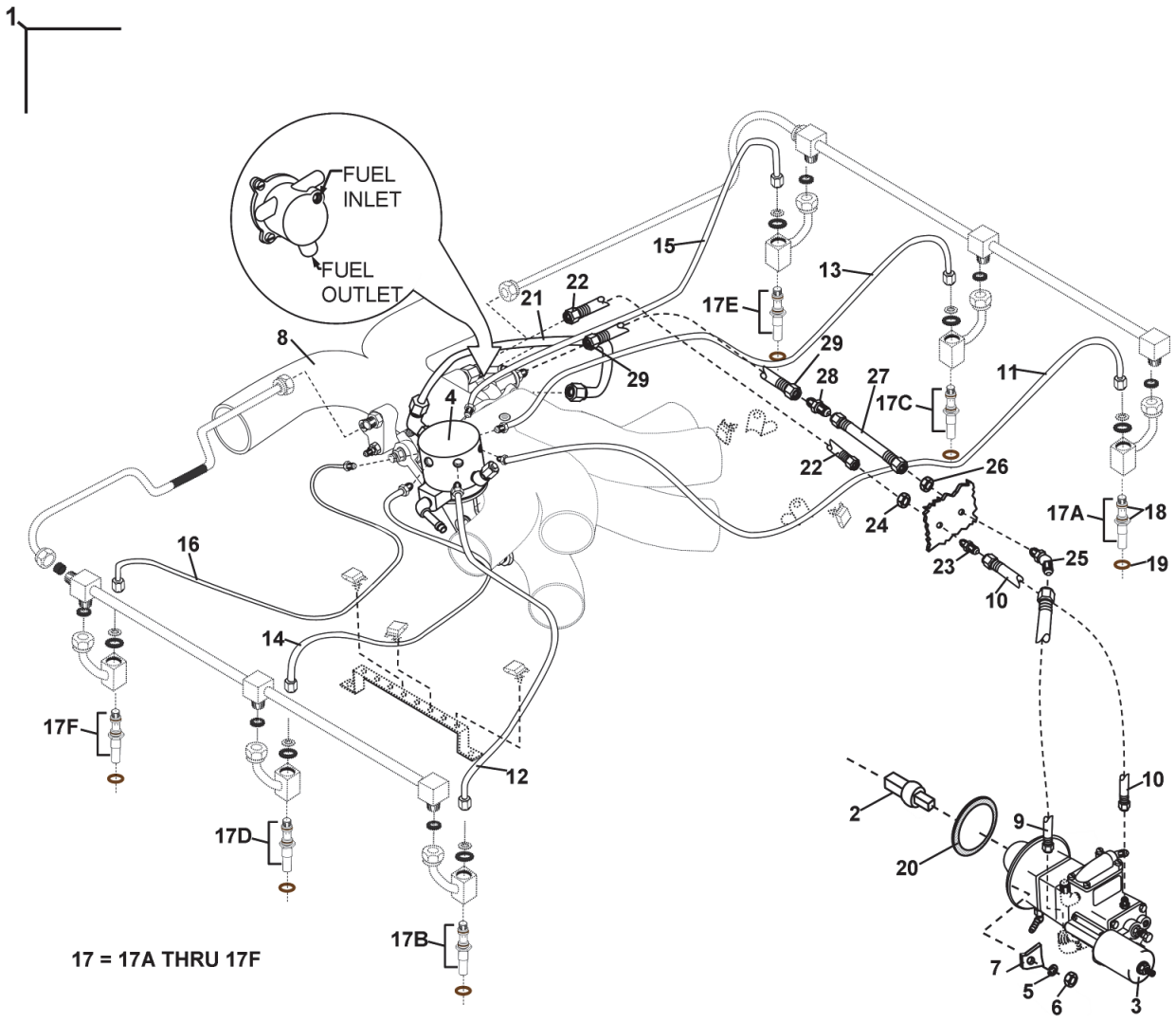


Figure 12-14 repeated for reference

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).

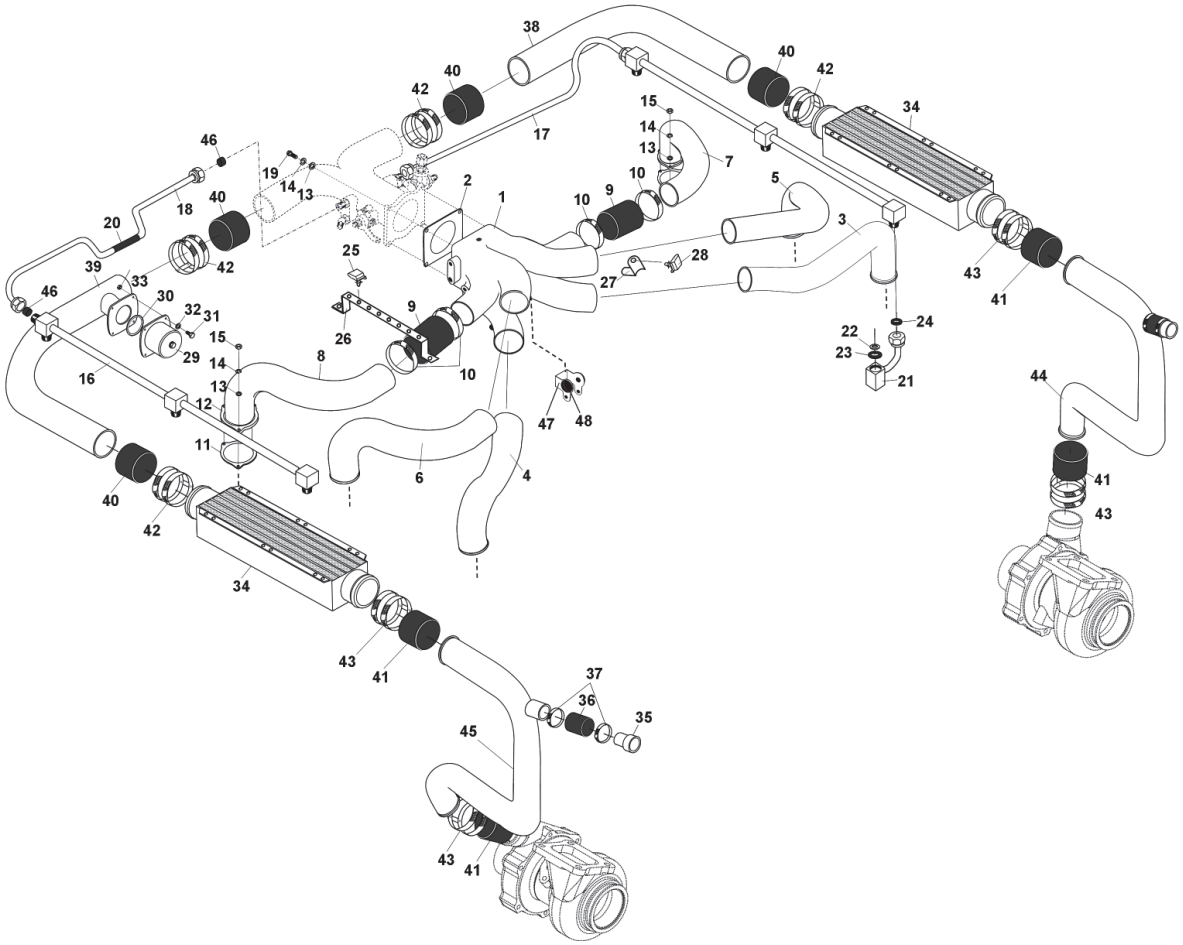


Figure 12-15. Induction Assembly G

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.

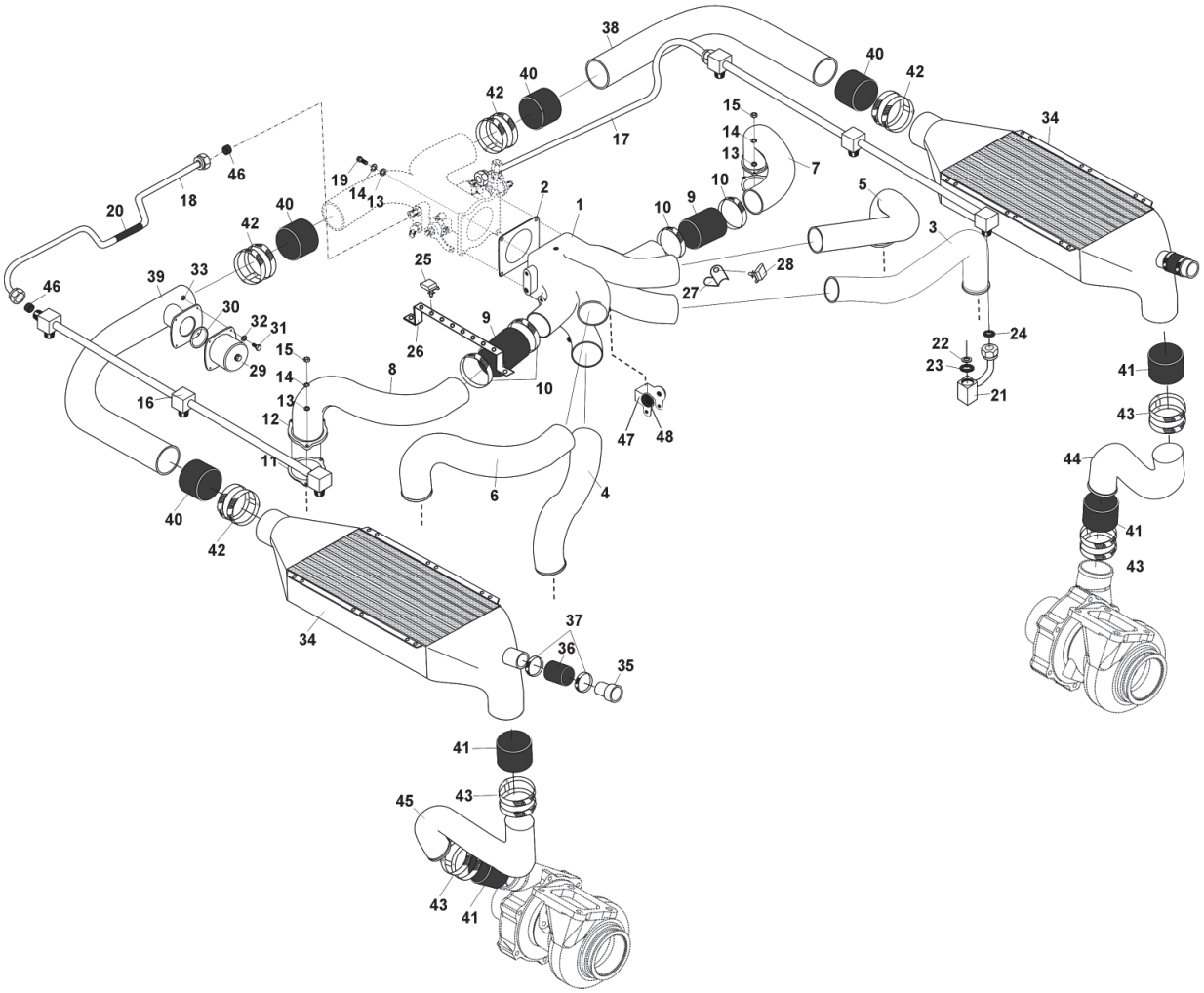


Figure 12-16. Induction System B C E K N

1	Manifold & Fitting Assembly	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Dist. Tube Bracket	38	1-3-5 FWD Induction Tube
3	Tube	15	Nut	27	Fuel Inj. Line Bracket	39	2-4-6 FWD Induction Tube
4	Tube	16	Air Manifold Tube Assembly	28	Tube Clamp	40	Hose
5	Tube	17	Right Air Reference Tube	29	Overboost Valve	41	Hose
6	Tube	18	Left Air Reference Tube	30	O-ring	42	Clamp Assembly
7	Tube	19	Screw	31	Bolt	43	Clamp Assembly
8	Tube	20	Hose	32	Washer	44	1-3-5 AFT Induction Tube
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	2-4-6 AFT Induction Tube
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Intake Manifold Gasket	23	Washer	35	Sonic Venturi Nozzle		
12	Flange	24	Compression Seal	36	Hose		

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.

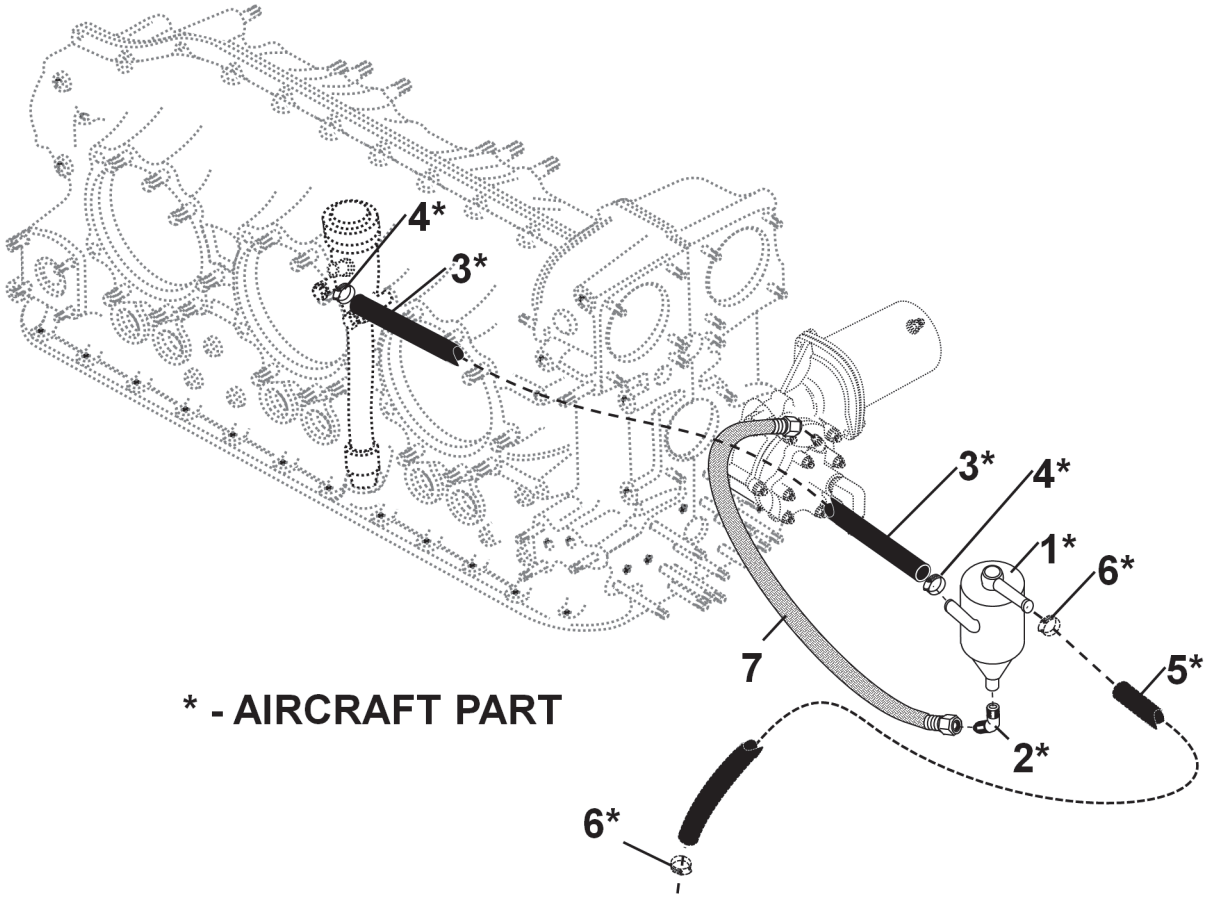


Figure 12-17. Crankcase Ventilation Hose Routing K N
See legend for Figure 12-18

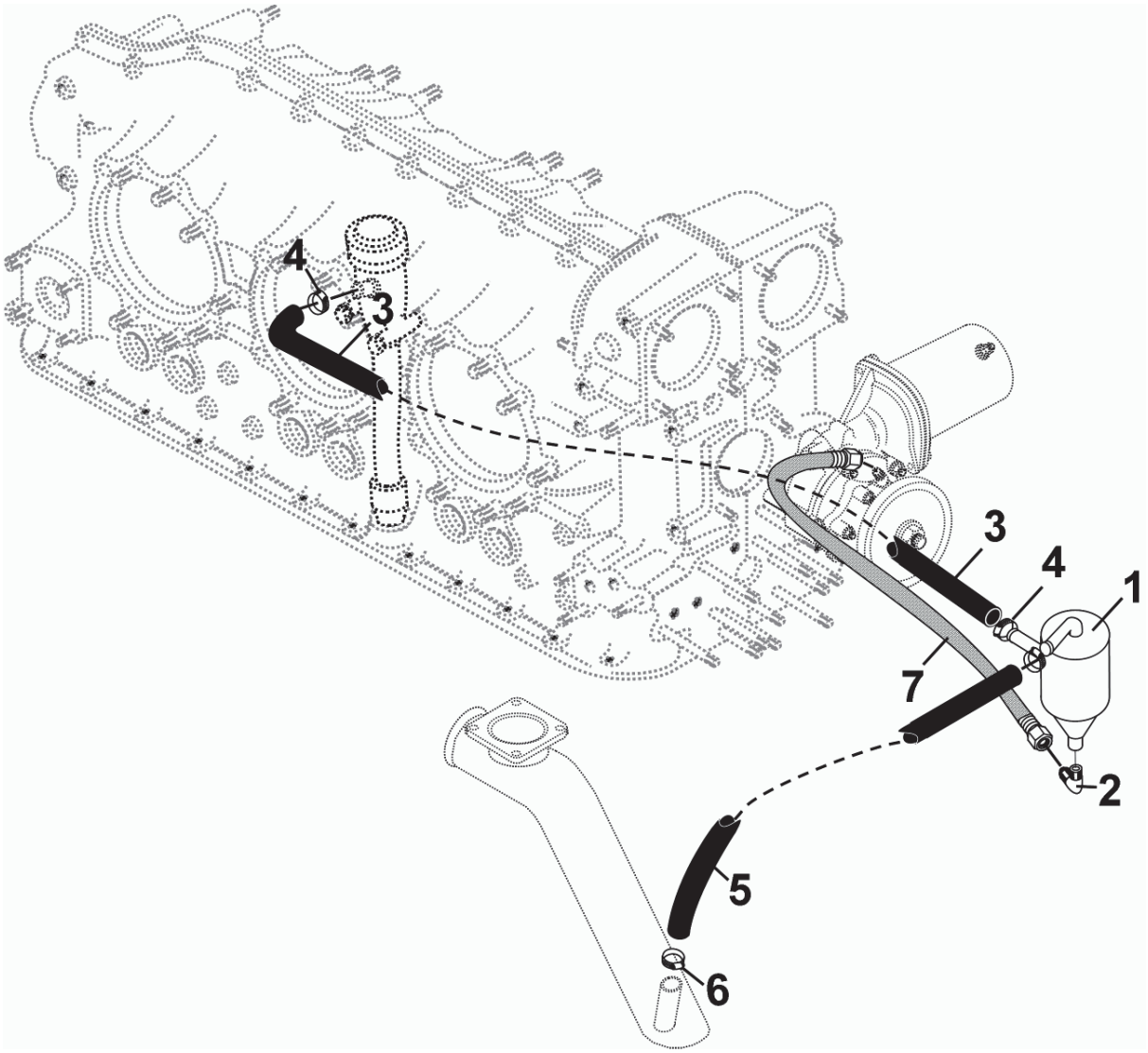


Figure 12-18. Crankcase Ventilation Hose Routing B C E G

1	Air/Oil Separator Assembly	3	Hose Assembly	5	Hose Assembly	7	Hose
2	90°Elbow Fitting	4	Hose Clamp	6	Hose Clamp		

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).

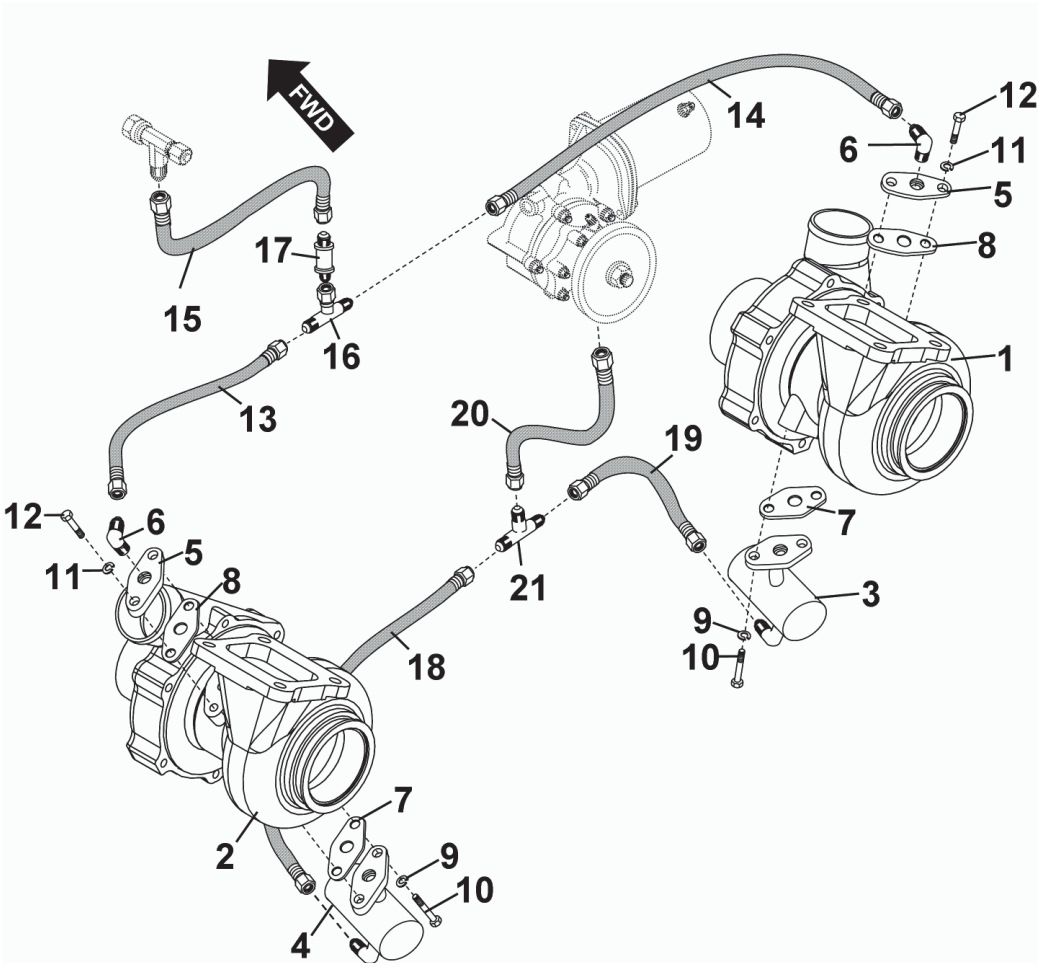


Figure 12-19. Turbocharger Lubrication B C E G

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		

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).

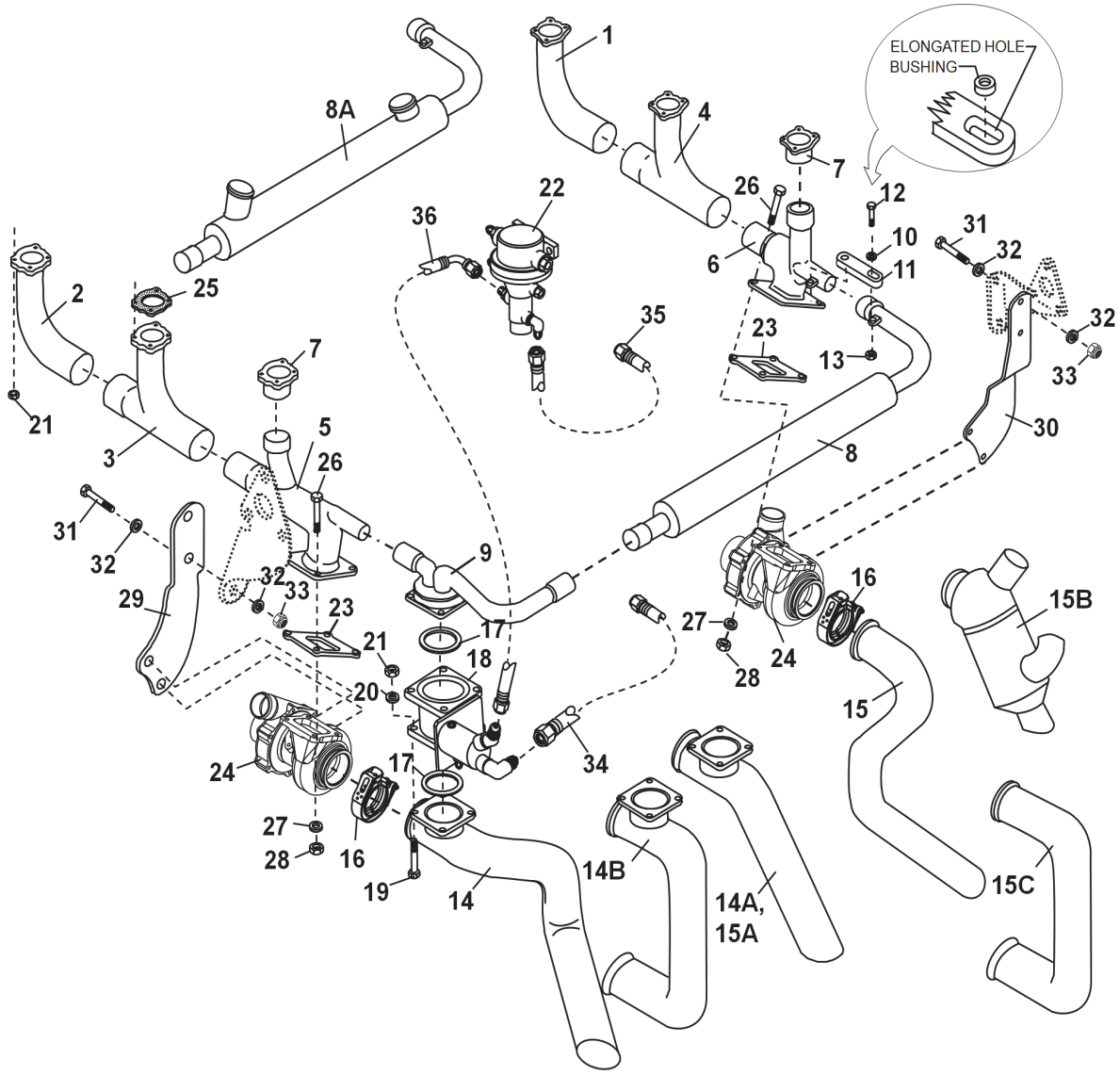


Figure 12-20. Composite Turbocharger and Exhaust B C E G

1	Elbow Riser	11	Tie Rod	19	Bolt	31	Bolt
2	Elbow Riser	12	Bolt	20	Washer	32	Washer
3	Tee Assembly	13	Lock Nut	21	Lock Nut	33	Lock Nut
4	Tee Assembly	14	Contoured Tailpipe	22	Controller	34	Hose
5	Turbo Transition	14C	Inverse Tailpipe Option	23	Gasket	35	Hose
6	Turbo Transition	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
7	Riser	15A	Straight Tailpipe	25	Gasket		
8	Crossover Assembly	15B	Heater	26	Bolt		
8A	Crossover Assy with Heater Shroud Option	15C	Inverse Tailpipe Option	27	Washer		
		16	V-band clamp	28	Lock Nut		
9	Transition	17	Gasket	29	Bracket		
10	Bushing	18	Wastegate Assembly	30	Bracket		

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.

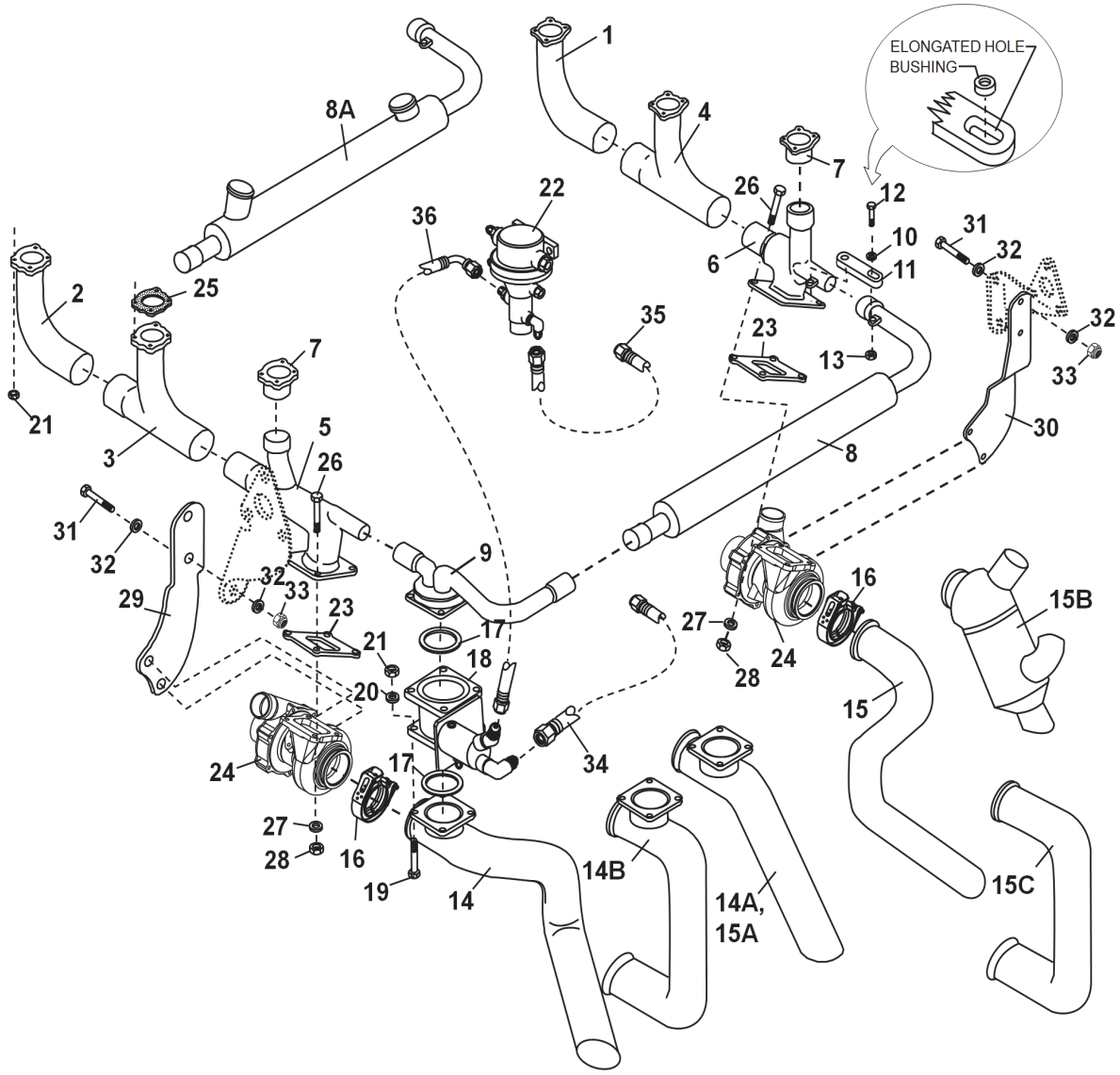


Figure 12-20 repeated for reference

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).

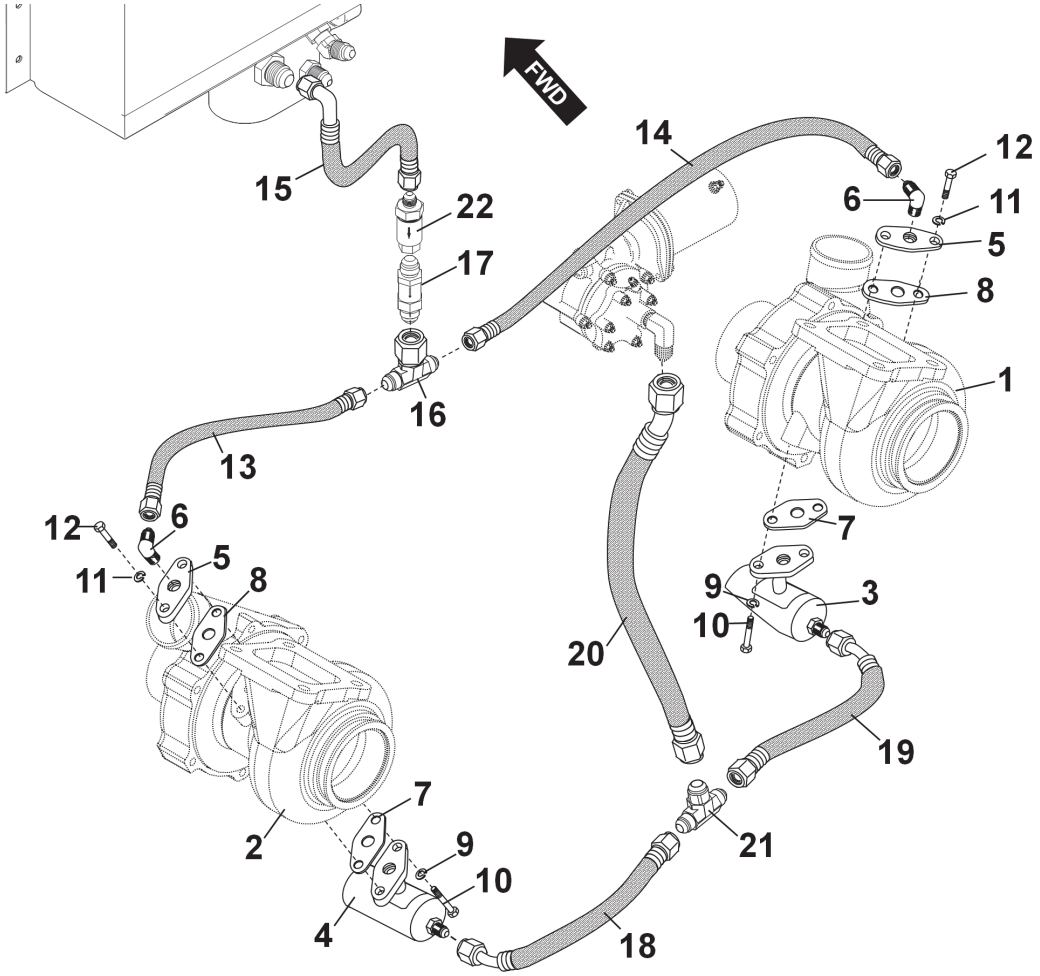


Figure 12-21. Turbocharger Lubrication Hose Routing K

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	22	Check Valve Filter Assy
5	Adapter	11	Lock Washer	17	Check Valve		
6	Elbow Fitting	12	Bolt	18	Hose		

6. Remove the V-band clamps (Figure 12-22) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).

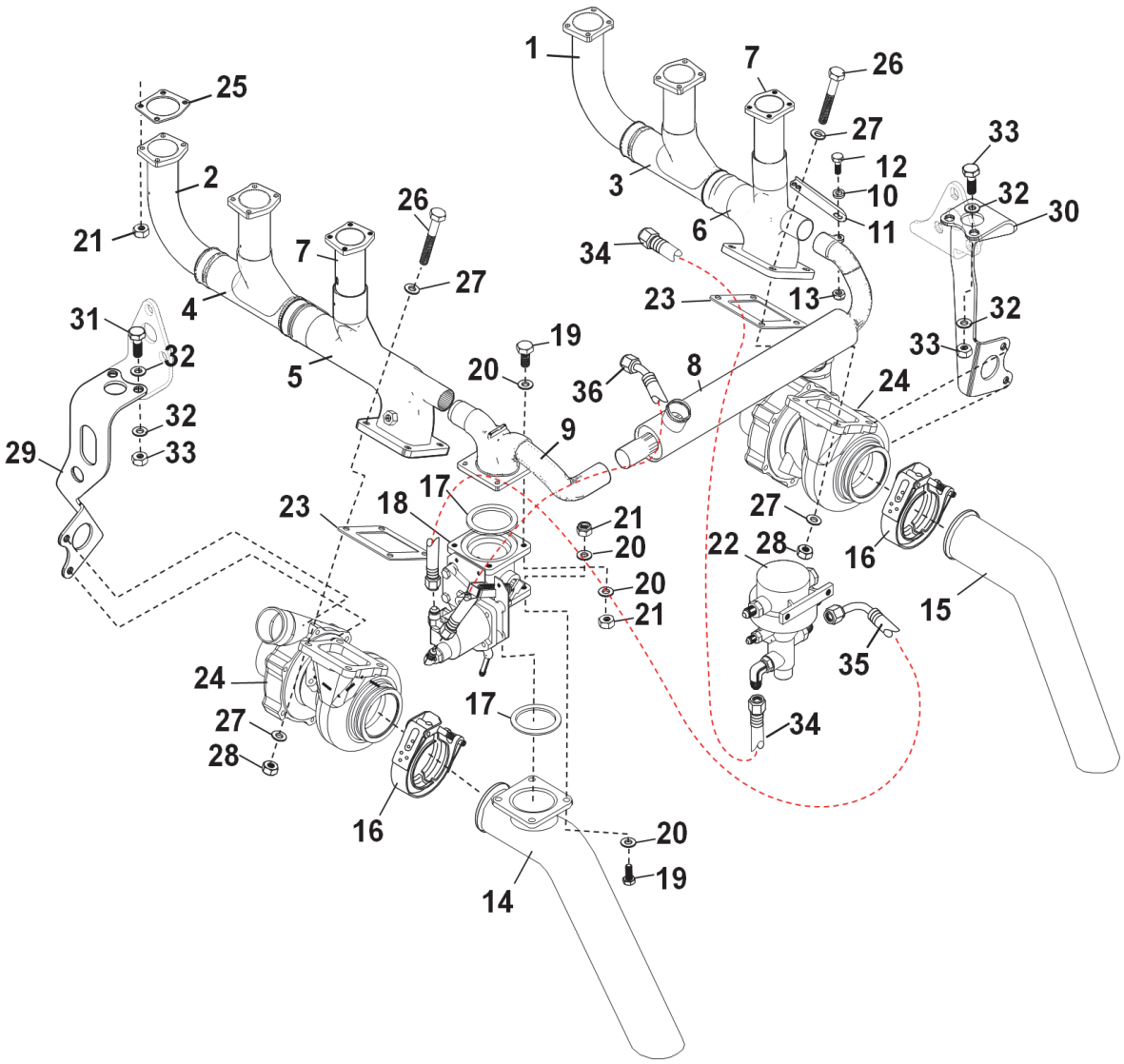


Figure 12-22. TSIO-550-K Turbocharger and Exhaust

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

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 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.

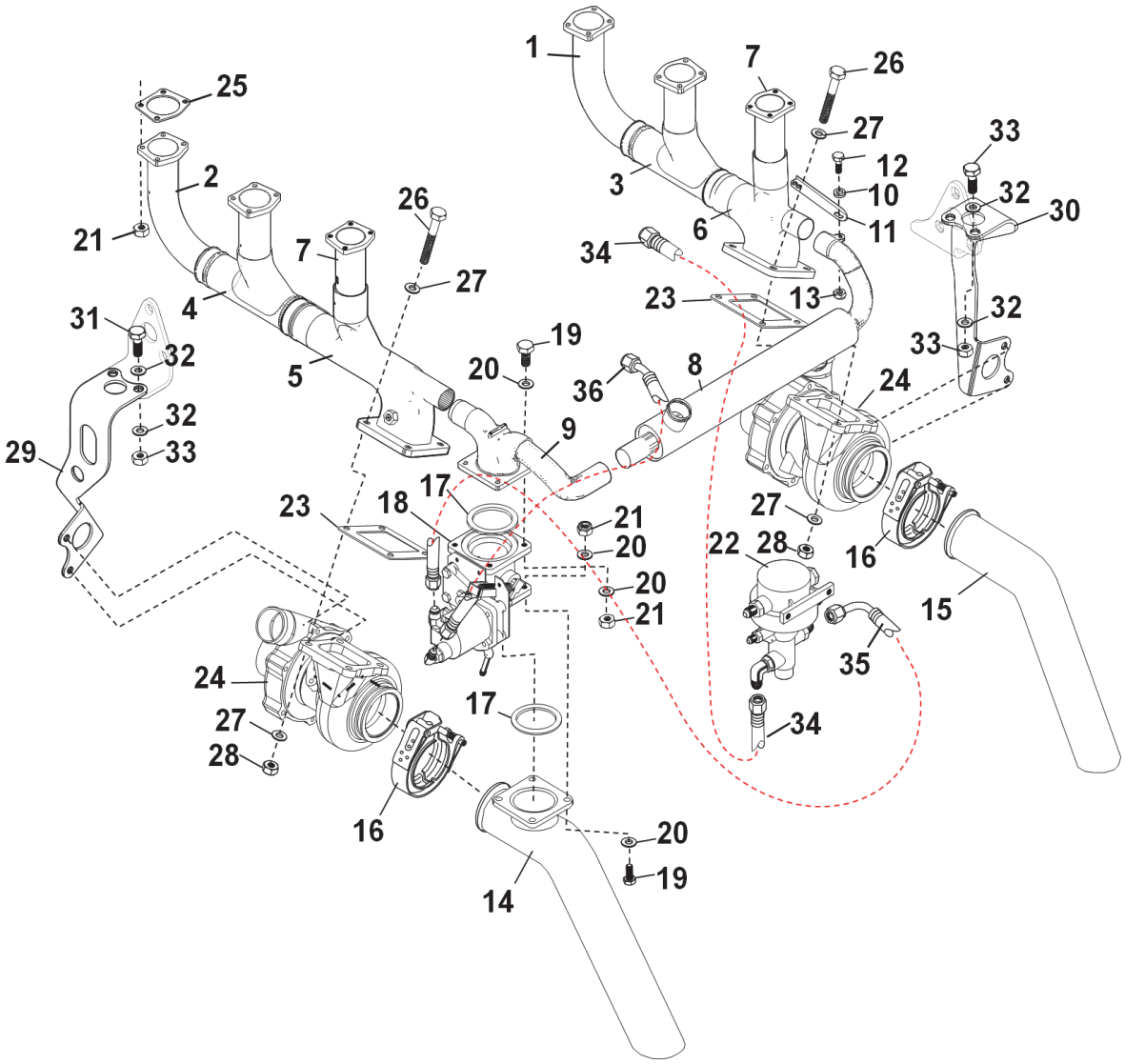


Figure 12-22 repeated for reference

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).

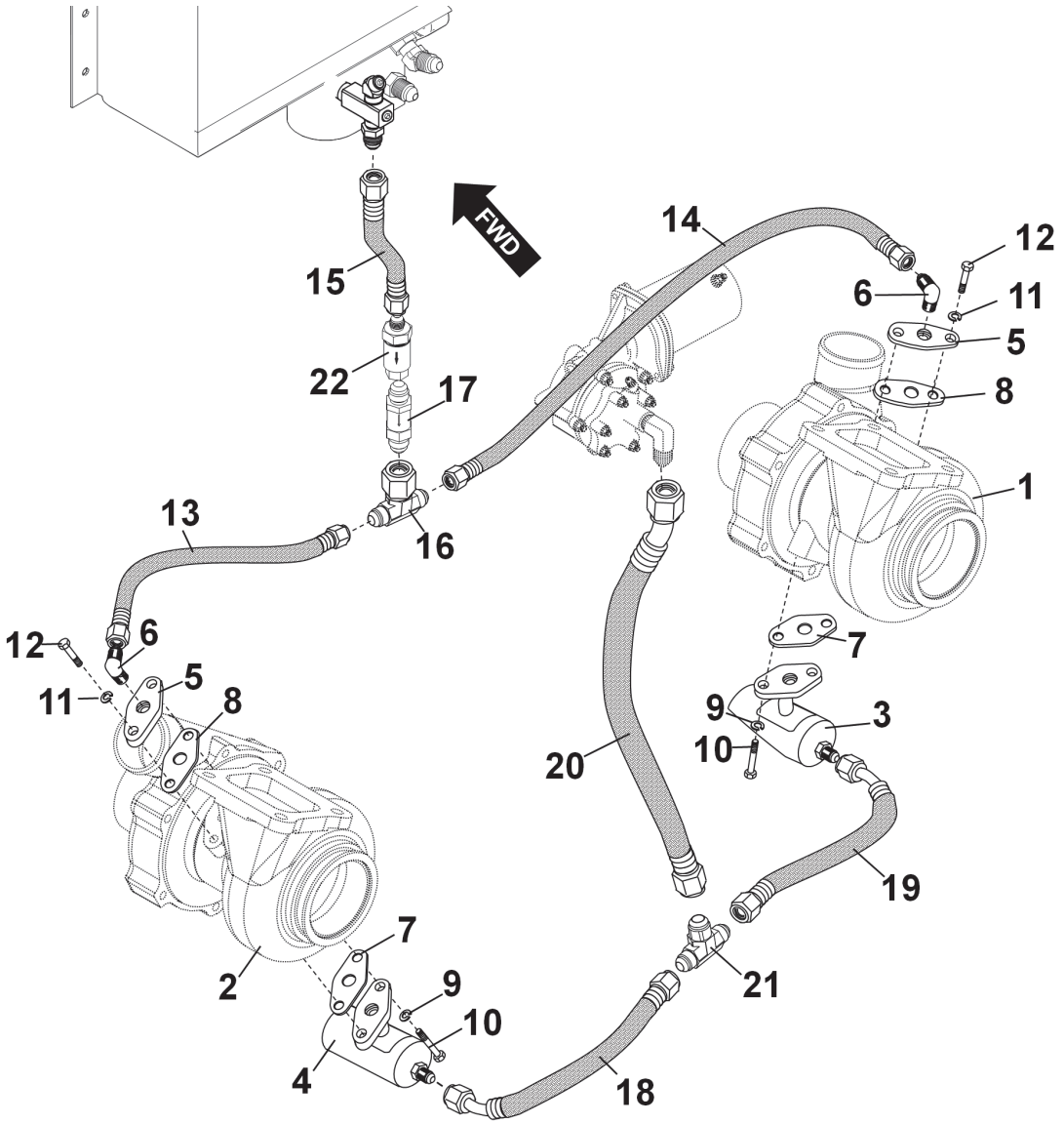


Figure 12-23. Turbocharger Lubrication Hose Routing N
See Figure 12-21 for parts index

6. Remove the V-band clamps (Figure 12-24) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).

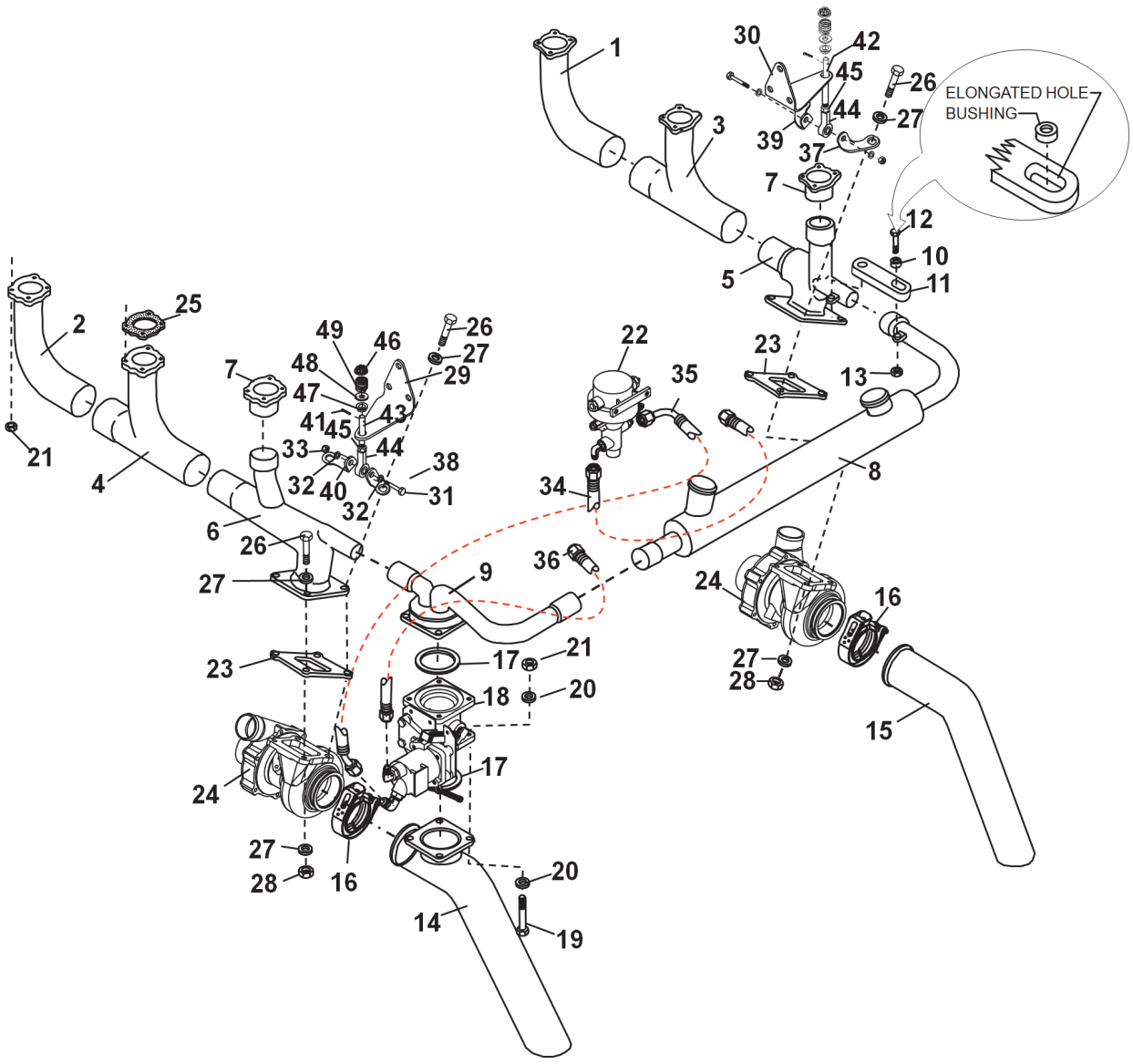


Figure 12-24. Turbocharger and Exhaust Assembly N

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

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.

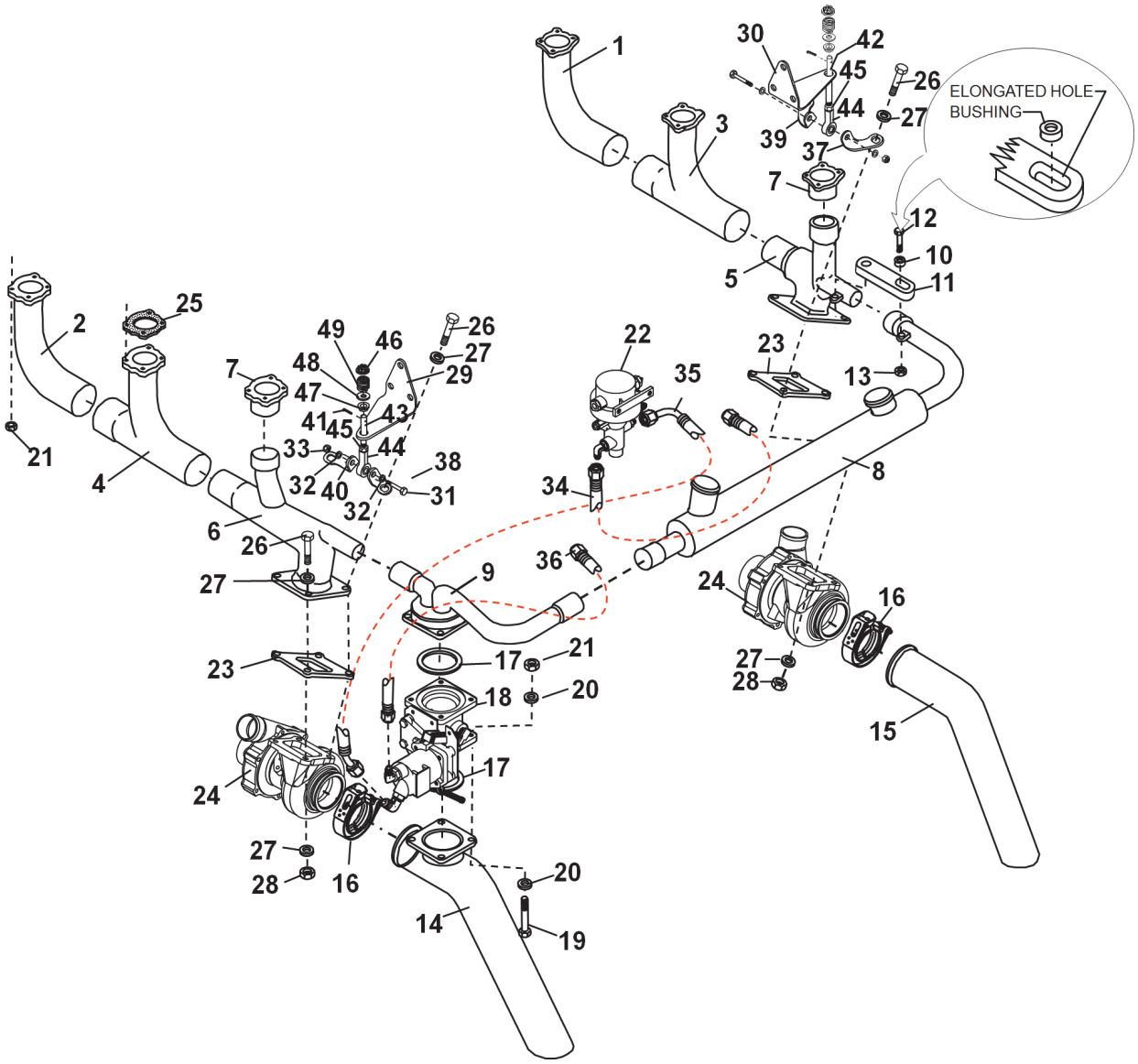


Figure 12-24 repeated for reference

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).

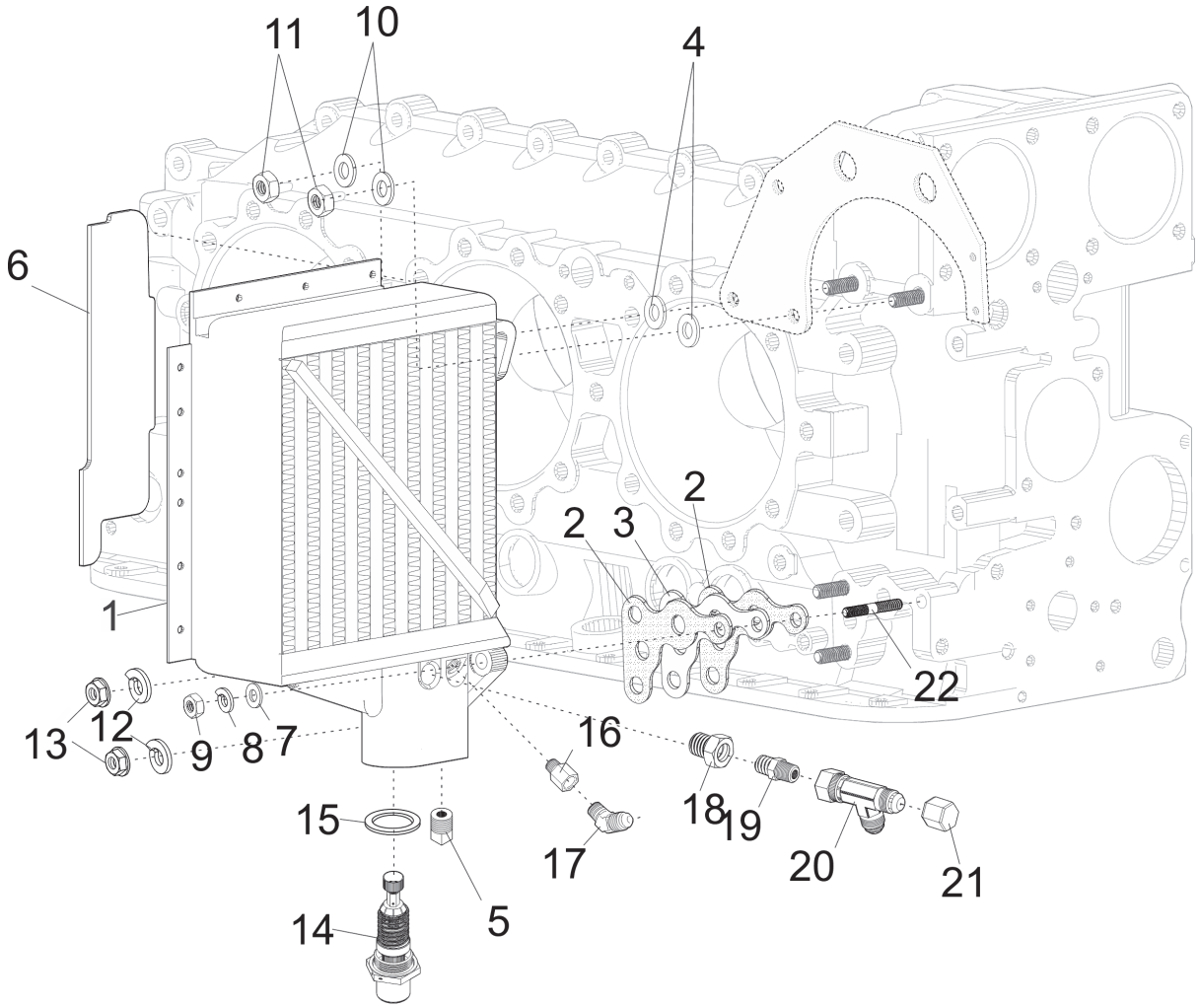
NOTE: The TSIO-550-C oil cooler fittings may be configured as depicted in Figure 12-25 or Figure 12-26. Consult the engine illustrated parts catalog to determine the appropriate configuration of the engine model specification and follow the applicable disassembly instructions.

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.



* ITEM 14 INCLUDES ITEM 15

Figure 12-25. Oil Cooler B C E G

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Adapter Fitting
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	Tee Fitting
3	Spacer	9	Nut	15	Gasket	21	Cap
4	Gasket-Washer	10	Washer	16	Adapter	22	Stud
5	Plug	11	Nut	17	Elbow Fitting		
6	Baffle	12	Lock Washer	18	Reducer Bushing		

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.

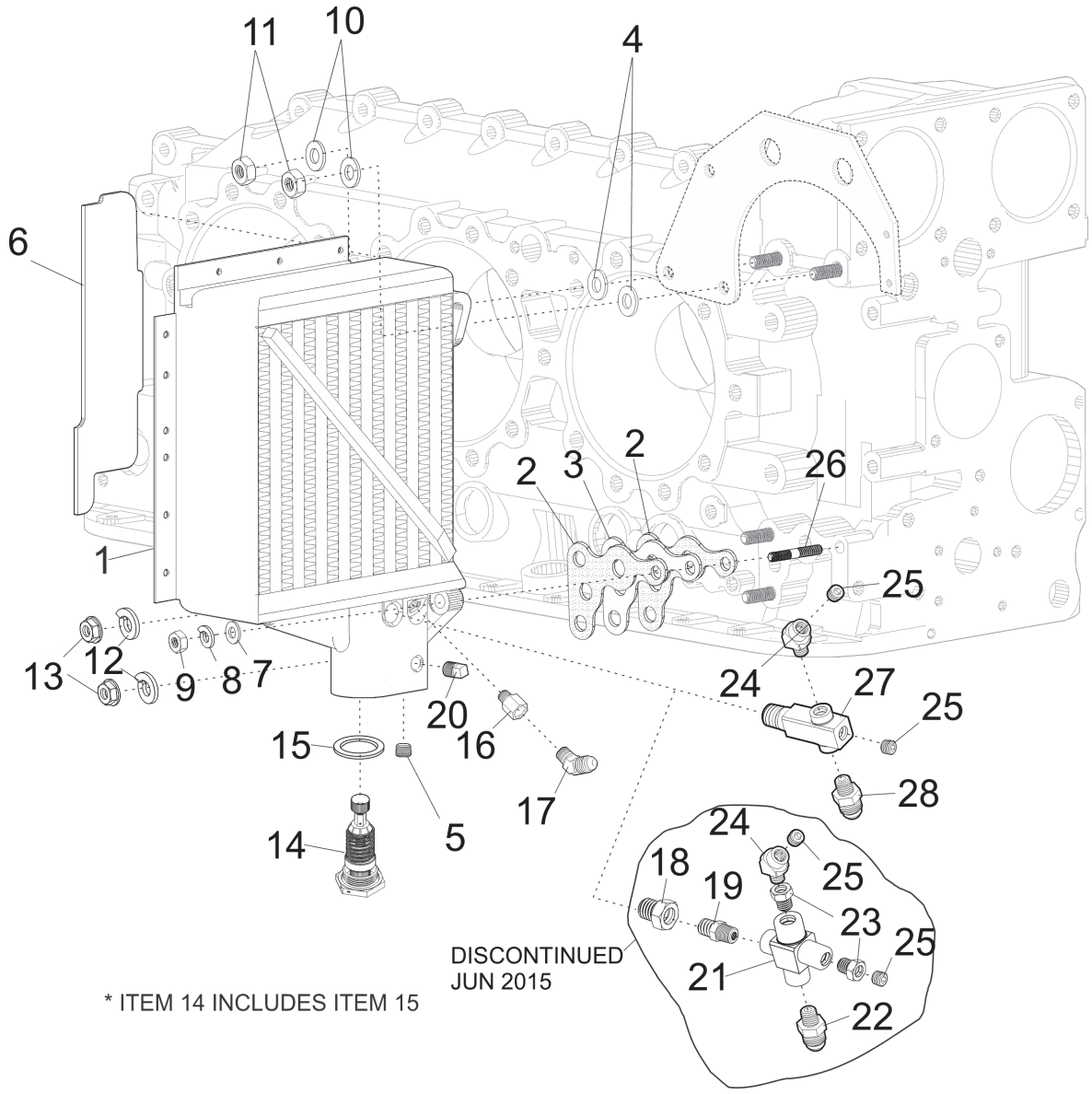


Figure 12-26. Oil Cooler C

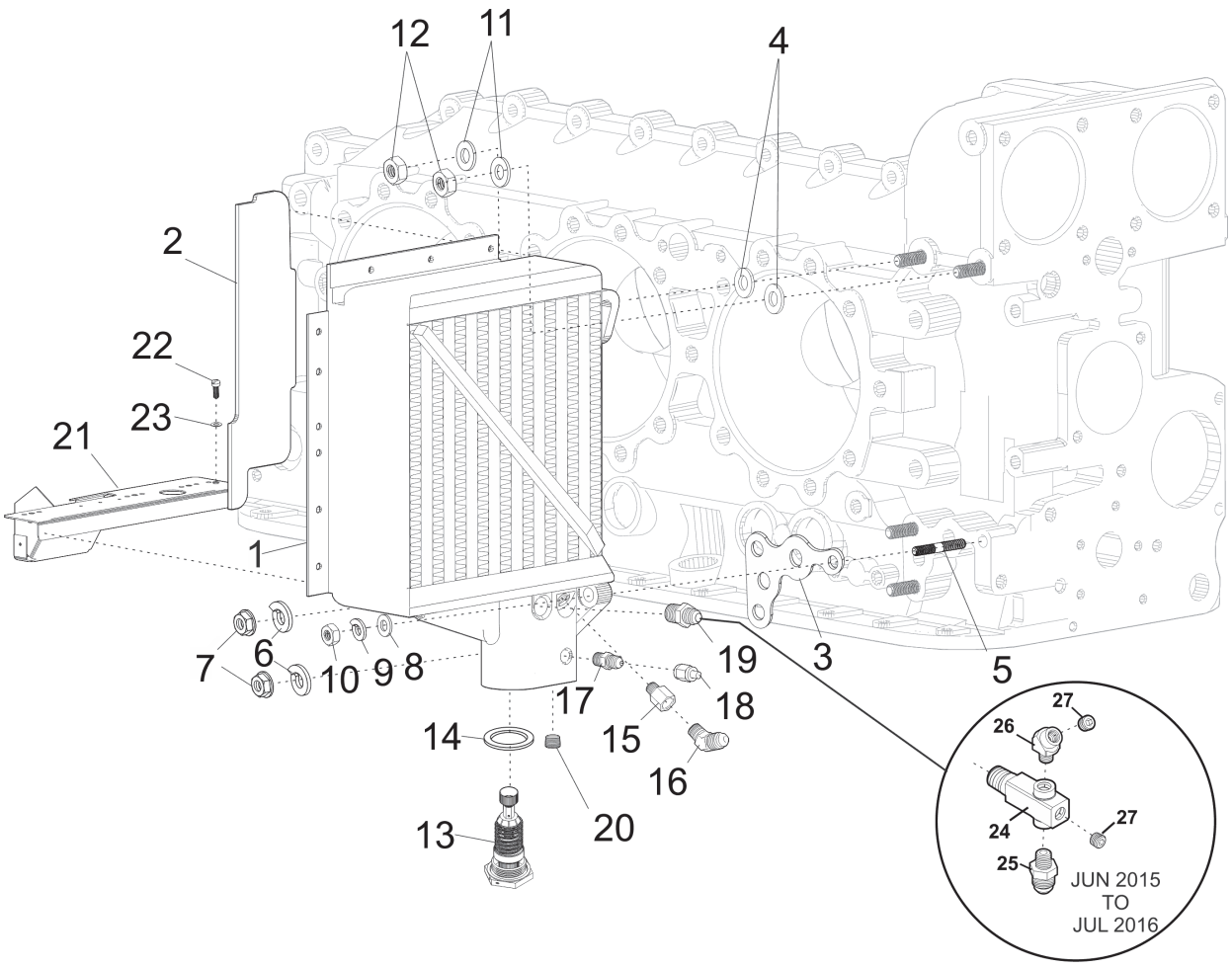
1	Oil Cooler Assembly	8	Lock Washer	15	Gasket	22	Flared Nipple Fitting
2	Gasket	9	Nut	16	Adapter Fitting	23	Pipe Bushing
3	Spacer	10	Washer	17	45° Elbow Fitting	24	45° Street Elbow
4	Gasket-Washer	11	Nut	18	Pipe Bushing	25	Plug
5	Plug	12	Lock Washer	19	Pipe Nipple Fitting	26	Stud
6	Baffle	13	Flanged Nut	20	Plug	27	Cross Fitting
7	Washer	14	Oil Temp. Control Valve	21	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 and 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.



* ITEM 13 INCLUDES ITEM 14

Figure 12-27. Oil Cooler K

1	Oil Cooler	8	Washer	15	Adapter Fitting	22	Screw
2	Baffle	9	Lock Washer	16	Elbow Fitting	23	Washer
3	Oil Cooler Gasket	10	Nut	17	Adapter Fitting	24	Cross Fitting
4	Gasket- Washer	11	Washer	18	Cap Assembly	25	Flared Nipple Fitting
5	Stud	12	Nut	19	Flared Nipple Fitting	26	45° Elbow Fitting
6	Lock Washer	13	Oil Temp. Control Valve	20	Plug	27	Plug
7	Flanged Nut	14	Gasket	21	Baffle Assembly		

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 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. 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.

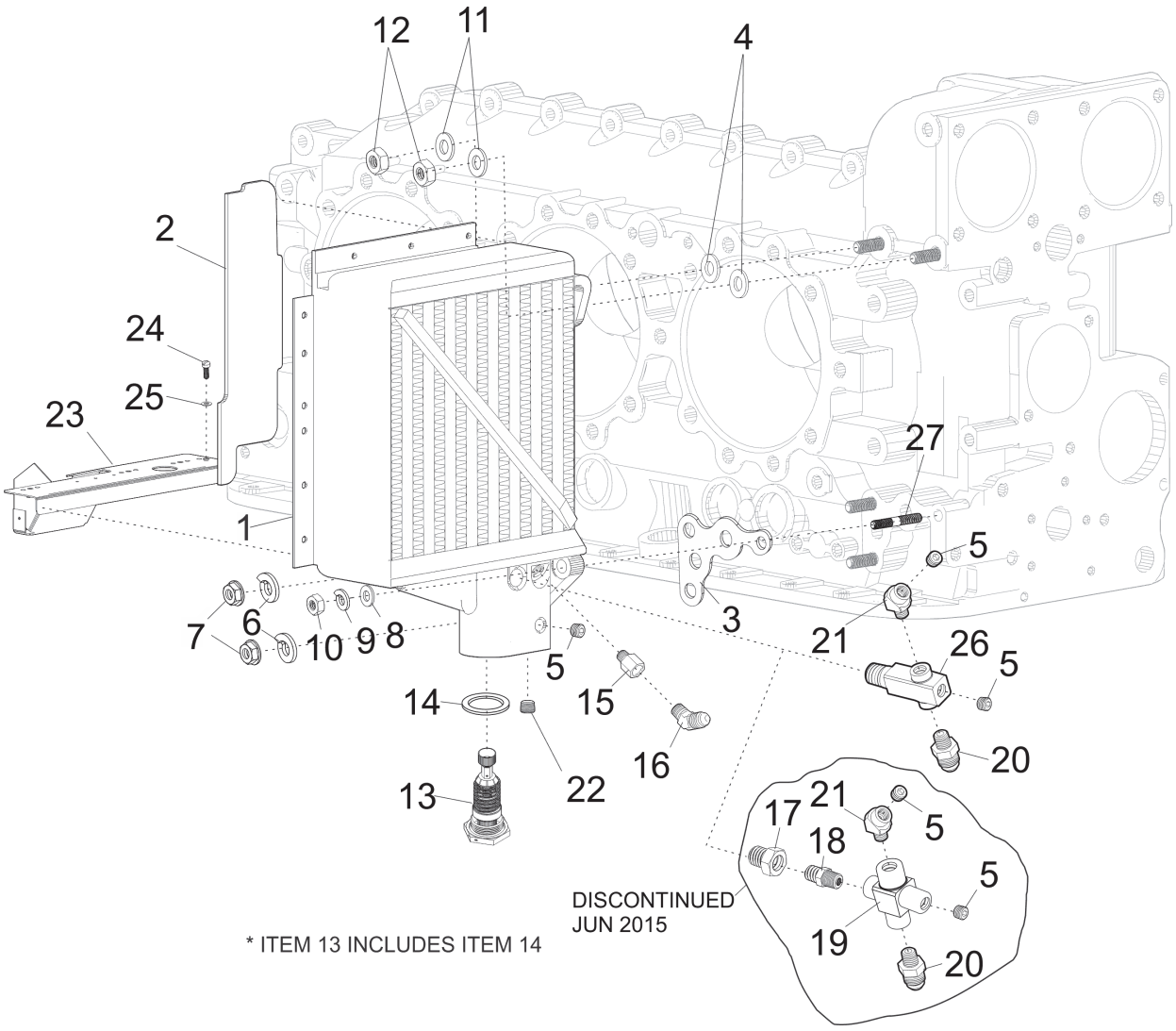


Figure 12-28. Oil Cooler N

1	Oil Cooler	8	Washer	15	Adapter Fitting	22	Plug
2	Baffle	9	Lock Washer	16	Elbow Fitting	23	Baffle Assembly
3	Oil Cooler Gasket	10	Nut	17	Pipe Bushing	24	Screw
4	Gasket- Washer	11	Washer	18	Pipe Nipple Fitting	25	Washer
5	Plug	12	Nut	19	Cross Fitting	26	Cross Fitting
6	Lock Washer	13	Oil Temp. Control Valve	20	Flared Nipple Fitting	27	Stud
7	Nut	14	Gasket	21	45° Street Elbow Fitting		

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.

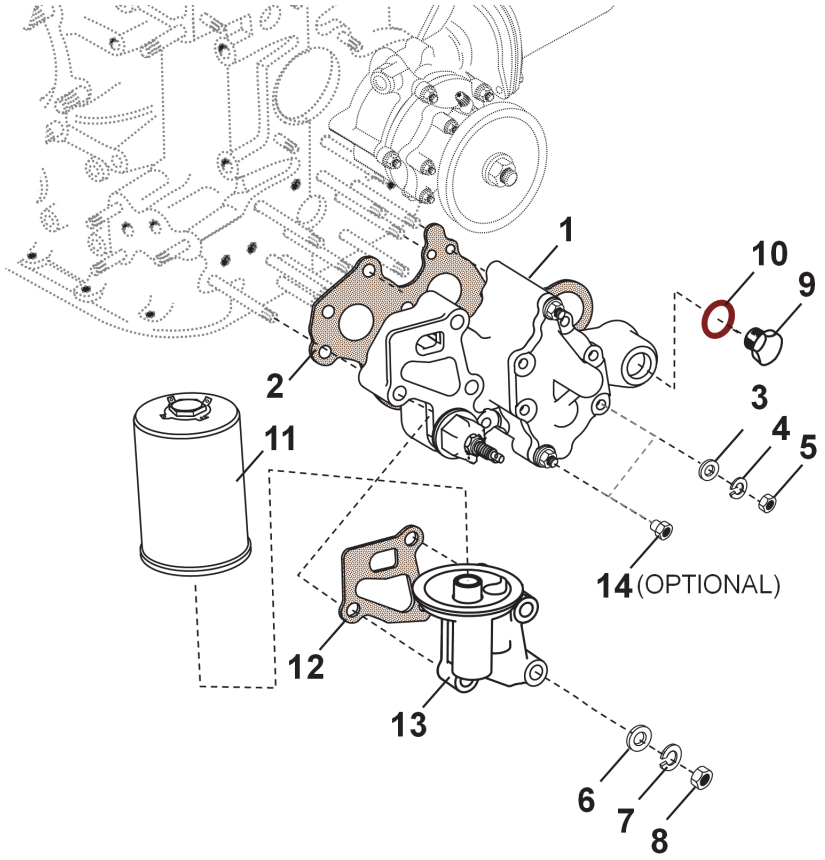


Figure 12-29. Oil Pump

1	Oil Pump Assembly	5	Nut	9	Plug	13	Oil Filter Adapter
2	Oil Pump Gasket	6	Washer	10	Gasket	14	Coupling Nut
3	Washer	7	Lock Washer	11	Oil Filter		
4	Lock Washer	8	Nut	12	Gasket		

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).

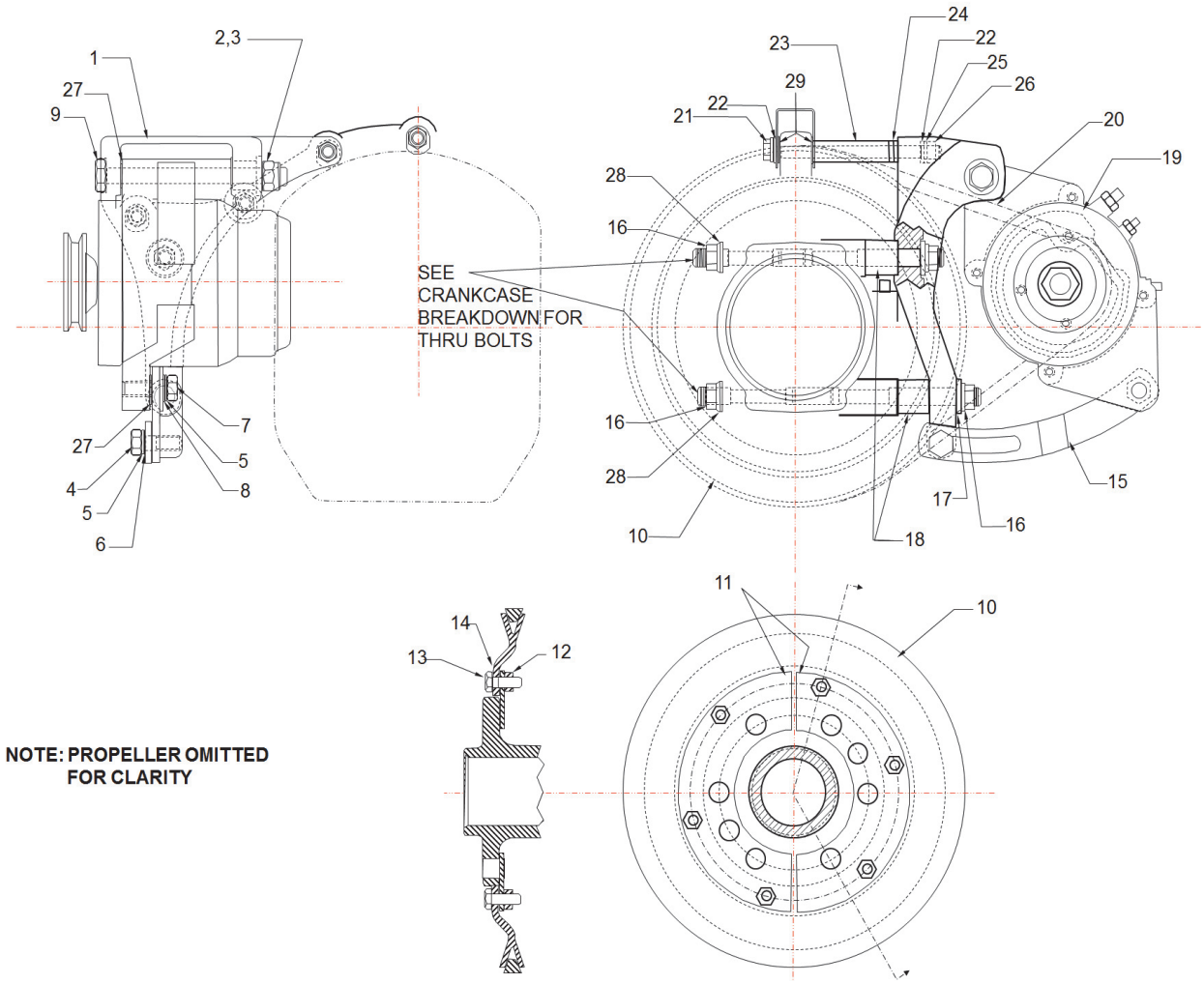


Figure 12-30. Belt-Driven Alternator Bracket Assembly

1	Bracket Assembly	9	Bolt	17	Washer	25	Lock Washer
2	Washer	10	Sheave	18	Spacer	26	Nut
3	Nut	11	Adapter	19	Alternator Assembly	27	Shim
4	Screw	12	Lock Nut	20	V-belt	28	Washer
5	Lock Washer	13	Bolt	21	Bolt	29	Washer
6	Washer	14	Washer	22	Washer		
7	Screw	15	Adjustable Brace	23	Spacer		
8	Washer	16	Nut	24	Shim		

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.

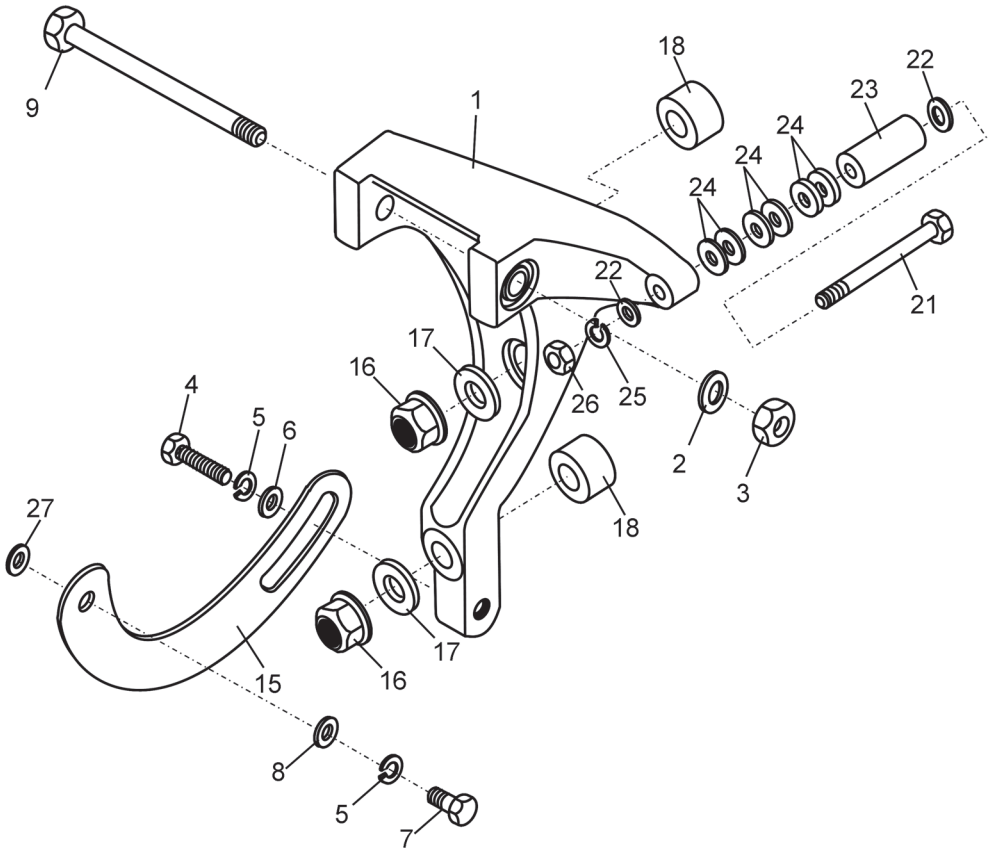


Figure 12-31. Optional 70 Amp Alternator Bracket Assembly

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.

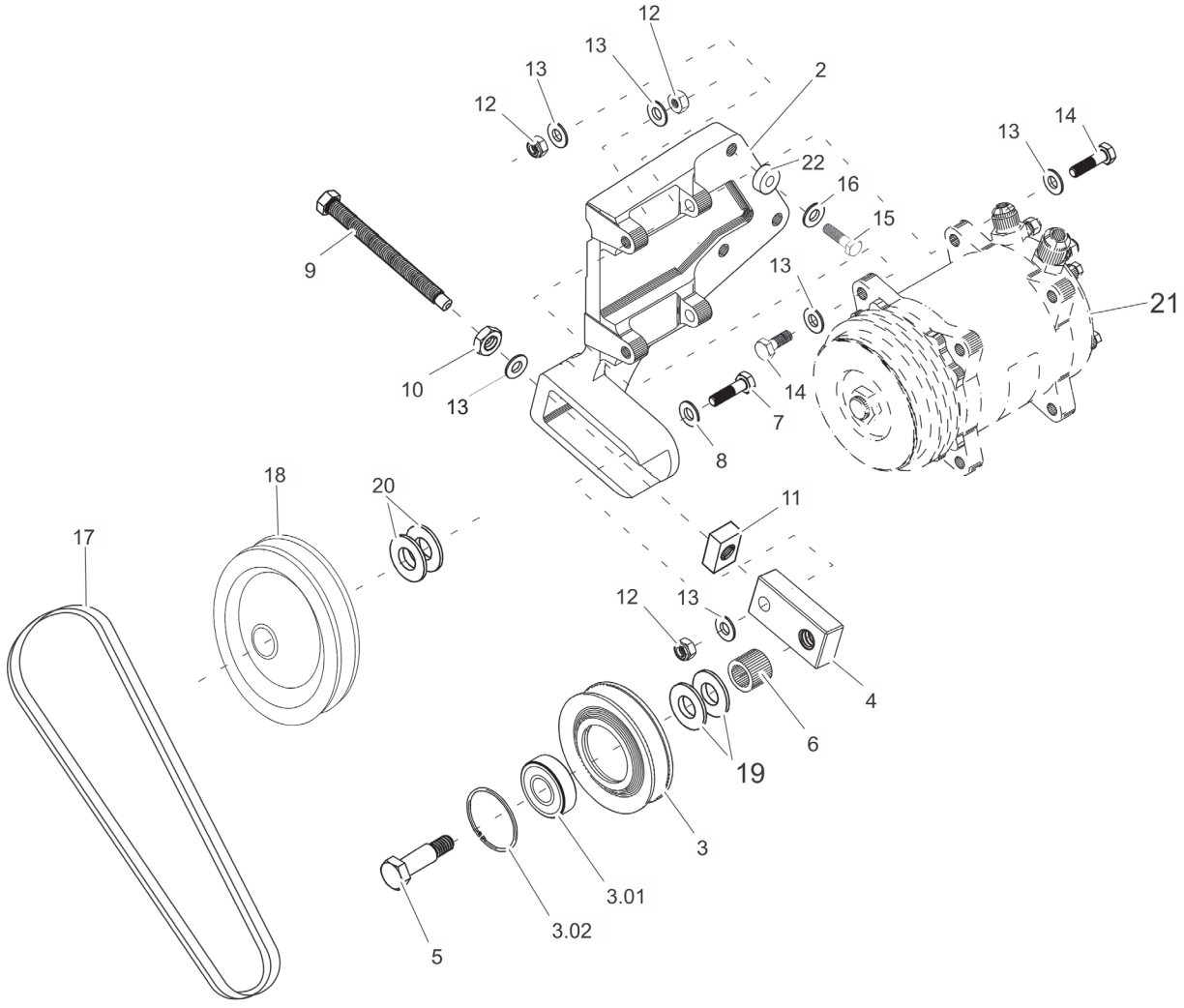


Figure 12-32. Optional Air Conditioning Compressor Mount Assembly

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

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.

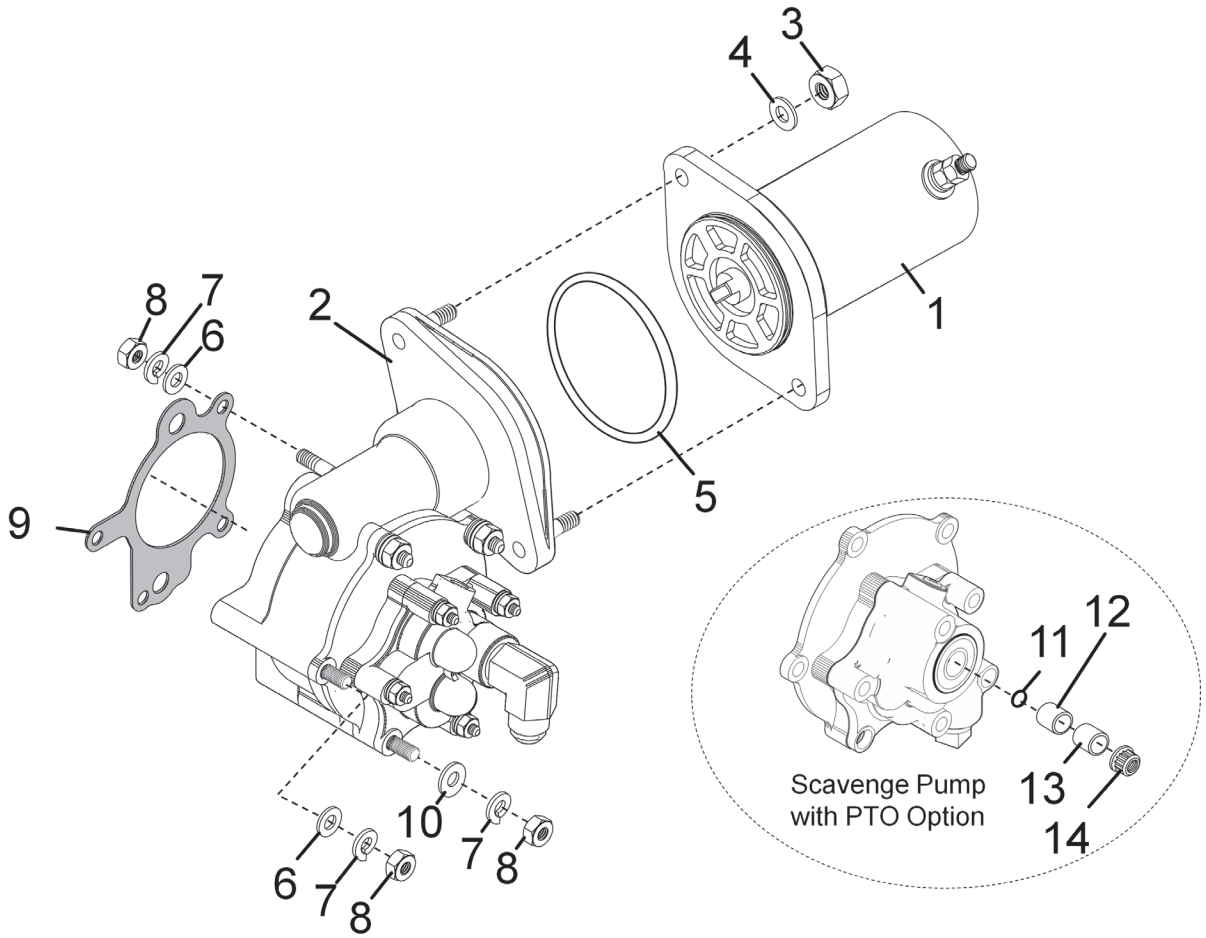


Figure 12-33. Starter and Adapter

1	Starter Motor	5	O-ring	9	Gasket	13	Spacer
2	Starter Adapter	6	Washer	10	Washer	14	Lock Nut
3	Nut	7	Lock washer	11	O-ring		
4	Washer	8	Nut	12	Sleeve		

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. B E 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).

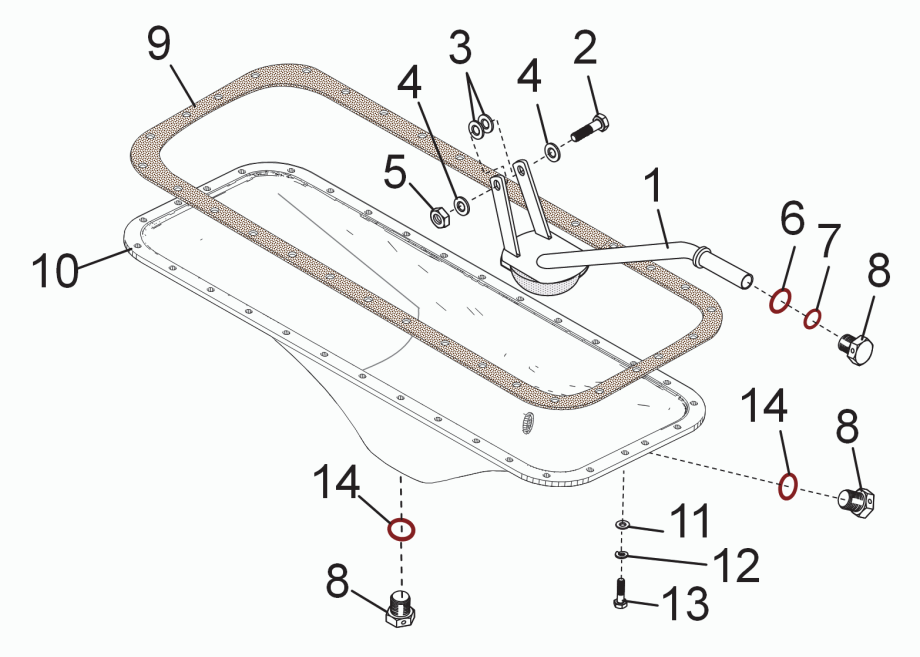


Figure 12-34. Oil Sump C

1	Oil Suction Tube Assy	6	Copper Gasket	11	Washer	15	Bracket B E
2	Bolt	7	Copper Gasket	12	Lock Washer	15	Bolt G K N
3	Washer	8	Plug	13	Bolt	16	Oil Coupling G K N
4	Washer	9	Oil Sump Gasket	14	Copper Gasket		
5	Nut	10	Oil Sump				

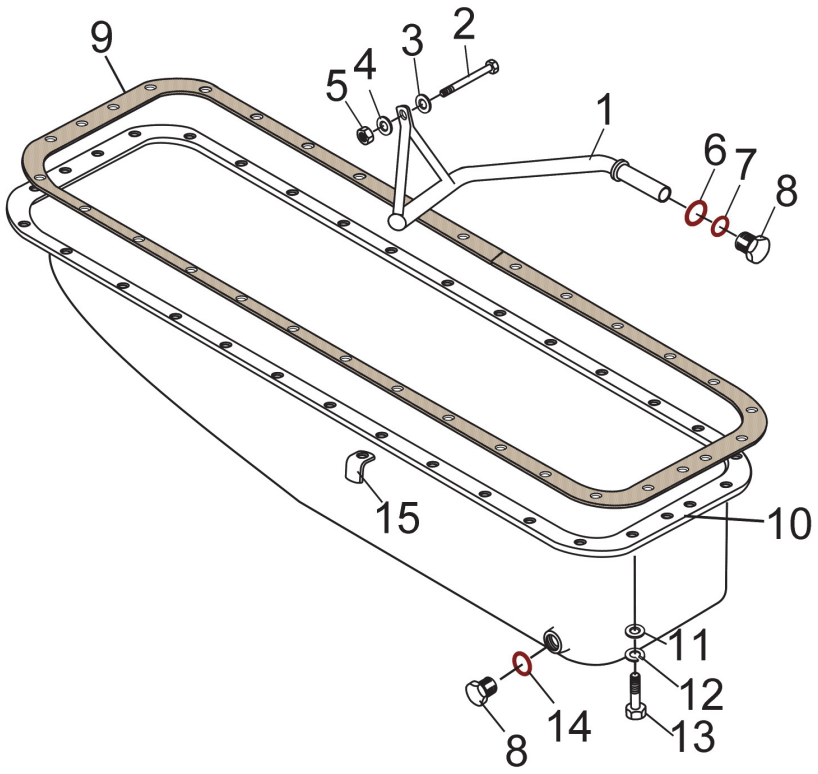


Figure 12-35. Oil Sump B E

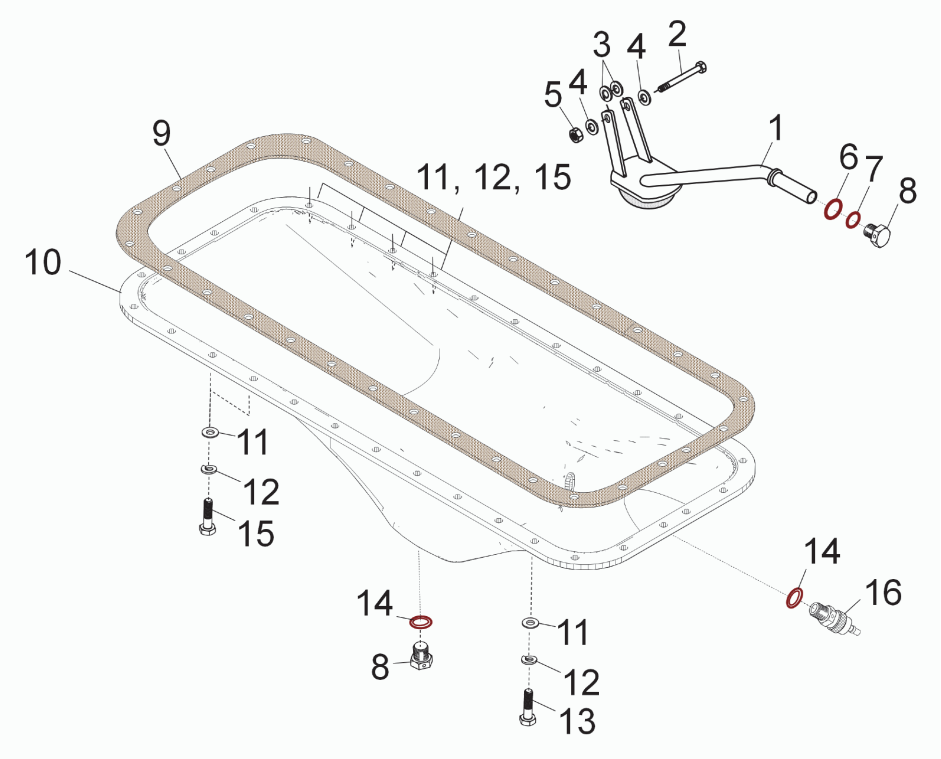


Figure 12-36. Oil Sump G K N

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.

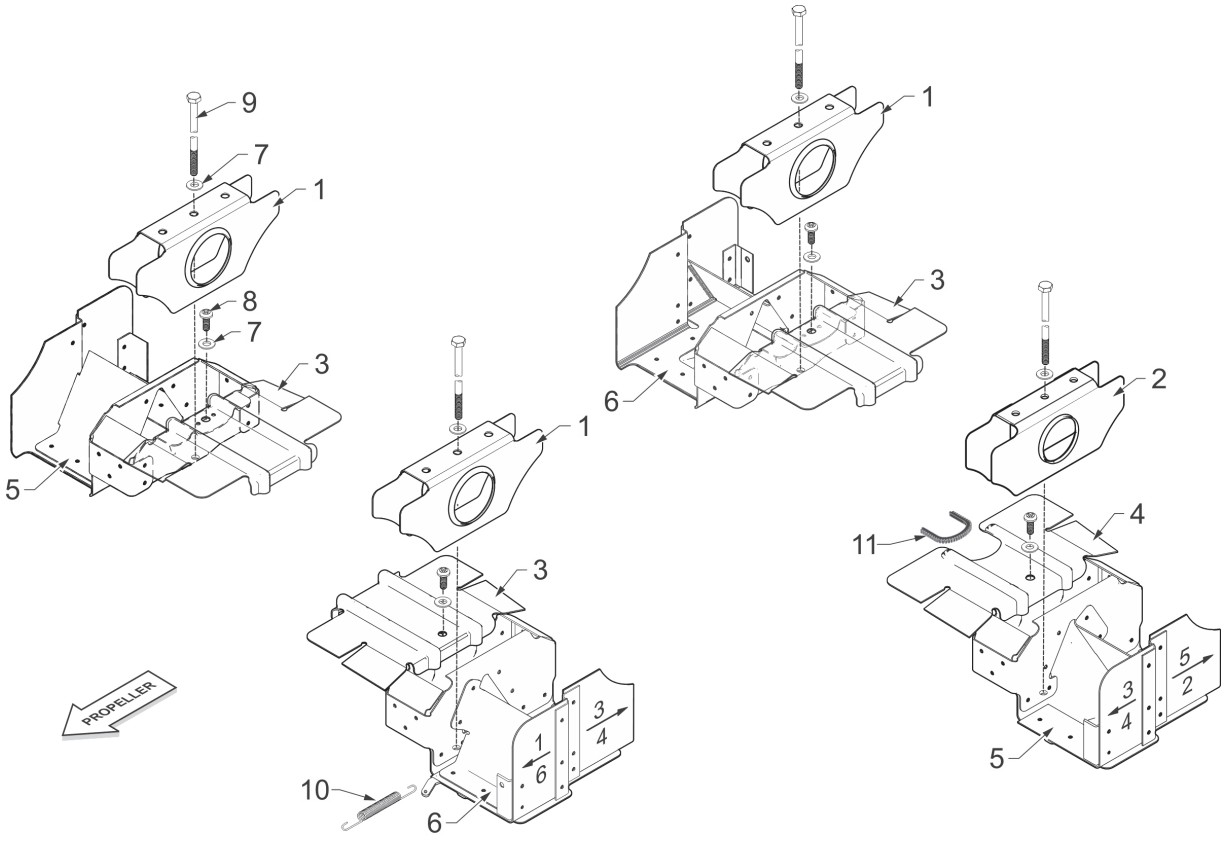


Figure 12-37. Inter-Cylinder Baffle Assembly

1	Baffle Support	4	Cylinder Base Baffle	7	Washer	10	Baffle Tie Spring
2	Baffle Support	5	Baffle Assembly	8	Screw	11	Grommet
3	Cylinder Base Baffle	6	Baffle Assembly	9	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.

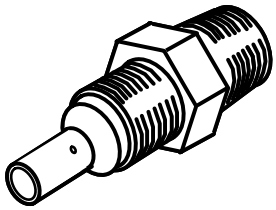


Figure 12-38. Cylinder Drain Tube Fitting

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.

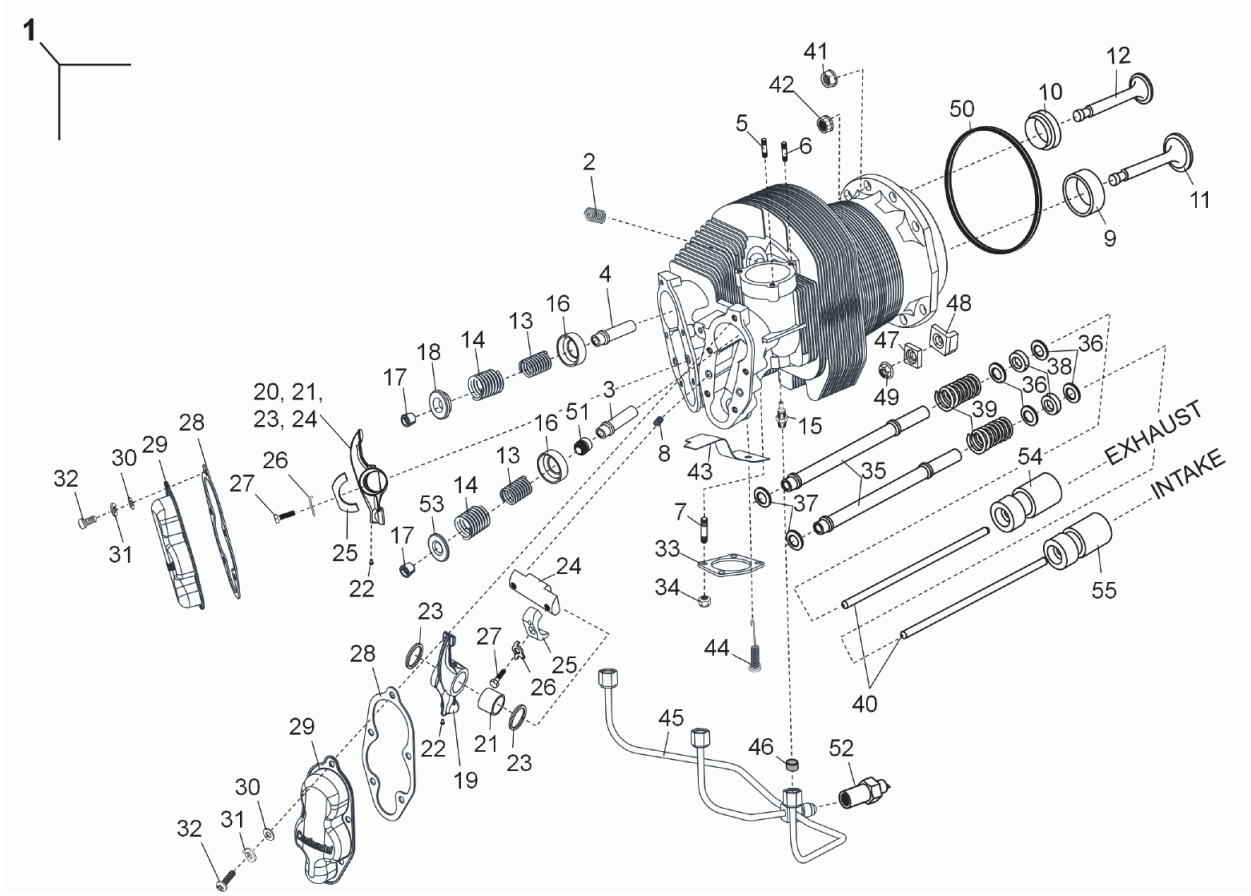


Figure 12-39. Engine Cylinder Assembly

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		

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).

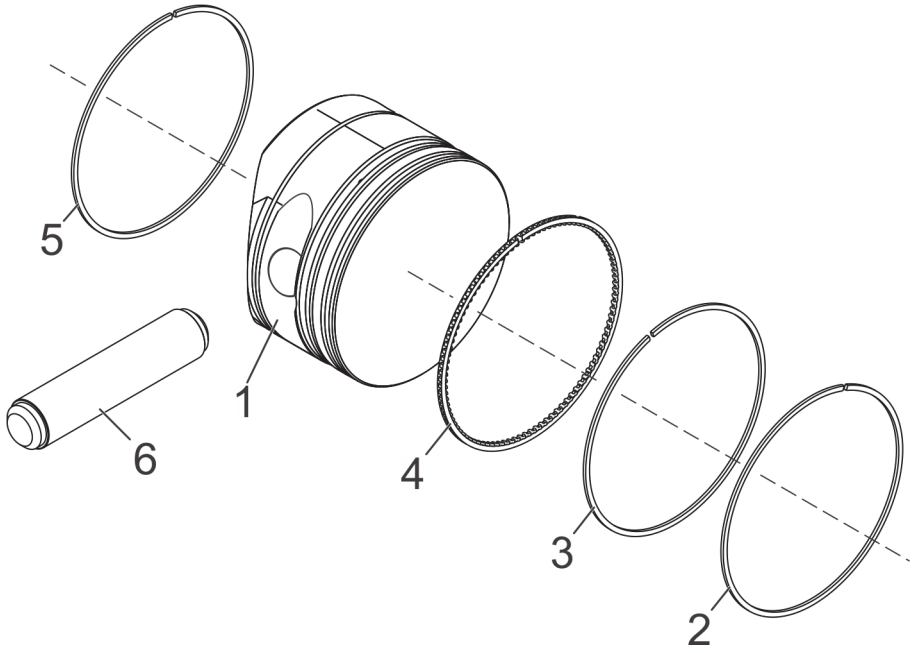


Figure 12-40. Piston, Piston Pin and Rings

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.

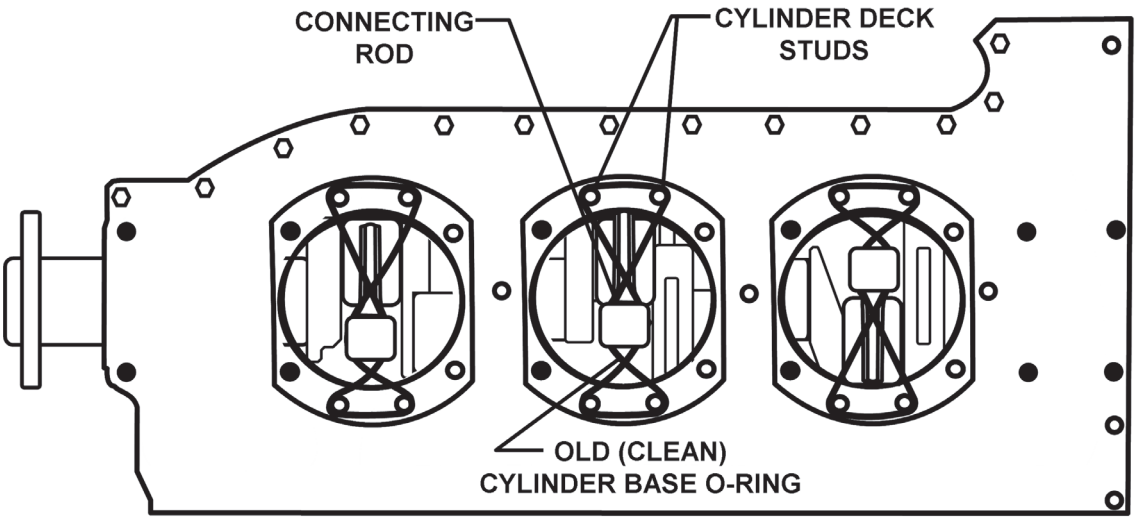


Figure 12-41. Cylinder Base O-Ring used to Support the Connecting Rods

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.

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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.

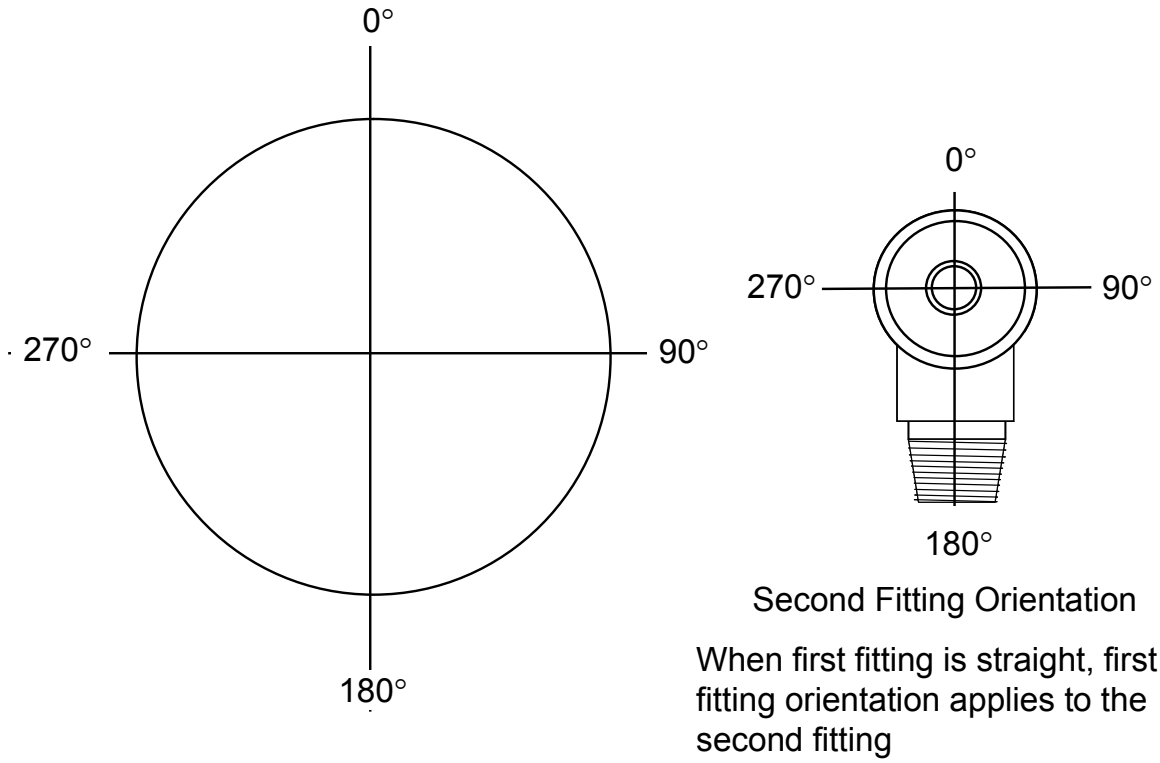

Figure 13-1. Fitting Orientation Guide

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.

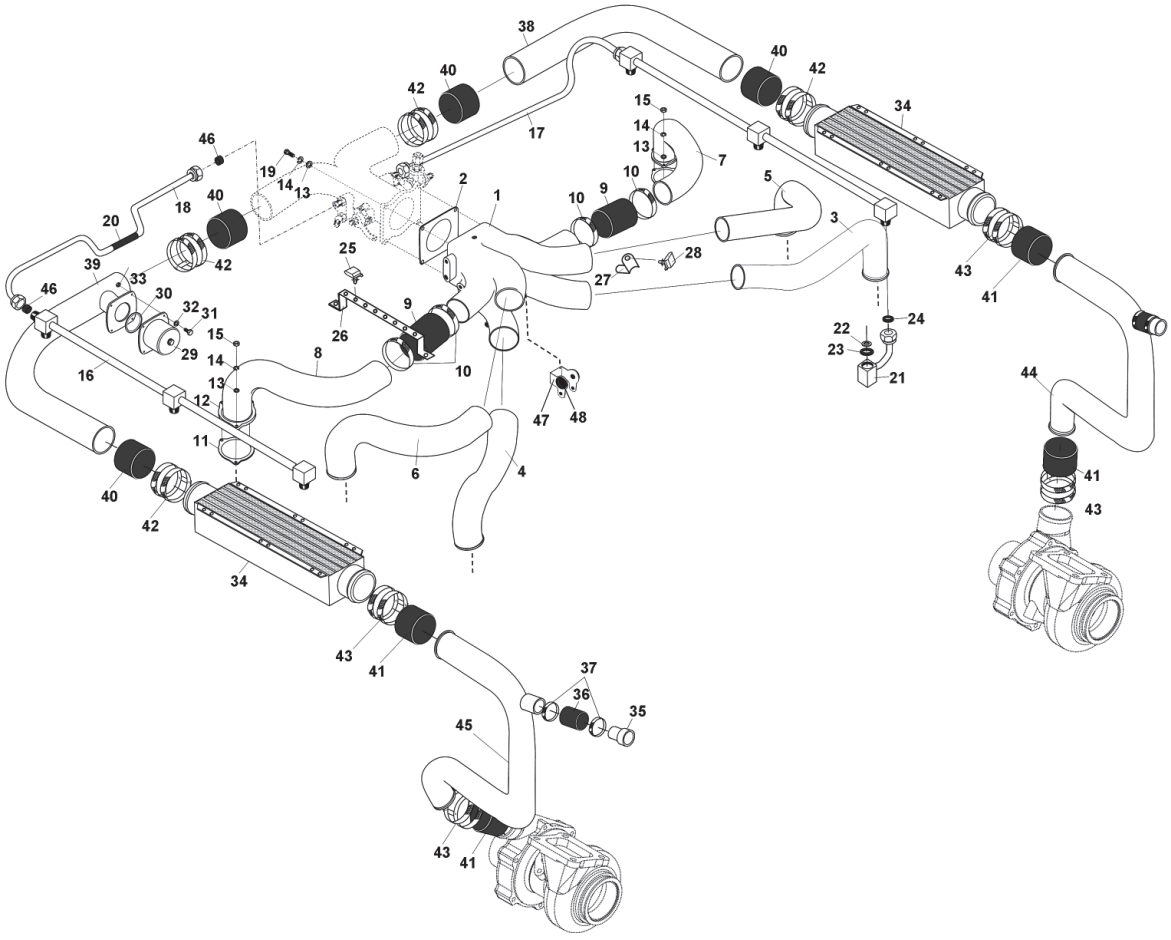

Figure 13-2. Induction System G

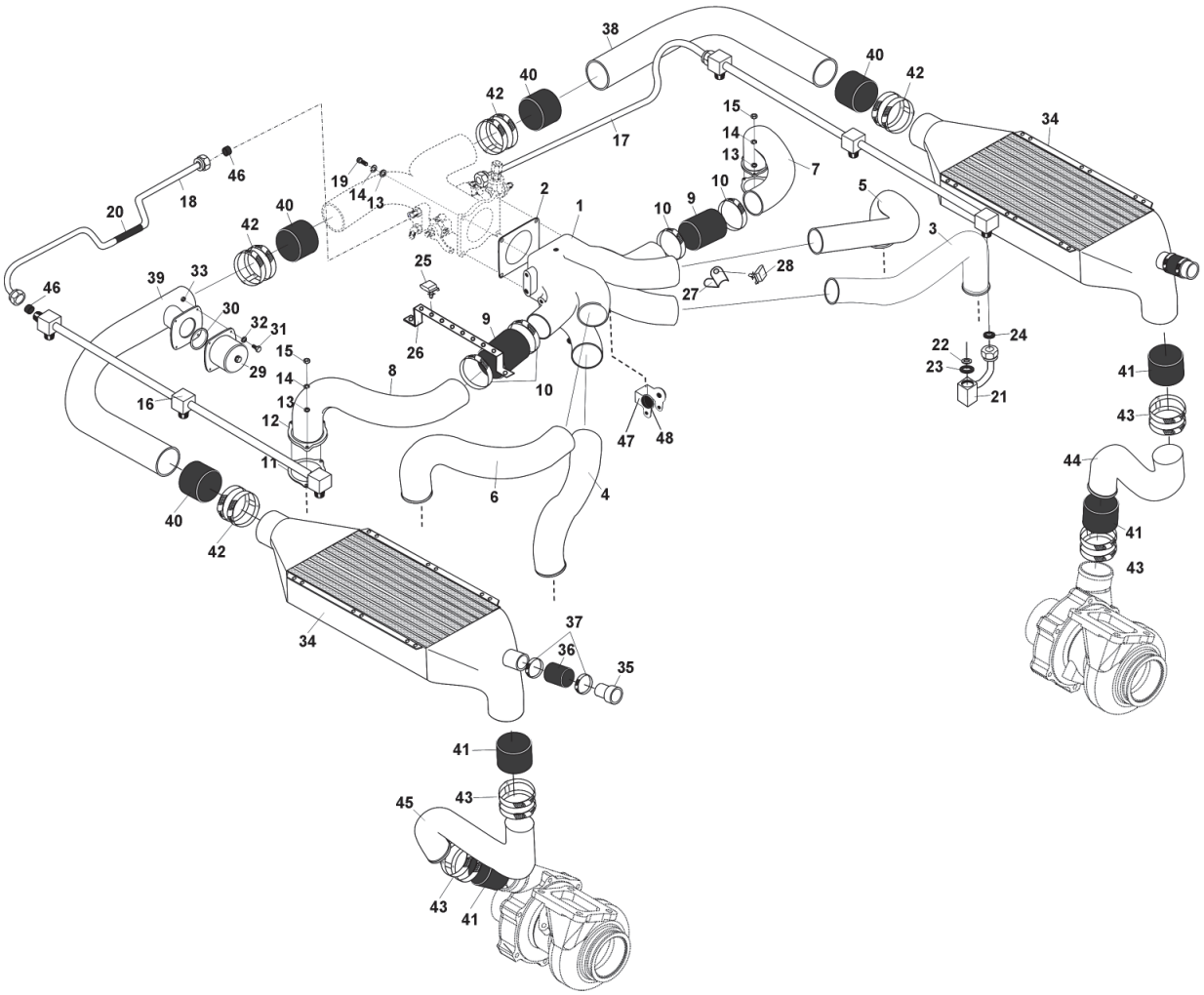

Figure 13-3. Induction System B C E K N

1	Manifold & Fitting Assembly	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Dist. Tube Bracket	38	1-3-5 FWD Induction Tube
3	Tube	15	Nut	27	Fuel Inj. Line Bracket	39	2-4-6 FWD Induction Tube
4	Tube	16	Air Manifold Tube Assembly	28	Tube Clamp	40	Hose
5	Tube	17	Right Air Reference Tube	29	Overboost Valve	41	Hose
6	Tube	18	Left Air Reference Tube	30	O-ring	42	Clamp Assembly
7	Tube	19	Screw	31	Bolt	43	Clamp Assembly
8	Tube	20	Hose	32	Washer	44	1-3-5 AFT Induction Tube
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	2-4-6 AFT Induction Tube
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Intake Manifold Gasket	23	Washer	35	Sonic Venturi Nozzle		
12	Flange	24	Compression Seal	36	Hose		

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.

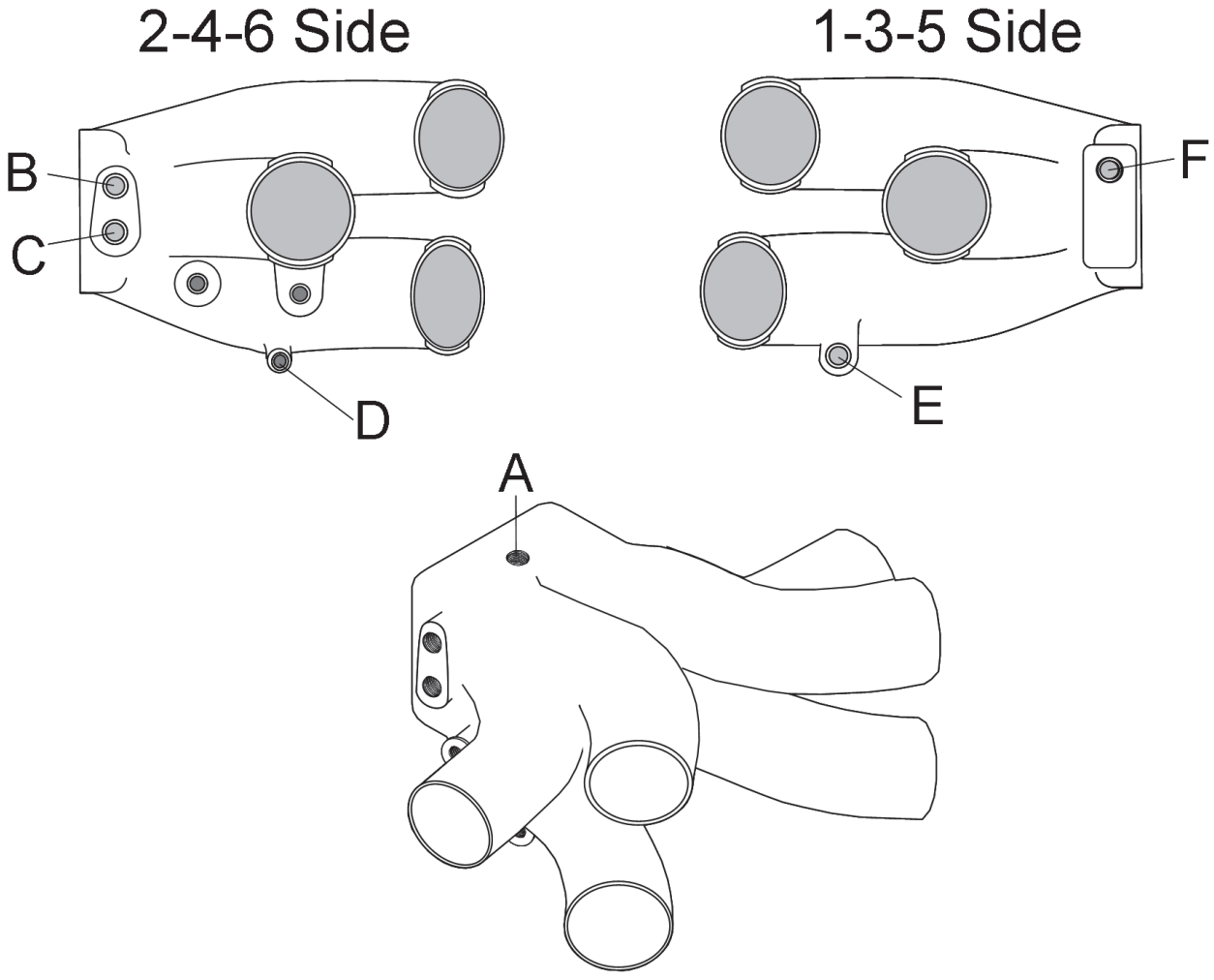

Figure 13-4. Induction Manifold Port Detail

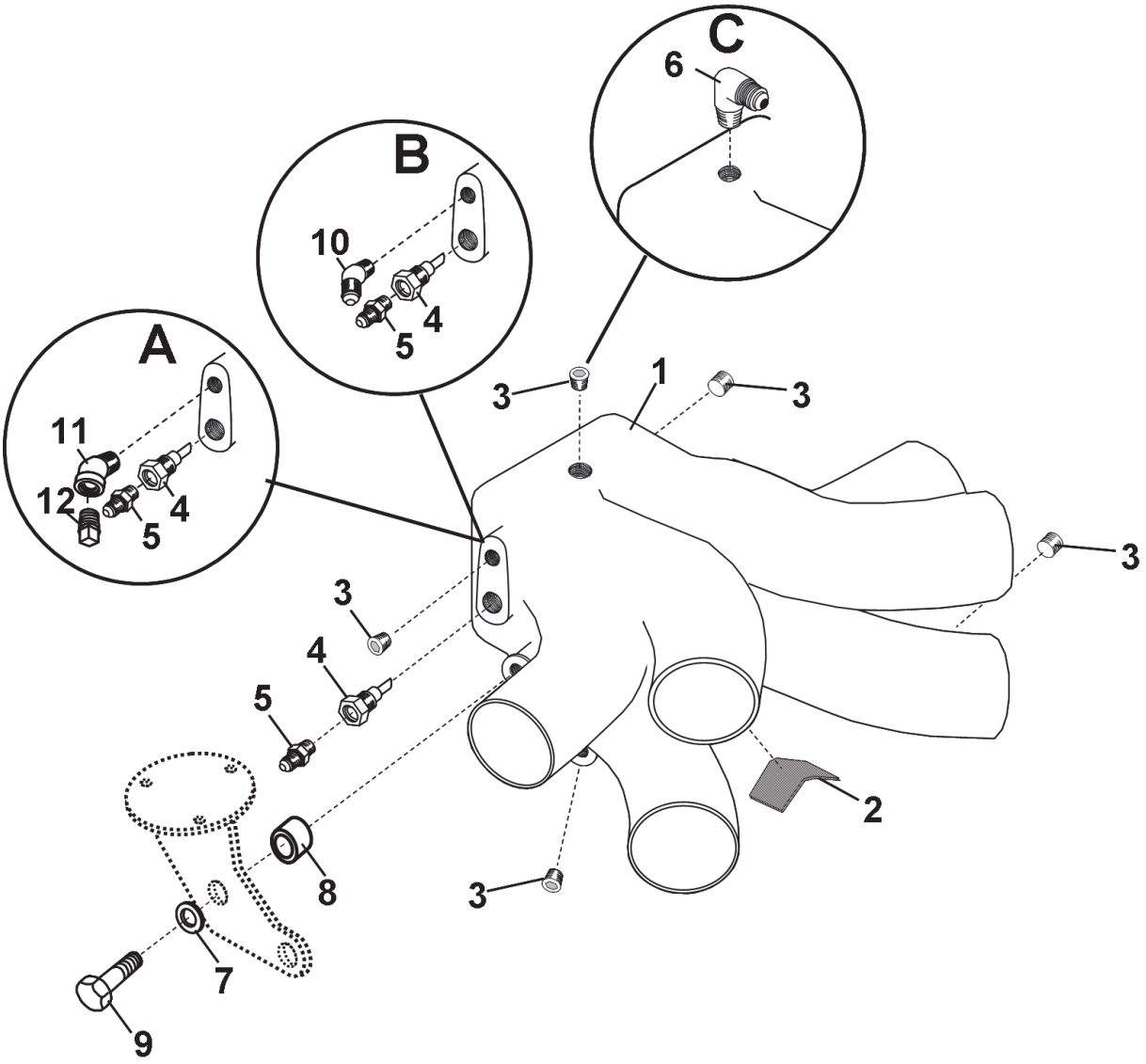

Figure 13-5. Induction Manifold

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).

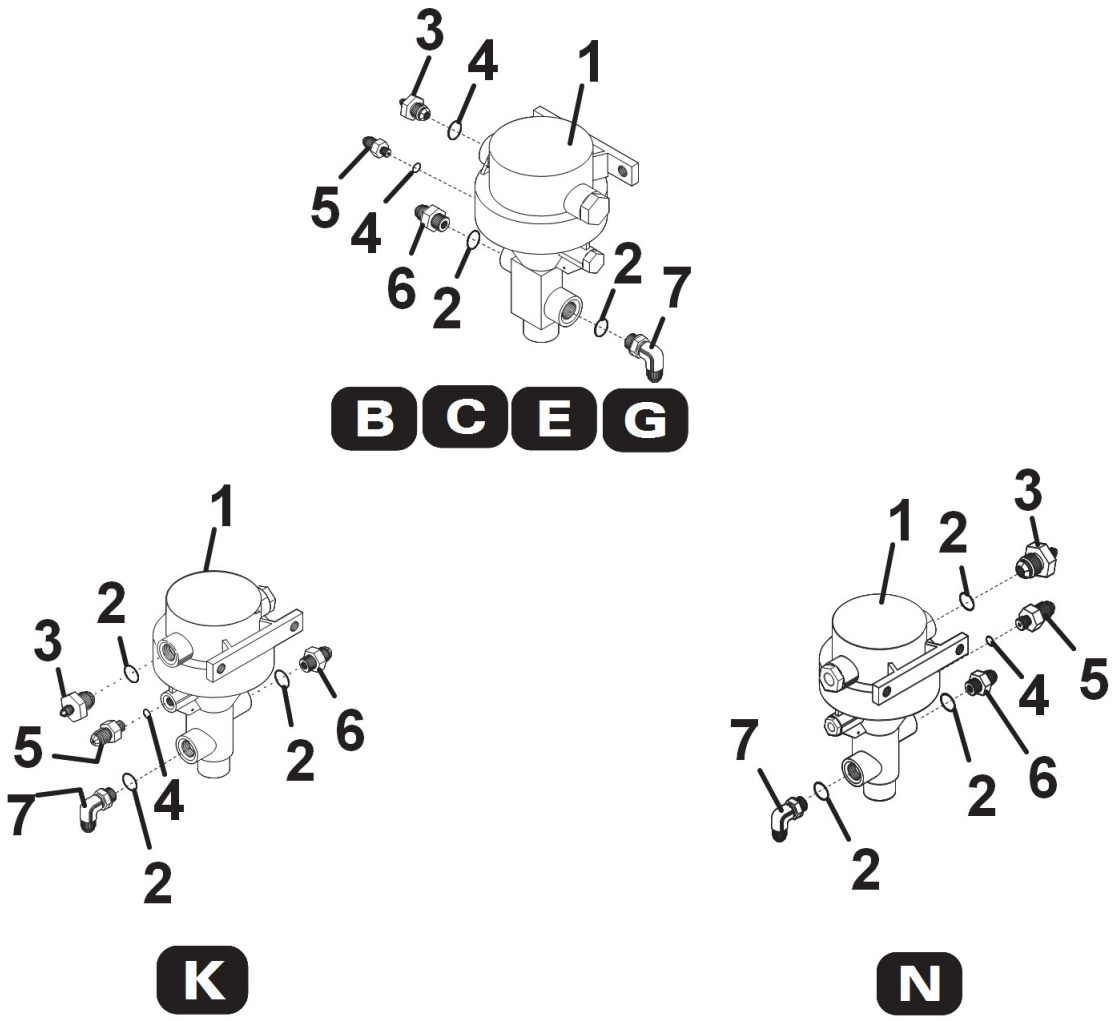

Figure 13-6. Wastegate Controller Fittings

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).

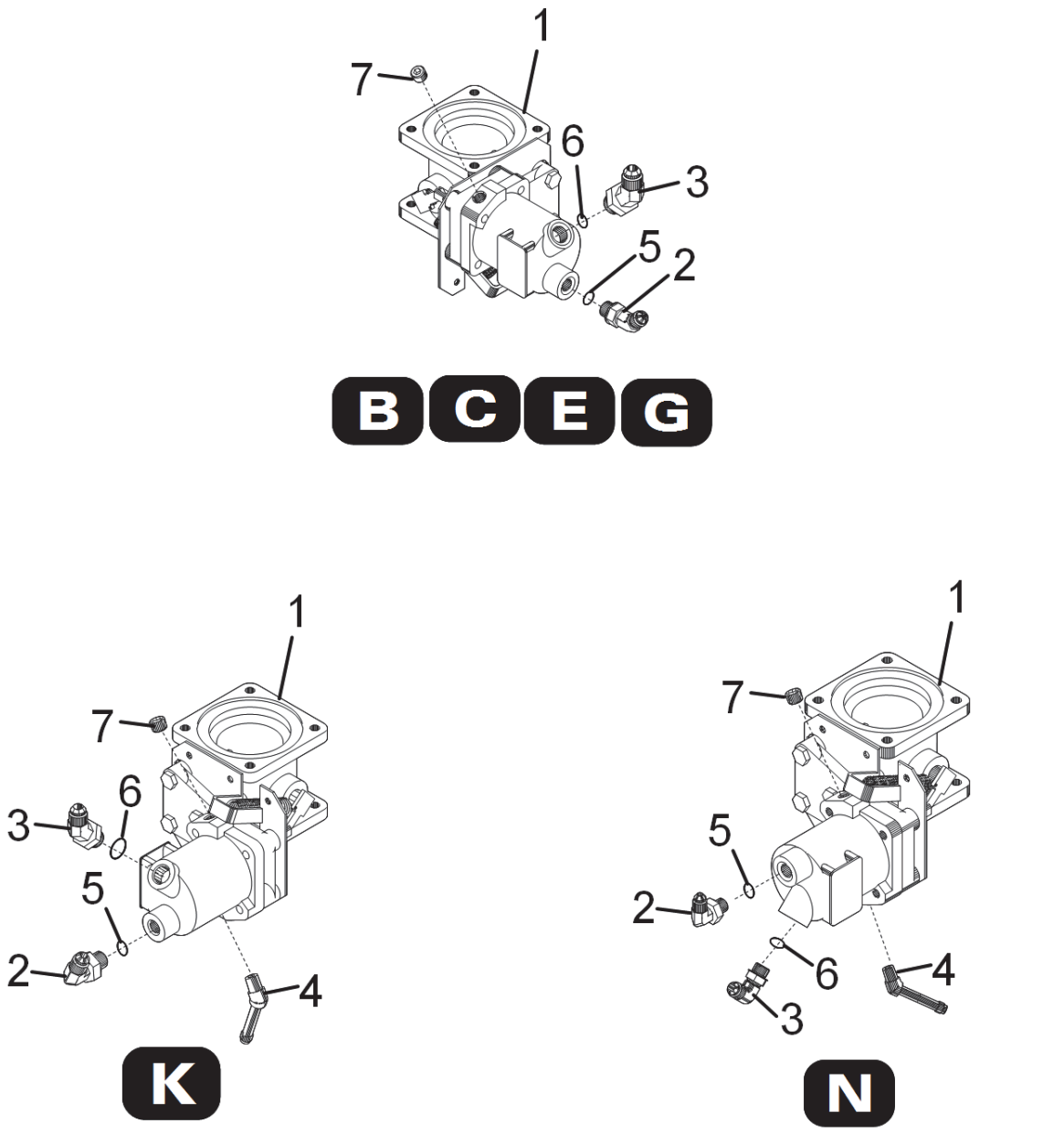

Figure 13-7. Wastegate Fittings

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.

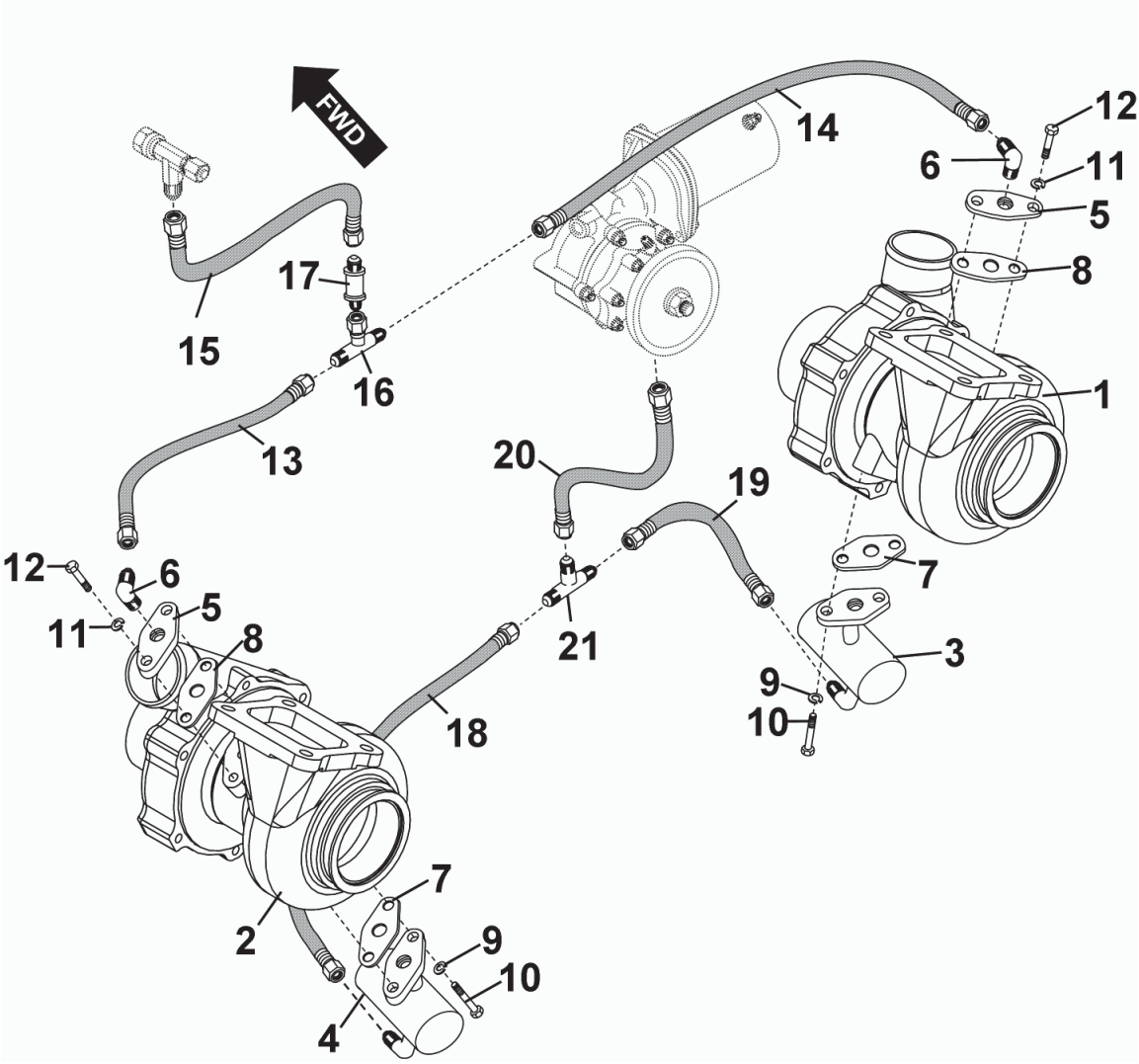

Figure 13-8. Turbocharger Lubrication B C E G

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
4	Left Oil Reservoir	10	Bolt	16	Tee		
5	Adapter	11	Lock Washer	17	Check Valve		
6	Fitting	12	Bolt	18	Hose		

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.

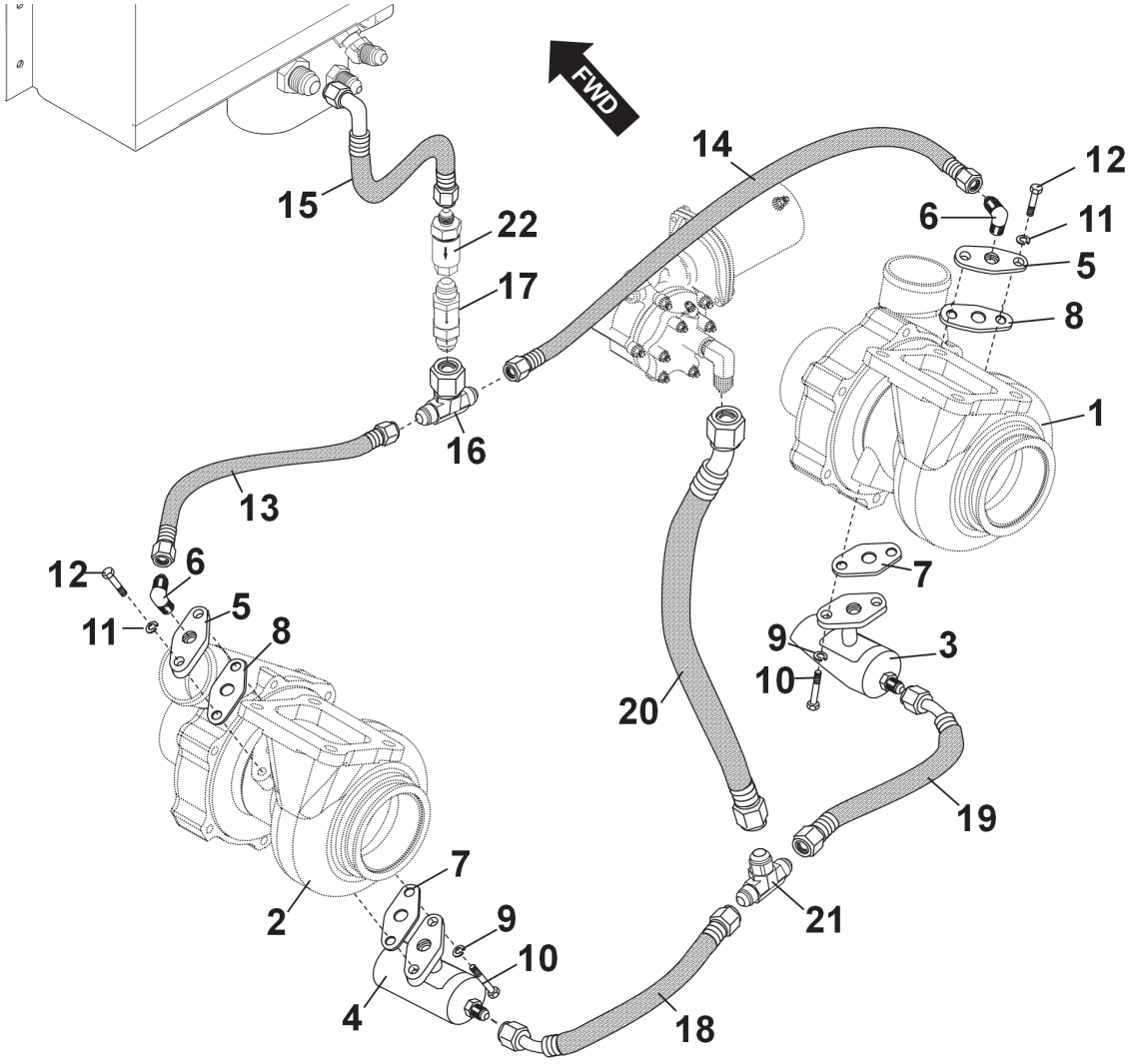

Figure 13-9. Turbocharger Lubrication K
See Figure 13-8 for parts index

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).

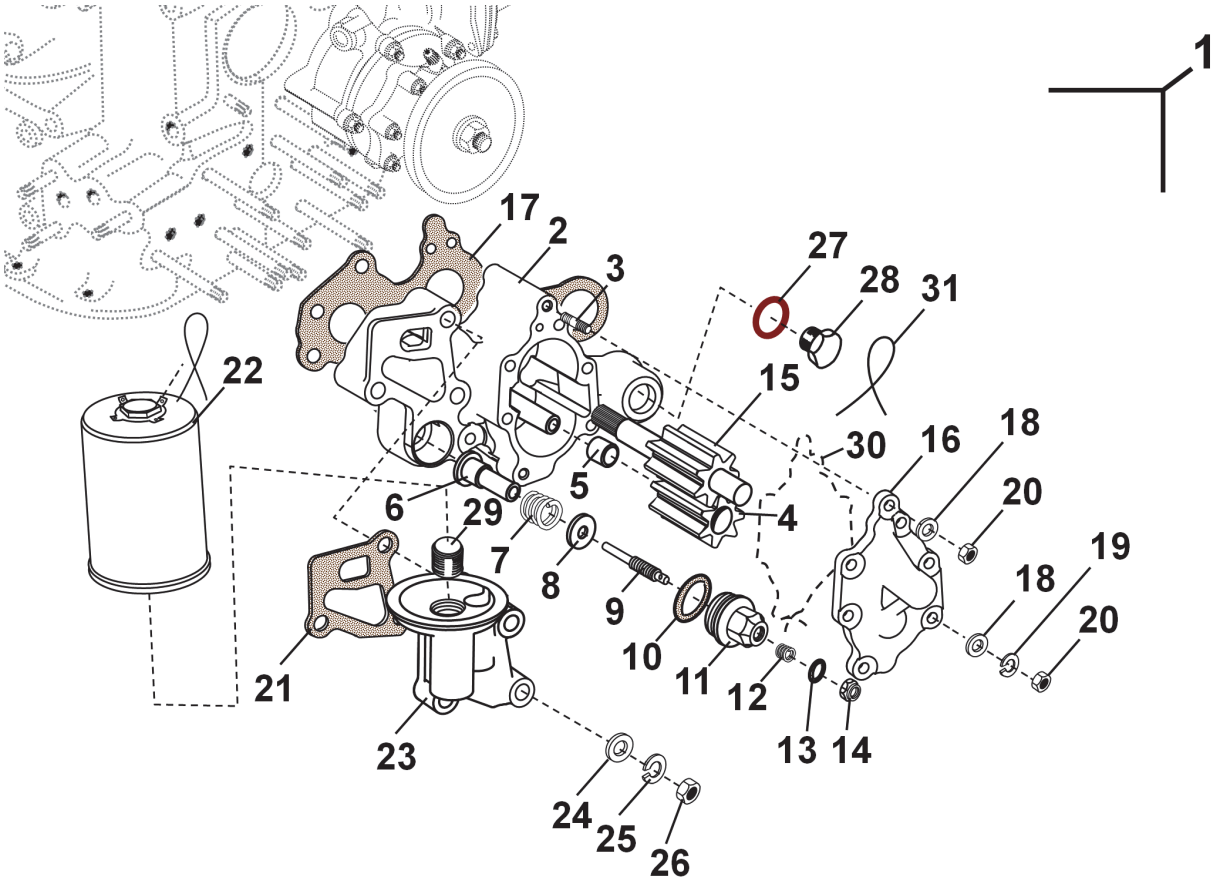

Figure 13-10. Oil Pump Assembly

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	Copper Washer
4	Driven Gear	12	Helicoil	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	Driver Gear	23	Oil Filter Adapter	31	Safety Wire
8	Seat	16	Cover	24	Washer		

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.

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).

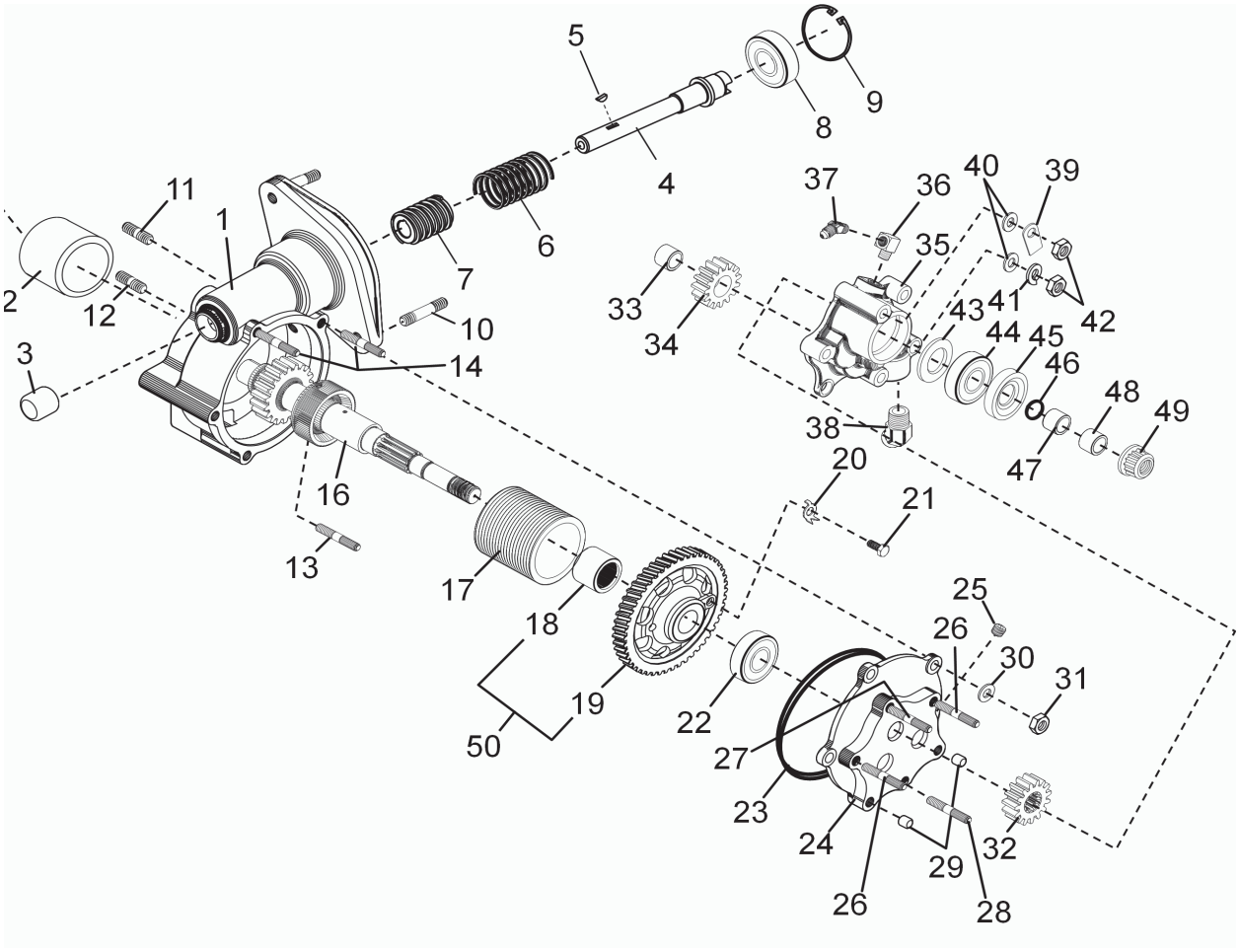

Figure 13-11. Starter and Adapter Assembly with Accessory Drive

1	Starter Adapter Housing	14	Stud	27	Stud	40	Washer
2	Sleeve, Clutch Spring	15	Dowel	28	Stud	41	Lock Washer
3	Needle Bearing	16	Starter Shaft Gear	29	Dowel	42	Nut
4	Worm Drive Shaft	17	Clutch Spring	30	Washer	43	Spacer
5	Woodruff Key	18	Roller Bearing	31	Nut	44	Bearing
6	Starter Spring	19	Starter Worm Gear	32	Scav. Pump Driven Gear	45	Starter Shaft Seal
7	Starter Worm Gear	20	Tab Washer	33	Bushing	46	O-ring Seal
8	Radial Ball Bearing	21	Screw	34	Scav. Pump Driver Gear	47	Starter Shaft Sleeve
9	Internal Retaining Ring	22	Ball Bearing	35	Scav. Pump Body	48	Starter Shaft Spacer
10	Stud	23	O-Ring	36	90° Street Elbow	49	Flanged Nut
11	Stud	24	Cover Assembly	37	45° Elbow		
12	Stud	25	Plug	38	90° Elbow		
13	Stud	26	Stud	39	Seal Retainer Clip		

Procedure continues on next page

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.

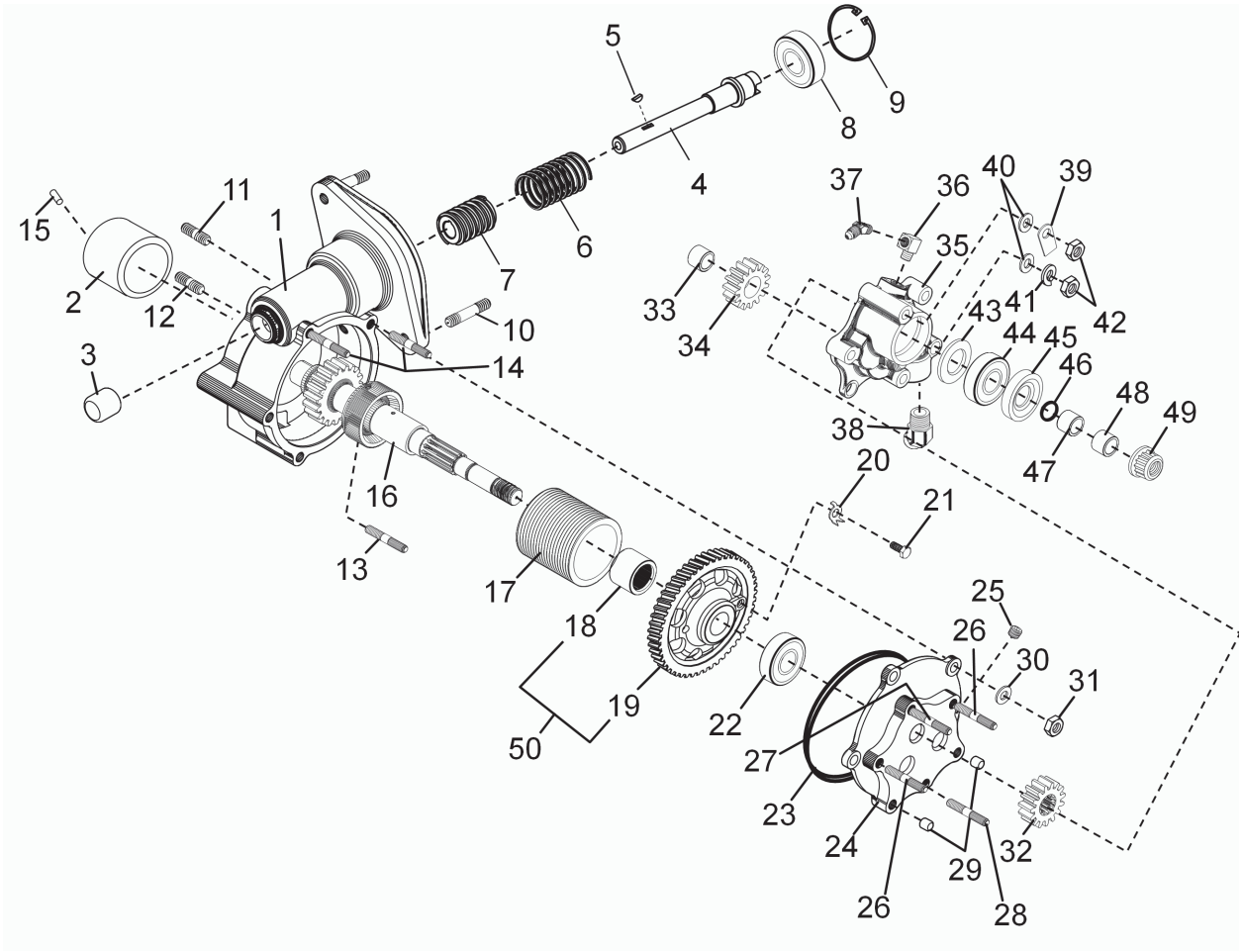

Figure 13-11 repeated for reference

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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.

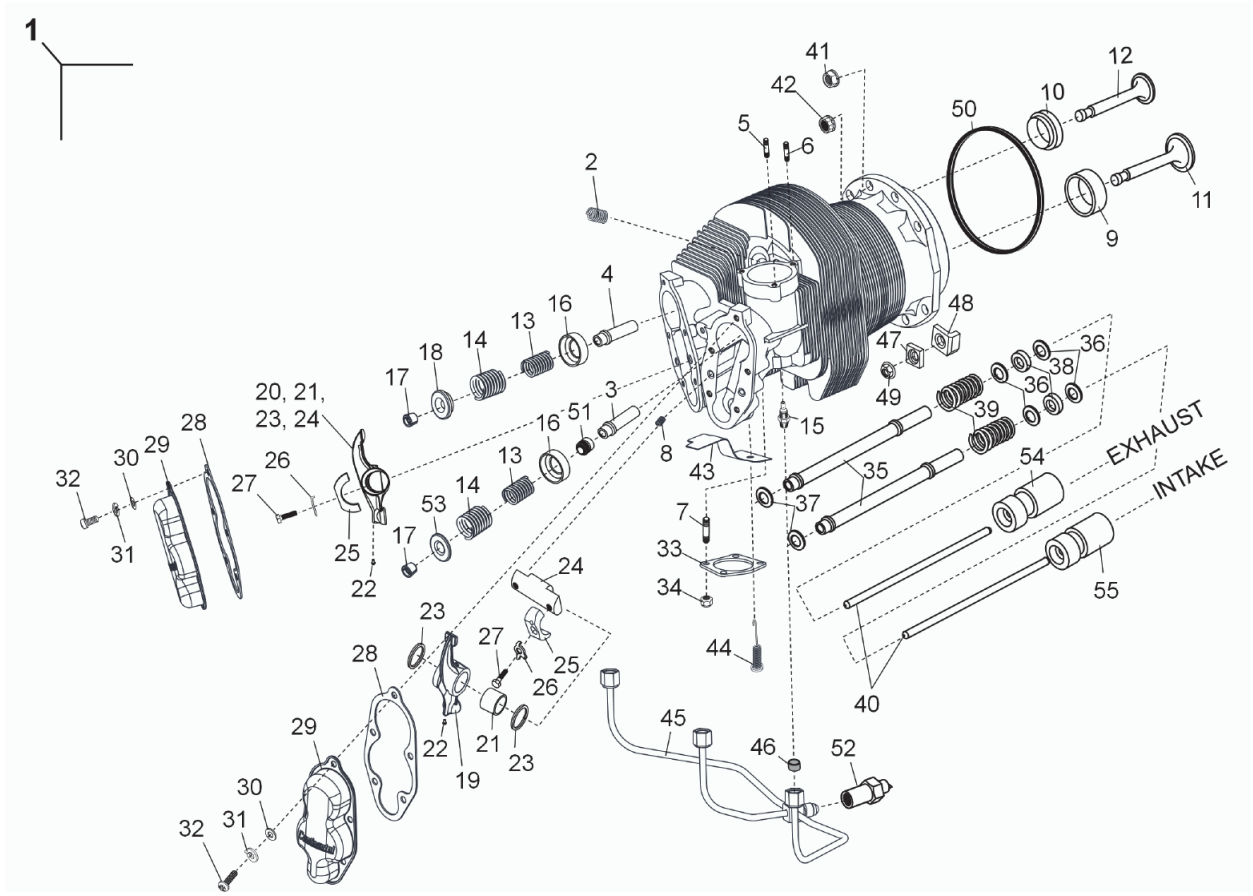


Figure 13-12. Cylinder Assembly

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		

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.

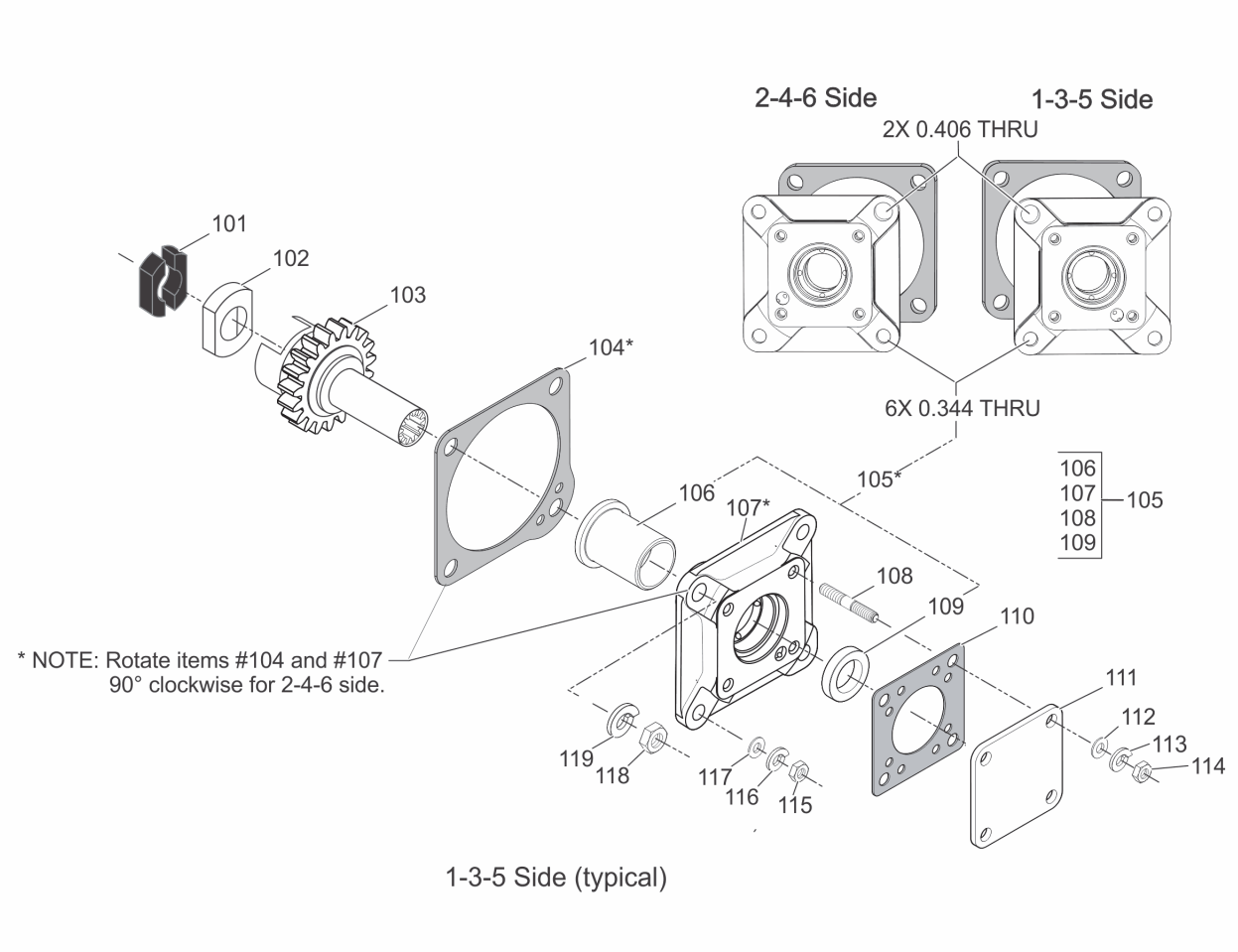


Figure 13-13. Accessory Drive Assembly

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		

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).

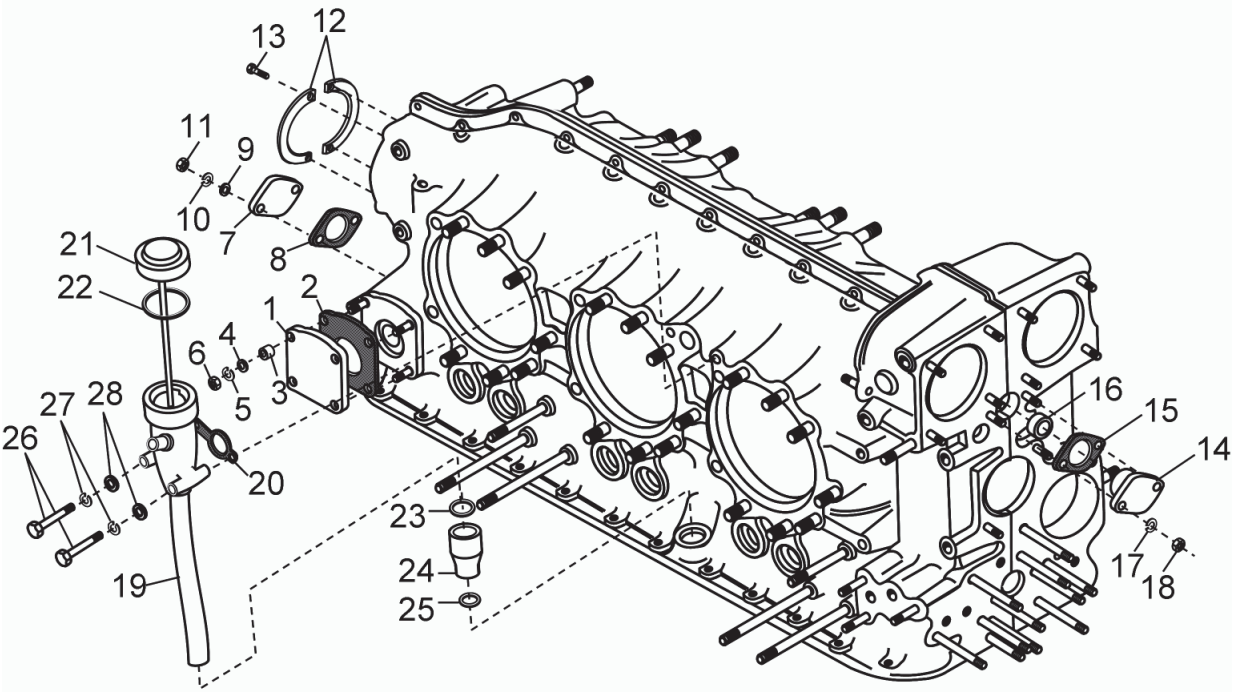


Figure 13-14. Miscellaneous Crankcase Hardware

1	Cover	8	Camshaft Cover Gasket	15	Idler Pin Cover Gasket	22	Oil Filler Gasket
2	Gasket	9	Washer	16	Idler Gear Bushing	23	O-ring
3	Spacer	10	Lock Washer	17	Lock Washer	24	Adapter
4	Washer	11	Nut	18	Nut	25	O-ring
5	Lock Washer	12	Gasket	19	Oil Filler Assembly	26	Screw
6	Nut	13	Screw	20	Gasket	27	Lock Washer
7	Camshaft Cover	14	Idler Gear Support Pin	21	Oil Gauge & Cap Assembly	28	Washer

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).

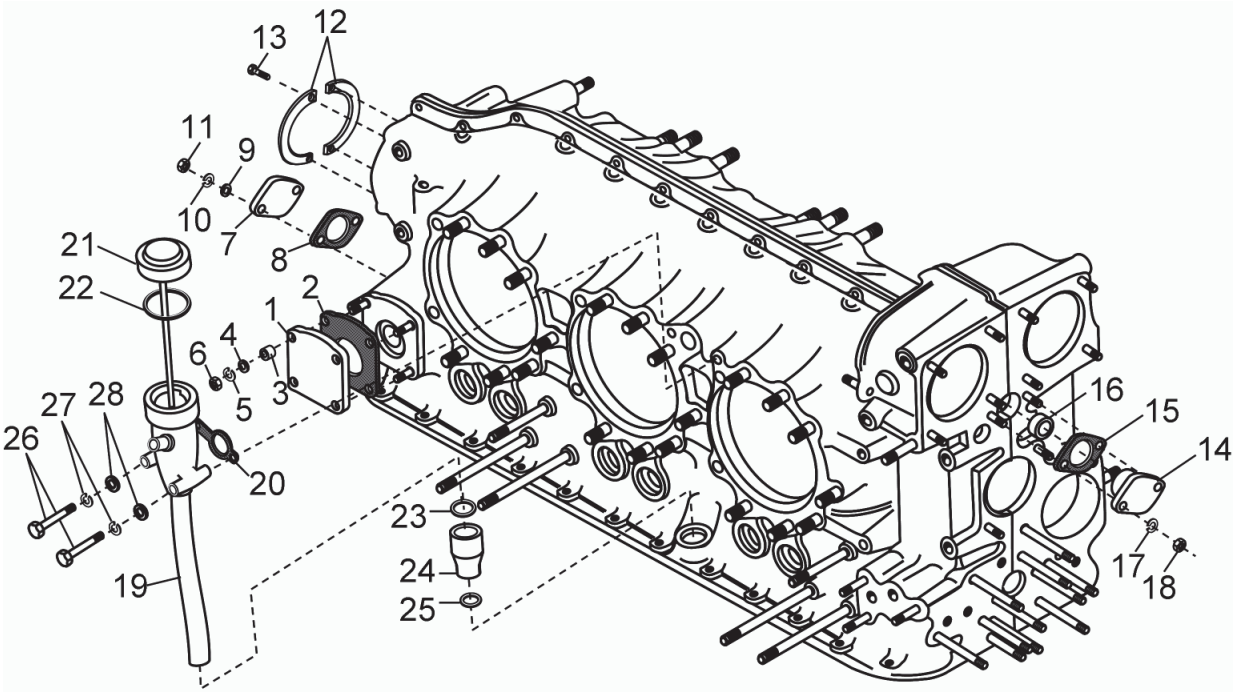


Figure 13-14 repeated for reference

7. Remove the nuts and washers holding the rear lifting eye. Remove the lifting eye from the crankcase.

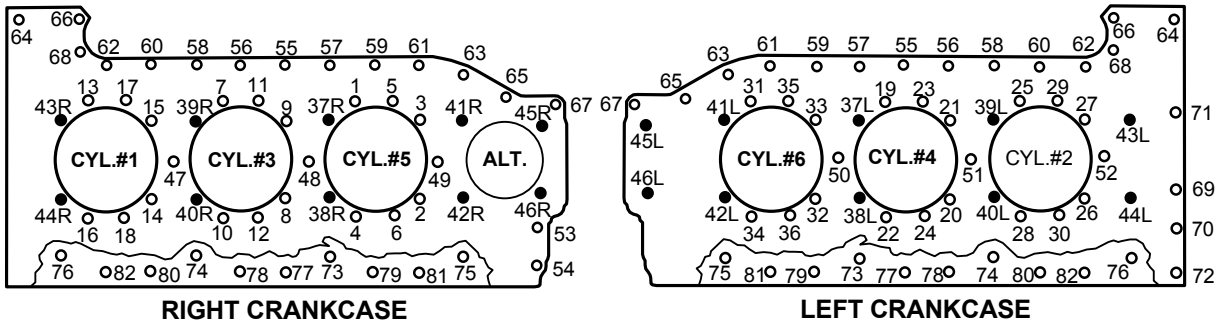


Figure 13-15. Crankcase Fastener Locations

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.

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).

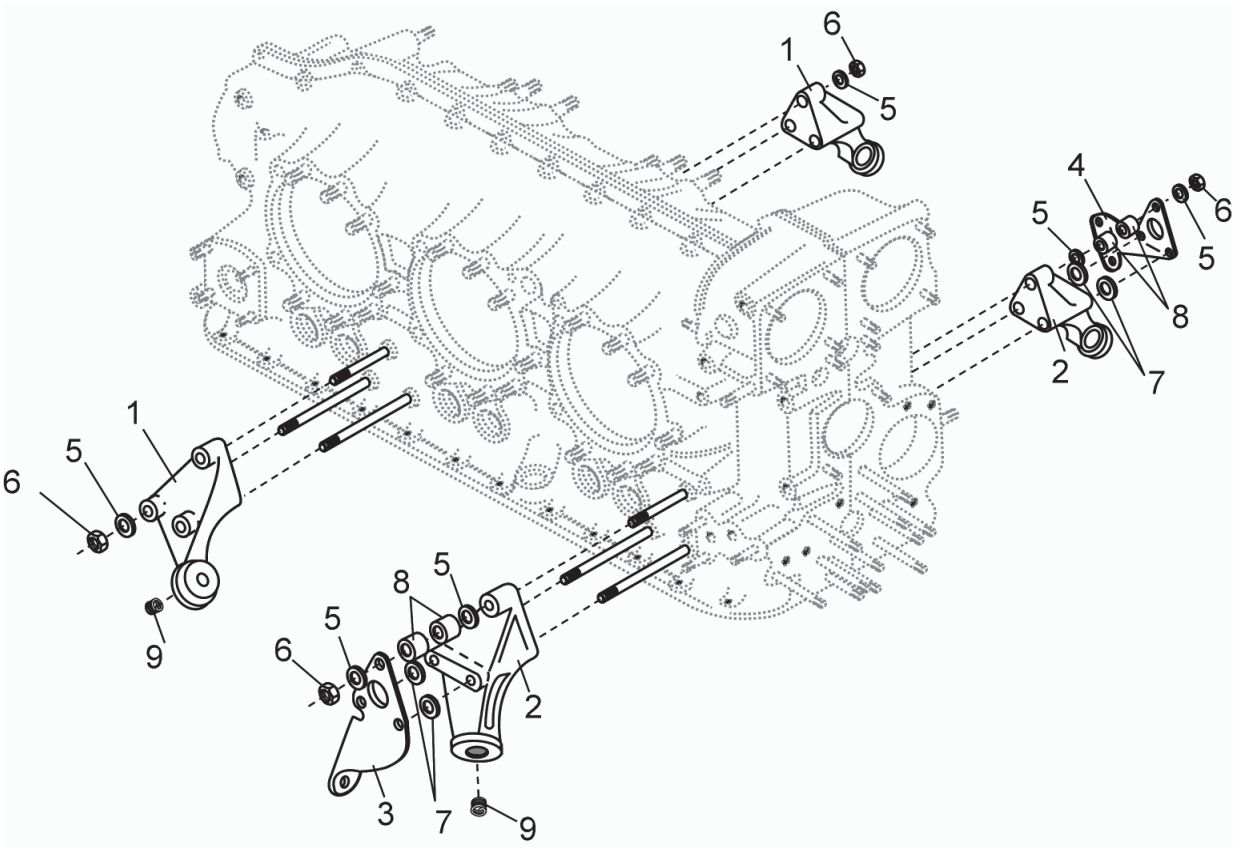


Figure 13-16. Engine and Turbocharger Mounting Brackets B C E

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).

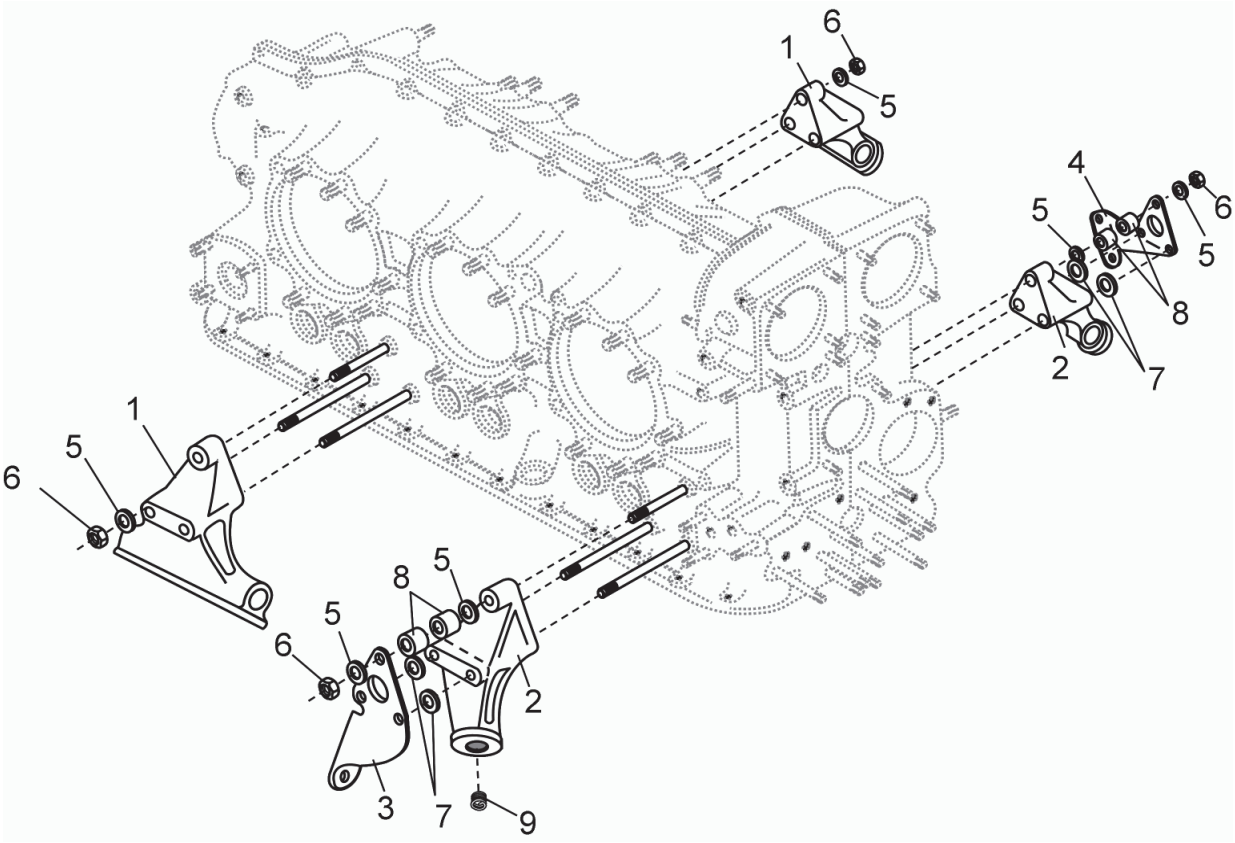


Figure 13-17. Engine and Turbocharger Mounting Brackets G

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).

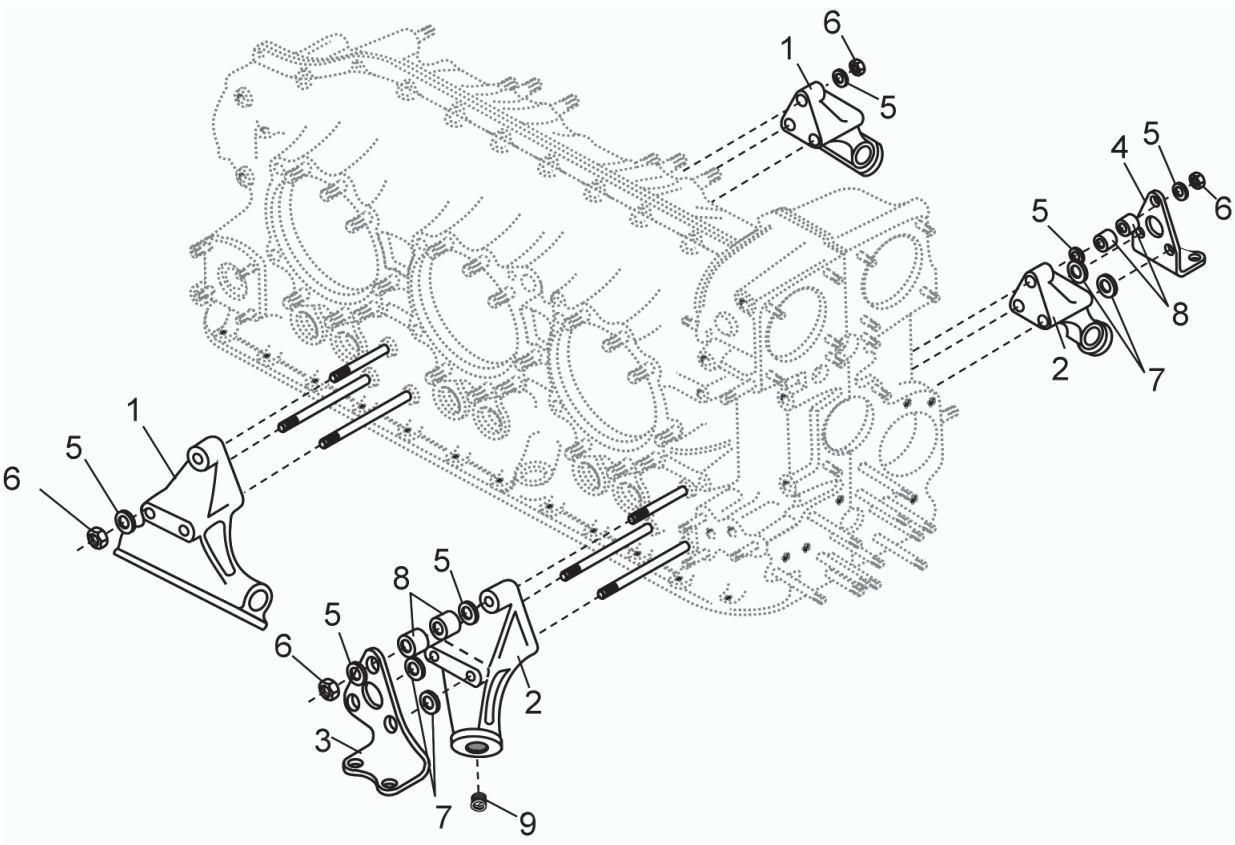


Figure 13-18. Engine and Turbocharger Mounting Brackets K

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

13-9.3.4. 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).

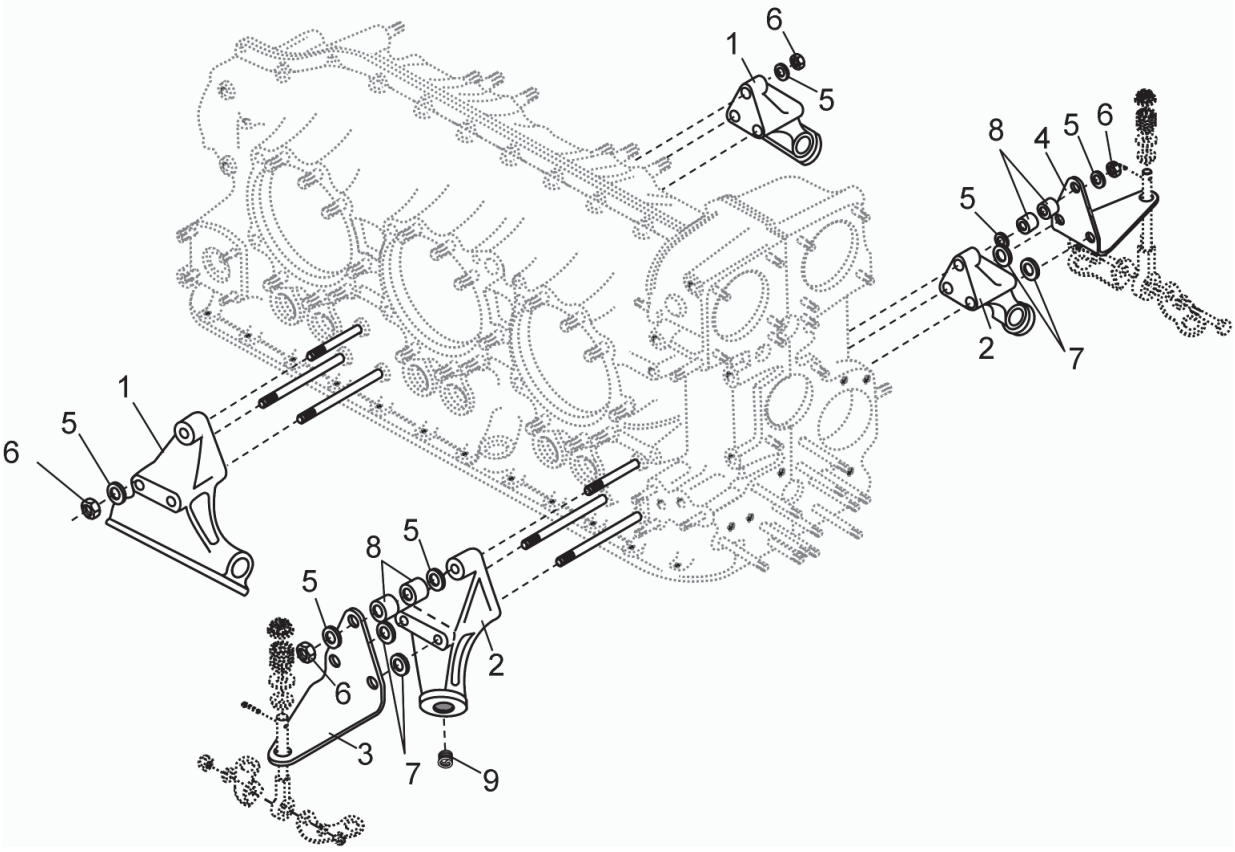


Figure 13-19. Engine and Turbocharger Mounting Brackets N

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.

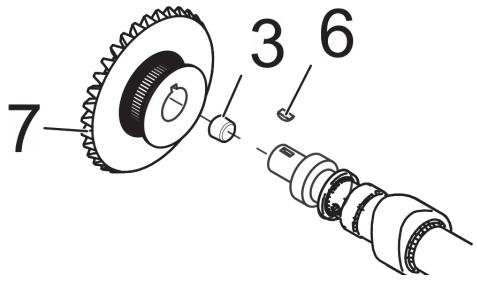


Figure 13-20. Keyed Camshaft

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).

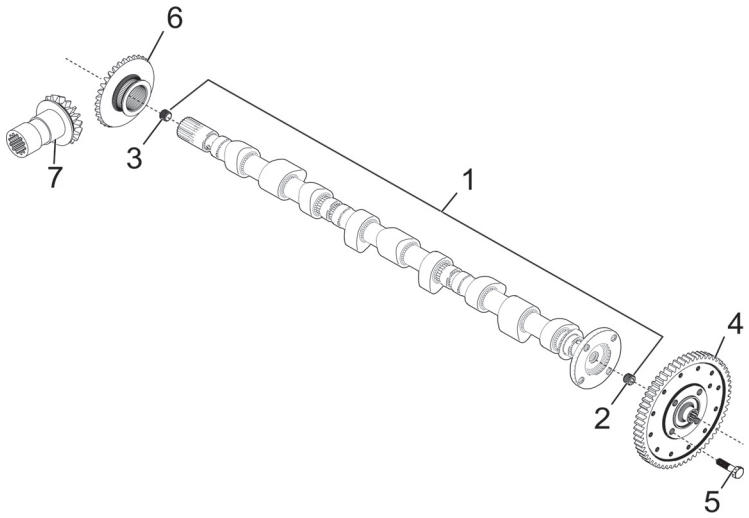


Figure 13-21. Camshaft Assembly

1	Camshaft Assembly	3	Plug	5	Bolt	7	Governor Driven Gear
2	Plug	4	Camshaft Gear	6	Governor Drive Gear		

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).

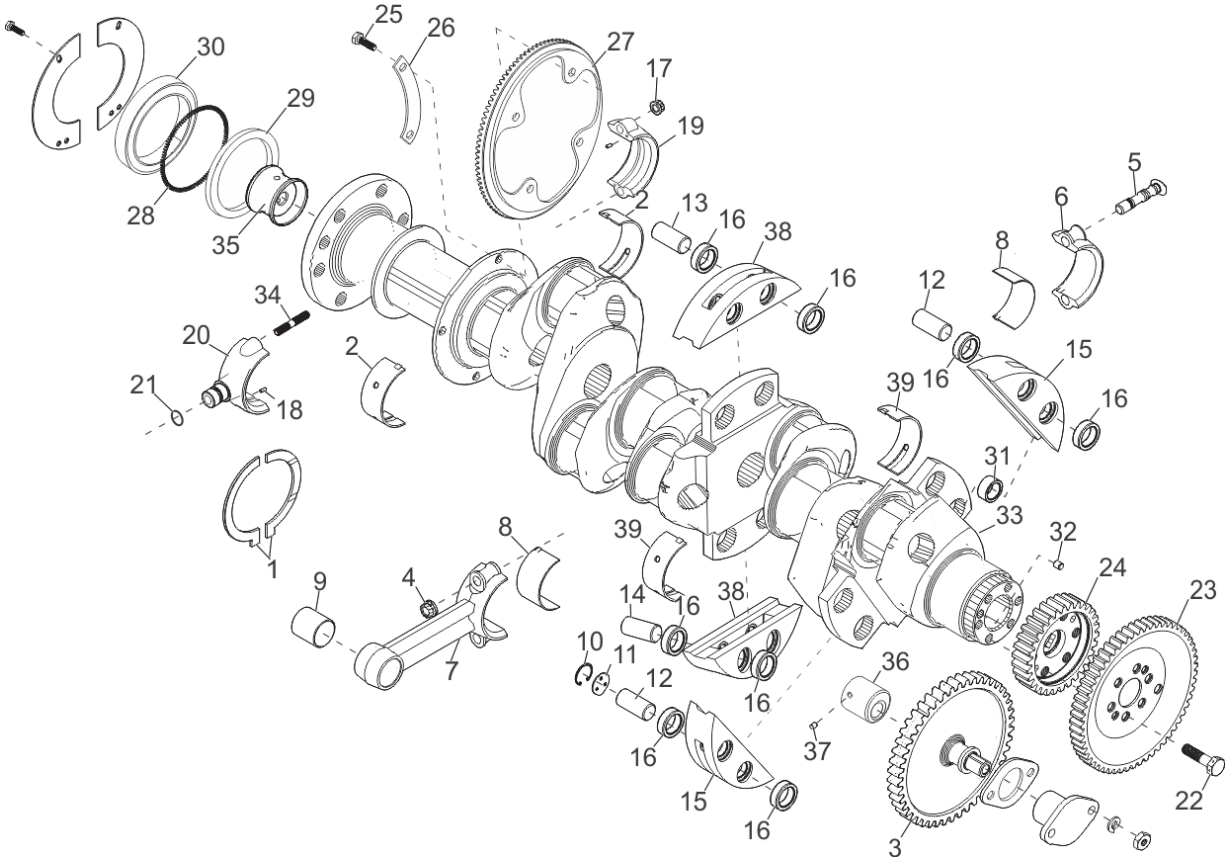


Figure 13-22. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	C'shaft Main Bearing, 4 & 5	12	6th Order Counterweight Pin	22	Drilled Head Screw	32	Crankshaft Dowel
3	Idler Gear	13	4th Order Counterweight Pin	23	Large Gear Cluster	33	Crankshaft
4	Spiral Lock Nut	14	5th Order Counterweight Pin	24	Small Gear Cluster	34	Stud
5	Connecting Rod Bolt	15	Counterweight Assembly	25	Bolt	35	Oil Transfer Plug
6	Connecting Rod Cap	16	Counterweight Bushing	26	Tab Lock Plate	36	Idler Gear Bushing
7	Connecting Rod	17	Lock Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring	38	Counterweight Assembly
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring	39	C'shaft Main Bearing, Rear & Intermediate
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

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

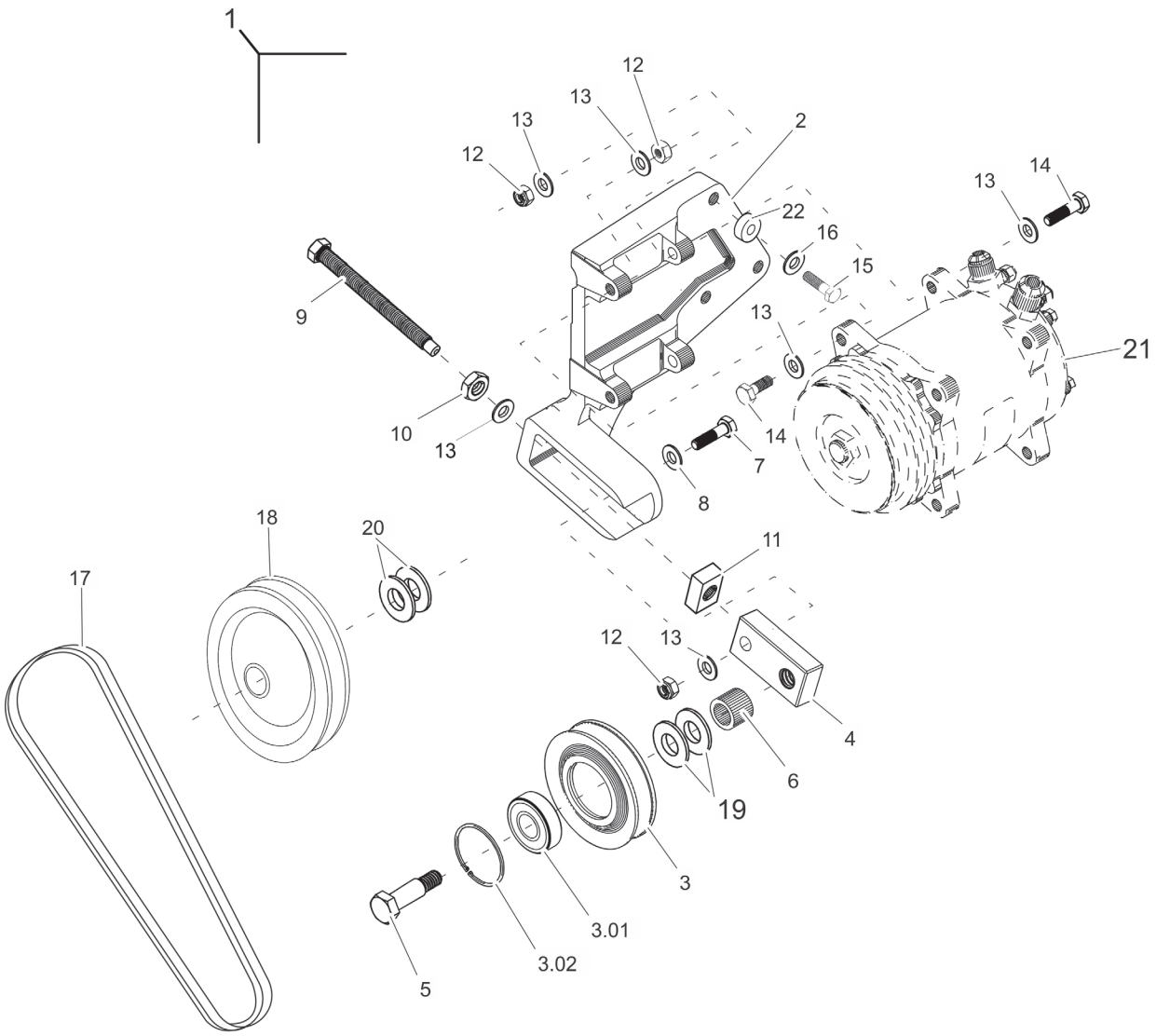
1. Refer to the Crankshaft Counterweight Removal instructions in Section 10-9.1.1 of M-0, Standard Practice Maintenance Manual.
2. Inspect the Crankshaft Counterweights according to the instructions in Section 10-9.1.3 and Section 10-9.1.4 of M-0, Standard Practice Maintenance Manual.
3. Inspect the 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.



ITEMS 2 THRU 14 INCLUDED IN ITEM 1

Figure 13-23. Freon Compressor Mounting Kit

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

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Chapter 14. Engine Cleaning

Refer to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual.

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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 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 ½ 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.

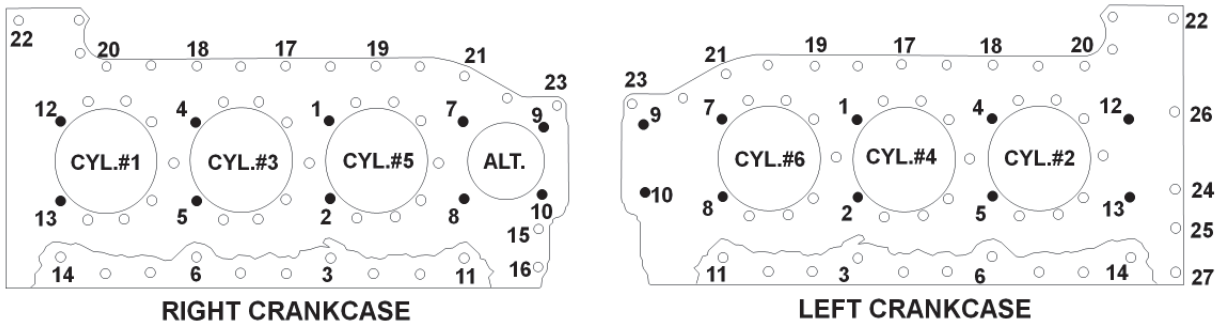


Figure 15-1. Crankcase Dimensional Inspection Torque Sequence

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.

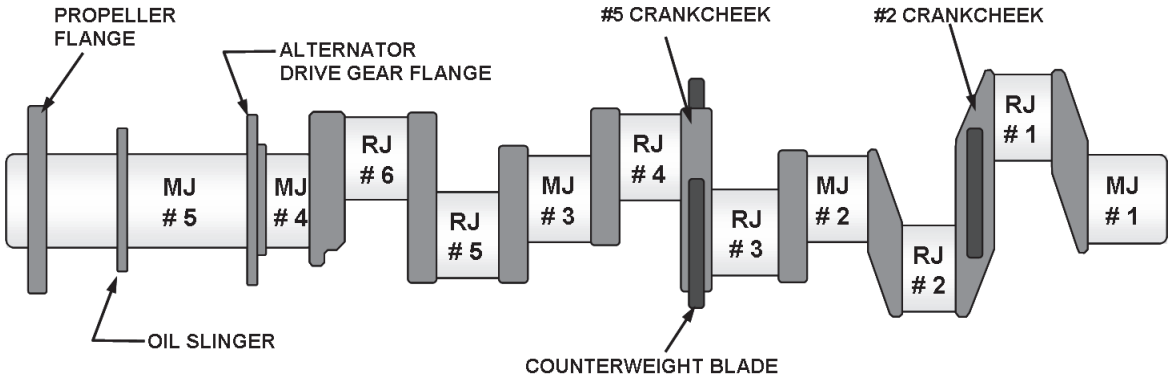


Figure 15-2. Crankshaft Journals

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).

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

Refer to the "Crankshaft Counterweight Bushing Bore Inspection" instructions in Section 10-9.1.4 of M-0, Standard Practice Maintenance Manual.

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."

Inspection Item	Inspection Action
Stacks Risers Elbows	Check parts for: • Burned areas • Cracks • Loose parts/hardware • Inspect welds and seams for cracks • Replace worn, cracked or burned parts
Slip joints	Inspect for bulges or cracks
Multi-segment V-band clamps	Replace at overhaul

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

Illustration and Tables in Section D-9 provide stud sizes and heights for the items listed below. Items in the tables match the referenced item numbers in the illustrations.	
Inspection Item	**Inspect for:**
Starter Adapter	• Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness. • Check the stud alignment using a tool maker's square. • Studs should measure within the limits provided in Appendix D-9. • Replace unserviceable studs according to instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual. • 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.
Accessory Drive Adapter	
Lubrication System	
Oil Control Collar	
Crankcase	
Cylinder	

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.

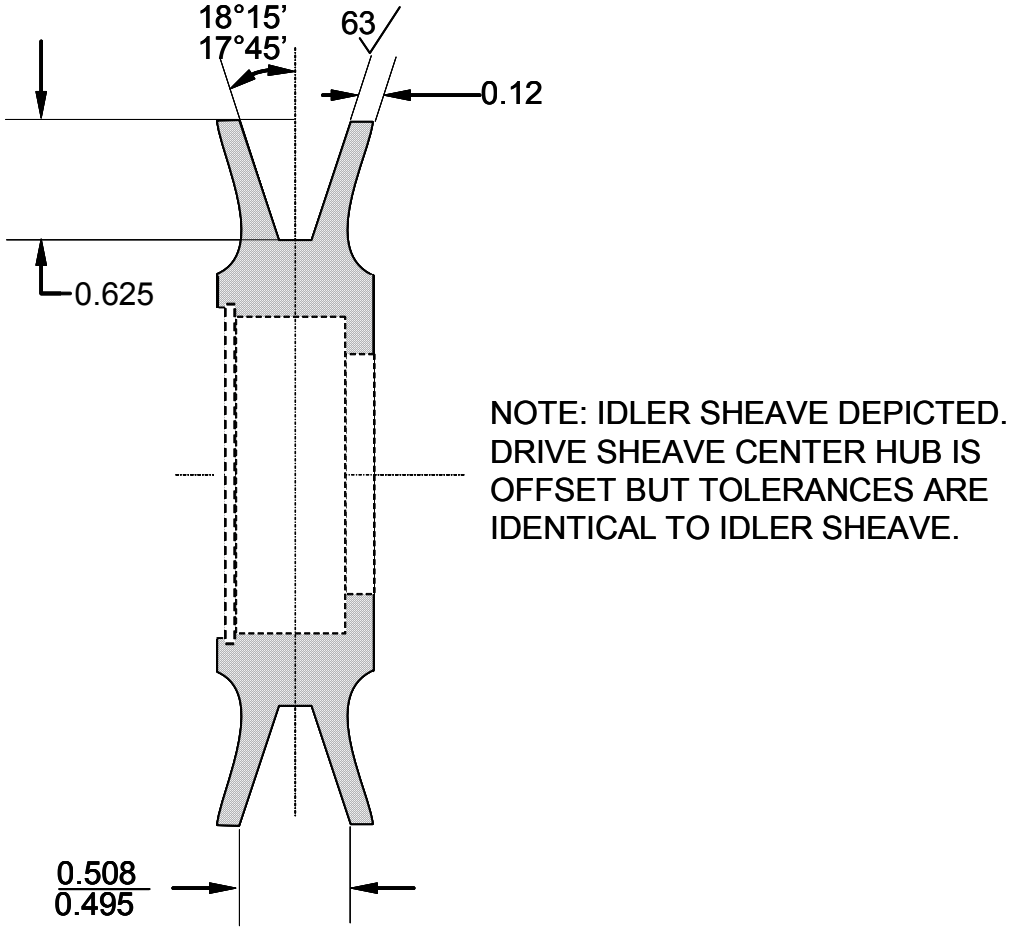


Figure 15-3. Air Conditioning Compressor Sheave

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. Worm 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.

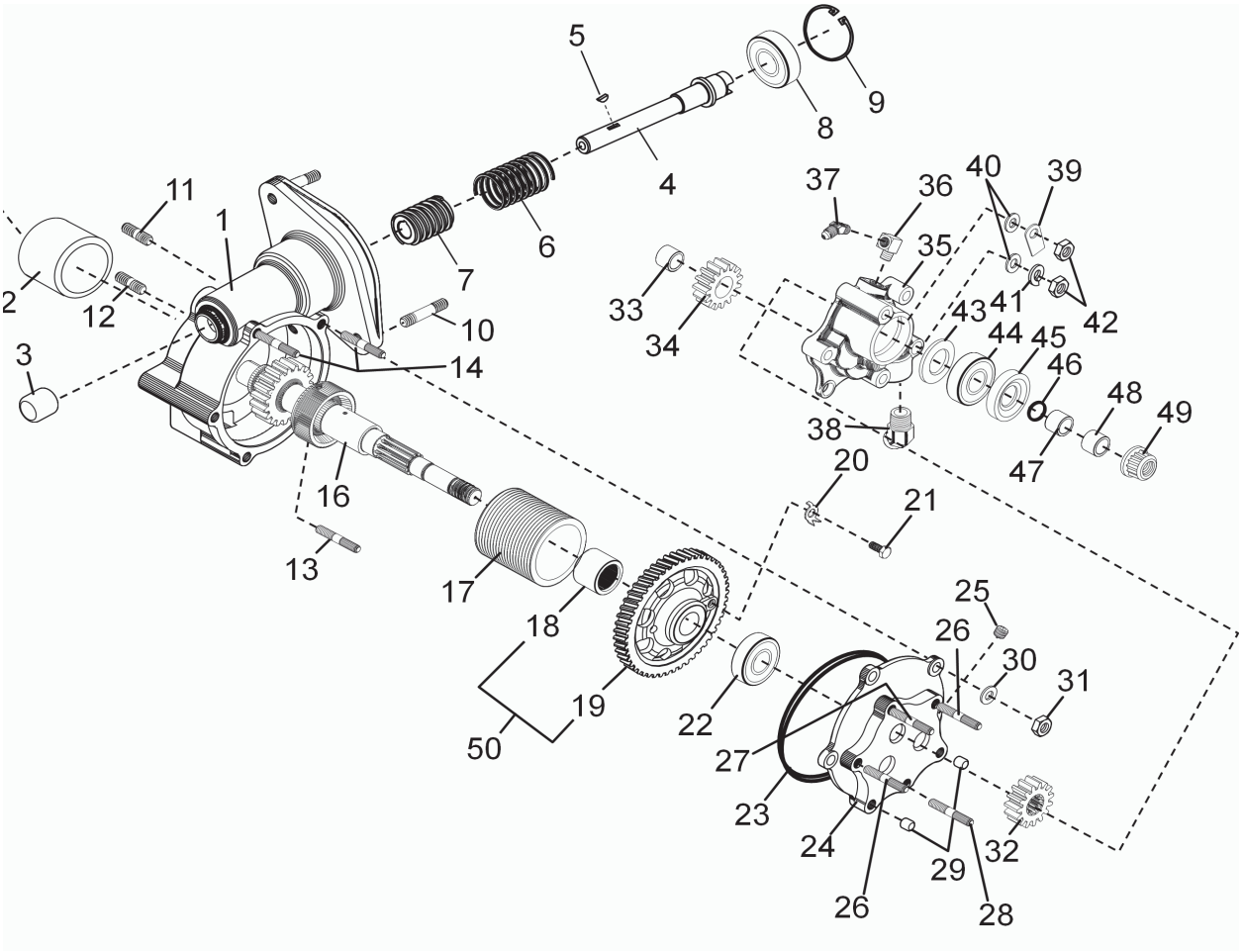


Figure 15-4. Starter and Starter Adapter

1	Starter Adapter Housing	14	Stud	27	Stud	40	Washer
2	Sleeve, Clutch Spring	15	Dowel	28	Stud	41	Lock Washer
3	Needle Bearing	16	Starter Shaft Gear	29	Dowel	42	Nut
4	Worm Drive Shaft	17	Clutch Spring	30	Washer	43	Spacer
5	Woodruff Key	18	Roller Bearing	31	Nut	44	Bearing
6	Starter Spring	19	Starter Worm Gear	32	Scav. Pump Driven Gear	45	Starter Shaft Seal
7	Starter Worm Gear	20	Tab Washer	33	Bushing	46	O-ring Seal
8	Radial Ball Bearing	21	Screw	34	Scav. Pump Driver Gear	47	Starter Shaft Sleeve
9	Internal Retaining Ring	22	Ball Bearing	35	Scav. Pump Body	48	Starter Shaft Spacer
10	Stud	23	O-Ring	36	90° Street Elbow	49	Flanged Nut
11	Stud	24	Cover Assembly	37	45° Elbow		
12	Stud	25	Plug	38	90° Elbow		
13	Stud	26	Stud	39	Seal Retainer Clip		

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.

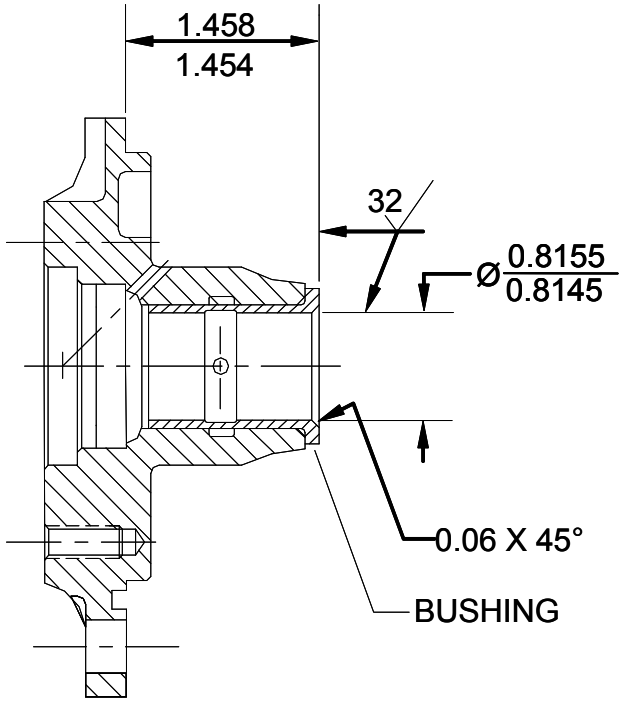


Figure 15-5. Accessory Drive Adapter Bushing Installation Detail

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.

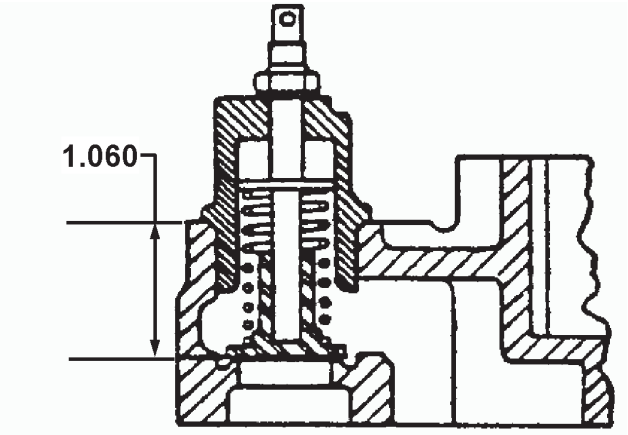


Figure 15-6. Oil Pressure Relief Valve

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.

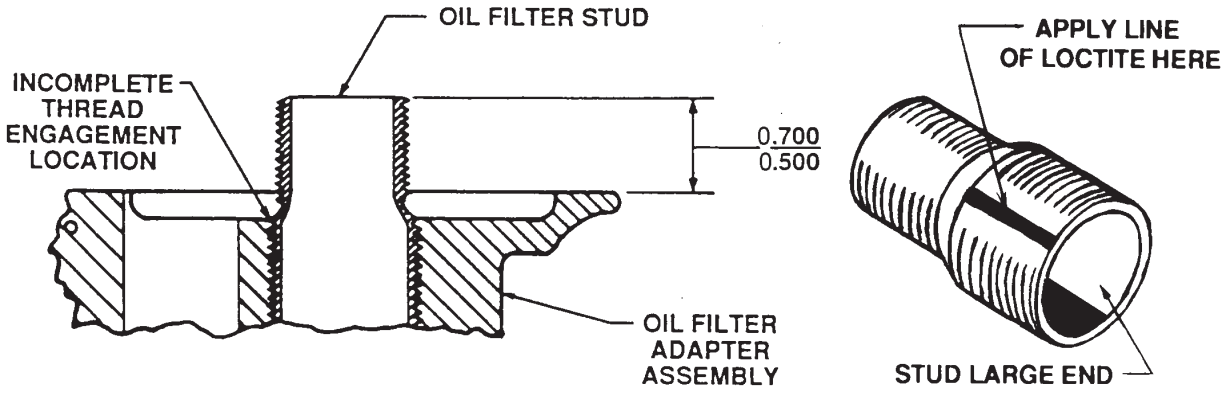


Figure 15-7. Oil Filter Adapter Stud

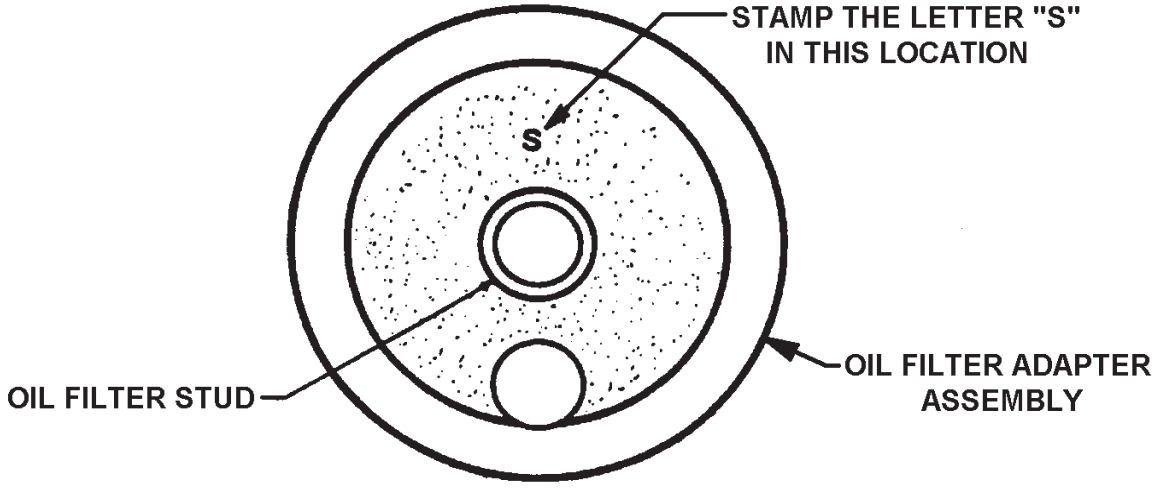


Figure 15-8. Identification of Oil Filter Adapter Stud Modification

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

Condition	Corrective Action
Cylinder with radial fin crack extending to the root of a fin	Replace[1] the cylinder
Broken, bent (or straightened), or pitted cylinder head or barrel fins	Replace[1] the cylinder
Power stroke stress on cylinder barrel; heavy rust or pitting, indentation; chafing or cracks on cylinder barrel	Replace[1] the cylinder
Cracks in cylinder head structure	Replace[1] the cylinder
Cracked or eroded valve seat bore	Replace[1] the cylinder
Static seal leakage or leakage from head to barrel seal or crack in head or barrel	Replace[1] the cylinder
Discolored/burned paint, Piston pin scoring or damage to the cylinder bore (usually due to overheating)	Replace[1] the cylinder Do Not Repair[2]
Blistered paint on the cylinder barrel	Replace[1] the cylinder
Cylinder head-to-barrel junction movement	Replace[1] the cylinder
Low differential pressure coupled with excessive oil consumption	Repair or replace[3] the cylinder
Scratches in the honed surface of the cylinder wall or cylinder bore	Repair the cylinder
Pitting, sharp dents or chafing in fin tips less than 0.050 inches (1.3 mm) deep	Repair the cylinder

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) • Baffle Retainer Spring • Cylinder Deck Stud Nuts and Through-Bolts • Cylinder Exhaust Flange Studs • Exhaust Flange Gaskets • Exhaust Manifold Nuts • Exhaust Valves • Intake Valves • Intake and Exhaust Valve Tappets • Lock Washers • Pistons & Piston Rings • Piston Pin	• Pushrod Tube Compression Springs • Pushrod Tube Packing • Retainer Keys • Rocker Arm Bushings • Rocker Cover Gaskets • Rocker Shafts • Rotocoils • Seals, O-rings, Gaskets • Springs • Tab Washers • Thrust Washers • 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.

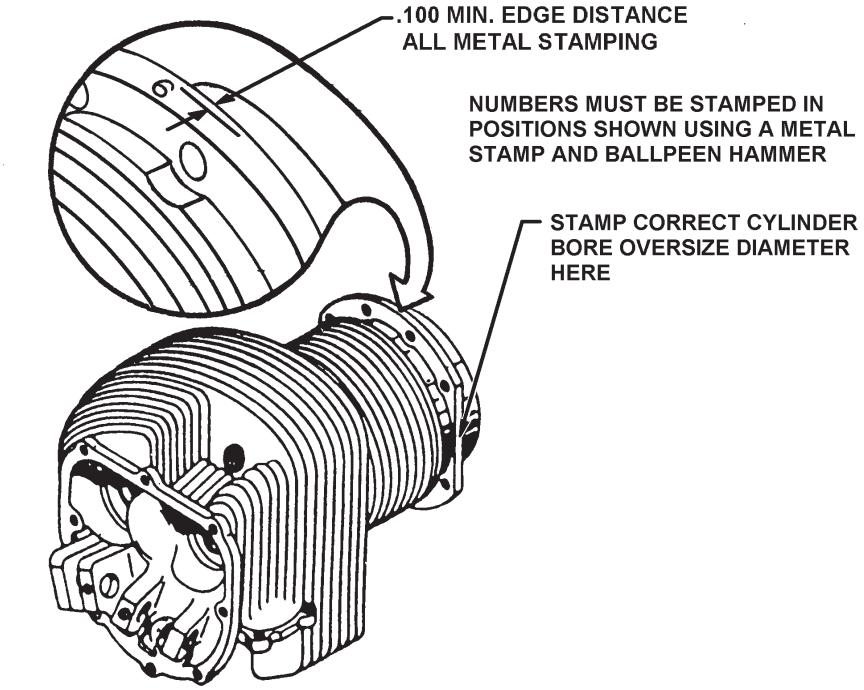


Figure 15-9. Cylinder Position Number

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.”

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.
14. Inspect the valve guide bore new inside diameter (Appendix D).

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.

15-8.9.12. Valve Guide Bore Reaming

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.

15-8.9.14. Spark Plug Helical Coil Insert Replacement

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

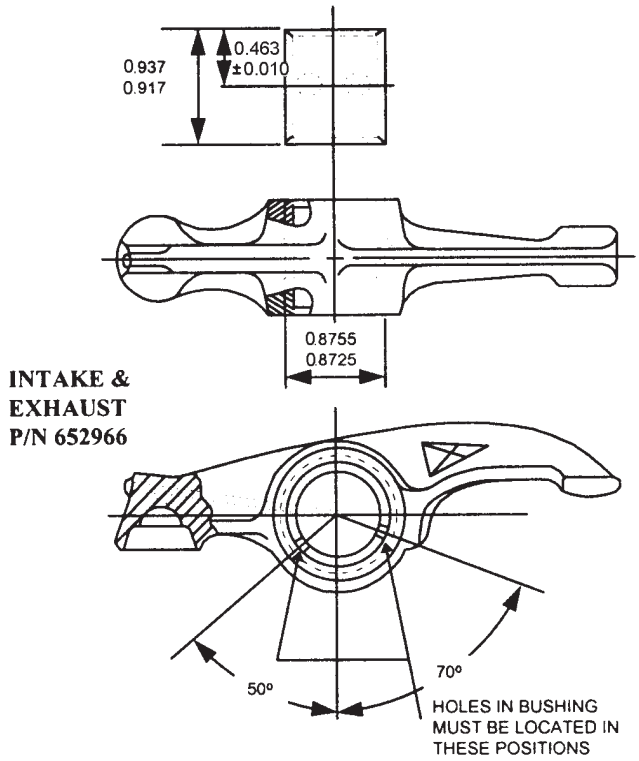
- Borroughs Part No. 8118 Rocker Arm Bushing Remover/Installer
- Borroughs Part No. 8116-1R through 15R Reamers, or equivalent
- Arbor Press

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.

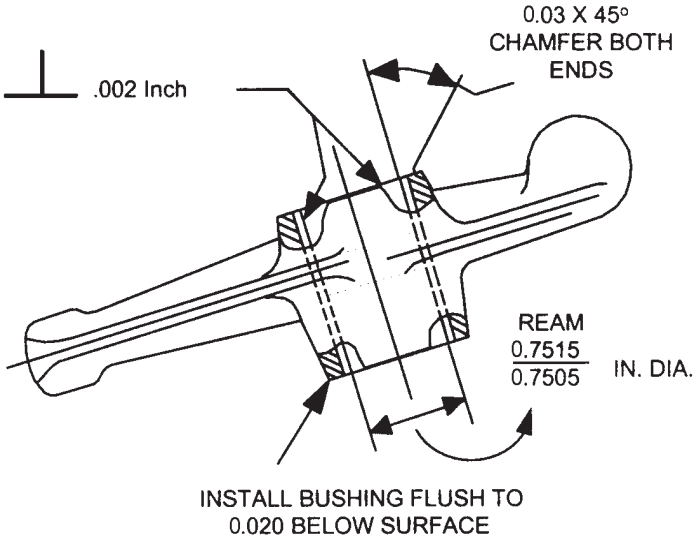
WARNING

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/lnstaller, 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.



* Bushing O. D. must maintain a 0.0020-0.0065 Press Fit in a 0.8755-0.8725 Rocker Arm Bushing Bore.



Bushing 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.

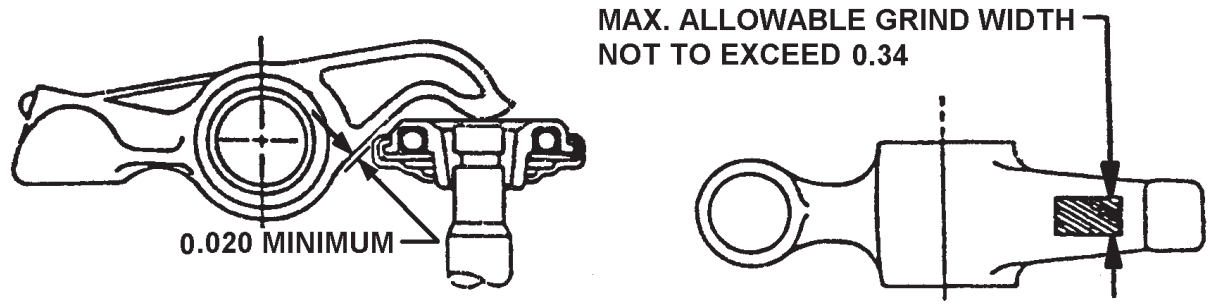


Figure 15-11. Rocker Arm to Retainer Clearance

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.

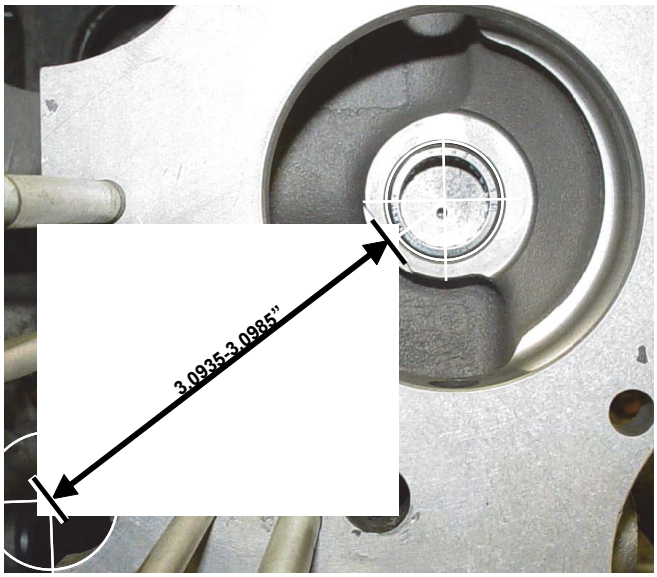


Figure 15-12. Radius Cut Distance from Camshaft Centerline

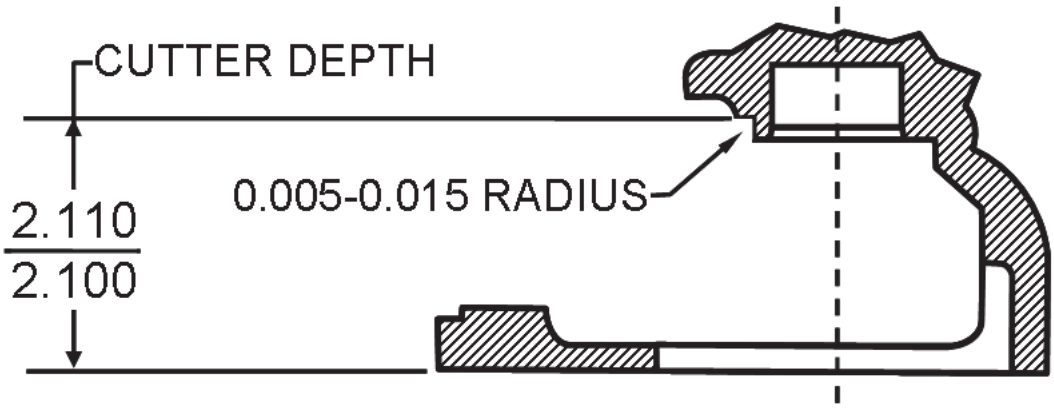


Figure 15-13. Overhead View of Radius Cut Depth

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.

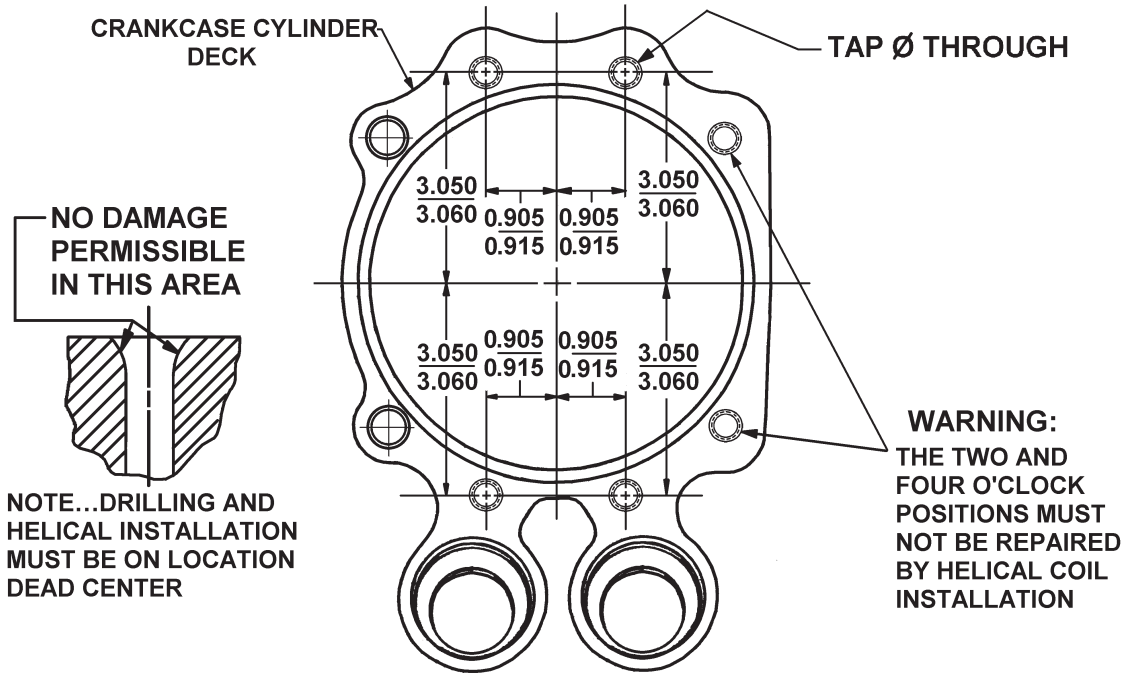


Figure 15-14. Crankcase Cylinder Deck Stud Repair Specifications

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 by 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

Part to Consider for Replacement	Discard and Replace Criteria
WARNING **Use only replacement crankshafts with the letters VAR (for vacuum arc re-melted) forged in the crankshaft cheek to ensure proper engine operation. Do not replace the crankshaft with any other brand.**	
Crankshaft	Discard/replace a crankshaft with any of the following conditions: • Worn, pitted, fretted, or out-of-round counterweight bushing bores • Worn counterweight bushing bores • Cracked counterweight hanger blades • Cracks, rust or pitting on crankshaft
Camshaft	Discard/replace a camshaft with any of the following conditions: • cracks, scoring, galling corrosion pitting or other physical damage • Worn bearing surfaces • 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.

Table 15-4. Engine Drive Train Parts Replacement

Part to Consider for Replacement	Discard and Replace Criteria
WARNING **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.**	
Crankshaft Counterweight[1]	Discard any counterweight that is: • Cracked • Worn, pitted, fretted, or out of round bushing bores • Worn or has distortions in the retaining ring groove that can affect the retaining ring seating
Oil Control Plugs	Discard/replace loose or leaking oil plugs
Connecting Rods	Discard/replace any connecting rods: • With a bore exhibiting nicks or gouges • If the rod and cap do not align properly

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.”

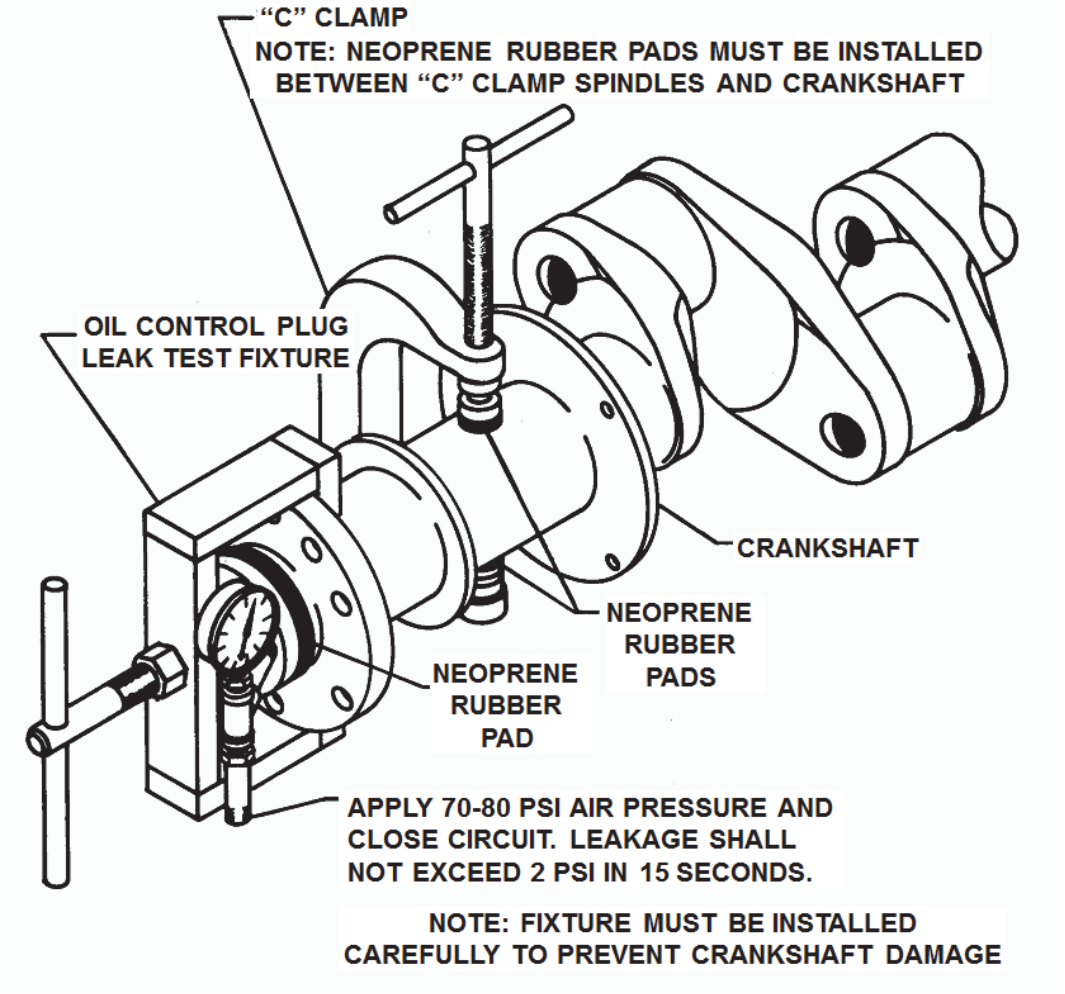


Figure 15-15. Oil Control Plug/Crankshaft Pressure Test

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.

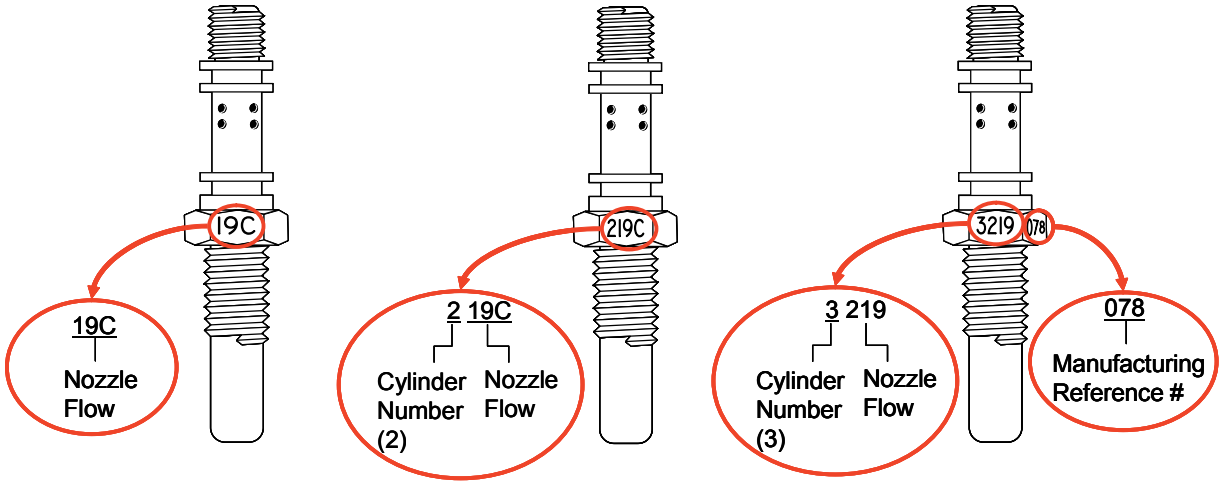


Figure 16-1. Fuel Injector Nozzle Identification

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.

