IO-550-A
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CONTINENTAL® AIRCRAFT ENGINE

PERMOLD SERIES ENGINE

MAINTENANCE AND OVERHAUL MANUAL

Technical Portions Accepted by the Federal Aviation Administration

Publication M-16

CHANGE 1
FEB 2015

Supersedure Notice

This manual is a revision of publication M-16, dated 31 August 2011. Instruction contained in the previous edition of M-16 and Forms X30634 and X30568 are superseded upon FAA acceptance and release of this document.

Effective Changes for this Manual

0 .... 1 September 2014			
1 ....15 February 2015			

List of Effective Pages

Document Title: IO-550 Permold Series Engine Maintenance and Overhaul Manual
Publication Number: M-16 Initial Publication Date: 1 September 2014

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Published and printed in the U.S.A. by Continental Motors, Inc.

Available exclusively from the publisher: P.O. Box 90, Mobile, AL 36601

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

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

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

WARNING

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

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

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

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Chapter 1. Introduction

1-1. Scope and Purpose of This Manual

This manual provides engine maintenance and overhaul instructions applicable to IO-550-A, B, C, G, N, P and R aircraft engine models using the Permold crankcase design. referred to collectively as "IO-550 Permold Series" engines, manufactured by Continental Motors. Instructions in this manual are specific to the IO-550 Permold Series engines. For information specific to other Continental Motors engine series, accessories, or the airplane, refer to the appropriate manual. Chapters are arranged in sequential order to install, test, and operate the engine.

Chapter 2 contains detailed engine model descriptions and specifications. Chapter 5 provides engine installation instructions. Chapter 7 provides supplemental information for the airplane flight manual (AFM) or pilot operating handbook (POH) in regards to specific engine operating procedures. Appendix A contains a glossary of common terms and acronyms used throughout the manual; Appendix B provides torque specifications, and Appendix C contains standard maintenance practices.

1-1.1. Instructions for Continued Airworthiness

CMI Part No. M-16, is the principal instruction for continued airworthiness for IO-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-16	Maintenance and Overhaul Manual	IO-550 engines
X30592	Starter Service Instructions	CMI Energizer® starters
X30531	Alternator Service Instructions	CMI alternators
X42001	S-1200 Series Magneto Service Manual	CMI S-1200 magnetos
X42002	S-20/200 Series Magneto Service Manual	CMI S-20/S-200 magnetos

1-1.2. Effectivity Symbols

Slight variations in IO-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:

IO-550-A A	IO-550-B B	IO-550-C C
IO-550-G G	IO-550-N N	IO-550-P P
IO-550-R R		
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, the accessory manuals listed in Table 1-1, and certain service documents that are incorporated into the manuals as revisions constitute the Instructions for Continued Airworthiness (ICAs) prepared by Continental Motors and accepted by the Federal Aviation Administration (FAA). Continental Motors 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 parts catalog for engine model-specific illustrated parts breakdowns.

Continental Motors provides ICAs 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 FAA.

WARNING

Continental Motors Instructions for Continued Airworthiness are applicable *only* to engines conforming to the approved, type certified engine model configuration. Continental Motors ICAs *must not* be used for aftermarket parts obtained from sources other than Continental Motors or our authorized distributors.

Installation of aftermarket parts on a Continental Motors engine constitutes a deviation from FAA approved 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.

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.

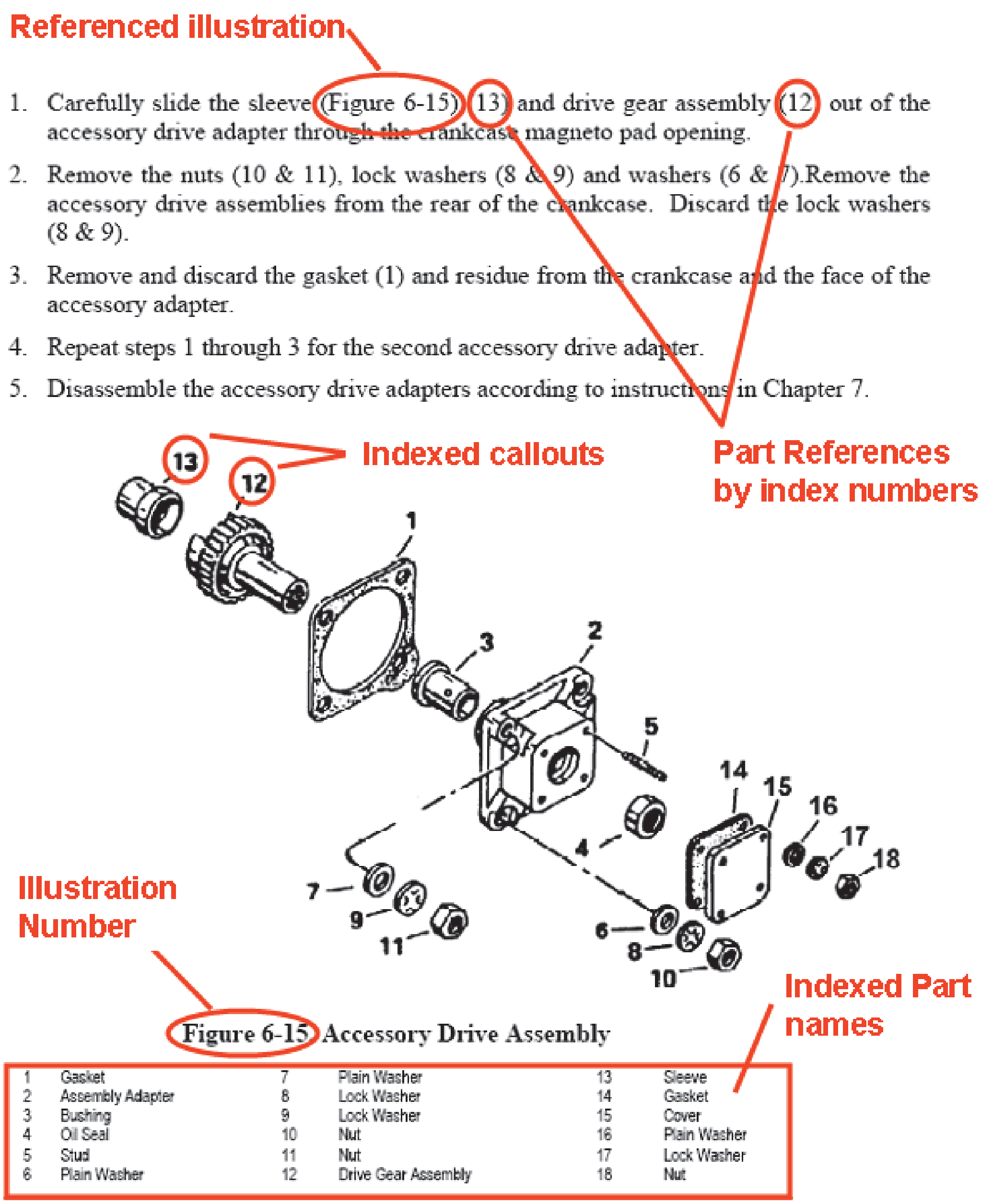


Figure 1-1. Figure and Index Reference

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 and certain service bulletins that are incorporated into the ICAs as revisions. Engine service life is calculated 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 installation or maintenance, the owner must ensure the mechanic meets FAA (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 working under the supervision of an FAA licensed mechanic. 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 injury or 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 ICAs or other methods, techniques, and practices 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 acceptable to 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 current AFM/POH published by the airframe 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 format (*filenam*e.pdf) 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.

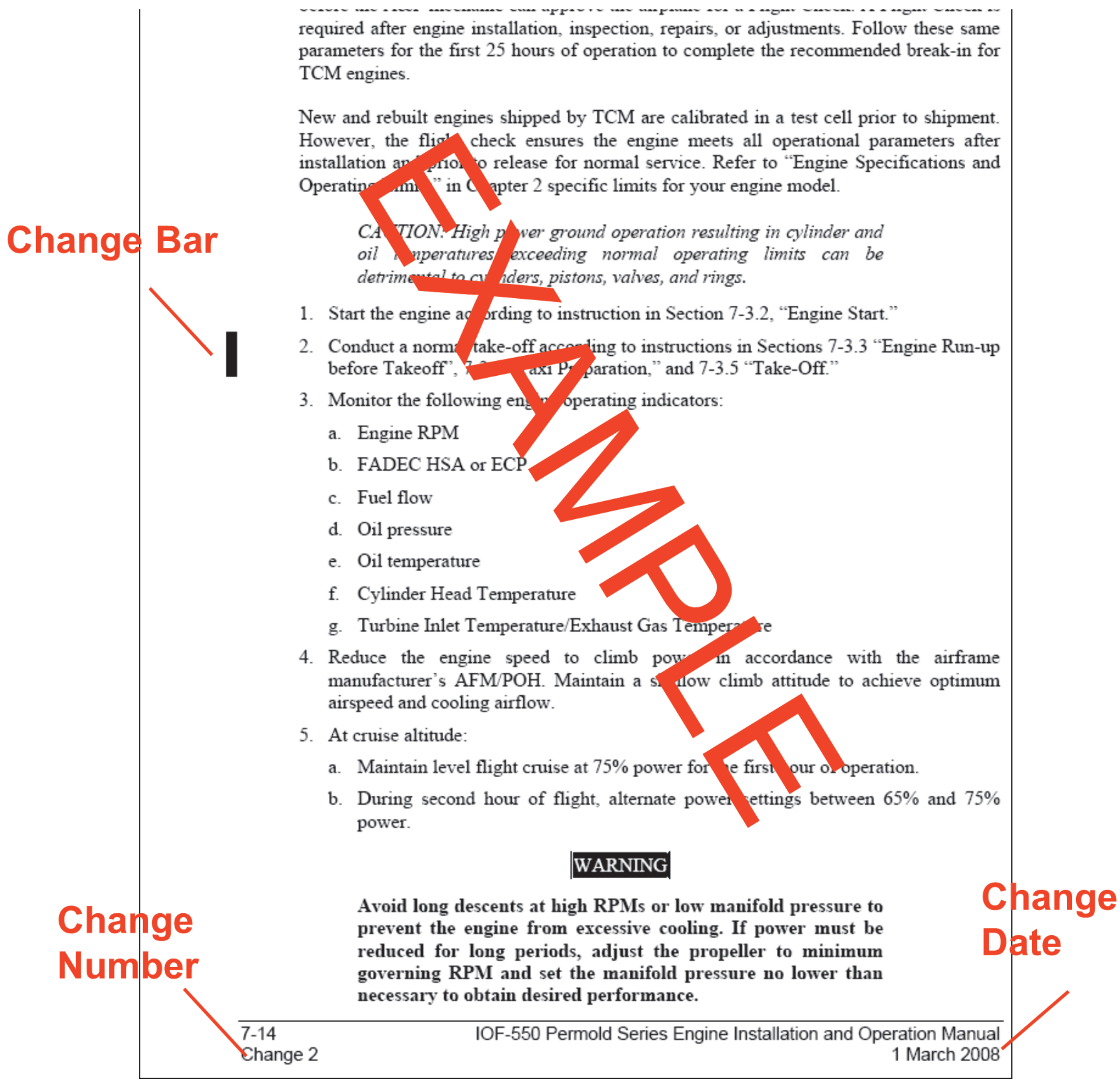
The instructions in this manual represent the best and most complete information available at the time of publication. Product or process improvements may trigger changes to existing product design specifications or procedures contained in publications. As new technical information becomes available, 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 IO-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.


required after engine installation, inspection, repairs, or adjustments. Follow these same parameters for the first 25 hours of operation to complete the recommended break-in for TCM engines.

New and rebuilt engines shipped by TCM are calibrated in a test cell prior to shipment. However, the flight check ensures the engine meets all operational parameters after installation and prior to release for normal service. Refer to "Engine Specifications and Operating Limits" in Chapter 2 specific limits for your engine model.

CAUTION: High power ground operation resulting in cylinder and oil temperatures exceeding normal operating limits can be detrimental to cylinders, pistons, valves, and rings.

1. Start the engine according to instruction in Section 7-3.2, "Engine Start."
2. Conduct a normal take-off according to instructions in Sections 7-3.3 "Engine Run-up before Takeoff", 7-3.4 "Taxi Preparation," and 7-3.5 "Take-Off."
3. Monitor the following engine operating indicators:
   a. Engine RPM
   b. FADEC HSA or ECP
   c. Fuel flow
   d. Oil pressure
   e. Oil temperature
   f. Cylinder Head Temperature
   g. Turbine Inlet Temperature/Exhaust Gas Temperature
4. Reduce the engine speed to climb power in accordance with the airframe manufacturer's AFM/POH. Maintain a shallow climb attitude to achieve optimum airspeed and cooling airflow.
5. At cruise altitude:
   a. Maintain level flight cruise at 75% power for the first hour of operation.
   b. During second hour of flight, alternate power settings between 65% and 75% power.

WARNING

Avoid long descents at high RPMs or low manifold pressure to prevent the engine from excessive cooling. If power must be reduced for long periods, adjust the propeller to minimum governing RPM and set the manifold pressure no lower than necessary to obtain desired performance.

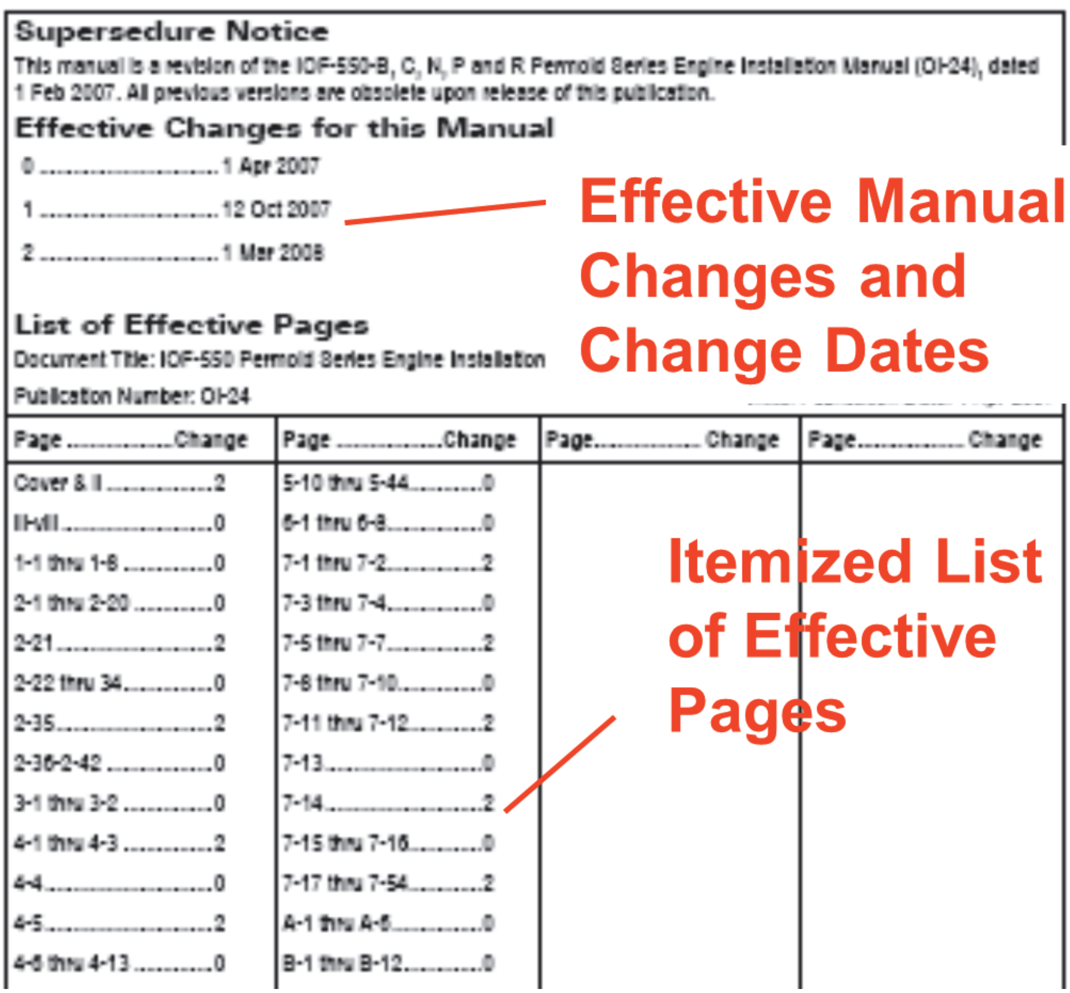
7-14 IOF-550 Permold Series Engine Installation and Operation Manual
Change 2 1 March 2008

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

List of Effective Pages

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Publication Number: OI-24

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4-4 0	7-17 thru 7-54 2		
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4-6 thru 4-13 0	B-1 thru B-12 0		

Figure 1-3. List of Effective Pages

1-2.4. Service Documents

Six categories of Service Documents may be issued by Continental Motors 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 Continental Motors' 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 Continental Motors' 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 Continental Motors' 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 Continental Motors' 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. Continental Motors 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 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
M76-4, Installation of Propeller Shafts and Nose Oil Seals	Oil Seal replacement	10, 16, 17
M86-13R1, Camshaft Plug Inspection and Overhaul Revision	Camshaft Inspection and Replacement	13
M87-15, Alternator Ground Strap	Alternator Replacement	10
M88-9, Lightning Strikes	Unscheduled Maintenance	6
M88-10, Contaminated Fuels	Unscheduled Maintenance	6
M89-9, Excessive Crankcase Pressure	Unscheduled Maintenance	6, 7 & 8
M90-13, Exhaust Valve Stem Corrosion/Erosion	Inspection and Overhaul	10
M92-6, Rocker Arm Retention Improvement for Inclined Valve Cylinder	Overhaul	15
M93-5, Chamfer on Crankcase Main Bearing Oil Feed Holes	Inspection	15
SIL93-11B, New 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	Appendix C
MSB94-8D, Magneto to Engine Timing	Service	5, 6, 7, 10 & 17
SIL94-5, Mobil AV-1 Oil	Authorized Lubricants	3
SB95-2, Inspection and Maintenance of Engine Control Cables and Linkage	Inspection	6
SIL95-5, Hose and Tubing Installation	Hose and tubing installation	Appendix C
SB96-7C, Torque Limits	fastener torque	Appendix B
MSB96-10A, Crankshaft Ultrasonic Inspection	Crankshaft Removal & Replacement	15
SB96-11B, Propeller Strikes and Hydraulic Lock	Scheduled Inspection	6
SB96-12, Continued Airworthiness for TCM Cylinders	Scheduled Inspection	6 & 10
SIL97-1, Airworthiness Limitations	Airworthiness Limitations	4
SID97-2B, TCM Cylinder Warranties	N/A	N/A
SID97-3F, Continuous Flow Fuel Injection System Operational Check and Adjustment	Operational Checks and Adjustments	6
SID97-4F, Cylinder Bore and Piston Fit Specifications	Overhaul & Service Limits	10 & Appendix D
SB97-6B, Mandatory Replacement Parts	Engine Inspection & Assembly	Throughout
CSB97-10A, Piston Pin Plug Wear	Service Limits	10
CSB98-1B, Intake and Exhaust Valve Inspection	Service Limits	10 & 15
SIL98-5, Production Release of P/N 654837A1 Camshaft Assembly	Camshaft Replacement	15
SIL98-9C, Time Between Overhaul Periods	Engine Specifications, Scheduled Maintenance	2 & 6

Service Document	Subject	Affected Chapter
SIL99-1, Engine Preservation for Active and Stored Aircraft	Engine preservation and returning an engine to service after storage	9
SIL99-2C, Authorized List of Sealants, Lubricants and Adhesives	Materials	Throughout
SB99-8A, Engine Fuel Injection System Preservation	Fuel Injection system storage	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, TCM P/N 649304A1 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
SIL04-2, Cylinder Barrel Ultrasonic Inspection	N/A	10, 15
CSB04-5A, TCM Ignition Systems CSB665A	Magneto Service	10
CSB04-6A, 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
SIL04-12A, TCM Authorized Engine Adjustments, Component Replacement and Repositioning	Engine Specification	2, 5, 10 & 17
SID05-1A, Inspection Guidelines for Camshafts and Hydraulic Lifters	Inspection Criteria	15 & Appendix D
SB05-2, Overspeed Limitations	Unscheduled Maintenance	6 & 7
SIL05-3A, Engine Specification Numbers	Engine Specification	2
SB05-7, TCM Position Tuned Fuel Injector Nozzle	Fuel Injector Replacement	2, 6, 10 & 16
SB05-8A, Improved Camshaft Gear	Camshaft Gear Replacement and Overhaul	13, 15 & 17
SB06-1A, Fuel System 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
SB07-8, Recommended Minimum RPM & Manifold Pressure Cruise Operations Limits	Engine Operation	7
CSB08-3C, Throttle & Mixture Control Levers	Fuel Injection System Assembly	5, 6, 10 & 17
SB08-4, Fuel Injection System Contamination	Fuel Injection Service	5, 7
SB08-8, Slick Service Bulletin SB2-08	Magneto Inspection	6, 15

Service Document	Subject	Affected Chapter
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
SB09-4A, 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
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SIL13-3, Placement of O-Ring on specific Fuel Injector Nozzles	Fuel System Service	10, 16
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SB13-6A, Crankshaft Gear Replacement	Engine Overhaul	13
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SIL14-4A, 24V/70A Belt-Driven Alternator Brace Adjustment	Alternator Installation	6, 10, 17

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 Chapter 1, 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 Bulletins Release After This Manual

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1-2.5. Related Publications

The table below lists related publications, source, and accessibility relevant to IO-550 Permold Series engine installation, operation, maintenance and 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	Electronic version available for download[1]	Printed manual available for purchase
Instructions for Continued Airworthiness			
IO-550 Maintenance and Overhaul Manual (M-16) (this manual)	Yes	Yes	Yes
Starter Service Instructions (X30592)[2]	Yes	Yes	Yes
Alternator Service Instructions (X30531)	Yes	Yes	Yes
S-20/S-200 Series Magneto Service Manual (X42002)	Yes	Yes	Yes
S-1200 Series Magneto Service Manual (X42001)	Yes	Yes	Yes
Engine Installation Manual			
Installation and Operation Manual (OI-16)	Yes[3]	Yes	Yes
Illustrated Parts Catalog			
Electronic Engine Product Catalog (by Engine Model and Specification)	No	Yes (view only)	No

1. Our web site (continentalmotors.aero) provides 24-hour access to engine technical data via the Internet. If you are an Internet service subscriber, you can access the web site to confirm and review the latest revision of this manual. If you have not subscribed to Internet service and are using printed materials, contact a customer service representative using the “Contact Information” on page 1-15. to confirm you have the latest revision of the manual.
2. As applicable to engine model specification
3. The Installation and Operation Manual is provided to the airframe 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 Continental Motors’ Customer Service department immediately, using our toll-free number, if you discover incorrect information which adversely affects safety.

1-3. Contact Information

Continental Motors service 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 authorized Continental Motors distributor or Continental Motors field representative. Our mailing address, telephone numbers and Internet address are listed below:

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

Continental Motors Customer Service:

Toll free within the Continental United States:	1-888-826-5465
International:	1-251-438-8299

Internet address: http://continentalmotors.aero.

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Chapter 2. Engine Description

2-1. General Engine Description

IO-550-A, B, C, G, N, P & R engines are six cylinder fuel injected engines with horizontally opposed air cooled cylinders designed for variable-pitch propeller applications. IO-550-A, B & C engine models feature an updraft cylinder design; IO-550-G, N, P & R engine models use the cross flow cylinder design with overhead inclined valves.

The 550 cubic inch displacement is achieved using a 5.25 inch diameter cylinder bore and a 4.25 inch piston stroke. IO-550-A, B, C, G, N, P & R engines utilize the Permold Series crankcase design. Basic engine weights, minus accessories, are listed in Section 2-3. Engine weights vary by model specification, refer to the engine Detailed Model Specification for installed engine weights, including accessories.

The engine is provided with four 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 number 2 and number 4 cylinders. A 0.374-24 UNF threaded port is located on 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 engine driven pressure oil pump, engine mounted oil cooler, oil sump, full flow oil filter, oil pressure relief valve, and provisions for aircraft pressure and temperature instrumentation. An oil cooler is mounted on the left crankcase half behind the number 2 cylinder. An oil temperature control valve, called a “Vernatherm” restricts oil flow through the oil cooler until normal operating temperatures are reached. During engine warm up, a cavity in the base of the oil cooler allows free flow of oil back to the crankcase, bypassing the vernatherm.

IO-550-A, B & C engines incorporate an updraft balanced port induction system with an engine mounted throttle body. IO-550-G, N, P & R feature a downdraft balanced port fuel injection system with 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.

IO-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 and mixture control angle. The metered fuel is fed to continuous flow air bled injector nozzles located at each cylinder intake port. IO-550 engines with updraft cylinders feature fuel drains located in the induction tubes. IO-550 engines with crossflow cylinders feature fuel drains at the bottom of each cylinder.

2-1.1. Engine Model Number Definition

The engine model number indicates key features of the engine. Each alphanumeric character in the engine model number has a specific meaning, Figure 2-1 depicts the significance of each character in the IO-550-B1B engine model designation.

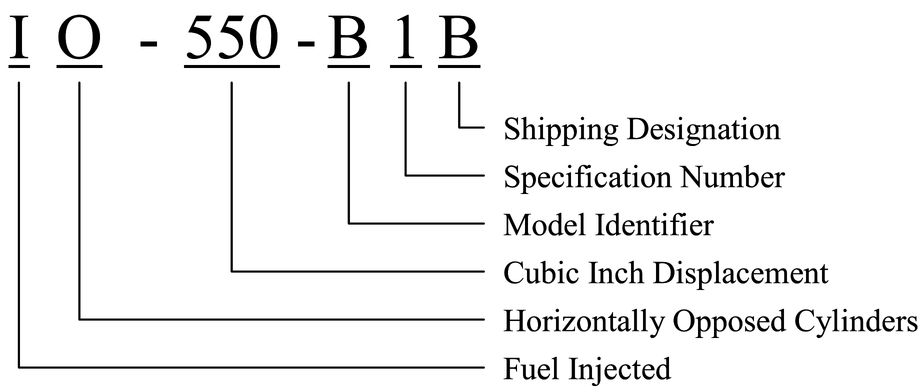

Figure 2-1. Engine Model Definition

2-1.2. Cylinder Number Designations

Refer to Figure 2-2:

- 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.

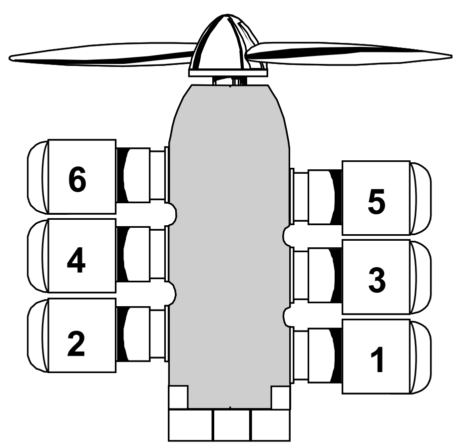

Figure 2-2. Cylinder Number Designation

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 crankcases 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.

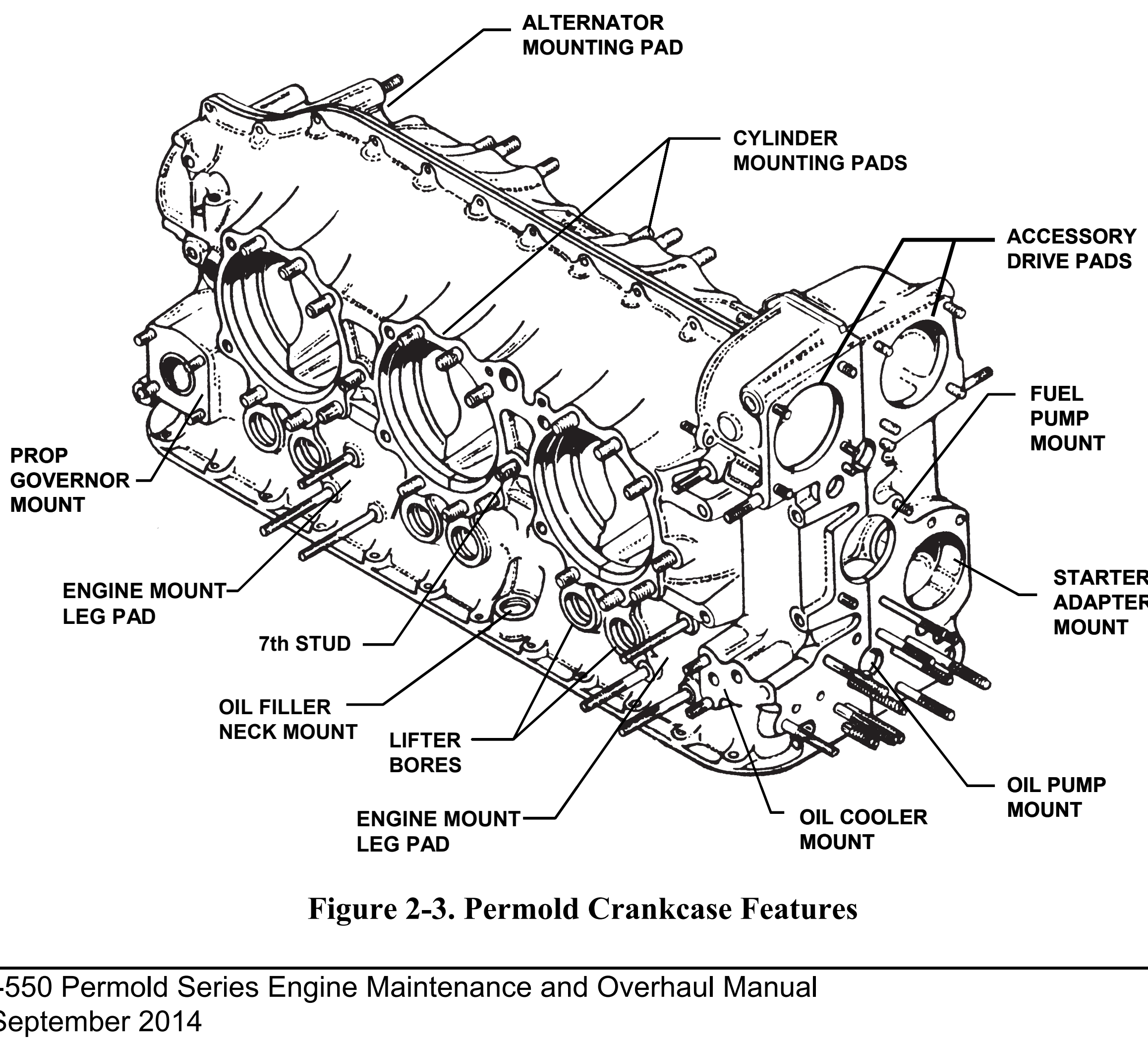

Figure 2-3. Permold Crankcase Features

2-2.2. Engine Drive Train

When starting the engine, torque is transmitted from the starter through the starter adapter components to the large 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 small 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 mates directly with the square drive machined in the center of the small 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.

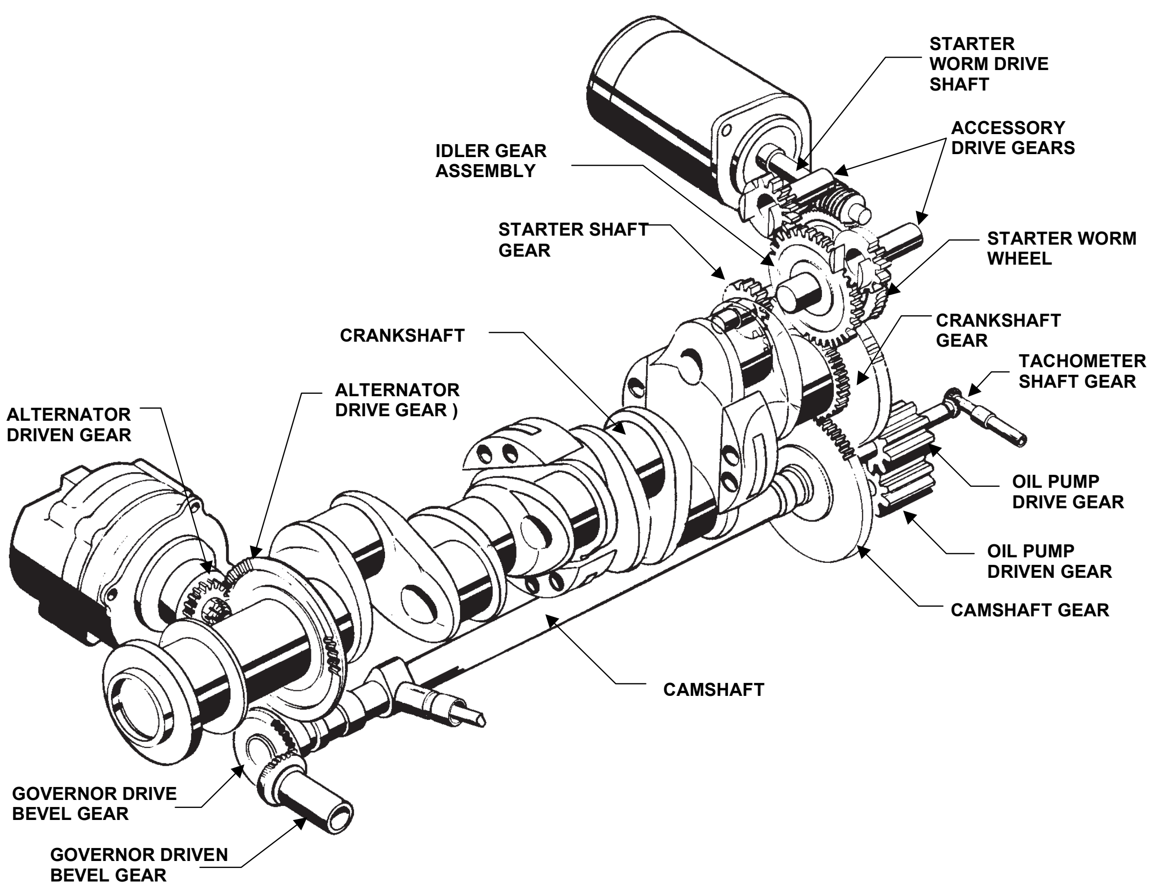

Figure 2-4. Engine Drive Train

2-2.2.1. Crankshaft

The crankshaft is precision machined aircraft quality steel supported within the crankcase by precision tri-metallic bearing inserts installed in each of the five main bearings saddles. Six, machined rod journals provide for attachment of 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 on the number two crankshaft cheek hangers. Installed on the number five crankshaft cheek hangers is one fifth order counterweight and one fourth order counterweight.

The crankshaft gear is heated prior to installation to facilitate installation. The gear is positioned on the crankshaft by a dowel pin; it incorporates a machined square to interface with the direct drive 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 number 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.

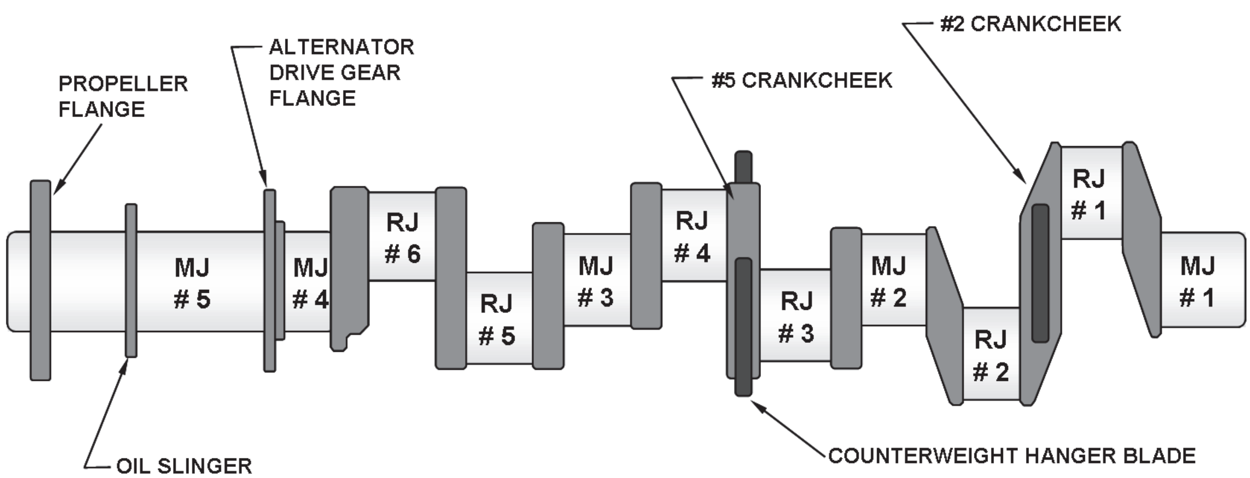

Figure 2-5. Crankshaft

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 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 piston pin-to-bushing fit. Connecting rods are supplied in weight-matched pairs within opposing cylinder bays and must be replaced in matched pairs.

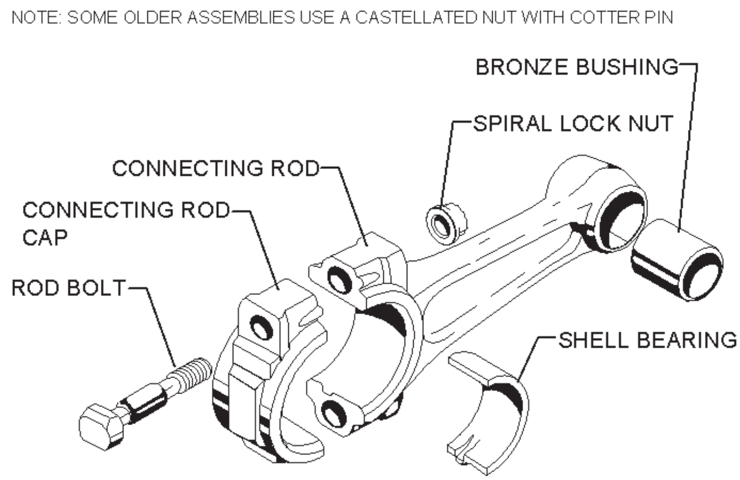

Figure 2-6. Connecting Rod

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 mount flange at the rear of the camshaft. The camshaft journals are supported by 4 precision line bored saddles within the crankcase. 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 crankcase 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 splined bevel gear provides torque to the prop governor drive bevel gear.

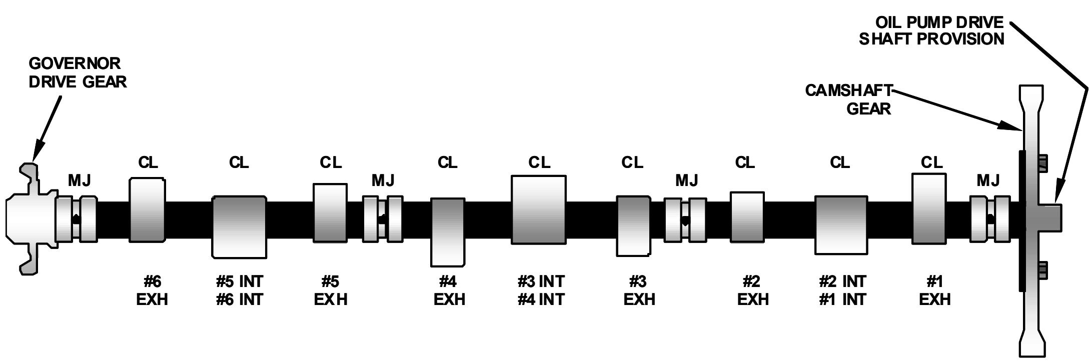

Figure 2-7. Camshaft

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

The IO-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 steel, nitrided cylinder barrel for wear resistance. Helical coil 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.

IO-550 Permold Series engines employ an inclined valve design. The inclined valve design permits the creation of a hemispherical dome in the top of the combustion chamber which improves airflow efficiency through the cylinder head. The intake valve seat is a Venturi style seat permitting improved airflow into the cylinder combustion chamber. The exhaust valve is a solid design and transfers the heat generated during combustion directly into the exhaust valve seat where it is radiated into the cylinder head.

The IO-550 engine features either cross-flow or updraft cylinders, depending on the engine model. Refer to Section 2-2.3.1, “Updraft Cylinder Design” and Section 2-2.3.2, “Cross-flow Cylinder Design” for descriptions of the two cylinder designs.

2-2.3.1. Updraft Cylinder Design

The IO-550-A, B & C engine cylinder head design has intake and exhaust ports located on the bottom of the cylinder. This design is referred to as an “updraft configuration.” (Figure 2-8) The valve rocker cover is one piece made of painted die-cast aluminum. Induction and exhaust tubes attach to the intake and exhaust ports on the bottom of the cylinders.

2-2.3.2. Cross-flow Cylinder Design

IO-550-G, N, P & R Series engine cylinders have intake ports located on top of the cylinder (Figure 2-9). 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.

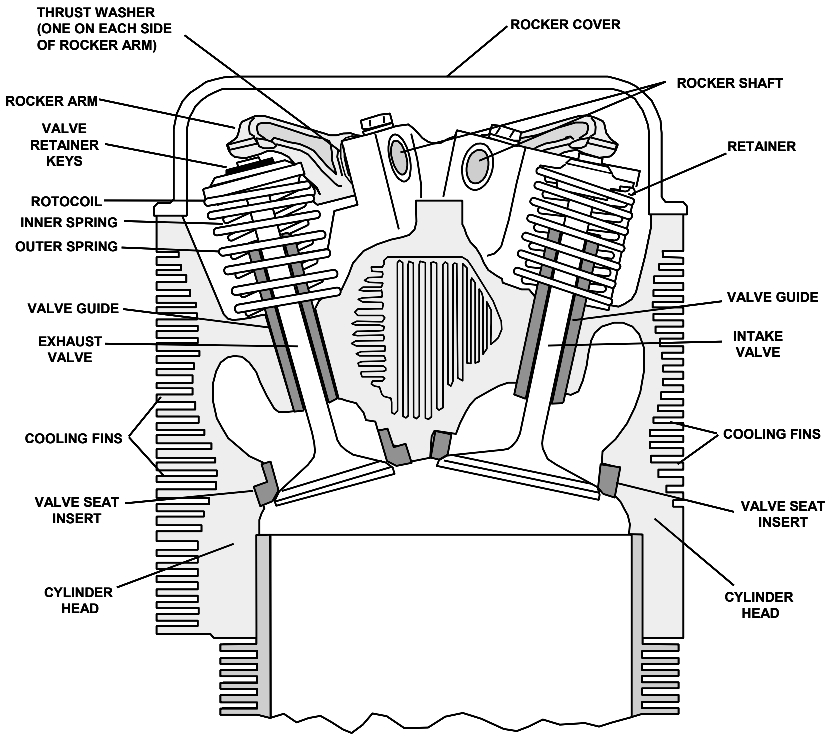

Figure 2-8. Updraft Cylinder Features

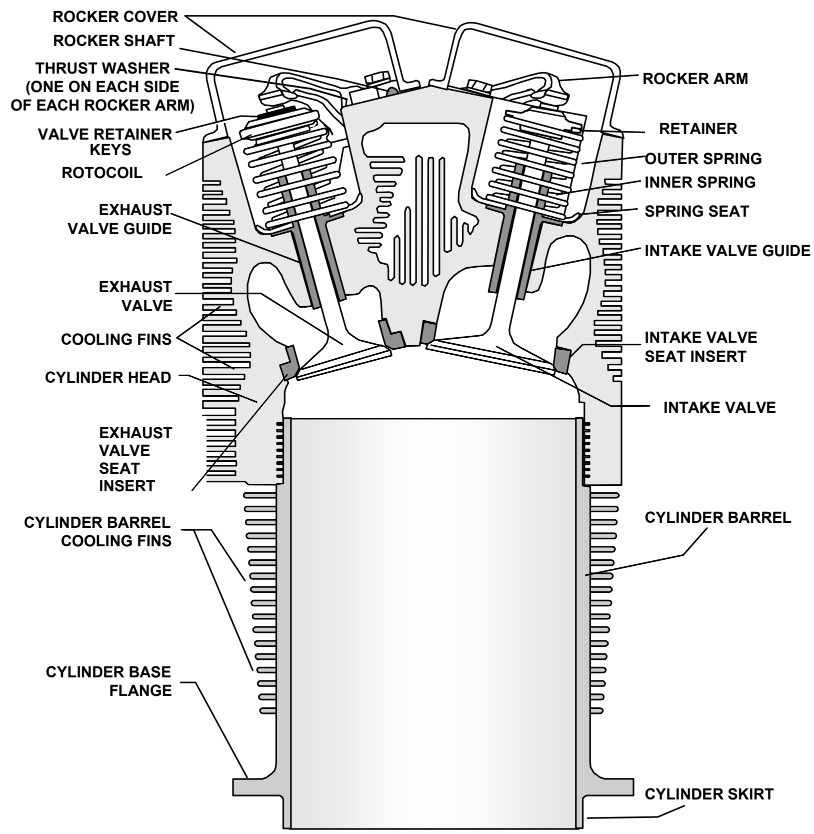

Figure 2-9. Crossflow Cylinder Features

2-2.3.3. Pistons

Pistons are aluminum alloy castings with a steel insert cast into the top ring groove. The skirts are solid with cylindrical relief cuts at the bottom. Pistons have three ring grooves above the piston pin hole and one ring groove below. Compression rings are installed in the top and second grooves. The groove below the pin hole contains an oil scraper. A center grooved and slotted oil control ring is installed in the third groove which has six oil drain holes to the interior. Weight differences are limited to ½ ounce between opposing cylinders bays. Piston pins are full floating with permanently pressed-in aluminum end plugs.

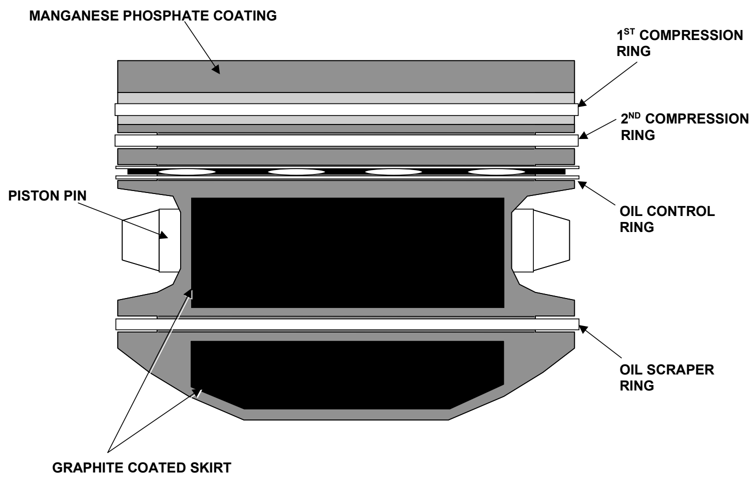

Figure 2-10. Piston Features

2-2.3.4. 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.

2-2.4. Lubrication System

The engine oil supply is contained in the oil sump. Oil is drawn through a screen in to the oil suction tube from the sump to the oil pump inlet. Pressurized oil from the oil pump outlet is directed past the oil pressure relief valve to the full flow, replaceable oil filter. From the oil filter discharge port, pressurized oil flows through a crankcase passage to the oil cooler.

Oil entering the engine is directed to the hollow camshaft which serves as the engine main oil gallery. Oil leaving the camshaft interior at the front of the crankcase is directed to the left crankcase gallery. From there, oil is directed upward through the crankcase oil passages to the front main bearings and thrust washers, the governor drive gear, and propeller governor pad. From the propeller governor pad, lubricating oil is directed through the propeller governor and drilled crankcase passages to the oil transfer collar and crankshaft. Oil then travels through a transfer plug inside the crankshaft and routed to the variable pitch propeller. Hydraulic valve tappets transfer oil from the oil galleries to the cylinder overhead through hollow pushrods to drilled oil passages in the rocker arms. Oil exiting the rocker arms lubricates the rocker shafts, valves stems, roto coils and springs. The oil then flows through the lower portion of the rocker cavity and returns to the crankcase and sump through the pushrod housings.

Oil from the left crankcase gallery is also directed through crankcase oil passages to the crankshaft main bearings and idler gear bushing. Oil from the idler gear bushing feeds both accessory drive bushings. Oil lubricating the crankshaft mains is directed through the upper main bearing oil holes, through crankcase passages to oil squirt nozzles that spray a mist of oil on the under side of the piston for cooling; gravity returns the engine oil to the sump to repeat the lubrication process.

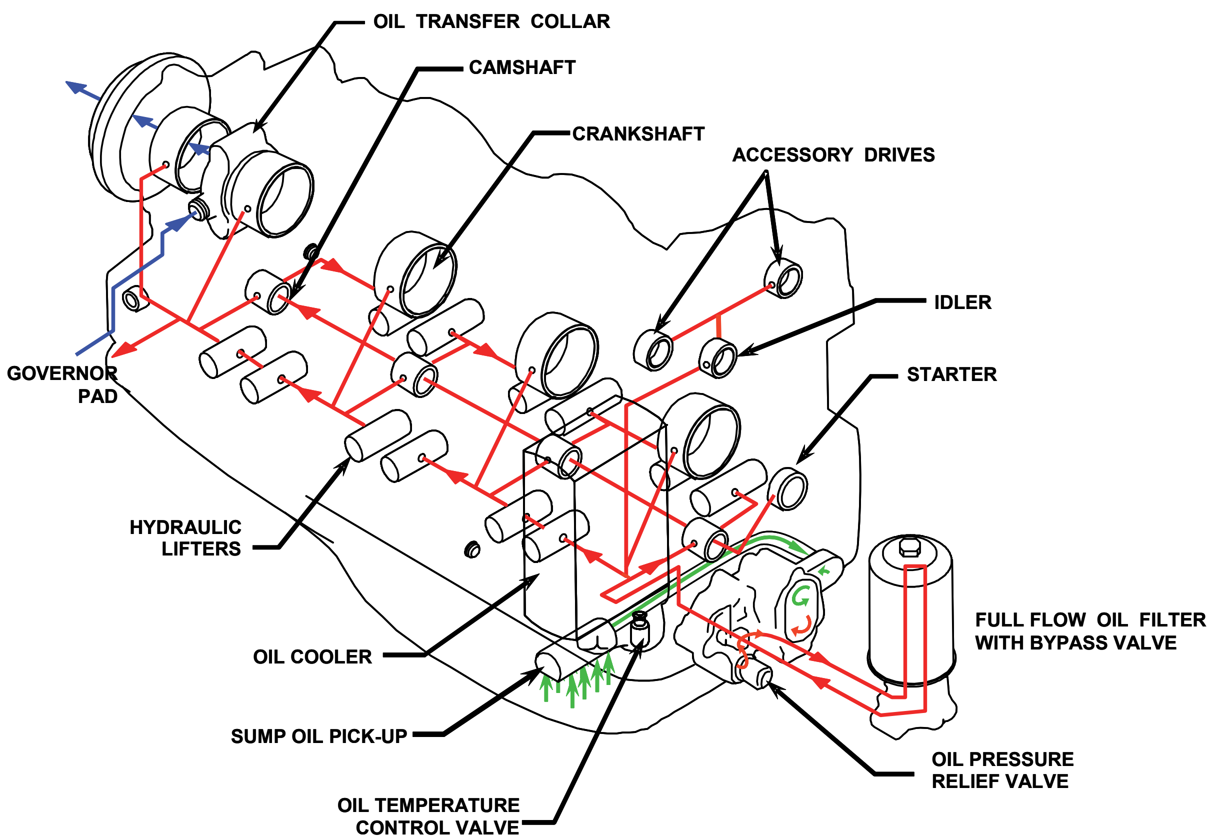

Figure 2-11. Lubrication Schematic

2-2.4.1. Oil Pump

The positive displacement oil pump consists of two meshed gears that revolve inside the pump housing cavity.

The camshaft drives the oil pump drive gear which turns the oil pump driven gear. The oil pump driven gear is supported by a shaft pressed into the oil pump housing. The oil pump drive gear shaft is supported by the outboard cover (or tach drive housing, if equipped) on one end and the oil pump housing at the opposite end. The oil pump drive gear may feature a tachometer drive gear outboard of the oil pump housing to drive a tachometer shaft gear inside the tach drive housing for either electrical or mechanical tachometers.

As the engine rotates, the oil pump drive gear turns counterclockwise (viewed from rear of engine). The drive gear meshes with the driven gear to turn it clockwise. The rotating gears create the suction necessary to draw oil from the sump through the oil suction tube to the pump gear inlet.

Oil flows from the oil pump to the oil filter housing and filter element. Passing through the filter element, oil flows to a passage in the oil pump housing and out to the left crankcase oil gallery. The oil filter incorporates a bypass to divert oil around the filter element, back to the oil pump housing passage in the event the filter element becomes clogged. An adjustable oil pressure relief valve limits oil pressure to a predetermined value. Oil pressure is adjusted by turning the oil pressure relief valve adjusting screw.

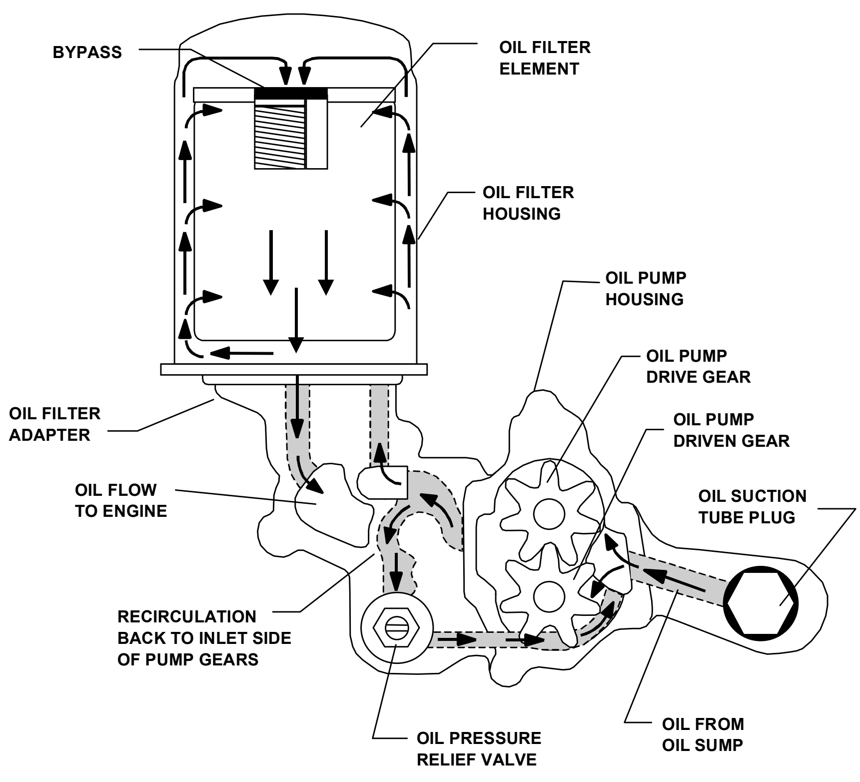

Figure 2-12. Oil Pump

2-2.4.2. Oil Sumps

The sump is attached to the crankcase oil sump mounting flange with bolts, washers, and lock washers. The oil sump assembly incorporates a threaded boss for a drain plug and crush washer to facilitate draining engine oil. The drain plug boss has provisions for safety wiring the oil drain plug after it has been properly torqued.

The oil suction tube is immersed in the oil supply and extends upward from the oil sump, through the rear of the crankcase and the oil pump housing where it is secured to the oil pump housing with a crush washer and plug.

2-2.4.3. Oil Cooler and Oil Temperature Control Valve

Oil flowing from the oil pump enters the oil cooler inlet where it is directed upward to the cooler core by the cast oil gallery. When the oil is below normal operating temperature the oil temperature control valve (vernatherm) is open, allowing oil to bypass the cooler and flow to the engine inlet. In some oil coolers, a portion of the oil flow is directed through a special channel to ensure a limited, but constant flow of oil through the cooler at low ambient temperatures.

When oil temperature reaches the vernatherm setpoint (approx. 180°F), the vernatherm expands, blocking oil flow through the bypass. Oil flow is then directed through the oil cooler core. As the oil flows through the cooler core, ram air flows through the oil cooler fins to dissipate heat from the oil. Oil exiting the oil cooler returns to the crankcase to feed the camshaft and crankshaft via the left oil gallery.

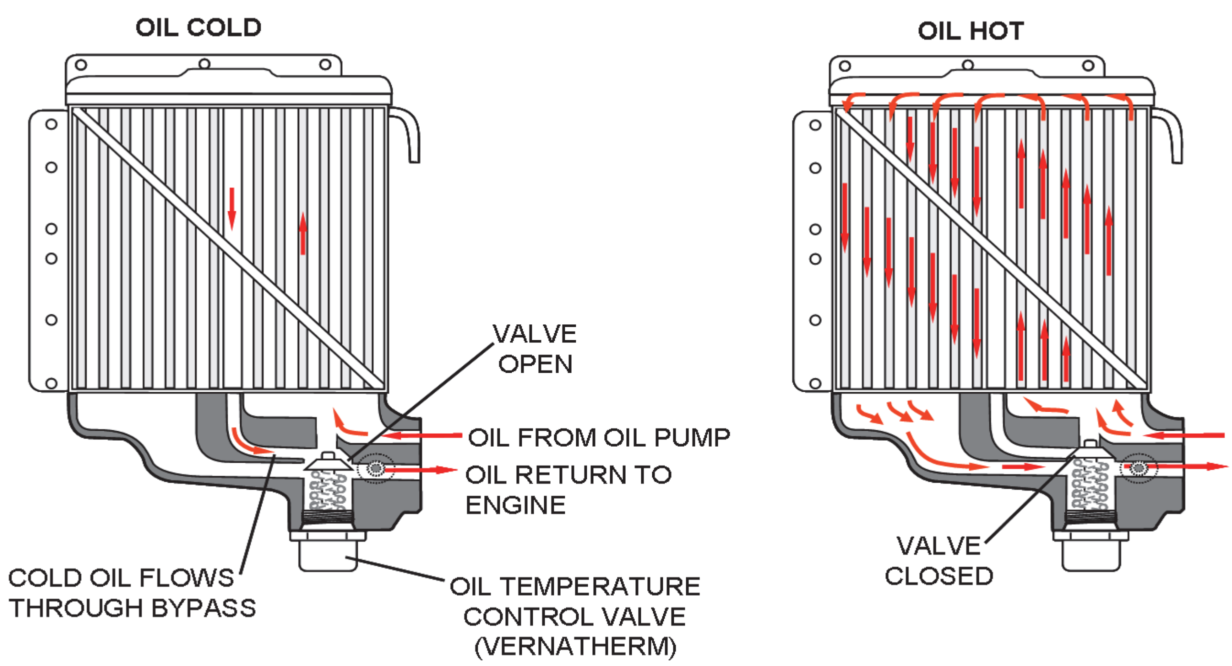

Figure 2-13. Oil Cooler

2-2.5. Fuel System

The fuel system is composed of an engine-driven fuel pump, a throttle body, a fuel manifold valve and fuel injector assemblies. The multi-port, continuous flow fuel injection system controls engine fuel flow. The fuel metering unit / throttle meters the amount of fuel to the fuel manifold valve based on throttle and mixture control positions.

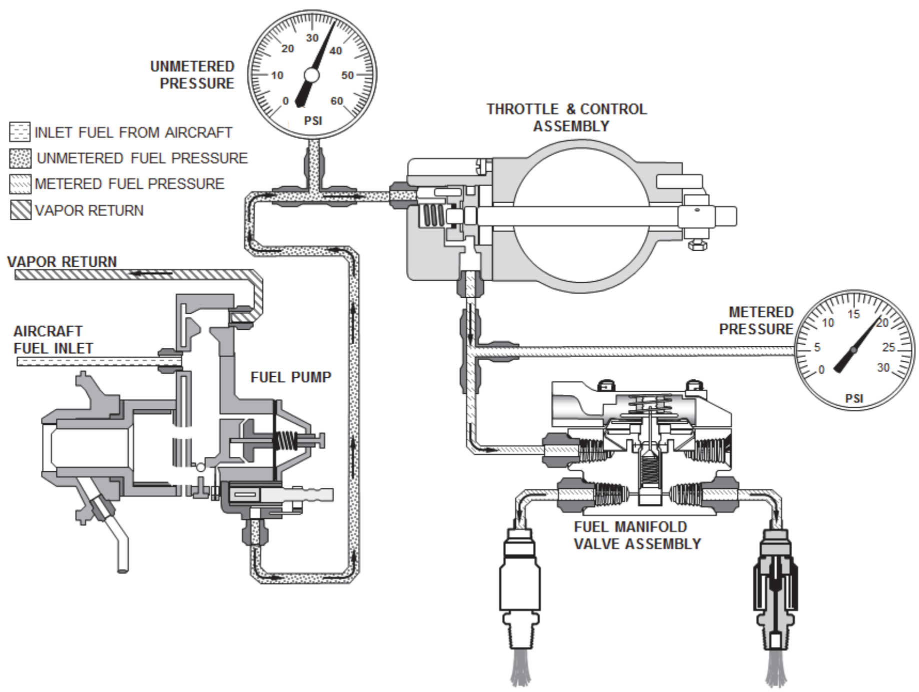

Figure 2-14. IO-550-G, N, P & R Fuel System Schematic

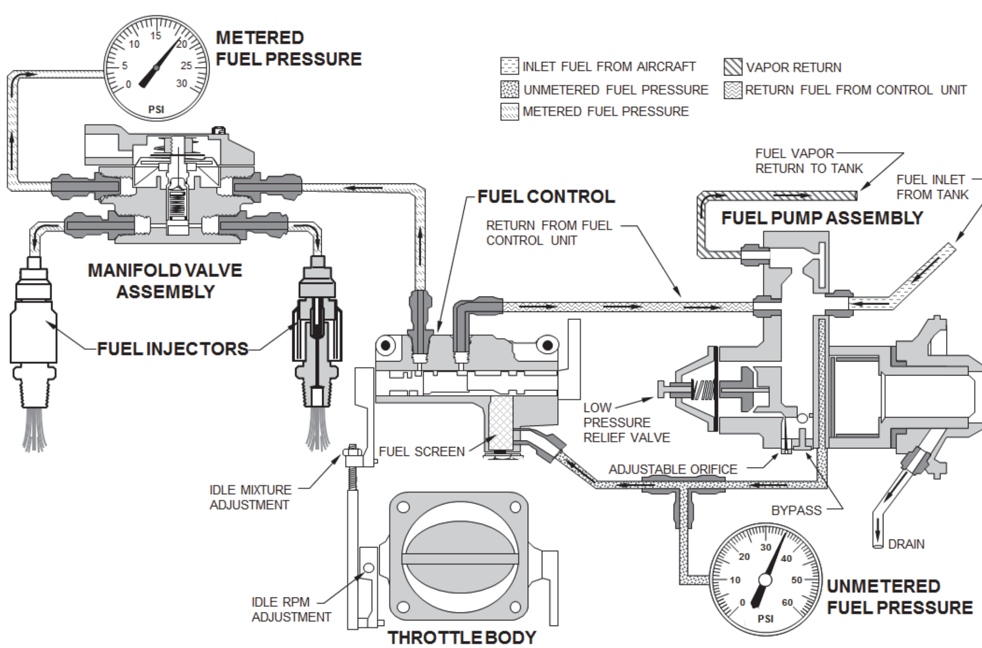

Figure 2-15. IO-550-A, B & C Fuel System Schematic

2-2.5.1. Fuel Pump

Fuel enters the fuel pump at the top of the vapor separator swirl chamber where it is centrifuged, separating the liquid from fuel vapors. Liquid fuel is forced through the fuel pump inlet vanes which create the necessary differential pressure required to draw fuel into the pump inlet and expel pressurized fuel through the pump outlet. Fuel vapors separated in the swirl chamber return to the aircraft fuel tank. Pressurized fuel flows from the pump outlet through fuel hoses to the fuel manifold valve and fuel injector nozzles.

The positive displacement, engine-driven pump responds to changes in engine speed, affecting pump flow and pressure proportionally. The fuel pump is designed to exceed engine fuel requirements. The combination of mechanical control circuits ensures proper pump pressure and fuel delivery for all engine operating speeds. A check valve allows the use of an auxiliary aircraft fuel boost pump pressure to bypass the engine driven fuel pump during engine priming and starting.

The primary difference between IO-550-A, B, C and G, N, P & R engine fuel systems is the location of the mixture control. IO-550-A, B & C engine fuel systems feature an air throttle which is mechanically linked to an externally mounted fuel control unit. The mixture control lever is attached to a a shaft and valve assembly that travels the length of the fuel control unit. IO-550-G, N, P & R engine fuel systems feature an integrated throttle control assembly and a fuel pump with an integral mixture control. Operating functions are transparent to the pilot but adjustment locations differ for the maintainer.

Some IO-550 engine model specifications feature altitude compensating fuel pumps which vary output pressure in response to changes in atmospheric pressure. Altitude compensating fuel pumps are readily identifiable by an aneroid housing, protruding either from the side or bottom of the fuel pump body. The aneroid housing contains a bellows assembly which reacts to atmospheric pressure. The adjustable aneroid works in series with the unmetered fuel pressure to adjust pump output pressure as barometric pressure decreases.

Table 2-1. Legend for Figure 2-16

Fittings	
A	Fuel Inlet
B[1]	Fuel Outlet (Unmetered Pressure)
C	Fuel Return
D	Vapor Return
E	Drain
F[2]	Ambient (or Deck) Pressure Reference
G	Air Inlet

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

1. The B[1] and B[2] references in Figure 2-16 indicate the fitting may be installed in either location, based on the configuration of the fuel pump.
2. The F[1] and F[2] references in Figure 2-16 indicate the fitting may be installed in either location, based on the configuration of the fuel pump.

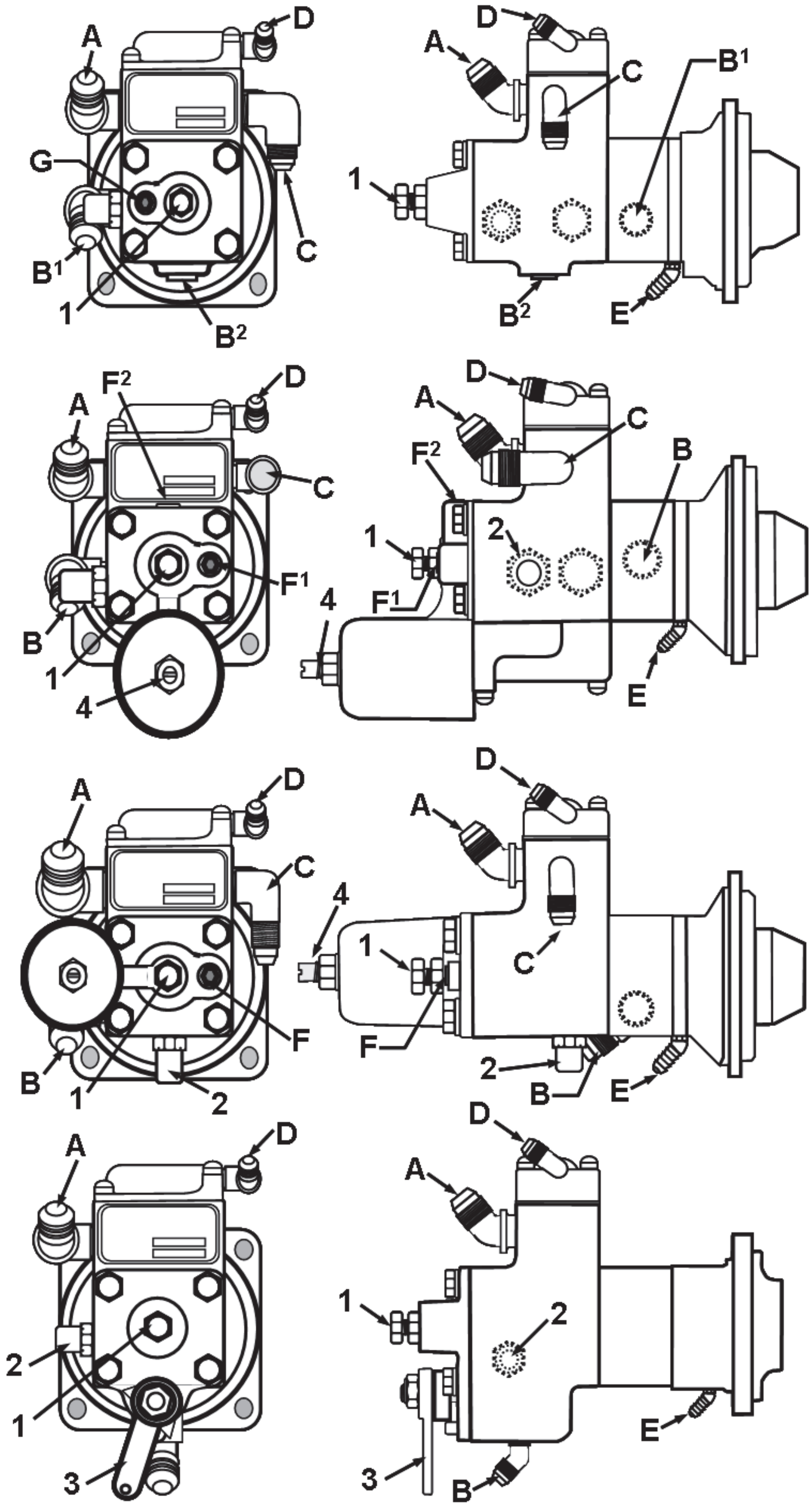

Figure 2-16. IO-550 Fuel Pump Fittings and Adjustments

2-2.5.2. Fuel Injectors

Fuel injectors are a constant flow design. The fuel pump delivers fuel to the manifold valve where the liquid is divided into equal amounts for delivery to the individual cylinder injectors. The fuel injectors are calibrated to work as a set, and designated for specific cylinder installations.

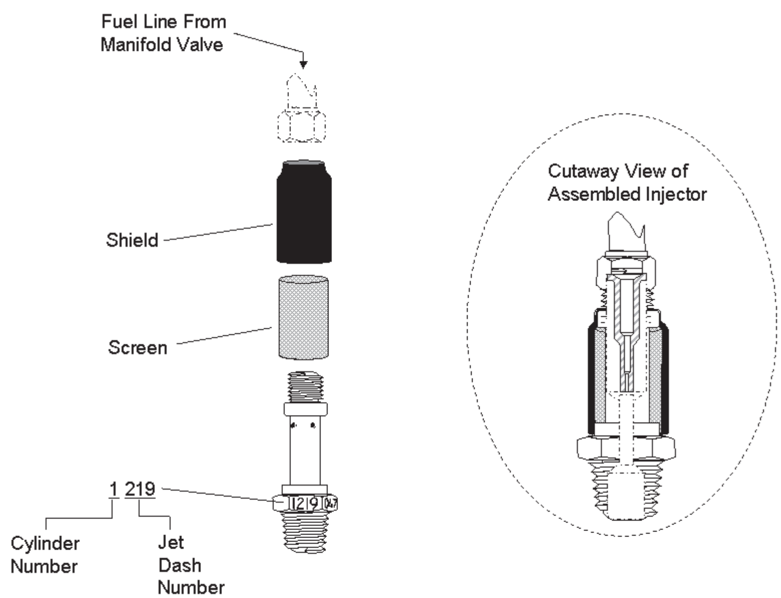

Figure 2-17. IO-550-A, B & C Fuel Injector Nozzle

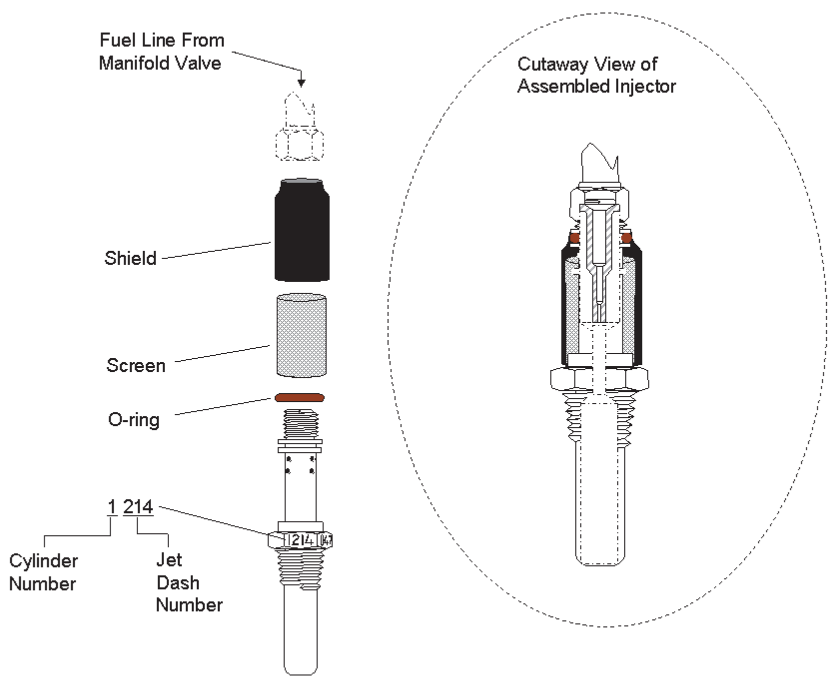

Figure 2-18. IO-550-G, N, P & R Fuel Injector Nozzle

2-2.6. Starter Assembly

The Starting System consists of an electric starter motor mounted on a right angle starter drive adapter. 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.

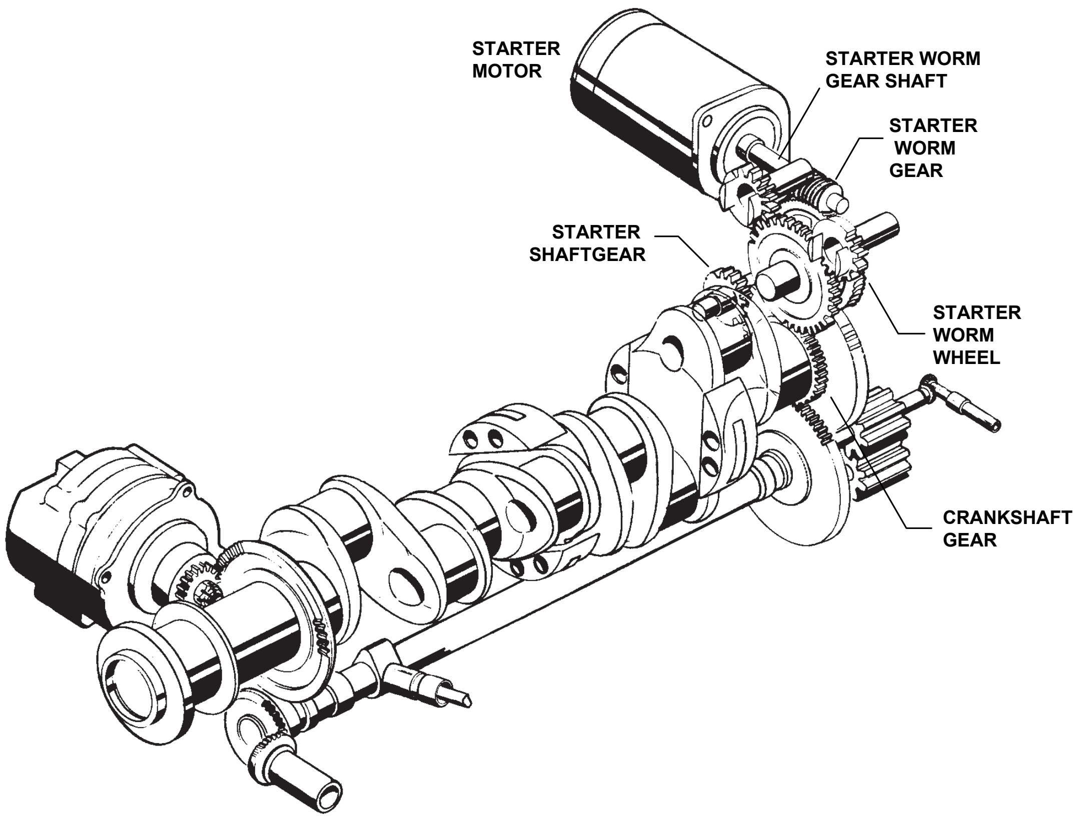

Figure 2-19. Starting System

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 and supplies it to the voltage regulator 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. Continental Motors alternators are available in multiple voltage output options to match aircraft circuit requirements.

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

IO-550 Permold Series engine ignition systems use either Continental Motors or Champion Slick impulse coupled, or dual breaker point magnetos for independent ignition to each cylinder. The ignition harness connects the magneto high voltage output to dual spark plugs screwed into bosses in the top and bottom of the cylinder head. Continental Motors magneto key features are indicated by the part number (Figure 2-20). The engine firing order (Figure 2-21 or Figure 2-22) is determined by the camshaft lobes; magneto firing order is sequential from the number one position and must be synchronized to the crankshaft.

Magnetos are installed at the rear of the engine, driven by the crankshaft. The magnetos may employ impulse couplings or retard breakers for improved engine start ignition. Impulse couplings rotate faster than the engine cranking speed, automatically retarding the spark during engine cranking. Magnetos fitted with retard breakers boost ignition energy by feeding pulsating battery voltage to the magneto primary circuit during starting and automatically retard the spark during engine cranking. Magnetos may be fitted with a tachometer sensor installed in the flange housing vent.

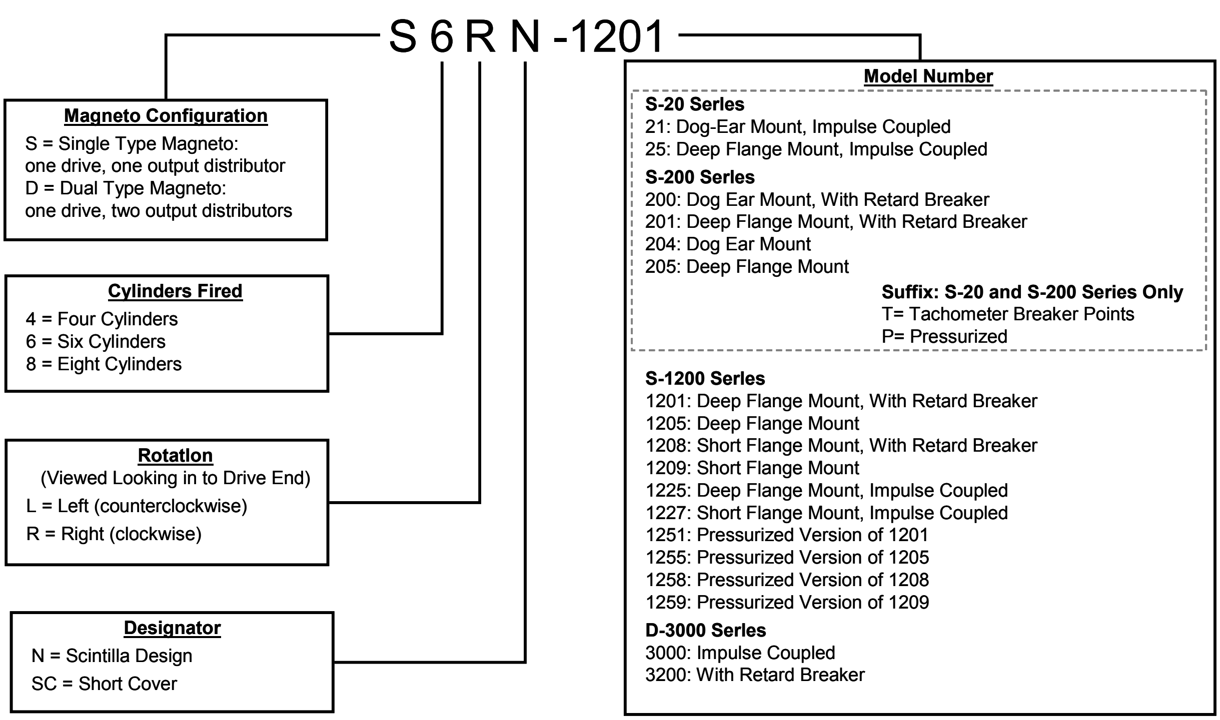

Figure 2-20. Continental Motors Magneto Part Number Definition

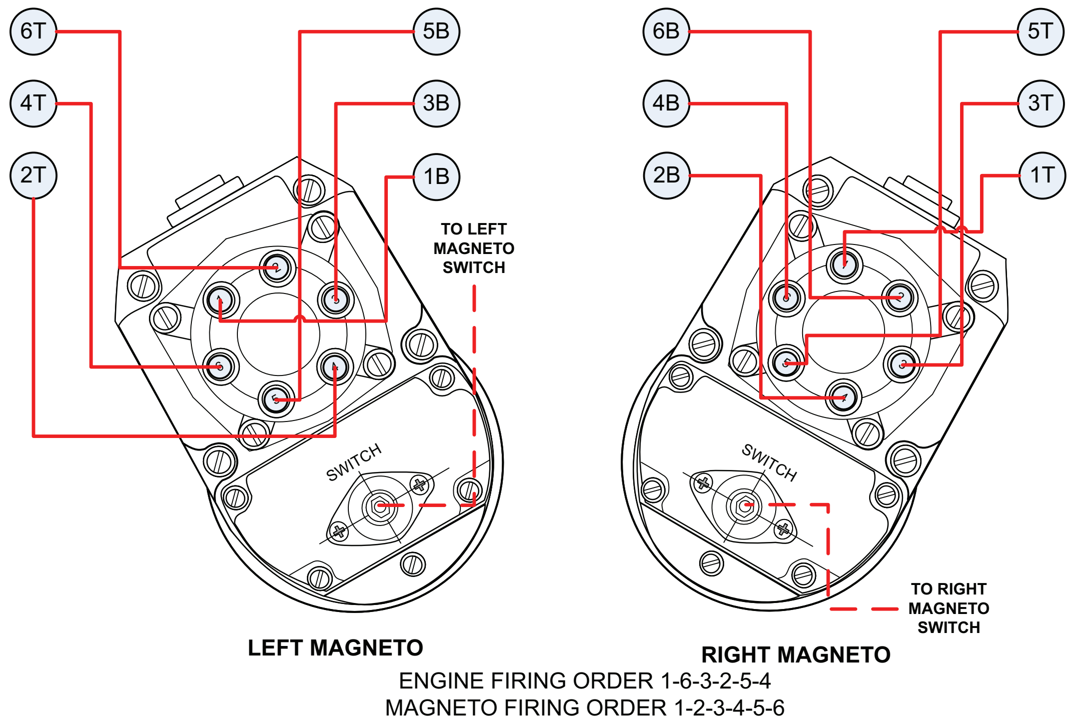

Figure 2-21. Continental Motors Ignition System Schematic

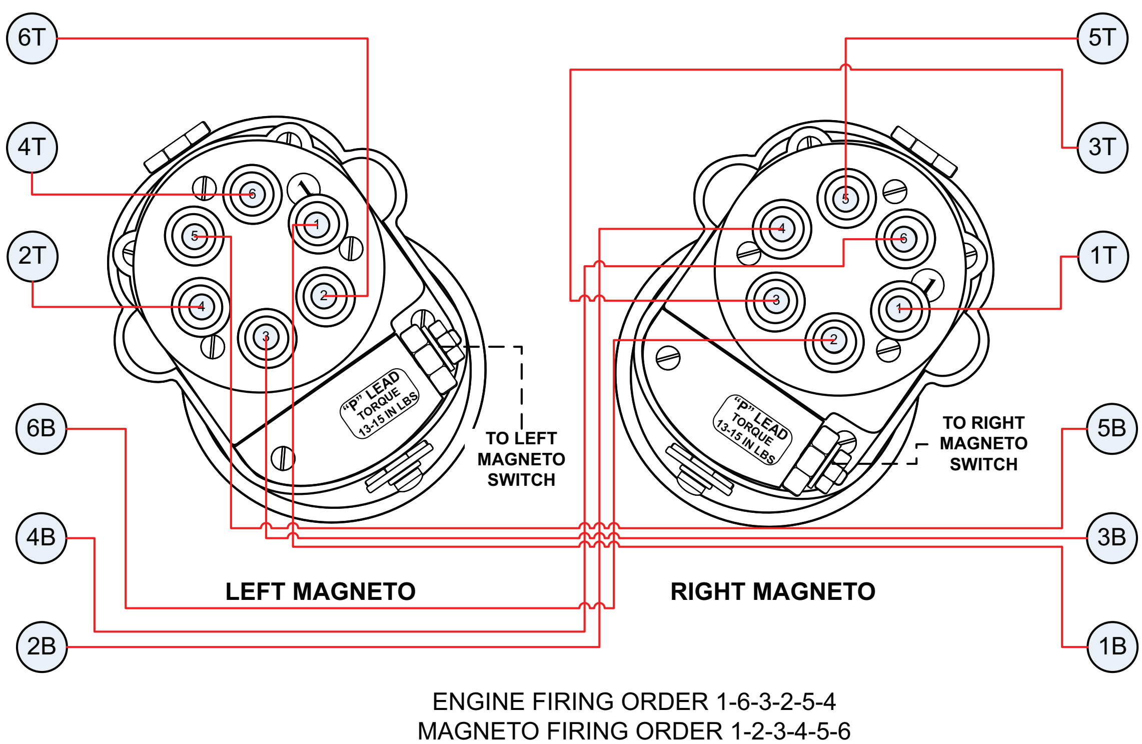

Figure 2-22. Champion Slick Ignition System Schematic

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 airframe 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 is used as an aid in controlling engine operating temperatures.

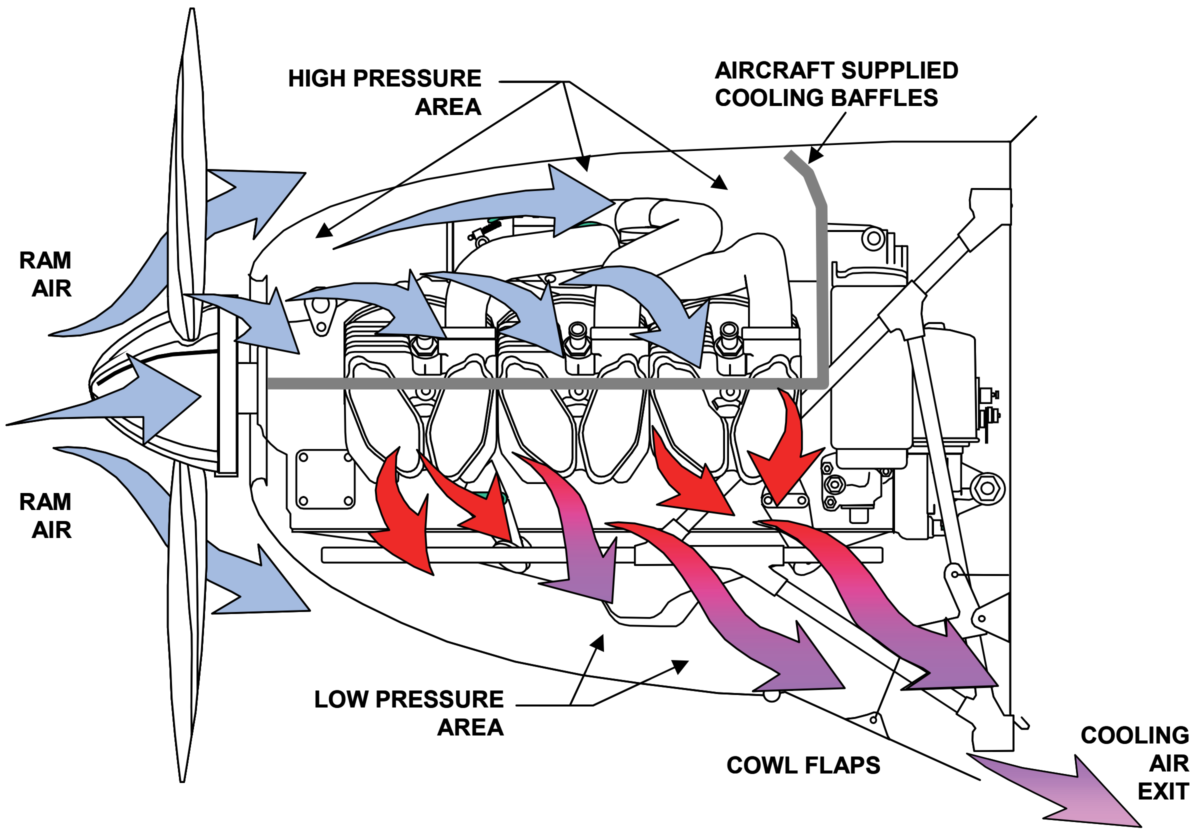

Figure 2-23. Engine Cooling

2-2.10. Induction System

The Induction System carries induction air to individual cylinder intake ports. The cylinder head design on the IO-550-A, B & C engines uses an updraft-type (Figure 2-24) Induction System with intake ports located on the bottom of the cylinder. The IO-550-A & C induction systems mount on the back of the engine and branch through balance tubes aft of the engine, rather than the bottom of the engine as pictured in Figure 2-24.

The IO-550-G, N, P & R Induction Systems carries induction air to individual cylinder intake ports through a cross flow cylinder head design. A downdraft-type (Figure 2-25) 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.

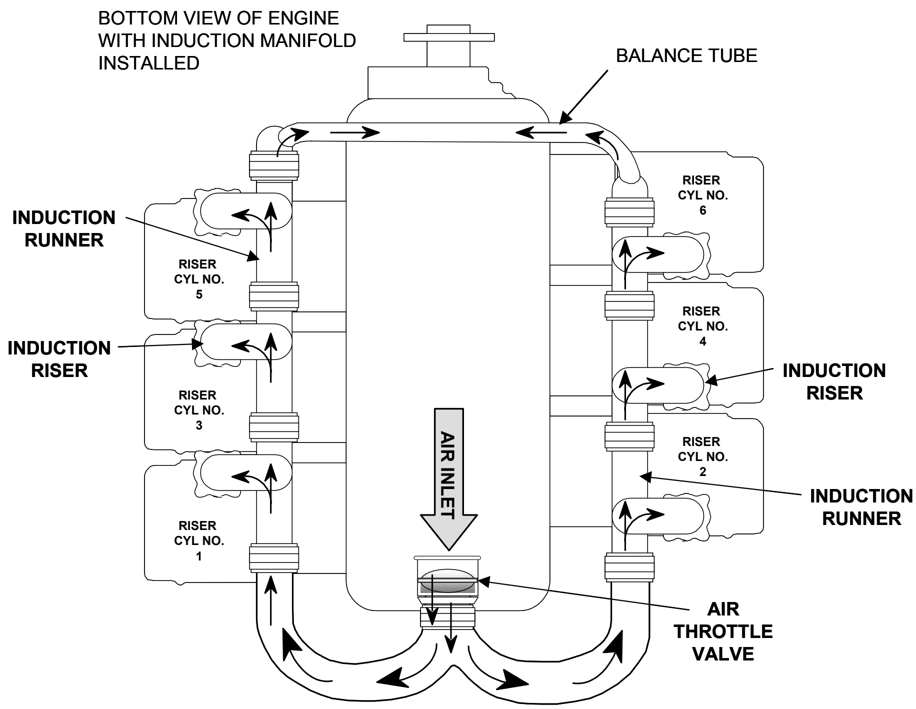

Figure 2-24. Typical Updraft Induction System

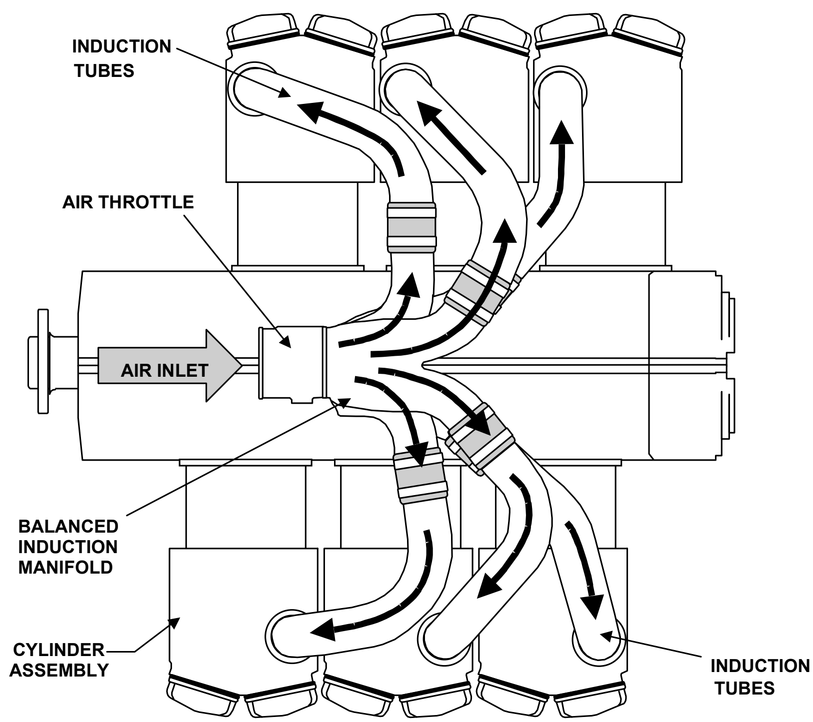

Figure 2-25. Typical Cross-flow Induction System

2-2.11. Exhaust System

Continental Motors provides exhaust manifold studs, gaskets and nuts with the engine. The balance of the engine exhaust system is provided by the airframe manufacturer.

2-3. Engine Specifications

2-3.1. IO-550-A Specifications

Table 2-2. IO-550-A Specifications

General		
Model	IO-550-A	
FAA Type Certificate	E3S0	
Installation Drawing Number	641029	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	8.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Recommended Time Between Overhaul (TBO)	Refer to Table 6-1	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	550 cubic inches	9.05 L
Crankshaft Speed & Brake Horsepower		
Rated Maximum Continuous Operation[1]	300 bhp -0% +5% @2700 rpm	
Crankshaft Speed (Maximum rated)	2700 rpm	
Engine Idle Speed, Minimum	600 +/- 25 rpm	
Maximum Recommended Cruise	225 bhp @ 2500 rpm	
Fuel System Specifications		
Fuel Control System	Continuous Flow Fuel Injection	
Fuel Minimum Grade[2]	ASTM D910 (100/100LL)	
Russian Commonwealth of Independent States[3]	B95/130	
People’s Republic of China[3]	RH95/130	
Fuel System Pressure & Flow	Refer to Table 6-3	
Boost Fuel Pump Specifications	Refer to OI-16 Installation Manual	
Fuel Consumption		
Power Level	BHP (kW)	lbs./hr (max)
Rated Power, 100%	300 (233.7)	150.2
Cruise, 75%	225 (167.8)	114
Cruise, 65%	195 (145.4)	100
Cruise, 55%	165 (123.0)	88
Ignition		
Spark Plugs to be used	See latest revision of SIL03-2	
Ignition Timing	22° BTC ± 1°	
Spark Plug Gap	Spark plug manufacturer’s specified gap.	

Table 2-2. IO-550-A Specifications

Cylinder Head Temperature (measured with bayonet thermocouple)		
Normal Operational Temperature (cruise)	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
Minimum Takeoff Temperature	240°F	116°C
NOTE: All temperature are measured with bayonet thermocouples		
Exhaust		
Exhaust System back-pressure, maximum, measured at port, in Hg (kPa)		2.5 (8.5)
Oil		
Oil Pressure - Normal Operation @ 75° to 240°F (24° to116°C)[4]	30 to 60 psig	
Maximum Allowable Oil Pressure[4] (cold oil)	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[4]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[4]	240°F	116°C
Minimum Take-off Oil Temperature[4]	75°F	24°C
Cruise Flight Oil Temperature	160° to 180° F	71° to 81° F
Oil Sump Capacity	12.0 quarts	11.36L
Usable Oil - 20° Nose Up (12 quart fill)	6.2 quarts	5.87L
Usable Oil - 14.5° Nose Down (12 quart fill)	4.7 quarts	4.45L
Recommended Oil Grade, SAE - above 40° F	50 or Multi viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi viscosity	
Oil Grade[5]	SAE J 1899 (normal ops)/SAE J 1966 (break-in)	
CAUTION: Oil must be aviation oil conforming to SAE J-1899 or SAE J -1966 specification.		
Brake Specific Oil Consumption		
Maximum BSOC = 0.006 lb./HP/HR x (%Power/100)		
Engine Physical Specifications		
Weight, dry (basic engine), lb. (kg) +/- 2.5% Detailed weights by Specification Number	414.4 (187.9) Refer to Engine Detailed Model Specification	
Overall Dimensions, inches (mm) Height Width Length	 20.41 33.56 46.80	 (518.4) (852.4) (1188.8)

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 10° F (5.6° C) change in compressor inlet air temperature. Correction must also be made for the effect of exhaust back pressure and accessory drive losses. Contact Continental Motors engineering for correction factors for specific applications.
2. Engine is certified for operation with ASTM D910 (100 or 100LL), B95/130, or R95/130 aviation fuels. If the minimum fuel grade is not available, use the next higher grade available; never use a lower grade fuel.
3. Operation with this fuel is limited to 9840 ft (2999 m) at maximum continuous power and speed and 19680 ft (5998 m) at maximum recommended cruise power and speed.
4. Oil pressure and temperature are measured at the oil cooler adapter.
5. See Section 3-2 for the list of aircraft engine oils Continental Motors has verified as compliant with SAE J-1899.

2-3.2. IO-550-B Specifications

Table 2-3. IO-550-B Specifications

General		
Model	IO-550-B	
FAA Type Certificate	E3S0	
Installation Drawing Number	646608	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	8.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Recommended Time Between Overhaul (TBO)	Refer to Table 6-1	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	550 cubic inches	9.05 L
Crankshaft Speed & Brake Horsepower		
Rated Maximum Continuous Operation[1]	300 bhp -0% +5% @2700 rpm	
Crankshaft Speed (Maximum rated)	2700 rpm	
Engine Idle Speed, Minimum	600 +/- 25 rpm	
Maximum Recommended Cruise	235 bhp @ 2500 rpm	
Fuel System Specifications		
Fuel Control System	Continuous Flow Fuel Injection	
Fuel Minimum Grade[2]	ASTM D910 (100/100LL)	
Russian Commonwealth of Independent States[3]	B95/130	
People's Republic of China[3]	RH95/130	
Fuel System Pressure & Flow	Refer to Table 6-3	
Boost Fuel Pump Specifications	Refer to OI-16 Installation Manual	
Fuel Consumption		
Power Level	BHP (kW)	lbs./hr (max)
Rated Power, 100%	300 (233.7)	156
Cruise, 75%	225 (167.8)	116.5
Cruise, 65%	195 (145.4)	104
Cruise, 55%	165 (123.0)	93
Ignition		
Spark Plugs to be used	See latest revision of SIL03-2	
Ignition Timing	22° BTC ± 1°	
Spark Plug Gap	Spark plug manufacturer's specified gap.	
Cylinder Head Temperature (measured with bayonet thermocouple)		
Normal Operational Temperature (cruise)	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
Minimum Takeoff Temperature	240°F	116°C
All temperature are measured with bayonet thermocouples		

Table 2-3. IO-550-B Specifications

Exhaust		
Exhaust System back pressure, maximum, measured at port, in Hg (kPa)		2.5 (8.5)
Oil		
Oil Pressure - Normal Operation @ 75° to 240°F (24° to116°C)[4]	30 to 60 psig	
Maximum Allowable Oil Pressure[4] (cold oil)	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[4]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[4]	240°F	116°C
Minimum Take-off Oil Temperature[4]	75°F	24°C
Cruise Flight Oil Temperature[4]	160° to 180° F	71° to 81° F
Oil Sump Capacity	12.0 quarts	11.36L
Usable Oil - 20° Nose Up (12 quart fill)	7.5 quarts	7.10L
Usable Oil - 14.5° Nose Down (12 quart fill)	5.9 quarts	5.59L
Recommended Oil Grade, SAE - above 40° F	50 or Multi viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi viscosity	
Oil Grade[5]	SAE J 1899 (normal ops)/SAE J 1966 (break-in)	
CAUTION: Oil must be aviation oil conforming to SAE J-1899 or SAE J -1966 specification.		
Brake Specific Oil Consumption		
Maximum BSOC = 0.006 lb./HP/HR x (%Power/100)		
Engine Physical Specifications		
Weight, dry (basic engine), lb. (kg) +/- 2.5% Detailed weights by Specification Number	424.61 (192.6) Refer to Engine Detailed Model Specification	
Overall Dimensions, inches (mm) Height Width Length	 27.32 33.56 37.97	 (693.9) (852.4) (964.4)

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 10°F (5.6° C) change in compressor inlet air temperature. Correction must also be made for the effect of exhaust back pressure and accessory drive losses. Contact Continental Motors engineering for correction factors for specific applications.
2. Engine is certified for operation with ASTM D910 (100 or 100LL), B95/130, or R95/130 aviation fuels. If the minimum fuel grade is not available, use the next higher grade available; never use a lower grade fuel.
3. Operation with this fuel is limited to 9840 ft (2999 m) at maximum continuous power and speed and 19680 ft (5998 m) at maximum recommended cruise power and speed.
4. Oil pressure and temperature are measured at the oil cooler adapter.
5. See Section 3-2 for the list of aircraft engine oils Continental Motors has verified as compliant with SAE J-1899.

2-3.3. IO-550-C Specifications

Table 2-4. IO-550-C Specifications

General		
Model	IO-550-C	
FAA Type Certificate	E3S0	
Installation Drawing Number	646616	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	8.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Recommended Time Between Overhaul (TBO)	Refer to Table 6-1	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	550 cubic inches	9.05 L
Crankshaft Speed & Brake Horsepower		
Rated Maximum Continuous Operation[1]	300 bhp -0% +5% @2700 rpm	
Crankshaft Speed (Maximum rated)	2700 rpm	
Engine Idle Speed, Minimum	600	
Maximum Recommended Cruise	235 bhp @ 2500 rpm	
Fuel System Specifications		
Fuel Control System	Continuous Flow Fuel Injection	
Fuel Minimum Grade [2]	ASTM D910 (100/100LL)	
Russian Commonwealth of Independent States[3]	B95/130	
People’s Republic of China[3]	RH95/130	
Fuel System Pressure & Flow	Refer to Table 6-3	
Boost Fuel Pump Specifications	Refer to OI-16 Installation Manual	
Fuel Consumption		
Power Level	BHP (kW)	lbs./hr (max)
Rated Power, 100%	300 (233.7)	160
Cruise, 75%	225 (167.8)	129
Cruise, 65%	195 (145.4)	116
Cruise, 55%	165 (123.0)	102.5
Ignition		
Spark Plugs to be used	See latest revision of SIL03-2	
Ignition Timing	22° BTC ± 1°	
Spark Plug Gap	Spark plug manufacturer’s specified gap.	

Table 2-4. IO-550-C Specifications

Cylinder Head Temperature (measured with bayonet thermocouple)		
Normal Operational Temperature (cruise)	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
Minimum Takeoff Temperature	240°F	116°C
All temperature are measured with bayonet thermocouples		
Exhaust		
Exhaust System back pressure, maximum, measured at port, in Hg (kPa)		2.5 (8.5)
Oil		
Oil Pressure - Normal Operation @ 75° to 240°F (24° to116°C)[4]	30 to 60 psig	
Maximum Allowable Oil Pressure[4] (cold oil)	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[4]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[4]	240°F	116°C
Minimum Take-off Oil Temperature[4]	75°F	24°C
Cruise Flight Oil Temperature[4]	170° to 200° F	77° to 93° F
Oil Sump Capacity	12.0 quarts	11.36L
Usable Oil - 20° Nose Up (12 quart fill)	6.2 quarts	5.87L
Usable Oil - 15° Nose Down (12 quart fill)	6.0 quarts	5.68L
Recommended Oil Grade, SAE - above 40° F	50 or Multi viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi viscosity	
Oil Grade[5]	SAE J 1899 (normal ops)/SAE J 1966 (break-in)	
CAUTION: Oil must be aviation oil conforming to SAE J-1899 or SAE J -1966 specification.		
Brake Specific Oil Consumption		
Maximum BSOC = 0.006 lb./HP/HR x (%Power/100)		
Engine Physical Specifications		
Weight, dry (basic engine), lb. (kg) +/- 2.5% Detailed weights by Specification Number	433.2 (196.5) Refer to Engine Detailed Model Specification	
Overall Dimensions, inches (mm) Height Width Length	 19.78 33.56 43.31	 (502.4) (852.6) (1100.0)

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 10°F (5.6° C) change in compressor inlet air temperature. Correction must also be made for the effect of exhaust back pressure and accessory drive losses. Contact Continental Motors engineering for correction factors for specific applications.
2. Engine is certified for operation with ASTM D910 (100 or 100LL), B95/130, or R95/130 aviation fuels. If the minimum fuel grade is not available, use the next higher grade available; never use a lower grade fuel.
3. Engine operation with this fuel is limited to 9840 ft (2999 m) at maximum continuous power and speed and 19680 feet (5998 m) at maximum recommended cruise power and speed.
4. Oil pressure and temperature are measured at the oil cooler adapter.
5. See Section 3-2 for the list of aircraft engine oils Continental Motors has verified as compliant with SAE J-1899.

2-3.4. IO-550-G Specifications

Table 2-5. IO-550-G Specifications

General		
Model	IO-550-G	
FAA Type Certificate	E3S0	
Installation Drawing Number	652180	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	8.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Recommended Time Between Overhaul (TBO)	Refer to Table 6-1	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	550 cubic inches	9.05 L
Crankshaft Speed & Brake Horsepower		
Rated Maximum Continuous Operation[1]	280 bhp -0% +5% @2700 rpm	
Crankshaft Speed (Maximum rated)	2700 rpm	
Engine Idle Speed, Minimum	600	
Maximum Recommended Cruise	240 bhp @ 2500 rpm	
Fuel System Specifications		
Fuel Control System	Continuous Flow Fuel Injection	
Fuel Minimum Grade [2]	ASTM D910 (100/100LL)	
Russian Commonwealth of Independent States[3]	B95/130	
People's Republic of China[3]	RH95/130	
Fuel System Pressure & Flow	Refer to Table 6-3	
Boost Fuel Pump Specifications	Refer to OI-16 Installation Manual	
Fuel Consumption		
Power Level	BHP (kW)	lbs./hr (max)
Rated Power, 100%	280 (208.8)	130.0
Cruise, 85%	238 (177.5)	114.0
Cruise, 75%	210 (156.6)	103.5
Cruise, 65%	182 (135.7)	93.5
Ignition		
Spark Plugs to be used	See latest revision of SIL03-2	
Ignition Timing	22° BTC ± 1°	
Spark Plug Gap	Spark plug manufacturer's specified gap.	

Table 2-5. IO-550-G Specifications

Cylinder Head Temperature (measured with bayonet thermocouple)		
Normal Operational Temperature (cruise)	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
Minimum Takeoff Temperature	240°F	116°C
NOTE: All temperature are measured with bayonet thermocouples		
Exhaust		
Exhaust System back pressure, maximum, measured at port, in Hg (kPa)		2.5 (8.5)
Oil		
Oil Pressure - Normal Operation @ 75° to 240°F (24° to116°C)[4]	30 to 60 psig	
Maximum Allowable Oil Pressure[4] (cold oil)	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[4]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[4]	240°F	116°C
Minimum Take-off Oil Temperature[4]	75°F	24°C
Cruise Flight Oil Temperature[4]	160° to 180° F	71° to 82° F
Oil Sump Capacity	8.0 quarts	7.57L
Usable Oil - 20° Nose Up (8 quart fill)	5.0 quarts	4.73L
Usable Oil - 15° Nose Down (8) quart fill)	4.5 quarts	4.26L
Recommended Oil Grade, SAE - above 40° F	50 or Multi viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi viscosity	
Oil Grade[5]	SAE J-1899 (normal ops)/SAE J-1966 (break-in)	
CAUTION: Oil must be aviation oil conforming to SAE J-1899 or SAE J -1966 specification.		
Brake Specific Oil Consumption		
Maximum BSOC = 0.006 lb./HP/HR x (%Power/100)		
Engine Physical Specifications		
Weight, dry (basic engine), lb. (kg) +/- 2.5% Detailed weights by Specification Number	450.3 (204.3) Refer to Engine Detailed Model Specification	
Overall Dimensions, inches (mm) Height Width Length	 20.41 34.04 38.43	 (518.4) (864.6) (975.4)

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 10° F (5.6° C) change in compressor inlet air temperature. Correction must also be made for the effect of exhaust back pressure and accessory drive losses. Contact Continental Motors engineering for correction factors for specific applications.
2. Engine is certified for operation with ASTM D910 (100 or 100LL), B95/130, or R95/130 aviation fuels. If the minimum fuel grade is not available, use the next higher grade available; never use a lower grade fuel.
3. Engine operation with this fuel is limited to 9840 ft (2999 m) at maximum continuous power and speed and 19680 feet (5998 m) at maximum recommended cruise power and speed.
4. Oil pressure and temperature are measured at the oil cooler adapter.
5. See Section 3-2 for the list of aircraft engine oils Continental Motors has verified as compliant with SAE J-1899.

2-3.5. IO-550-N Specifications

Table 2-6. IO-550-N Specifications

General		
Model	IO-550-N	
FAA Type Certificate	E3S0	
Installation Drawing Number	652180	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	8.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Time Between Overhaul (TBO)	Refer to Table 6-1	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	550 cubic inches	9.05 L
Crankshaft Speed & Brake Horsepower		
Rated Maximum Continuous Operation[1]	310 bhp -0% +5% @ 2700 rpm	
Crankshaft Speed (Maximum rated)	2700 rpm	
Engine Idle Speed, Minimum	600	
Maximum Recommended Cruise	262 bhp @ 2500 rpm	
Fuel System Specifications		
Fuel Control System	Continuous Flow Fuel Injection	
Fuel Minimum Grade [2]	ASTM D910 (100/100LL)	
Russian Commonwealth of Independent States[3]	B95/130	
People's Republic of China[3]	RH95/130	
Fuel System Pressure & Flow	Refer to Table 6-3	
Boost Fuel Pump Specifications	Refer to OI-16 Installation Manual	
Fuel Consumption		
Power Level	BHP (kW)	lbs./hr (kg/hr) (max)
Rated Power, 100%	310 (231)	160 (72.5)
Cruise, 85%	262 (195)	132 (59.9)
Cruise, 75%	232 (173)	118 (53.5)
Cruise, 65%	201 (150)	108 (48.9)
Ignition		
Spark Plugs to be used	See latest revision of SIL03-2	
Ignition Timing	22° BTC ± 1°	
Spark Plug Gap	Spark plug manufacturer's specified gap.	
Cylinder Head Temperature (measured with bayonet thermocouple)		
Normal Operational Temperature (cruise)	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
Minimum Takeoff Temperature	240°F	116°C
All temperature are measured with bayonet thermocouples		

Table 2-6. IO-550-N Specifications

Exhaust		
Exhaust System back pressure, maximum, measured at port, in Hg (kPa)		2.5 (8.5)
Oil		
Oil Pressure - Normal Operation @ 75° to 240°F (24° to116°C)[4]	30 to 60 psig	
Maximum Allowable Oil Pressure[4] (cold oil)	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[4]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[4]	240°F	116°C
Minimum Take-off Oil Temperature[4]	75°F	24°C
Cruise Flight Oil Temperature[4]	160° to 180° F	71° to 82° F
Oil Sump Capacity	8.0 quarts	7.57L
Usable Oil - 16° Nose Up (8 quart fill)	5.0 quarts	4.73L
Usable Oil - 10° Nose Down (8 quart fill)	4.5 quarts	4.26L
Recommended Oil Grade, SAE - above 40° F	50 or Multi viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi viscosity	
Oil Grade[5]	SAE J-1899 (normal ops)/SAE J-1966 (break-in)	
CAUTION: Oil must be aviation oil conforming to SAE J-1899 or SAE J -1966 specification.		
Brake Specific Oil Consumption		
Maximum BSOC = 0.006 lb./HP/HR x (%Power/100)		
Engine Physical Specifications		
Weight, dry (basic engine), lb. (kg) +/- 2.5% Detailed weights by Specification Number	450.3 (204.3) Refer to Detailed Model Specification	
Overall Dimensions, inches (mm) Height Width Length	 20.41 34.04 38.43	 (518.4) (864.6) (975.4)

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 10° F (5.6° C) change in compressor inlet air temperature. Correction must also be made for the effect of exhaust back pressure and accessory drive losses. Contact Continental Motors engineering for correction factors for specific applications.
2. Engine is certified for operation with ASTM D910 (100 or 100LL), B95/130, or R95/130 aviation fuels. If the minimum fuel grade is not available, use the next higher grade available; never use a lower grade fuel.
3. Engine operation with this fuel is limited to 9840 ft (2999 m) at maximum continuous power and speed and 19680 feet (5998 m) at maximum recommended cruise power and speed.
4. Oil pressure and temperature are measured at the oil cooler adapter.
5. See Section 3-2 for the list of aircraft engine oils Continental Motors has verified as compliant with SAE J-1899.

2-3.6. IO-550-P Specifications

Table 2-7. IO-550-P Specifications

General		
Model	IO-550-P	
FAA Type Certificate	E3S0	
Installation Drawing Number	654576	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	8.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Recommended Time Between Overhaul (TBO)	Refer to Table 6-1	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	550 cubic inches	9.05 L
Crankshaft Speed & Brake Horsepower		
Rated Maximum Continuous Operation[1]	310 bhp -0% +5% @2700 rpm	
Crankshaft Speed (Maximum rated)	2700 rpm	
Engine Idle Speed, Minimum	600	
Maximum Recommended Cruise	262 bhp @ 2500 rpm	
Fuel System Specifications		
Fuel Control System	Continuous Flow Fuel Injection	
Fuel Minimum Grade [2]	ASTM D910 (100/100LL)	
Russian Commonwealth of Independent States[3]	B95/130	
People's Republic of China[3]	RH95/130	
Fuel System Pressure & Flow	Refer to Table 6-3	
Boost Fuel Pump Specifications	Refer to OI-16 Installation Manual	
Fuel Consumption		
Power Level	BHP (kW)	lbs./hr (kg/hr) (max)
Rated Power, 100%	310 (231)	160 (72.5)
Cruise, 85%	262 (195)	132 (59.9)
Cruise, 75%	232 (173)	118 (53.5)
Cruise, 65%	201 (150)	108 (48.9)
Ignition		
Spark Plugs to be used	See latest revision of SIL03-2	
Ignition Timing	22° BTC ± 1°	
Spark Plug Gap	Spark plug manufacturer's specified gap.	
Cylinder Head Temperature (measured with bayonet thermocouple)		
Normal Operational Temperature (cruise)	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
Minimum Takeoff Temperature	240°F	116°C
NOTE: All temperature are measured with bayonet thermocouples		
Exhaust		

Table 2-7. IO-550-P Specifications

Exhaust System back pressure, maximum, measured at port, in Hg (kPa)		2.5 (8.5)
Oil		
Oil Pressure - Normal Operation @ 75° to 240°F (24° to116°C)[4]	30 to 60 psig	
Maximum Allowable Oil Pressure[4] (cold oil)	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[4]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[4]	240°F	116°C
Minimum Take-off Oil Temperature[4]	75°F	24°C
Cruise Flight Oil Temperature[4]	170° to 220° F	77° to 104° F
Oil Sump Capacity	10.0 quarts	7.57L
Usable Oil - 16° Nose Up (10 quart fill)	7.8 quarts	4.73L
Usable Oil - 10° Nose Down (10 quart fill)	6.7 quarts	4.26L
Recommended Oil Grade, SAE - above 40° F	50 or Multi viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi viscosity	
Oil Grade[5]	SAE J-1899 (normal ops)/SAE J-1966 (break-in)	
CAUTION: Oil must be aviation oil conforming to SAE J-1899 or SAE J -1966 specification.		
Brake Specific Oil Consumption		
Maximum BSOC = 0.006 lb./HP/HR x (%Power/100)		
Engine Physical Specifications		
Weight, dry (basic engine), lb. (kg) +/- 2.5% Detailed weights by Specification Number	429 (194.6) Refer to Engine Detailed Model Specification	
Overall Dimensions, inches (mm) Height Width Length	 23.84 34.04 38.43	 (606) (865) (976)
Center of Gravity, inches (mm) Forward of rear accessory case Below crankshaft centerline Beside crankshaft centerline toward 1-3-5 side	 12.66 0.21 0.23	 (321.6) (5.33) (5.84)
Moment of Inertia standard accessory package, in·lb·sec^2 (mm·kg·sec^2) Roll-Longitudinal Axis, ($I_{x\ x}$) Pitch-Lateral Axis, (I_{y-y}) Yaw-Vertical Axis, (I_{z-z})	 82.1 104.7 171.5	 (946) (1206) (1976)

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 10° F (5.6° C) change in compressor inlet air temperature. Correction must also be made for the effect of exhaust back pressure and accessory drive losses. Contact Continental Motors engineering for correction factors for specific applications
2. Engine is certified for operation with ASTM D910 (100 or 100LL), B95/130, or R95/130 aviation fuels. If the minimum fuel grade is not available, use the next higher grade available; never use a lower grade fuel.
3. Engine operation with this fuel is limited to 9840 ft (2999 m) at maximum continuous power and speed and 19680 feet (5998 m) at maximum recommended cruise power and speed.
4. Oil pressure and temperature are measured at the oil cooler adapter.
5. See Section 3-2 for the list of aircraft engine oils Continental Motors has verified as compliant with SAE J-1899.

2-3.7. IO-550-R Specifications

Table 2-8. IO-550-R Specifications

General		
Model	IO-550-R	
FAA Type Certificate	E3S0	
Installation Drawing Number	655575	
Arrangement	Individual cylinders, horizontally opposed	
Compression Ratio	8.5:1	
Number of Cylinders	6	
Firing Order	1-6-3-2-5-4	
Recommended Time Between Overhaul (TBO)	Refer to Table 6-1	
Bore	5.25 in.	13.335 cm
Stroke	4.25 in.	10.795 cm
Piston Displacement	550 cubic inches	9.05 L
Crankshaft Speed & Brake Horsepower		
Rated Maximum Continuous Operation[1]	310 bhp -0% +5% @2700 rpm	
Crankshaft Speed (Maximum rated)	2700 rpm	
Engine Idle Speed, Minimum	600	
Maximum Recommended Cruise	262 bhp @ 2500 rpm	
Fuel System Specifications		
Fuel Control System	Continuous Flow Fuel Injection	
Fuel Minimum Grade [2]	ASTM D910 (100/100LL)	
Russian Commonwealth of Independent States	B95/130[3]	
People's Republic of China	RH95/130[3]	
Fuel System Pressure & Flow	Refer to Table 6-3	
Boost Fuel Pump Specifications	Refer to OI-16 Installation Manual	
Fuel Consumption		
Power Level	BHP (kW)	lbs./hr (kg/hr) (max)
Rated Power, 100%	310 (231)	160 (72.5)
Cruise, 85%	262 (195)	132 (59.9)
Cruise, 75%	232 (173)	118 (53.5)
Cruise, 65%	201 (150)	108 (48.9)
Ignition		
Spark Plugs to be used	See latest revision of SIL03-2	
Ignition Timing	22° BTC ± 1°	
Spark Plug Gap	Spark plug manufacturer's specified gap.	
Cylinder Head Temperature (measured with bayonet thermocouple)		
Normal Operational Temperature (cruise)	420°F	215°C
Maximum Allowable Operational Temperature	460°F	238°C
Minimum Takeoff Temperature	240°F	116°C
All temperature are measured with bayonet thermocouples		
Exhaust		

Table 2-8. IO-550-R Specifications

Exhaust System back pressure, maximum, measured at port, in Hg (kPa)		2.5 (8.5)
Oil		
Oil Pressure - Normal Operation @ 75° to 240°F (24° to116°C)[4]	30 to 60 psig	
Maximum Allowable Oil Pressure[4] (cold oil)	100 psig	
Minimum Oil Pressure @ Idle (600 RPM)[4]	10 psig at or below 240°F	
Maximum Allowable Oil Temperature[4]	240°F	116°C
Minimum Take-off Oil Temperature[4]	75°F	24°C
Cruise Flight Oil Temperature[4]	170° to 220° F	77° to 104° F
Oil Sump Capacity	12.0 quarts	11.4L
Usable Oil - 16° Nose Up (12 quart fill)	7.5 quarts	7.1L
Usable Oil - 10° Nose Down (12 quart fill)	7.3 quarts	6.9L
Recommended Oil Grade, SAE - above 40° F	50 or Multi viscosity	
Recommended Oil Grade, SAE - below 40° F	30 or Multi viscosity	
Oil Grade[5]	SAE J-1899 (normal ops)/SAE J-1966 (break-in)	
CAUTION: Oil must be aviation oil conforming to SAE J-1899 or SAE J -1966 specification.		
Brake Specific Oil Consumption		
Maximum BSOC = 0.006 lb./HP/HR x (%Power/100)		
Engine Physical Specifications		
Weight, dry (basic engine), lb. (kg) +/- 2.5% Detailed weights by Specification Number	439.5 (191.6) Refer to Detailed Model Specification	
Overall Dimensions, inches (mm) Height Width Length	 22.93 34.04 38.43	 (582) (865) (976)
Center of Gravity, inches (mm) Forward of rear accessory case Below crankshaft centerline Beside crankshaft centerline toward 1-3-5 side	 12.81 0.45 0.23	 (325.4) (11.4) (5.84)
Moment of Inertia standard accessory package, $in\cdot lb\cdot sec^2$ ($mm\cdot kg\cdot sec^2$) Roll-Longitudinal Axis, ($I_{x\ x}$) Pitch-Lateral Axis, (I_{y-y}) Yaw-Vertical Axis, (I_{z-z})	 82.1 104.7 171.5	 (946) (1206) (1976)

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 10° F (5.6° C) change in compressor inlet air temperature. Correction must also be made for the effect of exhaust back pressure and accessory drive losses. Contact Continental Motors engineering for correction factors for specific applications.
2. Engine is certified for operation with ASTM D910 (100 or 100LL), B95/130, or R95/130 aviation fuels. If the minimum fuel grade is not available, use the next higher grade available; never use a lower grade fuel.
3. Engine operation with this fuel is limited to 9840 ft (2999 m) at maximum continuous power and speed and 19680 feet (5998 m) at maximum recommended cruise power and speed.
4. Oil pressure and temperature are measured at the oil cooler adapter.
5. See Section 3-2 for the list of aircraft engine oils Continental Motors has verified as compliant with SAE J-1899.

2-3.8. IO-550-Accessory Drive Ratios

Table 2-9. Accessory Drive Ratios

Accessory	Direction of Rotation[1]	Drive Ratio to Crankcase	Maximum Torque (in. lbs.) Cont.	Maximum Torque (in. lbs.) Static	Maximum Overhang Moment, (in lbs.)
Optional Tachometer	CCW	0.5:1	7	50	25
Magneto	CCW	1.5:1	-	-	-
Starter Motor	CCW	48:1	200	400	60
Propeller Governor[2]	CW	1:1	29	85	50
Fuel Pump	CW	1:1	25	680	60
Alternator	CCW	3:1	150	800	150
Optional Accessory Drive[3]	CCW	2:1	100	500	N/A
AND20000 Pads[4]	CW	1.5:1	100	800	40

1. CW=Clockwise Rotation CCW=Counterclockwise rotation; viewed facing the drive
2. Drive is a modified AND20010 and shall be supplied with a cover
3. Belt tension 70 lbs. (may be used with appropriate optional equipment kit to drive an airframe provided refrigerant compressor)
4. One drive is eligible at 160 in lbs. continuous torque load providing the other does not exceed 100 in. lbs. continuous torque load. Drive pads conform to AND2000, optionally, per MS3325 modified, and shall be provided with covers

2-3.8.1. Accessory Drive Pad

The accessory drive pad is an AND20000 specification that has been modified for speed, torque, and moment and provides an oil feed to the face of the pad. The drive pad is provided with a cover in the event that its use is not required in the end application.

2-3.9. Oil Specifications

Commercially available ashless dispersant aviation oils are described in Section 3-2.1. Do not use any other commercial quality oil.

2-3.10. Performance Data

Refer to the applicable Detailed Model Specification 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.

2-3.10.1. IO-550-A Performance Charts

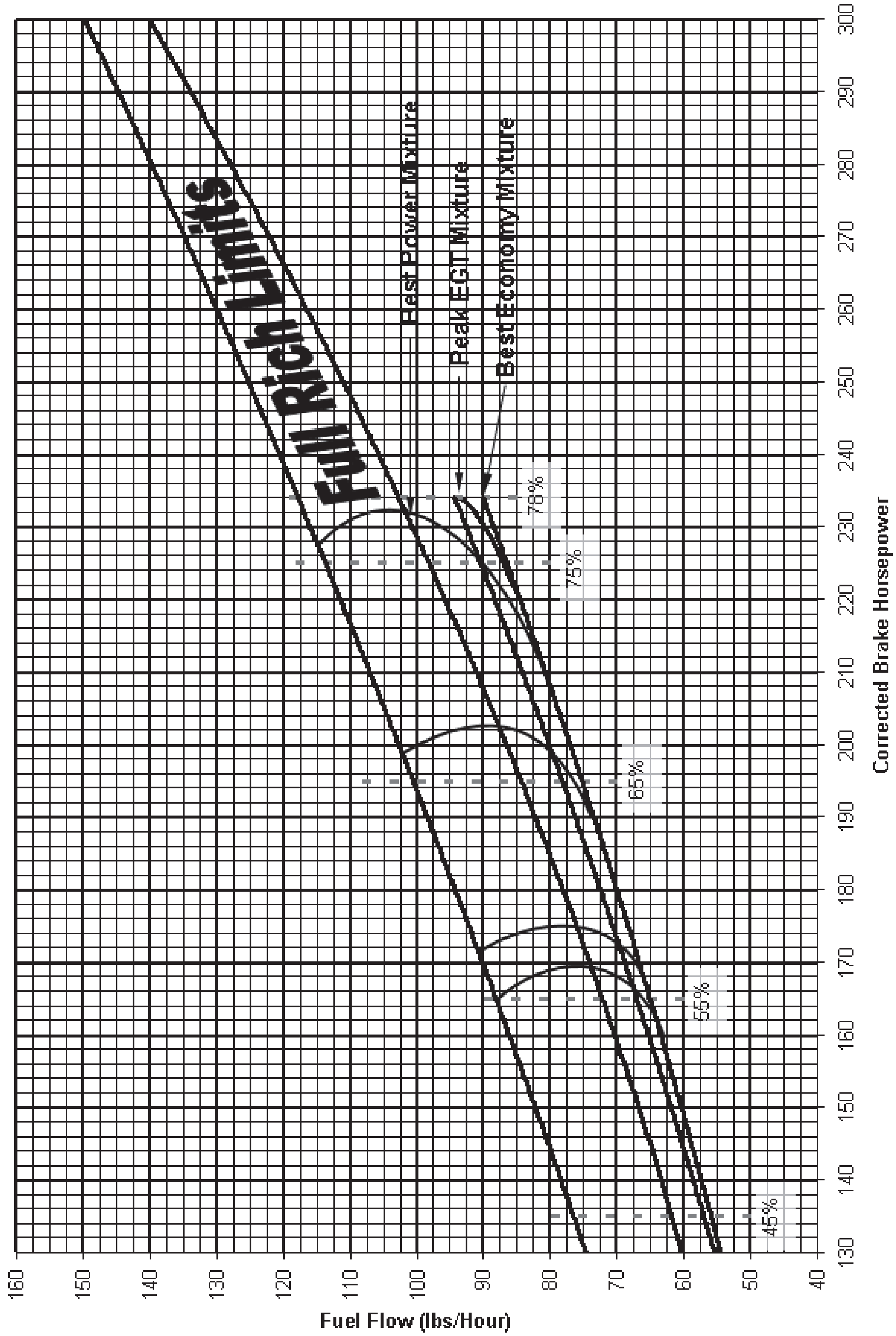

Figure 2-26. IO-550-A Fuel Flow vs. Brake Horsepower

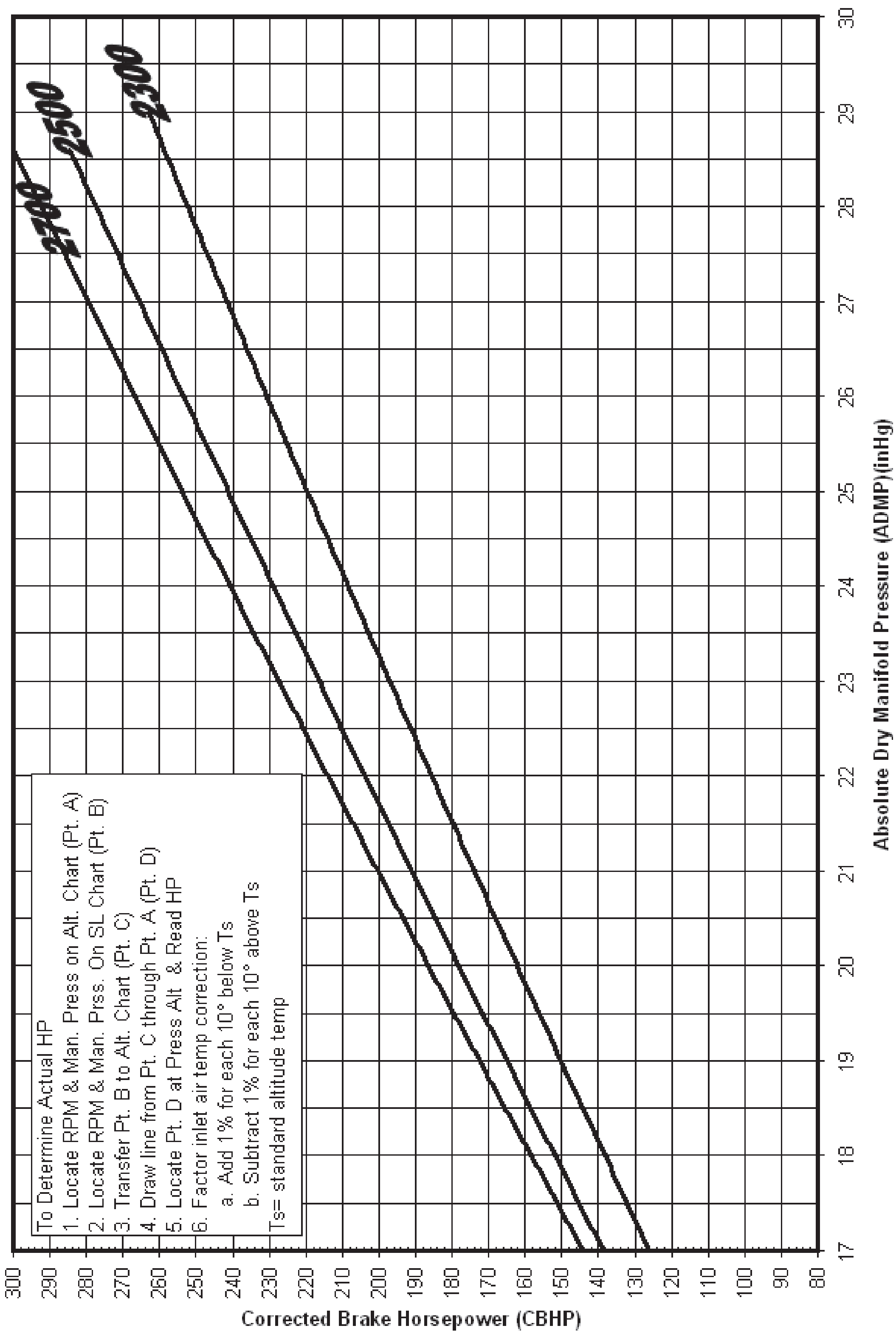

Figure 2-27. IO-550-A Sea Level Performance

2-3.10.2. IO-550-B Performance Charts

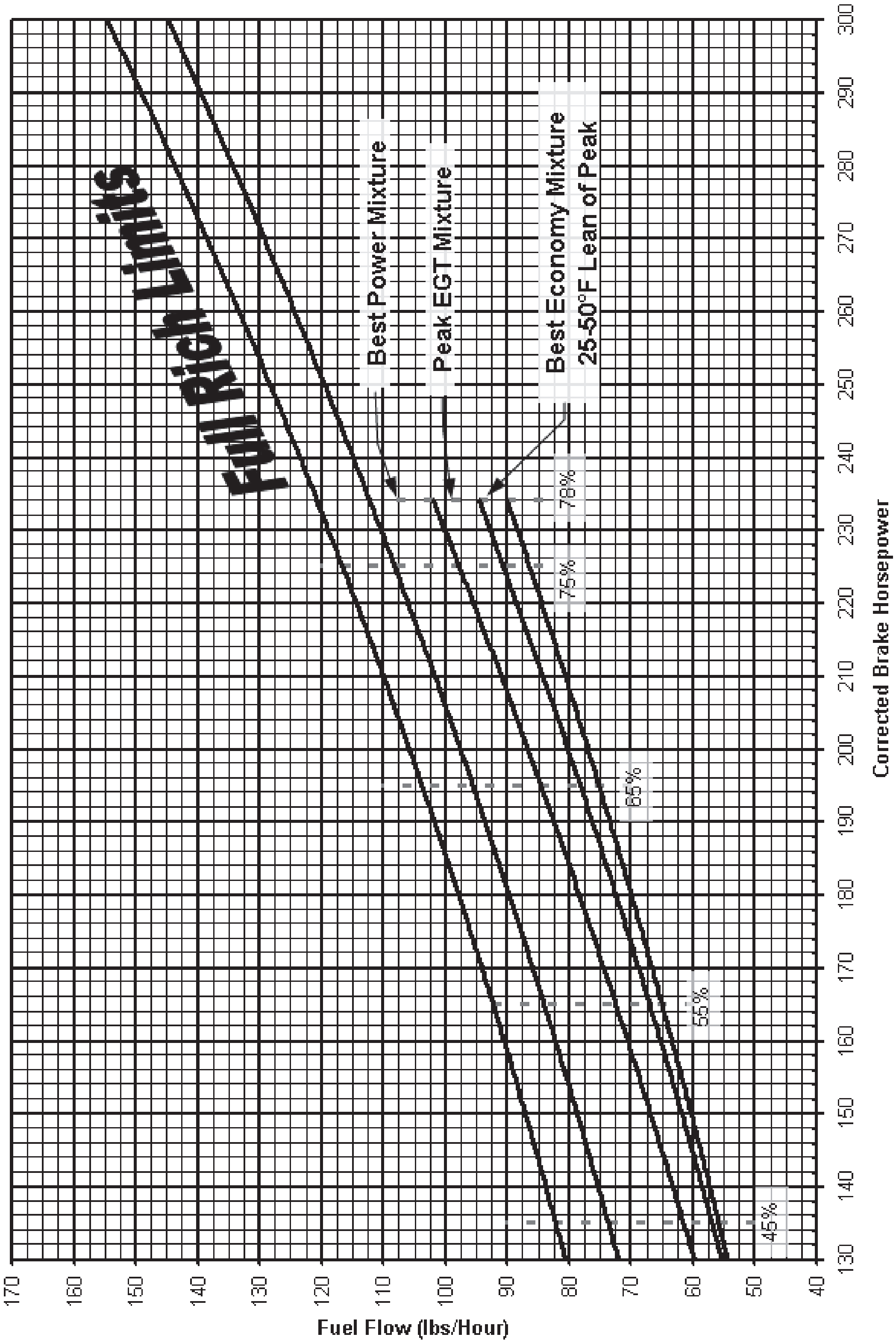

Figure 2-28. IO-550-B Fuel Flow vs. Brake Horsepower

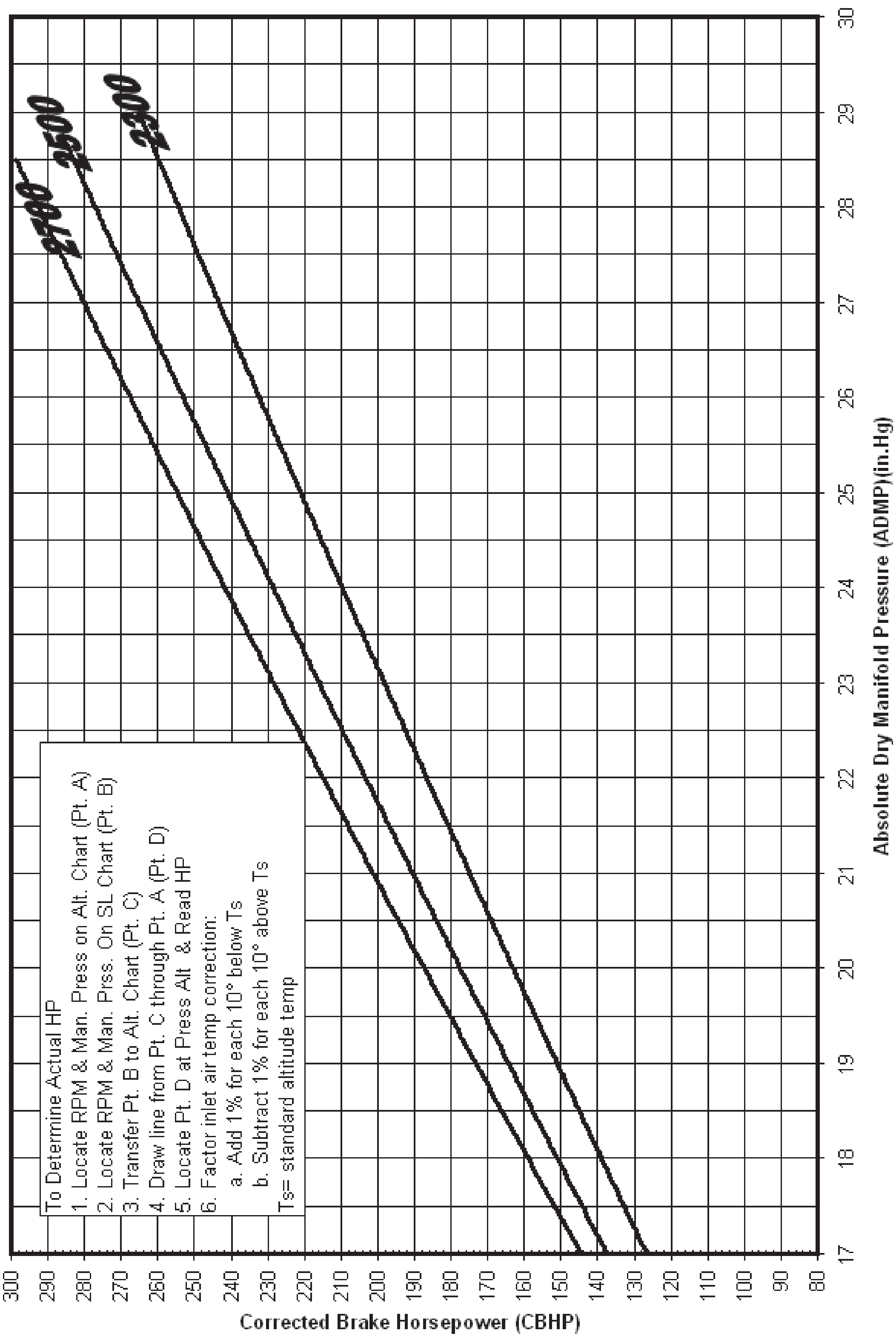

Figure 2-29. IO-550-B Sea Level Performance

2-3.10.3. IO-550-C Performance Charts

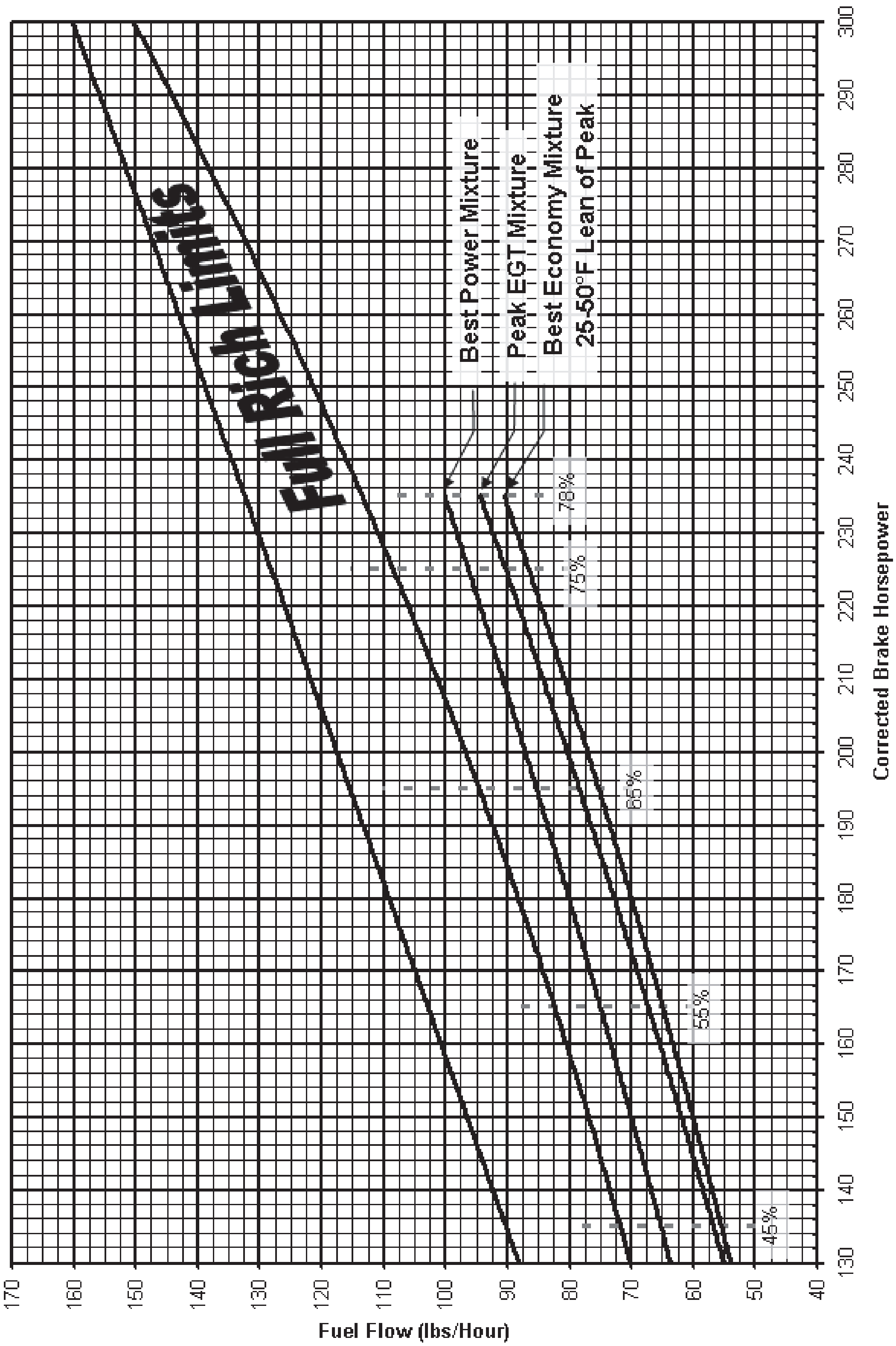

Figure 2-30. IO-550-C Fuel Flow vs. Brake Horsepower

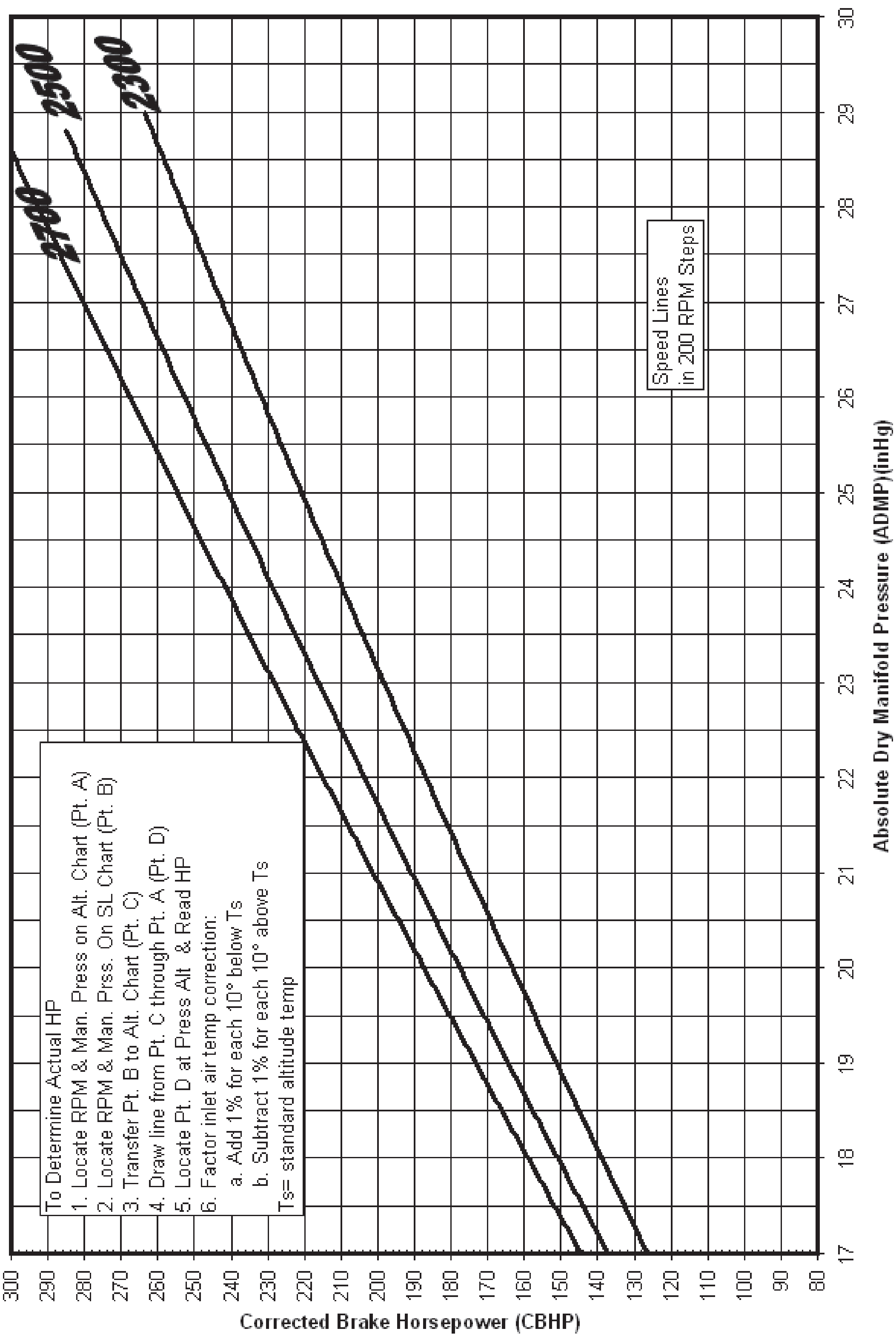

Figure 2-31. IO-550-C Sea Level Performance

2-3.10.4. IO-550-G Performance Charts

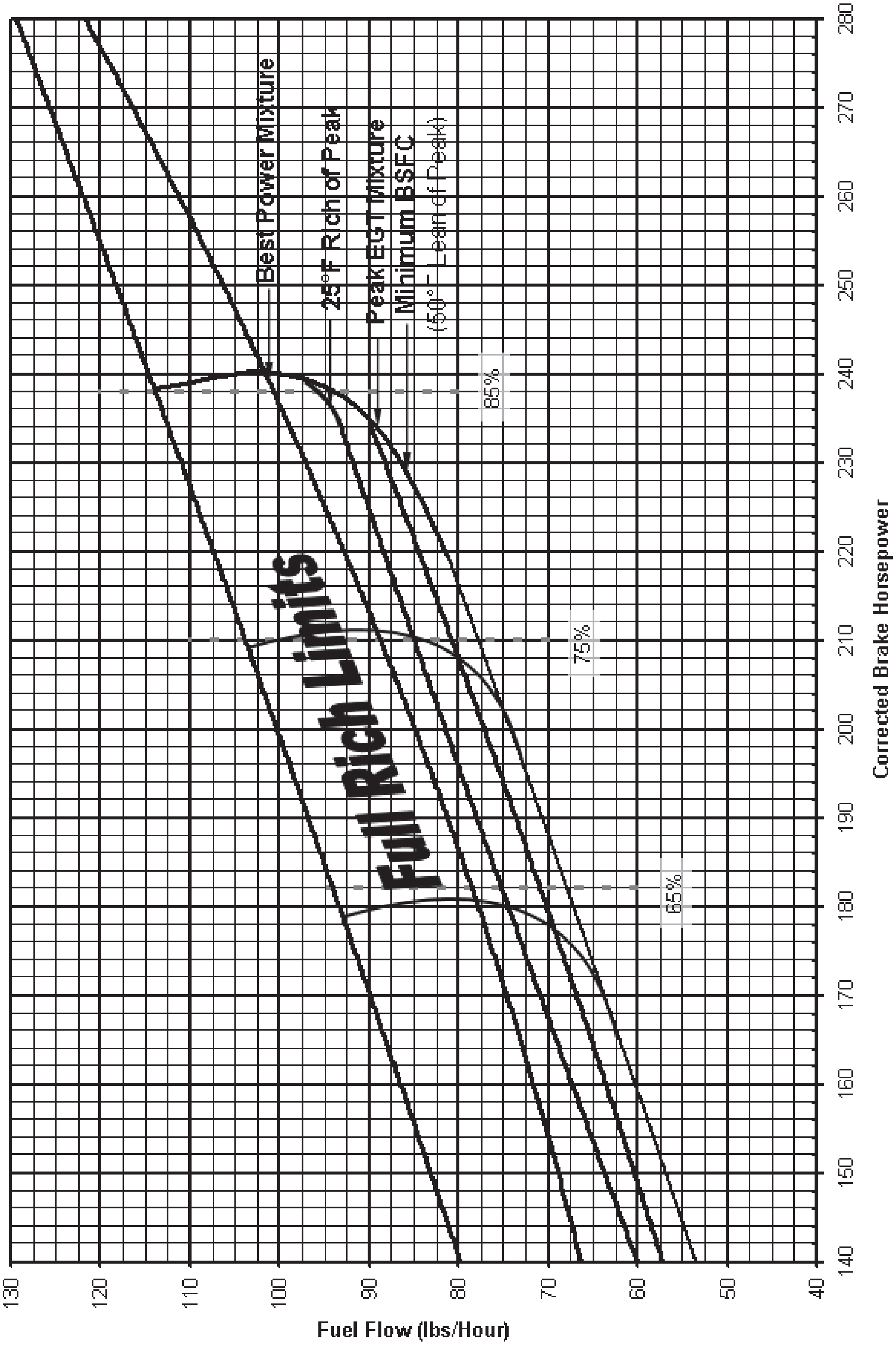

Figure 2-32. IO-550-G Fuel Flow vs. Brake Horsepower

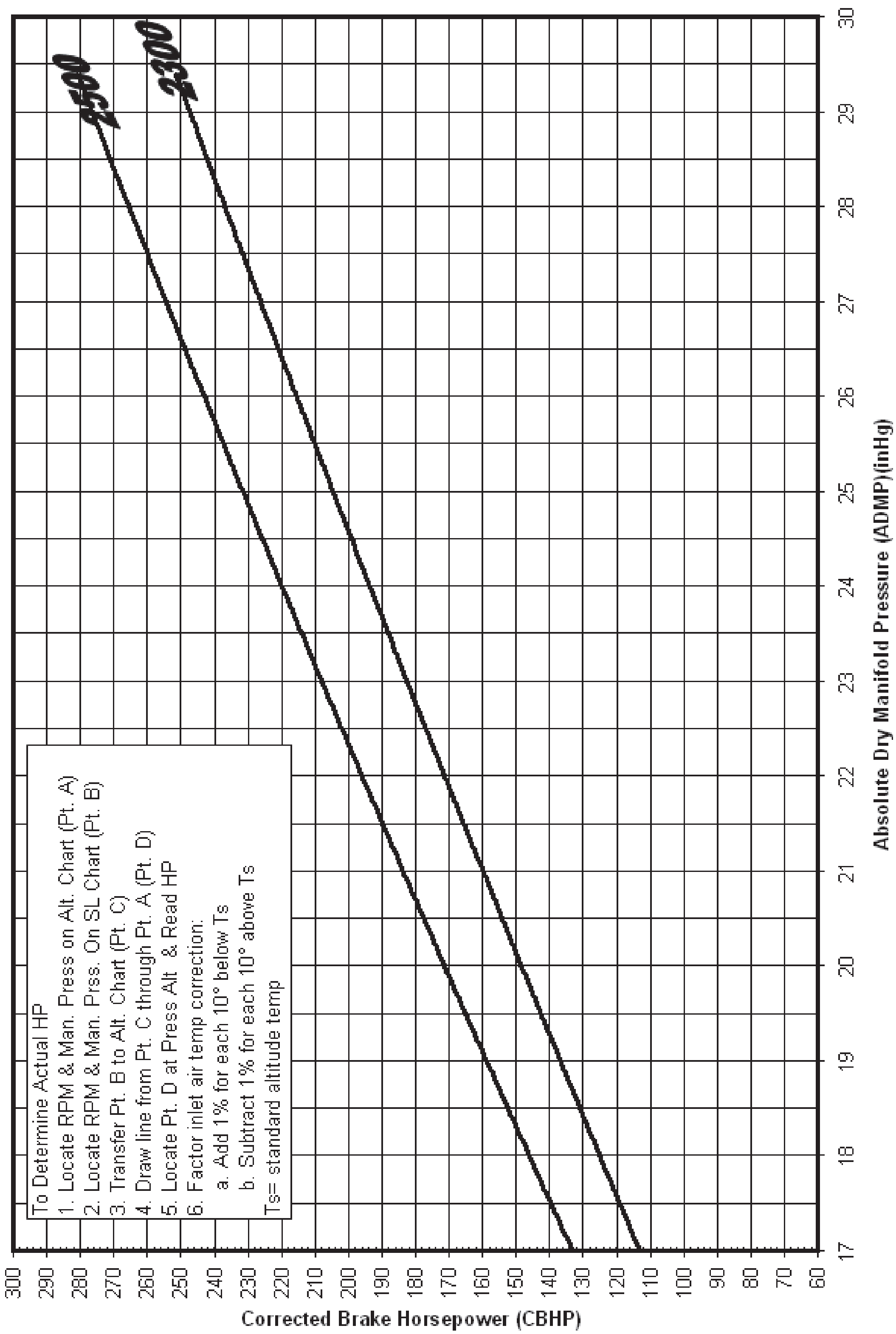

Figure 2-33. IO-550-G Sea Level Performance

2-3.10.5. IO-550-N, P & R Performance Charts

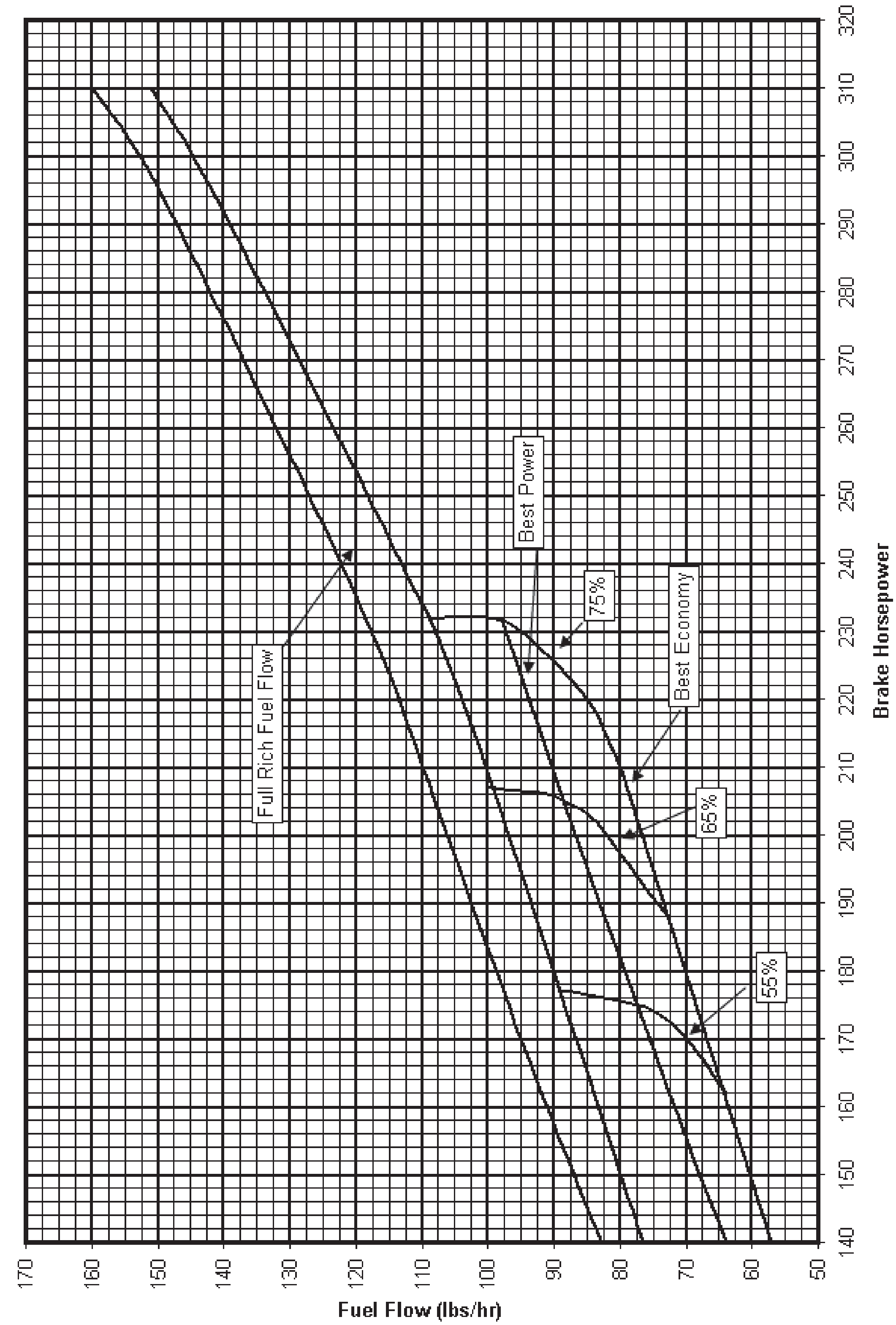

Figure 2-34. IO-550-N, P & R Fuel Flow vs. Brake Horsepower

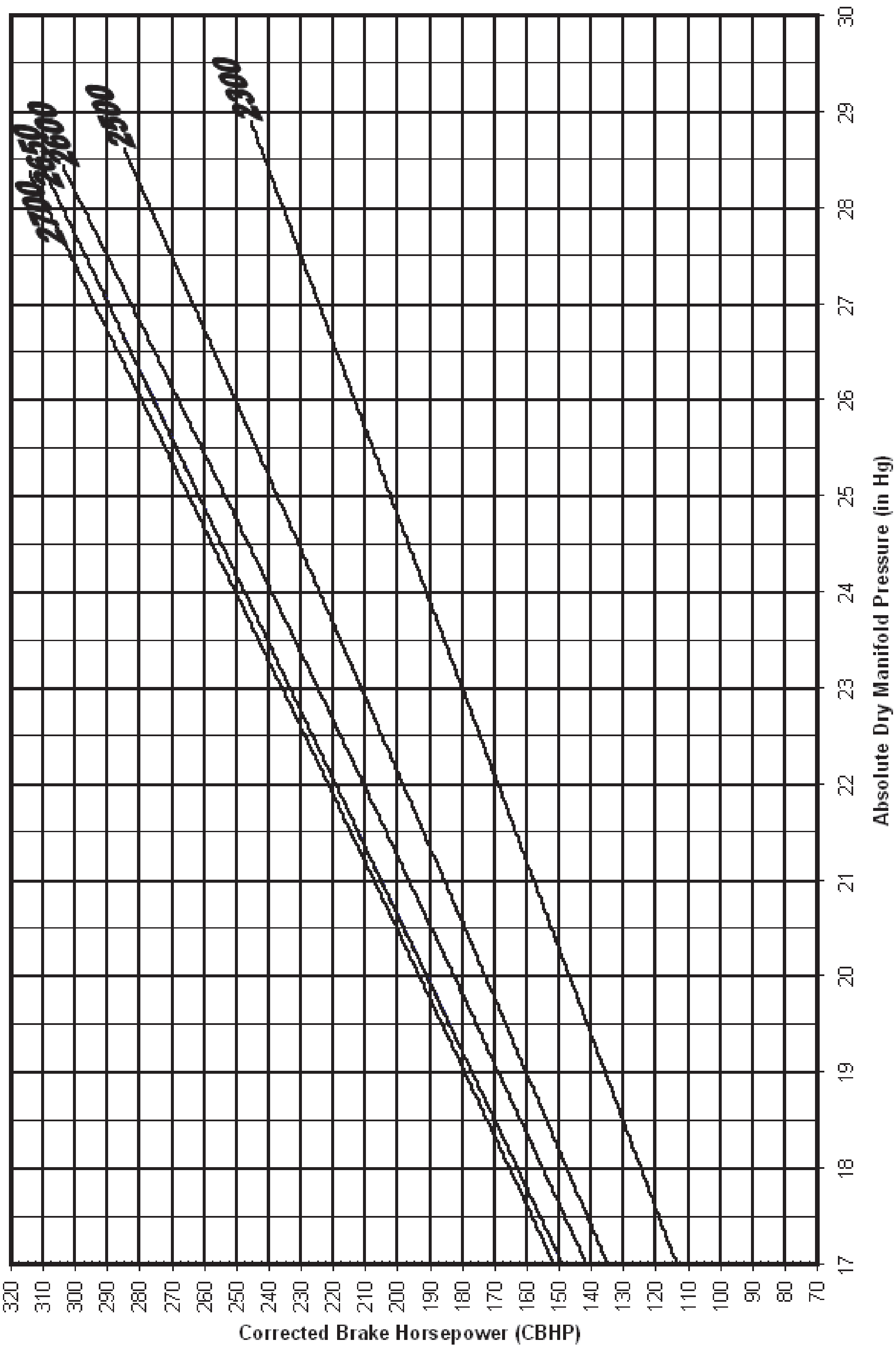

Figure 2-35. IO-550-N, P & R Sea Level Performance

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Chapter 3. Special Tools and Supplies

3-1. Special Tools

NOTE: All tools in the Special Tool List are for reference only, not for the purpose of promoting a particular vendor or requiring the customer to purchase from the indicated sources. The providers listed are potential sources for the items based on information available at the time of printing. Customers are free to obtain equivalent items from alternate sources. Items with Continental Motors part numbers may be purchased from Continental Motors Inc.

Contact information for special tool suppliers is follows this Special Tools List in Table 3-2 on page 3-7.

Table 3-1. Special Tools List

Special Tool	Use or Reference	Suggested Supplier	Part Number
Maintenance			
0-30 psi Gauge (graduated in 0.2-psi increments)	Engine Operational Check	Davis Instruments	Various
0-60 psi Gauge (graduated in 1-psi increments)	Engine Operational Check	Davis Instruments	Various
Alternator Analyzer Voltage Regulator Tester	Alternator Voltage Regulator Check	Eastern Technology Corporation	647
Alternator Drive Hub Spanner Wrench	Alternator Assembly Alternator Drive Hub Assembly Inspection	Ideal Aviation	9001-IA
Alternator Drive Hub Torque Tool	Alternator Drive Hub Slippage Inspection	Fabricate according to Figure 3-5	---
Alternator/Regulator/ Battery Tester	Check Battery	Eastern Technology Corporation	E100
Bearing Installation Tool (Worm Gear Roller Bearing)	Starter & Starter Adapter Assembly	Fabricate according to Figure 3-11	---
Belt Tension Gage	Drive Belt Tension Adjustment	Ideal Aviation	BT-33-73F-IA
Borescope	Cylinder Borescope Inspection	Q.A. Technologies	AUTOSCOPE™ Lenox Instrument Company
Differential Pressure Tester	Cylinder Differential Pressure Test	Eastern Technology Corporation	Model E2M
Digital Multimeter	Troubleshooting	Commercial, off the shelf	---
High Tension Lead Test Kit	Ignition Harness Troubleshooting	Eastern Technology Corporation	E-5
High Tension Lead Test Kit	Ignition Harness Troubleshooting	Kell-Strom	11-8950-2
1/2-inch Injector Nozzle Removal/Insertion Tool	Fuel Injector Removal And Installation	Ideal Aviation	8168-IA

Table 3-1. Special Tools List

Special Tool	Use or Reference	Suggested Supplier	Part Number
7/16-inch Injector Nozzle Removal/ Insertion Tool	Fuel Injector Removal And Installation	Ideal Aviation	8167-IA
Master Orifice Tool	Cylinder Differential Pressure Test	No Longer Available	646953
Model 20 ATM-C Porta-Test Unit	Engine Operational Check	Aero Test (formerly Approved Aircraft Accessories)	630045-20 ATM-C
Oil Filter Can Cutter	Cut Oil Filter Canister	Champion Aerospace	CT-923
Oil Filter Torque Wrench	Oil Filter Installation	Champion Aerospace	CT-921
Portable Digital EGT/ CHT Tester	Verify EGT/CHT/TIT Accuracy	Alcor, Inc.	ALCAL 2000
Protractor/Timing Indicator Disc and TDC Locator	Engine Timing	Eastern Technology Corporation	E-25
Pulley Alignment Tool	Belt Drive Pulley Alignment	Ideal Aviation	8082-IA
Pulley Puller	Remove Generator/Alternator Sheave	Ideal Aviation	61-5-IA
Timing Light	Magneto to Engine Timing	Eastern Technology Corporation	E50
Voltage & Circuit Tester	Check Voltage/Circuits	Eastern Technology Corporation	Model 29
Worm Shaft Tool & Starter Adapter Disassembly Tool	Starter & Starter Adapter Disassembly	Fabricate according to Figure 3-6	---
Overhaul			
Bearing Puller	Component Maintenance	Borroughs***	8093C
Boring Bars	Cylinder Repair	Borroughs***	8116-1B through -15B
Carbide Tipped Reamer	Valve Guide Reaming	Kent-Moore***	2847-2CP 2847-1CP
Common Drive Handle	Cylinder Repair	Borroughs***	8122A
Common Parts Kit	Valve Seat Replacement	Borroughs***	8116
Connecting Rod Boring & Alignment Fixture	Connecting Rod Piston Bushing Replacement	Borroughs***	8111A
Connecting Rod Bushing Removal/ Installation Set	Connecting Rod Piston Bushing Replacement	Borroughs***	8098
Connecting Rod Bushing Installation and Removal Tool Adapter Kit	Connecting Rod Piston Pin Bushing Replacement	Borroughs***	8042C
Connecting Rod Bushing Reamer	Honing The Connecting Rod Bushing Bore	Kent-Moore***	5008
Contact Profilometer	Cylinder Bore Honing	Commercial, off the shelf	---

Table 3-1. Special Tools List

Special Tool	Use or Reference	Suggested Supplier	Part Number
Counterweight Hanger Blade Replacement Tool	Counterweight Hanger Blade Replacement	Borroughs***	4965A
Counterweight Bushing Replacement Fixture	Counterweight Bushing Replacement	Borroughs***	8077C
Crankcase Needle Bearing Installer Tool	Crankcase Assembly	Fabricate according to Figure 3-12	---
Crankcase Splitter	Separate The Crankcase	Kent-Moore***	L423
Crankcase Through Bolt Remover	Crankcase Disassembly	Borroughs***	8114-8
Crankshaft Nose Oil Seal Installer Tool	Connecting Rod And Bearing Installation Crankshaft Nose Oil Seal Installation	Kent-Moore***	5209
Cylinder Base Nut Wrenches	Cylinder Maintenance	Kent-Moore***	5203, 5204, & 8158A, 3882, & 3882-2
		Borroughs***	8079
Cylinder Heating Stand	Cylinder Maintenance	Borroughs***	8156
Cylinder Holding Fixture	Valve Seat Replacement Valve Guide Replacement Valve Seat Machining	Borroughs***	5221B
Cylinder Holding Fixture Adapters	Valve Seat Replacement Valve Guide Replacement Valve Seat Machining	Borroughs***	5221-13A 5221-15A 5221-16A
Cylinder Hone	Engine Cylinder Bore Honing	Snap On Tools	CFL10
Dial Indicator	Gear Backlash Measurement	Commercial, off the shelf	---
Exhaust Valve Seat Grinding Stone (Roughening 45°)	Valve Seat Machining	Aircraft Tool Supply	K95
Exhaust Valve Seat Grinding Stone (Finishing 45°)	Intake Or Exhaust Valve Seat Machining	Aircraft Tool Supply	K25
Expanding Guide Bodies	Valve Guide Replacement	Borroughs***	8116-1 through -16
Generator Drive Holder	Secure The Generator Drive	Borroughs ***	4973
Helical Coil Extracting Tool	Helical Coil Insert Replacement	Emhart Fastening Teknologies	---
Helical Coil Installation Tool	Helical Coil Insert Replacement	Emhart Fastening Teknologies	---
Helical Coil Expanding Tool No. 520-2	Helical Coil Insert Replacement	Emhart Fastening Teknologies	520-2
High Speed Steel Reamer	Reaming Valve Guides	Kent-Moore***	2847-1HP 2847-2HP
Intake Valve Seat Grinding Stone (Roughening 30°)	Valve Seat Machining	Aircraft Tool Supply	K106

Table 3-1. Special Tools List

Special Tool	Use or Reference	Suggested Supplier	Part Number
Intake Valve Seat Grinding Stone (Finishing 30°)	Valve Seat Machining	Aircraft Tool Supply	K46
Needle Bearing Installer Tool	Starter Adapter Housing Worm Shaft Needle Bearing Replacement	Borroughs***	23-1
O-ring Installation Tool	Crankcase Hardware Installation	Fabricate according to Figure 3-14	---
Oil Control Plug Installation Tool	Oil Control Plug Replacement	Fabricate according to Figure 3-7	---
Oil Control Plug Leak Test Fixture	Oil Control Plug Replacement	Fabricate according to Figure 3-8	---
Oil Pressure Relief Spot Facer	Oil Pressure Relief Valve Seat Refacing	Kent-Moore***	8048
Oil Seal Tool	Crankcase And Accessory Drive Adapter Oil Seal Installation	Fabricate according to Figure 3-15	MT500260
Piston Ring Compressor	Engine Cylinder Installation	Kent-Moore***	3601
Piston Ring Removers	Piston Ring Removal	Kent-Moore***	8121
Polishing Tool	Engine Drive Train Inspection	Borroughs***	8087B
Pushrod Spring Compressor Tool	Pushrod Installation	Kent-Moore	68-3
Reamers	Valve Guide Reaming	Borroughs***	8116-1R through -15R
Reamer, Adjustable Blade	Magneto Drive Adapters Bushing And Oil Seal Installation		Size range 25132-27132
Rocker Arm Bushing Remover/Installer	Rocker Arm Bushings (Single-Bushing Type) Replacement	Kent-Moore***	8118
Rocker Arm Bushing Reamer	Ream Rocker Arm Bushing	Kent-Moore***	7232
Rosan Stud Remover	Remove Step-Type Rosan Studs	McMaster-Carr Supply Company	---
Rosan® Stud Remover (Rosan® is a registered trademark of Fairchild Aerospace Fastener Division)	Remove Rosan Studs	McMaster-Carr Supply Company	2769A13
Rosan® Lock Ring Installer	Rosan Studs Installation	Kent-Moore***	8074
Spark Plug Insert Remover	Spark Plug Helicoil Insert Removal	Borroughs***	4919
Spark Plug Insert Replacer	Spark Plug Helicoil Insert Installation	Borroughs***	4918
Spark Plug Tap (18 mm)	Repair Damaged Spark Plug Threads/Boss	Borroughs***	445
Test Club	Post-Overhaul Testing	Hartzell Propeller, Inc.	

Table 3-1. Special Tools List

Special Tool	Use or Reference	Suggested Supplier	Part Number
Valve Guide Boss Reamers	Valve Guide Reaming	Kent-Moore***	4943-1 HS through -5HS
Valve Guide Floating Holder	Valve Guide Replacement	Borroughs***	3170
Valve Guide Remover	Valve Guide Replacement	Kent-Moore***	4981
Valve Guide Seal Installation Tool	Valve Guide Seal Installation	Fabricate according to Figure 3-13	---
Valve Seat Grinder Set “Sioux Brand”	Machining Intake Or Exhaust Valve Seat	Aircraft Tool Supply	1675
Valve Seat Grinder Pilot 0.437 diameter	Machining Intake Or Exhaust Valve Seat	Aircraft Tool Supply	AEX 437
Valve Seat (Straight Side) Insert Cutters	Valve Seat Repair	Kent-Moore***	5224 & 5225
Valve Seat (Step Side) Insert Cutters	Valve Seat Repair	Kent-Moore***	8135, 8136, & 8138
Valve Seat Insert Remover & Replacer	Valve Seat Replacement	Borroughs***	8086
Valve Spring Compressor Tool	Engine Cylinder Assembly	Kent-Moore***	3602
Overhaul Inspection			
Contour Probe	Magnetic Particle Inspection	Parker Research Corporation	DA-200
Federal Dimension Air Gage (with setting ring and air plug) or equivalent with 1.1268 Setting Ring 1.1268 Air Plug	Counterweight Hanger Blade Bushing Replacement Counterweight Bushings Replacement	MAHR Federal	D-4000
Dial Bore Gauges	Cylinder Bore Inner Diameter Dimensional Inspection	MAHR Federal	545-116
Plug Gauge	Cylinder Intake Valve Guide Inspection	Kent-Moore***	2848-1
Ultrasonic Test Instrument, Portable	Crankshaft Ultrasonic Inspection	Krautkramer-Branson	Krautkramer-Branson P/N: USK 7D OR7S USL 42 USL 48 USN 50 USN 52
Ultrasonic Test Instrument Calibration Block	Crankshaft Ultrasonic Inspection (Equipment Calibration)	Krautkramer-Branson	DSC Block or Rompas Block (steel)
Coaxial Cable - Grade 74 RG174/U 50 ohm Microdot to BNC (6’)	Crankshaft Ultrasonic Inspection (For Connecting The Transducer To The Ultrasonic Equipment)	Krautkramer-Branson	Krautkramer-Branson P/N 118140012
Coaxial Cable MMD to BNC (6’)	Cylinder Barrel Ultrasonic Inspection	Krautkramer-Branson	Krautkramer-Branson P/N C-047

Table 3-1. Special Tools List

Special Tool	Use or Reference	Suggested Supplier	Part Number
Filter (microhenry BNC to BNC)	Cylinder Barrel Ultrasonic Inspection	Krautkramer-Branson	Krautkramer-Branson P/N 281-678-200
Fixture 60° Axial	Cylinder Barrel Ultrasonic Inspection	Krautkramer-Branson	Krautkramer-Branson P/N 291-678-000
Flaw Detector	Cylinder Barrel Ultrasonic Inspection	Krautkramer-Branson	Krautkramer-Branson P/N USL-42 or equivalent
Transducer 5.0 MHz, 0.125 diameter	Cylinder Barrel Ultrasonic Inspection	Krautkramer-Branson	Krautkramer-Branson P/N SMSWS 113-214-585
Transducer, Miniature (Gamma Series 5 MHz)	Crankshaft Ultrasonic Inspection (Provide Piezoelectric Effect)	Krautkramer-Branson	Krautkramer-Branson P/N MSWS 224-580
Crankshaft Main Bearing 2.2375 – 2.2485 inches (5.6833 – 5.7112 cm) and	Crankshaft Ultrasonic Inspection	Continental Motors	654478-1
Miniature Wedge (45° shear wave)	Crankshaft Ultrasonic Inspection	Continental Motors	654484
Crankshaft Main Bearing 2.3630 – 2.3750 inches (6.0020 – 6.0325 cm) and	Crankshaft Ultrasonic Inspection	Continental Motors	654483-1
Miniature Wedge (45° shear wave)	Crankshaft Ultrasonic Inspection	Continental Motors	654578
Crankshaft Main Bearing 2.6140 – 2.6250 inches (6.6396 – 6.6675 cm) and	Crankshaft Ultrasonic Inspection	Continental Motors	654485-1
Miniature Wedge (45° shear wave)	Crankshaft Ultrasonic Inspection	Continental Motors	654484
Micrometers (series 3 point contact inside micrometers)	Counterweight Hanger Blade Bushing Replacement	Starrett	No. 78
Runout Block Set	Drive Train Dimensional Inspection	Borroughs***	8117a
*or equivalent **Providers can be subject to change or discontinue manufacturing tools *** The rights to manufacture Borroughs and Kent-Moore tools has been acquired by Kell-Strom Tool Company.			

3-1.1. Vendor Contact Information

NOTE: Vendor contact information is subject to change without notice. An internet search may provide more accurate results than the listed information.

Table 3-2. Tool, Accessory and Supply Vendors

Supplier	Address	Phone	FAX	Web Address
Aircraft Tool Supply	P.O. Box 370 1000 Old U.S. 23 Oscoda, MI 48750	800-248-0638 517-739-1447	517-739-1448	aircraft-tool.com
Alcor	300 Breesport San Antonio, TX 78216	800-343-7233 210-349-6491	210-308-8536	alcorav.com
Approved Aircraft Accessories	29300 Goddard Road Romulus, MI 48174	800-521-1046 734-946-9000	734-946-5547	approvedaircraft.net
A. W. Chesterton Co.	500 Unicorn Park Drive Woburn, MA 01801-3345	800-835-4135 781-438-7000	781-438-8971	chesterton.com
Borroughs	See Kell-Strom Tools			
Champion Aerospace, Inc.	1230 Old Norris Road Liberty, SC 29657	864-843-1162	864-843-5402	championaerospace.c om
CRC Industries/ Chemical Products	885 Louis Drive Warminister, PA 18974	800-272-4620 800-556-5074	800-272-4560 215-674-2196	crcindustries.com
Davis Instruments	625 East Bunker Court Vernon Hills, IL 60061	800-358-5525	888-818-3981 847-327-2600	davis.com inotek.com
Dow Corning Corporation	P.O. Box 997 South Saginaw Road Midland, MI 48686	517-496-6000 800-248-2481		dowcorning.com
Eastern Electronics	See Eastern Technology Corporation			
Eastern Technology Corporation	42 Nelson St. East Hartford CT 06108	860-528-9821	860-289-7639	easterntech.com
Emhart Fastening Teknologies	Industrial Division 50 Shelton Technology Center P.O. Box 859 Shelton, CT 06484	203-924-9341	203-925-3109	emhart.com
Federal Mogul	Southfield, MI	248-354-7700		federal-mogul.com
Hartzell Engine Technologies	2900 Selma Hwy Montgomery, AL 36108	877-359-5355 334-386-5400	334-386-5450	hartzellenginetechnlogi es.com
Hartzell Propeller Inc.	One Propeller Place Piqua, OH 45356	937-778-4200	937-778-4271	hartzellprop.com
Ideal Aviation	564 Juanita Avenue Mesa, AZ 85204	480-963-8890	480-963-8887	idealaviation.com
Kell Strom Tool	214 Church Street Wethersfield, CT 06109	800-851-6851 860-529-6851	860-257-9694	kell-strom.com
Kent-Moore	See Kell-Strom Tools			

Table 3-2. Tool, Accessory and Supply Vendors

Supplier	Address	Phone	FAX	Web Address
Krautkramer-Branson	50 Industrial Park Road Lewistown, PA 17044	717-242-0327 334-438-3411		metrologyworld.com/storefronts/krautkramer.html
Loctite	1001 Trout Brook Crossing Rocky Hill, CT 06067-3910	860-571-5100 800-243-4874	860-571-5465	loctite.com
LPS Laboratories	4647 Hugh Howell Road Tucker, GA 30084	800-241-9334 770-243-8800	770-243-8899	lpslabs.com
Lubriplate	129 Lockwood St. Newark, NJ	973-589-9150 800-733-4755	973-589-4432	lubriplate.com
MAHR Federal	1144 Eddy Street Providence, RI 02905	401-784-3271 800-343-2050	401-784-3246	mahr.com
McMaster-Carr Supply Co.	P.O. Box 4355 Chicago, IL 60680-4355	630-833-0300	630-834-9427	mcmaster.com
Merit Abrasives	201 W. Mansville Dr. Compton, CA 90224	800-421-1936 310-639-4242	800-472-3094	meritabr.com
Miller-Stephenson Chemical Co.	6348 Oakton St. Morton Grove, IL 60053	847-966-2022 800-992-2424	847-966-8468	miller-stephenson.com
Q.A. Technologies	P.O. Box 61085 Savannah, GA 31420	912-330-0500	912-330-0104	qatek.com
Parker Research Corporation	P.O. Box 1406 Dunedin, FL 34697	800-525-3935 727-796-4066	727-797-3941	parkreascorp.com
Shell Oil Co.	P.O. Box 2463 Houston, TX 77252	713-241-4819	713-241-6511	shell-lubricants.com
Snap On (Tools)		877-740-1900	877-740-1880	snapon.com
L.S. Starrett Company	121 Crescent Street Athol, MA 01331	800-541-8887 978-249-3551	978-249-8495	starrett.com
Tanair (Tanis Aircraft Services)	P14871 Pioneer Trail Suite. 200 Eden Prairie, MN 55347	800-443-2136 In Minnesota: 952-224-4425	952-224-4426	tanisaircraft.com
U.S. Industrial Tool & Supply	14083 South Normandie Ave. Gardena, CA 90249	310-464-8400 800-464-8400	310-464-8880	ustool.com
*Unless otherwise indicated, type *http://www.* and the internet address				

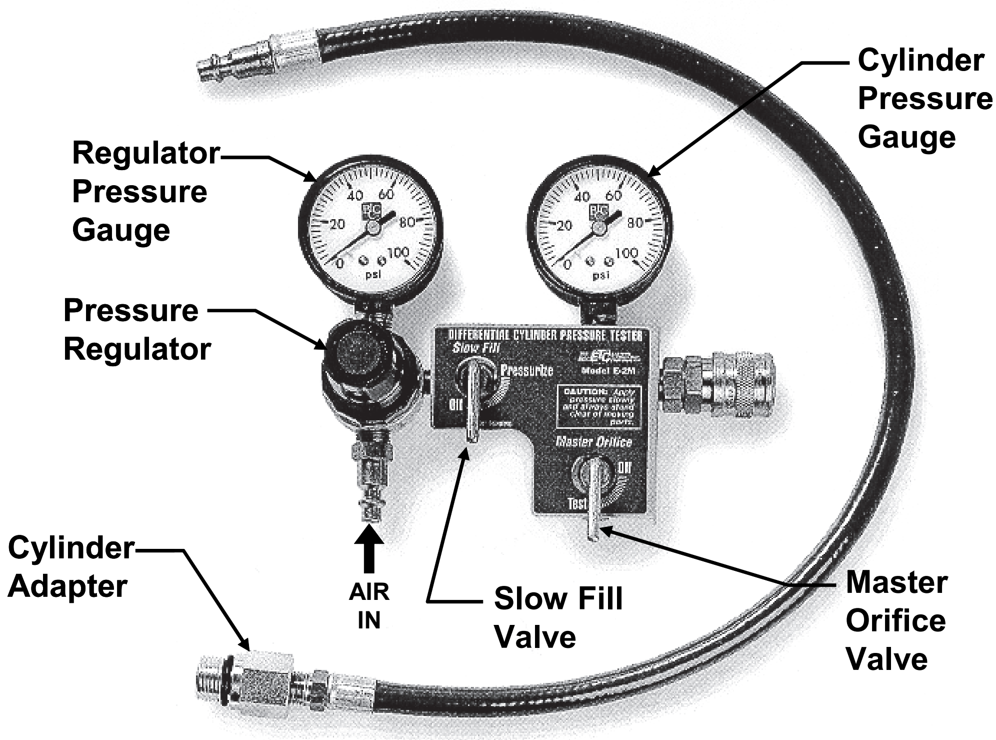


Figure 3-1. Model E2M Differential Pressure Tester (built in Master Orifice Tool)

Figure 3-2. Borescope (Autoscope®)

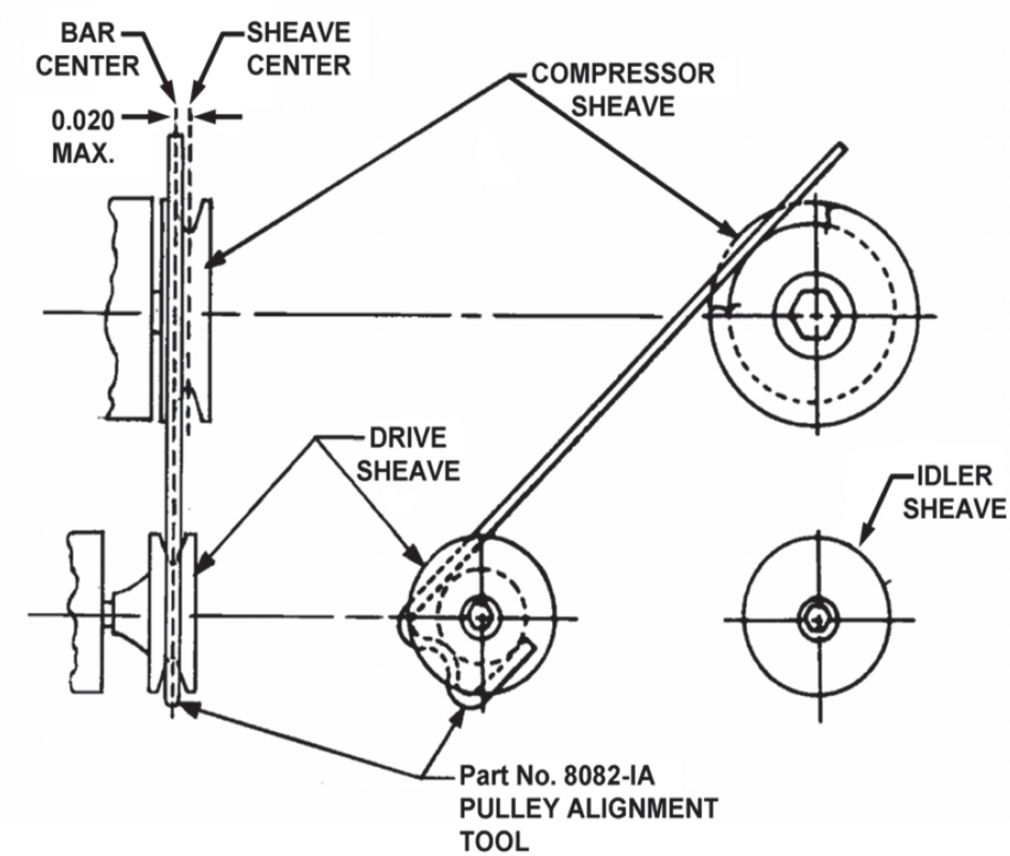


Figure 3-3. Pulley Alignment Tool

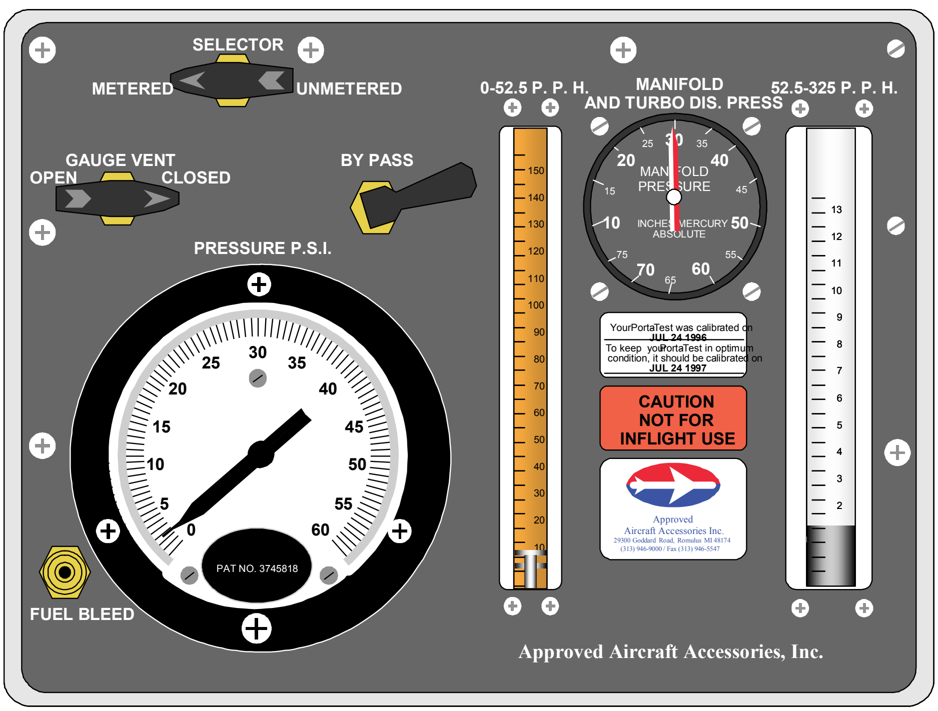


Figure 3-4. Model 20 ATM-C Porta-Test Unit

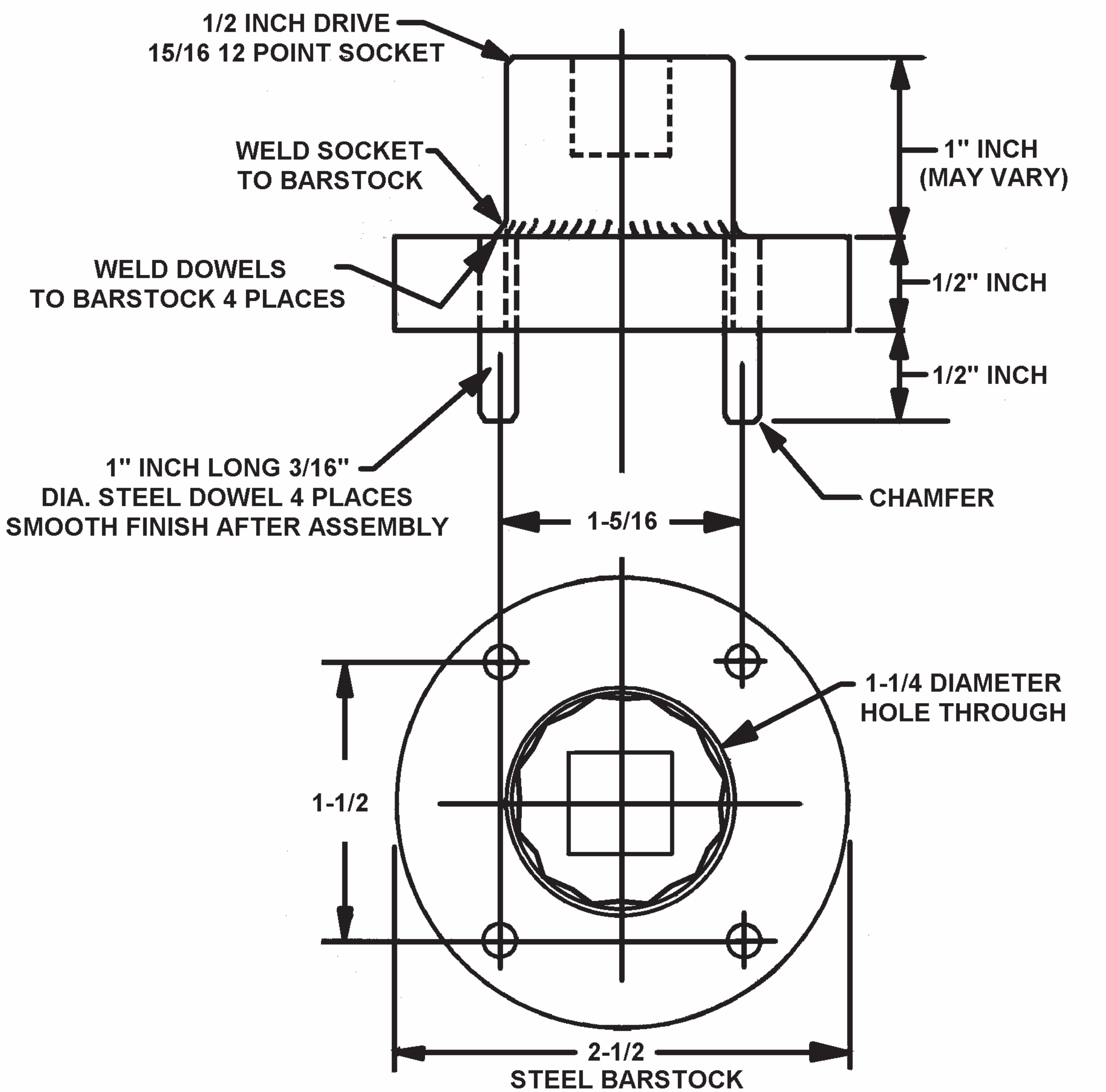


Figure 3-5. Alternator Drive Hub Torque Tool

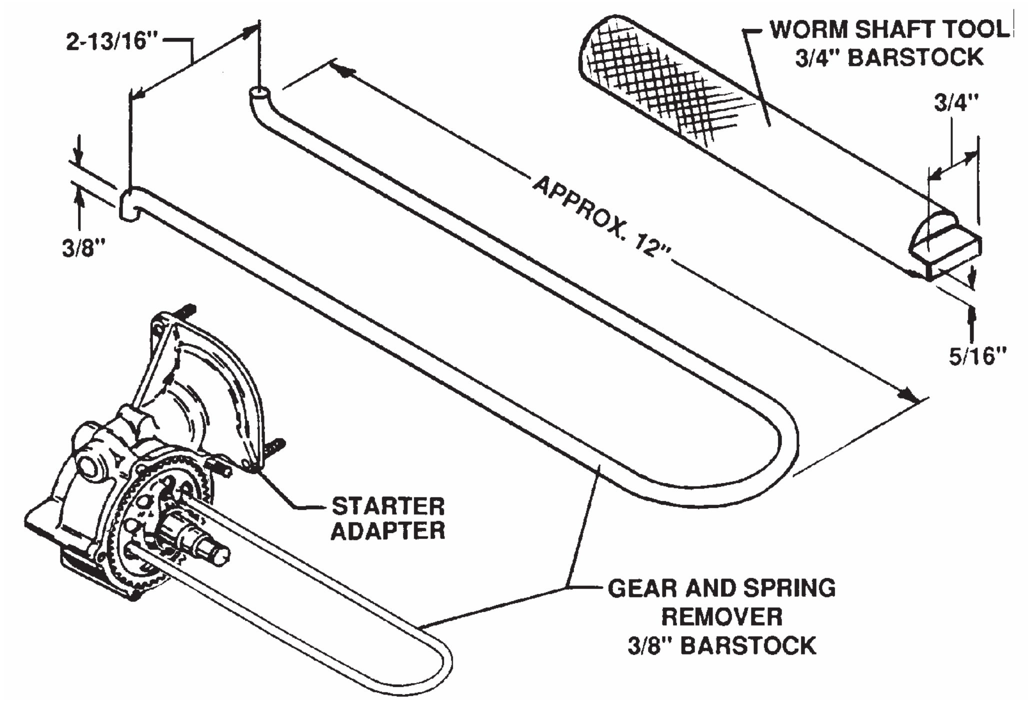


Figure 3-6. Worm Shaft Tool and Starter Adapter Disassembly Tool

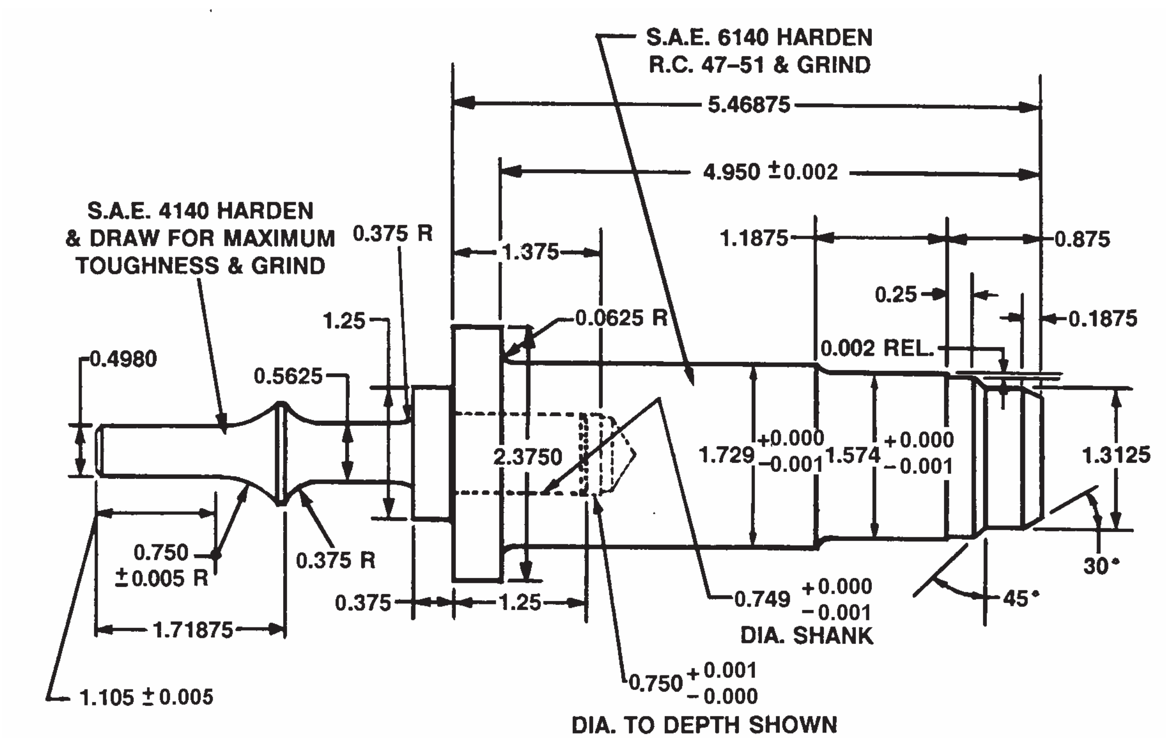


Figure 3-7. Oil Control Plug Installation Tool

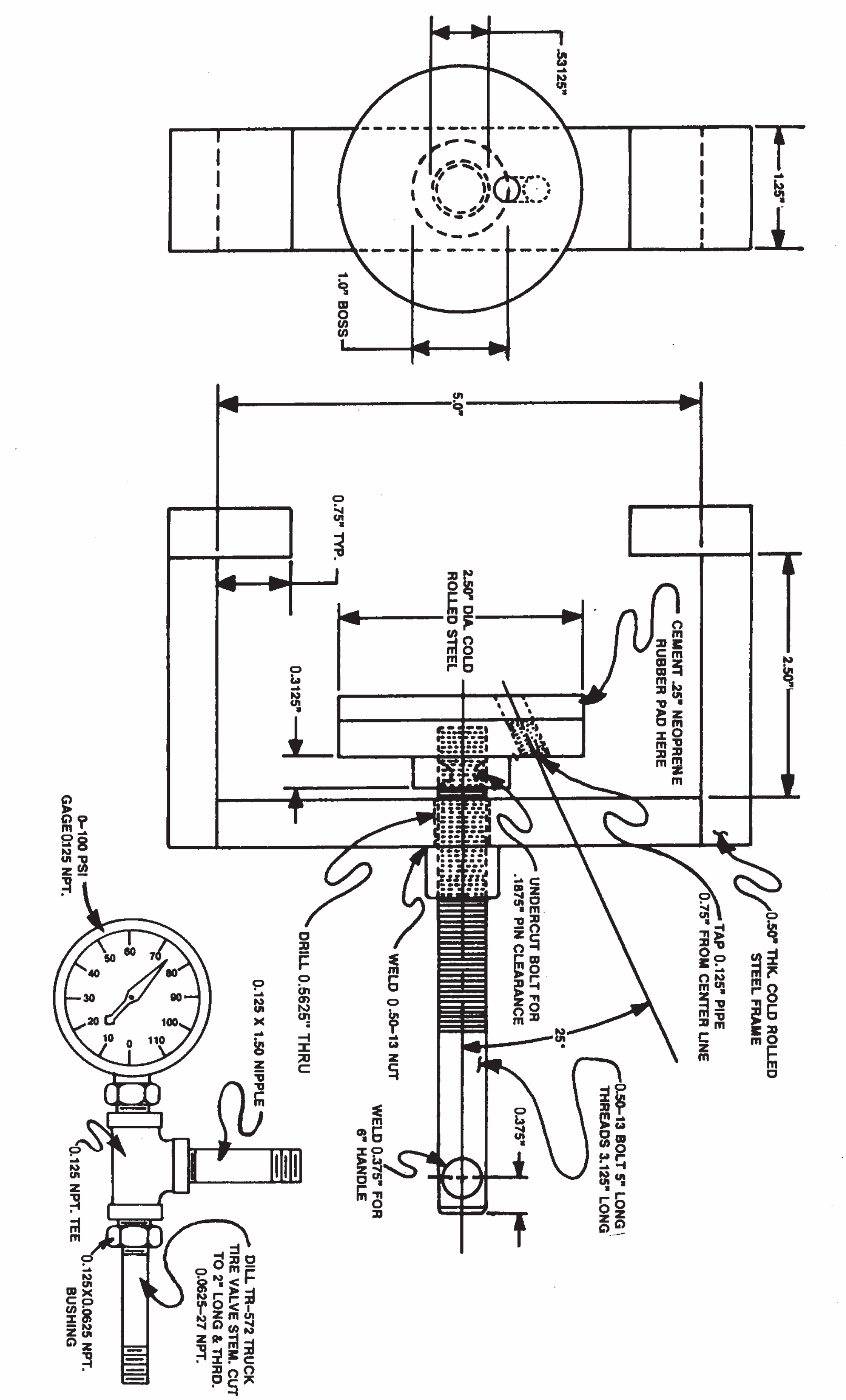


Figure 3-8. Oil Control Plug Leak Test Fixture

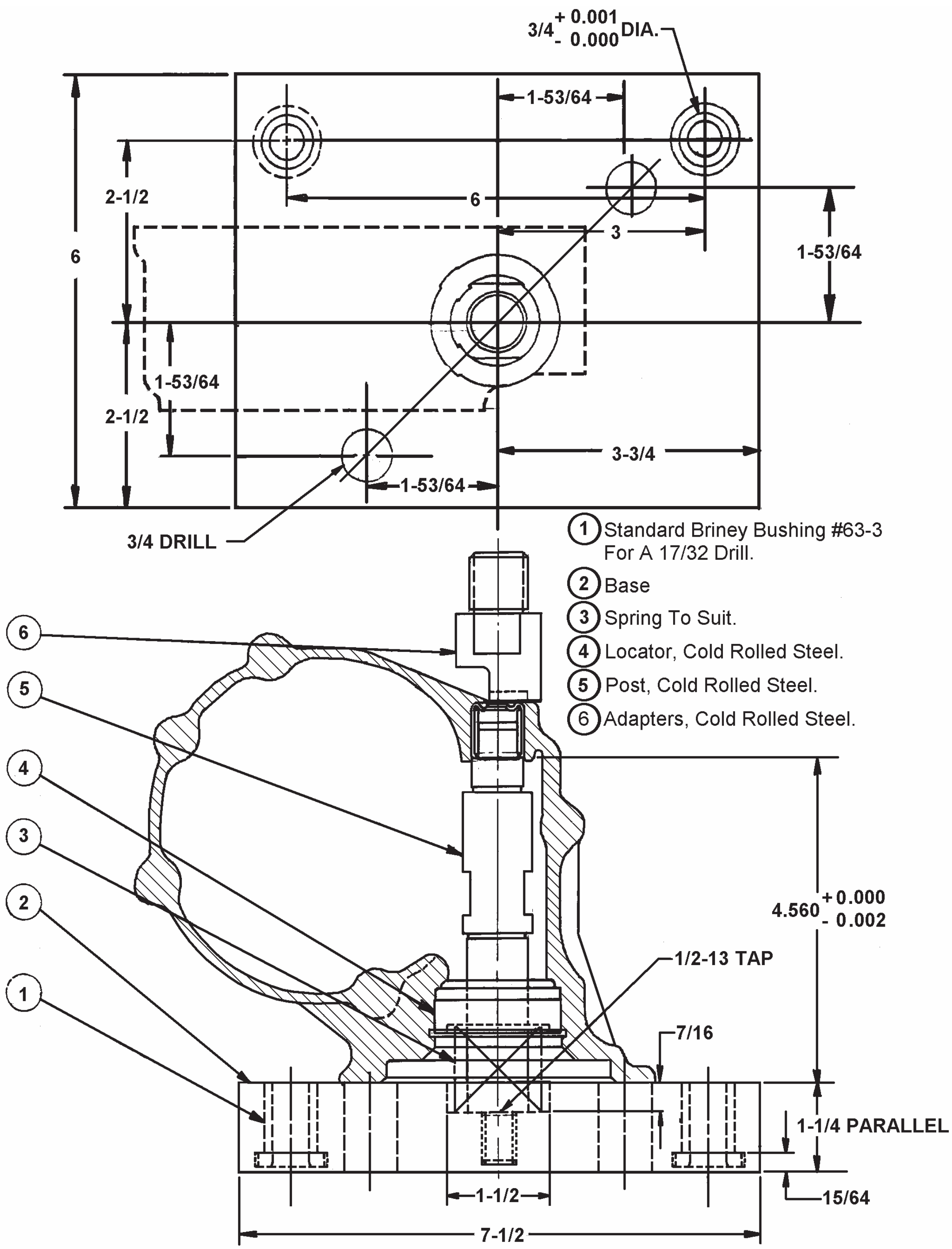


Figure 3-9. Needle Bearing Installation Tool -Part 1

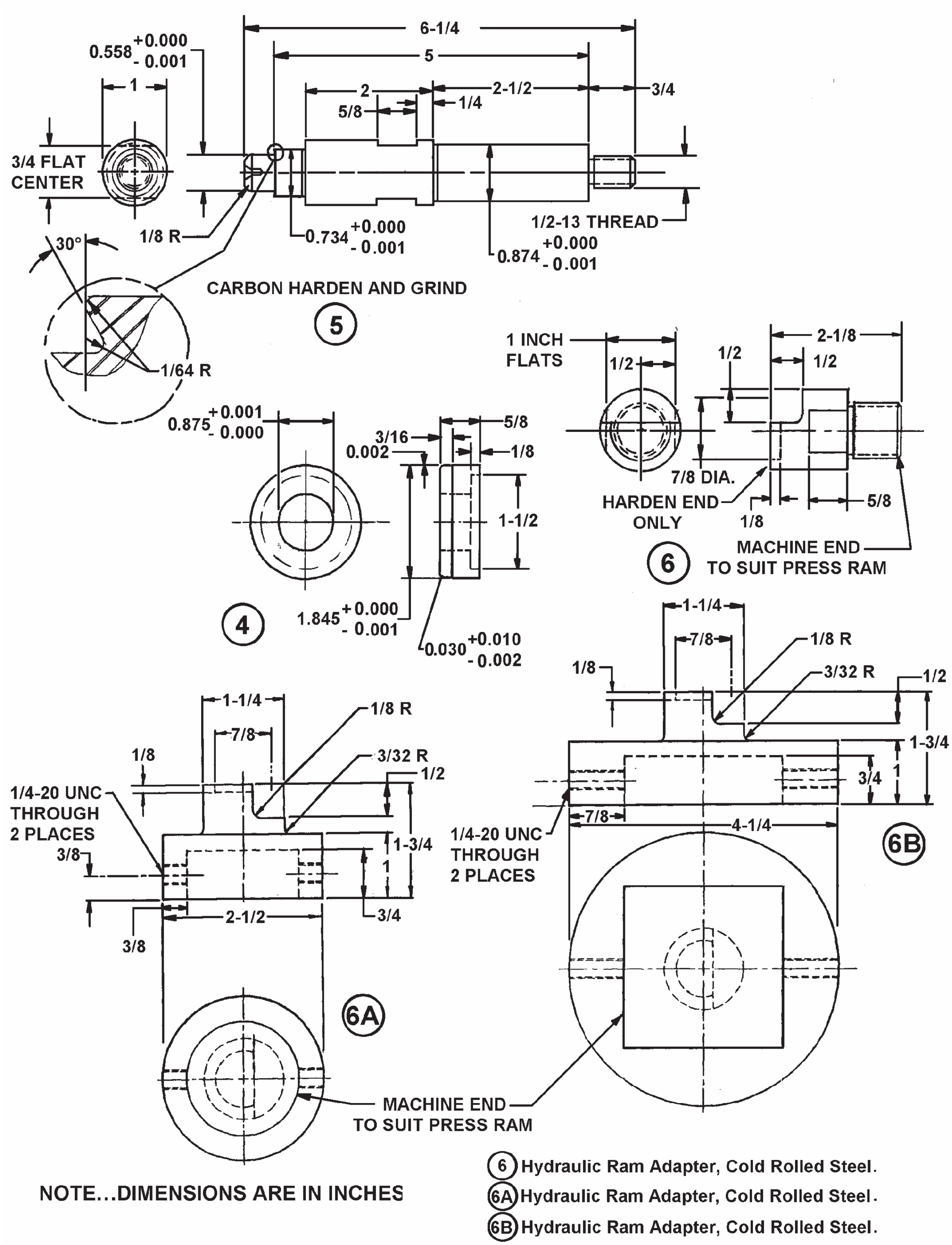


Figure 3-10. Needle Bearing Installation Tool -Part 2

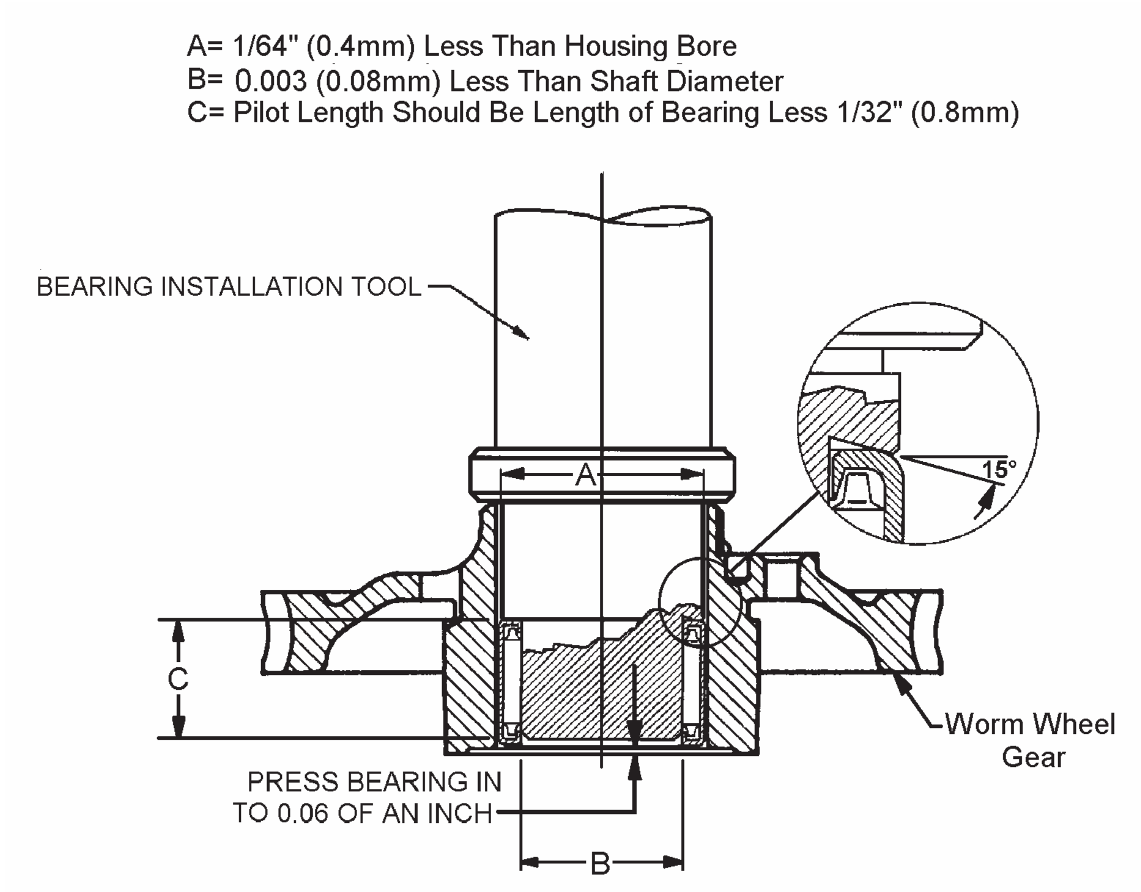


Figure 3-11. Bearing Installation Tool

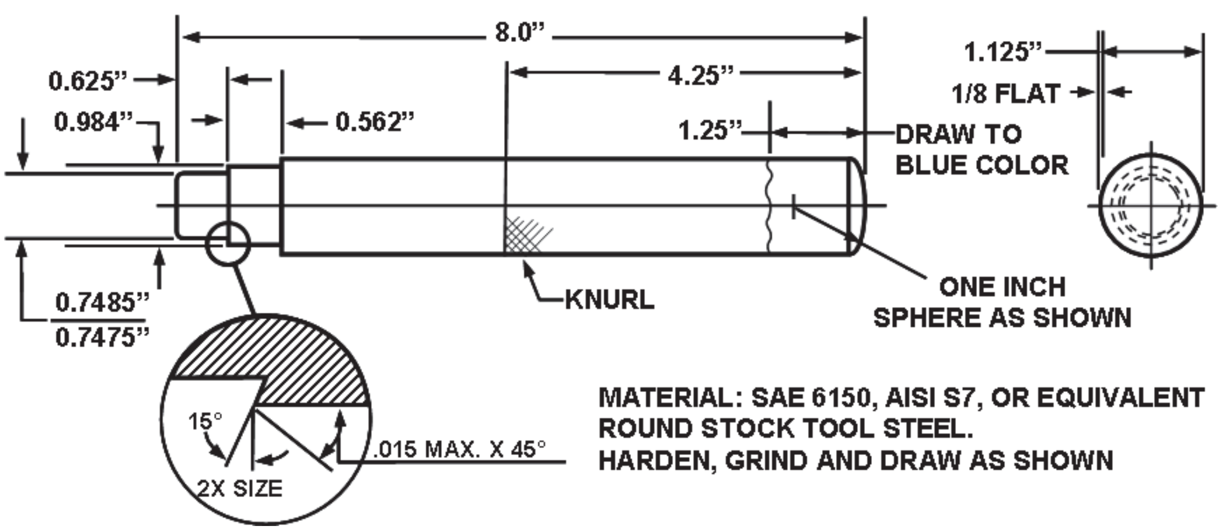


Figure 3-12. Crankcase Needle Bearing Installation Tool

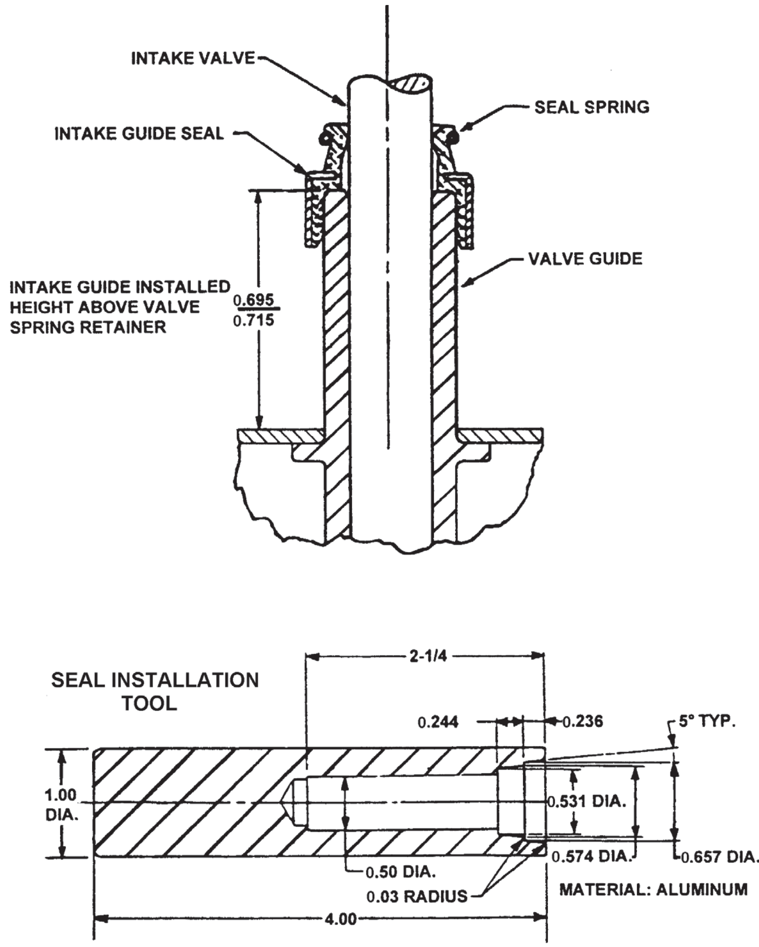
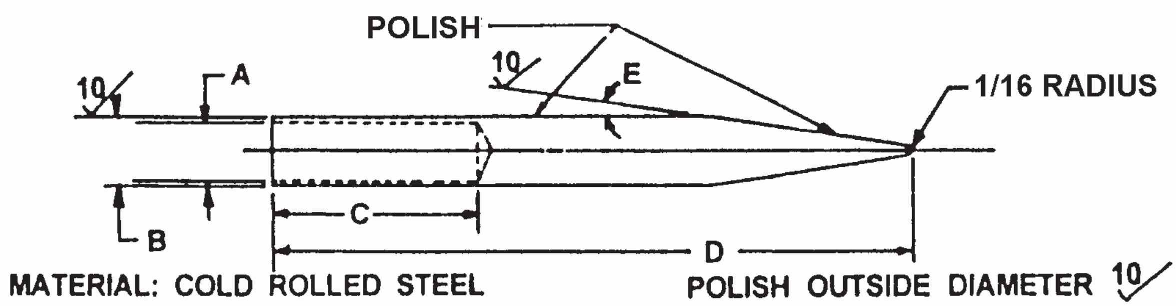


Figure 3-13. Valve Guide Seal Installation Tool



3/8 BOLTS	3/8" Dia.	7/16" Dia.	1-3/8"	4°	8°Degrees
7/16 BOLTS	7/16" Dia.	1/2" Dia.	1-3/8"	4°	8°Degrees
1/2 BOLTS	1/2" Dia.	9/16" Dia.	1-3/8"	4°	8°Degrees
SIZE	A	B	C	D	E

Figure 3-14. O-Ring Installation Tool

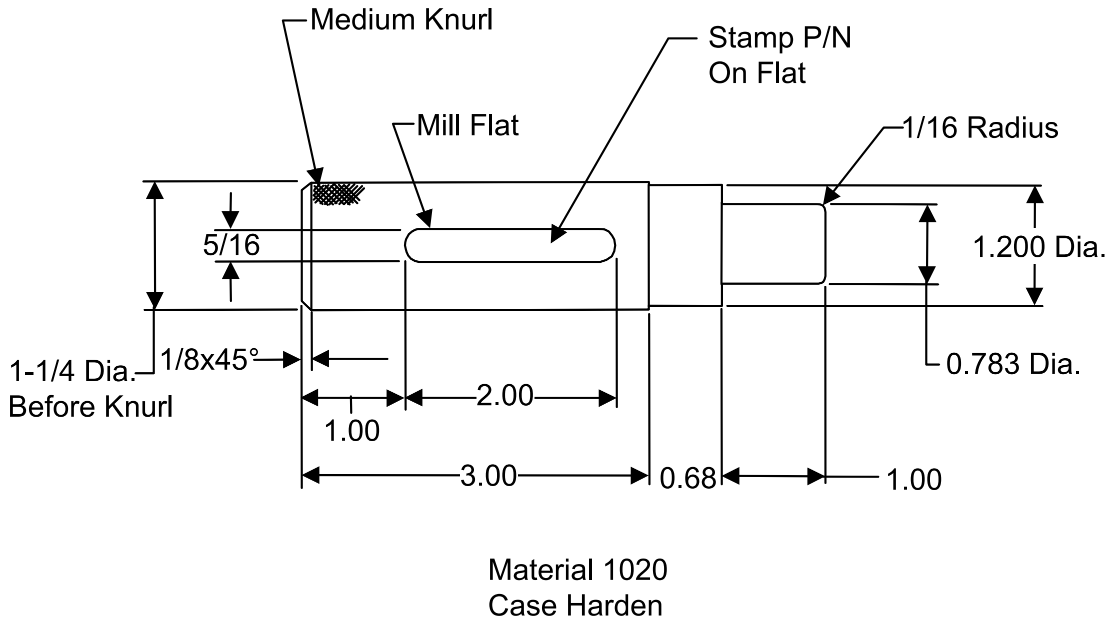


Figure 3-15. Oil Seal Tool

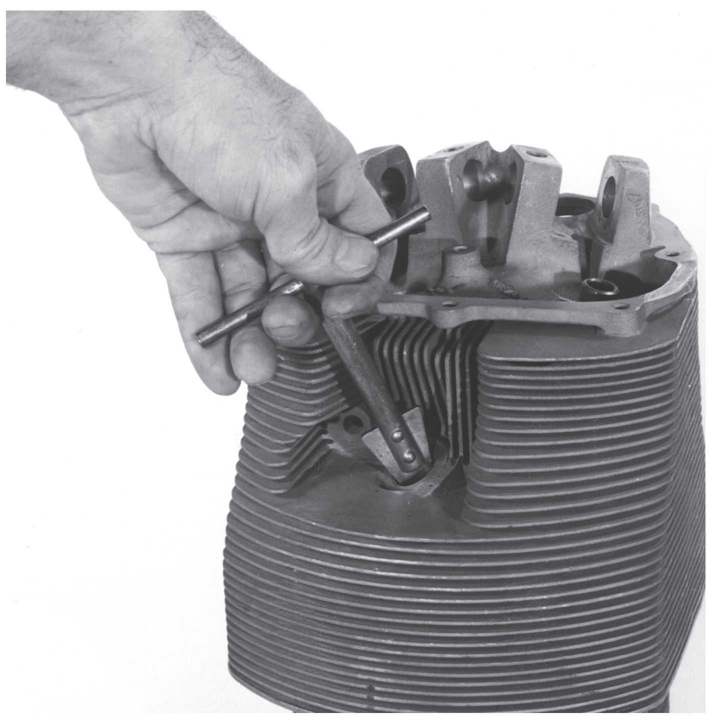


Figure 3-16. Helical Coil Extraction Tool

Figure 3-17. Helical Coil Insertion Tool

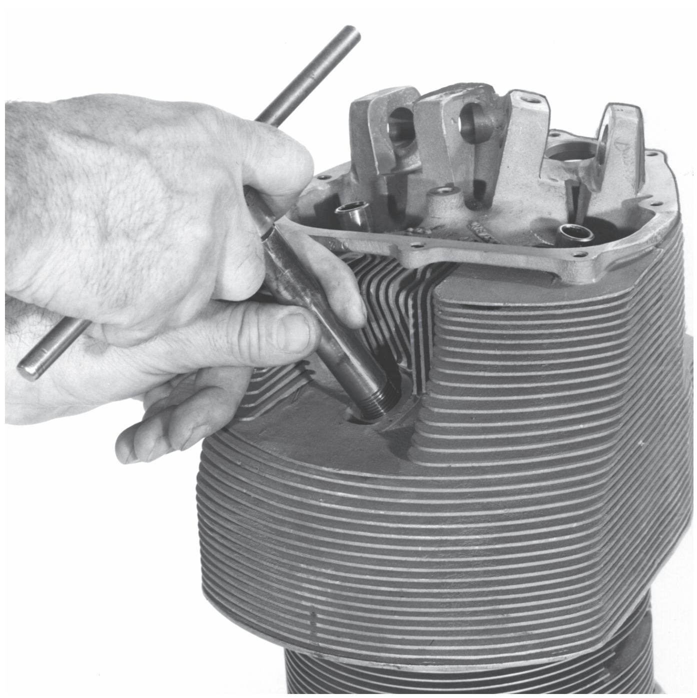


Figure 3-18. Helical Coil Expanding Tool

Figure 3-19. Rosan® Stud Removal Tool

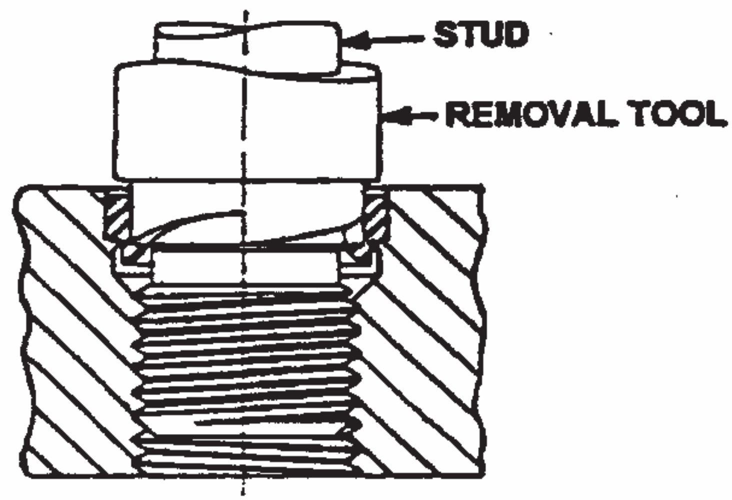


Figure 3-20. Rosan Stud Removal Tool Installed on Stud

3-1.2. Mechanic's Tools

The tools listed below are required to perform overhaul procedures on the engines.