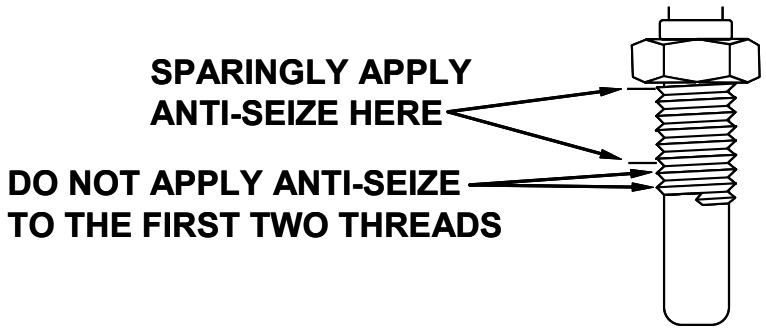


Figure 16-2. Apply Anti-Seize to Fuel Injector Threads

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.

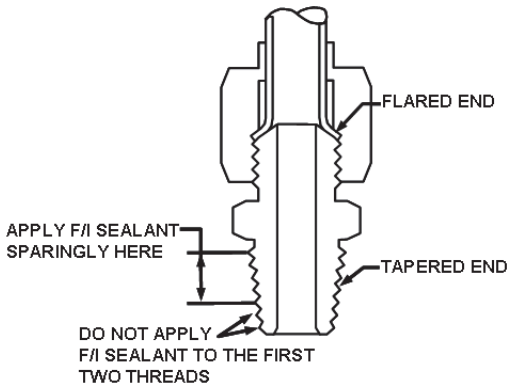


Figure 16-3. Fuel Injection Fitting F/I Sealant Application

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.

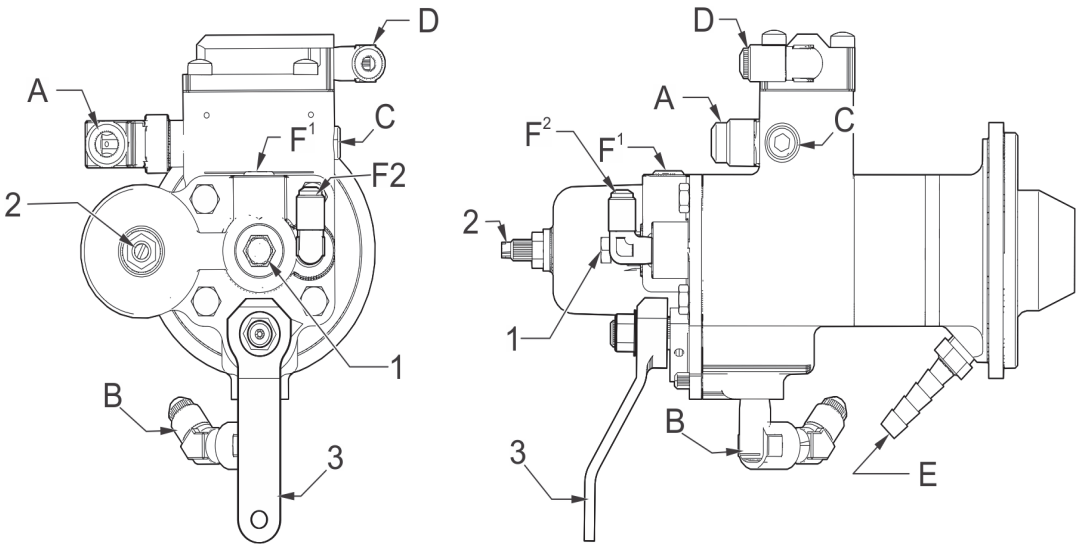


Figure 16-4. Fuel Pump Assembly with Fittings

1	Low Pressure Relief Valve Adjustment	A	Pump Inlet	E	Drain
2	Variable Orifice Adjustment (N/A)	B	Pump Outlet	F	Deck Pressure Reference
3	Mixture Control	C	Fuel Return		
4	Aneroid Adjustment	D	Vapor Return		

16-1.4. Diverter Valve Assembly B C E

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.

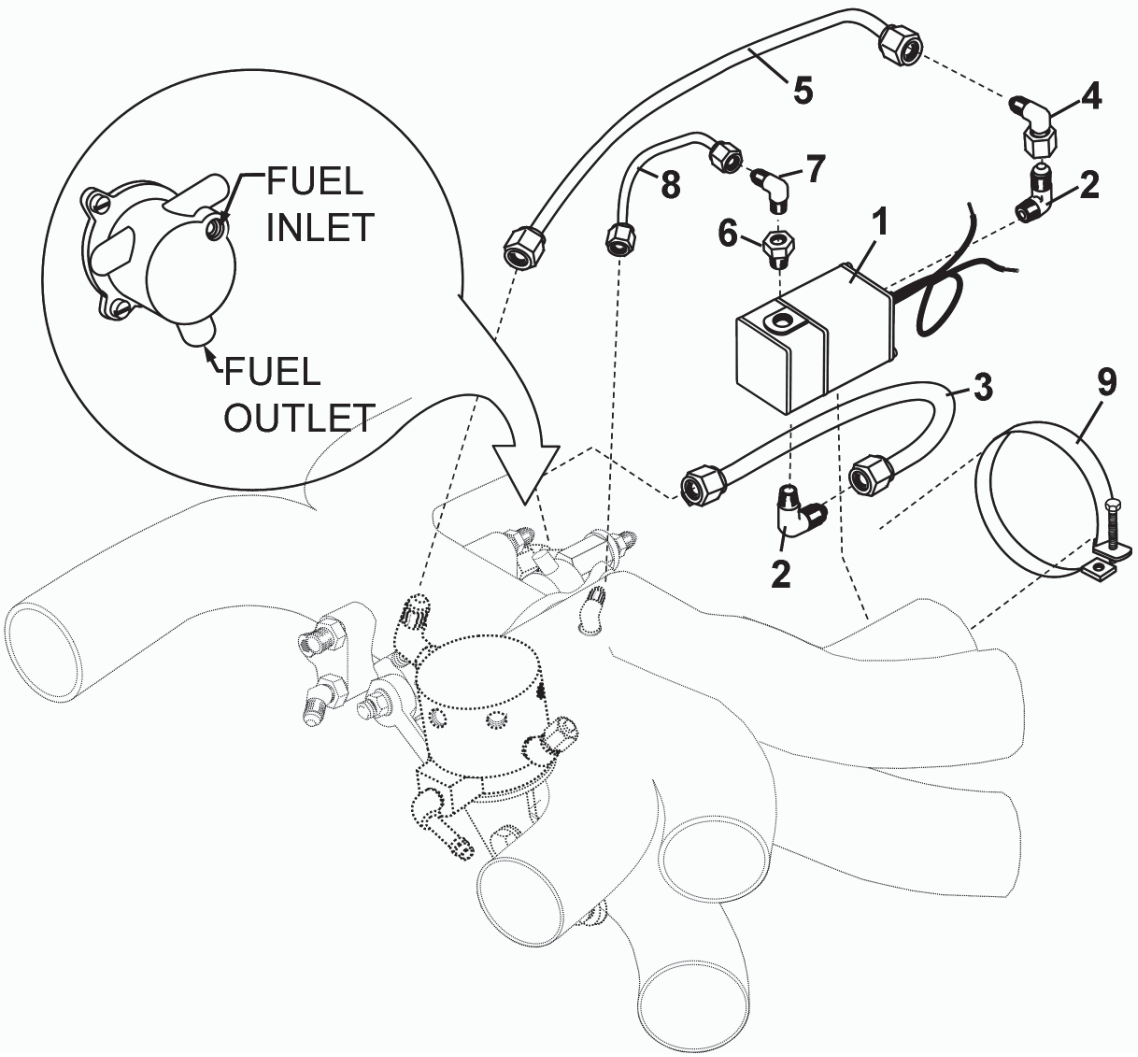


Figure 16-5. Fuel Priming System B C E

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

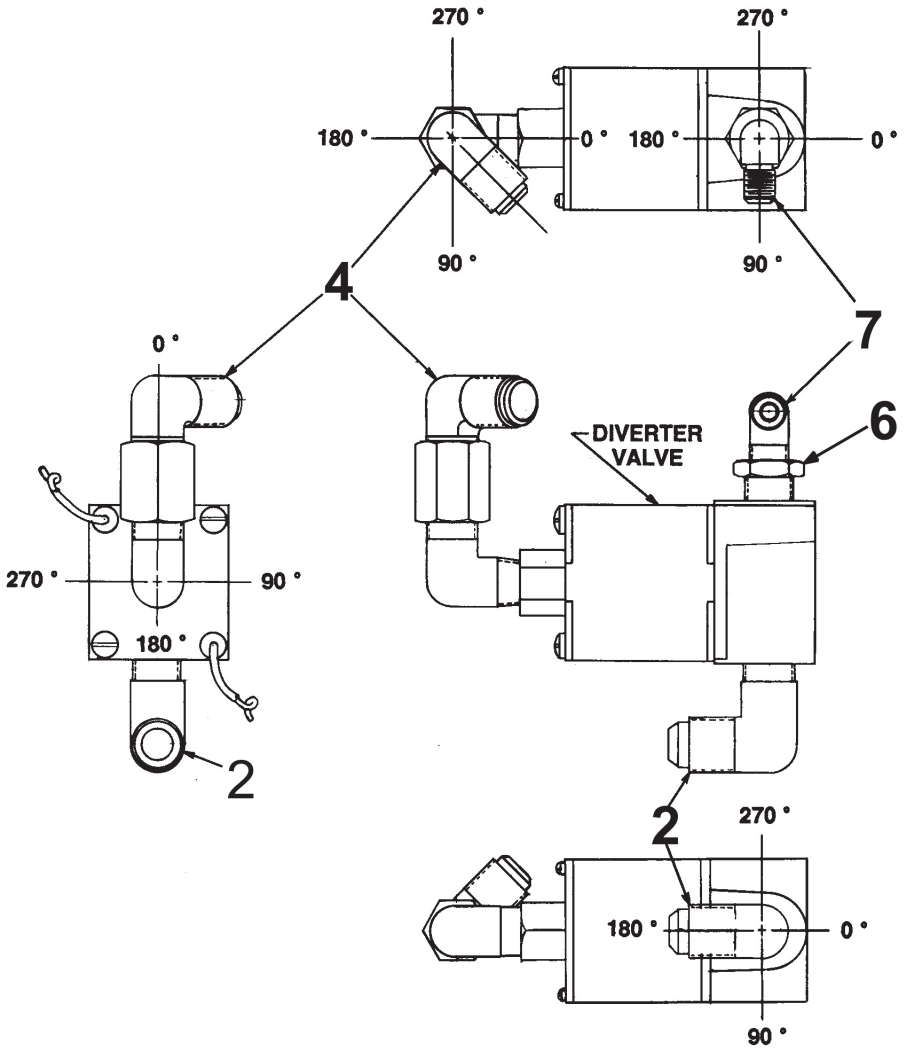


Figure 16-6. Diverter Valve Fitting Detail

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 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.

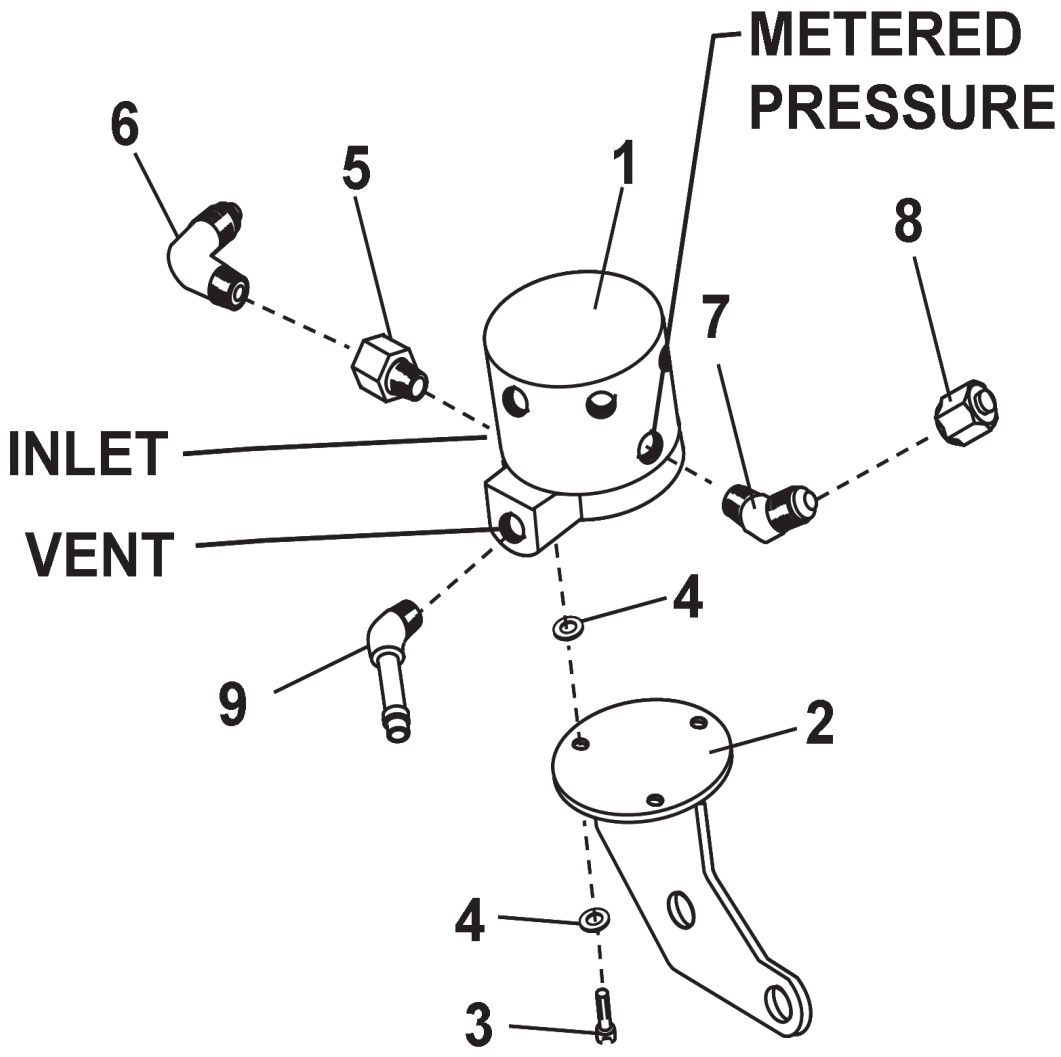


Figure 16-7. Fuel Manifold Valve Assembly

1	Manifold Valve	4	Washer	7	45° Elbow
2	Bracket	5	Adapter	8	Flare Tube Cap
3	Fillister Head Screw	6	90° Elbow	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.

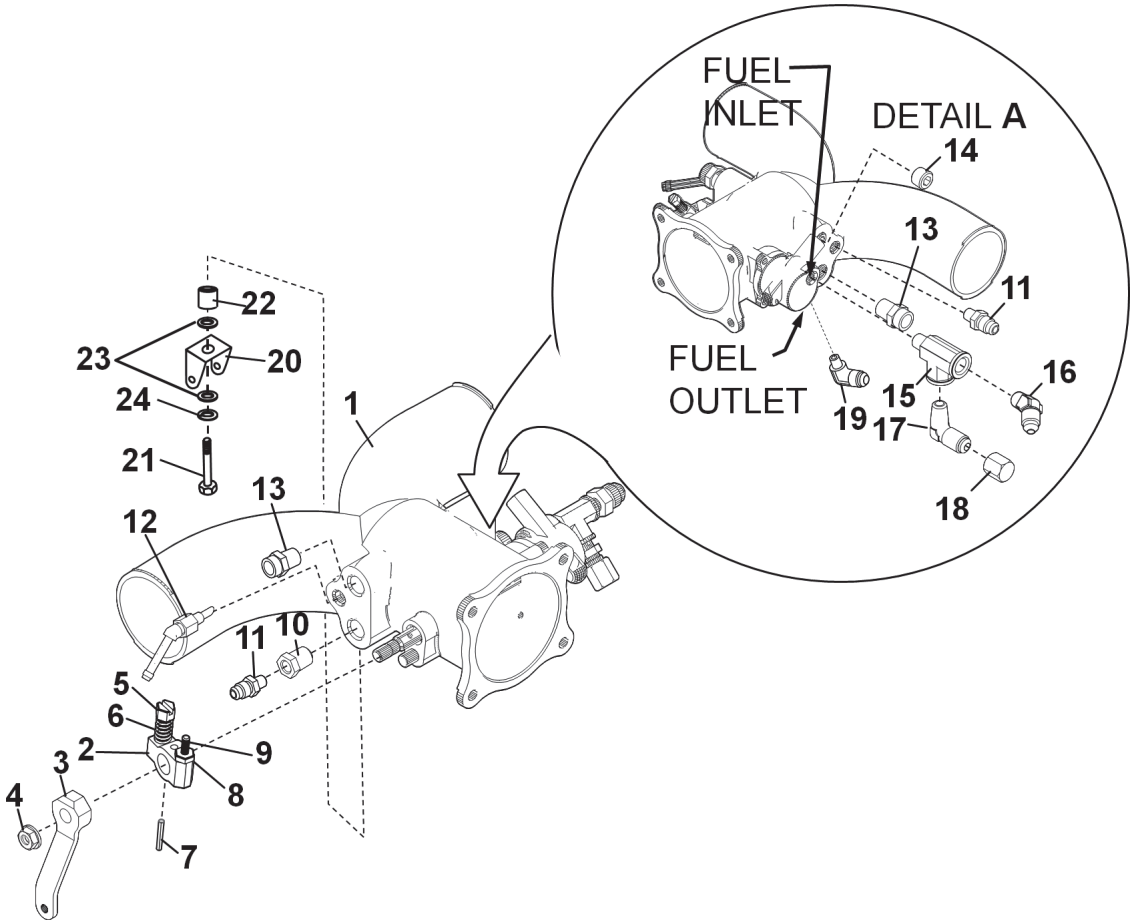


Figure 16-8. Throttle Assembly B C E

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.

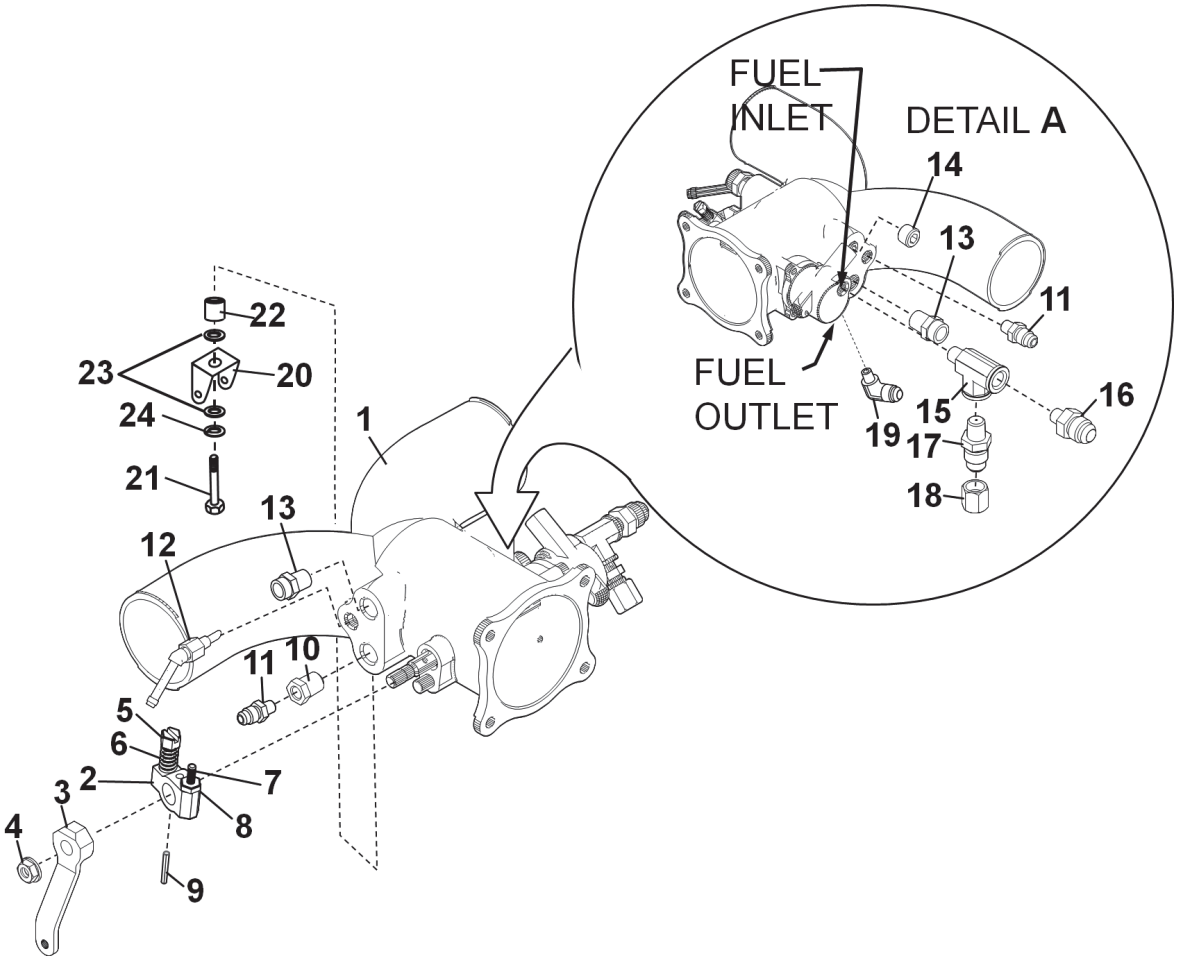


Figure 16-9. Throttle Assembly B C E G

1	Throttle Assembly	7	Pin	13	Flex Connector	19	90° Elbow
2	Lever	8	Nut	14	Plug	20	Bracket
3	Throttle & Mixture Control Lever	9	Set Screw	15	Tee	21	Bolt
4	Lock Nut	10	Reducer Bushing	16	45° Elbow or Connector Fitting	22	Sleeve
5	Adjustment Screw	11	Connector Fitting	17	90° Elbow or Orifice Fitting Adapter	23	Washer
6	Spring	12	Adapter Assembly	18	Cap	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.

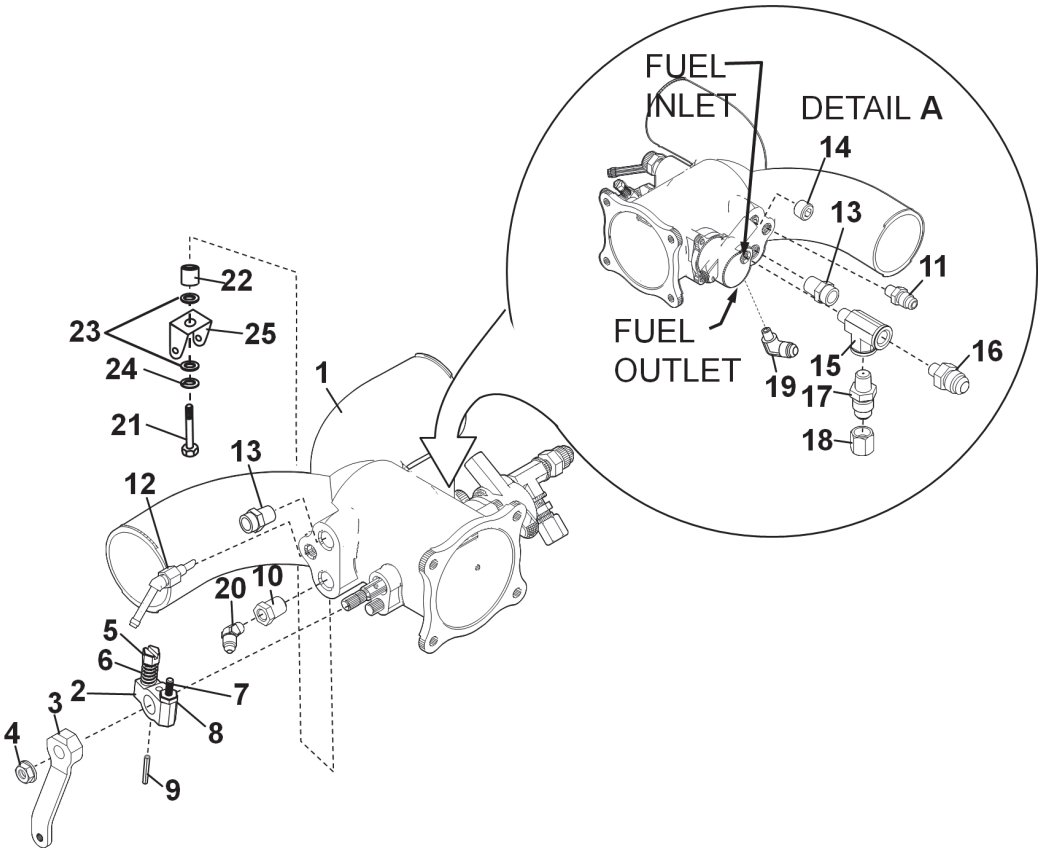


Figure 16-10. Throttle Assembly K

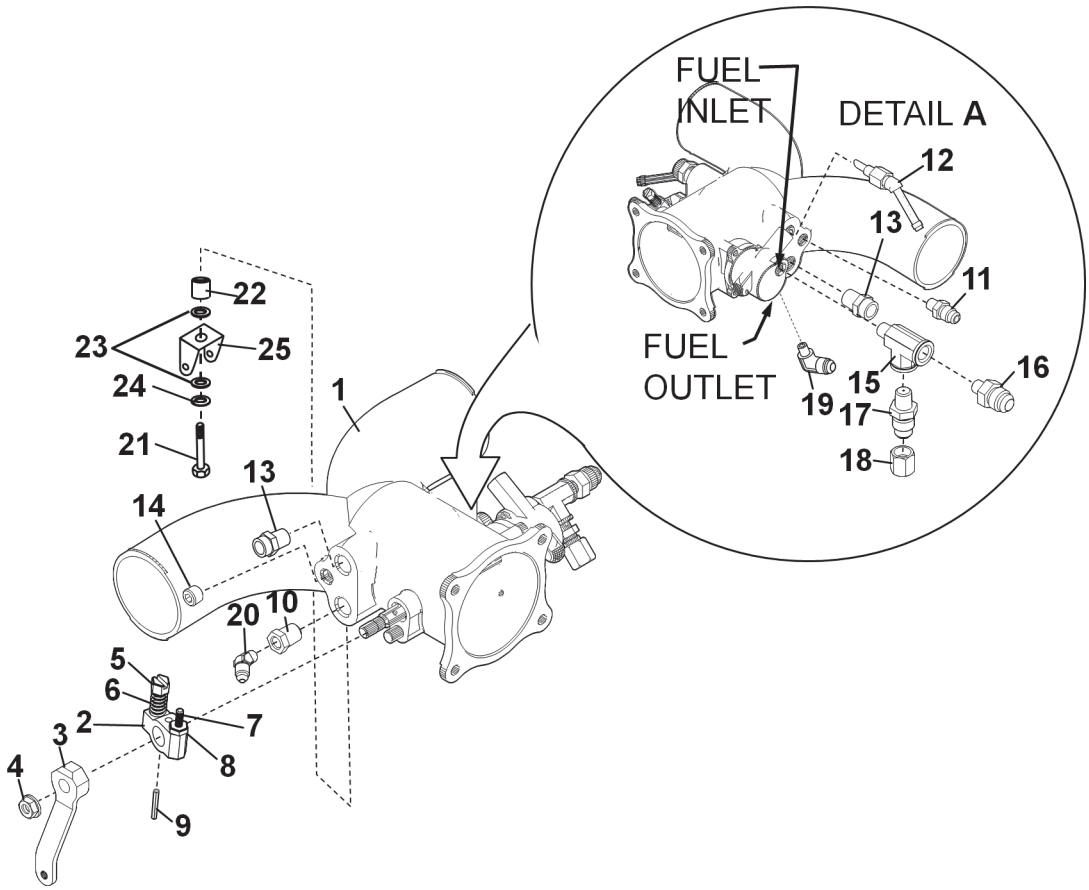


Figure 16-11. Throttle Assembly N

1	Throttle Assembly	8	Nut	15	Tee	22	Sleeve
2	Lever	9	Pin	16	Connector Fitting	23	Washer
3	Throttle & Mixture Control Lever	10	Reducer Bushing	17	Orifice Fitting Adapter	24	Washer
4	Lock Nut	11	Connector Fitting	18	Cap	25	Throttle Body Bracket
5	Adjustment Screw	12	Adapter Assembly	19	90° Elbow		
6	Spring	13	Flex Connector	20	45° Elbow Fitting		
7	Set Screw	14	Plug	21	Bolt		

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.

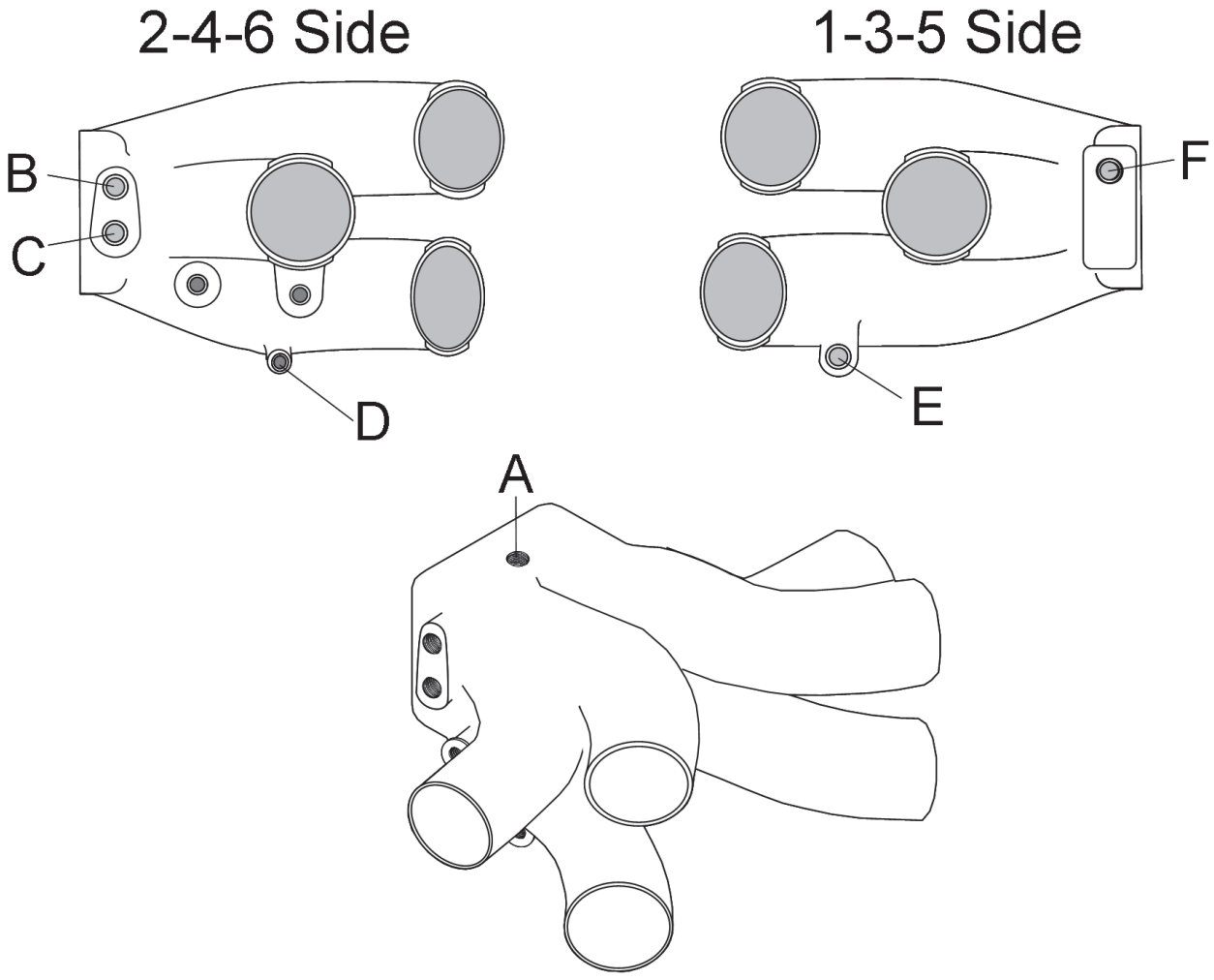


Figure 16-12. Induction Manifold Port Detail

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.

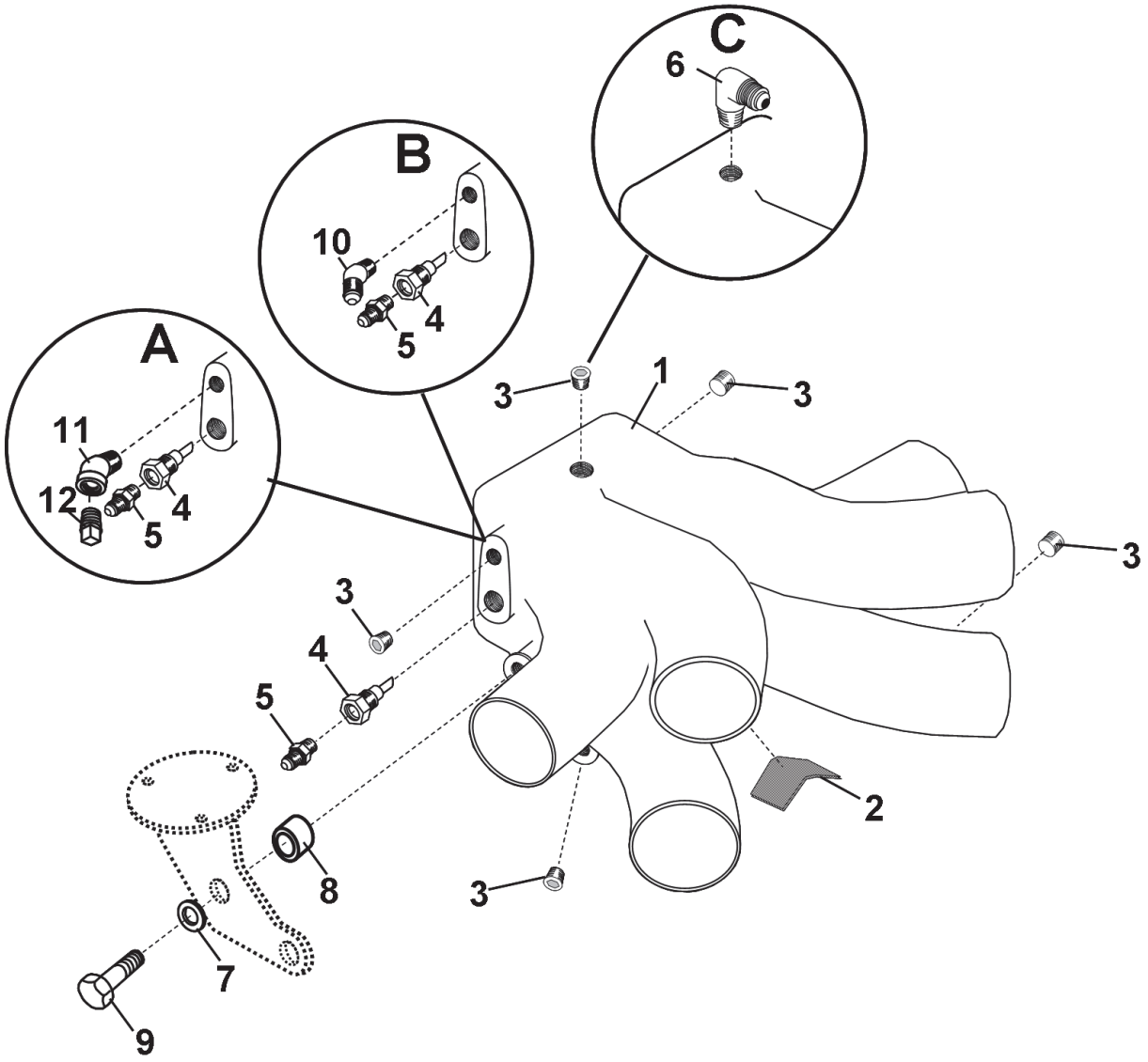


Figure 16-13. Composite Induction Manifold

1	Induction Manifold	4	Adapter Assembly	7	Washer	10	45° Elbow
2	Felt Bumper Pad	5	Nipple Connector	8	Spacer	11	45° Street Elbow
3	Plug	6	90° Elbow	9	Bolt	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.

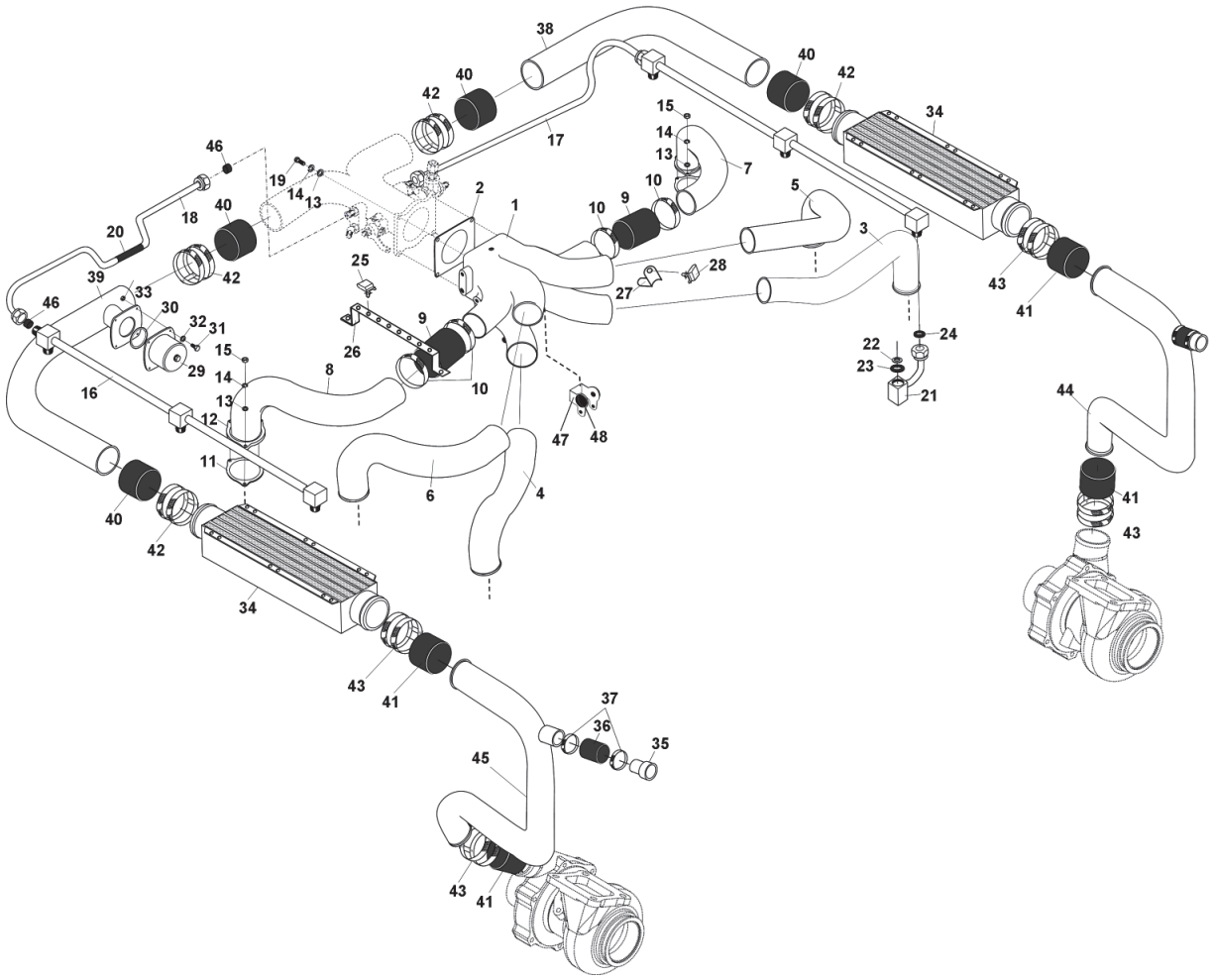


Figure 16-14. Induction System G

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.

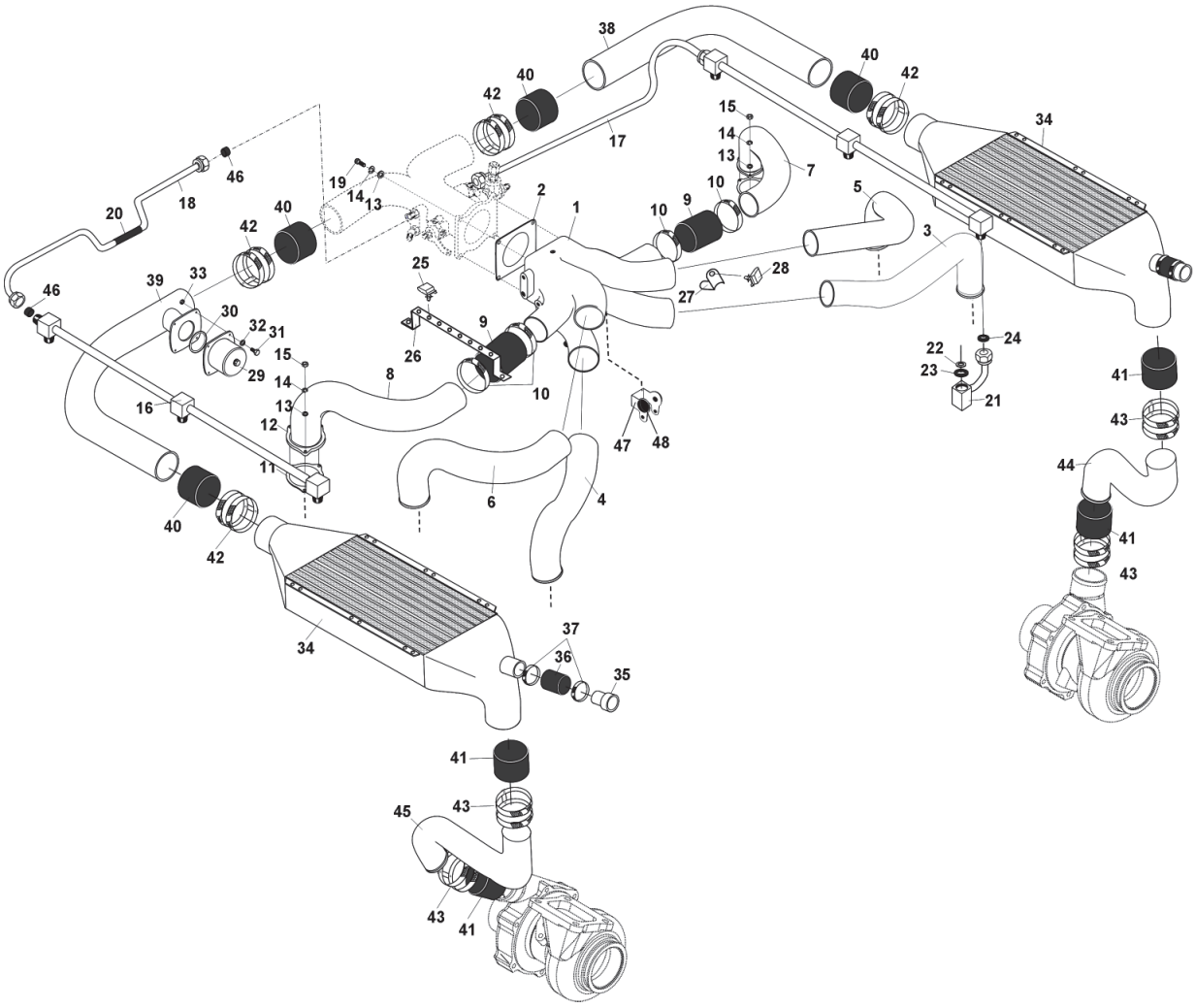


Figure 16-15. Induction System B C E K N

1	Induction Manifold	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Distribution Tube Bracket	38	Induction Tube, 1-3-5 FWD
3	Intake Tube, #1 Cylinder	15	Nut	27	Fuel Injection Line Bracket	39	Induction Tube, 1-3-5 FWD
4	Intake Tube, #2 Cylinder	16	Tube Assembly	28	Tube Clamp	40	Intake Hose
5	Intake Tube, #3 Cylinder	17	Tube Assembly, Right	29	Overboost Valve	41	Hose
6	Intake Tube, #4 Cylinder	18	Tube Assembly, Left	30	O-Ring Seal	42	Clamp Assembly
7	Intake Tube, #5 Cylinder	19	Screw	31	Bolt	43	Clamp Assembly
8	Intake Tube, #6Cylinder	20	Hose	32	Washer	44	Induction Tube, 1-3-5 AFT
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	Induction Tube, 1-3-5 AFT
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Gasket	23	Washer	35	Sonic Venturi Nozzle		
12	Intake Manifold Tube Flange	24	Compression Seal	36	Hose		

16-3. Alternator Assembly

Refer to the “Gear Driven Alternator Replacement” instructions in Section 10-4.1 of M-0, Standard Practice Maintenance Manual.

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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.

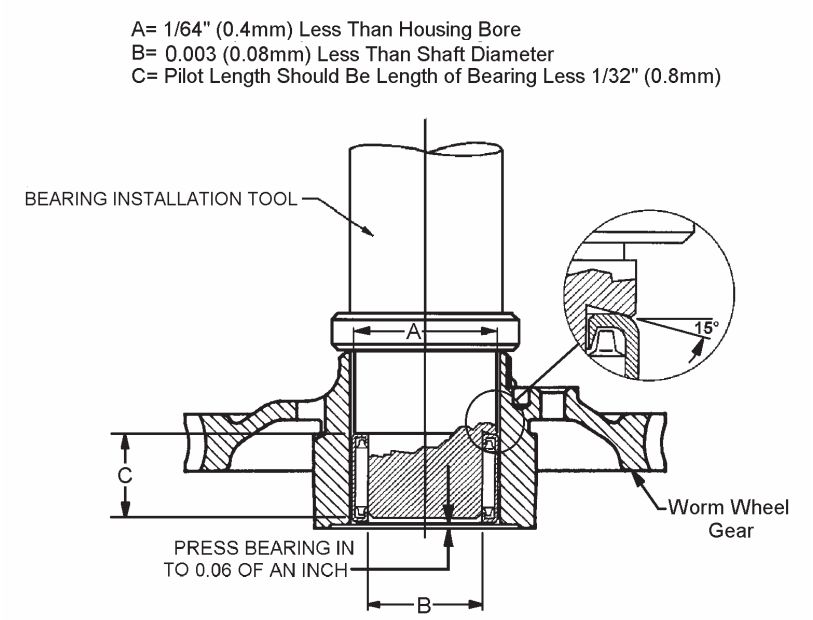


Figure 16-16. Worm Wheel Gear Roller Bearing Installation

5. Lubricate the inside diameter of the clutch spring (Figure 16-17) (17) liberally with clean 50 weight aviation engine oil.

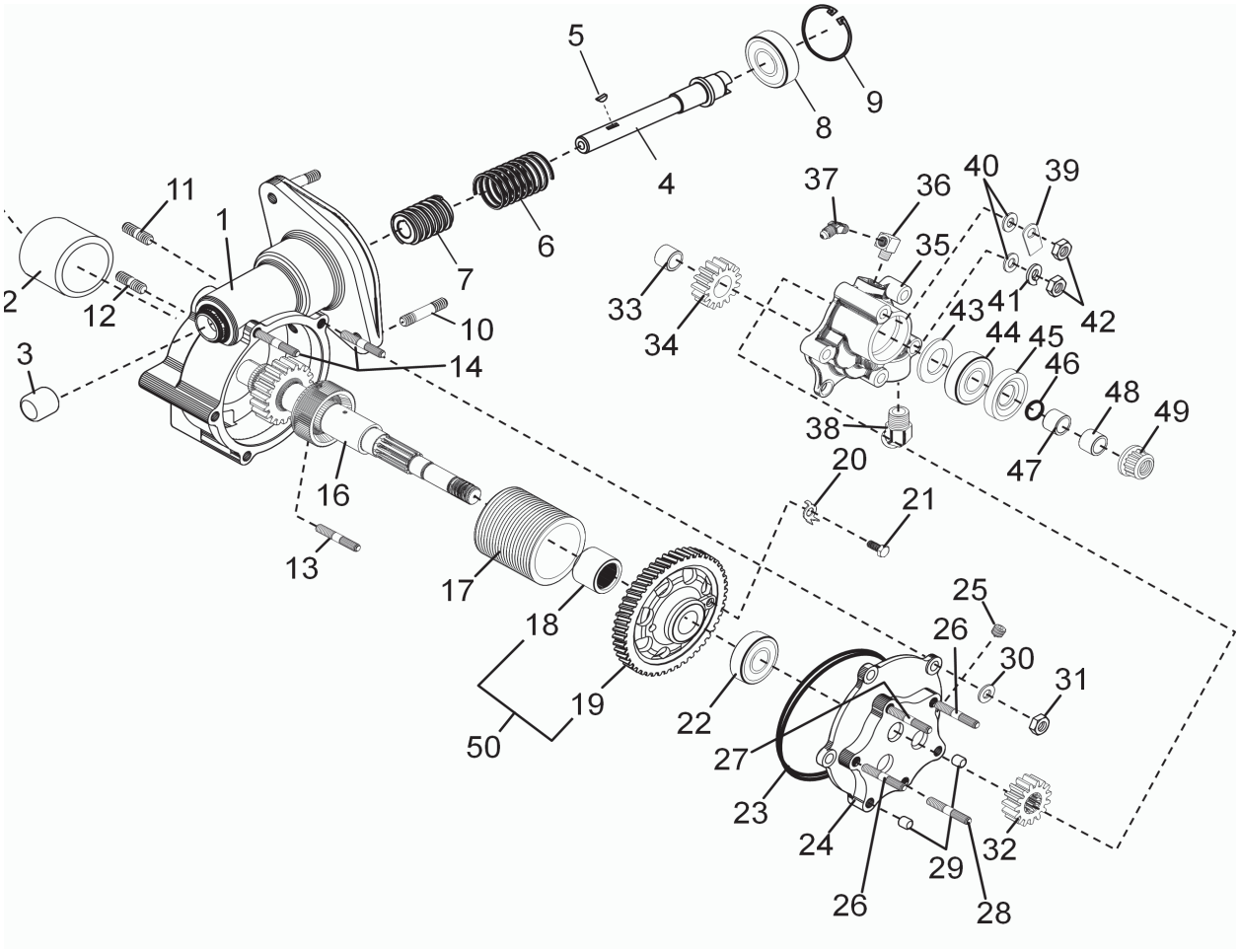


Figure 16-17. Starter and Adapter with Scavenge Pump and Accessory Drive

1	Starter Adapter Housing	14	Stud	27	Stud	40	Washer
2	Sleeve, Clutch Spring	15	Dowel	28	Stud	41	Lock Washer
3	Needle Bearing	16	Starter Shaft Gear	29	Dowel	42	Nut
4	Worm Drive Shaft	17	Clutch Spring	30	Washer	43	Spacer
5	Woodruff Key	18	Roller Bearing	31	Nut	44	Bearing
6	Starter Spring	19	Starter Worm Gear	32	Scav. Pump Driven Gear	45	Starter Shaft Seal
7	Starter Worm Gear	20	Tab Washer	33	Bushing	46	O-ring Seal
8	Radial Ball Bearing	21	Screw	34	Scav. Pump Driver Gear	47	Starter Shaft Sleeve
9	Internal Retaining Ring	22	Ball Bearing	35	Scav. Pump Body	48	Starter Shaft Spacer
10	Stud	23	O-Ring	36	90° Street Elbow	49	Flanged Nut
11	Stud	24	Cover Assembly	37	45° Elbow		
12	Stud	25	Plug	38	90° Elbow		
13	Stud	26	Stud	39	Seal Retainer Clip		

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.

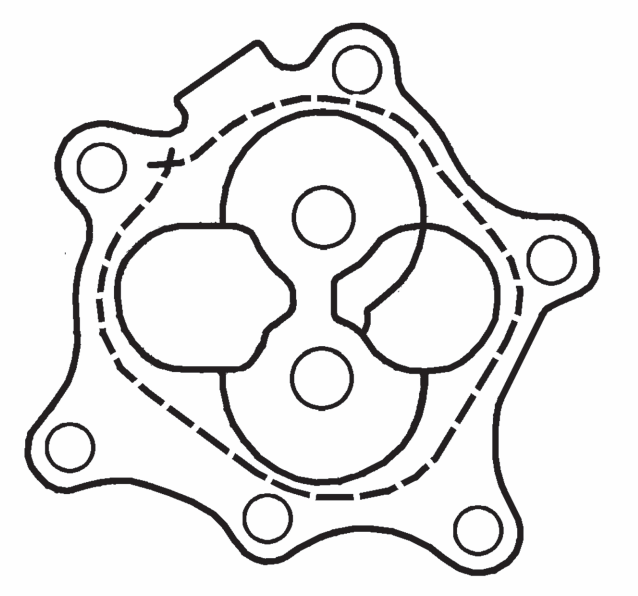


Figure 16-18. Scavenge Pump Body Silk Thread Pattern

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).

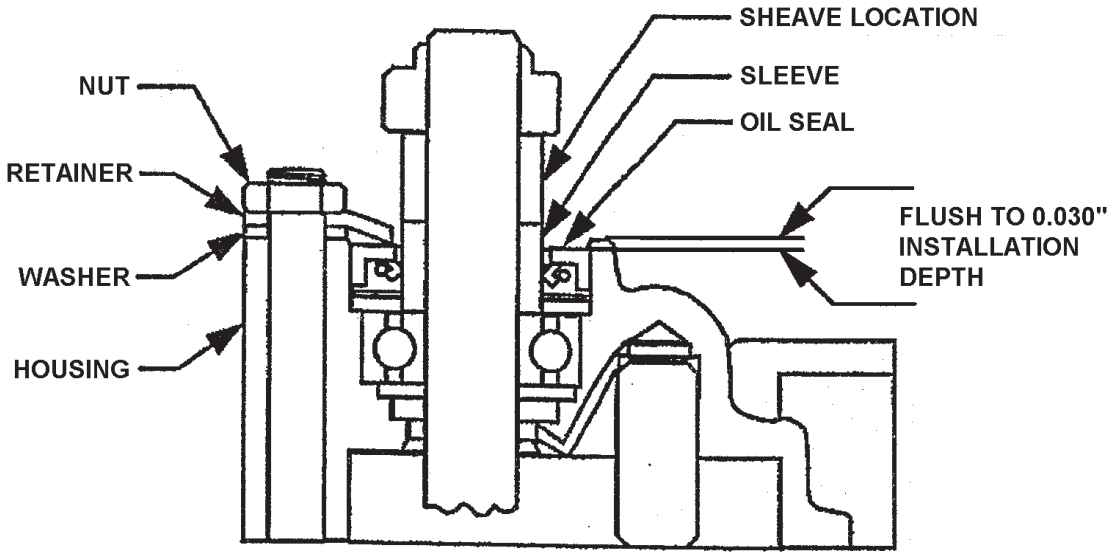


Figure 16-19. Scavenge Pump Oil Seal Position

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.

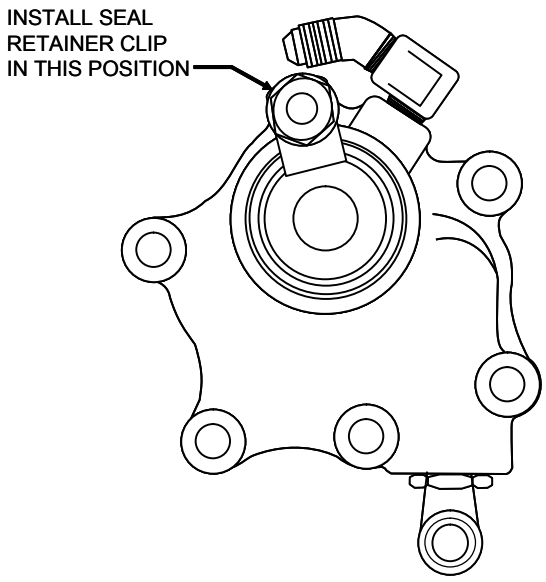


Figure 16-20. Seal Retainer Clip Position

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.

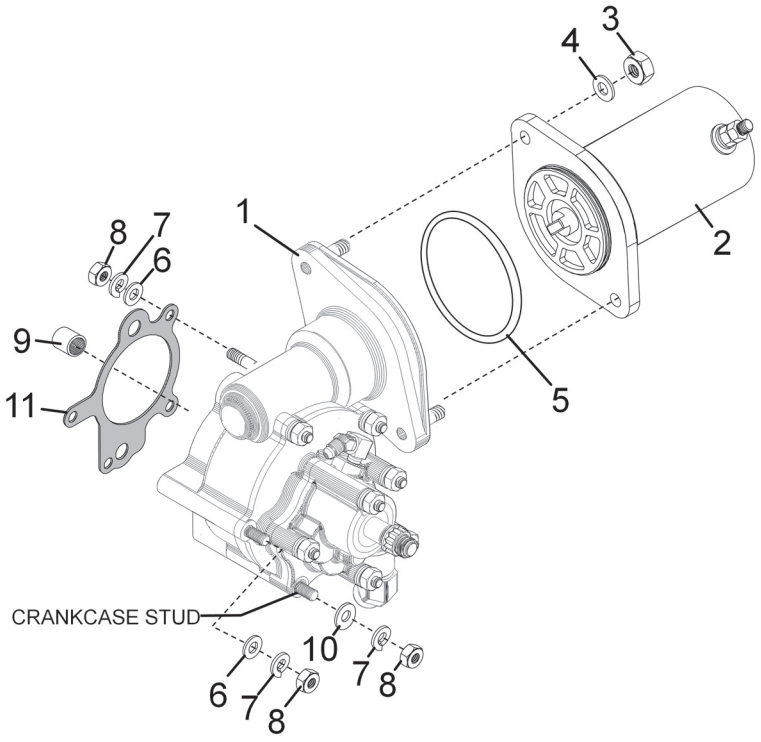


Figure 16-21. Starter and Starter Adapter Assembly

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.
4. Torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
5. Bend the tabs up against the bolt heads with a drift.

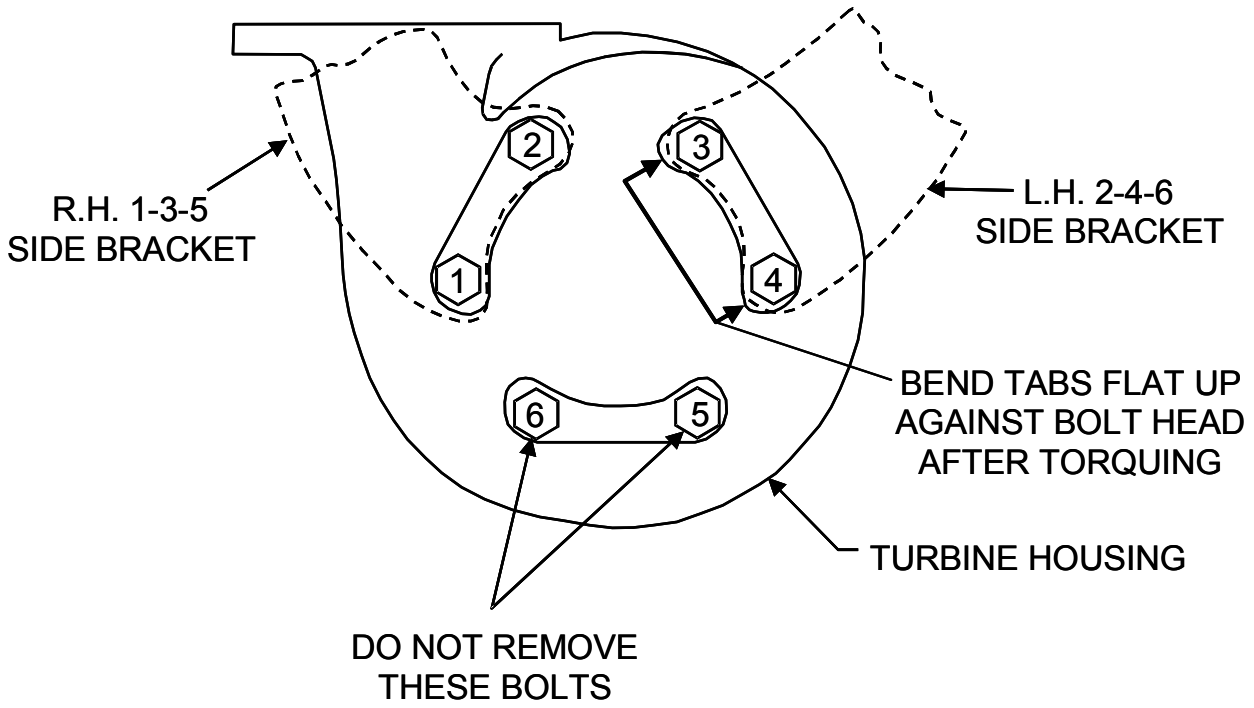


Figure 16-22. Turbocharger Bracket Orientation B C E G K

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.

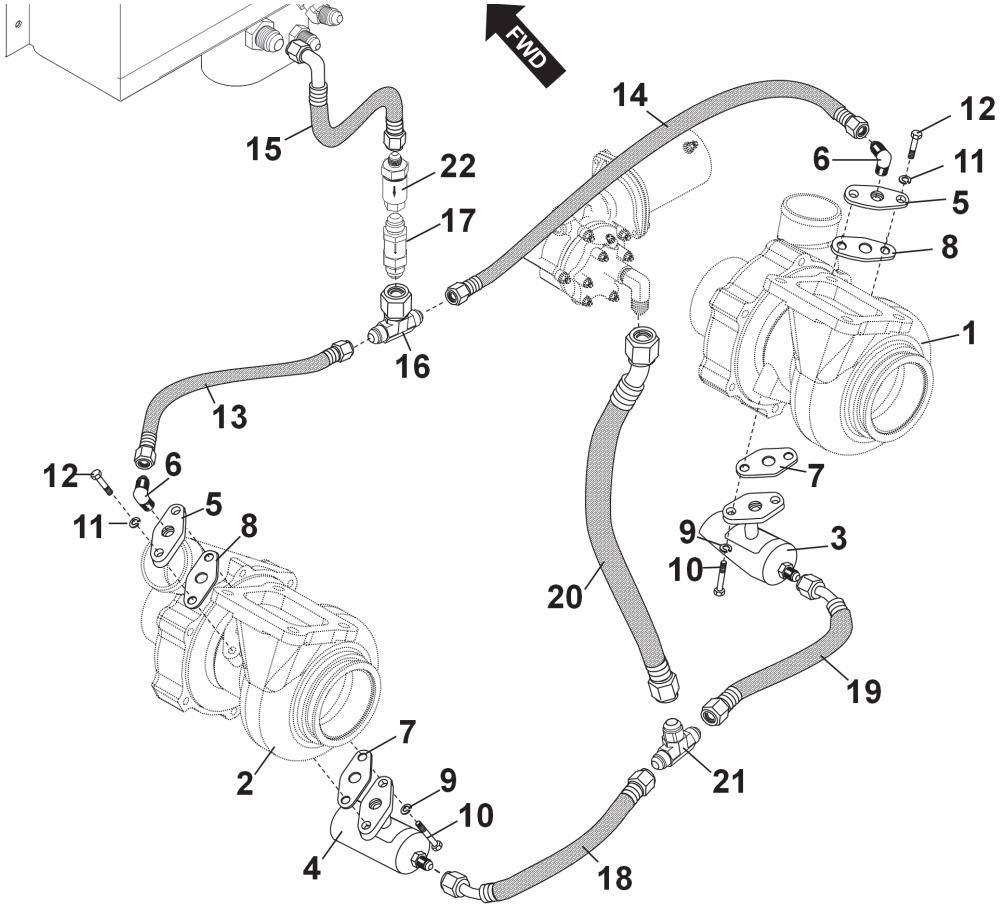


Figure 16-23. Turbocharger Lubrication K N

1	Left Turbocharger	7	Gasket	13	Tee	19	Hose
2	Right Turbocharger	8	Left Oil Reservoir	14	Check Valve	20	Hose
3	Gasket	9	Right Oil Reservoir	15	Hose	21	Hose
4	Adapter	10	Lock Washer	16	Hose		
5	Lock Washer	11	Bolt	17	Hose		
6	Bolt	12	Adapter	18	Tee		

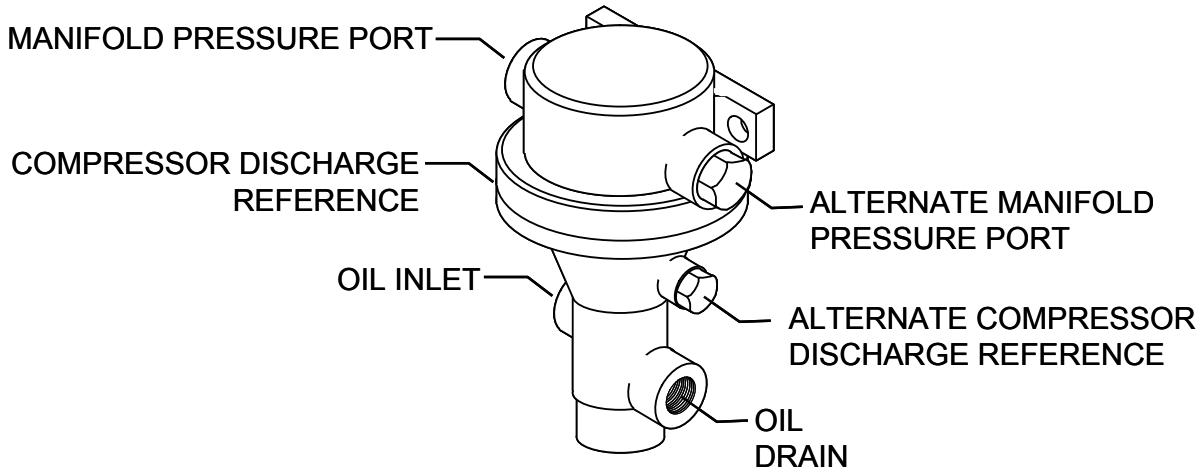


Figure 16-24. Wastegate Controller Ports

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 (47) 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) **B C E G** manifold pressure port or **K N** 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.

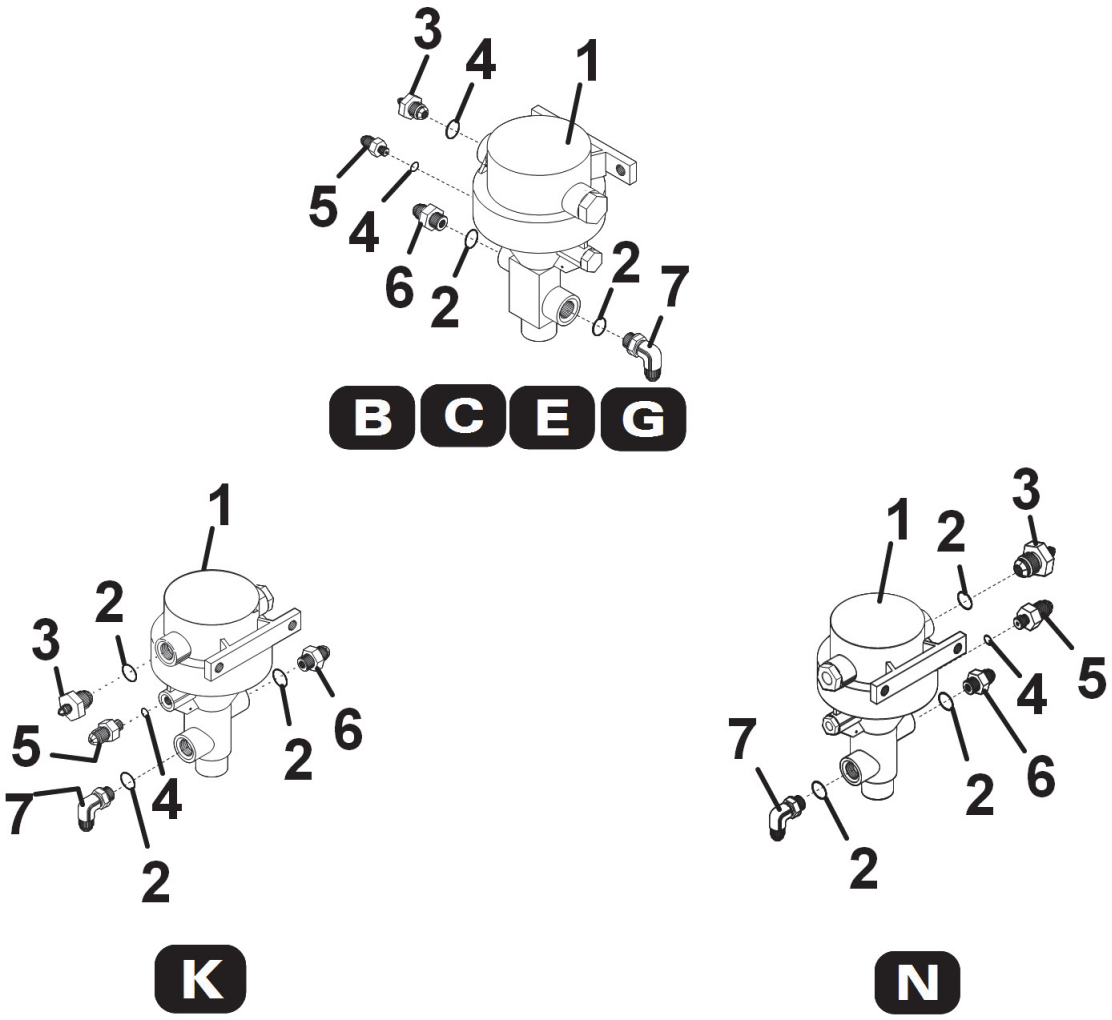


Figure 16-25. Wastegate Controller Fitting Detail

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. K N 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.

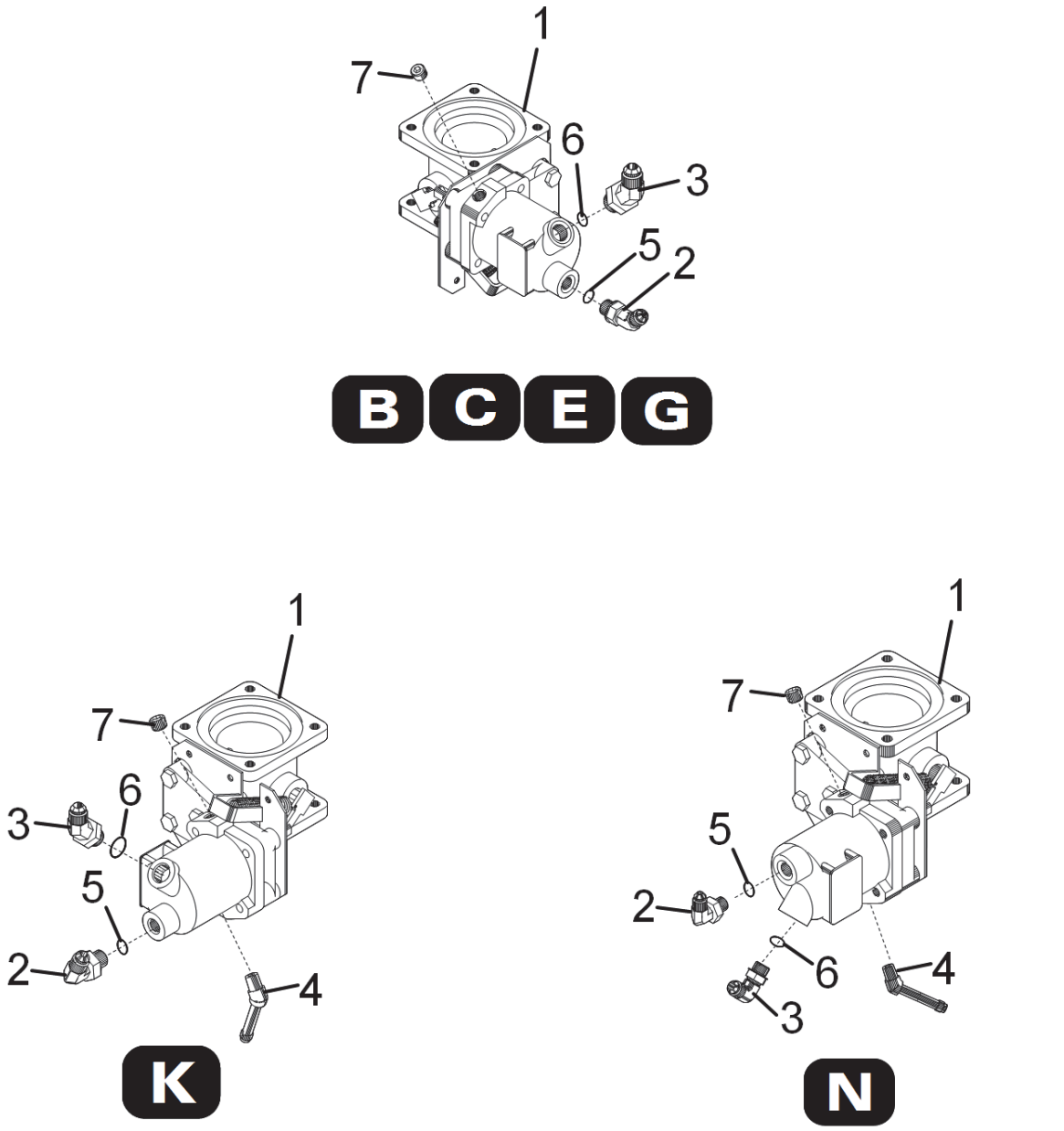


Figure 16-26. Wastegate Fitting Detail

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.

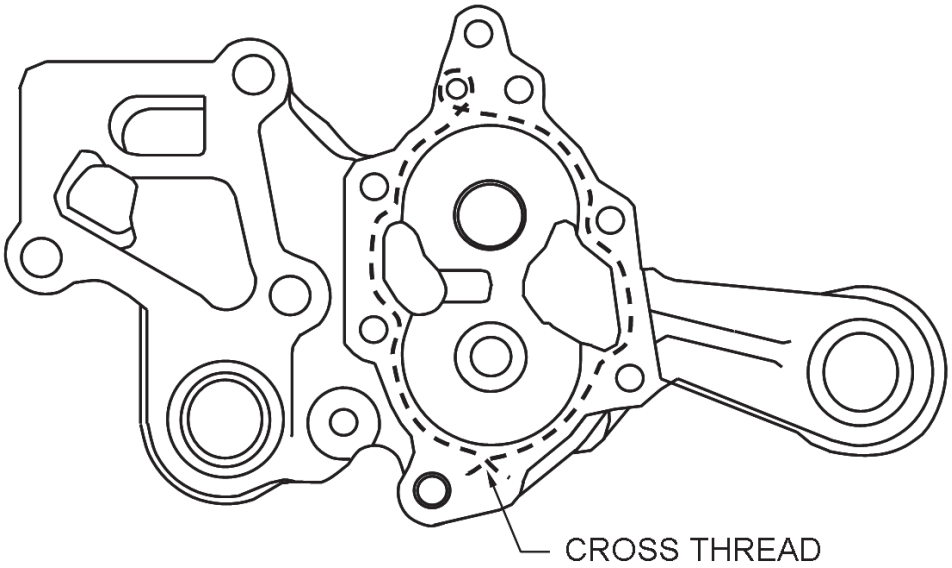


Figure 16-27. Oil Pump Housing Silk Thread Pattern

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 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.

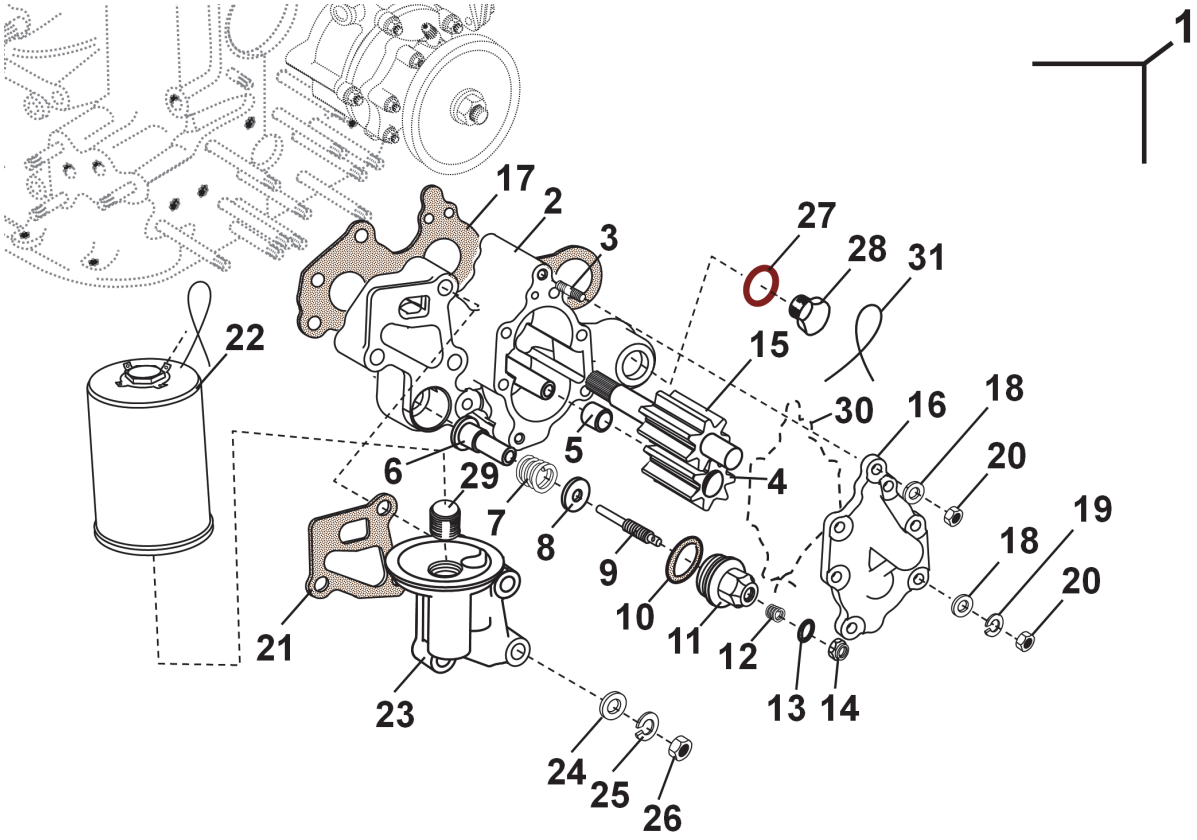


Figure 16-28. Oil Pump Assembly

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		

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.

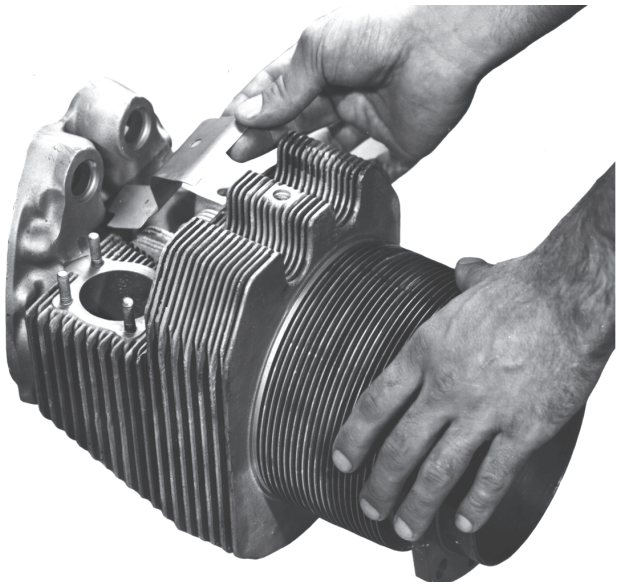


Figure 16-29. Cylinder Baffle Installation

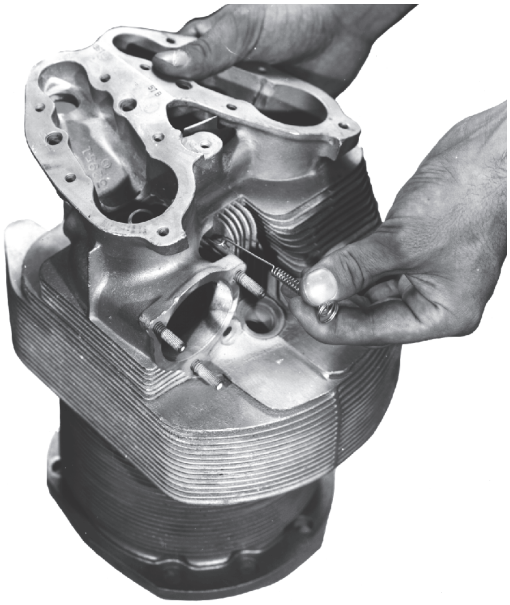


Figure 16-30. Secure Baffle with Spring

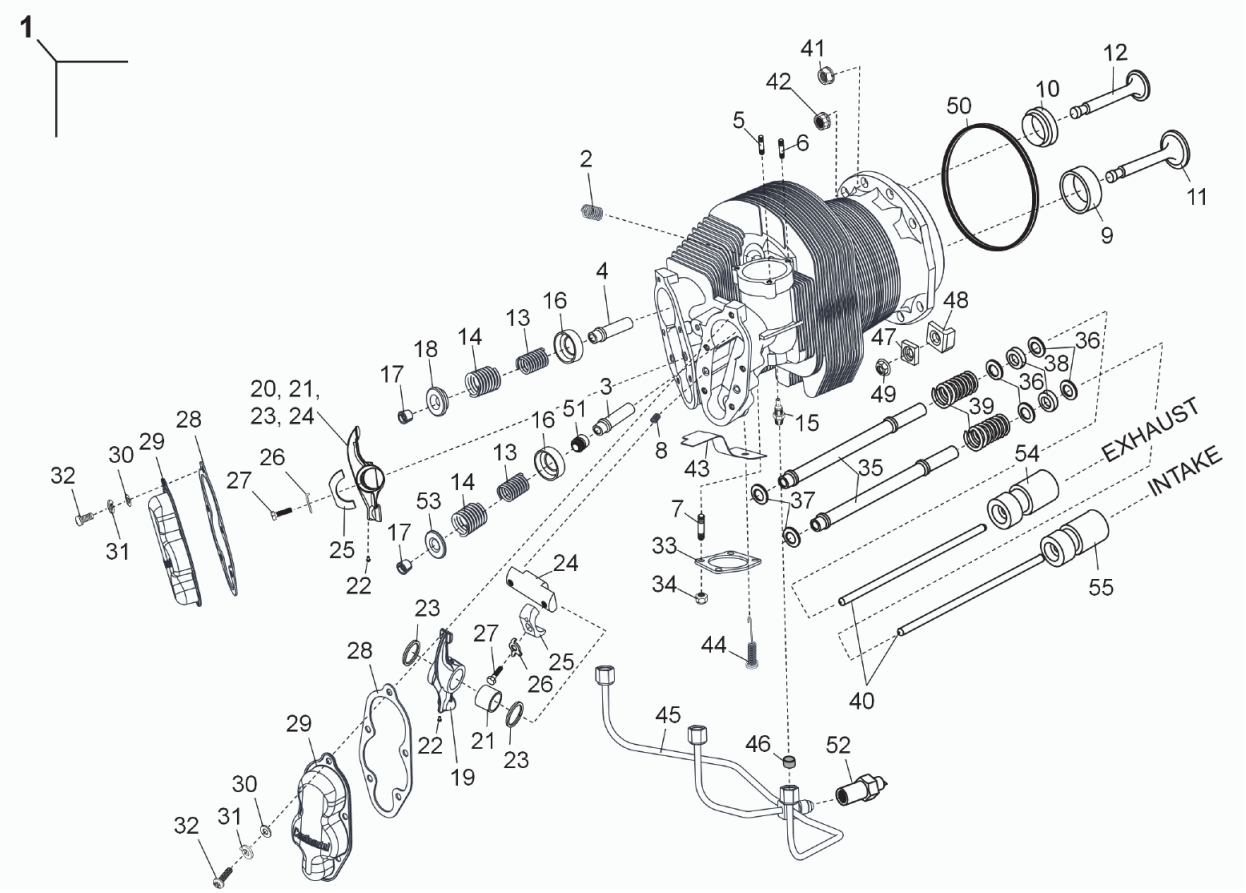


Figure 16-31. Cylinder Assembly

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 <u>any</u> 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 <u>any</u> 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.

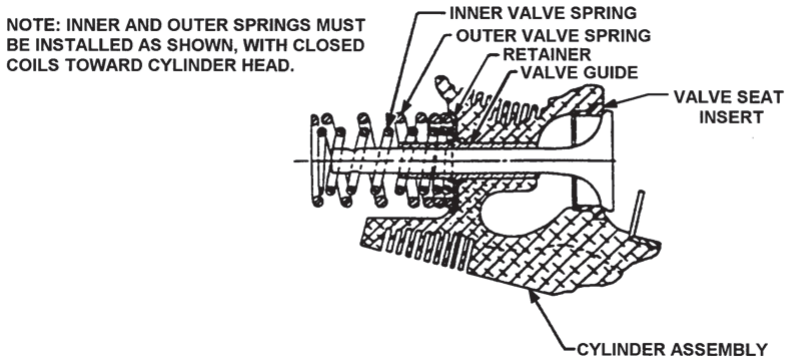


Figure 16-32. Valve Spring Installation

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.

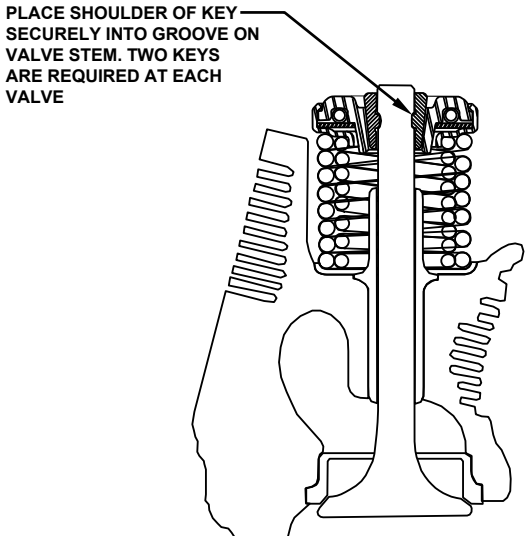


Figure 16-33. Valve Retainer Key Installation

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.

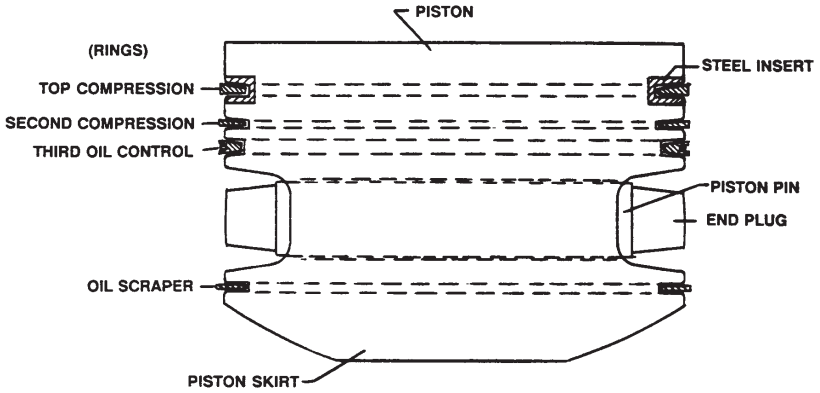


Figure 16-34. Piston Ring Installation Order

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.

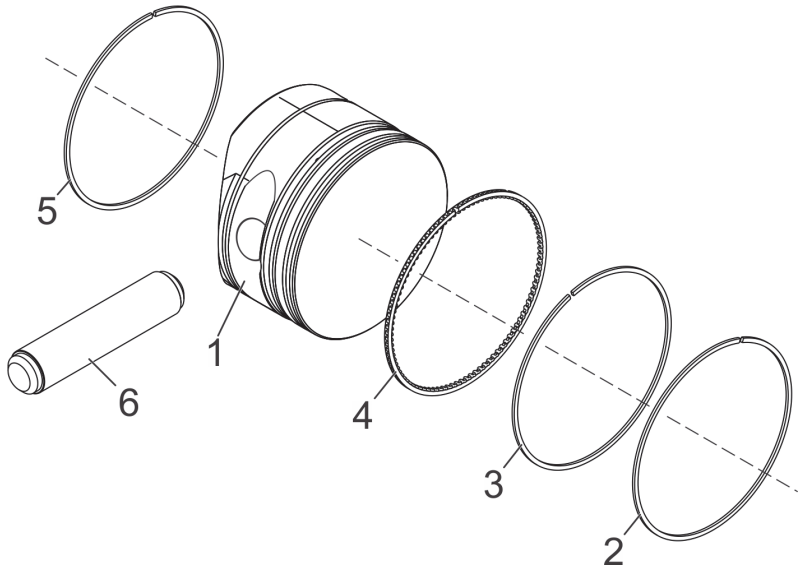


Figure 16-35. Piston, Piston Pin and Rings

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.

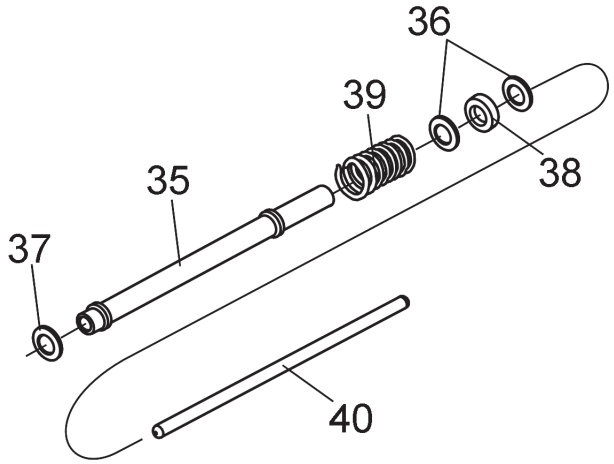


Figure 16-36. Pushrod Tube Assembly

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.

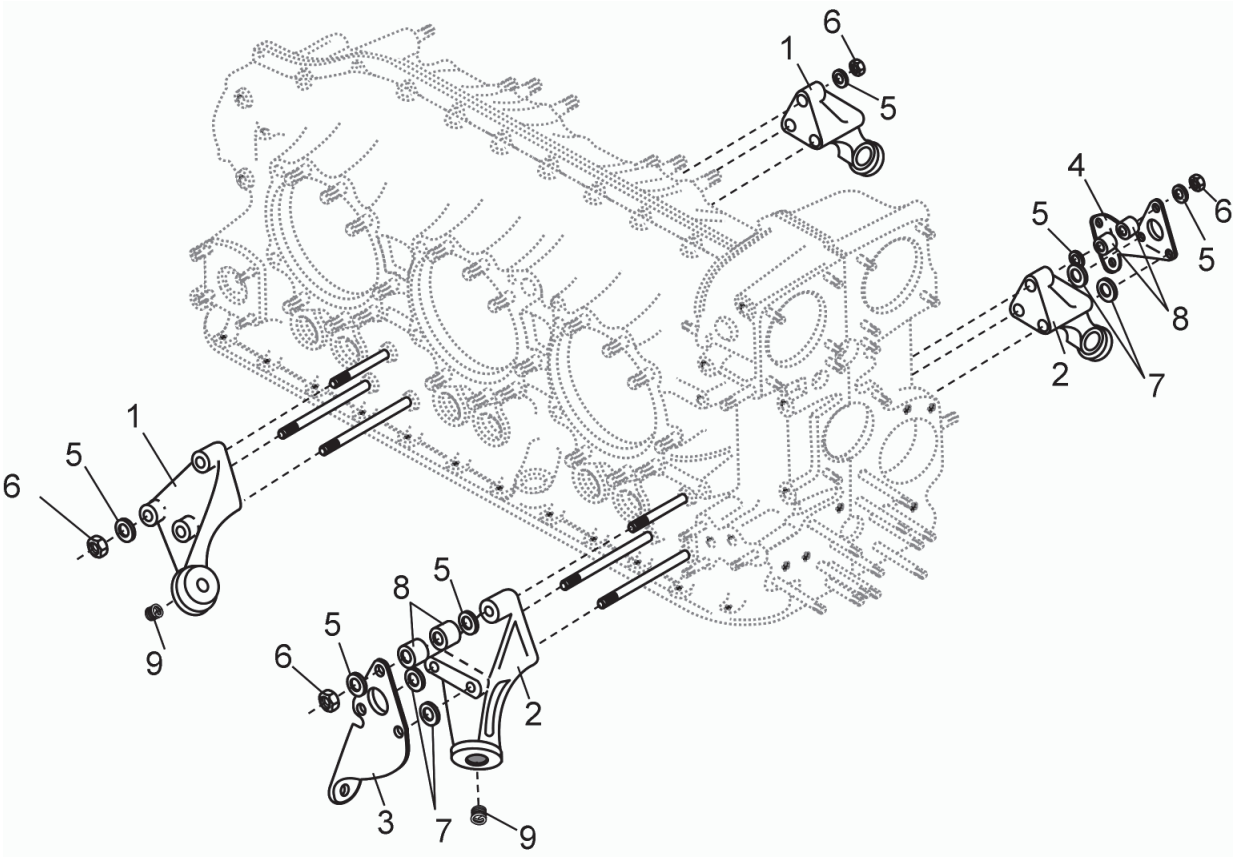


Figure 16-37. Engine and Turbocharger Mounting Brackets B C E G

1	Fwd Engine Mount	4	Right Turbo Support Bracket	7	Washer
2	Aft Engine Mount	5	Washer	8	Spacer
3	Left Turbo Support Bracket	6	Nut	9	Heli-Coil Insert

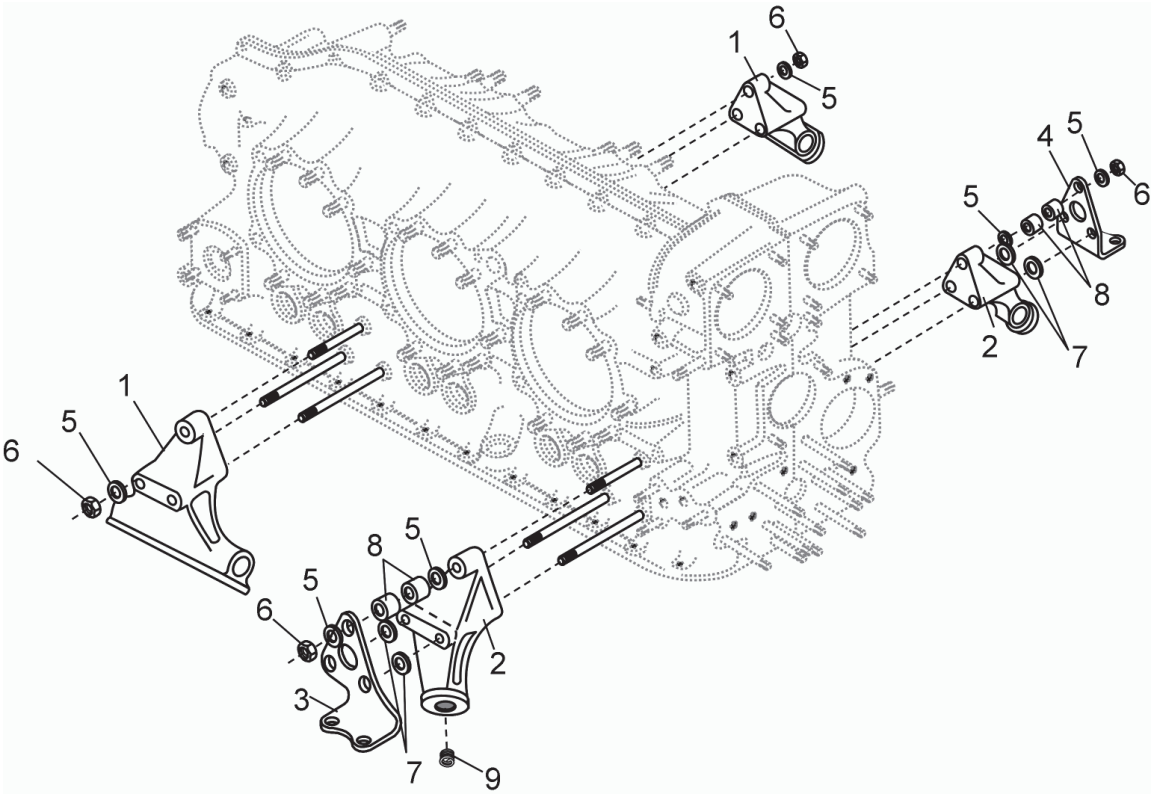


Figure 16-38. Engine and Turbocharger Mounting Brackets K

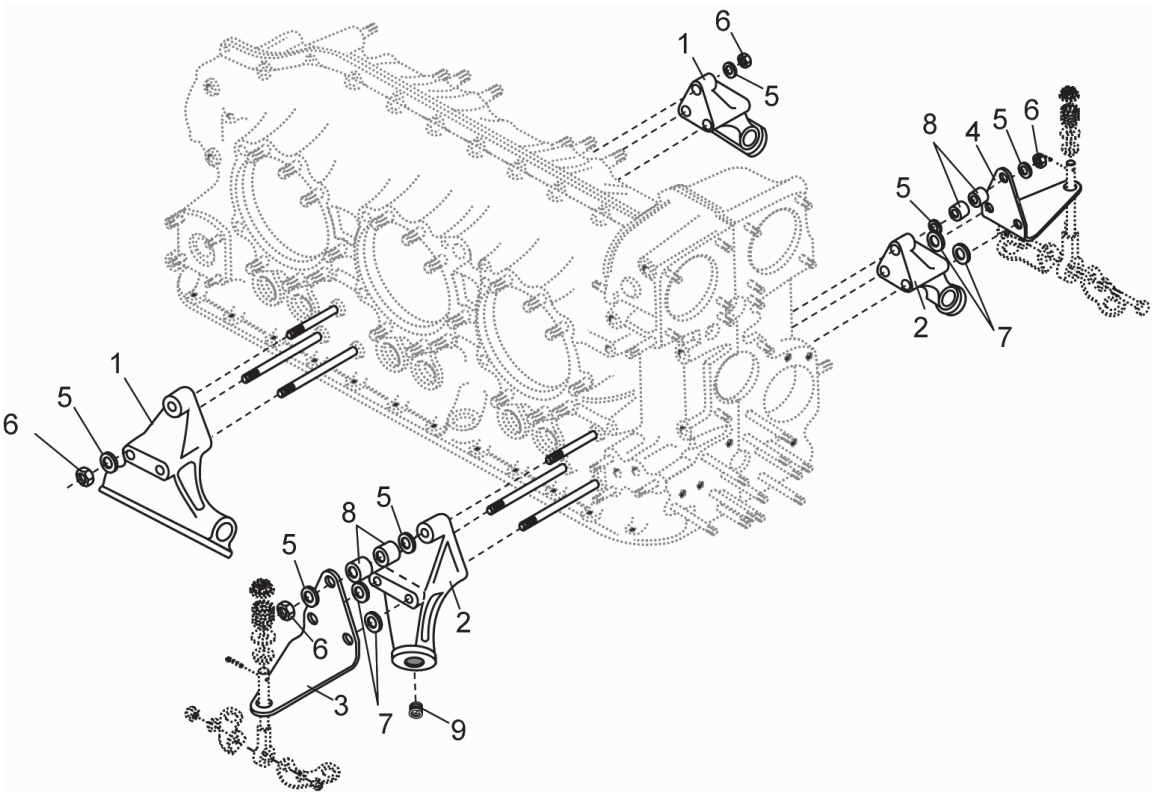


Figure 16-39. Engine and Turbocharger Mounting Brackets N

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.

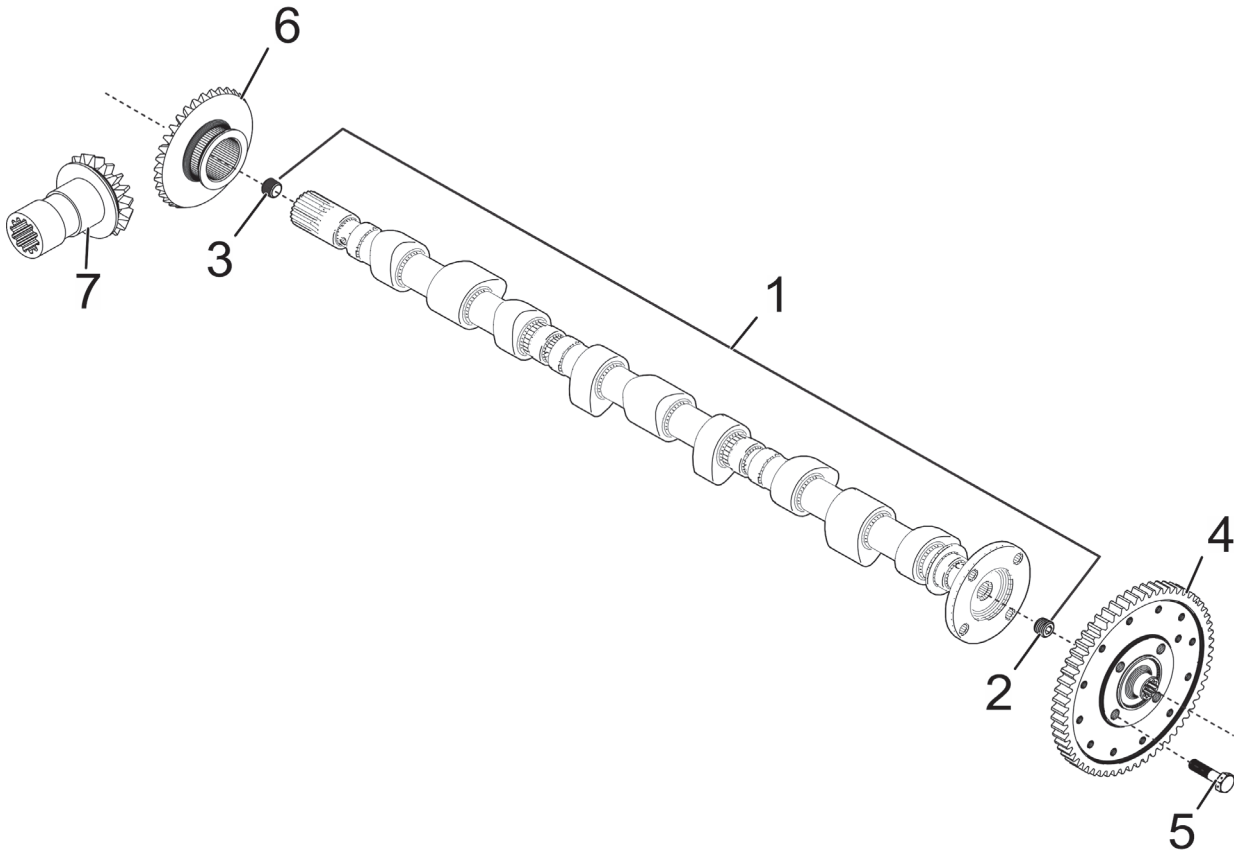


Figure 16-40. Camshaft Assembly

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.

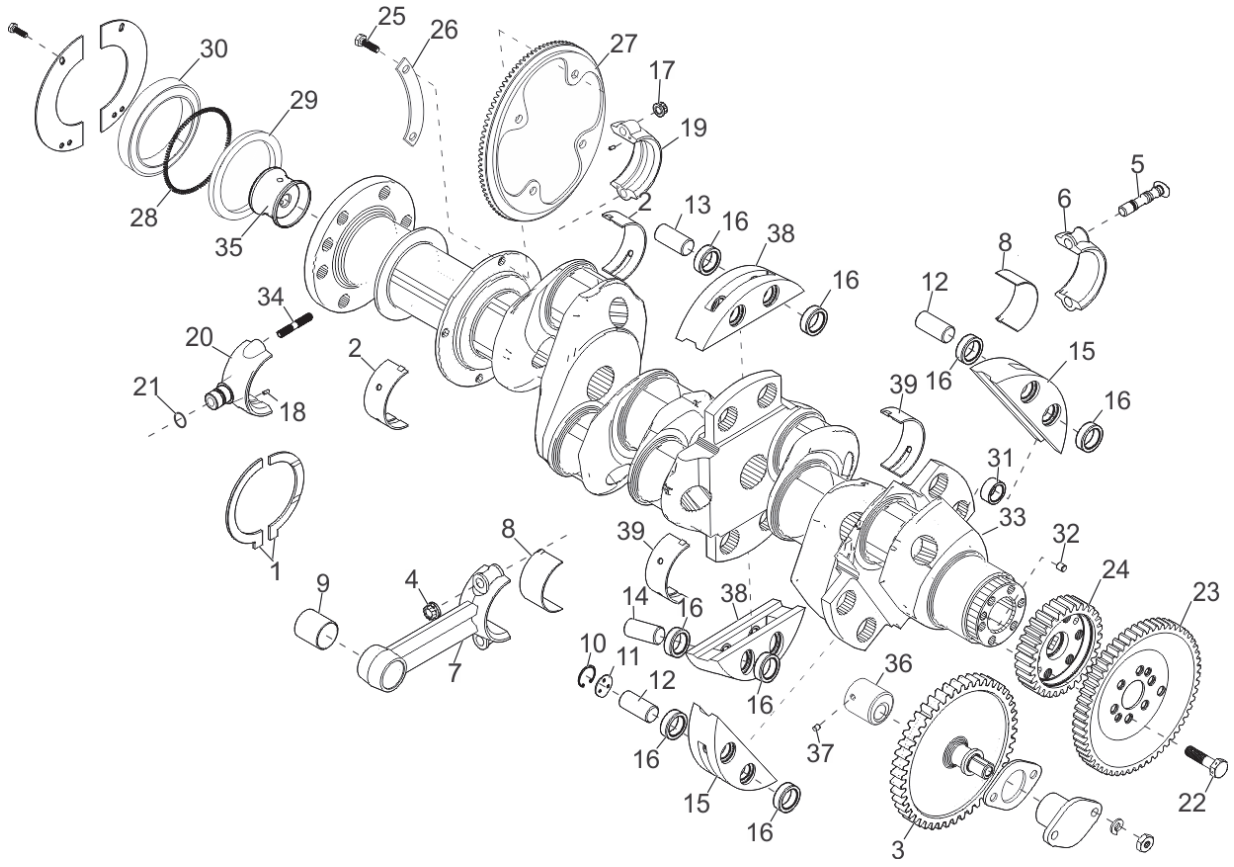


Figure 16-41. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	C'shaft Main Bearing, 4 & 5	12	6th Order Counterweight Pin	22	Drilled Head Screw	32	Crankshaft Dowel
3	Idler Gear	13	4th Order Counterweight Pin	23	Large Gear Cluster	33	Crankshaft
4	Spiral Lock Nut	14	5th Order Counterweight Pin	24	Small Gear Cluster	34	Stud
5	Connecting Rod Bolt	15	Counterweight Assembly	25	Bolt	35	Oil Transfer Plug
6	Connecting Rod Cap	16	Counterweight Bushing	26	Tab Lock Plate	36	Idler Gear Bushing
7	Connecting Rod	17	Lock Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring	38	Counterweight Assembly
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring	39	C'shaft Main Bearing, Rear & Intermediate
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

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.

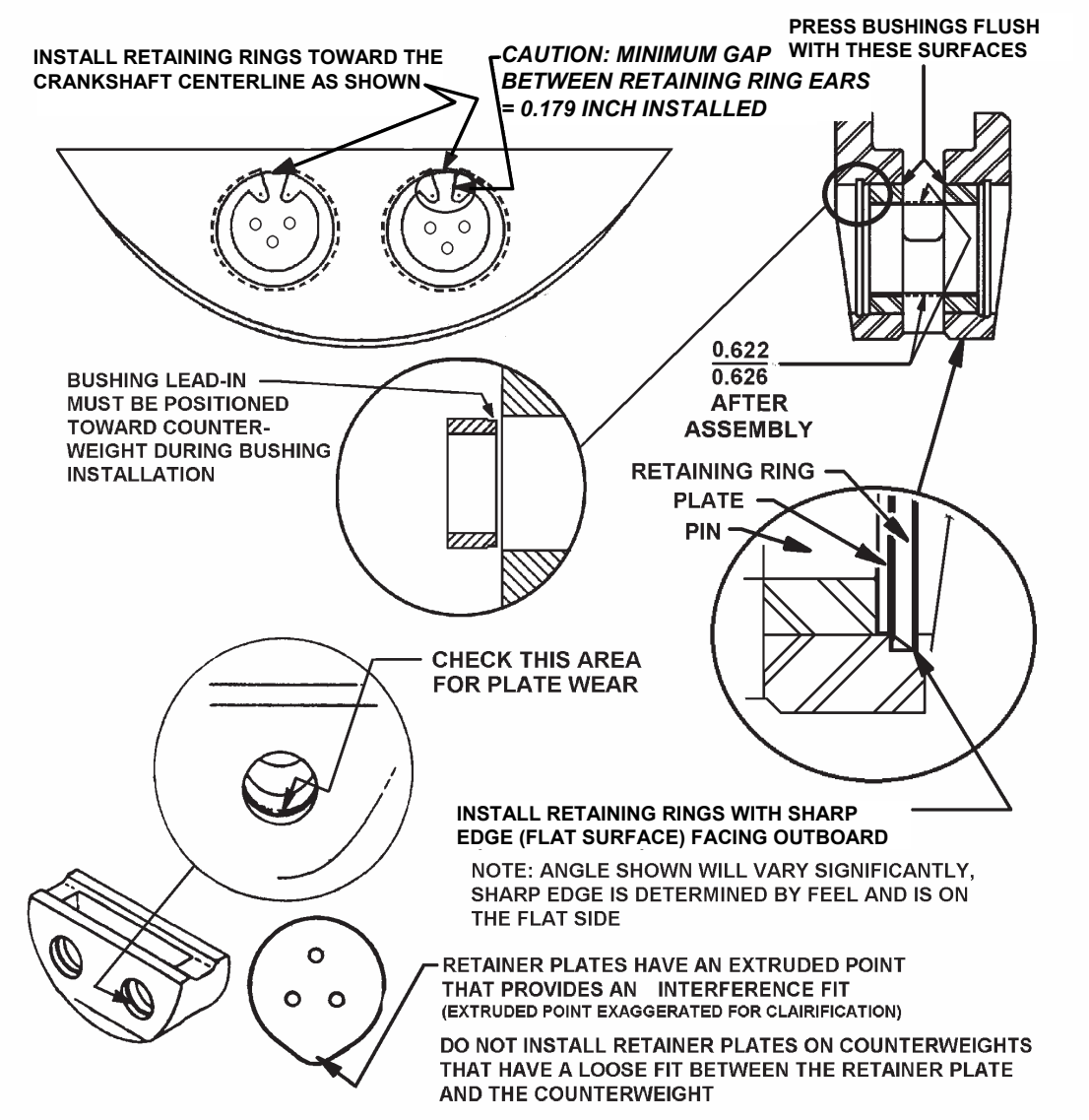


Figure 16-42. Counterweight Inspection, Repair and Installation

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.

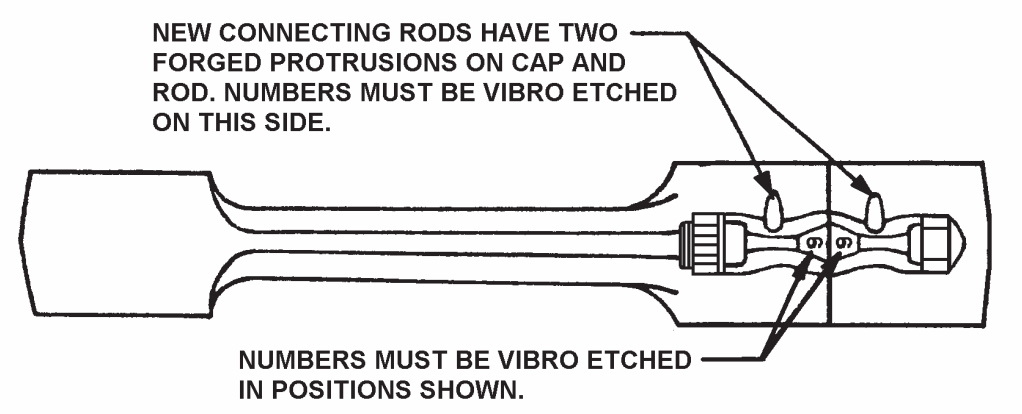


Figure 16-43. Connecting Rod Position Number

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

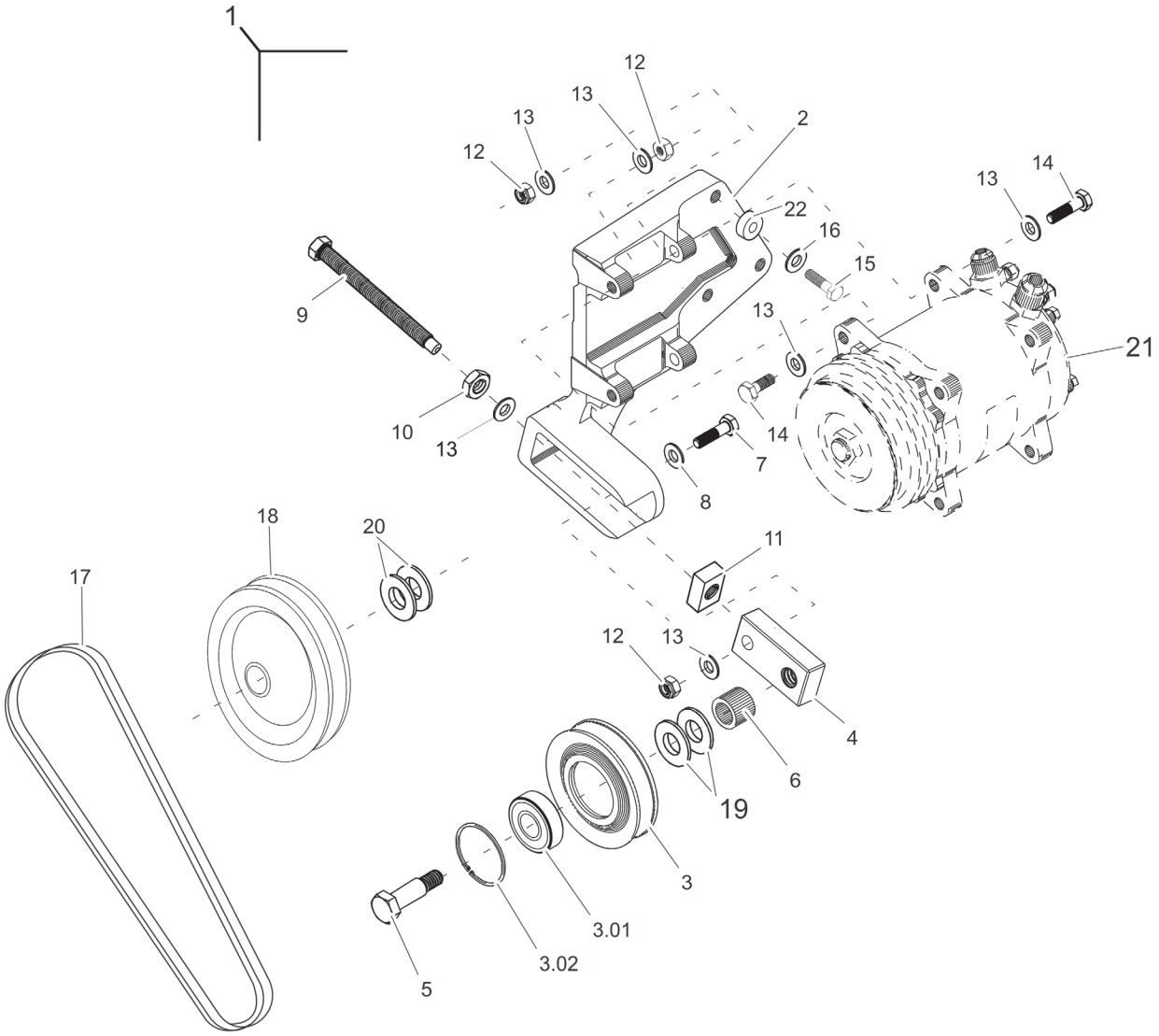
Install the Crankshaft Nose Oil Seal according to the "Split Type Nose Oil Seal Installation" instructions in Section 10-10.4 of M-0, Standard Practice Maintenance Manual.

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.



ITEMS 2 THRU 14 INCLUDED IN ITEM 1

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

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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 <u>any</u> 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 <u>any</u> 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.

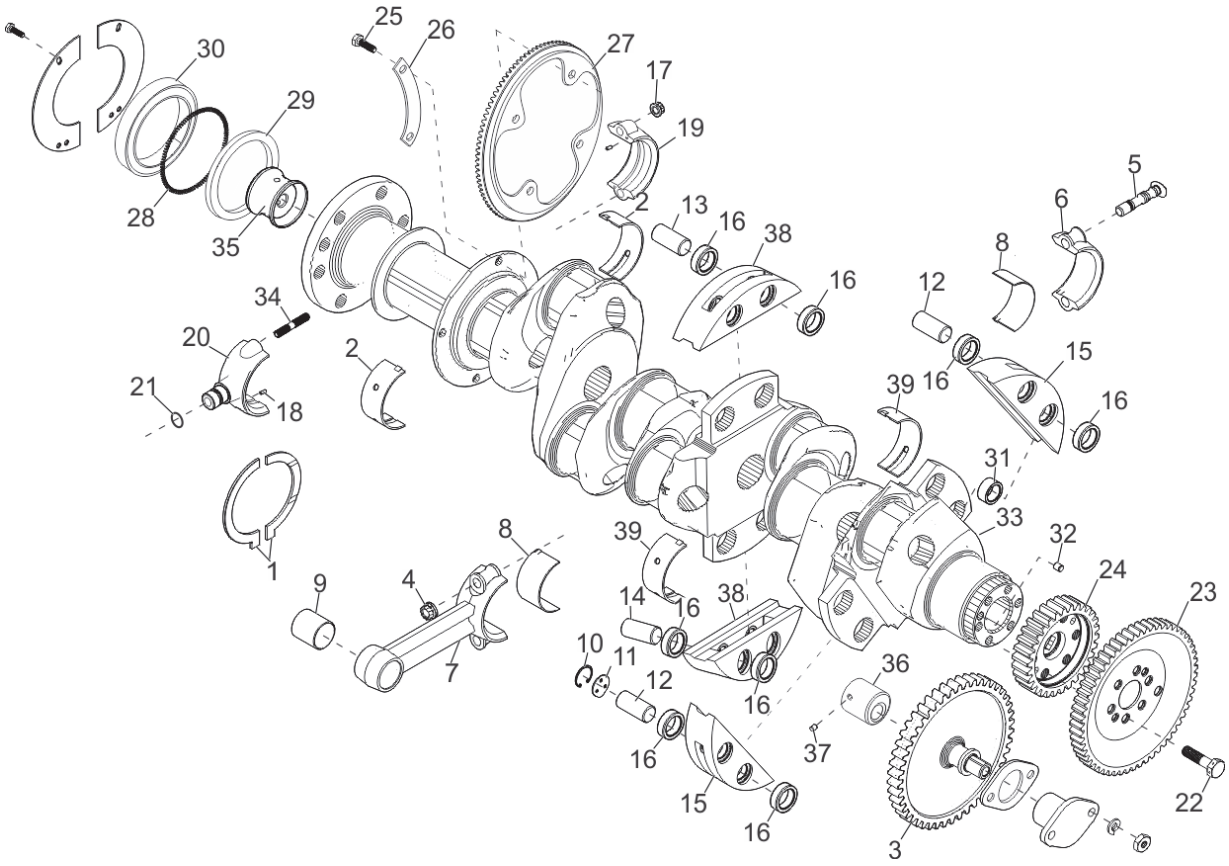


Figure 17-1. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	C'shaft Main Bearing, 4 & 5	12	6th Order Counterweight Pin	22	Drilled Head Screw	32	Crankshaft Dowel
3	Idler Gear	13	4th Order Counterweight Pin	23	Large Gear Cluster	33	Crankshaft
4	Spiral Lock Nut	14	5th Order Counterweight Pin	24	Small Gear Cluster	34	Stud
5	Connecting Rod Bolt	15	Counterweight Assembly	25	Bolt	35	Oil Transfer Plug
6	Connecting Rod Cap	16	Counterweight Bushing	26	Tab Lock Plate	36	Idler Gear Bushing
7	Connecting Rod	17	Lock Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring	38	Counterweight Assembly
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring	39	C'shaft Main Bearing, Rear & Intermediate
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

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).

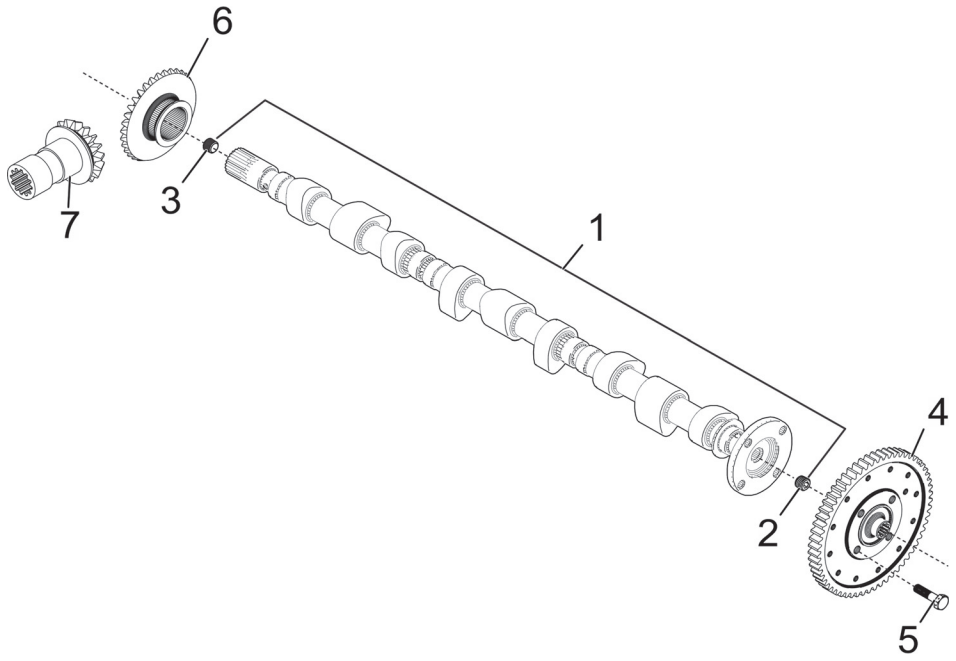


Figure 17-2. Camshaft Assembly

1	Camshaft Assembly	3	Plug	5	Bolt	7	Governor Driven Gear
2	Plug	4	Camshaft Gear	6	Governor Drive Gear		

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.

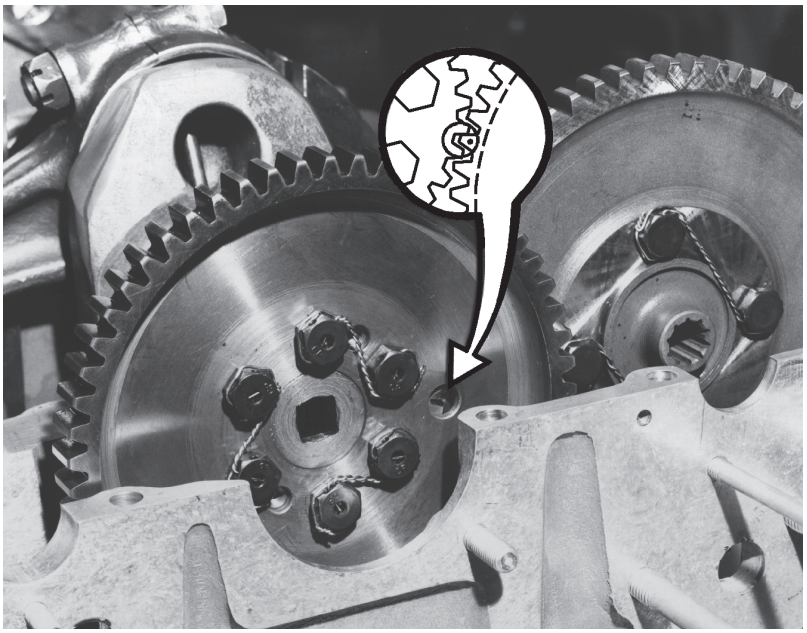


Figure 17-3. Timing Mark Alignment

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.
26. Coat the camshaft lobes with Dow Corning G-N Paste.

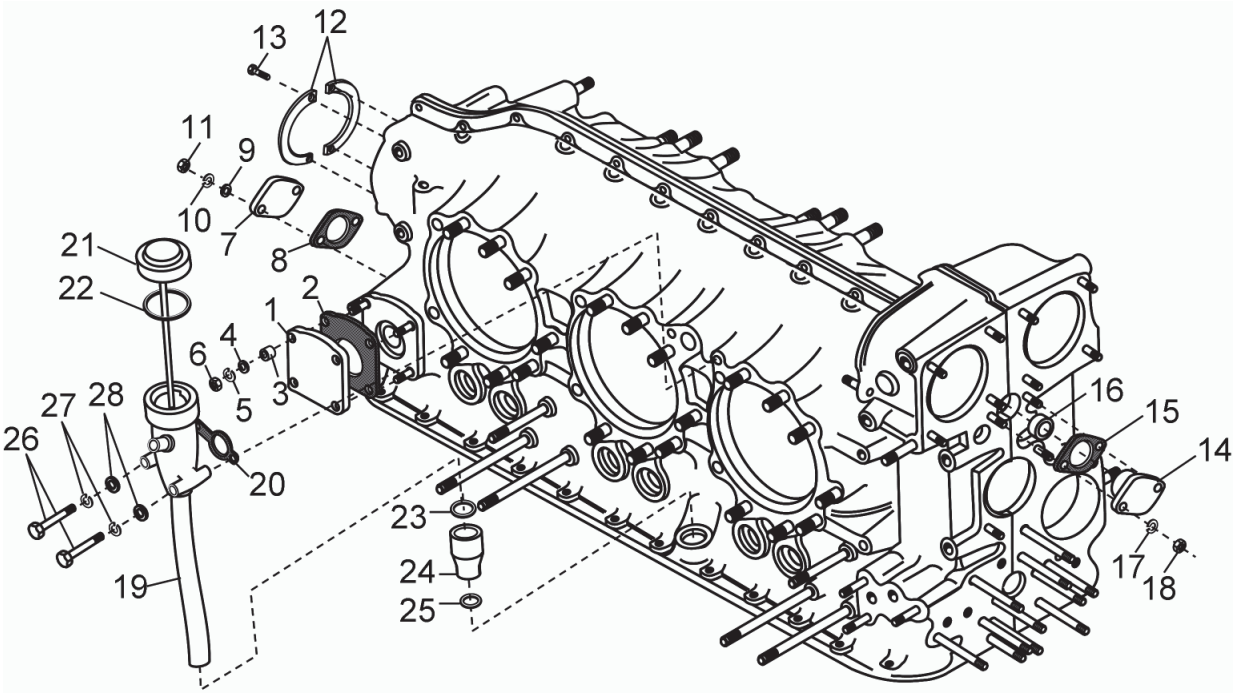


Figure 17-4. Miscellaneous Crankcase Hardware

1	Cover	8	Camshaft Cover Gasket	15	Idler Pin Cover Gasket	22	Oil Filler Gasket
2	Gasket	9	Washer	16	Idler Gear Bushing	23	O-ring
3	Spacer	10	Lock Washer	17	Lock Washer	24	Adapter
4	Washer	11	Nut	18	Nut	25	O-ring
5	Lock Washer	12	Gasket	19	Oil Filler Assembly	26	Screw
6	Nut	13	Screw	20	Gasket	27	Lock Washer
7	Camshaft Cover	14	Idler Gear Support Pin	21	Oil Gauge & Cap Assembly	28	Washer

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.

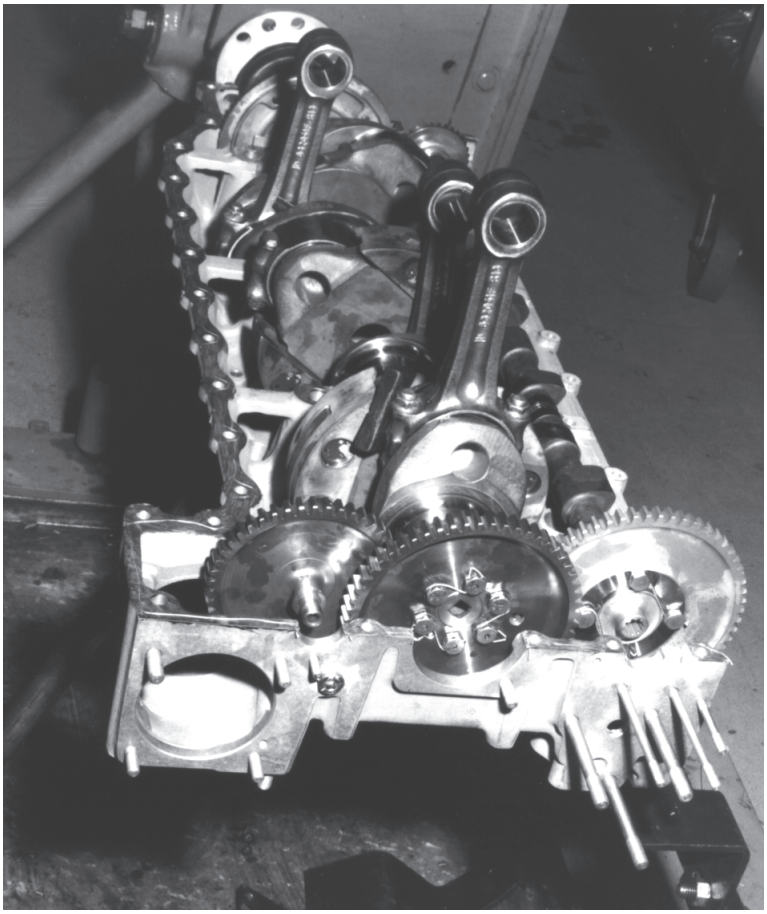


Figure 17-5. Left Crankcase Assembled on Stand

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.

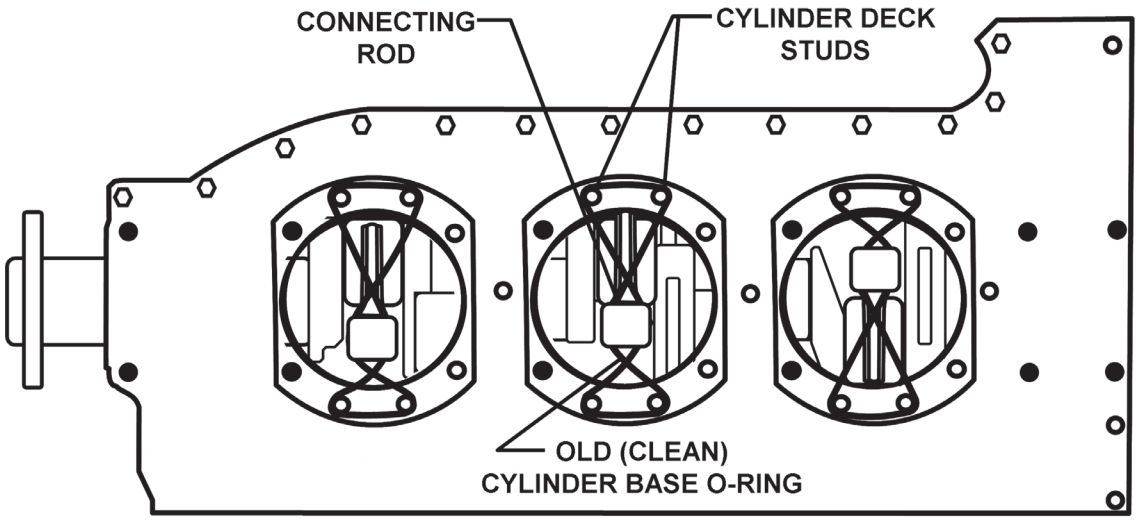


Figure 17-6. Cylinder Base O-ring to Support Connecting Rods

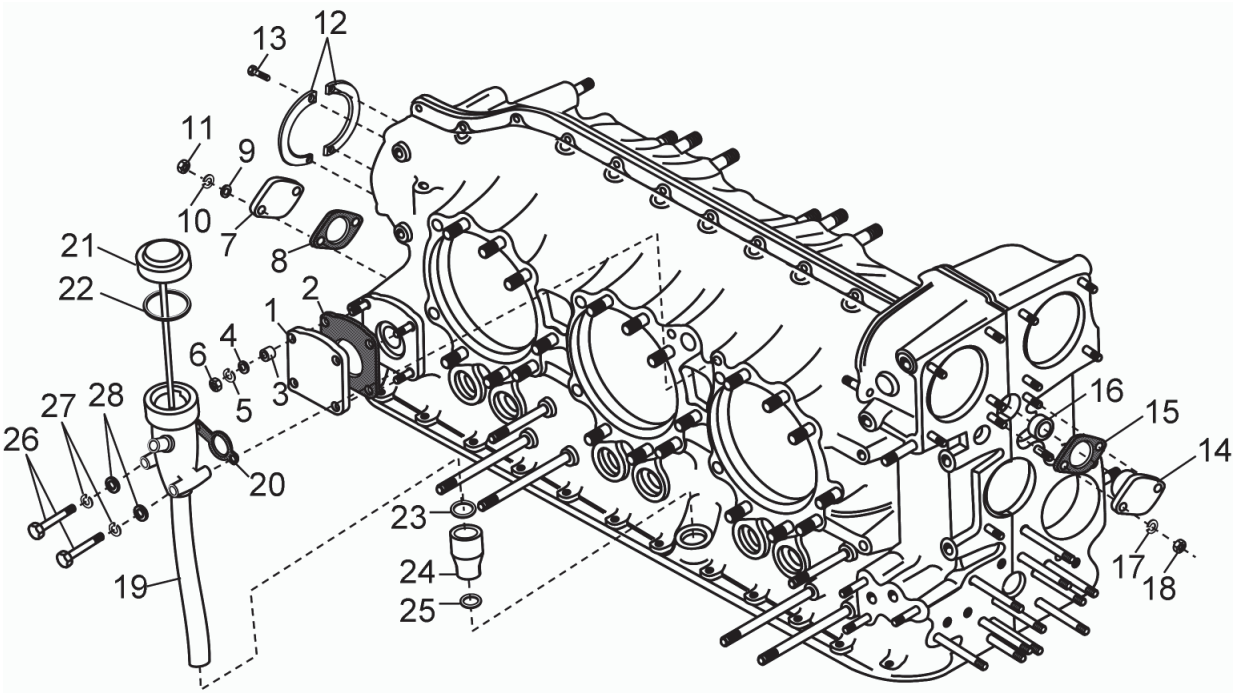


Figure 17-4 repeated for reference

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.

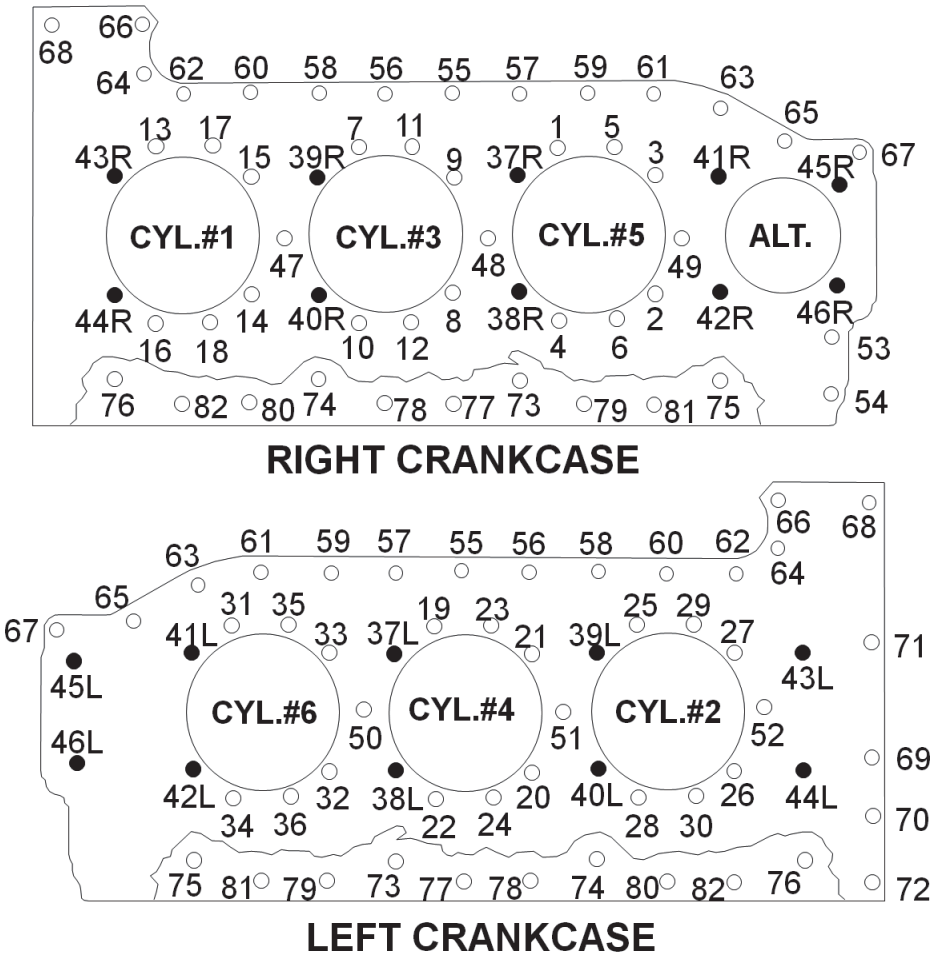


Figure 17-7. Crankcase Fastener Locations

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.

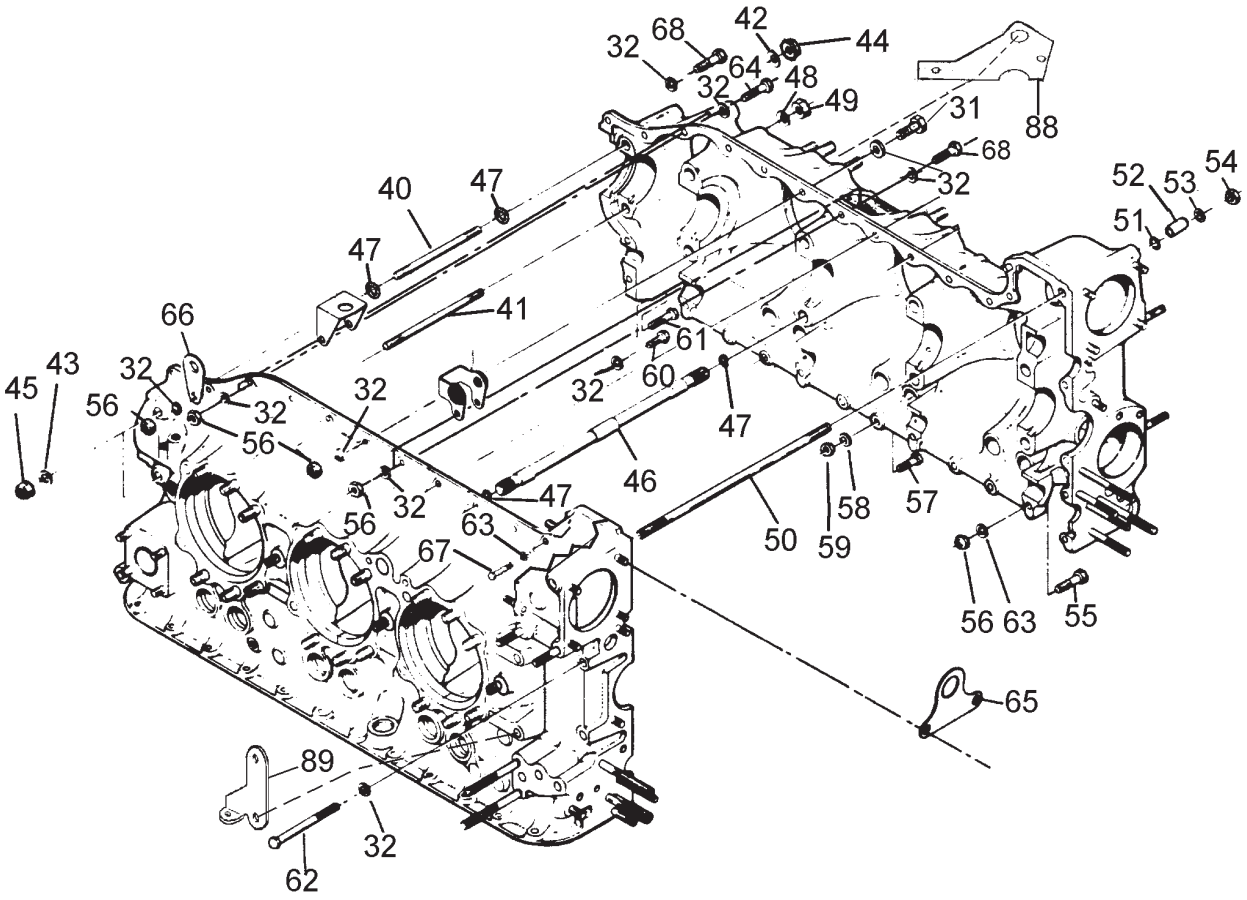


Figure 17-8. Crankcase Fasteners

31	Bolt 0.31-24 X 1.47	47	O-ring	55	Bolt 0.3125-24 UNF	63	Washer
32	Washer	48	Washer	56	Nut	64	Bolt 0.31-24 X 1.47
40	Thru-bolt 0.4375-20 X 6.74	49	Nut	57	Screw 0.25-28 X 1.63	65	Lifting Eye
41	Thru-bolt 0.44-20 X 7.58	50	Thru-bolt 0.38-24 X 11.67	58	Washer	66	Lifting Eye
43	Spacer	51	O-ring	59	Nut	67	Bolt 0.31-24 X 1.34
44	Flanged Nut	52	Spacer	60	Bolt 0.3125-18 X 1.12	68	Bolt 0.31-24 X 1.59
45	Nut	53	Washer	61	Bolt 0.3125-18 X 1.38	88	Baffle Support
46	Thru-bolt 0.50-20 X 10.75	54	Nut	62	Bolt	89	Baffle Support

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 <u>any</u> 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 <u>any</u> 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.

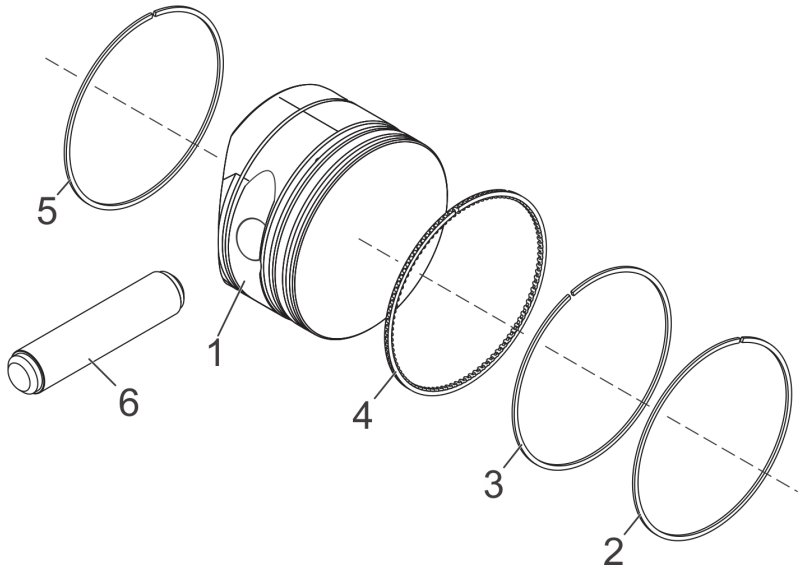


Figure 17-9. Piston, Piston Pin and Rings

1	Piston	3	Compression Ring	5	Scraper Ring
2	Compression Ring	4	Oil Control Ring	6	Piston Pin

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."

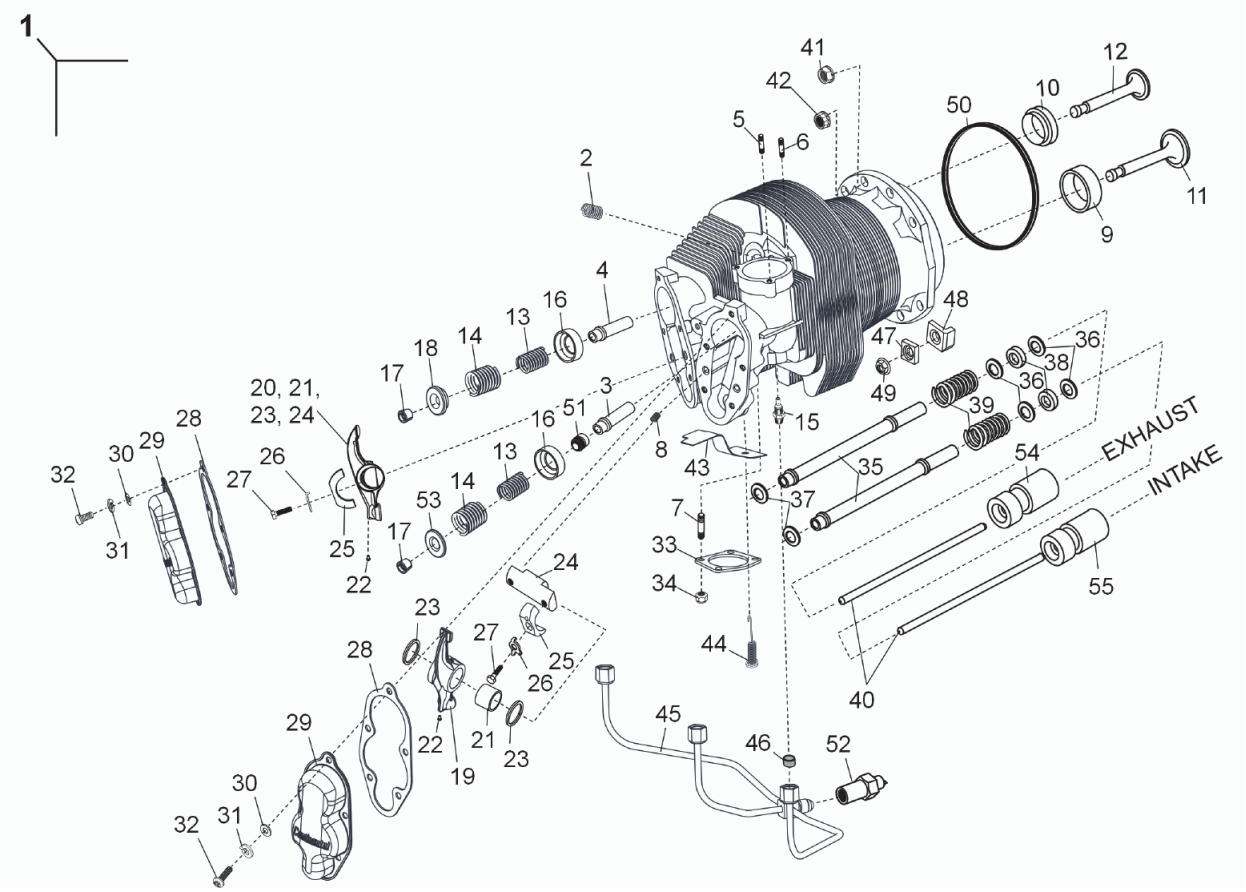


Figure 17-10. Cross-flow Cylinder Assembly

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		

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.

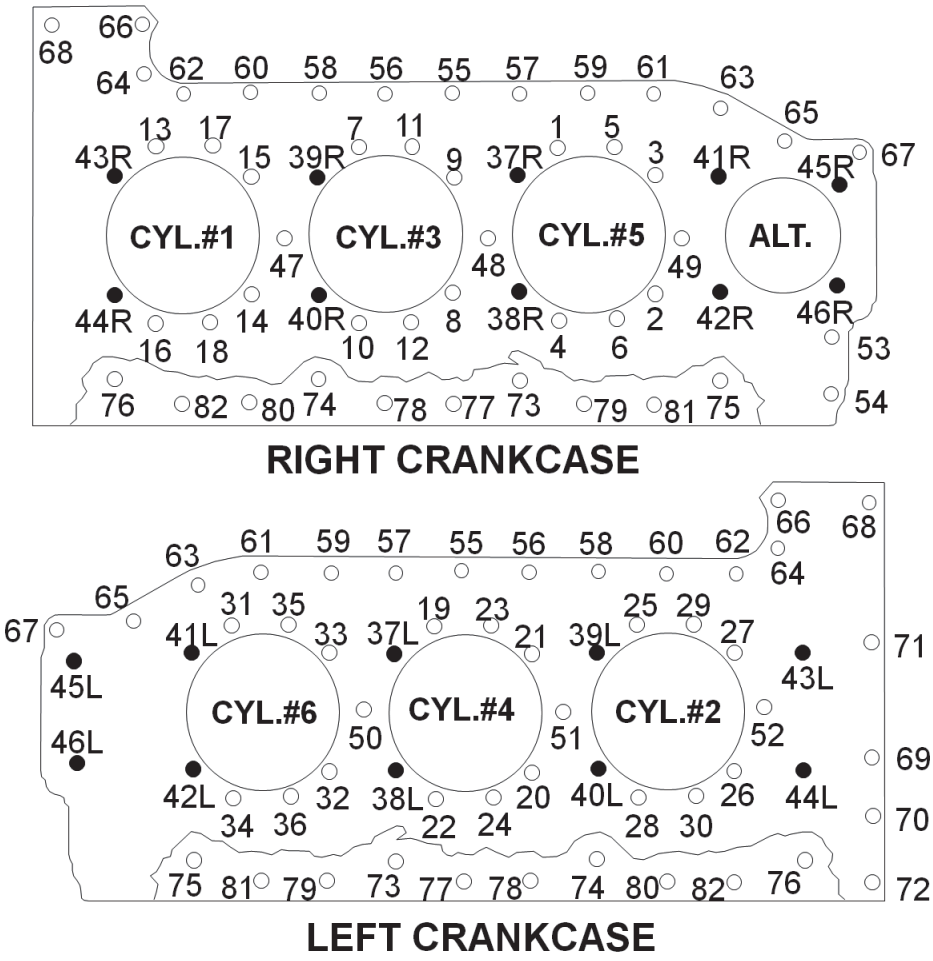


Figure 17-7 repeated for reference

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.

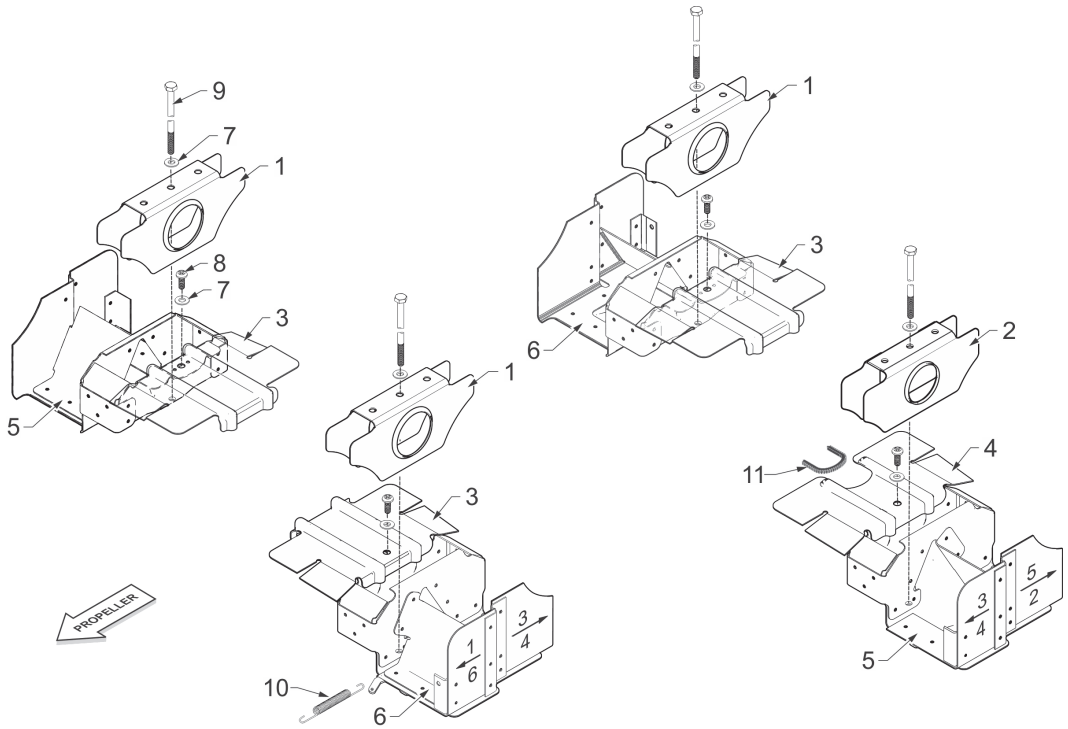


Figure 17-11. Inter-Cylinder Baffle Assembly

1	Baffle Support	4	Cylinder Base Baffle	7	Washer	10	Baffle Tie Spring
2	Baffle Support	5	Baffle Assembly	8	Screw	11	Grommet
3	Cylinder Base Baffle	6	Baffle Assembly	9	Bolt		

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).
4. Torque the drain tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
5. Install the drain valve assemblies in accordance with the aircraft manufacturer's instructions.

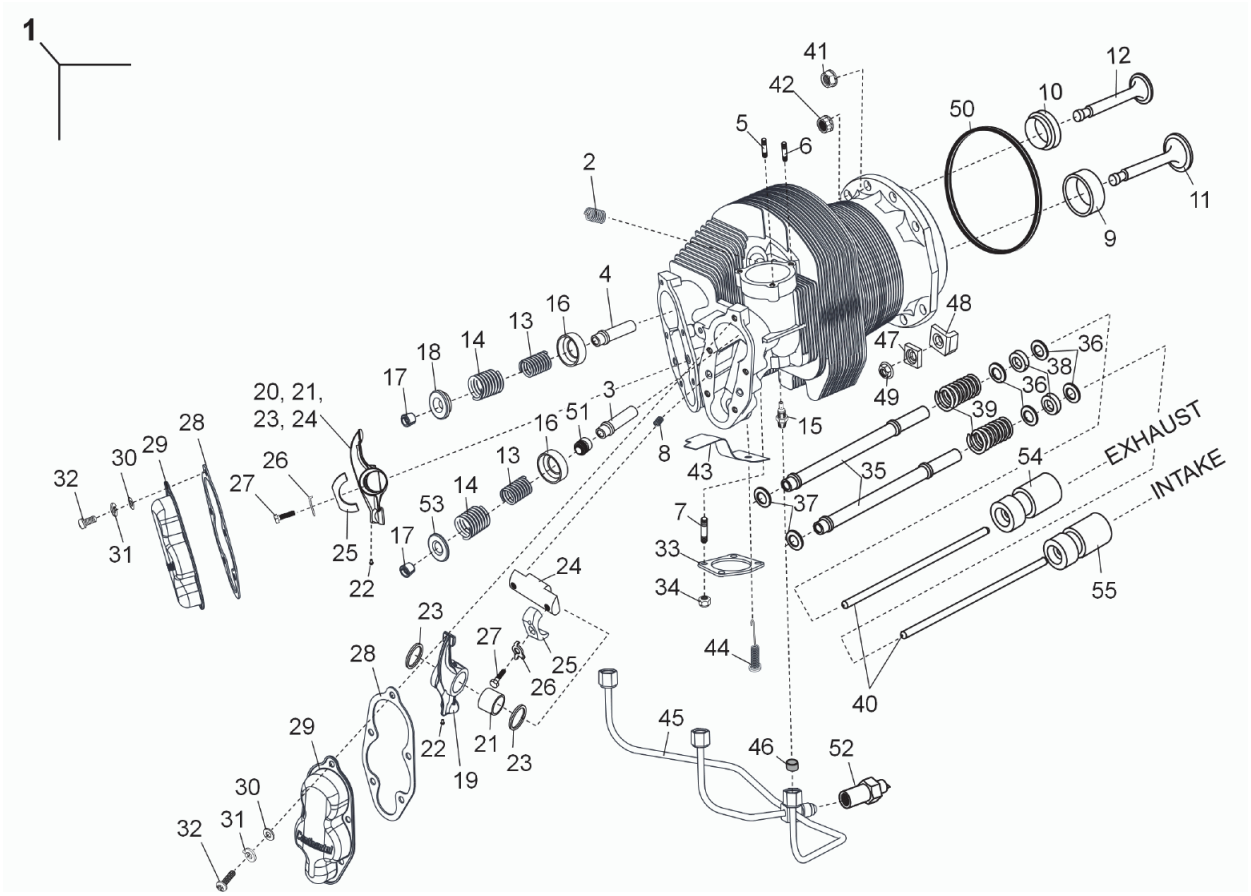


Figure 17-10 repeated for reference

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 <u>any</u> 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 <u>any</u> 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.

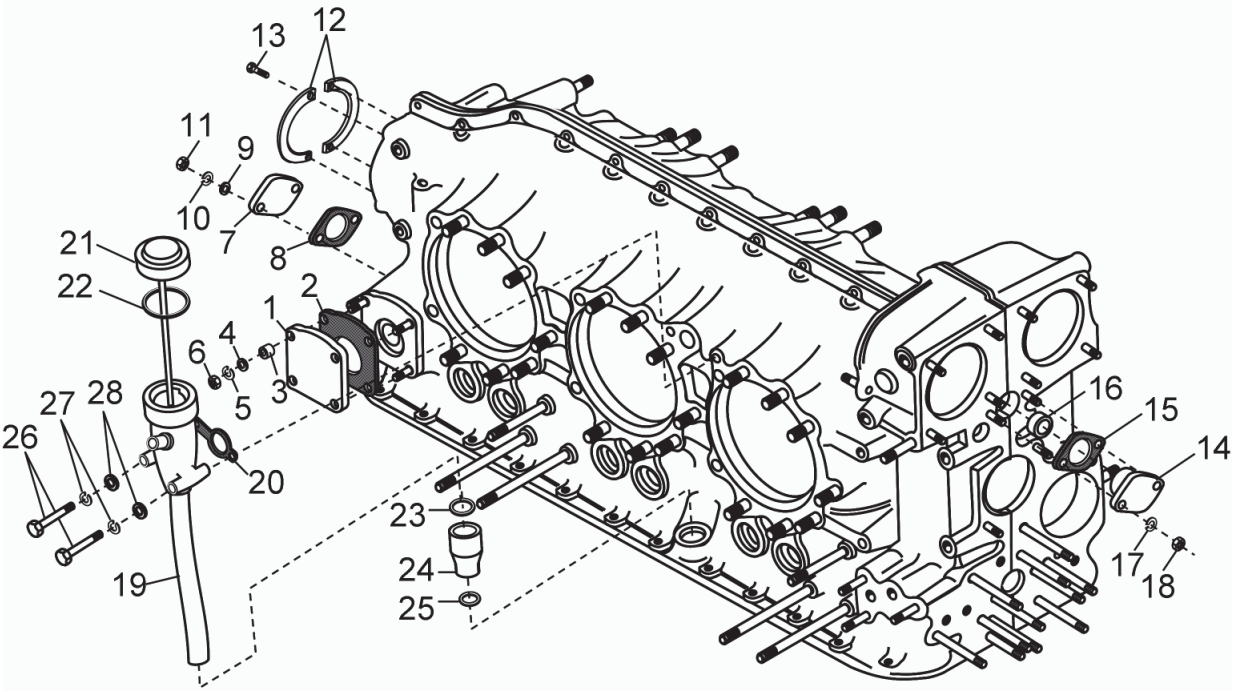


Figure 17-4 repeated for reference

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).

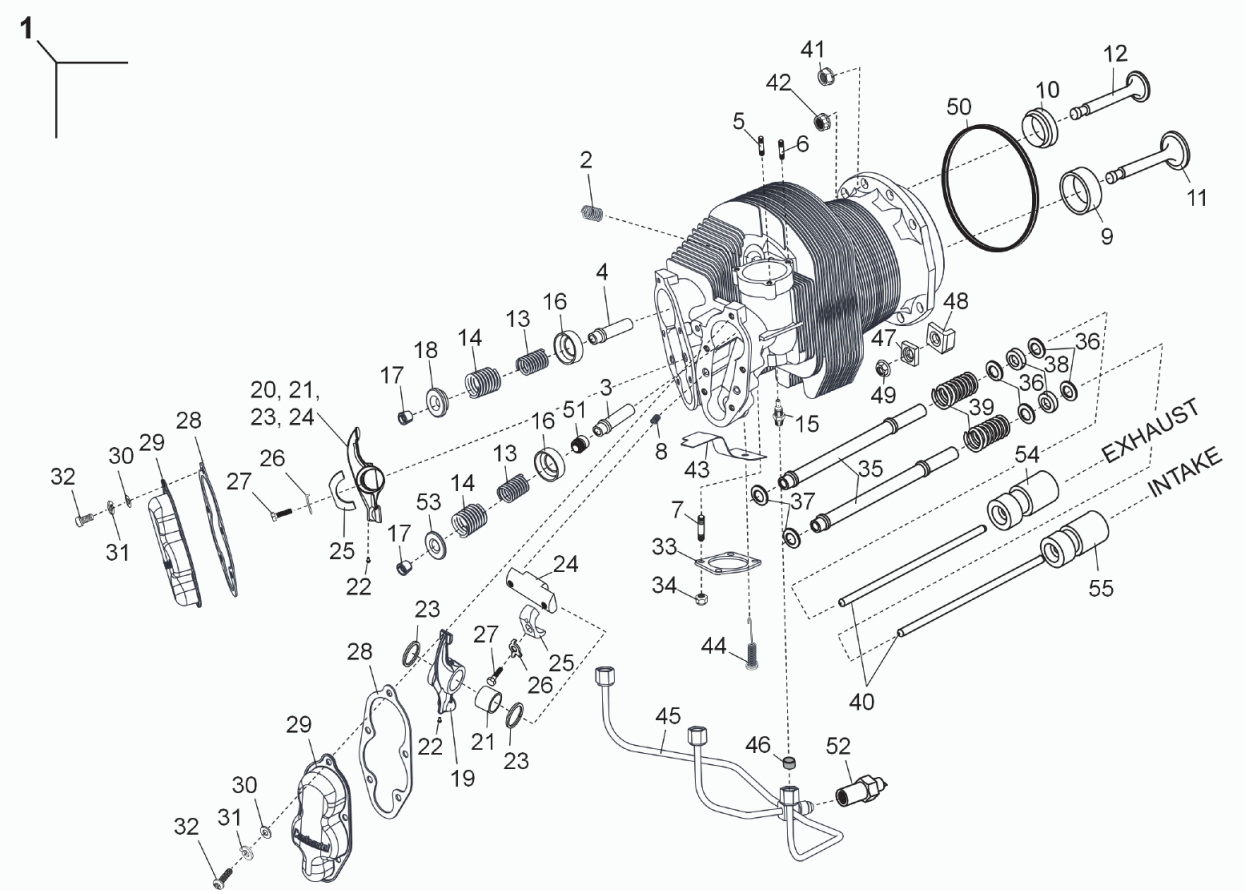


Figure 17-10 repeated for reference

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.

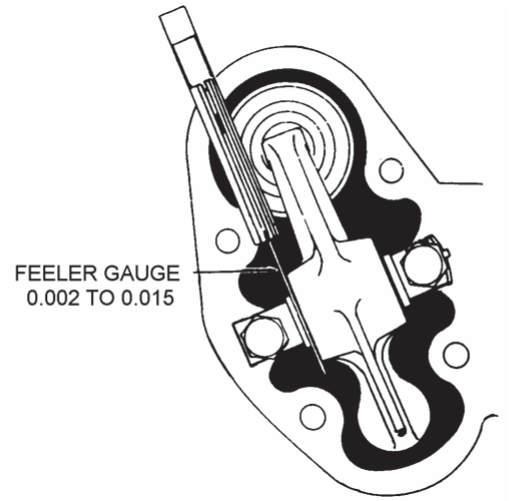


Figure 17-13. Rocker Arm Side Clearance

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.

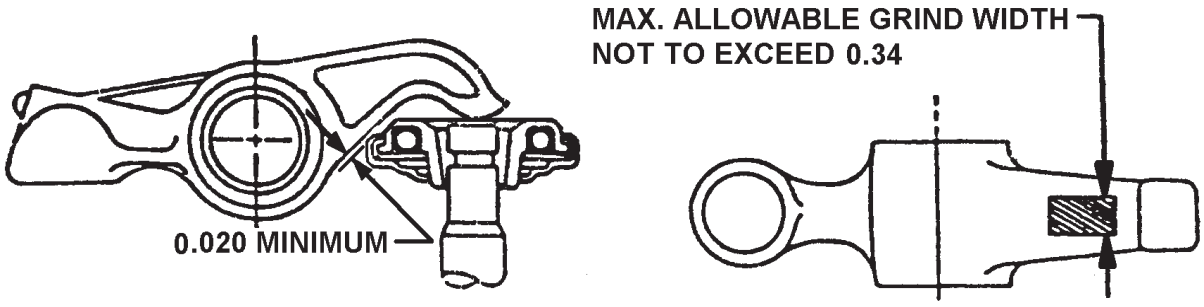


Figure 17-14. Rocker Arm to Retainer Clearance

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.

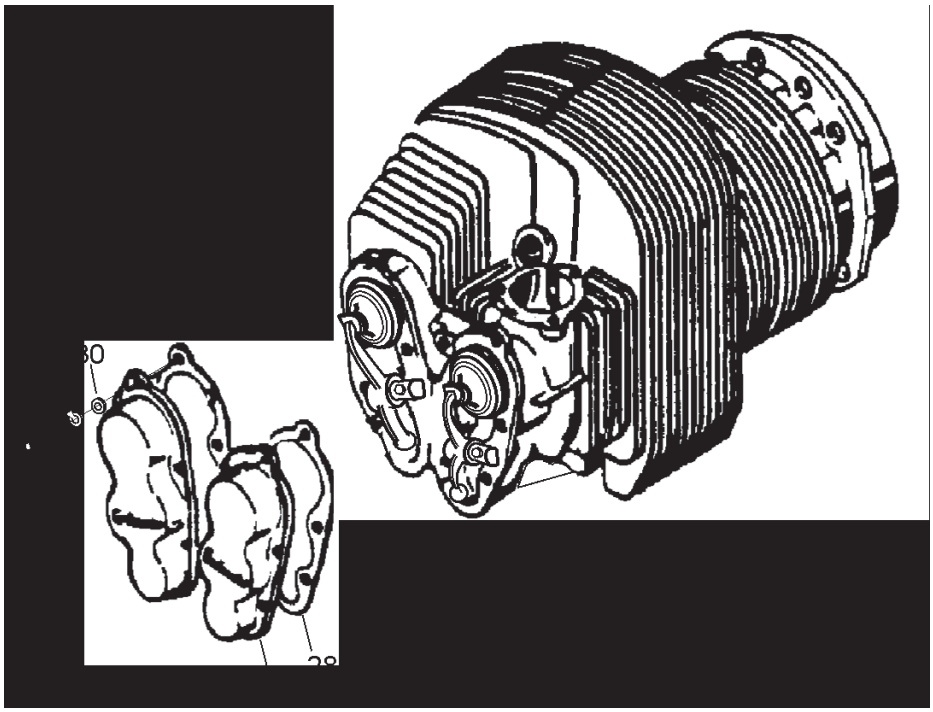


Figure 17-10 repeated for reference

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.

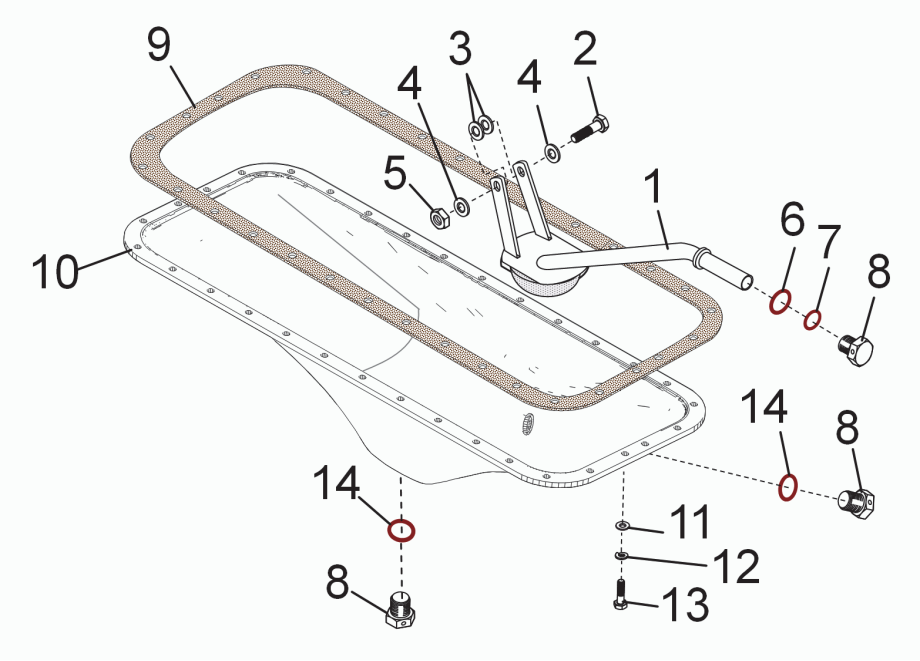


Figure 17-15. Oil Sump C

1	Oil Suction Tube Assy	6	Copper Gasket	11	Washer	15	Oil Coupling G K N
2	Bolt	7	Copper Gasket	12	Lock Washer	16	Bolt G K N
3	Washer	8	Plug	13	Bolt		
4	Washer	9	Oil Sump Gasket	14	Copper Gasket		
5	Nut	10	Oil Sump	15	Bracket B E		

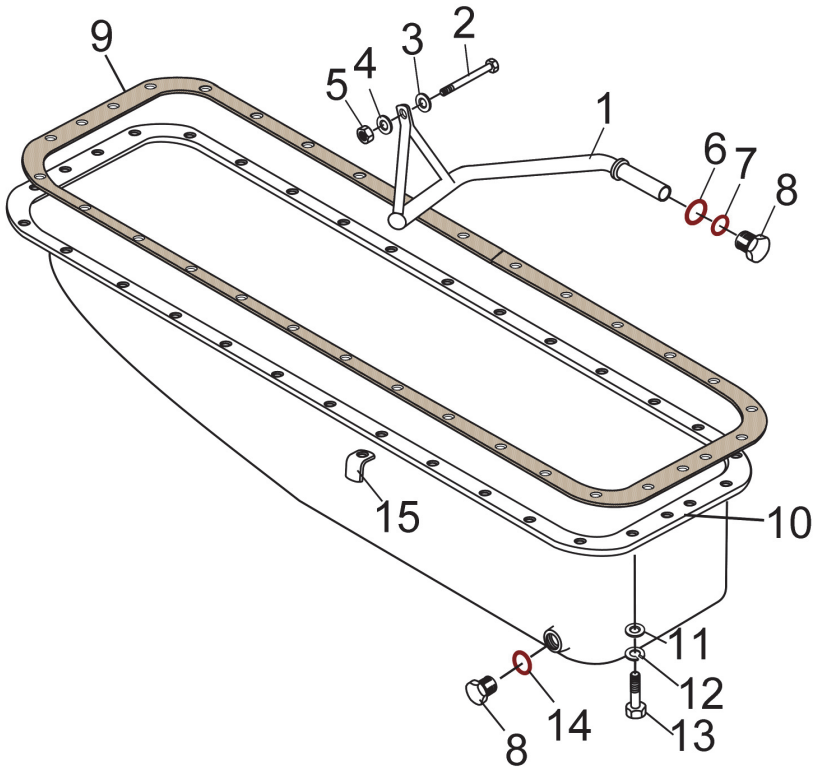


Figure 17-16. Oil Sump B E

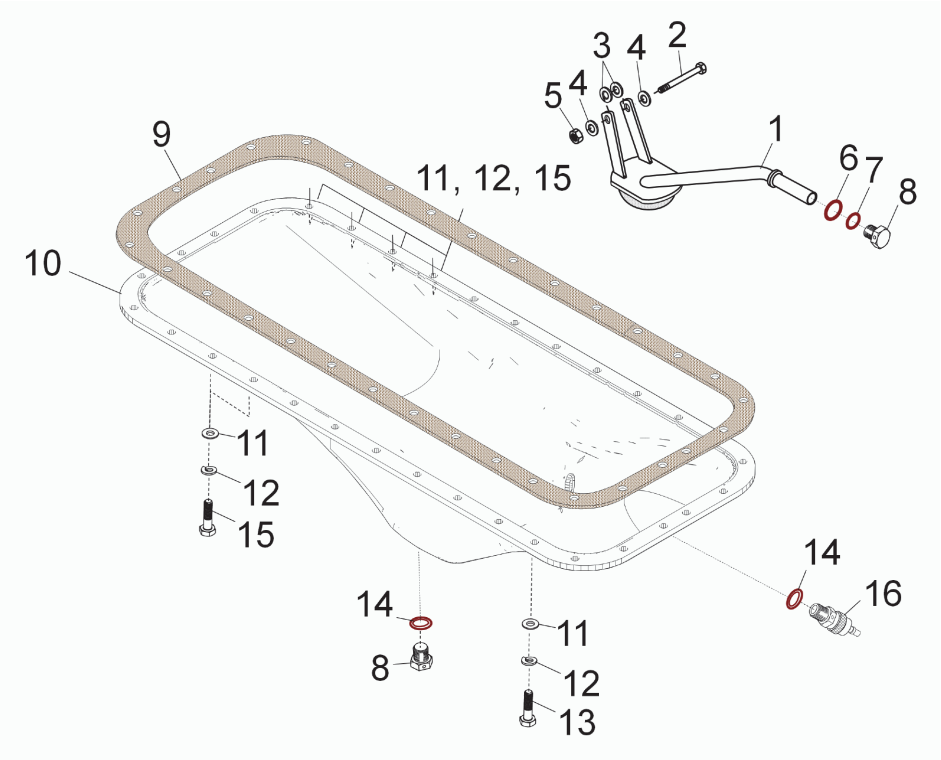


Figure 17-17. Oil Sump G K N

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. **B E** 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. **C** 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. **G K N** 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).

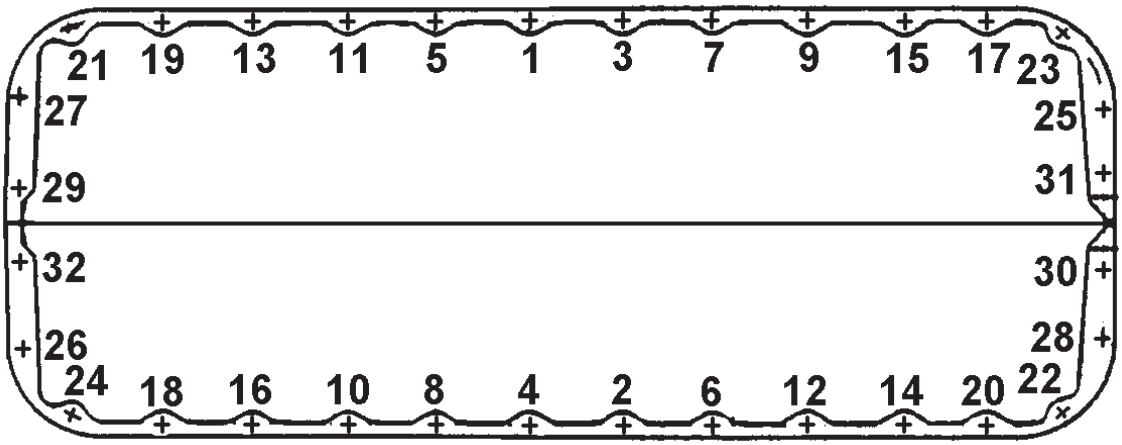


Figure 17-18. Oil Sump Torque Sequence

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.

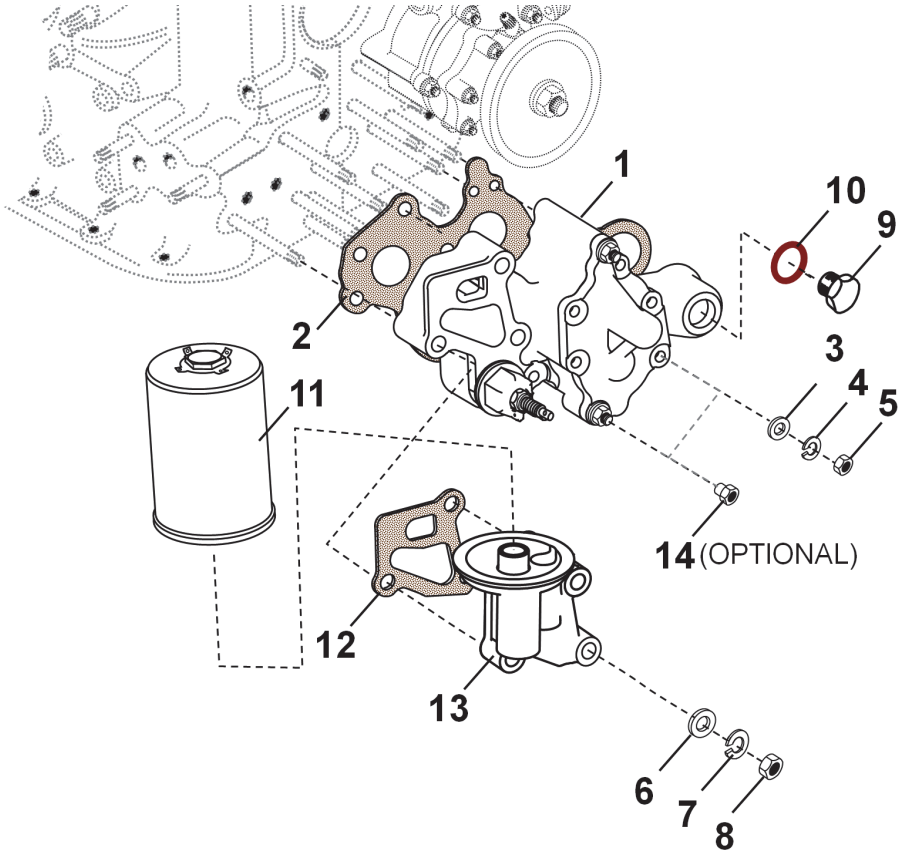


Figure 17-19. Oil Pump Assembly

1	Oil Pump Assembly	5	Nut	9	Plug	13	Oil Filter Adapter
2	Oil Pump Gasket	6	Washer	10	Gasket	14	Coupling Nut
3	Washer	7	Lock Washer	11	Oil Filter		
4	Lock Washer	8	Nut	12	Gasket		

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.
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.
9. Install a reducer bushing (18) in the oil outlet port. Torque the reducer bushing 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.

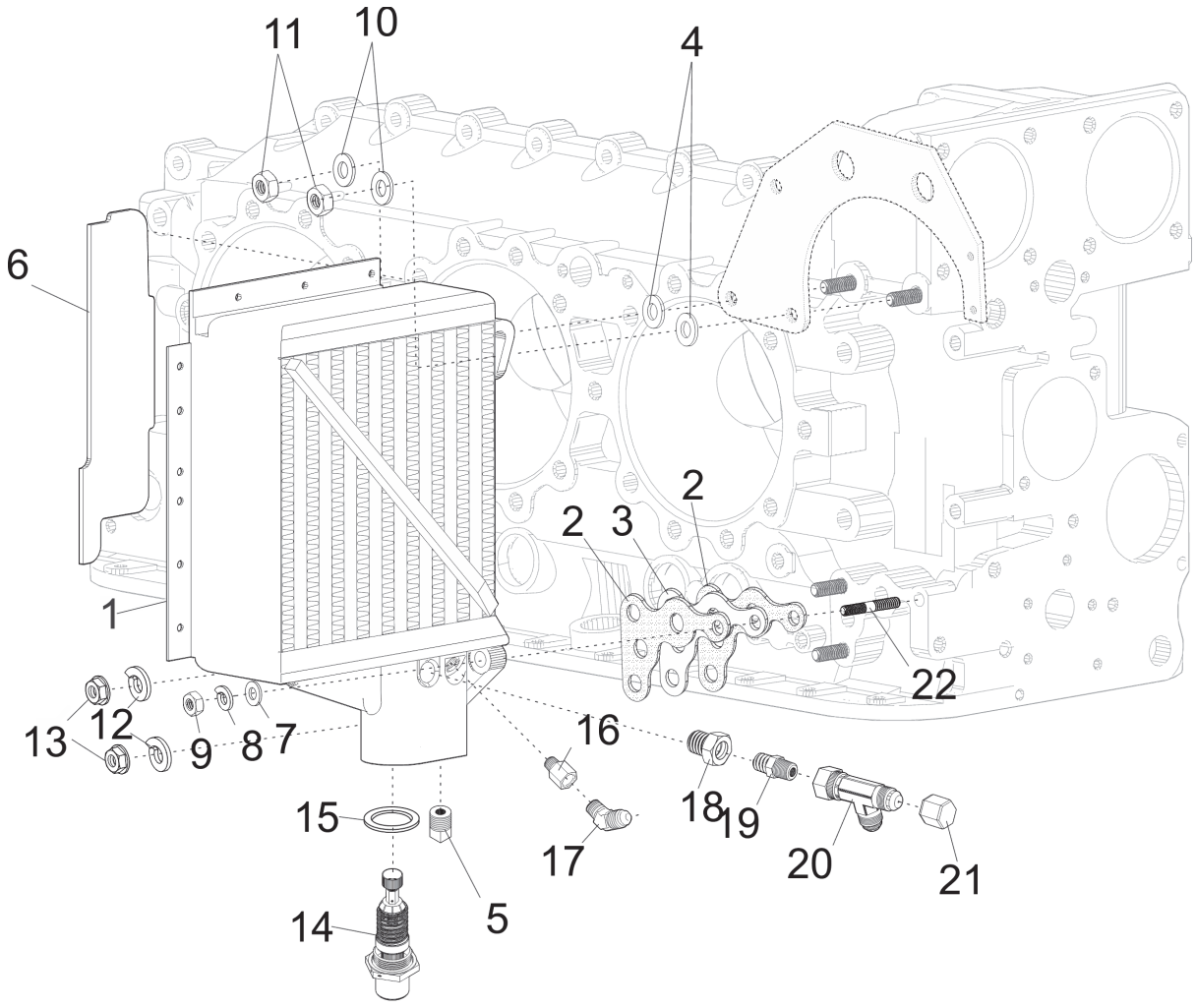


Figure 17-20. Oil Cooler B C E

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Connector Fitting
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	Tee Fitting
3	Spacer	9	Nut	15	Gasket	21	Cap
4	Gasket-Washer	10	Washer	16	Adapter	22	Stud
5	Plug	11	Nut	17	45° Elbow Fitting		
6	Baffle	12	Lock Washer	18	Reducer Bushing		

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.

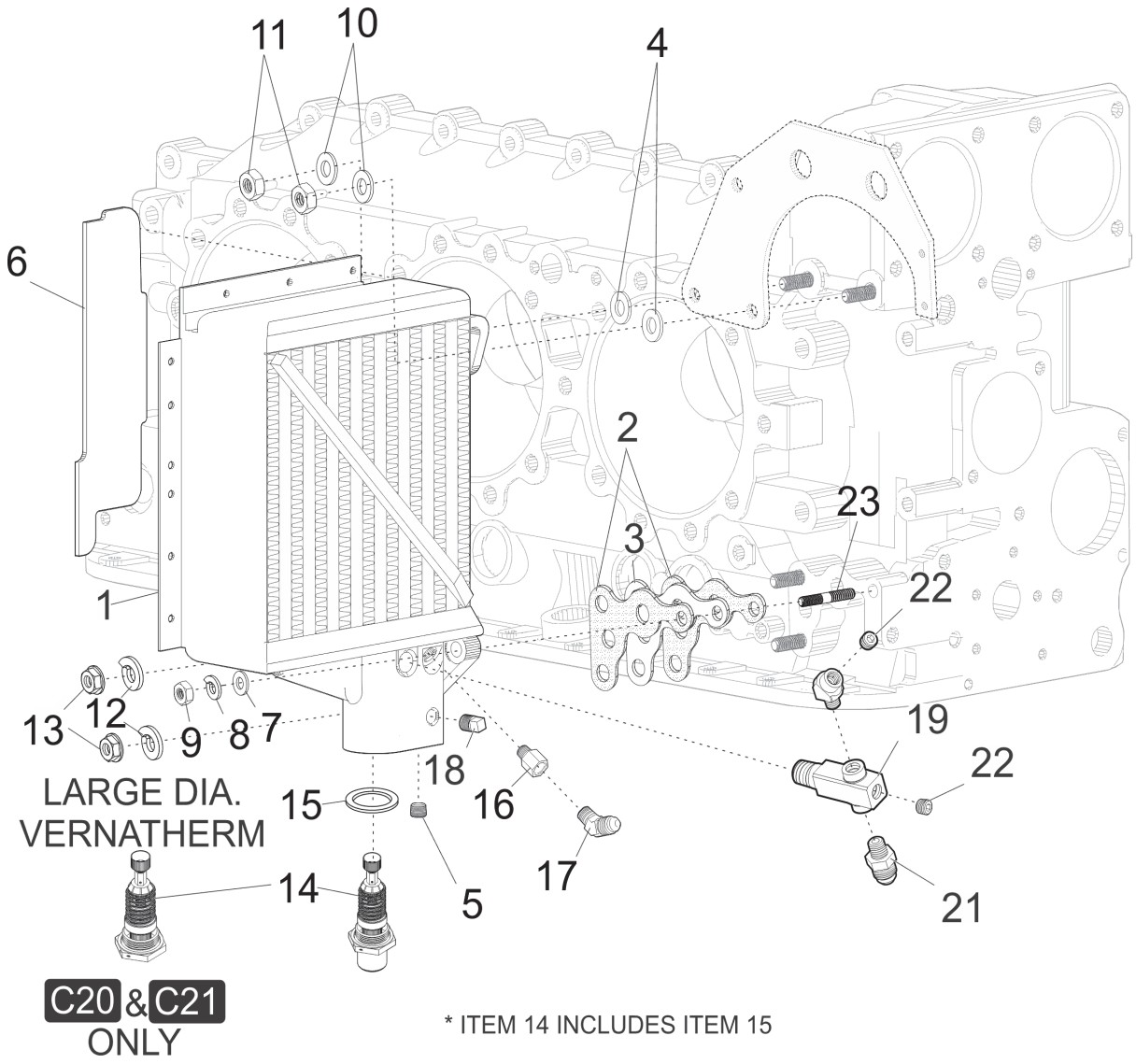


Figure 17-21. Oil Cooler G

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Cross Fitting
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	45° Street Elbow
3	Spacer	9	Nut	15	Gasket	21	Flared Nipple Fitting
4	Gasket-Washer	10	Washer	16	Adapter Fitting	22	Plug
5	Plug	11	Nut	17	45° Elbow Fitting	23	Stud
6	Baffle	12	Lock Washer	18	Plug		

procedure continues on next page...

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.

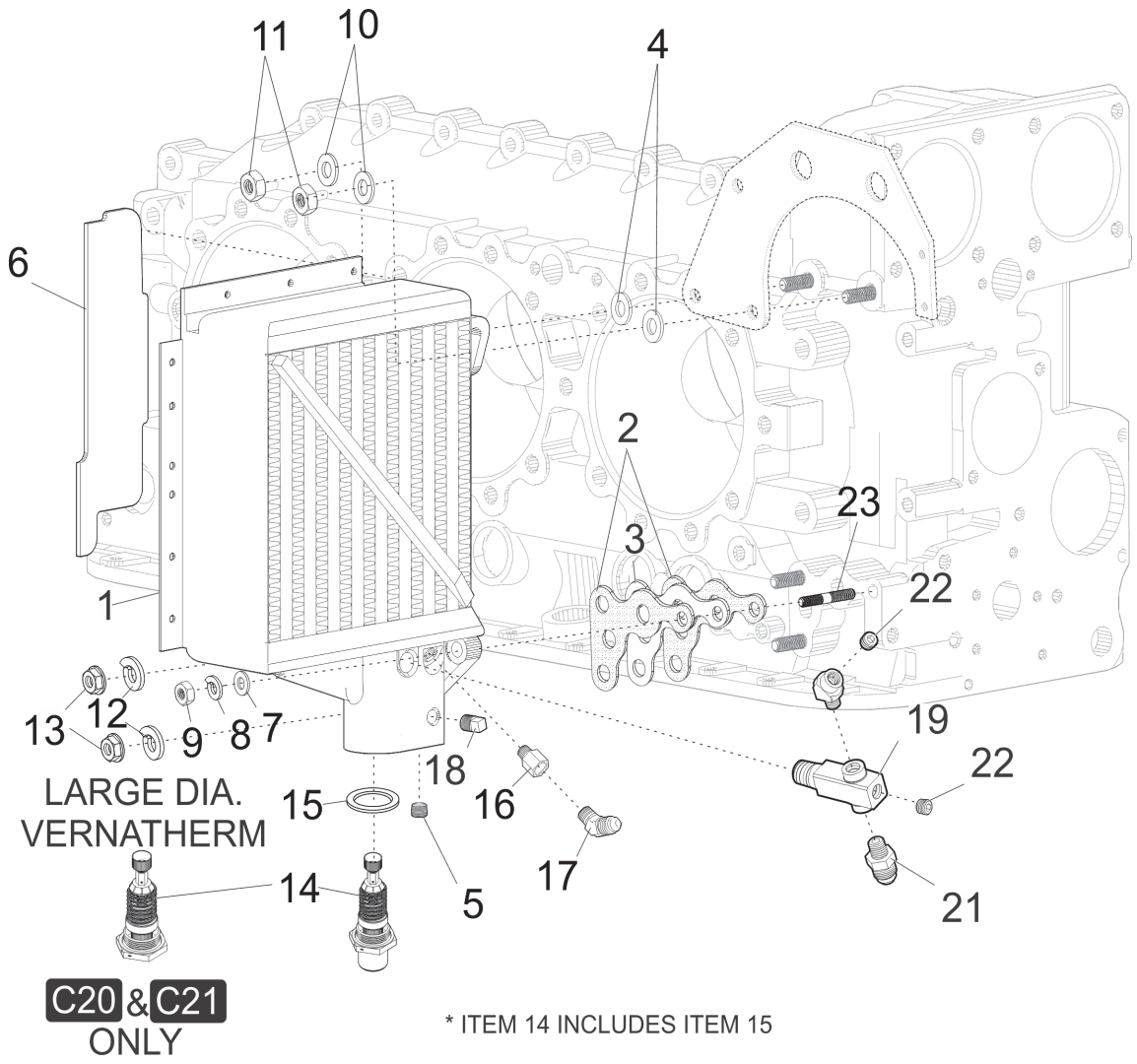


Figure 17-21 repeated for reference

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.
11. Install a reducer bushing (16) in the oil outlet port. Torque the reducer bushing 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.

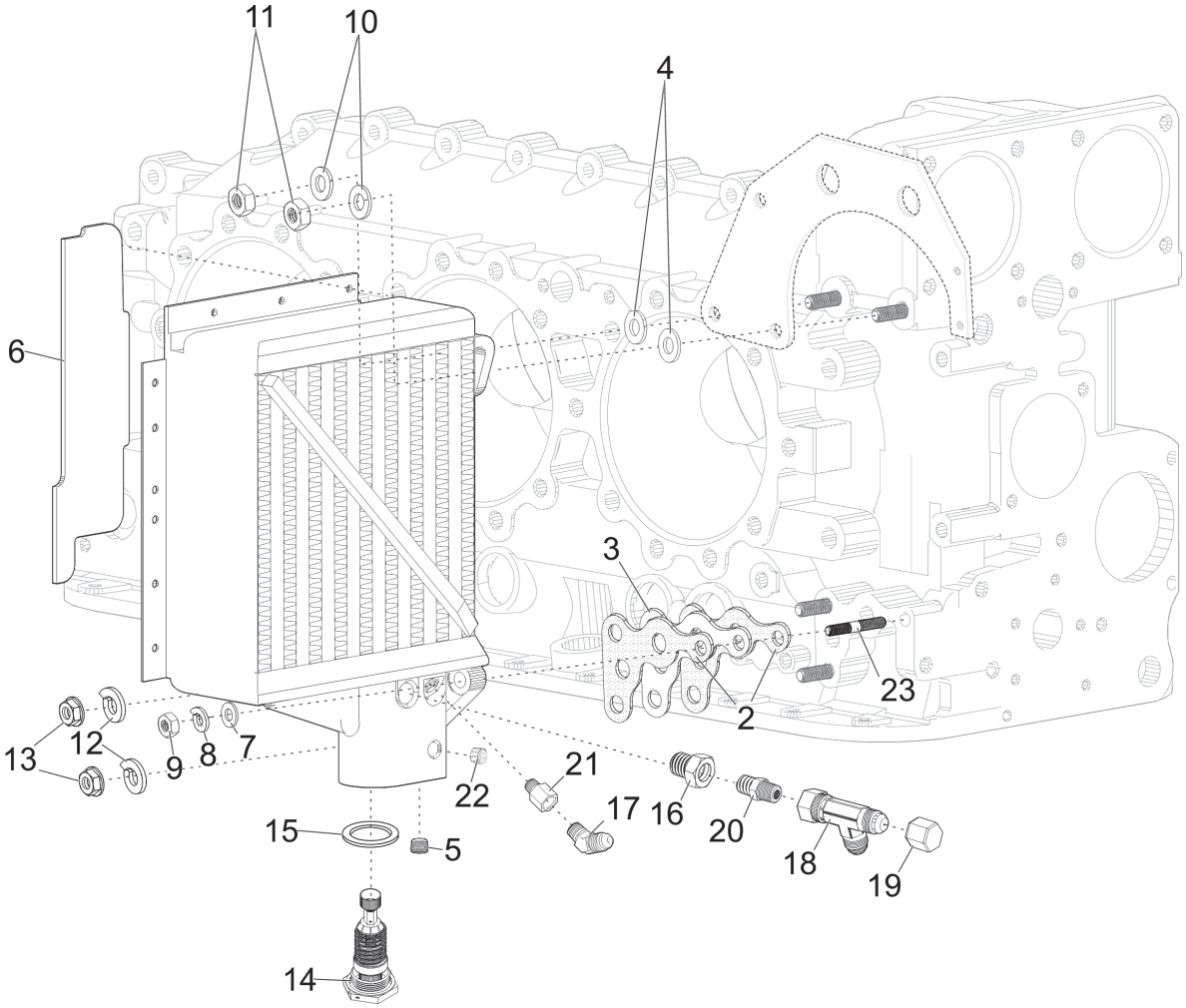


Figure 17-22. Oil Cooler G

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Cap
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	Connector Fitting
3	Spacer	9	Nut	15	Gasket	21	Adapter
4	Gasket-Washer	10	Washer	16	Reducer Bushing	22	Aircraft Part
5	Plug	11	Nut	17	45° Elbow Fitting	23	Stud
6	Baffle	12	Lock Washer	18	Tee Fitting		

17-6.4. TSIO-550-K Oil Cooler Installation

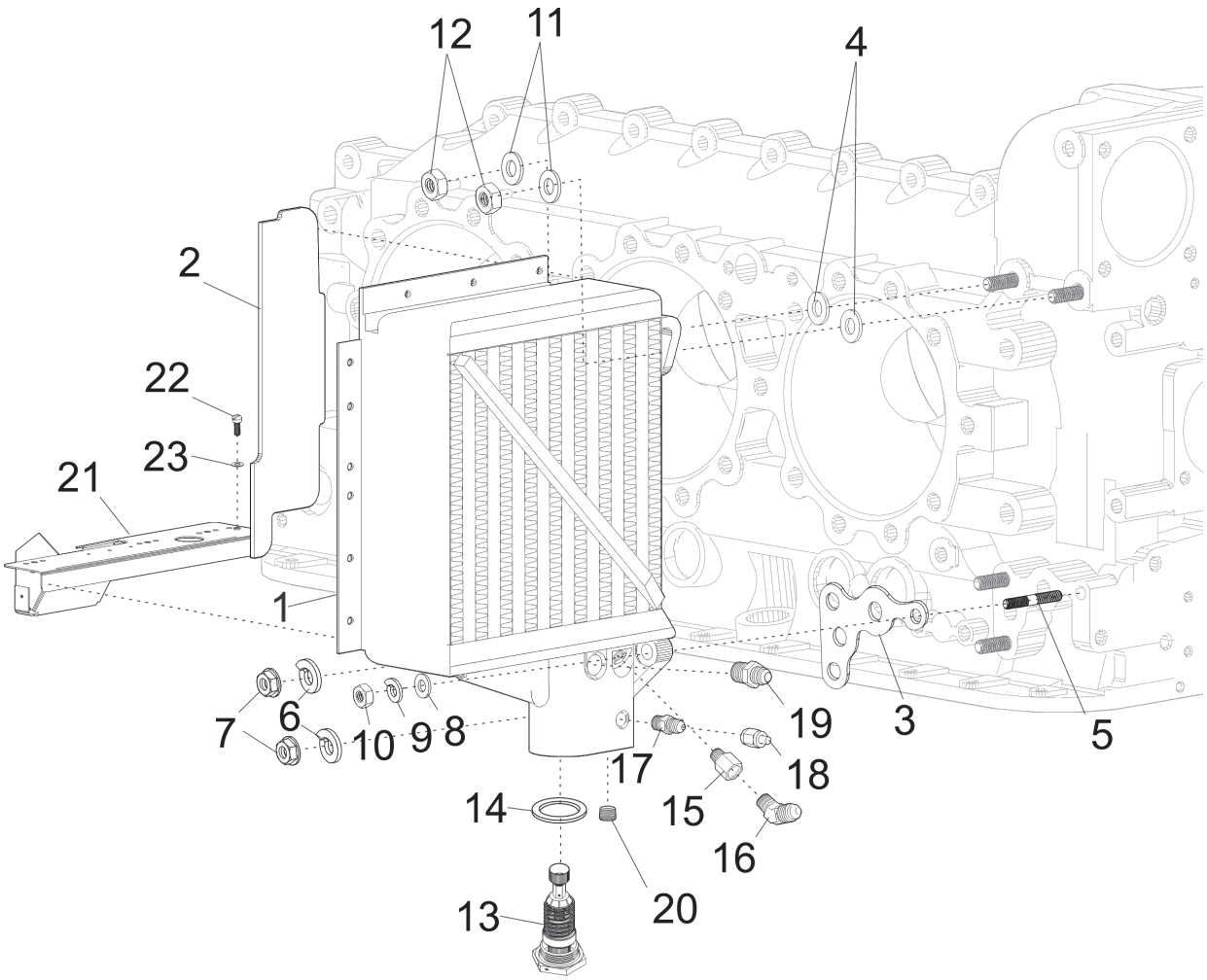
WARNING

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 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 CSB15-7 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.



* ITEM 13 INCLUDES ITEM 14

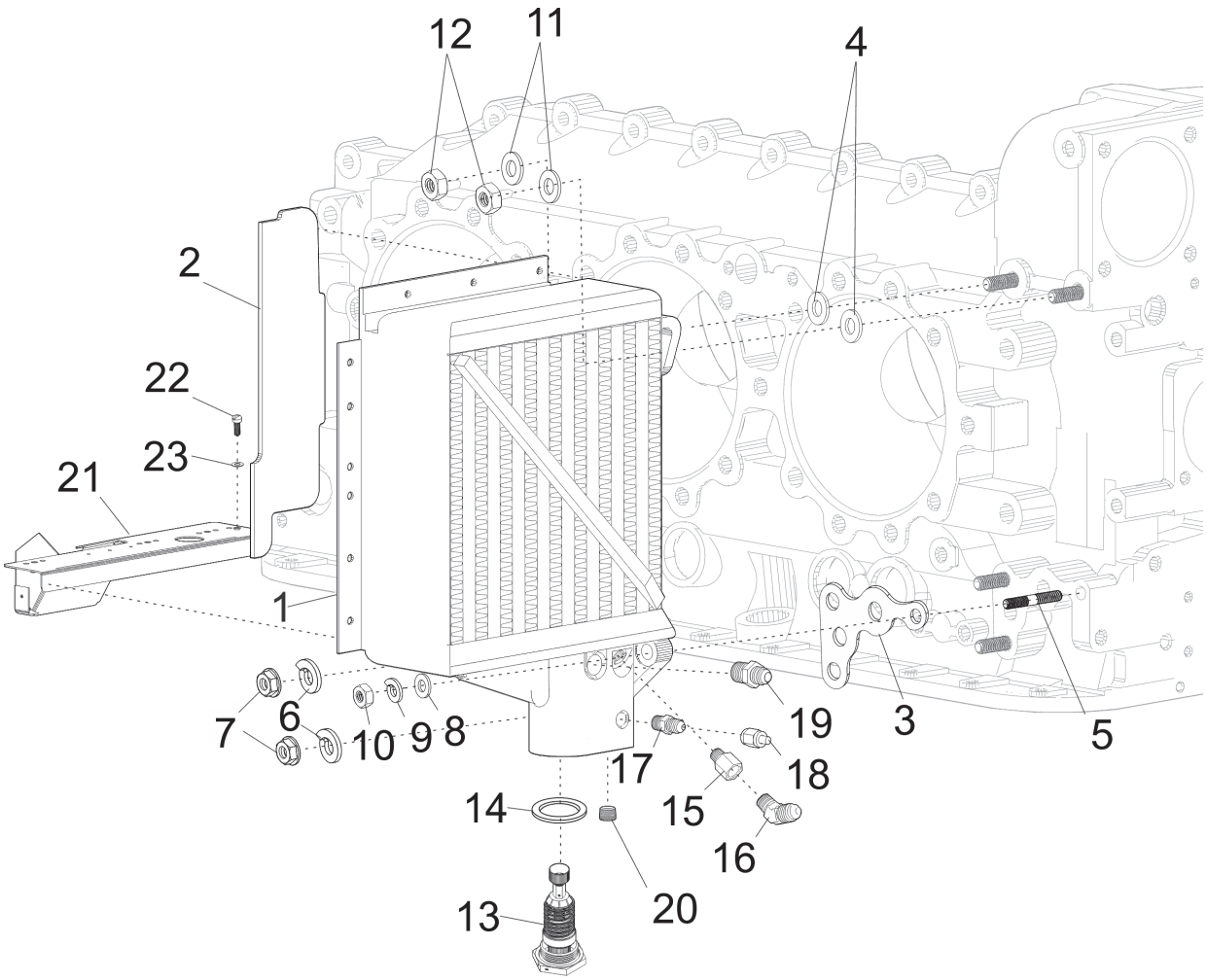
Figure 17-23. Oil Cooler K

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		

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.
14. Install an adapter fitting (19) in the upper outboard pressure port; torque 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

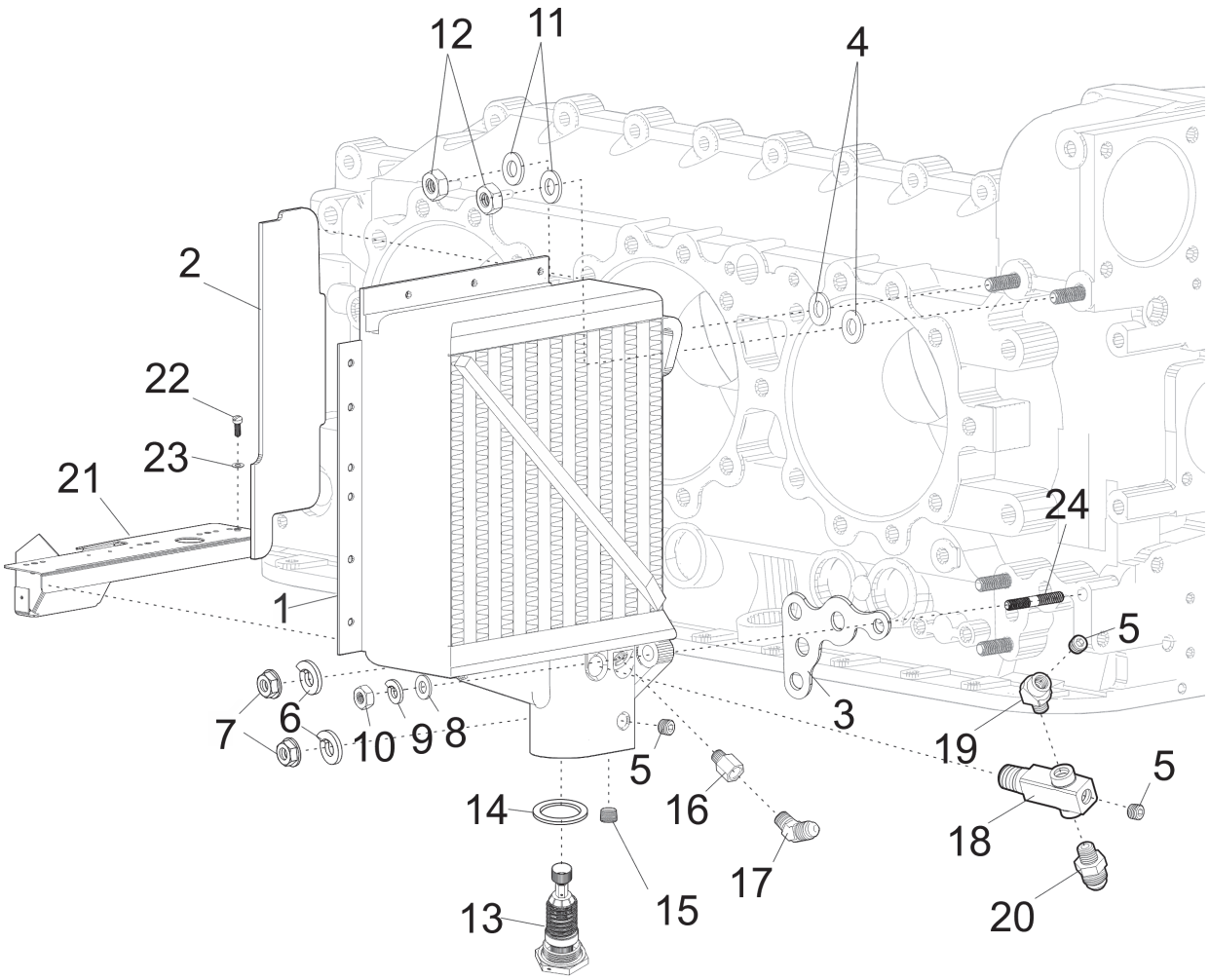
WARNING

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.



* ITEM 13 INCLUDES ITEM 14

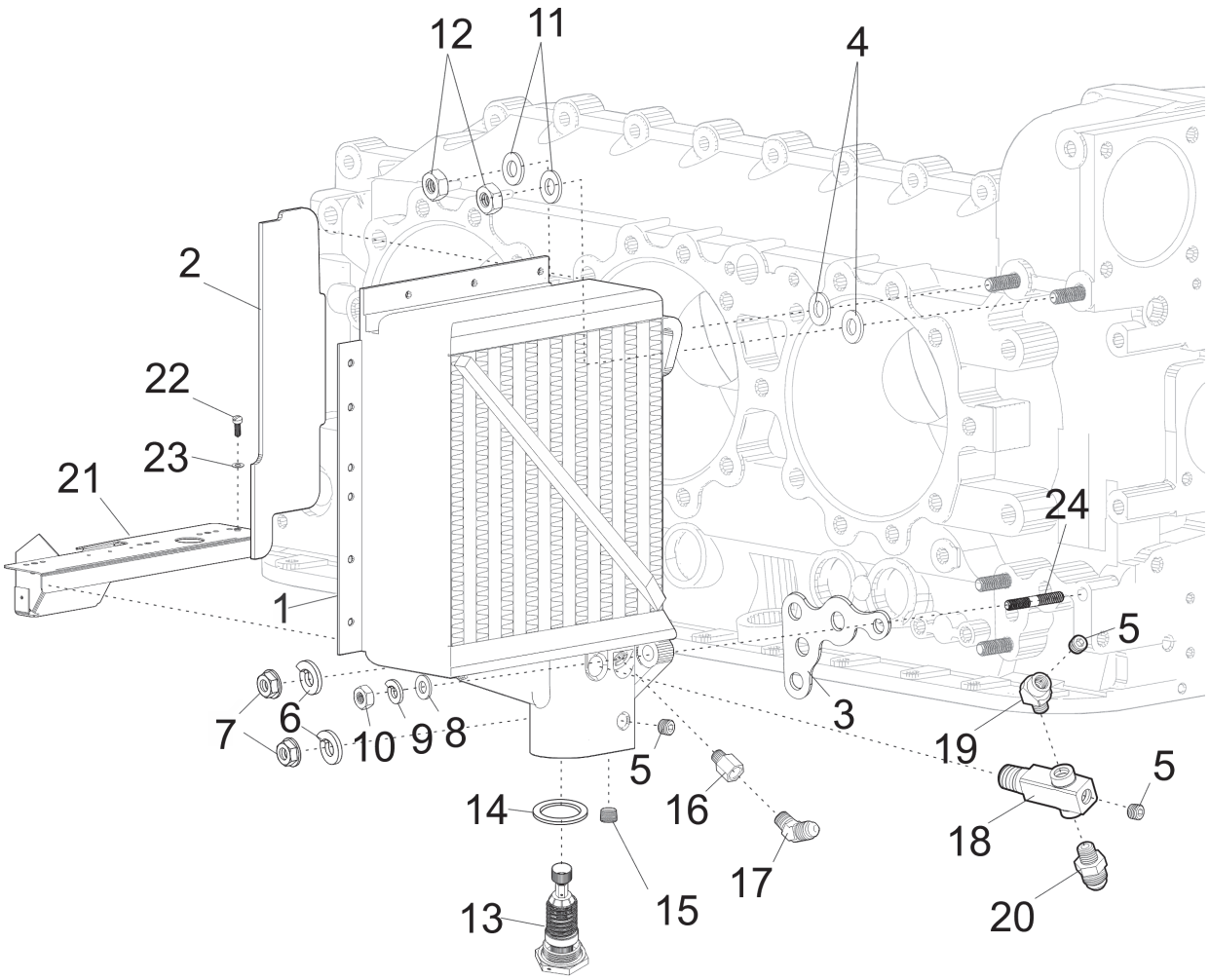
Figure 17-24. Oil Cooler N

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
3	Gasket	9	Lock Washer	15	Plug	21	Baffle
4	Gasket-Washer	10		16	Adapter Fitting	22	Screw
5	Plug	11	Washer	17	45° Elbow Fitting	23	Washer
6	Lock Washer	12	Nut	18	Cross Fitting	24	Stud

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.



* ITEM 13 INCLUDES ITEM 14

Figure 17-24 repeated for reference

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. 8082IA, 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.

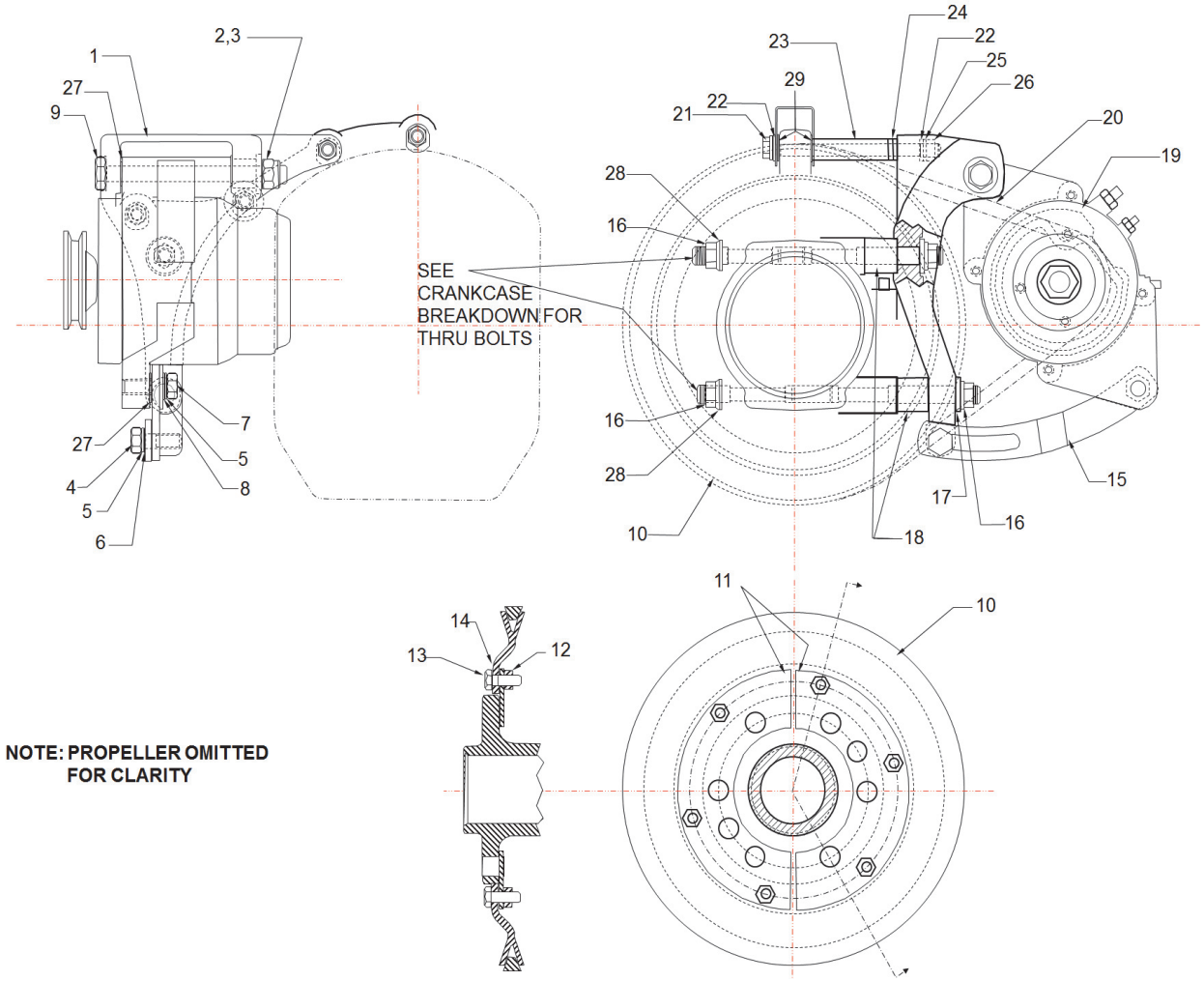


Figure 17-25. Belt-Driven Alternator Assembly (Optional)

1	Bracket Assembly	9	Bolt	17	Washer	25	Lock Washer
2	Washer	10	Sheave	18	Spacer	26	Nut
3	Nut	11	Adapter	19	Alternator Assembly	27	Shim
4	Screw	12	Lock Nut	20	V-belt	28	Washer
5	Lock Washer	13	Bolt	21	Bolt	29	Washer
6	Washer	14	Washer	22	Washer		
7	Screw	15	Adjustable Brace	23	Spacer		
8	Washer	16	Nut	24	Shim		

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".

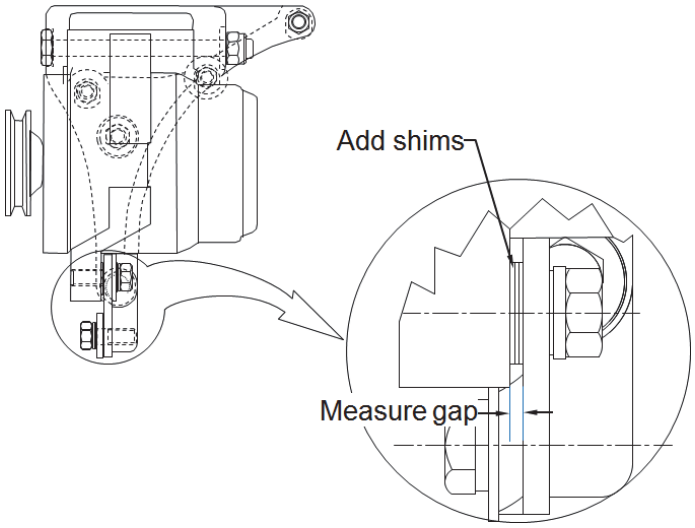


Figure 17-26. Alternator Brace Shim Location

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.

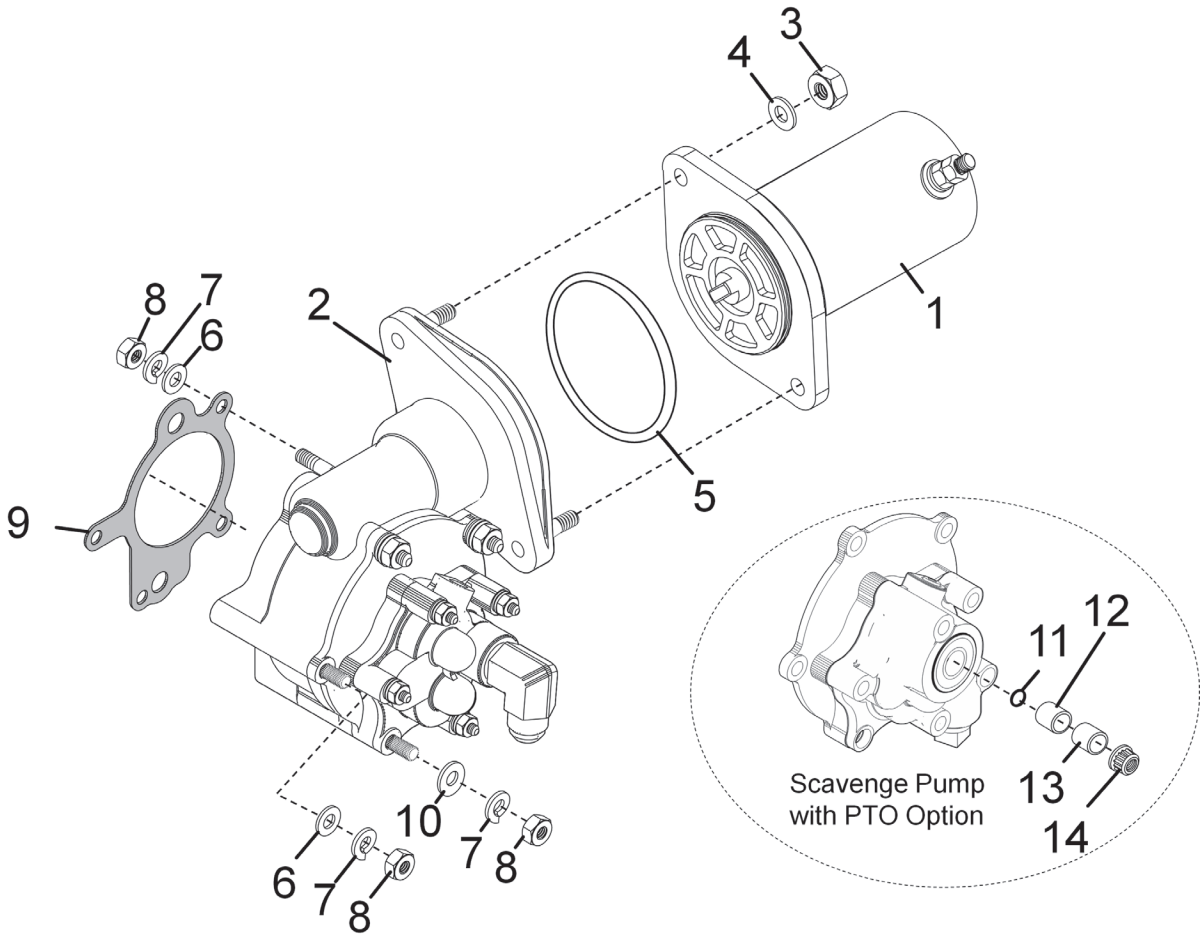


Figure 17-27. Starter and Adapter Assembly

1	Starter Motor	5	O-ring	9	Gasket	13	Spacer
2	Starter Adapter	6	Washer	10	Washer	14	Lock Nut
3	Nut	7	Lock washer	11	O-ring		
4	Washer	8	Nut	12	Sleeve		

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.

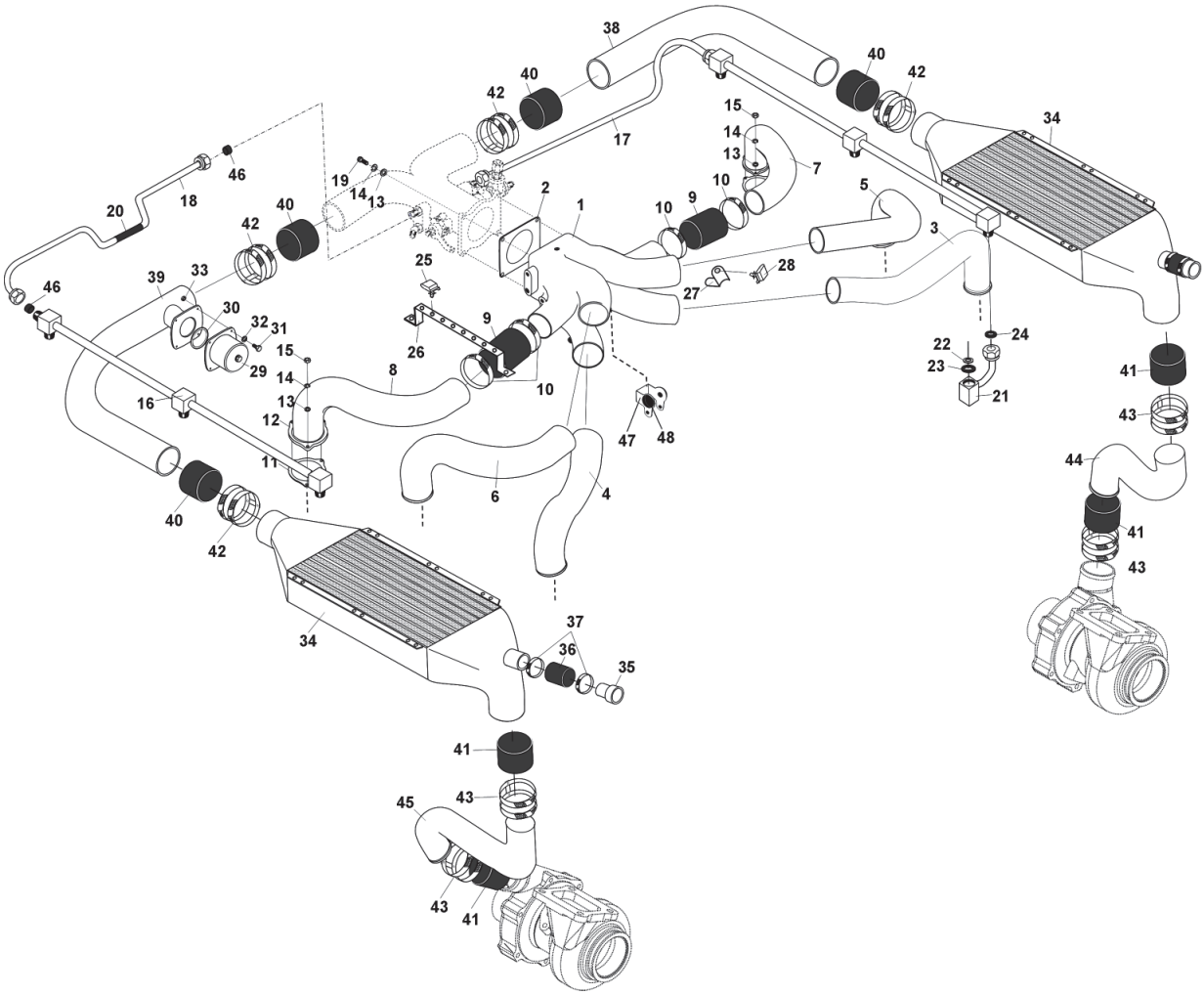


Figure 17-28. Induction System B C E K N

1	Manifold & Fitting Assembly	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Dist. Tube Bracket	38	1-3-5 FWD Induction Tube
3	Tube	15	Nut	27	Fuel Inj. Line Bracket	39	2-4-6 FWD Induction Tube
4	Tube	16	Air Manifold Tube Assembly	28	Tube Clamp	40	Hose
5	Tube	17	Right Air Reference Tube	29	Overboost Valve	41	Hose
6	Tube	18	Left Air Reference Tube	30	O-ring	42	Clamp Assembly
7	Tube	19	Screw	31	Bolt	43	Clamp Assembly
8	Tube	20	Hose	32	Washer	44	1-3-5 AFT Induction Tube
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	2-4-6 AFT Induction Tube
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Intake Manifold Gasket	23	Washer	35	Sonic Venturi Nozzle	47	Manifold Locator Bracket
12	Flange	24	Compression Seal	36	Hose	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.

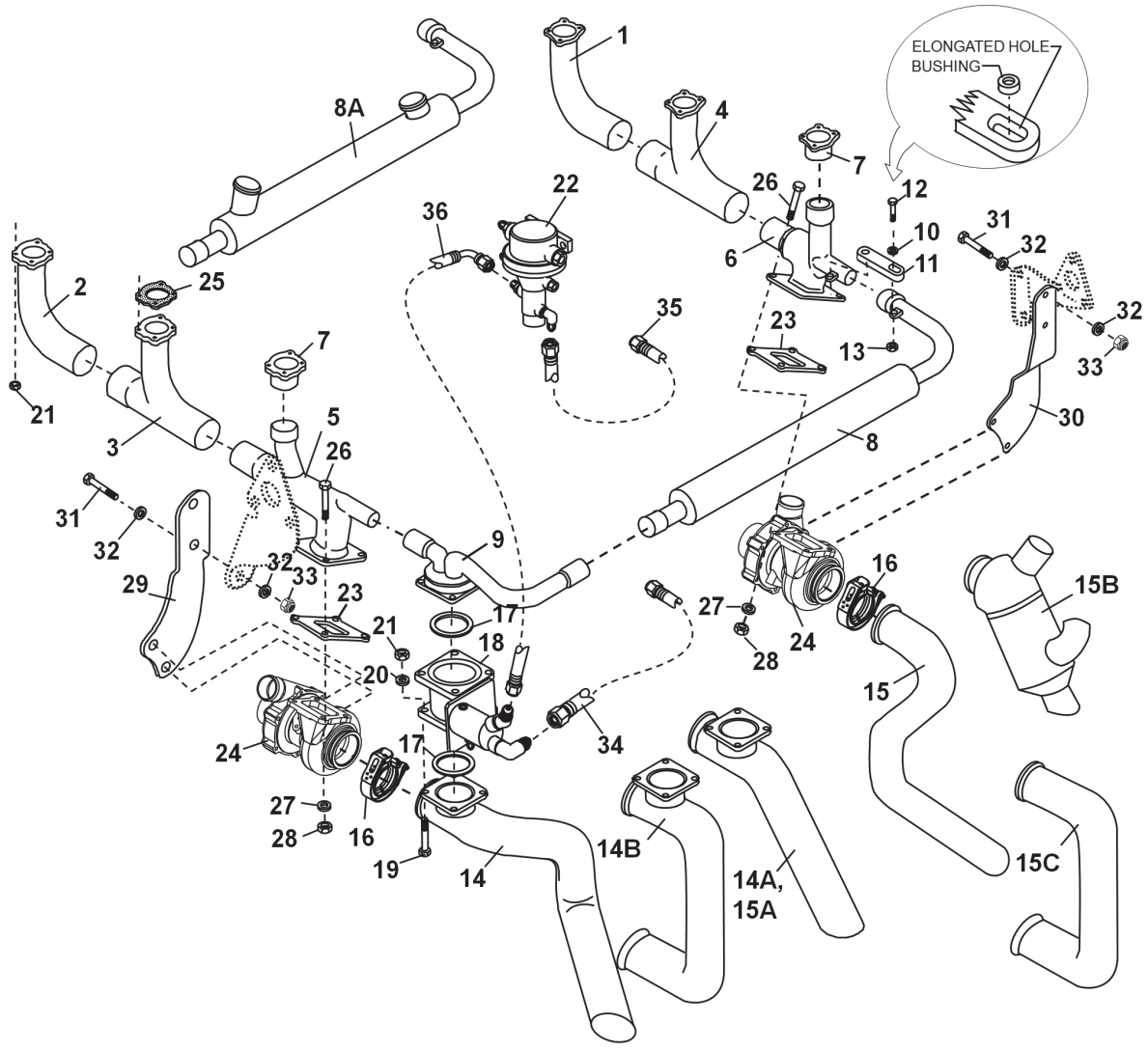


Figure 17-29. Composite Turbocharger and Exhaust System

1	Elbow Riser	10	Bushing	17	Gasket	28	Lock Nut
2	Elbow Riser	11	Tie Rod	18	Wastegate Assembly	29	Bracket
3	Tee Assembly	12	Bolt	19	Bolt	30	Bracket
4	Tee Assembly	13	Lock Nut	20	Washer	31	Screw
5	Turbo Transition	14	Contoured Tailpipe	21	Lock Nut	32	Washer
6	Turbo Transition	14C	Inverse Tailpipe Option	22	Controller	33	Lock Nut
7	Riser	15	Contoured Tailpipe	23	Gasket	34	Hose
8	Crossover Assembly	15A	Straight Tailpipe	24	Turbocharger Assembly	35	Hose
8A	Crossover Assy with Heater Shroud Option	15B	Heater	25	Gasket	36	Hose
9	Transition	15C	Inverse Tailpipe Option	26	Bolt		
		16	V-band clamp	27	Washer		

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.

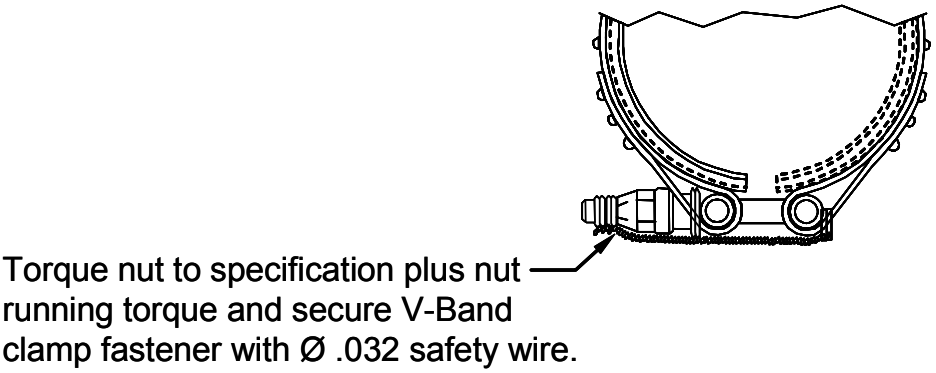


Figure 17-30. V-Band Clamp Safety Wire Detail

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.

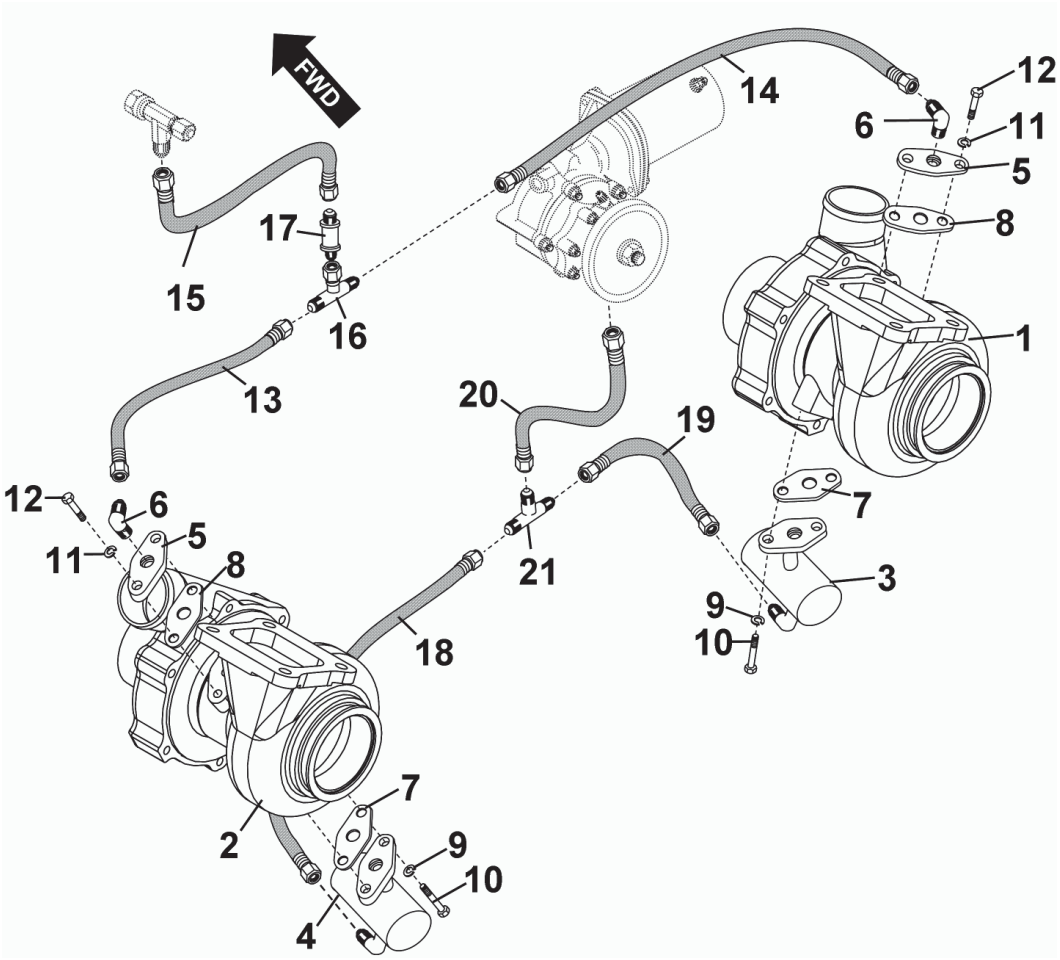


Figure 17-31. Turbocharger Lubrication B C E G

1	Left Turbocharger	7	Gasket	13	Tee	19	Hose
2	Right Turbocharger	8	Left Oil Reservoir	14	Check Valve	20	Hose
3	Gasket	9	Right Oil Reservoir	15	Hose	21	Hose
4	Adapter	10	Lock Washer	16	Hose		
5	Lock Washer	11	Bolt	17	Hose		
6	Bolt	12	Adapter	18	Tee		

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.

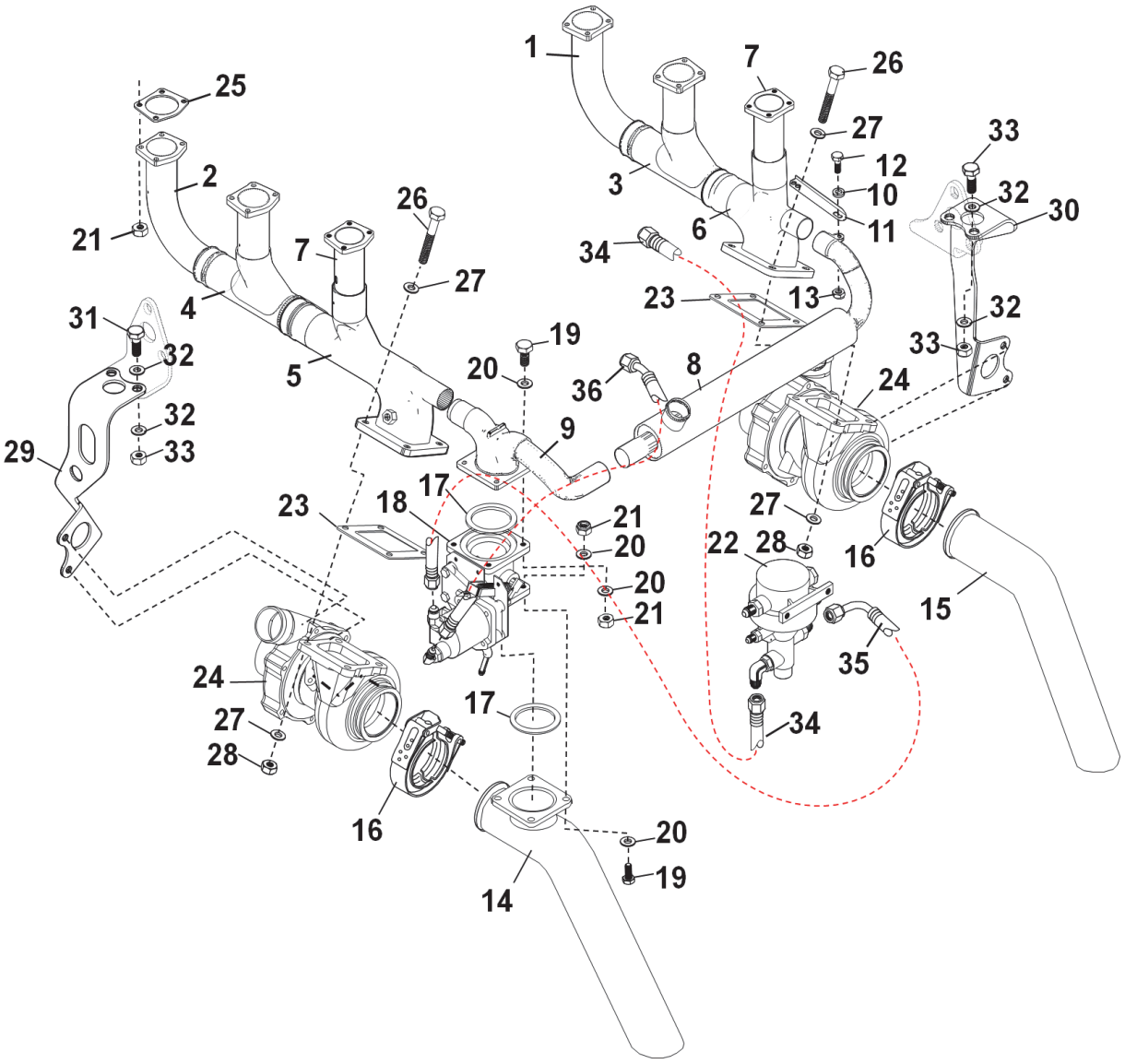


Figure 17-32. Turbocharger and Exhaust System

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.

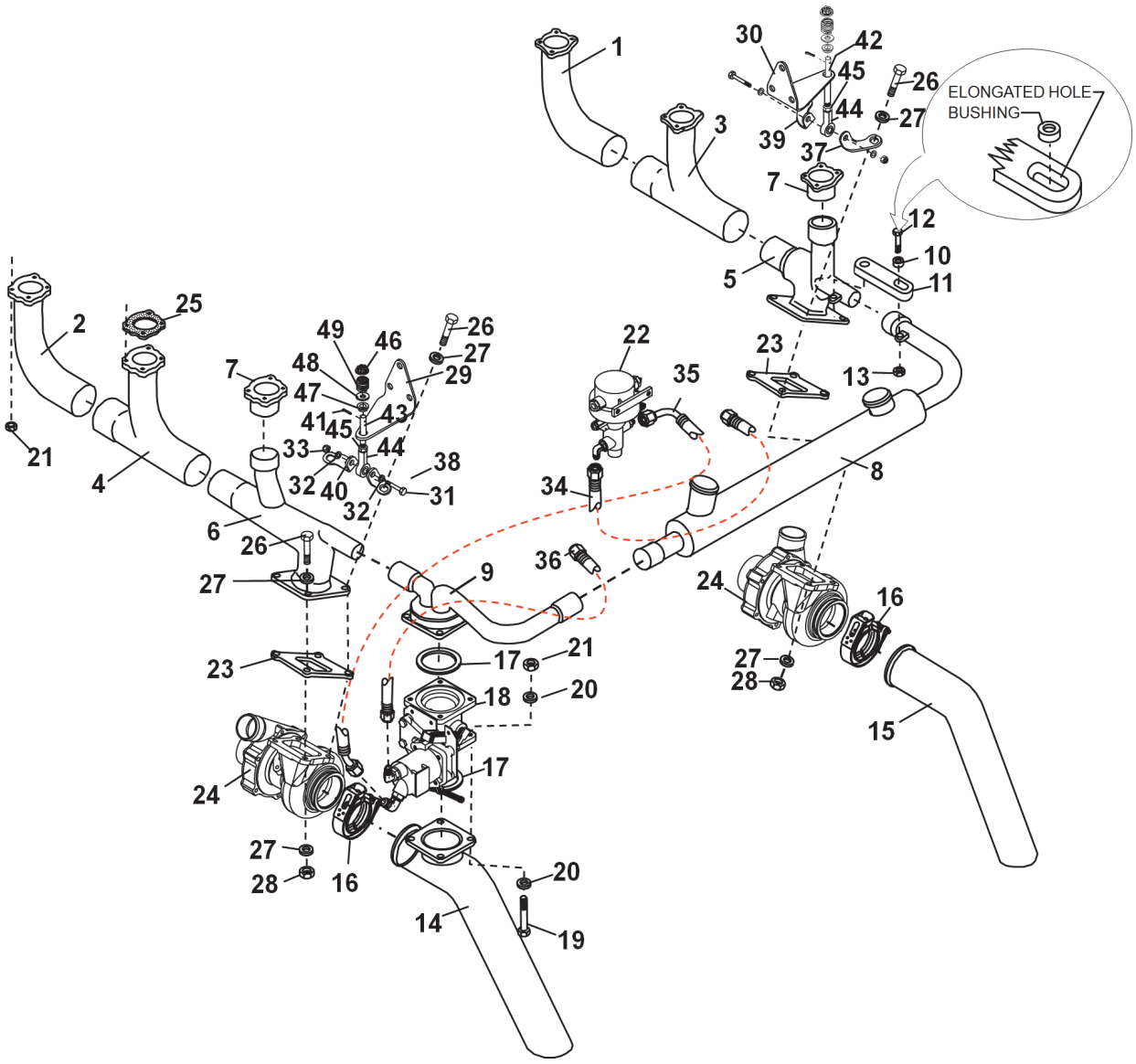


Figure 17-33. Turbocharger and Exhaust System

1	Elbow Riser	11	Tie Rod	19	Bolt	31	Screw
2	Elbow Riser	12	Bolt	20	Washer	32	Washer
3	Tee Assembly	13	Lock Nut	21	Lock Nut	33	Lock Nut
4	Tee Assembly	14	Contoured Tailpipe	22	Controller	34	Hose
5	Turbo Transition	14C	Inverse Tailpipe Option	23	Gasket	35	Hose
6	Turbo Transition	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
7	Riser	15A	Straight Tailpipe	25	Gasket		
8	Crossover Assembly	15B	Heater	26	Bolt		
8A	Crossover Assy with Heater Shroud Option	15C	Inverse Tailpipe Option	27	Washer		
		16	V-band clamp	28	Lock Nut		
9	Transition	17	Gasket	29	Bracket		
10	Bushing	18	Wastegate Assembly	30	Bracket		

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

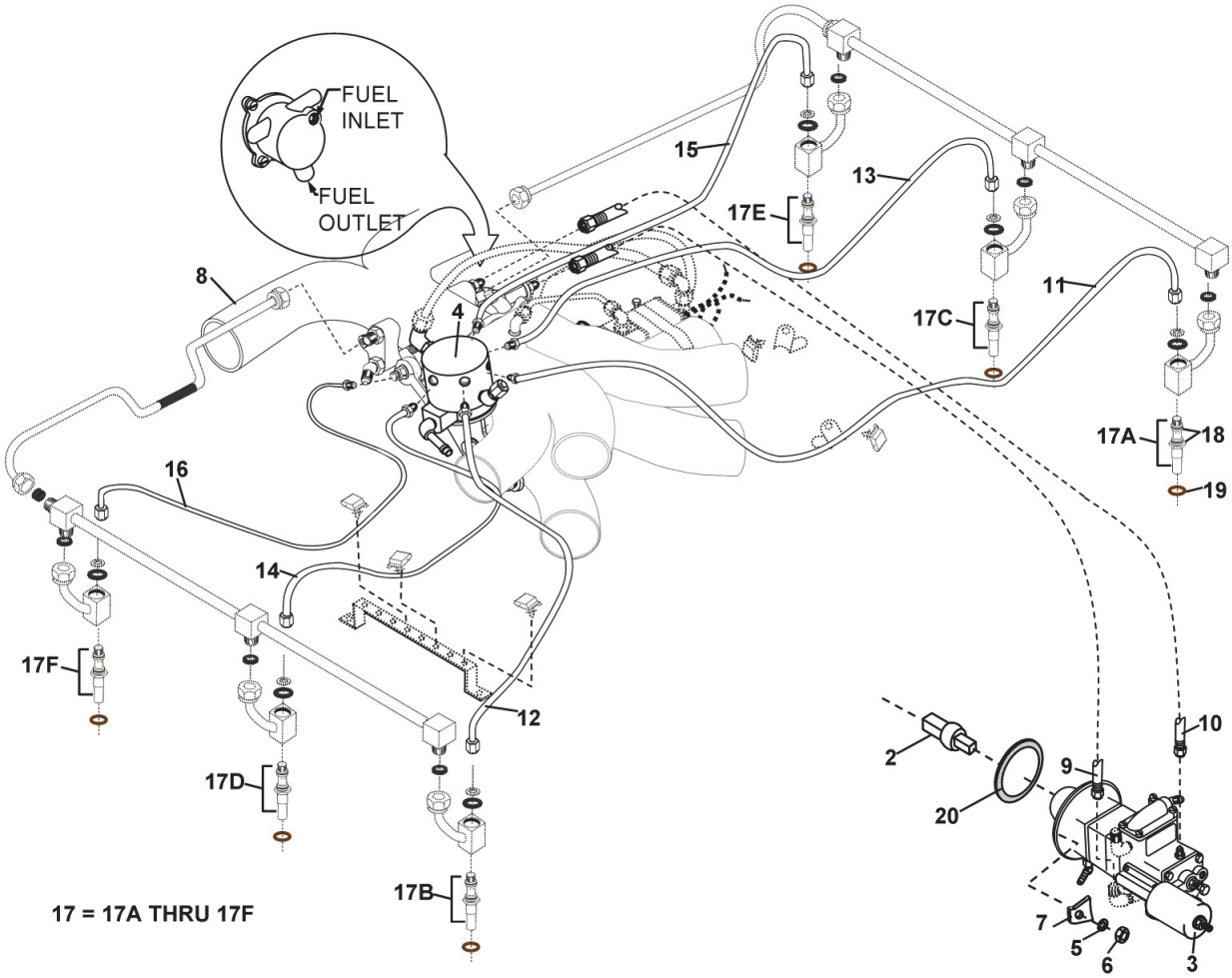


Figure 17-34. Fuel Injection System B C E

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		

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.

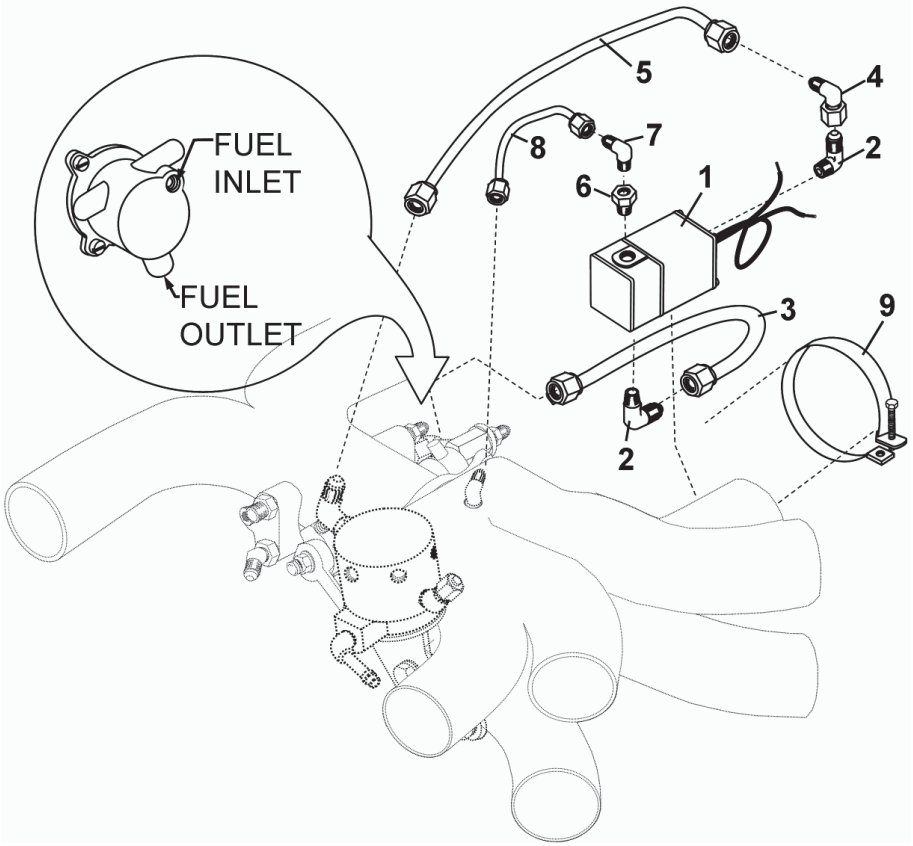


Figure 17-35. Fuel Priming System B C E

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

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

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-IA 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.

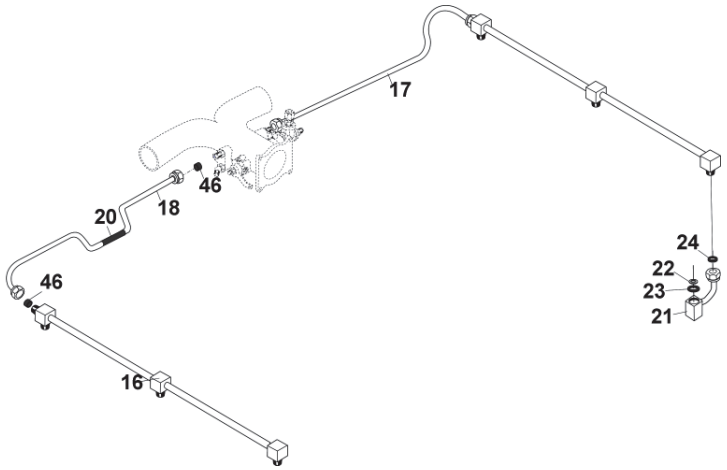


Figure 17-37. Air Reference Tubes
See Figure 17-28 for index

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.

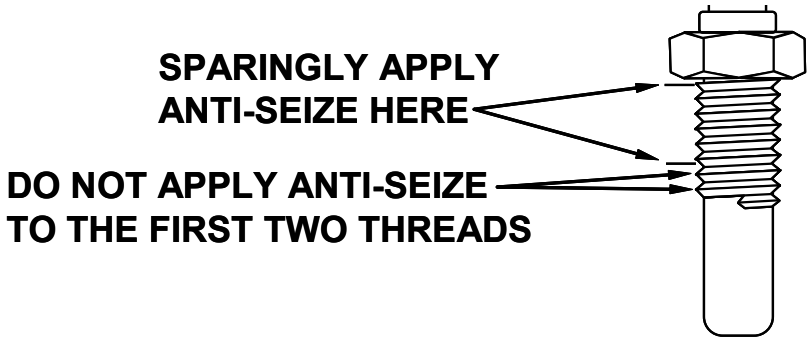


Figure 17-36 repeated for reference

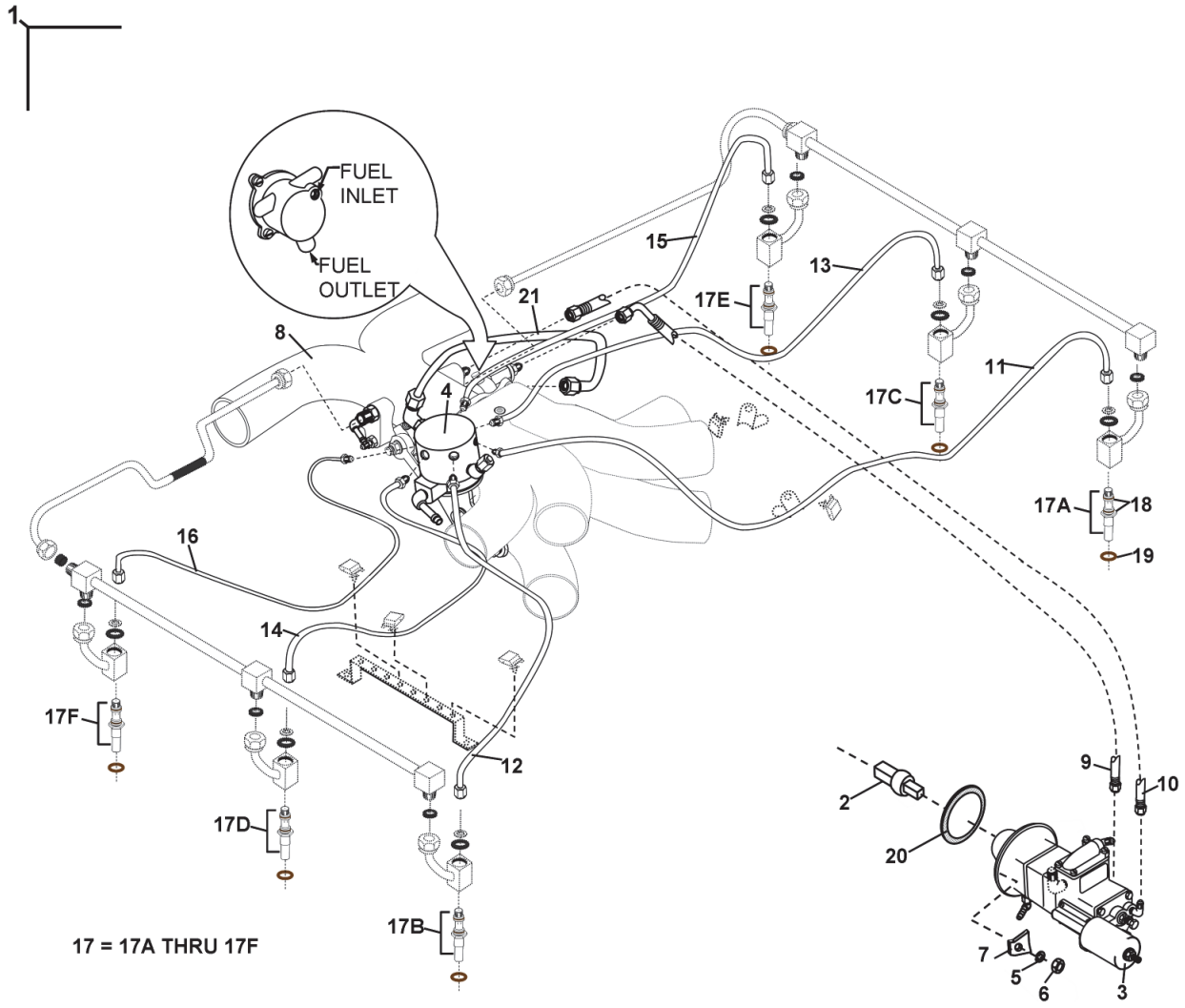


Figure 17-38. Fuel Injection System G

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		

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.

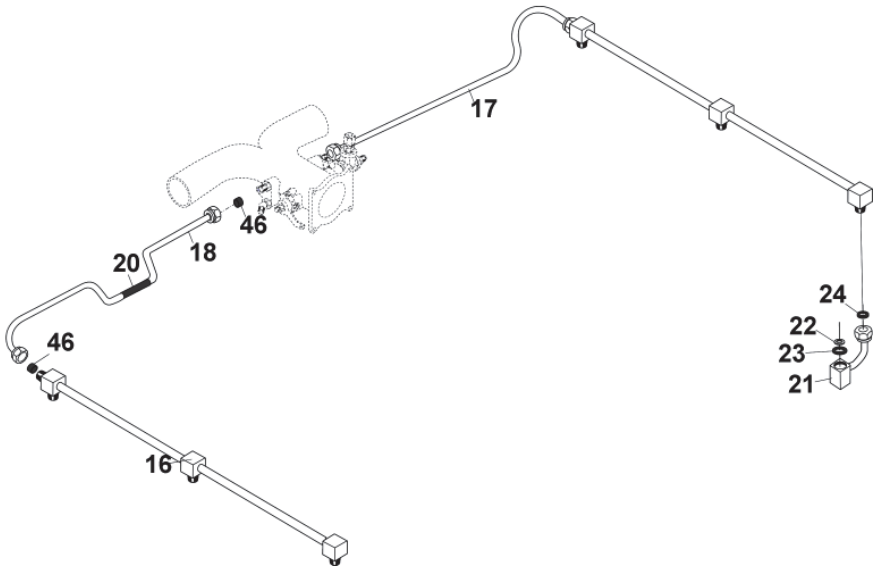


Figure 17-37 repeated for reference

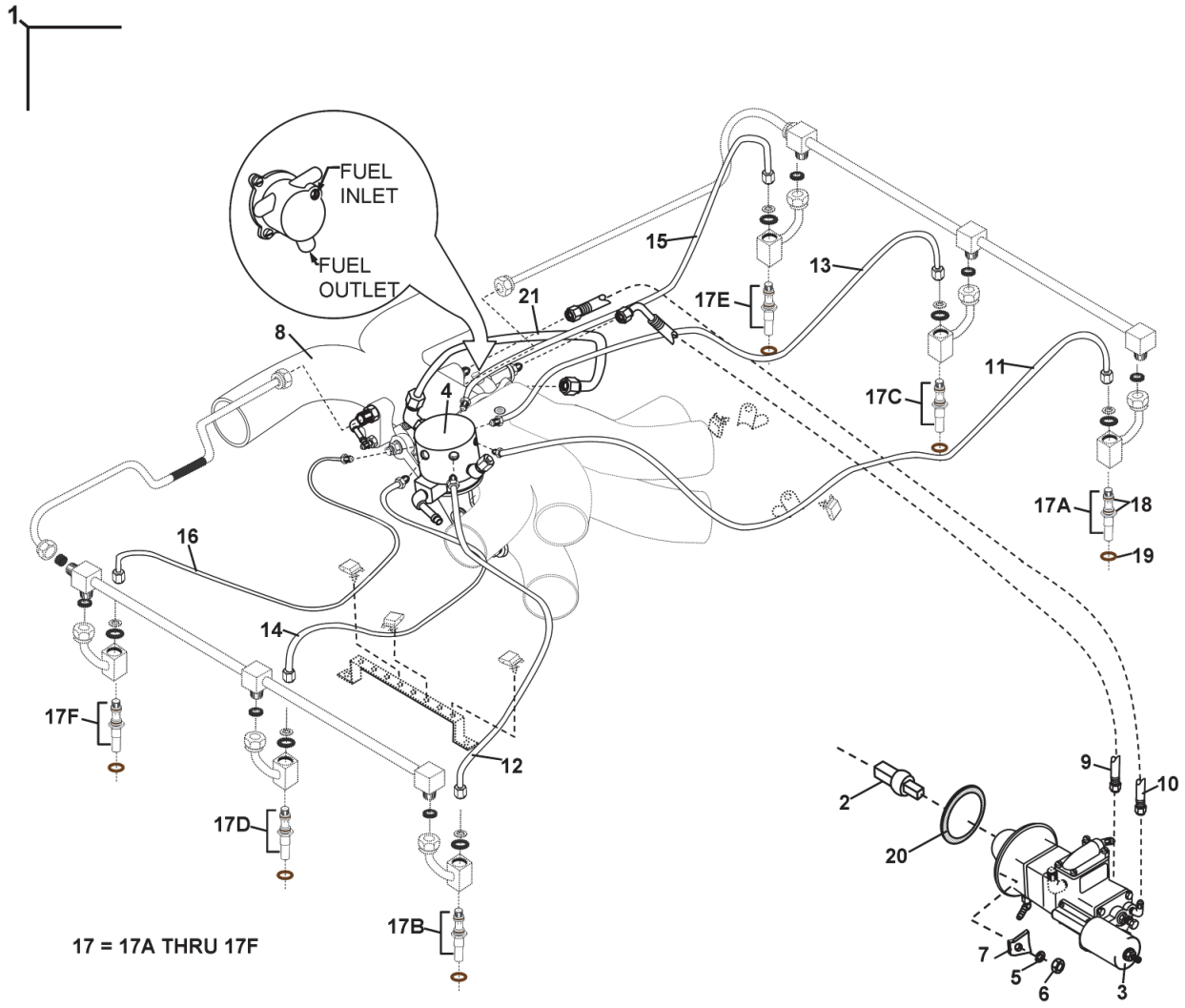


Figure 17-38 repeated for reference

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.

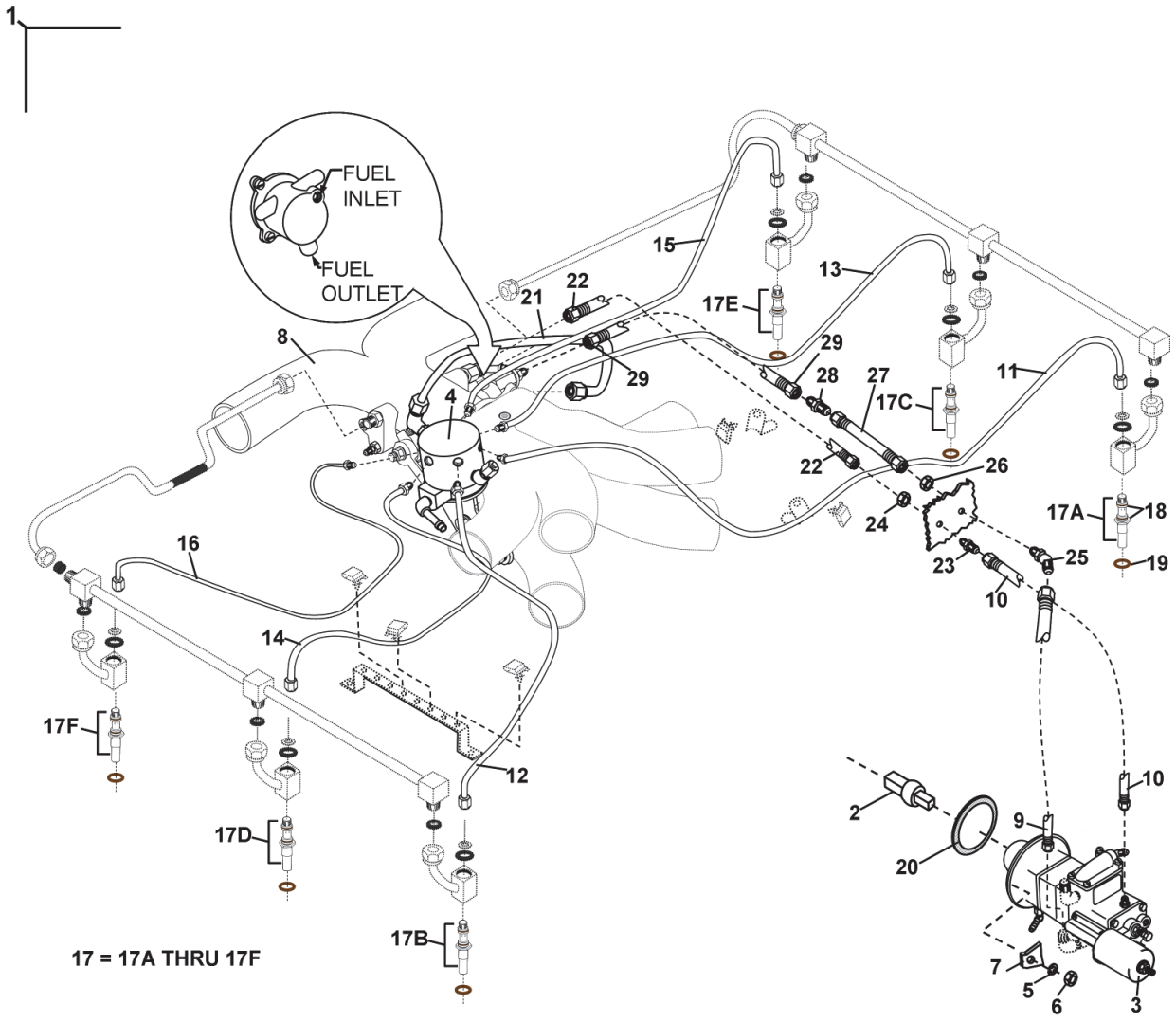


Figure 17-39. Fuel Injection System K N

1	Fuel Injection Kit	10	Hose Assembly	17B	Injector Nozzle #2	22	Hose Assembly
2	Crankshaft Gear Coupling	11	Fuel Inj. Tube Assembly #1	17C	Injector Nozzle #3	23	Bulkhead Union
3	Fuel Pump Assembly	12	Fuel Inj. Tube Assembly #2	17D	Injector Nozzle #4	24	Bulkhead Nut
4	Fuel Manifold Valve Assy.	13	Fuel Inj. Tube Assembly #3	17E	Injector Nozzle #5	25	Bulkhead 45° Fitting
5	Lock Washer	14	Fuel Inj. Tube Assembly #4	17F	Injector Nozzle #6	26	Bulkhead Nut
6	Nut	15	Fuel Inj. Tube Assembly #5	18	Washer	27	Hose Assembly
7	Hold Down Washer	16	Fuel Inj. Tube Assembly #6	19	O-Ring	28	Bulkhead Union
8	Throttle & Metering Assembly	17	Injector Nozzle Kit	20	Fuel Pump Adapter Gasket	29	Hose Assembly
9	Hose Assembly	17A	Injector Nozzle #1	21	Fuel Tube		

Figure 17-36 repeated for reference

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.

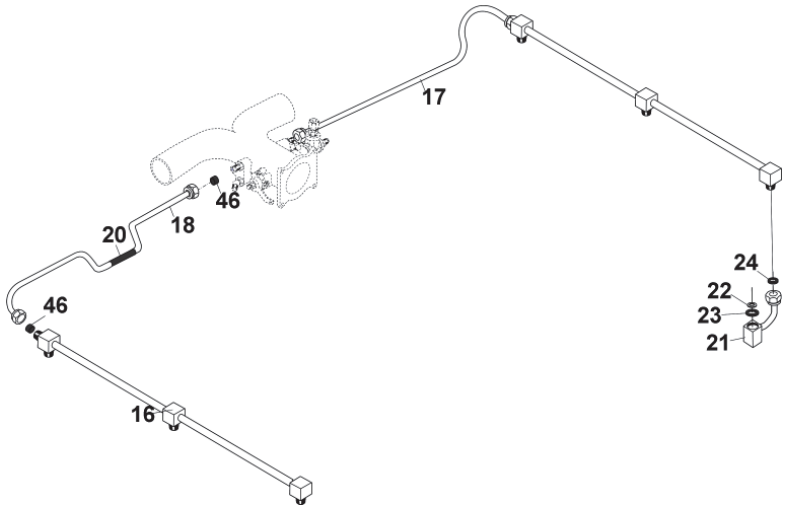


Figure 17-37 repeated for reference

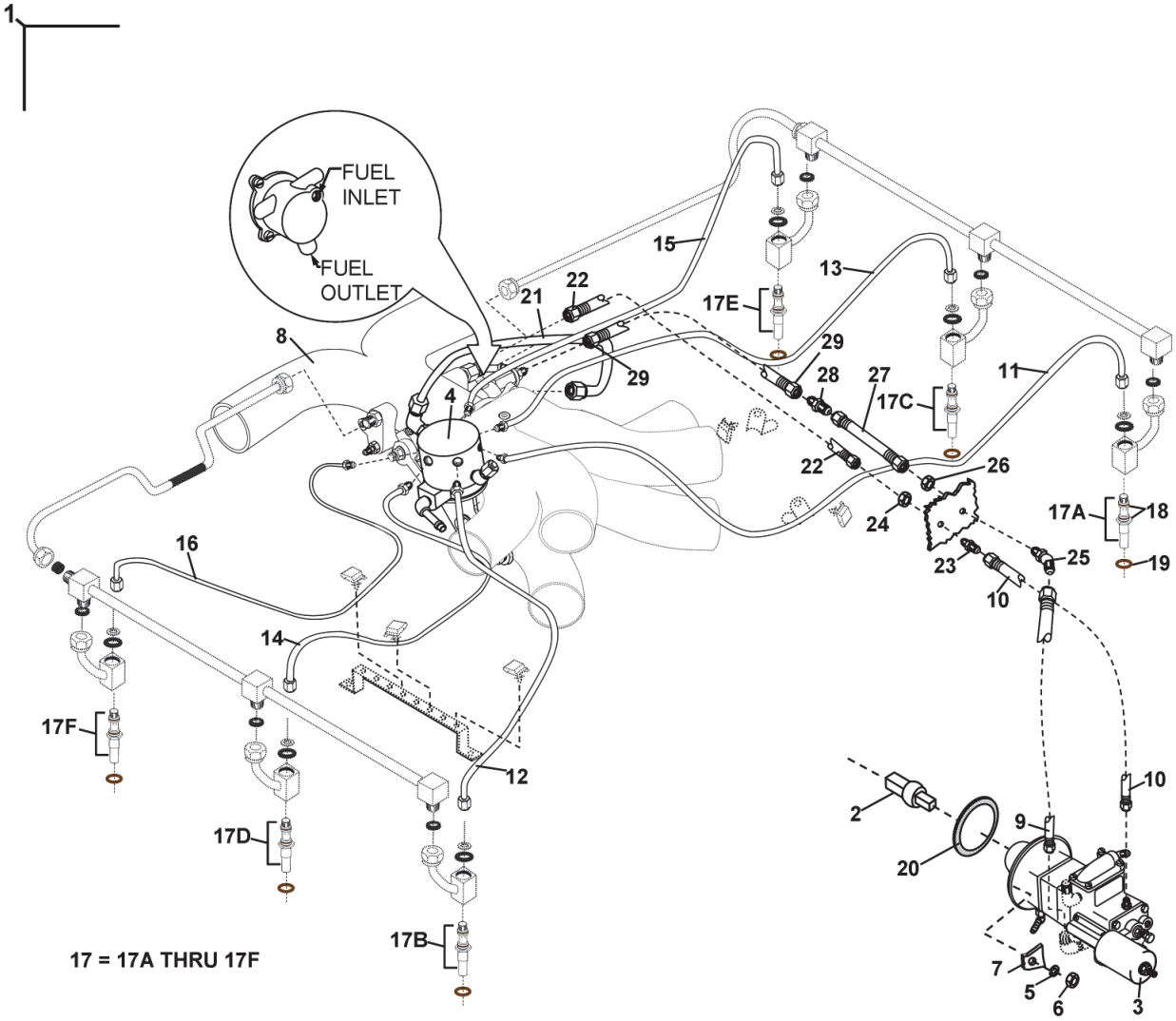


Figure 17-39 repeated for reference

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.

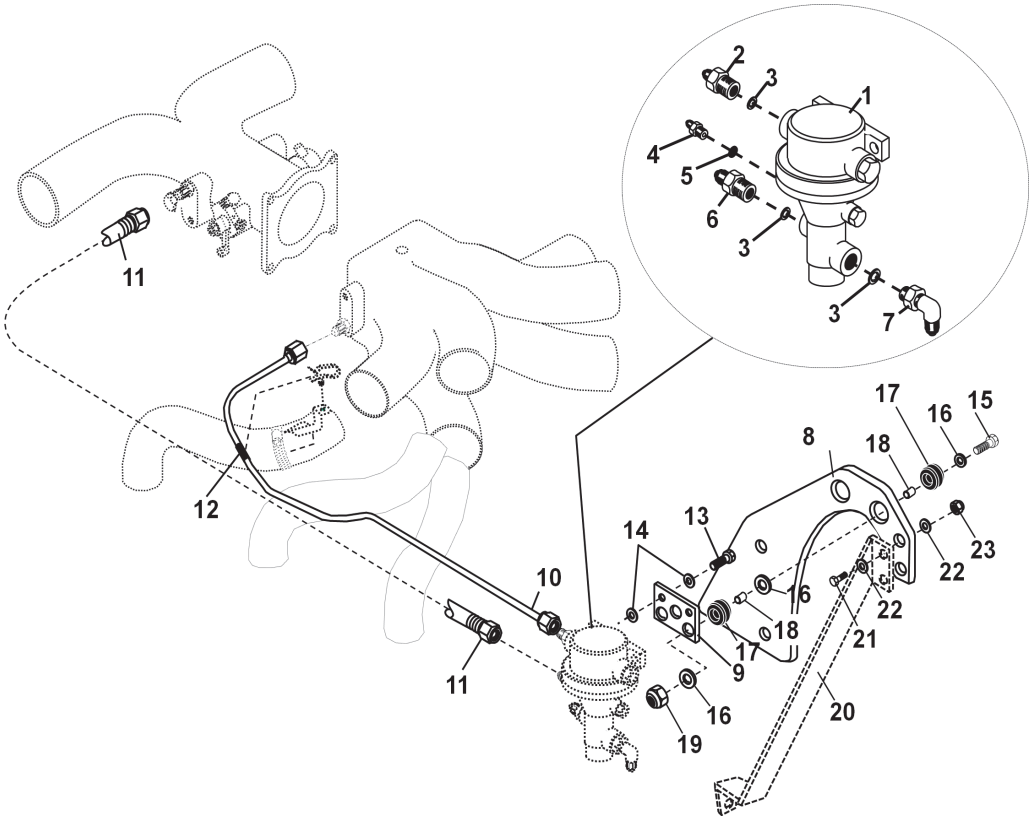


Figure 17-40. Wastegate Controller B C E G

1	Controller	7	90° Elbow Fitting	13	Bolt	19	Lock Nut
2	Reducer	8	Bracket	14	Washer	20	Bracket
3	O-Ring	9	Bracket	15	Bolt	21	Bolt
4	Adapter	10	Tube Assembly	16	Washer	22	Washer
5	O-Ring	11	Hose Assembly	17	Grommet	23	Lock Nut
6	Adapter Fitting	12	Line Protector	18	Spacer		

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.

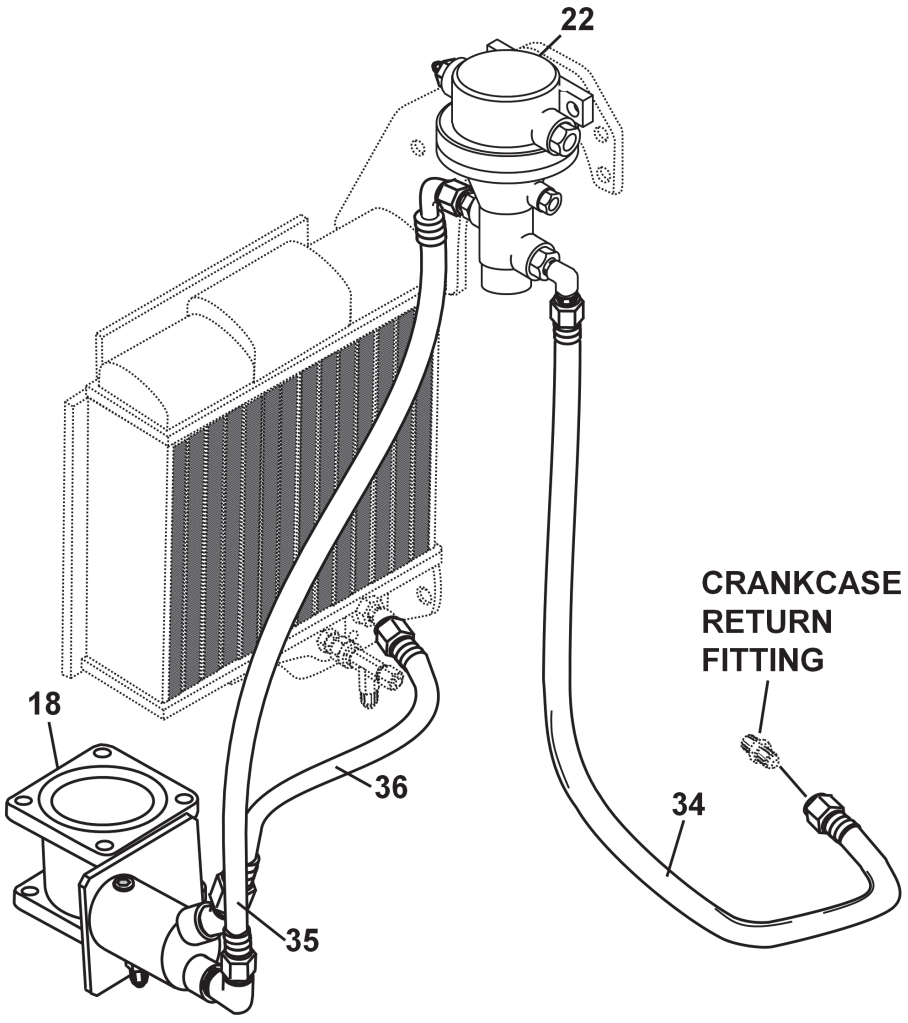


Figure 17-41. Wastegate Controller Lubrication

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).

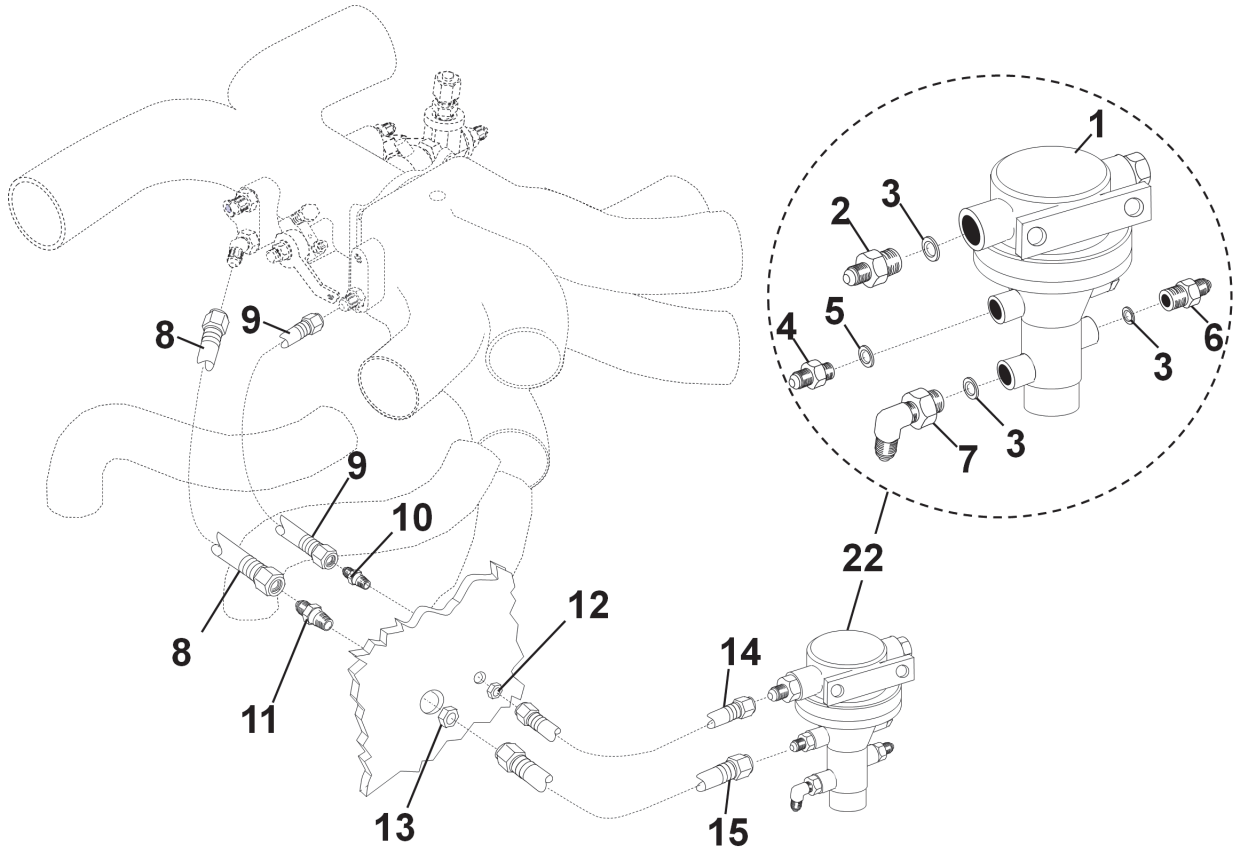


Figure 17-42. Wastegate Controller Hydraulic Hose Installation K

1	Controller	5	O-Ring Seal	9	Hose Assembly	13	Bulkhead Nut
2	Reducer	6	Adapter Fitting	10	Bulkhead Union	14	Hose Assembly
3	O-Ring Seal	7	Elbow	11	Bulkhead Union	15	Hose Assembly
4	#4 Tube Adapter	8	Hose Assembly	12	Bulkhead Nut		

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.

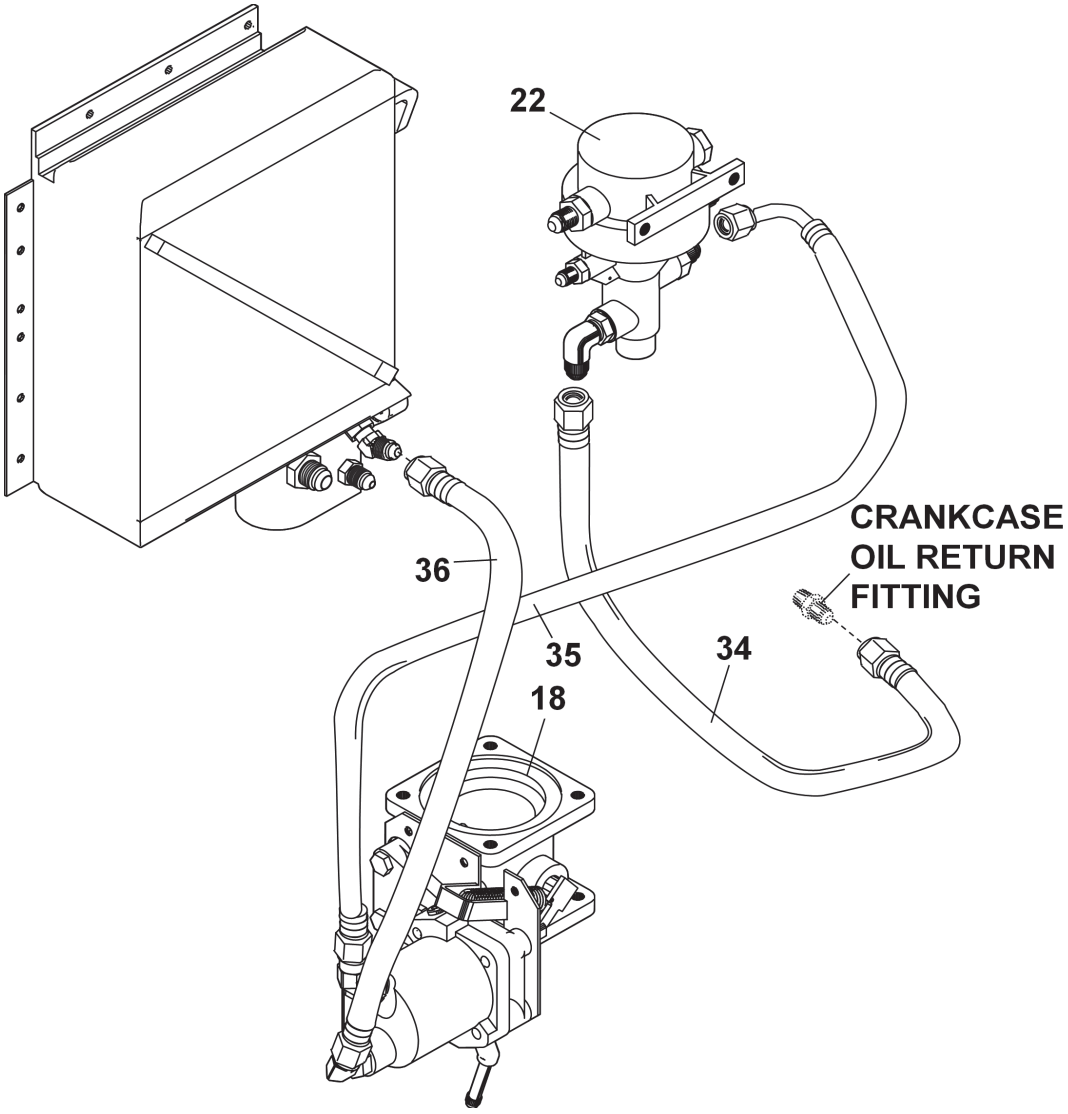


Figure 17-43. Wastegate Controller Lubrication K

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).

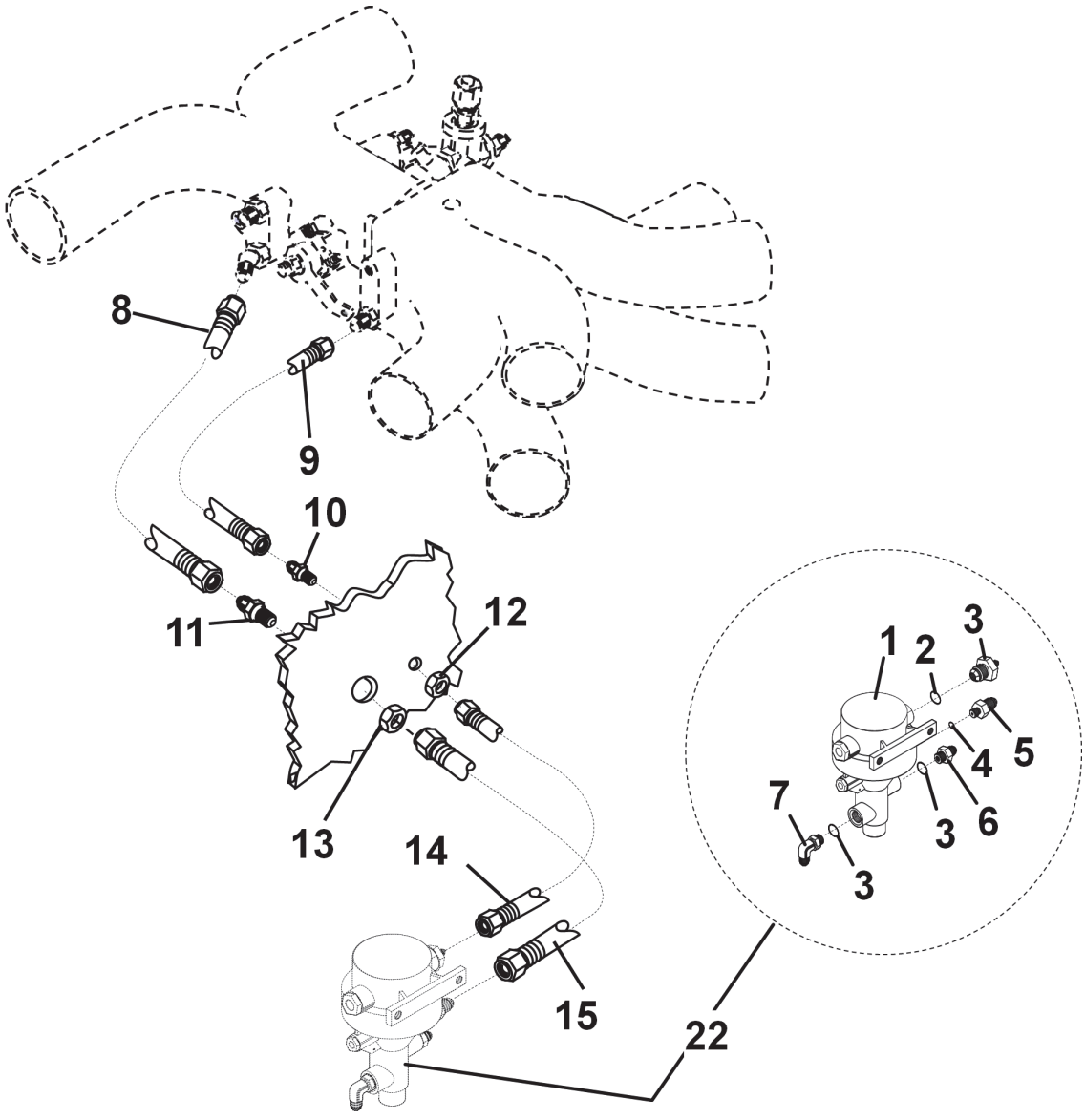


Figure 17-44. Wastegate Controller Hydraulic Hose Installation N

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.

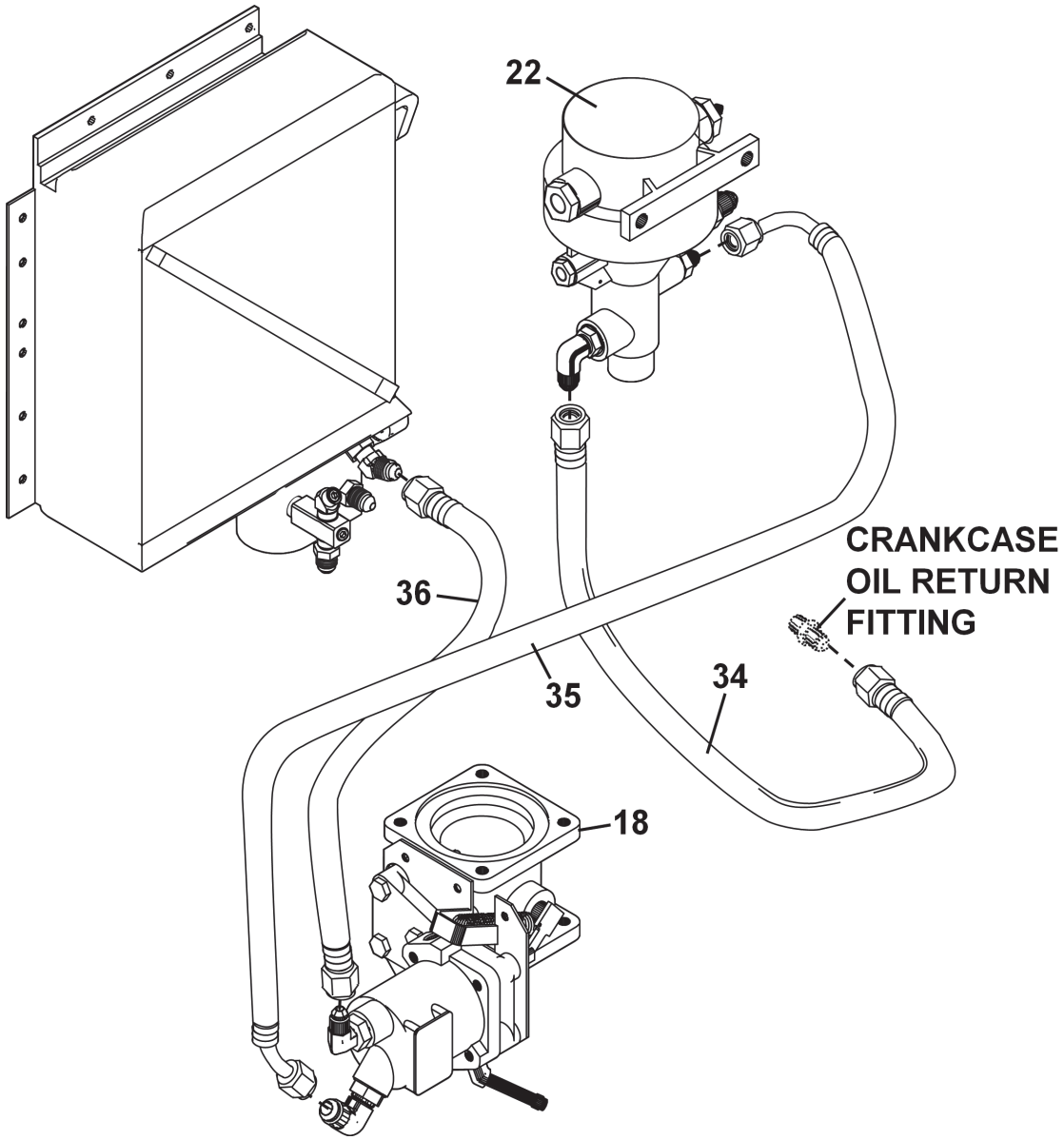


Figure 17-45. Wastegate Controller Lubrication N

17-13. Air/Oil Separator Installation

NOTE: K N 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).

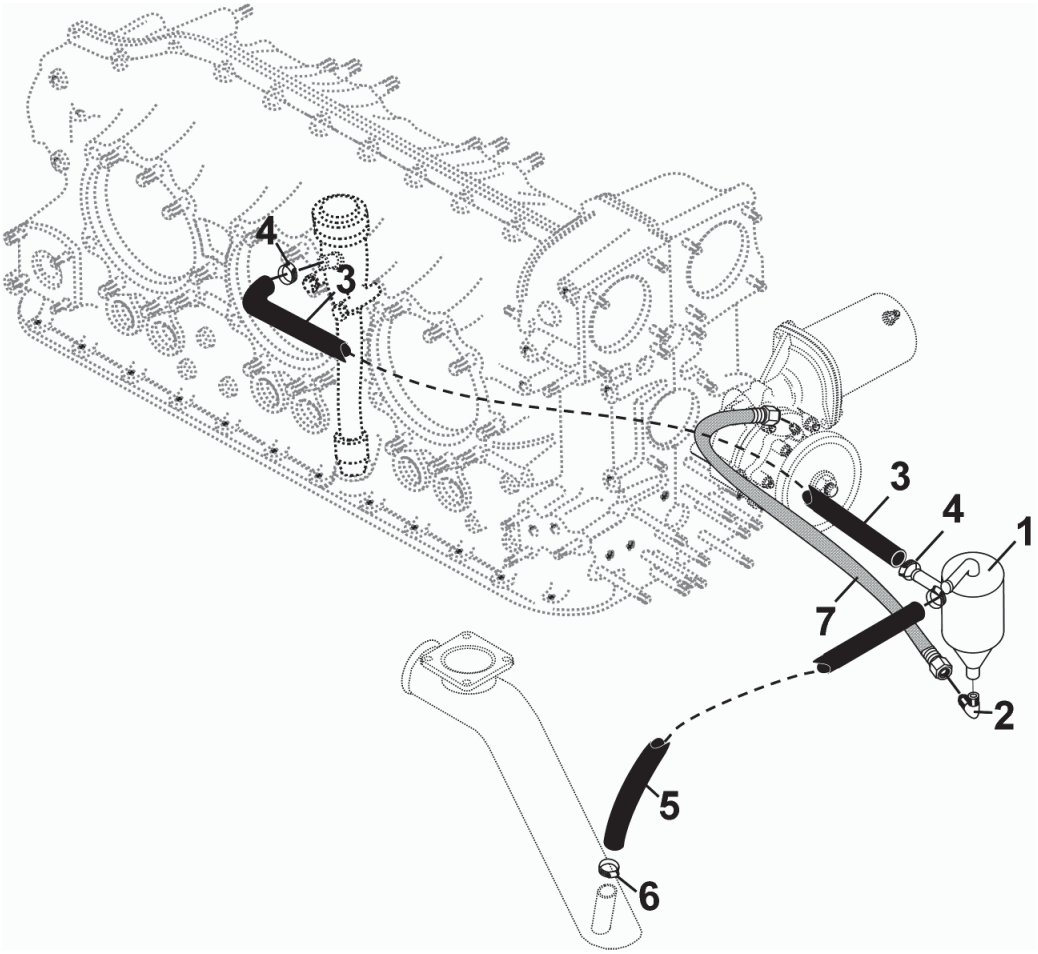


Figure 17-46. Air/Oil Separator B C E G

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 **B C E G** bottom or **K N** 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.

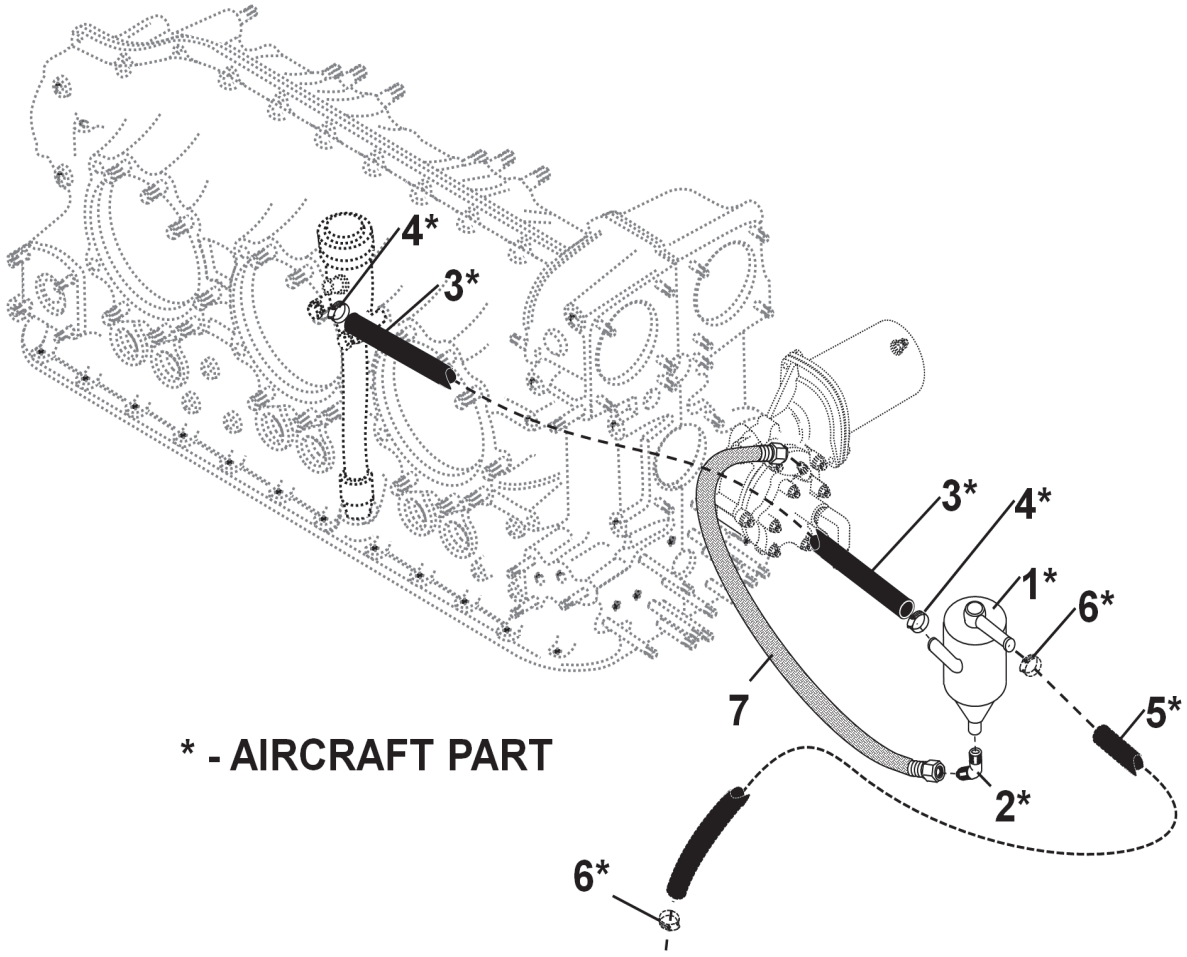


Figure 17-47. Air/Oil Separator K

1	Air/Oil Separator Assembly	3	Hose Assembly	5	Hose Assembly	7	Hose
2	Elbow Fitting	4	Hose Clamp	6	Hose Clamp		

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.

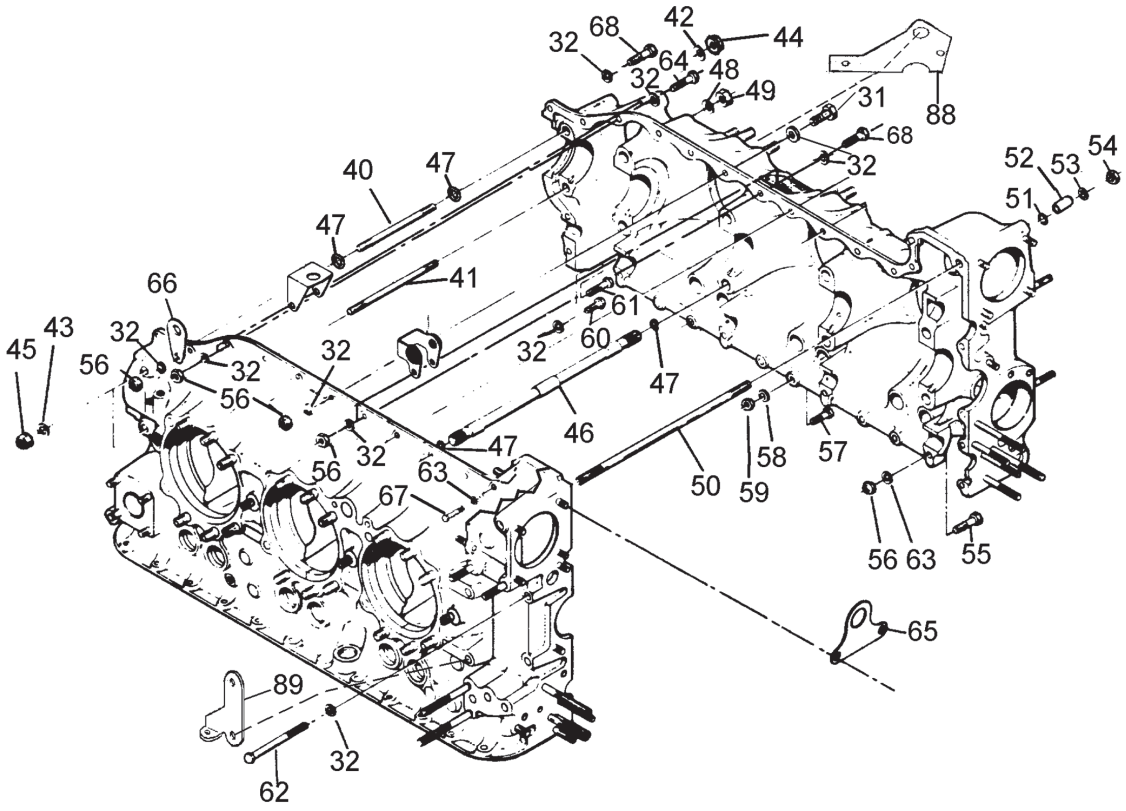


Figure 17-8 repeated for reference

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.

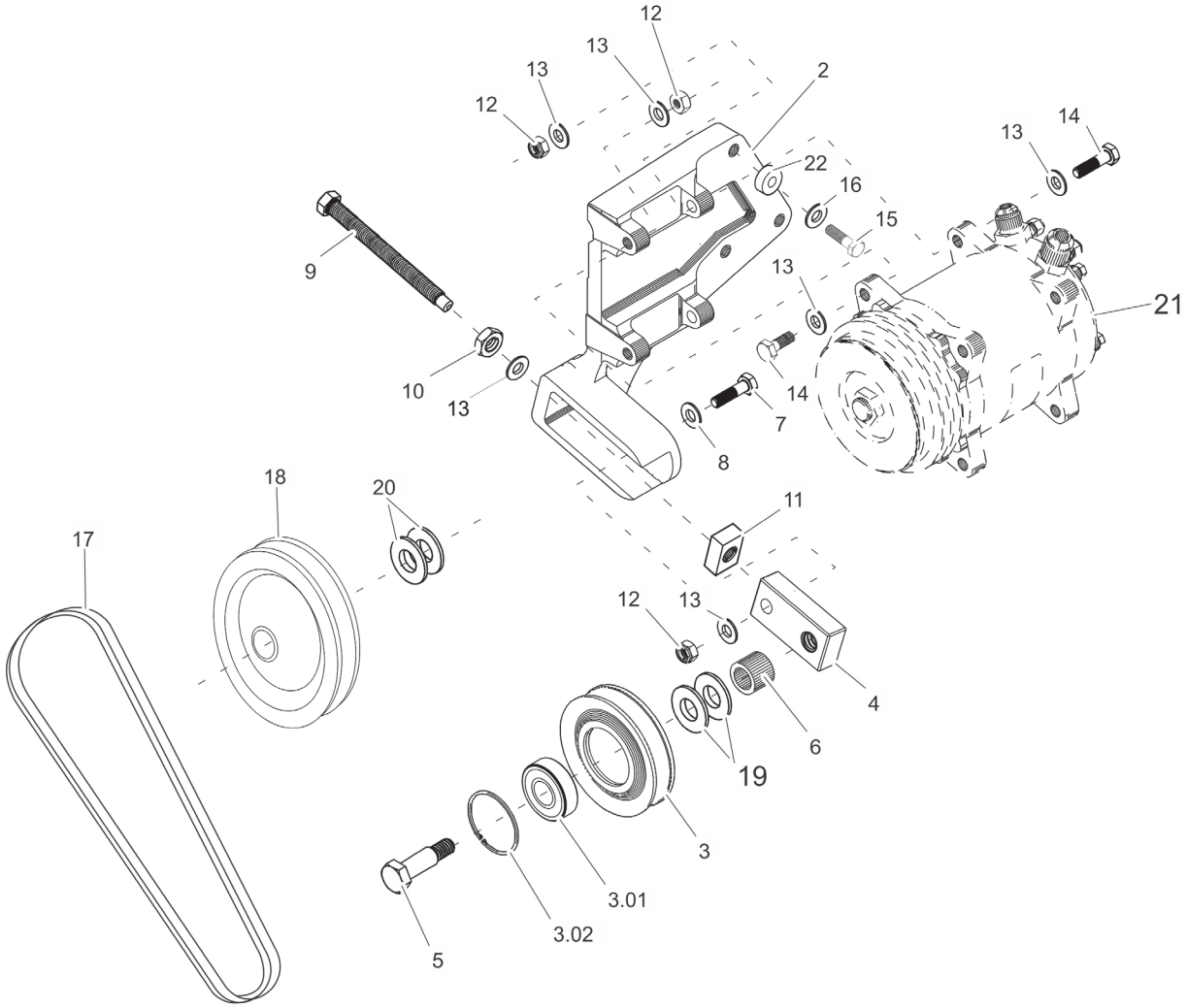


Figure 17-48. Air Conditioning Compressor Mounting Assembly

1	Mounting Bracket	7	Spacer	13	Nut	19	Sheave
2	Idler Sheave	8	Bolt	14	Plain Washer	20	Self-locking 12 point nut
3	Ball Bearing	9	Special Washer	15	Bolt	21	Shim
4	Retaining Ring	10	Tensioning Bolt	16	Bolt	22	Shim
5	Block Assembly	11	Nut	17	Washer		
6	Sheave Support Bolt	12	Rectangular Nut	18	Drive Belt		

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.

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.

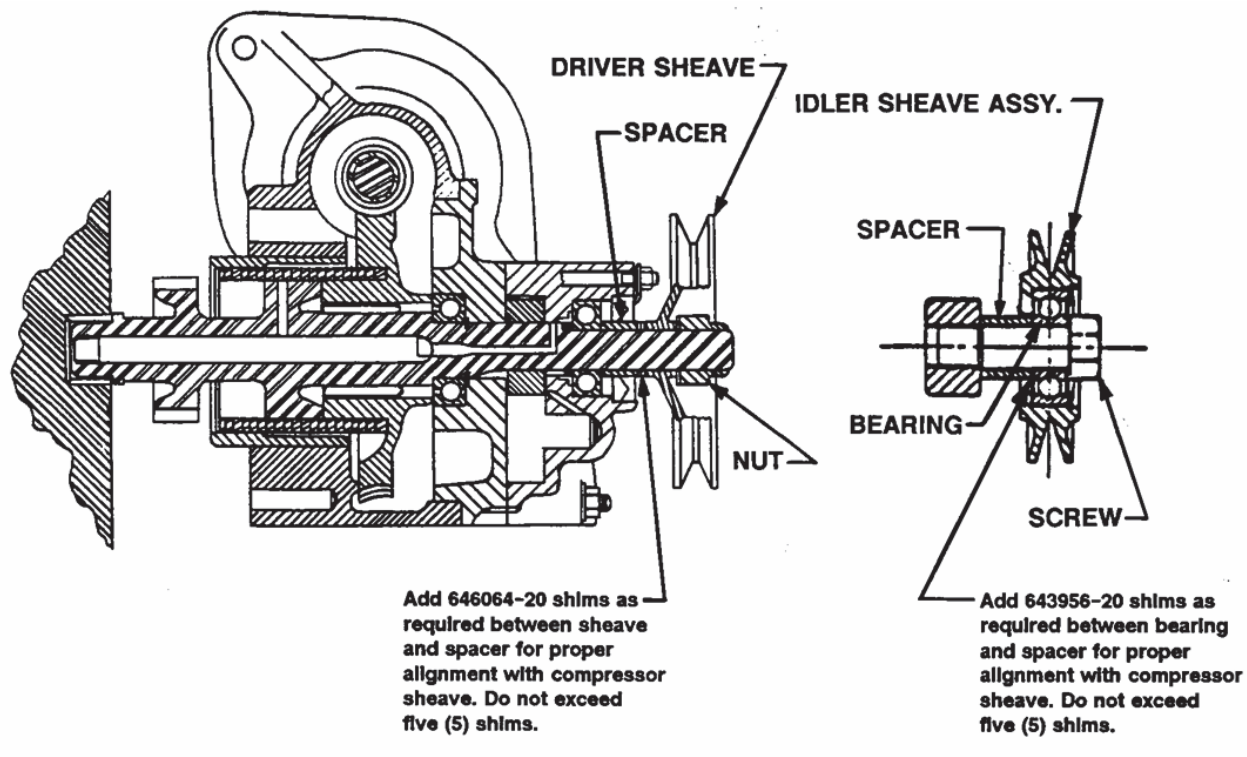


Figure 17-49. Starter Adapter Belt Sheave Alignment

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.

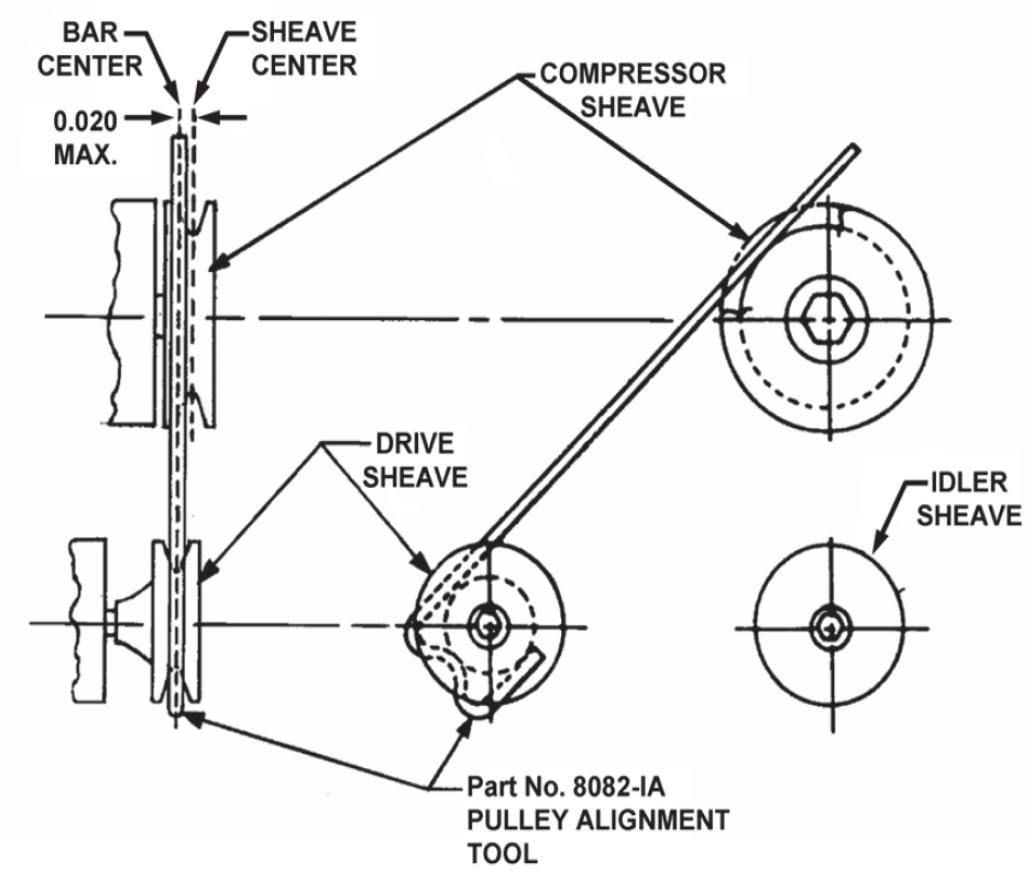


Figure 17-50. Sheave Alignment

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.

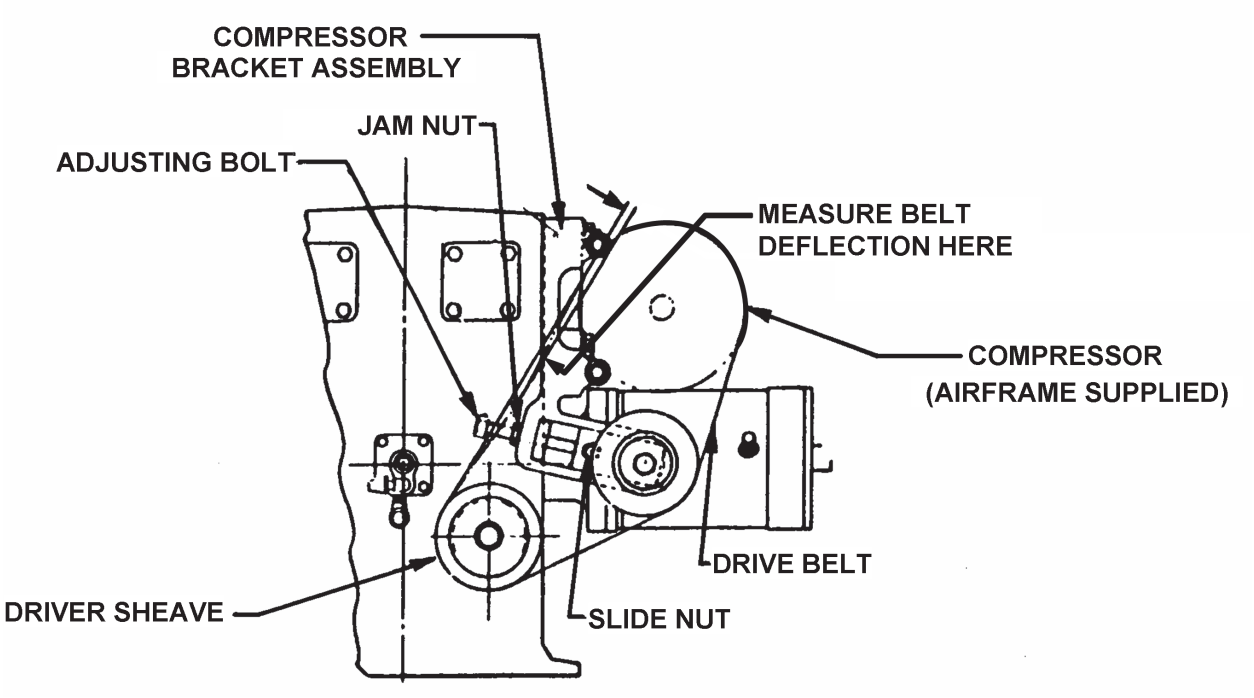


Figure 17-51. Belt Tension Adjustment

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.

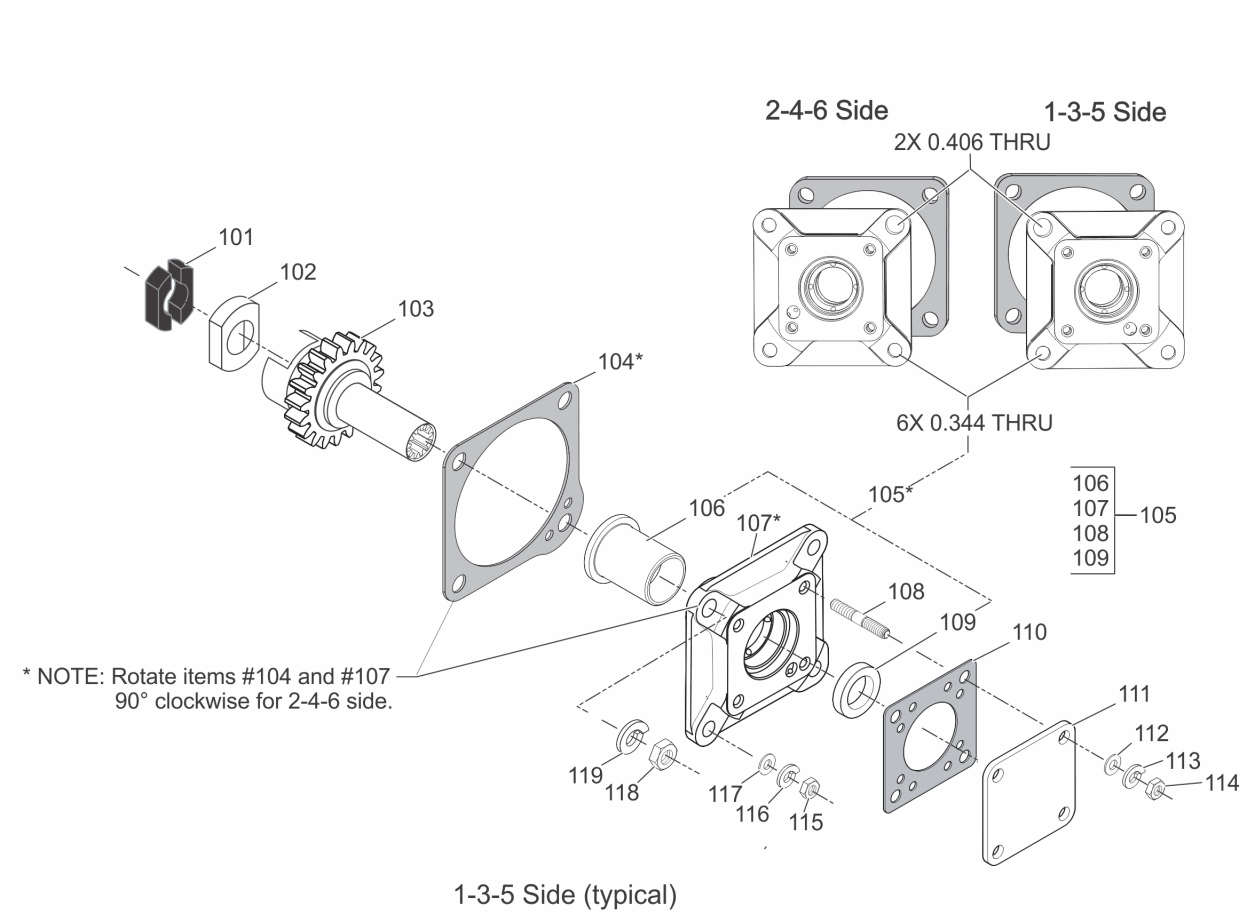

Figure 17-52. Accessory Drive Adapter

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		

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.

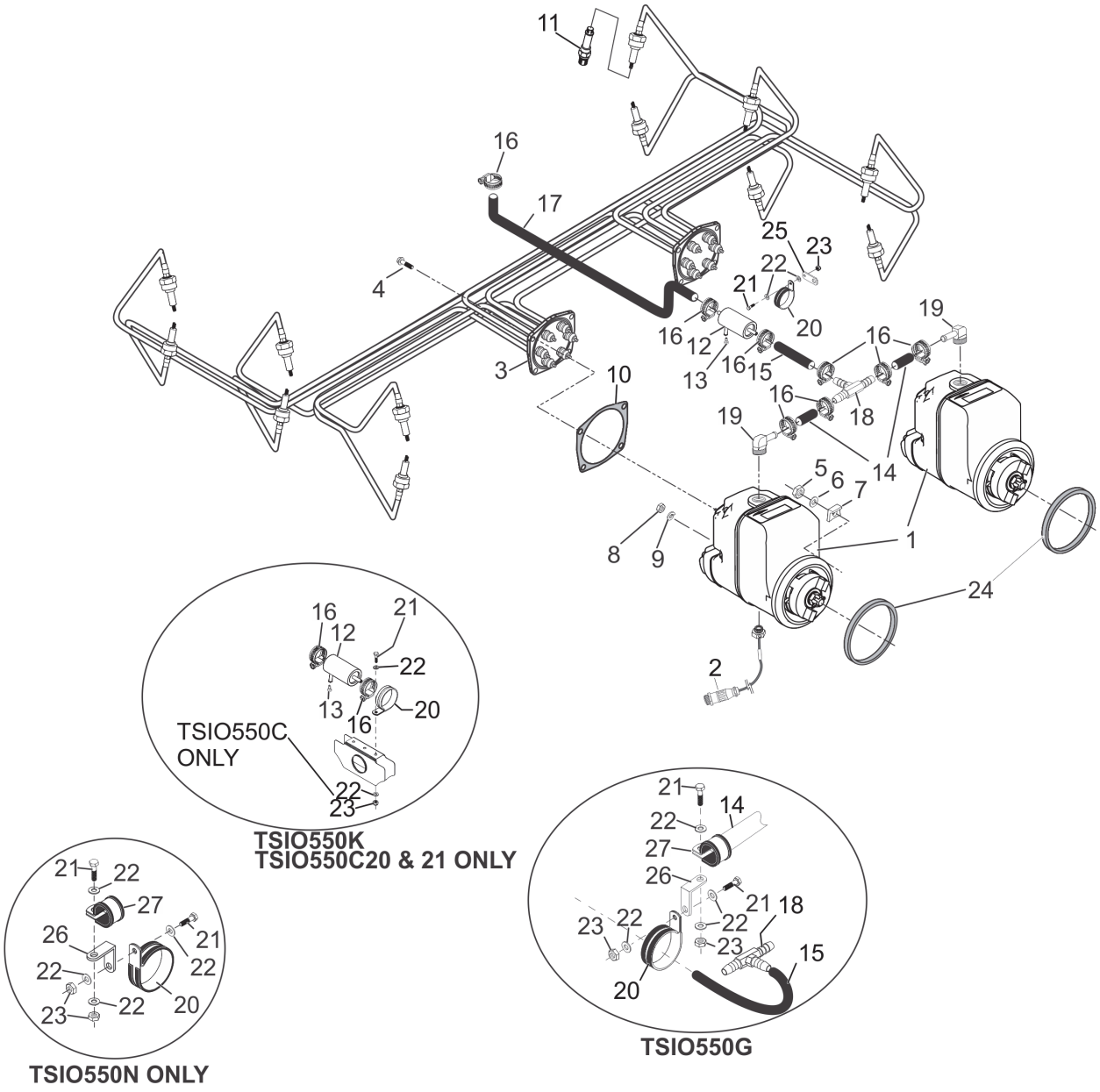

Figure 17-53. Continental Motors Ignition

1	Magneto	8	Nut	15	Hose	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		

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.
6. Torque the hose clamps to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
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.

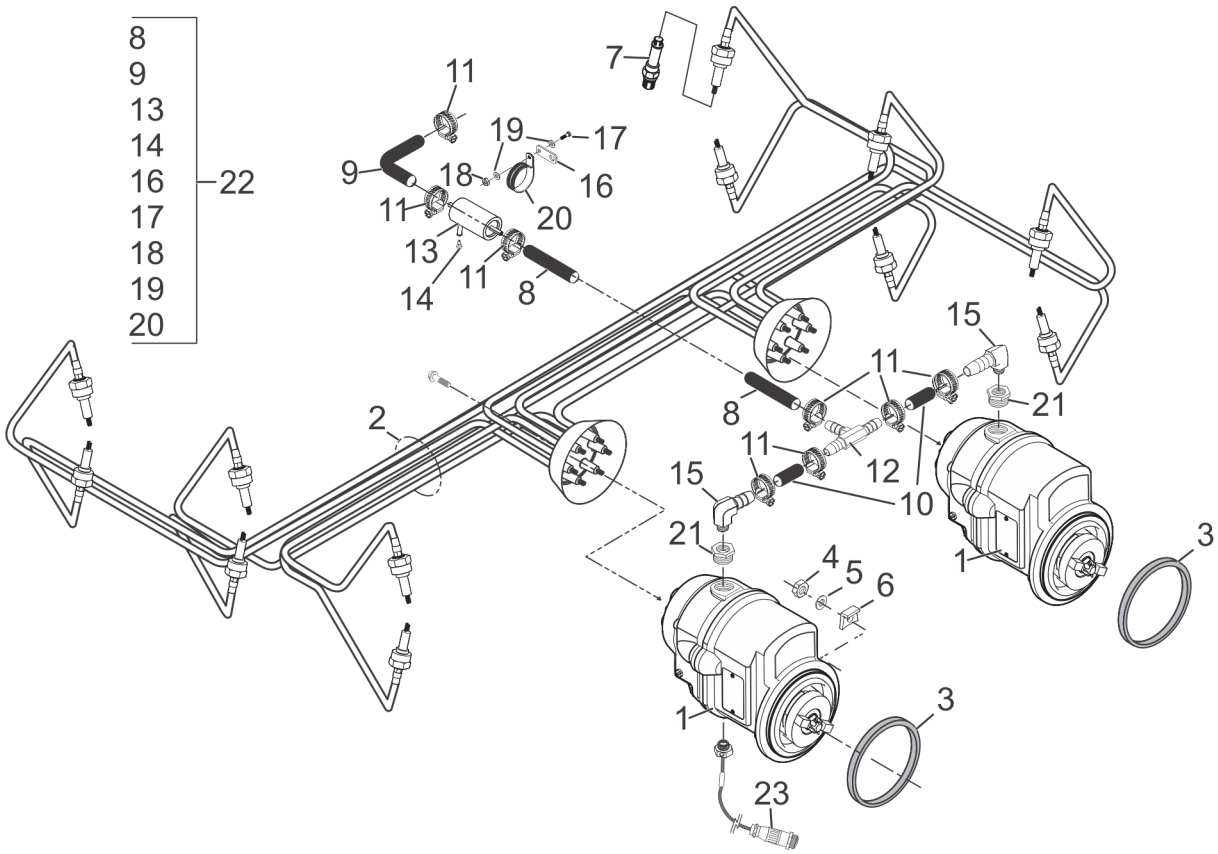

Figure 17-54. Champion (Slick) Ignition System

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
	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		

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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

Sequence	Requirement	Section References
1	Prepare the Engine for Operation	"Maintenance Preflight Inspection" in Section 6-4.7.2 of M-0, Standard Practice Maintenance Manual
2	Maintenance Test Run	"Standard Acceptance Test" in Section 18-4
3	Complete Operational Checklist	"Engine Operational Checklist" in Section 6-6 of M-0, Standard Practice Maintenance Manual
4	Perform Flight Check	"Flight Check" instructions in Section 7-2.3[1]

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.

    - 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 18-2. Standard Acceptance Test Requirements

Engine Run Period	Oil (F°) Minimum	CHT (F°) Minimum	Duration (Minutes)	Engine RPM
1	120	175	N/A[1]	1200 ± 25 RPM
2	150	225	N/A	1700 ± 25 RPM
3	165	250	N/A	2300 ± 25 RPM[2]
4	180	250	10	Rated Power RPM[3]
5	180	250	10	75% Power RPM Check Fuel and Oil Pressures. Check Temperatures.
6	180	250	5	Idle RPM (cooling period -300° Max. CHT at shut down.)[4]
7	N/A	N/A	---	Stop engine and perform leak check.[5]
8	180	250	10	75% Power RPM
9	180	250	5	Idle RPM (cooling period)[4 5]

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.

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

Engine Run Period	Time Duration (Minutes)	Engine RPM
1	5	1200 ± 25 RPM
2	5	1600 ± 25 RPM
3	5	2450 ± 25 RPM[1]
4	10	Rated Power RPM[2]
5	10	75% Power RPM Check Fuel and Oil Pressures. Check Temperatures.
6	5	Idle RPM (cooling period 300°F (149°C) maximum at shutdown)[3]
Stop engine, drain and weigh oil for oil consumption determination[4]		
7	5	Warm up to rated RPM
8	30	Rated Power Take engine readings every 10 minutes[4]
9	5	Idle RPM (cooling period 300° Max. CHT at shutdown.) [3 4 5]

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.

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Appendix B.Torque Specifications

Refer to the “Torque Specifications” in Appendix B of M-0, Standard Practice Maintenance Manual

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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.

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.

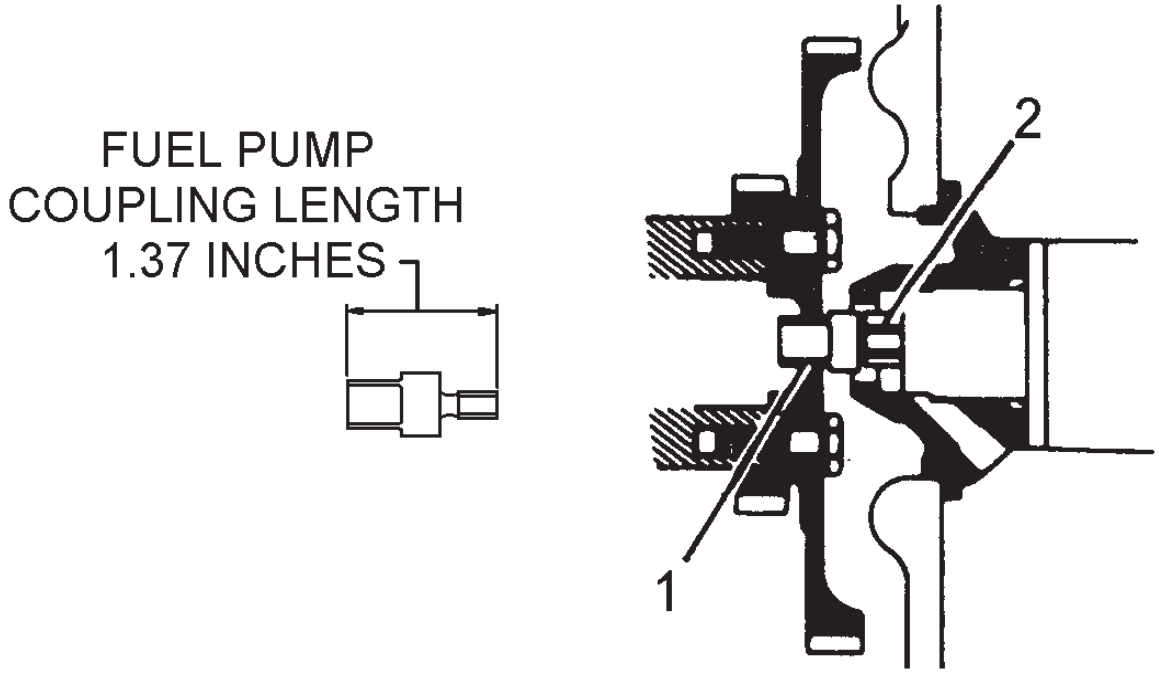


Figure D-1. Fuel Pump Drive Coupling Fits & Limits

Table D-1. Fuel Pump Drive Coupling Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Fuel pump drive coupling to crankshaft gear ..... clearance:	0.0095L	0.0155L
2	Fuel pump drive coupling to fuel pump ..... clearance:	0.0030L	0.0090L
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.

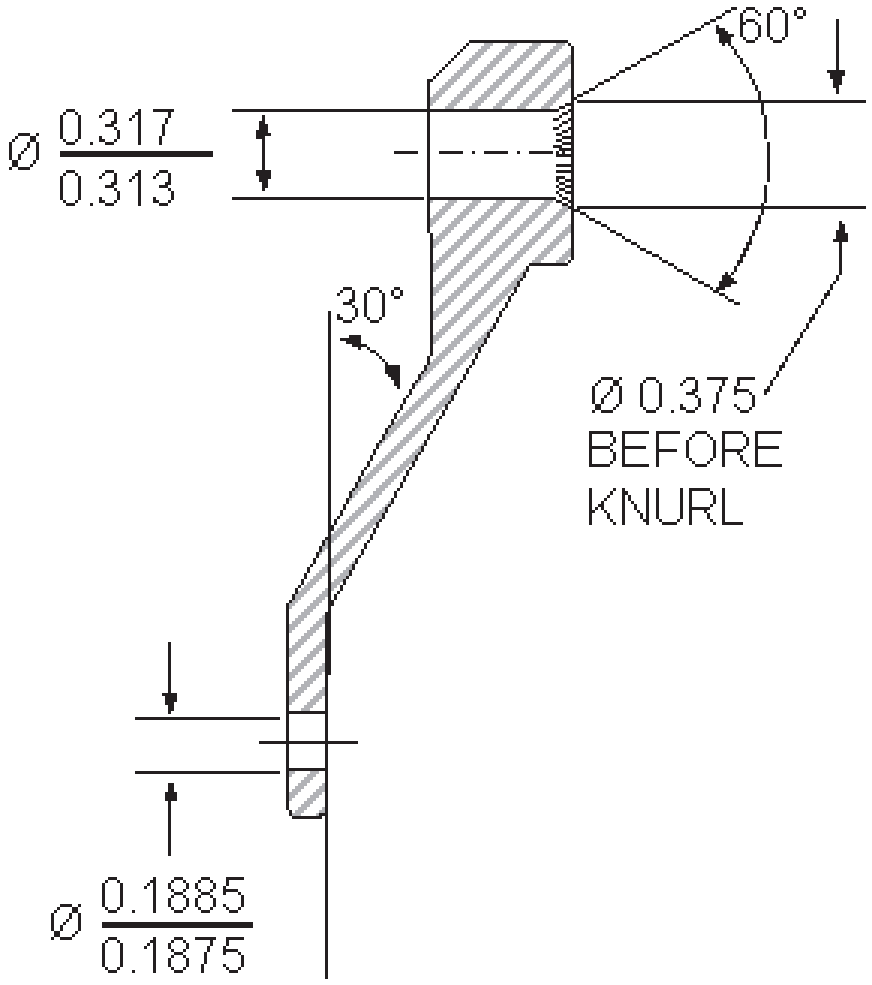


Figure D-2. Throttle Lever Dimensions

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.

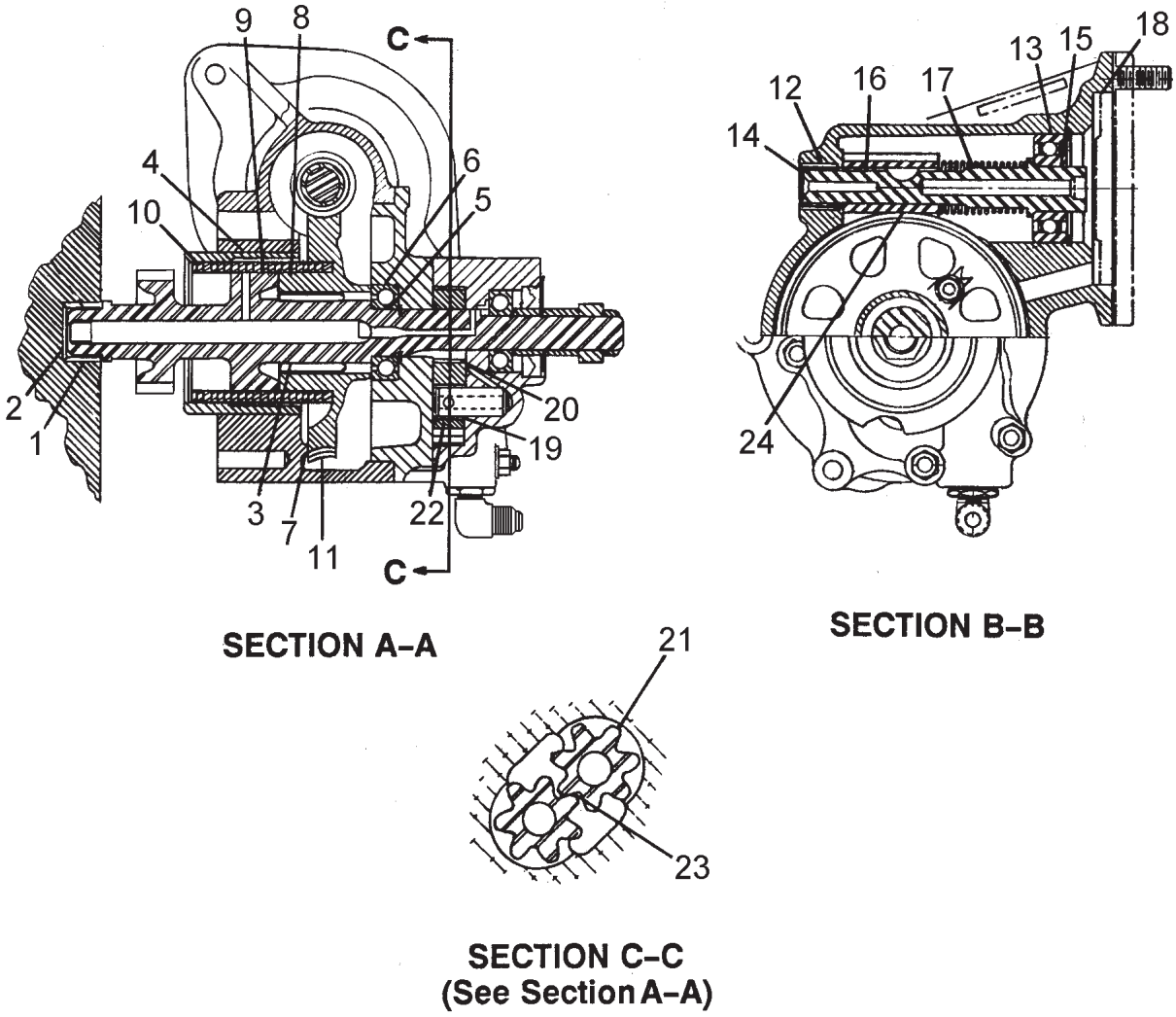


Figure D-3. Starter and Starter Adapter with Scavenge Pump Dimensions

Table D-2. Starter/Starter Adapter with Scavenge Pump Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Starter shaft gear needle bearing bore in crankcase ..... diameter:	0.9990	1.0000
2	Starter shaft gear front (bearing) journal ..... diameter:	0.7495	0.7500
3	Starter shaft gear in clutch drum bearing ..... diameter:	0.9995	1.0000L
4	Clutch spring sleeve in starter adapter ..... diametric clearance:	0.0030T	0.0050T
5	Starter shaft gear in ball bearing ..... diametric clearance:	0.0001T	0.0005L
6	Bearing in starter adapter cover ..... diametric clearance:	0.0001T	0.0010L
7	Worm wheel gear .....end clearance:	0.0016	0.0166
8	Worm wheel drum ..... diameter:	See Figure D-4	
9	Starter shaft gear drum ..... diameter:	See Figure D-5	
10	Clutch spring in clutch spring sleeve[1] ..... diametric clearance:	0.0310T	0.0380T
11	Center line of worm gear shaft to starter adapter thrust pads...clearance	0.2450	0.2490
12	Needle bearing bore starter adapter ..... diameter:	0.7485	0.7495
13	Ball bearing in starter adapter ..... diametric clearance:	0.0001T	0.0013L
14	Worm gear shaft in needle bearing area ..... diameter:	0.5615	0.5625
15	Worm gear shaft in ball bearing ..... diametric clearance:	0.0001L	0.0007T
16	Starter worm gear on shaft ..... diametric clearance:	0.0005L	0.0025L
17	Starter spring on worm drive shaft ..... diametric clearance:	0.0050L	0.0250L
18	Starter pilot to starter drive adapter ..... diametric clearance:	0.0010L	0.0070L
19	Scavenge pump driven gear on shaft ..... diametric clearance:	0.0005L	0.0025L
20	Scavenge pump driver and driven gear in body .....end clearance:	0.0015	0.0040
21	Scavenge pump driver gear in body diametric clearance:	0.0118L	0.0143L
22	Bushing in scavenge pump driven gear ..... diametric clearance:	0.0035T	0.0060T
23	Scavenge pump driver and driven gear ..... backlash:	0.0035	0.0050
24	Starter worm wheel gear and worm gear ..... backlash:	0.0090	0.0110
T= Tight L= Loose			

1. When the sandblasted finish is smoother than 125 RMS, replace the sleeve

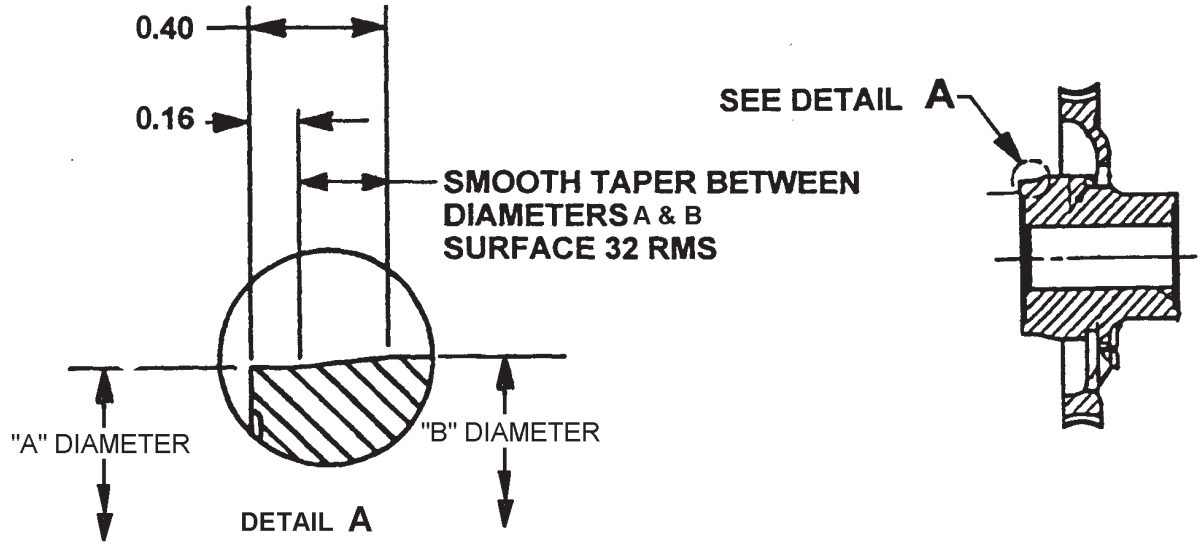


Figure D-4. Worm Wheel Drum Dimensions

Table D-3. Worm Wheel Drum Dimensions

Part	"A" Diameter (inches)		"B" Diameter (inches)	
	Minimum	Maximum	Minimum	Maximum
Worm Wheel Drum ..... diameter:	1.931	1.932	1.955	1.960
0.015 Undersize Worm Wheel Drum..... diameter:	1.916	1.917	1.940	1.945

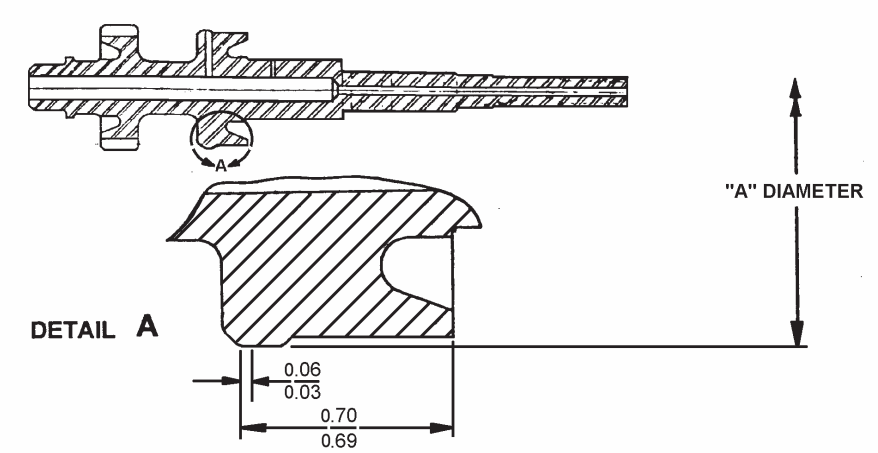


Figure D-5. Shaft Gear Drum Dimensions

Table D-4. Shaft Gear Drum Fits & Limits

Part	"A" Diameter (inches)	
	Minimum	Maximum
Shaft Gear Drum ..... diameter:	1.931	1.932
0.015 Undersize Shaft Gear Drum ..... diameter:	1.916	1.917

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

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Bushing in magneto and accessory drive adapter... diametric clearance:	0.0010T	0.0040T
2	Magneto and accessory drive gear in adapter bushing ..... diametric clearance:	0.0015L	0.0035L
3	Oil seal in adapter..... diametric clearance:	0.0010T	0.0070T
4	Sleeve in magneto and accessory drive gear..... diametric clearance:	0.0010T	0.0070T
5	Coupling retainer on drive gear sleeve .....diameter:	0.0250L	0.040L
6	Magneto and accessory drive gear.....end clearance:	0.0110L	0.0770L
7	Magneto coupling retainer in magneto drive gear slot..... side clearance:	0.0020T	0.0280T
8	Magneto coupling rubber bushings on drive lugs ..... side clearance:	0.014L	0.052T
9	Magneto pilot in crankcase..... diametric clearance:	0.001L	0.005L
T= Tight L= Loose			

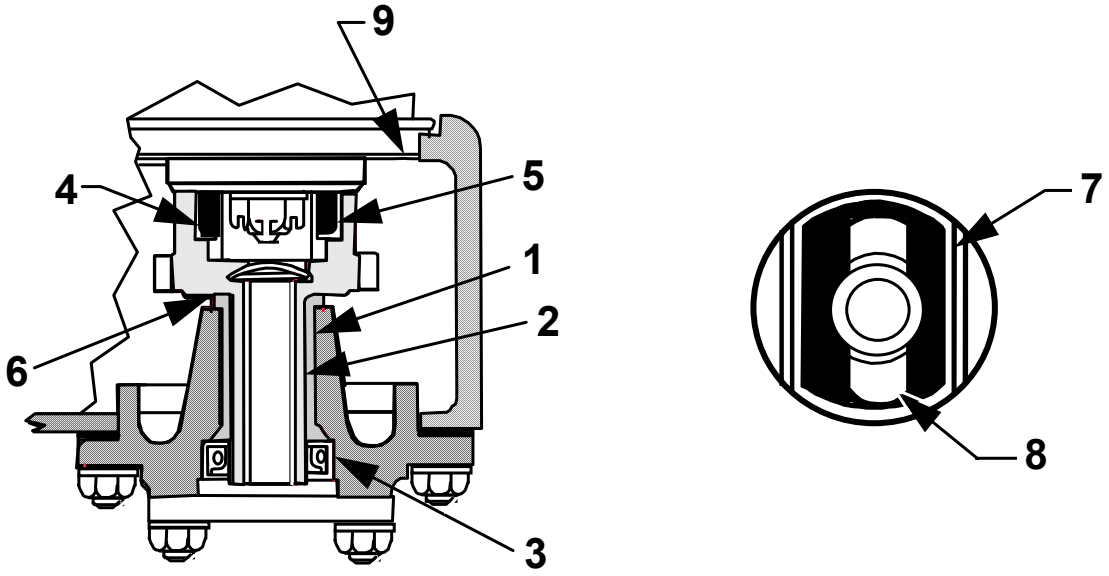


Figure D-6. Accessory Drive Adapter Dimensions

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 D-6. Lubrication System Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
Oil Pressure Relief Valve Assembly			
1	Oil pressure relief valve adjusting screw in plunger .....diameter:	0.0030	0.0070
2	Oil pressure relief valve seat in housing .....depth:	0.750	1.060
Oil Pump Assembly			
3	Oil pump driver gear in pump housing ..... diametric clearance:	0.0040L	0.0060L
4	Oil pump driver gear shaft in pump housing ..... diametric clearance:	0.0015T	0.0030L
5	Oil pump driven gear to driven gear shaft ..... diametric clearance:	0.0005L	0.0025L
6	Oil pump driver gear in pump housing .....end clearance:	0.0016L	0.0041
7	Oil pump driven gear in pump housing .....end clearance:	0.0016L	0.0041
8	Oil pump driver gear shaft in toil pump cover ..... diametric clearance:	0.0015L	0.0030L
9	Oil pump driven gear in housing ..... diametric clearance:	0.0040L	0.0060L
10	Oil pump driver and driven gears ..... backlash:	0.0090	0.0130
Spring Test Data			
11	Oil press. relief valve spring compressed to 1.25 inch length load:	32 lbs.	37 lbs.
12	Oil temp. control valve 0.090 inches minimum travel ..at oil temperature:	120°F	170°F
	Oil temperature must close between .....oil temperature:	168°F	172°F
T= Tight L= Loose			

Table D-7. Lubrication System Components Dimensions
Not shown in Figure D-7

Part Name	Inspection Item	Dimensions (inches)	
		Minimum	Minimum
Oil Pump Housing and Shaft Assembly	Driven Gear Shaft .....diameter:	0.5640	0.5650
	Driver Gear Shaft Hole .....diameter:	0.5620	0.5630
	Gear Chamber .....depth:	1.9985	2.0000
Oil Pump Driver Gear	Shaft.....diametric clearance:	0.0040L	0.0060L
Oil Pump Driven Gear	Bushing .....diametric clearance:	0.0015L	0.0030

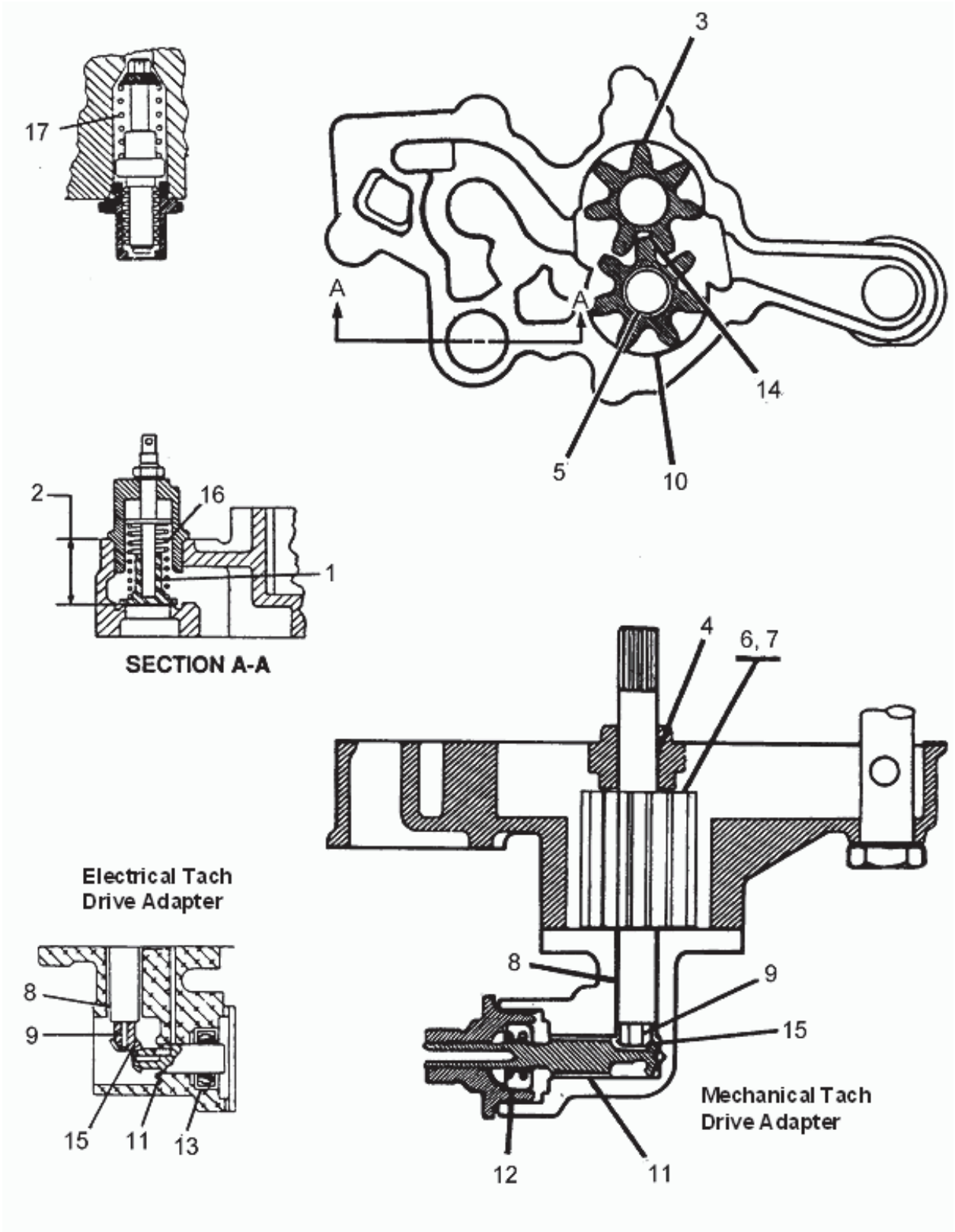


Figure D-7. Oil Pump Dimensions

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

Part Name	Inspection Item	Dimensions (inches)	
		Minimum	Maximum
Rocker Arm Bushings	Inside Diameter	0.7505	0.7515
Valve Rocker Shaft	Outside Diameter	0.7482	0.7500
Intake Valve	Stem Diameter	0.4334	0.4340
Exhaust Valve	Stem Diameter	0.4333	0.4340
Piston (Standard)	Diameter at Top[1]	5.2126	5.2166
	Diameter Below 1st Groove[1]	5.2157	5.2197
	Diameter at Bottom[1 2]	5.2414	5.2424
	Pin Bore Diameter	1.1246	1.1250
	Third Ring Groove Width	0.1910	0.1920
	Fourth Ring Groove Width	0.1000	0.1010
	Piston Pin to Top of Dome Height	1.652	1.656
Piston Pin Assembly	Length (including plugs)	5.220	5.242
Rocker Arm	Thrust Width	0.937	0.940

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.

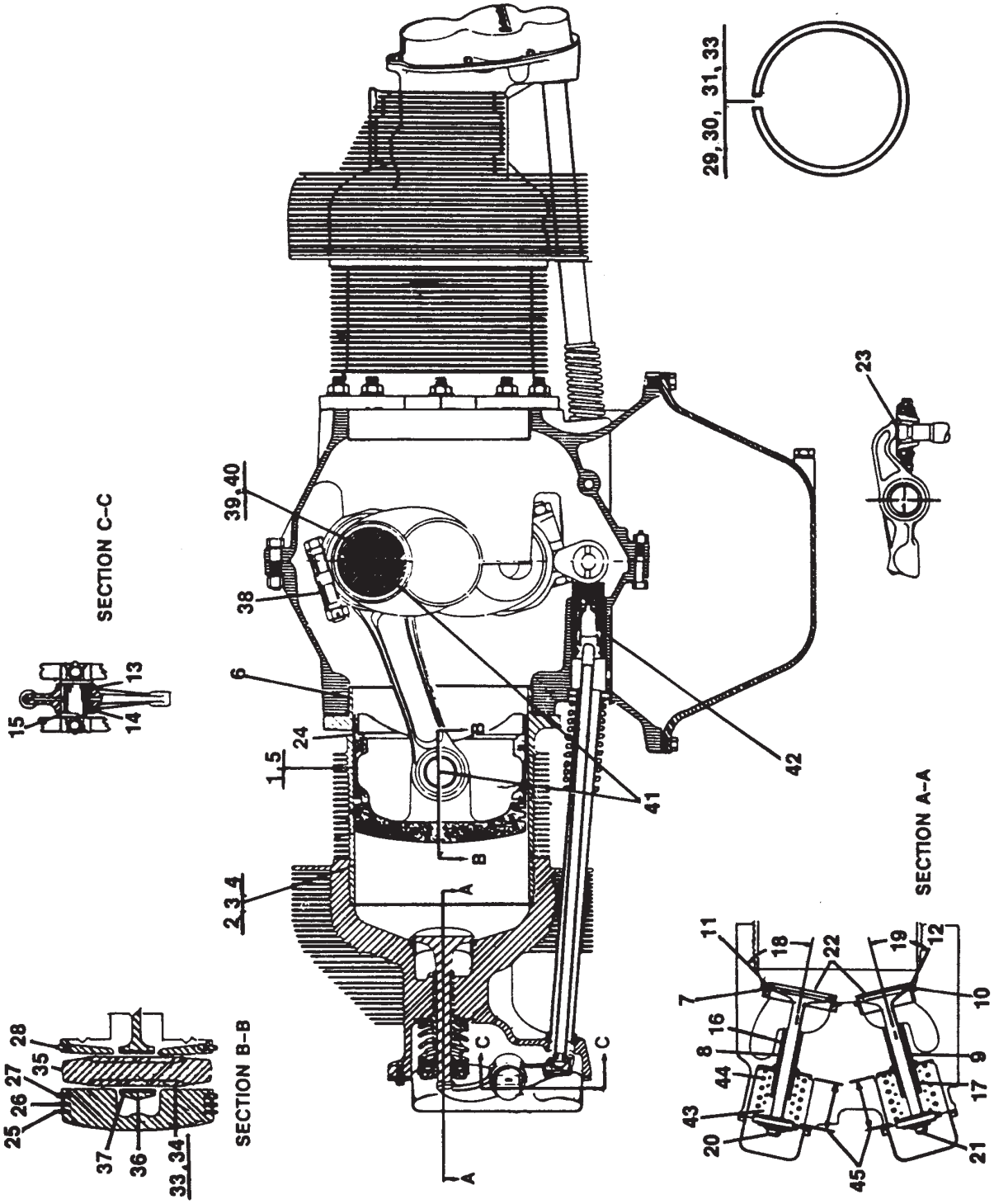


Figure D-8. Cylinder Assembly Dimensions

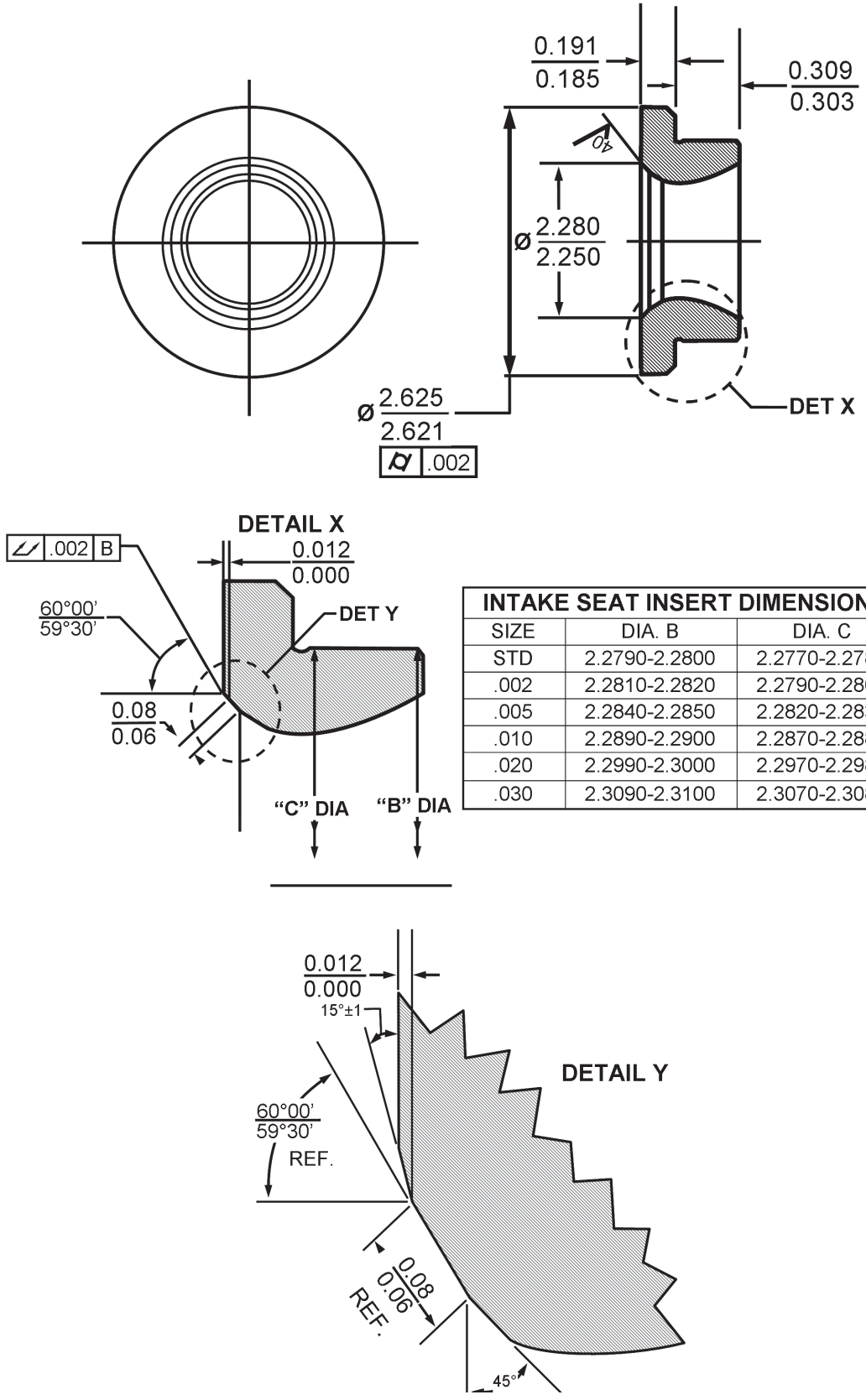
Table D-9. Engine Cylinder Assembly Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
	Cylinders		
1	Cylinder bore (lower 4-1/2 inch of barrel) ..... diameter:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual	
2	Cylinder bore choke (at 5.75 inch from open end of barrel) ..... taper:		
3	Cylinder bore ..... out-of-round:		
4	Cylinder bore ..... allowable oversize		
5	Cylinder bore surface (Nitrided Barrels) Cross hatch angle Finish in micro-inches R_a	 22° - 32° 35	 — 60
6	Cylinder barrel in crankcase ..... diametric clearance:	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head ..... diametric clearance:	0.0070T	0.0100T
8	Intake valve guide in cylinder head ..... diametric clearance:	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head ..... diametric clearance:	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head ..... diametric clearance:	0.0070T	0.0100T
11	Intake valve seat ..... width:	Figure D-9	
12	Exhaust valve seat ..... width:	Figure D-10	
	Rocker Arms and Shafts		
13	Rocker shaft in cylinder head boss ..... diametric clearance:	0.0005L	0.0033L
	Rocker shaft in rocker arm bushing ..... diametric clearance:	0.0005L	0.0033L
14	Rocker arm bushing bore ..... diameter:	0.8725	0.8755
	Rocker arm bushing – finish bore ..... inside diameter:	0.7505	0.7515
15	Rocker arm ..... side clearance:	0.0020	0.0150
16	Intake valve guide ..... inside diameter:	0.4350	0.4377
	Intake valve in guide ..... diametric clearance:	0.0010L	0.0042L
17	Exhaust valve guide ..... inside diameter:	0.4375	0.4395
	Exhaust valve in guide ..... diametric clearance:	0.0035L	0.0062L
18	Intake valve face-to-stem ..... axis angle:	60°00'	60°15'
19	Exhaust valve face-to-stem ..... axis angle:	45°00'	45°15'
20	Intake valve gauge line-to-stem ..... length:	Figure D-11	
21	Exhaust valve gauge line-to-stem ..... length:	Figure D-12 (Replace 100%)	
22	Intake & Exhaust valve face-to-stem ..... runout:	0.0000	0.0015
23	Rocker arm foot to valve stem (dry valve) ..... valve lash:	0.060	0.200
	Pistons, Rings, and Pins		
24	Piston, non-coated in cylinder[1] ..... diametric clearance:	0.008L[2] 0.007L[3]	0.011L[2] 0.010L[3]
	Piston, manganese phosphate coated in cylinder[1] ..... diametric clearance:	0.009L[2] 0.008L[3]	0.012L[2] 0.011L[3]
25	Top piston ring in groove ..... side clearance:	0.0015	0.0040
26	Second piston ring in groove ..... side clearance:	0.0015	0.0040
27	Third piston ring in groove ..... side clearance:	0.0035	0.0055
28	Fourth piston ring in groove ..... side clearance:	0.0060	0.0080
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

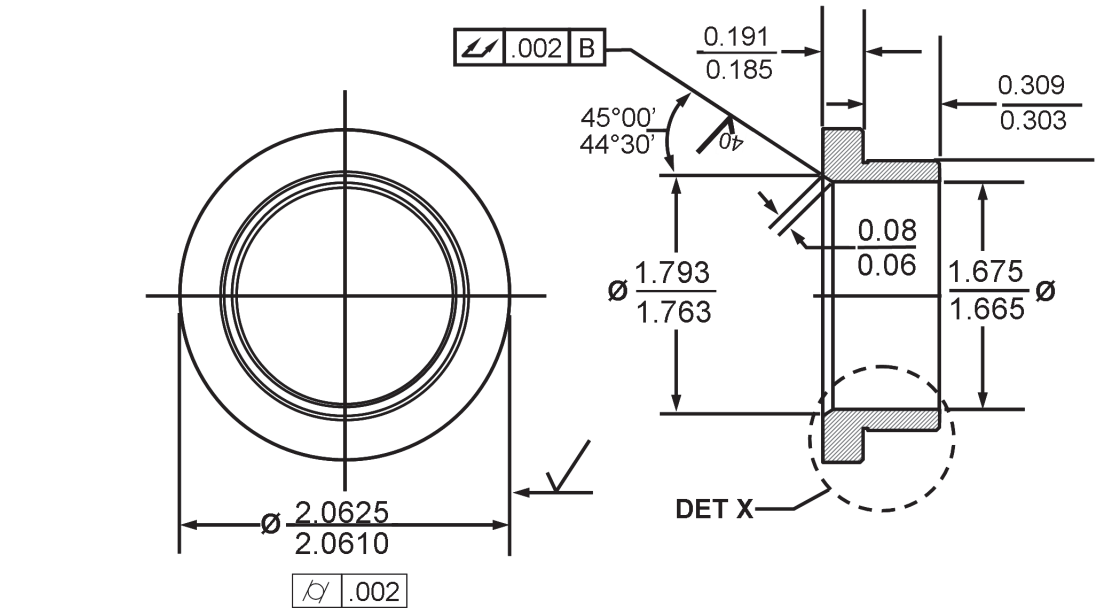
Index	Part	Dimensions (inches)	
		Minimum	Maximum
Dimensions for items 29B -32B apply only to Pre-Gold Standard Cylinders (5.252-5.254 Dia. Cylinder Bore)			
29B	Top ring .....gap:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual	
30B	Second ring .....gap:		
31B	Oil control ring .....gap:		
32B	Fourth ring .....gap:		
33	Piston pin in piston .....diametric clearance:	0.0001L	0.0007L
34	Piston Pin .....diameter:	1.1243	1.1245
	Piston Pin (0.005 oversize).....diameter:	1.1293	1.1295
35	Piston pin in cylinder..... end clearance:	0.0310L	0.0480L
36	Piston pin in connecting rod bushing.....diametric clearance:	0.0022L	0.0026L
37	Bushing in connecting rod .....diametric clearance:	0.0025T	0.0050T
38	Bolt in connecting rod .....diametric clearance:	0.0000L	0.0018L
39	Connecting rod bearing on crankpin.....diametric clearance:	0.0009L	0.0034L
40	Connecting rod on crankpin..... end clearance:	0.0060	0.0110L
41	Connecting rod bushing..... twist (convergence) per inch of length	See **M-0, Section 10-9.4**	
42	Hydraulic tappet in crankcase .....diametric clearance:	0.0010L	0.0025L
Spring Test Data			
43	Inner valve spring 654442 compressed to 1.230 in. length .....load:	70.3 Lbs.	77.3 Lbs.
	Inner valve spring 654442 compressed to 1.745 in. length .....load:	32.1 Lbs.	38.1 Lbs.
44	Outer valve spring 654441 compressed to 1.275 in. length .....load:	101.8 Lbs.	111.4 Lbs.
	Outer valve spring 654441 compressed to 1.790 in. length .....load:	49.1 Lbs.	55.1 Lbs.
45	Installed outer valve spring.....height:	1.791 inches	
T= Tight L= Loose			

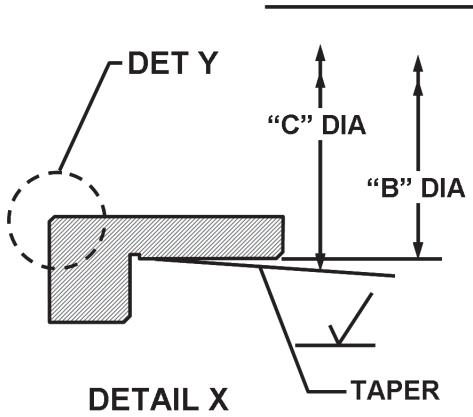
1. Measured below fourth ring groove
2. Pre-Gold Standard Dimension
3. Post-Gold Standard Dimension



INTAKE SEAT INSERT DIMENSIONS		
SIZE	DIA. B	DIA. C
STD	2.2790-2.2800	2.2770-2.2780
.002	2.2810-2.2820	2.2790-2.2800
.005	2.2840-2.2850	2.2820-2.2830
.010	2.2890-2.2900	2.2870-2.2880
.020	2.2990-2.3000	2.2970-2.2980
.030	2.3090-2.3100	2.3070-2.3080

Figure D-9. Intake Valve Seat Dimensions





EXHAUST SEAT INSERT DIMENSIONS		
SIZE	DIA. B	DIA. C
STD	1.796-1.797	1.794-1.795
.002	1.798-1.799	1.796-1.797
.005	1.801-1.802	1.799-1.800
.010	1.806-1.807	1.804-1.805
.020	1.816-1.817	1.814-1.815
.030	1.826-1.827	1.824-1.825

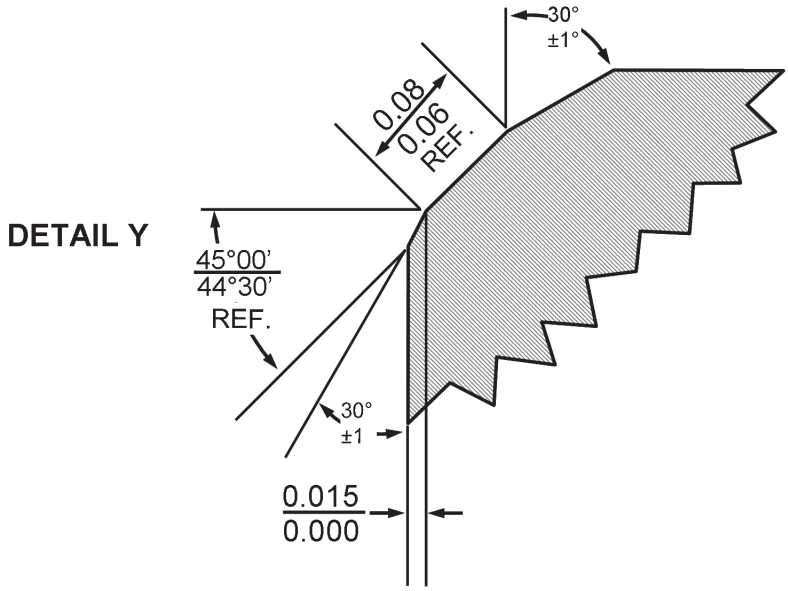


Figure D-10. Exhaust Valve Seat Dimensions

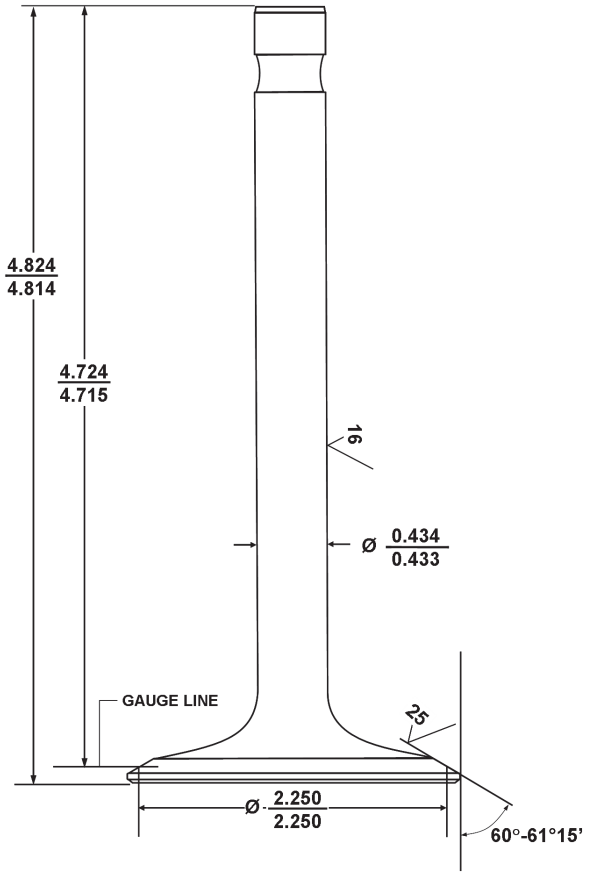


Figure D-11. Intake Valve Dimensions

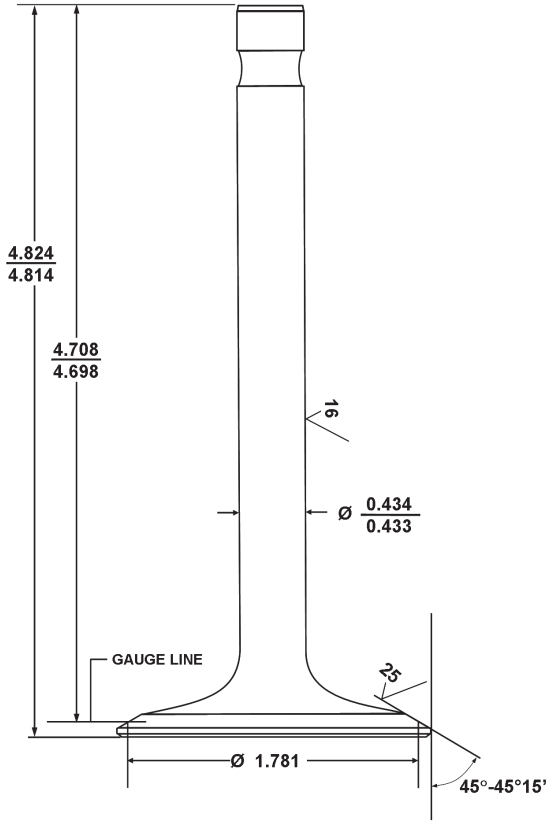


Figure D-12. Exhaust Valve Dimensions

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

Part Name/Feature	Dimensions (inches) Minimum	Maximum
Crankshaft Journal Bore (Rear & Intermediate) .....diameter	2.816	2.817
Crankshaft Main Journals (MJ #4 & #5) .....diameter	2.5625	2.5635
Camshaft Journal Bore .....diameter	1.0000	1.0010
Crankcase Tappet Guides .....diameter	1.0005	1.0015
Governor Driven Gear Bearing .....diameter	0.8750	0.8760
Starter Shaft Needle Bearing Hole .....diameter	0.9990	1.0000
Crankcase Idler Gear Support (front) .....diameter:	0.9990	1.0000
Crankcase Idler Gear Support (rear) .....diameter:	1.062	1.063
Camshaft Journal (4) .....diameter	0.9980	0.9990
Valve Tappets.....diameter	0.9990	0.9995

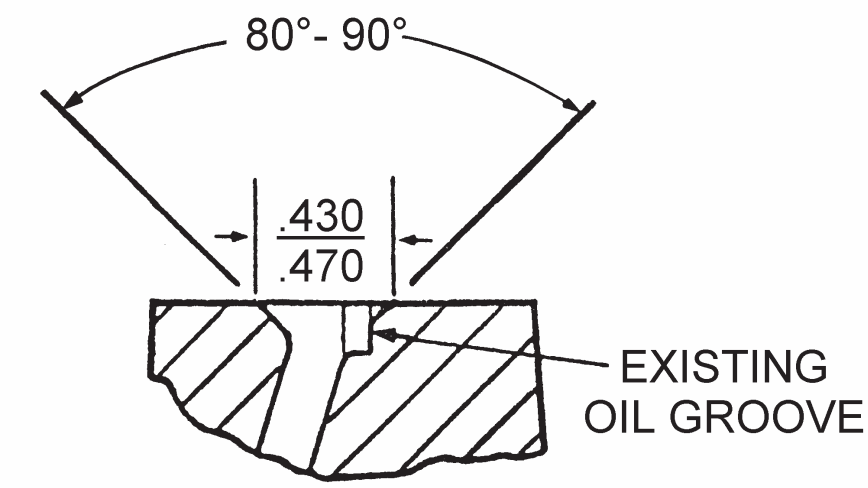


Figure D-13. Crankcase Main Bearing Oil Feed Hole Chamfer

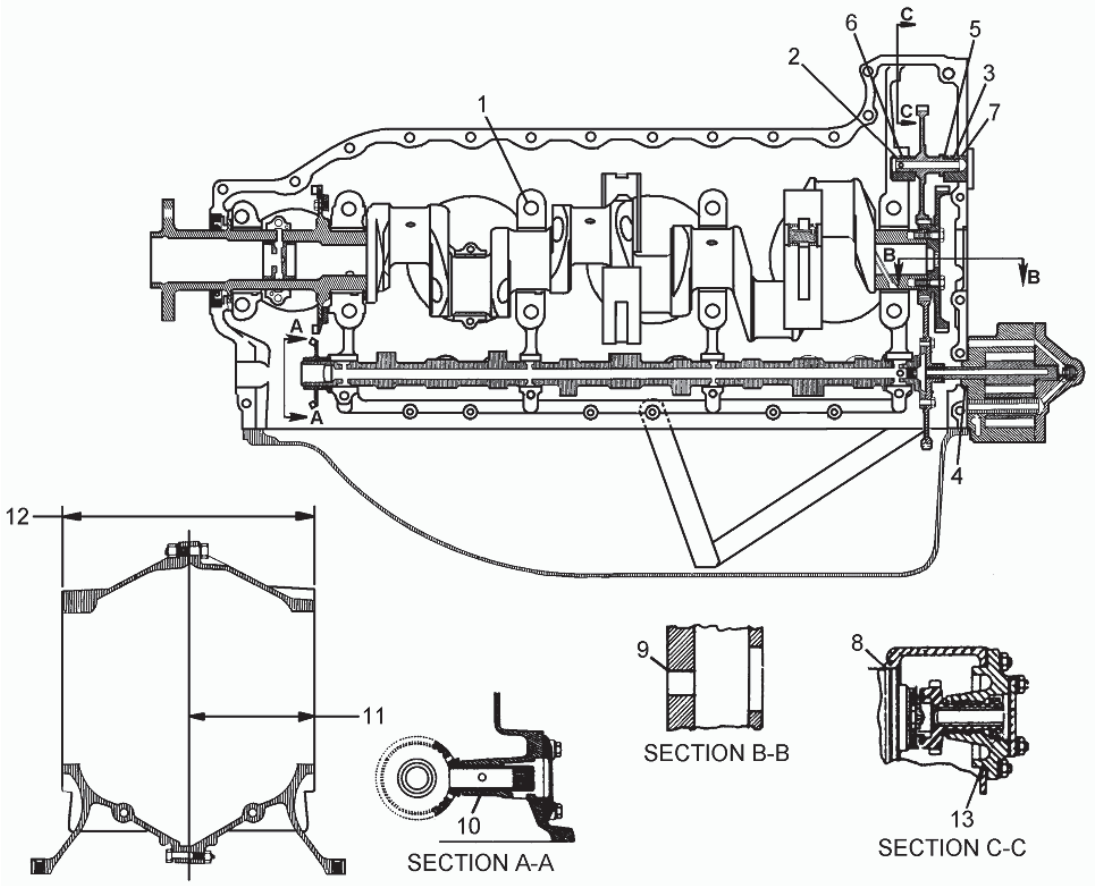


Figure D-14. Crankcase Dimensions

Table D-11. Crankcase Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Through-bolt in crankcase ..... diametric clearance:	0.0000	0.0015L
2	Idler gear support in crankcase (front) ..... diametric clearance:	0.0005L	0.0015T
3	Idler gear support in crankcase (rear) ..... diametric clearance:	0.0015L	0.0035L
4	Oil pump housing pilot in crankcase ..... diametric clearance:	0.0010L	0.0040L
5	Idler gear ..... end clearance:	0.0300	0.0770
6	Idler gear in support bushing (front) ..... diametric clearance:	0.0010L	0.0030L
7	Idler gear in support bushing (rear) ..... diametric clearance:	0.0010L	0.0030L
8	Magneto pilot in crankcase ..... diametric clearance:	0.0015L	0.0060L
9	Starter shaft gear roller bearing hole ..... diameter:	0.9995	1.0005
10	Governor drive shaft in crankcase ..... diametric clearance:	0.0014L	0.0034L
11	Crankcase deck height (each half) ..... width:	4.560	4.565
12	Crankcase (cylinder deck-to-cylinder deck) ..... width:	9.12	9.13
13	Accessory drive adapter pilot in crankcase ..... diametric clearance:	0.0000T	0.0040L
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.

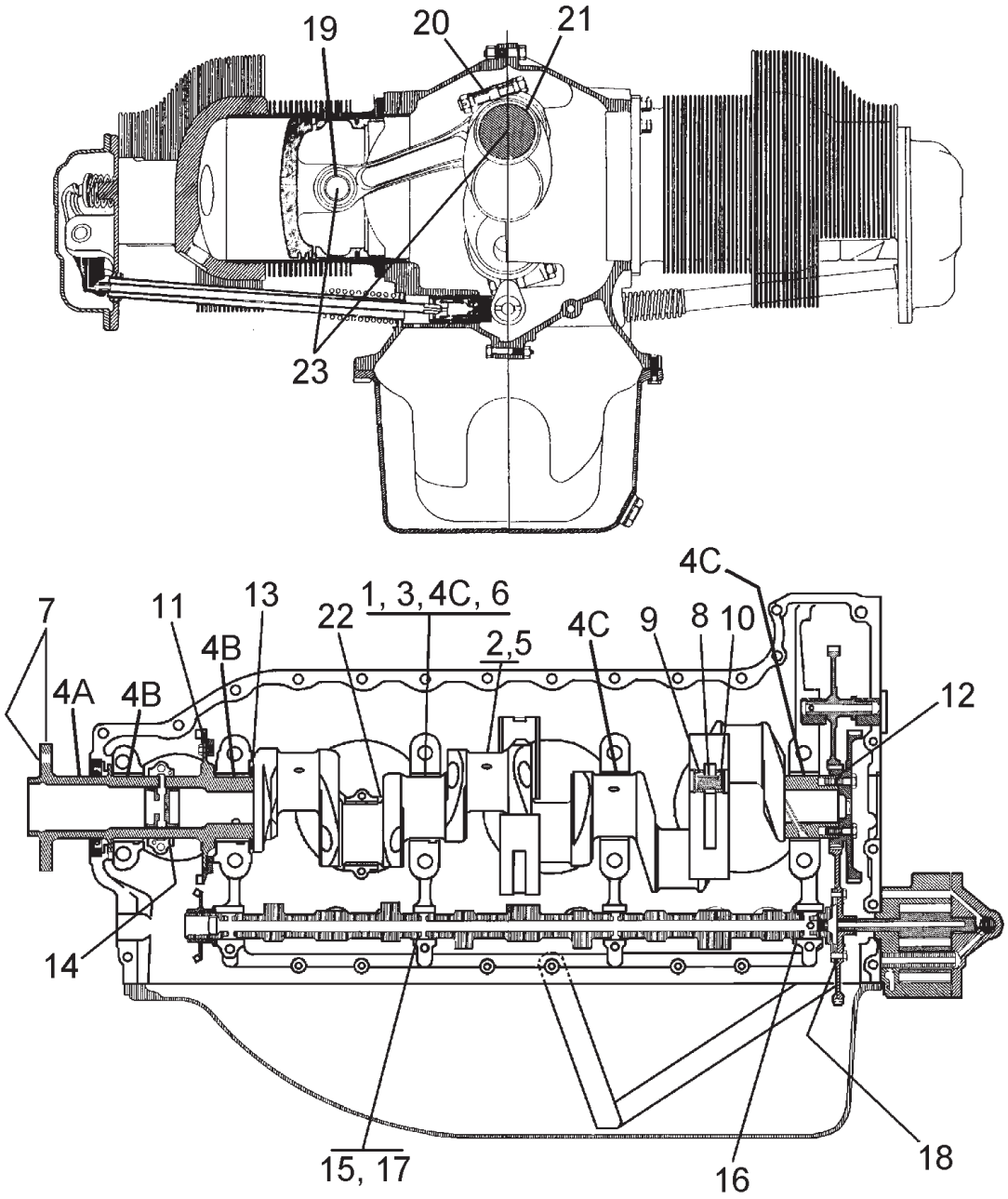


Figure D-15. Engine Drive Train Dimensions

Table D-12. Engine Drive Train Dimensions not depicted in Figure D-15

Part Name	Feature	Dimensions (inches) Minimum	Maximum
Crankshaft Ctrwt. Hanger	Blade Bushing ..... Inside Diameter	See **M-0, Section 10-9.1**	
Camshaft	Journal..... Diameter	0.9980	0.9990

Table D-13. Engine Drive Train Dimensions

Index	Part	Dimensions (inches) Minimum	Maximum
	Crankshaft		
1	Crankshaft in main bearing..... diametric clearance:	0.0010L	0.0040L
2	Crank pins[1] ..... out-of-round:	0.0000	0.0005
3	Main journals[1] ..... out-of-round:	0.0000	0.0005
4	Crankshaft		
4A	Front Journal.....diameter:	2.372	2.376
4B	#4 & #5 Main Journal.....diameter:	2.374	2.375
4C	Rear & Intermediate Journals .....diameter:	2.624	2.625
5	Crank pin .....diameter:	2.249	2.250
6	Crankshaft ..... runout:	0.0000	0.0070
7	Propeller Flange ..... runout:	0.000	0.003
8	Damper pin bushing in crank cheek ..... diametric clearance:	0.0015T	0.0030T
9	Damper pin bushing in counterweight ..... diametric clearance:	0.0015T	0.0030T
10	Damper pin in counterweight..... end clearance:	0.0090L	0.0390L
11	Alternator gear on crankshaft ..... diametric clearance:	0.0005T	0.0035T
12	Crankshaft gear on crankshaft..... diametric clearance:	0.0000	0.0020T
13	Crankshaft in thrust bearing..... end clearance:	0.004	0.016
14	Governor oil transfer collar on crankshaft..... diametric clearance:	0.0005L	0.0018L
	Camshaft		
15	Camshaft journals in crankcase..... diametric clearance:	0.0010L	0.0030L
16	Camshaft in crankcase ..... end clearance:	0.008	0.012
17	Camshaft ..... run-out:	0.0000	0.0010
18	Camshaft gear on camshaft flange..... diametric clearance:	0.0005T	0.0015T
	Connecting Rod		
19	Bushing in connecting rod ..... diametric clearance:	0.0025T	0.0050T
20	Bolt in connecting rod ..... diametric clearance:	0.0000	0.0018L
21	Connecting rod bearing on crank pin..... diametric clearance:	0.0009L	0.0034L
22	Connecting rod on crank pin..... end clearance:	0.0060	0.0113
23	Connecting rod bushing twist (convergence) per inch of length	See **M-0, Section 10-9.4**	
24	Connecting rod bushing bore..... diameter:	See **M-0, Section 10-9.4**	
25	Bushing center to crankpin center	See **M-0, Section 10-9.4**	
T= Tight L= Loose			

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.

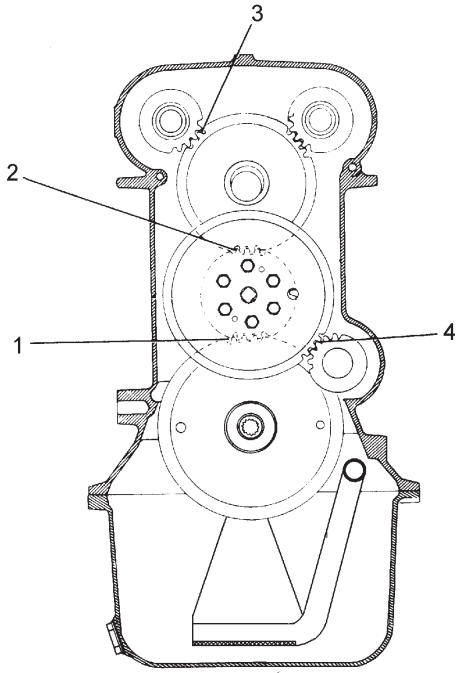
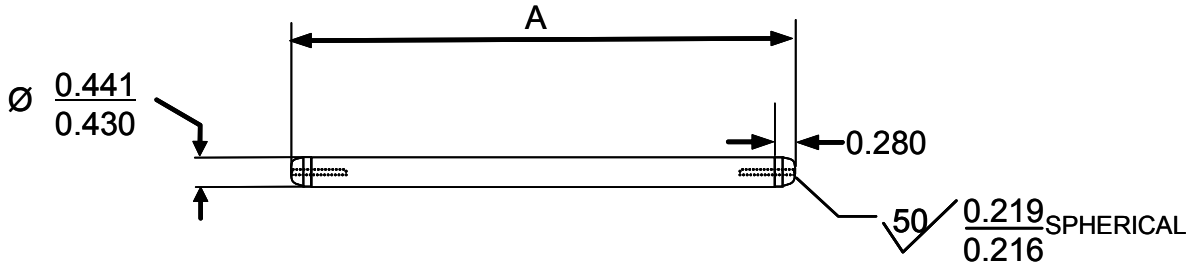


Figure D-16. Crankshaft, Camshaft, and Idler Gear Backlash

Table D-14. Crankshaft, Camshaft, and Idler Gear Backlash

Index	Part (See Figure D-16)	Dimensions (inches)	
		Minimum	Maximum
1	Crankshaft gear and camshaft gear ..... backlash	0.0080	0.0120
2	Crankshaft gear and idler gear ..... backlash	0.0080	0.0120
3	Idler gear and magneto drive gear (right and left) ..... backlash	0.0080	0.0120
4	Starter shaft gear and crankshaft gear ..... backlash	0.0080	0.0120



"A" dimension	Min	Max
Standard	13.632	13.662
P030 Oversize	13.662	13.692

Figure D-17. Pushrod Dimensions

D-8.1. Crankshaft Counterweight Assemblies

Refer to “Crankshaft Counterweight Inspection” in Section 10-9.1.3 of M-0, Standard Practice Maintenance Manual.

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

Refer to “Crankshaft Counterweight Inspection and Repair” in Section 10-9.1 of M-0, Standard Practice Maintenance Manual.

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.

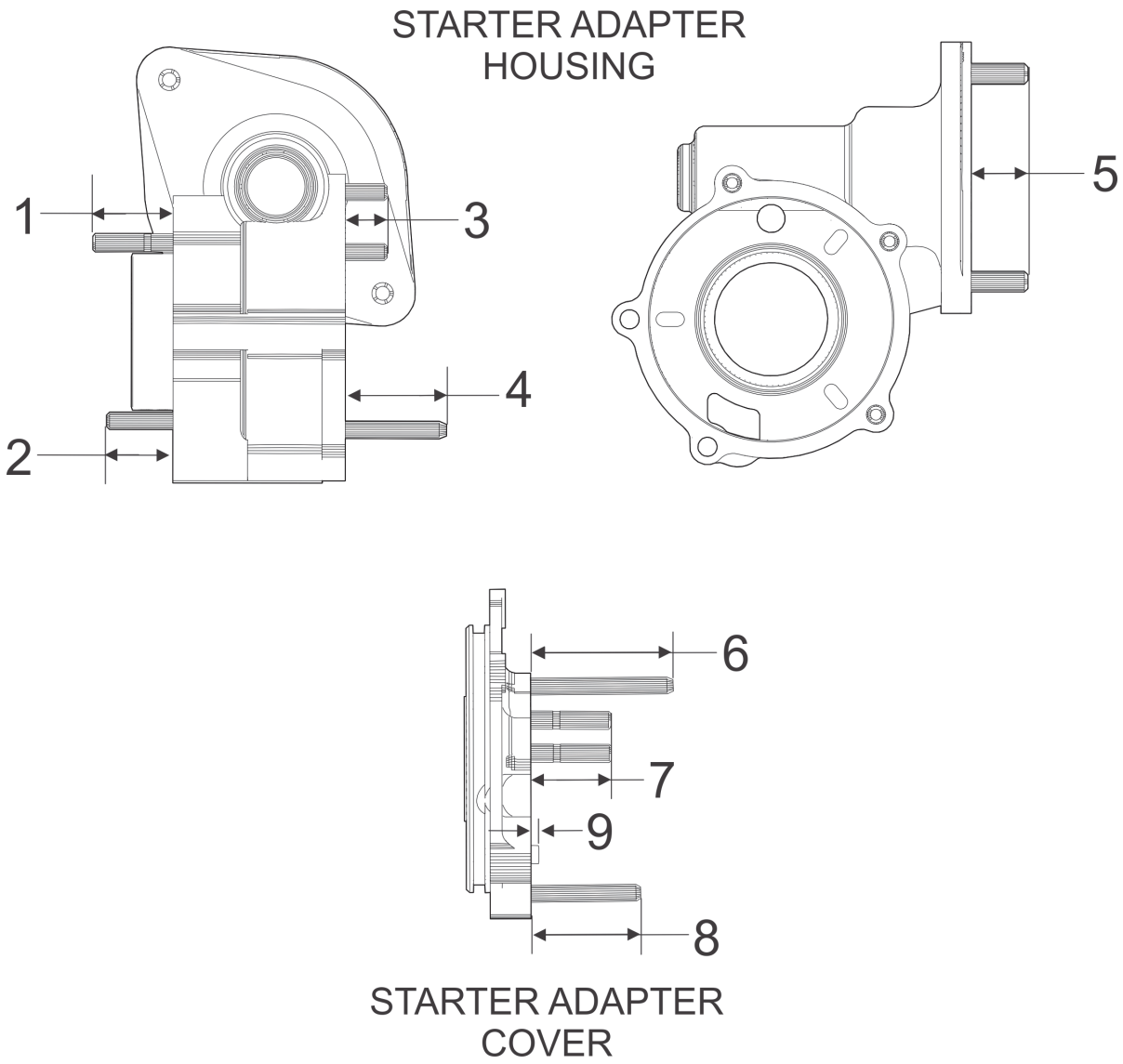


Figure D-18. Starter Adapter with Scavenge Pump

Table D-15. Starter Adapter with Scavenge Pump Stud Heights

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Starter Adapter to Crankcase	0.3125-18 X 0.3125-24	1.32	1
2	Stud, Starter Adapter to Crankcase	0.3125-18 X 0.3125-24	1.09	1
3	Stud, Cover to Adapter	0.3125-18 X 0.3125-24	0.67	3
4	Stud, Cover & Scavenge Body to Adapter	0.38-16 X 0.38-24	2.13	1
5	Stud, Starter Motor to Adapter	0.3125-18 X 0.3125-24	1.00	2
6	Stud, Cover to Scavenge Body	0.3125-18 X 0.3125-24	2.25	1
7	Stud, Cover to Scavenge Body	0.3125-18 X 0.3125-24	1.31	2
8	Stud, Cover to Scavenge Body	0.3125-18 X 0.3125-24	1.55	1
9	Dowel, Cover to Scavenge Body	0.45 X 0.625	0.15	1

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.

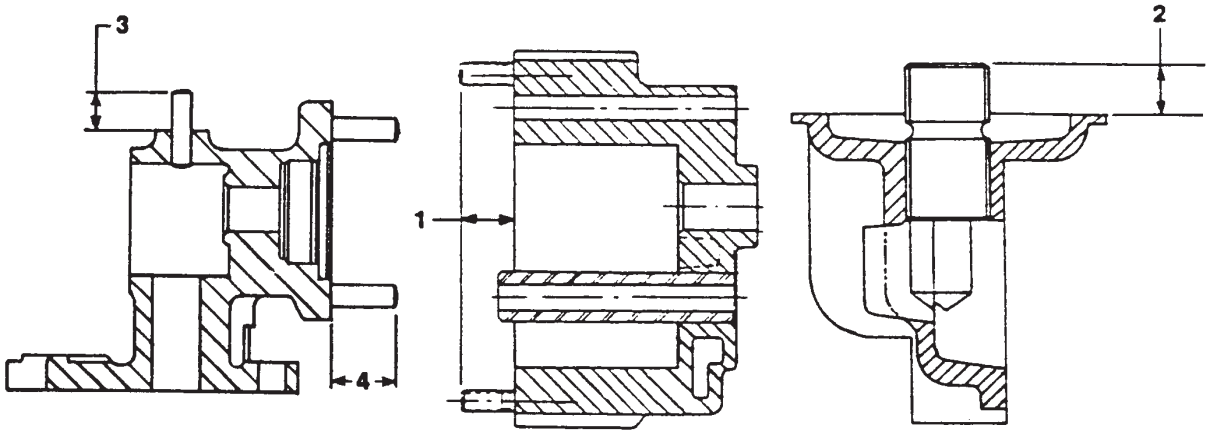


Figure D-19. Lubrication System Stud Height Settings

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Cover to Housing	0.25- 20 X 0.25 - 28	0.65	2
2	Stud, Oil Filter To Adapter	0.75-16 X 0.8125-16	0.500-0.700	1
	Note: Entries below only apply to oil pumps with a tachometer drive adapter			
3	Stud, Throttle Support	0.25- 20 X 0.25 - 28	0.44	1
4	Stud, Cover to Housing	0.25- 20 X 0.25 - 28	0.75	4

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.

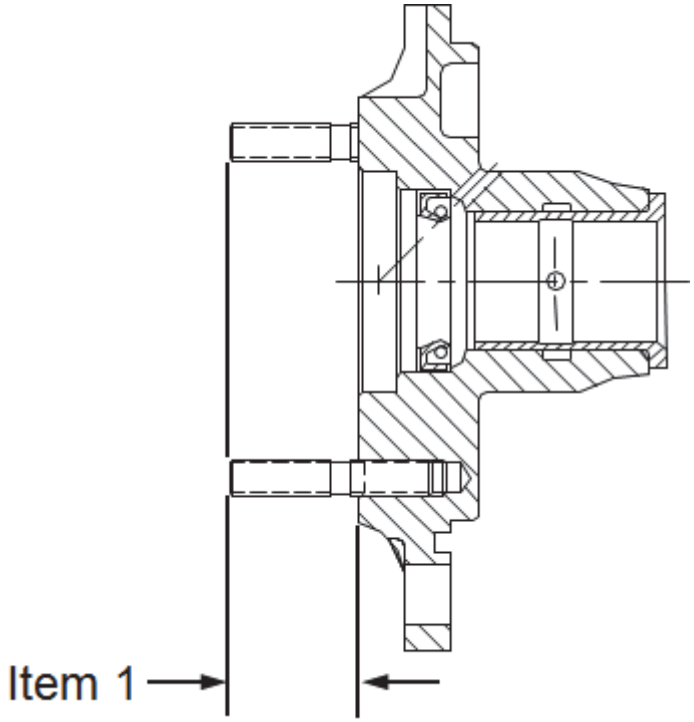


Figure D-20. Accessory Drive Adapter

Item	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Accessory to Adapter	0.25-20X 0.25-28	0.87-0.90	4

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.

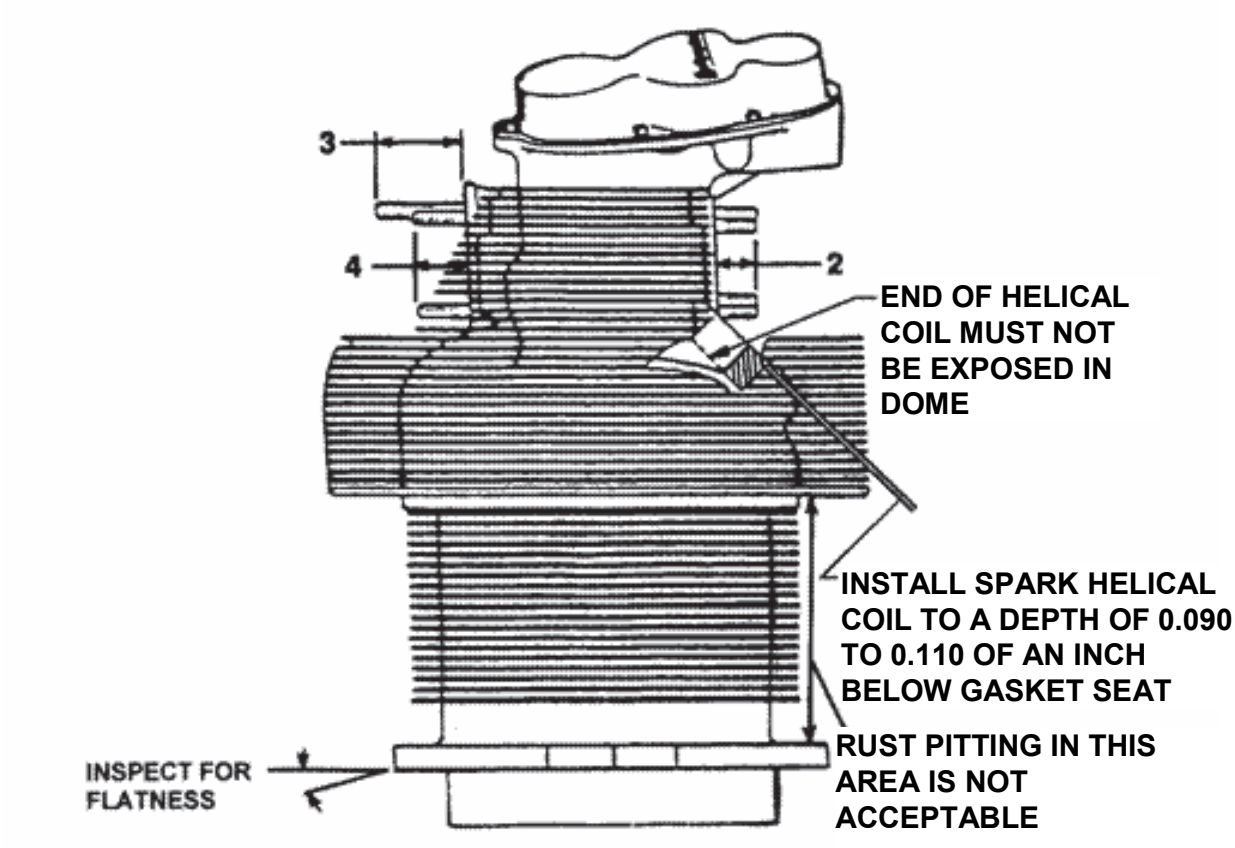


Figure D-21. Cylinder Stud Heights

Table D-16. Cylinder Stud Heights

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Exhaust flange stud (ring-locked)	1/4-20 x 1/4-28	0.865-0895	4
2	Exhaust flange stud (ring-locked)	1/4-20 x 1/4-28	0.865-0895	4
3	Intake flange stud	1/4-20 x 1/4-28	1.00	1
4	Intake flange stud	1/4-20 x 1/4-28	0.78	2

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**.

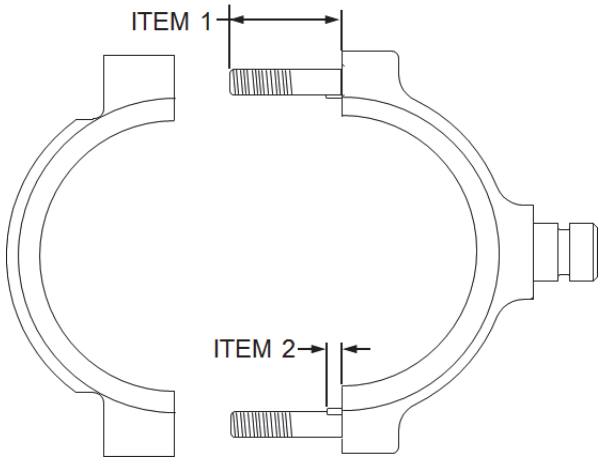


Figure D-22. Oil Control Collar Stud Height Settings

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Oil Control Collar Stud	1/4X1-1/4 LG	0.94	2
2	Dowel (Ferrule)	1/8X 7/16 LG	0.15	2

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 B C E G

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-23	1
2	Helical Coil	0.31-18	Install per Appendix C	2
3	Helical Coil	0.31-18	Install per Appendix C	3
4	Pin, Dowel	3/16X 0.50 LG	0.17 - 0.19	1
5	Stud, Through	5/16X18-24	0.98	1
6	Magneto Mount Pad	5/16X18-24	0.72	4
7	Accessory Pad	3/8X16-24	0.97	2
8	Accessory Pad	5/16X18-24	0.98	2
9	Idler Pin Pad	1/4X20-28	0.56	2
10	Fuel Pump Pad	5/16X18-24	0.75	2
11	Starter Adapter Pad	5/16X18-24	3.69	1
12	Oil Pump Pad	1/4X20-28	3.38	5
13	Plug	3/8 X18	--	1
14	Oil Pump Pad	3/8X16-24	2.94	3
15	Oil Pump Pad	1/4X20-28	1.77	1
16	Oil Pump Pad	5/16X18-24	4.27	1
17	Plug	1/8X27	---	3
18	Plug	1/16X27	---	4
19	Plug	1/8X27	---	2
20	Camshaft Cover Pad	1/4X20-28	0.69	2
21	Plug	1/8X27NPTF	---	1
22	Accessory Drive	5/16X18-24	0.81	1
23	Helical Coil	---	Install per Appendix C	2
24	Plug	1/4X27	---	1
25	Cylinder Mount Pad	7/16X14-20	0.81	36
26	Cylinder, 7th Stud	7/16X14-20	0.95	6
27	Plug	--	--	1
28	Oil Cooler Mount Pad	3/8X16-24	1.08	2
29	Gasket	--	--	1
30	Propeller Governor Pad	5/16X18-24	1.38	4
31	Bolt, Backbone	5/16X18-24	Install prior to studs (6)	10
32	Washer	5/16 I.D.	Install prior to studs (6)	2
33	Bearing	--	--	1
34	Engine Mount	3/8X16-24	3.32	4
35	Engine Mount	3/8X16-24	1.51	2
36	Squirt Nozzle	---	Not field replaceable	6
37	Oil Cooler Mount	3/8X16-24	0.92	2
38	Engine Mount	3/8X16-24	3.60	4
39	Accessory Pad	5/16X18-24	0.75	3
40	Dowel	0.625X1.00 LG	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	5/16X18-24	0.81	4
43	Engine Mount	3/8X16-24	3.60	2

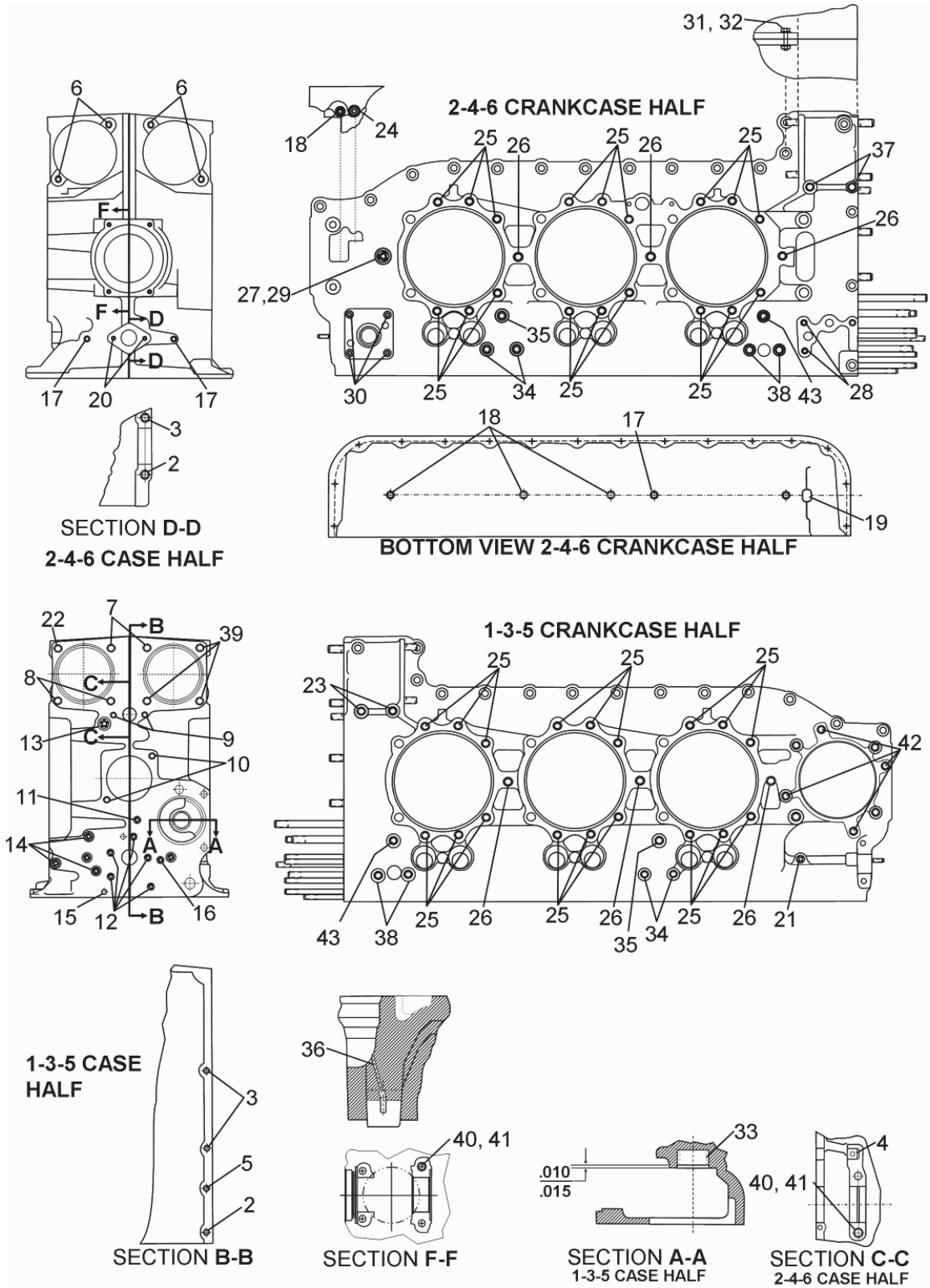


Figure D-23. Crankcase Stud Detail B C E G

Table D-19. Crankcase Stud Height Settings K N

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-24	1
2	Helical Coil	0.3125-18	Install per Appendix C	2
3	Helical Coil	0.3125-18	Install per Appendix C	3
4	Pin, Dowel	0.1875 X 0.50 LG	0.17 - 0.19	1
5	Stud, Through	0.3125 X18-24	5.34	1
6	Magneto Mount Pad	0.3125 X18-24	0.72	4
7	Accessory Pad	0.375 X16-24	0.97	2
8	Accessory Pad	0.3125 X18-24	0.98	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.3125 X18-24	0.75	2
11	Starter Adapter Pad	0.3125 X18-24	3.69	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Plug	0.375 X18	--	1
14	Oil Pump Pad	0.375 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.3125 X18-24	4.27	1
17	Plug	0.125 X 27	---	3
18	Plug	0.0625 X 27	---	4
19	Plug	0.125 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.125 X 27NPTF	---	1
22	Accessory Drive	0.3125 X18-24	0.81	1
23	Helical Coil	---	Install per Appendix C	2
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.4375 X14-20	0.81	36
26	Cylinder, 7th Stud	0.4375 X14-20	0.95	6
27	Plug	--	--	1
28	Oil Cooler Mount Pad	0.375 X16-24	0.88	2
29	Gasket	--	--	1
30	Propeller Governor Pad	0.3125 X18-24	1.38	4
31	Bolt, Backbone	0.3125 X18-24	Install prior to installing studs (6)	10
32	Washer	0.3125 I.D.	Install prior to installing studs (6)	2
33	Bearing	--	--	1
34	Engine Mount	0.375 X16-24	3.32	4
35	Engine Mount	0.375 X16-24	1.51	2
36	Squirt Nozzle	---	Not field replaceable	6
37	Oil Cooler Mount	0.375 X16-24	0.81	2
38	Engine Mount	0.375 X16-24	3.60	6
39	Accessory Pad	0.3125 X18-24	0.75	3
40	Dowel	0.625 X1.00 LG	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.3125 X18-24	0.81	4

Crankcase Stud Detail

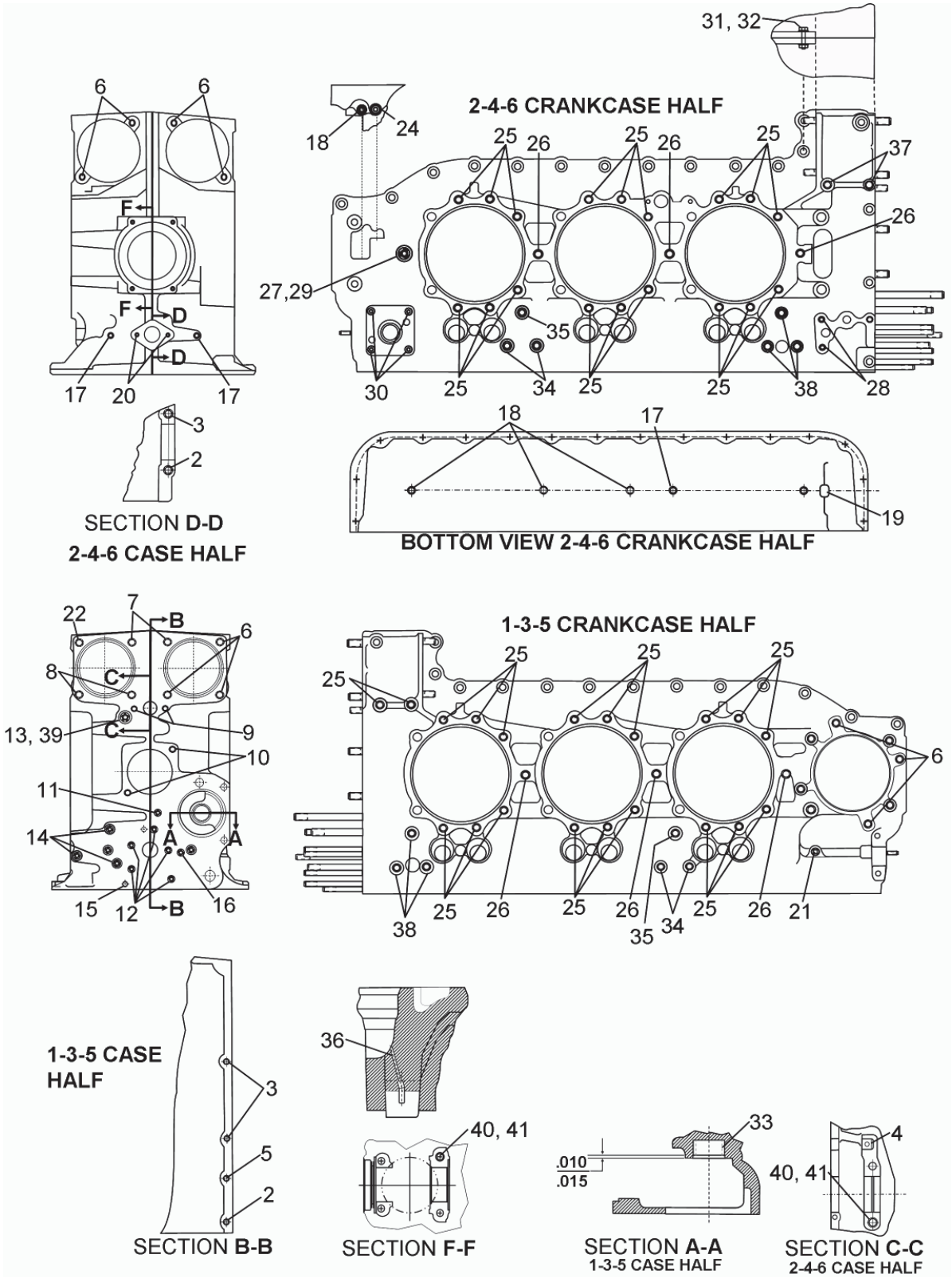


Figure D-24. Crankcase Stud Detail K N

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CONTINENTAL® AIRCRAFT ENGINE

PERMOLD SERIES ENGINE

MAINTENANCE AND OVERHAUL MANUAL

Technical Portions Accepted by the Federal Aviation Administration

Publication M-18

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SEP 2017

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

0 ..... 21 September 2017			

List of Effective Pages

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Publication Number: M-18 Initial Publication Date: 21 September 2017

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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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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.

Part No.	Title	Applicability
M-18	Maintenance and Overhaul Manual	TSIO-550 engines
M-0	Maintenance and Overhaul Manual	Various
X30592	Starter Service Instructions	CMI Energizer® starters
X30531	Alternator Service Instructions	CMI alternators
X42002	S-20/S-200 Magneto Service Manual	Various

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 **B**	TSIO-550-C **C**	TSIO-550-E **E**
TSIO-550-G **G**	TSIO-550-K **K**	TSIO-550-N **N**
Energizer Starter **EZR**	Iskra Starter **ISK**	SkyTec Starter **SKY**

1-1.3. Advisories

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

WARNING

A 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.

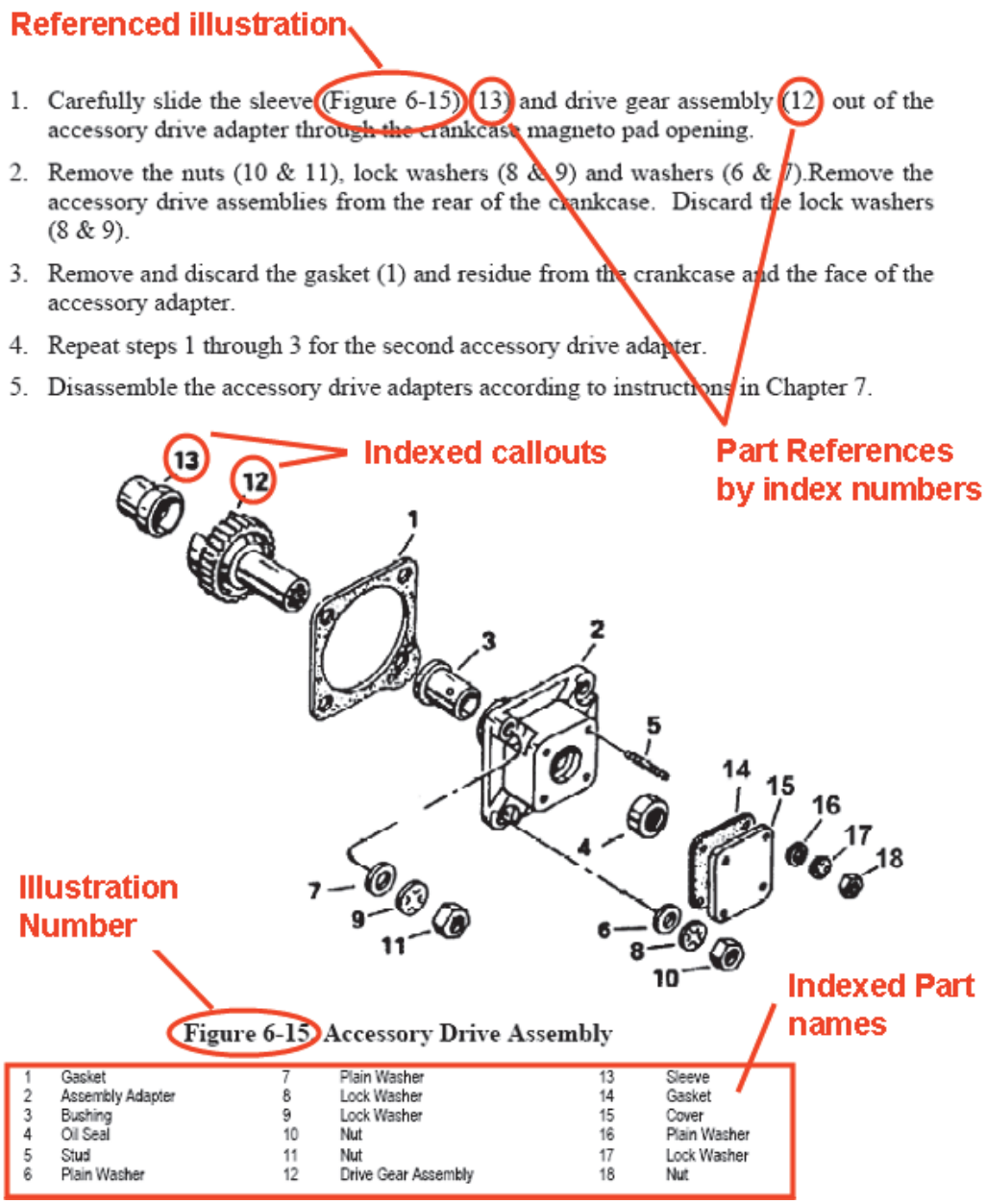


Figure 1-1. Figure and Index Reference

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 web site upon notification of FAA document acceptance/approval. Printed publication subscribers receive printed changes and revisions as they are released.

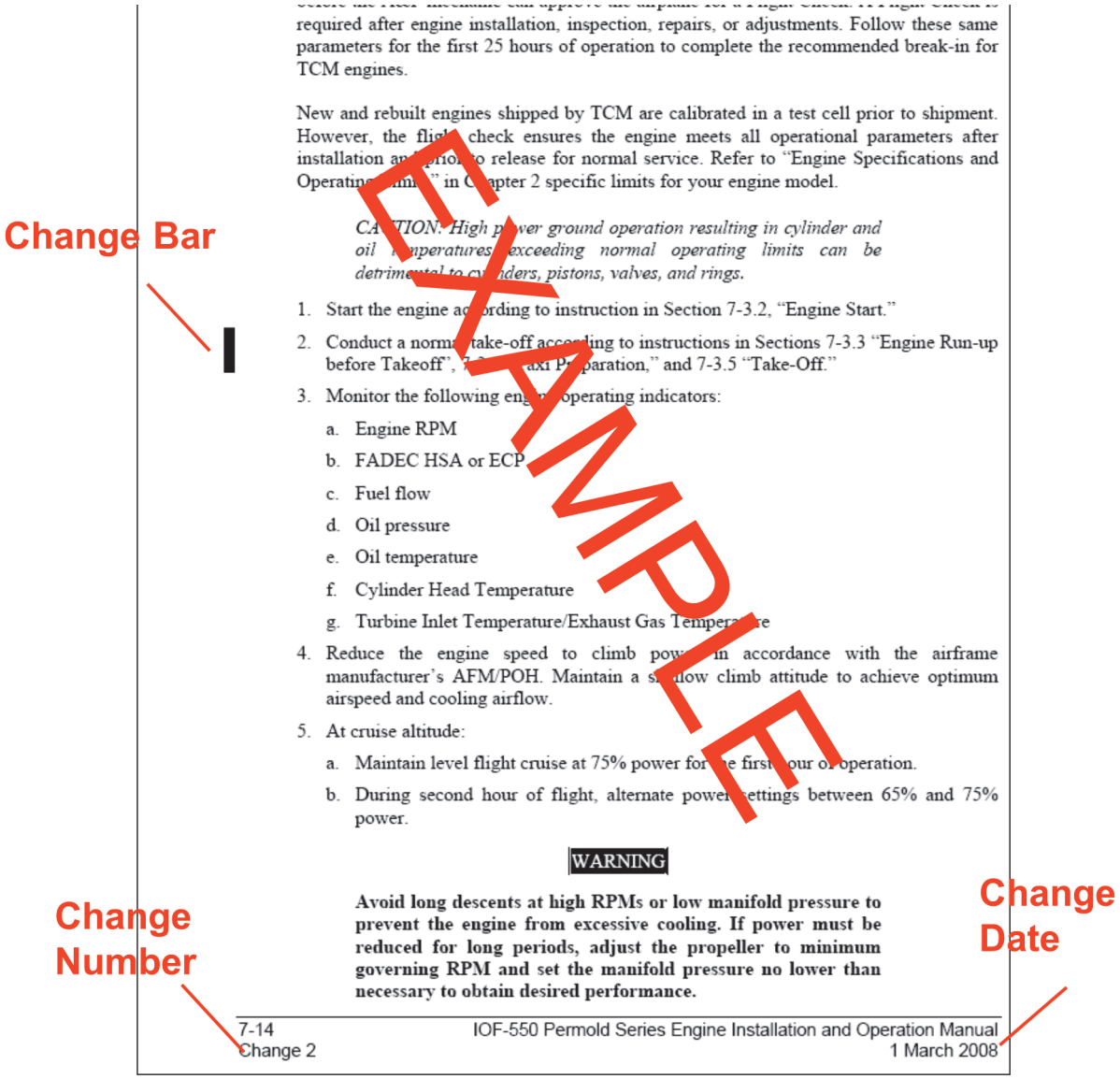
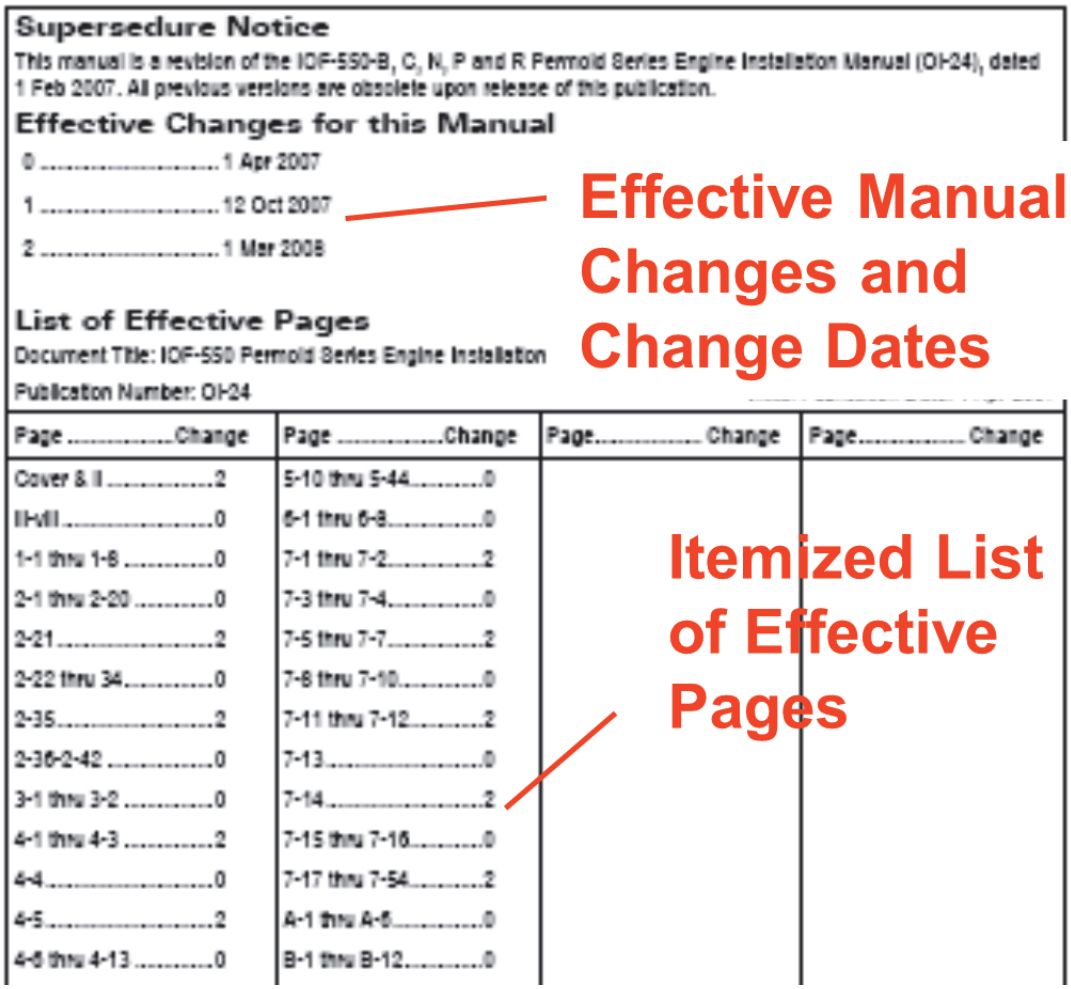


Figure 1-2. Change Page Identification

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.



Supersedure Notice

This manual is a revision of the IOF-550-B, C, N, P and R Permold Series Engine Installation Manual (OI-24), dated 1 Feb 2007. All previous versions are obsolete upon release of this publication.

Effective Changes for this Manual

0 ..... 1 Apr 2007
1 ..... 12 Oct 2007
2 ..... 1 Mar 2008

Effective Manual Changes and Change Dates

List of Effective Pages

Document Title: IOF-550 Permold Series Engine Installation
Publication Number: OI-24

Page ..... Change	Page ..... Change	Page ..... Change	Page ..... Change
Cover & II 2	5-10 thru 5-44 0		
II-Hdl 0	6-1 thru 6-8 0		
1-1 thru 1-8 0	7-1 thru 7-2 2		
2-1 thru 2-20 0	7-3 thru 7-4 0		
2-21 2	7-5 thru 7-7 2		
2-22 thru 34 0	7-8 thru 7-10 0		
2-35 2	7-11 thru 7-12 2		
2-36-2-42 0	7-13 0		
3-1 thru 3-2 0	7-14 2		
4-1 thru 4-3 2	7-15 thru 7-16 0		
4-4 0	7-17 thru 7-54 2		
4-5 2	A-1 thru A-6 0		
4-6 thru 4-13 0	B-1 thru B-12 0		

Itemized List of Effective Pages

Figure 1-3. 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.

Service Document	Subject	Affected Chapter
CSB668, Inspection of Ignition Harness Attachment Plate	Magneto or Ignition Harness Maintenance	6, 10, 16
SB669, Magneto Distribution Gear Block	Magneto Inspection and Maintenance	6
M67-12, Overboost of Turbocharged Engines	Unscheduled Maintenance	6 & 7
M72-17R1, Maximum Weight Difference Between Connecting Rods and Pistons in the Same Engine	Parts Replacement	M-0
M76-4, Propeller Shaft or Crankshaft Oil Seal Replacement	Unscheduled Maintenance	M-0
M85-14, Magneto Pressurization Filter	Magneto Inspection	6, 10, 15
M86-13R1, Camshaft Plug Inspection and Overhaul Revision	Camshaft Inspection and Replacement	13
M87-15, Alternator Ground Strap	Alternator Replacement	10, 15, 17
M88-9, Lightning Strikes	Unscheduled Maintenance	M-0
M88-10, Contaminated Fuels	Unscheduled Maintenance	M-0
M89-7R1, Engine Operation after Cylinder Replacement and/or Major Overhaul	Engine Operation/Post Overhaul Testing	M-0
M89-9, Excessive Crankcase Pressure	Unscheduled Maintenance	M-0
M89-18, Exhaust Gas Temperature (EGT) Recommendations for Standard Engines	Engine Operation	7
M93-4, Crankshaft Counterweights	Crankshaft Repair	M-0
M93-8, Rocker Arm to Rotocoil Clearance	Rocker Arm Installation	10, 16
SIL93-11B, Service Document Format	Service Documents	1
SIL93-14, CFC Compliance	N/A	N/A
SIL93-15, General Practices for Installation of Lock Wire, Tab Washers, and Cotter Pins	Standard Practices	M-0
SB94-2, Oil Filter mounting Stud	Service	10 & 15
MSB94-8D, Magneto to Engine Timing	Service	M-0
SIL94-5, Mobil AV-1 Oil	Authorized Lubricants	M-0
SB95-2, Inspection and Maintenance of Engine Control Cables and Linkage	Inspection	M-0
SIL95-5, Hose and Tubing Installation	Hose and tubing installation	M-0, Appendix C
SB95-7A, Manifold Valve Cover Inspection	Fuel system maintenance	6, 8, 10
SB96-3C, Crankshaft Gear Bolt Inspection	Crankshaft Assembly	16
SB96-7D, Torque Limits	Fastener torque	M-0, Appendix B
MSB96-10B, Crankshaft Ultrasonic Inspection	Crankshaft Removal & Replacement	15
SB96-11B, Propeller Strikes and Hydraulic Lock	Scheduled Inspection	6
SB96-12, Cylinder Continued Airworthiness	Scheduled Inspection	6 & 10
SIL97-1, Airworthiness Limitations	Airworthiness Limitations	4

Service Document	Subject	Affected Chapter
SID97-2B, Design, Operation Maintenance and Warranty of Cylinders	N/A	N/A
SID97-3G, Continuous Flow Fuel Injection Systems Adjustment Specifications and Instructions	Operational Checks and Adjustments	M-0
SID97-4F, Cylinder Bore and Piston Fit Specifications	Overhaul & Service Limits	10 & Appendix D, M-0
SB97-6B, Mandatory Replacement Parts	Engine Inspection & Assembly	M-0, Appendix C
CSB97-10B, Piston Pin Plug Wear	Service Limits	10
SIL97-12, Installation of Starter Adapter Shaft Seal	Starter Adapter Assembly	12, 16
CSB98-1C, Intake and Exhaust Valve Inspection	Service Limits	10 & 15
SIL98-3B, Production Release of New Intake and Exhaust Valve Springs	Cylinder Assembly	10 & 15
SIL98-5, Production Release of P/N 654837A1 Camshaft Assembly	Camshaft Replacement	15
SIL98-9E, Time Between Overhaul Periods	Engine Specifications, Scheduled Maintenance	M-0
SIL99-1, Engine Preservation for Active and Stored Aircraft	Engine preservation and returning an engine to service after storage	M-0
SIL99-2C, Sealants, Lubricants and Adhesives Authorized by CMI	Materials	M-0
SB99-8B, Engine Fuel Injection System Preservation	Fuel Injection system preservation	5
SB00-3A, Crankshaft, Counterweight and Connecting Rod Repair Information	Repair Specifications	10
SB00-4A, Australian AVGAS Contamination	Inspection and Operation	6
MSB00-6C, Slick Service Bulletin SB1-00C	Slick magnetos	2, 6, 10, 12, 17
SIL00-7A, Oil Gauge Rod Application	Oil Servicing	6
SIL00-9A, Engine Data Plates	N/A	N/A
SB00-10, Fuel Pump Seal	Fuel Pump Installation	10 & 17
SIL00-11B, Release of new Cylinder Induction Port Drain Connector	Cylinder Assembly	10 & 17
SB01-3A, P/N649304A1 and 649305A1 Gear-driven Alternators	Alternator overhaul	6, 10 & 15
SIL02-4, Production Release of New Lightweight Starter Motors	Starter replacement	10, 15 & 17
SIL02-6A, Production Release of Optional Intake And Exhaust Valves	Cylinder Assembly	10 & 15
SIL03-1, Cold Weather Operation – Engine Preheating	Preheating procedures	7
SIL03-2C, Currently Active Approved Spark Plug Application	Spark plugs	2 & 6
SIL03-3, Differential Pressure Test and Borescope Inspection	Inspection Criteria	6
SIL04-2A, Cylinder Barrel Ultrasonic Inspection	N/A	M-0
CSB04-5A, Ignition Systems CSB665A	Magneto Service	10
CSB04-6B, Inspection of TSIO-550 and TSIOL-550 Engines with P/N 654867 Pistons Installed	Engine Inspection	6
SB04-10, Piston Pin Marking	Overhaul Repairs	10 & 15
SB04-11, Valve Guide Application, Installation and Reaming	Valve Guide Repairs	10 & 15

Service Document	Subject	Affected Chapter
SIL04-12A, Authorized Engine Adjustments, Component Replacement and Repositioning	Engine Specification	M-0
SID05-1B, Inspection Guidelines for Camshafts and Hydraulic Lifters	Inspection Criteria	15 & Appendix D
SB05-2, Overspeed Limitations	Unscheduled Maintenance	M-0
SIL05-3A, Engine Specification Numbers	Engine Specification	2
MSB05-8B, Improved Camshaft Gear	Camshaft Gear Replacement and Overhaul	13, 15 & 17
SB06-1A, Fuel Injection Nozzle Inspection & Replacement	Injector Nozzle Installation	6, 10 & 16
SIL06-3, Crankshaft Gear Retaining Screw	Engine Assembly	16
SB07-1, Connecting Rod Piston Pin Bushing Inspection	Inspection	15
MSB07-4, Kelly Aerospace Power Systems Turbocharger Replacement	Turbocharger Inspection	6, 10 & 15
CSB08-3C, Throttle & Mixture Control Levers	Fuel Injection System Assembly	5, 6, 10 & 17
SB08-4A, Fuel Injection System Contamination	Fuel Injection Service	M-0
SB08-8, Slick Service Bulletin SB2-08	Magneto Inspection	6, 15
SB08-9A, Slick Service Bulletin SB3-08A	Magneto Inspection	6, 15
SB08-13, Induction System Hose and Clamp Installation	Induction System Inspection & Assembly	6, 10 & 17
SB09-4B, Crankcase Inspection for Permold Engines Equipped with Air Conditioner Systems from 1998 to present	Scheduled Inspections	6
SB09-7, Potential Pushrod Seal Leakage	Engine Inspections	5, 6, 9, 10
MSB09-8A, Inspection and Removal of Certain Hydraulic Lifters	Engine Inspection	6, 10, 13, 15 & 16
SB09-14, Crankshaft Corrosion Treatment	Engine Inspection	6, 10, 12, 15, 16
CSB09-11A, Minimum Cruise RPM Limits	Engine Operation	2 & 7
SB10-1A, Exhaust and Turbocharger System Inspection	Turbocharger Inspection	M-0
MSB10-3, KAES SB039 Turbine Wheel Replacement	Turbocharger Inspection	6, 10, 17
SIL10-6A, Oil Cooler and Vernatherm Valve for Certain Engines Experiencing Low Oil Temperatures	Engine Operation	7, 10
SB10-8A, KAES SB040A Turbocharger Center Housing Rotating Assembly Inspection	Turbocharger Inspection	6, 10, 17
SB11-1A, Hartzell Engine Technologies, SIL A-138	Alternator Inspection	N/A
SB11-2, Continued Airworthiness Instructions Part No. 656802 Alternator	Alternator Service	6, 10
SB11-3, Alternator and Drive Coupling Installation	Alternator Replacement	6, 10, 12, 13, 15, 16, 17
CSB12-1, P/N 641909 Lock Plate Inspection	Engine Assembly	15, 16, 17
SIL13-2A, Alternator Instructions for Continued Airworthiness	Alternator Replacement	6, 10, 12, 13, 15, 16, 17
SB13-4C, Aneroid Equipped Fuel Pumps	Scheduled Maintenance	6
SB13-6A, Crankshaft Gear Replacement	Engine Disassembly	13
SB13-8, Hartzell Engine Technologies SIL A-137	Alternator Service	6
SIL14-4B, 24V/70 Amp Belt-driven Alternator Brace Alignment	Alternator Service	10, 17, M-0
SB14-5A, Hartzell Engine Technologies SB 059	Alternator Inspection	6
SB14-8, Exhaust Flange to Cylinder Installation	Exhaust System Installation	M-0

Service Document	Subject	Affected Chapter
SIL14-9, Fuel Pump Mixture Control Lever Configuration	Fuel Pump Configuration	6
SB15-1, Continental Motors Ignition System Service Bulletin SB669	Magneto Inspection	6
CSB15-2C, Oil Cooler Cross Fitting Replacement	Engine Assembly	5, 13, 16
SB15-3A, Oil Sump Assembly Inspection	Scheduled Maintenance	6
SB15-5, Champion Aerospace Slick Service Letter SL4300/6300-74-20-001	Ignition Timing	6, M-0
SB15-6A, NIC3 Cylinder Assemblies	Optional Cylinder Assemblies	7, 10, Appendix D
CSB15-7B, TSIO-550-K Oil Cooler Cross Fitting Replacement	Engine Assembly	5, 13, 16
SIL16-1, Optional 24V Starters	Starter Replacement	10, 17
SIL16-2, M-0, Standard Practice Maintenance Manual Release	Multiple	Throughout
SB16-3, Turbocharger Check Valve Inspection	Scheduled Maintenance	M-0
SB16-4, Incorrectly Identified Control Levers	Scheduled Maintenance	6
SB16-6, Engine Damage Due to Kickback	Engine Operation	7
SB16-8, Turbo Exhaust Transition 657631	Exhaust System Maintenance	6, 10
SB16-9, Hartzell Engine Technologies (HET) SB No. 066	Alternator Maintenance	6

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

Service Documents Release After This Manual

Document Number:		**Release Date:**	/ /	**Affected Sections:**	
Title:					
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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

Publication	Supplied With Engine	Internet via CMI web site[1]	Printed Manual Available for Purchase
Instructions for Continued Airworthiness			
TSIO-550 Permold Series Engine Maintenance and Overhaul Manual (M-18) (this manual)	Yes	Yes	Yes
Standard Practice Maintenance Manual (M-0)	Yes	Yes	Yes
Starter Service Instructions (X30592)	Yes	Yes	Yes
Alternator Service Instructions (X30531)	Yes	Yes	Yes
Magneto Service Manual (X42002)	Yes	Yes	Yes
Engine Installation Manual			
Installation and Operation Manual (OI-18)	Yes[2]	Yes	Yes
Illustrated Parts Catalogs			
Electronic Engine Product Catalog (by Engine Model and Specification)	No	Yes (view only)	No

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.

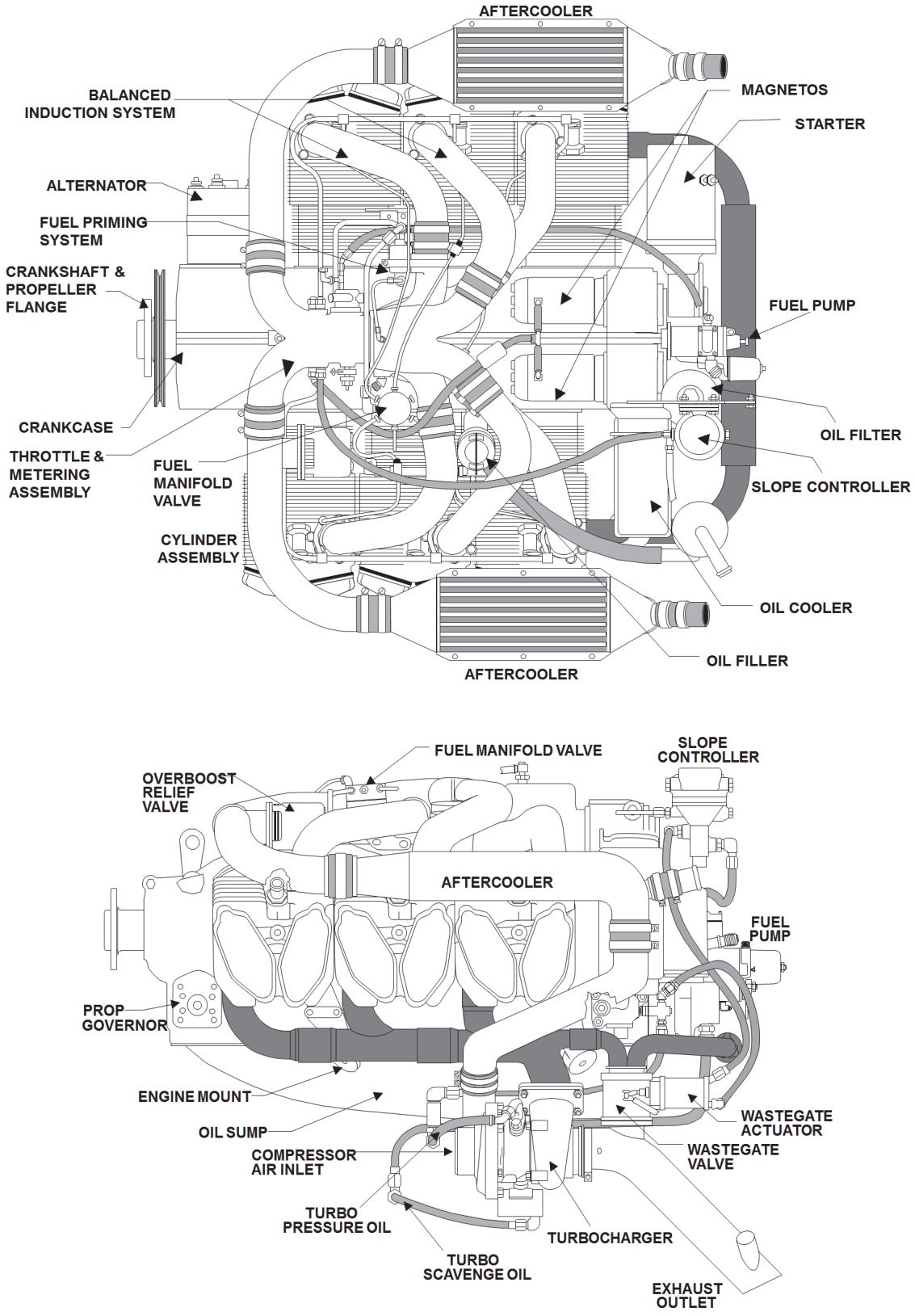


Figure 2-1. TSIO-550 Typical Top and Side Views

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).

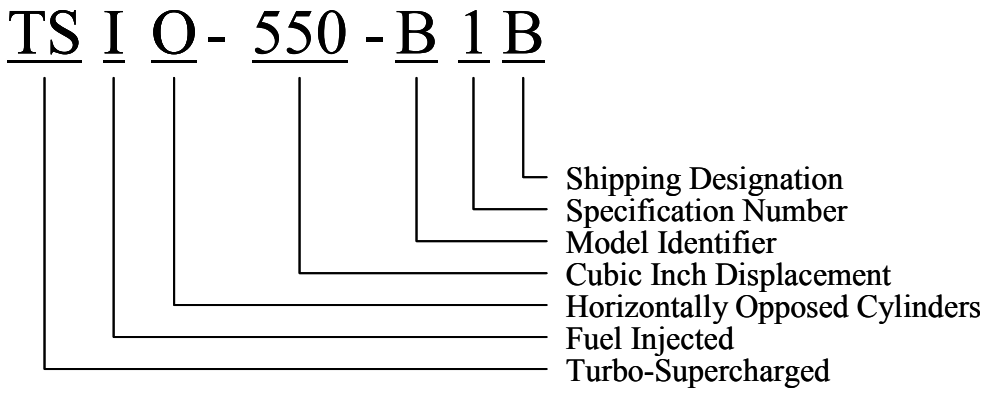


Figure 2-2. Engine Model Definition

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.

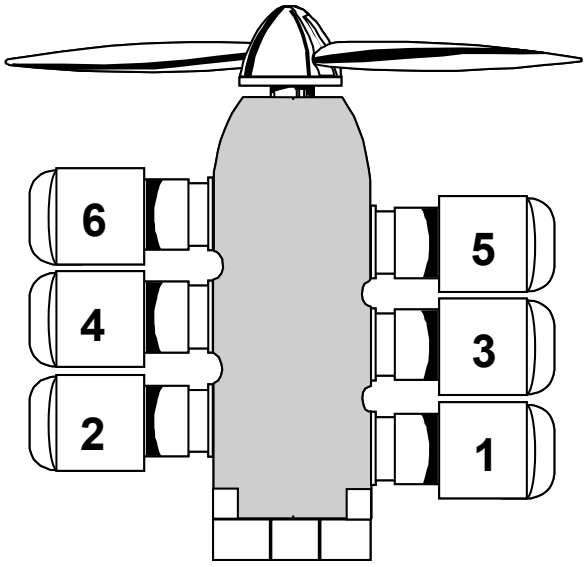


Figure 2-3. Cylinder Number Designation

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.

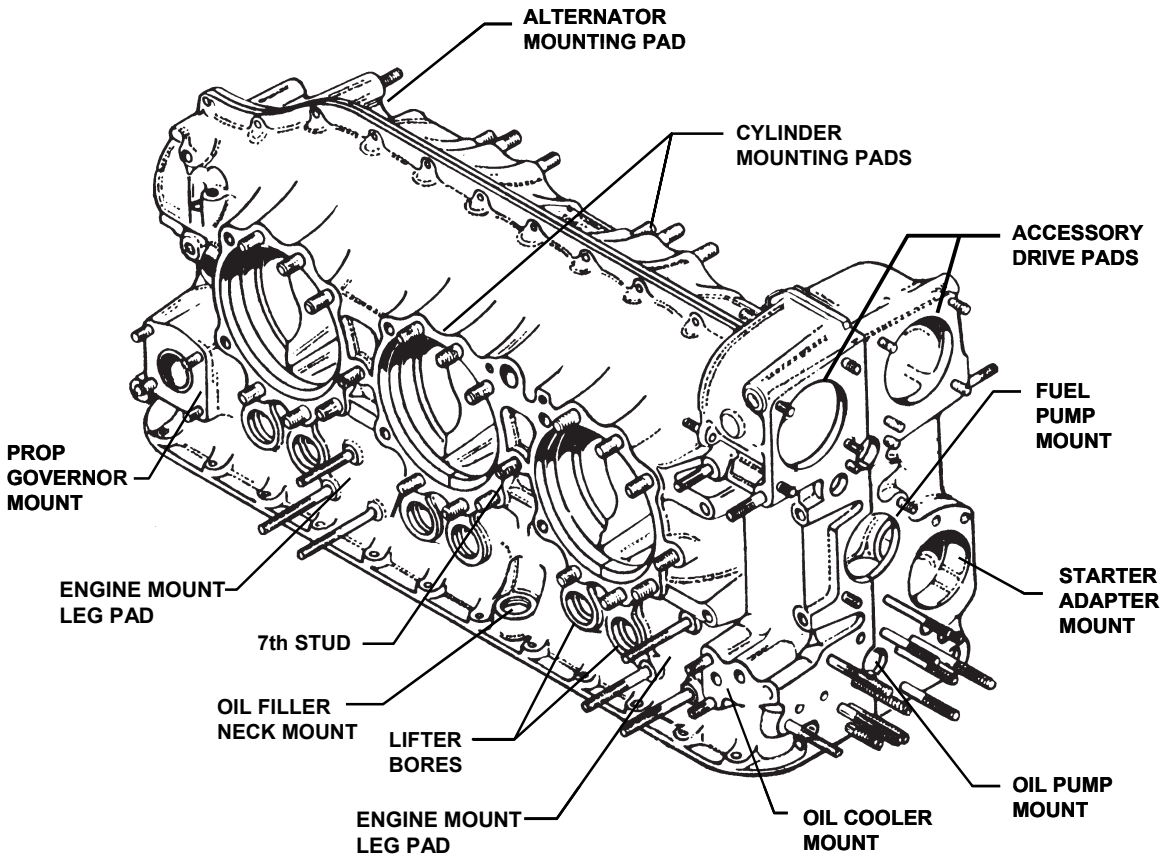


Figure 2-4. Permold Crankcase Features

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.

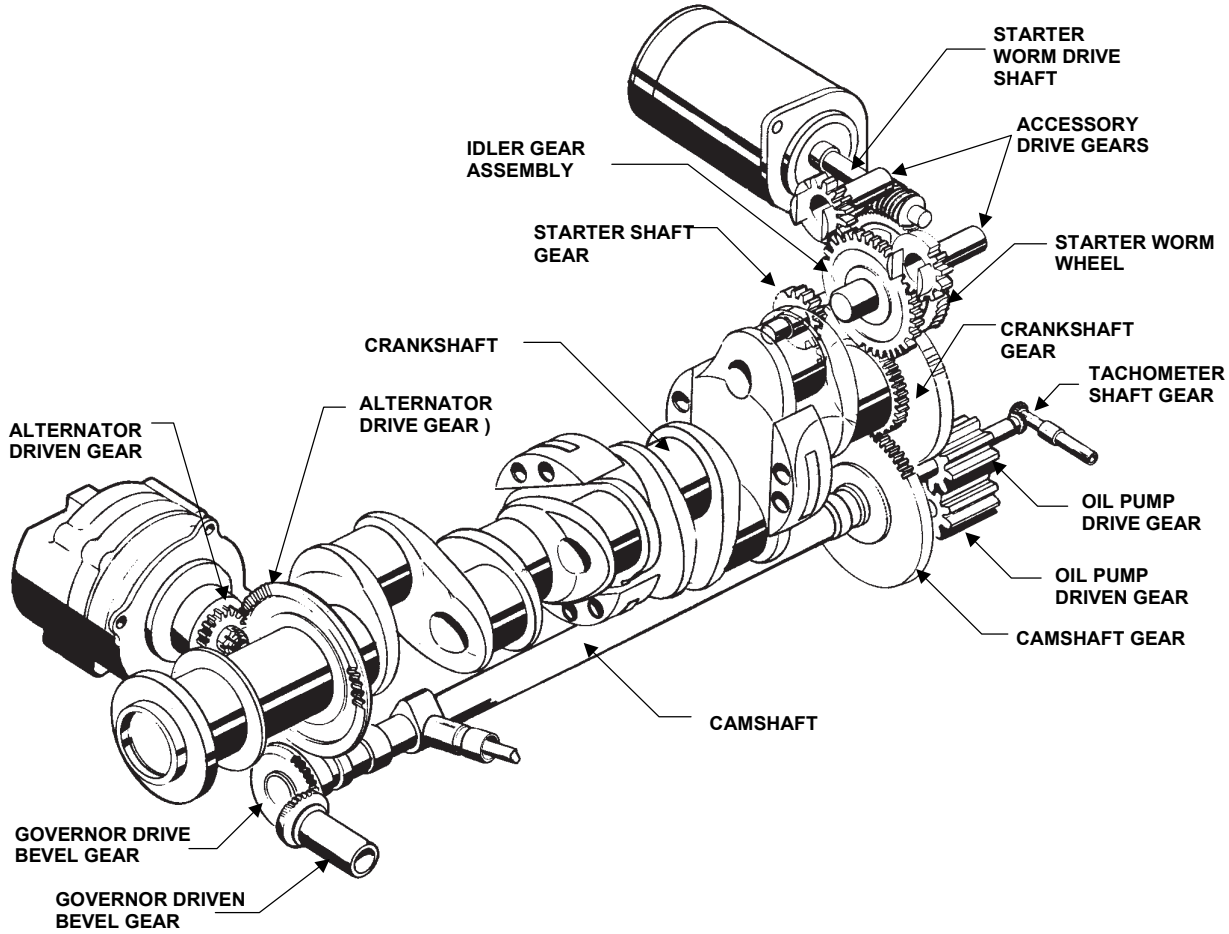


Figure 2-5. Engine Drive Train

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.

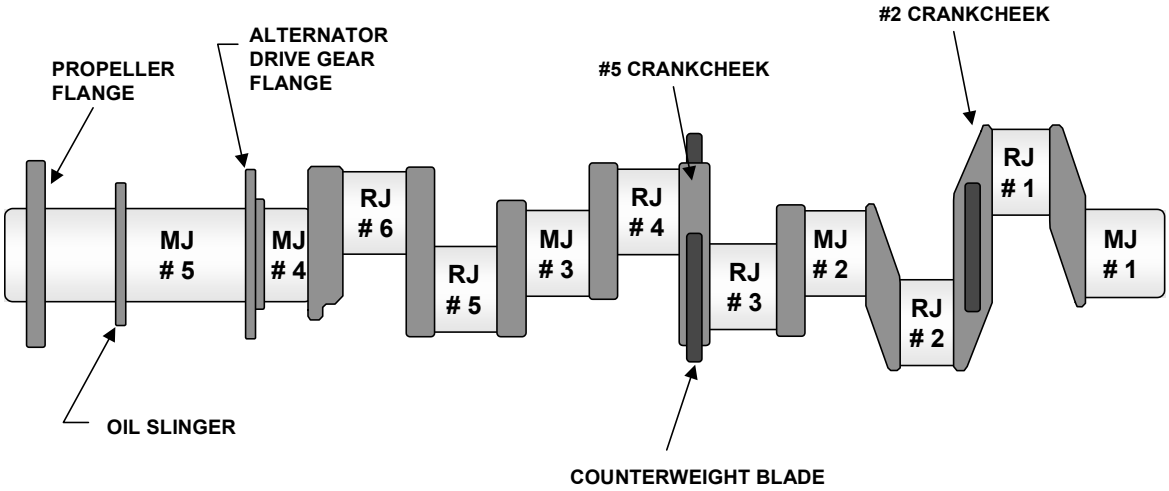


Figure 2-6. Crankshaft

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.

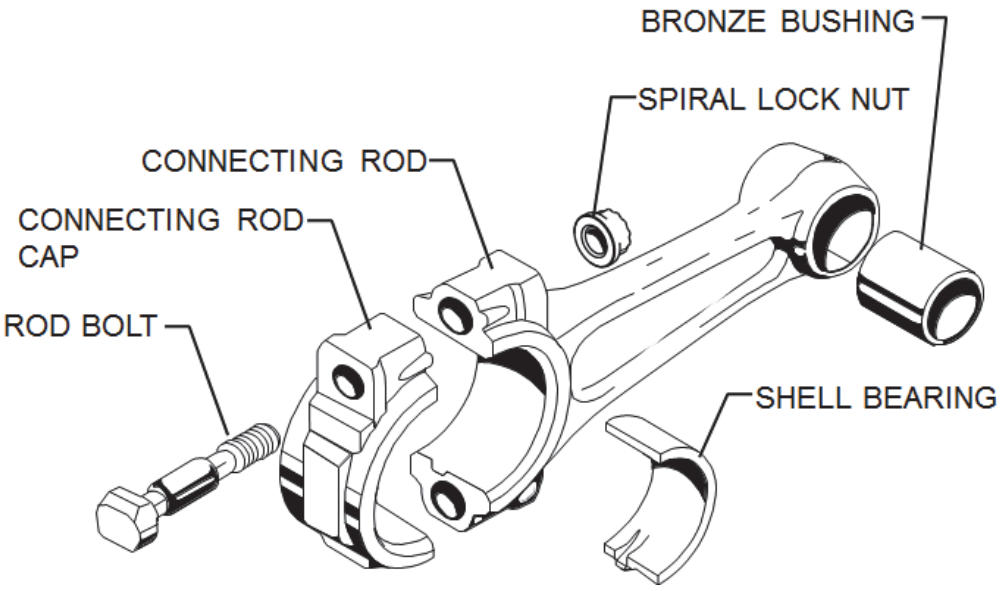


Figure 2-7. Connecting Rod

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.