Open end wrenches – ¼-inch through 1-inch	1/4-inch Slide hammer
Socket wrenches: 1/4-inch drive • 5/32 through 1/2-inch 3/8-inch or 1/2-inch drive • 7/16-inch through 1-1/2-inch	Ratchets: • 1/4-inch drive • 3/8-inch drive • 1/2-inch drive
Deep well sockets: 1/2-inch drive • 7/16-inch through 1-inch	Heat Gun (variable intensity/ equipped with a small tip)
Calibrated torque wrenches: • 0 to 500 in-lbs • 0 to 1000 in-lbs • 0 to 100 ft-lbs	• Drill, 0.266 (H) Pneumatic drill • 00.339 Drill High speed borer • Drill bit No. 17 bit (0.1730)
Micrometers	Ball peen hammer
Allen wrenches - assortment	Pullers
Slotted screwdrivers – assortment	Blind Bearing Remover
Phillips screwdrivers – Nos. 1 and 2	Vernier calipers
Safety wire pliers	Leather or soft plastic mallet
Common pliers	Small hole gauges, thickness gauges
Diagonal cutter pliers	Feeler gauges (leaf-type)
Needle nose pliers	C-clamps
Duck bill pliers	Brass wire brush
Snap ring pliers (with 90-degree bend)	Stiff-bristled, non-wire scrub brush
Inspection light/flashlight	Dry blaster cleaning tool
2-inch Merit wheel	Air impact tool
T-handle Drive	Tool maker's square
Magnifying glass (10X power)	Profilometer
Mirror	Chamfer Tool
Utility Knife	Morse adapter
Scissors	Heavy duty drill press
Crimp Tool	Arbor press (and 8-inch arbors)
Wire ties	Vertical mill
Ring expander	Engine hoist
Shield vise	Engine stand
Fiber drift, brass drift, pin or punch	Transport dolly
Magnet	Aircraft tie downs and stop blocks
Stud Extractor Tool	V-blocks
Ezy Out	

3-2. Lubricants, Sealants and Adhesives

3-2.1. Engine Oil Specifications

Lubricating oils qualified for use in Continental Motors engines are required to meet SAE (Society of Automotive Engineers) specifications. SAE J-1899 is the specification for aircraft piston engine ashless-dispersant oil. SAE J-1966 is the specification for aircraft piston engine non-dispersant mineral oil.

NOTE: MIL-L-6082E, dated 1 November 1995 and MIL-L-22851D, dated 1 November 1995 have been superseded by SAE specifications SAE J-1966 and SAE J-1899, respectively.

QPL-J-1899: Qualified Products List is available from:

SAE Headquarters
400 Commonwealth Drive
Warrendale, PA 15096-0001

The Naval Air Systems Command maintains QPL-J-1899 and QPL-J-1966.

Commander, Naval Air Systems Command
47123 Buse Road
Building 2272, Suite 540
Patuxent River, MD 20670
http://www.anchordesk.navy.mil

Recommended Oil Grade:

Above 40°F ambient air, sea level- SAE 50 or Multi Viscosity

Below 40°F ambient air, sea level - SAE 30 or Multi Viscosity

NOTE: Continental Motors makes no endorsement of the listed products. The alphabetical listing is provided only for the convenience of our customers. If the aviation oil you use or wish to use is not listed, contact the Naval Air Systems Command.

Table 3-3. Qualified SAE J-1899 Ashless Dispersant Engine Oil

Supplier	Brand
Air BP Lubricants	Castrol Aviator AD Oil
	Castrol Aviator A Oil
ChevronTexaco	ChevronTexaco Aero Oil AD
	ChevronTexaco Aero Oil AD SAE 20W-50
Delta Petroleum Company	Delta Avoil Oil
Exxon Company, USA	Exxon Elite
	Exxon Aviation Oil EE
Gulf Oil Company	Gulfpride Aviation AD
Mobil Oil Company	Mobil Aero Oil
NYCO SA	Turbonycoil 3570
Pennzoil Company	Pennzoil Aircraft Engine Oil
Phillips 66	Phillips 66 Aviation Oil, Type A 100 AD, 120 AD
	Phillips 66 X/C Aviation Oil SAE 20W-50, SAE 25W-60
	Phillips 66 Victory Aviation Oil 100AW
Quaker State Oil & Refining Co.	Quaker State AD Aviation Oil
Red Ram Limited (Canada)	Red Ram X/C Aviation Oil 20W-50
Shell Aviation	Aeroshell Oil, (Mineral) 65, 80, 100, 2F Anti Corrosion Formula
	Aeroshell Multi-grade Oil AD, 15W - 50
	Aeroshell Oil W65, W80, W100
	Aeroshell Oil W80 Plus, W100 Plus Anti Corrosion Formula
Sinclair Oil Company	Sinclair Avoil
Total France	Total Aero DM 15W - 50

Table 3-4. Break-in Oil

Type	Equivalent	Application
SAE J-1966 Aviation	Non-dispersant mineral oil for piston aircraft engines	First 25 hours of engine operation or until oil consumption stabilizes
MIL-C-6529 Type II Corrosion preventive mineral oil	Fly-away oil	

NOTE: Mineral oil conforming to MIL-C-6529 Type II contains a corrosion preventive additive and must not be used for more than 25 hours or six months, whichever occurs first. If oil consumption has not stabilized in this time, drain and replenish the oil and replace the oil filter.

Table 3-5. Preservative Oil

Type	Equivalent	Application
MIL-PRF-46002, Grade 1	NOX-RUST VCI-105	Temporary or Indefinite Storage
MIL-PRF-46002, Grade 1	Motorstor Engine Protectant	Temporary or Indefinite Storage

3-2.2. Oil Change Intervals

Refer to the engine maintenance manual and/or the aircraft manufacturers or Supplemental Type Certificate (STC) holders AFM/POH for fuel specifications, specified oil change intervals and inspection procedures.

Oil change intervals published in this manual are minimum requirements. Continental Motors believes more frequent oil and filter changes enhance engine service life. Drain and replenish engine oil every 25 hours of operation or 4 months for engines that incorporate a reusable oil screen. On engines with the small (4.80 inch) replaceable oil filter cartridge, change the oil and filter every 50 hours and/or 6 months. If the engine is equipped with the larger (5.80 inch) replaceable oil filter cartridge, change the oil and filter every 100 hours and/or 6 months. Inspect oil screens and oil filter elements for contaminants at each oil change. Oil analysis may be used in addition to the oil screen or filter element inspection, but not as a replacement for it.

3-2.3. Additives

We often receive inquiries regarding the potential use of alternative fuel and oil additives and/or concentrates (formulated primarily for automotive and industrial engine applications) for use in our aircraft engines. Most of these additives and concentrates are not compatible with air-cooled, light aircraft engines in their operating environments. With the exception of the use of isopropyl alcohol or diethylene glycol monomethyl ether (DiEGME) compound (described in the following paragraph), we do not recommend the use of additives or concentrates in any of our aircraft engines. The use of unapproved additives may void the engine warranty. Use only recommended fuels and lubricants.

WARNING

Mixing of DiEGME compound with fuel concentration in excess of the recommended (0.15% volume maximum) could have a harmful effect on engine components. Use only the manufacturer's recommended blending equipment and procedures to achieve proper proportioning.

Under certain ambient conditions of temperature and humidity, sufficient quantities of water may exist in the fuel to create restrictive ice formation in the fuel supply. To alleviate this occurrence, it is permitted to add no more than 3% (by volume) isopropyl alcohol to the fuel supply. Also, DiEGME conforming to military specification MIL-DTL-85470B, if approved by the aircraft manufacturer, may be added for this purpose. DiEGME compound must be carefully mixed with the fuel in concentrations not to exceed 0.15% (by volume).

Table 3-6. Lubricants

Type	Application	Remarks
Part No. 646943 Loctite 76732 Anti-Seize Lubricant	Fuel injector nozzles (at cylinder head)	Use sparingly on male threads only
	Exhaust studs	Apply to nut end before torque
	Mechanical tachometer drive housing threads not through to an oil source.	At engine assembly
	Vernatherm plug	
	All 0.3125 and larger studs unless otherwise noted	
	Throttle body air reference fittings	where applicable
Part No. 654468 Shell #5 MIL-G-3545-C Grease	Fuel injection linkages	During assembly
	Fuel pump o-rings	
	Fuel pressure regulator spring seat	
	Mixture shaft bushings	
Part No. 654561 Shell Alvania # 2	Light coat at contact point between nut seat and ignition lead ferrule	All Models
Part No. 656817 Molyshield Grease	Starter worm gear & bevel gear teeth	All Models during engine assembly
	Needle bearings and ball bearings	
	Valve stems	
	Accessory drive splines and couplings	where applicable
	Idler gear and pin	
	Oil seal lips only	All Models
	Fuel injection controls, o-rings, springs, shafts and bushings	
	Magneto rubber drive bushings	
	Oil pumps (pressure & scavenge)	Coat gear cavity during pump assembly
Spark Plug Manufacturer's recommended spark plug thread lubricant	Spark plugs	All Models
Chesterton #995 Release agent or WD-40	Induction system hoses and flex duct connections, fuel pump aneroid seal	All Models
CRC 3-36 Rust Preventative Compound	Spray exhaust end of turbocharger	Engine Preservation
Dow Corning® No. 4	Rubber oil seal of spin-on oil filter	where applicable
	Governor pad gaskets (both sides)	
	Starter adapter cover o-rings	
Dow Corning® G-N Paste	Camshaft lobes and tappet faces	During engine assembly
LPS 2	Throttle and Mixture Control Linkages	Apply at pivot points during periodic maintenance
Lubriplate 630 AA	Throttle and Mixture Control Valves	Apply at pivot points during assembly
Lubriplate 930 AA	O.D. of valve guides	During valve guide installation
Miller-Stephenson MS-122AD	Ignition harness terminals at magneto block	All models

Table 3-6. Lubricants

Type	Application	Remarks
SAE J-1966 Grade 50 Aviation Oil	Crankshaft bearings Connecting rod bearings	All Models
	Prop driver, driven gears & bearings	
	Camshaft bearings	
	Tachometer gears & adapters	
	Accessory spur gear teeth	
	Quill shaft splines	
	Prop governor transfer collar & sleeve	
	Starter cone, bushing & nut	
	Starter clutch spring (id & od)	
	Valve guide seals	Apply to sealing surface
	Pistons, piston pins & piston rings	All Models
	Thrust washers	All Models
	Oil filter adapter seals	
	O-rings	
	Cylinder studs and through bolts, crankcase studs, connecting rod bolts and nuts; and engine accessory studs unless otherwise specified	lubricate bolt thread and nut seat before tightening nuts

Table 3-7. Sealants

Type	Application	Remarks
Part No. 642188 CRC Copper Coat 401504 Gasket Sealant	Cam bore cover gasket - (except beaded gaskets)	
	Idler pin gasket	
	Intake manifold gasket	All Models
	All press type plugs (Hubbard etc)	All Models
	In parting line area of 3-way joints	Sump to crankcase or sump to crankcase to accessory case
	2 bolt suction tube gasket - both sides	where applicable
Part No. 646940 - F/I Sealant Loctite 569 Hydraulic Sealant	All pipe thread fittings in fuel injection system	where applicable
Part No. 646942 - Gasket Maker Loctite 515™ Gasket Eliminator® Flange Sealant	Crankcase parting face	where applicable
Part No. 653692 Loctite LocQuic Primer 7649	Crankshaft nose oil seal area	All models
Part No. 654663 Loctite Aviation Gasket Sealant, Item # 1522029, with Part No. 641543 Silk Thread	Crankcase parting face	Apply according to assembly instructions
	Starter adapter to accessory case	
	Accessory drive adapter	
	Pressure oil pump covers, Pressure scavenge pump covers	

Table 3-7. Sealants

Type	Application	Remarks
Loctite 592 Teflon PS/T Pipe Sealant	Use on all pipe threads except as noted All pressure relief valve housing threads Permold 2 studs engine mount 1-3-5 side bottom	where applicable
	All threaded fasteners installed in a through hole to an oil source	Apply before installing threaded fastener

Table 3-8. Adhesives

Type	Application	Remarks
Part No. 646940 Loctite 222 Sealant (optional Loctite Hydraulic Sealant 569)	Through stud holes on accessory end of crankcase	apply when installing studs
	Manifold valve to bracket screws	All models
	Studs 0.25 diameter and smaller	All models
	Manifold valve assembly data plate screws	All models
Part No. 646941 Loctite 271 High Strength Adhesive Sealant used with Part No. 653693 Loctite 7471 Primer	Cylinder deck studs	breakaway torque minimum 100 in-lbs. after two hours
	Crankcase nose seal retainer bolts	All models
	Squirt nozzle	All models
	Mechanical tachometer drive studs to an oil source	where applicable
	Oil gauge rod housing to crankcase	
Part No. 649366 Loctite 242	Magneto housing pressurization fitting	where applicable
Part No. 655700	Cylinder baffle isolators	As Required
Part No. 658493	Induction manifold Diverter Valve Brackets	As Required

Table 3-9. Miscellaneous

Type	Application	Remarks
P/N 626531-1 Enamel - Gold (1qt) P/N 626531-2 Enamel - Gold (1 gal)	High temperature paint for cosmetic and corrosion protection	
P/N 535011 Safety wire -.032 in dia. Steel, Corrosion Resistant	Where safety wire is required	
“ACCELAGOLD” Turco® Products	Corrosion protection interior and exterior aluminum parts	

Chapter 4. Airworthiness Limitations

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

There are no airworthiness limitations associated with Continental Motors, Inc. IO-550-A, -B, -C, -G, -N, -P and -R engines.

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 and Installation

5-1. Engine Removal

WARNING

Disconnect engine electrical power prior to commencing any engine maintenance. If the power is not turned OFF, a loose or broken wire could allow the engine to start and the propeller to rotate. Do not stand or allow anyone else to stand within the rotational arc of the propeller.

1. Turn off the Ignition Switch and Master Power Switch according to the airframe manufacturer's instructions. Open the circuit breakers powering the switches according to the airframe manufacturer's instructions. Turn the fuel selector valve to the OFF position and disconnect engine electrical (aircraft battery) power according to the airframe manufacturer's instructions.
2. If the cylinders will be overhauled, perform a “Differential Pressure Test” according to the instructions in Section 6-3.11.2; use the Cylinder Inspection checklist to record test results. If all cylinders will be replaced during overhaul, proceed to step 3.
3. Remove the engine compartment cowling and airframe accessories that could obstruct engine removal according to the airframe manufacturer’s instructions.
4. Disconnect the airframe electrical harness from the starter and alternator according to the airframe manufacturer’s instructions.
5. Remove the propeller, spinner and back-plate from the propeller according to the airframe manufacturer’s instructions.
6. Remove the airframe baffling required to avoid contact with the nacelle during removal according to the airframe manufacturer’s instructions.
7. Remove the oil sump drain plug and gasket; drain the oil according to the “Engine Oil Servicing” instructions in Section 6-3.8.
8. Temporarily re-install the oil sump drain plug and gasket to prevent contamination during transit. The gasket will be replaced when the oil is serviced.
9. Disconnect and tag the ignition circuit p-leads from the magnetos according to the airframe manufacturer's instructions.
10. Disconnect and tag the engine wiring bundles and other connections from the following components according to the airframe manufacturer’s instructions.
    a. Pneumatic pump, air conditioning compressor or vacuum pumps
    b. Tachometer drive (electrical or mechanical)
    c. Oil temperature and pressure sensor connection(s)
    d. Exhaust gas temperature sensor connection
    e. Cylinder head temperature sensor connection

f. Fuel pressure sensor connection

g. Fuel flow sensor connection

h. Alternator (“Direct Drive Alternator Removal” instructions in Section 12-9.1)

i. Manifold pressure gauge line

j. Airframe fuel supply and return hoses to the engine driven fuel pump and priming circuit

k. Throttle and mixture control cables

l. Airframe accessories and instrument connections

11. Disconnect the Ignition Harness according to instructions in Section 12-2.
12. Remove all wiring bundle attaching clamps and hardware according to the airframe manufacturer’s instructions. Route wiring bundle clear of engine.
13. Disconnect the propeller governor, hoses and/or lines according to the airframe manufacturer’s instructions to allow the engine to be removed from the airframe.

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

14. Properly cap (or plug) off lines and connections to prevent fuel spillage and debris from entering the engine.
15. Ensure all wires, lines, hoses and attachments between the engine and airframe are disconnected.
16. Disconnect and remove the Exhaust System according to the airframe manufacturer’s instructions.

CAUTION: Do not allow 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 the engine hoist to the engine using lifting eyes. (lifting eye locations are depicted in the “Engine Installation Drawings” in Section 5-4.
18. Remove the engine mount isolators and fastening hardware according to the airframe manufacturer’s instructions.
19. Relieve the engine weight from the engine mounts and carefully lift the engine slowly out of the airframe.
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. Materials Required

NOTE: Engine Installation Drawings are provided in Section 5-4.

Required Tools and Equipment

1. Engine Hoist (rated for 800 lbs. minimum)
2. Oil conforming to SAE J-1966 (break-in oil, non-dispersant mineral oil) MIL-C-6529 Type II (Fly-away oil)
3. Ashless dispersant oil conforming to SAE J-1899
4. MIL-P-46002, Grade 1 oil
5. Approved aviation fuel for the engine model (see Section 2-3)
6. Spark plugs and copper gaskets
7. MS20995 Type A Safety Wire (.032”)
8. Cable ties or nylon lacing cord
9. Bladder-type pressure pot (at least 1 gallon capacity)
10. Type 1 flammable fuel container (at least 1 gallon capacity)
11. Clean fuel hoses (fuel system setup)
12. AN union fittings (fuel system setup)
13. MS-122AD Spray (available from Miller-Stephenson)
14. Spark Plug Manufacturer’s recommended spark plug thread lubricant
15. Part No. 646940, Loctite Hydraulic Sealant
16. Part No. 646943, Anti-seize Lubricant
17. Loctite Part No. 592 Pipe Sealant
18. Other tools and materials, as required by the airframe manufacturer’s installation instructions.

5-2.2. Engine Receipt and Handling

When the engine arrives, inspect the crating for damage. If the engine crating appears damaged, contact Continental Motors’ Service Department (refer to “Contact Information” in Section 1-3) and the freight shipping company. If the crating appears intact, proceed to Section 5-2.2.1.

5-2.2.1. Uncrating the Engine

1. Remove the lag screws attaching the wooden cover to the base.
2. Lift the wooden cover and remove it.
3. Open the plastic bag wrapped around the engine.
4. Inspect the engine according to the "Acceptance Inspection" criteria in Section 5-2.2.3.

   NOTE: The engine is preserved for indefinite storage at the factory; if it is not immediately installed after acceptance, refer to the "Engine Preservation and Storage" instructions in Chapter 9 for ongoing corrosion protection instructions. Environmental conditions (humidity), seasonal changes, and engine usage influence susceptibility to corrosion. In areas of high humidity, corrosion can occur within two days of uncrating the engine. The owner/operator is responsible for recognizing the risk of corrosion and taking the appropriate precautions.

5. If the engine is to be preserved, follow the "Engine Preservation and Storage" instructions in Chapter 9.

5-2.2.2. Crating an Engine for Shipping

1. Lower the engine onto the container base.
2. Attach the engine using shock mounts and bolts.
3. Cover the engine with a plastic bag.
4. Install and attach the container cover to the base.

5-2.2.3. Acceptance Inspection

CAUTION: If hidden engine damage or corrosion is discovered, contact Continental Motors Service Department (see "Contact Information" in Section 1-3). Do not install or place a damaged/corroded engine in storage.

1. Verify the engine serial number and model number on the engine nameplate are the same as specified in the engine logbook and the packing slip.
2. Inspect the engine for any signs of damage or corrosion.
   a. If the engine exhibits no sign of damage or corrosion, proceed with installation.
   b. If damage or corrosion is discovered, contact the supplier of the engine for disposition.

5-2.2.4. Engine Transport

Refer to the “Engine Installation Drawings” in Section 5-4 for the engine lifting eye locations.

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. Attach a hoist to the engine lifting eyes located at the top of the crankcase backbone.
2. Take up slack on the hoist prior to loosening the engine mount bolts; remove the bolts from the shipping shock mounts.
3. Lift the engine and install it on a transportation stand or dolly.

5-3. Installation Procedures

5-3.1. Prepare the Airframe for Engine Installation

1. Verify the airframe fuel filter and boost pump are installed and operate according to the airframe 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, fuel pump damage and/ or malfunction.

CAUTION: Follow the airframe manufacturer's scheduled interval for airframe mounted fuel and oil hose replacement. Hoses become brittle with age; We recommend 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 container fitted with 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, preserve it according to "Engine Preservation and Storage" instructions in Chapter 9.

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 engine 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 to remove the engine preservation oil from the cylinders.
5. Catch the 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 preservation oil from the oil sump. Drain plug locations are depicted in the “Engine Installation Drawings” in Section 5-4.
8. Reinstall the drain plug with a new crush washer; torque the drain plug according to Appendix B specifications and safety wire the drain plug according to instructions in Appendix C-4.
9. Place a catch basin underneath the fuel pump. Remove the shipping cap installed on 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 Appendix B specifications. Re-install the shipping cap on the fuel pump inlet fitting.

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. 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.

11. Install the propeller governor according to the airframe 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 airframe manufacturer’s instructions.

12. Install all airframe manufacturer-required components according to the airframe manufacturer’s instructions, including the following:
    a. Cooling baffles
    b. Hoses and fittings
    c. Brackets
    d. Ground straps
    e. Pneumatic, air conditioning compressor, or vacuum pumps
    f. Exhaust system
    g. Other airframe manufacturer required item(s)

13. Install the engine in the sequence indicated in Section 5-3.3.

5-3.3. Installation Sequence

1. Install the engine in the airframe mounts according to the airframe 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 fuel supply, vapor return and fuel pump drain connections to the engine driven fuel pump fittings according to the airframe manufacturer's instructions.
3. 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.

4. Connect the starter and alternator wiring and torque fasteners according to the airframe manufacturer's instructions.
5. Install the propeller according to the airframe and propeller manufacturer's instructions.
6. Connect the airframe ignition switch wiring to the P-leads of each magneto and perform a functional check of the circuit to verify the ignition switch properly disables the magnetos.
7. If the magnetos were loosened or rotated during engine installation, adjust magneto to engine timing according to the "Magneto Timing" instructions in Section 6-3.9.1.
8. Install aircraft accessories listed below according to the aircraft manufacturer's instructions.
   a. Pneumatic, air conditioning compressor, or vacuum pumps
   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 connections
   f. Manifold pressure gauge line
   g. Throttle and mixture control cables

h. Remaining airframe manufacturer supplied accessories and instrument connections

9. Perform the “Engine Pre-oiling” procedure according to Section 5-3.4.
10. Complete a “Fuel Injection System Purge” according to instructions in Section 5-3.5.
11. Perform an “Installation Inspection” according to instructions in Section 5-3.6.

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.

12. Perform an “Engine Operational Check” according to instructions in Section 6-3.7.

5-3.4. Engine Pre-oiling

Engine pre-oiling must be accomplished prior to engine start-up after engine installation or overhaul/re-assembly. Two methods are provided in Section 5-3.4.1 and Section 5-3.4.2, “Pre-oiling Method 1” is preferred.

NOTE: If engine cylinders were installed or the engine has been overhauled, follow instructions in Section 5-3.4.1.

5-3.4.1. Pre-oiling Method 1

1. Install and torque the spark plugs and ignition lead wires according to instructions in Section 6-3.9.2, “Spark Plug Maintenance” and Section 6-3.9.3, “Ignition Harness Maintenance.”
2. Verify the lubrication lines, fittings, hoses, screens, and filters are in place prior to pre-oiling.
3. Obtain a one gallon capacity bladder-type pressure pot with an output pressure of 50 psi (not to exceed 60 psi).
4. Connect the pre-oiler supply hose to the engine oil pressure output (fitting).
5. Disconnect the safety wire from the engine oil filter and loosen (do not remove) the oil filter from the oil filter adapter.
6. Open the pre-oiler valve. Watch the seam of the oil filter for evidence of oil flow. Depending upon the oil temperature, it may take as long as 20 minutes to see an indication of oil flow.
7. Close the pre-oiler valve.
8. After oil flow confirmation, torque the oil filter according to Appendix B instructions and safety wire the filter according to the instructions in Appendix C.
9. Disconnect the pre-oiler supply hose and cap; connect the engine oil pressure output to the oil pressure gauge connection (fitting).

WARNING

Do not operate the engine unless the oil is serviced to the proper level.

10. Check the oil level in the sump using the oil gauge rod (dip stick). Verify the engine oil is at the proper level according to instructions in Section 6-3.8.1.

5-3.4.2. Pre-oiling Method 2

1. Service the engine oil level according to instructions in Section 6-3.8.

WARNING

Do not exceed the starter duty cycle in any mode of operation. The duty cycle for Energizer and Iskra starter motors is 30 seconds. The Skytec starter motor duty cycle is 10 seconds.

2. Turn the fuel selector valve to the OFF position.
3. Position the throttle to the IDLE/CUTOFF position.
4. Repeatedly engage the starter, respectful of the starter motor duty cycle, until oil pressure is indicated on the oil pressure gauge. If no oil pressure is indicated after three maximum engage/cool down intervals, check connections and gauge operation.
5. Install and torque the spark plugs and ignition lead wires according to instructions in Section 6-3.9.2, “Spark Plug Maintenance” and Section 6-3.9.3, “Ignition Harness Maintenance.”

5-3.5. 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 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 Appendix B specifications.

   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.

5-3.6. Installation Inspection

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

5-3.7. 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 prior to releasing the aircraft for normal service to ensure the engine meets the manufacturer's performance and operational specifications.

WARNING

The fuel system must be adjusted after installation in the airframe according to the "Engine Operational Check" in Chapter 6 to ensure proper operation. Correct all discrepancies prior to release for flight.

IO-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 the Flight Check.

Check the oil level in the sump and service, if necessary, to the capacity specified in Section 2-3, "Engine Specifications" with oil meeting the SAE specification described in "Engine Oil Specifications" in Section 3-2.1. Pressure check the fuel system for leaks before starting the engine.

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 6-3.7.
2. Perform a "Flight Check" according to instructions in Section 7-2.3.

5-4. Engine Installation Drawings

Installation drawings are provided to assist the airframe manufacturer in determining the appropriate fittings and fasteners for airframe interconnect and determine engine compartment fit and limit requirements. Slight variations between the basic IO-550 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. IO-550 Common Installation Drawings

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

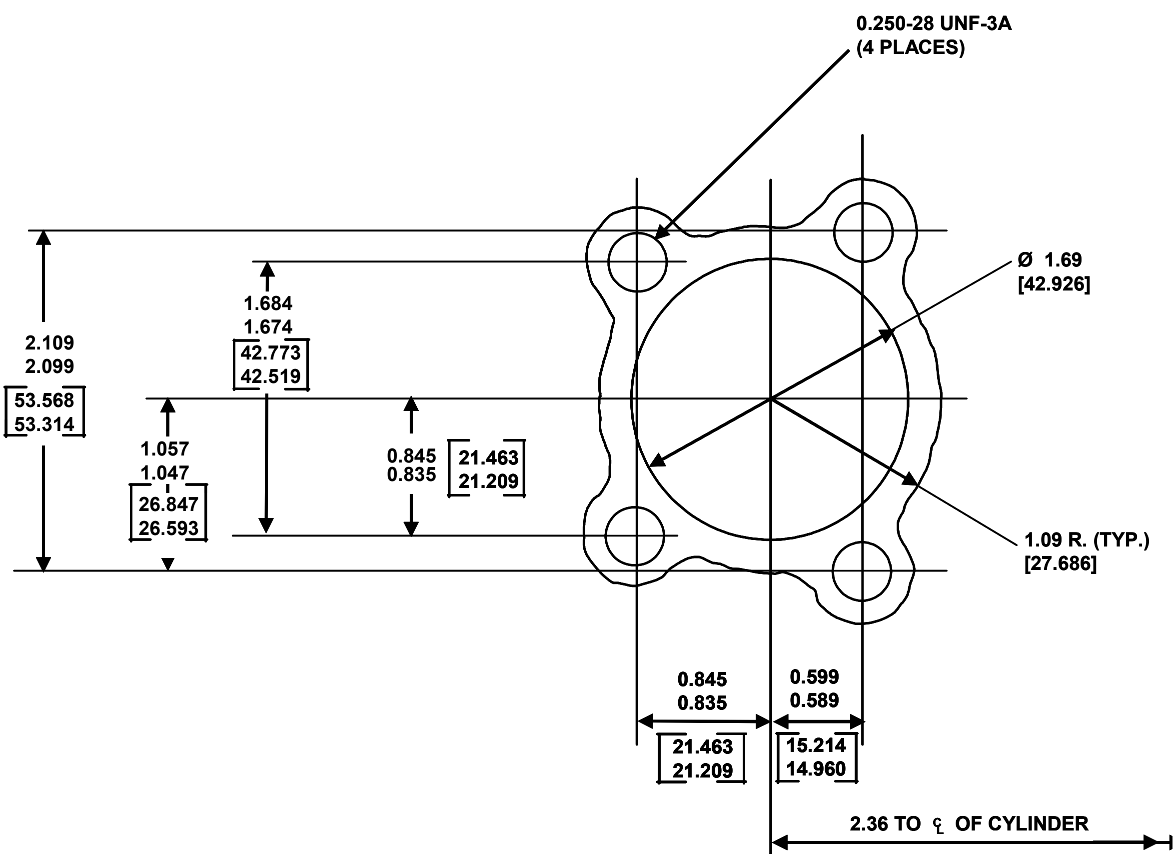


Figure 5-1. Exhaust Port Dimensions

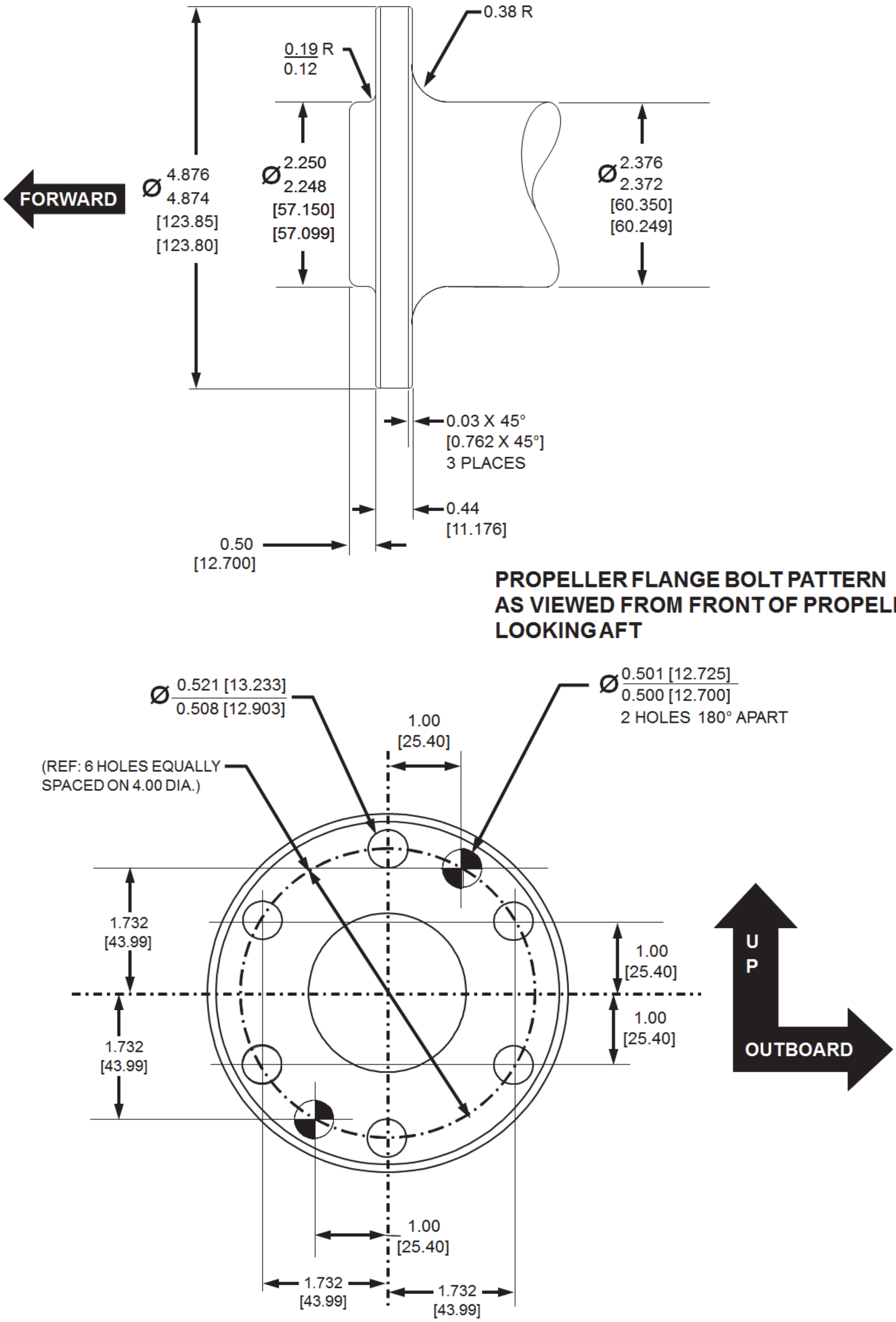


Figure 5-2. Propeller Flange Dimensions

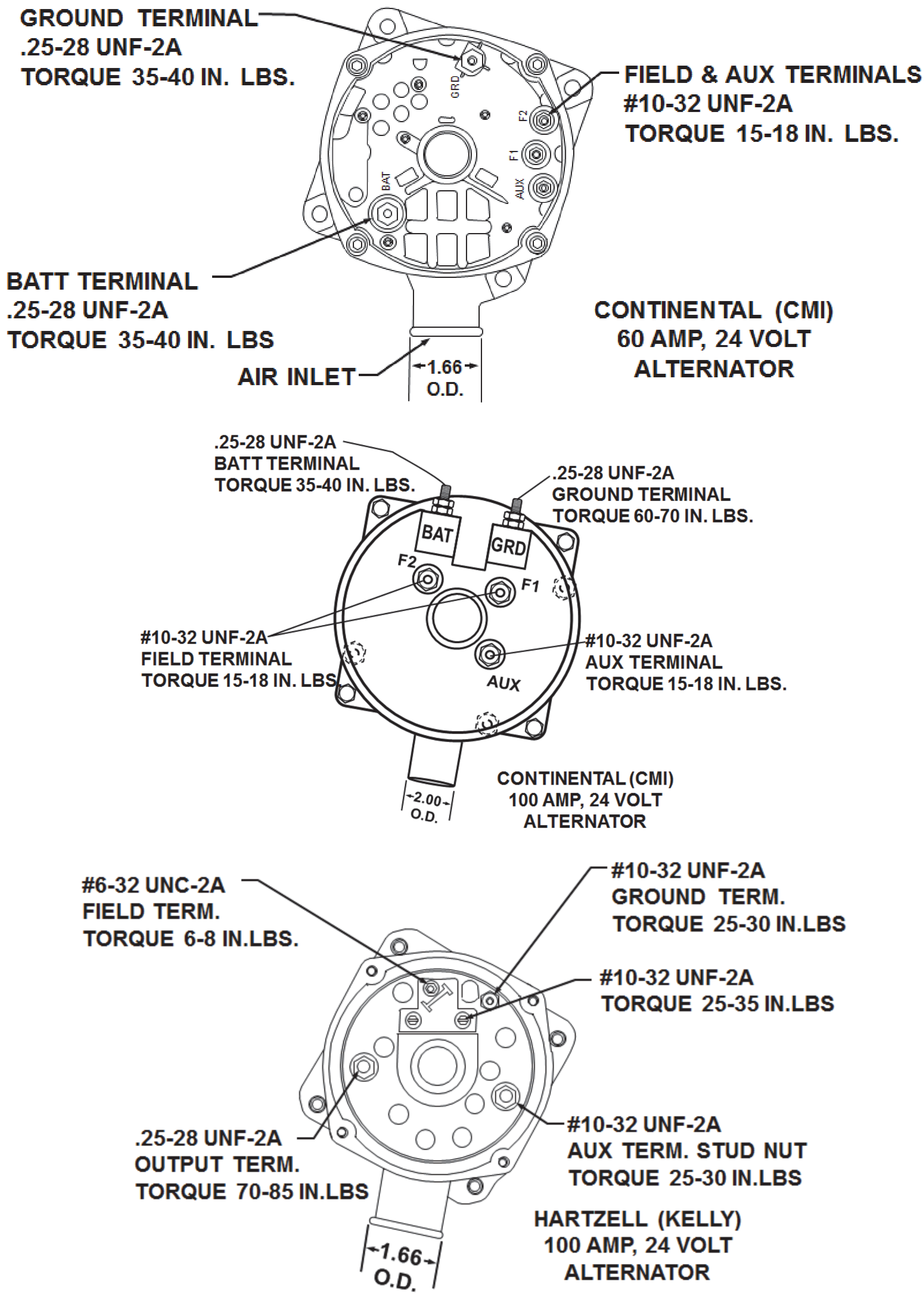


Figure 5-3. Gear Driven Alternator Detail

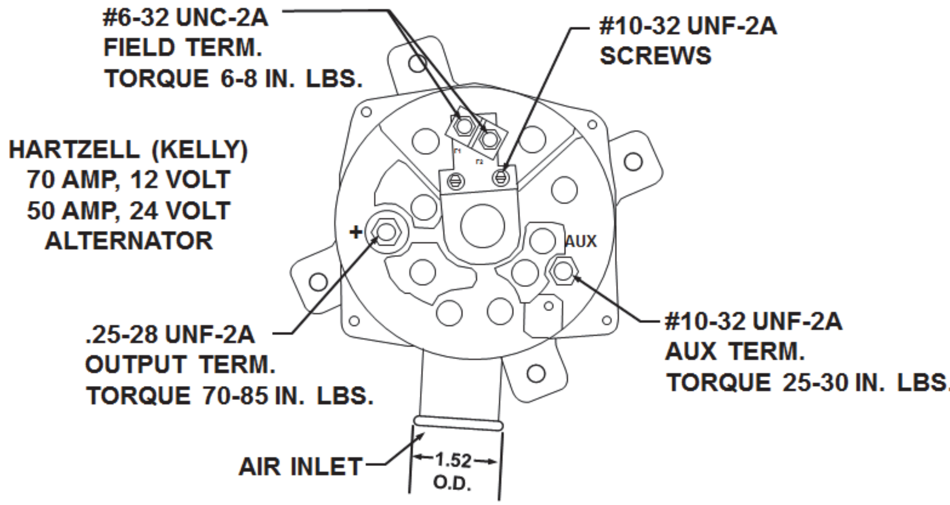
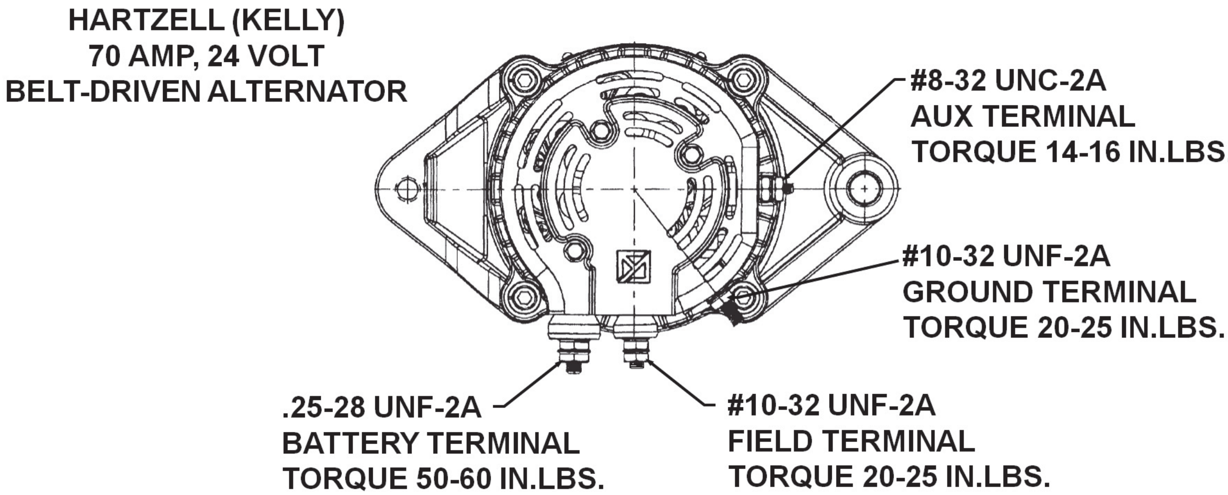


Figure 5-4. Gear Driven Alternator Detail, cont.



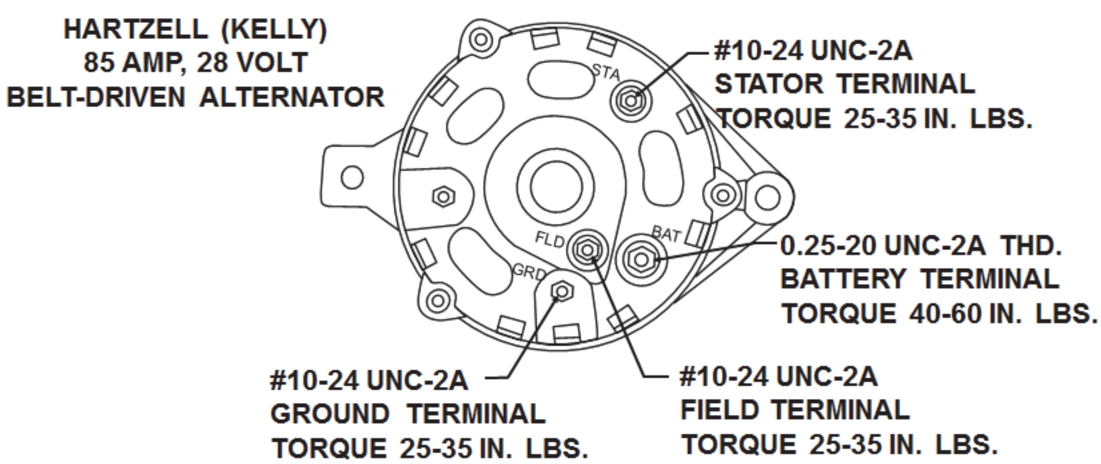


Figure 5-5. Belt Driven Alternator Detail

5-4.2. IO-550-A Installation Drawings

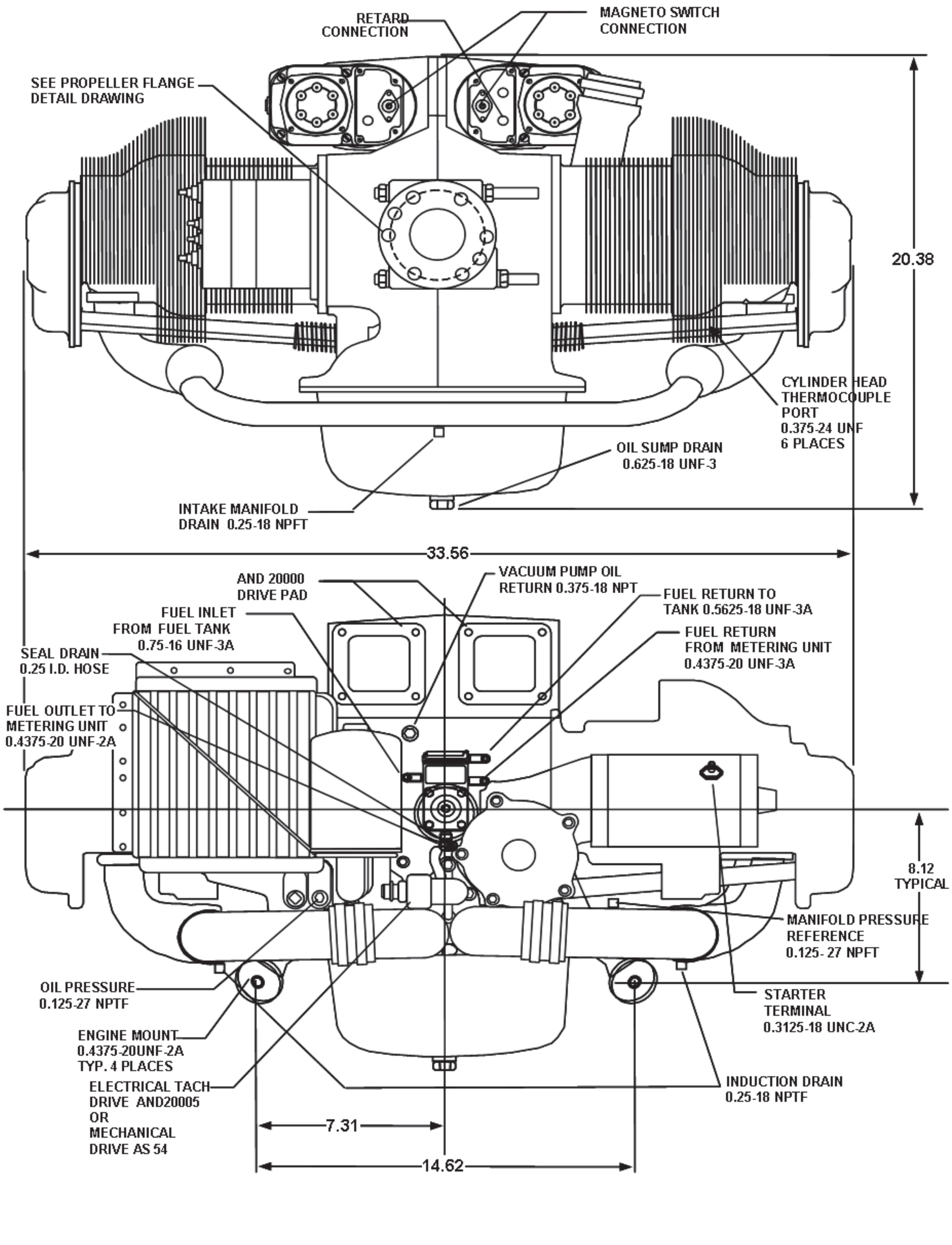


Figure 5-6. IO-550-A Front & Rear View

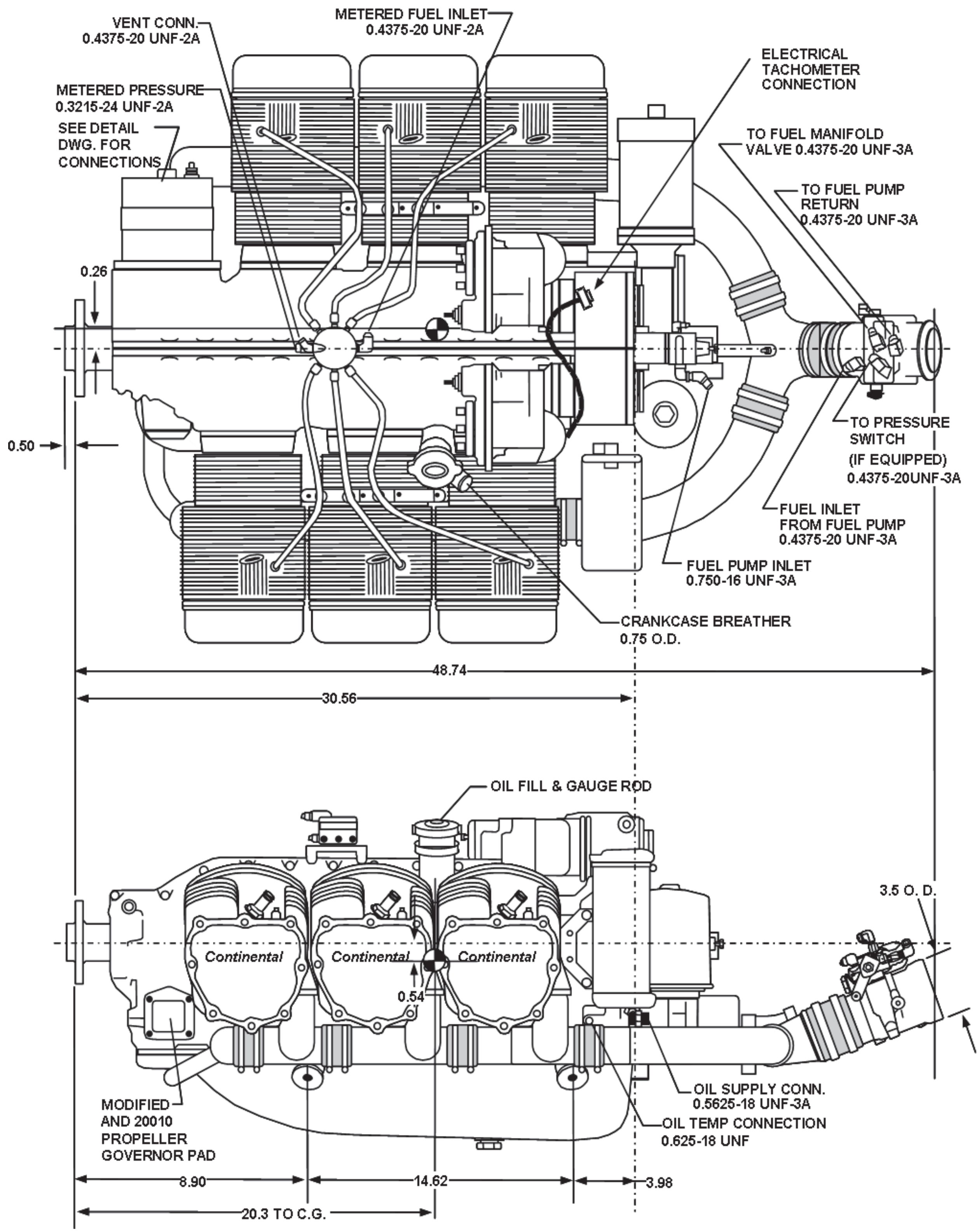


Figure 5-7. IO-550-A Top & Side View

5-4.3. IO-550-B Installation Drawings

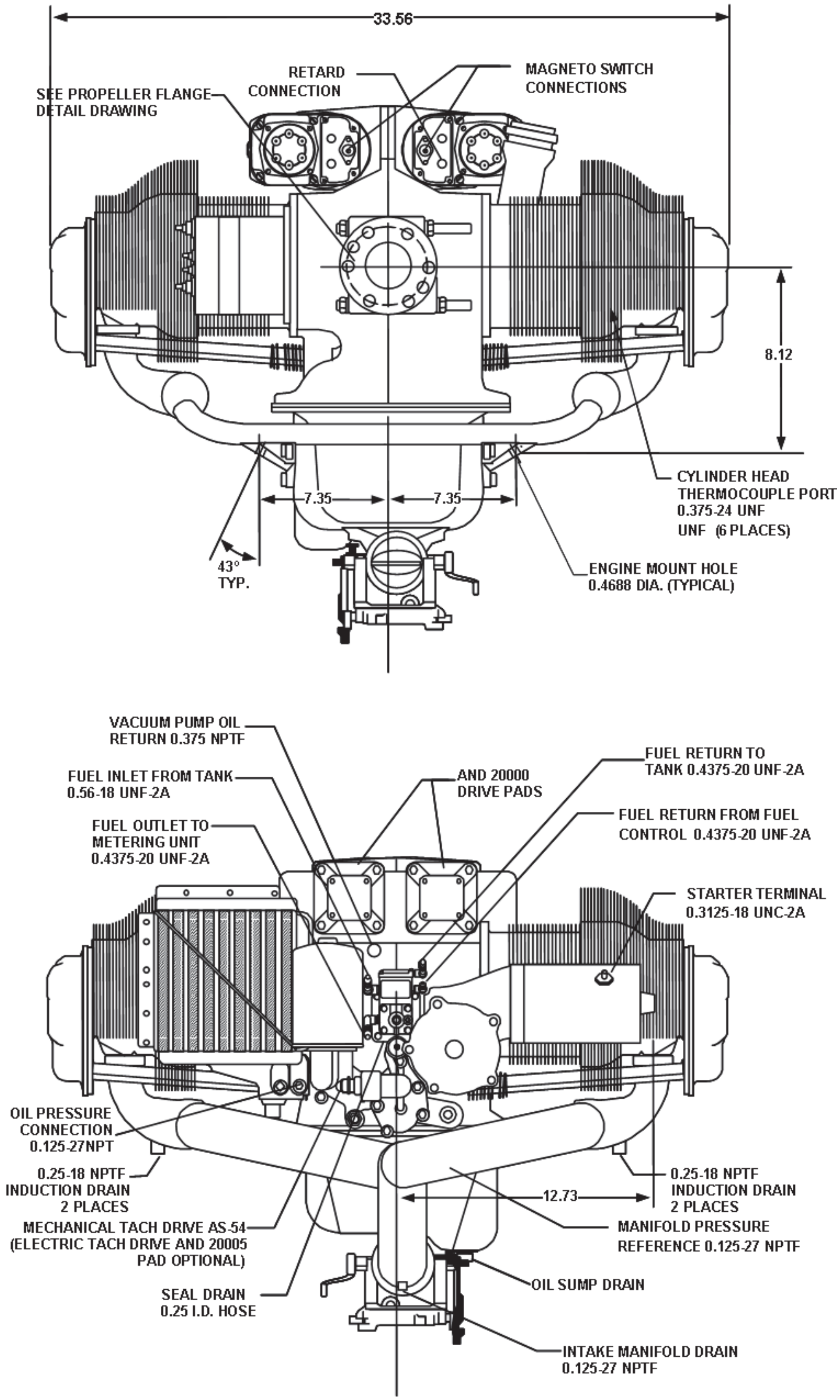


Figure 5-8. IO-550-B Front & Rear View

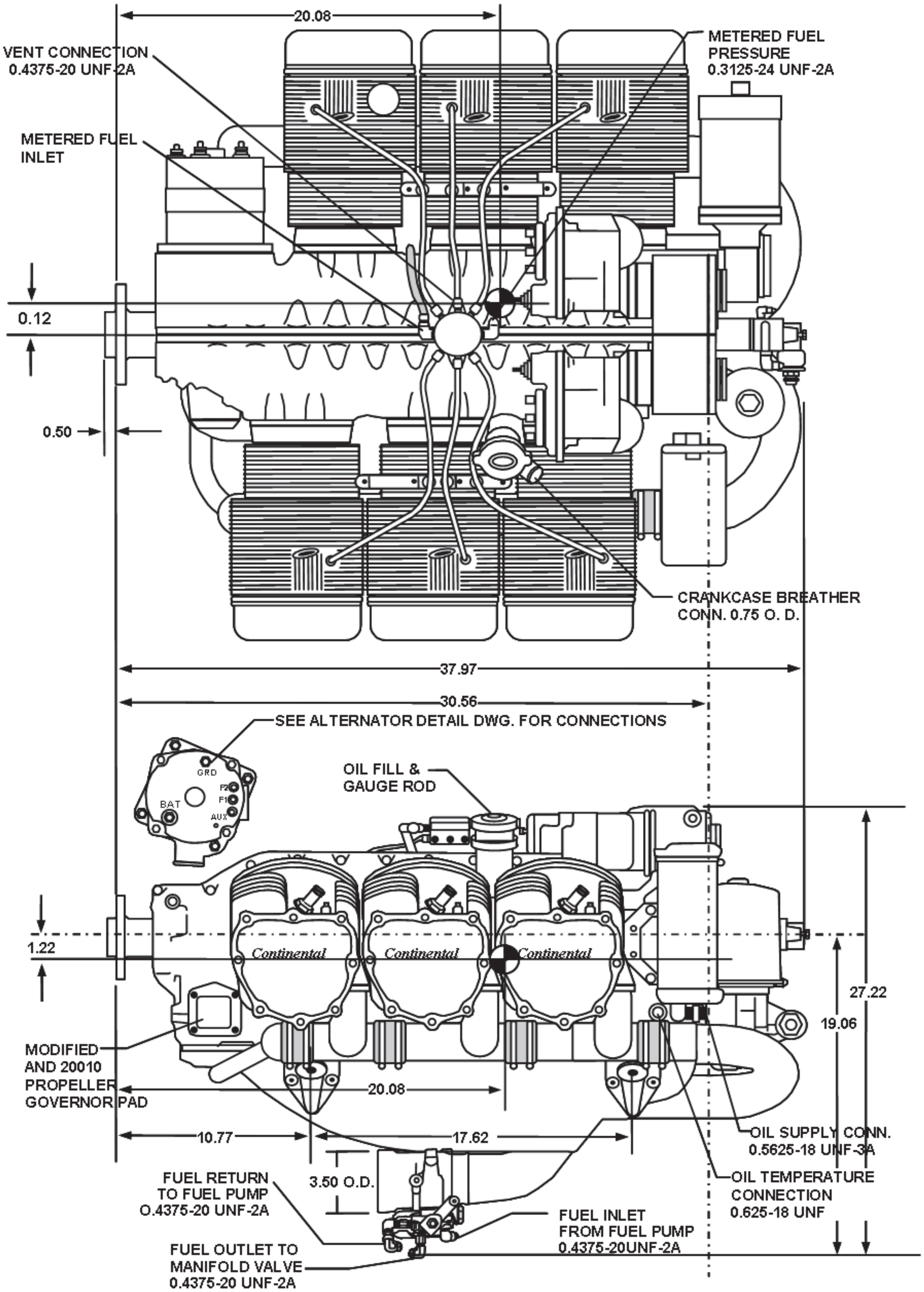


Figure 5-9. IO-550-B Top & Side View

5-4.4. IO-550-C Installation Drawings

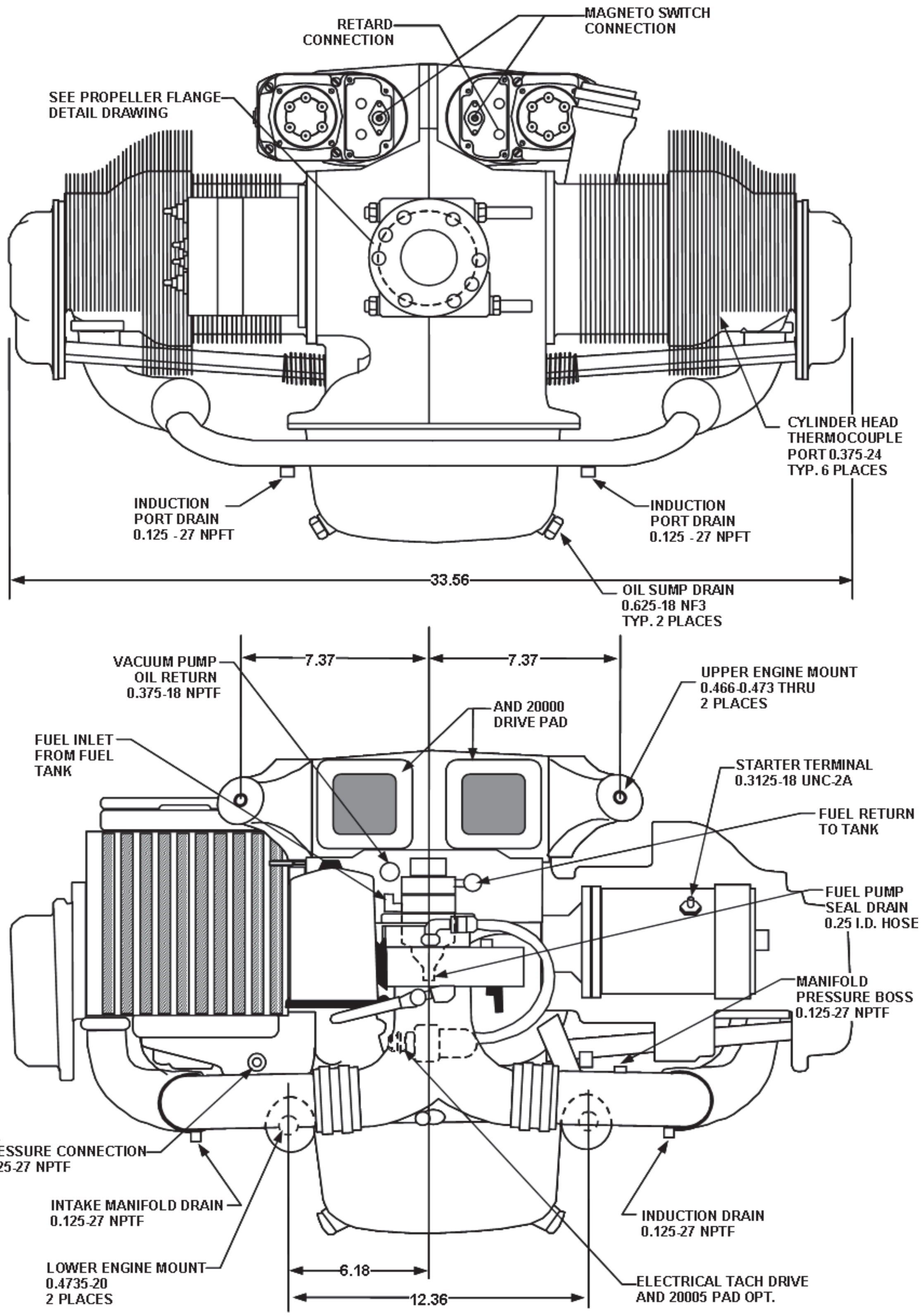


Figure 5-10. IO-550-C Front & Rear View

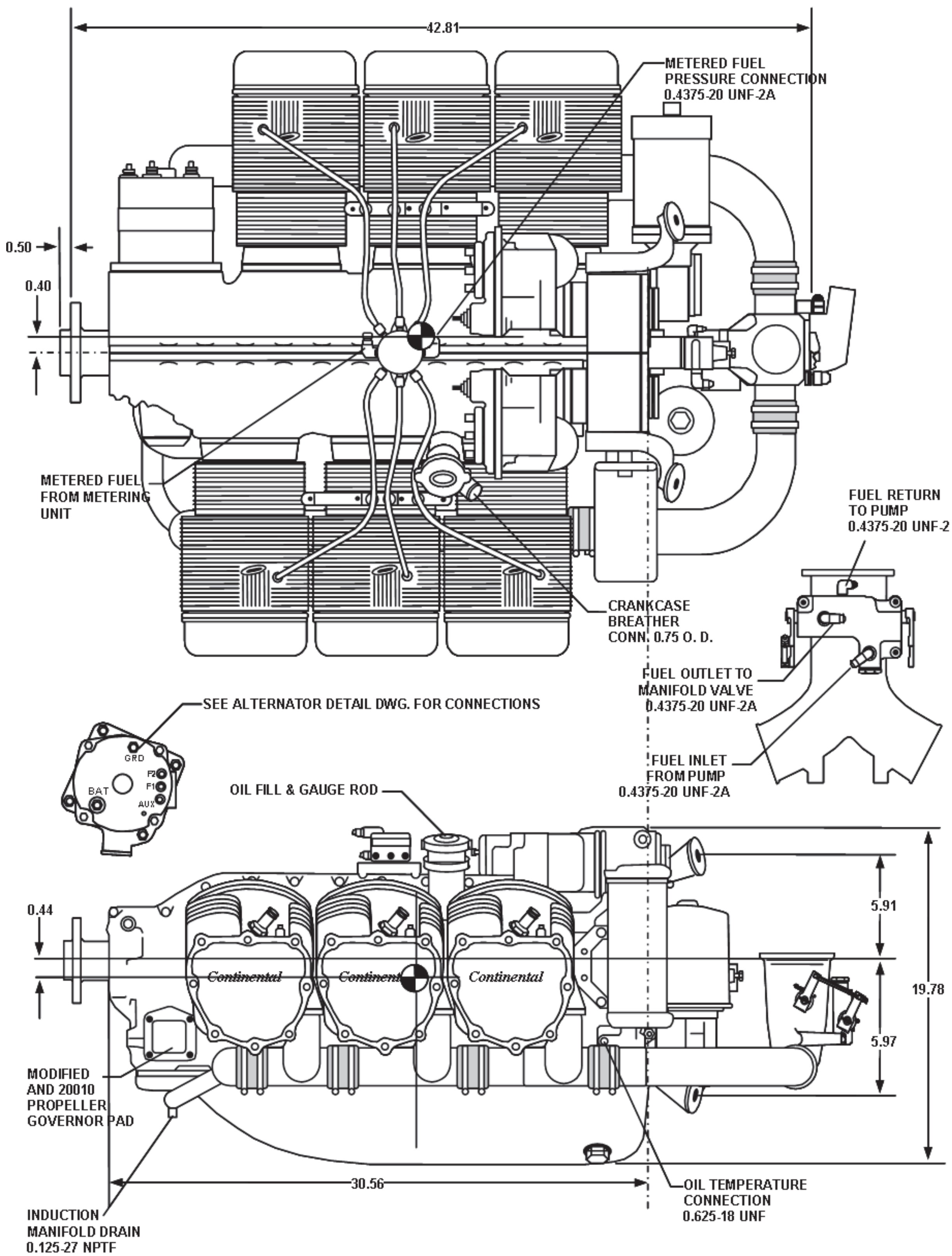


Figure 5-11. IO-550-C Top & Side View

5-4.5. IO-550-G & N Installation Drawings

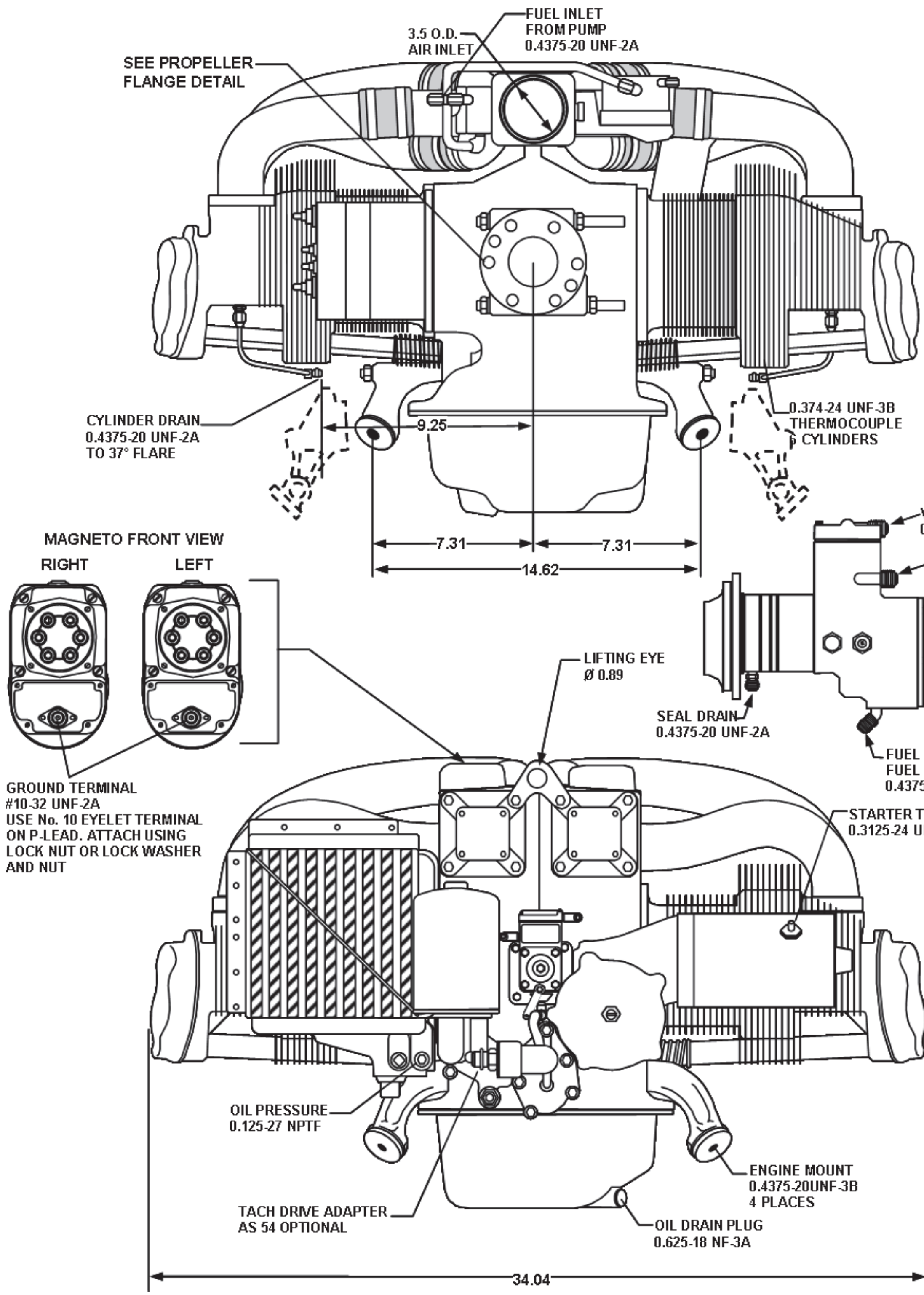


Figure 5-12. IO-550-G & N Front & Rear View

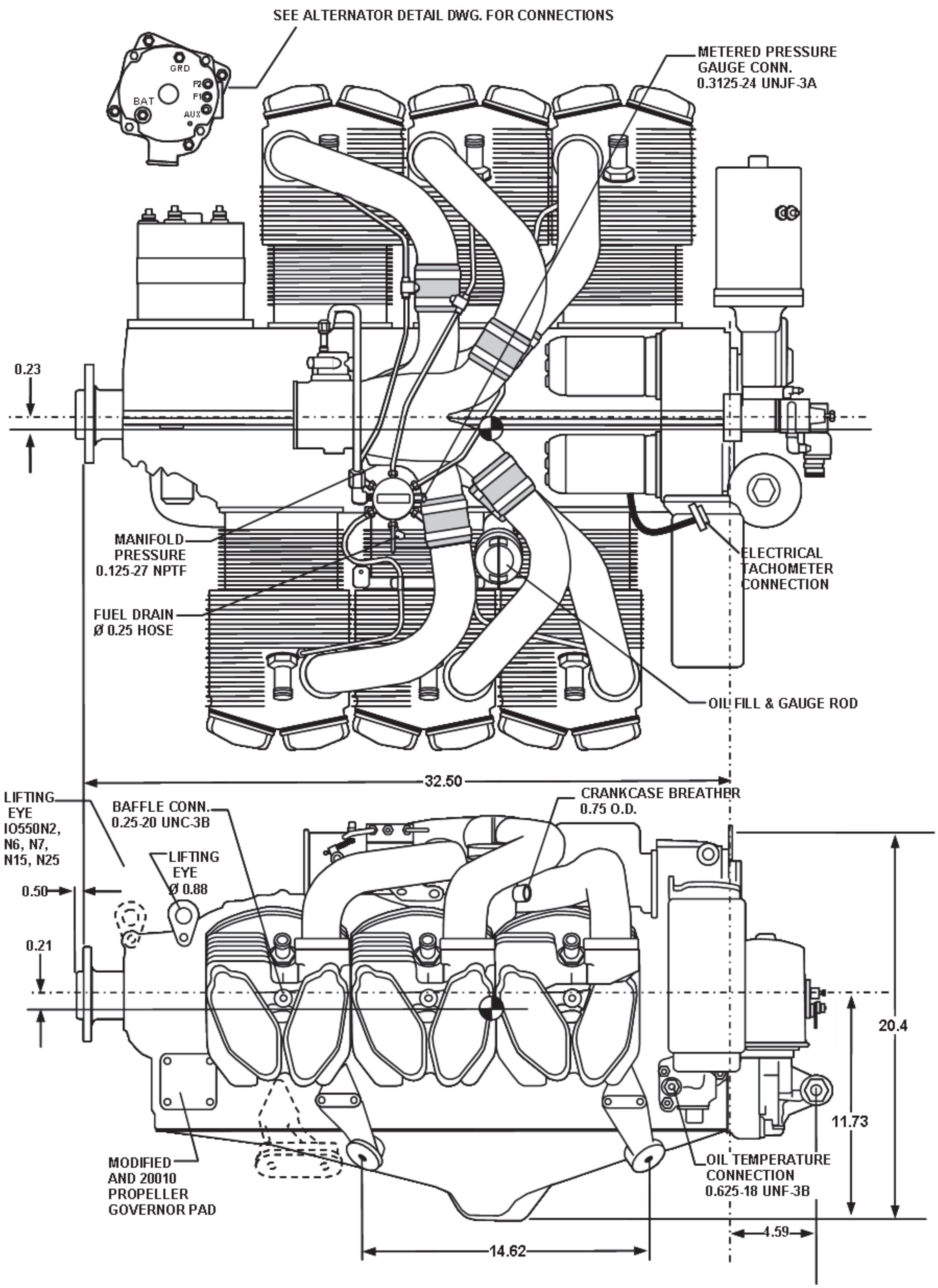


Figure 5-13. IO-550-G & N Top & Side View

5-4.6. IO-550-P Installation Drawings

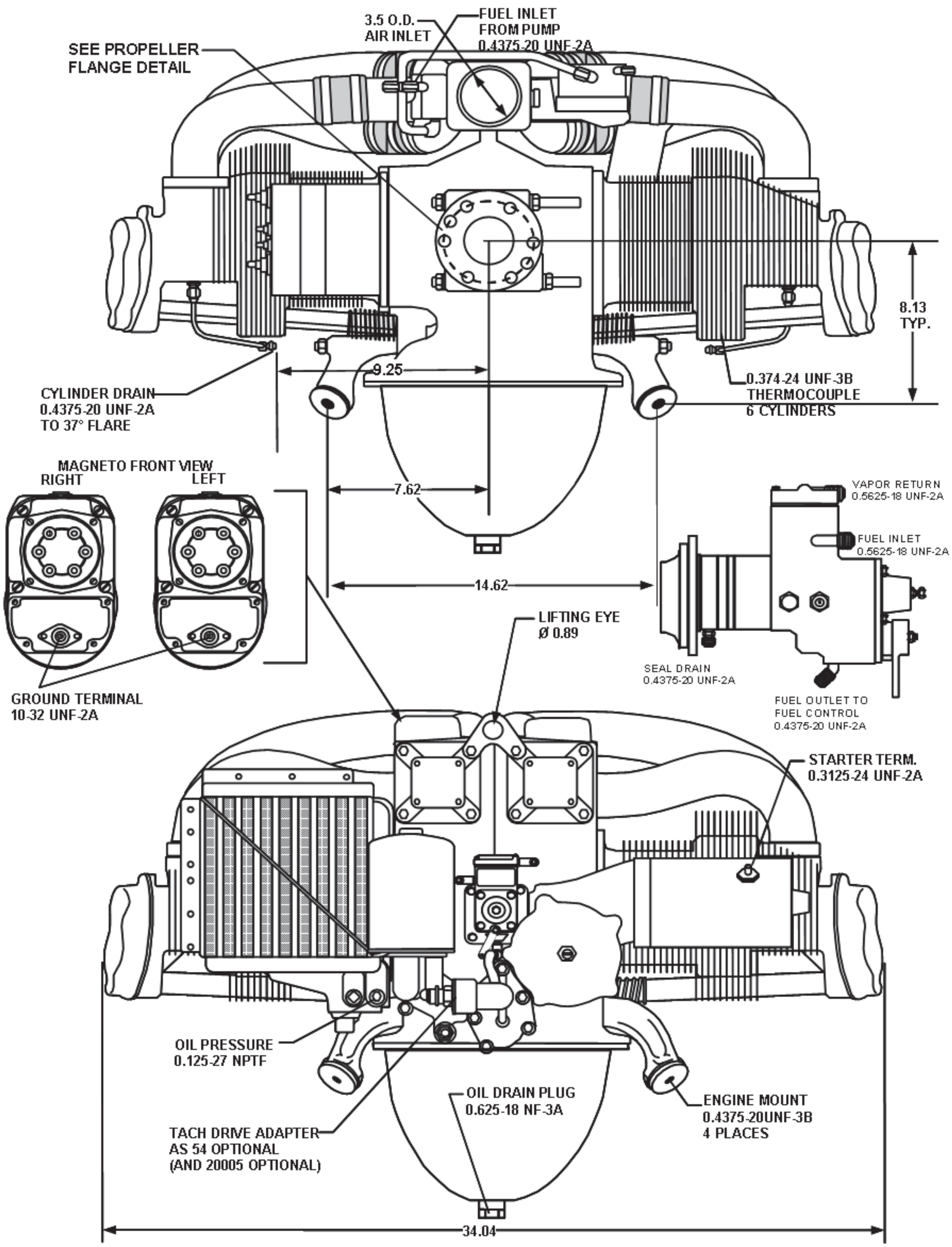


Figure 5-14. IO-550-P Front & Rear View

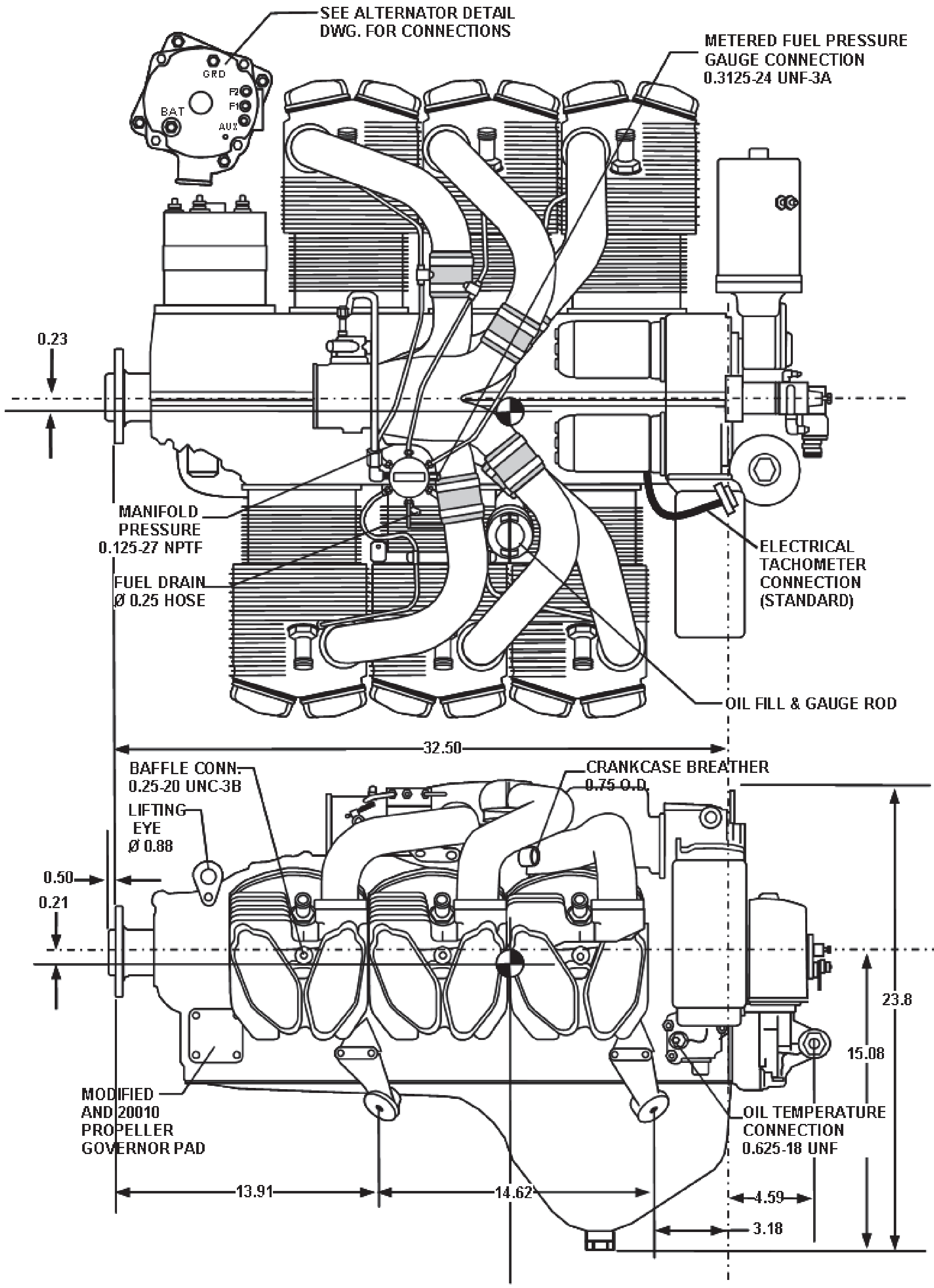


Figure 5-15. IO-550-P Top & Side View

5-4.7. IO-550-R Installation Drawings

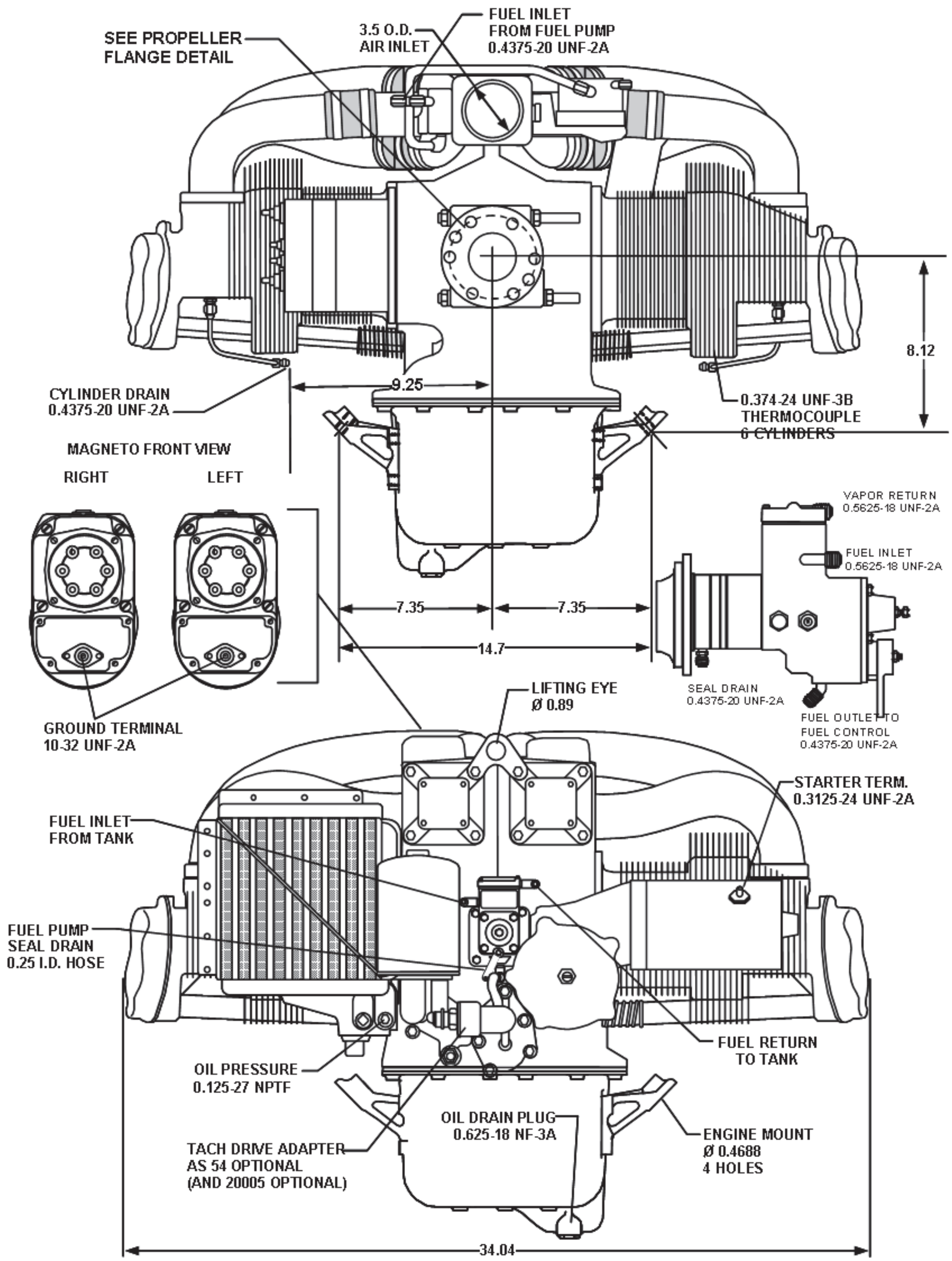


Figure 5-16. IO-550-R Front & Rear View

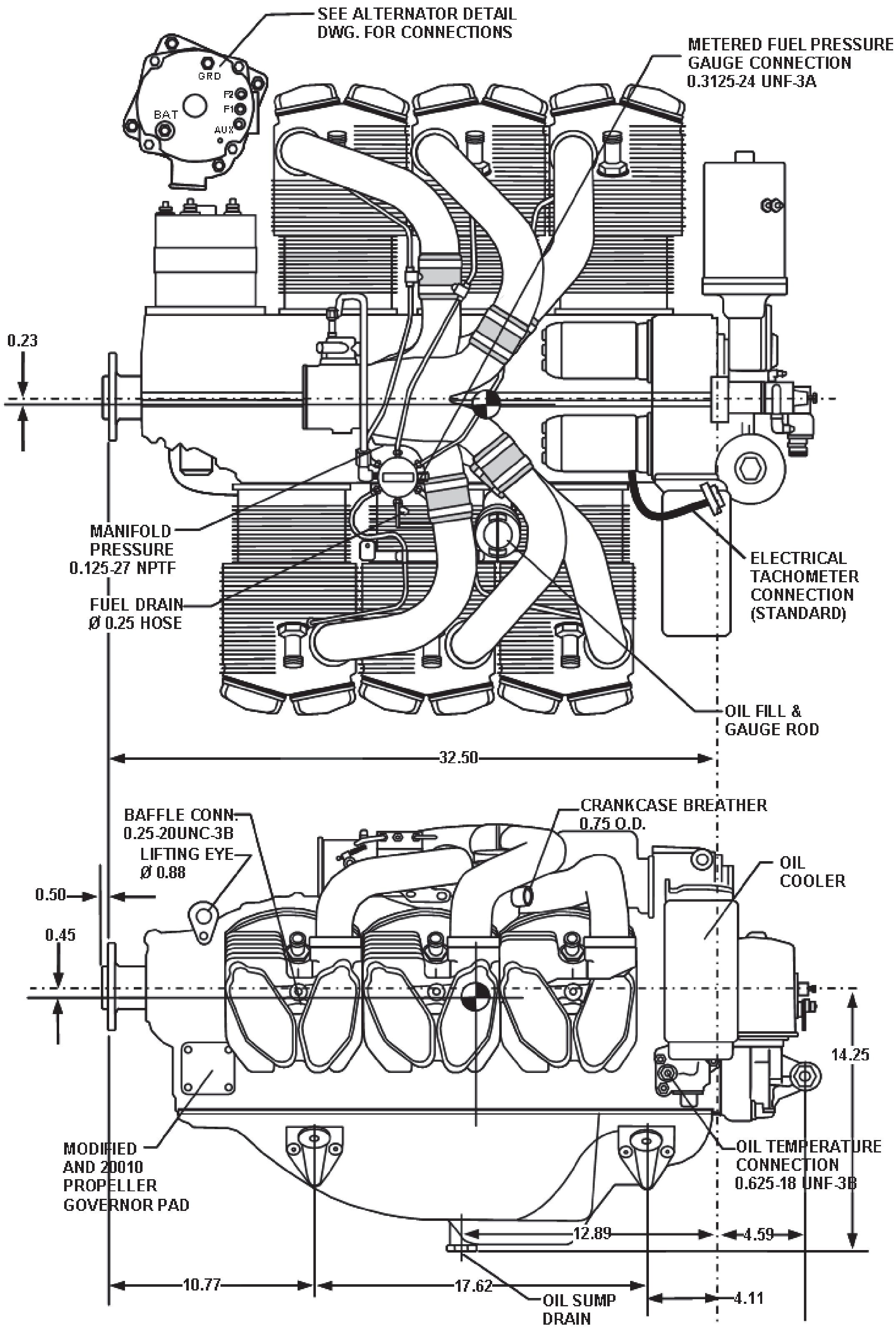


Figure 5-17. IO-550-R Top & Side View

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 Airframe Manufacturer's manual for airframe 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

NOTE: If operating hours and a calendar period are specified, perform the inspection coincident with the earliest occurrence.

Interval			
Cumulative Operating Hours	Calendar	Task	Reference
5	---	Drive Belt (optional equipment) Tension Check	Section 6-3.1
10	---	Alternator Initial Inspection (One Time)	Section 6-3.1
25	4 months	Oil Change (with integral oil screen)	Section 6-3.8
25	6 months	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
50	4 months	50-hour engine inspection	Section 6-3.3
50	6 months	Oil and Filter Change (w/ 4.8” replaceable filter cartridge)	Section 6-3.8
100	6 months	Oil and Filter Change (w/ 5.8” replaceable filter cartridge)	Section 6-3.8
100	Annual	100-hour engine inspection	Section 6-3.4
300	Annual	Clean fuel injector nozzles	Section 6-3.4
500	4 years	Magneto inspection	Section 6-3.4
500	---	500-hour inspection	Section 6-3.5
NOTE: At engine TBO, engine accessories, including the starter, alternator, magnetos and fuel system must be replaced with new assemblies or assemblies which have been overhauled according to FAA approved procedures.			
1700[1 2]	12 years	IO-550-A, B & C Recommended Time Between Overhaul (TBO)	N/A
2000[1 2]	12 years	IO-550-G, N, P & R Recommended Time Between Overhaul (TBO)	N/A

1. If an engine consistently accumulates 40 or more hours per month since being placed in service, add 200 hours to recommended TBO. See latest revision of Service Information Letter (SIL)98-9.
2. Engines with Serial Number 1006000 or higher, add 200 hours to TBO listed above.

6-3.1. One Time Post - Installation Inspections

Check tension of new drive belts after the first five hours of operation. Adjust belt tension, as required, according to the instructions in Section 6-3.10.4, “Belt Tension Check and Adjustment.”

Perform a visual inspection (Section 6-3.6) of the alternator(s) and associate wiring and hardware after the first ten hours of operation. Inspect the bolts and safety wire application. Look for signs of arcing or overheating. Check the cooling duct connections for cleanliness and security. Check terminals and insulators for tightness and condition.

6-3.2. 25-Hour Initial Operation Inspection

Frequency

- Twenty-five (25) hours or six months (whichever occurs first) after:
  - Placing a new, rebuilt, or overhauled engine in service
  - Replacement of one or more engine cylinder and/or piston rings
- After every 25 hours of engine operation until oil consumption stabilizes

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.

Procedure

WARNING

Correct all fuel or oil leaks. Flammable petroleum products may ignite if exposed to an ignition source.

1. Perform a visual inspection according to instructions in Section 6-3.6; correct any discrepancies.
2. Perform a normal “Engine Start” according to instructions in Section 7-3.2 and “Ground Run-up” according to instructions in Section 7-3.3. When the engine reaches normal operating temperatures, check the following:
   a. Idle RPM .... 600 RPM
   b. Idle/Cut-Off Mixture Rise .... 25-50 RPM
   c. Acceleration .... Smooth from IDLE to Wide Open
   If acceleration is rough or the Idle RPM or Idle/Cut-Off Mixture Rise is outside the parameters specified in Table 6-3, perform an “Engine Operational Check” according to Section 6-3.7 and adjust the fuel system accordingly.
3. Determine oil consumption by reviewing engine log book service record. Calculate the brake specific oil consumption (BSOC) using the formula in Section 2-3. If oil consumption exceeds the maximum limit, consumption is excessive, proceed to step 3a. If consumption is acceptable, proceed to step 4.

   a. If oil consumption is excessive, troubleshoot according to the instructions in Chapter 8, “Troubleshooting.”
   b. Perform a “Cylinder Borescope Inspection” according to the instructions in Section 6-3.11.3.
   c. Service the engine with mineral oil conforming to SAE J-1966 rather than the ashless dispersant oil specified in step 5. Repeat this inspection after 25 hours of operation.
4. Establish and oil analysis profile by collecting an oil sample according to the instructions in Section 6-3.8.4, “Oil Sample Collection” and Section 6-3.8.5, “Oil Trend Monitoring and Spectrographic Oil Analysis.”
5. Change the oil and filter according to the “Oil Change” instructions in Section 6-3.8.2. Fill the oil sump to the proper capacity for the engine model (Section 2-3) with fresh, ashless dispersant aviation engine oil conforming to SAE J-1899 (Section 3-2.1).
6. Remove and inspect the induction air filter. Clean or replace the filter media if necessary. Verify the induction air filter is installed properly; tighten any loose fastening hardware. With the induction air filter installed, verify the induction air filter retainer is properly installed and the attaching hardware is secure in accordance with the aircraft manufacturer's instructions.
7. Inspect the induction/cylinder system drains according to the instructions in Section 6-3.19.

6-3.3. 50-Hour Engine Inspection

Frequency

- 25 hours after the 25 hour Initial Operation Inspection
- After every 50 hours of engine operation or four months

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.

Procedure

WARNING

Correct all fuel or oil leaks. Flammable petroleum products may ignite if exposed to an ignition source.

1. Perform a “Visual Inspection” according to instructions in Section 6-3.6; correct any discrepancies.
2. Perform a normal “Engine Start” according to instructions in Section 7-3.2 and “Ground Run-up” according to instructions in Section 7-3.3. When the engine reaches normal operating temperatures, check the following:
   a. Idle RPM .... 600 RPM
   b. Idle Cut-Off Mixture Rise .... 25-50 RPM
   c. Acceleration .... Smooth from IDLE to Wide Open
   If acceleration is rough or the Idle RPM or Idle/Cut-Off Mixture Rise are outside the normal operating parameters specified in the “Engine Specifications” in Section 2-3, perform an “Engine Operational Check” according to instructions in Section 6-3.7.
3. Collect an engine oil sample according to the instructions in Section 6-3.8.4, “Oil Sample Collection” and submit it for analysis according to Section 6-3.8.5, “Oil Trend Monitoring and Spectrographic Oil Analysis.”
4. Change the engine oil and filter according to the “Oil Change” instructions in Section 6-3.8.2. Fill the oil sump to the proper capacity for the engine model (Section 2-3) with fresh, ashless dispersant aviation engine oil conforming to SAE J-1899 (Section 3-2.1).
5. Perform an “Induction System Inspection” according to Section 6-3.14.
6. Inspect the induction/cylinder fuel drains according to the instructions in Section 6-3.19.

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

Frequency

The 100-Hour Inspection is accomplished under two circumstances:

- After every 100 hours of accumulated engine operation
- Annually, if the engine did not accumulate 100 hours of operation during the calendar year since the last 100-Hour Engine Inspection.

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.

Procedure

WARNING

Correct all fuel or oil leaks. Flammable petroleum products may ignite if exposed to an ignition source.

NOTE: Clean the fuel injector nozzles during the first 100-Hour Inspection after installation of a new, rebuilt or overhauled engine. Thereafter, clean the nozzles every 300 hours or annually.

1. Perform a “Visual Inspection” according to instructions in Section 6-3.6; correct any discrepancies.
2. Perform an “Engine Operational Check” according to instructions in Section 6-3.7.
3. Collect an engine oil sample according to the instructions in Section 6-3.8.4, “Oil Sample Collection” and submit it for analysis according to Section 6-3.8.5, “Oil Trend Monitoring and Spectrographic Oil Analysis.”
4. Perform the “Cylinder Inspections” according to instructions in Section 6-3.11. The cylinder inspections consist of multiple inspections and checks including Cylinder Power Stroke Area, Differential Pressure, Borescope, Baffle, Cowling, and Cylinder Mounting Deck Inspections.
5. Perform a “Crankcase Inspection” according to Section 6-3.12.
6. Perform an “Engine Mount Inspection” according to Section 6-3.13.
7. Perform an “Induction System Inspection” according to Section 6-3.14.
8. Perform an “Ignition System Inspection” according to Section 6-3.15.
9. Perform an “Engine Gauge Inspection” according to Section 6-3.16.
10. Perform a “Fuel System Inspection” according to Section 6-3.17.
11. Perform an “Engine Control Linkage Inspection” according to Section 6-3.18.
12. Perform a “Induction or Cylinder Drain Inspection” according to Section 6-3.19.
13. Inspect the Exhaust System according to the airframe manufacturer’s instructions.

14. Change the engine oil and filter according to the “Oil Change” instructions in Section 6-3.8.2. Fill the oil sump to the proper capacity for the engine model (Section 2-3) with fresh, ashless dispersant aviation engine oil conforming to SAE J-1899 (Section 3-2.1).
15. Inspect installed accessories for mounting security, condition, and proper operation according to the aircraft maintenance manual or accessory manufacturer’s instructions.
16. Perform an “Engine Operational Check” according to instructions in Section 6-3.7.

6-3.5. 500-Hour Engine Inspection

Frequency

- After each 500 hours of accumulated engine operation

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.

Procedure

1. Complete the “100-Hour (Annual) Engine Inspection” requirements in Section 6-3.4.
2. Replace magnetos which are not manufactured by Continental Motors with new, rebuilt, or serviceable units. Perform a 500-Hour Magneto Inspection on Continental Motors magnetos according to the Magneto Service Manual (See Section 1-2.5, “Related Publications.”)
3. Replace paper type induction air filters according to the airframe manufacturer’s instructions, regardless of condition.
4. Perform an “Alternator Inspection” according to the instructions in Section 6-3.21. Inspect and test the alternator for proper operation.
5. For any other optional engine accessories, refer to the accessory manufacturer’s maintenance instructions for inspection criteria.

6-3.6. Visual Inspection

Frequency

- Begin any service interval with a visual inspection

Procedure

1. Verify the engine nacelle is clean and free of fuel leaks, oil leaks, dirt and debris.
2. Inspect all fuel and oil lines for signs of chafing.
3. Inspect the oil cooler and oil filter for signs of leaks and physical discrepancies.
4. Check the following on the engine for cracks, dents, pitting or physical damage:
   a. External cylinder barrels
   b. Cylinder barrel fins
   c. Areas between and adjacent to the cylinder barrel fins.
   d. External surfaces of the cylinder head, including areas around
      1) Cylinder head fins
      2) Top and bottom spark plug bosses
      3) Fuel nozzle bosses
      4) Crankcase external surfaces
      5) Accessories
      6) Support structures adjacent to accessories

   NOTE: If cylinder discrepancies are discovered during the visual inspection, perform the "Cylinder Inspections" in Section 6-3.11.
5. Check security of engine and accessory wiring harnesses, including ignition leads. Check for signs of thermal breakdown, chafing, deterioration or improper routing.
6. Replace broken or damaged cushion clamps and stressed or broken wire ties.
7. Check magnetos for external damage, cracks and mounting security. Ensure the harness outlet plate is securely fastened to the magneto and the harness is properly routed.
8. Inspect external drive belts for nicks, cracks and visible wear; replace belts exhibiting nicks, cracks, or visible wear. Check belt tension and adjust, as required according to instructions in Section 6-3.10.4.
9. Inspect the exposed area of the crankshaft between the crankshaft nose oil seal and the propeller flange for evidence of corrosion.
   a. If corrosion is detected, use a Scotch- Brite® pad and a no-corrosive soap solution to remove surface corrosion.
   b. If the cleaning process eliminated the corrosion and no evidence of pitting exists, apply a generous coat of silver or aluminum paint according to the paint

manufacturer's instructions to the exposed portion of the crankshaft to prevent further corrosion.

c. If cleaning is unsuccessful (suspected corrosion has advanced to pitting), disassemble the engine and replace the crankshaft.

10. Check electrical connectors for signs of corrosion or contamination; if external corrosion or contamination is discovered, disconnect the connectors and inspect the internal pins for corrosion or contamination.
11. Inspect installed accessories for proper mounting and security. Inspect alternator brush holders for soot accumulation. If large amount of soot is present, inspect brushes (Section 6-3.21).

    NOTE: For items 12 - 15, inspect for obvious signs of physical damage, wear or deterioration, loose or missing hardware, leaks or foreign material that may hinder normal operation. Correct any discrepancies.

12. Inspect the physical integrity of the fuel system.
13. Inspect the physical integrity of the induction system airbox, ducts, seals and gaskets according to the airframe manufacturer's instructions.
14. Inspect the physical integrity of the lubrication system.
15. Inspect the physical integrity of the exhaust system according to the airframe manufacturer's instructions.
16. Repair any observable damage or deficiency before the aircraft is returned to service. Refer to Chapter 10, Non-Overhaul Repair and Replacement Procedures.

6-3.7. Engine Operational Check

WARNING

Flight is prohibited until the engine successfully completes the operational check and a flight check. If, during an operational check or engine warm-up, abnormal operation is observed or leaks occur, do not take-off. Determine the cause of the problem and take corrective action.

Perform an engine operational check after any of the following activities:

- Engine Installation
- Fuel Injection System parts replacement, maintenance or troubleshooting
- Post-Overhaul
- Return from storage
- After each 100-Hour/Annual, and 500-Hour Inspection

Perform the tasks listed in Table 6-2 on a newly installed, repaired or overhauled engine before the engine can be released for normal flight.

Table 6-2. Engine Operation Prerequisites

Sequence	Requirement	Section Reference
1	Prepare the engine for operation	Maintenance Preflight Inspection
2	Check Engine Operation	Engine Operational Check
3	Complete the Engine Operational Checklist	Operational Checklist
4	Perform Flight Check	"Flight Check" in Section 7-2.3[1]

1. and according to the AFM/POH

6-3.7.1. Engine Operating Limits

Table 6-3. IO-550 Engine Operating Limits

Specification	A B C		G	N	P	R
Full Throttle Speed +/- 25 RPM	2700		2500	2700	2700	2700
Minimum Idle Speed	600		600			
Unmetered Fuel Pressure @ idle (psi)	8.0 -10.0		8.0-10.0			
Metered Fuel Pressure (psi)	A	17.7-20.0	G		14.7-16.0	
	B	16.5-18.4	N		19.0-21.3	
	C	17.6-19.6	P		19.0-21.3	
			R		19.0-21.3	
Unmetered Fuel Pressure @ Max. RPM (psi)	A	32.0-36.0	G		22.0-26.0	
	B	29.2-36.2	N		28.0-30.0	
	C	31.6-37.8	P		28.0-30.0	
			R		28.0-30.0	
Oil Pressure w/Oil Temp 75-240°F	30-60		30-60			
Oil Pressure (Min. - Max.) (psi)	10-100		10-100			
Magneto RPM Drop/Spread (RPM)	150/75		150/75			

6-3.7.2. Maintenance Preflight Inspection

Prior to starting the engine, perform a preflight inspection of the engine, propeller, nacelle, and aircraft. This inspection must be performed prior to the first flight after engine installation, inspection, troubleshooting, maintenance, or overhaul work to determine if the aircraft and engine are in an airworthy condition. Do not release a malfunctioning engine for flight.

WARNING

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

Procedure

1. Turn the Master Power Switch and the Ignition Switch to the OFF position.
2. Remove engine cowling according to the airframe manufacturer’s instructions.
3. Check the throttle, propeller, and alternate air supply controls for freedom of movement and full range of travel.

WARNING

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

4. Drain the aircraft fuel sumps according to the airframe manufacturer's instructions.
5. Remove, clean, inspect, and reinstall the aircraft fuel screens according to the airframe manufacturer's instructions.
6. Inspect the aircraft vapor return system for proper operation in accordance with airframe manufacturer's instructions.
7. Purge the aircraft fuel system.
   a. Disconnect the fuel supply hose from the engine driven fuel pump and terminate the fuel supply hose in a large, clean container suitable for waste fuel.
   b. Operate the aircraft fuel boost pump to allow a minimum of one gallon of fuel to flow into the container. Inspect the fuel for contaminants; locate and correct the source of contaminated fuel, if detected.
   c. Reconnect the fuel supply line to the fuel pump inlet fitting and torque to Appendix B specifications.

WARNING

Use of inaccurate gauges will result in incorrect fuel system adjustment, probable accelerated engine wear and possible engine damage.

8. Verify the fuel system components are properly configured (part numbers conform to type design and parts are installed properly).
9. Ensure the fuel manifold valve vent and fuel pump drain lines are properly installed, open and free of obstructions.

10. Inspect the engine control rod ends for wear, proper installation and security in accordance with airframe manufacturer's instructions.
11. Lubricate engine control rod ends and fuel system moving parts using the approved lubricants listed in Section 3-2 and the airframe manufacturer's instructions.

WARNING

The engine is certified for operation with aviation fuels specified in Section 2-3. If the minimum grade required is not available, use the next higher grade. Use of lower octane rated fuel or jet fuel will result in damage to, or destruction of, an engine the first time high power is applied. If the aircraft is inadvertently serviced with the wrong grade of fuel, or jet fuel, drain the fuel system completely and service the fuel tanks in accordance with the aircraft manufacturer's instructions and perform a "Contaminated Fuel System Inspection" inspection according to instructions in Section 6-4.5.

12. Service the aircraft fuel system according to the airframe manufacturer's instructions.
13. Check the engine oil level. Service the oil sump as required with the oil grade specified in Section 3-2.1.
14. Verify the engine crankcase breather is secured according to the airframe manufacturer's instructions and no breather air flow restrictions exist.
15. If the engine is newly installed or being returned to service after long-term storage, pre-oil the engine according to the instructions in Section 5-3.4.
16. Verify the induction air filter is clean and secured according to the airframe manufacturer's instructions. Replace the air filter with a clean one if it is dirty; tighten the filter if it is loose.
17. Visually inspect the engine, propeller hub area, and nacelle for evidence of fuel and engine oil leaks. Correct any discrepancies.
18. Visually inspect the engine and nacelle for debris, loose, missing or broken lines, hoses, fittings, clamps and connections. Inspect for restrictions to cooling airflow; remove any debris.
19. Verify all baffles and baffle seals are installed, correctly positioned, and serviceable according to the airframe manufacturer's instructions.
20. If the engine has been exposed to temperatures below 20ºF (-7 C) for more than two hours, preheat the engine according to "Engine Preheating" instructions in Section Section 7-4.1.1. If the engine has been exposed to an ambient temperature between 20º to 40ºF (-7º to 4º C), refer to the "Cold Weather Starting Without Preheating" instructions in Section 7-4.1.1.3.

6-3.7.3. Oil Pump Operational Check

1. Perform a "Maintenance Preflight Inspection" according to Section 6-3.7.2.
2. Perform a normal "Engine Start" according to instructions in Section 7-3.2 and "Ground Run-up" according to Section 7-3.3 to allow the engine to warm to normal operating temperatures (75-240°F).
3. Oil Pressure.. Check
   RESULT: Verify oil pressure is between 30 and 60 psi at full power RPM. If necessary, adjust according to the "Oil Pressure Adjustment" instructions in Section 6-3.10.1. If no oil pressure is noted, shut down the engine immediately and investigate the cause.
4. If no further checks are required, proceed to "Engine Shutdown" on page 6-24.

6-3.7.4. Fuel System Operational Check

A fuel system operational check is required after replacement of fuel injection system components, such as the fuel pump, fuel manifold valve, or fuel injectors. The fuel system setup is a critical component of proper engine operation.

Setup instructions differ for the fuel system, depending on the test equipment being used. If a Porta-Test Unit will be used for the operational check, follow the test equipment setup instructions in Section 6-3.7.4.1. If using calibrated gauges for the operational check, begin with Section 6-3.7.4.2.When the test equipment is set up properly, proceed with the Operational Check Procedure in Section 6-3.7.4.3. Upon completion of the operational check, a flight check, according to instructions in Section 7-2.3, is required for engine equipped with an altitude compensating fuel pump or for engines that fail to reach rated full power engine ROM during the operational check on the ground.

NOTE: Fuel system adjustments are interactive. Once begun, perform the entire procedure for proper fuel injection system operation.

Required Test Equipment

- Portable Tachometer
- Model 20 ATM-C Porta Test Unit (Figure 3-4)

OR

- Calibrated pressure gauges

  NOTE: Pressure gauges must be accurate within +/- 1%. The calibration period should not exceed one year.

  - A calibrated 0-60 psi gauge graduated in 1 psi increments (unmetered pressure).
  - A calibrated 0-30 psi gauge graduated in 0.2 psi increments (metered pressure and fuel flow gauge verification).
  - Two P/N MS51523-B4 swivel tees used to insert gauges in line with fuel lines for metered and unmetered pressure references.
  - Hoses of sufficient length to allow personnel and equipment to perform the test at a safe distance from the propeller arc and blast area.

NOTE: Engine driven fuel pump pressures vary with engine RPM. Rated FULL POWER RPM may not be achieved during ground run-up. Use the Static Ground Setup Compensation Table to adjust the metered pressures if FULL POWER RPM cannot be achieved.

Table 6-4. Static Ground Setup Compensation Table

Static Engine RPM	Correction Factor	Corrected Metered Pressure
Metered pressure vs. RPM @ 70° F fuel temperature		
Rated RPM	1	
-20	.991	
-40	.982	
-60	.973	
-80	.964	
-100	.955	
-120	.946	

Procedure

If rated full power RPM cannot be achieved during ground run-up, determine the appropriate correction factor with the following calculation:

Subtract the maximum observed static RPM from the engine model's rated RPM in Table 6-3.

Locate the number closest to the difference between the engine model's rated RPM and observed static RPM in the first column in Table 6-4.

Multiply the correction factor in the second column adjacent to the static RPM by the engine model's rated metered fuel pressure to determine the corrected metered pressure.

Example:	IO-550-C rated RPM	2700
	Maximum static RPM	2660
	Difference	40

Maximum Static RPM	Metered Pressure Range	Correction Factor	Corrected Metered Pressure
2660 (-40)	17.6-19.6 X	.982=	17.28-19.25

6-3.7.4.1. Fuel System Operational Checkout with the Port-Test Unit

Procedure

1. Connect the unmetered fuel test hose to one of the following:

   a. A B C Loosen and remove the unmetered fuel supply hose from the fuel pump outlet fitting or the fuel control unit inlet fitting, depending on access to connections.

   b. G N P R Remove and set aside the protective cap from the tee fitting on the integral throttle body metering unit. The cap will be reinstalled when the test and any necessary adjustments are complete.

2. Connect one MS51523-B4 swivel tee to the fuel connection loosened in step 1.

   NOTE: Some installations may require a number of fittings to adapt the metered and unmetered test equipment to the fuel injection system.Connect the unmetered fuel supply hose to the straight end of the tee connector.

3. Connect the unmetered fuel supply hose to the straight end of the tee connector.
4. Connect the Porta-Test Unmetered Pressure hose to the 90° side of the swivel tee fitting.
5. Connect the metered pressure test hose to one of the following:

   a. G N P R Remove the cap from the metered fuel port fitting on the fuel manifold valve.

   b. A B C Loosen and remove the metered pressure fuel supply hose from the manifold valve inlet fitting. Connect one MS51523-B4 swivel tee to the manifold valve inlet fitting. Connect the metered pressure fuel supply hose to the straight end of the tee connector.

6. Connect the Porta Test Unit metered pressure test hose to fitting left open in step 5.
7. Torque all connections to Appendix B specifications.
8. Position the throttle control to the FULL OPEN position and the mixture control to FULL RICH. Operate the aircraft boost pump in accordance with the aircraft manufacturer's instructions. Bleed the air from the test unit and hoses according to the Porta-Test unit instructions.

WARNING

Allow excess fuel to drain from the induction/cylinder drains prior to attempting engine start. Failure to comply may result in hydraulic lock and subsequent engine failure.

9. Install the engine cowling or cooling shroud during ground operation.
10. Proceed to Section 6-3.7.4.3.

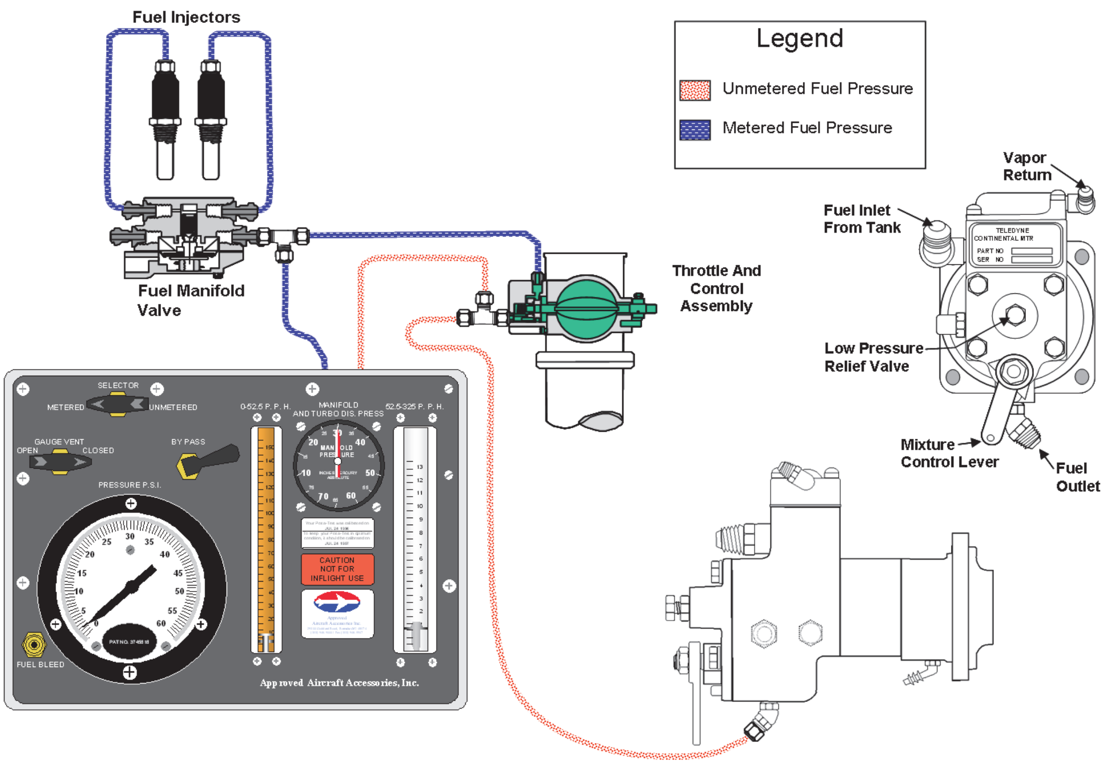


Figure 6-1. Porta-Test Connections to Integral Throttle Body/Metering Unit

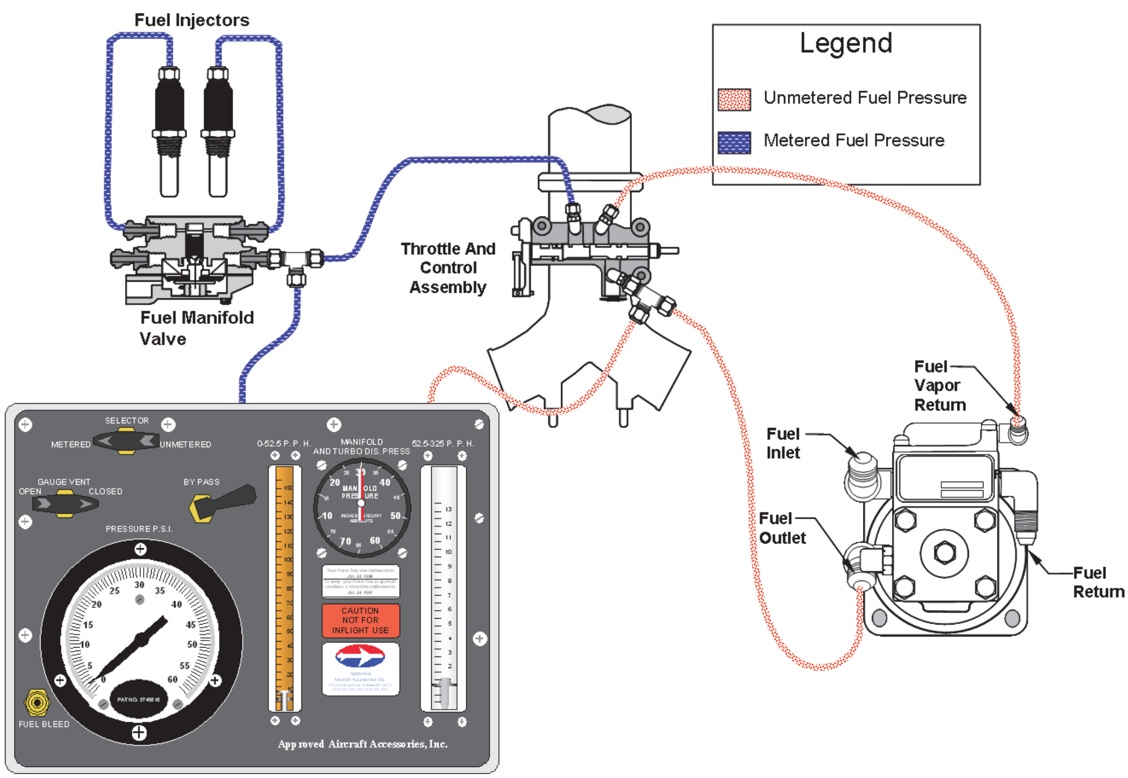


Figure 6-2. Porta-Test Connections to Fuel Control Unit

6-3.7.4.2. Fuel System Operational Checkout with Calibrated Gauges

Procedure

1. Connect the unmetered fuel test hose to one of the following:
   a. A B C Loosen and remove the unmetered fuel supply hose from the fuel pump outlet fitting or the fuel control unit inlet fitting, depending on access to connections.
   b. G N P R Remove and set aside the protective cap from the tee fitting on the integral throttle body metering unit. The cap will be reinstalled when the test and any necessary adjustments are complete.
2. Connect one MS51523-B4 swivel tee to the fuel connection loosened in step 1.

   NOTE: Some installations may require a number of fittings to adapt the metered and unmetered test equipment to the fuel injection system.Connect the unmetered fuel supply hose to the straight end of the tee connector.
3. Connect the unmetered fuel supply hose to the straight end of the tee connector.
4. Connect the 0-60 psi unmetered fuel pressure gauge to the 90° side of the swivel tee fitting.
5. Connect the metered pressure test hose to one of the following:
   a. G N P R Remove the cap from the metered fuel port fitting on the fuel manifold valve.
   b. A B C Loosen and remove the metered pressure fuel supply hose from the manifold valve inlet fitting. Connect one MS51523-B4 swivel tee to the manifold valve inlet fitting. Connect the metered pressure fuel supply hose to the straight end of the tee connector.
6. Connect the 0-30 psi pressure gauge metered pressure test gauge to the hose to fitting left open in step 5.
7. Torque all connections to Appendix B specifications.
8. Position the throttle control to the FULL OPEN position and the mixture control to FULL RICH. Operate the aircraft boost pump in accordance with the aircraft manufacturer's instructions.

   NOTE: Gauges must remain at the same height or above the fuel injection system components under test for the duration of the operational check. Indicated fuel pressure at the gauge will increase if the gauges are below the fuel injection system, causing erroneous indications.

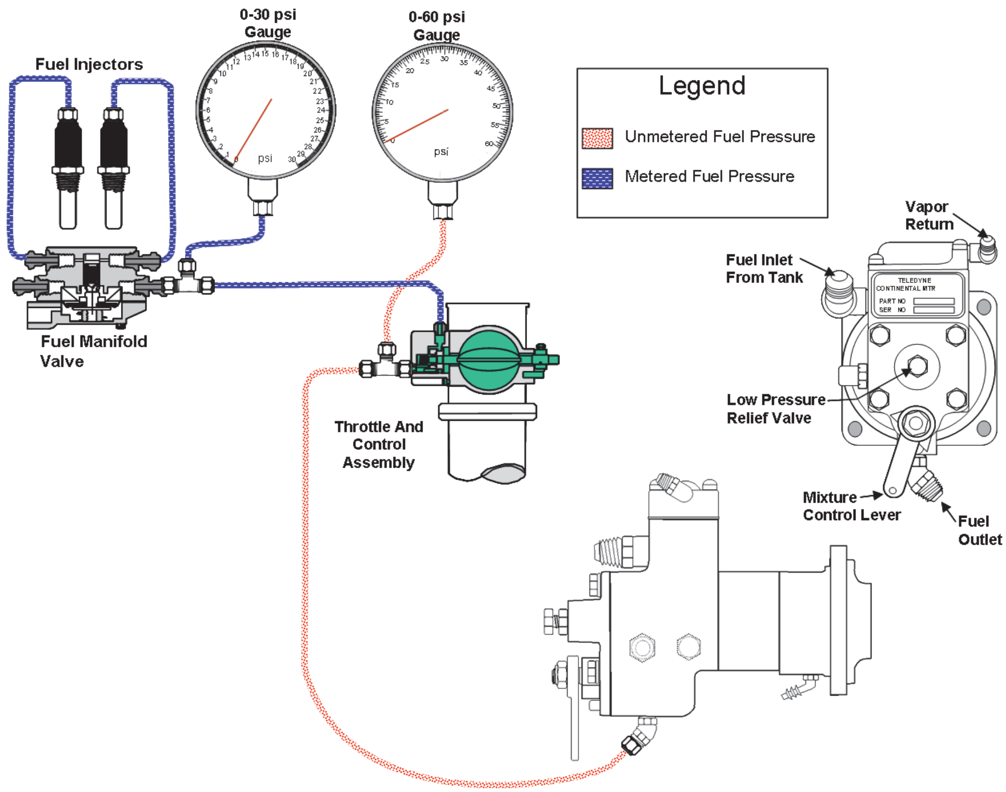


Figure 6-3. Calibrated Gauge Connections to Integral Throttle Body/Metering Unit

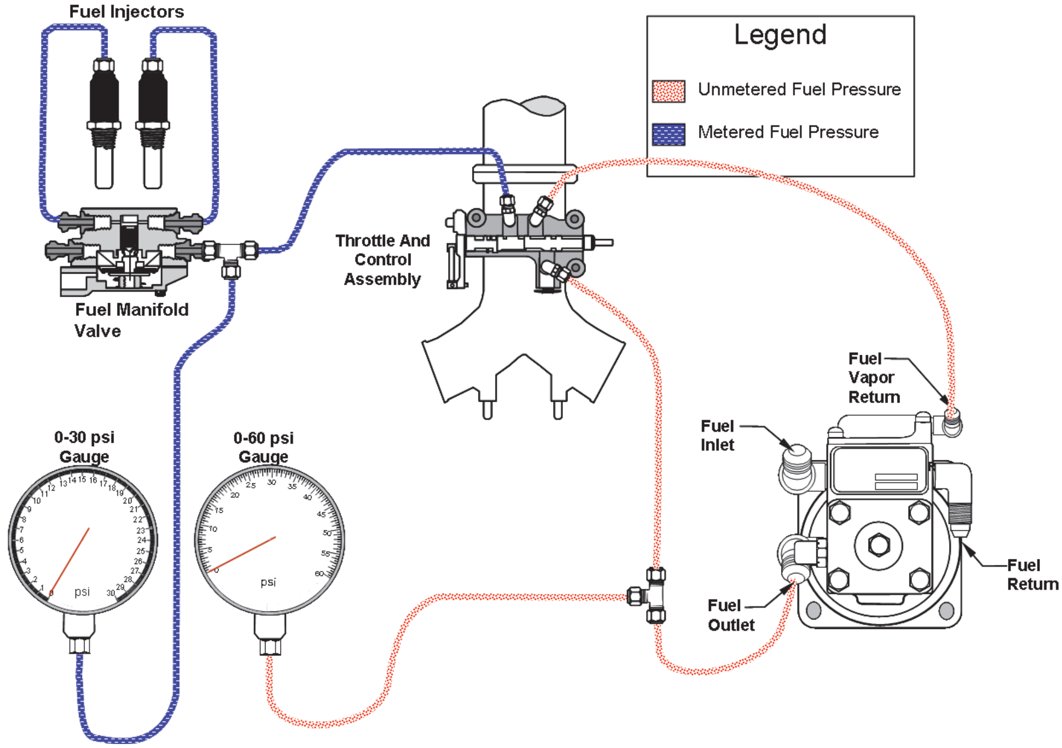


Figure 6-4. Calibrated Gauge Connections to Fuel Control Unit

9. Loosen the test connections at each gauge to bleed the lines of air. Hold the gauge at, or slightly above, the height of fuel system components to allow the fuel to force the air out of the lines. Operate the boost pump only long enough to purge the air from the fuel system. Torque all loosened fittings to Appendix B specifications.

WARNING

Drain all fuel from the induction system prior to attempting engine start. Failure to comply may result in hydraulic lock ad subsequent engine failure.

10. Install the engine cowling or cooling shroud during ground operation.
11. Proceed to Section 6-3.7.4.3.

6-3.7.4.3. Fuel System Operational Checkout Procedure

Procedure

1. Verify the accuracy of the tachometer and fuel flow gauges prior to making any fuel system adjustments; replace faulty gauges.
2. Locate the IDLE speed stop screw (Figure 6-5 or Figure 6-6) on the throttle body and turn it counter-clockwise two complete turns. During the operational check, IDLE RPM will be controlled manually using the cockpit throttle control.

WARNING

Ensure the propeller area is clear before starting the engine.

3. Fuel Selector Valve .... ON
4. Mixture Control .... FULL RICH
5. Boost Pump.. ON (according to AFM/POH)
6. Perform a normal “Engine Start” according to instructions in Section 7-3.2 and “Ground Run-up” according to Section 7-3.3 to allow the engine to warm to normal operating temperatures.

   NOTE: A puff of white smoke from a new or rebuilt engine, or an engine returned from storage is normal. The source of the smoke is the remaining preservation oil in the burning off in the combustion chamber. The smoke should dissipate quickly; if smoke persists, shut down the engine and investigate the cause.

7. Throttle.. 600-1000 RPM (One minute)
   RESULT: Operate the engine for one minute, gradually increasing the speed to 1000 RPM in 3 minutes.

   CAUTION: Operating the engine without oil pressure will result in engine malfunction or failure.

8. Oil Temperature .... Check
   RESULT: Allow the engine oil to reach normal operating temperature (75°F (24°C)) before proceeding to the next step.

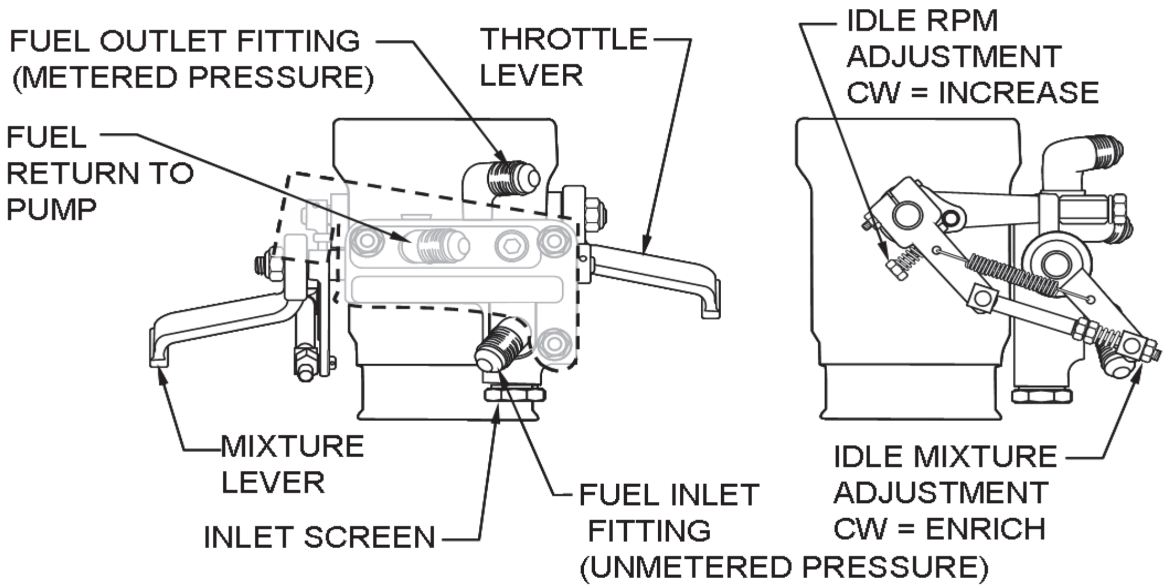


Figure 6-5. IO-550-A, B & C Throttle Body Adjustments

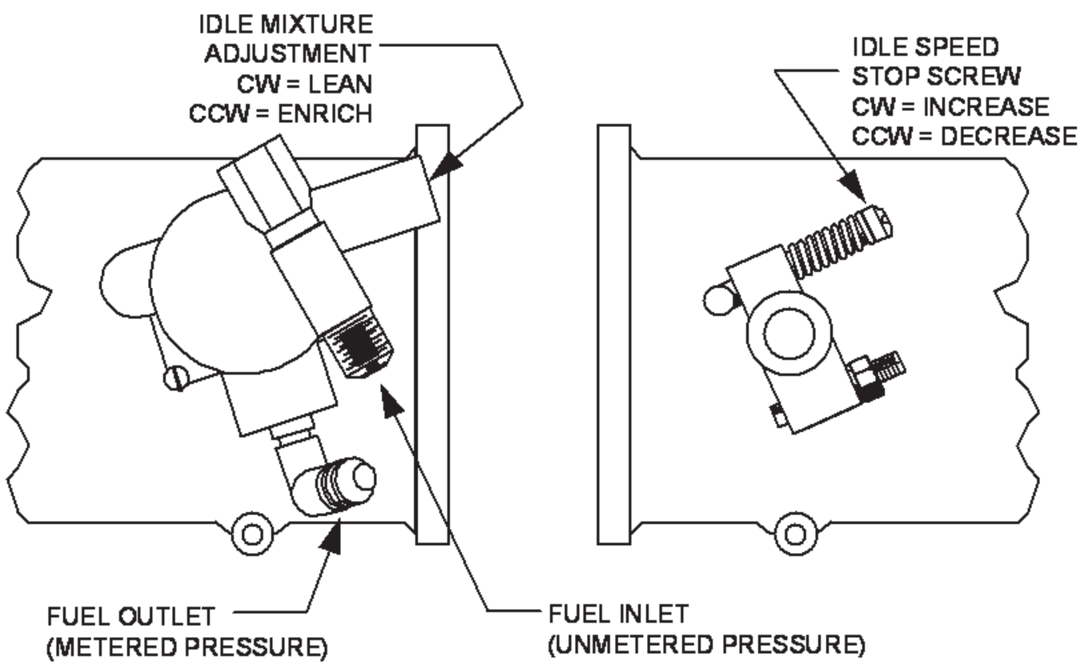


Figure 6-6. IO-550-G, N, P & R Throttle Body Adjustments

9. Boost Pump...OFF
10. Mixture Control ....FULL RICH
11. Throttle...600±25 RPM
12. Unmetered Fuel Pressure Gauge.....................Check
    RESULT: Unmetered fuel pressure is within the range specified in Table 6-5. Maintain engine speed until CHT is 250°F to 350°F. Record the unmetered fuel

pressure, regardless of setting. If the unmetered fuel pressure is not within the limits specified in Table 6-5, adjust the fuel pressure according to the instructions in Section 6-3.10.2.

Table 6-5. IO-550 Fuel Injection System Pressures

Specification	A B C		G	N	P	R
Full Throttle Speed +/- 25 RPM	2700		2500	2700	2700	2700
Minimum Idle Speed	600		600			
Unmetered Fuel Pressure @ idle (psi)	8.0 -10.0		8.0-10.0			
Metered Fuel Pressure (psi)	A	17.7-20.0	G		14.7-16.0	
	B	16.5-18.4	N		19.0-21.3	
	C	17.6-19.6	P		19.0-21.3	
			R		19.0-21.3	

WARNING

Do not operate the engine at speeds above 1700 RPM until the oil temperature is at least 75°F (24°C) and oil pressure is within the normal operating range. Operating at speeds above 1700 RPM before reaching the minimum oil temperature may result in engine malfunction or engine failure.

NOTE: to eliminate rough idling after the mixture rise check, increase engine RPM to 1500-1800 RPM for 15 seconds before returning to IDLE RPM.

13. Mixture Control .... Retard slowly toward IDLE
    RESULT: The engine speed should increase 25 to 50 rpm before beginning to decrease. If the rise is less that 25 rpm, the mixture is too lean. If the engine speed increases more that 50 rpm, the mixture is too rich. Adjust the idle fuel pressure mixture rise according to Section 6-3.10.2.
14. Mixture Control .... FULL RICH
15. Propeller Governor .... WIDE OPEN
16. Throttle.. WIDE OPEN
    RESULT: Check the engine RPM with a portable tachometer. Record the engine speed on the checklist. If the engine does not reach the rated, full power RPM, calculate the corrected metered fuel pressure (Table 6-4).
17. Metered Fuel Pressure Gauge .... Check
    RESULT: The full power, metered fuel pressure should equal the value in Table 6-5, with Table 6-4 correction factor, if applicable. Record the metered fuel pressure, regardless of setting. If full power, metered fuel pressure is not within the specified limits, adjust the metered fuel pressure according to Section 6-3.10.2.
18. Throttle.. Position to desired IDLE RPM
    RESULT: adjust IDLE RPM according to instructions in Section 6-3.10.2.
19. If no further checks are required, proceed to “Engine Shutdown” on page 6-24.

6-3.7.5. Magneto RPM Drop Check

WARNING

Absence of RPM drop during magneto check may be an indication of a faulty ignition circuit (Hot Magneto). Should the propeller be turned by hand (as in during preflight), the engine could inadvertently start and cause personal injury or death. Flight is prohibited until the condition is corrected.

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.

Procedure

1. Start the engine according to the “Engine Start” instructions in Section 7-3.2.
   RESULT: No defects noted. Allow the engine oil to warm to minimum normal (75°F (24°C)) operating temperature.

   CAUTION: Avoid prolonged single magneto operation to preclude spark plug fouling.

2. Throttle..1700 RPM
3. Magneto Switch ....R
   RESULT: RPM drop does not exceed 150 RPM; record Left Magneto RPM drop result. Maximum allowable RPM drop spread between magnetos is 75 RPM.
4. Magneto Switch ....BOTH
5. Magneto Switch L
   RESULT: RPM drop does not exceed 150 RPM; record Right Magneto RPM drop result. Maximum allowable RPM spread between magnetos is 75 RPM.
6. Magneto Switch ....BOTH
7. Throttle..Reduce to IDLE
8. If no further checks are required, proceed to “Engine Shutdown” on page 6-24.

6-3.7.6. Engine Shutdown

Procedure

1. Perform a normal engine shutdown according to the “Engine Shutdown” instructions in Section 7-3.4.
2. Remove installed test equipment.
   a. Disconnect the metered fuel pressure test hose from the engine fittings.
   b. Disconnect the unmetered fuel pressure test hose from the engine fittings.
   c. Remove the tee fittings and any additional test fittings installed to adapt the plumbing to the test equipment.
3. Reconnect and torque the fuel system hoses to Appendix B specifications.
   a. Connect the unmetered pressure hose between the fuel pump and the fuel control assembly.

   CAUTION: Use only the protective cap designed for the integrated throttle body/metering unit (Part No. 639494). Aftermarket cap assemblies may damage the fitting.

   b. Install protective caps (or airframe-installed fitting to cockpit metered pressure gauge) on the fuel manifold valve (metered pressure) and integrated throttle body/metering unit fittings.
4. Leak Check
   a. Master Power Switch .... ON
   b. Ignition Switch.. BOTH
   c. Boost Pump Switch..................................... ON (according to AFM/POH)
   d. Throttle... WIDE OPEN
   e. Mixture.. FULL RICH
   f. Check for leaks in the following areas and correct any discrepancies before releasing the engine for flight:
      1) Induction System
      2) Exhaust System
      3) Fuel System
      4) Lubrication System
   g. Boost Pump Switch..................................... OFF (according to AFM/POH)
   h. Mixture.. IDLE/CUT-OFF
   i. Throttle.. IDLE
   j. Ignition Switch.. OFF
   k. Master Power Switch .... OFF

6-3.8. Engine Oil Servicing

The engine lubrication system provides either pressure or splash oil to areas of the engine subject to frictional loading. A certain amount of oil consumption is normal if the plane is flown on a regular basis. However, if oil consumption exceeds the Brake Specific Oil Consumption rate in Section 2 or there is an abrupt change in the rate of oil consumption, determine the cause and correct it before further flight.

WARNING

Do not fly the aircraft if oil consumption is abnormal or is suspect; investigate for oil leakage. If no oil leakage is noted, perform the "Cylinder Inspections" in Section 6-3.11.

6-3.8.1. Check and Replenish Engine Oil Level

Maintain the oil sump capacity at the specified level. To check the oil level or add oil, perform the following procedure:

WARNING

Check the oil level before each flight and maintain the engine oil at the specified level. Engine operation with less than the specified capacity will cause engine malfunction or failure.

Petroleum based aviation engine oil is flammable. Follow fire hazard precautions. Store oil in a well-ventilated area away from heat or ignition sources.

Procedure

1. Withdraw the oil gauge rod (dipstick) (See Figure 6-7, Figure 6-8, Figure 6-9 or Figure 6-10 for engine oil servicing points).
2. Wipe the oil from the oil gauge rod with a clean, lint-free cloth. Avoid getting any lint or debris in the oil sump.
3. Insert the cleaned oil gauge rod back into the oil sump and withdraw the rod again.
4. Verify the oil on the rod touches, but does not pass the oil fill line on the rod.

   NOTE: IO-550 oil sump capacities differ by engine models. Refer to the "Engine Specifications" in Section 2-3.

   CAUTION: When adding oil, completely remove the protective seal from the oil container to prevent the seal from falling into the oil fill port. Prevent any debris from falling into the oil fill port.

5. If more oil is required, add a sufficient quantity of oil meeting the specifications in Section 3-2.1 to reach the fill line on the oil gauge rod.

   NOTE: If oil is spilled on the engine or nacelle during servicing, clean the spilled oil immediately and dispose of oily rags and absorbent materials according to local environmental regulations.

6. Install and lock the oil gauge rod in the fill tube after servicing the engine oil.

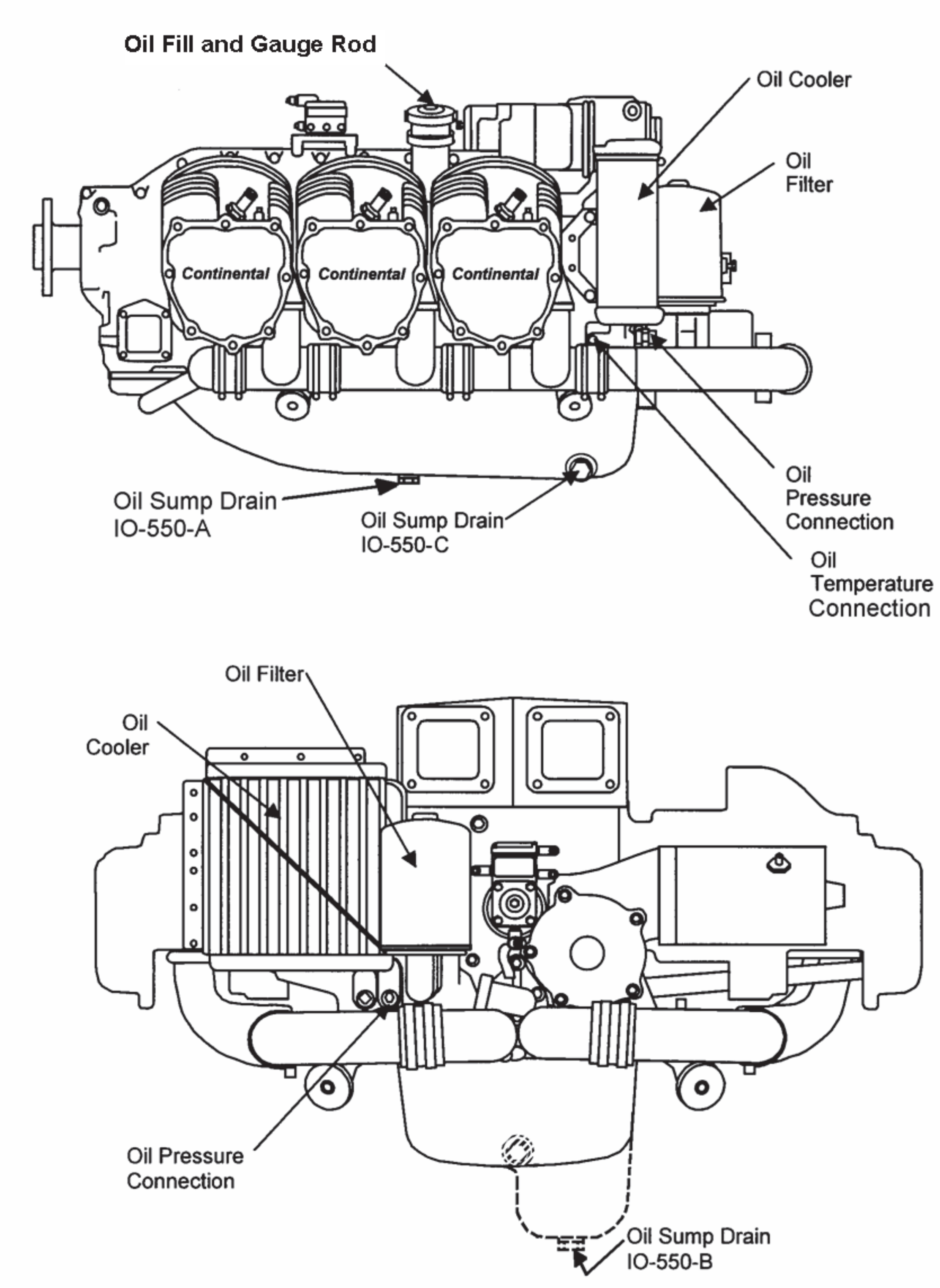


Figure 6-7. IO-550-A, B & C Oil Servicing Points

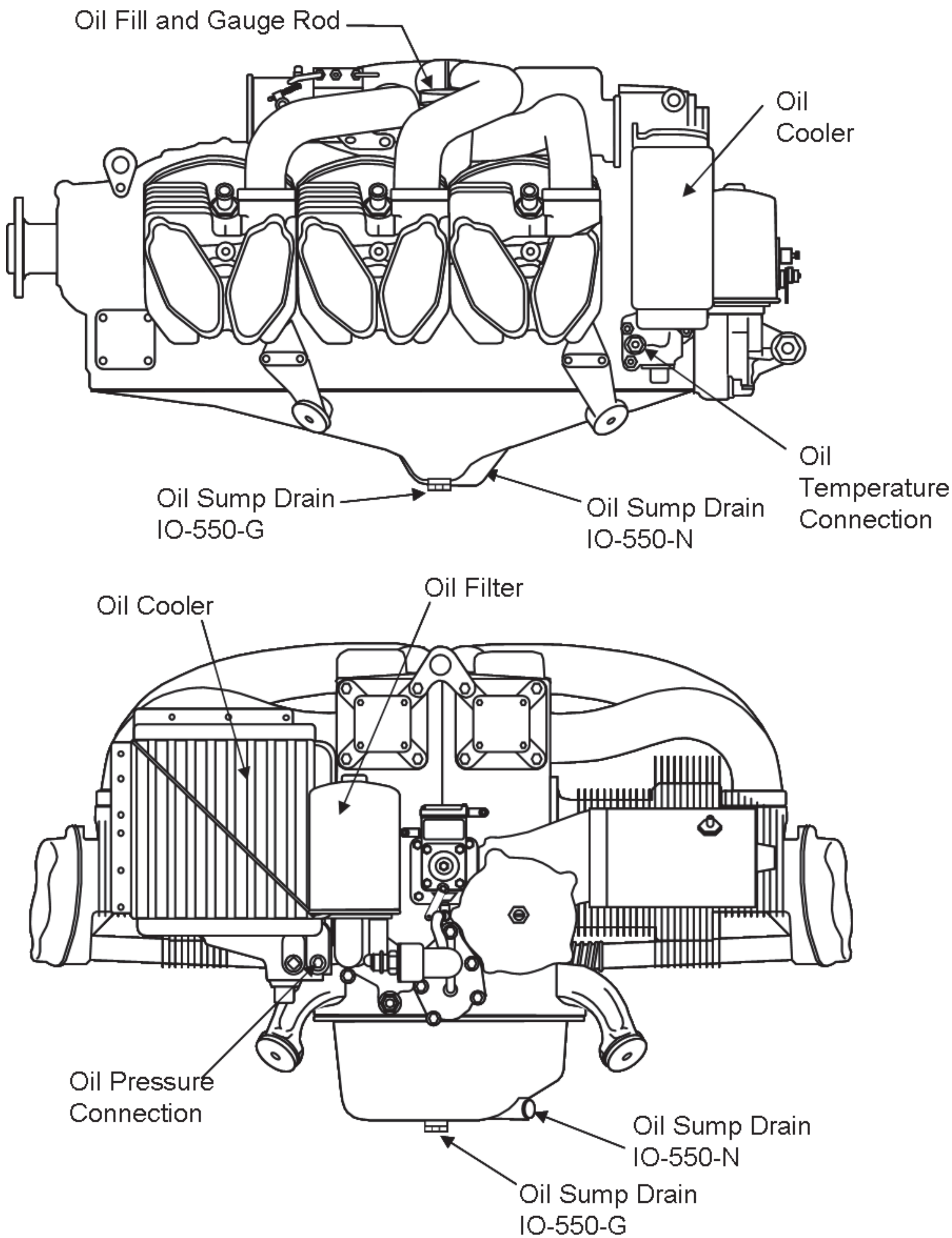


Figure 6-8. IO-550-G & N Oil Servicing Points

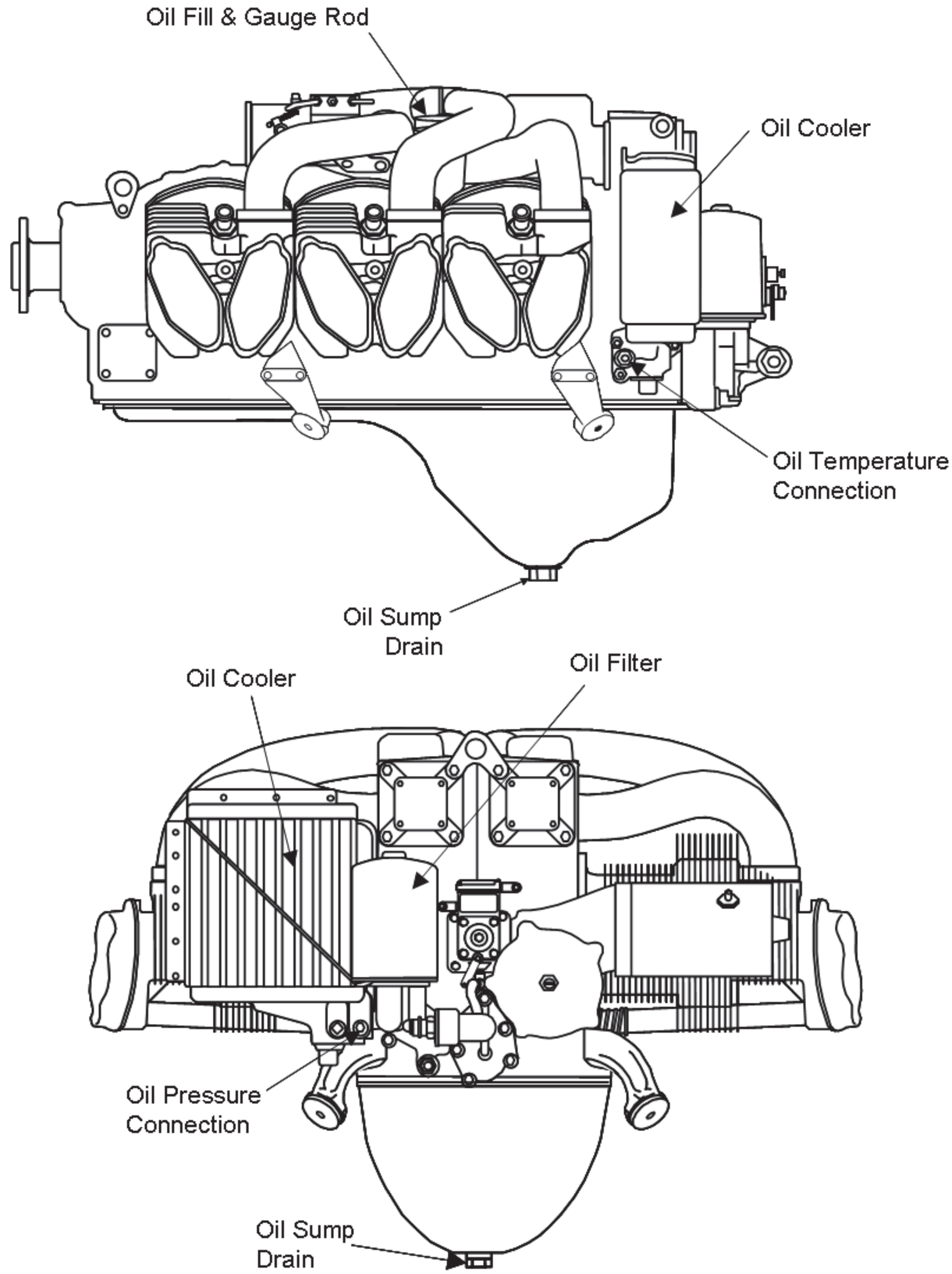


Figure 6-9. IO-550-P Oil Servicing Points

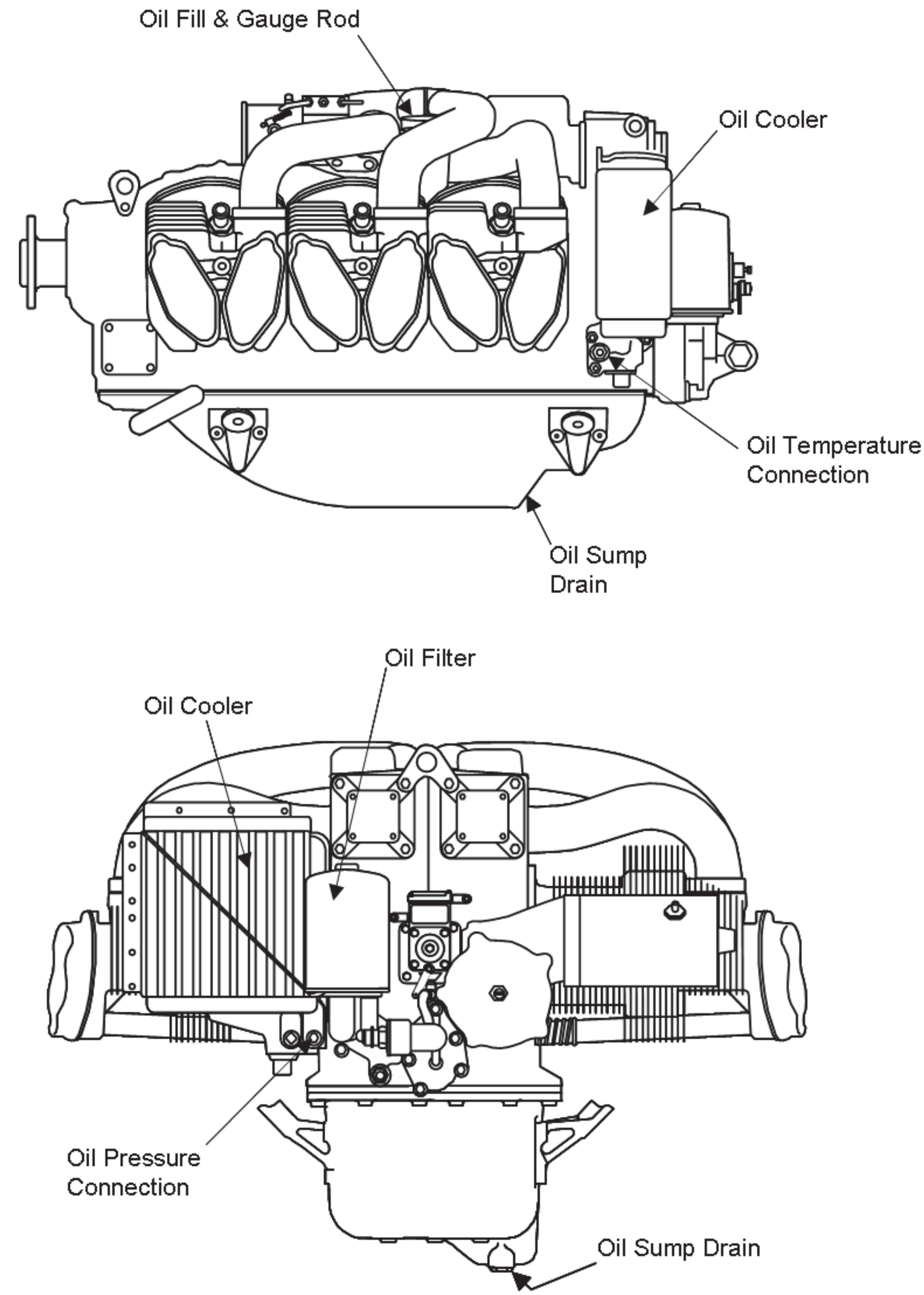


Figure 6-10. IO-550-R Oil Servicing Points

6-3.8.2. Oil Change

Perform an oil change within 30 minutes of engine shutdown (to obtain a useful oil sample) according to the oil changes intervals specified in Section 6-2.

NOTE: More frequent oil changes are recommended under extreme usage (flight training, shuttle service, or crop dusting) or adverse (desert or arctic climates) weather conditions.

Procedure

1. Place a catch basin, approved for collecting oil, beneath the oil sump. Remove the oil sump drain plug (Figure 6-7, Figure 6-8, Figure 6-9 or Figure 6-10) and drain and drain the oil into the catch basin.
2. Collect an oil sample according to the "Oil Sample Collection" instructions in Section 6-3.8.4. Inspect the oil sump drain plug for evidence of wear material. Metal fragments on the drain plug may indicate excessive wear or part disintegration. Evidence of bronze in the oil sump suggests piston pin bushing loss. Remove the cylinders and inspect the piston pin bushings for proper installation according to instructions in Section 10-8.

   CAUTION: Dispose of used engine oil in accordance with local environmental standards.

   NOTE: Continental Motors recommends customers submit a sample of the oil drained during each oil change, or if engine trouble is suspected, for spectrographic oil analysis. The first three samples establish the oil analysis trend baseline.

   The amount of wear material present in new, rebuilt, or overhauled engines is typically greater during the engine break in period, tapering off during subsequent oil changes. If the amount of wear material does not decrease during subsequent oil changes, note the wear material characteristics (refer to Section 6-3.8.5, "Oil Trend Monitoring and Spectrographic Oil Analysis") and troubleshoot the engine according to instructions in Chapter 8.
3. Remove the oil filter (Figure 6-7, Figure 6-8, Figure 6-9 or Figure 6-10). Cut the oil filter in two parts using an Oil Filter Can Cutter (P/N CT-923 (Table 3-1, "Special Tools List")).
   a. Inspect the oil filter element for metal debris trapped within the filter to assess the engine condition. If debris is found, wash the filter media in a clean glass container to determine content. Use a magnet to check for steel particulate.
   b. New, rebuilt, or overhauled engines exhibit more wear material during the break-in period. Wear material will decrease after the third and subsequent oil changes. If wear material in the oil filter does not decrease after the third and subsequent oil changes, note the characteristics of the wear material (Section 6-3.8.5, "Oil Trend Monitoring and Spectrographic Oil Analysis") and troubleshoot the engine according to instructions in Chapter 8.

4. Apply a thin coating of Dow Corning DC-4 compound to the oil filter gasket to prevent gasket material sticking to the mating surface. Install the new oil filter; torque the filter to Appendix B specifications and safety wire the filter according to instructions in Section C-4.
5. Reinstall the oil drain plug with a new crush gasket; torque the drain plug to Appendix B specifications and safety wire the drain plug according to instructions in Section C-4.
6. Add fresh oil and check the oil level according to instructions in Section 6-3.8.1.
7. Check for oil leaks according to instructions in Section 6-3.8.3.

6-3.8.3. Check for Oil Leaks

WARNING

Keep the engine compartment, nacelle, and fuselage adjacent to the nacelle clean to enable detection of oil leaks.

Procedure

1. Perform a normal "Engine Start" according to instructions in Section 7-3.2 and "Ground Run-up" according to Section 7-3.3 to allow the engine to warm to normal operating temperatures. Document engine oil pressure and temperature.
2. Shut down the engine according to the "Engine Shutdown" instructions in Section 7-3.4.
3. Check the engine nacelle, engine compartment, and adjacent area for oil leaks. If leaks are found, determine the source and correct the cause of the leak(s).
4. Check the oil level in the sump according to Section 6-3.8.1, "Check and Replenish Engine Oil Level."

6-3.8.4. Oil Sample Collection

Oil samples may be collected during the oil change procedure, before new oil is added or between oil changes. The oil sample must be taken after the engine has been operated within normal (Section 2-3, "Engine Specifications") operating limits, including normal cruise and maximum power settings for at least 30 minutes.

NOTE: Collect oil samples within 30 minutes of engine shutdown.

Procedure

1. Clean any dirt or debris from around the oil sump drain plug.
2. Use the following sample collection devices:
   a. Sampling tube and/or funnel
   b. Sample vial

   NOTE: Oil sampling equipment must be clean and free of debris, foreign material, or residue to ensure sample integrity and accurate analysis.
3. Collect one to two ounces (30 to 60 ml) of oil from one of the following sample collection locations consistently:

a. Midstream of the oil drain flow after 1/3 of the oil has drained from the oil sump.

b. From the oil fill port, at least 2 to 3 inches above the bottom of the oil sump.

NOTE: Never take an oil sample from the bottom of the oil sump or the oil filter canister.

4. Fill the oil sample tube or vial 3/4 full and tighten the cap.
5. Label the oil sample vial with the date the sample was taken, the serial number of engine it was taken from, and the submitter's name and company.

NOTE: Duplicate oil samples submitted to different oil analysis laboratories will render an equal number of different reports. Establish a rapport with one laboratory and use it consistently for meaningful trend analysis.

6. Submit the oil sample for analysis. The following laboratories provide thorough, detailed oil analysis and reporting:

Aviation Oil Analysis	Aviation Laboratories
3319 Earll Drive	910 Maria Street
Phoenix, AZ 85017	Kenner, LA 70062

6-3.8.5. Oil Trend Monitoring and Spectrographic Oil Analysis

Spectrographic oil analysis identifies concentration, in parts per million (PPM), of wear material in an oil sample (see Section 6-3.8.4) collected during an oil change. Analysis begins with the first oil change sample, and continues with successive oil changes. The first samples establish a baseline. Subsequent samples, taken over time, establish trends. These trends help determine if wear material is deviating from the baseline. (Establishment of the baseline and ensuing wear trends assume analysis is done by the same laboratory using the same method of analysis.)

Spectrographic oil analysis results will vary for reasons exclusive of engine condition. Chemical composition of engine oils vary by manufacturer. For consistent, meaningful analysis, service the engine with the appropriate grade of aviation engine oil from the same manufacturer, collect engine oil samples at regular intervals and submit the samples to the same laboratory for analysis.

6-3.9. Ignition System Maintenance

6-3.9.1. Magneto Timing

Equipment Required

- Eastern Technology Corporation Model E-25 Timing Indicator (or equivalent)
- Top Dead Center Locator
- Eastern Technology Corporation Model E50 timing light (or equivalent)

NOTE: Instructions to turn the crankshaft clockwise or counterclockwise in Section 6-3.9.1.1 and Section 6-3.9.1.2 reference the pilot's perspective, viewed from behind the propeller. Standing in front of the engine, all directions are opposite of the printed text.

6-3.9.1.1. Crankshaft Top Dead Center Alignment

WARNING

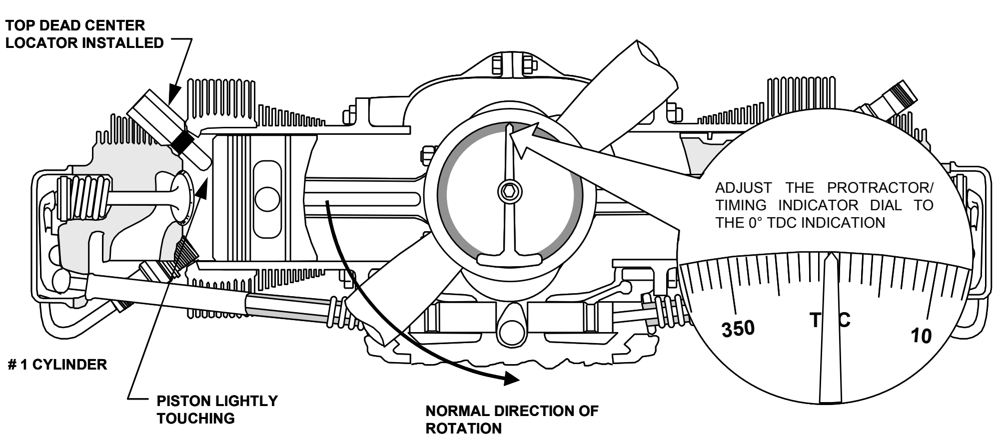
Turn the Ignition Switch OFF and disconnect engine electrical power before commencing maintenance or inspections. Confirm continuity between the magneto capacitor and aircraft ground to prevent accidental engine start during maintenance. Do not stand or place equipment within the arc of the propeller.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

CAUTION: Incorrect timing, in addition to a rough running engine, can lead to detonation, pre-ignition, possible internal engine damage, or engine failure.

Gravity affects the timing indicator pendulum position. Prior to checking or adjusting engine timing, level the aircraft (engine).

NOTE: Some starter adapters incorporate a spring clutch design that restricts reverse engine rotation. If the engine does not freely turn in the opposite direction of normal rotation, remove the starter motor to complete magneto to engine timing.

1. Place the fuel selector valve in the OFF position.
2. Turn the ignition switch to the OFF position. Disconnect the aircraft battery according to the airframe manufacturer's instructions.
3. Remove top spark plugs from each cylinder. Find the No. 1 cylinder compression stroke by placing a finger over the spark plug hole and rotating the crankshaft. When the cylinder is on the compression stroke, the valves will be closed and pressure will build as the piston moves to the top of the cylinder. Pressure buildup in the cylinder can be felt at your fingertip.
4. Install the top dead center (TDC) locator (Figure 6-11) in the No. 1 cylinder spark plug hole.



NOTE: THE PROTRACTOR/TIMING INDICATOR SHOWN IS USED WITH THE PROPELLER AND SPINNER INSTALLED.

Figure 6-11. Timing Disk and TDC Locator Installed

NOTE: Ensure the timing disk is securely fastened to the propeller to prevent movement during engine timing.

5. Securely install the timing disk indicator on the crankshaft flange, propeller spinner or propeller hub using the supplied elastic bands.
6. Turn propeller slowly in the direction of normal rotation until the piston lightly touches the top dead center locator.
7. Rotate the timing disc until the Top Dead Center (TDC) mark aligns with the weighted pendulum pointer.
8. Slowly rotate the crankshaft in the opposite direction of normal rotation until the piston again lightly touches the top dead center locator (Figure 6-12).

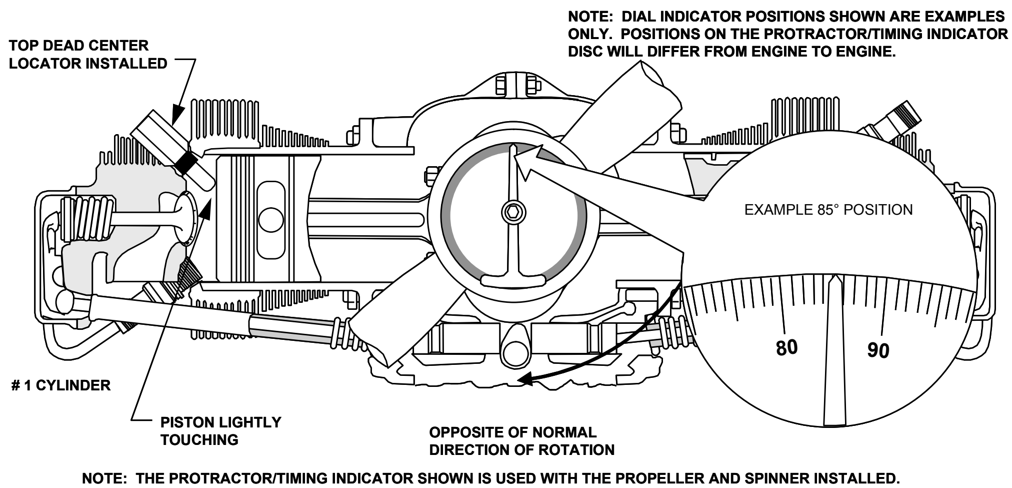


Figure 6-12. No. 1 Cylinder Positioned at Top of Intake Stroke

9. Determine the difference between TDC and the current pointer indication (Figure 6-12) and divide by two; turn the timing disk to align the pointer with the resulting number (Figure 6-13), without turning the timing indicator base.

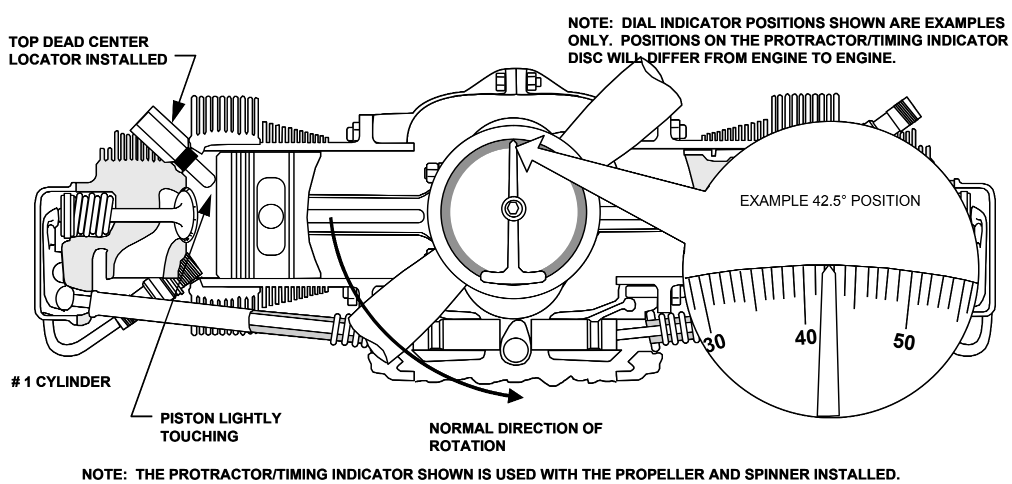
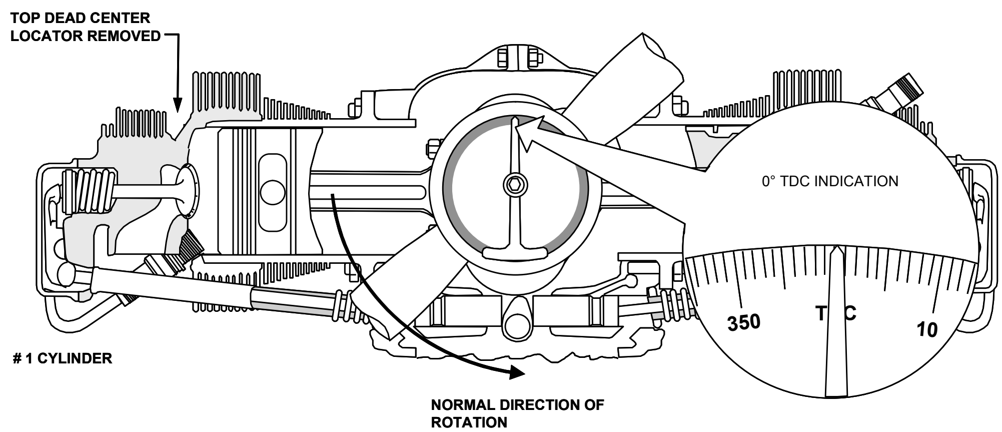


Figure 6-13. Crankshaft Positioned at TDC

10. Remove the Top Dead Center locator from the No.1 cylinder (Figure 6-14).

NOTE: Impulse couplings may trip on either side of TDC. The impulse couplings must be tripped in order for the timing light to respond correctly to the ignition point setting.

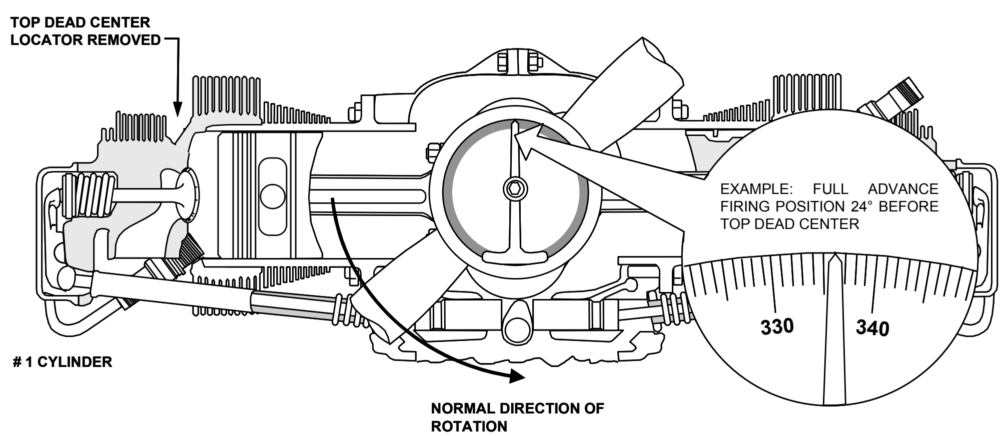
11. Rotate the crankshaft in the direction of normal rotation on the compression stroke until the pointer aligns with the 0° mark. On magnetos equipped with impulse couplings, continue turning the crankshaft in the direction of normal rotation until each impulse coupling trips. Couplings may trip a few degrees on either side of TDC. If one or both couplings trip after TDC, rotate the crankshaft opposite of the direction of normal rotation a few degrees before TDC, then back in the direction of normal rotation toward TDC. Impulse couplings should not be armed at this point.
12. The crankshaft is now positioned at Top Dead Center (TDC) of the No. 1 cylinder compression stroke.



NOTE: THE PROTRACTOR/TIMING INDICATOR SHOWN IS USED WITH THE PROPELLER AND SPINNER INSTALLED.

Figure 6-14. Cylinder No. 1 Top of Compression Stroke

13. Rotate the crankshaft in the opposite direction of normal rotation beyond the engine timing specification to remove gear backlash. Rotate the crankshaft in the direction of normal rotation until the pointer aligns with the 22°BTC mark on the timing disk. The engine is now prepared for magneto removal, installation or magneto to engine timing.



NOTE: THE PROTRACTOR/TIMING INDICATOR SHOWN IS USED WITH THE PROPELLER AND SPINNER INSTALLED.

Figure 6-15. No. 1 Cylinder Full Advance Firing Position

6-3.9.1.2. Magneto to Engine Timing

Procedure

1. Complete Section 6-3.9.1.1, "Crankshaft Top Dead Center Alignment."

   NOTE: Be familiar with the test equipment function prior to use. Some timing lights indicate proper ignition timing by illuminating a lamp; other models illuminate a lamp until the magneto cam lobe opens the circuit and turns the lamp off while other timing indicators use an audible signal to indicate timing status.

2. Disconnect the P-leads from the magnetos. Connect a timing light right lead to the right magneto ground terminal and the left lead to the left magneto ground terminal. Connect the timing light ground lead to a suitable ground on the engine such as an unpainted bolt or stud.

   NOTE: Engines equipped with impulse coupling magnetos must be turned in the direction of normal rotation past the impulse coupling trip point prior to centering the pointer at engine timing mark.

3. With the crankshaft in the correct timing position, turn the crankshaft in the opposite direction of normal rotation a few degrees before 22°BTC to clear valve backlash. Turn the crankshaft in the direction of normal rotation toward the point of ignition and observe the timing light as the needle approaches 22°BTC. As the pointer aligns with the correct ignition timing, the timing light should indicate proper timing. Lightly tap the end of the pointer with a finger to verify the pointer position.

4. If the timing light fails to illuminate, loosen the nuts securing the magneto to the mounting flange and rotate the magneto to the left or right in the mount until the lamp illuminates. If magneto timing adjustment is not possible, remove the suspect Continental Motors magneto and repair according to the Magneto Service Manual; If the magneto is not manufactured by Continental Motors, replace the suspect magneto with a new, rebuilt, or serviceable unit.

   CAUTION: Do not exceed the specified magneto to flange torque. Excessive torque will crack the magneto mounting flange.

5. Torque the correctly timed magneto fasteners to Appendix B specifications.

6. Remove the protractor and timing disk from the propeller flange, spinner or propeller hub. Reconnect the ground switch (P-leads) wires to the magneto.

7. Inspect the spark plugs according to Section 6-3.9.2.

8. Inspect the ignition harness according to Section 6-3.9.3.

9. Connect the aircraft battery according to the aircraft manufacturer's instructions.

6-3.9.2. Spark Plug Maintenance

Procedure

1. Remove the ignition harness leads from all spark plugs.
2. Remove the spark plug from the top and bottom of each cylinder. Mark each plug's installed location during removal.
3. Inspect plug condition using Figure 6-16 for spark plug serviceability. Discard spark plugs that fail to meet the “normal electrode condition” characteristics.
4. Remove and discard the copper gaskets from all reusable spark plugs.
5. If a new spark plug is required, select one from the list in Table 6-6, or the most current version of SIL03-2.

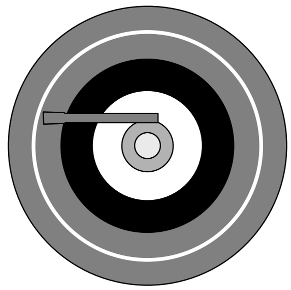
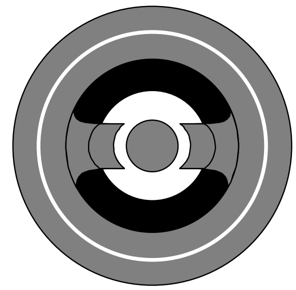
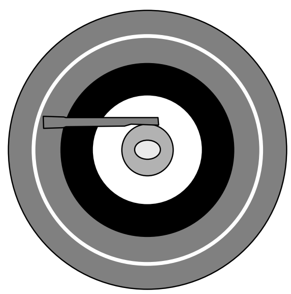
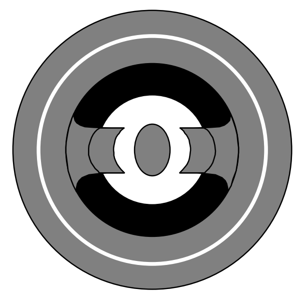
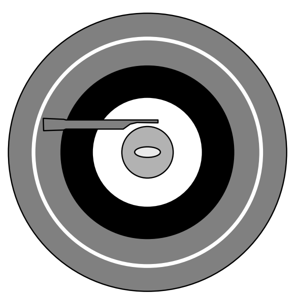
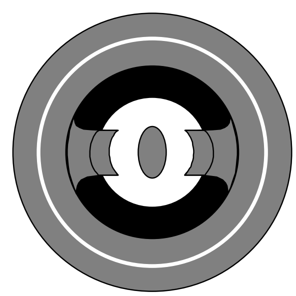
	FINE WIRE ELECTRODE	MASSIVE ELECTRODE
NORMAL ELECTRODE CONDITION •INSULATOR TIP GRAY, TAN OR LIGHT BROWN •FEW COMBUSTION DEPOSITS •ELECTRODES NOT BURNED OR ERODED •PROPER TYPE AND HEAT RANGE PLUG FOR ENGINE AND SERVICE. •SPARK PLUG SHOULD BE CLEANED, REGAPPED AND TESTED BEFORE REINSTALLTION		
NORMAL WORN-OUT CONDITION •ELECTRODES ERODED BY HIGH VOLTAGE SPARKING AND BY CORROSIVE GASES FORMED DURING COMBUSTION TO LESS THAN 1/2 ORIGINAL THICKNESS •MORE VOLTAGE NEEDED TO FIRE SPARK PLUGS - OFTEN MORE THAN IGNITION SYSTEM CAN PRODUCE. •REPLACE WITH NEW APPROVED AVIATION SPARK PLUGS.		
SEVERE WORN-OUT CONDITION •EXCESSIVELY ERODED CENTER AND GROUND ELECTRODES PLUS EXTENSIVE NECKING OF FINE WIRE GROUND ELECTRODES INDICATE ABNORMAL ENGINE POWER OR PLUGS LONG OVERDUE FOR REPLACEMENT. •DISCARD SPARK PLUGS AND CHECK HEAT RANGE BEFORE INSTALLING NEW ONES. •REPLACE WITH NEW APPROVED AVIATION SPARK PLUGS IN APPROPRIATE HEAT RANGE.		

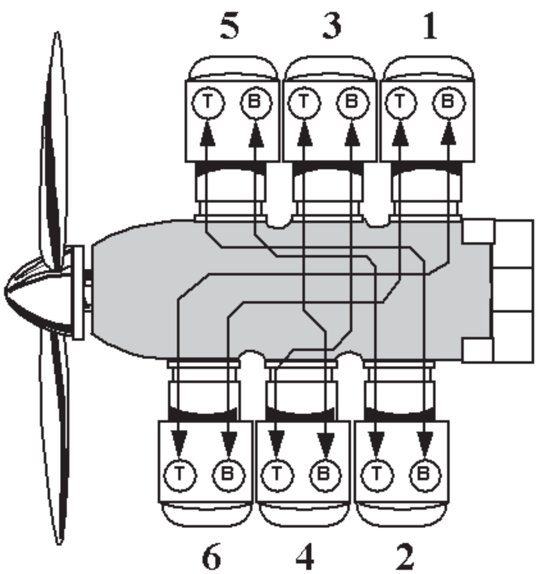
Figure 6-16. Spark Plug Inspection Criteria

6. Clean the spark plugs (new or serviceable) according to the cleaning instructions in Section 14-1. Set the spark plug gap to the spark plug manufacturer's data recommended setting for the spark plug part number.
7. Install new copper gaskets on all 12 spark plugs.

Table 6-6. IO-550 Approved Spark Plug List

Manufacturer Part Number	CMI Part Number	Barrel Size	Electrode Gap
TEMPEST			
URHB32E	655908	3/4”-20	.016”-.021”
URHB32S	658474	3/4”-20	.017”-.020”
CHAMPION			
RHB32E	N/A	3/4”-20	.016”-.021”
RHB36S	N/A	3/4”-20	.016”-.021”
RHB32S	N/A	3/4”-20	.016”-.021”

8. Refer to the spark plug rotation chart (Figure 6-17); mark serviceable spark plugs with the respective “TO” cylinder number. For all remaining locations, replace with a new spark plug.



CYLINDER ROTATION	
CYLINDER NUMBER	CYLINDER NUMBER
FROM	TO
1 TOP	6 BOTTOM
1 BOTTOM	6 TOP
2 TOP	5 BOTTOM
2 BOTTOM	5 TOP
3 TOP	4 BOTTOM
3 BOTTOM	4 TOP
4 TOP	3 BOTTOM
4 BOTTOM	3 TOP
5 TOP	2 BOTTOM
5 BOTTOM	2 TOP
6 TOP	1 BOTTOM
6 BOTTOM	1 TOP

Figure 6-17. Spark Plug Rotation Chart

9. Sparingly apply the spark plug manufacturer’s recommended thread lubricant to all except the first row of threads on the spark plug.
10. Thread each spark plug by hand into the engine cylinder head within one to two threads of the gasket. If the spark plug cannot be easily turned by hand, inspect the cylinder and spark plug threads. Clean or repair the threads, as thread condition requires.
11. Torque the spark plugs to Appendix B specifications using a calibrated torque wrench and six-point deep well socket.

6-3.9.3. Ignition Harness Maintenance

NOTE: Cable outlet plates are keyed to attach to the magneto in only one position. No. 1 position marked on the magneto cover aligns with the Cylinder No. 1 spark plug firing position.

Procedure

1. Inspect the spark plug leads for chafing, heat damage, wear or cracking. Replace damaged cables, if repair kits are available, or replace the harness.
2. Clean and spray the mating surfaces with MS-122AD spray before installing harness on magneto.
3. Install and tighten the screws around the cable outlet plate alternately to seat the cover squarely on magneto. Torque the screws to Appendix B specifications.
4. Refer to the airframe manufacturer's instructions for specific ignition harness routing through baffling and cushion clamp placement. Observe the following precautions when installing the ignition harness on the engine:
    a. Support leads with the necessary clamps and cable ties to prevent whipping or chafing action. Inter-cylinder baffles are fitted with nut plates to secure ignition harness clamps.
    b. Refer to the airframe manufacturer’s instructions for routing the ignition through baffling and cushion clamp placement; ensure the ignition harness is not routed in close proximity to the exhaust system.
    c. Wipe the spark plug lead connector clean using a lint-free cloth moistened with isopropyl alcohol
    d. To prevent the sleeves from sticking and minimize twisting of the ferrule, coat the insulating sleeves (see Figure 6-18) with MS-122AD spray.

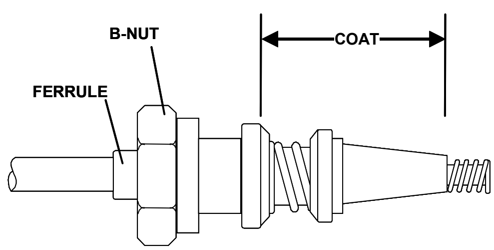


Figure 6-18. Lubricate Ignition Wire with MS-122AD

    e. Apply a light coat of Shell Alvania No. 2 lubricant to the contact point between the nut seat and ferrule on each ignition lead.
    f. Route the ignition leads to the cylinder number and position found on the labels on the loose end of the cable. If the labels are missing or unclear, refer to the ignition harness routing illustrations (Figure 6-19 or Figure 6-20). Secure the ignition leads to the rocker covers using the ignition lead cushion clamps and rocker cover fasteners.
5. Verify the inside of the spark plug barrel is clean and dry.

CAUTION: Hold ferrules while torquing or loosening spark plug coupling nuts to protect the ignition cable from twisting.

6. Insert the spring-end of the lead into the spark plug barrel. While holding the ignition lead B-nut, firmly push the rubber insulator into the spark plug.
7. Push the ferrule against the spark plug and turn the B-nut clockwise. Continue turning the B-nut until it seats and is finger-tight. While holding the spark plug lead ferrule stationary, torque the B-nut to Appendix B specifications.
8. If all maintenance is complete, perform an "Engine Operational Check" according to the instructions in Section 6-3.7.

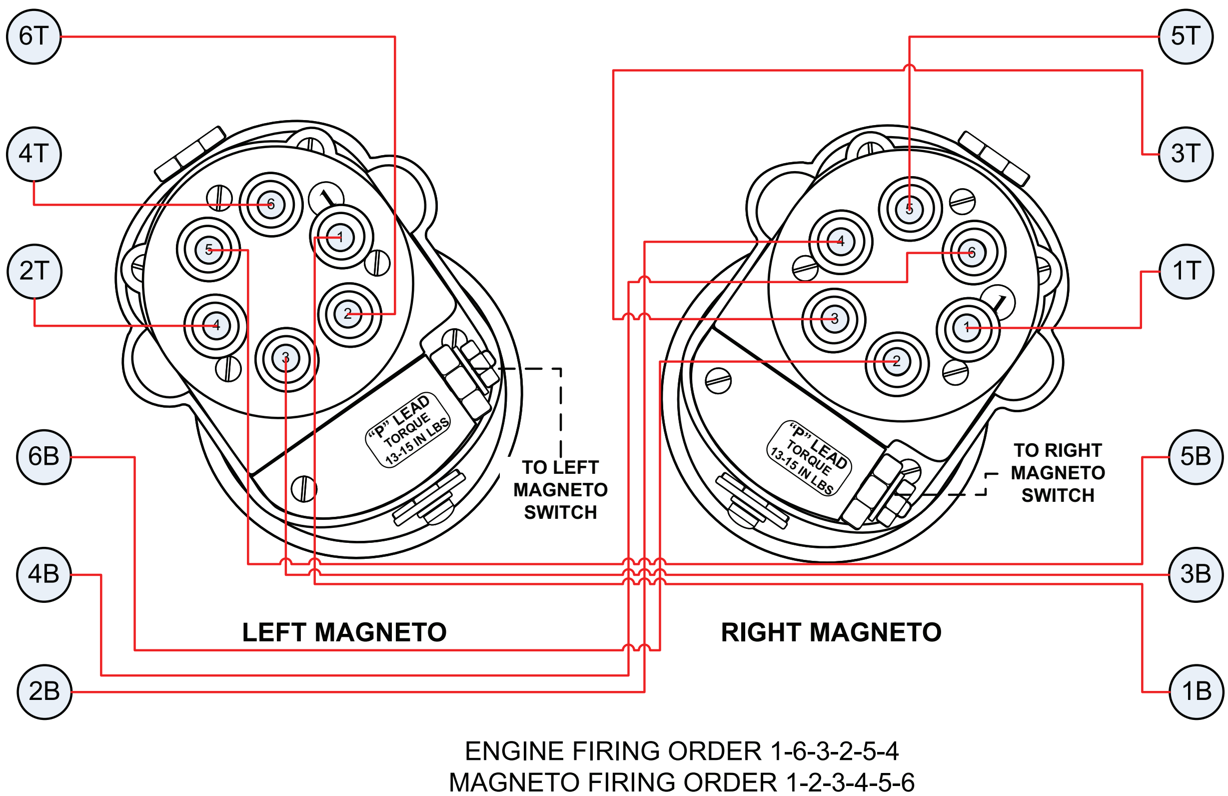
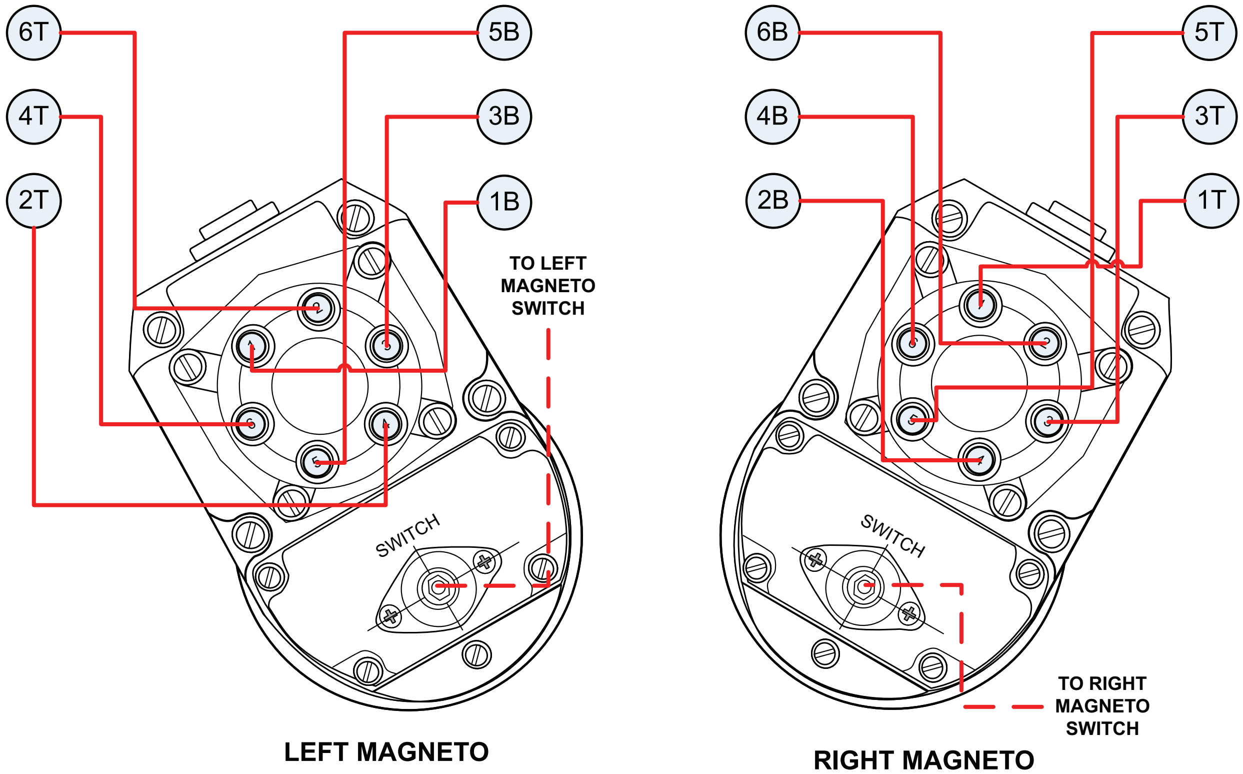


Figure 6-19. Champion (Slick) Ignition Harness Routing



ENGINE FIRING ORDER 1-6-3-2-5-4
MAGNETO FIRING ORDER 1-2-3-4-5-6

Figure 6-20. Continental Motors Ignition Harness Routing

6-3.10. Engine Adjustments

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.

The procedures listed herein apply to Continental Motors fuel injected engines in their original type design. For modified engine designs, refer to the Supplemental Type Certificate holder information and instructions.

NOTE: Before performing any engine fuel system adjustment, verify the aircraft fuel system and fuel pump are operating according to the airframe manufacturer's specifications and perform an “Engine Operational Check” according to the instruction in Section 6-3.7.

6-3.10.1. Oil Pressure Adjustment

Procedure

1. Perform an "Oil Pump Operational Check" according to the instructions in Section 6-3.7.3. Adjust oil pressure if the recorded pressure is not within the specified limits.

   NOTE: The engine oil temperature must be within normal operating range (75 - 240°F) before checking engine oil pressure.

2. Loosen the jam nut securing the oil pressure adjustment screw at the base of the oil pump (Figure 6-21).
3. Adjust oil pressure to maintain 30-60 psi at full power RPM. To *increase* oil pressure, turn the oil pressure adjusting screw (Figure 6-21) *clockwise (CW)*. To *decrease* oil pressure, turn the oil pressure adjusting screw *counterclockwise (CCW)*.
4. Torque the jam nut to Appendix B specifications and safety wire the jam nut according to instructions in Appendix C.

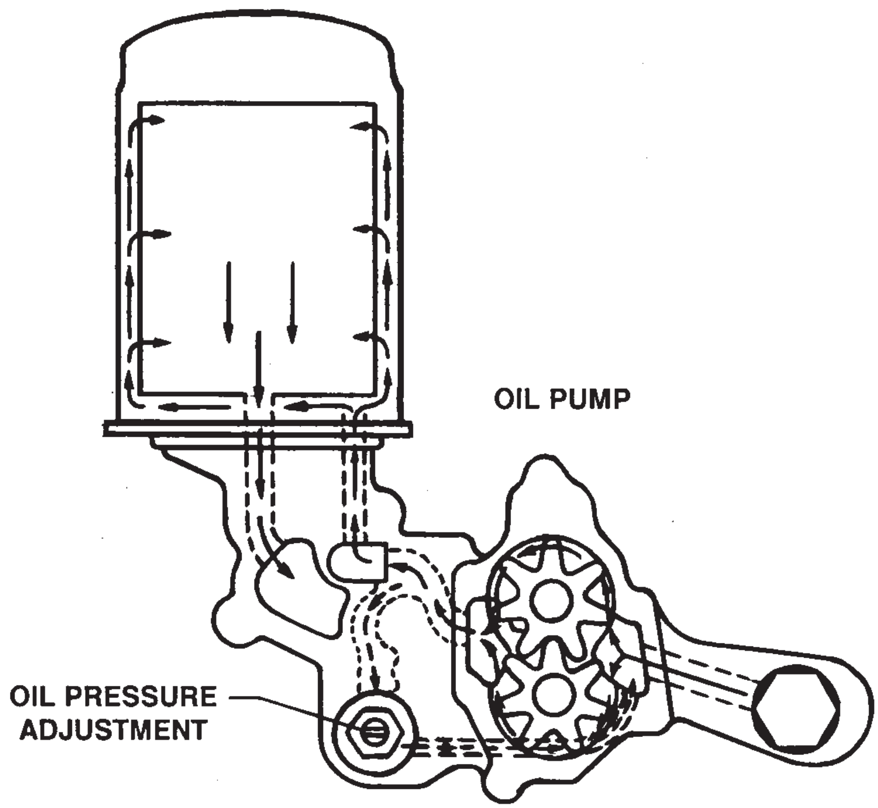


Figure 6-21. Oil Pressure Relief Valve Adjustment Screw

6-3.10.2. Fuel System Adjustment

Procedure

Perform the "Fuel System Operational Check" according to instructions in Section 6-3.7.4. Record operational check results on a copy of the "Engine Operational Checklist". Determine adjustment requirements according to results of the Operational Check.

WARNING

Make all adjustments with the engine stopped and the Ignition Switch and Master Power Switch in the OFF position!

NOTE: After each fuel system adjustment, restart the engine and operate the engine between 1500-1800 rpm for one minute before further system measurements or adjustments.

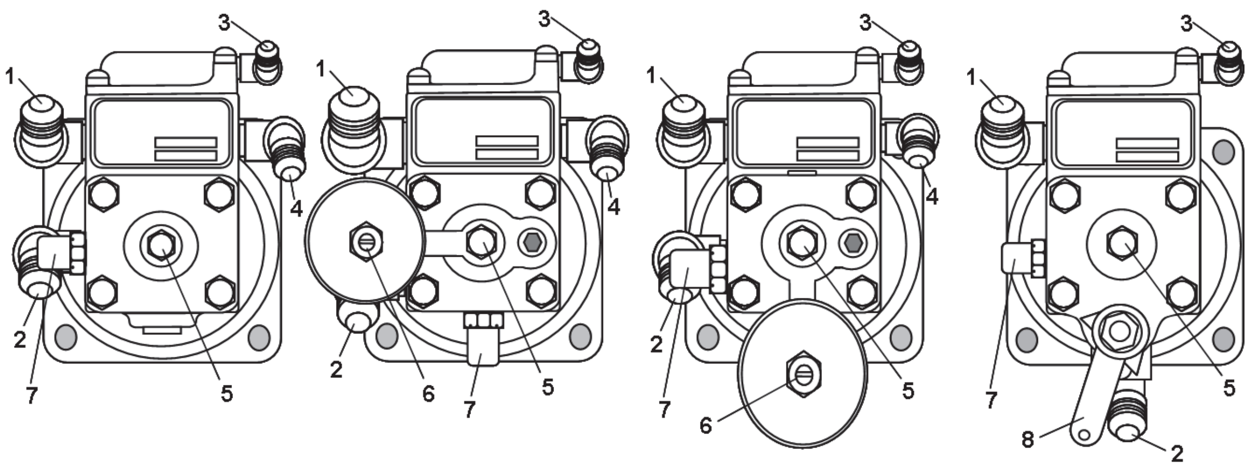


Figure 6-22. Fuel Pump Adjustments

1	Fuel Inlet	3	Fuel Vapor Return	5	Low Pressure Relief Valve Adjustment	7	Adjustable Orifice
2	Fuel Outlet	4	Fuel Return	6	Variable Orifice Adjustment	8	Mixture Control

Procedure

1. Unmetered Fuel Pump Pressure:

   a. Loosen the jam nut on the fuel pump low pressure relief valve assembly (Figure 6-22) (5).

   b. Turn the low pressure relief valve adjustment screw *clockwise* ***(CW)*** to *increase* unmetered fuel pump pressure, or *counter-clockwise* ***(CCW)*** to *decrease* unmetered fuel pump pressure.

   c. Tighten the jam nut on the low pressure relief valve adjustment screw but do not torque at this time; further adjustment may be required.

NOTE: set the IDLE RPM unmetered pressure to the minimum limit. With properly adjusted fuel/air mixture, this will provide slight fuel enrichment during part throttle operations.

2. Fuel Mixture Adjustment

   a. Turn the idle mixture adjustment screw in the direction specified in Figure 6-5 or Figure 6-6) to adjust mixture setting. Note the Idle Mixture Adjustment in Figure 6-5 requires clockwise (***CW***) rotation to **enrich** the fuel mixture while turning the idle mixture clockwise (***CW***) in Figure 6-6 will **lean** the fuel mixture. Repeat the operational check to verify the fuel system settings are adjusted within the specified limits.

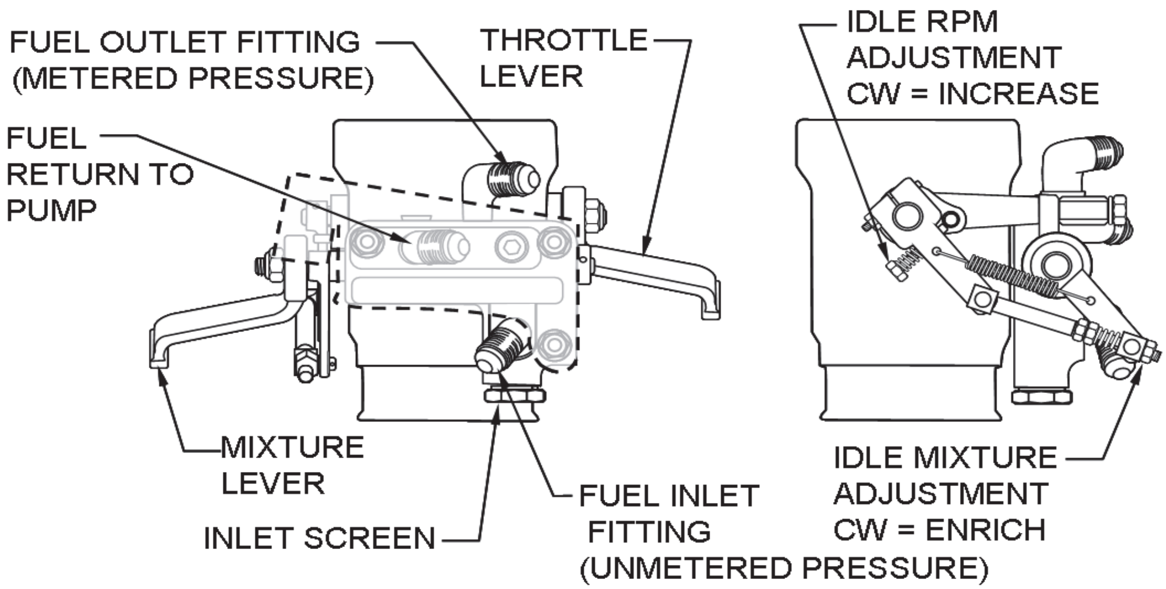


Figure 6-5 repeated for reference

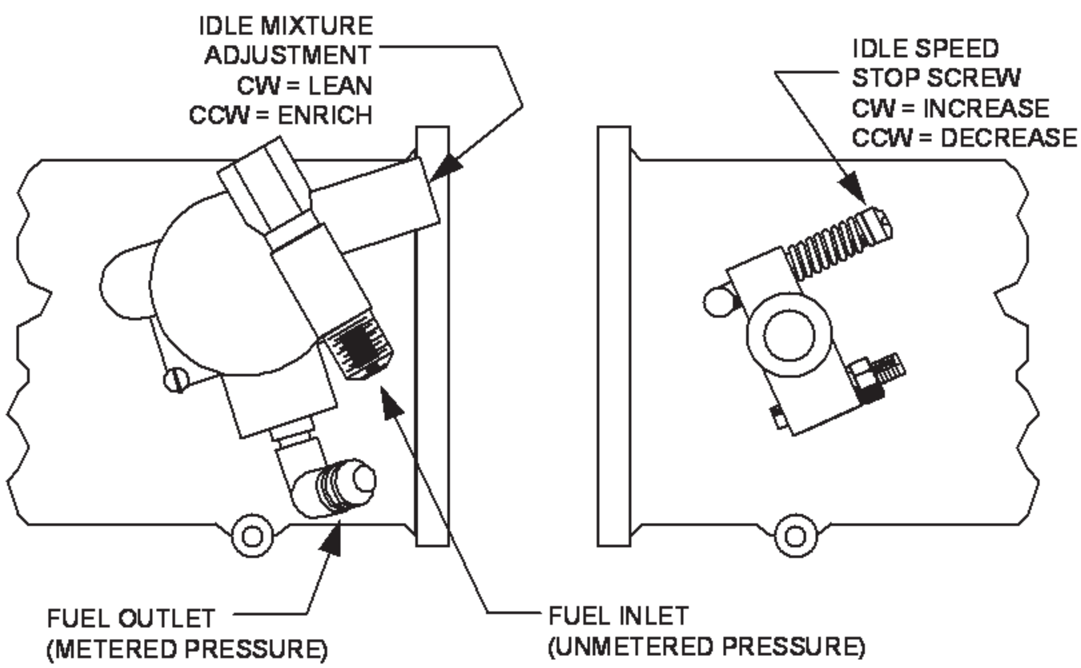


Figure 6-6 repeated for reference

3. Full Power Metered Fuel Pressure Adjustment
   Turn the adjustable orifice adjustment screw (Figure 6-22) clockwise (***CW***) to increase full power metered fuel pressure; turn the screw counter-clockwise (***CCW***) to decrease full power, metered fuel pressure.

Table 6-5 repeated for reference

<table>
<tr><th>Specification</th><th colspan="2">A B C</th><th>G</th><th>N</th><th>P</th><th>R</th></tr>
<tr><td>Full Throttle Speed +/- 25 RPM</td><td colspan="2">2700</td><td>2500</td><td>2700</td><td>2700</td><td>2700</td></tr>
<tr><td>Minimum Idle Speed</td><td colspan="2">600</td><td colspan="4">600</td></tr>
<tr><td>Unmetered Fuel Pressure @ idle (psi)</td><td colspan="2">8.0 -10.0</td><td colspan="4">8.0-10.0</td></tr>
<tr><td rowspan="4">Metered Fuel Pressure (psi)</td><td>A</td><td>17.7-20.0</td><td colspan="2">G</td><td colspan="2">14.7-16.0</td></tr>
<tr><td>B</td><td>16.5-18.4</td><td colspan="2">N</td><td colspan="2">19.0-21.3</td></tr>
<tr><td>C</td><td>17.6-19.6</td><td colspan="2">P</td><td colspan="2">19.0-21.3</td></tr>
<tr><td colspan="2"></td><td colspan="2">R</td><td colspan="2">19.0-21.3</td></tr>
</table>

4. Recheck IDLE unmetered fuel pump pressure, IDLE mixture rise and full power metered fuel pressure until all are within the specified limits (Table 6-3).
5. After final adjustments are complete, carefully torque the jam nut on the low pressure relief valve to Appendix B specifications without disturbing the fuel system adjustments. Do not exceed lock nut torque limits.
6. Check idle speed unmetered fuel pump pressure, fuel mixture setting and full power metered fuel pressure to verify fastener torque did not affect fuel system adjustments. If values are not within specified limits, repeat the adjustment procedures.

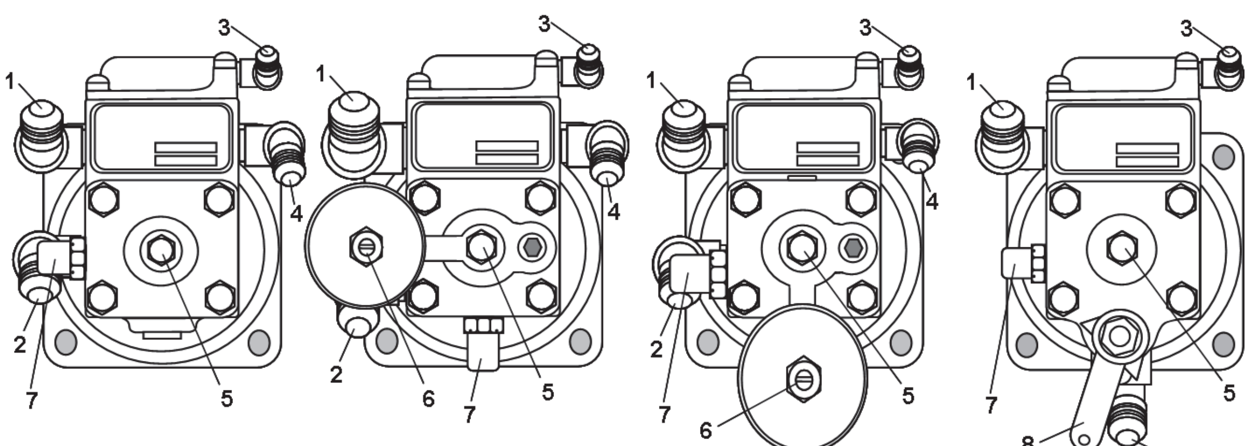


Figure 6-22 repeated for reference

WARNING

Make all adjustments with the engine stopped and the Ignition Switch and Master Power Switch in the OFF position!

NOTE: After each fuel system adjustment, restart the engine and operate the engine between 1500 and 1800 rpm for one minute before further system measurements or adjustments.

7. IDLE RPM Adjustment
   After adjusting fuel pressures to meet specifications, adjust the IDLE RPM to the desired setting that provided smooth operation with minimal control adjustment for ground operation. Do not adjust the IDLE setting below the minimum setting.
   a. Turn the idle RPM adjustment screw until the end of the screw contacts the throttle stop pin.
   b. Turn the idle RPM adjustment screw clockwise (**CW**) to increase idle RPM or counter-clockwise (**CCW**) to decrease idle RPM.

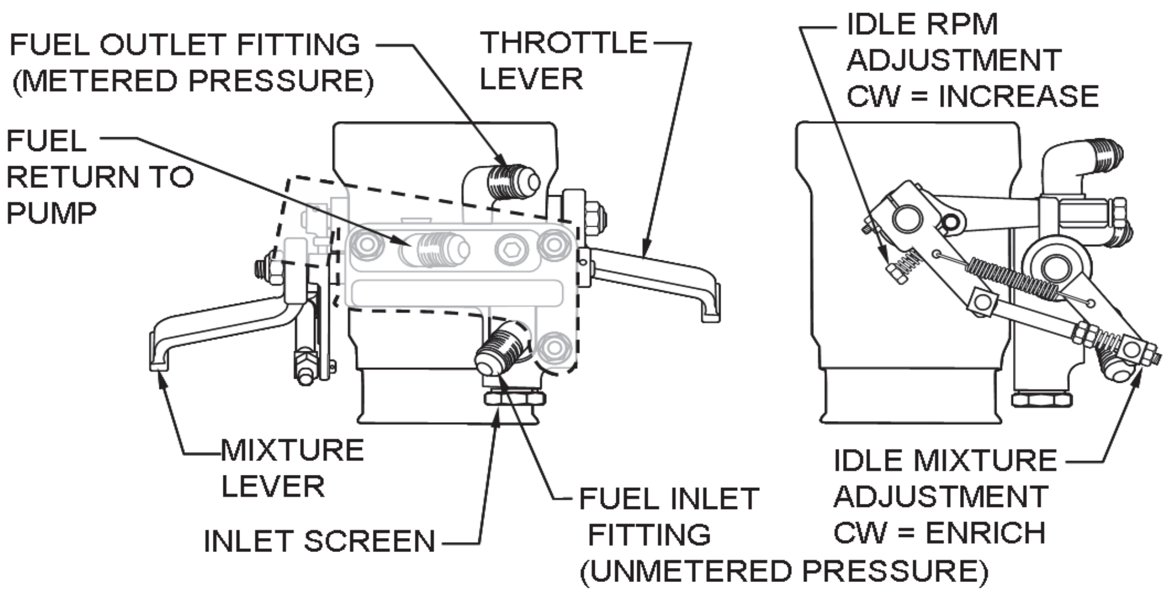


Figure 6-5 repeated for reference

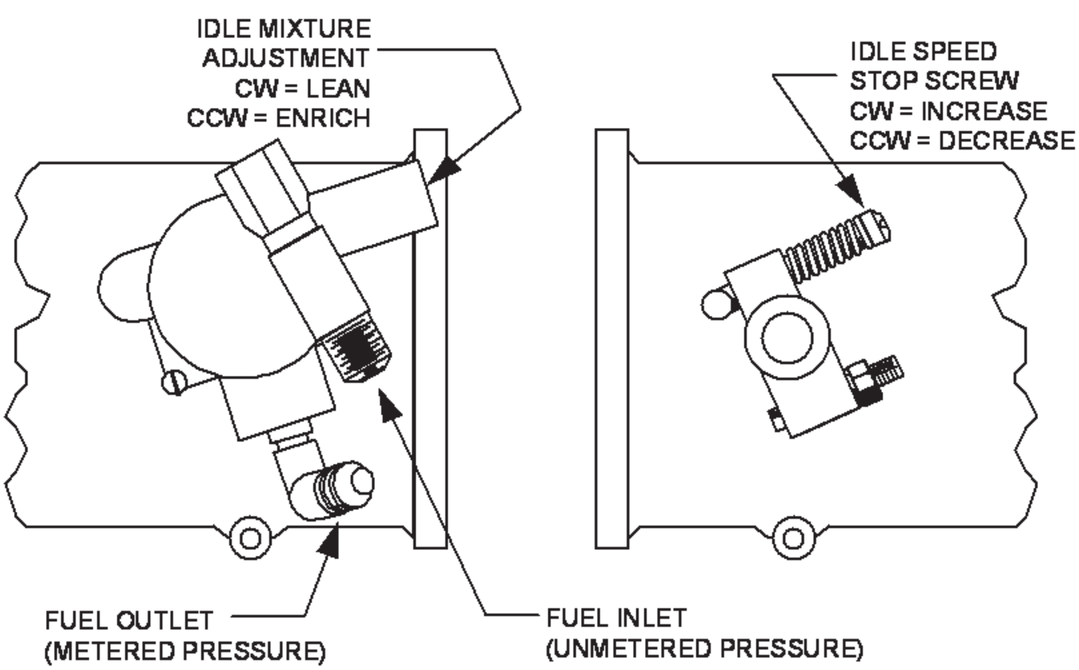


Figure 6-6 repeated for reference

6-3.10.3. Auto Leaning Schedule Adjustments

CAUTION: Do not attempt to adjust the IO-550-A or C auto-leaning schedule at field elevations higher than 1000 ft above sea level. Do not attempt to adjust the IO-550-B auto-leaning schedule at field elevations higher than 3000 ft above sea level.

The altitude compensating fuel pump auto-leaning schedule is a function of the bellows installed in series with the adjustable orifice on the fuel pump. Perform an "IO-550 Altitude Compensating Fuel System Flight Check" according to the instructions in Section 7-2.3.3 to determine if the auto-leaning function is operating within the limits specified in Table 7-1 and Figure 7-1 through Figure 7-3. Auto leaning schedule adjustments may require the engine operational check and adjustments to be repeated.

NOTE: Variable orifice (aneroid) adjustments affect fuel pump unmetered and metered fuel pressures and consequently fuel flow. Make adjustment in small increments to avoid drastic changes to fuel pump operating characteristics. Variable orifice adjustments will require the Engine Operational Check to be repeated; further unmetered and metered fuel pressure adjustments may be required.

Procedure

1. If installed, cut the safety wire as close as possible to the stem of the variable orifice adjustment (6) and remove the lead seal and safety wire from the variable orifice (Figure 6-22). Trim and twist the remaining safety wire pigtail according to instructions in Appendix C to secure the fuel pump through bolts. It is not necessary to replace the variable orifice safety wire in the field.

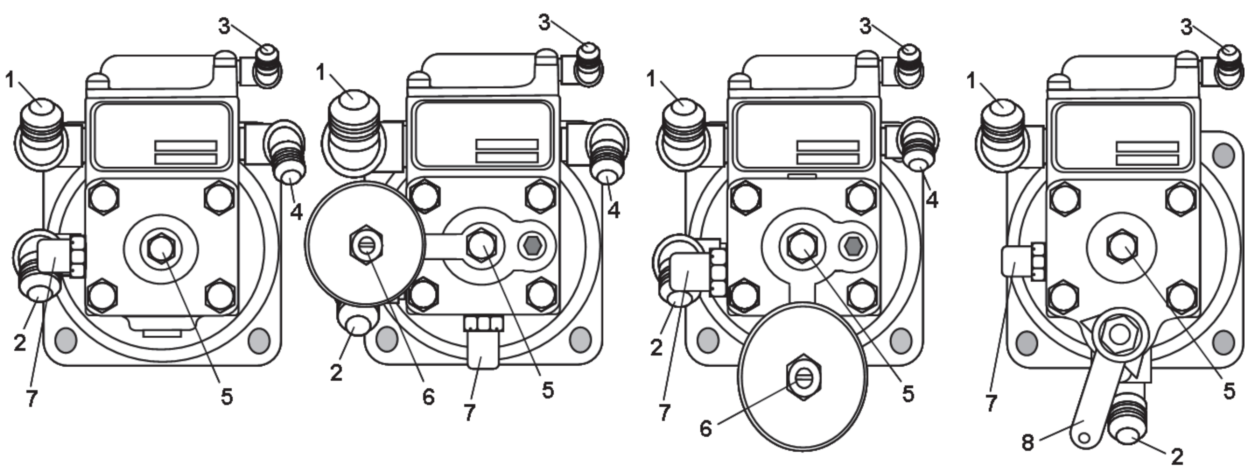


Figure 6-22 repeated for reference

CAUTION: Excessive force applied to the adjustable orifice (aneroid) stem will damage the fine threads on the aneroid or the jam nut. Do not over-torque the jam nut.

2. Loosen the variable orifice jam nut and unscrew the jam nut to allow the adjustment to turn freely.

CAUTION: The variable orifice (aneroid) adjustment terminates with a tapered needle valve inside the aneroid housing. The needle valve will be damaged if forced against the seat. If resistance increases while turning the variable orifice adjustment clockwise, turn the variable orifice adjustment screw in the opposite direction to relieve pressure. Do not apply excessive force to the variable orifice adjustment screw stem or jam nut.

3. Turn the variable orifice adjustment screw one (1) revolution for each 1000 feet required to correct the auto-leaning schedule. Clockwise adjustment decreases pressure altitude; Counterclockwise adjustment will increase pressure altitude.
4. Hold the variable orifice adjustment screw in place with a screwdriver while securing the jam nut against the aneroid housing. Torque the jam nut to Appendix B specifications.
5. Repeat the Engine Operational Check to verify unmetered fuel pressure, IDLE mixture rise, metered fuel pressure, and idle adjustment.
6. Repeat the "IO-550 Altitude Compensating Fuel System Flight Check" according to instructions in Section 7-2.3.3 to verify the Auto-leaning Schedule meets the engine specifications in Table 7-1 and Figure 7-1 through Figure 7-3.

6-3.10.4. Belt Tension Check and Adjustment

IO-550 engines may be fitted with an optional belt driven refrigerant 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.

6-3.10.4.1. Refrigerant Compressor Drive Belt Tension Check and Adjustment

Procedure

1. Inspect the drive belt for obvious signs of wear, nicks, or cracks; replace if necessary.
2. Check the belt tension at the point indicated in Figure 6-23 with a Direct Reading Tension Gauge (Ideal Aviation BT-33-73FIA in Section 3) for 50 to 70 pounds of belt tension or measure belt deflection with a five pound load at the center of the longest belt span for 0.30 to 0.40 inches of deflection. If deflection is within tolerance, document the inspection results. To adjust belt tension, proceed to the next step.

   NOTE: One full turn of the adjusting screw yields approximately 10 pounds change in tension.

3. Loosen the jam nut on the idler pulley. Tighten the adjusting bolt to increase tension, loosen the adjusting bolt reduce tension. When properly adjusted, secure the adjusting bolt with the jam nut and torque according to Appendix B specifications.

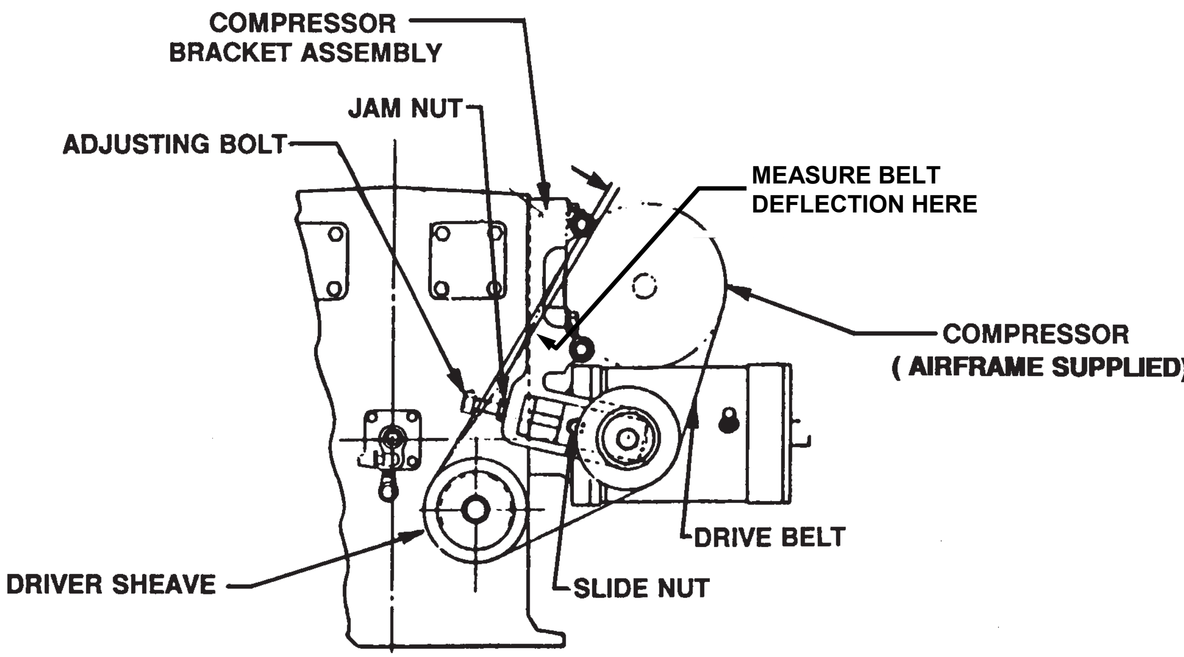


Figure 6-23. Refrigerant Compressor Belt Tensioning

6-3.10.4.2. 70 Amp Alternator Drive Belt Tension Check and Adjustment

Procedure

1. Inspect the drive belt for obvious signs of wear, nicks, or cracks; replace if necessary.
2. Inspect the bracket, brace, and associated hardware for cracks or physical damage; replace if necessary.
3. Check the belt tension at the center of the span between the drive sheave and the alternator with a Direct Reading Tension Gauge (Ideal Aviation BT-33-73FIA in Section 3) for 6-8 pounds of belt tension or no more than 0.11 inch deflection. If deflection is within tolerance, document the inspection results. To adjust belt tension, proceed to the next step.
4. Loosen the upper bolt (Figure 6-24) (4) washer (2) and nut (3) securing the alternator (12) to the bracket (1).
5. Loosen the pivot screw (9) securing the alternator (12) to the adjustable brace (10).
6. Remove the safety wire and loosen the screw (5) at the bottom of the adjustable brace (10).
7. Adjust the belt (11) tension until deflection is less than 0.11 inch and tighten the adjustment screw (5). Torque the adjustment screw to Appendix B specifications.
8. Torque the mounting nut (3) and pivot screw (9) to Appendix B specifications.
9. Safety wire the adjustment screw (5) to an nearby through bolt according to Appendix C instructions.

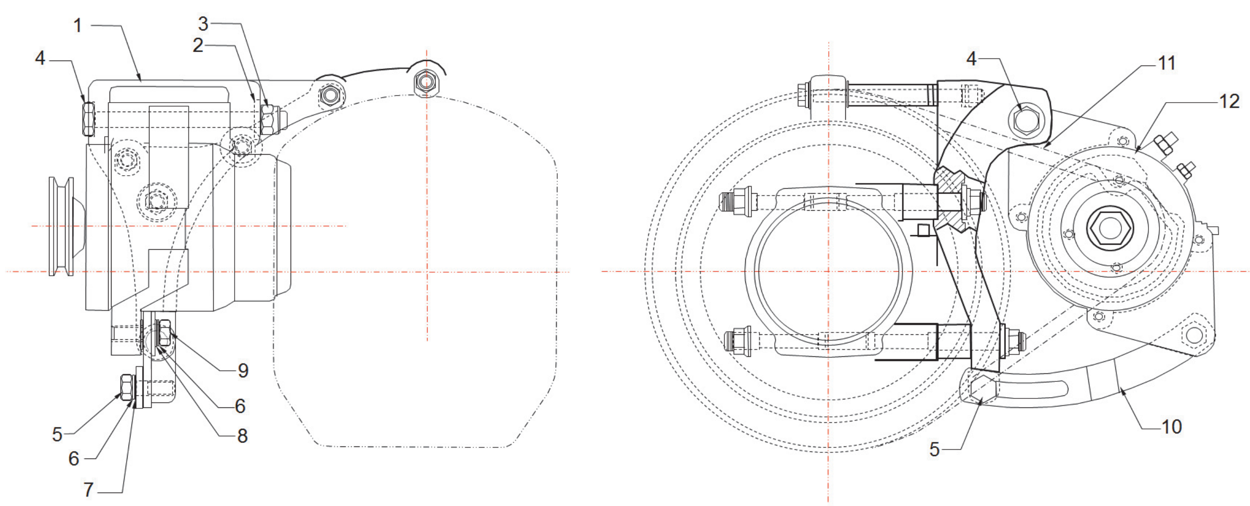


Figure 6-24. 70 Amp Alternator Belt Tensioning

1	Bracket Assembly	4	Bolt	7	Washer	10	Adjustable Brace
2	Washer	5	Screw	8	Washer	11	V-belt
3	Nut	6	Lock Washer	9	Screw	12	Alternator Assembly

6-3.10.4.3. 85 Amp Alternator Drive Belt Tension Check and Adjustment

Procedure

1. Inspect the drive belt for obvious signs of wear, nicks, or cracks; replace if necessary.
2. Check the belt tension at the center of the span between the drive sheave and the alternator with a Direct Reading Tension Gauge (Borroughs BT-33-73F) for 50-70 pounds of belt tension or no more than 0.11 inch deflection. If deflection is within tolerance, document the inspection results. To adjust belt tension, proceed to the next step.
3. Loosen the screw (Figure 6-25) (5) securing the alternator (10) to the adjustment brace (11).
4. Loosen the alternator mounting bolt (4) and nut (3) at the top of the bracket (1) to allow the alternator (10) to rotate.
5. Remove the safety wire and loosen the pivot screw (12) at the bottom of the alternator bracket (1).
6. Adjust the belt tension until deflection is less than 0.11 inch and tighten the adjustment screw (5). Torque the adjustment screw (8) to Appendix B specifications.
7. Torque the alternator mounting bolt (4) and pivot screw (5) to Appendix B specifications. Safety wire the pivot screw (5) to the hole drilled in the adjustment brace according to Appendix C instructions.

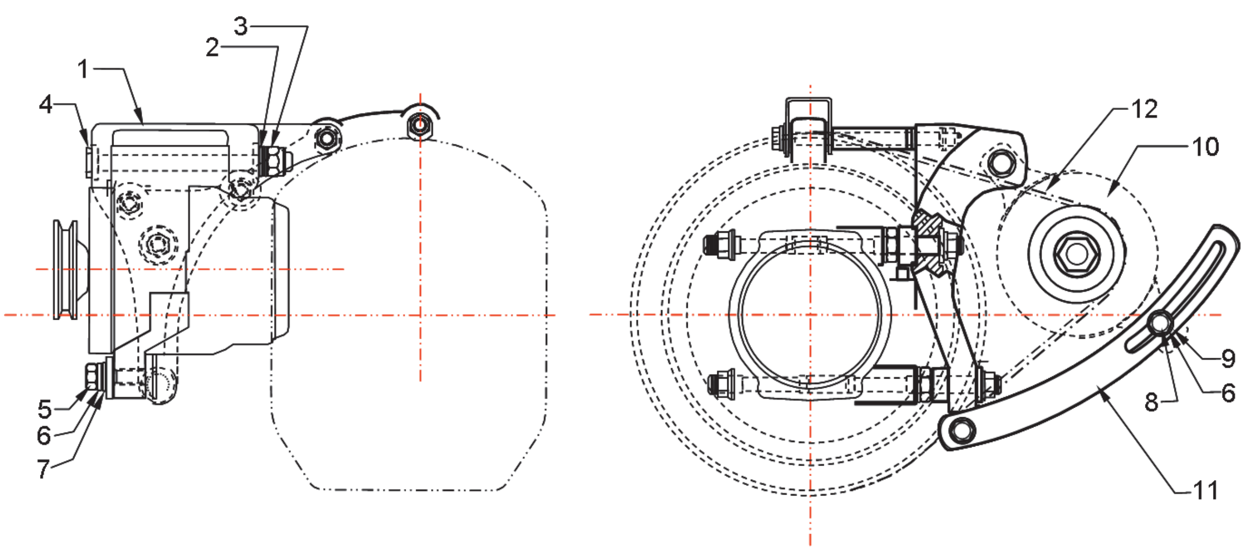


Figure 6-25. 85 Amp Alternator Belt Tensioning

1	Bracket Assembly	4	Bolt	7	Lock Washer	10	Alternator
2	Washer	5	Screw	8	Screw	11	Adjustment Arm
3	Nut	6	Lock Washer	9	Washer	12	V-belt

6-3.11. Cylinder Inspections

A complete cylinder inspection entails the tasks described in the respective sections Table 6-7 below. Performing all of the tasks in Table 6-7 ensures items that can affect cylinder operation have been inspected and verified for proper operation. Use a copy of the “Cylinder Inspection Checklist” on page 6-113 to record inspection progress and findings.

Table 6-7. Cylinder Inspection Tasks and References

Task[1]	Section Reference
Visually inspect cylinders	Section 6-3.11.1
Check cylinder differential pressure	Section 6-3.11.2
Inspect engine cylinders with borescope	Section 6-3.11.3
Inspect cylinder to crankcase mounting deck	Section 6-3.11.4
Inspect baffles	Section 6-3.11.5
Inspect cowling	Section 6-3.11.6

1. All tasks in this table must be performed for a complete cylinder inspection.

6-3.11.1. Cylinder Visual Inspections

Procedure

1. Remove the engine compartment cowling according to the airframe manufacturer's instructions and perform steps 2 & 3 without cleaning the engine.
2. Inspect the cylinder barrel power stroke areas (Figure 6-26) with an inspection mirror and light for cracks, sharp indentations, chafing, damage or pitting. Repair discrepancies according to instructions in Chapter 15. The power stroke areas include the:
   - Twelve o'clock area on the first six fins below the head on the 1-3-5 side of the engine as mounted on the crankcase.
   - Six o'clock area on the first six fins below the head on the 2-4-6 side of the engine as mounted on the crankcase.
3. Inspect the external surfaces of the cylinder head including the fins, intake and exhaust ports, top and bottom spark plug bosses and fuel nozzle bosses for cracks, exhaust flange leakage or any signs of oil, fuel, or soot leakage indicating the cylinder or the head-to-barrel junction structural integrity has been breached.

   NOTE: If discrepancies are noted during the visual inspection, perform a "Differential Pressure Test" according to instructions in Section 6-3.11.2 and a "Cylinder Borescope Inspection" according to instructions in Section 6-3.11.3.

4. Thoroughly clean the exterior of the engine according to instructions in Chapter 14 and repeat steps 2 & 3.

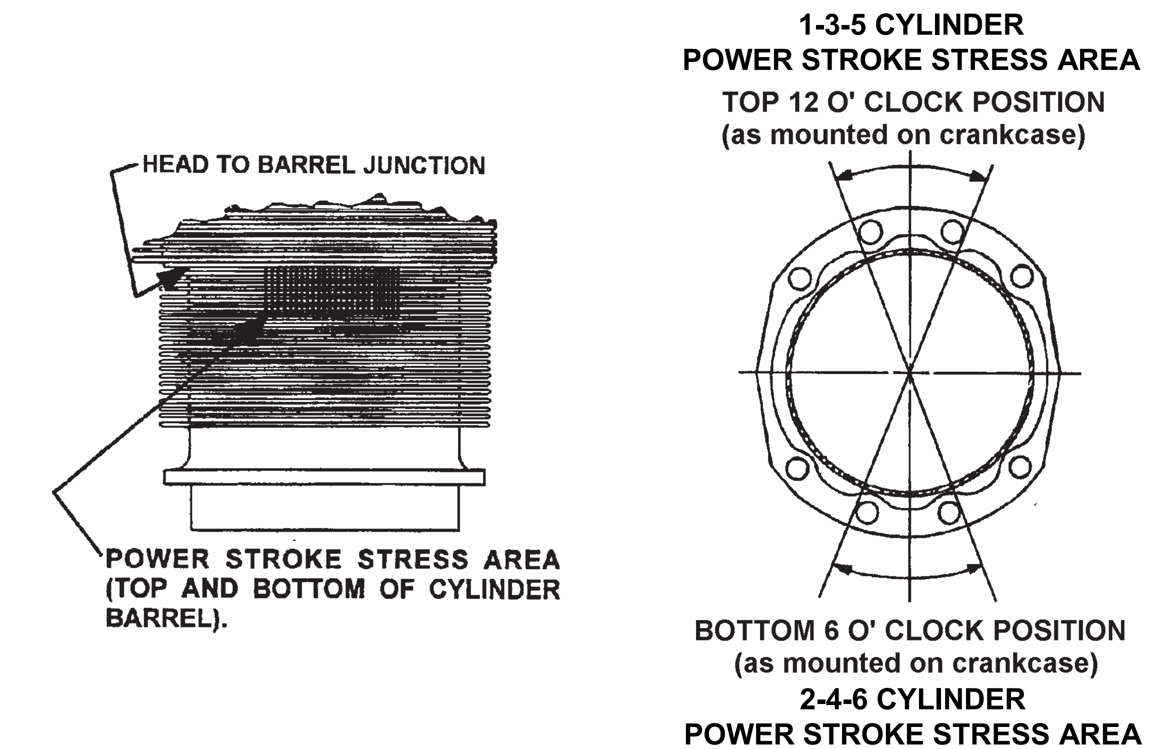


Figure 6-26. Cylinder Power Stroke Areas

6-3.11.2. Differential Pressure Test

Purpose

The Cylinder Differential Pressure Test is a nondestructive method of determining the internal condition of cylinders and cylinder components. As with any test or inspection, the Cylinder Differential Pressure Test has certain limitations that may necessitate its use in conjunction with other non-invasive inspections. The Cylinder Differential Pressure Test identifies leaks and the source of leaks, with the engine under static conditions (not running), using a regulated 80 psi pressure source. Marginal or unsatisfactory results of the Cylinder Differential Pressure Test or Cylinder Borescope inspections may indicate the need to perform additional inspections.

> NOTE: The static leak check does not relate directly to cylinder pressures developed during actual engine operations.

Monitor and record engine oil consumption, the appearance or color of the engine oil and any visual indications of high crankcase pressure (combustion blow-by) such as an oily, wet area on the aircraft belly or lower wing surface.

Monitor and record the engine's oil consumption, the appearance or color of the engine oil and any visual indications of high crankcase pressure (combustion blow-by) such as an oily, wet area on the aircraft belly or lower wing surface.

> NOTE: Prior to performing the cylinder differential pressure test, determine the baseline master orifice calibrated pressure reading according to instructions in Section 6-3.11.2.1.

Excess cylinder wall or piston ring wear, broken piston rings and burned valves exhibit additional symptoms that include, but are not limited to the following:

- Excessive cylinder barrel wear and/or piston ring wear:
  - Elevated crankcase pressure; see "Excess Crankcase Pressure" in Section 8-9.1.
  - Sudden increased oil consumption (based on trend monitoring)
  - Oil discolored within first 10 hours after an oil change
- Broken piston rings:
  - Scored, grooved cylinder wall, evident via a borescope inspection
  - Abnormal debris in oil filter or oil screen
- Burned valves:
  - Extremely low cylinder differential pressure test results
  - Usually evident during borescope inspection.

Many variables affect Differential Pressure Test results, such as:

- Abnormal amounts of oil in the cylinder
- Engine temperature and cylinder temperature uniformity
- Test equipment accuracy
- Capacity and quality of the compressed air source
- Techniques used by the technician when performing the test

Frequency

Perform the differential pressure test:

- During 100-hour or Annual inspections
- If excessive oil consumption or blow-by is suspected
- If the cylinder exhibits signs of accelerated wear

Test Equipment

- Dry, oil-free compressed air source capable of providing a minimum line pressure of 125 P.S.I. with a minimum flow capability of 15 Cubic Feet per Minute (CFM).

  NOTE: Master Orifice Tool (Part No. 646953A) is no longer available. Without the Master Orifice Tool, the Model E2A Differential Pressure Tester is not a valid test equipment option; the Model E2M Differential Pressure Tester must be used. If the facility performing the repairs is in possession of both a Model E2A Differential Pressure Tester and the Master Orifice Tool, the shop may continue to use them as alternatives to the Model E2M Differential Pressure Tester. Instructions in this manual apply only to the Model E2M Differential Pressure Tester.

  The Eastern Technology web site (eastertech.com) indicates a Model E2M-1000, with a 0.060 Master Orifice should be used on cylinders with a bore greater than 5.0 inches however, approved type certificate data pertaining to engines in this manual were approved by the FAA using a Model E2M Differential Pressure Tester with a 0.040 inch Master Orifice.

- Eastern Technology Corporation Model E2M Cylinder Differential Pressure Tester (Figure 6-27). This Differential Pressure Tester incorporates a 0.040 inch Master Orifice Tool.

WARNING

Differential Pressure Test equipment must be calibrated annually. Failure to properly maintain and calibrate the Differential Pressure Test equipment may result in misleading or erroneous Differential Pressure Test readings.

Perform the “Differential Pressure Tester Setup” instructions in Section 6-3.11.2.1 to calibrate the test equipment prior to conducting the Cylinder Differential Pressure Test. Perform the Cylinder Differential Pressure Test as soon as possible after the aircraft has returned from flight. If the aircraft cannot be flown prior to performing the Cylinder Differential Pressure Test, operate it on the ground, with the cowling installed until a minimum of 300 to 350°F (149 to 177°C) is observed on the aircraft cylinder head temperature (CHT) gauge.

WARNING

Shut the fuel supply off and ground the magnetos prior to performing the Differential Pressure Test to prevent accidental engine starts. Take necessary precautions to prevent accidental rotation of the propeller while performing this test. Differential pressure tests are best performed with two people, one to adjust the pressure regulator and one to hold the aircraft propeller.

The “Master Orifice” is a calibration standard that must be used prior to performing the Cylinder Differential Pressure Test. The Master Orifice establishes the acceptable cylinder pressure leakage limit for the test equipment being used and the atmospheric conditions at the time of the test. Record the acceptable cylinder pressure leakage limit, along with the individual cylinder readings in the engine logbook and on a copy of “Cylinder Inspection Checklist”on page 6-113.

6-3.11.2.1. Differential Pressure Tester E2M Setup

Perform this procedure to prepare the Model E2M Differential Pressure Tester (Figure 6-27) for use and establish the acceptable cylinder pressure leakage limit.

Procedure

1. Turn the Differential Pressure Tester pressure regulator valve OFF.
2. Position the Master Orifice Valve to the OFF position; handle is horizontal and directly over the OFF label.
3. Position the Slow Fill Valve (next to the pressure regulator) to the OFF position; handle is vertical, pointing down.
4. With the Slow Fill Valve in the OFF position, connect the air source to the Differential Pressure Tester male quick disconnect.
5. Adjust the pressure regulator for indicated 80 psi.
6. Set the Master Orifice Valve to the TEST position; handle is vertical, pointing down.
7. Turn the Slow Fill Valve to the PRESSURIZE position.
8. If necessary, adjust the pressure regulator to maintain an 80 psi indication on the regulator pressure gauge.
9. Record the cylinder pressure gauge indication on a copy of the Cylinder Inspection Checklist - this is the Acceptable Cylinder Pressure Leakage Limit.
10. Turn the Slow Fill Valve to the OFF position; handle is vertical, pointing down.
11. Turn the Master Orifice Valve to the OFF position; handle is horizontal, directly over the OFF label.
12. The Differential Pressure Tester is ready for use; proceed to Section 6-3.11.2.3, “Cylinder Differential Pressure Test.”

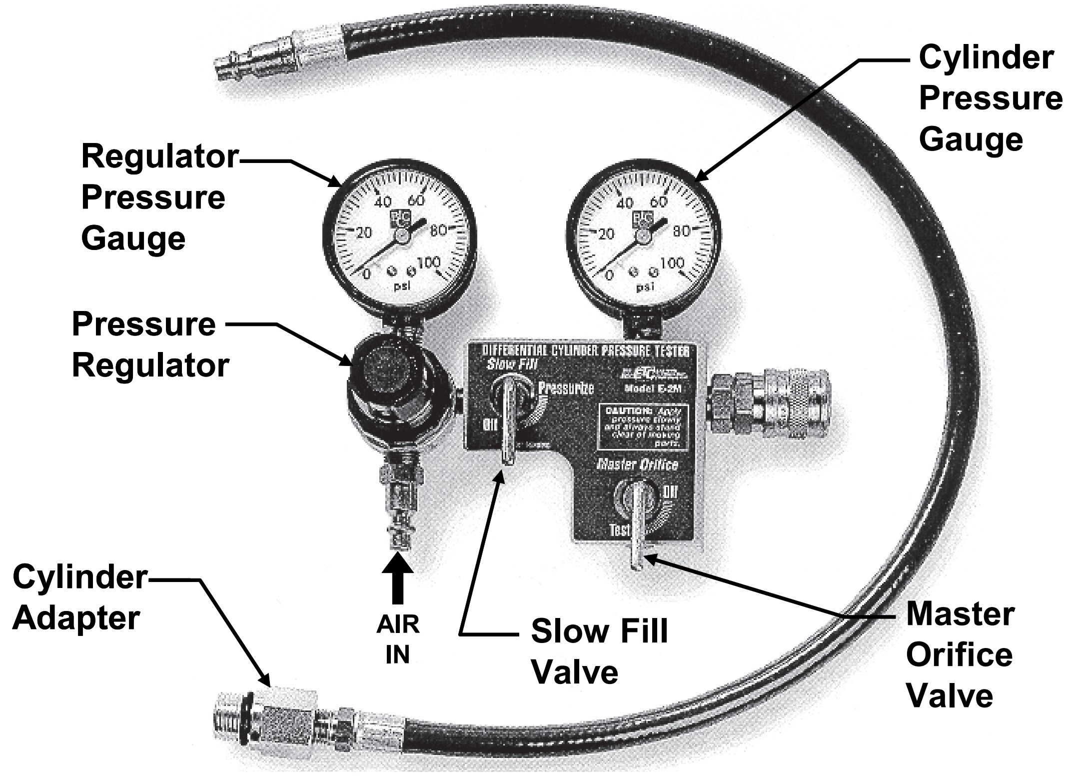


Figure 6-27. Model E2M Differential Pressure Tester

6-3.11.2.2. Differential Pressure Tester Reliability Check

Keep the Differential Pressure Tester clean and check it periodically for accuracy:

1. Apply a line pressure of 100 to 120 psi; close the Slow Fill Valve.
2. Adjust the pressure regulator to 80 psi. The pressure in both gauges should stabilize with no leakage.

6-3.11.2.3. Cylinder Differential Pressure Test

Have an assistant hold the propeller when applying air pressure to the cylinder to prevent propeller rotation.

WARNING

Turn the Ignition Switch OFF and disconnect engine power before commencing maintenance or inspections. Do not stand or place equipment within the arc of the propeller.

Procedure

1. Perform the test as soon as possible after engine shut down to ensure the piston rings, cylinder walls, and other engine parts are well lubricated and at operating clearance.
2. Remove the most accessible spark plug from each cylinder. Identify the cylinder number and position of the removed spark plugs. Examine the spark plugs to aid in diagnosing engine and cylinder conditions. Refer to the spark plug manufacturer’s technical data.

3. Turn the crankshaft by hand in the direction of rotation until the piston in the cylinder under test is positioned just before its compression stroke.
4. Install the cylinder adapter in the spark plug hole and connect the Differential Pressure Tester to the cylinder adapter (Figure 6-28).

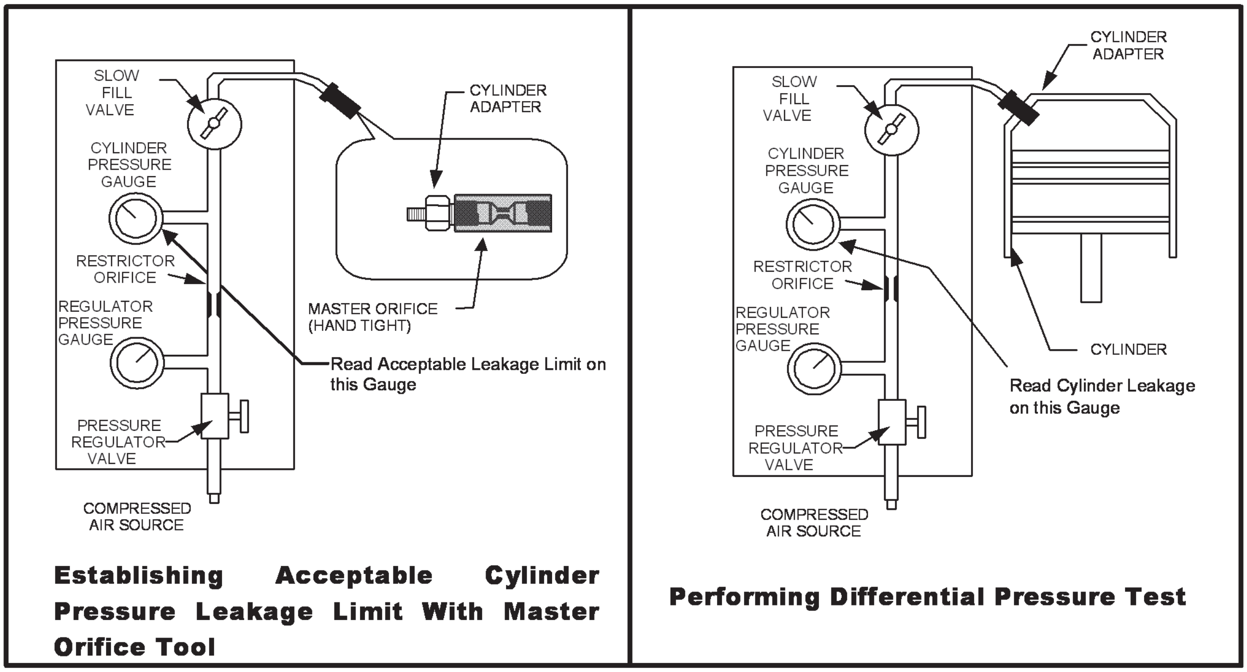


Figure 6-28. Differential Pressure Test Equipment Usage

NOTE: The Slow Fill Valve should be in the CLOSED position.

WARNING

Exercise care when opening the cylinder pressure valve, air pressure entering the cylinder may cause the crankshaft to rotate if the piston is not at bottom dead center.

5. Have an assistant secure the propeller to prevent rotation and slowly turn the Slow Fill Valve in the direction of the PRESSURIZE position to pressurize the cylinder to 20 psi.

   NOTE: Some engines feature a lightweight starter which restricts turning the propeller in the opposite direction of normal rotation. For these engines, remove the starter prior to commencing the test or continue to turn the propeller in the normal direction of rotation to seek the TDC position with the highest pressure indication on the cylinder pressure gauge.

6. Continue turning the propeller in the normal direction of rotation, against the pressure until the piston reaches top dead center (TDC) indicated by a sudden decrease in the force required to turn the crankshaft. If the crankshaft is rotated too far, back up at least one-half revolution and start over again to eliminate the effect of valve train backlash and to keep the piston rings seated.

WARNING

The probability of air pressure in the cylinders turning the propeller during this procedure will be highest when the air pressure in the cylinder is raised to 80 psi in step 7. Stand outside the propeller arc with balanced footing while holding the propeller firmly to avoid injury.

7. With the piston at top dead center, open the Slow Fill Valve completely. Observe the regulator pressure gauge and adjust the pressure regulator, if necessary, for an 80 psi indication.
8. To ensure the piston rings are seated and the piston is square in the cylinder bore, move the propeller slightly back and forth with a rocking motion, while applying the regulated pressure of 80 psi, to obtain the highest indicated pressure reading on the cylinder pressure gauge. Adjust the pressure regulator, as necessary, to maintain a regulated pressure indication of 80 psi.
9. Record cylinder pressure gauge indication. The difference between indicated cylinder pressure and indicated regulator pressure is the amount of cylinder leakage. Record cylinder pressure indication as: $^{\text{(pressure reading)}}/_{\text{80 psi}}$.

   NOTE: Repeat steps 3 through 9 on each engine cylinder. Record Cylinder Differential Pressure Test results for each cylinder on a copy of the Cylinder Inspection Checklist.

10. Compare the recorded test results with Table 6-8 to determine what action, if any, is recommended.
11. Turn the Slow Fill Valve to the OFF position.
12. Disconnect the test equipment from the cylinder and proceed to the “Cylinder Borescope Inspection” in Section 6-3.11.3.

Table 6-8. Differential Pressure Test Results

Air Discharge Source	Pressure Test Value	Symptoms and Observations	Recommended Action
Air discharge at oil filler/ crankcase breather.	Cylinder Differential Pressure Test reading above the acceptable cylinder pressure leakage limit.	Normal borescope indications. Oil consumption stable, no excessive oil discharge out engine breather	Continue engine in service. Repeat Differential Pressure Test at next 100-hour/annual inspection.
	Cylinder Differential Pressure Test reading below the acceptable cylinder pressure leakage limit.	Normal borescope indications. Oil consumption stable, no excessive oil discharge out engine breather.	Fly aircraft at Cruise Power setting[1] and repeat Cylinder Differential Pressure Test.
	Cylinder Differential Pressure Test reading below the acceptable cylinder pressure leakage limit after re-test.	Not applicable	Remove cylinder for repair.
	Cylinder Differential Pressure Test reading above or below the acceptable cylinder pressure leakage limit	Oil consumption abnormal[2], with oil discharge out engine breather. Borescope inspection reveals heavy carbon deposits in combustion chamber and on piston crown with excessive oil puddling in cylinder barrel.	Remove cylinder for repair.
Little to no air discharge at oil filler/crankcase breather.	Cylinder Differential Pressure Test reading abnormally high	Oil consumption abnormal[2], with oil discharge out engine breather. Borescope inspection reveals heavy carbon deposits in combustion chamber and on piston crown with excessive oil puddling in cylinder barrel.	Remove cylinder for repair.

Table 6-8. Differential Pressure Test Results

Air Discharge Source	Pressure Test Value	Symptoms and Observations	Recommended Action
Air discharge into induction system	Cylinder Differential Pressure Test reading above the acceptable cylinder pressure leakage limit.	Normal cylinder borescope inspection results.	Continue engine in service.
	Cylinder Differential Pressure Test reading below the acceptable cylinder pressure leakage limit.	Normal cylinder borescope inspection results.	Fly aircraft at cruise power setting[1] and repeat Cylinder Differential Pressure Test.
	Cylinder Differential Pressure Test reading below the acceptable cylinder pressure leakage limit after re-check.	Not Applicable	Remove cylinder for repair.
Air discharge into exhaust system	Cylinder Differential Pressure Test reading above the acceptable cylinder pressure leakage limit.	Normal cylinder borescope inspection results.	Continue engine in service.
	Cylinder Differential Pressure Test reading below the acceptable cylinder pressure leakage limit.	Normal cylinder borescope inspection results.	Fly aircraft at cruise power setting[1] and repeat Cylinder Differential Pressure Test.
	Cylinder Differential Pressure Test reading below the acceptable cylinder pressure leakage limit after re-check.	Not Applicable	Remove cylinder for repair.
Air escaping at spark plug spot face	Cylinder Differential Pressure Test readings not applicable	Dye penetrant check of area reveals cracks.	Remove cylinder for replacement.
Air discharge at cylinder head to barrel juncture or between barrel fins	Cylinder Differential Pressure Test readings above the acceptable cylinder pressure leakage limit.	First cylinder head fin above cylinder barrel wet with oil or baked on oil residue. See the latest revision of Service Bulletin SB96-12 for additional tests to be performed.	Remove cylinder for replacement.

1. Fly the aircraft at cruise power setting between 65 and 75 percent power according to the Aircraft Flight manual/Pilots Operating Handbook (AFM/POH) for a duration that will allow engine oil and temperatures to stabilize, or at least 45 minutes. Repeat the differential pressure test on the suspect cylinder.
2. A sudden increase in oil consumption from the established, normal trend.

6-3.11.3. Cylinder Borescope Inspection

Regular engine operation provides an oil coating for the cylinder and minimizes rust formation. New cylinders are particularly sensitive to rust formation if the engine is infrequently used or not properly preserved during storage.

NOTE: Ground operation of the engine is an unacceptable substitute for in-flight engine operation. Ground operation does not provide adequate cylinder cooling and introduces water and acids into the lubrication system.

Purpose

The cylinder borescope inspection provides a non-destructive method of visually examining the internal cylinder components and must be used in conjunction with the "Differential Pressure Test" to assess the condition of the valve, piston top, deposits, and the hone pattern on the cylinder barrel and identify abnormal wear patterns which can contribute to low differential pressure readings or increased oil consumption.

The cylinder wall hone pattern consists of engineered surface "scratches" which aid in ring seating by allowing the ring and wall surface to wear uniformly and provides a reservoir of oil for lubrication during ring travel. The cylinder walls and rings are designed to wear over the life of the engine, particularly in the power stroke area. The visible hone pattern in the upper portion of the bore may disappear during normal operation; and is not cause for cylinder replacement.

Required Equipment

- Mechanics tools
- Borescope

Frequency

- During 100-hour/Annual inspection
- If oil consumption is excessive
- After an engine overspeed incident
- Whenever an anomaly is suspected

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.

Take preventive measures to avoid burns when performing a Cylinder Borescope Inspection on a hot engine.

Procedure

1. Remove the engine cowling as necessary to gain access to the top spark plugs.
2. Remove the upper spark plug from each cylinder.

3. Position the piston at bottom dead center on the power stroke. The exhaust valve will be open with the piston in this position.
4. Insert the borescope probe through the upper spark plug hole and inspect the internal surfaces of each cylinder, including the exhaust valve and exhaust valve seat.
5. Position the piston at bottom dead center at the end of the intake stroke.
6. Insert the borescope through the upper spark plug hole and inspect the intake valve and valve seat. Use Table 6-9 and Figure 6-29 through Figure 6-32 to interpret inspection findings.

Table 6-9. Borescope Inspection Objectives and Corrective Actions

Inspection Item	Objective	If Abnormality Noted
Combustion Chamber	Inspect: •Valve seat inserts for erosion, burning •Spark plug heli-coils for protrusion into combustion chamber •Heavy carbon deposits/presence of excessive oil	Remove cylinder for repair
Exhaust Valve Face	Inspect for signs of leakage or damage indicated by: •Localized discoloration on the valve face circumference (Figure 6-30) •Minute cracks •Erosion (missing material)	Repair or replace cylinder
Intake Valve Face	Inspect for signs of leakage or damage indicated by: •Localized discoloration on the valve face circumference •Erosion (missing material)	Repair or replace cylinder
Cylinder Bore	Inspect exposed surface of bore for: •Heavy scoring/piston rub (Figure 6-33) •Piston pin rub (wide band pattern in horizontal plane at 3 o'clock and/or 9 o'clock position)	Repair or replace cylinder
	Corrosion (Figure 6-32)[1] Excessive oil in cylinder/heavy deposits of carbon in combustion chamber	Remove cylinder for repair
	Upper portion of cylinder bore has no visible hone pattern (Figure 6-34) and (Figure 6-35)	Normal indication for in service cylinders
Piston Head	Inspect for: •Piston crown for erosion, missing material •Visible damage from foreign debris	Remove cylinder for repair

1. Remove cylinder for repair or replacement. Perform complete inspection of connecting rod bushing for correct installation and finishing.

Figure 6-29. Normal Combustion Chamber

Exhaust valve has reddish deposit in center with dark outer edge. Intake valve has light brown combustion deposits. Combustion chamber has light brown deposits.

Figure 6-30. Burned Exhaust Valve

Note the edge of valve face has lost all combustion residue with striations moving toward center of valve.

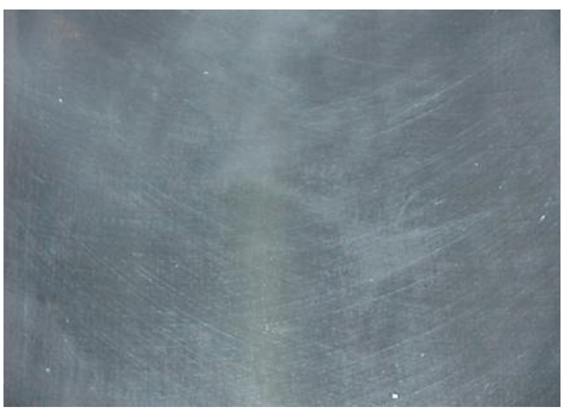


Figure 6-31. Phosphate-Coated Cylinder w/ Revised Hone Pattern

Phosphate coating provides increased corrosion protection during initial hours of engine operation.

Figure 6-32. Phosphated Cylinder Bore

Phosphate coating in valleys of the cylinder bore hone pattern. Light corrosion at top of cylinder bore, above piston ring travel limit in this area is normal.

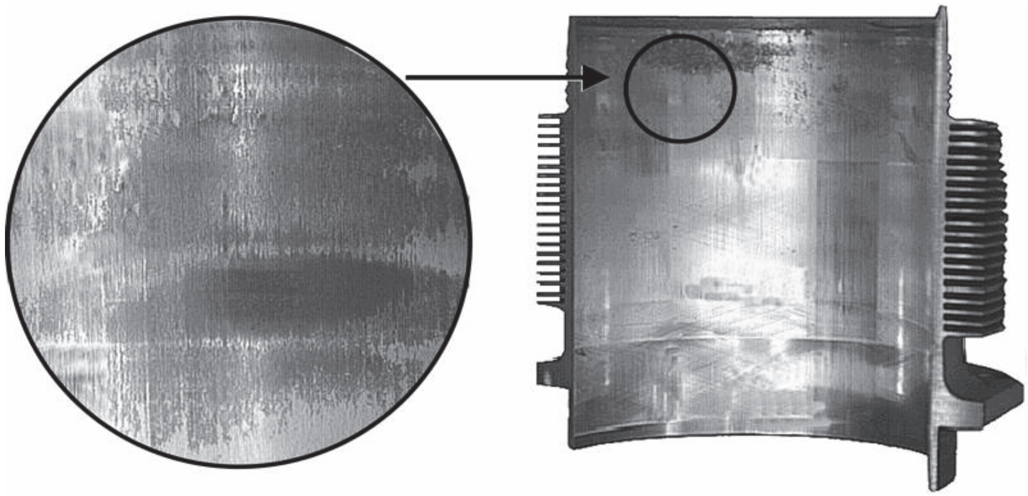


Figure 6-33. Cylinder Barrel Scoring and Piston Rub

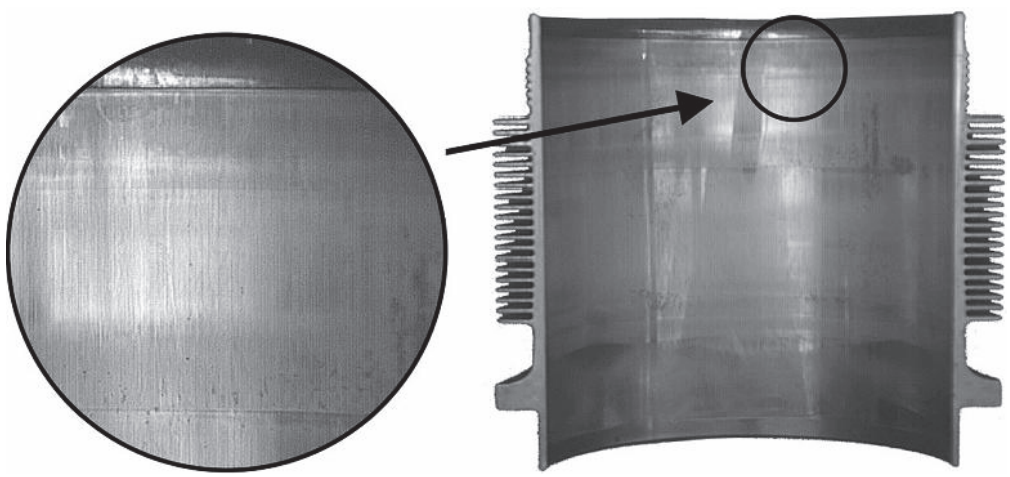


Figure 6-34. Typical Wear in Upper Ring Travel

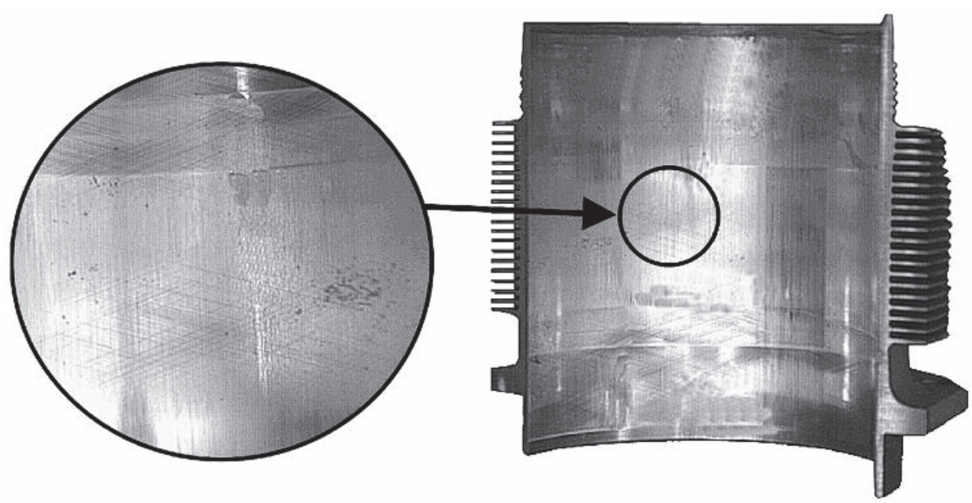


Figure 6-35. Typical Cylinder Wear

6-3.11.4. Cylinder to Crankcase Mounting Deck Inspection

Purpose

Proper cylinder torque requires a solid mounting surface. Foreign materials, such as grease or unauthorized sealants applied to the mounting base or flange will not allow proper fastener preload. Proper torque procedures are critical to engine operation.

Frequency

- During 100-hour/Annual inspection

WARNING

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

Procedure

Inspect the cylinder-to-crankcase mounting deck for evidence of silicone RTV sealant on the cylinder deck flange. If silicone RTV sealant or any other unauthorized sealant or adhesive is discovered, the engine must be completely disassembled, cleaned, inspected and assembled according to the overhaul instructions in Chapter 12-18 of this manual.

1. Remove the engine from the aircraft according to instructions in Section 5-1.
2. Disassemble the engine according to the instructions in Chapter 12-13.
3. Clean the engine components according to the instructions in Chapter 14.
4. Inspect the engine components according to the instructions in Chapter 15.
5. Reassemble the engine according to instructions in Chapters 16 and 17.
6. Perform the “Post-overhaul Testing” according to instructions in Chapter 18.
7. Install the overhauled engine according to instruction in Section 5-2.

6-3.11.5. Baffle Inspection

Purpose

To prevent cylinder deterioration and verify baffles are properly fitted and installed. This inspection performed in concert with the cylinder inspection.

The heat transfer in piston engines requires efficient and reliable operation of cooling baffles to prevent rapid deterioration of the cylinders and other engine components. Verify the baffles are installed, intact, and positioned properly.

Frequency

- During 100-hour/Annual inspection or whenever the cowling is removed

Procedure

1. Check the following for deterioration, wear, correct position, and proper contact with the cowl. Figure 6-36 through Figure 6-39 show improperly positioned baffle seals.
2. Repair or replace worn or distorted baffles in accordance with the airframe manufacturer or Supplemental Type Certificate (STC) holder's information.
3. Check and adjust inter-cylinder baffles to ensure a tight fit.
4. Inspect for holes and cracks that would allow cooling airflow to be wasted. Seal any cracks or holes by applying a non-corrosive silicone adhesive/sealant. Consult the aircraft manufacturer for application instructions. Baffle conditions shown in Figure 6-40 shows air gaps that lead to inadequate cooling airflow. Figure 6-41 and Figure 6-42 show evidence of cooling air loss at the baffle seals.
5. Check the integrity of all cooling ducts, heater ducts, etc. and repair as necessary.

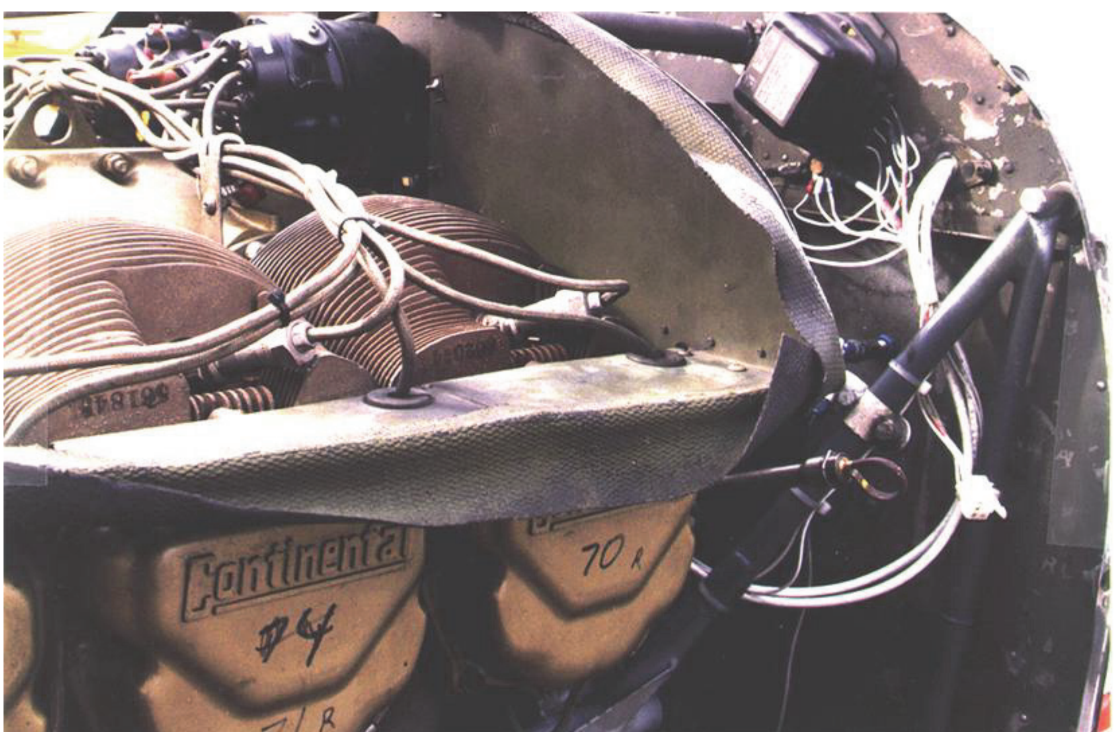


Figure 6-36. Improperly Positioned Baffle Seals

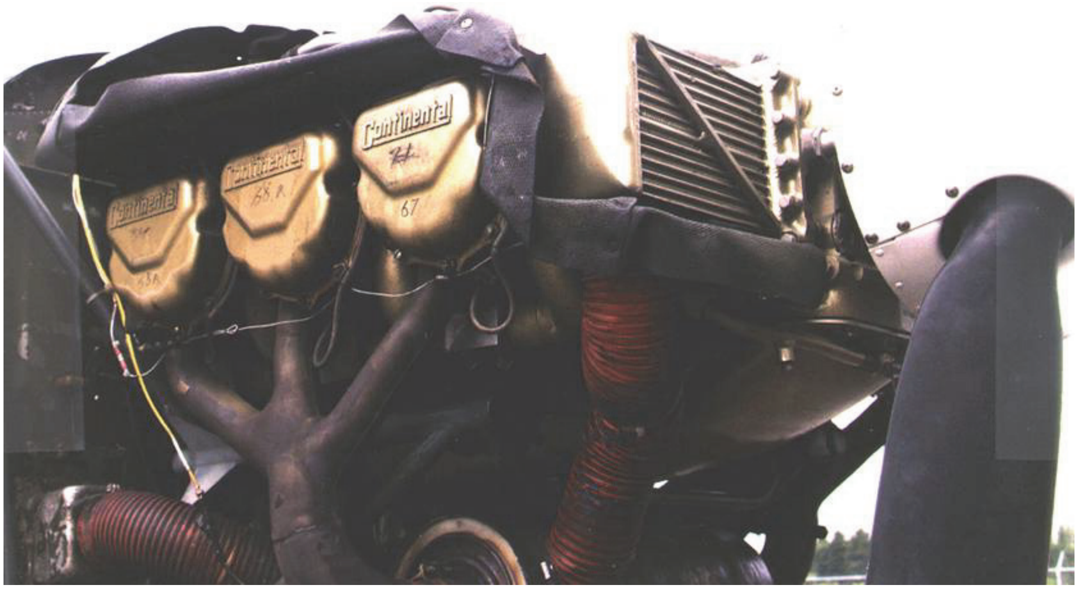


Figure 6-37. Improperly Positioned Baffle Seals

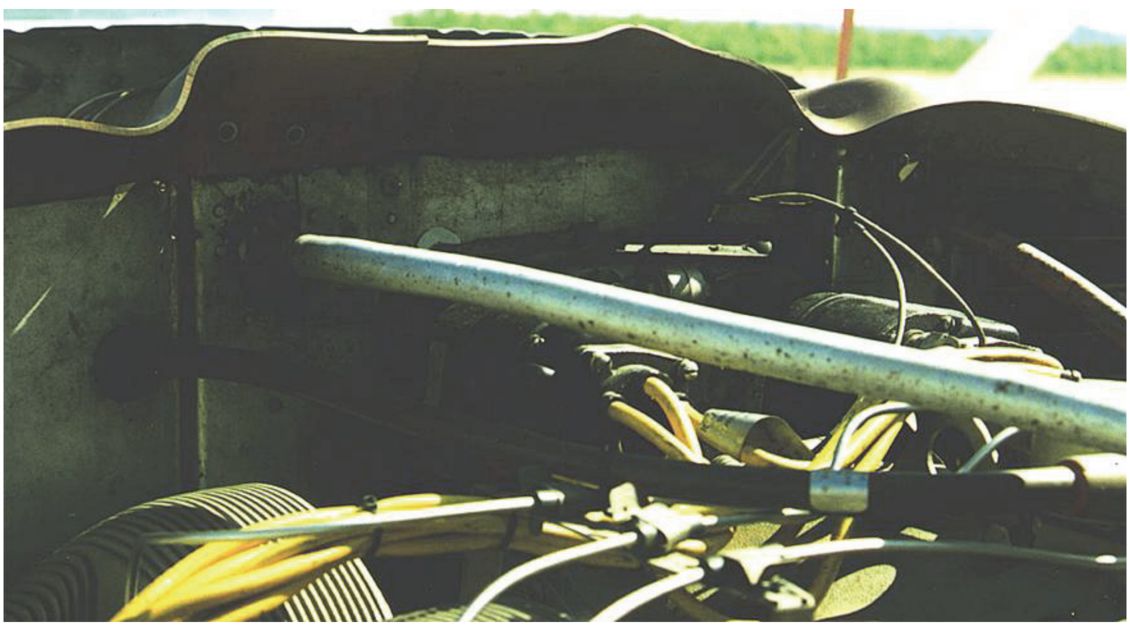


Figure 6-38. Improperly Positioned Aft and Side Peripheral Baffle Seals

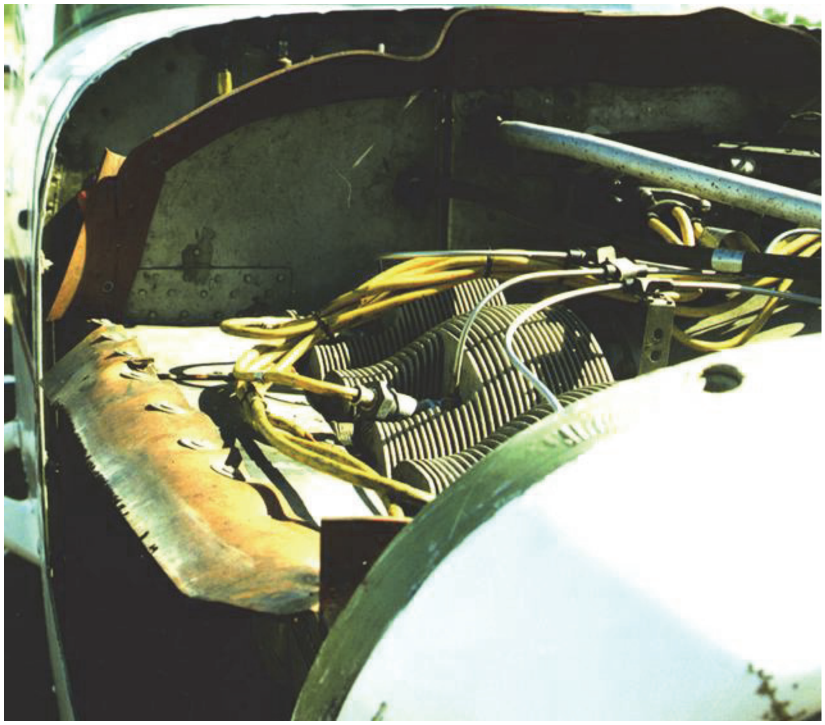


Figure 6-39. Improperly Positioned Aft and Side Peripheral Baffle Seals

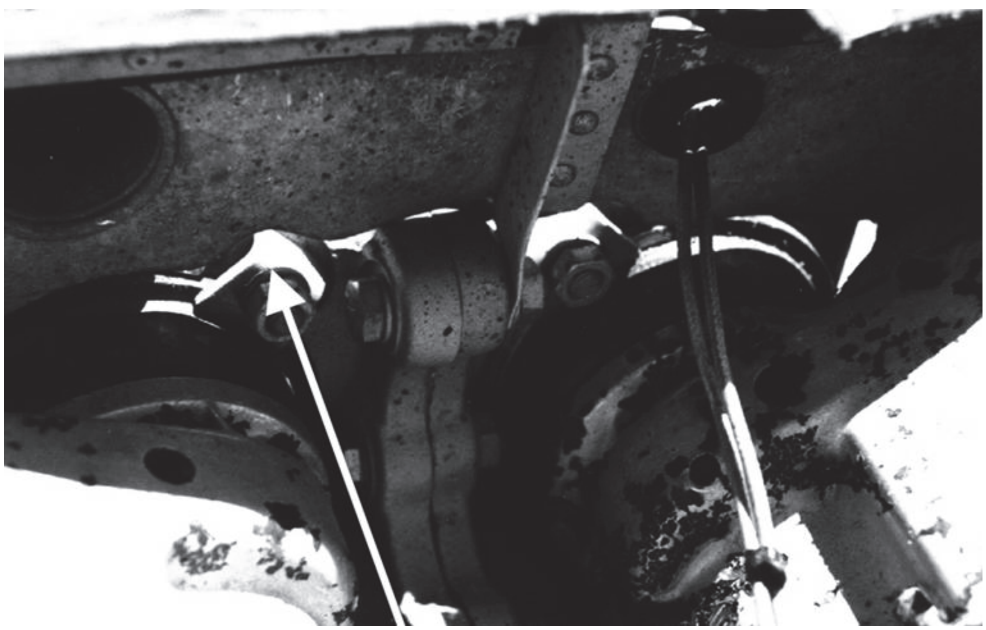


Figure 6-40. Aft and Side Baffles with Air Gaps

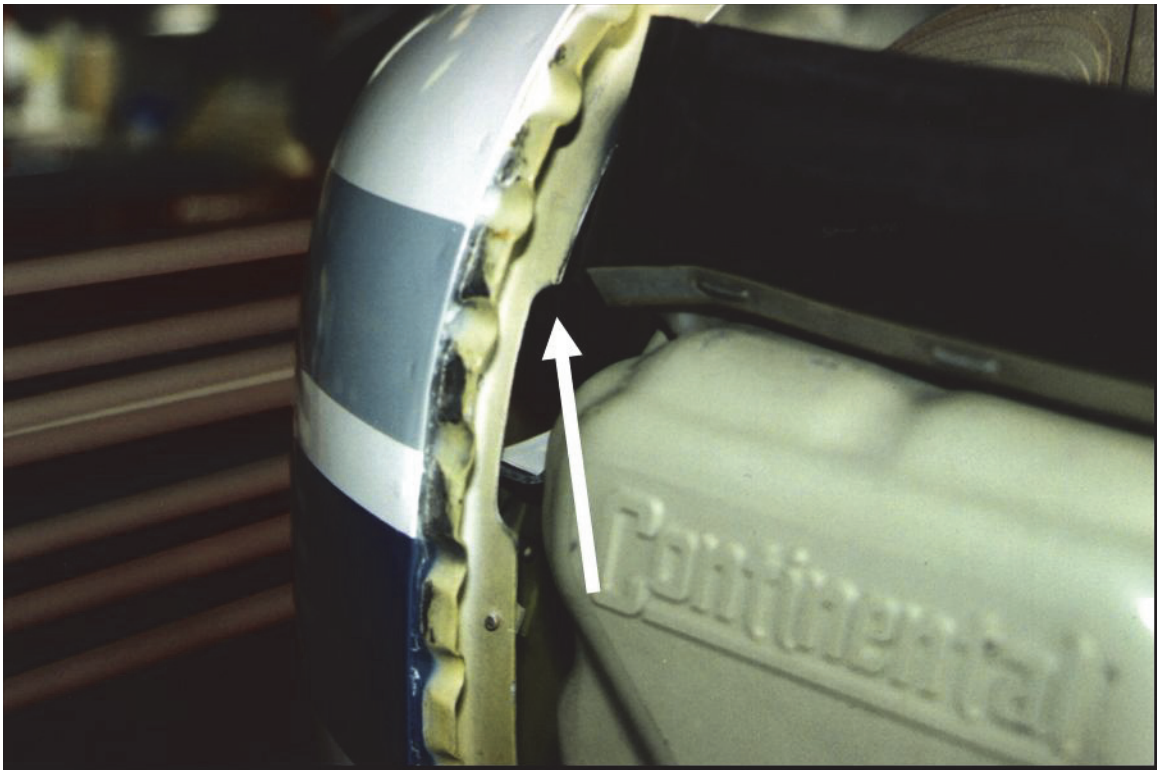


Figure 6-41. Cooling Loss Due to Gaps in Baffle Seals

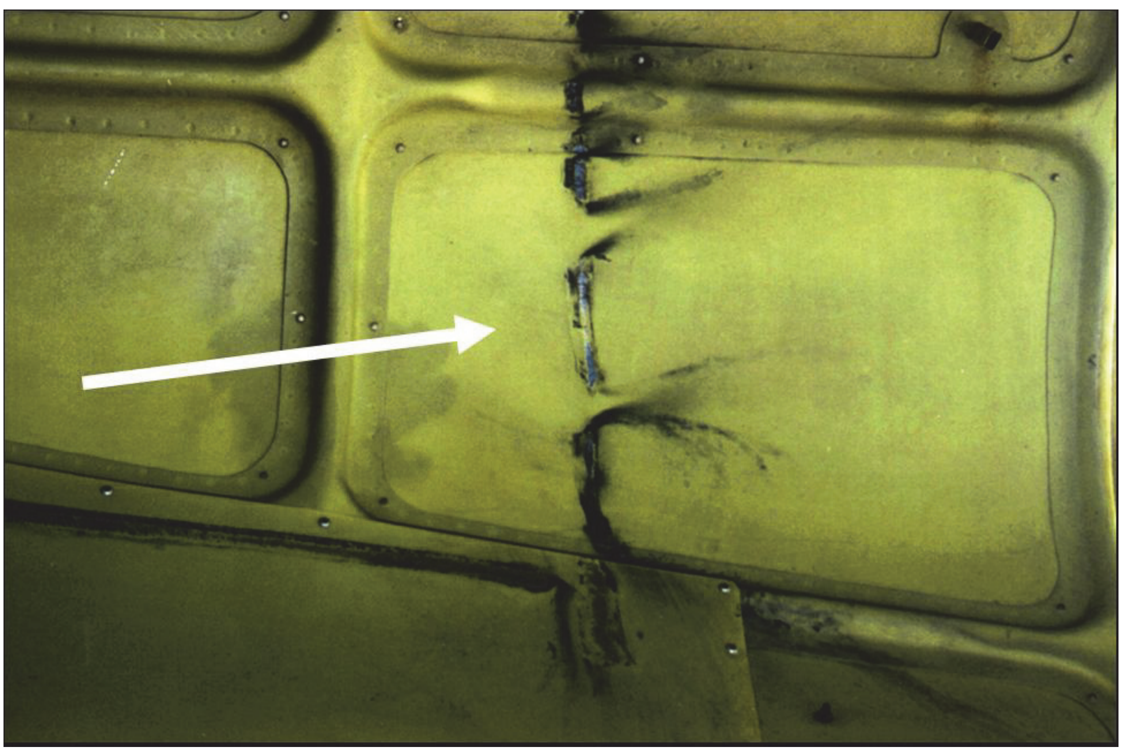


Figure 6-42. Cooling Loss Due to Gaps in Baffle Seals

6-3.11.6. Cowling Inspection

Purpose

Check cowl openings for restrictions and proper operation of the cowl flap. Cowl flap operation is an integral function of engine cooling control.

Frequency

- During 100-hour/Annual inspection

Procedure

1. Verify add-on accessories and their associated hardware do not restrict cowl inlet, cowl outlet, and air flow through the cooling fins.
2. Verify the cowl flap rigging and operation meet the appropriate aircraft maintenance manual specifications.
3. Check for cracks and other obvious physical defects.

6-3.12. Crankcase Inspection

Purpose

To verify the crankcase is free of oil leaks, cracks, and physical damage.

Frequency

- During 100-hour/Annual inspection

Procedure

WARNING

If neglected, crankcase cracks may progress to the point of causing major oil leakage or engine structural failure.

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.

   NOTE: All crankcase cracks require attention, regardless of size or location. Do not ignore crankcase cracks.

   a. Cylinder deck (white/non-shaded in Figure 6-43 = critical areas) cracks, regardless of size require **immediate crankcase replacement**.

   b. Repair cracks two inch (5.08 cm) or longer in the shaded (non-critical) locations of Figure 6-43 according to instructions in Section 15-8.11. Replace the crankcase if satisfactory repair is not possible.

   c. Cracks shorter than two inches in the shaded locations of Figure 6-43 may remain in service. Scribe the extremities of cracks smaller than two inches in the non-critical areas to monitor further growth progression. Cracks with seeping oil must be repaired or replaced immediately. Inspect cracks previously identified in the non-critical stress areas of Figure 6-43 for progression at 25-hour inspection intervals. If a crack in the non-critical area of Figure 6-43 progresses to two inches or more in length, repair or replace the crankcase. Inspect the scribed cracks at the next 50 hour engine inspection for progression. If no progression is noted, repeat the progression inspection at each 100-hour inspection interval until the crack is repaired or the crankcase is replaced. Repair or replace the crankcase if cracks in the non-critical area progress to two inches or beyond in the shaded locations.

2. Investigate oil leaks as possible crack indications. If oil leaks are the result of damaged or improperly sealed gaskets, replace questionable gaskets according to the overhaul instructions.

3. Inspect the crankcase breather for cracks or dents; inspect tube ends for scoring or eccentricity that may prohibit a proper seal. Replace unserviceable components.

4. Inspect engine mount brackets for cracks, dents and wear. Inspect hardware for distorted, stripped threads and damaged wrench flats. Discard and replace unserviceable components.

5. Inspect the crankcase backbone seam for signs of oil leaks. Oil leakage in this area may be caused by improperly torqued through bolts. Check through bolt torque

according to the instructions in Section 17-3.3. If through bolt torque is less than the minimum specifications, remove, disassemble, and inspect the engine immediately to determine the cause of through bolt torque loss.

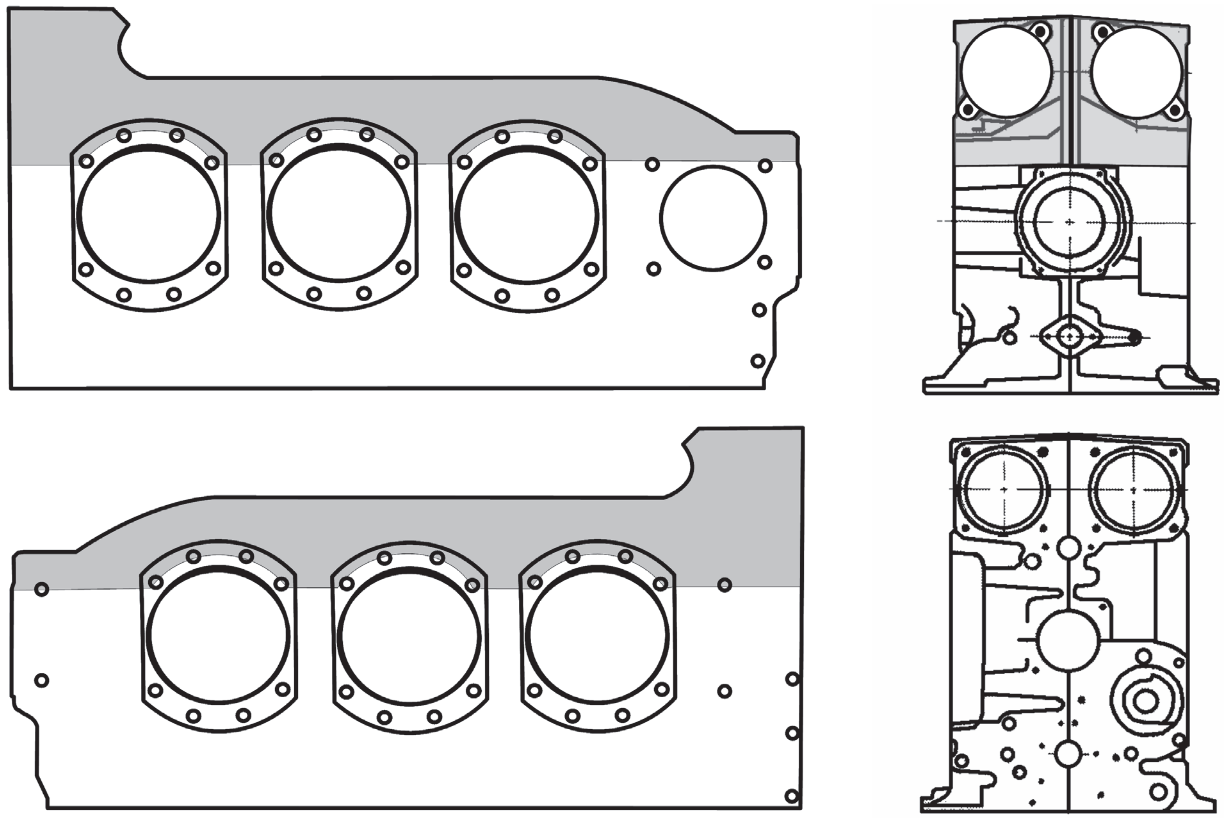


Figure 6-43. Crankcase Critical (white) and Non-critical (Shaded) Area

WARNING

Use of sealants or lubricants other than those specified on mating threads and between mating surfaces can cause incorrect torque application and subsequent engine damage or failure.

6. Inspect the cylinder deck for signs of RTV Sealant used on the cylinder deck flange. If RTV Sealant is found, refer to Section 6-3.11.4, "Cylinder to Crankcase Mounting Deck Inspection" for corrective action.

7. If the engine is equipped with a Refrigerant Compressor, perform a "Crankcase Inspection with Refrigerant Compressor" according to the instructions in Section 6-3.12.1.

6-3.12.1. Crankcase Inspection with Refrigerant 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 6-44 and Figure 6-45. If your crankcase matches the configuration depicted in Figure 6-44, 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 6-45, continue with the visual inspection.

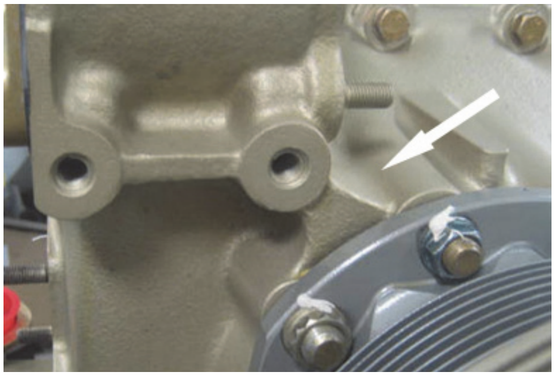


Figure 6-44. Mount Boss with Thick Rib

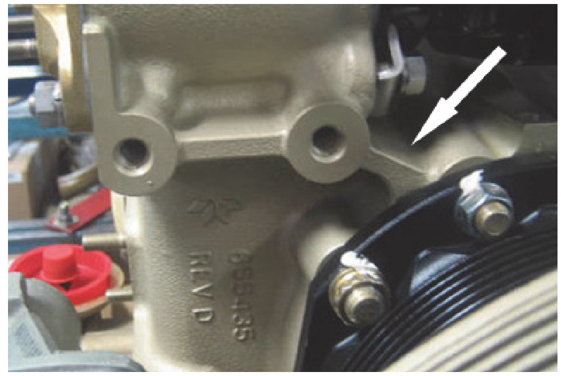


Figure 6-45. Mount Boss with Thin Rib

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 6-46 and Figure 6-47.

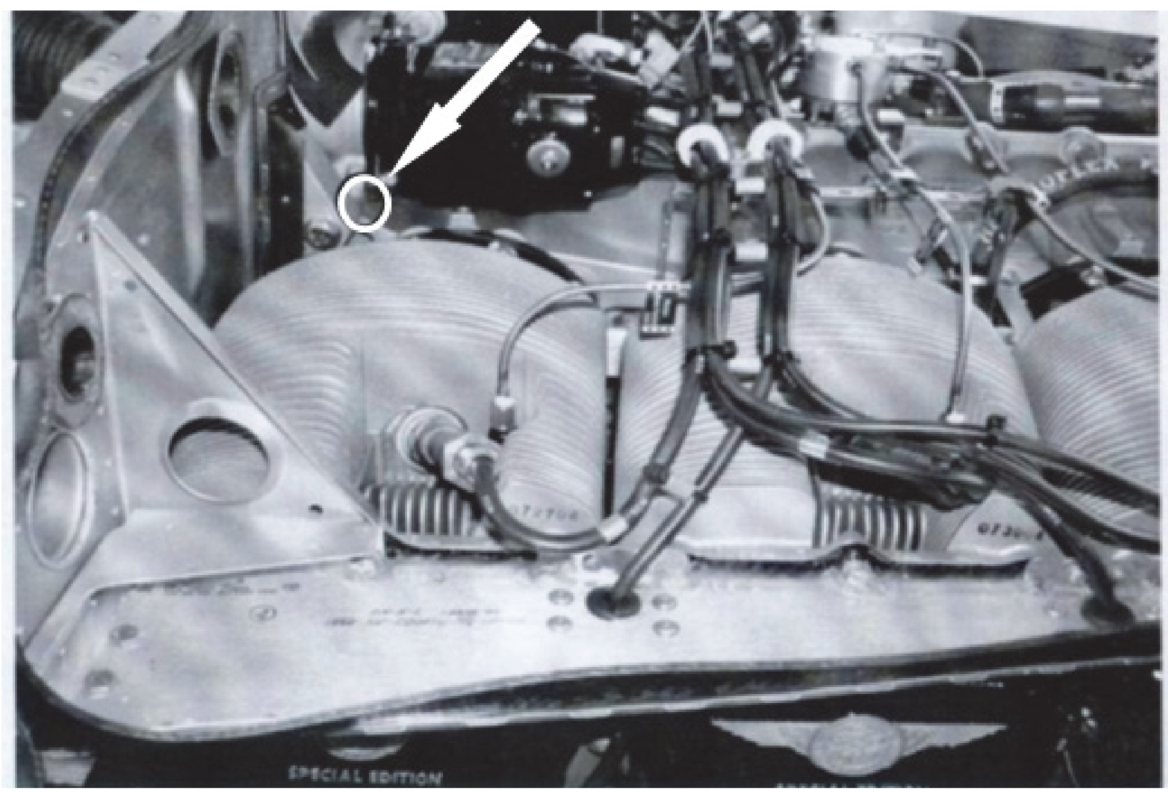


Figure 6-46. General Inspection Area

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 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 Refrigerant Compressor Mounting Bracket is replaced 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 6-3.12 and Figure 6-43.

Figure 6-47. Suspect Crack Indication

6-3.13. Engine Mount Inspection

Frequency

- During 100-hour/Annual inspection

Procedure

1. Inspect engine mounts for signs of cracks, deterioration, proper assembly and security. If cracks are suspected, perform a nondestructive inspection using dye penetrant or eddy current methods to determine engine mount condition. Replace cracked engine mounts.

WARNING

Do not allow a cracked engine mount to remain in service. Replace upon discovery.

2. Inspect engine mount isolators for signs of deterioration, proper assembly and security. Replace engine mount isolators exhibiting any of these conditions.
3. Replace damaged or deteriorated engine mounts or engine mount isolators.

6-3.14. Induction System Inspection

Purpose

Check the integrity of the air filter, seals, and airbox to prevent particulates from entering the engine that can abrade cylinder walls and ring faces thereby damaging the engine.

Frequency

- During 100-hour/Annual inspection

Procedure

1. Remove and inspect the induction air filter for cleanliness, normal operation and the absence of gaps or leaks in the filtering element. Verify the air filter seal prevents airflow except through the filter. Inspect or replace, as required, according to the airframe manufacturer/STC holder's instructions.
2. Verify the integrity of the airbox; look for alternate air circuits which can bypass the filtering system. Repair holes or bypass circuits found behind the filtering element according to the airframe manufacturer/STC holder's instructions.
3. Verify operation of the alternate air door and the integrity of the seal in the closed position. Verify the door operating mechanism closes securely. Replace or repair, as required, according to the airframe manufacturer/STC holder's instructions.
4. If oil analyses are done on engine oil samples, check the silicone content of the most recent oil analysis and the overall silicone trend to further assess the possibility of Induction System leaks or pilot operational issues such as extensive use of carburetor heat or alternate air during ground operation.
5. Inspect the induction tube and hose connections to verify proper installation. Induction tubes incorporate a “bead” (Figure 6-48) which provides an anchor point for the induction tube clamps and enhances the seal between the induction tube and hose. Remove, inspect and install induction system according to instructions in Section 17-10 if induction tubes, hoses or clamps are improperly installed or

inspection identifies parts as unserviceable.

a. Visually inspect the induction system clamps for proper fit and positioning. Clamps should be positioned squarely over the joint between the induction tubes and hose (Figure 6-48), inboard of the induction tube bead; no part of the end of the induction tube should be visible with the hose and clamp properly installed. Loosen the clamps, reposition, and torque to Appendix B specifications, if necessary. If the clamp will not tighten or remain torqued to Appendix B specifications, the clamp is unserviceable - replace the clamp.

b. Perform a visual inspection on the induction hoses for proper fit and positioning. Hoses should be flexible; splits, tears, or cracks are unserviceable conditions. Replace cracked, split, or torn induction hoses. Hoses should not exhibit "twists" from misalignment, which can cause stress cracks. Hoses must be positioned over the induction tubes to secure the induction tube beads within the clamped portion of the hose.

c. Perform a visual inspection on the induction tubes. Replace tubes exhibiting deep scratches, dents, cracks, or eroded sealing beads.

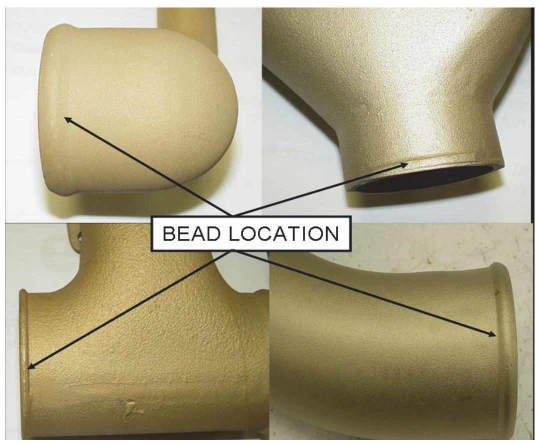


Figure 6-48. Induction Tube Bead Location

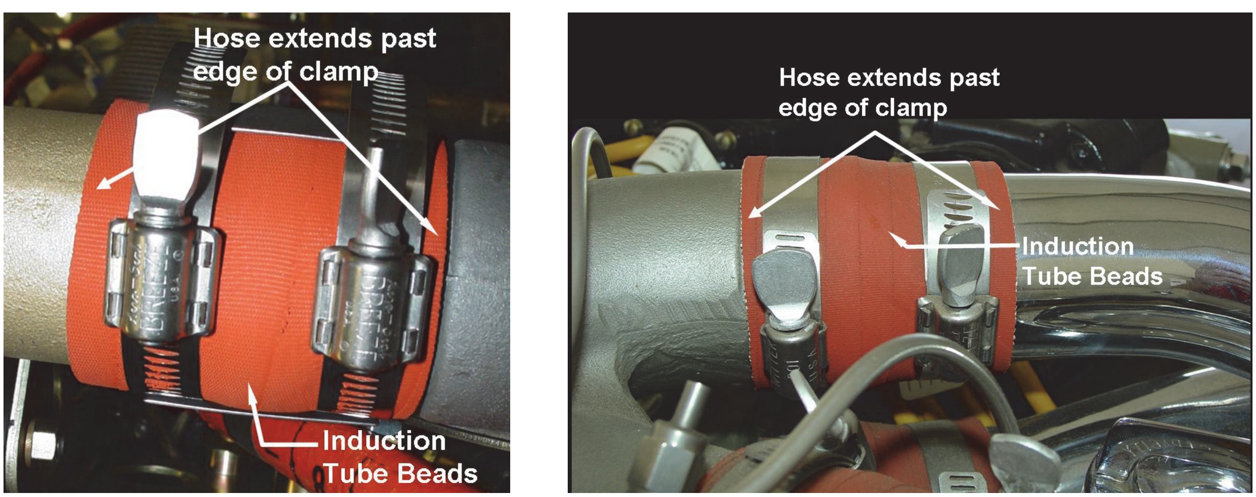


Figure 6-49. Properly Installed Induction Tube, Hose and Clamps

6-3.15. Ignition System Inspection

Purpose

Verify the following:

- Magneto housing and flange is free of damage
- Magneto to engine timing is set properly
- Ignition leads are intact and secure
- Spark plugs are clean, operating properly, and correctly gapped

Frequency

- During 100-hour/Annual inspection

Procedure

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 an accidental engine start. Do not stand or place equipment within the arc of the propeller.

1. Ignition Switch.. OFF
2. Remove the spark plug leads from the upper and lower spark plugs and ground the leads to the engine.
3. Verify the magnetos are properly grounded.
4. Clean the ignition leads and visually inspect the ignition leads for chafing, deterioration and insulation breakdown. Replace worn, frayed or chafed ignition wires.
5. For engines equipped with impulse coupled magnetos, perform an “Impulse Coupling Functional Check” according to the instructions in Section 6-3.15.1.
6. Remove the spark plugs from each cylinder. Clean, inspect, and rotate spark plugs according to instructions in Section 6-3.9.2.

WARNING

Failure to maintain the magneto, spark plugs and ignition leads can cause engine damage or failure due to misfire.

7. Perform the “Crankshaft Top Dead Center Alignment” in Section 6-3.9.1.1 to position the crankshaft to the proper position from magneto to engine timing.
8. Visually inspect the external surfaces of the magneto for physical security or corrosion. Replace non-Continental Motors magnetos exhibiting damage, unusual wear or corrosion. Correct Continental Motors magneto discrepancies according to the Magneto Service Manual.

CAUTION: Verify the magneto pressurization vent is open. If the vent is clogged, nitrogen gases accumulating in the magneto will *cause rapid degradation of the magneto internal components, leading to imminent magneto failure.*

9. Verify the plug is fully seated in the bottom of the filter drain tube and the orifice is clear of debris to allow for drainage.
    1) Remove the magneto calibrated orifice plug (bottom of magneto housing) and clean the opening with a small segment of clean 0.015" piano wire. Install the calibrated orifice plug and torque according to instructions in the Magneto Service Manual.
    2) Remove, disassemble and inspect Continental Motors magnetos for corrosion according to the instructions in the Magneto Service Manual. Remove and replace Champion (Slick) Magnetos with new or serviceable units.

    NOTE: Continental Motors magnetos with riveted impulse couplings require 100 hour inspections. Refer to the Magneto Service Manual for details.
10. Perform a 100-Hour inspection on Continental Motors magnetos according to instructions in the Magneto Service Manual.
11. Note the magneto RPM drop test results recorded during the "Engine Operational Check" in Section 6-3.7. If magneto RPM drop or spread during run-up was not within published limits, inspect, troubleshoot, repair and adjust as required to correct discrepancy.
12. Check magneto to engine timing according to the "Magneto to Engine Timing" instructions in Section 6-3.9.1.2. If magneto timing cannot be adjusted:
    a. Remove the magneto from the engine according to the instructions in Section 10-6, "Magneto Replacement."
    b. Perform a "Magneto Drive Coupling Inspection" according to the instructions in Section 6-3.15.3.
    c. Replace non-Continental Motors magnetos with a new, rebuilt, or serviceable magneto. Troubleshoot and repair Continental Motors magnetos according to instructions in the Magneto Service Manual.
13. For engines equipped with a shower of sparks ignition system, perform a "Starting Vibrator Functional Check" according to instructions in Section 6-3.15.3 after verification of magneto to engine timing.

6-3.15.1. Impulse Coupling Functional Check

This functional check is a simple method to determine if the magneto impulse couplings are functioning properly without disassembly. This functional check is not a suitable substitute for the impulse coupling inspection in the Magneto Service Manual.

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.

Procedure

1. Mixture Control .... IDLE/CUT-OFF
2. Throttle.. CLOSED
3. Fuel Selector Valve .... OFF
4. Master Power Switch .... ON
5. Crank the engine several revolutions using the Start switch (if separate from the Ignition switch) or Ignition switch (if start function is controlled by the Ignition switch).
   RESULT: Impulse coupling operation is audible and can be felt through the magneto housing. The “clicking” sound from the impulse couplings should be consistent while the engine is cranked. If no “clicking” is heard, or the clicking is intermittent, remove the magnetos and service according to the manufacturer's instructions.

6-3.15.2. Starting Vibrator Functional Check

WARNING

Do not stand or place equipment within the arc of the propeller.

Procedure

1. Disconnect aircraft electrical power from the starter according to the airframe manufacturer's instructions.
2. Remove the lower spark plug lead from the No. 1 cylinder. Position the tip of the spark plug lead 3/16” from a suitable grounding point on the engine.
3. Master Switch .... ON

   CAUTION: The starting vibrator duty cycle is 16.6% or 20/120 seconds; do not engage the starting vibrator for longer than 20 seconds in a two minute period. Exceeding the duty cycle will overheat the circuit and may damage the starting vibrator.

4. Ignition Switch... START (maximum 20 seconds)
   RESULT: A strong blue spark emits from the spark plug lead at a few degrees before top dead center on the No. cylinder compression stroke. If no spark is observed before the maximum advanced position, inspect the left magneto main and retard contact point timing circuit according to the appropriate manufacturer's Magneto Service Manual.
5. Reconnect the spark plug lead to the No. 1 cylinder lower spark plug.
6. Reconnect aircraft electrical power to the starter according to the airframe manufacturer's instructions.

6-3.15.3. Magneto Drive Coupling Inspection

1. Remove the magnetos from the engine according to the “Magneto Replacement” instructions in Section 10-6.
2. Inspect the drive coupling bushings and retainers for serviceability and proper installation. If the bushings are torn or exhibit missing material, perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-4.6.
3. Perform a “Gear Tooth Inspection” according to instructions in Section 15-3.1 on the magneto drive gear and idler gear assembly. Rotate the crankshaft 360° in order to inspect the circumference of the gear. If the gear teeth are chipped, broken, or otherwise damaged, remove the accessory drive adapter according to instructions in Section 12-3, inspect the accessory drive adapter according to instructions in Section 15-7.9 using the service limits in Section 10-6.3, perform the necessary repairs according to instructions in Section 15-8.6 and perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-4.6.

6-3.16. Engine Gauge Inspection

CAUTION: Inaccurate aircraft engine related gauges can cause operation outside of engine certification and specification limits and can lead to decreased cylinder life. Aircraft gauge calibration errors can be particularly harmful for high horsepower engines. Gauges may require re-marking for modified (STC) engines. Significant aircraft engine gauge inaccuracies can lead to engine damage.

Purpose

Verify proper gauge operation and ensure reliable condition feedback to the pilot.

Frequency

- During 100-hour/Annual inspection

Procedure

Verify the following indicators are working properly according to instructions in the Aircraft Maintenance Manual. Repair or replace faulty components.

- Tachometer
- Manifold pressure gauge
- Fuel flow gauge
- Oil pressure gauge
- Oil temperature gauge
- Cylinder head temperature gauge
- Exhaust gas temperature gauge

NOTE: Verify the accuracy of the EGT indicating system. The aircraft manufacturer may require EGT reporting be operational for all categories of flight. Consult the Aircraft Maintenance Manual for interval and operational requirements. In many cases, EGT calibration is a 100-hour inspection requirement.

6-3.17. Fuel System Inspection

Purpose

Engine operation and cooling are directly related to the correct fuel-air ratio. Improper fuel settings can affect engine performance in terms of both power and throttle response.

Purpose

- Verify fuel injector operation
- Verify fuel lines are clear
- Verify the fuel pump is properly adjusted

Frequency

- During 100-hour/Annual inspection
- Clean fuel injectors at the first 100-hour inspection and every 300 hours (or annually) thereafter, whichever comes first.

Procedure

1. Inspect each fuel line to the connection point at the fuel manifold valve for chafing, wear, or damage. Replace worn, chafed or damaged fuel lines with new fuel lines.
2. Inspect the fuel manifold valve for leaks and security of fittings.
3. Clean the fuel injectors:
   a. Remove the fuel injectors (Section 10-3.2) from they cylinder; note the location from which the fuel injectors were removed.
   b. Clean the fuel injectors according to the instructions in Chapter 14.
   c. Install the fuel injectors (Section 10-3.3).
4. Inspect the fuel line and fittings from the fuel pump outlet to the fuel manifold valve, including the fuel filter (if installed) for wear or damage. Replace faulty parts.
5. Turn the aircraft boost pump ON.
   a. Visually inspect the fuel pump, fuel lines, fuel manifold valve, fuel hoses and fittings for signs of fuel leaks.
   b. Verify no fuel is leaking from the fuel pump dry bay drain.
   c. Inspect each fuel injector to the fuel line connection point.
6. Turn the aircraft boost pump OFF.

   NOTE: The "Fuel System Operational Check" is part of the "Engine Operational Check" performed at the beginning and conclusion of the 100-hour scheduled inspections.

7. Perform the "Fuel System Operational Check" according to instructions in Section 6-3.7.4.

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6-3.18. Engine Control Linkage Inspection

Purpose

To ensure proper operation and avoid accelerated wear, inspect the engine control linkage for excessive play, which may restrict control travel or damage control levers or cables.

Frequency

- During 100-hour/Annual inspection

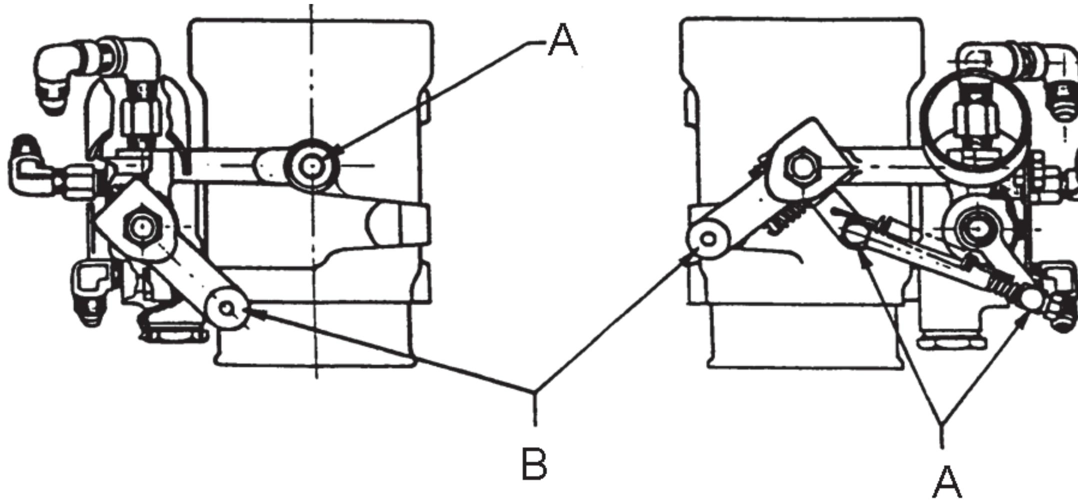
Procedure

1. Inspect the pivot points of levers and linkages for debris, old grease, and oil.

WARNING

If the lock nut securing a bronze throttle or mixture control lever is loosened for any reason, replace the bronze lever with the appropriate stainless steel replacement lever.

2. Inspect throttle and mixture control arm condition and security according to the "Throttle and Mixture Control Lever Inspection" instructions in Section 15-7.7. Grasp the throttle lever firmly and apply lateral force to the end of the lever. No free play is permitted between the shaft and control arm.
3. Replace worn or corroded linkage and attaching hardware according to the airframe manufacturer's instructions.
4. Clean pivot point areas thoroughly according to instructions in Chapter 14. After cleaning, dry each cleaned area using compressed air.
5. Unless otherwise specified by the airframe manufacturer's instructions, apply LPS 2, LOCTITE Maintain™ Lubricant, or equivalent to each pivot point (A B C Figure 6-50 or G N P R Figure 6-51), including the throttle shaft bushings.
6. Consult the airframe manufacturer's instructions concerning aircraft engine control cable attach point inspection, cleaning, repair, installation, and lubrication.
7. Cycle throttle and mixture controls through the full range of motion.
   a. Verify each control has full range of travel and the required safeties are in place.
   b. Ensure levers and linkages do not bind and control movement is unrestricted by parts or components in close proximity.



A- Clean, inspect, and lubricate according to instructions in this section.

B- Clean, inspect, and lubricate according to airframe manufacturer's instructions.

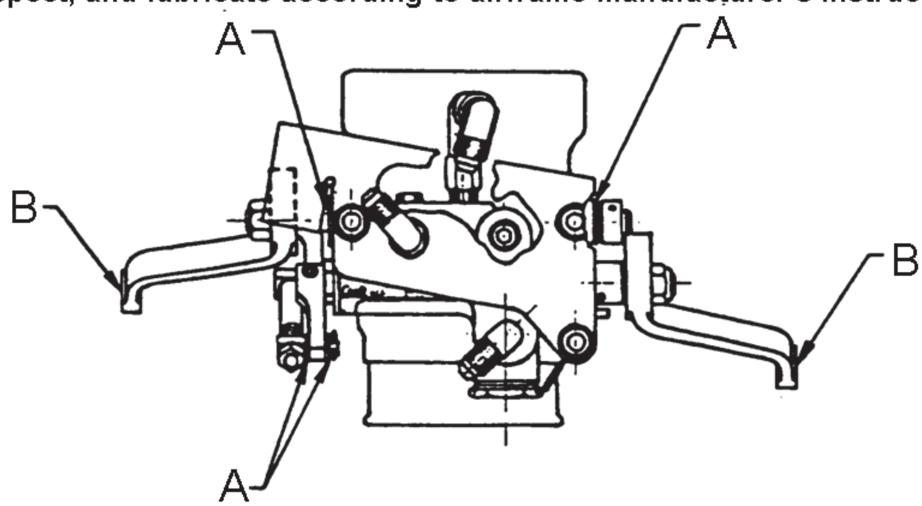


Figure 6-50. IO550-A, B & C Throttle Control Linkage

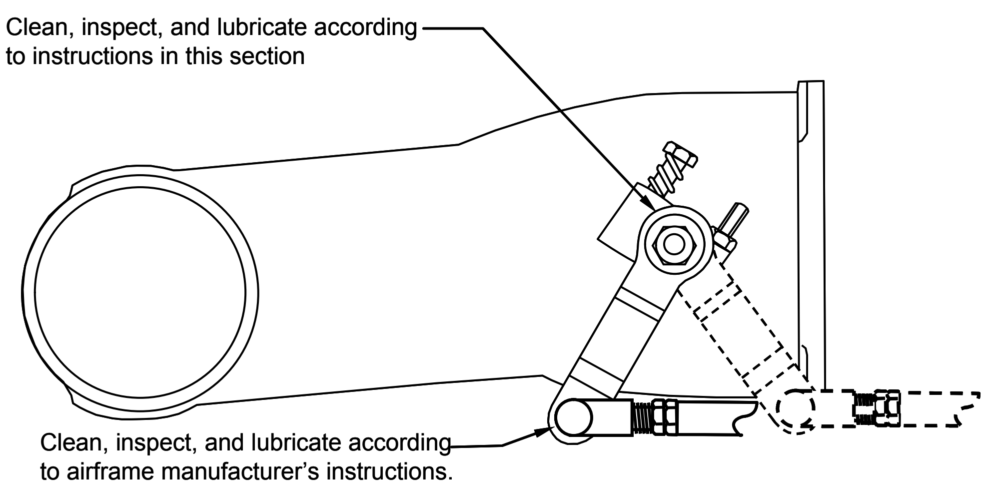


Figure 6-51. IO-550-G, N, P & R Throttle Control Linkage

6-3.19. Induction or Cylinder Drain Inspection

Purpose

Cylinder intake port fuel drains evacuate excess fuel from the intake ports. Restricted intake port drains can accumulate fuel and may cause cylinder hydraulic lock.

Frequency

- During all periodic inspections

Procedure

1. Connect a section of clear, fuel rated hose to the induction or cylinder drain hose.

WARNING

Vacuum pumps are commercially available from a number of sources. Use only a spark-arrested vacuum pump, designed for use with flammable liquids.

2. Apply light vacuum (< -5 psi) from a spark-arrested source rated for flammable liquids to the clear hose and activate the aircraft engine fuel primer system for five seconds.
   RESULT: Fuel drains from the hose into the container.
3. Apply light positive pressure (< 5 psi) from a spark-arrested source rated for flammable liquids to the clear hose and activate the aircraft engine fuel primer system for five seconds.
   RESULT: No fuel flows into the clear hose.
4. Remove air pressure source from the cylinder drain hose. Allow the drain hose to flow into a fuel rated container.
   RESULT: Fuel drains from the hose into the container.

6-3.20. Exhaust System Inspection

Refer to the airframe manufacturer's instructions for exhaust system inspection criteria and frequency.

6-3.21. Alternator Inspection

Frequency

- During 500-hour inspection

Procedure

1. Remove engine cowling and airframe components necessary to gain access to the alternator.
2. Remove the alternator according to instructions in Section 10-5.1 or Section 10-5.3.1. Perform the “Alternator Drive Hub Inspection” in Section 6-3.21.1 on all gear driven alternators. For belt driven alternators, proceed to step 3.
3. Inspect Continental Motors Alternators according to the Alternator Service Manual (Section 1-2.5, “Related Publications”); correct any discrepancies discovered during the inspection. Inspect Hartzell ES10024 Alternators according to the instructions in Section 6-3.21.2. For engines equipped with Hartzell ES7024 belt driven alternators, consult CMI SB11-1 for one time inspection requirements and Section 6-3.26.3 or SIL13-8 for instructions for continued airworthiness. For additional instructions regarding Hartzell alternator instructions for continued airworthiness, consult CMI SIL13-2. Correct any discrepancies discovered during the alternator inspection. Remove and replace all other alternators with a new, rebuilt or serviceable alternators.
4. Install the serviceable alternator according to Section 10-5.2, “Direct Drive Alternator Installation” or Section 10-5.3.2, “70 Amp Belt Driven Alternator Installation” after successfully completing the alternator manufacturer's service and inspection requirements.
5. Perform the instructions in the normal “Engine Start” (Section 7-3.2) and “Ground Run-up” (Section 7-3.3) to verify alternator operation.
6. Install airframe components and cowling according to the airframe manufacturer's instructions.

6-3.21.1. Alternator Drive Hub Inspection

NOTE: This procedure only applies to the direct drive alternator. The alternator drive hub is designed to slip when abnormal torque is required to rotate the alternator shaft.

Procedure

1. Remove the upper spark plugs according to instructions in Section 6-3.9.2.
2. Perform a “Gear Tooth Inspection” according to instructions in Section 15-3.1 on the alternator drive hub gear and the crankshaft gear.
   a. Rotate the crankshaft 360° in order to inspect the circumference of the face gear.
   b. Inspect the drive hub gear teeth for damage or missing material. If damage to the drive hub clutch is suspect, or damage is obvious, perform a “Foreign Object Contamination Inspection” according to instructions in Section 6-4.6.

3. Remove the alternator drive hub according to instructions in Section 10-5.1.1, “Direct Drive Alternator Drive Hub Removal.”

   NOTE: If the alternator drive hub exhibits damage or missing material, perform a “Foreign Object Contamination Inspection” according to the instructions in Section 6-4.6. Remove the foreign material from the crankcase and perform a visual inspection to determine if surrounding components were damaged as a result of the component failure.

4. Alternator couplings with a drive spring assembly were superseded in 1996 by the elastomer drive coupling. If the alternator is assembled with a drive spring assembly, remove the drive spring assembly and replace it with an elastomer drive coupling according to the instructions in Section 10-5.1.1 and Section 10-5.1.2.
5. Inspect the alternator drive coupling assembly for shearing or tearing of the elastomeric (rubber) element. Replace worn or damaged parts observed according to instructions in Section 10-5.1.2, “Direct Drive Alternator Drive Hub Installation.” Inspect the exterior of the alternator for evidence of oil leakage; Consult the alternator service instructions for oil seal replacement instructions. If the oil seal cannot be replaced, replace the alternator according to instructions in Section 10-5.

   CAUTION: Secure only the outer diameter of the drive hub assembly; allow the gear freedom of movement to prevent shearing the elastomer coupling.

6. Perform an “Alternator Drive Hub Slippage Inspection” according to the instructions in Section 15-7.6 on the elastomer drive coupling.
7. Install the serviceable drive hub on the alternator according to instructions in Section 10-5.1.2, “Direct Drive Alternator Drive Hub Installation.”
8. Install the upper spark plugs according to instructions in Section 6-3.9.2.

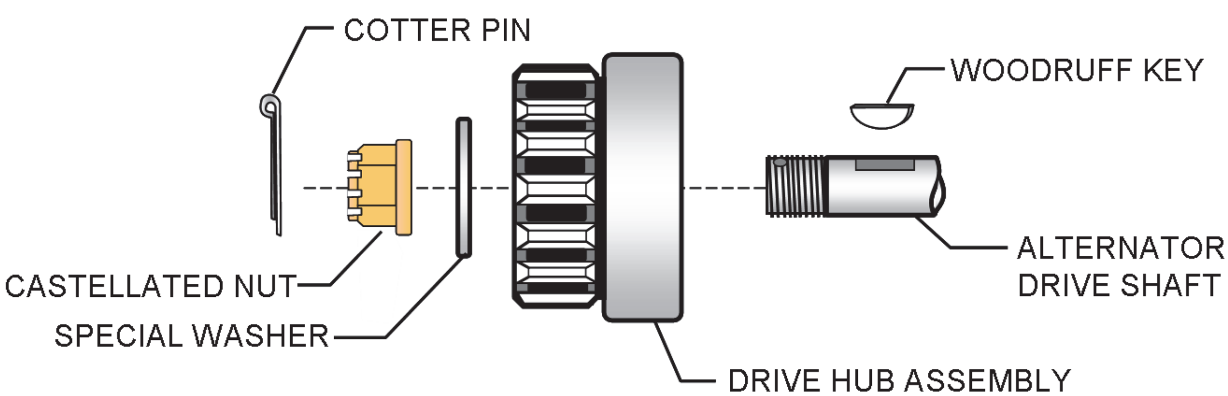


Figure 6-52. Alternator Drive Hub

6-3.21.2. 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 6-53) (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 (8) 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.

   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.

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

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 to Appendix B specifications.
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 in to place.

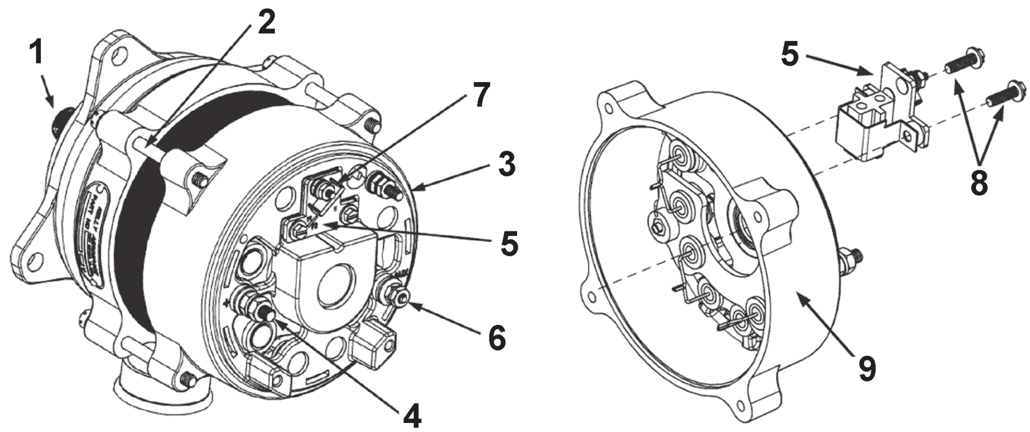


Figure 6-53. ES10024 Alternator

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						

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 6-3.21 to complete the alternator inspection.

6-3.21.3. Hartzell (Kelly) 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.

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.

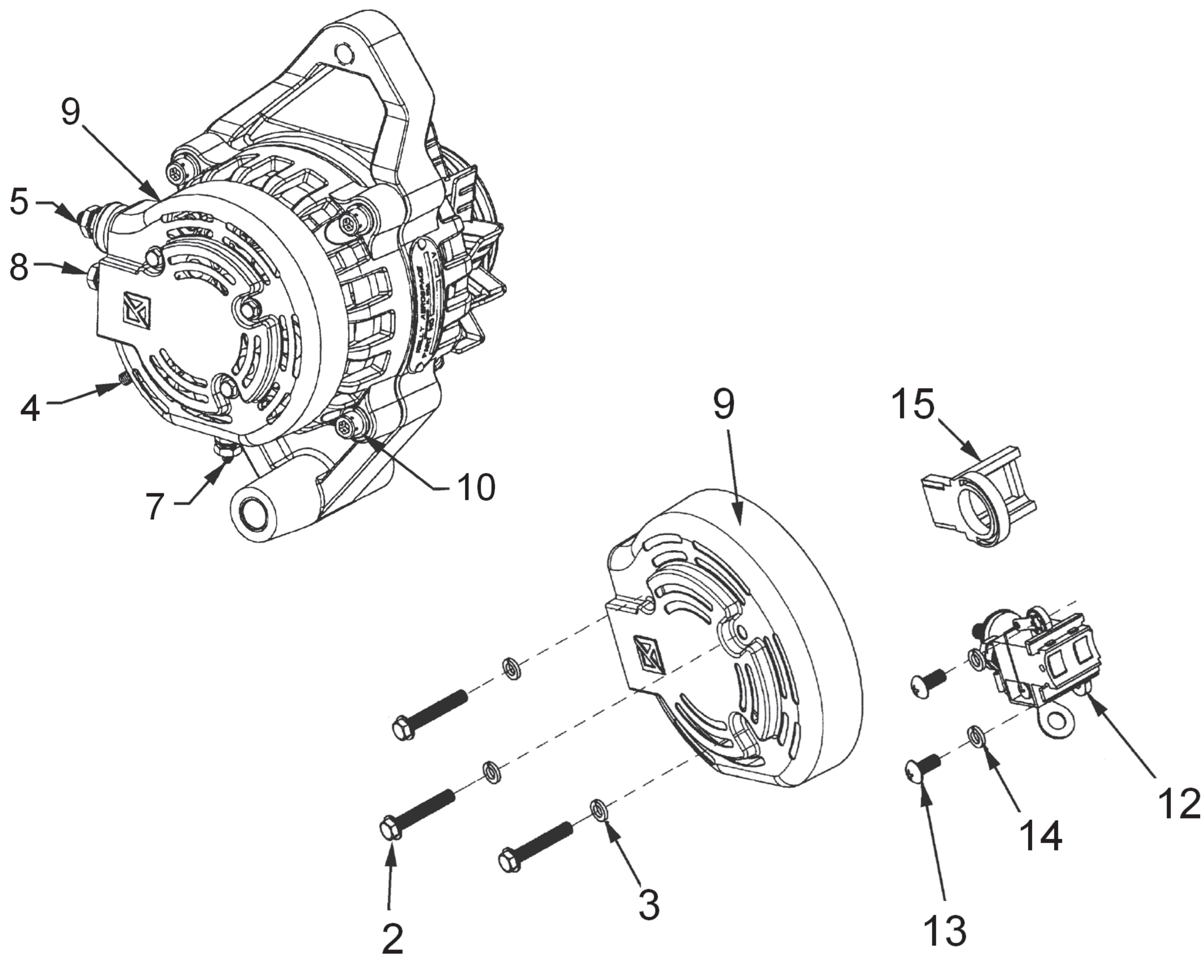


Figure 6-54. ES7024 Alternator Assembly

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	Seal
4	Ground Terminal	8	Field Terminal	12	Brush Assembly		

5. Disconnect the F1 (field) wire by removing the hardware. Remove the three screws and lock washers securing the back cover to the housing. Remove the back cover (Figure 6-54) (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.

   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 in to 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 and three new lock washers. Torque the screws 20-25 in. lbs.
14. Return to Section 6-3.21 to complete the alternator inspection.

6-4. Unscheduled Maintenance

6-4.1. Propeller Strike

A propeller strike is any incident (whether or not the engine is operating) in which the propeller contacts a foreign object that 1)results in the necessity to repair the propeller blade(s) (other than minor blade dressing) or 2)results in loss of engine RPM at the time of contact. Propeller strikes can cause engine and component damage even if the propeller continues to rotate. This damage can result in catastrophic engine failure.

WARNING

Do not attempt to dress a propeller blade without consulting the propeller manufacturer's instructions. Stresses imposed on the propeller are more concentrated in areas that are nicked and cut. They may act as stress risers. Stress risers weaken the blade and can eventually cause the blade to fracture.

In cases where a small foreign object such as a small stone, strikes the propeller during operation, inspect and repair the propeller according to the propeller manufacturer's instructions. If foreign object damage requires removal of the propeller for repair(s) perform the “Propeller Strike Inspection” in Section 6-4.1.1.

6-4.1.1. Propeller Strike Inspection

Procedure

1. Remove the propeller - inspect according to aircraft and propeller manufacturer's instructions.
2. Remove the engine from the aircraft according to instructions in Section 5-1.
3. Disassemble the engine completely according to instructions in Chapter 12 and 13.
4. Discard and replace all counterweight pins, counterweight bushings, counterweight end plates and snap rings, regardless of condition.
5. Thoroughly clean the crankshaft according to instruction in Chapter 14; all surfaces, especially those forward of the front main bearing, must be free of paint, sludge, or any substance that may mask cracks.
6. Perform a “Magnetic Particle Inspection” on the crankshaft, connecting rods, gears and remaining steel internal engine parts according to instructions in Section 15-5.
7. Clean the crankcase thoroughly according to instruction in Chapter 14; all surfaces must be free of paint, sludge, or any substance that may mask reliable inspection.
8. Perform a “Fluorescent Penetrant Inspection” on the crankcase according to instructions in Section 15-4, paying particular attention to the forward crankcase bearing support and adjacent structure.
9. Inspect the remainder of the engine according to the instructions in Chapter 15.
10. Perform the aircraft inspections required by the airframe manufacturer.
11. Inspect all engine accessories according to the manufacturer's instructions.

12. Regardless of condition, replace all counterweight pins, bushings, end plates and snap rings. Replace all connecting rod nuts and bolts, regardless of condition.
13. Assemble the engine according to instructions in Chapters 16 and 17, replacing items identified in the Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”
14. Install the engine according to instruction in Section 5-2.

6-4.2. Hydraulic Lock Inspection

Hydraulic lock occurs when fluid accumulates in the induction system or the cylinder assembly. The fluid restricts piston travel during the compression stroke. Engine damage occurs when the other cylinders fire, forcing the piston in the fluid filled cylinder through the compression stroke. Engine damage from hydraulic lock can be extensive due to the high stresses generated, which can adversely affect connecting rods, pistons, cylinder assemblies, piston pins, the crankcase, and crankshaft. Hydraulic lock may occur because of any of the following:

- Improper maintenance of the cylinder fuel drain lines
- Improper starting procedures
- Failure to properly remove preservative oil from an engine returned from storage

WARNING

Do not operate the engine if hydraulic lock is suspected.

1. Remove the engine from the aircraft according to instructions in Section 5-1.
2. Remove all engine components that: are attached to, or hinder access to, the engine cylinders according to instructions in Chapters 12 and 13.
3. Remove all engine cylinders and connecting rods according to instructions in Chapters 12 and 13.
4. Perform a “Connecting Rod Magnetic Particle Inspection” according to the instructions in Section 15-5.1 and “Connecting Rod Dimensional Inspection” according to Section 15-7.2.1. If all connecting rods pass the inspection criteria, proceed to step 6, otherwise continue with the step 5.

   NOTE: Destroy the stressed parts to prevent future installation.

5. If any connecting rod fails the inspection criteria, disassemble the engine completely according to Chapter 12 and 13. Clean the crankcase, cylinders and pistons according to instructions in Chapter 14. Perform Magnetic Particle, Fluorescent Penetrant and Ultrasonic Inspections, as appropriate, on the crankshaft, crankcase and cylinder parts. Perform the dimensional inspections for the crankcase and crankshaft according to Chapter 15 instructions. Replace any part which fails the inspection criteria and destroy the faulty part(s).
6. Reassemble the engine according to Chapters 16 and 17 and perform the “Post-overhaul Testing” according to instructions in Chapter 18.
7. Install the engine according to instruction in Section 5-2.

6-4.3. Engine Overspeed Inspections

Operating an engine beyond its capacity can damage the engine and result in subsequent engine failure. Engine overspeed severity is divided into three categories in Table 6-10:

Table 6-10. Overspeed Categories

Category	Engine Speed
CAT I	Rated Full power RPM to 3000 RPM
CAT II	3000-3300 RPM
CAT III	Over 3300 RPM

NOTE: Rated RPM limits for aircraft equipped with digital RPM measuring equipment may be adjusted to include a +2% deviation for normal operations. Any operation beyond the rated RPM limit plus the 2% deviation must follow the inspection criteria.

6-4.3.1. Category I Overspeed Inspection

If the duration of the overspeed event is less than ten seconds, no action is required. If the overspeed event persists longer than 10 seconds, land the plane and perform the following inspection:

Procedure

1. Drain oil and inspect for debris. Remove the oil filter (or screen) and inspect the filter element for debris.
2. Remove the rocker covers and inspect the following for damage or debris:
   a. Valves
   b. Springs
   c. Rocker arms
   d. Tappets
   e. Spring retainers
   f. Pushrods
3. Inspect components using the service limits in Chapter 10; repair and assemble the engine components according to instructions Chapters 15-18.
4. Check accessory drives for excessive backlash.
5. Service the engine with new oil and oil filter according to instructions in 6-3.8.2.
6. If no discrepancies are noted, repeat step 1 after five hours of accumulated flight.

6-4.3.2. Category II Overspeed Inspection

If the overspeed event duration is less than ten seconds, perform the Category I Overspeed Inspection and Service requirements specified in Section 6-4.3.1. If the overspeed event lasts longer than 10 seconds, land the plane and perform the following inspection:

Procedure

1. Complete Category I inspection and service requirements.
2. Remove all cylinder assemblies, including pistons and rods.
3. Remove all counterweights.
4. Replace all connecting rod nuts and bolts. Inspect removed components using service limits in Chapter 10 of this manual and assemble the engine according to instructions in Chapters 16 and 17.

6-4.3.3. Category III Overspeed Inspection

Overspeed conditions in this category are considered extreme. Category III overspeed cases must be evaluated based on factors at the time of the incident. A Continental Motors service representative (see "Contact Information" in Section 1-3) will assist in determining required actions to return the engine to an airworthy service condition.

Procedure

1. Remove the engine and clearly identify the reason for removal:

   "Removed for excessive overspeed"

2. Perform a complete engine overhaul. Replace the following without regard to overhaul inspection limits:
   a. connecting rods
   b. connecting rod bolts and nuts
   c. all valve train components

6-4.4. Lightning Strike Inspection

Procedure

1. Remove the engine according to instructions in Section 5-1.
2. Disassemble the engine according to instructions in Chapter 12 and 13.
3. Inspect the engine for arcing and heat damage to the crankshaft rod journals, main journals, counterweights, camshaft lobes, bearings, gear teeth, and all other hardened surfaces. Perform a "Magnetic Particle Inspection" according to instructions in Section 15-5 and degauss all steel parts of the engine during the inspection.
4. Perform dimensional inspections on the remaining parts according to Chapter 15 according to the Service Limits in Chapter 10. Replace all non-conforming parts.
5. Reassemble the engine according to instructions in Chapter 15-18.
6. Install the engine according to instruction in Section 5-2.

6-4.5. Contaminated Fuel System Inspection

Engines described in this manual are certified for operation with 100-LL Blue or 100 Green aviation fuels. If the fuel tanks are filled with an improper grade of fuel but neither the aircraft boost pump nor the engine is operated with the improper grade of fuel, purge the fuel tanks according to the aircraft maintenance manual instructions. If the aircraft boost pump or the engine are operated with an incorrect grade of aviation fuel or jet fuel:

Procedure

1. Do not fly the aircraft.
2. Drain and purge the aircraft fuel system according to the aircraft manufacturer's instructions.
3. Remove the engine according to instructions in Section 5-1.
4. Disassemble, clean, and inspect the engine according to Chapters 11-15 instructions. Replace any cylinder, piston, piston pin, connecting rod or crankshaft exhibiting signs of detonation.
5. Reassemble and test the engine according to instructions in Chapters 15-18.
6. Install the engine according to instruction in Section 5-2.

6-4.6. Foreign Object Contamination Inspection

Foreign Object Damage (FOD) occurs when material that wasn't included in the original design contacts (internally or externally) and contaminates the engine. FOD can increase friction, prohibit normal distance of travel, block oil passages, accelerate wear on contact surfaces or cause immediate catastrophic failure of components or the entire engine. FOD may be caused by external elements (i.e. sand, grit or metal shavings) or debris from fractured internal components such as an improperly torqued fasteners.

WARNING

Exercise strict housekeeping standards when performing aircraft and engine maintenance. Inventory tools before and after performing maintenance. When replacing engine parts, remove all remnants (safety wire, gasket material, o-rings, fragmented parts, etc.) of the removed part from the engine before installing the new part.

Procedure

1. Drain the engine oil and remove the oil sump from the crankcase.
2. Conduct a thorough inspection of the oil sump, crankcase, crankshaft, camshaft, cylinder walls and pistons for the presence of, or damage caused by foreign objects.
   a. If damage is discovered or any portion of the foreign material is not accounted for: disassemble, clean, inspect, repair and assemble the engine according to instructions in Chapters 12-15 using the service limits in Chapter 10.

   CAUTION: Disassemble and thoroughly inspect the entire engine before assembly and return to service following a foreign object contamination event. Minimum inspection requirements are provided in step b if the owner/operator determines no foreign material remains in the engine and elects to not perform a complete inspection. Continental Motors assumes no responsibility for engine operation or airworthiness after a contamination event.

   b. If 100% of the foreign material is retrieved from the oil sump and no further material is discovered, clean the sump according to instructions in Chapter 14; install the oil sump, service the engine oil and return the engine to service. Perform the next three oil changes at ten hour intervals to confirm lack of foreign material in the oil.
3. Correct discrepancies discovered during the inspection. Do not return the engine to service until the contamination is eliminated and appropriate repairs are made to correct any discrepancies discovered during the inspection.

6-5. Inspection Checklists

Inspection checklists are included as a convenient record of inspection progress and findings. Using a copy of the form ensures a blank form will be available for the next scheduled inspection. When an inspection is due, make a copy of the inspection checklist to record inspection progress and findings while following the steps in the inspection procedures. The checklists are not designed to replace the procedures; only augment them. File the completed checklists in the aircraft logbook.

Table 6-11. Engine Operational Checklist

Aircraft Make & Model:		**Aircraft Registration #:**			
Engine Model:		**Engine Position:**	**Left**	**Right**	**Front** / **Rear**
Engine Serial Number:		**Engine Total Time:**	❑ **New**	❑ **Overhaul**	
Date	**Location:**	**Elevation:**	**Outside Air Temp.:**	**Altitude:**	

Operational Check

RPM		Magneto Drop Check			MAP		Cylinder Head Temp. - °F						EGT	TIT
Spec	Actual	L	R	Drop/Spread	Spec	Actual	1	2	3	4	5	6	°F	°F

Adjustments

IDLE Fuel Pressure (psi)				Full Power Fuel Pressure (psi)				Oil			
Spec	Actual	Adjustments		Spec	Actual	Adjustments		Pressure	Temp.	Adjustments	
		CW	CCW			CW	CCW	PSI	°F	CW	CCW

Check Flight Data

RPM	MAP	Pressure Altitude	EGT °F		TIT °F		CHT °F	
		Set altimeter to 29.92"	Spec	Actual	Spec	Actual	Spec	Actual

Fuel Flow		Oil PSI		Oil Temp. °F		Indicated Airspeed
Spec	Actual	Spec	Actual	Spec	Actual	Nautical M.P.H. (knots)

Remarks:

Signature:

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Table 6-12. 25-Hour Initial Operation Inspection Checklist

Engine Model Number: ___________________ Engine Serial Number: _________________

Total Time Engine Has Been in Service: _______________

Time Since Major Overhaul (TSMOH) __________________ Engine in Storage? ________

Date Inspection Performed: ________ Inspection Performed by:_____________________

Complete the 25-hour inspection according to the instructions referenced in the table, heeding all warnings, cautions and notes. Initial the block beside the procedure upon completion. Note discrepancies in the Inspector Comments or Remarks sections.

Inspection Item	Initials	Inspector Comments
"Visual Inspection" (Section 6-3.6)		
Check Oil Consumption (Section 6-3.2)		
Collect an oil sample and submit to laboratory for spectrographic analysis. (Section 6-3.8.4 and Section 6-3.8.5)		
"Induction System Inspection" (Section 6-3.14)		
"Induction or Cylinder Drain Inspection"(Section 6-3.19)		
Change Engine Oil and Filter (Section 6-3.8.2)		
Engine Run (Section 7-3.2)		
•Idle RPM:		
•Idle Mixture Cut-Off Rise		
•Acceleration		

Remarks:

Approval Block:

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Table 6-13. 50-Hour Engine Inspection Checklist

Engine Model Number: ___________________ Engine Serial Number: _________________

Total Time Engine Has Been in Service: _______________

Time Since Major Overhaul (TSMOH) __________________ Engine in Storage? ________

Date Inspection Performed: ________ Inspection Performed by:_____________________

Complete the 50-hour inspection according to the instructions referenced in the table, heeding all warnings, cautions and notes. Initial the block beside the procedure upon completion. Note discrepancies in the Inspector Comments or Remarks sections.

Inspection Item	Initials	Inspector Comments
Oil Consumption and Trend Monitoring		
Oil Analysis Profile Established? (Section 6-3.8.5)		
Oil Analysis Laboratory used?		
Date of last oil sample analysis:		
Silicone content of last sample:		
Oil consumption quantity noted during oil change:		
Is oil consumption excessive? ❑Yes ❑No		
"Visual Inspection" (Section 6-3.6)		
Oil and Filter Change (Section 6-3.8.2) (4.8" filter only)		
"Induction System Inspection" (Section 6-3.14)		
"Induction or Cylinder Drain Inspection" (Section 6-3.19)		
Engine Run (Section 7-3.2)		
•Idle RPM:		
•Idle Mixture Cut-Off Rise		
•Acceleration		

Remarks:

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Table 6-14. 100-Hour Engine Inspection Checklist

Engine Model Number: ___________________ Engine Serial Number: _________________

Total Time Engine Has Been in Service: _______________

Time Since Major Overhaul (TSMOH) __________________ Engine in Storage? ________

Date Inspection Performed: ________ Inspection Performed by:_____________________

Complete the 100-hour inspection according to the instructions referenced in the table, heeding all warnings, cautions and notes. Initial the block beside the procedure upon completion. Note discrepancies in the Inspector Comments or Remarks sections.

Inspection Item	Initials	Inspector Comments
Engine Operational Check(Section 6-3.7)		
Oil Consumption and Trend Monitoring		
Oil Analysis Profile Established? (Section 6-3.8.5)		
Oil Analysis Laboratory used?		
Date of last oil sample analysis:		
Silicone content of last sample:		
Oil consumption quantity noted during oil change:		
Is oil consumption excessive? ❑Yes ❑No		
“Visual Inspection” (Section 6-3.6)		
Accessory Mounting and Security Inspection (Step 15 in Section 6-3.4)		
“Cylinder Inspections”(Section 6-3.11) using the Cylinder Inspection Checklist (Table 6-16 on page 6-113)		
“Crankcase Inspection”(Section 6-3.12)		
“Engine Mount Inspection” (Section 6-3.13)		
“Induction System Inspection” (Section 6-3.14)		
“Ignition System Inspection” (Section 6-3.15)		
“Engine Gauge Inspection” (Section 6-3.16)		
“Fuel System Inspection” (Section 6-3.17)		
“Engine Control Linkage Inspection” (Section 6-3.18)		
“Induction or Cylinder Drain Inspection”(Section 6-3.19)		
“Exhaust System Inspection” (Section 6-3.20)		
Oil and Filter Change (Section 6-3.8.2)		
Engine Operational Check (Section 6-3.7)		

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Table 6-14. 100-Hour Engine Inspection Checklist

Engine Model Number: ___________________ Engine Serial Number: _________________ **Total Time Engine Has Been in Service: _______________** **Time Since Major Overhaul (TSMOH) __________________ Engine in Storage? ________** **Date Inspection Performed: ________ Inspection Performed by:_____________________**
Remarks:
Approval Block:
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Table 6-15. 500-Hour Engine Inspection Checklist

Engine Model Number: ___________________ **Engine Serial Number:** _________________

Total Time Engine Has Been in Service: _______________

Time Since Major Overhaul (TSMOH) __________________ **Engine in Storage?** ________

Date Inspection Performed: ________ **Inspection Performed by:**____________________

Complete the 500-hour inspection according to the instructions referenced in the table, heeding all warnings, cautions and notes. Initial the block beside the procedure upon completion. Note discrepancies in the Inspector Comments or Remarks sections.

Inspection Item	Initials	Inspector Comments
Engine Operational Check(Section 6-3.7)		
Oil Consumption and Trend Monitoring		
Oil Analysis Profile Established? (Section 6-3.8.5)		
Oil Analysis Laboratory used?		
Date of last oil sample analysis:		
Silicone content of last sample:		
Oil consumption quantity noted during oil change:		
Is oil consumption excessive? ❑Yes ❑No		
“Visual Inspection” (Section 6-3.6)		
Accessory Mounting and Security Inspection (Step 15 in Section 6-3.4)		
Paper Induction Filter Replacement (Section 6-3.5)		
“Cylinder Inspections”(Section 6-3.11) using the “Cylinder Inspection Checklist” (Table 6-16)		
“Crankcase Inspection”(Section 6-3.12)		
“Engine Mount Inspection” (Section 6-3.13)		
“Induction System Inspection” (Section 6-3.14)		
“Ignition System Inspection” (Section 6-3.15)		
500-Hour (Continental Magneto) Inspection or (non-Continental) Magneto Replacement (Section 6-3.15)		
“Engine Gauge Inspection” (Section 6-3.16)		
“Fuel System Inspection” (Section 6-3.17)		
“Engine Control Linkage Inspection” (Section 6-3.18)		
“Induction or Cylinder Drain Inspection”(Section 6-3.19)		
“Exhaust System Inspection” (Section 6-3.20)		

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Table 6-15. 500-Hour Engine Inspection Checklist

Engine Model Number: __________________ Engine Serial Number: ________________ **Total Time Engine Has Been in Service: ______________** **Time Since Major Overhaul (TSMOH) _________________ Engine in Storage? _______** **Date Inspection Performed: _______ Inspection Performed by:____________________**		
“Alternator Inspection” (Section 6-3.21)		
Oil and Filter Change (Section 6-3.8.2)		
Engine Operational Check (Section 6-3.7)		
Remarks:		
Approval Block:		
Checklist Page 2 of 2		

Table 6-16. Cylinder Inspection Checklist

Engine Model Number: ___________________ **Engine Serial Number:** _________________

Total Time Engine Has Been in Service: _______________

Time Since Major Overhaul (TSMOH) __________________ **Engine in Storage?** ________

Date Inspection Performed: ________ **Inspection Performed by:**_____________________

Inspection Item						Inspector Comments
Complete the cylinder inspection according to the instructions referenced in the table, heeding all warnings, cautions and notes. Initial the block beside the procedure upon completion. Note discrepancies in the Inspector Comments or Notes sections.						
Complete a visual inspection of the cylinder exterior and power stroke areas for signs of cracks, leaks, rust or pitting (Section 6-3.11.1).						
Cylinders						
1	**2**	**3**	**4**	**5**	**6**	
❑	❑	❑	❑	❑	❑	
Complete a visual inspection of the cylinder head barrel, fins, ports and bosses for evidence of fuel oil or soot (Section 6-3.11.1)						
Cylinders						
1	**2**	**3**	**4**	**5**	**6**	
❑	❑	❑	❑	❑	❑	
Inspect the cylinder to crankcase mounting deck for visible signs of RTV sealant (Section 6-3.11.4).						
Cylinders						
1	**2**	**3**	**4**	**5**	**6**	
❑	❑	❑	❑	❑	❑	
Differential Pressure Check (Section 6-3.11.2)						
Baseline Master Orifice Calibrated Pressure Reading:						
Cylinder Pressure Reading						
1	**2**	**3**	**4**	**5**	**6**	
NOTES:						
Page 1 of 3						

Table 6-16. Cylinder Inspection Checklist

Engine Model Number: ___________________ Engine Serial Number: _________________

Total Time Engine Has Been in Service: _______________

Time Since Major Overhaul (TSMOH) __________________ Engine in Storage? ________

Date Inspection Performed: ________ Inspection Performed by:____________________

Cylinder Borescope Findings (Section 6-3.11.3)

Place a check mark in the column of any cylinder exhibiting the characteristics described in the left column.

Condition	**1**	**2**	**3**	**4**	**5**	**6**
Normal Wear.	❑	❑	❑	❑	❑	❑
Light Rust (acceptable in absence of excessive oil consumption or leaks)	❑	❑	❑	❑	❑	❑
Small areas of heavy rust (less than ½ inch diameter)	❑	❑	❑	❑	❑	❑
Heavy rust (greater than ½ inch)	❑	❑	❑	❑	❑	❑
Pitting of on cylinder wall.	❑	❑	❑	❑	❑	❑
Heavy wear	❑	❑	❑	❑	❑	❑
Scoring	❑	❑	❑	❑	❑	❑
Static seal leakage	❑	❑	❑	❑	❑	❑
Other discrepancies	❑	❑	❑	❑	❑	❑

Cylinder Inspection Summary

Place a check mark in the column of any cylinder exhibiting the characteristics described in the left column. Cylinders exhibiting the following characteristics must be removed and repaired or replaced according to the instructions in Section 10-8, “Engine Cylinder Maintenance.”

Condition	**1**	**2**	**3**	**4**	**5**	**6**
Heavy rust, characterized by pitting of the cylinder wall	❑	❑	❑	❑	❑	❑
Scoring or scratches in the honed surface of the cylinder wall (or bore)	❑	❑	❑	❑	❑	❑
Blistered paint on the cylinder barrel/other evidence of excessive wear and internal heat	❑	❑	❑	❑	❑	❑
Cylinder subjected to overheating/ detonation/piston scoring or piston pin damage to the cylinder bore.	❑	❑	❑	❑	❑	❑
Cylinder with radial fin crack extending to the root of a fin	❑	❑	❑	❑	❑	❑
Cylinder with barrel fin crack	❑	❑	❑	❑	❑	❑
Cylinder head turned in relation to barrel flange	❑	❑	❑	❑	❑	❑

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Table 6-16. Cylinder Inspection Checklist

Engine Model Number: ___________________ **Engine Serial Number:** _________________

Total Time Engine Has Been in Service: _______________

Time Since Major Overhaul (TSMOH) __________________ **Engine in Storage?** ________

Date Inspection Performed: ________ **Inspection Performed by:**_____________________

Condition	1	2	3	4	5	6
Heavy bore wear	❑	❑	❑	❑	❑	❑
Cylinder leaks	❑	❑	❑	❑	❑	❑
Low differential pressure/ excessive oil consumption	❑	❑	❑	❑	❑	❑
Static seal leakage/head to barrel leakage, or crack in head or barrel	❑	❑	❑	❑	❑	❑
	❑	❑	❑	❑	❑	❑

Inspection Follow-up

Check all column(s) that apply to the scope of inspection and repair.

Condition	1	2	3	4	5	6
Cylinder passed inspection	❑	❑	❑	❑	❑	❑
Repaired Cylinder	❑	❑	❑	❑	❑	❑
Replaced Cylinder	❑	❑	❑	❑	❑	❑

Remarks:

Approval Block:

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Chapter 7. Engine Operation

7-1. Introduction

This chapter contains IO-550 Permold series engine operating instructions to facilitate maintenance personnel. For complete engine operating instructions, refer to Chapter 4 in the IO-550 Permold Series Engine Installation and Operation Manual (OI-16).

Instructions in this chapter apply to IO-550 Permold Series engine operation conforming to the engine original type design approved by the Federal Aviation Administration that have been equipped by the aircraft manufacturer with variable pitch propellers.

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 6-3.7 prior to releasing the engine for normal operation.

WARNING

The "Engine Operational Check" in Section 6-3.7 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.

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 6-3.8.

The Oil Change Interval is specified in Table 6-1, "Engine Inspection and Maintenance Schedule."

7-2.2. Engine Fuel Requirements

WARNING

The engine is certified for operation with the aviation fuels specified in Section 2-3. 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 6-4.5.

7-2.3. Flight Check and Break-In

New and factory rebuilt Continental Motors engines are adjusted to meet engine specifications in a test cell prior to shipment. A flight check ensures the engine meets operational specifications after installation and prior to release for normal service. Section 2-3, “Engine Specifications” contains the engine specifications and operating limits for each engine model.

Perform an operational check, preflight and ground run-up, according to the AFM/POH, before releasing the engine for a Flight Check. Engines with an altitude compensating fuel pump require a Flight Check after engine installation, fuel system repairs or adjustments, significant changes in geographic location from the last operational check, if the auto-leaning function is suspect, and at twelve month intervals, in conjunction with the Annual/100-hour inspection. Engines equipped with a standard fuel pump flight check requirements are the same as the engines with an altitude compensating fuel pump except geographic location and auto-leaning functions do not apply. A flight check is also required for engines with a standard fuel pump if rated, full power RPM cannot be verified during a ground run-up.

Follow the instructions in Section 7-2.3 for the first 25 hours of operation to complete the recommended break-in period for Continental Motors engines. Perform a flight check on engine models equipped with a standard fuel pump according to instructions in Section 7-2.3.2; see Section 7-2.3.3 for engine models with an altitude compensating fuel pump.

7-2.3.1. Engine Break-In

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 your engine model. Table 7-1 contains engine model parameters applicable to the flight check.

CAUTION: High power ground operation resulting in cylinder and oil temperatures exceeding normal operating limits can be detrimental to cylinders, pistons, valves, and rings.

1. Start the engine according to instructions in Section 7-3.2, "Engine Start."
2. Conduct a normal ground run-up and take-off according to the AFM/POH instructions.
3. Monitor the following engine instrument panel indications: a) engine RPM, b) fuel flow and pressure, c) Oil pressure and temperature, d) cylinder head temperature, and e) exhaust gas temperature.
4. 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.
5. 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°F-150°F rich of peak exhaust gas temperature. Adjust engine controls or aircraft attitude to maintain engine instrumentation within specification.

    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

Long descents at high engine RPM or low manifold pressure may cause 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).

6. 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.
7. Comply with the scheduled maintenance intervals specified in Table 6-1, "Engine Inspection and Maintenance Schedule."

7-2.3.2. IO-550 Standard Fuel System Flight Check

1. Start the engine and conduct a normal ground run-up and take-off according to the AFM/POH.
2. Monitor the following engine instrument panel indications: a) engine RPM, b) fuel flow and pressure, c) oil pressure and temperature, d) cylinder head temperature, and e) exhaust gas temperature.
3. Ascend to a safe cruise altitude for the vicinity where the flight check will be performed.
4. Increase fuel mixture, propeller governor, and throttle, in that order, to achieve rated full power engine RPM.
   RESULT: Engine RPM and full power, metered fuel pressure meets the engine model specifications in Table 7-1, “IO-550 Engine Operating Limits.” If the engine fails to meet the operating specifications, repeat the engine operational check and necessary adjustments according to the instructions in Section 6-3.7, “Engine Operational Check.” and Section 6-3.10, “Engine Adjustments.”

7-2.3.3. IO-550 Altitude Compensating Fuel System Flight Check

NOTE: Accuracy of tachometer and fuel flow metering device is critical to the outcome of the flight check. Verify tachometer and flow meter accuracy according to the airframe manufacturer's instructions prior to performing the flight check.

1. Start the engine and conduct a normal ground run-up and take-off according to the AFM/POH.
2. Monitor the following engine instrument panel indications: a) engine RPM, b) fuel flow and pressure, c) Oil pressure and temperature, d) cylinder head temperature, and e) exhaust gas temperature.
3. Set the altimeter to 29.92 in. Hg.
4. Navigate the aircraft to an area of low air traffic density. Ascend to a pressure altitude which offers unobstructed straight and level flight within the altitude scale presented in Table 7-1 on page 5.
   RESULT: If the engine RPM and full power fuel flow meet the specifications depicted in the Altitude Leaning Schedule in Figure 7-1 through Figure 7-3 for IO-550-A, B & C engines equipped with altitude compensating fuel pumps, proceed to step 5. If the engine fails to meet the operating specifications, repeat the “Engine Operational Check” in Section 6-3.7 and make necessary adjustments according to the “Fuel System Adjustment” and “Auto Leaning Schedule Adjustments” instructions in Section 6-3.10.2 and Section 6-3.10.3, respectively.

WARNING

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

5. Release the engine to normal service.

7-2.3.4. Flight Check Limits

Table 7-1. IO-550 Engine Operating Limits

Specification	Engine Model Limits						
	A	B	C	G	N	P	R
Full Throttle Speed +/- 25 RPM	2700	2700	2700	2500	2700	2700	2700
Idle Speed +/- 25 RPM	600	600	600	600	600	600	600
Unmetered Fuel Pump Pressure (Idle) (psi)	8.0-10.0	8.0-10.0	8.0-10.0	8.0-10.0	8.0-10.0	8.0-10.0	8.0-10.0
Metered Full Power Fuel Pressure	17.7-20.0	16.5-18.4	17.6-19.6	14.7-16.0	19.0-21.3	19.0-21.3	19.0-21.3
Unmetered Fuel Pump Pressure (Full Power) (psi) (reference)	32.0-36.0	29.2-36.2	31.6-37.8	22.0-26.0	28.0-30.0	28.0-30.0	28.0-30.0
Oil Temperature	75° - 240°F (24°-116 °C)						
Oil Pressure (min.-max.)	10-100 psig						
Magneto Drop/Spread	150/75						
Cylinder Head Temperature	460°F (238°C)						

Altitude Leaning Schedules (applicable only to engines with altitude compensating fuel pumps)

Pressure Altitude (ft.) (set altimeter to 29.92 in. Hg)	IO-550-A				IO-550-B				IO-550-C			
	Fuel Flow (lbs/hr.)		Fuel Pressure (psid)		Fuel Flow (lbs/hr.)		Fuel Pressure (psid)		Fuel Flow (lbs/hr.)		Fuel Pressure (psid)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Sea Level	142	152	16.5	17.2	146	156	17.2	18.3	152	160	18.2	18.9
1000	141	149	16.3	17.1	145.5	155.5	17.1	18.2	151	159	18.0	18.7
2000	138	146	15.9	16.6	145	155	17.0	18.1	148	156	17.5	18.2
3000	133	141	15.1	15.7	144	154	16.9	17.9	143	151	16.7	17.4
4000	128	136	14.3	14.9	142	152	16.5	17.5	138	146	15.9	16.5
5000	123	131	13.6	14.1	139	149	16.1	17.0	134	142	15.3	15.9
6000	120	128	13.2	13.7	135.5	145.5	15.5	16.5	130	138	14.7	15.3
8000	113	121	12.3	12.7	127	137	14.2	15.1	123	131	13.6	14.1
10000	108	116	11.6	12.1	117	127	12.8	13.6	118	126	12.9	13.4
12000	103	111	11.0	11.4	110	120	11.9	12.6	113	121	12.3	12.7
14000	98	106	10.4	10.7	105	115	11.3	11.9	108	116	11.7	12.1

Dividing the charted fuel value by 5.87 will convert pounds per hour (lbs.hr.) to gallons per hour @ 70°F

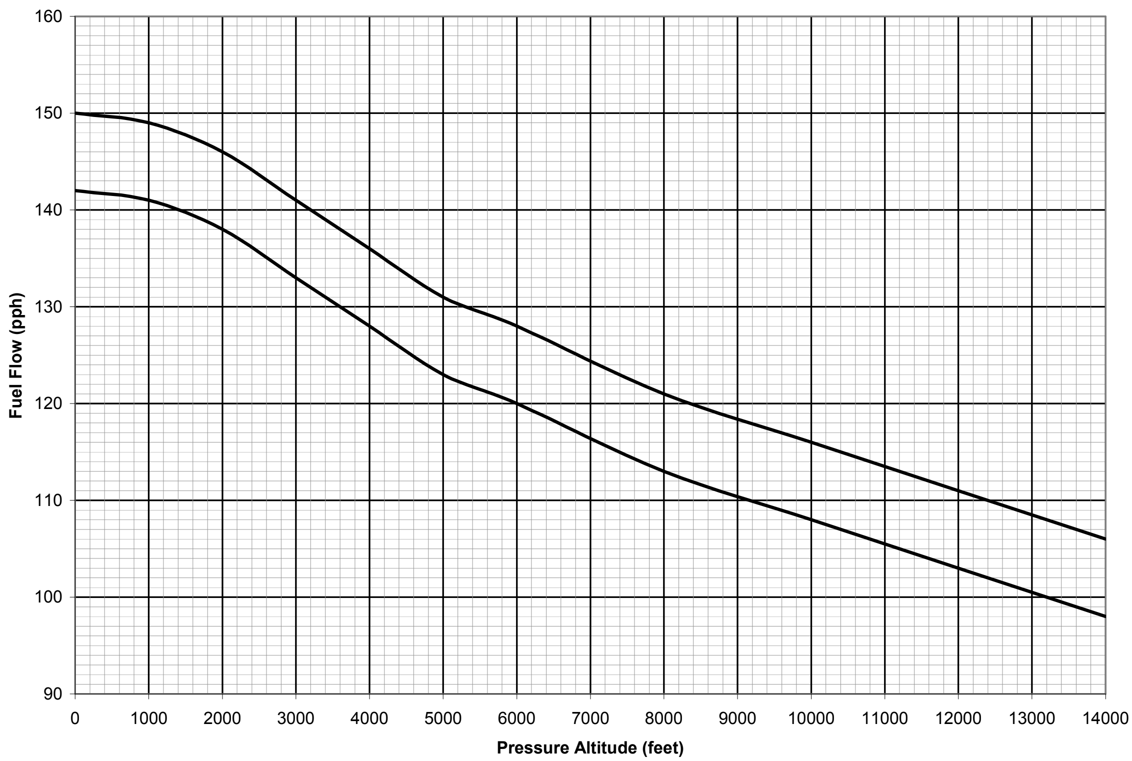

Figure 7-1. IO-550-A Altitude Leaning Chart

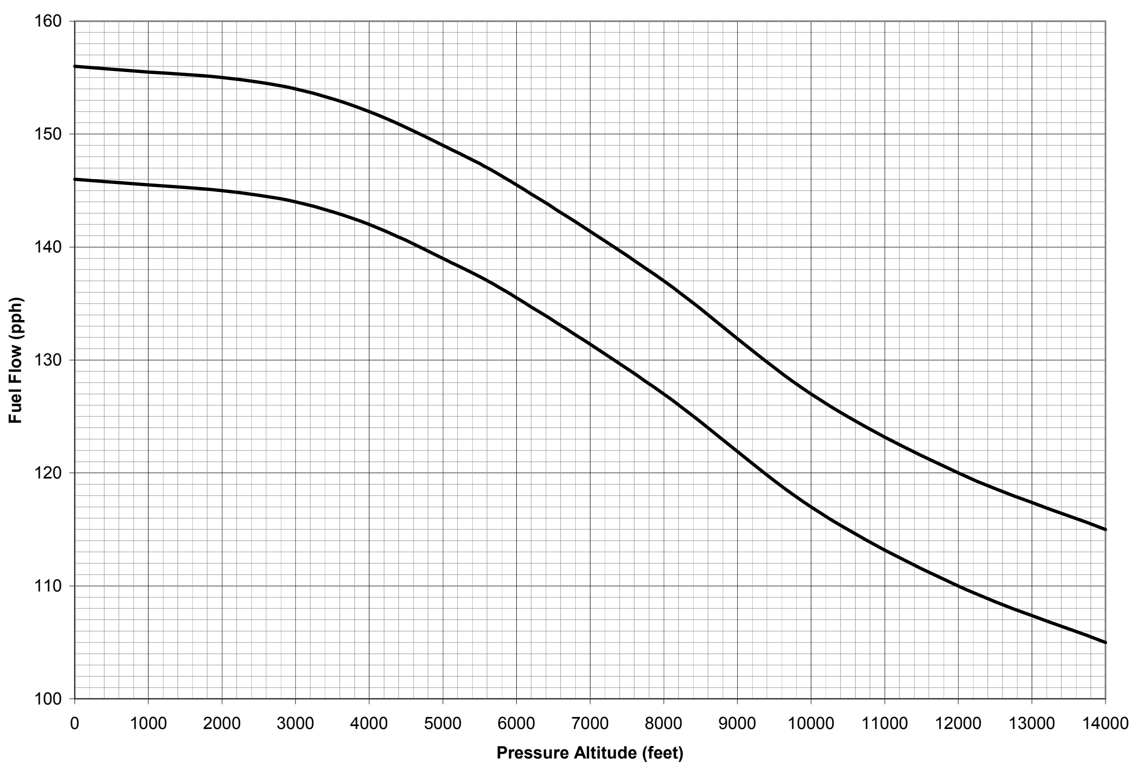

Figure 7-2. IO-550-B Altitude Leaning Chart

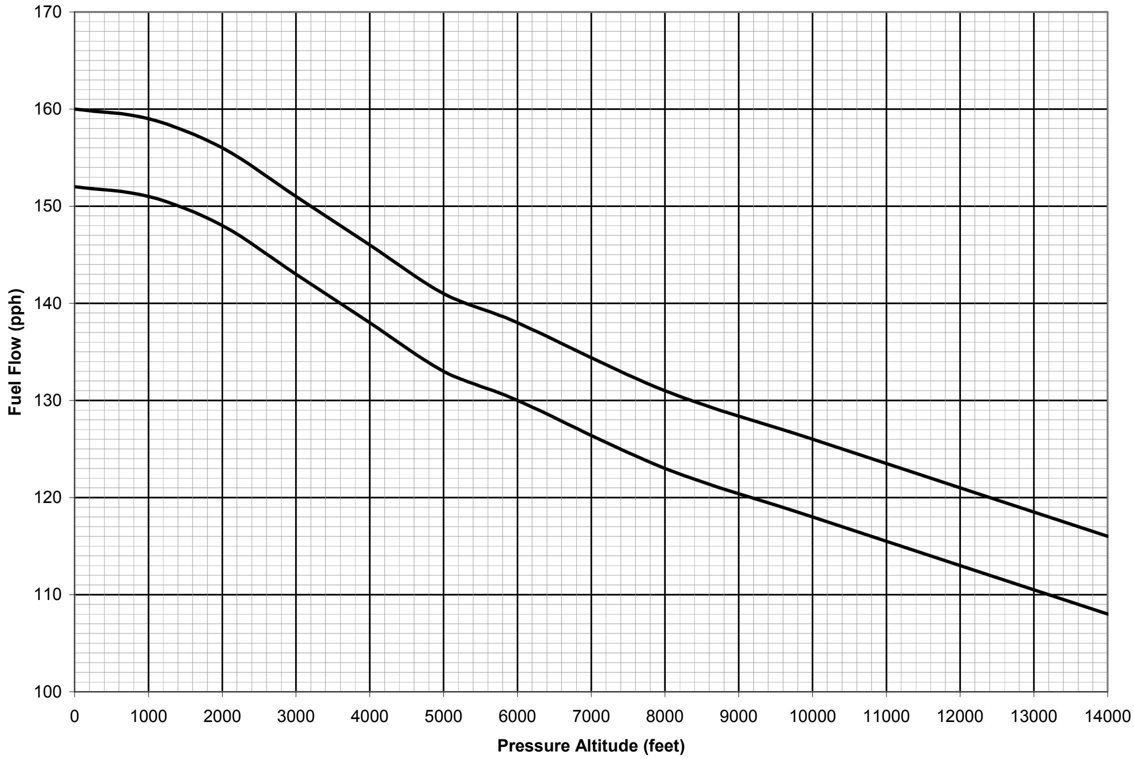

Figure 7-3. IO-550-C Altitude Leaning Chart

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 for all aircraft operation unless directed otherwise by the AFM/POH.

WARNING

Before flying the aircraft, ensure all tasks listed in the section "Flight Prerequisites" in Section 7-2 have been completed, in addition to those required aircraft manufacturer's instructions 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 Run-up
- Engine Shutdown

7-3.1. Pre-operational Requirements

1. Check the oil level, and verify quantity is within specified limits.
2. Verify oil fill cap and gauge rod (dipstick) are secure.
3. Drain all fuel sumps and strainers in accordance with airframe manufacturer's recommendations.
4. Check the fuel system according to the AFM/POH and verify compliance with Section 7-2.2, "Engine Fuel Requirements."
5. Check propeller and propeller hub for cracks, oil leaks, and security.
6. Check engine nacelle for signs of damage, leaks, and debris.

7-3.2. Engine Start

Refer to the AFM/POH for detailed engine starting procedures. Complete the "Pre-operational Requirements" tasks listed in Section 7-3.1 prior to starting the engine; ensure you are 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, possible engine kick-back resulting in a broken starter adapter clutch spring and/or subsequent internal engine damage.

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 AFM/POH or Supplemental Type Certificate (STC) holder. Note the following:

- If the engine is being started in extreme cold, preheating is required if the temperature is at or below 20°F. Refer to Section 7-4.1, "Engine Operation in Extreme Cold."
- 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."

1. Propeller...Clear
2. Fuel Selector Valve ....BOTH of fullest tank
3. Master Power Switch ....ON
4. Ignition Switch..BOTH
5. Mixture Control ....Full Rich
6. Propeller Control...High RPM
7. Auxiliary Boost Pump....................................ON (according to AFM/POH)
8. Throttle..¼ Open

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 fuel pump as instructed by the airframe manufacturer.

CAUTION: Release the starter as soon as the engine fires. Never engage the starter while the propeller is 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 does not start after six attempts, release the starter switch and allow the starter motor to cool for 30 minutes before another starting attempt.*

9. Ignition Switch... START (10 seconds) RELEASE
10. Throttle.. Adjust for 900 - 1100 RPM

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

    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.

11. 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 primer (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 and verify proper cylinder/induction system drain operation.

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 6-4.2. If no fuel drainage is observed, discontinue starting attempts until the cause is determined. Inspect the fuel system drains for obstructions.

7-3.2.3. Hot Start

NOTE: For several minutes after stopping a hot engine, heat soaked fuel injection components, (especially the fuel pump) may cause fuel vaporization, making restarting difficult.

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

1. Fuel Selector Valve .... ON (according to the AFM/POH)
2. Throttle.. CLOSED
3. Mixture Control .... IDLE/CUT-OFF
4. Boost Pump... ON (3-5 seconds)
5. Boost Pump... OFF
   Allow excess fuel to drain from induction tubes/cylinder 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 75°F (24°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
2. Throttle.. IDLE
3. Propeller RPM .... FULL INCREASE

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

4. Mixture Control .... 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 75°F (24°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 Checkout

      1) Ignition Switch..................................... R
         RESULT: RPM drops 150 RPM or less; record Left Magneto RPM drop results. Maximum allowable RPM drop spread between magnetos is 75 RPM.

      2) Ignition Switch..................................... BOTH
         RESULT: Engine RPM returns to approximately 1700 RPM.

      3) Ignition Switch..................................... L
         RESULT: RPM drops 150 RPM or less; record Right Magneto RPM drop results. Maximum allowable RPM drop spread between magnetos is 75 RPM.

   b. Propeller Governor Checkout

      1) Throttle... 1700 RPM

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

      3) Propeller Governor .... 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 Governor .... Feather
         RESULT: RPM drops below minimum governing speed.

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

7-3.4. Engine Shutdown

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

1. 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 RPM drop results. Maximum allowable RPM drop spread between magnetos is 75 RPM.
4. Ignition Switch .... BOTH
   RESULT: Engine RPM returns to approximately 1700 RPM.
5. Ignition Switch L
   RESULT: RPM drops 150 RPM or less; record Right Magneto RPM drop results. Maximum allowable RPM drop spread between magnetos is 75 RPM.
6. Throttle .... IDLE
7. Mixture Control .... IDLE/CUT-OFF
8. Ignition Switch .... OFF

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

Engine starting is more difficult in extremely cold weather. Cold soaking causes the oil to thicken (more viscous) and clearances are reduced due to the low temperature. These factors increase friction, reduce engine cranking rpm and increase starter cranking amperage from the battery. At low temperatures, aviation gasoline does not vaporize readily, further complicating the starting procedure.

WARNING

Over priming can cause a flooded intake resulting in a "hydraulic lock" event and subsequent engine malfunction or failure. If you over-prime (flood) the engine, make certain that excess fuel has drained from the intake manifold and/or cylinder prior to attempting engine start.

CAUTION: Use an external power source when attempting to start aircraft engine in cold weather. Attempting to start an engine with a partially discharged aircraft battery may result in damage to the starter relay, possible engine kick-back resulting in a broken starter adapter clutch spring and/or subsequent internal engine damage.

False starting (failure to continue running after starting) often results in condensation on spark plug electrodes. This moisture can freeze and must be eliminated either by preheating the engine or removing and cleaning the spark plugs.

Engine preheating and an auxiliary power unit (APU) are required to facilitate engine starting when the engine has been exposed to temperatures below 20ºF (-7°C) for more than 2 hours. Refer to Section 7-4.1.1 and the AFM/POH for specific instructions. At ambient temperatures between 20º and 40ºF (-7º and 4ºC), refer to Section 7-4.1.1.3.

WARNING

Failure to properly preheat a cold-soaked engine may result in oil congealing within the engine, oil hoses, and oil cooler with subsequent loss of oil flow, possible internal damage to the engine, and subsequent engine failure.

Superficial application of preheat to a cold soaked engine can cause damage to the engine. An inadequate application of preheat may warm the engine enough to permit starting but will not decongeal oil in the sump, lines, cooler, filter, etc. Congealed oil in these areas require considerable preheat. The engine may start and appear to run satisfactorily, but can be damaged from lack of lubrication due to the congealed oil

blocking proper oil flow through the engine. The amount of damage will vary and may not become evident for many hours. However, the engine may be severely damaged and may fail shortly after application of high power.

Prior to operation and/or storage in cold weather, ensure the engine is serviced with the correct viscosity oil for the ambient air temperature.

In the event of temporary cold weather operation, store the aircraft in a heated hangar between flights. Service the oil sump as required with the specified oil grade according to the “Engine Oil Servicing” instructions in Section 6-3.8.

7-4.1.1. Engine Preheating

CAUTION: Proper engine preheating procedures require thorough application of preheat to all parts of the engine. Hot air must be applied directly to the oil sump and external oil lines as well as the cylinders, air intake, and oil cooler. Because excessively hot air can damage non-metallic components such as seals, hoses, and drive belts, do not attempt to hasten the preheat process.

The preferred method of preheating is to place the aircraft in a heated hangar for a minimum of 4 hours prior to flight. Optional preheating methods are:

- A high volume combustion heater with ducts directed to the engine oil sump, cylinders, and oil cooler; refer to Section 7-4.1.1.1.

OR

- An engine mounted preheating system; refer to Section 7-4.1.1.2.

7-4.1.1.1. Engine Preheat with a Combustion Heater

If a heated hangar is not available and the aircraft and engine have been exposed to temperatures below 20ºF (-7ºC) for two hours or more, without an engine mounted preheating system, use the following method:

1. Select a high-volume air heater.

   NOTE: Small electric heaters inserted in the cowling opening do not appreciably warm the oil and may result in superficial preheating.

2. Preheat all engine parts. Apply preheated air directly to the listed parts for at least 30 minutes:

   a. Oil sump

   b. Oil filter

   c. External oil lines

   d. Oil cooler

   e. Cylinder assemblies

   f. Air intake

3. Start the engine immediately after completion of the preheating process. Since the engine will be warm, follow the normal start instructions in Section 7-3.2.

   CAUTION: If oil pressure is not indicated within 30 seconds, shut down the engine and determine the cause. Operating the engine without oil pressure may result in engine damage.

   Do not close the cowl flaps in an attempt to hasten engine warm-up.

4. Operate the engine at 1000 RPM until some oil temperature is indicated.
   a. Monitor the oil pressure closely. If necessary, retard the throttle to maintain oil pressure below 100 psi. If oil pressure is less than 30 psi, or cannot be maintained below 100 psi, shut the engine down and repeat the preheat process. Do not close the cowl flaps to facilitate engine warm-up.
   b. Monitor the oil temperature until it reaches at least 75ºF (24ºC).

   CAUTION: Do not operate the engine at speeds above 1700 RPM unless the oil temperature is at least 75ºF (24ºC) and the indicated oil pressure is between 30 and 60 psi.

5. Run the engine up to 1700 RPM; in 100 RPM increments to prevent oil pressure from exceeding 100 psi.

   WARNING

   Operating the engine above 1700 RPM before reaching the minimum oil temperature may result in engine malfunction, engine failure, injury or death.

6. At 1700 RPM, adjust the propeller control to FULL DECREASE RPM until minimum governing RPM is observed; return the control to FULL INCREASE RPM. Repeat this procedure three or four times to circulate warm oil into the propeller dome.
7. If the aircraft manufacturer recommends checking the propeller feathering system, move the control to the FEATHER position. Do not allow the RPM to drop more than 300 RPM below minimum governing speed.

   CAUTION: Continually monitor oil pressure during run up.

8. When oil temperature has reached 75°F (24°C) and oil pressure does not exceed 60 psi at 2500 RPM, the engine has been warmed sufficiently to accept full rated power.

7-4.1.1.2. Engine Preheat with an Engine-Mounted Preheater

WARNING

Do not leave an engine-mounted pre-heater system on for more than 24 hours prior to flight. Continuous operation of engine-mounted preheater systems may result in aggressive internal engine corrosion.

If a heated hangar is not available and the aircraft and engine have been exposed to temperatures below 20ºF (-7ºC) for 2 hours or more and has an engine-mounted preheating system the following procedure may be used.

Engine mounted preheating systems should include individual cylinder head heater thermocouples, oil sump heater pad and crankcase heater pad. The use of a nacelle blanket will increase the effectiveness of engine preheating.

1. Follow the preheating system's manufacturer's installation and operation instructions.
2. Begin preheating of the engine at least five hours prior to expected departure. Do not operate an engine preheating system continuously for more than 24 hours.

   NOTE: The use of an approved thermal blanket or cover will help reduce the effects of wind and cold air circulation when the aircraft is not stored in a hangar. The preheating system manufacturer should have thermal blankets available.

3. Start the engine immediately after completion of the preheating process using the normal start procedure in Section 7-3.2.

   CAUTION: If oil pressure is not indicated within 30 seconds, shut down the engine and determine the cause. Operating the engine without oil pressure may result in engine damage.

   NOTE: Do not close the cowl flaps in an attempt to hasten engine warm-up.

4. Operate the engine at 1000 RPM until some oil temperature is indicated.
   a. Monitor the oil pressure closely. If necessary, retard the throttle to maintain oil pressure below 100 psi. If oil pressure is less than 30 psi, or cannot be maintained below 100 psi, shut the engine down and repeat the preheat process. Do not close the cowl flaps to facilitate engine warm-up.
   b. Monitor the oil temperature until it reaches at least 75ºF (24ºC).

   CAUTION: Do not operate the engine at speeds above 1700 RPM unless the oil temperature is at least 75ºF (24°C) and the oil pressure is between 30 to 60 psi.

5. Run the engine up to 1700 RPM; approach this RPM in increments to prevent oil pressure from exceeding 100 psi.

WARNING

Operating the engine above 1700 RPM before reaching the minimum oil temperature may result in engine malfunction, engine failure, injury or death.

6. At 1700 RPM, adjust the propeller control to FULL DECREASE RPM until minimum governing RPM is observed; return the control to FULL INCREASE RPM. Repeat this procedure three or four times to circulate warm oil into the propeller dome.
7. If the aircraft manufacturer recommends checking the propeller feathering system, move the control to the FEATHER position but do not allow the RPM to drop more than 300 RPM below minimum governing speed.

   CAUTION: Continually monitor oil pressure during run up.
8. When oil temperature has reached 75ºF (24ºC) and oil pressure does not exceed 60 psi at 2500 RPM, the engine has been warmed sufficiently to accept full rated power.

7-4.1.1.3. Cold Weather Starting Without Preheating

At ambient temperature between 20° to 40ºF (-7°to 4°C), perform the following:

CAUTION: Attempting to start your engine with a partially discharged aircraft battery may result in damage to the starter relay or possible engine kickback, resulting in a broken starter adapter clutch spring.

1. Use an external power source or ensure the aircraft battery is fully charged.
2. Use the normal start procedure in Section 7-3.2 and the aircraft AFM/POH. Do not overprime the engine.

WARNING

Overpriming can cause a flooded intake resulting in a "hydraulic lock" event and subsequent engine malfunction or failure. If you over prime, or flood your engine, ensure excess fuel has drained from the intake manifold and/or cylinder prior to attempting engine starting.

CAUTION: If oil pressure is not indicated within 30 seconds, shut down the engine and determine the cause. Operating the engine without oil pressure may result in engine damage.

Do not close the cowl flaps in an attempt to hasten engine warm-up.

3. Operate the engine at 1000 RPM until some oil temperature is indicated.
4. Monitor the oil pressure closely. If necessary, retard the throttle to maintain oil pressure below 100 psi. If oil pressure is less than 30 psi, or cannot be maintained below 100 psi, shut the engine down and follow the preheat instructions to prevent engine damage. Do not close the cowl flaps to facilitate engine warm-up.

5. Check the oil temperature; it should be at least 75°F (24°C).

   CAUTION: In the next step, do not operate the engine at speeds above 1700 RPM unless the oil temperature is at least 75°F (24° C) and the oil pressure is between 30 to 60 psig.

6. Run the engine up to 1700 RPM; approach this RPM in increments to prevent oil pressure from exceeding 100 psi.

   WARNING

   Operating the engine above 1700 RPM before reaching the minimum oil temperature may result in engine malfunction, engine failure, injury or death.

7. At 1700 RPM, adjust the propeller control to FULL DECREASE RPM until minimum governing RPM is observed; return the control to FULL INCREASE RPM. Repeat this procedure three or four times to circulate warm oil into the propeller dome.

8. If the aircraft manufacturer recommends checking the propeller feathering system, move the control to the FEATHER position but do not allow the RPM to drop more than 300 RPM below minimum governing speed.

   CAUTION: Continually monitor oil pressure during run up.

9. When oil temperature has reached 75°F (24°C) and oil pressure does not exceed 60 psi at 2500 RPM, the engine has been warmed sufficiently to accept full rated power.

7-4.2. Engine Operation in Hot Weather

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 between 30 minutes to one hour following shutdown. During this time, the fuel system will warm causing the fuel in the pump and fuel lines to "boil" or vaporize. During subsequent starting attempts, the fuel pump will initially be pumping a combination of fuel and fuel vapor. At the same time, the injection nozzle lines will be filled with varying amounts of fuel and vapor. Until the entire fuel system becomes filled with liquid fuel, difficult starting and unstable engine operation can be expected.

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)
- "Ground Operation at High Density Altitude" (Section 7-4.3)

Ensure the engine is serviced with the correct viscosity oil specified in Section 3-2.1, "Engine 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 6-3.8.

Operating Tips

- Inspect the air filter frequently for contamination; be prepared to clean or replace it, if necessary.
- If the aircraft is flown in dusty conditions, Continental Motors recommends more frequent oil changes.
- 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 from 30 to 60 minutes after 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. Boost pump .... ON (according to AFM/POH)
5. Boost pump .... OFF
6. Follow the “Engine Start” instructions in the AFM/POH and Section 7-3.2.

7-4.3. Ground Operation at High Density Altitude

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

High density altitude conditions may cause the idle fuel mixture to be too rich for stable operation. Lean the fuel mixture to sustain operation at low RPM. When practical, operate the engine at higher idle speed during ground operation. Refer to the AFM/POH for high density altitude takeoff operation.

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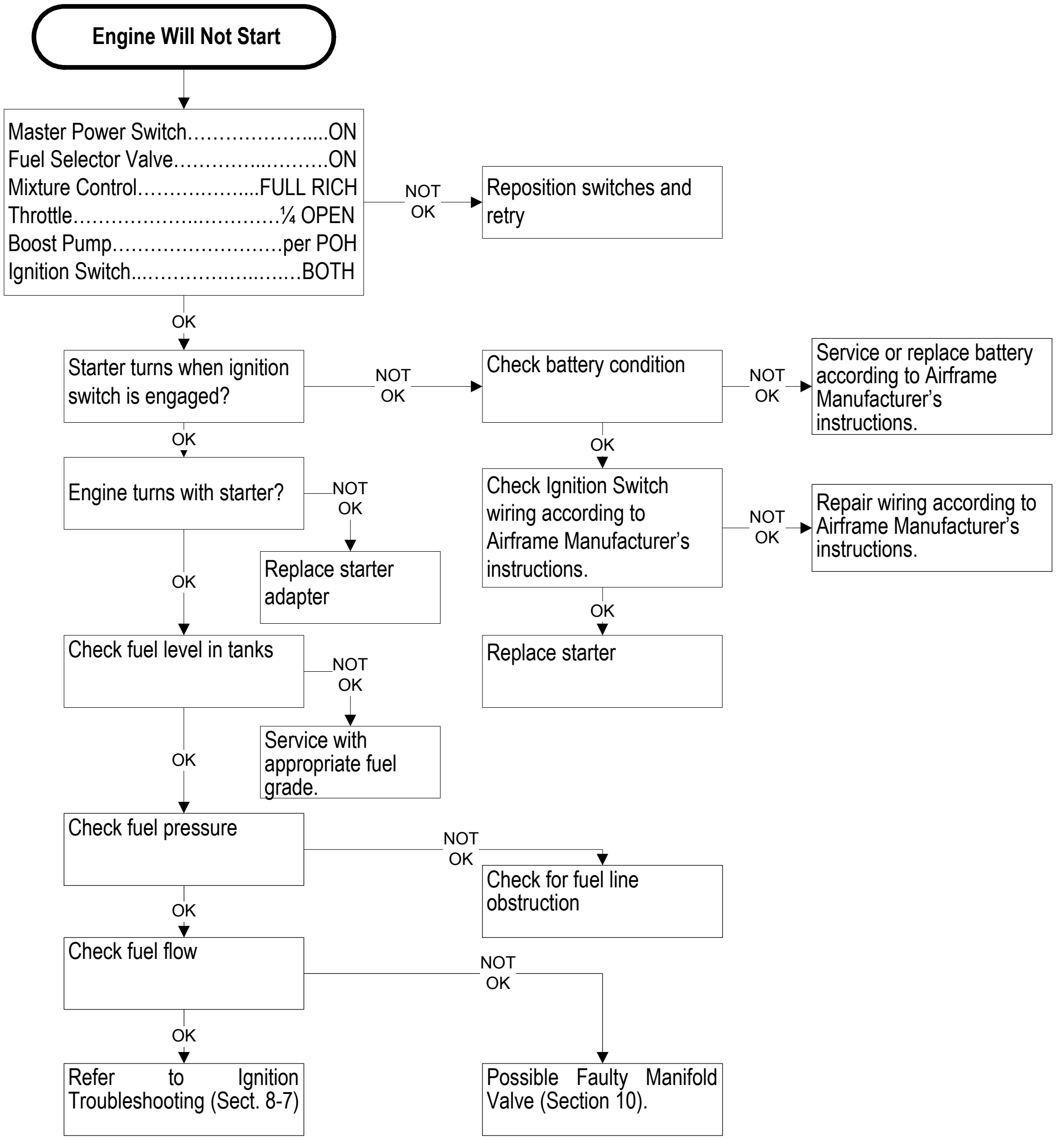
Chapter 8. Troubleshooting

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.