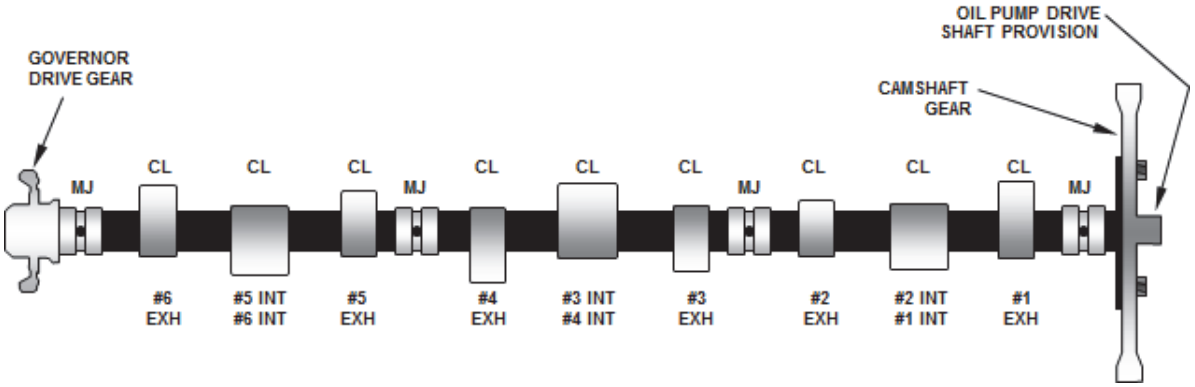


Figure 2-8. Camshaft

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.

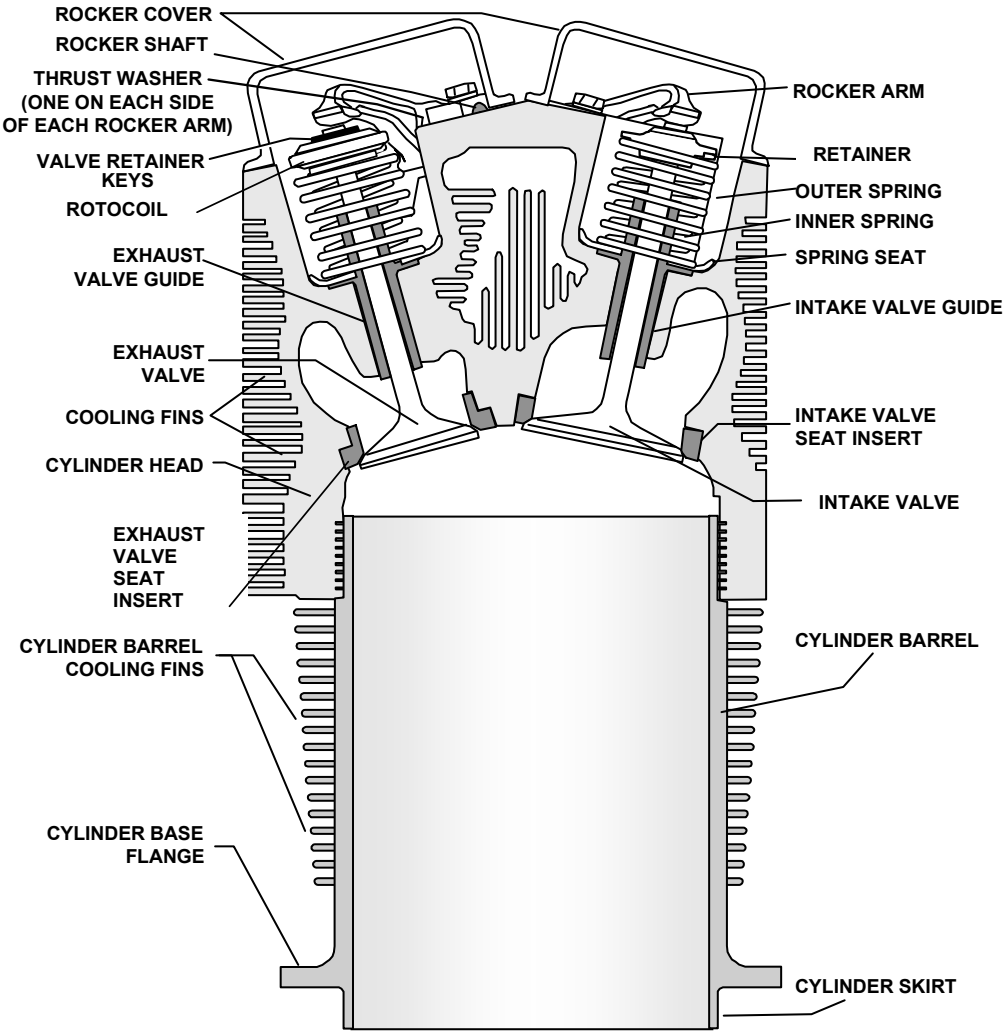


Figure 2-9. Cross-flow Cylinder Features

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.

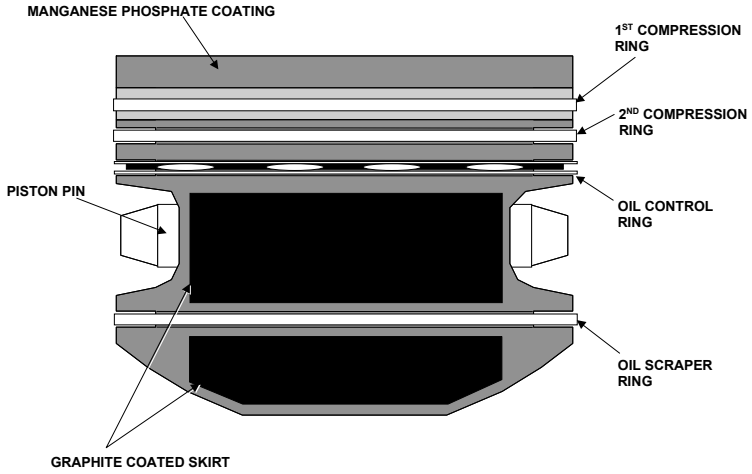


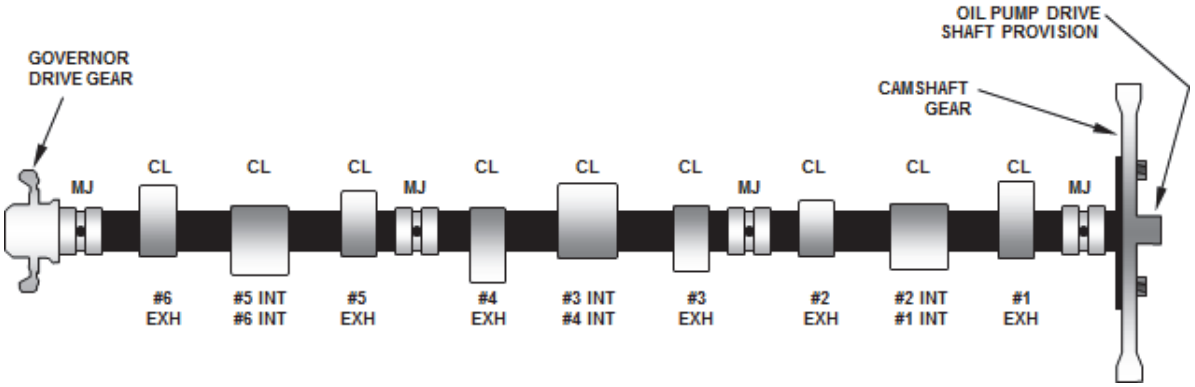
Figure 2-10. Piston Features

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.

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.



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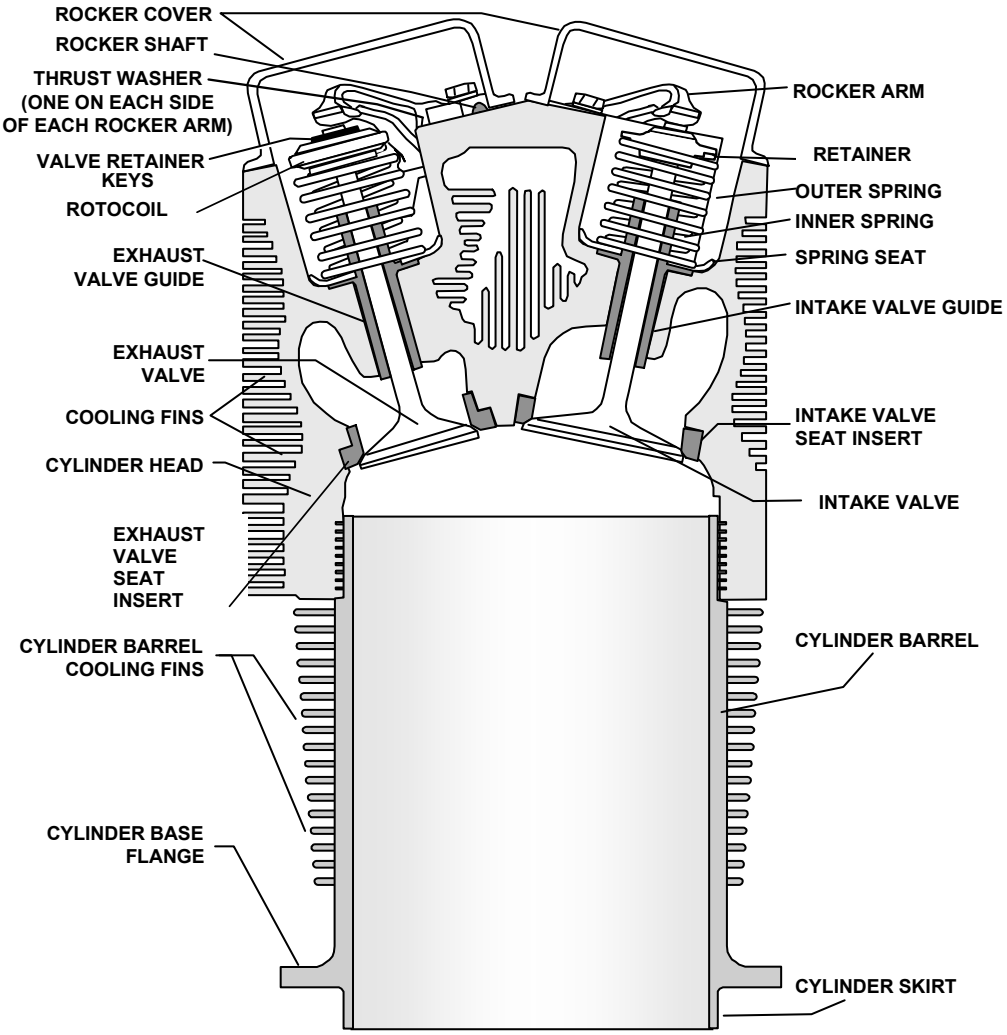

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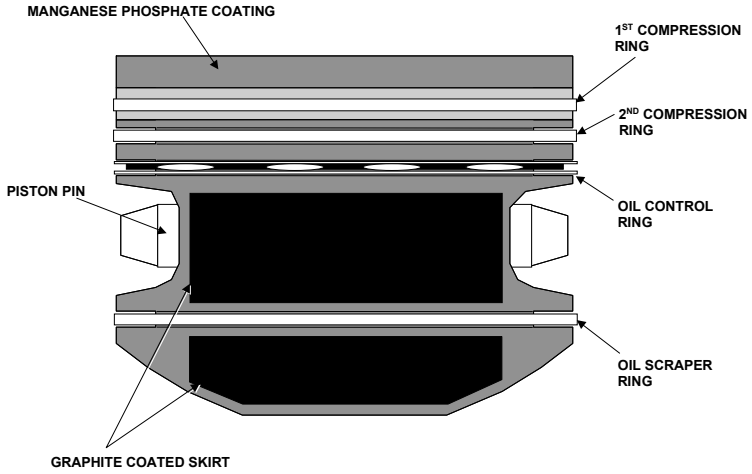

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The 550 cubic inch displacement is achieved using a 5.25 inch diameter cylinder bore and a 4.25 inch piston stroke. TSIO-550 Permold Series engines utilize the Permold crankcase design. Basic engine weights, minus accessories, are listed in Section 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.

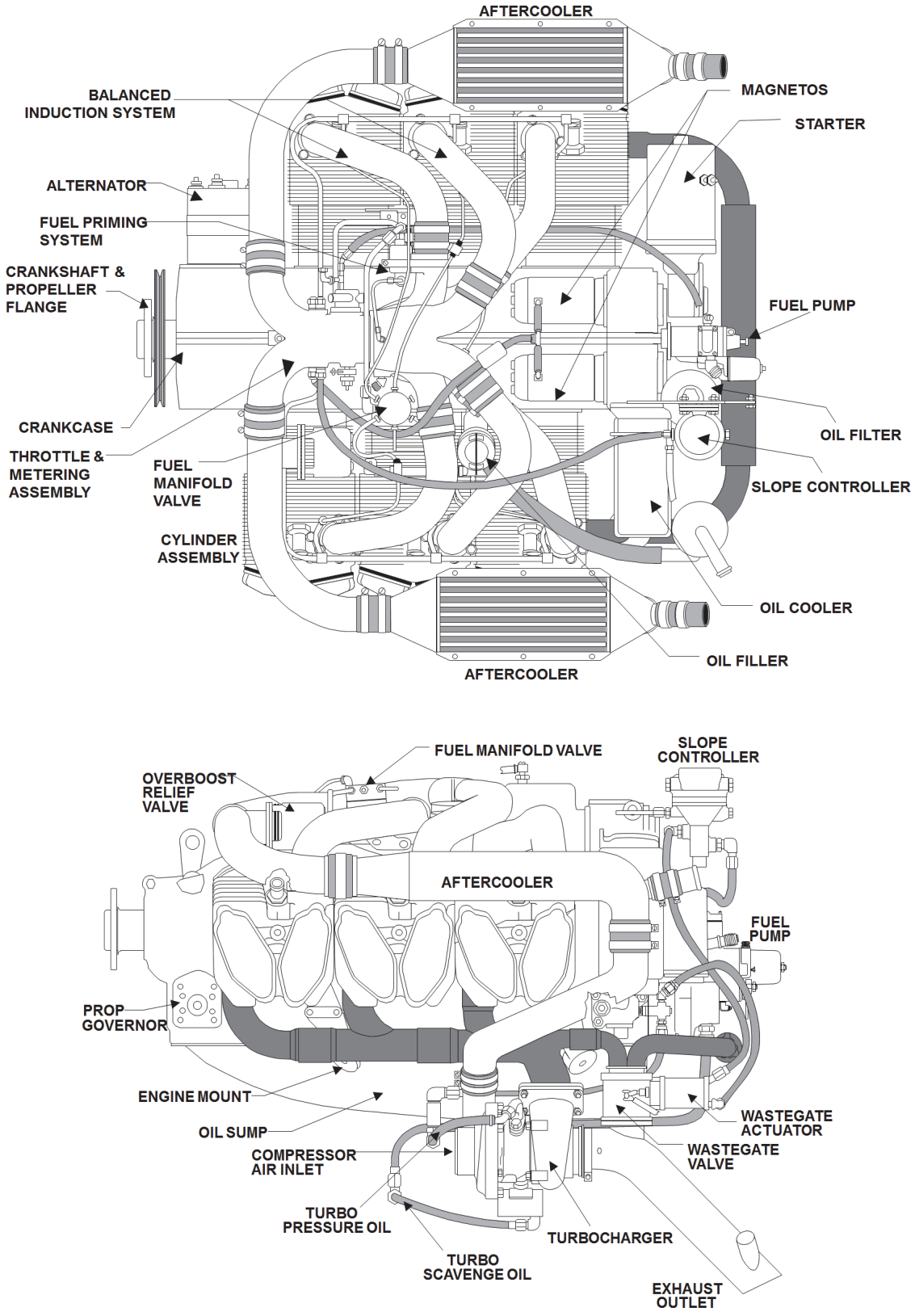

Figure 2-1. TSIO-550 Typical Top and Side Views

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).

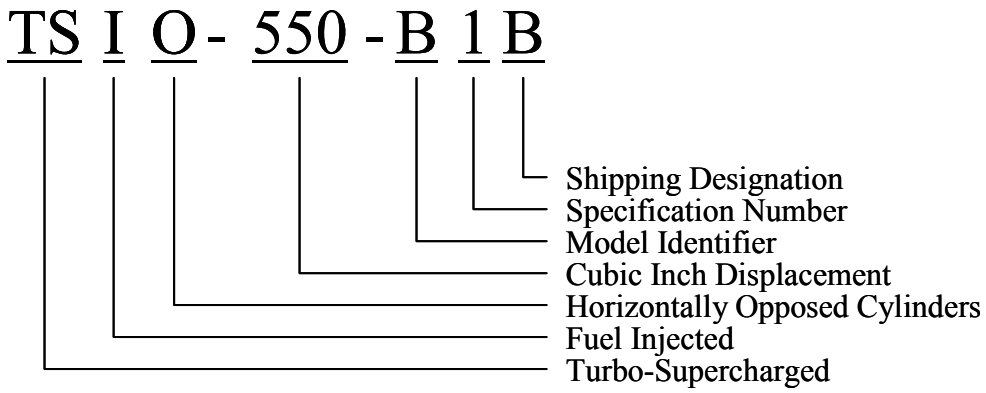

Figure 2-2. Engine Model Definition

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.

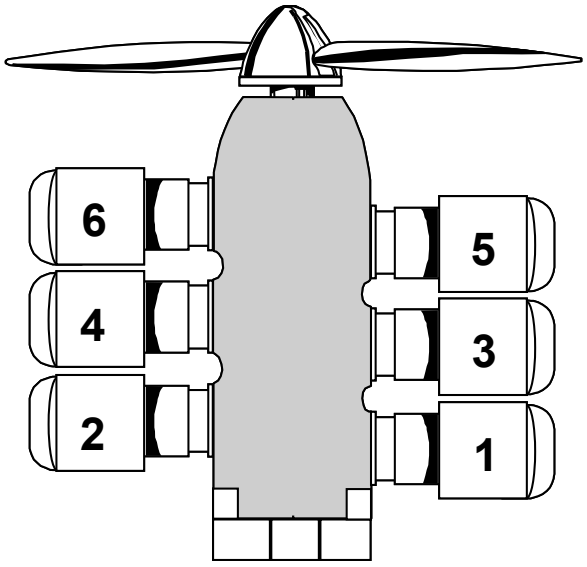

Figure 2-3. Cylinder Number Designation

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.

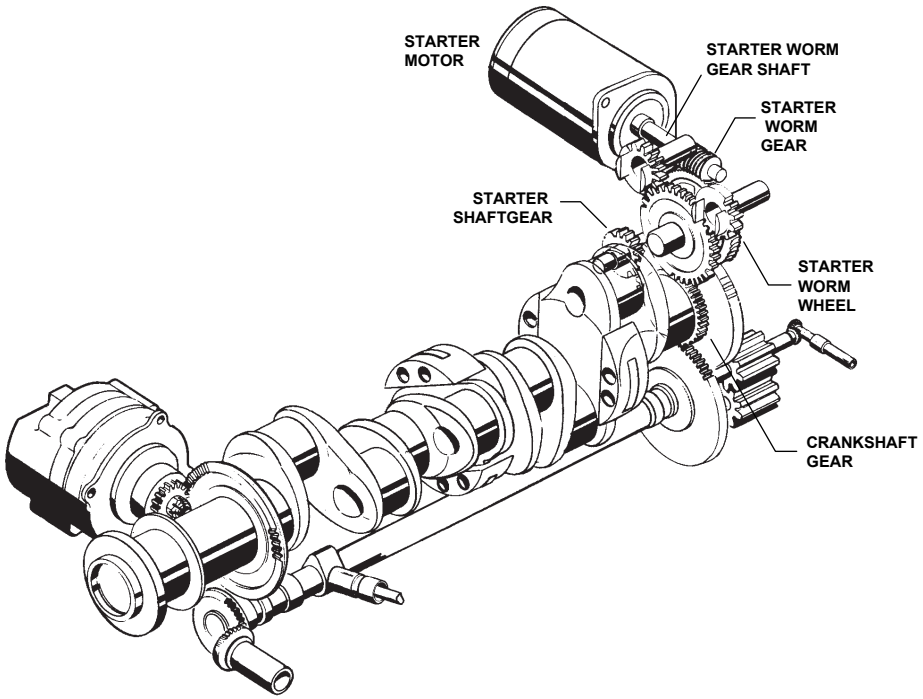

Figure 2-17. Starting System

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.

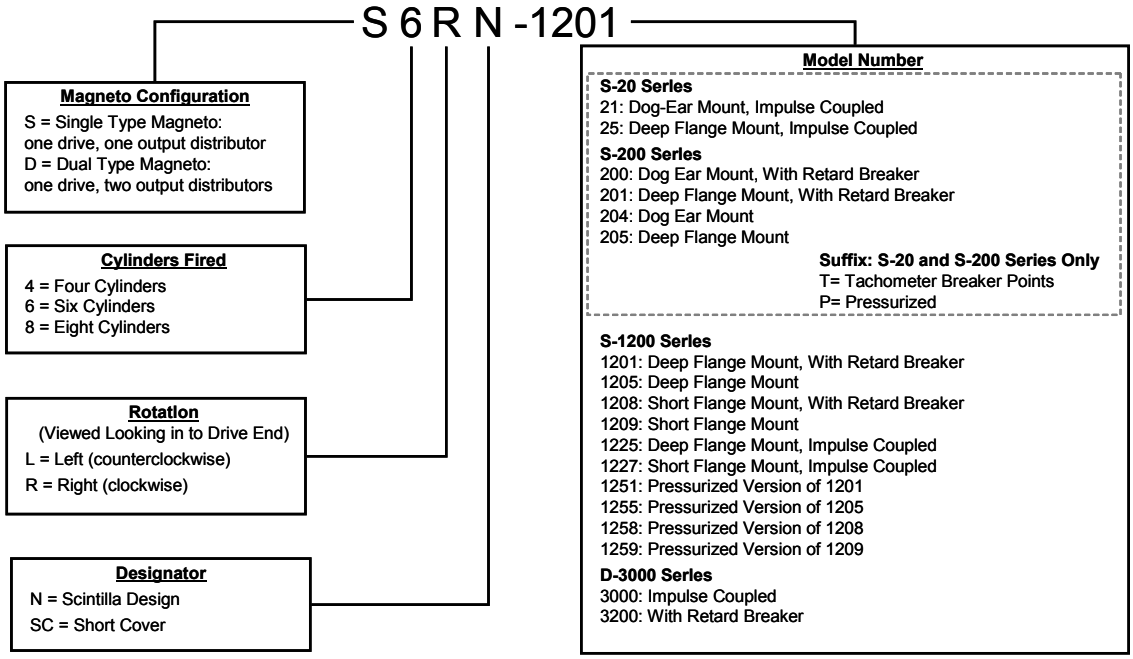

Figure 2-18. Continental Motors Magneto Model Number Structure

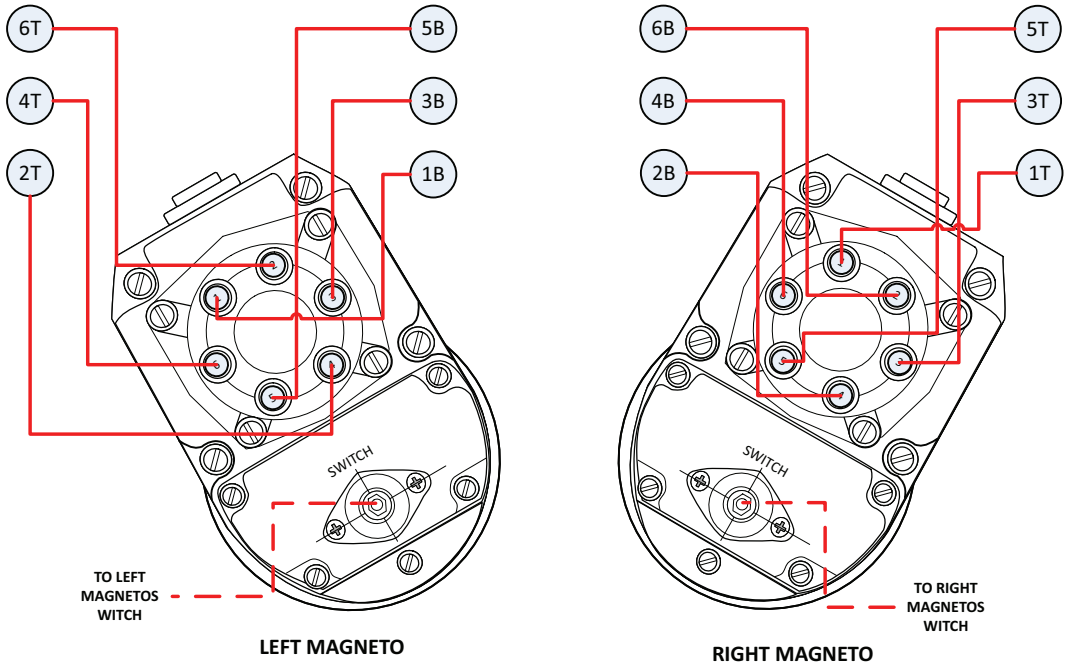

Figure 2-19. Continental Motors Ignition System Schematic

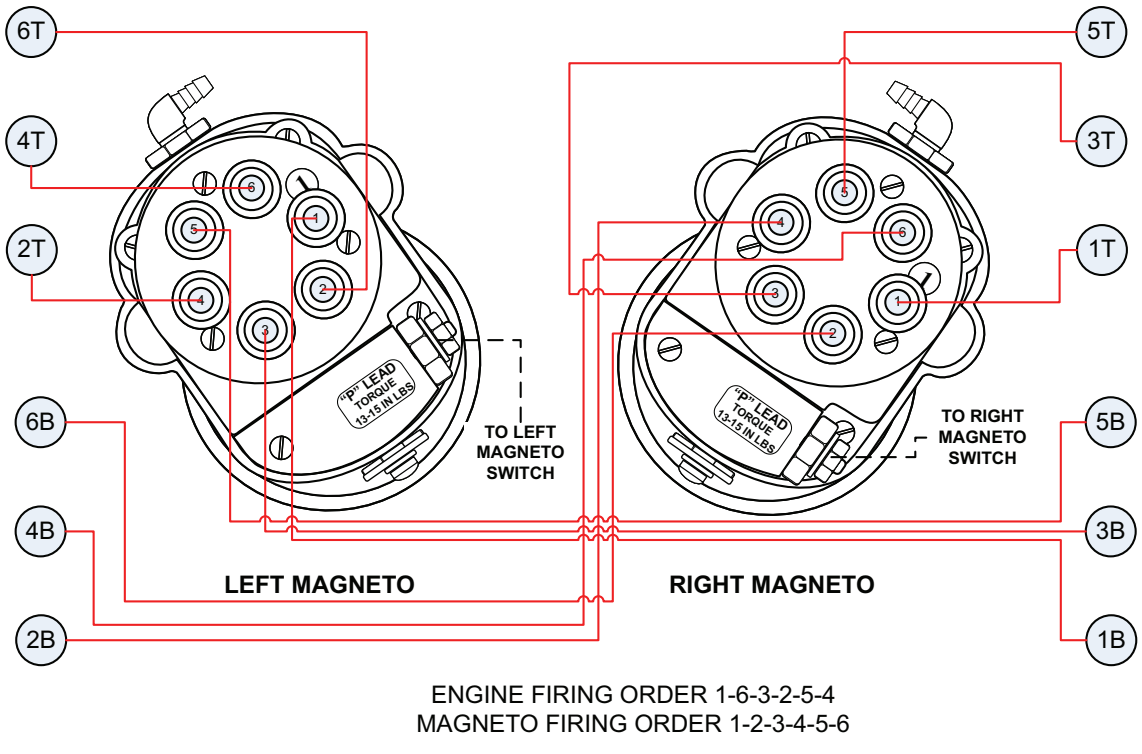

Figure 2-20. Champion (Slick) Ignition System Schematic

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.

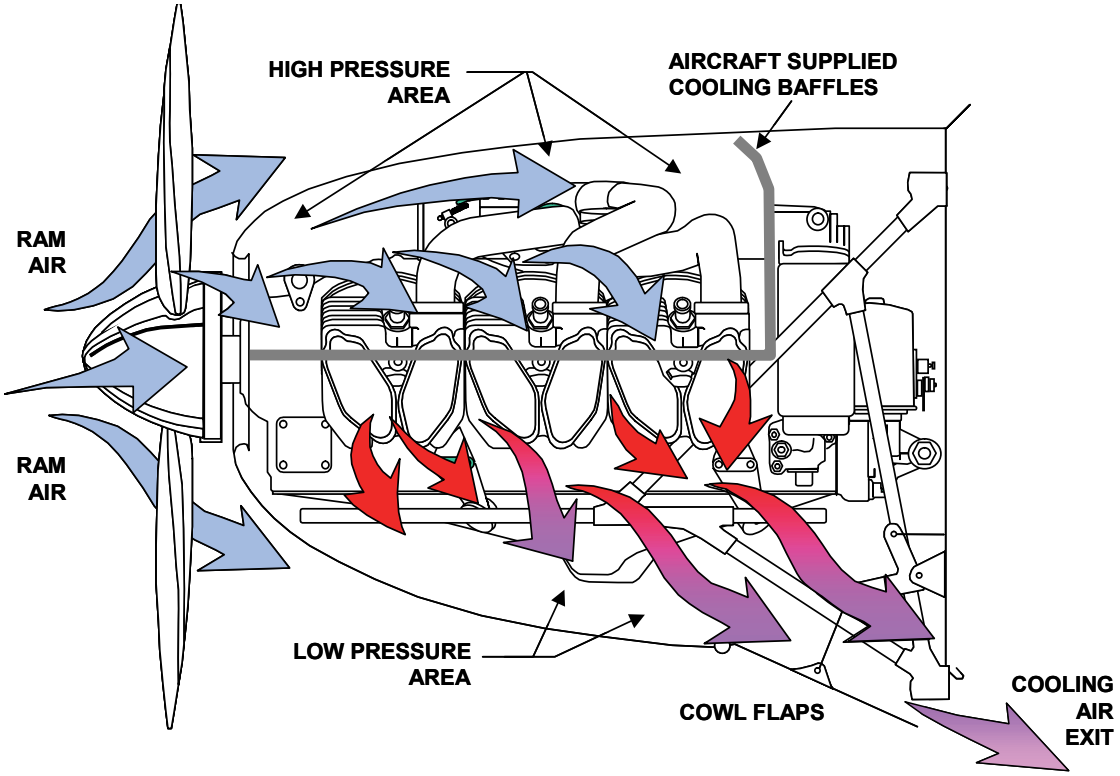

Figure 2-21. Engine Cooling

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.

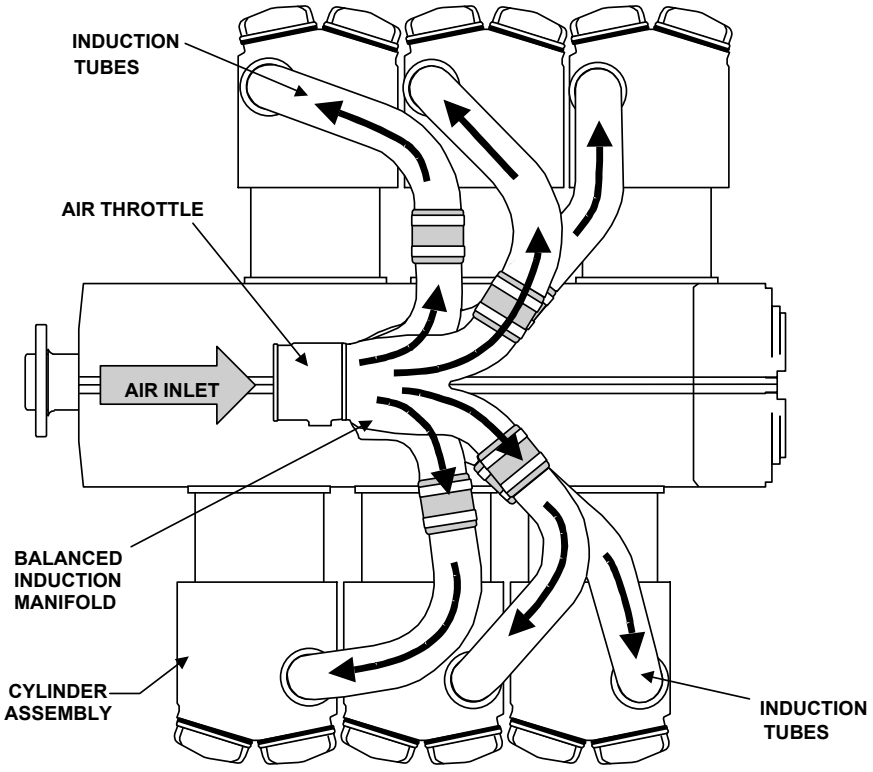

Figure 2-22. Typical Cross-flow Induction System

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.

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.

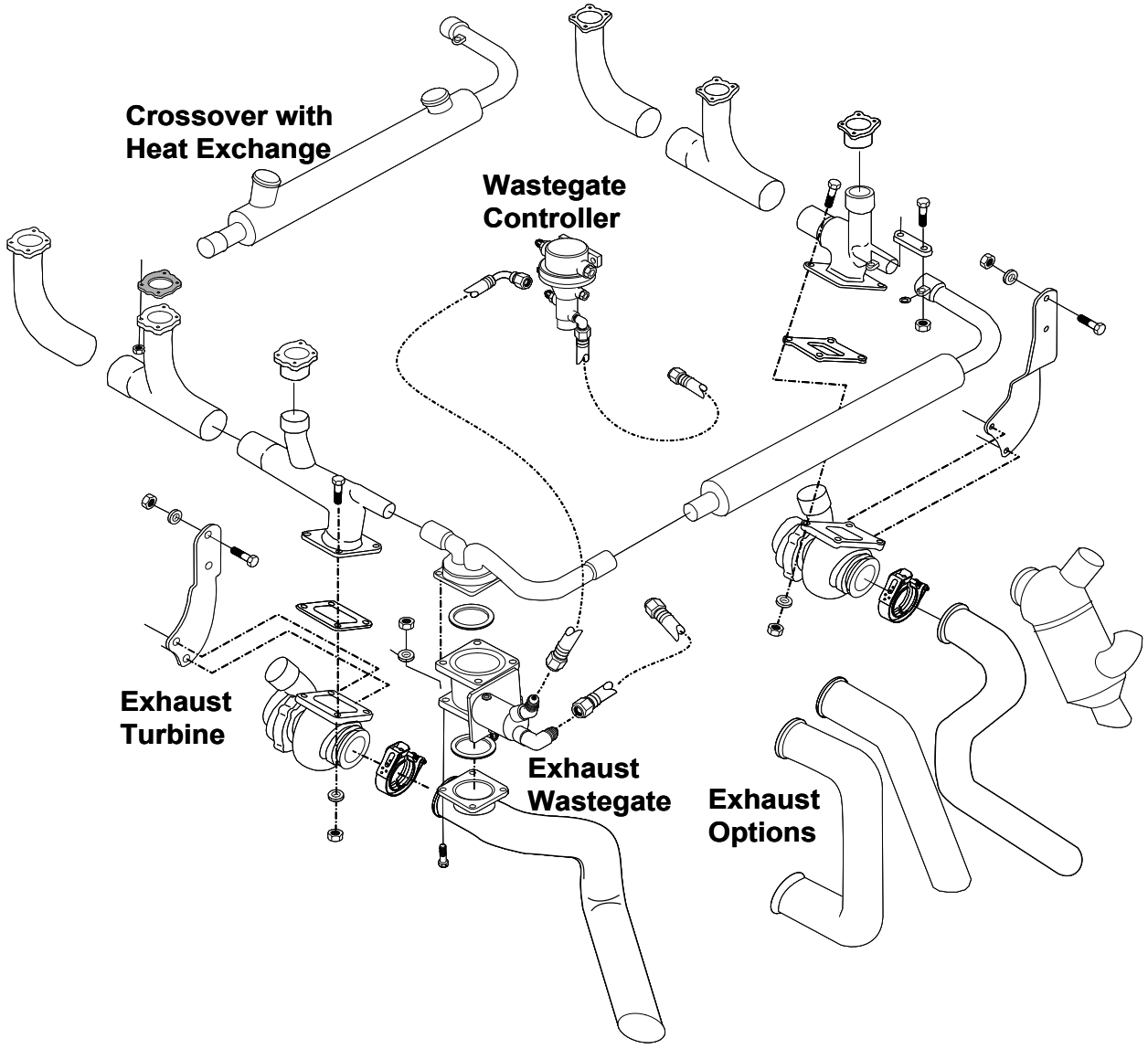

Figure 2-23. Typical Turbocharger and Exhaust System

2-3. Engine Specifications

Table 2-1. TSIO-550 Series Engine Characteristics

General		
FAA Type Certificate	E5S0	
Installation Drawing Number	(B) 653021 (C) 646618 & 656791 (E) 646618 (G) 657154 (K) 657645 (N) 658233	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	7.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Time Between Overhaul (TBO)	Refer to M-0, Section 6-3	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	552 cubic inches	9.05 L
Ignition		
Ignition Timing	24° BTC ± 1°	
Magneto Type	(B) (C) (E) Champion (Slick) 6320 (two) (G) CMI S6RSC-25P (two) (K) (N) 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) (N) 2.5 (8.46)	
Cylinder Head Temperature		
Maximum Cruise Operational Temperature[1]	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
	(K) 420°F[2]	215°C[2]
Minimum Take-off Temperature	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

Crankshaft Speed, Brake Horsepower & Manifold Pressure	
Rated Maximum Continuous Operation[1] @ Maximum rated Crankshaft Speed @ Maximum rated Manifold Pressure	**B** 350 bhp -0% +5% @2700 rpm@ 38.0 in. Hg **C** 310 bhp -0% +5% @2600 rpm@ 35.5 in. Hg **E** 350 bhp -0% +5% @2700 rpm@ 38.5 in. Hg **G** 310 bhp -0% +5% @2700 rpm@ 34.0 in. Hg **K** 315 bhp -0% +5% @2500 rpm@ 37.5 in. Hg **N** 315 bhp -0% +5% @2500 rpm@ 37.5 in. Hg
Crankshaft Speed (Maximum rated)	**B** 2700 rpm **C** 2600 rpm **E** 2700 rpm **G** 2700 rpm **K** 2500 rpm **N** 2500 rpm
Critical Altitude (feet)	**B** 12000 **C** 18000 **E** 18000 @ 2700 rpm @ 38.5 in. Hg 22000 @ 2500 rpm @ 31.0 in. Hg 25000 @ 2500 rpm @ 27.5 in. Hg **G** 22000 **K** 18000 **N** 18000
Engine Idle Speed, Minimum	600 rpm
Maximum Recommended Cruise Power	**B** 262 bhp @ 2500 rpm @ 30.5 in. Hg **C** 262 bhp @ 2500 rpm @ 30.5 in. Hg **E** 262 bhp @ 2500 rpm @ 30.5 in. Hg **G** 262 bhp @ 2500 rpm @ 30.5 in. Hg **K** 262 bhp @ 2500 rpm @ 30.5 in. Hg **K** 232 bhp @ 2500 rpm @ 27 in. Hg[2] **N** 262 bhp @ 2500 rpm @ 30.5 in. Hg
Minimum Cruise RPM	2300 RPM

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

Oil		
Oil Pressure - Normal Operation @ 100° to 240°F (38° to 116°C)[1]	30 to 60 psig	
Maximum Allowable Oil Pressure (cold oil)[1]	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[1]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[1]	240°F	116°C
Minimum Take-off Oil Temperature[1]	100°F	38°C
Oil Sump	C G K N	B E
Fill Capacity	8.0 qts. (7.6L)	12.0 qts. (11.3L)
Usable Oil - 16° Nose Up (8 qt fill), 20° Nose Up (12 qt fill)	5.0 qts. (4.7L)	7.5 qts. (5.8L)
Usable Oil - 10° Nose Down (8 qt fill), 14.5° Nose Down (12 qt fill)	4.5 qts. (4.3L)	6.5 qts. (5.6L)
Recommended Oil Grade, SAE - above 40° F	50 or Multi-viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi-viscosity	
Oil Grade	See M-0, Section 3-1	
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

Fuel System	
Fuel Control System	Continuous Flow Fuel Injection
Certified Fuel Specifications	
Minimum Fuel Grade	Refer to M-0, Table 7-1 and Table 7-2 for authorized fuels and applicable engines
Regional Fuel Specifications	
Russian Commonwealth of Independent States	Refer to M-0, Table 7-1 and Table 7-2
People's Republic of China	Refer to M-0, Table 7-1 and Table 7-2
Fuel Injection System Pressure	
Unmetered Fuel Pressure, 600 RPM, psig (kPa)	7.0-9.0 (48.3-62.1)
Unmetered Fuel Pressure[1], Rated Power, psig (kPa)	
Unmetered Fuel Pressure, 2700 RPM	B 32.0-36.0 (220.6-248.2)
Unmetered Fuel Pressure, 2600 RPM	C 26.0-29.0 (179.2-199.9)
Unmetered Fuel Pressure, 2700 RPM	E 32.0-36.0 (220.6-248.2)
Unmetered Fuel Pressure, 2500 RPM	G 20.5-23.5 (141.3-162.0) [2]
Unmetered Fuel Pressure, 2500 RPM	K N 20.5-28.5 (141.3-196.5)
Metered Nozzle Pressure[3] [4], psid (kPa)	
Metered Nozzle Pressure, 2700 RPM	B 15.3-16.9 (105.5-116.5)
Metered Nozzle Pressure, 2600 RPM	C 12.7-13.9 (87.6-95.8)
Metered Nozzle Pressure, 2700 RPM	E 15.3-16.9 (105.5-116.5)
Metered Nozzle Pressure, 2500 RPM	G 12.4-13.6 (85.5-93.8)[2]
Metered Nozzle Pressure, 2500 RPM	K N 14.2-14.8 (97.9-102.0)
Fuel Injection Pump Inlet Pressure: psig (kPa) Maximum allowable pressure above 1500 RPM with boost pump off Minimum Pressure at maximum flow condition Recommended flight minimum	 6.0 (41.4) -2.0 (-14) -1.0 (-6.9)
Fuel Vapor Return Outlet, psig (kPa) Maximum allowable at maximum flow Recommended flight maximum	 3.5 (24.2) 2.5 (17.2)
Fuel Flow	
Fuel Flow, lb./hr (kg/hr), including return flow: Fuel Flow vs. Brake Horsepower	B Figure 2-24 C Figure 2-27 E Figure 2-30 G Figure 2-33 K Figure 2-36 N Figure 2-36
Fuel Injection System Adjustment Specifications:	Refer to M-0, Section 6-4.7

Table 2-4. TSIO-550 Fuel System Specifications

Fuel Vapor Return Outlet Flow, lb/hr (kg/hr): Maximum @ 23.5 psig pump outlet [5]	K 51.5 (23.4)
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. TheTSIO-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
5. May be determined using a calibrated in-line flow measuring device. Otherwise use metered fuel pressure specifications. Refer to aircraft manufacturer's maintenance manual for method of verifying accuracy of fuel flow indicator.

Table 2-5. TSIO-550 Fuel Consumption

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.

	B E		C		G		K N	
Power Level	BHP (kW)	lbs./hr (max)	BHP (kW)	lbs./hr (max)	BHP (kW)	lbs./hr (max)	BHP (kW)	lbs./hr (max)
Rated Power, 100%	350 (261)	255	310 (231)	224	310 (231)	210	315 (235)	220
Cruise, 85%	---	---	263.5 (196)	162	263.5 (196)	155	---	---
Cruise, 83.5%	---	---	---	---	---	---	262 (195)	143
Cruise, 75%	263 (196)	157	232.5 (173)	143	232.5 (173)	128	236 (176)	128
Cruise, 65%	228 (170)	125	201.5 (150)	126	201.5 (150)	102	205 (153)	110
Cruise, 55%	193 (138)	108	---	---	---	---	---	---

Table 2-6. Induction

Mass Flow	
B Sea level, standard day conditions, 350 bhp (261 kW)	40.0 lb/min (18.1 kg/min)
C Sea level, standard day conditions, 310 bhp (231 kW)	41.0 lb/min (18.6 kg/min)
E Sea level, standard day conditions, 350 bhp (261 kW)	50.2 lb/min (22.8 kg/min)
G Sea level, standard day conditions, 310 bhp (231 kW)	40.2 lb/min (18.2 kg/min)
K N Sea level, standard day conditions, 315 bhp (235 kW)	41.5 lb/min (18.8 kg/min)
Induction Manifold Temperature	
K Maximum @ rated take-off power (ASTM D7592 only)	130°F (54.4°C)
K Maximum @ maximum cruise power (ASTM D7592 only)	115°F (46.1°C)

Table 2-7. Propeller

Moment of Inertia	
Engine Idle RPM	**Minimum (in.·lb.·sec.^{2})**
800	15
700	16

Table 2-8. Physical Dimensions and Weight

Engine Physical Characteristics						
	B	C	E	G	K	N
Weight, dry, lb. (kg) +/- 2.5%	571 (259)	565 (257)	566 (257)	554 (251)	522.8 (237)	522.8 (237)
Overall Dimensions, inches (mm)						
Height	33.5 (851)	33.5 (851)	33.5 (851)	35.4 (899)	34.0 (864)	28.46 (723)
Width	42.5 (1080)	42.5 (1080)	42.5 (1080)	35.9 (912)	42.4 (1077)	42.4 (1077)
Length	42.6 (1082)	42.6 (1082)	42.6 (1082)	40.3 (1023)	39.2 (994)	38.7 (903)
Center of Gravity, inches (mm)						
From rear accessory case	11.4 (290)	11.4 (290)	11.4 (290)	11.4 (290)	12.7 (322)	12.7 (322)
From crankshaft centerline, below plus (+)	1.1 (27)	1.1 (27)	1.1 (27)	1.1 (27)	1.3 (33)	1.3 (33)
From crankshaft centerline, to 1-3-5 minus (-), to 2-4-6 plus (+)	0.37 (9)	0.37 (9)	0.37 (9)	0.37 (9)	-0.12 (3)	-0.12 (3)
Moment of Inertia, standard acc. package, in·lb·sec^2 (mm·kg·sec^2)						
Roll Longitudinal Axis, (Iy-y)	134.3 (946)	134.3 (946)	134.3 (946)	134.3 (946)	134.3 (946)	134.3 (946)
Pitch Lateral Axis, (Ix-x)	138.8 (1206)	138.8 (1206)	138.8 (1206)	138.8 (1206)	138.8 (1206)	138.8 (1206)
Yaw Vertical Axis, (Iz-z)	218.9 (1976)	218.9 (1976)	218.9 (1976)	218.9 (1976)	218.9 (1976)	218.9 (1976)

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

Accessory	Direction of Rotation[1]	Drive Ratio to Crankshaft	Maximum Torque (in. lbs.)		Maximum Overhang Moment, (in. lbs.)
			Cont.	Static	
Optional Tachometer	CCW	0.5:1	7	50	25
Magneto	CCW	1.5:1	-	-	-
Starter Motor	CCW	48:1	200	400	60
Alternator (gear-driven)	CCW	3:1	150	800	150
Propeller Governor[2]	CW	1:1	29	825	50
Fuel Pump	CW	1:1	25	680	60
AND20000 Pads[3]	CW	1.5:1	100	800	40
Optional Accessory Drive[4]	CCW	3:1	100	500	N/A
Oil Cooler	---	---	---	---	55 wet

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.

2-3.3.1. TSIO-550-B Performance Charts

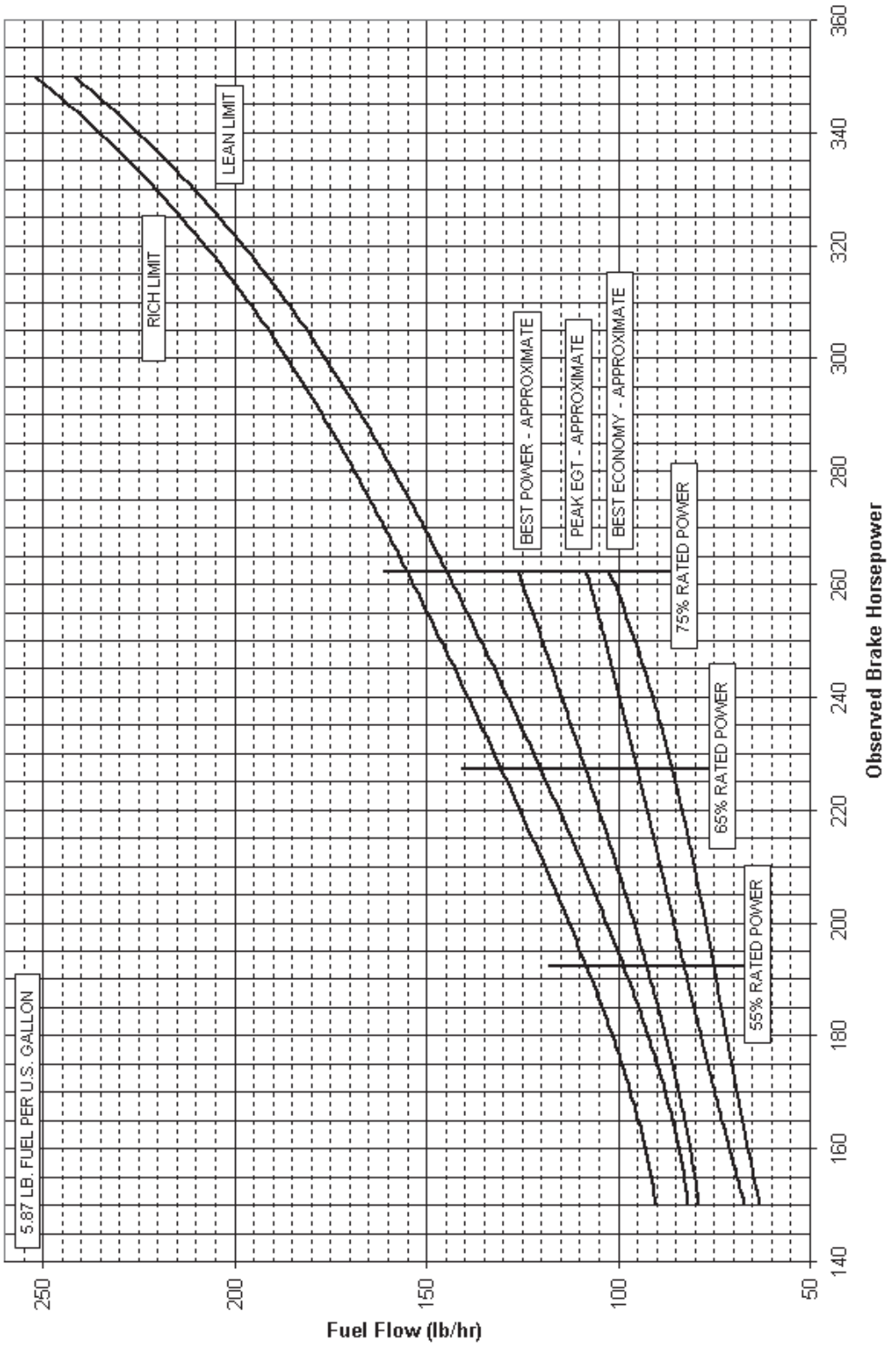

Figure 2-24. TSIO-550-B Fuel Flow vs. Sea Level Standard Brake Horsepower

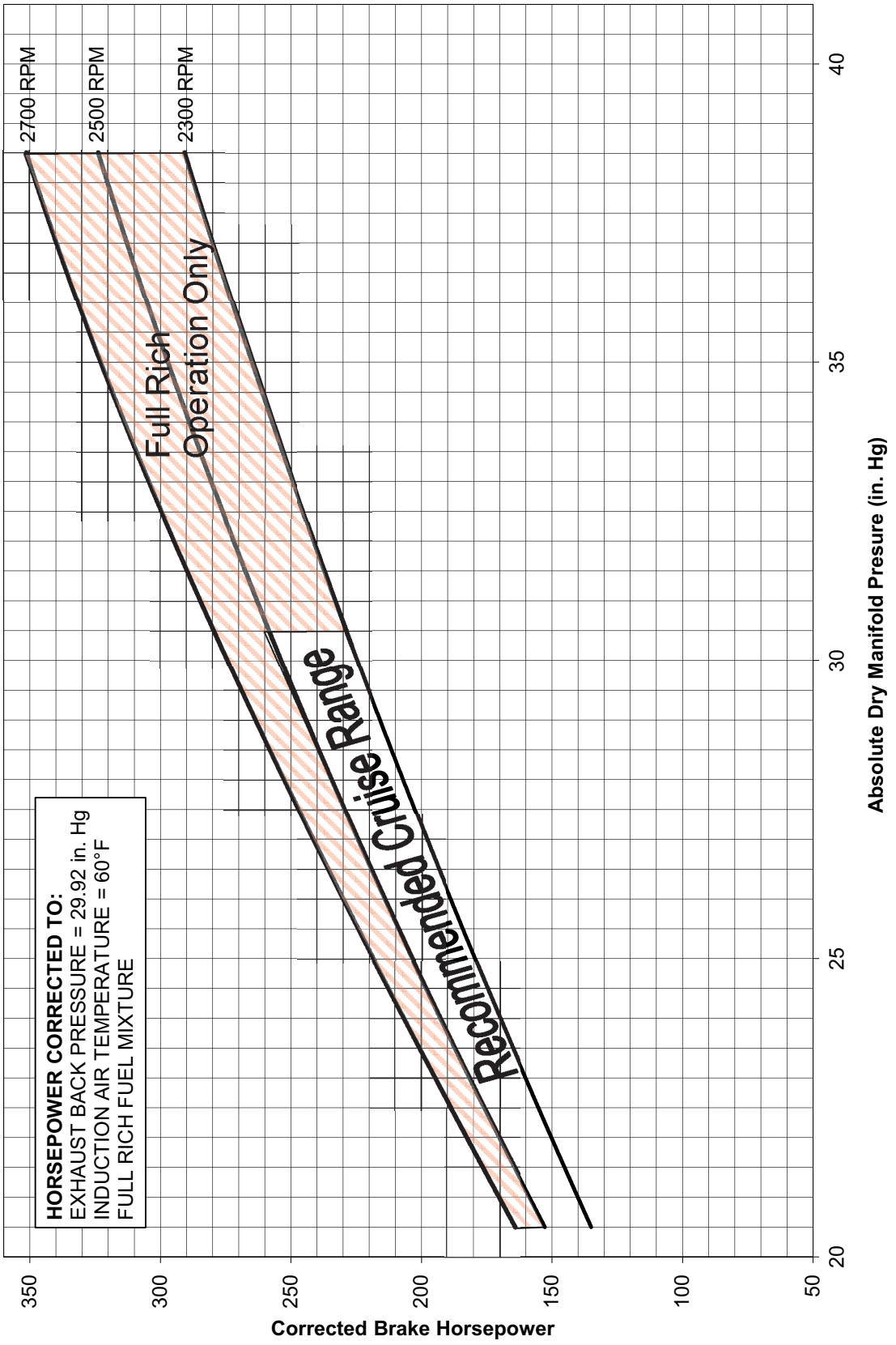

Figure 2-25. TSIO-550-B Sea Level Performance

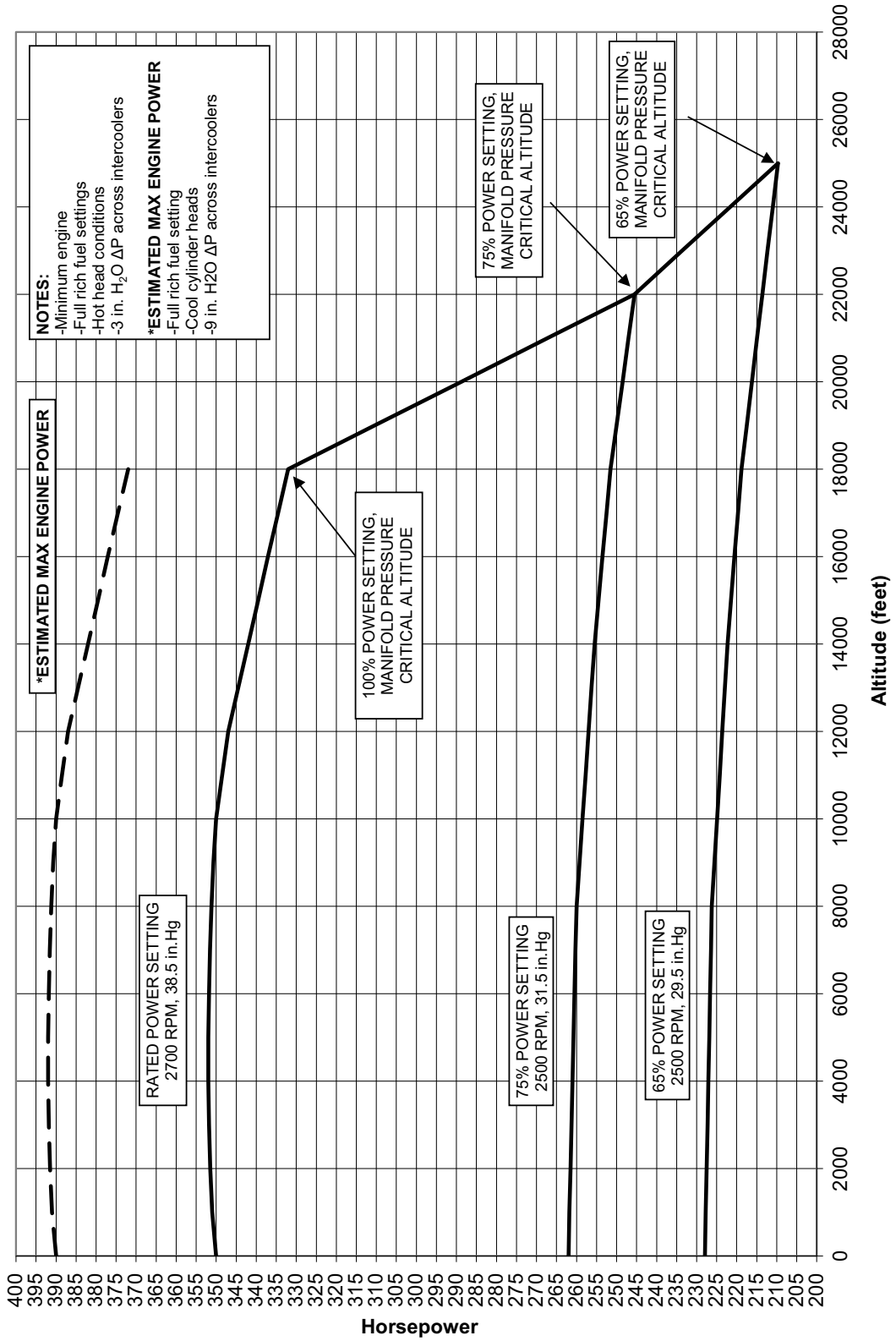

Figure 2-26. TSIO-550-B Altitude Performance

2-3.3.2. TSIO-550-C Performance Charts

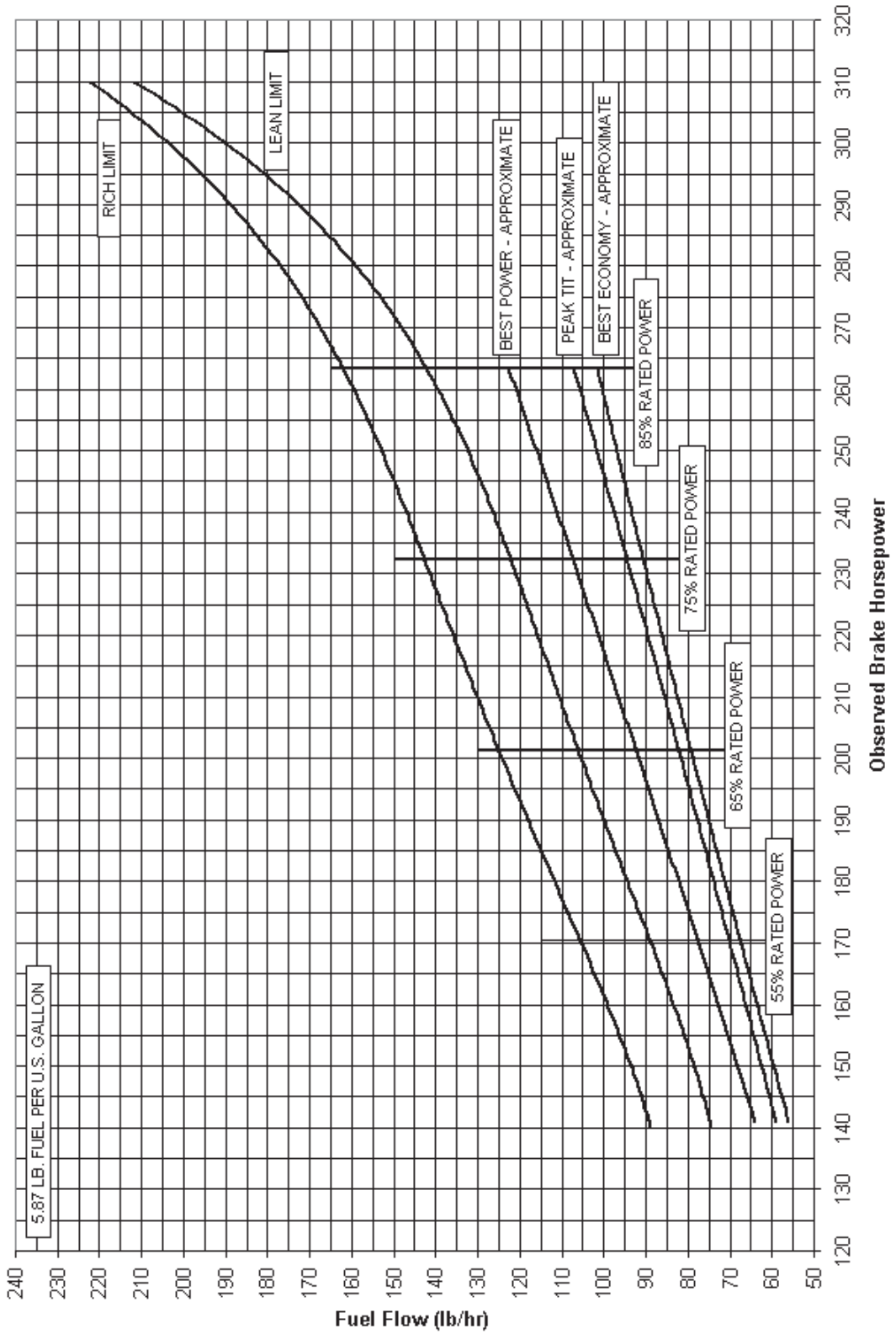

Figure 2-27. TSIO-550-C Fuel Flow vs. Sea Level Standard Brake Horsepower

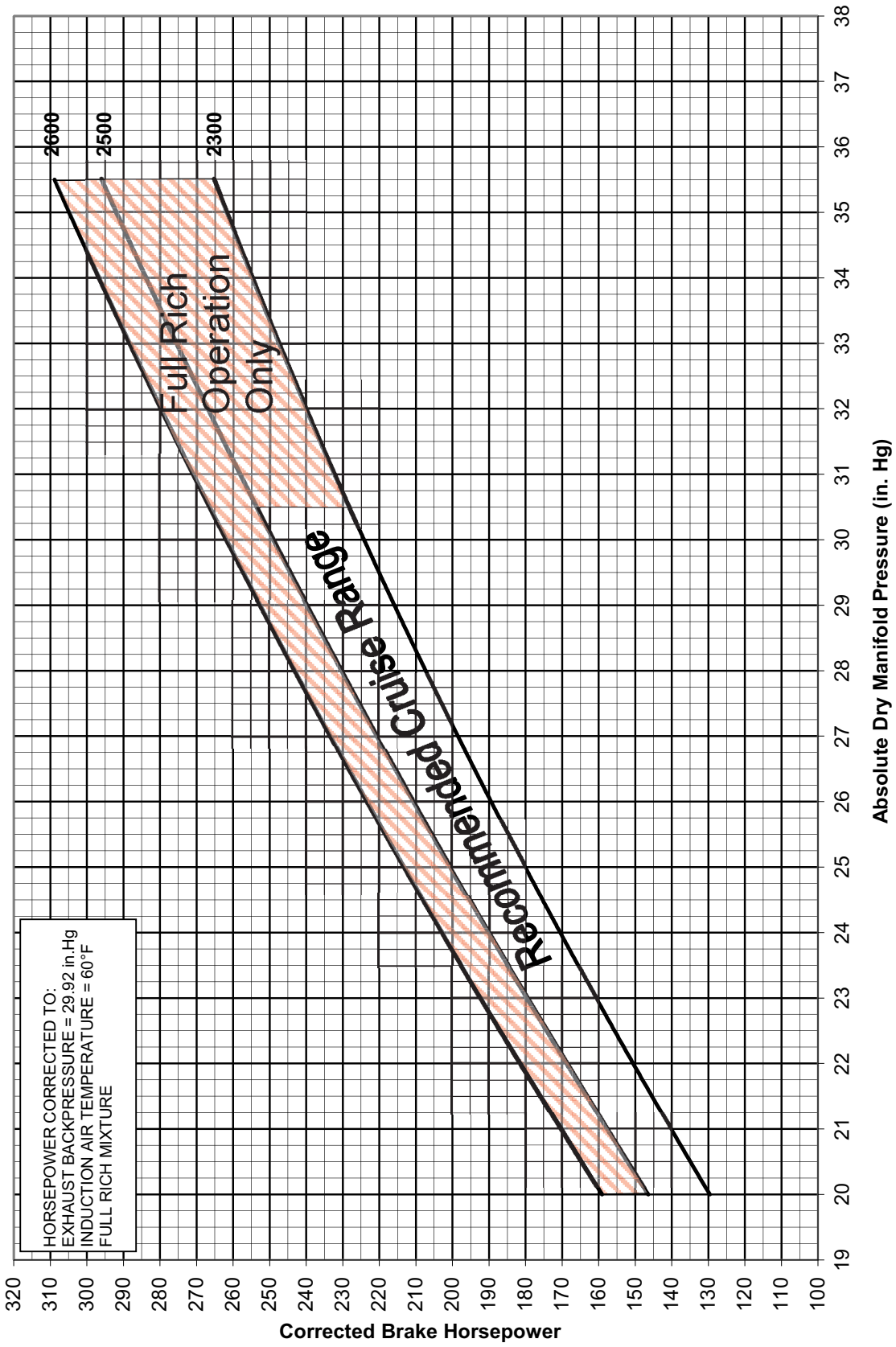

Figure 2-28. TSIO-550-C Sea Level Performance

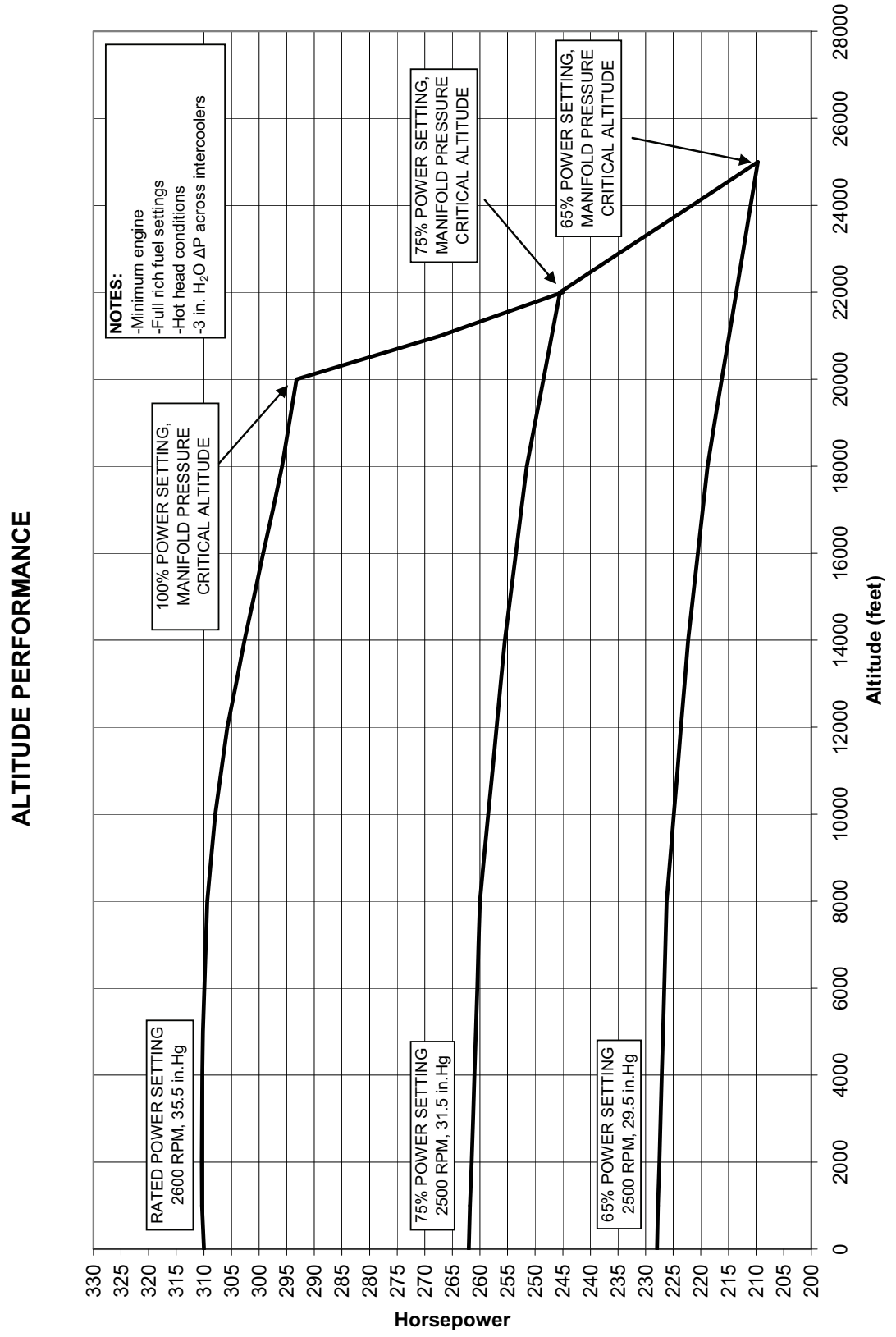

Figure 2-29. TSIO-550-C Altitude Performance

2-3.3.3. TSIO-550-E Performance Charts

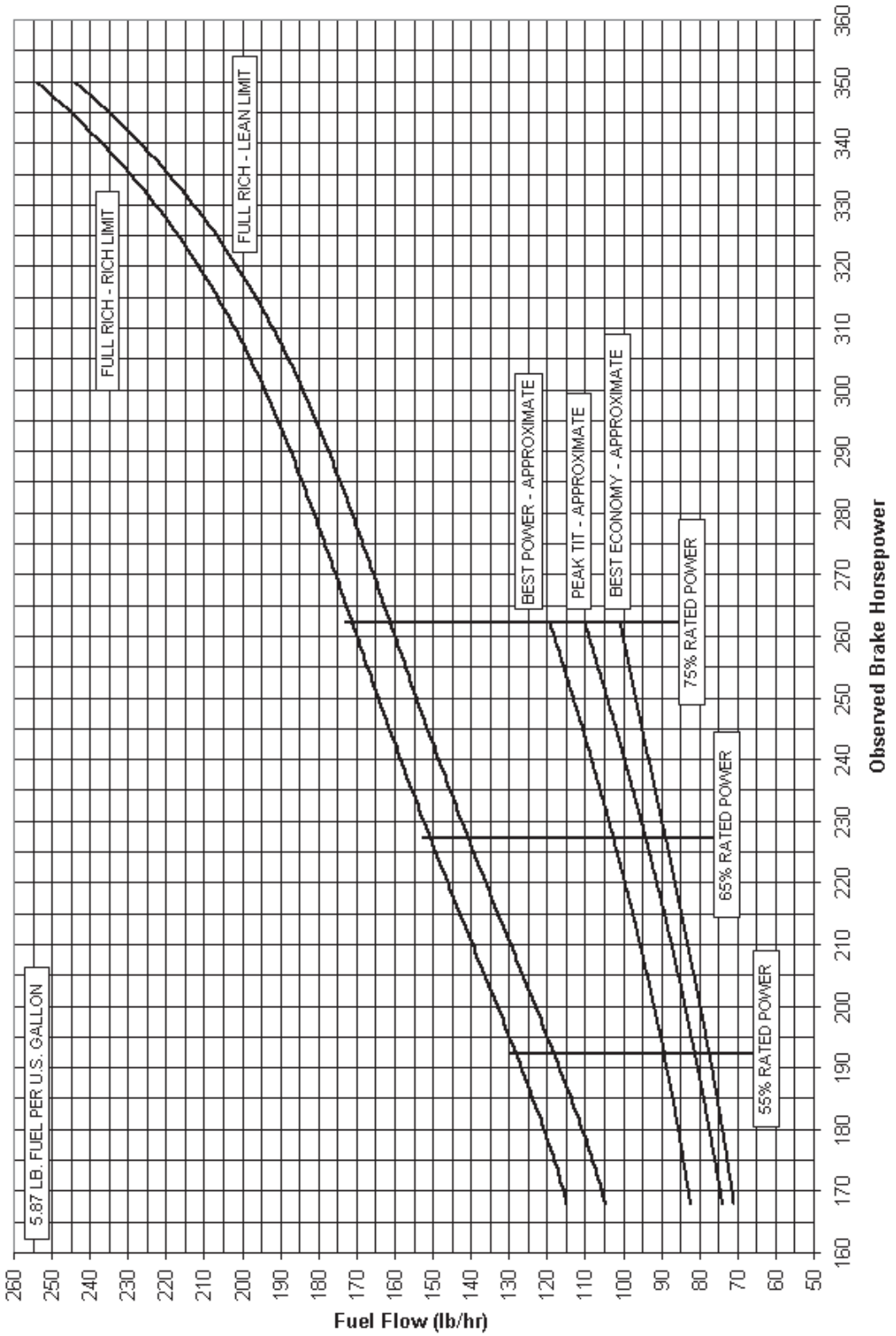

Figure 2-30. TSIO-550-E Fuel Flow vs. Sea Level Standard Brake Horsepower

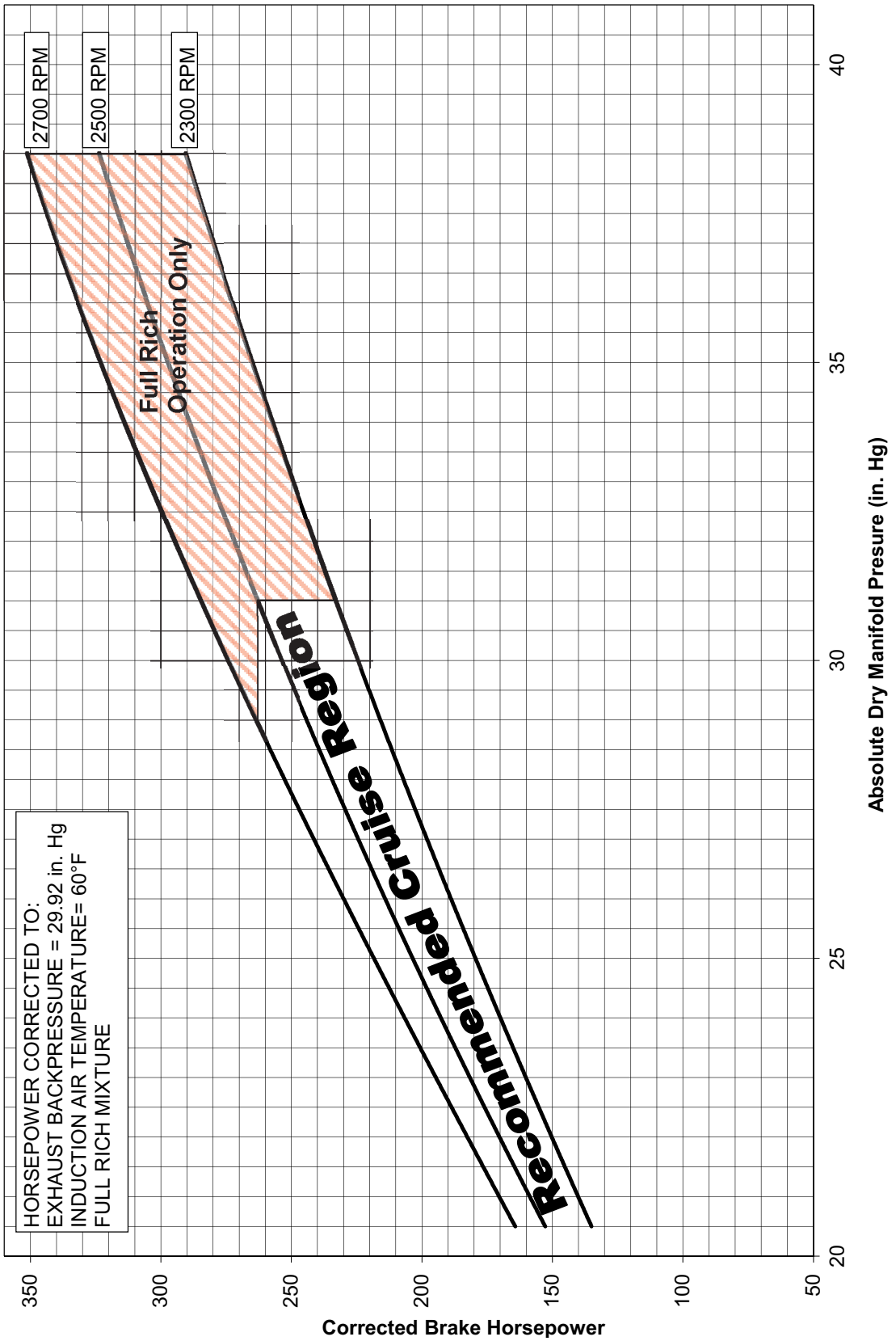

Figure 2-31. TSIO-550-E Sea Level Performance

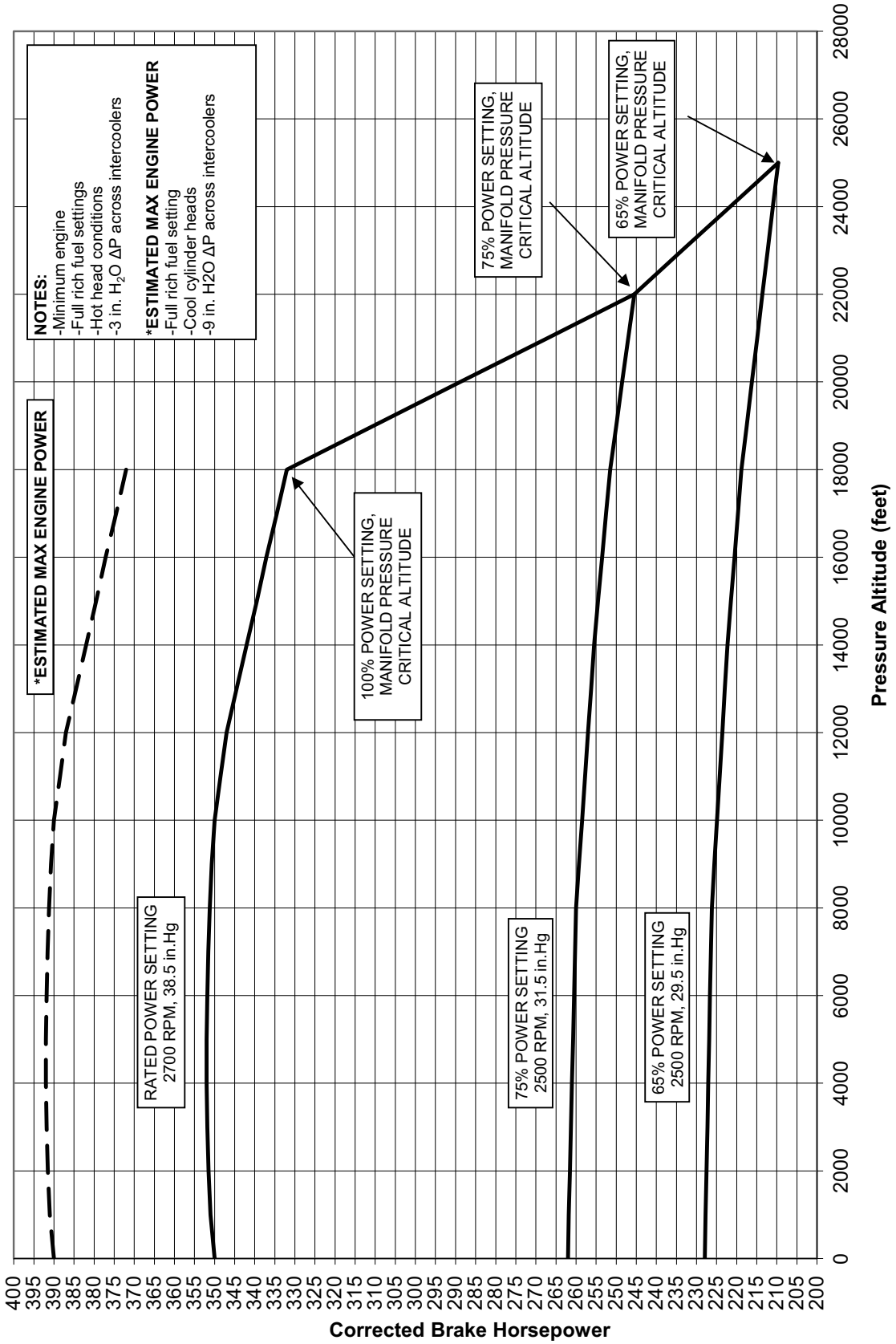

Figure 2-32. TSIO-550-E Altitude Performance

2-3.3.4. TSIO-550-G Performance Charts

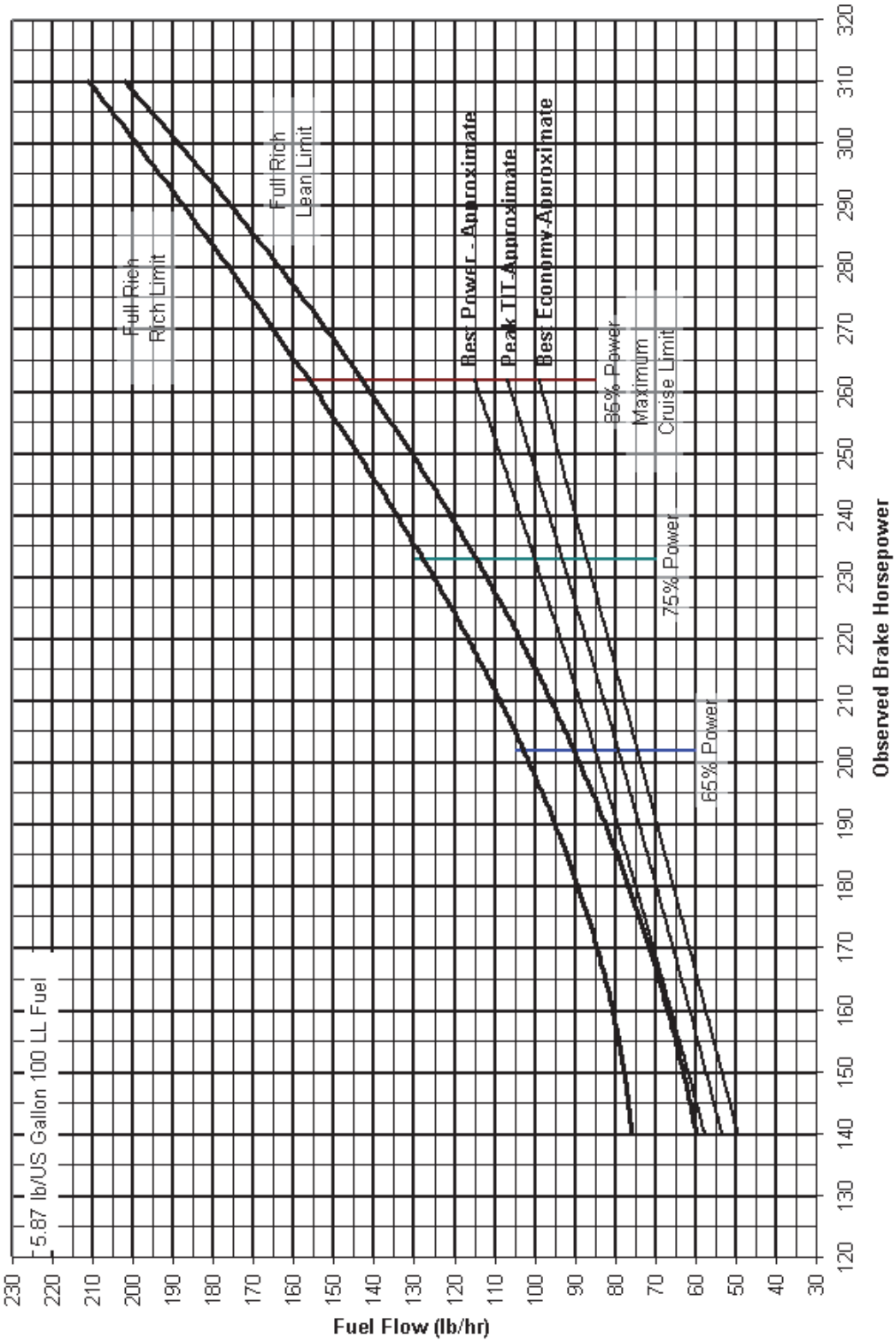

Figure 2-33. TSIO-550-G Fuel Flow vs. Sea Level Standard Brake Horsepower

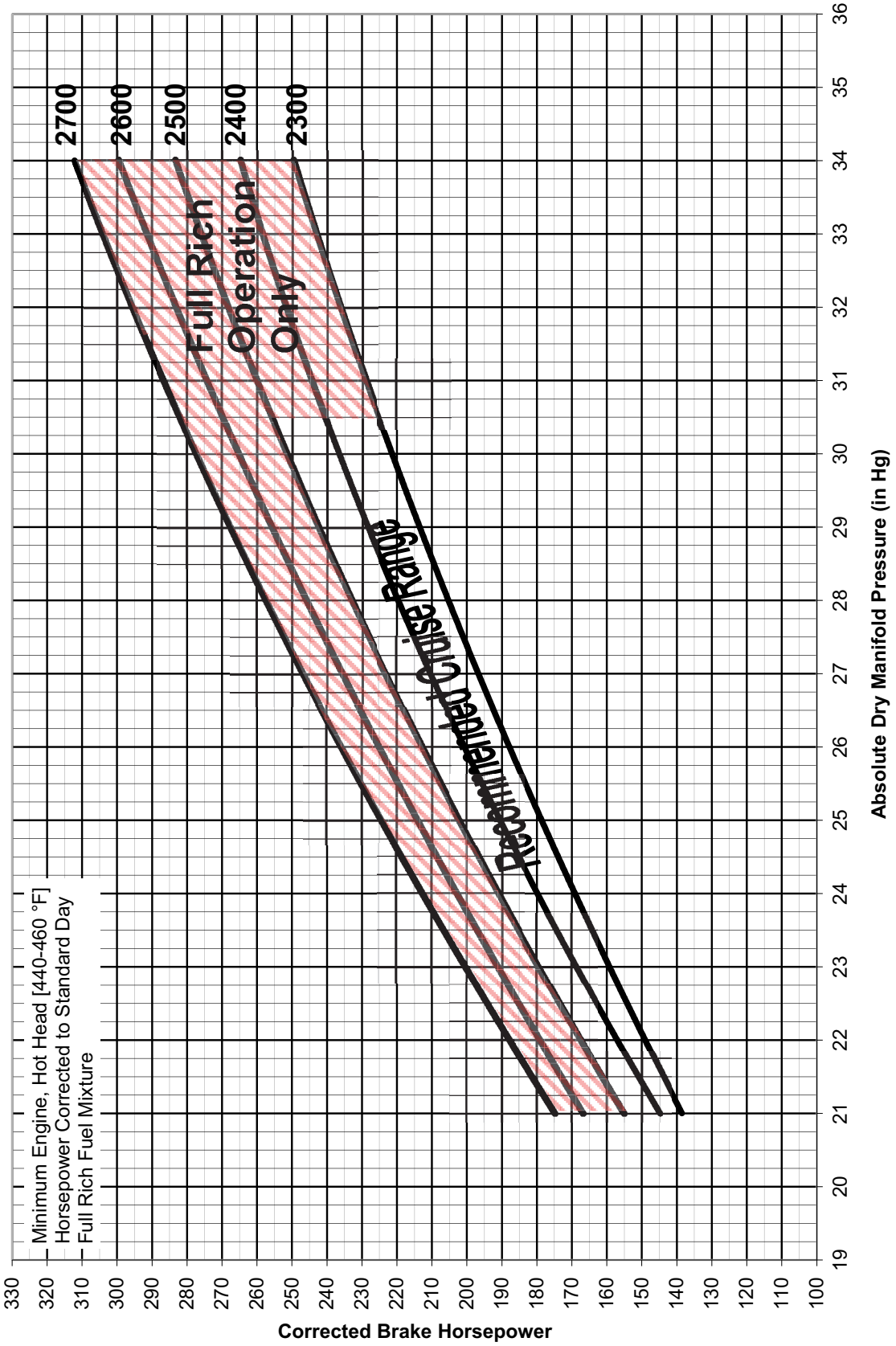

Figure 2-34. TSIO-550-G Sea Level Performance

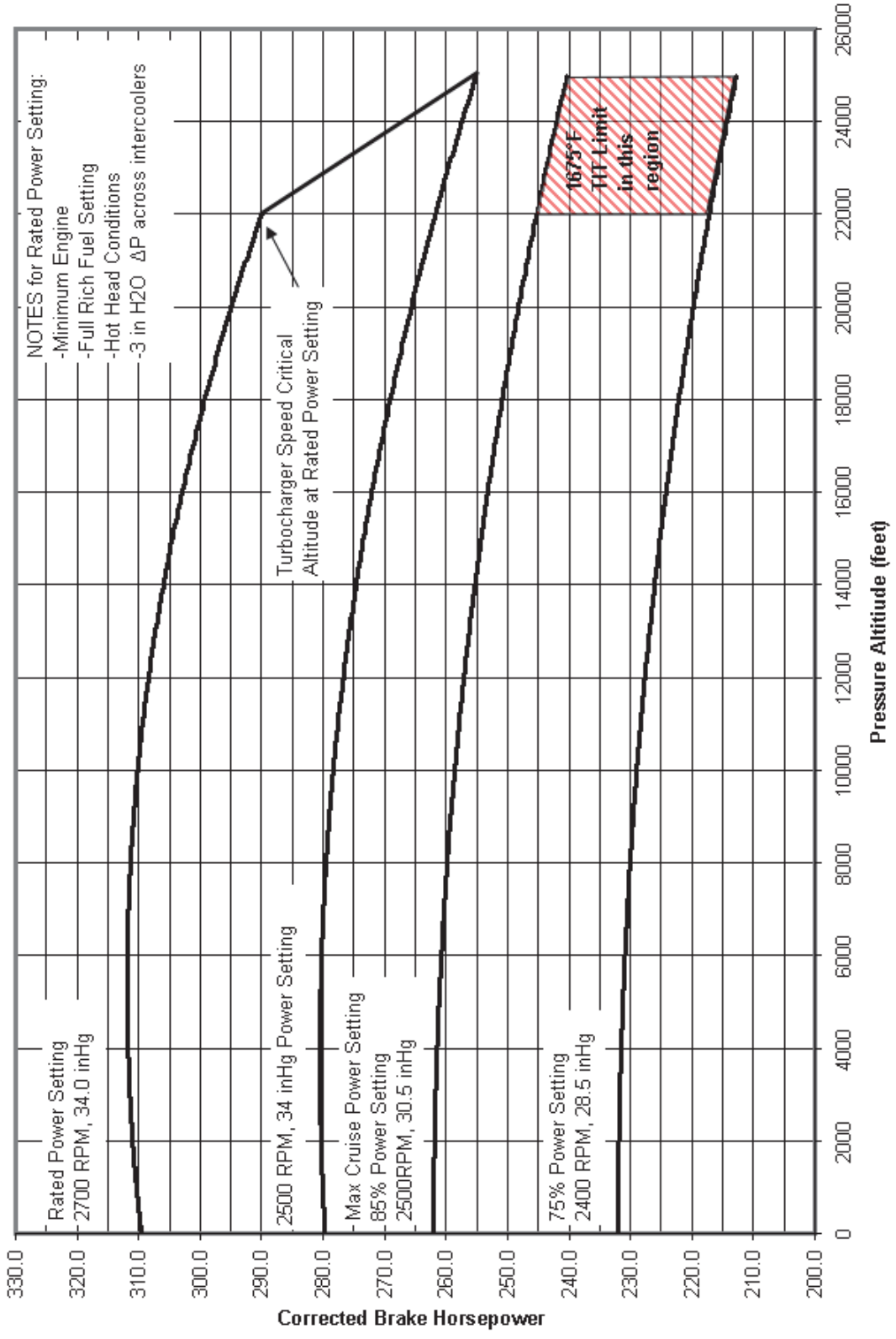

Figure 2-35. TSIO-550-G Altitude Performance

2-3.3.5. TSIO-550-K & N Performance Charts

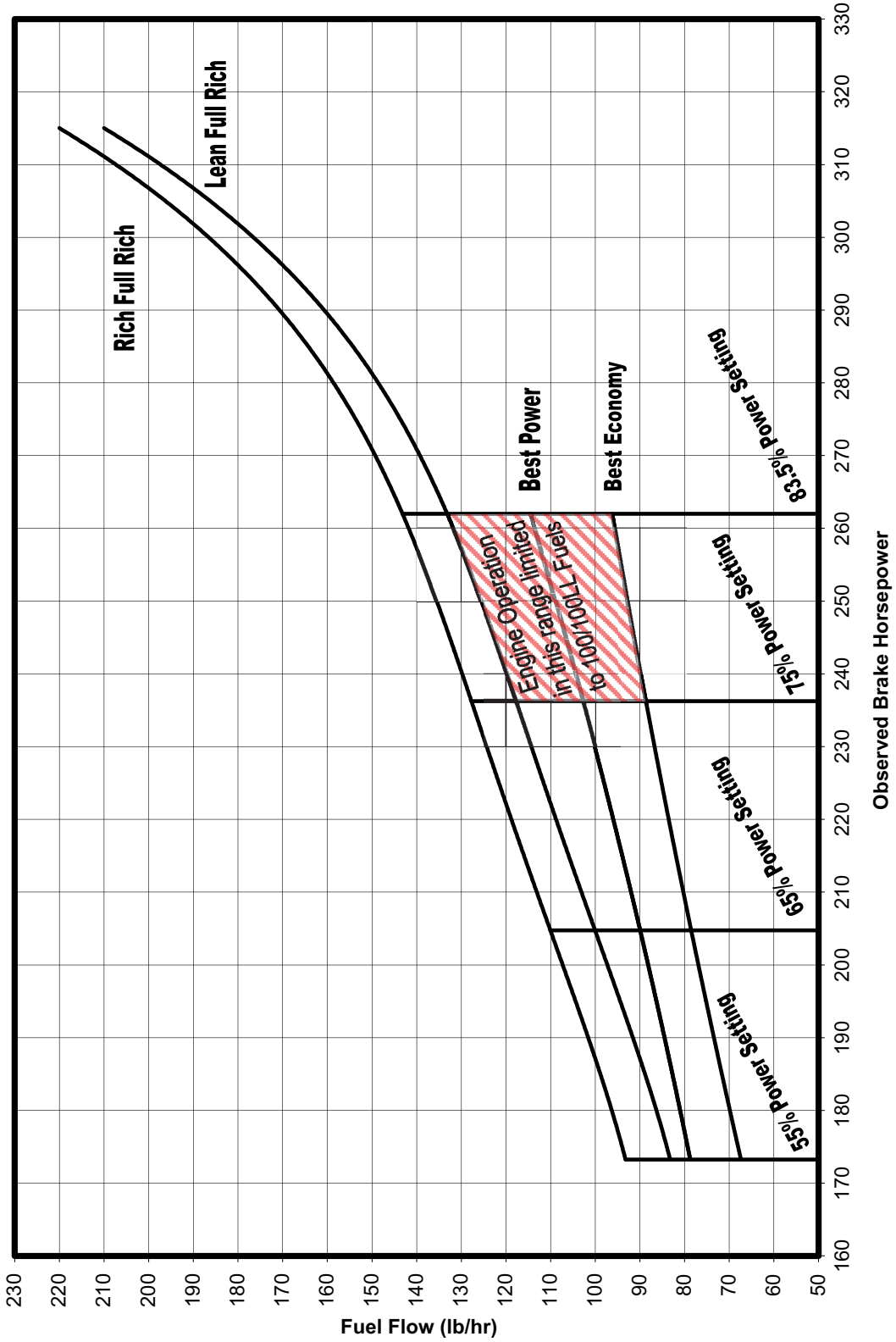

Figure 2-36. TSIO-550-K & N Fuel Flow vs. Sea Level Standard Brake Horsepower

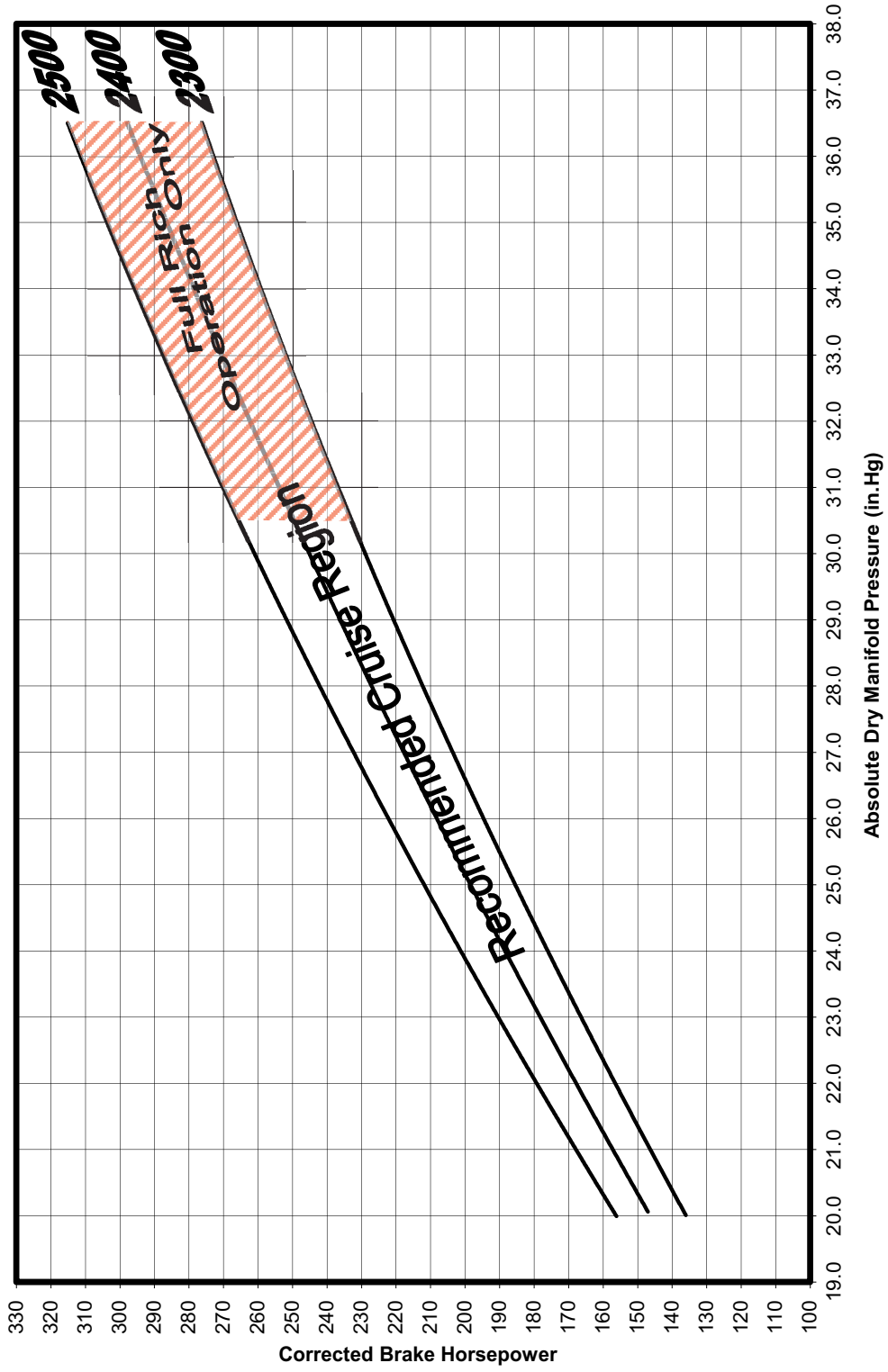

Figure 2-37. TSIO-550-K & N Sea Level Performance

2-3.4. TSIO-550 Accessory Performance Charts

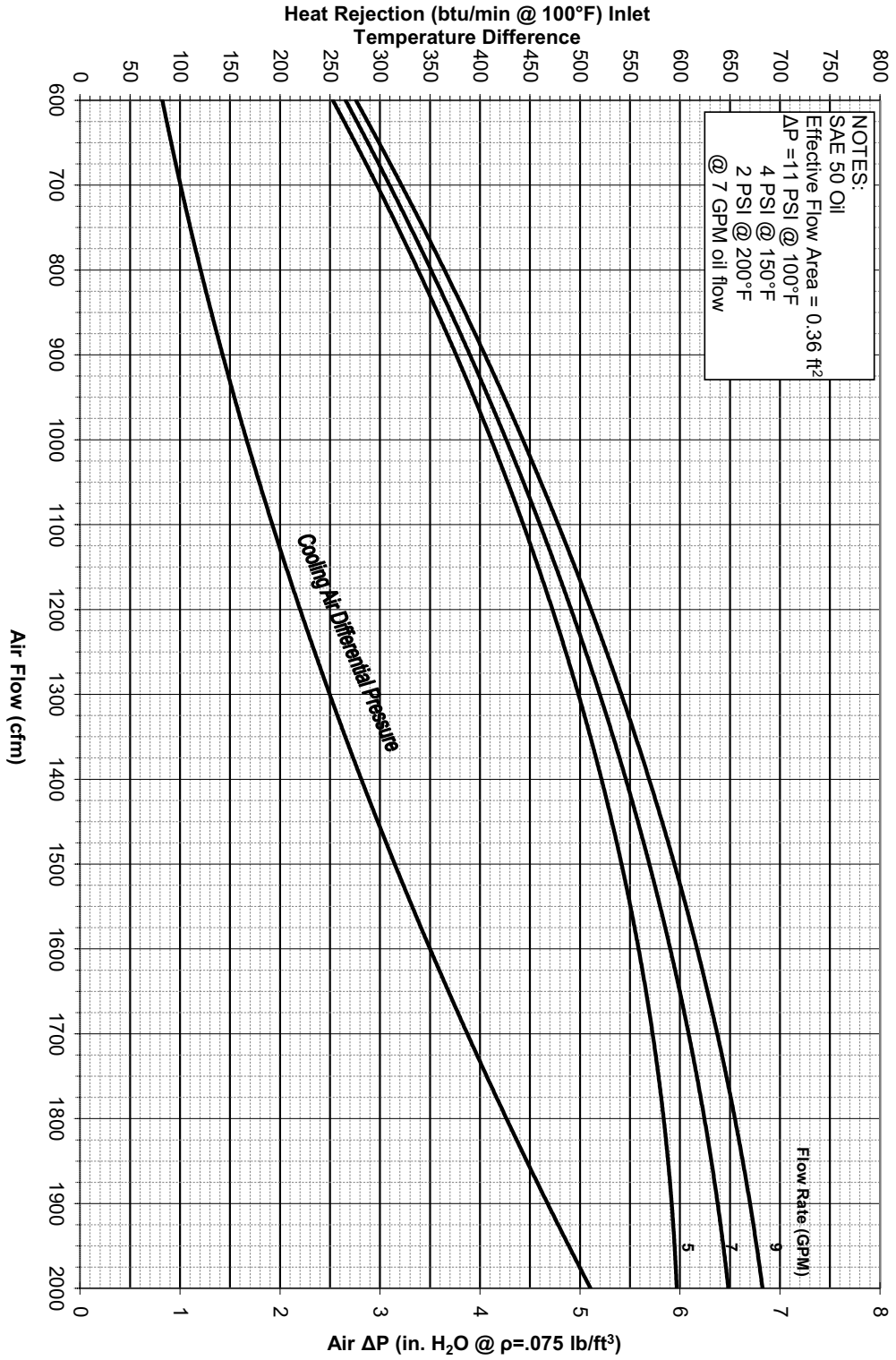

Figure 2-38. Oil Cooler Performance

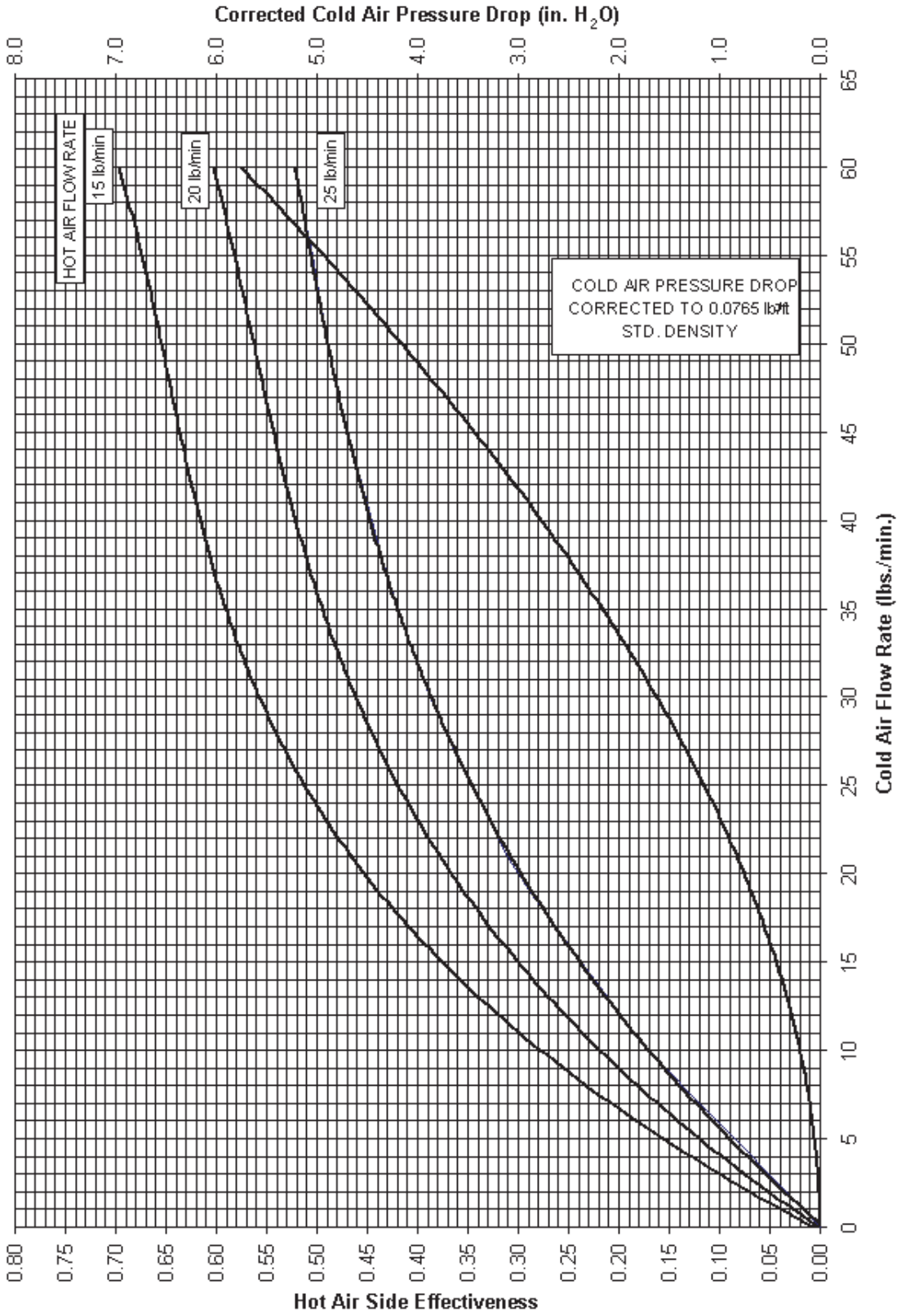

Figure 2-39. Aftercooler Performance Chart B C E K N

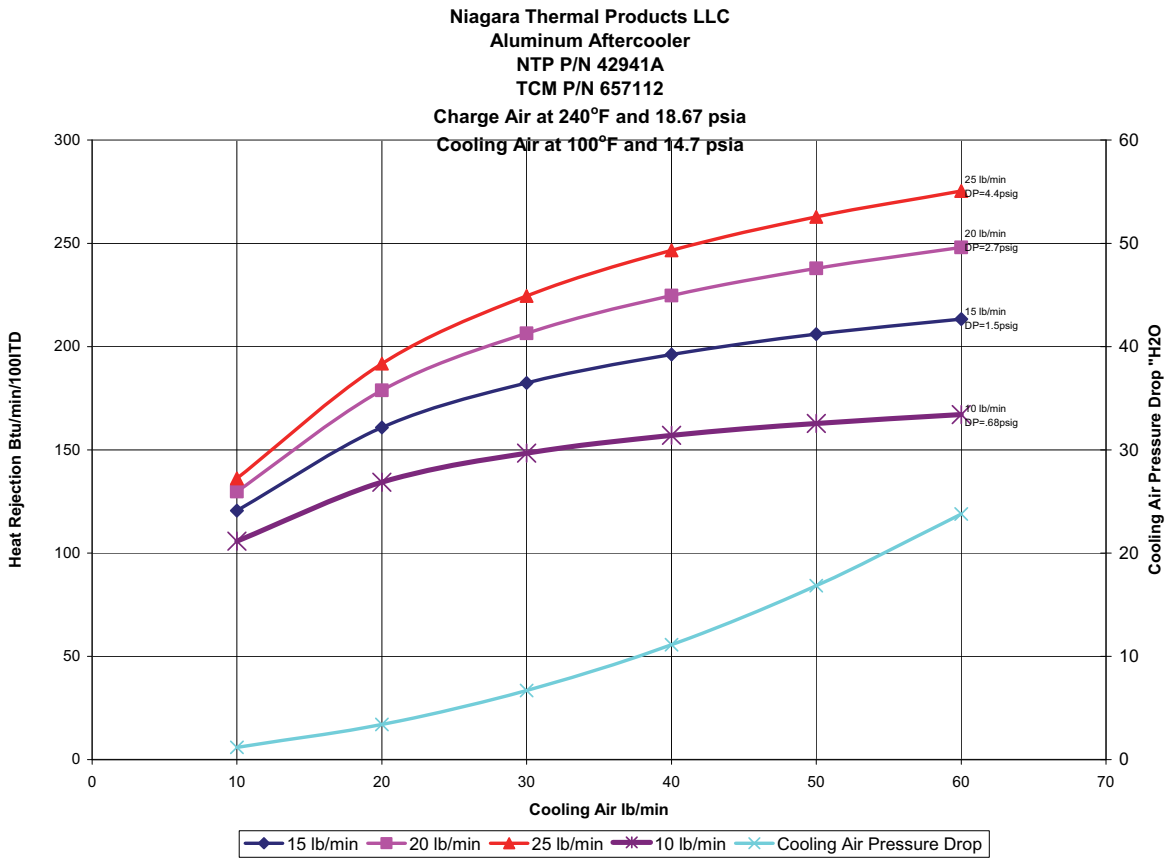

Figure 2-40. Aftercooler Performance Chart G

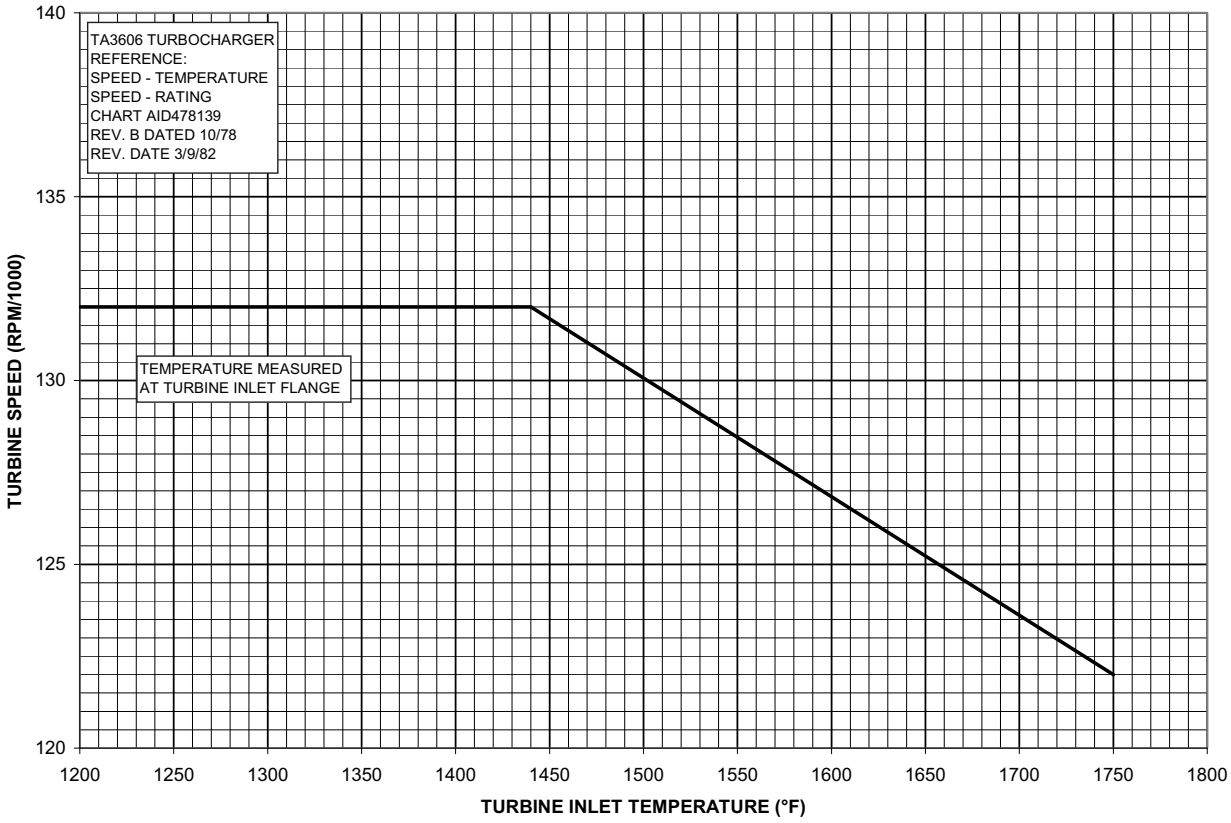

Figure 2-41. Turbine Speed vs. Turbine Inlet Temperature

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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.

3-2. Lubricants, Sealants and Adhesives

Refer to Chapter 3, “Lubricants, Sealants, and Adhesives”, in M-0, Standard Practice Maintenance Manual.

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

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.

12. Disconnect the Ignition Harness according to instructions in "Ignition System Maintenance" in Section 6-4.9 of M-0, Standard Practice Maintenance Manual.

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

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:

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

10. Perform the "Engine Pre-Oiling" procedure according to Section 5-2.9 of M-0, Standard Practice Maintenance Manual.

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.

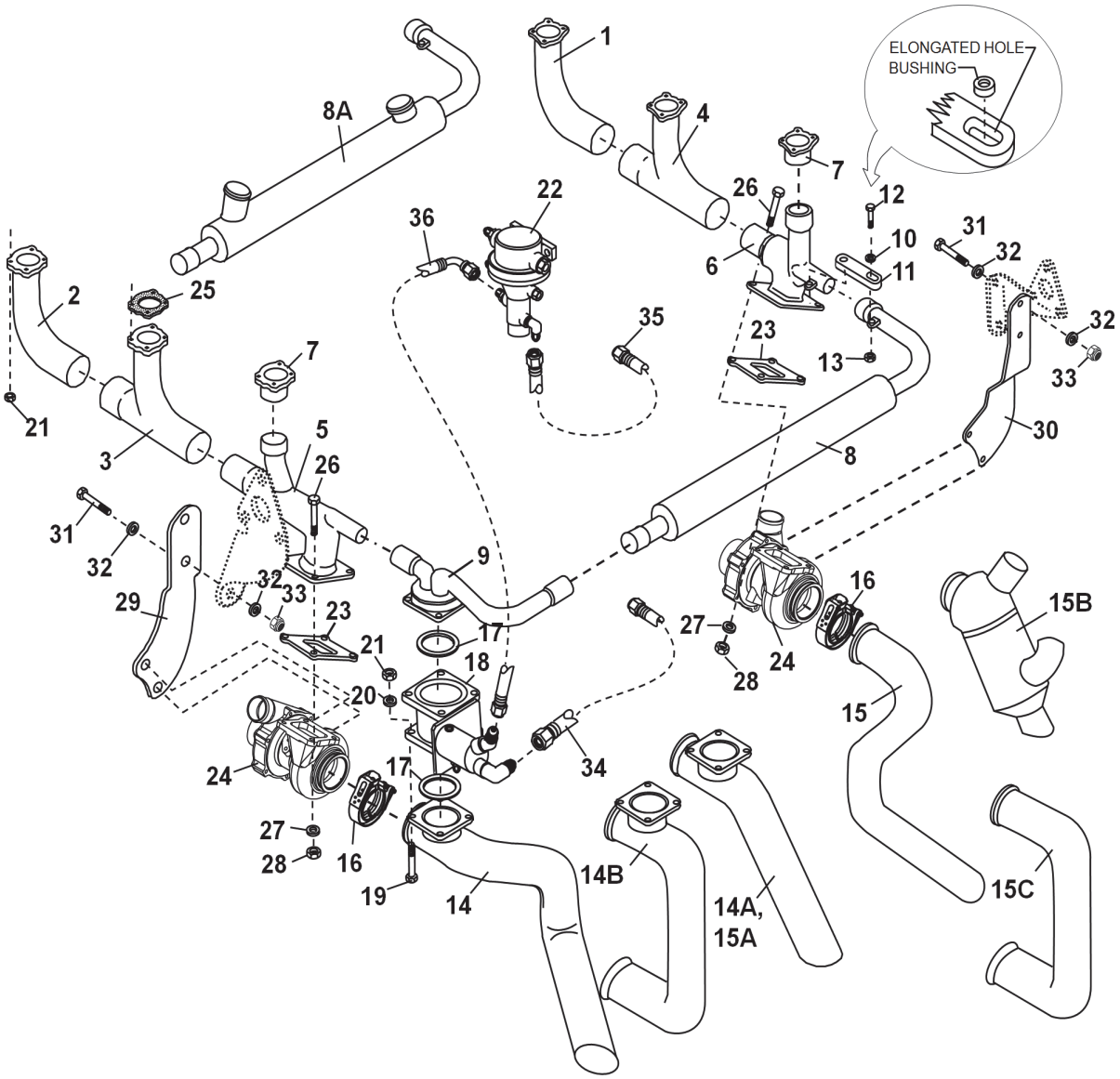

Figure 5-1. Turbocharger and Exhaust System B C E G

1	Elbow Riser	11	Tie Rod	18	Wastegate Assembly	30	Bracket
2	Elbow Riser	12	Bolt	19	Bolt	31	Bolt
3	Tee Assembly	13	Lock Nut	20	Washer	32	Washer
4	Tee Assembly	14	Contoured Tailpipe	21	Lock Nut	33	Lock Nut
5	Turbo Transition	14A	Straight Tailpipe	22	Controller	34	Hose
6	Turbo Transition	14B	Inverse Tailpipe Option	23	Gasket	35	Hose
7	Riser	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
8	Crossover Assembly	15A	Straight Tailpipe	25	Gasket		
8A	Crossover Assy with Heater Shroud Option	15B	Heater	26	Bolt		
		15C	Inverse Tailpipe Option	27	Washer		
9	Transition	16	V-band clamp	28	Lock Nut		
10	Bushing	17	Gasket	29	Bracket		

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.

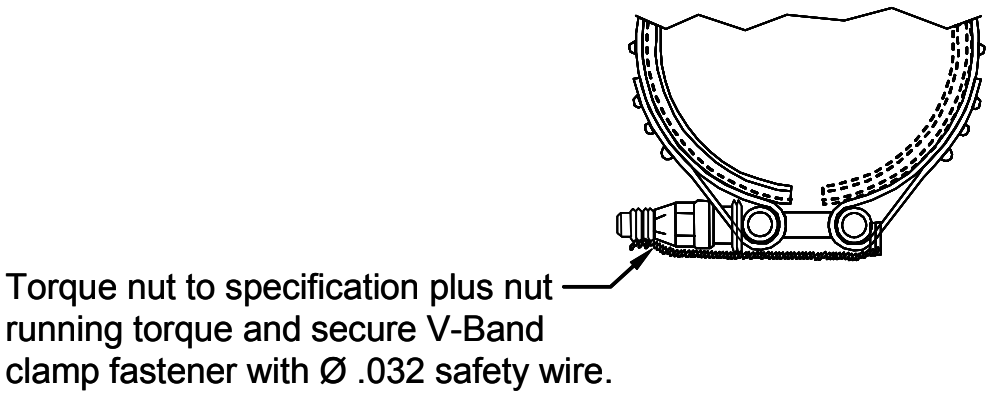

Figure 5-2. V-band Clamp Safety Wire

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

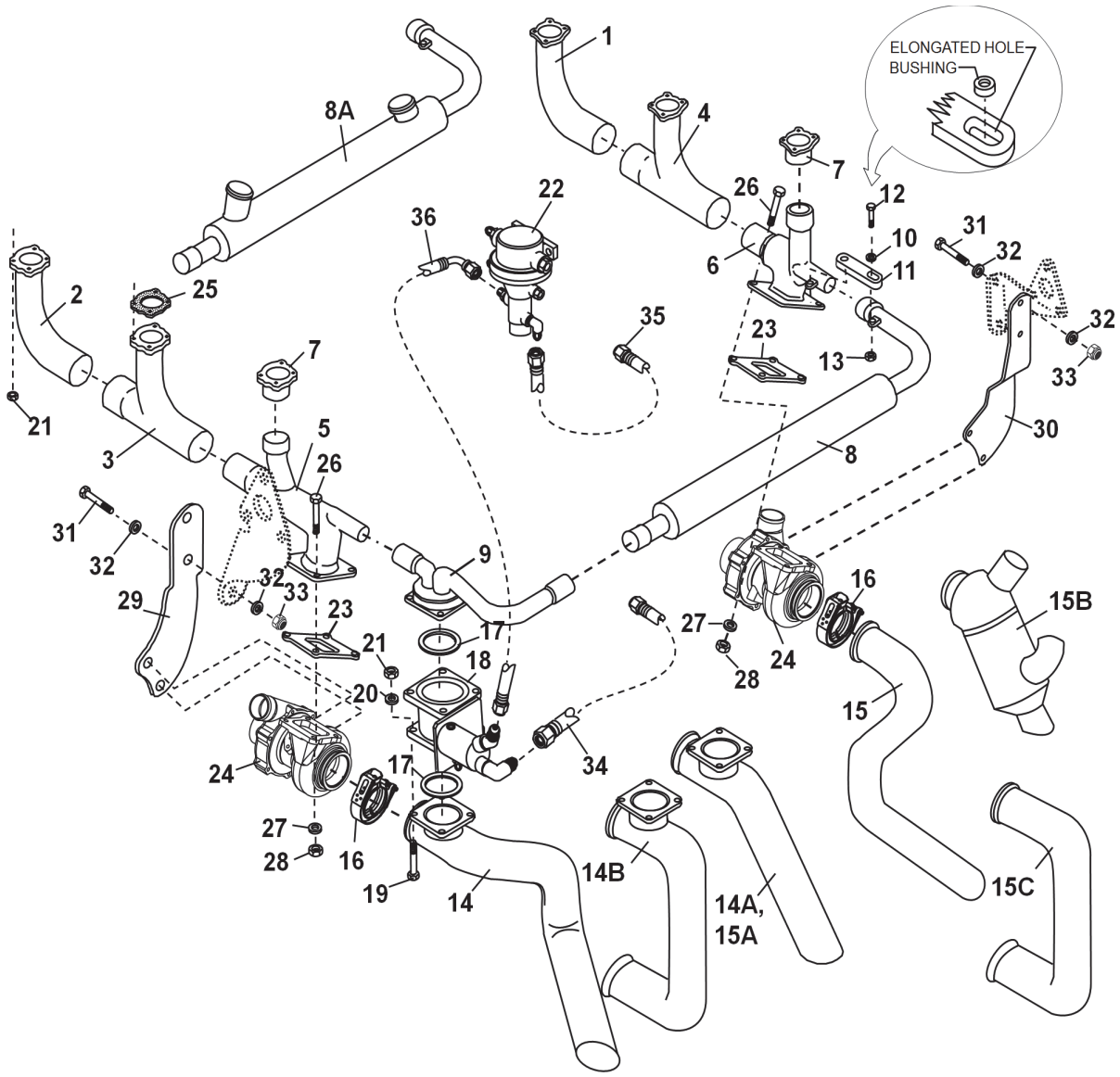

Figure 5-1 repeated for reference

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.

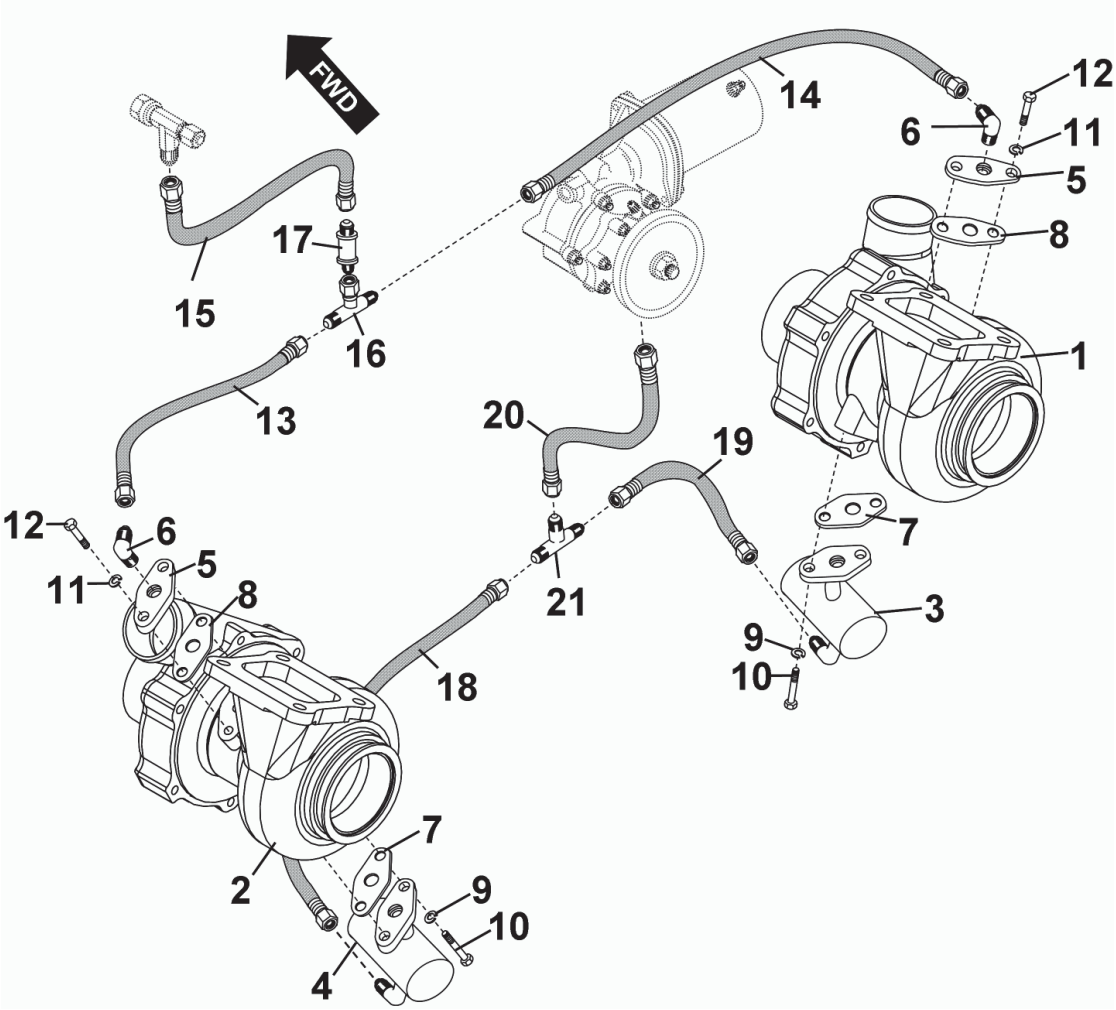

Figure 5-3. Turbocharger Lubrication Hose Routing B C E G

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.

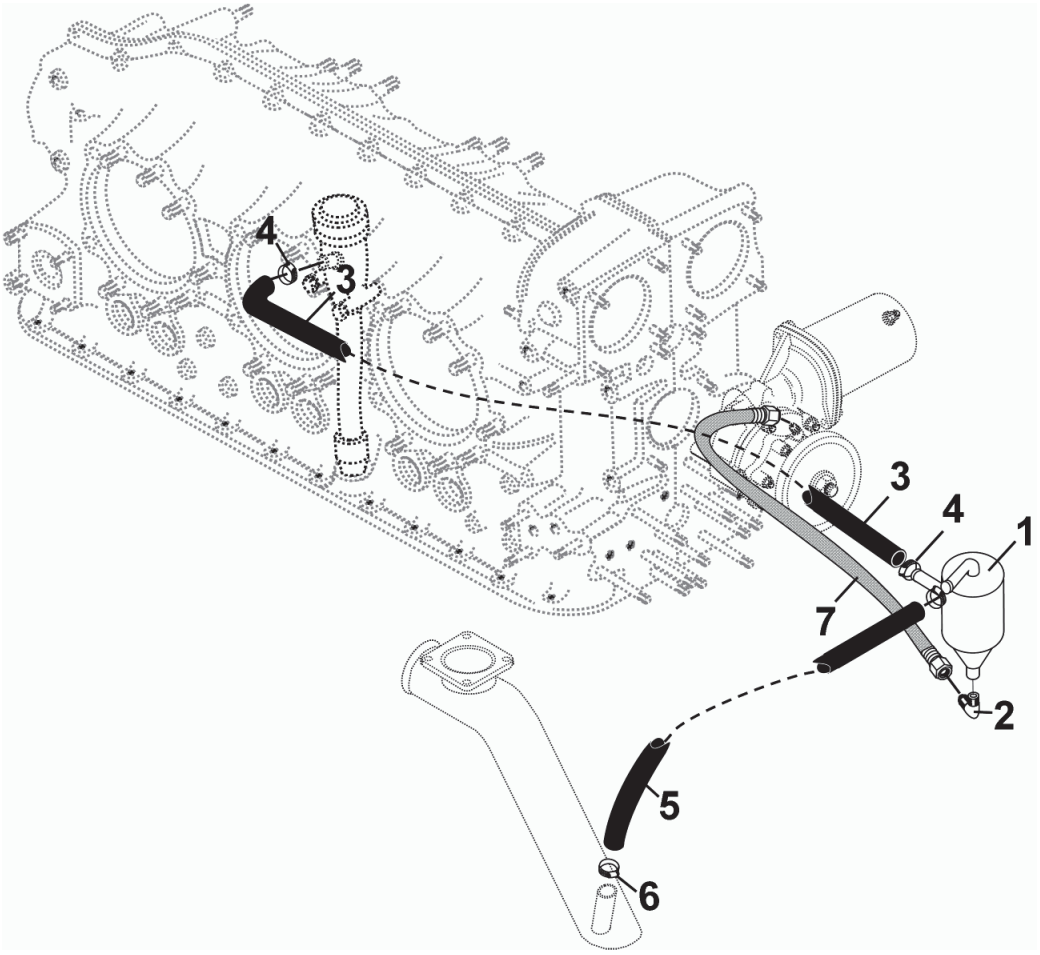

Figure 5-4. Crankcase Ventilation Hose Routing B C E G

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.

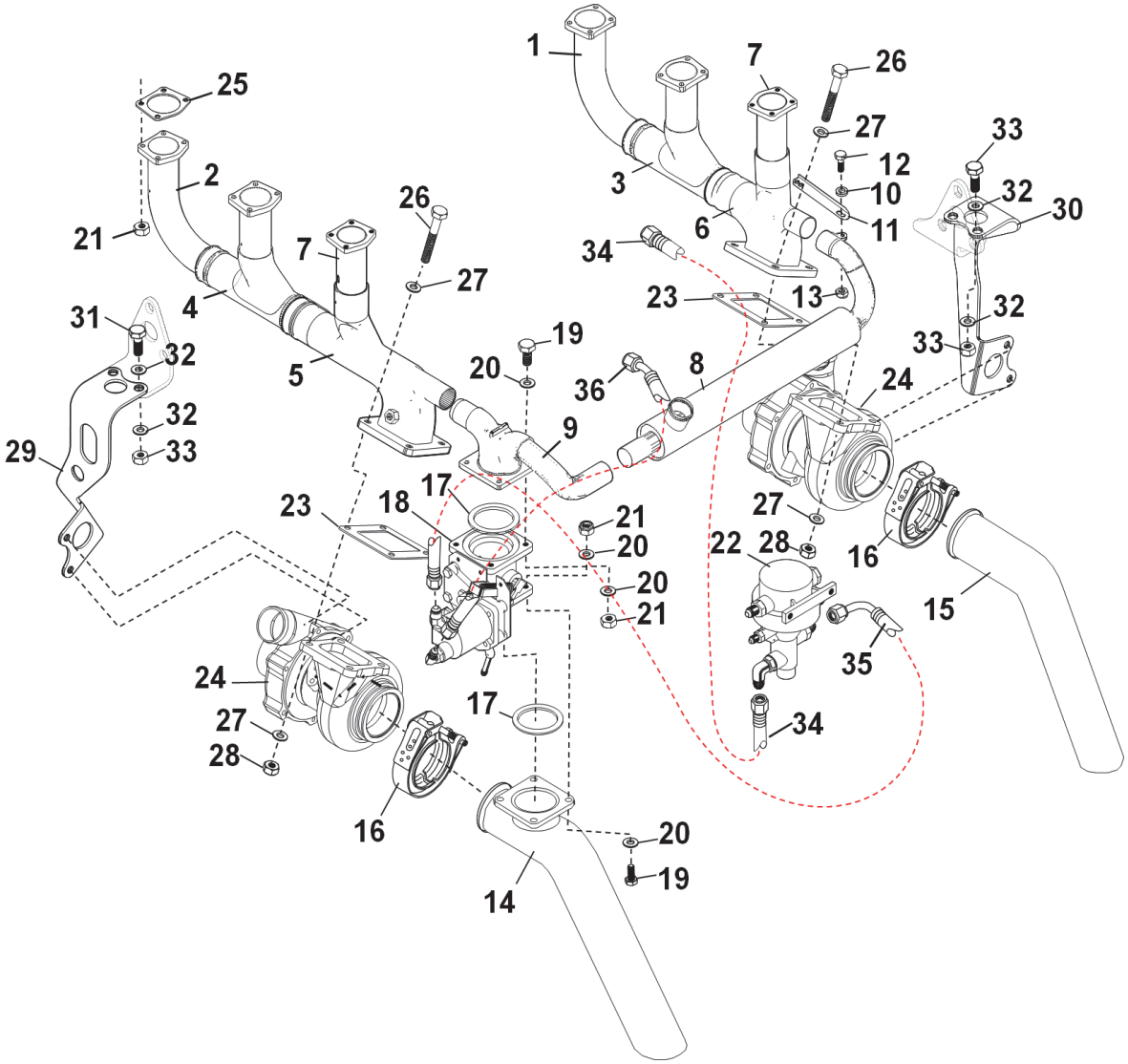

Figure 5-5. Turbocharger Assembly K

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	Bolt
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

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

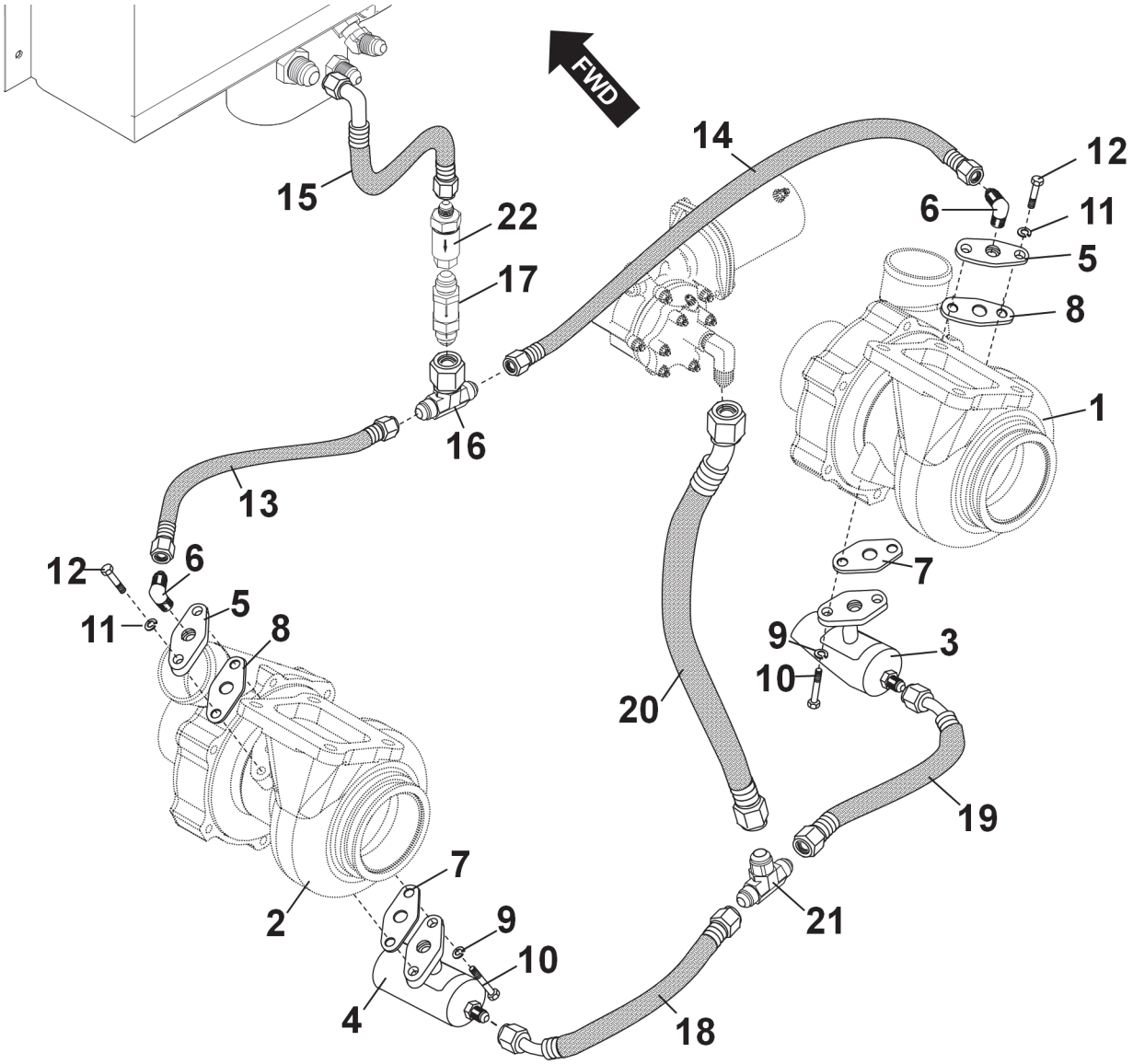

Figure 5-6. Turbocharger Lubrication Hose Routing K

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	22	Check Valve Filter Assy
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.

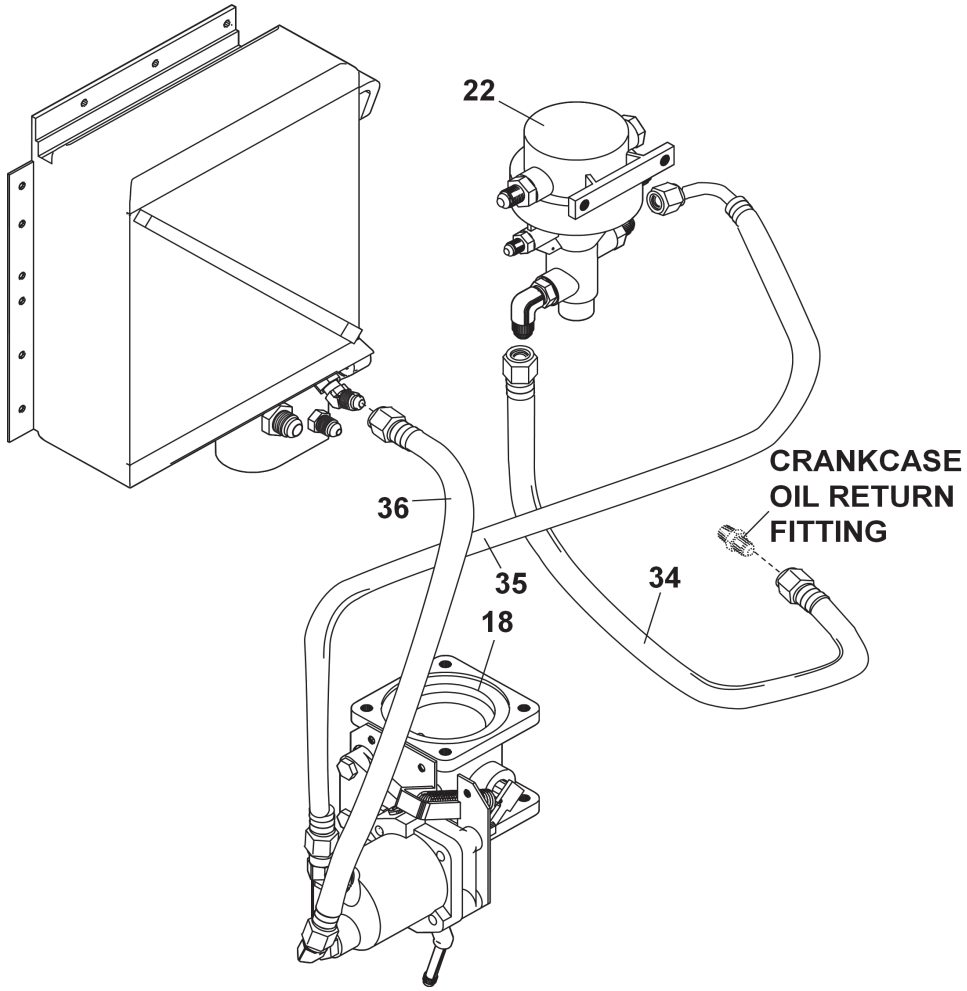

Figure 5-7. Wastegate Control Hose Connections K

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.

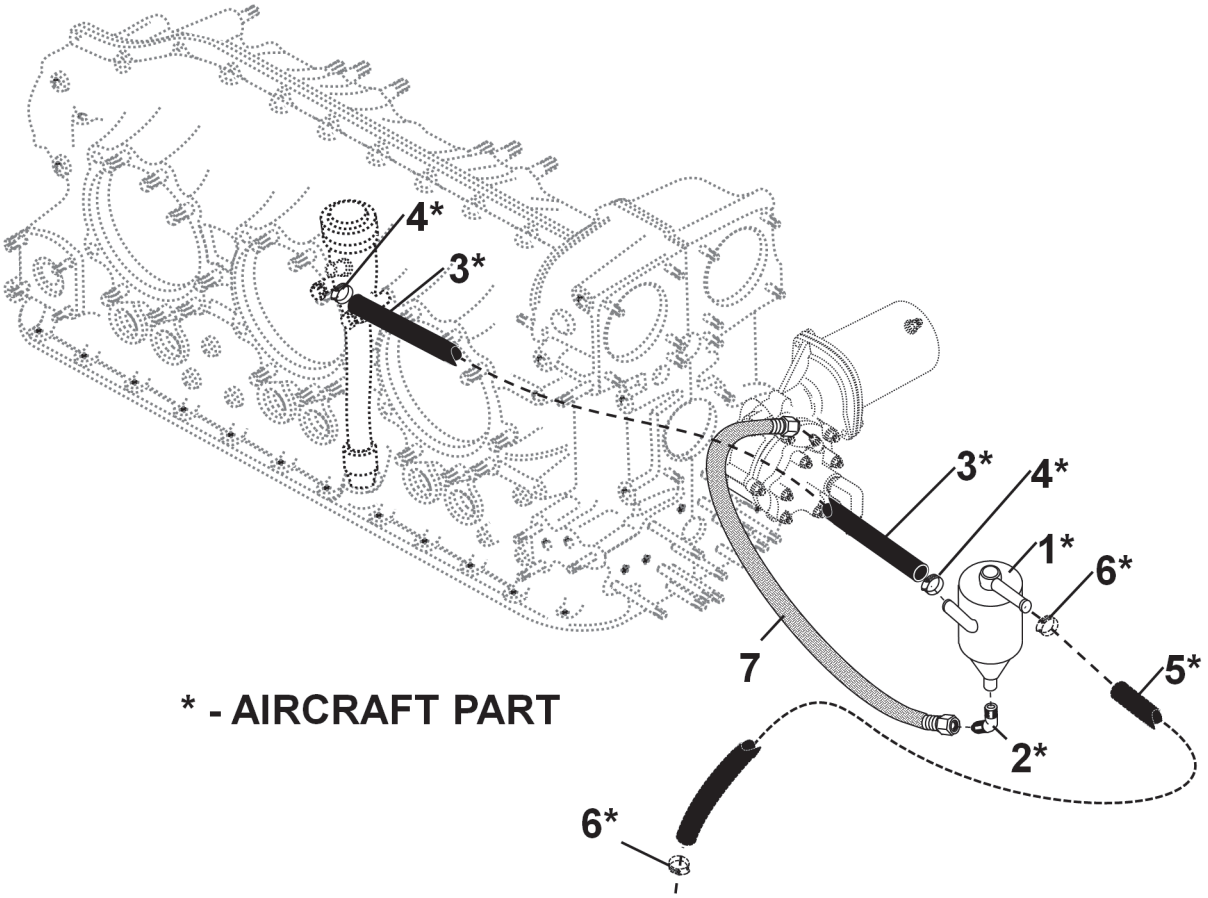

Figure 5-8. Crankcase Ventilation Hose Routing K

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.

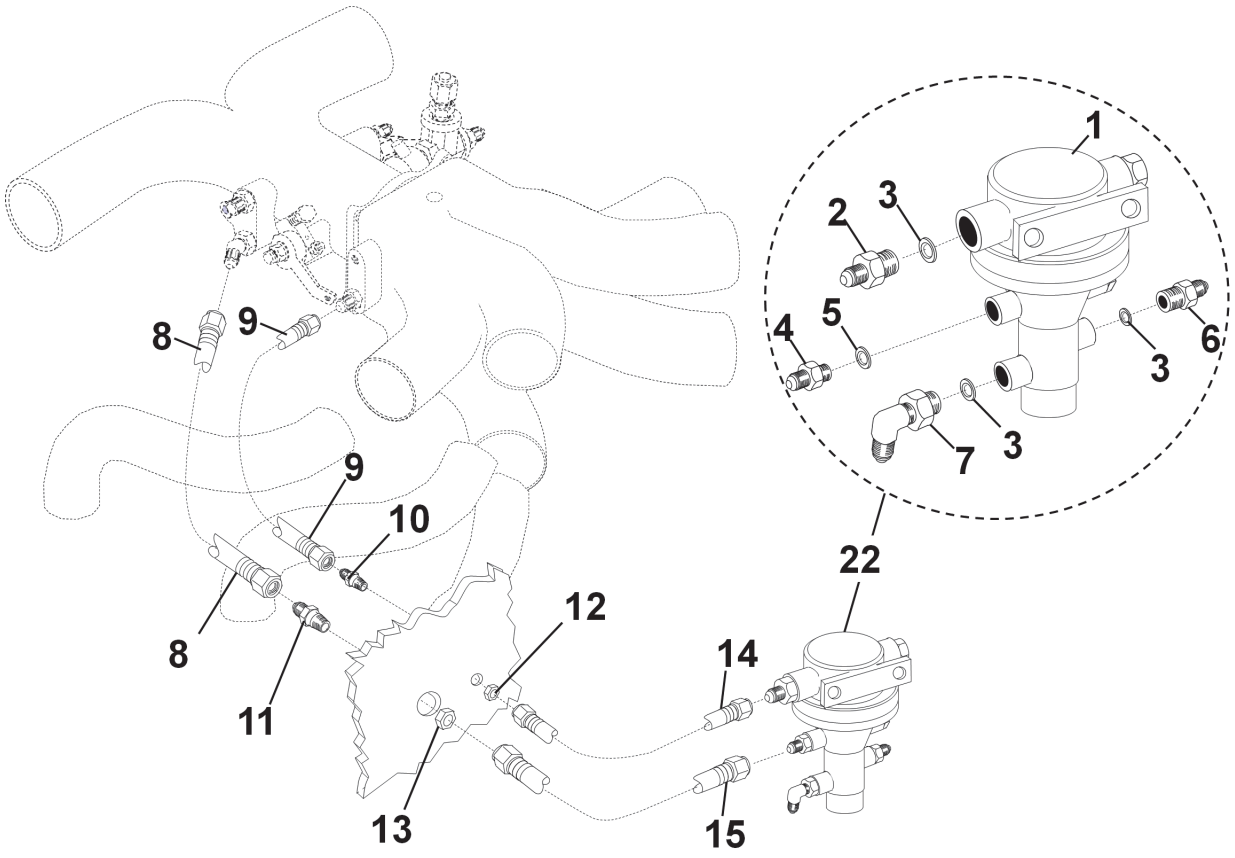

Figure 5-9. Wastegate Controller & Hoses K

1	Controller	5	O-Ring	9	Hose Assembly	13	Bulkhead Nut
2	Reducer	6	Adapter Fitting	10	Bulkhead Union	14	Hose Assembly
3	O-Ring	7	90° Elbow Fitting	11	Bulkhead Union	15	Hose Assembly
4	Adapter	8	Hose Assembly	12	Bulkhead Nut	22	Wastegate Controller Assy

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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

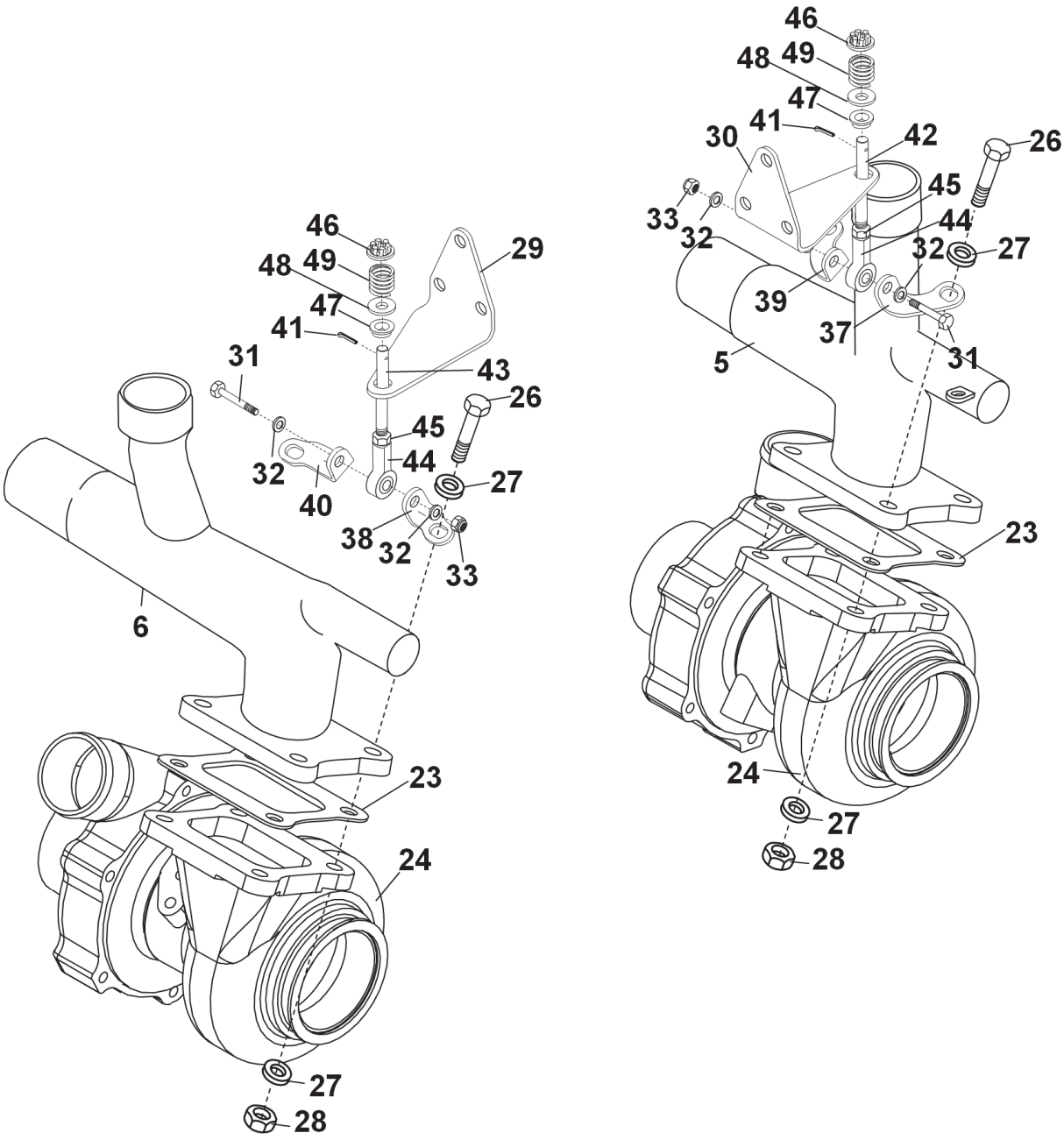

Figure 5-10. Turbocharger Support Detail N

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.
14. Torque the attaching hardware to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual in the following sequence: 26 & 28; 19 & 21.

    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

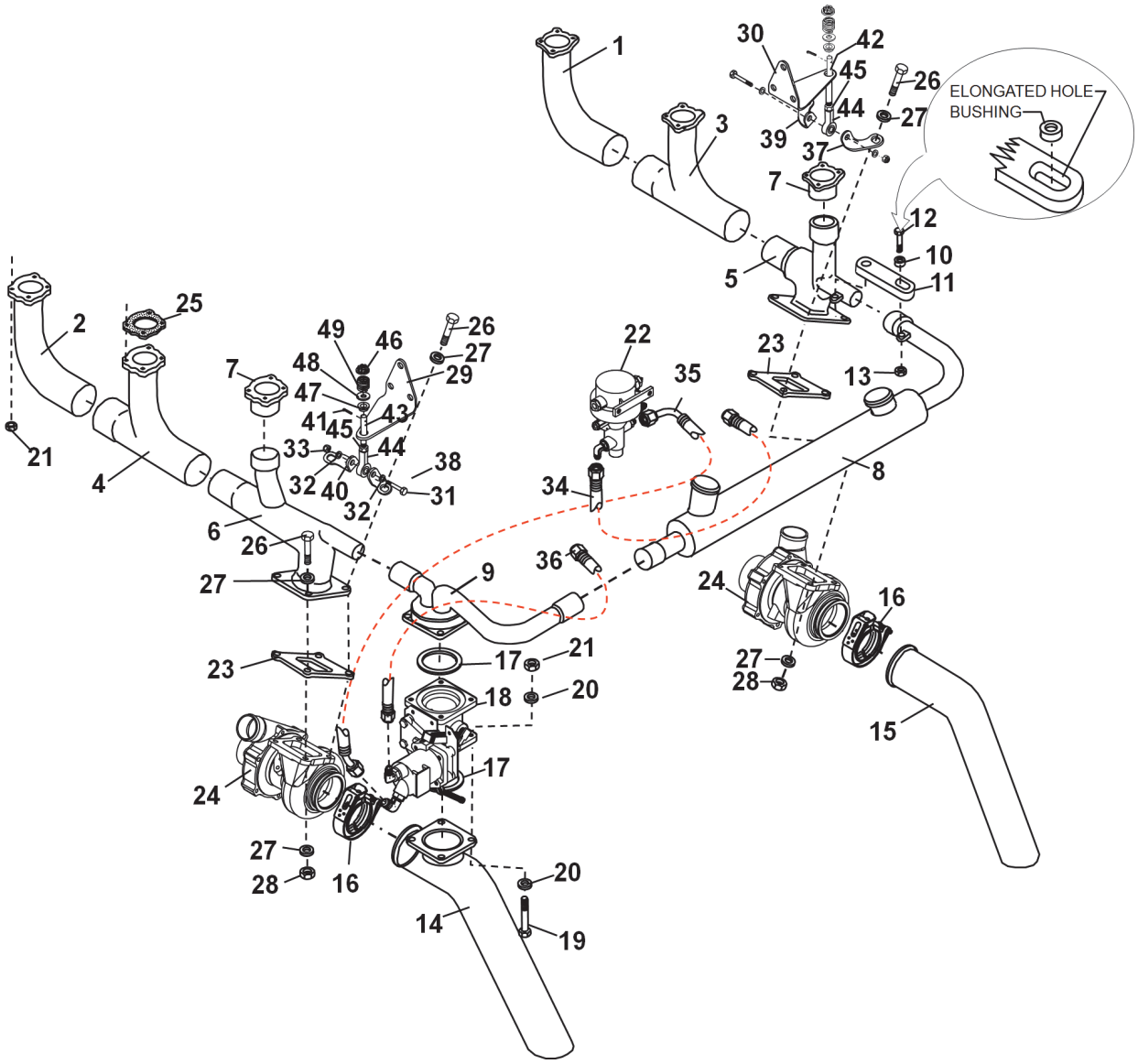

Figure 5-11. Turbocharger and Exhaust Assembly N

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

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.

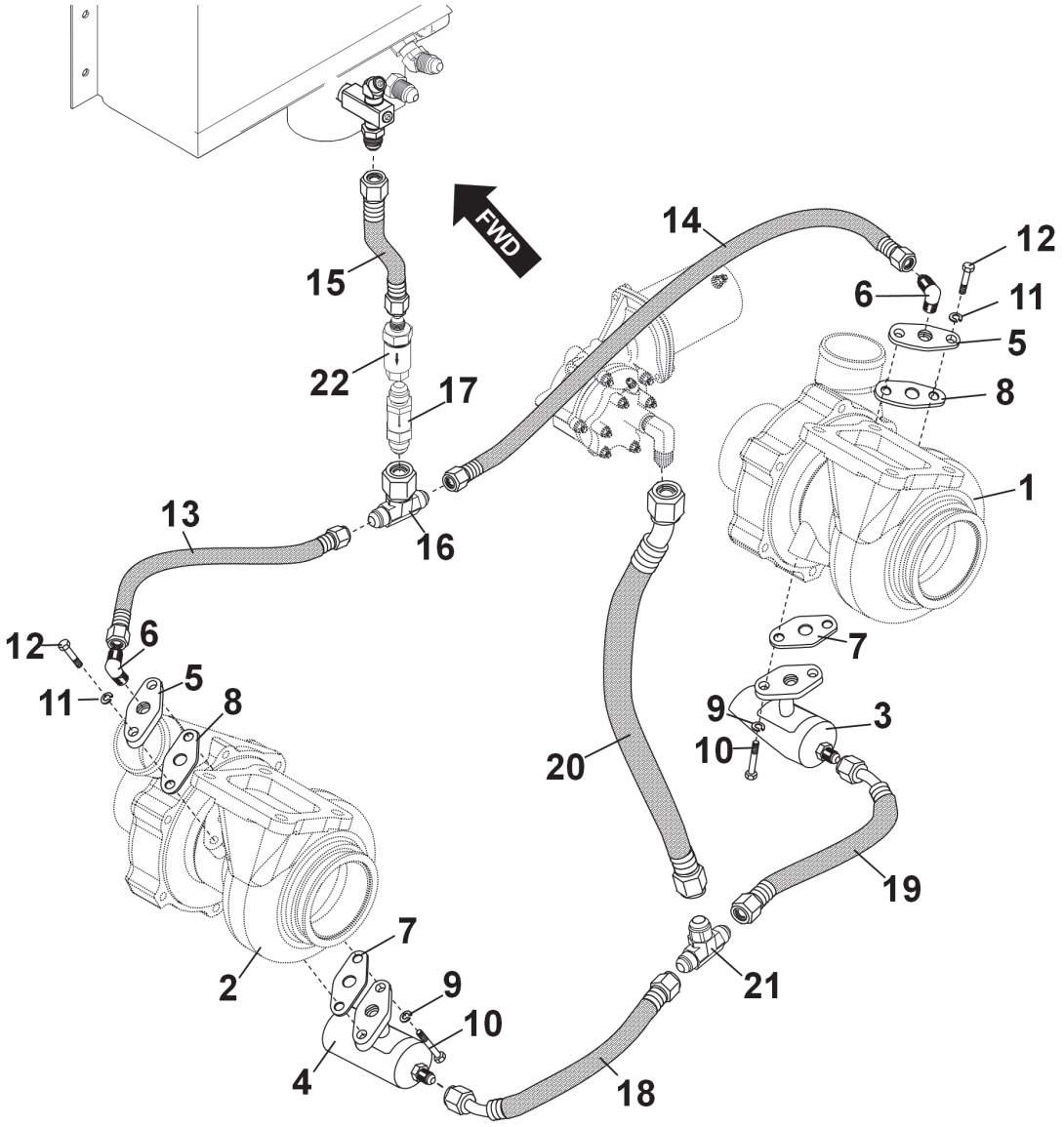

Figure 5-12. Turbocharger Lubrication Hose Routing N

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

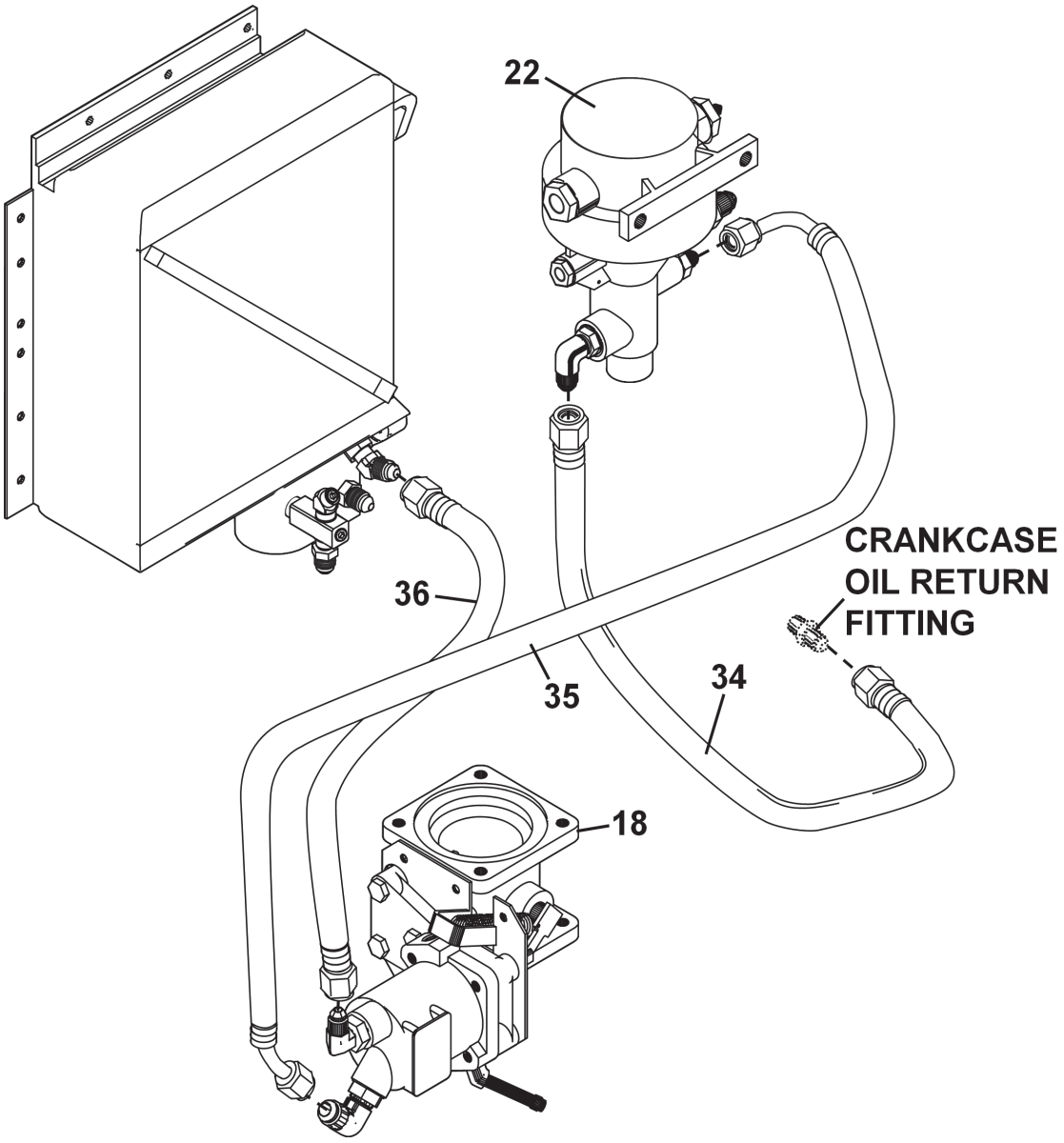

Figure 5-13. Wastegate Control Hose Connections N

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.

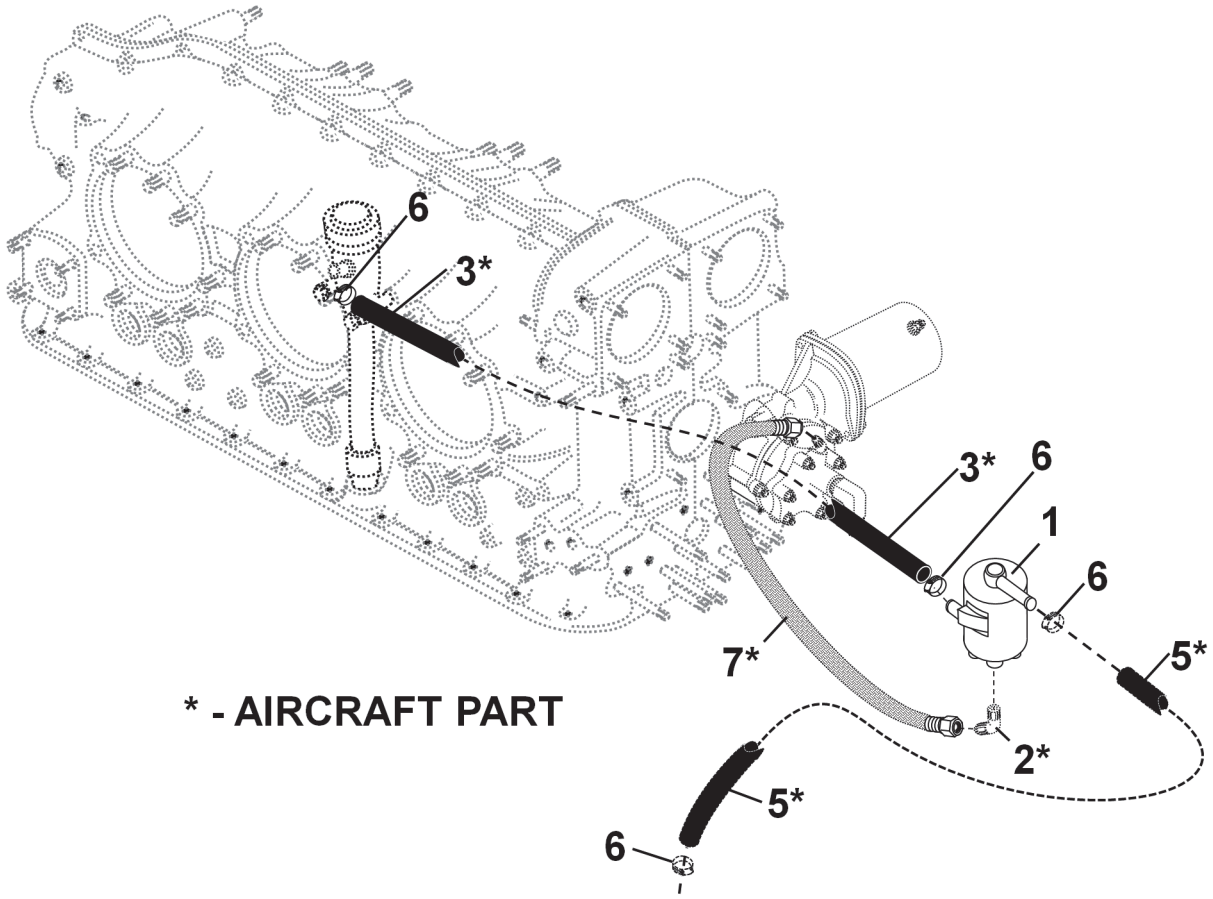

Figure 5-14. Air/Oil Separator N

1	Air/Oil Separator Assembly	3	Hose Assembly	5	Hose Assembly	7	Hose
2	Elbow Fitting	4	Hose Clamp	6	Hose Clamp		

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.

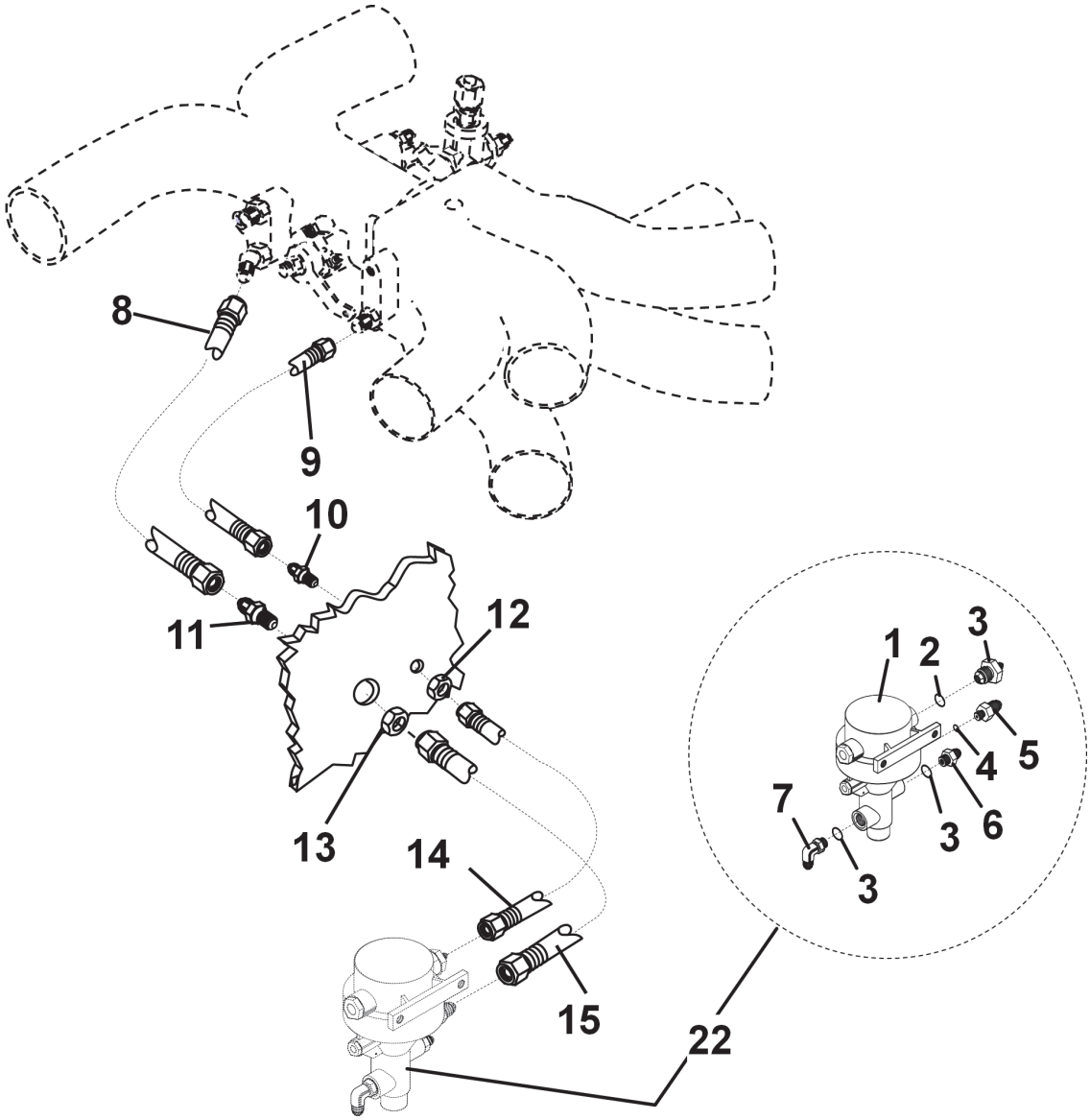

Figure 5-15. Turbocharger Controller and Hoses N

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

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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 colling 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.

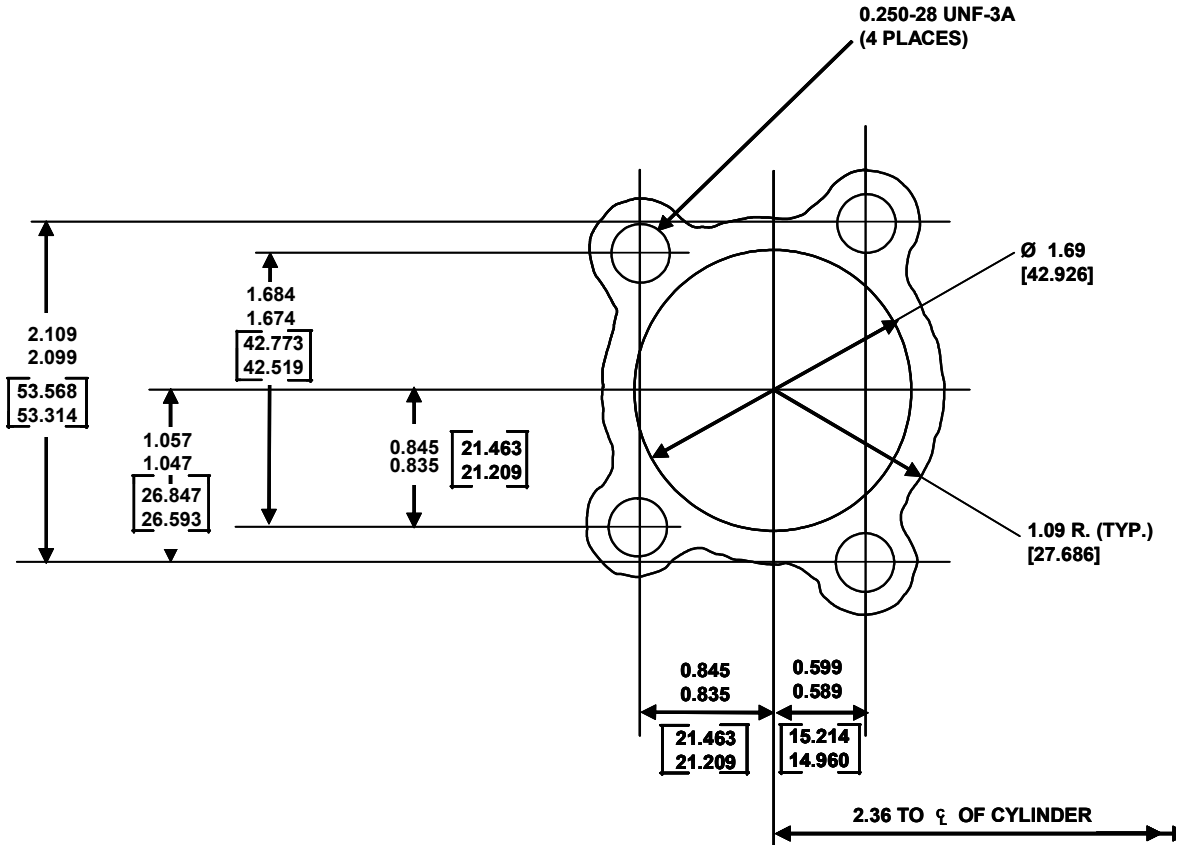


Figure 5-16. Exhaust Port Dimensions

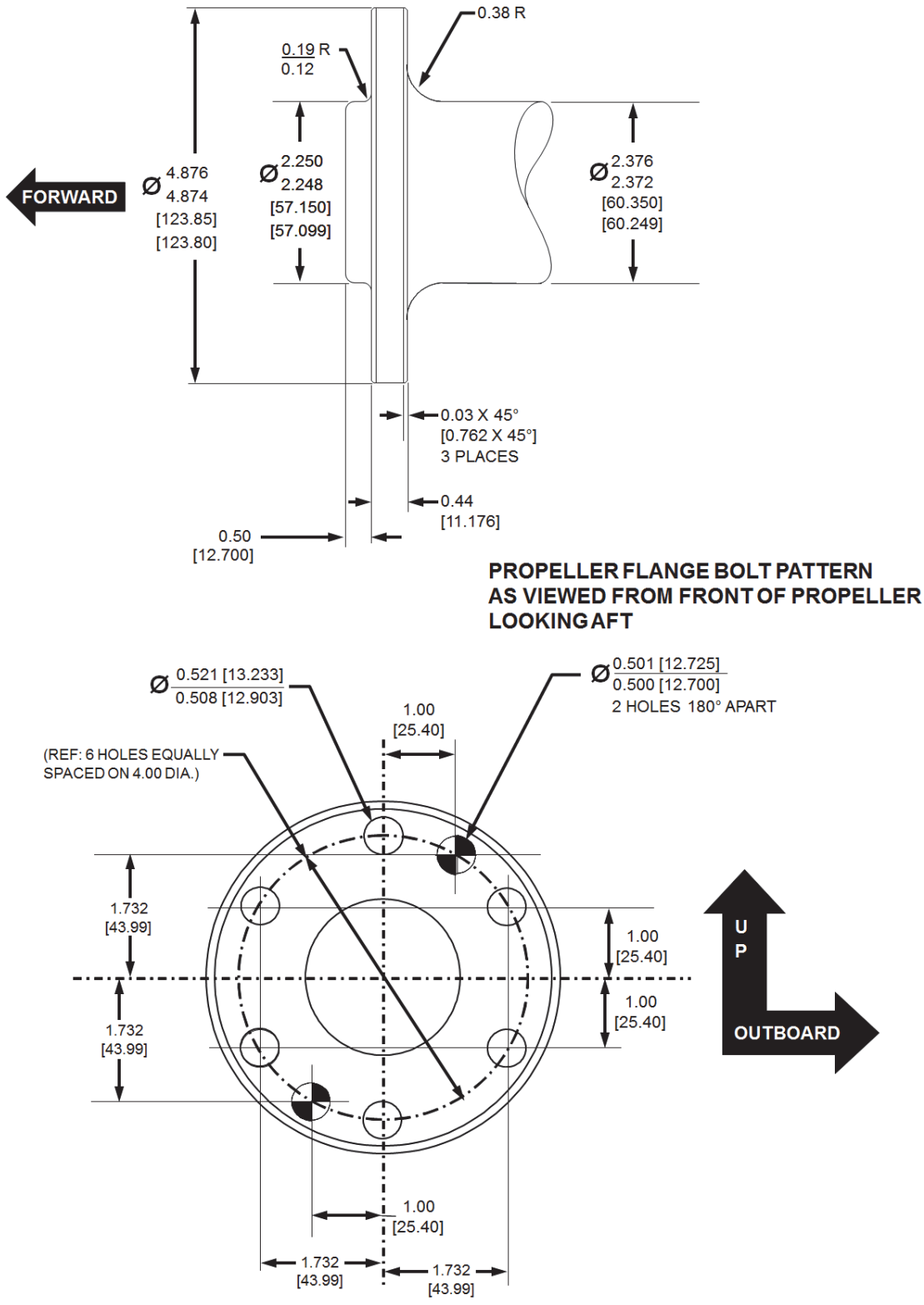


Figure 5-17. Propeller Flange Dimensions

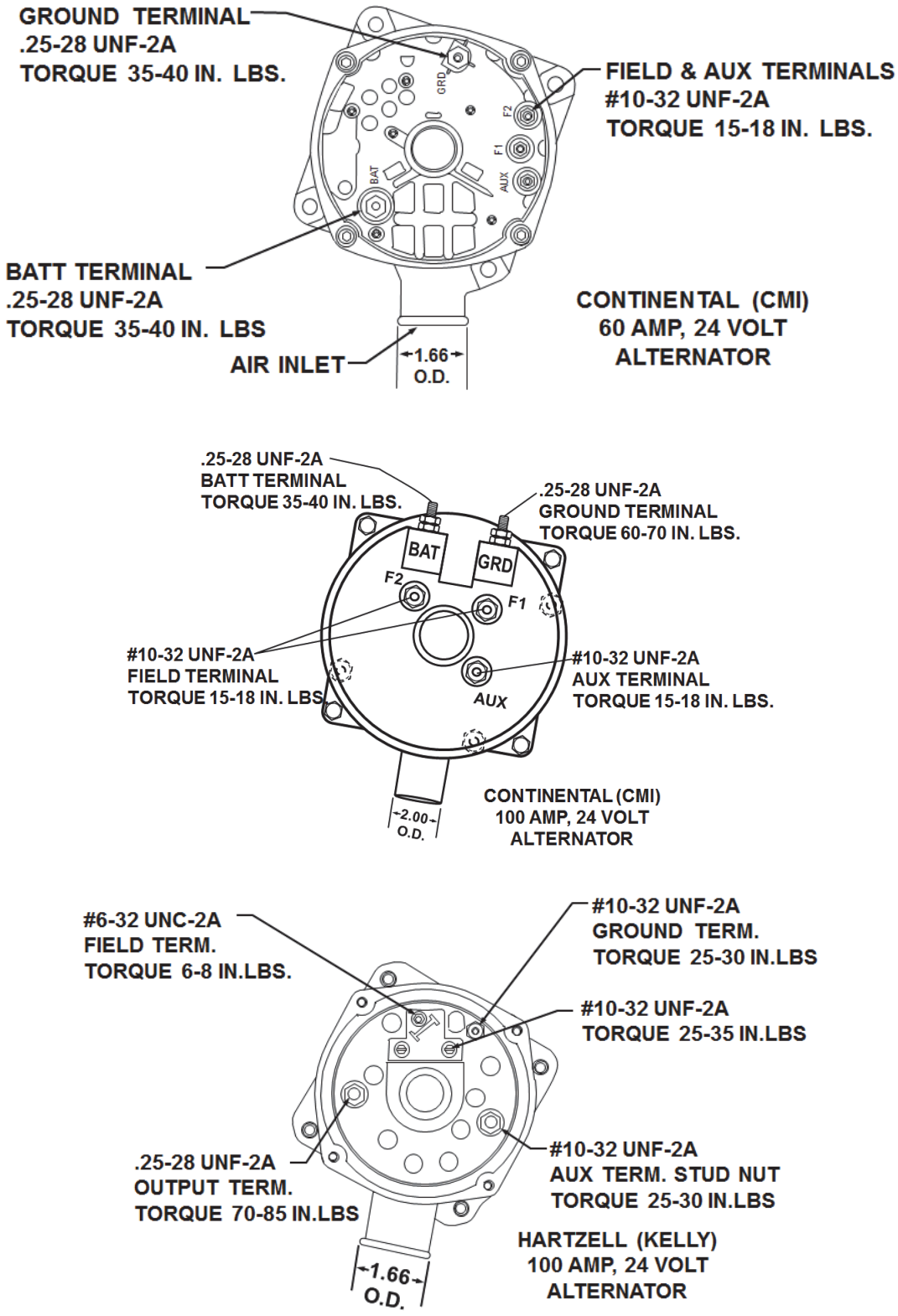


Figure 5-18. 24V Gear-Driven Alternator Detail

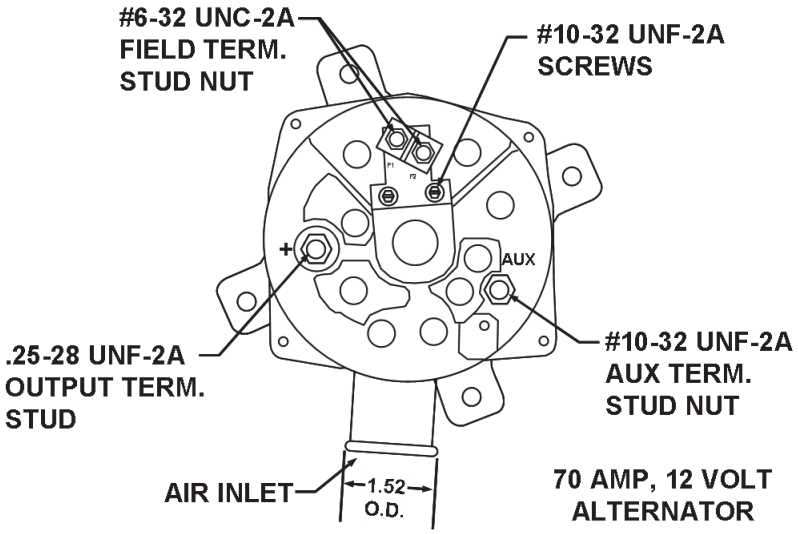


Figure 5-19. 12V Gear-Driven Alternator

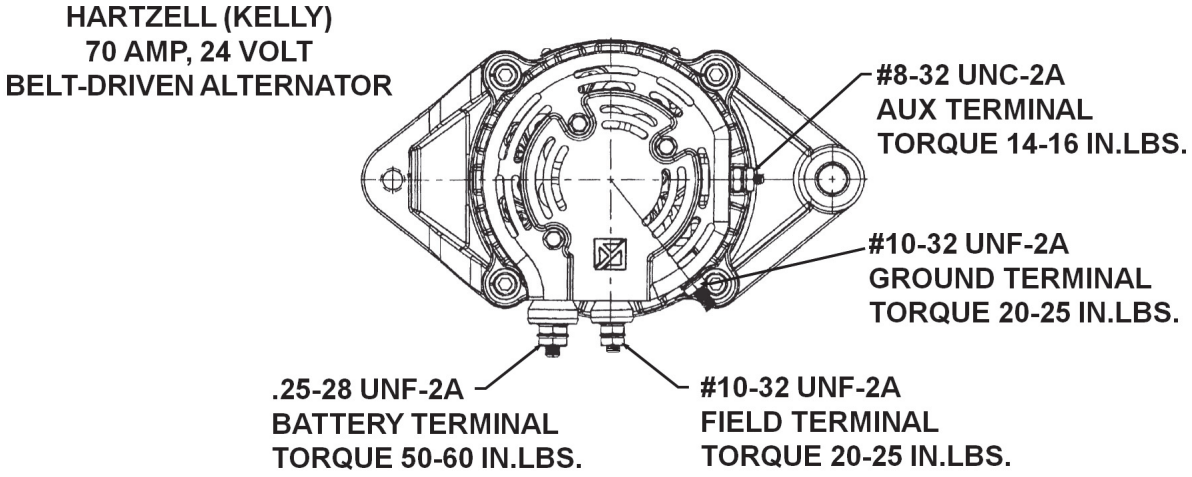


Figure 5-20. Belt-Driven Alternator Detail

5-4.2. TSIO-550-B Engine Installation Drawings

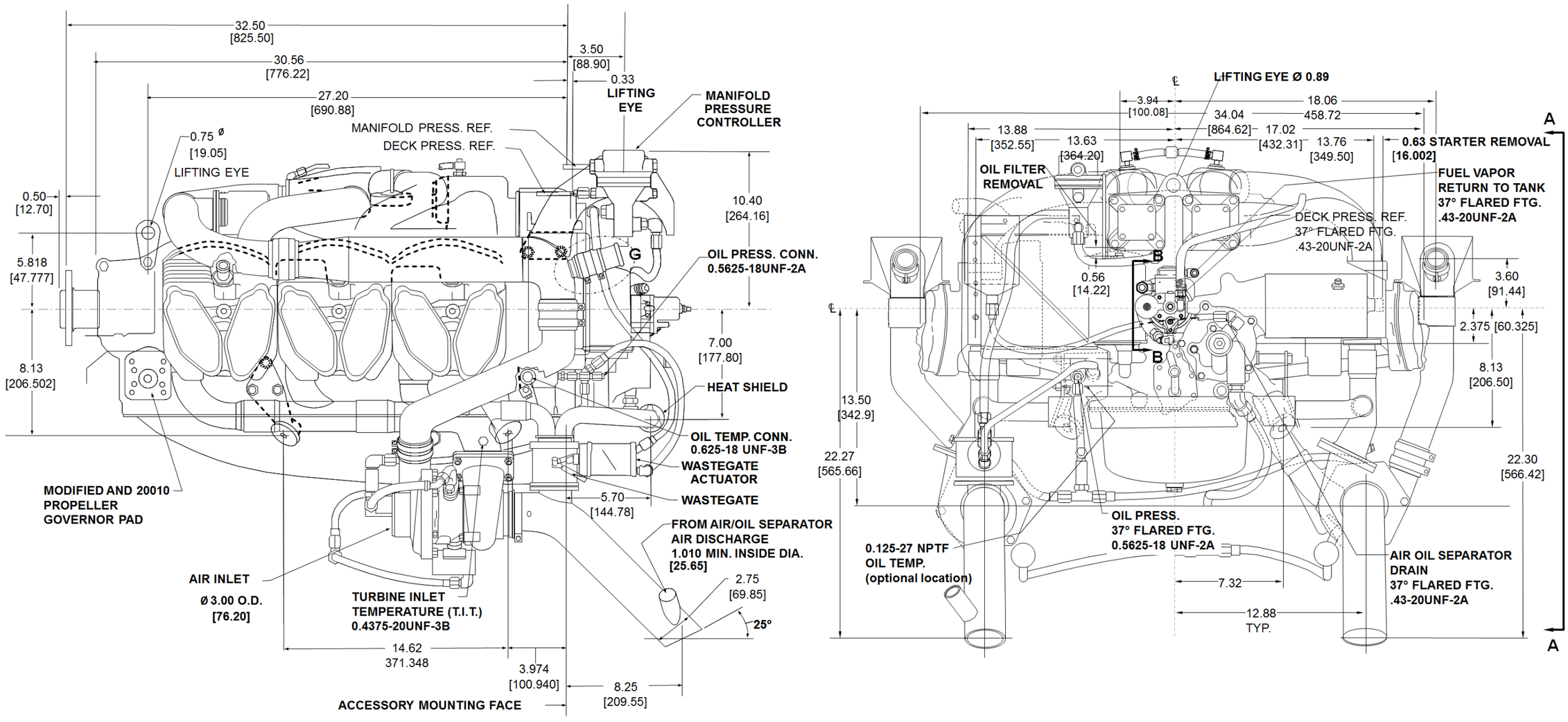


Figure 5-21. TSIO-550-B Installation Drawing 653021 - Sheet 1 of 3

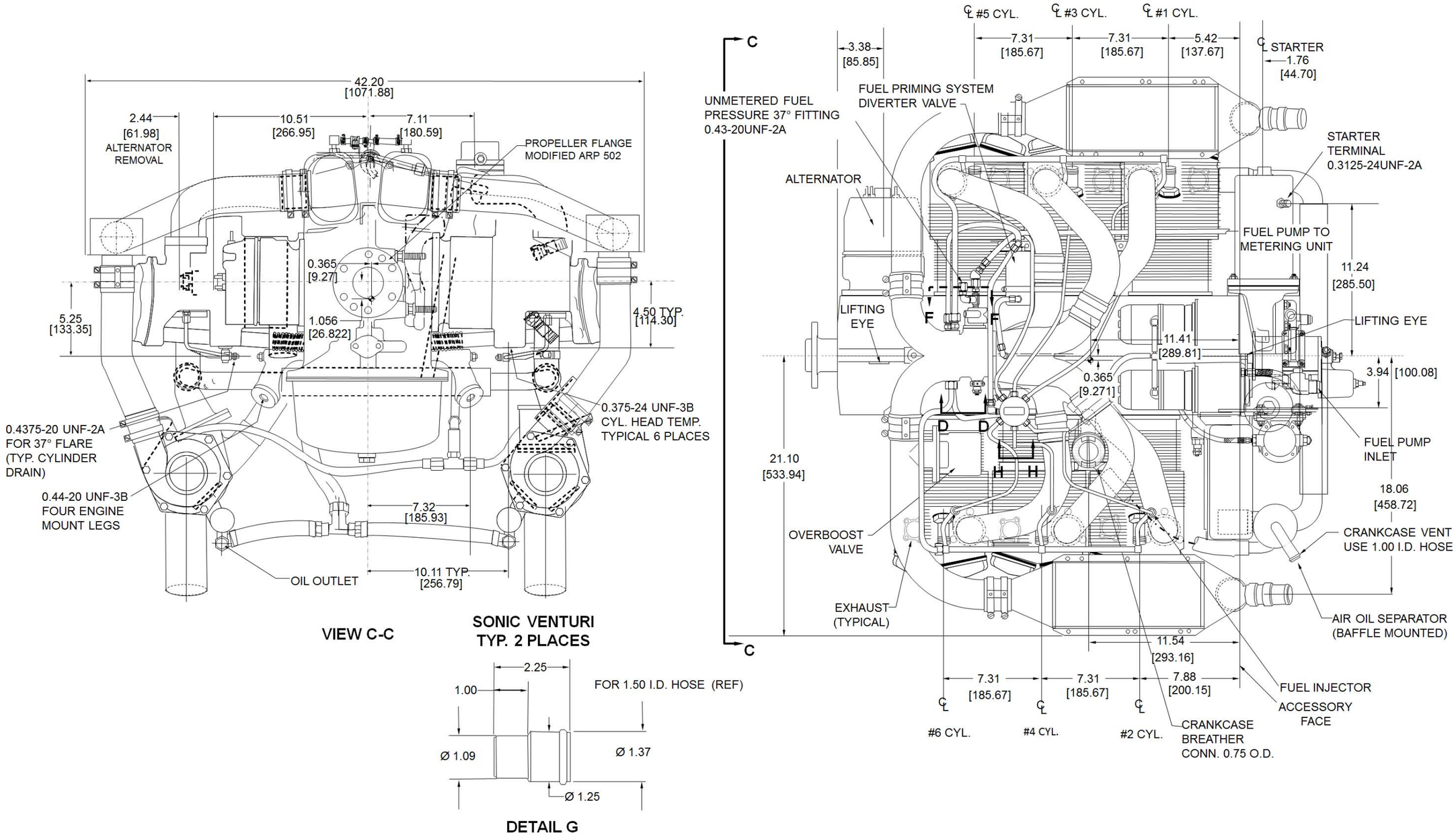
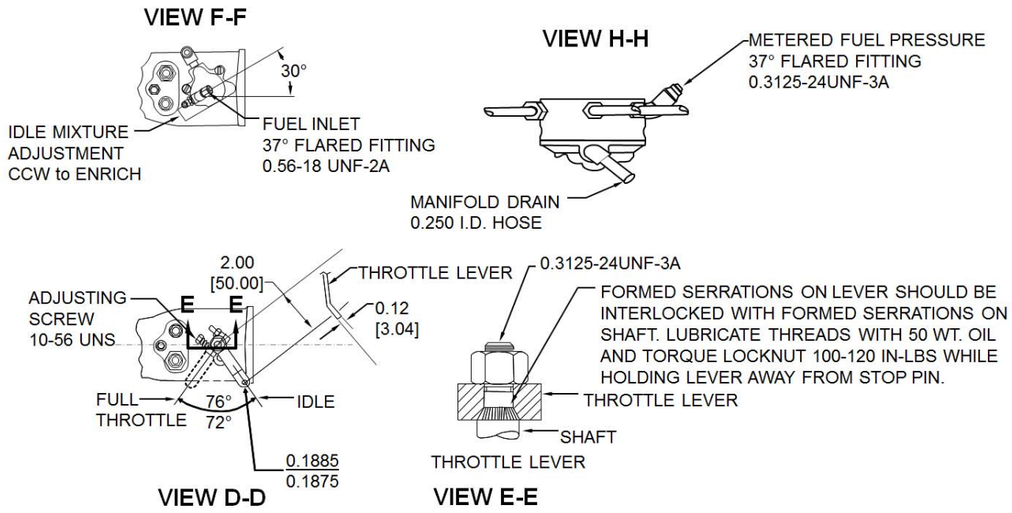


Figure 5-22. TSIO-550-B Installation Drawing 653021 - Sheet 2 of 3



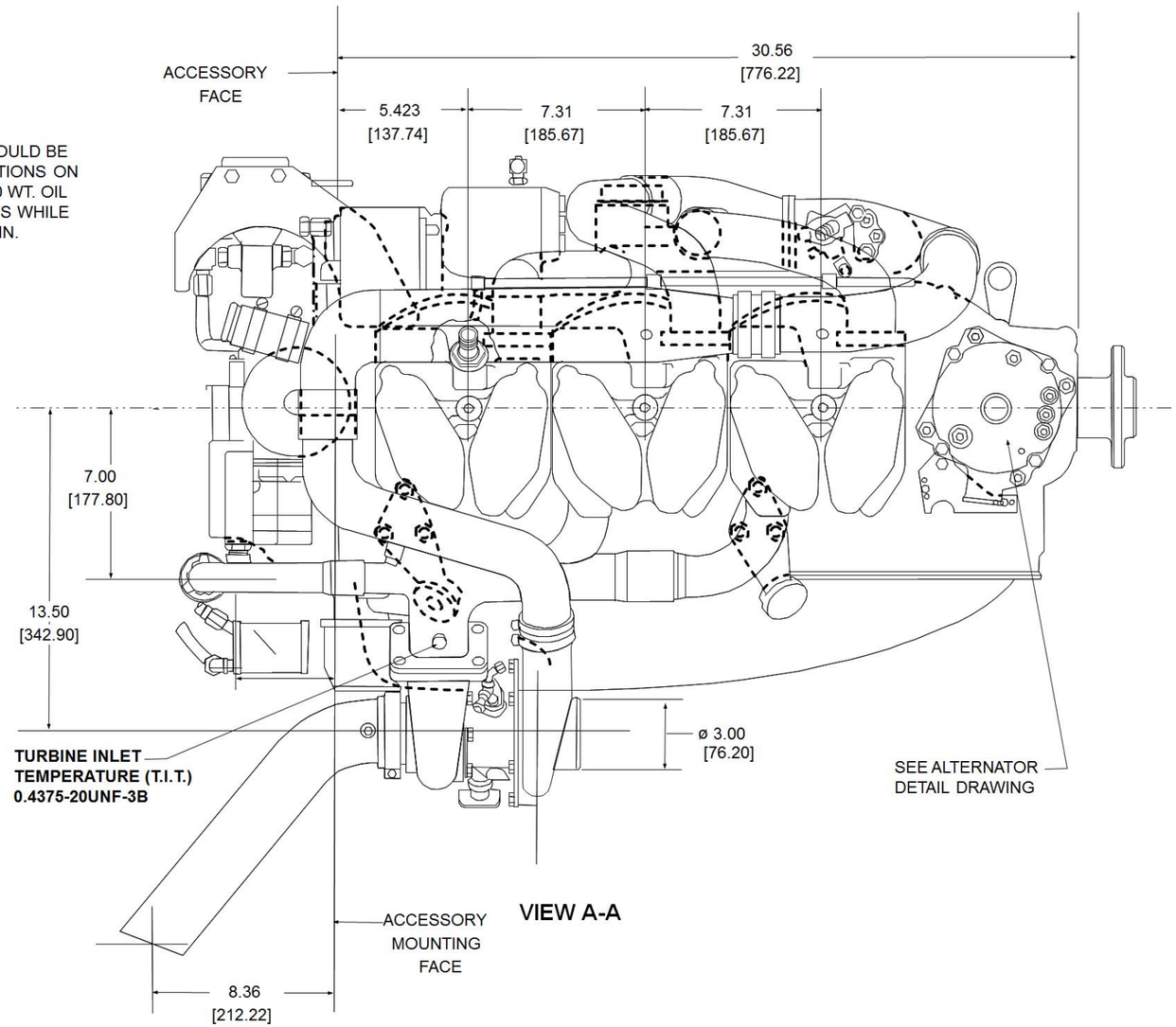


Figure 5-23. TSIO-550-B Installation Drawing 653021 - Sheet 3 of 3

5-4.3. TSIO-550-C&E Engine Installation Drawings

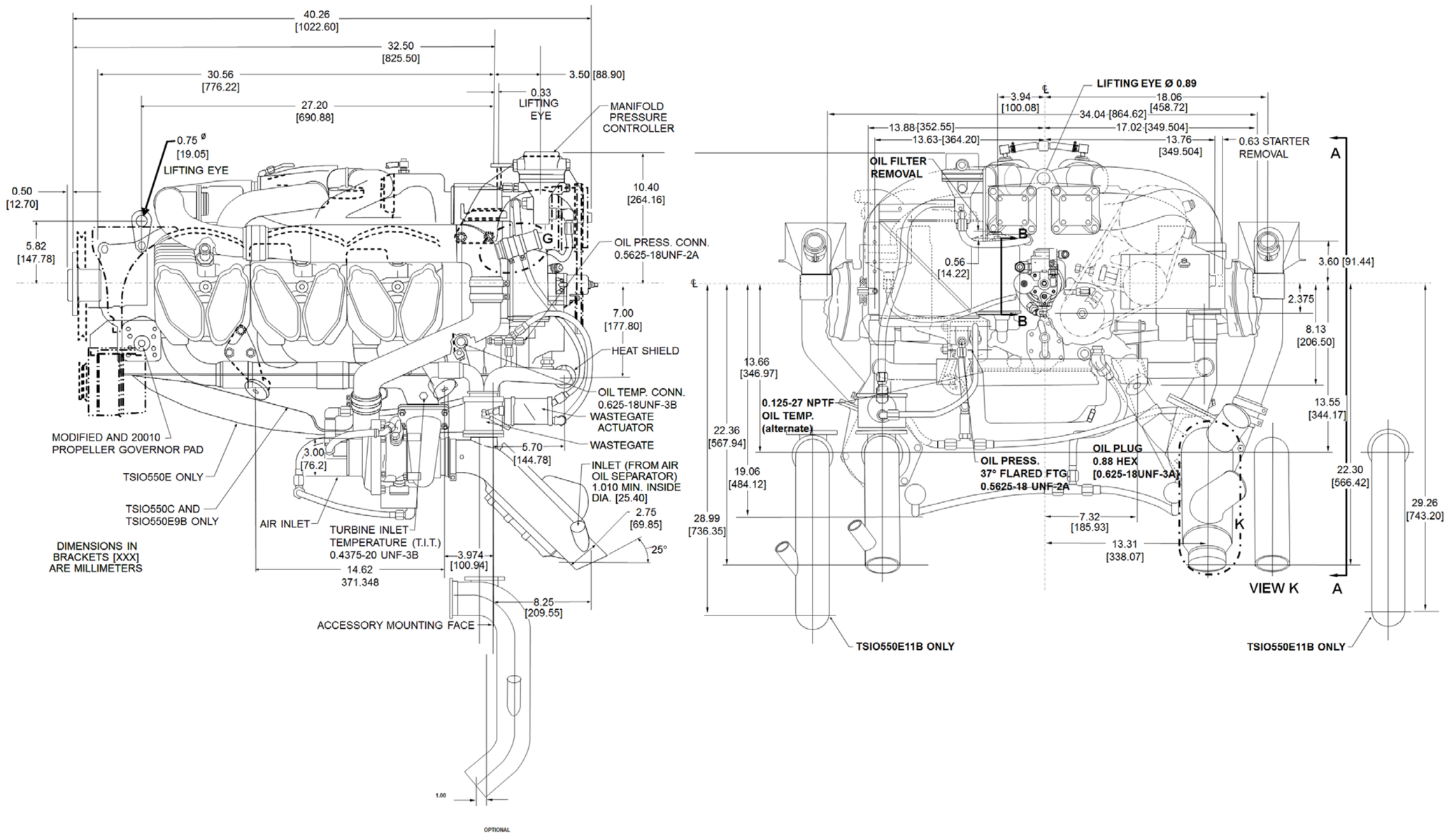


Figure 5-24. TSIO-550-C & E Installation Drawing 646618 - Sheet 1 of 3

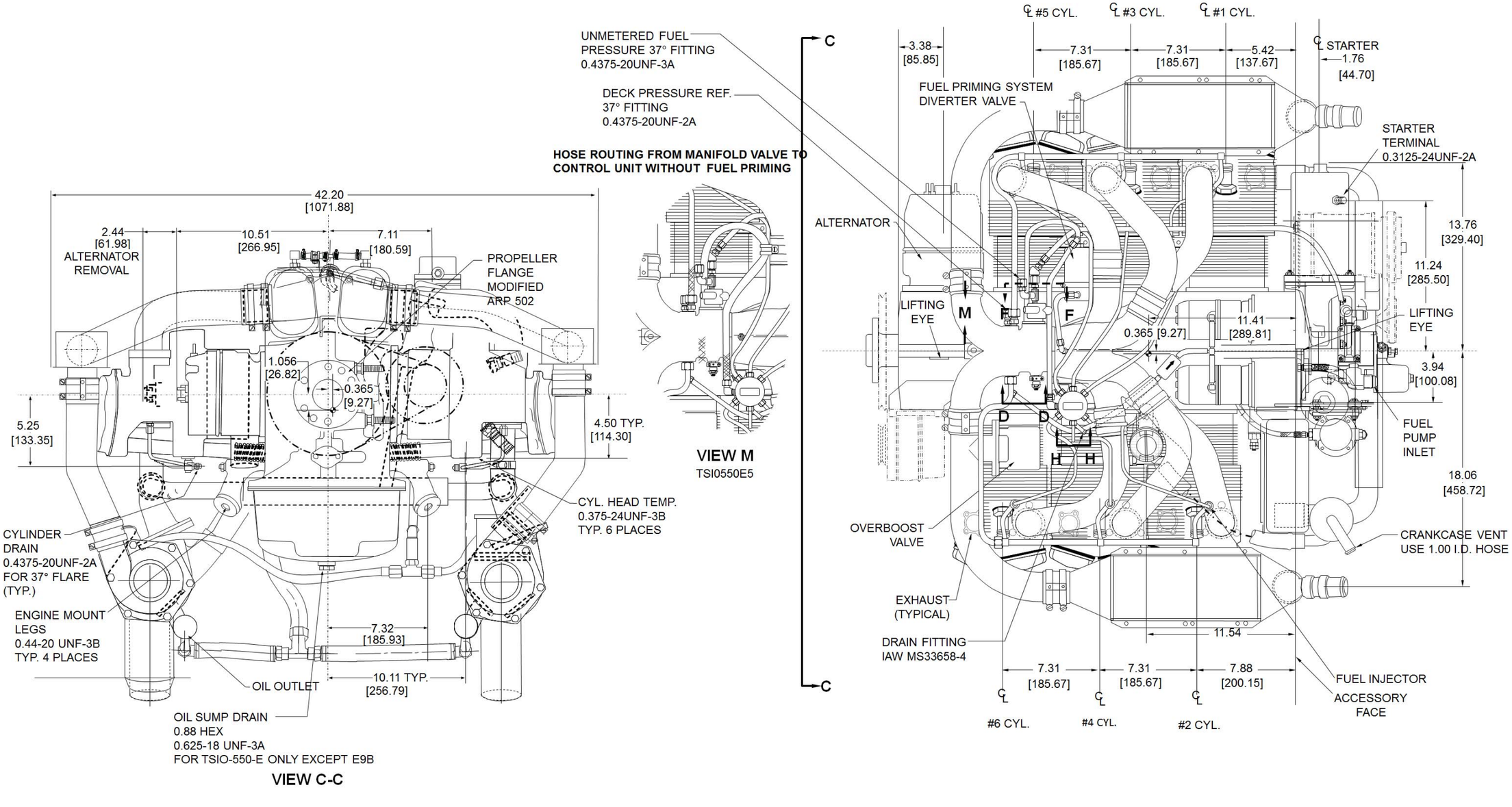


Figure 5-25. TSIO-550-C & E Installation Drawing 646618 - Sheet 2 of 3

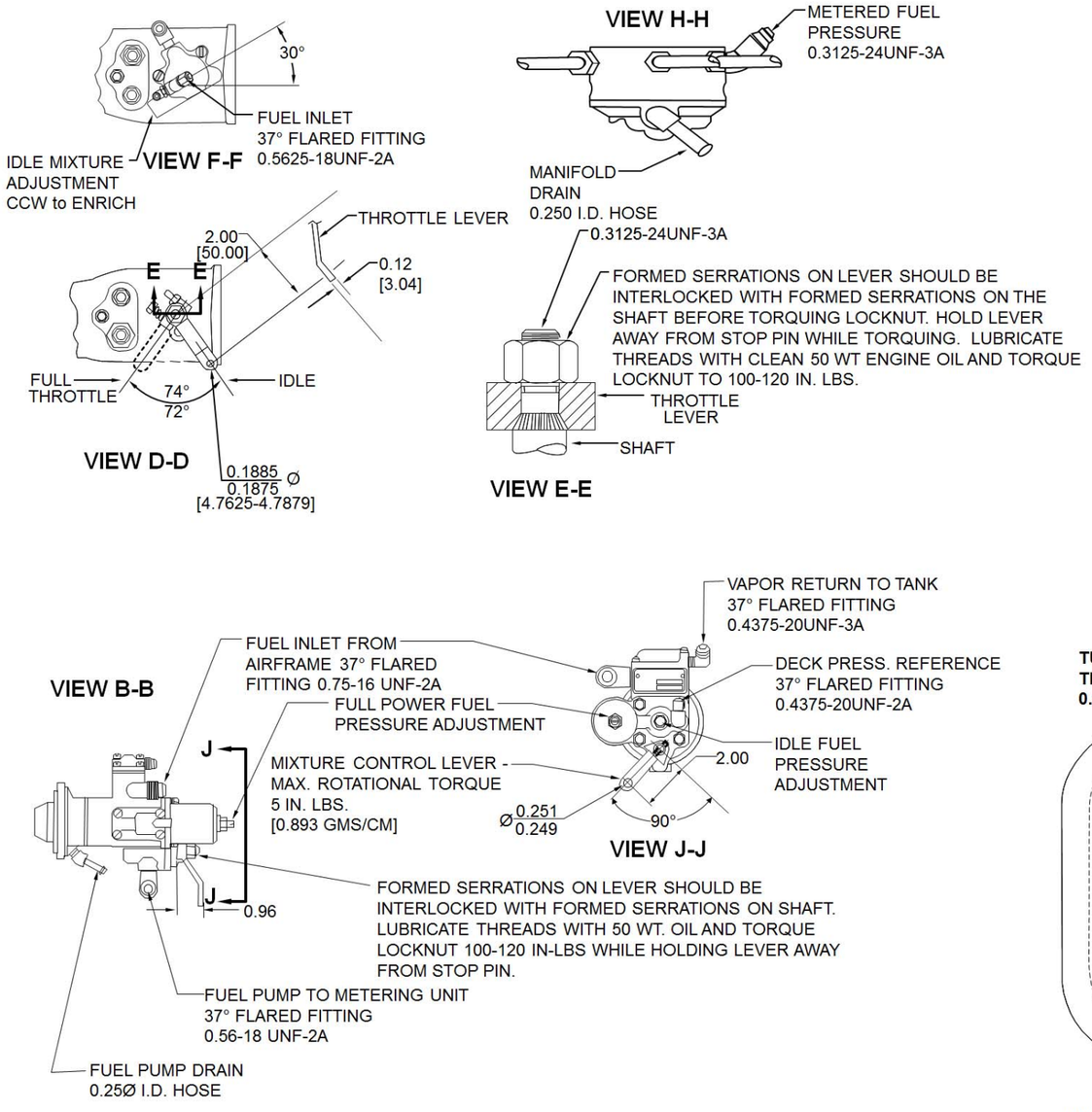


Figure 5-26. TSIO-550-C & E Installation Drawing 646618 - Sheet 3 of 3

5-4.4. TSIO-550-C Engine Installation Drawings

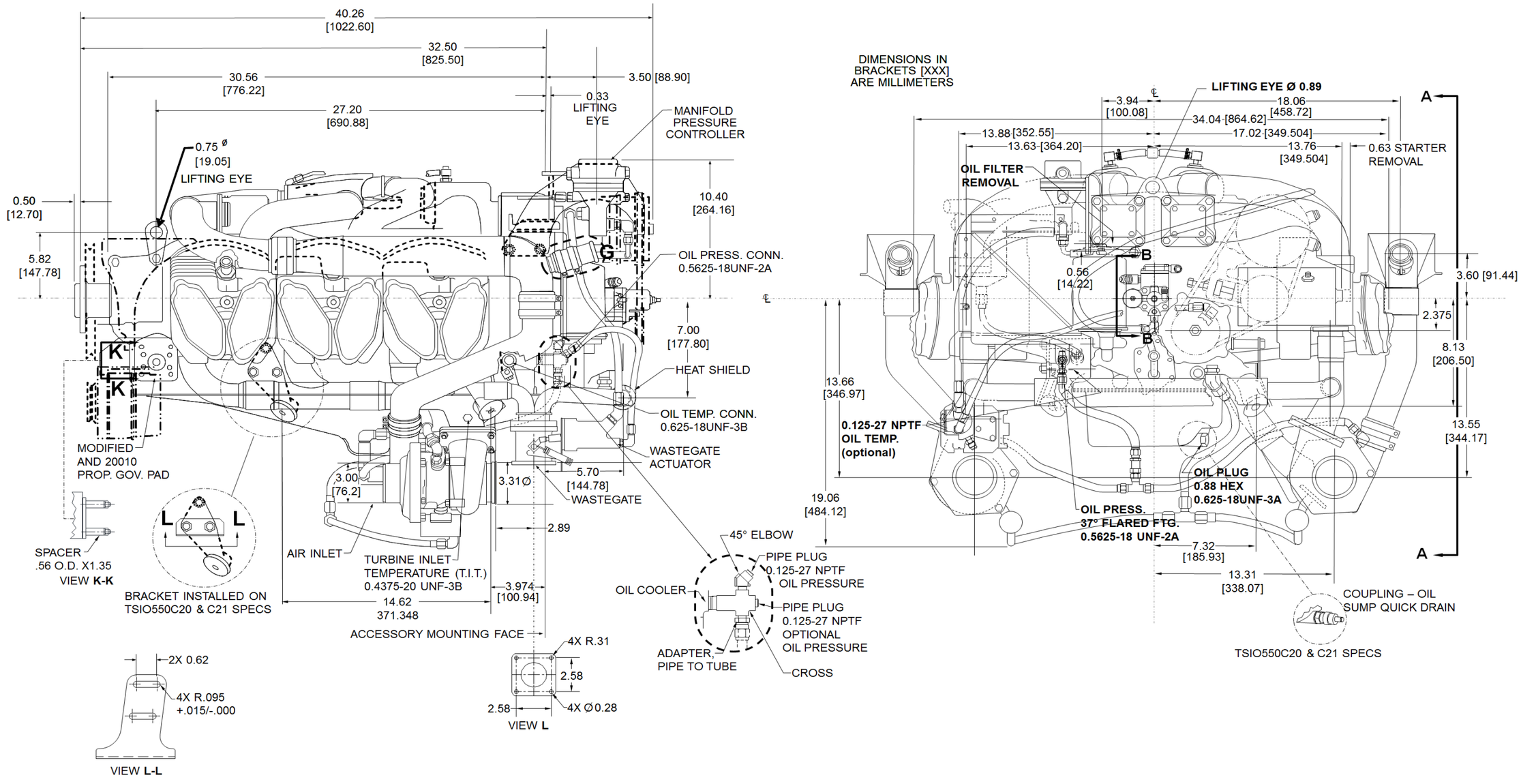


Figure 5-27. TSIO-550-C Installation Drawing 656791 - Sheet 1 of 3

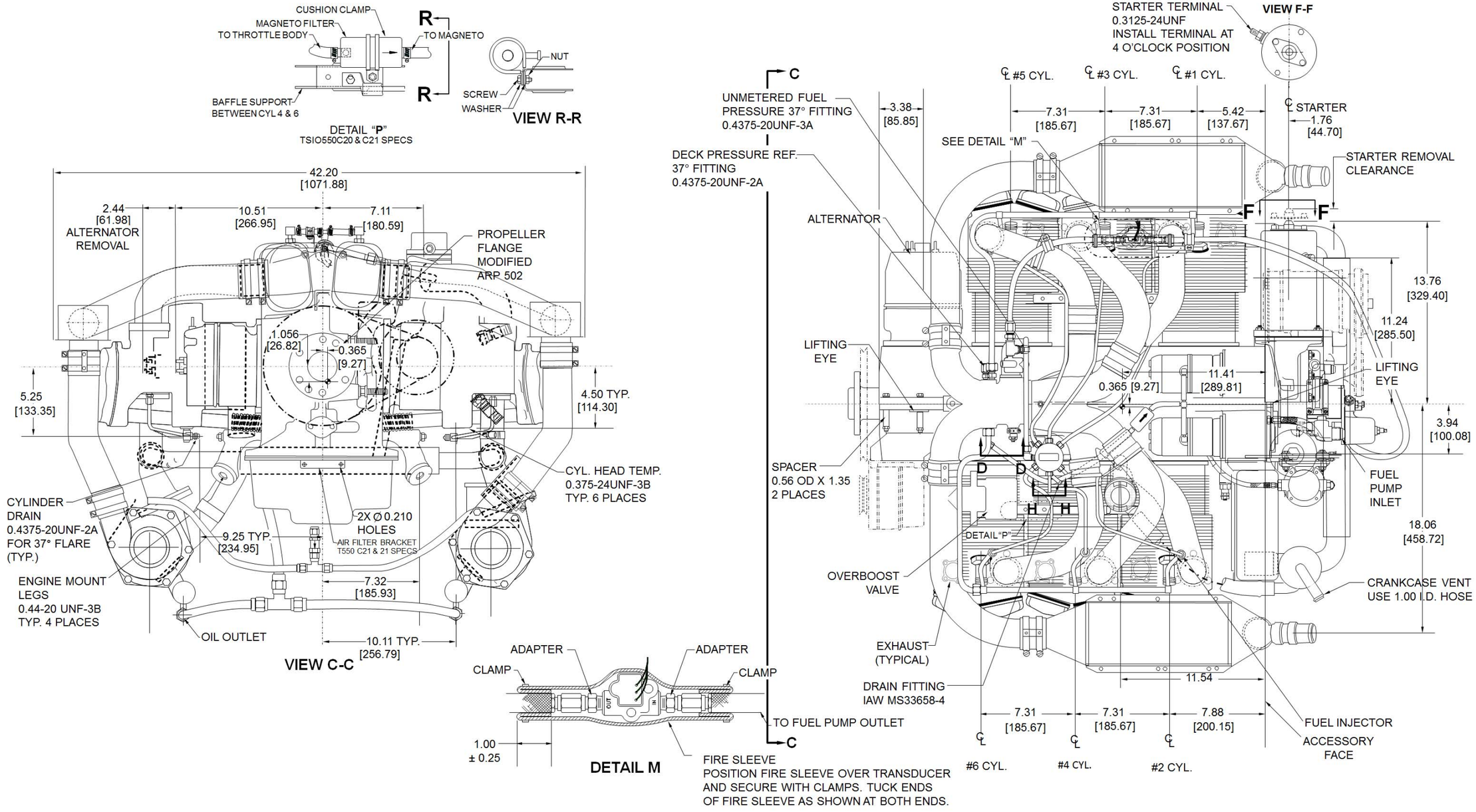
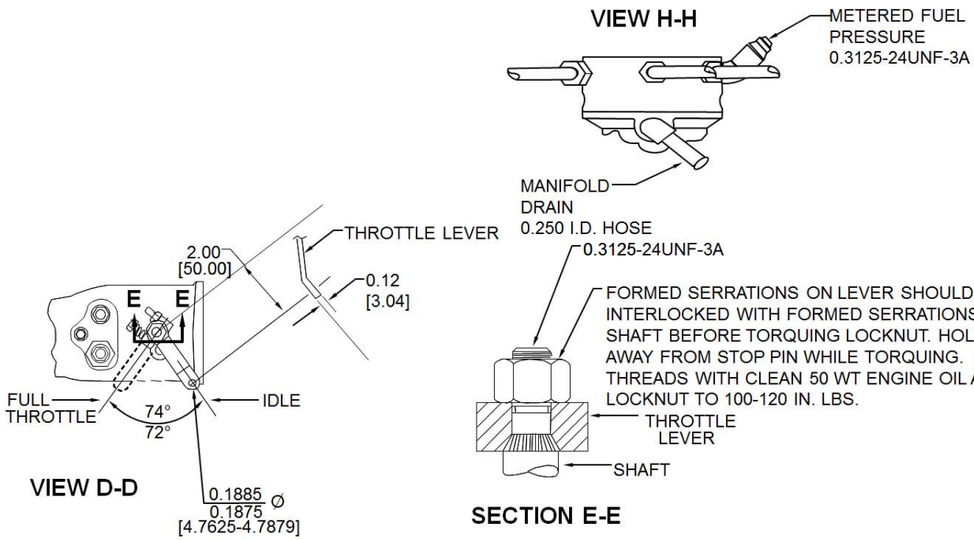
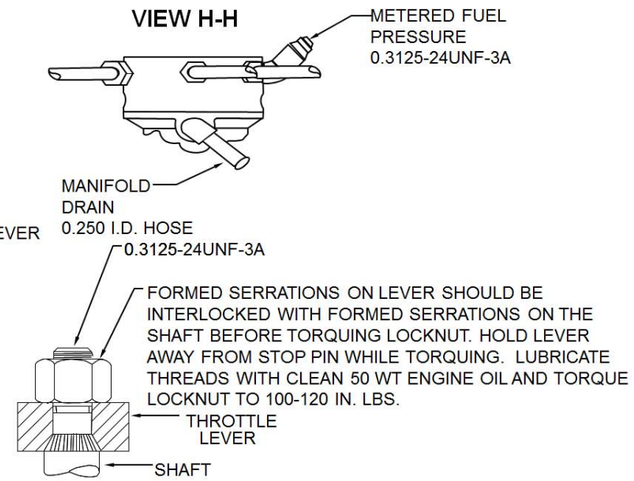


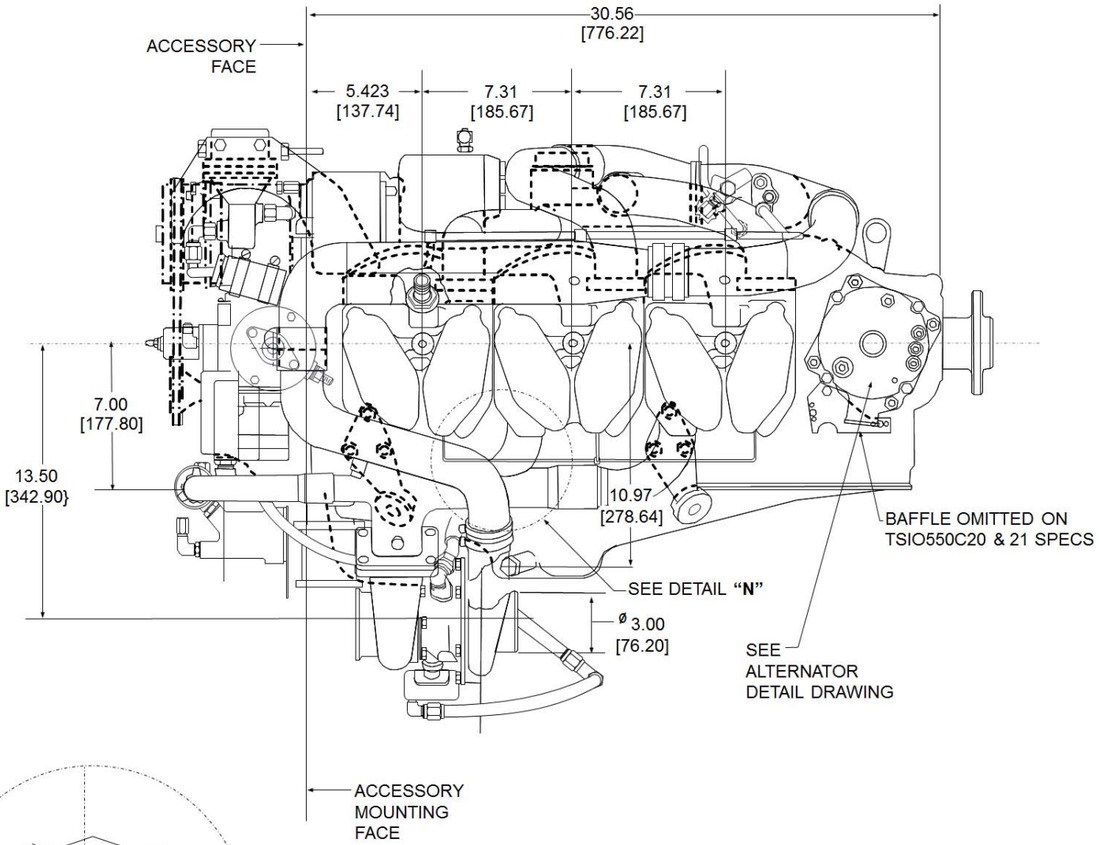
Figure 5-28. TSIO-550-C Installation Drawing 656791 - Sheet 2 of 3