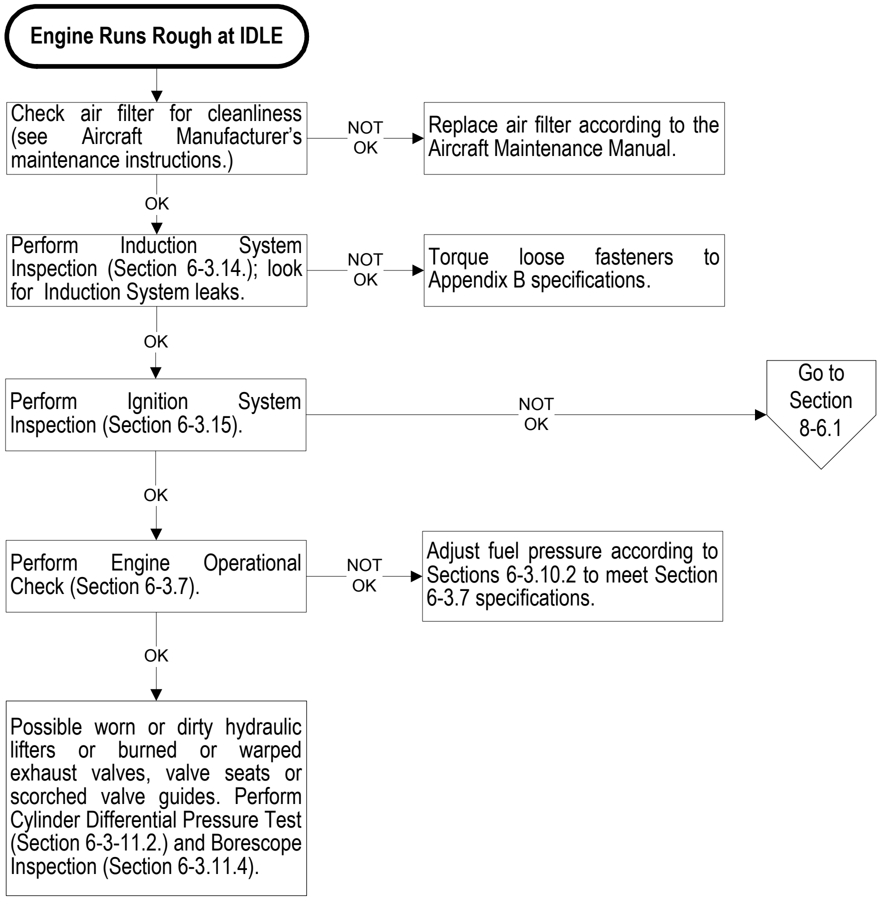
WARNING

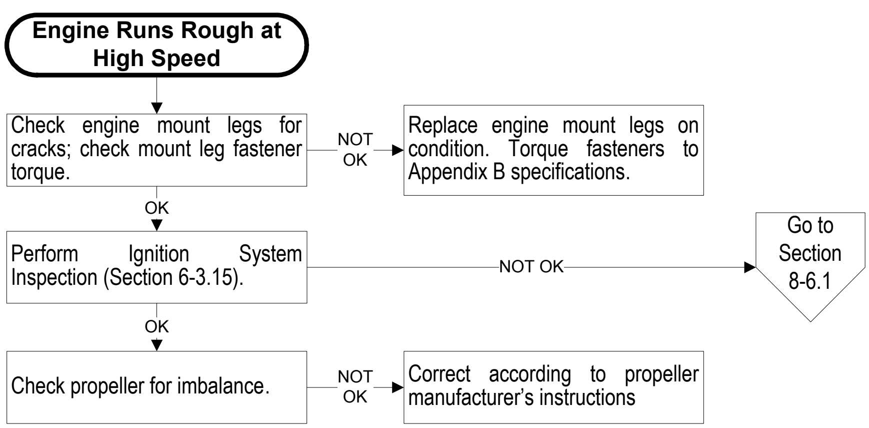
Any attempt by unqualified personnel to adjust, repair, or replace any parts may result in engine malfunction or failure. Continued operation of a malfunctioning engine can cause further damage to a disabled component and possible injury to personnel. Do not return an engine to service unless it functions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

8-1. General Troubleshooting

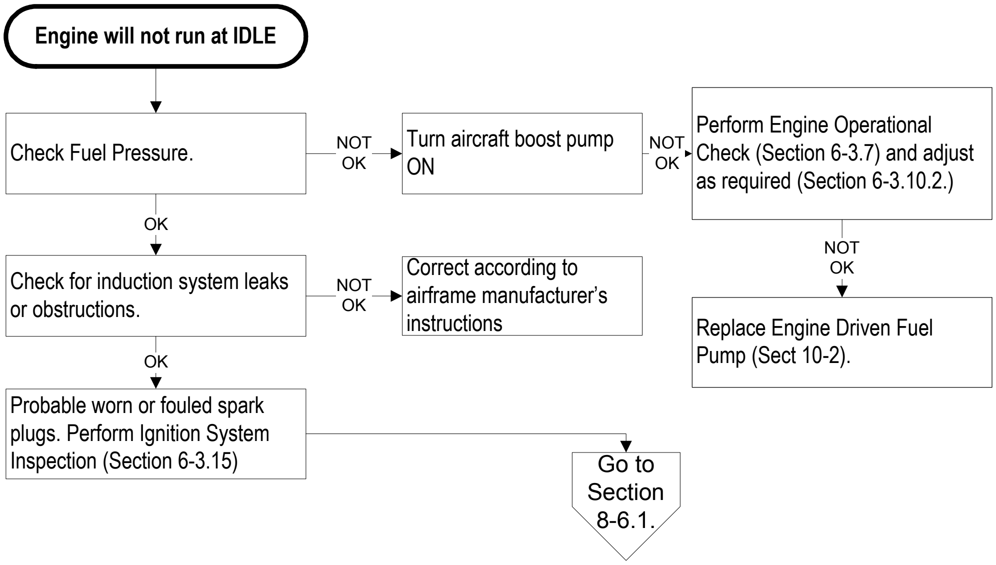


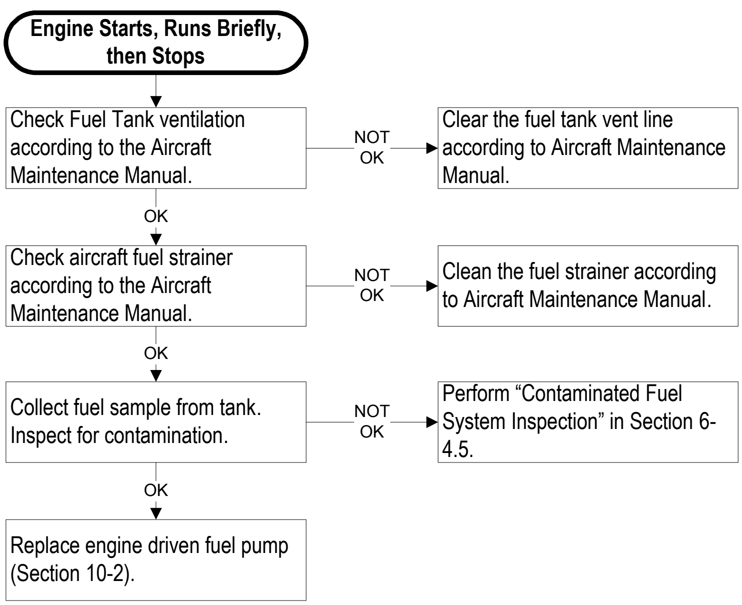
8-1.1. Engine Runs Rough



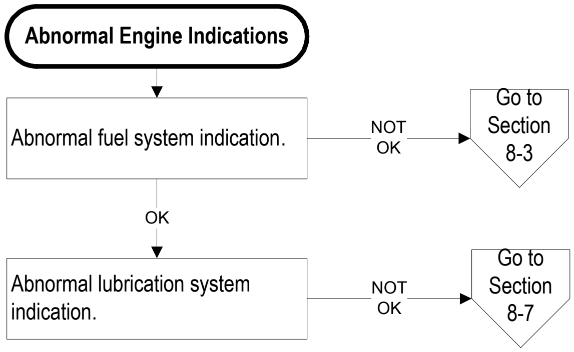


8-1.2. Engine Will Not Run



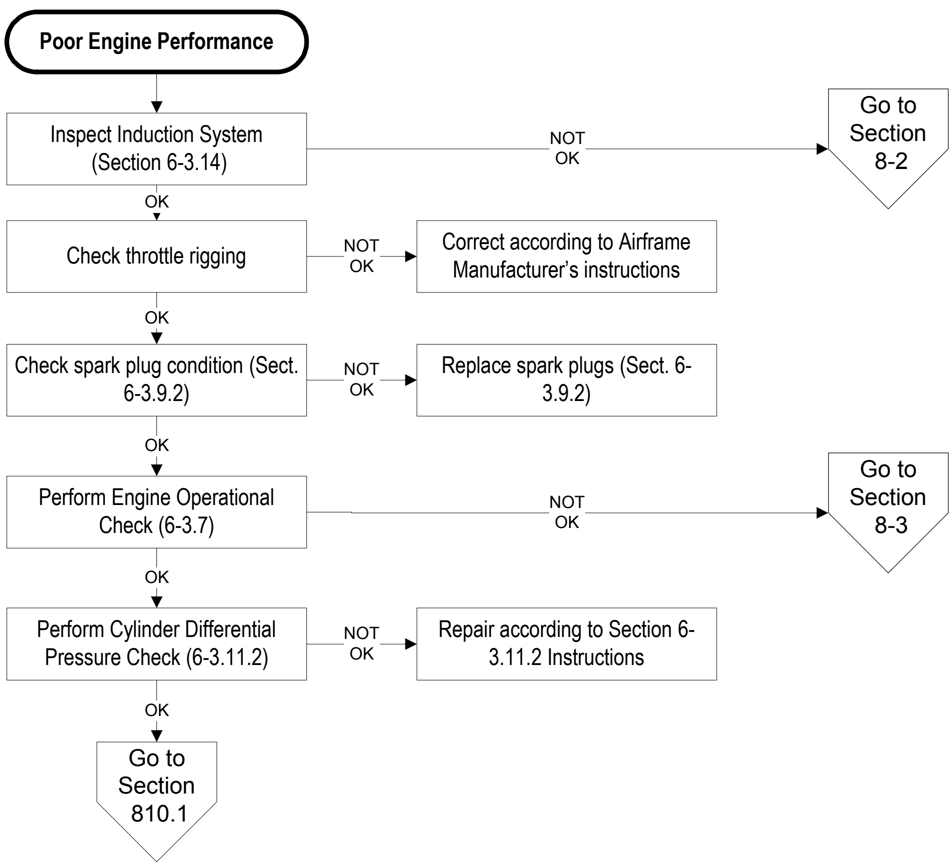


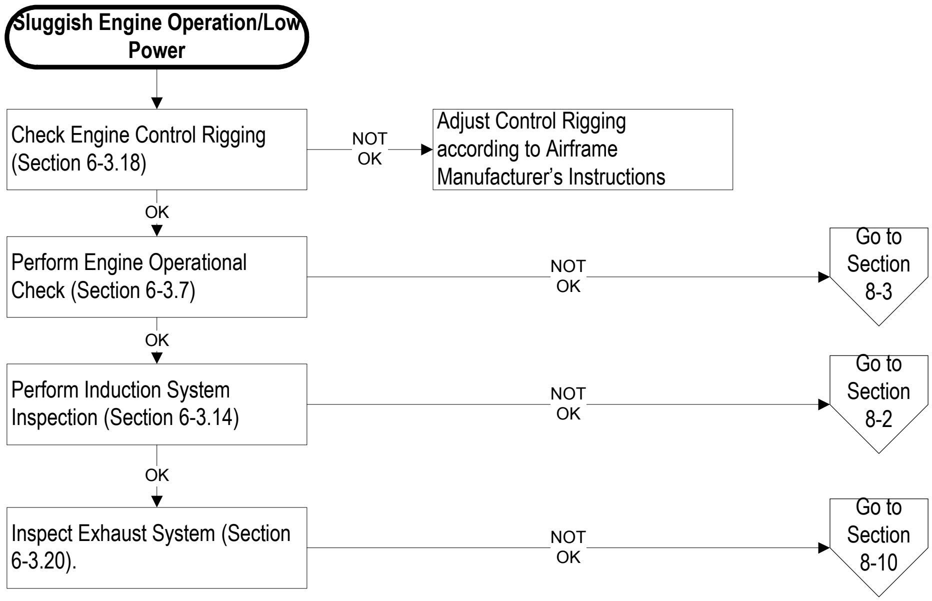
8-1.3. Engine Indication Malfunctions



8-1.4. Engine Performance Malfunctions

Engine Runs Rich at Cruise Power.................................. Go to Section 8-2.1
Engine Acceleration Poor .... Go to “Poor Engine Performance”
Engine Misses at High Speed .... Go to Section 8-8

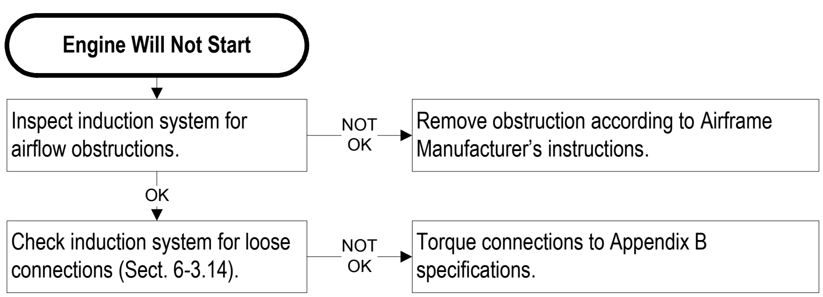




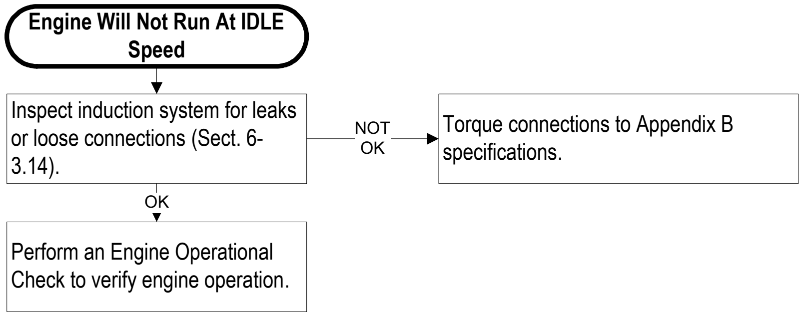
8-2. Induction System

Low Manifold Pressure..Go to Section 8-2.3
Loss of Aircraft Critical Altitude ....Go to Section 8-2.3

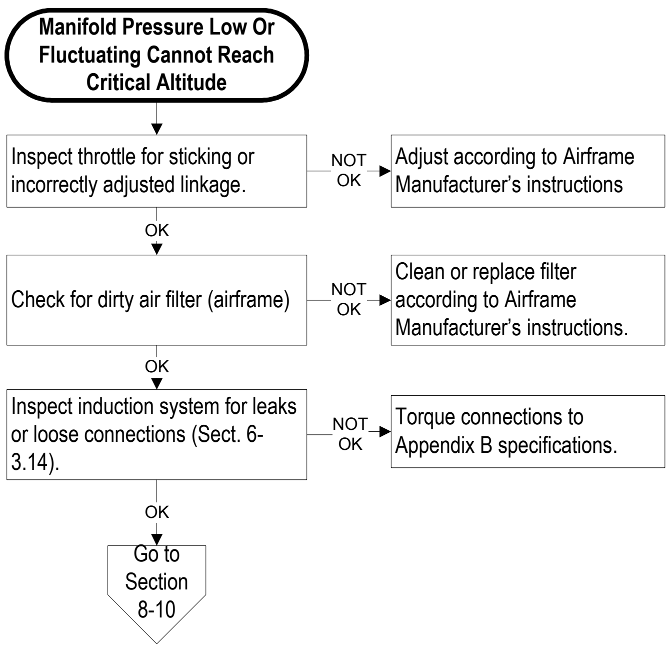
8-2.1. Engine Will Not Start



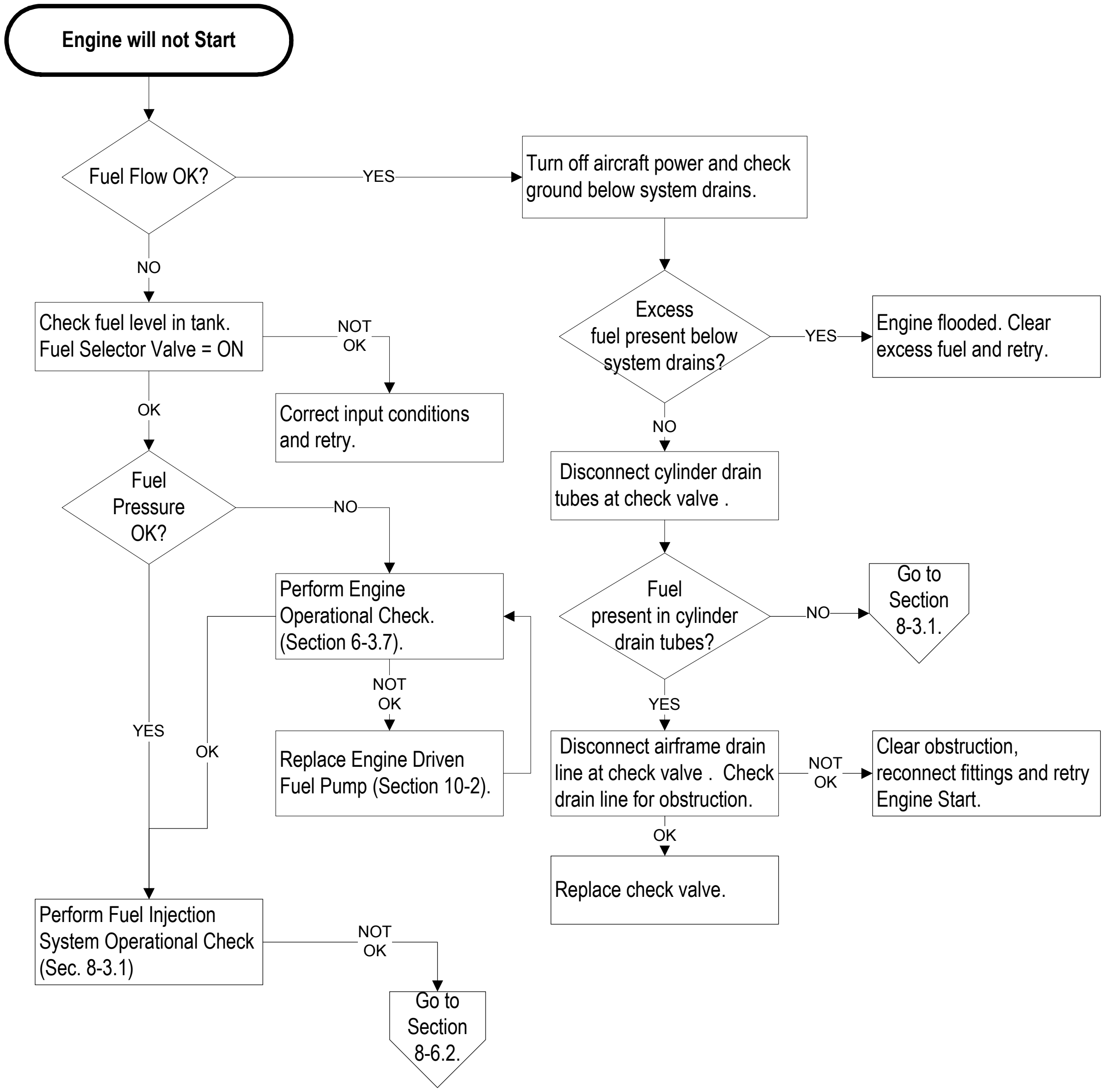
8-2.2. Engine Will Not Run

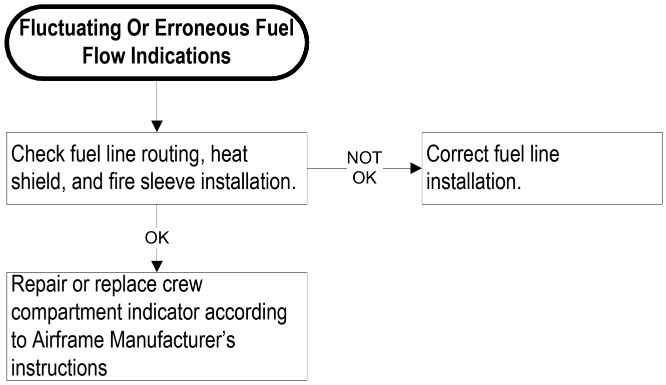


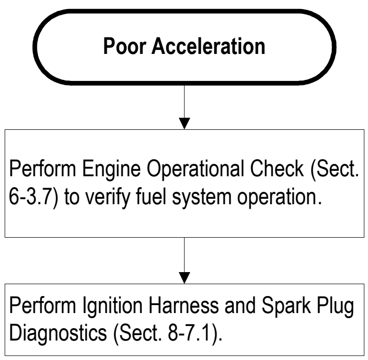
8-2.3. Engine Lacks Power/Manifold Pressure Low



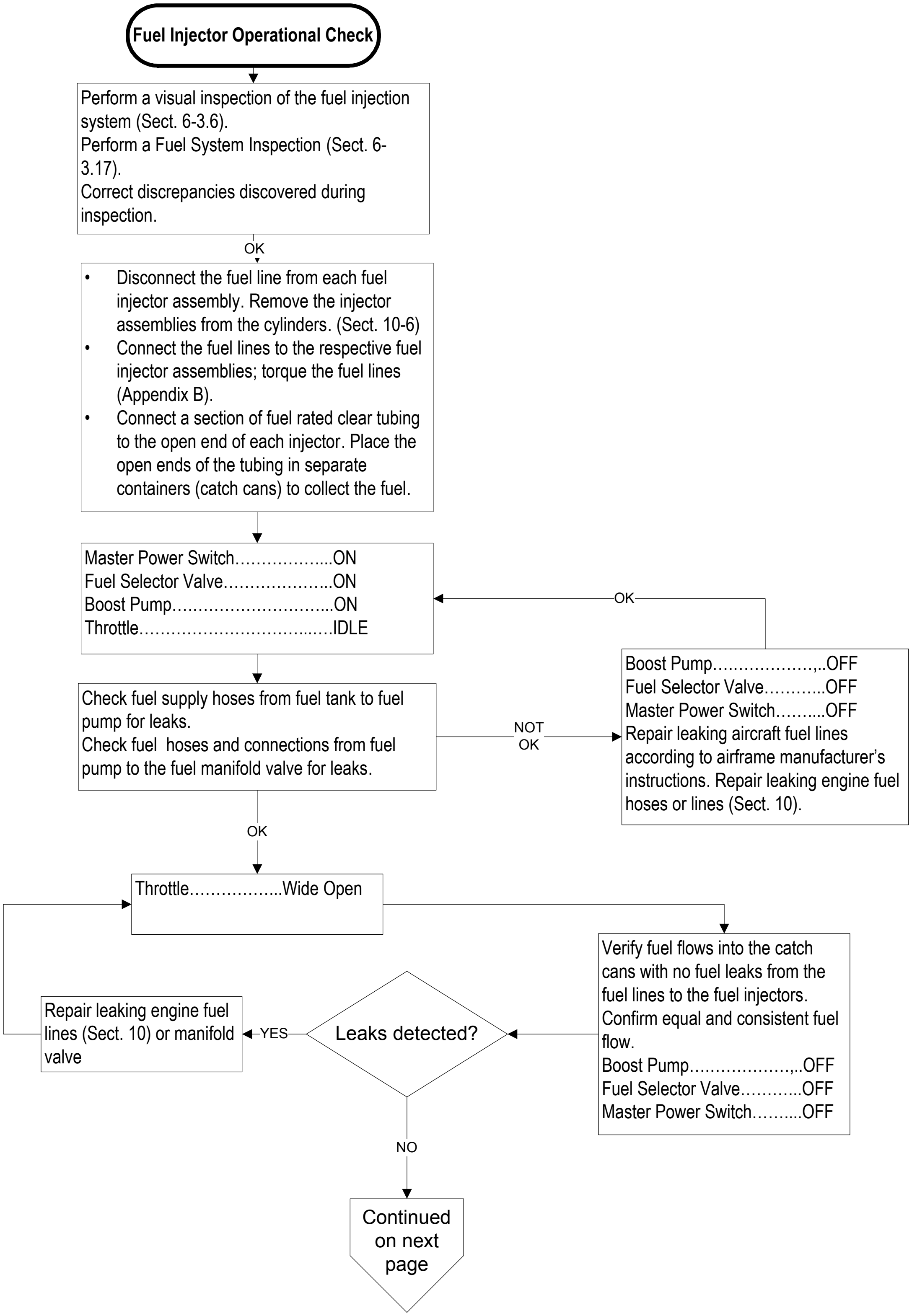
8-3. Fuel Injection System

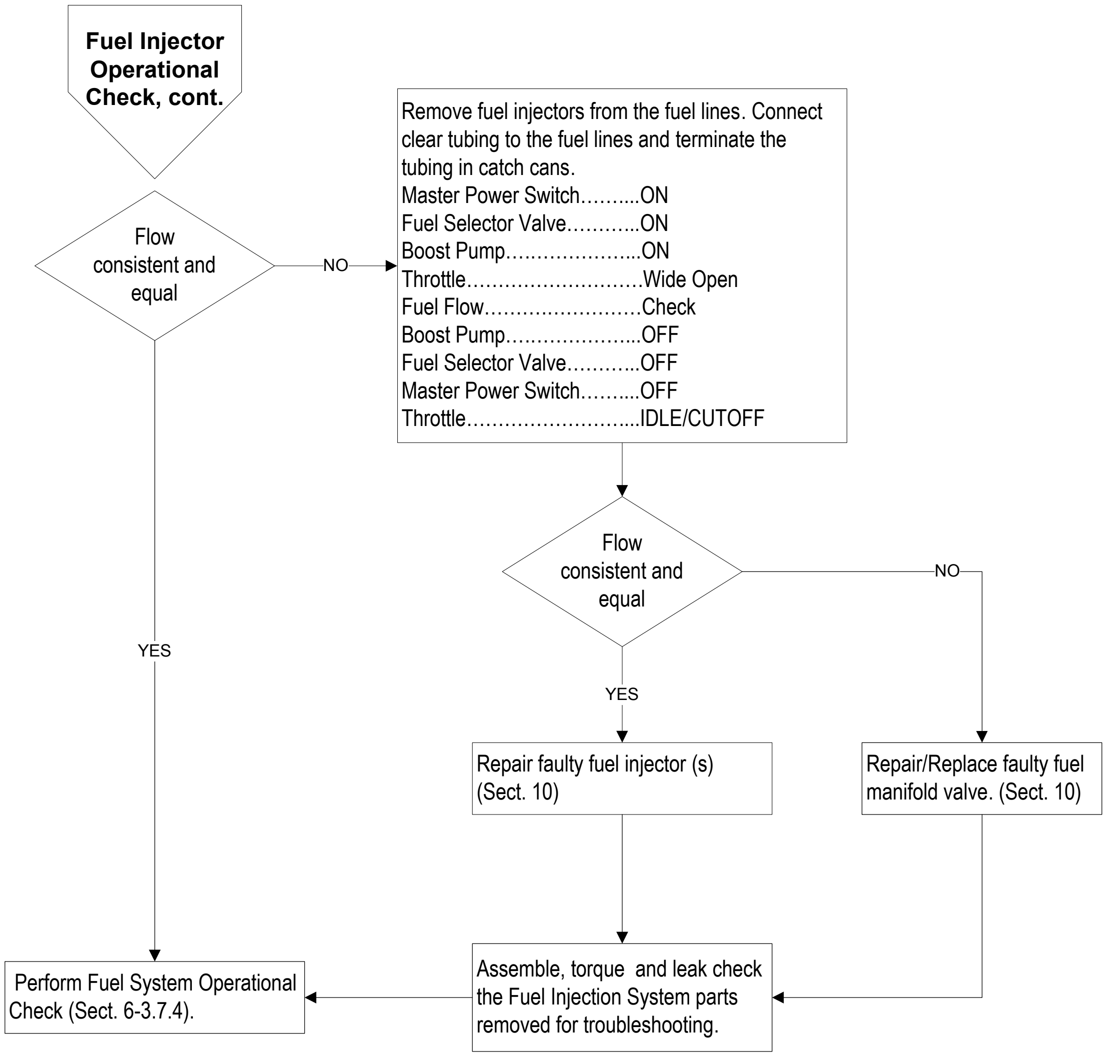



Fluctuating Or Erroneous Fuel Flow Indications
Check fuel line routing, heat shield, and fire sleeve installation.
NOT OK
Correct fuel line installation.
OK
Repair or replace crew compartment indicator according to Airframe Manufacturer’s instructions


Poor Acceleration
Perform Engine Operational Check (Sect. 6-3.7) to verify fuel system operation.
Perform Ignition Harness and Spark Plug Diagnostics (Sect. 8-7.1).

8-3.1. Fuel Injector Operational Check

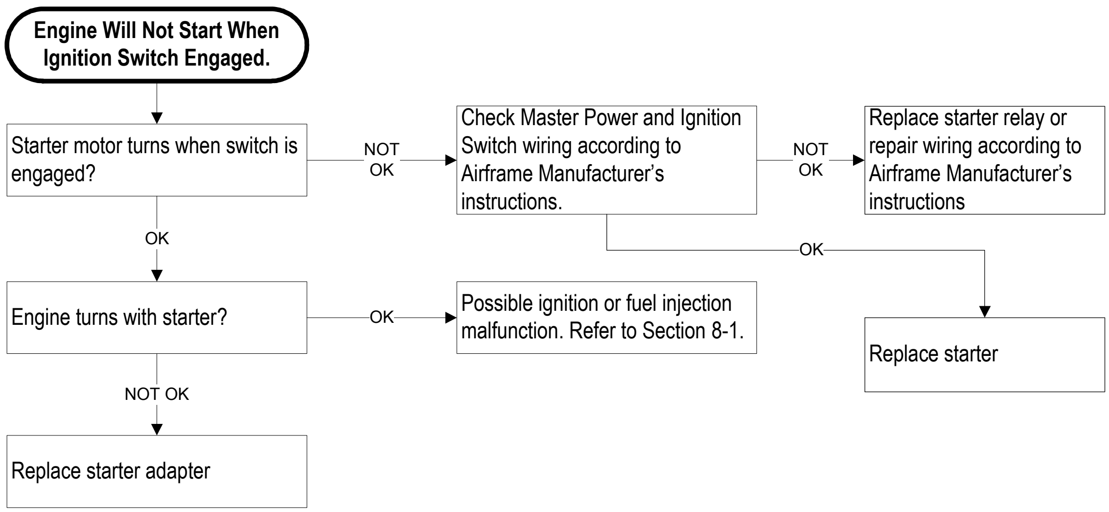


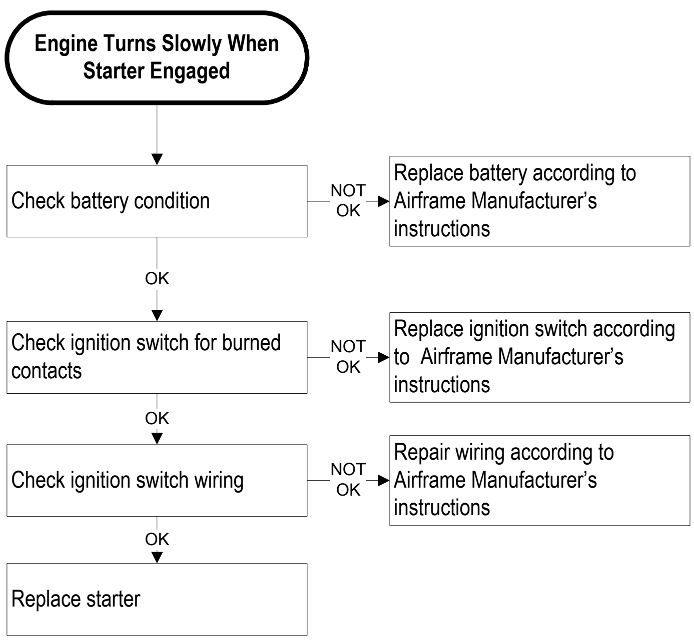

Fuel Injector Operational Check, cont.
Flow consistent and equal
NO
YES
Remove fuel injectors from the fuel lines. Connect clear tubing to the fuel lines and terminate the tubing in catch cans.
Master Power Switch……...ON
Fuel Selector Valve………..ON
Boost Pump………………...ON
Throttle………………………Wide Open
Fuel Flow……………………Check
Boost Pump………………...OFF
Fuel Selector Valve………..OFF
Master Power Switch……...OFF
Throttle……………………...IDLE/CUTOFF
Flow consistent and equal
NO
YES
Repair faulty fuel injector (s) (Sect. 10)
Repair/Replace faulty fuel manifold valve. (Sect. 10)
Assemble, torque and leak check the Fuel Injection System parts removed for troubleshooting.
Perform Fuel System Operational Check (Sect. 6-3.7.4).

8-4. Charging System

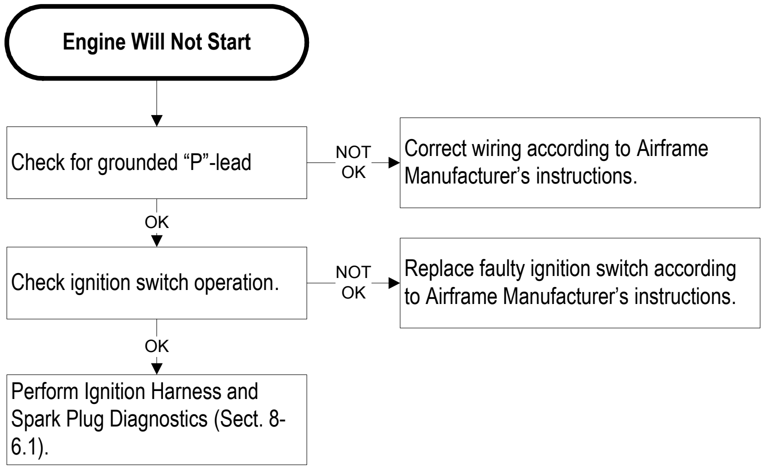
Refer to the airframe and alternator manufacturer's applicable charging system troubleshooting instructions.

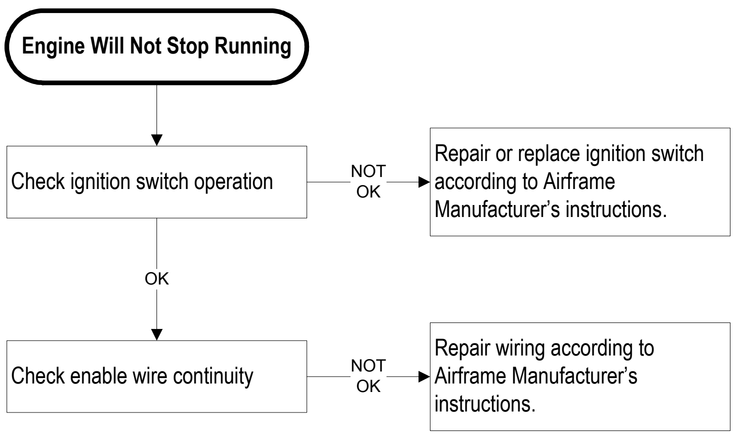
8-5. Starting System



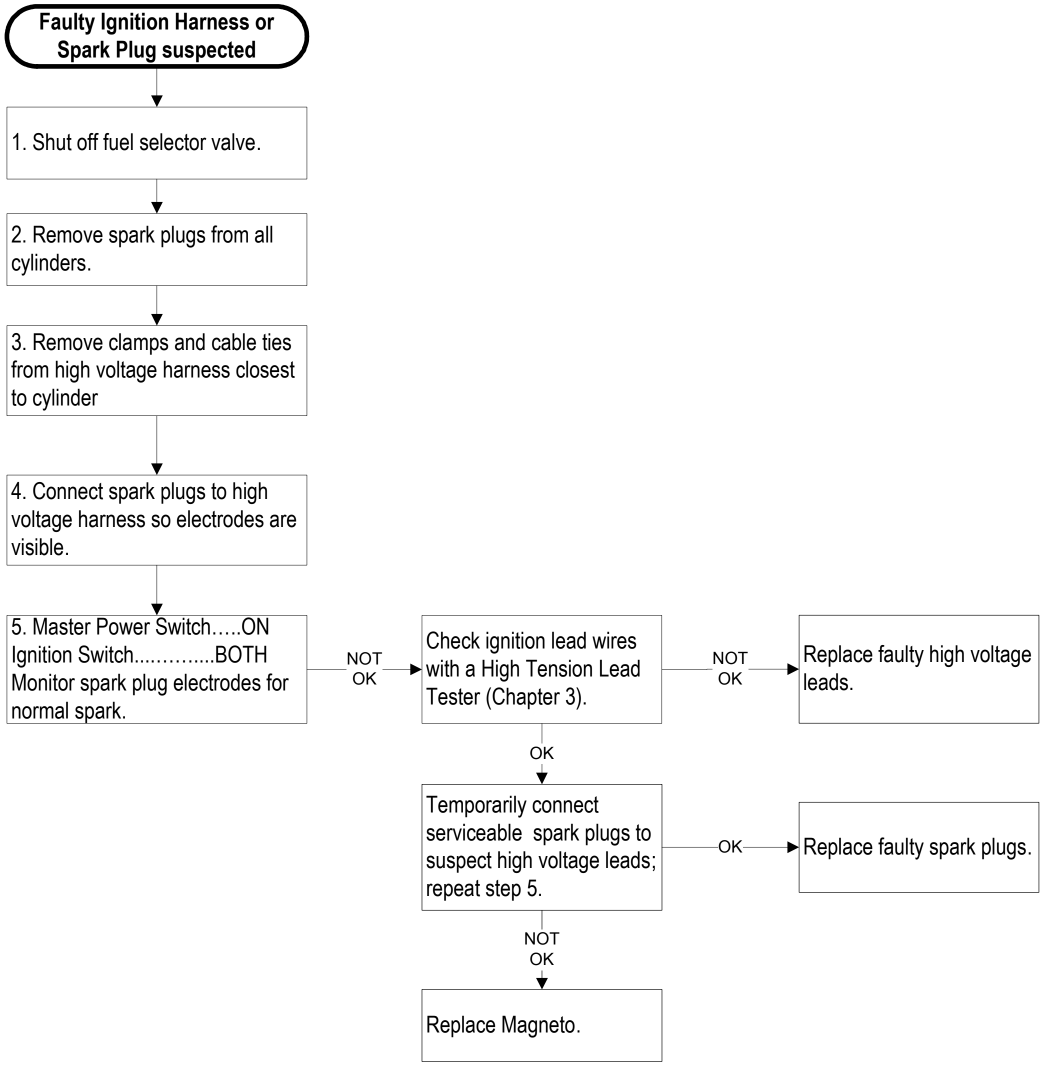


8-6. Ignition System

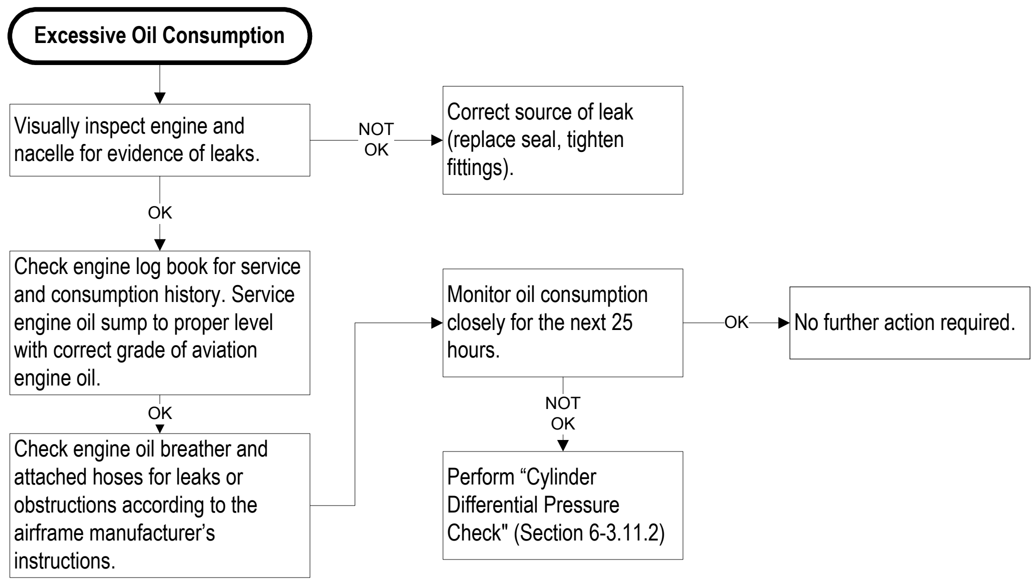


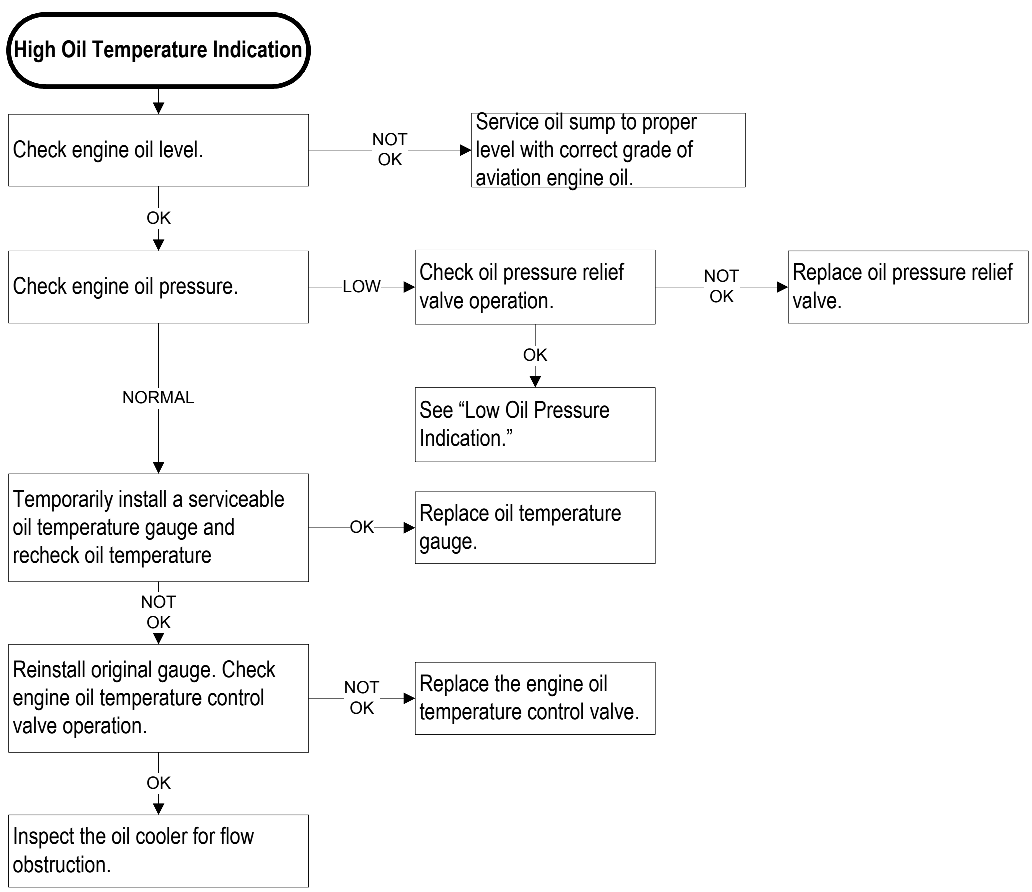


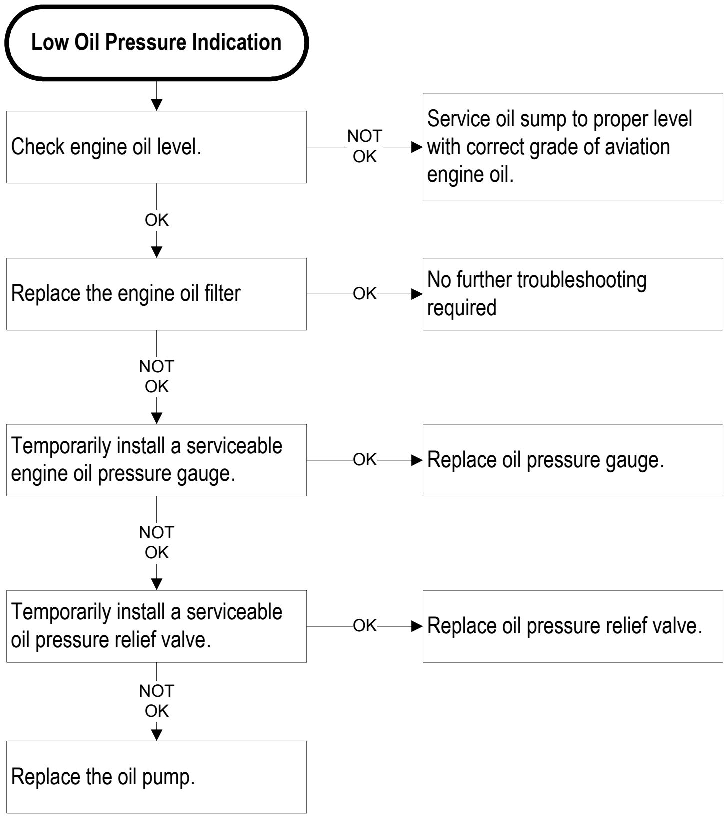
8-6.1. Ignition Harness and Spark Plug Diagnostics



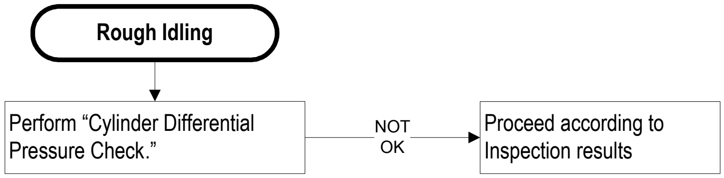
8-7. Lubrication System

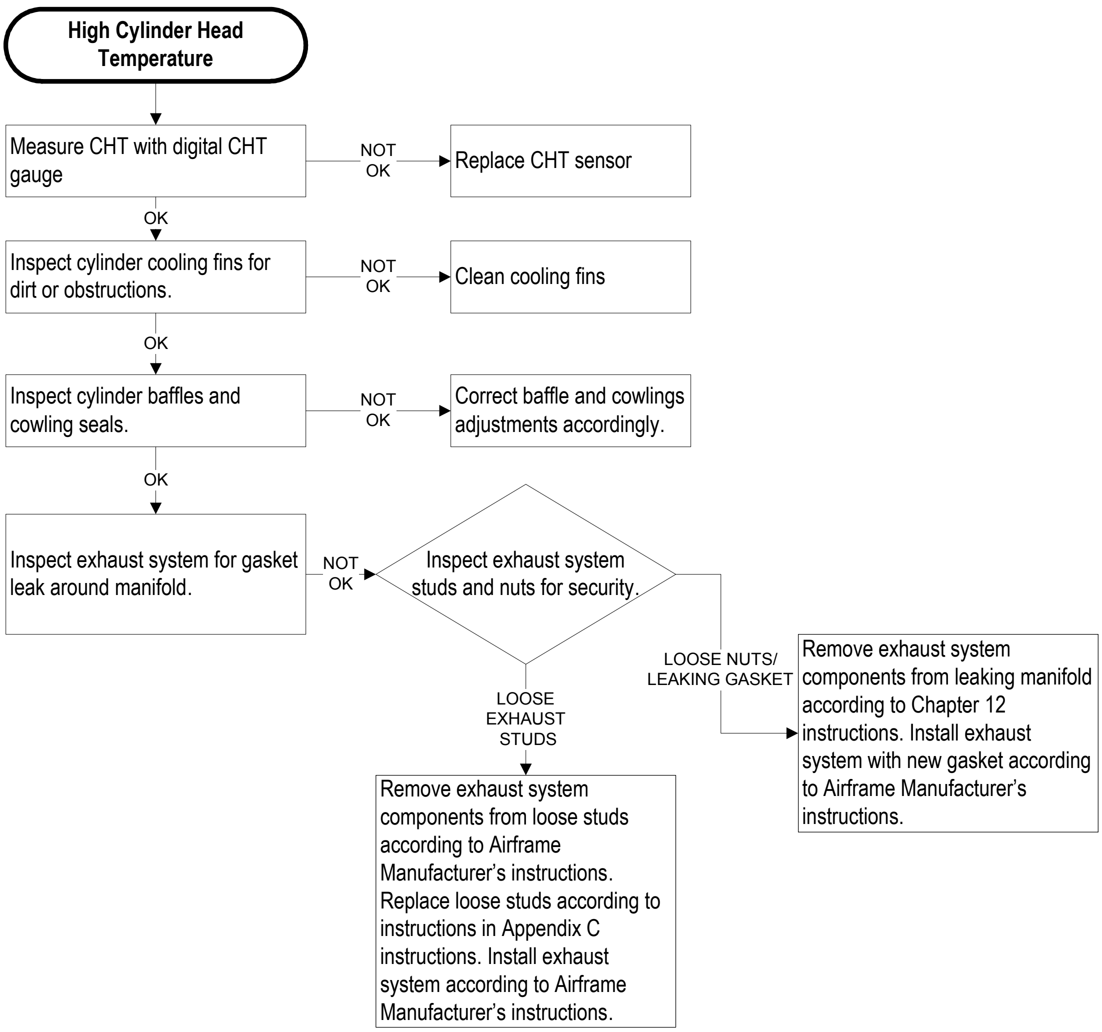




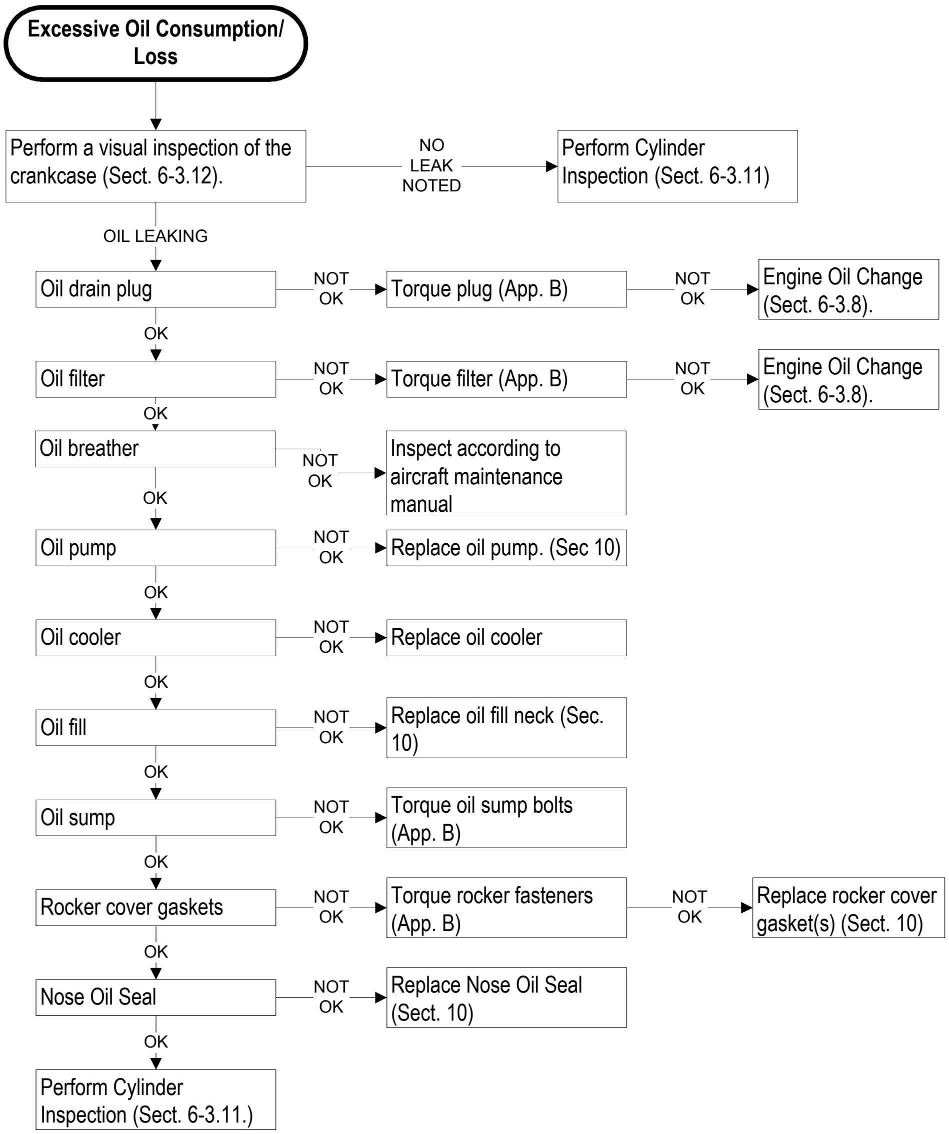

Low Oil Pressure Indication
Check engine oil level.
NOT OK
Service oil sump to proper level with correct grade of aviation engine oil.
OK
Replace the engine oil filter
OK
No further troubleshooting required
NOT OK
Temporarily install a serviceable engine oil pressure gauge.
OK
Replace oil pressure gauge.
NOT OK
Temporarily install a serviceable oil pressure relief valve.
OK
Replace oil pressure relief valve.
NOT OK
Replace the oil pump.

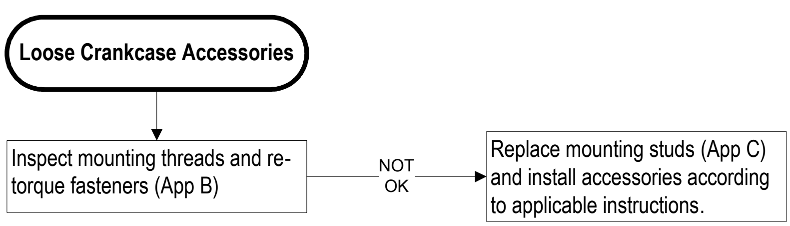
8-8. Engine Cylinders



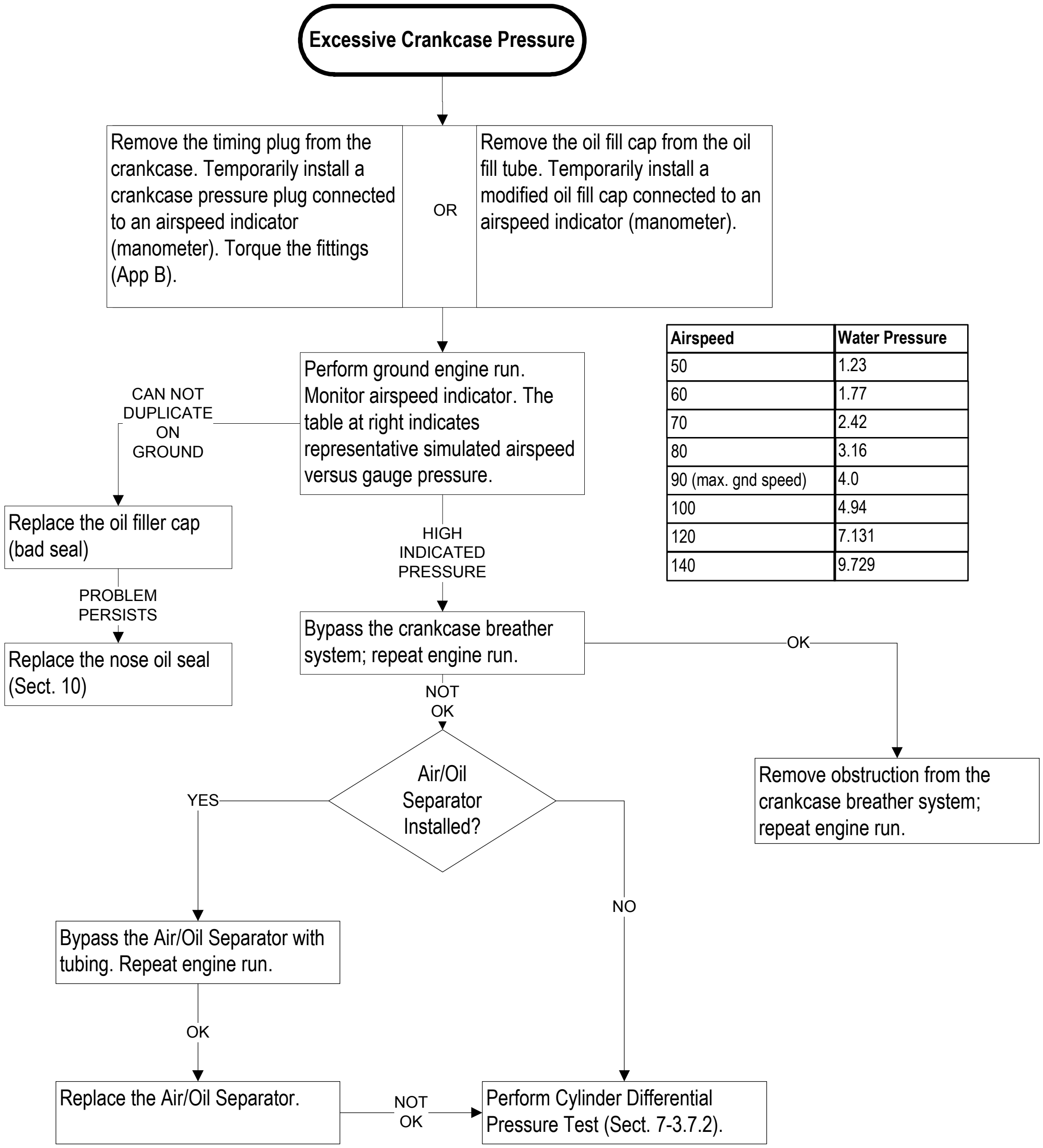


8-9. Crankcase





8-9.1. Excess Crankcase Pressure



Airspeed	Water Pressure
50	1.23
60	1.77
70	2.42
80	3.16
90 (max. gnd speed)	4.0
100	4.94
120	7.131
140	9.729

8-10. Exhaust System

Troubleshoot exhaust system malfunctions according to the airframe manufacturer's instructions.

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Chapter 9. Engine Preservation and Storage

9-1. Preserving and Storing an Engine

An engine which has been uncrated and not installed and/or operated within 30 days after uncrating should be placed in storage. There are separate instructions for temporary (from 30 days up to 90 days) and indefinite (90 days or more) storage.

9-1.1. Engine Preservation Checklist

Make a copy of the "Engine Preservation Checklist" on page 5 and record the serial number, date placed in storage and projected inspection dates 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 inspections until the engine is returned to service.

9-1.2. New or Unused Engine Storage

1. Determine the projected length of storage and refer to the appropriate section for preservation instructions.
    a. If the engine storage period is less than 90 days, follow the "Temporary Storage" instructions in Section 9-1.3.
    b. If the engine storage period is greater than 90 days, follow the "Indefinite Storage" instructions in Section 9-1.4.
2. After preservation, cover the engine with a plastic bag.
3. Install and attach the container cover to the base (if not already done).

9-1.3. Temporary Storage

Continental Motors defines temporary storage as a period of 30 to 90 days when the engine will not be used. If the storage period is likely to exceed 90 days, prepare the engine for long term storage according to Section 9-1.4.

1. Perform an oil change according to "Engine Oil Servicing" instructions in Section 6-3.8. Service the engine to the proper sump capacity with oil conforming to MIL-C-6529 Type II.

WARNING

If preheater are used to warm the engine, do not leave preheaters on for longer than 24 hours to prevent corrosion.

2. Perform an "Engine Start" and "Ground Run-up" according to AFM/POH instructions.
3. Perform a Preflight Inspection; correct any discrepancies noted.
4. Fly the aircraft for one hour at normal operating temperatures.
5. Allow the engine to cool after flight.
6. Disconnect and remove all spark plug leads.
7. Remove the upper spark plugs from the engine.

8. Cover the ignition leads with AN-4060 protectors.

WARNING

Disconnect all spark plug leads, place the Throttle in the CLOSED position, set the brake and chock the aircraft wheels. Install aircraft tie-downs, Do not stand or place equipment within the arc of the propeller.

9. With the piston at the Bottom Dead Center position, use a common garden sprayer with clean reservoir and nozzle to spray atomized cylinder preservation oil that meets MIL-P-46002, Grade 1 through the upper spark plug hole of each engine cylinder, with the pistons at bottom dead center. Rotate the crankshaft as opposite cylinders are sprayed.
10. Stop the crankshaft at a position where no pistons are at Top Dead Center.
11. Spray each cylinder again; thoroughly coat all interior cylinder surfaces by moving the nozzle from top to bottom of the cylinder while spraying. When all cylinders walls are thoroughly coated, ensure no piston is positioned at Top Dead Center.
12. Install the upper spark plugs; do not install the spark plug leads.
13. Seal all engine openings exposed to the atmosphere using suitable plugs and covers. Attach a “REMOVE BEFORE FLIGHT” streamer to each location.
14. Attach a tag in a prominent location on the engine, preferably the propeller (or storage container, if installed) with the following information:

DO NOT TURN PROPELLER - ENGINE PRESERVED
(preservation date)

15. Indicate the status of new or rebuilt engines which have not been placed in service on the preservation tag.

NOTE: If the engine is not returned to service within 90 days of initial temporary storage, it must be preserved according to the “Indefinite Storage” instructions in Section 9-1.4.

9-1.4. Indefinite Storage

WARNING

Perform this procedure in an area free of sparks, flames, or other ignition sources.

1. Perform an oil change according to "Engine Oil Servicing" instructions in Section 6-3.8. Service the engine to the proper sump capacity with oil conforming to MIL-C-6529 Type II.

WARNING

If preheaters are used to warm the engine, do not leave preheaters on for longer than 24 hours to prevent corrosion.

2. Perform an "Engine Start" and "Ground Run-up" according to the AFM//POH instructions.
3. Perform a Preflight Inspection; correct any discrepancies noted.
4. Fly the aircraft for one hour at normal operating temperatures.
5. Allow the engine to cool after flight.

WARNING

Disconnect all spark plug leads, place the Throttle in the CLOSED position, set the brake and chock the aircraft wheels. Install aircraft tie-downs, Do not stand or place equipment within the arc of the propeller.

6. Disconnect and remove all spark plug leads.
7. Remove the upper spark plugs from the engine.
8. Cover the ignition leads with AN-4060 protectors.
9. Install protective plugs (Part No. 22671) in the lower spark plug holes.
10. With the piston at the Bottom Dead Center position, use a common garden sprayer with clean reservoir and nozzle to spray atomized cylinder preservation oil that meets MIL-P-46002, Grade 1 through the upper spark plug hole of each engine cylinder, with the pistons at bottom dead center. Rotate the crankshaft as opposite cylinders are sprayed.
11. Spray each cylinder again; thoroughly coat all interior cylinder surfaces by moving the nozzle from top to bottom of the cylinder while spraying. When all cylinders walls are thoroughly coated, ensure no piston is positioned at Top Dead Center.
12. Install dehydrator plugs MS27215-1 or MS27215-2 in each of the top spark plug holes. Make sure that each dehydrator plug is dark blue in color when installed.
13. Attach a "REMOVE BEFORE FLIGHT" streamer to desiccant bags and place the tagged desiccant bag in the exhaust pipes. Seal the exhaust pipe openings.
14. Seal all other exposed engine openings with suitable plugs and covers. Attach a "REMOVE BEFORE FLIGHT" streamer to installed plugs and covers.

15. Affix a readily visible tag to the propeller (or storage container, if installed) with the following information:

    DO NOT TURN PROPELLER - ENGINE PRESERVED
    (preservation date)

16. Indicate the status of new or rebuilt engines which have not been placed in service on the preservation tag.
17. Make a copy of the “Engine Preservation Checklist” on page 5. Enter the serial number, storage date and next inspection due date on the form. Attach the form to the engine.
18. For indefinite storage, visually inspect the dehydrator plugs at 15-day intervals. Change the dehydrator plugs at the first indication (if any plug is not dark blue, replace the dehydrator plug) of color change. If more thane half the dehydrator plugs change color, replace all desiccant material on the engine.
19. Repeat application of cylinder preservative application at 90 intervals.

9-1.5. Return an Engine to Service after Storage

1. Remove seals and desiccant bags.
2. Remove cylinder dehydrators (or plugs) from upper and lower spark plug holes.
3. Perform an oil change according to the “Engine Oil Servicing” instructions in Section 6-3.8. Service the engine to the proper sump capacity with oil conforming to SAE J 1966 non-dispersant mineral oil.
4. Rotate propeller several revolutions by hand to remove preservative oil.
5. Service and install spark plugs and leads according to the instructions in Section 6-3.9.2, “Spark Plug Maintenance” and Section 6-3.9.3, “Ignition Harness Maintenance.”
6. Clean and service engine and aircraft according to the airframe manufacturer's instructions. Perform a visual inspection and correct any discrepancies noted.
7. Perform an “Engine Start” and “Ground Run-up” according to the AFM/POH instructions.
8. Conduct an “Engine Operational Check” according to instructions in Section 6-3.7; correct any discrepancies.
9. Perform a “Flight Check” according to instructions in Section 7-2.3; correct any discrepancies before releasing the aircraft for normal service.
10. Change engine oil and filter after first 25 hours of operation.

Table 9-1. Engine Preservation Checklist

Engine Serial Number:		**Date Placed in Storage**		
Inspection Item	**Status**	**Inspection Due Date**	**Completion Date**	**Performed by**
Engine preserved and stored according to the instructions in Section 9-1.4	❑ **YES**	N/A	/ /	
15 day inspection	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	
30 day inspection	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	
45 day inspection	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	
60 day inspection	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	
75 day inspection	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	
90 day inspection	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	
90 day cylinder treatment	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	
Engine removed from storage	❑ **PASSED** ❑ **CORRECTED**	/ /	/ /	

* Check condition of dehydrator plug for discoloration. Contents should be dark blue in color. If plugs are discolored, remove and replace with new plugs. If more than half the dehydrator plugs on the engine require replacement, remove and replace the desiccant bags in the exhaust pipes with fresh desiccant bags and reseal the exhaust pipe.

** Treat each cylinder bore with MIL-P-46002, Grade 1. With the piston at the bottom dead center position, use a clean garden sprayer to spray atomized cylinder preservation oil that meets MIL-P-46002, Grade 1 (at room temperature) through the upper spark plug hole of each engine cylinder. Thoroughly cover all interior cylinder surfaces by moving the nozzle from top to bottom. Rotate the crankshaft as opposite cylinders are sprayed. Leave no piston positioned at top dead center.

Inspector Notes:

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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 can be replaced along with respective references for replacement instructions. Table 10-2, the "Parts Repair Reference" indicates the items that can be repaired along with corresponding references to the repair instructions. Unless otherwise indicated, instructions are in this chapter.

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 uncommanded engine starts 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 tolerances in Appendix D.

Table 10-1. Non-Overhaul Parts Replacement Reference

Replaceable Item	Reference
Individual Engine Cylinder	Section 10-8, “Engine Cylinder Maintenance”
Hydraulic Tappets	Section 10-8.3, “Updraft Cylinder Hydraulic Tappet Removal” and Section 10-8.11, “Updraft Cylinder Hydraulic Tappet Installation” or Section 10-8.4, “Crossflow Cylinder Hydraulic Tappet Removal” and Section 10-8.12, “Crossflow Cylinder Hydraulic Tappet Installation”
Fuel Injectors	Table 10-3 and Section 10-3, “Fuel Injector Replacement”
Fuel Pump	Section 10-2, “Fuel Pump Replacement”
Fuel Manifold Valve	Section 12-4, “Fuel Injection System Removal” Section 17-11, “Fuel Injection System Installation”
Throttle Body	Section 12-5, “Induction System Removal” Section 17-10, “Induction System Installation”
Crankshaft Nose Oil Seal	Section 10-9, “Crankshaft Nose Oil Seal Replacement”
Engine Mounts	Section 12-14, “Engine Mount Removal” Section 16-8, “Engine Mount Installation”
Camshaft Plugs	Section 13-8.1, “Camshaft Disassembly” Section 16-9.1, “Camshaft Assembly”
Crankcase And Cylinder Studs	Section 15-8.11.7, “Crankcase Cylinder Deck Stud Replacement”
Crankcase Helical Coils	Section 15-8.11.6, “Crankcase Cylinder Deck Stud Helical Coil Installation”
Starter Needle Bearing	Section 10-4, “Starter Motor and Adapter Replacement” Section 13-4.1, “Basic Starter and Starter Adapter Disassembly” Section 13-4.2, “Starter Adapter with Accessory Drive Disassembly” Section 13-7.2, “Crankcase Studding Disassembly” Section 15-8.5.1, “Starter Adapter Housing Worm Shaft Needle Bearing Replacement”
Starter Motor	Section 10-4, “Starter Motor and Adapter Replacement”
Starter Adapter	Section 10-4, “Starter Motor and Adapter Replacement”
Alternator	Section 10-5, “Alternator Replacement”
Oil Pump	Section 10-7.2, “Oil Pump or Tachometer Drive 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 Sump Oil Suction Tube	Section 10-7.3, “Oil Sump and Oil Suction Tube Repair and Replacement”
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 Temperature Control Valve	Section 10-7.6, “Oil Temperature Control Valve Inspection and Replacement”
Magneto	Section 10-6, “Magneto Replacement”

Table 10-2. Parts Repair Reference

Repairable Item	Reference
Engine Cylinder	Section 10-8, “Engine Cylinder Maintenance”
Crankcase Cracks	Section 15-8.11, “Crankcase Overhaul Repair”
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”
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”
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

New and rebuilt fuel pumps are available for IO-550 Permold Series engines. Continental Motors 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, disconnect engine electrical power and confirm continuity between the magneto capacitor and aircraft ground before commencing maintenance to avoid uncommanded engine starts 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.

2. Disconnect the hoses from the fuel pump inlet fitting (Figure 10-1) (A), fuel pump outlet fitting (B), fuel pump vapor return fitting (D), fuel return fitting (C), and fuel pump drain fitting (E). Place protective caps on the fuel pump fittings and insert protective plugs in the open fuel hoses.
3. Remove the nuts (Figure 10-3) (6), lock washers (5), and hold-down washers (4), from the base of the fuel pump (3). Remove the fuel pump (3) from the crankcase. Remove and discard the gasket (22).
4. 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 dimensional limits in Figure 10-2.

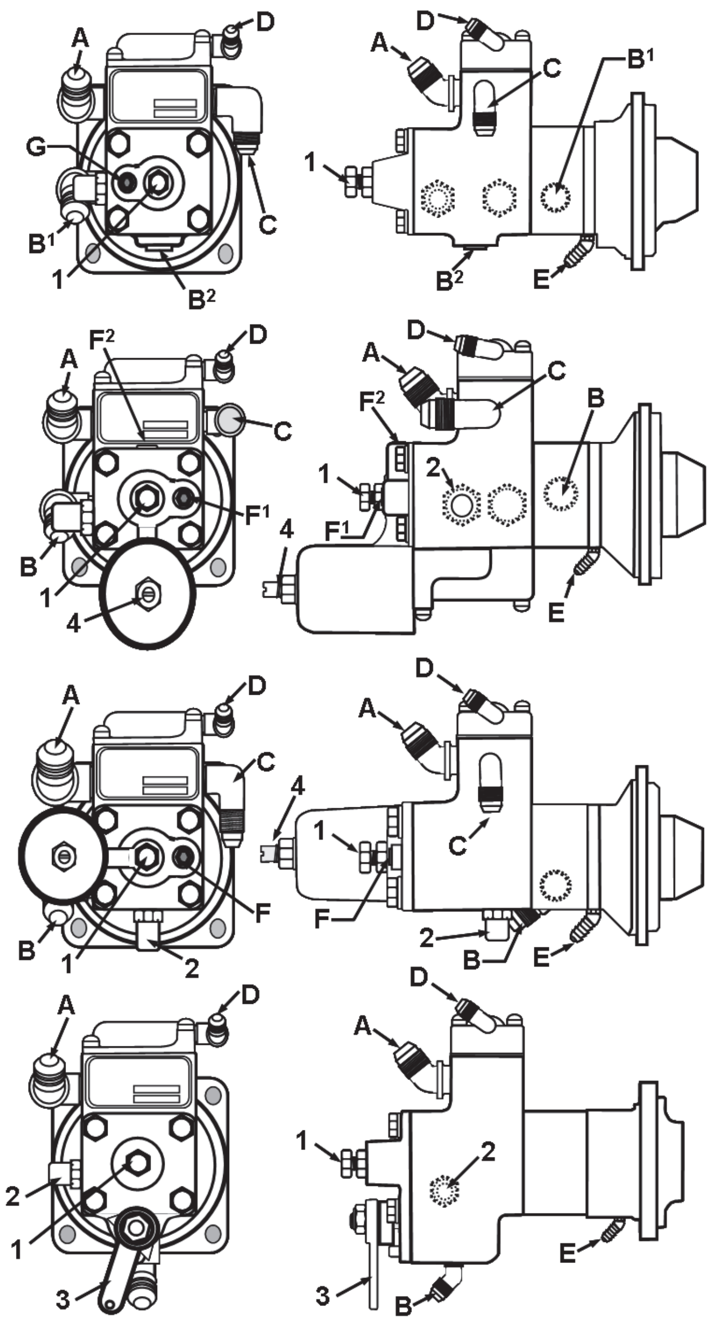


Figure 10-1. IO-550 Fuel Pump Adjustments & Fittings

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

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

10-2.2. Fuel Pump Service Limits

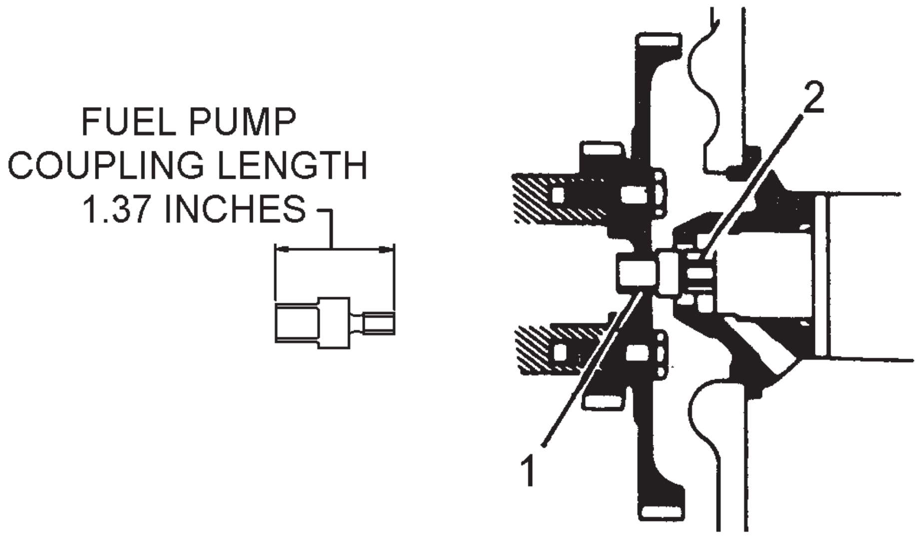


Figure 10-2. Fuel Pump Drive Coupling Fits and Limits

Table 10-4. 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			

10-2.3. Fuel Pump Installation

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 uncommanded engine starts 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 airframe cowling, as required, to access the fuel pump.
3. Apply Part No. 646942 Gasket Maker to the silk thread protruding from crankcase split line and the crankcase side of a new gasket (3).
4. Place the protruding ends of the silk thread in the crankcase split line and align the gasket with the crankcase fuel pump bore.
5. Apply Molyshield Grease to the fuel pump drive coupling (Figure 10-3) (2).
6. Install the fuel pump drive coupling (2) in the fuel pump (1).

7. Lubricate the fuel pump cavity with clean 50 weight aviation engine oil.
8. Install the fuel pump on the crankcase with hold down washers (4), new lock washers (5) and nuts (6). Torque the nuts to Appendix B specifications.
9. Connect the appropriate hoses to the fuel pump inlet (Figure 10-1) (A), fuel pump outlet (B), fuel return (C), if applicable, fuel vapor return (D), and drain (E) according to “Hose and Tubing Installation” instructions in Appendix C-13. Torque the hoses to Appendix B specifications.
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/CUT-OFF.
    i. Install any airframe components removed to facilitate repairs.
    j. Allow excess fuel to drain from the cylinder/induction system drains.
11. Perform an “Engine Operational Check” according to Section 6-3.7 instructions.

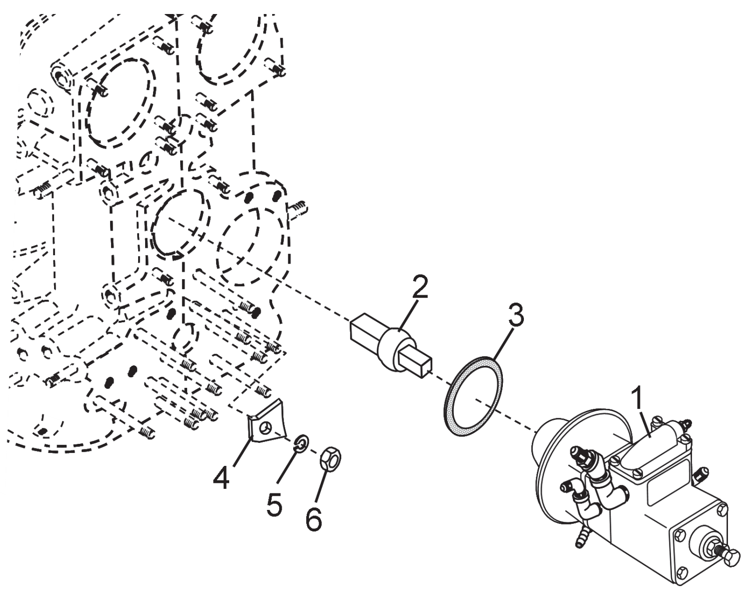


Figure 10-3. Fuel Pump Assembly

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

10-3. Fuel Injector Replacement

NOTE: Continental Motors tests fuel injectors and manifold valves as a set during the assembly process. Fuel injector nozzles may be replaced individually but we strongly recommend injector replacement as a complete set to ensure proper fuel mixture distribution and optimum engine performance.

10-3.1. Nozzle Identification

Continental Motors fuel injector assemblies have undergone two product improvement modifications since 1998. Original nozzles were identified by three-character nozzle size codes (Figure 10-4) on two of the hexagonal wrench flats.

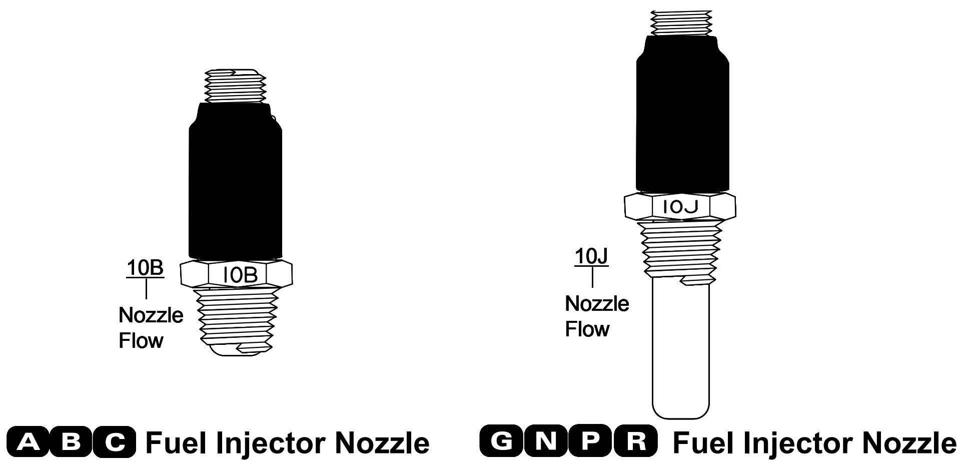


Figure 10-4. Original Fuel Injector Nozzles

The first modification extended the identification to four-characters, including the installed cylinder position at the left-most character (Figure 10-5) in the ID.

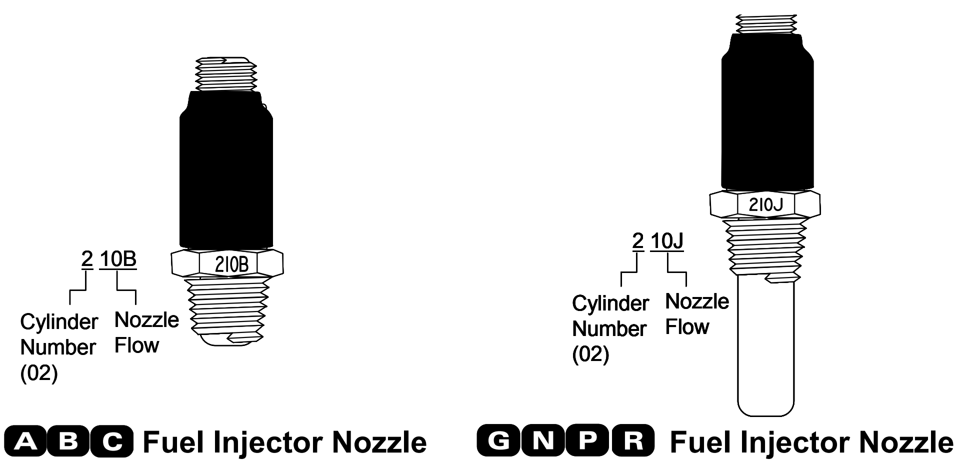


Figure 10-5. Position Tuned Fuel Injector Nozzle

Position tuned fuel injector nozzles manufactured after Dec 2005 are etched on four of the nozzle wrench flats (see Figure 10-6). To select the proper replacement nozzles, you must first identify which nozzle generation is installed. If the removed injectors do not conform to the new format, the numbers must be cross-referenced. A factory service representative can assist in determining the proper replacement injector nozzle, based on the removed fuel injector identification.

Observe the markings in Figure 10-6. A three digit numeric code identifies the nozzle orifice bore is stamped on two of the injector's hexagonal wrench flats – ignore this number! Adjacent to the three digit number, the injector is stamped on two of the hexagonal wrench flats with a four digit code indicating the cylinder position number and the nozzle flow; use this 4 digit number when assigning nozzles to cylinders. When ordering replacement nozzles, specify the position number and nozzle flow for each replacement nozzle required.

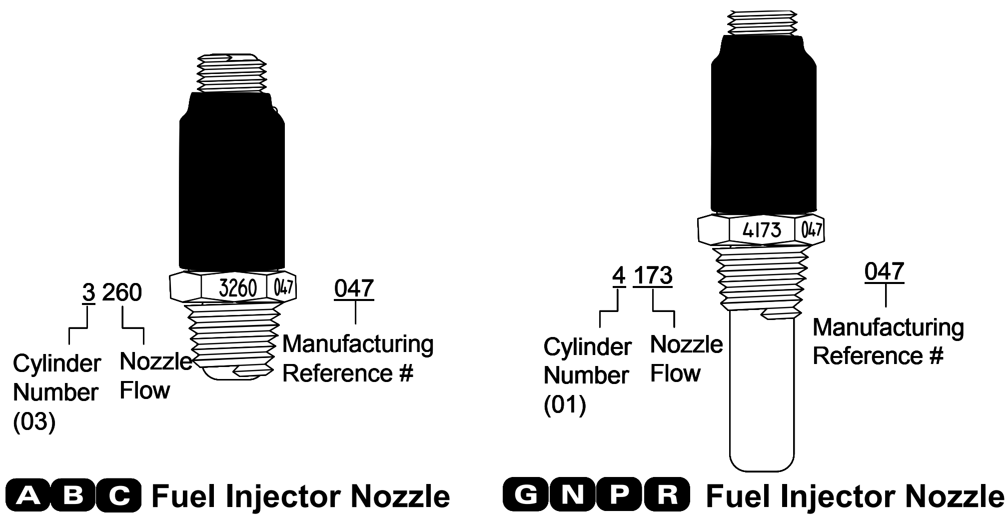


Figure 10-6. Post-2005 Position Tuned Fuel Injector Nozzle

10-3.2. Fuel Injector 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 uncommanded engine starts 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. Turn the aircraft fuel supply to the OFF position.
3. Loosen and remove the fuel line "B" nuts.
4. Remove fuel injector nozzles with an Ideal Aviation Part No. 8168-IA Injector Nozzle Removal/Insertion Tool ("Special Tools" in Chapter 3).
5. Place protective caps or plugs over the open fuel connections.
6. Record the nozzle identification and cylinder position for reinstallation or replacement.

10-3.3. Fuel Injector Installation

CAUTION: Ensure nozzle position numbers are matched to the appropriate cylinder. Installing incorrect nozzles or nozzles in the improper position will adversely affect engine performance.

Earlier model fuel injector nozzles (Part No. 652312) installed in IO-550-G, N, P & R engine models were machined with two grooves (Figure 10-8) in the nozzle body. If Part No. 652312 remain in operation, install only one O-ring in the upper groove after fuel injector service; leave the lower groove of the injector nozzle vacant.

1. Verify the cylinder position number (Figure 10-6) engraved on the nozzle wrench flat matches the intended cylinder. If the nozzle is a replacement, the cylinder position number and nozzle flow must be a suitable for the intended cylinder position.
2. Purge the fuel system according to the "Fuel System Service" instructions in Appendix C-9 to prevent fuel system contamination prior to connecting each injector line to the fuel nozzle.
3. G N P R If fuel injectors were removed and cleaned, new O-rings (Figure 10-8) are required prior to installation. Apply clean, 50-weight aviation engine oil to the new O-ring and install one O-ring in the groove at the top of the fuel injector nozzle. Install the screen and shroud over the upper portion of the fuel injector nozzle.
4. Apply a small amount of anti-seize lubricant to the nozzle according to Figure 10-7; hand tighten the nozzle in the cylinder head; torque the nozzle to Appendix B specifications with a Ideal Aviation Part No. 8168-IA Injector Nozzle Removal/Insertion Tool ("Special Tools" in Chapter 3).

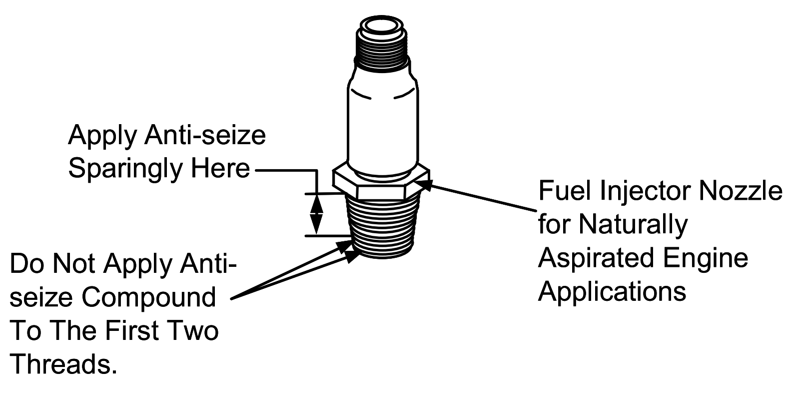


Figure 10-7. Apply Anti-Seize To Fuel Injector Nozzle

5. Connect the fuel lines to the fuel injectors at each cylinder and torque the "B" nuts to Appendix B specifications.

6. Perform an "Engine Operational Check" according to the instructions in Section 6-3.7.

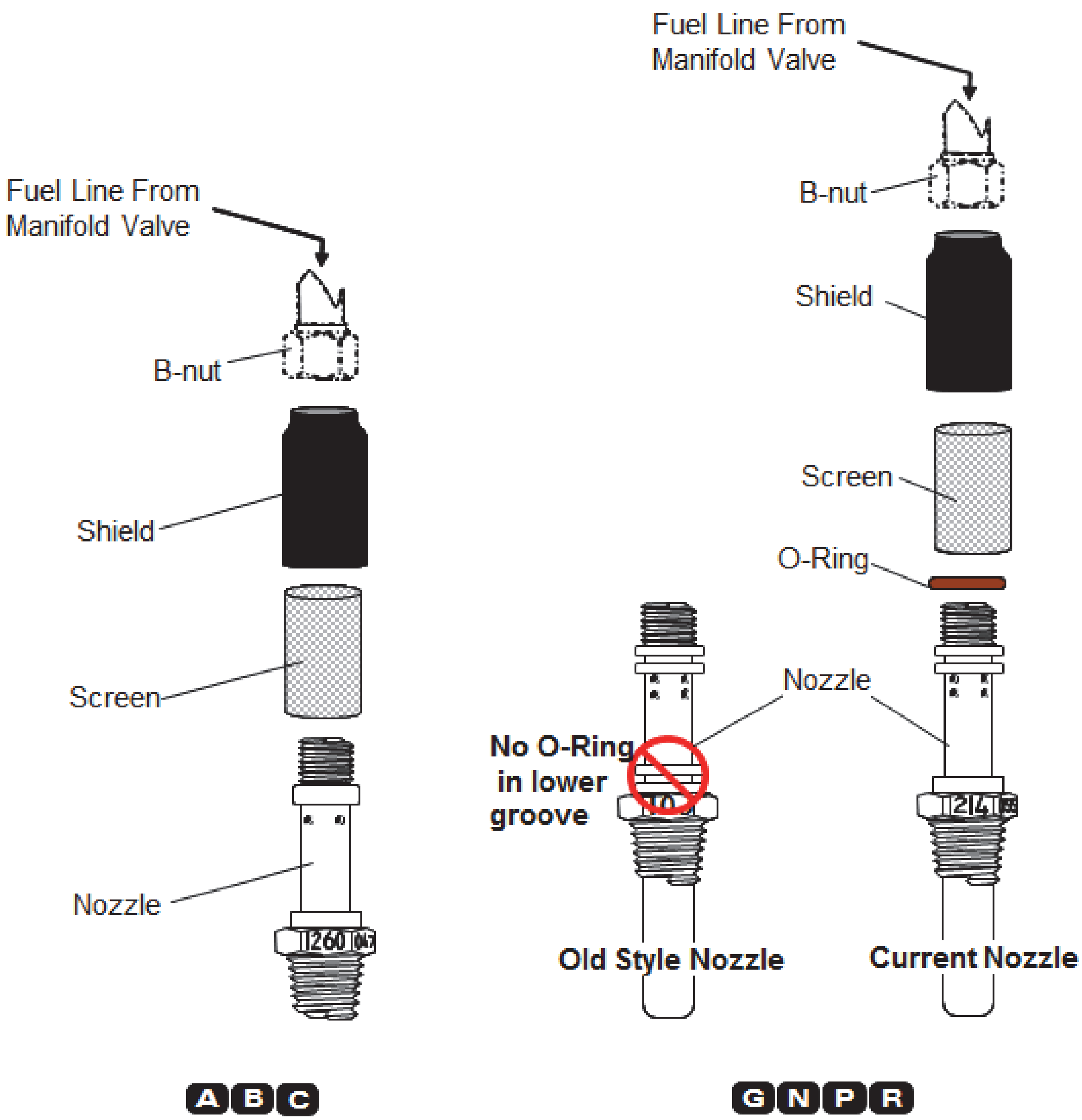


Figure 10-8. Fuel Injector Assemblies

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 Continental Motors Starter Service Instructions (X30592). The Iskra starter line (new, rebuilt and service) has been discontinued. For engines equipped with Iskra starters, serviceable units may remain in service until engine overhaul. Consult the illustrated parts catalog for the engine model specification on the CMI web site for suitable replacement unit. No field repair is authorized for the Skytec starter; replacement is the only remedy for Skytec starter motor failure.

Replace the starter adapter if starter motor turns but the starter adapter does not engage the engine or the starter adapter is malfunctioning.

10-4.1. Starter Motor 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 uncommanded engine starts 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. Disconnect the aircraft battery and electrical cable from the starter motor in accordance with the airframe manufacturer’s instructions.
3. Remove the two nuts (Figure 10-9) (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 to the appropriate starter manufacturer’s instructions.

10-4.2. Starter Adapter Removal

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

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 uncommanded engine starts during maintenance. Do not stand or place equipment within the arc of the propeller.

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

3. Remove the four sets of nuts (Figure 10-9) (8, 12), lock washers (7, 11), 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, 11).
5. Remove and discard the starter adapter gasket (9). Clean the gasket residue from the crankcase mating surface.
6. Inspect the starter and starter adapter parts using the service limits in Section 10-4.3. Ensure the appropriate plugs or fittings are installed in the accessory drive adapter prior to re-installation. Repair or replace parts which fail to meet the dimensional inspection criteria according to instructions in the Starter Service Instructions (X30592).

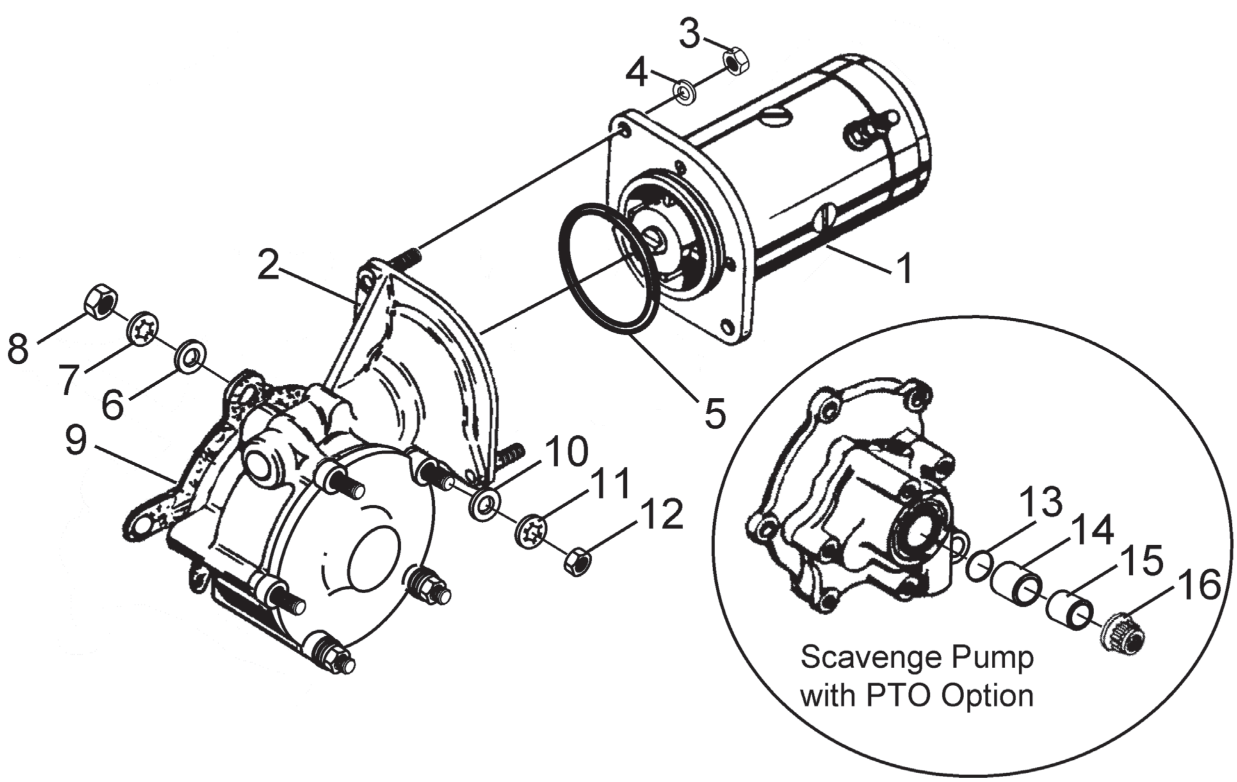


Figure 10-9. Starter Motor and Starter Adapter

1	Starter Motor	5	O-ring	9	Gasket	13	O-Ring
2	Starter Adapter	6	Washer	10	Washer	14	Sleeve
3	Nut	7	Lock washer	11	Lock washer	15	Spacer
4	Washer	8	Nut	12	Nut	16	12 Point Nut

10-4.3. Starter and Starter Adapter Service Limits

Service limits for the basic starter adapter are in Table 10-5 and Figure 10-10; The starter adapter with accessory drive service limits are in Table 10-8 and Figure 10-13. Index numbers in the first column of the Table correspond to the numbers in the illustrations.

Table 10-5. Basic Starter Adapter Dimensions

Index	Part	Dimensions (inches)		
		Service Limit	New Part Minimum (Inches)	New Part Maximum (inches)
1	Starter shaft gear needle bearing hole crankcase........................diameter:	1.005	0.9995	1.0005
2	Starter shaft gear front (bearing) journal ....diameter:	0.7480	0.7495	0.7500
3	Starter shaft gear in clutch drum bearing ....diameter:	1.0000L	0.9995	1.0000L
4	Clutch spring sleeve in starter adapter ....diameter:	0.0050T	0.0030T	0.0050T
5	Starter shaft gear in ball bearing ....diameter:	0.0007L	0.0001T	0.0005L
6	Bearing in starter adapter cover ....diameter:	0.0010L	0.0001T	0.0010L
7	Worm wheel gear ....end clearance:	0.0250	0.0016	0.0166
8	Worm wheel drum ....diameter:	Figure 10-12		
9	Starter shaft gear drum ....diameter:	Figure 10-11		
10	Clutch spring in clutch spring sleeve ....diameter[1]:	0.030T	0.0310T	0.0380T
11	From center line of worm gear shaft to starter adapter thrust pads	0.2520	0.2460	0.2480
12	Needle bearing hole starter adapter ....diameter:	0.7495	0.7485	0.7495
13	Ball bearing in starter adapter ....diameter:	0.0010L	0.0001T	0.0010L
14	Worm gear shaft in needle bearing area ....diameter:	0.5600	0.5615	0.5625
15	Worm gear shaft in ball bearing ....diameter:	0.0007T	0.0001L	0.0007T
16	Starter worm gear on shaft ....diameter:	0.0040	0.0005L	0.0025L
17	Starter spring on worm drive shaft ....diameter:	0.0025L	0.0050L	0.0250L
18	Starter pilot to starter drive adapter ....diameter:	0.0070L	0.0010L	0.0070L
19	Starter drive tongue to worm shaft drive slot...................... side clearance:	0.0210L	0.0100L	0.0210L
20	Starter worm wheel gear and worm gear .... backlash:	0.0130	0.0090	0.0130
21	Starter adapter cover pilot in adapter housing ....clearance:	0.0040L	0.0010L	0.0040L
T= Tight L= Loose				

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

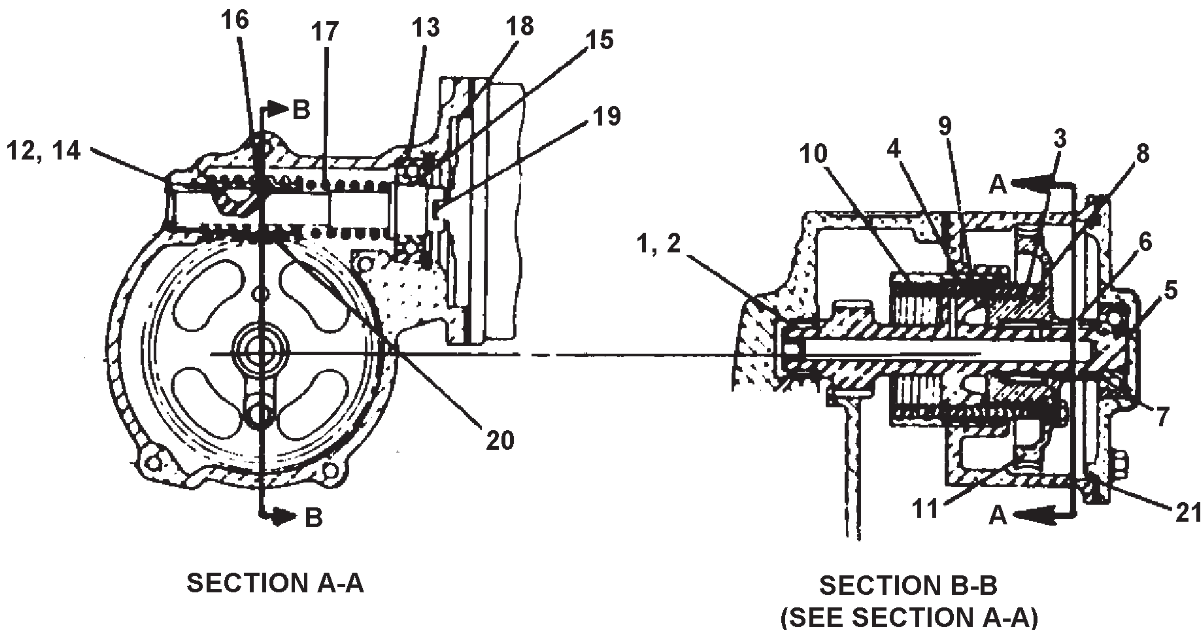


Figure 10-10. Basic Starter Adapter

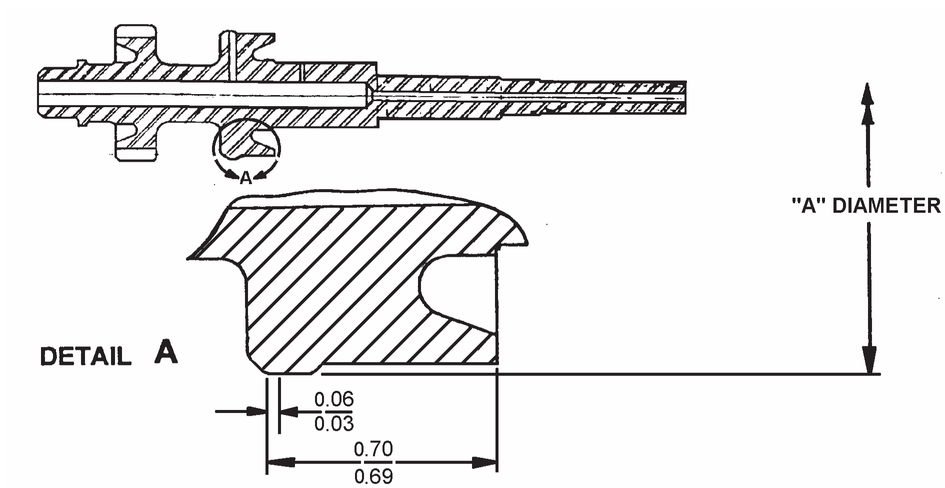


Figure 10-11. Shaft Gear Drum Dimensions

Table 10-6. 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 start adapter sleeve. The outside diameter should be 0.812 to 0.814 inches.		

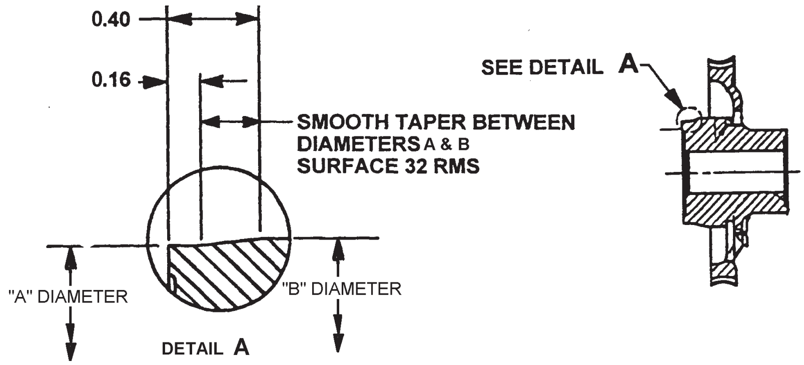


Figure 10-12. Worm Wheel Drum Dimensions

Table 10-7. 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

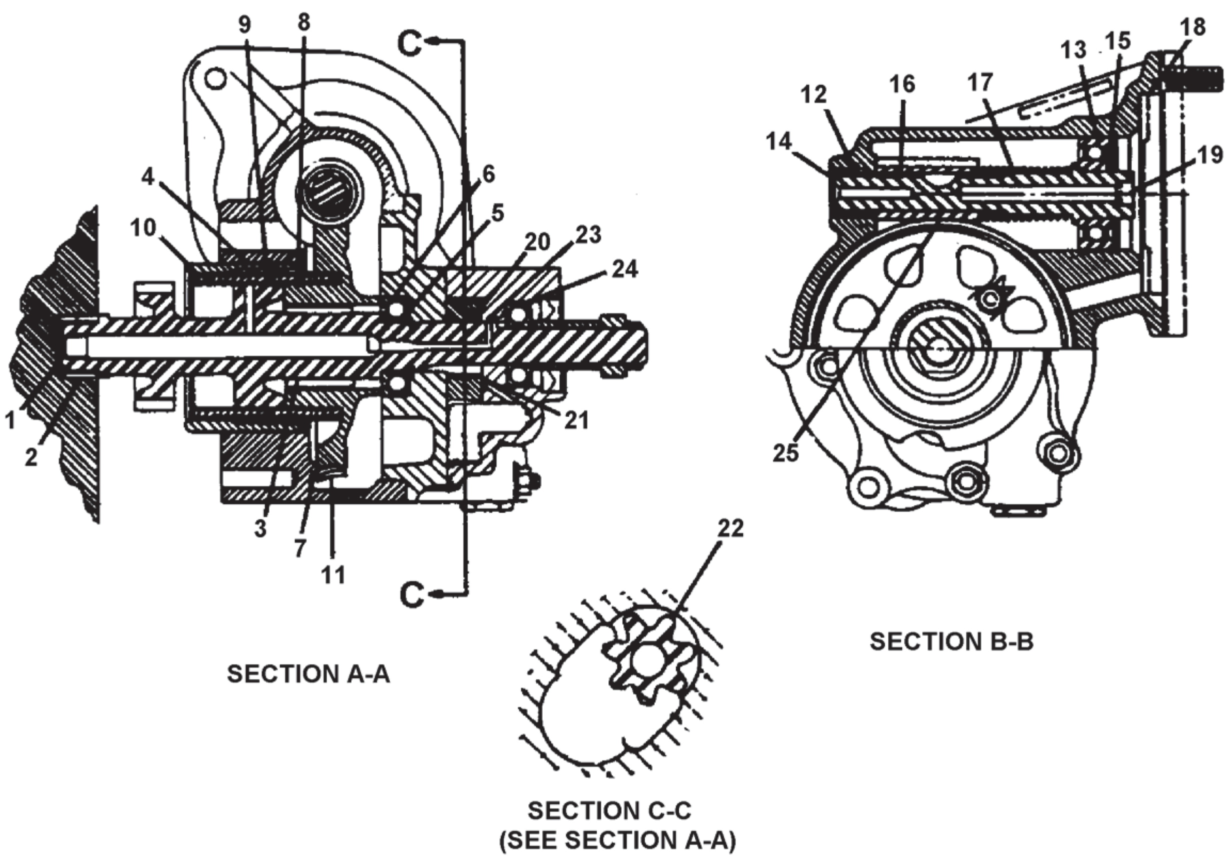


Figure 10-13. Starter Adapter with Scavenge Pump

Table 10-8. Starter Adapter with Accessory Drive Service Limits

Index	Description	Service Limit	New Part Minimum (inches)	New Part Maximum (inches)
1	Starter shaft gear needle bearing hole crankcase .... diameter:	1.0005	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:	1.0000L	0.9995	1.0000L
4	Clutch spring sleeve in starter adapter .... diameter:	0.0050T	0.0030T	0.0050T
5	Starter shaft gear in ball bearing.. diameter:	0.0007L	0.0001T	0.0005L
6	Bearing in starter adapter cover .... diameter:	0.0010L	0.0001T	0.0010L
7	Worm wheel gear .... end clearance:	0.0250	0.0016	0.0166
8	Worm wheel drum .... diameter:	Figure 10-12		
9	Starter shaft gear drum .... diameter:	Figure 10-11		
10	Clutch spring in clutch spring sleeve[1] .... diameter:	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.. diameter:	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 .... diameter:	0.0007T	0.0001L	0.0007T
16	Starter worm gear on shaft .... diameter:	0.0040	0.0005L	0.0025L
17	Starter spring on worm drive shaft .... diameter:	0.0250L	0.0050L	0.0250L
18	Starter pilot to starter drive adapter .... diameter:	0.0070L	0.0010L	0.0070L
19	Scavenge drive tongue to Worm Shaft Slot ....side clearance:	0.0340L	0.0120L	0.0340L
20	Scavenge pump driver gear on starter shaft gear........................ diameter:	0.0030L	0.0001L	0.0018L
21	Scavenge pump driver gear in body .... end clearance:	0.0060L	0.0015	0.0040
22	Scavenge pump driver gear in body .... diameter:	0.0160L	0.0018L	0.0143L
23	Starter Gear shaft in scavenge pump body .... diameter:	0.040L	0.0035	0.0050
24	Ball Bearing in scavenge pump body.. diameter:	0.011L	0.000	0.0011L
25	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

10-4.4. Starter Adapter Installation

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.

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

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 uncommanded engine starts during maintenance. Do not stand or place equipment within the arc of the propeller.

2. Inspect the starter adapter to ensure it is assembled according to the instructions in Chapter 16. Ensure the plugs and fittings are installed in the accessory adapter.
3. 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.

CAUTION: To prevent contaminating the oil supply, do not apply excessive Gasket Maker.

4. Apply a translucent coat of Gasket Maker according to the "Gasket Maker® Application" instructions in Section C-10 to the crankcase mating surface of the starter adapter gasket only.
5. Install the new gasket (Figure 10-9) (9) on the crankcase.
6. Lubricate the teeth on the starter shaft gear with clean 50-weight aviation engine oil.
7. Mesh the teeth with the crankshaft gear while placing the starter adapter in position.
8. Seat the starter adapter against the gasket.
9. Secure the starter adapter assembly to the crankcase with washers (6, 10), new lock washers (7, 11) and nuts (8, 12). Torque the nuts to Appendix B specifications.
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, disconnect engine electrical power and confirm continuity between the magneto capacitor and aircraft ground before commencing maintenance to avoid uncommanded engine starts 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 10-9) (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.
4. Apply Molyshield Grease to the starter motor drive lug.
5. 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).
6. Torque the mounting nuts to Appendix B specifications.
7. Verify the integrity of the electrical cable. Replace frayed or cracked wiring.
8. Reconnect the electrical cable and aircraft battery in accordance with the airframe manufacturer's instructions.
9. Perform an "Engine Start" according to the instructions in Section 7-3.2 to verify starter operation.

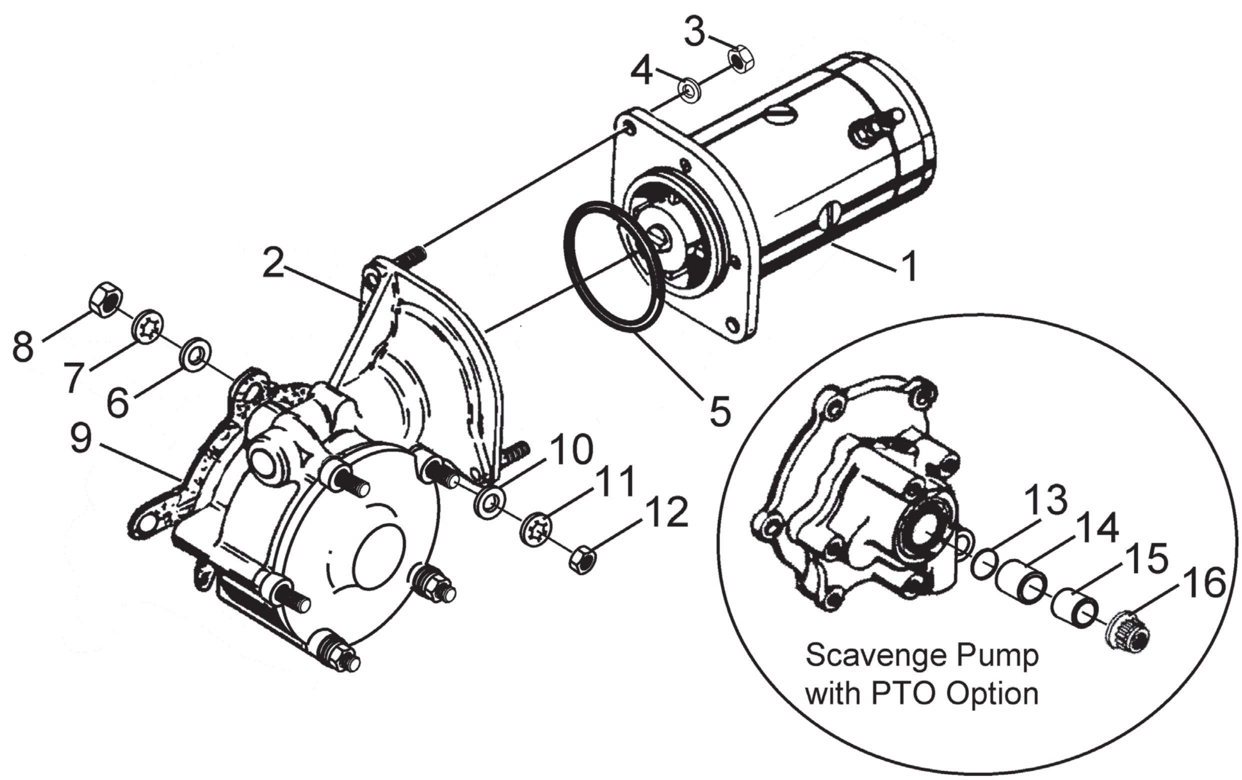


Figure 10-9 repeated for reference

10-5. Alternator Replacement

Replace the alternator if it fails to deliver the correct voltage and amperage to the aircraft electrical system. The engine may be equipped with a direct drive alternator, a belt-driven alternator, or both. For Continental Motors alternators, refer to Table 1-1 for the appropriate instructions to service or overhaul instructions. Consult CMI SIL13.2 for applicable Hartzell alternator continued airworthiness instructions For all other alternators, replace the suspect unit with a new, rebuilt, or serviceable alternator if it malfunctions and during each 500 hour inspection.

10-5.1. Direct Drive Alternator 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 uncommanded engine starts 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. Disconnect the aircraft battery according to the aircraft manufacturer's instructions.
3. Disconnect electrical connections from the alternator according to the aircraft manufacturer's instructions.
4. Remove the plain washer (Figure 10-14) (8), lock washer (9), and nut (10) from the four alternator mounting studs; discard the lock washers (9).
5. Remove the alternator (2) from the crankcase mounting studs.

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

6. Remove and discard the gasket (1); clean any remaining gasket residue from the crankcase flange according to instructions in Chapter 14.
7. Perform a "Gear Tooth Inspection" on the alternator drive hub gear according to the instruction in Section 15-3.1. If the drive hub gear teeth are chipped, broken, or otherwise damaged, replace the drive hub according to instructions in Section 10-5.1.1 and perform a "Foreign Object Contamination Inspection" according to instructions in Section 6-4.6.
8. Inspect the drive hub coupling for serviceability. If the coupling exhibits damage or missing material, replace the drive hub and perform a "Foreign Object Contamination Inspection" according to instructions in Section 6-4.6.
9. Perform a "Gear Tooth Inspection" on the crankshaft face gear according to instruction in Section 15-3.1. If the face gear teeth are chipped, broken, or otherwise damaged, disassemble the engine and replace the crankshaft face gear.

10. Perform an “Alternator Drive Hub Slippage Inspection” according to instructions in Section 15-7.6.

10-5.1.1. Direct Drive Alternator Drive Hub Removal

1. Remove the alternator from the crankcase according to the instructions in Section 10-5.1.
2. Remove the cotter pin (7) and slotted nut (4).
3. Remove the drive hub assembly (5) from the alternator shaft.
4. Remove the Woodruff key (3).
5. Discard the cotter pin (7) and Woodruff key (3).
6. Separate the thrust washer (6) and drive hub assembly (5).
7. Inspect, disassemble, troubleshoot, repair, and assemble Continental Motors alternators according to the Alternator Service Instruction (X30531). If the alternator is manufactured for CMI by Hartzell Engine Technologies, consult CMI SIL13-2 for applicable airworthiness instructions. For all other alternators, replace the alternator with a new, rebuilt, or serviceable unit.

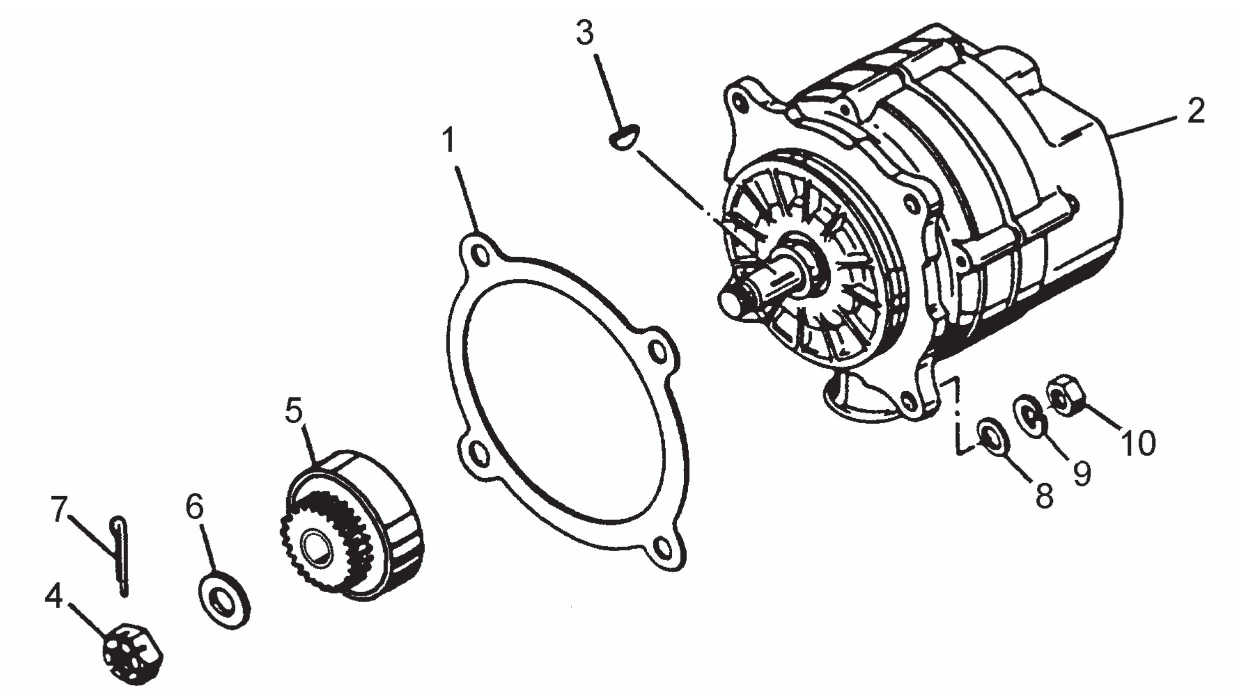


Figure 10-14. Gear Driven Alternator Assembly

1	Gasket	4	Slotted Nut	7	Cotter Pin	9	Lock Washer
2	Alternator	5	Drive Hub Assembly	8	Plain Washer	10	Nut
3	Woodruff Key	6	Thrust Washer				

10-5.1.2. Direct Drive Alternator Drive Hub Installation

WARNING

If the shipping washer is not removed prior to installing the drive hub assembly, the shipping washer will cause interference with the face gear on the crankshaft and will result in damage to the engine and alternator.

1. Remove the shipping spacer and washer from the alternator shaft to prevent interference with the face gear on the crankshaft.
2. Perform an "Alternator Drive Hub Slippage Inspection" in Section 15-7.6.
3. Install a new Woodruff key (Figure 10-14)(3), drive hub assembly (5), and new thrust washer (6).

   CAUTION: The special thrust washer (6) must be installed with the bearing surface (copper color) toward the alternator.
4. Install the slotted nut (4) on the alternator shaft.

   CAUTION: Secure only the outer diameter of the drive hub assembly when torquing the slotted nut; allow the gear freedom of movement to prevent shearing the elastomer coupling.
5. Secure the outer diameter of the drive hub with an Ideal Aviation Part No. 9000IA, "Alternator Drive Hub Spanner Wrench" ("Special Tools" in Chapter 3) and torque the slotted nut to the minimum value specified in Appendix B.
6. If the slots of the nut do not align with the cotter pin hole in the alternator shaft, the slotted nut may be torqued up to the maximum value in Appendix B. If the cotter pin holes will not align with the nut slot within the torque range, replace the nut.
7. Install the new cotter pin (7) according to the "Cotter Pin Installation" instructions in Appendix C-8, cut and bend the cotter pin to prevent it from touching the thrust washer to attain clearance when installing the alternator on the engine.
8. Install the alternator according to "Direct Drive Alternator Installation" instructions in Section 10-5.2.

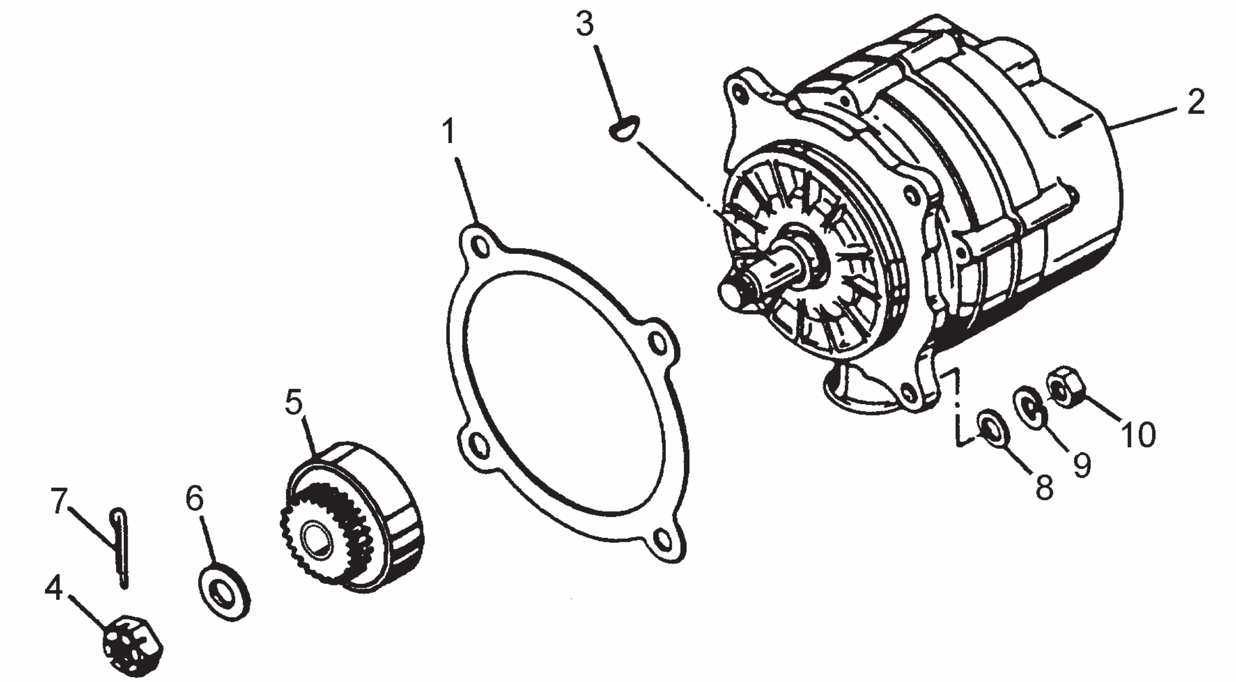


Figure 10-14 repeated for reference

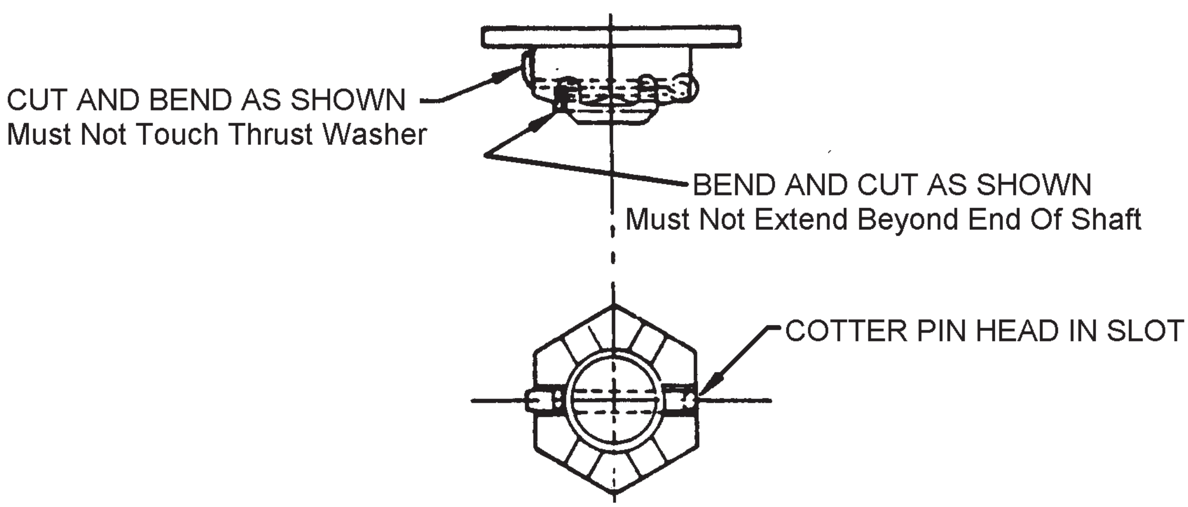


Figure 10-15. Alternator Cotter Pin Installation

10-5.2. Direct Drive Alternator Installation

Prior to alternator installation, perform an “Alternator Drive Hub Slippage Inspection” in Section 15-7.6. and install a serviceable drive hub according to instructions in Section 10-5.1.2.

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 uncommanded engine starts 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 the crankshaft face gear teeth according to the “Gear Tooth Inspection” in Section 15-3.1. If the crankshaft face gear exhibits damage, refer to the “Engine Disassembly” instructions in Chapter 12 to replace the crankshaft face gear.
3. Install a new gasket (Figure 10-14) (1) on the alternator mounting studs.
4. Install the alternator (2) on the mounting studs using four plain washers (8), four *new* lock washers (9), and four nuts (10).
5. Torque the nuts (10) to Appendix B specifications.
6. If the alternator had a grounding strap when it was removed, install the grounding strap when installing the alternator.
7. Reconnect electrical connections at the alternator according to the airframe manufacturer’s instructions.
8. Reconnect the aircraft battery per instructions in the aircraft manual.
9. Start the engine according to the “Engine Start” instructions in Section 7-3.2 and test the alternator output according to the instructions in the Aircraft Maintenance Manual.

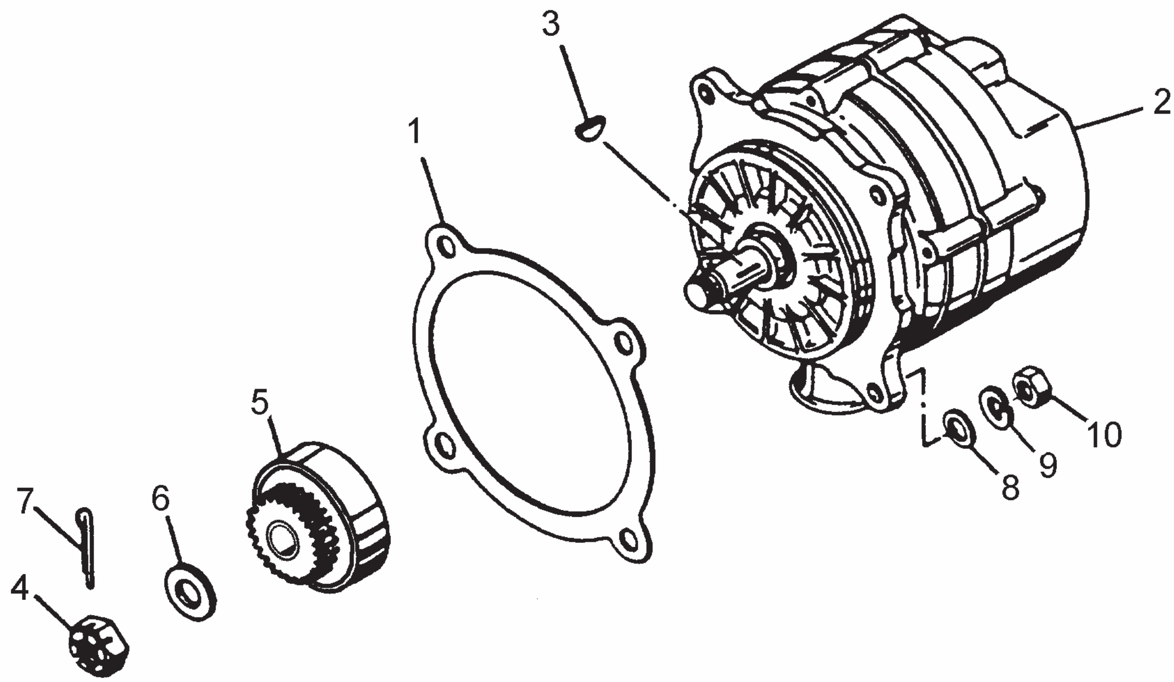


Figure 10-14 repeated for reference

10-5.3. Belt Driven Alternator Replacement Instructions

Belt driven alternators are available in 70 or 85 amp options: the 70 amp alternator belt tension adjustment is at the bottom of the bracket; the 85 amp alternator belt tension adjustment is outboard of the alternator. Refer to the removal and installation instructions applicable to the installed alternator. For drive sheave and alternator mounting bracket removal instructions, refer to the instructions in Section 12-9.3. To install a replacement drive sheave or alternator mounting bracket, refer to the instructions in Section 17-9.2.

10-5.3.1. 70 Amp Belt Driven Alternator 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 uncommanded engine starts 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 the alternator wiring harness connections according to the airframe manufacturer's instructions.
3. Remove the safety wire from the adjustment screw (Figure 10-16) (4). Loosen the adjustment screw, upper alternator mounting bolt (9) and the screw (7) securing the alternator (19) to the adjustable brace (15).
4. Remove the screw (7), lock washer (5) and washer (8) from the alternator and adjustable brace; discard the lock washer (5). If shims (27) are used to align the brace to the alternator; retain the shims (27), if used, for installation.
5. Remove the V-belt (20) from the alternator and drive sheave (10).
6. Remove the upper mounting bolt (9), washer (2), and nut (3) from the alternator and bracket and remove the alternator from the bracket; retain the shims (27), if used, for installation.
7. Inspect, disassemble, troubleshoot, repair, test and assemble the alternator according to Hartzell Engine Technologies Alternator Overhaul Manual (Part No. OE-A2).

10-5.3.2. 70 Amp Belt Driven Alternator Installation

1. Inspect the belt driven alternator bracket and hardware for excessive wear or physical damage. Check the brace for elongated holes or cracks. Replace worn or damaged bracket assembly components.
2. Inspect the V-belt (Figure 10-16) (20) (20) for cracks, abnormal wear, or frayed edges; replace if necessary.
3. Install the alternator (19) on the upper mounting bracket with the bolt (9), washer (2), and nut (3). Insert shims (27), as required, between the bracket and the leading edge of the alternator to align the alternator sheave with the drive sheave.
4. Raise the adjustable brace (15) to align with the outboard alternator mounting boss. and temporarily torque the screw (4) to 150 in. lbs. Measure the gap between the adjustable brace (15) and the alternator mounting boss.

   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.

5. Insert shims (27) to completely fill the gap between the adjustable brace (15) and the alternator mounting boss. Insert a screw (7), new lock washer (5) and washer (8) through adjustable brace (15) into the alternator outboard threaded mounting boss.

6. Adjust the V-belt tension according to instructions in Section 6-3.10.4. Torque the fasteners (3, 4 & 7) to Appendix B specifications after V-belt tension adjustment.

7. Connect the airframe wiring harness to the alternator according to the airframe manufacturer's instructions.

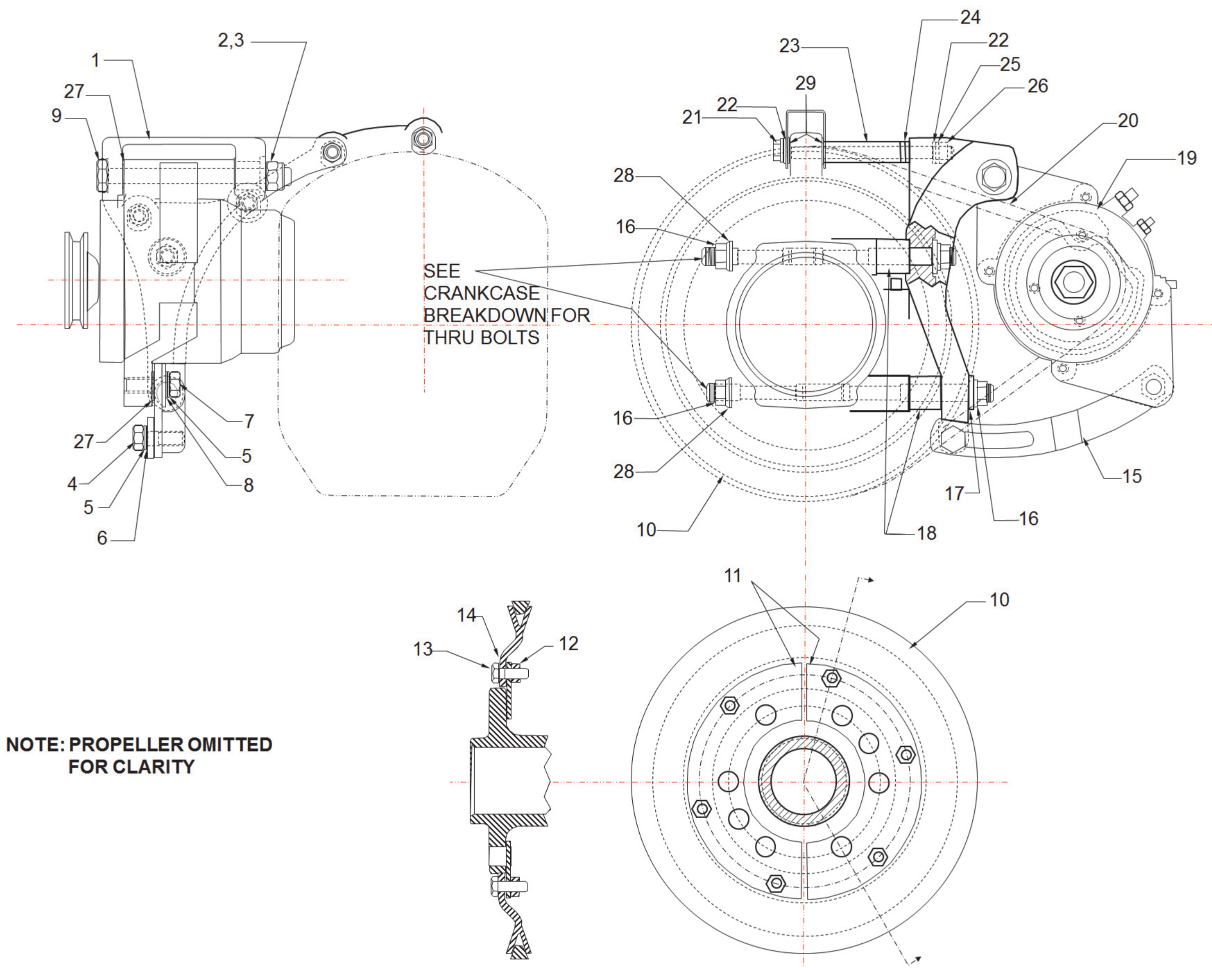


Figure 10-16. 70 Amp Belt Driven Alternator Bracket Assembly

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		

10-5.3.3. 85 Amp Belt Driven Alternator Removal

WARNING

If electrical power is not turned OFF, a loose or broken wire could allow the engine to start and the propeller to rotate. Do not stand or place equipment within the arc of the propeller.

1. Turn the Aircraft Master Power Switch and FADEC Enable Switches to the OFF position and disconnect engine electrical power.
2. Remove the alternator wiring harness connections according to the airframe manufacturer's instructions.

1. Loosen the pivot bolt (Figure 10-17) (4), upper mounting bolt (9) and outboard mounting bolt (7).
2. Remove the V-belt from the alternator sheave. Inspect the V-belt for cracks, wear, or frayed edges; replace if necessary.
3. Remove the outboard mounting bolt (7), lock washer (5) and washer (8) from the alternator and bracket; discard the lock washer (2).
4. Remove the upper mounting bolt (9), washer (2), and nut (3) from the alternator and bracket and remove the alternator from the bracket.

10-5.3.4. 85 Amp Belt Driven Alternator Installation

1. Inspect the belt driven alternator bracket and hardware for wear or physical damage. Check the adjustable arm for elongated holes or cracks. Replace worn or damaged bracket assembly components.
2. Inspect the V-belt (Figure 10-17) (20) for cracks, abnormal wear, or frayed edges; replace if necessary.
3. Install the alternator (19) on the upper mounting bracket with the bolt (9), washer (2), and a new nut (3).
4. Align the adjustable arm (15) bolt hole with the outboard alternator mounting boss. Loosely install the bolt (7), new lock washer (5) and washer (8) through adjustable arm (15) into the alternator outboard mounting hole.
5. Check the alignment of the alternator drive sheave to the split sheave (11) with a Part No. 8082IA Pulley Alignment Tool (Chapter 3). 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 split sheave - no more than 0.010 inch deflection is permitted. If deflection is greater than 0.010 inch, remove the bolt (7), lock washer (5) and washer (8) from the alternator mounting boss and install shims (26) to fill the gap between the adjustable arm and the alternator outboard mounting boss. When alignment is within 0.010 inch, reinstall the bolt (7), lock washer (5) and washer (8) through the adjustable arm (15) into the alternator mounting boss.
6. Adjust the V-belt tension according to instructions in Section 6-3.10.4.

7. Torque the fasteners (7, 4, & 9) to Appendix B specifications after V-belt tension adjustment.

8. Connect the airframe wiring harness to the alternator according to the airframe manufacturer's instructions.

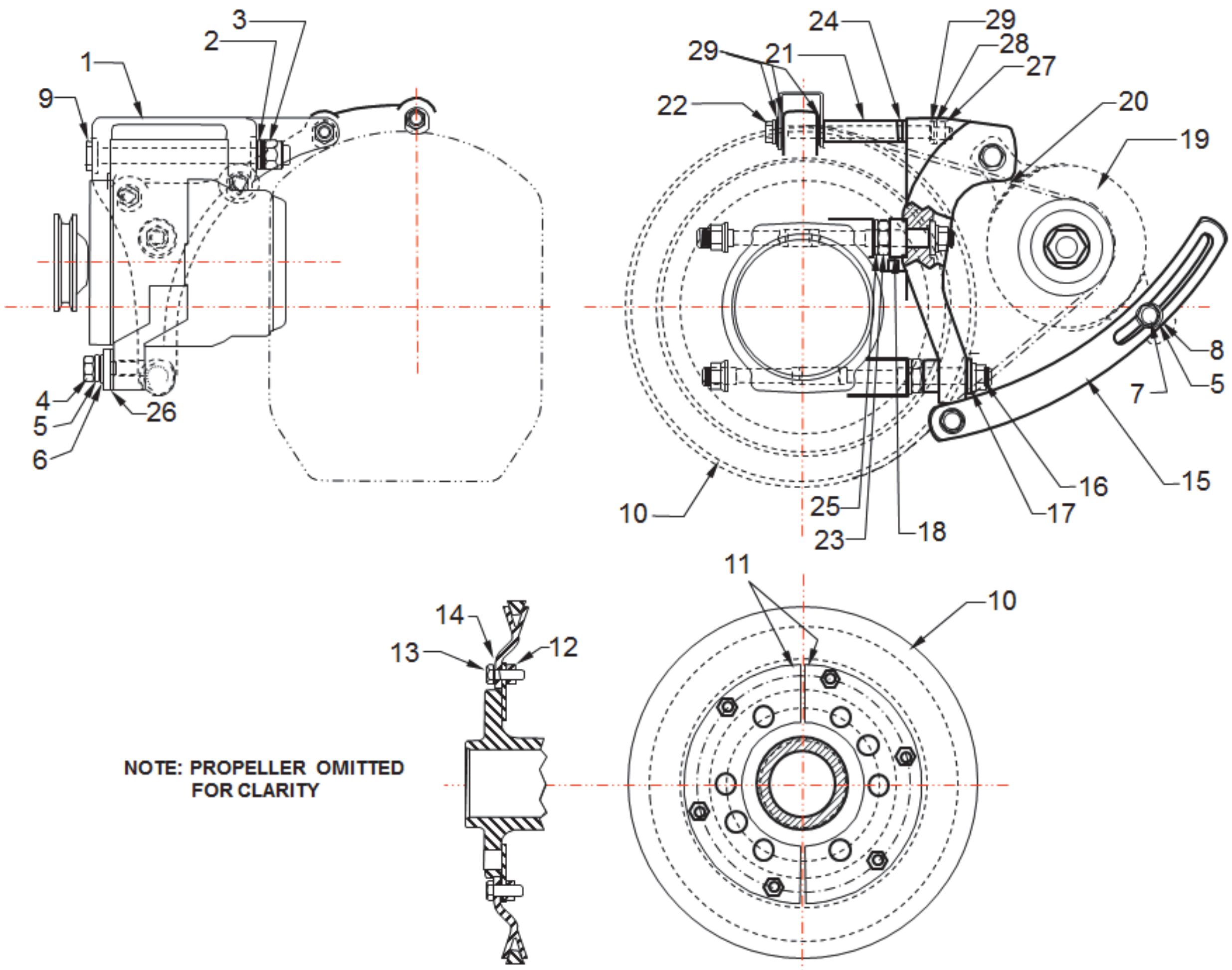


Figure 10-17. 85 Amp Belt Driven Alternator Assembly

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

10-6. Magneto Replacement

IO-550 Permold Series engine ignition systems may feature Continental Motors' S-20 or S-1200 Series magnetos or the engine ignition may be supplied by Champion (Slick). Locate the instructions that apply to the magneto installed on the engine.

10-6.1. Continental Motors' Magneto 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 uncommanded engine starts 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 the nut (Figure 10-18) (8) and washer (9) and disconnect the airframe wiring from the magneto ground terminal according to the airframe manufacturer's instructions.
3. Remove the screws (106) from the cable outlet plate (part of item 3 connected to ignition wires).

   CAUTION: Remove the magneto carefully to avoid dropping the bushings or retainers into the crankcase.

4. Remove nuts (5), lock washers (6), and magneto retainers (7) from either side of magneto. Remove and discard gasket (4).
5. Perform an "Ignition System Inspection" according to Section 6-3.15 instructions.
6. Refer to the Ignition System Service Manual (X42001 for S-1200 Series Magnetos or X42002 for S-20/S-200 Series Magnetos) for applicable magneto maintenance instructions.

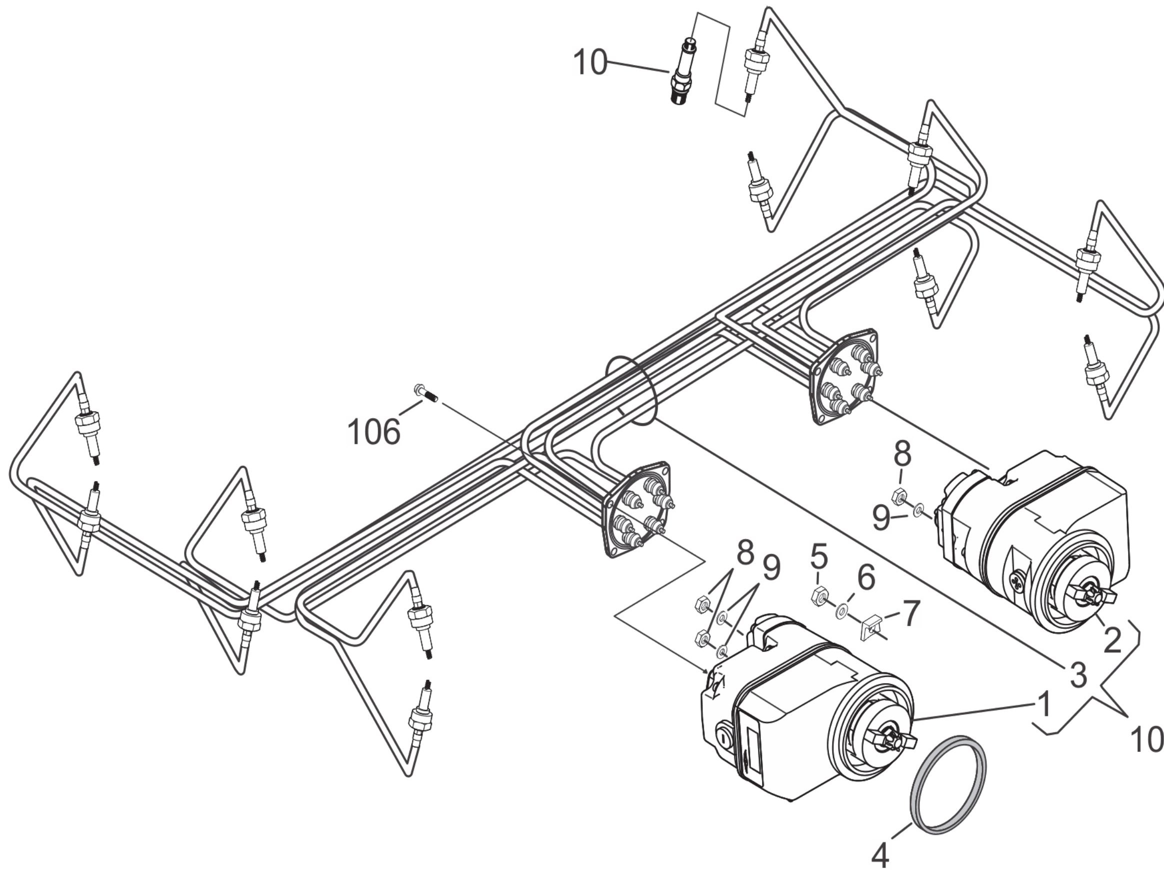


Figure 10-18. Continental Motors Ignition System

1	Magneto (2-4-6)	4	Gasket	7	Retainer, Magneto	10	Spark Plug
2	Magneto (1-3-5)	5	Nut	8	Nut	105	Ignition System Kit
3	Ignition Harness	6	Lock Washer	9	Lock Washer	106	Screw

10-6.2. Champion (Slick) Magneto 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 uncommanded engine starts 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. Disconnect the airframe wiring from the magneto ground terminal according to the airframe manufacturer's instructions.
3. Remove the screws (Figure 10-19) from the cable outlet plate (part of item 3 connected to ignition wires) and separate the cable outlet plate from the magneto.

   CAUTION: Remove the magneto carefully to avoid dropping the bushings or retainers into the crankcase.

4. Remove nuts (4), lock washers (5), and magneto retainers (6) from either side of magneto. Carefully remove the magneto from the crankcase, disengaging the drive coupling lugs from the drive bushing slot. Remove and discard gasket (2).
5. Perform an "Ignition System Inspection" according to Section 6-3.15 instructions.
6. Refer to the Champion (Slick) Ignition Systems Service Index (Form F-1100) for applicable magneto maintenance instructions.

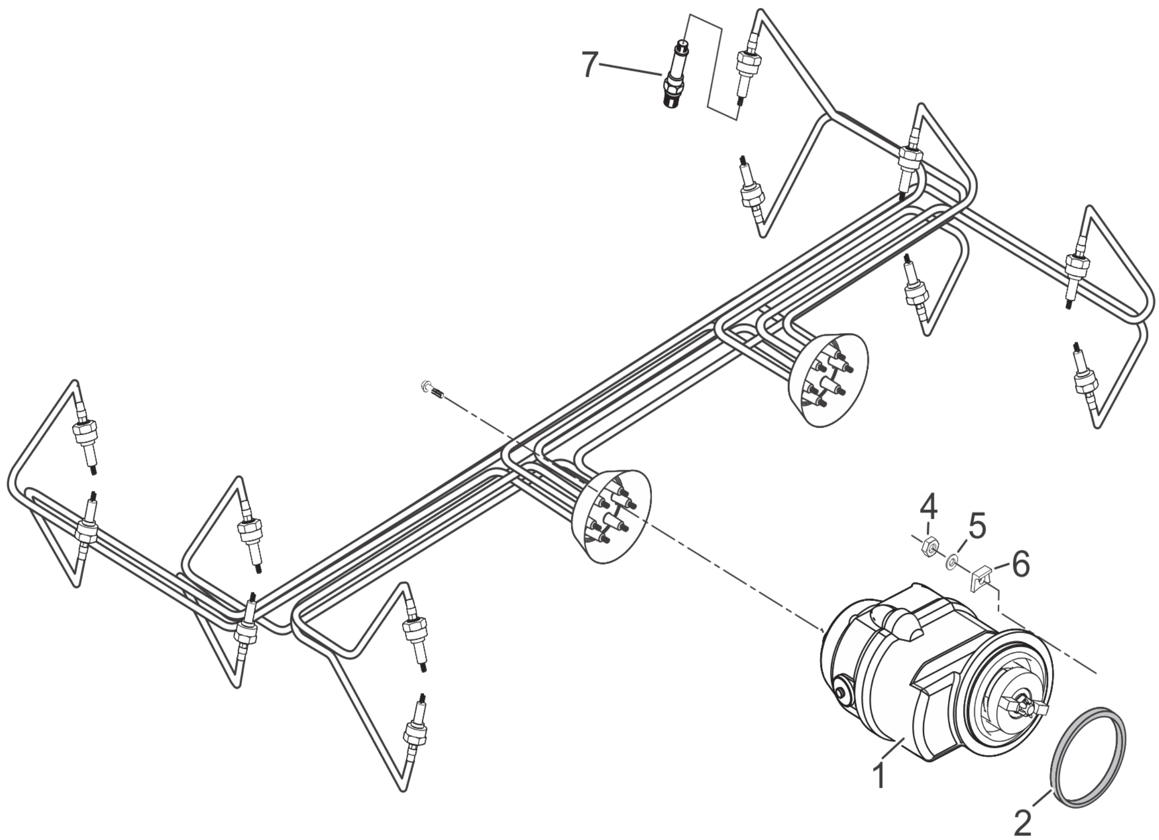


Figure 10-19. Champion Slick Ignition System

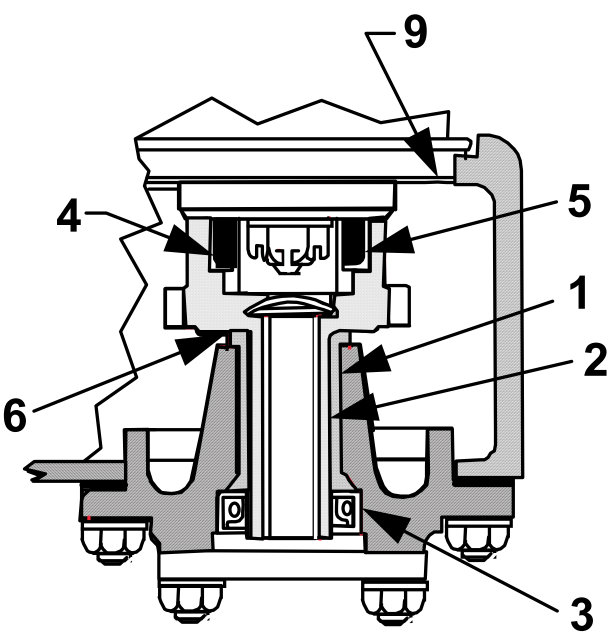
1	Magneto	3	Ignition Harness	5	Lock Washer	7	Spark Plug
2	Gasket	4	Nut	6	Retainer, Magneto		

10-6.3. Ignition System Service Limits

The ignition system component service limits are shown in Section 10-9. Index numbers in the first column correspond to the numbers in Figure 10-20.

Table 10-9. Ignition System Service Limits

Index	Description	Service Limit	New Part Minimum (inches)	New Part Maximum (inches)
1	Bushing in magneto and accessory drive adapter .... diameter:	0.0040T	0.0010T	0.0040T
2	Magneto and accessory drive gear in adapter bushing . diameter:	0.0050L	0.0015L	0.0035L
3	Oil seal in adapter .... diameter:	0.0070T	0.0010T	0.0070T
4	Sleeve in magneto and accessory drive gear .... diameter:	0.0040T	0.0010T	0.0070T
5	Magneto coupling retainer on drive gear sleeve .... diameter:	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 .... diameter:	0.0050L	0.001L	0.005L
T = Tight and L = Loose				



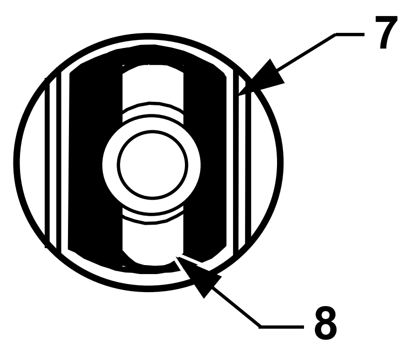


Figure 10-20. Accessory Drive Adapter Dimensions

10-6.4. Continental Motors' Magneto Installation

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 uncommanded engine starts 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. Complete the "Crankshaft Top Dead Center Alignment" in Section 6-3.9.1.1.
3. Verify the magneto drive coupling bushings and retainer are properly installed.
4. Perform steps 1-3 of the "Magneto to Engine Timing" in Section 6-3.9.1.2.
5. Remove the ventilation plug from the magneto(s). Turn the impulse coupling backward until the marked distributor gear tooth is centered in the window.
6. Without turning the magneto coupling, hold the magneto in the position it will occupy when installed.
   a. Align the gear coupling slot and impulse coupling lugs by pulling the magneto gear out and turning it to the desired position.
   b. Push the gear back into the meshed position.
7. Lubricate both sides of an new gasket with Dow Corning No. 4 lubricant and install the new gasket (Figure 10-18) (4) on the magneto flange.
8. Carefully insert the magneto in the crankcase, aligning the drive coupling lugs mate with the drive bushing slot. Install four sets of magneto retainers (7), lock washers (6) and nuts (5); hand-tighten the nuts at this time.
9. Install the ventilation plug removed for inspection.
10. Complete "Magneto to Engine Timing" in Section 6-3.9.1.2.
11. Torque nuts according to Appendix B specifications.
12. Disconnect timing light from magnetos. Attach the airframe wiring harness to the magneto ground terminal according the airframe manufacturer's instructions.
13. Install the spark plugs and ignition harness according to instructions "Ignition System Maintenance" in Section 6-3.9.
14. Start the engine according to the "Engine Start" instructions in Section 7-3.2 instructions and perform a "Magneto RPM Drop Check" according to the instructions in Section 6-3.7.5.

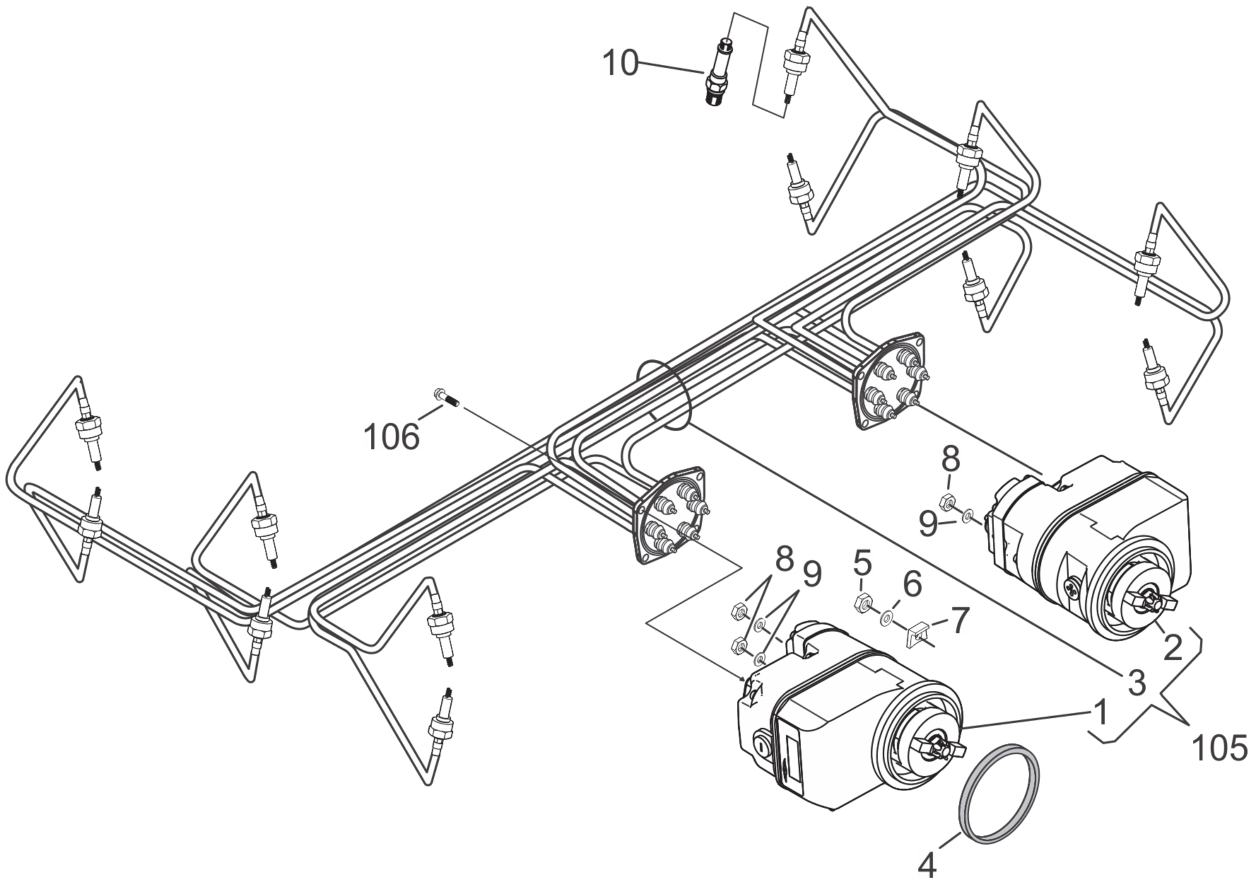


Figure 10-18 repeated for reference

10-6.5. Champion (Slick) Magneto Installation

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 uncommanded engine starts 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. Complete the “Crankshaft Top Dead Center Alignment” in Section 6-3.9.1.1.
3. Perform steps 1-3 of the “Magneto to Engine Timing” in Section 6-3.9.1.2.
4. Insert T118 timing pin in “L” or “R” hole (depending on magneto rotation) in the distributor block. Turn rotor in the opposite direction of rotation until pin engages the gear.
5. Without turning the magneto coupling, hold the magneto in the position it will occupy when installed.
   a. Align the gear coupling slot and impulse coupling lugs by pulling the magneto gear out and turning it to the desired position.

   CAUTION: Remove the T118 timing pin before rotating the crankshaft to prevent magneto damage.

   b. Push the gear back into the meshed position and remove the T118 timing pin from the magneto.
   c. Verify the magneto drive coupling bushings and retainers are properly installed.
6. Verify the magneto drive coupling bushings and retainers are serviceable and properly installed. Apply Dow Corning No. 4 lubricant to both sides of a new magneto gasket (Figure 10-19) (2) on the magneto flange.
7. Carefully insert the magneto in the crankcase, aligning the drive coupling lugs with the drive bushing slot. Secure the magneto to the crankcase with retainers (6), lock washers (5) and nuts (4); hand-tighten the nuts at this time.
8. Complete “Magneto to Engine Timing” in Section 6-3.9.1.2.
9. Torque nuts (4) according to Appendix B specifications.
10. Disconnect timing light from magnetos. Attach the magneto ground wire according the airframe manufacturer’s instructions.
11. Install the spark plugs and ignition harness according to instructions “Ignition System Maintenance” in Section 6-3.9.
12. Start the engine according to the “Engine Start” instructions in Section 7-3.2 instructions and perform a “Magneto RPM Drop Check” according to the instructions in Section 6-3.7.5.

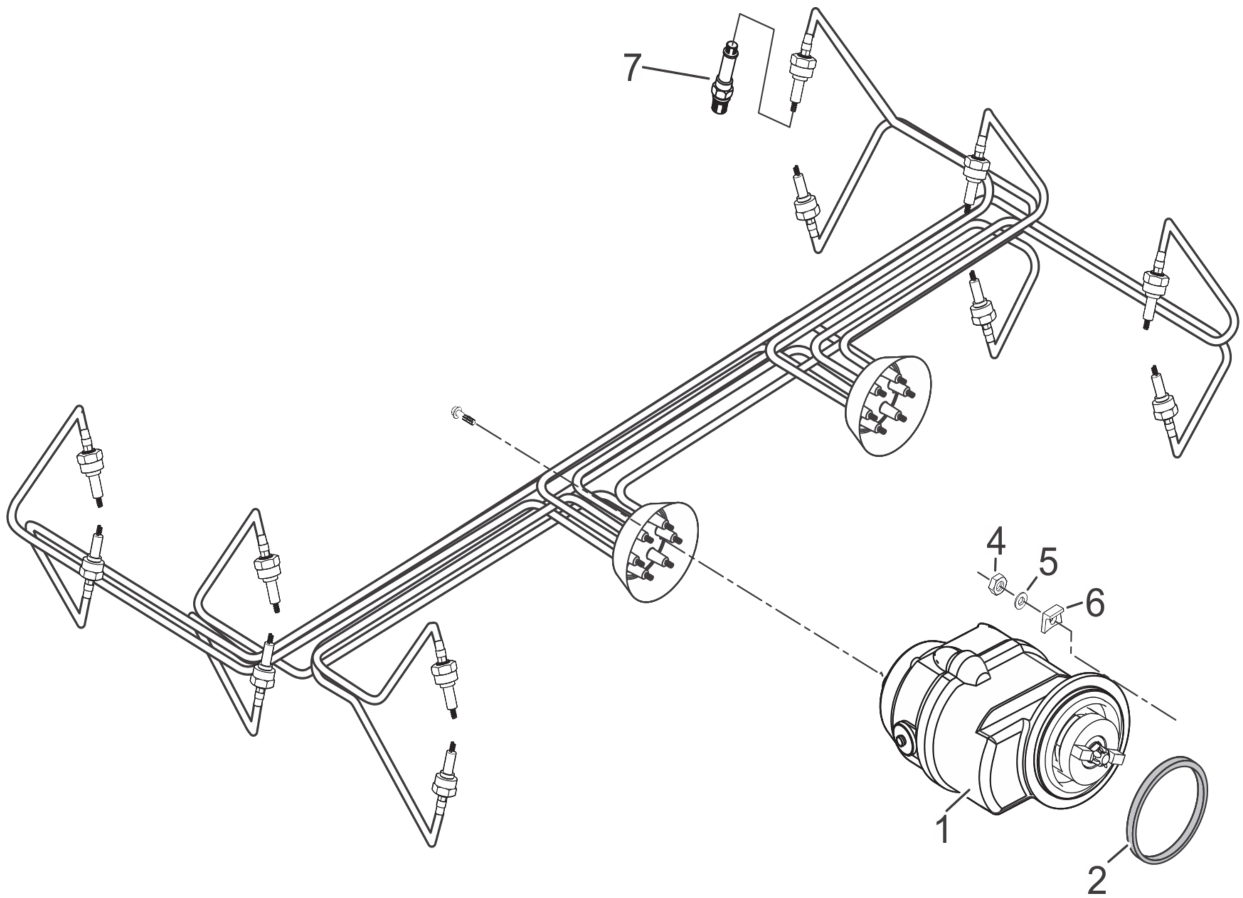


Figure 10-19 repeated for reference

10-6.6. Accessory Drive Adapter Replacement

1. Disconnect the airframe accessory connected to the accessory drive according to the airframe 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 13-6. 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 6-4.6.
   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 6-4.6.
   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 17-6.
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.

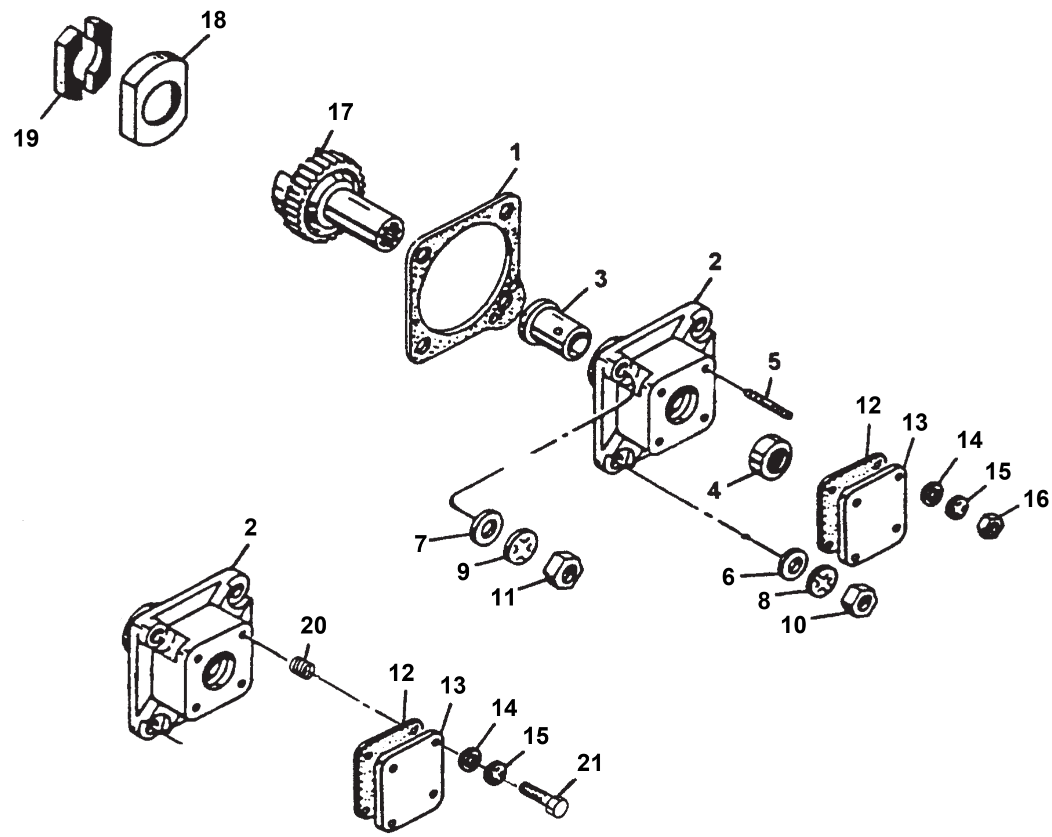


Figure 10-21. Accessory Drive Assembly

1	Gasket	6	Plain Washer	11	Nut	16	Nut
2	Adapter Assembly	7	Plain Washer	12	Gasket	17	Drive Gear Assembly
3	Bushing	8	Lock Washer	13	Cover	18	Retainer
4	Oil Seal	9	Lock Washer	14	Washer	19	Rubber Bushing
5	Stud	10	Nut	15	Lock Washer	20	Helical Coil Insert
						21	Bolt

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, disconnect engine electrical power and confirm continuity between the magneto capacitor and aircraft ground before commencing maintenance to avoid uncommanded engine starts 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 6-3.8.2 but do not refill the oil at this time.
3. Replace the oil filter adapter stud according to the instructions in Section 15-8.8.3. When stud replacement is complete, complete the oil change.
4. Perform the “Oil Pump Operational Check” according to instructions in Section 6-3.7.3.

10-7.2. Oil Pump or Tachometer Drive Repair and Replacement

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 uncommanded engine starts 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 pumps or oil pump components by removing the oil pump according to the “Oil Pump Removal” instructions in Section 12-8.
3. Inspect the oil pump components according to the “Lubrication Component Service Limits” in Section 10-7.7. Replace parts that do not meet the dimensional specifications.
4. Install the new oil pump according to 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 the gear chamber becomes scored or enlarged, discard and replace the oil 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 an “Oil Pump Operational Check” according to instructions in Section 6-3.7.3.

10-7.3. Oil Sump and Oil Suction Tube Repair and Replacement

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 uncommanded engine starts 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 airframe to remove the oil sump. Follow appropriate engine removal instructions in Chapter 5.

2. Remove the oil sump and oil suction tube according to the "Oil Sump Removal" instructions in Section 12-12. Install a new oil sump and suction tube according to the "Oil Sump & Suction Tube Installation" instructions in Section 17-4.
3. Perform an "Oil Pump Operational Check" according to instructions in Section 6-3.7.3.

10-7.4. Oil Cooler Repair and Replacement

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 uncommanded engine starts 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 the oil cooler according to the "Oil Cooler Removal" instructions in Section 12-7.
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 17-8.
6. Service the engine according to "Engine Pre-oiling" instructions in Section 5-3.4.
7. 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 and operating limits in Chapter 2.

10-7.5. Oil Pressure Relief Valve Repair and Replacement

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

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 uncommanded engine starts during maintenance. Do not stand or place equipment within the arc of the propeller.

2. Cut, remove, and discard the safety wire from the oil pressure relief valve housing located at the rear of the engine (Figure 10-22). Remove the self locking nut and copper washer from the adjusting screw; discard the copper washer.
3. Remove the oil pressure relief valve from the oil pump housing; discard the gasket.

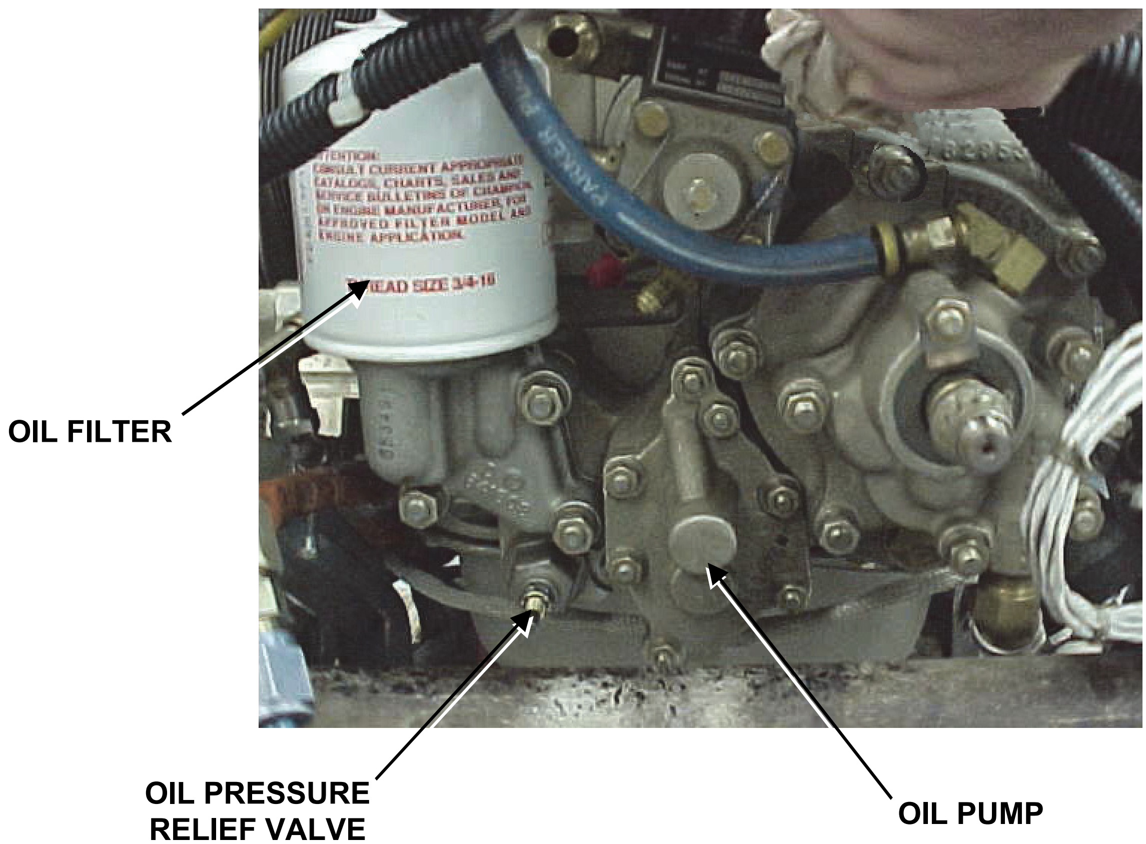


Figure 10-22. Rear View of Engine

4. Inspect the oil pressure relief valve plunger (Figure 10-23) and valve seat (Figure 10-24) in the oil pump housing for scoring, nicks, and rough spots. If the plunger has scoring, nicks, or roughening, replace the oil pressure relief valve plunger. If the oil pump housing valve seat is nicked or the surface is rough, reface

the valve seat according to instructions in Section 15-8.8.2.

Figure 10-23. Oil Pressure Relief Valve

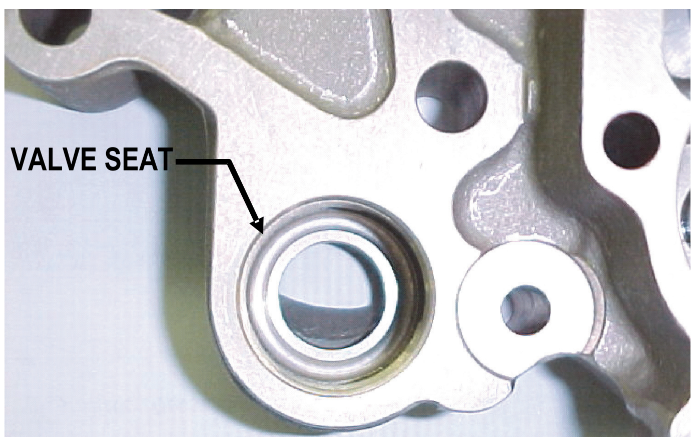


Figure 10-24. Valve Seat in the Oil Pump Housing

5. Dimensionally inspect the oil pressure relief valve using the service limits in Table 10-10; replace the oil pressure relief valve if it does not meet the service limits.
6. Assemble serviceable oil pressure relief valve components according to instructions in Section 16-5.1.
7. Perform an "Oil Pump Operational Check" according to instructions in Section 6-3.7.3.

10-7.6. Oil Temperature Control Valve Inspection and Replacement

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 uncommanded engine starts during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Disconnect engine electrical power and turn the Ignition Switch to the OFF position.
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 10-25) 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 Anti-Seize Lubricant to the threads on the oil temperature control valve where shown in Figure 10-25.
7. Install the oil temperature control valve with a new washer; Torque the oil temperature control valve to Appendix B specifications and safety wire the oil temperature control valve housing according to the instructions in Appendix C-4.
8. Perform an "Oil Pump Operational Check" in Section 6-3.7.3.

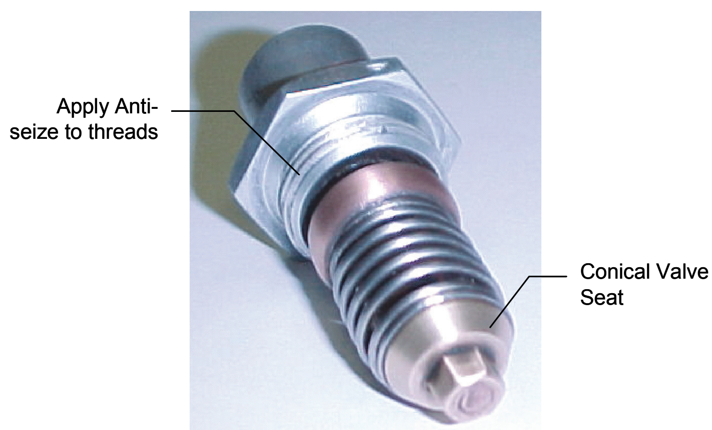


Figure 10-25. Oil Temperature Control Valve

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10-7.7. Lubrication Component Service Limits

Lubrication System Component Service Limits are shown in Table 10-10. Index numbers in the first column correspond to the item numbers in Figure 10-26.

Table 10-10. Lubrication System Component Service Limits

Index	Part	Dimensions (inches)		
		Service	Minimum	Maximum
Oil Pressure Relief Valve Assembly				
1	Oil pressure relief valve adjusting screw in plunger .... diameter:	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 .... diameter:	0.0065L	0.0040L	0.0060L
4	Oil pump driver gear shaft in pump housing .... diameter:	0.0045L	0.0015T	0.0030L
5	Oil pump driven gear to driven gear shaft .... diameter:	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 drive housing .... diameter:	---	0.0015L	0.0030L
9	Oil pump driver gear shaft pin in bevel gear .... diameter:	---	0.0005L	0.0025L
10	Oil pump driven gear in housing .... diameter:	0.0065L	0.0040L	0.0060L
11	Tach drive shaft in tach drive housing .... diameter:	---	0.0015L	0.0030L
12	Oil seal in mechanical tach drive housing .... diameter:	---	0.003T	0.005T
13	Oil seal in electrical tach drive housing .... diameter:	---	0.0015T	0.0065T
Gear Backlash				
14	Oil pump driver and driven gears .... backlash:	---	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 temp.control valve 0.090” minimum travel................ at oil temperature:	---	120°F	170°F
18	Oil temperature must close between .... oil temperature:	---	168°F	172°F
T= Tight L=Loose				

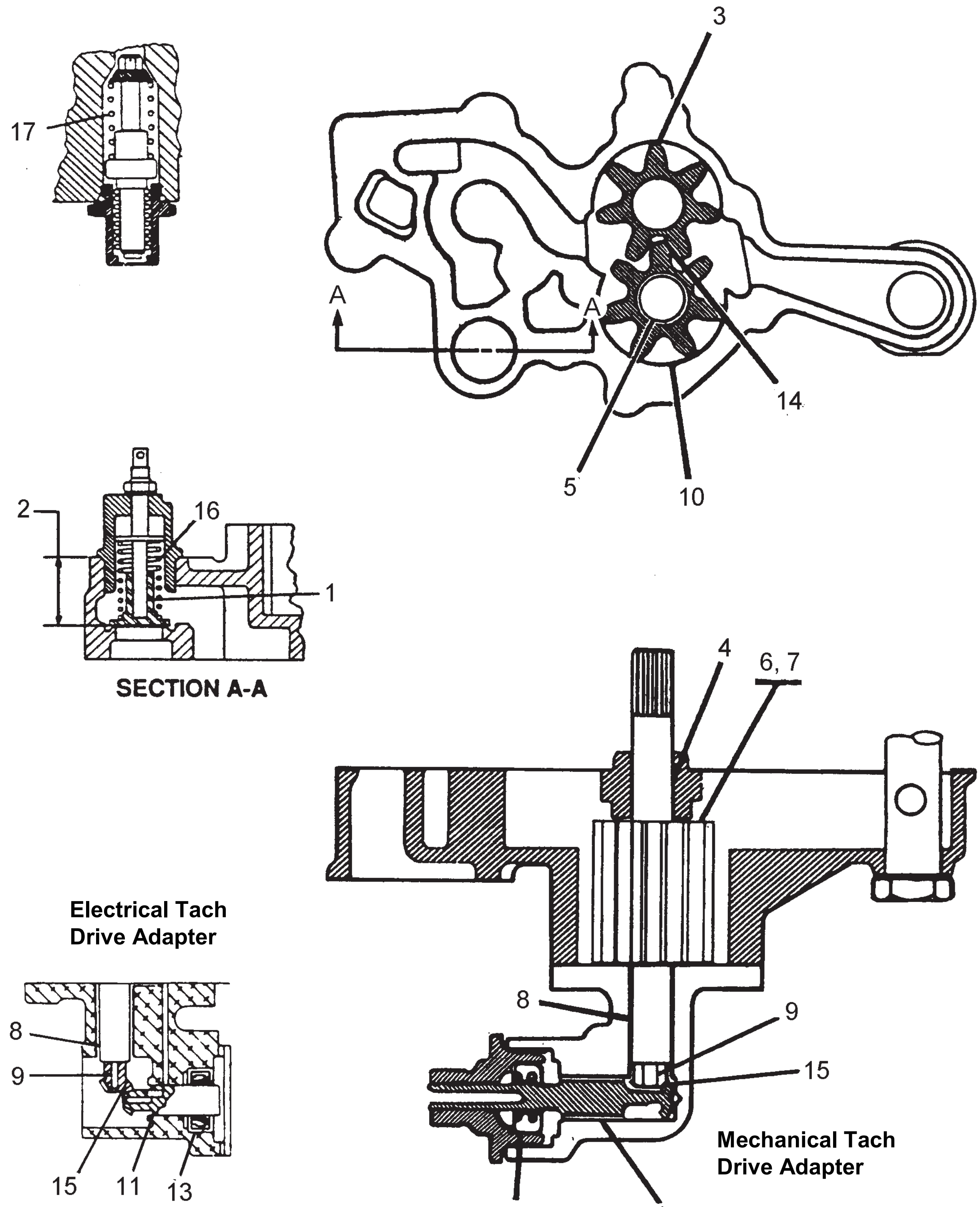

Figure 10-26. Lubrication System Service Limits

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.

The IO-550 engine series features two distinct cylinder configurations. IO-550-A, B & C updraft cylinders have a single rocker cover on each cylinder. The cross flow cylinders on IO-550-G, N, P & R have individual rocker covers over the intake and exhaust valve assemblies. Separate removal and installation instructions are provided for each cylinder configuration.

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 uncommanded engine starts 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 airframe manufacturer's instructions.
4. Remove cowling and any airframe supplied accessories in accordance with the airframe 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. IO-550-A, B & C Rocker Arm Removal A B C

1. Perform the preliminary steps in Section 10-8 prior to rocker arm removal.
2. Position the crankshaft so the piston is at top dead center on the compression stroke and both intake and exhaust valves of the rocker arms to be removed are closed.
3. Bleed the hydraulic lifters (Figure 10-27) (45 & 46) down by applying steady pressure to the pushrod end of the rocker arm; hydraulic lifter pressure relief should be obvious.
4. Remove the screws (32), lock washers (31), washers (30) and the rocker cover (29) from the cylinder. Discard the lock washers (31).
5. Remove and discard the rocker cover gasket (28).
6. Remove the screws (20) & washers (19) from the rocker arm boss.
7. Slide the rocker shafts (18) out far enough to remove the rocker arms (21 & 24) and thrust washers (27).

8. Remove the rocker arms (21& 24) and thrust washers (27) from the rocker shafts.
9. Remove the pushrods (39) from the cylinder. Mark the location and position of removal to ensure installation in the same position and location.
10. Inspect the rocker assemblies and pushrods according to instructions in Section 10-8.7.

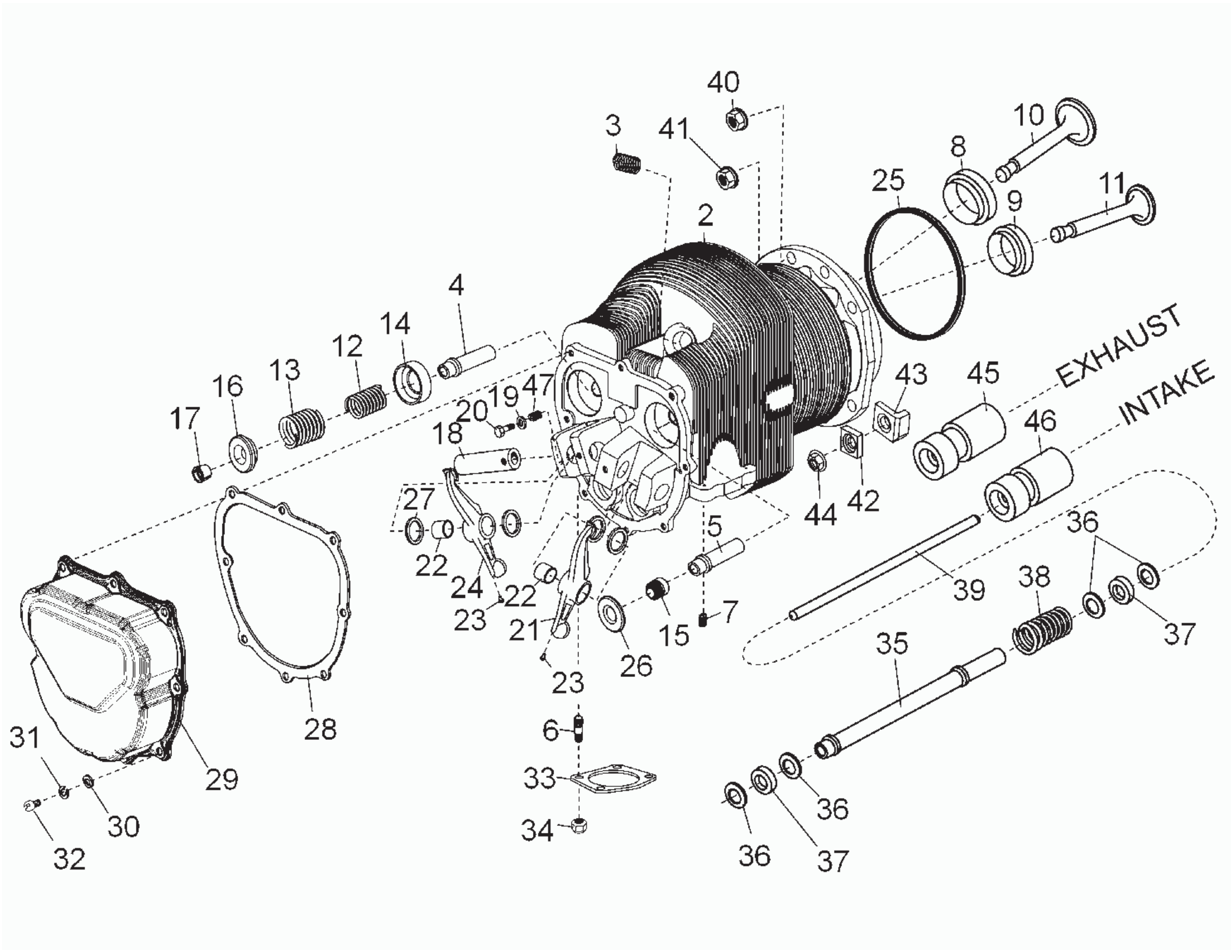

Figure 10-27. Updraft Cylinder Assembly A B C

1	Cylinder Assembly	13	Outer Spring	25	Cylinder Base O-ring	37	Packing
2	Cylinder	14	Lower Retainer	26	Intake Valve Retainer	38	Spring
3	Spark Plug Insert	15	Seal	27	Thrust Washer	39	Pushrod
4	Exhaust Valve Guide	16	Rotocoil	28	Rocker Cover Gasket	40	Flange Nut
5	Intake Valve Guide	17	Retainer Key	29	Rocker Cover	41	Flange Nut
6	Stud	18	Rocker Shaft	30	Washer	42	7th Stud Bracket
7	Intake Flange Insert	19	Plain Washer	31	Lock Washer	43	7th Stud Bracket
8	Intake Valve Seat	20	Screw	32	Screw	44	Flange Nut
9	Exhaust Valve Seat	21	Rocker Arm, Intake	33	Exhaust Flange Gasket	45	Hydraulic Exhaust Tappet
10	Intake Valve	22	Rocker Arm Bushing	34	Nut	46	Hydraulic Intake Tappet
11	Exhaust Valve	23	Drive Screw	35	Pushrod Housing	47	Helical Coil Insert
12	Inner Spring	24	Rocker Arm, Exhaust	36	Washer		

10-8.2. IO-550-G, N, P & R Rocker Arm Removal G N P R

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 uncommanded engine starts during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Perform the preliminary steps in Section 10-8 prior to rocker arm removal.
2. Remove the screws (Figure 10-28) (32), lock washers (31), and washers (30) and the 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 lifters (53 & 54) down by applying steady pressure to the pushrod end of the rocker arm; hydraulic lifter 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 (20), rocker shafts (24), thrust washers (23), and retainers (25) from the cylinder.
8. Withdraw the pushrods (40) from the pushrod housing (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 instructions in Section 10-8.7.

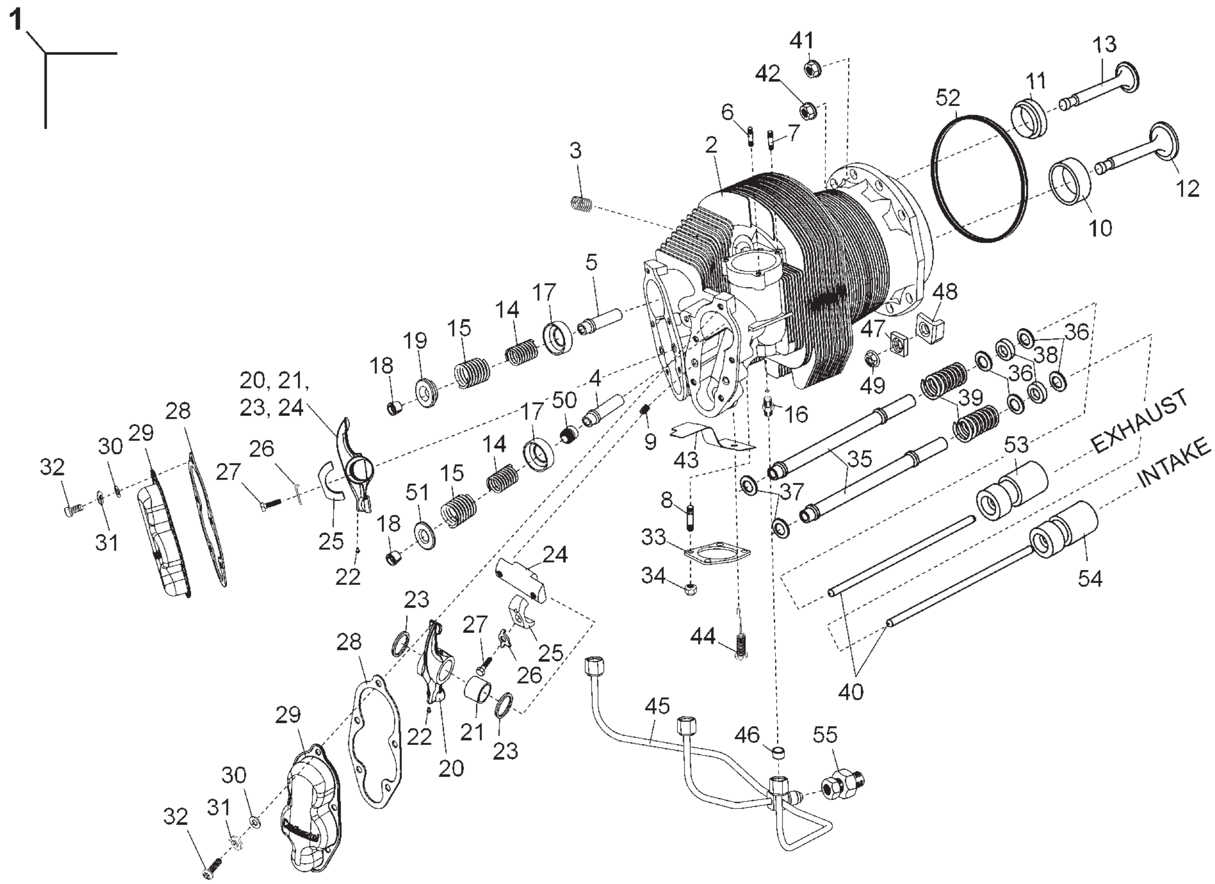

Figure 10-28. Crossflow Cylinder Assembly G N P R

1	Cylinder Assembly	15	Outer Spring	29	Rocker Cover	43	Baffle
2	Cylinder	16	Drain Fitting	30	Washer	44	Spring
3	Spark Plug Insert	17	Inner Retainer	31	Lock Washer	45	Drain Tube
4	Intake Guide	18	Retainer Key	32	Screw	46	Drain Tube Seal
5	Exhaust Valve Guide	19	Rotocoil	33	Exhaust Flange Gasket	47	7th Stud Bracket
6	Stud	20	Rocker Arm Assembly	34	Lock Nut	48	7th Stud Bracket
7	Stud	21	Rocker Arm Bushing	35	Pushrod Housing	49	Flange Nut
8	Stud	22	Drive Screw	36	Washer	50	Seal
9	Helicoil Insert	23	Thrust Washer	37	O-ring Seal	51	Retainer
10	Intake Valve Seat Insert	24	Rocker Arm Shaft	38	Pushrod Housing Packing	52	Cylinder Base O-ring
11	Exhaust Valve Seat Insert	25	Retainer	39	Pushrod Housing Spring	53	Hydraulic Exhaust Tappet
12	Intake Valve	26	Tab Washers	40	Pushrod Assembly	54	Hydraulic Intake Tappet
13	Exhaust Valve	27	Screw	41	Flange Nut	55	Check Valve
14	Inner Spring	28	Rocker Cover Gasket	42	Flange Nut		

10-8.3. Updraft Cylinder Hydraulic Tappet Removal A B C

1. Remove the rocker arm and pushrod assemblies according to instructions in Section 10-8.1.
2. Grasp the pushrod housing (Figure 10-29) (35) and push it inward toward the crankcase, compressing the pushrod housing spring (38); lower the cylinder end of the pushrod housing away from the cylinder assembly. Remove the pushrod housing (35), the pushrod housing springs (38), washers (36) and packing (37). Discard the packing (37). Repeat this step for the remaining pushrod housings to be removed.
3. Remove the hydraulic tappets from the crankcase bores by rotating the cam to lift the tappet above the tappet bore. Use fingers or non-ferrous (copper, brass) wire to extract the hydraulic tappets from the crankcase tappet 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.

    NOTE: Hydraulic tappet assemblies are not rebuild or overhaul candidates. Replace unserviceable hydraulic tappet assemblies with new assemblies.
4. 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.

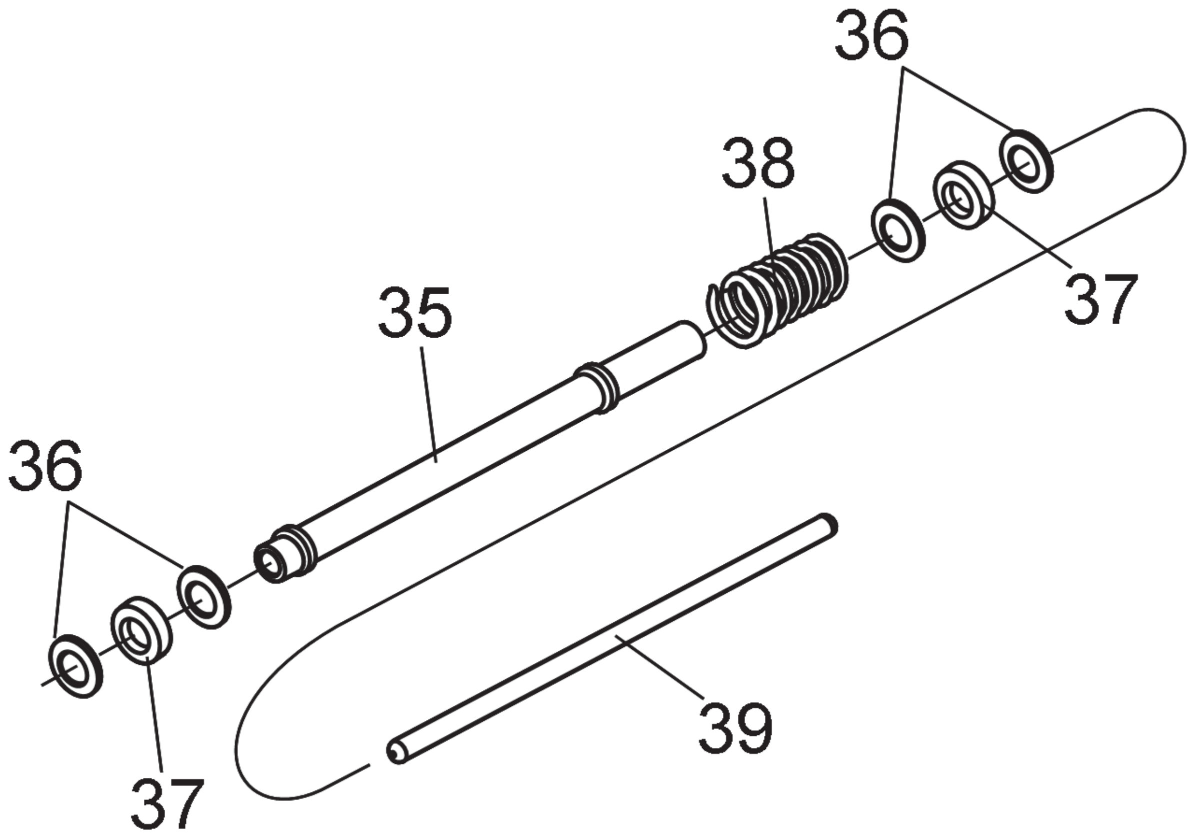

Figure 10-29. Updraft Cylinder Pushrod Tube Assembly A B C

see Figure 10-27 for index

10-8.4. Crossflow Cylinder Hydraulic Tappet Removal G N P R

1. Remove the rocker arm and pushrod assemblies according to instructions in Section 10-8.2.
2. Grasp the pushrod housing (Figure 10-30) (35) and push it inward toward the crankcase, compressing the pushrod housing spring (39); lower the cylinder end of the pushrod housing away from the cylinder assembly. Remove the pushrod housing (35), the pushrod housing springs (39), washers (36), packing (38) and O-ring seal (37). Discard the packing (38) and O-ring seal (37). Repeat this step for the remaining pushrod housings to be removed.
3. Remove the hydraulic tappets from the crankcase bores by rotating the cam to lift the tappet above the tappet bore. Use fingers or non-ferrous (copper, brass) wire to extract the hydraulic tappets from the crankcase tappet 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.

   NOTE: Hydraulic tappet assemblies are not rebuild or overhaul candidates. Replace unserviceable hydraulic tappet assemblies with new assemblies.
4. 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.

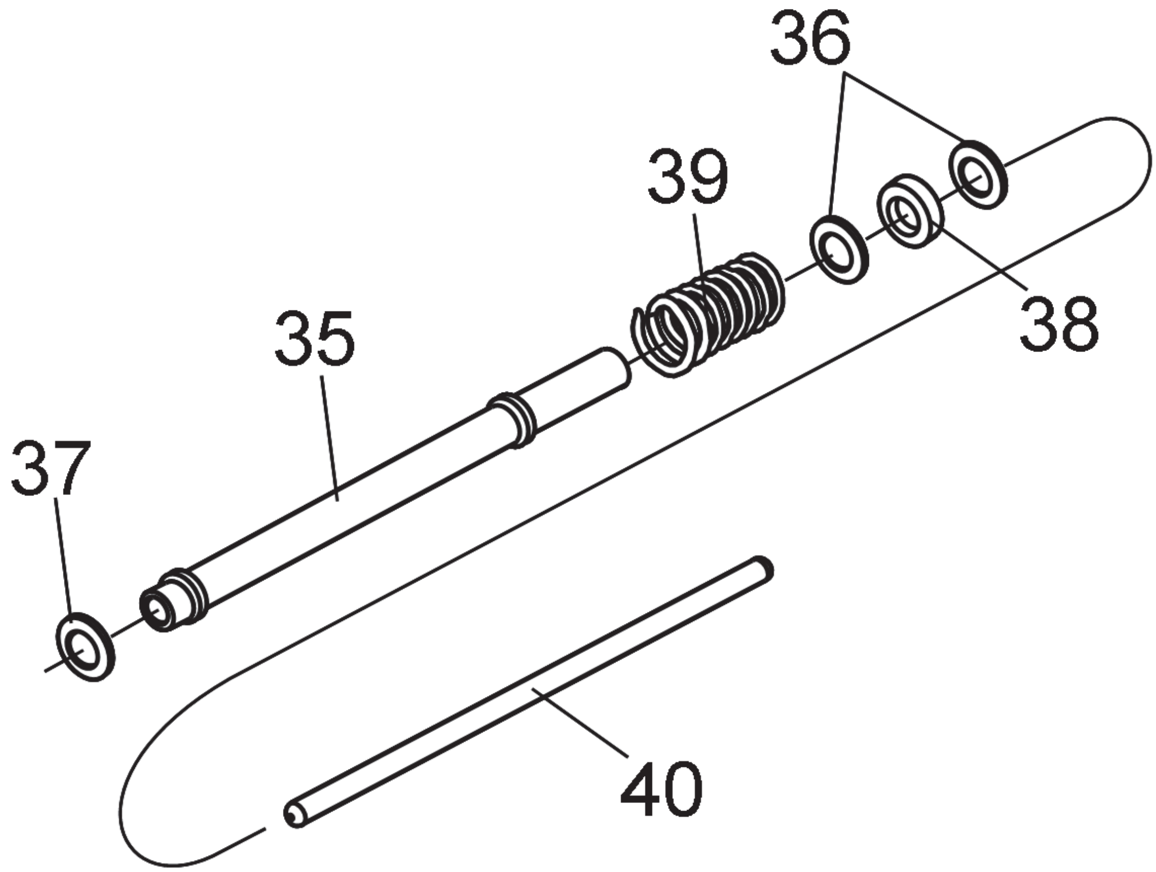

Figure 10-30. Crossflow Cylinder Pushrod Tube Assembly G N P R

see Figure 10-28 for index

10-8.5. IO-550-A, B & C Cylinder Removal A B C

1. Perform the preliminary steps in Section 10-8 prior to cylinder removal.
2. Remove the Induction System components according to the instructions in Section 12-5.
3. Remove the exhaust system components according to the applicable airframe manufacturer's instructions.
4. Remove the fuel injector(s) from the cylinder to be removed according to instructions in Section 10-3.
5. Remove the rocker arm assemblies according to instructions in Section 10-8.1.
6. Remove the pushrod housings according to the instructions in Section 10-8.3.
7. While removing an engine cylinder, inspect components for wear and conformance to dimensional criteria. Replace any worn component or component out of tolerance based on the following criteria:
   a. Allow only parts that meet the *service limits* in Section 10-8.7.1 to remain in service or be re-used.
   b. Replace parts that fail to meet the dimensional inspection criteria in Section 10-8.7.
8. Ensure the piston in the cylinder to be removed is at top dead center of the compression stroke.
9. Using the appropriate wrenches, carefully remove the flange nuts (Figure 10-27) (40, 41, & 44) from the cylinder base flange and seventh stud locations.
10. As the last pieces of fastening hardware are being removed, cradle the cylinder in your arm to support the cylinder. Note that the piston within the cylinder can fall down if care is not used in subsequent steps where the cylinder will be withdrawn.
11. Remove the 7th stud brackets (42 & 43).
12. 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 damage to the crankcase.