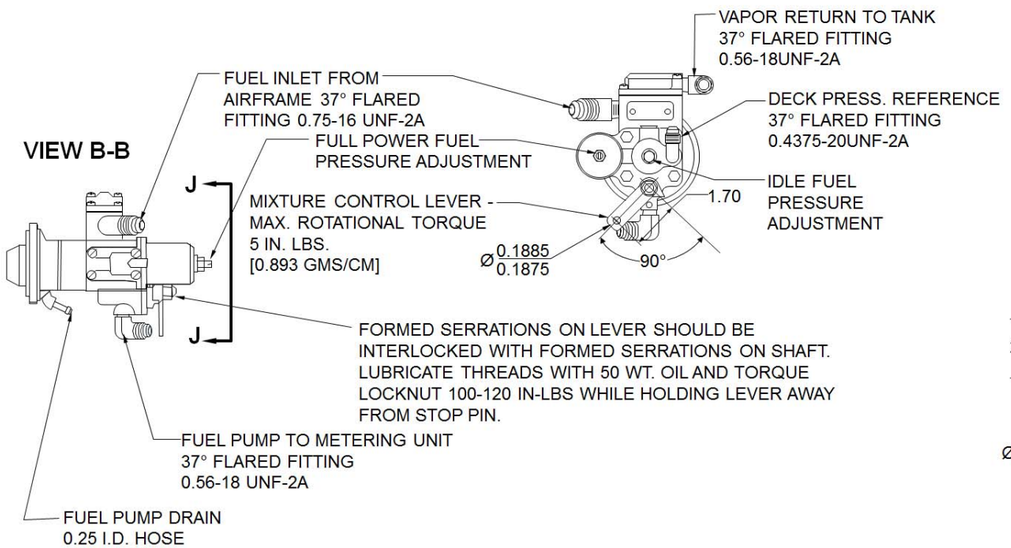
VIEW D-D

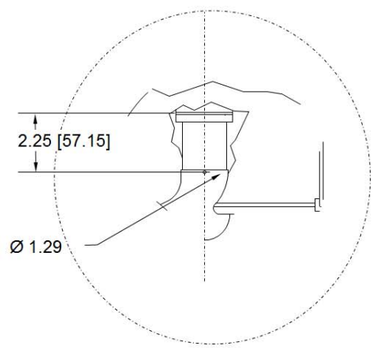


SECTION E-E



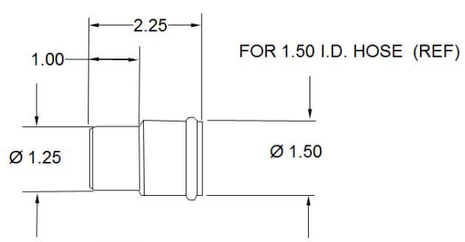
VIEW A-A





DETAIL "N"
EGT PROBE (EXHAUST)
TYPICAL 6 PLACES

SONIC VENTURI
TYP. 2 PLACES



DETAIL G

Figure 5-29. TSIO-550-C Installation Drawing 656791 - Sheet 3 of 3

5-4.5. TSIO-550-G Engine Installation Drawings

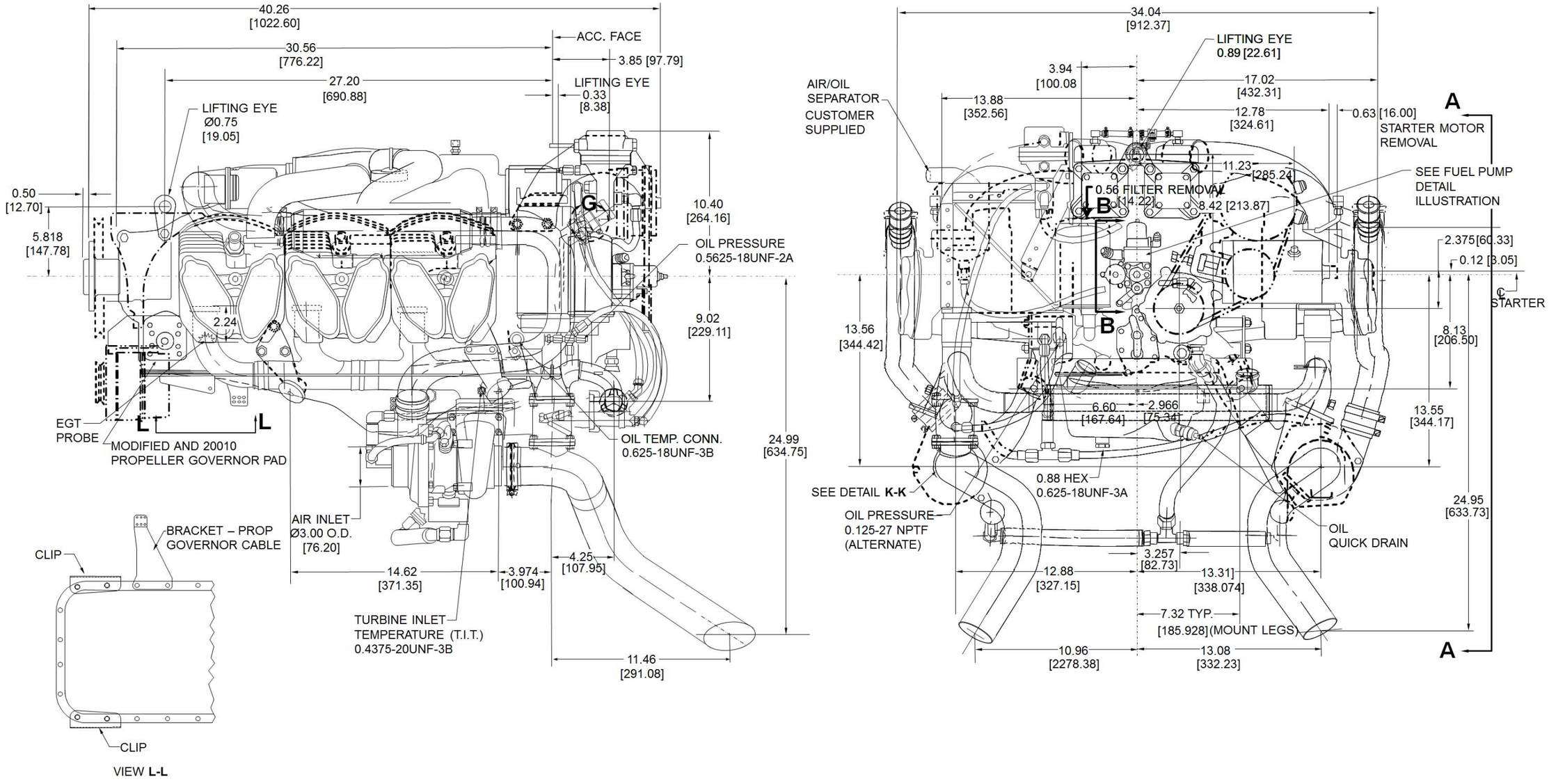


Figure 5-30. TSIO-550-G Installation Drawing 657154 - Sheet 1 of 3

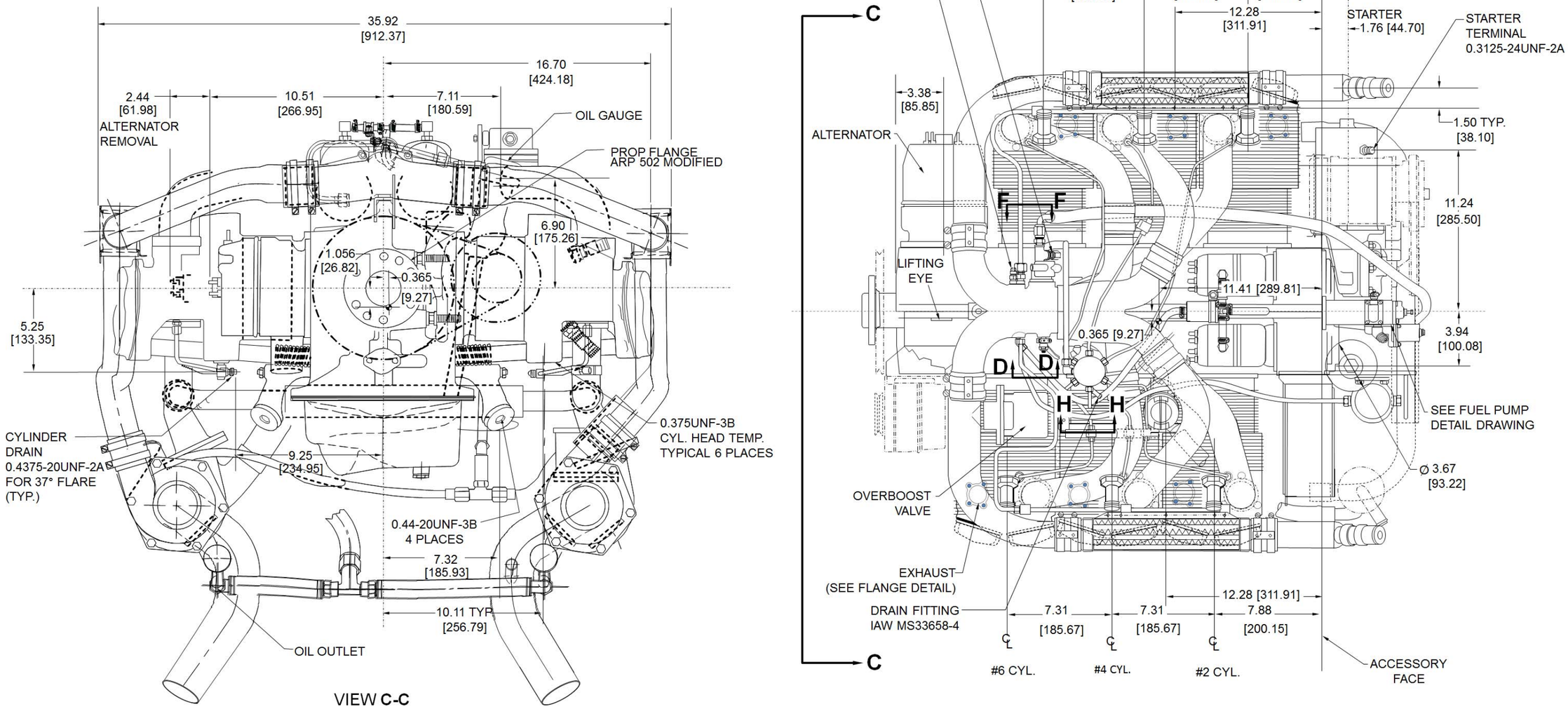


Figure 5-31. TSIO-550-G Installation Drawing 657154 - Sheet 2 of 3

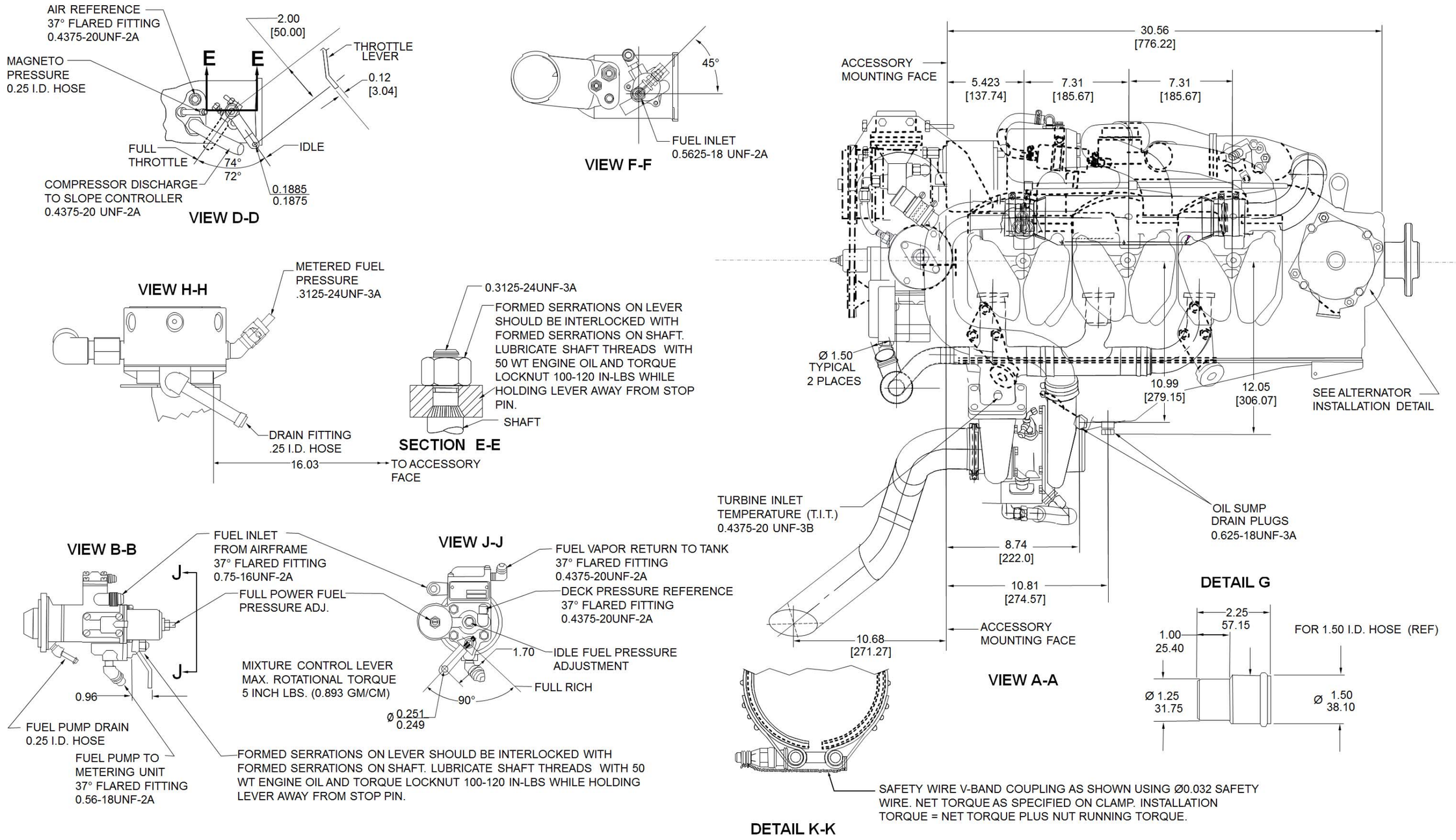


Figure 5-32. TSIO-550-G Installation Drawing 657154 - Sheet 3 of 3

5-4.6. TSIO-550-K Engine Installation Drawings

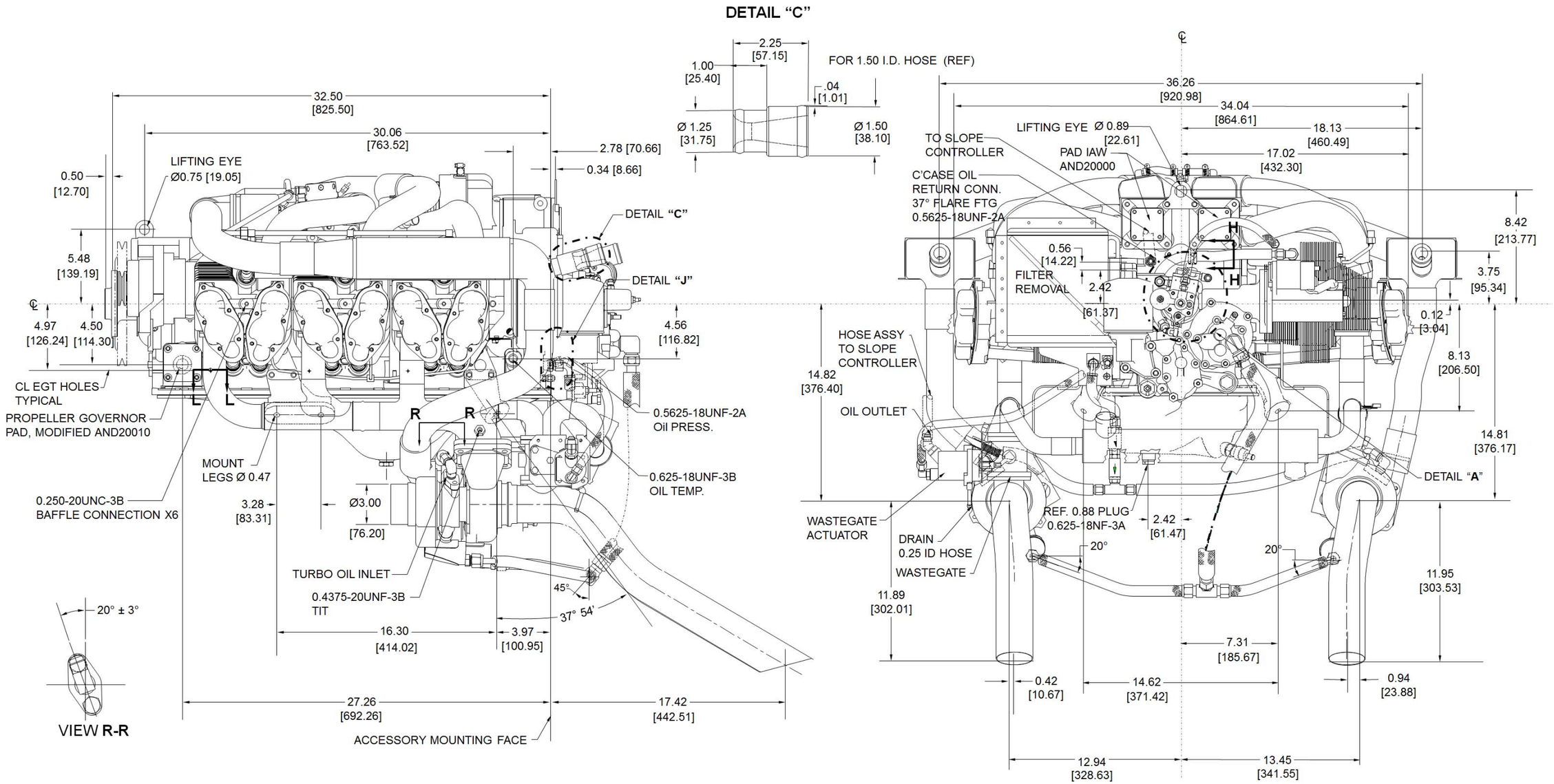


Figure 5-33. TSIO-550-K Installation Drawing 657645 - Sheet 1 of 4

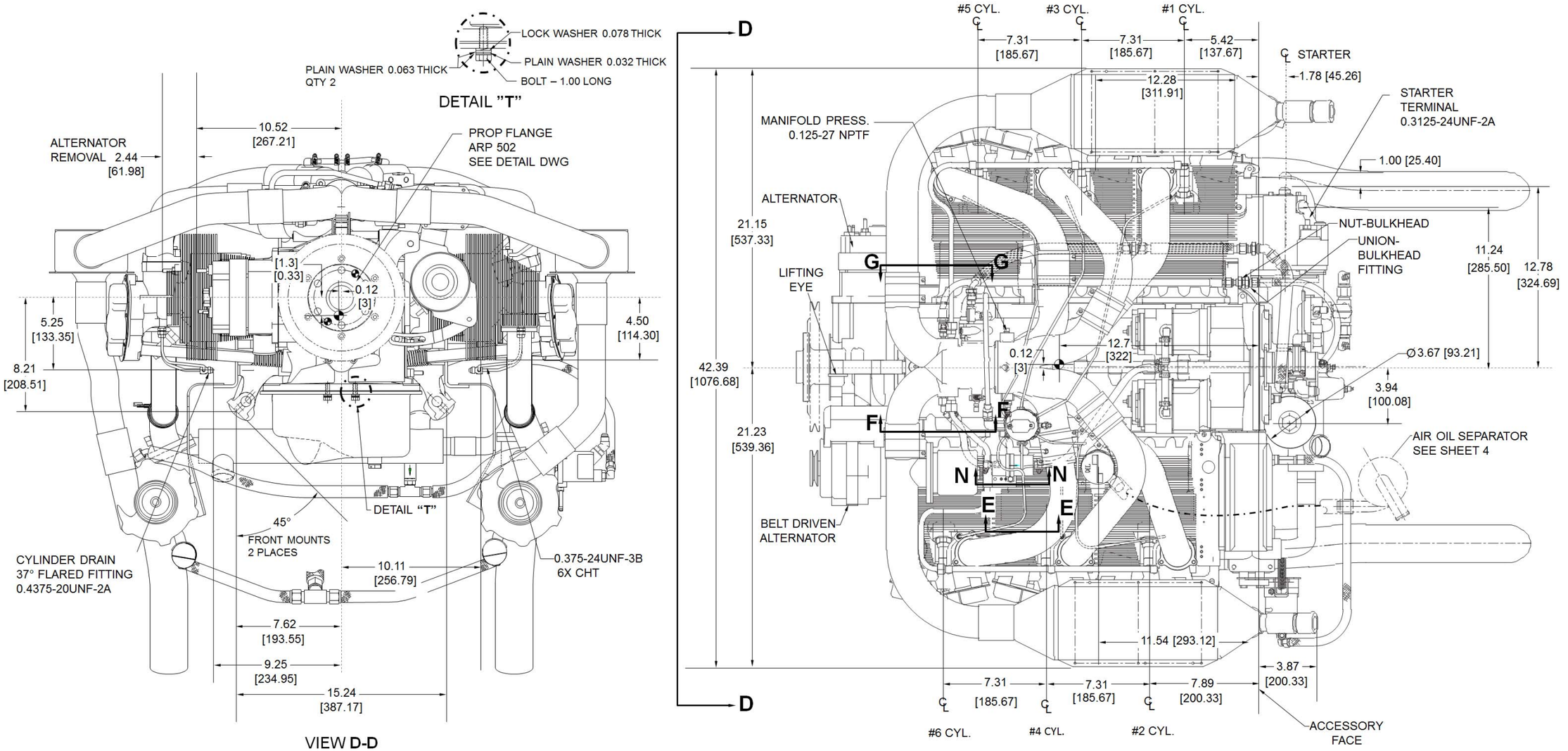


Figure 5-34. TSIO-550-K Installation Drawing 657645 - Sheet 2 of 4

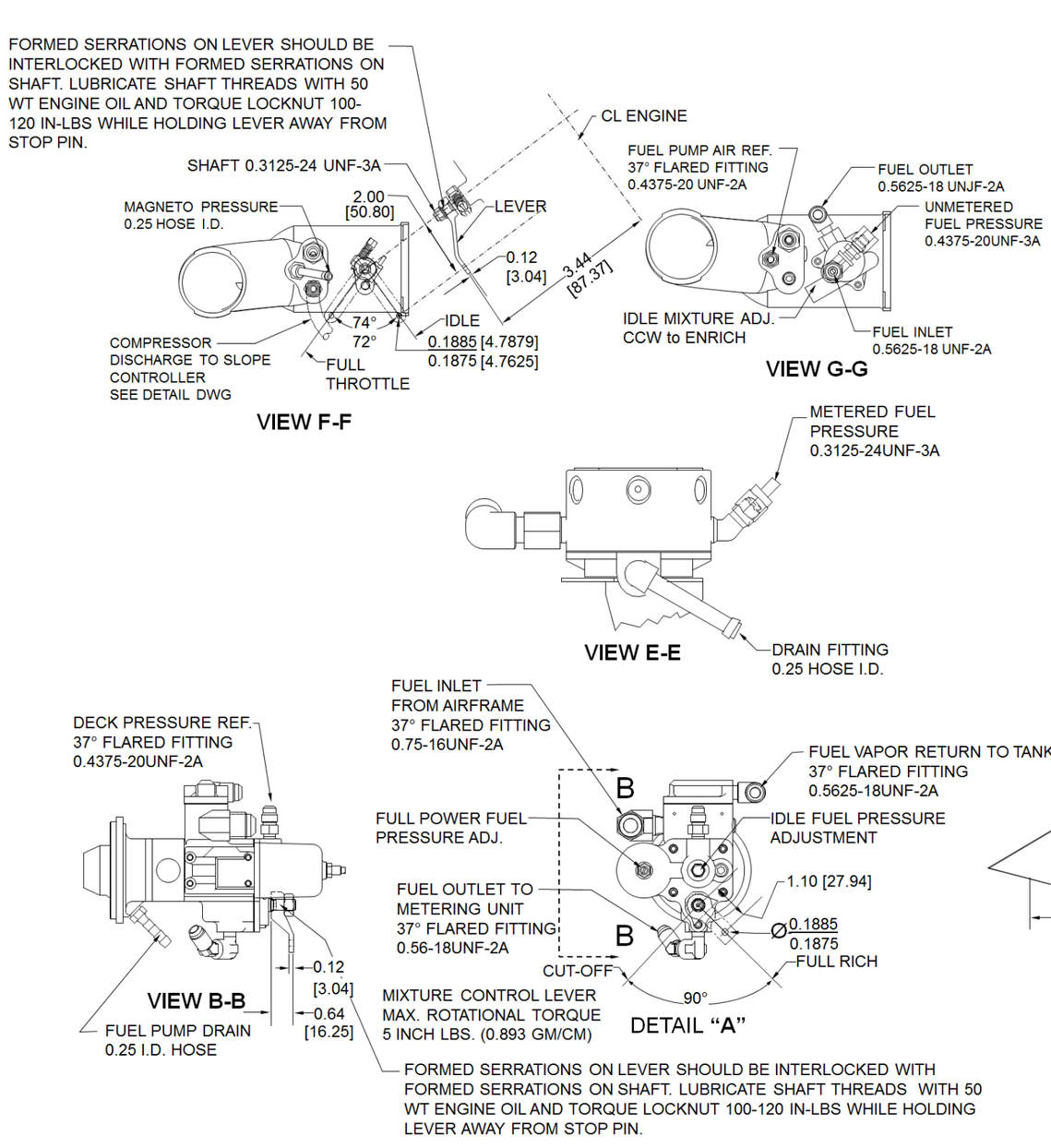
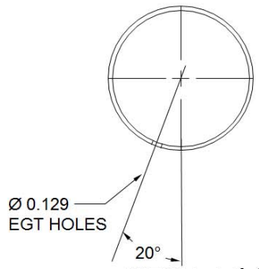
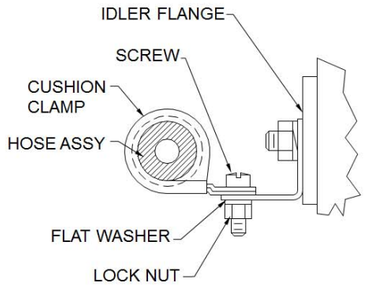


Figure 5-35. TSIO-550-K Installation Drawing 657645 - Sheet 3 of 4

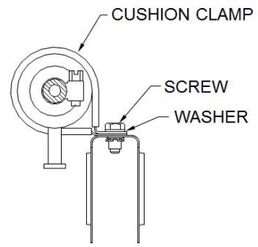


VIEW L-L 1-3-5 CYLINDERS

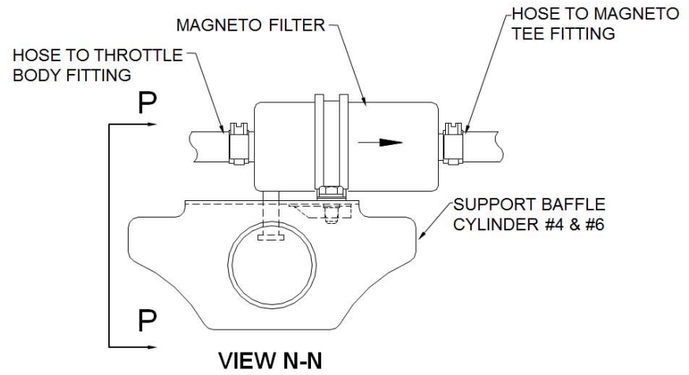
VIEW M-M 2-4-6 CYLINDERS



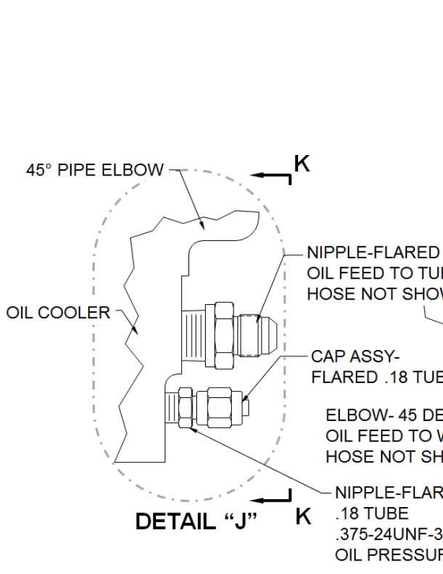
VIEW H-H



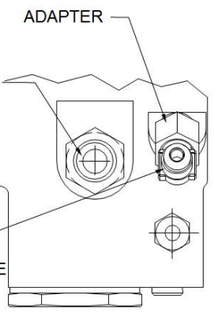
VIEW P-P



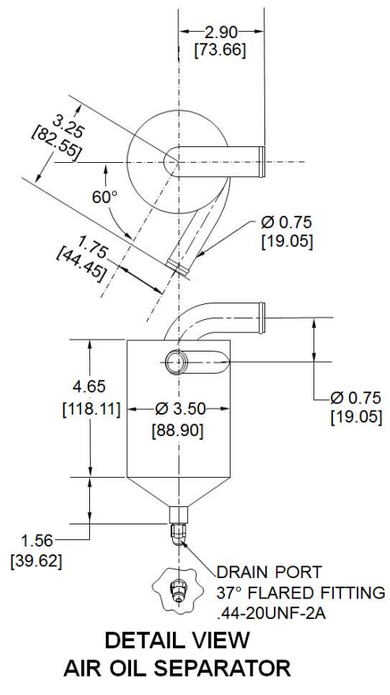
VIEW N-N



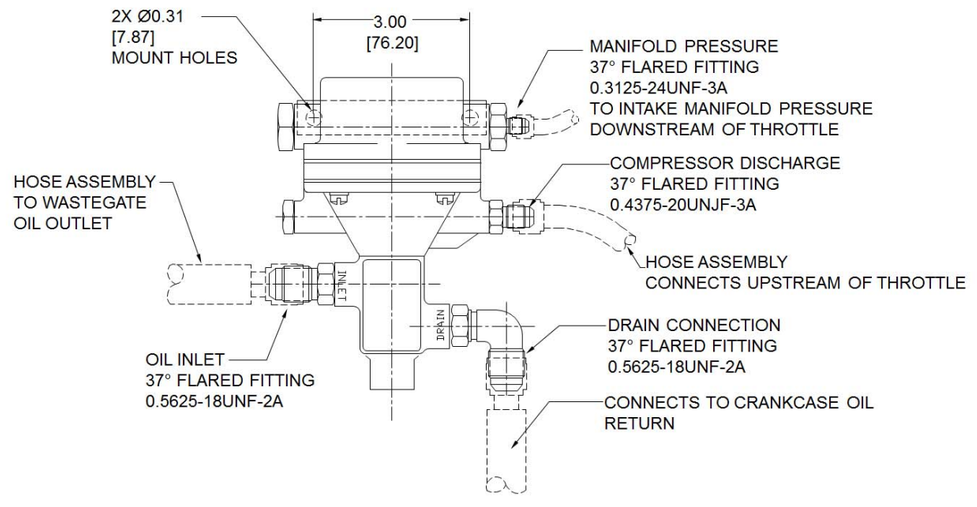
DETAIL "J"



VIEW K-K



DETAIL VIEW
AIR OIL SEPARATOR



DETAIL VIEW
AIRFRAME MOUNTED
SLOPE CONTROLLER

Figure 5-36. TSIO-550-K Installation Drawing 657645 - Sheet 4 of 4

5-4.7. TSIO-550-N Engine Installation Drawings

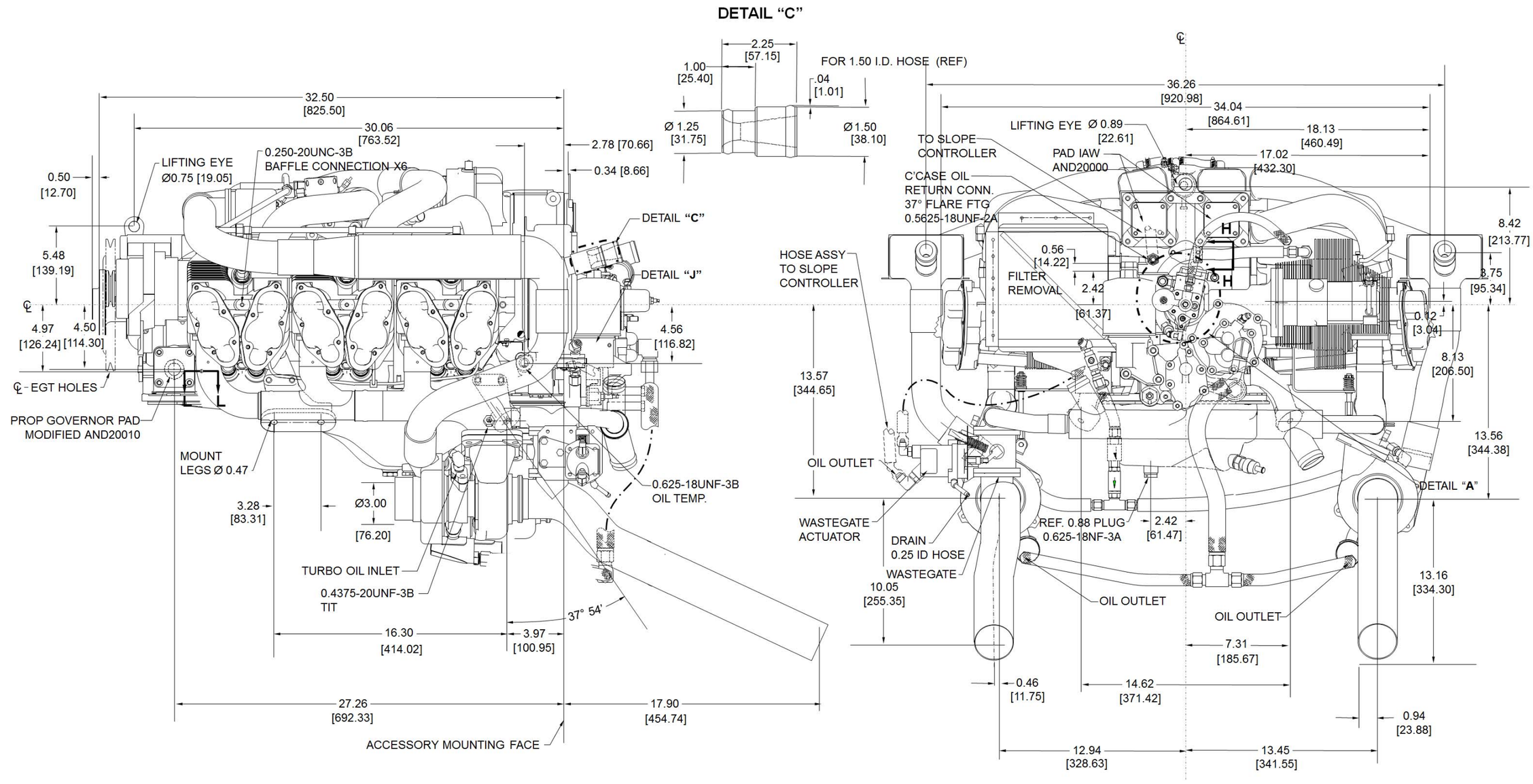


Figure 5-37. TSIO-550-N Installation Drawing 658233 - Sheet 1 of 5

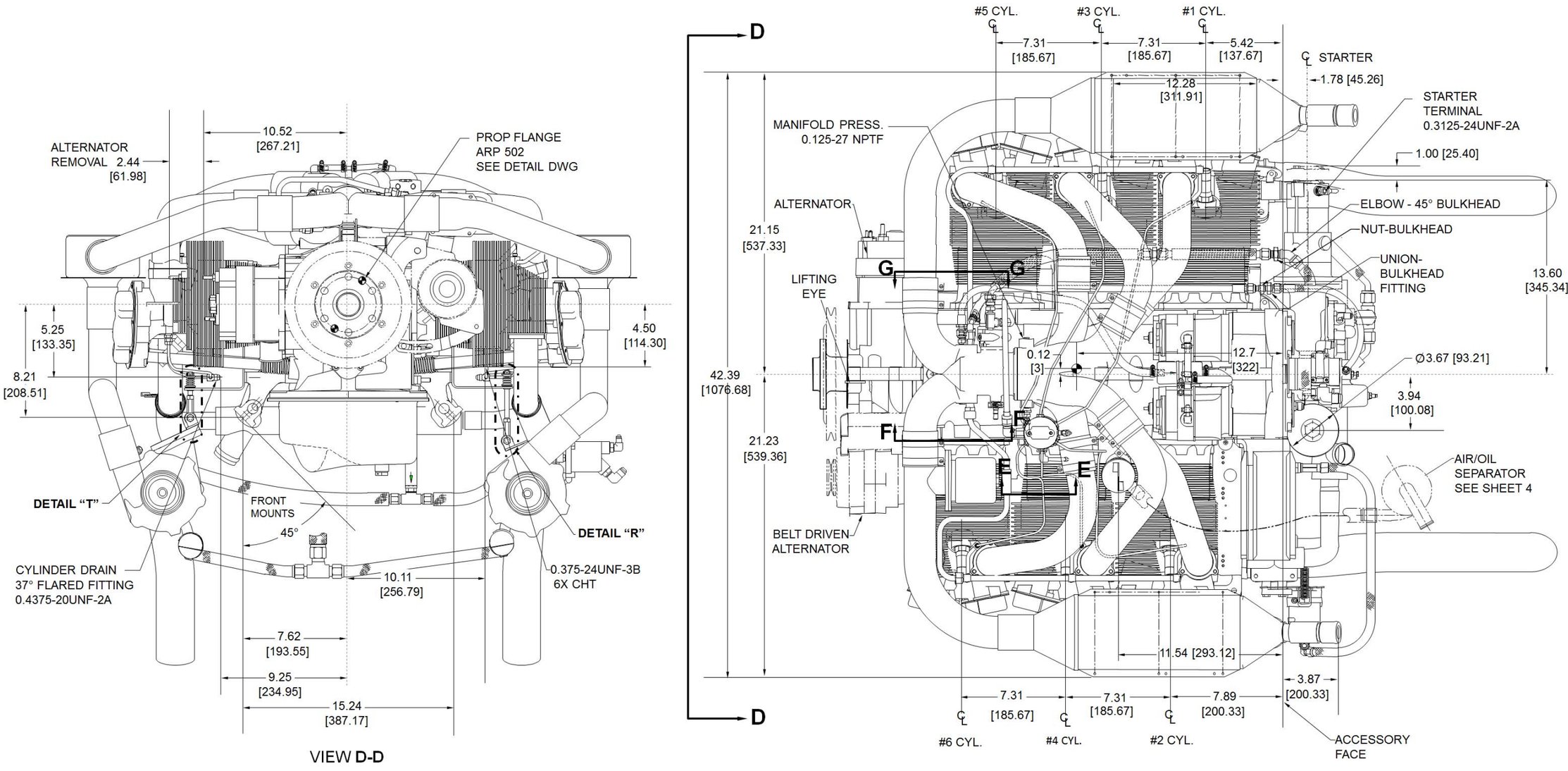


Figure 5-38. TSIO-550-N Installation Drawing 658233 - Sheet 2 of 5

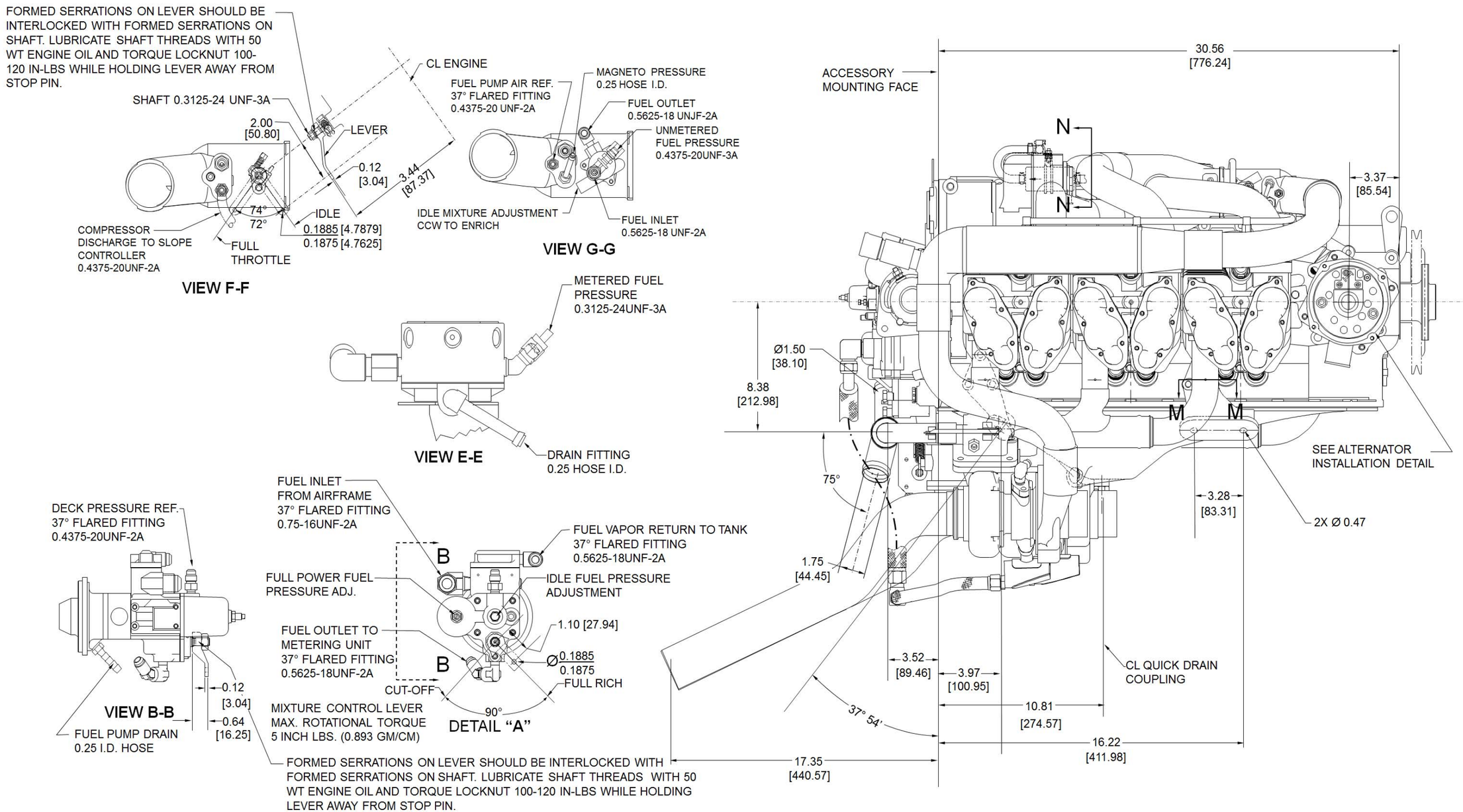
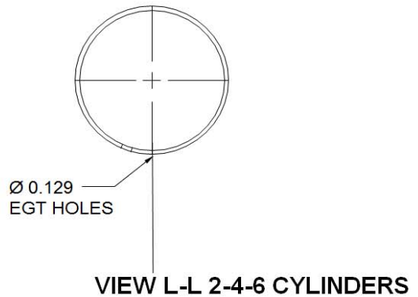
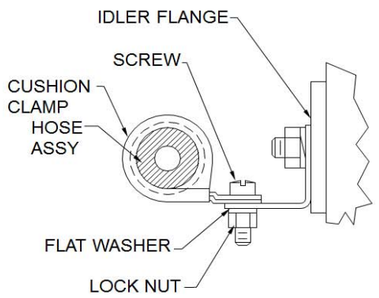


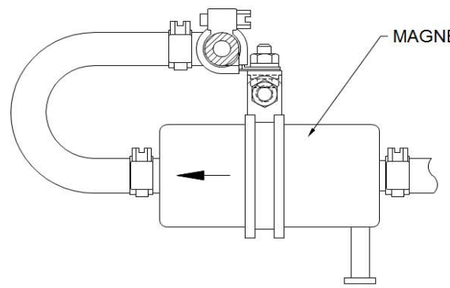
Figure 5-39. TSIO-550-N Installation Drawing 658233 - Sheet 3 of 5



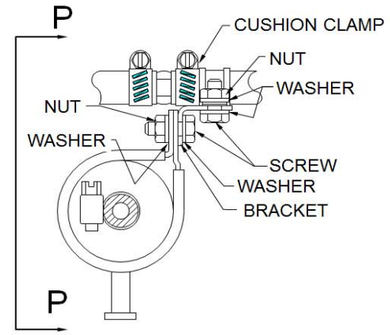
VIEW L-L 2-4-6 CYLINDERS
VIEW M-M 1-3-5 CYLINDERS



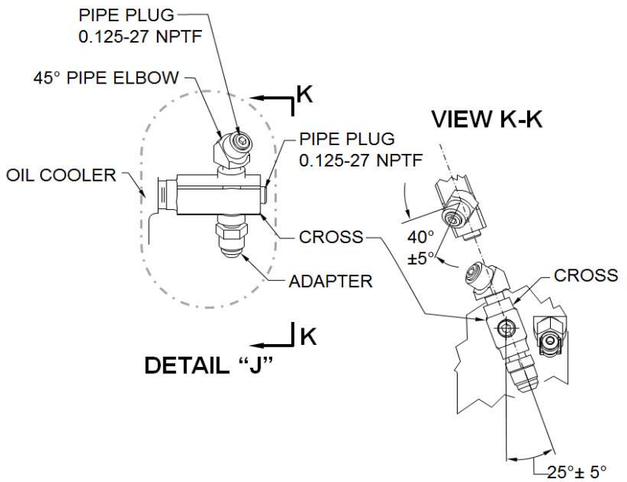
VIEW H-H

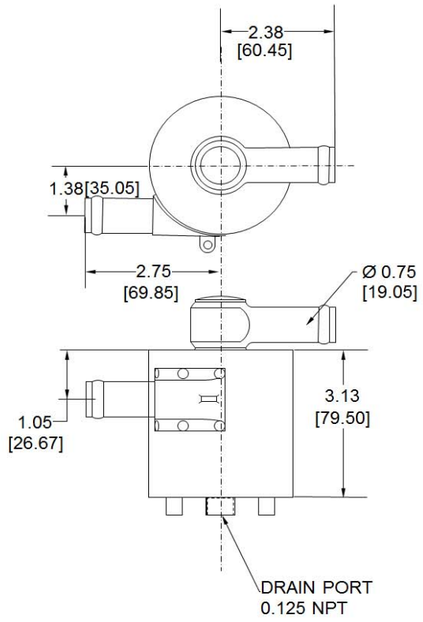


VIEW P-P

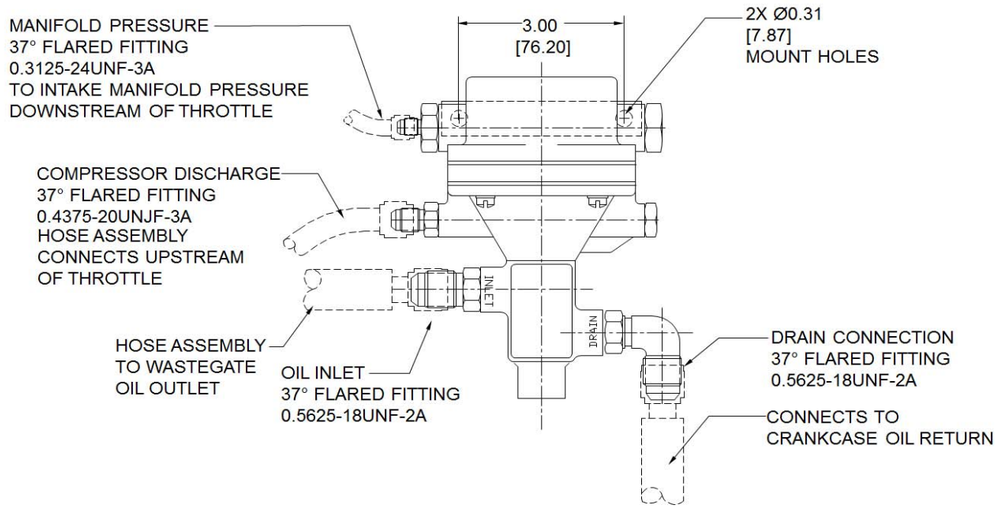


VIEW N-N



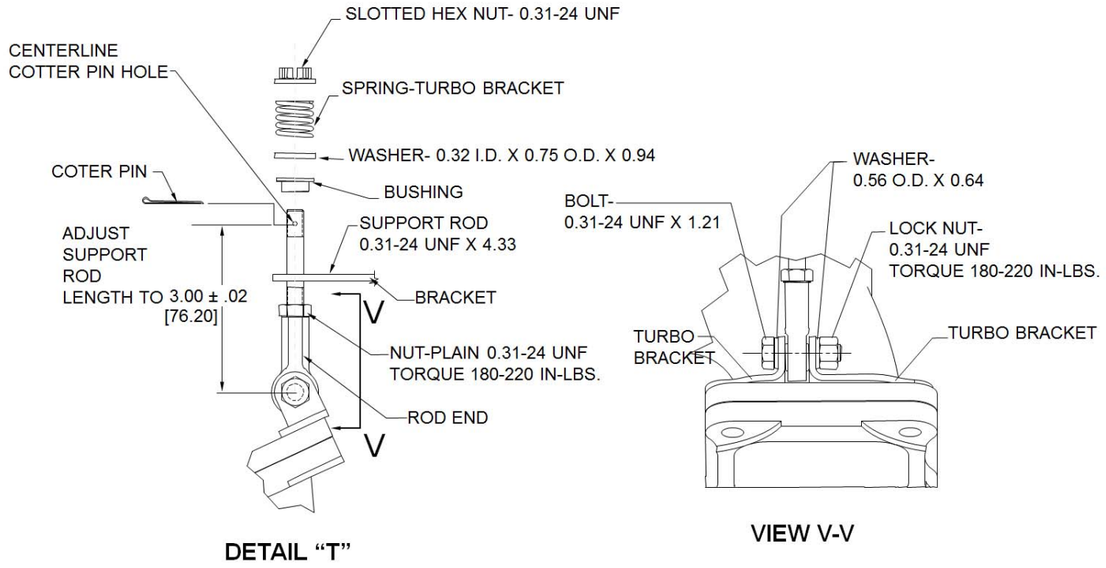


DETAIL VIEW
AIR OIL SEPARATOR

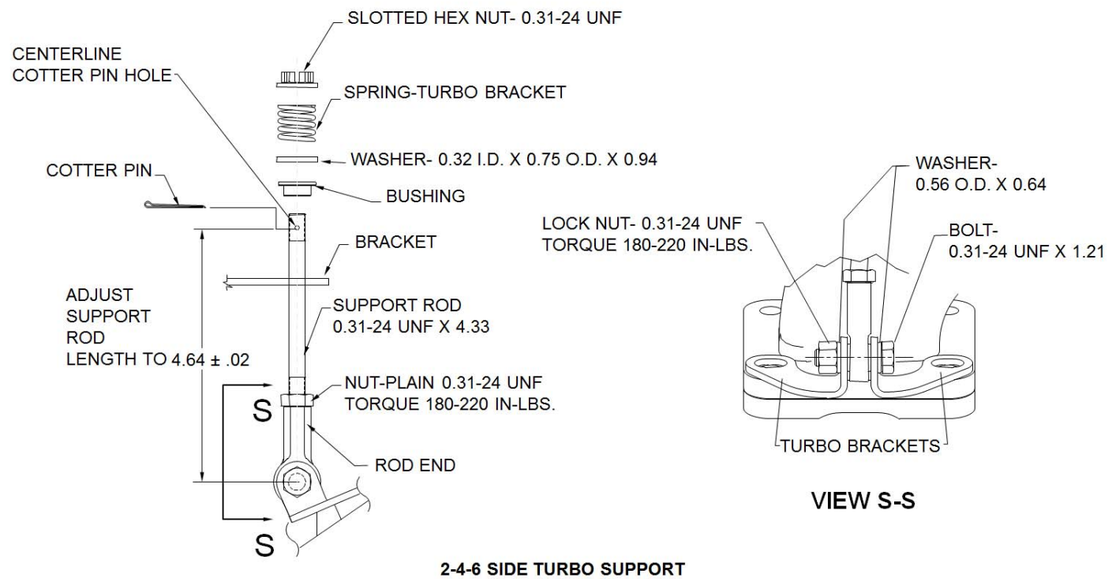


DETAIL VIEW
AIRFRAME MOUNTED
SLOPE CONTROLLER

Figure 5-40. TSIO-550-N Installation Drawing 658233 - Sheet 4 of 5



1-3-5 SIDE TURBO SUPPORT



2-4-6 SIDE TURBO SUPPORT

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.

Table 6-1. Engine Inspection and Maintenance Schedule

Interval		Task	Reference
Cumulative Operating Hours	**Calendar**		
See Table 6-2 in M-0, Standard Practice Maintenance Manual		Drive Belt (optional equipment) Tension Check	Section 6-3.1
		Hartzell Alternator Initial Inspection (One Time)	Section 6-3.1
		Initial operation inspection after placing a new, rebuilt, or overhauled engine in service, including cylinder replacement. Repeat this inspection after each 25 hours of operation until oil consumption stabilizes.	Section 6-3.2
		Oil Change (with integral oil screen)	Section 6-3.8
		50-Hour engine inspection and service	Section 6-3.3
		100-Hour engine inspection and service	Section 6-3.4
		Clean fuel injector nozzles	Section 6-3.4
		Magneto inspection	Section 6-3.4
		500-Hour inspection and service	Section 6-3.5

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.

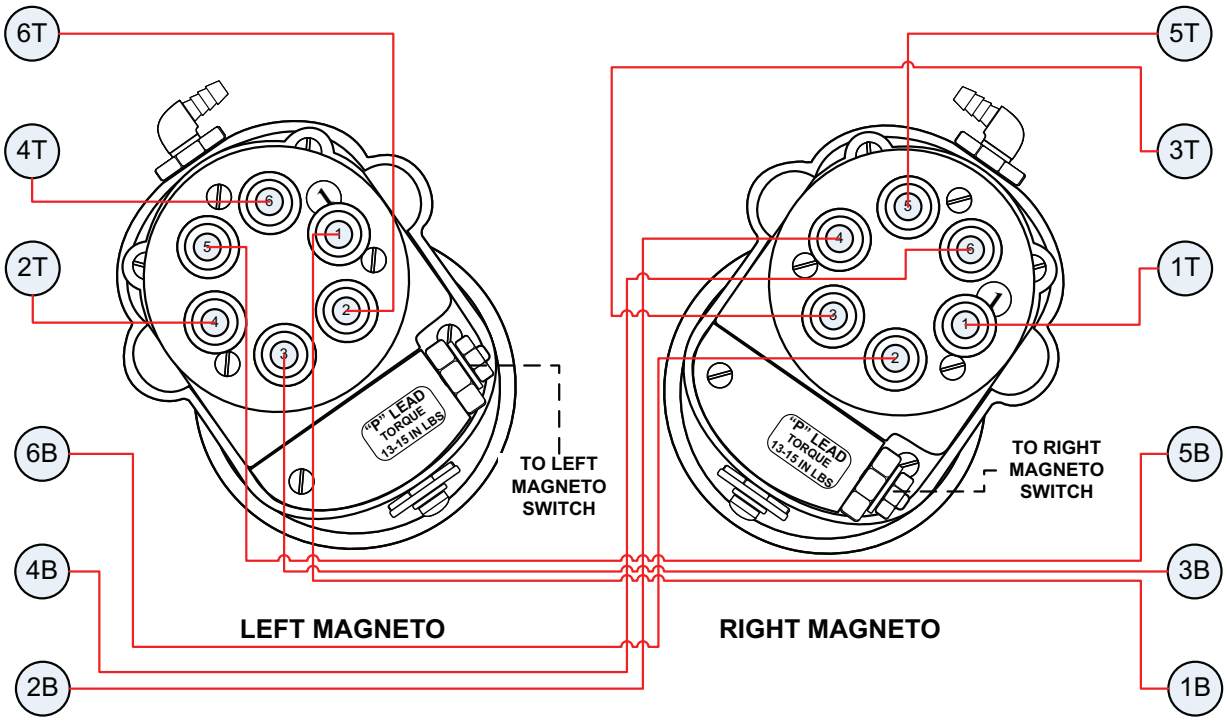

Figure 6-1. Champion (Slick) Ignition Harness Routing

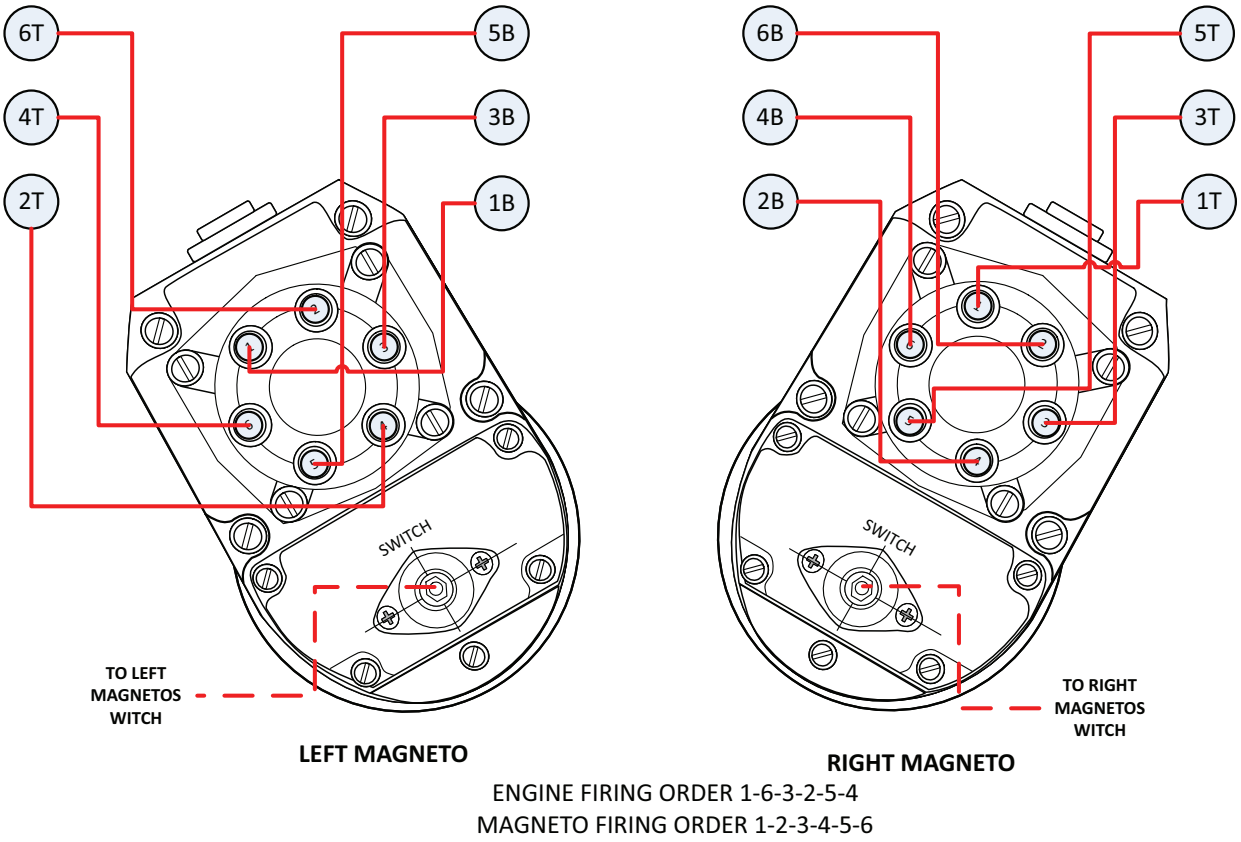

Figure 6-2. Continental (Bendix) Ignition Harness Routing

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.

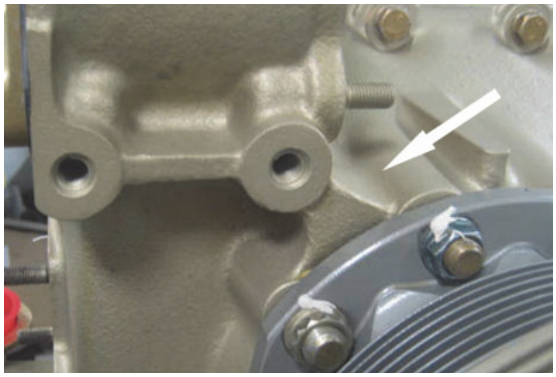

Figure 6-3. Mount Boss with Thick Rib

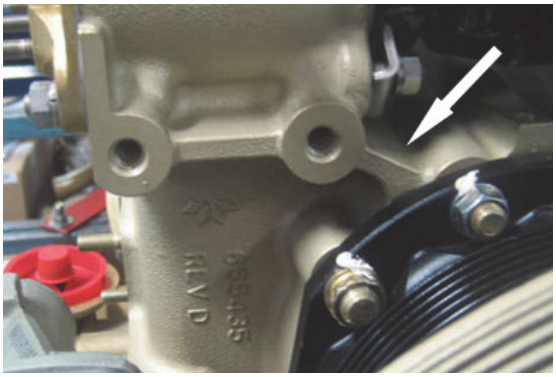

Figure 6-4. Mount Boss with Thin Rib

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.

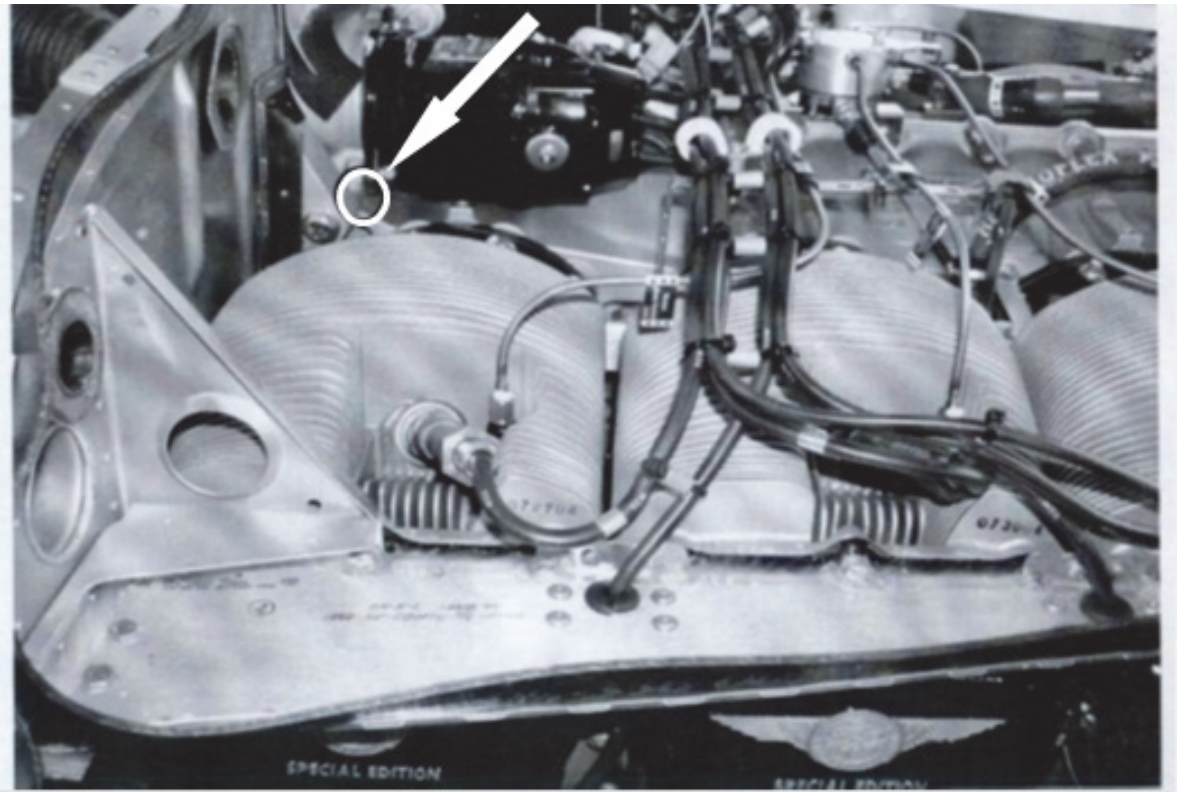

Figure 6-5. General Inspection Area

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

Refer to the "Engine Mount Inspection" in Section 6-4.13 of M-0, Standard Practice Maintenance Manual.

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.

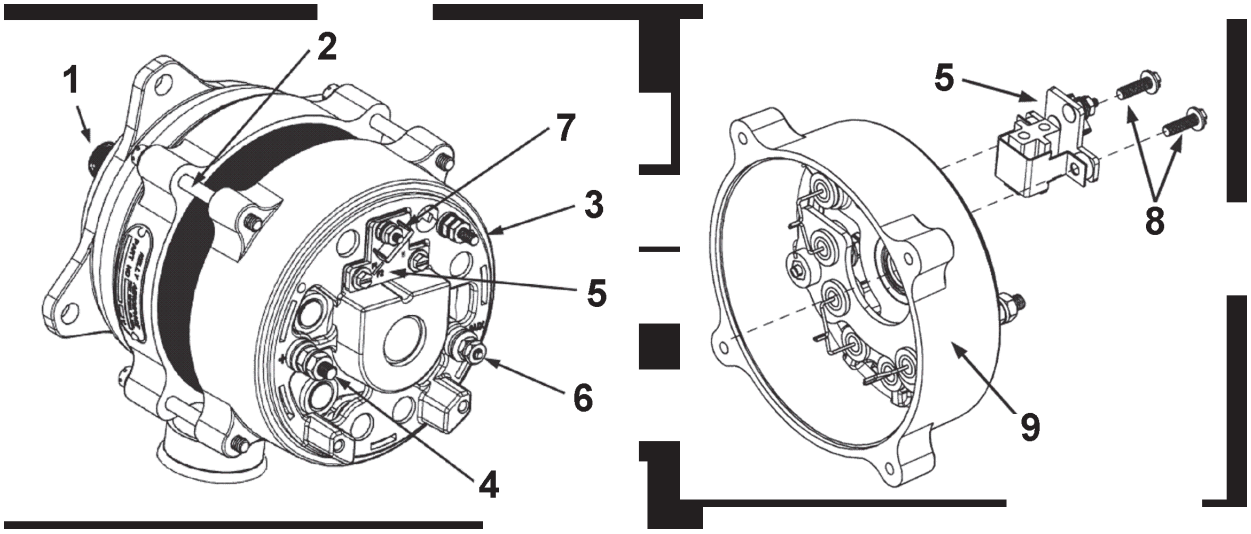

Figure 6-7. ES10024 Alternator

1	Output Shaft	4	Battery Terminal	6	Aux Terminal	8	Screws
2	Thru Bolts	5	Brush Assembly	7	Field Terminal	9	Slip Ring End Housing
3	Ground Terminal						

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.

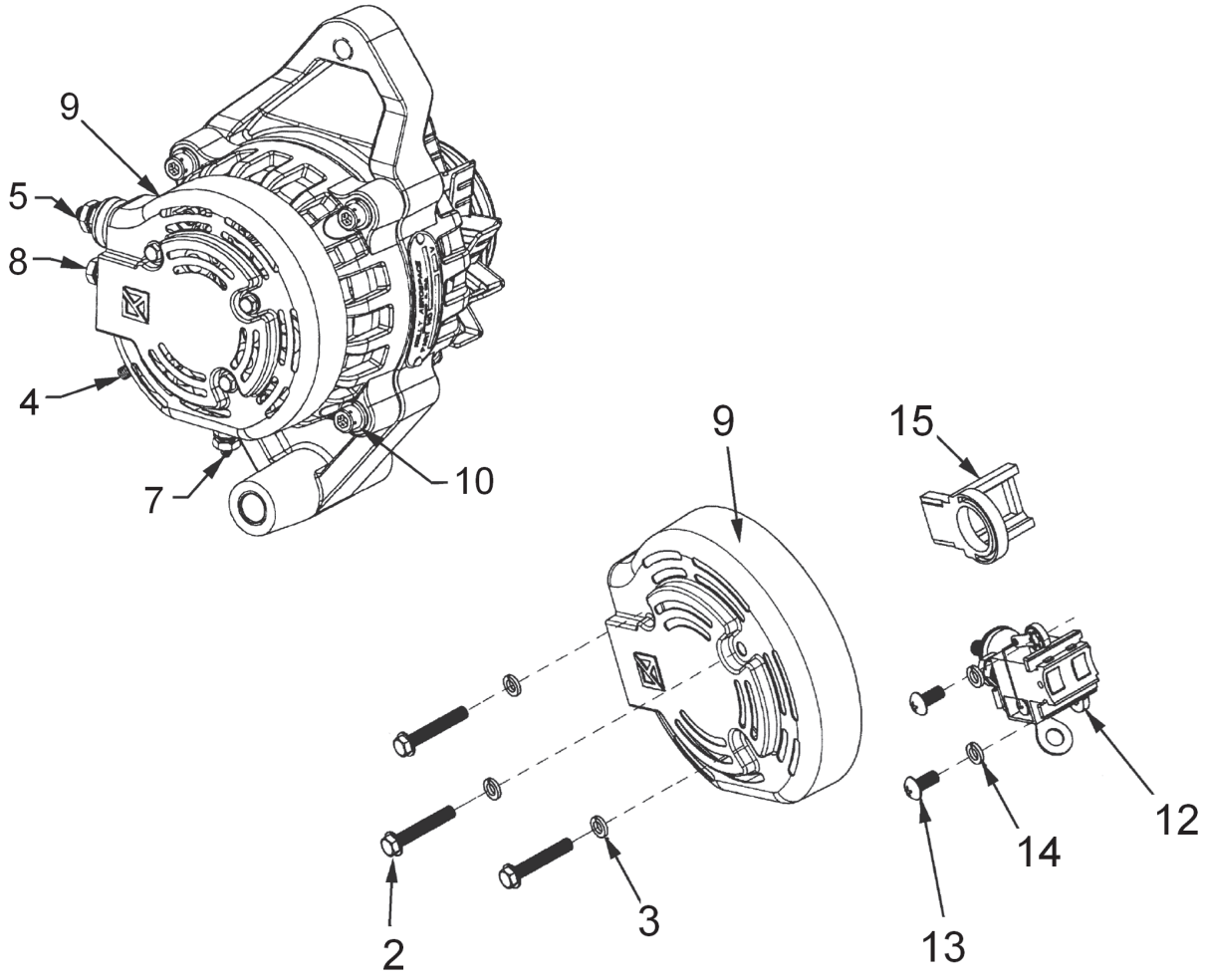

Figure 6-8. ES7024 Alternator Assembly

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

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.

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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.

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.

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.

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.
3. Monitor temperatures closely.
4. Maintain sufficient airspeed and attitude to provide engine cooling.
5. Cowl flaps ..... FULLY OPEN (if equipped)

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.

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.

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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.

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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.

S*ervice 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

Replaceable Item	Reference
Alternator	Section 10-5, “Alternator Replacement”
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”
Engine Mounts	Section 13-9.3, “Engine and Turbocharger Mount Disassembly” 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” and 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

Repairable Item	Reference
Crankcase Cracks	Section 15-8.10, “Crankcase Overhaul Repair”
Engine Cylinder	Section 10-8, “Engine Cylinder Maintenance”
Oil Cooler	Section 10-7.4, “Oil Cooler Repair and 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 and Oil Suction Tube	Section 10-7.3, “Oil Sump and Oil Suction Tube Repair and Replacement”
Starter Motor	Section 10-4, “Starter Motor and Adapter Replacement”

Table 10-3. Parts Handling Guidelines

Parts/Components	Handling Instructions
Wrapped new or rebuilt parts	Parts that require protection from atmospheric dust and moisture should be wrapped or boxed after acceptance inspection and remain wrapped until time of installation
Spark plugs	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.

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.

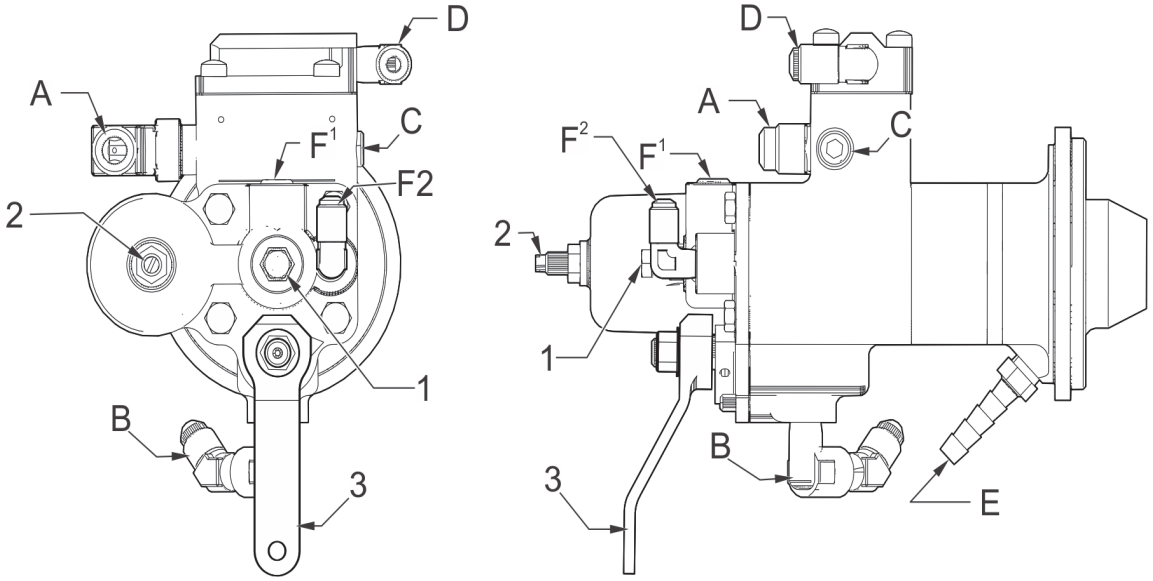

Figure 10-1. Fuel Pump Adjustments & Fittings (typical)

Fittings	
A	Fuel Inlet
B	Fuel Outlet (Unmetered Pressure)
C	Fuel Return
D	Fuel Vapor Return
E	Drain
F	Ambient (or Deck) Pressure Reference

Adjustments	
1	Low Pressure Relief Valve CW = INCREASE
2	Aneroid Adjustment CCW = INCREASE
3	Mixture Control 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.

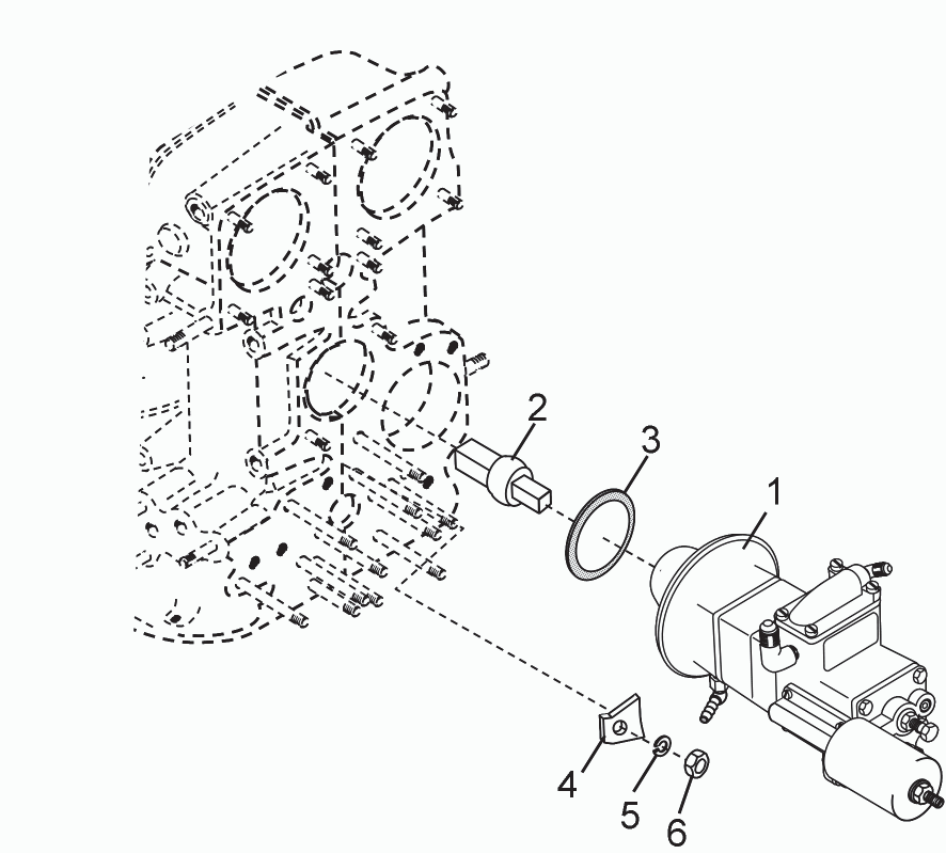

Figure 10-2. Fuel Pump Assembly

1	Fuel Pump Assembly	4	Hold Down Washer
2	Coupling, Fuel Pump Drive	5	Lock Washer
3	Fuel Pump Gasket	6	Nut

10-2.2. Fuel Pump Service Limits

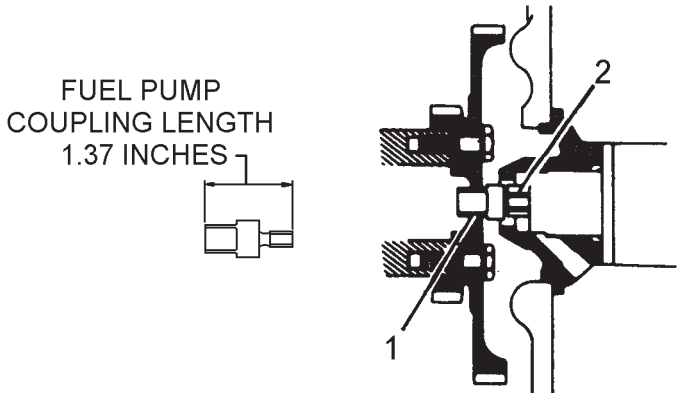

Figure 10-3. Fuel Pump Drive Coupling Fits and Limits

Table 10-4. Fuel Pump Drive Coupling Dimensions

Ref. No.	Part	Dimensions (inches)	
		Minimum	Maximum
1	Fuel pump drive coupling to crankshaft gear ..... Clearance:	0.0095L	0.0155L
2	Fuel pump drive coupling to fuel pump ..... Clearance:	0.0030L	0.0090L
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 (F^1 or F^2,depending on engine model) according to "Hose and Tubing Installation" instructions in Section C-11of 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.

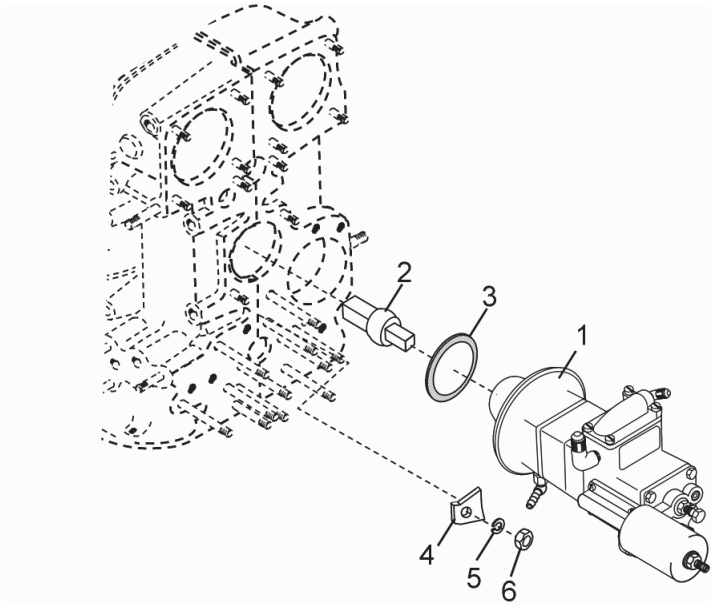

Figure 10-2 repeated for reference

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.

Refer to "Fuel Injector Replacement" in Section 10-2 of M-0, Standard Practice Maintenance Manual.

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.

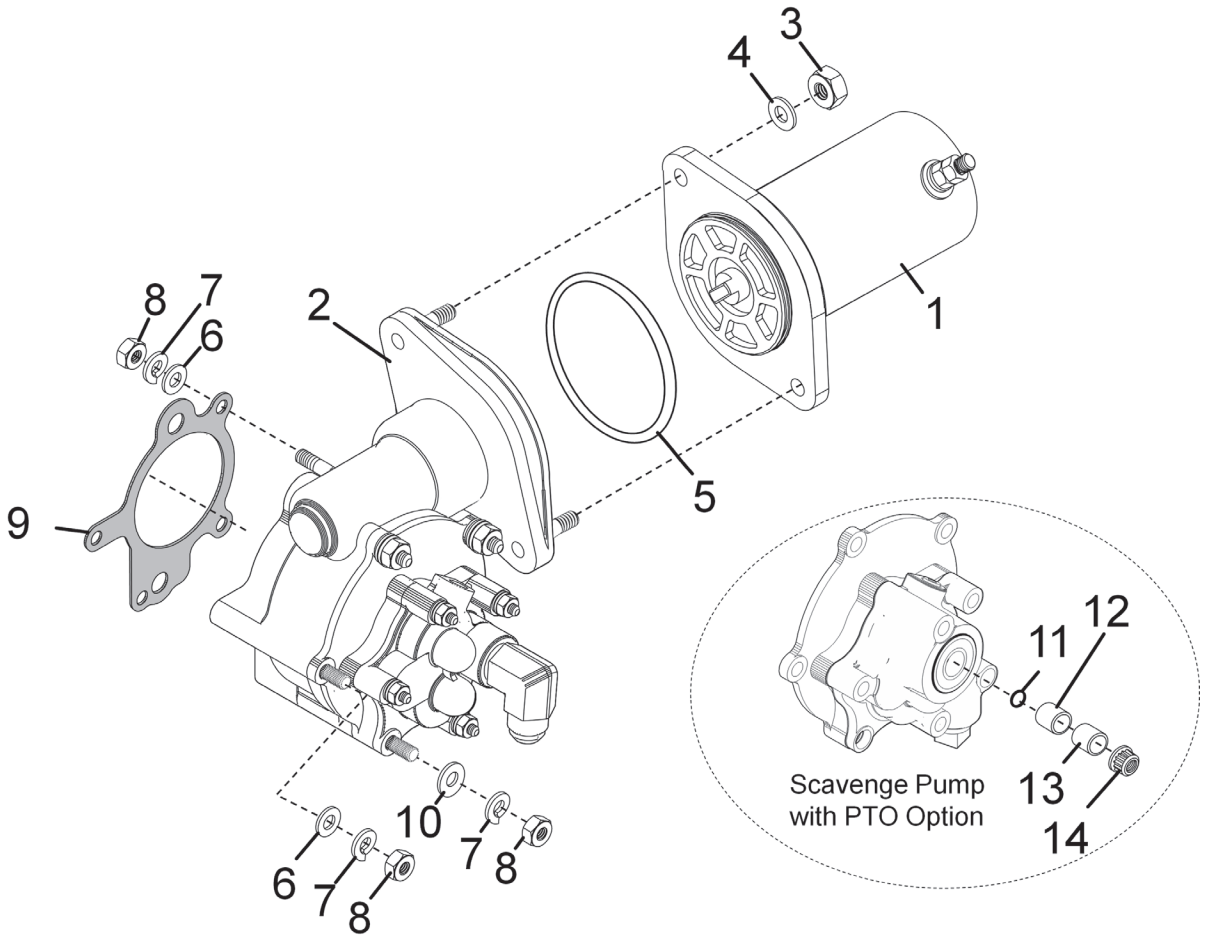

Figure 10-4. Starter Motor and Starter Adapter

1	Starter Motor	5	O-ring	9	Gasket	13	Spacer
2	Starter Adapter	6	Washer	10	Washer	14	Lock Nut
3	Nut	7	Lock washer	11	O-ring		
4	Washer	8	Nut	12	Sleeve		

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.

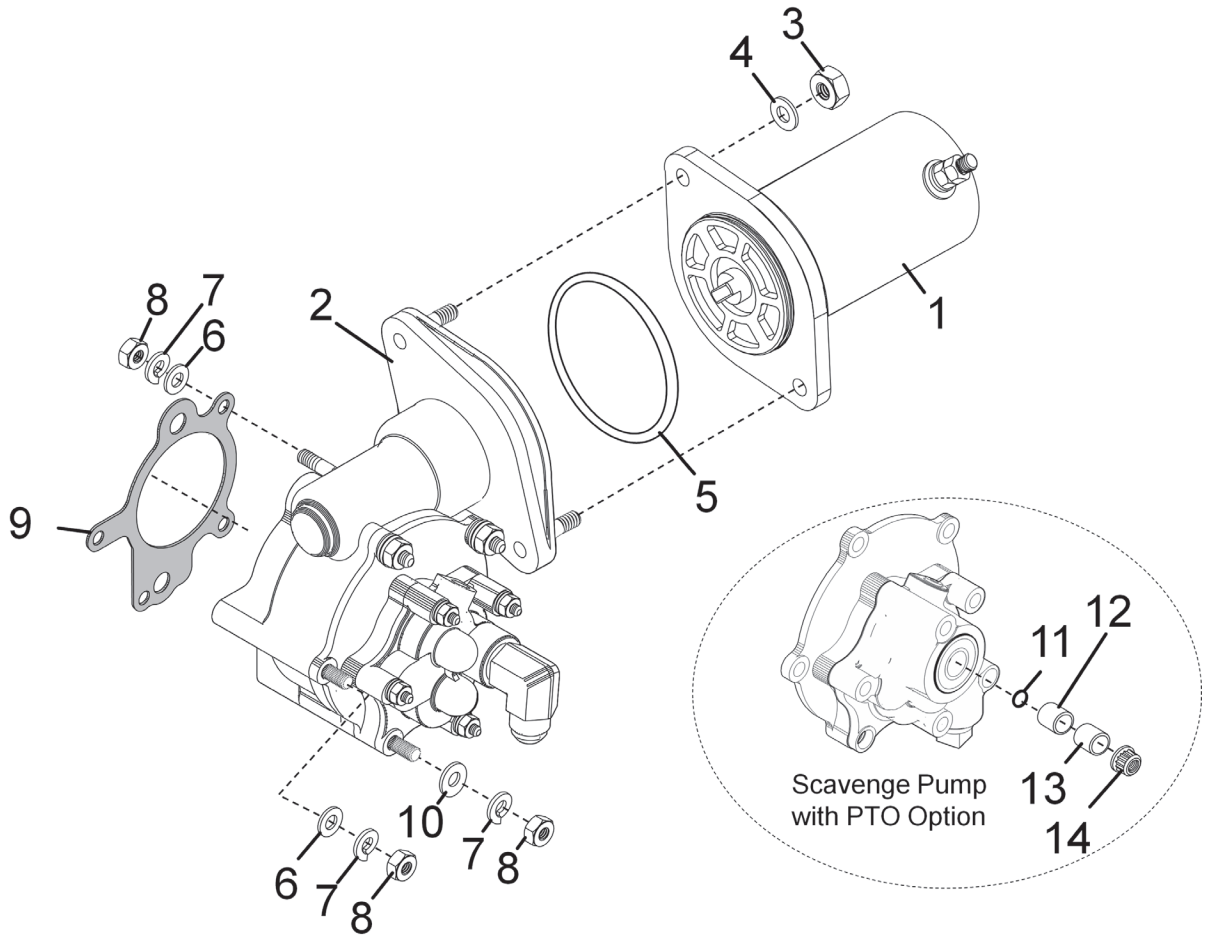

Figure 10-4 repeated for reference

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

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

1. When the sandblasted diameter finish is smoother than 125 RMS, replace the sleeve

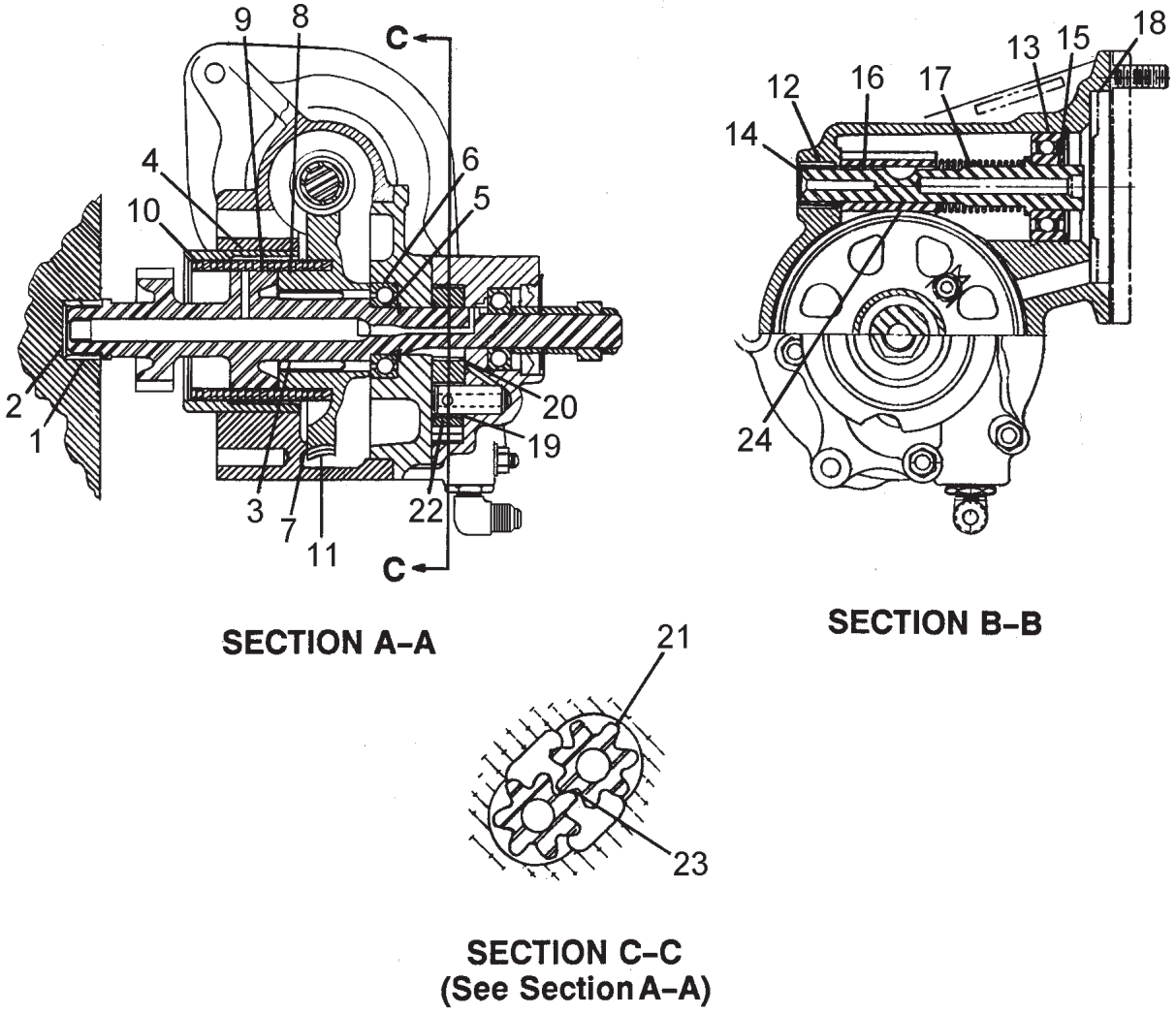

Figure 10-5. Starter and Starter Adapter Dimensions

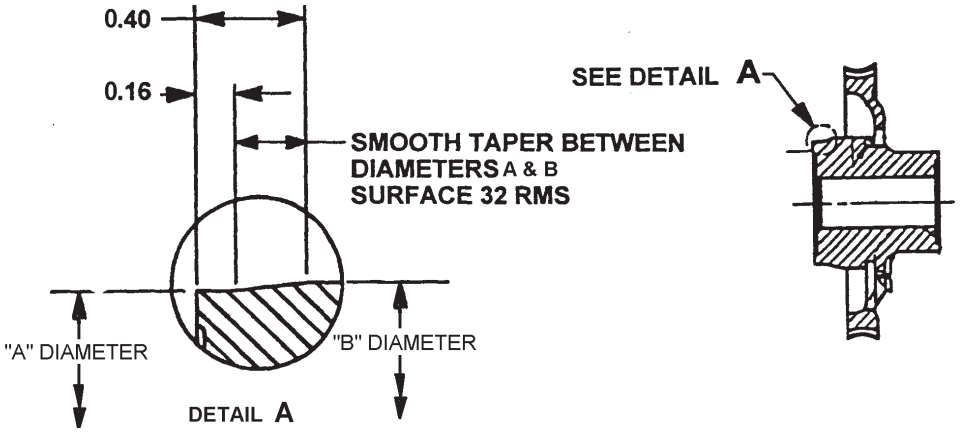

Figure 10-6. Worm Wheel Drum Dimensions

Table 10-6. Worm Wheel Drum Dimensions

Part	"A" Diameter (inches)		"B" Diameter (inches)	
	Minimum	Maximum	Minimum	Maximum
New Worm Wheel Drum	1.931	1.932	1.955	1.960
0.015 Undersize	1.916	1.917	1.940	1.945

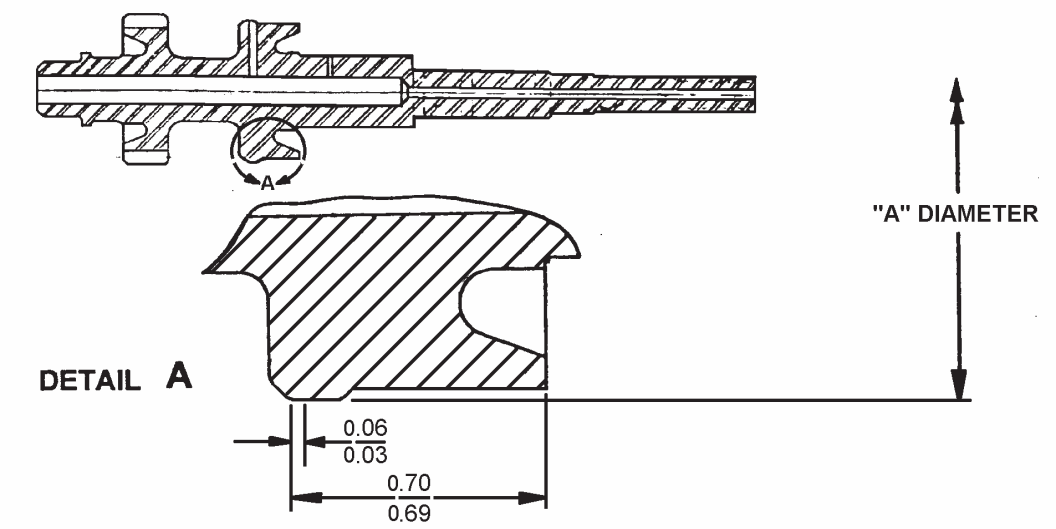

Figure 10-7. Shaft Gear Drum Dimensions

Table 10-7. Shaft Gear Drum Service Limits

Part	"A" Diameter (inches)	
	Minimum	Maximum
New Shaft Gear Drum Dimensions	1.931	1.932
0.015 Undersize	1.916	1.917
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.

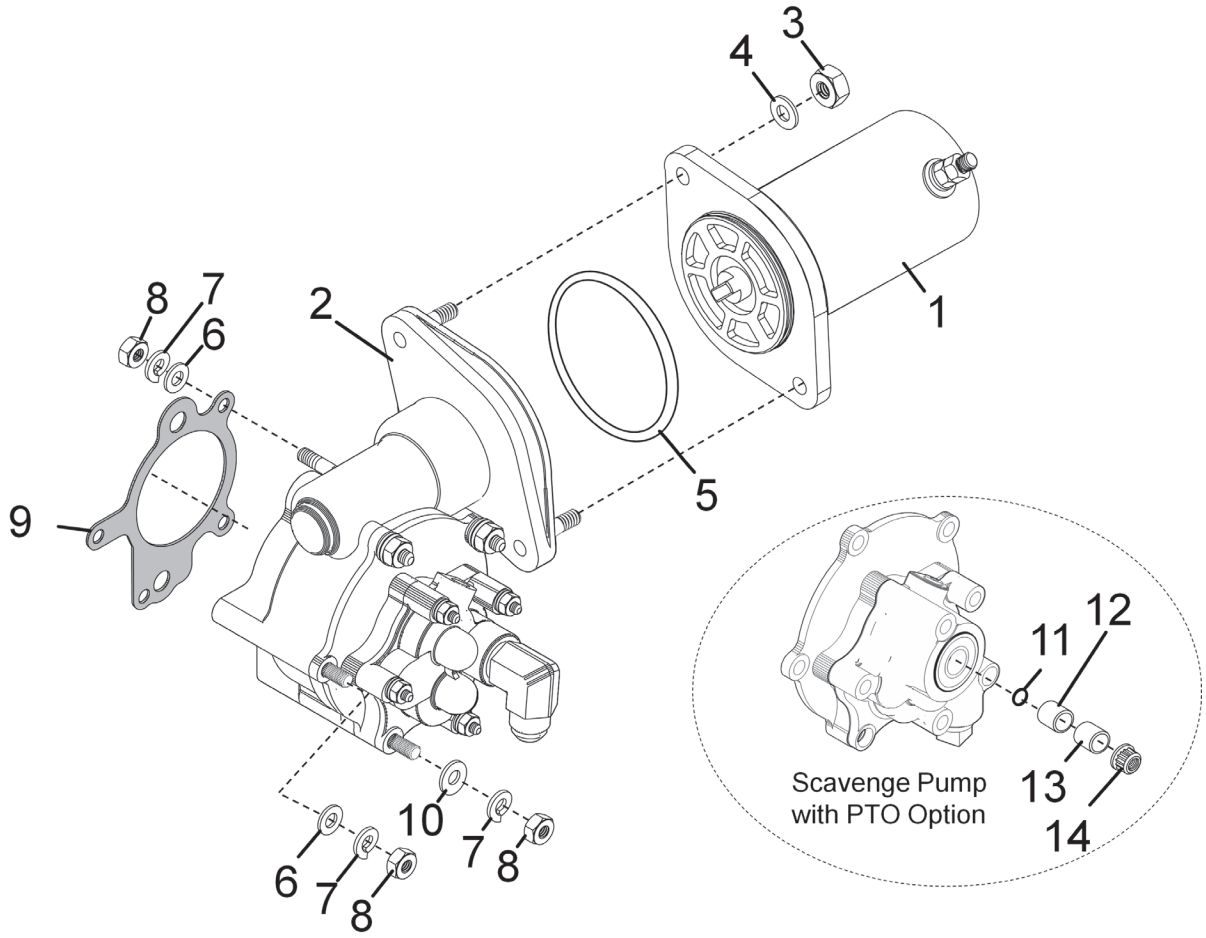

Figure 10-4 repeated for reference

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.

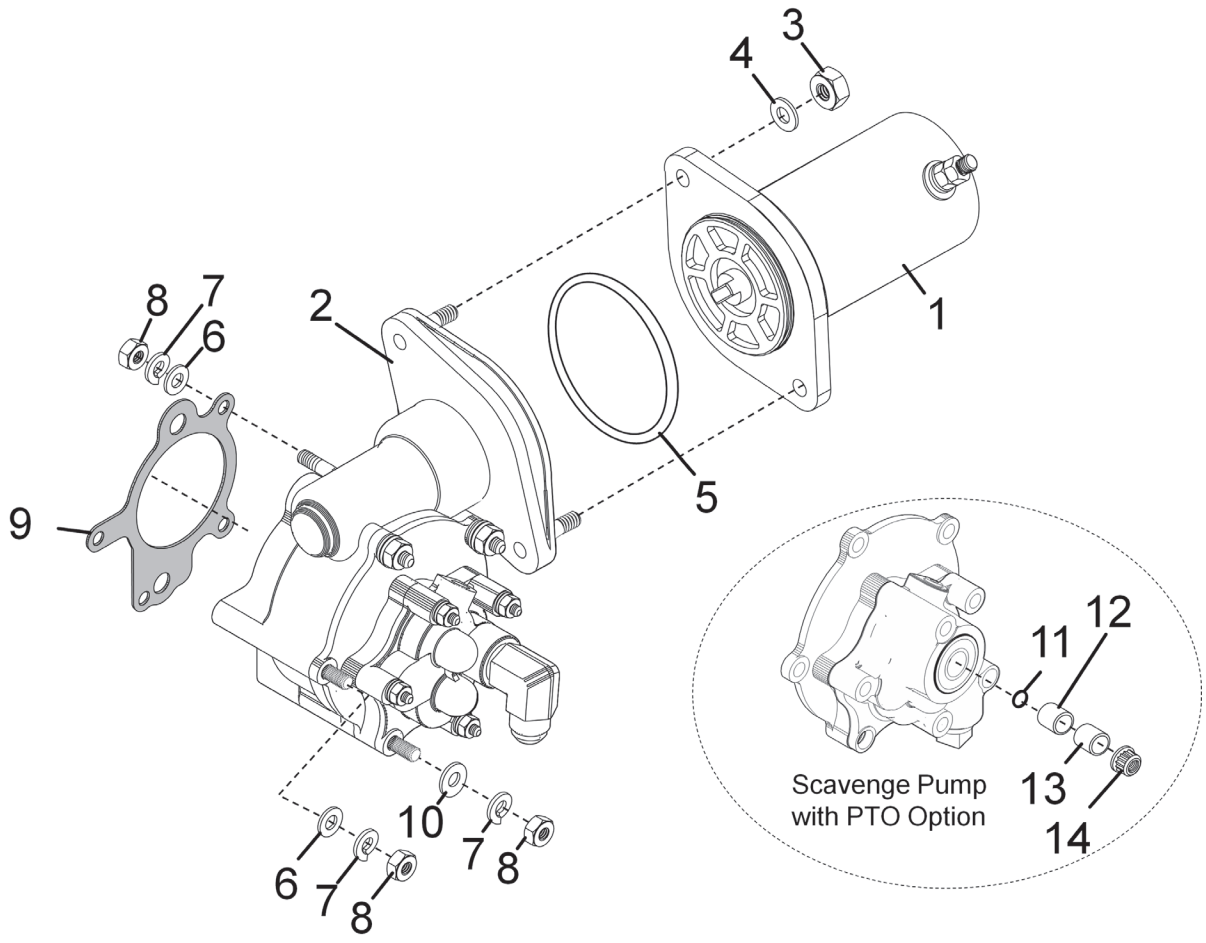

Figure 10-4 repeated for reference

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

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

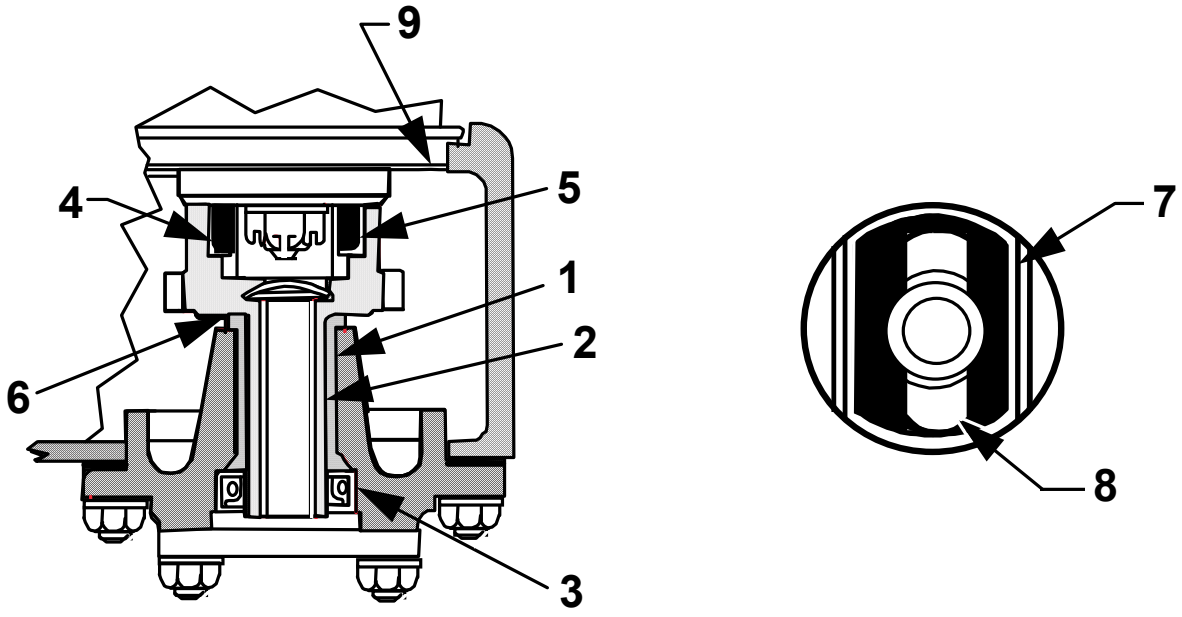

Figure 10-8. Accessory Drive Adapter Dimensions

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.

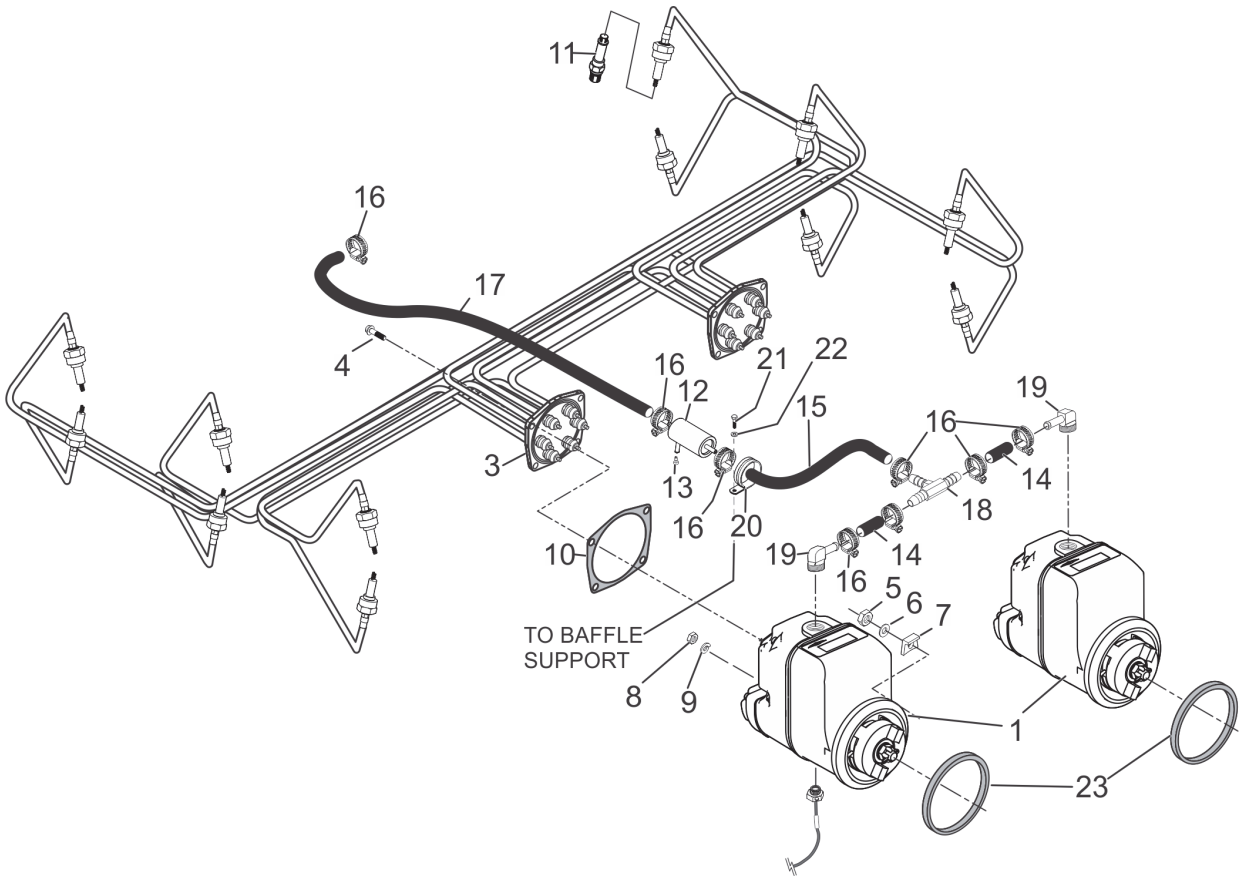

Figure 10-9. Continental Motors Ignition System

1	Magneto	7	Mag Hold Washer	13	Drain, Filter Reducer	19	Elbow Fitting
2	Magneto Tachometer Sensor	8	Nut	14	Hose	20	Clamp
3	Ignition Harness	9	Lock Washer	15	Hose	21	Bolt
4	Screw Assembly	10	Gasket	16	Hose Clamp	22	Washer
5	Nut	11	Spark Plug Assembly	17	Hose	23	Gasket
6	Lock Washer	12	Magneto Filter Assembly	18	Tee		

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.

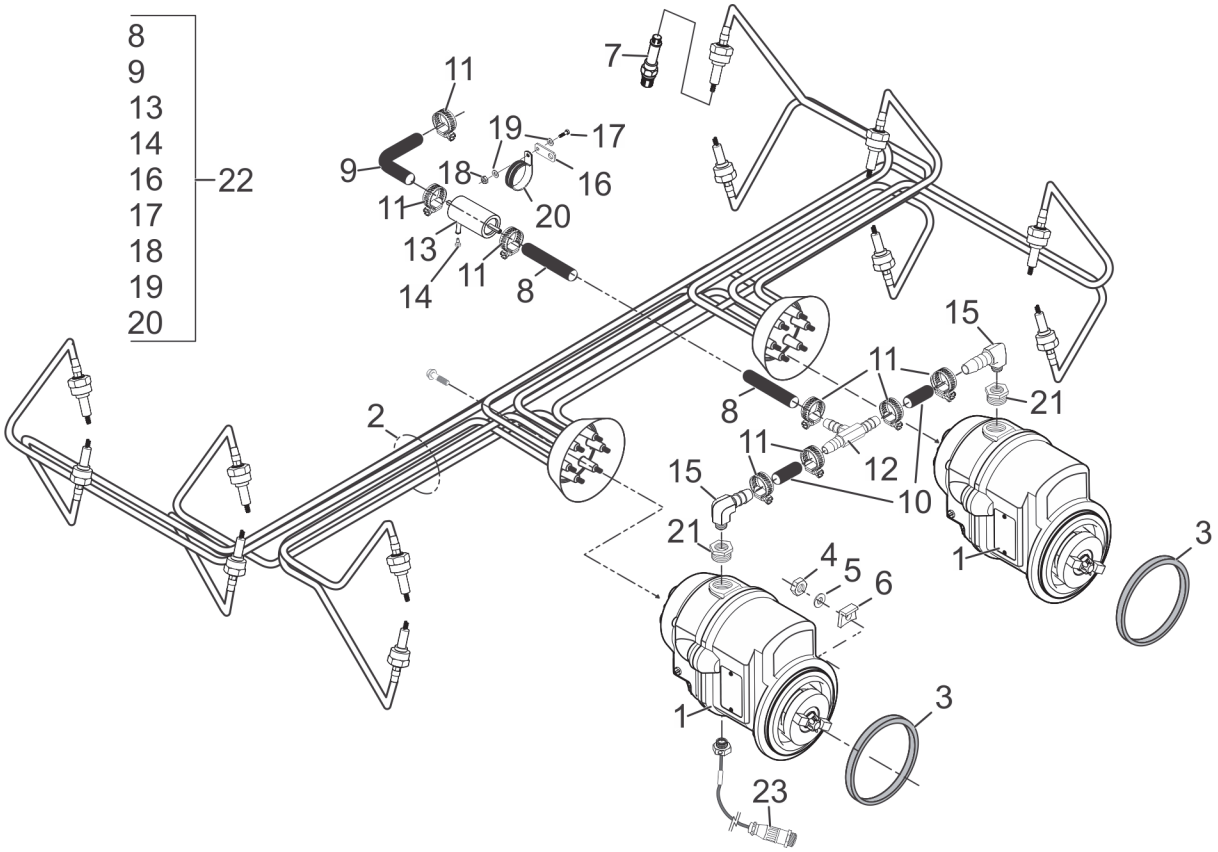

Figure 10-10. Champion (Slick) Ignition System

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
	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 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.

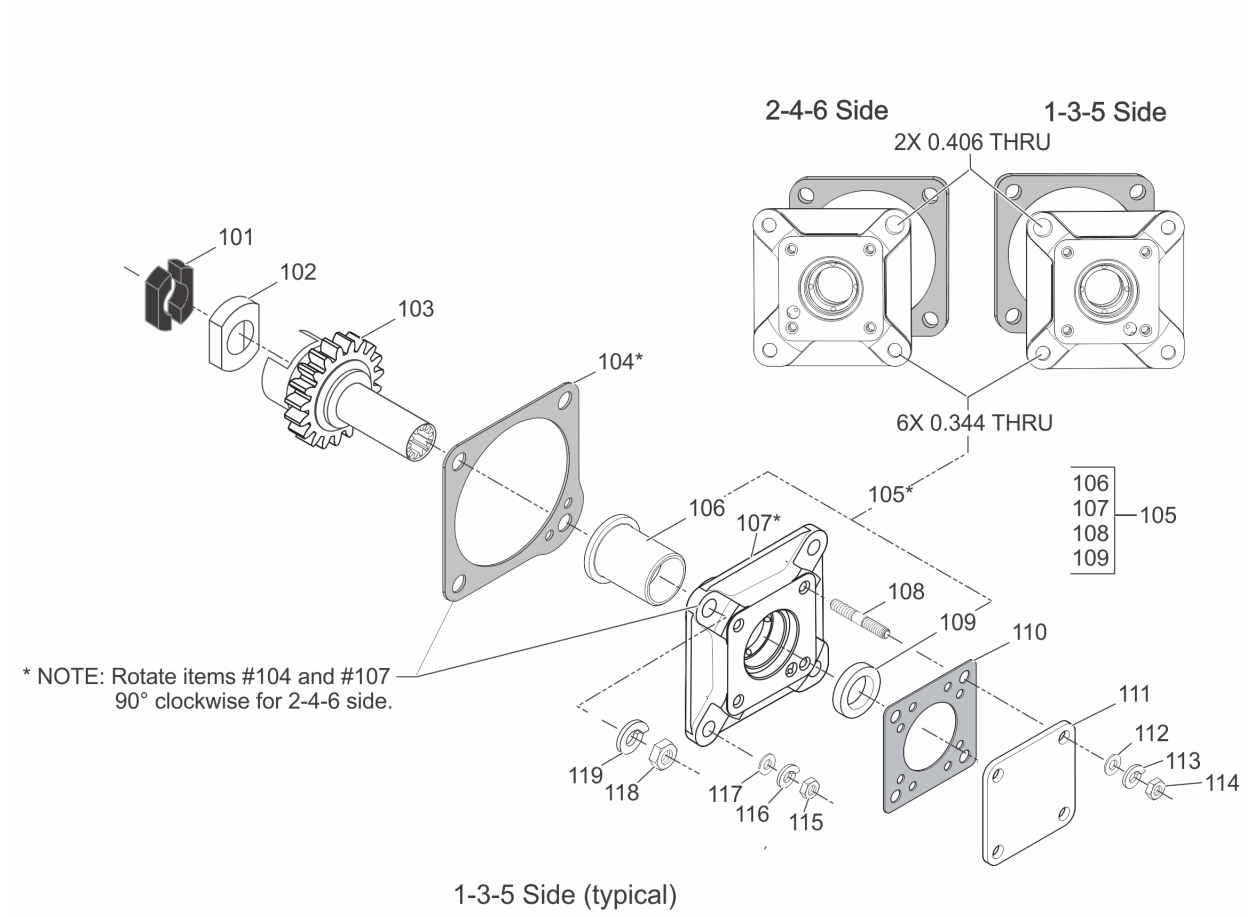

Figure 10-11. Accessory Drive Adapter Assembly

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		

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.

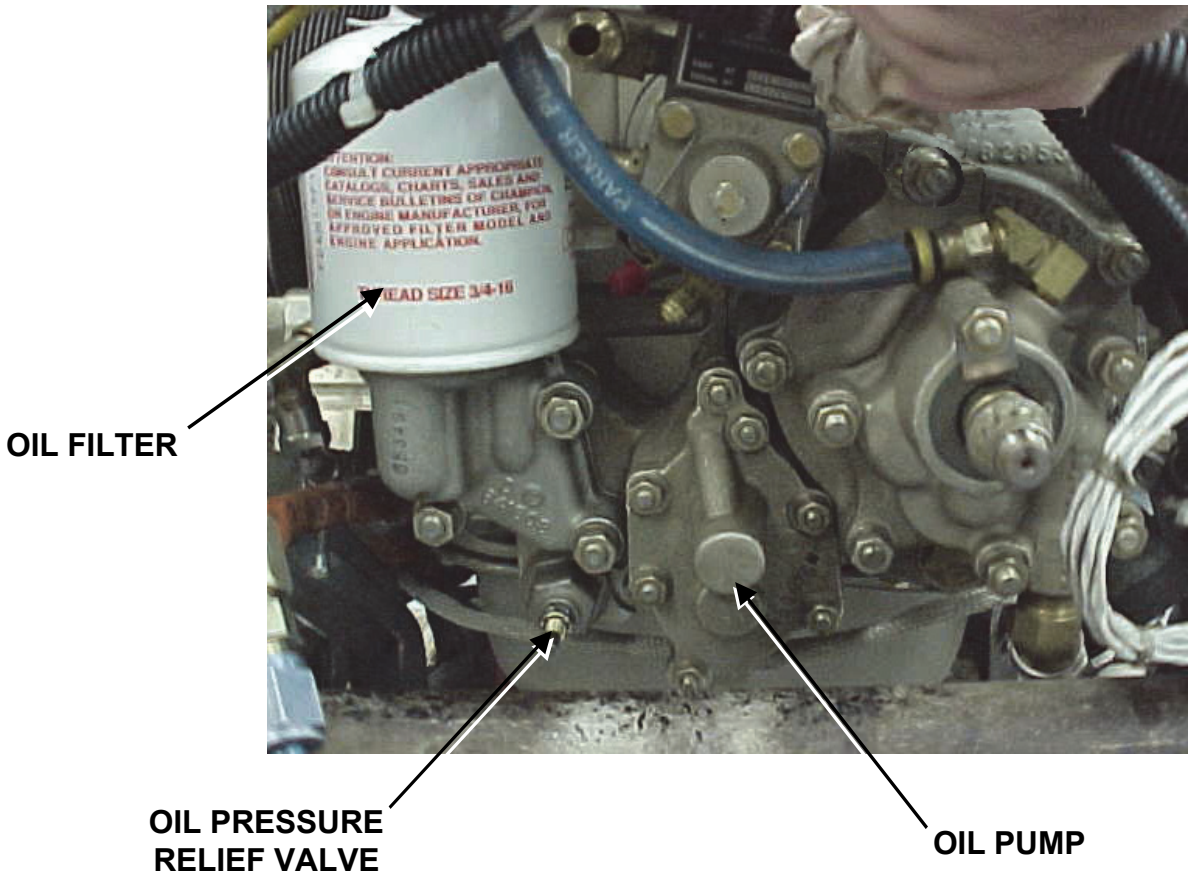

Figure 10-12. Rear View of Engine

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

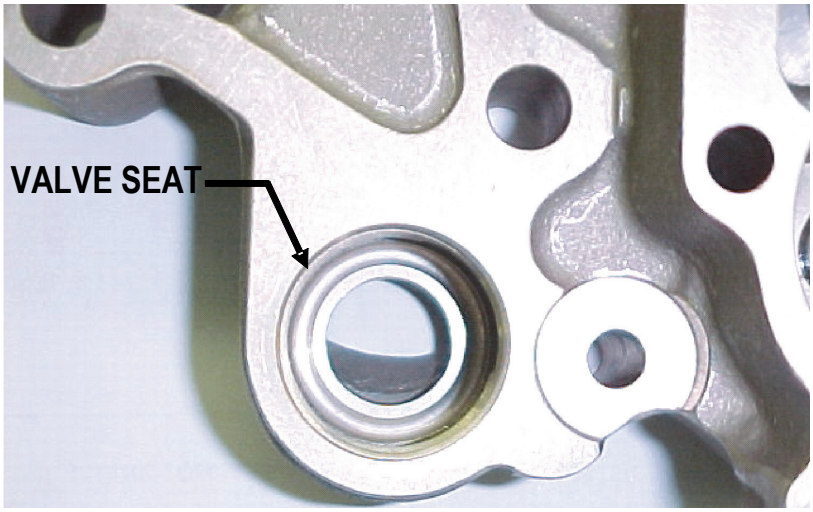

Figure 10-14. Valve Seat in the Oil Pump Housing

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.

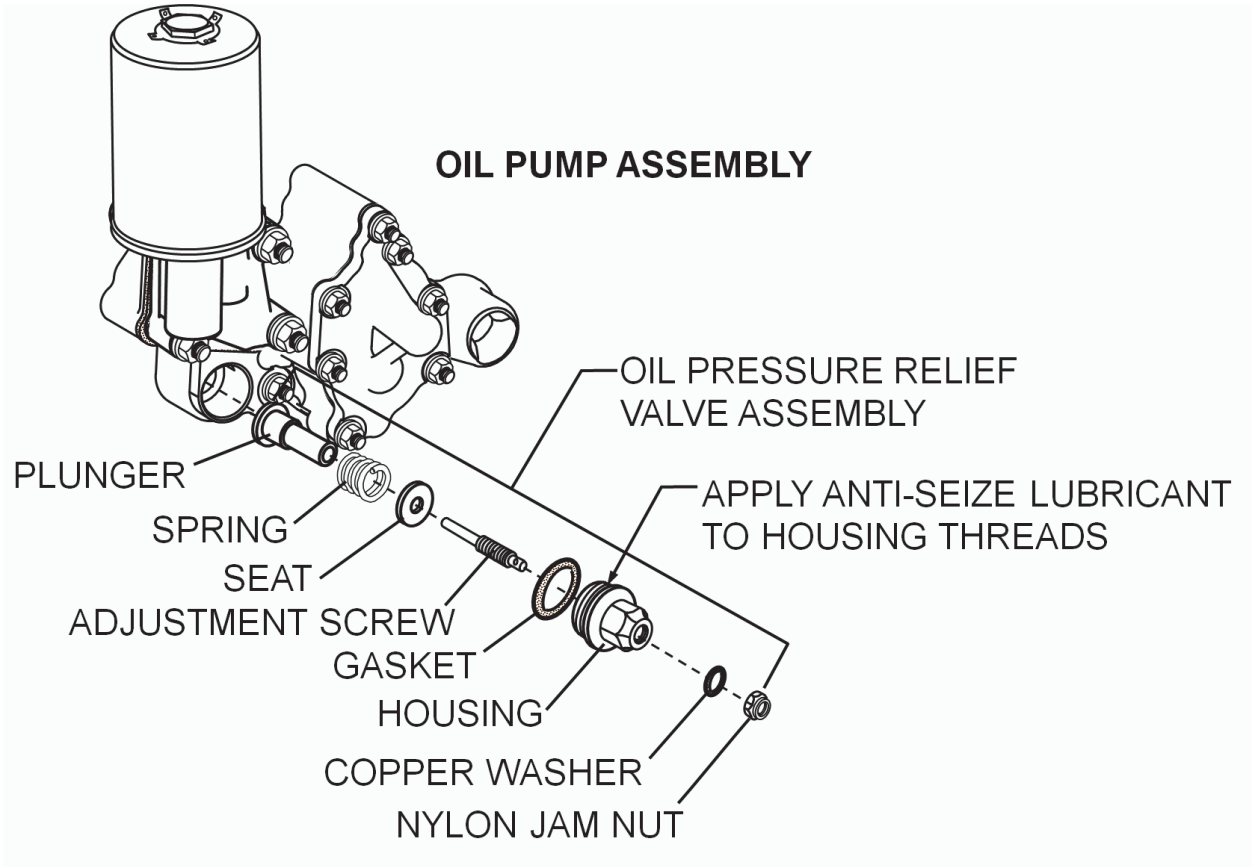

Figure 10-15. Oil Pump and Oil Pressure Relief Valve

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.
9. Perform an "Oil Pump Operational Check" according instructions in Section 6-4.7.3 of M-0, Standard Practice Maintenance Manual.

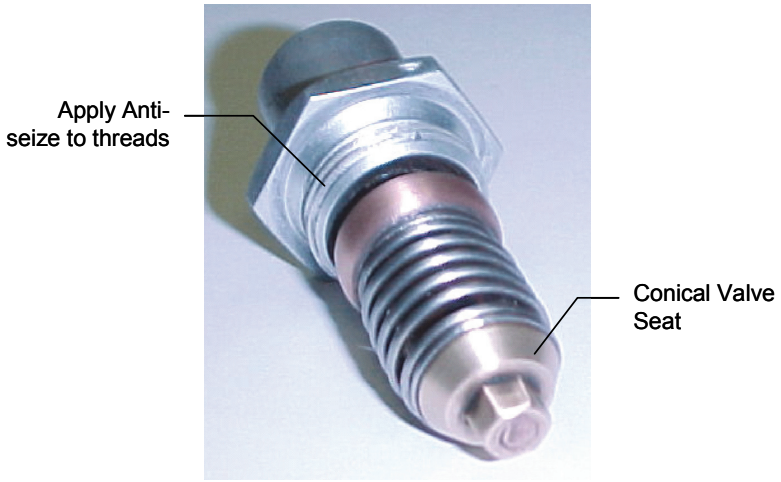

Figure 10-16. Oil Temperature Control Valve

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

Index	Part		Dimensions (inches)	
		Service	Minimum	Maximum
Oil Pressure Relief Valve Assembly				
1	Oil pressure relief valve adjusting screw ..... diametric clearance: in plunger	0.0070L	0.0030	0.0070
2	Oil pressure relief valve seat in housing ..... depth:	1.060	0.750	1.060
Oil Pump Assembly				
3	Oil pump driver gear in pump housing .....body	0.0065L	0.0040L	0.0060L
4	Oil pump driver gear shaft in pump housing .. diametric clearance:	0.0045L	0.0015T	0.0030L
5	Oil pump driven gear to driven gear shaft ..... diametric clearance:	0.0040L	0.0005L	0.0025L
6	Oil pump driver gear in pump housing .....end clearance:	0.0050	0.0016L	0.0041
7	Oil pump driven gear in pump housing .....end clearance:	0.0050	0.0016L	0.0041
8	Oil pump driver gear shaft in tach ..... diametric clearance: drive housing	---	0.0015L	0.0030L
9	Oil pump driver gear shaft pin in bevel gear .. diametric clearance:	---	0.0005L	0.0025L
10	Oil pump driven gear in housing ..... diametric clearance:	0.0065L	0.0040L	0.0060L
11	Tachometer drive shaft in tach drive housing diametric clearance:	---	0.0015L	0.0030L
12	Oil seal in mechanical tach drive housing..... diametric clearance:	---	0.003T	0.005T
13	Oil seal in electrical tach drive housing..... diametric clearance:	---	0.0015T	0.0065T
Gear Backlash				
14	Oil pump driver and driven gears ..... backlash:	0.0160	0.0090	0.0130
15	Tach drive and driven bevel gears ..... backlash:	---	0.0040	0.0080
Spring Test Data				
16	Oil pressure relief valve spring compressed to 1.25 inch length load:	30 lbs.	32 lbs.	37 lbs.
17	Oil temperature control valve 0.090” minimum travel ..... at oil temperature:	---	120°F	170°F
18	Oil temperature control valve must close between ..... oil temperature:	---	168°F	172°F
T= Tight L=Loose				

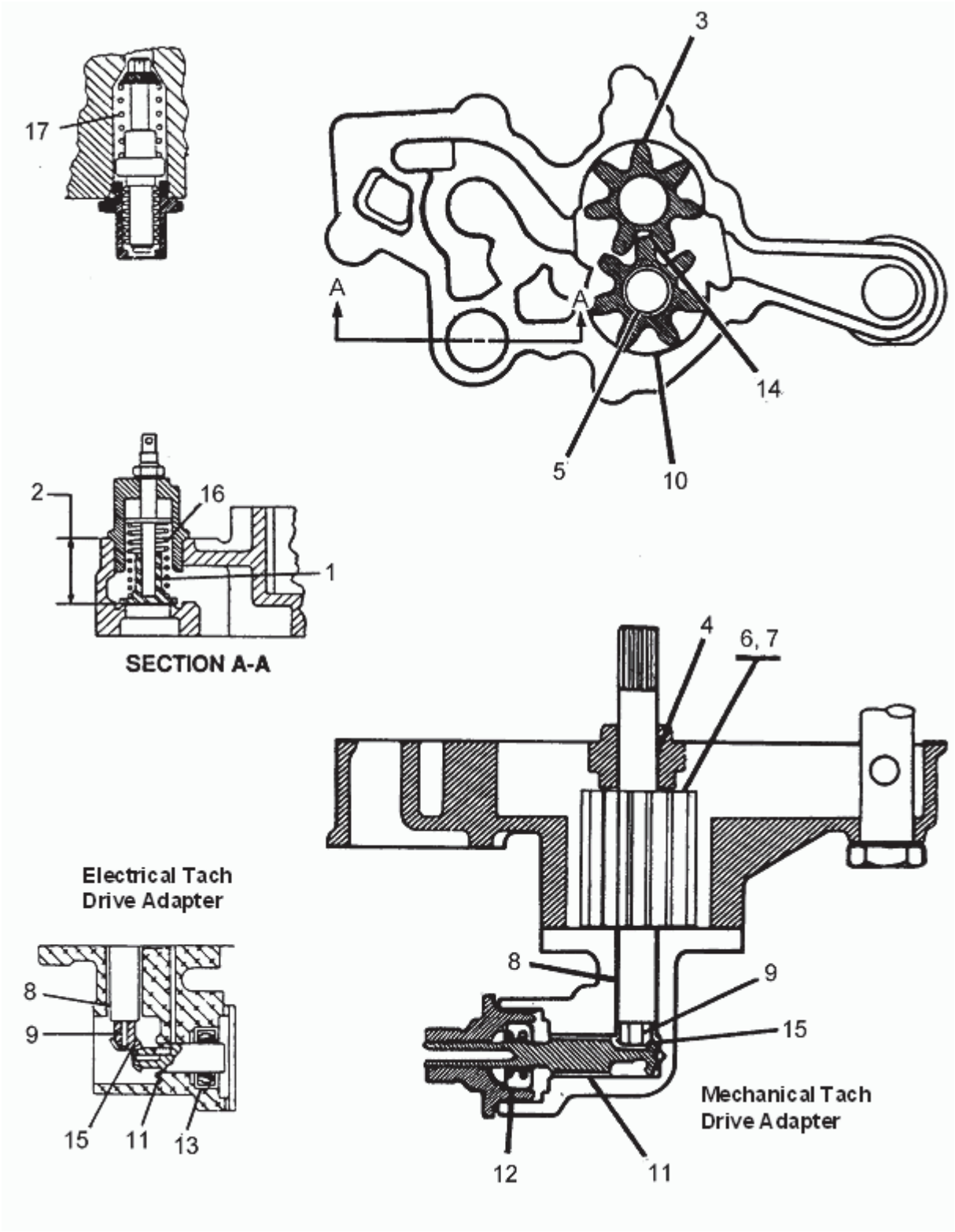

Figure 10-17. Lubrication System Service Limits

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.

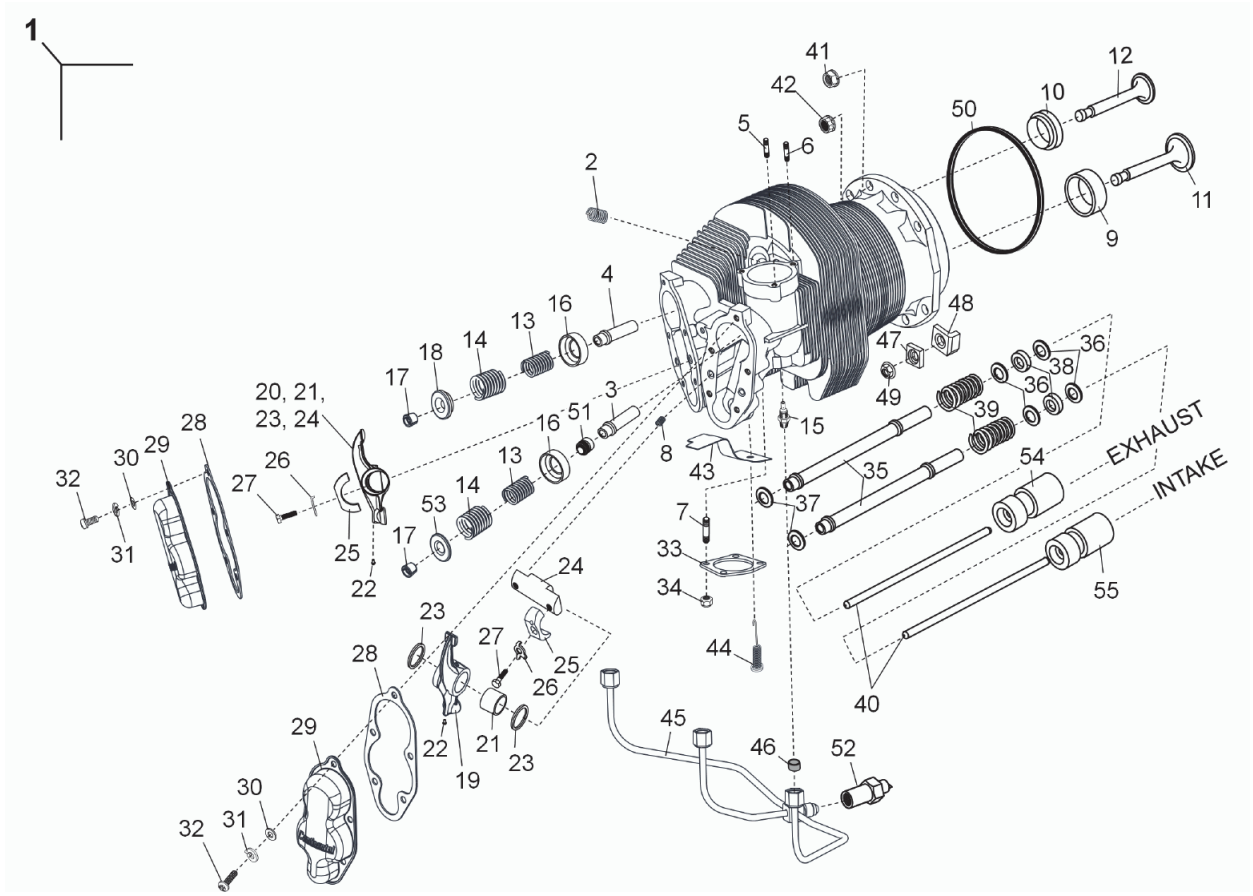

Figure 10-18. Engine Cylinder

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.

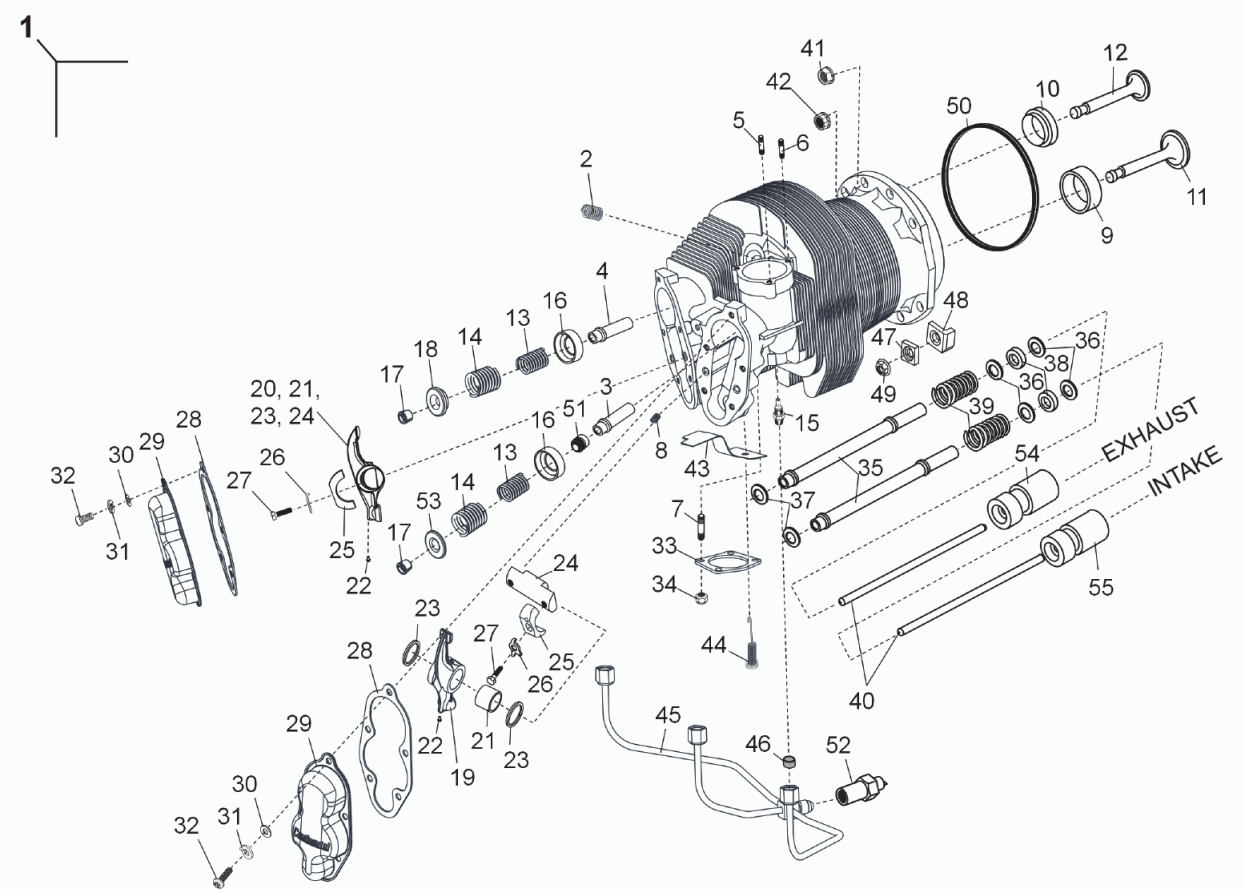

Figure 10-18 repeated for reference

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.

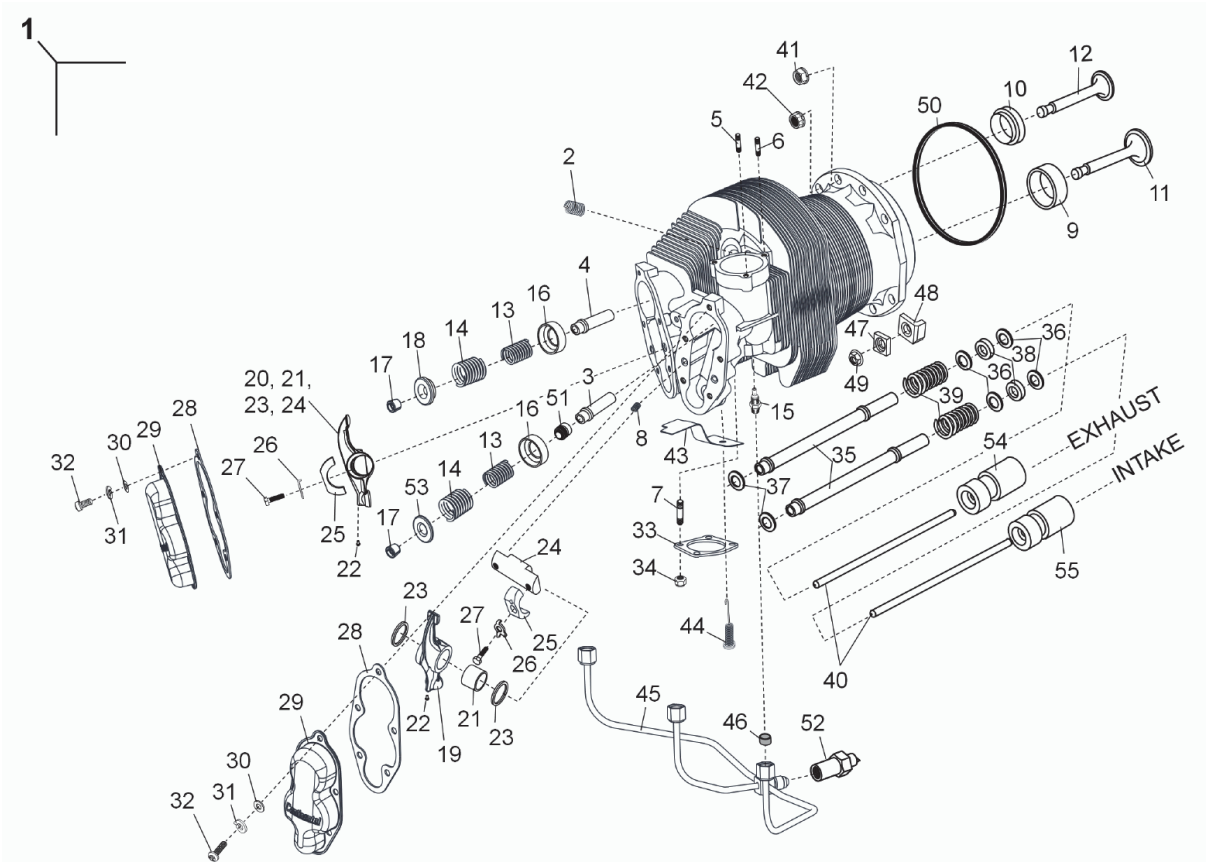

Figure 10-18 repeated for reference

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).

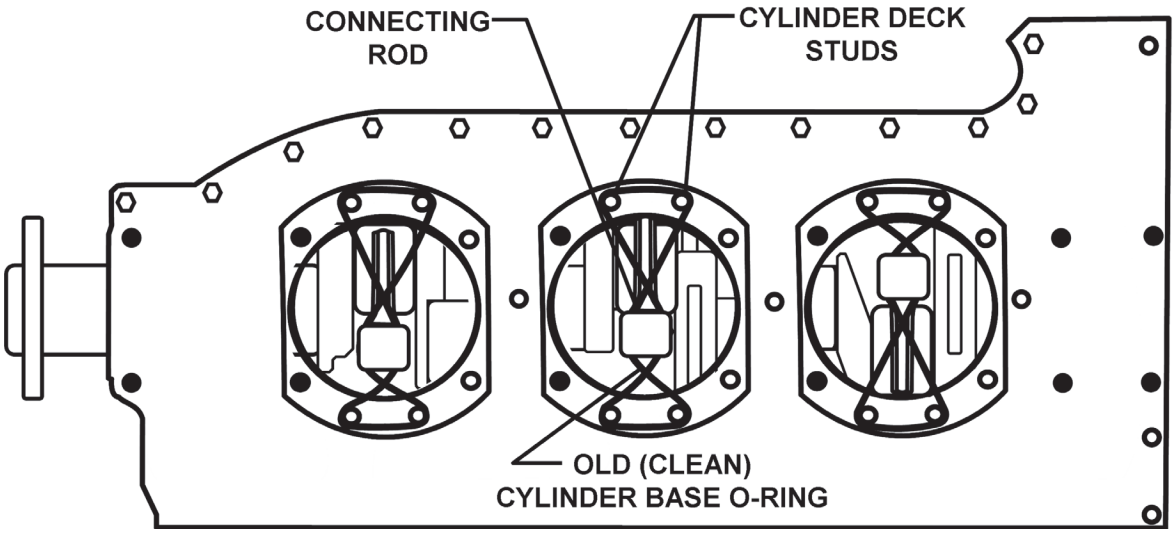

Figure 10-19. Cylinder Base O-Ring Used to Secure the Connecting Rods

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.

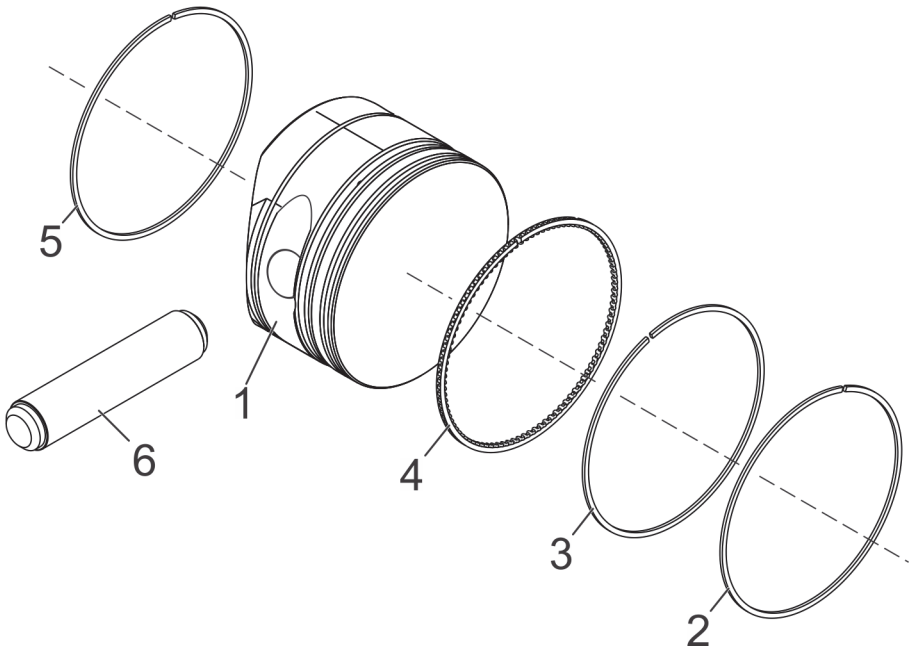

Figure 10-20. Piston, Piston Pin and Rings

1	Piston	3	Compression Ring	5	Scraper Ring
2	Compression Ring	4	Oil Control Ring	6	Piston Pin

18. Repeat steps 11 through 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.

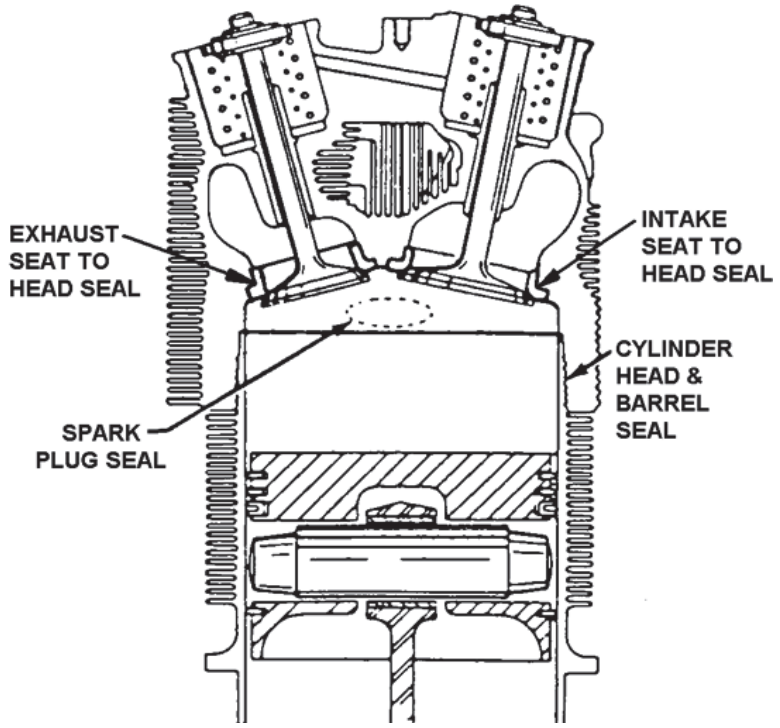

Figure 10-21. Cylinder Static Seal

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.

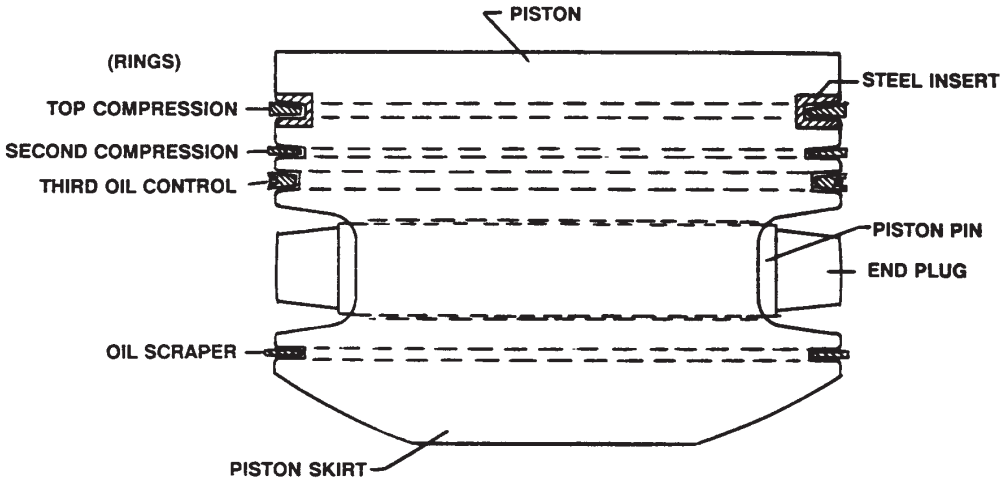

Figure 10-22. Piston, Piston Pin, and Piston Ring Detail

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.

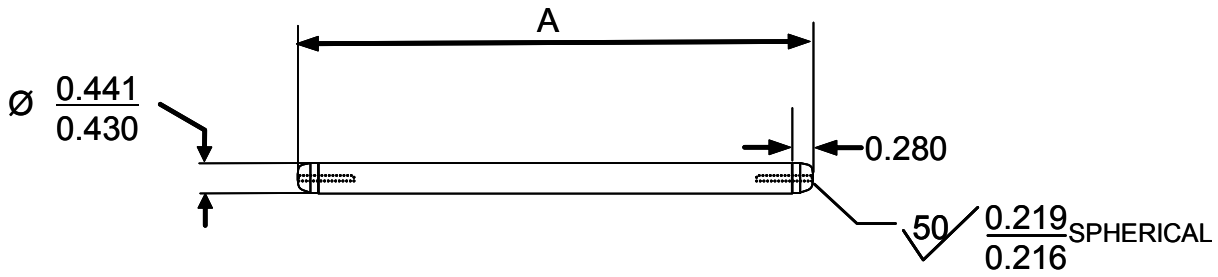

Figure 10-23. Pushrod Dimensions

"A" dimension	Min	Max
Standard	13.632	13.662
P030 Oversize	13.662	13.692

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

Index	Description	Service Limit	New Part Minimum (inches)	New Part Maximum (inches)
Cylinder Assembly				
1	Cylinder bore (lower 4-1/4 inch of barrel) .....diameter:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual		
2	Cylinder bore (5.75 inch into barrel) ..... choke:			
3	Cylinder bore ..... out-of-round:			
4	Cylinder bore .....allowable oversize:			
5	Cylinder bore surface (Nitrided Barrels) .....Cross hatch angle:	22° - 32°	22° - 32°	—
	.....Finish in micro-inches R_a:	35-60	35	60
6	Cylinder barrel in crankcase.....diametric clearance:	0.013L	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head .....diametric clearance:	0.007T	0.007T	0.010T
8	Intake valve guide in cylinder head .....diametric clearance:	0.001T	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head .....diametric clearance:	0.001T	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head .....diametric clearance:	0.007T	0.0070T	0.0100T
11	Intake valve seat .....width:	Figure 10-25		
12	Exhaust valve seat .....width:	Figure 10-26		
	Exhaust valve seat-to-valve guide .....axis angle:	45° 00'	44° 30'	45° 00'
	Intake valve seat-to-valve guide .....axis angle:	60° 15'	59° 30'	60° 00'
Rocker Arms and Shafts				
13	Rocker shaft in cylinder head bosses.....diametric clearance:	0.0031L	0.0005L	0.0031L
	Rocker shaft in rocker arm bushing.....diametric clearance:	0.0040L	0.0005L	0.0031L
14	Rocker arm bushing bore .....diameter: Rocker arm bushing (finish bore) .....inside diameter:	0.8755 0.7515	0.8725 0.7505	0.8755 0.7515
15	Rocker arm .....side clearance:	0.0150L	0.0020	0.0150
16	Intake valve guide .....inside diameter: Intake valve in guide .....diametric clearance:	 0.0050L	0.4350 0.0010L	0.4362 0.0032L
17	Exhaust valve guide .....inside diameter: Exhaust valve in guide .....diametric clearance:	 0.0062L	0.4370 0.0029L	0.4380 0.0046L
18	Intake valve face-to-stem .....axis angle:	60°15'	60°00'	60°15'
19	Exhaust valve face-to-stem .....axis angle:	45°15'	45°00'	45°15'
20	Intake valve gauge line-to-stem .....length:	Figure 10-27	Replace 100%	
21	Exhaust valve gauge line-to-stem .....length:	Figure 10-27	Replace 100%	
22	Intake & Exhaust valve face-to-stem .....runout:	0.0015	0.0000	0.0015
23	Rocker arm foot to valve stem (dry valve) .....valve lash:	0.060- 0.200	0.060	0.200

Table 10-10. Cylinder Assembly Service Limits

Index	Description	Service Limit	New Part Minimum (inches)	New Part Maximum (inches)
Pistons, Rings, and Pins				
24	Piston, non-coated in cylinder[1] ..... diametric clearance:	0.011L[2] 0.010L[3]	0.008L[2] 0.007L[3]	0.011L[2] 0.010L[3]
	Piston, manganese phosphate coated in cylinder[1] ..... diametric clearance:	0.012L[2] 0.011L[3]	0.009L[2] 0.008L[3]	0.012L[2] 0.011L[3]
25	Top piston ring in groove ..... side clearance:	0.006L	0.0015	0.0040
26	Second piston ring in groove ..... side clearance:	0.006L	0.0015	0.0040
27	Third piston ring in groove ..... side clearance:	0.0075L	0.0035	0.0055
28	Fourth piston ring in groove ..... side clearance:	0.0100L	0.0060	0.0080
Dimensions for items 29A -32A apply only to Post-Gold Standard Cylinders (5.251-5.253 Dia. Cylinder Bore)				
29A	Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual		
30A	Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)[4] ..... gap:			
31A	Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:			
32A	Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:			
Dimensions for items 29B -32B apply only to Pre-Gold Standard Cylinders (5.252-5.254 Dia. Cylinder Bore)				
29B	Top ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual		
30B	Second ring gap at 1.00 ± 0.50 depth (in cylinder barrel)[4] ..... gap:			
31B	Third ring gap at 1.00 ± 0.50 depth (in cylinder barrel)[1] ..... gap:			
32B	Fourth ring gap at 1.00 ± 0.50 depth (in cylinder barrel) ..... gap:			
33	Piston pin in piston ..... diametric clearance:	0.0013L	0.0001L	0.0007L
34	Piston pin ..... diameter:	1.1243	1.1243	1.1245
35	Piston pin in cylinder ..... end clearance:	0.0480L	0.0100L	0.0340L
36	Piston pin in connecting rod bushing ..... diametric clearance:	0.0040L	0.0012L	0.0018L
37	Bushing in connecting rod ..... diametric clearance:	0.0050T	0.0025T	0.0050T
38	Bolt in connecting rod ..... diametric clearance:	0.0023L	0.0000L	0.0018L
39	Connecting rod bearing on crankpin ..... diametric clearance:	0.0034L	0.0009L	0.0034L
40	Connecting rod on crankpin ..... end clearance:	0.0160	0.0060	0.0110
41	Connecting rod bearing and bushing twist ..... per inch of length:	See **M-0, Section 10-9.4**		
42	Hydraulic tappet in crankcase ..... diametric clearance:	0.0035L	0.0010L	0.0025L
Spring Test Data				
43	Inner valve spring 654442 compressed to 1.230"	67 Lbs.	70.3 Lbs.	77.3 Lbs.
	Inner valve spring 654442 compressed to 1.745"	31 Lbs.	32.1 Lbs.	38.1 Lbs.
44	Outer valve spring 654441 compressed to 1.275"	98 Lbs.	101.8 Lbs.	111.4 Lbs.
	Outer valve spring 654441 compressed to 1.790"	46 Lbs.	49.1 Lbs.	55.1 Lbs.
45	Installed outer valve spring ..... height:	1.791 inches		
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

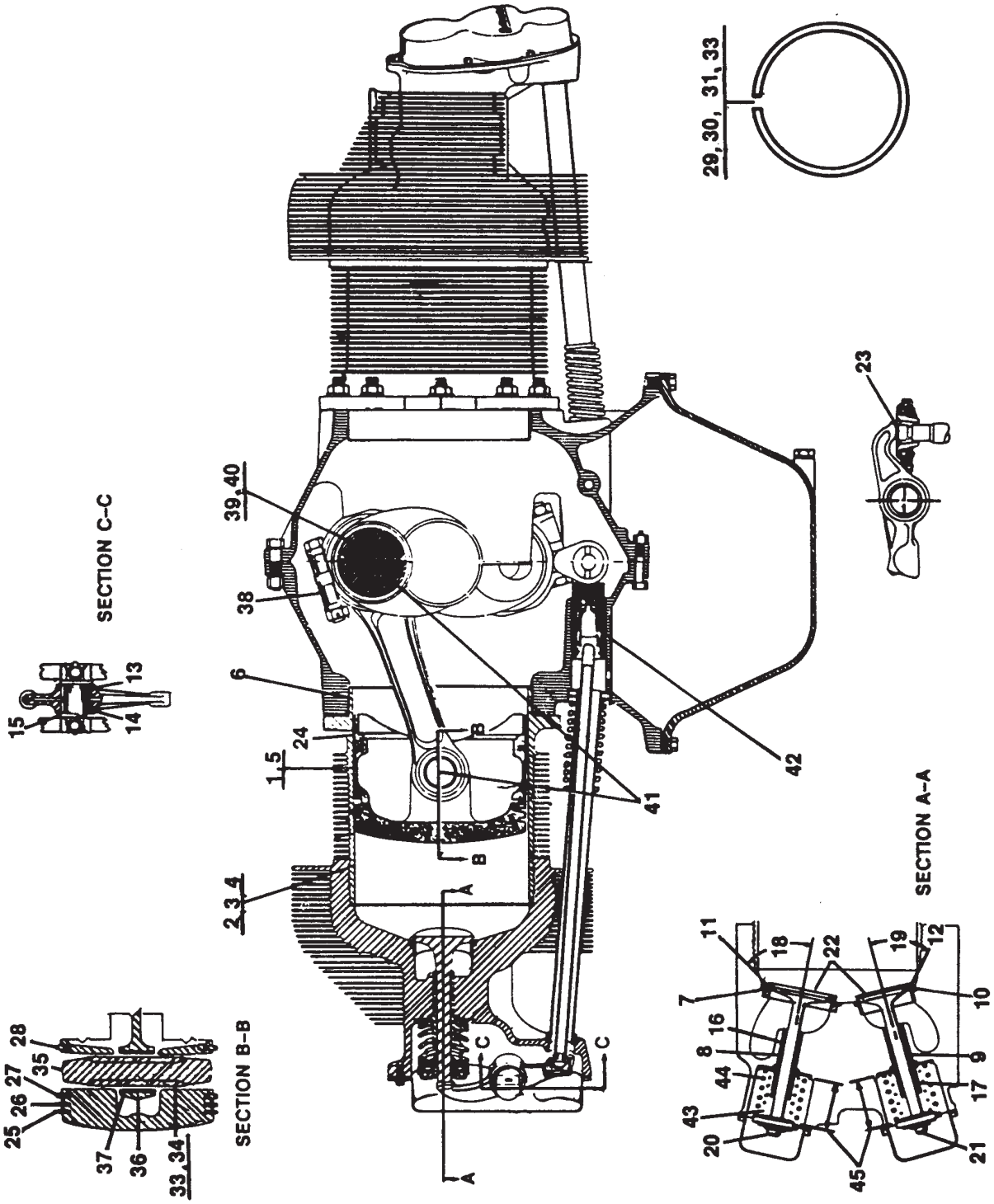

Figure 10-24. Cylinder Assembly Service Limits

NOTE: See Section D-6 for Intake and Exhaust Valve Seat Machining Dimensions.

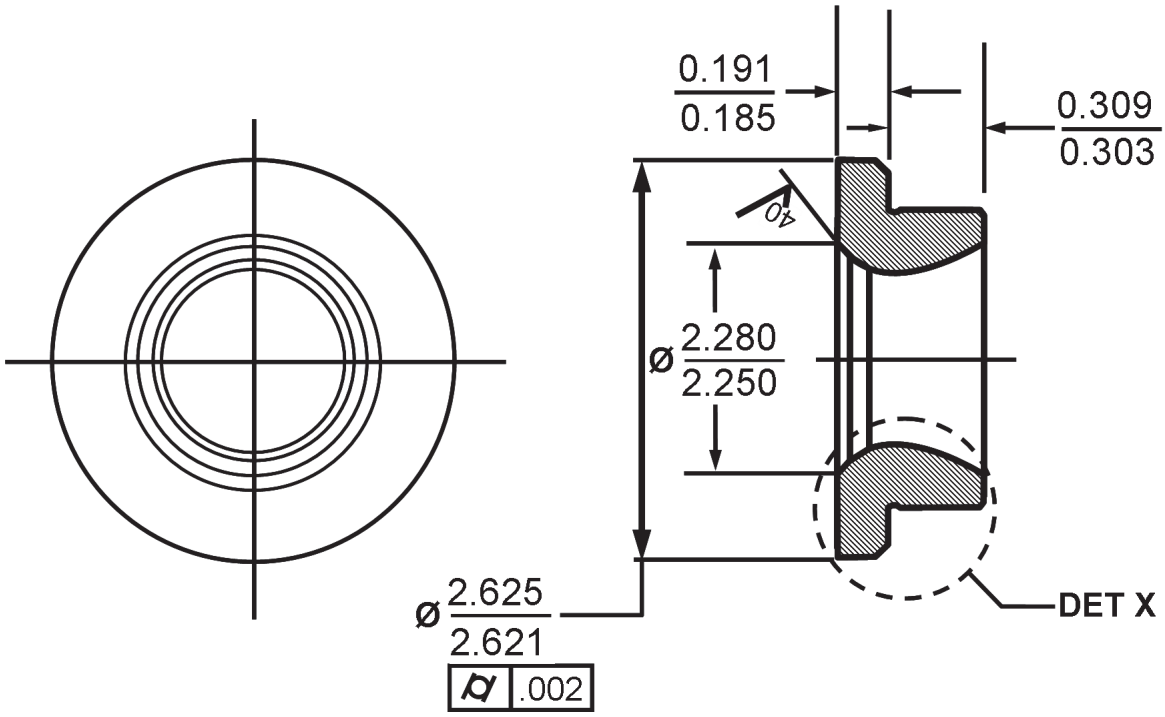

Figure 10-25. Intake Valve Seat Dimensions

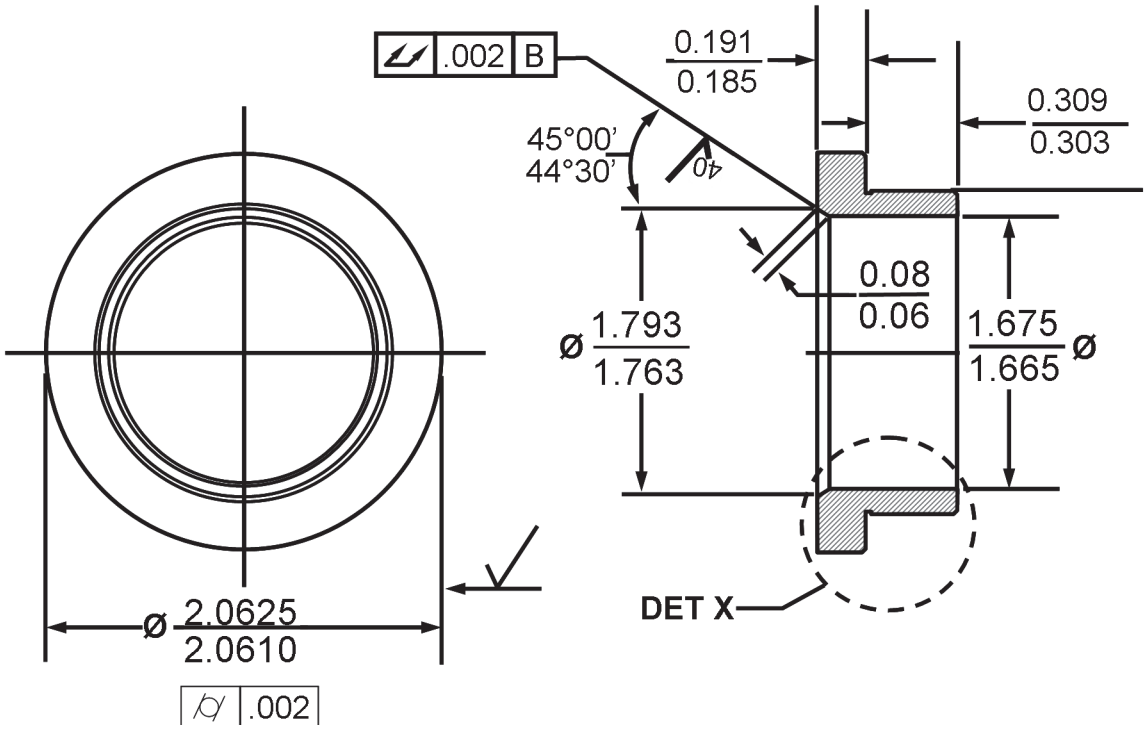

Figure 10-26. Exhaust Valve Seat Dimensions

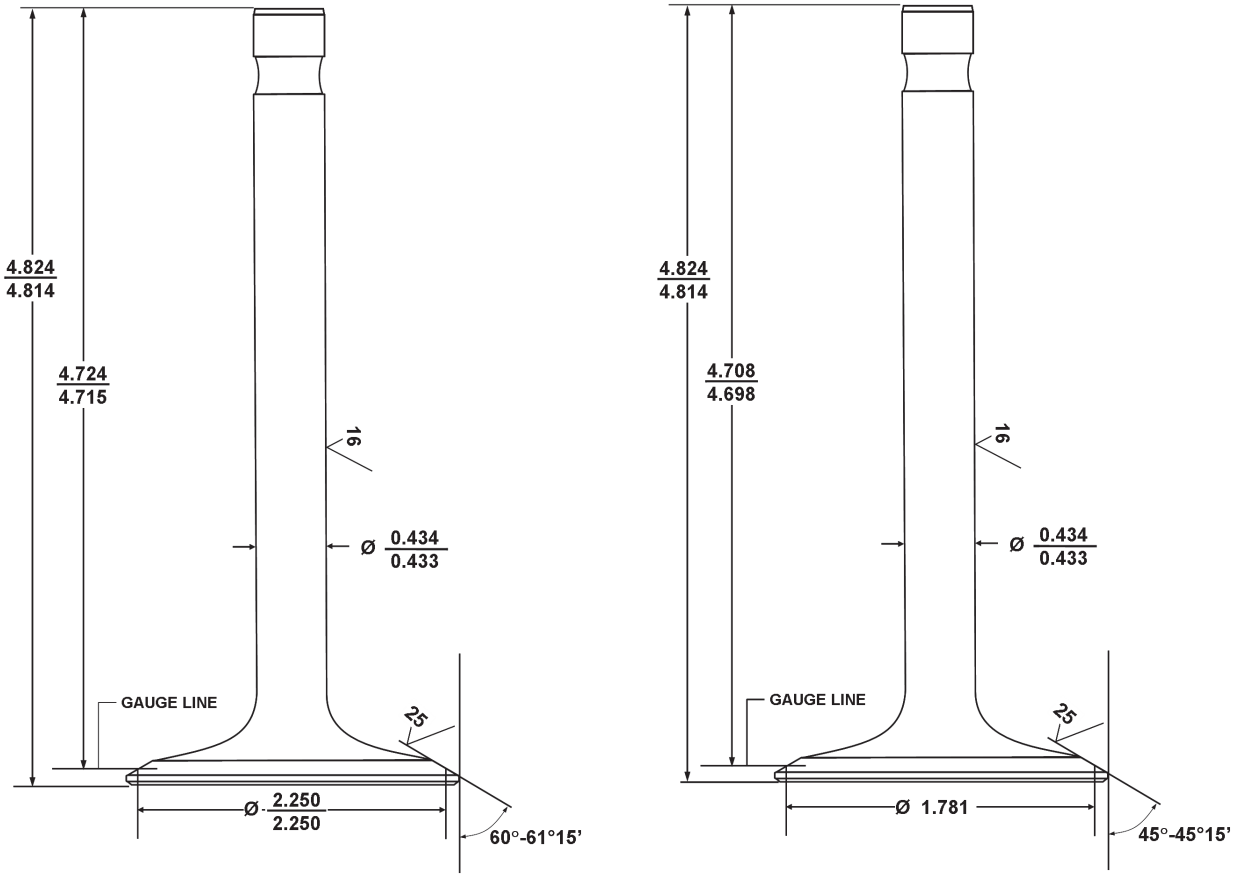

Figure 10-27. Valve Service Limits

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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 <u>any</u> 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 <u>any</u> 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.

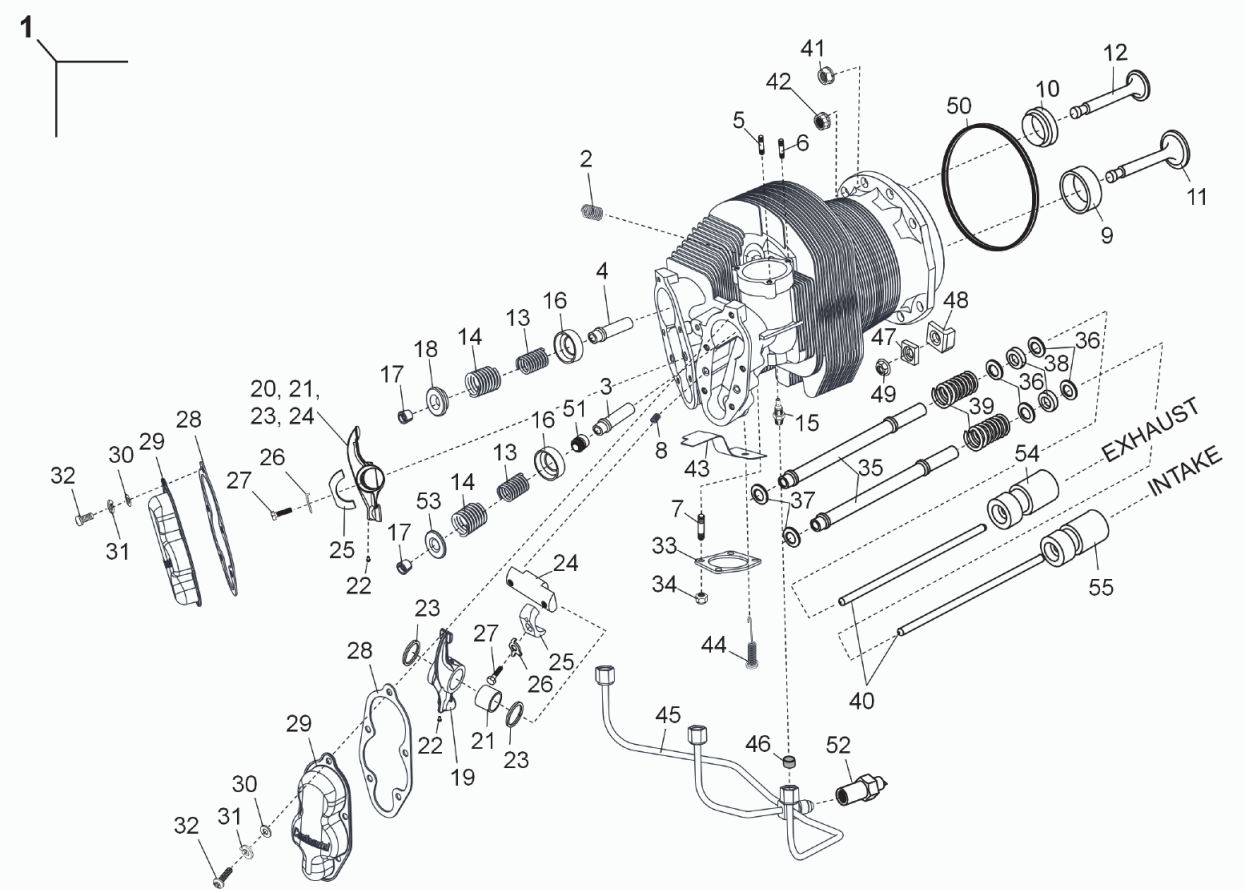

Figure 10-18 repeated for reference

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.

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 n 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).

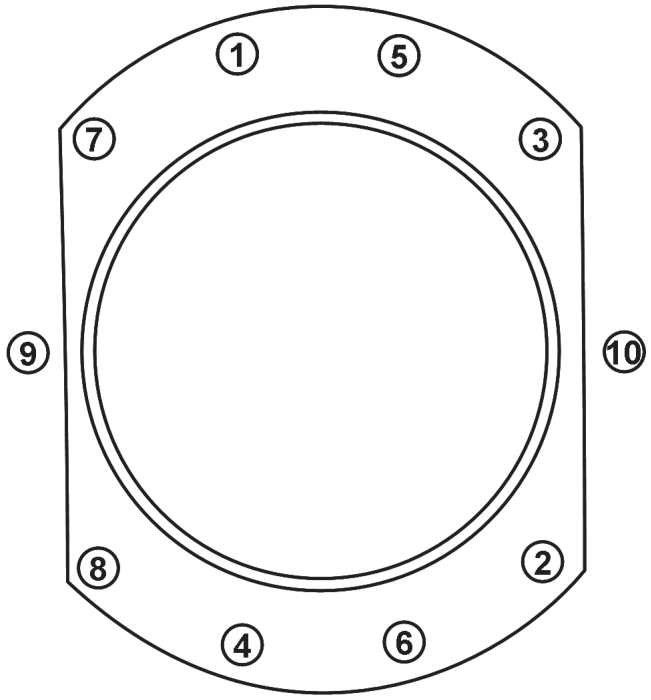

Figure 10-28. Single Cylinder Torque Sequence

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.

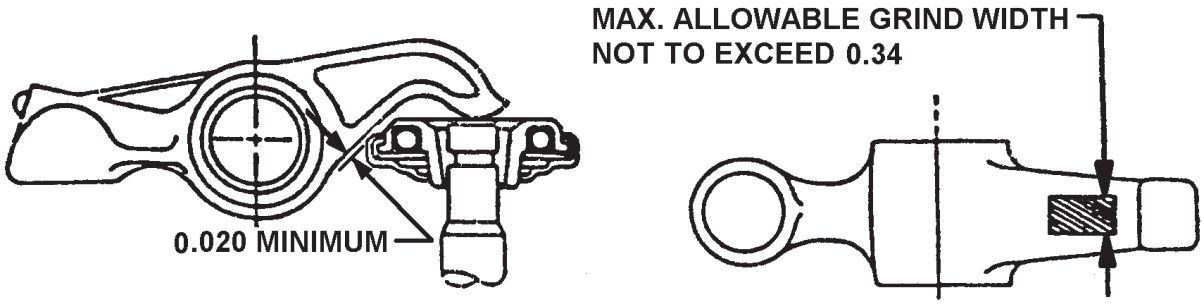

Figure 10-29. Rocker Arm to Retainer Clearance

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.

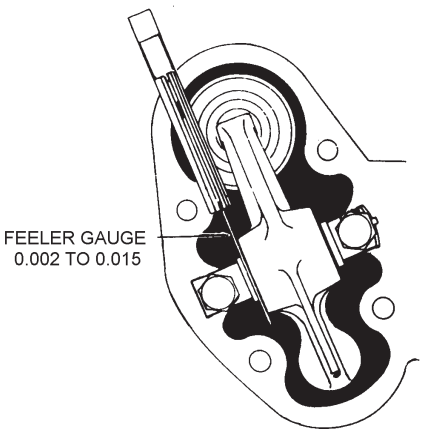

Figure 10-30. Rocker Arm Side Clearance

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

Engine Model	Serial Number	Engine Model	Serial Number	Engine Model	Serial Number
TSIO550C	802854	TSIO550C	802867	TSIO550G	915041
TSIO550C	802855	TSIO550C	802868	TSIO550G	915042
TSIO550C	802856	TSIO550C	802876	TSIO550G	915043
TSIO550C	802859	TSIO550C	802877	TSIO550G	915044
TSIO550C	802860	TSIO550C	802878	TSIO550G	915046
TSIO550C	802861	TSIO550C	802881	TSIO550G	915048
TSIO550C	802862	TSIO550C	802882	TSIO550G	915050
TSIO550C	802863	TSIO550C	814585	TSIO550G	915061
TSIO550C	802864	TSIO550G	915033	TSIO550G	905062
TSIO550C	802865	TSIO550G	815039		
TSIO550C	802866	TSIO550G	915040		

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 B C E G K

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.

To remove the left side (2-4-6) turbocharger:	**To remove the right side (1-3-5) turbocharger:**
Remove bolts 3 and 4 (Figure 10-31).	Remove bolts 1 and 2 (Figure 10-31).

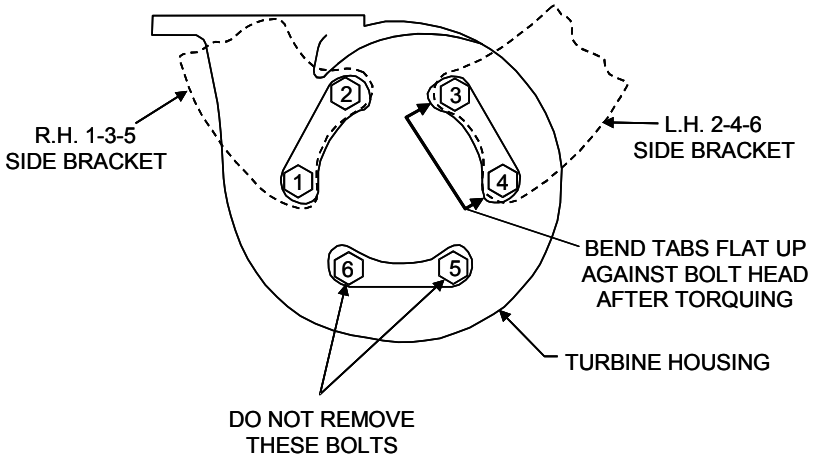

Figure 10-31. Turbocharger Bracket Orientation

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.

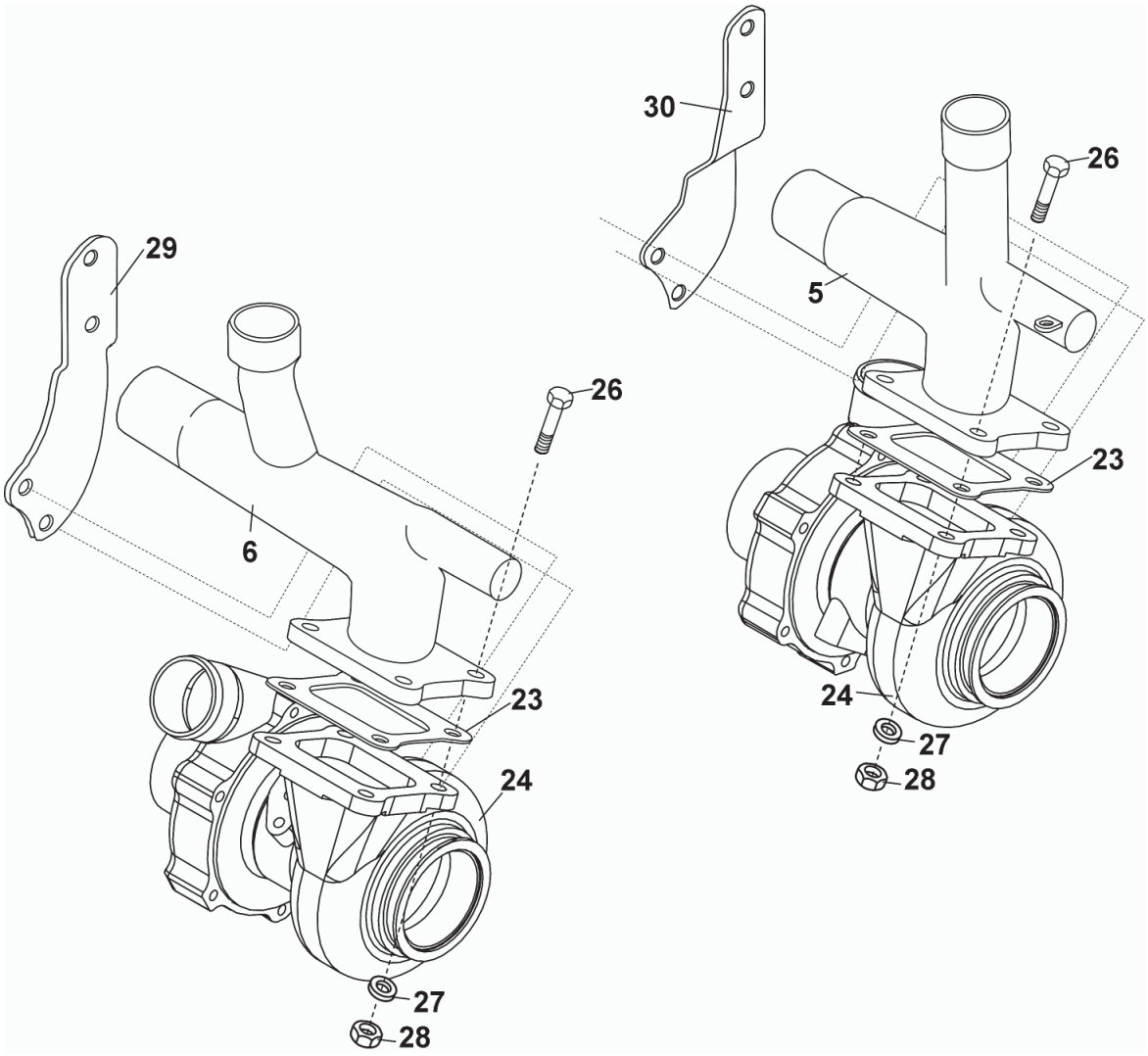

Figure 10-32. Turbocharger Installation Detail B C E G

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.

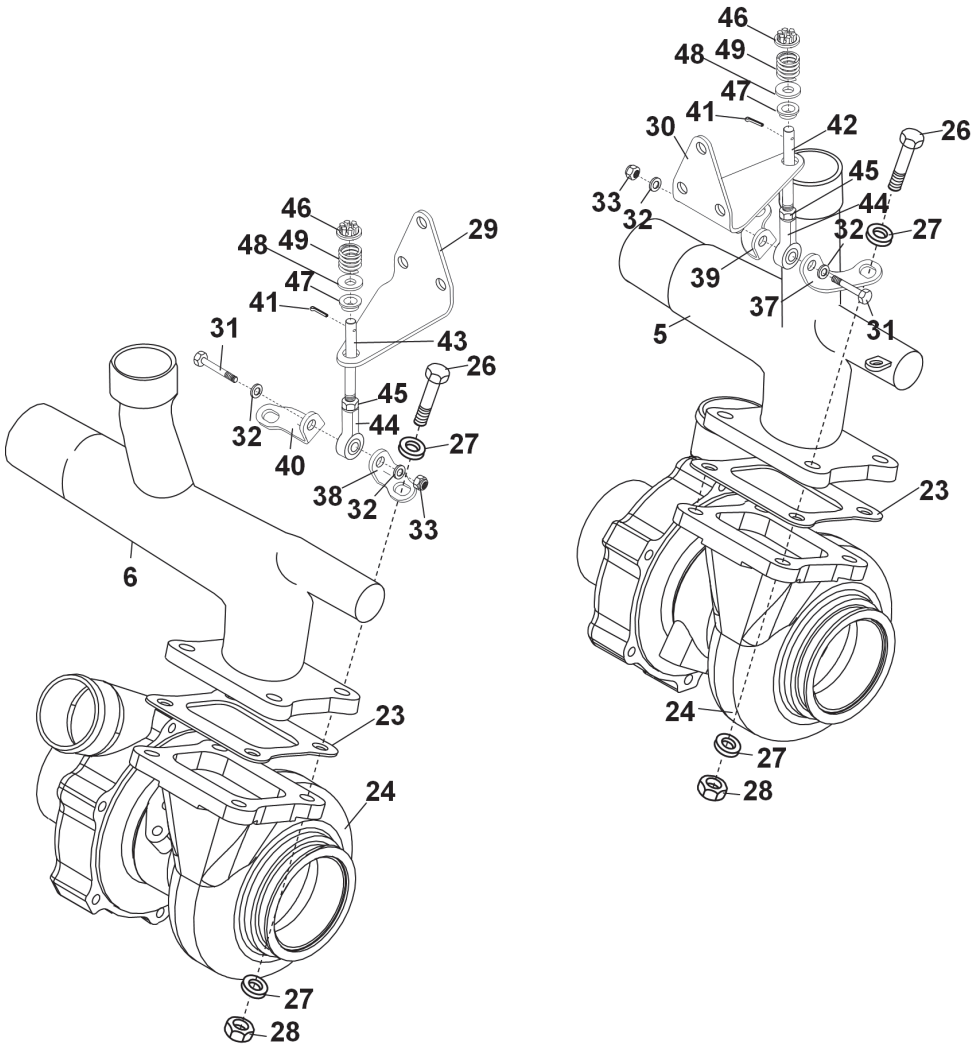

Figure 10-33. Turbocharger Installation Detail N

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.
6. Torque the oil supply and return hoses and fittings to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual using the "Hose and Tubing Installation" instructions in Appendix C-11 of M-0, Standard Practice Maintenance Manual.
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.

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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 is 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).

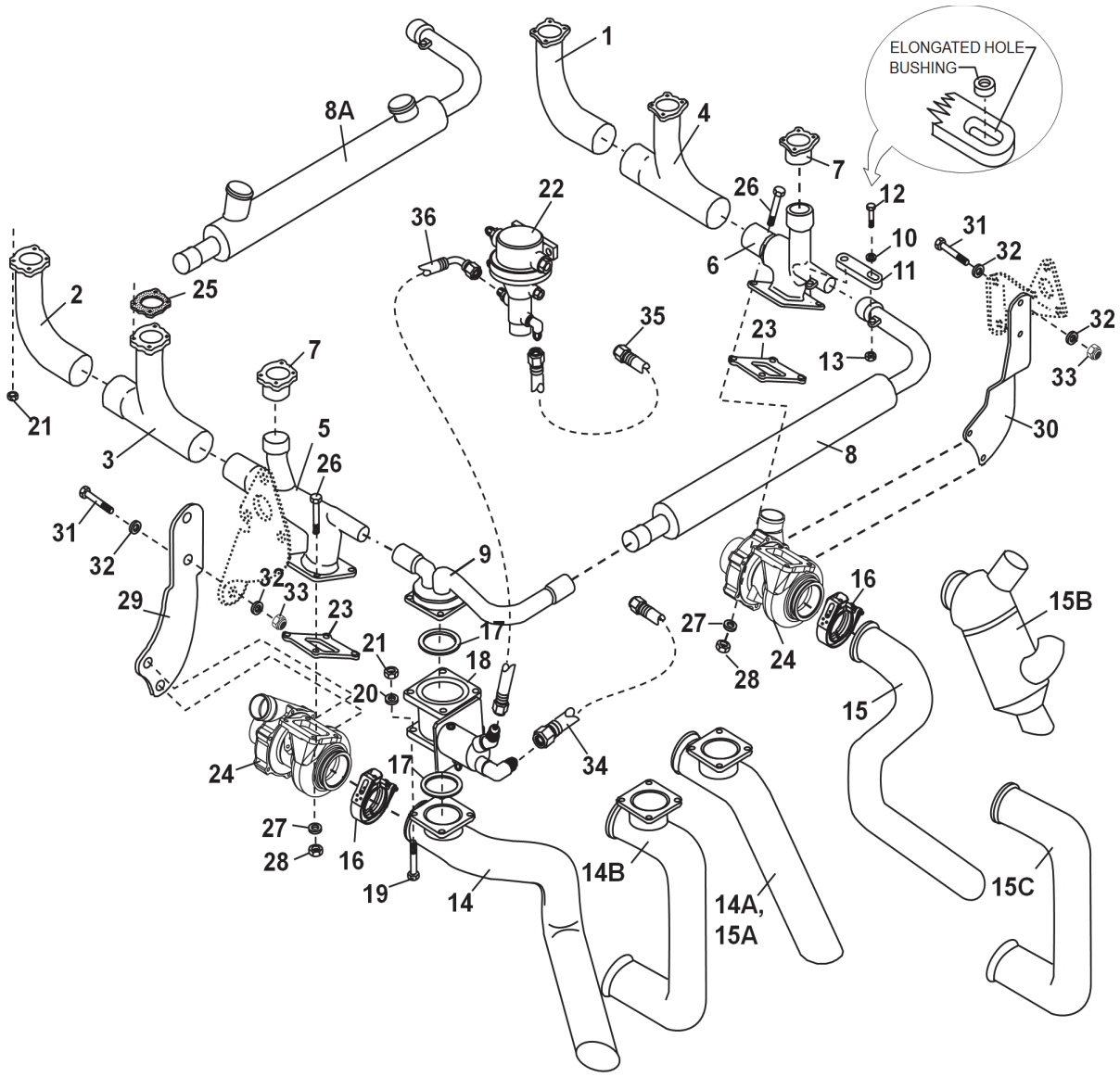

Figure 10-34. Composite Turbocharger and Exhaust System

1	Elbow Riser	11	Tie Rod	18	Wastegate Assembly	30	Bracket
2	Elbow Riser	12	Bolt	19	Bolt	31	Screw
3	Tee Assembly	13	Lock Nut	20	Washer	32	Washer
4	Tee Assembly	14	Contoured Tailpipe	21	Lock Nut	33	Lock Nut
5	Turbo Transition	14A	Straight Tailpipe	22	Controller	34	Hose
6	Turbo Transition	14B	Inverse Tailpipe Option	23	Gasket	35	Hose
7	Riser	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
8	Crossover Assembly	15A	Straight Tailpipe	25	Gasket		
8A	Crossover Assy with Heater Shroud Option	15B	Heater	26	Bolt		
		15C	Inverse Tailpipe Option	27	Washer		
9	Transition	16	V-band clamp	28	Lock Nut		
10	Bushing	17	Gasket	29	Bracket		

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."

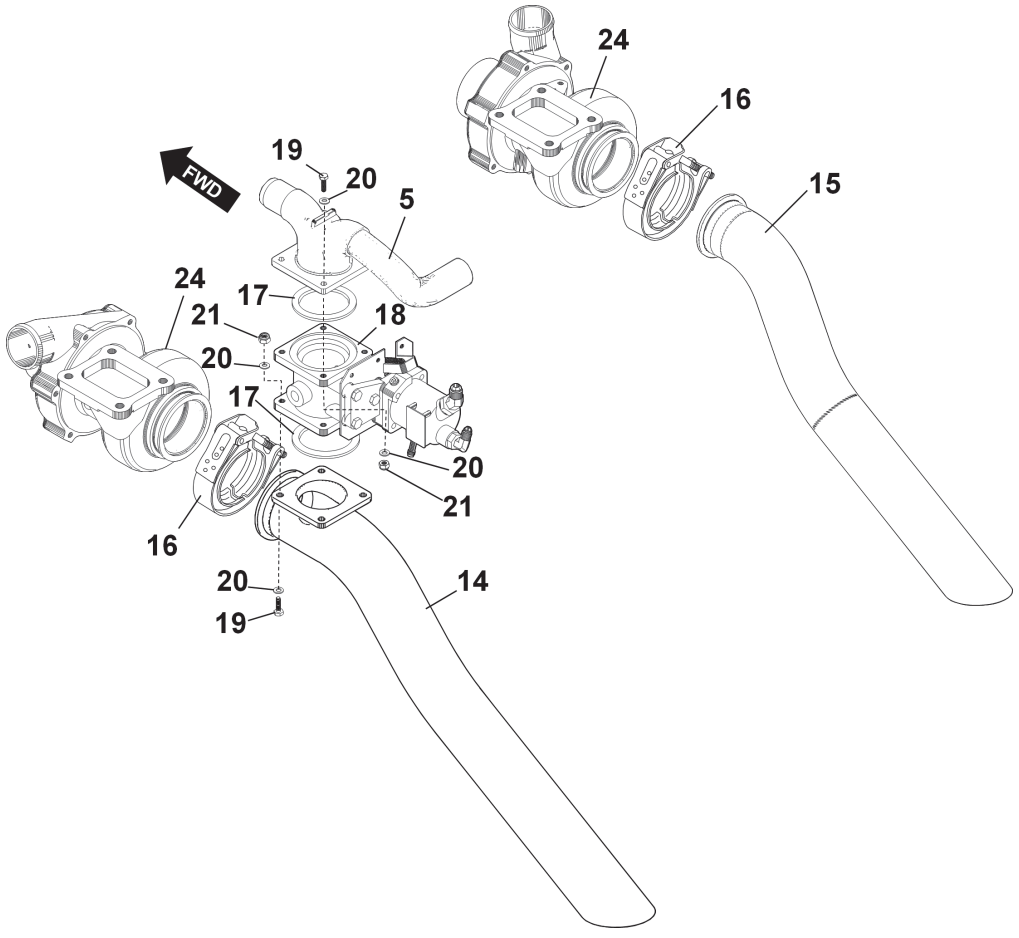

Figure 10-35. Tailpipe and V-Band Clamp Detail

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.

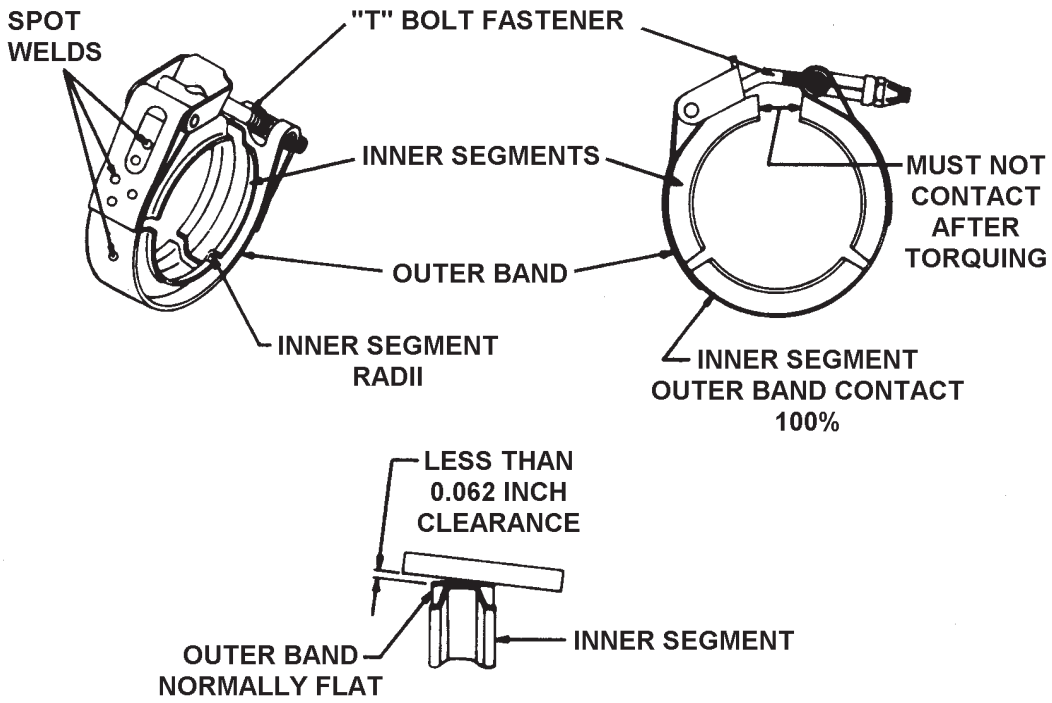

Figure 10-36. V-Band Clamp Inspection Criteria

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.

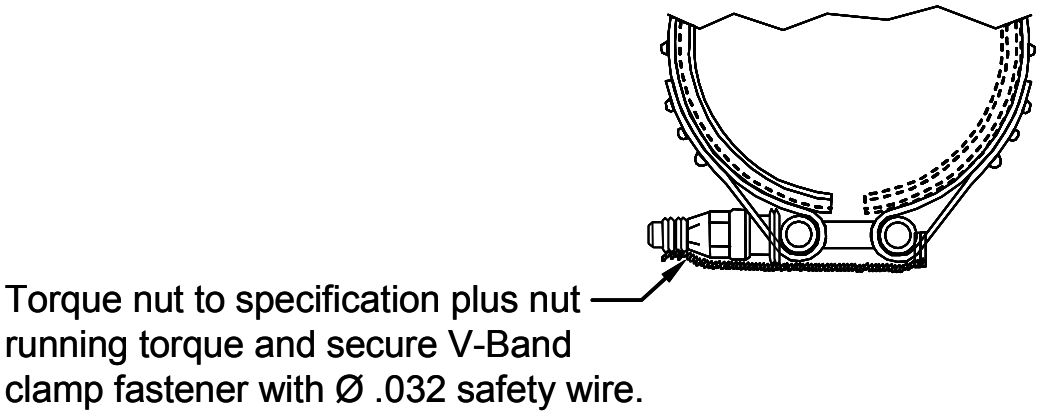

Figure 10-37. V-Band Clamp Safety Wire

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.

11-3. Overhaul Sequence

Perform engine overhaul in the sequence described in Table 11-1.

Table 11-1. Overhaul Sequence

Action	Reference
1. Remove the engine from the aircraft.	Section 5-1, “Engine Removal”
2. Disassemble the engine.	Chapter 12, “Engine Disassembly”
3. Disassemble engine components.	Chapter 13, “Component Disassembly”
4. Clean engine parts.	Chapter 14, “Engine Cleaning”
5. Inspect engine parts for serviceability.	Perform inspections and complete the Overhaul Inspection Checklist: Chapter 15, “Overhaul Inspection and Repair” Appendix D, “Overhaul Dimensional Limits”
6. Repair or replace unserviceable parts or parts identified as 100% replacement parts or mandatory overhaul replacement parts.	Repair or replace parts specified in Section 15-8, “Overhaul Repair”
7. Apply protective coating to engine parts.	“Protective Coatings” in Chapter 12 of M-0, Standard Practice Maintenance Manual
8. Assemble the engine components.	Chapter 16, “Component Assembly”
9. Assemble the engine.	Chapter 17, “Engine Assembly”
10. Install the engine in the aircraft.	“Section 5-2, “Engine Installation”
11. Test the overhauled engine.	Chapter 18, “Post-Overhaul Test and Adjustments”

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

Overhaul Step	Initials	Findings
Complete a Cylinder Visual Inspection (Section 6-4.11.1 of M-0, Standard Practice Maintenance Manual)		
Complete a Cylinder Differential Pressure Test. (Section 6-4.11.2 of M-0, Standard Practice Maintenance Manual)		
Remove the engine from the aircraft (Section 5-1).		
Remove the Ignition System (Section 12-2).		
Remove the Accessory Drive Adapters (Section 12-3).		
Remove the Wastegate Controller (Section 12-4.1).		
Remove the Induction System (Section 12-5).		
Remove the Fuel Injection System (Section 12-5).		
Remove the Air/Oil Separator (Section 12-7).		
Remove the Turbocharger & Exhaust System (Section 12-8).		
Remove the Oil Cooler (Section 12-9).		
Remove the Oil Pump (Section 12-10).		
Remove the Alternator(s) (Section 12-11).		
Remove the Starter Adapter Assembly (Section 12-13).		
Remove the Oil Sump (Section 12-14).		
Remove the Engine Cylinders and Pistons (Section 12-16).		
Disassemble the Ignition System (Section 13-1).		
Disassemble the Fuel Injection System (Section 13-2).		
Disassemble the Starter and Starter Adapter (Section 13-6).		
Disassemble the Engine Cylinders (Section 13-7).		
Disassemble the Accessory Drive Adapters (Section 13-8).		
Disassemble the Crankcase (Section 13-9).		
Disassemble the Drive Train (Section 13-10).		
Disassemble the Compressor Mount (Section 13-11).		
Perform a visual inspection prior to cleaning the engine parts (Section 11-1 of M-0, Standard Practice Maintenance Manual).		
Clean engine parts (Chapter 12 of M-0, Standard Practice Maintenance Manual).		
Perform detailed visual parts inspection (Section 11-1 of M-0, Standard Practice Maintenance Manual).		
Perform Fluorescent Penetrant Inspections (Section 11-2 of M-0, Standard Practice Maintenance Manual).		

Table 11-2. Engine Removal and Disassembly Checklist

Overhaul Step	Initials	Findings
Perform Magnetic Particle Inspections (Section 11-3 of M-0, Standard Practice Maintenance Manual).		
Perform Ultrasonic Inspections (Section 11-4 of M-0, Standard Practice Maintenance Manual).		
Perform Dimensional Inspections (Section 15-7).		
Perform overhaul repairs (Section 15-8).		
Assemble engine components (Chapter 16).		
Assemble the engine (Chapter 17).		
Install the engine in the aircraft (Section 5-2).		
Complete Post-Overhaul Test and Adjustments (Chapter 18).		

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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.		
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	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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	**Part Number**	**Reason**
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**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
Starter/Starter Adapter		
Perform a visual inspection of the starter and starter adapter components.		
Inspect the exterior of the starter adapter housing and cover for cracks with a 10X magnifying glass.		
Inspect the starter adapter housing and accessory drive adapter housing studs for distorted or stripped threads, corrosion, or pitting, or looseness.		
Check the shaft gears, worm wheel gears, worm gear, or worm gear shafts for cracks.		
Check for damaged or loose studs on the starter and accessory drive adapter.		
Replacement Part Description	**Part Number**	**Reason**
Lubrication System		
Inspect the exterior and cavity of the oil pump housing with a 10X magnifying glass.		
Inspect the oil pump cover, tach drive housing, and oil filter adapter with a 10X magnifying glass.		
Inspect the oil pump cover for scoring at gear contact surfaces.		
Using a flashlight and 10X magnifying glass, inspect all remaining Lubrication System components.		
Inspect all oil passages, especially in the oil pump housing and tach drive housings, for flow restrictions.		
Inspect the oil pump housing gear shaft for security and scoring.		
Inspect the oil pump pressure relief valve plunger for scoring and nicks and the face for roughness.		
Check the oil pump drive gear shaft and shaft splines for wear or damage.		
Inspect the oil sump and sump bolt holes.		

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
Inspect the oil drain plug boss and drain plug for damaged threads and damaged wrench flats.		
Inspect the oil suction tube assembly for dents, cracks, distorted or restricted openings.		
Inspect the oil pump housing and tach drive housing studs for distorted or stripped threads.		
Inspect the lubrication system fastening studs.		
Replacement Part Description	**Part Number**	**Reason**
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”.		
Replacement Part Description	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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.		
Replacement Part Description	**Part Number**	**Reason**
Engine Drive Train		
Inspect the drive train components using the “Engine Drive Train Inspection Checklist”(Section 11-9)		
Replacement Part Description	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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	**Part Number**	**Reason**

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.		
Inspection Item	**Focus**	**Initials**
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.		
Inspection Item	**Focus**	**Initials**
Oil pump cover	•Oil pump cavity area •Mounting flanges	
Oil filter adapter	•Mounting flanges •Oil seal or bushing seats	
Cast aluminum oil sump	•Mounting flanges •Bolt holes	
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.		
Inspection Item	**Initials**	**Inspector Notes**
Crankshaft: •Journals •Fillets •Oil holes •Thrust flanges •Prop flange		
Cylinder Barrels: •Fin tips •Fin roots		
Camshaft: •Lobes •Journals •Drilled hole edges		
Rocker arms: •Pad •Socket under side arms and boss		
Idler sheave support bolt		
Starter Adapter: •Shaft gear •Worm shaft •Worm gear		
Lubrication System: •Oil pump gears •Bevel gears •Tach drive shaft		

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.		
Inspection Item	**Initials**	**Inspector Notes**
•Counterweights (after bushings installed) •Counterweight hanger blade (after bushing installed) •Crankshaft gears •Camshaft gear •Idler gear •Governor drive gear		
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 11-6. 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		
Inspection Item	**Result**	**Remedy**
Crankshaft (Section 15-6.1)		
Crankshaft Main Journal #1		
Crankshaft Main Journal #2		
Crankshaft Main Journal #3		
Crankshaft Main Journal #4		
Crankshaft Main Journal #5		
Vibroetch Passing Crankshaft with Inspection Results		
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		
Inspection Item	**Dimension**	**Initials**
Crankcase (Section 15-7)		
Through-bolt in crankcase diameter		
Idler gear support in crankcase (front) diameter		
Idler gear support in crankcase (rear) diameter		
Oil pump housing pilot in crankcase diameter		
Idler gear end clearance		
Idler gear in support bushing (front) diameter		
Idler gear in support bushing (rear) diameter		
Magneto pilot in crankcase diameter		
Starter shaft gear roller bearing hole diameter		
Governor drive shaft in crankcase diameter		
Crankcase (each half) width		
Crankcase (cylinder deck-to-cylinder deck) width		
Accessory drive adapter pilot in crankcase diameter		
Governor Drive Gear Backlash		
Crankshaft Journal Bore diameter		
Camshaft Journal Bore Diameter		
Tappet Guides Diameter		
Governor Driven Gear Bearing Diameter		
Starter Shaft Needle Bearing Hole Diameter		
Idler gear support pin front cc diameter		
Idler gear support pin rear cc diameter		
Camshaft journal diameter 1		
Camshaft journal diameter 2		
Camshaft journal diameter 3		
Camshaft journal diameter 4		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Intake valve tappets OD							
Exhaust valve tappets OD							
Drive Train (Section 15-7)							
Crankshaft front journal							
Crankshaft rear journal							
Crankshaft #2 journal							
Crankshaft #3 journal							
Crankshaft #4 journal							
Crankshaft #5 journal							
Crank pins							
Counterweight hanger blade bushing							
Camshaft journal diameter							
Crankshaft main bearings diameter							
Crank pins out-of-round							
Main journals out-of-round							
Crankshaft front journal diameter							
Crankshaft rear journal diameter							
Crankshaft #2 journal diameter							
Crankshaft #3 journal diameter							
Crankshaft #4 journal diameter							
Crankshaft #5 journal diameter							
Crank pin diameter							
Crankshaft run-out at center main journals							
Crankshaft run-out at propeller flange pilot							
Crankshaft run-out at propeller flange face							
Crankshaft Counterweights (Section 10-9.1 of M-0, Standard Practice Maintenance Manual)							
Damper pin bushing in crank cheek ext. diameter							
Damper pin bushing in counterweight diameter							
Damper pin in counterweight end clearance							
Alternator gear on crankshaft diameter							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D		
Inspection Item	**Dimension**	**Initials**
Crankshaft gear on crankshaft diameter		
Crankshaft in thrust bearing end clearance		
Governor oil transfer collar on crankshaft diameter		
Camshaft journals in crankcase diameter		
Camshaft in crankcase end clearance		
Camshaft run-out at center journals (shaft support at end journals) full indicator reading		
Camshaft gear on camshaft flange diameter		
Bushing in connecting rod diameter		
Bolt in connecting rod diameter		
Connecting rod bearing on crank pin diameter		
Connecting rod on crank pin end clearance		
Connecting rod bearing and bushing twist or convergence per inch of length		
Crankshaft gear and camshaft gear backlash		
Crankshaft gear and idler gear backlash		
Idler gear and accessory drive gear (right and left) backlash		
Starter shaft gear and crankshaft gear backlash		
Counterweight 4^{th} order pins		
Counterweight 5^{th} order pins		
Counterweight 6^{th} order pins (1)		
Counterweight 6^{th} order pins (2)		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Journal	**1**	**2**	**3**	**4**			
Counterweight bushing bore							
Counterweight bushing ID							
Counterweight hanger blade bushing ID							
Counterweight hanger blade bore							
Connecting Rods (Section 10-9.4.1 in M-0)	**1**	**2**	**3**	**4**	**5**	**6**	
Bushing bore diameter (bushing installed)							
Bushing center to crank pin center							
Engine Cylinders (Section 15-7.3)	**1**	**2**	**3**	**4**	**5**	**6**	
Cylinder bore (lower 4-1/4 inch of barrel) diameter							
Cylinder bore choke (at 5.75 inch from open end of barrel) taper							
Cylinder bore out-of-round							
Cylinder bore – allowable oversize							
Cylinder bore surface (Nitrided Barrels) Cross hatch angle Finish in micro-inches R_a							
Cylinder barrel in crankcase diameter							
Intake valve seat insert in cylinder head diameter							
Intake valve guide in cylinder head diameter							
Exhaust valve guide in cylinder head diameter							
Exhaust valve seat insert in cylinder head diameter							
New intake valve seat width							
New exhaust valve seat width							
Rocker shaft in cylinder head bosses diameter							
Rocker arm bushing bore diameter							
Rocker arm bushing inside diameter – finish bore							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Engine Cylinders (cont.)	**1**	**2**	**3**	**4**	**5**	**6**	
Rocker arm side clearance							
Intake valve guide inside diameter							
Intake valve in guide diameter							
Exhaust valve guide inside diameter							
Exhaust valve in guide diameter							
Rocker arm foot to valve stem (dry valve gear lash)							
Piston, moly coated (bottom of skirt) in cylinder diameter							
Top piston ring in groove side clearance							
Second piston ring in groove side clearance							
Third piston ring in groove side clearance							
Fourth piston ring in groove side clearance							
Top ring gap							
Second ring gap							
Third ring gap							
Fourth ring gap							
Piston pin in piston diameter							
Piston Pin diameter							
Piston pin in cylinder end clearance							
Piston pin in connecting rod bushing diameter							
Bushing in connecting rod diameter							
Connecting rod bearing on crankpin diameter							
Connecting rod on crankpin end clearance							
Connecting rod bearing and bushing twist or convergence per inch of length							
Hydraulic tappet in crankcase diameter							
Inner valve spring 654442 compressed to 1.230 in. length load							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Engine Cylinders (cont.)	**1**	**2**	**3**	**4**	**5**	**6**	
Inner valve spring 654442 compressed to 1.745 in. length load							
Outer valve spring 654441 compressed to 1.275 in. length load							
Outer valve spring 654441 compressed to 1.790 in. length load							
Installed outer valve spring height							
Cylinder assembly intake valve guide bore							
Cylinder assembly exhaust valve guide bore							
Rocker arm bushings inside diameter							
Valve rocker shaft outside diameter							
Intake valve stem diameter							
Exhaust valve stem diameter							
Piston diameter at top							
Piston diameter below 1st groove							
Piston diameter at bottom							
Piston pin bore diameter							
Piston third ring groove width							
Piston fourth ring groove width							
Piston pin length w/plugs							
Rocker arm thrust width							
Cylinder dimension STD D							
Cylinder dimension 0.005 D							
Cylinder dimension STD X							
Cylinder dimension 0.005 X							
Cylinder dimension STD Y							
Cylinder dimension 0.005 Y							
Starter Adapter (Section 15-7.4)							
Starter shaft gear needle bearing hole crankcase diameter							
Starter shaft gear front (bearing) journal diameter							
Starter shaft gear in clutch drum bearing diameter							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D		
Inspection Item	**Dimension**	**Initials**
Starter Adapter (cont.)		
Clutch spring sleeve in starter adapter diameter		
Starter shaft gear in ball bearing diameter		
Bearing in starter adapter cover diameter		
Worm wheel gear end clearance		
Worm wheel drum diameter		
Starter shaft gear drum diameter		
Clutch spring in clutch spring sleeve diameter		
From center line of worm gear shaft to starter adapter thrust pads		
Needle bearing hole starter adapter diameter		
Ball bearing in starter adapter diameter		
Worm gear shaft in needle bearing area diameter		
Worm gear shaft in ball bearing diameter		
Starter worm gear on shaft diameter		
Starter spring on worm drive shaft diameter		
Starter pilot to starter drive adapter diameter		
Scavenge pump driven gear on shaft diameter		
Scavenge pump driver and driven gear in body end clearance		
Scavenge pump driver and driven gear in body diameter		
Bushing in scavenge pump driven gear diameter		
Scavenge pump driver and driven gear backlash		
Starter worm wheel gear and worm gear backlash		
Worm wheel drum A dimension		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D		
Inspection Item	**Dimension**	**Initials**
0.015 Undersize worm wheel drum A dimension		
Worm wheel drum B dimension		
0.015 Undersize worm wheel drum B dimension		
Shaft Gear Drum dimension		
0.015 Undersize Shaft Gear Drum dimension		
Lubrication System (Section 15-7.5)		
Oil pump driven gear shaft diameter		
Oil pump drive gear hole diameter		
Oil pump gear chamber depth		
Oil pump drive gear shaft diameter		
Oil pump driven gear shaft diameter		
Oil pressure relief valve adjusting screw in plunger diameter		
Oil pressure relief valve seat in housing depth		
Oil pump driver gear in pump housing diameter		
Oil pump driver gear shaft in pump housing diameter		
Oil pump driven gear to driven gear shaft diameter		
Oil pump driver gear in pump housing end clearance		
Oil pump driven gear in pump housing end clearance		
Oil pump driver gear shaft in oil pump cover diameter		
Oil pump driven gear in housing diameter		
Oil pump drive and driven gears' backlash		
Oil pressure relief valve spring compressed to 1.25 inch length load		
Oil temp. control valve 0.090 inches minimum travel at oil temperature		
Oil temperature control valve must close between		

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
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	**1**	**2**	**3**	**4**	**5**	**6**	
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.							
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 11-8. Engine Cylinder Overhaul Inspection Checklist

Fluorescent Penetrant Inspection (on all non-ferrous metal parts) Perform the inspection according to the "Fluorescent Penetrant Inspection" instructions in Section 11-2 of M-0, Standard Practice Maintenance Manual.						
Cylinder	**1**	**2**	**3**	**4**	**5**	**6**
Cylinder Heads						
Cylinder Heads after Valve Seat or Valve Guide Installation						
Magnetic Particle Inspection (on all ferrous parts) Use the fluorescent wet continuous method according to the "Magnetic Particle Inspection" instructions in of M-0, Standard Practice Maintenance Manual.						
Engine cylinder barrel inner and outer surfaces using the close coil shot method						
Engine cylinder intake valve, and rocker arms using circular and longitudinal magnetization						
Dimensional Inspection Refer to the Section 15-7, "Dimensional Inspection" and Appendix D						
Cylinders						
Cylinder Components						

Table 11-9. Engine Drive Train Inspection Checklist

Item to Check	Initials	Action
Inspect the crankshaft, camshaft, connecting rods, and engine drive train components for rusting, pitting, and cracks.		
Using a 10X magnifying glass, inspect the camshaft journals and lobes for scoring, pitting, corrosion, or any other indication of wear.		
Inspect the camshaft gear splines for wear.		
Inspect the camshaft gear flange for nicks, peening, and other irregularities. (This flange must be smooth to align gears.)		
Inspect the bolt holes on the camshaft gear flange for distorted or stripped threads.		
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.		
Inspect the crankshaft main journals, crank pins, and oil seal area for scoring and burning.		
Inspect the crankshaft gear bolt holes for distorted or stripped threads.		
Check the oil passages on the crankshaft for obstruction or loose oil tubes.		
Check the gear dowel for the desired snug fit.		
Inspect the oil control plug for obstructions in the oil hole and loose fit.		
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.		
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.		
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.		

Table 11-9. Engine Drive Train Inspection Checklist

Item to Check	Initials	Action
Inspect the connecting rod for corrosion, pitting, rust, discoloration (blue), galling, impact damage, nicks, bending, or twisting.		
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.		
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.		
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.		
Inspect the oil transfer collar assembly for cracks and scoring.		
Verify the tin plating on the oil control collar is intact.		
Inspect studs on the oil control collar for corrosion, pitting, incomplete threads, or looseness.		
Check the stud height and dowel settings on the oil control collar according to Section 15-7.9, “Stud Height Dimensional Inspection.”		
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.		
Remove the piston pin bushing from the connecting rod; inspect the piston pin bushing bore and surrounding area for nicks, gouges and mechanical damage.		
Inspect the rod channel rails for nicks, gouges or mechanical damage.		

Table 11-10. Replacement Parts Inventory

Part Description	Part Number	Reason/Comment

Table 11-10. Replacement Parts Inventory

Part Description	Part Number	Reason/Comment

Table 11-10. Replacement Parts Inventory

Part Description	Part Number	Reason/Comment

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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.

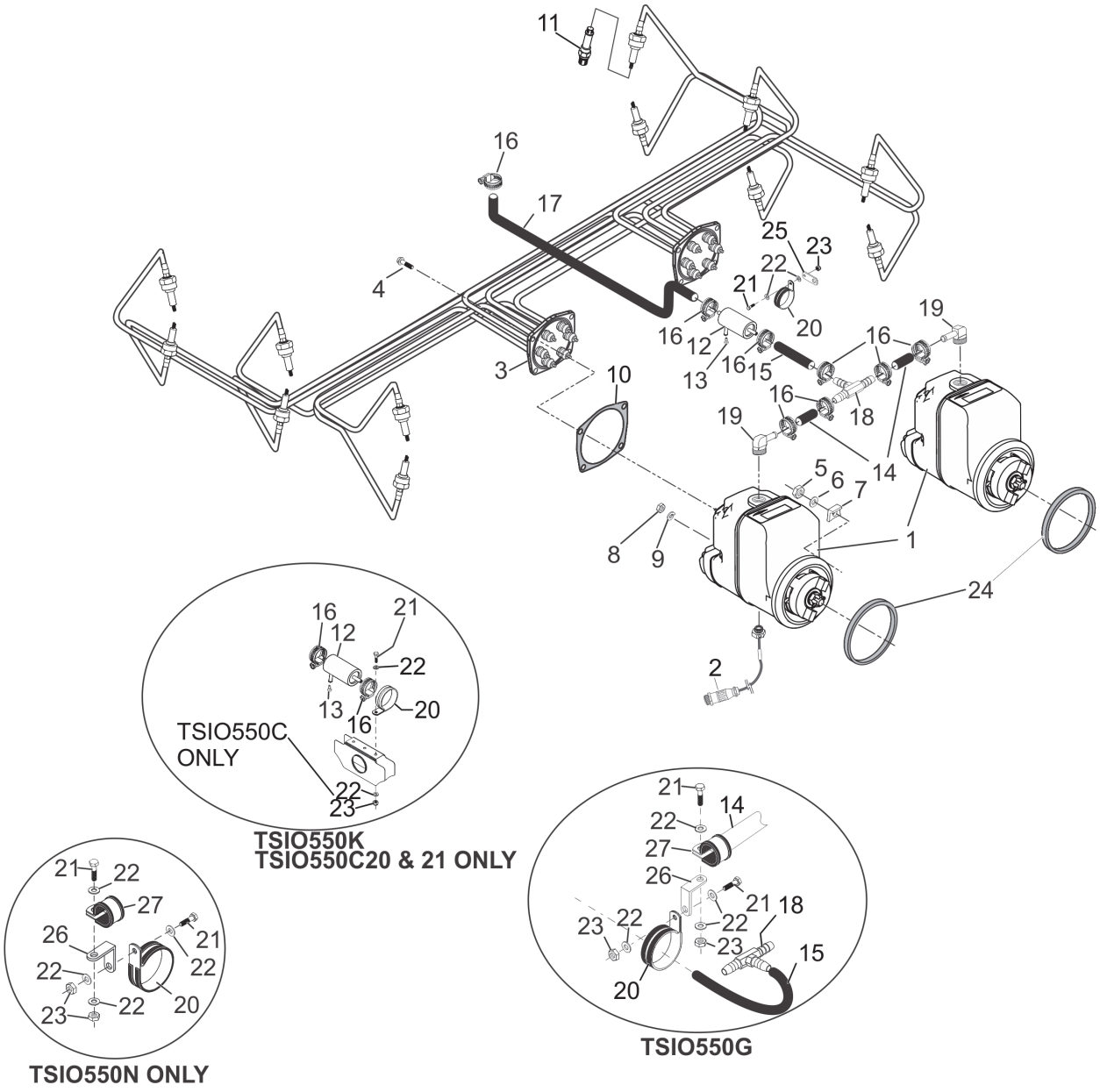


Figure 12-1. Continental Motors Ignition System

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		

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.

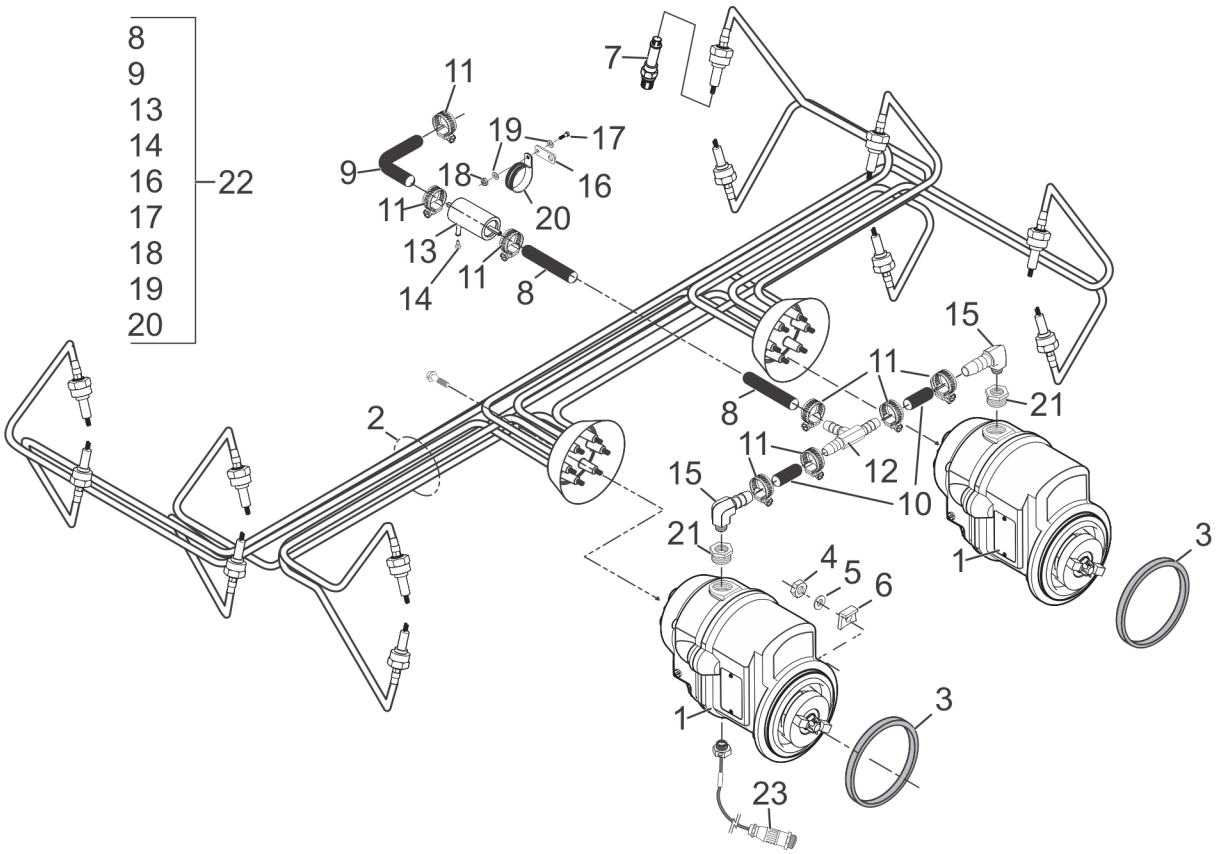


Figure 12-2. Champion (Slick) Ignition System

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
	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.

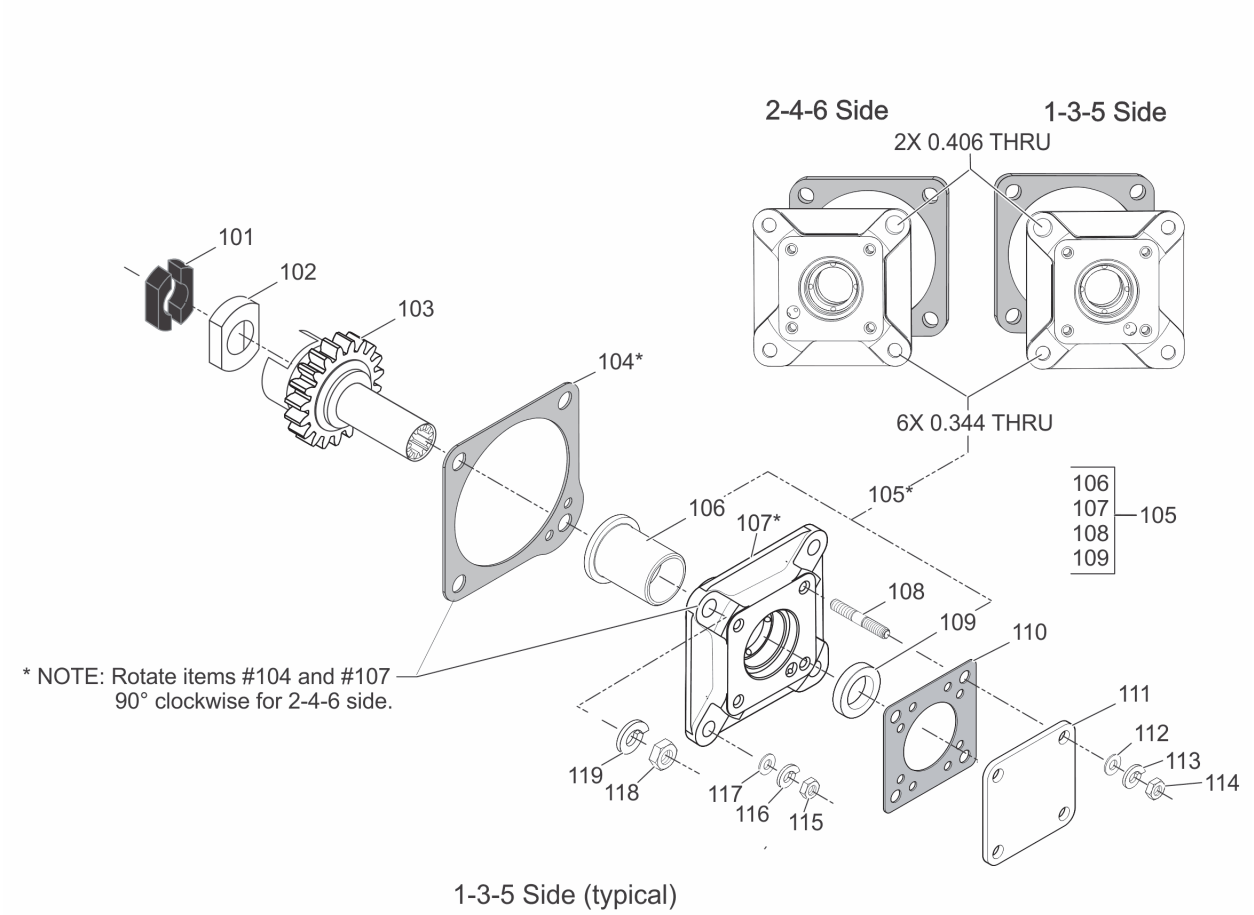


Figure 12-3. Accessory Drive Adapter Assembly

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		

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.

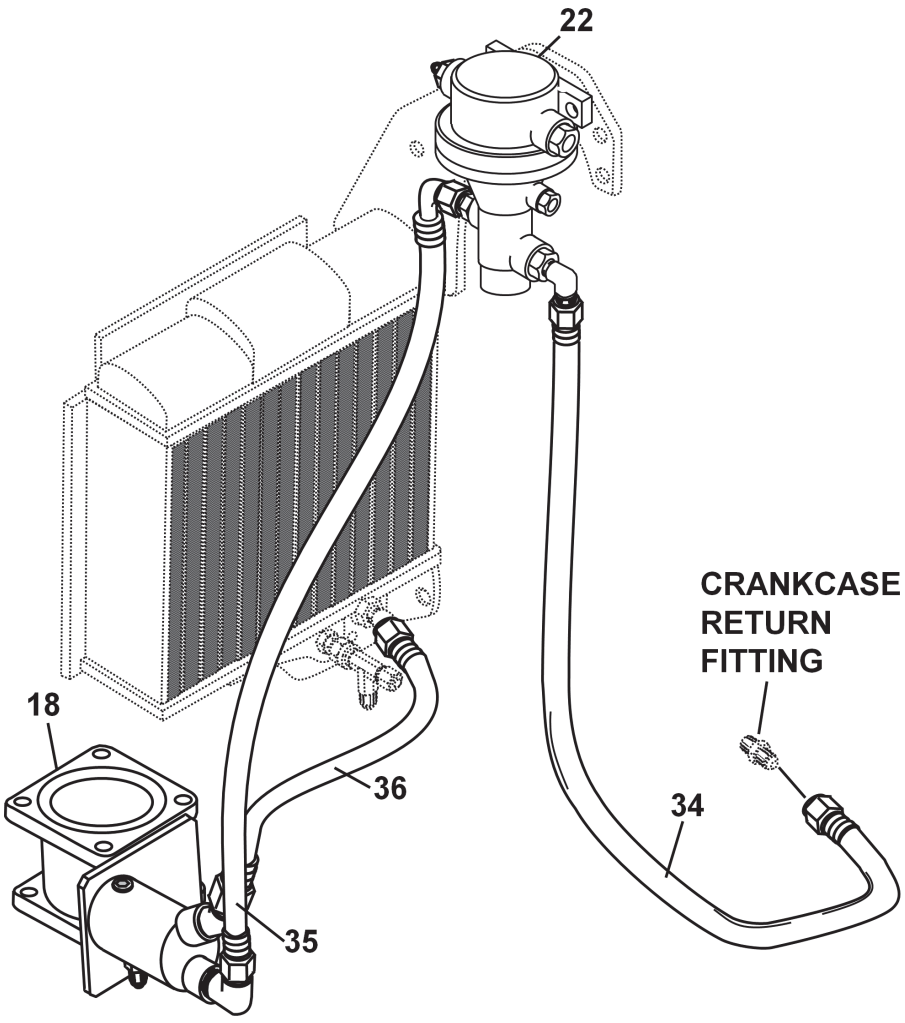


Figure 12-4. Wastegate Controller Lubrication B C E G

NOTE: See Figure 12-20 for legend

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).

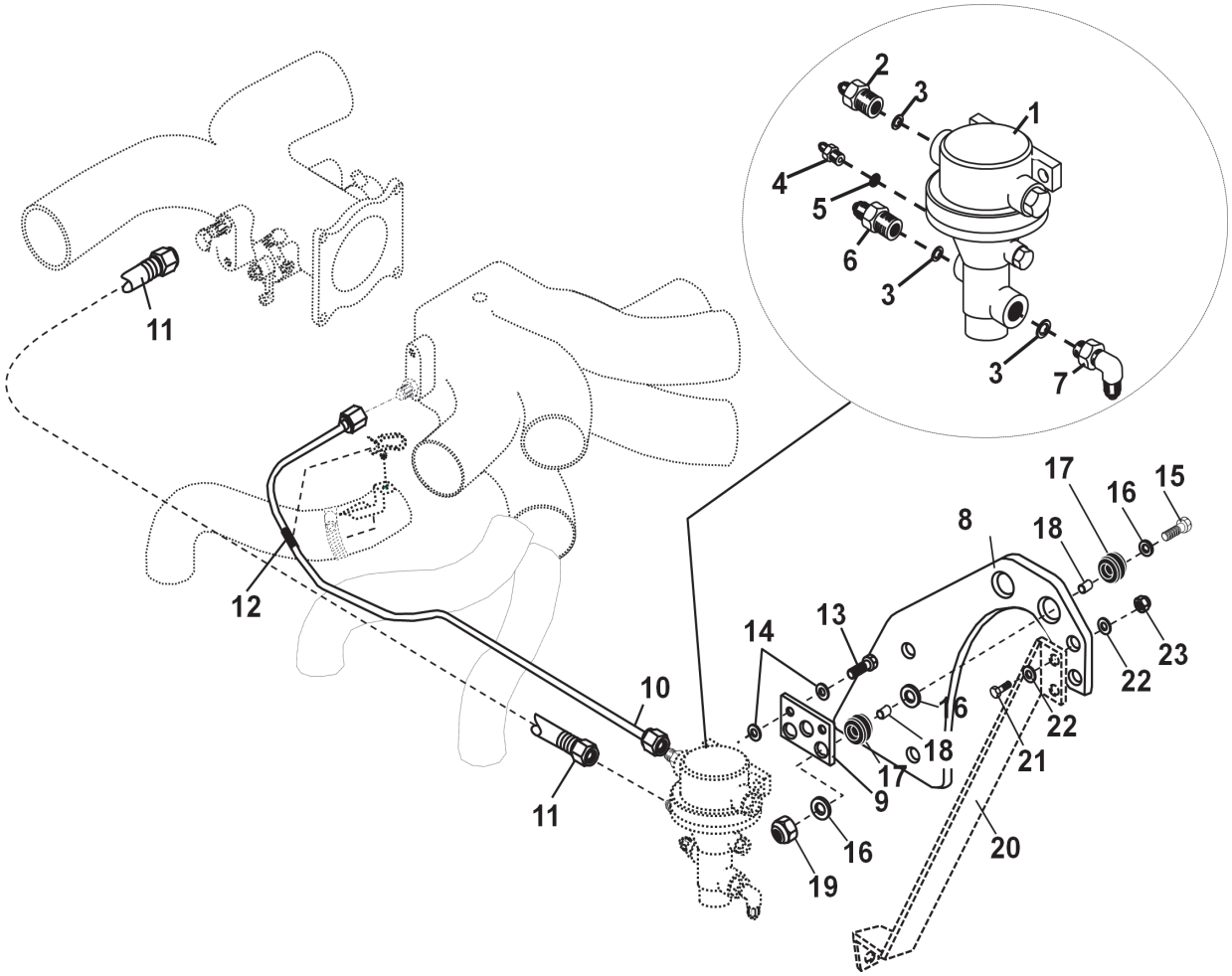


Figure 12-5. Wastegate Controller Assembly Detail B C E G

1	Controller	7	90° Elbow Fitting	13	Bolt	19	Lock Nut
2	Reducer	8	Bracket	14	Washer	20	Bracket
3	O-Ring	9	Bracket	15	Bolt	21	Bolt
4	Adapter	10	Tube Assembly	16	Washer	22	Washer
5	O-Ring	11	Hose Assembly	17	Grommet	23	Lock Nut
6	Adapter Fitting	12	Line Protector	18	Spacer		

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.

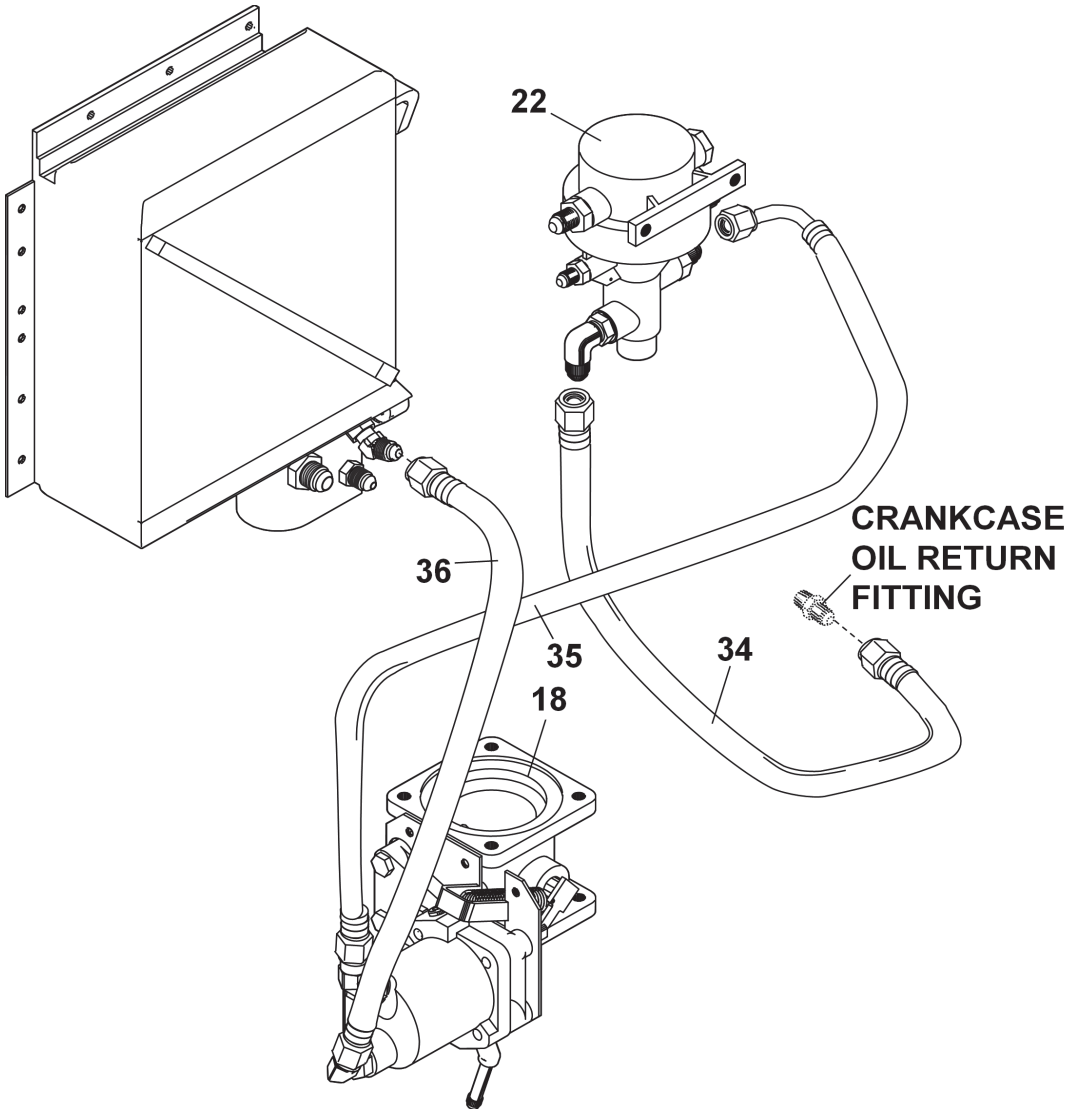


Figure 12-6. Wastegate Controller Lubrication K

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.

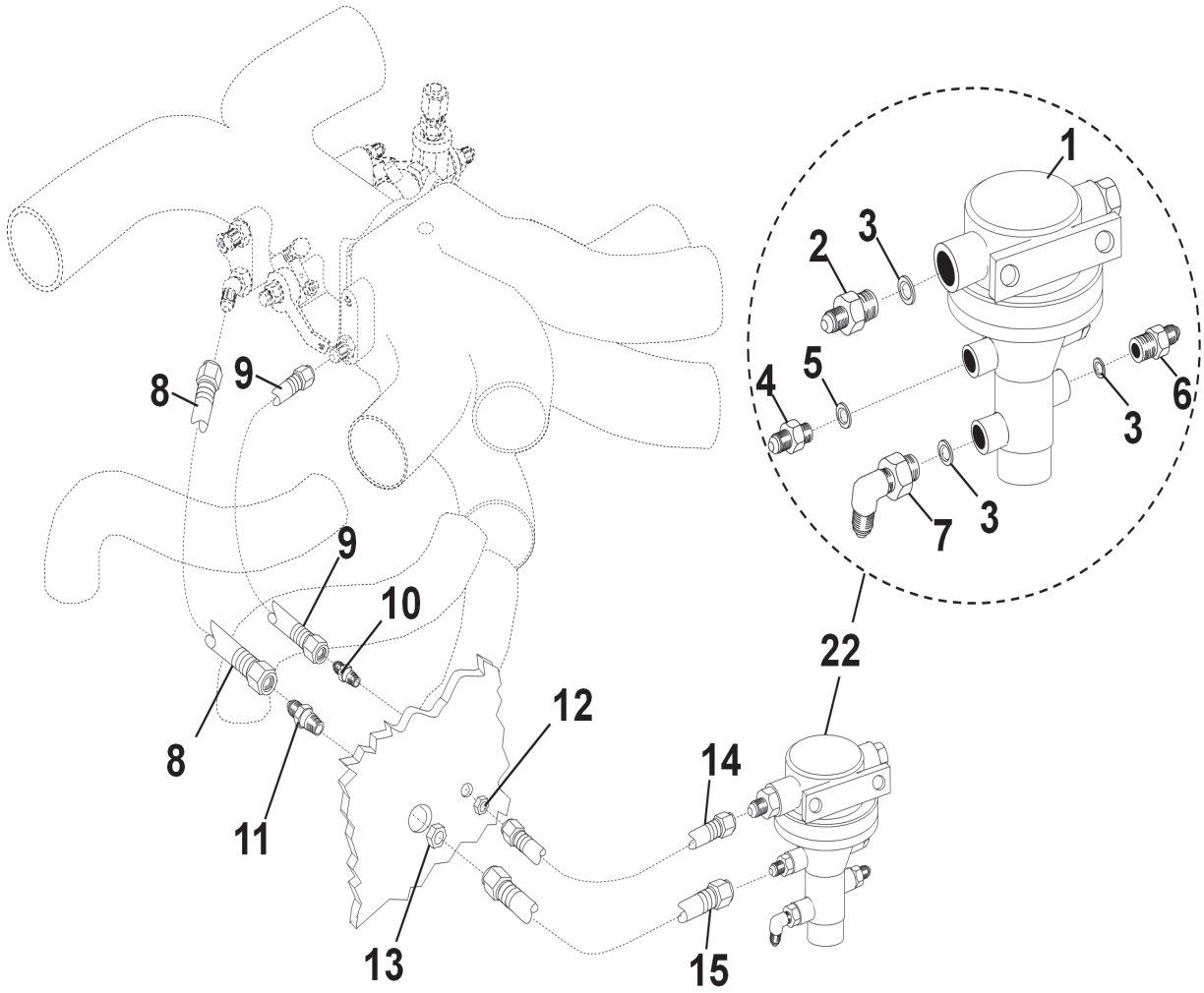


Figure 12-7. Wastegate Controller Assembly K

1	Controller	5	O-Ring Seal	9	Hose Assembly	13	Bulkhead Nut
2	Reducer	6	Adapter Fitting	10	Bulkhead Union	14	Hose Assembly
3	O-Ring Seal	7	Elbow	11	Bulkhead Union	15	Hose Assembly
4	#4 Tube Adapter	8	Hose Assembly	12	Bulkhead Nut		

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.

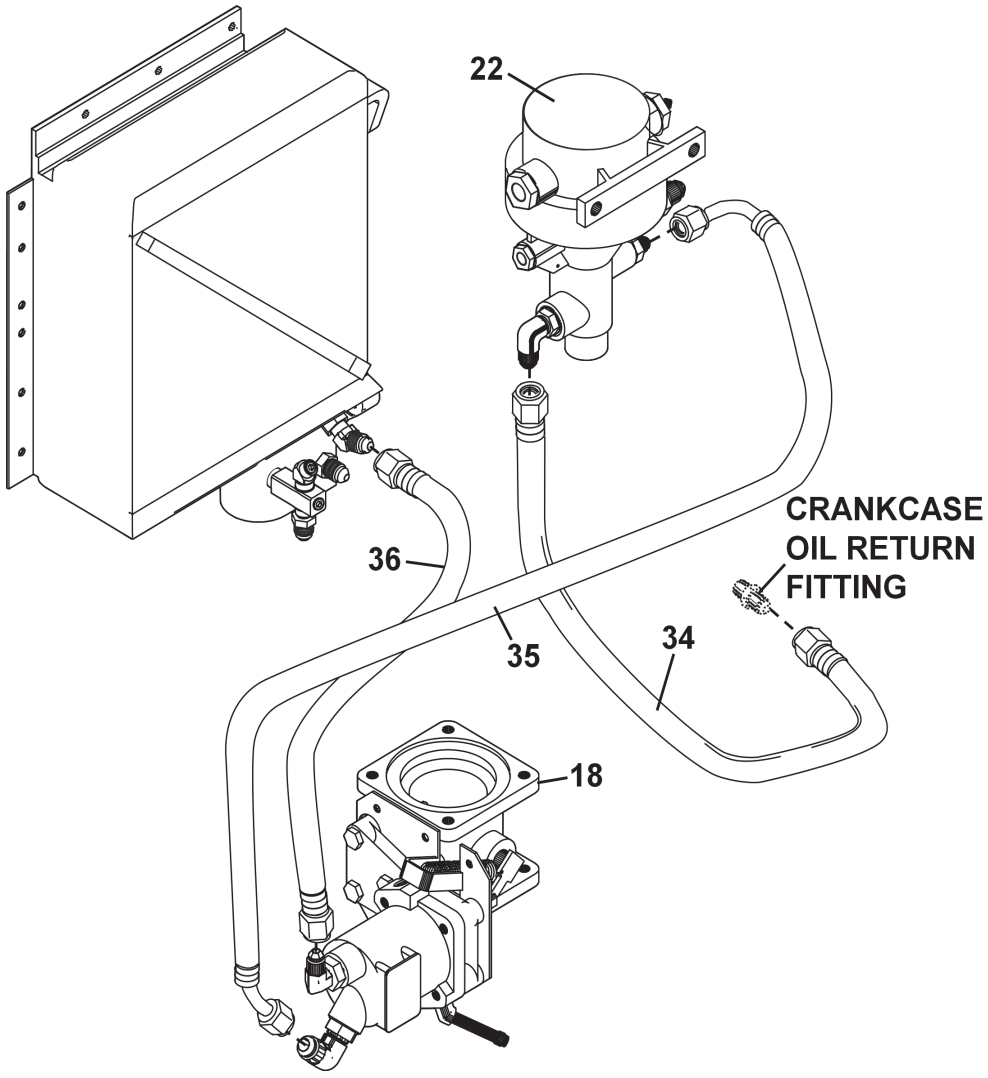


Figure 12-8. Wastegate Controller Lubrication N
See Figure 12-20 for legend

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.

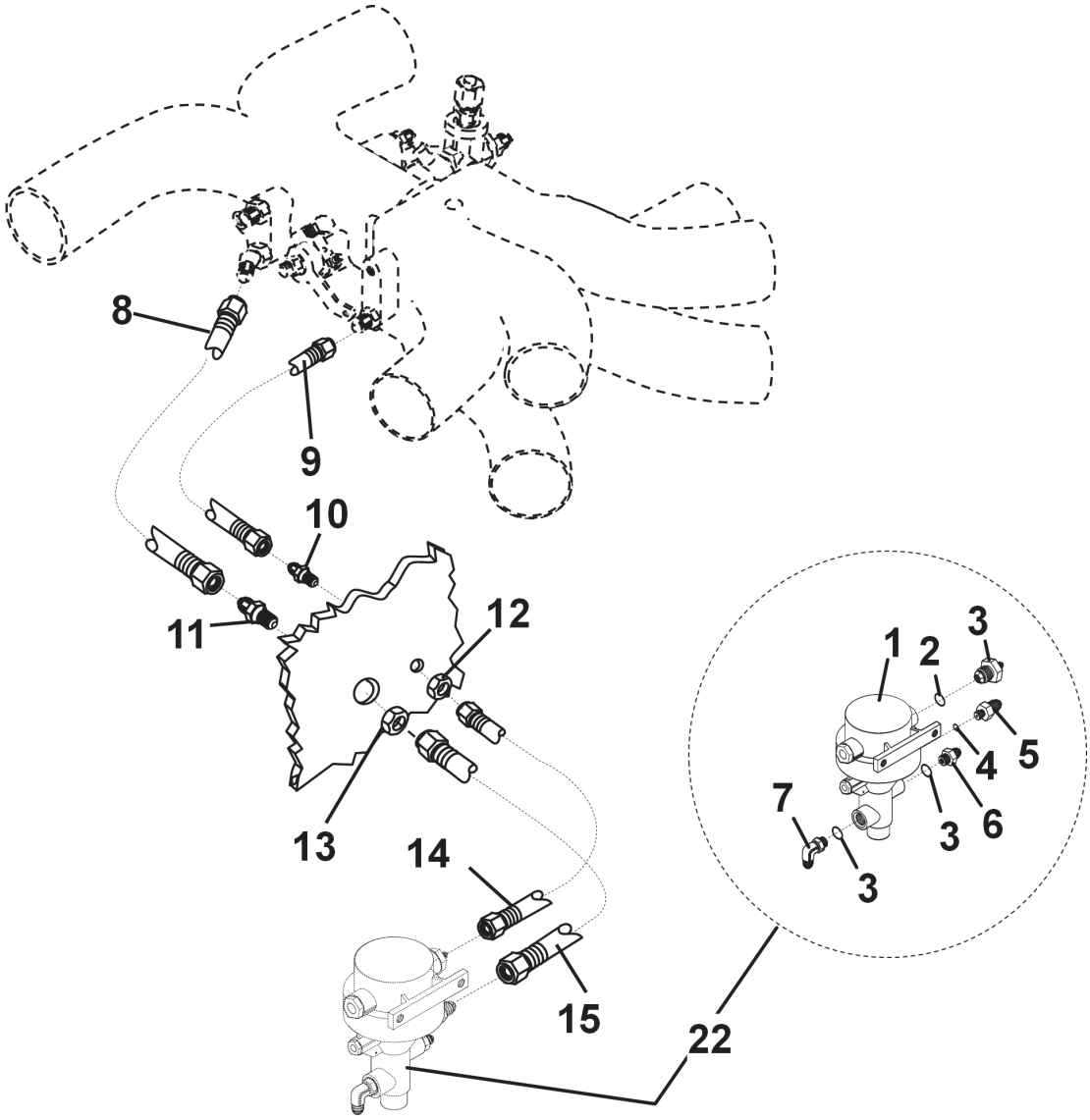


Figure 12-9. Turbocharger Controller and Hoses N

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

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

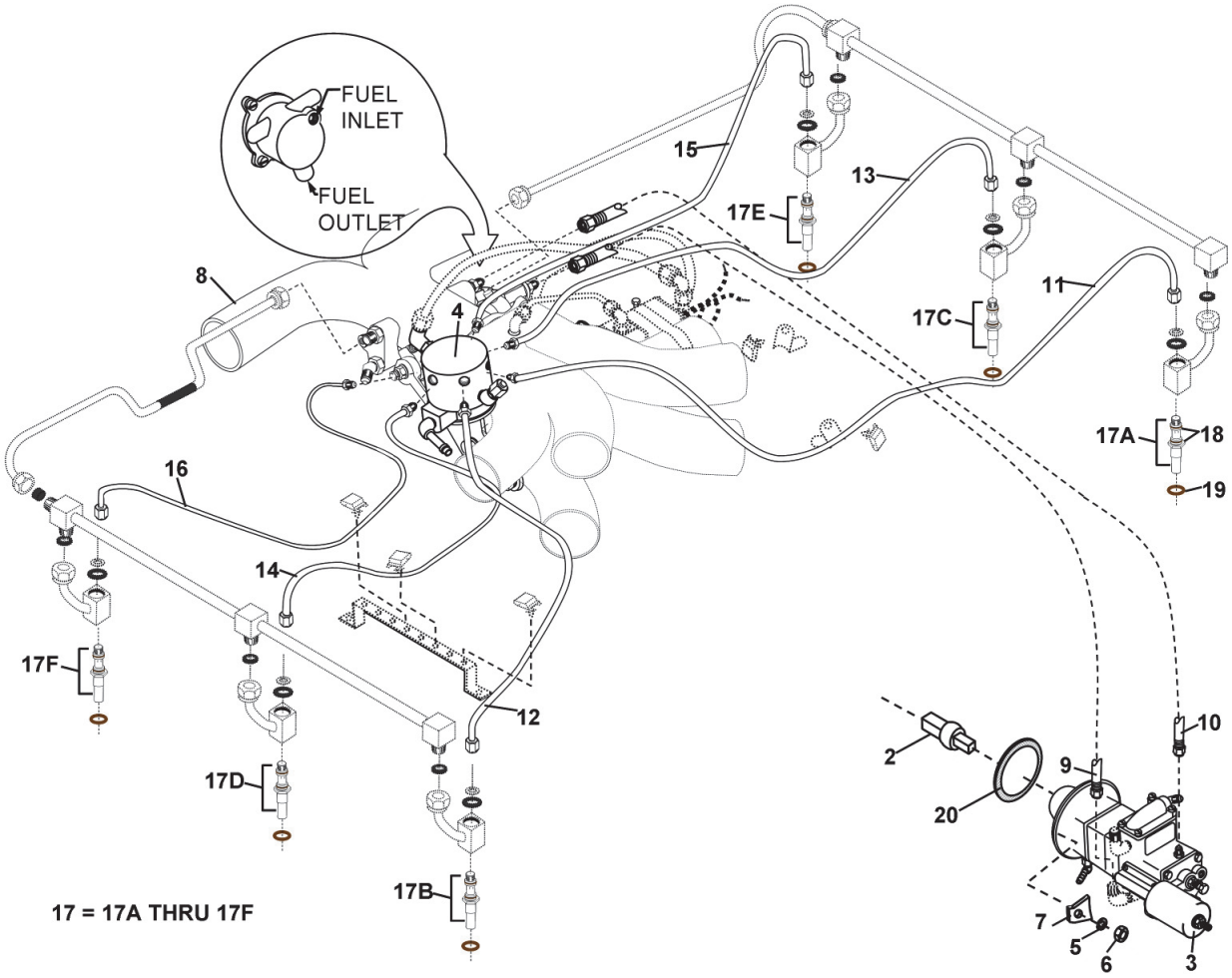


Figure 12-10. Fuel Injection System B C E

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		

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.

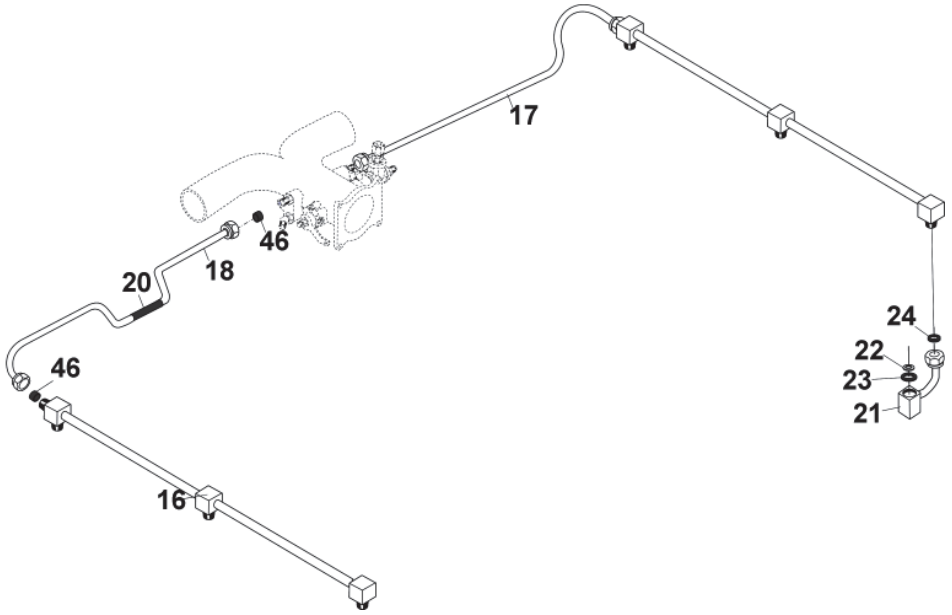


Figure 12-11. Air Reference Tubes

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.

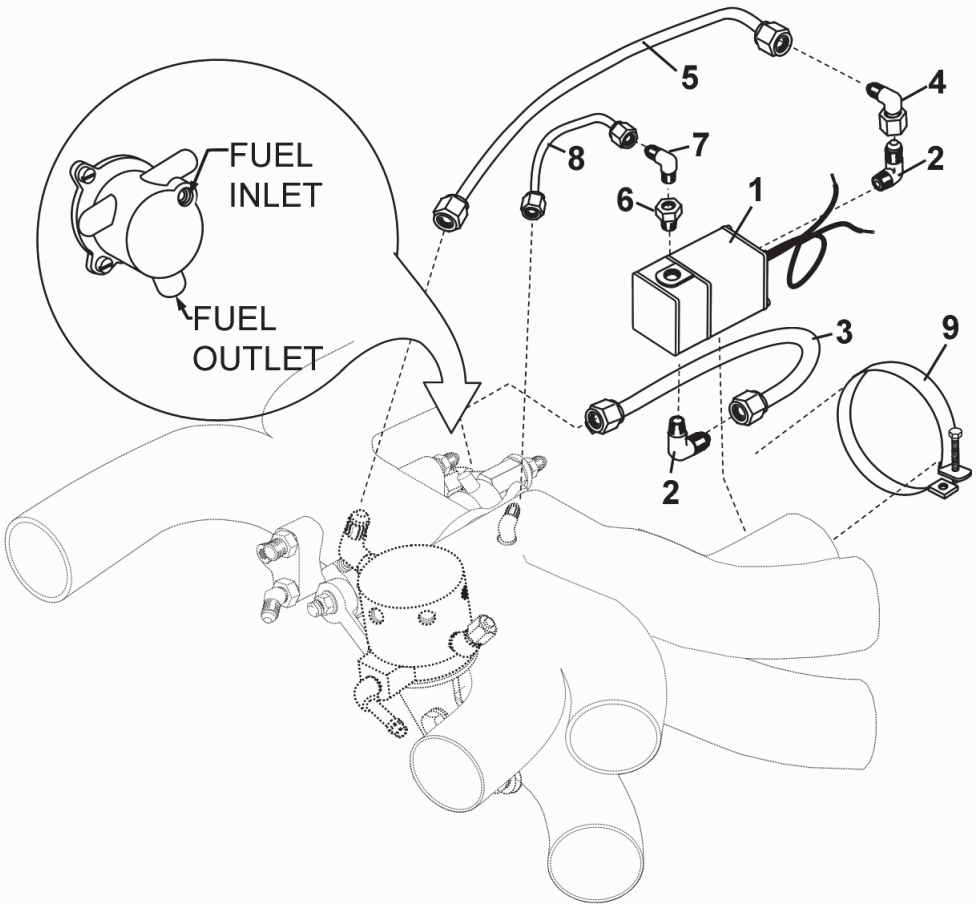


Figure 12-12. Fuel Priming System B C E

1	Diverter Valve	3	Metering Unit Tube	5	Manifold Valve Inlet Tube	7	Elbow
2	Street Elbow	4	Elbow	6	Reducer Bushing	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.

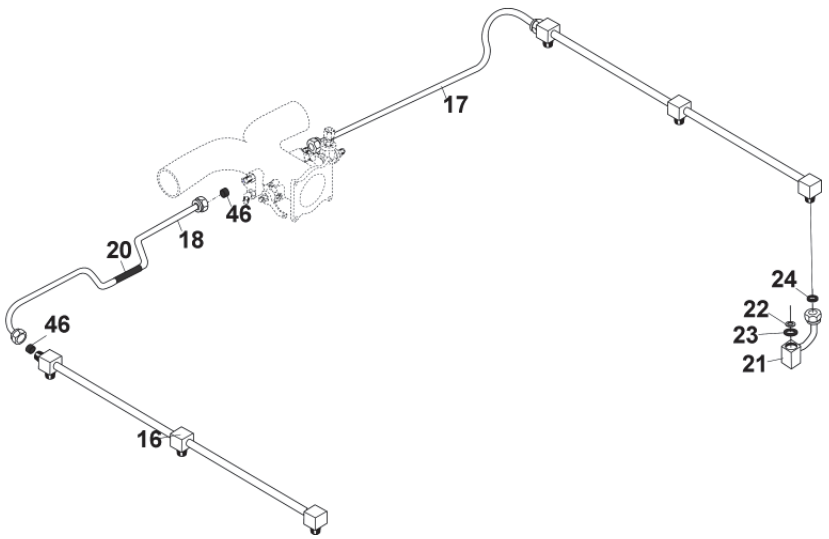


Figure 12-11 repeated for reference

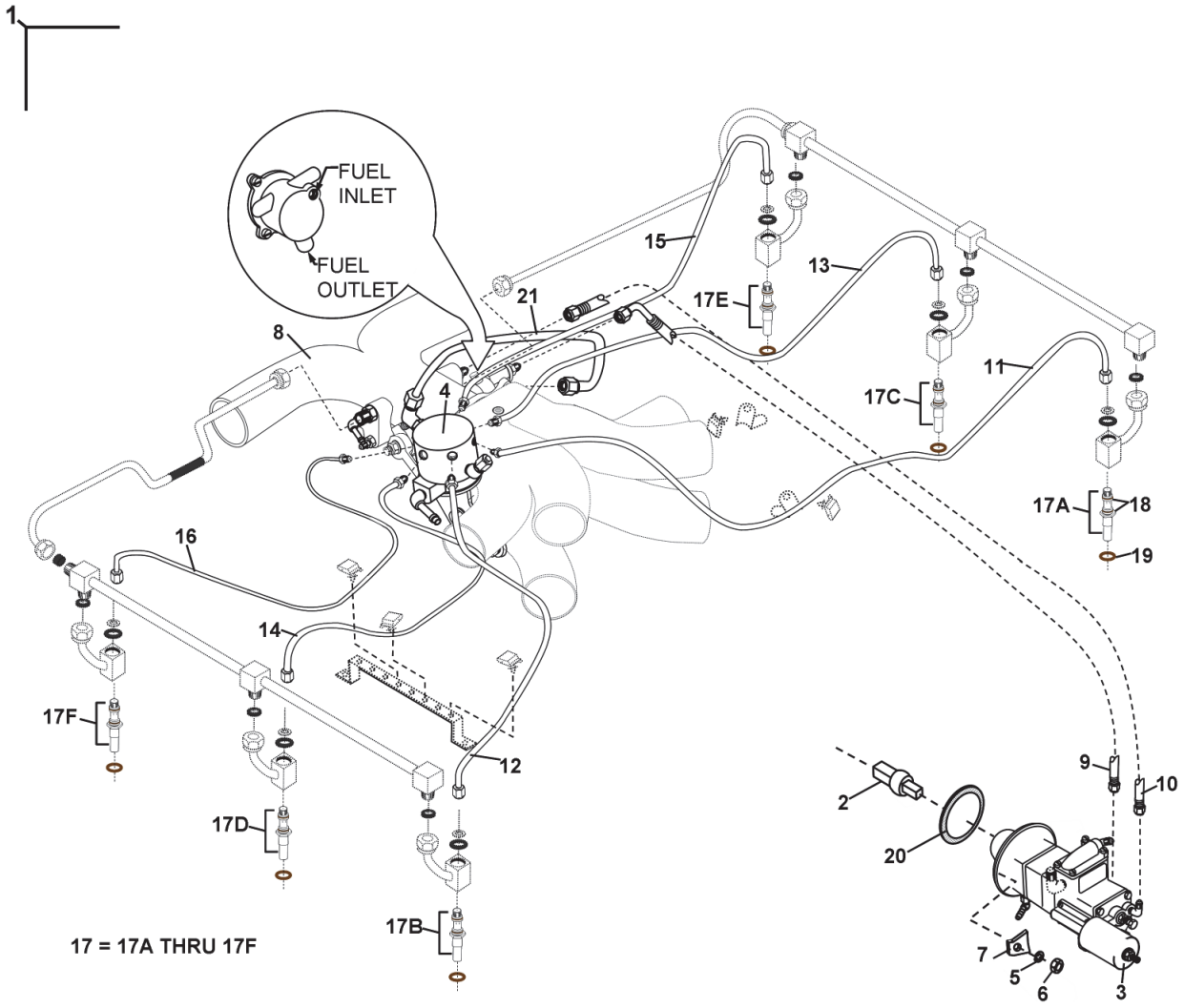


Figure 12-13. Fuel Injection System G

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		

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-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 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.

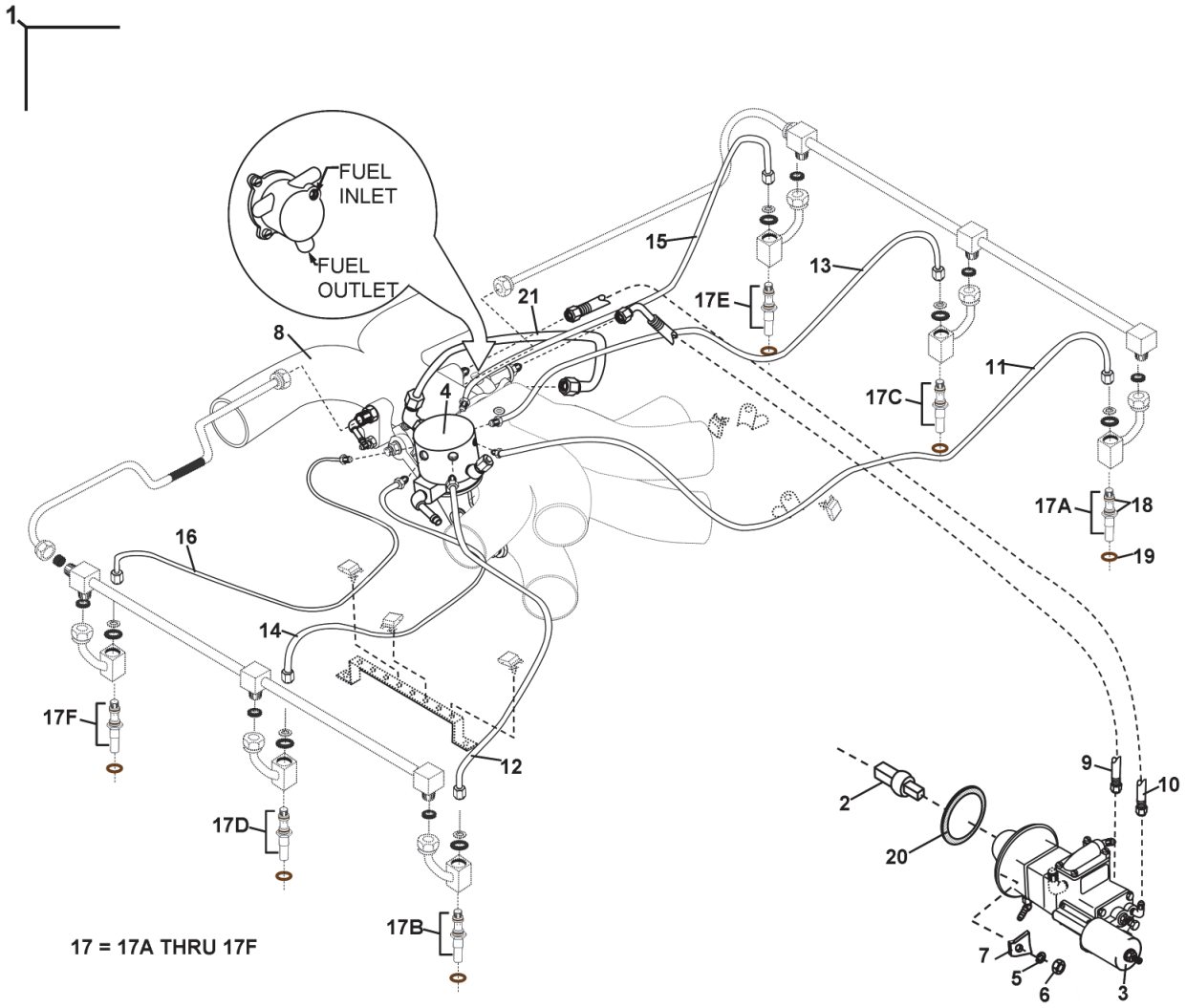


Figure 12-13 repeated for reference

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.

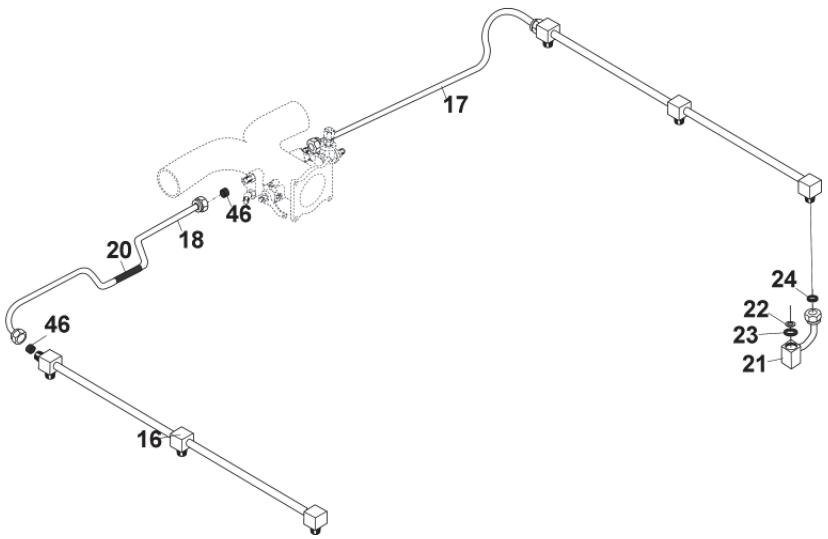


Figure 12-11 repeated for reference

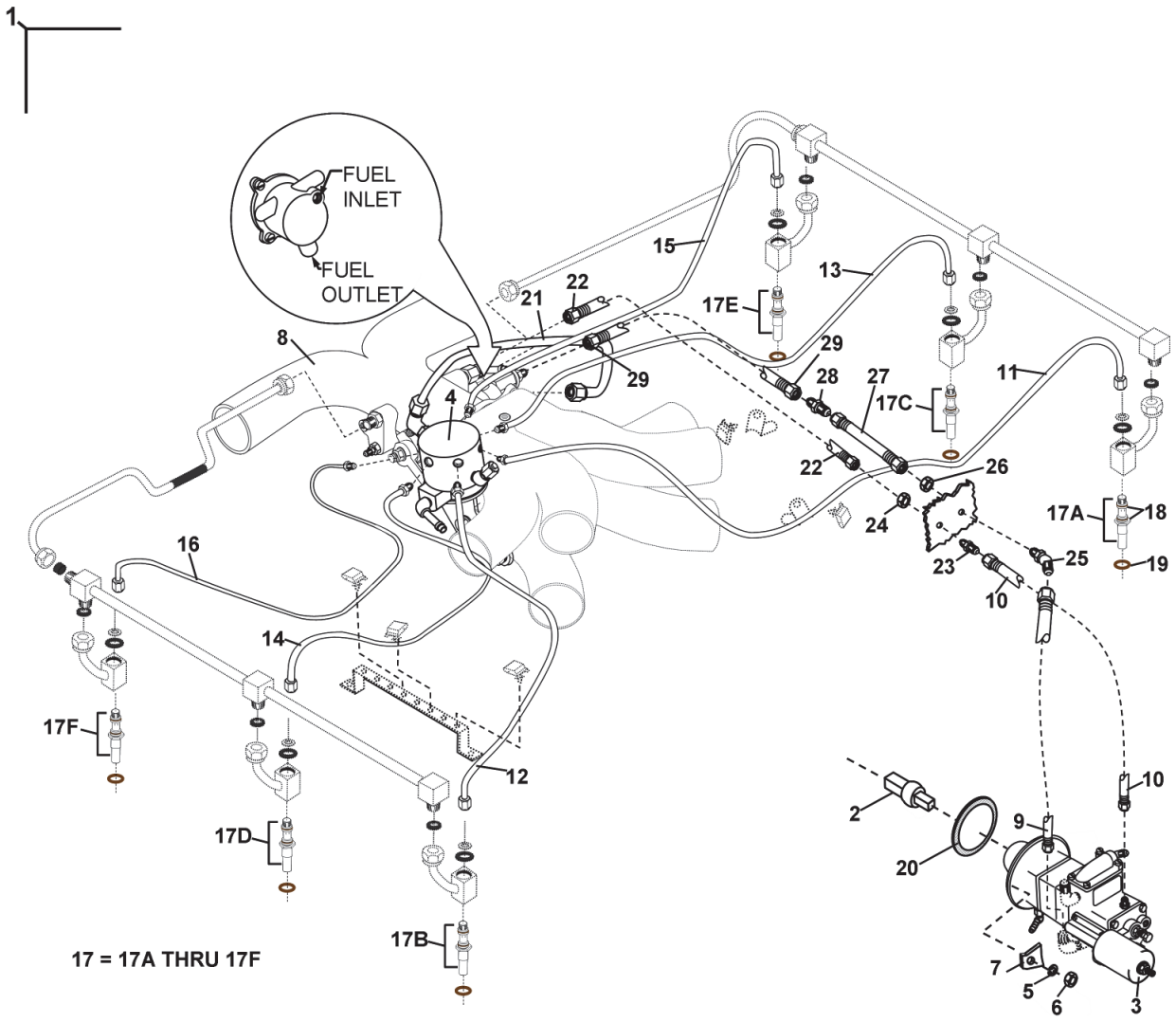


Figure 12-14. Fuel Injection System K N

1	Fuel Injection Kit	10	Hose Assembly	17B	Injector Nozzle #2	22	Hose Assembly
2	Crankshaft Gear Coupling	11	Fuel Inj. Tube Assembly #1	17C	Injector Nozzle #3	23	Bulkhead Union
3	Fuel Pump Assembly	12	Fuel Inj. Tube Assembly #2	17D	Injector Nozzle #4	24	Bulkhead Nut
4	Fuel Manifold Valve Assy.	13	Fuel Inj. Tube Assembly #3	17E	Injector Nozzle #5	25	Bulkhead 45° Fitting
5	Lock Washer	14	Fuel Inj. Tube Assembly #4	17F	Injector Nozzle #6	26	Bulkhead Nut
6	Nut	15	Fuel Inj. Tube Assembly #5	18	Washer	27	Hose Assembly
7	Hold Down Washer	16	Fuel Inj. Tube Assembly #6	19	O-Ring	28	Bulkhead Union
8	Throttle & Metering Assembly	17	Injector Nozzle Kit	20	Fuel Pump Adapter Gasket	29	Hose Assembly
9	Hose Assembly	17A	Injector Nozzle #1	21	Fuel Tube		

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.

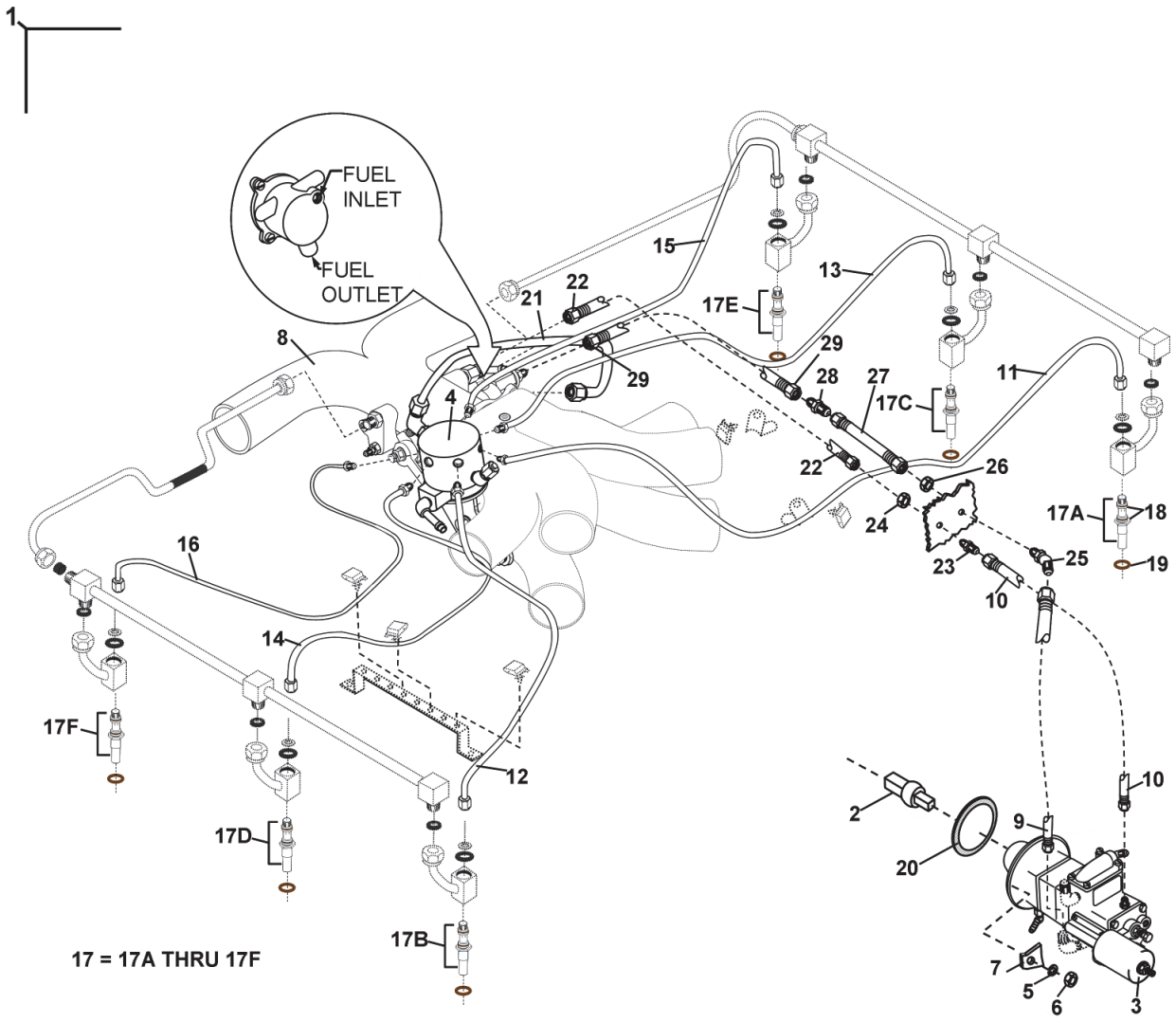


Figure 12-14 repeated for reference

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).

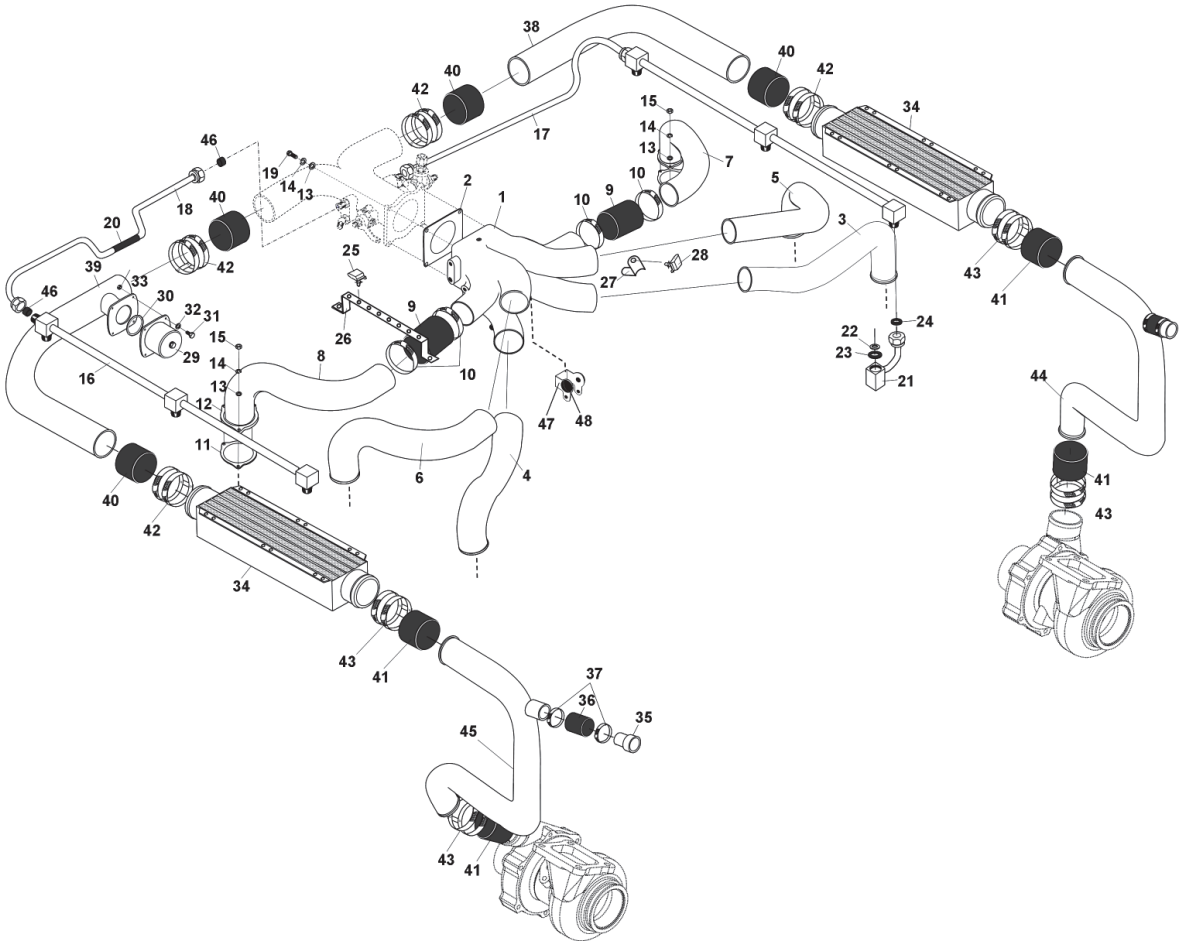


Figure 12-15. Induction Assembly G

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.

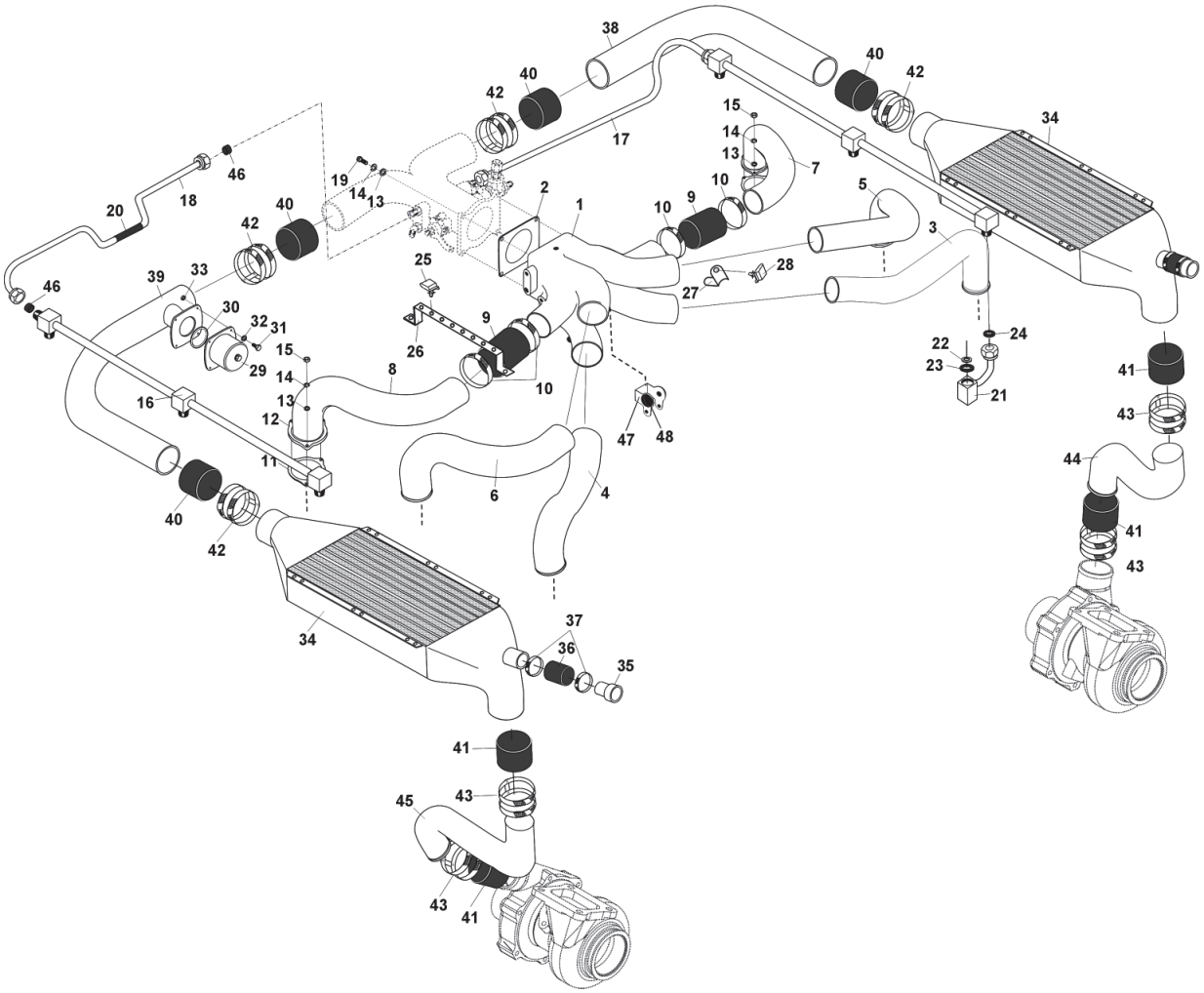


Figure 12-16. Induction System B C E K N

1	Manifold & Fitting Assembly	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Dist. Tube Bracket	38	1-3-5 FWD Induction Tube
3	Tube	15	Nut	27	Fuel Inj. Line Bracket	39	2-4-6 FWD Induction Tube
4	Tube	16	Air Manifold Tube Assembly	28	Tube Clamp	40	Hose
5	Tube	17	Right Air Reference Tube	29	Overboost Valve	41	Hose
6	Tube	18	Left Air Reference Tube	30	O-ring	42	Clamp Assembly
7	Tube	19	Screw	31	Bolt	43	Clamp Assembly
8	Tube	20	Hose	32	Washer	44	1-3-5 AFT Induction Tube
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	2-4-6 AFT Induction Tube
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Intake Manifold Gasket	23	Washer	35	Sonic Venturi Nozzle		
12	Flange	24	Compression Seal	36	Hose		

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.

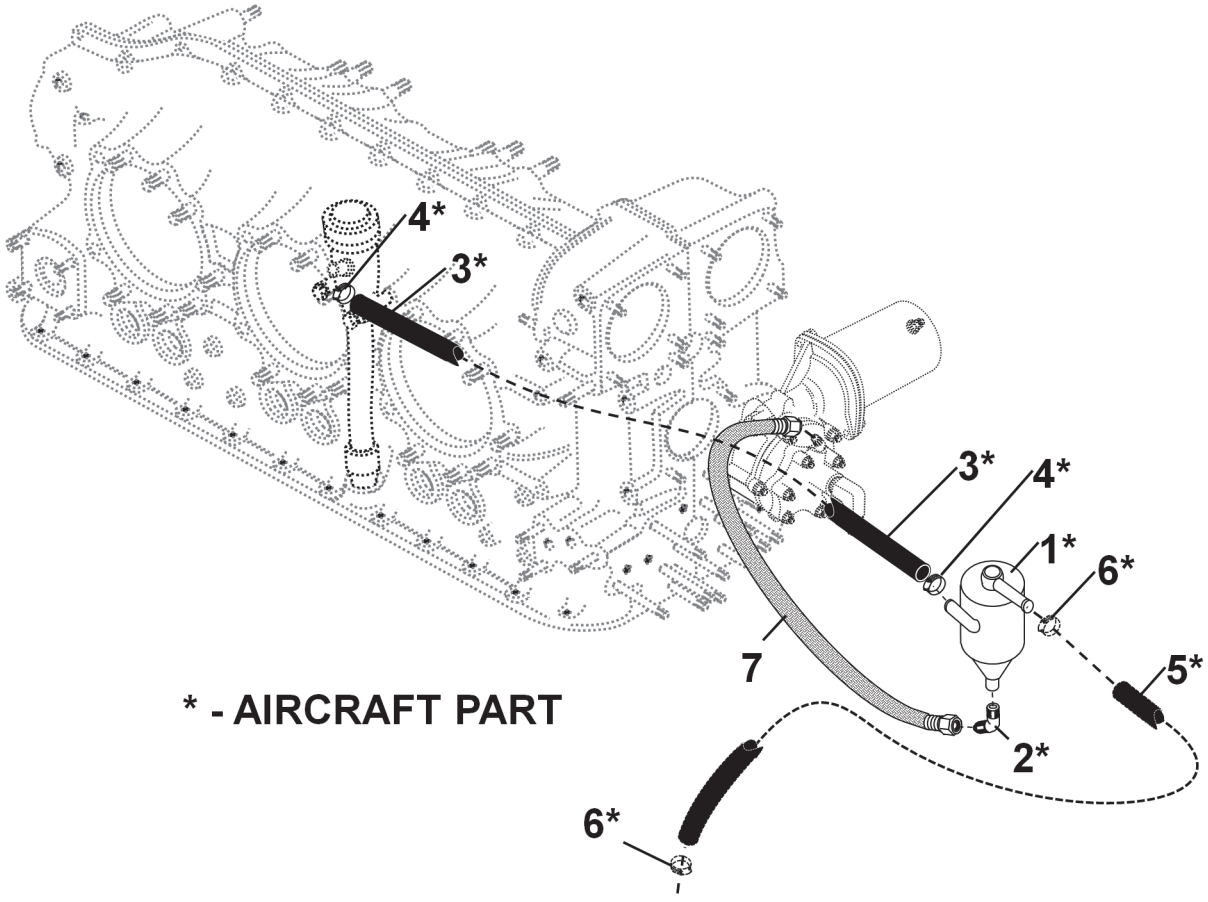


Figure 12-17. Crankcase Ventilation Hose Routing K N
See legend for Figure 12-18

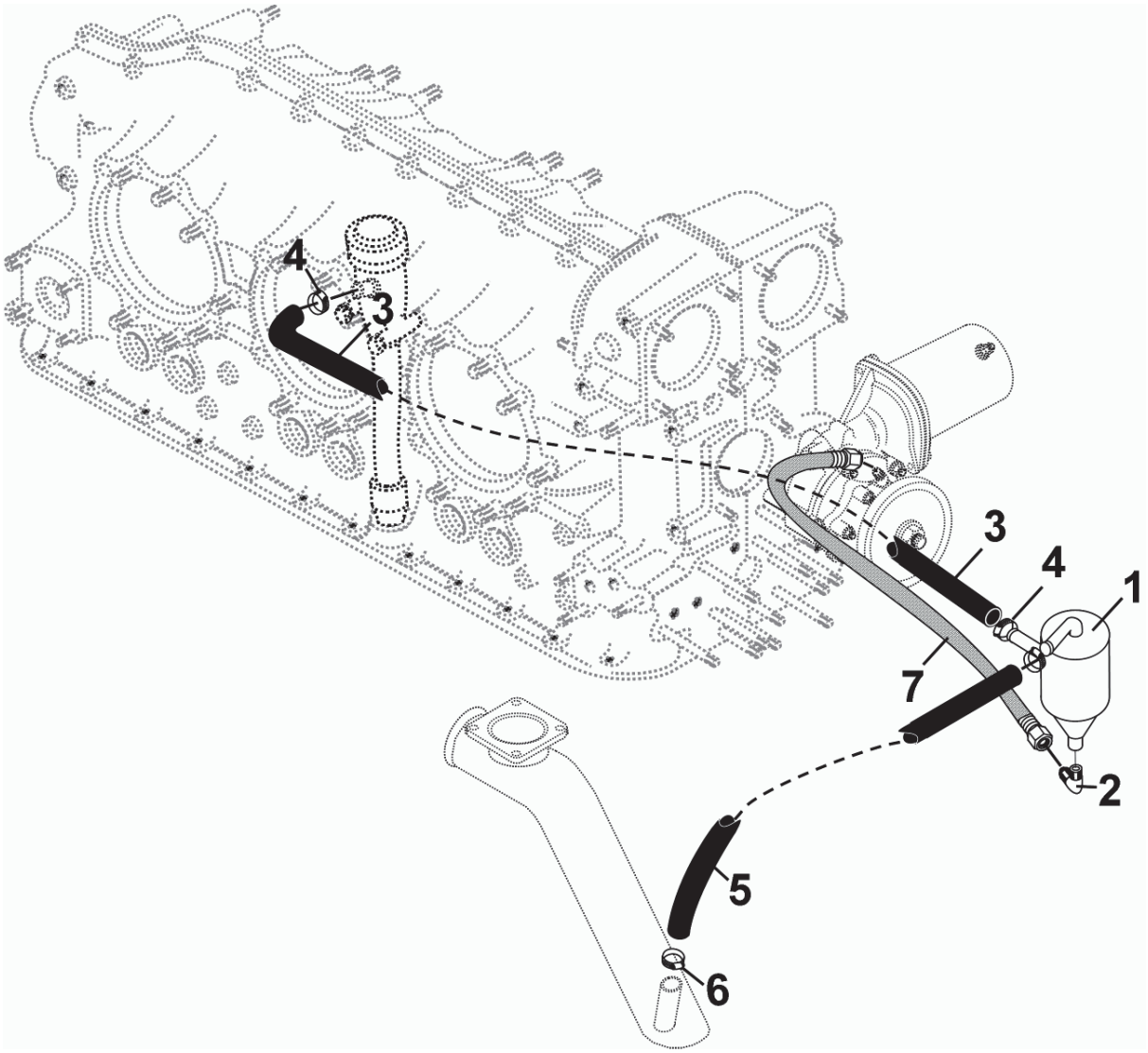


Figure 12-18. Crankcase Ventilation Hose Routing B C E G

1	Air/Oil Separator Assembly	3	Hose Assembly	5	Hose Assembly	7	Hose
2	90°Elbow Fitting	4	Hose Clamp	6	Hose Clamp		

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).

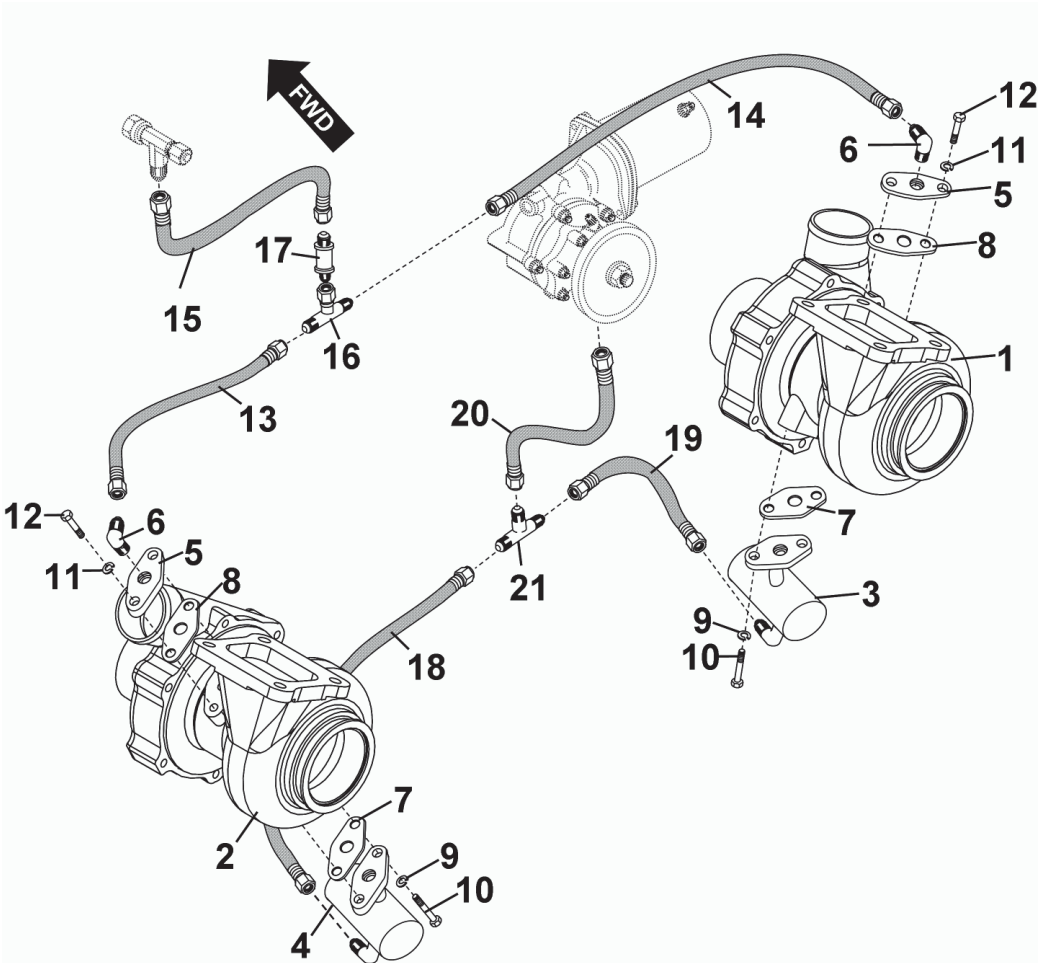


Figure 12-19. Turbocharger Lubrication B C E G

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		

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).

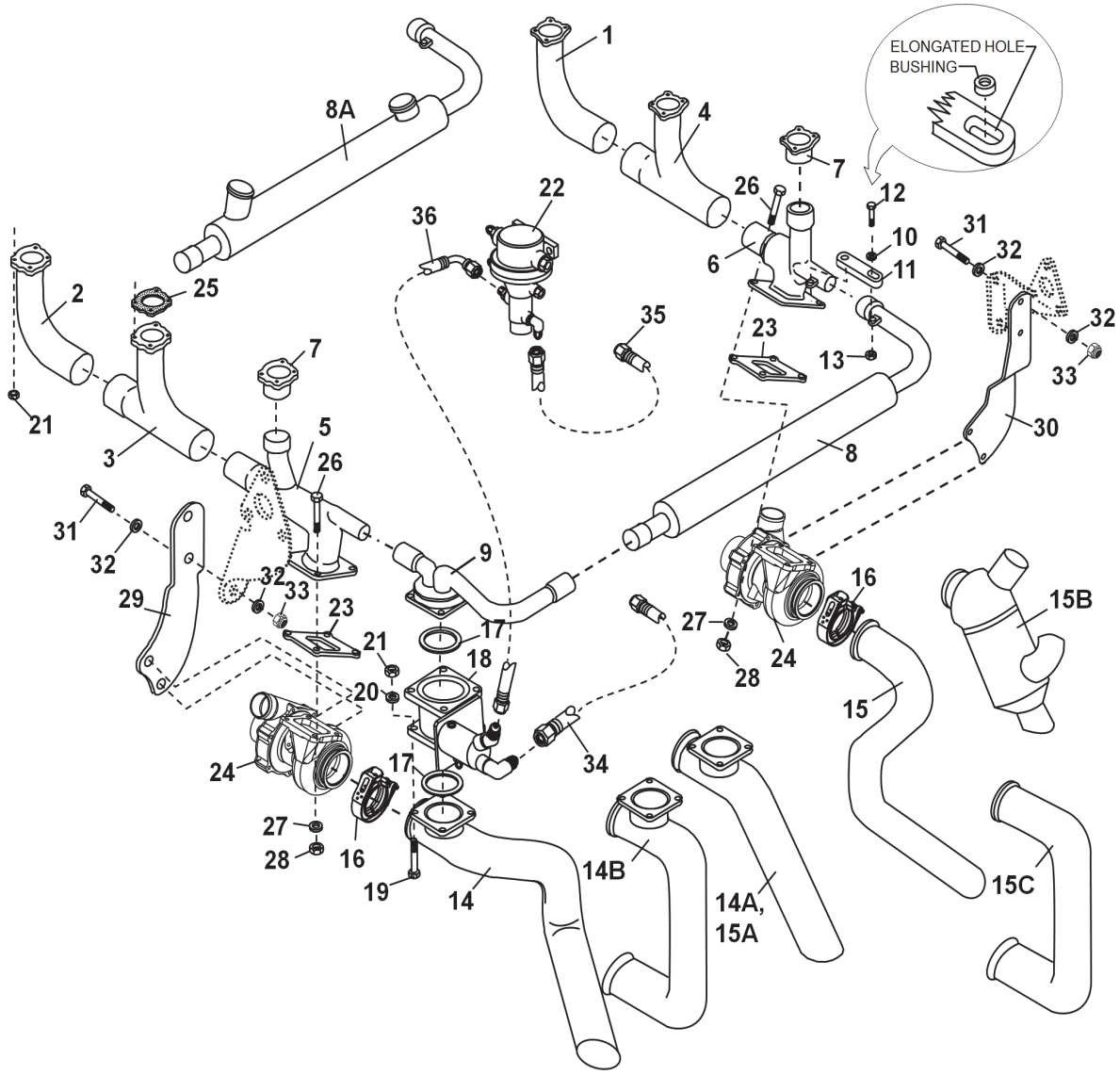


Figure 12-20. Composite Turbocharger and Exhaust B C E G

1	Elbow Riser	11	Tie Rod	19	Bolt	31	Bolt
2	Elbow Riser	12	Bolt	20	Washer	32	Washer
3	Tee Assembly	13	Lock Nut	21	Lock Nut	33	Lock Nut
4	Tee Assembly	14	Contoured Tailpipe	22	Controller	34	Hose
5	Turbo Transition	14C	Inverse Tailpipe Option	23	Gasket	35	Hose
6	Turbo Transition	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
7	Riser	15A	Straight Tailpipe	25	Gasket		
8	Crossover Assembly	15B	Heater	26	Bolt		
8A	Crossover Assy with Heater Shroud Option	15C	Inverse Tailpipe Option	27	Washer		
		16	V-band clamp	28	Lock Nut		
9	Transition	17	Gasket	29	Bracket		
10	Bushing	18	Wastegate Assembly	30	Bracket		

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.

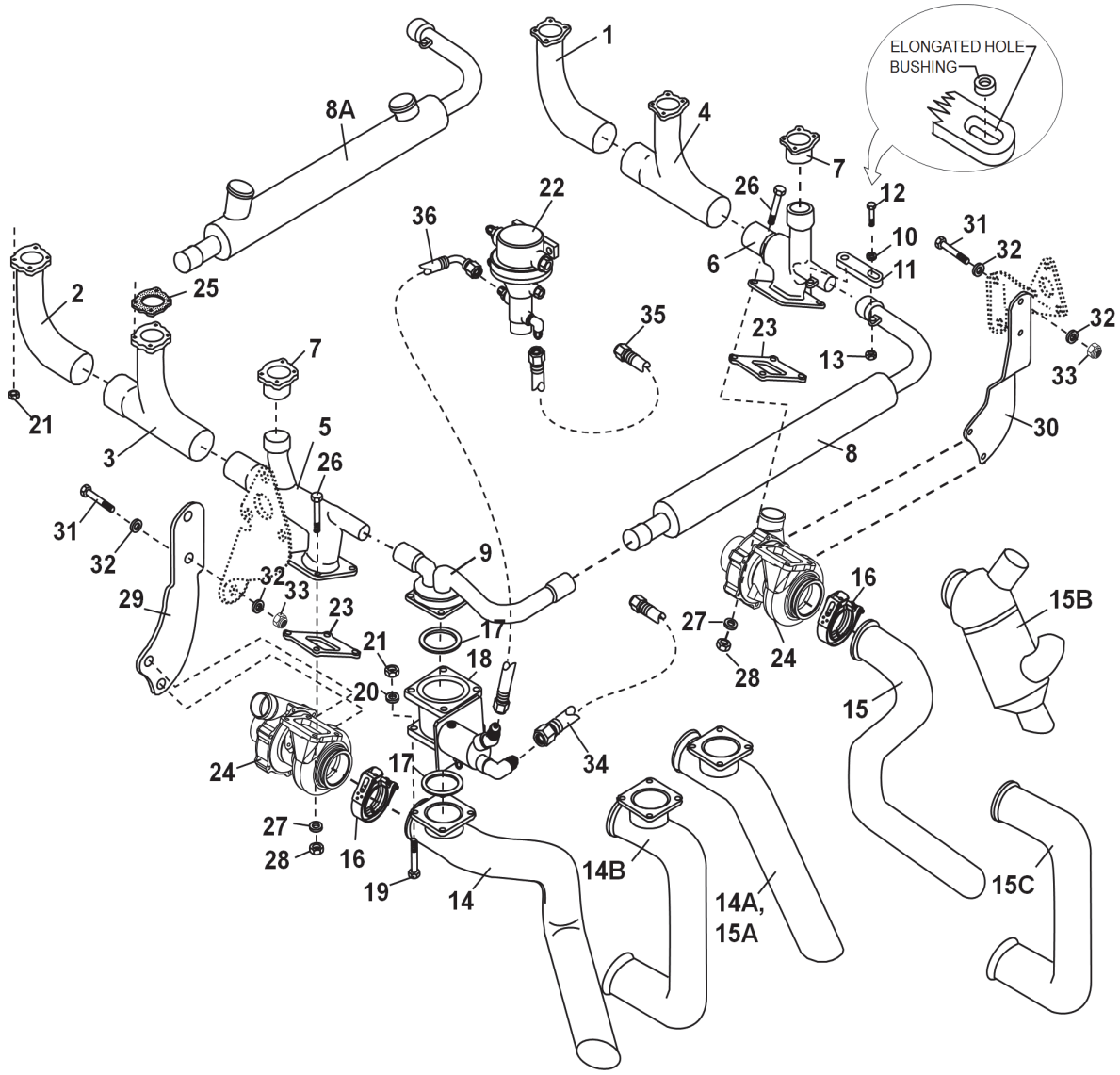


Figure 12-20 repeated for reference

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).

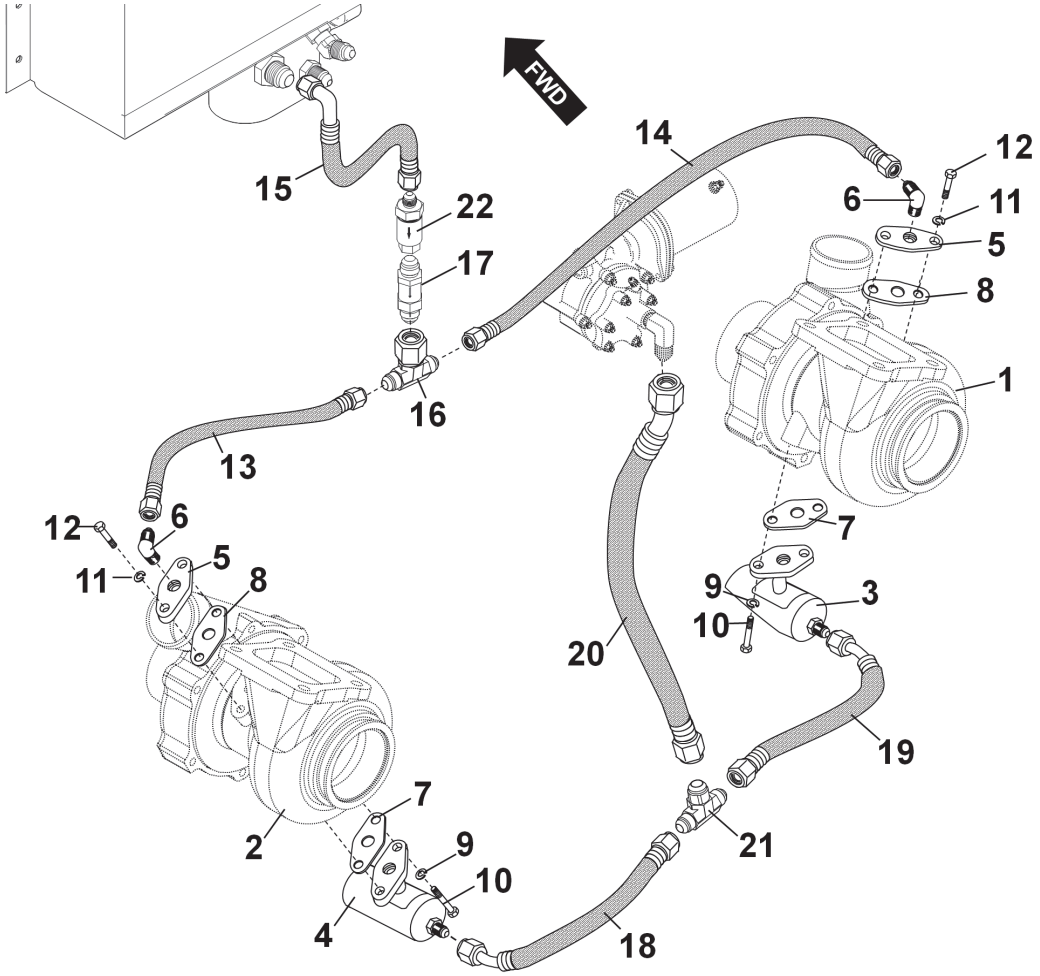


Figure 12-21. Turbocharger Lubrication Hose Routing K

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	22	Check Valve Filter Assy
5	Adapter	11	Lock Washer	17	Check Valve		
6	Elbow Fitting	12	Bolt	18	Hose		

6. Remove the V-band clamps (Figure 12-22) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).

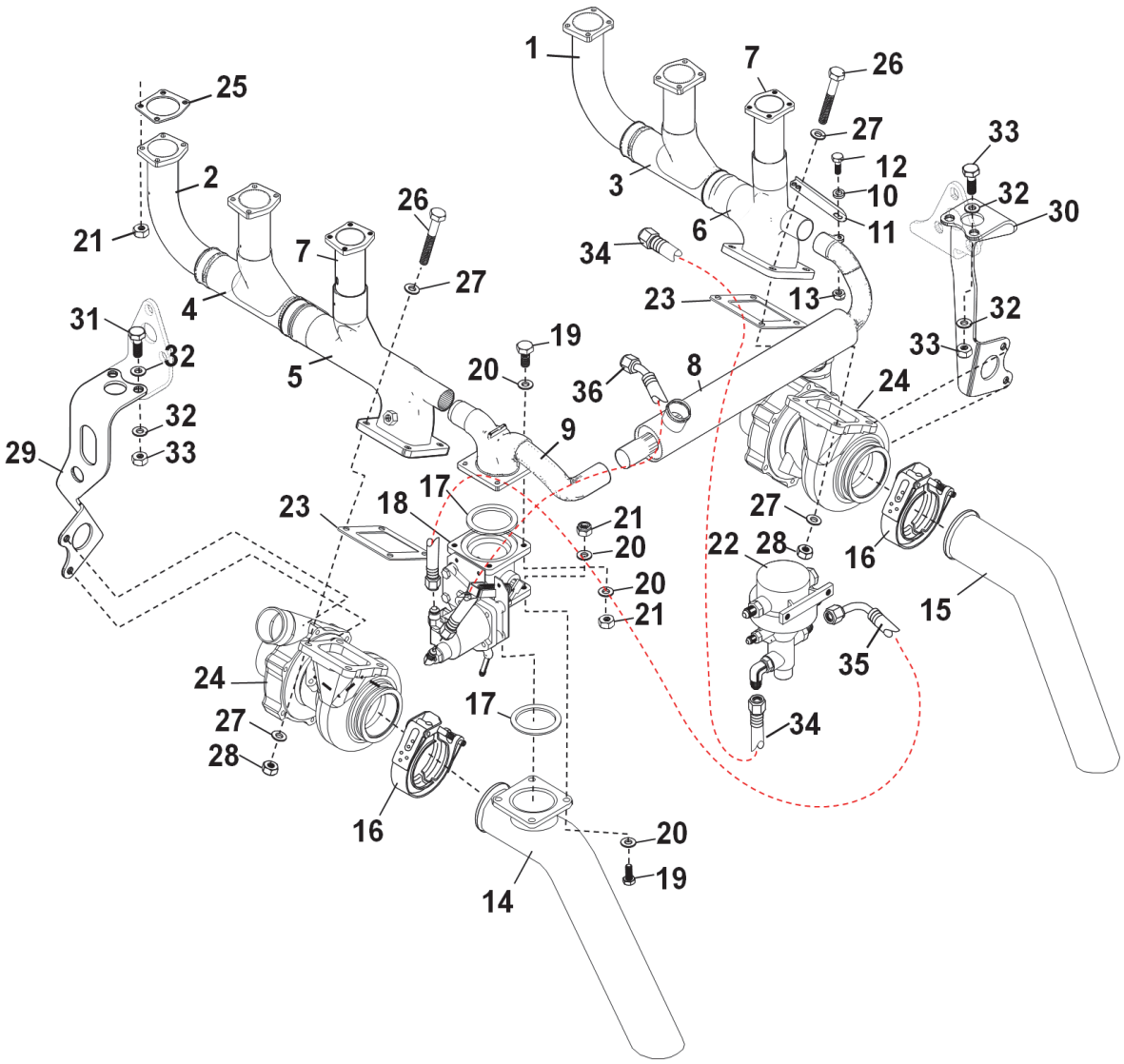


Figure 12-22. TSIO-550-K Turbocharger and Exhaust

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

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 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.

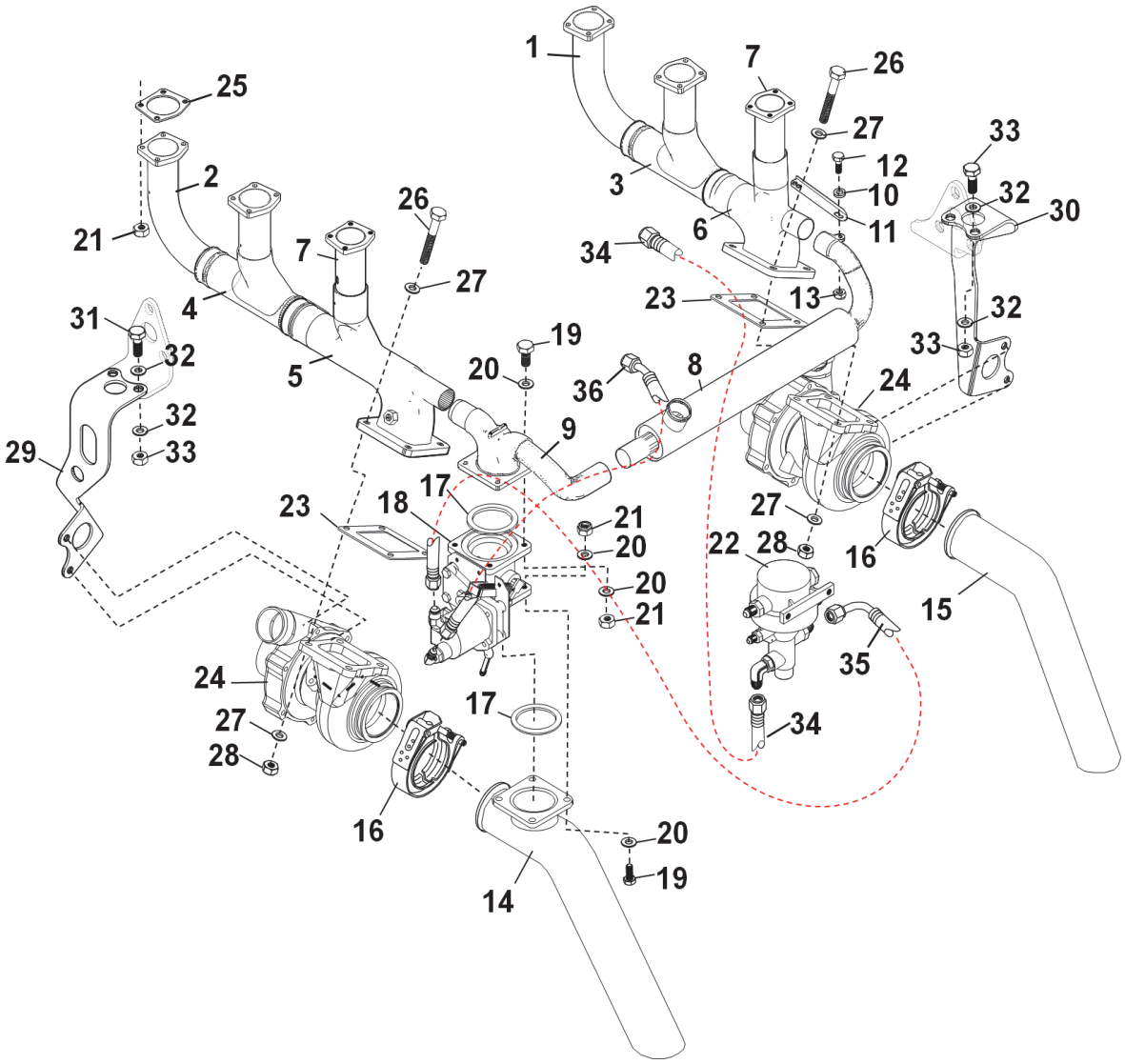


Figure 12-22 repeated for reference

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).

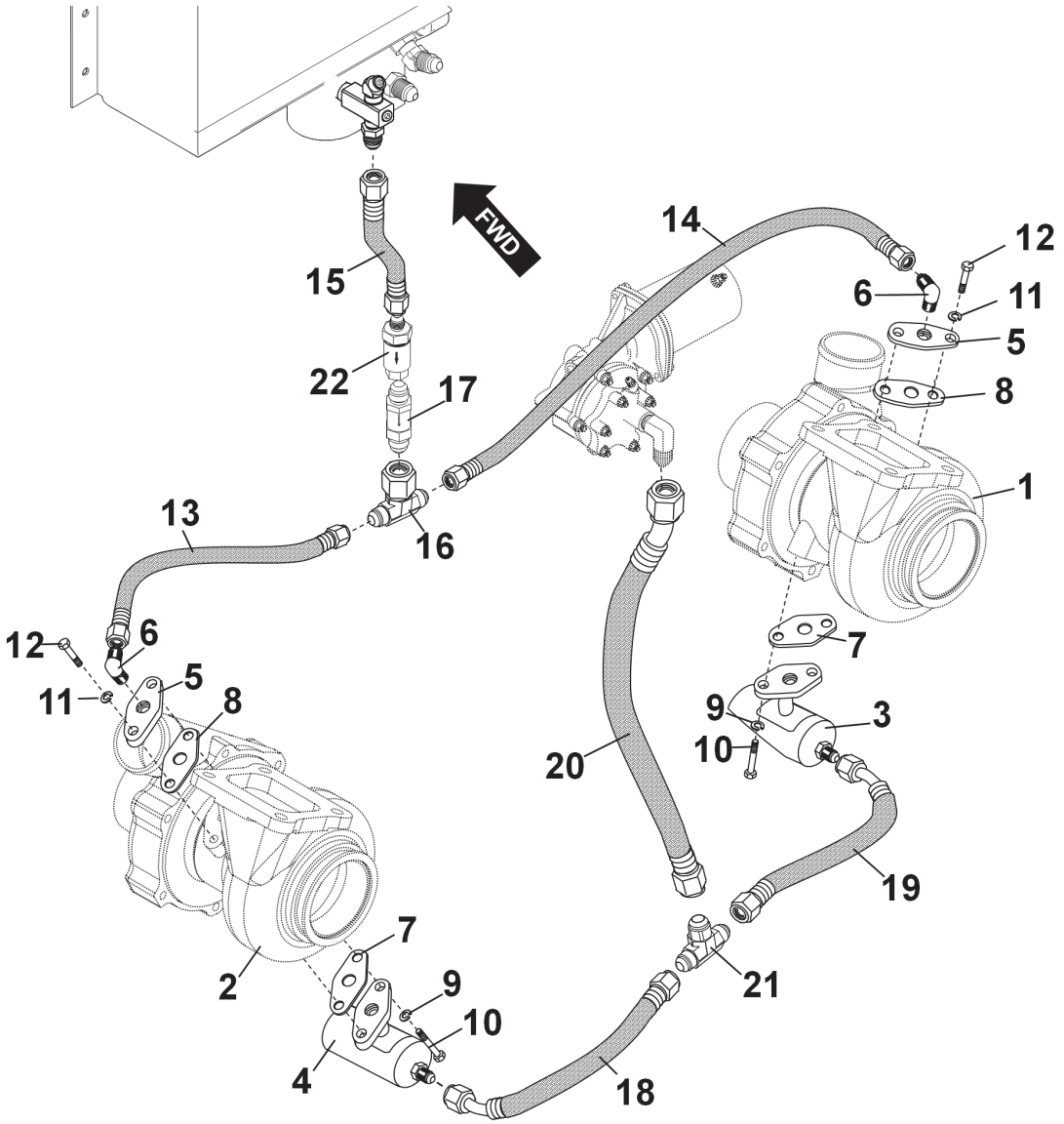


Figure 12-23. Turbocharger Lubrication Hose Routing N
See Figure 12-21 for parts index

6. Remove the V-band clamps (Figure 12-24) (16) from the tailpipe (14 & 15). Discard the V-band clamps (16).

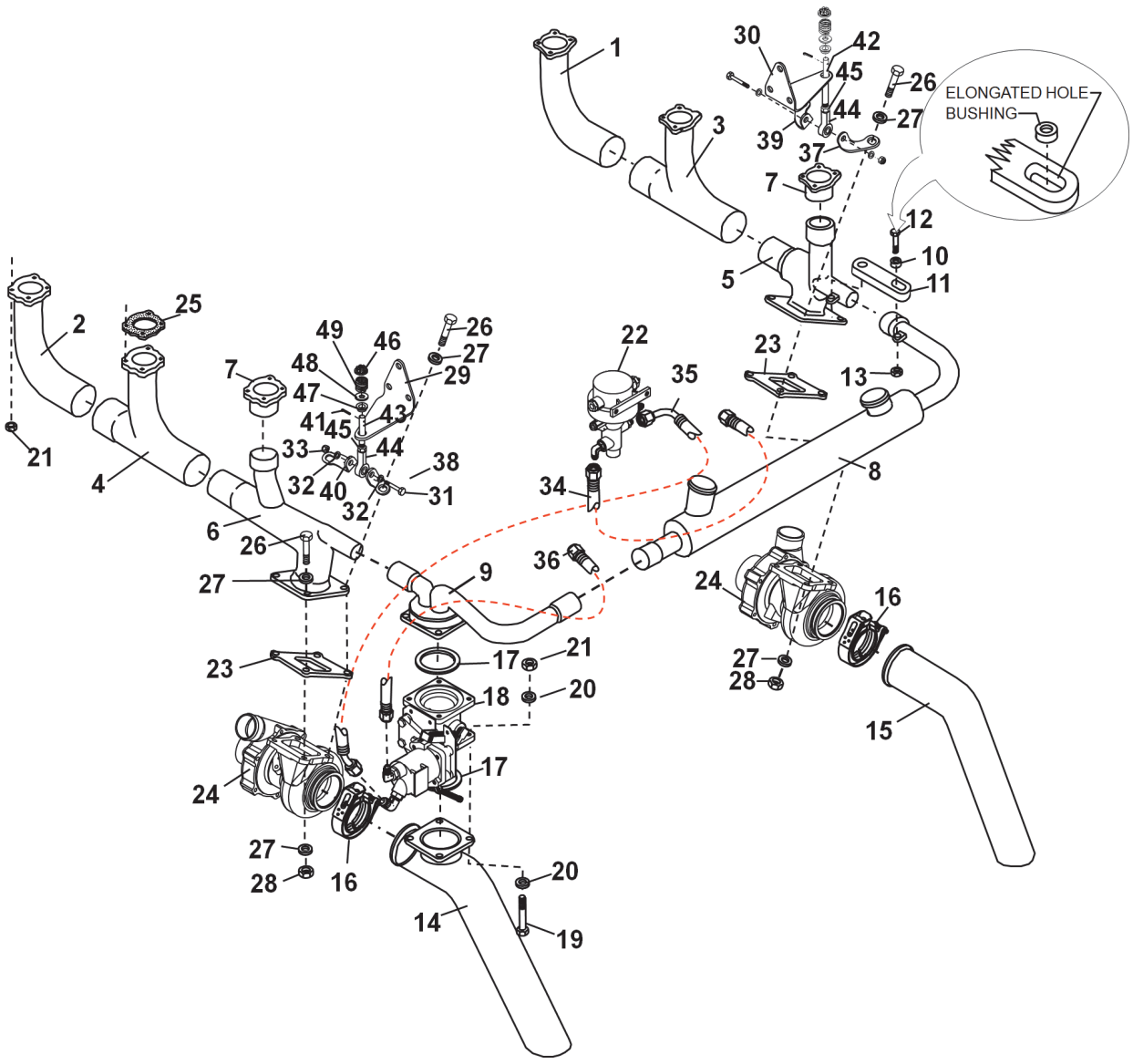


Figure 12-24. Turbocharger and Exhaust Assembly N

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

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.

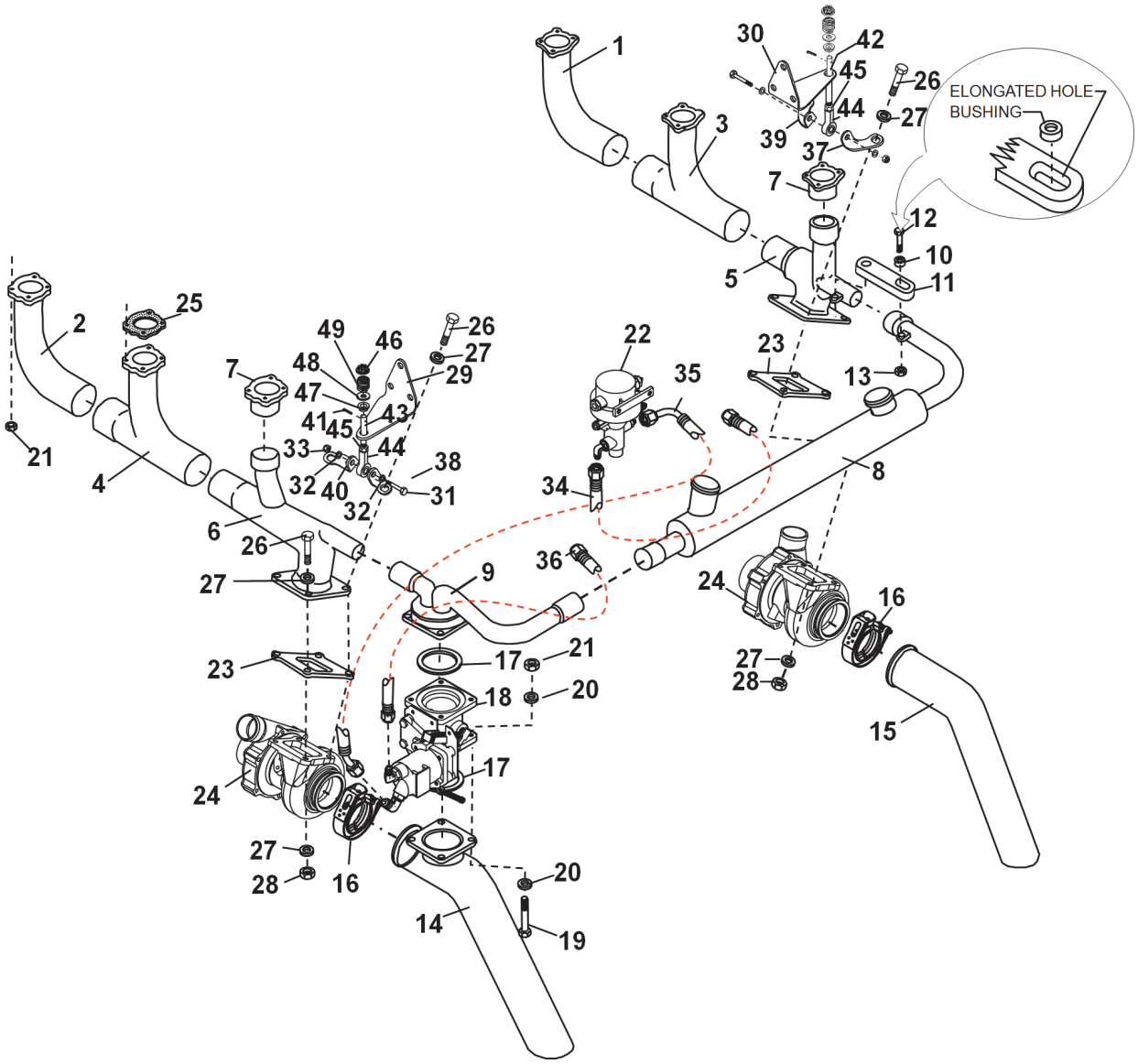


Figure 12-24 repeated for reference

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).

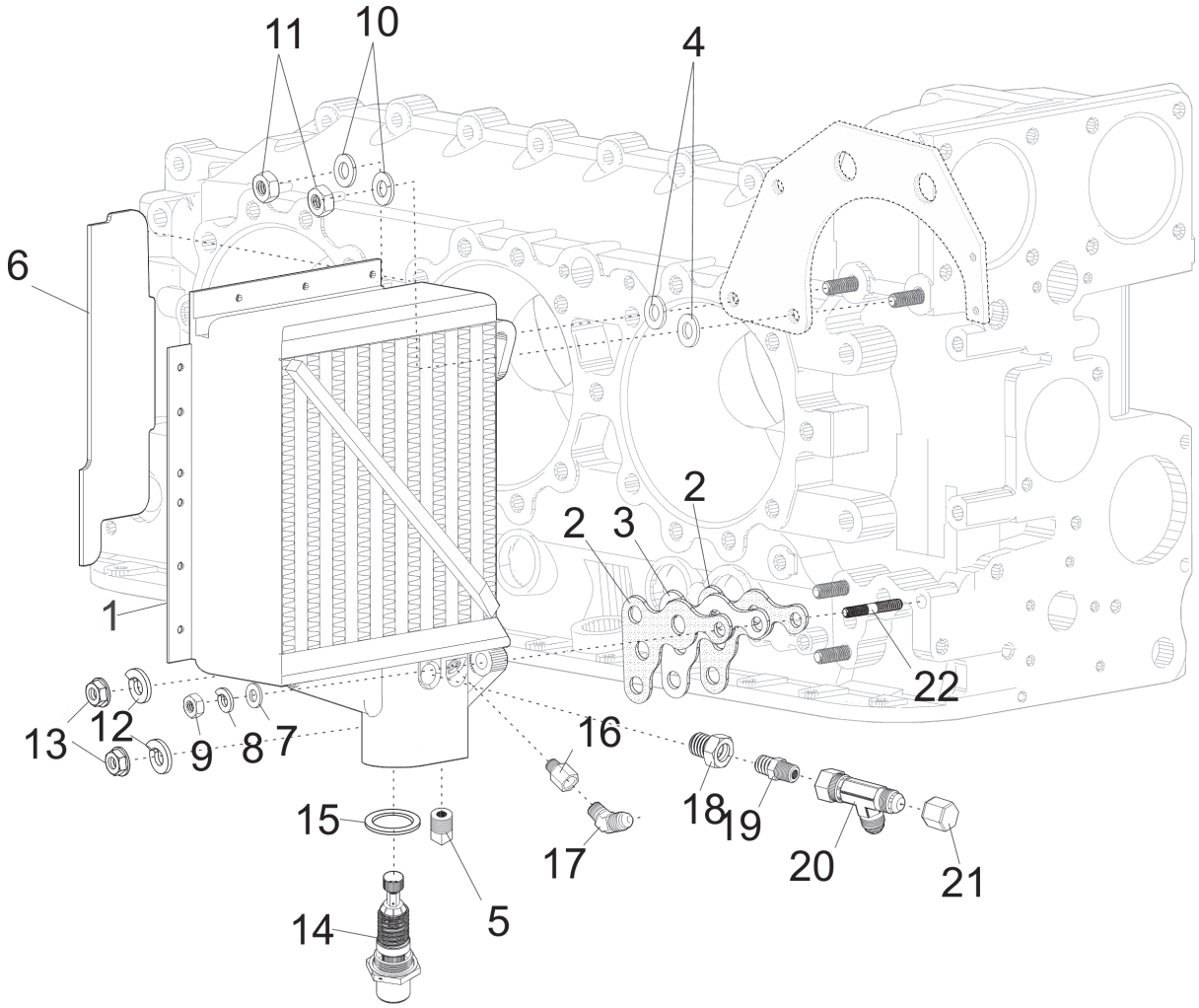
NOTE: The TSIO-550-C oil cooler fittings may be configured as depicted in Figure 12-25 or Figure 12-26. Consult the engine illustrated parts catalog to determine the appropriate configuration of the engine model specification and follow the applicable disassembly instructions.

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.



* ITEM 14 INCLUDES ITEM 15

Figure 12-25. Oil Cooler B C E G

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Adapter Fitting
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	Tee Fitting
3	Spacer	9	Nut	15	Gasket	21	Cap
4	Gasket-Washer	10	Washer	16	Adapter	22	Stud
5	Plug	11	Nut	17	Elbow Fitting		
6	Baffle	12	Lock Washer	18	Reducer Bushing		

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.

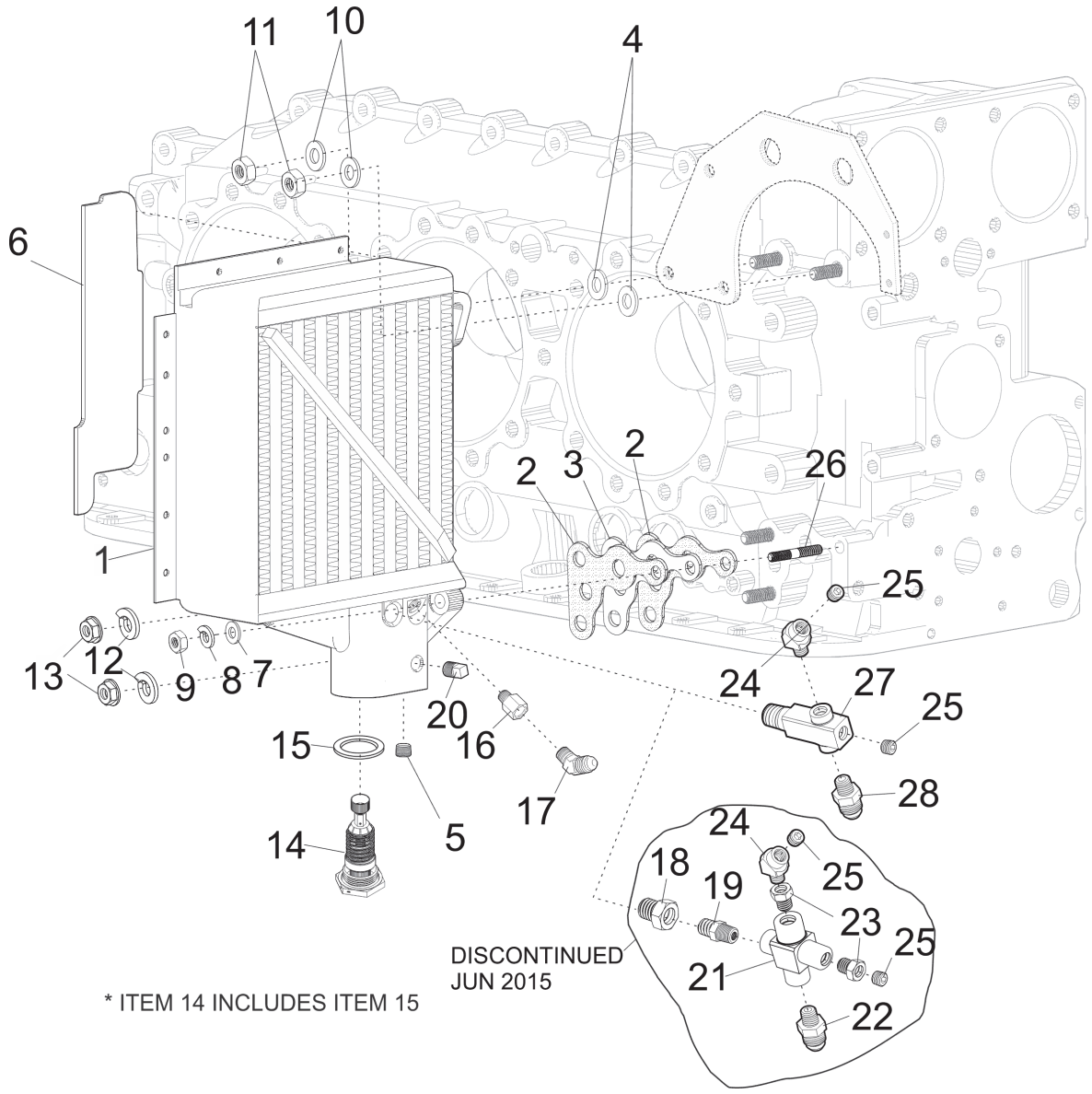


Figure 12-26. Oil Cooler C

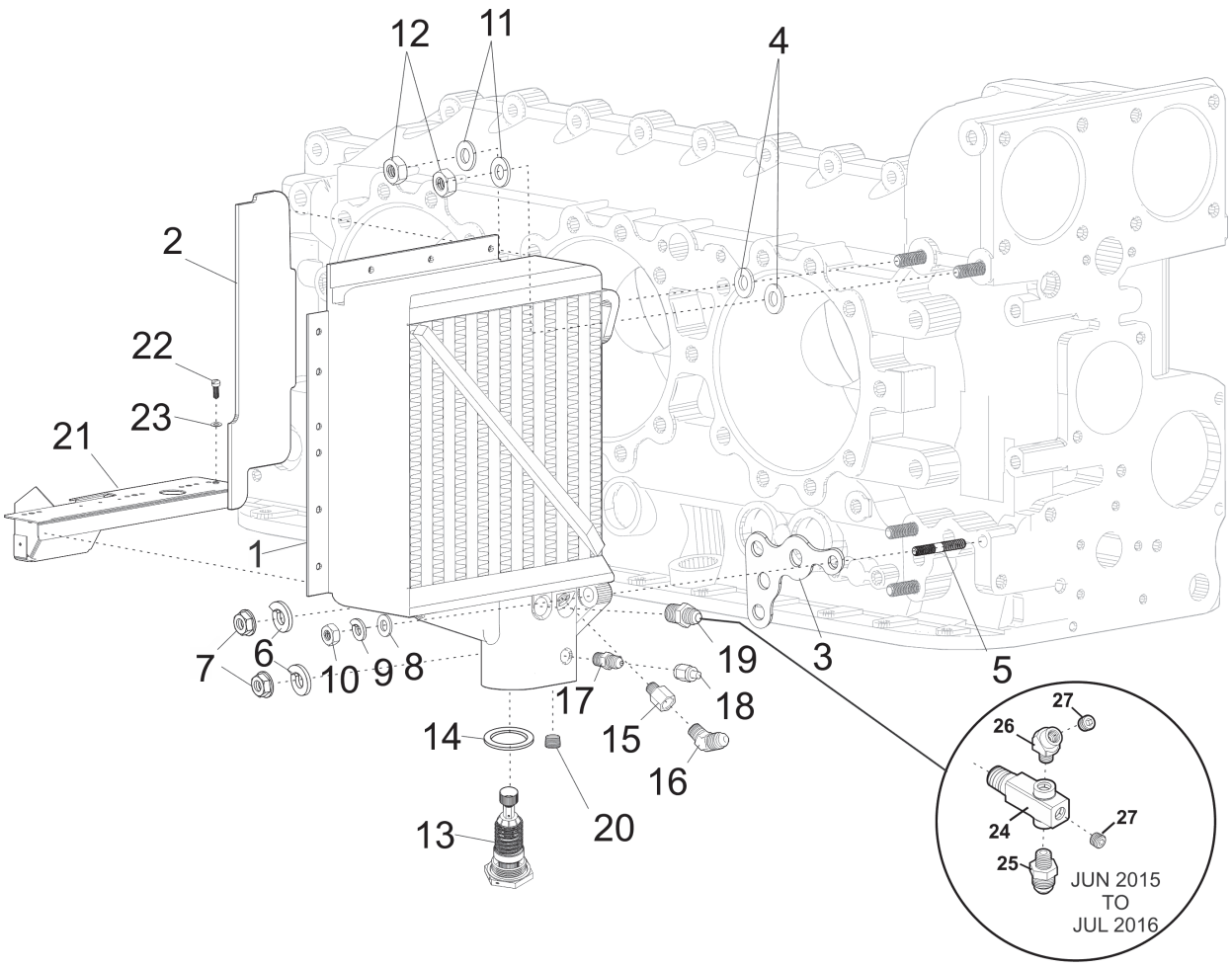
1	Oil Cooler Assembly	8	Lock Washer	15	Gasket	22	Flared Nipple Fitting
2	Gasket	9	Nut	16	Adapter Fitting	23	Pipe Bushing
3	Spacer	10	Washer	17	45° Elbow Fitting	24	45° Street Elbow
4	Gasket-Washer	11	Nut	18	Pipe Bushing	25	Plug
5	Plug	12	Lock Washer	19	Pipe Nipple Fitting	26	Stud
6	Baffle	13	Flanged Nut	20	Plug	27	Cross Fitting
7	Washer	14	Oil Temp. Control Valve	21	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 and 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.



* ITEM 13 INCLUDES ITEM 14

Figure 12-27. Oil Cooler K

1	Oil Cooler	8	Washer	15	Adapter Fitting	22	Screw
2	Baffle	9	Lock Washer	16	Elbow Fitting	23	Washer
3	Oil Cooler Gasket	10	Nut	17	Adapter Fitting	24	Cross Fitting
4	Gasket- Washer	11	Washer	18	Cap Assembly	25	Flared Nipple Fitting
5	Stud	12	Nut	19	Flared Nipple Fitting	26	45° Elbow Fitting
6	Lock Washer	13	Oil Temp. Control Valve	20	Plug	27	Plug
7	Flanged Nut	14	Gasket	21	Baffle Assembly		

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 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. 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.

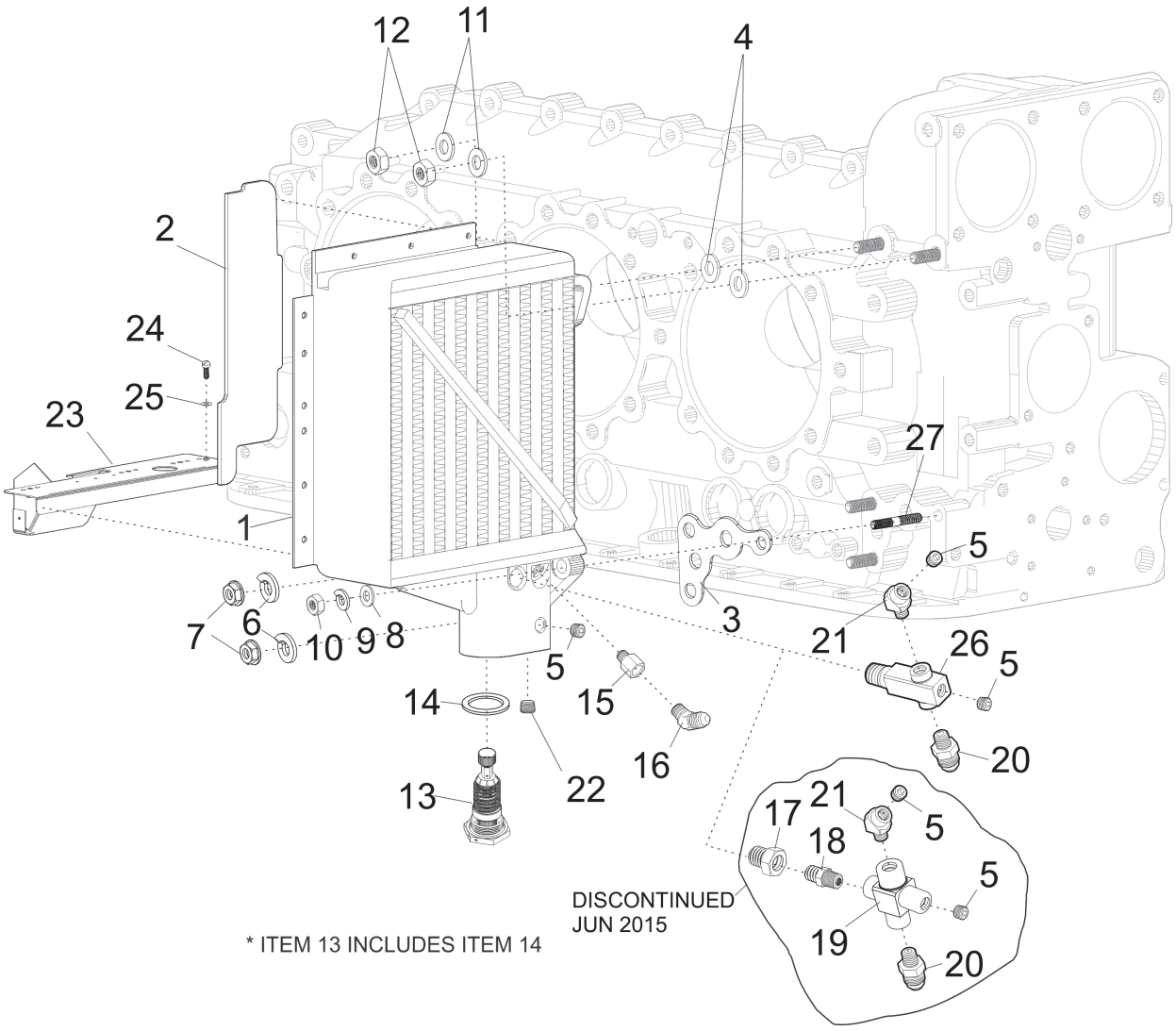


Figure 12-28. Oil Cooler N

1	Oil Cooler	8	Washer	15	Adapter Fitting	22	Plug
2	Baffle	9	Lock Washer	16	Elbow Fitting	23	Baffle Assembly
3	Oil Cooler Gasket	10	Nut	17	Pipe Bushing	24	Screw
4	Gasket- Washer	11	Washer	18	Pipe Nipple Fitting	25	Washer
5	Plug	12	Nut	19	Cross Fitting	26	Cross Fitting
6	Lock Washer	13	Oil Temp. Control Valve	20	Flared Nipple Fitting	27	Stud
7	Nut	14	Gasket	21	45° Street Elbow Fitting		

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.

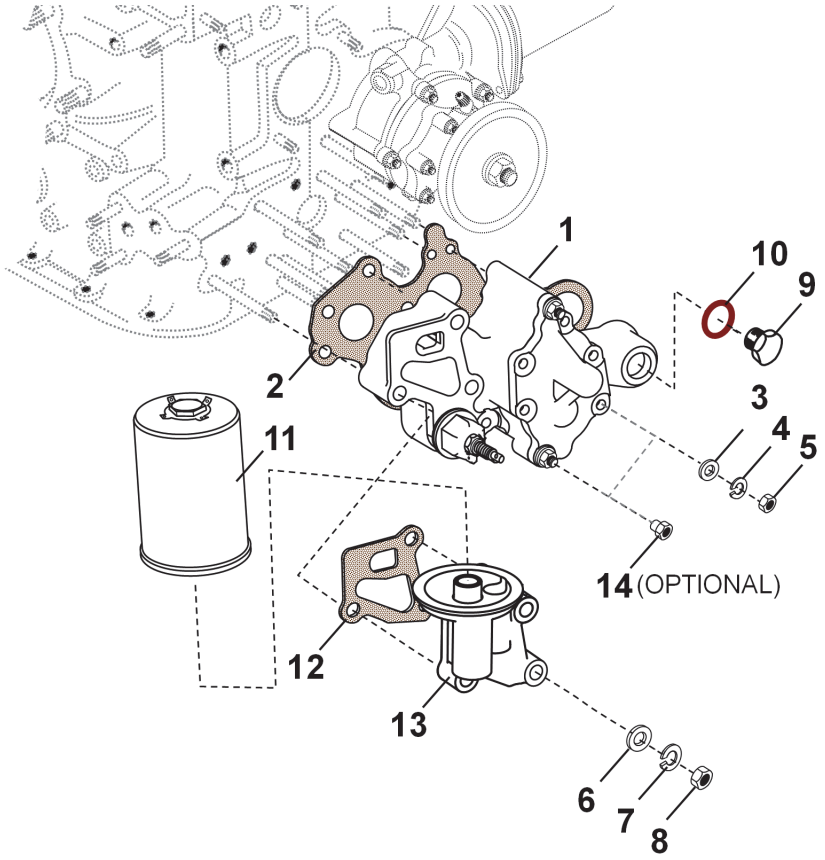


Figure 12-29. Oil Pump

1	Oil Pump Assembly	5	Nut	9	Plug	13	Oil Filter Adapter
2	Oil Pump Gasket	6	Washer	10	Gasket	14	Coupling Nut
3	Washer	7	Lock Washer	11	Oil Filter		
4	Lock Washer	8	Nut	12	Gasket		

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).

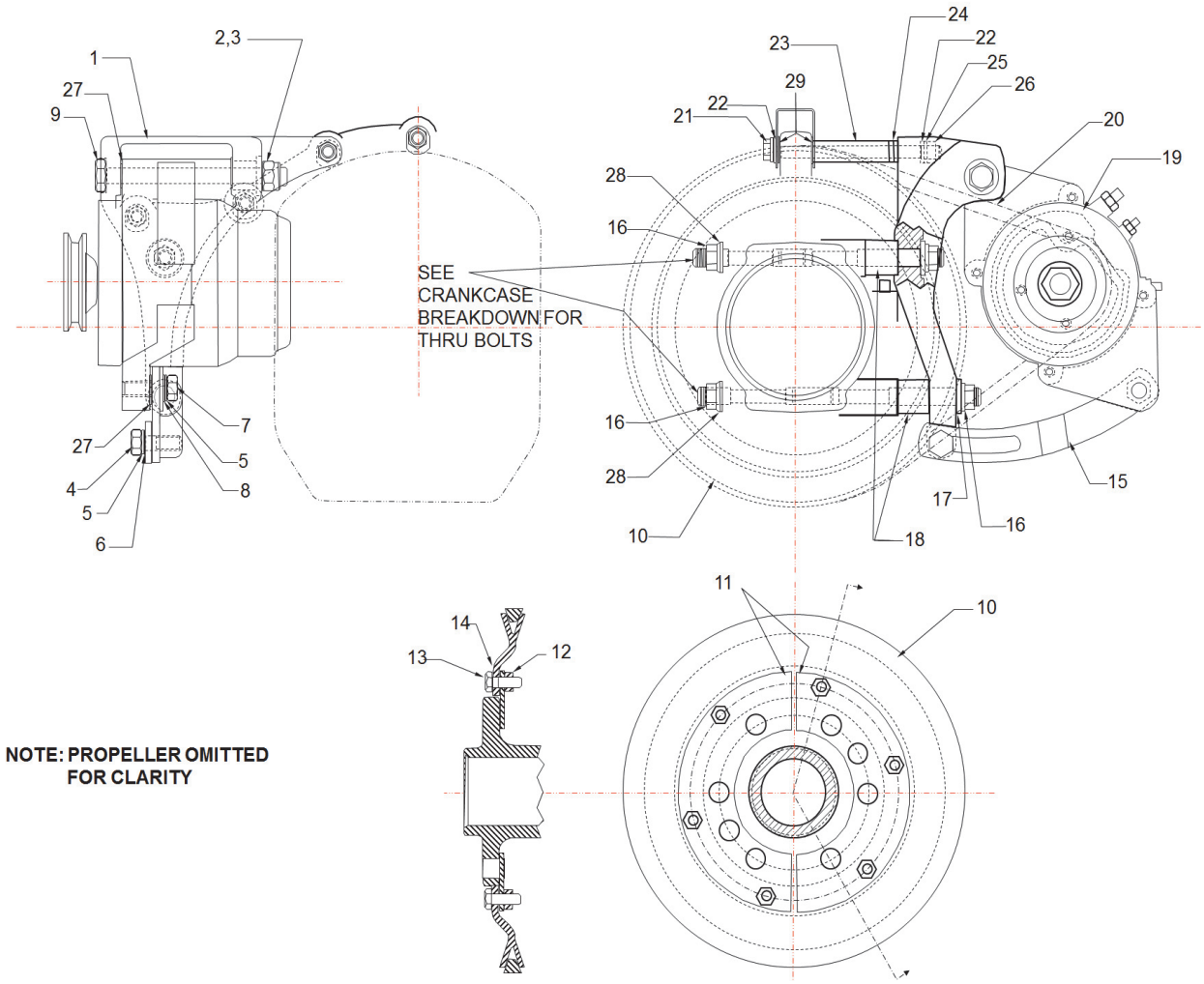


Figure 12-30. Belt-Driven Alternator Bracket Assembly

1	Bracket Assembly	9	Bolt	17	Washer	25	Lock Washer
2	Washer	10	Sheave	18	Spacer	26	Nut
3	Nut	11	Adapter	19	Alternator Assembly	27	Shim
4	Screw	12	Lock Nut	20	V-belt	28	Washer
5	Lock Washer	13	Bolt	21	Bolt	29	Washer
6	Washer	14	Washer	22	Washer		
7	Screw	15	Adjustable Brace	23	Spacer		
8	Washer	16	Nut	24	Shim		

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.

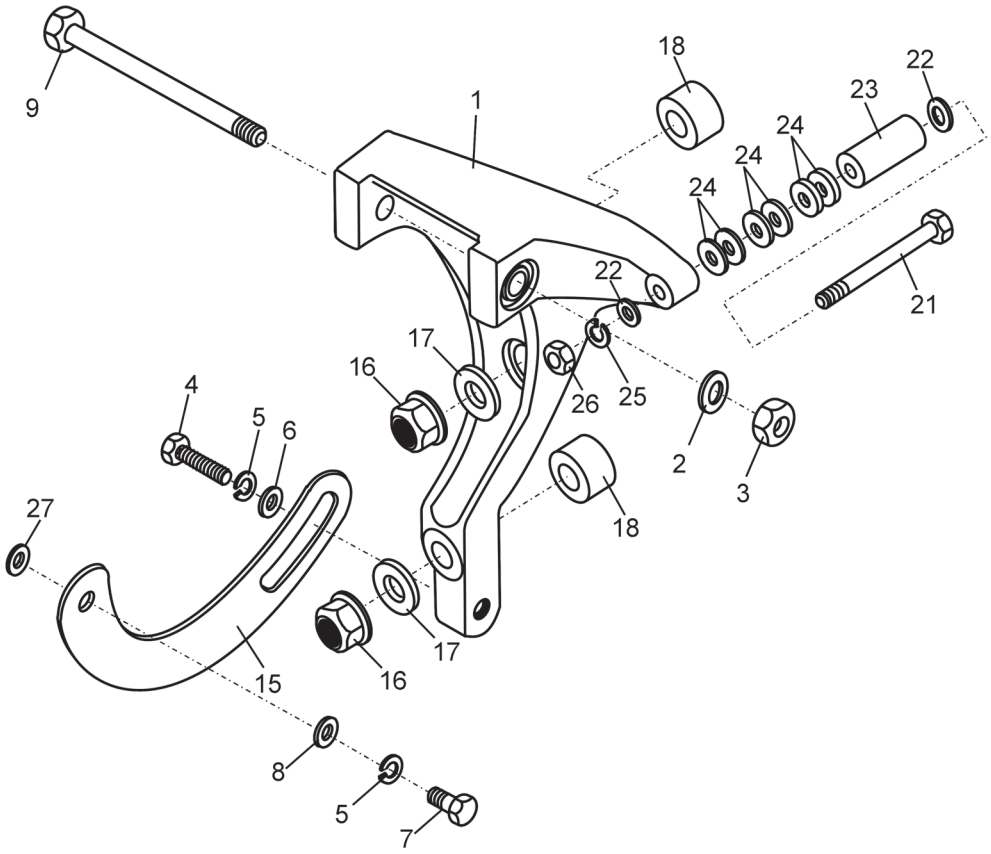


Figure 12-31. Optional 70 Amp Alternator Bracket Assembly

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.

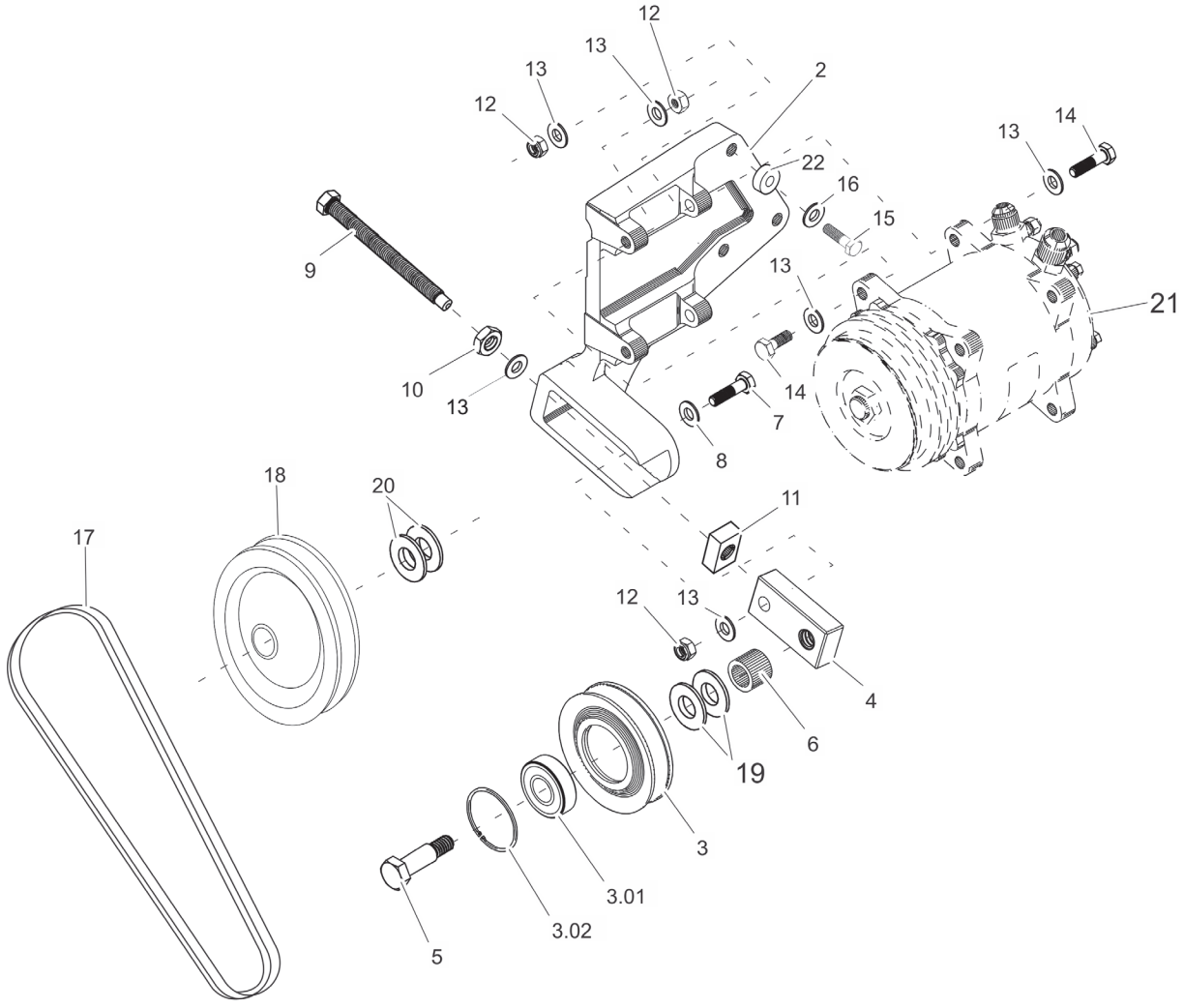


Figure 12-32. Optional Air Conditioning Compressor Mount Assembly

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

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.

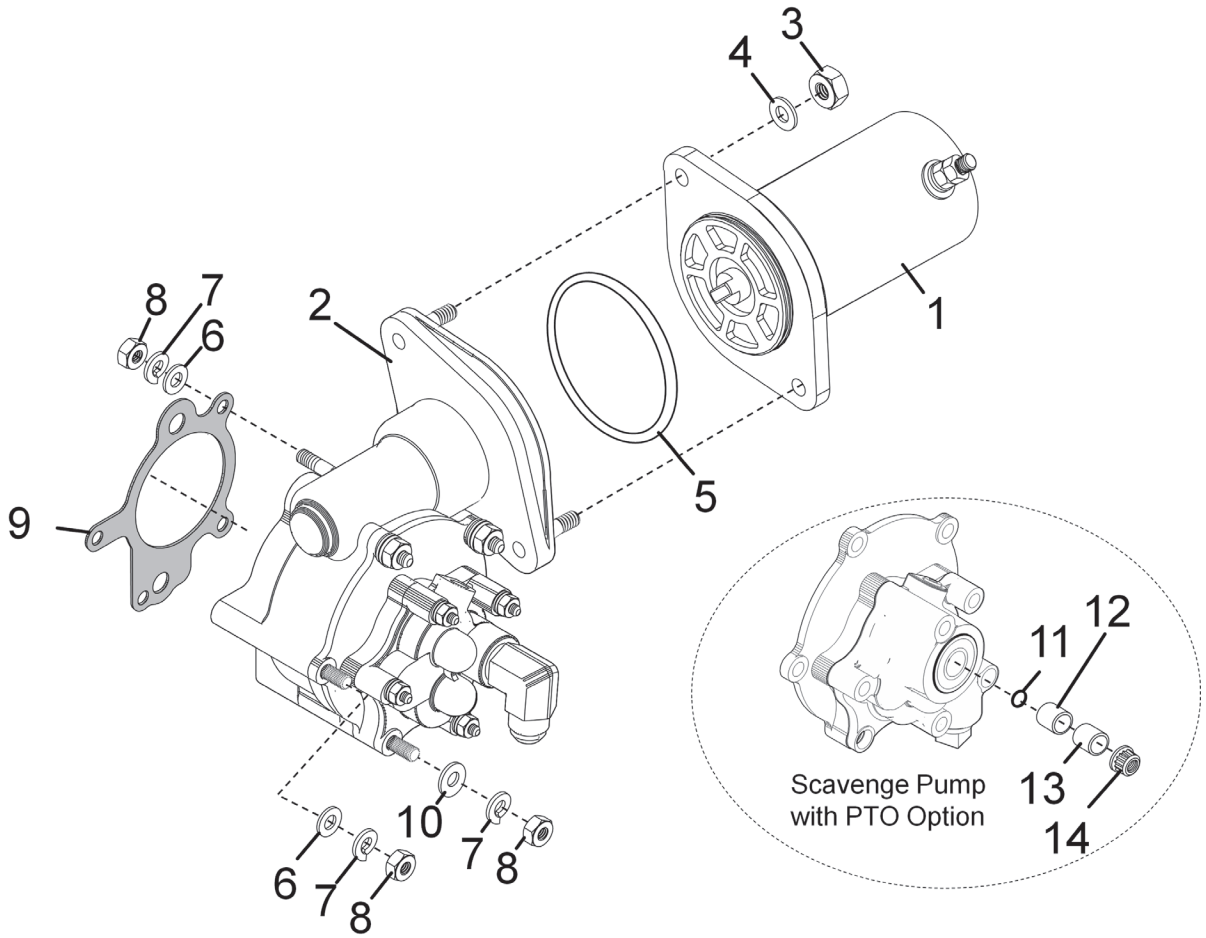


Figure 12-33. Starter and Adapter

1	Starter Motor	5	O-ring	9	Gasket	13	Spacer
2	Starter Adapter	6	Washer	10	Washer	14	Lock Nut
3	Nut	7	Lock washer	11	O-ring		
4	Washer	8	Nut	12	Sleeve		

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. B E 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).

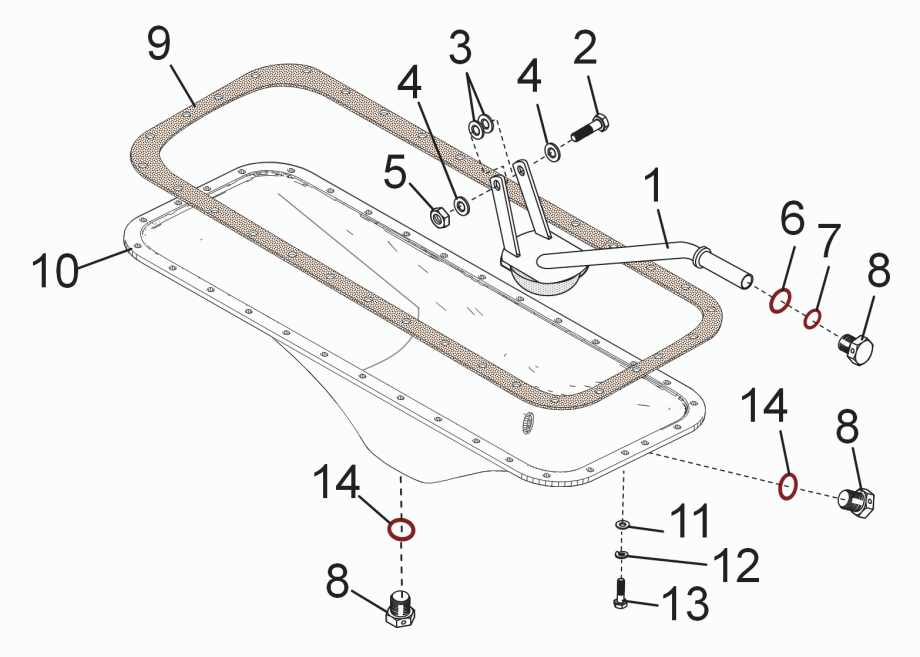


Figure 12-34. Oil Sump C

1	Oil Suction Tube Assy	6	Copper Gasket	11	Washer	15	Bracket B E
2	Bolt	7	Copper Gasket	12	Lock Washer	15	Bolt G K N
3	Washer	8	Plug	13	Bolt	16	Oil Coupling G K N
4	Washer	9	Oil Sump Gasket	14	Copper Gasket		
5	Nut	10	Oil Sump				

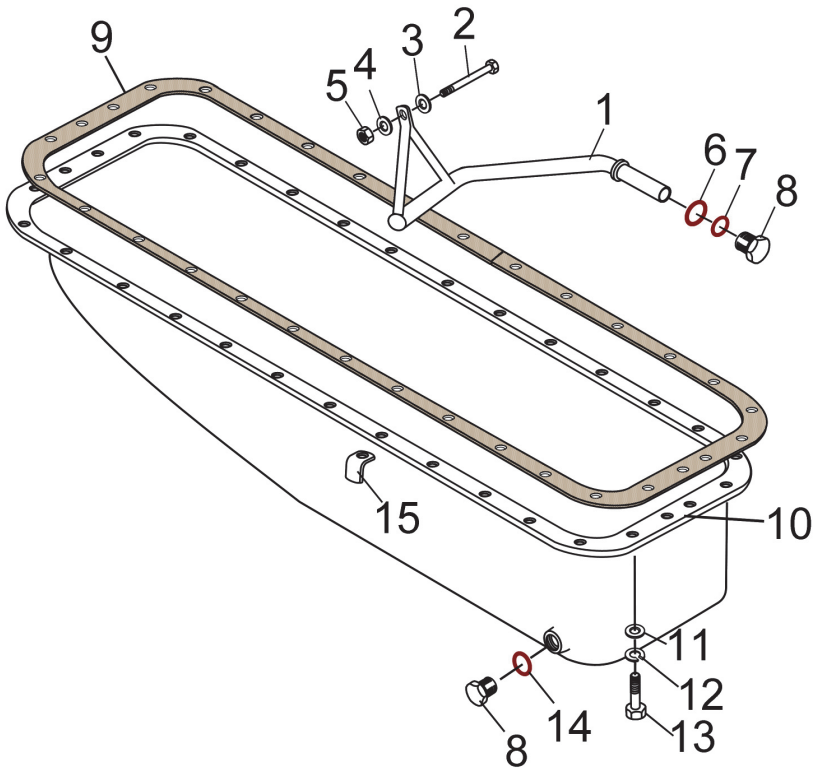


Figure 12-35. Oil Sump B E

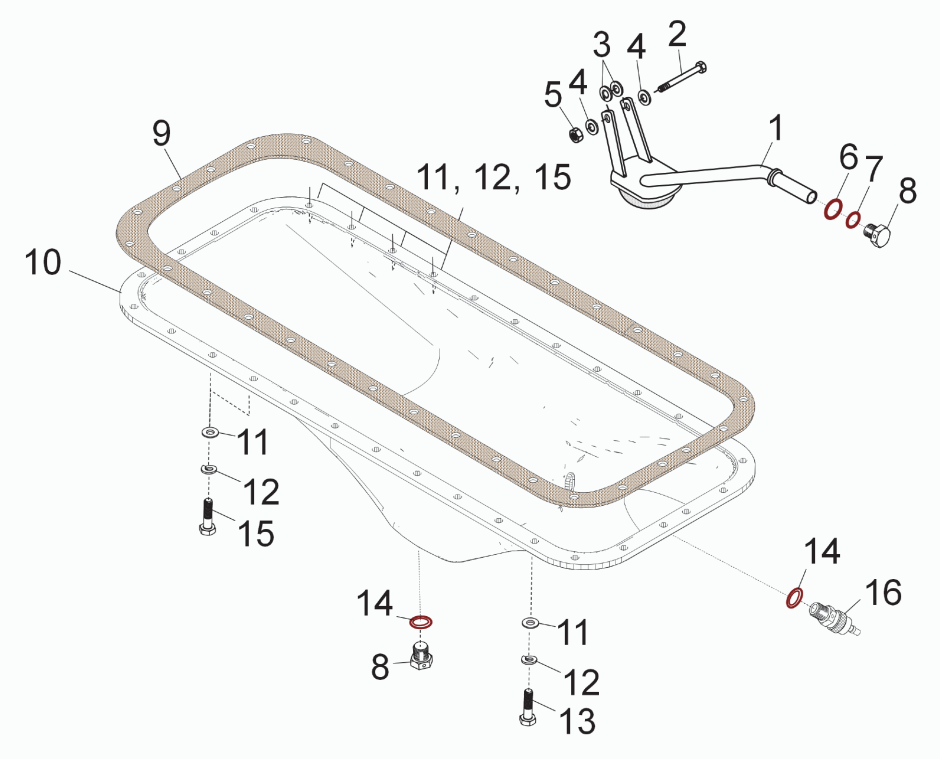


Figure 12-36. Oil Sump G K N

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.

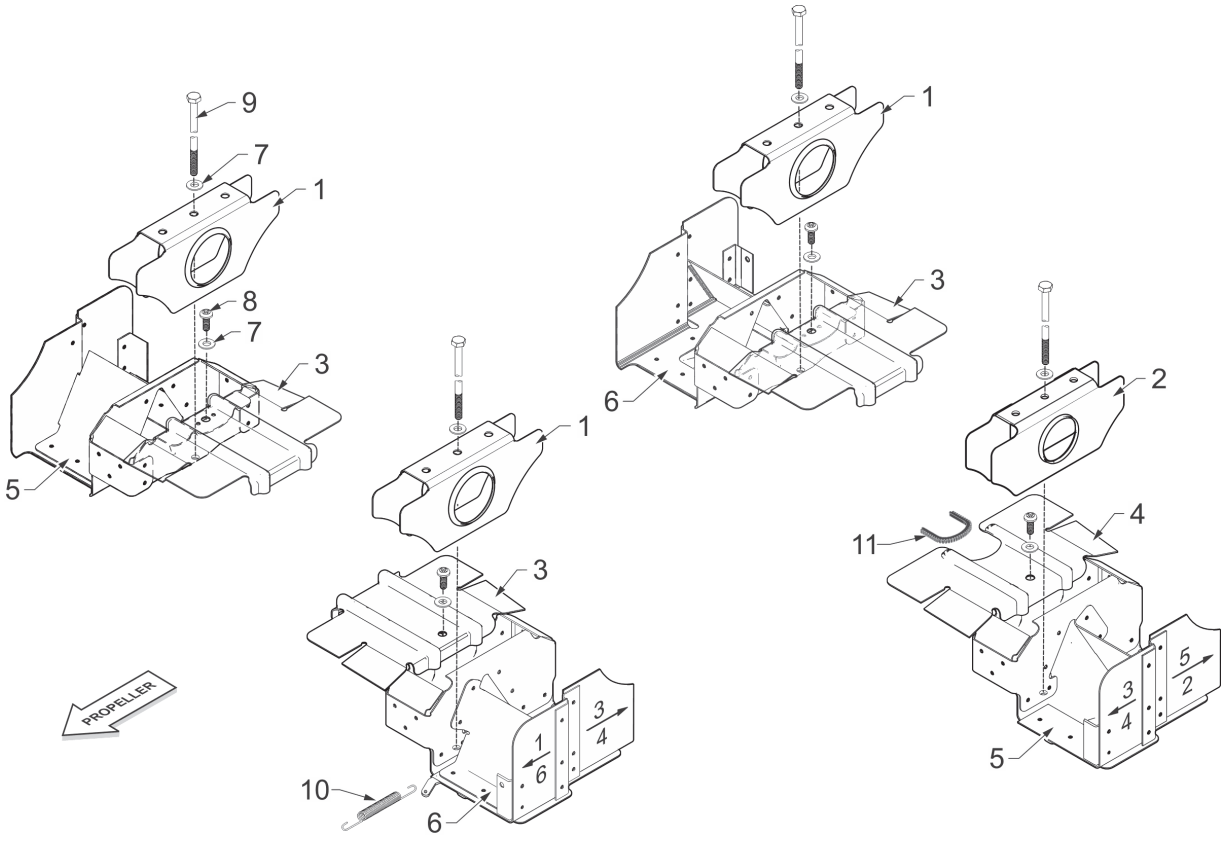


Figure 12-37. Inter-Cylinder Baffle Assembly

1	Baffle Support	4	Cylinder Base Baffle	7	Washer	10	Baffle Tie Spring
2	Baffle Support	5	Baffle Assembly	8	Screw	11	Grommet
3	Cylinder Base Baffle	6	Baffle Assembly	9	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.

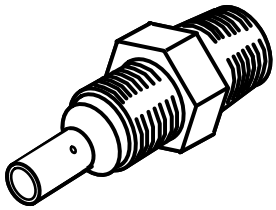


Figure 12-38. Cylinder Drain Tube Fitting

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.

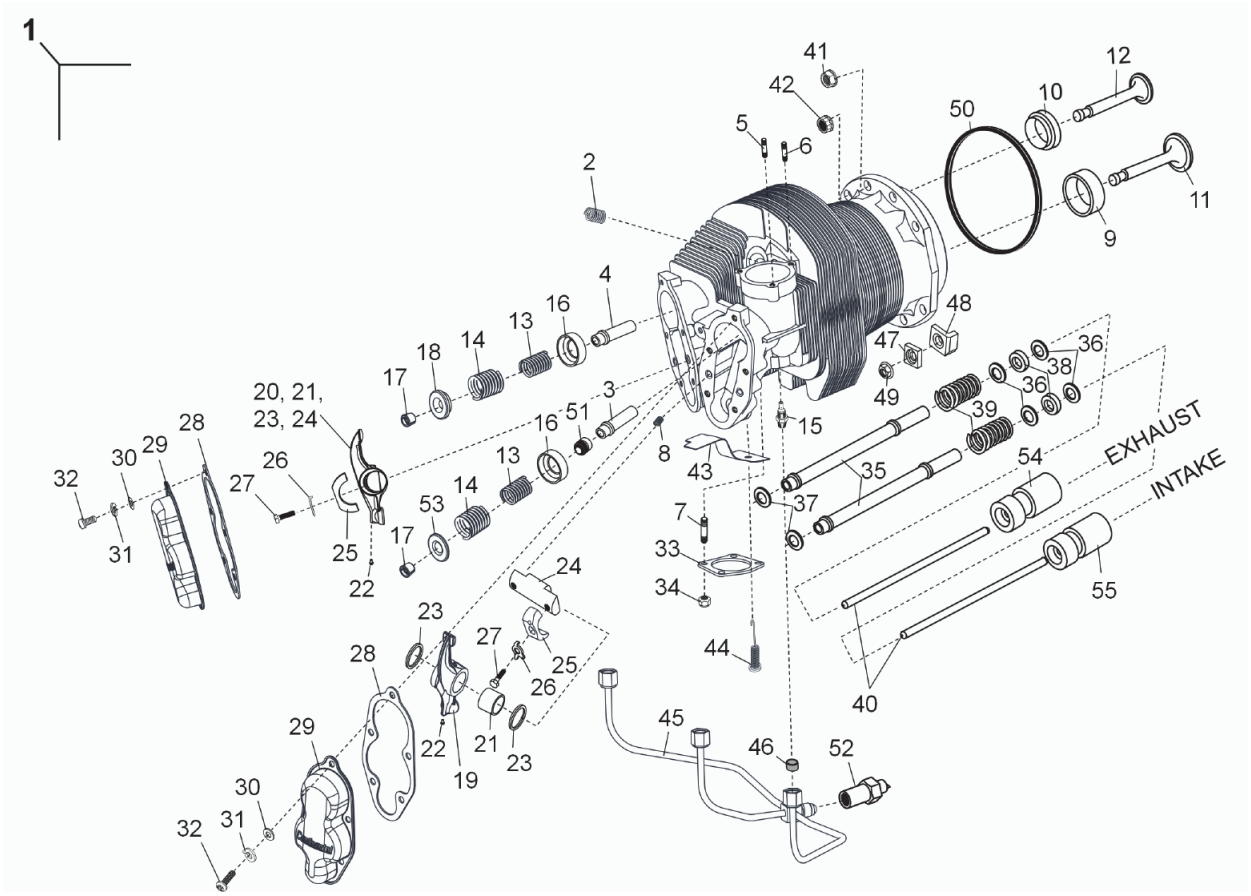


Figure 12-39. Engine Cylinder Assembly

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		

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).

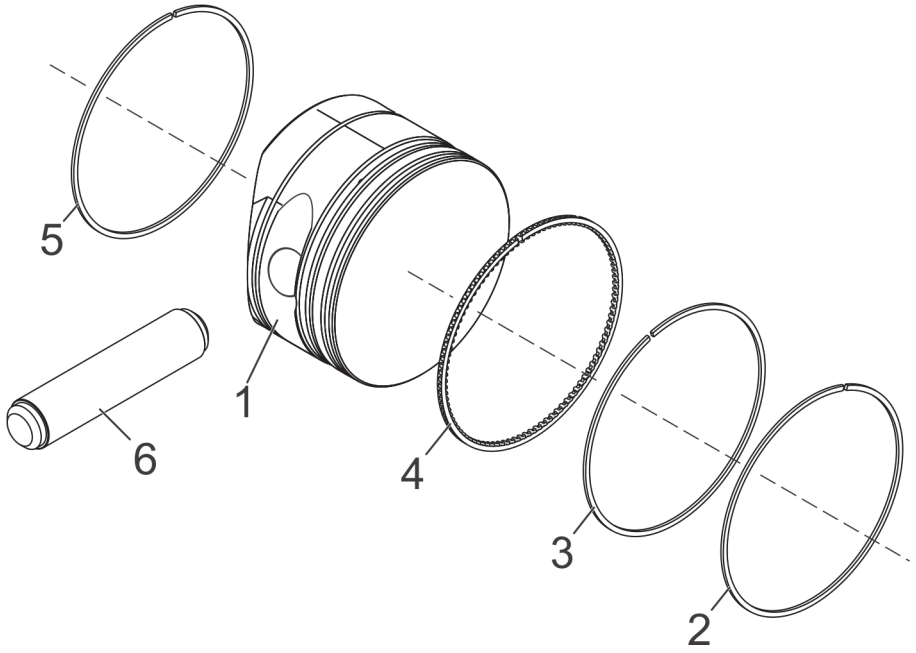


Figure 12-40. Piston, Piston Pin and Rings

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.

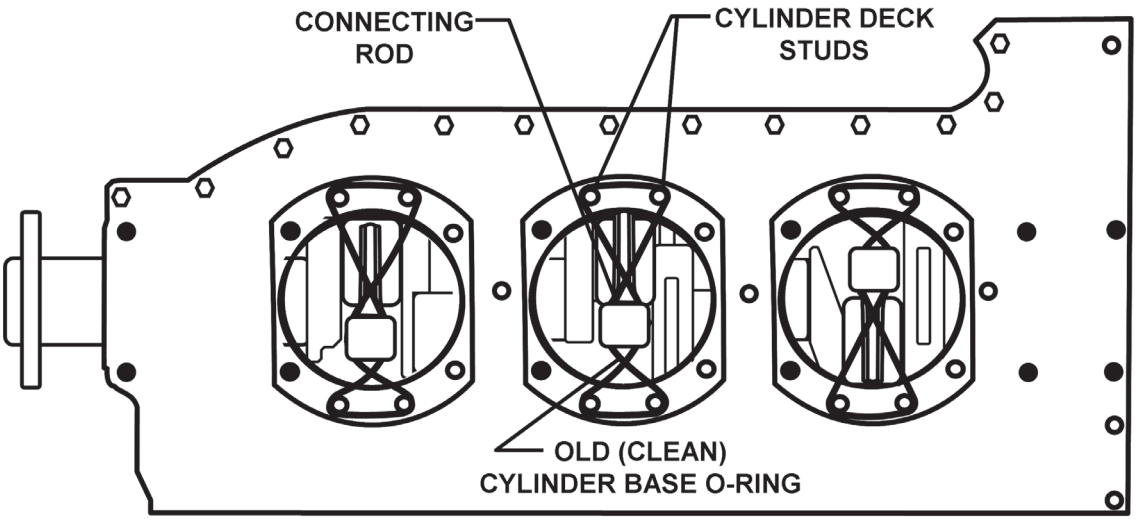


Figure 12-41. Cylinder Base O-Ring used to Support the Connecting Rods

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.

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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.

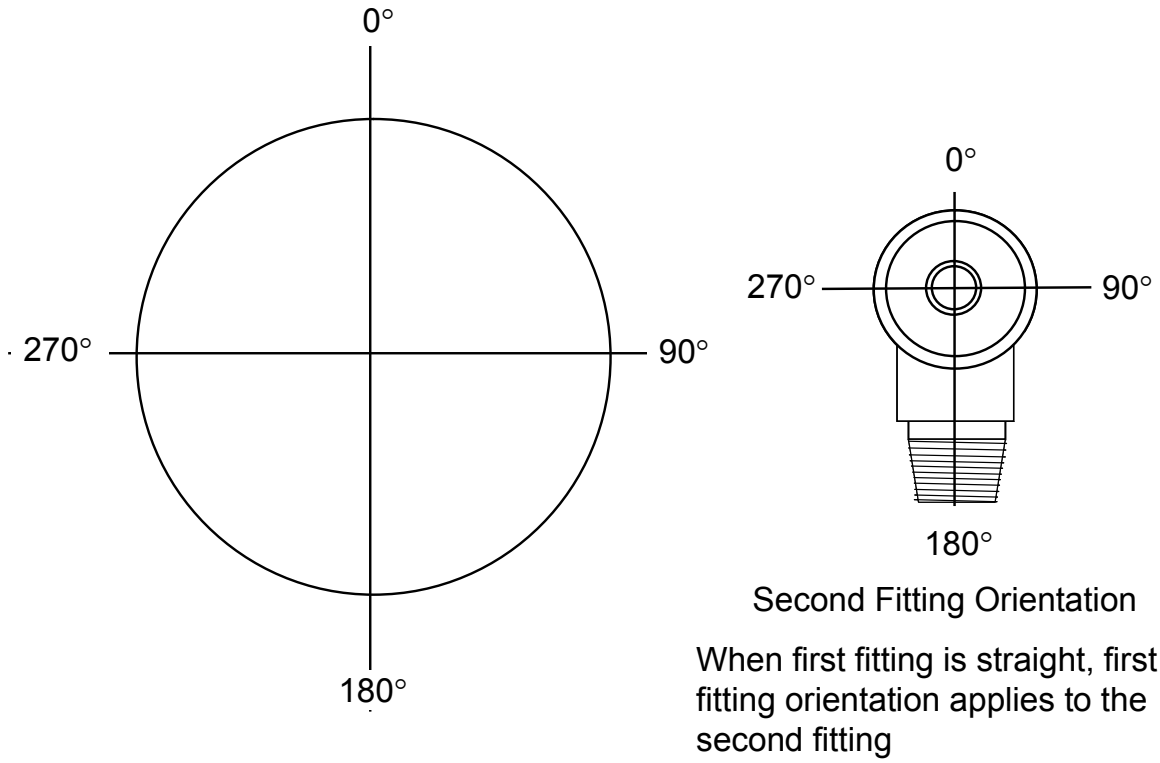

Figure 13-1. Fitting Orientation Guide

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.

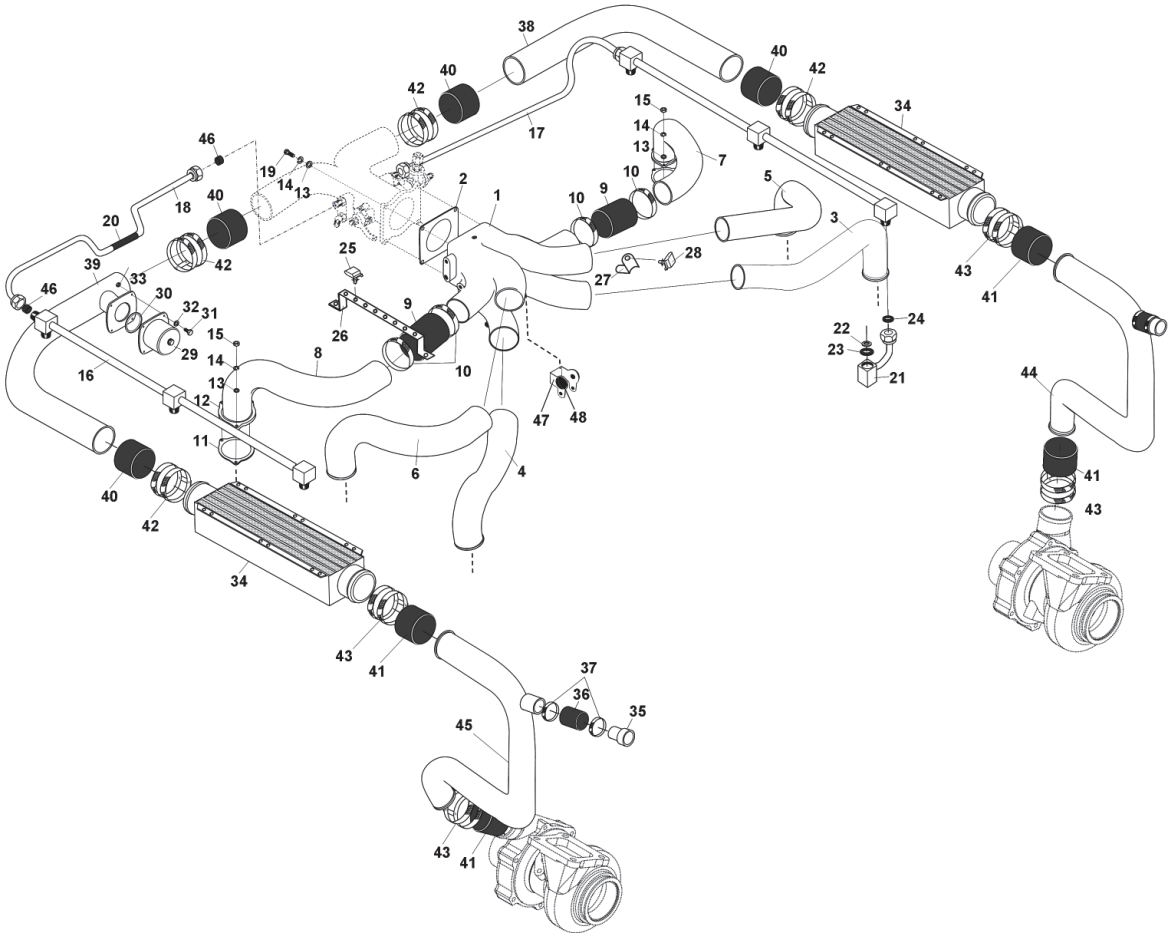

Figure 13-2. Induction System G

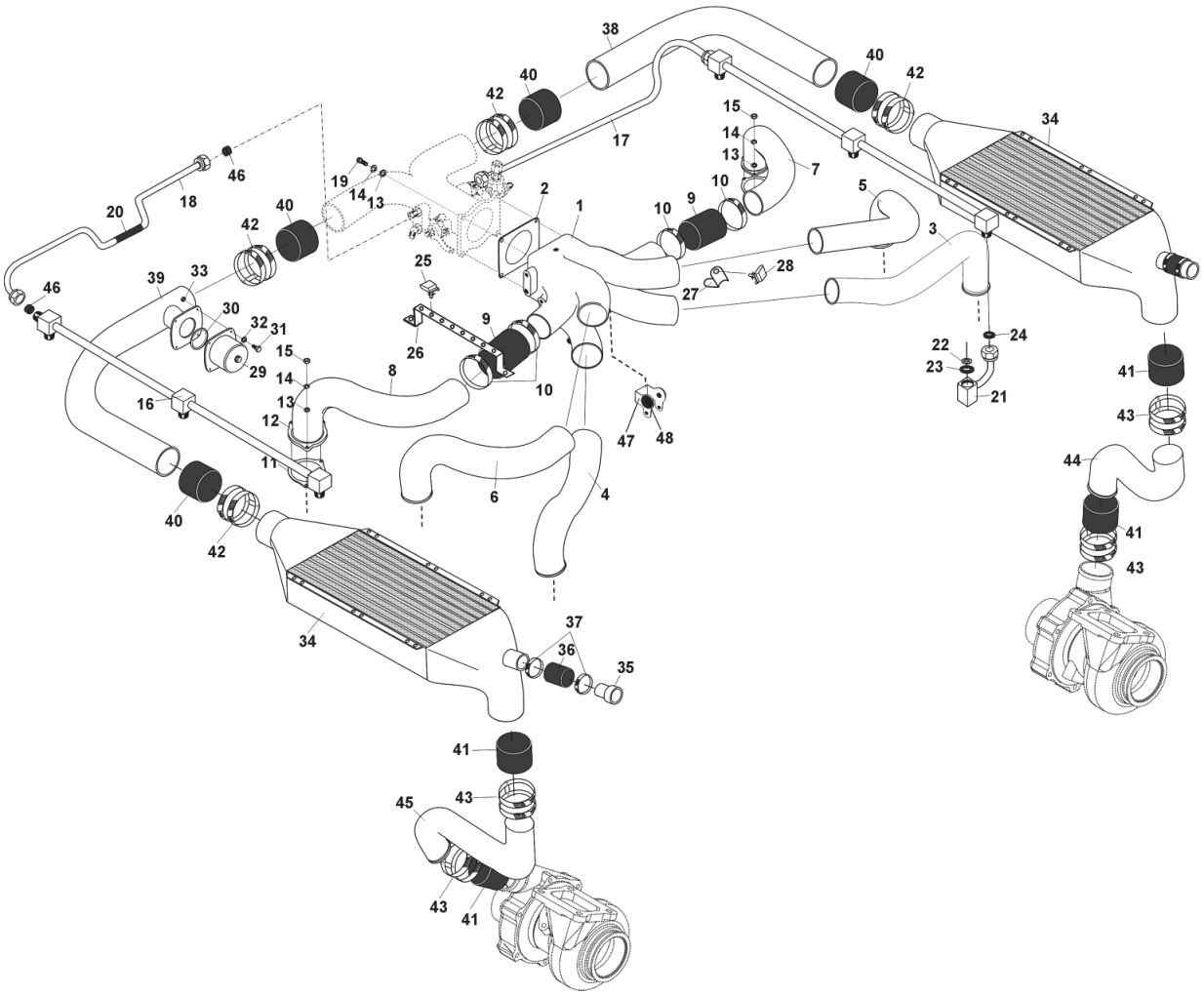

Figure 13-3. Induction System B C E K N

1	Manifold & Fitting Assembly	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Dist. Tube Bracket	38	1-3-5 FWD Induction Tube
3	Tube	15	Nut	27	Fuel Inj. Line Bracket	39	2-4-6 FWD Induction Tube
4	Tube	16	Air Manifold Tube Assembly	28	Tube Clamp	40	Hose
5	Tube	17	Right Air Reference Tube	29	Overboost Valve	41	Hose
6	Tube	18	Left Air Reference Tube	30	O-ring	42	Clamp Assembly
7	Tube	19	Screw	31	Bolt	43	Clamp Assembly
8	Tube	20	Hose	32	Washer	44	1-3-5 AFT Induction Tube
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	2-4-6 AFT Induction Tube
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Intake Manifold Gasket	23	Washer	35	Sonic Venturi Nozzle		
12	Flange	24	Compression Seal	36	Hose		

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.

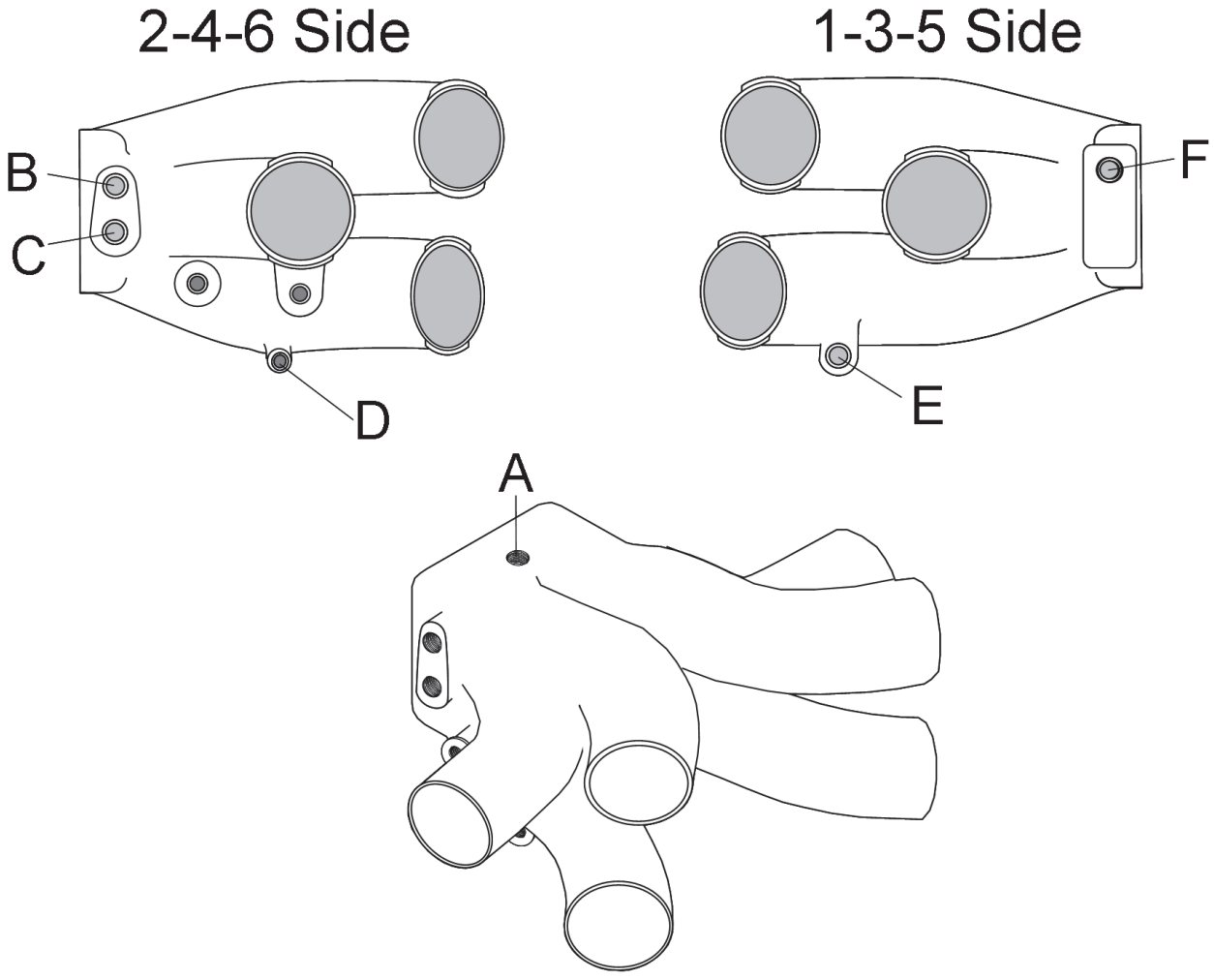

Figure 13-4. Induction Manifold Port Detail

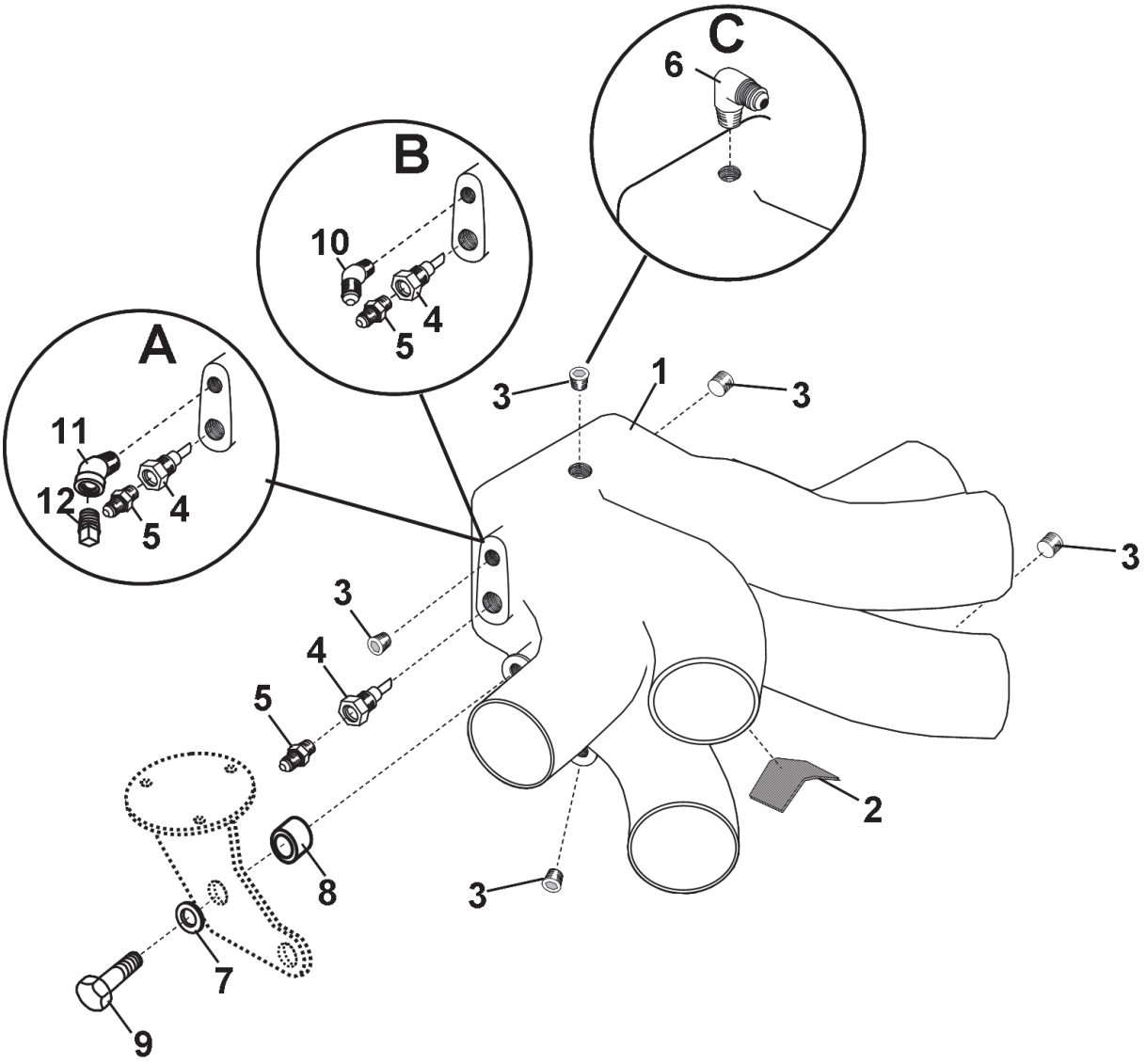

Figure 13-5. Induction Manifold

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).

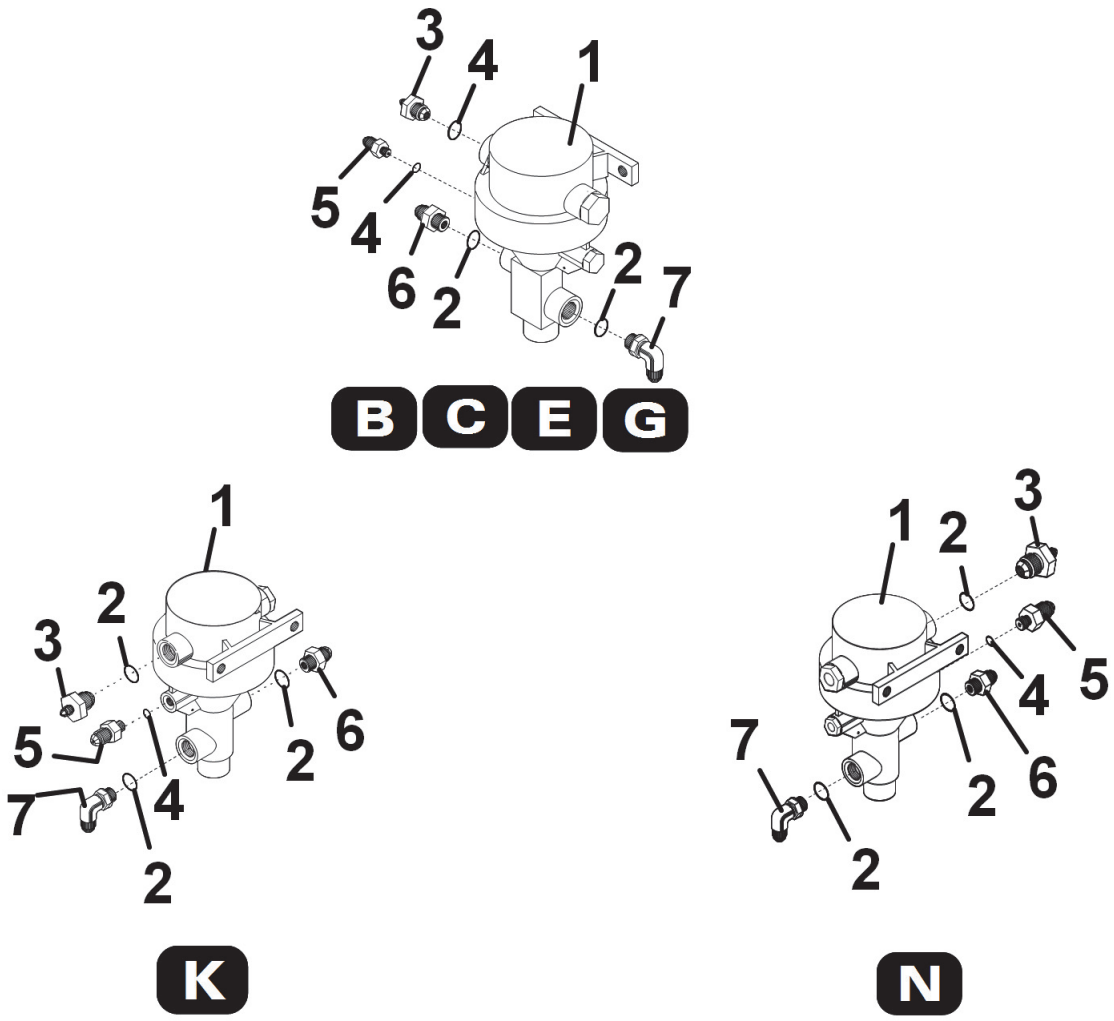

Figure 13-6. Wastegate Controller Fittings

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).

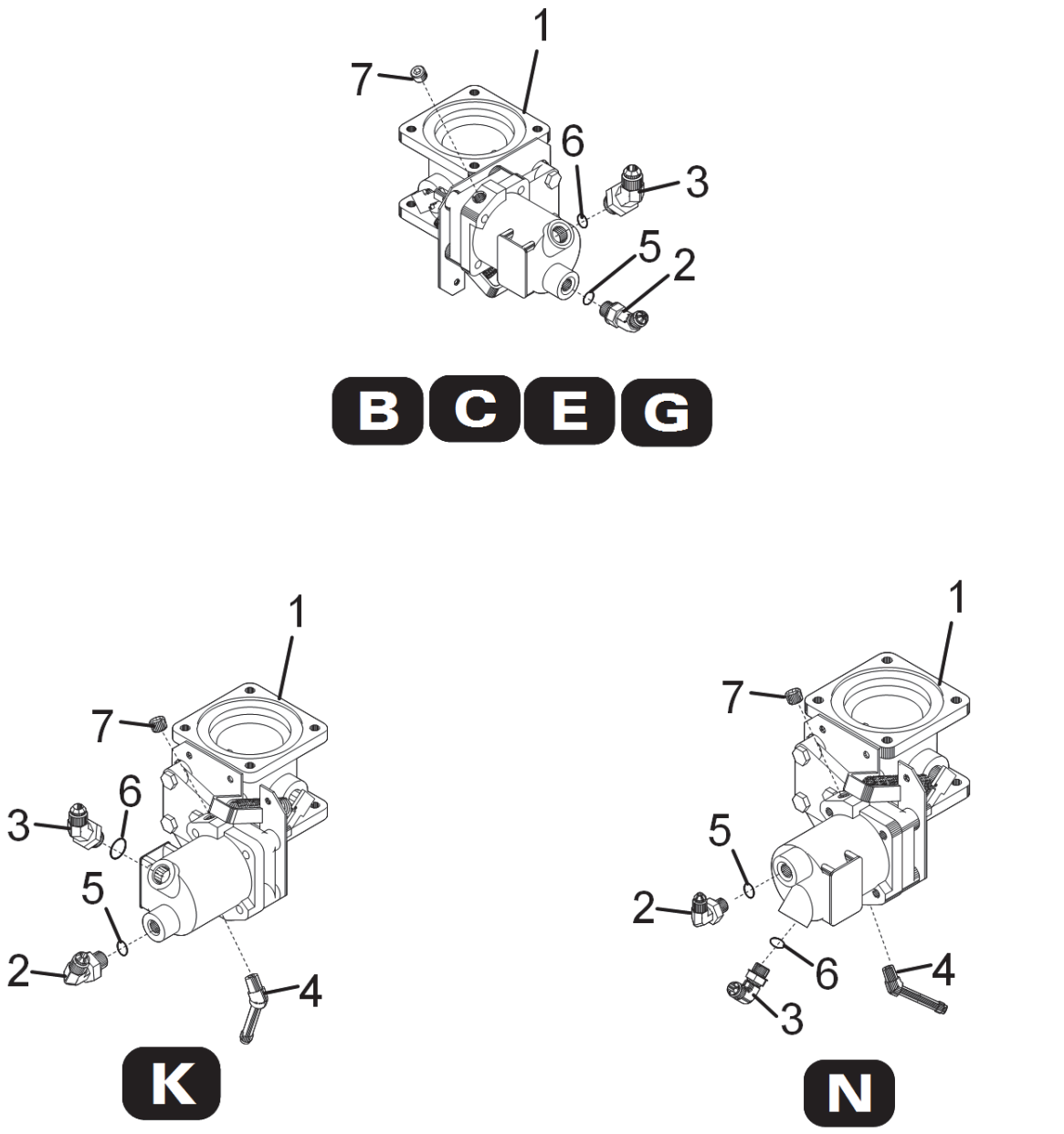

Figure 13-7. Wastegate Fittings

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.

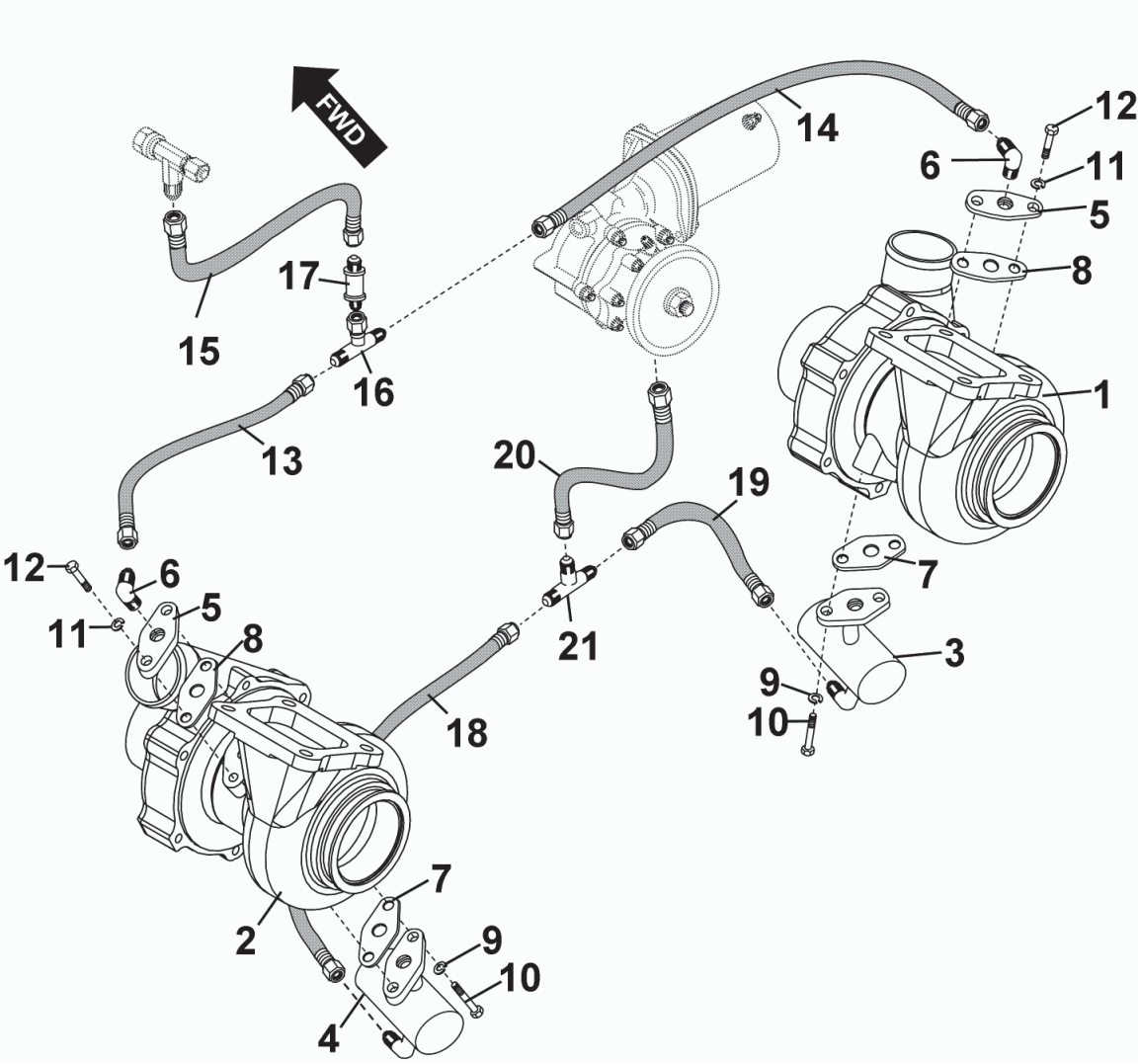

Figure 13-8. Turbocharger Lubrication B C E G

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
4	Left Oil Reservoir	10	Bolt	16	Tee		
5	Adapter	11	Lock Washer	17	Check Valve		
6	Fitting	12	Bolt	18	Hose		

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.

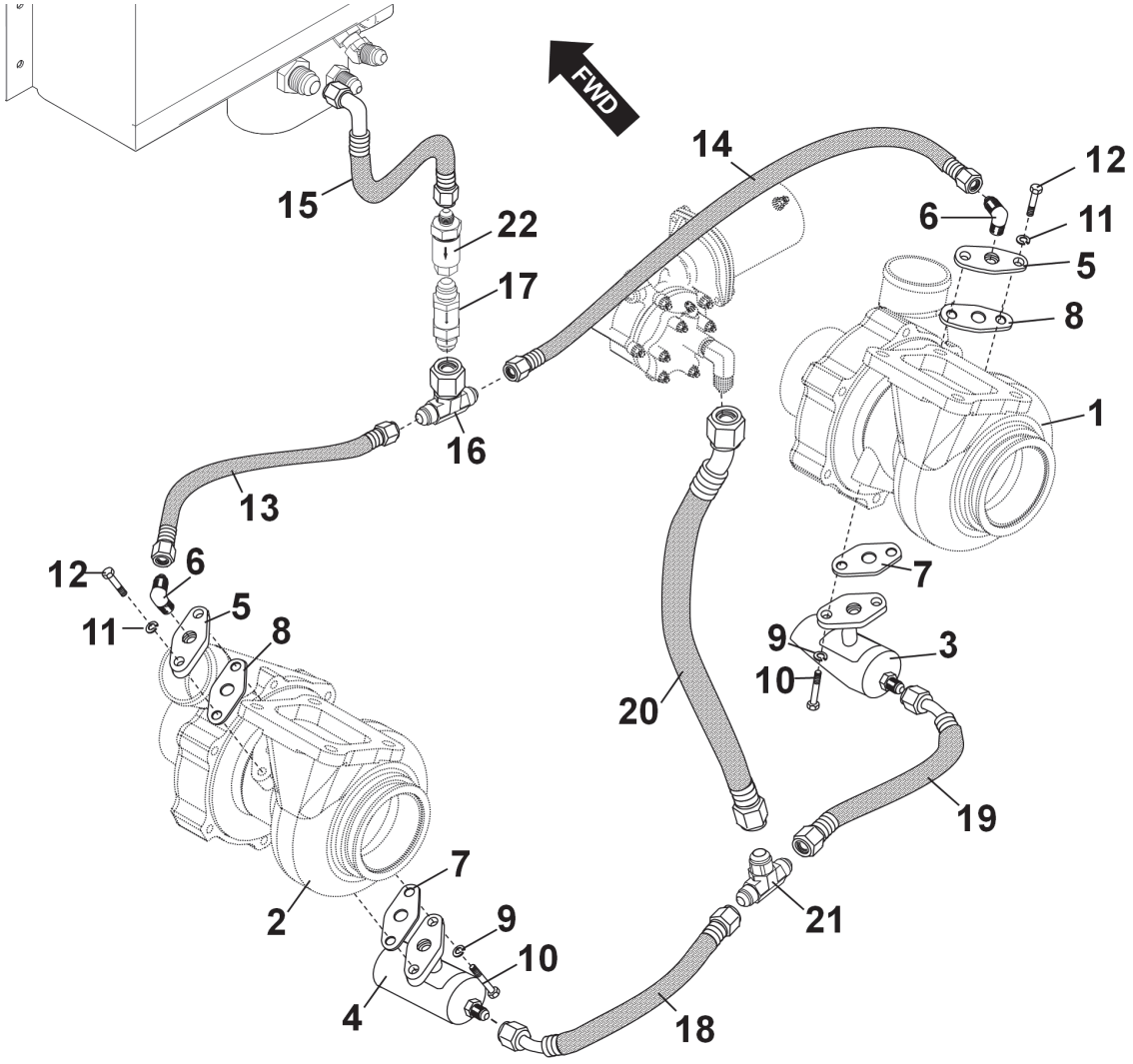

Figure 13-9. Turbocharger Lubrication K
See Figure 13-8 for parts index

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).

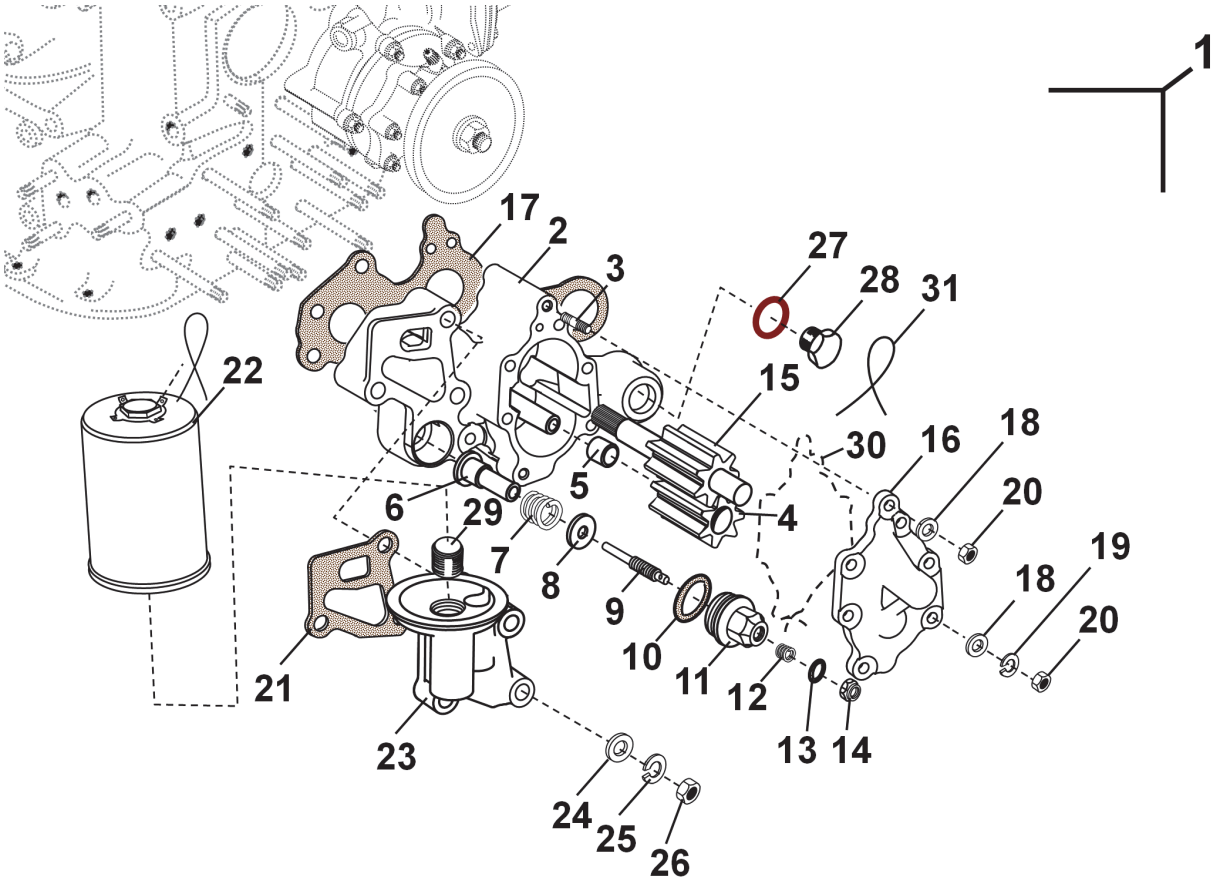

Figure 13-10. Oil Pump Assembly

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	Copper Washer
4	Driven Gear	12	Helicoil	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	Driver Gear	23	Oil Filter Adapter	31	Safety Wire
8	Seat	16	Cover	24	Washer		

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.

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).

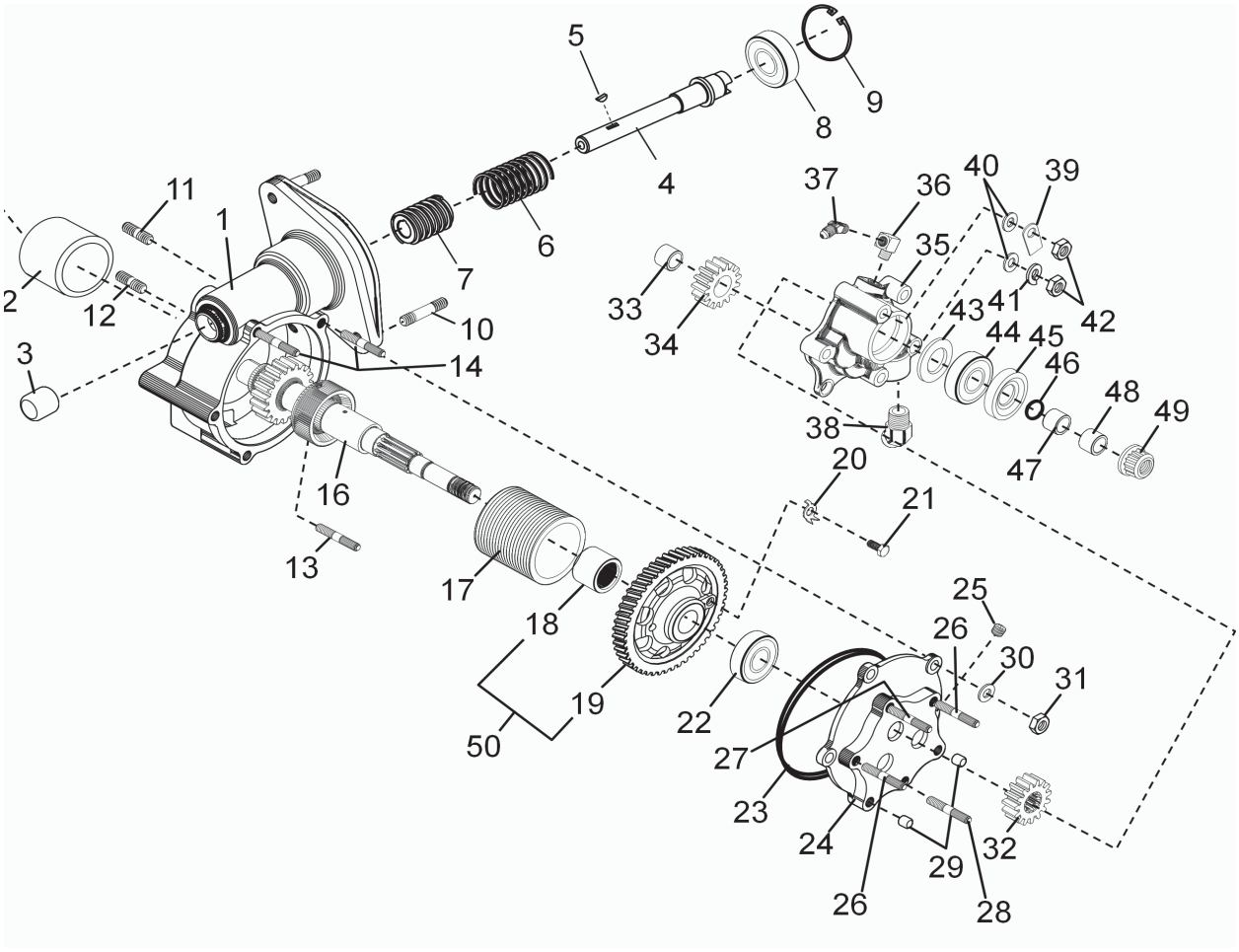

Figure 13-11. Starter and Adapter Assembly with Accessory Drive

1	Starter Adapter Housing	14	Stud	27	Stud	40	Washer
2	Sleeve, Clutch Spring	15	Dowel	28	Stud	41	Lock Washer
3	Needle Bearing	16	Starter Shaft Gear	29	Dowel	42	Nut
4	Worm Drive Shaft	17	Clutch Spring	30	Washer	43	Spacer
5	Woodruff Key	18	Roller Bearing	31	Nut	44	Bearing
6	Starter Spring	19	Starter Worm Gear	32	Scav. Pump Driven Gear	45	Starter Shaft Seal
7	Starter Worm Gear	20	Tab Washer	33	Bushing	46	O-ring Seal
8	Radial Ball Bearing	21	Screw	34	Scav. Pump Driver Gear	47	Starter Shaft Sleeve
9	Internal Retaining Ring	22	Ball Bearing	35	Scav. Pump Body	48	Starter Shaft Spacer
10	Stud	23	O-Ring	36	90° Street Elbow	49	Flanged Nut
11	Stud	24	Cover Assembly	37	45° Elbow		
12	Stud	25	Plug	38	90° Elbow		
13	Stud	26	Stud	39	Seal Retainer Clip		

Procedure continues on next page

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.

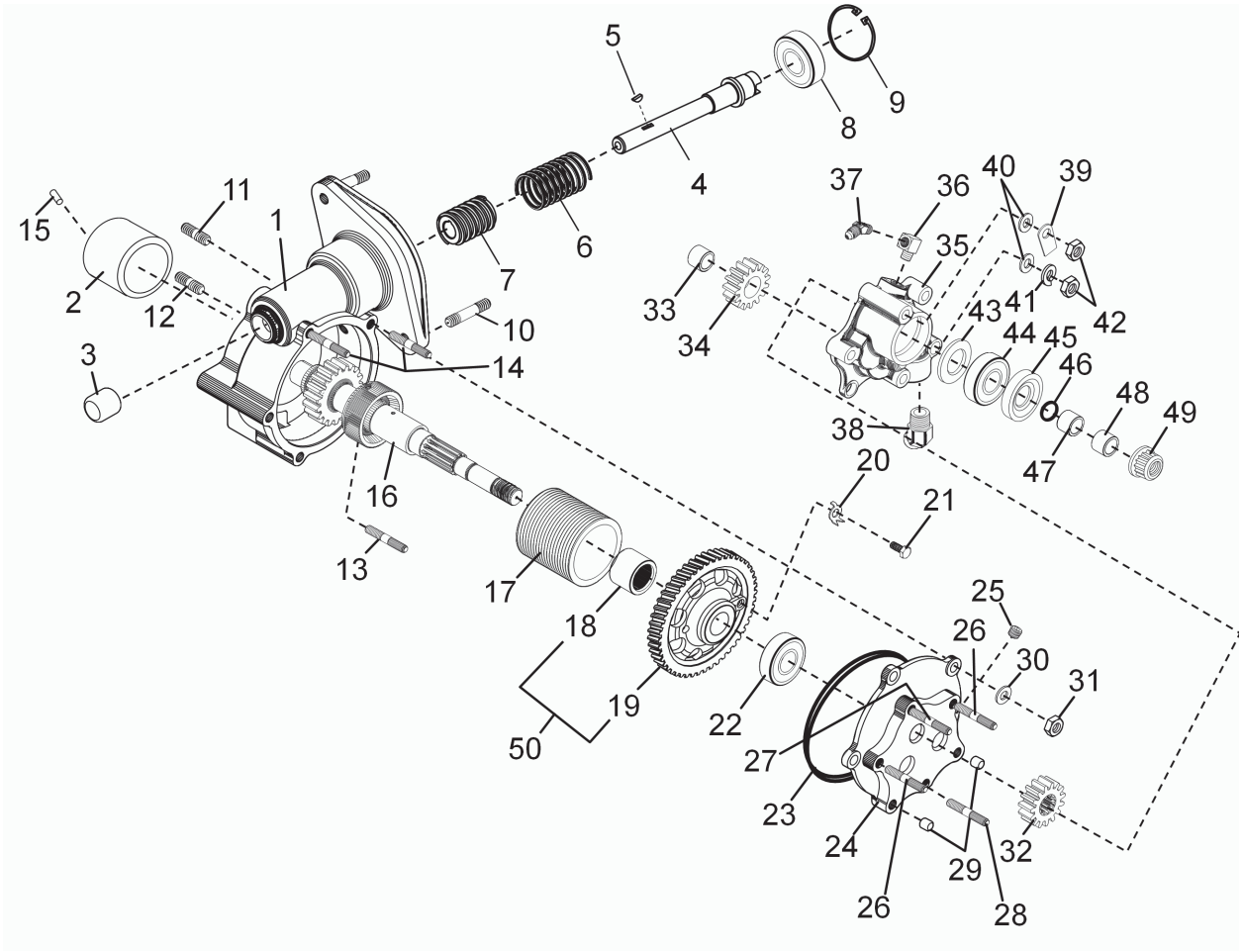

Figure 13-11 repeated for reference

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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.

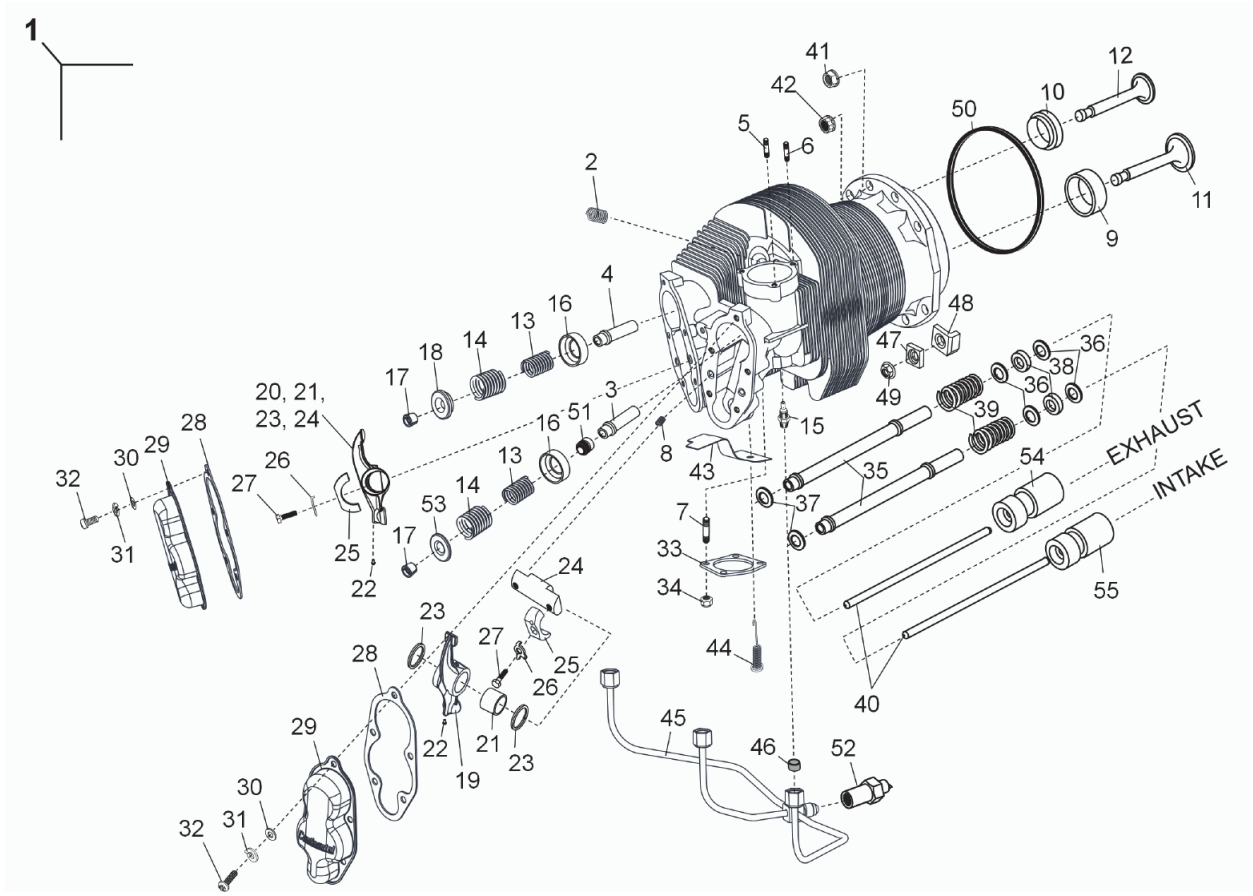


Figure 13-12. Cylinder Assembly

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		

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.

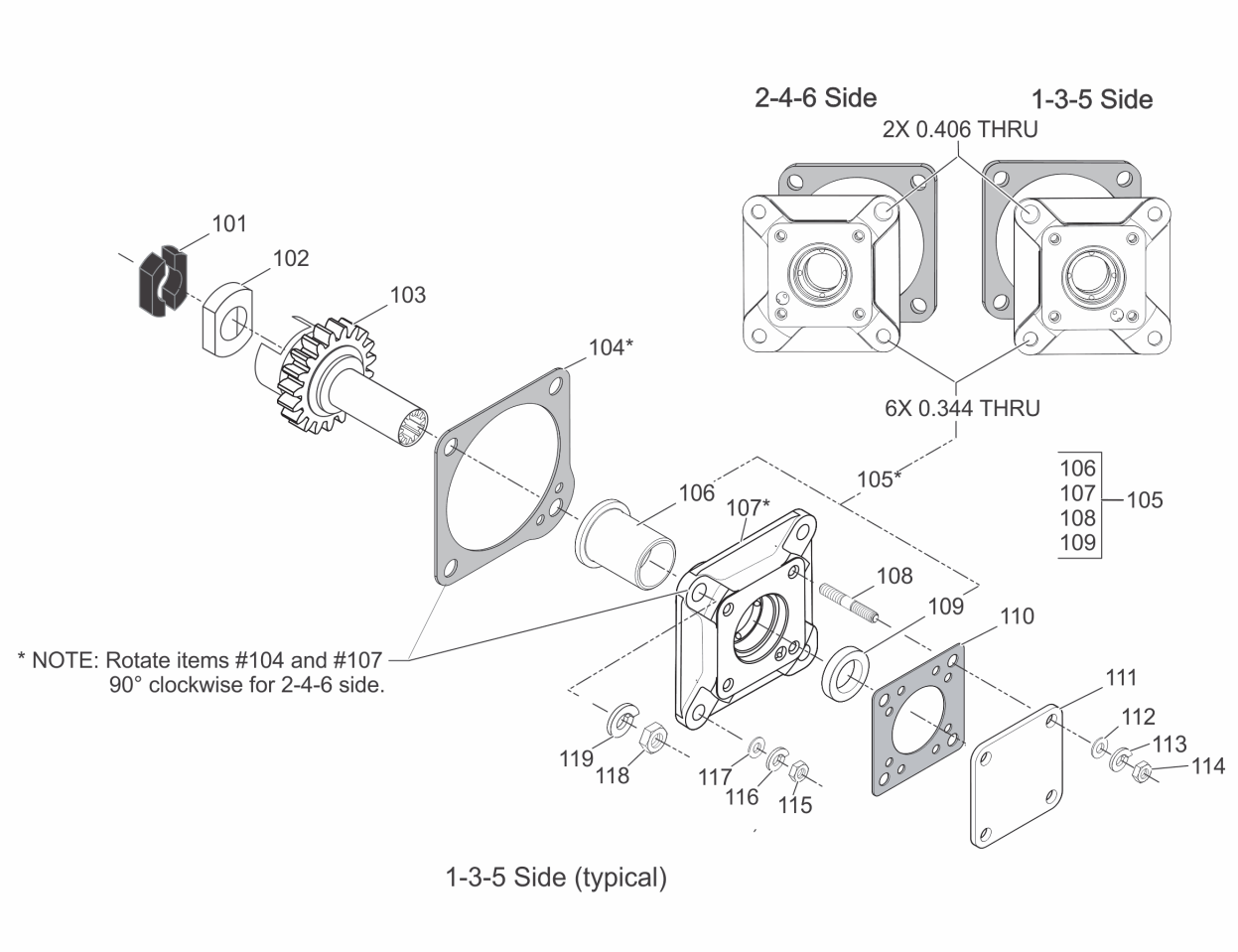


Figure 13-13. Accessory Drive Assembly

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		

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).

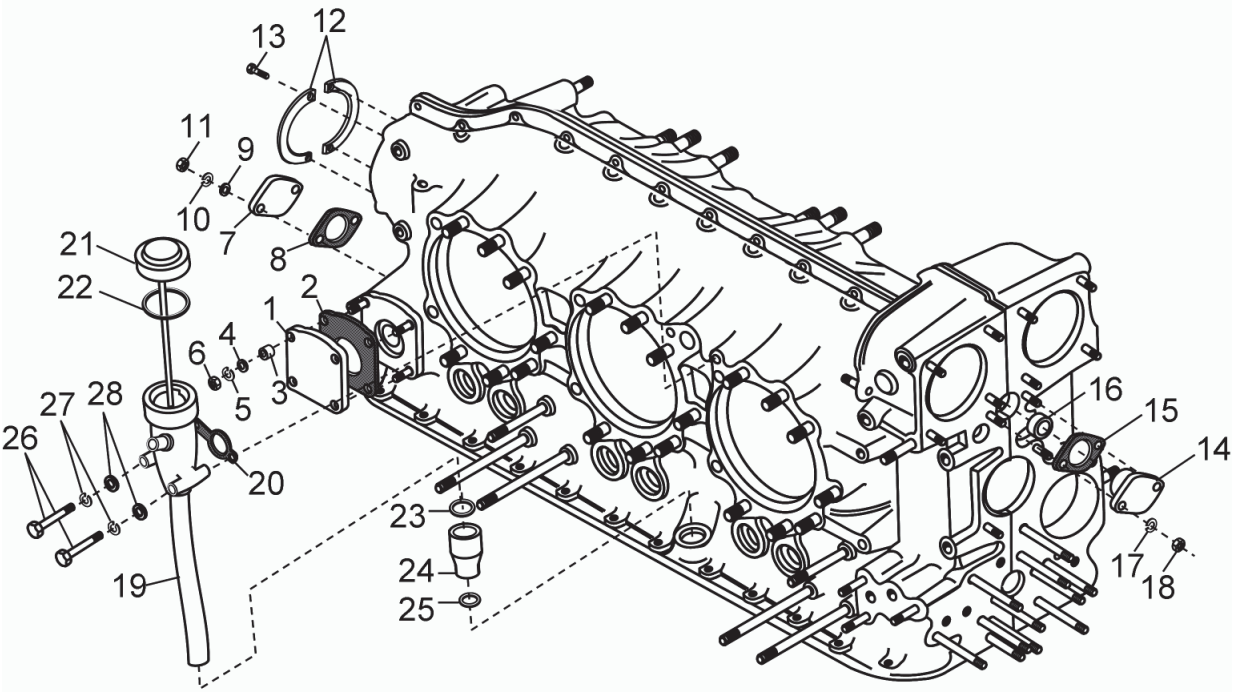


Figure 13-14. Miscellaneous Crankcase Hardware

1	Cover	8	Camshaft Cover Gasket	15	Idler Pin Cover Gasket	22	Oil Filler Gasket
2	Gasket	9	Washer	16	Idler Gear Bushing	23	O-ring
3	Spacer	10	Lock Washer	17	Lock Washer	24	Adapter
4	Washer	11	Nut	18	Nut	25	O-ring
5	Lock Washer	12	Gasket	19	Oil Filler Assembly	26	Screw
6	Nut	13	Screw	20	Gasket	27	Lock Washer
7	Camshaft Cover	14	Idler Gear Support Pin	21	Oil Gauge & Cap Assembly	28	Washer

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).

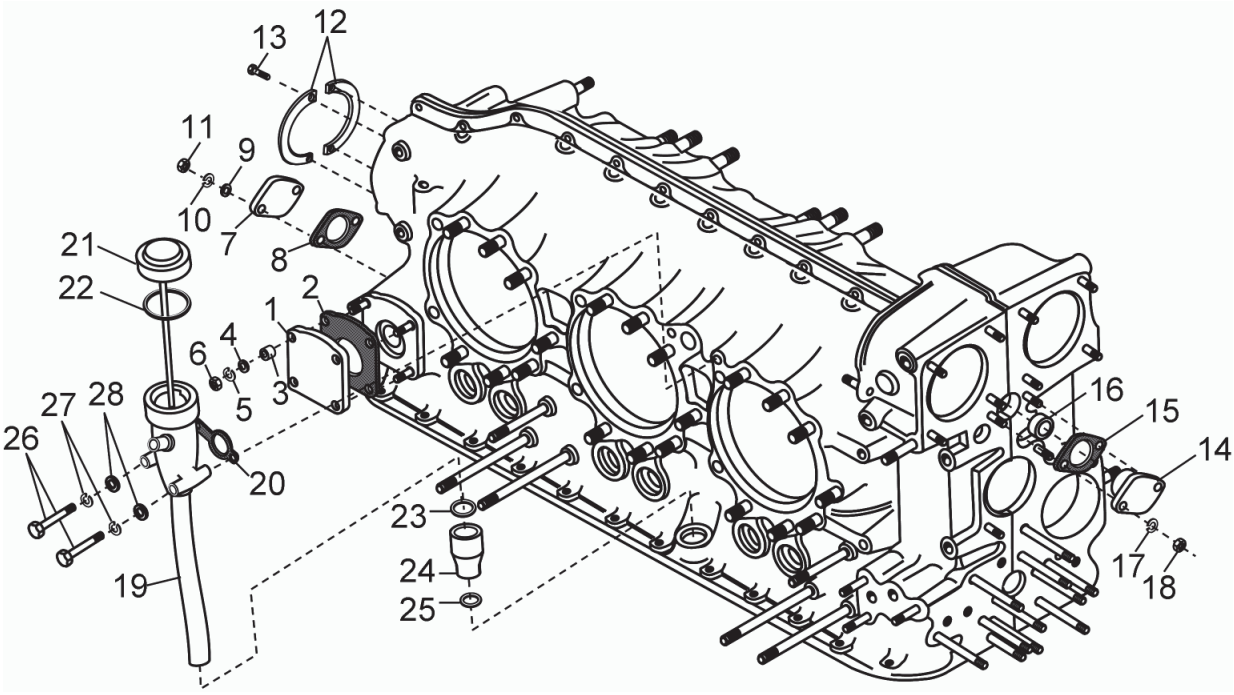


Figure 13-14 repeated for reference

7. Remove the nuts and washers holding the rear lifting eye. Remove the lifting eye from the crankcase.

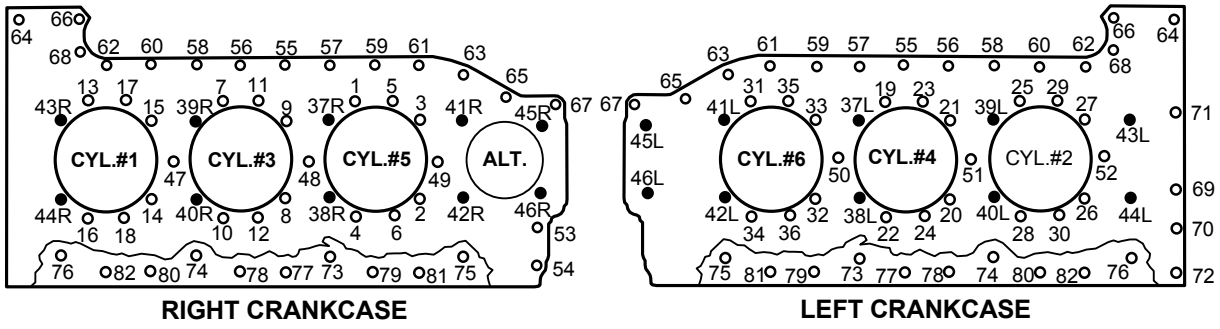


Figure 13-15. Crankcase Fastener Locations

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.

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).

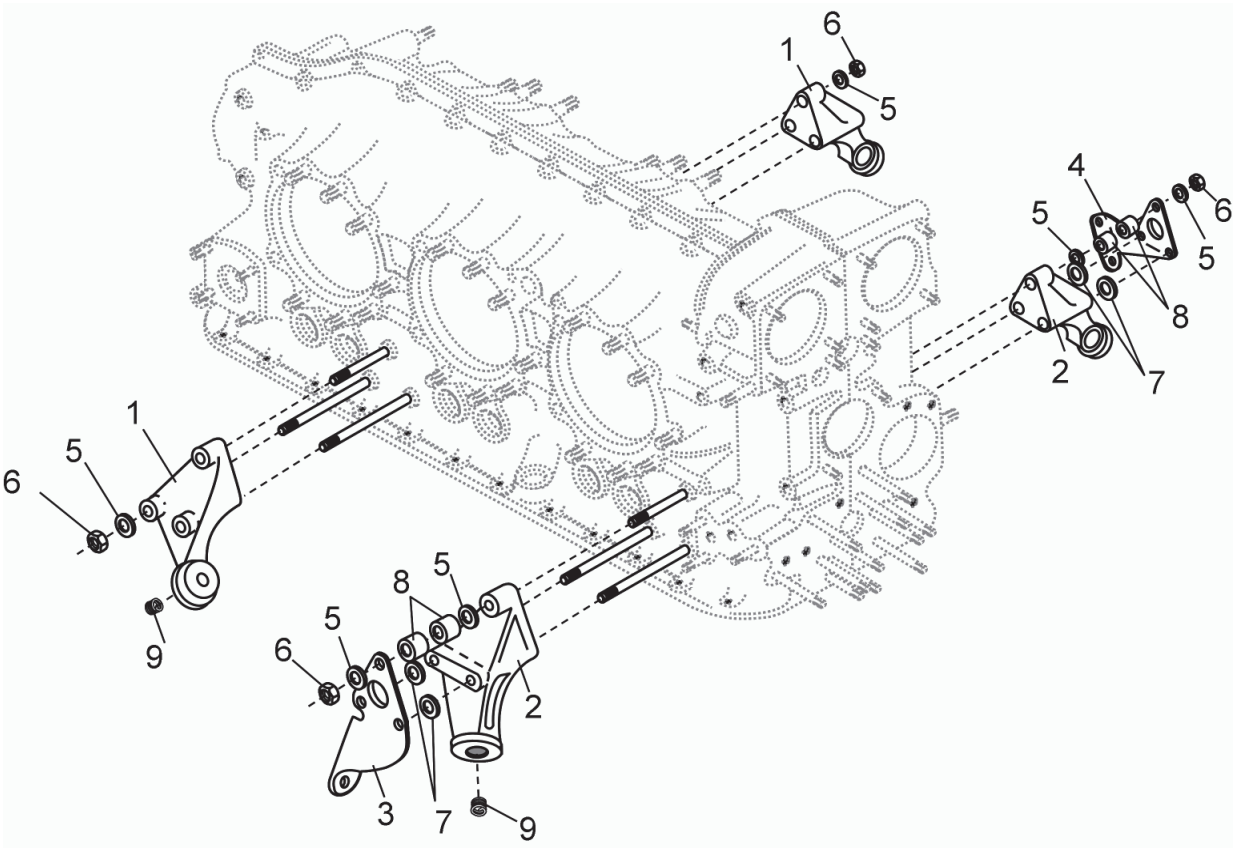


Figure 13-16. Engine and Turbocharger Mounting Brackets B C E

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).

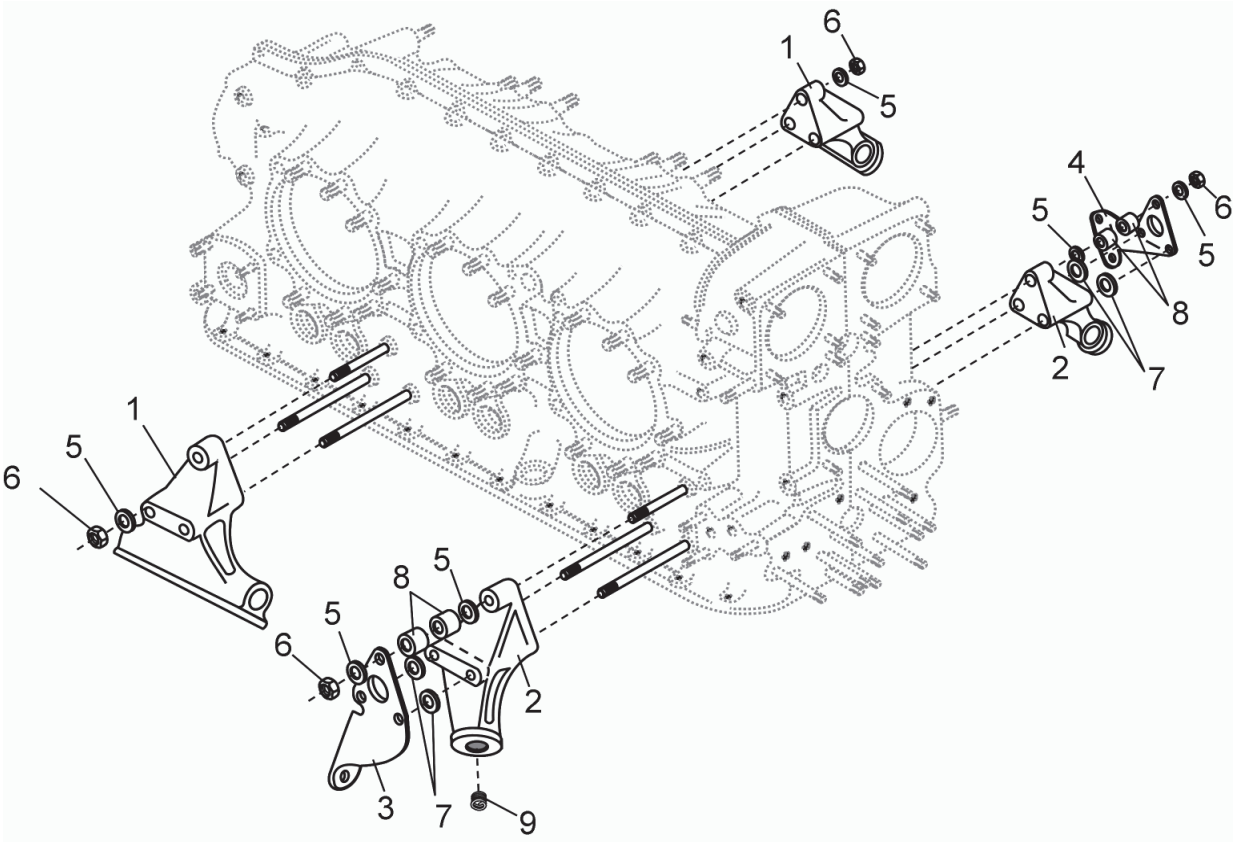


Figure 13-17. Engine and Turbocharger Mounting Brackets G

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).

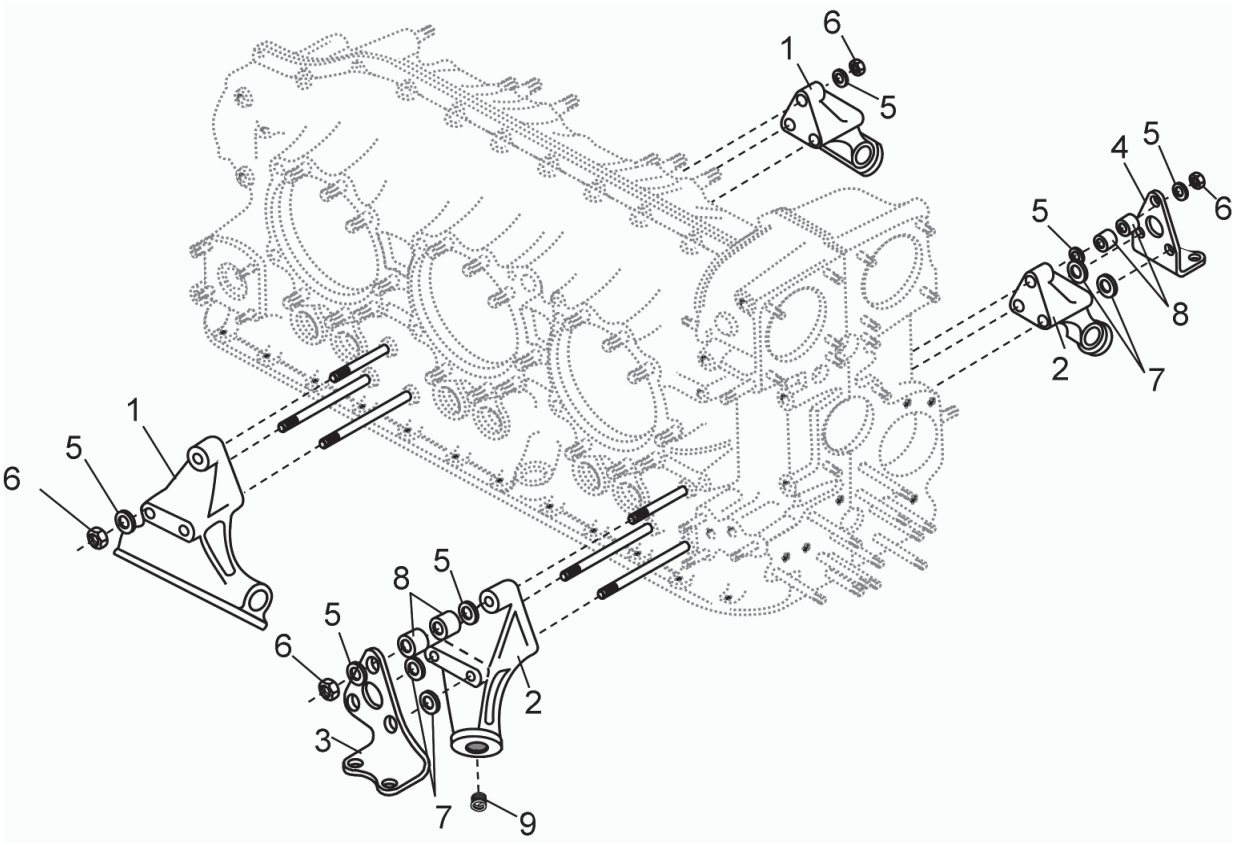


Figure 13-18. Engine and Turbocharger Mounting Brackets K

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

13-9.3.4. 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).

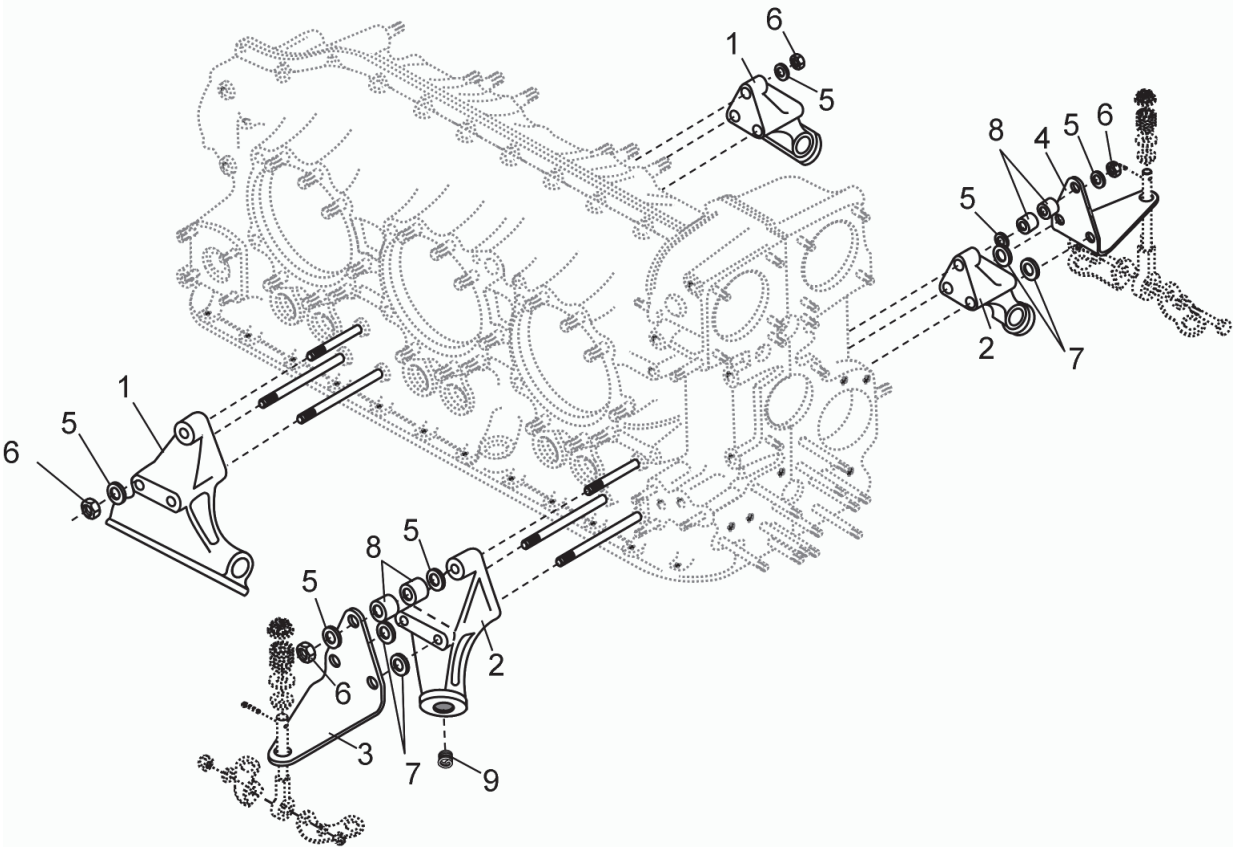


Figure 13-19. Engine and Turbocharger Mounting Brackets N

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.

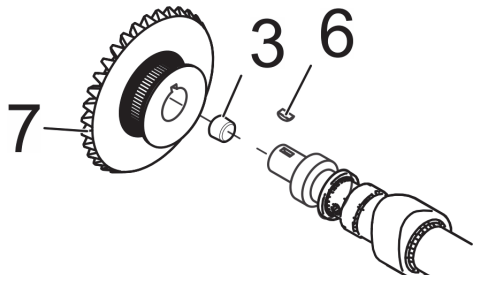


Figure 13-20. Keyed Camshaft

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).

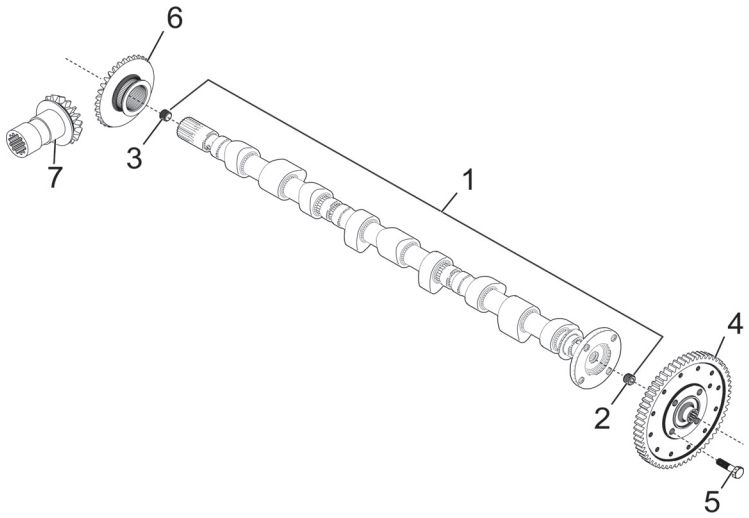


Figure 13-21. Camshaft Assembly

1	Camshaft Assembly	3	Plug	5	Bolt	7	Governor Driven Gear
2	Plug	4	Camshaft Gear	6	Governor Drive Gear		

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).

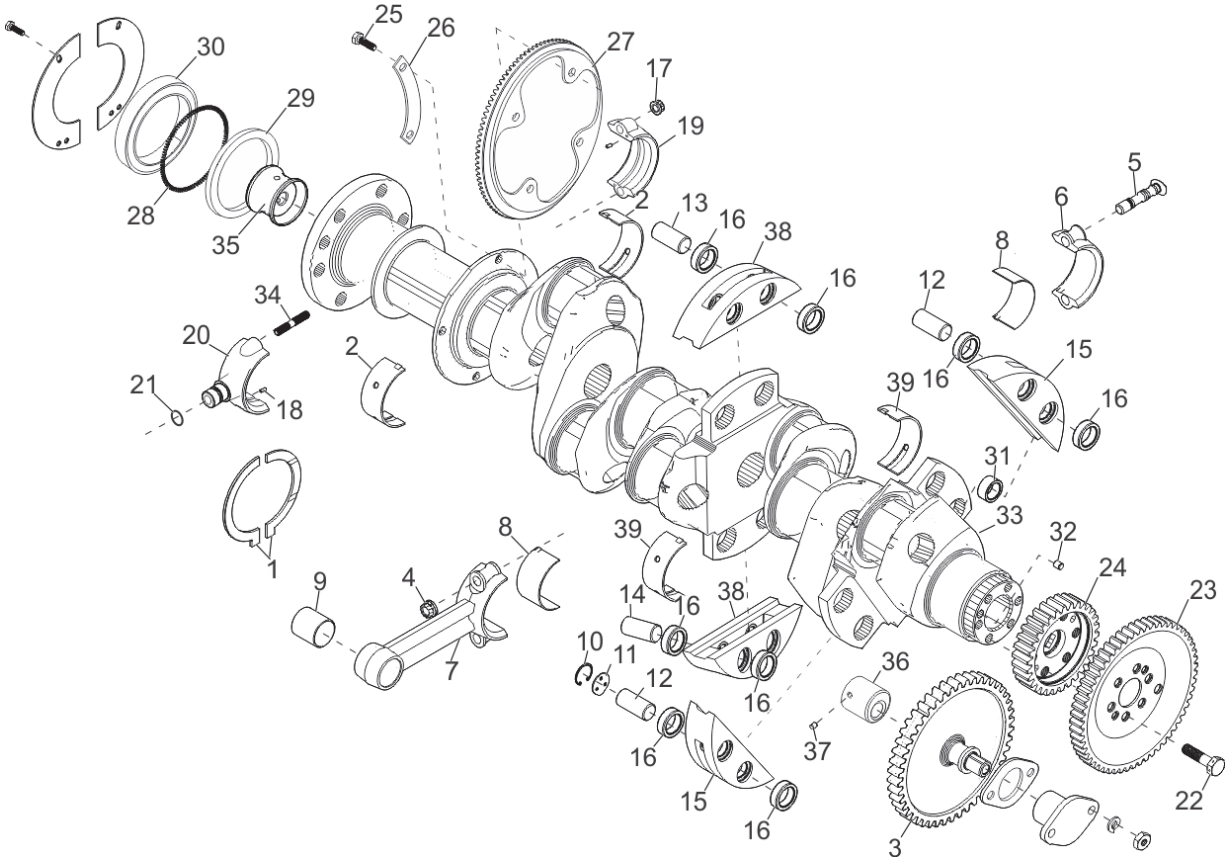


Figure 13-22. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	C'shaft Main Bearing, 4 & 5	12	6th Order Counterweight Pin	22	Drilled Head Screw	32	Crankshaft Dowel
3	Idler Gear	13	4th Order Counterweight Pin	23	Large Gear Cluster	33	Crankshaft
4	Spiral Lock Nut	14	5th Order Counterweight Pin	24	Small Gear Cluster	34	Stud
5	Connecting Rod Bolt	15	Counterweight Assembly	25	Bolt	35	Oil Transfer Plug
6	Connecting Rod Cap	16	Counterweight Bushing	26	Tab Lock Plate	36	Idler Gear Bushing
7	Connecting Rod	17	Lock Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring	38	Counterweight Assembly
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring	39	C'shaft Main Bearing, Rear & Intermediate
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

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

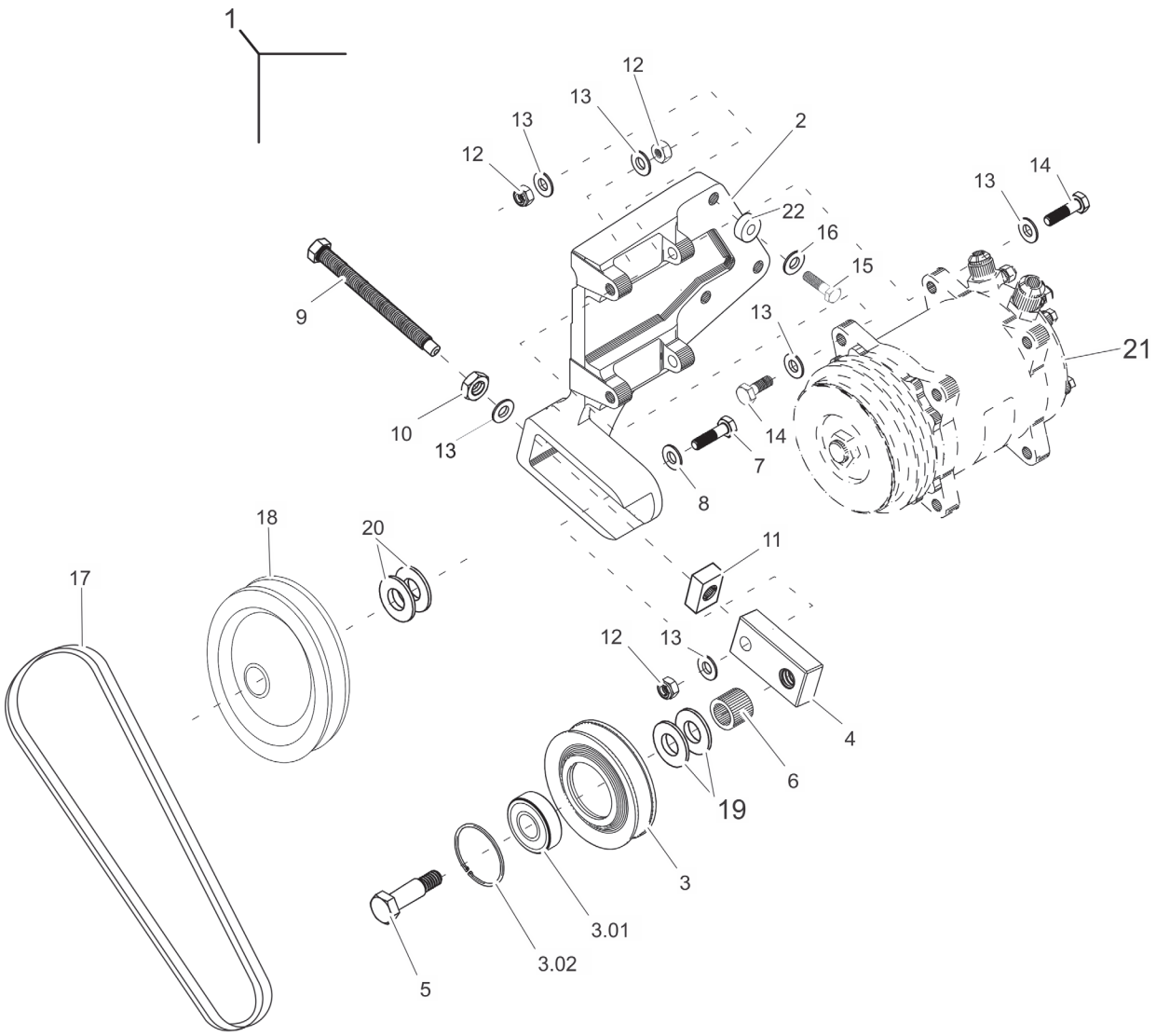
1. Refer to the Crankshaft Counterweight Removal instructions in Section 10-9.1.1 of M-0, Standard Practice Maintenance Manual.
2. Inspect the Crankshaft Counterweights according to the instructions in Section 10-9.1.3 and Section 10-9.1.4 of M-0, Standard Practice Maintenance Manual.
3. Inspect the 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.