    CAUTION: The crankcase flange and piston will be damaged if the connecting rod is allowed to fall against the cylinder mounting deck as the cylinder is withdrawn. Remove the cylinder base O-ring (25) and wrap the removed O-ring in a figure 8 (Figure 10-31) pattern around the crankcase studs to support the connecting rod.

13. Remove the cylinder base O-ring (25). Install the old O-ring in a figure 8 pattern similar to the illustration in Figure 10-31.

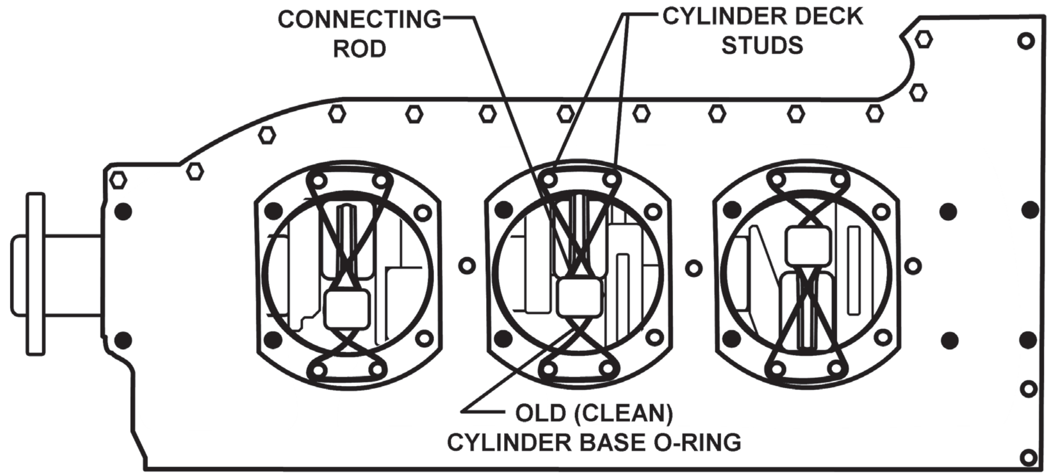

Figure 10-31. Packing Installed to Stabilize Connecting Rods

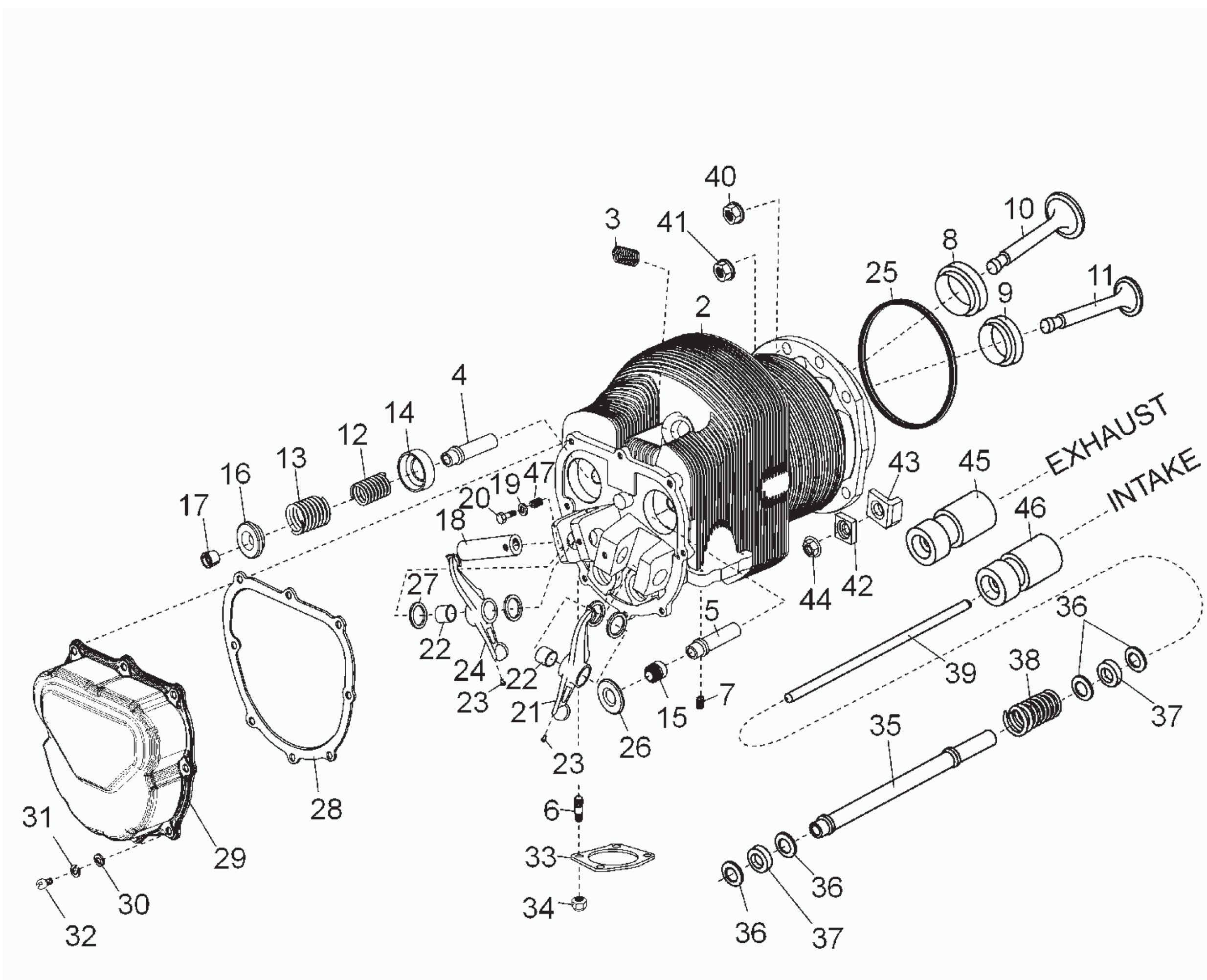

Figure 10-27 repeated for reference

Procedure continues on next page

14. Remove the piston pin (Figure 10-32) (6) and piston (1) from the connecting rod.
15. Clean the piston according to the "Piston Cleaning" instructions in Section 14-1.2.

CAUTION: Do not use automotive-type piston scrapers to clean piston ring lands.

16. Perform a "Fluorescent Penetrant Inspection" and "Magnetic Particle Inspection" according to instructions in Section 15.

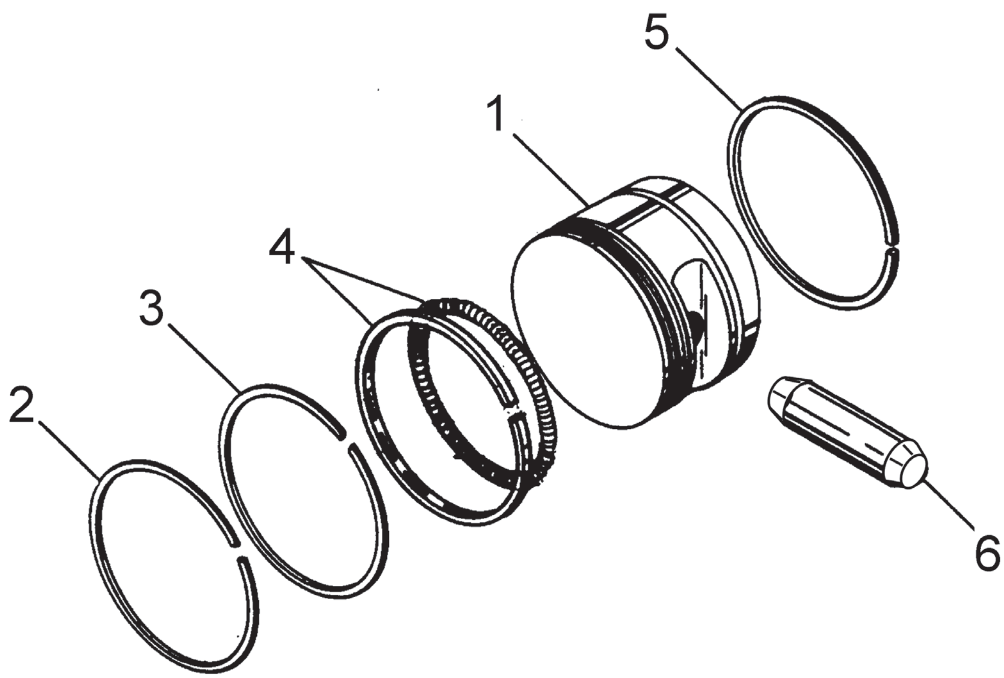

Figure 10-32. Piston, Piston Pin and Piston Rings

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

17. Perform a dimensional inspection on the cylinder, the piston, and components using the "IO-550-A, B & C Series Engines Cylinders Service Limits" in Section 10-8.7.1
18. Perform a static leak check on the cylinder:
    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 plug installed.
    d. Fill the inverted cylinder bore with nonflammable solvent.

e. Look for leaks in the static seal areas (Figure 10-33) of the cylinder. Pay particular attention to the cylinder head and barrel seal. 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 according to instructions in Table 15-7.

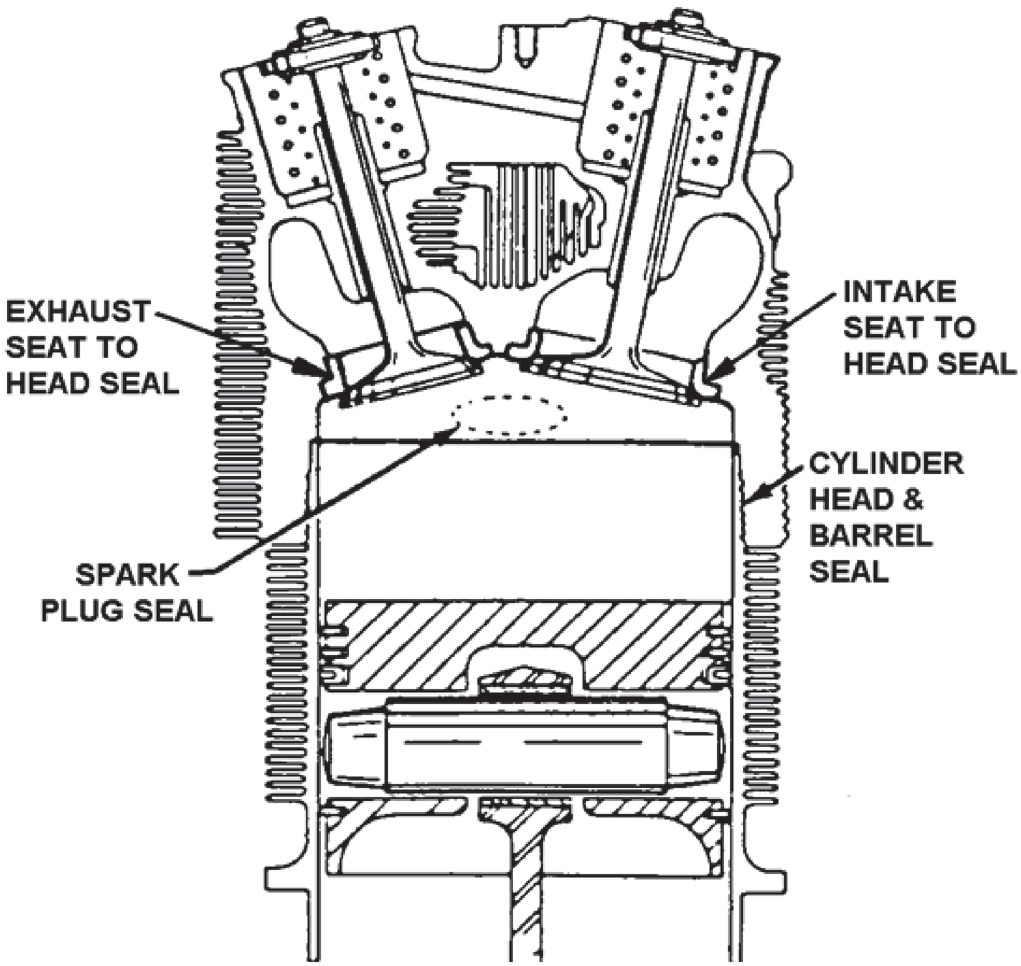

Figure 10-33. Static Seal

19. Assemble serviceable cylinders according to the "Engine Cylinder Assembly" instructions in Section 16-6 and install the cylinder according to the "IO-550-A, B & C Engine Cylinder Installation" instructions in Section 10-8.8.

10-8.6. IO-550 G, N, P & R Engine Cylinder Removal

WARNING

Turn the Ignition Switch OFF and disconnect engine power before commencing maintenance or inspections. Do not stand or place equipment within the arc of the propeller.

1. Disconnect the Induction System components from the cylinder according to instructions in Section 12-5.
2. Disconnect the exhaust system components from the cylinder according to the applicable airframe manufacturer's instructions.
3. Remove the fuel injector from the cylinder according to instructions in Section 10-3.
4. Remove the rocker covers, rocker arms, and pushrods according to the instructions in Section 10-8.2.
5. Remove the pushrod tubes and hydraulic lifters according to instructions in Section 10-8.4.
6. Remove the inter-cylinder baffles adjacent to the cylinder to be removed according to instructions in Section 12-13.2.

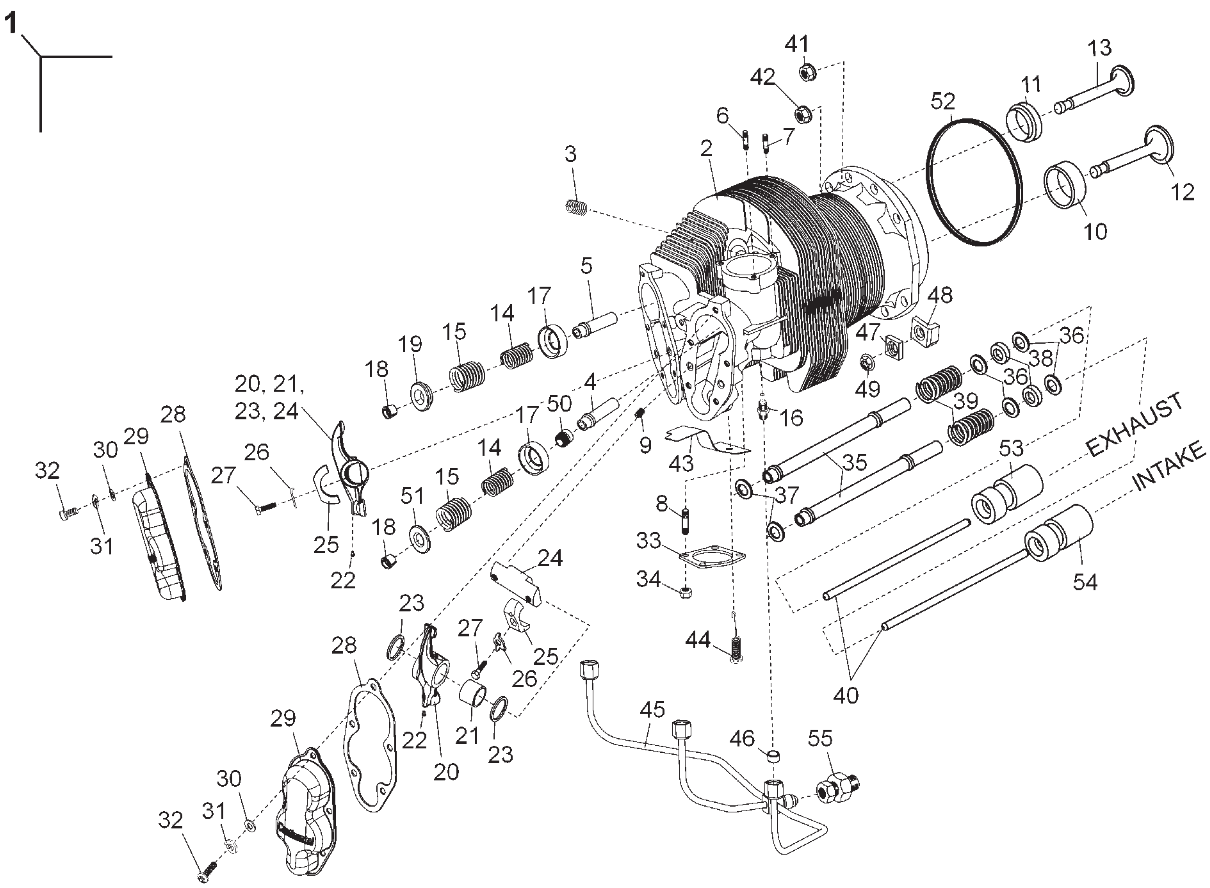

Figure 10-28 repeated for reference

7. Loosen and remove cylinder drain tubes (Figure 10-28) (45).

8. Remove and discard the drain tube seals (46). Remove the drain tube fittings (16).
9. 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.
10. Using the appropriate wrenches, carefully remove the flange nuts (41, 42, and 49) from the cylinder base flange and seventh stud locations. Remove the 7th stud brackets (47 and 48).
11. As the last pieces of fastening hardware are removed, cradle the cylinder in your arm for support.

    CAUTION: The crankcase flange and piston will be damaged if the connecting rod is allowed to fall against the cylinder mounting deck as the cylinder is withdrawn. Remove the cylinder base O-ring (52) and wrap the removed O-ring in a figure 8 (Figure 10-31) pattern around the crankcase studs to support the connecting rod.

12. 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, cylinder or piston.

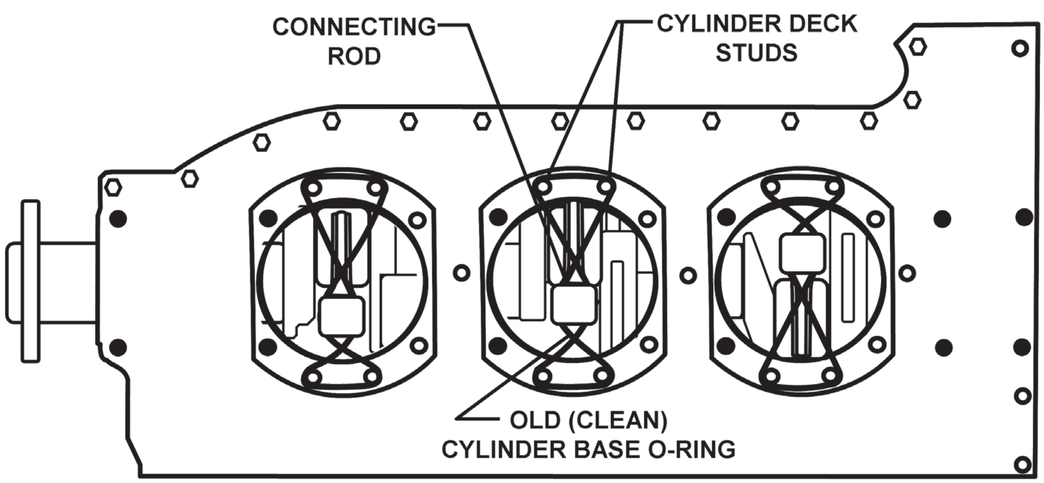

Figure 10-31 repeated for reference

Procedure continues on next page

13. Remove the piston pin (Figure 10-32) (6) and piston (1) from the connecting rod. Remove and discard the piston rings (2, 3, 4 & through 5).

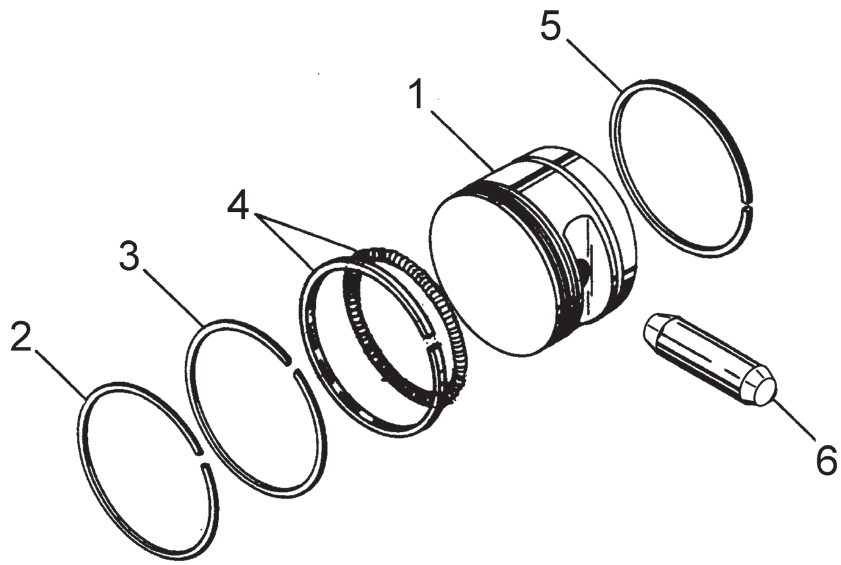

Figure 10-32 repeated for reference

14. Refer to Chapters 13 though 15 for instructions on cylinder disassembly, cleaning, inspection and repair.
    a. Clean the cylinder according to Section 14-1.2, "Cylinder Cleaning" instructions.
    b. Clean the piston (55) according to Section 14-1.3, "Piston Cleaning" instructions

    CAUTION: Do not use automotive-type piston scrapers to clean piston ring lands.

    c. Perform a "Fluorescent Penetrant Inspection" and "Magnetic Particle Inspection" according to instructions in Section 15.
    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 "IO-550-G, N, P & R Cylinder Service Limits" in Section 10-8.7.2.
15. Perform a static leak check on the cylinder
    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 plug 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.

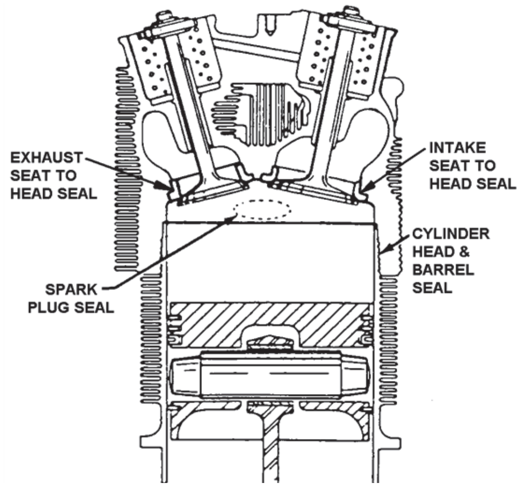

Figure 10-33 repeated for reference

16. Assemble serviceable cylinders according to the "Engine Cylinder Assembly" instructions in Section 16-6 and install the cylinder according to the "IO-550-G, N, P & R Cylinder Installation" instructions in Section 10-8.9.

10-8.7. Engine Cylinder Dimensional Inspection

Dimensional limits differ for the IO-550-A, B & C engines and IO-550-G, N, P & R engines. Refer to the appropriate sections for the correct service limits.

1. Inspect the "power stroke stress areas" according to instructions in Section 6-3.11.1, "Cylinder Visual Inspections."
2. Inspect cylinder bore dimensions according to the specifications in Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines). Grind cylinder bores that do not conform to the standard size dimensions to the next oversize dimension up to 0.15 inches oversize maximum. (Refer to "Cylinder Bore Honing" in Section 15-8.9.8 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 shaft hold down studs for security. 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.
5. If cylinder studs are removed for replacement, dimensionally inspect the stud holes using a thread gauge to determine the appropriate oversize replacement stud.
6. Dimensionally inspect the inside diameter of the valve guides using the service limits in Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P &

R Model engines). Replace cracked, eroded, burned, or pitted valve guides or those which fail to meet the service limit dimensional specifications.

7. Inspect the intake and exhaust valve seats for evidence of burning, pitting, erosion, or cracks. Check the valve seat dimensions according to Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines). Replace cracked, eroded, burned or pitted exhaust valve seats, or those which do not conform to the service limit.
8. 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.
9. Using a V-block with a surface plate and a dial indicator, inspect each intake and exhaust valve face for runout (eccentricity). Replace valves if they exceed the runout specification in Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines).
10. Perform a dimensional inspection on the intake and exhaust valves using the service limits in Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines). 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 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines).
        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” according to instructions in Section 15-5 on the intake and exhaust valves; discard valves if cracks, or indications of cracks are detected.

11. 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.

12. 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 Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines). 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." Discard piston pins exceeding the dimensional limits or out of round tolerance.

13. Measure the piston pin bore inside diameter to verify it meets Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines) dimensions. Insert the piston pin in the piston bore to verify the fit meets Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines) specifications.

14. 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 Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines).

15. Inspect the pushrods for cracks, nicks, burrs, pitting or corrosion. Inspect the rod caps for cracks or erosion. Verify the rod cap oil passages are clear and the bores meet Service Limit specifications. Dimensionally inspect the pushrods length and cap diameter with a micrometer and Service Limit specifications. Inspect runout with V-blocks and a dial indicator. The pushrod runout service limit is 0.003" total indicator reading over the length of the pushrod.

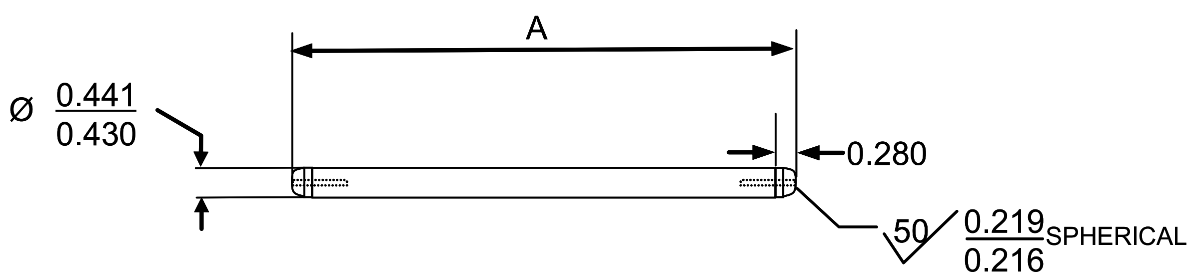

Figure 10-34. Pushrod Dimensions

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

16. Inspect pushrod tubes for cracks, dents, bending or chafing damage; discard pushrod tubes exhibiting these conditions. Inspect pushrod tubes for rust, pitting or missing cadmium plating; discard pushrod tubes exhibiting these conditions.

17. Dry fit the rocker arms in the rocker arm boss to dimensionally inspect the rocker arm thrust width using dimensional specifications in Section 10-8.7.1 (A, B & C Model engines) or Section 10-8.7.2 (G, N, P & R Model engines); replace rocker

arms if they cannot be ground and polished to meet dimensional 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 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 rivets. 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.

18. Inspect the Intake and Exhaust Valve Springs according to the dimensions in Section 10-8.7.1 or Section 10-8.7.2, depending on the engine model. Replace valve springs which fail the dimensional inspection or exhibit cracks, abnormal curvature or excessive wear.

19. Verify the connecting rod and cap mate marks are aligned and the position numbers stamped on or adjacent to the bolt boss match. Scrap connecting rods and caps with mate marks that do not align.

20. Visually inspect the connecting rods for corrosion pitting, rust, discoloration (bluing), galling, impact damage, nicks, bending and twisting. Scrap connecting rods with any of these indications.

21. Remove nuts and bolts from the connecting rod; separate the rod and cap. Visually inspect the connecting rod and cap parting surface. Contact signatures resulting from assembly forces are normal and acceptable. Connecting rods exhibiting fretting signatures, resulting in the loss of metal, indicated by erosion of the original machining marks, either locally or over the entire surface, are not acceptable for continued service. Scrap connecting rods with fretting at the parting surfaces; do not rework.

22. Visually inspect the nut seat area. Excessive fretting signatures indicate material loss. Scrap connecting rods with edge loading under the bolt head surface contact area.

23. Visually inspect dowel surfaces at the rod and cap bolt holes. Scrap connecting rods with distorted or scored nut seat areas.

24. Align the mate marks on matching position numbers and assemble the connecting rod and cap by installing one bolt through the cap and rod. With the cap seated firmly against the rod, you must be able to install the remaining bolt using hand pressure only. Scrap connecting rods if the bolts cannot be installed by hand.

25. Lubricate the connecting rod bolt and nut threads with clean 50-weight aviation oil.
26. Install and torque the nuts and bolts to Appendix B specifications.
27. Inspect the inside diameter joint of the rod to cap with both bolts and nuts installed and torqued. Mismatch (or a step) must be less than 0.001 inch.
    Check for a mismatch by placing the rod on a surface plate with the split line at the 6 and 12 o'clock position; use V-blocks to hold the connecting rod in place. Using a dial indicator mounted on a height gauge, zero out on one side of the split line. Move the indicator across the split line. There must be no more than 0.001 indicator movement. Reminder: a mismatch (or a step) of more than 0.001 inch is not acceptable.

WARNING

Removing and installing the piston pin bushing with makeshift tools will damage connecting rods.

28. Inspect the piston pin bushing for gouges or loss of material. Verify the piston pin bushing is installed with the split line at least 40 degrees away from the connecting rod centerline (see Figure D-25). Replace connecting rod piston pin bushings according to Chapter 15 instructions if these conditions exist.
29. Using precision measuring equipment, such as a dial bore gauge or air gauge; verify the connecting rod meets the Connecting Rod dimensional specifications in Figure D-25. Measure the "D" diameter within 15 to 30 degrees on either side of the connecting rod split line and 90 degrees from the first measurement. The average of these two measurements must be within drawing limits for out of round. The difference between these two measurements must not exceed 0.0015 inches. Scrap connecting rods and caps which fail to meet these specifications.
30. Inspect the connecting rod channel rails for damage such as nicks, gouges or mechanical damage. Scrap connecting rods with any of these indications.
31. Check the connecting rod piston pin bushing alignment with the crank pin end bearing bore. Make alignment measurements using a push fit arbor for the bushing bore (piston pin end) and another for the bearing seat (crank pin end). The arbors must be eight inches (8") long.
32. Measure as follows:
    a. Twist and insert the arbors into the rod bores.
    b. Place the large end arbor (crank pin end) in the V-blocks on the surface plate.
    c. Place the ground steel blocks under the ends of the bushing arbor (piston pin end) a measured distance apart.
    d. Use a leaf-type feeler gauge to detect any clearance under the arbor ends.
    e. Divide this measurement by the distance in inches of separation between the blocks which will equal the twist per inch of length.

    NOTE: Twist measurement/distance in inches = Twist/inch

33. Measure the connecting rod bushing and bearing convergence as follows:
    a. Mount a dial indicator on a surface gauge and swing the rod around the crank pin end arbor to the vertical position against a firm stop.
    b. Pass the indicator over the bushing arbor on both sides of the connecting rod at points which are an exact number of inches apart. For exact parallelism, the two measurements must be the same.

10-8.7.1. IO-550-A, B & C Series Engines Cylinders Service Limits

Table 10-11. IO-550-A, B & C Cylinder Assembly Service Limits

Index	Description (Figure 10-35)	Service Limit (inches)	New Part Minimum (inches)	New Part Maximum (inches)
	Cylinder Assembly			
1	Cylinder bore (lower 4-1/4 inch of barrel) ....diameter:	Figure 10-37		
2	Cylinder bore(5.75” in to barrel) ....choke:	Figure 10-37		
3	Cylinder bore ....out-of-round:	0.003	0.0000	0.001
4	Cylinder bore .... allowable oversize:	Figure 10-37		
5	Cylinder bore surface (Nitride Barrels) using 180 grit stone .... cross hatch angle: .... Finish (in micro inches) R_a:	 22° - 32° 30-50	 22° - 32° 35	 - 60
6	Cylinder barrel in crankcase ....diameter:	0.013L	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head ....diameter:	0.009T	0.009T	0.012T
8	Intake valve guide in cylinder head ....diameter:	0.001T	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head ....diameter:	0.001T	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head ....diameter:	0.007T	0.0070T	0.0100T
11	Intake valve seat .... width:	Figure 10-38		
12	Exhaust valve seat .... width:	Figure 10-39		
	Rocker Arms and Shafts			
13	Rocker shaft in cylinder head bosses ....diameter:	0.0025L	0.0002L	0.0025L
	Rocker shaft in rocker arm bushing ....diameter:	0.0040L	0.0010L	0.0028L
14	Rocker arm bushing bore ....diameter:	0.8755	0.8725	0.8755
	Rocker arm bushing (inside) - finish bore ....diameter:	0.7515	0.7505	0.7515
15	Rocker Arm .... side clearance:	0.0350L	0.0020	0.0150
16	Intake valve guide .... inside diameter: Intake valve in guide ....diameter:	 0.0050L	0.4350 0.0010L	0.4362 0.0032L
17	Exhaust valve guide .... inside diameter: Exhaust valve in guide ....diameter:	 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°-30'	45°00’	45°15'
20	Intake valve gauge line-to-stem ....length:	See Figure 10-40		
21	Exhaust valve gauge line-to-stem ....length:	See Figure 10-40		
22	Intake and Exhaust valve face-to-stem .... run-out:	0.0040	0.0000	0.0015
23	Rocker arm foot-to-valve stem (dry valve) ....valve lash:	0.200	0.0600	0.200

Table 10-11. IO-550-A, B & C Cylinder Assembly Service Limits

Index	Description (Figure 10-35)	Service Limit (inches)	New Part Minimum (inches)	New Part Maximum (inches)
Pistons, Rings, and Pins				
24	Piston, manganese phosphate coated, (below fourth ring groove, perpendicular to piston pin bore) in cylinder ....clearance:	0.011L	0.008L	0.011L
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
29	Top ring at 1.00 ± 0.50 depth (in cylinder barrel) .... gap:	0.052	0.029	0.043
30	Second ring at 1.00 ± 0.50 depth (in cylinder barrel)[1] .... gap:	0.058	0.035	0.049
31	Third ring at 1.00 ± 0.50 depth (in cylinder barrel) .... gap:	0.040	0.015	0.031
32	Fourth ring at 1.00 ± 0.50 depth (in cylinder barrel) .... gap:	0.040	0.015	0.031
33	Piston pin in piston (standard or 0.005 inch oversize) .... diameter:	0.0013L	0.0001L	0.0007L
34	Piston pin .... diameter:	1.1243	1.1243	1.1245
	Piston pin (0.005 inch oversize) .... diameter:	1.1293	1.1293	1.1295
35	Piston pin in cylinder ....end clearance:	0.048L	0.0310L	0.0480L
36	Piston pin in connecting rod bushing .... diameter:	0.0040L	0.0022L	0.0026L
37	Bushing in connecting rod .... diameter:	0.0050T	0.0025T	0.0050T
38	Bolt in connecting rod .... diameter:	0.0023L	0.0000L	0.0018L
39	Connecting rod bearing on crankpin .... diameter:	0.0034L	0.0009L	0.0034L
40	Connecting rod on crankpin ....end clearance:	0.0160	0.0060	0.0110L
41	Connecting rod bearing and bushing..................... twist per inch of length:	0.0010	0.0000	0.0005
42	Hydraulic tappet in crankcase .... diameter:	0.0035L	0.0010L	0.0025L
43	Inner valve spring 654442 compressed to 1.230 in. ....tension:	67 Lbs.	70.3 Lbs.	77.3 Lbs.
	Inner valve spring 654442 compressed to 1.745 in. ....tension:	31 Lbs.	32.1 Lbs.	38.1 Lbs.
44	Outer valve spring 654441 compressed to 1.275 in. ....tension:	98 Lbs.	101.8 Lbs.	111.4 Lbs.
	Outer valve spring 654441 compressed to 1.790 in. ....tension:	46 Lbs.	49.1 Lbs.	55.1 Lbs.
45	Installed outer valve spring ....height:	1.791	1.790	1.790
T=Tight L=Loose				

1. Gap for second ring is nominally 0.006” larger than the top ring

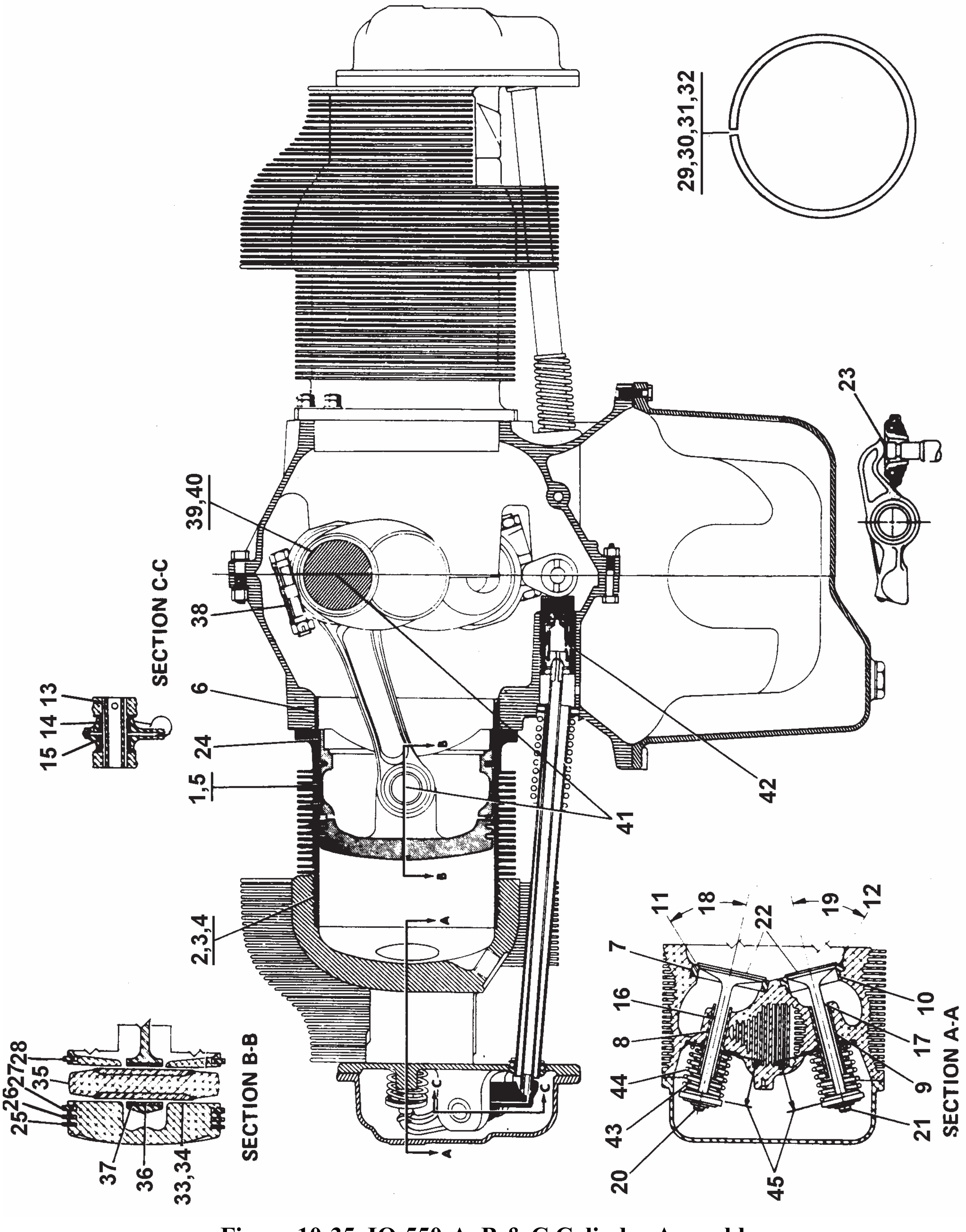

Figure 10-35. IO-550-A, B & C Cylinder Assembly

10-8.7.2. IO-550-G, N, P & R Cylinder Service Limits

Refer to the “IO-550-G, N, P & R Cylinder Assembly Service Limits” in Table 10-12 and corresponding Figure 10-36. Clean and dry the parts thoroughly according to “Engine Cleaning” instructions in Section 14. 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 specified service limits.

Table 10-12. IO-550-G, N, P & R 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:	Figure 10-37		
2	Cylinder bore (5.75 inch into barrel).... choke:	Figure 10-37		
3	Cylinder bore .... out-of-round:	0.003	0.000	0.001
4	Cylinder bore .... allowable oversize:	Figure 10-37		
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 ....diameter:	0.013L	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head ....diameter:	0.007T	0.007T	0.010T
8	Intake valve guide in cylinder head ....diameter:	0.001T	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head ....diameter:	0.001T	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head ....diameter:	0.007T	0.0070T	0.0100T
11	Intake valve seat .... width:	Figure 10-38		
12	Exhaust valve seat .... width:	Figure 10-39		
Rocker Arms and Shafts				
13	Rocker shaft in cylinder head boss ....diameter:	0.0031L	0.0005L	0.0031L
	Rocker shaft in rocker arm bushing ....diameter:	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 ....diameter:	 0.0050L	0.4350 0.0010L	0.4362 0.0032L
17	Exhaust valve guide .... inside diameter: Exhaust valve in guide ....diameter:	 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°30'	45°00’	45°15'
20	Intake valve gauge line-to-stem ....length:	See Figure 10-40		
21	Exhaust valve face-to-stem ....length:	See Figure 10-40		
22	Intake and Exhaust valve face-to-stem ....runout:	0.0015	0.0000	0.0015
23	Rocker arm foot to valve stem (dry valve) ....valve lash:	0.200	0.060	0.200

Table 10-12. IO-550-G, N, P & R Cylinder Assembly Service Limits

Index	Description	Service Limit	New Part Minimum (inches)	New Part Maximum (inches)
Pistons, Rings, and Pins				
24	Piston, manganese phosphate coated, (below fourth ring groove, perpendicular to piston pin bore) in cylinder .... clearance:	0.011L	0.008L	0.011L
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
29	Top ring gap at 1.00 $\pm$ 0.50 depth (in cylinder barrel) .... gap:	0.052	0.029	0.043
30	Second ring gap[1] at 1.00 $\pm$ 0.50 depth (in cylinder barrel) .... gap:	0.058	0.035	0.049
31	Third ring gap at 1.00 $\pm$ 0.50 depth (in cylinder barrel) .... gap:	0.040	0.015	0.031
32	Fourth ring gap at 1.00 $\pm$ 0.50 depth (in cylinder barrel) .... gap:	0.040	0.015	0.031
33	Piston pin in piston .... diameter:	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 .... diameter:	0.0040L	0.0012L	0.0018L
37	Bushing in connecting rod .... diameter:	0.0050T	0.0025T	0.0050T
38	Bolt in connecting rod .... diameter:	0.0023L	0.0000L	0.0018L
39	Connecting rod bearing on crankpin .... diameter:	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:	0.0010	0.0000	0.0005
42	Hydraulic tappet in crankcase .... diameter:	0.0035L	0.0010L	0.0025L
Spring Test Data				
43	Inner valve spring 654442 compressed to 1.230”........................... tension	67 Lbs.	70.3 Lbs.	77.3 Lbs.
	Inner valve spring 654442 compressed to 1.745”........................... tension	31 Lbs.	32.1 Lbs.	38.1 Lbs.
44	Outer valve spring 654441 compressed to 1.275“.......................... tension	98 Lbs.	101.8 Lbs.	111.4 Lbs.
	Outer valve spring 654441 compressed to 1.790“.......................... tension	46 Lbs.	49.1 Lbs.	55.1 Lbs.
45	Installed outer valve spring .... height:	1.791 inches		
NOTE: T = Tight and L = Loose				

1. second ring gap must be at least 0.006 larger than gap for top ring

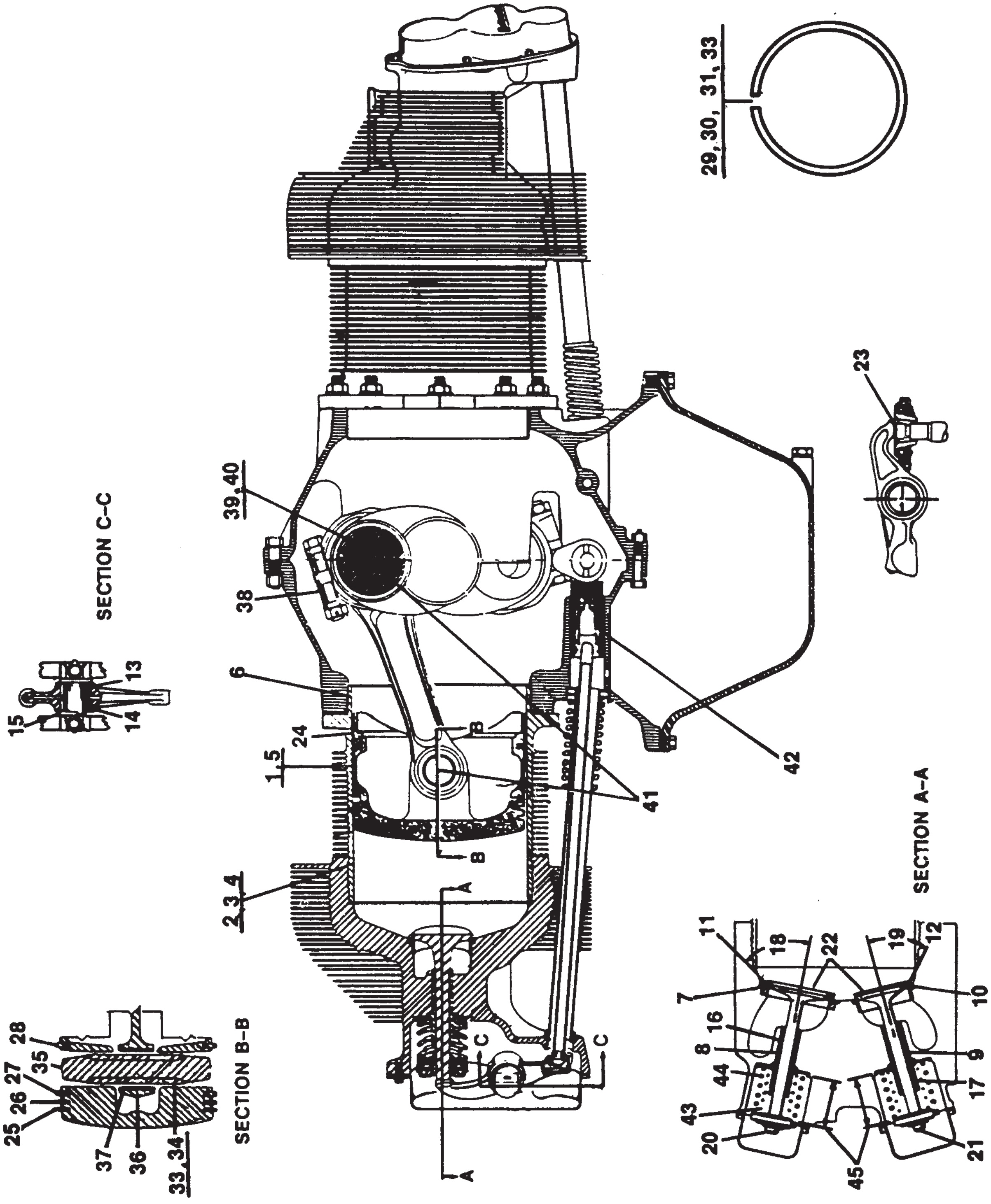

Figure 10-36. IO-550-G, N, P & R Cylinder Assembly Service Limits

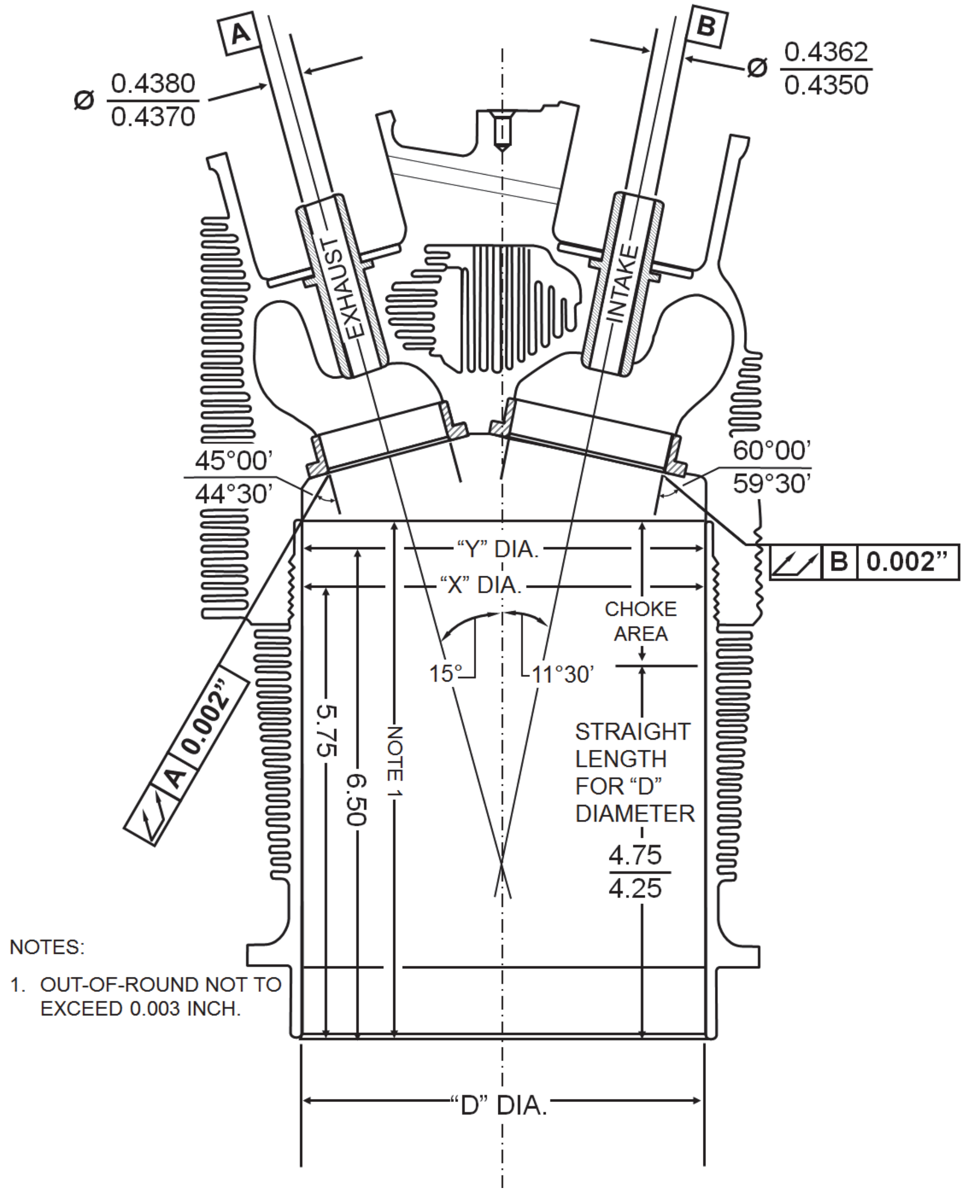

Figure 10-37. Cylinder Service Limits

Table 10-13. Cylinder Barrel Service Limits

Size	"D" Diameter Service Limits (max) (inches)	"X" Diameter Service Limits (max) (inches)	"Y" Diameter Service Limits (max) (inches)
STD	5.256	5.257	N/A
.005[1]	5.261	5.262	N/A
.010[1]	5.266	5.267	N/A
.015[1]	5.271	5.272	N/A
NOTE: Dimensions in the table above are shown in finish size after honing. Cylinder bore out of round service limit must not exceed (service) 0.003 inches at measured diameters.			

1. Requires use of corresponding oversize pistons and rings

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

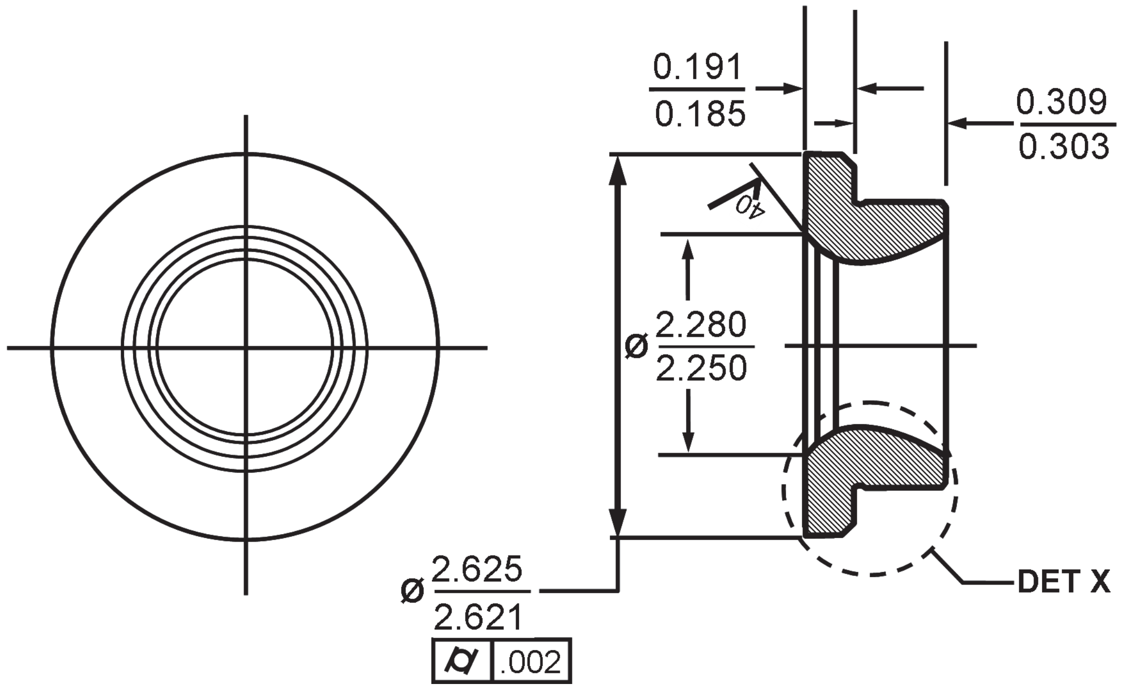

Figure 10-38. Intake Valve Seat Dimensions

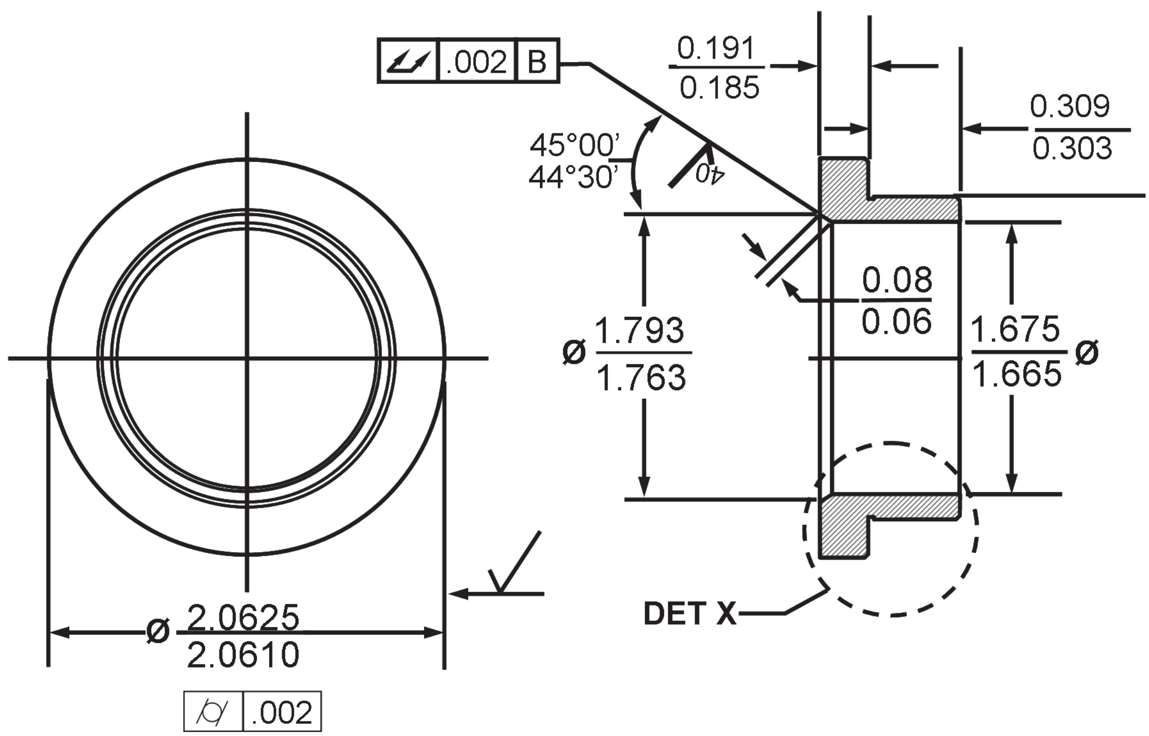

Figure 10-39. Exhaust Valve Seat Dimensions

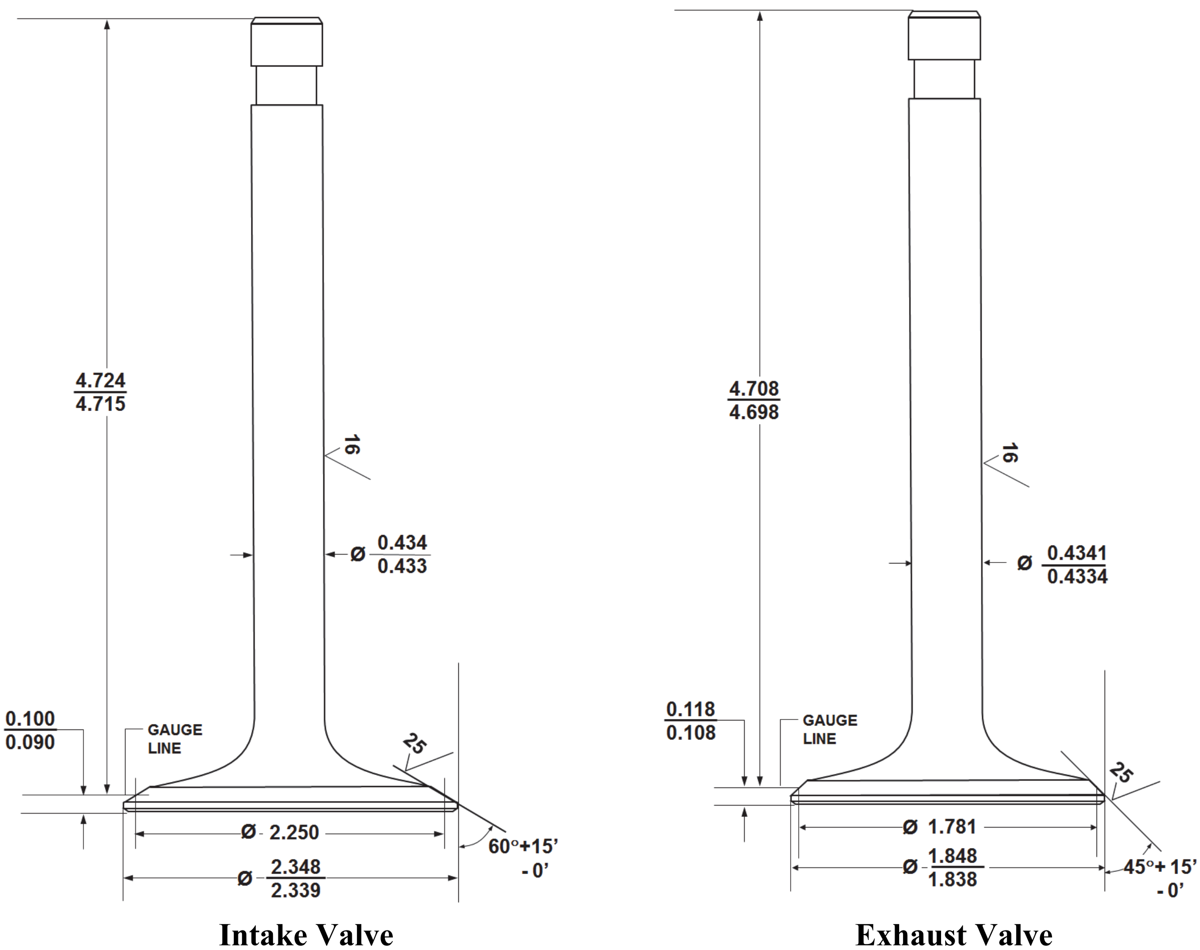

Figure 10-40. Valve Service Limits

10-8.8. IO-550-A, B & C Engine Cylinder Installation

Replace worn or out of tolerance components based on the following criteria:

- Only allow parts that meet the *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 Section 14-1.1, “Cylinder Cleaning” instructions.
- Clean pistons according to Section 14-1.2, “Piston Cleaning” instructions.
- Perform fluorescent penetrant, magnetic particle, and dimensional inspections on specified cylinder and piston parts as described in Chapter 15, Inspection and Repair.
- Install serviceable hydraulic tappets (lifters) in the same location from which they were removed.
- Assemble cylinders which meet the inspection criteria and service limits according to Section 16-6, “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.

1. Inspect a new cylinder base O-ring (Figure 10-27) (25) for cracks or deformities. Lubricate the serviceable, new cylinder base O-ring (25) with clean 50-weight aviation engine oil.
2. Install the new cylinder base O-ring (25), 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.
3. Thoroughly clean the cylinder deck and stud threads with Stoddard solvent; use a narrow brush to clean stud thread holes. The deck and stud holes must be free of all dirt and debris.
4. Lubricate cylinder through bolt and deck stud threads using clean 50 weight aviation engine oil.
5. Install the rocker shafts (18) in the cylinder rocker shaft bores according to instructions in Section 17-3.6.1 prior to installing the cylinders.
6. Verify the valve keepers have been properly installed.

7. Verify the piston rings (Figure 10-32) (49 to 52) have been partially installed in the cylinder barrel and a new cylinder base O-ring (Figure 10-27) (25) has been installed at the cylinder base.

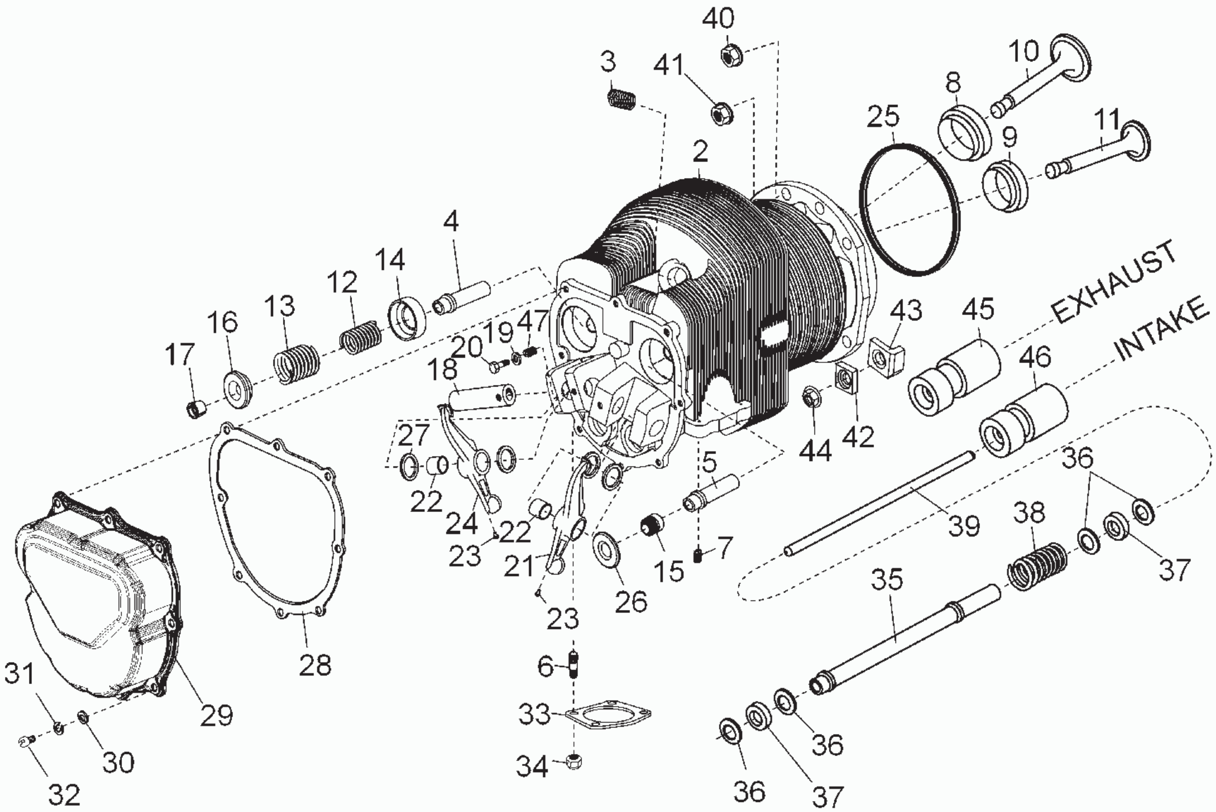

Figure 10-27 repeated for reference

CAUTION: The crankcase flange and piston will be damaged if the connecting rod is allowed to fall against the cylinder mounting deck.

8. Carefully rotate the crankshaft placing the connecting rod of the cylinder being installed in the fully extended position. Remove the O-ring supporting the connecting rod.

9. Back the piston pin (Figure 10-32)(6) out far enough to allow the piston (1) to be installed on the connecting rod.
10. Align the piston pin bore with the connecting rod and slide the piston pin into the connecting rod.
11. Using a ring compressor, compress the fourth piston ring and push the cylinder until the fourth piston ring is positioned inside the cylinder barrel.

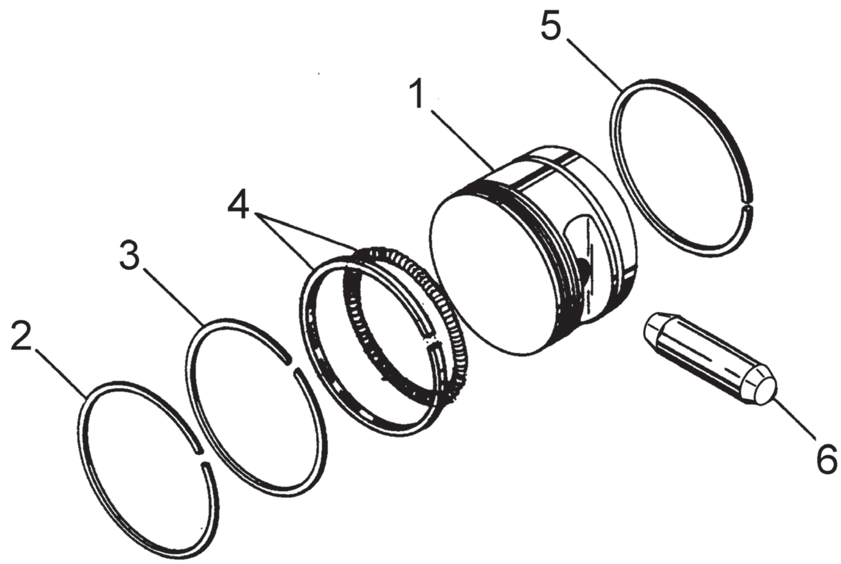

Figure 10-32 repeated for reference

12. Remove the ring compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.
13. While supporting the cylinder, install, but do not torque, the cylinder flange nuts (Figure 10-27)(40 & 41).
14. Install the 7th stud brackets (42 & 43) and nut (44). The 7th stud nuts have a conical seat.
15. For single cylinder replacement, torque the cylinder fastening hardware according to the "Cylinder Torque" instructions in Section 10-8.10. For multiple cylinder replacement, torque the cylinder fastening hardware for each cylinder being installed according the "Cylinder Torque" instructions in Section 10-8.10, steps 1 & 2. When all cylinders are installed, torque all cylinder and crankcase fasteners according to the instructions in Section 17-3.3. If re-torquing fasteners that were not removed during this maintenance action, apply torque to the specified torque value.
16. 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-17. If no end play is present, disassemble the engine to determine the cause.
17. Install the hydraulic tappets (lifters) and pushrod tubes according to instructions in Section 10-8.11.

18. Install the rocker arms according to Section 10-8.13.
19. Install the spark plugs and ignition harness according to the “Ignition System Maintenance” instructions in Section 6-3.9.
20. Install the Induction System components according to instructions in Section 17-10.
21. Install the Exhaust System according to the airframe manufacturer’s instructions.
22. Install the fuel injector nozzles according to instructions in Section 10-3.3.
23. Set the aircraft Fuel Selector Valve to the ON position and activate the fuel boost pump and leak check the fuel delivery system, including fuel lines and fittings.
24. Service the engine with mineral oil according to instructions in Section 6-3.8.
25. Install the aircraft cowling and airframe-supplied accessories according to the airframe manufacturer’s instructions.
26. Perform an “Engine Operational Check” according to instructions in Section 6-3.7.
27. 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 6-3.8.

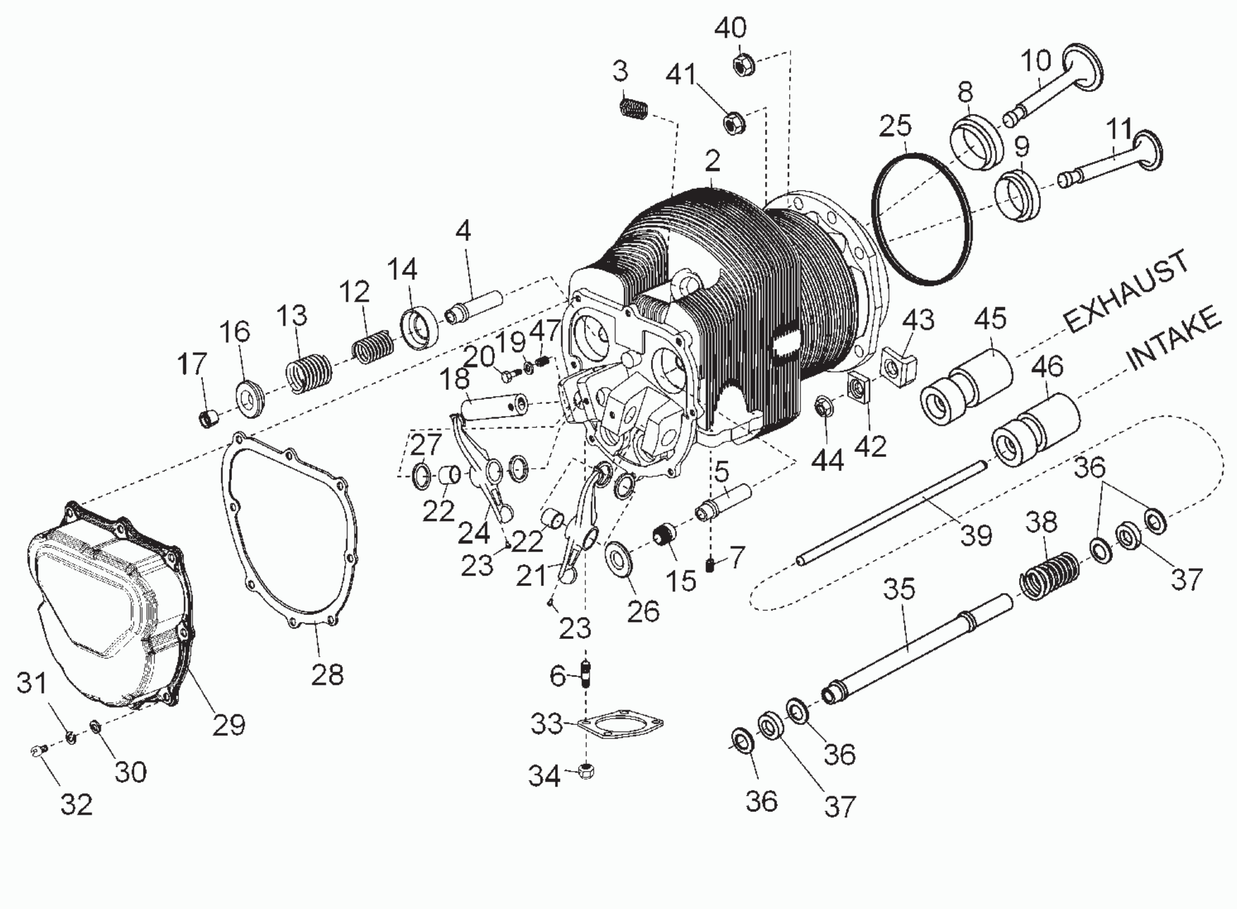

Figure 10-27 repeated for reference

10-8.9. IO-550-G, N, P & R Cylinder Installation

Replace worn or out of tolerance components based on the following criteria:

- Only allow parts that meet the *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 Section 14-1.1, "Cylinder Cleaning" instructions.
- Clean pistons according to Section 14-1.2, "Piston Cleaning" instructions.
- Perform fluorescent penetrant, magnetic particle, and dimensional inspections on specified cylinder and piston parts as described in Chapter 15, Inspection and Repair.
- 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 "Engine Cylinder Assembly" instructions in Section 16-6 with serviceable pistons and new piston rings.

WARNING

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

1. Inspect a new cylinder base O-ring (Figure 10-28) (52) for cracks or deformities. Lubricate the serviceable, new cylinder base O-ring (52) with clean 50-weight aviation engine oil.
2. Install the new cylinder base O-ring (52), 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.
3. 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.
4. Lubricate cylinder through bolt and deck stud threads using clean 50 weight aviation engine oil.
5. Install the rocker shafts (24) in the cylinder boss bores prior to installing the cylinders.
6. Carefully rotate the crankshaft, placing the connecting rod of the cylinder being installed in the outermost position. Remove the used O-ring that was installed for connecting rod support.

7. Back the piston pin (6) out far enough to allow the piston (1) to be installed on the connecting rod.
8. Line the piston up with the connecting rod and slide the piston pin (6) in to the connecting rod.
9. Using a ring compressor, compress the fourth piston ring and push the cylinder until the fourth piston ring is positioned inside the cylinder barrel.
10. Remove the ring compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.

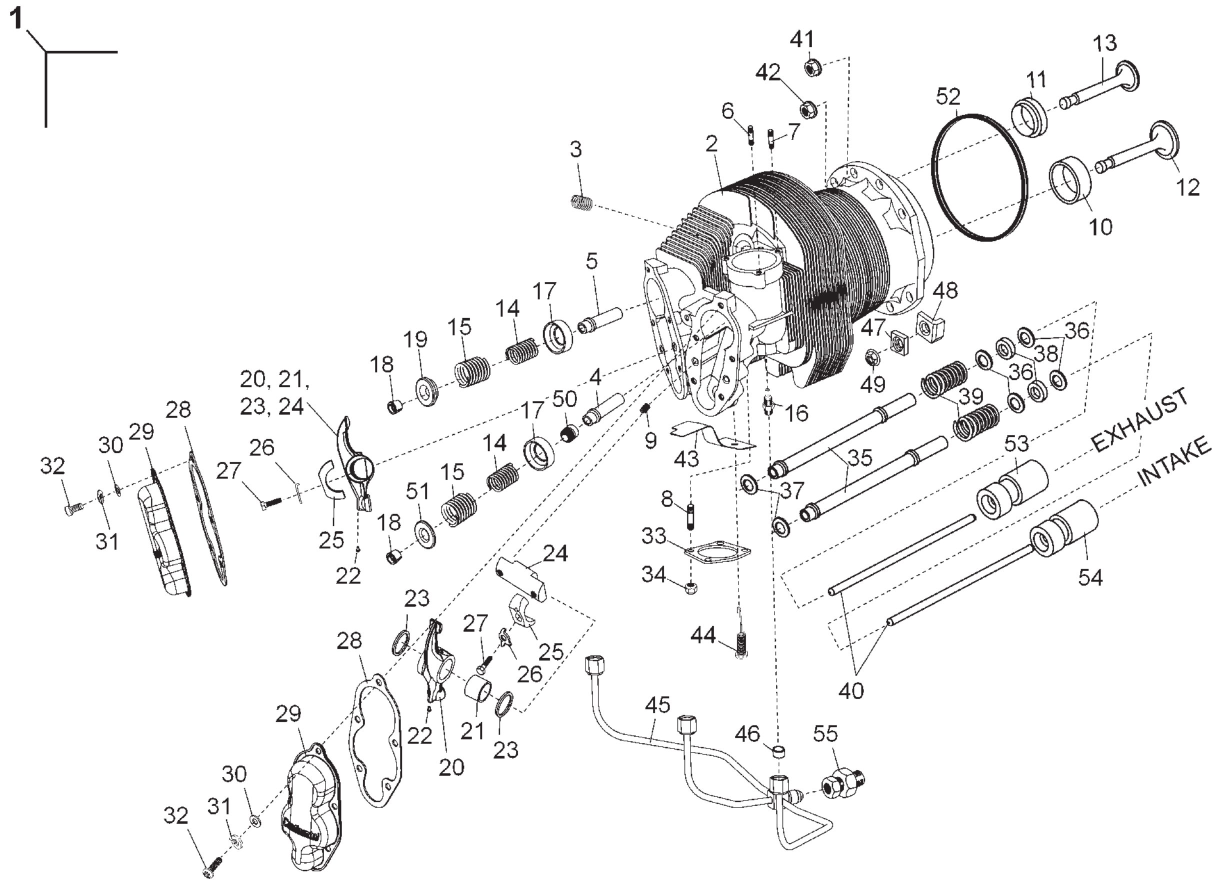

Figure 10-28 repeated for reference

11. While supporting the cylinder, install, but do not torque, the cylinder flange nuts (41 and 42).
12. Install the 7th stud brackets (47 and 48) and flange nut (49). The 7th stud nuts have a conical seat.
13. For single cylinder replacement, torque the cylinder fastening hardware according to the "Cylinder Torque" instructions in Section 10-8.10. For multiple cylinder replacement, torque the cylinder fastening hardware for each cylinder being installed according the "Cylinder Torque" instructions in Section 10-8.10, steps 1 & 2. When all cylinders are installed, torque all cylinder and crankcase fasteners

according to the instructions in Section 17-3.3. If re-torquing fasteners that were not removed during this maintenance action, apply torque to the specified torque value.

14. 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 Appendix. If no end play is present, disassemble the engine to determine the cause.
15. Install the hydraulic tappets (lifters) and pushrod housings according to instructions in Section 10-8.12.

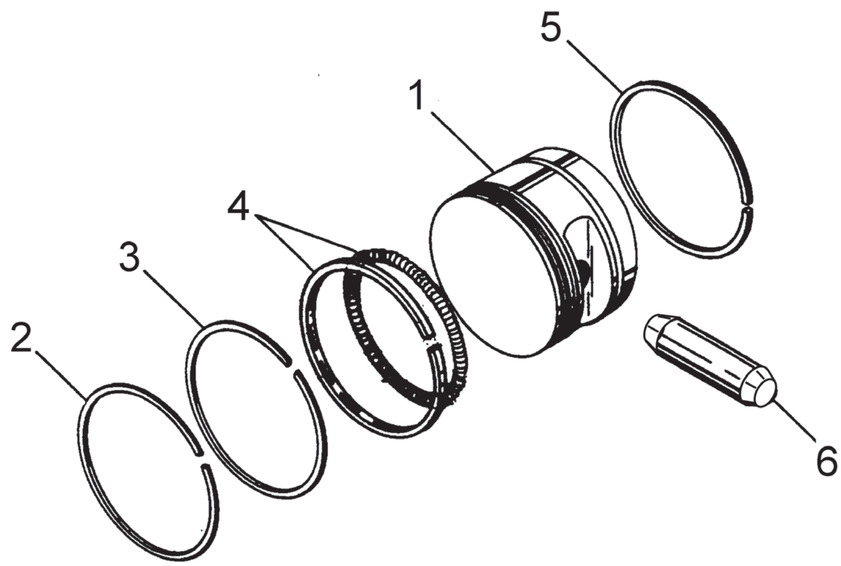

Figure repeated for reference

16. Install the valve train according to instructions in Section 10-8.14.
17. Install the inter-cylinder baffles according to instructions in Section 17-3.7.
18. Install the drain tube fittings (16) and torque according to Appendix B.
19. Install new drain tube seals (46) cylinder drain tubes (45) and check valve (55). Torque the "B" nuts to Appendix B specifications.
20. Install the spark plugs and ignition harness according to the "Ignition System Maintenance" instructions in Section 6-3.9.
21. Install the Exhaust System according to the airframe manufacturer's instructions.
22. Install the Induction System components according to instructions in Section 17-10.
23. Install the fuel injector nozzles according to instructions in Section 10-3.3.
24. 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 J-1966 mineral oil for engine break-in.

25. Service the engine with mineral oil according to instructions in Section 6-3.8.

26. Install the aircraft cowling and airframe-supplied accessories according to the airframe manufacturer's instructions.
27. Perform an "Engine Operational Check" according to instructions in Section 6-3.7.
28. 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 6-3.8.

10-8.10. 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 **<u>on BOTH sides</u>** 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 stud nuts to one half (1/2) the specified value in Appendix B in the order shown in Figure 10-41.
3. Torque the through bolt nuts and cylinder base stud nuts to the full specified torque value in Appendix B. Torque the through bolt nuts on both sides of the engine (even if only one cylinder is being installed).

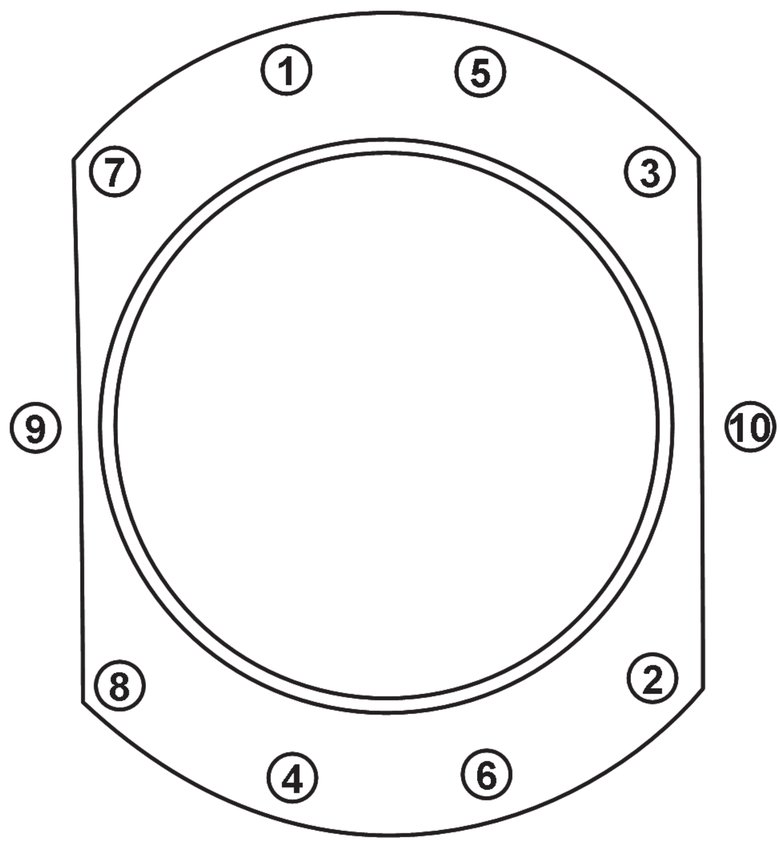

Figure 10-41. Single Cylinder Torque Sequence

10-8.11. Updraft Cylinder Hydraulic Tappet Installation A B C

1. Perform the dimensional inspections (Section 10-8.7) applicable to the hydraulic tappets (lifters) and pushrods. Replace parts which fail to meet the service limits.
2. Gather the replacement parts necessary to satisfy the “100% Parts Replacement Requirements” criteria in Appendix C-2.3.
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. Install the 12 pushrod housings (Figure 10-29) (35).
   a. Using a Kent-Moore Part No. 68-3 Pushrod Spring Compressor Tool (or equivalent), compress a new spring (38).
   b. Place new packing (37) between two steel washers (36), and install on the *crankcase* end of the pushrod housing.
   c. Position the pushrod housing (35), with new packing (37) and washers (36) in the respective crankcase tappet guides.
   d. While the spring (38) is still compressed and the housing installed in the crankcase, slide a new packing (37) sandwiched between two steel washers (36) on the *cylinder* end of the pushrod housing (35).
   e. Guide the *cylinder* end of the pushrod housing (35) into the cylinder head bore while slowly releasing the tension on the pushrod spring with the Pushrod Spring Compressor Tool. Remove the Pushrod Spring Compressor Tool from the pushrod housing. Verify the packing (37) and washers (36) are properly seated in the cylinder flange.
8. Rotate the engine to the upright position on the stand.
9. Lubricate the pushrods (39) with clean 50-weight aviation engine oil and insert the pushrods through the cylinder openings into the pushrod housings (35).
10. Install the rocker arms and rocker covers according to instruction in Section 10-8.13.

11. Install any airframe equipment, accessories, and cowling removed to facilitate hydraulic tappet replacement according to the airframe manufacturer's instructions.
12. Perform an "Engine Operational Check" according to instructions in Section 6-3.7

Figure 10-42. Pushrod Spring Compressor

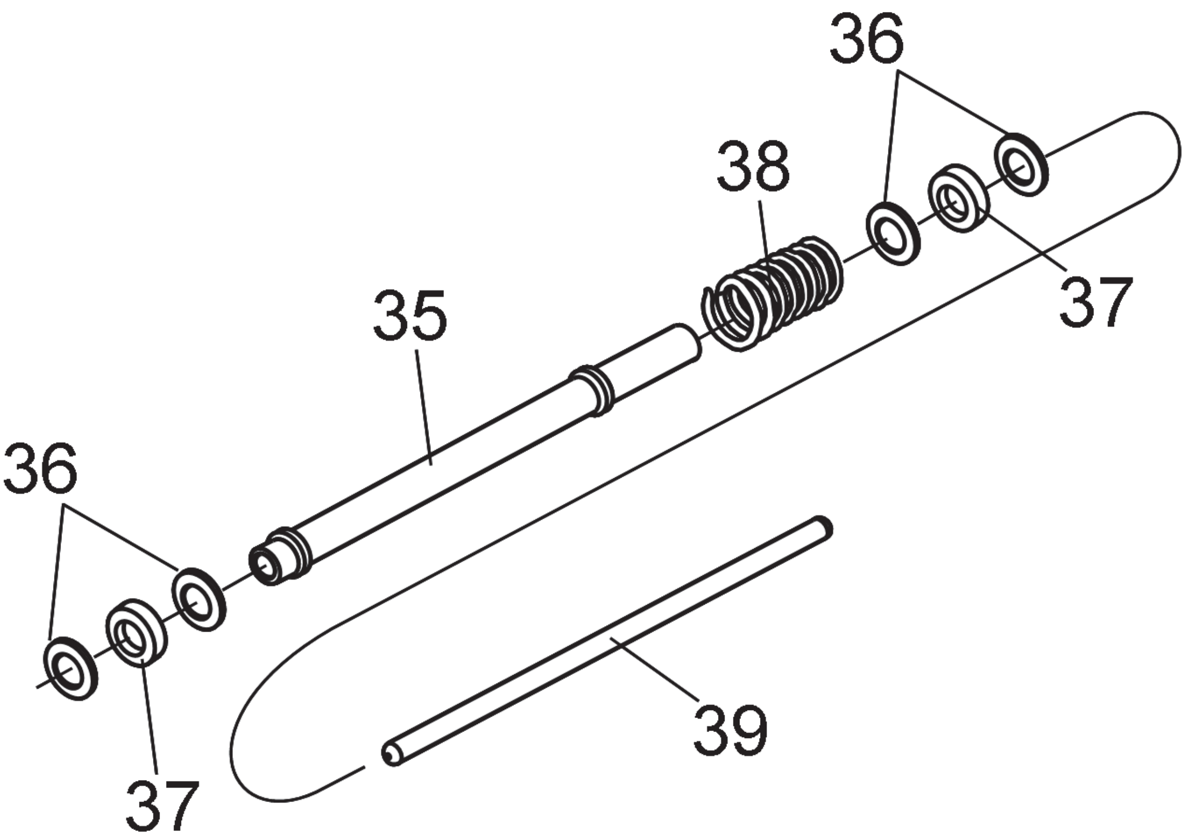

Figure 10-29 repeated for reference

10-8.12. Crossflow Cylinder Hydraulic Tappet Installation G N P R

1. Perform the dimensional inspections (Section 10-8.7) applicable to the hydraulic tappets (lifters) and pushrods. Replace parts which fail to meet the service limits.
2. Gather the replacement parts necessary to satisfy the “100% Parts Replacement Requirements” criteria in Section C-2.3.
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 3-1, “Special Tools”) or equivalent, compress the pushrod housing spring (Figure 10-30)(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. Lubricate the pushrods (40) with clean 50-weight aviation engine oil and insert the pushrods through the cylinder openings into the pushrod housings (35).
14. Install the rocker arms, and rocker covers according to instruction in Section 10-8.14.
15. Install any airframe equipment, accessories, and cowling removed to facilitate hydraulic tappet replacement according to the airframe manufacturer’s instructions.

16. Perform an "Engine Operational Check" according to instructions in Section 6-3.7.

Figure 10-42 repeated for reference

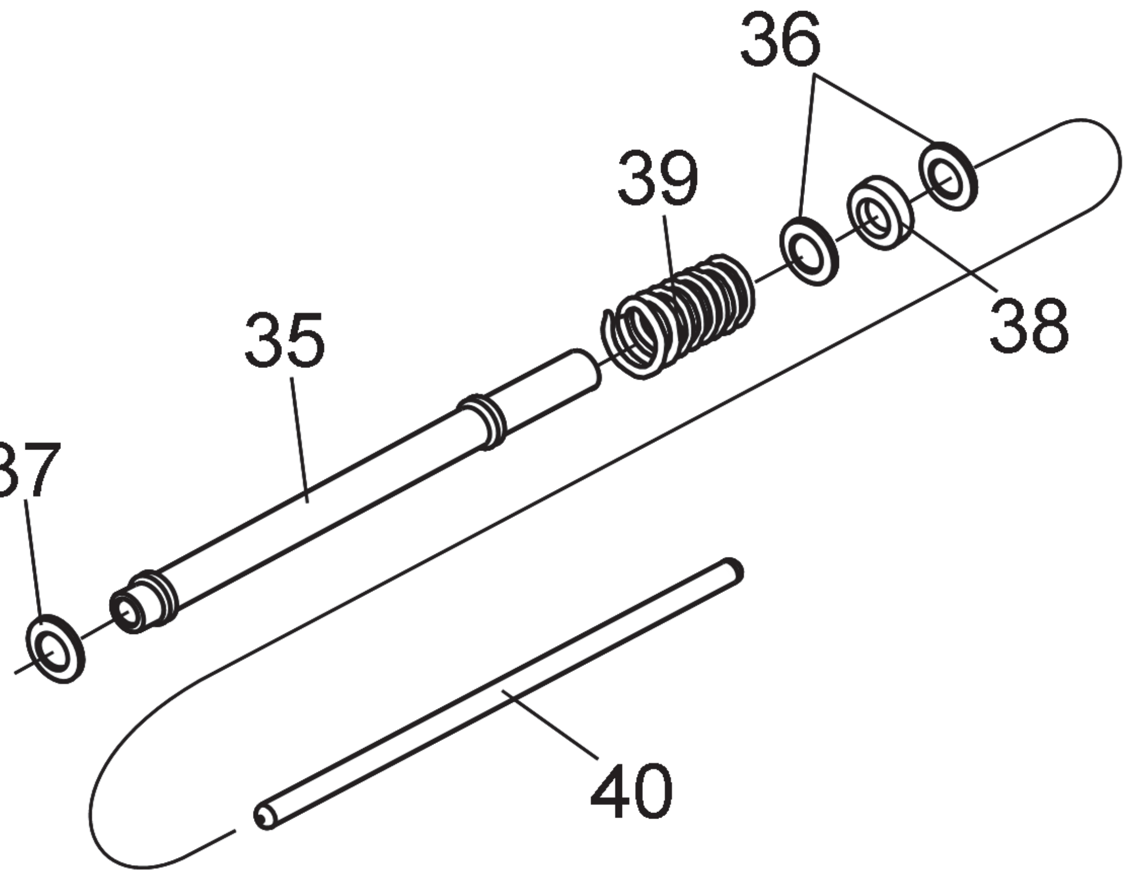

Figure 10-30 repeated for reference

10-8.13. Updraft Cylinder Rocker Arm Installation A B C

1. Rotate the crankshaft until the piston is at top dead center on the compression stroke and the pushrods for the rocker arm being installed are at their lowest position. If necessary, bleed down the lifter by applying a constant pressure on the pushrod with the cap end of the rocker arm.
2. Lubricate the rocker arms (Figure 10-27) (21 & 24), new thrust washers (27) and new rocker arm shaft (18) with clean 50-weight aviation engine oil.
3. Install a new rocker arm shaft (18) with the beveled side facing the cylinder base.
4. Slide the rocker arm shafts to the side to install the rocker arm.
5. Insert the rocker arm (24), sandwiched between two new thrust washers (27) in the rocker arm bosses.
6. Slide the new rocker shafts (18) through the boss, thrust washers and rocker arm into place, centered in the rocker arm boss; secure with washers (19) and screws (20).
7. Measure the rocker arm side clearance (Figure 10-43) between the rocker boss and rocker arms; side clearance must be 0.002 - 0.015 inches. If side clearance exceeds 0.015 inch, replace the thrust washer with a thicker (oversize) thrust washer to reduce side clearance.

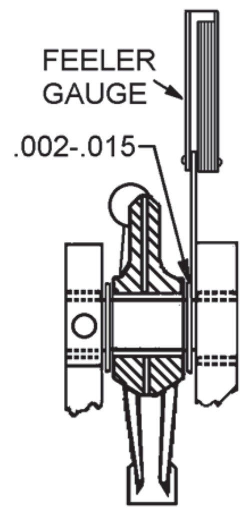

Figure 10-43. Updraft Cylinder Rocker Arm Side Clearance

8. Refer to Figure 10-44; measure the rocker arm-to-retainer clearance. If the clearance is less than 0.020, grind the underside of the rocker arm according to the instructions in Section 15-8.9.20.
9. Measure and compare the dry valve lash between the valve tip and the rocker foot by applying pressure on the rocker arm at the ball (pushrod) end. Insert a feeler gauge between the rocker arm foot and valve tip; valve lash must not exceed Section 10-8.7.1 limits. Replace the pushrods with authorized over size (AO) pushrods if dry valve lash exceeds the maximum limit.

10. Align the rocker shaft (18) and rocker boss screw holes; install screws (20), new lock washers (19) and plain washers (47). Torque the screws (20) to Appendix B specifications.
11. Repeat steps 1-10 to install the valve actuating parts for the remaining cylinders.

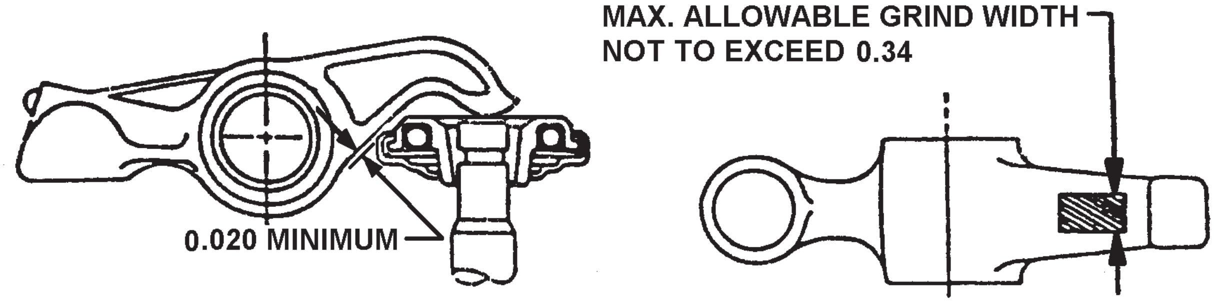

Figure 10-44. Rocker Arm to Retainer Clearance

12. Install new rocker cover gaskets (28) and the rocker covers (29); secure them with bolts (32), new lock washers (31), and washers (31).Torque the rocker cover screws (32) to Appendix B specifications.

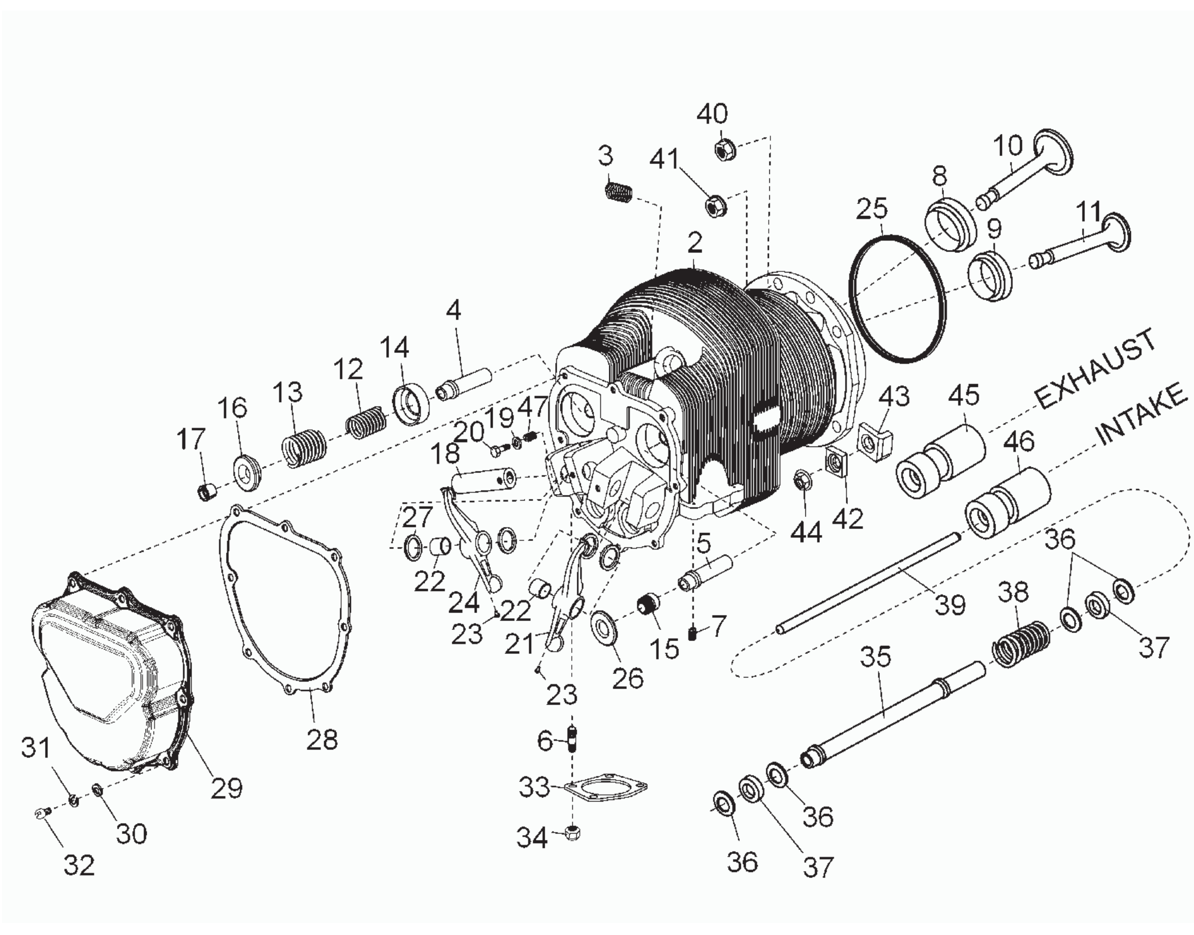

Figure 10-27 repeated for reference

10-8.14. Crossflow Cylinder Rocker Arm Installation G N P R

1. With the engine upright, lubricate the pushrods (Figure 10-28) (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 rocker arms (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.
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 10-44) and 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.

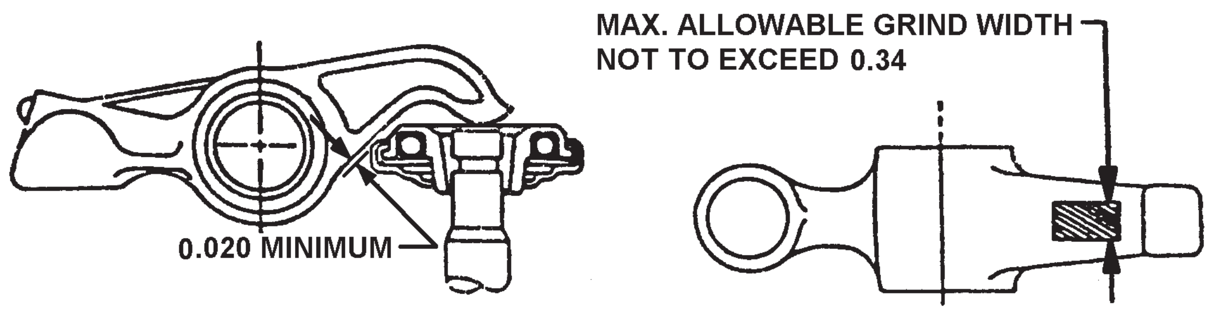

Figure 10-44 repeated for reference

6. Check rocker arm to retainer side clearance (Figure 10-45) 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 allowable tolerance.
7. Measure and compare the dry valve gear lash between the valve tip and the rocker foot at the ball (pushrod) end. Insert a feeler gauge between the rocker arm foot and valve tip; valve lash must not exceed the service limits in Section 10-8.7.2. Replace the pushrods with authorized over size pushrods (P030) if dry valve gear lash exceeds the maximum limit.

CAUTION: Do not over- or under-torque bolts to align tab washers; replace the bolt and re-torque to obtain proper alignment.

8. Torque the screws (Figure 10-28) (27) to Appendix B specifications and secure the rocker assembly with the tab washers (26) according to "Tab Washer Installation" instructions in "Tab Washer Installation". Do not re-align the screw head to the tab washer.

9. 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 Appendix B specifications.

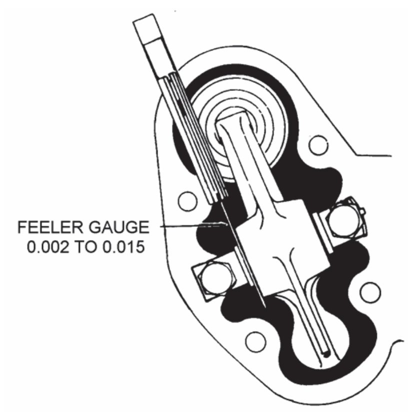

Figure 10-45. Rocker Arm Side Clearance

10. Install airframe equipment, accessories, and cowling removed to facilitate hydraulic tappet replacement according to the airframe manufacturer's instructions.
11. Perform an "Engine Operational Check" according to instructions in Section 6-3.7.

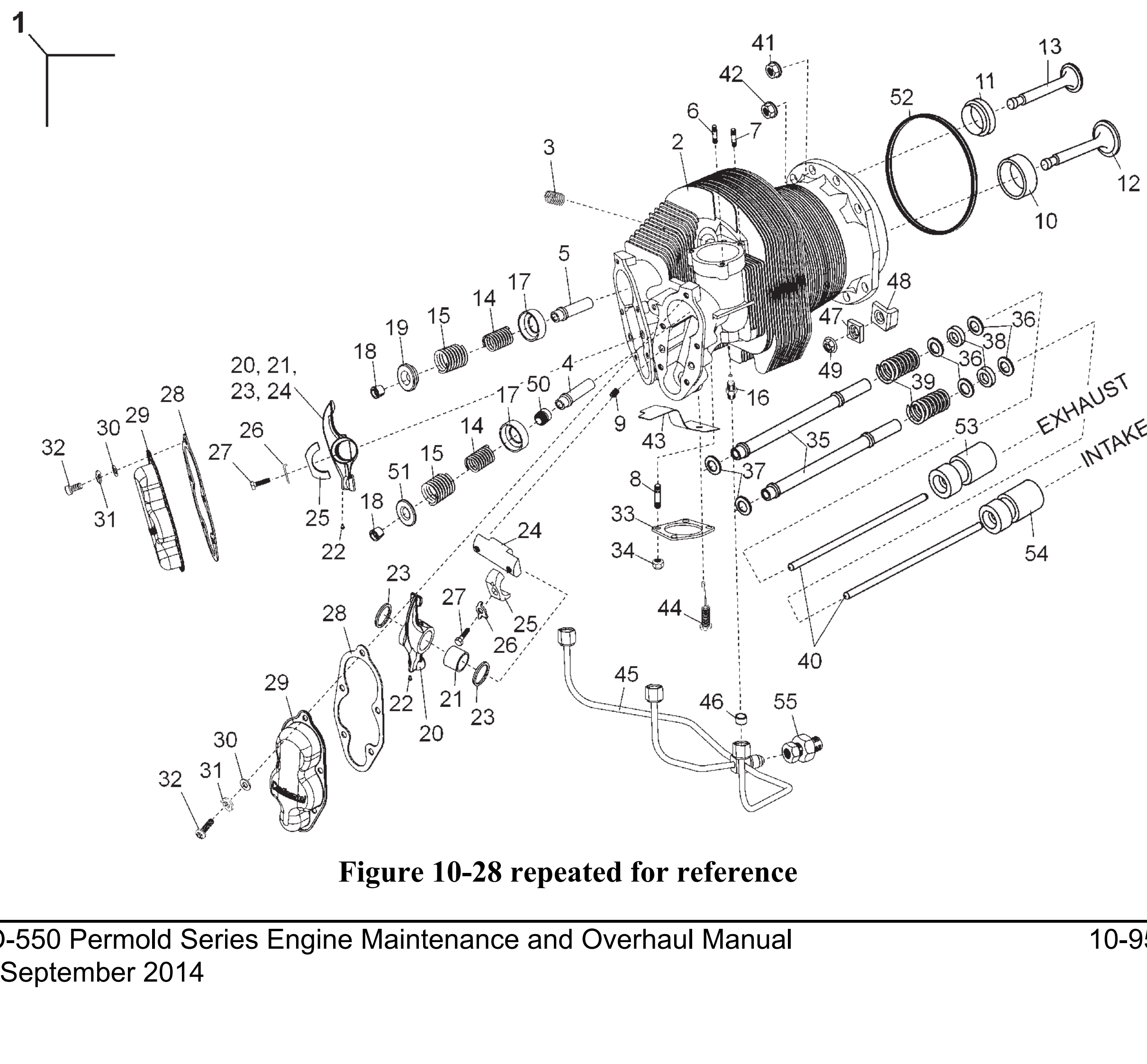

Figure 10-28 repeated for reference

10-9. Crankshaft Nose Oil Seal Replacement

Replace the crankshaft nose oil seal if it is damaged or if the following conditions exist:

- Ram air is entering the engine interior
- Oil leaks from the nose seal or nose seal retainers

10-9.1. Crankshaft Nose Oil Seal 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 uncommanded engine starts 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. Disconnect all spark plug leads.
3. Set the brakes and block the aircraft wheels.
4. Ensure that aircraft tie-downs are installed and the cabin door latch is open.
5. Remove the propeller in accordance with the propeller manufacturer’s and airframe manufacturer’s instructions.

   CAUTION: Do not scratch, mar, or damage the crankshaft or crankcase while removing the crankshaft nose oil seal.

6. Remove the screws (Figure 10-46) and the retainer plates from the crankcase.

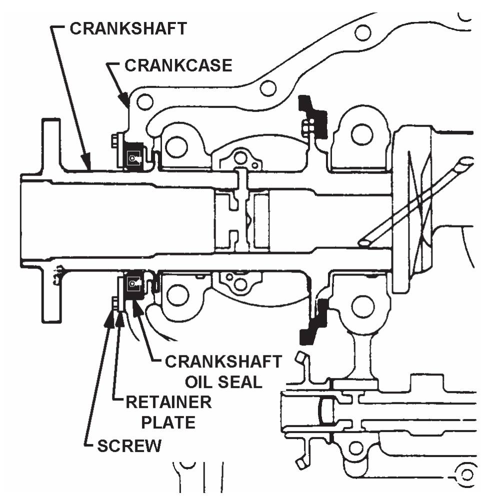

Figure 10-46. Retainer Plate and Screws on Front of Crankcase

7. Remove the crankshaft nose oil seal, (made up of three components, a seal, a reinforcing ring, and spring as shown in Figure 10-47). gentle force may be required to remove the nose oil seal parts from the counterbore.
8. Clean the Gasket Maker residue out of the counterbore recess using a chlorinated solvent such as Loctite Chisel® or methylene chloride followed by a naptha solvent

such as Loctite ODC-Free Cleaner and Degreaser. Remove all residue and debris from the bore.

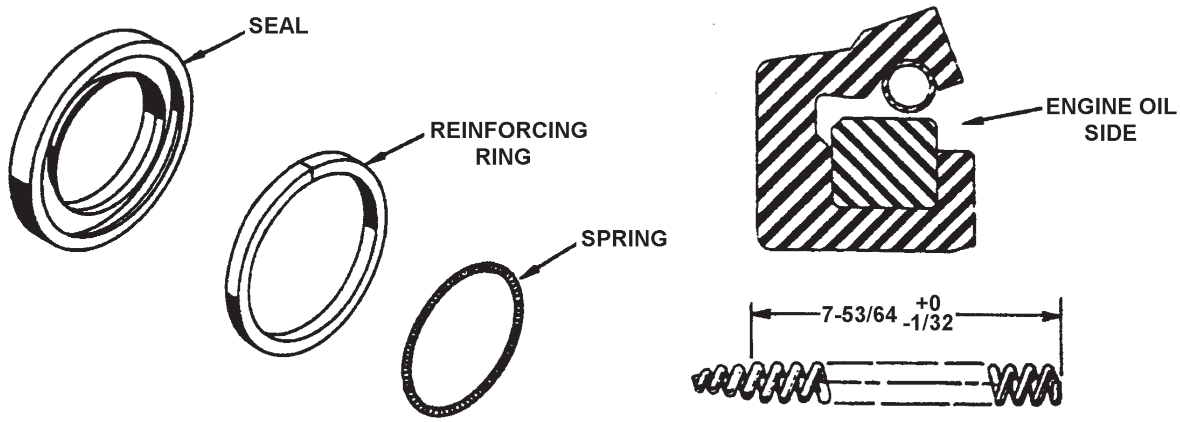

Figure 10-47. Crankshaft Nose Oil Seal Parts

9. Remove the tin plating in the 1-inch area of the crankshaft shown in Figure 10-48 with a strip of very fine emery cloth, buffing the shaft to attain a smooth uniform finish without any scratches.

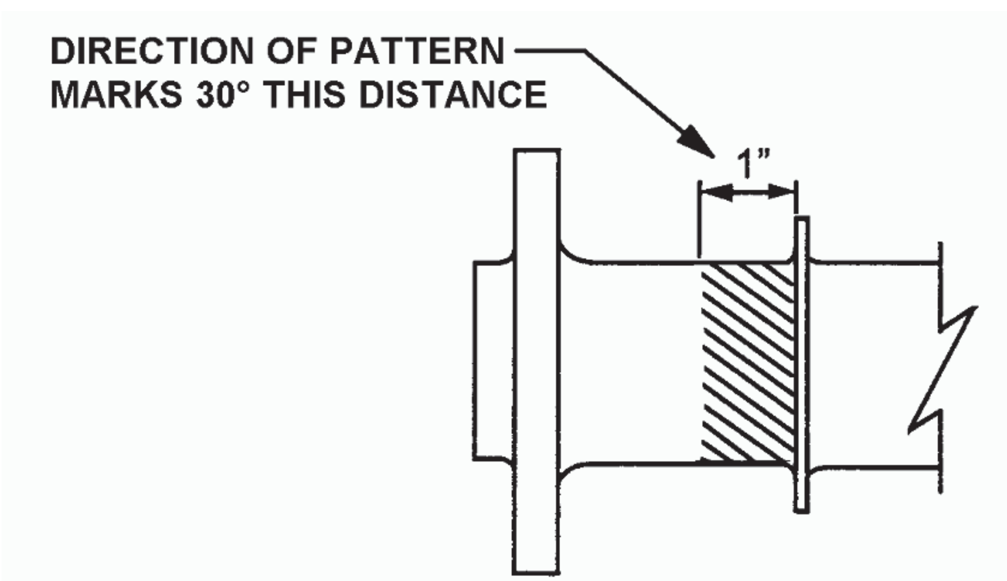

Figure 10-48. Crankshaft Plated Area

10. Apply a ½-inch wide strip of 180 grit emery cloth against the newly polished 1-inch area on the crankshaft with a firm pressure to lightly scratch (not score or gouge) a new helix design in a 30° pattern in the plated area as shown in Figure 10-48. Rub the emery cloth in the plated area outward toward the propeller flange, counter-clockwise. For left-hand rotating engines, rub clockwise. Rotate crankshaft by hand and continue rubbing with the 180 grit emery cloth until the entire 1-inch plated area (Figure 10-48) around the exposed portion of the crankshaft is lightly scratched with the helical design. (Lightly scratching the surface of the crankshaft that contacts the oil seal promotes a better seal and prevents leakage.)

11. Wipe the plated area (Figure 10-48) with acetone. Ensure the crankshaft is free of any debris and particulate matter to facilitate a clean seal.

10-9.2. Crankshaft Nose Oil Seal Installation

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 uncommanded engine starts during maintenance. Do not stand or place equipment within the arc of the propeller.

1. Prepare the exposed portion of the crankshaft with a fresh helix pattern according to instructions in Section 10-9.
2. Remove the spring and reinforcing ring from the crankshaft nose oil seal.
3. Unhook the spring ends using an unwinding motion.
4. Verify the seal spring length is 7.80” to 7.83” as illustrated in Section 10-47. If the spring length is not within this tolerance, replace it.
5. Place the spring around the crankshaft in the helix area.
6. Turn the spring ends in an unwinding direction and allow one end to wind into the other end.
7. Apply Shell Alvania No. 2 Grease to the lip of the new seal and the propeller flange.
8. Squeeze the seal until it is egg shaped and install it on the crankshaft starting from the propeller flange using the Crankshaft Oil Seal Installer Tool.
9. After the oil seal is installed on the crankshaft, wipe the grease from the oil seal and crankshaft. Verify the outer diameter of the oil seal is clean and dry.
10. Press the reinforcing ring into the oil seal recess in both directions from the split. Ensure the reinforcing ring is in the deepest part of the recess all the way around.
11. Install the spring in the oil seal cavity.
12. Apply Gasket Sealant (Part No. 654663) to the mating crankcase flange.
13. Spray Gasket Sealant Primer (Part No. 653692) on the oil seal counterbore and allow it to dry for 1 to 2 minutes.
14. Apply a translucent coat of Gasket Maker (Part No. 646942) on the wall of the oil seal counterbore. Refer to Gasket Maker application instructions in Appendix C.
15. Using thumb pressure, work the seal into the crankcase counterbore.
16. After the seal is in place, wipe any remaining oil from the seal and crankshaft.
17. Spray the exposed portion of the lightly scratched crisscross area with aluminum paint and allow it to dry.
18. Apply High Strength Adhesive Sealant (Part No. 646941) to the oil seal retainer screws.

19. Apply High Strength Adhesive Primer (Part No. 653693) to the crankcase oil seal retainer screw holes.
20. Install the crankshaft nose oil seal retainer plates and secure them with the nose oil seal retainer screws. Torque the screws per Appendix B.
21. Inspect the propeller according to the propeller manufacturer's and airframe manufacturer's instructions.
22. Install the propeller according to the propeller manufacturer's and airframe manufacturer's instructions.
23. Perform a normal "Engine Start" (Section 7-3.2) and "Ground Run-up" (Section 7-3.2). Run the engine for a minimum of five minutes to reach normal operating temperatures. Shut down the engine according to the "Engine Shutdown" (Section 7-3.4) instructions and inspect the Crankcase Nose Oil Seal area for leaks.

10-10. Crankcase Repair

See Section 15-8.11, "Crankcase Overhaul Repair."

10-11. Exhaust System Repairs

Refer to the aircraft maintenance manual for exhaust system repair instructions.

10-12. Engine Preservation and Storage

"Engine Preservation and Storage" instructions are in Chapter 9.

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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. Appendix C contains standard practices for recurring common procedures, like cotter pin and safety wire installation, and helical coil replacement. Appendix C also contains details regarding mandatory replacement parts disposition during maintenance (Appendix C-2.3) and overhaul (Appendix C-2.4). These sections will be referred to often throughout the procedures. Refer to the airframe manufacturer’s manual for instructions pertaining to mandatory replacement items during engine replacement or engine overhaul.

This manual does not contain overhaul requirements for supplemental type certificated engines, components or systems.

11-2. Overhaul Schedule

Engine time between overhaul (TBO) is determined by the engine model type certification data submitted to and approved by the FAA. Refer to the “Recommended Time Between Overhaul” entry in Table 6-1 or the latest revision of SIL98-9 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 airframe.	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 as specified in Section C-2.
7. Apply protective coating to engine parts.	Section 14-4, “Protective Coatings”
8. Assemble the engine components.	Chapter 16, “Component Assembly”
9. Assemble the engine.	Chapter 17, “Engine Assembly”
10. Install the engine in the airframe.	“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 in the listed chapters 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 14, “Engine Cleaning”
- 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 6-3.11.1) Document results on the "Cylinder Inspection Checklist"(Table 6-16).		
Complete a Cylinder Differential Pressure Test. (Section 6-3.11.2). Document results on the "Cylinder Inspection Checklist"(Table 6-16).		
Remove the engine from the airframe (Section 5-1).		
Remove the Ignition System (Section 12-2).		
Remove the Accessory Drive Adapters (Section 12-3).		
Remove the Fuel Injection System (Section 12-4).		
Remove the Induction System (Section 12-5).		
Remove the Exhaust System (Section 12-6).		
Remove the Oil Cooler (Section 12-7).		
Remove the Oil Pump (Section 12-8).		
Remove the Alternator(s) (Section 12-9).		
Remove the Starter and Starter Adapter (Section 12-11).		
Remove the Oil Sump (Section 12-12).		
Remove the Engine Cylinders and Pistons (Section 12-13).		
Remove the Engine Mounting Brackets (Section 12-14).		
Disassemble the Ignition System (Section 13-1).		
Disassemble the Fuel Injection System (Section 13-2).		
Disassemble the Starter and Starter Adapter (Section 13-4).		
Disassemble the Engine Cylinders (Section 13-5).		
Disassemble the Accessory Drive Adapters (Section 13-6).		
Disassemble the Crankcase (Section 13-7).		
Disassemble the Drive Train (Section 13-8)		
Disassemble the Compressor Mount (Section 13-9).		
Perform a visual inspection prior to cleaning the engine parts (Section 15-3)		
Clean engine parts (Section 14-1).		
Perform detailed visual parts inspection (Section 15-3 and Table 11-3).		
Perform Fluorescent Penetrant Inspections (Section 15-4).		
Perform Magnetic Particle Inspections (Section 15-5).		
Perform Ultrasonic Inspections (Section 15-6)		
Perform Dimensional Inspections (Section 15-7).		
Perform overhaul repairs (Section 15-8).		
Assemble engine components (Section 16).		
Assemble engine (Section 17).		
Install engine (Section 5-2).		
Complete Post-Overhaul Test and Adjustments (Section 18).		

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	**Initials**	**Findings**
Complete the cursory visual inspection according to Section 15-3 during disassembly to avoid cleaning parts which ultimately will be replaced. After disassembly and cleaning, complete a thorough inspection of all parts which are not identified as 100% replacement items (Ref. Section C-2.3) or mandatory replacement items during overhaul (Ref. Section C-2.4). 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 tubes and fittings 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.		
Obtain new, rebuilt, or overhauled fuel pump, manifold valve, and throttle and control assembly/integrated throttle and metering unit. Inspect tapped holes and helical coils on the fuel injection system for distorted or stripped threads, cracks or dents.		
Using a flashlight and 10X magnifying glass, inspect the fuel pump and manifold housing, and bracket exterior for cracks.		
Replacement Part Description	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
Induction System		
Inspect induction tubes, risers, clamps and induction 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 system brackets, manifold, clamps and tubes with a 10X magnifying glass.		
Replacement Part Description	**Part Number**	**Reason**
Alternator		
Obtain new, rebuilt, or overhauled alternator.		
Inspect fasteners for damaged or stripped heads.		
Check the alternator drive hub per “Alternator Drive Hub Slippage Inspection” instructions in Section 15-7.6		
Inspect the alternator brackets, and associated hardware 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		
Obtain new, rebuilt, or overhauled starter motor.		
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**
Ignition System		
Obtain new, rebuilt magneto or overhaul the magnetos according to the Magneto Service Manual.		
Replace the ignition harness		
Replacement Part Description	**Part Number**	**Reason**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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 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.		
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**

Table 11-3. Engine Overhaul Visual Inspection Checklist

Inspection Item	Initials	Findings
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

Perform this inspection on clean, aluminum or non-ferrous metal parts IAW ASTM E1417, E1208, E1209, and E1219. Use Type I, Penetrant Method A, B, C, or D and the "Fluorescent Penetrant Inspection"instructions in Section 15-4.		
Inspection Item	**Focus**	**Initials**
General Look for discontinuities such as: • Cracks • Grinding • 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 pump body • Vapor separator • 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	

Table 11-4. Fluorescent Penetrant Inspection Checklist

Inspection Item	Focus	Initials
Perform this inspection on clean, aluminum or non-ferrous metal parts IAW ASTM E1417, E1208, E1209, and E1219. Use Type I, Penetrant Method A, B, C, or D and the "Fluorescent Penetrant Inspection"instructions in Section 15-4.		
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	
Oil pump cover	• Oil pump cavity area • Mounting flanges	
Oil filter adapter	• Mounting flanges • Oil seal or bushing seats	
Tach drive housing	• 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," on page 28 for an accurate inventory of required parts to rebuild. Mark the faulty parts as defective and discard.		

Table 11-5. Magnetic Particle Inspection Checklist

<table>
<tr><td colspan="3">Use the fluorescent method wet continuous procedure on all ferrous parts. Follow the latest ASTM E1444 procedure and the “Magnetic Particle Inspection” instructions in Section 15-5.</td></tr>
<tr><th>Inspection Item</th><th>Initials</th><th>Inspector Notes</th></tr>
<tr><td>Crankshaft
• Journals
• Fillets
• Oil holes
• Thrust flanges
• Prop flange</td><td></td><td></td></tr>
<tr><td>Cylinder Barrels
• Fin tips
• Fin roots
• Mounting flange
• Mounting flange holes</td><td></td><td></td></tr>
<tr><td>Camshaft
• Lobes
• Journals
• Drilled hole edges</td><td></td><td></td></tr>
<tr><td>Rocker arms
• Pad
• Socket under side arms and boss</td><td></td><td></td></tr>
<tr><td>Idler sheave support bolt</td><td></td><td></td></tr>
<tr><td>Starter Adapter
• Shaft gear
• Worm shaft
• Worm gear</td><td></td><td></td></tr>
<tr><td>Lubrication System:
• Oil pump gears
• Bevel gears
• Tach drive shaft</td><td></td><td></td></tr>
<tr><td>• Counterweights (after bushings installed)
• Counterweight hanger blade (after bushing installed)
• Crankshaft gears
• Camshaft gear
• Idler gear
• Governor drive gear</td><td></td><td></td></tr>
<tr><td>Connecting rods (Section 15-5.1)</td><td></td><td></td></tr>
<tr><td colspan="3">Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory,” on page 28 for an accurate inventory of required parts to rebuild. Mark the faulty parts as defective and discard.</td></tr>
</table>

Table 11-6. Ultrasonic Inspection Checklist

Only certified, trained personnel can perform this inspection Ref: “Ultrasonic Inspection Certification” instructions in Section 15-6.1 and “Ultrasonic Inspections” instructions in Section 15-6		
Inspection Item	**Result**	**Remedy**
Crankshaft (Section 15-6.2)		
Crankshaft Main Journal #1		
Crankshaft Main Journal #2		
Crankshaft Main Journal #3		
Crankshaft Main Journal #4		
Vibroetch Passing Crankshaft with Inspection Results		
Record parts which do not pass the inspection on Table 11-10, “Replacement Parts Inventory,” on page 28 for an accurate inventory of required parts to rebuild. 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 bore 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							
Intake valve tappets OD							
Exhaust valve tappets OD							

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D		
Inspection Item	**Dimension**	**Initials**
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 15-7)		
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		
Crankshaft gear on crankshaft diameter		
Crankshaft in thrust bearing end clearance		

Table 11-7. Dimensional Inspection Checklist

Reference “Dimensional Inspection” (Section 15-7) and “Overhaul Dimensional Limits” in Appendix D					
Inspection Item	**Dimension**				**Initials**
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 4th order pins					
Counterweight 5th order pins					
Counterweight 6th order pins (1)					
Counterweight 6th order pins (2)					
Journal	**1**	**2**	**3**	**4**	
Counterweight bushing bore					
Counterweight bushing ID					
Counterweight hanger blade bushing ID					
Counterweight hanger blade bore					

Table 11-7. Dimensional Inspection Checklist

Reference "Dimensional Inspection" (Section 15-7) and "Overhaul Dimensional Limits" in Appendix D							
Inspection Item	**Dimension**						**Initials**
Connecting Rods (Section 15-7.2.1)	**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							
Intake valve seat width							
Exhaust valve seat width							
Exhaust valve seat-to-valve guide axis angle							
Intake valve seat-to-valve guide axis angle							
Rocker shaft in cylinder head bosses diameter							
Rocker arm bushing bore diameter							
Rocker arm bushing inside diameter – finish bore							
Rocker arm side clearance							
Intake valve guide inside diameter							
Intake valve in guide diameter							
Exhaust valve guide inside diameter							
Exhaust valve in guide diameter							

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**	
Intake valve face-to-stem axis angle							
Exhaust valve face-to-stem axis angle							
Intake valve gauge line-to-stem length							
Exhaust valve face-to-stem length							
Intake valve face-to-stem runout							
Rocker arm foot to valve stem (dry valve lash)							
Piston, 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							
Inner valve spring 654442 compressed to 1.745 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**	
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 0.010 D							
Cylinder dimension STD X							
Cylinder dimension 0.005 X							
Cylinder dimension 0.010 X							
Cylinder dimension STD Y							
Cylinder dimension 0.005 Y							
Cylinder dimension 0.010 Y							
Starter Adapter (Section 15-7.4)							
Starter shaft gear needle bearing bore in 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**
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 bore in 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		
0.015 Undersize worm wheel drum A dimension		
Worm wheel drum B dimension		

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.)		
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 temperature 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 15-7.10)							
Starter Adapter to Crankcase							
Starter Adapter to Crankcase							
Cover to Adapter (1)							
Cover to Adapter (2)							
Cover to Adapter (3)							
Cover and Scavenge Body to Adapter							
Starter Motor to Adapter (1)							
Starter Motor to Adapter (2)							
Starter Adapter Cover to Scavenge Body (1)							
Starter Adapter Cover to Scavenge Body(2)							
Starter Adapter Cover to Scavenge Body							
Starter Adapter Cover to Scavenge Body							
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)							
Intake flange stud							
Intake flange stud (1)							
Intake flange stud (2)							
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," on page 28 for an accurate inventory of required parts to rebuild. 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 in accordance with ASTM E1417, 1208, E1209, and E1219. Use Type I, Penetrant Method A, B, C, or D. and the “Fluorescent Penetrant Inspection” in Section 15-4.						
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 and follow the latest ASTM E1444 procedure. Also refer to the section “Magnetic Particle Inspection” in Section 15-5.						
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 sections “Dimensional Inspection” and “Engine Cylinder Dimensional Inspection”						
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. Then 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 Section 15-7.2.2, “Crankshaft Counterweight Inspection” Use tags to identify these parts. Do not use a scribe or punch to mark on these parts.		
Using a 10X magnifying glass, inspect the crankshaft gear and idler gear drive teeth for signs of overheating and wear according to instructions in Section 15-3.1, “Gear Tooth Inspection.” Normal wear produces a fine polish on the tooth thrust faces.		
Verify that the crankshaft connecting rod and cap mate marks are adjacent to each other and that 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 (if not already done 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 nut seat area on the connecting rod; check for loss of material or signatures of edge loading of the bolt under the head surface contact area. 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 that the mate marks adjacent to each other match. 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 or redress and apply aluminum paint.		
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 15-7.10, "Stud Height Dimensional Inspection."		
Inspect the connecting rods according to Section 15-7.2.1, "Connecting Rod Dimensional Inspection."		
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

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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. Fuel Injection System Removal
4. Induction System Removal
5. Exhaust System Removal
6. Oil Cooler Removal
7. Oil Pump Removal
8. Alternator Removal (and optional alternator bracket assembly)
9. Optional Compressor Mounting Assembly Removal
10. Starter and Starter Adapter Removal
11. Oil Sump Removal
12. Engine Cylinder and Piston Removal

12-2. Ignition System Removal and Disassembly

IO-550 ignition systems may be Champion (Slick) 6310 series magnetos or Continental Motors' S6RSC-20 series, S6RN-200 series or S6RN-1200 series. Magnetos may feature retard breakers coupled with a starting vibrator or impulse couplings. Some IO-550 magnetos are fitted with a tachometer drive sensor. Removal and installation procedures a similar, with only minor differences. Separate instructions are provided for Continental Motors and Champion Magnetos.

12-2.1. Continental Motors Ignition System Removal

1. Remove ignition leads from each spark plug (Figure 12-2) (10).
2. On each magneto, remove four screws (106) from the cable outlet plate; disconnect the cable outlet plates from magnetos (1 & 2).
3. Remove clamps and cable ties; remove the ignition harness assembly from the engine and discard.
4. Unscrew the Magneto Tachometer Sensor (Figure 12-1) from the housing, if installed. Inspect the magneto sensor for cracks or physical damage; verify the vent hole is open and free of obstructions; replace on condition.
5. Remove nuts (Figure 12-2) (5) lock washers (6), and magneto retainers (7) from each magneto.

   CAUTION: The rubber bushings (Figure 12-4) (19) may fall out of the retainer 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 12-2) (1) from the crankcase, disengaging the drive coupling lugs from the drive bushings.
7. Refer to the Magneto Service Support Manual (X42002 for S-20/200 Series Magnetos - or X42001 for S-1200 Series Magnetos) for Overhaul Instructions.

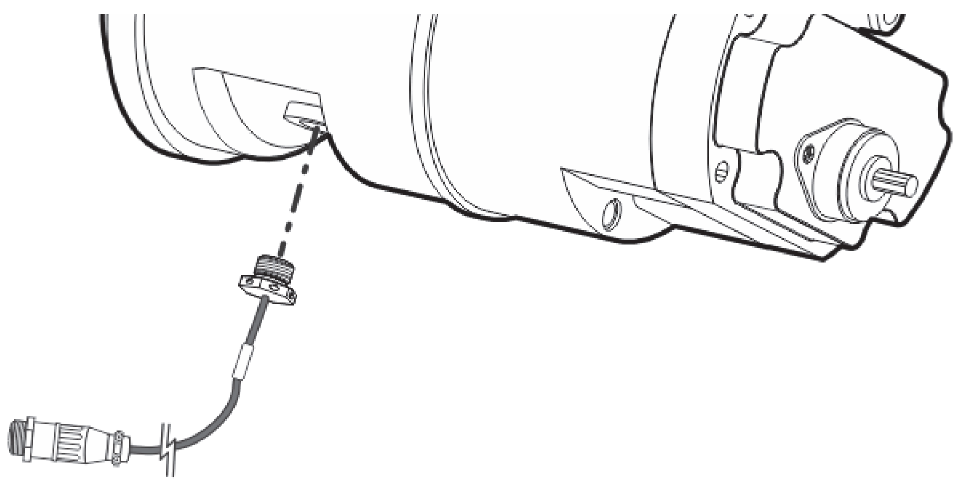

Figure 12-1. Magneto Tachometer Sensor

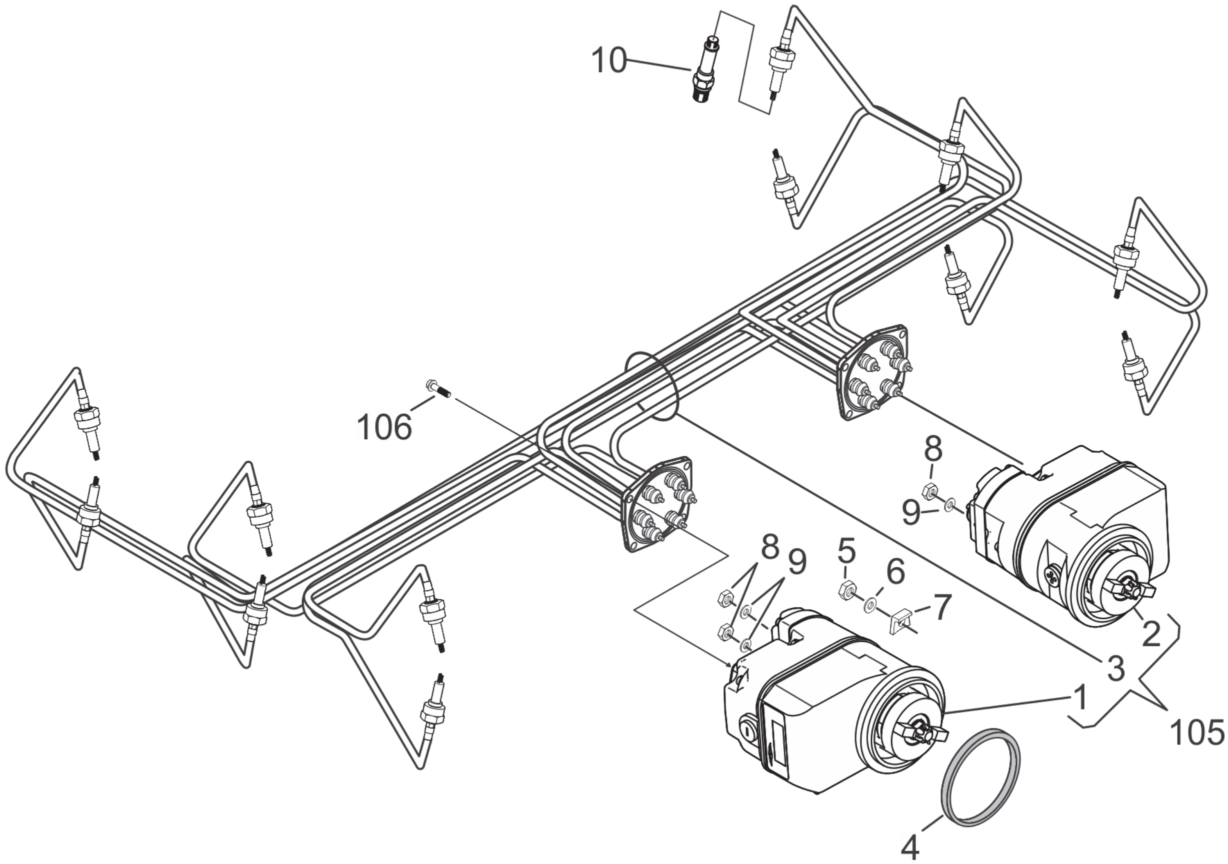

Figure 12-2. Continental Ignition System

1	Magneto (2-4-6)	4	Gasket	7	Retainer, Magneto	10	Spark Plug
2	Magneto (1-3-5)	5	Nut	8	Nut	105	Ignition System Kit
3	Ignition Harness	6	Lock washer	9	Lock Washer	106	Screw

12-2.2. Champion (Slick) Ignition System Removal

1. Disconnect the ignition leads from each spark plug (Figure 12-3) (7).
2. On each magneto, remove three screws from the cable outlet plate; disconnect the cable outlet plates from the magneto(s) (1).
3. Remove clamps and cable ties and discard the ignition harness (2).

   CAUTION: The rubber bushings (Figure 12-4) (19) may fall out of the retainer 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.

4. Remove nuts (4), lock washers (5), and magneto retainers (6) from either side of magneto. Carefully remove the magneto from the accessory case, disengaging the drive coupling lugs from the drive bushing slot.
5. Remove and discard the magneto gasket (2).
6. Replace the magnetos with a new, rebuilt, or overhauled unit.

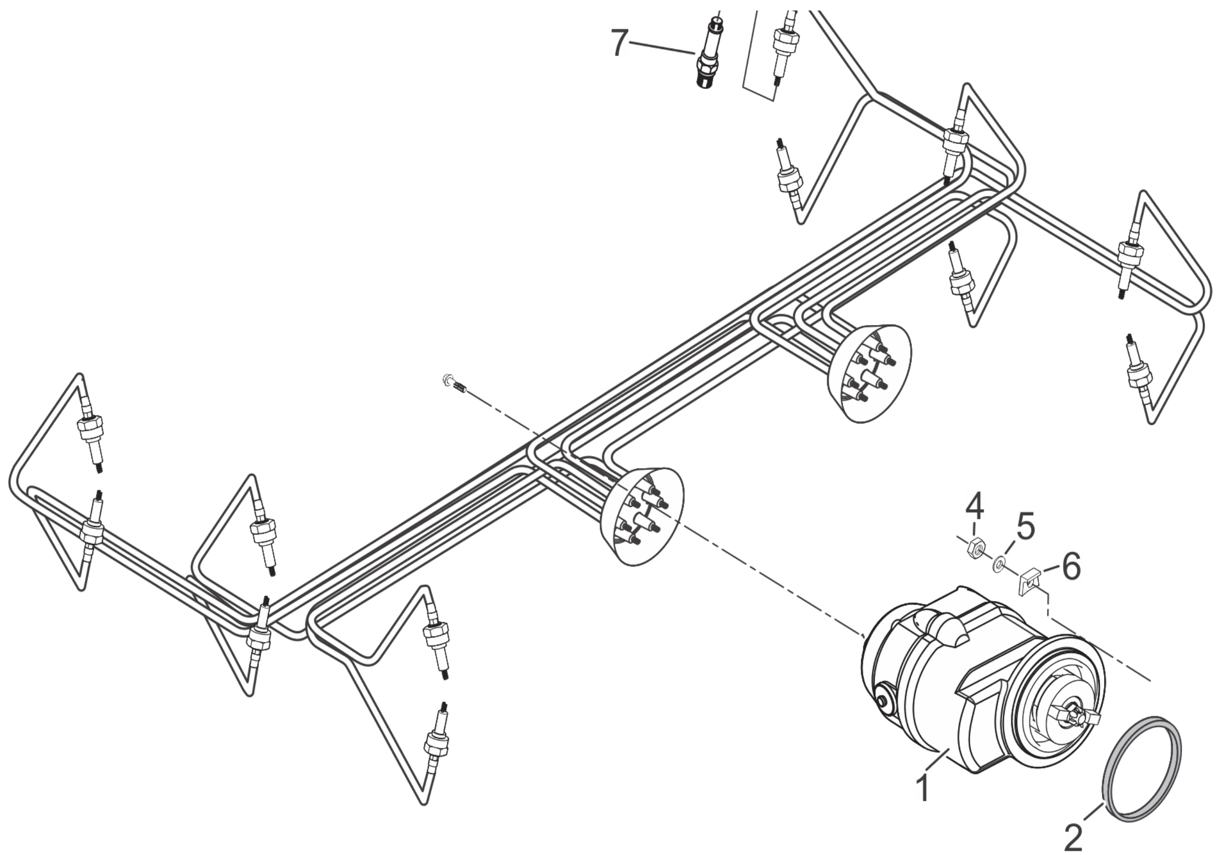

Figure 12-3. Champion (Slick) Ignition System

1	Magneto	3	Ignition Harness	5	Lock washer	7	Spark Plug
2	Gasket	4	Nut	6	Retainer, Magneto		

12-3. Accessory Drive Adapter Removal

1. Carefully slide the drive gear assembly (Figure 12-4) (17, 18 & 19) out of the accessory drive adapter (2).
2. Remove the nuts (10 & 11), lock washers (8 & 9) and washers (6 & 7). Remove the accessory drive assemblies from the rear of the crankcase. Discard the lock washers (8 & 9). Remove and discard the gasket (1).
3. Place the accessory drive components in a clean protected area to await inspection.

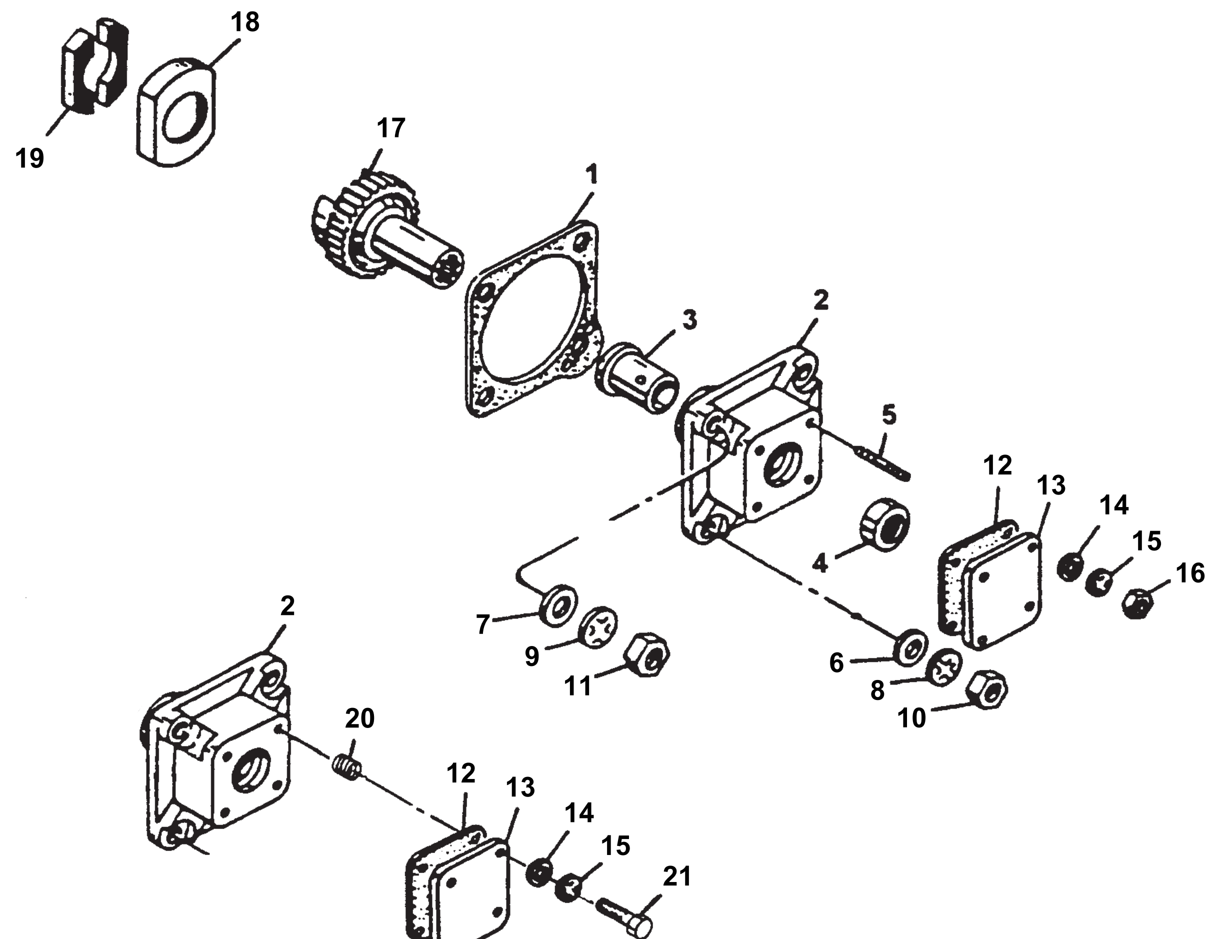

Figure 12-4. Accessory Drive Adapter Assembly

1	Gasket	7	Plain Washer	13	Cover	19	Rubber Bushing
2	Adapter Assembly	8	Lock Washer	14	Washer	20	Helical Coil Insert
3	Bushing	9	Lock Washer	15	Lock Washer	21	Bolt
4	Oil Seal	10	Nut	16	Nut		
5	Stud	11	Nut	17	Drive Gear Assembly		
6	Plain Washer	12	Gasket	18	Retainer		

12-4. Fuel Injection System Removal

Fuel injection systems vary significantly between engine models; refer to the instructions which apply to the engine model being overhauled.

12-4.1. IO-550-A Fuel Injection System Removal A

1. Mark each fuel injection line (Figure 12-5) (6 through 11) with its cylinder number to facilitate reinstallation.

WARNING

Fuel injection lines must not be bent or deformed. Discard and replace bent, chafed, or deformed fuel injection lines.

2. Fuel injection line removal:
   a. Disconnect fuel lines (6 through 11) from fuel nozzles (12).
   b. Disconnect fuel lines (6 through 11) from the fuel manifold valve assembly (5) and remove fuel lines from engine.
3. Remove and discard the fuel nozzles (12A-F) from each cylinder.
4. Remove fuel hoses (17, 18) from fuel control unit and fuel pump. Remove fuel hose (17) from the fuel control unit and manifold valve. Discard fuel hoses (17, 18).
5. Remove the throttle body (4) and fuel control unit (5) from the induction tube (Figure 12-5) (24). Place the throttle and fuel control unit in a clean, protected area until inspection and overhaul.
6. Remove the crankcase backbone hardware that secures the fuel manifold valve to the engine and remove fuel manifold valve (5). Place the fuel manifold valve in a clean, protected area until it is to be overhauled.
7. Remove nuts (16), lock washers (15) and hold down washers (14); discard the lock washers (15).
8. Remove fuel pump assembly (3) and gasket (13).
9. Remove the drive coupling (2) from crankcase fuel pump cavity and discard the drive coupling.
10. Remove and discard fuel pump gasket (13) and lock washers (15). Place the fuel pump in a clean, protected area until it is to be overhauled.

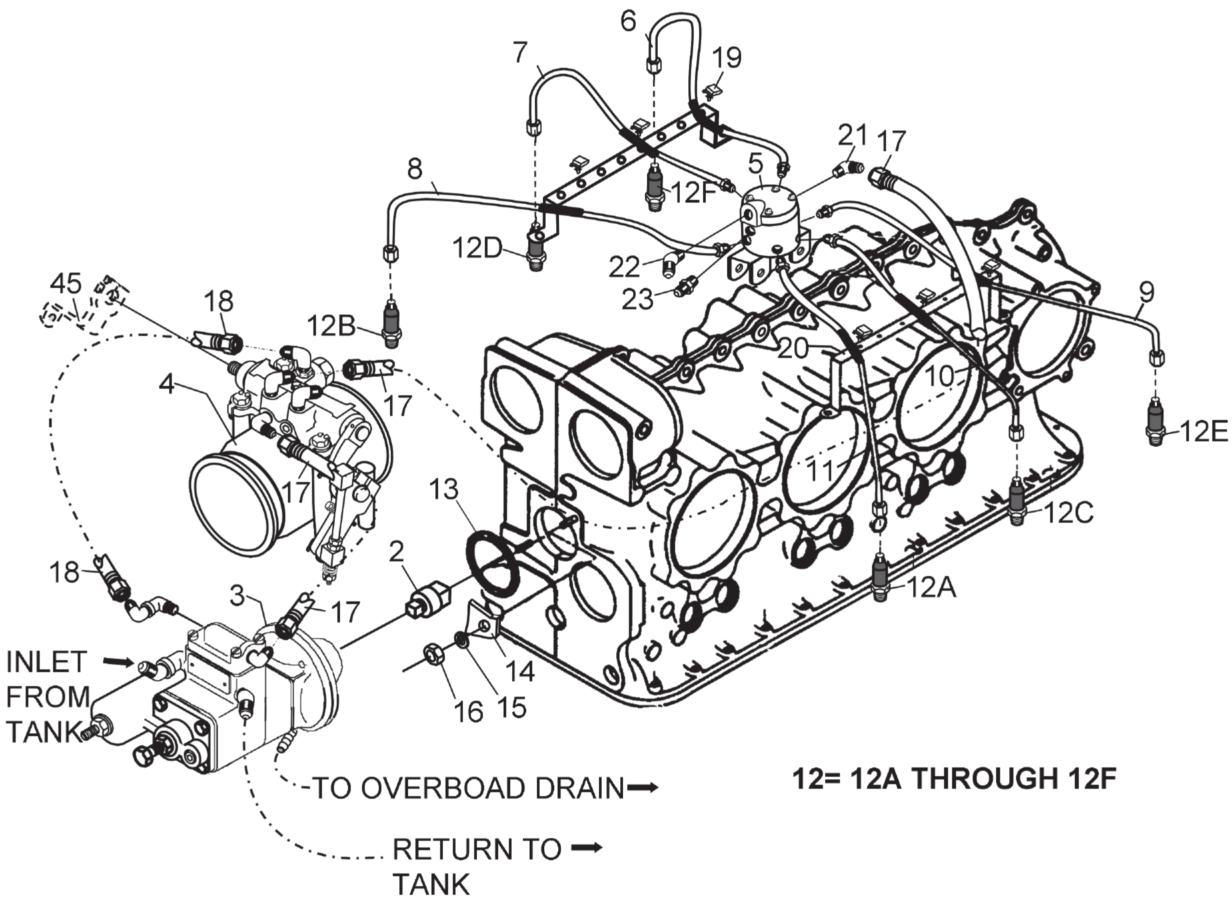

Figure 12-5. IO-550-A Fuel Injection Assembly A

1	Fuel Injection Kit	7	Tube Bend Assy	13	Gasket	19	Clamp Assy
2	Coupling	8	Tube Bend Assy	14	Washer	20	Bracket
3	Pump Assy.	9	Tube Bend Assy	15	Lock Washer	21	Elbow
4	Throttle Assy	10	Tube Bend Assy	16	Nut	22	Elbow
5	Fuel Manifold Assy.	11	Tube Bend Assy	17	Hose Assy	23	Tube Fitting
6	Tube Bend Assy	12	Tuned Injector Nozzle Kit	18	Hose Assy	45	Airframe Part

12-4.2. IO-550-B Fuel Injection System Removal B

1. Mark each fuel injection line (Figure 12-6) (14, 15, 16 & 17) with its cylinder number to facilitate reinstallation.

WARNING

Fuel injection lines must not be bent or deformed. Discard and replace bent, chafed, or deformed fuel injection lines.

2. Fuel injection line removal:
   a. Disconnect fuel lines (14, 15, 16 & 17) from fuel injector nozzles (31A-F).
   b. Disconnect fuel lines (14, 15, 16 & 17) from the fuel manifold valve assembly (4). Compress the spring legs of each clamp (33) and remove fuel lines from engine.
3. Remove and discard the fuel injector nozzles (31A-F) from each cylinder.
4. Loosen and remove the screws (40), washers (30), lock washers (5) and clamps (38, 39) securing the fuel hoses (28 & 29) to the crankcase; discard the lock washers (32).
5. Disconnect and remove the fuel hose (29) between the manifold valve assembly (4) and the throttle and control assembly (8).
6. Disconnect and remove the fuel hoses (28) between the fuel pump (3) and the throttle and control assembly (8).
7. Loosen and remove the clamp (9) and hose (7) connecting the throttle and control assembly to the induction manifold; discard the hose (7).
8. Remove bolts (13) and washers (12) securing the throttle and control assembly (8) to the oil sump. Remove the throttle and control unit (8) as an assembly from the oil sump. Place the throttle and control unit assembly in a clean, protected area until it is overhauled or packed for core return.
9. Remove the crankcase backbone hardware that secures the fuel manifold valve to the engine and remove fuel manifold valve (4). Place the fuel manifold valve in a clean, protected area until it is overhauled or packed for core return.
10. Remove the fasteners securing the fuel distribution tube brackets (21 & 22) from the engine and store for cleaning.
11. Remove nuts (36), lock washers (35) and hold down washers (34); discard the lock washers (35).
12. Remove the fuel pump assembly (3) and gasket (6) from the crankcase; discard the gasket (6).Place the fuel pump assembly in a clean, protected area until it is overhauled or packed for core return.
13. Remove and discard the drive coupling (2) from crankcase fuel pump cavity.

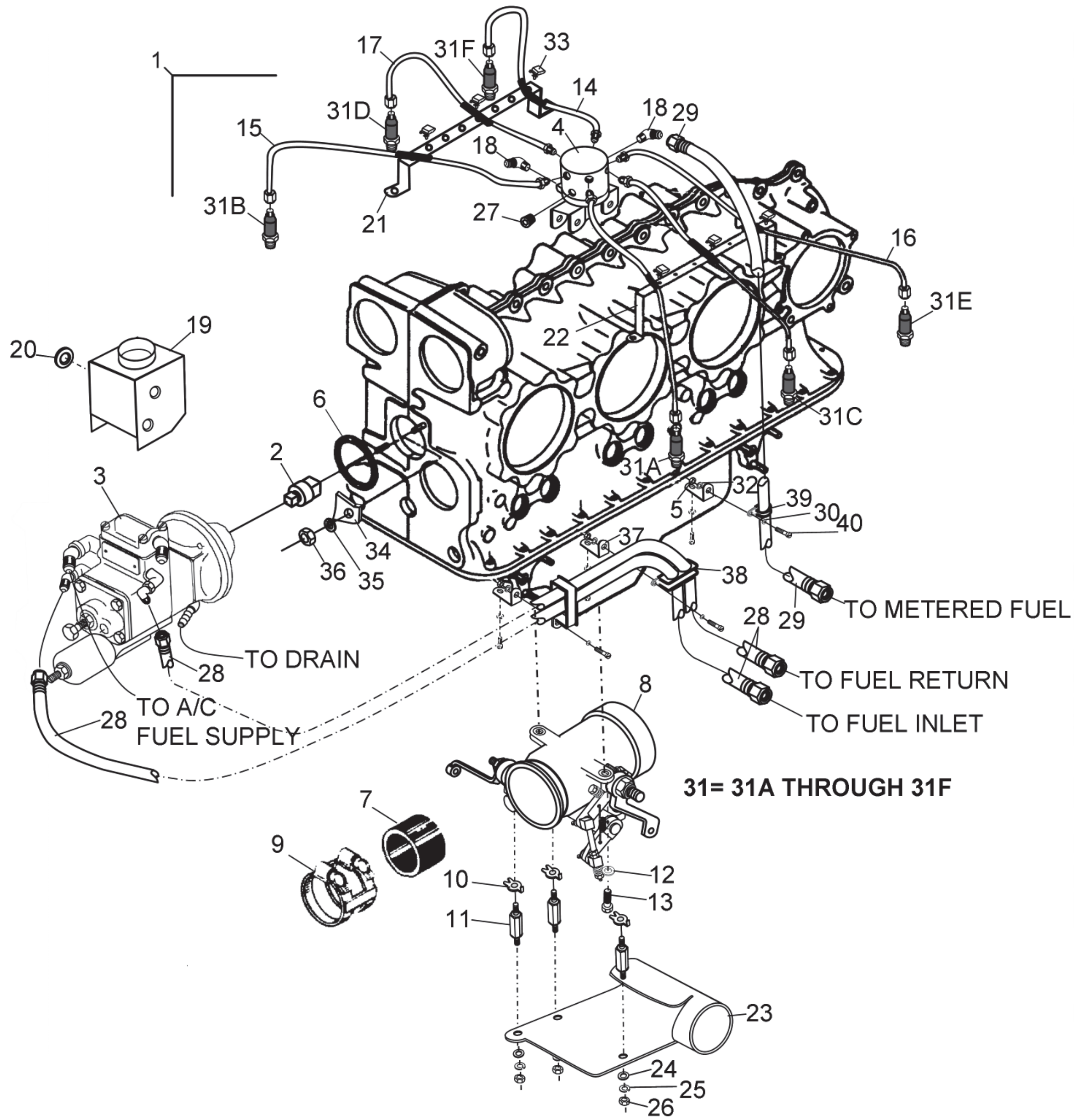

Figure 12-6. IO-550-B Fuel Injection Assembly B

1	Fuel Injection System	11	Screw	21	Fuel Dist. Tube Bracket	31	Tuned Injector Nozzle Kit
2	Coupling	12	Washer	22	Fuel Dist. Tube Bracket	32	Lock Washer
3	Fuel Pump Assy.	13	Screw	23	Shroud	33	Clamp
4	Fuel Manifold Valve Assy	14	Tube Assy	24	Washer	34	Hold Down Washer
5	Nut	15	Tube Assy	25	Washer	35	Lock Washer
6	Gasket	16	Tube Assy	26	Nut	36	Nut
7	Hose	17	Tube Assy	27	Plug	37	L Bracket
8	Throttle & Control Assy	18	45° Elbow	28	Hose Assy	38	Clamp
9	Clamp Assy	19	Shroud	29	Hose Assy	39	Clamp
10	Washer	20	Grommet	30	Washer	40	Screw

12-4.3. IO-550-C Fuel Injection System Removal C

1. Mark each fuel injection line (Figure 12-7) (8. 9. 10 & 11) with its cylinder number to facilitate reinstallation.

WARNING

Fuel injection lines must not be bent or deformed. Discard and replace bent, chafed, or deformed fuel injection lines.

2. Fuel injection line removal:
   a. Disconnect fuel lines (8. 9. 10 & 11) from fuel the injector nozzles (12).
   b. Disconnect fuel lines from fuel manifold valve assembly (7) and remove fuel lines from engine.
3. Remove fuel injector nozzles (12) from each cylinder.
4. Remove the fuel hose (18) between the throttle and control assembly and fuel pump. Remove fuel hose (19) between the throttle and control assembly and manifold valve. Discard fuel hoses (18 & 19).
5. Remove attaching hardware (20, 21, 22 & 64) and fuel control shroud (23).
6. Loosen and remove nut and bolt (33 & 34), brackets (31 & 32), bushings (29) sleeve (30) from the bracket (26). The hardware that attaches bracket (26) to the engine was removed during magneto and accessory drive adapter disassembly.
7. Remove bracket (26) and discard the self locking nut (34).
8. Remove nuts (22) and bracket (36).
9. Remove the throttle and control assembly (5) from engine; remove and discard the gasket (6).
10. Place the throttle and control unit assembly (5) in a clean, protected area until it is overhauled or packed for core return.
11. Remove the crankcase backbone hardware that secures the fuel manifold valve to the engine and remove the fuel manifold valve (7). Place the fuel manifold valve in a clean, protected area until it is overhauled or packed for core return.
12. Remove nuts (17) lock washers (16) and hold down washers (15) and remove the fuel pump assembly (3) and gasket (4) from the crankcase; discard the lock washers (16) and gasket (4).
13. Remove drive coupling (2) from crankcase fuel pump cavity.
14. Place the fuel pump in a clean, protected area until it is overhauled or packed for core return

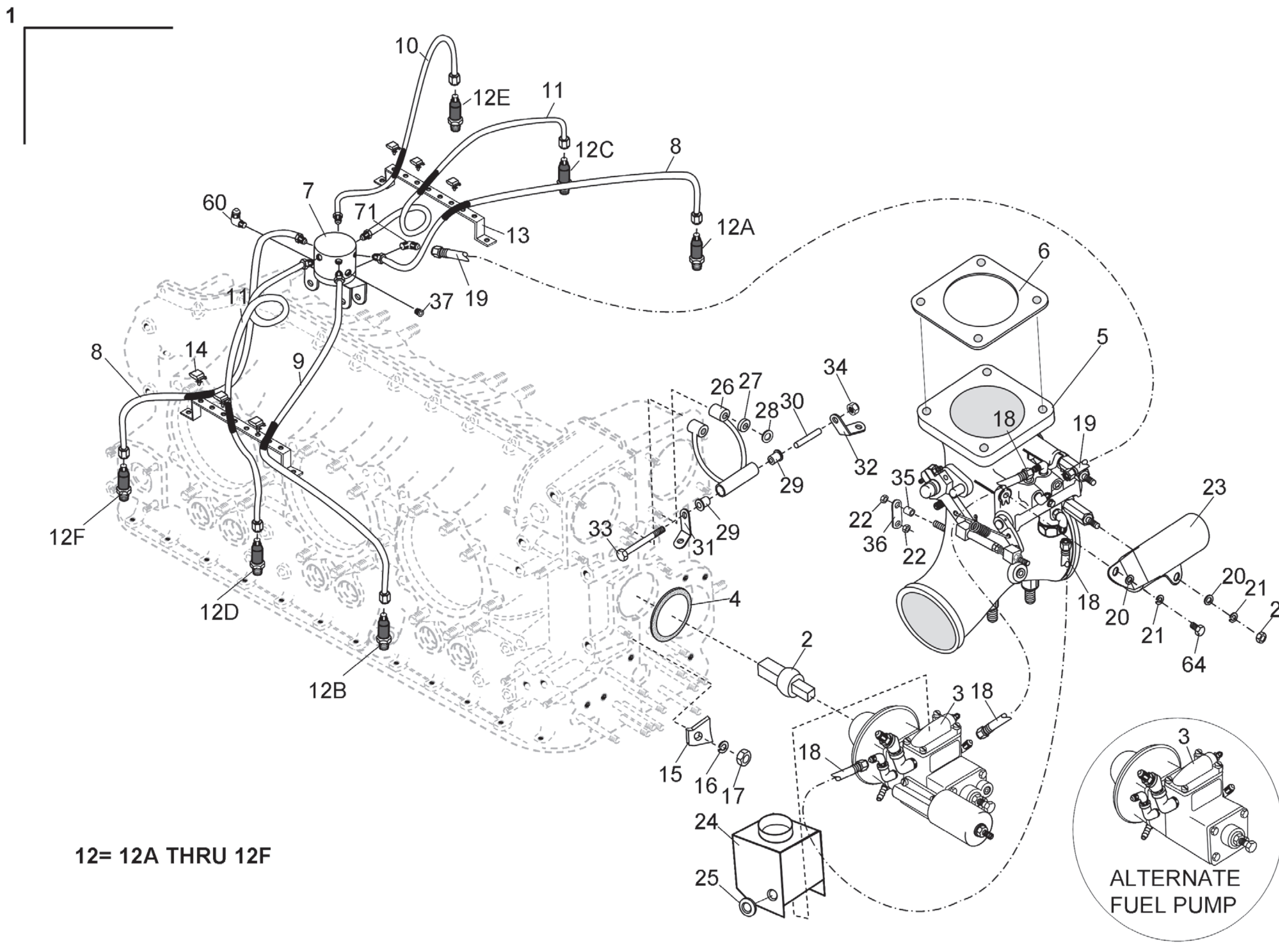

Figure 12-7. IO-550-C Fuel Injection Assembly C

1	Fuel Injection System	11	Tube Assy	21	Lock Washer	31	Bracket
2	Coupling	12	Tuned Nozzle Assy	22	Nut	32	Bracket
3	Fuel Pump.	13	Bracket	23	Fuel Control Unit Shroud	33	Bolt
4	Gasket	14	Clamp	24	Fuel Pump Shroud	34	Lock Nut
5	Throttle and Control Assy	15	Washer	25	Grommet	35	Spacer
6	Gasket	16	Lock Washer	26	Bracket Assy	36	Bracket
7	Fuel Manifold Valve Assy	17	Nut	27	Screw	37	Plug
8	Tube Assy	18	Hose Assy	28	Washer	60	90° Elbow
9	Tube Assy	19	Hose Assy	29	Bushing	64	Bolt
10	Tube Assy	20	Washer	30	.Sleeve		

12-4.4. IO-550 G, N, P, R Fuel Injection System Removal G N P R

1. Mark each fuel injection line (Figure 12-8) (6 through 11) with its cylinder number to facilitate reinstallation.

WARNING

Fuel injection lines must not be bent or deformed. Discard and replace bent, chafed, or deformed fuel injection lines.

2. Fuel injection line removal:
   a. Disconnect fuel lines (6 through 11) from fuel nozzles (5A-F).
   b. Disconnect the fuel lines from fuel manifold valve assembly (4). Compress spring legs of each clamp (28) and remove fuel lines from engine.
3. Remove fuel injector nozzles (5A-F) from each cylinder.
4. Remove fuel hoses:
   a. Remove the fuel hoses (20, 21 & 22) from the tee (Figure 12-9)(65) between the fuel metering unit (Figure 12-8) (3) and fuel pump (2); discard the fuel hoses (20, 21 & 22).
   b. For engines equipped with a fuel flow transducer: remove the fuel hose (20 & 22) from the tee (Figure 12-9) (65) between the fuel metering unit (Figure 12-8) (3) and fuel pump (2). Discard the fuel hoses (20 & 22). Refer to the airframe manufacturer's instructions for disposition of the fuel flow transducer.
5. Remove fuel hose (24) from the throttle body (3) fuel metering unit outlet fitting and fuel manifold valve (4) inlet fitting.
6. Remove four bolts (Figure 12-13) (17), lock washers (14), and washers (15) that secure the throttle body to the induction manifold; discard the lock washers (14).
7. Remove the throttle and metering unit from the induction manifold. Remove and discard gasket (1). Place the throttle and fuel metering unit in a clean, protected area until it is overhauled or packed for core return.
8. Remove crankcase fasteners securing the fuel manifold valve to the crankcase. Place the fuel manifold valve assembly in a clean, protected area until it is overhauled or packed for core return.
9. Remove nuts (Figure 12-8) (19) lock washers (18) and hold-down washers (17) securing the fuel pump assembly to the crankcase. Remove fuel pump assembly (2) and gasket (15) from the crankcase. Discard the fuel pump gasket (15) and lock washers (18).
10. Remove the drive coupling (16) from crankcase fuel pump cavity.
11. Place the fuel pump in a clean, protected area until it is overhauled or packed for core return.

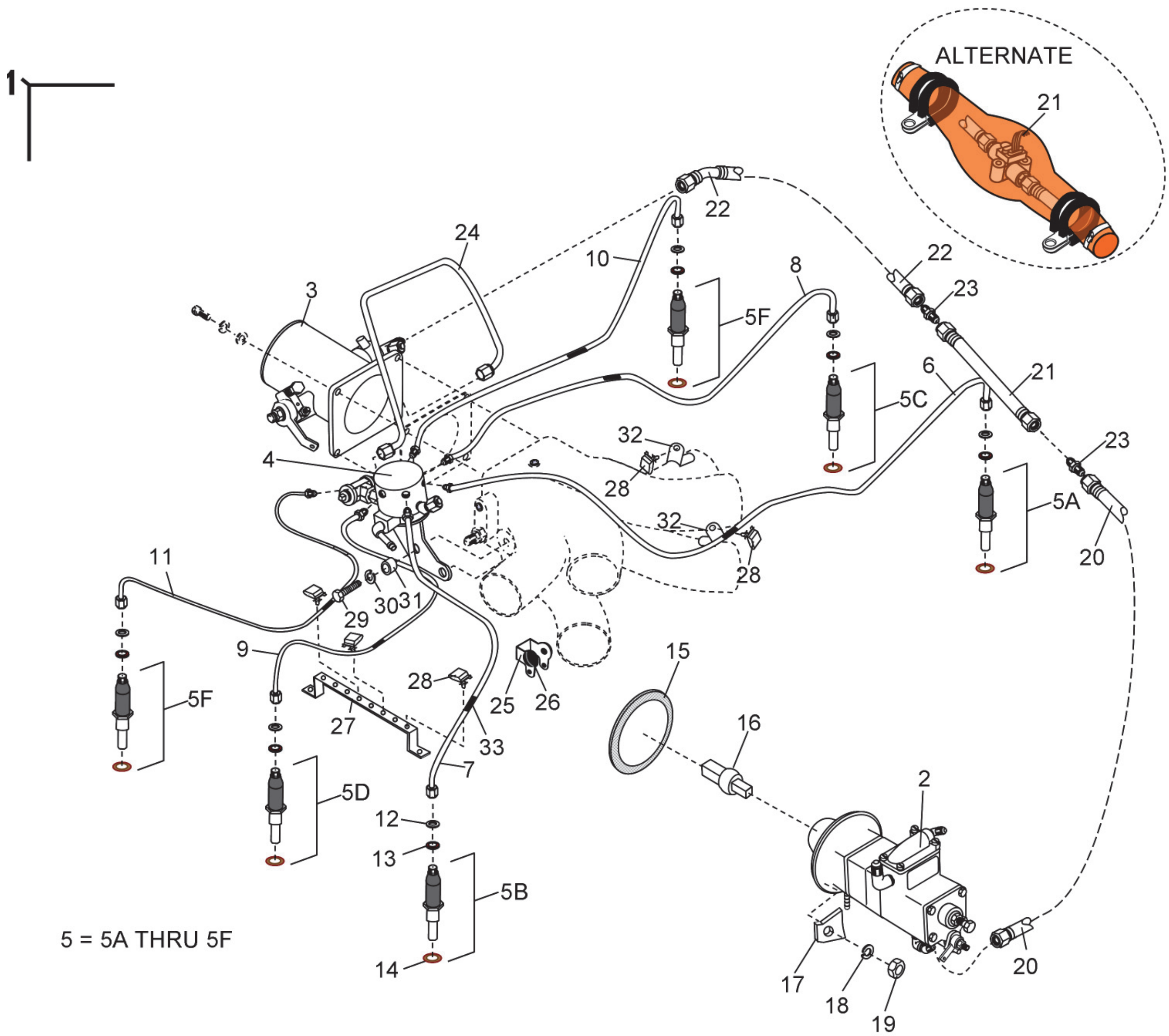

Figure 12-8. IO-550-G, N, P, & R Fuel Injection Assembly G N P R

1	Fuel Injection System	10	Tube Assy	19	Nut	27	Bracket
2	Fuel Pump	11	Tube Assy	20	Hose Assy	28	Clamp
3	Throttle and Metering Assy	12	Washer	21	Hose Assy	29	Bolt
4	Fuel Manifold Valve Assy	13	Washer	21	Transducer	30	Washer
5	Position Tuned Nozzle	14	Copper Washer	22	Hose Assy	31	Spacer
6	Tube Assy	15	Gasket	23	In-line Coupling	32	Bracket
7	Tube Assy	16	Coupling	24	Tube Assy	33	Protector
8	Tube Assy	17	Hold Down Washer	25	Bracket Assy		
9	Tube Assy	18	Lock Washer	26	Bumper		

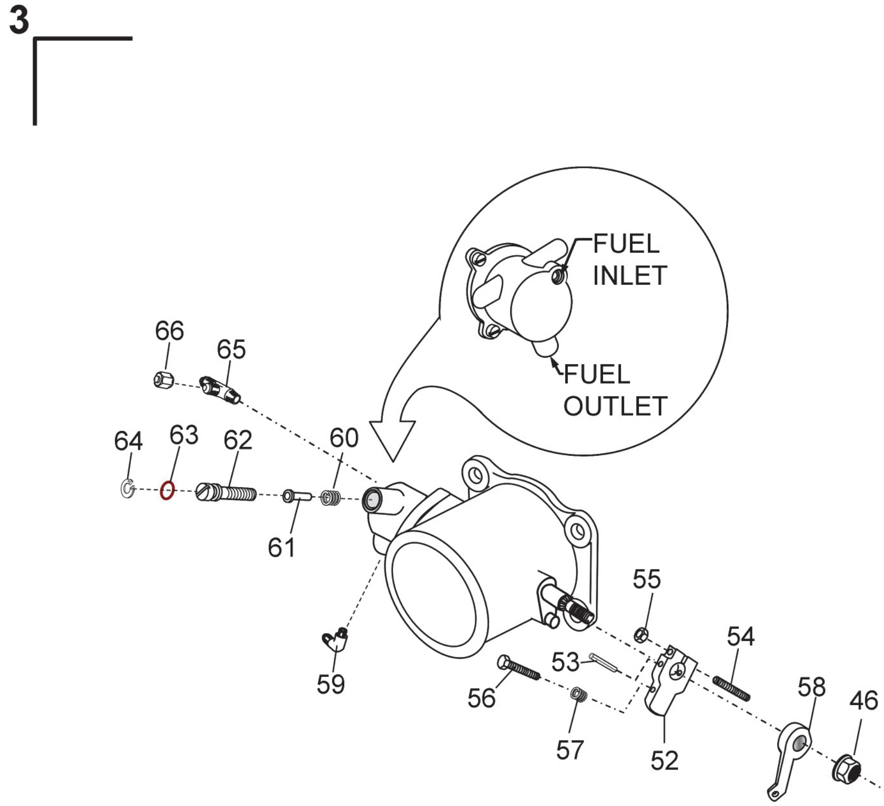

Figure 12-9. IO-550-G, N, P & R Throttle and Metering Assembly G N P R

3	Throttle and Metering Assy	55	Nut	60	Nut	65	Tee
46	Lock Nut	56	Screw	61	Bushing	66	Cap
52	Lever	57	Spring	62	Screw		
53	Pin	58	Control Lever	63	Seal		
54	Screw	59	90° Elbow	64	Ring		

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12-5. Induction System Removal

12-5.1. IO-550-A Induction System Removal A

1. Remove and discard the duct (Figure 12-10) (24) from the induction manifold (13). Remove the nut (23), washer (22), bolts (20), bracket (19) and spacers (21) from the elbows (10 & 11) and induction manifold (13).
2. Loosen the clamps (8) and disconnect the hoses from the induction system joints between the elbows (10 & 11) and the 1-3-5 and 2-4-6 side induction tubes.
3. Loosen the clamps (8) and disconnect the hoses between the elbows (10 & 11) and the induction manifold (13).
4. Remove the screws that attach the balance tube bracket (15) to the oil sump and crankcase.
5. Remove the clamp (16) and bracket (15) from the balance tube (17) and the oil sump.
6. Loosen the clamps (8) and disconnect the hoses (9) from the balance tube (17), Remove the balance tube from the front of the 1-3-5 and 2-4-6 side induction system joints.
7. Loosen the clamps (7 & 8) and hoses (9) at the 1-3-5 and 2-4-6 side induction system joints.
8. Remove screws (6), lock washers (5) and washers (4); discard lock washers (5).
9. Remove the risers (2 & 3) from the cylinders and disconnect the risers from the hoses (9) and clamps (7 & 8); discard the hoses (9).
10. Place the induction manifold, elbows, risers, clamps, bracket, balance tube and fasteners in a clean, protected area until ready for overhaul inspection.

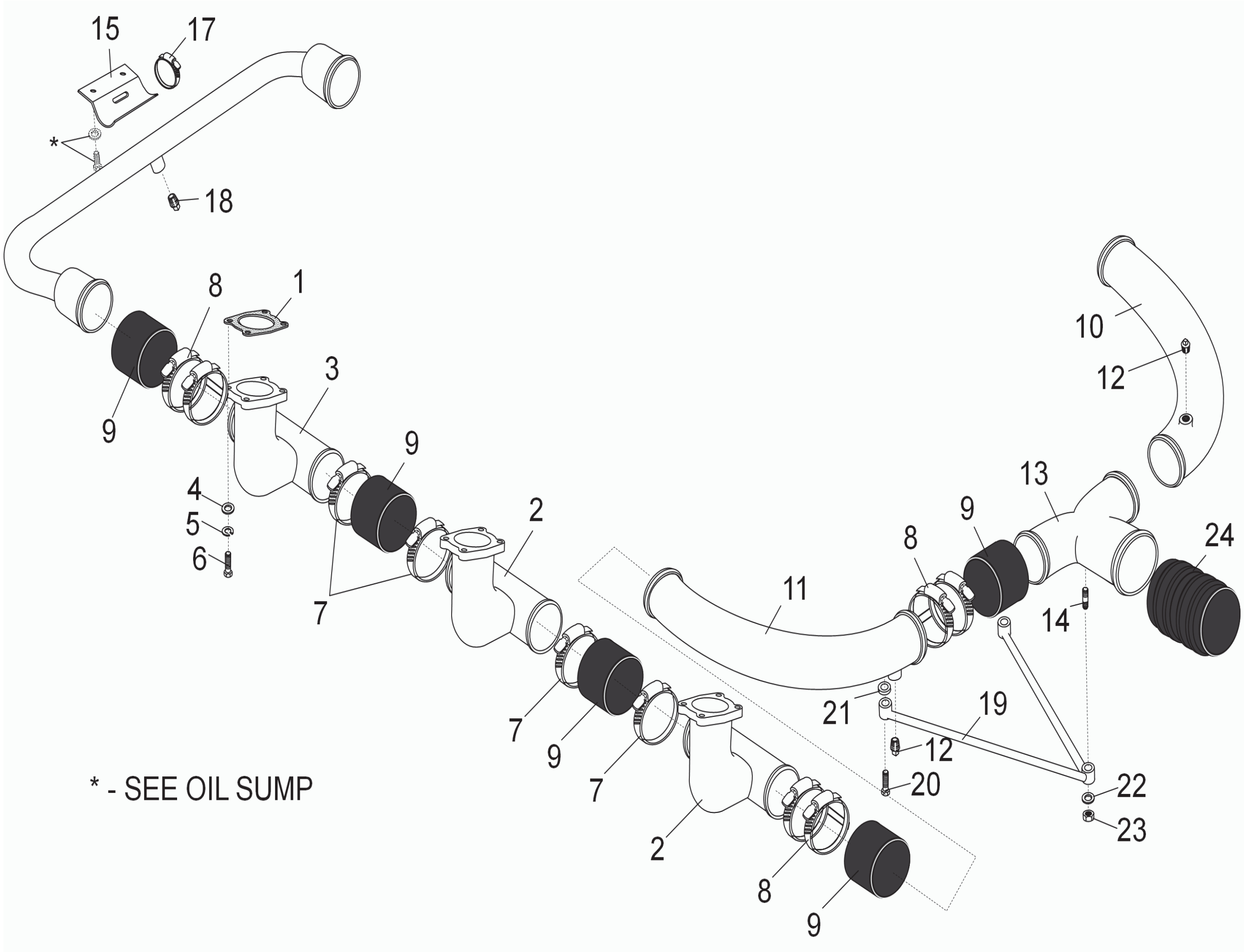

Figure 12-10. IO-550-A Induction Assembly A

1	Gasket	7	Clamp	13	Riser	19	Bracket
2	Elbow	8	Clamp	14	Stud	20	Screw
3	Elbow	9	Hose	15	Bracket	21	Spacer
4	Washer	10	Intake Tube	16	Clamp	22	Washer
5	Lock Washer	11	Intake Tube	17	Balance Tube	23	Nut
6	Screw	12	Plug	18	Plug	24	Duct

12-5.2. IO-550-B Induction System Removal B

1. Loosen clamps (Figure 12-11) (7 & 8) and remove the manifold assembly (10). Remove clamps and hoses (7, 9) from elbow risers (2 & 3); discard the hoses (9).
2. Remove the oil sump screws that attach the balance tube bracket (12) to the oil sump and crankcase.
3. Remove clamp (13) and bracket (12) from the balance tube (14) and the oil sump.
4. Loosen clamps (8) and remove the balance tube (14) from front hoses (9).
5. Remove screws (6), lock washers (5) and washers (4); discard lock washers (5). Remove risers (2, 3) from cylinders.
6. Place the induction manifold, risers, clamps, balance tube and fasteners in a clean, protected area until ready for overhaul inspection

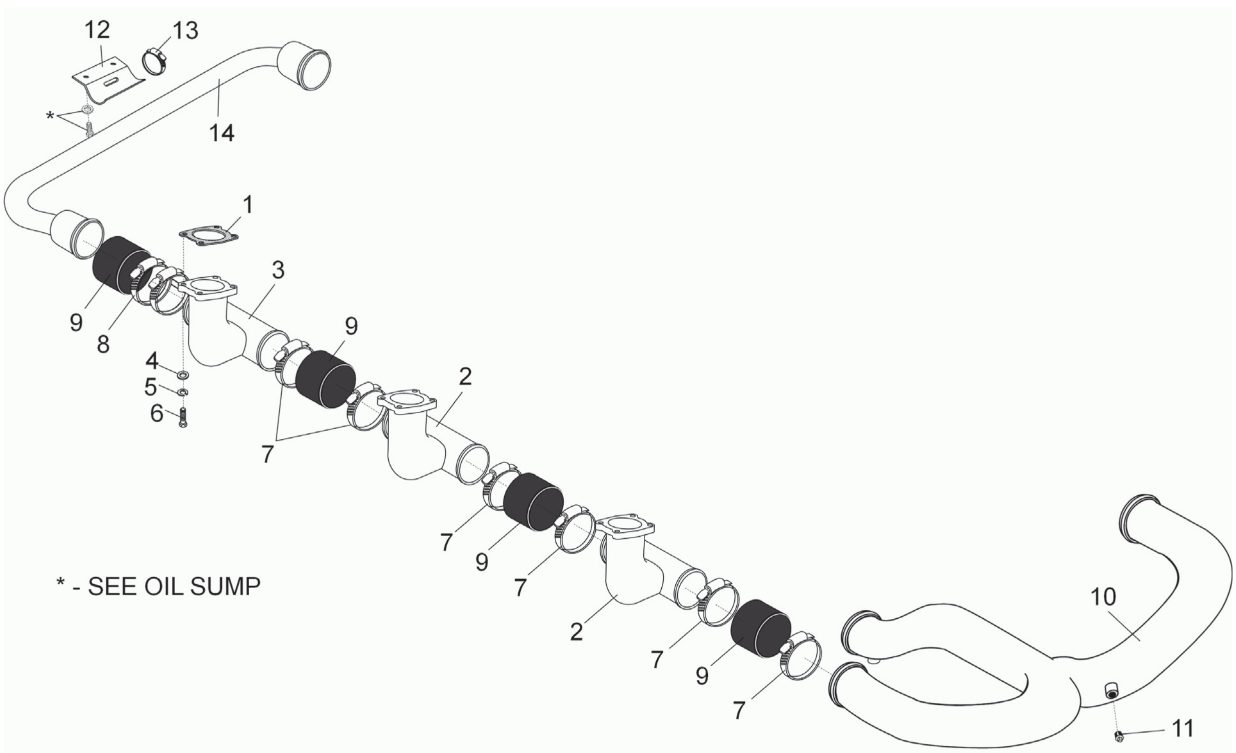

Figure 12-11. IO-550-B Induction Assembly B

1	Gasket	5	Lock Washer	9	Intake Hose	13	Clamp
2	Elbow, Riser	6	Screw	10	Riser Manifold Assembly	14	Balance Tube
3	Elbow, Riser	7	Hose Clamp	11	Plug		
4	Washer	8	Clamp	12	Bracket		

12-5.3. IO-550-C Induction System Removal C

1. Loosen the clamps (Figure 12-12) (7, 8) at each joint between the elbows (10 & 11), risers (2 & 3) and balance tube (14).
2. Remove oil sump screws that attach the balance tube bracket (12) to the oil sump and crankcase.
3. Remove clamp (13) and bracket (12) from the balance tube (14) and oil sump.
4. Remove balance tube (14) from the front hoses (9).
5. Remove screws (6), lock washers (5) and washers (4); discard lock washers (5). Remove risers (2, 3) from cylinders.
6. Remove the 1-3-5 and 2-4-6 side induction tube assembly from the engine.
7. Remove clamps (7 & 8) and hoses (9) from elbows (10, 11) and risers (2 & 3; discard the hoses (9).
8. Place the induction elbows, risers, clamps, balance tube and fasteners in a clean, protected area until ready for overhaul inspection.

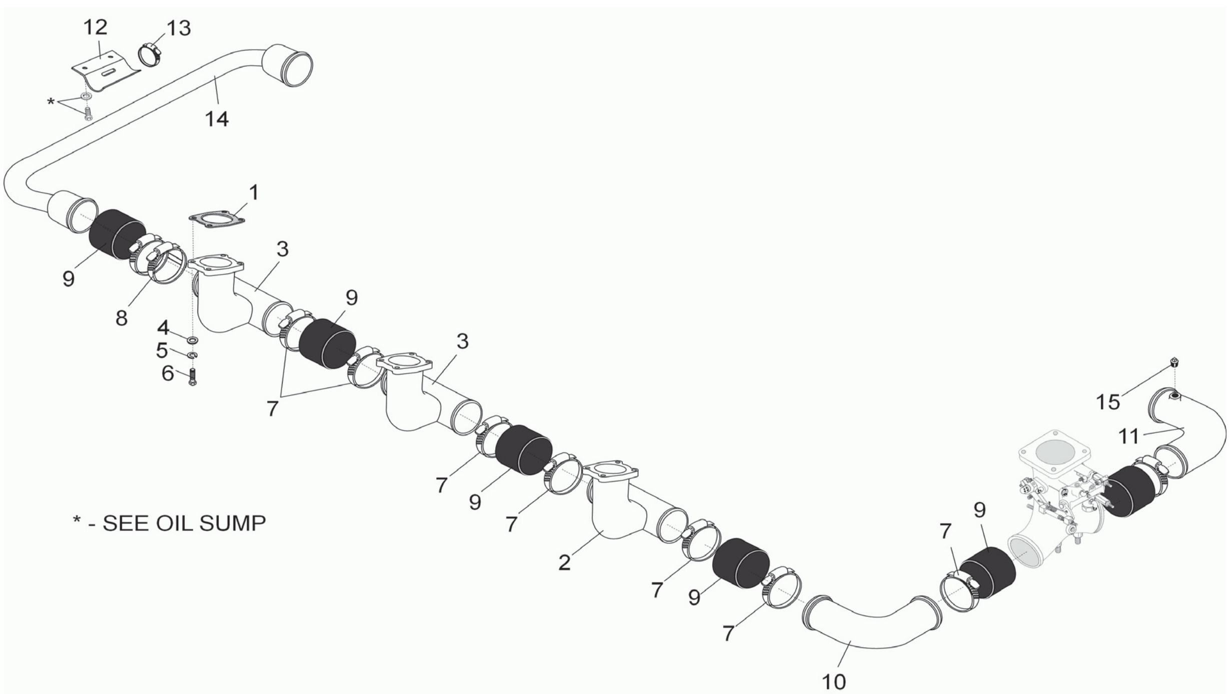

Figure 12-12. IO-550-C Induction Assembly C

1	Gasket	5	Lock Washer	9	Hose	13	Clamp
2	Elbow Riser	6	Screw	10	Tube Assy.	14	Balance Tube
3	Elbow Riser	7	Clamp	11	Tube Assy.	15	Plug
4	Washer	8	Clamp	12	Bracket		

12-5.4. IO-550-G, N, P, & R Induction System Removal G N P R

1. Remove nuts (Figure 12-13) (16), lock washers (15), and washers (14) from all induction flanges at the cylinders. Discard lock washers (15).
2. Loosen the hose clamps (10) to increase hose (9) flexibility and lift the entire induction and throttle assembly from engine as a unit.
3. Disconnect the induction tubes (6 through 11), hoses (9) and clamps (10) from balanced induction manifold (1). Discard the hoses (9).
4. Remove gaskets (12) from all cylinders and discard.
5. Remove crankcase backbone hardware that secures the manifold support bracket to the engine and remove support bracket.
6. Remove and discard the rubber bumper (11).

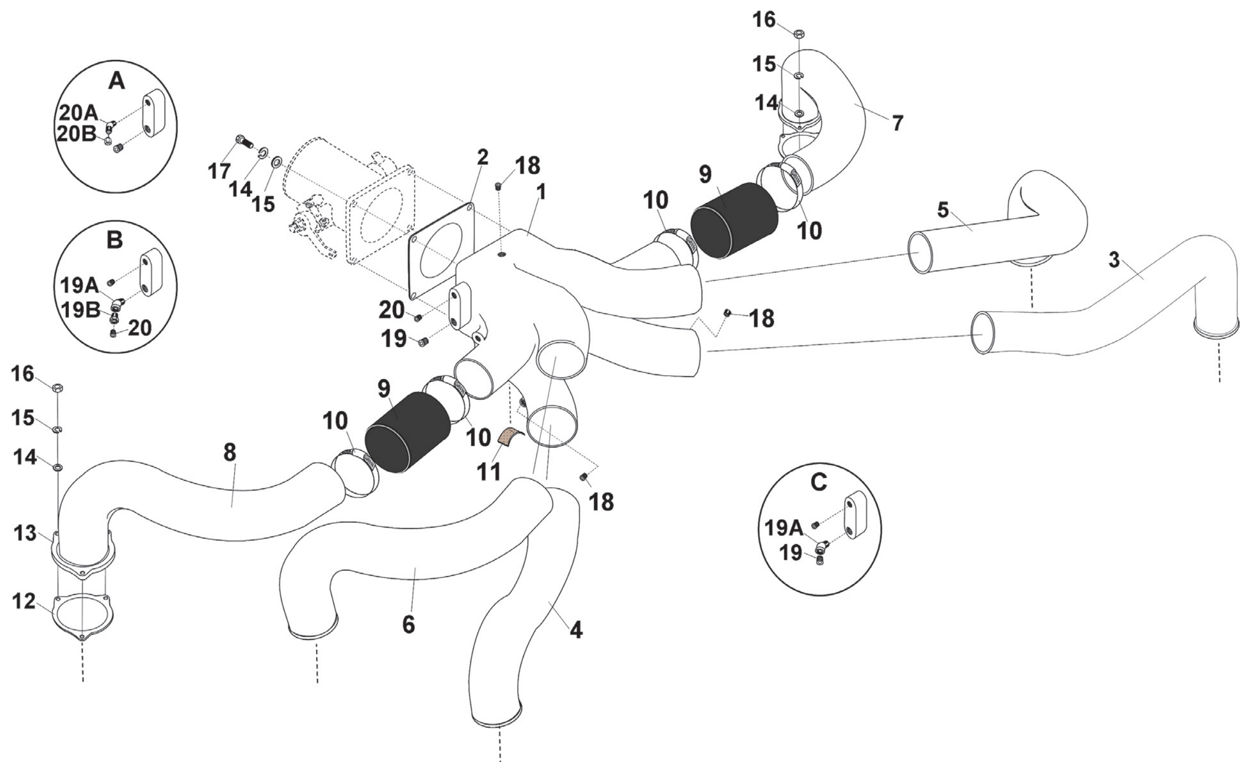

Figure 12-13. IO-550-G, N, P, & R Induction Assembly G N P R

1	Manifold	7	Intake Tube	13	Flange	19	45° Fitting
2	Gasket	8	Intake Tube	14	Washer	19A	Plug
3	Intake Tube	9	Hose	15	Lock Washer	19B	Reducer Bushing
4	Intake Tube	10	Hose Clamp	16	Nut	20	Plug
5	Intake Tube	11	Rubber Bumper	17	Screw	20A	90° Fitting
6	Intake Tube	12	Gasket	18	Plug	20B	Cap

12-6. Exhaust System Removal

Refer to the airframe manufacturer's instructions for exhaust system removal and overhaul instructions.

12-7. Oil Cooler Removal

IO-550 oil coolers interface with the 2-4-6 crankcase oil gallery. The oil coolers assemblies vary slightly in capacity and available interface ports but removal instructions are essentially the same for all IO-550 engine models. Instructions are provided to address the differences.

NOTE: Replace any oil cooler exhibiting structural damage, bent/broken or cracked cooling fins with a new or serviceable oil cooler. Oil cooler mounting flange weld repairs are permitted only at FAA approved Part 145 repair stations.

NOTE: The oil temperature control valve is available in multiple operating ranges. Some control valves have a cap on the exposed portion of lead; others are flat. Physical characteristics of the oil temperature control valve have no impact on valve operation.

12-7.1. Oil Cooler Removal A B

1. Remove the nuts (Figure 12-14) (7), lock washers (6), and washers (5) from the upper oil cooler mounting studs; discard the lock washers (6).
2. Remove the nuts (11), lock washers (10), and washers (9) from the lower aft oil cooler mounting studs; discard the lock washers (10).
3. Remove the flanged nuts (8), lock washers (6), and washers (5) from the lower forward oil cooler mounting studs; discard the lock washers (6).
4. Remove the oil cooler (1) from the crankcase studs.
5. Remove and discard the gasket-washers (4) and gasket (3).
6. Remove the oil temperature control valve (15) and gasket (16); discard the gasket (16).
7. Take a photo of, or sketch, the location and orientation of fittings (12, 13, 14) installed in the oil cooler. Remove the fittings from the oil cooler before sending the oil cooler out for repair.
8. Send the oil cooler to an FAA approved Part 145 repair station.

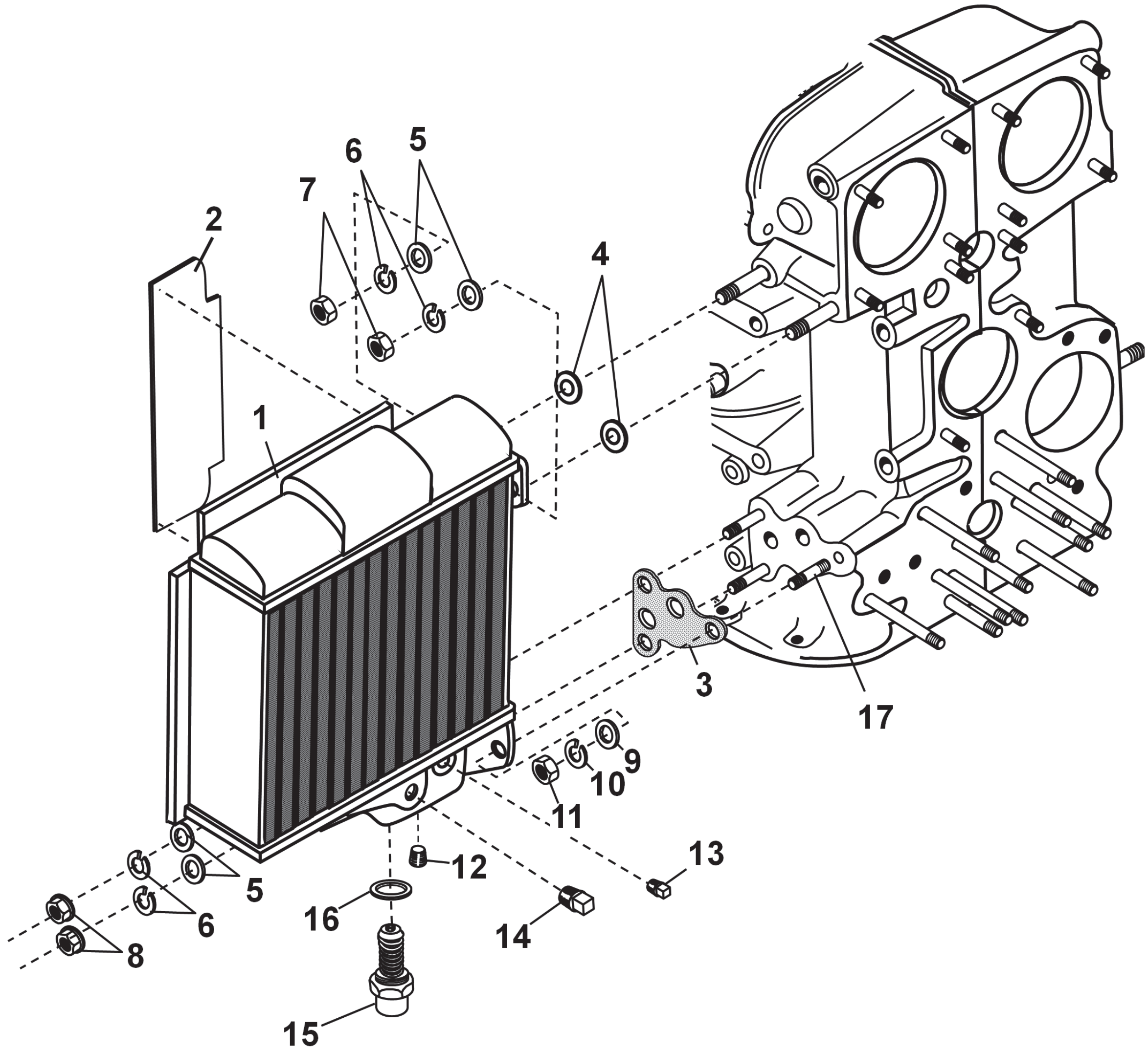

Figure 12-14. IO-550-A & B Oil Cooler A B

1	Oil Cooler	5	Washer	9	Washer	13	Plug
2	Baffle	6	Lock Washer	10	Lock Washer	14	Plug
3	Gasket	7	Nut	11	Nut	15	Oil Temp.Control Valve
4	Gasket-Washer	8	Flanged Nut	12	Plug	16	Gasket

12-7.2. Oil Cooler Removal C

1. Remove the nuts (Figure 12-15) (7), lock washers (6), and washers (5) from the upper oil cooler mounting studs; discard the lock washers (6).
2. Remove the nuts (11), lock washers (10), and washers (9) from the lower aft mounting studs; discard the lock washers (10).
3. Remove the flanged nuts (8), lock washers (6), and washers (5) from the lower forward mounting studs; discard the lock washers (6).
4. Remove the oil cooler (1) from the crankcase studs.
5. Remove the upper and lower dynafocal engine mount legs (Section 12-14.2) from the 2-4-6 crankcase studs.
6. Remove and discard the gasket-washers (4) and O-ring seals (12).
7. Remove the oil temperature control valve (18) and gasket (17); discard the gasket (17).
8. Take a photo of, or sketch, the location and orientation of fittings (13, 14, 15 & 16) installed in the oil cooler. Remove the fittings from the oil cooler before sending the oil cooler out for repair.
9. Send the oil cooler to an FAA approved Part 145 repair station.

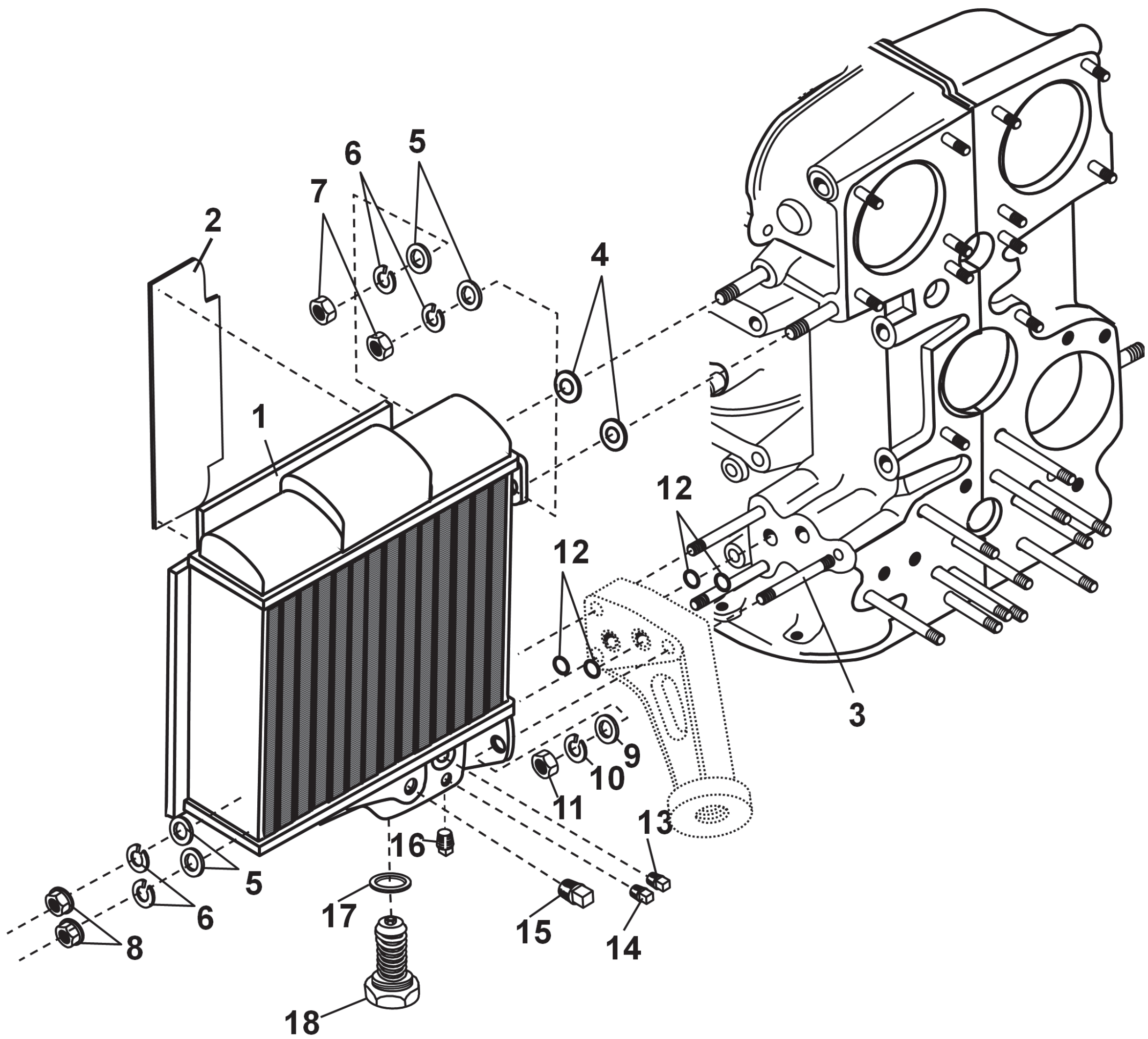

Figure 12-15. IO-550-C Oil Cooler C

1	Oil Cooler	6	Lock Washer	11	Nut	16	Plug
2	Baffle	7	Nut	12	O-ring	17	Gasket
3	Stud	8	Flanged Nut	13	Plug	18	Oil Temp.Control Valve
4	Gasket-Washer	9	Washer	14	Plug		
5	Washer	10	Lock Washer	15	Plug		

12-7.3. Oil Cooler Removal G N P R

1. Remove the nuts (Figure 12-16) (7), lock washers (6), and washers (5) from the upper oil cooler mounting studs; discard the lock washers (6).
2. Remove the nuts (11), lock washers (10), and washers (9) from the lower aft oil cooler mounting studs; discard the lock washers (10).
3. Remove the flanged nuts (8), lock washers (6), and washers (5) from the lower forward oil cooler mounting studs; discard the lock washers (6).
4. Remove the oil cooler (1) from the crankcase studs.
5. Remove and discard the gasket-washers (4) and gasket (3).
6. Remove the oil temperature control valve (15) and gasket (16); discard the gasket (16).
7. Take a photo of, or sketch, the location and orientation of fittings (12, 13, 14 & 18) installed in the oil cooler. Remove the fittings from the oil cooler before sending the oil cooler out for repair.
8. Send the oil cooler to an FAA approved Part 145 repair station.