ITEMS 2 THRU 14 INCLUDED IN ITEM 1

Figure 13-23. Freon Compressor Mounting Kit

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

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Chapter 14. Engine Cleaning

Refer to the “Engine Cleaning” instructions in Chapter 12 of M-0, Standard Practice Maintenance Manual.

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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 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 ½ 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.

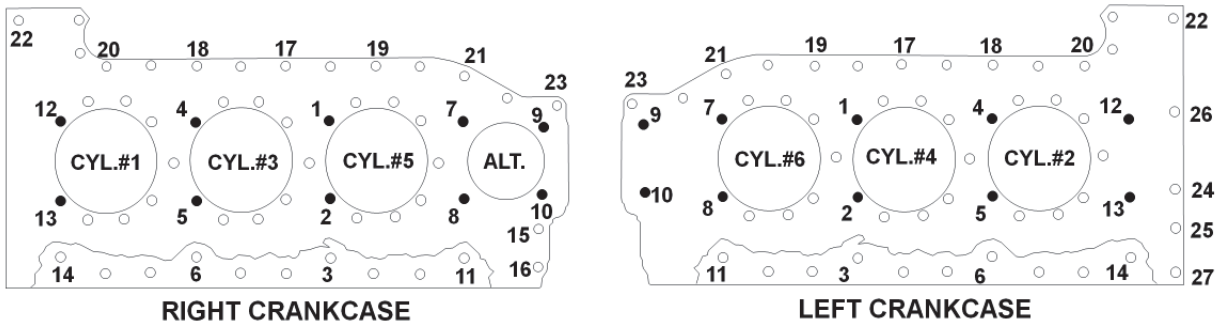


Figure 15-1. Crankcase Dimensional Inspection Torque Sequence

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.

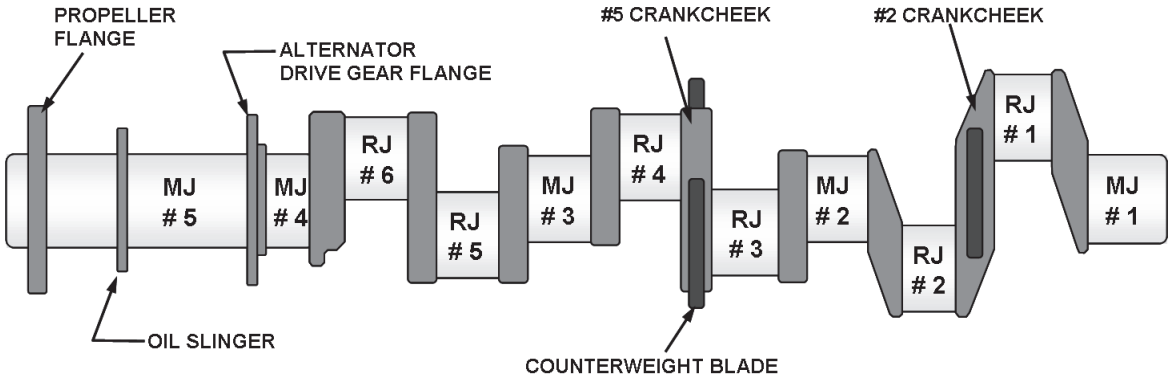


Figure 15-2. Crankshaft Journals

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).

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

Refer to the "Crankshaft Counterweight Bushing Bore Inspection" instructions in Section 10-9.1.4 of M-0, Standard Practice Maintenance Manual.

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."

Inspection Item	Inspection Action
Stacks Risers Elbows	Check parts for: • Burned areas • Cracks • Loose parts/hardware • Inspect welds and seams for cracks • Replace worn, cracked or burned parts
Slip joints	Inspect for bulges or cracks
Multi-segment V-band clamps	Replace at overhaul

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

Illustration and Tables in Section D-9 provide stud sizes and heights for the items listed below. Items in the tables match the referenced item numbers in the illustrations.	
Inspection Item	**Inspect for:**
Starter Adapter	• Inspect the studs for corrosion, distortion, stripped or incomplete threads, or looseness. • Check the stud alignment using a tool maker's square. • Studs should measure within the limits provided in Appendix D-9. • Replace unserviceable studs according to instructions in Appendix C-7 of M-0, Standard Practice Maintenance Manual. • 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.
Accessory Drive Adapter	
Lubrication System	
Oil Control Collar	
Crankcase	
Cylinder	

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.

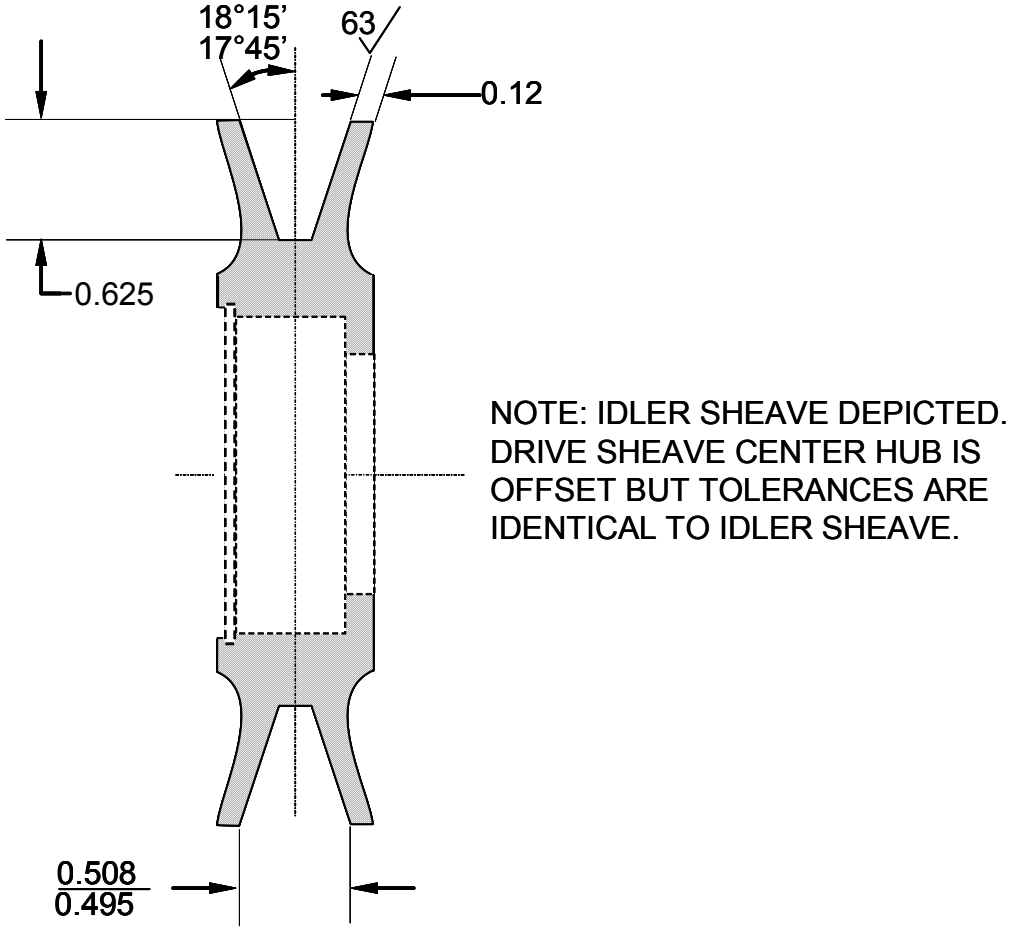


Figure 15-3. Air Conditioning Compressor Sheave

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. Worm 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.

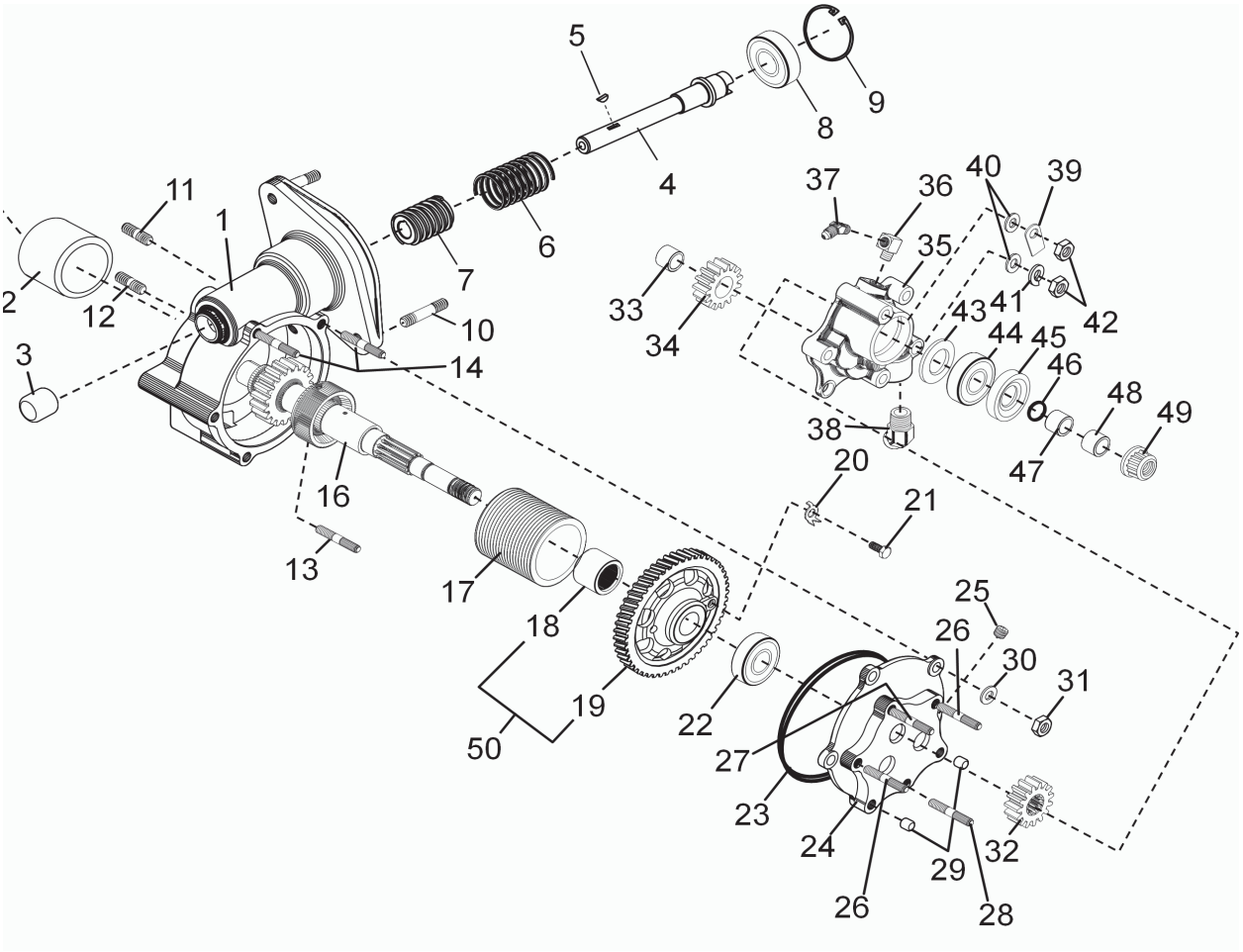


Figure 15-4. Starter and Starter Adapter

1	Starter Adapter Housing	14	Stud	27	Stud	40	Washer
2	Sleeve, Clutch Spring	15	Dowel	28	Stud	41	Lock Washer
3	Needle Bearing	16	Starter Shaft Gear	29	Dowel	42	Nut
4	Worm Drive Shaft	17	Clutch Spring	30	Washer	43	Spacer
5	Woodruff Key	18	Roller Bearing	31	Nut	44	Bearing
6	Starter Spring	19	Starter Worm Gear	32	Scav. Pump Driven Gear	45	Starter Shaft Seal
7	Starter Worm Gear	20	Tab Washer	33	Bushing	46	O-ring Seal
8	Radial Ball Bearing	21	Screw	34	Scav. Pump Driver Gear	47	Starter Shaft Sleeve
9	Internal Retaining Ring	22	Ball Bearing	35	Scav. Pump Body	48	Starter Shaft Spacer
10	Stud	23	O-Ring	36	90° Street Elbow	49	Flanged Nut
11	Stud	24	Cover Assembly	37	45° Elbow		
12	Stud	25	Plug	38	90° Elbow		
13	Stud	26	Stud	39	Seal Retainer Clip		

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.

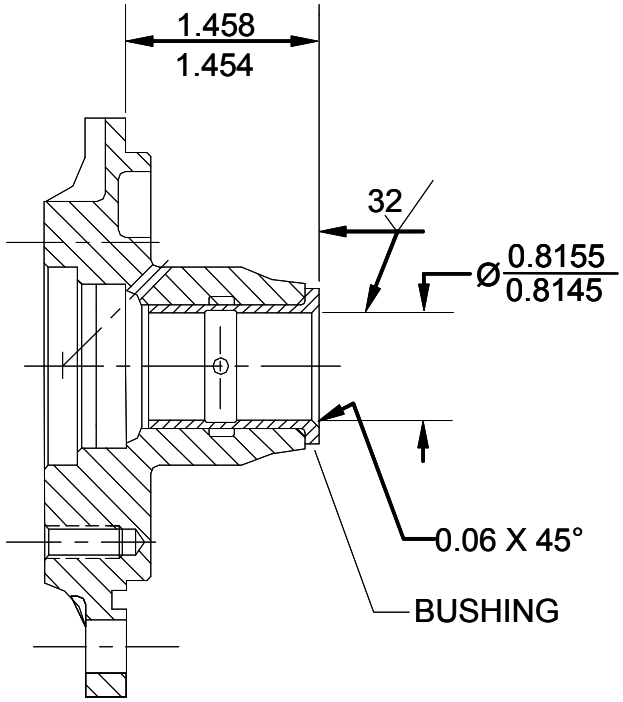


Figure 15-5. Accessory Drive Adapter Bushing Installation Detail

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.

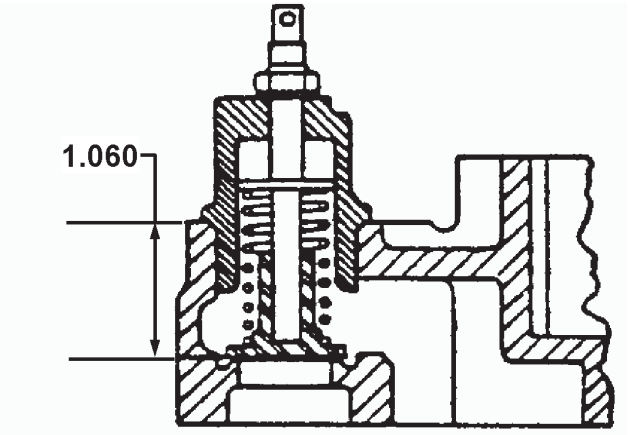


Figure 15-6. Oil Pressure Relief Valve

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.

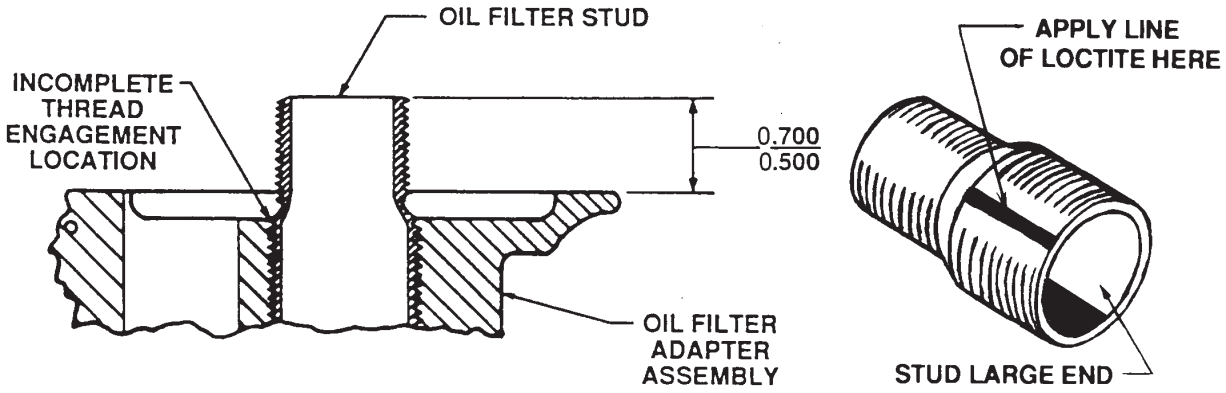


Figure 15-7. Oil Filter Adapter Stud

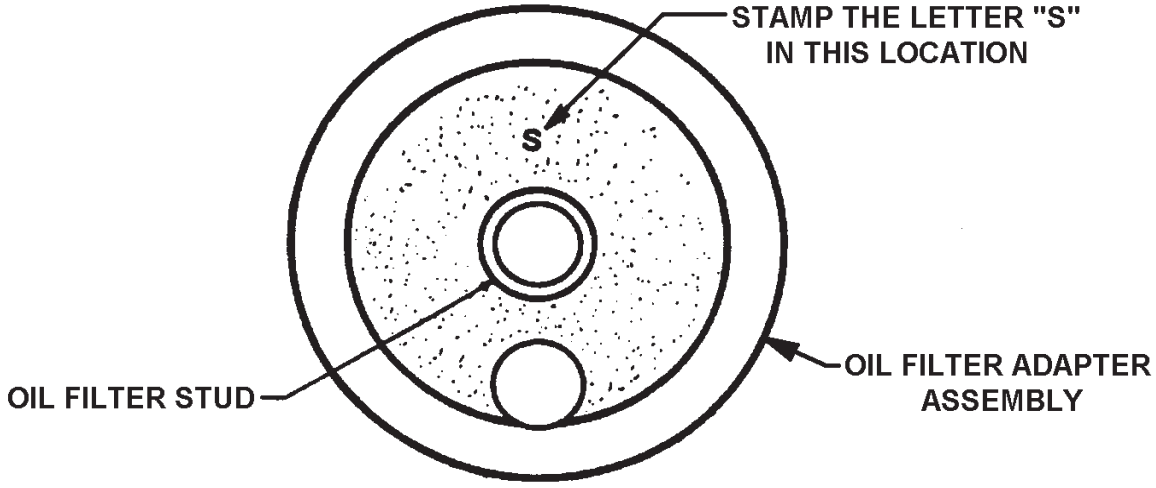


Figure 15-8. Identification of Oil Filter Adapter Stud Modification

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

Condition	Corrective Action
Cylinder with radial fin crack extending to the root of a fin	Replace[1] the cylinder
Broken, bent (or straightened), or pitted cylinder head or barrel fins	Replace[1] the cylinder
Power stroke stress on cylinder barrel; heavy rust or pitting, indentation; chafing or cracks on cylinder barrel	Replace[1] the cylinder
Cracks in cylinder head structure	Replace[1] the cylinder
Cracked or eroded valve seat bore	Replace[1] the cylinder
Static seal leakage or leakage from head to barrel seal or crack in head or barrel	Replace[1] the cylinder
Discolored/burned paint, Piston pin scoring or damage to the cylinder bore (usually due to overheating)	Replace[1] the cylinder Do Not Repair[2]
Blistered paint on the cylinder barrel	Replace[1] the cylinder
Cylinder head-to-barrel junction movement	Replace[1] the cylinder
Low differential pressure coupled with excessive oil consumption	Repair or replace[3] the cylinder
Scratches in the honed surface of the cylinder wall or cylinder bore	Repair the cylinder
Pitting, sharp dents or chafing in fin tips less than 0.050 inches (1.3 mm) deep	Repair the cylinder

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) • Baffle Retainer Spring • Cylinder Deck Stud Nuts and Through-Bolts • Cylinder Exhaust Flange Studs • Exhaust Flange Gaskets • Exhaust Manifold Nuts • Exhaust Valves • Intake Valves • Intake and Exhaust Valve Tappets • Lock Washers • Pistons & Piston Rings • Piston Pin	• Pushrod Tube Compression Springs • Pushrod Tube Packing • Retainer Keys • Rocker Arm Bushings • Rocker Cover Gaskets • Rocker Shafts • Rotocoils • Seals, O-rings, Gaskets • Springs • Tab Washers • Thrust Washers • 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.

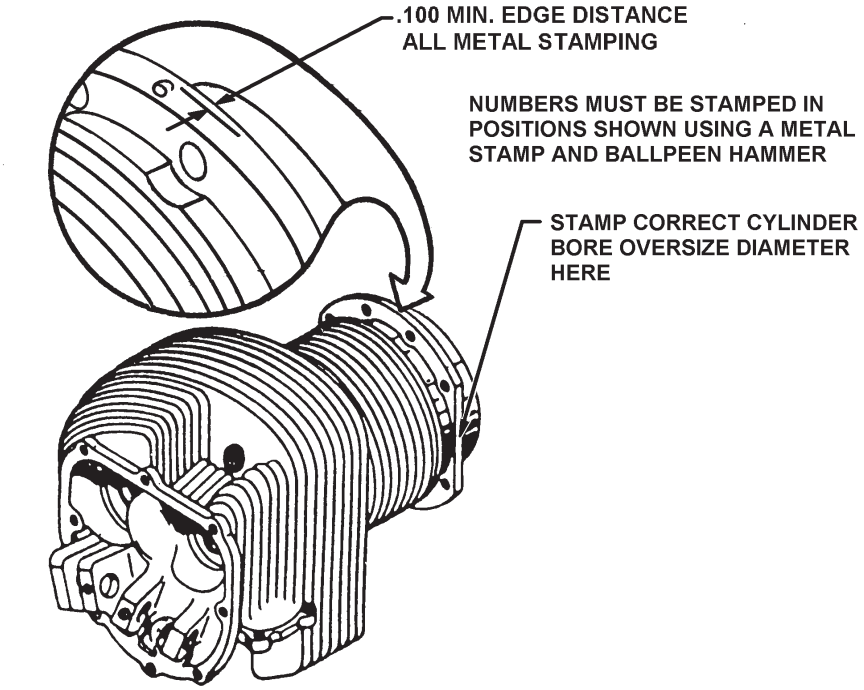


Figure 15-9. Cylinder Position Number

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.”

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.
14. Inspect the valve guide bore new inside diameter (Appendix D).

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.

15-8.9.12. Valve Guide Bore Reaming

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.

15-8.9.14. Spark Plug Helical Coil Insert Replacement

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

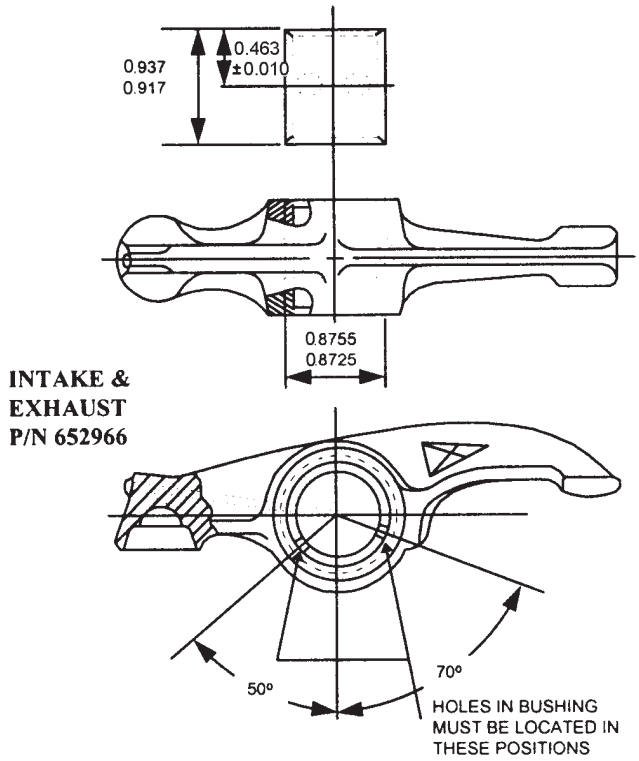
- Borroughs Part No. 8118 Rocker Arm Bushing Remover/Installer
- Borroughs Part No. 8116-1R through 15R Reamers, or equivalent
- Arbor Press

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.

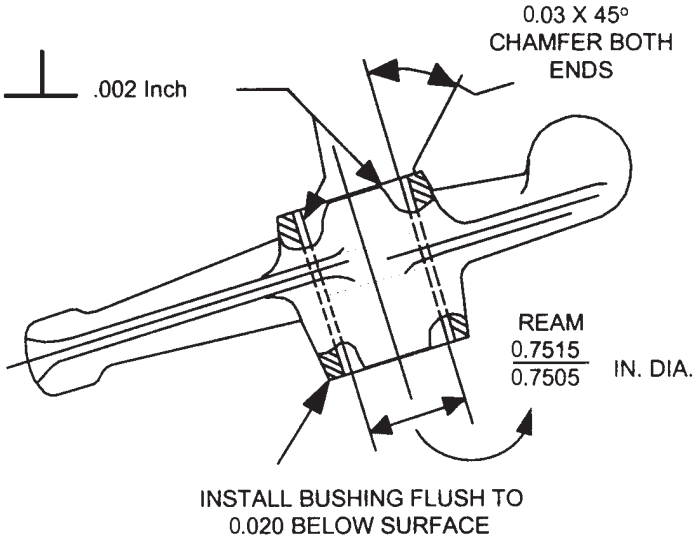
WARNING

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/lnstaller, 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.



* Bushing O. D. must maintain a 0.0020-0.0065 Press Fit in a 0.8755-0.8725 Rocker Arm Bushing Bore.



Bushing 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.

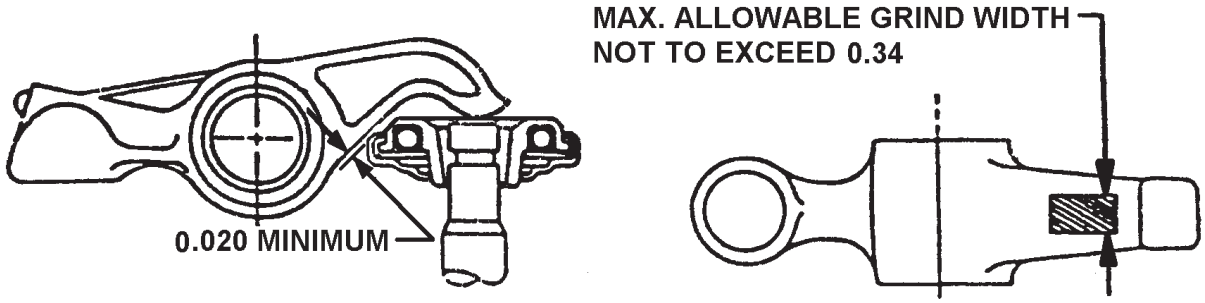


Figure 15-11. Rocker Arm to Retainer Clearance

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.

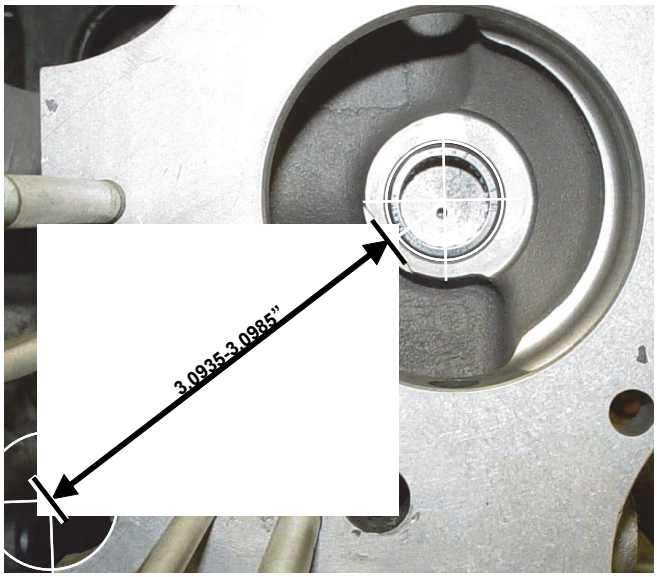


Figure 15-12. Radius Cut Distance from Camshaft Centerline

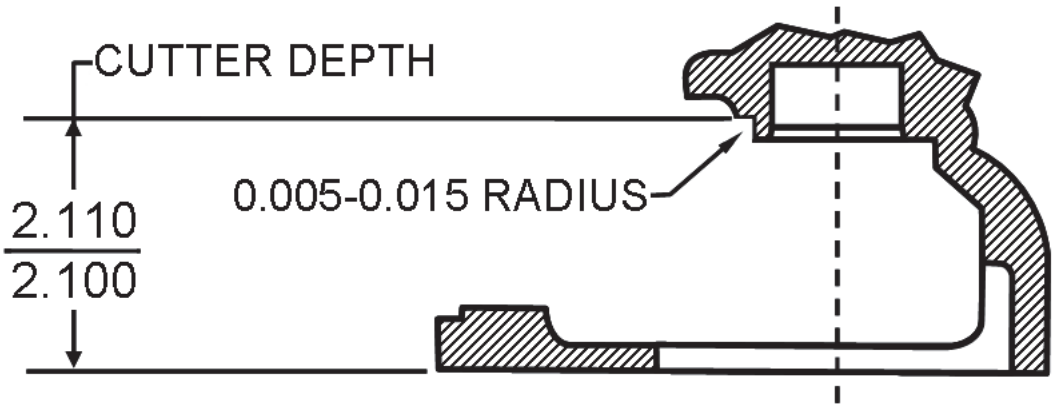


Figure 15-13. Overhead View of Radius Cut Depth

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.

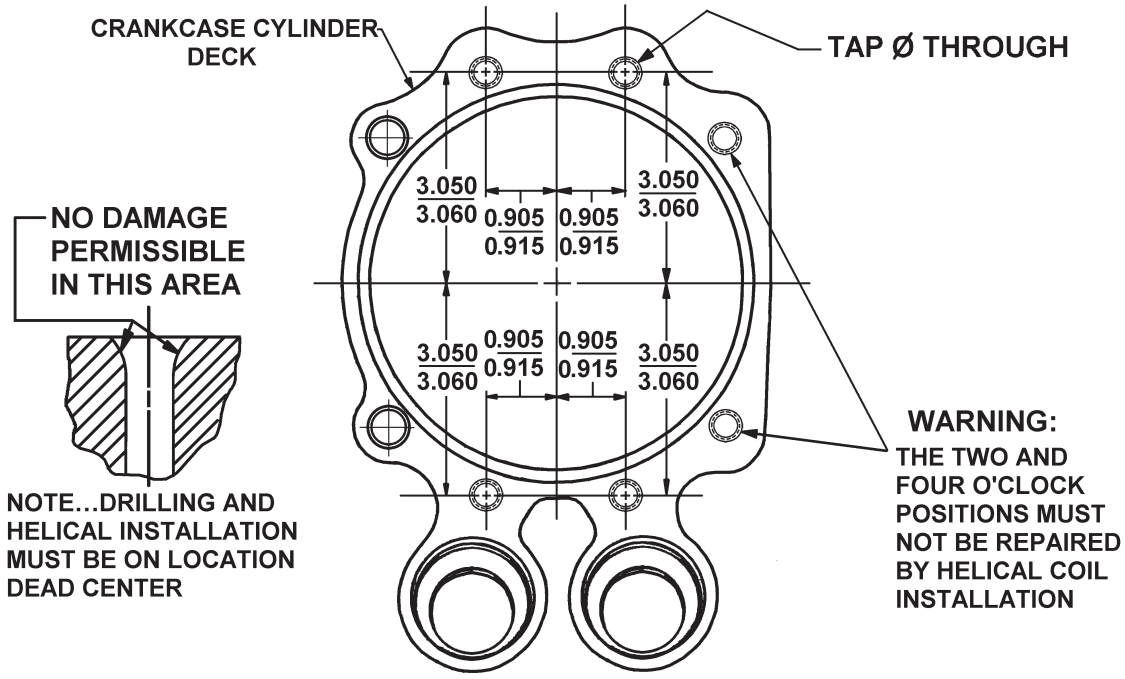


Figure 15-14. Crankcase Cylinder Deck Stud Repair Specifications

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 by 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

Part to Consider for Replacement	Discard and Replace Criteria
WARNING **Use only replacement crankshafts with the letters VAR (for vacuum arc re-melted) forged in the crankshaft cheek to ensure proper engine operation. Do not replace the crankshaft with any other brand.**	
Crankshaft	Discard/replace a crankshaft with any of the following conditions: • Worn, pitted, fretted, or out-of-round counterweight bushing bores • Worn counterweight bushing bores • Cracked counterweight hanger blades • Cracks, rust or pitting on crankshaft
Camshaft	Discard/replace a camshaft with any of the following conditions: • cracks, scoring, galling corrosion pitting or other physical damage • Worn bearing surfaces • 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.

Table 15-4. Engine Drive Train Parts Replacement

Part to Consider for Replacement	Discard and Replace Criteria
WARNING **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.**	
Crankshaft Counterweight[1]	Discard any counterweight that is: • Cracked • Worn, pitted, fretted, or out of round bushing bores • Worn or has distortions in the retaining ring groove that can affect the retaining ring seating
Oil Control Plugs	Discard/replace loose or leaking oil plugs
Connecting Rods	Discard/replace any connecting rods: • With a bore exhibiting nicks or gouges • If the rod and cap do not align properly

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.”

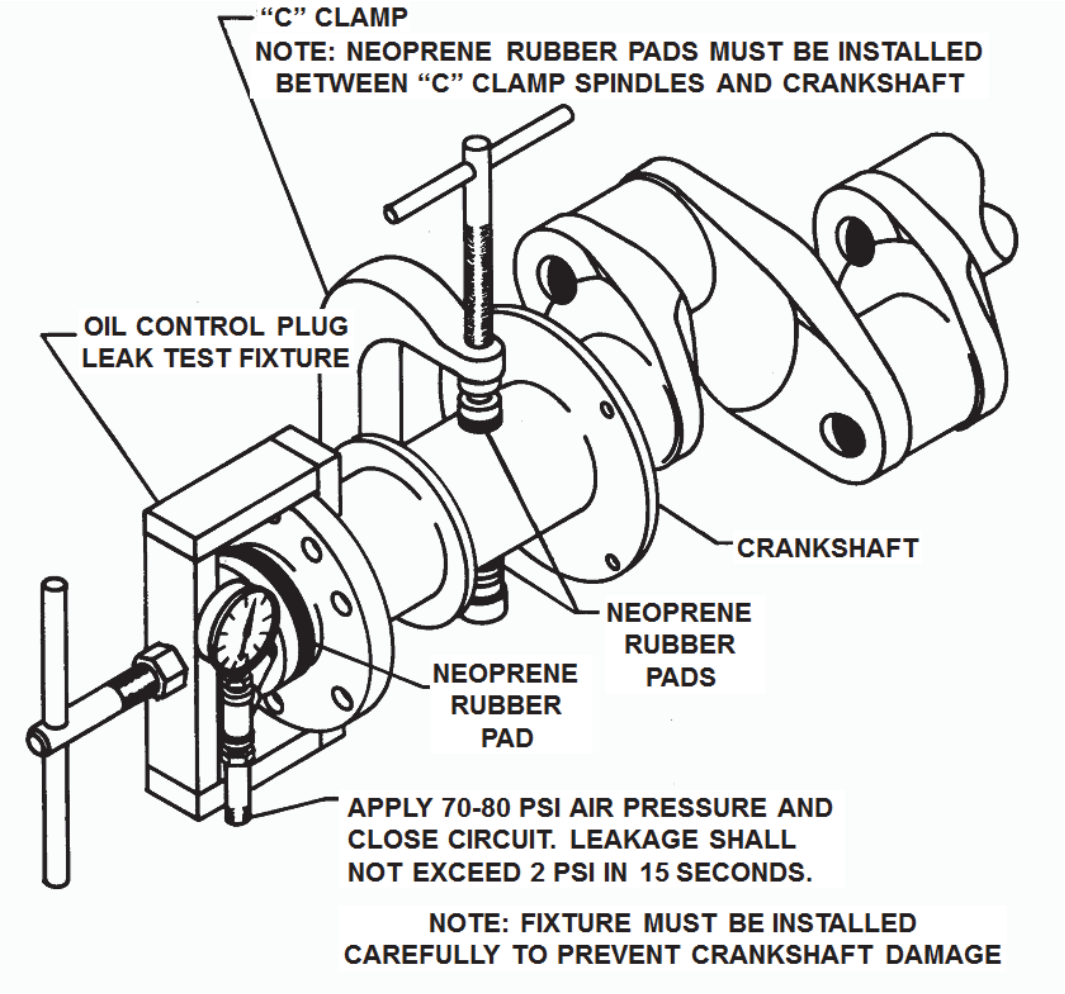


Figure 15-15. Oil Control Plug/Crankshaft Pressure Test

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.

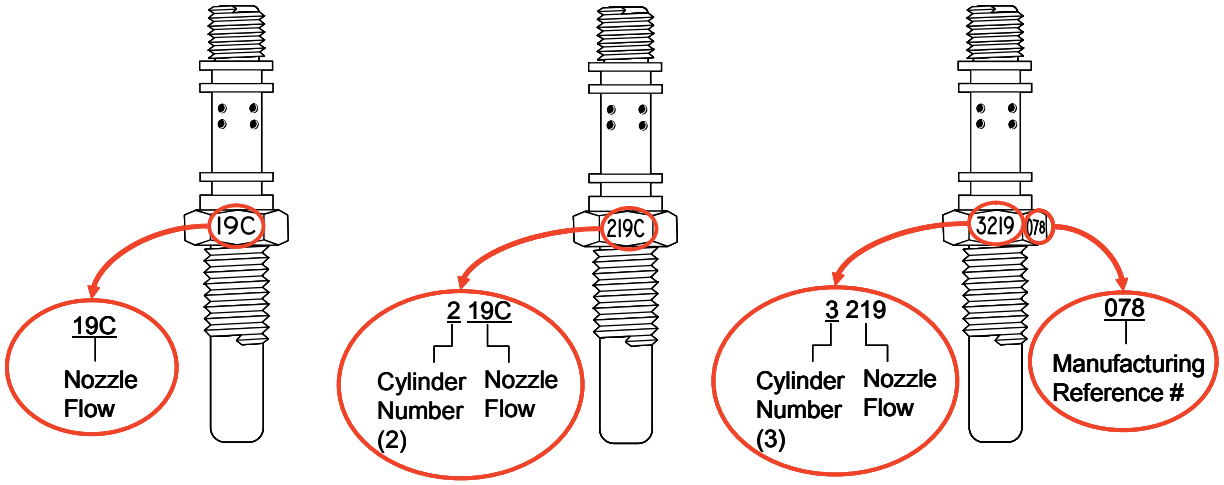


Figure 16-1. Fuel Injector Nozzle Identification

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.

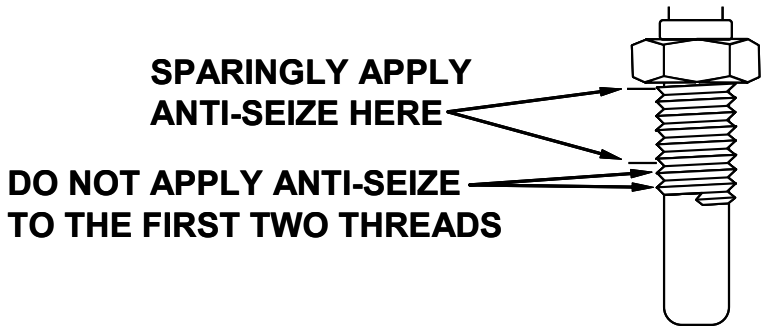


Figure 16-2. Apply Anti-Seize to Fuel Injector Threads

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.

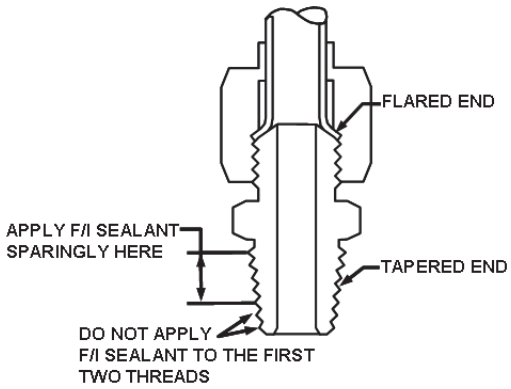


Figure 16-3. Fuel Injection Fitting F/I Sealant Application

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.

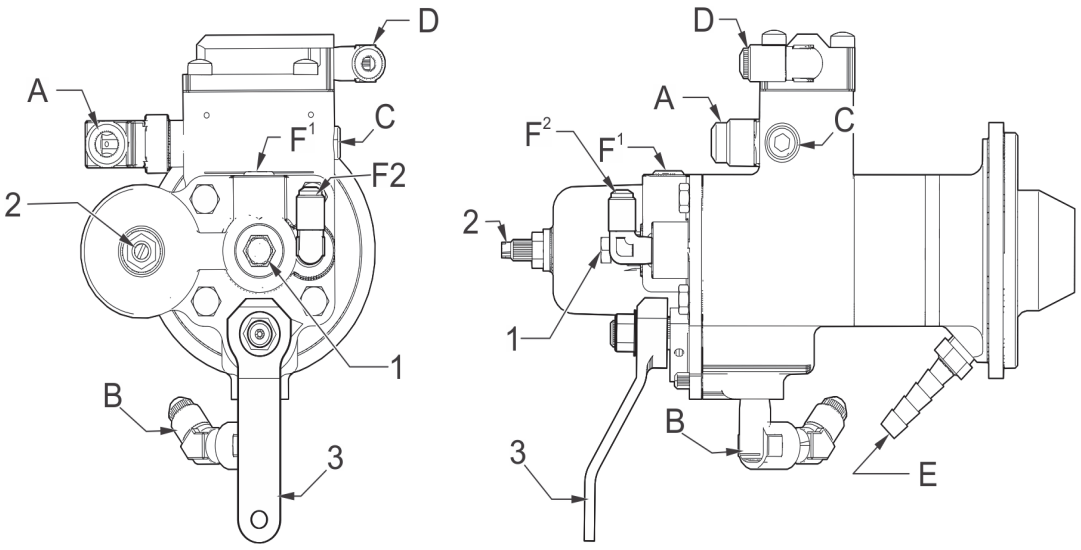


Figure 16-4. Fuel Pump Assembly with Fittings

1	Low Pressure Relief Valve Adjustment	A	Pump Inlet	E	Drain
2	Variable Orifice Adjustment (N/A)	B	Pump Outlet	F	Deck Pressure Reference
3	Mixture Control	C	Fuel Return		
4	Aneroid Adjustment	D	Vapor Return		

16-1.4. Diverter Valve Assembly B C E

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.

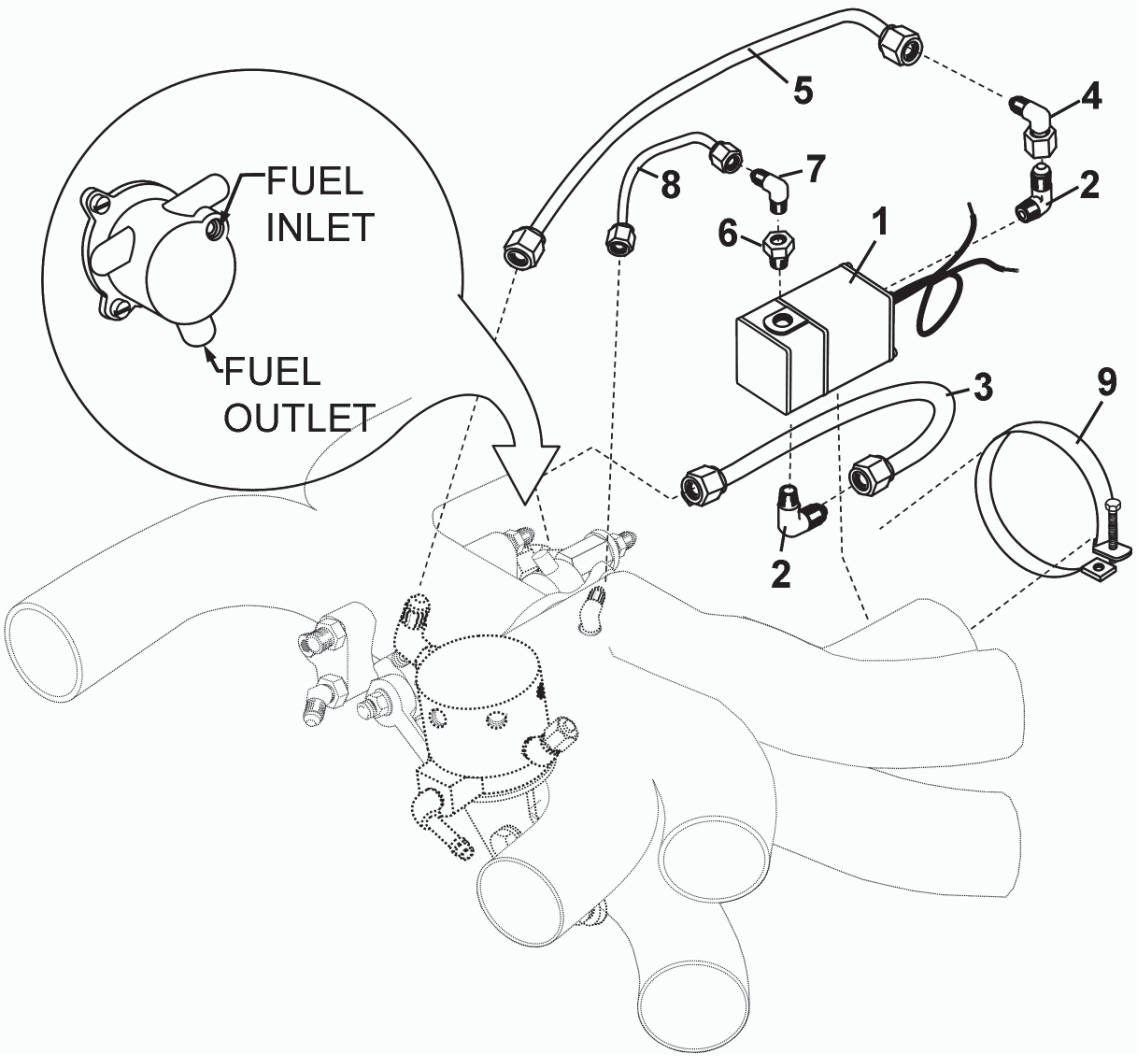


Figure 16-5. Fuel Priming System B C E

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

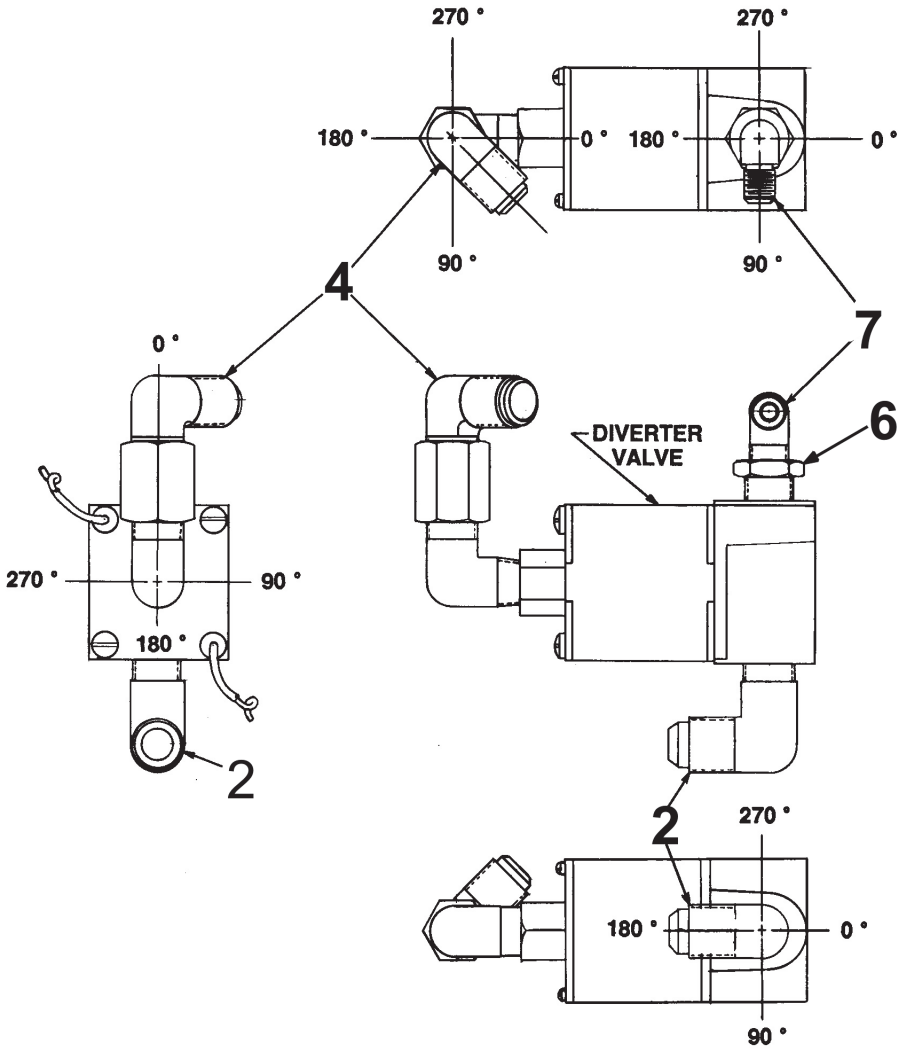


Figure 16-6. Diverter Valve Fitting Detail

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 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.

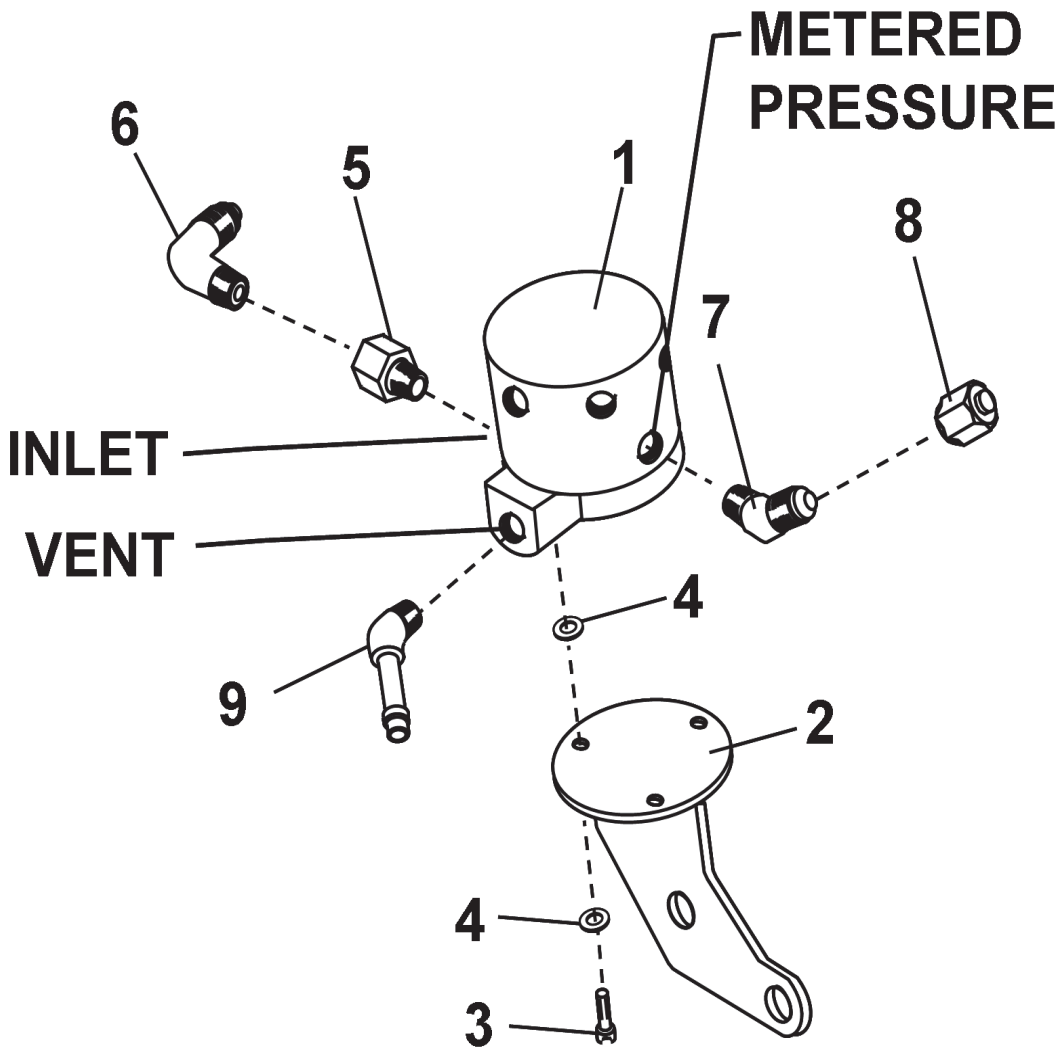


Figure 16-7. Fuel Manifold Valve Assembly

1	Manifold Valve	4	Washer	7	45° Elbow
2	Bracket	5	Adapter	8	Flare Tube Cap
3	Fillister Head Screw	6	90° Elbow	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.

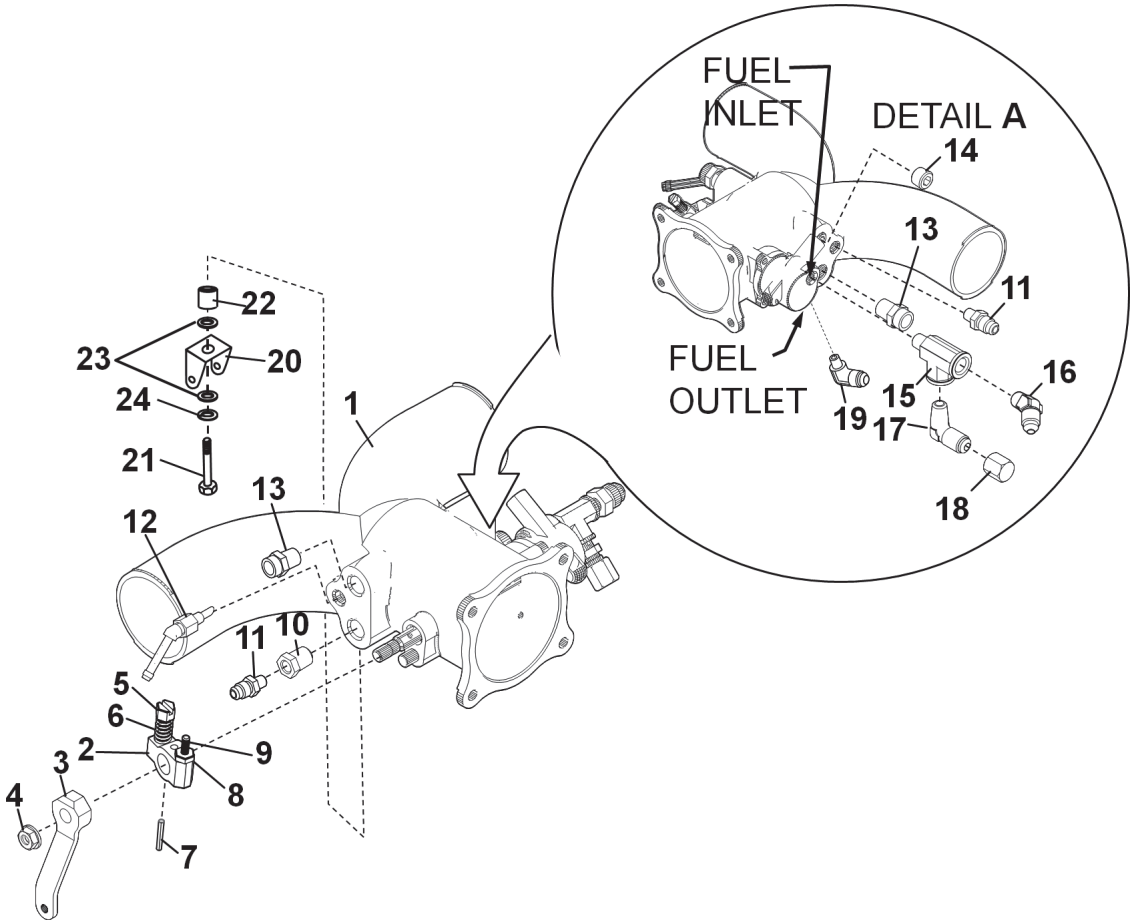


Figure 16-8. Throttle Assembly B C E

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.

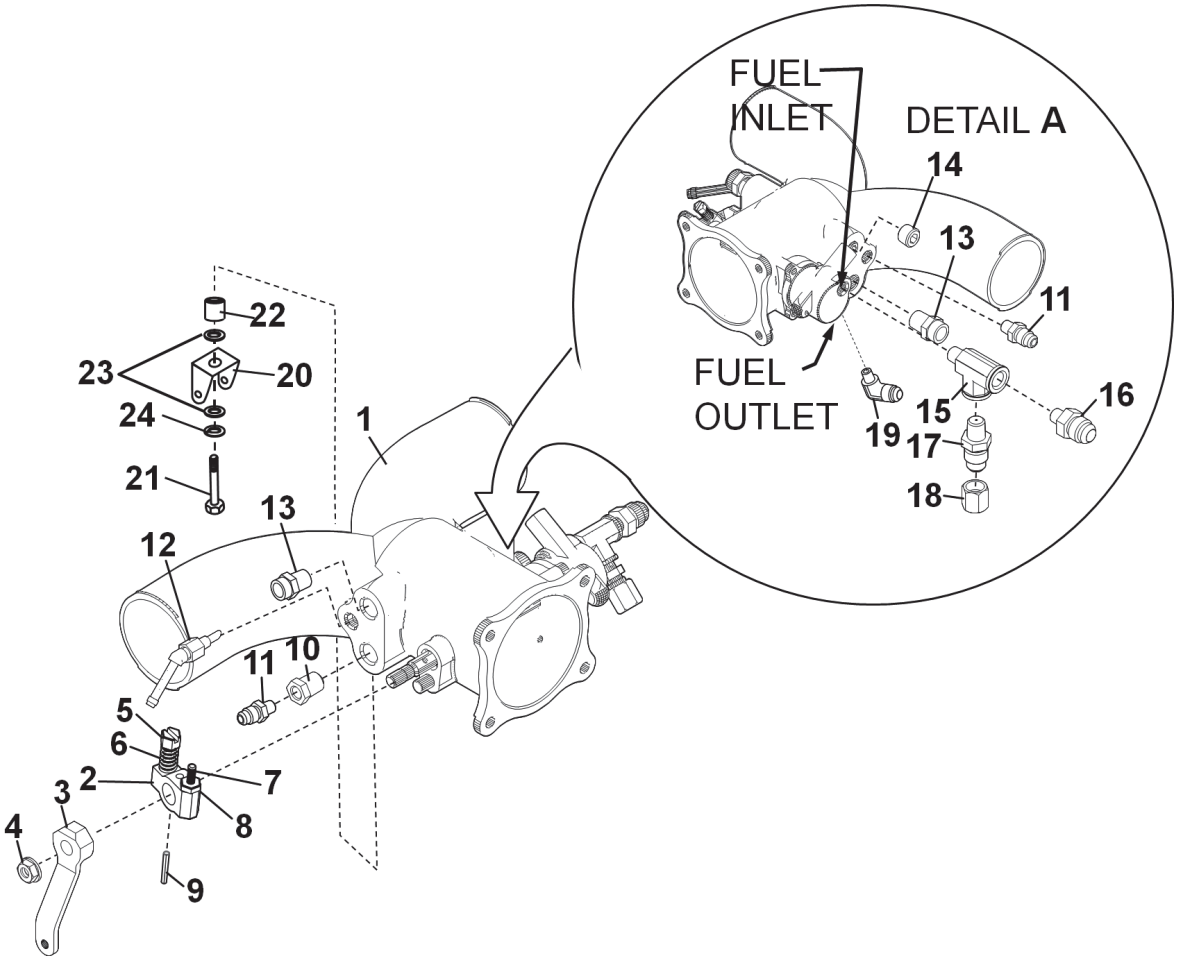


Figure 16-9. Throttle Assembly B C E G

1	Throttle Assembly	7	Pin	13	Flex Connector	19	90° Elbow
2	Lever	8	Nut	14	Plug	20	Bracket
3	Throttle & Mixture Control Lever	9	Set Screw	15	Tee	21	Bolt
4	Lock Nut	10	Reducer Bushing	16	45° Elbow or Connector Fitting	22	Sleeve
5	Adjustment Screw	11	Connector Fitting	17	90° Elbow or Orifice Fitting Adapter	23	Washer
6	Spring	12	Adapter Assembly	18	Cap	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.

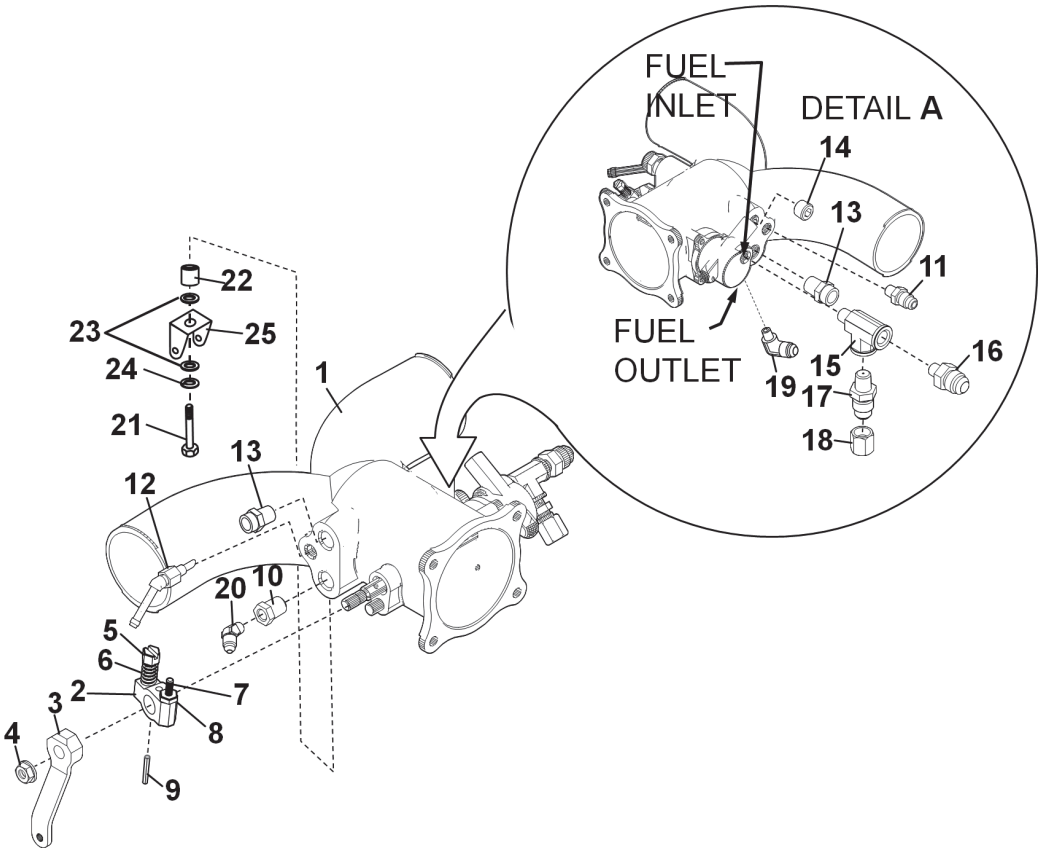


Figure 16-10. Throttle Assembly K

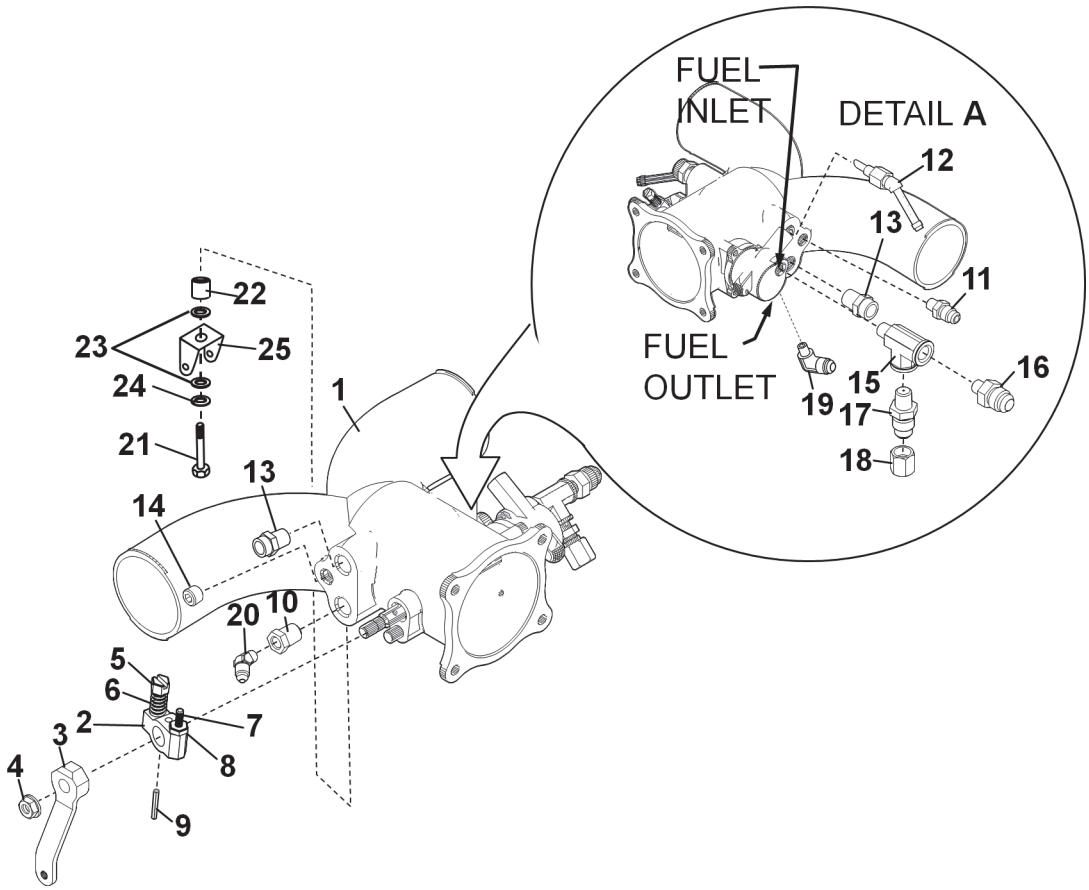


Figure 16-11. Throttle Assembly N

1	Throttle Assembly	8	Nut	15	Tee	22	Sleeve
2	Lever	9	Pin	16	Connector Fitting	23	Washer
3	Throttle & Mixture Control Lever	10	Reducer Bushing	17	Orifice Fitting Adapter	24	Washer
4	Lock Nut	11	Connector Fitting	18	Cap	25	Throttle Body Bracket
5	Adjustment Screw	12	Adapter Assembly	19	90° Elbow		
6	Spring	13	Flex Connector	20	45° Elbow Fitting		
7	Set Screw	14	Plug	21	Bolt		

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.

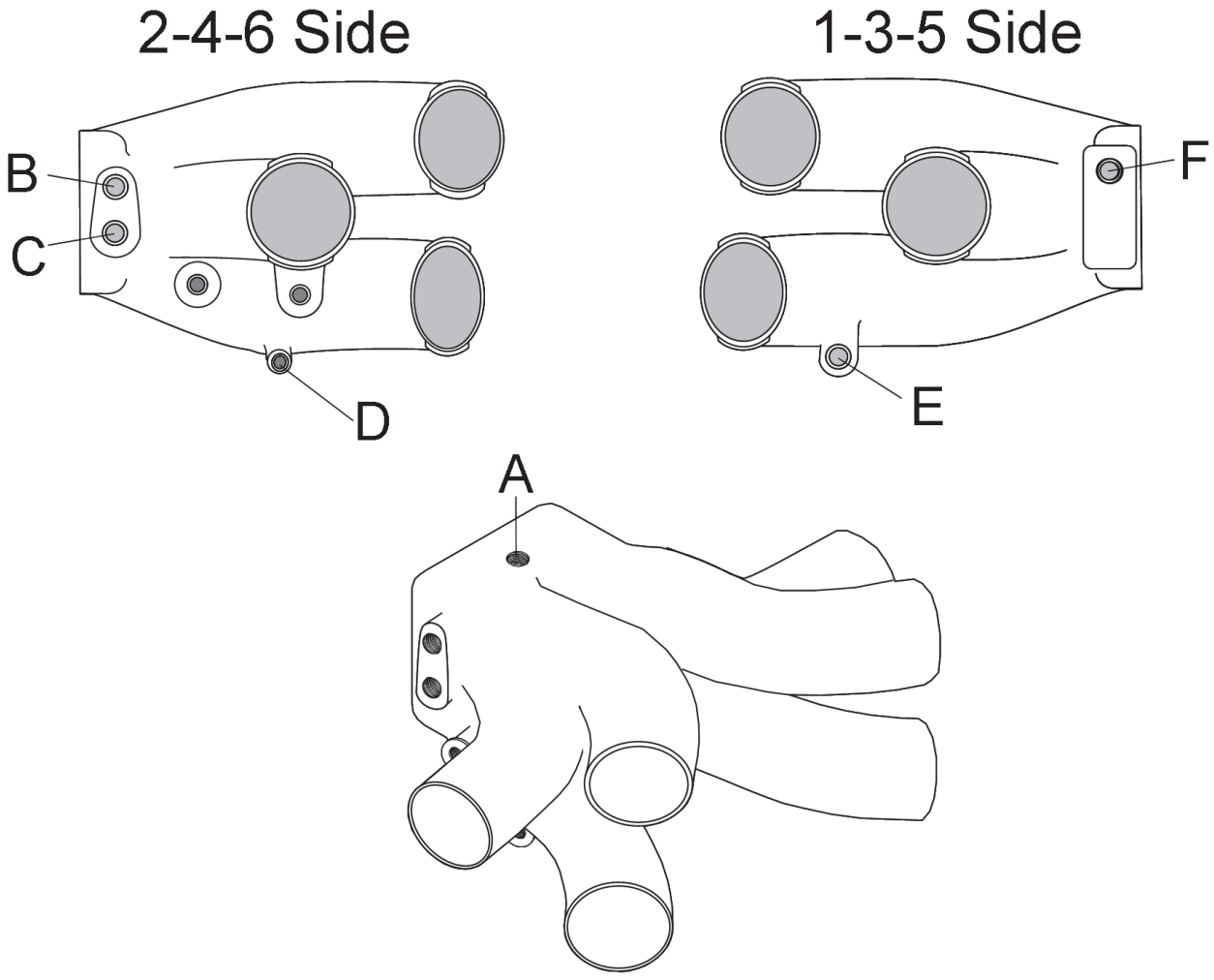


Figure 16-12. Induction Manifold Port Detail

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.

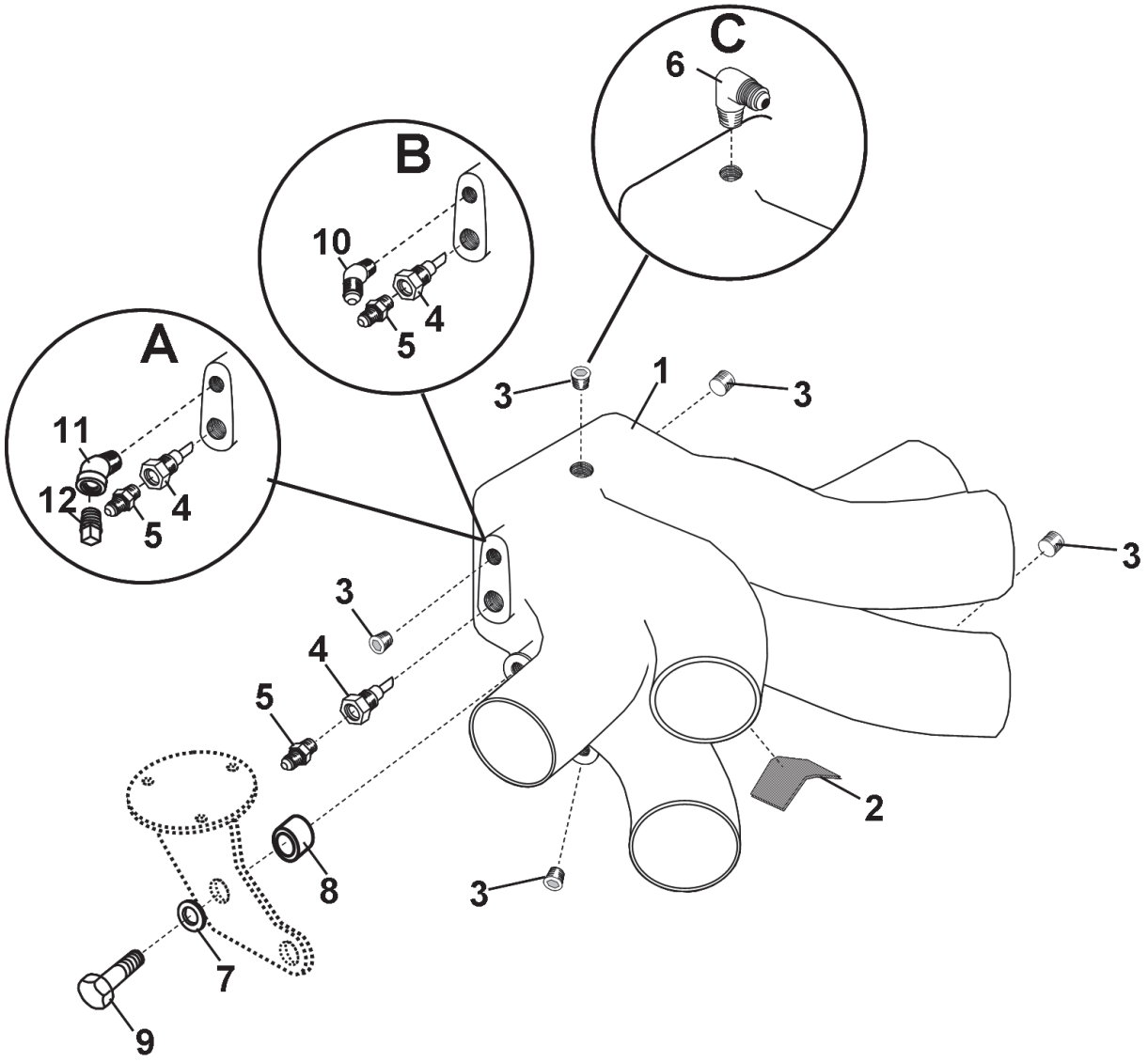


Figure 16-13. Composite Induction Manifold

1	Induction Manifold	4	Adapter Assembly	7	Washer	10	45° Elbow
2	Felt Bumper Pad	5	Nipple Connector	8	Spacer	11	45° Street Elbow
3	Plug	6	90° Elbow	9	Bolt	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.

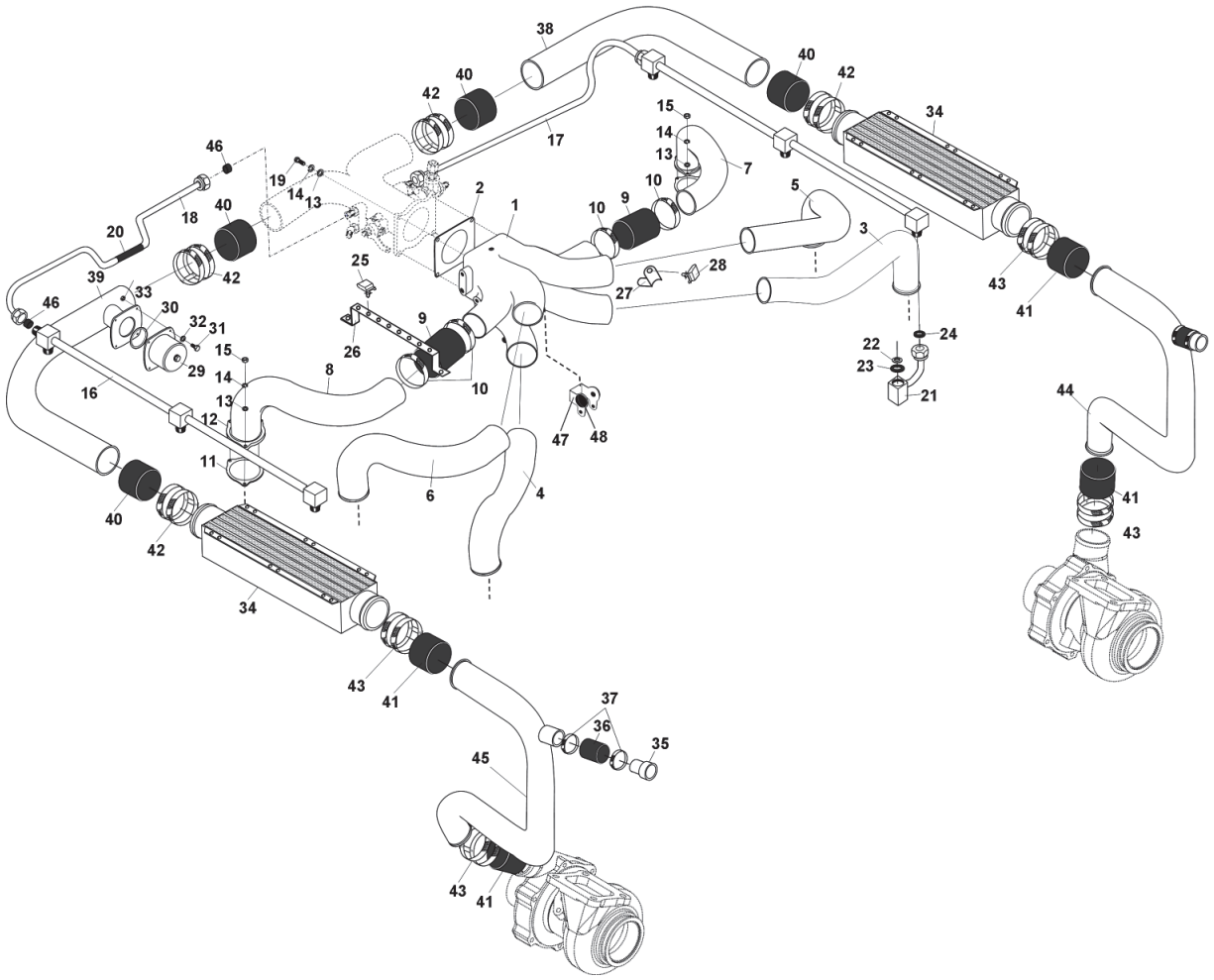


Figure 16-14. Induction System G

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.

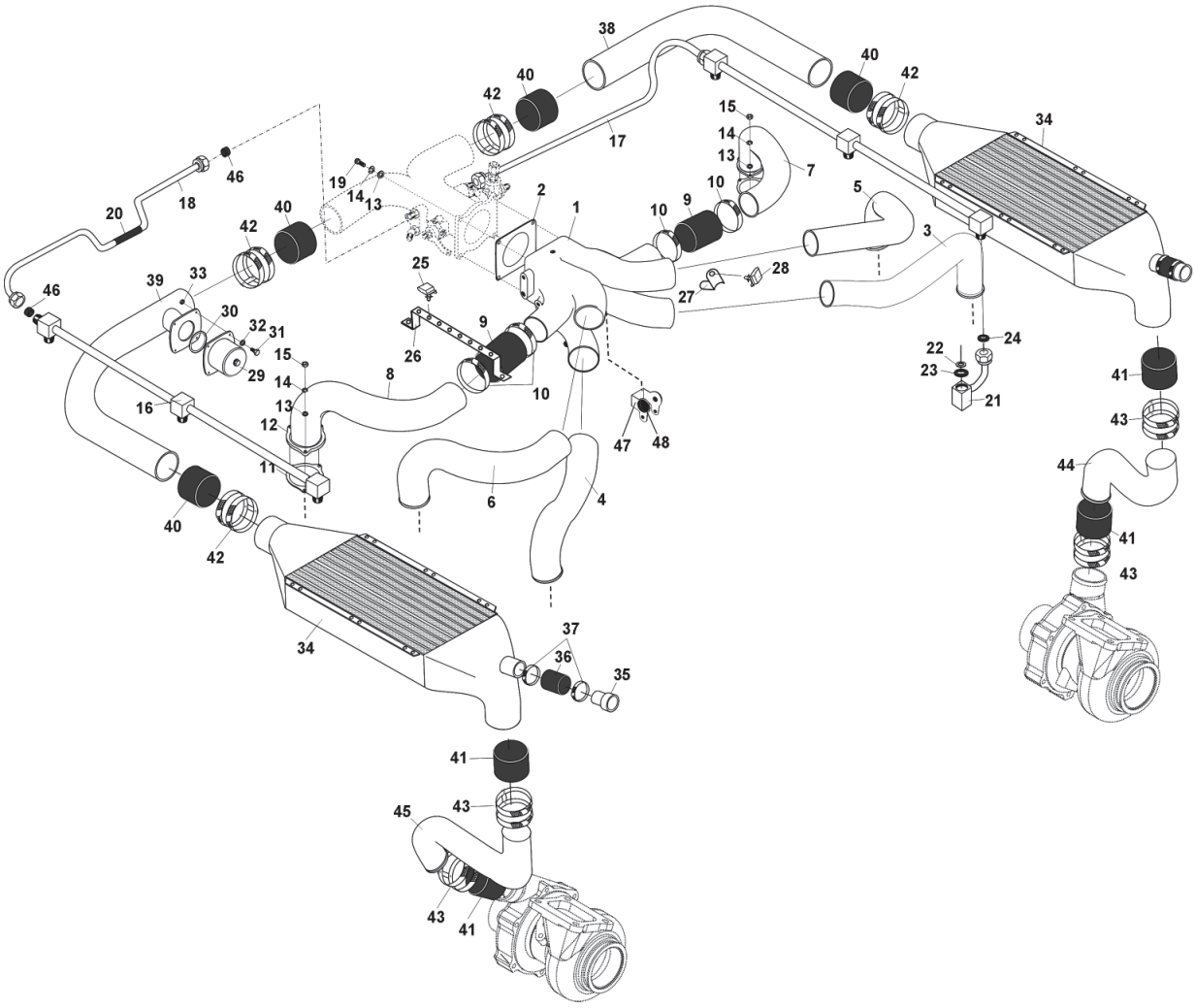


Figure 16-15. Induction System B C E K N

1	Induction Manifold	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Distribution Tube Bracket	38	Induction Tube, 1-3-5 FWD
3	Intake Tube, #1 Cylinder	15	Nut	27	Fuel Injection Line Bracket	39	Induction Tube, 1-3-5 FWD
4	Intake Tube, #2 Cylinder	16	Tube Assembly	28	Tube Clamp	40	Intake Hose
5	Intake Tube, #3 Cylinder	17	Tube Assembly, Right	29	Overboost Valve	41	Hose
6	Intake Tube, #4 Cylinder	18	Tube Assembly, Left	30	O-Ring Seal	42	Clamp Assembly
7	Intake Tube, #5 Cylinder	19	Screw	31	Bolt	43	Clamp Assembly
8	Intake Tube, #6Cylinder	20	Hose	32	Washer	44	Induction Tube, 1-3-5 AFT
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	Induction Tube, 1-3-5 AFT
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Gasket	23	Washer	35	Sonic Venturi Nozzle		
12	Intake Manifold Tube Flange	24	Compression Seal	36	Hose		

16-3. Alternator Assembly

Refer to the “Gear Driven Alternator Replacement” instructions in Section 10-4.1 of M-0, Standard Practice Maintenance Manual.

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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.

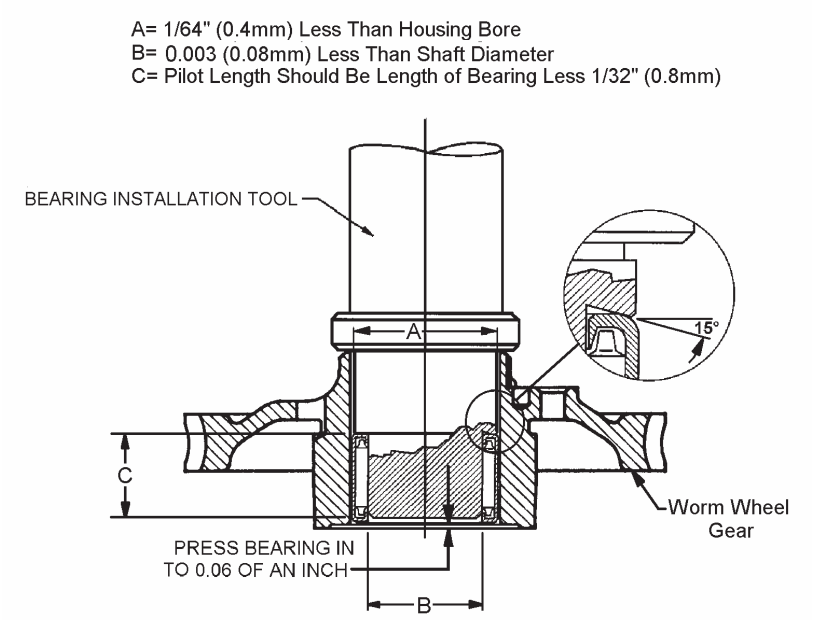


Figure 16-16. Worm Wheel Gear Roller Bearing Installation

5. Lubricate the inside diameter of the clutch spring (Figure 16-17) (17) liberally with clean 50 weight aviation engine oil.

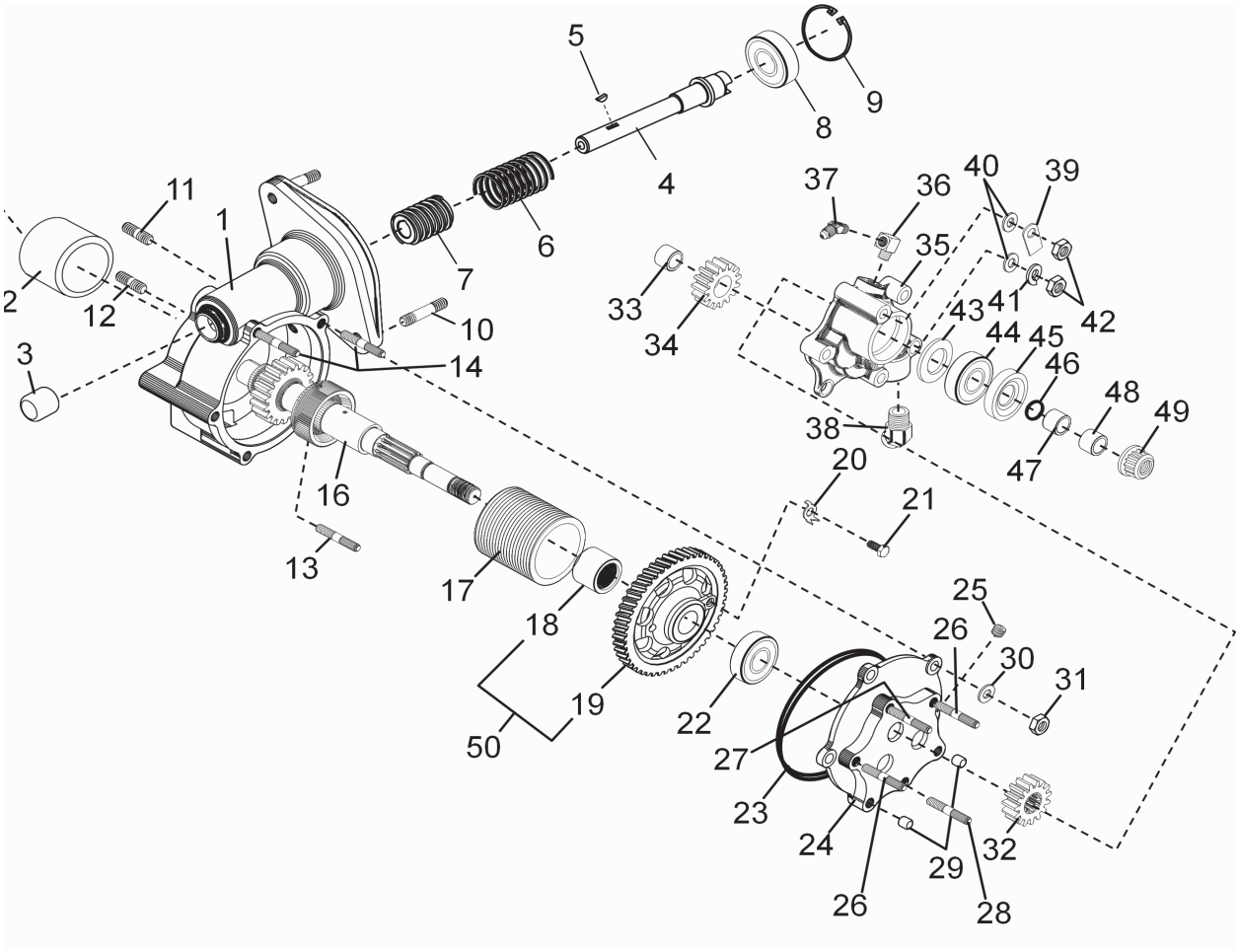


Figure 16-17. Starter and Adapter with Scavenge Pump and Accessory Drive

1	Starter Adapter Housing	14	Stud	27	Stud	40	Washer
2	Sleeve, Clutch Spring	15	Dowel	28	Stud	41	Lock Washer
3	Needle Bearing	16	Starter Shaft Gear	29	Dowel	42	Nut
4	Worm Drive Shaft	17	Clutch Spring	30	Washer	43	Spacer
5	Woodruff Key	18	Roller Bearing	31	Nut	44	Bearing
6	Starter Spring	19	Starter Worm Gear	32	Scav. Pump Driven Gear	45	Starter Shaft Seal
7	Starter Worm Gear	20	Tab Washer	33	Bushing	46	O-ring Seal
8	Radial Ball Bearing	21	Screw	34	Scav. Pump Driver Gear	47	Starter Shaft Sleeve
9	Internal Retaining Ring	22	Ball Bearing	35	Scav. Pump Body	48	Starter Shaft Spacer
10	Stud	23	O-Ring	36	90° Street Elbow	49	Flanged Nut
11	Stud	24	Cover Assembly	37	45° Elbow		
12	Stud	25	Plug	38	90° Elbow		
13	Stud	26	Stud	39	Seal Retainer Clip		

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.

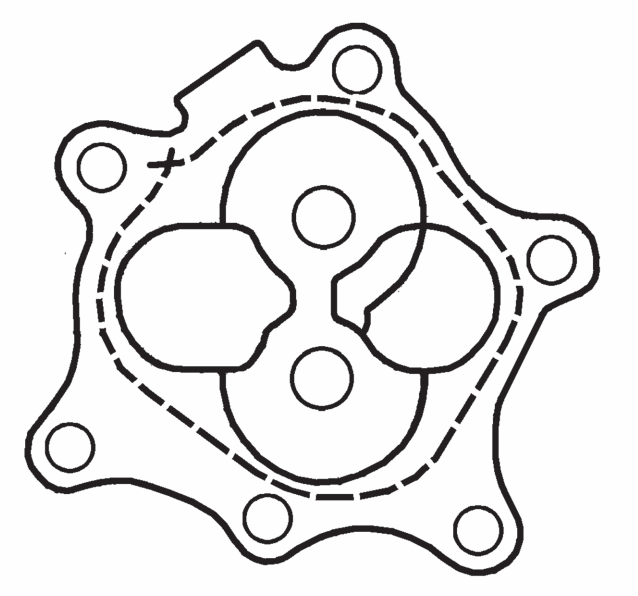


Figure 16-18. Scavenge Pump Body Silk Thread Pattern

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).

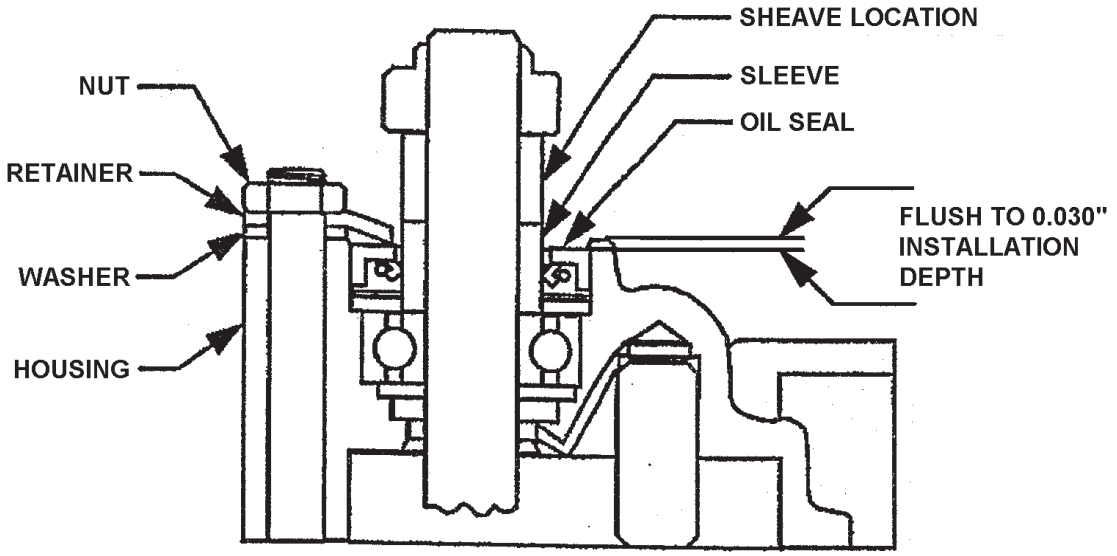


Figure 16-19. Scavenge Pump Oil Seal Position

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.

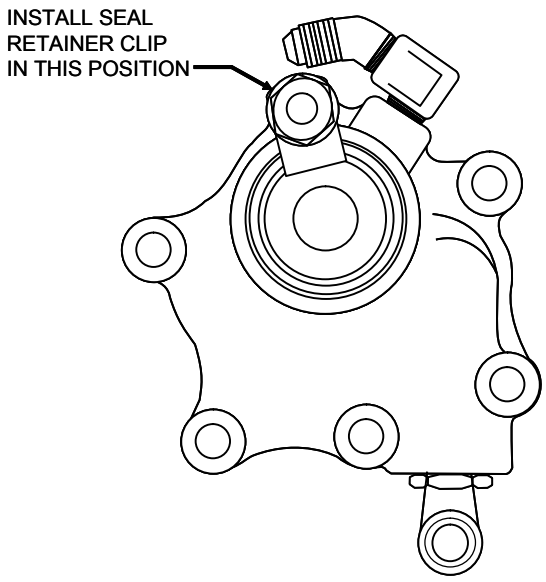


Figure 16-20. Seal Retainer Clip Position

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.

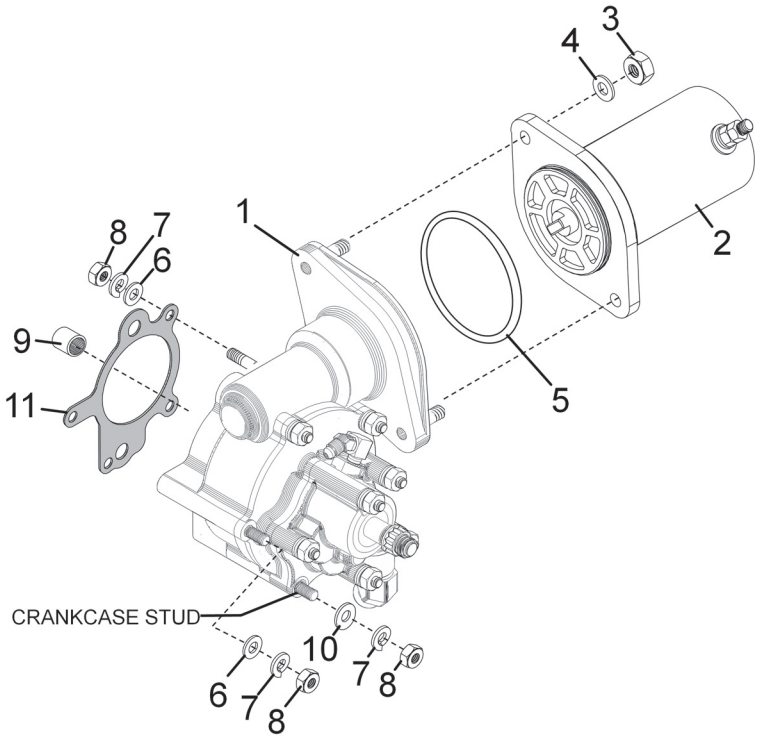


Figure 16-21. Starter and Starter Adapter Assembly

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.
4. Torque the bolts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
5. Bend the tabs up against the bolt heads with a drift.

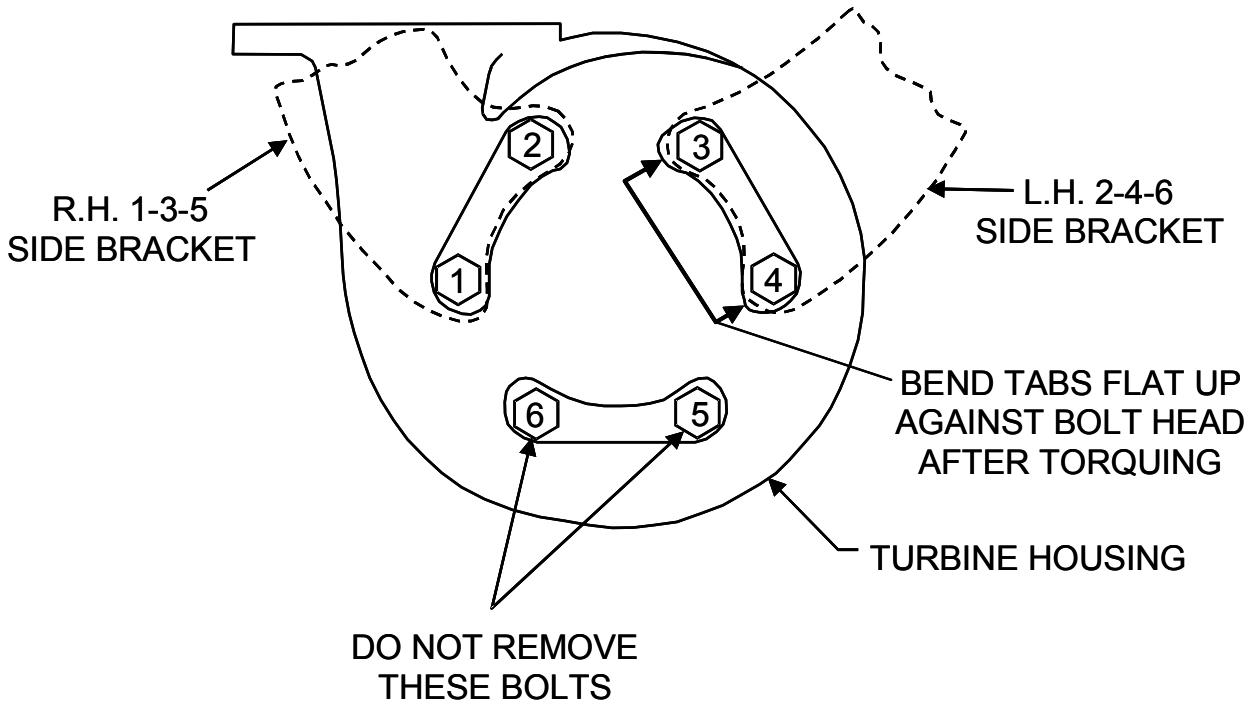


Figure 16-22. Turbocharger Bracket Orientation B C E G K

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.

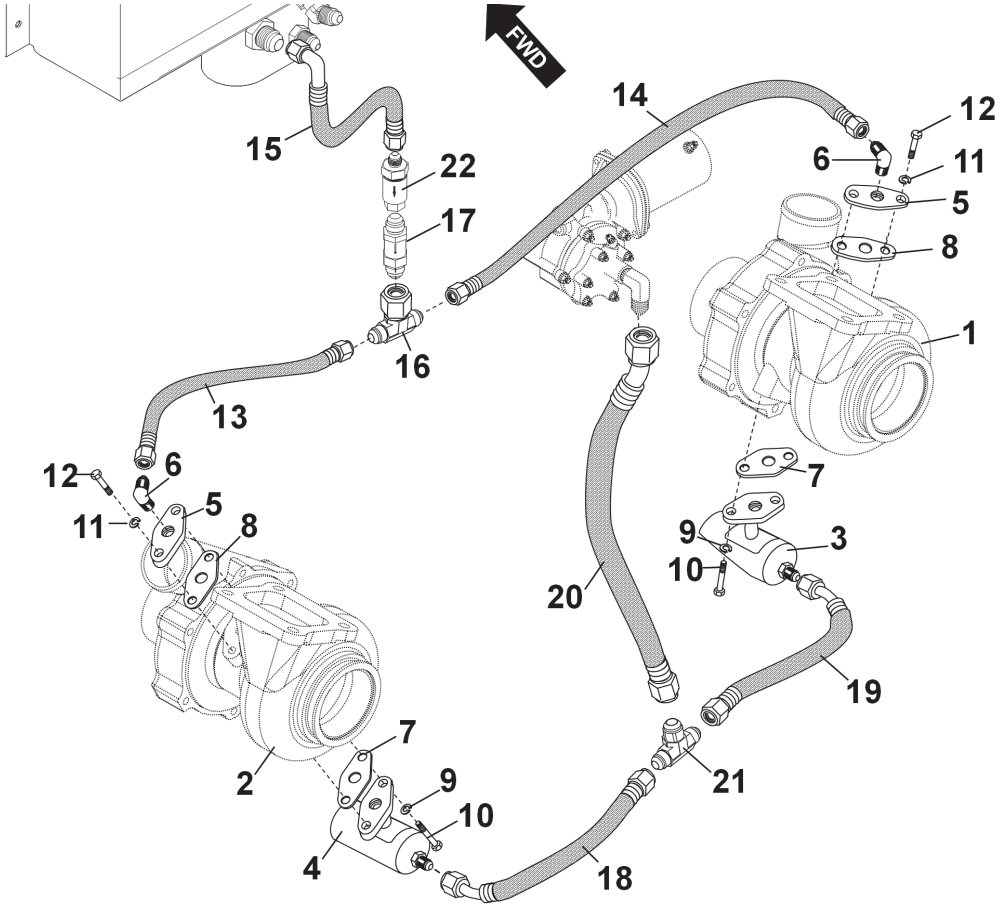


Figure 16-23. Turbocharger Lubrication K N

1	Left Turbocharger	7	Gasket	13	Tee	19	Hose
2	Right Turbocharger	8	Left Oil Reservoir	14	Check Valve	20	Hose
3	Gasket	9	Right Oil Reservoir	15	Hose	21	Hose
4	Adapter	10	Lock Washer	16	Hose		
5	Lock Washer	11	Bolt	17	Hose		
6	Bolt	12	Adapter	18	Tee		

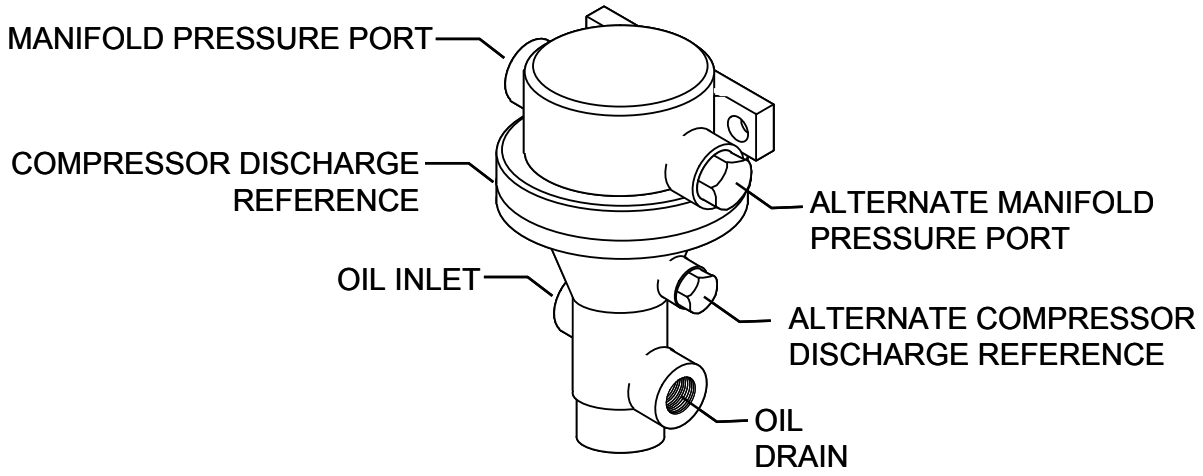


Figure 16-24. Wastegate Controller Ports

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 (47) 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) **B C E G** manifold pressure port or **K N** 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.

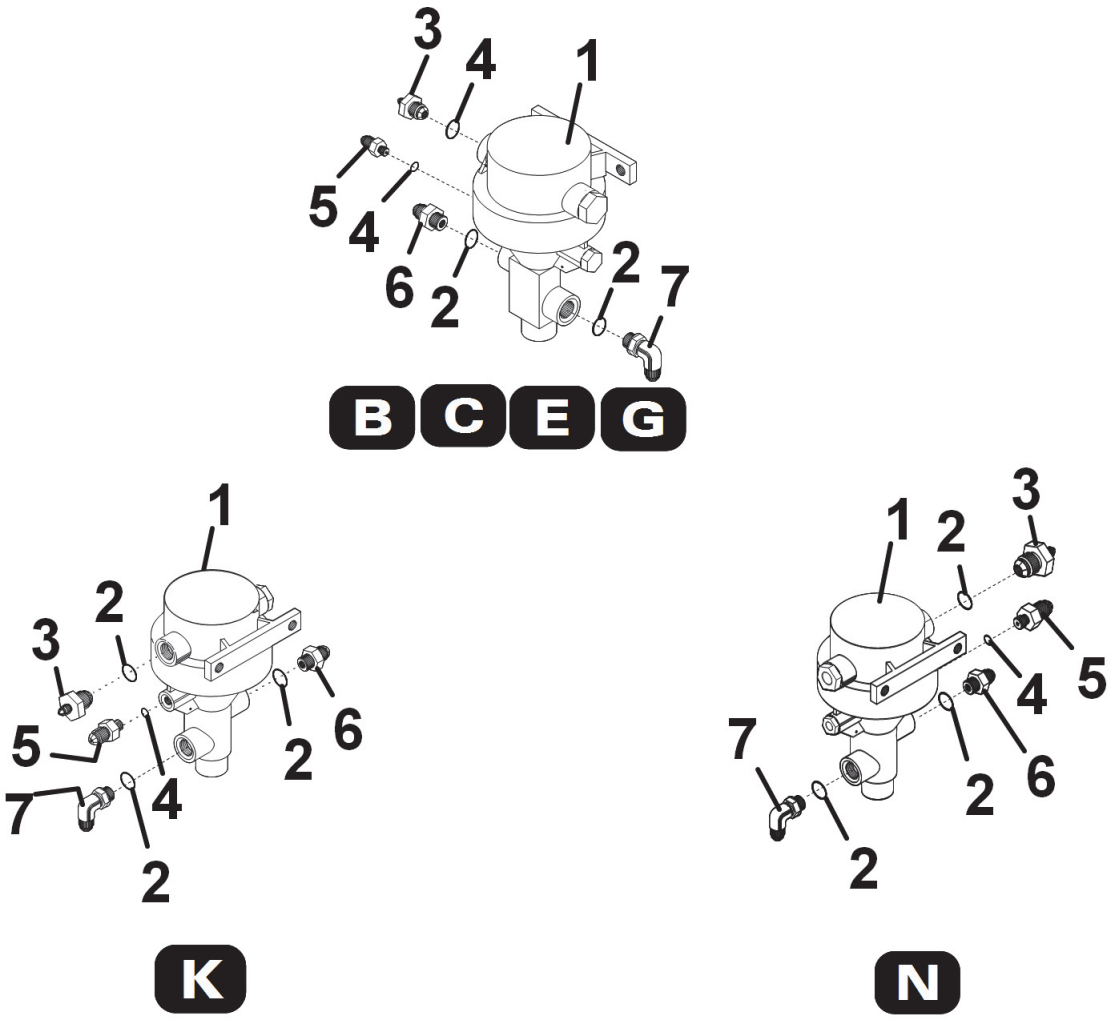


Figure 16-25. Wastegate Controller Fitting Detail

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. K N 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.

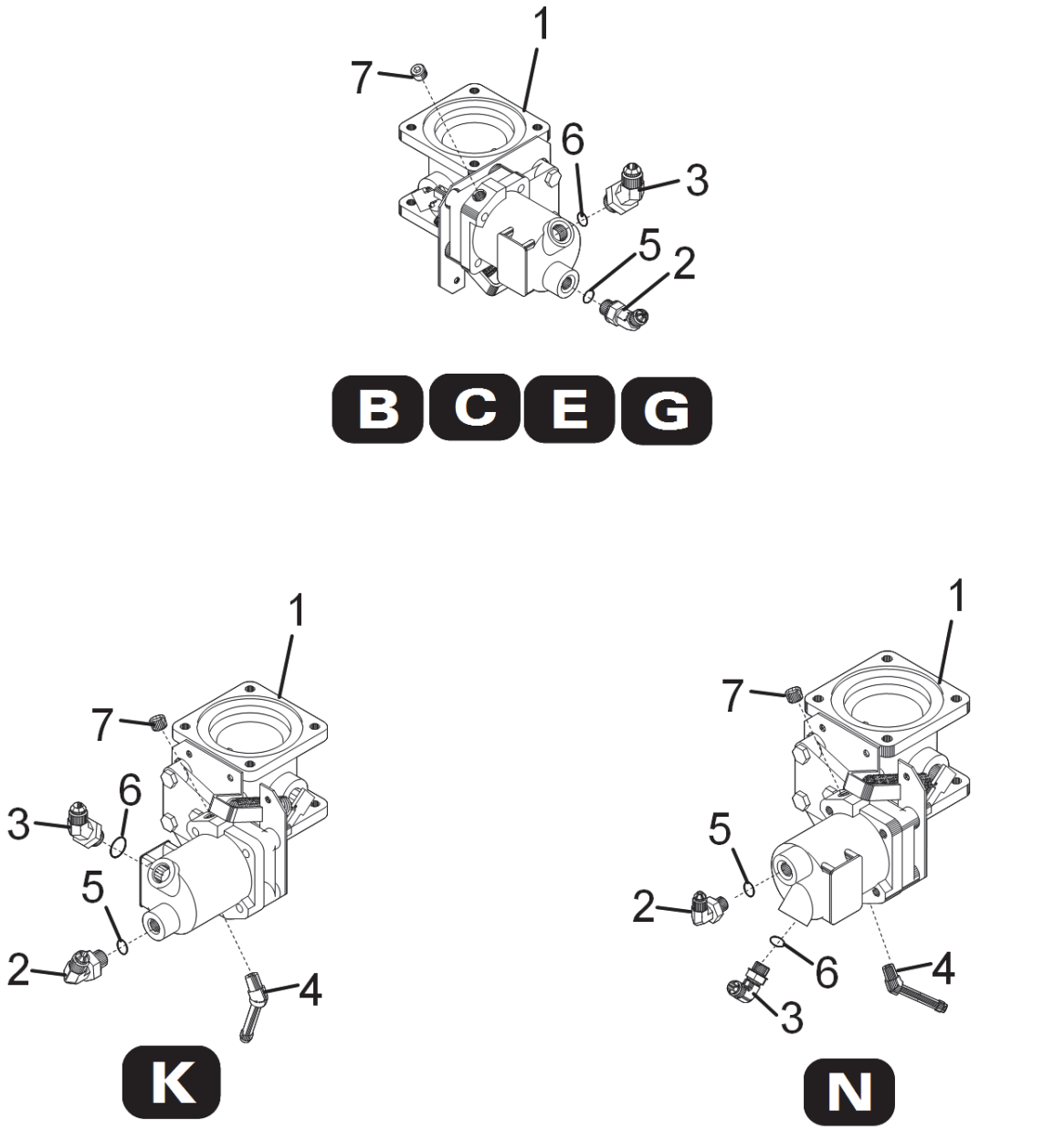


Figure 16-26. Wastegate Fitting Detail

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.

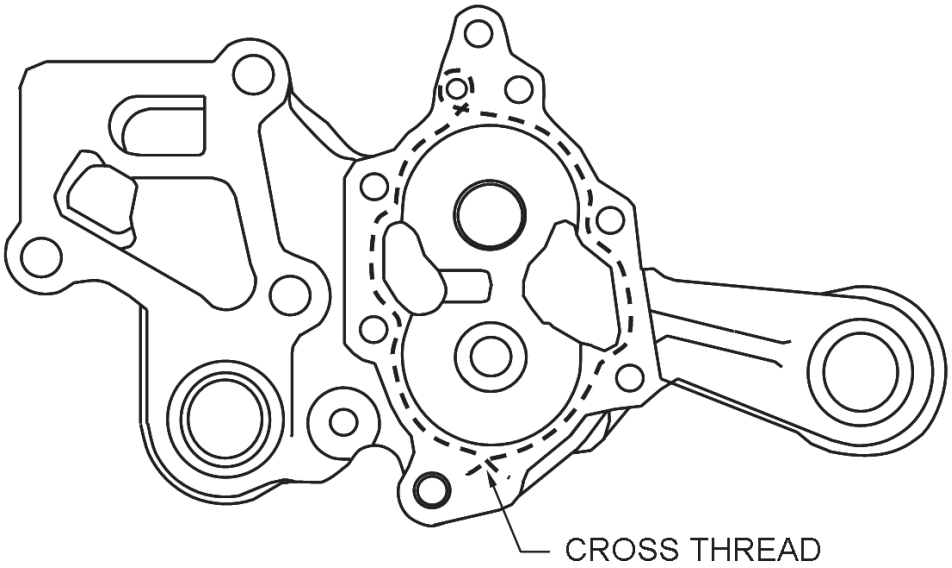


Figure 16-27. Oil Pump Housing Silk Thread Pattern

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 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.

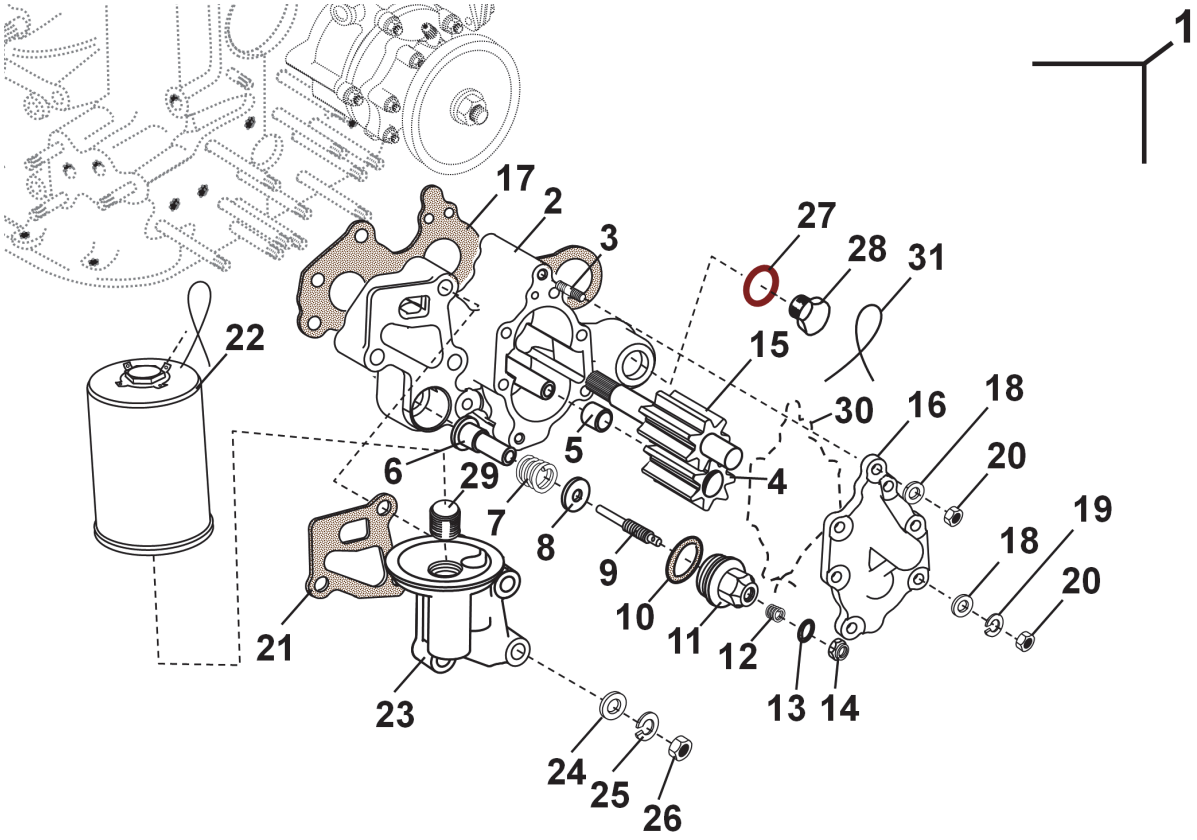


Figure 16-28. Oil Pump Assembly

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		

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.

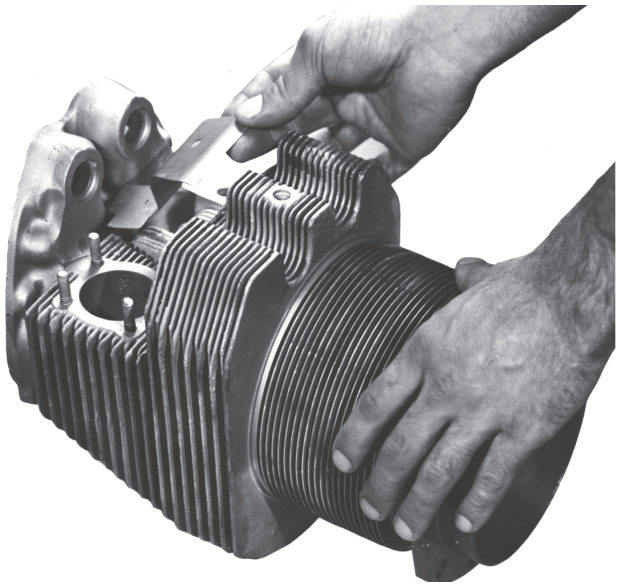


Figure 16-29. Cylinder Baffle Installation

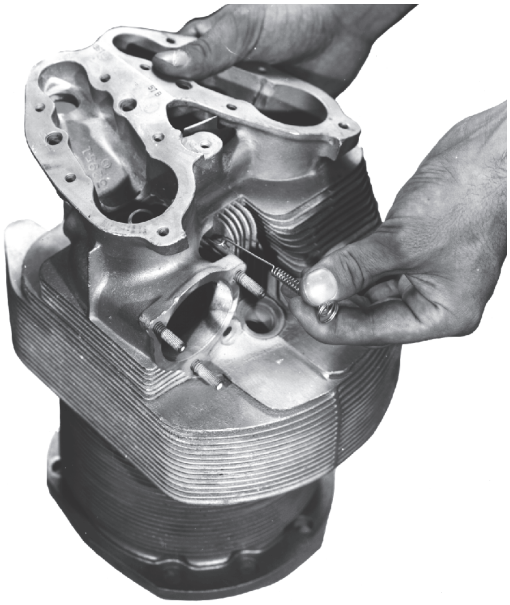


Figure 16-30. Secure Baffle with Spring

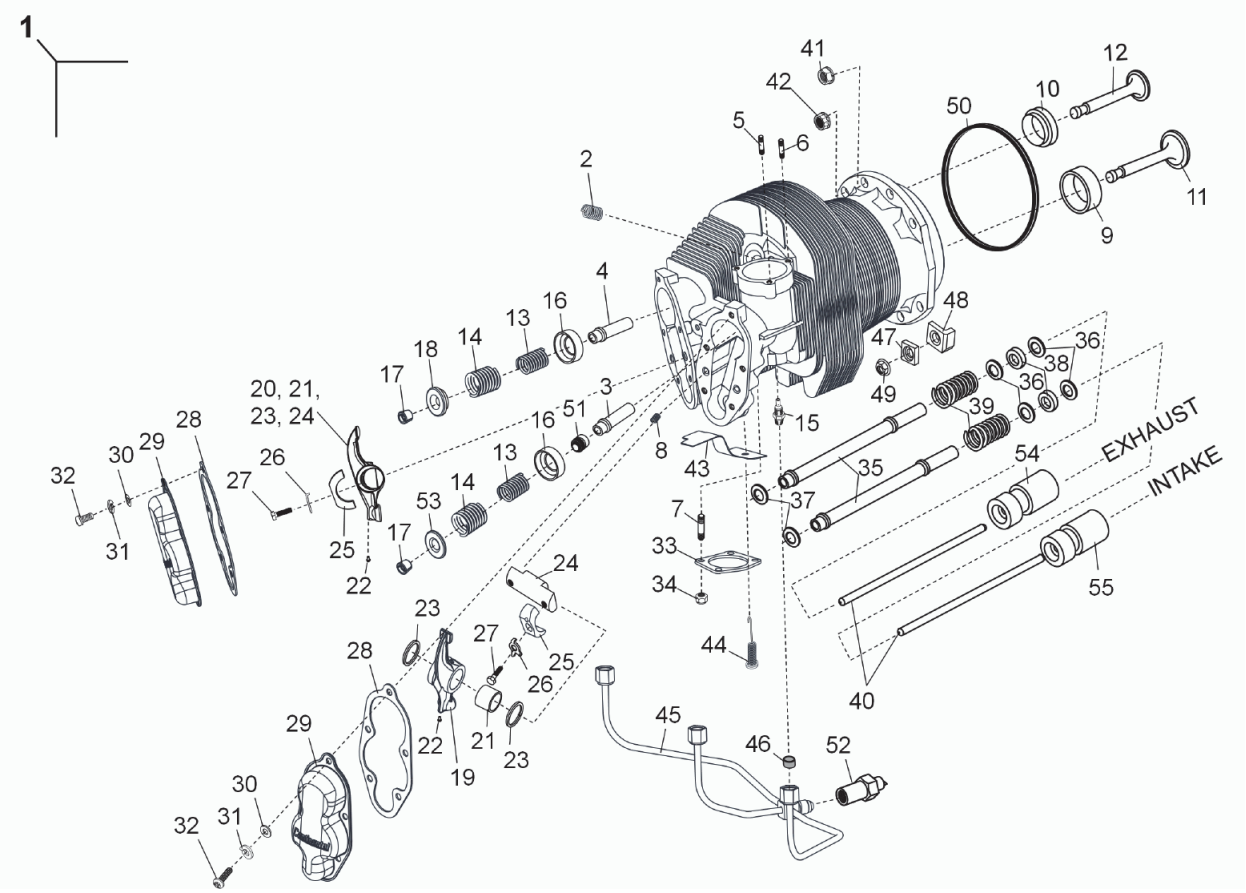


Figure 16-31. Cylinder Assembly

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 <u>any</u> 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 <u>any</u> 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.

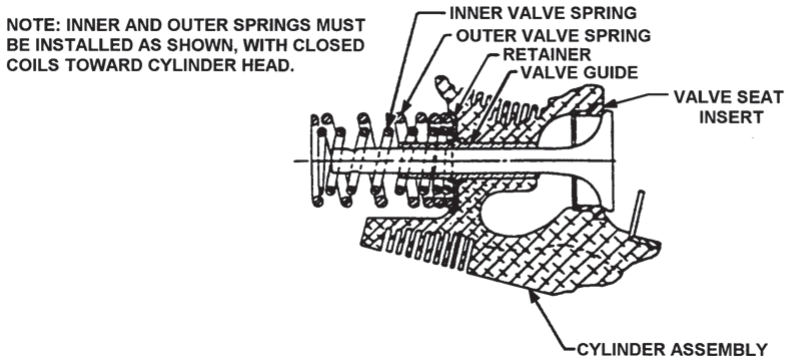


Figure 16-32. Valve Spring Installation

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.

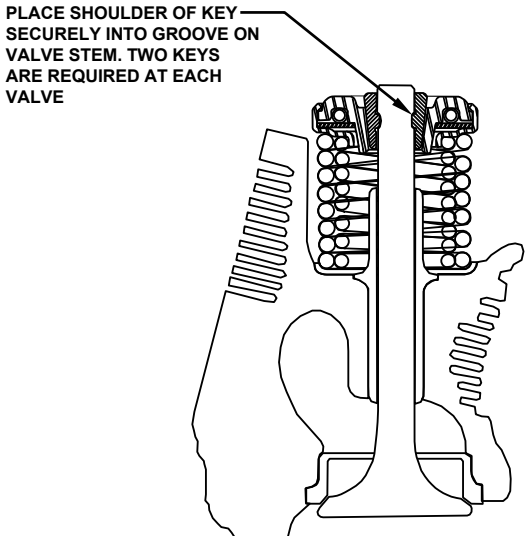


Figure 16-33. Valve Retainer Key Installation

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.

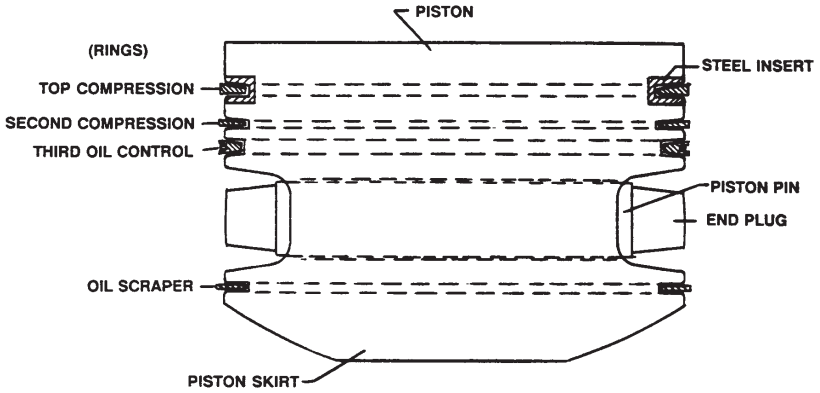


Figure 16-34. Piston Ring Installation Order

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.

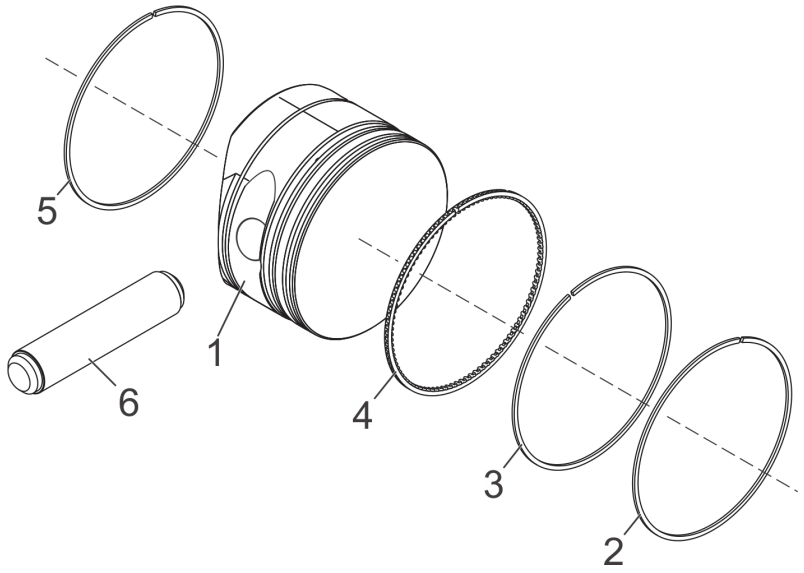


Figure 16-35. Piston, Piston Pin and Rings

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.

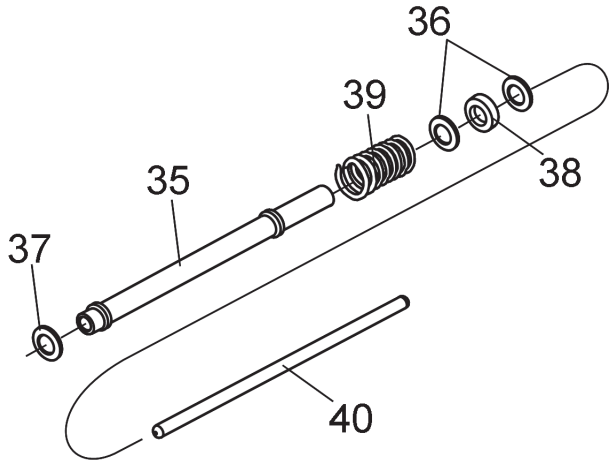


Figure 16-36. Pushrod Tube Assembly

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.

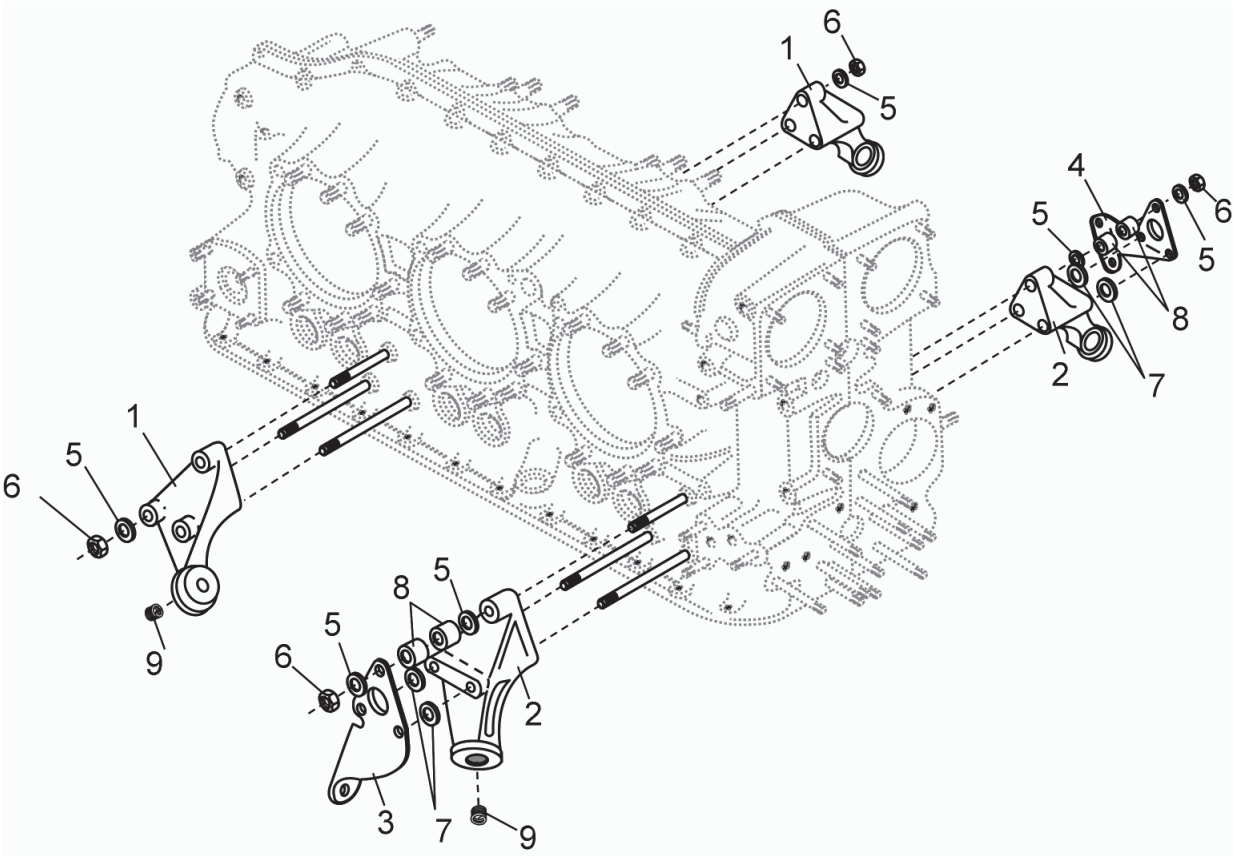


Figure 16-37. Engine and Turbocharger Mounting Brackets B C E G

1	Fwd Engine Mount	4	Right Turbo Support Bracket	7	Washer
2	Aft Engine Mount	5	Washer	8	Spacer
3	Left Turbo Support Bracket	6	Nut	9	Heli-Coil Insert

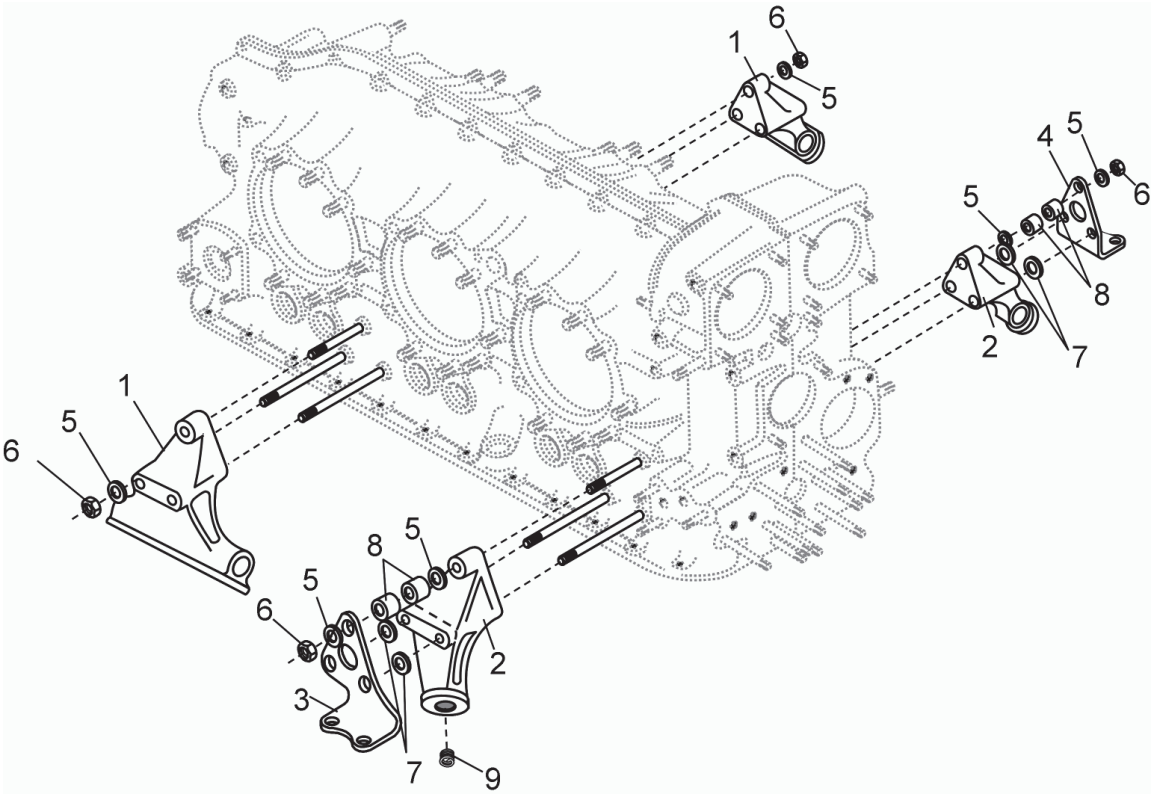


Figure 16-38. Engine and Turbocharger Mounting Brackets K

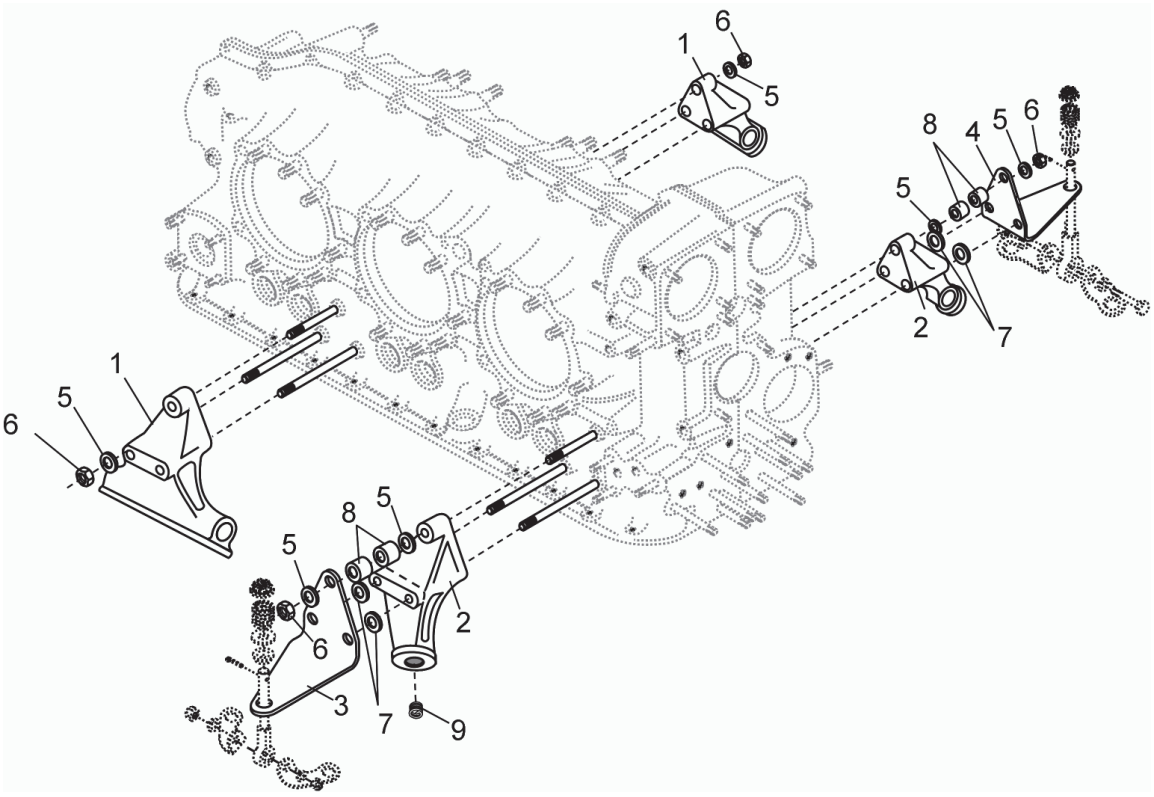


Figure 16-39. Engine and Turbocharger Mounting Brackets N

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.

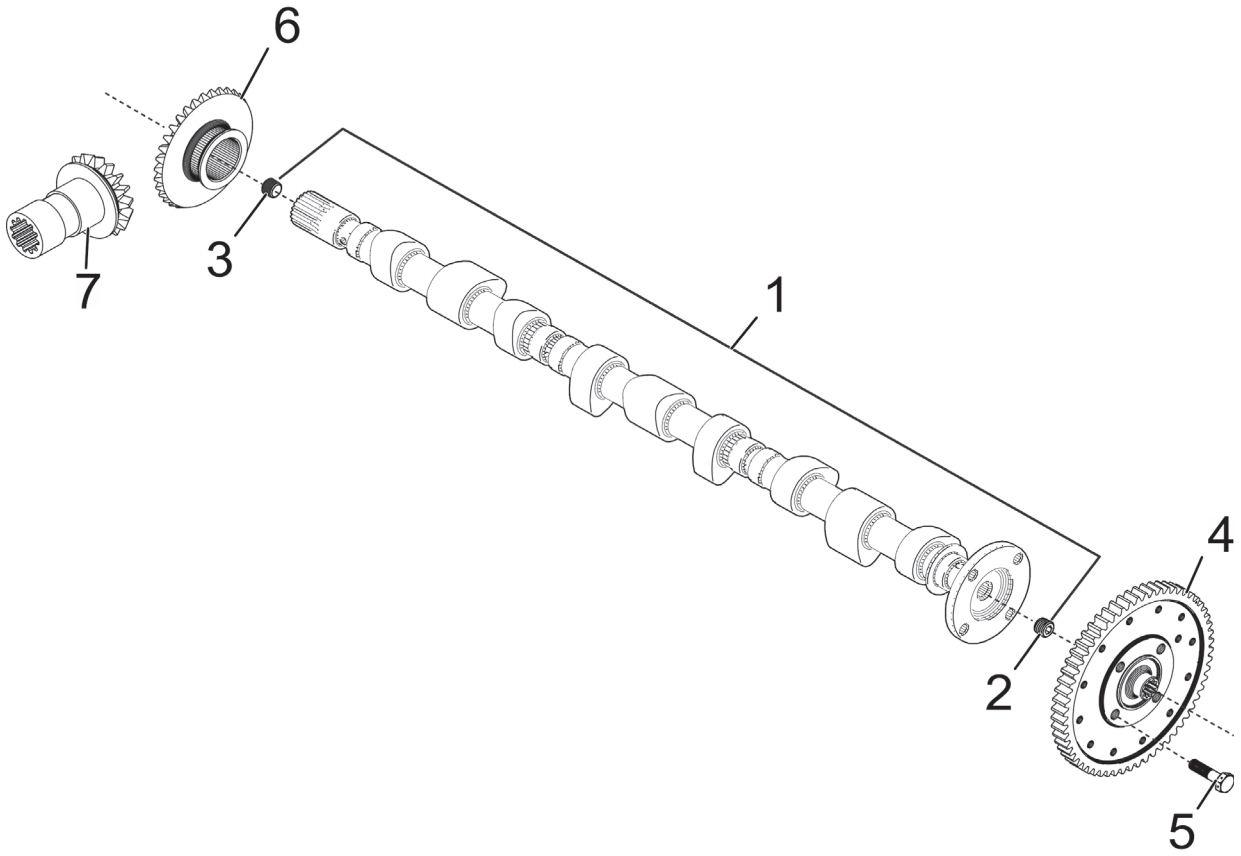


Figure 16-40. Camshaft Assembly

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.

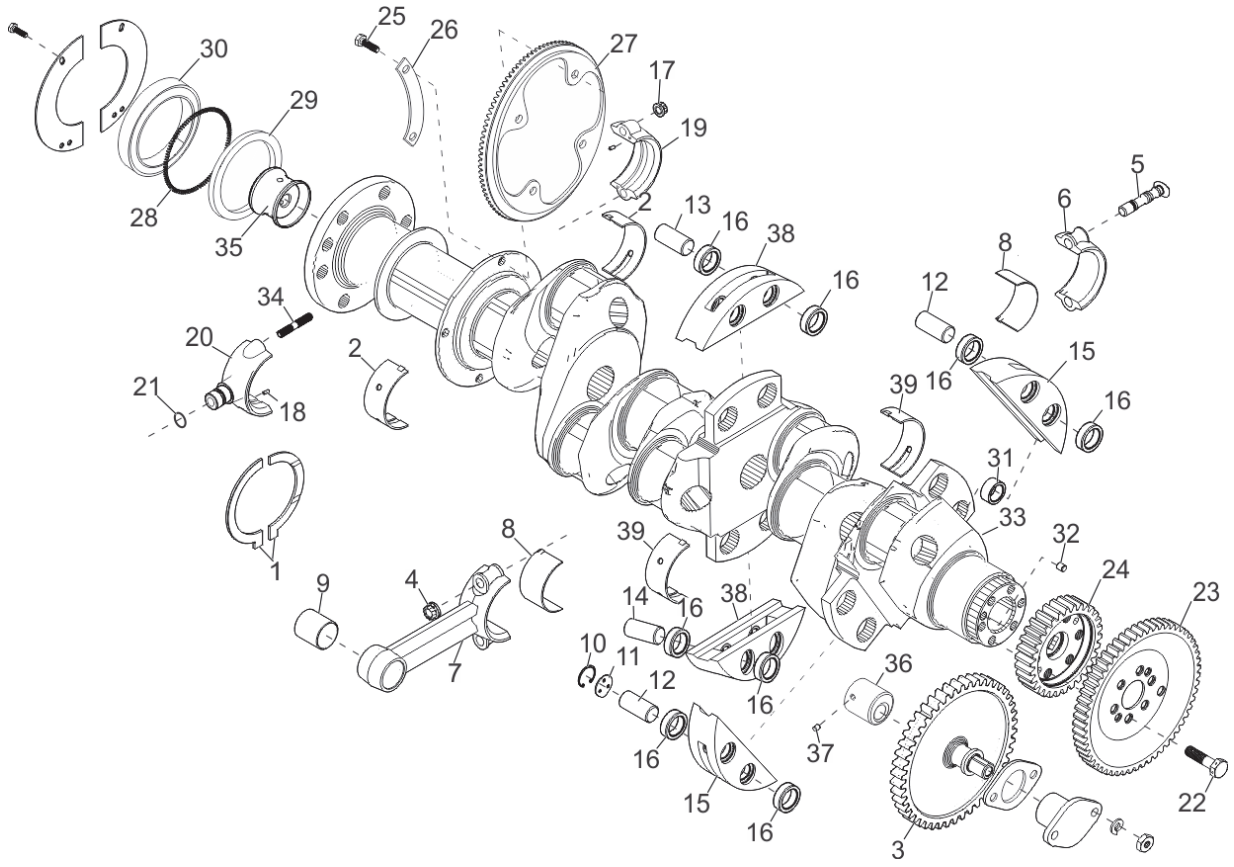


Figure 16-41. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	C'shaft Main Bearing, 4 & 5	12	6th Order Counterweight Pin	22	Drilled Head Screw	32	Crankshaft Dowel
3	Idler Gear	13	4th Order Counterweight Pin	23	Large Gear Cluster	33	Crankshaft
4	Spiral Lock Nut	14	5th Order Counterweight Pin	24	Small Gear Cluster	34	Stud
5	Connecting Rod Bolt	15	Counterweight Assembly	25	Bolt	35	Oil Transfer Plug
6	Connecting Rod Cap	16	Counterweight Bushing	26	Tab Lock Plate	36	Idler Gear Bushing
7	Connecting Rod	17	Lock Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring	38	Counterweight Assembly
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring	39	C'shaft Main Bearing, Rear & Intermediate
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

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.

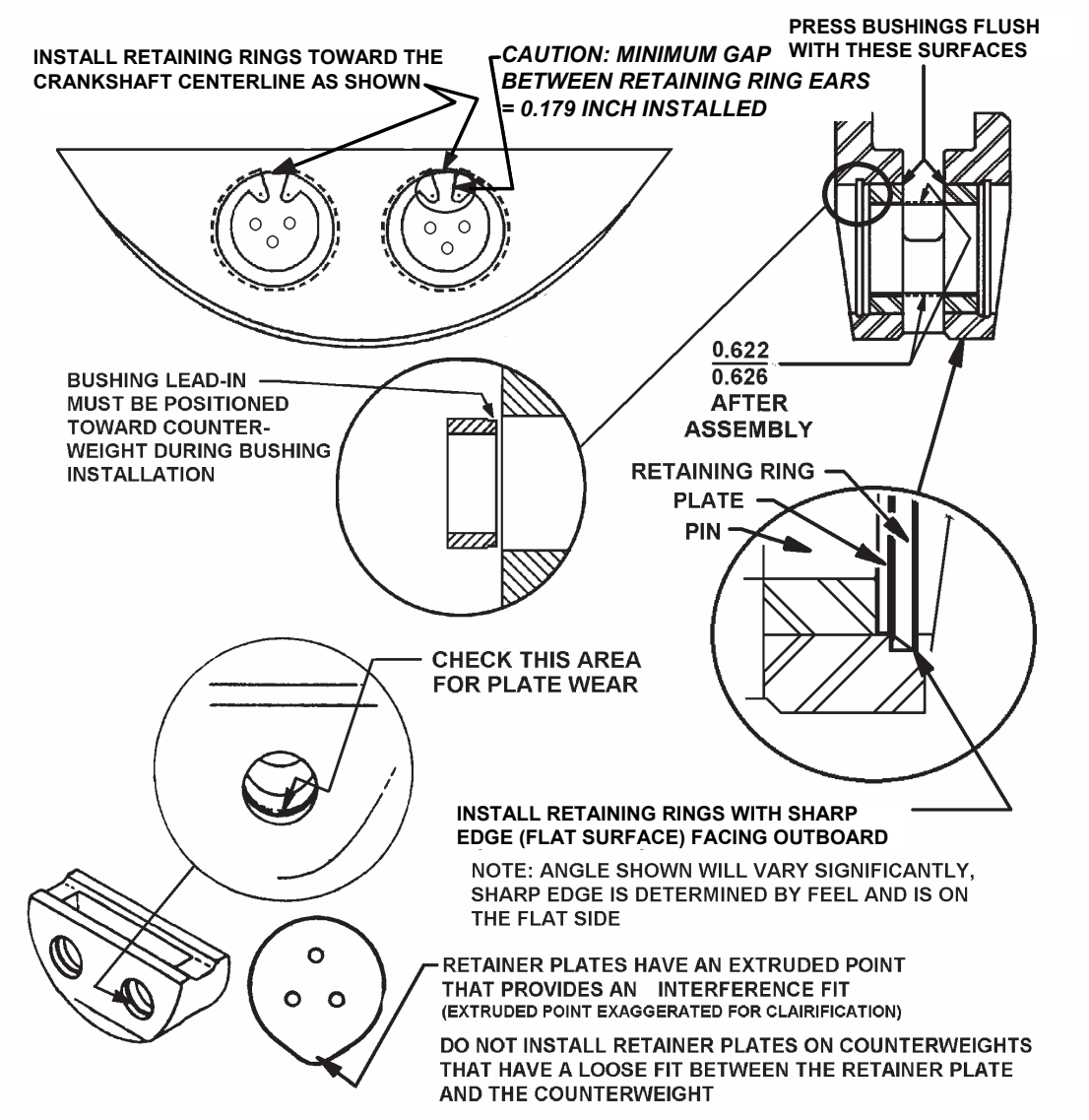


Figure 16-42. Counterweight Inspection, Repair and Installation

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.

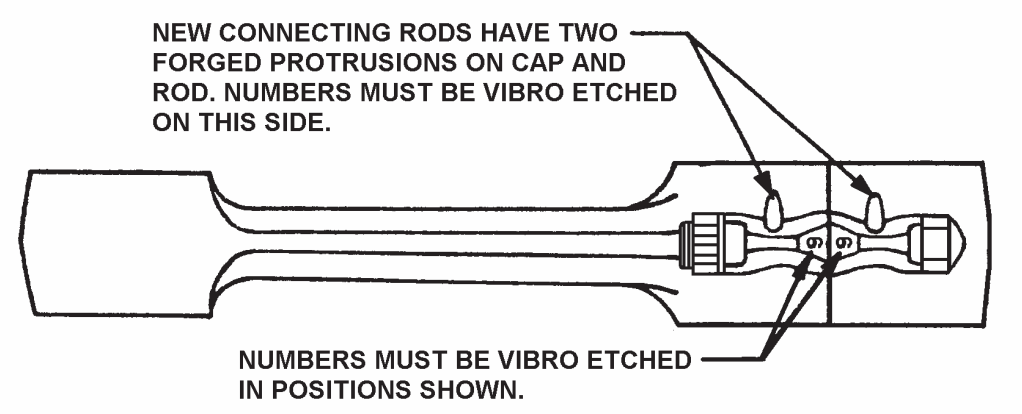


Figure 16-43. Connecting Rod Position Number

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

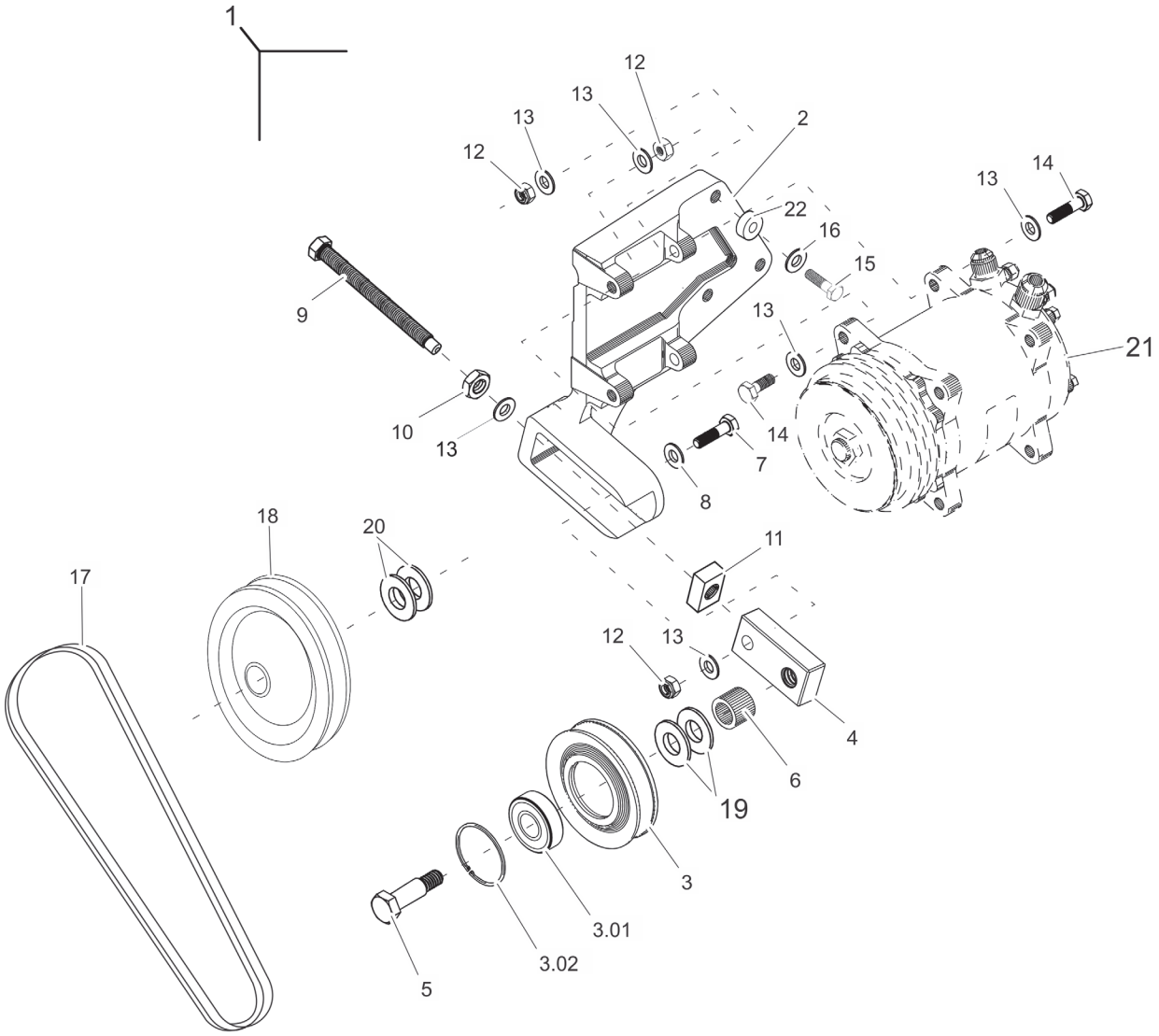
Install the Crankshaft Nose Oil Seal according to the "Split Type Nose Oil Seal Installation" instructions in Section 10-10.4 of M-0, Standard Practice Maintenance Manual.

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.



ITEMS 2 THRU 14 INCLUDED IN ITEM 1

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

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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 <u>any</u> 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 <u>any</u> 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.

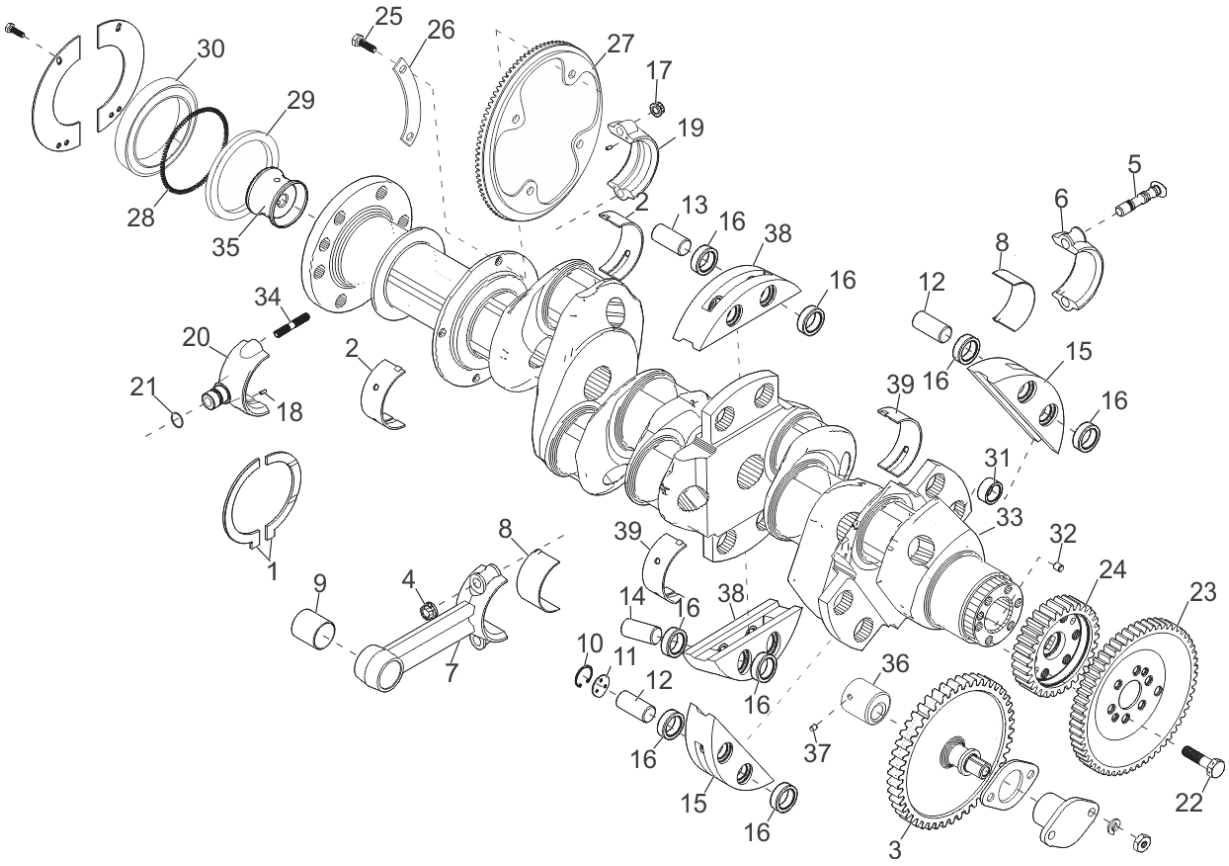


Figure 17-1. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	C'shaft Main Bearing, 4 & 5	12	6th Order Counterweight Pin	22	Drilled Head Screw	32	Crankshaft Dowel
3	Idler Gear	13	4th Order Counterweight Pin	23	Large Gear Cluster	33	Crankshaft
4	Spiral Lock Nut	14	5th Order Counterweight Pin	24	Small Gear Cluster	34	Stud
5	Connecting Rod Bolt	15	Counterweight Assembly	25	Bolt	35	Oil Transfer Plug
6	Connecting Rod Cap	16	Counterweight Bushing	26	Tab Lock Plate	36	Idler Gear Bushing
7	Connecting Rod	17	Lock Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring	38	Counterweight Assembly
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring	39	C'shaft Main Bearing, Rear & Intermediate
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

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).

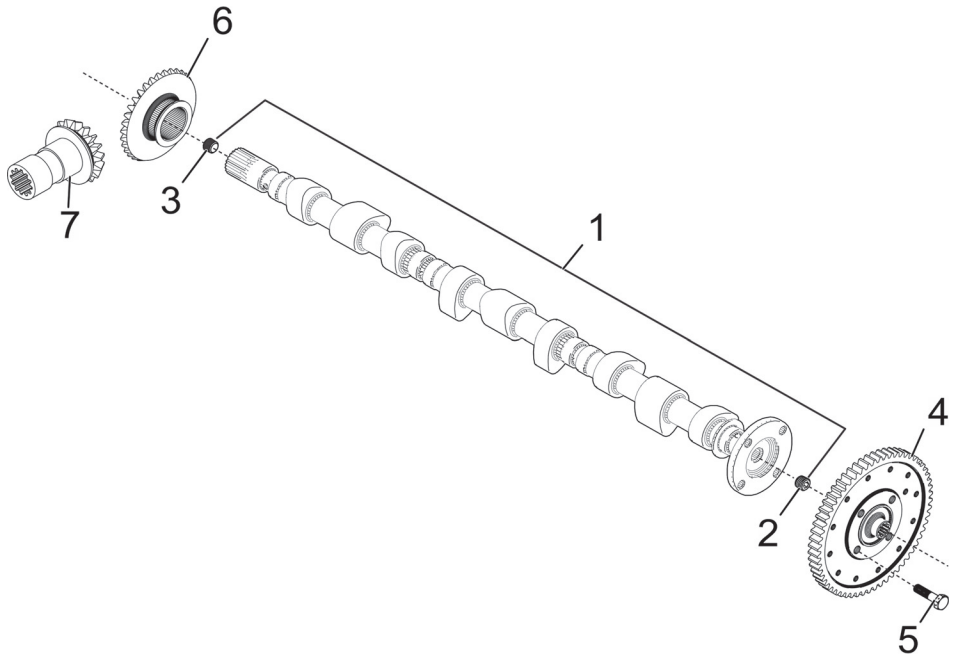


Figure 17-2. Camshaft Assembly

1	Camshaft Assembly	3	Plug	5	Bolt	7	Governor Driven Gear
2	Plug	4	Camshaft Gear	6	Governor Drive Gear		

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.

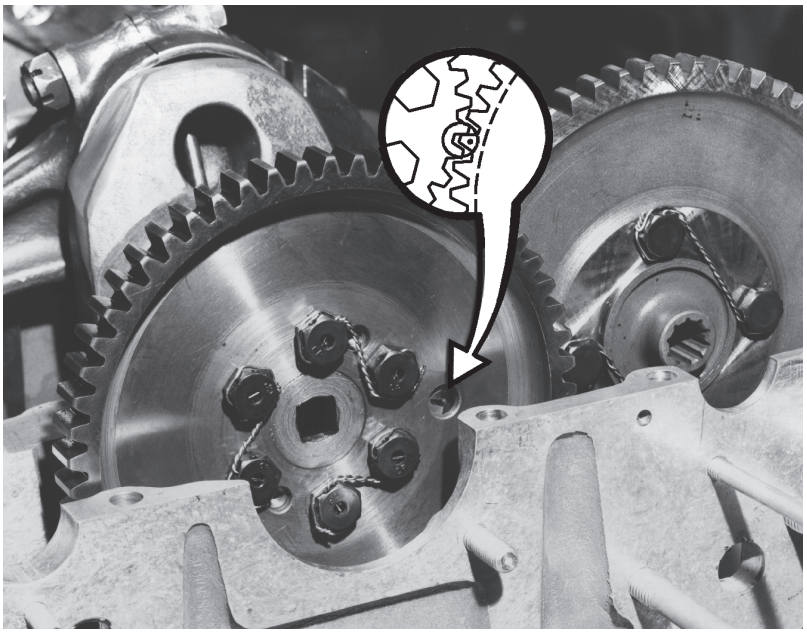


Figure 17-3. Timing Mark Alignment

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.
26. Coat the camshaft lobes with Dow Corning G-N Paste.

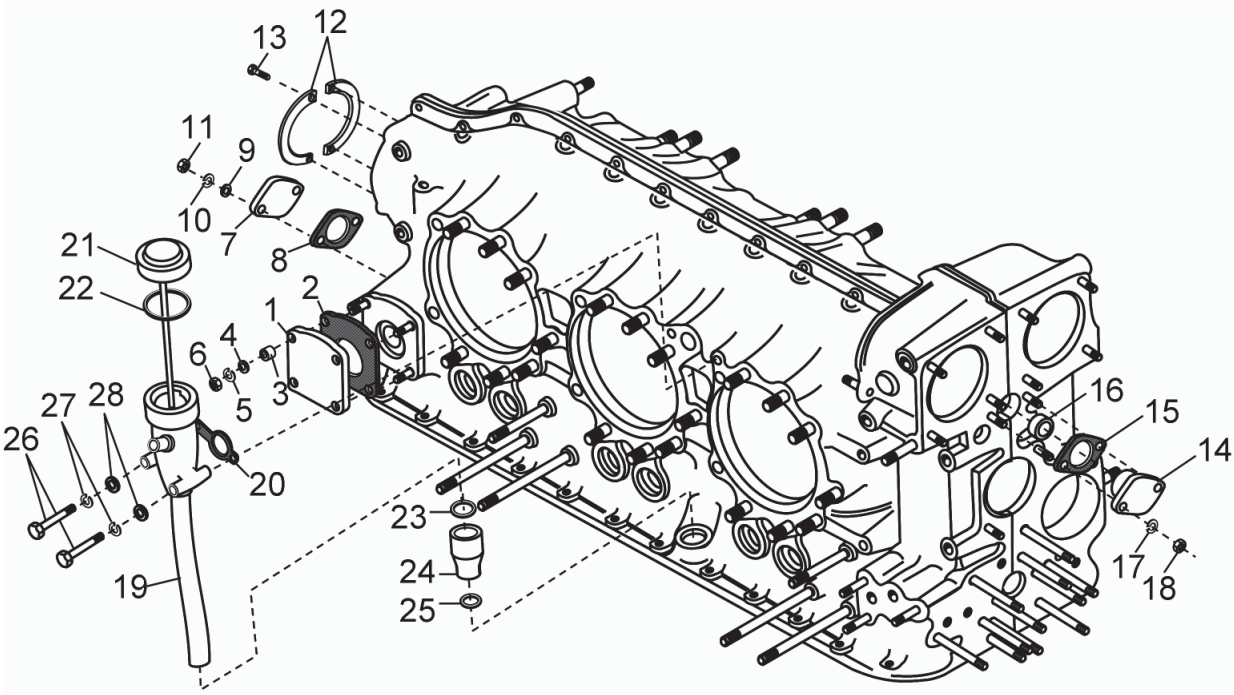


Figure 17-4. Miscellaneous Crankcase Hardware

1	Cover	8	Camshaft Cover Gasket	15	Idler Pin Cover Gasket	22	Oil Filler Gasket
2	Gasket	9	Washer	16	Idler Gear Bushing	23	O-ring
3	Spacer	10	Lock Washer	17	Lock Washer	24	Adapter
4	Washer	11	Nut	18	Nut	25	O-ring
5	Lock Washer	12	Gasket	19	Oil Filler Assembly	26	Screw
6	Nut	13	Screw	20	Gasket	27	Lock Washer
7	Camshaft Cover	14	Idler Gear Support Pin	21	Oil Gauge & Cap Assembly	28	Washer

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.

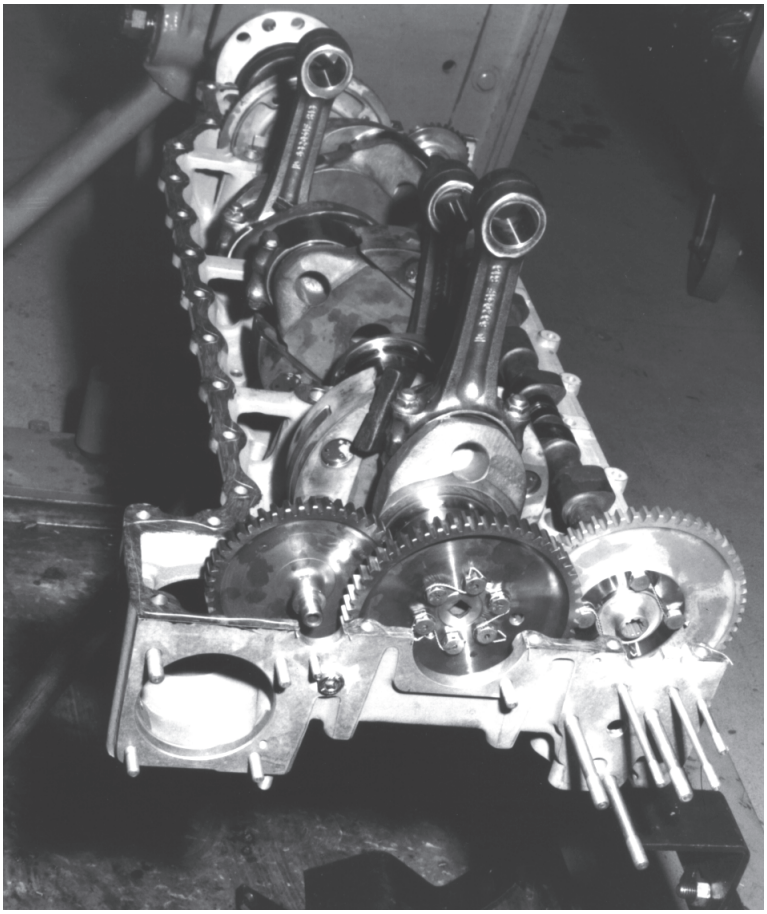


Figure 17-5. Left Crankcase Assembled on Stand

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.

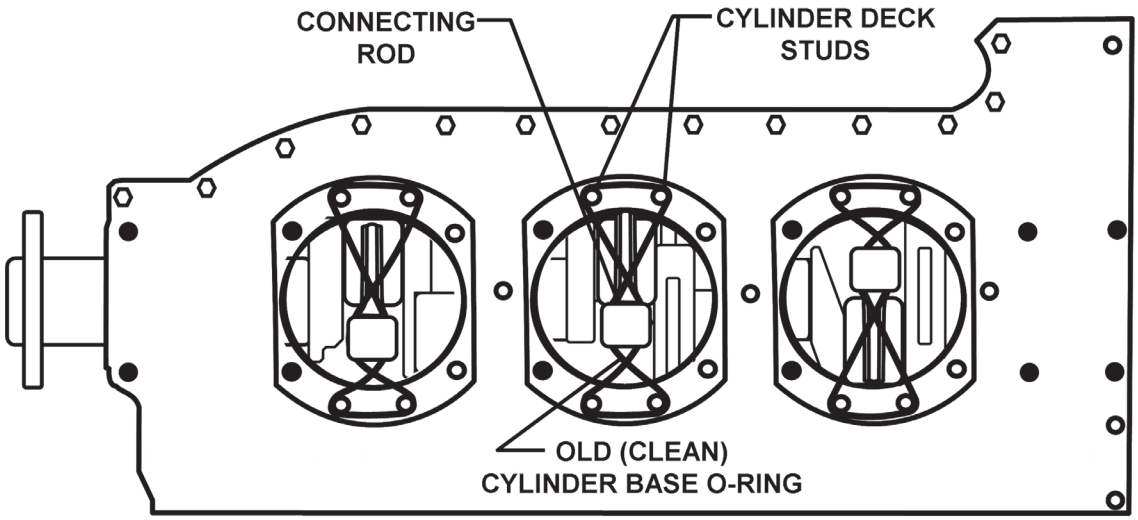


Figure 17-6. Cylinder Base O-ring to Support Connecting Rods

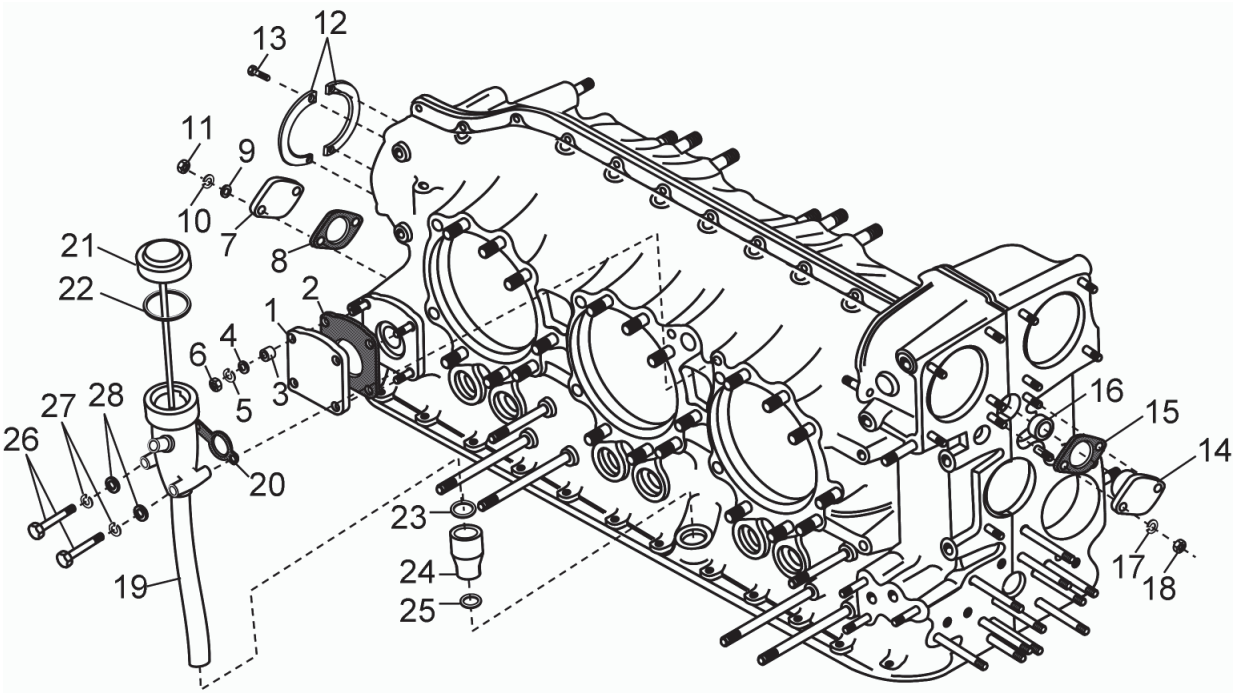


Figure 17-4 repeated for reference

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.

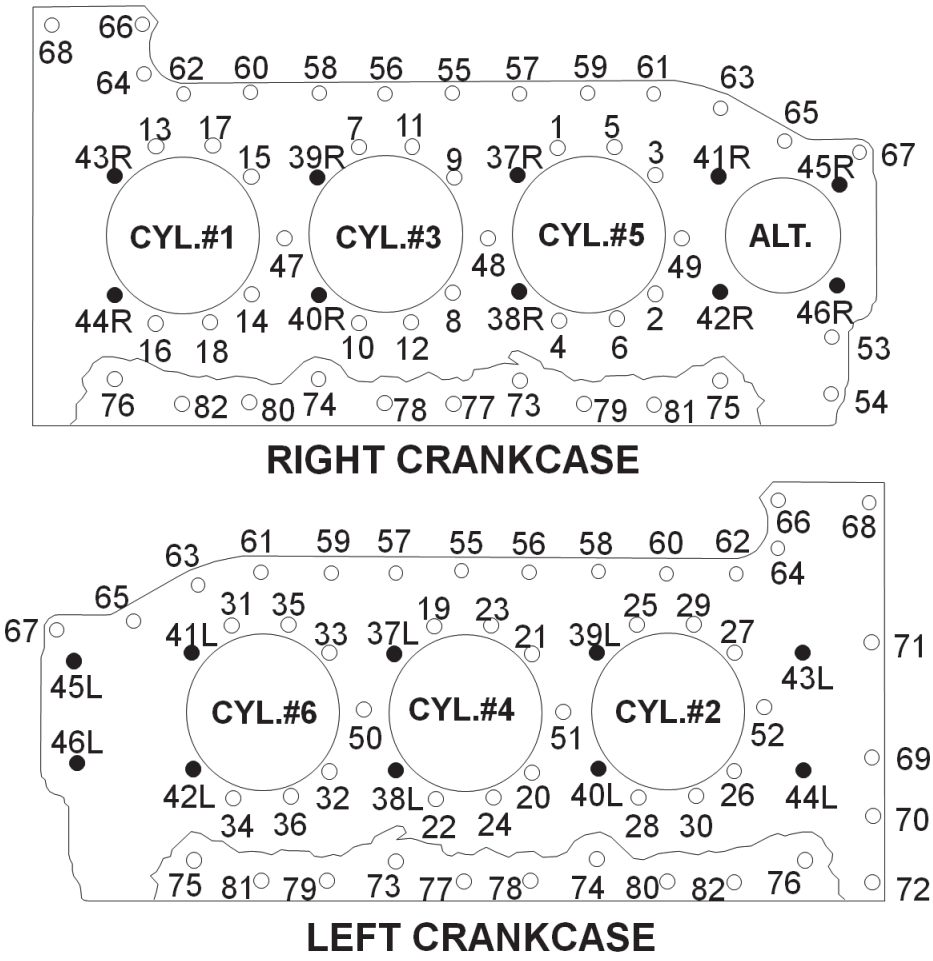


Figure 17-7. Crankcase Fastener Locations

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.

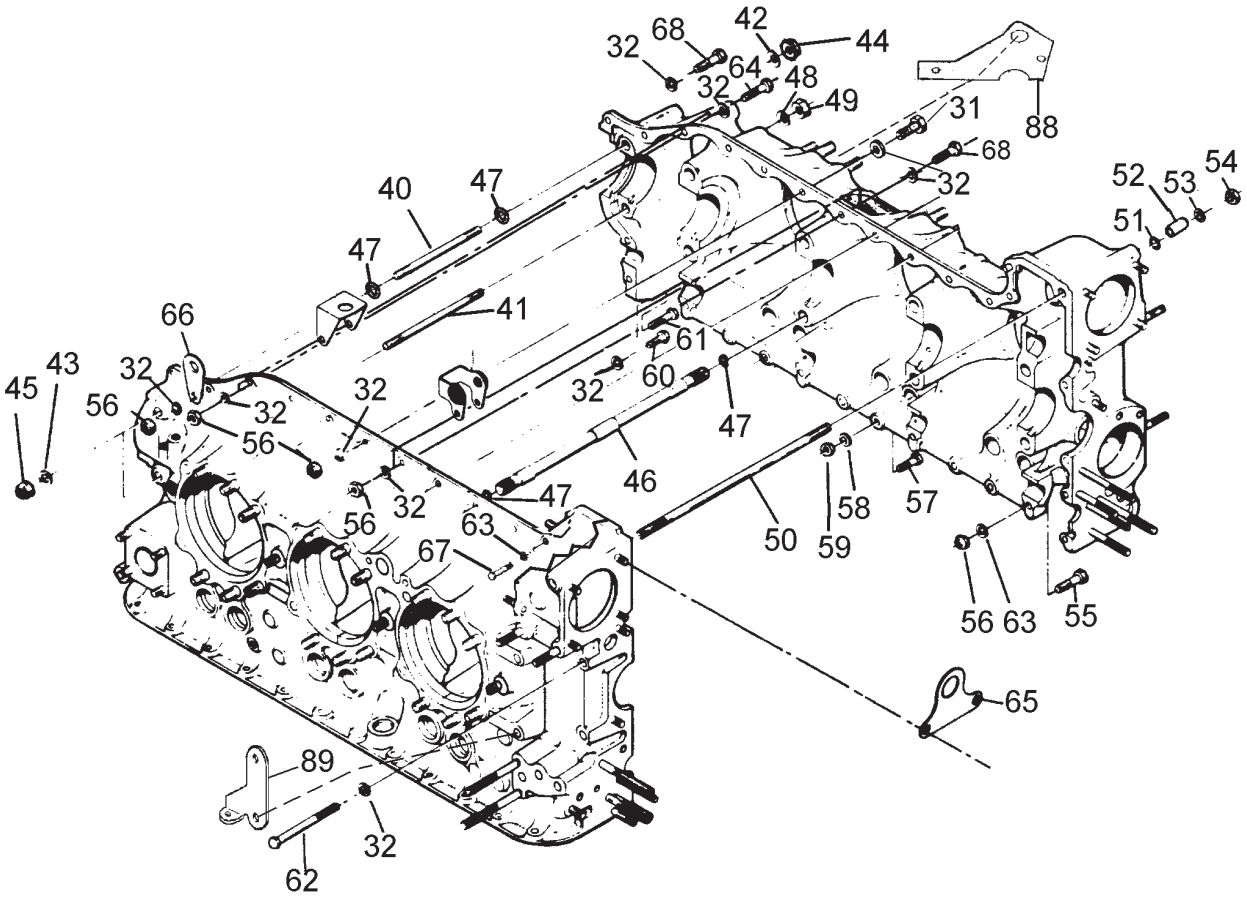


Figure 17-8. Crankcase Fasteners

31	Bolt 0.31-24 X 1.47	47	O-ring	55	Bolt 0.3125-24 UNF	63	Washer
32	Washer	48	Washer	56	Nut	64	Bolt 0.31-24 X 1.47
40	Thru-bolt 0.4375-20 X 6.74	49	Nut	57	Screw 0.25-28 X 1.63	65	Lifting Eye
41	Thru-bolt 0.44-20 X 7.58	50	Thru-bolt 0.38-24 X 11.67	58	Washer	66	Lifting Eye
43	Spacer	51	O-ring	59	Nut	67	Bolt 0.31-24 X 1.34
44	Flanged Nut	52	Spacer	60	Bolt 0.3125-18 X 1.12	68	Bolt 0.31-24 X 1.59
45	Nut	53	Washer	61	Bolt 0.3125-18 X 1.38	88	Baffle Support
46	Thru-bolt 0.50-20 X 10.75	54	Nut	62	Bolt	89	Baffle Support

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 <u>any</u> 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 <u>any</u> 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.

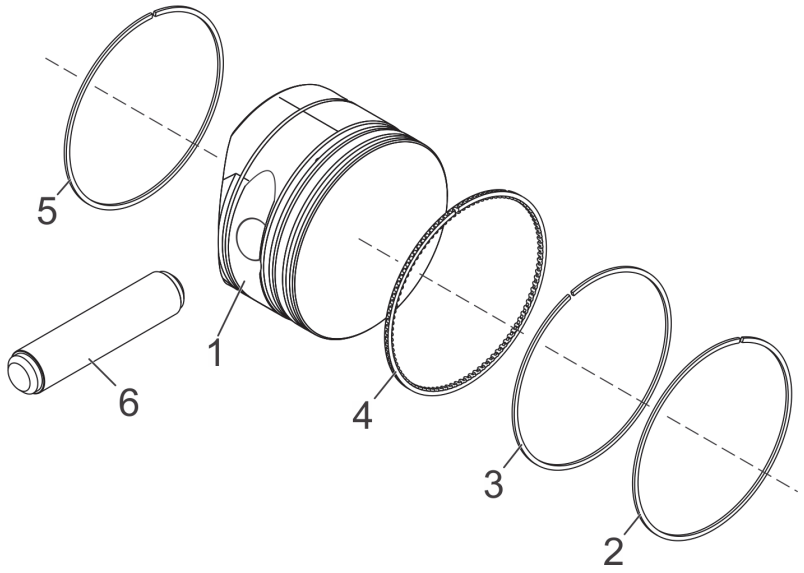


Figure 17-9. Piston, Piston Pin and Rings

1	Piston	3	Compression Ring	5	Scraper Ring
2	Compression Ring	4	Oil Control Ring	6	Piston Pin

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."

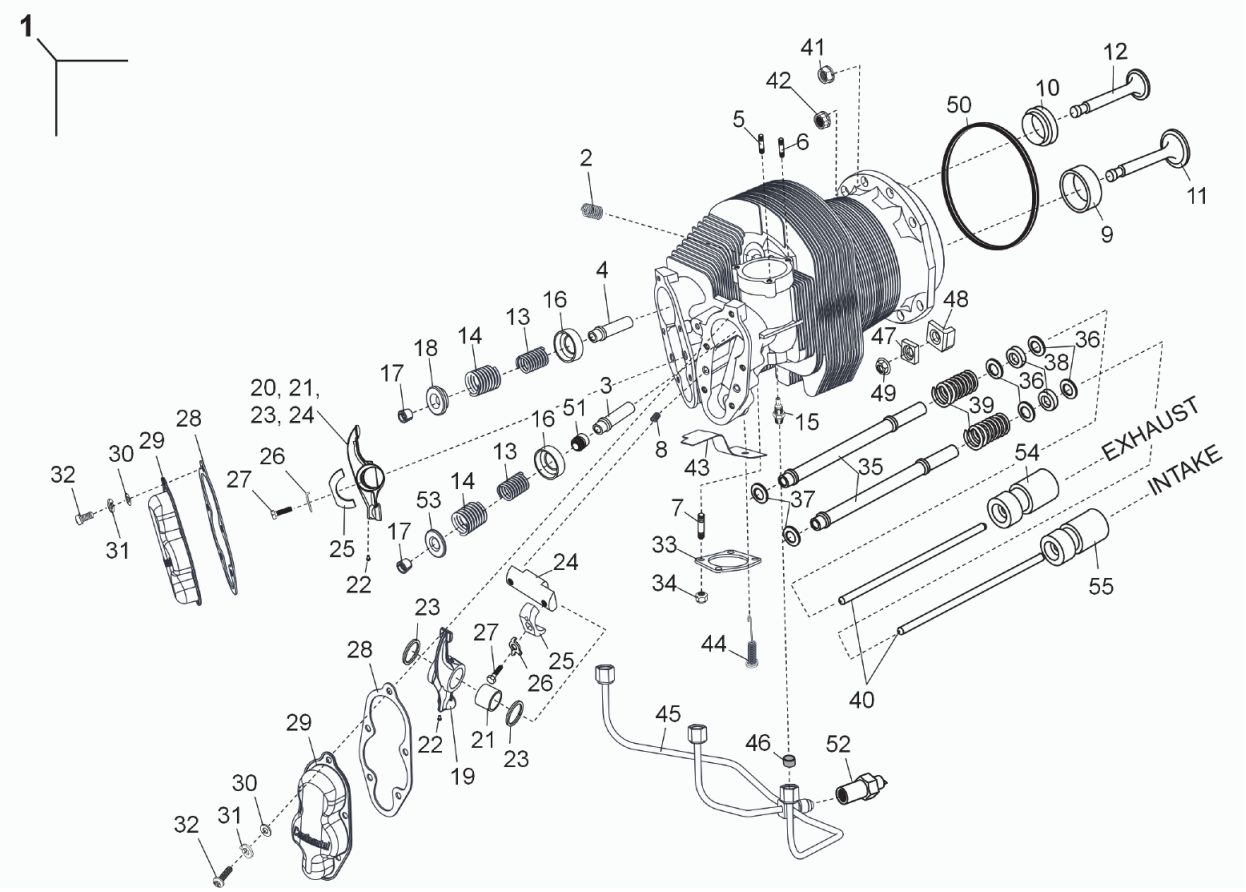


Figure 17-10. Cross-flow Cylinder Assembly

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		

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.

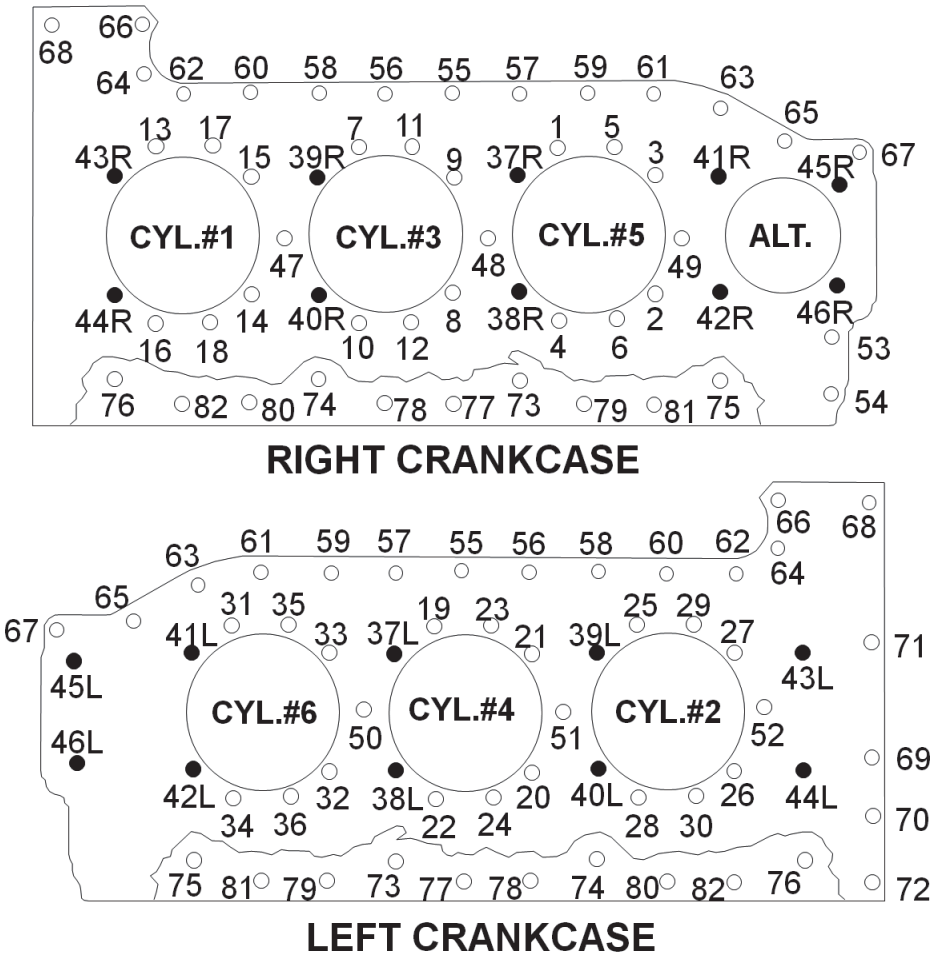


Figure 17-7 repeated for reference

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.

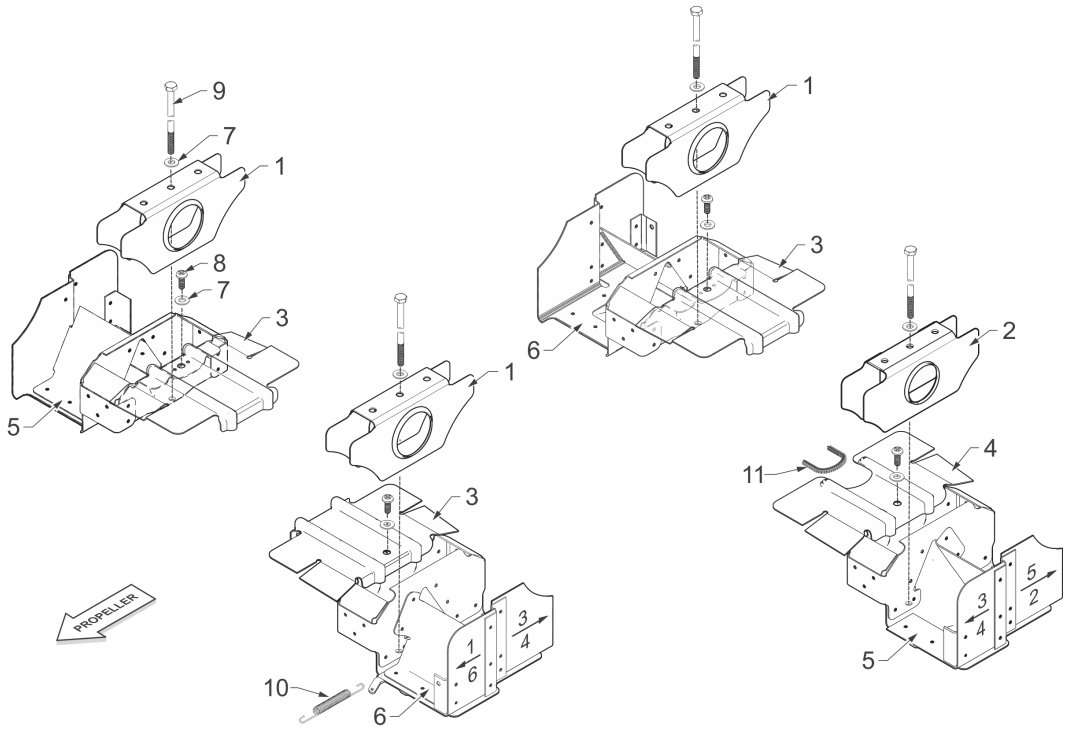


Figure 17-11. Inter-Cylinder Baffle Assembly

1	Baffle Support	4	Cylinder Base Baffle	7	Washer	10	Baffle Tie Spring
2	Baffle Support	5	Baffle Assembly	8	Screw	11	Grommet
3	Cylinder Base Baffle	6	Baffle Assembly	9	Bolt		

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).
4. Torque the drain tube “B” nuts to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
5. Install the drain valve assemblies in accordance with the aircraft manufacturer's instructions.

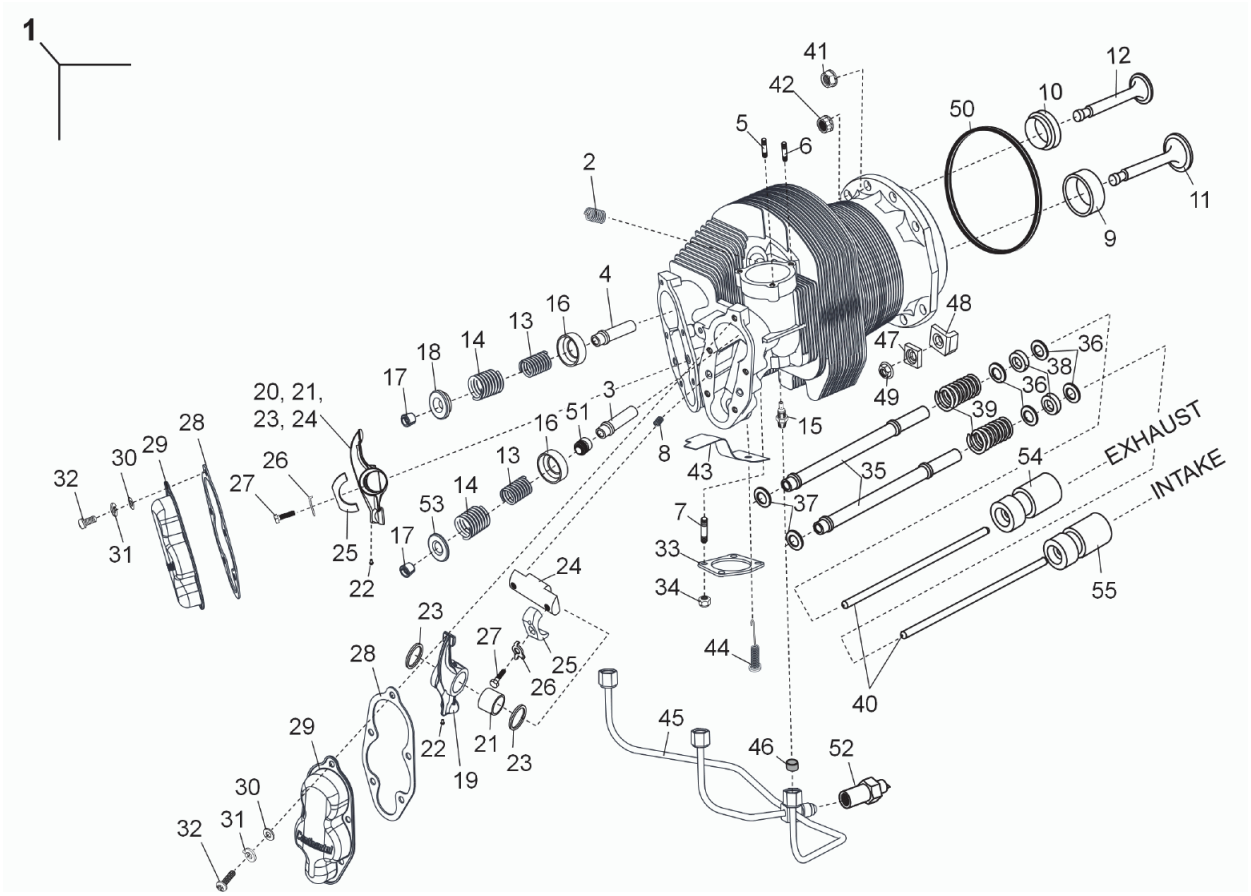


Figure 17-10 repeated for reference

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 <u>any</u> 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 <u>any</u> 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.

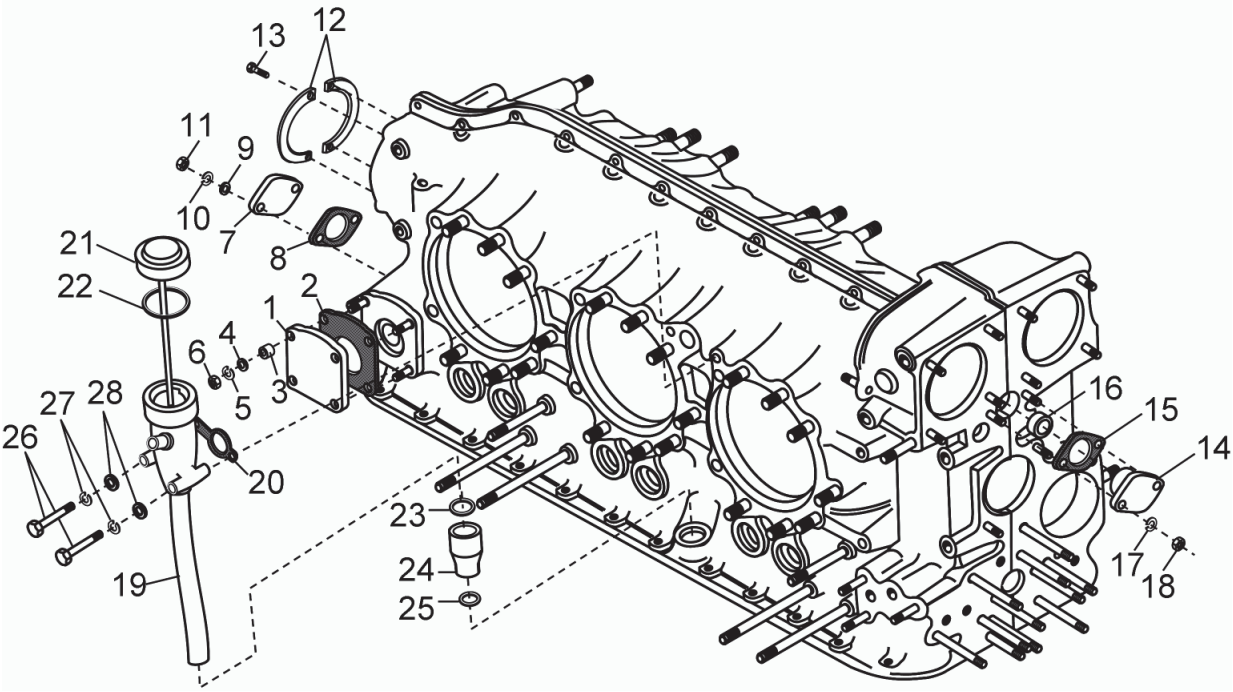


Figure 17-4 repeated for reference

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).

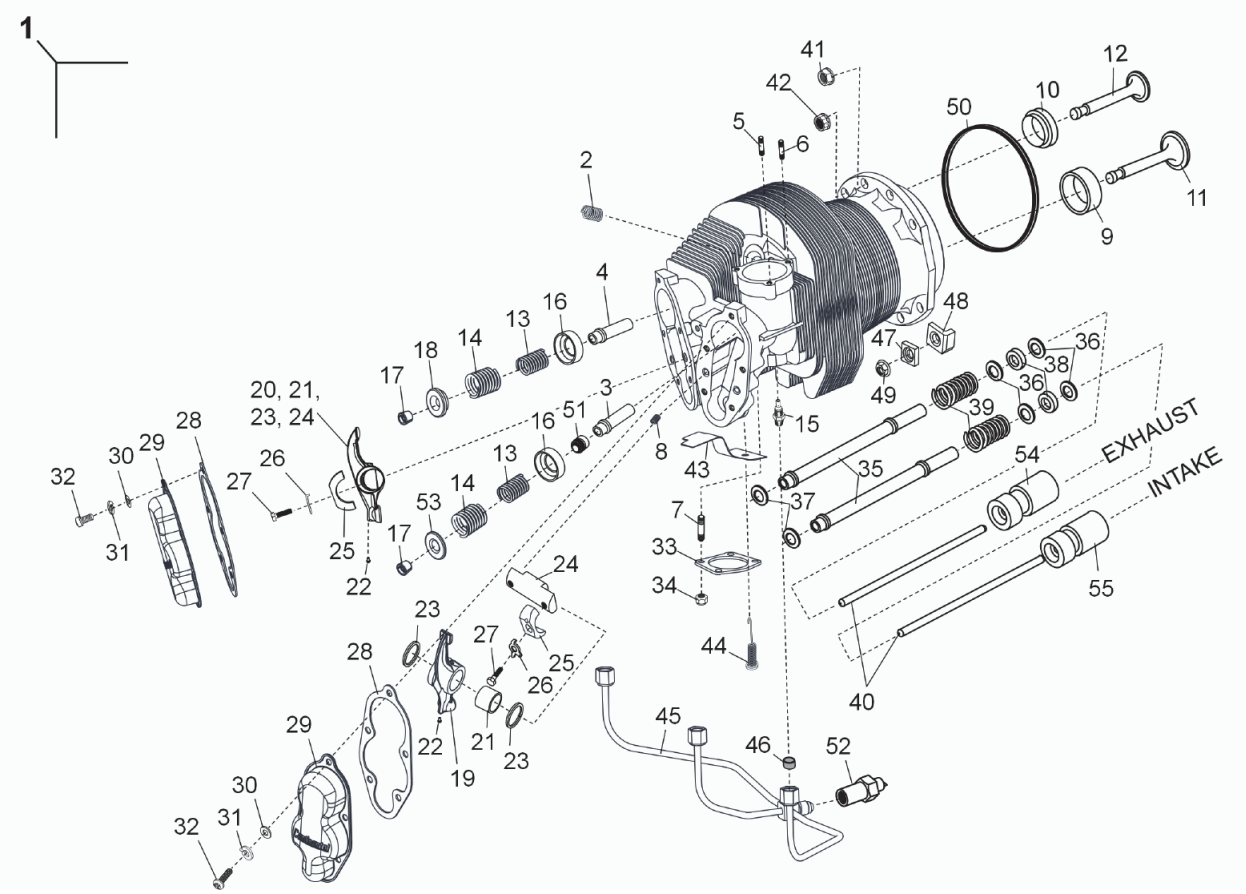


Figure 17-10 repeated for reference

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.

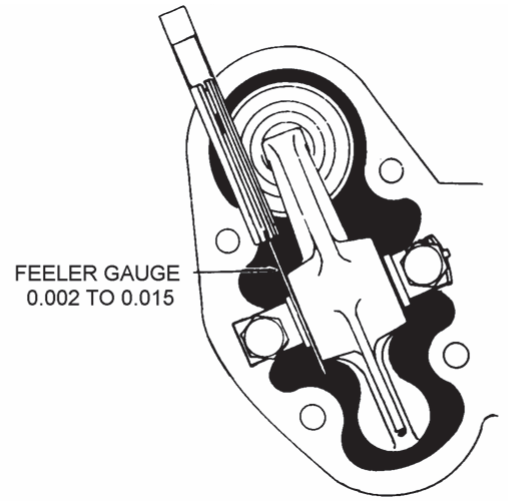


Figure 17-13. Rocker Arm Side Clearance

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.

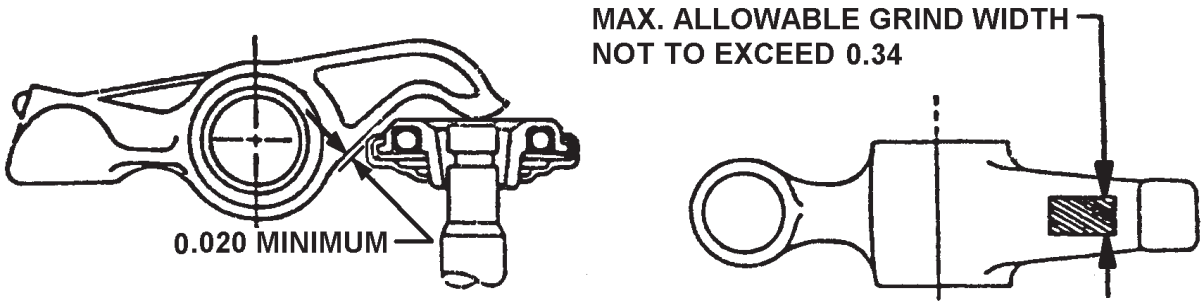


Figure 17-14. Rocker Arm to Retainer Clearance

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.

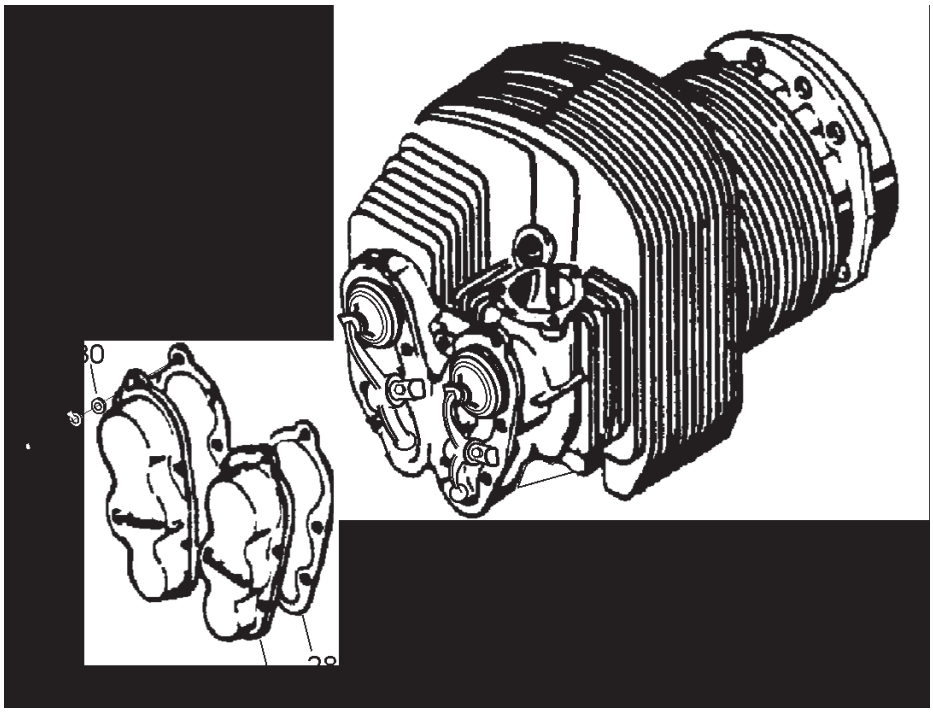


Figure 17-10 repeated for reference

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.

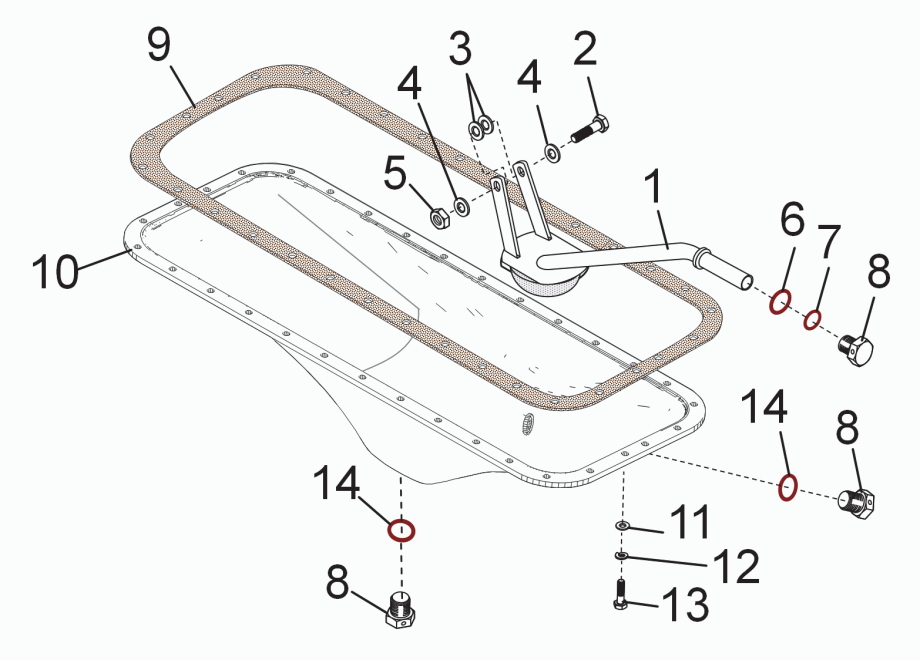


Figure 17-15. Oil Sump C

1	Oil Suction Tube Assy	6	Copper Gasket	11	Washer	15	Oil Coupling G K N
2	Bolt	7	Copper Gasket	12	Lock Washer	16	Bolt G K N
3	Washer	8	Plug	13	Bolt		
4	Washer	9	Oil Sump Gasket	14	Copper Gasket		
5	Nut	10	Oil Sump	15	Bracket B E		

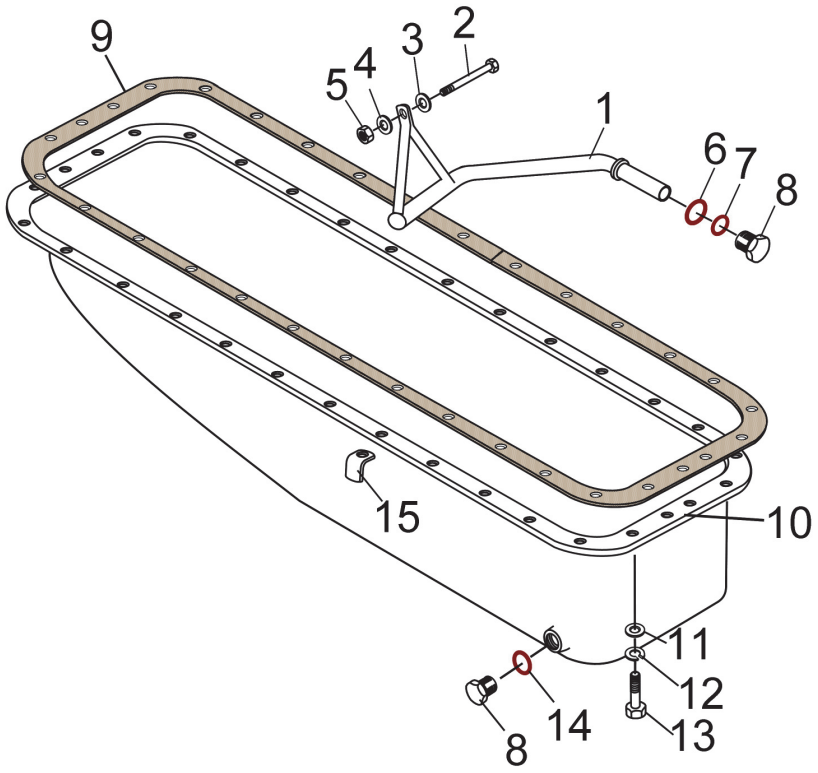


Figure 17-16. Oil Sump B E

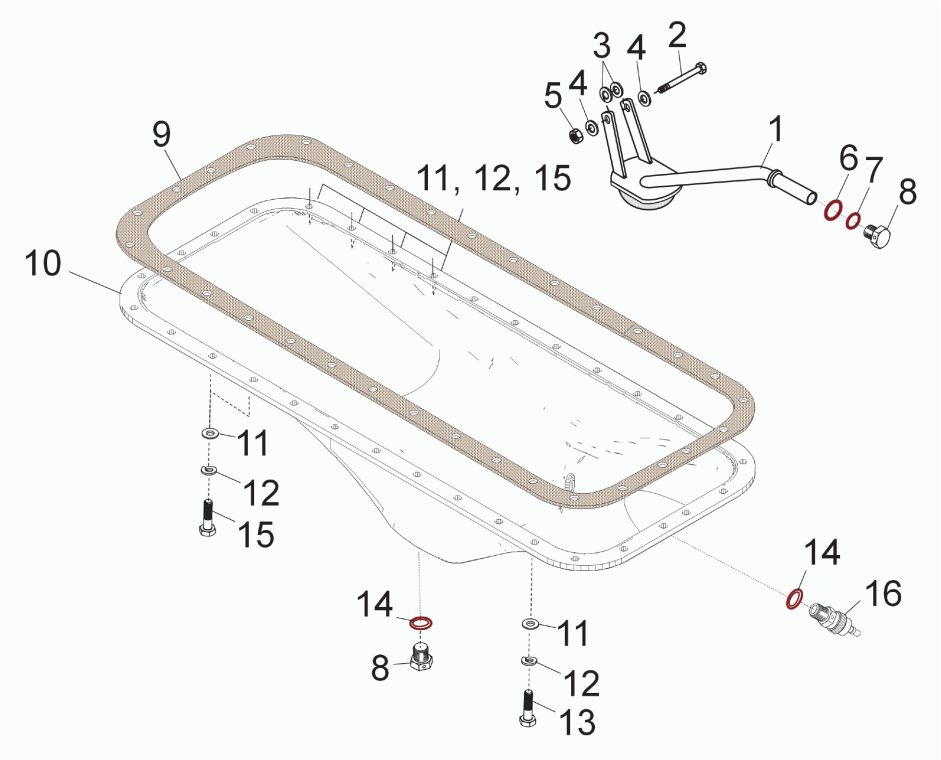


Figure 17-17. Oil Sump G K N

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. **B E** 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. **C** 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. **G K N** 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).

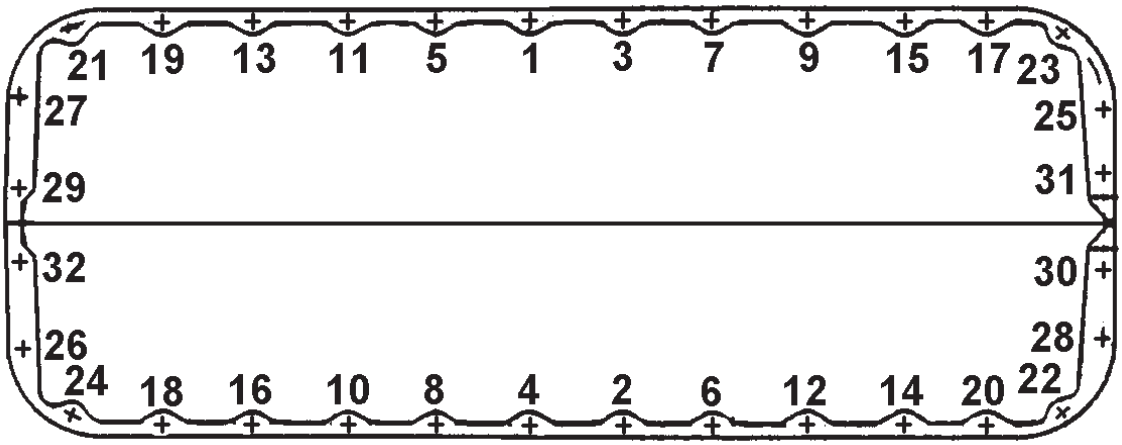


Figure 17-18. Oil Sump Torque Sequence

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.

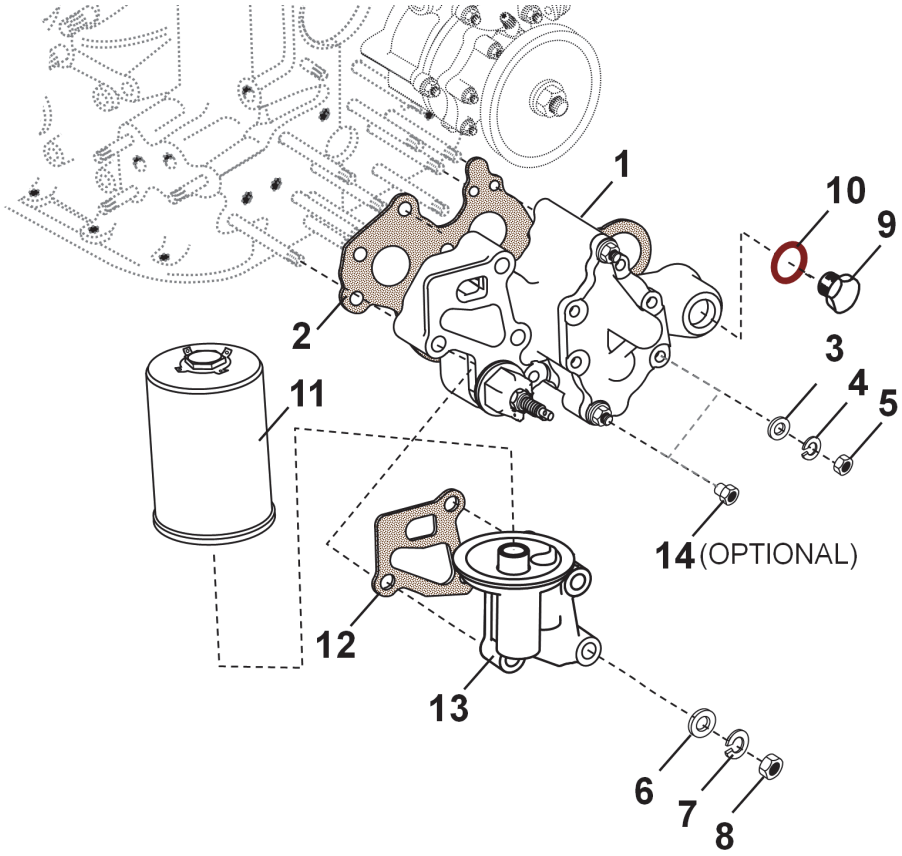


Figure 17-19. Oil Pump Assembly

1	Oil Pump Assembly	5	Nut	9	Plug	13	Oil Filter Adapter
2	Oil Pump Gasket	6	Washer	10	Gasket	14	Coupling Nut
3	Washer	7	Lock Washer	11	Oil Filter		
4	Lock Washer	8	Nut	12	Gasket		

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.
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.
9. Install a reducer bushing (18) in the oil outlet port. Torque the reducer bushing 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.

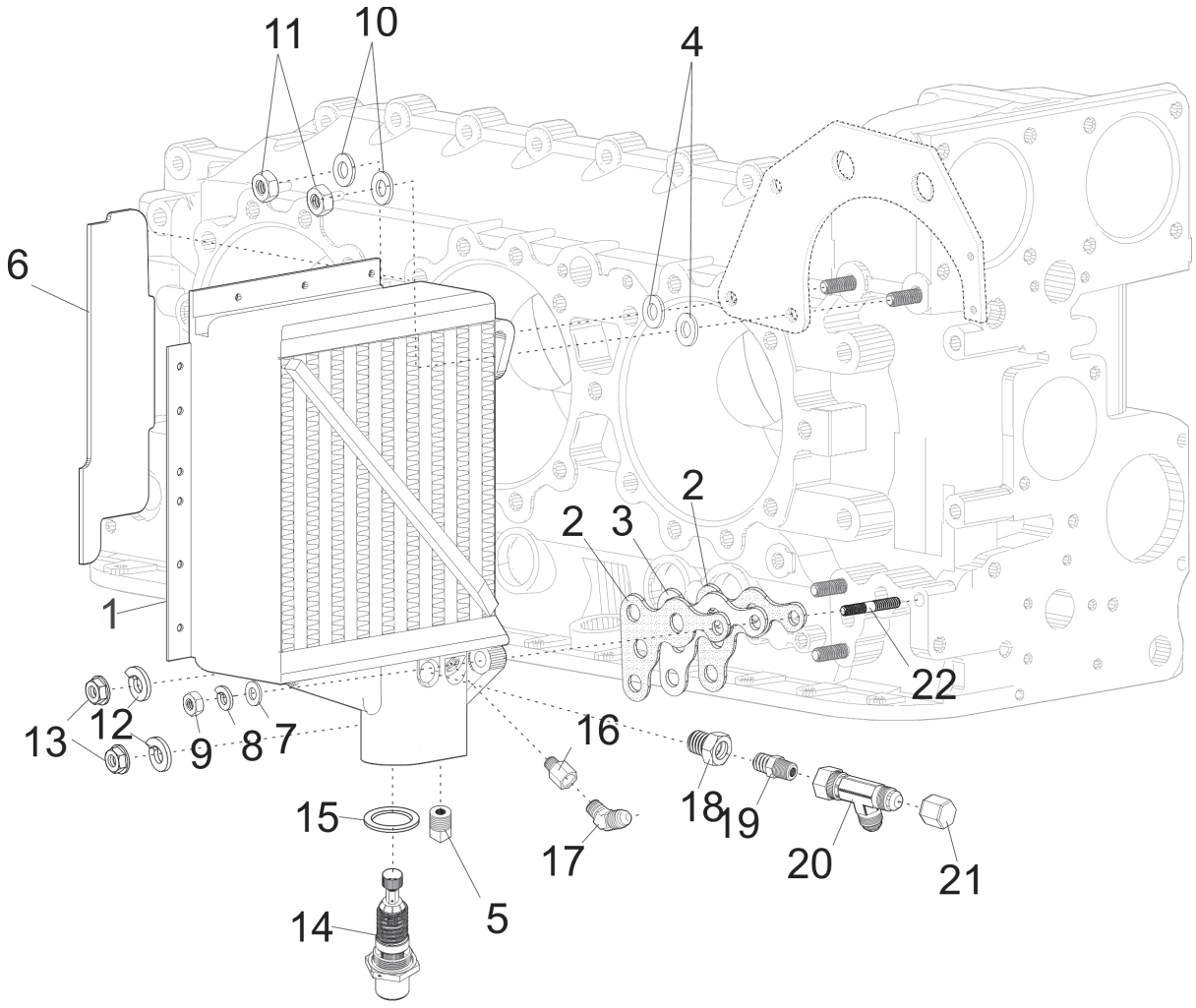


Figure 17-20. Oil Cooler B C E

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Connector Fitting
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	Tee Fitting
3	Spacer	9	Nut	15	Gasket	21	Cap
4	Gasket-Washer	10	Washer	16	Adapter	22	Stud
5	Plug	11	Nut	17	45° Elbow Fitting		
6	Baffle	12	Lock Washer	18	Reducer Bushing		

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.

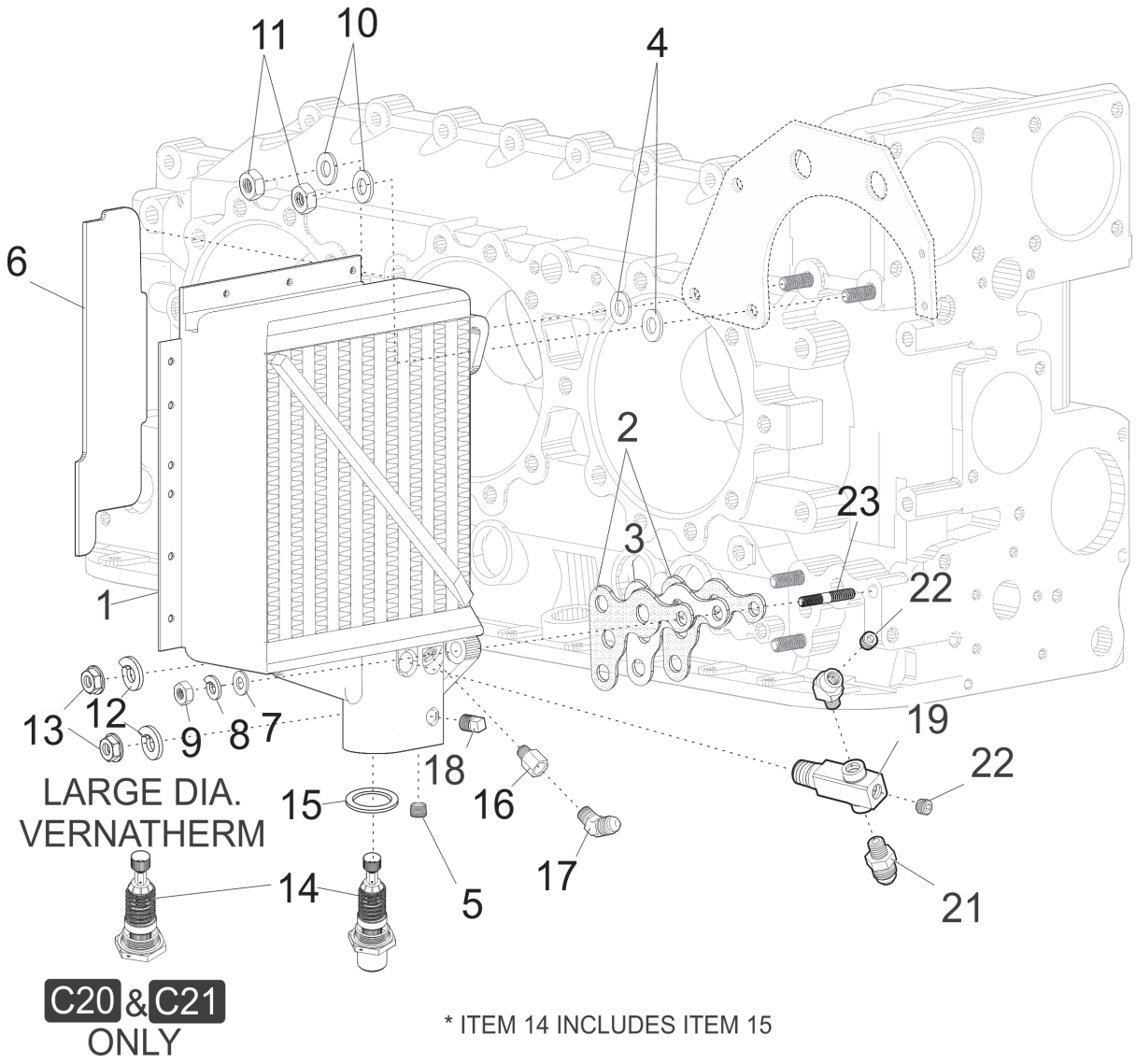


Figure 17-21. Oil Cooler G

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Cross Fitting
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	45° Street Elbow
3	Spacer	9	Nut	15	Gasket	21	Flared Nipple Fitting
4	Gasket-Washer	10	Washer	16	Adapter Fitting	22	Plug
5	Plug	11	Nut	17	45° Elbow Fitting	23	Stud
6	Baffle	12	Lock Washer	18	Plug		

procedure continues on next page...

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.