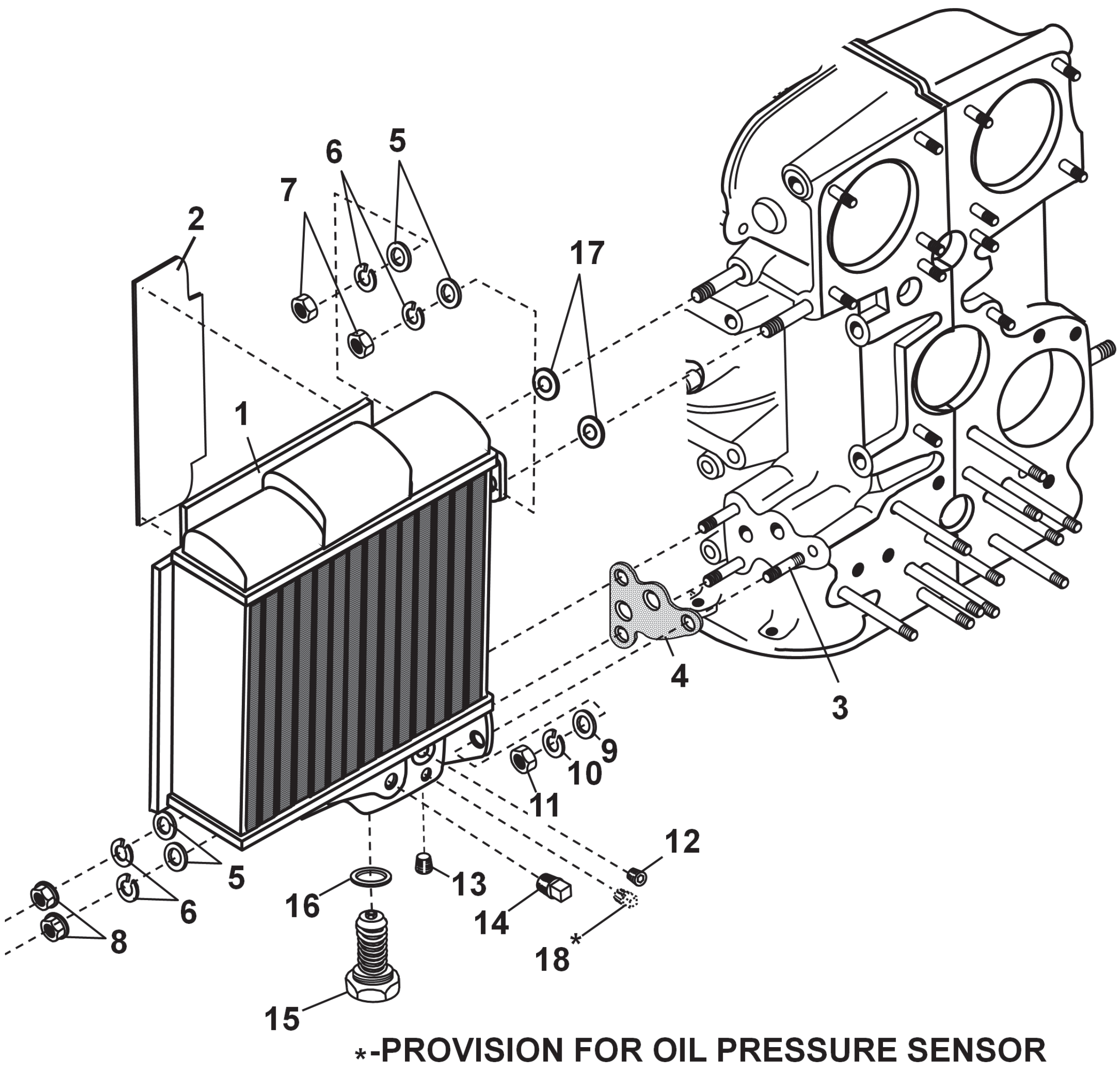

Figure 12-16. IO-550-G, N, P & R Oil Cooler G N P R

1	Oil Cooler	6	Lock Washer	11	Nut	16	Gasket
2	Baffle	7	Nut	12	Plug	17	Gasket-Washer
3	Gasket	8	Flanged Nut	13	Plug	18	See Aircraft Maintenance Manual
4	Stud	9	Washer	14	Plug		
5	Washer	10	Lock Washer	15	Oil Temp.Control Valve		

12-7.4. Oil Cooler Removal N

NOTE: The oil cooler configuration depicted on this page is used only on IO-550-N engines configured for aftermarket turbocharger installation.

1. Disconnect the hose (Figure 12-16) (21) between the tee fitting (19) and the starter adapter scavenge pump.
2. Disconnect the hoses to the turbocharger components according to the aircraft maintenance manual or the STC holder's instructions.
3. Remove the nuts (7), lock washers (6), and washers (5) from the upper oil cooler mounting studs; discard the lock washers (6).
4. Remove the nuts (11), lock washers (10), and washers (9) from the lower aft oil cooler mounting studs; discard the lock washers (10).
5. Remove the flanged nuts (8), lock washers (6), and washers (5) from the lower forward oil cooler mounting studs; discard the lock washers (6).
6. Remove the oil cooler (1) from the crankcase studs.
7. Remove and discard the gasket-washers (3) and gasket (2).
8. Remove the oil temperature control valve (14) and gasket (15); discard the gasket (15).
9. Take a photo of, or sketch, the location and orientation of fittings (12, 13, 16, 17, 18, 19 & 20) installed in the oil cooler. Remove the fittings from the oil cooler before sending the oil cooler out for repair.
10. Send the oil cooler to an FAA approved Part 145 repair station.

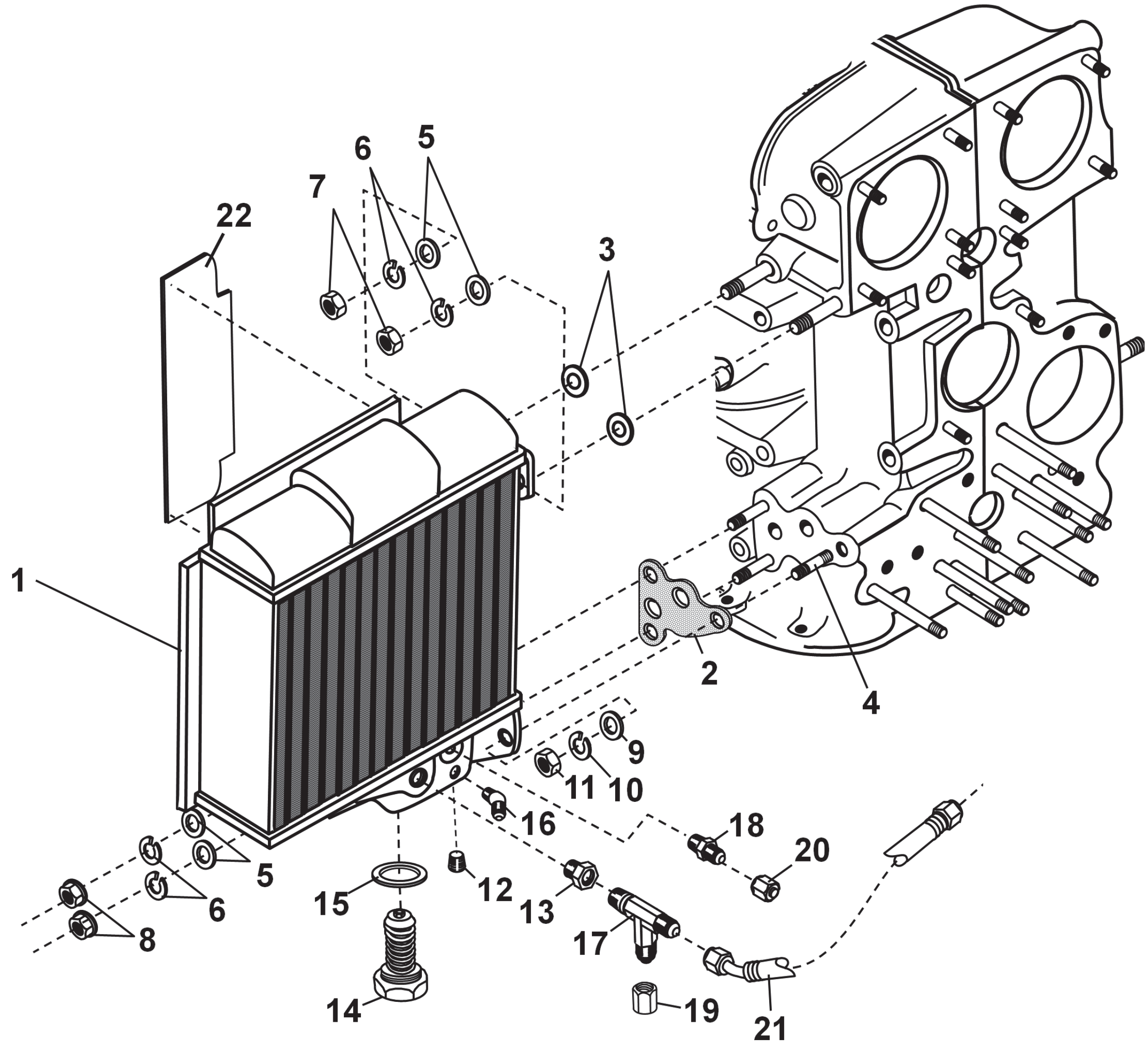

Figure 12-17. IO-550-N Oil Cooler N

1	Oil Cooler	7	Nut	13	Plug	19	Cap
2	Baffle	8	Flanged Nut	14	Plug	20	Cap
3	Gasket	9	Washer	15	Oil Temp.Control Valve	21	Hose
4	Stud	10	Lock Washer	16	Gasket	22	Baffle
5	Washer	11	Nut	17	Gasket-Washer		
6	Lock Washer	12	Plug	18	See Aircraft Maintenance Manual		

12-8. Oil Pump Removal

Permold series engines offer multiple oil pump configurations. The oil pump may have no tachometer drive adapter or it may feature an electronic or mechanical tachometer drive adapter. Removal instructions for all variations are the same. Disassembly instructions for each oil pump variation are provided in Chapter 13.

NOTE: To identify the oil pump installed on your engine, refer to Figure 12-18.

1. Remove and discard the safety wire securing the oil filter (Figure 12-18) (11) (accomplished prior to engine removal) and the plug (9).
2. Remove and discard the oil filter (11).
3. Remove three sets of nuts (8), lock washers (7), and washers (6); discard the lock washers (7).
4. Separate the oil filter adapter (13) and the gasket (12) from the oil pump housing (1); discard the gasket (12).
5. Remove the plug (9) and copper gasket (10) from the end of the oil suction tube; discard the copper gasket (10).
6. Remove the nuts (5), lock washers (4), and washers (3) from the studs securing the oil pump to the crankcase (all except 6 and 12 o'clock positions).
7. Remove the oil pump assembly (1) from the crankcase and store for disassembly in Chapter 13.

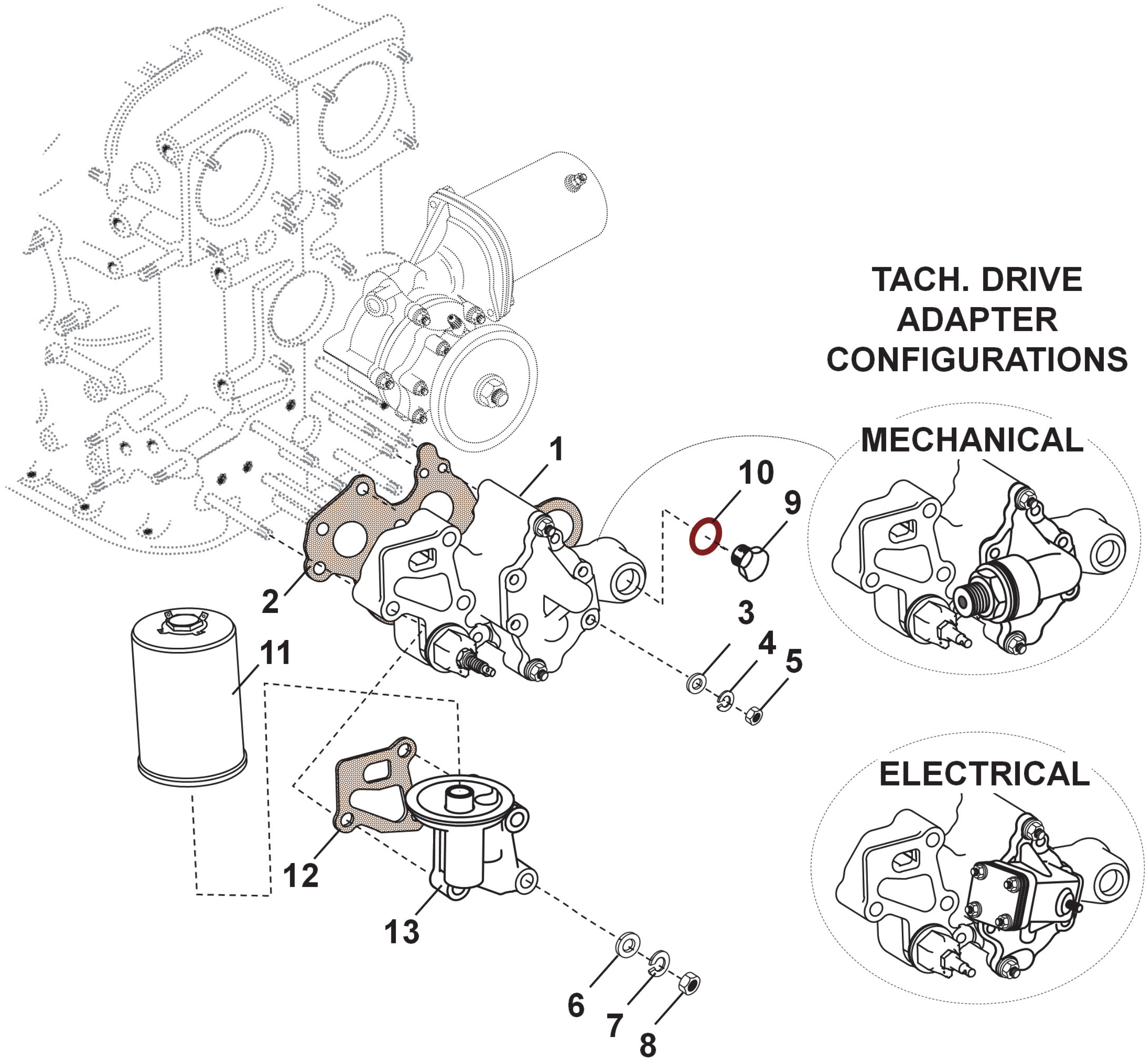

Figure 12-18. Oil Pump Assembly

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

12-9. Alternator Removal

The engine is fitted with a direct drive alternator as standard equipment. The alternator voltage and amperage output varies, depending on the engine model and specification. Optional belt-driven alternators are also available for a secondary, or back-up power source. Remove the alternator from the engine according to the appropriate instructions that match the installed engine configuration.

12-9.1. Direct Drive Alternator Removal

1. Disconnect the ram air cooling duct, if installed, according to the airframe manufacturer's instructions.
2. Remove the four sets of nuts (Figure 12-19)(10), lock washers (9), and washers (8) from the alternator (2) mounting studs; discard the lock washers (9).
3. Remove the alternator (2) from the crankcase studs.
4. Remove and discard the gasket (1) material from the crankcase and alternator mounting flange surfaces.
5. Remove the cotter pin (7), slotted nut (4) and thrust washer (6) from the shaft; discard the cotter pin (7) and thrust washer (6).
6. Remove the drive hub assembly (5) from the alternator shaft.
7. Remove and discard the Woodruff key (3).

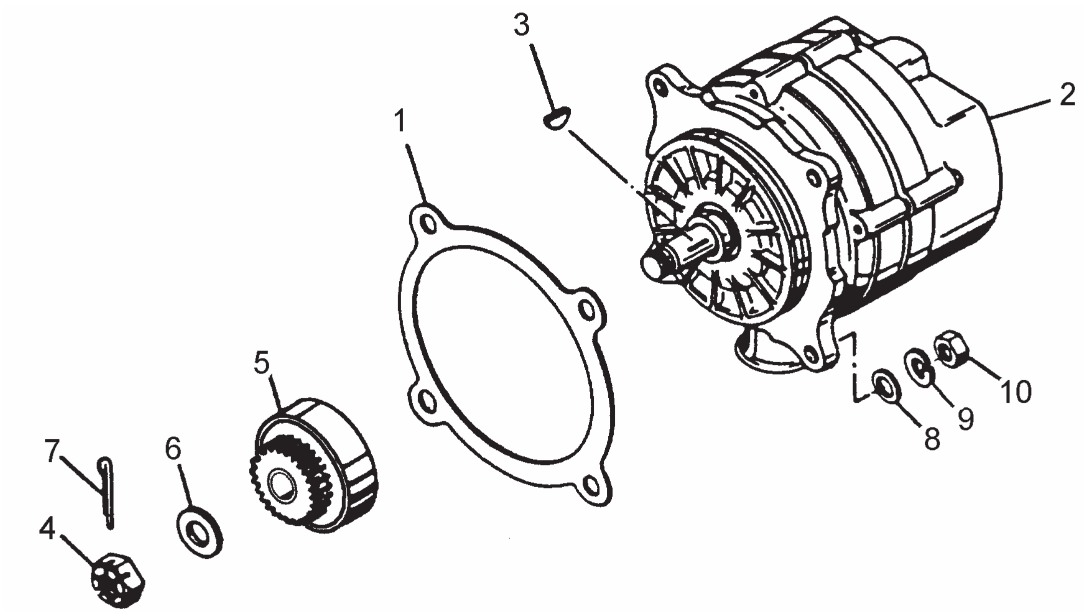

Figure 12-19. Direct Drive Alternator

1	Gasket	4	Slotted Nut	7	Cotter Pin	9	Lock Washer
2	Alternator	5	Drive Hub Assembly	8	Plain Washer	10	Nut
3	Woodruff Key	6	Thrust Washer				

12-9.2. Belt Driven Alternator Removal N

NOTE: Disconnect the electrical connections from the alternator according to the airframe manufacturer's instruction.

1. Remove the safety wire from the pivot screw (Figure 12-20) (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).

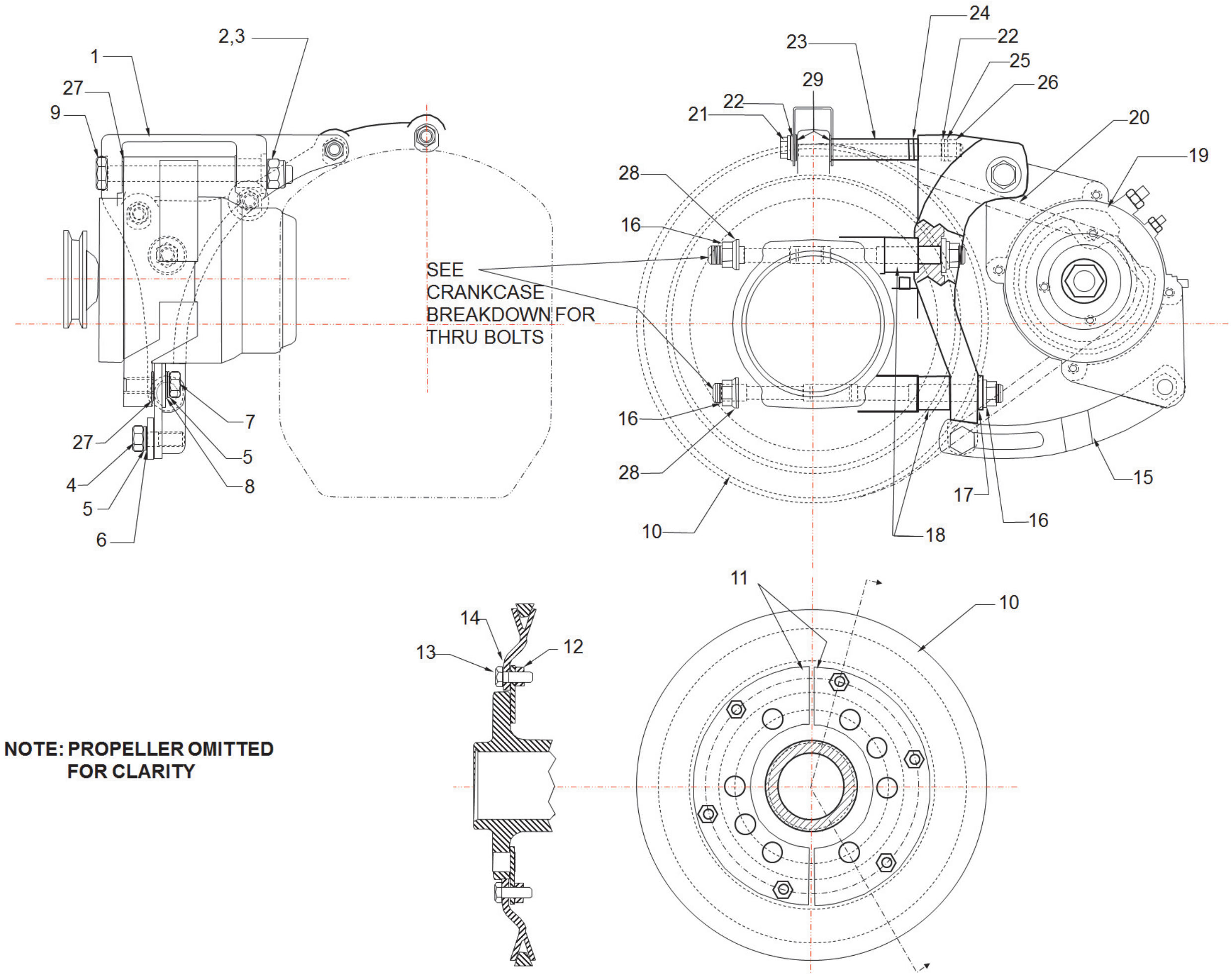

Figure 12-20. Belt Driven Alternator Bracket Assembly

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. Place the alternator in safe storage awaiting overhaul or core exchange.

12-9.3. Belt Driven Alternator Bracket and Drive Sheave Removal

1. Remove the belt driven alternator according to instructions in Section 12-9.2.
2. Remove the screw (Figure 12-21) (4), lock washer (5), washer (6), adjustable brace (15); discard the lock washer (6).

   NOTE: Shims (24) are installed to align the bracket (1) with the contour of the crankcase; the number of shims in the assembly 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.
6. Remove the six bolts (Figure 12-20) (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.

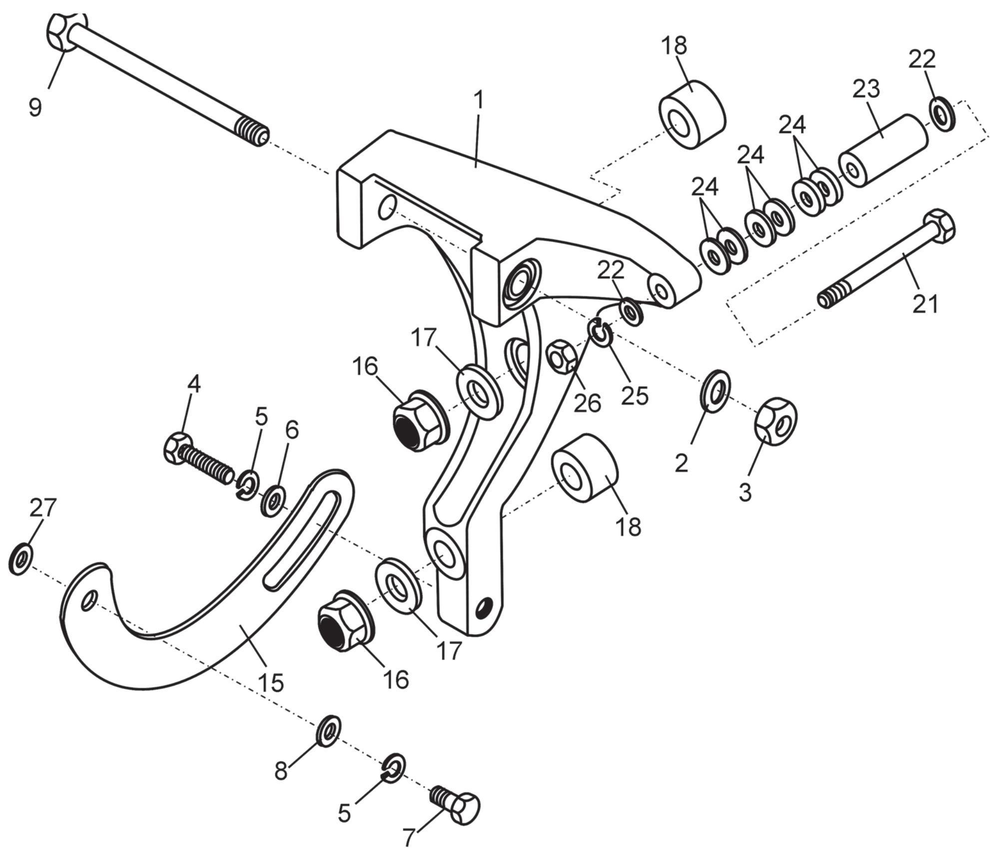

Figure 12-21. Optional Alternator Bracket Assembly

See Figure 12-20 for Index

12-10. Compressor Mounting Assembly (Optional) Removal

1. Follow the airframe manufacturer's instructions to remove the refrigerant compressor.
2. Turn the tensioning bolt (Figure 12-22) (10) counter-clockwise and relieve belt tension.
3. Remove and discard the compressor drive belt (18).
4. Remove three each bolts and washers (16 and 17).

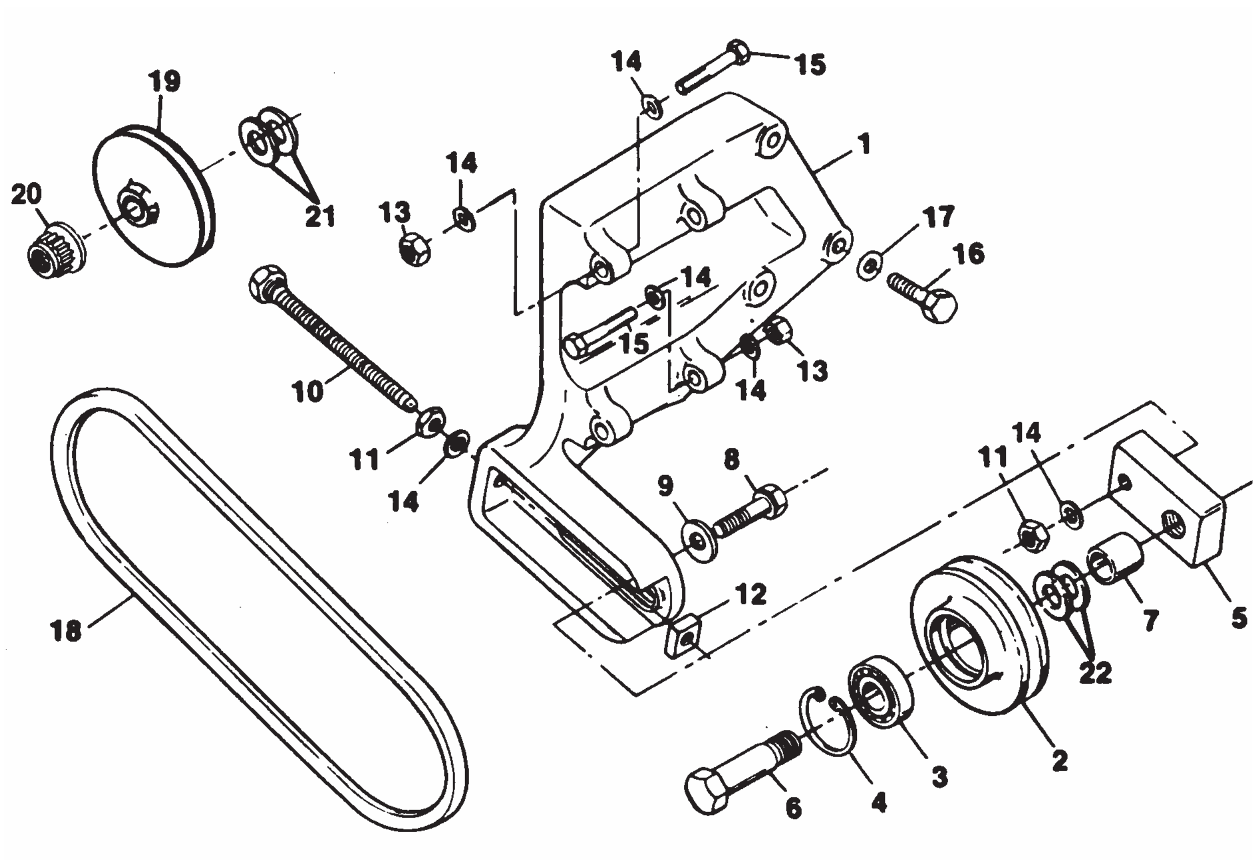

Figure 12-22. Optional Refrigerant Compressor Mount Assembly

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		

12-11. Starter and Adapter Removal

Different starter motors and starter adapters are used Permold series engine models; the primary physical difference is an accessory drive on the back of the housing or a flat cover. Figure 12-23 shows one possible accessory drive adapter option within a balloon.

1. Remove two sets of nuts and washers (Figure 12-23) (3 & 4).
2. Remove the starter motor (1) from the starter adapter.
3. Remove and discard the O-ring (5).
4. Remove the nuts (8), lock washers (7), and washers (6) from the outside of the crankcase between Cylinder 1 and the starter motor; discard the lock washers (7).
5. Remove the nuts (12), lock washers (11), and washers (10) from the back side of the adapter cover. Discard the lock washers (11).
6. Remove the starter adapter (2) from the crankcase. Place the starter motor in a clean, protected area awaiting overhaul instructions. Disassemble the starter adapter according to the "Starter and Adapter Disassembly" instructions in Section 13-4.

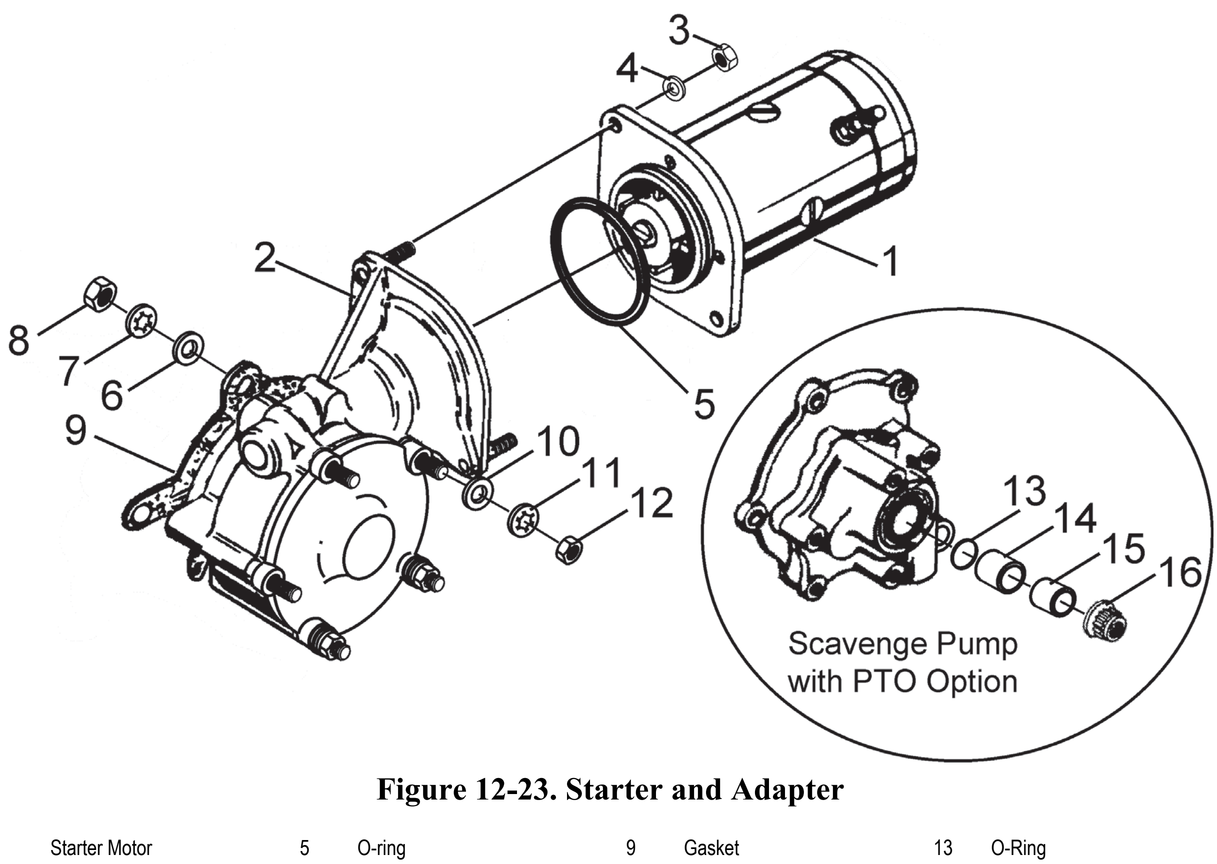

Figure 12-23. Starter and Adapter

1	Starter Motor	5	O-ring	9	Gasket	13	O-Ring
2	Starter Adapter	6	Washer	10	Washer	14	Sleeve
3	Nut	7	Lock Washer	11	Lock Washer	15	Spacer
4	Washer	8	Nut	12	Nut	16	12 Point Nut

12-12. Oil Sump Removal

12-12.1. IO-550-A & C Oil Sump Removal A C

1. Remove bolts (Figure 12-24) (13), lock washers (12), and washers (11) from sump perimeter; discard the lock washers.
2. Lightly tap the perimeter of the oil sump (10) using a soft mallet to loosen the gasket from the crankcase; remove the oil sump from the crankcase.
3. Remove the gasket (9) from the crankcase/oil sump and discard.
4. Remove nut (5), washers (3 & 4), and bolt (2) from the suction tube and crankcase.

   NOTE: The plug (8) and copper gasket (7) were removed with the oil pump.

5. Remove the oil suction tube assembly (1) from crankcase. Remove the copper gasket (6) from the oil suction tube and discard.

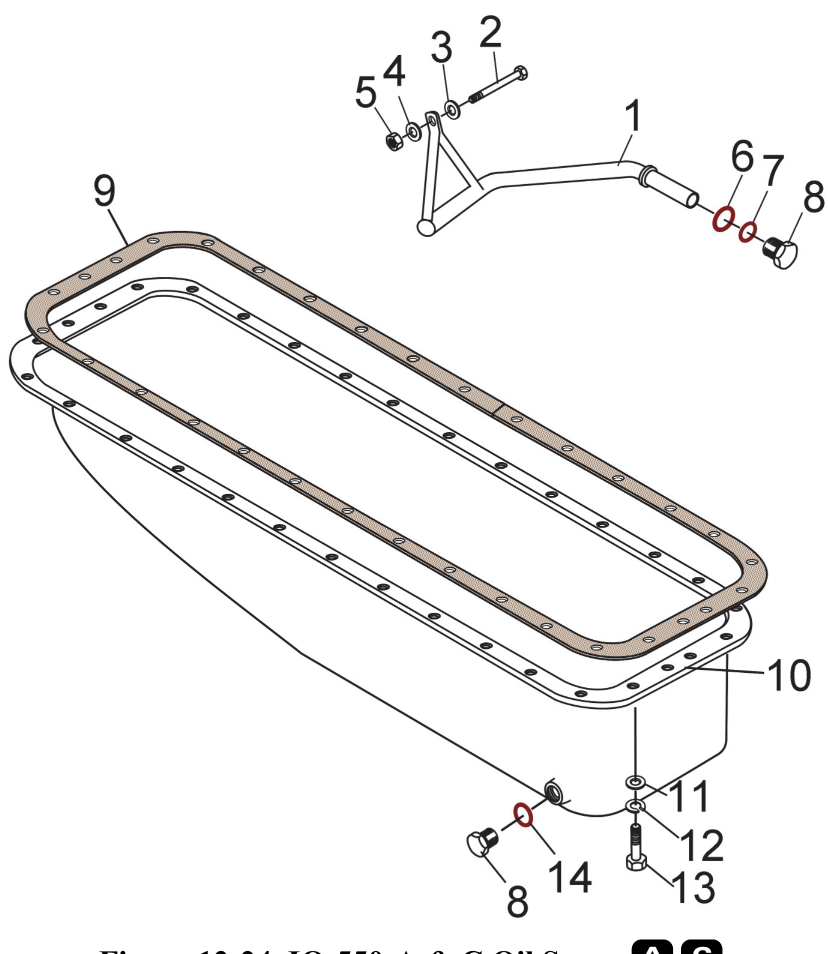

Figure 12-24. IO-550-A & C Oil Sump A C

1	Oil Suction Tube Assy	5	Nut	9	Gasket	13	Screw
2	Bolt	6	Copper Gasket	10	Oil Sump	14	Copper Gasket
3	Special Washer	7	Copper Gasket	11	Washer		
4	Washer	8	Plug	12	Lock Washer		

12-12.2. IO-550-B & R Oil Sump Removal B R

1. Remove bolts (Figure 12-25) (12), lock washers (11), and washers (10) from the oil sump perimeter; discard the lock washers (11).
2. Lightly tap the perimeter of the oil sump (7) using a soft mallet and remove from crankcase.
3. Remove gasket (6) from crankcase/oil sump and discard.
4. Remove the nuts (16) and washers (15) from the engine mount brackets (14).
5. Cut and remove safety wire from bolts (2); remove the bolts (2) from the lower crankcase flange (belly).

   NOTE: The plug (4) and copper gasket (5) were removed with the oil pump.

6. Remove oil suction tube assembly (1) from crankcase. Remove gasket (3) from oil suction tube and discard.

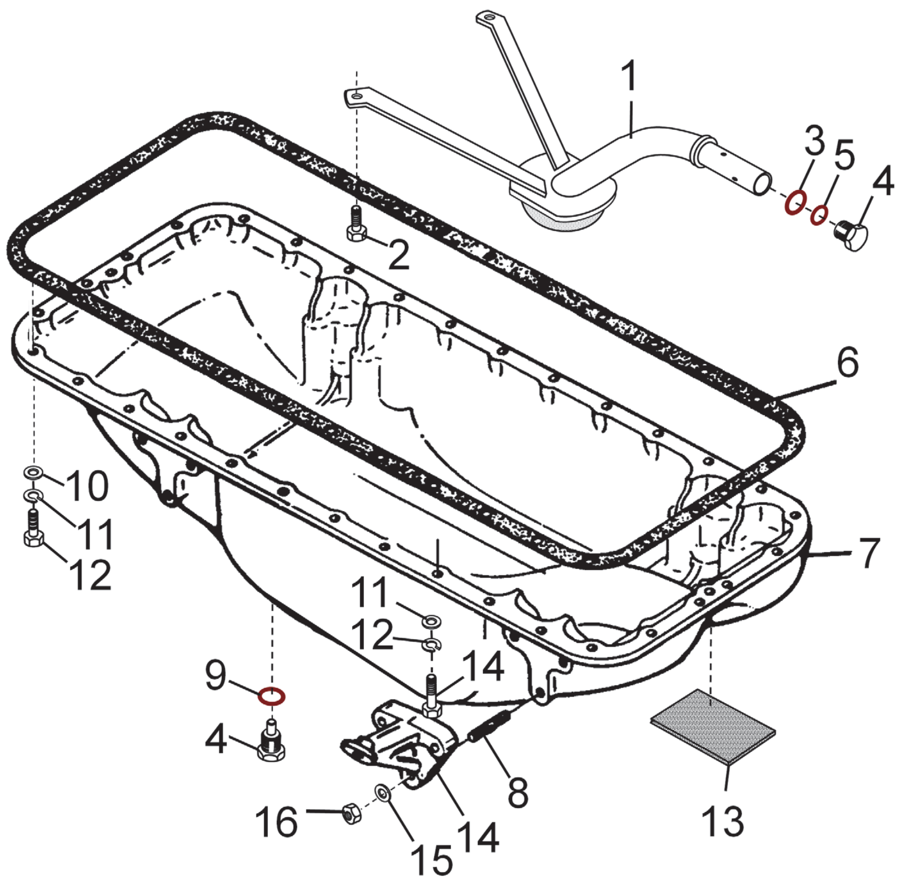

Figure 12-25. IO-550-B & R Oil Sump B R

1	Oil Suction Tube Assy	5	Copper Gasket	9	Copper Gasket	13	Felt
2	Special Washer	6	Gasket	10	Washer	14	Engine Mount Bracket
3	Copper Gasket	7	Oil Sump	11	Lock Washer	15	Washer
4	Plug	8	Stud	12	Screw	16	Nut

12-12.3. IO-550-G & N Oil Sump Removal G N

1. Remove the screws (Figure 12-26) (13), lock washers (12), and washers (11) from the oil sump perimeter; discard the lock washers (12).
2. Lightly tap the perimeter of the oil sump (10) using a soft mallet and remove from crankcase.
3. Remove gasket (9) from crankcase/oil sump and discard.
4. Remove nut (5), washers (3, 4), and bolt (2) from the suction tube and lower crankcase flange (belly).

   NOTE: The plug (8) and copper gasket (7) were removed with the oil pump.

5. Remove oil suction tube assembly from crankcase. Remove and discard the copper gasket (6) from oil suction tube.

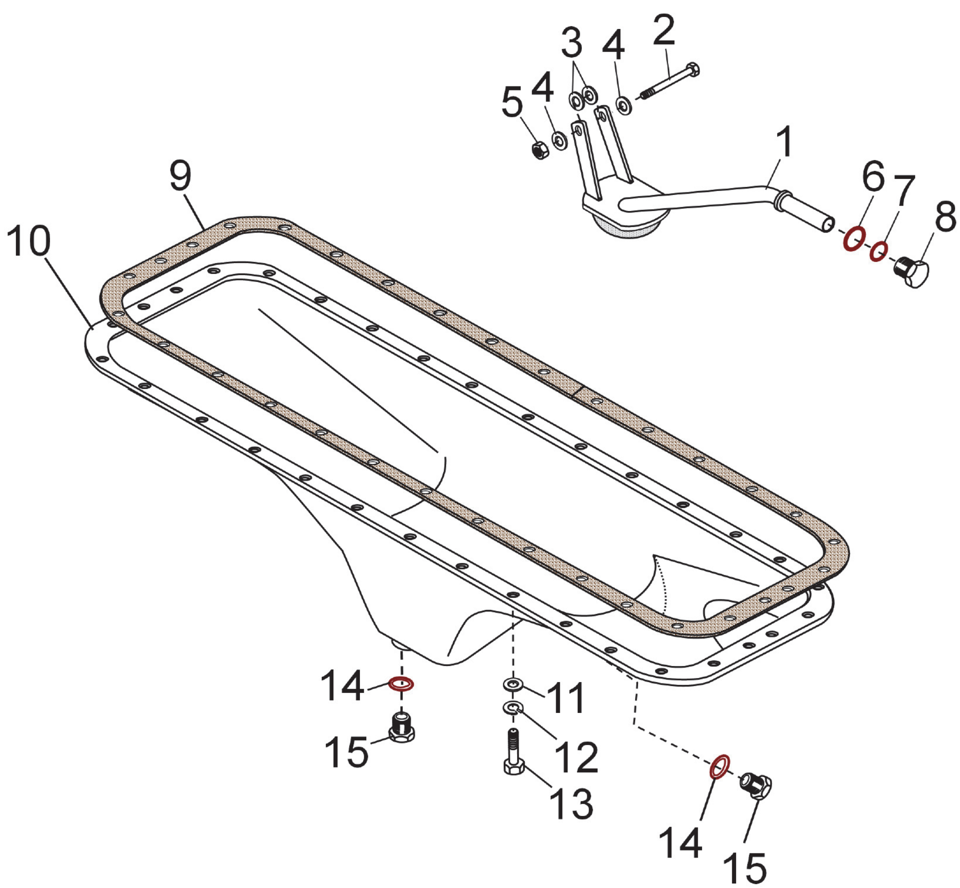

Figure 12-26. IO-550-G & N Oil Sump G N

1	Oil Suction Tube Assy	5	Nut	9	Gasket	13	Screw
2	Bolt	6	Copper Gasket	10	Oil Sump	14	Copper Gasket
3	Washer	7	Copper Gasket	11	Washer	15	Oil Drain Plug
4	Washer	8	Plug	12	Lock Washer		

12-12.4. IO-550-P Oil Sump Removal P

1. Remove the screws (Figure 12-27) (10), lock washers (9), and washers (8) from the oil sump perimeter; discard the lock washers (9).
2. Lightly tap the oil sump (7) perimeter using a soft mallet and remove from crankcase.
3. Remove gasket (6) from crankcase/oil sump and discard.
4. Remove nut (14), washers (3, 13), and bolt (4).

   NOTE: The plug (12) and copper gasket (5) were removed with the oil pump.
5. Remove oil suction tube assembly from crankcase. Remove and discard the copper gasket (1) from oil suction tube and discard.

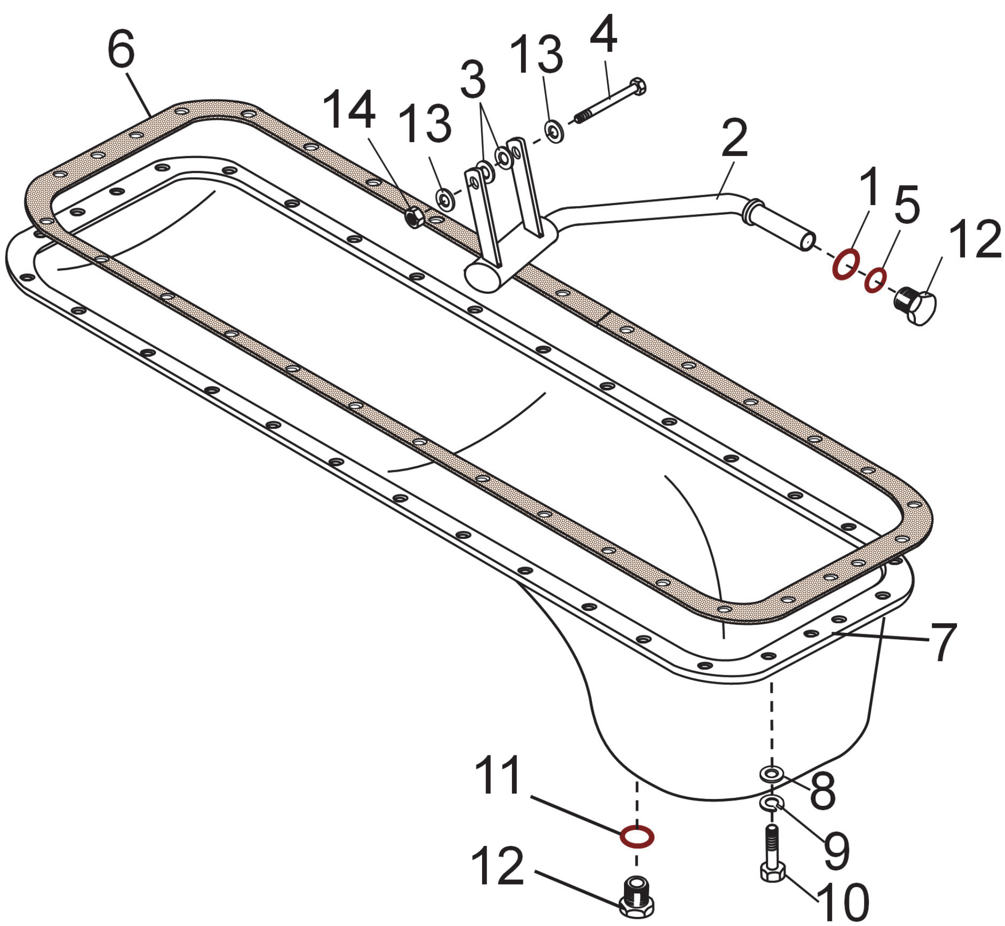

Figure 12-27. IO-550-P Oil Sump P

1	Copper Gasket	5	Copper Gasket	9	Lock Washer	13	Washer
2	Oil Suction Tube	6	Gasket	10	Screw	14	Nut
3	Washer	7	Oil Sump	11	Copper Gasket		
4	Washer	8	Washer	12	Drain Plug		

12-13. Engine Cylinder Removal

IO-550 Permold series engines may have cross-flow or downdraft cylinder heads. The easiest way to identify the differences is by looking at the rocker arm covers. Downdraft cylinder heads have a one piece rocker arm cover; cross-flow heads feature individual covers for intake and exhaust valve rocker arms. Refer to the cylinder removal procedure which applies to your engine.

12-13.1. IO-550-A, B & C Engine Cylinder Removal A B C

1. Remove the screws (Figure 12-28) (32), lock washers (31) and washers (30), and the rocker covers (29) from all cylinders. Discard the lock washers (31).
2. Remove and discard the rocker cover gaskets (28).
3. 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.
4. Remove the screws (20) and washers (19) from the rocker shafts. Slide the rocker shafts (18) outboard to remove the rocker arms (21 & 24) and thrust washers (27); discard the thrust washers (27). Remove and discard the rocker shafts (18).
5. Repeat steps 1-4 for the remaining cylinders.
6. Rotate the engine stand to place the engine in a “nose down” position, allowing access to the push rods.
7. Withdraw the push rods (39) from their respective housings (35); there are two push rods per cylinder.
8. Grasp the push rod housing (35) and push it inward toward the crankcase, compressing the push rod housing spring (38); lift the cylinder end and remove the push rod housing (35), the push rod housing springs (38), washers (36) and packing (37). Discard the packing (37) and push rod housing springs (38). Repeat this step for the remaining push rod housings.
9. Remove and discard the hydraulic tappets (45 & 46) by rotating the cam to lift the tappet above the tappet bore. Use fingers or non-ferrous (copper, brass) wire to extract the hydraulic tappets from the crankcase tappet bores.
10. Rotate the engine to an upright position. Make sure that the piston in the cylinder to be removed is at the top dead center position on the compression stroke.
11. Using the appropriate wrenches, carefully remove the flange nuts (40, 41, & 44) from the cylinder base flange and seventh stud locations. As the last several pieces of fastening hardware are being removed, cradle the cylinder in your arm to support the cylinder.
12. Remove the 7th stud brackets (42 & 43). Note that the piston within the cylinder can fall out if care is not used in step 13 where the cylinder will be withdrawn.
13. 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 damage to the piston or crankcase.

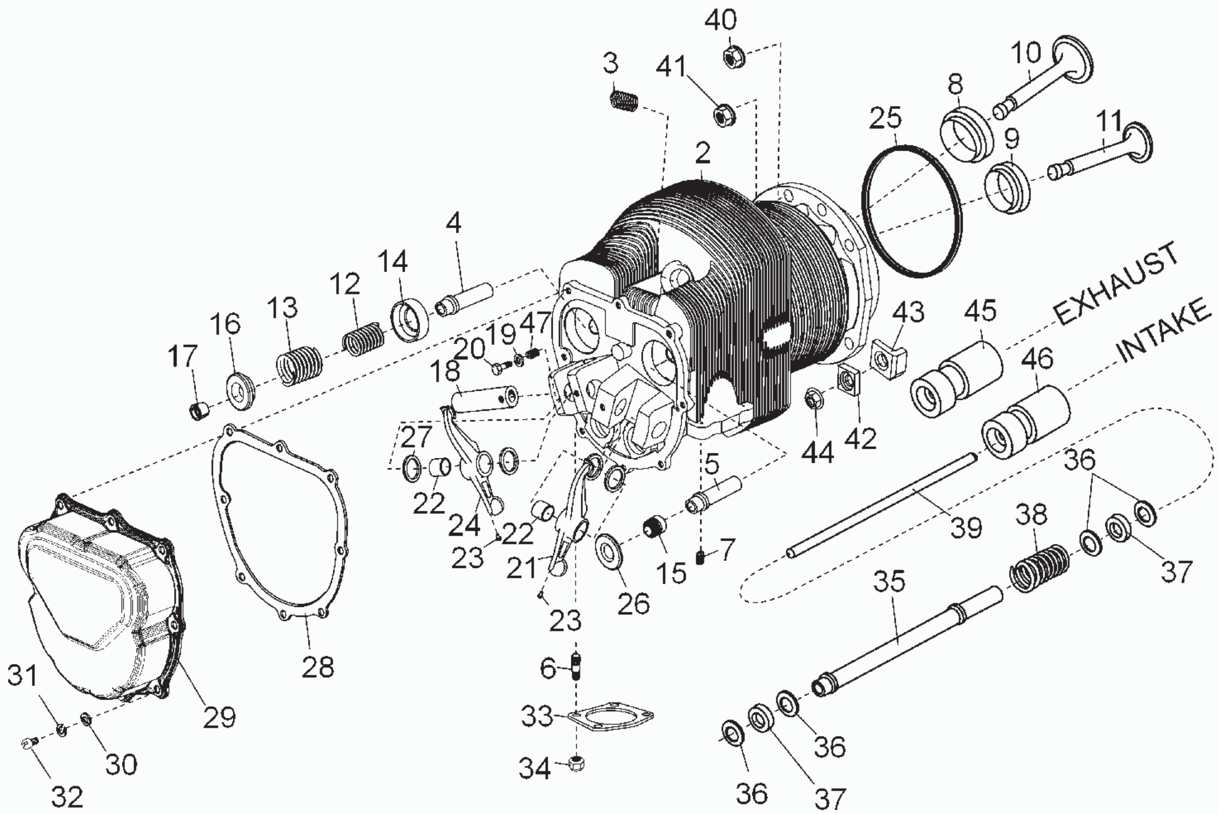

Figure 12-28. IO-550-A, B & C Engine Cylinder A B C

1	Cylinder Assembly	13	Outer Spring	25	Cylinder Base O-ring	37	Packing
2	Cylinder	14	Lower Retainer	26	Intake Valve Retainer	38	Spring
3	Spark Plug Insert	15	Seal	27	Thrust Washer	39	Pushrod
4	Exhaust Valve Guide	16	Rotocoil	28	Rocker Cover Gasket	40	Flange Nut
5	Intake Valve Guide	17	Retainer Key	29	Rocker Cover	41	Flange Nut
6	Stud	18	Rocker Shaft	30	Washer	42	7^{th} Stud Bracket
7	Intake Flange Insert	19	Plain Washer	31	Lock Washer	43	7^{th} Stud Bracket
8	Intake Valve Seat	20	Screw	32	Screw	44	Flange Nut
9	Exhaust Valve Seat	21	Rocker Arm, Intake	33	Exhaust Flange Gasket	45	Hydraulic Exhaust Tappet
10	Intake Valve	22	Rocker Arm Bushing	34	Nut	46	Hydraulic Intake Tappet
11	Exhaust Valve	23	Drive Screw	35	Pushrod Housing	47	Helical Coil Insert
12	Inner Spring	24	Rocker Arm, Exhaust	36	Washer		

14. Remove and retain the cylinder base O-ring (25). The O-ring will be replaced during cylinder overhaul but will be used to immobilize the connecting rods later.

15. Remove the piston pin & plug assembly (Figure 12-29) (6)) and piston (1) from the connecting rod. Discard the piston (1), piston rings (2 through 5) and piston pin & plug assembly (6).

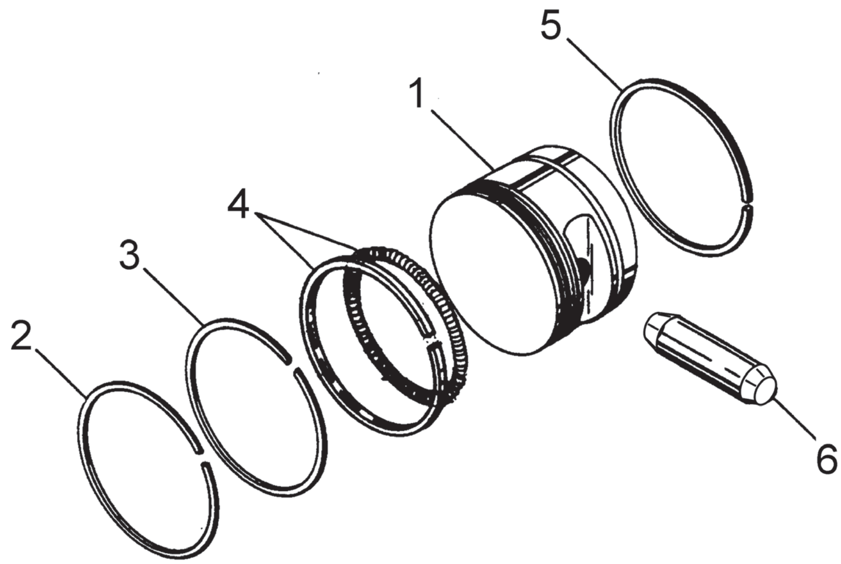

Figure 12-29. Piston Assembly

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

16. Install the cylinder base O-ring (Figure 12-28) (25) in a figure "8" pattern around the cylinder deck studs and connecting rod for support as shown in Figure 12-30.

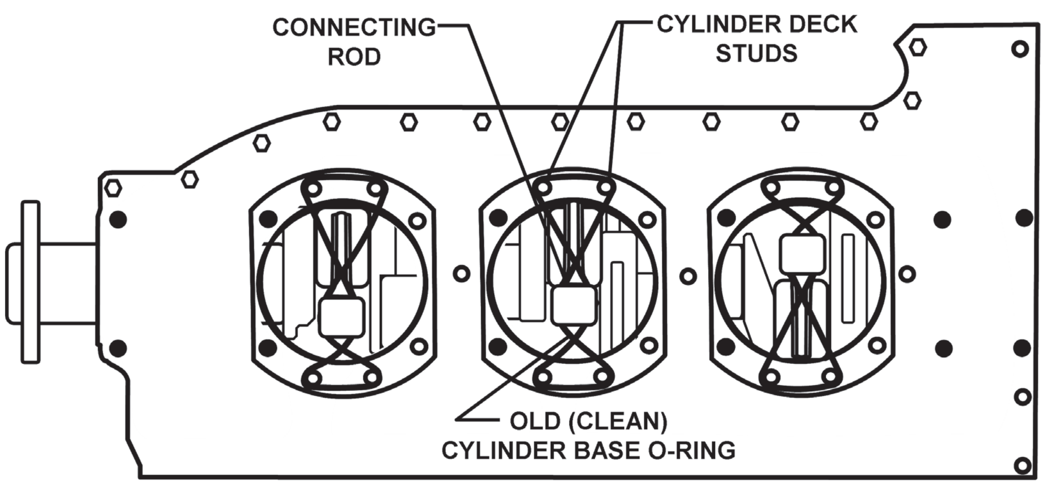

Figure 12-30. Cylinder Base Packing support Connecting Rods

17. Place the cylinder upright on a work bench.

18. Repeat steps 15 through 17 to remove and prepare the remaining cylinders for overhaul.

19. Place the engine cylinders in a clean, protected area until they are disassembled as described in Chapter 13, Component Disassembly.

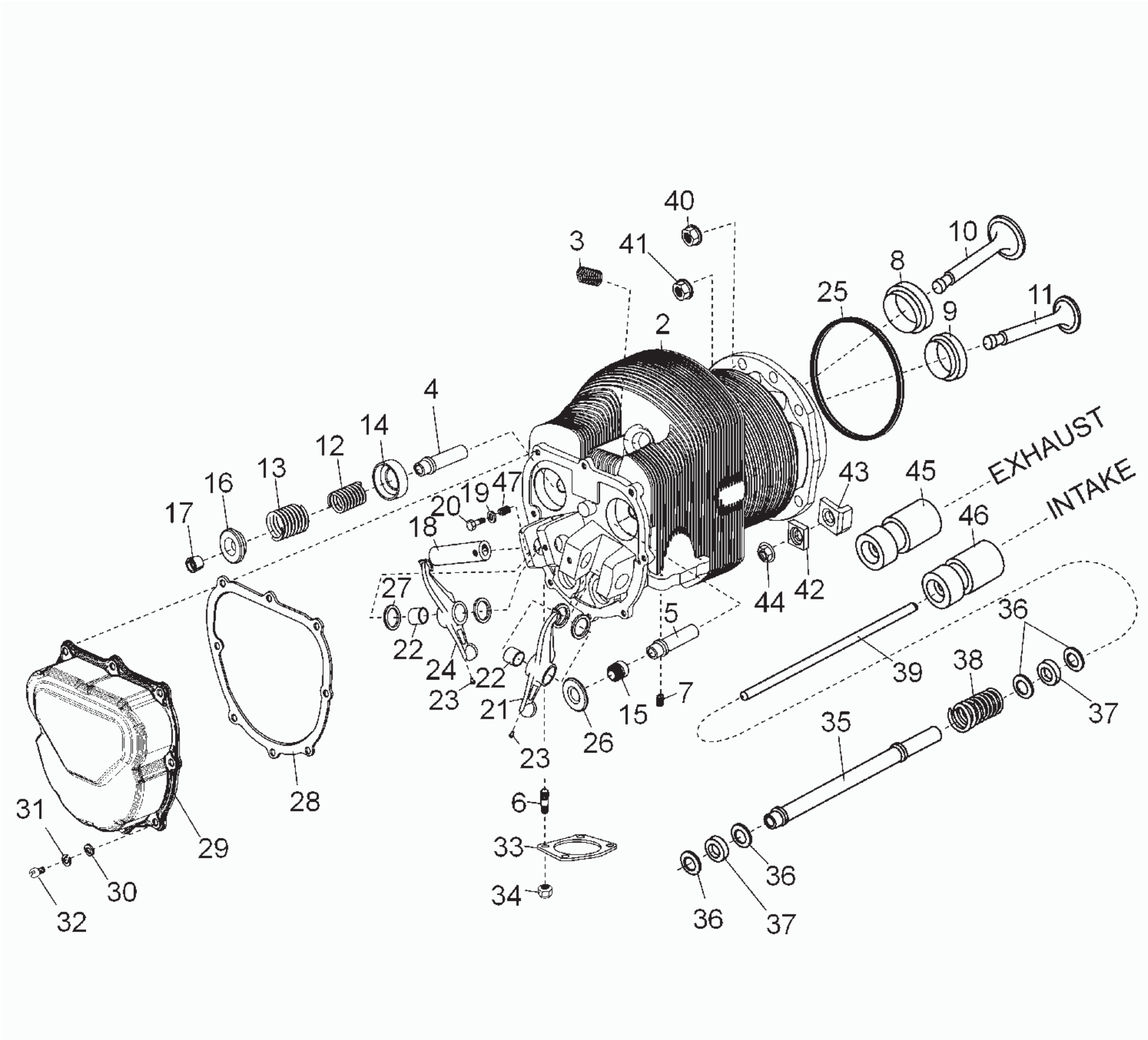

Figure 12-28 repeated for reference

12-13.2. IO-550-G, N, P & R Inter-Cylinder Baffle Removal G N P R

Inter-cylinder baffles are only used on engines with cross-flow induction and cylinders.

NOTE: Some engine specifications employ a nut plate on the 1-3 cylinder upper baffle support, Note the orientation of the nut plate (forward or aft) during disassembly. During engine assembly, install the upper baffle support (10) with the nut plate oriented as when installed.

1. Remove the screw (Figure 12-31) (8) and washer (7) from the cylinder base baffle (4) between cylinders 2 and 4; remove the cylinder base baffle (4) from the cylinder.
2. Remove the screw (8) and washer (7) from the cylinder base baffles (3) between cylinder 1 and 3, cylinder 3 and 5, and cylinder 5 and 6; remove the cylinder base baffles (3) from the cylinder.
3. On the baffles between cylinder 2-4 and 3-5, hold the lower baffle support (5) while removing the bolt (9) and washer (7) from the upper baffle supports (1 or 2); When the bolt clears the nut plate threads, remove the lower baffle supports (5) from the engine.
4. On the baffles between cylinder 1-3 and 4-6, hold the lower baffle support (6) while removing the bolt (9) and washer (7) from the upper baffle supports (1 or 10); When the bolt clears the nut plate threads, remove the lower baffle supports (6) from the engine.
5. Remove the upper baffle supports from cylinders 1 and 3 (1 or 10), 2 and 4 (2), 3 and 5 (1), and cylinders 4 and 6 (1).

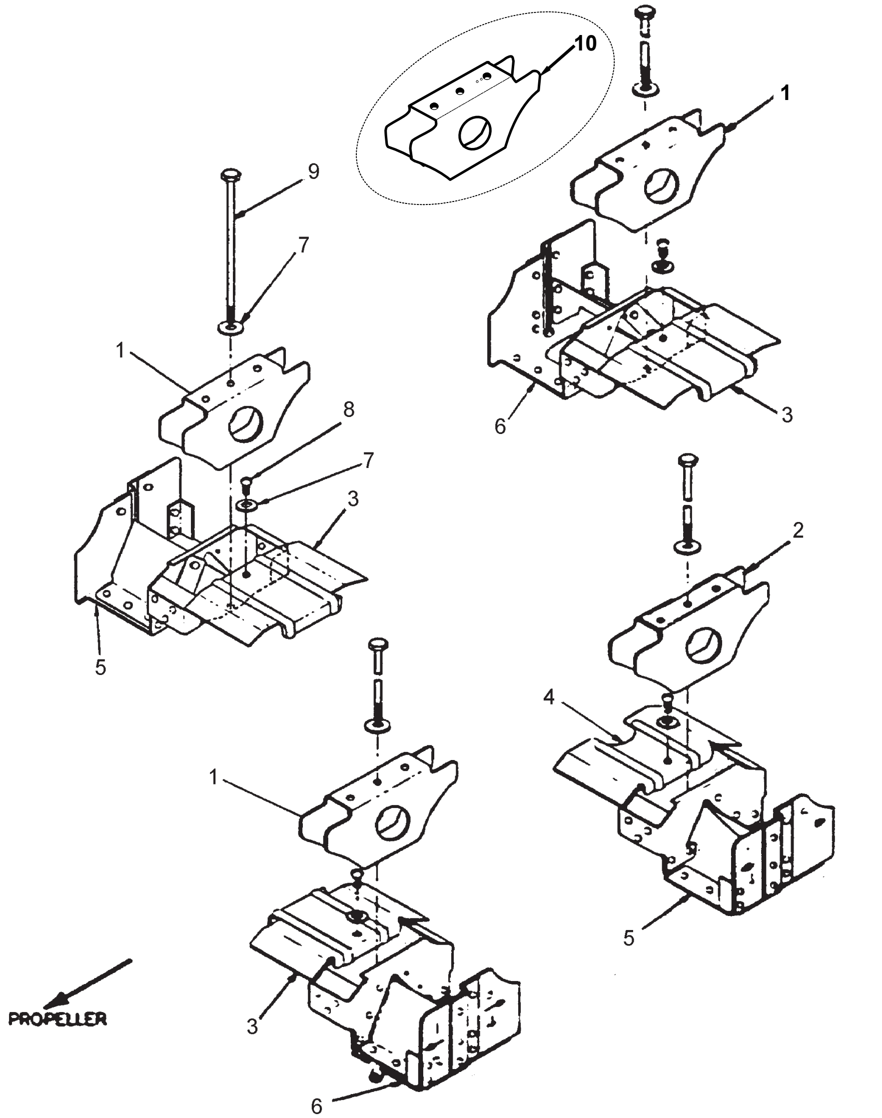

Figure 12-31. Inter-Cylinder Baffle Assembly

1	1-3; 3-5; 4-6 Cylinder Top Baffle Support	4	2-4 Cylinder Base Baffle	7	Washer	10	1-3 Cylinder Top Baffle Support (w/nut plate)
2	2-4 Cylinder Top Baffle Support	5	1-3; 4-6 Baffle Assembly	8	Screw		
3	1-3; 3-5; 4-6 Cylinder Base Baffle	6	2-4; 3-5 Baffle Assembly	9	Bolt		

12-13.3. IO-550-G, N, P & R Engine Cylinder Removal G N P R

1. Loosen and remove the cylinder drain tubes (Figure 12-33)(45).
2. 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 12-32) extending into the cylinder. If the cylinder drain terminates at the taper, replace the fittings with the improved nozzle, regardless of condition.

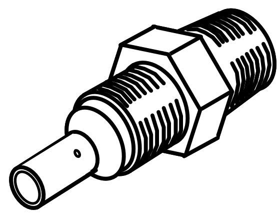

Figure 12-32. Cylinder Drain Tube Fitting

3. Remove the screws (Figure 12-33) (30), lock washers (31), and washers (32), and rocker covers (29) from all six cylinders; discard the lock washers (31).
4. Remove and discard the six rocker cover gaskets (28).
5. 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.
6. 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).
7. Remove the rocker arms (20), rocker arm shaft (24), thrust washers (23) and retainer (25) from the cylinder. Discard the rocker shafts (24) and thrust washers (23).
8. Withdraw the push rod assemblies (40) from their respective housings (35).
9. Repeat steps 5-8 for the remaining cylinders.
10. Grasp each push rod housing (35) and push it inward toward the crankcase, compressing the push rod housing spring (39); lift the cylinder end 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.
11. Rotate the engine stand to invert the engine.
12. Remove and discard both hydraulic tappets (53 & 54) by rotating the cam and push out (use either your finger or a non-ferrous metal (copper, brass) wire) the hydraulic tappets from the crankcase tappet bores.
13. Rotate the crankshaft until the piston in the cylinder to be removed is at the top dead center position on the compression stroke.
14. Using the appropriate wrenches, carefully remove flange nuts (41, 42, & 49) from the cylinder base flange and seventh stud locations.

15. As the last several pieces of fastening hardware are being removed, cradle the cylinder in your arm to support the cylinder.

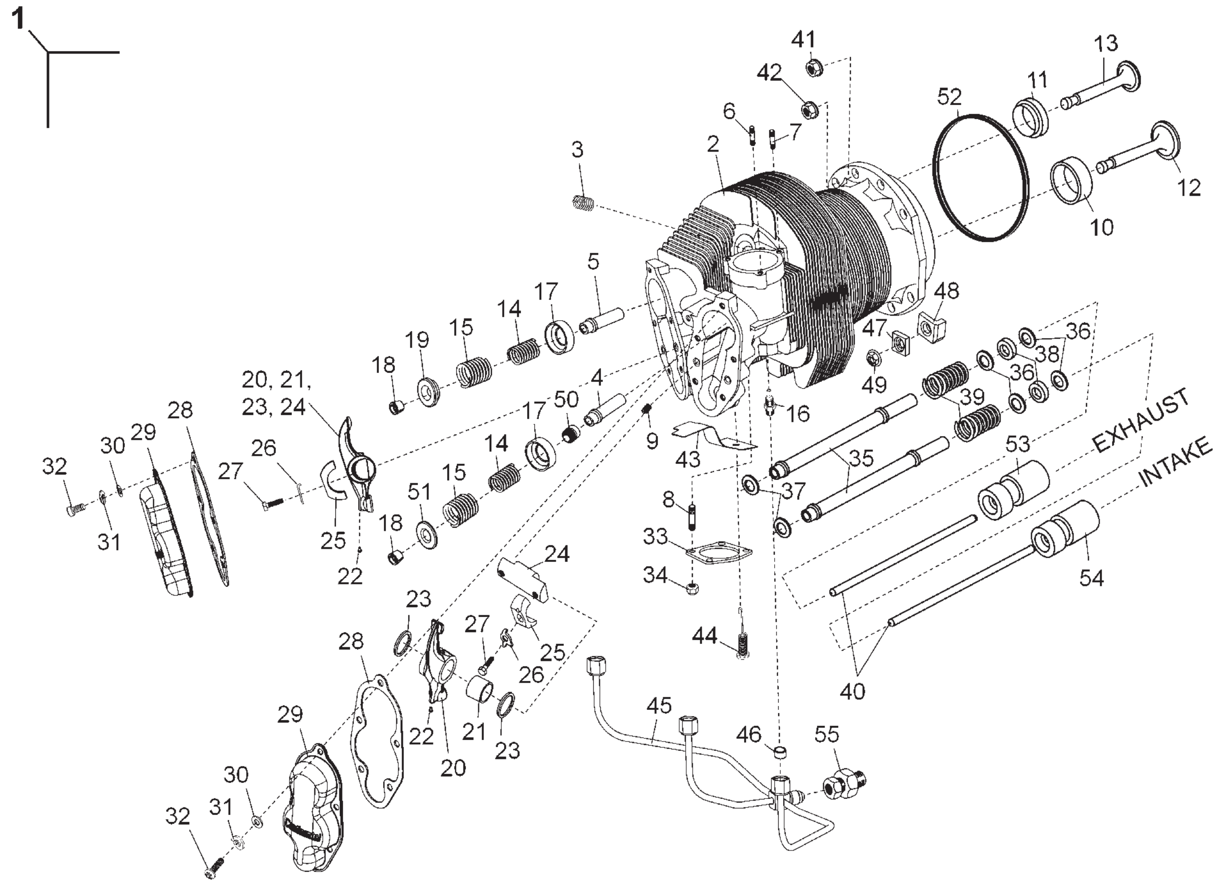

Figure 12-33. IO-550-G, N, P & R Engine Cylinder G N P R

1	Cylinder Assembly	15	Outer Spring	29	Rocker Cover	43	Baffle
2	Cylinder	16	Drain Fitting	30	Washer	44	Spring
3	Spark Plug Insert	17	Inner Retainer	31	Lock Washer	45	Drain Tube
4	Intake Guide	18	Retainer Key	32	Screw	46	Drain Tube Seal
5	Exhaust Valve Guide	19	Rotocoil	33	Exhaust Flange Gasket	47	7^{th} Stud Bracket
6	Stud	20	Rocker Arm Assembly	34	Lock Nut	48	7^{th} Stud Bracket
7	Stud	21	Rocker Arm Bushing	35	Pushrod Housing	49	Flange Nut
8	Stud	22	Drive Screw	36	Washer	50	Seal
9	Helicoil Insert	23	Thrust Washer	37	O-ring Seal	51	Retainer
10	Intake Valve Seat Insert	24	Rocker Arm Shaft	38	Pushrod Housing Packing	52	Cylinder Base O-ring
11	Exhaust Valve Seat Insert	25	Retainer	39	Pushrod Housing Spring	53	Hydraulic Exhaust Tappet
12	Intake Valve	26	Tab Washers	40	Pushrod Assembly	54	Hydraulic Intake Tappet
13	Exhaust Valve	27	Screw	41	Flange Nut	55	Check Valve
14	Inner Spring	28	Rocker Cover Gasket	42	Flange Nut		

16. Remove the 7^{th} stud brackets (47 & 48). Note that the piston within the cylinder can fall out if care is not used in step 17 when the cylinder is withdrawn.

17. 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.
18. Remove and retain the cylinder base O-ring (52) to support the connecting rod during disassembly.
19. Remove and discard the piston pin & plug assembly (Figure 12-29) (6), piston (1) and piston rings (2 through 5).

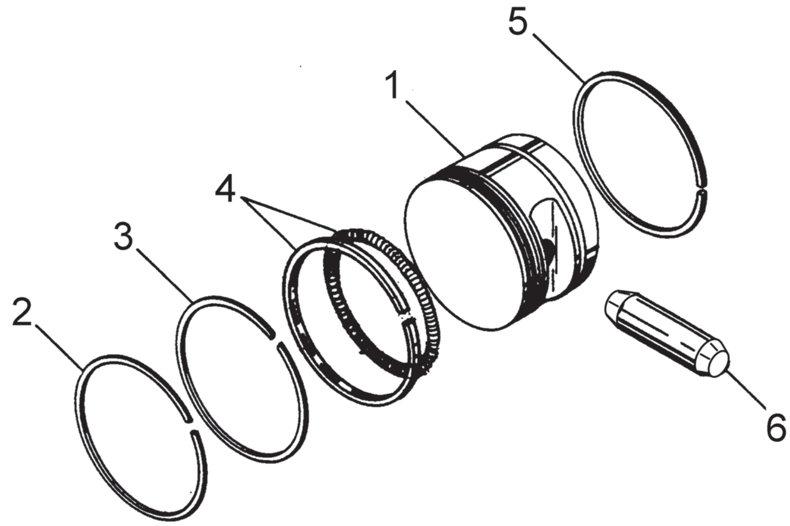

Figure 12-29 repeated for reference

20. Install the cylinder base O-ring (Figure 12-33) (52) in a figure “8” pattern (Figure 12-30) around the cylinder deck studs and connecting rod for support.

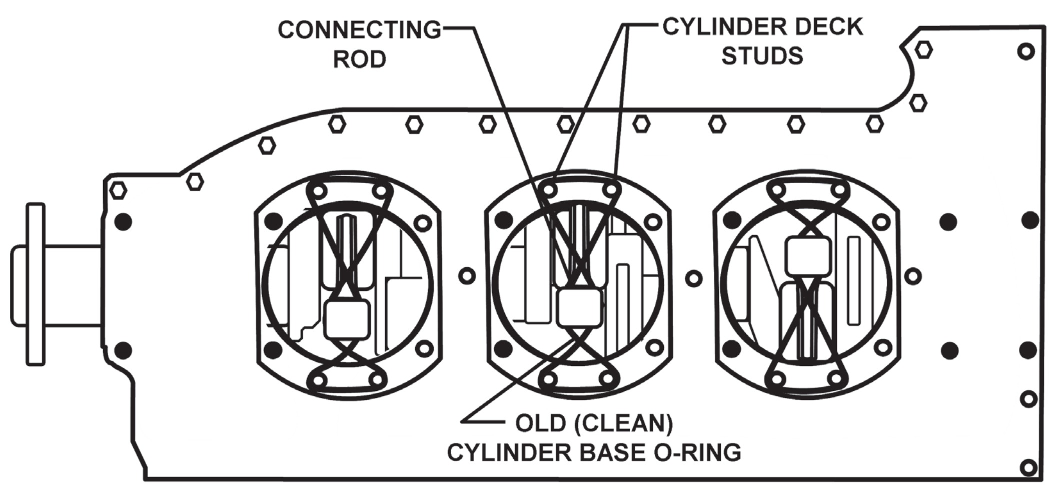

Figure 12-30 repeated for reference

21. Place the cylinder upright on a work bench.
22. Repeat steps 16 through 21 to remove and prepare the remaining cylinders for overhaul.
23. Place the engine cylinders in a clean, protected area until disassembly in Chapter 13, Component Disassembly.

12-14. Engine Mount Removal

NOTE: IO-550-B & R engine mount legs were removed with the oil sump.

12-14.1. IO-550-A Engine Mount Removal A

1. Remove nuts (Figure 12-34) (5) and washers (4) from the forward (1 & 2) and aft (1 & 2) engine mounts.
2. Remove the engine mounts (1 & 2) from both crankcase halves.

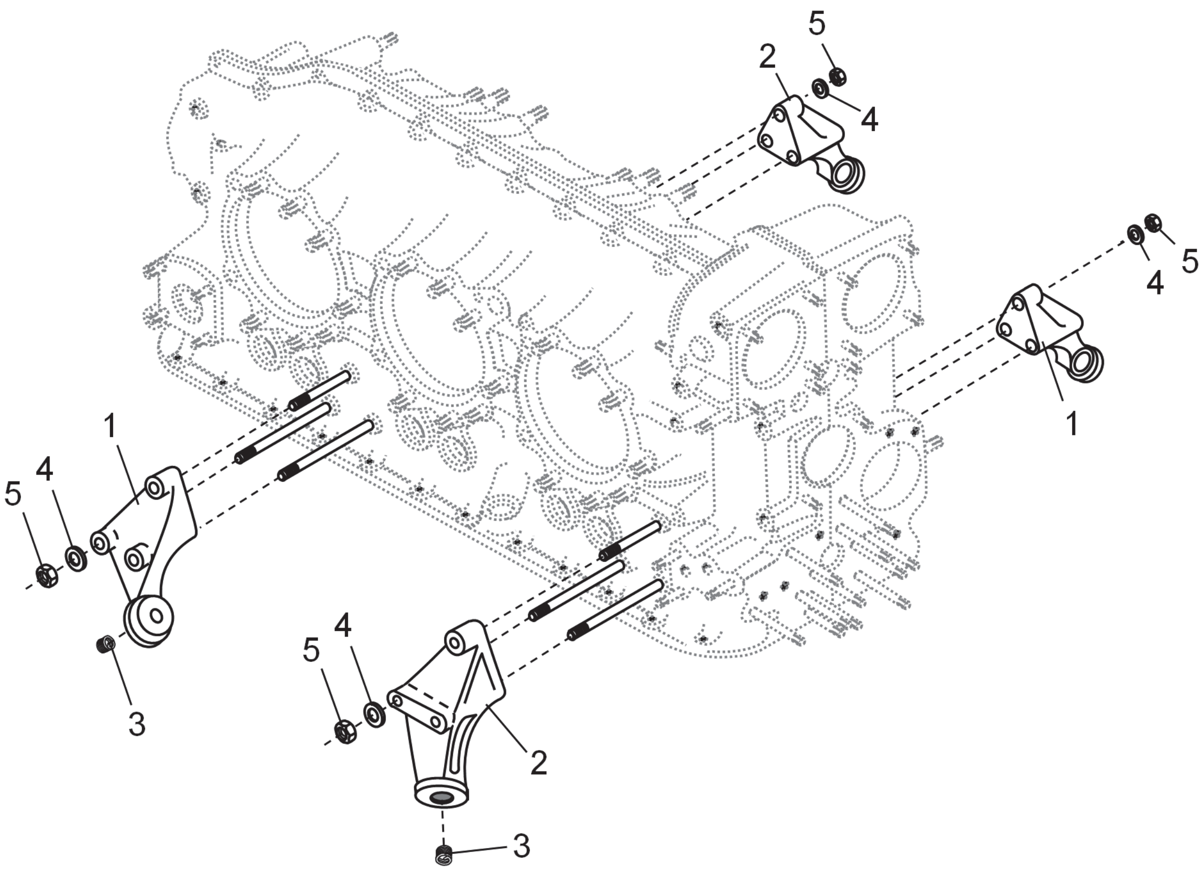

Figure 12-34. IO-550-A Engine Mounts A

1	Engine Mount Bracket, Cyl. 1 & 6	4	Washer
2	Engine Mount Bracket, Cyl. 2 & 5	5	Nut
3	Helical Coil Insert		

12-14.2. IO-550-C Engine Mount Removal C

NOTE: IO-550-C upper and lower engine mount hardware for 2-4-6 side of crankcase was removed with the oil cooler.

1. Remove nuts (Figure 12-35) (6) and washers (5) from the upper (2 & 4) engine mounts.
2. Remove nuts (6) and washers (5) from the lower right (3) engine mount.
3. Remove nuts (6 & 8) and washers (5 & 7) from the lower right (1) engine mount.
4. Remove the seals (9) from the counterbore in the left aft engine mount; discard the seals.
5. Remove the engine mounts (1, 2, 3 & 4) from both crankcase halves.

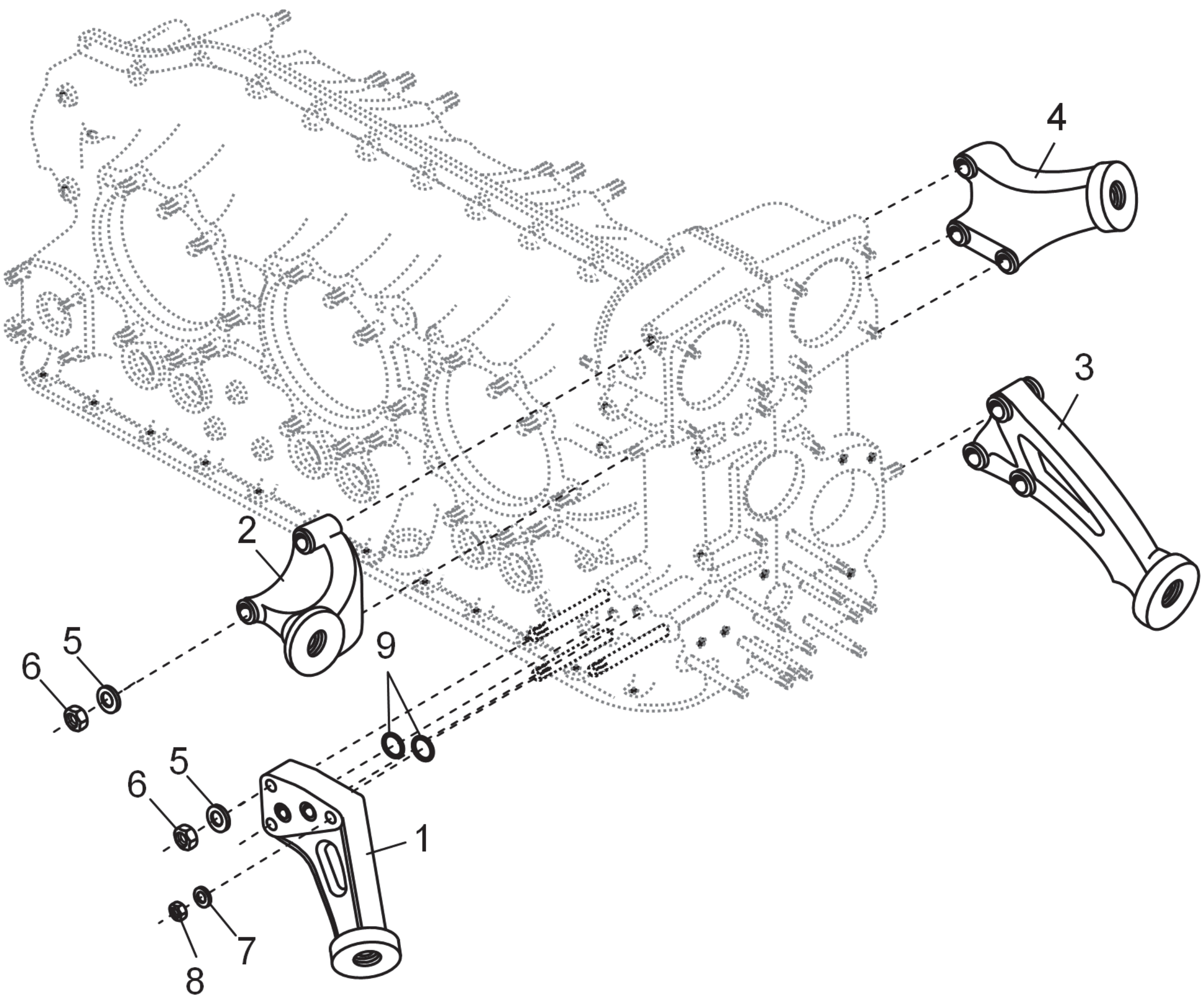

Figure 12-35. IO-550-C Engine Mounts C

1	Lower Left Engine Mount	4	Upper Right Engine Mount	7	Washer
2	Upper Left Engine Mount	5	Washer	8	Nut
3	Lower Right Engine Mount	6	Nut	9	Seal

12-14.3. IO-550-G, N & P Engine Mount Removal G N P

Two engine mount configurations are available for IO-550-G & N engines. For engines with six point engine mounts, the forward mounts are the same part number and the left and right aft mounts are different part numbers. Engines with focalized four point engine mounts use two brackets of one part number at the 1-3-5 forward position and 2-4-6 aft. and a different part number a different part number at the 1-3-5 aft position and 2-4-6 forward position.

1. Remove the bolts (Figure 12-36) (4 & 5) and washers (6) from the forward (1 or 2A and 3A) and aft (2 & 3) engine mounts.
2. Remove the engine mounts from the crankcase and place in storage to await cleaning and overhaul inspection.

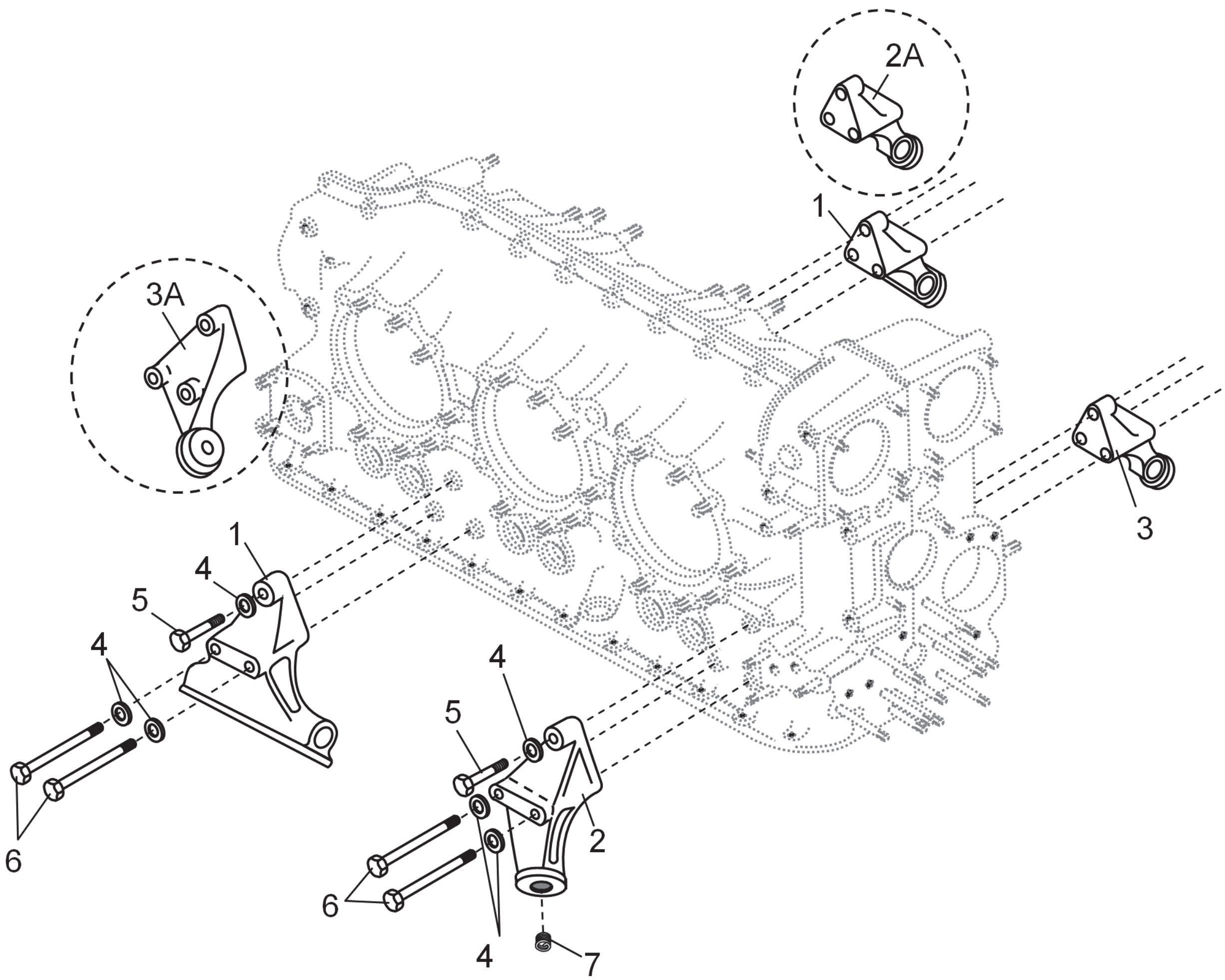

Figure 12-36. IO-550-G, N & P Engine Mounts G N P

1	Aft Engine Mount	4	Washer
2	Forward Six Point Engine Mount	5	Bolt
2A	2-4-6 Side Forward Engine Mount	6	Bolt
3	1-3-5 Side Aft Engine Mount	7	Helical Coil
3A	2-4-6 Side Forward Engine Mount		

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Chapter 13. Component Disassembly

13-1. Ignition System

Overhaul magnetos according to the magneto manufacturer's instructions. For Continental Motors' magnetos, refer to the applicable Magneto Service Support Manual. S-20/200 series magneto overhaul information is contained in X42002; S-1200 series magneto overhaul information is contained in X42001. For magnetos other than Continental, the magneto must be replaced with a new or rebuilt unit or the unit must be overhauled according to FAA approved instructions.

13-2. Fuel Injection System

Continental Motors does not provide overhaul instructions for the fuel pump, fuel manifold valve, throttle or mixture control assembly due to the precise calibration requirements after assembly. Continental Motors offers 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: Continental Motors offers new and rebuilt fuel pumps, fuel manifold valve assemblies, integral throttle assemblies and throttle and control assembles which meet new part specifications. Continental Motors does not control FAA Part 145 Repair Station activities; verify the repair station qualifications before contracting fuel injection system component overhaul. Fuel injection system component overhaul must be accomplished under carefully controlled conditions 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.

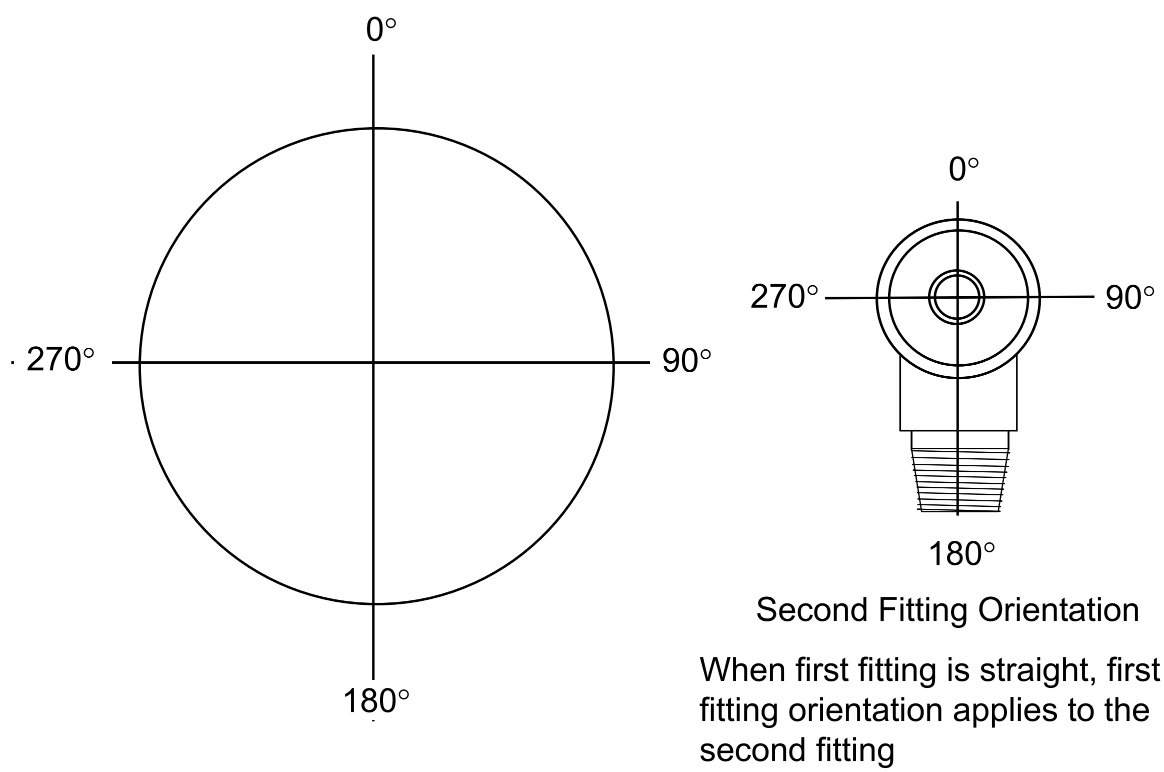


Figure 13-1. Fitting Orientation Guide

13-3. Oil Pump Disassembly

Three oil pumps are available on IO-550 Permold series engines.All oil pumps feature an adjustable oil pressure relief valve and oil filter adapter. Optional oil pumps with mechanical or electrical tachometer drive adapters are also available. Instructions for the standard oil pump disassembly are in Section 13-3.1. Disassembly instructions for the oil pump with mechanical tachometer drive are in Section 13-3.2. Instructions to disassemble the for the oil pump with electrical tachometer drive are in Section 13-3.3.

13-3.1. Standard Oil Pump Disassembly

1. Cut and remove the safety wire (if intact) from the oil pressure relief valve assembly.
2. Remove the nylon jam nut (Figure 13-2) (16) and copper washer (15) from the adjustment screw (12); discard the nylon jam nut (16) and copper washer (15).
3. Unscrew the oil pressure relief valve assembly housing (14) from the oil pump housing (1). Remove and discard the copper gasket (13).
4. Remove the seat (11), spring (10), and plunger (9) from the oil pump housing (1) if they remain after removing the oil pressure relief valve assembly from the oil pump housing (1).
5. Remove the nuts (8) and washers (6) from the studs at 6 and 12 o’clock. Remove the oil pump cover (5) from oil pump housing (1).
6. Remove the shaft gear assembly (2) and driven gear assembly (4) from the oil pump housing (1).
7. Store the remaining components for cleaning in Chapter 14.

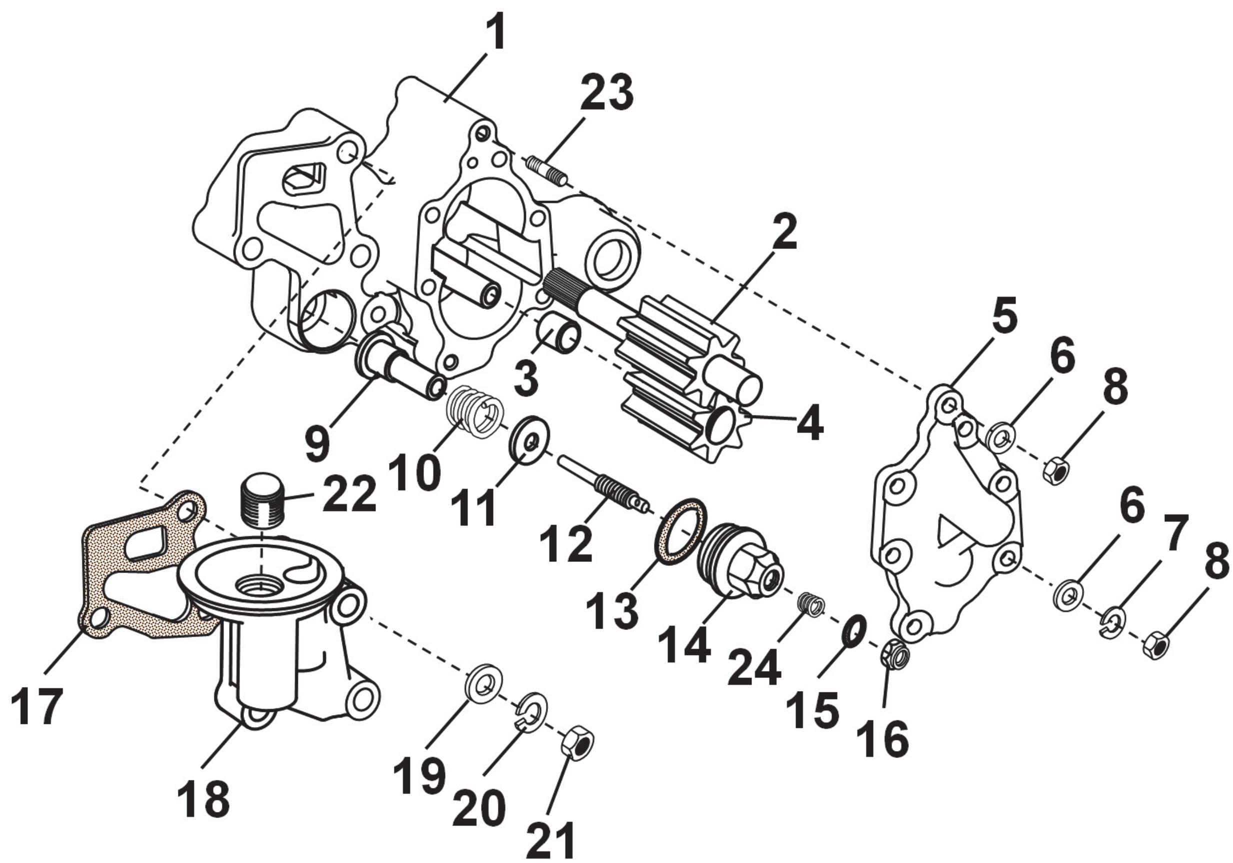


Figure 13-2. Standard Oil Pump

1	Oil Pump Housing	7	Lock Washer	13	Copper Washer	19	Washer
2	Shaft Gear Assembly	8	Nut	14	Nut	20	Lock Washer
3	Bushing	9	Plunger	15	Copper Washer	21	Nut
4	Driven Gear Assembly	10	Spring	16	Elastic Lock Nut	22	Stud
5	Cover	11	Seat	17	Gasket	23	Stud
6	Washer	12	Adjustment Screw	18	Oil Filter Adapter	24	Helical Coil

13-3.2. Oil Pump with Mechanical Tachometer Drive Adapter Disassembly

1. Remove the tachometer drive housing assembly (29) from the oil pump cover (5); remove and discard the gasket (28).
2. Remove and discard the oil seal (27) from tachometer drive housing (29).
3. Remove the tachometer drive shaft (26) from the cover (5) or housing (9).
4. Cut and remove the safety wire (if intact) from the oil pressure relief valve assembly.
5. Remove the nylon jam nut (Figure 13-2) (16) and copper washer (15) from the adjustment screw (12); discard the nylon jam nut (16) and copper washer (15).
6. Unscrew the oil pressure relief valve assembly housing (14) from the oil pump housing (1). Remove and discard the copper gasket (13).
7. Remove the seat (11), spring (10), and plunger (9) from the oil pump housing (1) if they remain after removing the oil pressure relief valve assembly from the oil pump housing (1).
8. Remove the nuts (8) and washers (6) from the studs at 6 and 12 o’clock. Remove the oil pump cover (5) from oil pump housing (1).
9. Remove the bevel gear assembly (25) from the shaft gear assembly (2).
10. Remove the shaft gear assembly (2) and driven gear assembly (4) from the oil pump housing (1).
11. Store the remaining components for cleaning in Chapter 14.

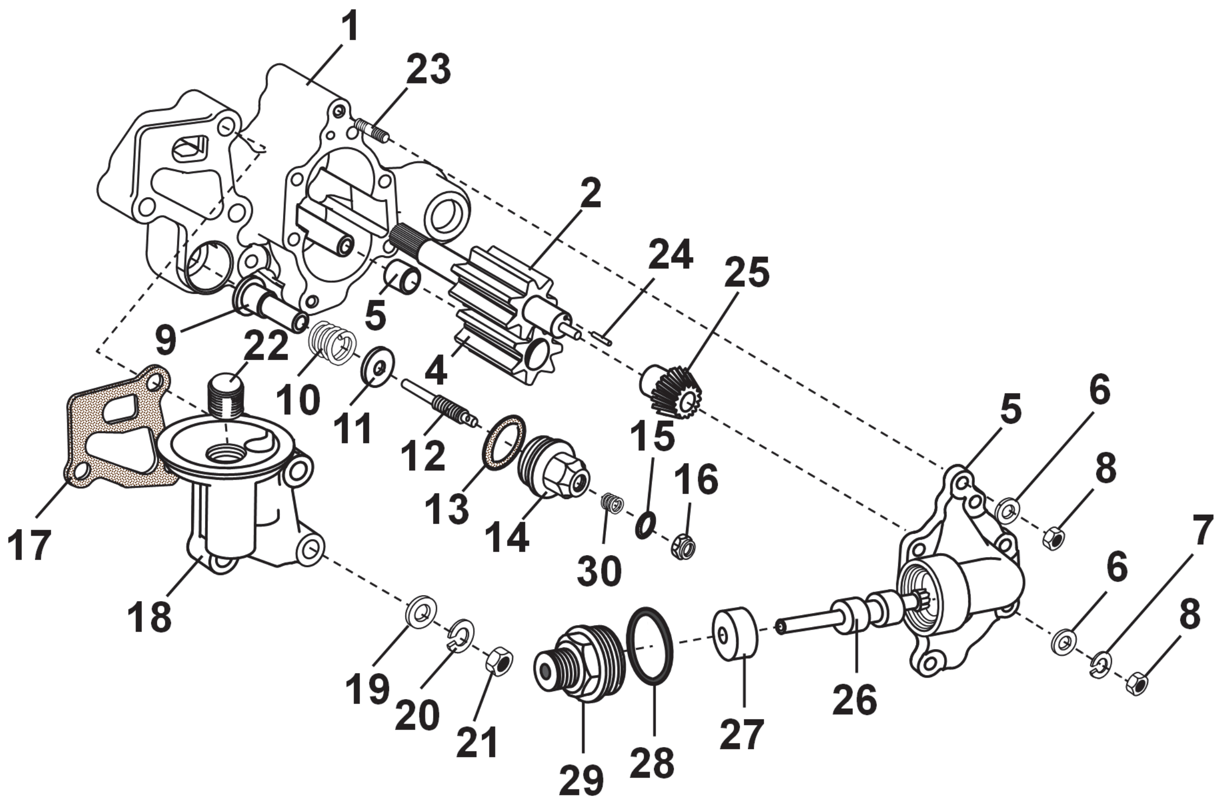


Figure 13-3. Oil Pump Assembly with Mechanical Tachometer Drive Adapter

1	Oil Pump Housing	9	Plunger	17	Gasket	25	Bevel Gear
2	Shaft Gear Assembly	10	Spring	18	Oil Filter Adapter	26	Tach. Drive Shaft
3	Bushing	11	Seat	19	Washer	27	Oil Seal
4	Driven Gear Assembly	12	Adjustment Screw	20	Lock Washer	28	Gasket
5	Cover	13	Copper Washer	21	Nut	29	Tach Drive Housing
6	Washer	14	Nut	22	Stud	30	Helical Coil
7	Lock Washer	15	Copper Washer	23	Stud		
8	Nut	16	Elastic Lock Nut	24	Dowel		

13-3.3. Oil Pump with Electrical Tachometer Drive Adapter Disassembly

1. Remove four screws (33) lock washers (32) and washers (31) from the right gearbox cover (27); discard the lock washers (32).
2. Tap the perimeter of the right gearbox cover (35) with a small mallet to loosen the seal. Remove the right gearbox cover (35) and gasket (34); discard the gasket (34).
3. Remove four nuts (8), lock washers (7) and washers (6 and 37) from the accessory cover (29); discard the lock washers (7).
4. Remove the accessory cover (29) and gasket from the right angle oil pump cover assembly (5); discard the gasket (28).
5. Remove two nuts (8) and washers (6) from the right angle oil pump cover assembly (5) and remove the right angle oil pump cover assembly (5) from the oil pump housing (1).
6. Remove the bevel gear assembly (26) and oil seal (27) from the right side of the right angle oil pump cover assembly; remove and discard the oil seal (27).
7. Cut and remove the safety wire (if intact) from the oil pressure relief valve assembly.
8. Remove the nylon jam nut (16) and copper washer (15) from the adjustment screw (12); discard the nylon jam nut (16) and copper washer (15).
9. Unscrew the oil pressure relief valve assembly housing (14) from the oil pump housing (1). Remove and discard the copper gasket (13).
10. Remove the seat (11), spring (10), and plunger (9) from the oil pump housing (1) if they remain after removing the oil pressure relief valve assembly from the oil pump housing (1).
11. Remove the nuts (8) and washers (6) from the studs at 6 and 12 o’clock. Remove the oil pump cover (5) from oil pump housing (1).
12. Remove the bevel gear assembly (25) from the shaft gear assembly (2).
13. Remove the shaft gear assembly (2) and driven gear assembly (4) from the oil pump housing (1).
14. Store the remaining components for cleaning in Chapter 14.

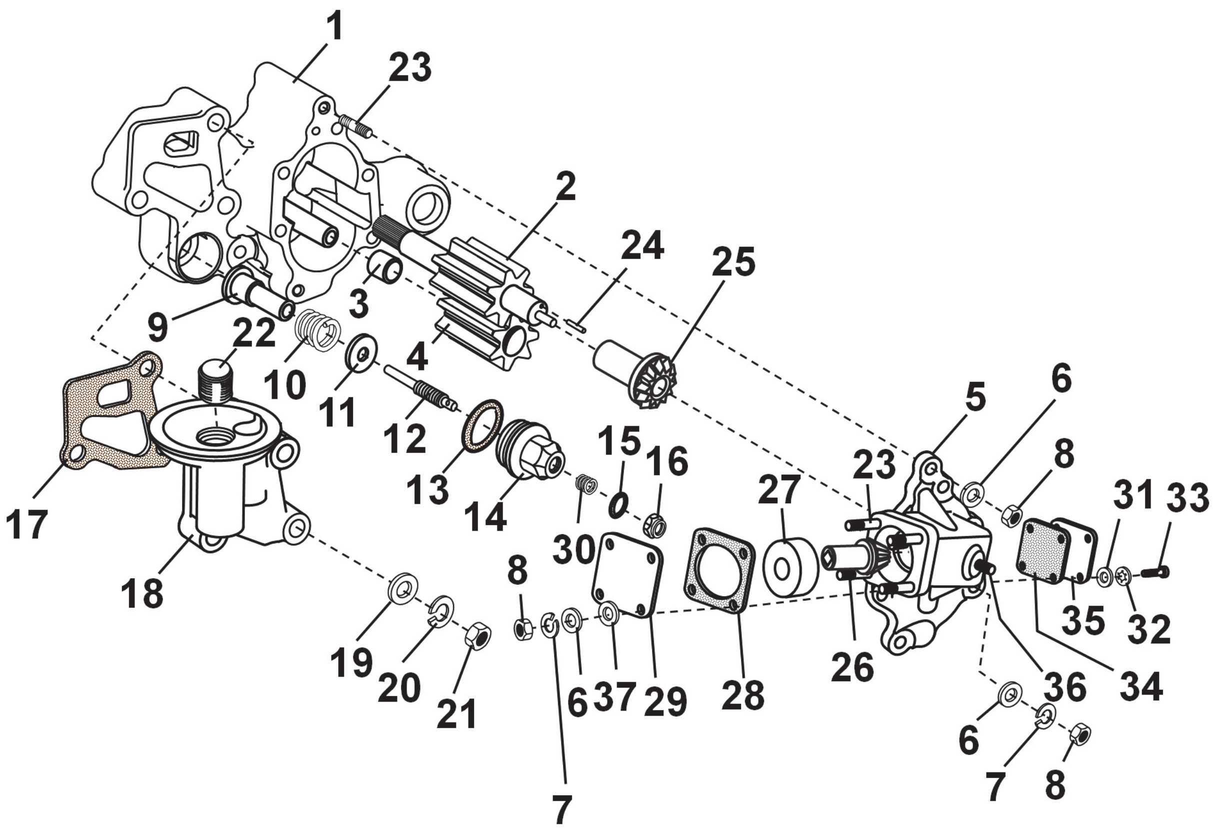


Figure 13-4. Oil Pump Assembly with Electrical Tachometer Drive Adapter

1	Oil Pump Housing	11	Seat	21	Nut	31	Washer
2	Shaft Gear Assembly	12	Adjustment Screw	22	Stud	32	Lock Washer
3	Bushing	13	Copper Washer	23	Stud	33	Screw
4	Driven Gear Assembly	14	Nut	24	Dowel	34	Gasket
5	Cover	15	Copper Washer	25	Bevel Gear	35	Cover
6	Washer	16	Elastic Lock Nut	26	Tach. Drive Shaft	36	Right Gearbox Cover
7	Lock Washer	17	Gasket	27	Oil Seal	37	Washer
8	Nut	18	Oil Filter Adapter	28	Gasket		
9	Plunger	19	Washer	29	Accessory Cover		
10	Spring	20	Lock Washer	30	Helical Coil		

13-4. Starter and Adapter Disassembly

Two starter adapters are available for IO-550 engine models, one incorporates an accessory drive at the end of the adapter. Refer to Section 13-4.1 or Section 13-4.2 for starter adapter disassembly instructions.

NOTE: To identify the starter/starter adapter installed on your engine, refer to Figure 13-5 and Figure 13-6 and determine which starter/starter adapter matches the figure and follow the corresponding procedure in the subsequent sub-sections.

13-4.1. Basic Starter and Starter Adapter Disassembly

1. Place the starter shaft gear (Figure 13-5) (15) in a shielded vise.

   CAUTION: Do not clamp the starter adapter housing (1) in a vise.

2. Remove and discard the retaining ring (8) using snap ring pliers.
3. Insert the Worm Shaft Tool (see “Special Tools” in Chapter 3) into the worm drive shaft (Figure 13-5) (3) slot and rotate the shaft counter-clockwise to dislodge the ball bearing (7). If necessary, use an arbor press to remove the ball bearing (7) from the worm drive shaft (3). Discard the ball bearing (7).
4. Remove the worm drive shaft (3), starter spring (5), starter worm gear (6) and Woodruff key (4). Discard the starter spring (5) and Woodruff key (4).
5. Remove the nuts (26), and washers (25) from the starter adapter cover (24).
6. Using an inertia puller or other suitable tool, remove the starter adapter cover (24) and O-ring (23) from the starter adapter. Discard the O-ring (23).
7. Remove and discard the retaining ring (22) using snap ring pliers.
8. Use the Starter Adapter Disassembly Tool (see “Special Tools” in Chapter 3) to rotate the starter gear assembly (Figure 13-5)(27) counter-clockwise while simultaneously pulling axially on the starter gear assembly (27) to separate it from the starter shaft gear (15). Remove the starter shaft gear (15) from the vise.
9. Separate the starter shaft gear (15) from the starter adapter housing (1).
10. Clamp the starter gear assembly (27) in a shielded vise.
11. Remove the clutch spring special screw (20) and tab washer (19). Discard the tab washer (19).
12. Place a straight slot screw driver through a hole in the starter gear to catch the end of the clutch spring (16). Rotate the clutch spring (16) clockwise to release it from the land in the starter gear (18). Discard the clutch spring (16).
13. Remove and discard the roller bearing (17) and ball bearing (21).
14. Use a slide hammer and Blind Bearing Remover to remove the needle bearing (2) from the starter adapter housing (1). Discard the needle bearing (2).
15. Examine the components for evidence of wear; clean the components according to instructions in Section 14-1 and inspect the components according to “Overhaul Inspection and Repair” instructions in Chapter 15.
16. Replace the Skytec starter with a new or rebuilt starter at overhaul. Iskra starters have been discontinued; for engines formerly equipped with Iskra starters, consult the illustrated parts catalog for a suitable new or rebuilt starter at overhaul. The Continental Motors’ Energizer starter motors may be replaced with a new or rebuilt unit or the starter may be overhauled according to the instructions in appropriate Starter Service Instructions (X30592).

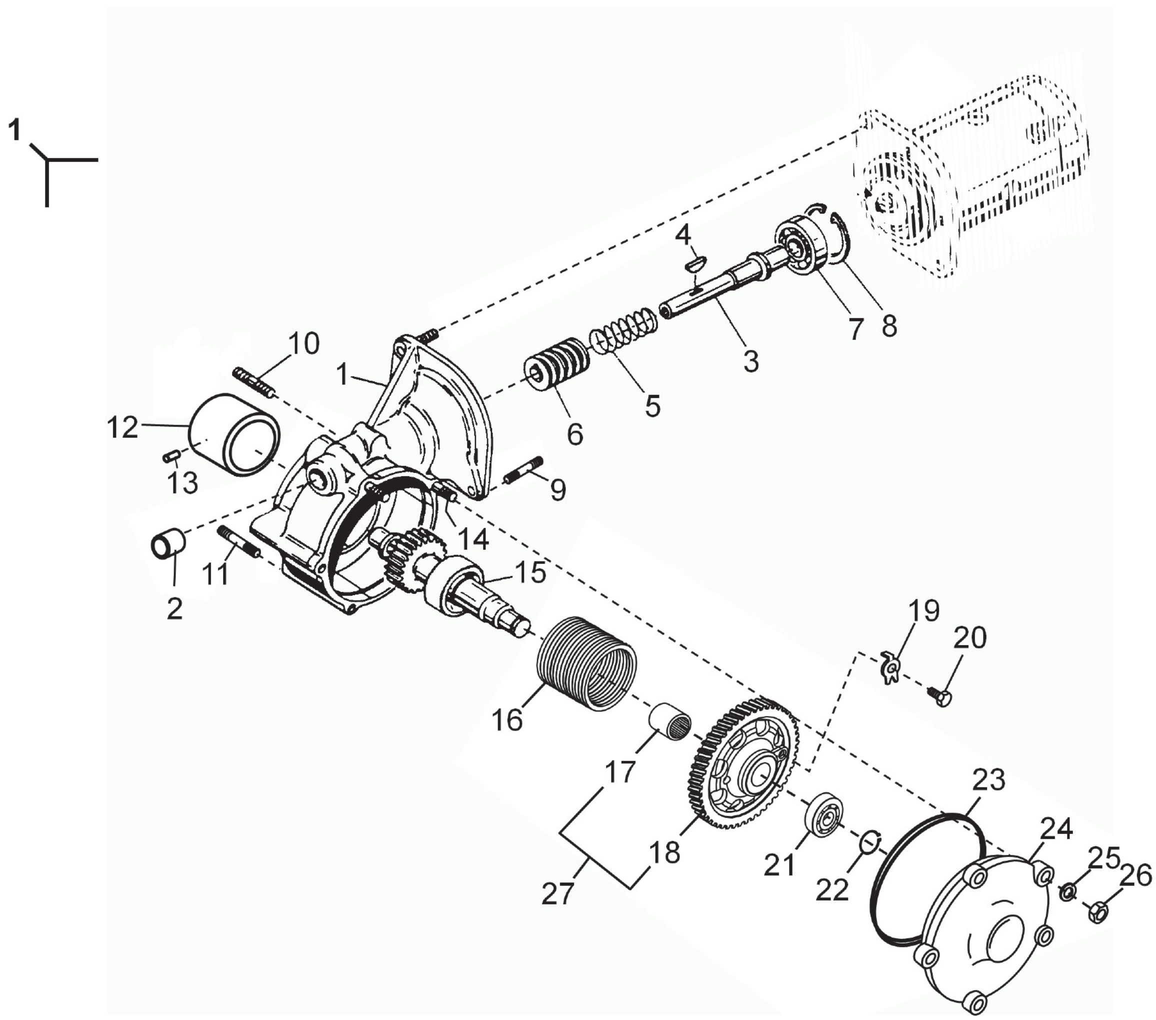


Figure 13-5. Starter and Adapter

1	Starter Adapter Housing	8	Retaining Ring	15	Starter Shaft Gear	22	Retaining Ring
2	Needle Bearing	9	Stud	16	Clutch Spring	23	O-ring
3	Worm Drive Shaft	10	Stud	17	Roller Bearing	24	Starter Adapter Cover
4	Woodruff Key	11	Starter Gear	18	Starter Gear	25	Washer
5	Starter Spring	12	Starter Drum	19	Tab Washer	26	Nut
6	Worm Gear	13	Dowel	20	Screw	27	Starter Gear Assembly
7	Ball Bearing	14	Stud	21	Ball Bearing		

13-4.2. Starter Adapter with Accessory Drive Disassembly

CAUTION: Do not clamp the starter adapter housing (1) in a vise.

1. Clamp the starter shaft gear (Figure 13-6) (15) teeth in shielded vise jaws to allow access to the scavenge pump body (31).
2. Remove and discard the retaining ring (9) using snap ring pliers.
3. Insert a Worm Shaft Tool (see “Special Tools” in Chapter 3) into the slots of the worm wheel gear and rotate the worm drive shaft (6) 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 (6)).
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. Separate the worm gear (4), spring (5), woodruff key (7), and shaft (6). Discard the bearing (8), woodruff key (7), and spring (5).
5. Use a 12-point deep socket, remove and discard the self-locking 12-point nut (40).
6. Remove the nut (30), lock washer (29), seal retainer clip (41) and washer (28) from the top hole in the scavenge pump body (31).
7. Remove the spacer (39) or sheave (not pictured), sleeve (38) and O-ring (37). Remove and discard the shaft seal (36) and bearing (35). Remove the spacer (34) from the scavenge pump body (31).
8. Remove the five remaining nuts (30), lock washers (29) and washers (28) from the scavenge pump body (31); discard the lock washers (29).
9. Use a rawhide or plastic mallet to gently tap the scavenge pump body (31) loose; remove the scavenge pump body (31) and driver gear (27).
10. Remove the nuts (30) and washers (28) from the perimeter of the starter adapter cover (2); use an inertia puller or other suitable tool to detach the cover (2).
11. Remove and discard the O-ring (23) from the starter adapter cover (2).
12. Remove and discard the clutch spring retaining screw (20) and tab washer (19).

Procedure continues following Figure 13-6

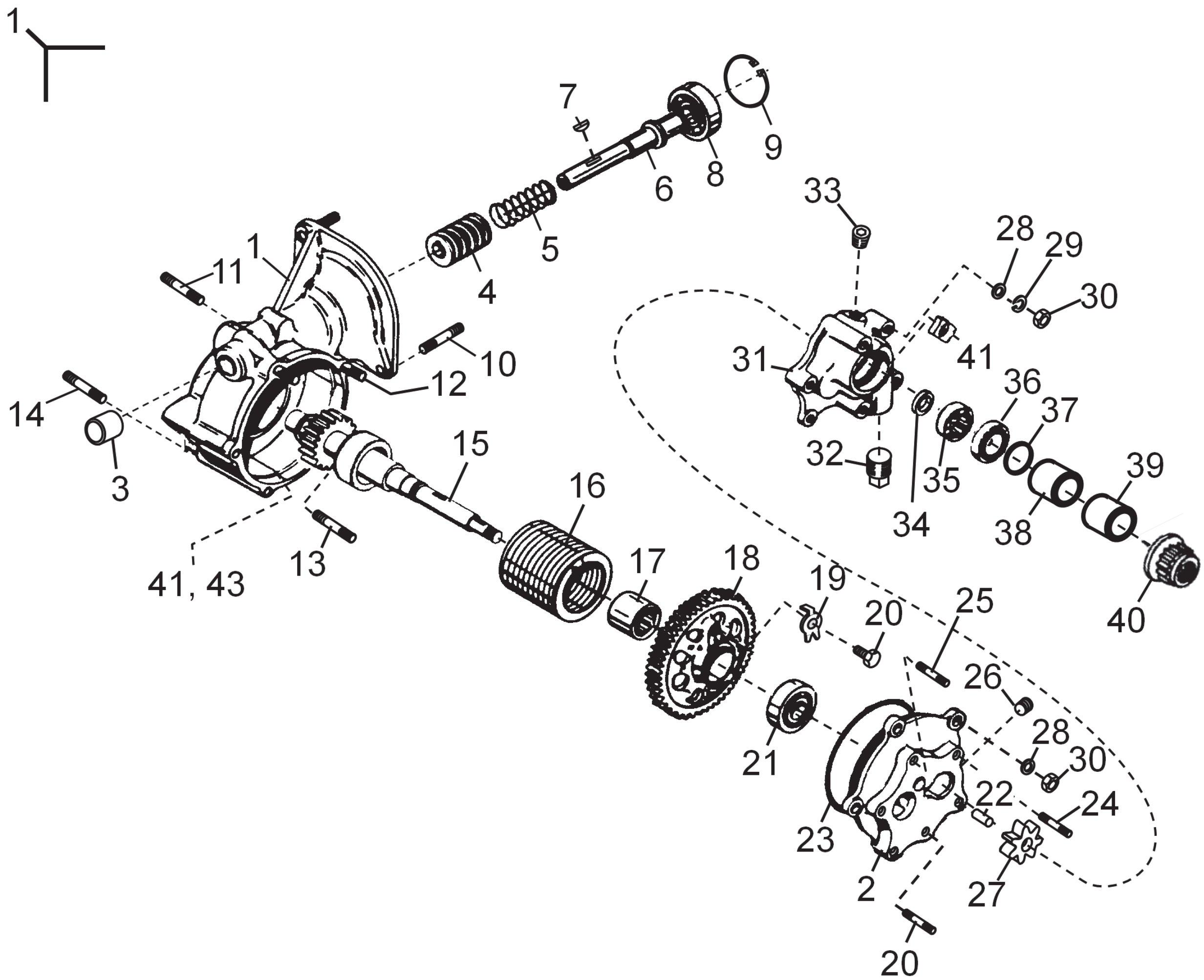


Figure 13-6. Starter and Adapter with Accessory Drive

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

13. Insert the Starter Adapter Disassembly Tool (see “Special Tools” in Chapter 3) in the worm wheel gear holes; rotate the starter assembly gear in a driving direction to wind the clutch spring (16) while simultaneously pulling axially to release the clutch spring (16) from the clutch spring sleeve (not pictured).

14. Clamp the starter gear assembly (18) in a shielded vise.
15. Remove the clutch spring special screw (20) and tab washer (19). Discard the tab washer (19).
16. Place a straight slot screw driver through a hole in the starter gear to catch the end of the clutch spring (16). Rotate the clutch spring (16) clockwise to release it from the land in the starter gear (18). Discard the clutch spring (16).
17. Remove and discard the roller bearing (17) and ball bearing (21).
18. Use an arbor press, or slide hammer and blind bearing remover to remove the needle bearing (3) from the starter adapter housing (1); discard the needle bearing (3).
19. Remove the plugs (32 & 33) from the scavenge pump body (31).
20. Clean, inspect and repair the starter and starter adapter according to the instructions in Chapters 14, 15 and Appendix D.
21. Replace the Skytec starter with a new or rebuilt starter at overhaul. Iskra starters have been discontinued; for engines formerly equipped with Iskra starters, consult the illustrated parts catalog for a suitable new or rebuilt starter at overhaul. The Continental Motors' Energizer starter motors may be replaced with a new or rebuilt unit or the starter may be overhauled according to the instructions in appropriate Starter Service Instructions (X30592).

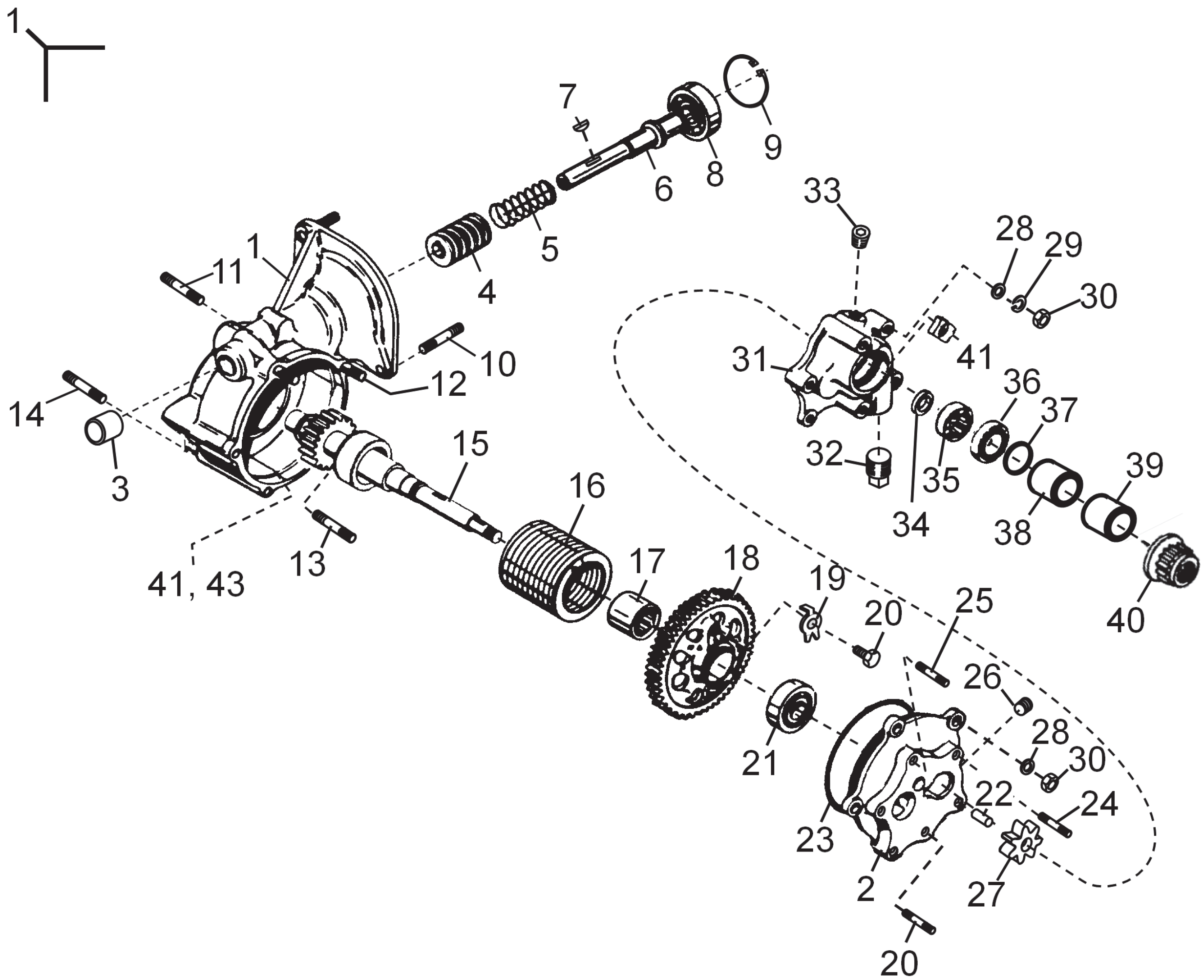


Figure 13-6 repeated for reference

13-5. Engine Cylinder Disassembly

13-5.1. IO-550-A, B, & C Engine Cylinder Disassembly A B C

CAUTION: To prevent damage to the engine cylinder, take the necessary precautions indicated in the "Stud Replacement" instructions in Section C-7.

1. Place the cylinder assembly (Figure 13-7) on a cylindrical block of wood anchored to a workbench.
2. Use a Valve Spring Compressor Tool to carefully compress the valve springs. Do not cock the rotocoil (16) or retainer key (17) which could score the valve stem.
3. Use needle nose pliers to remove and discard the retainer key(s) (17).
4. Remove and discard the rotocoil (16).
5. Remove the intake valve retainer (26), the outer spring (13), and inner spring (12). Discard the springs (12 & 13).
6. Remove the lower retainers (14).
7. Remove and discard the intake valve guide seal (15).
8. Hold the valve stems while lifting the cylinder from its support and place the cylinder on its side.
9. Remove and discard the intake (10) and exhaust (11) valves.
10. Remove and discard the exhaust flange studs (6), regardless of condition, according to the instructions in Section C-8.
11. Support the rocker arm (21 & 24) on a ring or vise that will allow the old bushings to pass through.
12. Press the worn rocker arm bushings (22) out using the proper size tool and an arbor press. Discard the bushings (22).
13. Perform a "Visual Inspection" according to instructions in Section 15-3 to determine if the cylinder may be a candidate for overhaul inspection and repair.

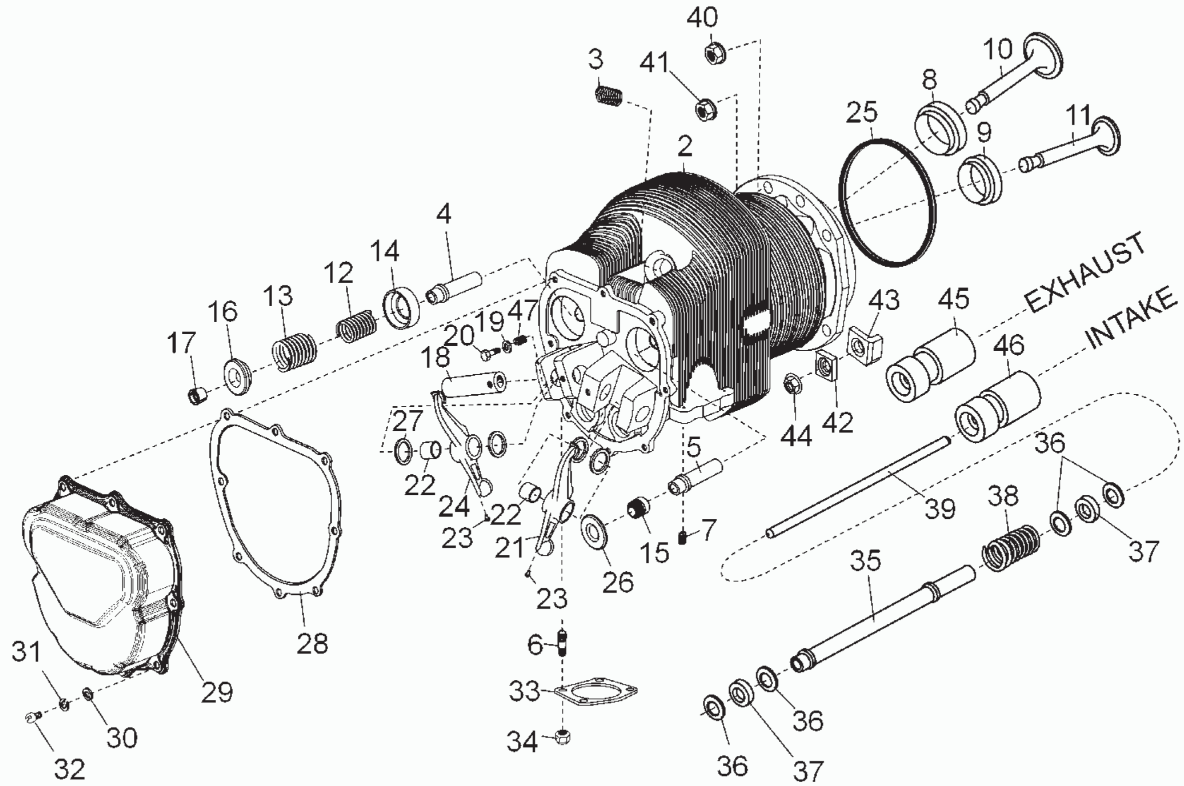


Figure 13-7. IO-550-A, B & C Cylinder Assembly A B C

1	Cylinder Assembly	13	Outer Spring	25	Cylinder Base O-ring	37	Packing
2	Cylinder	14	Lower Retainer	26	Intake Valve Retainer	38	Spring
3	Spark Plug Insert	15	Seal	27	Thrust Washer	39	Pushrod
4	Exhaust Valve Guide	16	Rotocoil	28	Rocker Cover Gasket	40	Flange Nut
5	Intake Valve Guide	17	Retainer Key	29	Rocker Cover	41	Flange Nut
6	Stud	18	Rocker Shaft	30	Washer	42	7^{th} Stud Bracket
7	Intake Flange Insert	19	Plain Washer	31	Lock Washer	43	7^{th} Stud Bracket
8	Intake Valve Seat	20	Screw	32	Screw	44	Flange Nut
9	Exhaust Valve Seat	21	Rocker Arm, Intake	33	Exhaust Flange Gasket	45	Hydraulic Exhaust Tappet
10	Intake Valve	22	Rocker Arm Bushing	34	Nut	46	Hydraulic Intake Tappet
11	Exhaust Valve	23	Drive Screw	35	Pushrod Housing	47	Helical Coil Insert
12	Inner Spring	24	Rocker Arm, Exhaust	36	Washer		

13-5.2. IO-550-G, N, P & R Cylinder Disassembly G N P R

CAUTION: To prevent damage to the engine cylinder, take the necessary precautions indicated in the "Stud Replacement" instructions in Section C-7.

1. Place the cylinder assembly (Figure 13-8) on a cylindrical block of wood anchored to a workbench.
2. Use a Valve Spring Compressor Tool (Chapter 3, Special Tools and Supplies) to carefully compress the valve springs. Do not cock the rotocoil (Figure 13-8) (19) or the retainer (51) which could score the valve stem.
3. Use needle nose pliers to remove and discard the retainer keys (18).
4. Remove and discard the rotocoil (19).
5. Remove and discard the following:
   a. Intake valve retainer (51)
   b. Outer springs (15)
   c. Inner springs (14)
6. Remove the lower retainers (17).
7. Remove and discard the intake valve guide seal (50)
8. Hold the valve stems while lifting the cylinder from its support and place the cylinder on its side.
9. Remove and discard the intake (12) and exhaust (13) valves.
10. Remove and discard the cylinder exhaust flange studs (8), regardless of condition according to instructions in Section C-7.
11. Support the rocker arm (20) on a ring or vise to allow the old bushings to pass.
12. Press the worn valve rocker bushings (21) out using the proper size tool. Discard the rocker arm bushings (21).
13. Remove the baffle (43). Each cylinder baffle is either to be repaired or replaced during overhaul.
14. Remove and discard the spring (44).
15. Perform a "Visual Inspection" according to instructions in Section 15-3 to determine if the cylinder may be a candidate for overhaul inspection and repair.

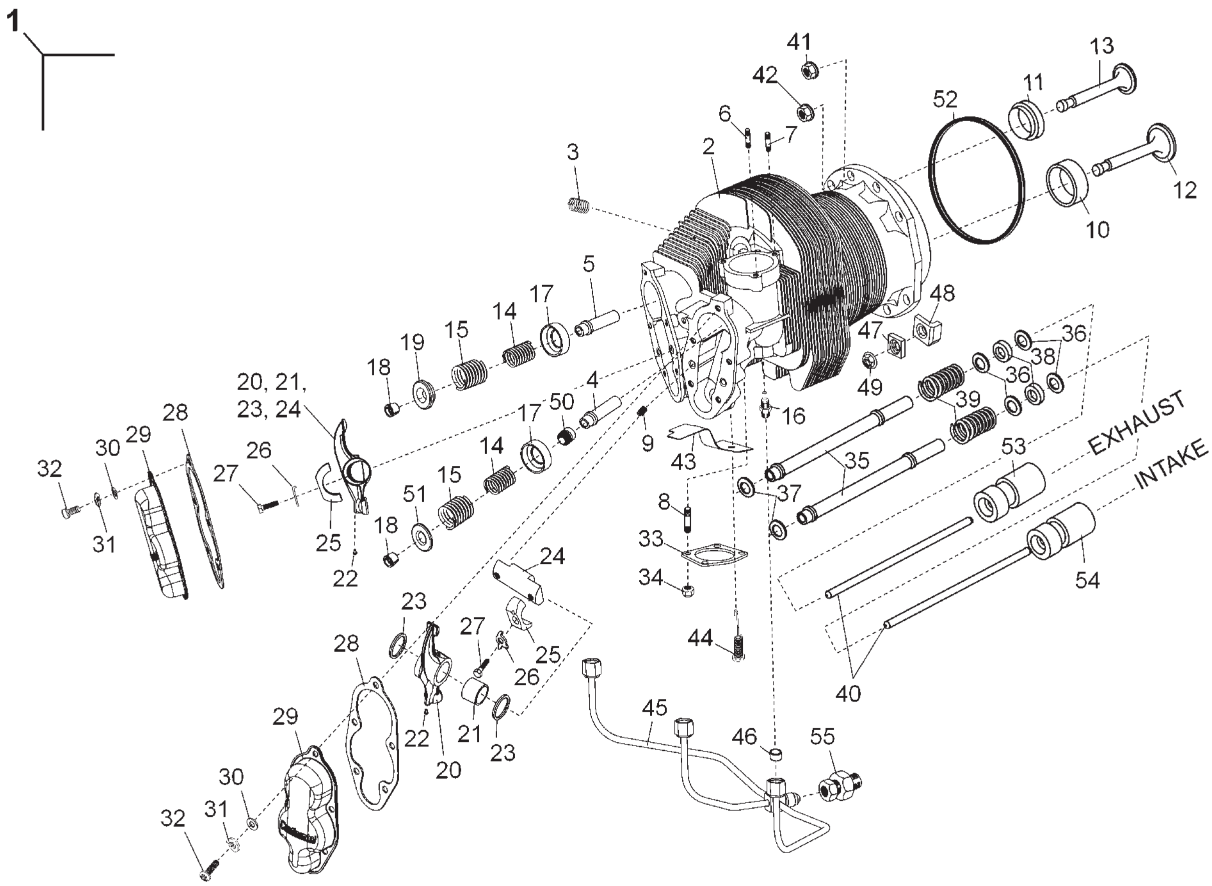


Figure 13-8. IO-550-G, N, P & R Cylinder Assembly G N P R

1	Cylinder Assembly	15	Outer Spring	29	Rocker Cover	43	Baffle
2	Cylinder	16	Drain Fitting	30	Washer	44	Spring
3	Spark Plug Insert	17	Inner Retainer	31	Lock Washer	45	Drain Tube
4	Intake Guide	18	Retainer Key	32	Screw	46	Drain Tube Seal
5	Exhaust Valve Guide	19	Rotocoil	33	Exhaust Flange Gasket	47	7th Stud Bracket
6	Stud	20	Rocker Arm Assembly	34	Lock Nut	48	7th Stud Bracket
7	Stud	21	Rocker Arm Bushing	35	Pushrod Housing	49	Flange Nut
8	Stud	22	Drive Screw	36	Washer	50	Seal
9	Helicoil Insert	23	Thrust Washer	37	O-ring Seal	51	Retainer
10	Intake Valve Seat Insert	24	Rocker Arm Shaft	38	Pushrod Housing Packing	52	Cylinder Base O-ring
11	Exhaust Valve Seat Insert	25	Retainer	39	Pushrod Housing Spring	53	Hydraulic Exhaust Tappet
12	Intake Valve	26	Tab Washers	40	Pushrod Assembly	54	Hydraulic Intake Tappet
13	Exhaust Valve	27	Screw	41	Flange Nut	55	Check Valve
14	Inner Spring	28	Rocker Cover Gasket	42	Flange Nut		

13-6. Accessory Drive Pad Disassembly

1. Remove the nuts (Figure 13-9) (16) or bolts (21), lock washers (15), and washers (14) from the four corners of the accessory pad cover (13). Remove the cover (13) and gasket (12). Discard the gasket (12) and lock washers (15).
2. Remove and discard the oil seal (4).
3. Remove the bushing from the adapter:
   a. Use an arbor press to drive the old bushing (3) out of the adapter with a 0.9 inch diameter ram; discard the bushing (3).
   b. Secure the adapter in a fixture on a drill press and bore bushing inside diameter to 0.939 diameter and collapse the remaining shell to remove it from the adapter.
4. Place the accessory drive components in a clean, storage area until overhaul inspection and repair in Chapter 15.

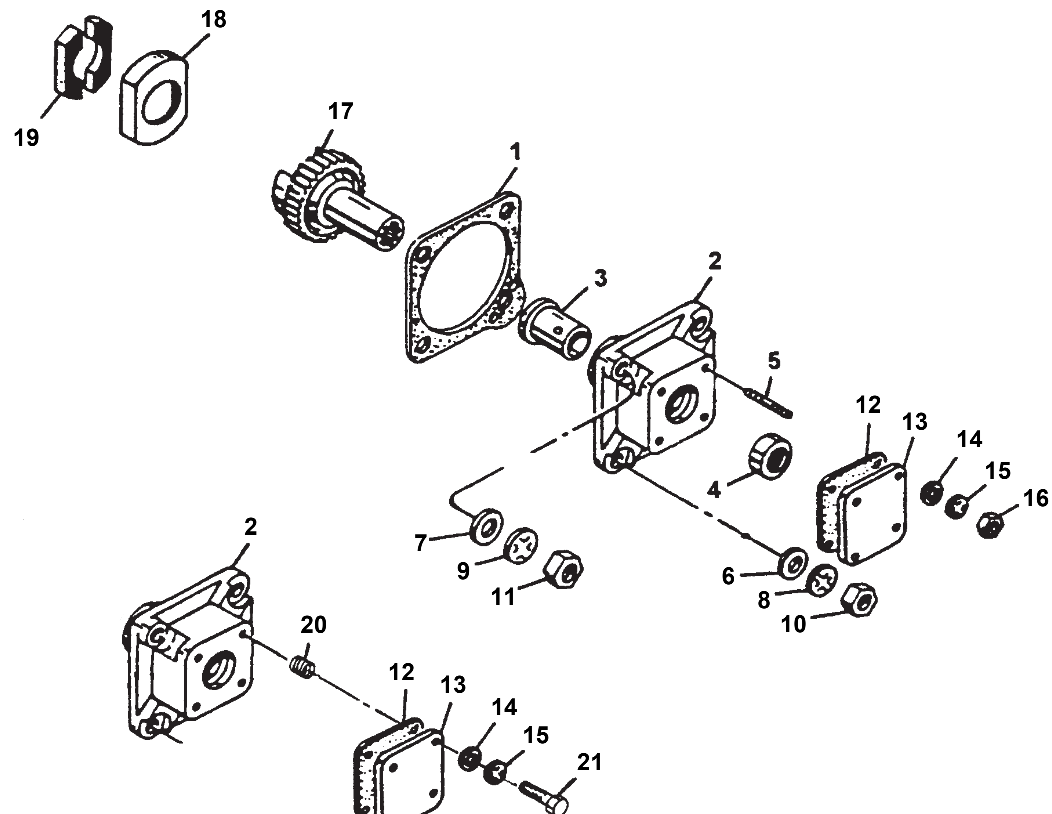


Figure 13-9. Accessory Drive Assembly

1	Gasket	7	Plain Washer	13	Cover	19	Rubber Bushing
2	Adapter Assembly	8	Lock Washer	14	Washer	20	Helical Coil Insert
3	Bushing	9	Lock Washer	15	Lock Washer	21	Bolt
4	Oil Seal	10	Nut	16	Nut		
5	Stud	11	Nut	17	Drive Gear Assembly		
6	Plain Washer	12	Gasket	18	Retainer		

13-7. Crankcase Disassembly

13-7.1. Miscellaneous Crankcase Accessory Removal

1. Remove two sets of nuts (Figure 13-10) (11), lock washers (10), and washers (19); discard the lock washers (10). 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).

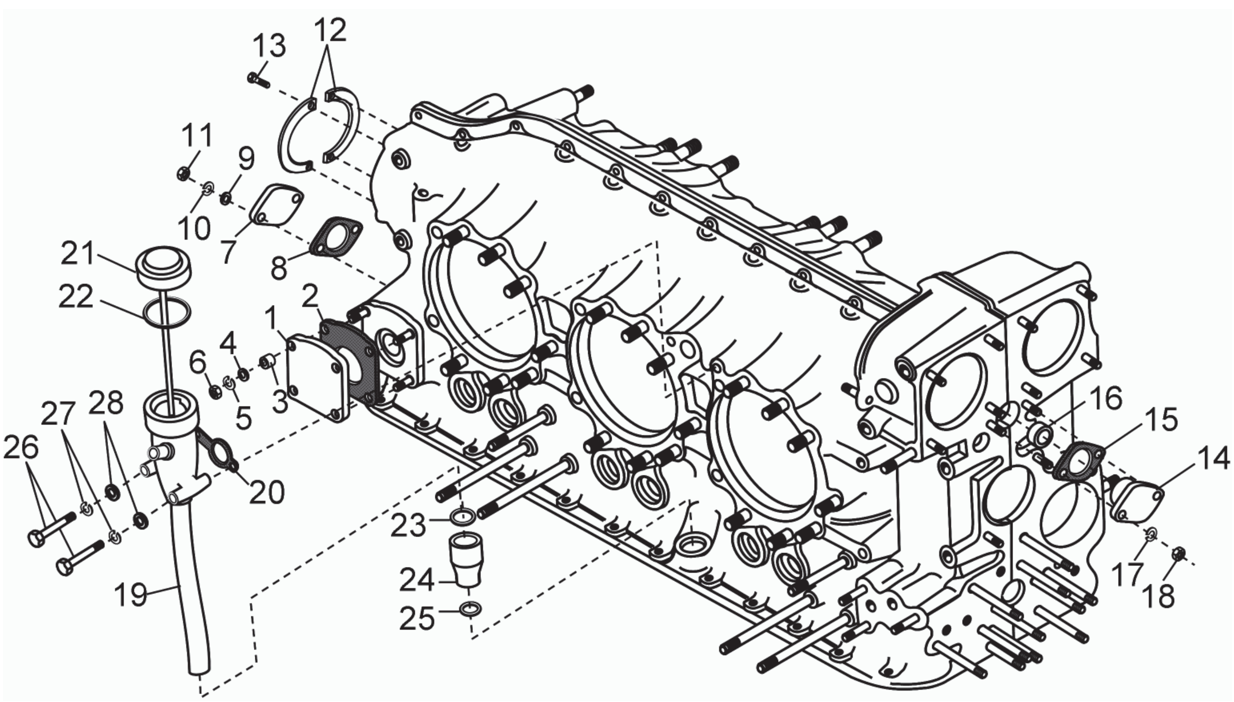


Figure 13-10. Miscellaneous Crankcase Hardware

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 (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 (2)). Remove the cover (2) and gasket (1) from the crankcase and discard the gasket (1).
7. 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).
8. Remove the nuts and washers holding the rear lifting eye. Remove the lifting eye from the crankcase.

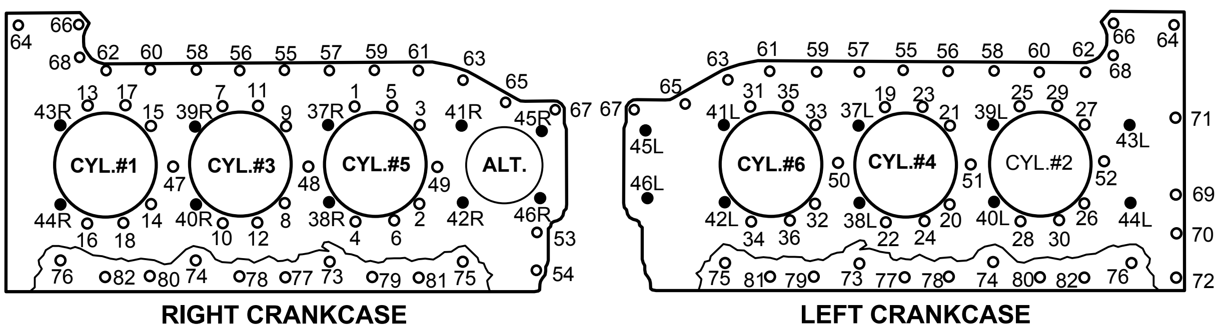


Figure 13-11. Crankcase Fastener Locations

NOTE: Reference the locations in Figure 13-11 for fastener removal. Due to lack of clearance, do not attempt to remove the bolt and washer adjacent to the right accessory drive stud.

9. Remove the 5/16” bolts, nuts and washers along the crankcase backbone (55-63 and 65-68).
10. Remove the lifting eye (63), throttle bracket (61) and fuel manifold valve bracket (55).
11. Remove the fastening hardware at locations 45 and 46. Using a soft mallet, tap out and discard the through-bolts.
12. Remove the three bolts and washers from positions 69, 70 and 71.
13. 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.
14. Remove the baffle supports from 42R; 43 and 44L.
15. Remove the fastening hardware (64) and O-ring; tap the through-bolt out with a mallet and discard the through-bolt and O-ring.
16. Rotate the engine stand to invert the engine.
17. Remove the six 1/4” screws (positions 77-82) from the crankcase belly.
18. Remove the 5/16” fasteners (positions 73-76) below the camshaft journal.

19. Rotate the engine stand placing the left crankcase half downward. Support the engine under the left crankcase half.
20. 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.
21. Check and record the gear backlash according to the specifications in Appendix D before proceeding to the next step.
22. Remove the crankshaft assembly (Figure 13-14) from the crankcase and place it in a holding fixture for inspection.
23. Remove the idler gear (3) from the crankcase.
24. Remove and discard the crankshaft bearings (2) and thrust washers (1).
25. Remove the camshaft assembly (Figure 13-13)(1) and governor driven gear (7) from the crankcase.

13-7.2. Crankcase Studding Disassembly

1. Remove starter shaft gear roller bearing (Figure D-33 through Figure D-37) (33) 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. Using the Crankcase Through-Bolt Remover Tool (“Special Tools” in Chapter 3), remove the applicable crankcase hardware and plugs listed in the Appendix D-9.6 to allow pressure flushing of the crankcase. Inspect the plugs for wear; replace worn plugs. Tag the plugs to identify their respective locations for accurate identification during reassembly.

3. Examine the components for evidence of leakage or wear; clean the components according to instructions in Chapter 14, and perform the inspections specified in Chapter 15.

13-8. Engine Drive Train Disassembly

The engine drive train consists of the camshaft and crankshaft.

13-8.1. Camshaft Disassembly

1. Remove the governor drive gear (Figure 13-13)(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 13-12), 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 13-13.

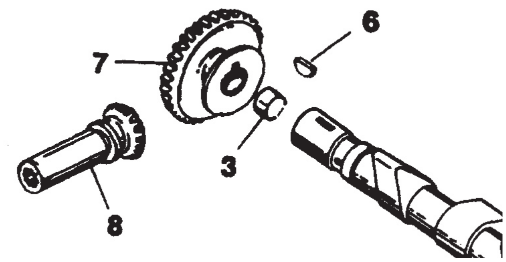


Figure 13-12. Keyed Camshaft

2. Cut and remove the safety wire from the bolts (Figure 13-13) (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).

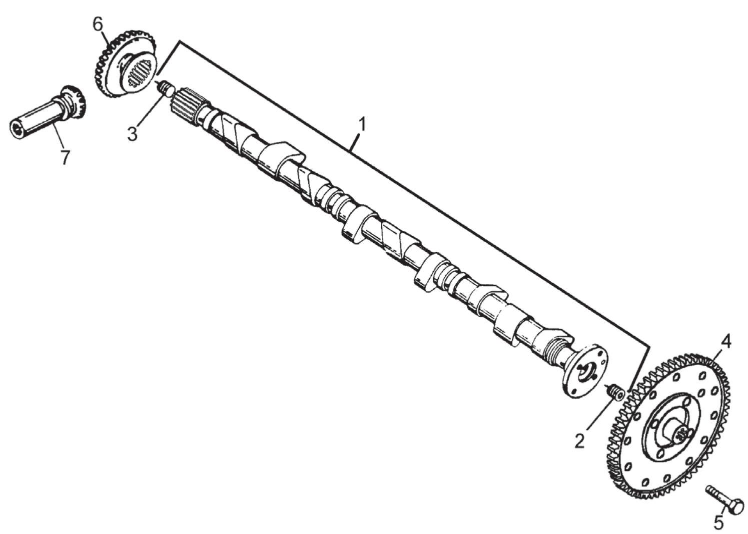


Figure 13-13. Camshaft Assembly

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

13-8.2. 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 13-14)(4) and connecting rod bolts (5). Separate the connecting rod caps (6) from the connecting rod (7) with their position numbers matched.
3. Remove the connecting rod bearing inserts (8).

NOTE: Leave the counterweights intact. Detailed counterweight removal and disassembly instructions are included in Chapter 15, Overhaul Inspection and Repair.

4. Remove the two nuts (17) securing the oil transfer collar. Separate the oil transfer collar assembly (18 through 21) from the crankshaft. Discard the 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 (23 and 24) 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 drive 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 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).

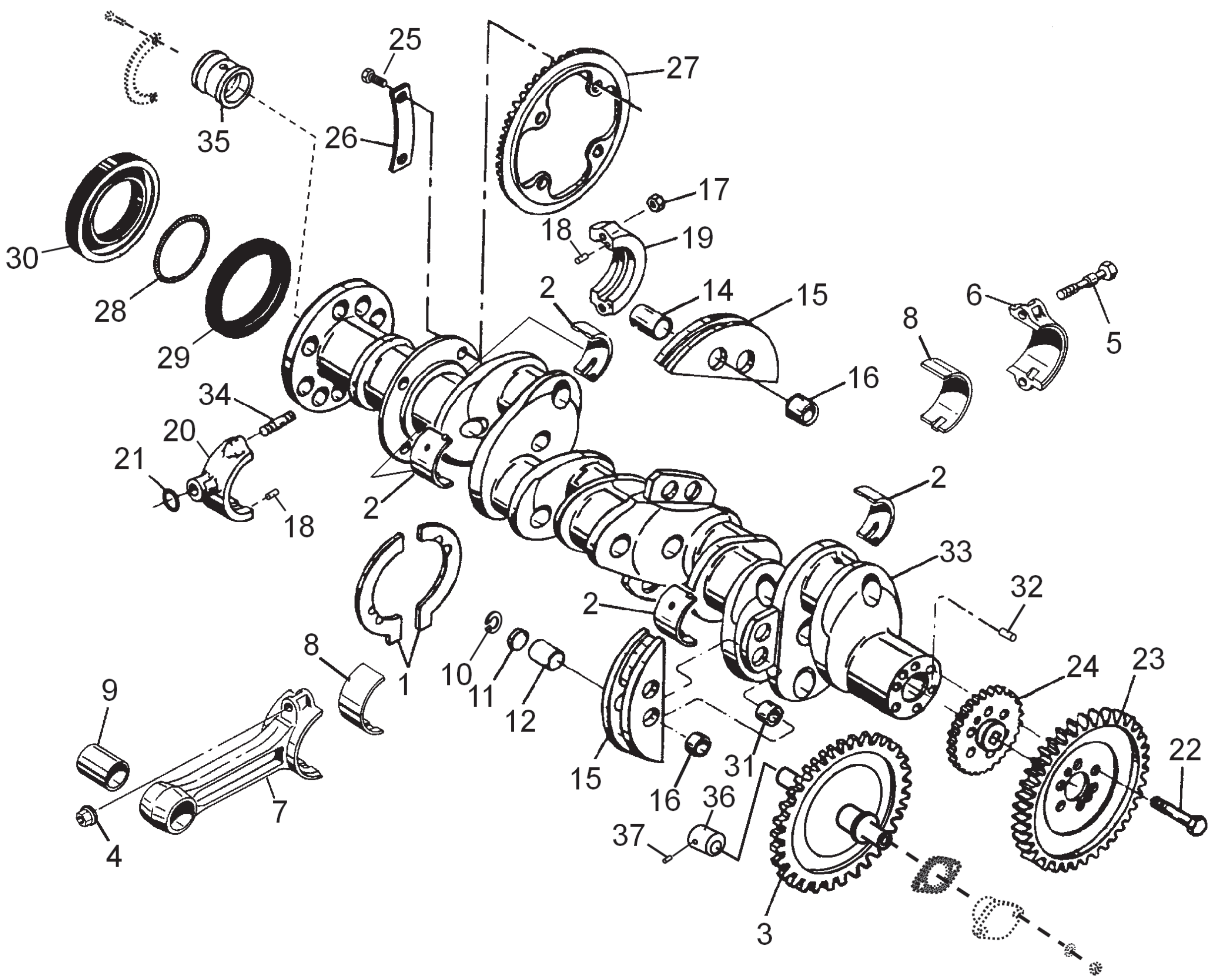


Figure 13-14. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	Crankshaft Main Bearing	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	Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring		
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring		
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 (30).
13. Clean the Gasket Maker residue out of the counterbore recess using a chlorinated solvent Loctite Chisel or methylene chloride followed by a naptha solvent such as Loctite ODC-Free Cleaner and Degreaser. Remove all debris to render the bore clean, without any trace debris.

13-9. Compressor Mounting Kit Disassembly

1. Remove the sheave support bolt (Figure 13-15) (6), sheave assembly (2, 3 & 4), shims (22), and spacer (7) from the block assembly (5). Discard the spacer (7) and shims (22).
2. Remove the retaining ring (4) from the idler sheave (2) with snap ring pliers; discard the retaining ring (4).
3. Support the idler sheave (2), face down on a 1” diameter cylindrical block centered under an arbor press. Press the bearing (3) out of the idler sheave (2) and discard the bearing.
4. Remove the bolt (8) and washer (9) from the block (5).
5. Remove the compressor mounting hardware (13, 14 and 15) from the bracket.
6. Remove the adjusting bolt (10); jam nut (11), washer (14), and rectangular nut (12) from the mounting bracket.
7. Remove the self-locking 12-point nut (20), sheave (19) and shims (21) from the starter adapter PTO shaft; discard the self-locking 12-point nut (20).

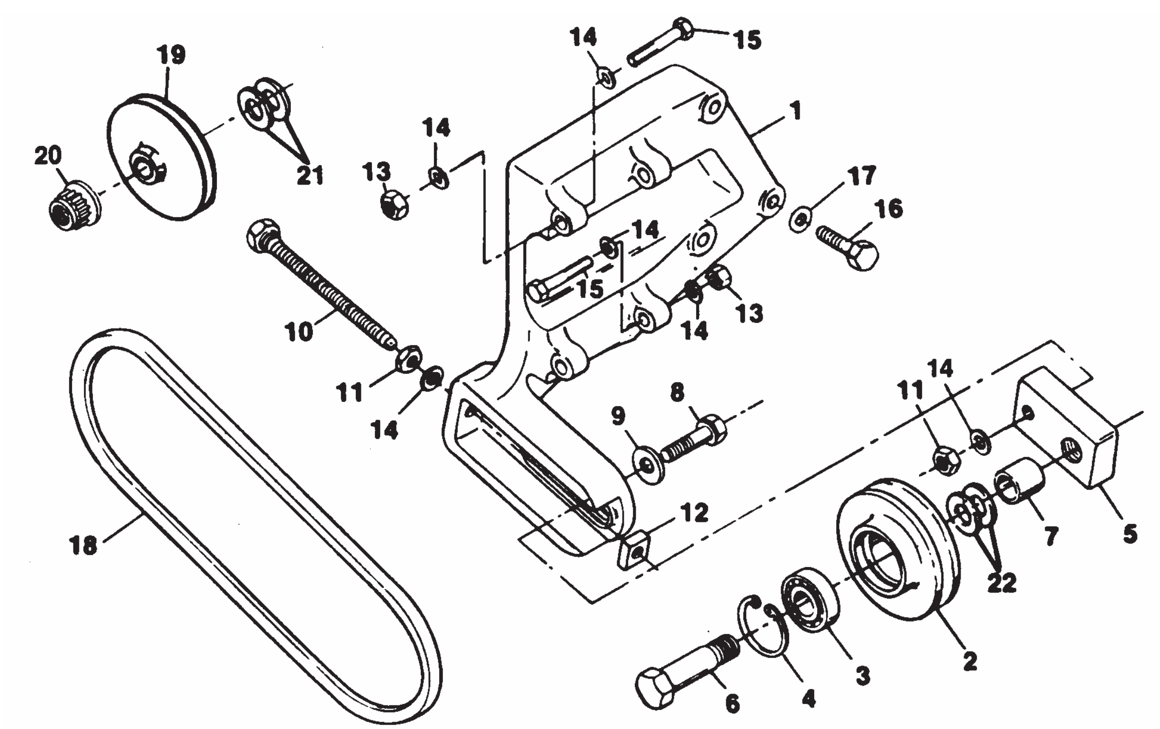


Figure 13-15. Refrigerant Compressor Mounting Kit

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		

Chapter 14. Engine Cleaning

14-1. Engine and Component Cleaning

The goal of cleaning engine components is to remove dirt and contamination. A "cleaned" part is free of dirt, carbon, varnish, and gum substances. The "Aircraft Engine Parts Cleaning Guidelines" (Table 14-1) offer instructions for specific engine parts during overhaul or maintenance. Refer to the "Cleaning Tips" in Table 14-2 for additional guidelines.

WARNING

Consult the manufacturer's Material Safety Data Sheet (MSDS) for specific handling, storage and disposal instructions, including personal protective equipment requirements.

To prevent death or injury, do not smoke or introduce sources of ignition or flame to the work area when using flammable cleaning fluids such as mineral spirits.

Do not use gasoline, kerosene, abrasive cleaning paste, or cleansing powder to clean the engine or engine parts.

Do not pressure blast gears with abrasive media. Blasting will remove surface hardening.

When cleaning with alkaline solutions, remove all traces of alkaline residue to prevent corrosion. Alkaline cleaning solutions induce corrosion if not completely removed.

NOTE: Prior to cleaning engine parts, visually inspect for leakage and metal shavings, rust or other obvious signs of wear.

Table 14-1. Aircraft Engine Parts Cleaning Guidelines

Item to Clean	Instructions/References/Tips
Fuel manifold valve	Mineral spirits
CAUTION: Never insert any object (wire, pipe cleaner, brush, etc.) in the fuel injector nozzle. If stain or obstruction cannot be removed with solvent or air, replace the nozzle.	
• Fuel injectors • Fuel screen	• Ultrasonic Cleaner Ultrasonic cleansing is the preferred method of cleaning; adhere to ultrasonic cleaner manufacturer's instructions. If ultrasonic cleaner is not available: • Acetone • MEK • Lacquer thinner Soak in solvent (acetone, lacquer thinner or MEK) to remove gum and fuel varnish stains and deposits. Use clean, oil free air to remove residue and dry the inside of nozzle.
Throttle control linkage pivot point areas	Stoddard solvent
Soiled aluminum alloy parts with carbon or gum deposits	Refer to "Cleaning Aluminum Alloy Parts" in Section 14-1.4.
Electrical charging system gears[1] with bushings[2]	Mineral spirits and a brass wire brush
Electrical charging system gears[1] without bushings	• Mineral spirits • Alkaline stripping bath followed by steam rinse to remove all alkaline traces (to prevent corrosion), inspect for traces of alkaline residue and re-spray with steam if alkaline residue found; flush with mineral spirits
• Starter adapter housing, cover and oil passages • Gears without bushings	Flush with mineral spirits (preferred cleansing agent) Alkaline stripping bath followed by steam rinse to remove all alkaline traces (to prevent corrosion); Dry with compressed air and inspect for traces of alkaline residue. Re-spray with steam if alkaline residue found; flush thoroughly with mineral spirits
Worm shaft on the starter/starter adapter	Mineral spirits
Starter/starter adapter gears[1] with bushings[2]	Mineral spirits and a brass wire brush
• Oil sump • Oil pump housing • Oil filter adapter • Tach drive adapter • Lubrication System gears without bushings	Flush with mineral spirits (preferred cleansing agent). Alkaline stripping bath followed by steam rinse to remove all alkaline traces (to prevent corrosion); Dry with compressed air and inspect for traces of alkaline residue. Re-spray with steam if alkaline residue found; flush thoroughly with mineral spirits
NOTE: All oil passages must be clear	
Oil suction tube assembly	Mineral spirits
Oil cooler	Must be cleaned by an FAA-certified repair facility

Table 14-1. Aircraft Engine Parts Cleaning Guidelines

Item to Clean	Instructions/References/Tips
Lubrication System gears[1] with bushings[2]	Mineral spirits and a brass wire brush
Engine cylinders[3]	Refer to “Cylinder Cleaning” instructions in Section 14-1.4.
Piston tops	To remove heavy carbon deposits on the piston tops, use vapor grit method - Refer to “Vapor Blasting” in Section 14-3.
Engine cylinder intake valves	Degrease intake valves with mineral spirits. Remove all carbon, varnish and gum either using a carbon solvent or by dry blasting according to instructions in Section 14-2, “Dry Blasting.” If dry blasting is performed, clean the valve with mineral spirits and air dry.
Pushrods and rocker arms	Soak in mineral spirits. Ensure passages within the pushrod and rocker arm are open by flushing the passages with mineral spirits using a squirt bottle. Discard and replace any pushrod or rocker arm that has obstructed passages and cannot be cleared. **Do <u>NOT</u> clean pushrods or rocker arms by dry blasting**
Cylinder baffles and cylinder hardware	Mineral spirits
Crankcase oil passages Oil squirt nozzles	Pressure flush with mineral spirits to remove clogs or free obstructed passages. (Use caution flushing the oil squirt nozzles, they are not field replaceable)
Engine mount brackets	Mineral spirits
Crankcase casting	Flush with mineral spirits (preferred cleansing agent) Alkaline stripping bath followed by steam rinse to remove all alkaline traces (to prevent corrosion); after drying, inspect for traces of alkaline residue and re-spray with steam if alkaline residue found; flush with mineral spirits.
Gasket surfaces on castings	Remove all old adhesive gasket material using the organic solvents listed below: • Acetone • Naptha • Methyl ethyl ketone (MEK) When removing the crankshaft nose oil seal, clean the Gasket Maker residue out of the counterbore recess using a chlorinated solvent Loctite Chisel® or methylene chloride followed by a naptha solvent such as Loctite ODC-Free Cleaner and Degreaser. Remove all debris to render the bore clean, without any trace debris.
CAUTION: When utilizing compressed air, wear OSHA approved protective eye wear. Never exceed 30 psi when using compressed gases for cleaning purposes. (OSHA 1910.242(b))	
Connecting rods, caps, bolts, and nuts	Thoroughly clean connecting rods using mineral spirits. Ensure that all surfaces are free of varnish, oil and residue. Place a sheet of crocus cloth on a flat surface plate and dampen with mineral spirits. Lightly rub the parting surface of the rod, cap and rod across crocus cloth to remove burrs or nicks. Clean the connecting rods, caps, bolts and nuts thoroughly. Dry the cleaned part with compressed air and place on a clean cloth.
Connecting rod bearing inserts	Clean the new bearing inserts in mineral spirits and blow dry.

Table 14-1. Aircraft Engine Parts Cleaning Guidelines

Item to Clean	Instructions/References/Tips
Camshaft Crankshaft	Degrease with mineral spirits (brushing or spraying). Remove all varnish or gummy deposits. Place the crankshaft or camshaft in a machinist's lathe and rotate at approximately 100 RPM, smooth the following with crocus cloth moistened in mineral spirits: • Crankshaft crank pins • Main journals • Oil seal race • Oil transfer collar area • Camshaft journals • Gear mount flange Clean all debris from bolt holes, threads, oil passages, and recesses
Counterweights[1]	Mineral spirits
Crankshaft and camshaft gears[1] with bushings[2]	Mineral spirits and a brass wire brush
Crankshaft and camshaft gears without bushings	Flush with mineral spirits (preferred cleansing agent) Alkaline stripping bath followed by steam rinse to remove all alkaline traces (to prevent corrosion); after drying, inspect for traces of alkaline residue and re-spray with steam. Flush alkaline residue with mineral spirits
Small steel parts	Spray or brush on mineral spirits to degrease the part. Soak heavily soiled parts for 15 minutes in mineral spirits.
Exhaust System – Multi-segment V-band clamps	Clean clamps using crocus cloth on the outer band of the clamp assembly. Use Stoddard solvent to clean the rest of the clamp
All other Exhaust System components	Spray the components with Stoddard solvent. Allow the solvent to drain, and wipe the parts dry with a clean cloth
WARNING **Except when removing carbon deposits and gum (oil varnish), do not use alkaline (caustic) cleaning solutions for external engine cleaning. Alkaline solutions remove the alodine finish of aluminum parts.**	
Engine exterior and components	Spray or brush cleaning solvent (mild detergent or mineral spirits) on the engine exterior or component
Connectors	• Electrical contact cleaner CR4 • Do not use water-base or petroleum-base solvent to clean connectors • If a cleaning fluid is suspected to have entered a connector, blow the excess away from the connector and place the effected component(s) in a warm dry environment; i.e. 90°F (32°C), overnight or until thoroughly dry. • As applicable, replace the sealant strip in the connector if any damage to the seal is evident.

1. Do not pressure blast gears or counterweights to clean them; blasting can remove the surface hardening.
2. Do not use alkaline cleaning solutions.
3. Do not use sand, glass shot, or metal grit to clean engine cylinders.

Table 14-2. Cleaning Tips

Dos	Don'ts
Use a cloth or compressed air to blow off the solvent.	Except when removing carbon deposits and gum (oil varnish), do not use alkaline (caustic) cleaning solutions for external engine cleaning. Alkaline solutions remove the alodine finish.
Remove dirt (especially caked dirt) and debris from bolts, nuts, and engine parts.	Do <u>not</u> use any of the following to clean the engine or parts: • Gasoline • Kerosene • Abrasive cleaning paste • Cleaning powder
Dispose of cleaning solvents in accordance with Environmental Protection Agency (EPA) regulations.	Do not scrape parts or use wire brushes, sandpaper, abrasive cloth or abrasive wheels to clean or polish parts to prevent concentrated stress to scratched areas and fatigue failure.
Dry blast only with plastic media or natural materials such as wheat grains	Do not use sand, metal grit, or glass beads for any type of cleaning or dry blasting.
After a part is cleaned, machined or repaired, or if the alodine finish is worn, apply alodine to aluminum surfaces, according to instruction in Section 14-4.1.	Do not tumble blast wrought or die cast smooth surface parts such as rocker covers or intake tubes.

14-1.1. Cylinder Cleaning

CAUTION: When utilizing compressed air, wear OSHA approved safety glasses, goggles or face shield. Never exceed 30 psi when using compressed gases for cleaning purposes. (OSHA 1910.242(b))

1. Soak the engine cylinders in mineral spirits for 15 minutes. Dry the cylinder with compressed air. Verify the cylinder is free of dirt and deposits. If the cylinder is satisfactorily cleaned after a mineral spirit bath, proceed to step 4.
2. If caked on carbon deposits remain, remove oil and loose materials from engine cylinders by spraying or brushing on a mild alkaline cleaner.
   a. Spray the cylinder with steam to remove all traces of alkaline residue.
   b. After the cylinder dries, inspect it again for traces of alkaline residue; respray with steam if alkaline residue is still present (to prevent corrosion) and repeat step 1.
3. For persistent carbon, varnish and gum deposits, dry blasting may be required.
   a. Seal and protect all machined surfaces on the cylinder such as the cylinder mount flange nut seats, barrel wall, small holes, and finished surfaces.

   CAUTION: Do not use sand, glass, shot or metal grit when dry blasting. These abrasives can damage engine components. This type of shot will become embedded in aluminum parts rendering them useless.

   b. Dry blast the cylinder to remove persistent carbon, varnish and gum deposits according to instructions in "Section 14-2, "Dry Blasting."
   c. Clean the cylinder with hot, soapy water and a stiff bristled (non-wire) scrub brush to remove blasting materials from the cylinder.
   d. Thoroughly rinse the cylinder with hot water.
   e. Dry the cylinder completely.
4. Coat all bare steel surfaces thoroughly with clean, 50-weight aviation oil to prevent cylinder bore damage due to rust and contamination.

14-1.2. Piston Cleaning

1. Soak the cylinder and piston in mineral spirits.
2. If carbon deposits do not yield to solvent and deposits remain, install a tight fitting skirt protector and dry blast the piston heads with soft grit or employ the vapor grit method (to clean the piston top). Refer to Section 14-2, “Dry Blasting.” and Section 14-3, “Vapor Blasting.”

WARNING

When dry blasting, do not use sand, glass, shot or metal grit which can damage engine components. This media will become embedded in aluminum parts rendering them unusable.

3. Clean the piston with hot, soapy water and a stiff bristled (non-wire) scrub brush to remove all blasting materials from the piston. Thoroughly rinse all soap residue from the piston and cylinder bore using hot water.

CAUTION: Do not use wire brushes or scrapers of any kind to clean the piston.

4. Clean the piston ring grooves by pulling lengths of binder twine or very narrow strips of crocus cloth through the groove. Do not use automotive ring grooves scrapers, since the corner radii at the bottom of the grooves and side clearances must not be altered. Do not use abrasive cloth on the piston skirts because the diameters and cam-ground contour must not be altered.
5. Discard scored or burned pistons.
6. After cleaning, thoroughly rinse pistons using a Stoddard solvent to remove all debris.

14-1.3. Cleaning Exhaust Parts

1. Clean the exhaust system parts (except for the multi-segment V-band clamps) with Stoddard solvent. Allow the solvent to drain and wipe the parts dry with a clean cloth.
2. Clean V-band clamps using crocus cloth on the outer band clamp assembly.

14-1.4. Cleaning Aluminum Alloy Parts

Degrease aluminum alloy parts with mineral spirits. Soak heavily soiled parts for 15 minutes in mineral spirits. To remove carbon and gum deposits, perform the following:

1. Immerse the part in a hot bath of any of the following *long enough to remove the deposit*:
   a. Inhibited, mild alkaline cleaning solution.
   b. Hot, soapy water.
   c. Carbon solvent (only for hard, thick carbon deposits).

   CAUTION: Do <u>not</u> use an alkaline etching solution.
2. Remove the cleaned part from the solvent bath.

   CAUTION: Remove all solvent residue (especially if soap or alkaline solvent used), paying particular attention to crevices, recesses, and holes to prevent engine oil contamination on re-assembly. If not removed completely, the alkaline residue can corrode the part.
3. Rinse thoroughly to remove all traces of the cleaning solution.

   CAUTION: When utilizing compressed air, wear OSHA approved safety glasses, goggles or face shield. Never exceed 30 psi when using compressed gases for cleaning purposes. (OSHA 1910.242(b))
4. Dry the part with dry compressed air.
5. If carbon deposits remain on the part, refer to Section 14-2, “Dry Blasting.”
6. Remove protective seals and masking material.
7. If the Alodine finish was removed during cleaning, restore the alodine finish according to Section 14-4.1, “Alodine.”

14-2. Dry Blasting

Dry blast cleaning entails aiming plastic pellets or processed natural materials such as wheat grains, crushed fruit pits/shells under pressure toward an area to be cleaned. To clean using the dry blast method, perform the following procedure:

CAUTION: Do not use sand, glass, shot or metal grit when dry blasting as this can damage engine components. This type of shot will become embedded in aluminum parts rendering them useless.

1. Prior to dry blasting any component, seal and protect all machined surfaces on the holes and finished surfaces.
2. Using plastic pellets or processed natural materials such as wheat grains, crushed fruit pits/shells. Adjust blast pressure to the lowest setting that will produce the desired cleaning action and aim toward the paint, varnish, or carbon deposit.

CAUTION: When utilizing compressed air, wear OSHA approved safety glasses, goggles or face shield. Never exceed 30 psi when using compressed gases for cleaning purposes. (OSHA 1910.242(b))

3. Blow off all dust with dry, compressed air.
4. Verify that no blasting material has lodged in crevices, recesses, or holes.

14-3. Vapor Blasting

Vapor blasting is used in specific, limited applications such as piston tops. This vapor grit method of cleaning employs high-pressure steam and a very fine abrasive to remove heavy carbon deposits. Clean parts thoroughly after vapor blasting to remove all traces of the blast media.

NOTE: Vapor blasting should not be used on bearing surfaces. Follow the equipment manufacturer’s instructions when employing this type of cleaning.

14-4. Protective Coatings

Protective or anti-corrosive coatings include:

- Alodine
- Zinc chromate primer
- Enamel paint
- 50 weight aviation oil

Apply a protective coating after any machining or repairing aluminum surfaces with an aluminum conversion coating. We recommend alodine, also known by the brand name Accelagold, to prevent corrosion on aluminum surfaces, see Section 14-4.1, “Alodine.”

14-4.1. Alodine

Apply a protective coating of alodine to any of the following:

- Parts with aluminum surfaces that have been cleaned, machined, or repaired
- Aluminum alloy castings
- Sheet metal
- Aluminum or metal tubing

If the original aluminum conversion coating has been removed or deteriorated, it must be restored. Apply Alodine or Accelagold solution in accordance with the manufacturer's instructions. For Accelagold, refer to Technical Data Bulletin Number 108-31 Turcoat® Accelagold Aluminum Conversion Coating.

14-4.2. Aviation Oil

Apply clean 50-weight aviation oil to cleaned, machined steel surfaces.

14-4.3. Paint

1. Mask all connection joints and mating surfaces.
2. Follow instructions in Table 14-3 to prepare and paint engine parts. Apply zinc chromate primer and enamel paint to the respective types of external parts. Do not prime or paint internal parts or interior surfaces of the engine.

   CAUTION: Do not apply primer or enamel paint to internal engine parts or any part that contacts the engine oil supply. The paint or primer may flake or break off during engine operation and contaminate the engine oil.

Table 14-3. Painting External Parts

Aluminum Parts	Ferrous Parts	Magnesium Parts
1. Apply alodine according to manufacturer’s instructions 2. Apply enamel to the part.	1. Apply zinc chromate primer. 2. Apply enamel to the parts. 3. Bake for 15 minutes using infrared heat or oven-dry for 60 minutes at 275 to 300°F (135 to 149°C).	1. Pickle the part. 2. Apply zinc chromate primer. 3. Apply enamel to the part. 4. Bake for 15 minutes using infrared heat or oven-dry for 60 minutes at 275 to 300°F (135 to 149°C).

Chapter 15. Overhaul Inspection and Repair

15-1. Engine Overhaul Inspection

The Engine Overhaul Inspection consists of inspection procedures in this chapter and checklists in Chapter 11. This inspection applies 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 airframe, disassembled, and cleaned according to the instructions provided.

15-3. Visual Inspection

Perform a visual inspection on all parts not specified as 100% replacement at overhaul. Examine parts prior to being cleaned for obvious evidence of wear or leakage. Reject obviously damaged parts during the preliminary visual inspection, there is no need to clean and perform non-destructive inspection on parts which cannot be used. If condition is uncertain, clean with remaining parts after the preliminary exam, according to the "Engine Cleaning" instructions in Chapter 14. Verify the parts are clean and free of all dirt, carbon, varnish, gum, and paint.

1. Visually inspect the parts using at least a 10X (power) magnifying glass under good lighting. Look for the following unacceptable conditions:
   - Nicks
   - Dents
   - Gouges
   - Cracks
   - Distortion
   - Burned areas
   - Pitting or Spalling
   - Metal transfer
   - Corrosion
   - Erosion
   - Enamel coating wear
2. Inspect all studs for bending, looseness or partial removal.
3. Inspect all threaded parts for nicks, damaged or deformed threads, faces, or heads.
4. Identify areas that warrant further cleaning.
5. Label parts which fail inspection; indicating reason for failure and if repair is possible or if replacement is required.
6. Record inspection findings on a copy of the "Engine Overhaul Visual Inspection Checklist" in Chapter 11.

15-3.1. Gear Tooth Inspection

Inspect the gear teeth for signs of overheating and wear. Normal wear produces a fine polish on the tooth thrust faces. Gears with uneven teeth profiles, score marks, burning, or pitting are unacceptable. Refer to Figure 15-1 for sample illustrated comparisons of acceptable and unacceptable gear wear.

Discard and replace unacceptable gears. Indicate the need to replace the gear(s) on the Engine Overhaul Inspection Checklist.

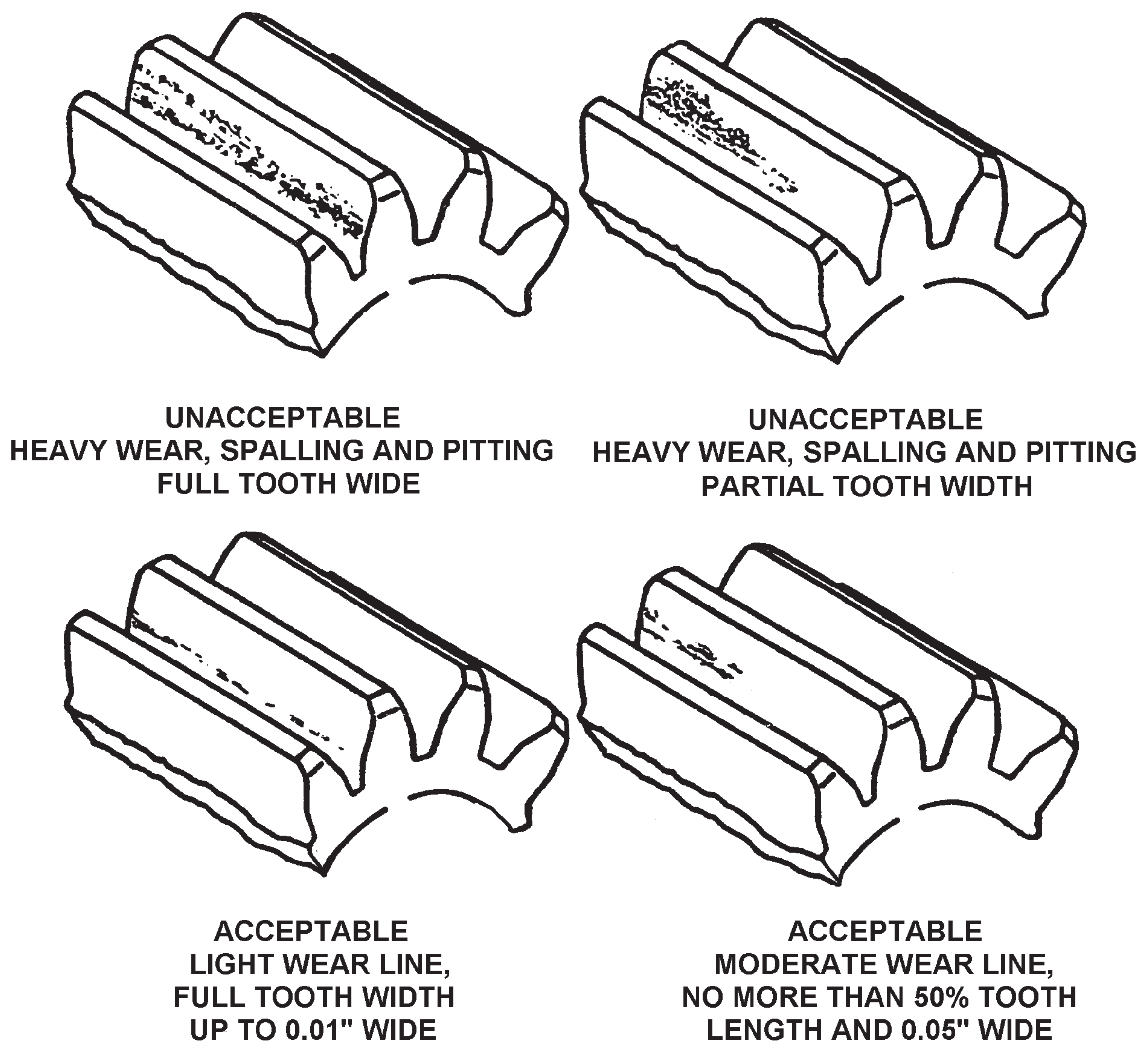


Figure 15-1. Gear Inspection Criteria

15-4. Fluorescent Penetrant Inspection

Perform this inspection on all cleaned, aluminum or non-ferrous metal parts, including the parts listed below in accordance with ASTM E1417, E1208, E1209, E1219, and Type 1 Fluorescent Penetrant Method A, B, C, or D.

Table 15-1. Parts requiring Fluorescent Penetrant Inspection

Inspect:	Pay particular attention to:	
• Accessory drive adapters • Brackets (non-ferrous) • Crankcase halves • Cylinder heads • Engine mounts • Induction tubes • Induction manifolds • Induction risers • Oil pump housings • Oil sumps (non-ferrous) • Starter adapter housings	• Areas where oil seals or bushings are pressed in or seated • Areas surrounding through-bolt holes • Bearing bosses • Between cylinder head cooling fins • Crankcase/crankshaft exit area • Cylinder-to-barrel mating surfaces • Intake and exhaust flanges • Intake and exhaust ports	• Oil pump cavity area mounting flanges • Mounting bosses and flanges where hardware has been previously torqued • Rocker boss areas • Shaft bores • Valve guide areas • Valve seat insert areas

1. Look for the following reject conditions:
   a. All cracks or indications of the start of cracks
   b. Grinding encountered after the manufacturing process
   c. Seams
   d. Laps or ruptures

Unless Section 15-8 contains specific instructions to remedy unsatisfactory conditions discovered during the inspection, discard parts which exhibit any of the conditions described in steps 1a through 1d.

2. Look for indications which break into corners, edges, holes, or fillets on parts. Identify parts that contain linear indications which cannot be reworked.
3. Follow the fluorescent penetrant manufacturer's instructions for the equipment and materials used to perform the inspection regarding use, safety data, and disposal.
4. Label each part's inspection status and required action.
5. Record inspection findings on a copy of the “Fluorescent Penetrant Inspection Checklist” in Chapter 11.

15-5. Magnetic Particle Inspection

Prior to performing a Magnetic Particle Inspection, verify the parts are clean and free of dirt, carbon, varnish, gum, and paint.

CAUTION: Clean the engine parts thoroughly according to the “Engine Cleaning” instructions in Chapter 14 prior to commencing the Magnetic Particle Inspection.

The Magnetic Particle Inspection must be performed by a certified technician on cleaned, ferrous parts according to ASTM E1444 using the wet continuous method and full wave rectified alternating current and fluorescent particles. Carefully follow the magnetic particle media manufacturer's instructions regarding use, safety data, and disposal.

1. On the cleaned parts to be inspected, plug small holes leading to obscure cavities with tight-fitting wooden plugs or with a hard grease (soluble in lubricating oil) to prevent particles from lodging in the cavities.
2. Follow the equipment and materials manufacturer's instructions to perform the inspection regarding use, safety data, and disposal. Use the corresponding method of magnetization and amperage listed in Table 15-2.
3. Inspect parts for the following conditions:
   a. Cracks or indications of the start of cracks
   b. Grinding encountered after the manufacturing process
   c. Cracks caused by heat treatment or brittleness.
   d. Seams
   e. Laps or ruptures

Unless Section 15-8 contains specific instructions to remedy unsatisfactory conditions discovered during the inspection, discard parts which exhibit any of the conditions described in steps 3a through 3e.

4. Record repair or replacement requirements on the Engine Overhaul Inspection Checklist.
5. Look for linear indications which break into corners, edges, holes, thread roots, fillets, gear tooth roots or keyways on parts. Identify parts which contain linear indications which cannot be reworked.
6. Label parts which fail inspection as such; indicate reason for failure and if repair or replacement action is required.
7. Remove plugs or grease from holes of inspected parts.
8. Clean the inspected parts thoroughly according to the “Engine Cleaning” instructions in Chapter 14.

CAUTION: When utilizing compressed air, wear OSHA approved protective eye wear. Never exceed 30 psi when using compressed gases for cleaning purposes (OSHA 1910.242(b)).Dry the parts with compressed air.

9. Demagnetize the inspected parts

Table 15-2. Magnetic Particle Inspection Reference

Part	Method of Magnetization	AC or DC Amperes	Focus	Inspect for
Crankshaft	Circular	2000	• Journals • Fillets • Oil holes	• Cracks • Heat cracks
	Longitudinal		• Thrust flanges • Prop flange	• Flange cracks from prop strike
Connecting rod[1]	Circular and Longitudinal	1500	All areas	Cracks
Camshaft	Circular and Longitudinal	1500	• Lobes • Journals • Drilled hole edges	• Heat stress cracks • Cracks
Rocker arms	On conductor bar and single	1000	• Pad • Socket under side arms and boss	Cracks
	Between heads	800		
Gears up to and including six inches in diameter	Circular or on Center Conductor	1000 to 1500	• Teeth • Splines • Keyways	Cracks
Gears over six inches in diameter	Shaft Circular Teeth between heat two times 90°	1000 to 1500	• Teeth • Splines	Cracks
Shafts	Circular and Longitudinal	1000 to 1500	• Splines • Keyways • Section transitions	• Cracks • Heat stress cracks
Through-bolts and connecting rod bolts[2]	Circular and Longitudinal	500	Threads under head	Cracks
Cylinder barrels	Circular and Longitudinal	1500	• Fin tips • Fin roots • Flange • Flange bolt holes	• Cracks • Heat stress cracks

1. Inspect connecting rod and cap according to the “Connecting Rod Magnetic Particle Inspection” in Section 15-5.1.
2. Perform only on service parts; replace 100% at overhaul

15-5.1. Connecting Rod Magnetic Particle Inspection

Before performing the Connecting Rod Magnetic Particle Inspection, the connecting rod and cap must be clean and free of rust, scale, oil, or other residue that may affect the reliability of the Magnetic Particle Inspection. Inspect the connecting rods using both the circular and longitudinal method of magnetization. Use the fluorescent method, wet continuous procedure, reference ASTM standards for non-destructive testing; D.C. amperage is preferred.

Refer to the Table 15-3 for inspection pass/fail criteria. Record inspection findings on a copy of the "Magnetic Particle Inspection Checklist" in Chapter 11.

NOTE: Reject connecting rod or caps exhibiting the unacceptable indications listed in the Fail column of Table 15-3.

Table 15-3. Connecting Rod Magnetic Particle Inspection Criteria

Pass	Fail
Steel inclusions or shallow imperfections on the forging surface - light indications running parallel to the rod axis or around the pin boss and cap ends less than ½-inch in length.	Indications associated with forging laps or with heat treatment are cracks
Blend area between the piston pin boss extending 1-inch into connecting rod I beam, the bolt spot face areas and the channel rail edges are free of any indications of cracks/wear.	Area of blend between the piston pin boss extending 1-inch into connecting rod I beam, the bolt spot face areas and the channel rail edges shows indications of cracks/wear
	Any indication transverse to the rod axis.

15-6. Ultrasonic Inspections

This inspection must be performed by technicians possessing inspection certification credentials according to Section 15-6.1, "Ultrasonic Inspection Certification."

15-6.1. Ultrasonic Inspection Certification

Cylinders and crankshaft nondestructive testing (NDT) inspectors must be certified and trained by Plumstead Quality and Training Services (PQT). Contact PQT to enroll in required training:

Plumstead Quality and Training Services (PQT)
806 Botany Road
Greenville, SC 29615
Phone: (864) 292-1115
www.PQT.net

15-6.2. Crankshaft Ultrasonic Inspection

Refer to “Special Tools” in Chapter 3, for test equipment requirements and availability.

1. Perform an Ultrasonic Inspection on the crankshaft according to the latest revision of Continental Motors MHS 200.
2. Record inspection results on a copy of the “Ultrasonic Inspection Checklist” in Chapter 11.

WARNING

Do not steel stamp the inspection result on the crankshaft, it will damage the nitride finish. Continental Motors factory crankshafts are stamped prior to nitride treatment.

Table 15-4. Crankshaft Ultrasonic Inspection Pass/Fail Action

<table>
<tr><th colspan="2">Crankshaft Meets Inspection Criteria</th><th>Crankshaft Fails Inspection Criteria</th></tr>
<tr><td colspan="2">Vibroetch the crankshaft flange as illustrated in Figure 15-2 with either a “V” (vacuum arc remelted (VAR) verified) or “U” (ultrasonic inspection) to identify the inspection method:</td><td rowspan="3">- Remove the crankshaft from service.
- Mutilate the crankshaft to identify it as "Unairworthy."
- Replace the crankshaft with a new one.
- Record results on a copy of the “Ultrasonic Inspection Checklist”</td></tr>
<tr><td>V/U</td><td>VAR Steel/Ultrasonic Inspected (Figure 15-2) EXAMPLE 1</td></tr>
<tr><td>U</td><td>Non-VAR Steel/Ultrasonic Inspected (Figure 15-2) EXAMPLE 2</td></tr>
</table>

NOTE: In some instances, the VAR identification may have been ground off in the balancing process and cannot be verified. If the VAR indication cannot be verified, replace the crankshaft.

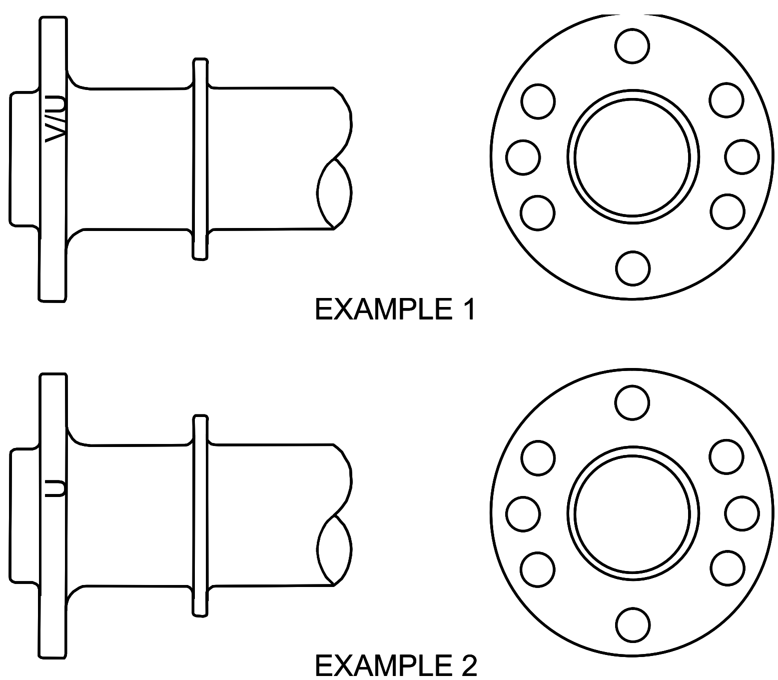


Figure 15-2. Crankshaft Ultrasonic Inspection Method Location

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, clean parts thoroughly according to the "Engine Cleaning" instructions in Chapter 14 and ensure the part conforms to all Visual, Fluorescent Penetrant, Magnetic Particle, and Ultrasonic Inspection requirements, as applicable.

1. Measure part dimensions in comparison to the dimensional limits specified in Appendix D. Record the measurements on a copy of the "Dimensional Inspection Checklist" in Chapter 11.
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 a copy of the "Dimensional Inspection Checklist" in Chapter 11.

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 and 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 identified during maintenance inspections:
   a. Cracks in the cylinder deck (white/non-shaded - critical areas in Figure 15-3) requires immediate crankcase replacement.
   b. Any crack two inches (5.08 cm) or more in length located in a shaded (non-critical) section of Figure 15-3 requires repair or replacement of the crankcase.

   NOTE: Cracks are frequently accompanied by oil seepage, investigate oil leaks.

   WARNING

   An FAA-approved repair facility is the only facility authorized to perform crankcase weld repairs. No weld repairs are authorized in the critical (non-shaded) areas of the crankcase (Figure 15-3) or the bearing support structures.

   c. If a crack is found in any area on the crankcase, do one of the following:
      1) Repair the crankcase: if there is no oil leakage and the crack is less than two inches in a *non-critical* (shaded area of Figure 15-3), the crankcase may be welded. Welding is an acceptable repair only on *non-critical* (shaded) stress areas of the crankcase and only when performed by an FAA Part 145 repair station certified to perform crankcase weld repairs. The dimensional integrity of the crankcase must be maintained.
      2) Replace the crankcase: if a crack of any length is in the *critical* (white/unshaded) stress section or if oil is leaking from a crack of any length on the

non-critical (shaded) section of the crankcase or the crack is two inches or longer.

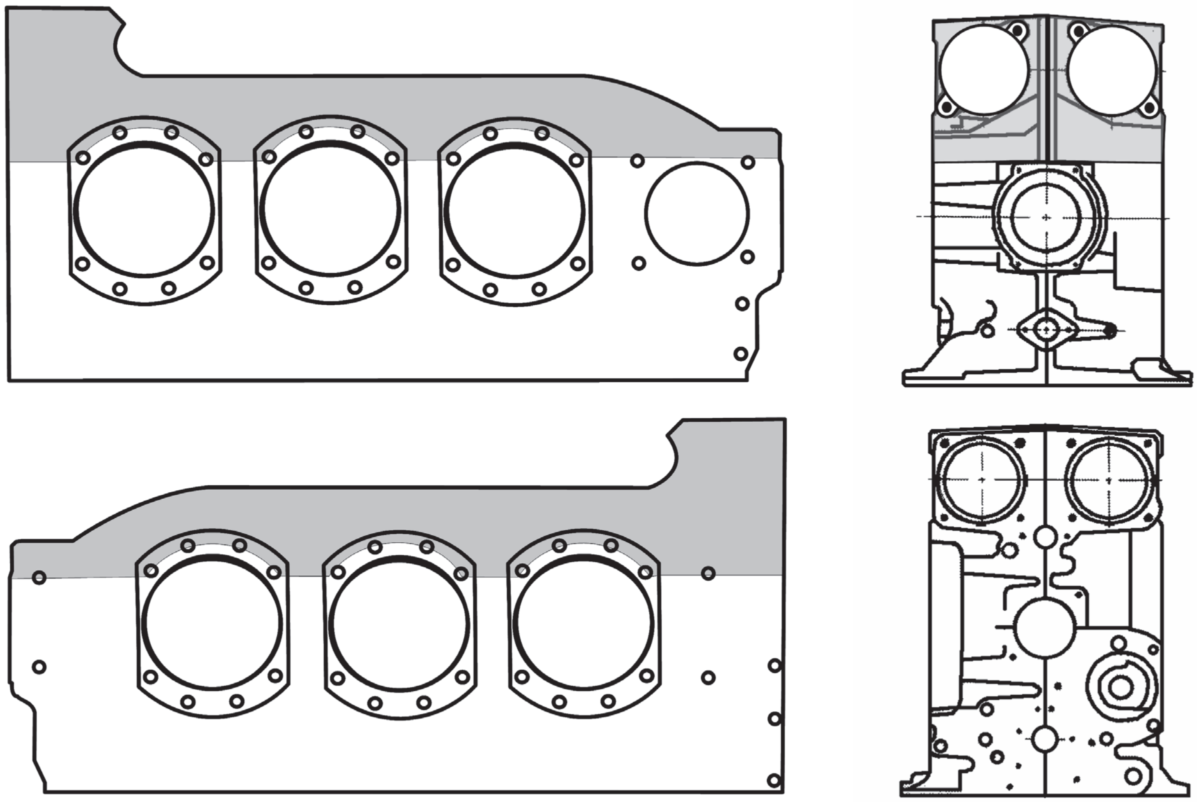


Figure 15-3. Crankcase Critical (White) Stress Areas

NOTE: Cracks longer than two inches in length may not be repaired; replace the crankcase.

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 and determine if they conform to the crankcase main bearing oil feed hole chamfer in Figure D-15. The subject passages are located in the left (2-4-6) case half and begin in the rear main bearing saddle, counting forward. A proper chamfer of the oil feed holes at the crankcase main bearing is required to prevent cracks from forming in the area.

Prerequisites

Prior to the completing the dimensional inspection of the crankcase, crankshaft, and camshaft bores, temporarily assemble and torque the crankcase specifically for this inspection using the torque sequence shown in Figure 15-4.

12. For the preliminary torque, torque the crankcase fasteners in Figure 15-4 to ½ the value specified in Appendix B.
13. Repeat the torque sequence in Figure 15-4 using the full value for the fastener indicated in Appendix B.

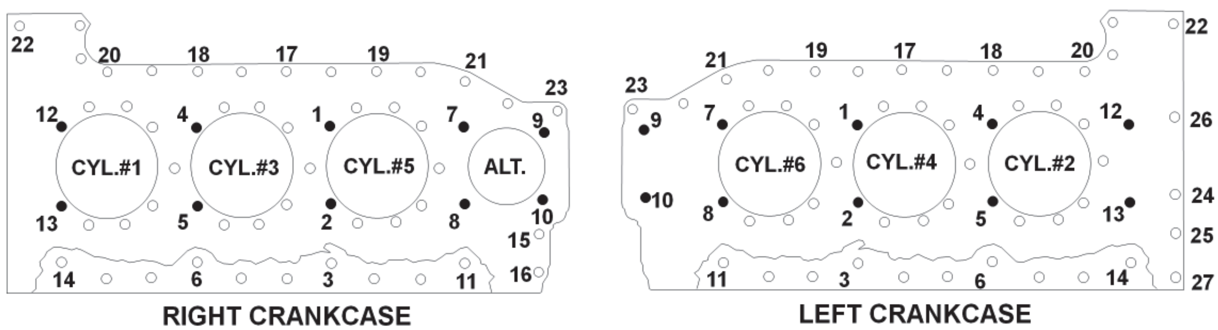


Figure 15-4. Crankcase Dimensional Inspection Torque Sequence

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 15-8.11 for crankcase machining requirements.
16. Record inspection results on a copy of the "Dimensional Inspection Checklist" in Chapter 11.

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 15-5).
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 hanger blade bushing bores meet Appendix D-8.3 dimensional specifications.

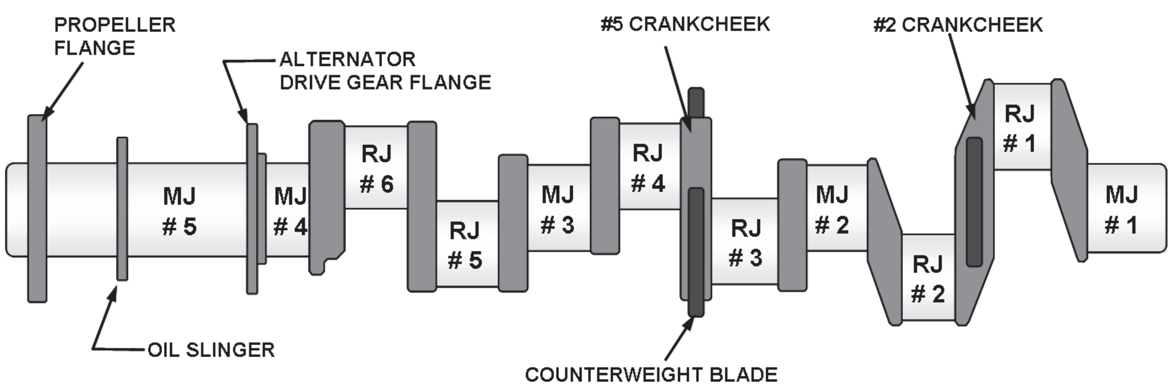


Figure 15-5. Crankshaft Journals

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

1. Verify the connecting rod and cap mate marks are aligned and the position numbers stamped on or adjacent to the bolt boss match. Scrap connecting rods and caps with mate marks that do not align.
2. Visually inspect the connecting rods for corrosion, pitting, discoloration (bluing), galling, bending, twisting, impact damage or nicks. Scrap connecting rods with any of these indications.
3. Visually inspect the connecting rod and cap parting surface. Contact signatures resulting from assembly forces are normal and acceptable. Connecting rods exhibiting fretting signatures, indicated by erosion of the original machining marks, either locally or over the entire surface, are not acceptable for continued service. Scrap connecting rods with fretting at the parting surfaces; do not attempt to rework.
4. Visually inspect the nut seat area. Excessive fretting signatures indicate material loss. Scrap connecting rods with edge loading under the bolt head surface contact area.
5. Visually inspect dowel surfaces at the rod and cap bolt holes. Scrap connecting rods with fretting at the dowel surface.
6. Align the mate marks on matching position numbers and assemble the connecting rod and cap by installing a bolt through the cap and rod. With the cap seated firmly against the rod, you must be able to install the remaining bolt using hand pressure only. Scrap connecting rods if the bolts cannot be installed by hand.
7. Lubricate the connecting rod bolt and nut threads with clean 50 weight aviation oil.
8. Install and torque the fasteners to Appendix B specifications.
9. Inspect the inside diameter joint of the rod to cap with both bolts and nuts installed and torqued; mismatch (or a step) must be less than 0.001 inch.
   Check for a mismatch by placing the rod on a surface plate with the split line at the 6 and 12 o'clock position; use V-blocks to hold the connecting rod in place. Use a dial indicator mounted on a height gauge, zero out on one side of the split line and move the indicator across the split line; a mismatch (or a step) of more than 0.001 inch is not acceptable.

WARNING

Removing and installing the piston pin bushing with makeshift tools will damage connecting rods.

10. Remove the piston pin bushing from the connecting rod using the Borroughs Part No. 8098 Connecting Rod Bushing Removal / Installation Set, or equivalent) and an arbor press.
11. Inspect the piston pin bushing bore and surrounding area for nicks, gouges and mechanical damage. Scrap connecting rods with any of these indications.
12. Using precision measuring equipment, such as a dial bore gauge or air gauge; verify the connecting rod meets the dimensional specifications in Figure D-25. Measure

the inside diameter of the rod and cap within 30° of the rod and cap joint; take a second measurement 90° from the first. Both measurements must meet Appendix D dimensions; The difference between these two measurements is an indication of out-of-round and must not exceed 0.0015 inches. Scrap connecting rods and caps which fail to meet Appendix D dimensional specifications.

13. Inspect the connecting rod channel rails for nicks, gouges or mechanical damage. Scrap connecting rods with any of these indications.

15-7.2.2. Crankshaft Counterweight Inspection

Equipment required

- 4% copper sulfate and water solution (by volume) ($CuSO_4$)
- A surface plate
- Two matched V-blocks
- Borroughs Part No. 8077C Counterweight Bushing Replacement Fixture, or equivalent

1. Inspect the bump surface as shown in Figure 15-6; bump surface contact marks must not exceed 0.005 inches in depth.
2. Remove and discard counterweight bushings using the Remover/Replacer Tool.
3. Thoroughly clean the counterweight bushing bore.
4. Verify tuftriding is present on the counterweight assemblies by placing one drop of a 4% copper sulfate and water solution (by volume) ($CuSO_4$) on the cleaned surface of the counterweight bushing bore.
5. Allow at least 15 seconds for the chemical reaction to take place.
6. Formation of red deposits indicates the absence of tuftriding. Discard any counterweight that does not exhibit tuftriding and replace with new counterweights.

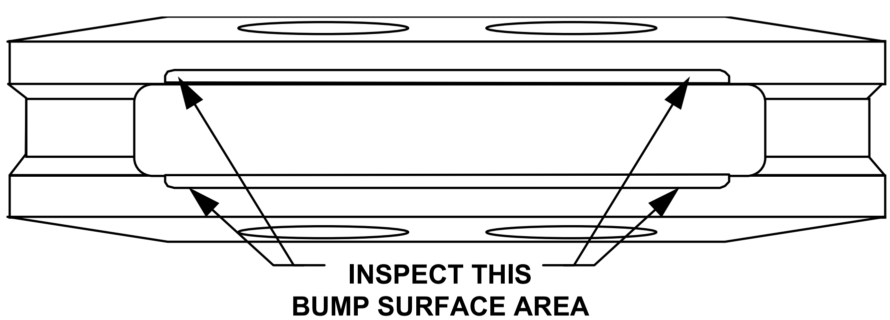


Figure 15-6. Crankshaft Counterweight Bump Surface Inspection

15-7.2.2.1. Crankshaft Counterweight Bushing Bore Inspection

Equipment Required:

- Federal Dimension Air Gauge (with appropriate setting ring and air plug) or
- Starrett No. 78 series 3 point contact inside micrometer

1. Verify the counterweight bushing bores are smooth. Discard counterweights with worn, pitted, fretted or out-of-round bushing bores.
2. Use a Federal Dimension Air Gauge (with appropriate setting ring and sir plug) or Starrett No. 78 series 3-point contact inside micrometer to measure the bushing bores. Compare the bushing bores specified total indicator reading (T.I.R.) to the "Engine Drive Train" dimensional specifications in Section D-8. Discard counterweights with bushing bores exceeding the specified dimensions.
3. Carefully inspect the counterweight counterbores for signs of wear in the wall that retains the counterweight pin retaining plates. This area is adjacent to the inside edge of the retaining ring groove. It may appear as an additional step and/or taper of the hole into the retaining ring groove. If wear is evident, discard the counterweight.
4. If no plate wear is evident, check the retaining ring groove in each hole for wear patterns that can affect the retaining ring seating. Any worn condition that may affect retaining ring seating will require replacement of the counterweight.
5. Crankshaft counterweights are matched in pairs with a maximum weight variation of two grams. If either counterweight is damaged, replace the counterweights as a matched pair.
6. Record inspection findings on a copy of the "Engine Drive Train Inspection Checklist."

15-7.3. Engine Cylinder Dimensional Inspection

Refer to Appendix D for dimensional limits.

1. Perform the "Cylinder Visual Inspections" according to instructions in Section 6-3.11.1. Replace cylinders that fail the inspection criteria.
2. For the IO-550-A, B & C cylinders, verify the "Rocker Shaft Retention Modification" has been complied with or complete the modification according to instructions in Section 15-8.9.3.
3. Inspect the cylinder base flanges for flatness. If a flange exceeds 0.001 inches out-of-flat, replace the cylinder.
4. Inspect cylinder bore dimensions using the appropriate illustrations and tables in the Appendix D-6. Cylinders may be bored and honed (see Section 15-8.9.7, "Engine Cylinder Overhaul Repair"and Section 15-8.9.8, "Cylinder Bore Honing") to meet the standard size dimensions in Appendix D to the next authorized oversize dimension.
5. Dimensionally inspect the intake flange studs, cylinder exhaust flange studs, and A B C rocker hold down stud bores using a thread gauge. Determine the appropriate oversize stud if replacement is required.
6. If the intake flange studs have been removed, dimensionally inspect the stud holes using a thread gauge. Determine the appropriate oversize stud for replacement.
7. Dimensionally inspect the inside diameter and geometry of the valve guides. Valve guide dimensions must be within specifications the entire length of the guide. Replace worn or non-conforming valve guides.
8. Inspect the intake and exhaust valve seats for indications of burning, pitting, erosion, or cracks. Check the valve seat dimensions according to Appendix D specifications. Regrind or replace valve seats which do not conform to Appendix D specifications or is cracked, eroded, burned or pitted.
9. 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 cap diameter with a micrometer and Appendix D specifications. Inspect runout with V-blocks according to Appendix D specifications.
10. 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.
11. 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.

12. Record inspection results on a copy of the “Engine Cylinder Overhaul Inspection Checklist.”

15-7.4. Starter Adapter Dimensional Inspection

Inspect the starter adapter sleeve and spacer for wear and damage; replace worn or damaged parts in addition to the items listed in the “Mandatory Overhaul Replacement Parts” in Appendix C-2.4. Inspect the starter and adapter parts using the dimensional limits in Appendix D-3.

1. Perform a “Gear Tooth Inspection” according to Section 15-3.1 on the worm gear, starter shaft gear and starter gear assembly. 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 dimensional limits in Appendix D-3.
4. Record inspection results a copy of the “Dimensional Inspection Checklist.”

15-7.5. Lubrication System Dimensional Inspection

1. Perform a “Gear Tooth Inspection” on the oil pump gears, according to Section 15-3.1. 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

NOTE: Perform the drive hub slippage inspection on the *new* drive hub after installation at engine overhaul.

1. Perform a "Gear Tooth Inspection" according to instructions in Section 15-3.1 on the drive hub teeth. Discard and replace unacceptable gears.
2. Secure the alternator drive hub with an Ideal Aviation Part No. 9000IA "Alternator Drive Hub Spanner Wrench" ("Special Tools" in Chapter 3); adjust the bolts using finger pressure only - do not torque the bolts.
3. Place the holding fixture and drive hub assembly into a shielded vise.
4. Torque-test the drive hub assembly using an "Alternator Drive Hub Torque Tool"("Special Tools" in Chapter 3) and a currently calibrated torque wrench. Turn the hub at a rate of 1° to 2° per second. Slippage occurs at the outside diameter elastomer. Acceptable slippage readings are:

Table 15-5. Alternator Drive Hub Slippage

Coupling Assembly	Acceptable Slippage
Coupling assembly with less than 25 hours of operation	180 in-lbs.
Coupling assembly with more than 25 hours of operation	140 in-lbs.

5. Discard any drive hub coupling which exceeds the acceptable slippage amount or has a damaged elastometer.
6. Record inspection results on a copy of the "Engine Overhaul Visual Inspection Checklist."

15-7.7. Throttle and Mixture Control Lever Inspection

NOTE: Continental Motors replaced bronze throttle and mixture control levers (Ref: CSB08-3) with improved stainless steel control levers featuring machined splines in the chamfer where the control lever contacts the throttle or mixture control shaft splines. Replace bronze throttle and mixture control levers with the stainless steel replacement at the next 100-Hour or annual inspection, or the next time the lock nut is loosened on the throttle or mixture control lever.

WARNING

Replace control levers or shafts exhibiting damage, deformation, or material loss. Improper or negligent control lever installation may result in loss of engine control.

1. Inspect the serrated, chamfered edges of the control lever and shaft (Figure 15-7). Verify the serrations are well defined and mechanically interlock when assembled. If the splines are malformed or worn, slippage is possible; replace the control lever.
2. At installation, lubricate the shaft threads with clean 50-weight aviation engine oil, align the control lever to the desired angle, engage the splines in shaft with the splines in the lever, install a new lock nut and tighten the nut to secure the lever.

3. Rotate the lever away from the stop pin and torque the nut to Appendix B specifications
4. Record inspection results on a copy of the "Engine Overhaul Visual Inspection Checklist."

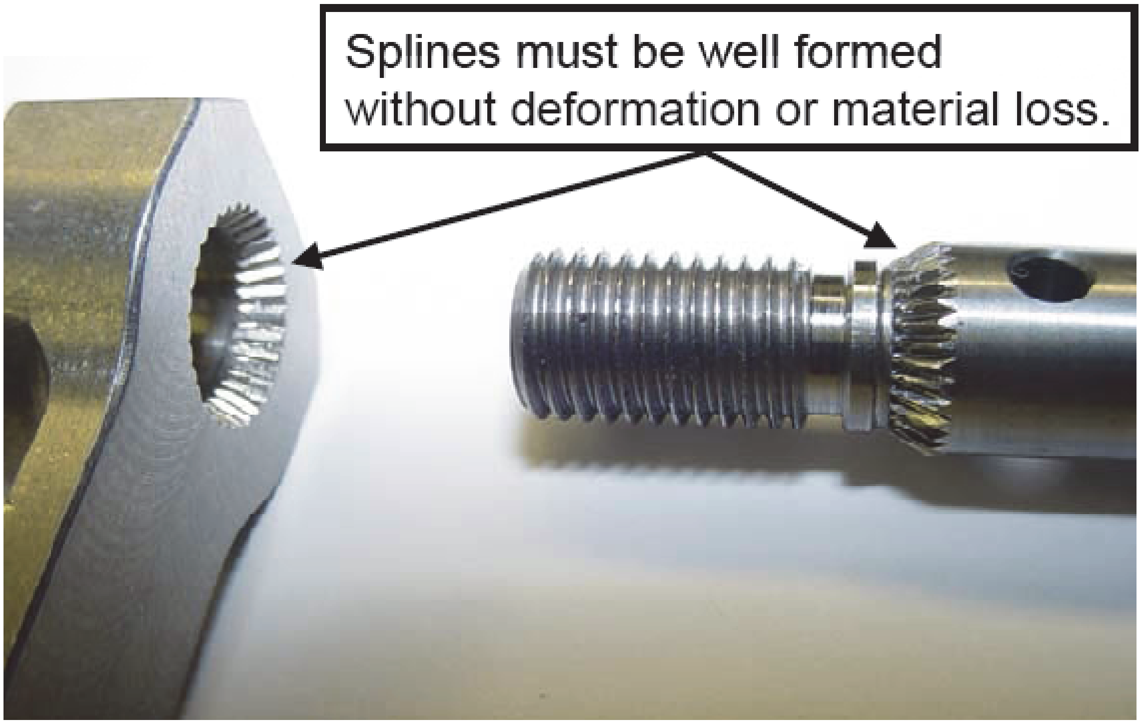


Figure 15-7. Serviceable Throttle/Mixture Control Lever & Shaft Splines

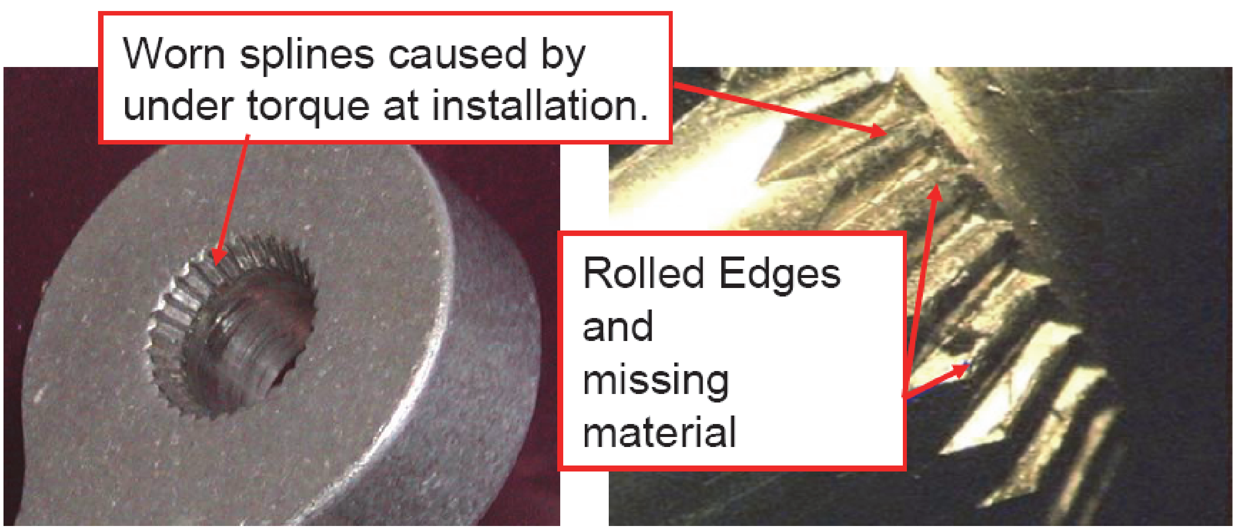


Figure 15-8. Worn Throttle and Mixture Control Lever & Shaft Splines

15-7.8. Exhaust System Inspection

NOTE: Clean parts prior to the visual inspection.

Inspect exhaust system components according to the Airframe Manufacturer's instructions.

15-7.9. Accessory Drive Adapter Dimensional Inspection

1. Inspect the inside diameter of the accessory drive adapter bore with the bushing removed to verify it is suitable for overhaul repair. Scrap the adapter if the bore is deeply pitted or gouged or the inside diameter cannot be restored to 0.940 inch inside diameter with a surface finish of 63 Ra.
   a. Adapter bore must be smooth and free of gouges with an inside diameter between 0.938 and 0.940 inch.
   b. Ream the adapter bore with an adjustable reamer to between 0.938 and 0.940 inch inside diameter with a surface finish of 63 Ra for new bushing installation.
2. Record inspection results on a copy of the "Dimensional Inspection Checklist."

15-7.10. Stud Height Dimensional Inspection

1. Inspect studs listed in Table 15-6 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 a copy of the "Dimensional Inspection Checklist."

Table 15-6. Stud Height Settings

Illustration and Tables in Appendix 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. • If studs installed in helical coil inserts are loose, the helical coil insert may require replacement according to instructions in Appendix C-6
Accessory Drive Adapter	
Lubrication System	
Oil Control Collar	
Crankcase	
Cylinder	

15-7.11. Refrigerant Compressor Dimensional Inspection

NOTE: The belt sheave inspection dimensions in Figure 15-9 apply only to Continental Motors supplied sheaves. Refer to the manufacturer's instructions for air conditioning kits obtained from other sources.

1. Inspect the belt sheaves (Figure 15-9) 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.

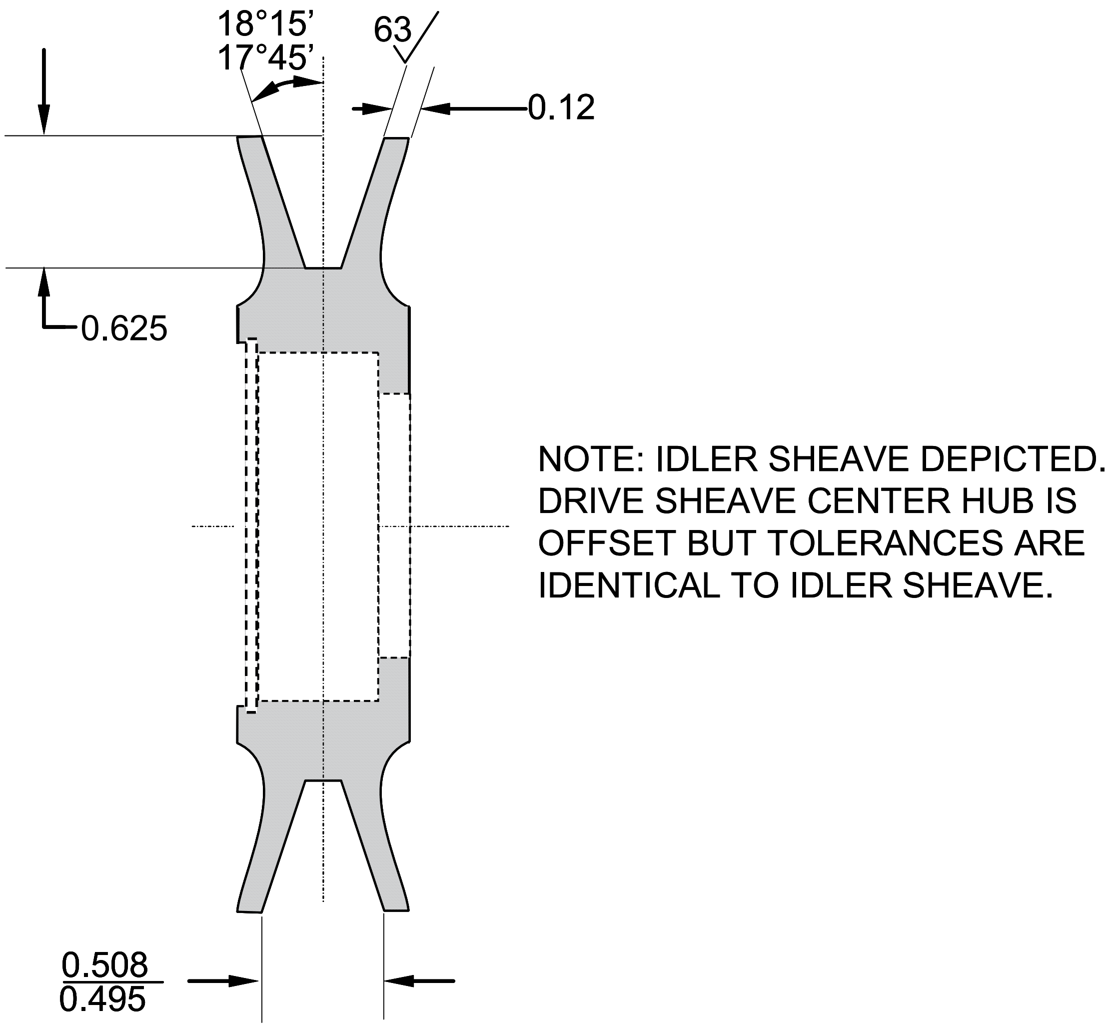


Figure 15-9. Refrigerant Compressor Sheave

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 throttle bodies which meet new part specifications. Fuel injection system parts overhaul must be accomplished in compliance with FAA approved procedures. Continental Motors does not control FAR Part 145 Repair Station activities; verify the Repair Station qualifications before contracting fuel injection system parts overhaul.

1. Collect the fuel injection system parts identified in 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. Install a new or factory rebuilt fuel pump, throttle and control assembly and fuel manifold valve have the components overhauled by a FAR Part 145 Authorized Repair Station. If the components will be rebuilt, replace brass throttle and mixture control levers with the stainless steel equivalents.
3. Inspect fuel injection tubes for serviceability:
   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 14 to remove debris and prevent fuel injection system contamination.

15-8.2. Induction System Overhaul Repair

Collect induction system parts identified in 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.

15-8.2.1. IO-550-G, N, P & R Induction Manifold Overhaul Repair G N P R

1. Verify the induction manifold has been thoroughly cleaned according to Chapter 14 instructions.
2. Apply a liberal coating of Part No. 658493 sealant (Section 3-2) to one side of a new bumper pad (Figure 15-10) (11) and install the new bumper pad in the center of the valley on the bottom of the induction manifold 0.75" behind the flange to absorb vibration.

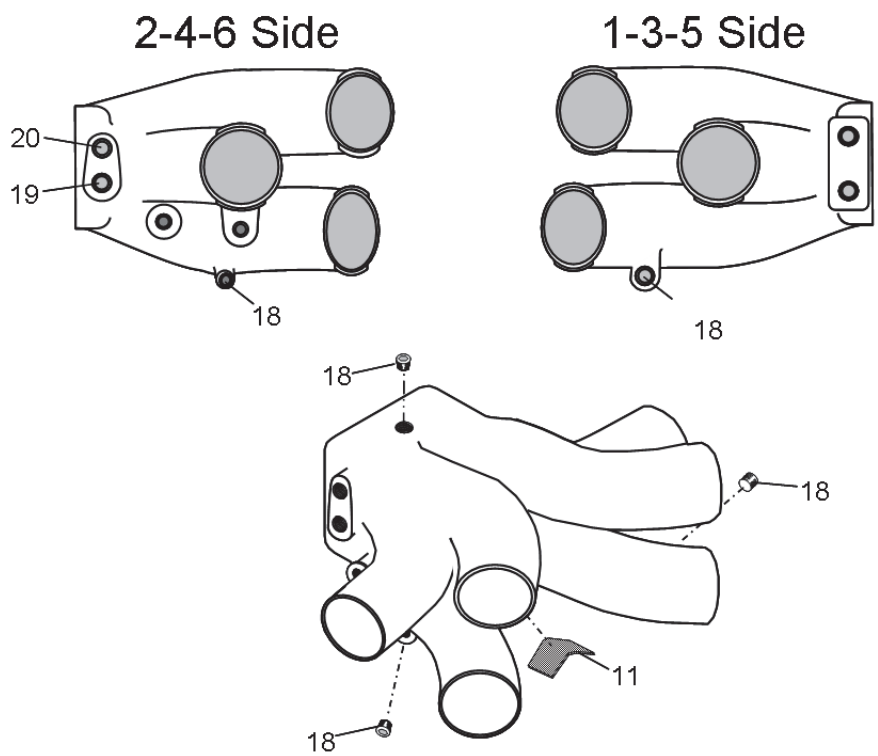


Figure 15-10. Induction Manifold Fittings

NOTE: Fitting size and orientation vary by engine model and specification. Consult the illustrated parts catalog for the engine being assembled on genuinecontinental.aero for fitting configuration.

3. Refer to the notes taken during induction manifold disassembly for fitting size and orientation. Apply F/I sealant (Section 3-2) to all except the first two threads of the fittings and install them in the induction manifold ports according to your notes.

15-8.3. Refrigerant Compressor Mount Overhaul Repair

Collect refrigerant compressor mounting bracket assembly overhaul parts identified in 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, X30531 (see Table 1-1). Replace non-Continental Motors’ alternators with a new unit or a unit which has been overhauled according to FAA approved procedures
2. Collect the alternator parts identified in 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 assembly.
3. If the engine is equipped with a belt-driven alternator bracket, collect the necessary parts specified in 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

1. Overhaul the Continental Energizer starter motor according to the instructions in Continental Motors’ Starter Service Instructions (X30592). Iskra starters have been discontinued; replace Iskra starters at overhaul with the appropriate replacement starter specified in the illustrated parts catalog. Replace non-Continental starters with a new unit or a unit which has been overhauled according to FAA approved procedures.
2. During overhaul, replace the following parts:
   a. Starter adapter housing worm shaft needle bearing according to instructions in Section 15-8.5.1.
   b. Shaft gears, worm wheel gears, worm gears or worm gear shafts exhibiting wear, cracks, or missing material.
   c. Worn scavenge pump covers and bushings on the starter/starter adapter assembly.
   d. Collect the necessary starter adapter parts identified in 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 starter adapter assembly.

15-8.5.1. Starter Adapter Housing Worm Shaft Needle Bearing Replacement

Press the new needle bearing (Figure 15-11) (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 ("Special Tools" in Chapter 3).

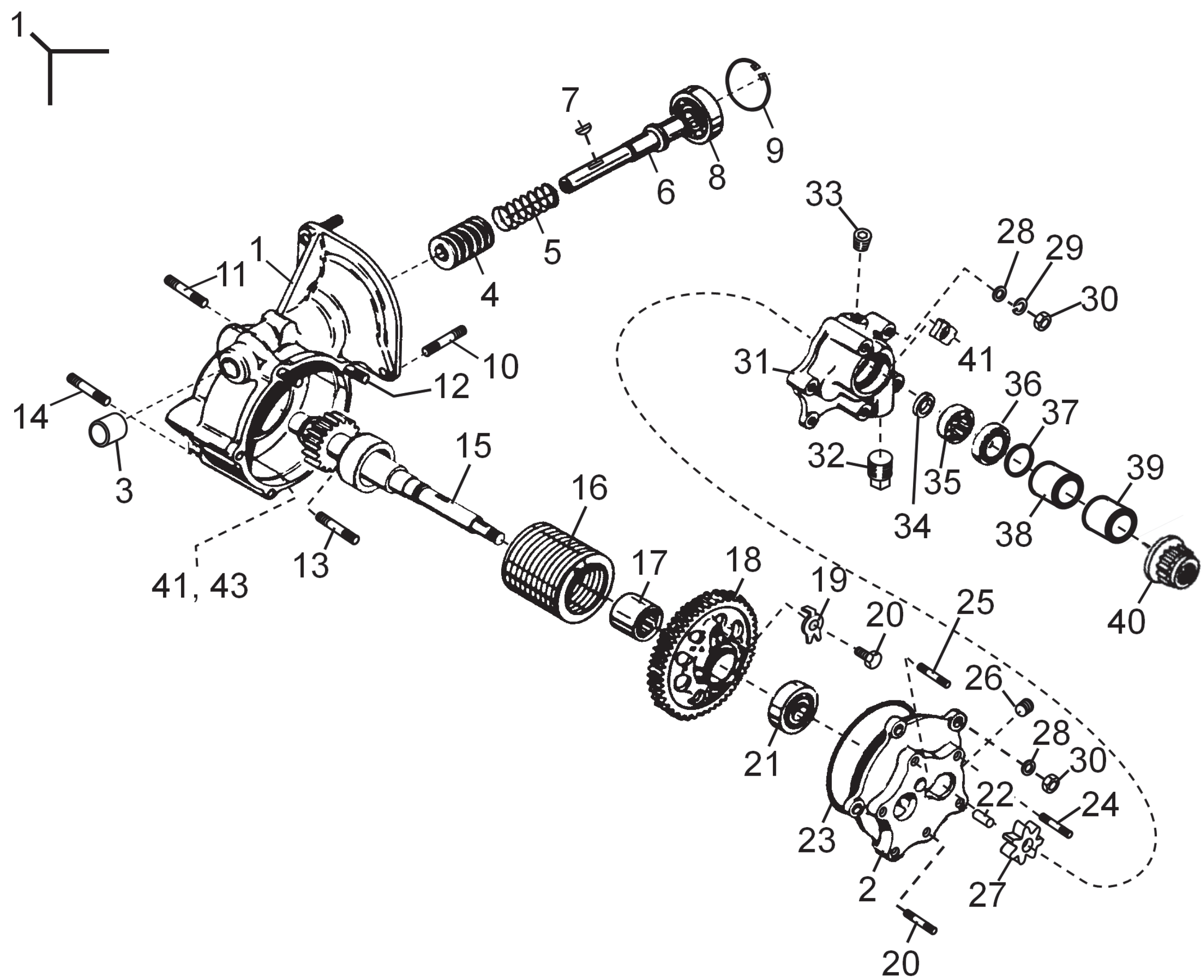


Figure 15-11. Starter and Adapter with Accessory Drive

15-8.6. Ignition System Overhaul

Replace Champion (Slick) magnetos with a new units, or units which has been overhauled according to FAA approved procedures. Overhaul Continental magnetos according to the applicable instructions in X42001 (S-1200 series magnetos) or X42002 (S-20/S-200 series magnetos). Overhaul the accessory drive adapter according to Section 15-8.6.1 instructions.

15-8.6.1. Accessory Drive Adapter Overhaul

During engine overhaul, collect the parts required by 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. Replace damaged or loose helical coils according to instructions in Appendix C-6.
2. Replace damaged or loose studs according to instructions in Appendix C-7.
3. Plug the accessory adapter oil passages with beeswax to protect them from flying debris contamination during the reaming process.
4. Place the accessory drive adapter, tapered side up, on an arbor press. Support the adapter drive flange on a flat, parallel block thick enough to raise the studs off the arbor press bed (approximately two inches).
5. 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.

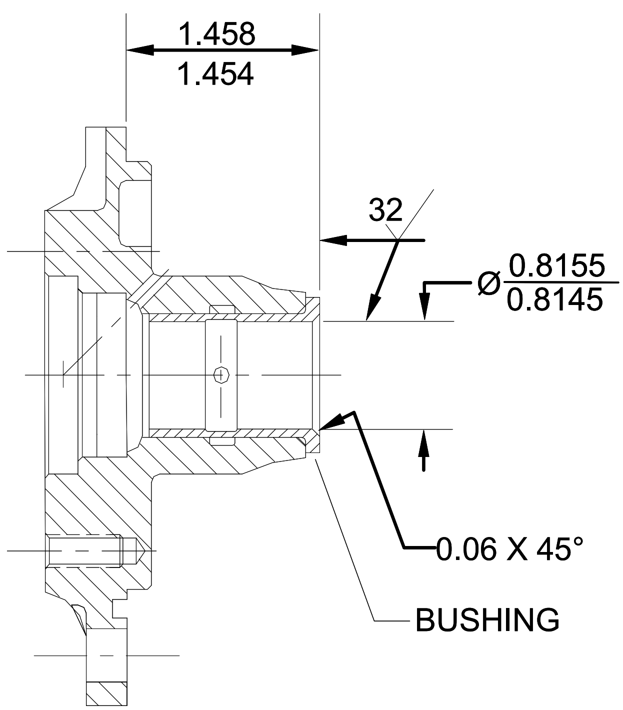


Figure 15-12. Accessory Drive Adapter Bushing Installation Detail

6. 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.
7. 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.
8. 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).
9. Repeat the previous steps for new bushings in the remaining magneto adapter.
10. Clean the accessory drive adapters according to the Chapter 14 cleaning instructions to remove reaming debris and beeswax; oil passages must be clear after cleaning.
11. 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.
12. 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 Part No. MT500260 Oil Seal Tool (“Special Tools” in Chapter 3) until it bottoms out in the adapter. Do not crush the oil seal. Wipe excess adhesive from the perimeter of the seal.
13. Perform a “Fluorescent Penetrant Inspection” on the accessory drive adapters after bushing and oil seal installation to ensure the accessory drive adapter assembly is free of cracks.

15-8.7. Exhaust System Overhaul Repair

Replace exhaust manifold gaskets and nuts with new components for overhaul assembly. Overhaul the exhaust system according to the airframe manufacturer’s instructions.

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).

1. Reface the oil pressure relief valve according to instructions in Section 15-8.8.2, “Oil Pressure Relief Valve Seat Repair.”
2. Collect the lubrication system parts identified in 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 Borroughs Part No. 8048 Oil Pressure Relief Valve Spot Facer (“Special Tools” in Chapter 3). Do not exceed the 1.060 depth limit on the valve seat (Figure 15-13).

Clean the oil pump housing after refacing the oil pressure relief valve seat according to the “Engine Cleaning” instructions in Section 14. No debris is permitted in the oil pump housing at assembly.

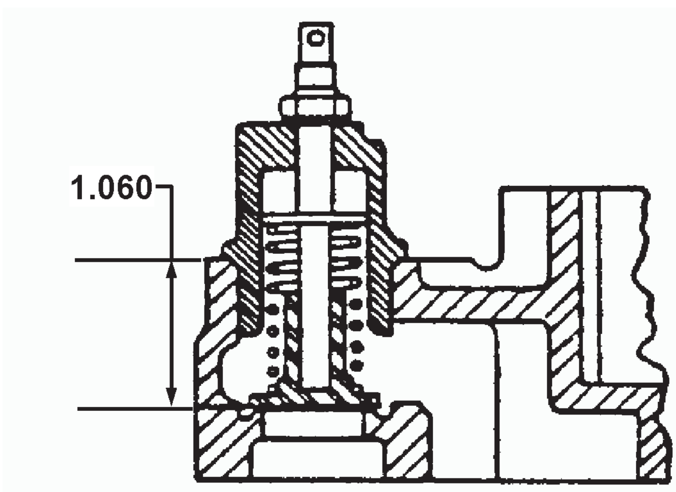


Figure 15-13. Oil Pressure Relief Valve

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 15-14, 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 Loctite 271 along the large threads (0.8125-16 end) of the oil filter adapter stud and torque the stud to Appendix B specifications.
9. Confirm the installed stud matches the illustration in Figure 15-14.
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 15-15, to indicate a new oil filter adapter stud has been installed in the adapter housing.

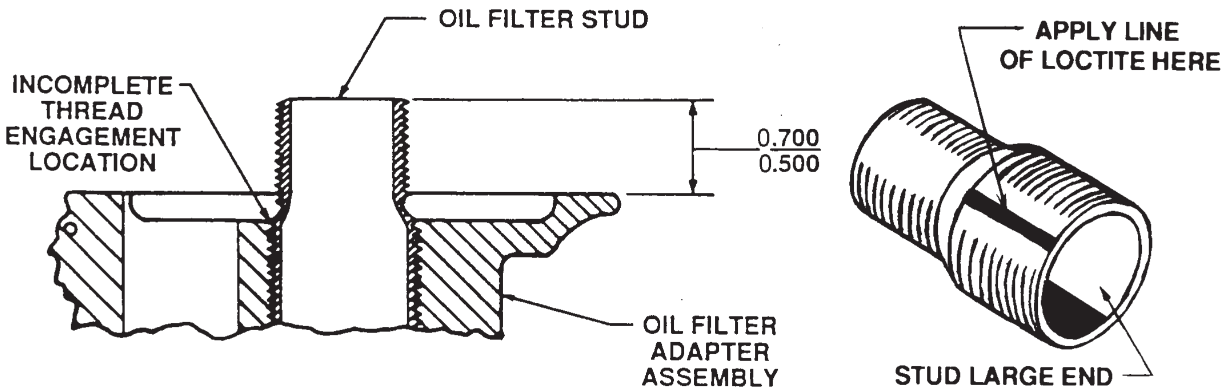


Figure 15-14. Oil Filter Adapter Stud

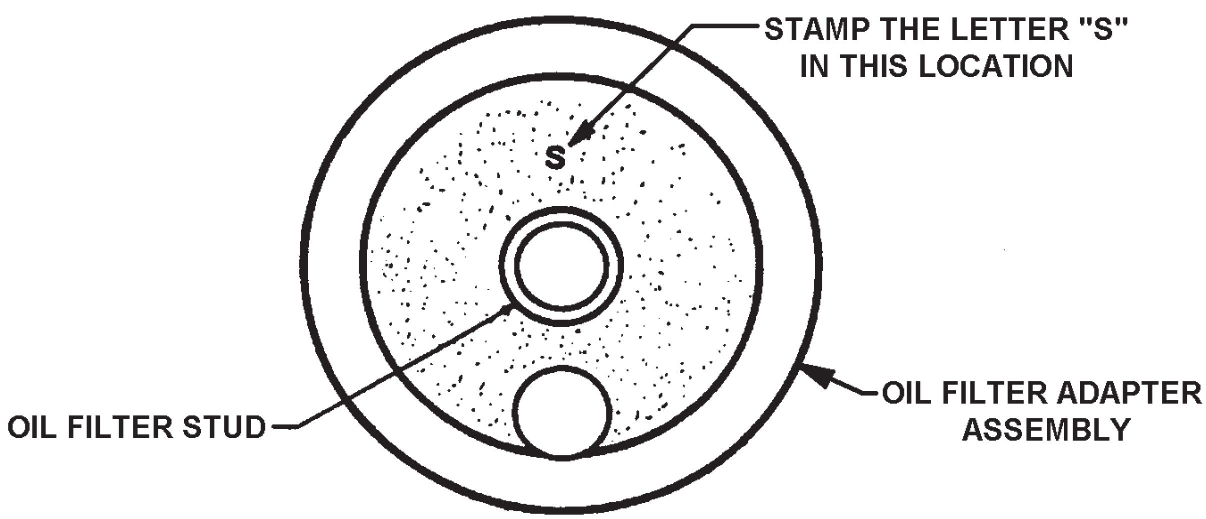


Figure 15-15. Identification of Oil Filter Adapter Stud Modification

15-8.8.4. Tachometer Drive Assembly Replacement

Discard any tachometer drive assembly exhibiting cracks or wear beyond Appendix D specified limits and replace with a new assembly. Replace loose or damaged studs on the tachometer drive assembly.

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 airframe. 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.
   Once the baseline inspection point is established, replace the valve seat as follows:

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 15-7 indicates possible cylinder symptoms and appropriate corrective actions.

Table 15-7. 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 genuinecontinental.aero for the latest parts information.
2. Do not attempt to remove overheating damage by grinding the cylinder bore to the next allowable size. Cylinder barrel overheating can destroy 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 15-8 during engine overhaul:

Table 15-8. Mandatory Cylinder Overhaul Replacement Parts

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

15-8.9.3. Rocker Shaft Retention Modification A B C

IO-550-A, B & C cylinder rocker shafts were modified by Service Bulletin M92-6. Compliance with M-92-6 is mandatory for affected cylinders at the next top or engine overhaul. Inspect the cylinder below the rocker cover flange (Figure 15-15) to determine if M92-6 modifications have been completed. If the cylinder has not been modified, complete this procedure to accomplish the modification.

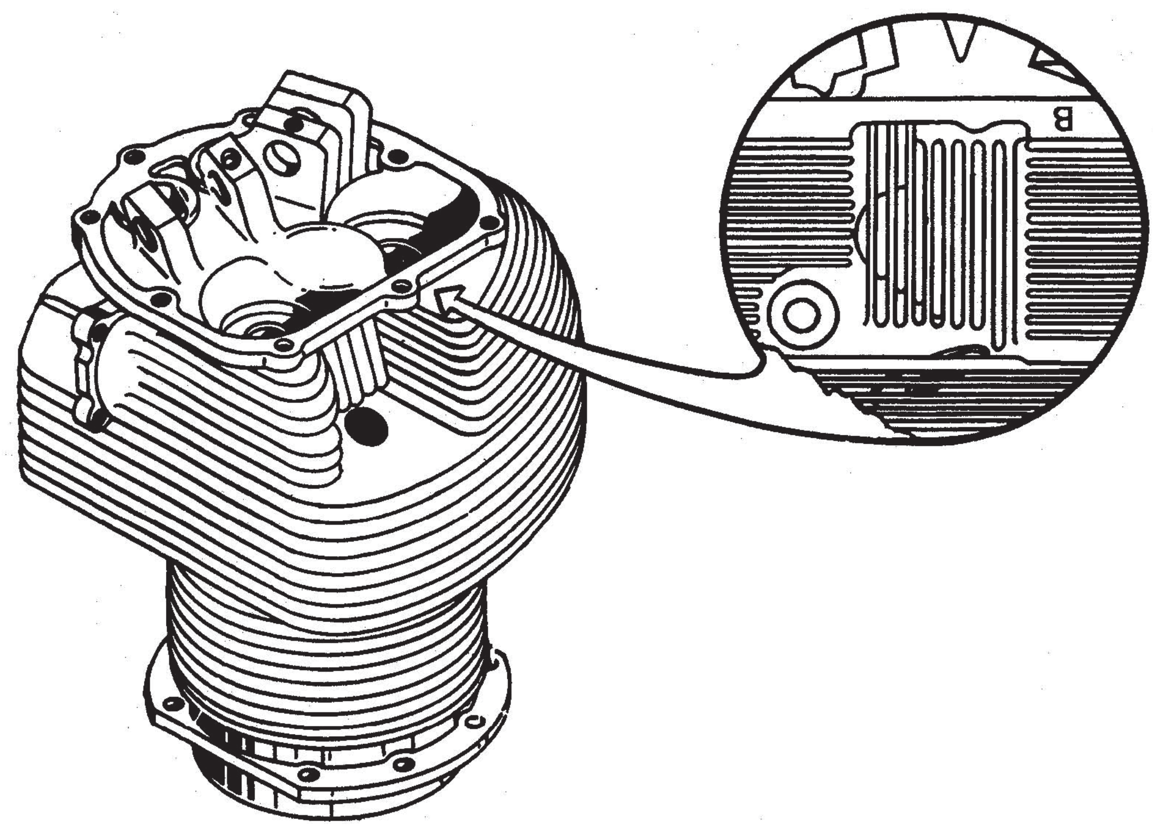


Figure 15-16. M92-6 Compliance Stamp

NOTE: This modification is only required on Continental Motors IO-550-A, B and C cylinder serial numbers prior to those listed below:

Engine Model	New	Remanufactured
IO-550-A	677006	280326
IO-550-B	675729	281646
IO-550-C	676623	271719

1. Complete the cylinder inspections to determine cylinder serviceability.
2. Install the drill guide kit, Borroughs P/N 8181, with the P/N 8181-1 drill guide (Figure 15-17) in the existing rocker boss bore.

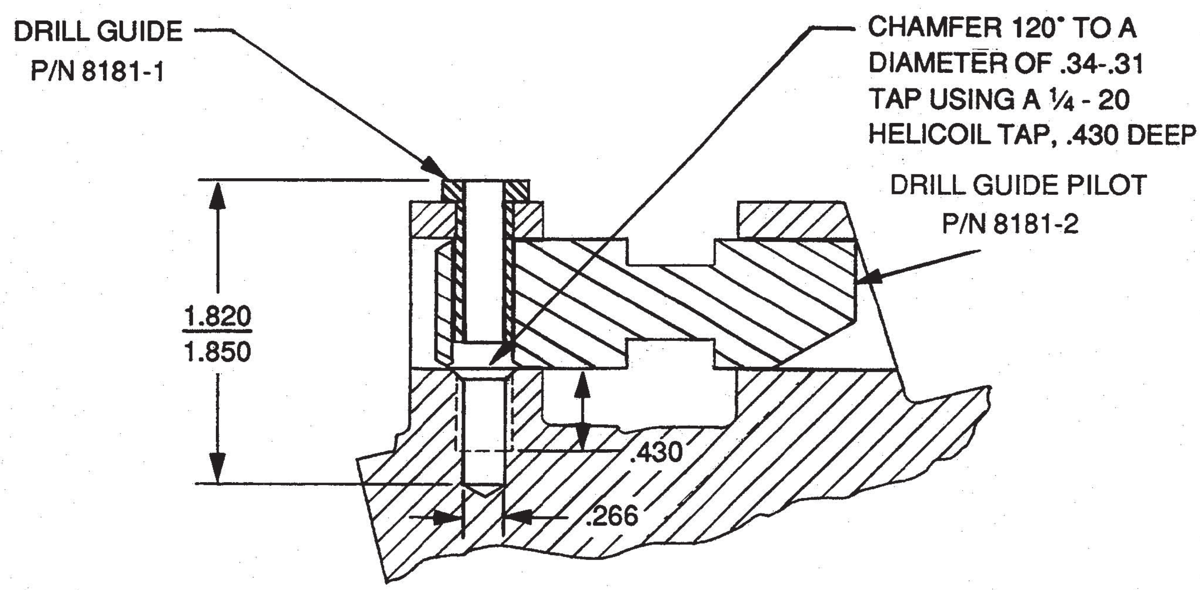


Figure 15-17. Part No. 8181 Drill Guide

3. Drill 0.266” holes, 1.820-1.850” deep, measure from the top of the drill guide in each of the rocker boss screw holes. Remove the drill guide from the rocker boss.
4. Finish each bore with 120° chamfer, 0.31-0.24 in diameter with a 0.339 drill bit and T-handle drill; deburr as required.
5. Install P/N 8181-2 drill guide pilot 90° from the original position and tap the hole to a depth of 0.430" with a 0.250" helical coil tap.
6. Install two MS21209C4-15 helical coils according to the instructions in Appendix C. The helical coil must be installed below the surface of the rocker shaft bore.
7. Clean the cylinder to remove all metal shaving residue according to the cleaning instructions in Chapter 14.
8. Impression stamp the cylinder according to Figure 15-16 to indicate compliance with the modification.

15-8.9.4. 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 15-18.

WARNING

Do not stamp or etch the cylinder position on the piston. Pistons are not stamped with position numbers. To mark the piston with installed position, use a felt tip marker or attach a tag indicating the installed position.

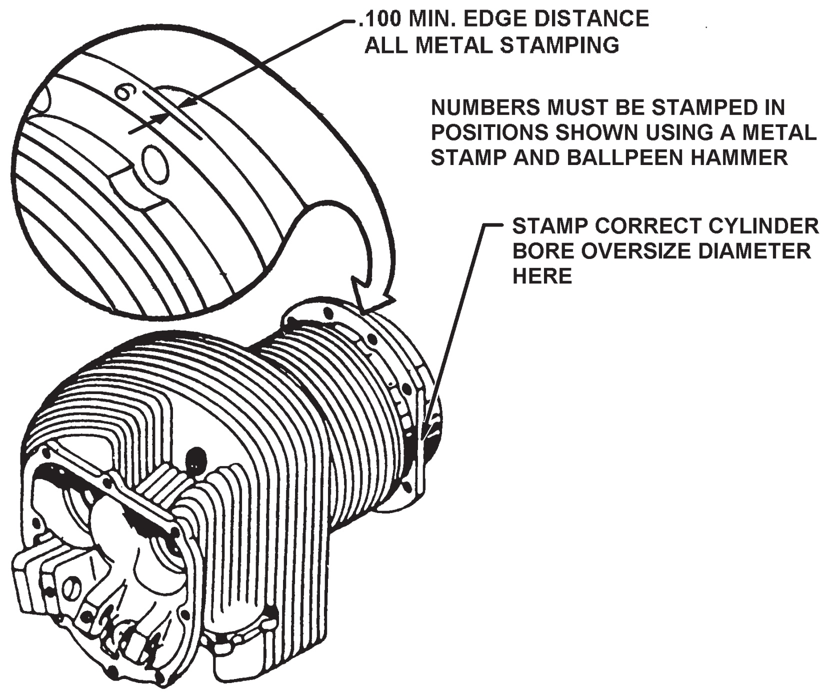


Figure 15-18. Cylinder Position Number

15-8.9.5. Cylinder Head Repair

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.

Replace cracked or damaged cylinders. Do not attempt to repair a cracked cylinder head.

15-8.9.6. Cylinder Fin Tip Repair

CAUTION: Do not attempt to straighten bent cylinder fins.

15-8.9.7. 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 15-18.

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 15-8.9.8, “Cylinder Bore Honing.”

15-8.9.8. 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-10 or Table D-11.
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 rotating 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 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-10 or Table D-11.

15-8.9.9. 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 to 450°F (232°C) maximum for one hour.
3. Using the correct special tool, remove the worn valve seat(s).
4. Allow the heated cylinder to cool to room temperature.
5. Inspect the valve 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 bore seat cutter based on the new valve seat insert outside diameter (see Appendix 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 figures 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 a copy of the "Engine Cylinder Overhaul Inspection Checklist" in Chapter 11). Refer to Appendix D for the valve overhaul dimensional limits.
11. Install a new valve seat according to Section 15-8.9.10, "Valve Seat Installation."

15-8.9.10. 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 15-8.9.12 followed by a "Fluorescent Penetrant Inspection" according to instructions in Section 15-4 on the newly installed valve seat and valve guides.

15-8.9.11. 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 Reamers, or equivalent
- Borroughs Part No. 8116-1 through 16 Expanding Guide Bodies, or equivalent
- Borroughs Part No. 3170 Floating Holder, or equivalent
- Proper size Morse adapter
- Heavy duty drill press

1. Inspect the cylinder head to barrel junction baseline (Section 15-8.9); discard cylinders exhibiting movement.
2. Install the proper size head on the 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. Repeat steps 1 through 7 to remove the remaining valve guides.
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 size.

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 new valve guide inside diameter to verify it meets Appendix D specifications.

15-8.9.12. 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 (Section 3-2 in Chapter 3) 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 15-8.9.13.
7. After reaming the valve guide to the proper inside dimension, perform a "Fluorescent Penetrant Inspection" (Section 15-4) on the new valve guide and the valve seat.

15-8.9.13. 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.

15-8.9.14. 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.
- Sioux Brand Valve Seat Grinder Pilot 0.437 diameter
- 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.

15-8.9.15. Spark Plug Helical Coil Insert Replacement

Equipment Required

- Emhart Fastening Teknologies Helical Coil Extracting Tool
- Emhart Fastening Teknologies Helical Coil Installation Tool
- Emhart Fastening Teknologies Part 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 helical coil end away from the cylinder head metal.
2. Tap the Helical Coil Extracting Tool into the insert until firmly seated; remove the helical coil.
3. Using the proper size mandrel on the Helical Coil Installation Tool, place a new stainless steel helical coil in the cutout side of the Helical 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 helical 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 helical coil insert end must not protrude into the combustion chamber after it has been installed.

7. Wind the helical 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 helical 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.

15-8.9.16. 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 "Rosan® Stud Installation" instructions in Appendix C-7.2.1. Install new studs to the specified heights listed in Appendix D-9.7. 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.

15-8.9.17. Piston Ring Replacement

Install new piston rings on each engine cylinder piston during the 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 15-8.9.8.

15-8.9.18. 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 14-4, "Protective Coatings."
3. Thoroughly clean the entire cylinder with mineral spirits and air dry.
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 3-9 in Chapter 3) to the cylinder barrel according to instructions in Section 14-4.3, "Paint."

   CAUTION: Do not paint the cylinder flange nut seats, skirt, or flange-to-crankcase mating surface.

6. After the paint has dried 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.

15-8.9.19. Rocker Arm Bushing Replacement

NOTE: Current production IO-550 rocker arms are fitted with a single bushing that spans the width of the rocker arm bore. Some early IO-550-A, B & C engines with updraft cylinders were built with dual bushing rocker arms. Use the instructions that apply to the rocker arms being replaced.

15-8.9.19.1. Rocker Arm (Dual) Bushing Replacement A B C

Equipment Required

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

NOTE: The following procedure applies ONLY to dual bushing-type rocker-arms:

1. Remove the old bushings from the rocker arm(s) using a Borroughs Part No. 8118 Rocker Arm Bushing Remover/Installer (“Special Tools” in Chapter 3) or the correct size drift in an arbor press.
2. Lubricate the new bushings with clean 50-weight aviation engine oil.
3. Press the new bushings in to the specifications in Figure 15-19.
4. Plug the oil passages on the rocker arm with beeswax.
5. Ream the rocker arms and the new bushings to the diameter specified in Figure 15-19.
6. Lightly break the sharp edge at each end of the new bushings.
7. Inspect the bushing size and surface finish to determine if it meets specifications.
8. After reaming, clean and flush the oil passages using clean mineral spirits.
9. Remove the beeswax plug and verify that the oil passages are clear of any debris, contamination or beeswax.
10. Clear any rocker arms that have obstructed oil passages by flushing with mineral spirits and blowing through the passage with compressed air. Discard rocker arm with obstructed oil passages.
11. Perform a “Visual Inspection” and “Magnetic Particle Inspection” on the overhauled rocker arm assemblies.

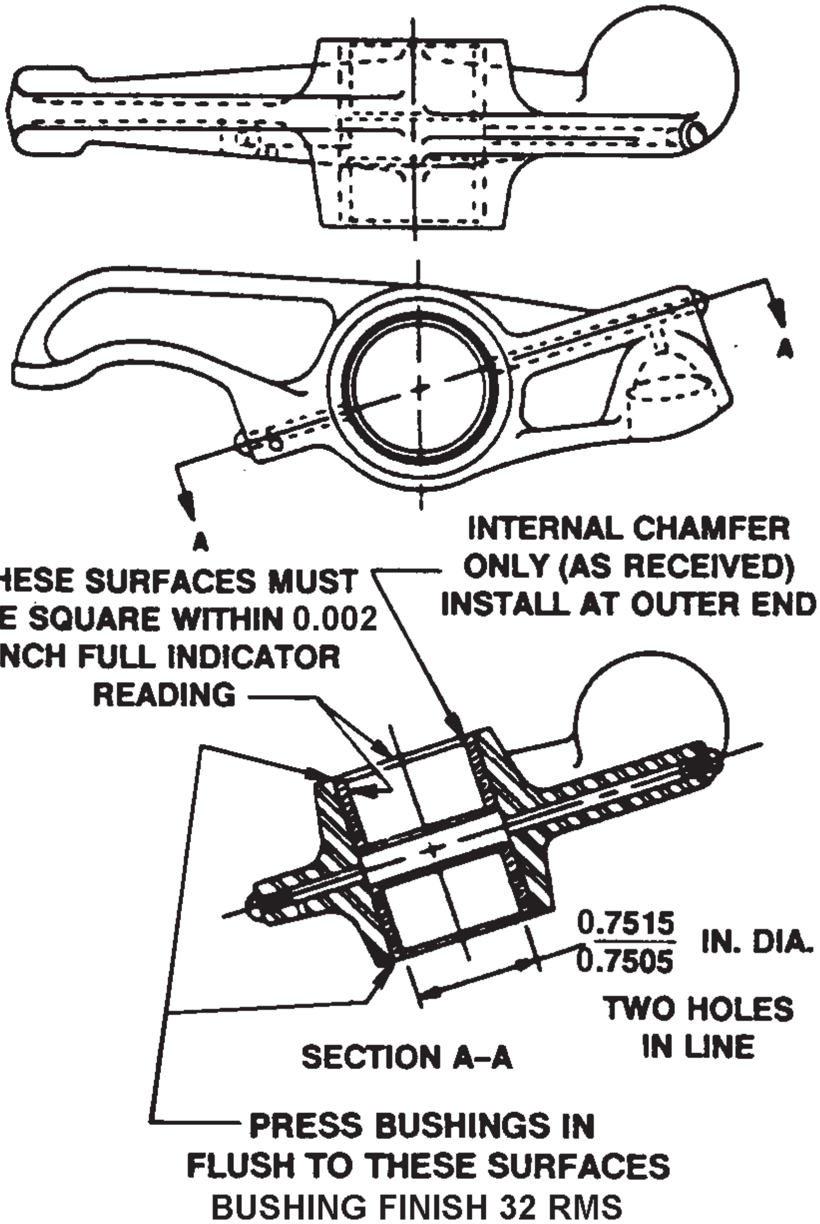


Figure 15-19. Rocker Arm Bushing (Dual Bushing Type) Replacement

15-8.9.19.2. Rocker Arm (Single) 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

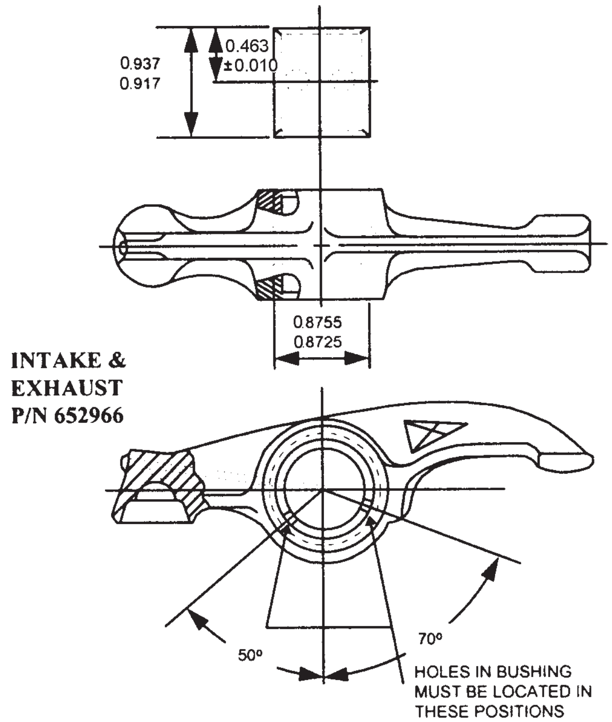
NOTE: The following procedure applies ONLY to single-bushing type rocker arm bushings:

1. Plug the oil passages on the rocker arm with beeswax.
2. Remove the old bushings from the rocker arm(s) using a Borroughs Part No. 8118 Rocker Arm Bushing Remover/Installer (“Special Tools” in Chapter 3) or the correct size drift in an arbor press.
3. Measure the rocker arm bushing bore inner and outer diameter and verify that it conforms to Appendix D dimensions.

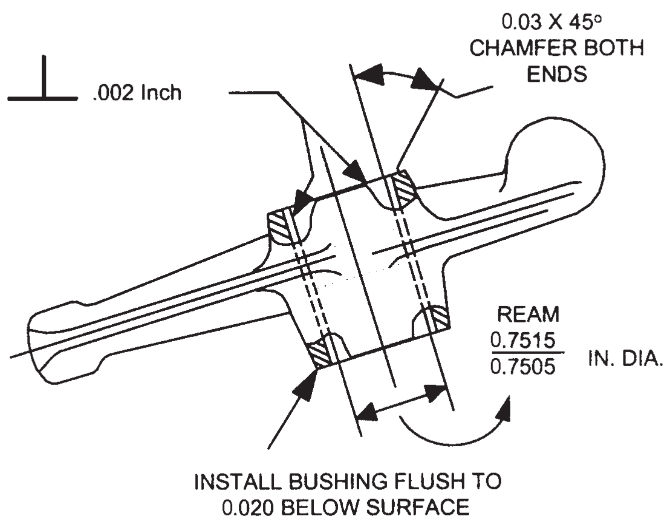
WARNING

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.

4. Verify the bushing oil passages are positioned as illustrated in Figure 15-20.
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 new bushing into the rocker arm bushing bore. The bushing must be installed flush to 0.020 below surface (Figure 15-21).
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 15-21).
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, removing beeswax and making certain that all passages are clear of any 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 a “Visual Inspection”and “Magnetic Particle Inspection” on the overhauled rocker arm assemblies.



* 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 15-20. Rocker Arm Single Bushing Replacement

15-8.9.20. Rocker Arm-to-Retainer Clearance

Maintain a minimum clearance of 0.020 inches (0.508 mm) between the rocker arm and 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 in the boss to verify rocker arm to retainer clearance.
2. Smoothly grind across the forging flash line on the underside of the rocker arm to obtain the specified 0.020-inch clearance. Cover the rocker arm bushing bore and oil passage to prevent contamination. The grind must be smooth and uniform and must not exceed the width illustrated in Figure 15-21. If the required clearance cannot be met without exceeding the grind width, discard and replace the rocker arm.
3. Polish the entire ground surface to remove grinding marks.
4. Remove the protective coverings from the rocker arm and clean thoroughly.
5. Perform a "Magnetic Particle Inspection"(Section 15-5) on the polished rocker arm to inspect for cracks.
6. Remove and thoroughly clean the rocker arm(s) before final engine assembly.

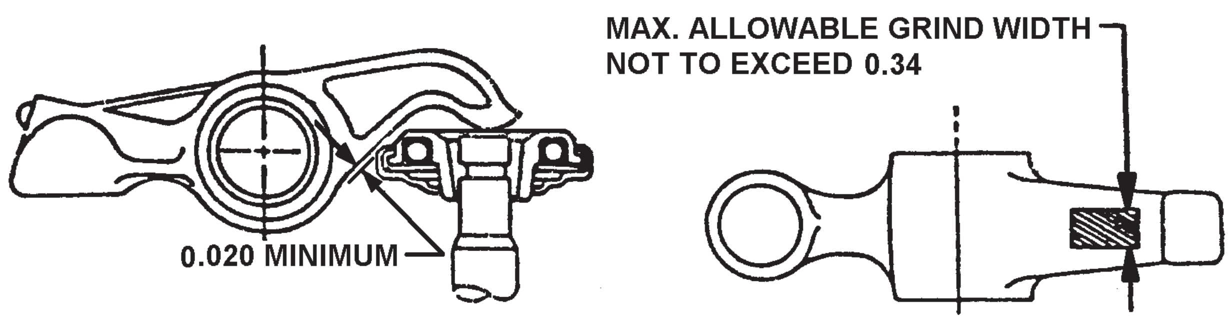


Figure 15-21. Rocker Arm to Retainer Clearance

15-8.10. Inter-Cylinder Baffle Repair

1. Perform a "Visual Inspection" according to instructions in Section 15-3 on the inter-cylinder baffles for condition, corrosion, loose rivets or missing material.
2. If a baffle is bent but the shape still conforms to the cylinder, minor bends may be straightened with a hammer and anvil.
3. Minor repairs, including rivet or nut plate replacement, using standard repair procedures is acceptable.
4. Clean the baffles and restore the protective finish according to instructions in Chapter 14.

15-8.11. Crankcase Overhaul Repair

1. Collect the crankcase replacement parts according to 100% Parts Replacement Requirements and Mandatory Overhaul Replacement Parts in Appendix C.
2. Replace crankcase or associated parts worn beyond Appendix D overhaul limits or if they fail to meet inspection criteria. Discard and replace all non-conforming components.

15-8.11.1. Camshaft Gear Replacement

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.

CAUTION: Crankcase machining should be accomplished only by an FAA Part 145 Approved Repair Station.

1. Measure 3.0935"- 3.0985" from the camshaft bore centerline to the center of the starter drive bearing boss (Figure 15-22).
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 15-23) from the accessory face in step 1.

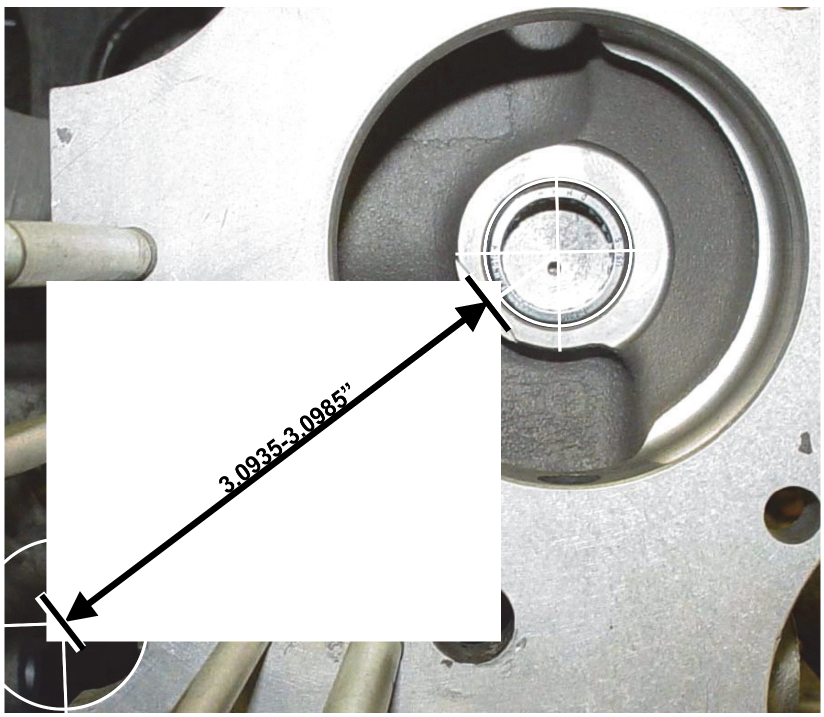


Figure 15-22. Radius Cut Distance from Camshaft Centerline

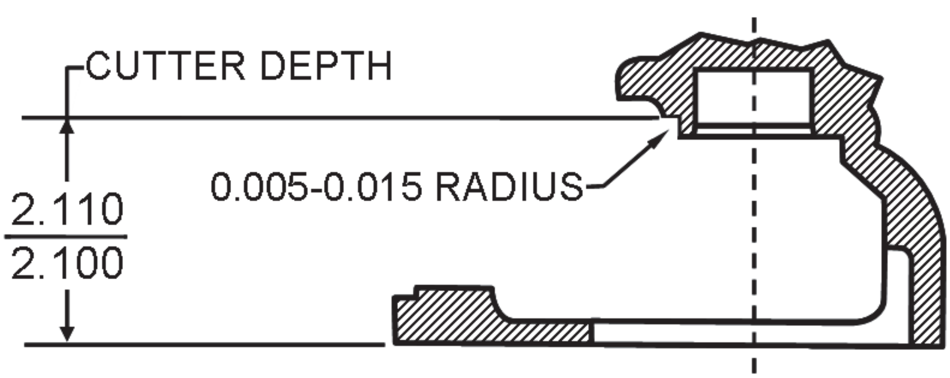


Figure 15-23. Overhead View of Radius Cut Depth

15-8.11.2. Crankcase Line Boring

Either discard or line-bore crankcases to the next authorized oversize dimension with crankshaft or camshaft bearing bores that exceed the specified critical new parts diameter. Only a certified repair facility 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.

15-8.11.3. Crankcase Machining

Discard and replace or machine crankcase halves 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 15-4.

15-8.11.4. Crankcase Welding

WARNING

No weld repairs are permitted in the critical (non-shaded) areas of the crankcase or the bearing support structures. An FAA-Part 145 Repair Station certified to perform crankcase repair is the only facility authorized to perform a crankcase weld repair.

Welding is only permitted on ***non-critical*** areas of the crankcase identified in the Section 15-7.1, “Crankcase Dimensional Inspection.” Only an FAA Part 145 Repair station certified to perform crankcase repair may complete the weld repair. The dimensional integrity of the crankcase must be maintained.

15-8.11.5. Oil Filler Overhaul Repair

Collect the oil filler replacement specified in Section C-2.3, “100% Parts Replacement Requirements” and Section C-2.4, “Mandatory Overhaul Replacement Parts.”

15-8.11.6. Crankcase Cylinder Deck Stud Helical Coil Installation

Replace unserviceable crankcase cylinder deck helical coils using instructions in Appendix C-6 and specifications in Figure 15-24.

WARNING

Do not attempt to repair the two or four o'clock crankcase cylinder deck stud positions by installing helical coil inserts.

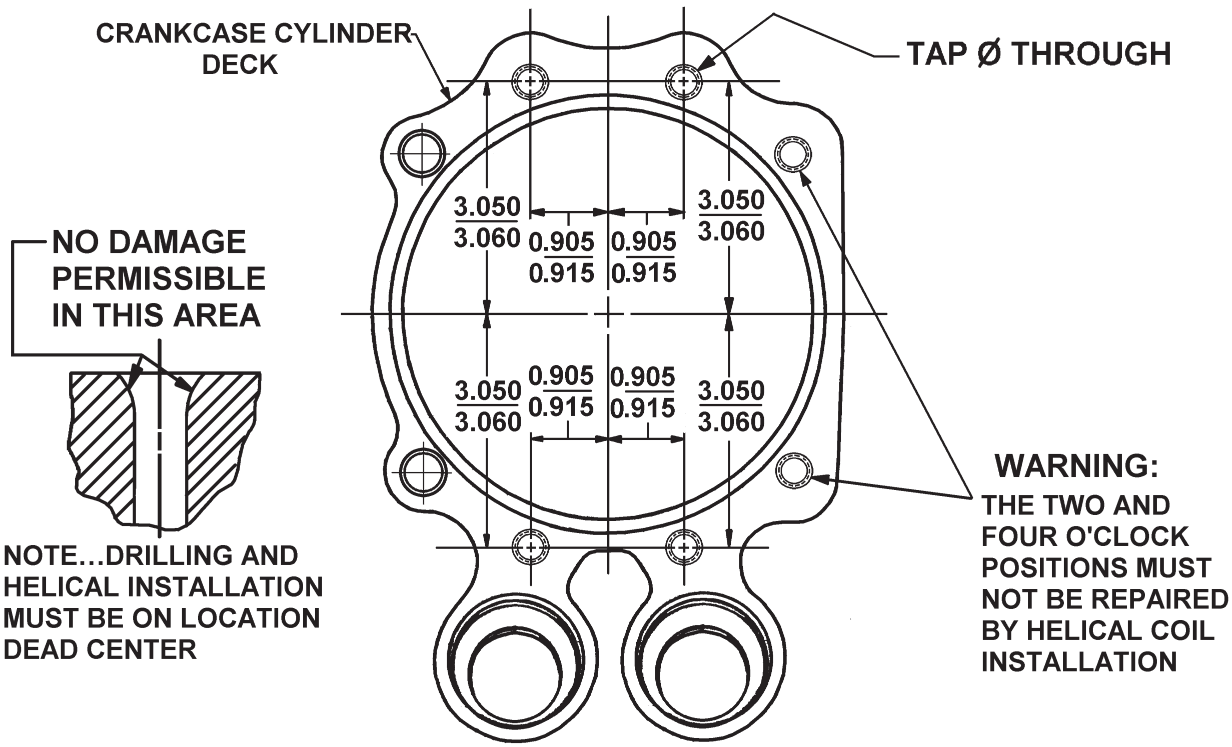


Figure 15-24. Cylinder Deck Stud Helical Coil Repair Instructions

15-8.11.7. Crankcase Cylinder Deck Stud Replacement

Crankcase cylinder deck studs (except at the two and four o'clock positions) may be replaced using these instructions. Replace any crankcase stud which is loose, damaged or fails to meet Appendix D stud height specifications according to the "Stud Replacement" instructions in Appendix C-7. Refer to Appendix D specifications for the proper stud height.

WARNING

Do not attempt to repair the two or four o'clock crankcase cylinder deck stud positions by installing helical coil inserts.

1. Verify the studs and tapped holes are clean and dry.
2. Apply Part No. 653693 High Strength Adhesive Primer to 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 stud height setting specified 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.

15-8.12. 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 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 15-9. 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
Crankshaft Counterweight[1]	Discard any counterweight that is: • Cracked • Worn, pitted, fretted, or out of round bushing bores • Worn pitted, fretted or out of round in the retaining plate seating area. • Worn or has distortions in the retaining ring groove that can affect the retaining ring seating

Table 15-9. Engine Drive Train Parts Replacement

Part to Consider for Replacement	Discard and Replace Criteria
Camshaft	Discard any camshaft with any of the following conditions: • cracks, scoring, galling corrosion pitting or other physical damages • 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
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

15-8.12.1. 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 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” according to instructions in Section 15-5 after camshaft rework.

15-8.12.2. 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.

If a crankshaft is repaired by an FAA Repair Station, the nitride treatment must be restored

The crankshaft may be repaired by grinding the crank pins and journals to 0.010 inches (0.254 mm) under the new shaft limits per Appendix D and re-nitriding. This repair is only authorized at an FAA Part 145 Repair Station certified to perform crankshaft repairs. Crankshaft repair procedures must be accomplished according to Federal Aviation Regulations. The repaired crankshaft must meet the new part dimensional limits specified in Appendix D.

1. Install the Crankshaft Oil Control Plug according to Section 15-8.12.2.1, "Oil Control Plug Replacement."
2. Install new crankshaft counterweight bushings according to Section 15-8.12.2.2, "Crankshaft Counterweight Bushing Replacement."
3. Install new crankshaft hanger blade bushings according to Section 15-8.12.2.3, "Crankshaft Hanger Blade Bushing Replacement."
4. After the oil control plug and both the hanger blade bushings and the counterweight bushings are installed, perform a "Magnetic Particle Inspection" on the crankshaft and counterweights and a "Crankshaft Ultrasonic Inspection" to ensure no cracks developed during the bushing or oil control plug installation process.

15-8.12.2.1. Oil Control Plug Replacement

Equipment Required

- Oil Plug Leak Test Fixture (Figure 3-8)
- Oil Control Plug Installation Tool (Figure 3-7)

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 4.69 to 4.75 inches. ***Do not*** use makeshift tools to install the oil control plug.

1. Remove the crankshaft oil control plug using an eight inch long 0.4375-20NF threaded bolt 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 (Figure 3-7) and Oil Control Plug Leak Test Fixture (Figure 3-8)) 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 (Figure 3-8) to the crankshaft using a C-clamp with neoprene rubber pads as shown in Figure 15-25. 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 crankshaft repairs are complete, restore the helix pattern to the exposed portion of the crankshaft according to instructions in Section 15-8.12.2.4, “Crankshaft Plating Overhaul.”

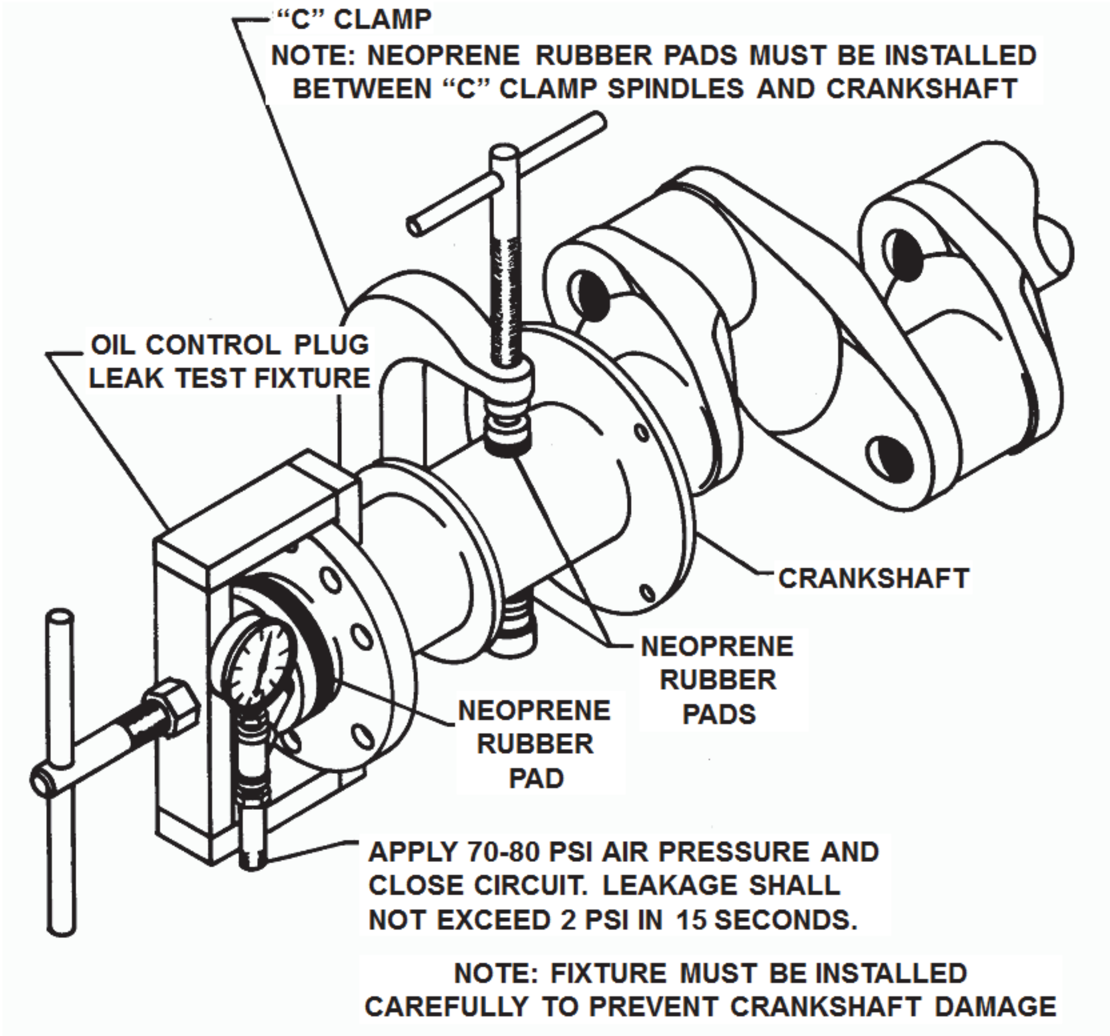


Figure 15-25. Oil Control Plug/Crankshaft Pressure Test

15-8.12.2.2. Crankshaft Counterweight Bushing Replacement

Equipment Required

- Borroughs Part No. 8077C Counterweight Bushing Replacement Fixture, or equivalent
- Federal Dimension Air Gauge (with appropriate setting ring and air plug) or
- Starrett No. 78 series 3 point contact inside micrometers
- Snap ring pliers (with 90-degree bend)
- Arbor press

The complete crankshaft /counterweight assembly is dynamically balanced; the counterweights are matched in pairs with a maximum weight variation of two grams. If either counterweight is damaged, both counterweights must be replaced as a pair on that crankshaft cheek, even if only one counterweight is unserviceable.

WARNING

Removing the hanger blade bushings with makeshift tools may cause irreparable damage which could lead to engine malfunction or failure.

1. Remove the crankshaft counterweight bushings with a Borroughs 8077C Counterweight Bushing Replacement Fixture and an arbor press.
2. Measure the crankshaft counterweight bushing bore inside diameter. The bushing bores must be smooth and cylindrical (no out-of-round). Replacement bushings must have an interference fit of 0.0015 to 0.003 inches in the bushing bores.
3. Evaluate the counterweights based using the criteria in Table 15-9, "Engine Drive Train Parts Replacement" to determine acceptability of parts. Replace counterweights with worn, pitted, fretted or out-of-round bushing bores.

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.

4. Inspect counterweight bores/counterbores for signs of wear in the wall that retains the counterweight pin retaining plates (area adjacent to the inside edge of the retaining groove; it may appear as a taper of the hole into the retaining ring groove). If any wear is evident, discard and replace the counterweight.

   NOTE: Replace both counterweights in the matched pair even if only one counterweight is unacceptable.

5. If the counterweight conforms to specifications, check the counterweight retaining ring groove for distortions in width, roundness or pattern which can affect the seating of the retaining ring. Discard and replace the counterweight matched pair if wear or distortions are found even on one counterweight.

6. Install new bushings in the same positions as the old bushings on the counterweight assemblies (Figure 15-26) using the Borroughs 8077C Counterweight Bushing Replacement Fixture. The bushing lead-in (Figure 15-26) must be positioned toward the counterweight during installation. Press the bushing flush with the surfaces as illustrated.
7. Verify the dimensions of the newly installed bushings. Close tolerances require replacement bushings be 100% dimensionally inspected according to Appendix D specifications using calibrated, accurate measuring equipment (one of the following):
    a. Federal Dimension Air Gauge (with appropriate setting ring and air plug)
    b. Starrett No. 78 series 3 point contact inside micrometers.
8. Perform a "Magnetic Particle Inspection" on the counterweight assembly to ensure the counterweight is free of cracks.

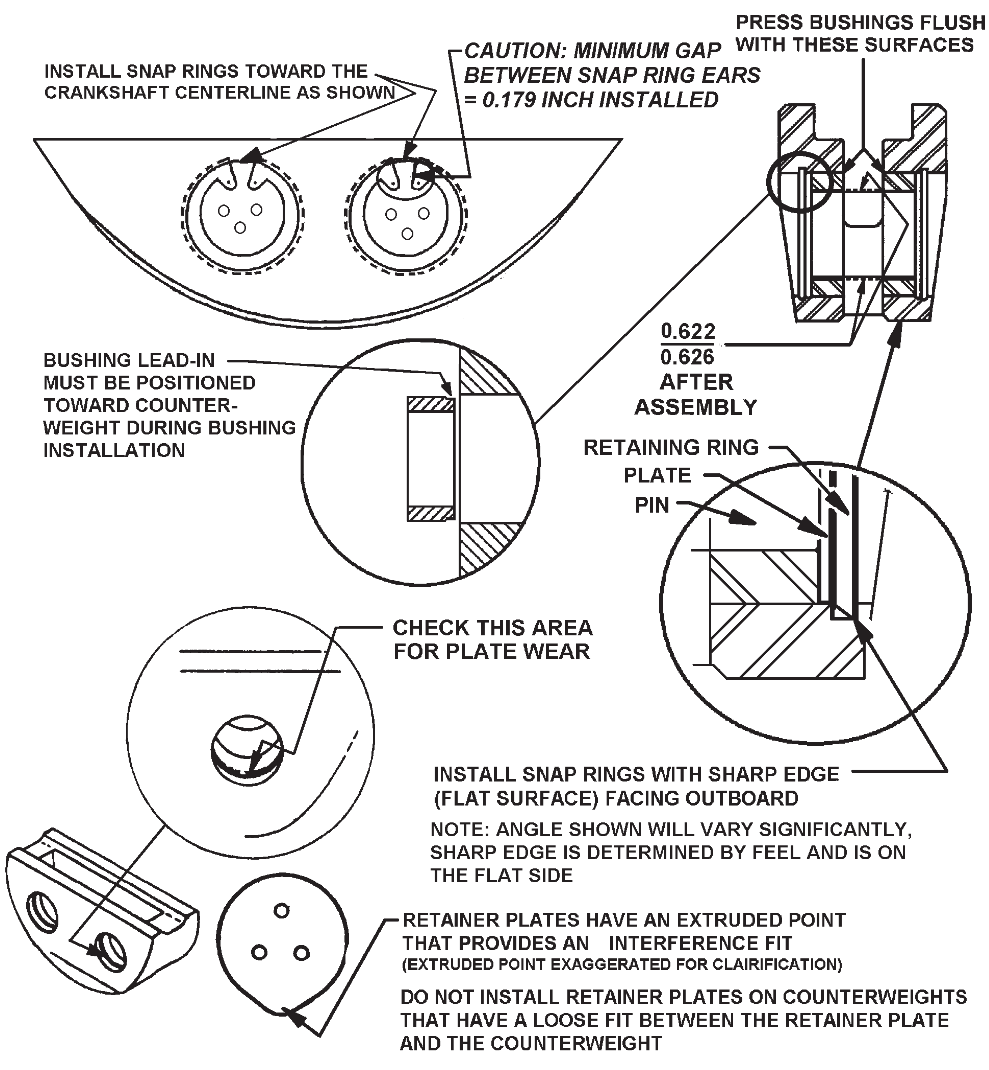


Figure 15-26. Counterweight Inspection, Repair and Installation

15-8.12.2.3. Crankshaft Hanger Blade Bushing Replacement

Crankshaft hanger blade bushings are also referred to as damper bushings. Crankshaft hanger blade bushings must meet Appendix D specifications. If the hanger blade bushing exhibits gouges or scratches, is loose, or is otherwise unserviceable, replace the hanger blade bushing:

Equipment Required

- Borroughs 4965A Crankshaft Hanger Blade Bushing Replacement Tool, or equivalent
- Federal Dimension Air Gauge (with appropriate setting ring and air plug) or Starrett No. 78 series 3 point contact inside micrometers

WARNING

Removing the bushing with makeshift tools may cause irreparable damage to the crankshaft that could lead to engine malfunction.

1. Install the new crankshaft hanger blade bushings according to Figure 15-27 using the Borroughs Part No. 4965A Crankshaft Hanger Blade Bushing Replacement Tool. The replacement bushings must have an interference fit of 0.0015 to 0.003 inches into the bushing bores. The bushing bores must be smooth.

   NOTE: The new bushings must be installed into the same positions as the original. Replacement crankshaft hanger blade bushings are available in standard and oversize dimensions.

2. Review Table 15-9, "Engine Drive Train Parts Replacement" to determine acceptability of parts.
3. Verify the dimensions of the newly installed bushings. Close tolerances require replacement bushings be 100% dimensionally inspected according to instructions in Figure 15-27 using calibrated, accurate measuring equipment (one of the following):
   a. Federal Dimension Air Gauge (with appropriate setting ring and air plug).
   b. Starrett No. 78 series 3 point contact inside micrometers.

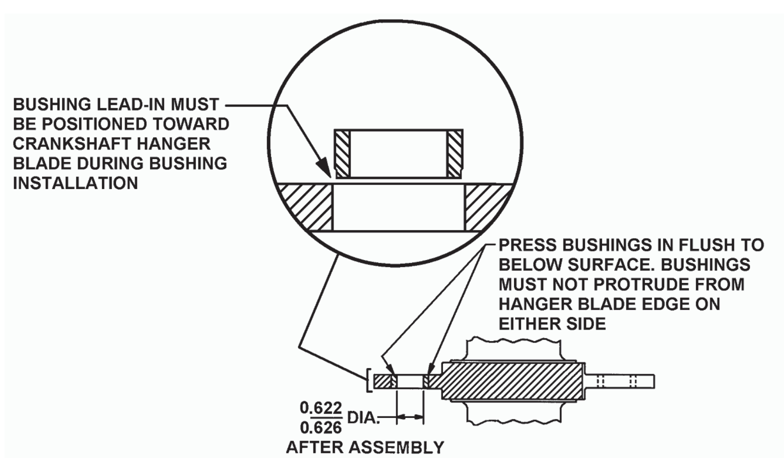


Figure 15-27. Crankshaft Hanger Blade Bushing Replacement

15-8.12.2.4. Crankshaft Plating Overhaul

1. Remove any tin plating on the crankshaft in the one inch area shown in Figure 15-28 by rubbing a piece of very fine emery cloth, buffing around the shaft to attain a smooth uniform finish without any scratches.
2. Apply a ½-inch wide strip of 180 grit emery cloth against the newly polished one inch area on the crankshaft with firm hand pressure to lightly scratch (not score or gouge) a new helix design in a 30° pattern in the plated area as shown in Figure 15-28. The helix promotes proper seating of the crankshaft oil seal - a better seal prevents leakage.
3. After preparing the first quarter portion, rotate the crankshaft by hand so that the next portion is visible and continue rubbing with the 180 grit emery cloth until the entire one inch plated area (Figure 15-28) around the crankshaft is lightly scratched with the helical design.
4. Flush the metal particles from the crankshaft with mineral spirits.
5. Wipe the plated area with the lightly scratched helical pattern on the crankshaft with acetone. Ensure the crankshaft is free of any debris and particulate matter to facilitate a clean seal.
6. Mask the crankshaft except for the area prepared in the previous steps to prevent overspray. Apply a uniform coat of aluminum paint to the portion of the crankshaft which will be exposed to the elements and allow the paint to dry to the touch.

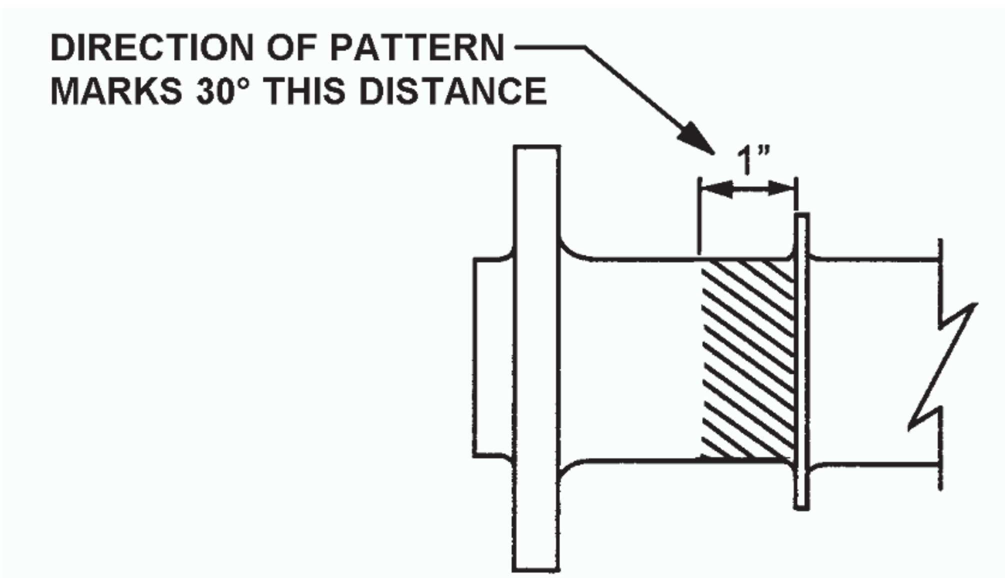


Figure 15-28. Crankshaft Helix Pattern

15-8.12.2.5. Connecting Rod Piston Pin Bushing Replacement

Replace all connecting rod piston pin bushings (Figure 15-31) (9) at overhaul.

Equipment Required

- Arbor press
- Borroughs Part No. 8098 Connecting Rod Bushing Removal/Installation Set, or equivalent
- Borroughs Part No. 8111A Connecting Rod Boring and Alignment Fixture, or equivalent
- High speed borer of the correct size
- Borroughs Part No. 8042C Adapter Kit, or equivalent
- Vertical mill or equivalent capable of maintaining 1750 RPM.
- Federal Dimension Air Gage with a 1.1268 setting ring and 1.1268 air plug (or equivalent)
- Profilometer

WARNING

Use only the special tools listed. Removing and installing connecting rod bushings with makeshift tools can damage the connecting rods.

Verify the piston pin bushing being installed is the correct part number for the application. Use a Connecting Rod Bushing Removal/Installation Set and an arbor press to install the piston pin bushing as follows:

1. Press out the old piston pin bushing using the Connecting Rod Bushing Removal/ Installation Set and an arbor press. Verify the connecting rod bore is smooth.
2. Verify the new bushing part number. Dip the new piston pin bushing in clean 50weight aviation engine oil before placing it in position. The bushing may be chilled to aid installation.
3. Inspect the piston pin bushing bore and assess the condition based on information in Table 15-9, “Engine Drive Train Parts Replacement” to determine acceptability of parts. No nicks or gouges are permissible on the bore after the bushing is removed. Discard the connecting rod if nicks/gouges are found.
4. Position the connecting rod over the pilot so the mate marks and piston pin bore chamfer are facing up.
5. Place the piston pin bushing on the pilot so the bushing split line is located 45° ± 5° from the center line of the connecting rod, facing the crankpin end. Refer to the Connecting Rod Dimensions in Appendix D.
6. Position the ram onto the pilot.
7. Using the arbor press, carefully press the new piston pin bushing flush with the piston pin bore.

8. Bore the new piston pin bushing to the diameter specified in Appendix D according to Section 15-8.12.2.6, “Piston Pin Bushing Boring” instructions.
9. Visually inspect the connecting rod for nicks or damage that may have occurred during bushing installation. Scrap connecting rods exhibiting these conditions.

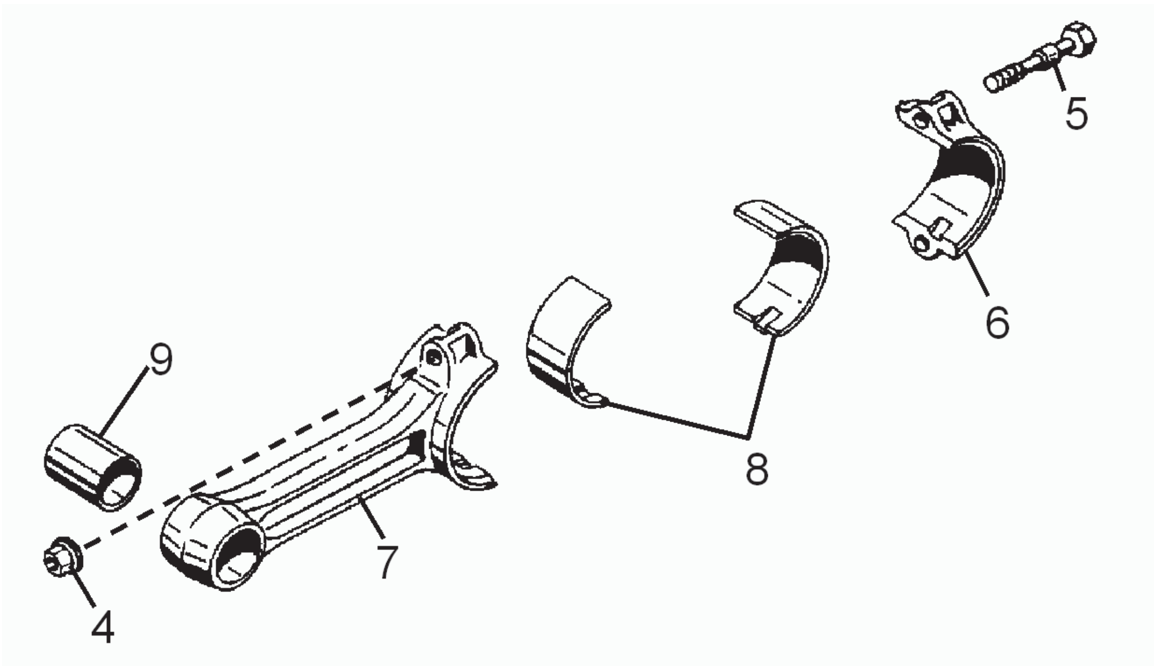


Figure 15-29. Connecting Rod Assembly

10. Verify the piston pin bushing meets Figure D-25 specifications.
11. Because of the close tolerances required, inspect the new piston pin bushing; note the bushing bore inner diameter must meet Appendix D specifications:
    a. Use a Federal Dimension Air Gauge (with the appropriate setting ring and air plug) to verify that the piston pin bushing is within the connecting rod minimum and maximum limits specified in Appendix D.
    b. Check the piston pin bushing surface finish with a profilometer. The surface finish must not exceed 16 Ra.
    c. Check the connecting rod bushing for alignment and twist after bushing installation using the Connecting Rod Boring and Alignment Fixture (Borroughs Part No. 8111A or equivalent).
    d. To check the connecting rod twist, insert the push-to-fit arbors into the pin and crank end of the connecting rod.
    e. Place the connecting rod crank pin end onto the V-blocks.
    f. Place the pin end arbor on the two machined parallel steel blocks spaced equal distance from the center line of the rod, but not less than 6 inches apart.

g. Use flat feeler gauge to detect clearance between the machined steel blocks and the pin end arbor. Refer to the connecting rod dimensions in Appendix D for specified limits.

h. To check the connecting rod alignment, rotate the pin end of the connecting rod to a vertical position with the arbor resting against a positive stop.

NOTE: The piston pin bushing must be bored to the proper inside diameter according to the "Piston Pin Bushing Boring" instructions in Section 15-8.12.2.6.

i. Using a dial indicator mounted on a vertical stand resting on the surface plate, measure the vertical distance of the pin end arbor from the surface plate at points of equal distance from the centerline of the connecting rod. Compare the connecting rod measurements to the connecting rod dimensions in Appendix D. Connecting rods exceeding Appendix D limits must have the piston pin bushing replaced and reamed or the connecting rod must be scrapped.

j. Compare the connecting rod bushing alignment and the large end bearing seat dimensions to the dimensions in Appendix D.

15-8.12.2.6. Piston Pin Bushing Boring

Equipment Required

- Borroughs Part No. 8111A Connecting Rod Boring and Alignment Fixture, or equivalent
- Borroughs Part No. 8042C Adapter Kit, or equivalent
- Vertical mill, or equivalent, capable of maintaining 1750 RPM.
- Boring tool of the correct sizes.

1. Place the connecting rod on the base plate and secure with retainers provided.
2. Select the correct adapter kit and boring tool for the connecting rod.
3. Using a vertical mill, or equivalent, bore the connecting rod bushing to size. Maintain 1750 RPM during the boring process.

15-8.12.2.7. 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 the preliminary steps detailed in earlier chapters. Parts must be properly removed, cleaned, inspected and repaired according to the instructions in earlier chapters prior to assembly. Adhere to the instructions in this chapter when assembling components. Prior to assembling components, refer to the following sections of the manual:

- Appendix C-1, "Handling Parts"
- Appendix C-2.2, "Acceptable Replacement Parts"
- Appendix C-2.3, "100% Parts Replacement Requirements"

The definition of "replace" in this manual is removal and disposal of the original part and substitution of a new part with the same form, fit, and function of the original when it was new.

16-1. Fuel Injection System

The fuel pump, throttle/metering assembly (or throttle and control unit assembly) and fuel manifold valve must be new, factory rebuilt, or overhauled and tested by an authorized FAA Part 145 Repair Station.

16-1.1. Fuel Injection System Component Assembly

NOTE: Before re-installation of fuel system component fittings ensure they are free of any debris by screwing them into the proper size holes of a soft wood block then thoroughly flushing them with an approved solvent.

Continental Motors offers new and rebuilt fuel pumps, throttle/metering assemblies (or throttle and control unit assemblies) and fuel manifold valve assemblies which meet new part specifications. Continental Motors does not control FAA Part 145 Repair Station activities; verify the repair station qualifications before contracting fuel manifold valve overhaul. Fuel manifold valve overhaul must be accomplished under carefully controlled conditions per approved procedures in compliance with FAA regulations.

16-1.2. Fuel Injector Nozzles

NOTE: Position-tuned injector nozzles must be replaced at engine overhaul. Replacement kits are available; part numbers may vary, even from one engine model specification to the next. Refer to Section 10-3 for detailed fuel injector replacement instructions.

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. Cap both ends of the new injector nozzles; mark them for the respective cylinders and place them in a clean storage container until ready for use.

16-2. Alternator Assembly

This procedure applies to alternators supplied by Continental Motors. For alternators procured from other manufactures or suppliers, refer to the manufacturer's instructions.

WARNING

Failure to remove the shipping washer prior to alternator installation will cause interference with the crankshaft face gear resulting in damage to the engine and alternator.

NOTE: All electrical charging system components must be clean and free of debris before assembly.

1. Remove the shipping spacer and washer from the alternator shaft to prevent interference with the crankshaft face gear.

   CAUTION: The special thrust washer (6) must be installed with the bearing surface (copper color) toward the alternator.

2. Install a new Woodruff key (Figure 16-1) (3), coupling assembly (5), and new thrust washer (6). Install the thrust washer (6) with the bearing surface (copper color) toward the alternator.
3. Install the slotted nut (4).

   CAUTION: Secure only the outer diameter of the drive hub assembly when torquing the slotted nut; allow the gear freedom of movement to prevent shearing the elastomer coupling.

4. Secure the outer diameter of the drive hub with an “Alternator Drive Hub Spanner Wrench” (“Special Tools” in Chapter 3) to prevent the hub from rotating while torquing the slotted nut.
5. Set the torque wrench for the minimum value published in Appendix B for the slotted nut (4) and torque the slotted nut (4).
6. If the slots of the nut do not align with the cotter pin hole in the alternator shaft, gradually increase the torque (not to exceed the maximum value) setting and retorque the slotted nut (4) until the slots align with the hole in the shaft. Do not back off the nut to align the slots with the hole in the shaft.
7. Install the new cotter pin (Figure 16-1) (7) as illustrated in Figure 16-2; cut and bend the cotter pin to provide adequate clearance during engine operation.

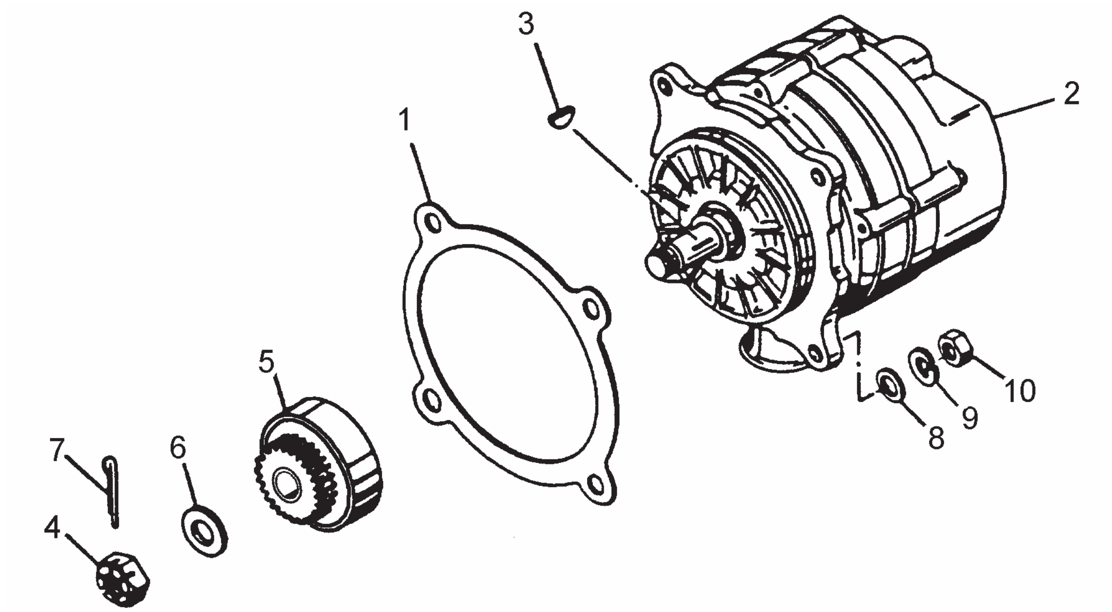


Figure 16-1. Direct Drive Alternator

1	Gasket	4	Slotted Nut	7	Cotter Pin	9	Lock Washer
2	Alternator	5	Drive Hub Assembly	8	Plain Washer	10	Nut
3	Woodruff Key	6	Thrust Washer				

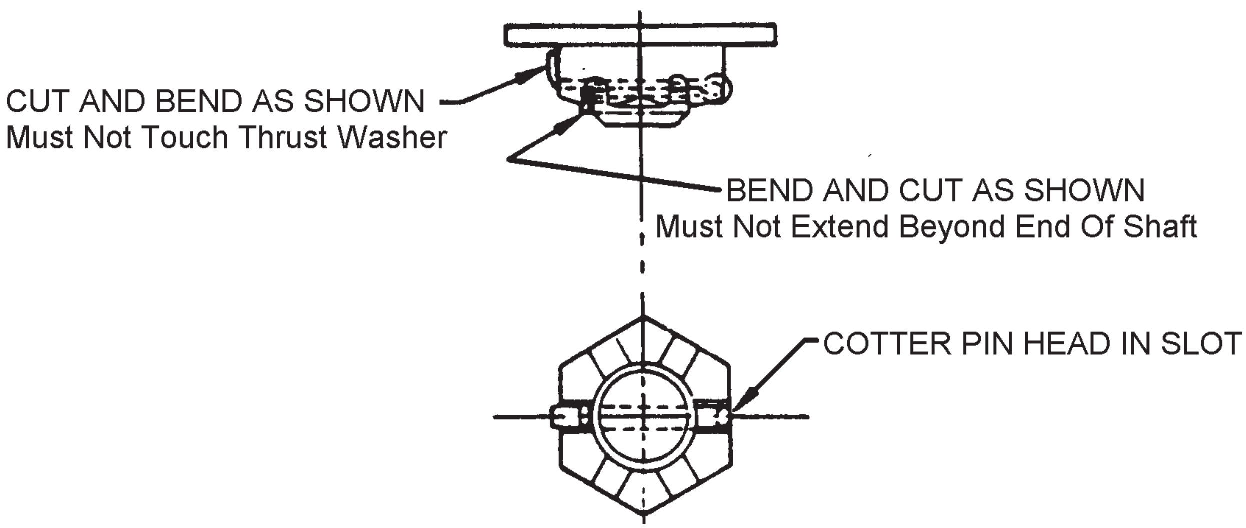


Figure 16-2. Alternator Cotter Pin Installation

16-3. Starter & Starter Adapter Assembly

Permold engine models offer a variety of starter motors and starter adapters. Identify the starter adapter features installed on the engine and refer to the corresponding starter and starter adapter instructions for assembly. Prior to starter and starter adapter assembly, ensure parts have been cleaned, inspected, and overhaul repairs were accomplished according to instructions in:

- Section 14, “Engine Cleaning”
- Section 15, “Overhaul Inspection and Repair”

NOTE: To identify the installed starter/starter adapter, refer to Section 16-3.1 and Section 16-3.2 to determine which procedure applies to the starter adapter; follow the corresponding procedure. For further assistance, consult the online parts catalog at genuinecontinental.aero (see "Contact Information" in Section 1-3).

16-3.1. Starter & Starter Adapter with Scavenge Pump Assembly B

1. Lubricate the inside diameter of a new bearing (Figure 16-4) (8) and the end of the worm drive shaft (6) with Molyshield grease. Press the new bearing (8) on to the worm drive shaft (6) until it rests on the shoulder of the worm drive shaft.
2. Lubricate the inside diameter of the worm gear (4) and the worm drive shaft (6) with Molyshield grease. Install a new woodruff key (7) in the slot of the worm drive shaft (6). Install a new spring (5) on the worm drive shaft (6), followed by the worm gear (4).
3. Lubricate the inside of the starter adapter housing (1) and the worm gear (4) 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 (6) is inside the new roller bearing (3). Use snap ring pliers to secure the assembly (4, 5, 6, 7 & 8) 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 (17) with Molyshield grease and install the roller bearing (17) in the worm wheel gear (18) using the Worm Wheel Gear Installation Tool (Figure 16-3) and an arbor press.

A= 1/64" (0.4mm) Less Than Housing Bore
B= 0.003 (0.08mm) Less Than Shaft Diameter
C= Pilot Length Should Be Length of Bearing Less 1/32" (0.8mm)

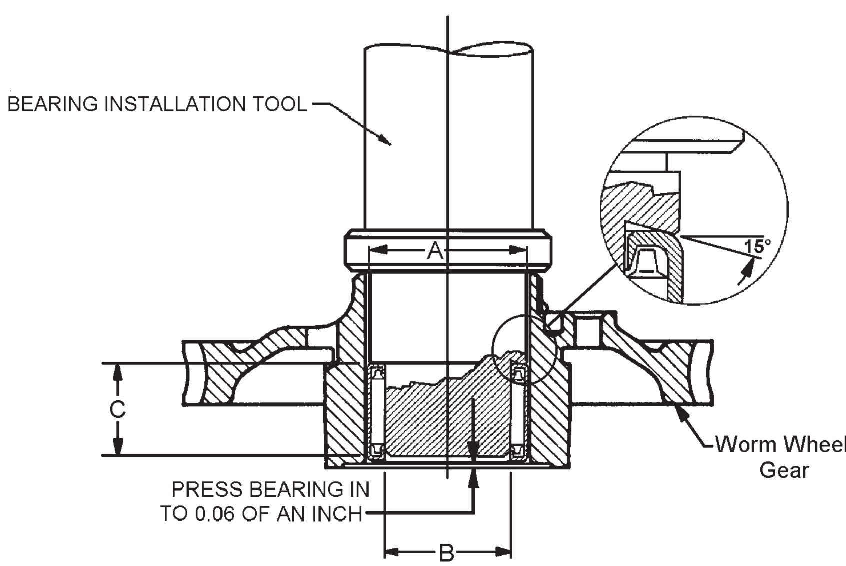


Figure 16-3. Worm Wheel Gear Installation Tool

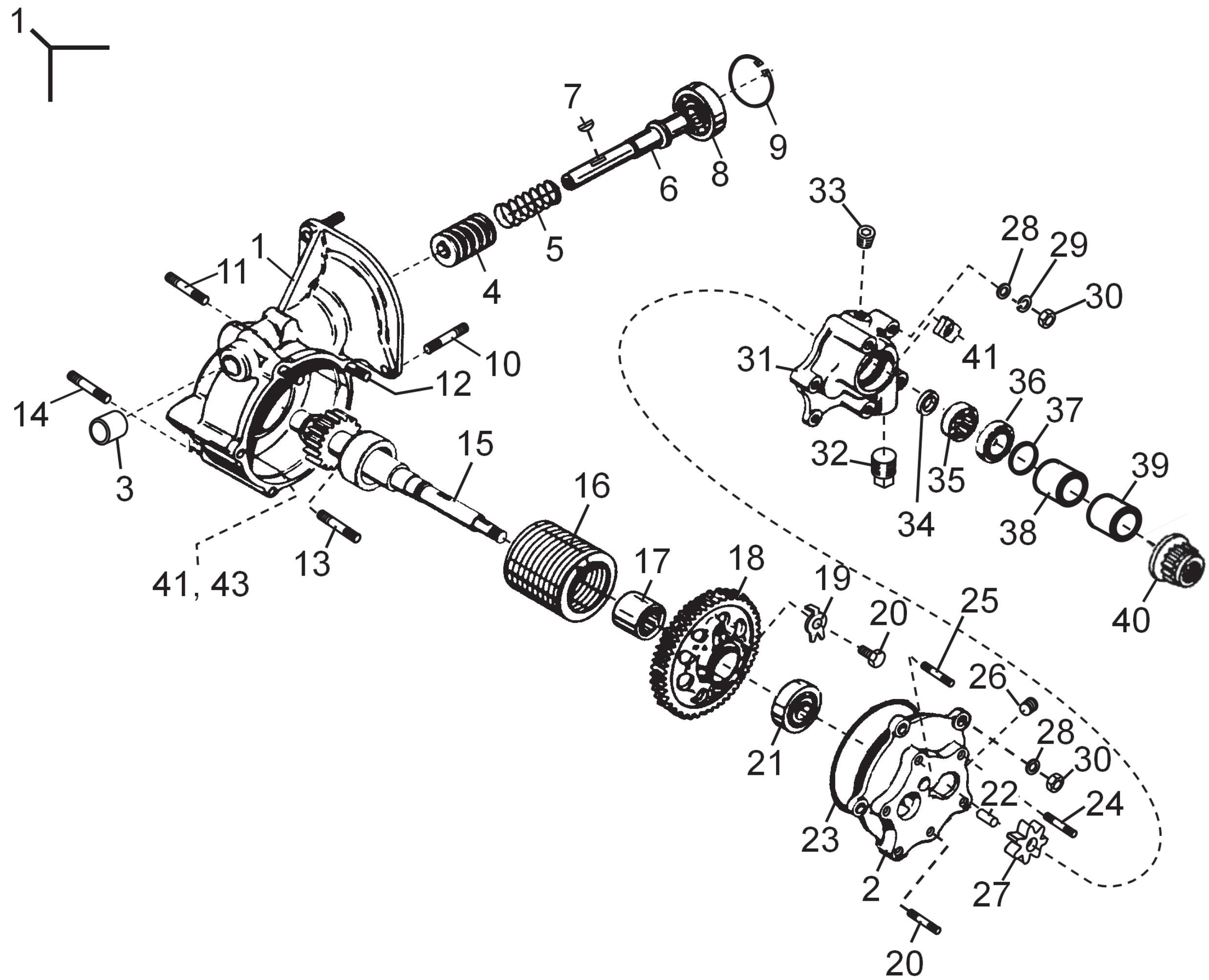


Figure 16-4. Starter with Accessory Drive B

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

5. Lubricate the clutch spring (Figure 16-4) (16) liberally with clean 50-weight aviation engine oil.

6. Twist the new clutch spring (16) clockwise on to the back side of the worm wheel gear assembly (18) until the offset end drops into the gear land and the tang aligns with the screw hole in the gear web.
7. Install a screw (20) with a new tab washer (19) in the threaded screw hole in the worm wheel gear assembly (18) web. Torque the screw (20) to Appendix B specifications and secure the fastener according to the "Tab Washer Installation" instructions in Appendix C-5.
8. Lubricate the starter shaft gear (15) collar and inside diameter of the clutch spring (16) liberally with clean 50 weight aviation engine oil.
9. Twist the assembled worm wheel gear (18) and clutch spring (16) clockwise on the starter shaft gear (15) until the starter shaft gear (15) contacts the roller bearing (17).
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 (4) and worm wheel gear (18) as the assembly enters the starter adapter housing (1).
11. Lubricate a new bearing (21) with Molyshield grease and press the bearing into the flange on the inside of the housing cover (2) using an arbor press. The ball bearing (21) should be seated against the inside flange of the housing cover (2).
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 (2) flange.
13. Align the starter adapter housing cover (2) with the starter adapter studs. Secure the cover with washers (28) and nuts (30); torque the nuts to Appendix B specifications.
14. Lubricate the inside diameter and gear teeth of the scavenge pump driver gear (27) with Molyshield grease and install the gear on the end of the starter shaft gear (15).

WARNING

Failure to install plugs (32 & 33) in the scavenge pump housing (31) during starter adapter assembly will result in engine oil starvation and subsequent catastrophic engine failure shortly after engine start.

15. Apply Loctite 592 to the plug threads and install the plugs (32 & 33) in the scavenge pump housing (31). Torque the plugs to Appendix B specifications.
16. Lightly coat the parting flange of the scavenge pump housing (31) with Part No. 654663 gasket sealant; Allow the Part No. 654663 to cure until it is slightly tacky.
17. 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 16-5.

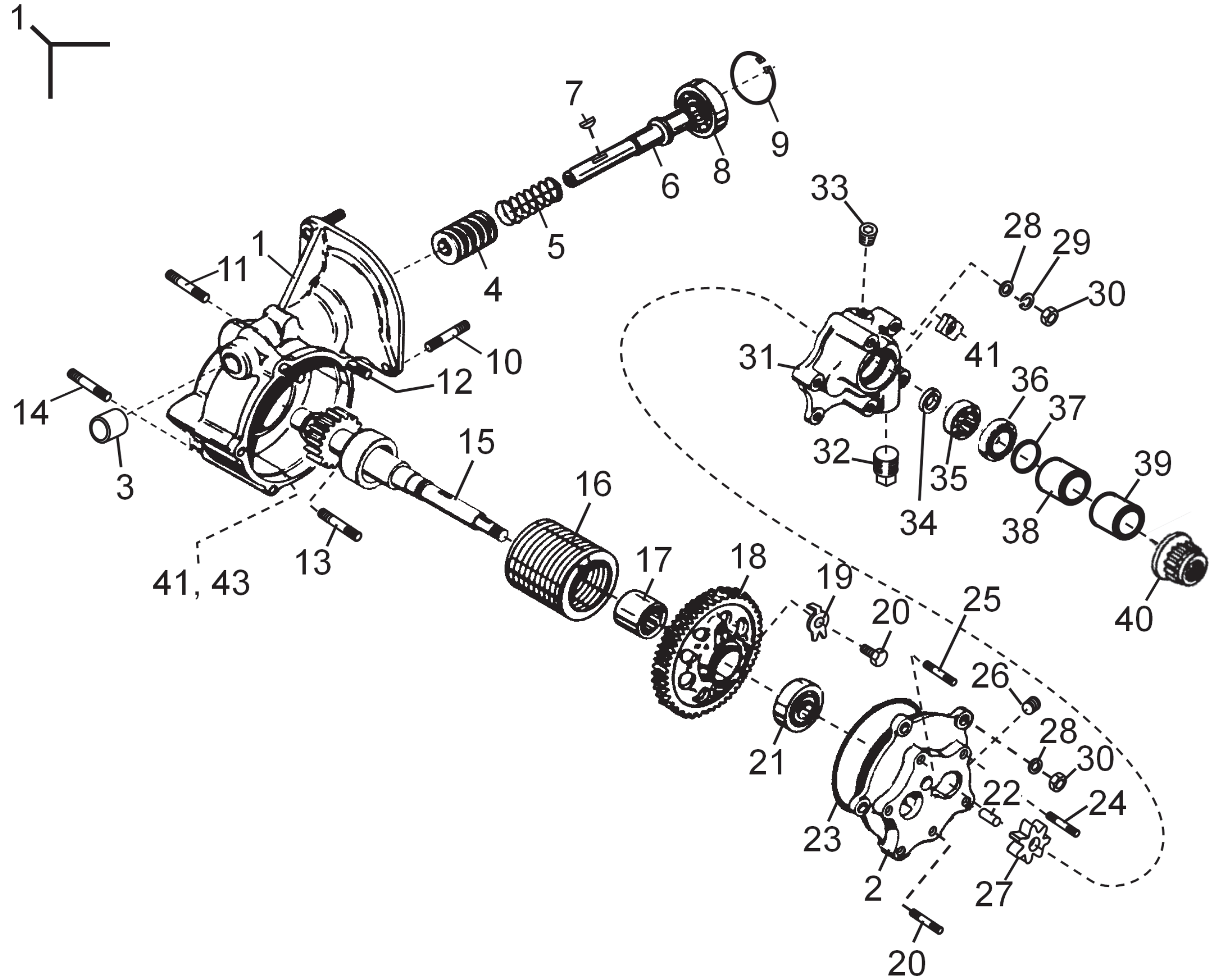


Figure 16-4 repeated for reference

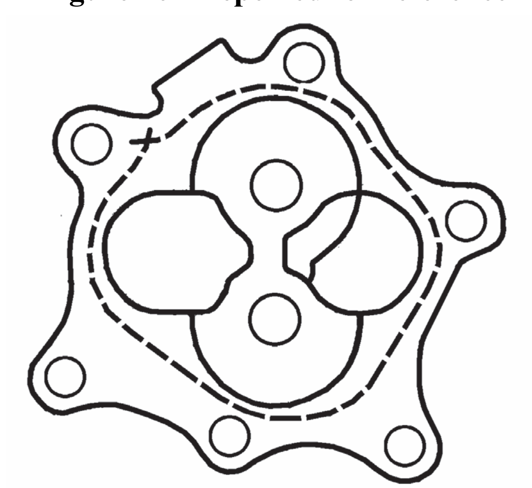


Figure 16-5. Scavenge Pump Housing Silk Thread Pattern

18. Install the scavenge pump housing (Figure 16-4) (31) on the starter adapter housing cover (2). Secure the scavenge pump housing with five sets of washers (28), new lock washers (29), and nuts (30). Do not install any hardware on the stud adjacent to

the starter shaft seal (36) bore. This hardware and seal retainer clip (41) will be installed after the starter shaft seal (36) and sleeve (38) are installed. Torque the nuts (30) to Appendix B specifications.

NOTE: The bearing (35) 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.

19. Install a new spacer (34) and new bearing (35) over the starter shaft gear (15) in the scavenge pump housing (31).
20. Lubricate the inside diameter of the starter shaft sleeve (38) with 50 weight aviation engine oil. Lubricate a new O-ring (37) with 50 weight aviation engine oil and install the new O-ring (37) in the starter shaft sleeve (38). Install the assembly (37 & 38), O-ring first on the starter shaft gear (15).
21. Lubricate the perimeter of the starter shaft seal (36), the inside diameter of the scavenge pump housing seal bore and the starter shaft sleeve (38) with 50 weight aviation engine oil. Work the starter shaft seal (36) into position in the seal bore with an O-ring installation tool. The starter shaft seal (36) must be installed flush within 0.030 inches (Figure 16-6).

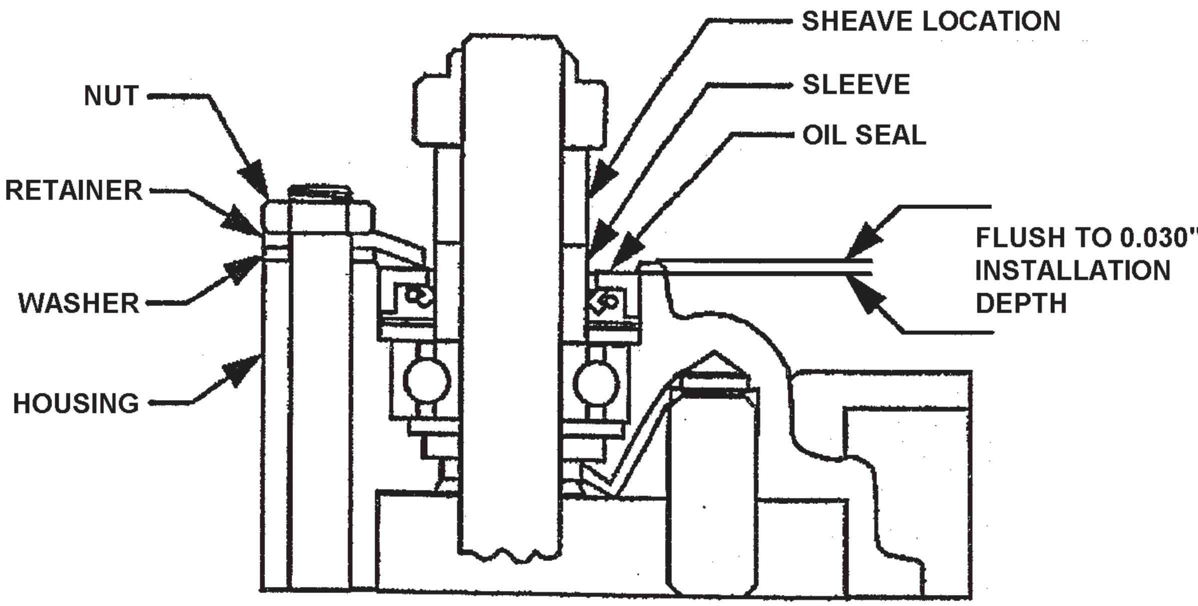


Figure 16-6. Starter w/Accessory Drive Adapter Oil Seal Position

22. Install the oil seal retainer clip (Figure 16-4) (41), washer (28) and nut (30) on the top stud of the scavenge pump housing (See Figure 16-7); torque the nut (30) to Appendix B specifications.

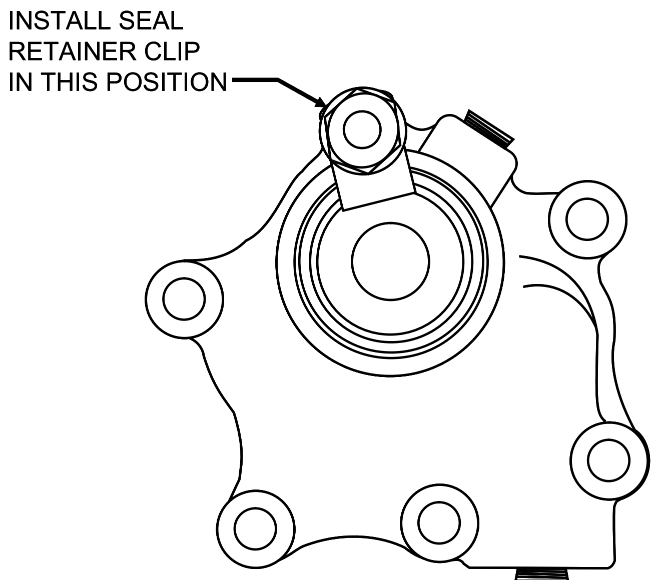


Figure 16-7. Oil Seal Retainer Clip Position

23. Install the spacer (39) or sheave (not shown) on the starter shaft gear (15).
    a. If a refrigerant compressor drive sheave is required for the installation, lubricate the shaft threads with clean 50 weight aviation engine oil and install the refrigerant compressor drive sheave (Figure 16-31) (39) and a new lock nut (Figure 16-4)(40) on the end of the shaft (15). Do not torque the lock nut (40) until the sheave alignment is verified in Section 17-13, “Compressor (Optional) Mount Installation”
    b. If a no refrigerant compressor drive sheave is required for the installation, lubricate the shaft threads with clean 50 weight aviation engine oil and install the spacer (39) and a new lock nut (40) on the end of the shaft (15); torque the lock nut (30) to Appendix B specifications.
24. Install the assembled starter 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.

16-3.2. Basic Starter & Starter Adapter Assembly

1. Lubricate the inside diameter of a new bearing (Figure 16-8) (7) and the end of the worm drive shaft (3) with Molyshield grease. Press the new bearing (7) on to the worm drive shaft (3) until it rests on the shoulder of the worm drive shaft.
2. Lubricate the inside diameter of the worm gear (6) and the worm drive shaft (3) with Molyshield grease. Install a new woodruff key (4) in the slot of the worm drive shaft (3). Install a new spring (5) on the worm drive shaft (3), followed by the worm gear (6).
3. Lubricate the inside of the starter adapter housing (1) and the worm gear (6) drive teeth with Molyshield grease. Insert the assembled worm drive (3, 4, 5, 6 & 7) in the starter adapter housing (1) so the end of the worm drive shaft (3) is inside the new roller bearing (2). Use snap ring pliers to secure the assembly (3, 4, 5, 6 & 7) with a new retaining ring (8) in the starter adapter housing (1) flange. Verify the retaining ring (8) is properly seated in the starter adapter housing (1) flange.
4. Lubricate a roller bearing (17) with Molyshield grease and install the roller bearing (17) in the worm wheel gear (18) using the Worm Wheel Gear Installation Tool (Figure 16-3) and an arbor press.
5. Lubricate the clutch spring (Figure 16-8) (16) liberally with clean 50-weight aviation engine oil.

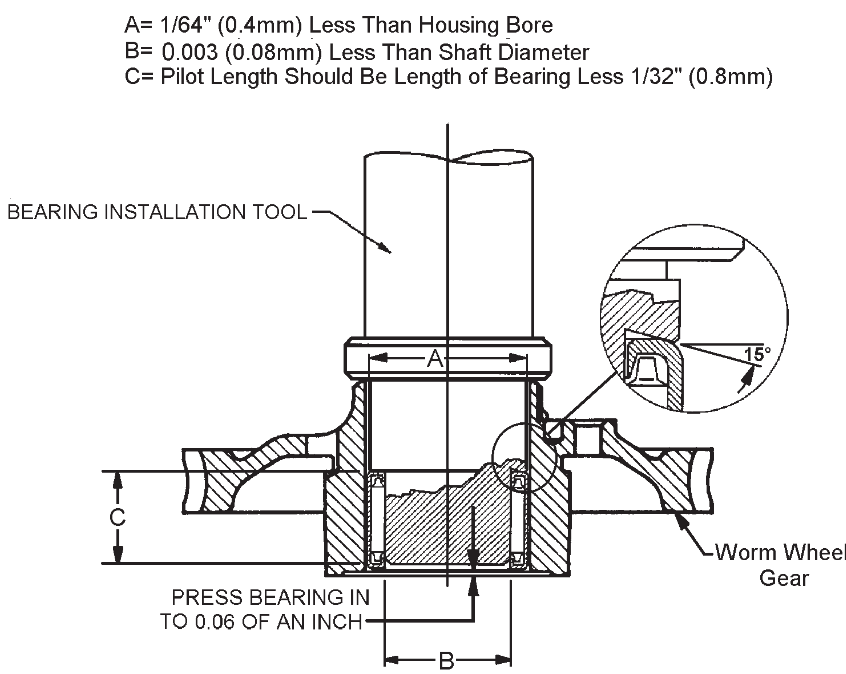


Figure 16-3 repeated for reference

Procedure continues after Figure 16-8

6. Twist the new clutch spring (16) clockwise on to the back side of the worm wheel gear assembly (27) until the offset end drops into the gear land and the tang aligns with the screw hole in the gear web.

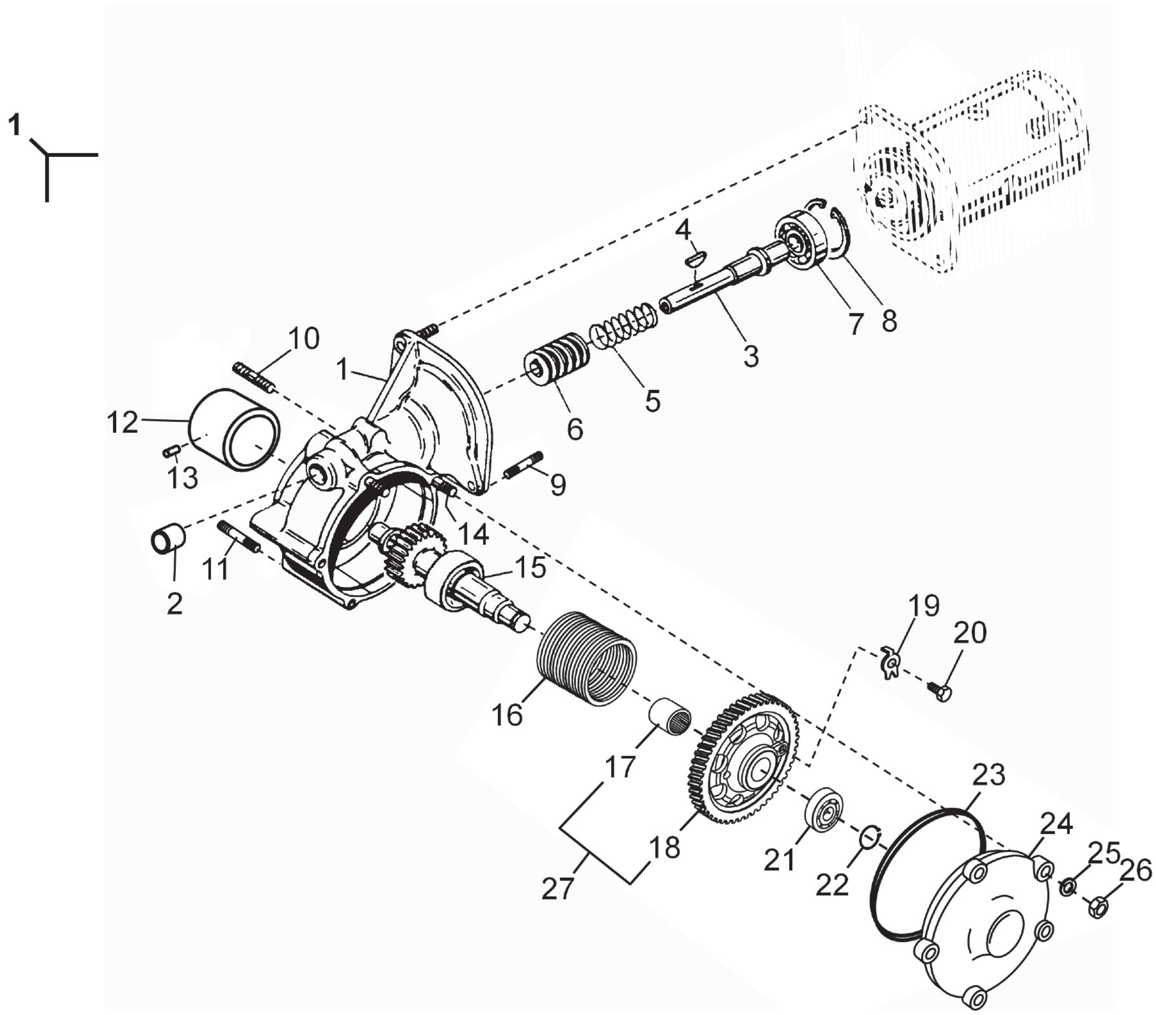


Figure 16-8. Basic Starter and Starter Adapter Assembly

1	Starter Adapter Housing	8	Retaining Ring	15	Starter Shaft Gear	22	Retaining Ring
2	Needle Bearing	9	Stud	16	Clutch Spring	23	O-ring
3	Worm Drive Shaft	10	Stud	17	Roller Bearing	24	Starter Adapter Cover
4	Woodruff Key	11	Starter Gear	18	Starter Gear	25	Washer
5	Starter Spring	12	Starter Drum	19	Tab Washer	26	Nut
6	Worm Gear	13	Dowel	20	Screw	27	Starter Gear Assembly
7	Ball Bearing	14	Stud	21	Ball Bearing		

7. Install a screw (20) with a new tab washer (19) in the threaded screw hole in the worm wheel gear assembly (27) web. Torque the screw (20) to Appendix B specifications and secure the fastener according to the "Tab Washer Installation" instructions in Appendix C-5.
8. Lubricate the starter shaft gear (15) collar and inside diameter of the clutch spring (16) liberally with clean 50 weight aviation engine oil.

9. Twist the assembled worm wheel gear (27) and clutch spring (16) clockwise on the starter shaft gear (15) until the starter shaft gear (15) contacts the roller bearing (27).
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 (6) and worm wheel gear (27) as the assembly enters starter adapter housing (1).
11. Lubricate a new bearing (40) with Molyshield grease and press the bearing on to the end of the starter shaft gear (36). Secure the bearing (40) on the starter shaft gear (36) with a new retaining ring (41). Verify the retaining ring fits securely in the groove.
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 (47) flange.
13. Align the starter adapter housing cover (24) with the starter adapter studs. Secure the cover with washers (25), and nuts (26); torque the nuts (26) to Appendix B specifications.
14. Test the starter adapter assembly for slippage by installing the adapter in a fixture and apply torque to the input shaft. The adapter must be able to withstand 300 in-lbs of torque without slippage.

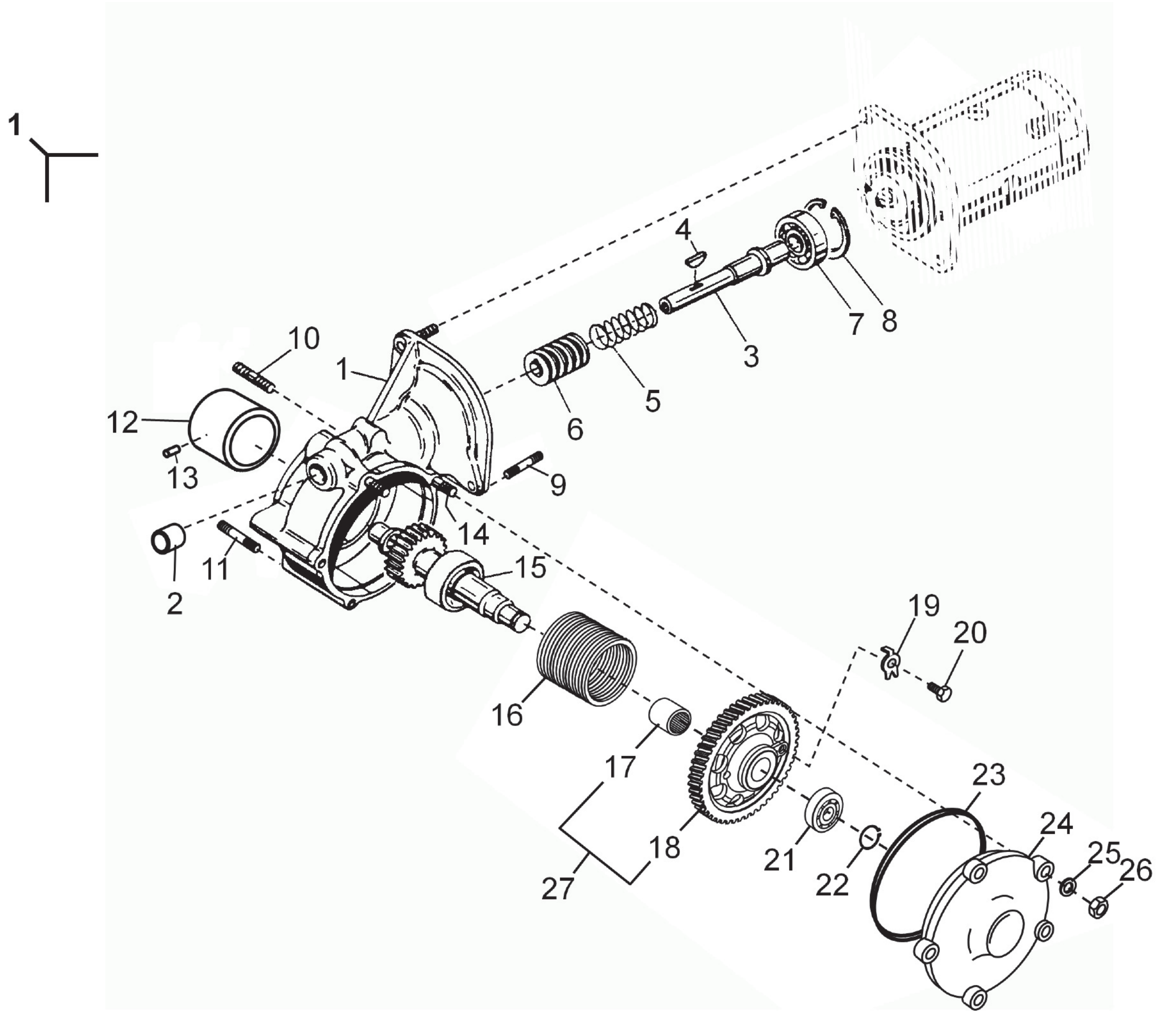


Figure 16-8 repeated for reference

16-4. Exhaust System Assembly

Refer to the airframe manufacturer's instruction for exhaust system assembly. Continental Motors engine assembly requires new exhaust flange studs, new exhaust flange gaskets and new nuts.

16-5. Lubrication System Assembly

Prior to lubrication system component assembly, ensure the components have been cleaned, inspected, and parts replaced according to instructions in:

- Section 14, “Engine Cleaning”
- Section 15, “Overhaul Inspection and Repair”

CAUTION: Never use Teflon tape on Lubrication System fittings.

16-5.1. Oil Pump Assembly

NOTE: Refer to Figure 16-10 through Figure 16-12 to determine the illustration that best matches the installed engine oil pump and follow the corresponding assembly procedure.

The oil pump assembly is available in multiple configurations. Assemble the oil pump according to the instructions that match the assembly.

16-5.1.1. Basic Oil Pump Assembly G N

1. Lightly coat the parting surface of the oil pump body (Figure 16-9) with Part No. 654663 (Loctite 30516) and allow the sealant 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 of the split line toward the oil pump.
3. Apply Part No. 646942 Gasket Maker to the portion of the oil pump cover (Figure 16-10) (16) that will mate with the oil pump housing where the Part No. 654663 and silk thread are applied.

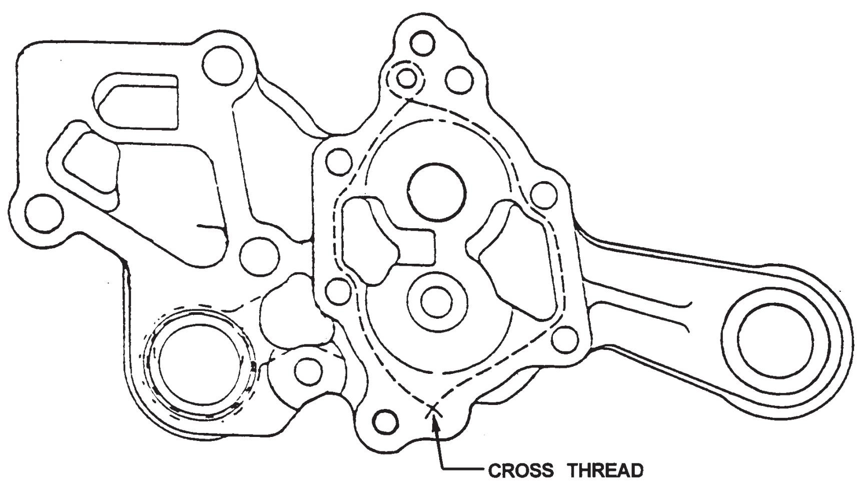


Figure 16-9. Oil Pump Housing Silk Thread Pattern

4. Install the oil pump housing (Figure 16-10) (2) in a suitable fixture and lubricate the cavity, gear contact areas, gears (4 & 15) and bushing (4) with Part No. 656817 Molyshield Grease.
5. Assemble the oil pressure relief valve plunger (6) with a new spring (7), and new 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 oil pressure relief valve components are aligned.

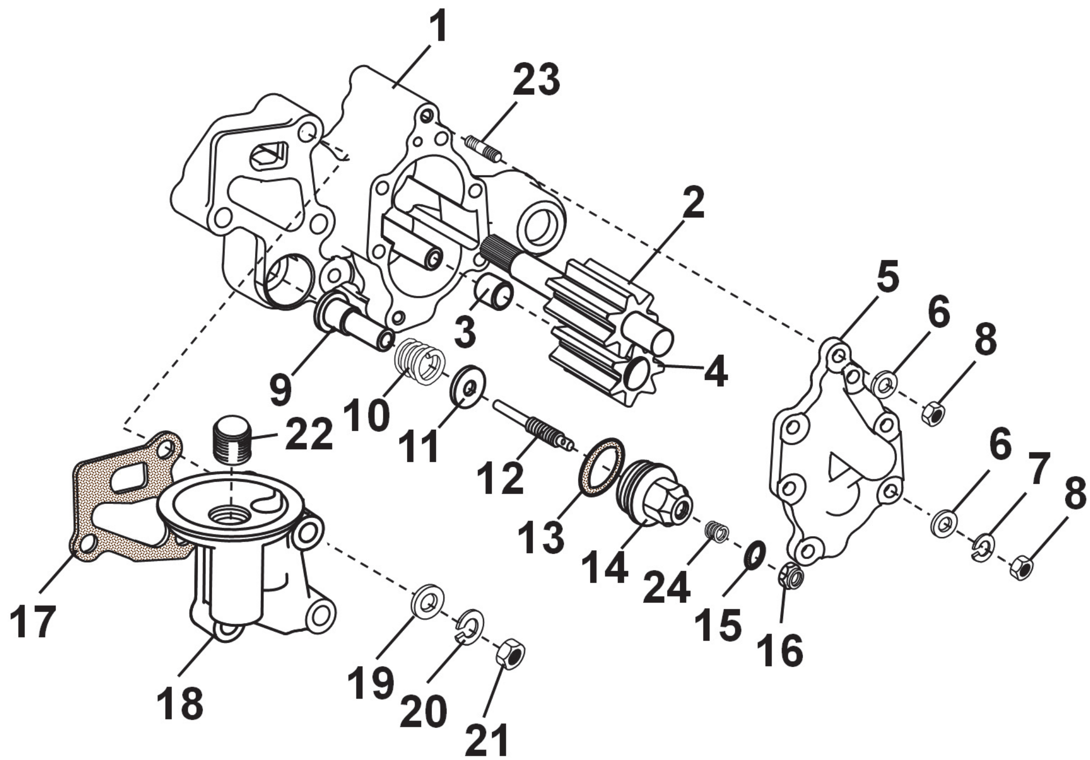


Figure 16-10. Oil Pump Assembly

1	Oil Pump Housing	7	Lock Washer	13	Copper Washer	19	Washer
2	Shaft Gear Assembly	8	Nut	14	Nut	20	Lock Washer
3	Bushing	9	Plunger	15	Copper Washer	21	Nut
4	Driven Gear Assembly	10	Spring	16	Elastic Lock Nut	22	Stud
5	Cover	11	Seat	17	Gasket	23	Stud
6	Washer	12	Adjustment Screw	18	Oil Filter Adapter	24	Helical Coil

6. Apply 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 Appendix B specifications. Safety wire the oil pressure relief valve housing (11) according to instructions in Appendix C-4.

7. Install a new copper washer (13) over the adjusting screw protruding from the base of the oil pressure relief valve housing and secure with a new self-locking nut (14). Torque the self-locking nut (14) to Appendix B specifications.

8. Lubricate the oil pump gear cavity, gear contact area, gears (15 and 4) and bushing (5) with Part No. 656817 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). Torque the nuts to Appendix B specifications.

10. Store the assembly in a clean location until final assembly. The oil pump, filter adapter and oil filter will be installed during engine assembly.

16-5.1.2. Oil Pump Assembly w/Mechanical Tach Drive Adapter

1. Lightly coat the parting surface of the oil pump body (Figure 16-9) with Part No. 654663 (Loctite 30516) and allow the sealant 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 of the split line toward the oil pump.
3. Apply Part No. 646942 Gasket Maker to the portion of the oil pump cover (Figure 16-11) (16) that will mate with the oil pump housing where the Loctite 30516 and silk thread are applied.
4. Install the oil pump housing (2) in a suitable fixture and lubricate the cavity, gear contact areas, gears (4 & 15) and bushing (4) with Part No. 656817 Molyshield Grease.
5. Assemble the oil pressure relief valve plunger (6) with a new spring (7), and new 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 oil pressure relief valve components are aligned.
6. Apply 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 Appendix B specifications. Safety wire the oil pressure relief valve housing (11) according to instructions in Appendix C-4.
7. Install a new copper washer (13) over the adjusting screw protruding from the base of the oil pressure relief valve housing and secure with a new self-locking nut (14). Torque the self-locking nut (14) to Appendix B specifications.
8. Lubricate the oil pump gear cavity, gear contact area, gears (15 and 4) and bushing (5) with Part No. 656817 Molyshield Grease. Install the shaft (driving) gear (15), bushing (5) and (driven) gear (4), in the oil pump housing (2).
9. Install the bevel gear (17) on the end of the shaft gear assembly (15) with a new dowel pin (16).
10. Coat the outside of the tach drive shaft assembly (24) and the inside diameter of a new oil seal (19) with Part No. 656817 Molyshield Grease.
11. Place the tach drive shaft assembly (24) into the tach drive cover (18); install it on the oil pump housing (2), making sure the silk thread is not displaced. Turn the shaft slightly to ensure proper meshing with the bevel gear (17). Secure the shaft with new lock washers (22) and nuts (23); torque the nuts (23) to Appendix B specifications.
12. Lubricate a new oil seal (19) with clean 50 weight aviation engine oil and insert it in the inside flange of the tach housing (26).
13. Coat the threads of the tach drive housing (26) with Anti-Seize Lubricant.
14. Lubricate a new gasket with clean 50 weight aviation engine oil and install the gasket on (25) on the flange outside of the tach drive housing (26) flange.

15. Install the left-hand threaded tach drive housing (26) by screwing it counter-clockwise on to the tach drive shaft assembly (24); torque the tach drive shaft housing (26) to Appendix B specifications. Safety wire the tach drive housing (26) according to “Safety Wiring Hardware” instructions in Appendix C-4.
16. Cover the assemblies and store in a clean protected area until final assembly.
17. The oil pump, filter adapter and oil filter assembly will be installed during final engine assembly.

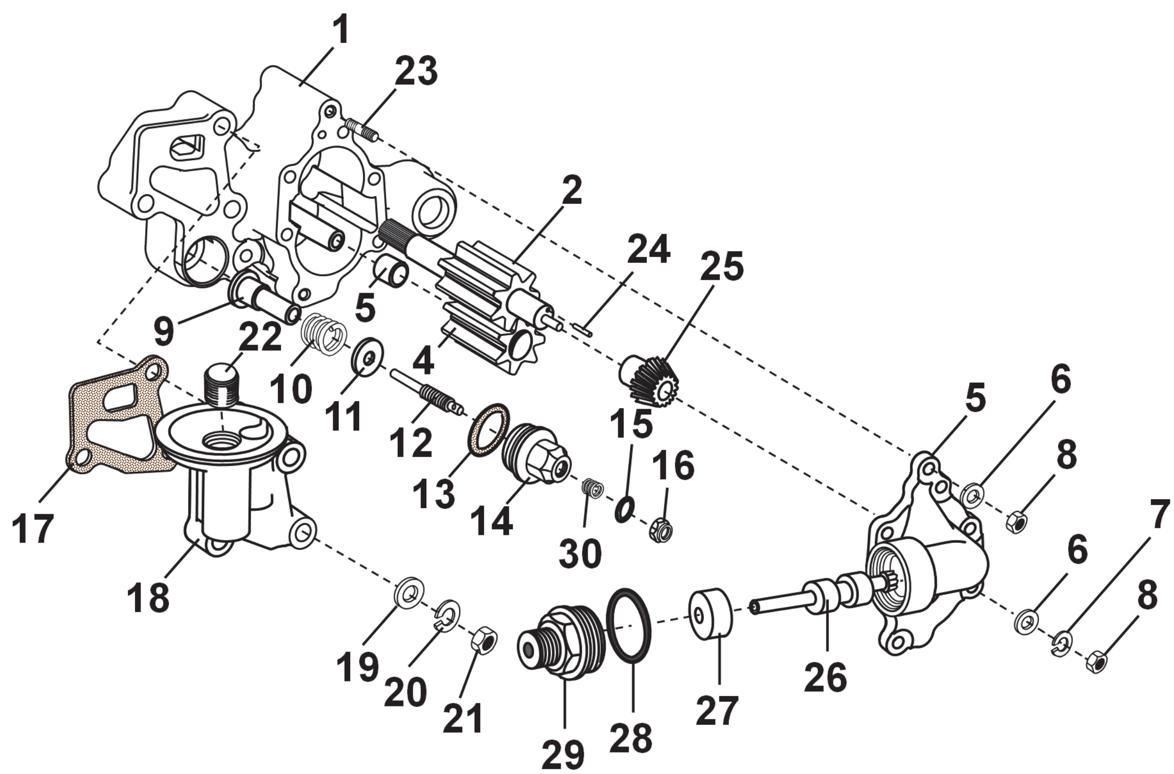


Figure 16-11. Oil Pump with Mechanical Tach Drive Assembly

1	Oil Pump Housing	9	Plunger	17	Gasket	25	Bevel Gear
2	Shaft Gear Assembly	10	Spring	18	Oil Filter Adapter	26	Tach. Drive Shaft
3	Bushing	11	Seat	19	Washer	27	Oil Seal
4	Driven Gear Assembly	12	Adjustment Screw	20	Lock Washer	28	Gasket
5	Cover	13	Copper Washer	21	Nut	29	Tach Drive Housing
6	Washer	14	Nut	22	Stud	30	Helical Coil
7	Lock Washer	15	Copper Washer	23	Stud		
8	Nut	16	Elastic Lock Nut	24	Dowel		

16-5.1.3. Oil Pump with Electric Tach Drive Adapter Assembly A B C

1. Lightly coat the parting surface of the oil pump body (Figure 16-9) with Part No. 654663 (Loctite 30516) and allow the sealant 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 of the split line toward the oil pump.
3. Apply Part No. 646942 Gasket Maker to the portion of the oil pump cover (Figure 16-12) (16) that will mate with the oil pump housing where the Part No. 654663 and silk thread are applied.
4. Install the oil pump housing (2) in a suitable fixture and lubricate the cavity, gear contact areas, gears (4 & 15) and bushing (4) with Part No. 656817 Molyshield Grease.
5. Assemble the oil pressure relief valve plunger (6) with a new spring (7), and new 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 oil pressure relief valve components are aligned.
6. Apply 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 Appendix B specifications. Safety wire the oil pressure relief valve housing (11) according to instructions in Appendix C-4.
7. Install the copper washer (13) over the adjusting screw protruding from the base of the oil pressure relief valve housing and secure with a new self-locking nut (14). Torque the self-locking nut (14) to Appendix B specifications.
8. Lubricate the oil pump gear cavity, gear contact area, gears (15 and 4) and bushing (5) with Part No. 656817 Molyshield Grease. Install the shaft (driving) gear (15), bushing (5) and (driven) gear (4), in the oil pump housing (2).
9. Install the bevel gear (17) on the end of the shaft gear assembly (15) with a new dowel pin (16).
10. Coat a new oil seal (19) with Part No. 656817 Molyshield Grease. Insert the new oil seal (19) into the electrical tach drive housing; verify the oil seal is squarely seated in the housing and press the new oil seal into place until it bottoms out using an arbor press and proper driving tool.
11. Coat the tach drive shaft bevel gear (25) with clean Molyshield Grease. Install the bevel gear (25) into the tach drive housing through the end opposite the oil seal.
12. Install the electrical tach drive housing on the oil pump; ensure the tach drive gear shaft and bevel gear properly mesh without disturbing the silk thread position. Secure the tach drive housing with washers (22), new lock washers (23) and new nuts (24); torque the nuts (24) to Appendix B specifications.

13. Using new gaskets (26 & 31) install the covers (27 & 32), secure with the washers (28 & 33), new lock washers (23 & 29) & new nuts (24), screws (30). Torque the nuts (24) and screws (30) to Appendix B specifications.
14. Cover the assemblies and store them in a clean protected area. The oil pump, filter adapter and oil filter assembly will be installed during final engine assembly.

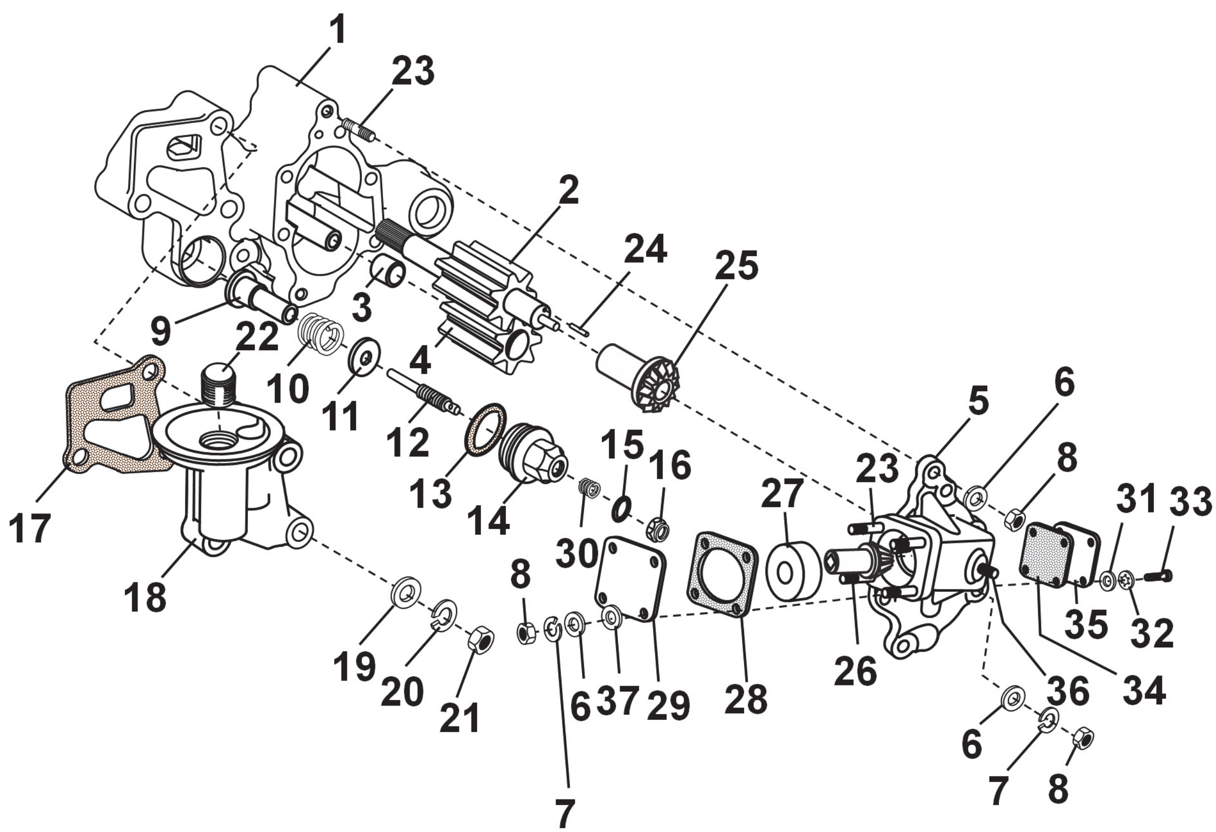


Figure 16-12. Oil Pump Assembly with Electrical Tach Drive Adapter A B C

1	Oil Pump Housing	11	Seat	21	Nut	31	Washer
2	Shaft Gear Assembly	12	Adjustment Screw	22	Stud	32	Lock Washer
3	Bushing	13	Copper Washer	23	Stud	33	Screw
4	Driven Gear Assembly	14	Nut	24	Dowel	34	Gasket
5	Cover	15	Copper Washer	25	Bevel Gear	35	Cover
6	Washer	16	Elastic Lock Nut	26	Tach. Drive Shaft	36	Right Gearbox Cover
7	Lock Washer	17	Gasket	27	Oil Seal	37	Washer
8	Nut	18	Oil Filter Adapter	28	Gasket		
9	Plunger	19	Washer	29	Accessory Cover		
10	Spring	20	Lock Washer	30	Helical Coil		

16-5.2. 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.

16-6. Engine Cylinder Assembly

Prior to engine cylinder assembly, ensure all cylinders and components were cleaned, and inspected and parts replaced according to instructions in:

- Section 14, “Engine Cleaning”
- Section 15, “Overhaul Inspection and Repair”

WARNING

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, O-ring, or fastener threads. These surfaces must be clean and free of sealants. The use of RTV silicone or other sealant on mating threads or between mating surfaces during engine assembly may cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of main bearing crush or fretting of the crankcase parting surfaces may lead to cylinder separation, main bearing movement, or oil starvation and catastrophic engine failure.

16-6.1. Cylinder Component Preparation

1. Thoroughly clean the new or repaired cylinder baffles, cylinders, intake valves, new exhaust valves, new rocker arm bushings, new retainers and new retainer keys, new pistons, new piston rings, new piston pin & plug assembly, pushrod housings, new inner and outer springs, and washers with mineral spirits and air dry.
2. Inspect parts for damage that may have occurred during handling or shipment.
3. Clean the cylinder bore using hot, soapy water and a hard bristle scrub brush. Thoroughly remove the soap residue by rinsing the cylinder with hot water. Dry the cylinder completely.
4. Thoroughly coat all bare steel surfaces with clean, 50-weight aviation engine oil.

16-6.2. Cylinder Baffle Installation G N P R

NOTE: Baffles are not installed on IO-550-A, B, or C cylinders, to assemble IO-550-A, B or C cylinders, proceed to the Section 16-6.3.

1. Install a new (or repaired) cylinder baffle (Figure 16-18) (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 16-13.
2. Insert the hooked end of a new spring (Figure 16-18) (44) through the baffle as depicted in Figure 16-14. 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.

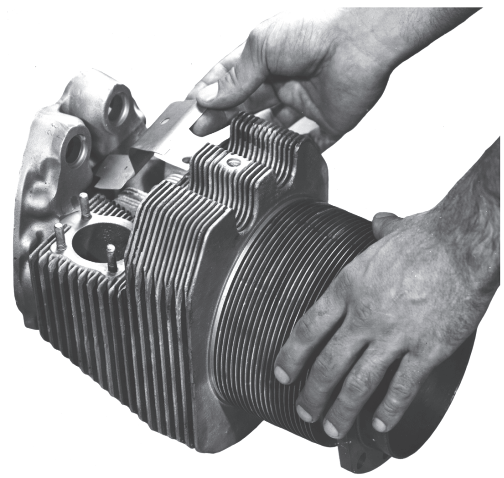


Figure 16-13. Cylinder Baffle Installation

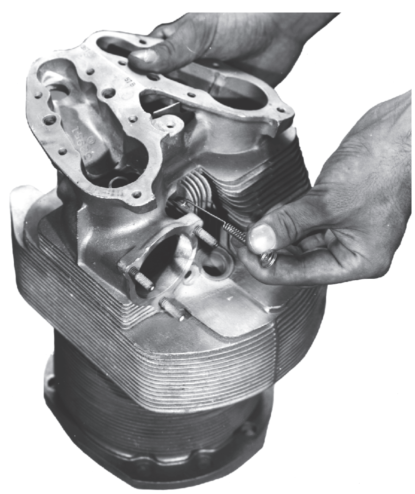


Figure 16-14. Secure Baffle with Spring

16-6.3. Piston Ring Gap Adjustment

1. Ensure the new piston and piston rings (Figure 16-15) are the correct size for the cylinder bore size. Inspect the piston-to-cylinder clearance of each matching piston and cylinder. Refer to the latest edition of Service Information Letter SIL 02-1 for information regarding piston weights now used to identify pistons (in lieu of piston position markings).
2. Thoroughly coat the cylinder barrel with clean 50-weight aviation engine oil.
3. Inspect each piston ring for the proper gap in the cylinder bore in which it will be assembled.
4. Insert one piston ring at a time in the cylinder bore; use the piston to push the piston ring to the cylinder barrel depth specified in Appendix D.
5. Remove the piston and inspect the ring gap using a leaf type feeler gauge. If the piston ring meets the specified gap, proceed to the next ring measurement. If the ring gap is less than specified, record the actual gap size and remove the ring from the cylinder bore.
    a. 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 ring end gap in the cylinder until the ring meets the specified gap. Confirm the gap for the second new piston ring is at least 0.006 inch larger than the gap for the top ring.
    b. After filing, deburr the ring gap ends using crocus cloth and thoroughly clean the piston ring with mineral spirits and air dry.
    c. Discard piston rings that exceed the specified piston ring gap dimensions.

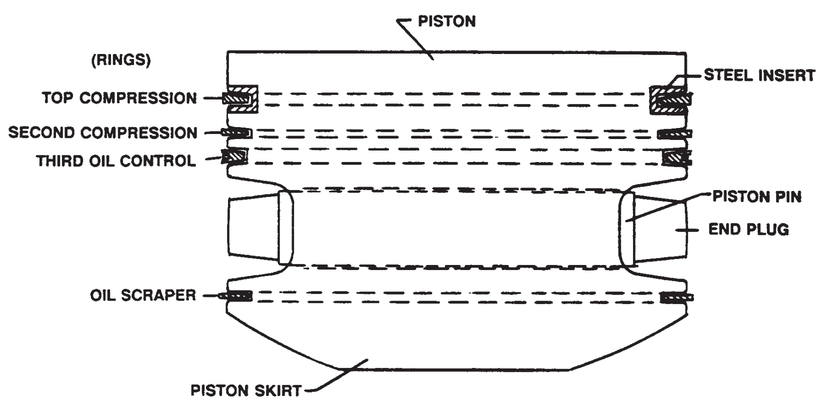


Figure 16-15. Piston Ring Installation Order

6. Install all new piston rings (Figure 16-16)(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 #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.

7. Inspect piston ring side clearances with the ring edge flush with the piston outside diameter. Piston ring side clearances must conform to Appendix D dimensional limits.

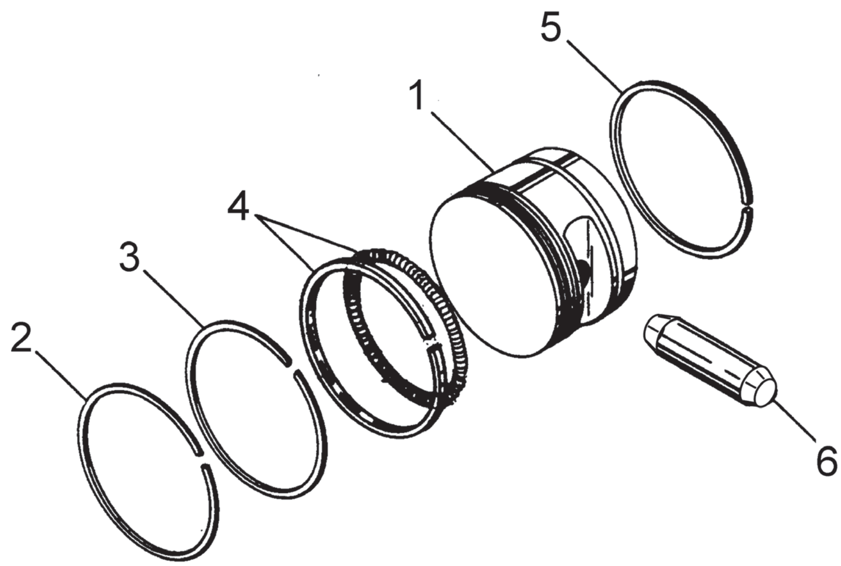


Figure 16-16. Pistons, Piston Rings and Piston Pin Assembly

NOTE: Weight differences of piston pairs in opposing bays must not exceed 1/2 ounce or 14.175 grams.

8. Lubricate the piston pin, piston, and ring assemblies with clean 50-weight aviation engine oil.

9. Place the new piston and ring assembly with the cylinder assembly for which it was previously sized and gapped. Insert the piston pin in the piston pin bore; the piston pin must slide freely in the piston pin bore.

10. Using a ring compressor, install each piston into its cylinder with top three rings are in the cylinder barrel and the piston pin is accessible for connecting rod installation.

16-6.4. Valve Train Installation

11. Apply Part No. 656817 Molyshield Grease over the entire length of the valve stems and insert the new intake and exhaust valves in the cylinders for which they have been lapped.
12. Grasp the cylinders by the valve stems and install the cylinder on a cylindrical block of wood anchored to a work bench.
13. Place the lower valve spring retainers (Figure 16-17 or Figure 16-18) (17) over the valve guides (4 and 5), cupped side up.
14. Coat the sealing surface of a new intake valve guide seal (50) with clean 50-weight aviation engine oil and position the new intake valve guide seal (50) on the valve guide by hand.
15. Using the Valve Guide Seal Installation Tool (Figure 3-13 in Chapter 3) and a plastic mallet, tap the seal onto the guide until it is firmly seated.
16. Install new inner and outer springs (Figure 16-17 or Figure 16-18) (14 & 15), with the closed coils toward the cylinder head (Figure 16-19), followed by a new exhaust valve rotocoil or retainer (19) and intake valve retainer (51).

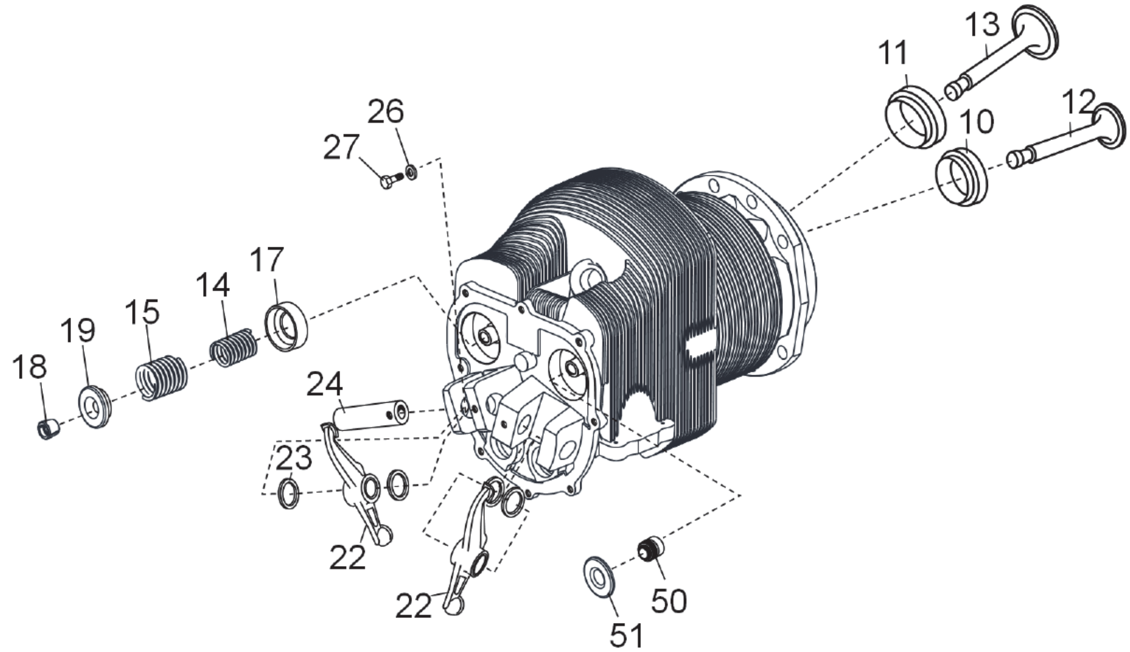


Figure 16-17. Updraft Cylinder Assembly A B C

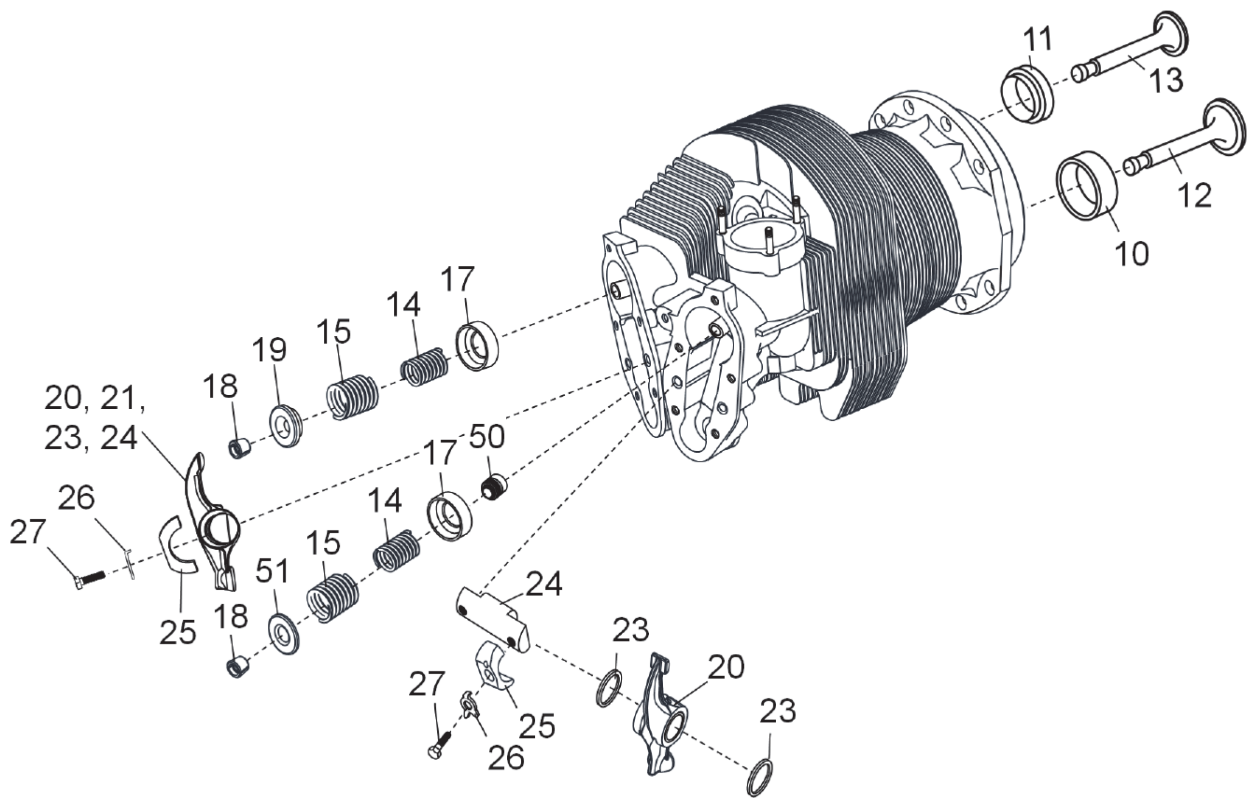


Figure 16-18. Crossflow Cylinder Assembly G N P R

WARNING

In step 17, do not allow the Valve Spring Compressor to contact the valve spring retainers. Contact between the retainer and valve stem will damage the valve stems. Before releasing pressure on the springs, ensure the keys are properly seated in the valve stem grooves.

17. Using the Valve Spring Compressor Tool, compress the valve springs and insert the new valve stem retainer keys (Figure 16-17 or Figure 16-18) (18). Depress the springs only enough to permit the keys to seat in the valve stem grooves. If too much clearance is provided for the keys (18), they may become fouled, which could cause them to damage the valve stem when the springs are released.

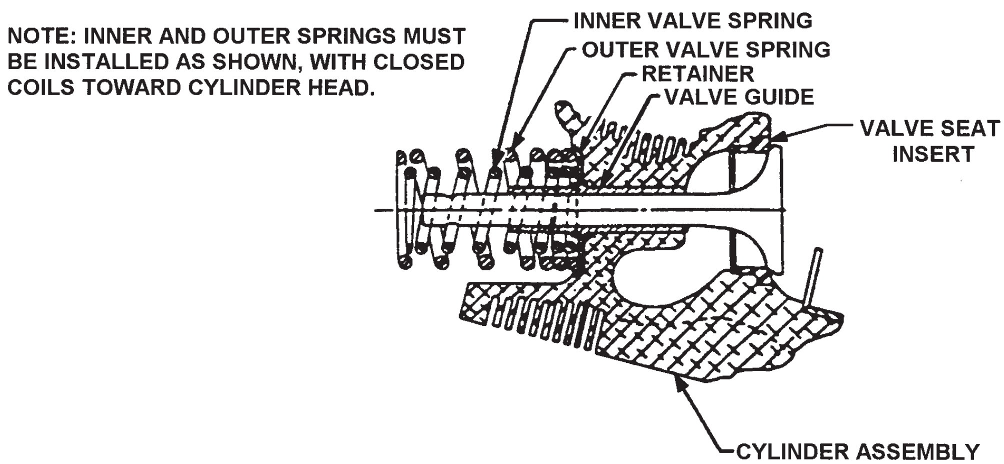


Figure 16-19. Valve and Spring Installation

18. Remove the cylinder from the fixture and place it upright on a workbench.
19. Place a plastic mallet squarely on the end of the valve stem and strike the plastic mallet sharply with a rawhide mallet to ensure correct seating of the valve retainer keys. DO NOT STRIKE THE RETAINER.
20. Verify the valve spring retainer keys (Figure 16-17 or Figure 16-18) (18) are properly positioned on each valve stem.
21. Carefully position the cylinder assembly with the cylinder bore facing upward and the cylinder resting on the rocker shaft mounting bosses.

16-6.5. Cylinder Component Assembly

1. For the IO-550-A, B & C, perform step a.; IO-550-G, N, P & R, perform step b.

   a. A B C Install a washer (Figure 16-20) (36), new packing (37) and second washer (36) on the cylinder end of the pushrod housings (35). Place two each, pushrod housings (35), new springs (38), new packing (37) and four washers (36) with each cylinder on the workbench.

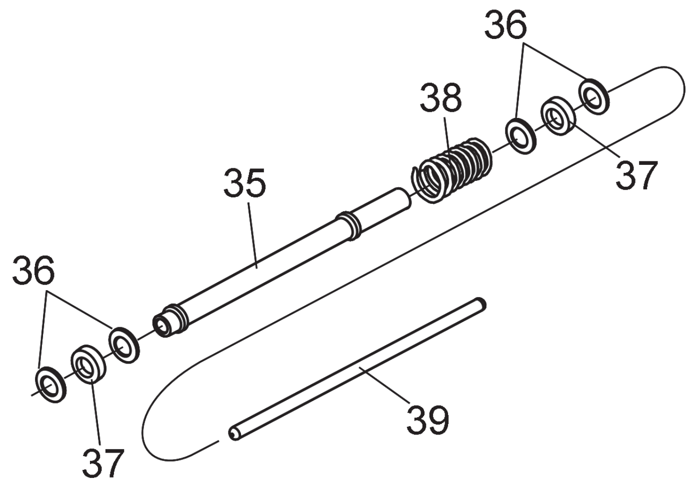


Figure 16-20. Updraft Cylinder Pushrod Tube Assembly A B C

   b. G N P R Install a new O-ring seal (Figure 16-21) (37) on the cylinder end of the pushrod housings (35). Place two each, pushrod housings, new springs (39), washers (36), new packing (38), and four washers (36) with each cylinder on the bench.

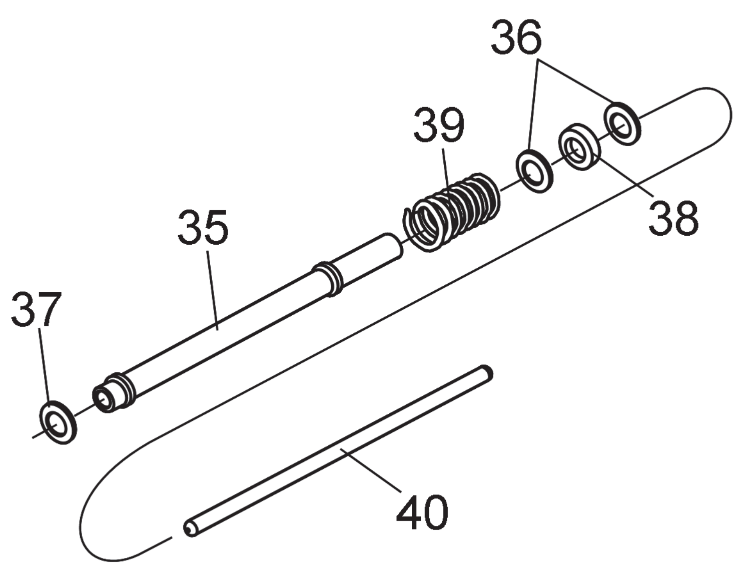


Figure 16-21. Crossflow Cylinder Pushrod Tube Assembly G N P R

16-7. 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 the new plugs identified in Appendix D-9.6, “Crankcase Plugs and Fittings”. The plugs must be installed in all of the corresponding locations to prevent oil leakage or pressure loss. Torque the plugs to Appendix B specifications.
2. Install the starter 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 “Crankcase Needle Bearing Installation Tool” or equivalent, as shown in Figure 3-12.
   c. Press the bearing into the crankcase until it bottoms out.

16-7.1. Oil Filler Installation

1. Lightly coat new O-rings (Figure 16-22) (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 (24) into the left crankcase half. Ensure the O-rings (23 & 25) are not pinched or twisted.
3. Apply Part No. 646944 Primer to the crankcase extension hole and dipstick guide.
4. Spread a thin coat of Part No. 646941 High Strength Adhesive Sealant on the oil filler assembly; install the oil filler assembly in the crankcase extension hole.
5. Insert the oil filler assembly (19) into the oil filler adapter (24). Do not displace the O-ring (23).
6. Install a new breather gasket (20) and secure the oil filler assembly to the left crankcase case half with bolts (26), new lock washers (27) and washers (28). Torque the bolts (67) to Appendix B specifications.
7. Install a new oil filler gasket (22) on the cap assembly.

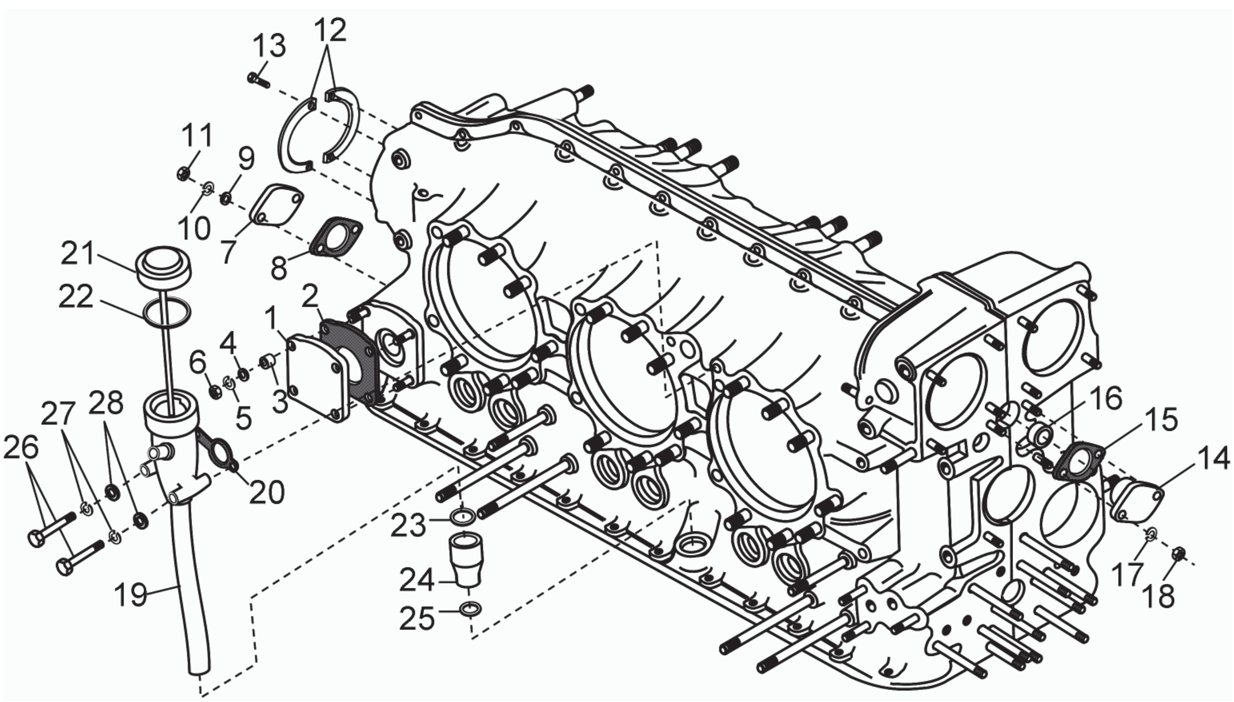


Figure 16-22. Miscellaneous Crankcase Hardware

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

16-8. Engine Mount Installation

NOTE: IO-550-B & R engine mount brackets are installed with the oil sump during engine assembly.

16-8.1. IO-550-A Engine Mount Installation A

1. Install engine mount brackets (Figure 16-23) (1 and 2) with washers (4) and nuts (5).
2. Torque the nuts (5) to Appendix B specifications.

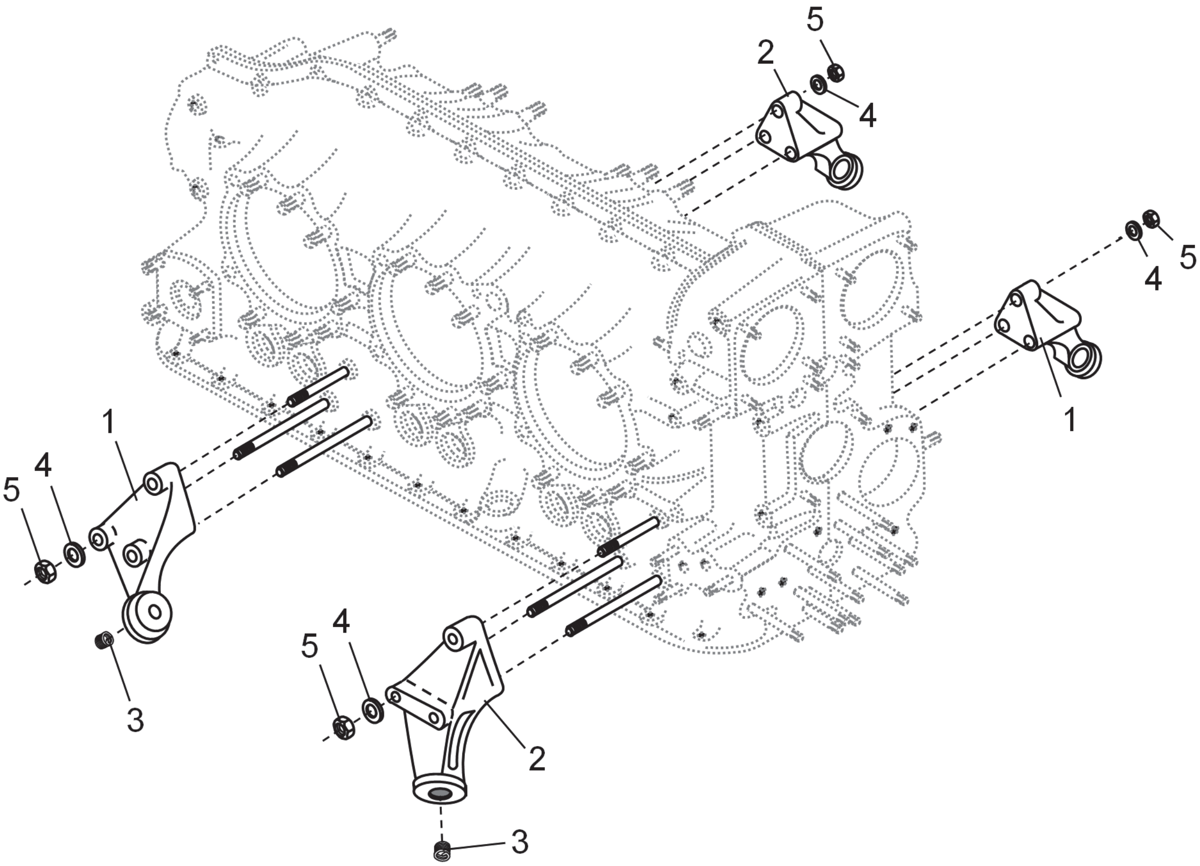


Figure 16-23. IO-550-A Engine Mounting Brackets A

1	Engine Mount, Cyl. 1 & 6	4	Washer
2	Engine Mount, Cyl. 2 & 5	5	Nut
3	Threaded Helical Coil Insert		

16-8.2. IO-550-C Engine Mount Installation C

1. Install the upper engine mount brackets (Figure 16-24) (2 & 4) with washers (5) and nuts (6); torque the nuts to Appendix B specifications.

   NOTE: IO-550-C lower left engine mount hardware is installed with the oil cooler.

2. Install the lower left engine mount (1) with new seals (9) between the engine mount and crankcase. Loosely install the washers (5 & 7) and nuts (6 & 8) until the oil cooler installation is complete.
3. Install the lower right engine mounts (3) with washers (5) and nuts (6); torque the nuts (6) to Appendix B specifications.

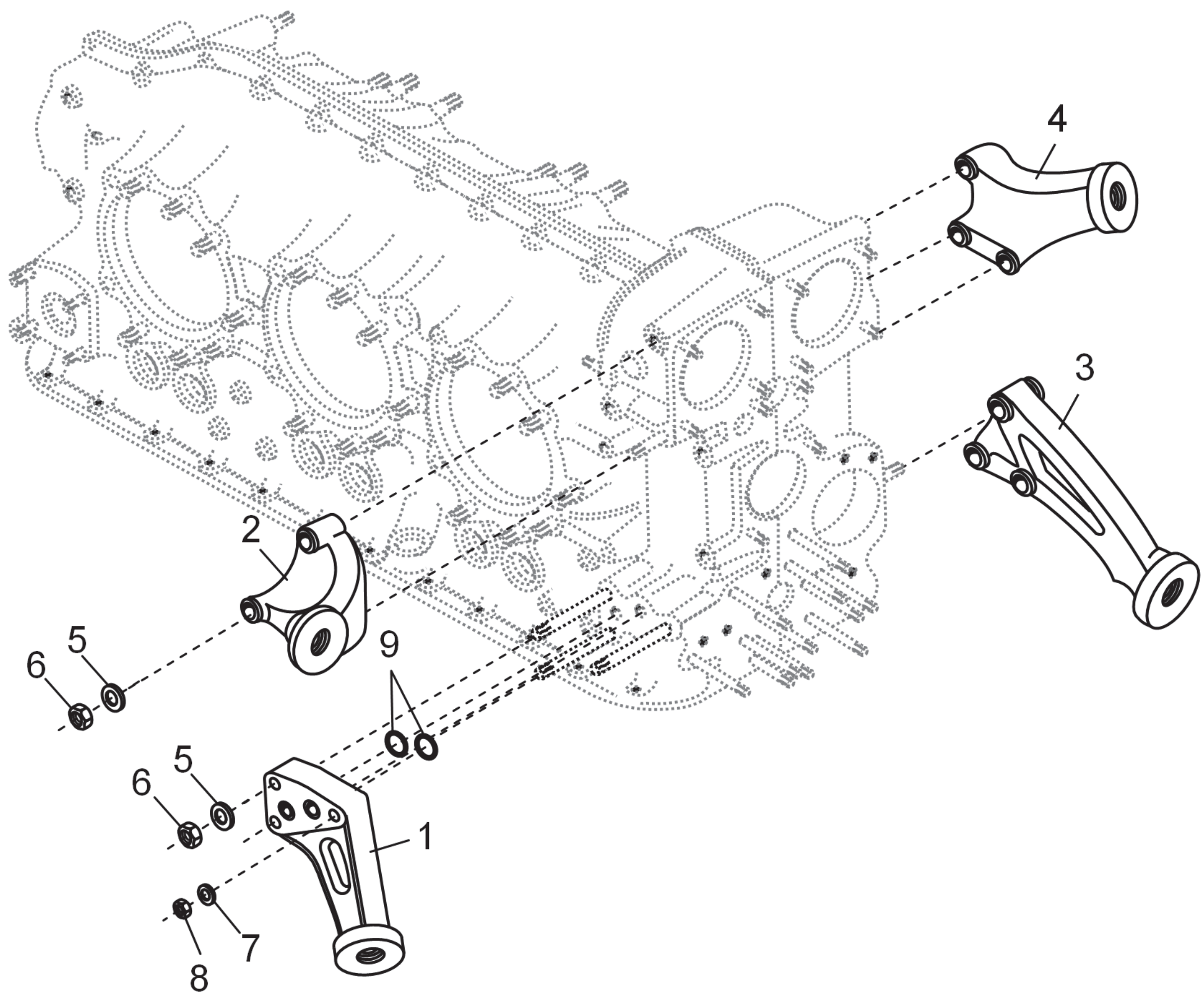


Figure 16-24. IO-550-C Engine Mounting Brackets C

1	Lower Left Engine Mount	4	Upper Right Engine Mount	7	Washer
2	Upper Left Engine Mount	5	Washer	8	Nut
3	Lower Right Engine Mount	6	Nut	9	Seal

16-8.3. IO-550-G, N & P Engine Mount Installation G N P

Several IO-550-G and N engine configurations utilize a six point mount system. Determine if the engine mounts are designed for a four point or six point mount. For engines with six point engine mounts, the forward mounts are the same part number and the left and right aft mounts are different part numbers. Engines with focalized four point engine mounts use two brackets of one part number at the 1-3-5 forward position and 2-4-6 aft. and a different part number a different part number at the 1-3-5 aft position and 2-4-6 forward position.

NOTE: The shorter screws are installed in the upper mounting hole.

1. Install 1-3-5 aft (Figure 16-25)(3) and 2-4-6 aft (2) engine mount brackets at the aft mounting locations with screws (4 & 5) and washers (6).
2. Install the 1-3-5 forward (1 or 2A) and 2-4-6 forward (1 or 3A) engine mount brackets at the forward mounting locations with screws (4 & 5) and washers (6).
3. Torque the screws (4 & 5) per Appendix B.

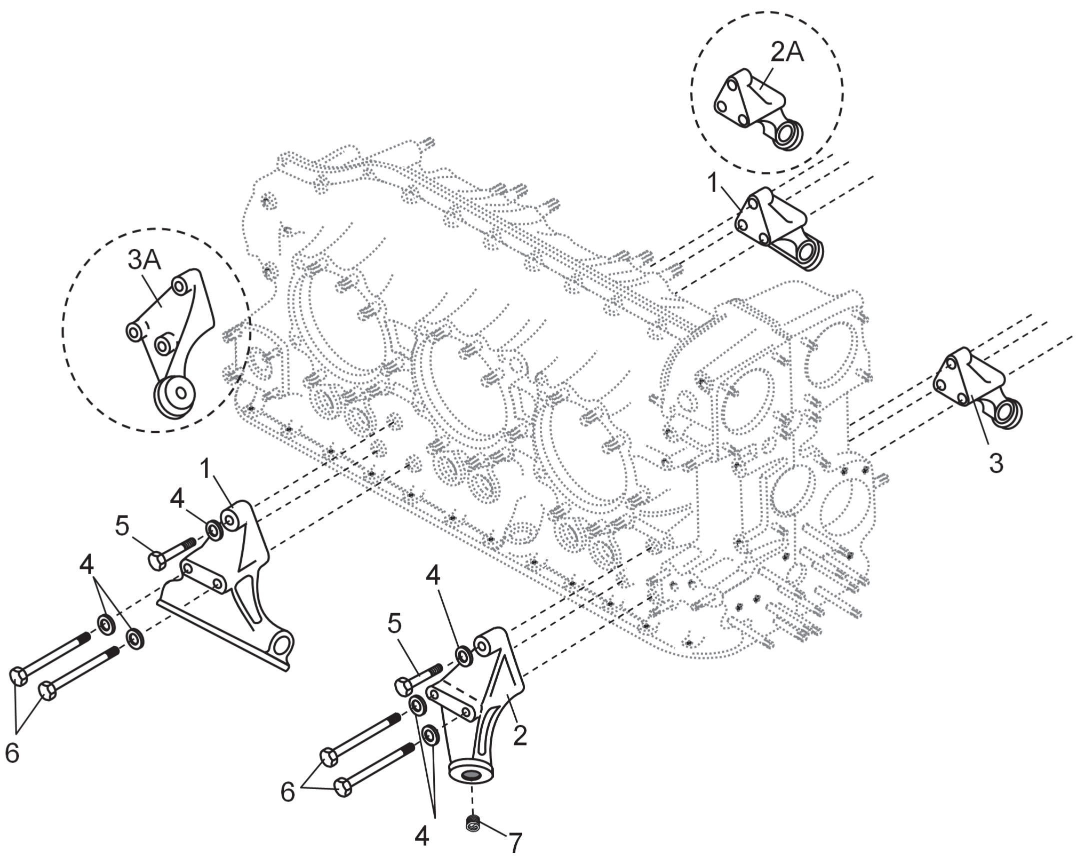


Figure 16-25. IO-550-G, N & P Engine Mounting Brackets G N P

1	Aft Engine Mount	4	Washer
2	Forward Six Point Engine Mount	5	Bolt
2A	2-4-6 Side Forward Engine Mount	6	Bolt
3	1-3-5 Side Aft Engine Mount	7	Helical Coil
3A	2-4-6 Side Forward Engine Mount		

16-9. Engine Drive Train Assembly

16-9.1. Camshaft Assembly

IO-550 camshafts have the same rear plugs but the front plug 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 and installed in the engine will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.

1. Install the camshaft in a suitable holding fixture. Apply Loctite Pipe Sealant 592 to the male threads of the new 0.25”-18 brass front and rear camshaft plugs (Figure 16-26) (2 & 3) and install the new plugs in the camshaft. Torque the plugs to Appendix B specifications and repeat the “Magnetic Particle Inspection” on the camshaft according to instructions in Figure 15-5.
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).

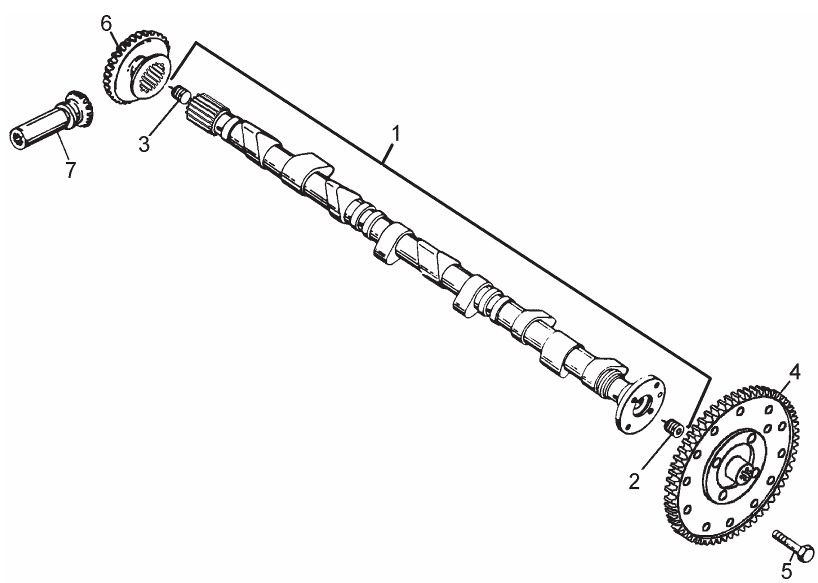


Figure 16-26. Camshaft Assembly

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

5. Install four new bolts (5) and torque to Appendix B specifications.

6. Safety wire the bolt heads according to the "Safety Wiring Hardware" instructions in Appendix C-4.
7. Coat the camshaft with 50-weight aviation engine oil.

16-9.2. Crankshaft Assembly

WARNING

Do not assemble and install the crankshaft if the VAR stamp is absent from the propeller flange.

1. Place the crankshaft on a bench with a notched wooden block under the front and rear main journals.

   CAUTION: Do not heat the gear cluster more than 10 minutes.

2. Install a new dowel 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. Use a uniform heating method (not a torch), heat the crankshaft small gear (Figure 16-27) (24) to 300°F (149°C) for 5 to 10 minutes. Heating the gear is necessary for a shrink fit installation.
4. While the small gear is still hot, align the dowel hole in the gear with the crankshaft dowel (32) and install the small gear on the crankshaft.
5. Attach the large gear (23) to the crankshaft small crankshaft gear (24) using six new drilled head screws (22). Torque the screws (22) in a crisscross pattern to Appendix B specifications.

   NOTE: 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.

6. Safety wire the drilled head screws (22) according to the "Safety Wiring Hardware" instructions in Appendix C-4.
7. Install the alternator drive gear (27) over the propeller flange.
8. With the holes aligned, install new tab lock plates (26) and four new bolts (25). Torque the bolts to Appendix B specifications. Do not over-torque the bolts to align the bolt with the lock tab. If the bolt head does not align with the lock tab within the acceptable torque range, replace the bolt.
9. Secure the tab lock plates against the bolt wrench flats with a brass drift.
10. Lubricate the oil transfer collar halves (19 & 20) with clean 50-weight aviation engine oil. Align the collar halves to mate each dowel (18) to the bore in the opposing collar half on the crankshaft and secure the installation with new nuts (17).
11. Confirm running clearance (Table D-17) between the collar and crankshaft for propeller oil pressure.
12. Alternately torque the nuts (17) in 20 inch-pound increments to Appendix B specifications; the collar must rotate freely.

Procedure continues after illustration...

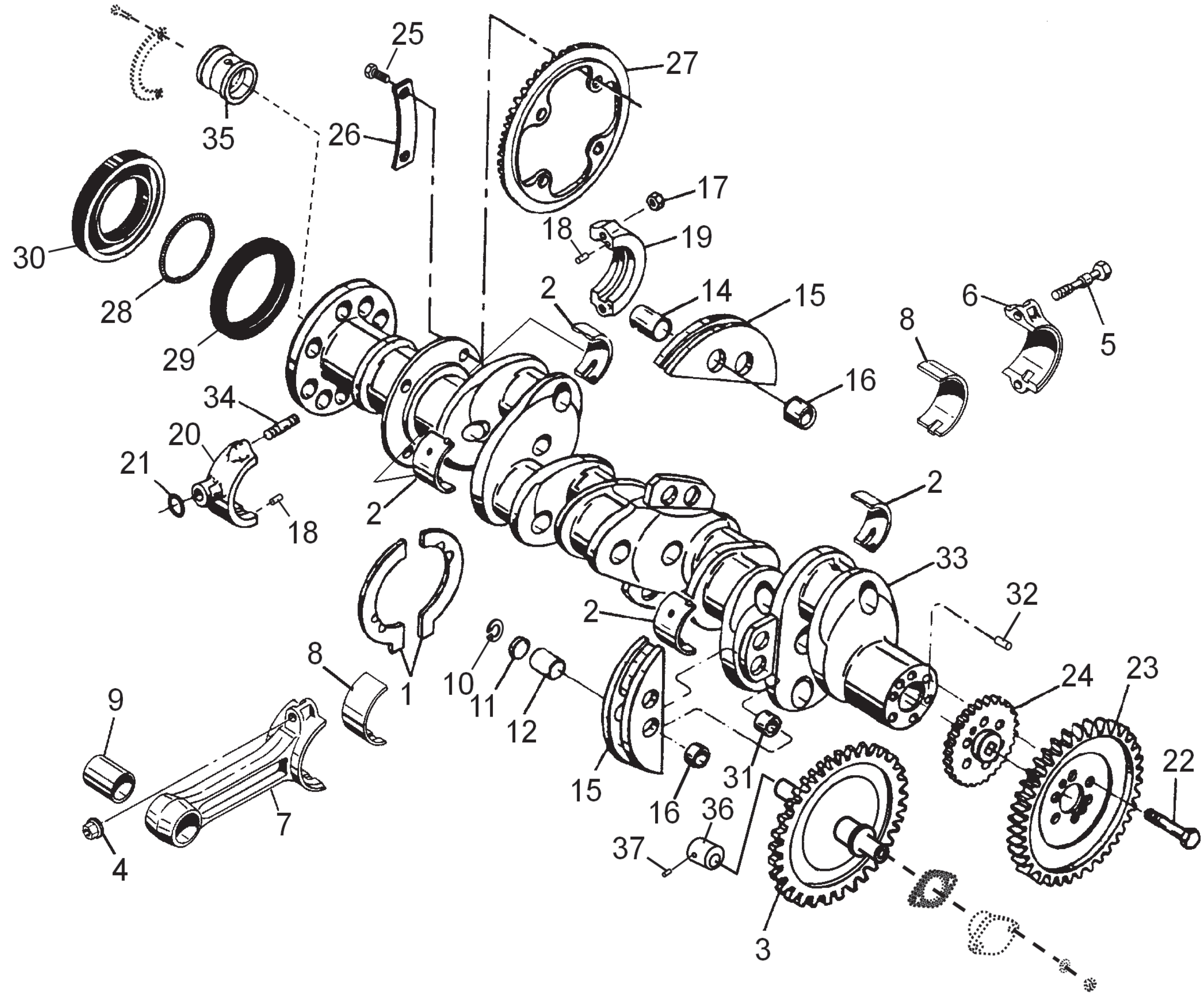


Figure 16-27. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	Crankshaft Main Bearing	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	Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring		
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring		
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

13. Install the counterweights

   a. Attach two counterweights (Figure 16-27) (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 Table D-19). Since the pin diameter controls the counterweight order, it is imperative that the correct pin be installed in the counterweight (as instructed in subsequent steps). The chart indicates the pin order, corresponding part number, and outer diameter dimension. Note the pin outer diameter increases with the order number.