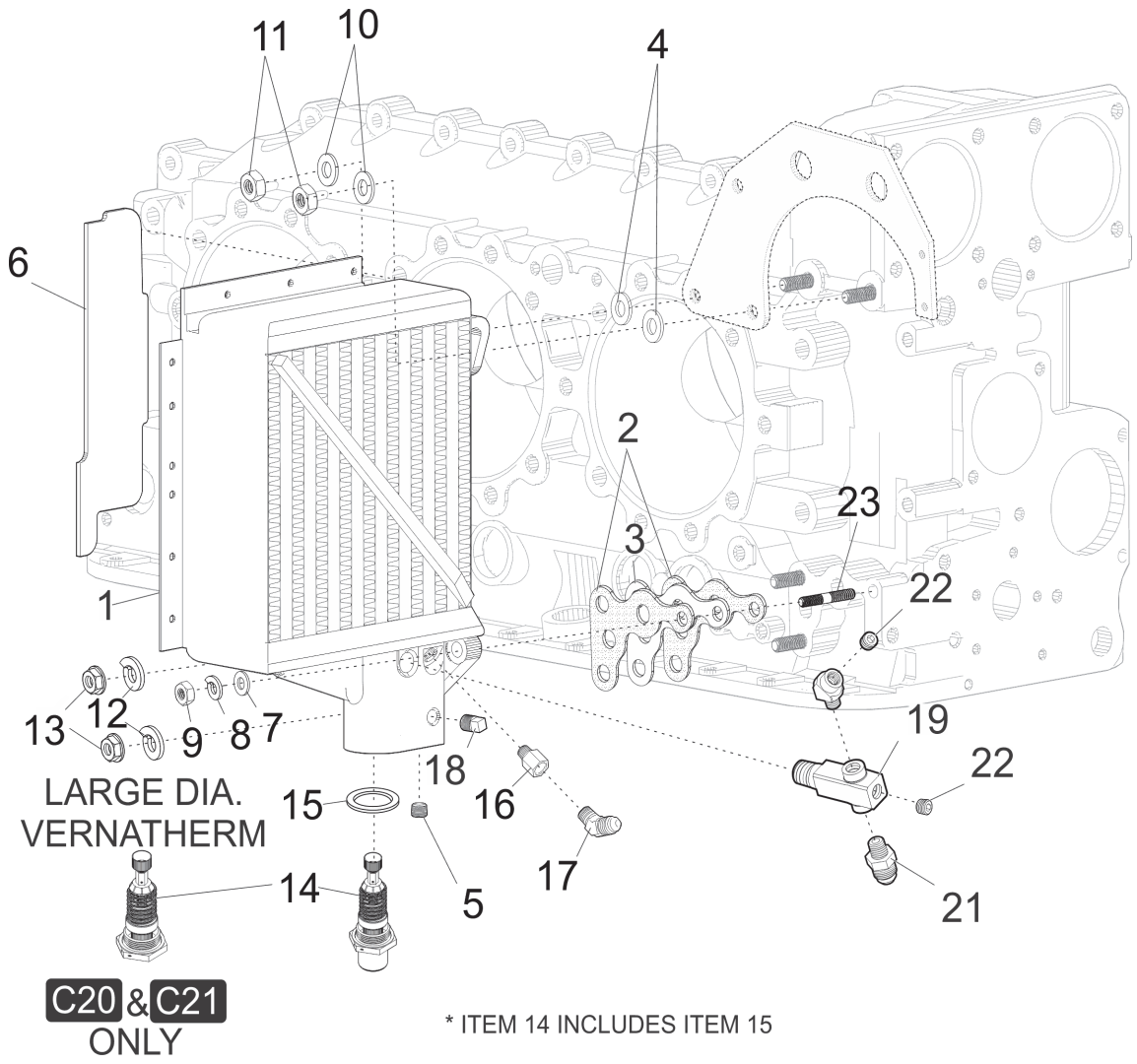


Figure 17-21 repeated for reference

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.
11. Install a reducer bushing (16) in the oil outlet port. Torque the reducer bushing 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.

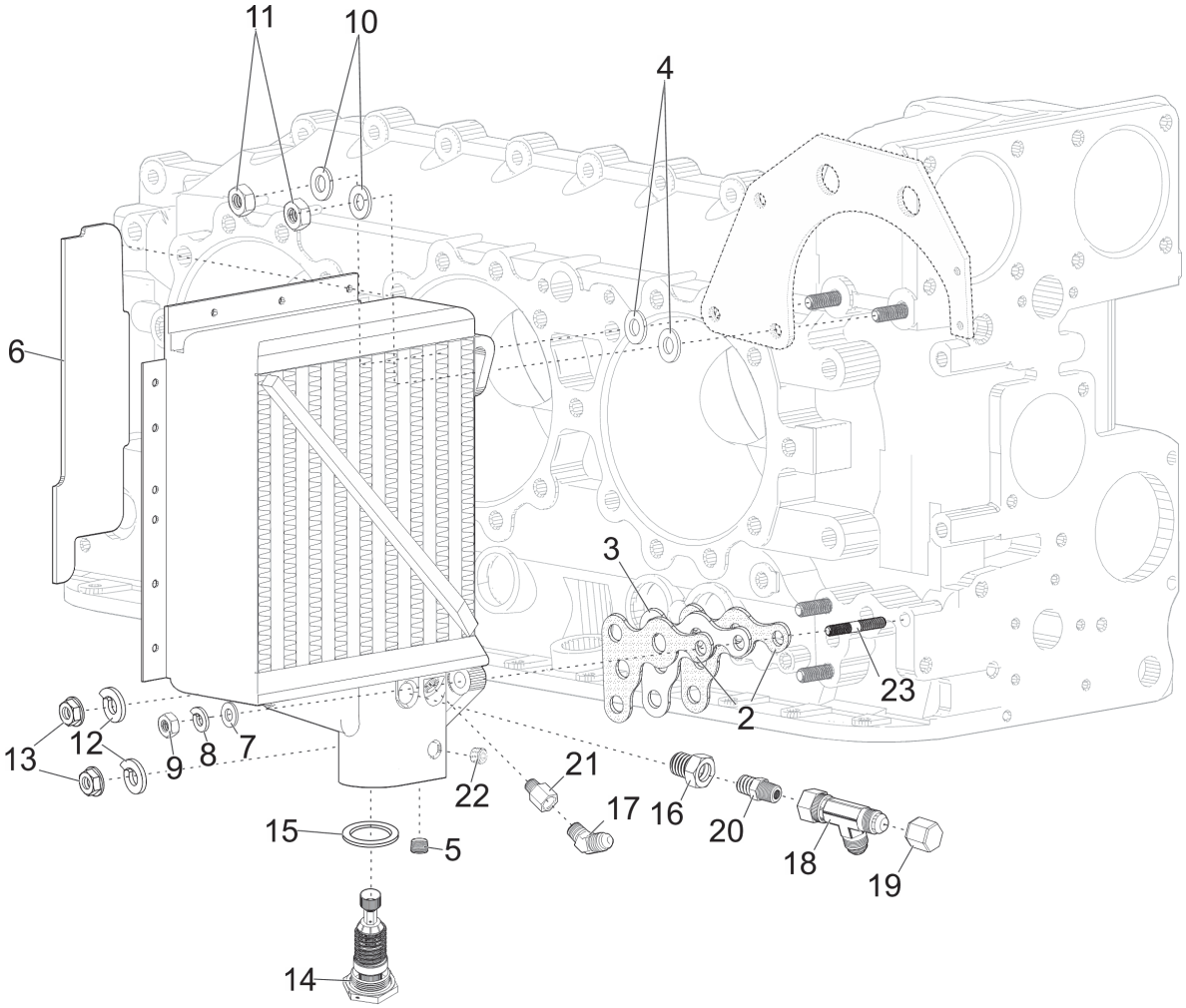


Figure 17-22. Oil Cooler G

1	Oil Cooler Assembly	7	Washer	13	Flanged Nut	19	Cap
2	Gasket	8	Lock Washer	14	Oil Temp. Control Valve	20	Connector Fitting
3	Spacer	9	Nut	15	Gasket	21	Adapter
4	Gasket-Washer	10	Washer	16	Reducer Bushing	22	Aircraft Part
5	Plug	11	Nut	17	45° Elbow Fitting	23	Stud
6	Baffle	12	Lock Washer	18	Tee Fitting		

17-6.4. TSIO-550-K Oil Cooler Installation

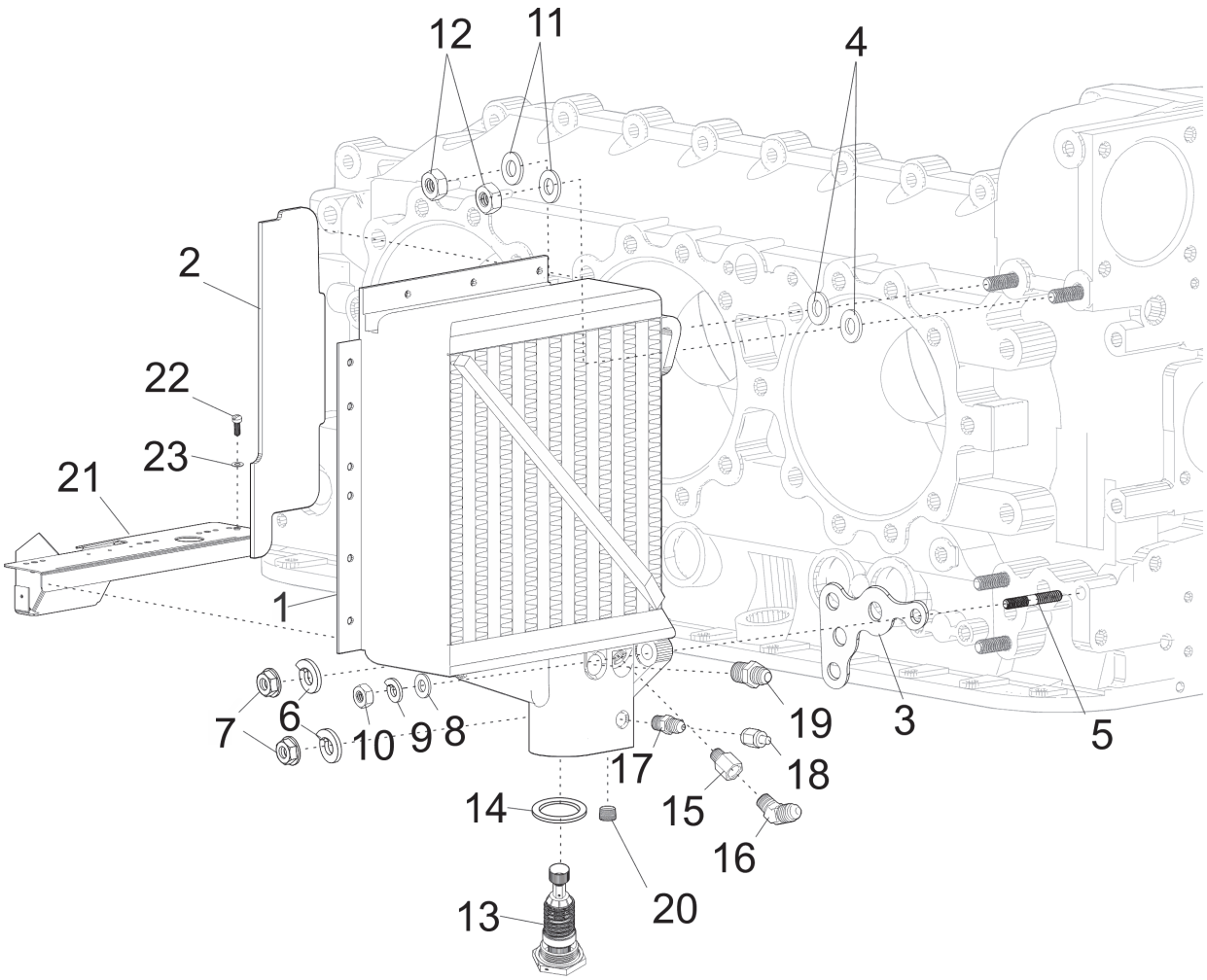
WARNING

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 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 CSB15-7 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.



* ITEM 13 INCLUDES ITEM 14

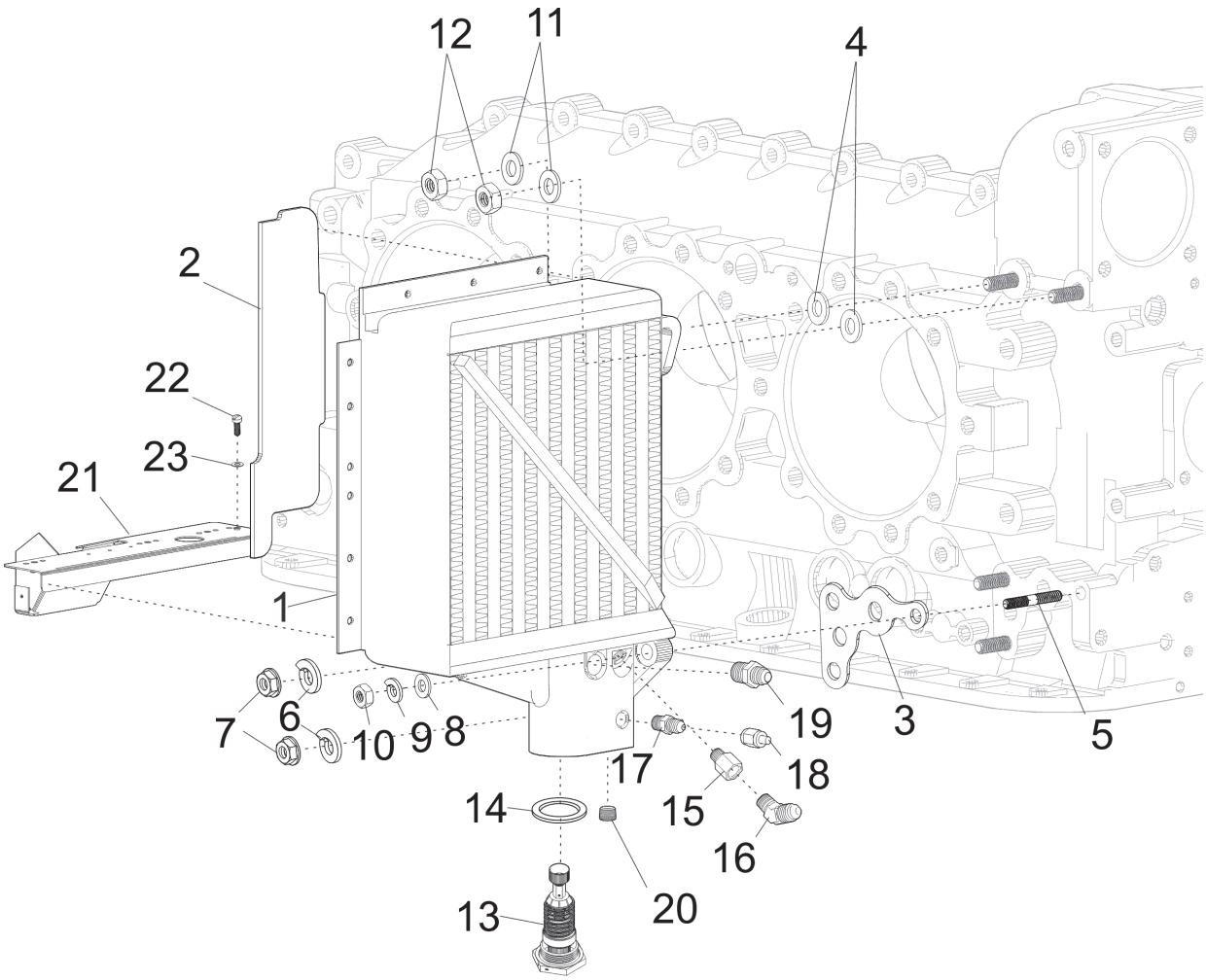
Figure 17-23. Oil Cooler K

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		

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.
14. Install an adapter fitting (19) in the upper outboard pressure port; torque 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

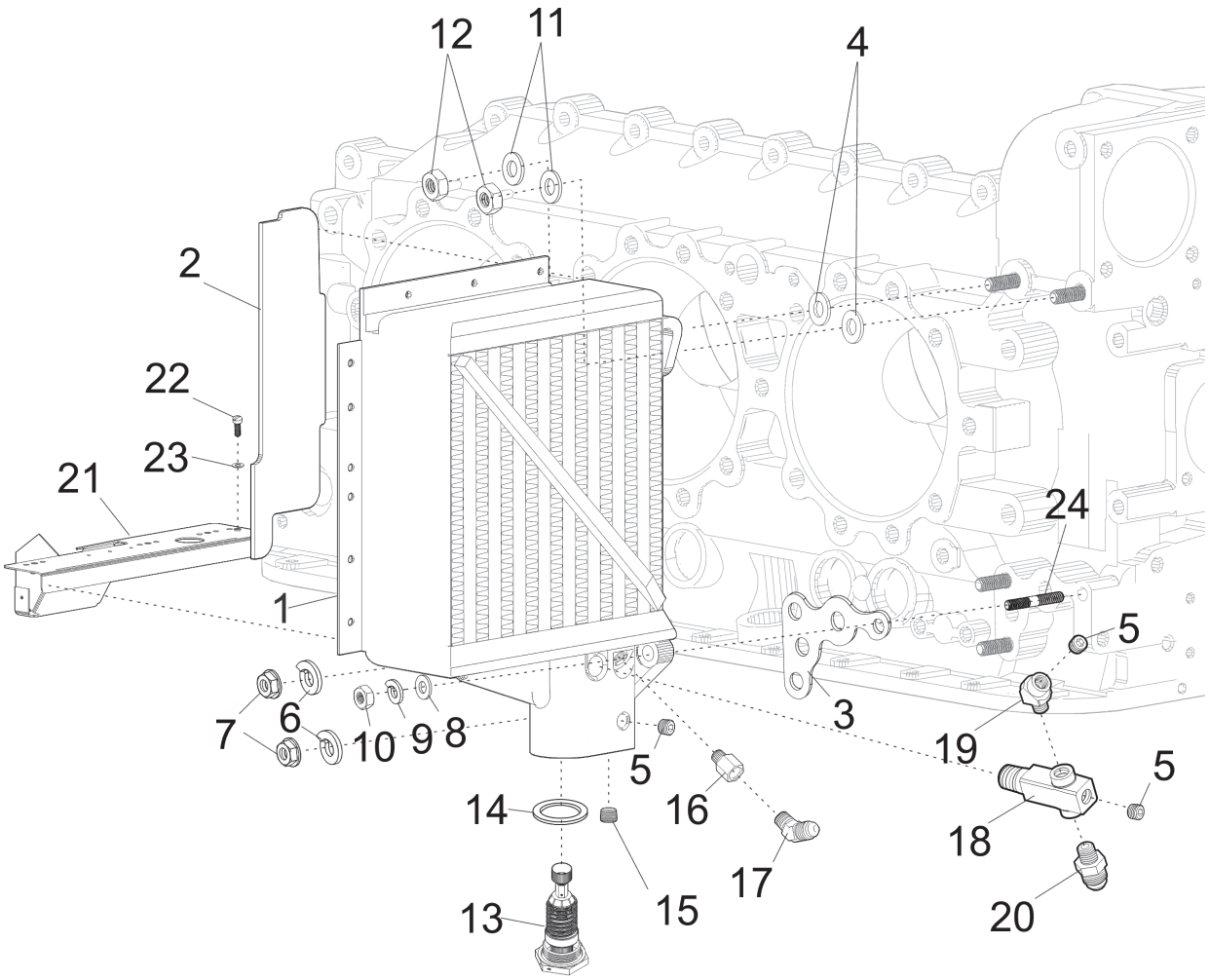
WARNING

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.



* ITEM 13 INCLUDES ITEM 14

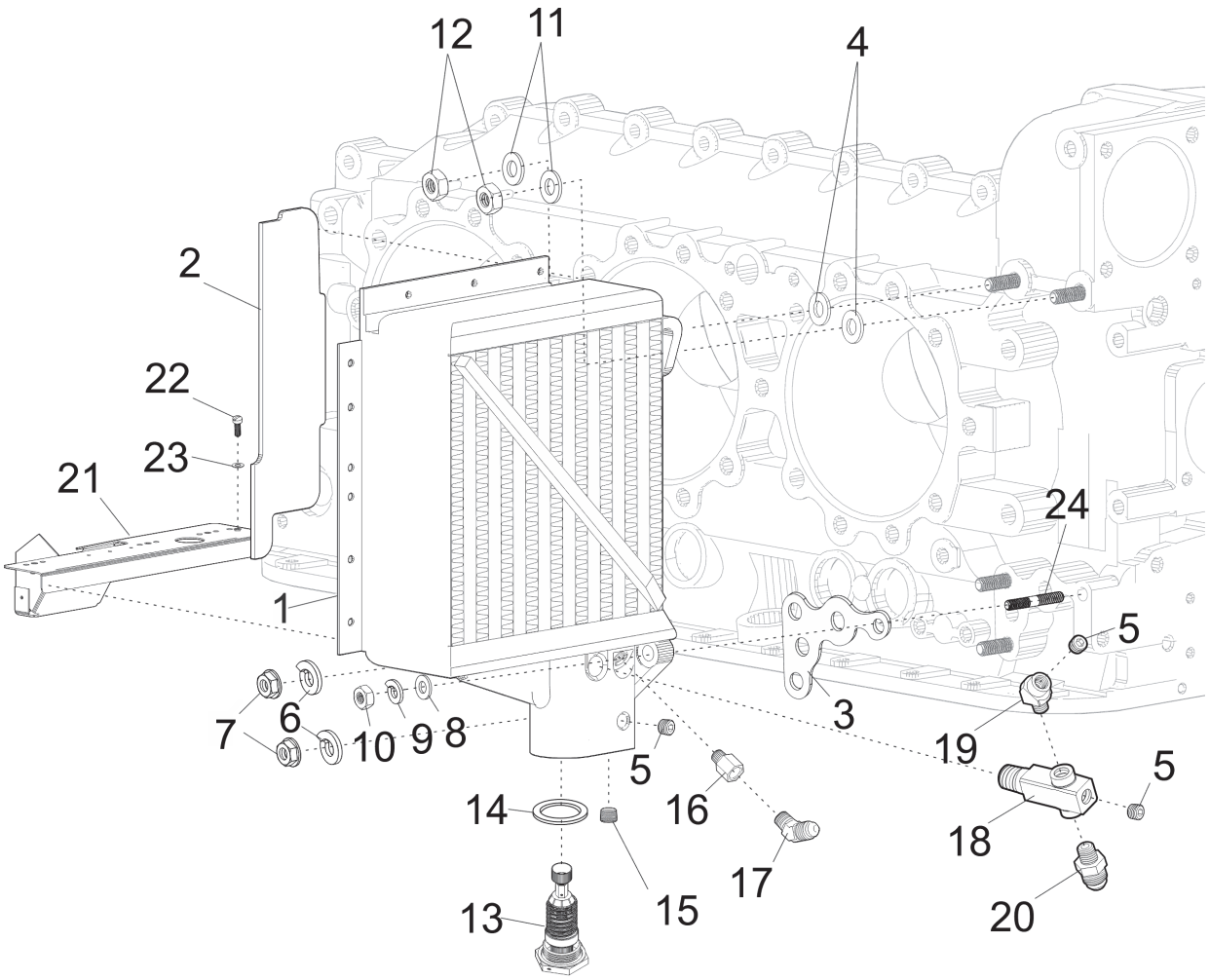
Figure 17-24. Oil Cooler N

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
3	Gasket	9	Lock Washer	15	Plug	21	Baffle
4	Gasket-Washer	10		16	Adapter Fitting	22	Screw
5	Plug	11	Washer	17	45° Elbow Fitting	23	Washer
6	Lock Washer	12	Nut	18	Cross Fitting	24	Stud

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.



* ITEM 13 INCLUDES ITEM 14

Figure 17-24 repeated for reference

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. 8082IA, 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.

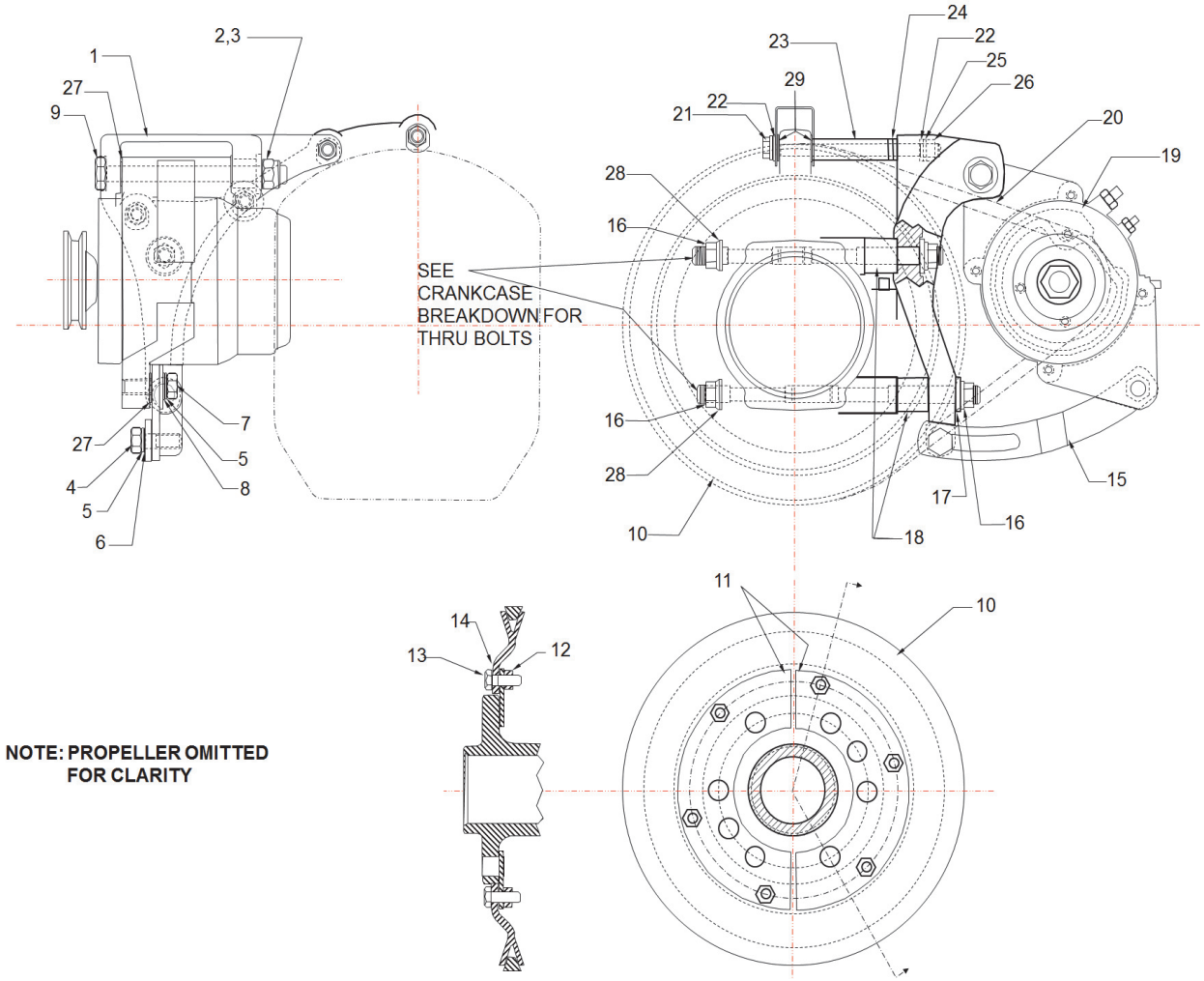


Figure 17-25. Belt-Driven Alternator Assembly (Optional)

1	Bracket Assembly	9	Bolt	17	Washer	25	Lock Washer
2	Washer	10	Sheave	18	Spacer	26	Nut
3	Nut	11	Adapter	19	Alternator Assembly	27	Shim
4	Screw	12	Lock Nut	20	V-belt	28	Washer
5	Lock Washer	13	Bolt	21	Bolt	29	Washer
6	Washer	14	Washer	22	Washer		
7	Screw	15	Adjustable Brace	23	Spacer		
8	Washer	16	Nut	24	Shim		

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".

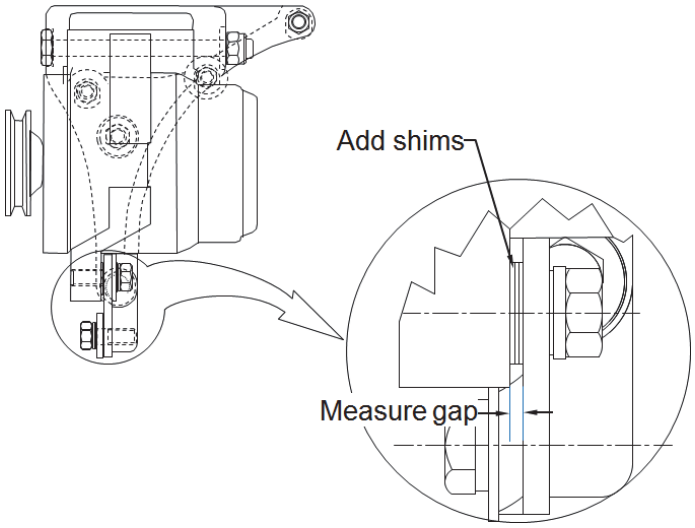


Figure 17-26. Alternator Brace Shim Location

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.

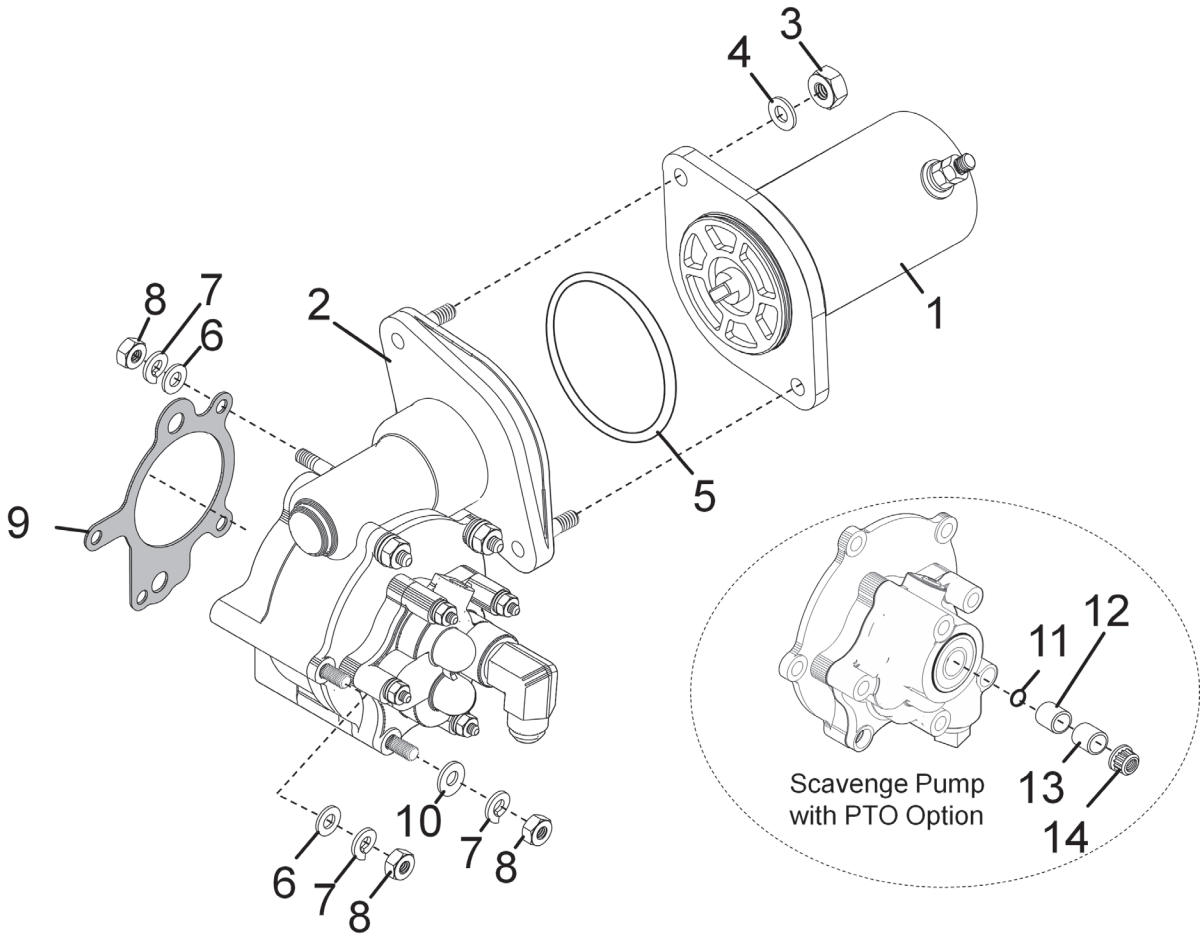


Figure 17-27. Starter and Adapter Assembly

1	Starter Motor	5	O-ring	9	Gasket	13	Spacer
2	Starter Adapter	6	Washer	10	Washer	14	Lock Nut
3	Nut	7	Lock washer	11	O-ring		
4	Washer	8	Nut	12	Sleeve		

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.

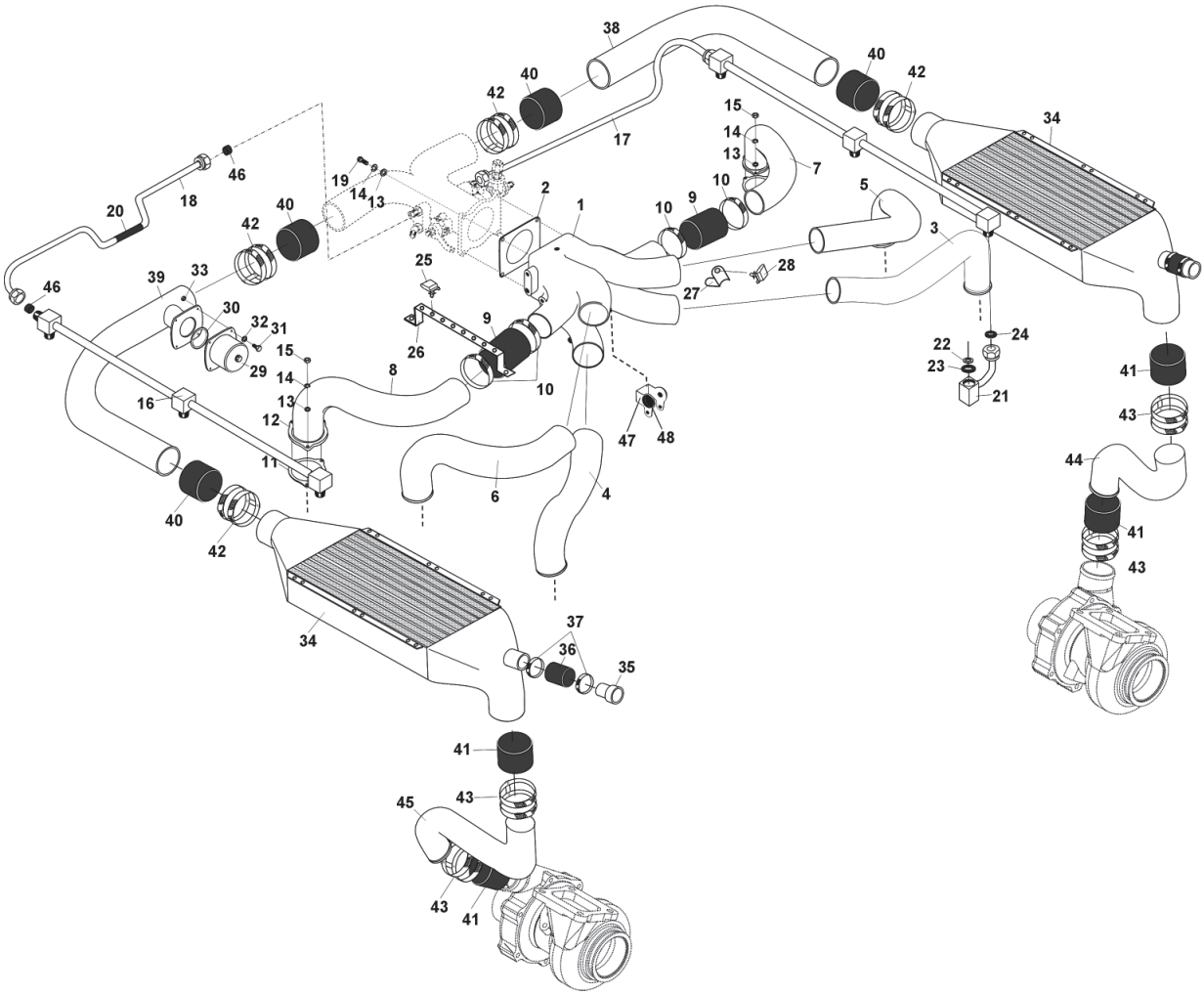


Figure 17-28. Induction System B C E K N

1	Manifold & Fitting Assembly	13	Washer	25	Clamp Assembly	37	Clamp
2	Gasket	14	Lock Washer	26	Fuel Dist. Tube Bracket	38	1-3-5 FWD Induction Tube
3	Tube	15	Nut	27	Fuel Inj. Line Bracket	39	2-4-6 FWD Induction Tube
4	Tube	16	Air Manifold Tube Assembly	28	Tube Clamp	40	Hose
5	Tube	17	Right Air Reference Tube	29	Overboost Valve	41	Hose
6	Tube	18	Left Air Reference Tube	30	O-ring	42	Clamp Assembly
7	Tube	19	Screw	31	Bolt	43	Clamp Assembly
8	Tube	20	Hose	32	Washer	44	1-3-5 AFT Induction Tube
9	Hose	21	Sleeve Assembly	33	Lock Nut	45	2-4-6 AFT Induction Tube
10	Hose Clamp	22	Washer	34	Aftercooler Assembly	46	Compression Seal
11	Intake Manifold Gasket	23	Washer	35	Sonic Venturi Nozzle	47	Manifold Locator Bracket
12	Flange	24	Compression Seal	36	Hose	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.

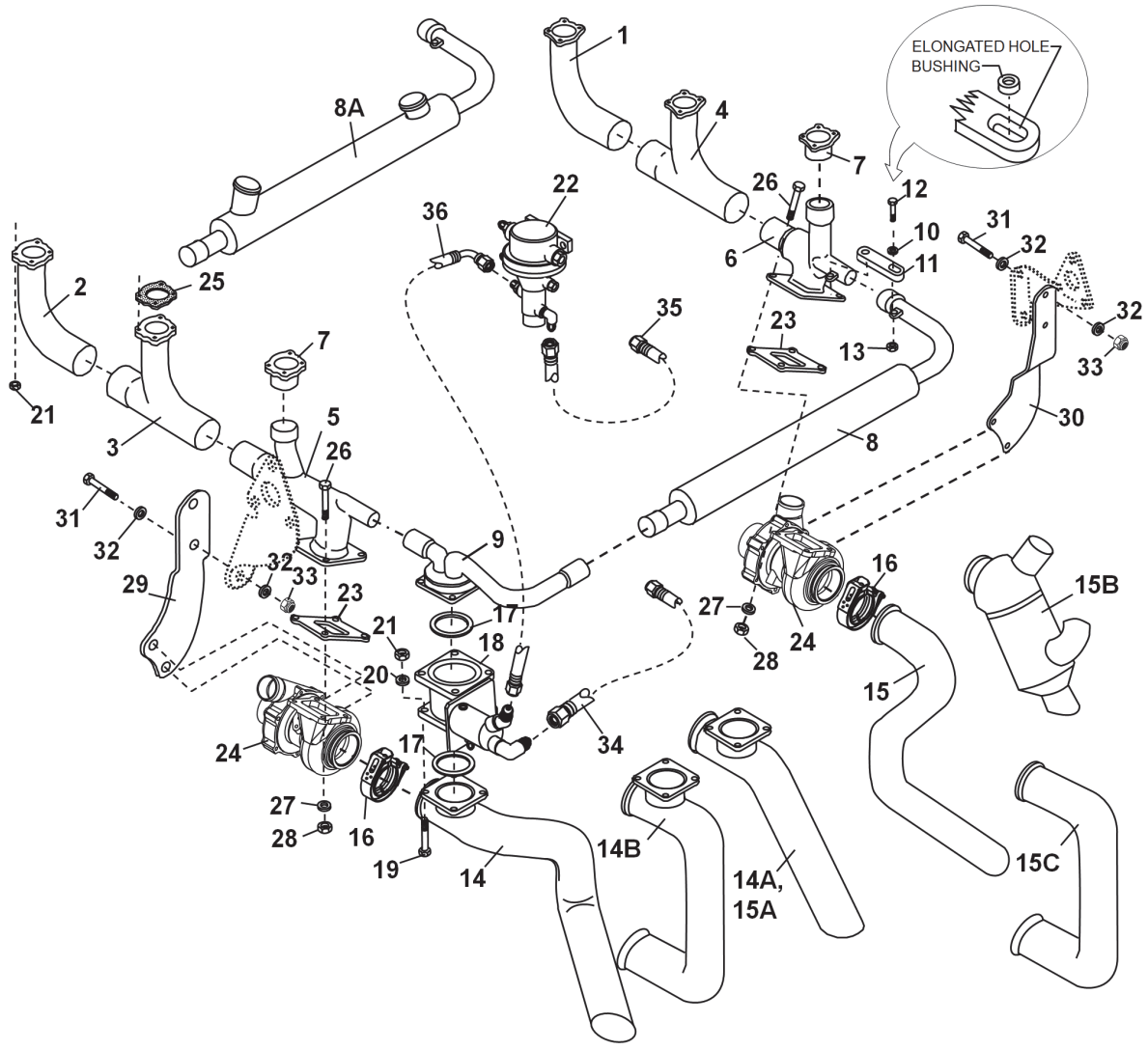


Figure 17-29. Composite Turbocharger and Exhaust System

1	Elbow Riser	10	Bushing	17	Gasket	28	Lock Nut
2	Elbow Riser	11	Tie Rod	18	Wastegate Assembly	29	Bracket
3	Tee Assembly	12	Bolt	19	Bolt	30	Bracket
4	Tee Assembly	13	Lock Nut	20	Washer	31	Screw
5	Turbo Transition	14	Contoured Tailpipe	21	Lock Nut	32	Washer
6	Turbo Transition	14C	Inverse Tailpipe Option	22	Controller	33	Lock Nut
7	Riser	15	Contoured Tailpipe	23	Gasket	34	Hose
8	Crossover Assembly	15A	Straight Tailpipe	24	Turbocharger Assembly	35	Hose
8A	Crossover Assy with Heater Shroud Option	15B	Heater	25	Gasket	36	Hose
9	Transition	15C	Inverse Tailpipe Option	26	Bolt		
		16	V-band clamp	27	Washer		

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.

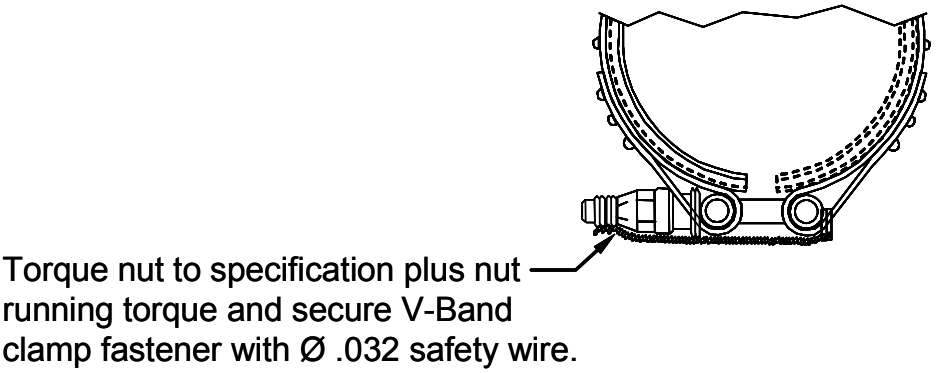


Figure 17-30. V-Band Clamp Safety Wire Detail

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.

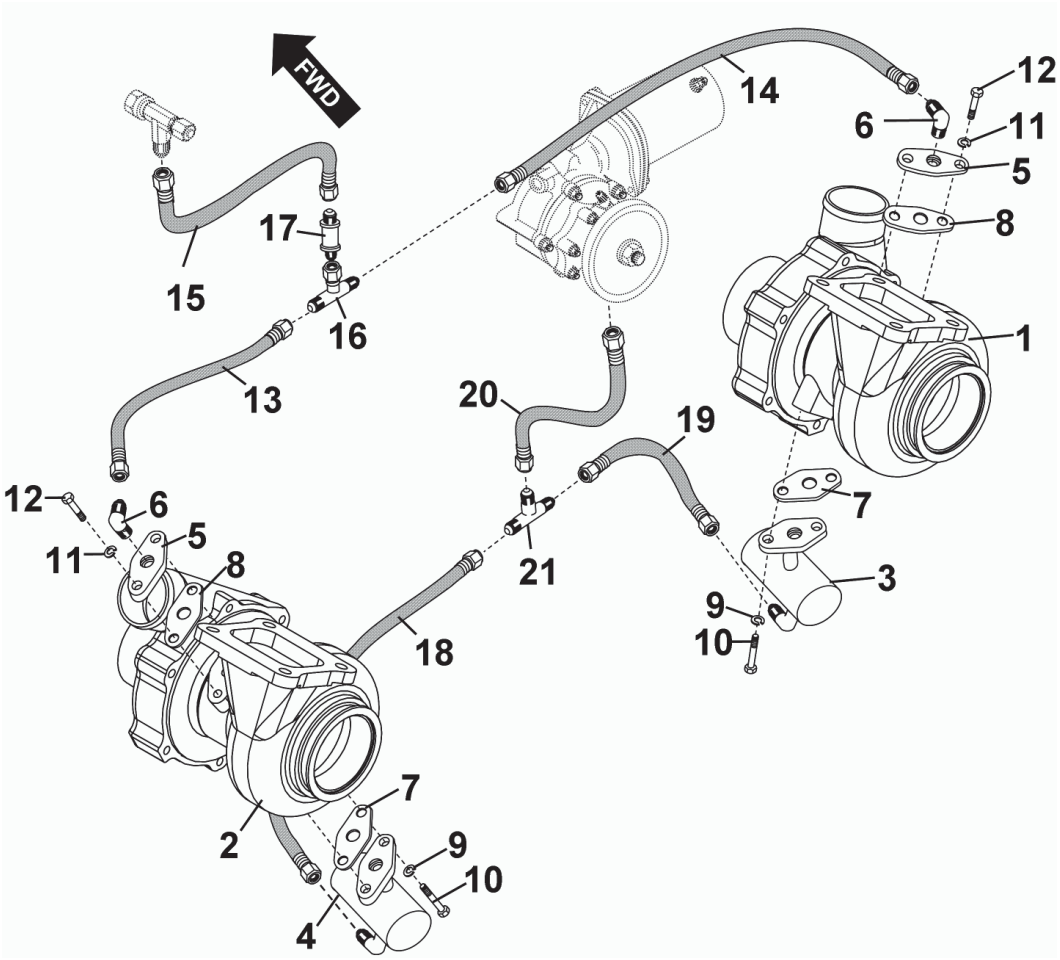


Figure 17-31. Turbocharger Lubrication B C E G

1	Left Turbocharger	7	Gasket	13	Tee	19	Hose
2	Right Turbocharger	8	Left Oil Reservoir	14	Check Valve	20	Hose
3	Gasket	9	Right Oil Reservoir	15	Hose	21	Hose
4	Adapter	10	Lock Washer	16	Hose		
5	Lock Washer	11	Bolt	17	Hose		
6	Bolt	12	Adapter	18	Tee		

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.

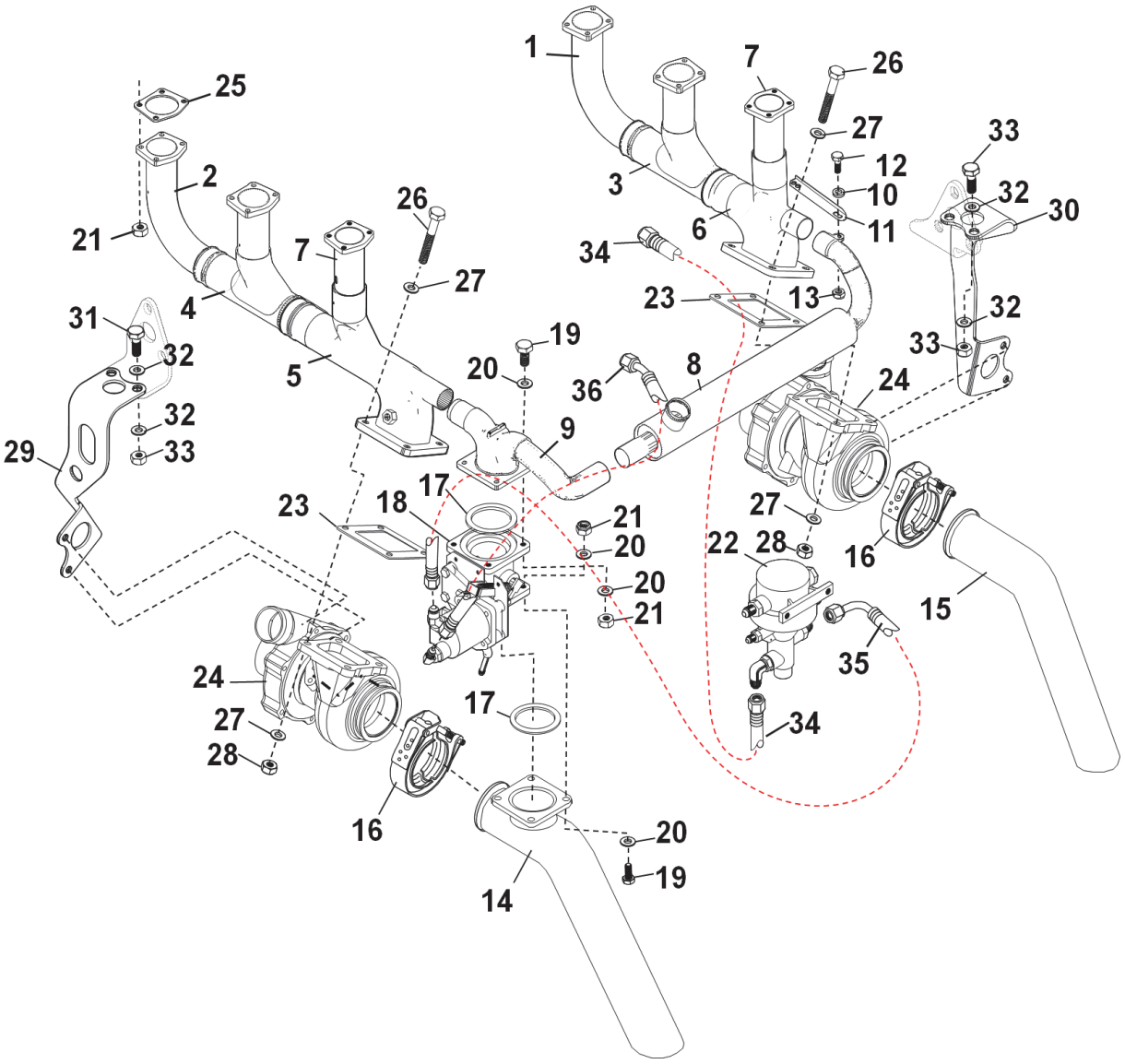


Figure 17-32. Turbocharger and Exhaust System

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.

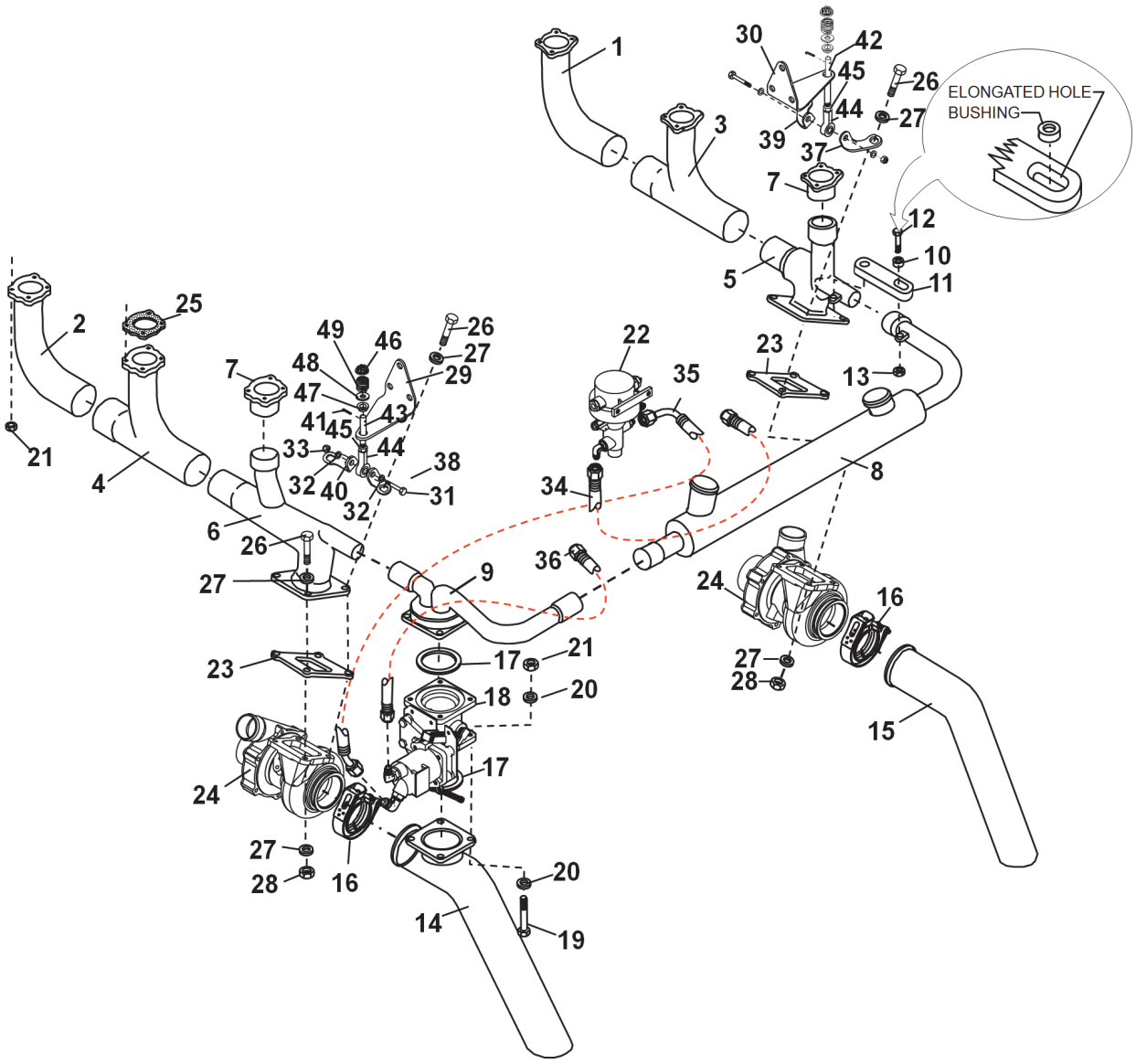


Figure 17-33. Turbocharger and Exhaust System

1	Elbow Riser	11	Tie Rod	19	Bolt	31	Screw
2	Elbow Riser	12	Bolt	20	Washer	32	Washer
3	Tee Assembly	13	Lock Nut	21	Lock Nut	33	Lock Nut
4	Tee Assembly	14	Contoured Tailpipe	22	Controller	34	Hose
5	Turbo Transition	14C	Inverse Tailpipe Option	23	Gasket	35	Hose
6	Turbo Transition	15	Contoured Tailpipe	24	Turbocharger Assembly	36	Hose
7	Riser	15A	Straight Tailpipe	25	Gasket		
8	Crossover Assembly	15B	Heater	26	Bolt		
8A	Crossover Assy with Heater Shroud Option	15C	Inverse Tailpipe Option	27	Washer		
		16	V-band clamp	28	Lock Nut		
9	Transition	17	Gasket	29	Bracket		
10	Bushing	18	Wastegate Assembly	30	Bracket		

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

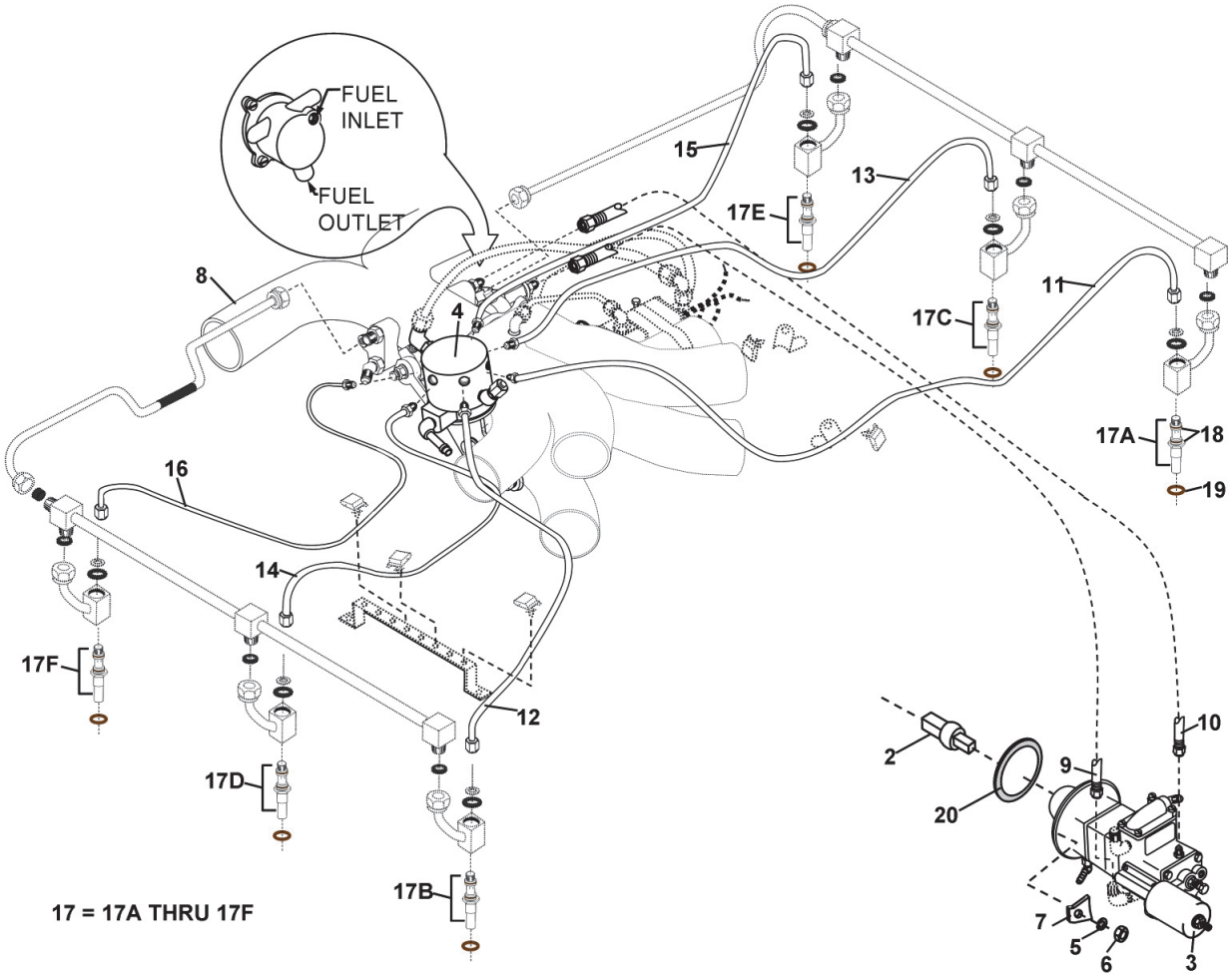


Figure 17-34. Fuel Injection System B C E

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		

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.

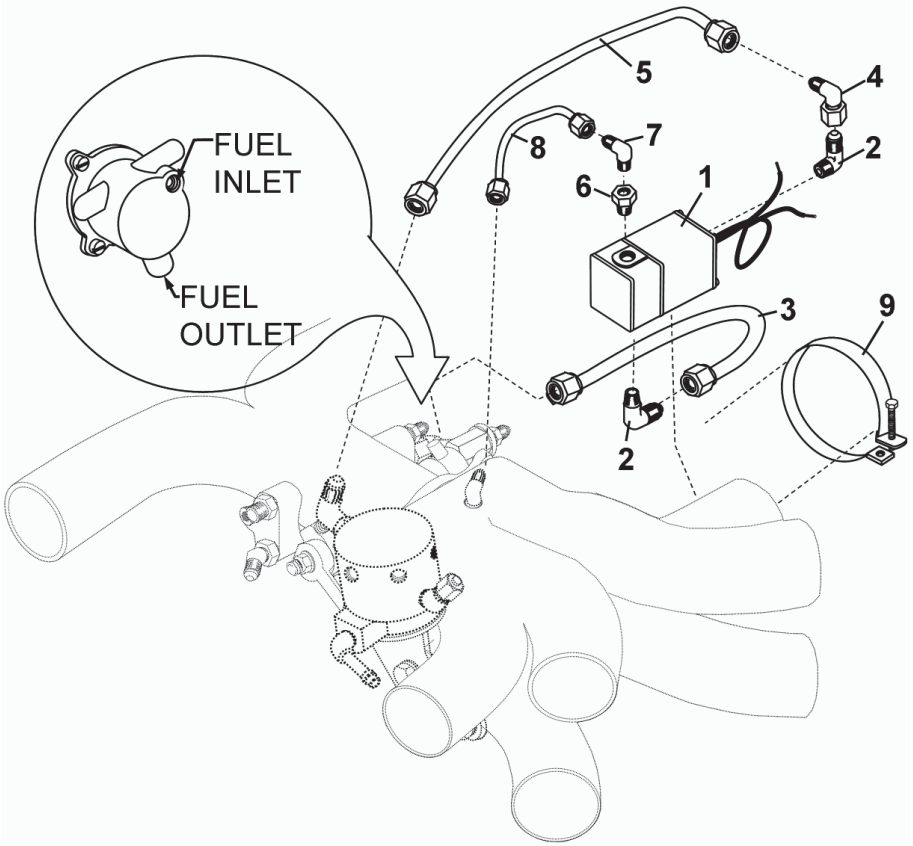


Figure 17-35. Fuel Priming System B C E

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

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

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-IA 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.

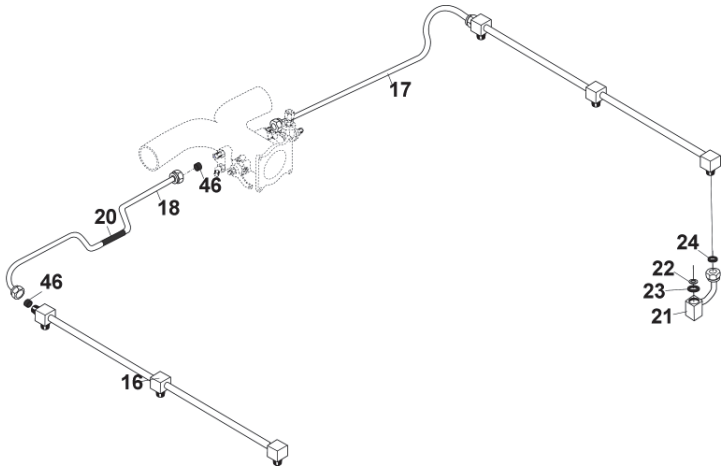


Figure 17-37. Air Reference Tubes
See Figure 17-28 for index

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.

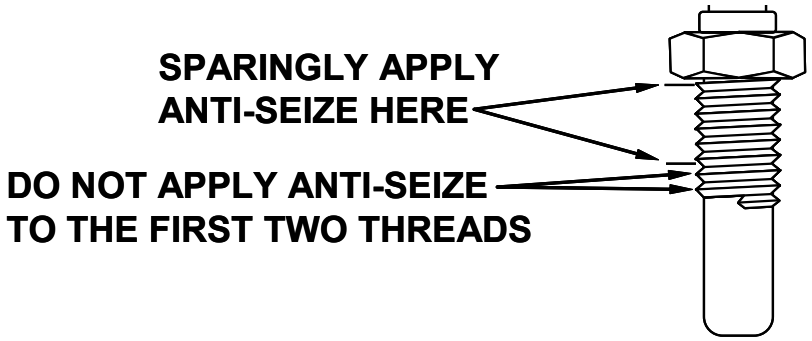


Figure 17-36 repeated for reference

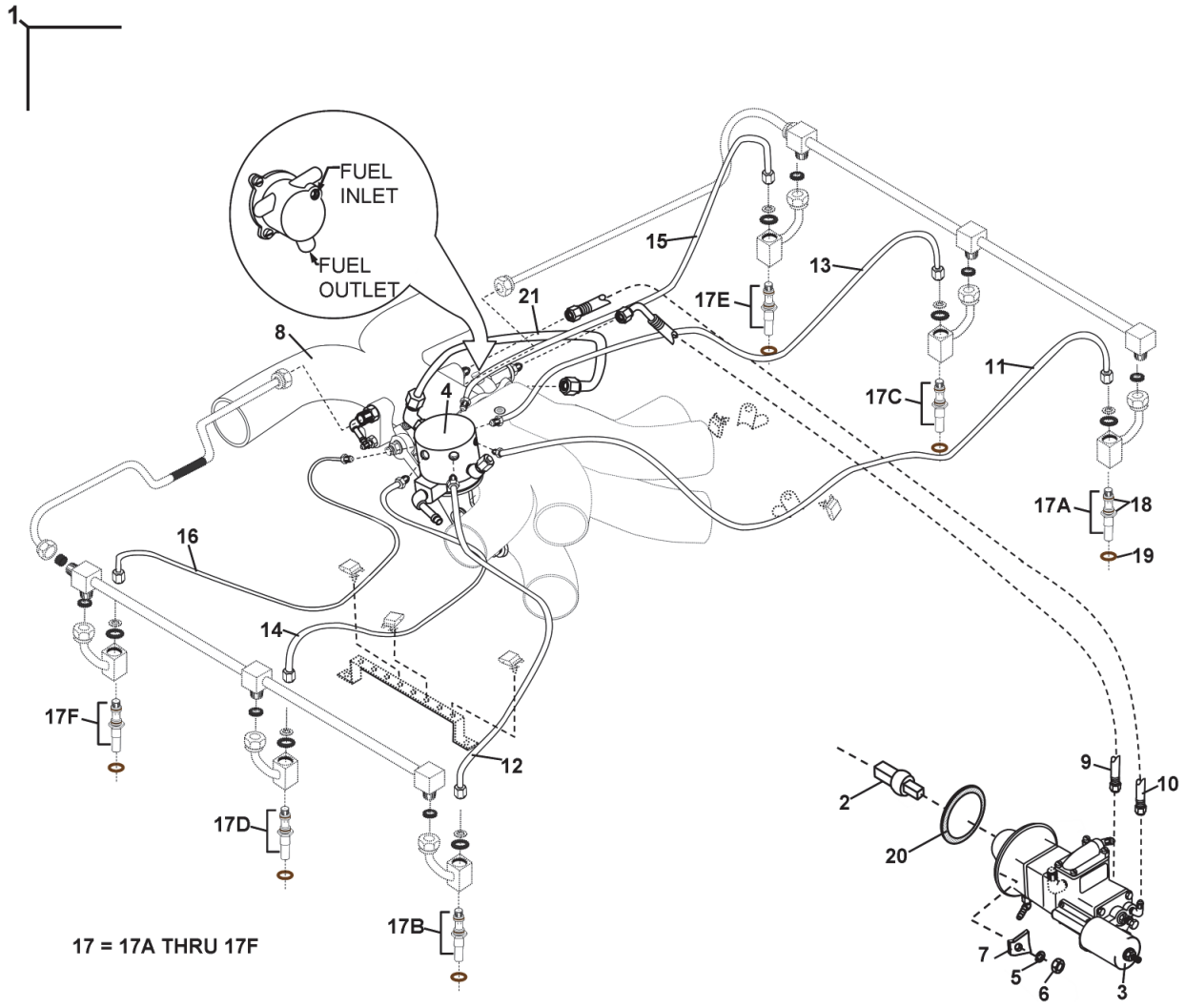


Figure 17-38. Fuel Injection System G

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		

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.

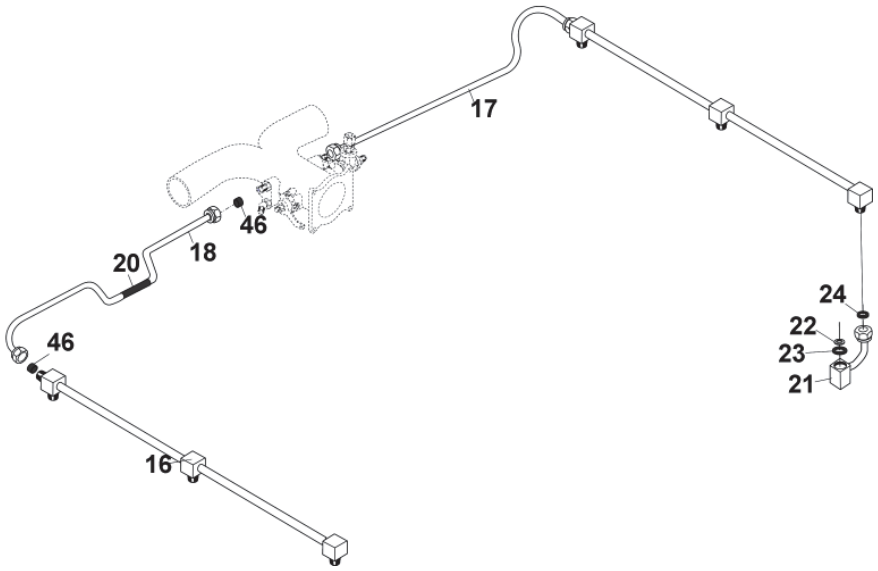


Figure 17-37 repeated for reference

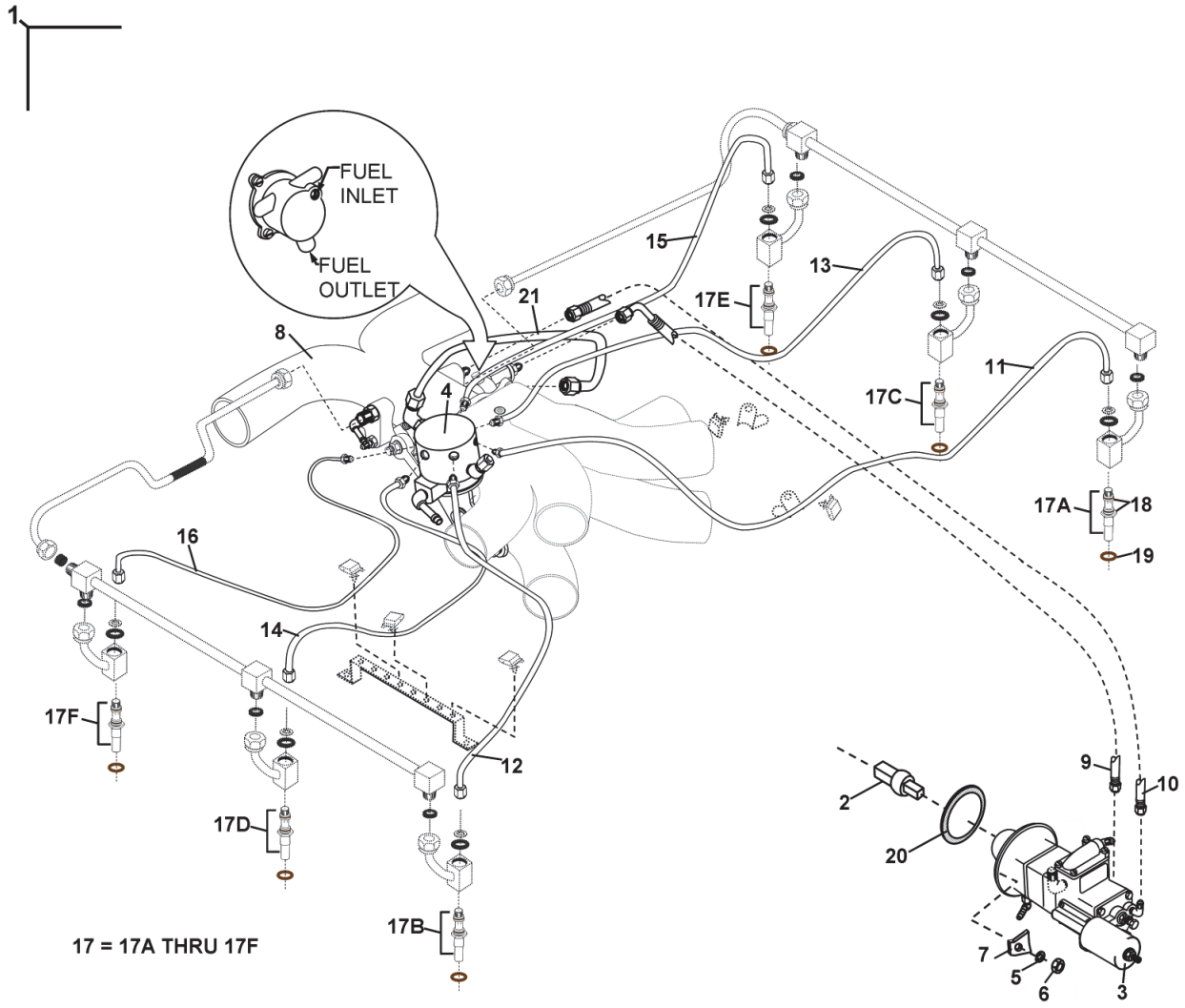


Figure 17-38 repeated for reference

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.

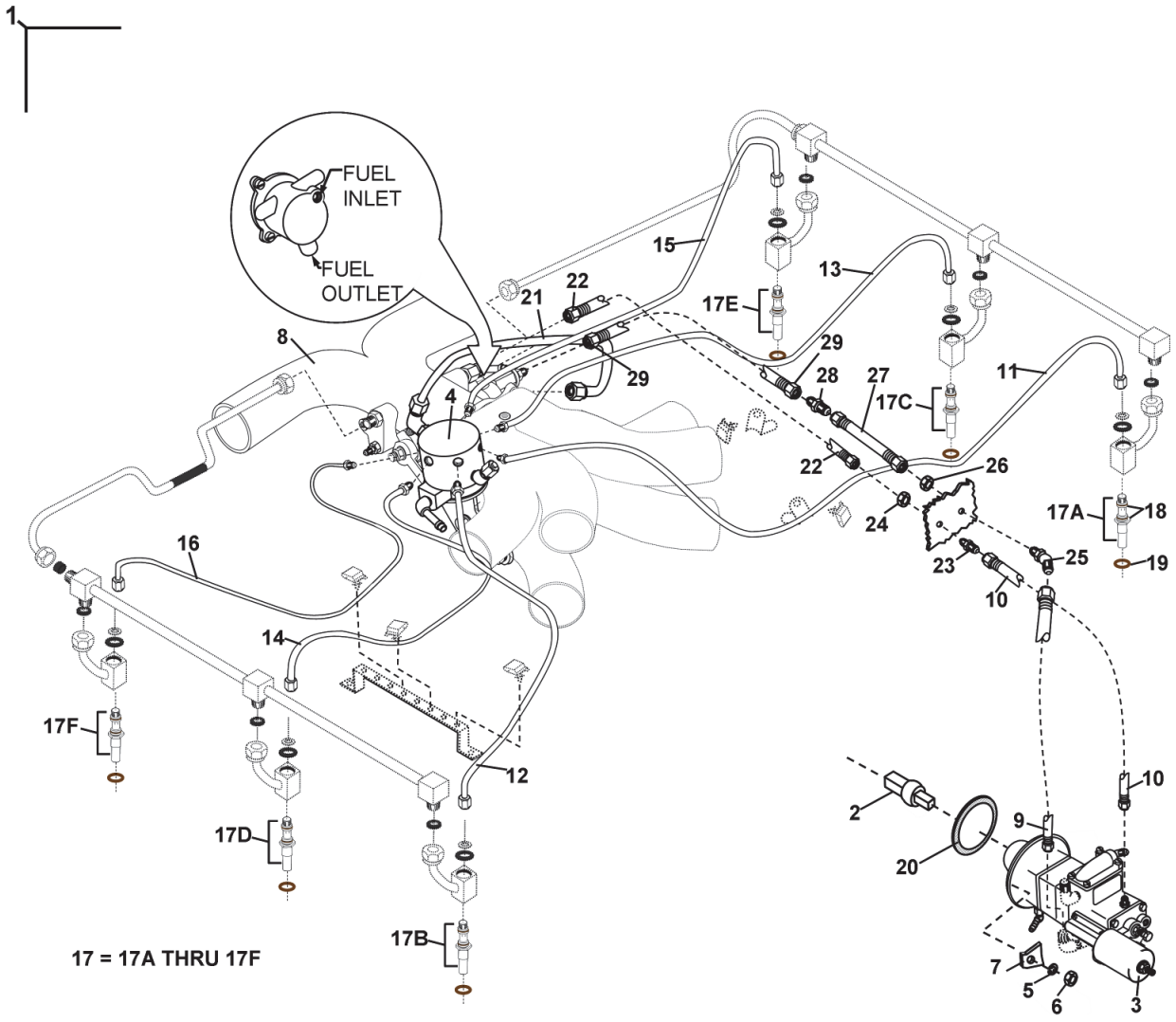


Figure 17-39. Fuel Injection System K N

1	Fuel Injection Kit	10	Hose Assembly	17B	Injector Nozzle #2	22	Hose Assembly
2	Crankshaft Gear Coupling	11	Fuel Inj. Tube Assembly #1	17C	Injector Nozzle #3	23	Bulkhead Union
3	Fuel Pump Assembly	12	Fuel Inj. Tube Assembly #2	17D	Injector Nozzle #4	24	Bulkhead Nut
4	Fuel Manifold Valve Assy.	13	Fuel Inj. Tube Assembly #3	17E	Injector Nozzle #5	25	Bulkhead 45° Fitting
5	Lock Washer	14	Fuel Inj. Tube Assembly #4	17F	Injector Nozzle #6	26	Bulkhead Nut
6	Nut	15	Fuel Inj. Tube Assembly #5	18	Washer	27	Hose Assembly
7	Hold Down Washer	16	Fuel Inj. Tube Assembly #6	19	O-Ring	28	Bulkhead Union
8	Throttle & Metering Assembly	17	Injector Nozzle Kit	20	Fuel Pump Adapter Gasket	29	Hose Assembly
9	Hose Assembly	17A	Injector Nozzle #1	21	Fuel Tube		

Figure 17-36 repeated for reference

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.

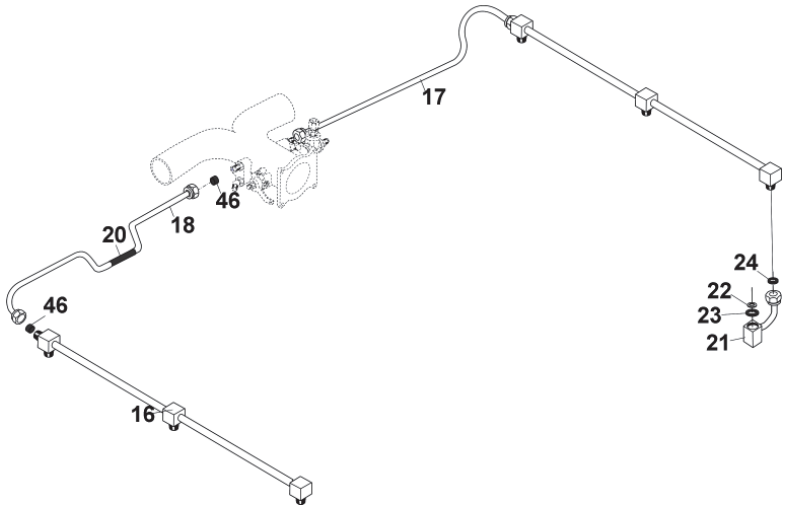


Figure 17-37 repeated for reference

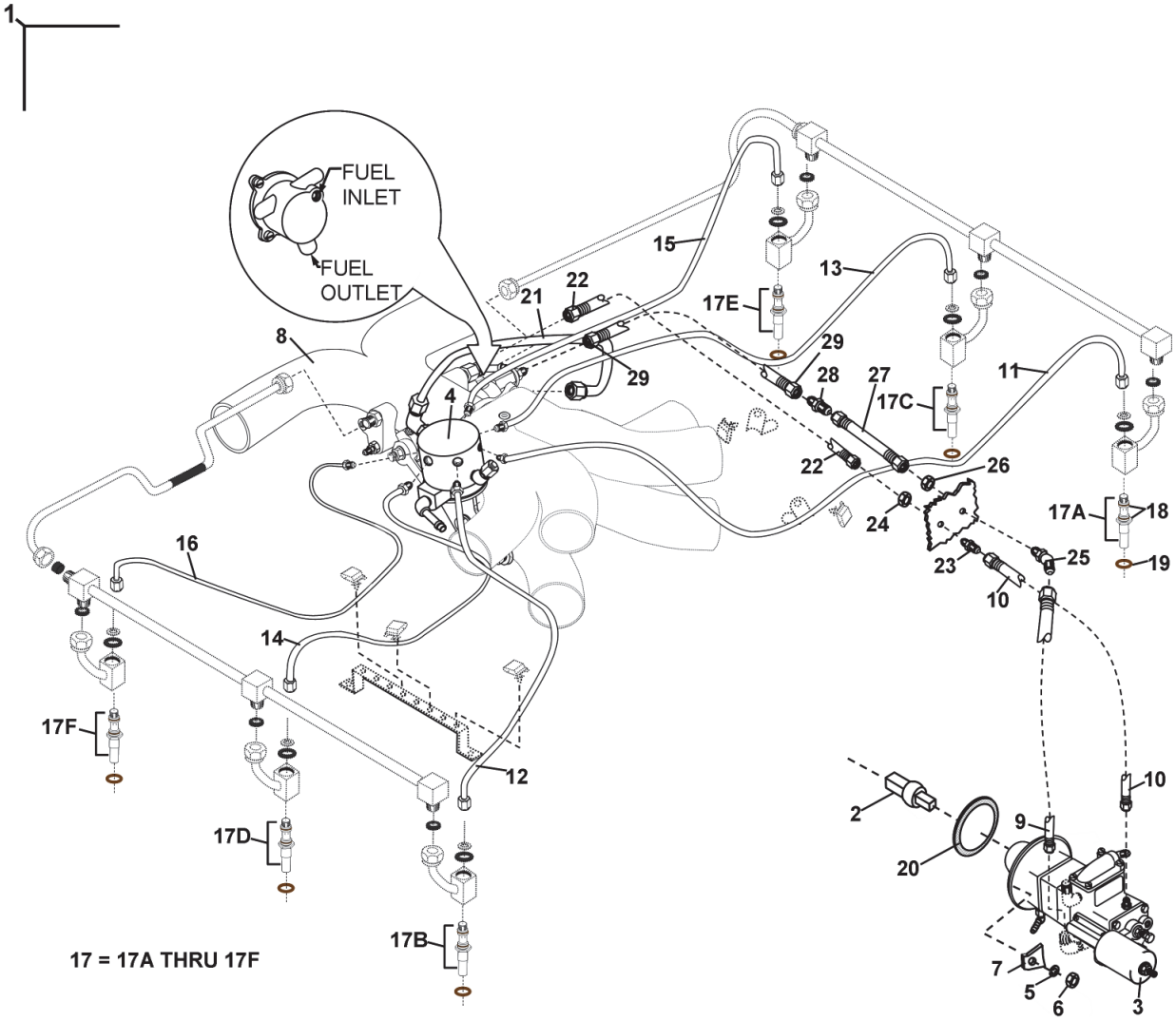


Figure 17-39 repeated for reference

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.

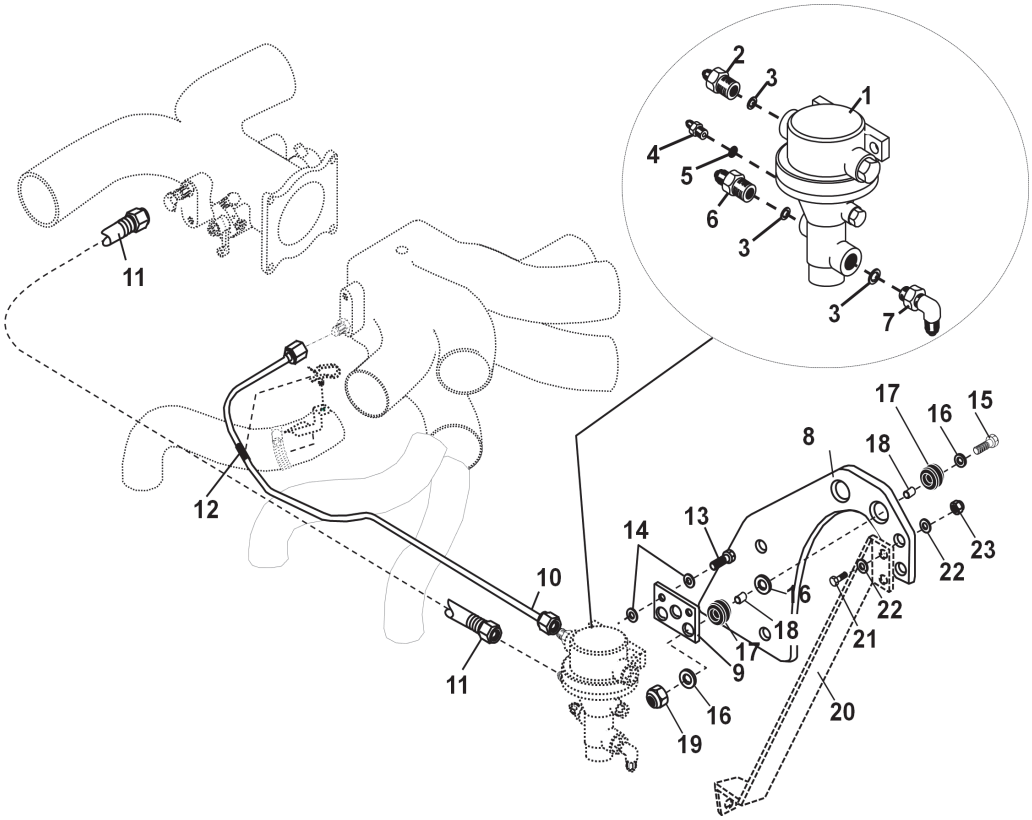


Figure 17-40. Wastegate Controller B C E G

1	Controller	7	90° Elbow Fitting	13	Bolt	19	Lock Nut
2	Reducer	8	Bracket	14	Washer	20	Bracket
3	O-Ring	9	Bracket	15	Bolt	21	Bolt
4	Adapter	10	Tube Assembly	16	Washer	22	Washer
5	O-Ring	11	Hose Assembly	17	Grommet	23	Lock Nut
6	Adapter Fitting	12	Line Protector	18	Spacer		

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.

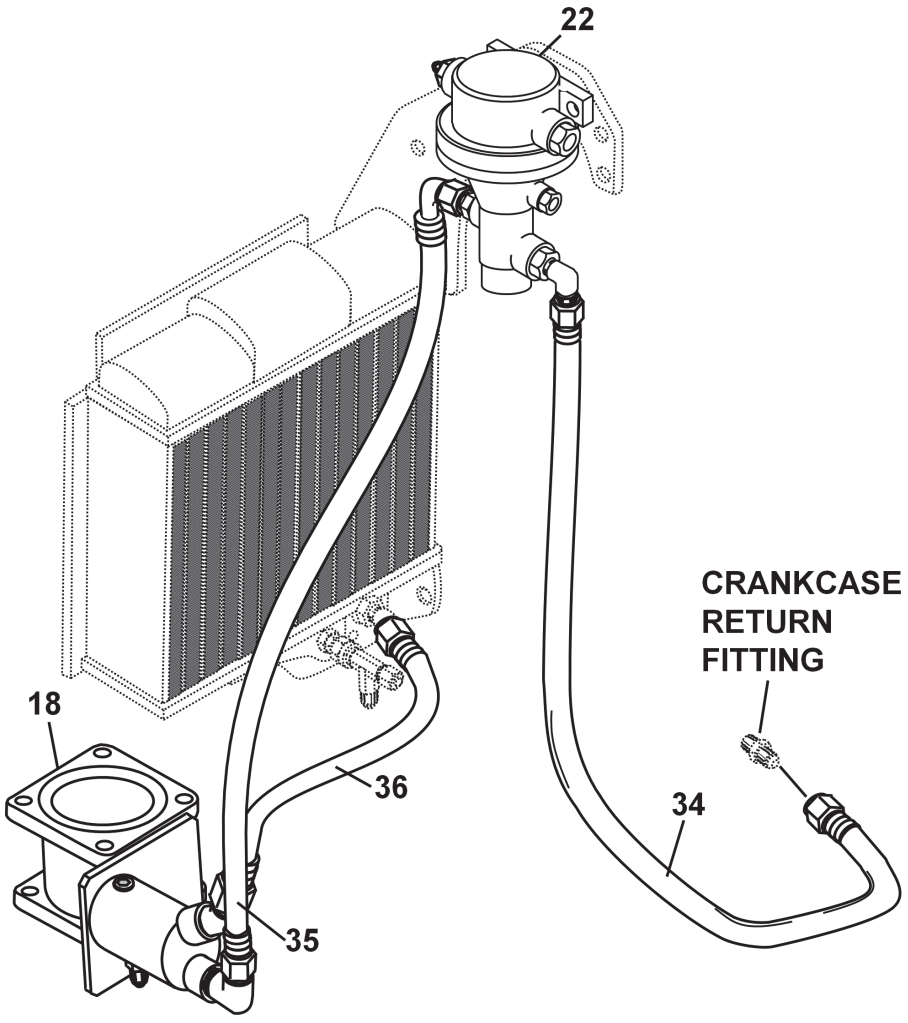


Figure 17-41. Wastegate Controller Lubrication

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).

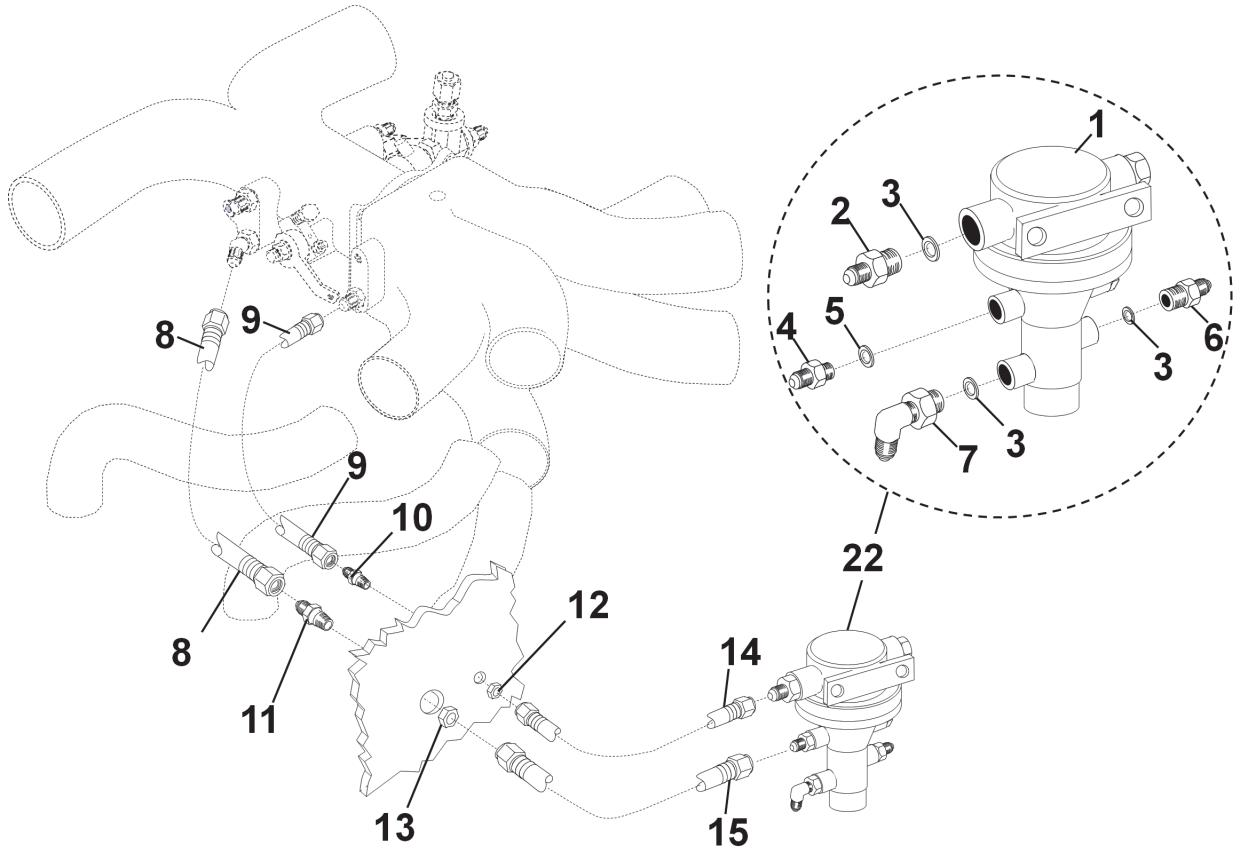


Figure 17-42. Wastegate Controller Hydraulic Hose Installation K

1	Controller	5	O-Ring Seal	9	Hose Assembly	13	Bulkhead Nut
2	Reducer	6	Adapter Fitting	10	Bulkhead Union	14	Hose Assembly
3	O-Ring Seal	7	Elbow	11	Bulkhead Union	15	Hose Assembly
4	#4 Tube Adapter	8	Hose Assembly	12	Bulkhead Nut		

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.

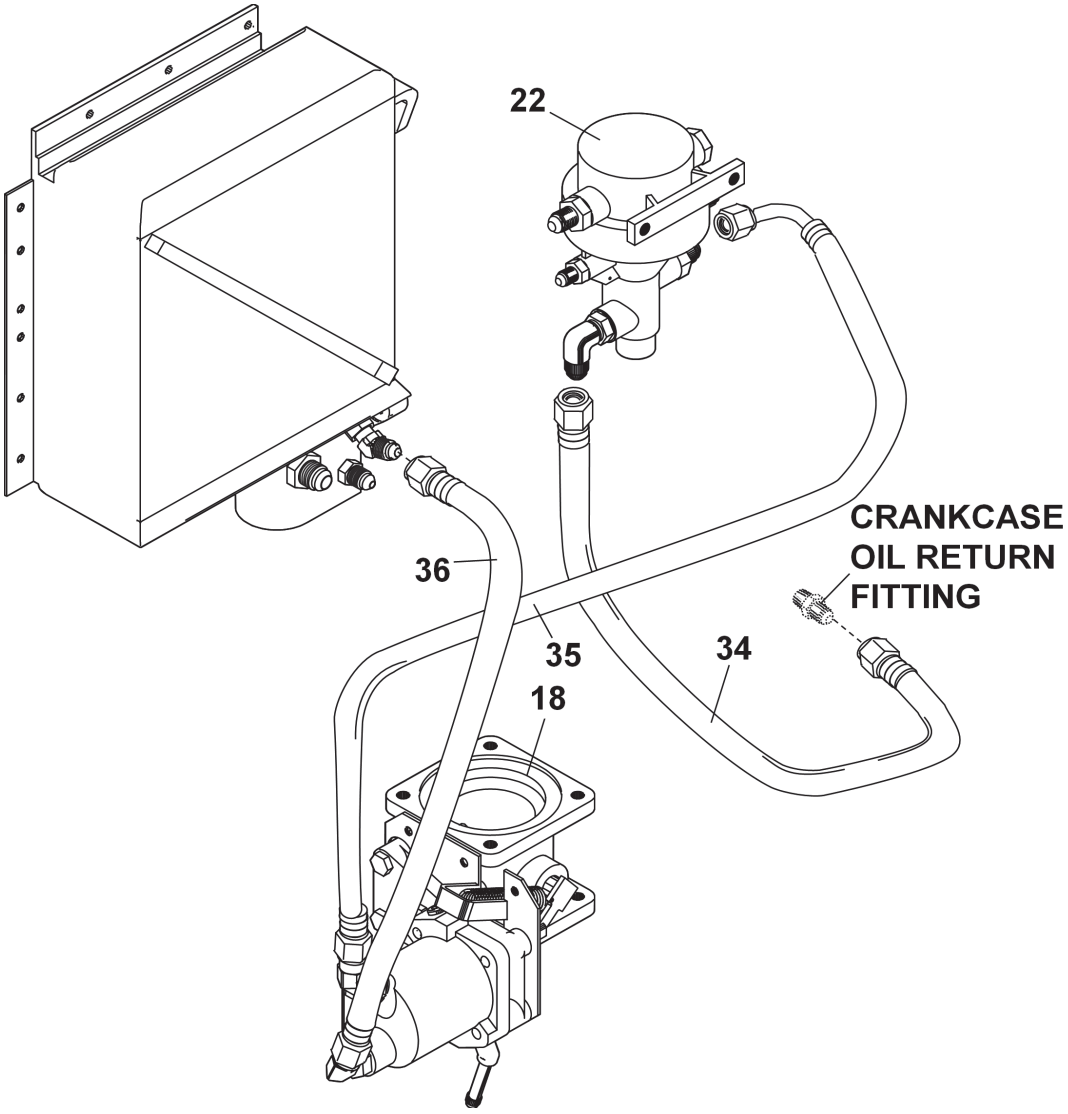


Figure 17-43. Wastegate Controller Lubrication K

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).

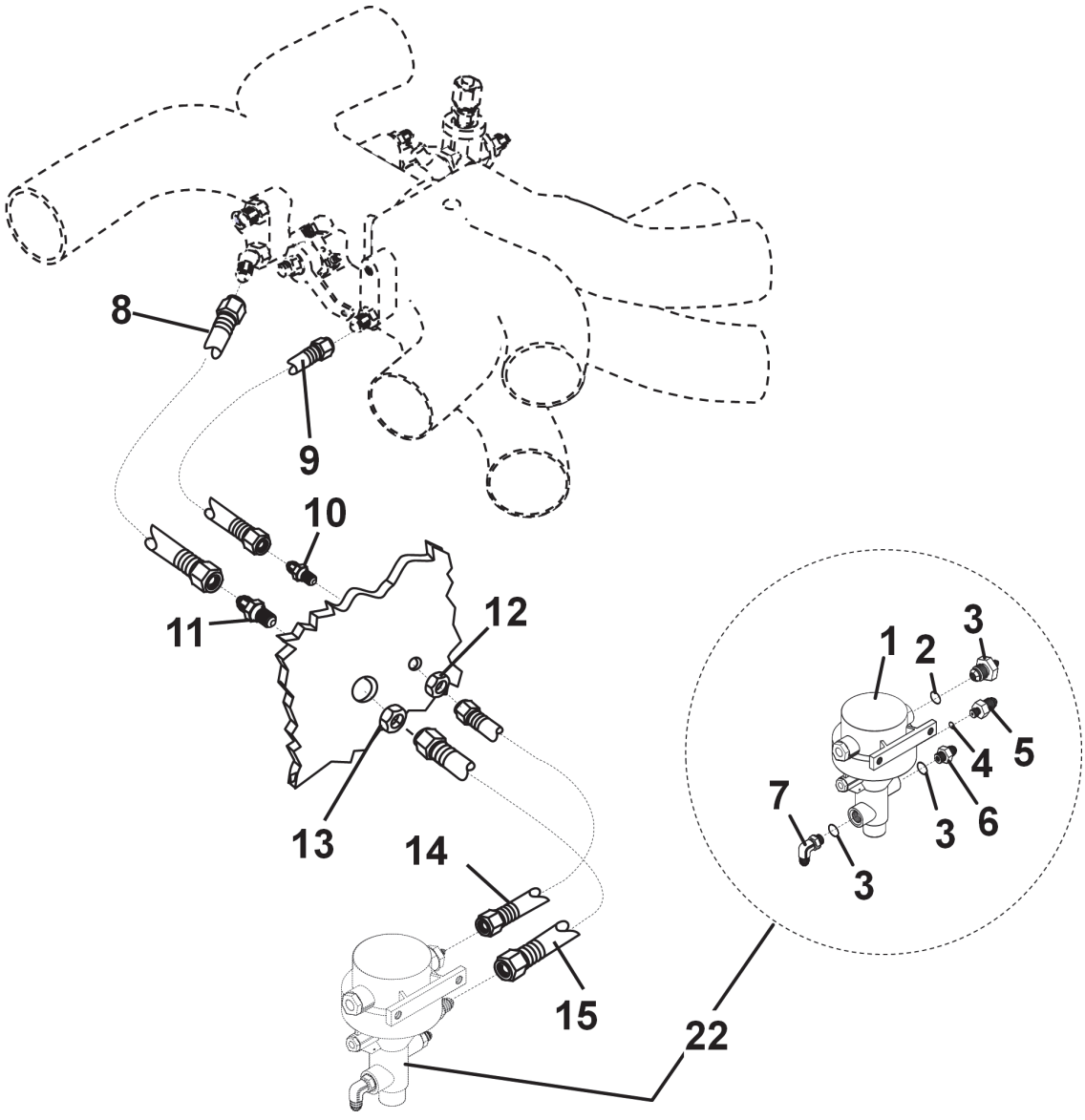


Figure 17-44. Wastegate Controller Hydraulic Hose Installation N

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.

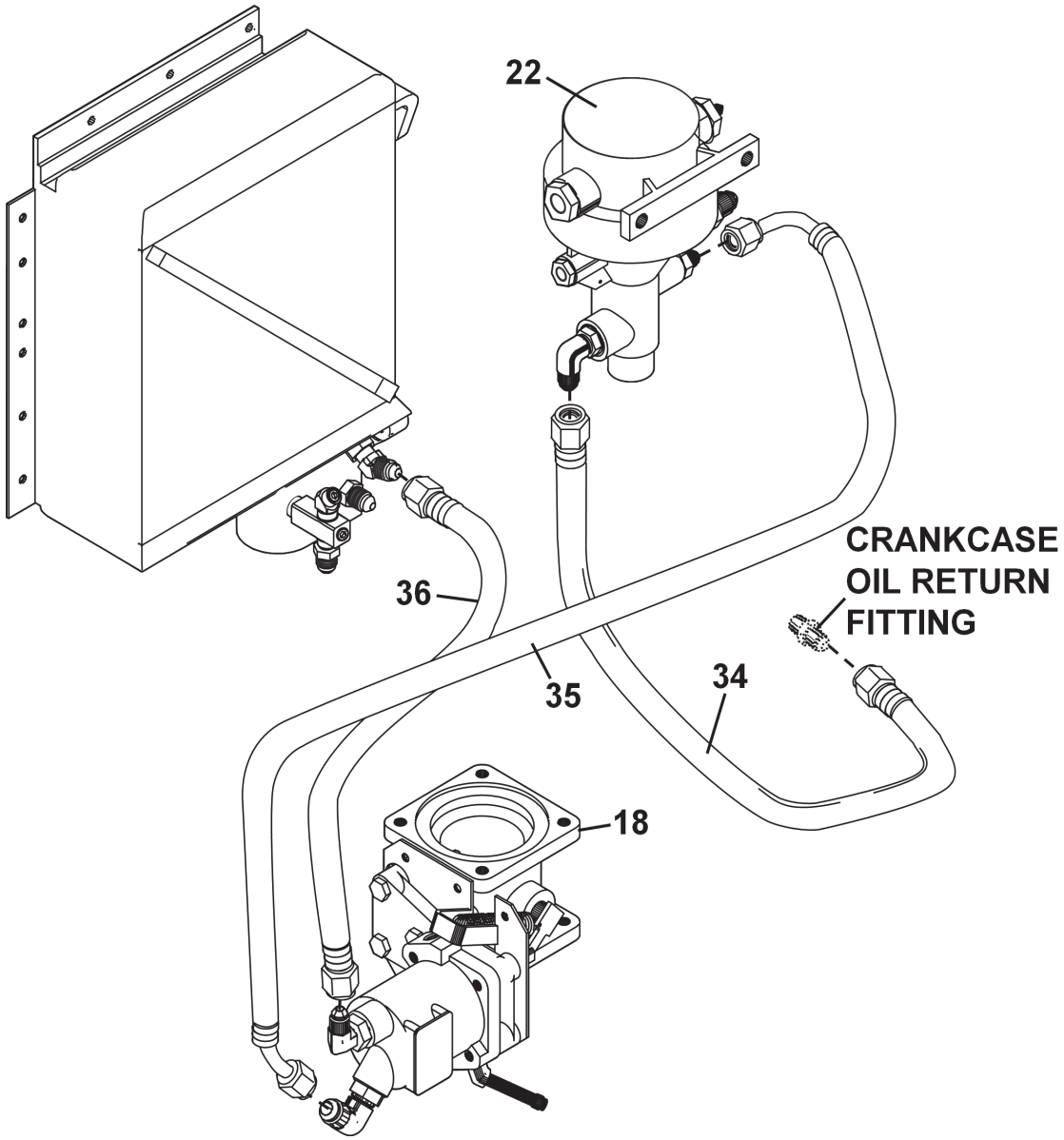


Figure 17-45. Wastegate Controller Lubrication N

17-13. Air/Oil Separator Installation

NOTE: K N 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).

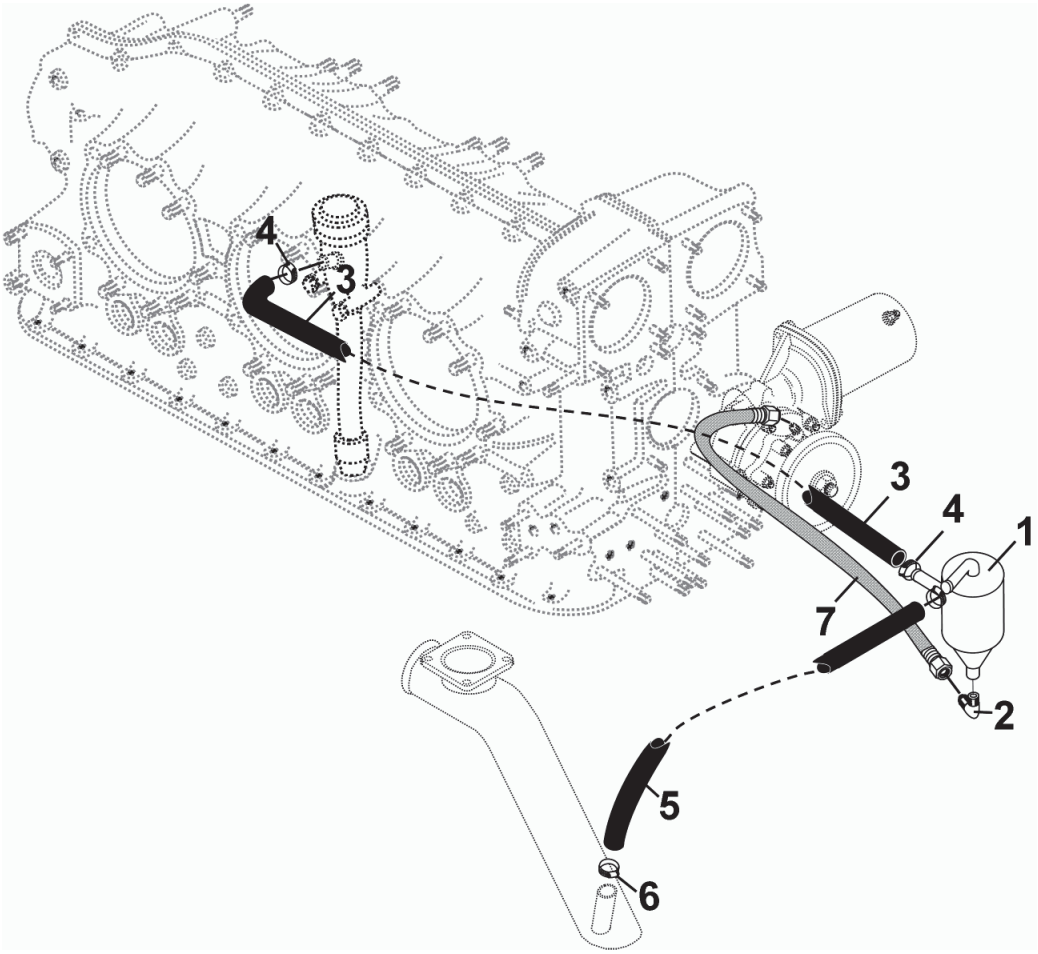


Figure 17-46. Air/Oil Separator B C E G

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 **B C E G** bottom or **K N** 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.

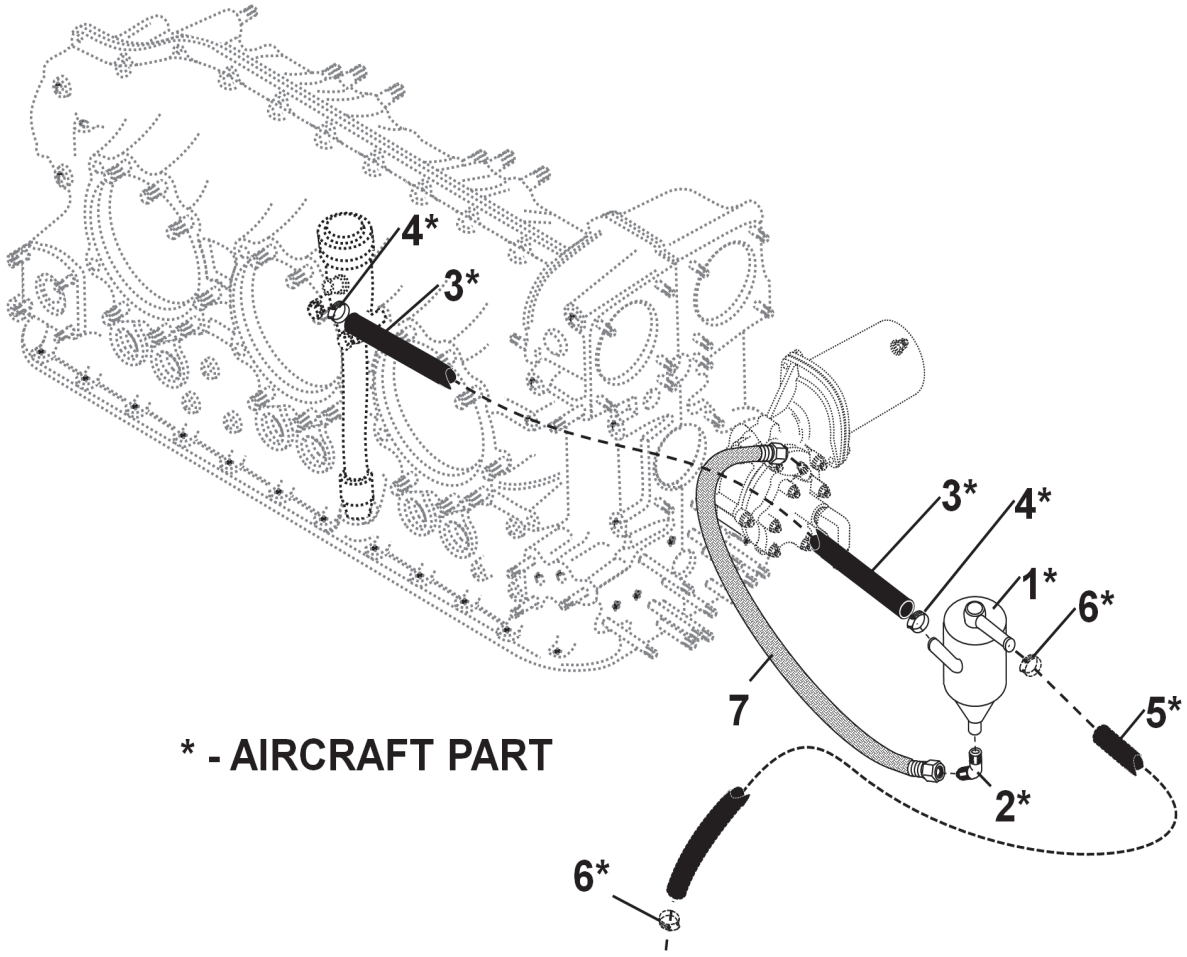


Figure 17-47. Air/Oil Separator K

1	Air/Oil Separator Assembly	3	Hose Assembly	5	Hose Assembly	7	Hose
2	Elbow Fitting	4	Hose Clamp	6	Hose Clamp		

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.

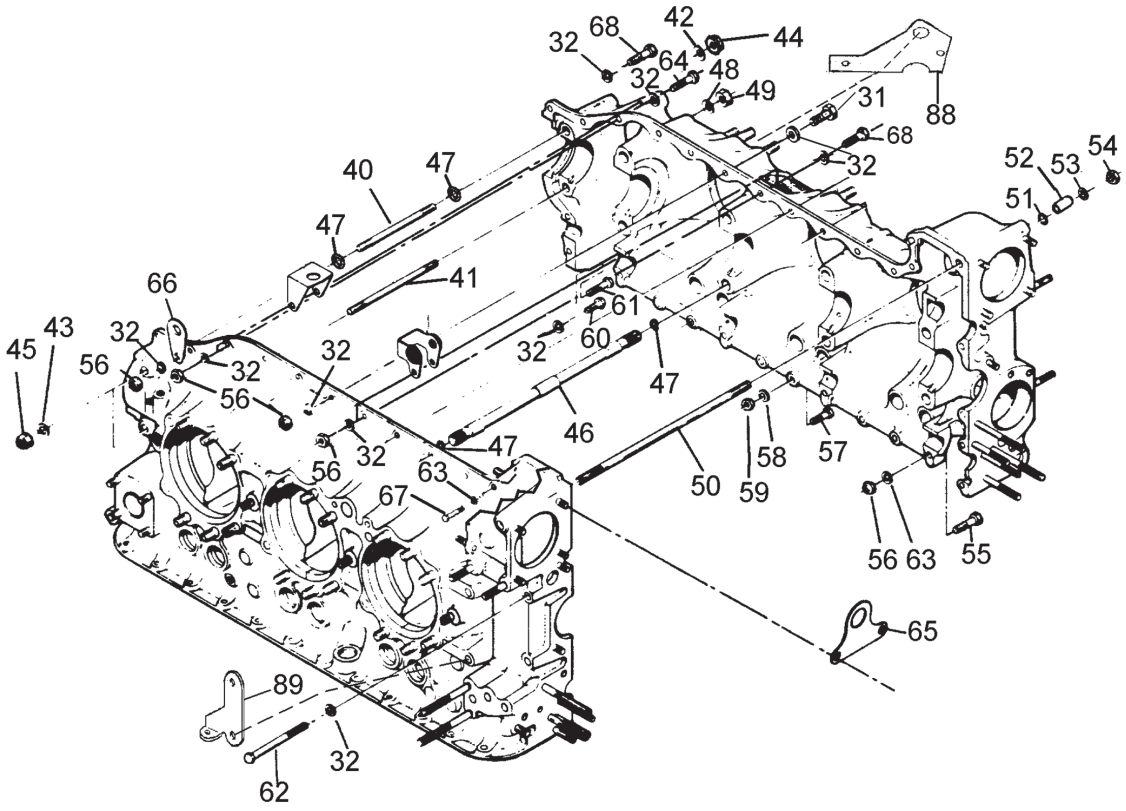


Figure 17-8 repeated for reference

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.

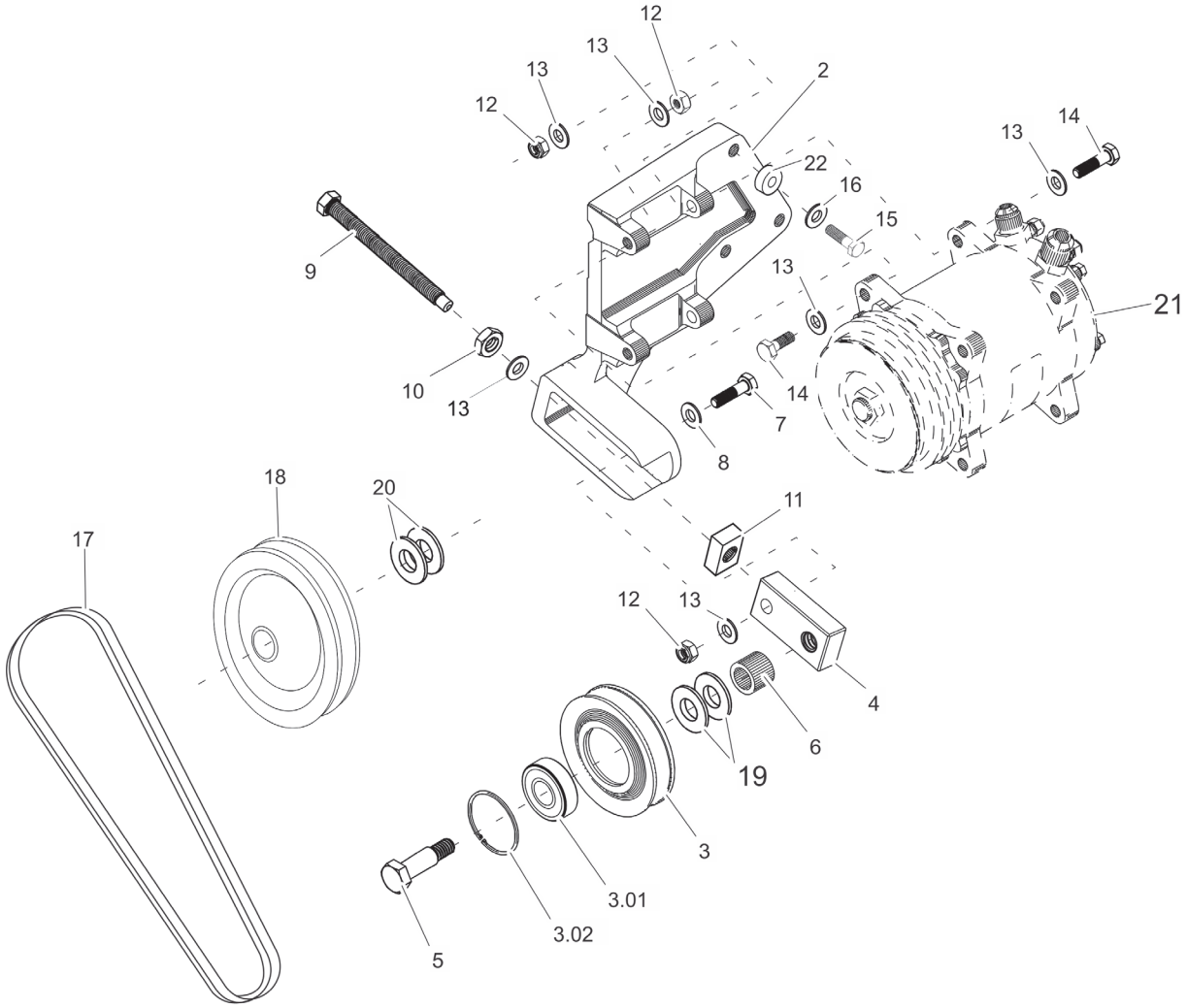


Figure 17-48. Air Conditioning Compressor Mounting Assembly

1	Mounting Bracket	7	Spacer	13	Nut	19	Sheave
2	Idler Sheave	8	Bolt	14	Plain Washer	20	Self-locking 12 point nut
3	Ball Bearing	9	Special Washer	15	Bolt	21	Shim
4	Retaining Ring	10	Tensioning Bolt	16	Bolt	22	Shim
5	Block Assembly	11	Nut	17	Washer		
6	Sheave Support Bolt	12	Rectangular Nut	18	Drive Belt		

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.

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.

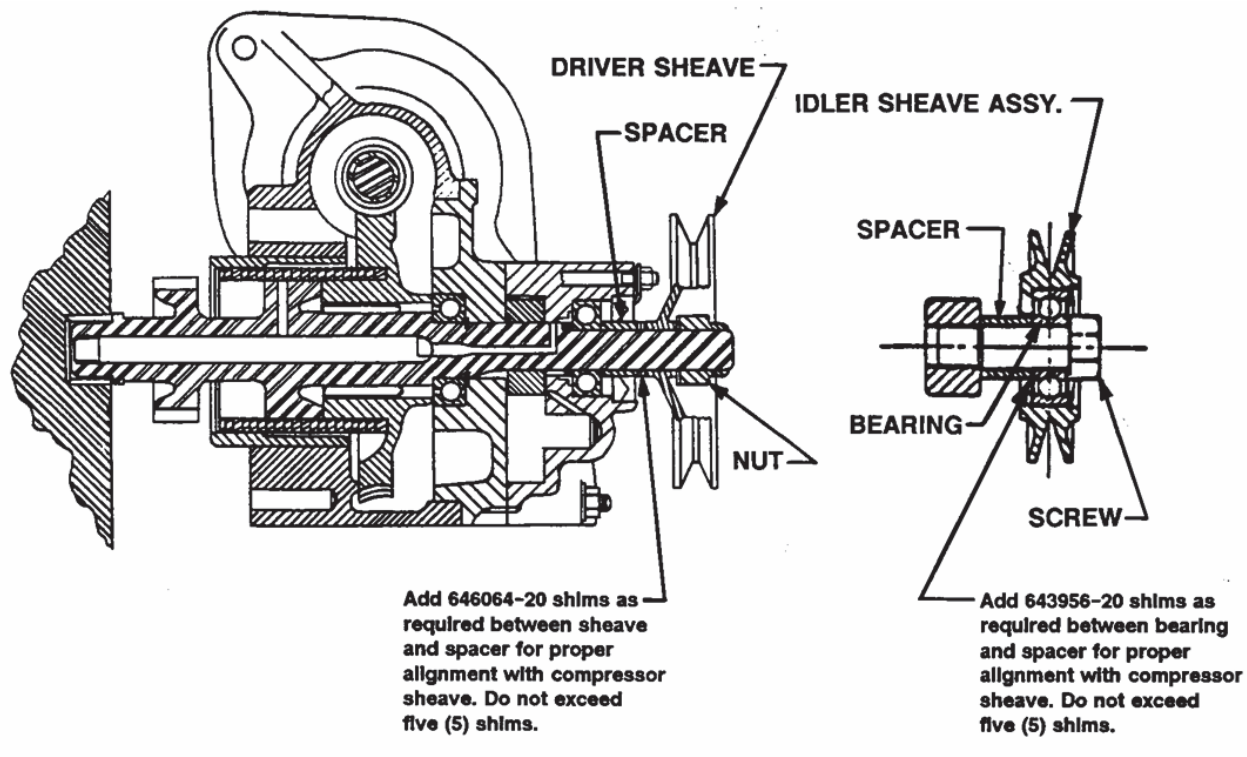


Figure 17-49. Starter Adapter Belt Sheave Alignment

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.

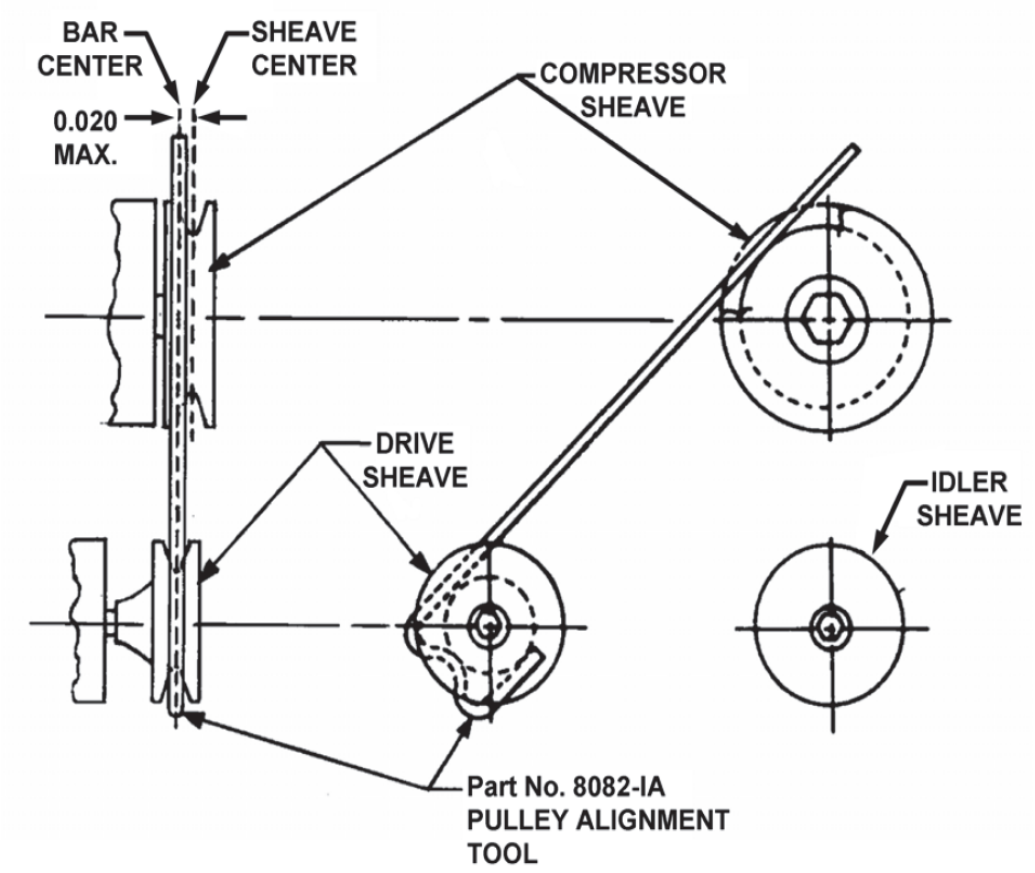


Figure 17-50. Sheave Alignment

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.

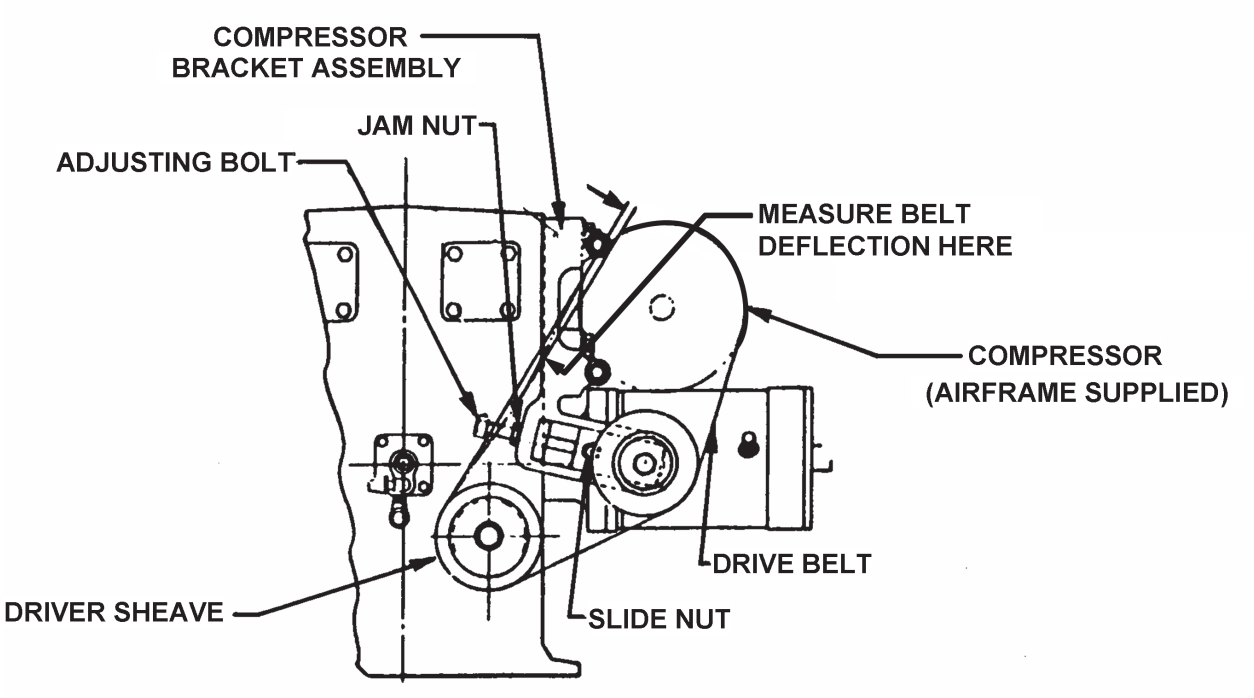


Figure 17-51. Belt Tension Adjustment

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.

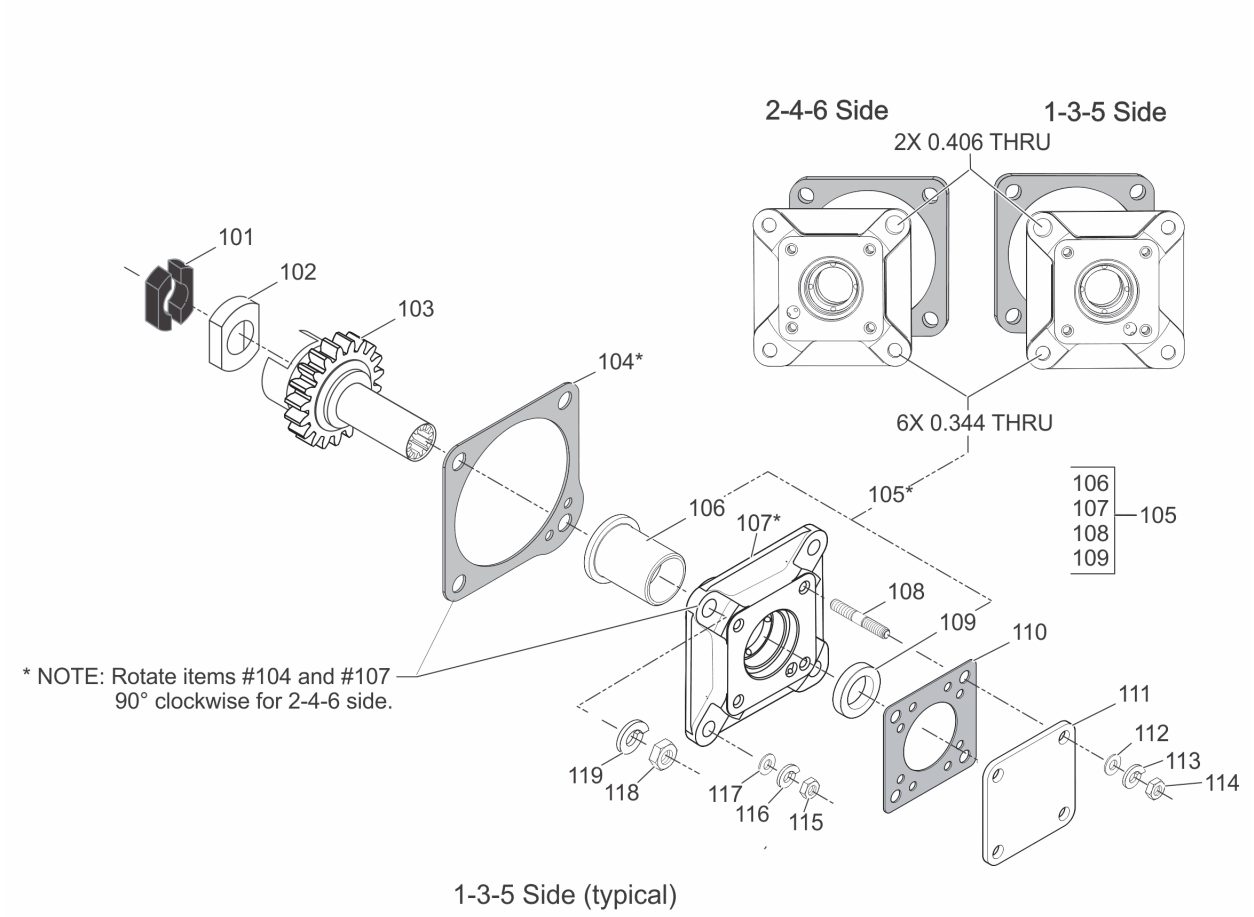

Figure 17-52. Accessory Drive Adapter

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		

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.

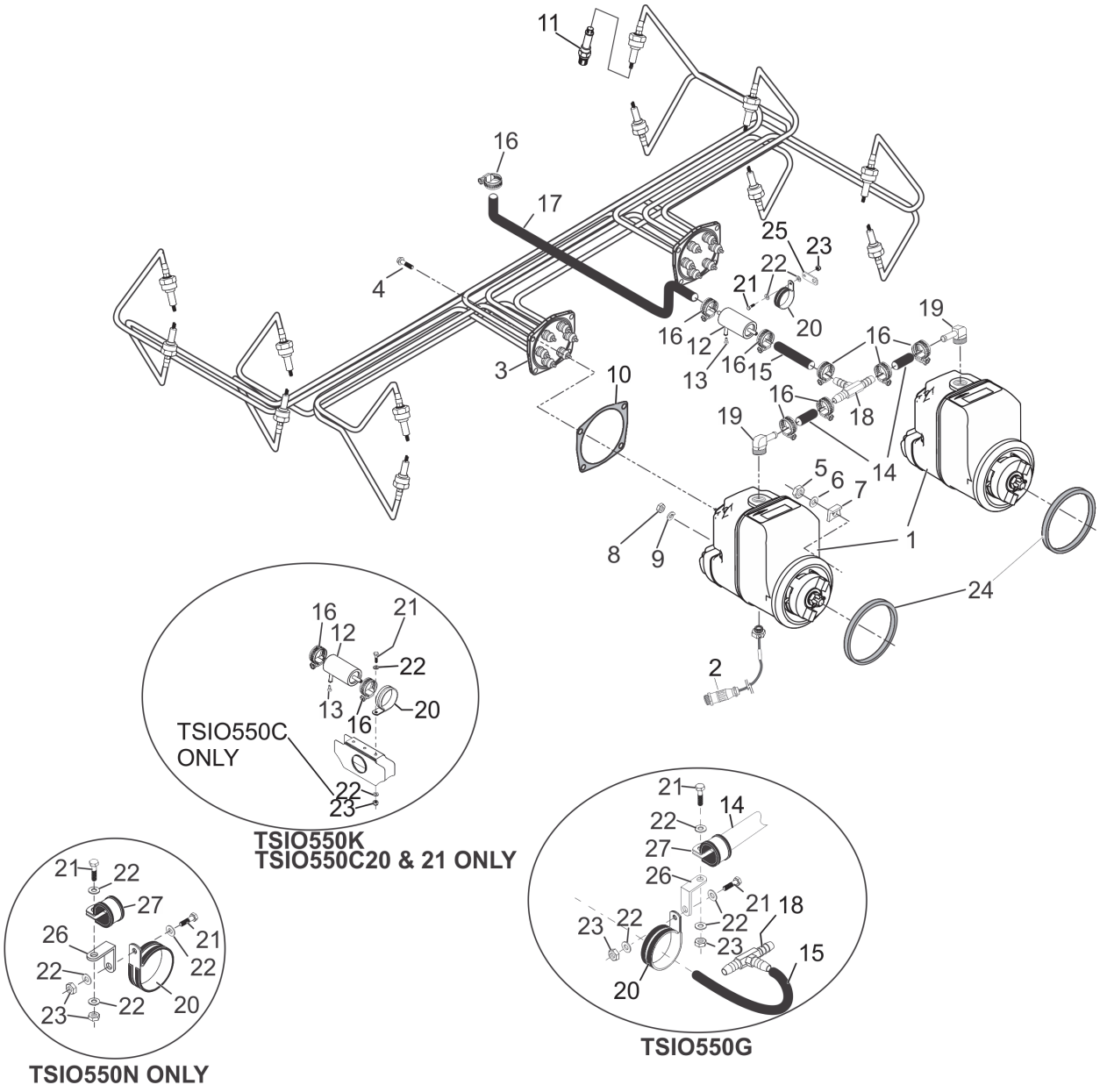

Figure 17-53. Continental Motors Ignition

1	Magneto	8	Nut	15	Hose	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		

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.
6. Torque the hose clamps to the value specified in Appendix B of M-0, Standard Practice Maintenance Manual.
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.

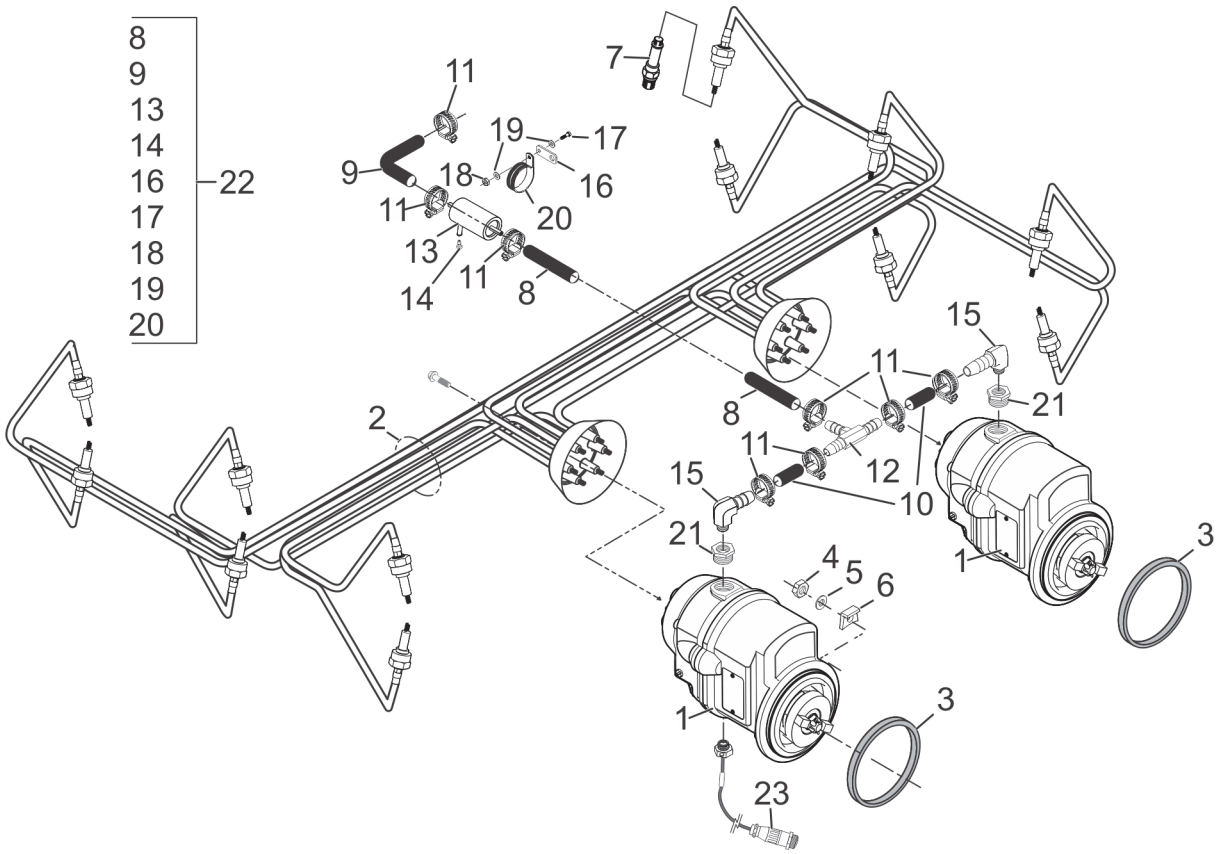

Figure 17-54. Champion (Slick) Ignition System

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
	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		

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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

Sequence	Requirement	Section References
1	Prepare the Engine for Operation	"Maintenance Preflight Inspection" in Section 6-4.7.2 of M-0, Standard Practice Maintenance Manual
2	Maintenance Test Run	"Standard Acceptance Test" in Section 18-4
3	Complete Operational Checklist	"Engine Operational Checklist" in Section 6-6 of M-0, Standard Practice Maintenance Manual
4	Perform Flight Check	"Flight Check" instructions in Section 7-2.3[1]

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.

    - 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 18-2. Standard Acceptance Test Requirements

Engine Run Period	Oil (F°) Minimum	CHT (F°) Minimum	Duration (Minutes)	Engine RPM
1	120	175	N/A[1]	1200 ± 25 RPM
2	150	225	N/A	1700 ± 25 RPM
3	165	250	N/A	2300 ± 25 RPM[2]
4	180	250	10	Rated Power RPM[3]
5	180	250	10	75% Power RPM Check Fuel and Oil Pressures. Check Temperatures.
6	180	250	5	Idle RPM (cooling period -300° Max. CHT at shut down.)[4]
7	N/A	N/A	---	Stop engine and perform leak check.[5]
8	180	250	10	75% Power RPM
9	180	250	5	Idle RPM (cooling period)[4 5]

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.

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

Engine Run Period	Time Duration (Minutes)	Engine RPM
1	5	1200 ± 25 RPM
2	5	1600 ± 25 RPM
3	5	2450 ± 25 RPM[1]
4	10	Rated Power RPM[2]
5	10	75% Power RPM Check Fuel and Oil Pressures. Check Temperatures.
6	5	Idle RPM (cooling period 300°F (149°C) maximum at shutdown)[3]
Stop engine, drain and weigh oil for oil consumption determination[4]		
7	5	Warm up to rated RPM
8	30	Rated Power Take engine readings every 10 minutes[4]
9	5	Idle RPM (cooling period 300° Max. CHT at shutdown.) [3 4 5]

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.

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Appendix B.Torque Specifications

Refer to the “Torque Specifications” in Appendix B of M-0, Standard Practice Maintenance Manual

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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.

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.

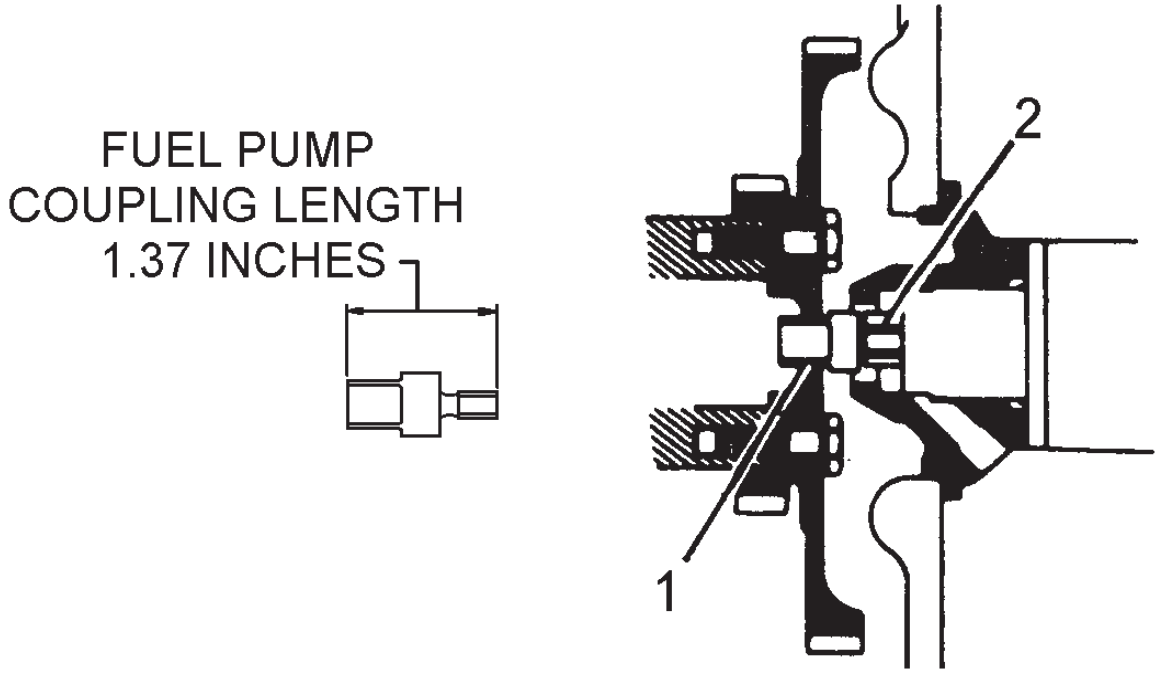


Figure D-1. Fuel Pump Drive Coupling Fits & Limits

Table D-1. Fuel Pump Drive Coupling Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Fuel pump drive coupling to crankshaft gear ..... clearance:	0.0095L	0.0155L
2	Fuel pump drive coupling to fuel pump ..... clearance:	0.0030L	0.0090L
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.

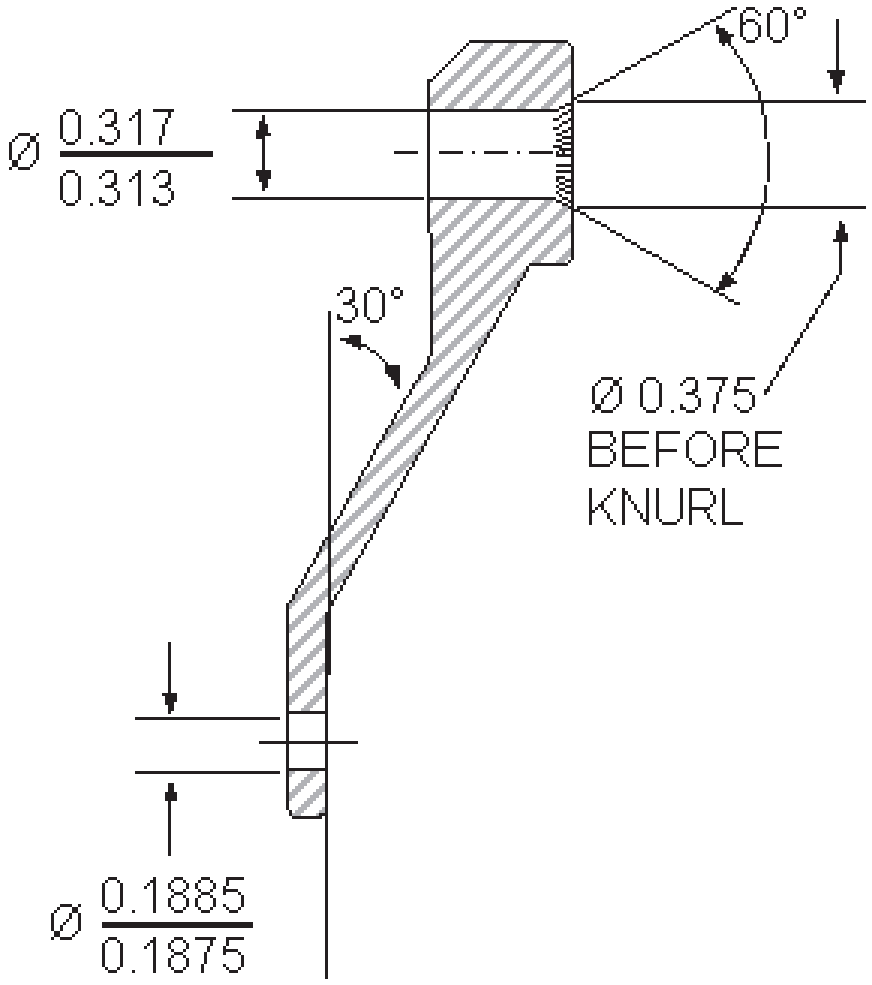


Figure D-2. Throttle Lever Dimensions

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.

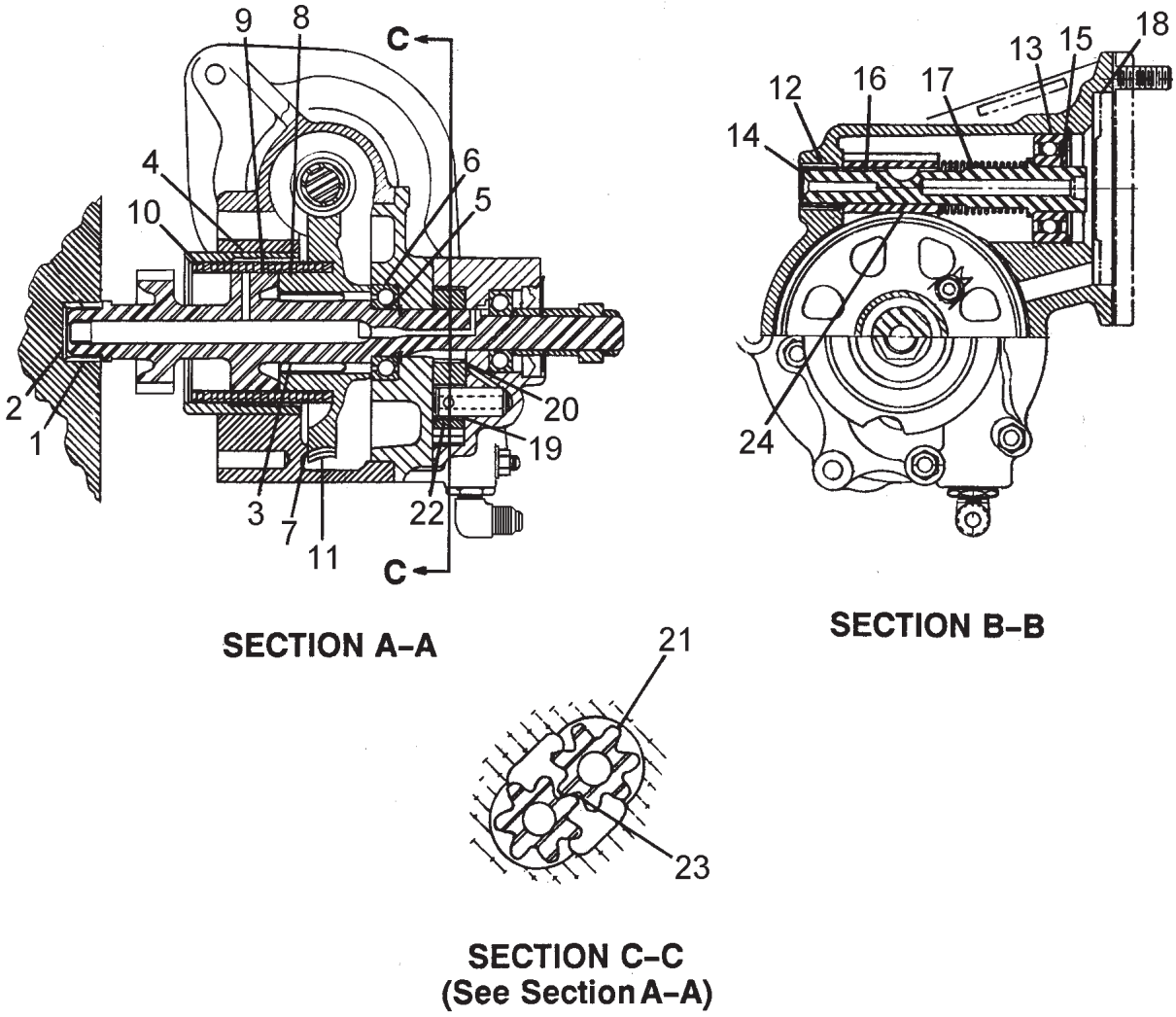


Figure D-3. Starter and Starter Adapter with Scavenge Pump Dimensions

Table D-2. Starter/Starter Adapter with Scavenge Pump Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Starter shaft gear needle bearing bore in crankcase ..... diameter:	0.9990	1.0000
2	Starter shaft gear front (bearing) journal ..... diameter:	0.7495	0.7500
3	Starter shaft gear in clutch drum bearing ..... diameter:	0.9995	1.0000L
4	Clutch spring sleeve in starter adapter ..... diametric clearance:	0.0030T	0.0050T
5	Starter shaft gear in ball bearing ..... diametric clearance:	0.0001T	0.0005L
6	Bearing in starter adapter cover ..... diametric clearance:	0.0001T	0.0010L
7	Worm wheel gear .....end clearance:	0.0016	0.0166
8	Worm wheel drum ..... diameter:	See Figure D-4	
9	Starter shaft gear drum ..... diameter:	See Figure D-5	
10	Clutch spring in clutch spring sleeve[1] ..... diametric clearance:	0.0310T	0.0380T
11	Center line of worm gear shaft to starter adapter thrust pads...clearance	0.2450	0.2490
12	Needle bearing bore starter adapter ..... diameter:	0.7485	0.7495
13	Ball bearing in starter adapter ..... diametric clearance:	0.0001T	0.0013L
14	Worm gear shaft in needle bearing area ..... diameter:	0.5615	0.5625
15	Worm gear shaft in ball bearing ..... diametric clearance:	0.0001L	0.0007T
16	Starter worm gear on shaft ..... diametric clearance:	0.0005L	0.0025L
17	Starter spring on worm drive shaft ..... diametric clearance:	0.0050L	0.0250L
18	Starter pilot to starter drive adapter ..... diametric clearance:	0.0010L	0.0070L
19	Scavenge pump driven gear on shaft ..... diametric clearance:	0.0005L	0.0025L
20	Scavenge pump driver and driven gear in body .....end clearance:	0.0015	0.0040
21	Scavenge pump driver gear in body diametric clearance:	0.0118L	0.0143L
22	Bushing in scavenge pump driven gear ..... diametric clearance:	0.0035T	0.0060T
23	Scavenge pump driver and driven gear ..... backlash:	0.0035	0.0050
24	Starter worm wheel gear and worm gear ..... backlash:	0.0090	0.0110
T= Tight L= Loose			

1. When the sandblasted finish is smoother than 125 RMS, replace the sleeve

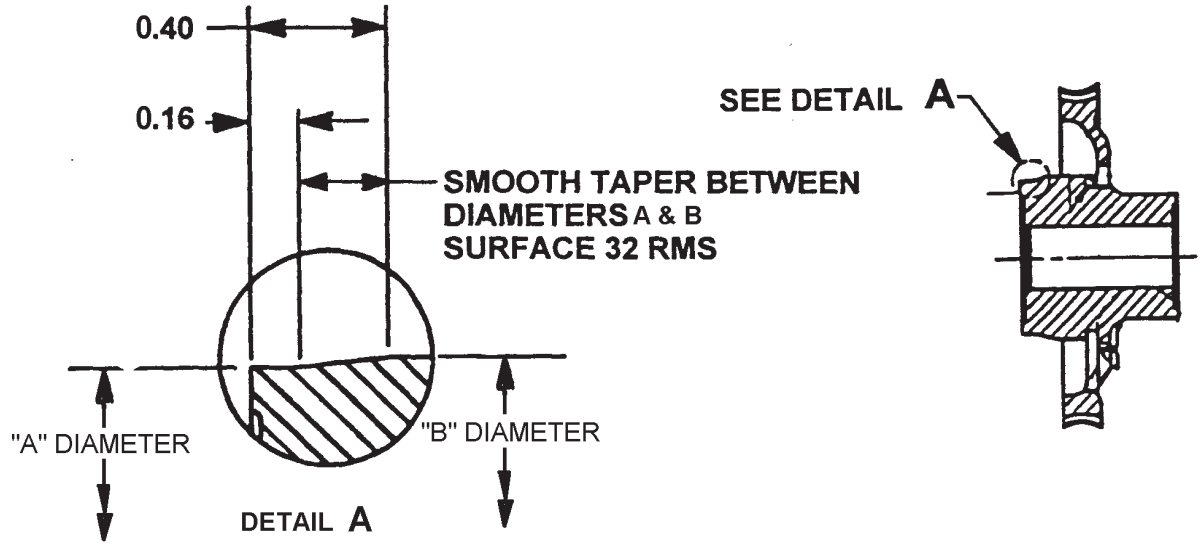


Figure D-4. Worm Wheel Drum Dimensions

Table D-3. Worm Wheel Drum Dimensions

Part	"A" Diameter (inches)		"B" Diameter (inches)	
	Minimum	Maximum	Minimum	Maximum
Worm Wheel Drum ..... diameter:	1.931	1.932	1.955	1.960
0.015 Undersize Worm Wheel Drum..... diameter:	1.916	1.917	1.940	1.945

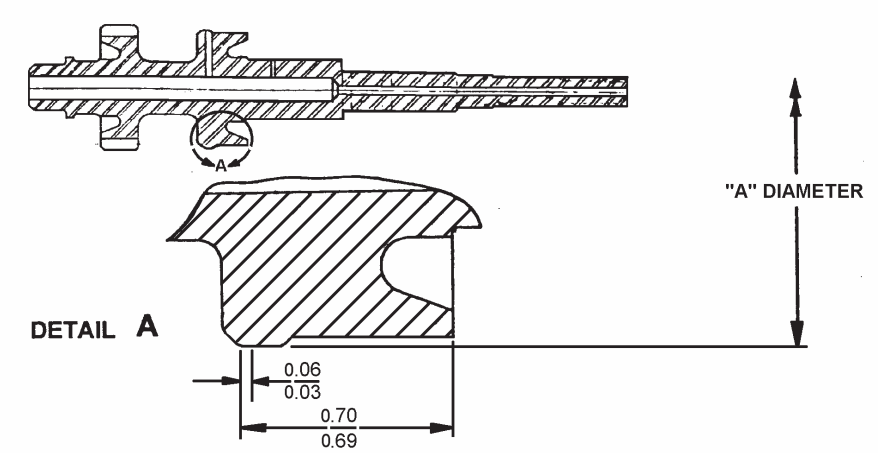


Figure D-5. Shaft Gear Drum Dimensions

Table D-4. Shaft Gear Drum Fits & Limits

Part	"A" Diameter (inches)	
	Minimum	Maximum
Shaft Gear Drum ..... diameter:	1.931	1.932
0.015 Undersize Shaft Gear Drum ..... diameter:	1.916	1.917

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

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Bushing in magneto and accessory drive adapter... diametric clearance:	0.0010T	0.0040T
2	Magneto and accessory drive gear in adapter bushing ..... diametric clearance:	0.0015L	0.0035L
3	Oil seal in adapter..... diametric clearance:	0.0010T	0.0070T
4	Sleeve in magneto and accessory drive gear..... diametric clearance:	0.0010T	0.0070T
5	Coupling retainer on drive gear sleeve .....diameter:	0.0250L	0.040L
6	Magneto and accessory drive gear.....end clearance:	0.0110L	0.0770L
7	Magneto coupling retainer in magneto drive gear slot..... side clearance:	0.0020T	0.0280T
8	Magneto coupling rubber bushings on drive lugs ..... side clearance:	0.014L	0.052T
9	Magneto pilot in crankcase..... diametric clearance:	0.001L	0.005L
T= Tight L= Loose			

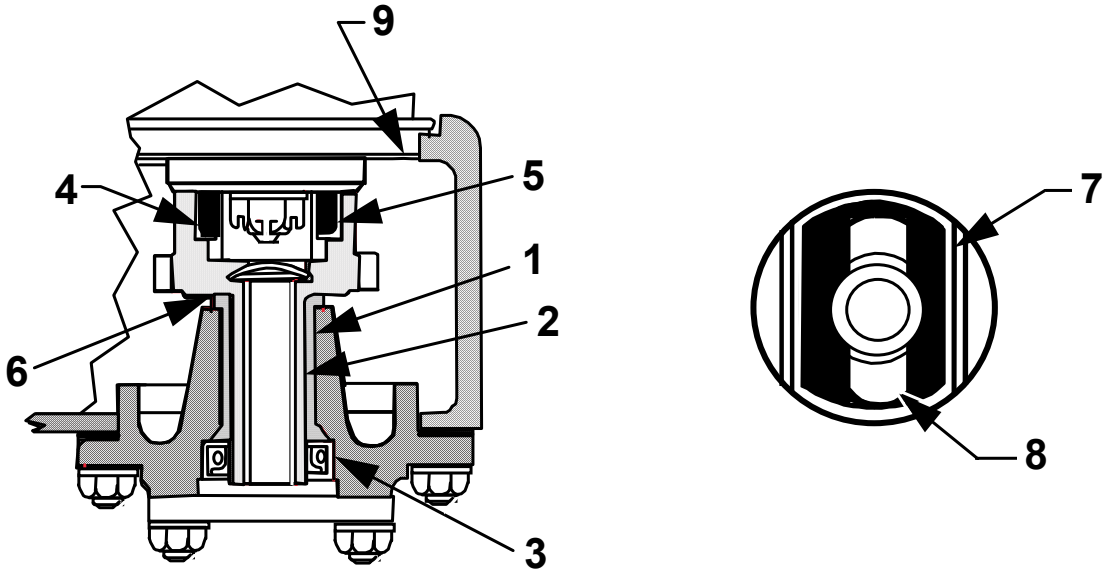


Figure D-6. Accessory Drive Adapter Dimensions

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 D-6. Lubrication System Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
Oil Pressure Relief Valve Assembly			
1	Oil pressure relief valve adjusting screw in plunger .....diameter:	0.0030	0.0070
2	Oil pressure relief valve seat in housing .....depth:	0.750	1.060
Oil Pump Assembly			
3	Oil pump driver gear in pump housing ..... diametric clearance:	0.0040L	0.0060L
4	Oil pump driver gear shaft in pump housing ..... diametric clearance:	0.0015T	0.0030L
5	Oil pump driven gear to driven gear shaft ..... diametric clearance:	0.0005L	0.0025L
6	Oil pump driver gear in pump housing .....end clearance:	0.0016L	0.0041
7	Oil pump driven gear in pump housing .....end clearance:	0.0016L	0.0041
8	Oil pump driver gear shaft in toil pump cover ..... diametric clearance:	0.0015L	0.0030L
9	Oil pump driven gear in housing ..... diametric clearance:	0.0040L	0.0060L
10	Oil pump driver and driven gears ..... backlash:	0.0090	0.0130
Spring Test Data			
11	Oil press. relief valve spring compressed to 1.25 inch length load:	32 lbs.	37 lbs.
12	Oil temp. control valve 0.090 inches minimum travel ..at oil temperature:	120°F	170°F
	Oil temperature must close between .....oil temperature:	168°F	172°F
T= Tight L= Loose			

Table D-7. Lubrication System Components Dimensions
Not shown in Figure D-7

Part Name	Inspection Item	Dimensions (inches)	
		Minimum	Minimum
Oil Pump Housing and Shaft Assembly	Driven Gear Shaft .....diameter:	0.5640	0.5650
	Driver Gear Shaft Hole .....diameter:	0.5620	0.5630
	Gear Chamber .....depth:	1.9985	2.0000
Oil Pump Driver Gear	Shaft.....diametric clearance:	0.0040L	0.0060L
Oil Pump Driven Gear	Bushing .....diametric clearance:	0.0015L	0.0030

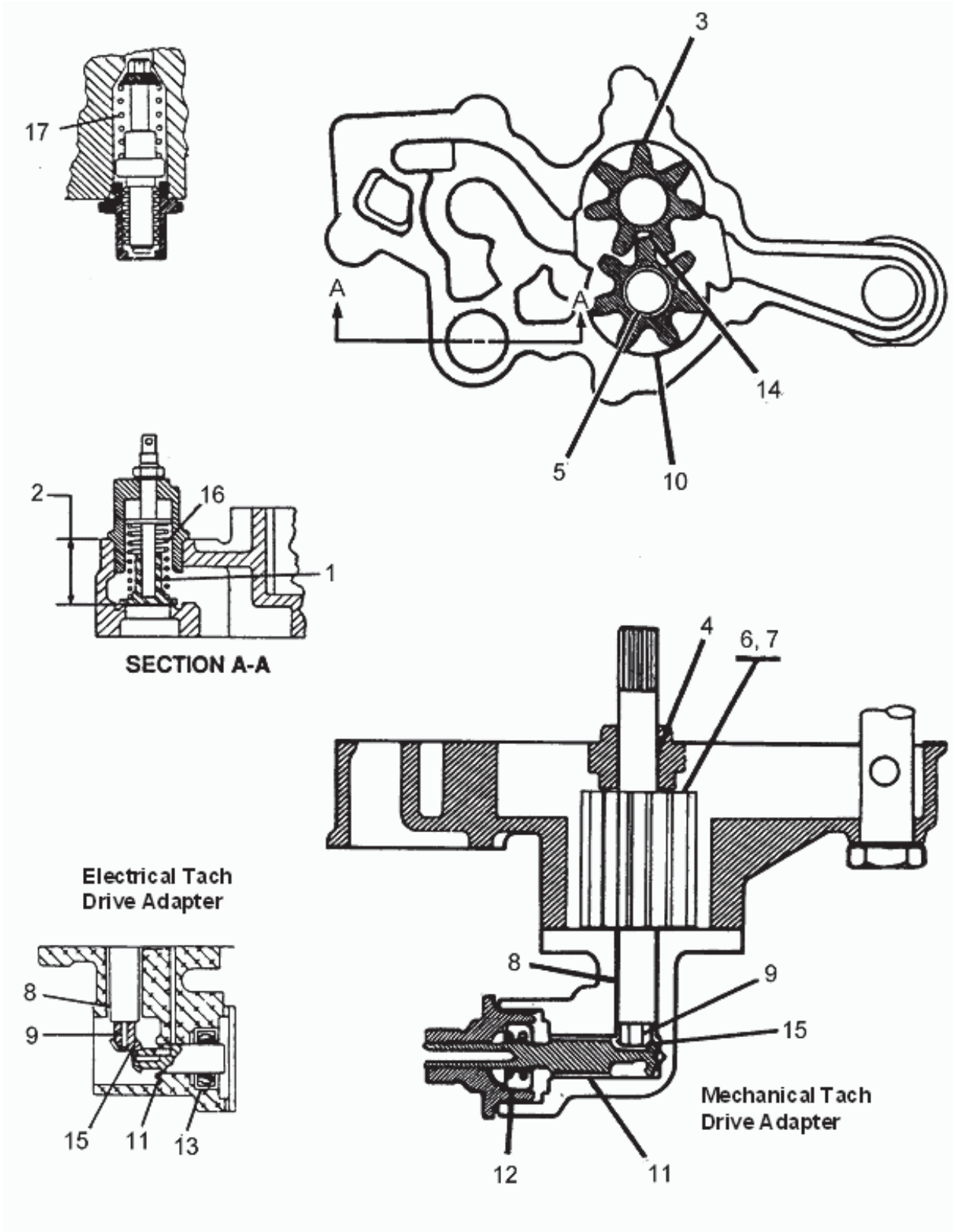


Figure D-7. Oil Pump Dimensions

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

Part Name	Inspection Item	Dimensions (inches)	
		Minimum	Maximum
Rocker Arm Bushings	Inside Diameter	0.7505	0.7515
Valve Rocker Shaft	Outside Diameter	0.7482	0.7500
Intake Valve	Stem Diameter	0.4334	0.4340
Exhaust Valve	Stem Diameter	0.4333	0.4340
Piston (Standard)	Diameter at Top[1]	5.2126	5.2166
	Diameter Below 1st Groove[1]	5.2157	5.2197
	Diameter at Bottom[1 2]	5.2414	5.2424
	Pin Bore Diameter	1.1246	1.1250
	Third Ring Groove Width	0.1910	0.1920
	Fourth Ring Groove Width	0.1000	0.1010
	Piston Pin to Top of Dome Height	1.652	1.656
Piston Pin Assembly	Length (including plugs)	5.220	5.242
Rocker Arm	Thrust Width	0.937	0.940

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.

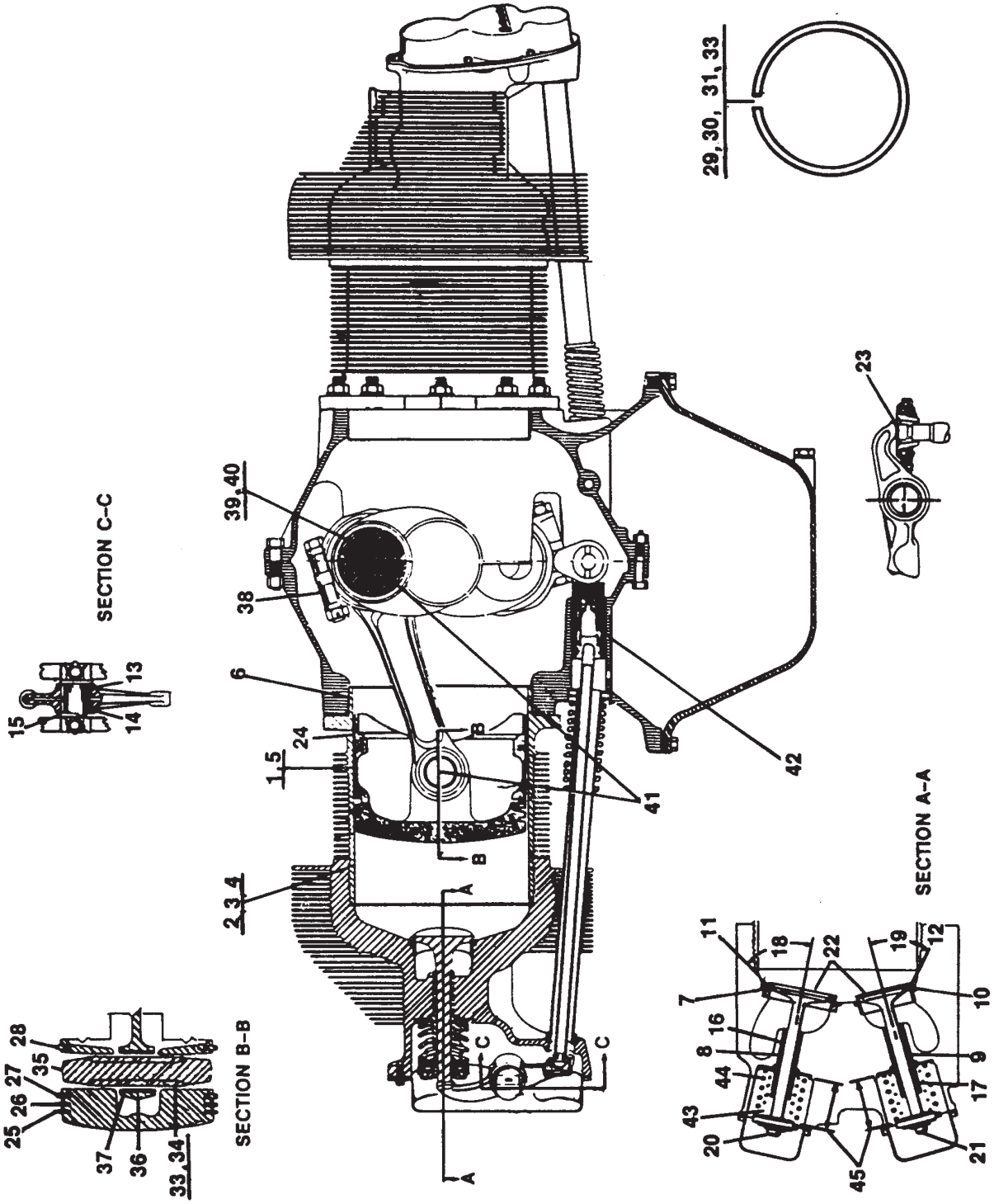


Figure D-8. Cylinder Assembly Dimensions

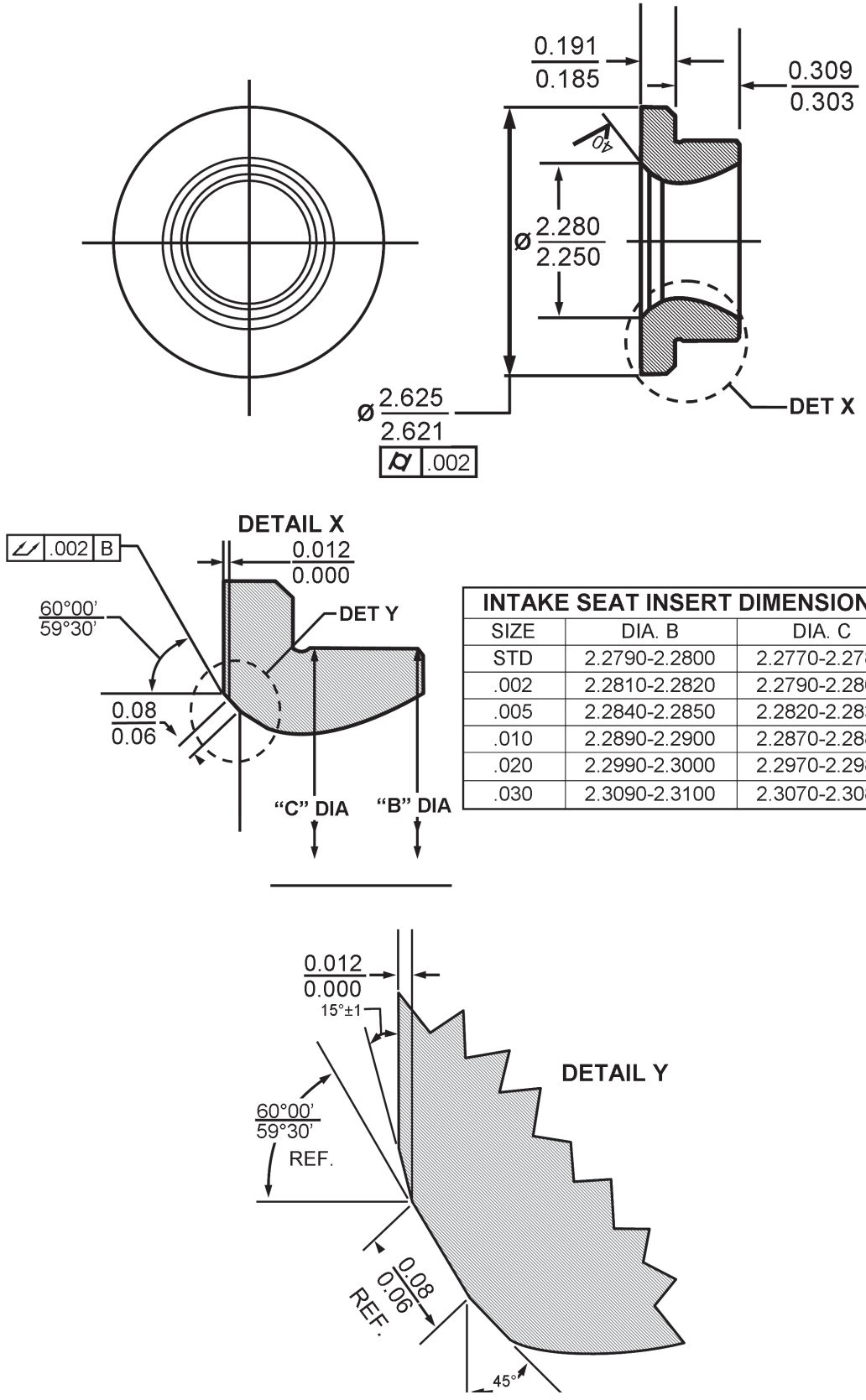
Table D-9. Engine Cylinder Assembly Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
	Cylinders		
1	Cylinder bore (lower 4-1/2 inch of barrel) ..... diameter:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual	
2	Cylinder bore choke (at 5.75 inch from open end of barrel) ..... taper:		
3	Cylinder bore ..... out-of-round:		
4	Cylinder bore ..... allowable oversize		
5	Cylinder bore surface (Nitrided Barrels) Cross hatch angle Finish in micro-inches R_a	 22° - 32° 35	 — 60
6	Cylinder barrel in crankcase ..... diametric clearance:	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head ..... diametric clearance:	0.0070T	0.0100T
8	Intake valve guide in cylinder head ..... diametric clearance:	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head ..... diametric clearance:	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head ..... diametric clearance:	0.0070T	0.0100T
11	Intake valve seat ..... width:	Figure D-9	
12	Exhaust valve seat ..... width:	Figure D-10	
	Rocker Arms and Shafts		
13	Rocker shaft in cylinder head boss ..... diametric clearance:	0.0005L	0.0033L
	Rocker shaft in rocker arm bushing ..... diametric clearance:	0.0005L	0.0033L
14	Rocker arm bushing bore ..... diameter:	0.8725	0.8755
	Rocker arm bushing – finish bore ..... inside diameter:	0.7505	0.7515
15	Rocker arm ..... side clearance:	0.0020	0.0150
16	Intake valve guide ..... inside diameter:	0.4350	0.4377
	Intake valve in guide ..... diametric clearance:	0.0010L	0.0042L
17	Exhaust valve guide ..... inside diameter:	0.4375	0.4395
	Exhaust valve in guide ..... diametric clearance:	0.0035L	0.0062L
18	Intake valve face-to-stem ..... axis angle:	60°00'	60°15'
19	Exhaust valve face-to-stem ..... axis angle:	45°00'	45°15'
20	Intake valve gauge line-to-stem ..... length:	Figure D-11	
21	Exhaust valve gauge line-to-stem ..... length:	Figure D-12 (Replace 100%)	
22	Intake & Exhaust valve face-to-stem ..... runout:	0.0000	0.0015
23	Rocker arm foot to valve stem (dry valve) ..... valve lash:	0.060	0.200
	Pistons, Rings, and Pins		
24	Piston, non-coated in cylinder[1] ..... diametric clearance:	0.008L[2] 0.007L[3]	0.011L[2] 0.010L[3]
	Piston, manganese phosphate coated in cylinder[1] ..... diametric clearance:	0.009L[2] 0.008L[3]	0.012L[2] 0.011L[3]
25	Top piston ring in groove ..... side clearance:	0.0015	0.0040
26	Second piston ring in groove ..... side clearance:	0.0015	0.0040
27	Third piston ring in groove ..... side clearance:	0.0035	0.0055
28	Fourth piston ring in groove ..... side clearance:	0.0060	0.0080
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

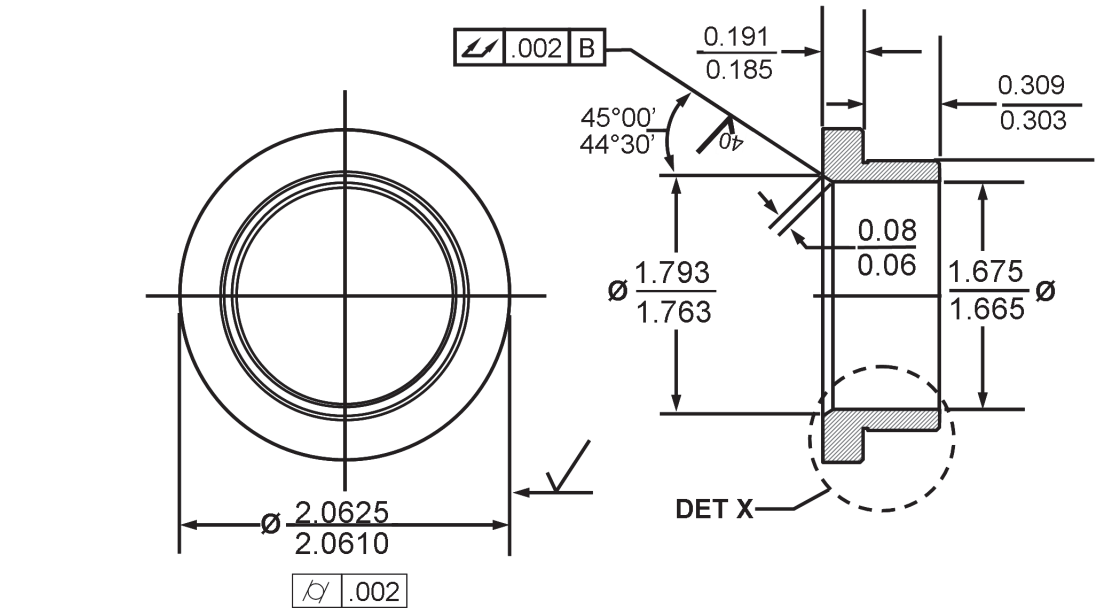
Index	Part	Dimensions (inches)	
		Minimum	Maximum
Dimensions for items 29B -32B apply only to Pre-Gold Standard Cylinders (5.252-5.254 Dia. Cylinder Bore)			
29B	Top ring .....gap:	See Section 10-6.9 in M-0, Standard Practice Maintenance Manual	
30B	Second ring .....gap:		
31B	Oil control ring .....gap:		
32B	Fourth ring .....gap:		
33	Piston pin in piston .....diametric clearance:	0.0001L	0.0007L
34	Piston Pin .....diameter:	1.1243	1.1245
	Piston Pin (0.005 oversize).....diameter:	1.1293	1.1295
35	Piston pin in cylinder..... end clearance:	0.0310L	0.0480L
36	Piston pin in connecting rod bushing.....diametric clearance:	0.0022L	0.0026L
37	Bushing in connecting rod .....diametric clearance:	0.0025T	0.0050T
38	Bolt in connecting rod .....diametric clearance:	0.0000L	0.0018L
39	Connecting rod bearing on crankpin.....diametric clearance:	0.0009L	0.0034L
40	Connecting rod on crankpin..... end clearance:	0.0060	0.0110L
41	Connecting rod bushing..... twist (convergence) per inch of length	See **M-0, Section 10-9.4**	
42	Hydraulic tappet in crankcase .....diametric clearance:	0.0010L	0.0025L
Spring Test Data			
43	Inner valve spring 654442 compressed to 1.230 in. length .....load:	70.3 Lbs.	77.3 Lbs.
	Inner valve spring 654442 compressed to 1.745 in. length .....load:	32.1 Lbs.	38.1 Lbs.
44	Outer valve spring 654441 compressed to 1.275 in. length .....load:	101.8 Lbs.	111.4 Lbs.
	Outer valve spring 654441 compressed to 1.790 in. length .....load:	49.1 Lbs.	55.1 Lbs.
45	Installed outer valve spring.....height:	1.791 inches	
T= Tight L= Loose			

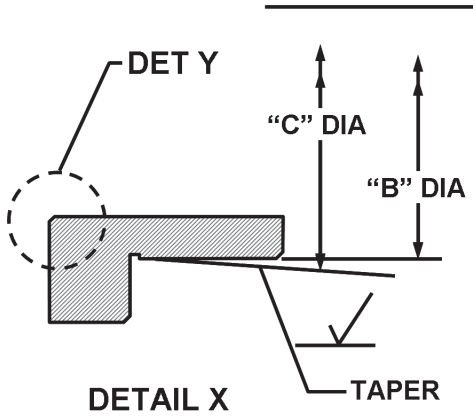
1. Measured below fourth ring groove
2. Pre-Gold Standard Dimension
3. Post-Gold Standard Dimension



INTAKE SEAT INSERT DIMENSIONS		
SIZE	DIA. B	DIA. C
STD	2.2790-2.2800	2.2770-2.2780
.002	2.2810-2.2820	2.2790-2.2800
.005	2.2840-2.2850	2.2820-2.2830
.010	2.2890-2.2900	2.2870-2.2880
.020	2.2990-2.3000	2.2970-2.2980
.030	2.3090-2.3100	2.3070-2.3080

Figure D-9. Intake Valve Seat Dimensions





EXHAUST SEAT INSERT DIMENSIONS		
SIZE	DIA. B	DIA. C
STD	1.796-1.797	1.794-1.795
.002	1.798-1.799	1.796-1.797
.005	1.801-1.802	1.799-1.800
.010	1.806-1.807	1.804-1.805
.020	1.816-1.817	1.814-1.815
.030	1.826-1.827	1.824-1.825

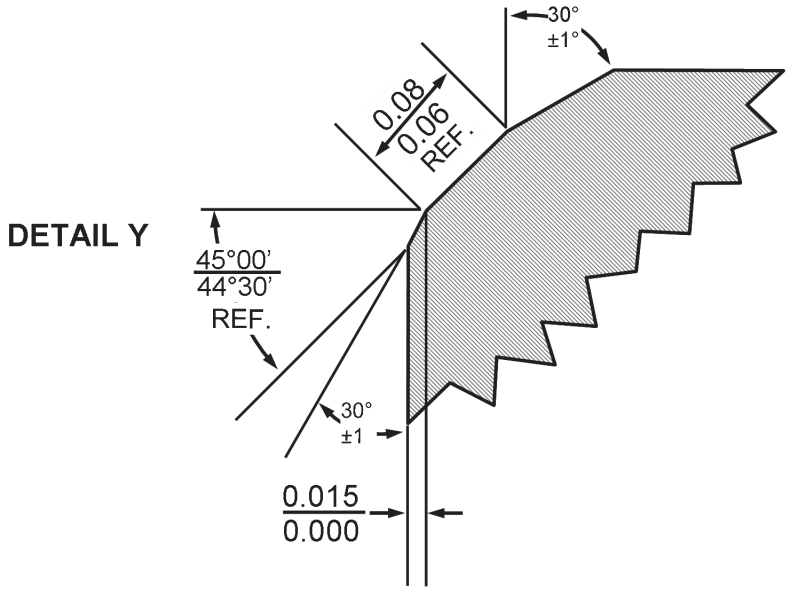


Figure D-10. Exhaust Valve Seat Dimensions

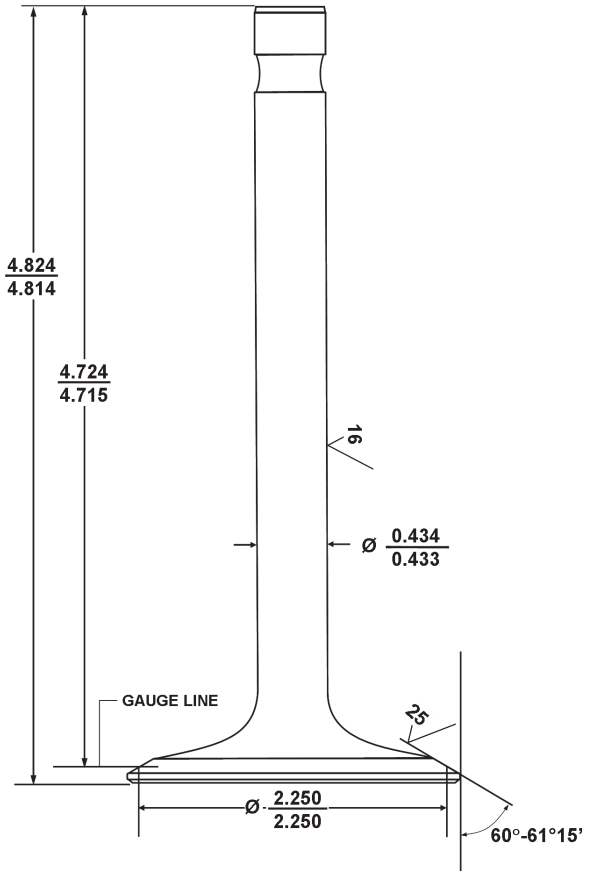


Figure D-11. Intake Valve Dimensions

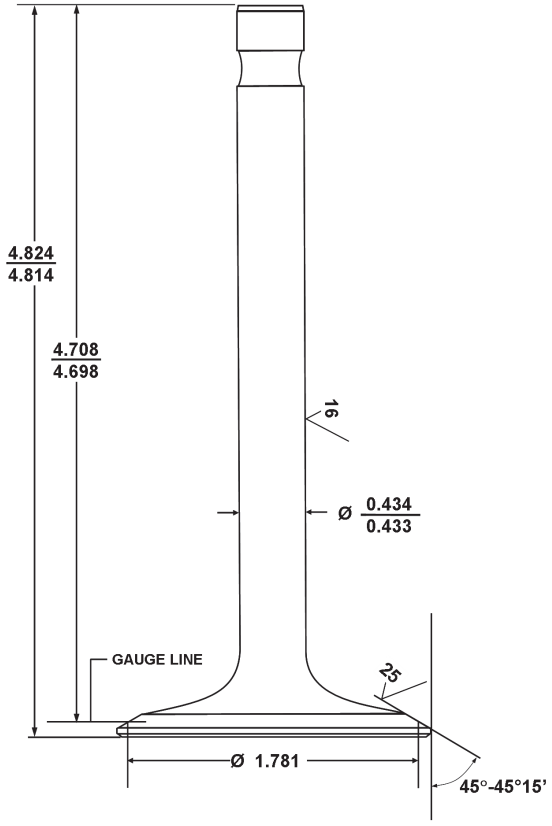


Figure D-12. Exhaust Valve Dimensions

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

Part Name/Feature	Dimensions (inches) Minimum	Maximum
Crankshaft Journal Bore (Rear & Intermediate) .....diameter	2.816	2.817
Crankshaft Main Journals (MJ #4 & #5) .....diameter	2.5625	2.5635
Camshaft Journal Bore .....diameter	1.0000	1.0010
Crankcase Tappet Guides .....diameter	1.0005	1.0015
Governor Driven Gear Bearing .....diameter	0.8750	0.8760
Starter Shaft Needle Bearing Hole .....diameter	0.9990	1.0000
Crankcase Idler Gear Support (front) .....diameter:	0.9990	1.0000
Crankcase Idler Gear Support (rear) .....diameter:	1.062	1.063
Camshaft Journal (4) .....diameter	0.9980	0.9990
Valve Tappets.....diameter	0.9990	0.9995

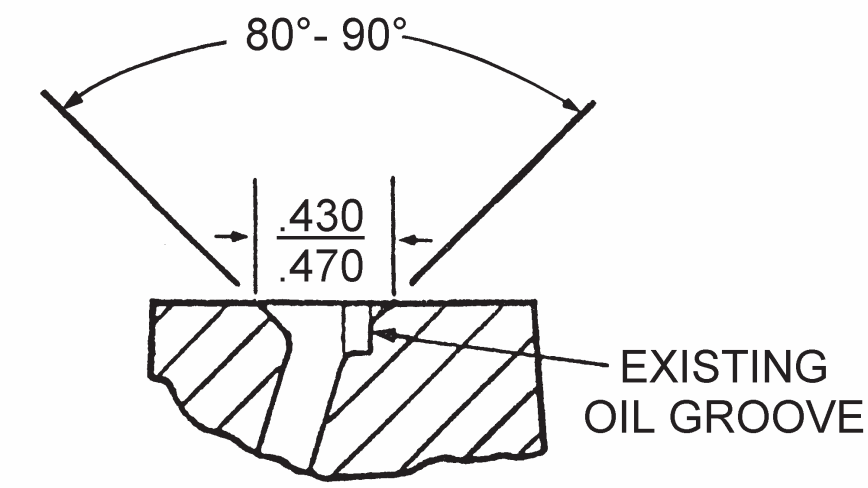


Figure D-13. Crankcase Main Bearing Oil Feed Hole Chamfer

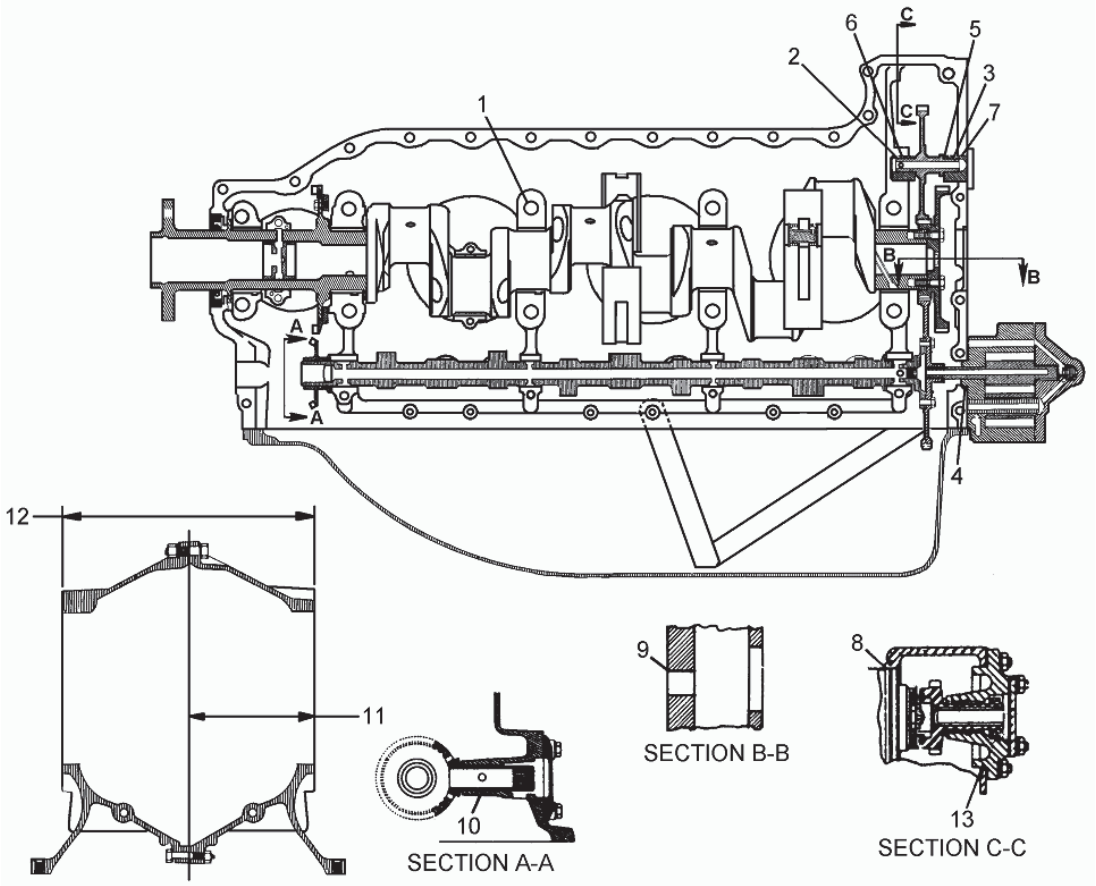


Figure D-14. Crankcase Dimensions

Table D-11. Crankcase Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Through-bolt in crankcase ..... diametric clearance:	0.0000	0.0015L
2	Idler gear support in crankcase (front) ..... diametric clearance:	0.0005L	0.0015T
3	Idler gear support in crankcase (rear) ..... diametric clearance:	0.0015L	0.0035L
4	Oil pump housing pilot in crankcase ..... diametric clearance:	0.0010L	0.0040L
5	Idler gear ..... end clearance:	0.0300	0.0770
6	Idler gear in support bushing (front) ..... diametric clearance:	0.0010L	0.0030L
7	Idler gear in support bushing (rear) ..... diametric clearance:	0.0010L	0.0030L
8	Magneto pilot in crankcase ..... diametric clearance:	0.0015L	0.0060L
9	Starter shaft gear roller bearing hole ..... diameter:	0.9995	1.0005
10	Governor drive shaft in crankcase ..... diametric clearance:	0.0014L	0.0034L
11	Crankcase deck height (each half) ..... width:	4.560	4.565
12	Crankcase (cylinder deck-to-cylinder deck) ..... width:	9.12	9.13
13	Accessory drive adapter pilot in crankcase ..... diametric clearance:	0.0000T	0.0040L
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.

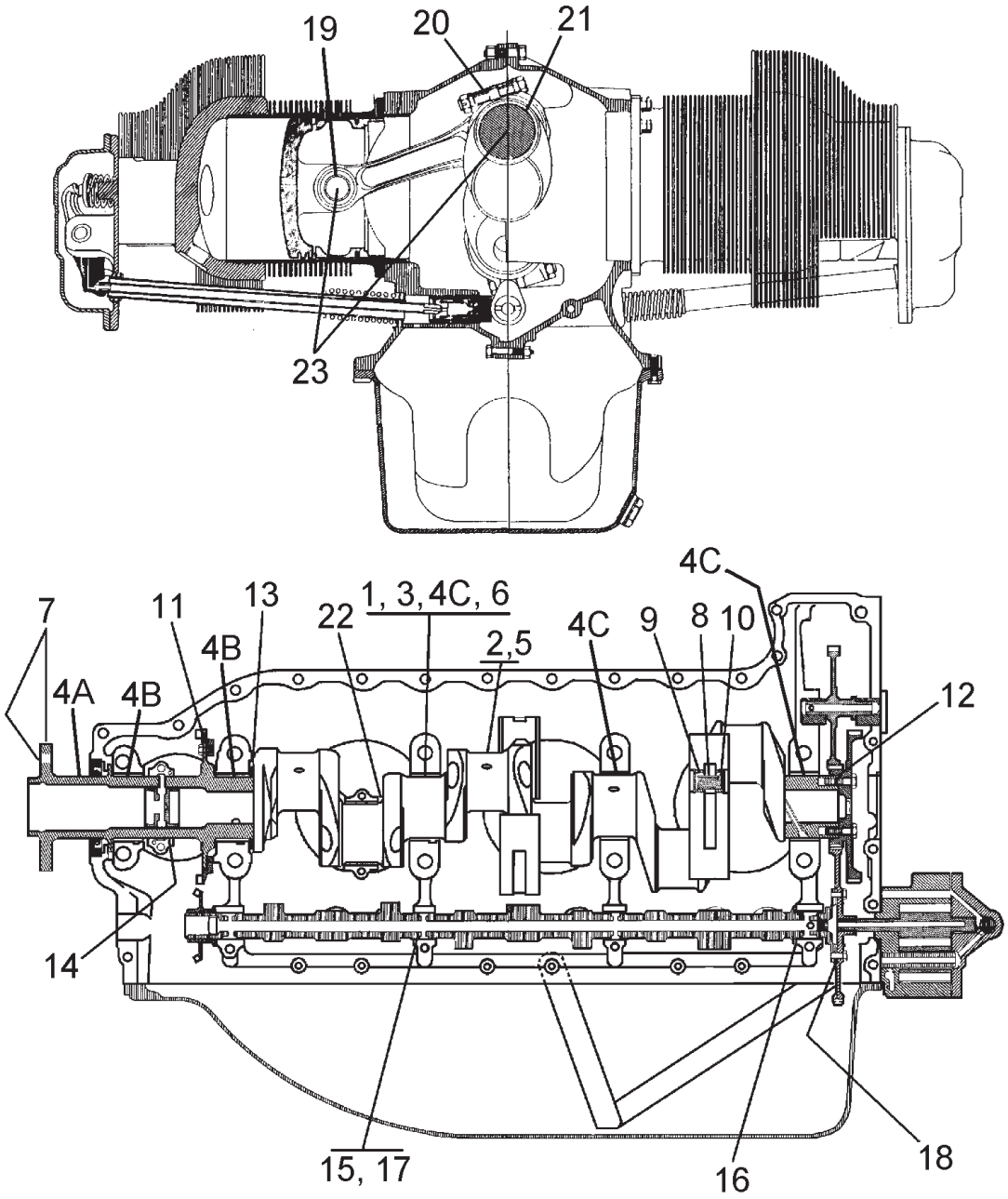


Figure D-15. Engine Drive Train Dimensions

Table D-12. Engine Drive Train Dimensions not depicted in Figure D-15

Part Name	Feature	Dimensions (inches) Minimum	Maximum
Crankshaft Ctrwt. Hanger	Blade Bushing ..... Inside Diameter	See **M-0, Section 10-9.1**	
Camshaft	Journal..... Diameter	0.9980	0.9990

Table D-13. Engine Drive Train Dimensions

Index	Part	Dimensions (inches) Minimum	Maximum
	Crankshaft		
1	Crankshaft in main bearing..... diametric clearance:	0.0010L	0.0040L
2	Crank pins[1] ..... out-of-round:	0.0000	0.0005
3	Main journals[1] ..... out-of-round:	0.0000	0.0005
4	Crankshaft		
4A	Front Journal.....diameter:	2.372	2.376
4B	#4 & #5 Main Journal.....diameter:	2.374	2.375
4C	Rear & Intermediate Journals .....diameter:	2.624	2.625
5	Crank pin .....diameter:	2.249	2.250
6	Crankshaft ..... runout:	0.0000	0.0070
7	Propeller Flange ..... runout:	0.000	0.003
8	Damper pin bushing in crank cheek ..... diametric clearance:	0.0015T	0.0030T
9	Damper pin bushing in counterweight ..... diametric clearance:	0.0015T	0.0030T
10	Damper pin in counterweight..... end clearance:	0.0090L	0.0390L
11	Alternator gear on crankshaft ..... diametric clearance:	0.0005T	0.0035T
12	Crankshaft gear on crankshaft..... diametric clearance:	0.0000	0.0020T
13	Crankshaft in thrust bearing..... end clearance:	0.004	0.016
14	Governor oil transfer collar on crankshaft..... diametric clearance:	0.0005L	0.0018L
	Camshaft		
15	Camshaft journals in crankcase..... diametric clearance:	0.0010L	0.0030L
16	Camshaft in crankcase ..... end clearance:	0.008	0.012
17	Camshaft ..... run-out:	0.0000	0.0010
18	Camshaft gear on camshaft flange..... diametric clearance:	0.0005T	0.0015T
	Connecting Rod		
19	Bushing in connecting rod ..... diametric clearance:	0.0025T	0.0050T
20	Bolt in connecting rod ..... diametric clearance:	0.0000	0.0018L
21	Connecting rod bearing on crank pin..... diametric clearance:	0.0009L	0.0034L
22	Connecting rod on crank pin..... end clearance:	0.0060	0.0113
23	Connecting rod bushing twist (convergence) per inch of length	See **M-0, Section 10-9.4**	
24	Connecting rod bushing bore..... diameter:	See **M-0, Section 10-9.4**	
25	Bushing center to crankpin center	See **M-0, Section 10-9.4**	
T= Tight L= Loose			

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.

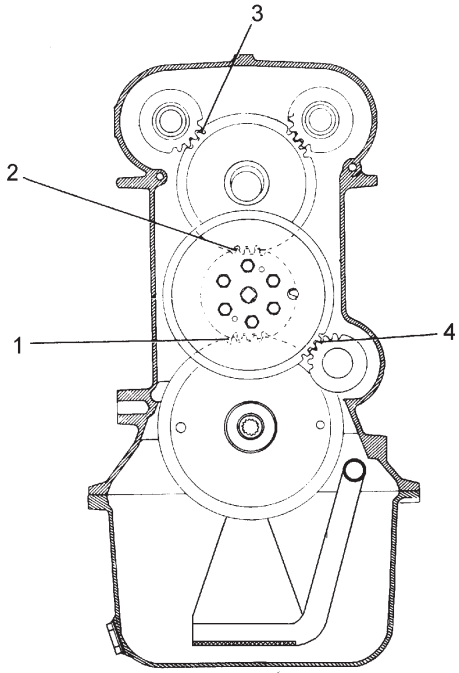
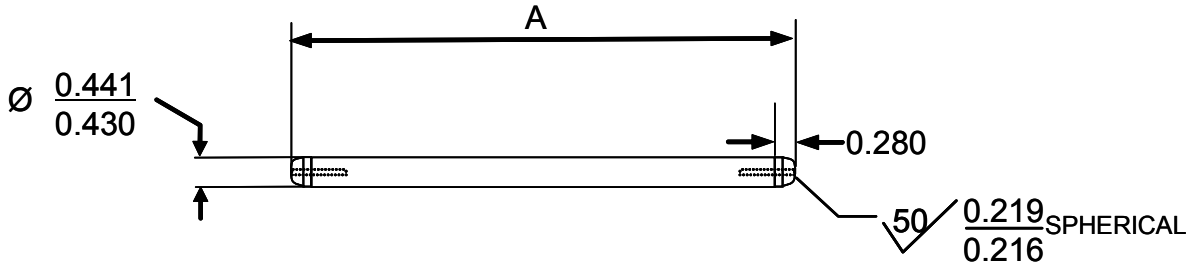


Figure D-16. Crankshaft, Camshaft, and Idler Gear Backlash

Table D-14. Crankshaft, Camshaft, and Idler Gear Backlash

Index	Part (See Figure D-16)	Dimensions (inches)	
		Minimum	Maximum
1	Crankshaft gear and camshaft gear ..... backlash	0.0080	0.0120
2	Crankshaft gear and idler gear ..... backlash	0.0080	0.0120
3	Idler gear and magneto drive gear (right and left) ..... backlash	0.0080	0.0120
4	Starter shaft gear and crankshaft gear ..... backlash	0.0080	0.0120



"A" dimension	Min	Max
Standard	13.632	13.662
P030 Oversize	13.662	13.692

Figure D-17. Pushrod Dimensions

D-8.1. Crankshaft Counterweight Assemblies

Refer to “Crankshaft Counterweight Inspection” in Section 10-9.1.3 of M-0, Standard Practice Maintenance Manual.

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

Refer to “Crankshaft Counterweight Inspection and Repair” in Section 10-9.1 of M-0, Standard Practice Maintenance Manual.

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.

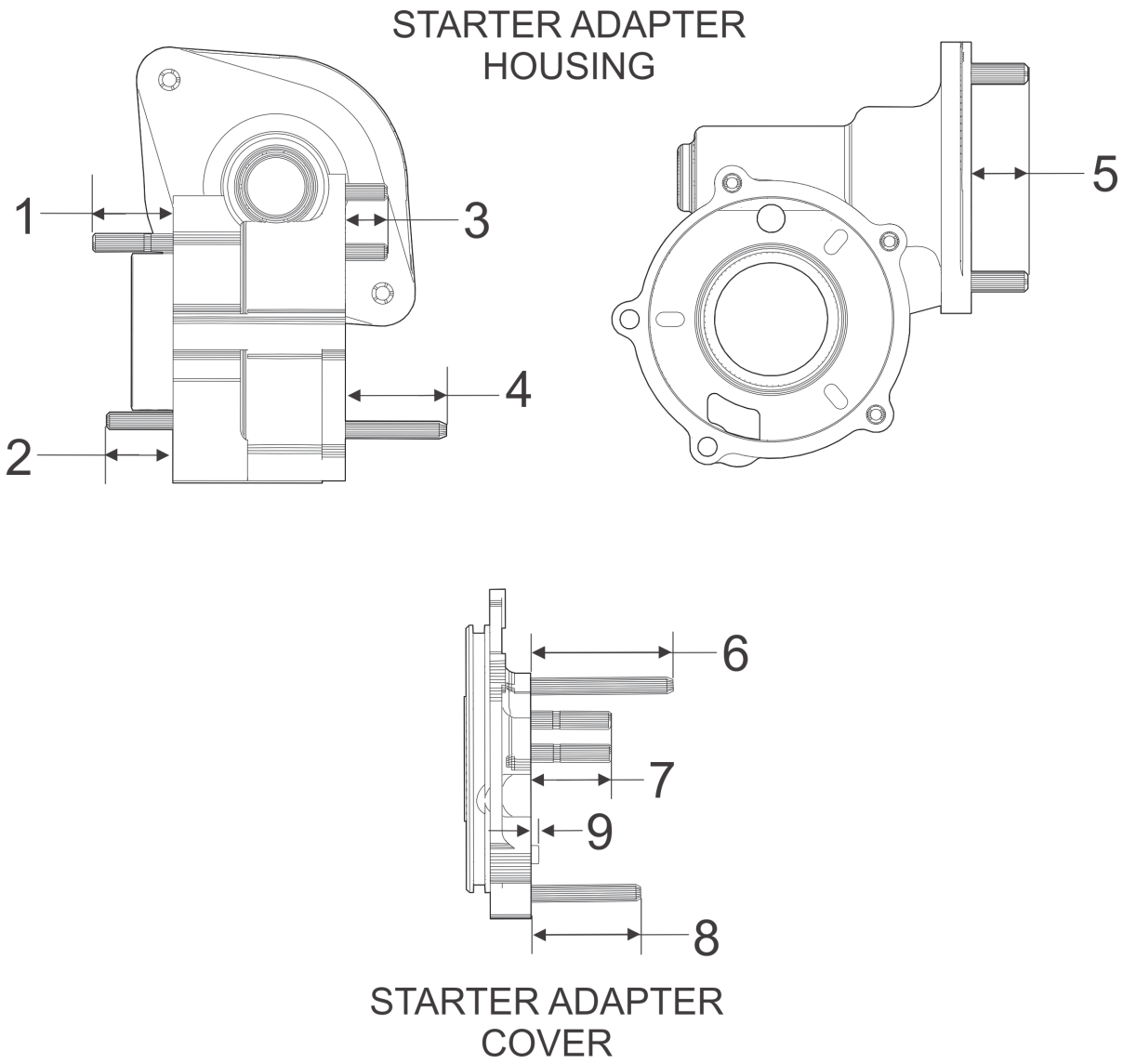


Figure D-18. Starter Adapter with Scavenge Pump

Table D-15. Starter Adapter with Scavenge Pump Stud Heights

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Starter Adapter to Crankcase	0.3125-18 X 0.3125-24	1.32	1
2	Stud, Starter Adapter to Crankcase	0.3125-18 X 0.3125-24	1.09	1
3	Stud, Cover to Adapter	0.3125-18 X 0.3125-24	0.67	3
4	Stud, Cover & Scavenge Body to Adapter	0.38-16 X 0.38-24	2.13	1
5	Stud, Starter Motor to Adapter	0.3125-18 X 0.3125-24	1.00	2
6	Stud, Cover to Scavenge Body	0.3125-18 X 0.3125-24	2.25	1
7	Stud, Cover to Scavenge Body	0.3125-18 X 0.3125-24	1.31	2
8	Stud, Cover to Scavenge Body	0.3125-18 X 0.3125-24	1.55	1
9	Dowel, Cover to Scavenge Body	0.45 X 0.625	0.15	1

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.

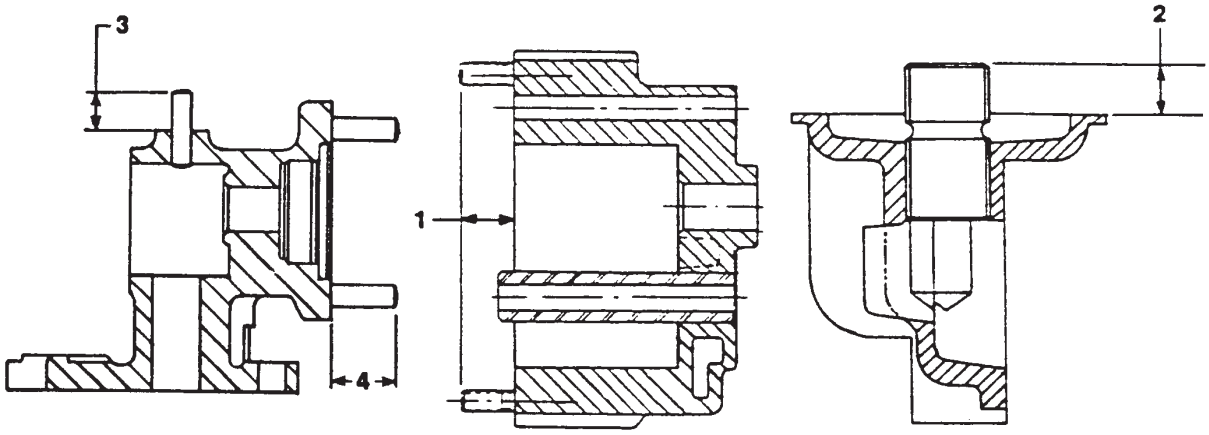


Figure D-19. Lubrication System Stud Height Settings

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Cover to Housing	0.25- 20 X 0.25 - 28	0.65	2
2	Stud, Oil Filter To Adapter	0.75-16 X 0.8125-16	0.500-0.700	1
	Note: Entries below only apply to oil pumps with a tachometer drive adapter			
3	Stud, Throttle Support	0.25- 20 X 0.25 - 28	0.44	1
4	Stud, Cover to Housing	0.25- 20 X 0.25 - 28	0.75	4

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.

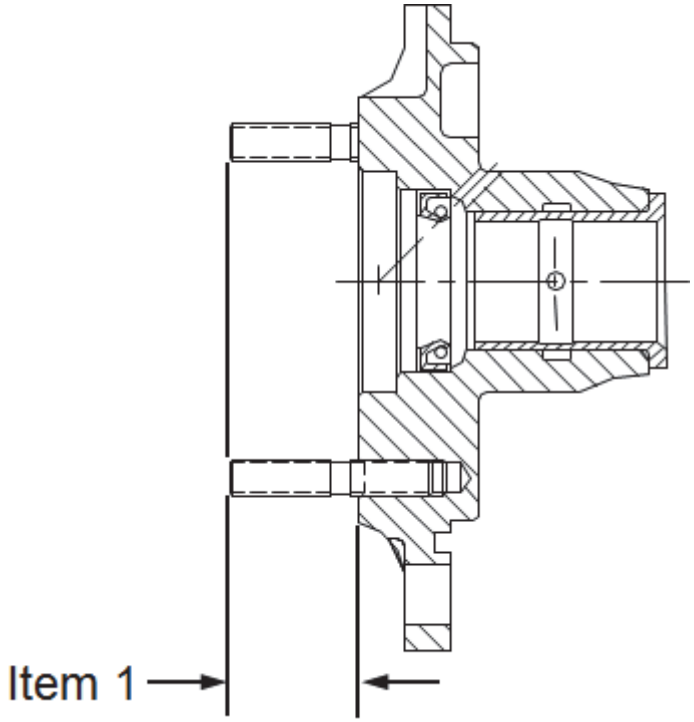


Figure D-20. Accessory Drive Adapter

Item	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Accessory to Adapter	0.25-20X 0.25-28	0.87-0.90	4

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.

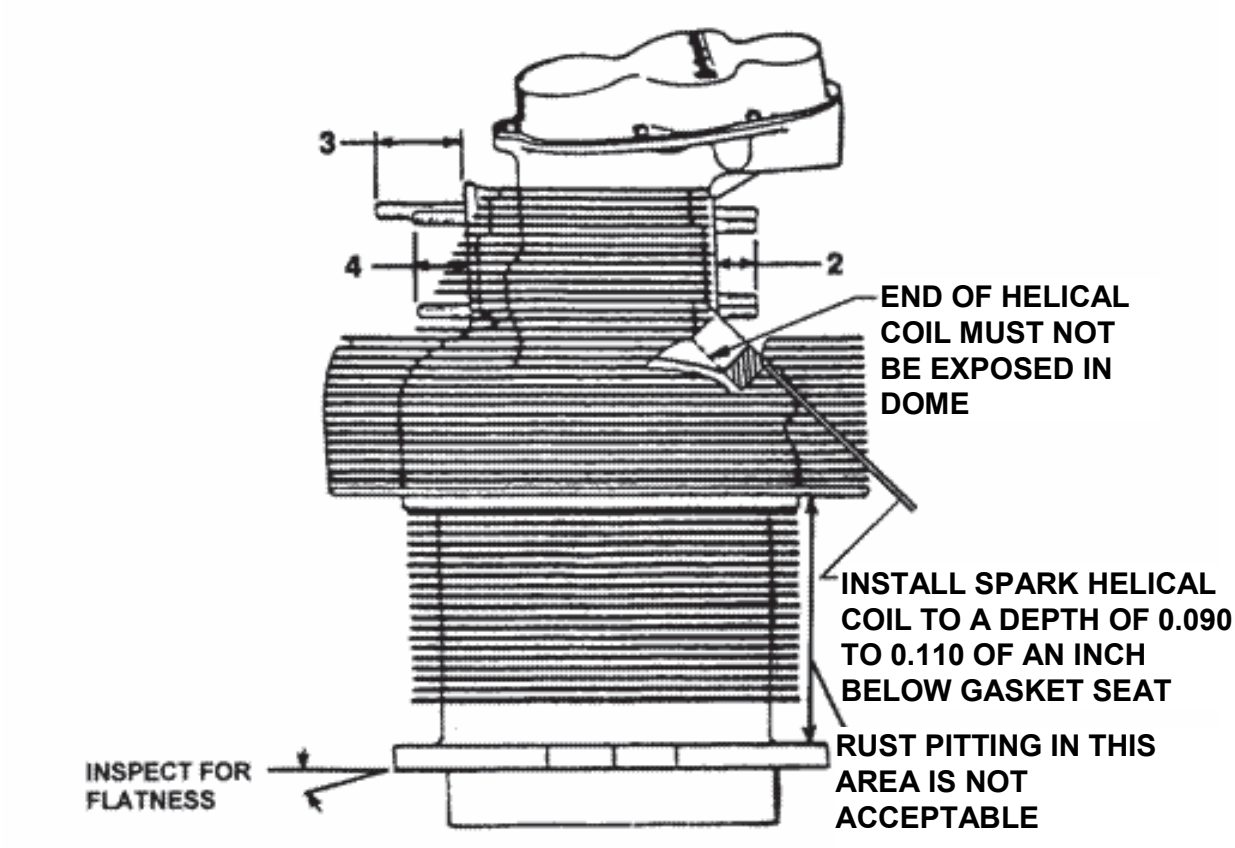


Figure D-21. Cylinder Stud Heights

Table D-16. Cylinder Stud Heights

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Exhaust flange stud (ring-locked)	1/4-20 x 1/4-28	0.865-0895	4
2	Exhaust flange stud (ring-locked)	1/4-20 x 1/4-28	0.865-0895	4
3	Intake flange stud	1/4-20 x 1/4-28	1.00	1
4	Intake flange stud	1/4-20 x 1/4-28	0.78	2

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**.

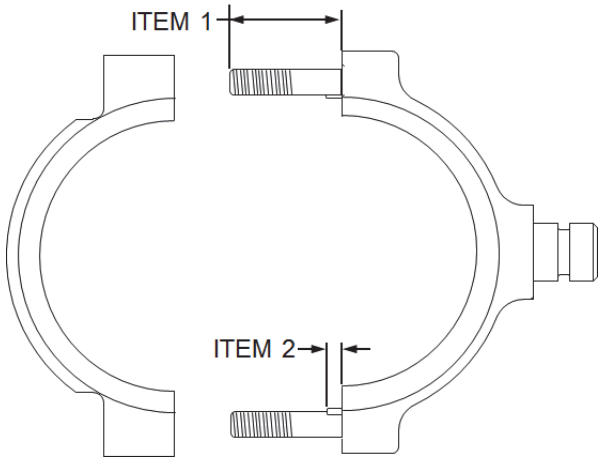


Figure D-22. Oil Control Collar Stud Height Settings

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Oil Control Collar Stud	1/4X1-1/4 LG	0.94	2
2	Dowel (Ferrule)	1/8X 7/16 LG	0.15	2

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 B C E G

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-23	1
2	Helical Coil	0.31-18	Install per Appendix C	2
3	Helical Coil	0.31-18	Install per Appendix C	3
4	Pin, Dowel	3/16X 0.50 LG	0.17 - 0.19	1
5	Stud, Through	5/16X18-24	0.98	1
6	Magneto Mount Pad	5/16X18-24	0.72	4
7	Accessory Pad	3/8X16-24	0.97	2
8	Accessory Pad	5/16X18-24	0.98	2
9	Idler Pin Pad	1/4X20-28	0.56	2
10	Fuel Pump Pad	5/16X18-24	0.75	2
11	Starter Adapter Pad	5/16X18-24	3.69	1
12	Oil Pump Pad	1/4X20-28	3.38	5
13	Plug	3/8 X18	--	1
14	Oil Pump Pad	3/8X16-24	2.94	3
15	Oil Pump Pad	1/4X20-28	1.77	1
16	Oil Pump Pad	5/16X18-24	4.27	1
17	Plug	1/8X27	---	3
18	Plug	1/16X27	---	4
19	Plug	1/8X27	---	2
20	Camshaft Cover Pad	1/4X20-28	0.69	2
21	Plug	1/8X27NPTF	---	1
22	Accessory Drive	5/16X18-24	0.81	1
23	Helical Coil	---	Install per Appendix C	2
24	Plug	1/4X27	---	1
25	Cylinder Mount Pad	7/16X14-20	0.81	36
26	Cylinder, 7th Stud	7/16X14-20	0.95	6
27	Plug	--	--	1
28	Oil Cooler Mount Pad	3/8X16-24	1.08	2
29	Gasket	--	--	1
30	Propeller Governor Pad	5/16X18-24	1.38	4
31	Bolt, Backbone	5/16X18-24	Install prior to studs (6)	10
32	Washer	5/16 I.D.	Install prior to studs (6)	2
33	Bearing	--	--	1
34	Engine Mount	3/8X16-24	3.32	4
35	Engine Mount	3/8X16-24	1.51	2
36	Squirt Nozzle	---	Not field replaceable	6
37	Oil Cooler Mount	3/8X16-24	0.92	2
38	Engine Mount	3/8X16-24	3.60	4
39	Accessory Pad	5/16X18-24	0.75	3
40	Dowel	0.625X1.00 LG	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	5/16X18-24	0.81	4
43	Engine Mount	3/8X16-24	3.60	2

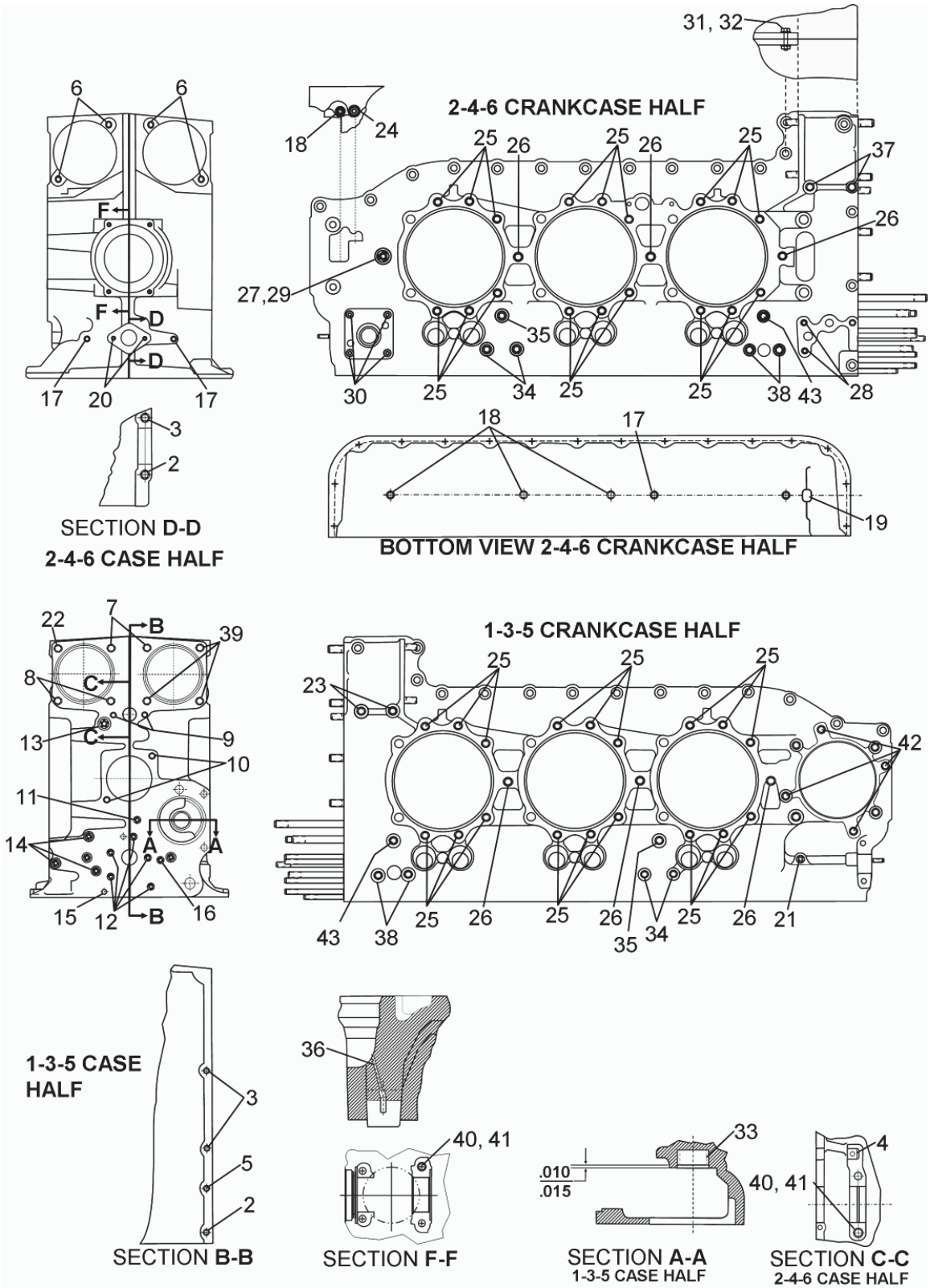


Figure D-23. Crankcase Stud Detail B C E G

Table D-19. Crankcase Stud Height Settings K N

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-24	1
2	Helical Coil	0.3125-18	Install per Appendix C	2
3	Helical Coil	0.3125-18	Install per Appendix C	3
4	Pin, Dowel	0.1875 X 0.50 LG	0.17 - 0.19	1
5	Stud, Through	0.3125 X18-24	5.34	1
6	Magneto Mount Pad	0.3125 X18-24	0.72	4
7	Accessory Pad	0.375 X16-24	0.97	2
8	Accessory Pad	0.3125 X18-24	0.98	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.3125 X18-24	0.75	2
11	Starter Adapter Pad	0.3125 X18-24	3.69	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Plug	0.375 X18	--	1
14	Oil Pump Pad	0.375 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.3125 X18-24	4.27	1
17	Plug	0.125 X 27	---	3
18	Plug	0.0625 X 27	---	4
19	Plug	0.125 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.125 X 27NPTF	---	1
22	Accessory Drive	0.3125 X18-24	0.81	1
23	Helical Coil	---	Install per Appendix C	2
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.4375 X14-20	0.81	36
26	Cylinder, 7th Stud	0.4375 X14-20	0.95	6
27	Plug	--	--	1
28	Oil Cooler Mount Pad	0.375 X16-24	0.88	2
29	Gasket	--	--	1
30	Propeller Governor Pad	0.3125 X18-24	1.38	4
31	Bolt, Backbone	0.3125 X18-24	Install prior to installing studs (6)	10
32	Washer	0.3125 I.D.	Install prior to installing studs (6)	2
33	Bearing	--	--	1
34	Engine Mount	0.375 X16-24	3.32	4
35	Engine Mount	0.375 X16-24	1.51	2
36	Squirt Nozzle	---	Not field replaceable	6
37	Oil Cooler Mount	0.375 X16-24	0.81	2
38	Engine Mount	0.375 X16-24	3.60	6
39	Accessory Pad	0.3125 X18-24	0.75	3
40	Dowel	0.625 X1.00 LG	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.3125 X18-24	0.81	4

Crankcase Stud Detail

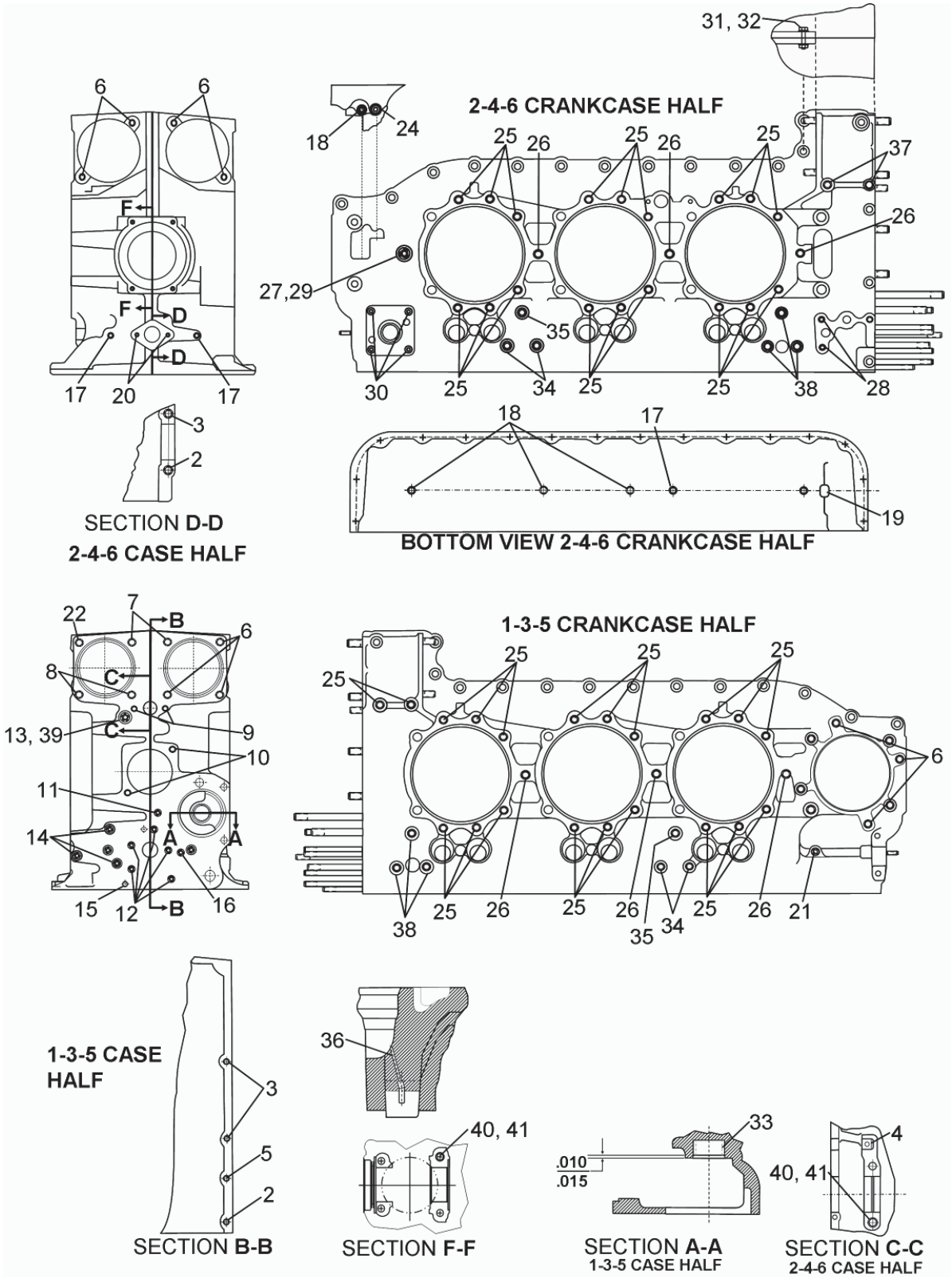


Figure D-24. Crankcase Stud Detail K N

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