   CAUTION: Install order pins with the same part number (same dash number) in the counterweight to ensure proper operation.

   b. Install new counterweight plates (11) with the sharp edge (flat surface) outboard as shown in Figure 16-28.

   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 the actual 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. Install new retaining rings (10), with the opening toward the crankshaft to secure the counterweight assembly on the hanger blade as shown in Figure 16-28. Measure the distance between the two retaining ring “ears” after installation-minimum gap is 0.179. If the gap is smaller, the retaining ring is not seated in the groove - remove the retaining ring and repeat the installation procedure.

   d. Attach two counterweight (6) on either side of the No. 5 crank cheeks.

   e. Install two new 4th order counterweight pins (Figure 16-27) (13) in the 4th order counterweights.

   f. Install two new 5th order counterweight pins (14) in the 5th order counterweights.

   g. Install new counterweight plates (11) with the sharp edge (flat surface) outboard as shown in Figure 16-28.

   h. Install new retaining rings (10), with the opening toward the crankshaft to secure the counterweight assembly on the hanger blade as shown in Figure 16-28. Measure the distance between the two retaining ring “ears” after installation-minimum gap is 0.179. If the gap is smaller, the retaining ring is not seated in the groove - remove the retaining ring and repeat the installation procedure.

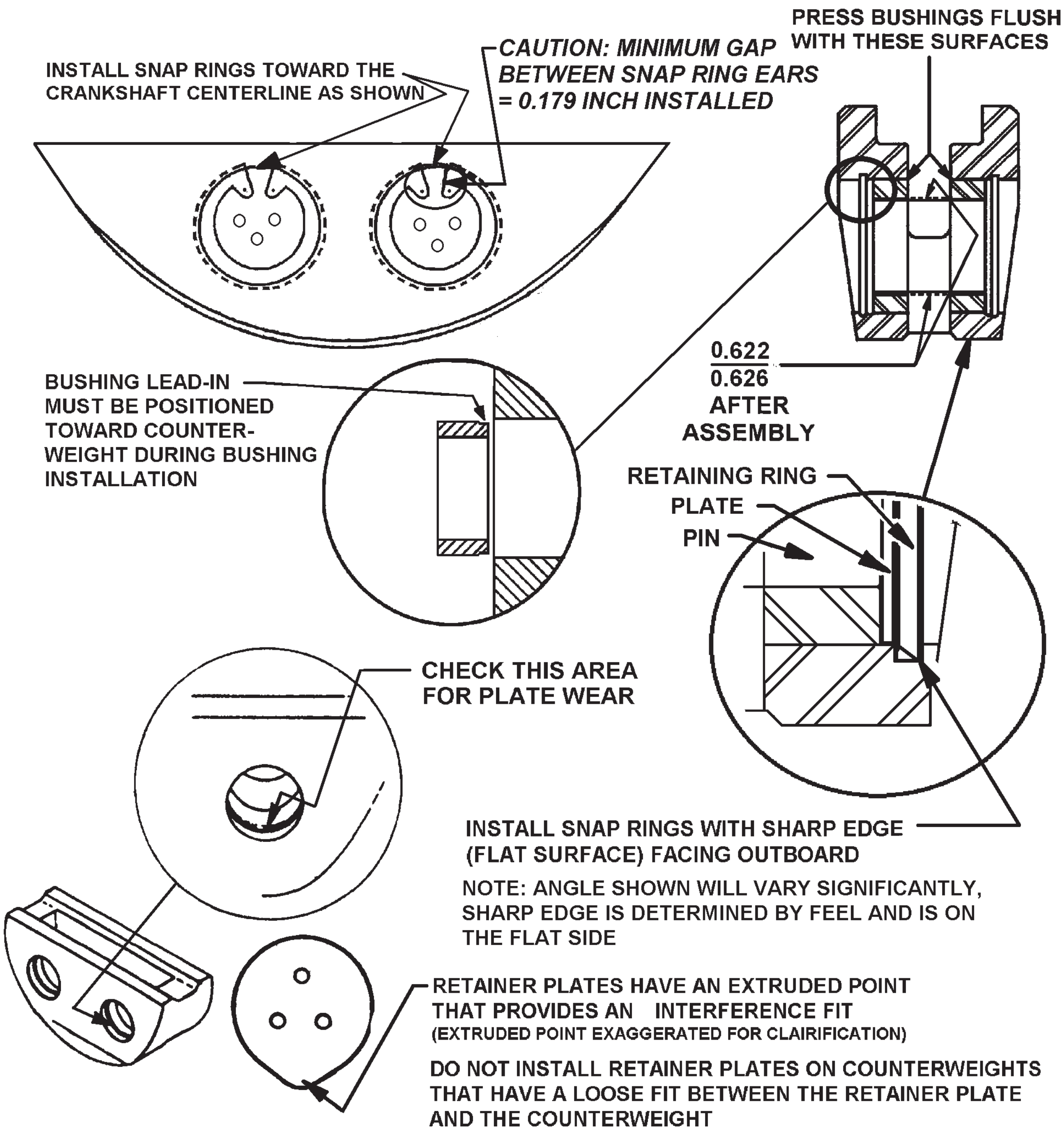


Figure 16-28. Counterweight Inspection, Repair and Installation

16-9.3. Connecting Rod and Bearing Assembly

1. Dampen a sheet of crocus cloth with solvent and place it on a flat surface plate.
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 are numbered 1 through 6 to identify the installed crankpin position. Vibro-etch new connecting rods and cap pairs with the position numbers of the connecting rod being replaced, in the location shown in Figure 16-29.

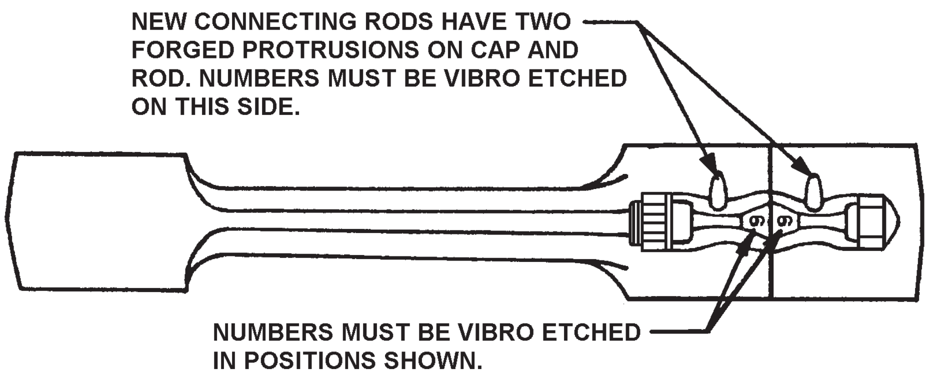


Figure 16-29. Connecting Rod Position Number

4. Install a new connecting rod bearing (Figure 16-27) (8) in each connecting rod (7) and cap. Ensure the bearing ends project the same distance, even with the parting surface and they are properly seated.
5. Look closely for and remove any metal that may have shaved from the bearing back onto the parting surface during assembly.
6. Lubricate the threads of the new connecting rods and caps, connecting rod bolts (10) and new spiral lock nuts (11) with clean 50 weight aviation engine oil. Insert the connecting rod bolts (10) through the lower side of the connecting rod cap.
7. Viewing the crankshaft from the rear (gear end), install the No. 1 connecting rod on the right side of the crankshaft at crankpin No. 1 with the position number facing up. Align the connecting rod cap and bolts with the connecting rod, position number facing up and secure the assembly on the crankshaft with a new spiral locknut. Repeat for the No. 3 and No. 5 connecting rod assembly.
8. Viewing the crankshaft from the rear (gear end), install the No. 2 connecting rod on the left side of the crankshaft at crankpin No. 2 with the position number facing up. Align the connecting rod cap and bolts with the connecting rod, position number facing up and secure the assembly on the crankshaft with a new spiral locknut. Repeat for the No. 4 and No. 6 connecting rod assembly.
9. Torque the connecting rod bolts and caps to Appendix B specifications.
10. Check connecting rod to crankshaft pin end clearance according to Appendix D specifications.

16-9.4. Crankshaft Nose Oil Seal Assembly

1. Place a new spring (Figure 16-27)(30) around the crankshaft in the oil seal area. Turn the spring ends in an unwinding direction. Allow one end of the spring to wind into the other.
2. Apply Shell Alvania No. 2 Grease to the lip of the new oil seal (part of 31) and propeller flange.
3. Squeeze the oil seal until it is egg shaped and install it on the crankshaft starting from the propeller flange using a Kent-Moore Part No. 5209 “Crankshaft Nose Oil Seal Installer Tool” (Table 3-1) to stretch the new oil seal over the propeller flange.
4. After the oil seal is on the crankshaft, wipe the excess Shell Alvania No. 2 Grease from the oil seal and crankshaft.
5. Press a new reinforcing ring (part of 31) into the oil seal recess in both directions from the split. Verify the ring is fully seated in the oil seal recess all the way around.
6. Press a new spring (30) into the oil seal cavity.

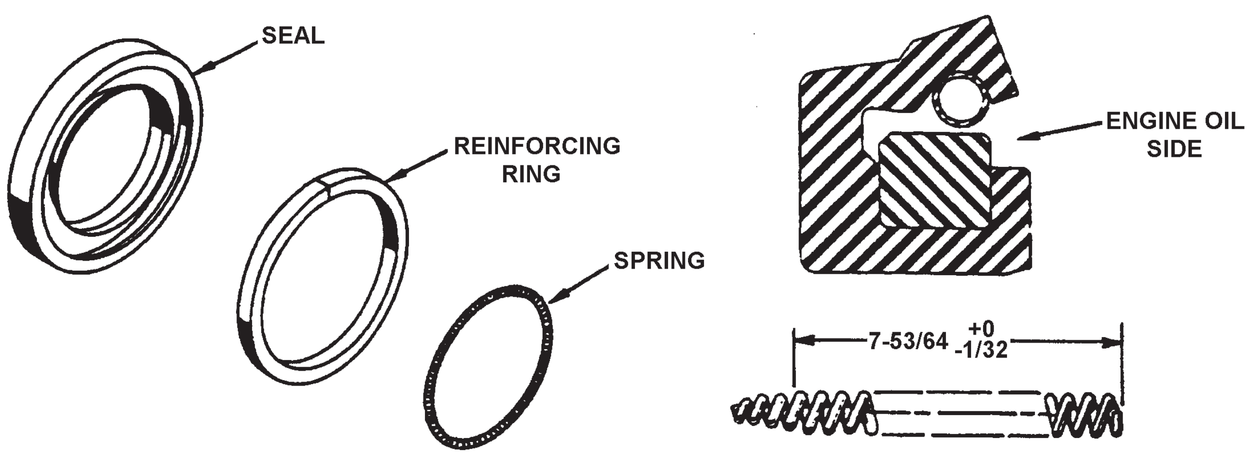


Figure 16-30. Crankshaft Nose Oil Seal Parts

16-10. Compressor Mounting Kit Assembly

1. Install a new bearing (Figure 16-31) (3) into the idler sheave (2). Secure the new bearing (3) with a new retaining ring (4).

   NOTE: Shims (21 & 22) are used to align the driven sheave (19), idler sheave (2) and the starter adapter drive sheave. Add or subtract shims, as required, to align the three sheaves during refrigerant compressor installation.

2. Install the idler sheave (2) on the block assembly (5) with the sheave support bolt (6), shims (22), and spacer (7). Do not torque the sheave support bolt at this time.
3. Loosely assemble the tensioning hardware (10, 11, 12, and 14) on the mounting bracket (1).
4. Install the idler sheave (2) and block assembly (5) on the mounting bracket (1) using fastening hardware (8 and 9). Do not torque the hardware at this time.

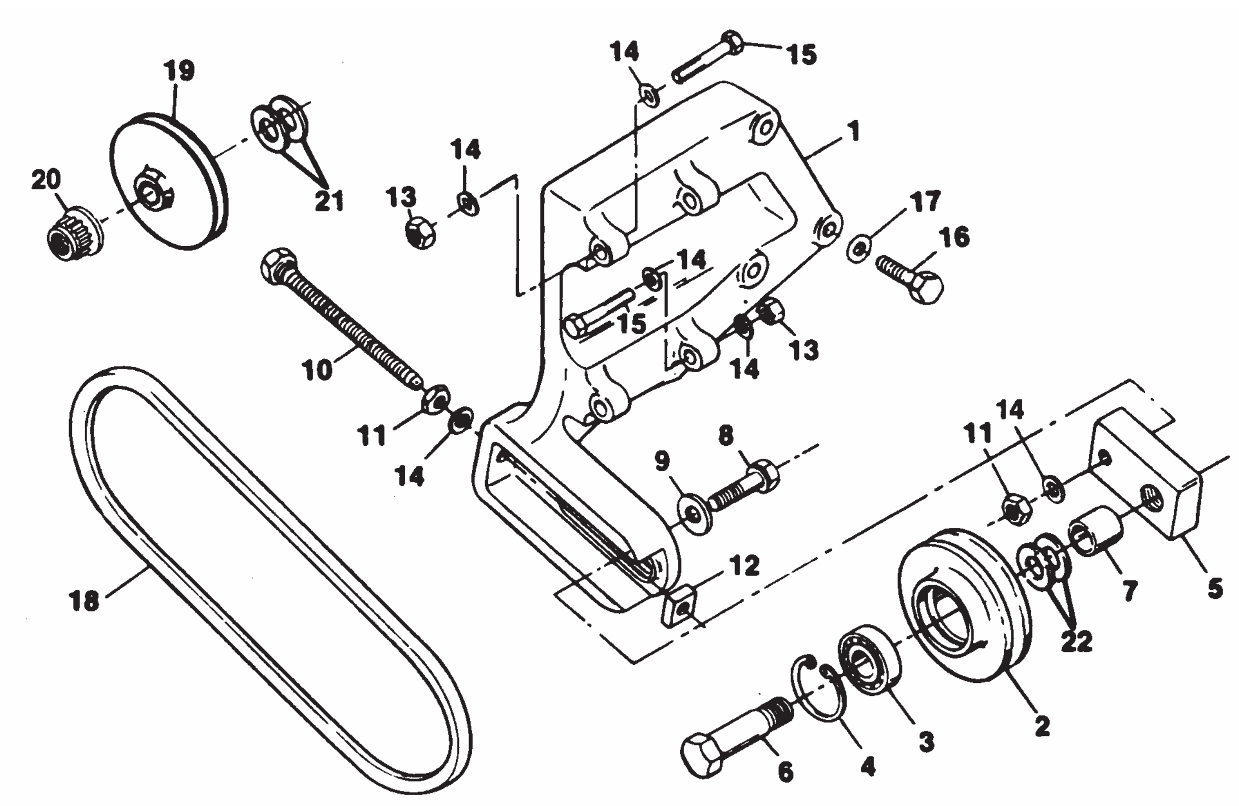


Figure 16-31. Refrigerant Compressor Mounting Assembly

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		

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.
4. Torque the engine cylinders and crankcase.
5. Install the cylinder drain tubes.
6. Install the hydraulic tappets and pushrods.
7. Install the rocker arms and valve train.
8. Install the cylinder baffles.
9. Install the oil suction tube and oil sump.
10. Install the oil pump.
11. Install the accessory drive pads.
12. Install the starter and starter adapter assembly.
13. Install the alternator (and optional alternator bracket assembly).
14. Install the oil cooler.
15. Install the Induction System.
16. Install the Fuel Injection System.
17. Install the Ignition System.
18. Install the optional refrigerant compressor mount assembly.
19. Install the engine in the airframe according to instructions in Section 5-2.

17-1.1. Component Lubrication

WARNING

Lubricate hardware according to instructions in Chapter 3 and Appendix B. Inspect fasteners for proper plating and thread form. Verify fastener serviceability and correctly lubricate the fastener for proper fastener pre-loading and torque application.

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. Section 3-2 includes a comprehensive list of authorized lubricants, sealants and adhesives.

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. With the exception of the crankshaft bearing saddles, thoroughly coat the crankcase camshaft bearing surfaces, propeller governor gear bearing surface, starter shaft gear bushing, and new idler gear bushing with clean, 50-weight aviation engine oil:
3. Shake or mix well full strength, non-thinned Part No. 654663 gasket sealant.
4. Apply Part No. 654663 and silk thread as illustrated in Figure 17-1. Do not apply Part No. 654663 gasket sealant to the crankshaft nose seal area. Apply Part No. 654663 gasket sealant to the 2-4-6 case half only in areas where thread is shown. Apply an even thin coat of Part No. 654663 gasket sealant using short light brush strokes. Part No. 654663 gasket sealant should be viscous enough for brush marks to disappear. If not, use a new container of Part No. 654663 gasket sealant.
5. Allow the gasket sealant to air dry to a tacky condition before threading.

   NOTE: Refer to Appendix C for detailed Part No. 646942 Gasket Maker application instructions.

6. Apply a thin translucent coat of Part No. 646942 Gasket Maker not to exceed 0.010 inch thick to 1-3-5 case half. Apply Gasket Maker in areas where Part No. 654663 was applied on the 2-4-6 case half.
7. Apply grade D silk thread on the 2-4-6 case half only as shown in Figure 17-1. Ensure the free ends of the thread are covered by gaskets except at the nose oil seal.

   CAUTION: Do not apply engine oil on the crankshaft bearing saddles. Bearing saddles must be dry when installing the crankshaft main bearings.

WARNING

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, cylinder fastener threads or crankcase main bearing bosses. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

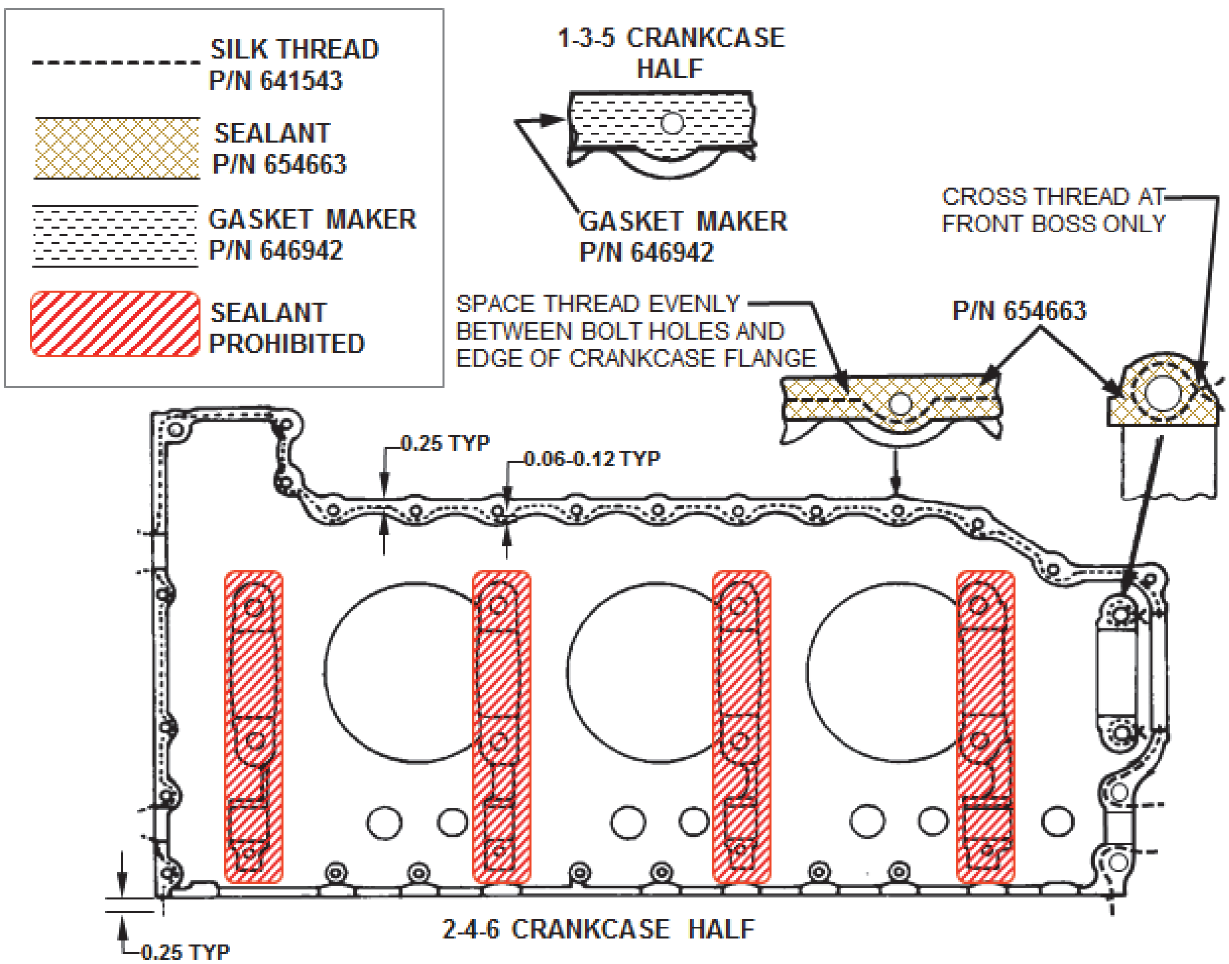


Figure 17-1. Crankcase Sealant and Threading

CAUTION: Do not apply engine oil to the crankshaft bearing saddles. Bearing saddles must be dry when installing the crankshaft main bearings.

8. Install new crankshaft main bearings (Figure 17-2) (2) 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.
9. 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.
10. With the aid of an assistant, lift the crankshaft assembly by the No. 1 connecting rod and propeller flange.
11. 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 in the crankcase.
12. Apply clean 50 weight aviation engine oil to the thrust washer lands in the crankcase to hold the thrust washer in place during assembly.
13. Install new thrust washers (1).
14. Ensure the bearing and thrust washer ends project equally.
15. Verify the new O-ring (21), new crankshaft main bearings (2), and new thrust washers (1) are seated properly.
16. Carefully place the odd-numbered connecting rods on the upper case flange. Connecting rod position numbers, if properly installed, will be toward the upper case flange.
17. Apply clean, 50-weight aviation engine oil to the governor driven gear (Figure 17-3) (7) and camshaft assembly (1).
18. Install the governor-driven gear (7) in the crankcase bore.

WARNING

Failure to install plugs in the camshaft prior to engine assembly will result in loss of internal oil pressure. With little or no lubrication of internal moving engine parts, engine failure will be imminent.

19. Install the assembled camshaft assembly (1) in the crankcase.

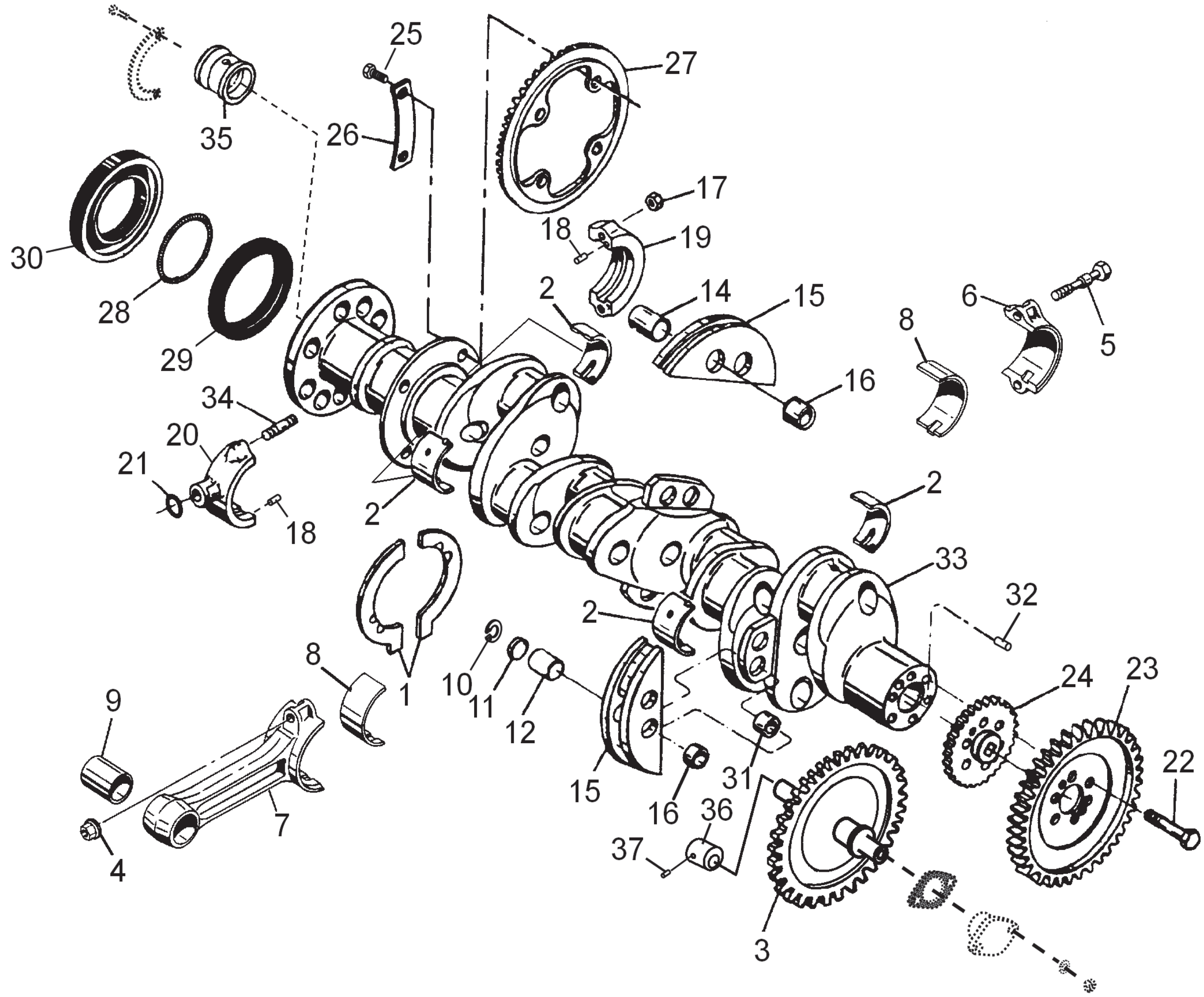


Figure 17-2. Crankshaft Assembly

1	Thrust Washer	11	Counterweight Plate	21	O-ring	31	Counterweight Bushing
2	Crankshaft Main Bearing	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	Nut	27	Alternator Drive Gear	37	Dowel Pin
8	Connecting Rod Bearing	18	Dowel Pin	28	Spring		
9	Piston Pin Bushing	19	1-3-5 Side Collar	29	Reinforcing Ring		
10	Retaining Ring	20	2-4-6 Side Collar	30	Oil Seal		

20. Ensure the timing marks (Figure 17-4) on the camshaft and crankshaft align as the gears mesh.
21. 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.
22. Measure the governor-driven gear backlash to ensure it meets Appendix D specifications. If gear backlash is not within tolerance, inspect the gear, camshaft, and crankcase to determine the cause of non-conformance).

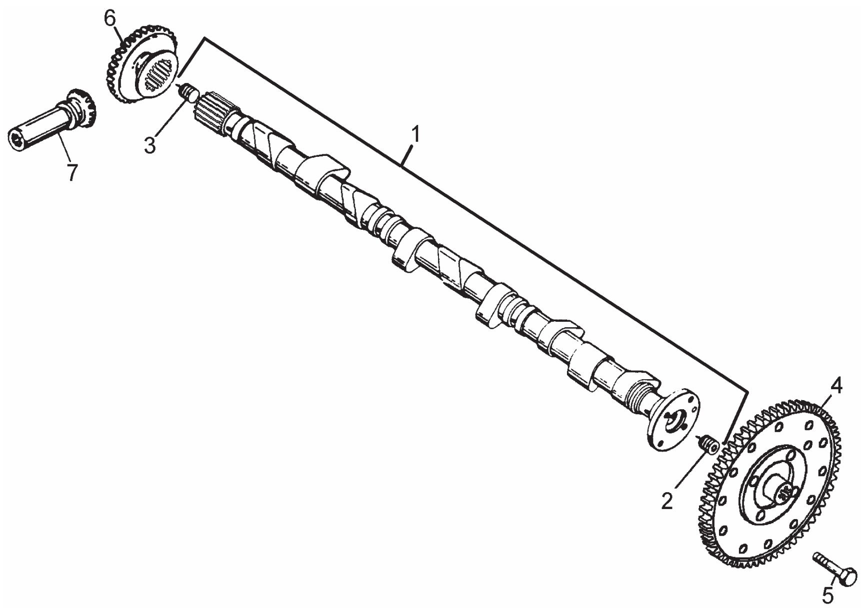


Figure 17-3. Camshaft Assembly

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

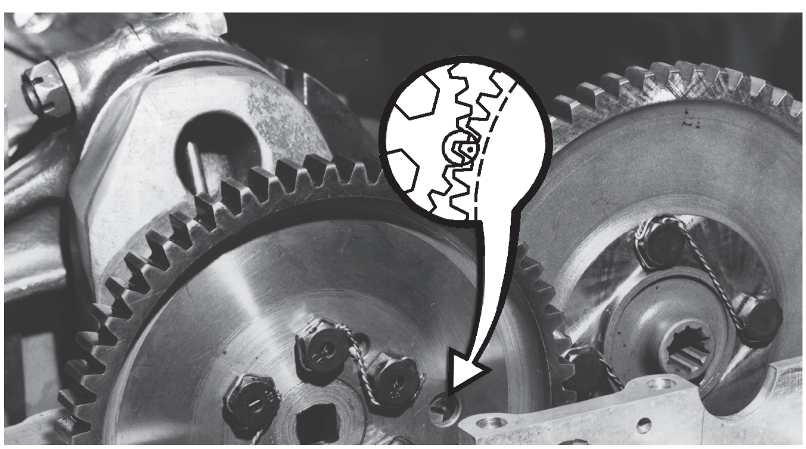


Figure 17-4. Timing Mark Alignment

23. Measure crankshaft end clearance with a dial indicator set at zero against the propeller flange to verify it meets Appendix D specifications.

24. Measure the camshaft end clearance at both ends of the rear main bearing to ensure it conforms to Appendix D specifications.
25. Install a new idler gear bushing (Figure 17-5) (16) in the crankcase.
26. Lubricate the idler gear (Figure 17-2) (33) with clean 50-weight aviation engine oil.
27. 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.
28. Place a new gasket (Figure 17-5) (15) on the idler gear support pin (14). Secure the idler gear using the idler gear support pin (14) lubricated with clean, 50-weight aviation engine oil. The idler gear support pin will be torqued later.

WARNING

Failure to achieve minimum gear backlash during engine assembly will cause gear damage and subsequent engine failure.

29. Measure idler gear, camshaft gear and crankshaft gear backlash to verify they meet Appendix D specifications with a dial indicator.
30. Coat the camshaft lobes with Dow Corning G-N Paste.

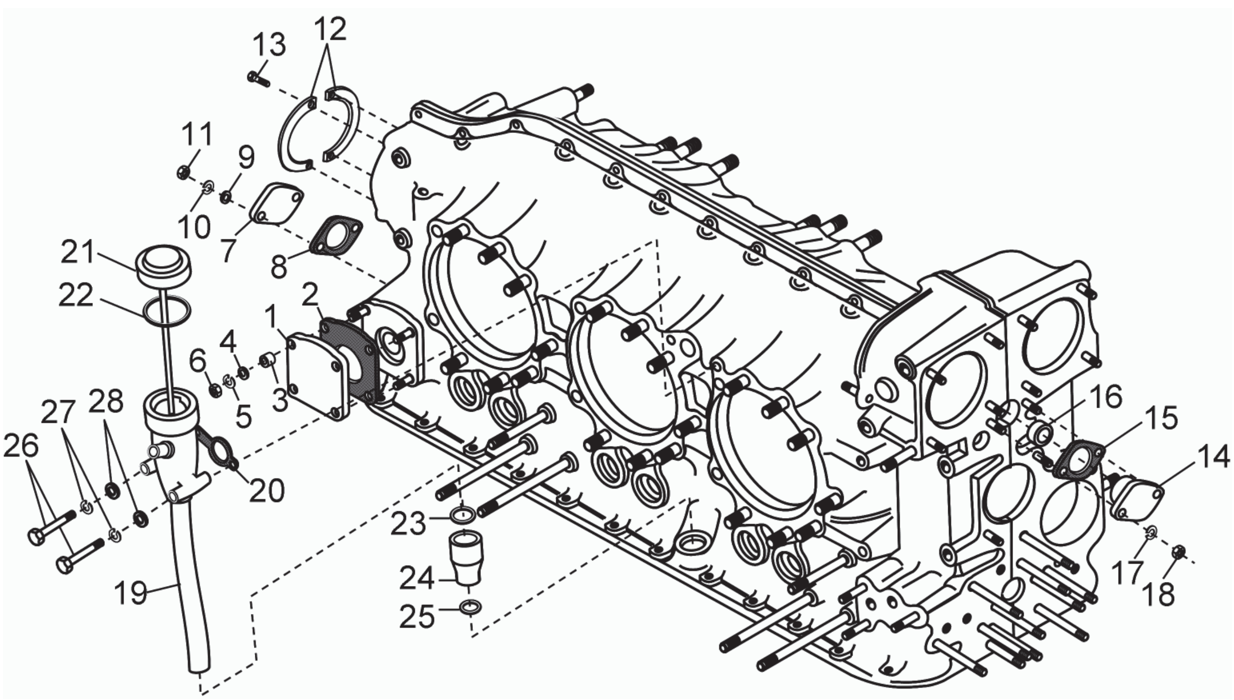


Figure 17-5. Oil Filler, Support Pin, and Camshaft Cover

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

31. Have an assistant balance the odd numbered connecting rods upright (Figure 17-6) and guide the connecting rods through the 1-3-5 crankcase half cylinder openings.

WARNING

Failure to lubricate designated fasteners may results in damage to the crankcase bearing bore, crankshaft bearing, and crankshaft and subsequent engine malfunction or failure.

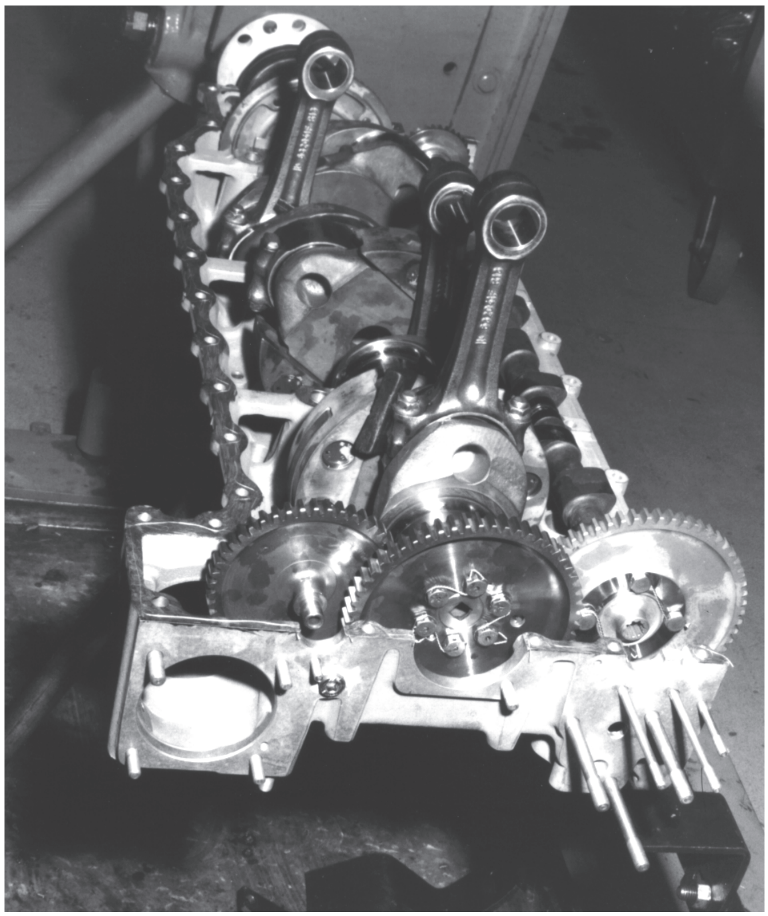


Figure 17-6. Left Crankcase Assembled on Stand

32. Back the idler gear support pin (Figure 17-5) (14) partially out to clear the studs.
33. Lower the 1-3-5 (right) crankcase half on the 2-4-6 (left) crankcase half.
34. Push the idler gear support pin (14) back onto the studs, flush with the crankcase.
35. Secure the idler gear support pin with a nut (18) and new lock washer (17) but do not torque it at this time.
36. Verify the thrust washer (Figure 17-2) (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 17-7*) the connecting rods or the cylinder mounting deck could be damaged.*

37. Use the old cylinder base O-rings (Figure 17-7) to immobilize the connecting rods until the cylinders are installed.

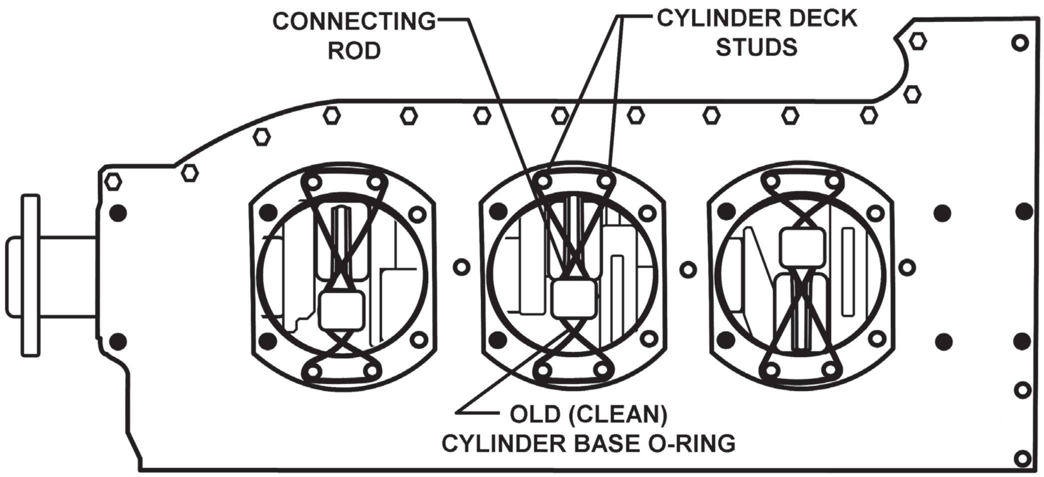


Figure 17-7. Cylinder Base O-ring supporting the Connecting Rods

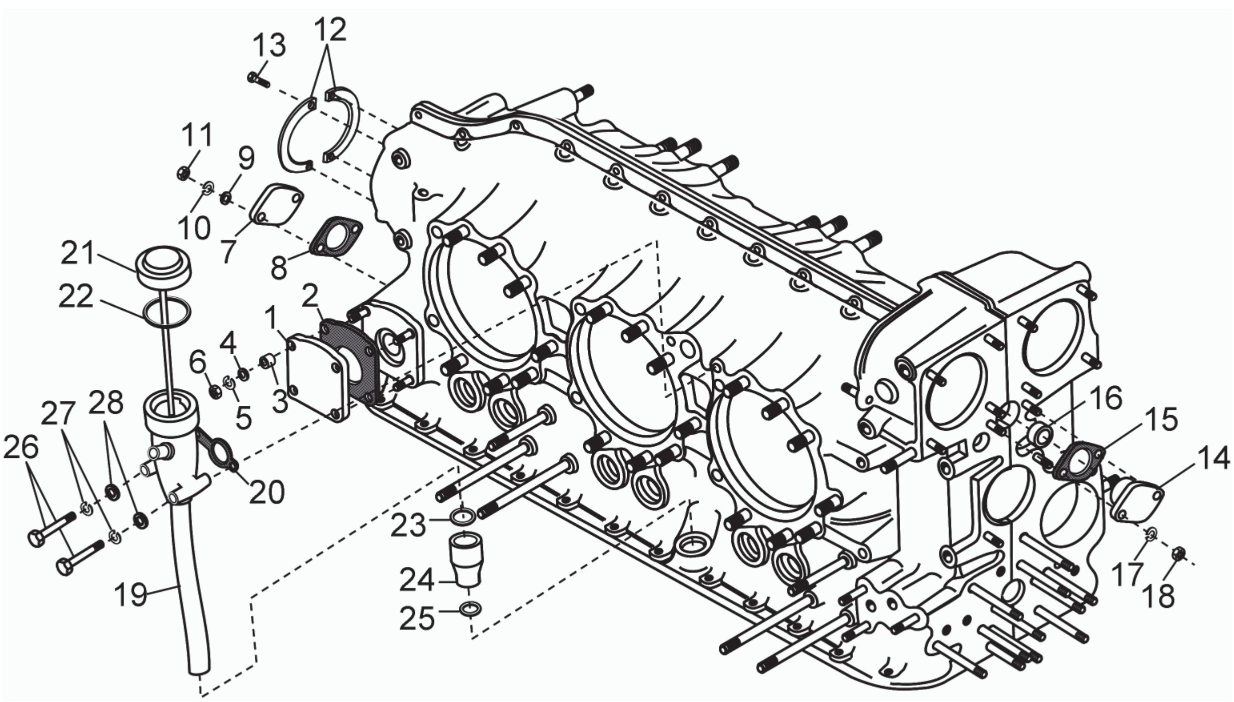


Figure 17-5 repeated for reference

17-2.2. Crankcase Hardware Installation

CAUTION: IO-550 crankcase assembly is the same for all engine models except external hardware fastener lengths vary. Refer to the instructions matching the engine model in Section 17-2.2.1 or Section 17-2.2.2

17-2.2.1. IO-550-A, B & C Crankcase Assembly A B C

1. Lubricate all studs and crankcase through-bolts according to instructions in Appendix B with approved lubricants (Chapter 3, Special Tools and Supplies).

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 17-8.

2. Use an O-ring Installation Tool (“Special Tools” in Section 3) to install eight new 0.5” x 10.75” through-bolts (Figure 17-9)(46) with new o-rings (47) in positions 37 through 44. If necessary, use a mallet to tap the through-bolts.
3. Install three new 0.31” x 4.00” tie bolts (62) with washers (32) in positions 69, 71 and 72; tighten, but do not torque the tie bolts (62).
4. Install a new 0.4375” x A B 5.31” (C 6.74”) through-bolt (40) with new O-rings in position 45.
5. Install a new 0.4375” inch x A B 6.19” (C 6.96”) through bolt (41) with new O-rings in position 46.
6. Install 0.88” flange washer on the 2-4-6 side of through-bolts (40 & 41) followed by 0.45” washers (42) and flange nuts (44) on both sides of the through bolts (40 & 41).
7. Install a 0.31” x 1.12” screw in position 54 and a 0.31” X 1.38” screw in position 53.

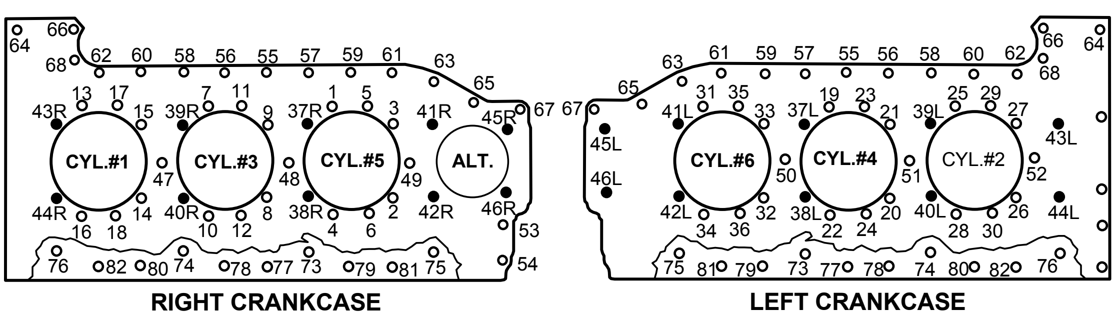


Figure 17-8. Crankcase Fastener Locations

8. Install a 0.38” x A 10.44” (B 11.67” C 12.14”) through bolt (50), two o-rings (51), spacer (52), washers (53), and nuts (54) in position 64.

9. Rotate the engine on the stand to the upright position. With connecting rods supported by old cylinder o-rings, secure 1-3-5 side engine mounts to engine stand.
10. Install the fuel manifold valve bracket at positions A 55 and 57 (B C 55 & 56) and secure with 0.31 -24 x 1.59" bolts (68), washers (32) & nuts (56).
11. Install the forward lifting eye (not shown) at positions 56 & 58 on the crankcase backbone and secure with 0.31 -24 x 1.72" bolts (64), washers (32) & nuts (56).

    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.

12. Install 1.34" backbone bolts (67) washers (32) & nuts (56) at position 68; finger tighten nuts (56), do not torque at this time.
13. Install remaining 1.47" backbone bolts (31), washers (32) & nuts (56) at positions 57 through 68 and tighten but do not torque the fasteners at this time.
14. Install six 0.31" bolts (55) in positions 77-82 with washers (63) and nuts (56); tighten, but do not torque at this time.
15. Install four 0.25" bolts (57) in positions 73-76 with washers (58) and nuts (59); tighten, but do not torque at this time.

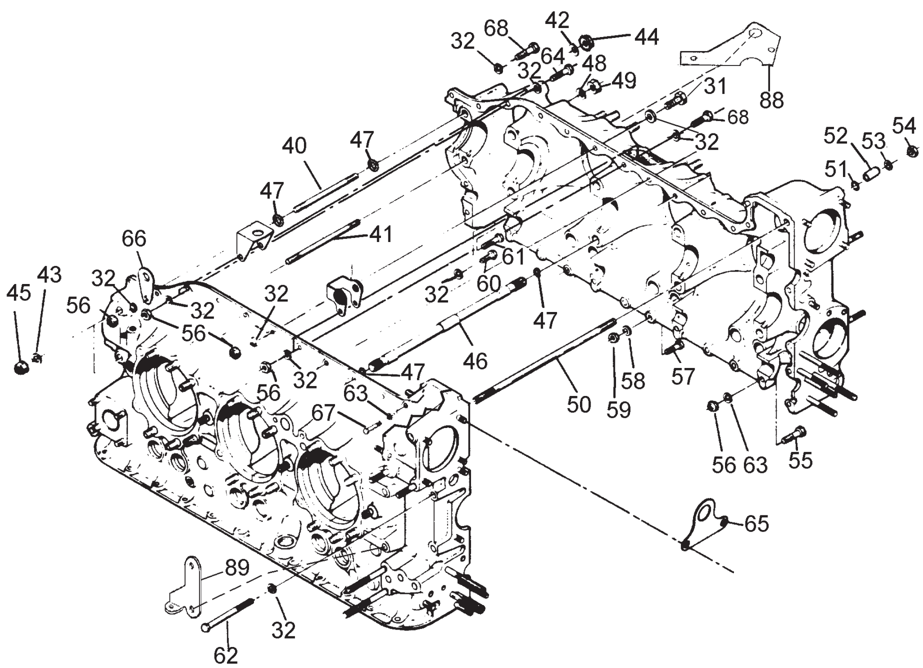


Figure 17-9. Permold Crankcase Fasteners

31	Bolt 0.31-24X1.47	46	Thru-bolt 0.50-20X10.75	54	Nut	62	Bolt 0.31-18X4.00
32	Washer	47	O-ring	55	Bolt 0.3125-24 UNF	63	Washer
40	Thru-bolt 0.4375-20X5.31	48	Washer	56	Nut	64	Bolt 0.31-24X1.72
41	Thru-bolt 0.44-20X6.19	49	Nut	57	Screw 0.25-28X1.63	65	Lifting Eye
42	Washer 0.45	50	Thru-bolt 0.38-24X11.67	58	Washer	66	Lifting Eye
43	Washer 0.88 thick X 0.43	51	O-ring	59	Nut	67	Bolt 0.31-24X1.34
44	Flanged Nut	52	Spacer	60	Screw 0.3125-18X1.12	68	Bolt 0.31-24X1.59
45	Nut	53	Washer	61	Screw 0.3125-18X1.38	88	Baffle Support

17-2.2.2. IO-550-G, N, P & R Crankcase Assembly G N P R

1. Lubricate all studs and crankcase through-bolts according to instructions in Appendix B with approved lubricants (“Lubricants, Sealants and Adhesives” in Chapter 3).

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 17-8.

2. Using an O-ring Installation Tool (“Special Tools” in Chapter 3), install eight new 0.5” x 10.75” through-bolts (Figure 17-9)(46) with new o-rings (47) in positions 37 through 44. If necessary, use a mallet to tap the through-bolts into position.
3. Install three new 0.31” x 4.00” tie bolts (62) with washers (32) in positions 69, 71 and 72; tighten, but do not torque the tie bolts (62).
4. Install a new 0.4375” x 5.31” through-bolt (40) with new O-rings in position 45.
5. Install a new 0.4375” inch x 6.19” through bolt (41) with new O-rings in position 46.
6. Install 0.880” washer on the 2-4-6 side of through-bolts (40 & 41) followed by 0.45” washers (42) and flange nuts (44) on both sides of the through bolts (40 & 41).
7. Install a 0.31” x 1.12” screw in position 54 and a 0.31” X 1.38” screw in position 53.

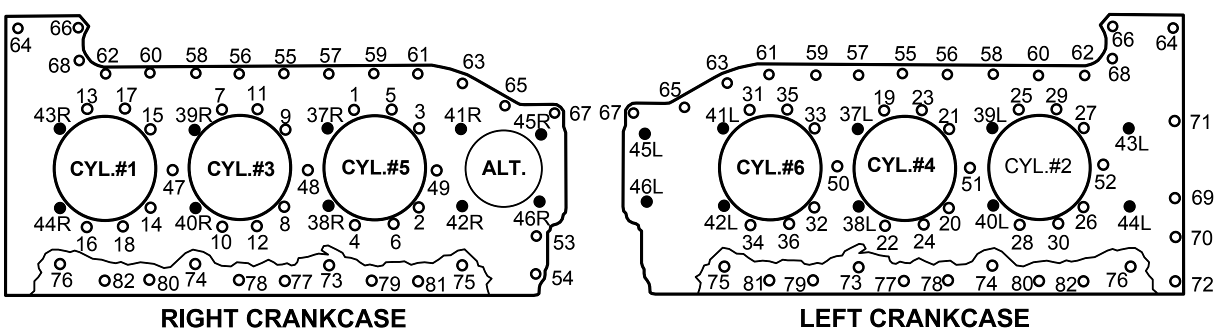


Figure 17-8 repeated for reference

8. Install a 0.38” x 11.67” through bolt (50), two o-rings (51), spacer (52), washers (53), and nuts (54) in position 64.
9. Rotate the engine on the stand to the upright position. With connecting rods supported by old cylinder o-rings, secure 1-3-5 side engine mounts to the engine stand.
10. Install the fuel manifold valve bracket at positions 55 and 57 on the crankcase backbone and secure with 0.31” -24 x 1.59” bolts (68), washers (32) & nuts (56).
11. Install the forward lifting eye (66) at position 65 on the 2-4-6 side of the crankcase backbone and secure with 0.31”-24 x 1.72” bolt (64), washer (32) & nut (56).

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.

12. Install 1.34” backbone bolts (67) washers (32) & nuts (56) at position 68; finger tighten nuts (56), do not torque at this time.
13. Install the manifold locator bracket with the open end to the aft of the engine at position 55. Insert a 0.31” 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.
14. Install the throttle support bracket with a 0.31” 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).
15. Install remaining 1.47” backbone bolts (31), washers (32) & nuts (56) at positions 57 through 68 and tighten but do not torque the fasteners at this time.
16. At the cam journal bosses below the camshaft, insert six 0.31” bolts (55) in positions 77-82 from the 1-3-5 side and secure with washers (63) and nuts (56) on the 2-4-6 side of the engine; tighten, but do not torque at this time.
17. Install four 0.25” bolts (57) in positions 73-76 with washers (58) and nuts (59); tighten, but do not torque at this time.

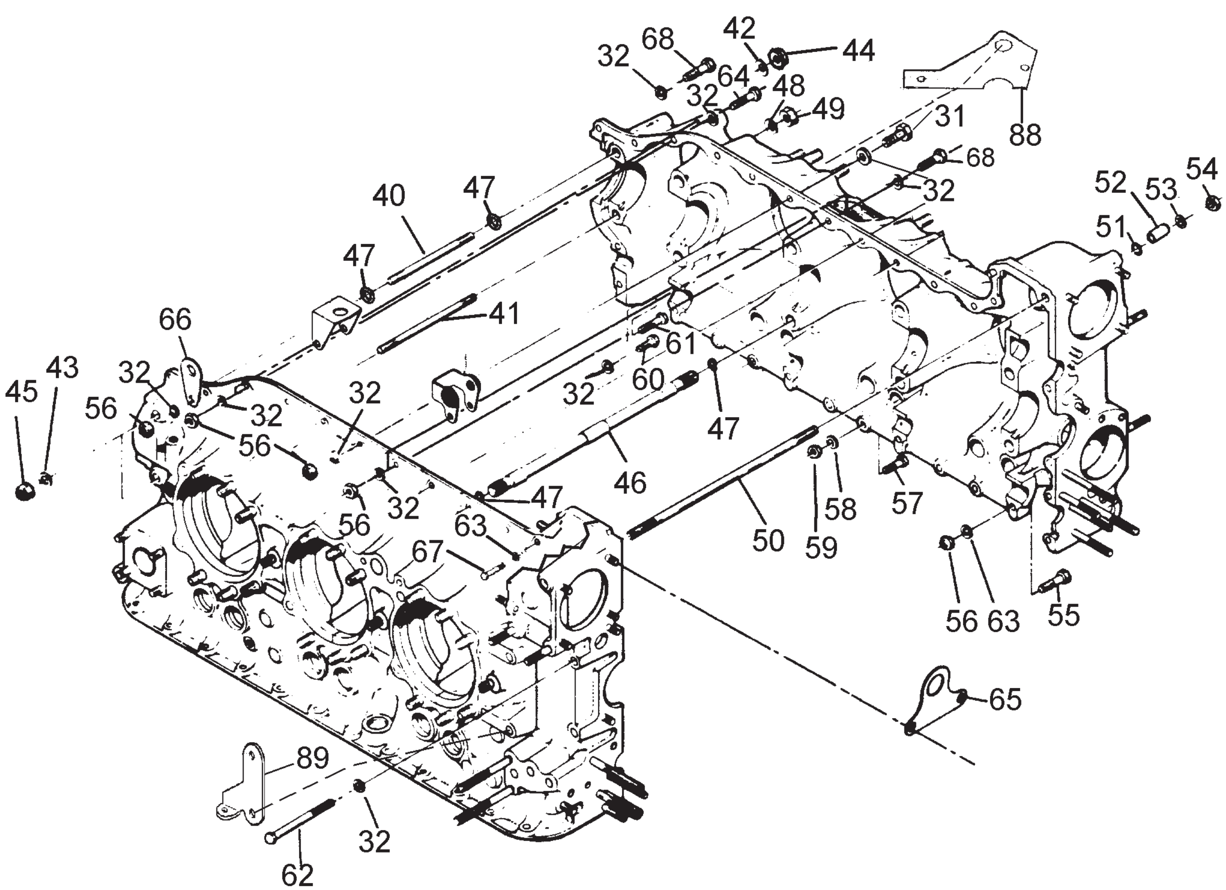


Figure 17-9 repeated for reference

17-3. Cylinder Installation

17-3.1. IO-550-A, B & C Cylinder Installation A B C

WARNING

Do not install a cylinder that does not conform to Section 15, "Overhaul Inspection and Repair"and Section D, "Overhaul Dimensional Limits." Ensure each cylinder has the required new parts and is clean, free of cracks, nicks, scratches, pitting, and corrosion before installation.

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 surfaces noted in listing 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 OIL ON THE SURFACES LISTED.

1. Install a new cylinder base O-ring (Figure 17-10) (25), lubricated with clean 50-weight aviation engine oil, on the cylinder base flange; verify the O-ring is not twisted on the cylinder base after installation.
2. Lubricate all cylinder through-bolt and deck stud threads with clean 50-weight aviation engine oil ("Lubricants, Sealants and Adhesives" in Chapter 3).
3. Carefully rotate the crankshaft until the connecting rod of the cylinder being installed is in the outer most position. Remove the old cylinder base O-ring from the connecting rod.
4. Back the new piston pin (Figure 17-10) (53) out of the piston far enough to allow the new piston (48) to be installed on the connecting rod.

   NOTE: Verify the new cylinder base o-ring is properly installed on the cylinder flange with no twists.
5. Align the piston (48) pin bore with the connecting rod and slide the piston pin (53) into the connecting rod.
6. Compress the fourth piston ring (52) with a ring compressor and push the cylinder until the fourth piston ring is positioned inside the cylinder barrel. Remove the Ring Compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.
7. While supporting the cylinder, install, but do not torque, the cylinder flange nuts (41 and 42). Install the 7th stud brackets (42 and 43) and nuts (44). The 7th stud nuts have a conical seat.

8. Repeat step 3-7 for the remaining cylinders.
9. Proceed to Section 17-3.3, “Cylinder and Crankcase Torque.”

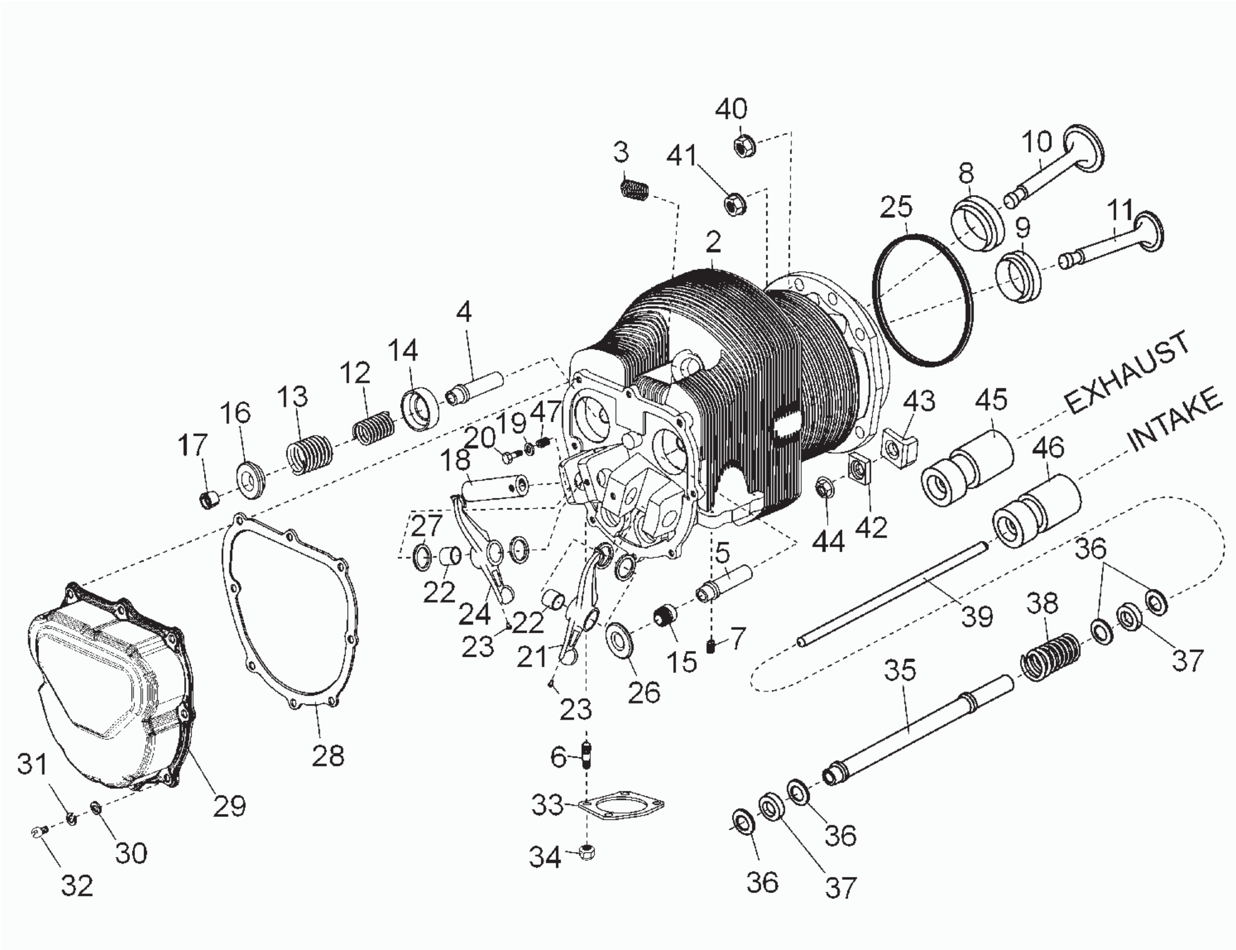


Figure 17-10. Updraft Cylinder Assembly A B C

1	Cylinder Assembly	13	Outer Spring	25	Cylinder Base O-ring	37	Packing
2	Cylinder	14	Lower Retainer	26	Intake Valve Retainer	38	Spring
3	Spark Plug Insert	15	Seal	27	Thrust Washer	39	Pushrod
4	Exhaust Valve Guide	16	Rotocoil	28	Rocker Cover Gasket	40	Flange Nut
5	Intake Valve Guide	17	Retainer Key	29	Rocker Cover	41	Flange Nut
6	Stud	18	Rocker Shaft	30	Washer	42	7^{th} Stud Bracket
7	Intake Flange Insert	19	Plain Washer	31	Lock Washer	43	7^{th} Stud Bracket
8	Intake Valve Seat	20	Screw	32	Screw	44	Flange Nut
9	Exhaust Valve Seat	21	Rocker Arm, Intake	33	Exhaust Flange Gasket	45	Hydraulic Exhaust Tappet
10	Intake Valve	22	Rocker Arm Bushing	34	Nut	46	Hydraulic Intake Tappet
11	Exhaust Valve	23	Drive Screw	35	Pushrod Housing	47	Helical Coil Insert
12	Inner Spring	24	Rocker Arm, Exhaust	36	Washer		

17-3.2. IO-550-G, N, P & R Cylinder Installation G N P R

WARNING

Do not install a cylinder that does not conform to Section 15, "Overhaul Inspection and Repair"and Section D, "Overhaul Dimensional Limits." Ensure each cylinder has the required new parts and is clean, free of cracks, nicks, scratches, pitting, and corrosion before installation.

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket maker or any other sealant on surfaces noted in listing 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 OIL ON THE SURFACES LISTED.

1. Install a new cylinder base O-ring (Figure 17-12) (52), lubricated with clean 50-weight aviation engine oil, on the cylinder base flange; verify the O-ring is not twisted on the cylinder base after installation.
2. Lubricate all cylinder through-bolt and deck stud threads with clean 50-weight aviation engine oil ("Lubricants, Sealants and Adhesives" in Chapter 3).
3. Rotate the crankshaft until the connecting rod of the cylinder being installed is in the outermost position. Remove the old cylinder base O-ring from the connecting rod.
4. Back the new piston pin (Figure 17-11) (6) out of the piston pin bore far enough to connect the piston to the connecting rod. Align the piston (1) pin bore with the connecting rod and slide the piston pin (6) into the connecting rod.

NOTE: Verify the new cylinder base o-ring is properly installed on the cylinder flange with no twists.

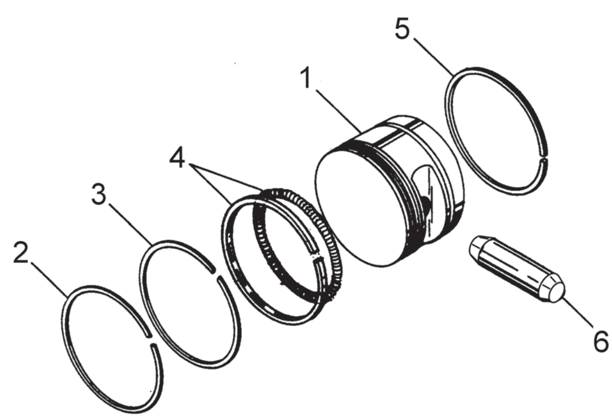


Figure 17-11. Piston, Piston Rings & Piston Pin

5. 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. Remove the Ring Compressor and push the cylinder assembly against the crankcase cylinder deck with the stud holes aligned.

6. Install, but do not torque, the cylinder deck and through bolt nuts (Figure 17-12)(41 and 42). Install the 7th stud brackets (47 and 48) and nuts (49). The 7th stud nuts have a conical seat.

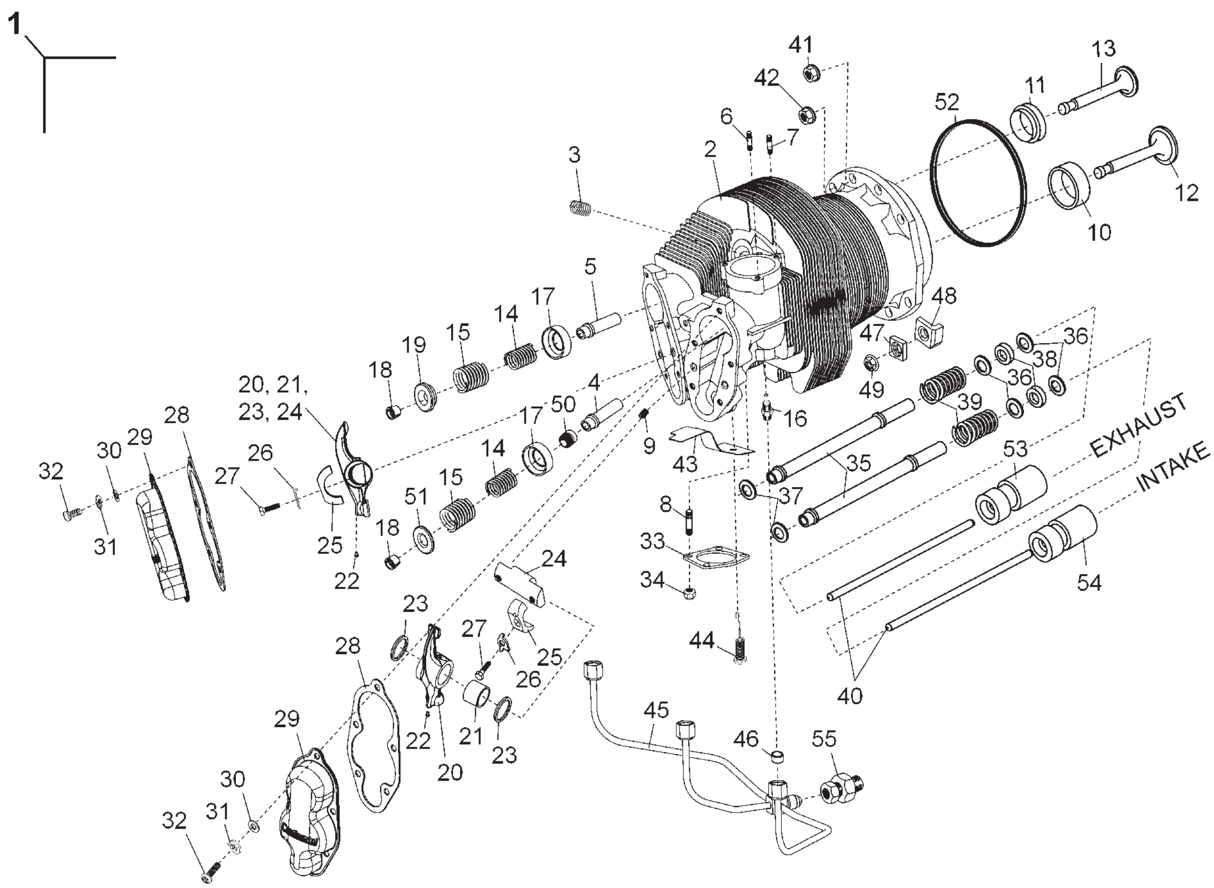


Figure 17-12. Crossflow Cylinder Assembly G N P R

1	Cylinder Assembly	15	Outer Spring	29	Rocker Cover	43	Baffle
2	Cylinder	16	Drain Fitting	30	Washer	44	Spring
3	Spark Plug Insert	17	Inner Retainer	31	Lock Washer	45	Drain Tube
4	Intake Guide	18	Retainer Key	32	Screw	46	Drain Tube Seal
5	Exhaust Valve Guide	19	Rotocoil	33	Exhaust Flange Gasket	47	7th Stud Bracket
6	Stud	20	Rocker Arm Assembly	34	Lock Nut	48	7th Stud Bracket
7	Stud	21	Rocker Arm Bushing	35	Pushrod Housing	49	Flange Nut
8	Stud	22	Drive Screw	36	Washer	50	Seal
9	Helicoil Insert	23	Thrust Washer	37	O-ring Seal	51	Retainer
10	Intake Valve Seat Insert	24	Rocker Arm Shaft	38	Pushrod Housing Packing	52	Cylinder Base O-ring
11	Exhaust Valve Seat Insert	25	Retainer	39	Pushrod Housing Spring	53	Hydraulic Exhaust Tappet
12	Intake Valve	26	Tab Washers	40	Pushrod Assembly	54	Hydraulic Intake Tappet
13	Exhaust Valve	27	Screw	41	Flange Nut	55	Check Valve
14	Inner Spring	28	Rocker Cover Gasket	42	Flange Nut		

NOTE: Cylinder drain fittings are only used on the IO-550-G, N, P & R model engine cylinders.

7. Coat the tapered male threads of the cylinder drain fittings (Figure 17-13) with Loctite 592 Teflon PS/T Pipe Sealant. Coat the tapered male threads only.

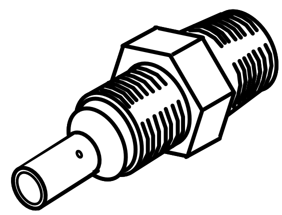


Figure 17-13. Cylinder Drain Fitting

8. Install the cylinder drain fittings (Figure 17-12)(16) in the cylinders; torque to Appendix B specifications.
9. Repeat steps 1-8 for the remaining cylinders.
10. Connect the cylinder drain tubes (45), with new O-rings (46) to the cylinder drain fittings (16) on the bottom side of each cylinder. Install a new check valve (55) on the open end of the cylinder drain tubes (45); torque the drain tube "B" nuts to Appendix B specifications.
11. Proceed to Section 17-3.3, "Cylinder and Crankcase Torque."

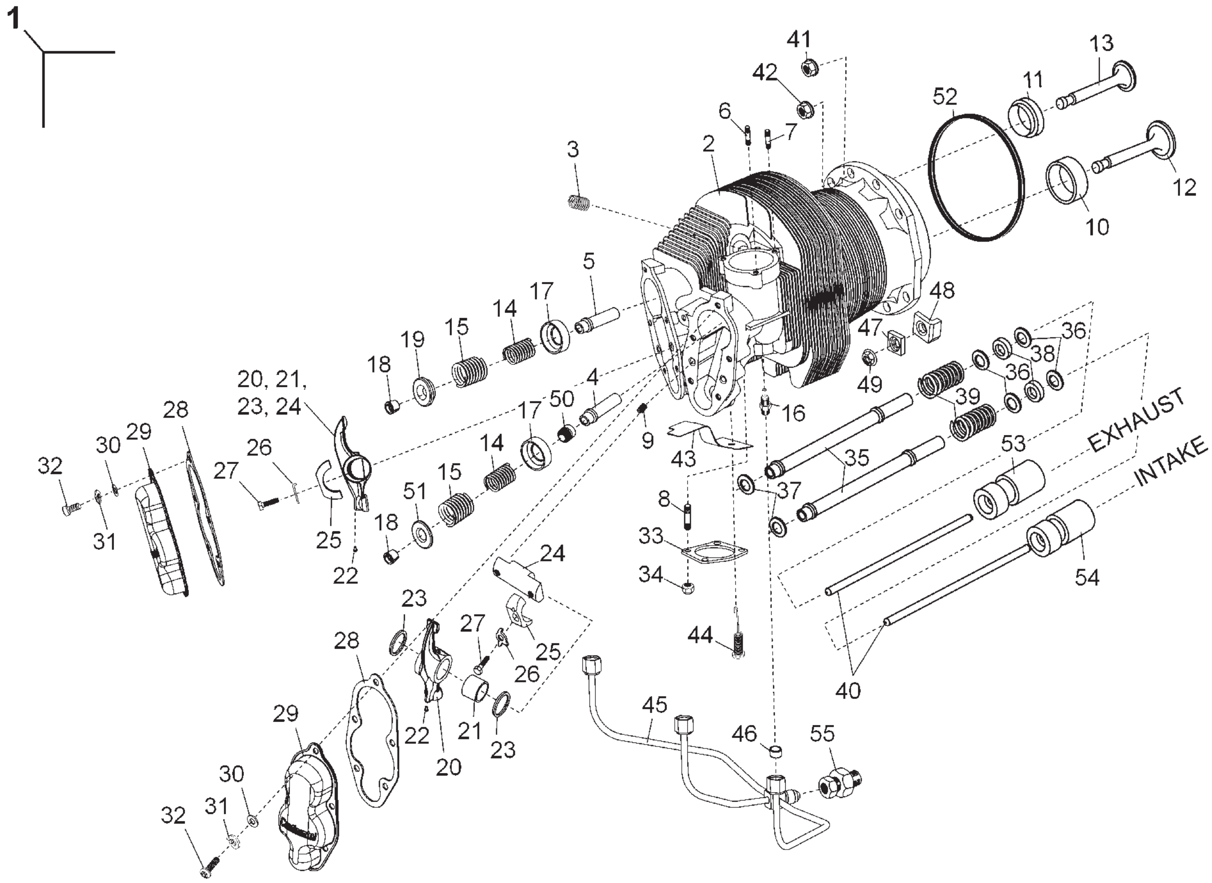


Figure 17-12 repeated for reference

17-3.3. 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 installation, have an assistant secure the opposite end of all fasteners passing through the crankcase, including through bolts; simultaneously torque each crankcase fastener in the sequence shown in Figure 17-14 to ½ the value listed in Appendix B.

   NOTE: Filled circles in Figure 17-14 indicate through-bolt positions.

2. Using the torquing sequence shown in Figure 17-14, torque nuts at positions (1 through 82) to the final torque values listed Appendix B.

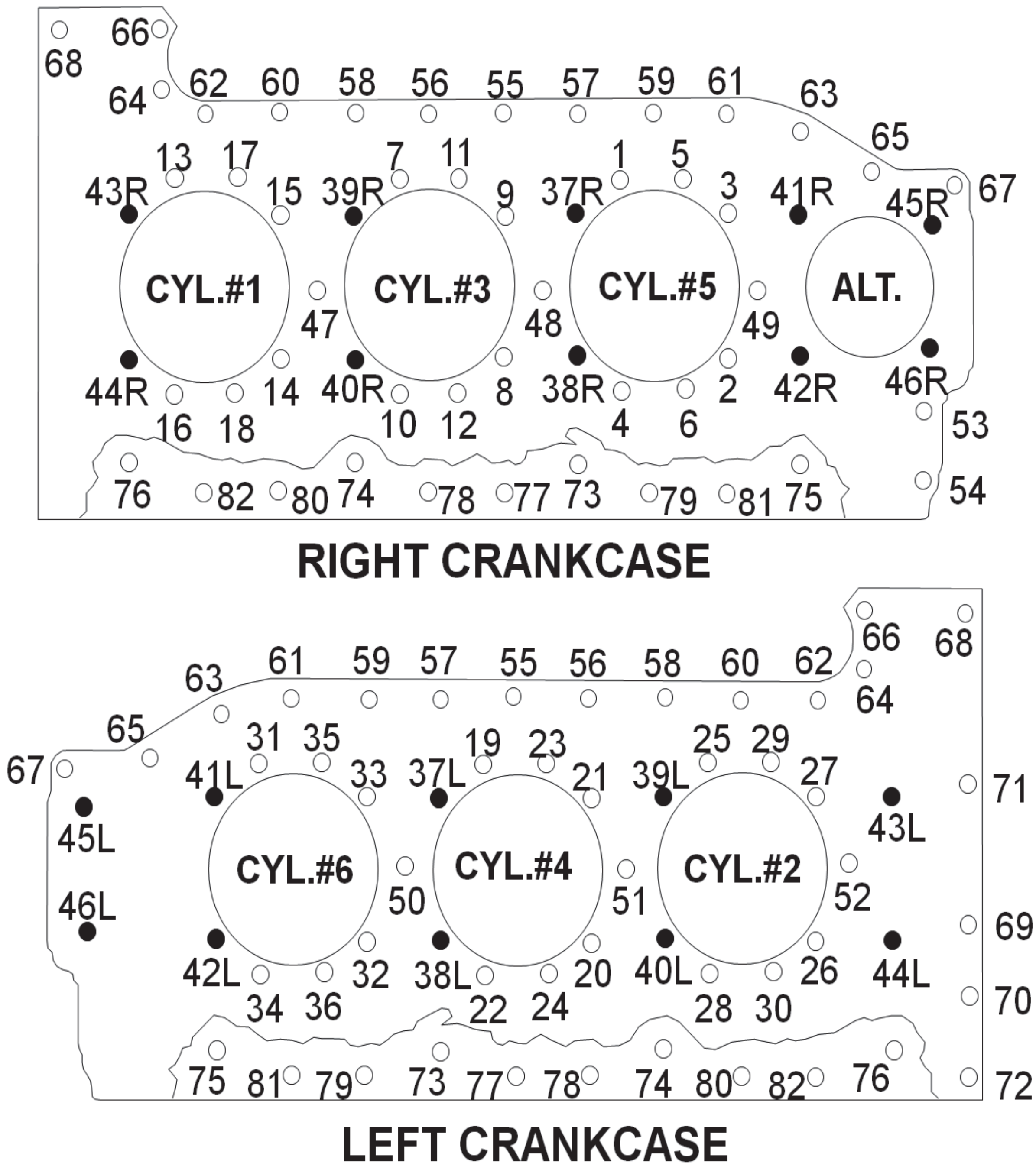


Figure 17-14. Permold Crankcase Torque Sequence

17-3.4. Crankcase Miscellaneous Hardware Installation

WARNING

Use of any form of silicone RTV or other unapproved sealant during engine assembly may cause a loss of through-bolt torque which will result in loss of main bearing crush and fretting of the crankcase parting surfaces. Fretting of the crankcase parting surfaces promotes main bearing movement which can cause oil starvation to the connecting rod journals and crankshaft journals leading to subsequent engine failure.

CAUTION: Use care to prevent displacement or damage to the crankshaft nose seal and silk thread.

1. Spray Loctite Loc Quic Primer 7649 on the oil seal counterbore and allow it to dry for 1 to 2 minutes.
2. Apply a thin translucent coat of Gasket Maker to the wall of the oil seal counterbore according to Appendix C instructions.

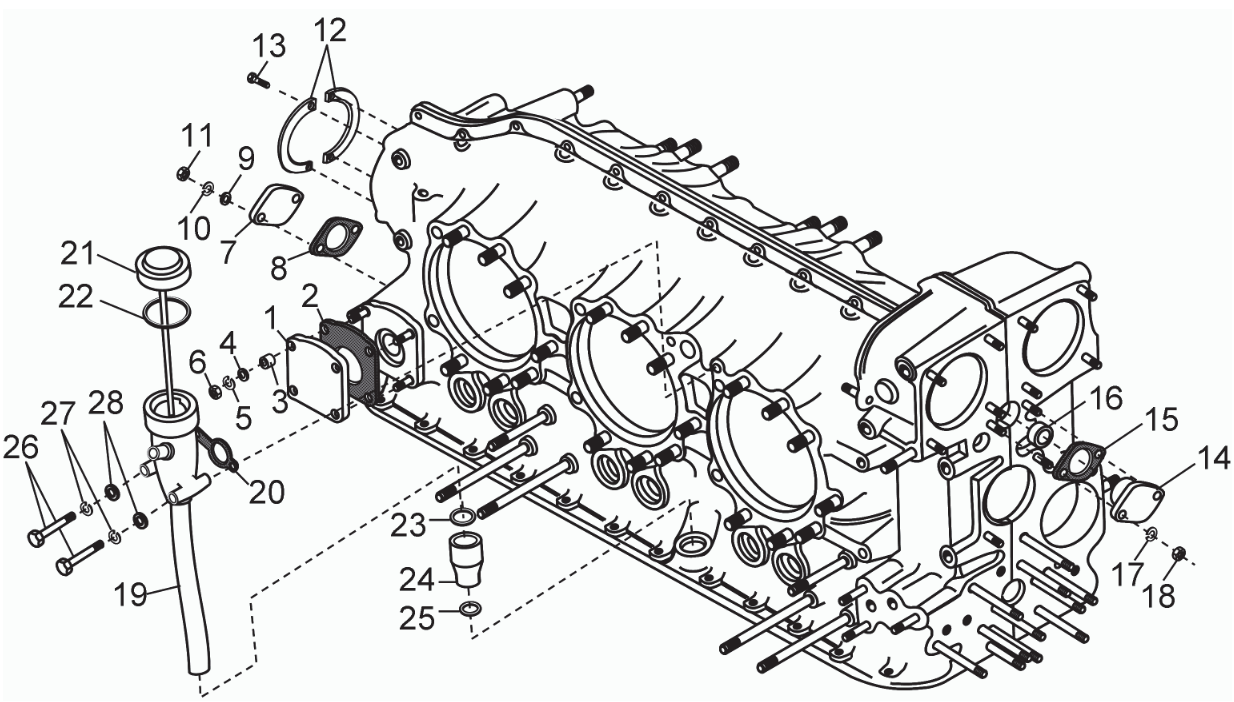


Figure 17-15. Miscellaneous Crankcase Fasteners

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

3. 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.

4. Apply Loctite 271 to the bolt (Figure 17-15) (13) threads. Apply Primer 7471 to the bolt holes; install the oil seal retainer plates (12) with bolts (13) and torque the bolts to Appendix B specifications.
5. Install the propeller governor pad cover (Figure 17-5) (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 (6) to Appendix B specifications.
6. Install a new cam cover gasket (8) and cam hole 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).
7. Coat both sides of a new flange gasket (Figure 17-5) (15) with copper coat.
8. Remove the idler gear support pin (14) which was temporarily installed during crankcase assembly. 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 washers (17) and nuts (18). Torque the nuts to Appendix B specifications.

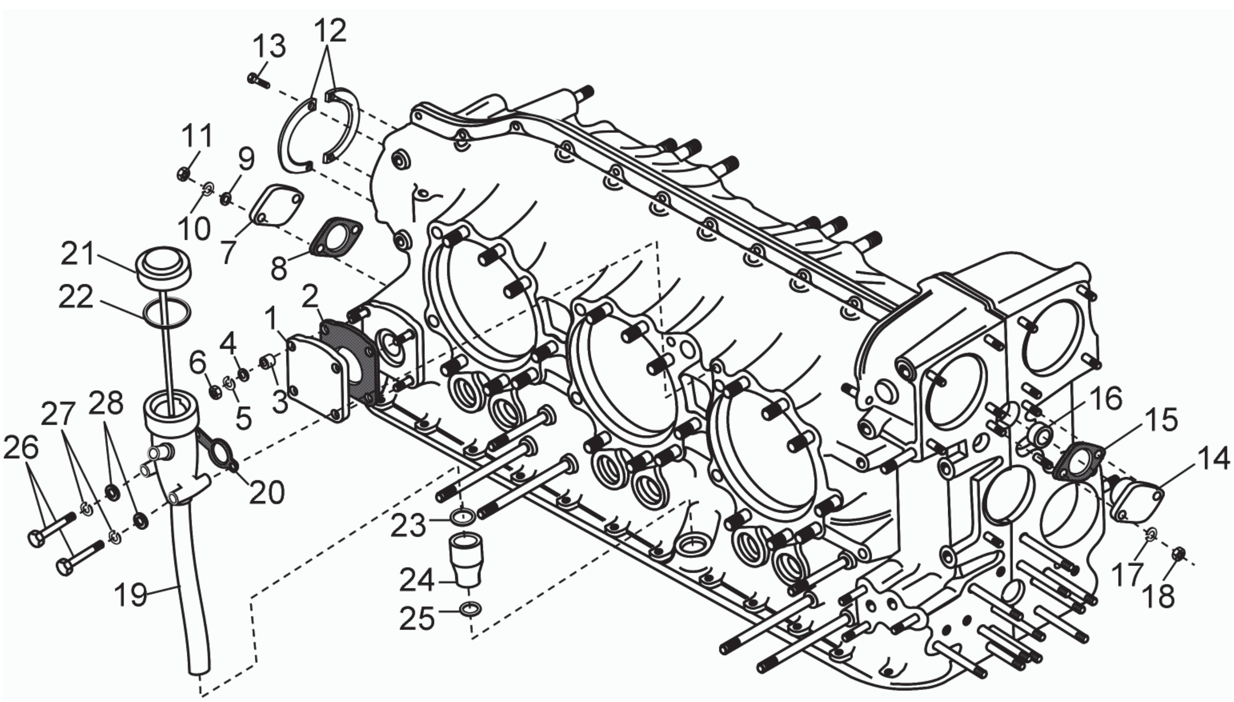


Figure 17-5 repeated for reference

17-3.5. Hydraulic Valve Tappet and Pushrod Installation

17-3.5.1. IO-550-A, B & C Valve Tappet and Pushrod Installation A B C

1. Lubricate the new 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 (Figure 17-10) (45) (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 (46) (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 12 pushrod housings (35).
   a. Using a Kent-Moore Part No. 68-3 Pushrod Spring Compressor Tool (or equivalent), compress a new spring (38).
   b. Place new packing (37) between two steel washers (36), and install on the *crankcase* end of the pushrod housing.
   c. Position the pushrod housing (35), with new packing (37) and washers (36) in the respective crankcase tappet guides.
   d. While the spring (38) is still compressed and the housing installed in the crankcase, slide a new packing (37) sandwiched between two steel washers (36) on the *cylinder* end of the pushrod housing (35).
   e. Guide the *cylinder* end of the pushrod housing (35) into the cylinder head bore while slowly releasing the tension on the pushrod spring with the Pushrod Spring Compressor Tool. Remove the Pushrod Spring Compressor Tool from the pushrod housing. Verify the packing (37) and washers (36) are properly seated in the cylinder flange.

Figure 17-16. Pushrod Housing Installation

6. Rotate the engine to the upright position on the stand.
7. Lubricate the pushrods (39) with clean 50-weight aviation engine oil and insert the pushrods through the cylinder openings into the pushrod housings (35).

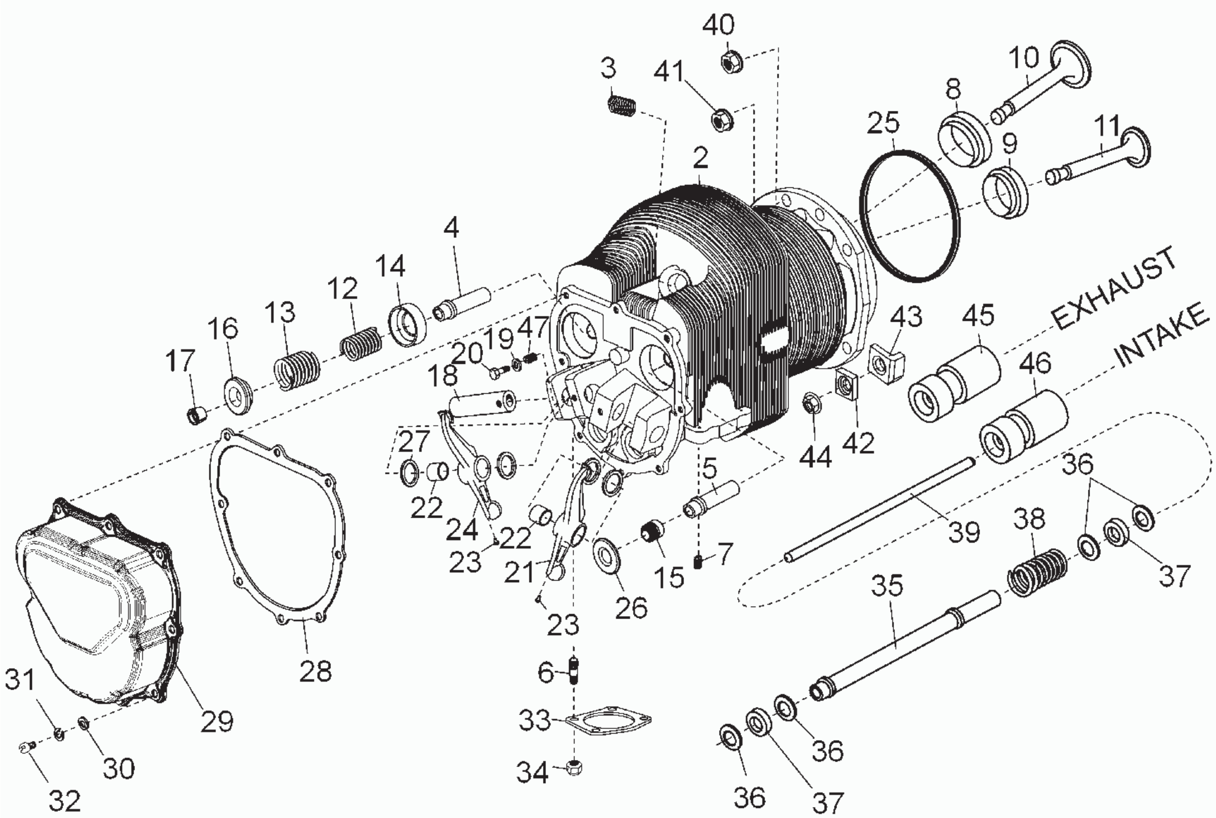


Figure 17-10 repeated for reference

17-3.5.2. IO-550-G, N, P & R Valve Tappet and Pushrod Installation G N P R

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 (Figure 17-12)(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 12 pushrod housings (35).
   a. Using a Borroughs 68-3 Pushrod Spring Compressor (Figure 17-16) or equivalent, compress a new spring (Figure 17-12) (39) on the *crankcase* end of the pushrod housing (35).
   b. Place new packing (38) between two steel washers (36), and install on the *crankcase* end of the pushrod housing (35).
   c. Place new O-ring seal (37) on the *cylinder* end of the pushrod housing.
   d. Guide the *cylinder* end of the pushrod housing (35) into the cylinder head bore while slowly releasing the tension on the pushrod spring (39) with the Pushrod Spring Compressor Tool.
   e. Verify the O-ring (37) is properly seated in the cylinder flange.

Figure 17-16 repeated for reference

6.Rotate the engine to the upright position on the stand.

7.Lubricate the pushrods (40) with clean 50-weight aviation engine oil and insert the pushrods through the cylinder openings into the pushrod housings (35).

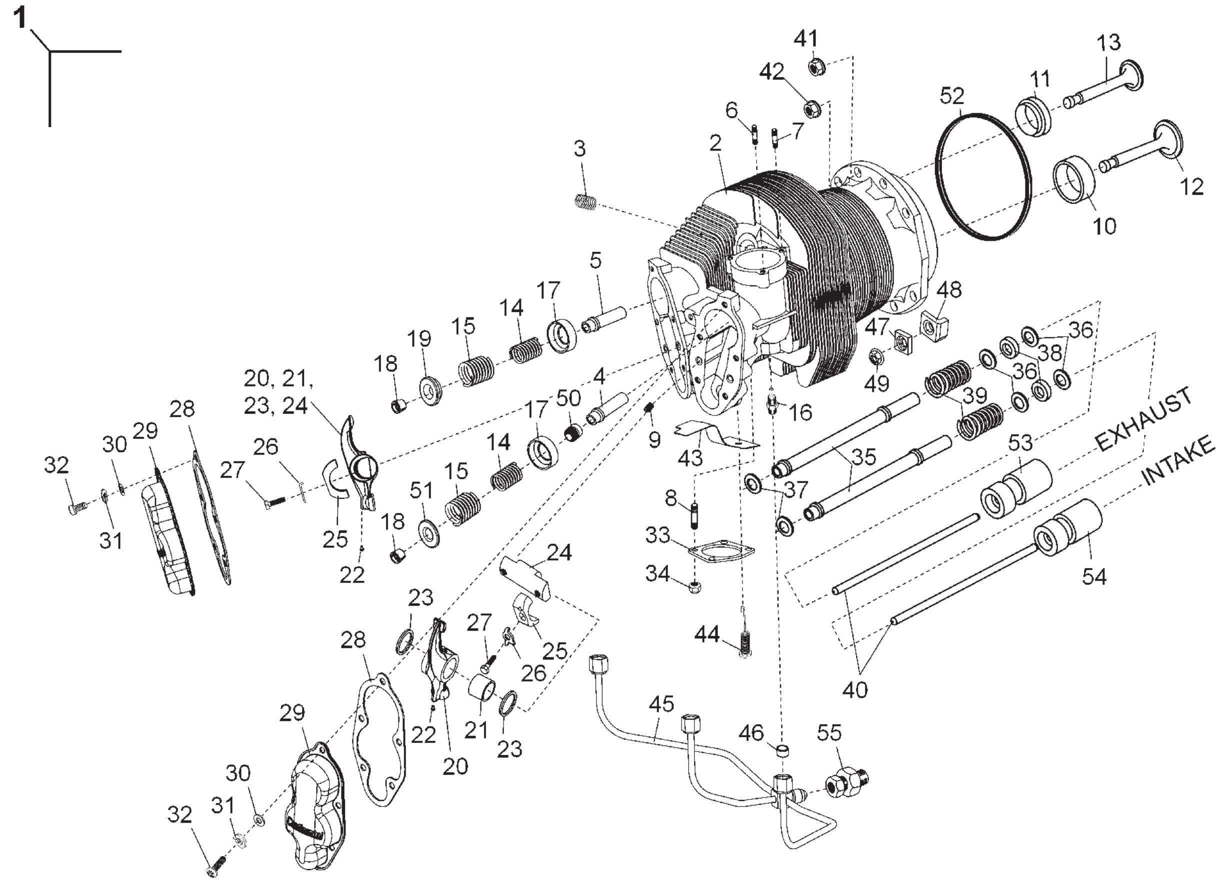


Figure 17-12 repeated for reference

17-3.6. Rocker Arm Installation

17-3.6.1. IO-550-A, B & C Rocker Arm Installation A B C

1. Rotate the crankshaft until the piston is at top dead center on the compression stroke and the pushrods for the rocker arm being installed are at their lowest position. If necessary, bleed down the lifter by applying a constant pressure on the pushrod with the cap end of the rocker arm.
2. Lubricate the rocker arms (Figure 17-10) (21 & 24), new thrust washers (27) and new rocker arm shaft (18) with clean 50-weight aviation engine oil.
3. Install a new rocker arm shaft (18) with the beveled side facing the cylinder base.
4. Slide the rocker arm shafts to the side to install the rocker arm.
5. Insert the rocker arm (24), sandwiched between two new thrust washers (27) in the rocker arm bosses.
6. Slide the new rocker shafts (18) through the boss, thrust washers and rocker arm into place, centered in the rocker arm boss; secure with washers (19) and screws (20).
7. Measure the rocker arm side clearance (Figure 17-17) between the rocker boss and rocker arms; side clearance must be 0.002 - 0.015 inches. If side clearance exceeds 0.015 inch, replace the thrust washer with a thicker (oversize) thrust washer to reduce side clearance.

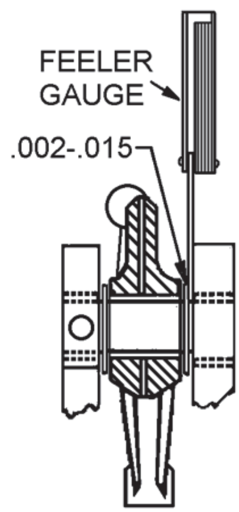


Figure 17-17. Updraft Cylinder Rocker Arm Side Clearance

8. Refer to Figure 17-18; measure the rocker arm-to-retainer clearance. If the clearance is less than 0.020, grind the underside of the rocker arm according to the instructions in Section 15-8.9.20.
9. Measure dry valve lash at valve tip-to-rocker foot by applying pressure on the rocker arm at the ball (pushrod) end. Insert a feeler gauge between the rocker arm foot and valve tip; Valve lash must not exceed Appendix D limits. Replace the pushrods with authorized over size (AO) pushrods if dry valve lash exceeds the maximum limit.

10. Align the rocker shaft (18) and rocker boss screw holes; install screws (20), new lock washers (19) and plain washers (47). Torque the screws (20) to Appendix B specifications.
11. Repeat steps 1-10 to install the valve actuating parts for the remaining cylinders.

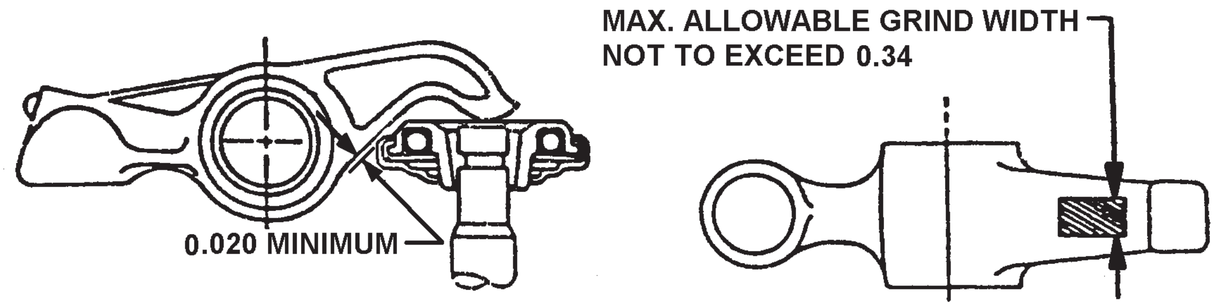


Figure 17-18. Rocker Arm to Retainer Clearance

12. Install new rocker cover gaskets (28) and the rocker covers (29); secure them with bolts (32), new lock washers (31), and washers (31).Torque the rocker cover screws (32) to Appendix B specifications.

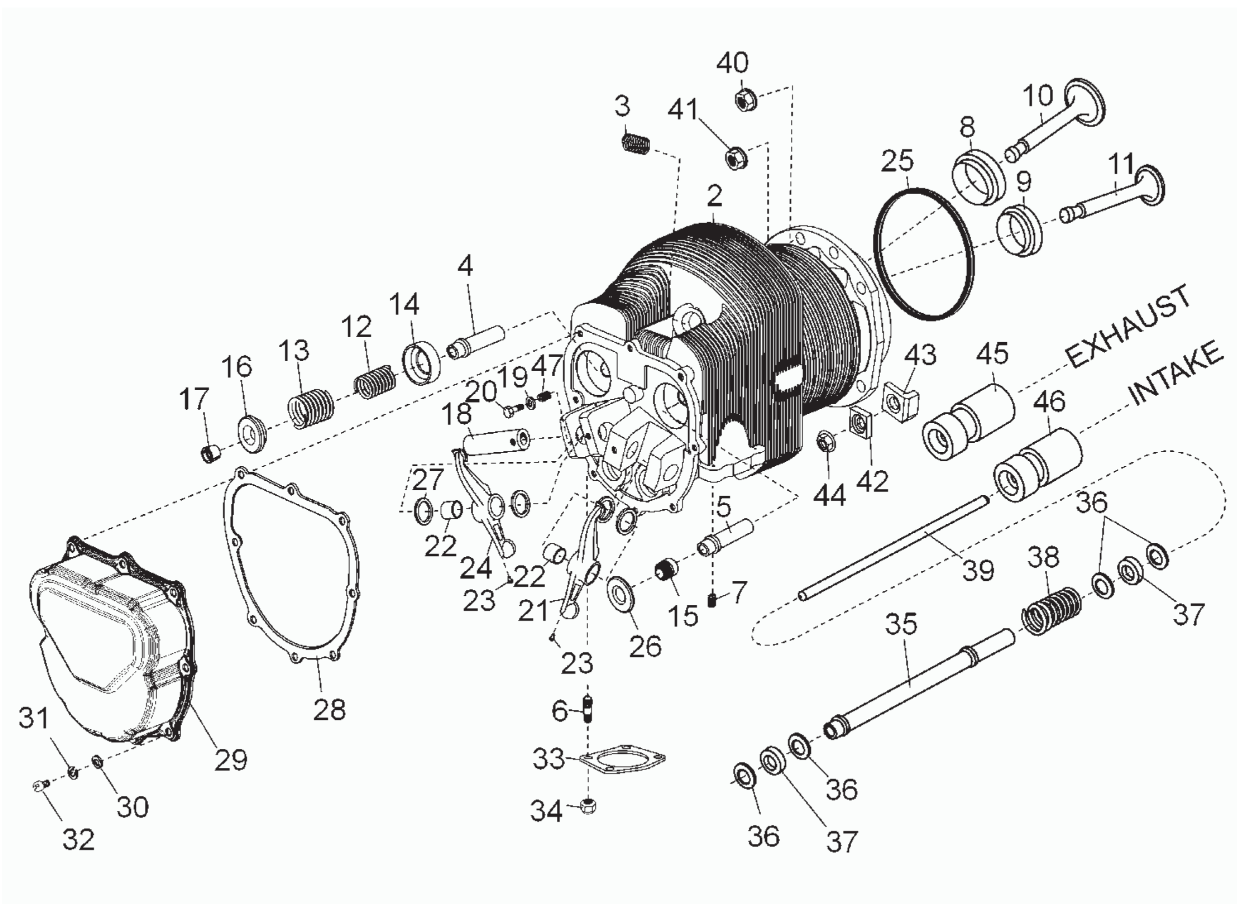


Figure 17-10 repeated for reference

17-3.6.2. IO-550-G, N, P & R Rocker Arm Installation G N P R

1. Rotate the crankshaft until the piston is at top dead center on the compression stroke and the pushrods for the rocker arm being installed are at their lowest position. If necessary, bleed down the lifter by applying a constant pressure on the pushrod with the cap end of the rocker arm.
2. Lubricate the rocker arms (Figure 17-12) (20), new thrust washers (23) and new rocker shafts (24) with clean 50-weight aviation engine oil. The beveled side of the rocker shaft (24) must be installed facing toward the cylinder base.
3. Slide the rocker shaft (24) into the rocker arm assembly. Place a thrust washer (23) outboard of each side of the rocker arm.
4. Install the rocker arms and shaft assemblies, in the correct intake and exhaust positions, on the rocker arm boss with retainers (25), new tab washers (26) and screws (27). Do not torque the screws until side clearance, rocker arm to retainer clearance and valve lash are measured.
5. Using a feeler gauge, check the side clearance between the retainers and rocker arms as illustrated in Figure 17-19; side clearance must be 0.002 - 0.015 inches. If side clearance exceeds 0.015 inch, replace the thrust washer with a thicker (oversize) thrust washer to reduce side clearance.

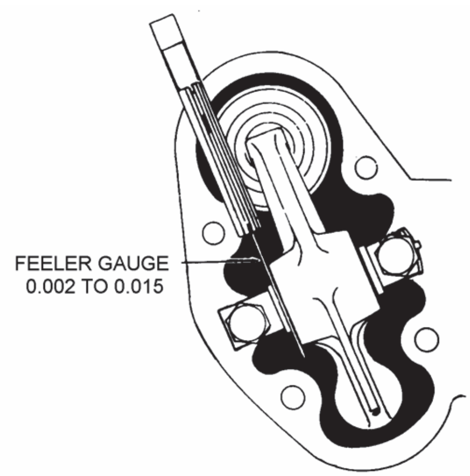


Figure 17-19. Crossflow Cylinder Rocker Arm Side Clearance

6. Measure the rocker arm-to-retainer clearance (Figure 17-18). If clearance is less than 0.020, grind the underside of the rocker arm according to the instructions in Section 15-8.9.20.
7. Measure the dry valve lash at valve tip-to-rocker foot with the piston at top dead center. Verify the dry valve lash does not exceed the overhaul limits in Appendix D. Replace the pushrods with authorized over-sized (AO) pushrods if the dry valve lash exceeds the limit.
8. If all measurements and clearances are correct, torque the screws (27) to Appendix B specifications.

9. Secure the rocker assembly to the cylinder by bending the new tab washers (Figure 17-12)(26) flat up against the head of the screws (27) according to the "Tab Washer Installation" instructions in Appendix C-5. Do not re-align the screw head to the tab washer.

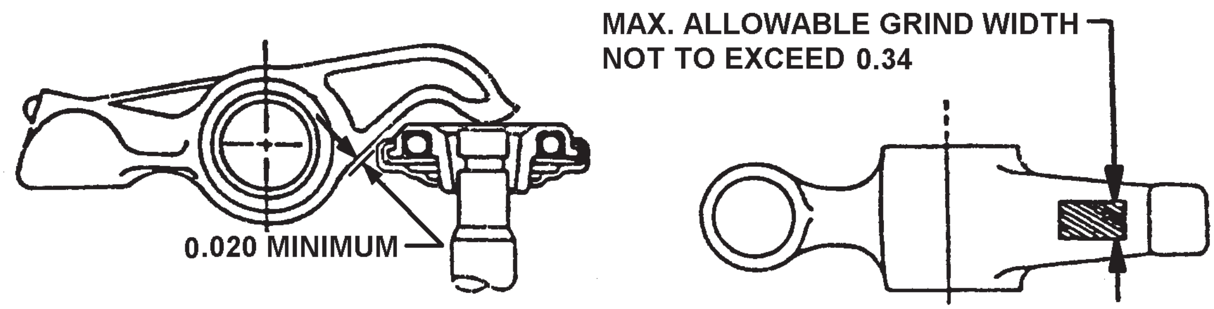


Figure 17-18 repeated for reference

CAUTION: Do not over- or under-torque bolts to align tab washers; replace the bolt and re-torque to obtain proper alignment.

10. Repeat steps 1-9 for remaining cylinders.
11. Install the rocker covers (29) with new rocker cover gaskets (28) (beaded side of gasket toward the rocker cover); secure the rocker covers with screws (32), new lock washers (31) and washers (30).
12. Torque the rocker cover screws (32) to Appendix B specifications.

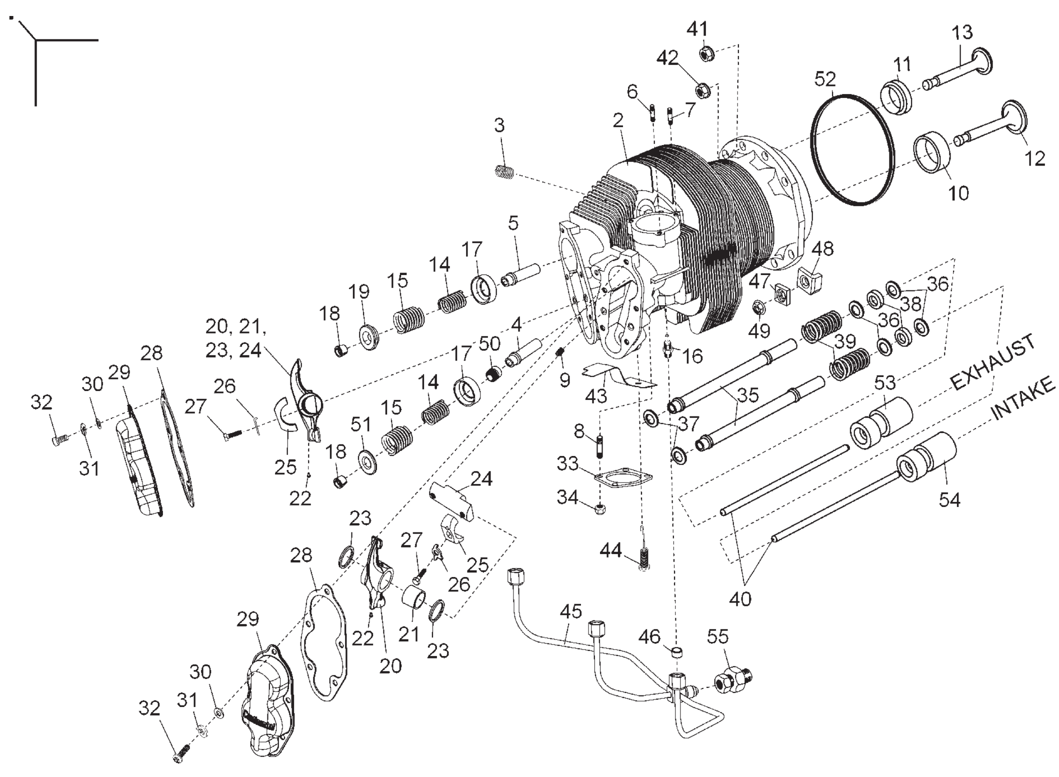


Figure 17-12 repeated for reference

17-3.7. Inter-Cylinder Baffle Installation G N P R

NOTE: IO-550-A, B & C engines are not fitted with inter-cylinder baffles, For IO-550-A, B & C engine assembly, proceed to Section 17-4.

Inter-Cylinder baffles must be either be repaired or replaced at overhaul.

1. Insert an upper baffle supports (Figure 17-20) (1) between cylinders 1 and 3, 3 and 5, and cylinders 4 and 6, aligned with cylinder barrel fins 3 and 9. Insert the 2-4 cylinder upper baffle support (2) between cylinders 2 and 4, aligned with cylinder barrel fins 3 and 9.

   N For engine specifications that employ a nut plate on the 1-3 cylinder upper baffle support (10), install the upper baffle support (10) with the nut plate oriented toward the front of the engine, above the No. 3 cylinder.

2. Below cylinders 2-4, align the lower baffle support (5) nut plate with the bolt hole in the upper baffle support (2). Install the bolt and washer (9 and 7) to secure the upper baffle support (2) to the lower baffle support (5). Torque the bolt (9) to Appendix B specifications.

3. Below cylinders 1-3 and 4-6, align the lower baffle support (6) nut plate with the bolt hole in the upper baffle support (1). Install the bolt and washer (9 and 7) to secure the upper baffle supports (1) to the lower baffle supports (6). Torque the bolts (9) to Appendix B specifications.

4. Below cylinders 3-5, align the lower baffle support (5) nut plate with the bolt hole in the upper baffle support (1). Install the bolt and washer (9 and 7) to secure the upper baffle support (1) to the lower baffle support (5). Torque the bolt (9) to Appendix B specifications.

5. Align the cylinder base baffles (3) with the screw holes in the 1-3, 3-5 and 4-6 cylinder baffle assemblies (5 or 6); secure the cylinder base baffles (3) to the baffle assemblies with a screw (8) and washer (7). Torque the screw (8) to Appendix B specifications.

6. Align the cylinder base baffle (4) with the screw hole in the 2-4 cylinder baffle assembly (6); secure the cylinder base baffles (4) to the baffle assembly with a screw (8) and washer (7). Torque the screw (8) to Appendix B specifications.

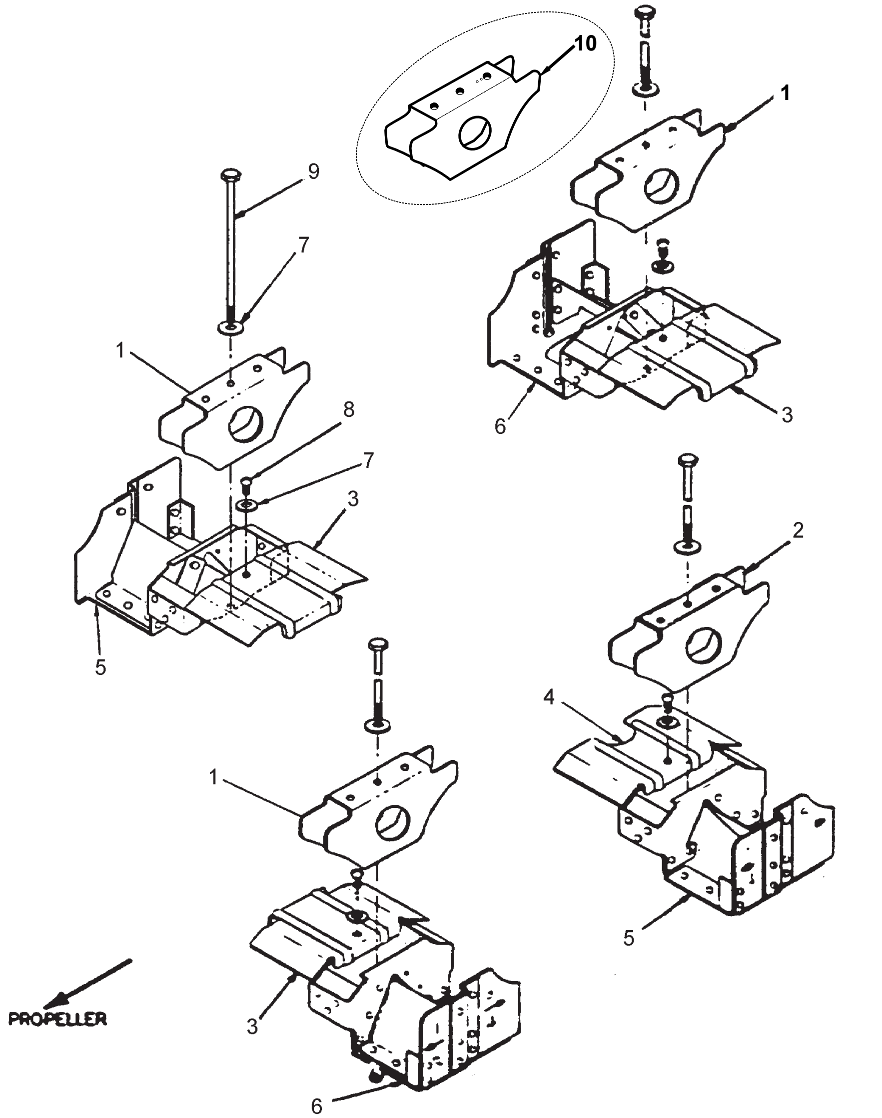


Figure 17-20. Inter-Cylinder Baffle Assembly

1	1-3; 3-5; 4-6 Cylinder Top Baffle Support	4	2-4 Cylinder Base Baffle	7	Washer	10	1-3 Cylinder Top Baffle Support (w/nut plate)
2	2-4 Cylinder Top Baffle Support	5	1-3; 4-6 Baffle Assembly	8	Screw		
3	1-3; 3-5; 4-6 Cylinder Base Baffle	6	2-4; 3-5 Baffle Assembly	9	Bolt		

17-4. Oil Sump & Suction Tube Installation

Oil sump and suction tube hardware varies by IO-550 Permold Series Engine model. Refer to the instructions matching the engine model being assembled; torque the oil sump according to the sequence shown in Figure 17-21.

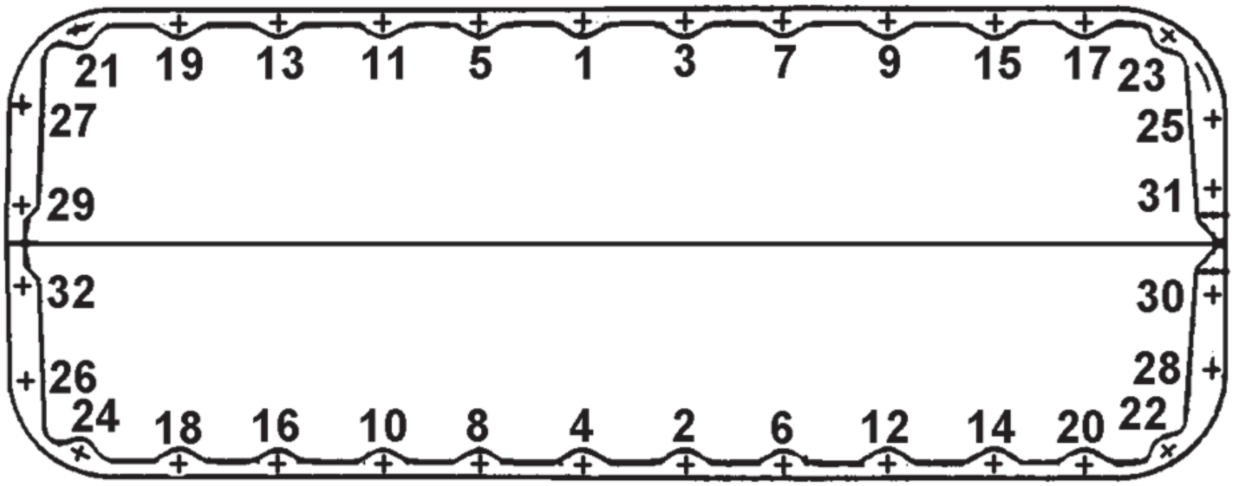


Figure 17-21. Oil Sump Torque Sequence

17-4.1. IO-550-A & C Oil Suction Tube & Sump Installation A C

1. Install a new copper gasket (Figure 17-22) (6) on the oil suction tube (1) with the split line toward the crankcase.
2. Insert the threaded end of the oil suction tube through the suction tube bore at the rear of the crankcase. Install a new copper gasket (7) and plug (8) on the protruding, threaded end of the oil suction tube. Do not torque the plug (8) at this time.
3. Install the special washer (3) on the bolt (2). Insert the bolt and washer through the bracket and crankcase from the 1-3-5 side of the engine and secure the bracket to the crankcase with a washer (4) and nut (5), torque the bolt (3) and nut (5) to Appendix B specifications.
4. Verify the crankcase belly bone bolts have been installed and torqued.
5. Verify there are no foreign objects in the engine or oil sump.
6. Install a new copper gasket (14) (with the split line toward the oil sump) on the oil sump drain plug (8).
7. Install the oil sump drain plug (8) in the bottom of the oil sump (10). Torque the drain plug (10) to Appendix B specifications and safety wire the drain plug according to the safety wiring instructions in Section C-4.
8. Apply a bead of Gasket Maker to the oil sump (10) 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 for Gasket Maker application instructions.

9. Install a new oil sump gasket (9) on the oil sump flange with the beaded side of the gasket facing the oil sump.
10. Align the oil sump gasket and oil sump assembly with the crankcase oil sump rail. Install the induction tube bracket (Figure 17-39) (15) with two bolts (12) and washers (11) at torque positions (Figure 17-21) 29 and 32. Secure the oil sump to the crankcase with bolts (Figure 17-22) (13), new lock washers (12), and washers (11). Torque the fasteners in the sequence shown in Figure 17-21.
11. Install the bracket (Figure 17-39) (19) on oil sump using attaching hardware (21, 20) and torque to Appendix B specifications.

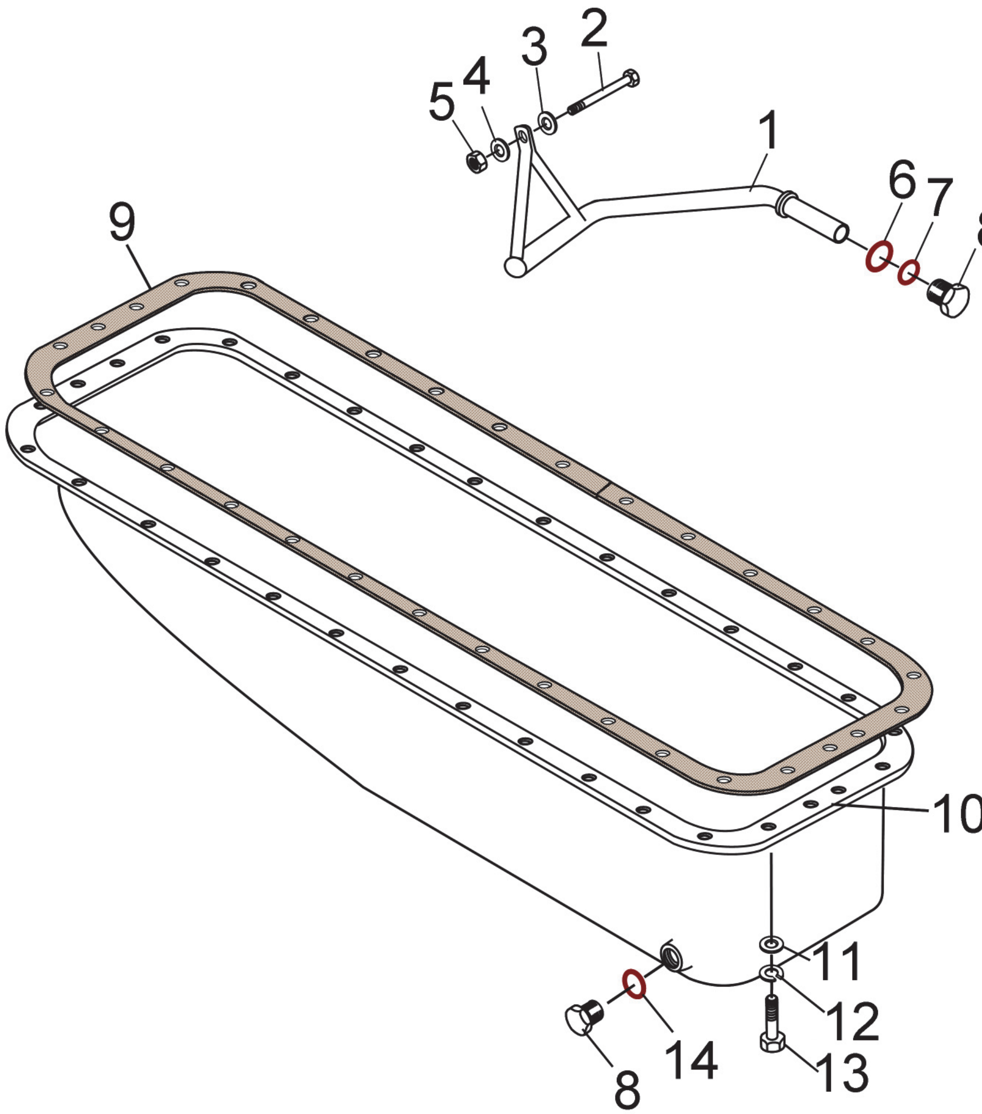


Figure 17-22. IO-550-A & C Oil Sump A C

1	Oil Suction Tube Assy	5	Nut	9	Gasket	13	Screw
2	Bolt	6	Copper Gasket	10	Oil Sump	14	Copper Gasket
3	Special Washer	7	Copper Gasket	11	Washer		
4	Washer	8	Plug	12	Lock Washer		

17-4.2. IO-550-B & R Oil Suction Tube & Sump Installation B R

1. Install a new copper gasket (3) (Figure 17-23) with the split line toward the crankcase on oil suction tube (1).

   NOTE: The oil suction tube extends through the oil pump housing. The plug (4) and copper gasket (5) will be removed and re-installed during oil pump installation on the crankcase.

2. Insert the threaded end of the oil suction tube (1) through the suction tube bore at the rear of the crankcase. Install a new copper gasket (5) and plug (4) on the protruding, threaded end of the oil suction tube. Do not torque the plug (4) at this time.
3. Fasten the oil suction tube (1) support bracket to the crankcase with bolts (2); torque the bolts to Appendix B specifications and safety wire the bolts to one another according to Appendix C safety wire instructions.
4. Install the four engine mount brackets (14) to the oil sump with washers (15) and nuts (16). Torque the nuts (16) to Appendix B specifications.
5. Apply a bead of Gasket Maker to the oil sump (7) flange; do not allow silk thread on the crankcase split line to protrude beyond the mating surface for the oil sump flange gasket (6). Refer to Appendix C for instructions on applying Gasket Maker.
6. Install a new oil sump flange gasket (6) with the beaded side of the gasket facing the oil sump.
7. Install the oil sump:

   a. B Align the gasket (6) and oil sump assembly with the crankcase oil sump rail and secure to the crankcase with bolts (12), new lock washers (11), and washers (10). Install the induction tube bracket (Figure 17-40) (12) with two bolts (12) and washers (11) at torque positions (Figure 17-21) 29 and 32. Install three L-brackets (Figure 17-40) (37) on the 1-3-5 side of the sump at torque positions (Figure 17-21) 1, 9 and 23. Torque the fasteners in the sequence shown in Figure 17-21.

   b. R Align the gasket (6) and oil sump assembly with the crankcase oil sump rail and secure to the oil sump to the crankcase with bolts (12), new lock washers (11), and washers (10). Torque the fasteners in the sequence shown in Figure 17-21.

8. Install a new felt pad (Figure 17-23) (13) with Part No. 656700 adhesive in the center of the aft end of the oil sump.
9. Install a new copper gasket (9) (with the split line toward the oil sump) on the oil sump drain plug (4).
10. Install the oil sump drain plug (4) in the bottom of the oil sump (7). Torque the drain plug (4) to Appendix B specifications and safety wire the drain plug according to the safety wiring instructions in Appendix C.

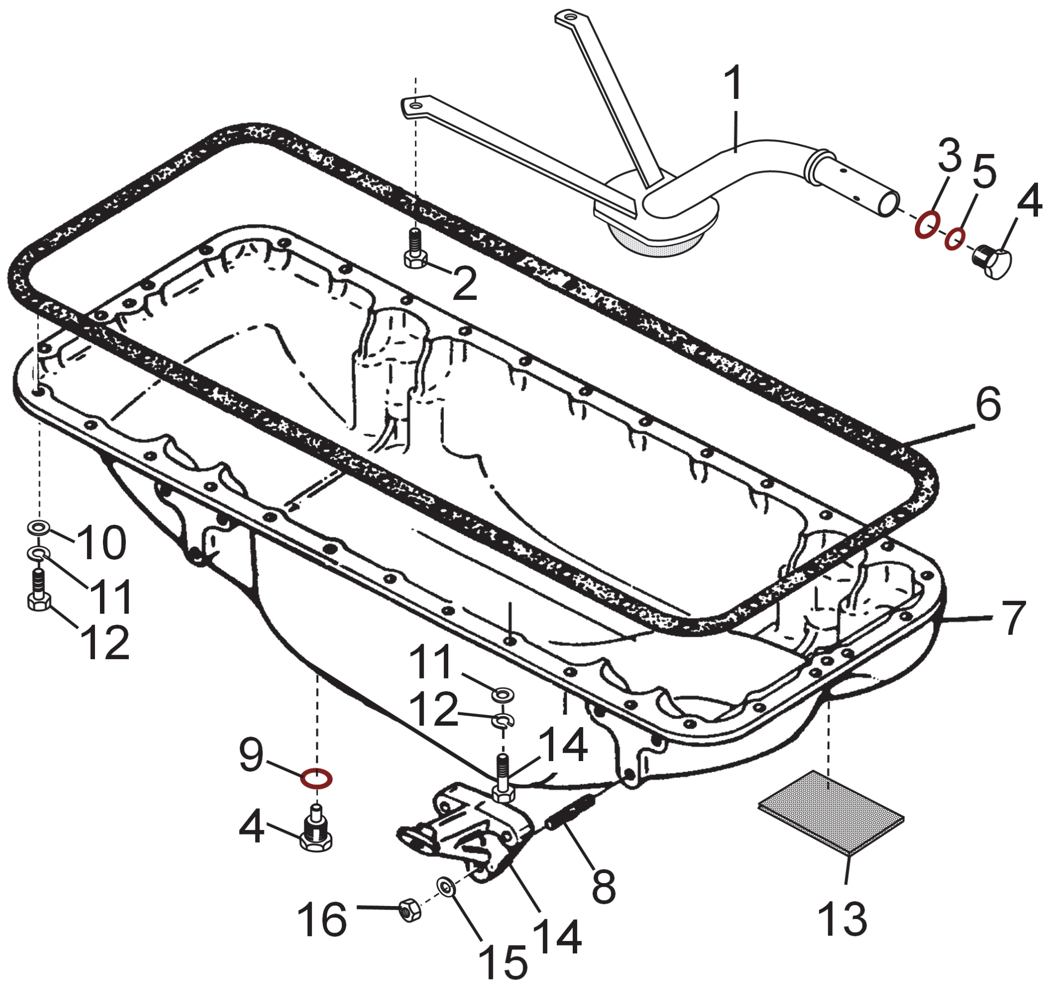


Figure 17-23. IO-550-B & R Oil Sump Assembly B R

1	Oil Suction Tube Assy	5	Copper Gasket	9	Copper Gasket	13	Felt Pad
2	Special Washer	6	Gasket	10	Washer	14	Engine Mount Bracket
3	Copper Gasket	7	Oil Sump	11	Lock Washer	15	Washer
4	Plug	8	Stud	12	Screw	16	Nut

17-4.3. IO-550-G & N Oil Suction Tube & Sump Installation G N

1. Install a new copper gasket (Figure 17-24) (6) with the split line toward the crankcase on the oil suction tube (1).
2. Insert the threaded end of the oil suction tube (1) through the suction tube bore at the rear of the crankcase.

   NOTE: The oil suction tube extends through the oil pump housing. The plug (8) and copper gasket (8) will be removed and re-installed during oil pump installation on the crankcase.

3. Install a new copper gasket (7) and plug (8) on the protruding, threaded end of the oil suction tube. Do not torque at this time.
4. Install the washer (2) on the bolt (3). Insert the bolt and washer through the bracket and crankcase from the 1-3-5 side of the engine and secure the bracket to the crankcase with two washers (3) inside the bracket against the crankcase, another washer (4) outside the bracket, and nut (5), torque the bolt (2) and nut (5) to Appendix B specifications.
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 flange gasket (9). Refer to Appendix C for instructions on applying Gasket Maker.
6. Install a new oil sump flange gasket (9) with the beaded side of the gasket facing the oil sump.
7. Install the oil sump on the crankcase. Align the gasket (9) and oil sump assembly with the crankcase oil sump rail.
8. Secure the oil sump (10) with screws (13), new lock washers (12), and washers (11). Torque the screws (13) in the sequence shown in Figure 17-21 to Appendix B specifications.
9. Install a new copper gasket (Figure 17-24) (14) (with the split line toward the oil sump) on the oil sump plug (15). Torque the drain plug (15) to Appendix B specifications and safety wire the plug according to the safety wiring instructions in Appendix C.

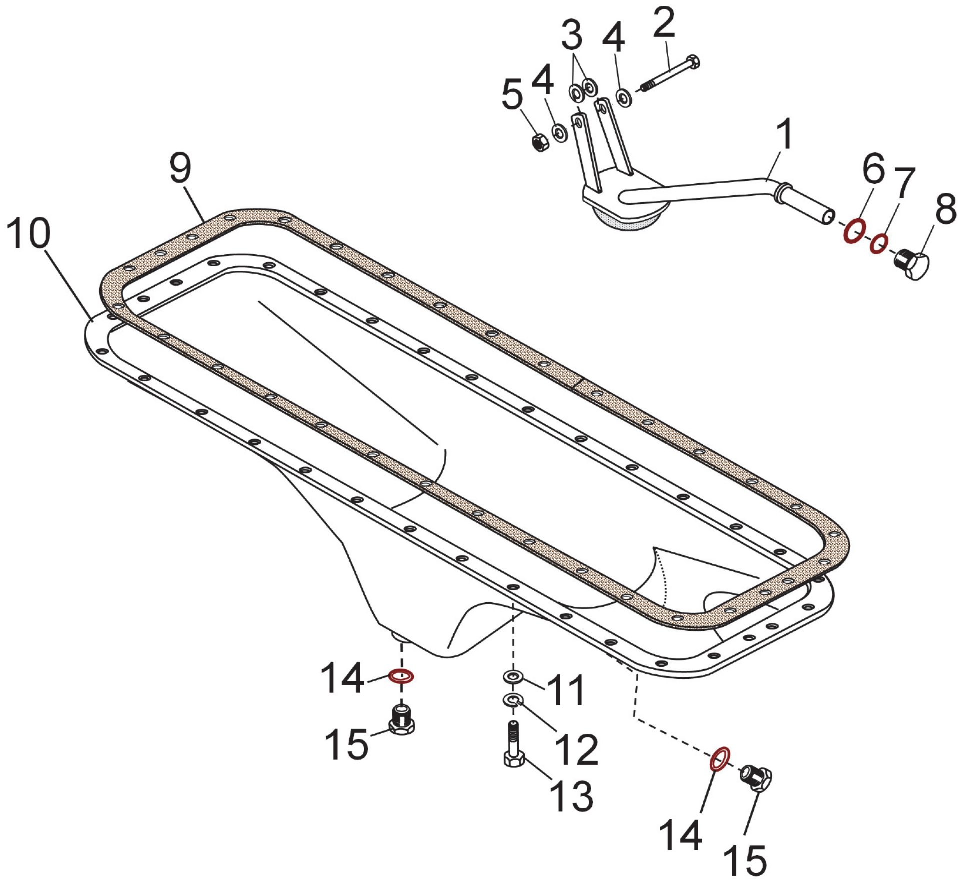


Figure 17-24. IO-550-G & N Oil Sump Assembly G N

1	Oil Suction Tube Assy	5	Nut	9	Gasket	13	Screw
2	Bolt	6	Copper Gasket	10	Oil Sump	14	Copper Gasket
3	Washer	7	Copper Gasket	11	Washer	15	Plug
4	Washer	8	Plug	12	Lock Washer		

17-4.4. IO-550-P Oil Sump Installation P

1. Install a new copper gasket (Figure 17-25) (1) with the split line toward the crankcase on the oil suction tube (2).
2. Insert the threaded end of the oil suction tube (1) through the suction tube bore at the rear of the crankcase.

   NOTE: The oil suction tube extends through the oil pump housing. The plug (12) and copper gasket (5) will be removed and re-installed during oil pump installation on the crankcase.
3. Install a new copper gasket (5) and plug (12) on the protruding, threaded end of the oil suction tube. Do not torque at this time.
4. Install a washer (13) on the bolt (4). Insert the bolt and washer through the bracket and crankcase from the 1-3-5 side of the engine and secure the bracket to the crankcase with two washers (3) inside the bracket against the crankcase, another washer (13) outside the bracket, and nut (14), torque the bolt (4) and nut (14) to Appendix B specifications.
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 flange gasket (6). Refer to Appendix C for instructions on applying Gasket Maker.
6. Install a new oil sump flange gasket (6) on the oil sump (7) with the beaded side of the gasket facing the oil sump.
7. Align the gasket (6) and oil sump assembly with the crankcase oil sump rail. Secure the oil sump (7) with screws (10), washers (9), and new lock washers (12). Torque the screws (10) to Appendix B specifications, in the sequence shown in Figure 17-21.
8. Install a new copper gasket (Figure 17-25)(11) (with the split line toward the oil sump) in the oil sump plug (12). Torque the plug (12) to Appendix B specifications and safety wire the plug per safety wiring instructions in Section C-4.

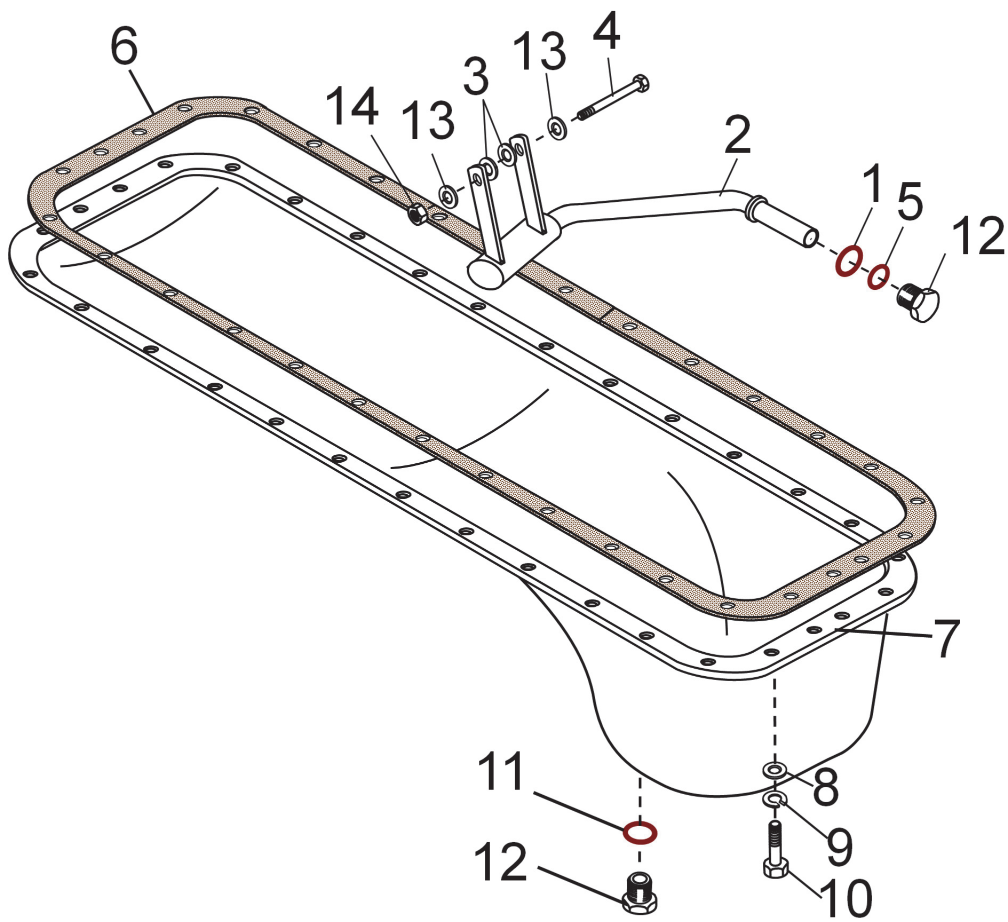


Figure 17-25. IO-550-P Oil Sump Assembly P

1	Copper Gasket	5	Copper Gasket	9	Lock Washer	13	Washer
2	Oil Suction Tube	6	Gasket	10	Screw	14	Nut
3	Washer	7	Oil Sump	11	Copper Gasket		
4	Washer	8	Washer	12	Drain Plug		

17-5. Oil Pump Installation

Different oil pumps are used on various Permold engine series. Identify the oil pump installed your engine and refer to the corresponding sections herein for removing the oil pump. The key difference between pumps is the availability and type of tachometer drive assembly. Match your pump to the options in the illustration.

> NOTE: To identify the oil pump installed on your engine, refer to Figure 17-26. If you need help, refer to continentalmotors.aero or contact a service representative according to the "Contact Information" in Chapter 1.

1. Remove the plug (Figure 17-26) (9) and gasket (10) from the oil suction tube.
2. Apply Gasket Maker to the silk thread and split line of the crankcase at the oil pump bore. Refer to Section C-10 for instructions on applying Gasket Maker.
3. Bend the silk thread ends into the split line of the oil pump bore.
4. Place the oil pump (1) with a new oil pump gasket (2) on the crankcase studs.
5. Secure the oil pump to the crankcase with washers (3), and new lock washers (4), and nuts (5). Torque the nuts (5) to Appendix B specifications.
6. Install the oil filter adapter (13) with a new gasket (12) on the oil pump housing studs. Fasten the oil filter adapter securely with three sets of washers (6), new lock washers (7) and nuts (8). Torque the nuts (8) to Appendix B specifications.
7. Apply a thin coat of Dow Corning No. 4 to the oil filter seal.
8. Install a new oil filter (11) but do not torque at this time. The oil filter will be loosened during engine installation for engine pre-oiling.
9. Install the plug (9) and the new gasket (10). Torque the plug to Appendix B specifications. Safety wire the plug according to Section C-4 safety wire instructions.

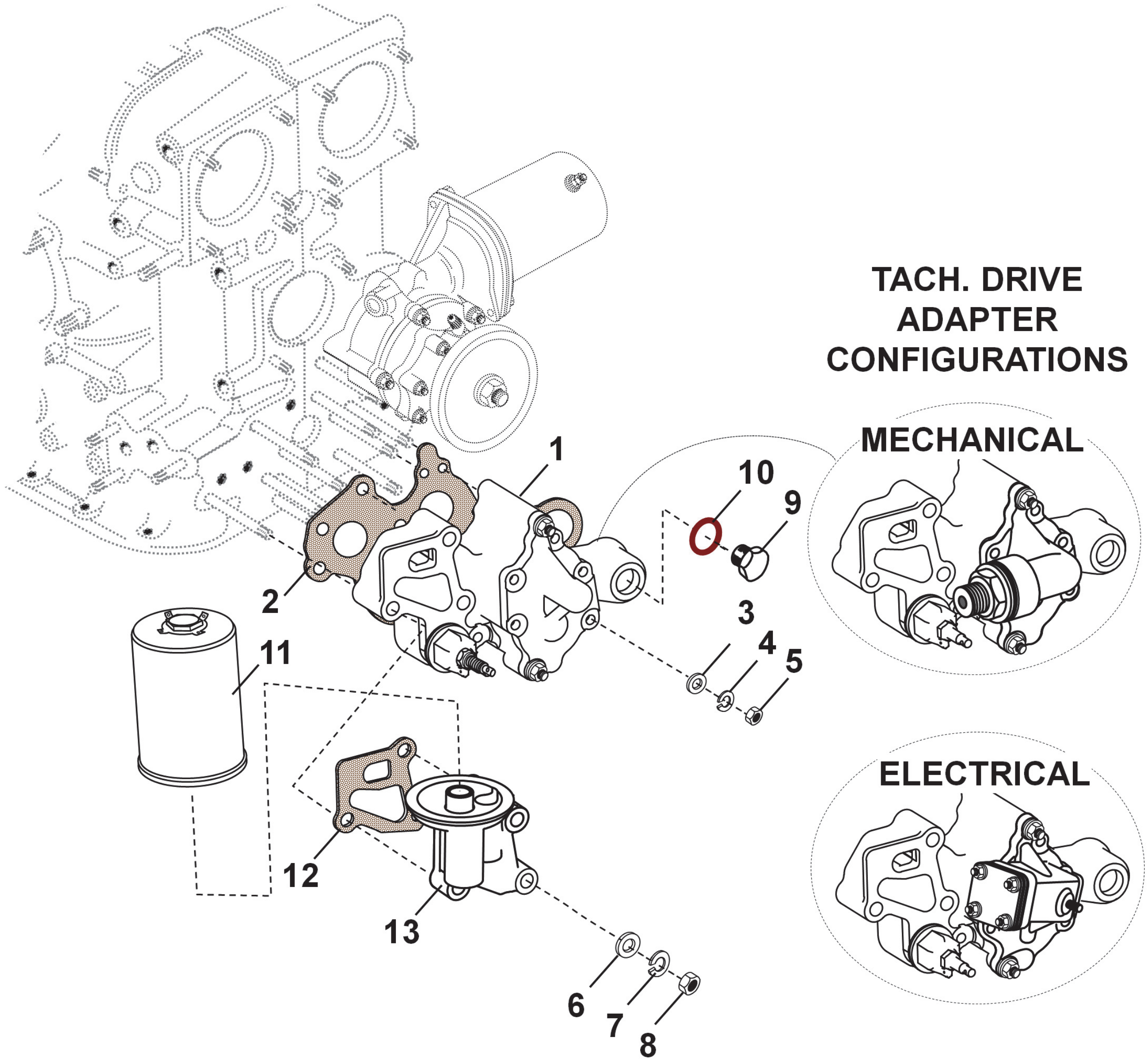


Figure 17-26. Oil Pump Assembly

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

17-6. Accessory Drive Pad Installation

WARNING

Oil pressure is applied to the face of the accessory drive pads. Apply proper gasket and torquing procedures.

NOTE: Accessory/magneto drive pads are fundamentally the same in the IO-550 engine model family except some use studs while others have bolts to attach the accessories.

1. Place two new gaskets (Figure 17-28) (1) on the two upper mount pads at the rear of the crankcase. The oil holes in gaskets must be aligned with the crankcase oil outlet holes.

   NOTE: The upper inboard stud for the accessory drive adapter is 0.38” diameter. The remaining crankcase mounting studs for the accessory drive adapter are 0.31” diameter. The accessory drive adapter oil feed holes are on a diagonal opposite (lower outboard) the 0.38” stud location.

2. Install two adapter assemblies (2) on the crankcase mount pads. The adapter oil holes must be aligned with the crankcase oil outlet holes.
3. Fasten the accessory drive adapters to the crankcase upper inboard studs with washers (7), new lock washers (9) and nuts (11).
4. Attach the rear lifting eye to the upper inside stud on each of the accessory drive pad adapters (2) and secure with washers ((7), new lock washers (9) and nuts (11).
5. C For IO-550-C engines only, attach the throttle support bracket (Figure 17-27) to the accessory drive adapter inside lower stud positions and secure with washers (Figure 17-28) (6), new lock washers (8) and nuts (10).
6. Fasten the accessory drive adapters to the remaining crankcase studs with washers (6), new lock washers (8) and nuts (10).

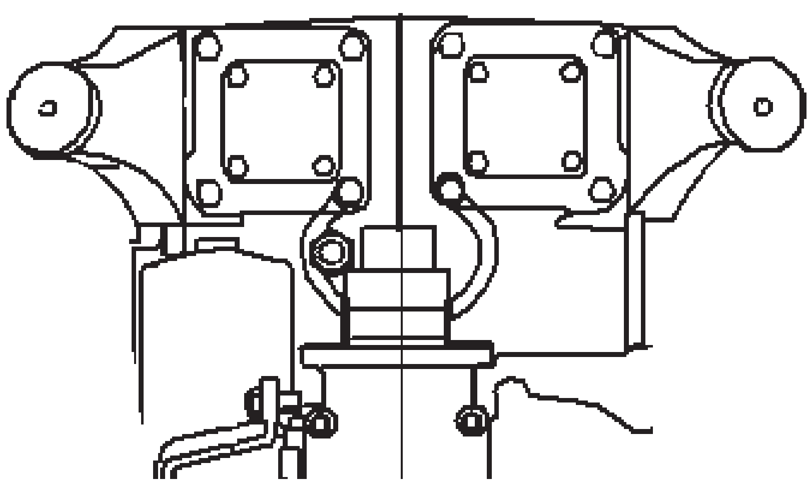


Figure 17-27. IO-550-C Throttle Support Bracket C

7. Torque the nuts (10 & 11) to Appendix B specifications.

8. Place a new gasket (12) and accessory drive cover (13) on each accessory drive adapter and secure with four washers (14), new lock washers (15), and nuts (16).

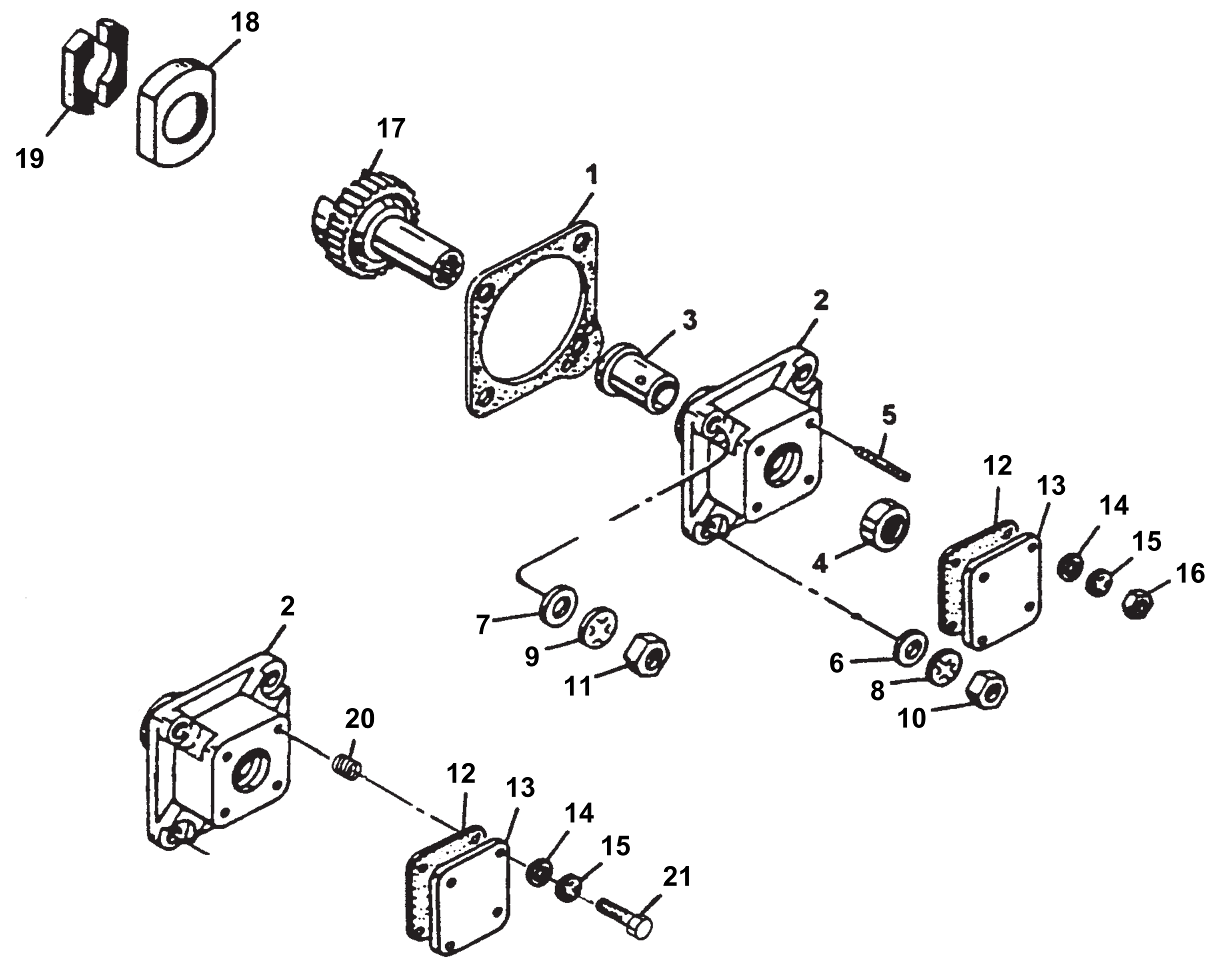


Figure 17-28. Accessory Drive Adapter Assembly

1	Gasket	7	Plain Washer	13	Cover	19	Rubber Bushing
2	Adapter Assembly	8	Lock Washer	14	Washer	20	Helical Coil Insert
3	Bushing	9	Lock Washer	15	Lock Washer	21	Bolt
4	Oil Seal	10	Nut	16	Nut		
5	Stud	11	Nut	17	Drive Gear Assembly		
6	Plain Washer	12	Gasket	18	Retainer		

17-7. Starter and Starter Adapter Installation

1. Apply a thin, translucent coating of Gasket Maker to the silk thread on the crankcase and lay it in the split line inward towards the starter adapter bore.
2. Install a new starter adapter gasket over the studs on the rear of the crankcase. Verify that silk thread is under the starter adapter gasket and is not exposed.
3. Lubricate the starter shaftgear teeth with clean 50 weight aviation engine oil and mesh with 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 (10) to seat the adapter against gasket (9).
4. Install washers (16), new lock washers (15), and nuts on the crankcase studs extending from the starter adapter cover (10).
5. Install washers (6), new lock washers (7), and nuts (8) on the starter adapter studs passing through the crankcase forward of the starter adapter.
6. Refer to Figure 17-28; install the four sets of attaching hardware (47 and 49) with new lock washers (48) to mount the adapter (1). Torque the four nuts (49) to Appendix B specifications.

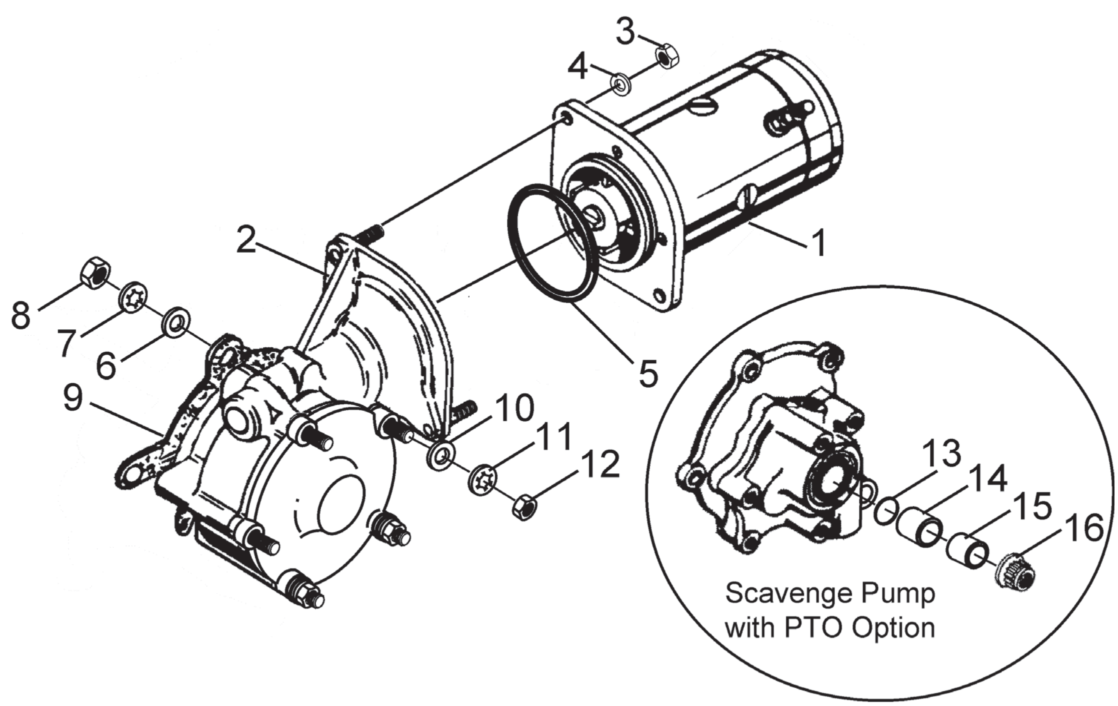


Figure 17-29. Starter and Adapter Assembly

1	Starter Motor	5	O-ring	9	Gasket	13	O-Ring
2	Starter Adapter	6	Washer	10	Washer	14	Sleeve
3	Nut	7	Lock washer	11	Lock washer	15	Spacer
4	Washer	8	Nut	12	Nut	16	12 Point Nut

17-8. Oil Cooler Installation

NOTE: The oil cooler must be disassembled, cleaned, overhauled, and assembled by an appropriately rated FAA (or foreign country equivalent) 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.

IO-550 oil cooler assemblies vary by engine model. Refer to the appropriate subsection matching the engine model configuration for installation instructions.

17-8.1. IO-550-A & B Oil Cooler Installation A B

1. Install plugs, fittings, and the oil temperature control valve in the appropriate oil cooler locations.
   a. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.125” fitting (Figure 17-30) (12 & 13) threads. Install the pipe fitting (12, 13 & 14) in the inboard ports at the bottom of the oil cooler. Torque the fittings to Appendix B specifications.
   a. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.38” fitting (14) threads. Install the fitting (14) in the outboard port at the bottom of the oil cooler. Torque the fitting to Appendix B specifications.
   b. Apply Anti-Seize lubricant to the oil temperature control valve (15) threads and install the valve with a new gasket (16) in the oil temperature control valve port on the bottom of the oil cooler.
2. Position the oil cooler baffle (2) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler.
3. Secure the oil cooler baffle (2) with four equally-spaced staples.
4. Coat the mounting stud threads with Anti-Seize lubricant and install the gasket washers (4) on the studs.
5. Apply a light coating of Gasket Maker to the crankcase oil cooler pad and allow to cure to a light tack.
6. Install a new gasket (4) on the crankcase oil cooler mounting pad.
7. Install the oil cooler assembly over the studs starting on the lower left side of the oil cooler using washers, (5), new lock washers (6) and flanged nuts (8) on the forward studs and a washer (9), new lock washer (10) and nut (11) on the aft stud. Install washers (5), new lock washers (6) and nuts (7) on the studs at the top of the oil cooler. Torque the nuts to Appendix B specifications.

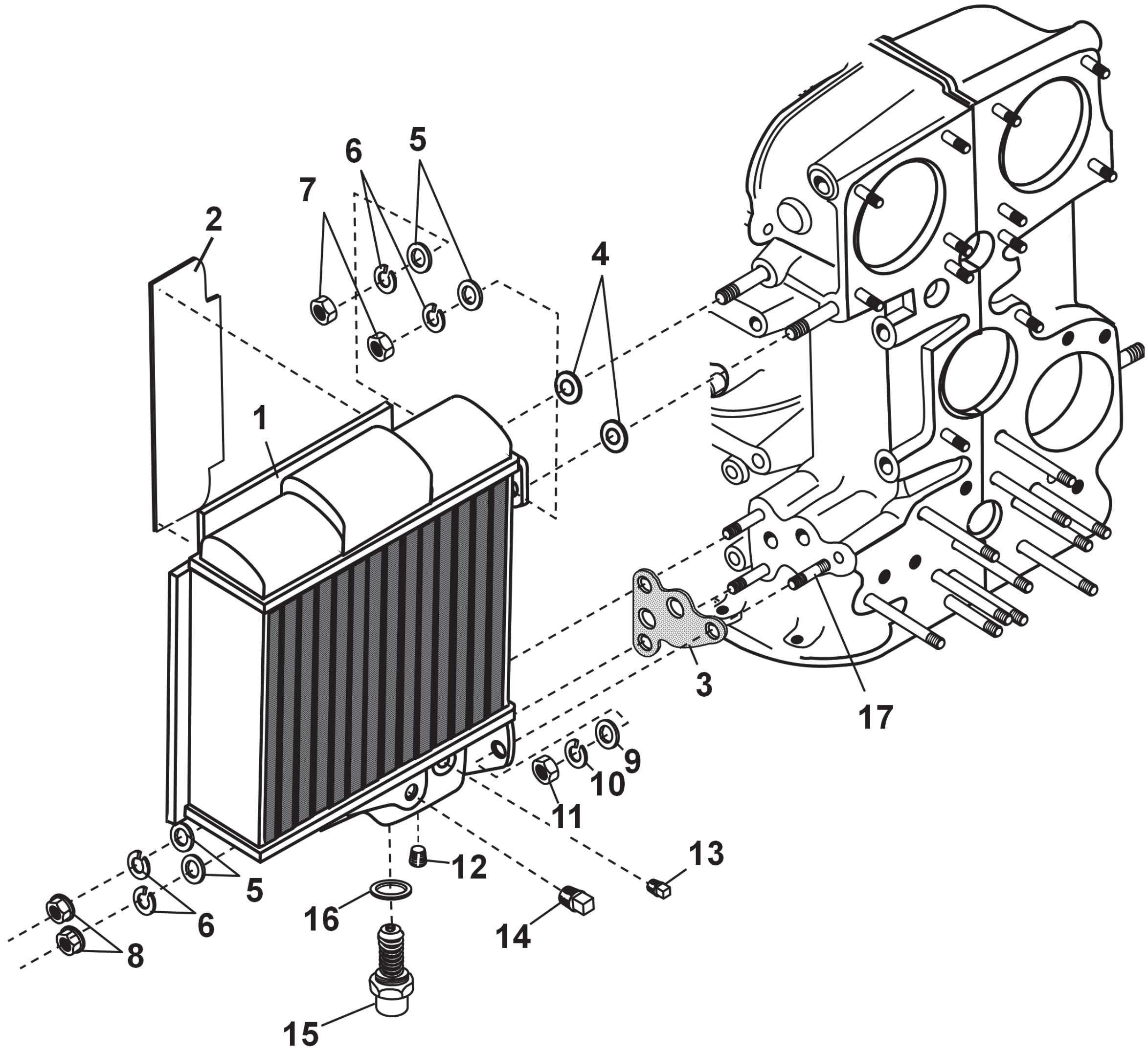


Figure 17-30. IO-550-A & B Oil Cooler Assembly A B

1	Oil Cooler	5	Washer	9	Washer	13	Plug
2	Baffle	6	Lock Washer	10	Lock Washer	14	Plug
3	Gasket	7	Nut	11	Nut	15	Oil Temp.Control Valve
4	Gasket-Washer	8	Flanged Nut	12	Plug	16	Gasket

17-8.2. IO-550-C Oil Cooler Installation C

1. Install plugs, fittings, and the oil temperature control valve in the appropriate oil cooler locations.
   a. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.125” fitting (Figure 17-31) (13, 14 & 16) threads. Install the pipe fitting (13, 14 & 16) in the inboard ports at the bottom of the oil cooler. Torque the fittings to Appendix B specifications.
   b. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.38” fitting (15) threads. Install the fitting (15) in the outboard port at the bottom of the oil cooler. Torque the fitting to Appendix B specifications.
   c. Apply Anti-Seize lubricant to the oil temperature control valve (18) threads and install the valve with a new gasket (17) in the oil temperature control valve port on the bottom of the oil cooler.
2. Position the oil cooler baffle (2) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler.
3. Secure the oil cooler baffle (2) with four equally-spaced staples.
4. Coat the mounting stud threads with Anti-Seize lubricant and install the gasket washers (4) on the studs.
5. Apply a light coating of Gasket Maker to the crankcase oil cooler pad and allow to cure to a light tack.
6. Place new O-rings (12) in the oil feed hole counterbores on both sides of the 2-4-6 side aft engine mount. Ensure the O-rings fit smoothly in the counterbore, without twisting or deformation to avoid oil leaks.
7. Install the 2-4-6 side aft engine mount on the crankcase studs.
8. Install the oil cooler assembly over the studs starting on the lower left side of the oil cooler using washers, (5), new lock washers (6) and flanged nuts (8) on the forward studs and a washer (9), new lock washer (10) and nut (11) on the aft stud. Install washers (5), new lock washers (6) and nuts (7) on the studs at the top of the oil cooler. Torque the nuts to Appendix B specifications.

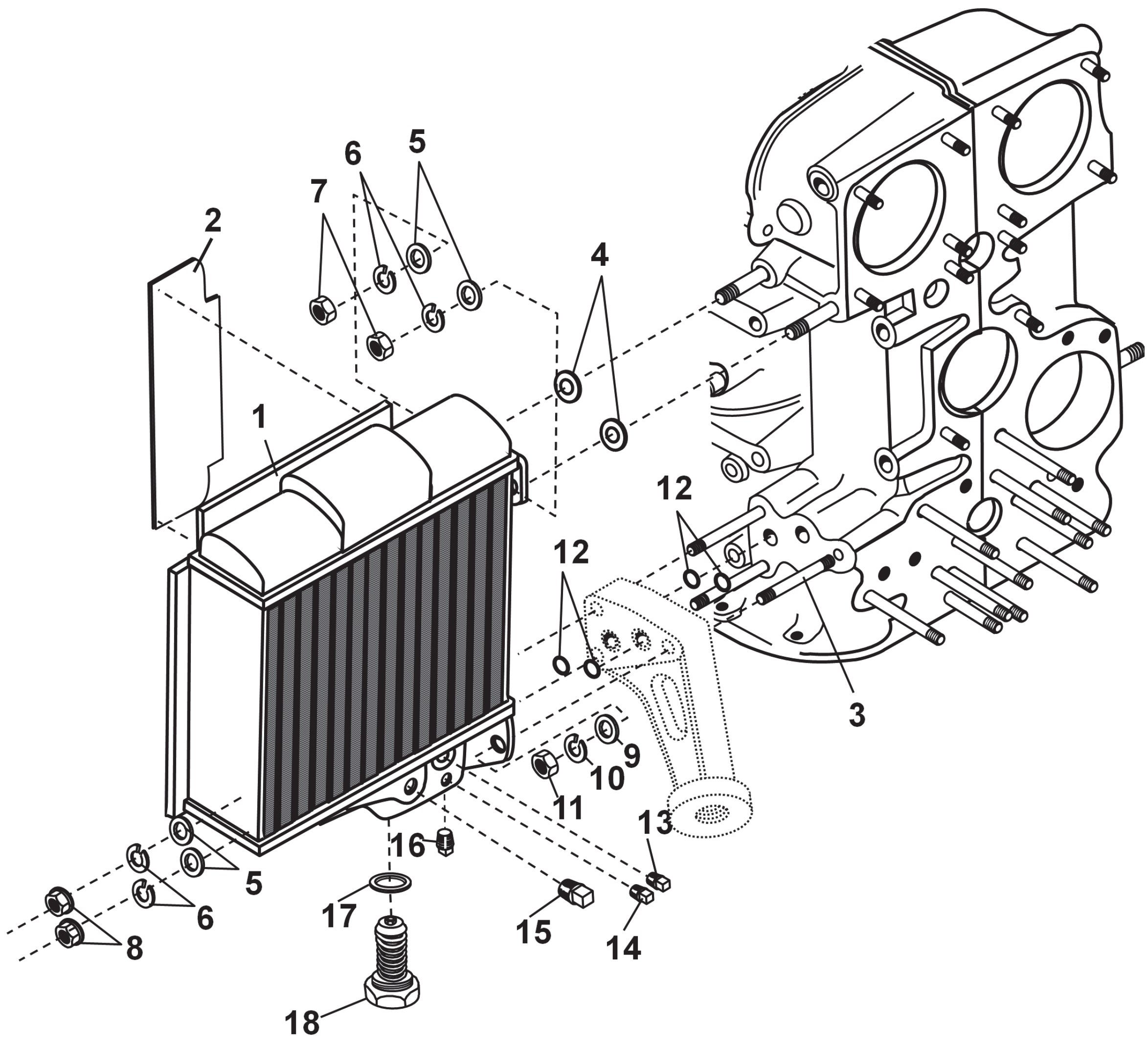


Figure 17-31. IO-550-C Oil Cooler C

1	Oil Cooler	6	Lock Washer	11	Nut	16	Plug
2	Baffle	7	Nut	12	O-ring	17	Gasket
3	Stud	8	Flanged Nut	13	Plug	18	Oil Temp.Control Valve
4	Gasket-Washer	9	Washer	14	Plug		
5	Washer	10	Lock Washer	15	Plug		

17-8.3. IO-550-G, N, P & R Oil Cooler Installation G N P R

1. Install plugs, fittings, and the oil temperature control valve in the appropriate oil cooler locations.
   a. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.125” pipe fitting (Figure 17-32)(12 & 13) threads. Install pipe fittings (12 & 13) in the ports at the bottom of the oil cooler. Torque the pipe plug to Appendix B specifications.
   b. The inboard middle 0.125” pressure port (18) is the oil pressure gauge source. Install the fitting designated by the aircraft manufacturer in the inboard middle pressure port.
   c. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.38” fitting (14) threads. Install the fitting (14) in the outboard port at the bottom of the oil cooler. Torque the fitting to Appendix B specifications.
   d. Apply Anti-Seize lubricant to the oil temperature control valve (15) threads and install the valve with a new gasket (16) in the oil temperature control valve port on the bottom of the oil cooler.
2. Position the oil cooler baffle (2) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler.
3. Secure the oil cooler baffle (2) with four equally-spaced staples.
4. Coat the mounting stud threads with Anti-Seize lubricant and install the gasket washers (17) on the studs.
5. Apply a light coating of Gasket Maker to the crankcase oil cooler pad and allow to cure to a light tack.
6. Install a new gasket (4) on the crankcase oil cooler mounting pad.
7. Install the oil cooler assembly over the studs starting on the lower left side of the oil cooler using washers, (5), new lock washers (6) and flanged nuts (8) on the forward studs and a washer (9), new lock washer (10) and nut (11) on the aft stud. Install washers (5), new lock washers (6) and nuts (8) on the studs at the top of the oil cooler. Torque the nuts to Appendix B specifications.

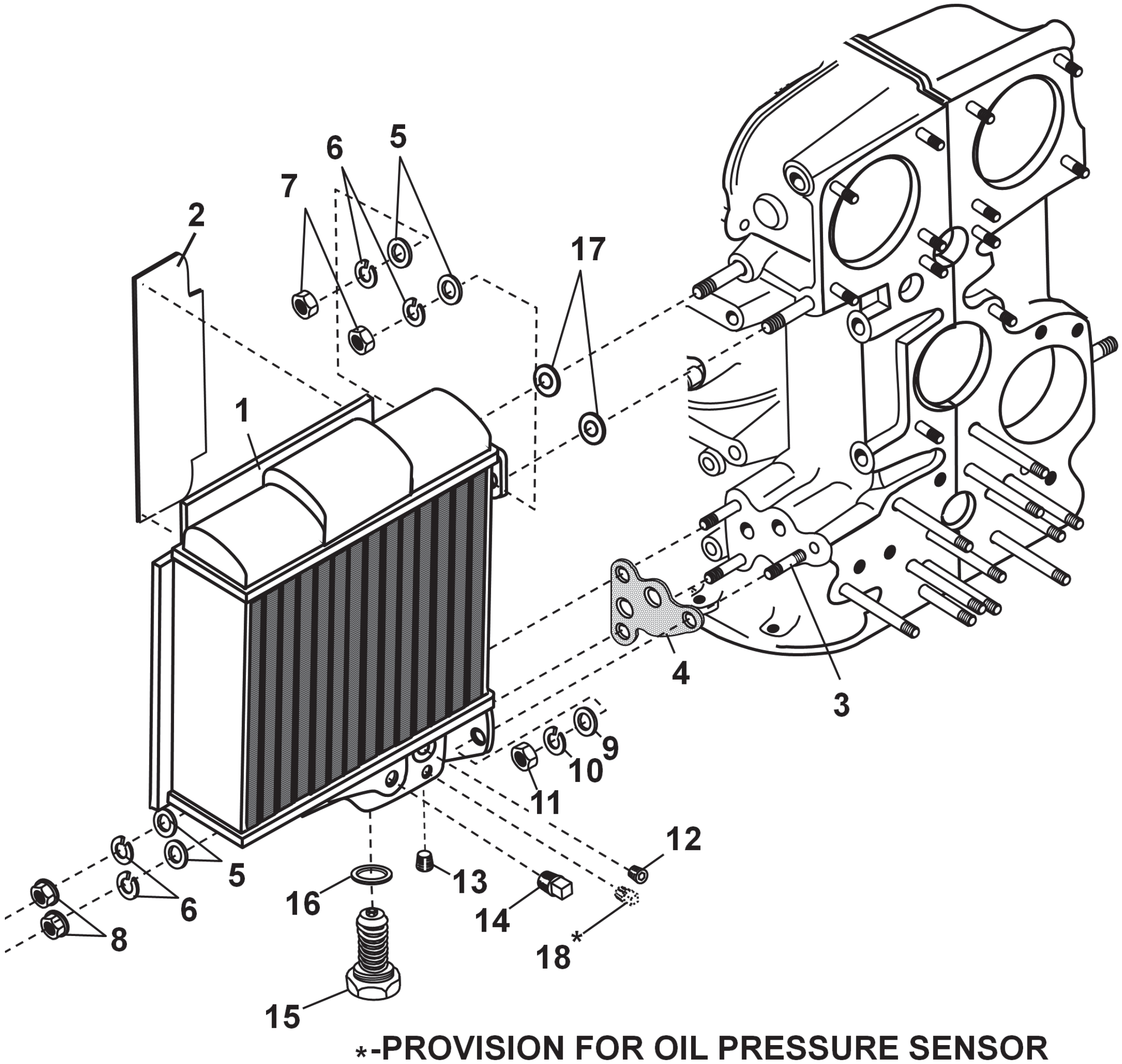


Figure 17-32. IO-550-G, N, P & R Oil Cooler Assembly G N P R

1	Oil Cooler	6	Lock Washer	11	Nut	16	Gasket
2	Baffle	7	Nut	12	Plug	17	Gasket-Washer
3	Gasket	8	Flanged Nut	13	Plug	18	See Aircraft Maintenance Manual
4	Stud	9	Washer	14	Plug		
5	Washer	10	Lock Washer	15	Oil Temp.Control Valve		

17-8.4. IO-550-N Oil Cooler Installation N

NOTE: The oil cooler configuration depicted on this page is used only on IO-550-N engines configured for aftermarket turbocharger installation.

1. Install plugs, fittings, and the oil temperature control valve in the appropriate oil cooler locations.
   a. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.125” pipe fitting (Figure 17-33)(12, 16 & 18) threads. Install pipe fittings (12, 16 & 18) in the ports at the bottom of the oil cooler. Torque the pipe plug to Appendix B specifications.
   b. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.38” bushing fitting (13) threads. Install the fitting (13) in the outboard port at the bottom of the oil cooler. Torque the fitting to Appendix B specifications.
   c. Apply Loctite 592 Teflon PS/T Pipe Sealant to the 0.25” tee fitting (13) threads. Install the fitting (13) in the bushing (17). Torque the fitting to Appendix B specifications. Place a cap (19) on the lower outlet of the tee fitting (17) and connect the oil supply hose (21) to the aft port of the tee fitting (17). Install a shipping plug in the open end of the hose connection until the hose is connected to the starter adapter scavenge pump fitting.
   d. Apply Anti-Seize lubricant to the oil temperature control valve (14) threads and install the valve with a new gasket (15) in the oil temperature control valve port on the bottom of the oil cooler.
2. Position the oil cooler baffle (22) 1.5 inches above the oil cooler flange and attach the baffle to the oil cooler.
3. Secure the oil cooler baffle (22) with four equally-spaced staples.
4. Coat the mounting stud threads with Anti-Seize lubricant and install the gasket washers (3) on the studs.
5. Apply a light coating of Gasket Maker to the crankcase oil cooler pad and allow to cure to a light tack.
6. Install a new gasket (2) on the crankcase oil cooler mounting pad.
7. Install the oil cooler assembly over the studs starting on the lower left side of the oil cooler using washers, (5), new lock washers (6) and flanged nuts (8) on the forward studs and a washer (9), new lock washer (10) and nut (11) on the aft stud. Install washers (5), new lock washers (6) and nuts (7) on the studs at the top of the oil cooler. Torque the nuts to Appendix B specifications.

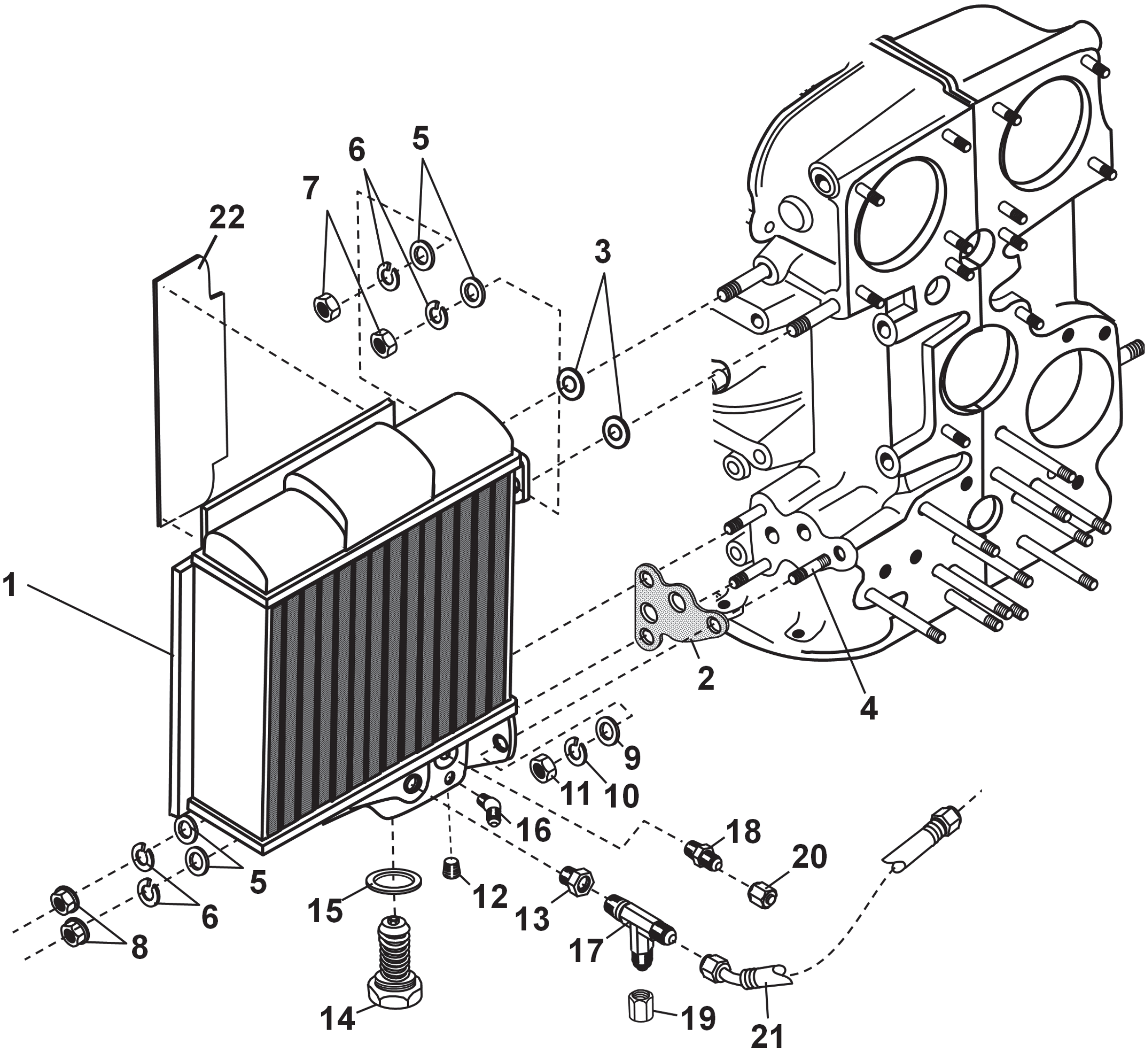


Figure 17-33. IO-550-N Oil Cooler N

1	Oil Cooler	7	Nut	13	Plug	19	Cap
2	Baffle	8	Flanged Nut	14	Plug	20	Cap
3	Gasket	9	Washer	15	Oil Temp.Control Valve	21	Hose
4	Stud	10	Lock Washer	16	Gasket	22	Baffle
5	Washer	11	Nut	17	Gasket-Washer		
6	Lock Washer	12	Plug	18	See Aircraft Maintenance Manual		

17-9. Alternator Installation

The IO-550 basic engine is fitted with a direct drive alternator. A belt drive alternator is an available option.

17-9.1. Direct Drive Alternator Installation

1. Install a new gasket (Figure 17-34)(1) (with the clipped edge of the gasket (1) toward the cylinder) on the studs on the crankcase alternator flange.

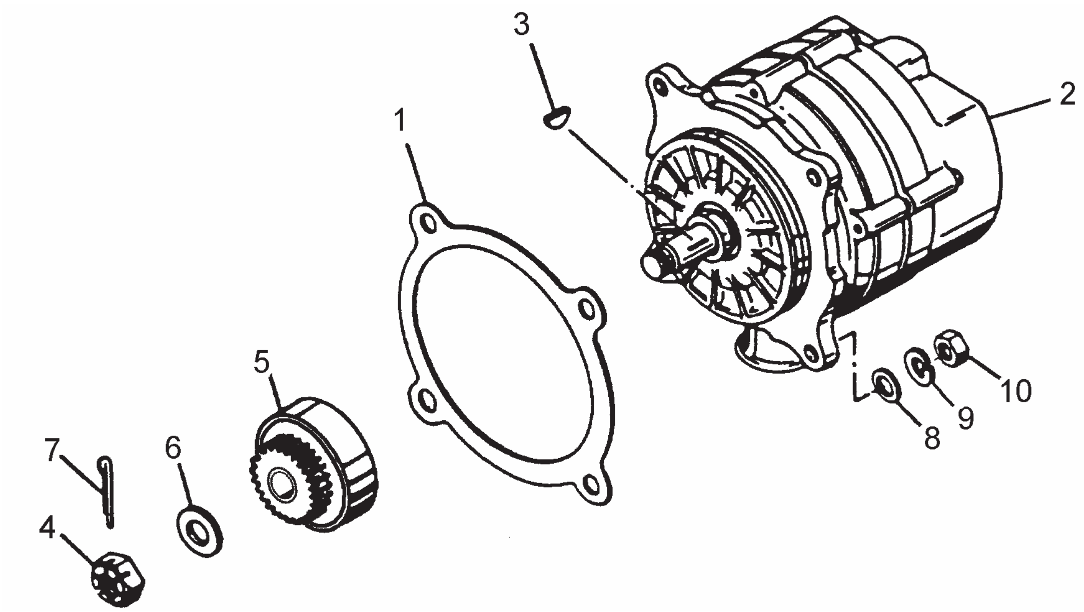


Figure 17-34. Direct Drive Alternator

1	Gasket	4	Slotted Nut	7	Cotter Pin	9	Lock Washer
2	Alternator	5	Drive Hub Assembly	8	Plain Washer	10	Nut
3	Woodruff Key	6	Thrust Washer				

2. Mount the alternator over the studs and against the crankcase, positioning the cooling air tube to the bottom of the engine. Verify the alternator pilot enters the crankcase pilot bore squarely. Do not force entry with attaching nuts which could stress the lugs and lead to cracking and malfunction.
3. With the alternator pilot properly engaged in the pilot bore, install plain washers (8), new lock washers (9), and nuts (10). Finger-tighten the nuts evenly and snugly then torque the nuts to Appendix B specifications.
4. If the stud interferes with mounting the alternator, do not force the alternator over the studs. Correct the interference by enlarging the mounting hole. Drill or ream the hole to a maximum of 0.387 inches. The standard opening is 0.337 to 0.347 inches in diameter.
5. If installing a new or rebuilt alternator and interference occurs between the crankcase through-bolts and the alternator drive end housing, do the following:
   a. Use a grinder or a 0.750 to 0.812 inch-diameter end mill cutter, modify the contour of the alternator drive end housing according to Figure 17-35.

b. Verify a minimum radius of 0.005 inches at all corners.

c. Wipe all chips, dust, or debris from the alternator.

d. Treat the housing with Alodine and apply enamel paint according to "Protective Coatings" instructions in Section 14-4.

e. Install the alternator as described in this procedure.

f. Verify the through-bolt does not contact the alternator drive end housing.

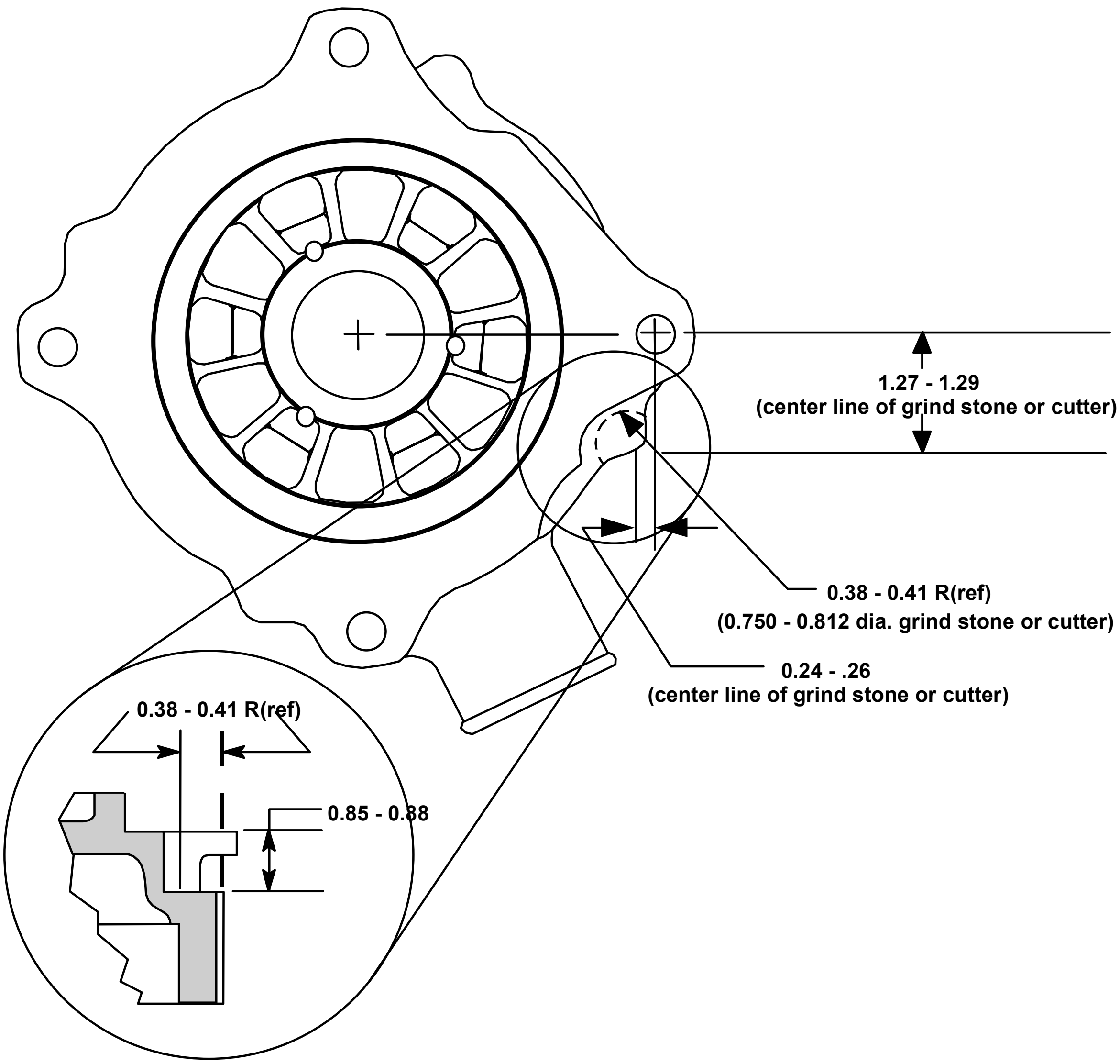


Figure 17-35. Alternator Drive End Housing Modification

17-9.2. 70 Amp 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 adapter 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 (Figure 17-36)(10) 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), into the adapters (11) bolt holes on the back side of the propeller flange. Install a nut (12) on each of the six bolts. Torque the bolts to Appendix B specifications.
4. Install the bracket (Figure 17-36)(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 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 washer (32) on the 2-4-6 side of the bolt (21), followed by the spacer (23). 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 to the crankcase with a washer (22), lock washer (25), and nut (26).
5. Torque the nuts (26) to Appendix B specifications. Torque the through-bolts (16) according to Section B-2, "Cylinder Torque Procedure" instructions.
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 3).
   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.

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

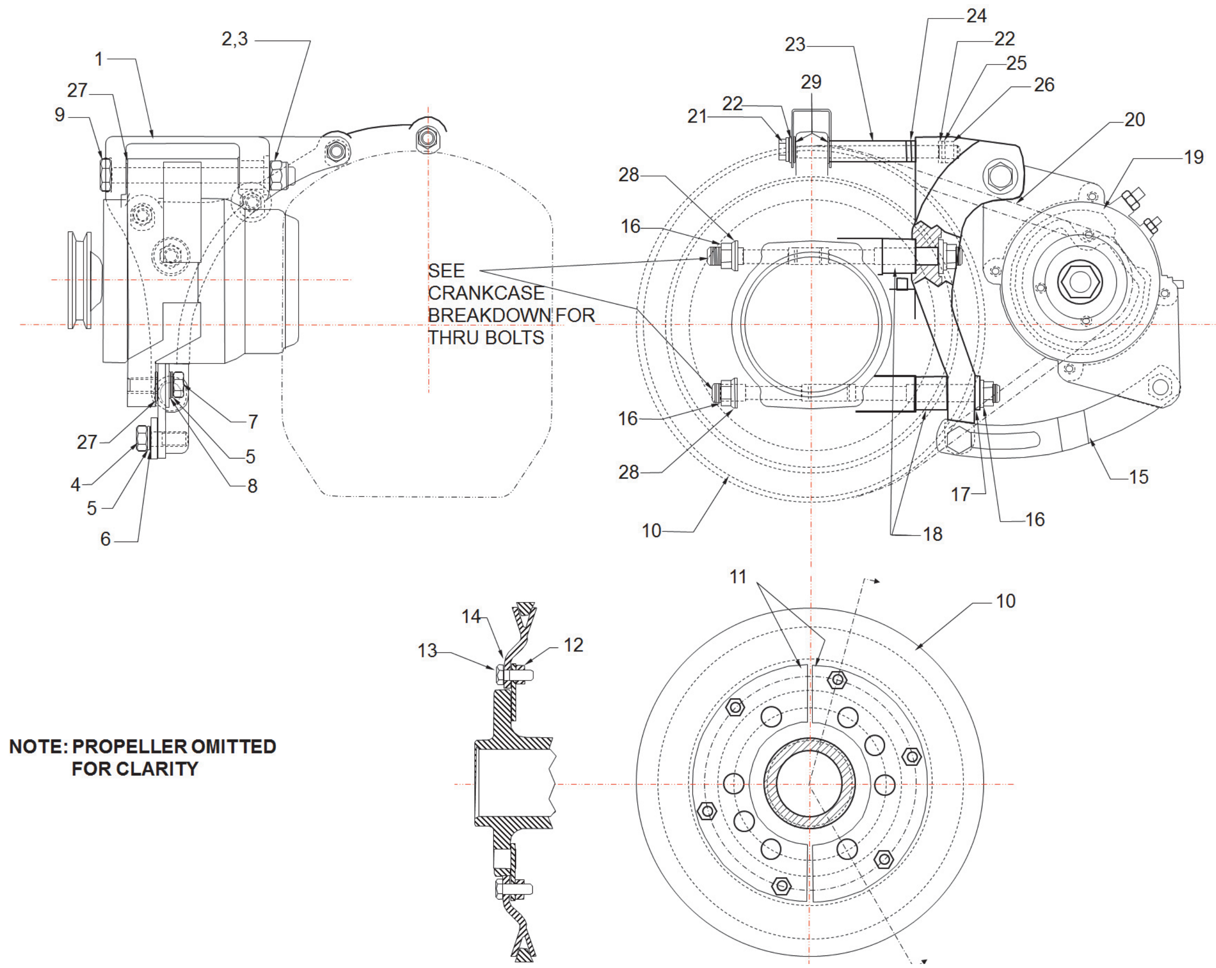


Figure 17-36. 70 Amp Belt-Driven Alternator Assembly (Optional)

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

Procedure continues on next page

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 17-37) to determine the number of shims (Figure 17-36)(27) required 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".

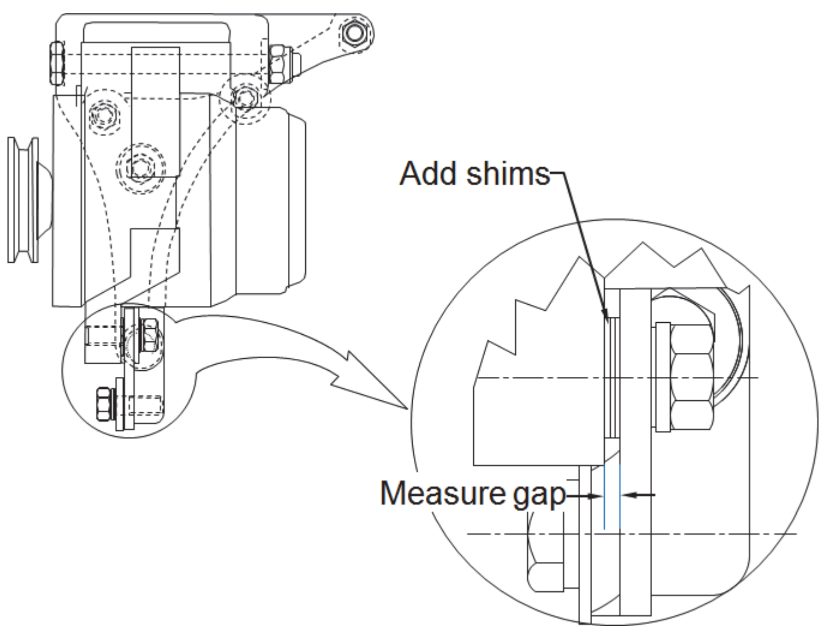


Figure 17-37. Alternator Brace Shim Location

11. Loosen the screw (4) and insert shims (27) to completely fill the gap between the brace and the alternator mounting boss. Install a 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 6-3.10.4.
13. Torque the fasteners (3, 4 and 7) to Appendix B specifications after belt adjustment.
14. Safety wire the screw (4) to a nearby through bolt according to Appendix C instructions.

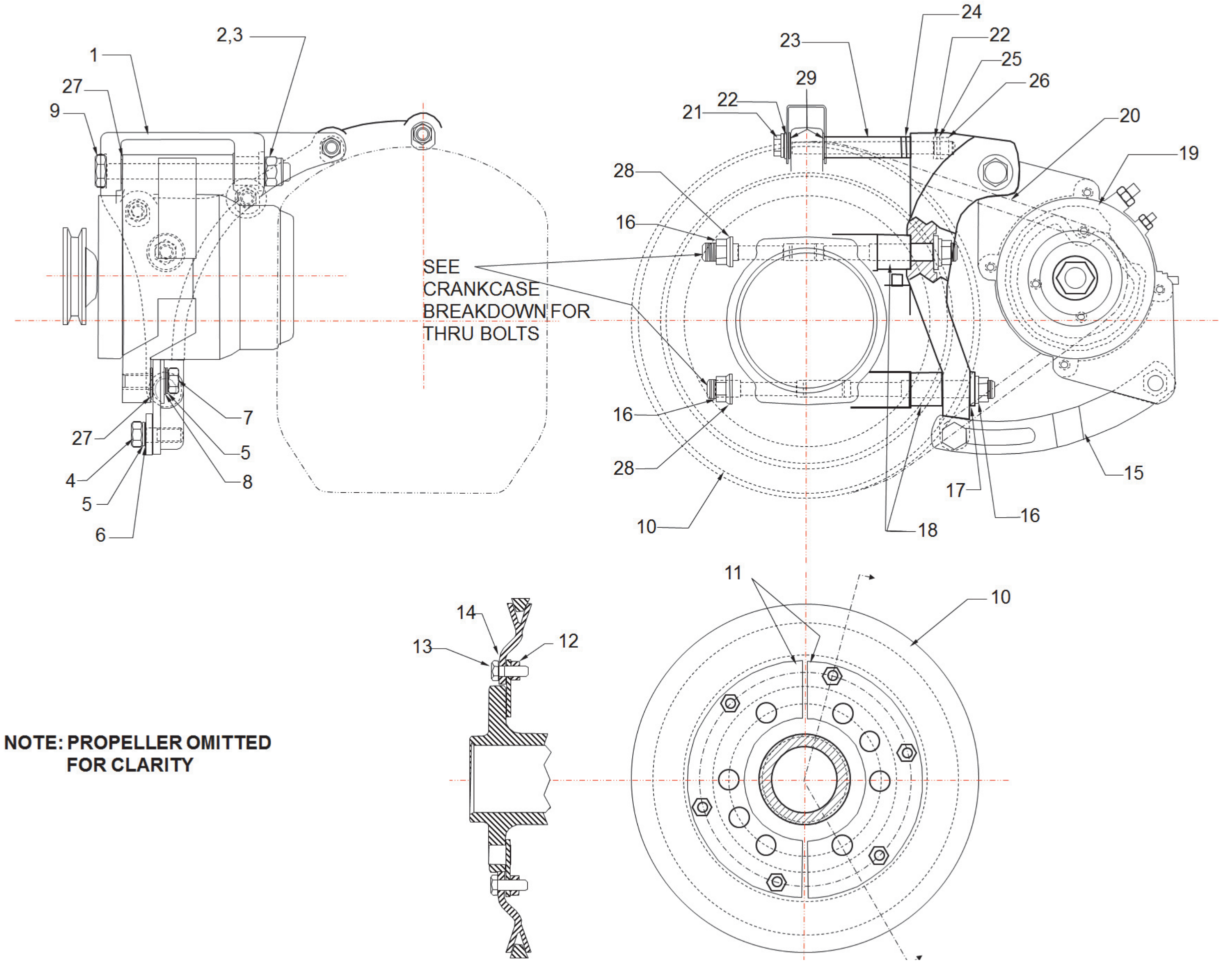


Figure 17-36 repeated for reference

17-9.3. 85 Amp Belt Driven Alternator Installation

NOTE: The through bolt nuts at the mounting location must be removed to install the mounting bracket.

The drive sheave, adapter and the propeller must be installed at the same time. If the propeller is not available at the time of assembly, defer installation until engine is installed in aircraft.

1. Install the propeller according to the manufacturer's instructions.
2. Align the holes on the split sheave adapter (Figure 17-36) (11) with the propeller flange holes. Align the drive sheave (10) bolt holes with the split sheave adapter.
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 nut (12) on each of the six bolts. Torque the bolts to Appendix B specifications.
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.
   c. Align the throttle assembly bracket with the crankcase bolt hole; Insert a bolt (22), with washer (29), through the 1-3-5 side of the throttle body bracket. Place a washer (29) on the 2-4-6 side of the bolt (22), followed by the spacer (22). Add shims (24), as required, to fill the space between the spacer and the bracket and align the bracket assembly (1) with the crankcase assembly and upper and lower through-bolts. Secure the bracket to the crankcase with a washer (29), new lock washer (28), and nut (27).
5. Torque the nut (27) to Appendix B specifications. Torque the crankcase through-bolt nuts (16) according to Section B-2, "Cylinder Torque Procedure" instructions.
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. Align the round hole in the adjustment arm (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 face of the threaded lower bolt hole in the bracket assembly (1).
8. Raise the adjustment arm (15) to align the slotted bolt hole with outboard alternator (19) mounting boss. Loosely install a screw (7), new lock washer (5) and washer (8) through the hole in the adjustment arm (15) and into the threaded outboard alternator mounting boss.
9. Check the alignment of the alternator sheave to the drive sheave (10) with a Part No. 8082IA, or equivalent, Pulley Alignment Tool (Chapter 3). Place the alignment tool

in the center of the alternator sheave and lower the opposite end of the alignment tool into the channel of the propeller drive sheave - no more than 0.010 inch deflection is permitted. If deflection is greater than 0.010 inch, remove the bolt (7), lock washer (5) and washer (8) from the alternator mounting boss and install shims (26) to fill the gap between the adjustment arm (15) and the alternator outboard mounting boss. When alignment is within 0.010 inch, reinstall the bolt (7), lock washer (5) and washer (8) through the adjustment arm (15) into the alternator mounting boss.

10. Install a new V-belt (20) and adjust the belt tension according to instructions in Section 6-3.10.4.
11. Torque the fasteners (9 & 3, 4 and 7) to Appendix B specifications after belt adjustment.

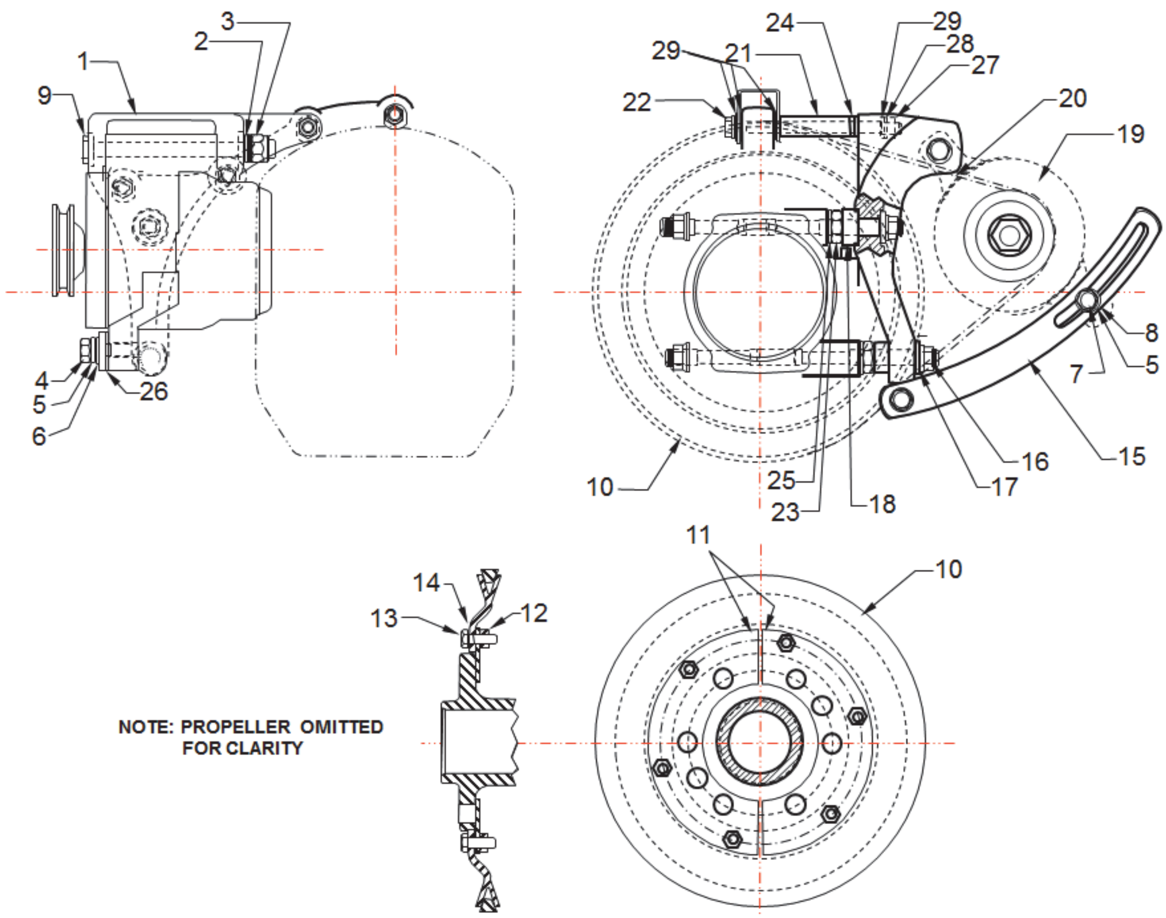


Figure 17-38. 85 Amp Belt Driven Alternator

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

17-10. Induction System Installation

Induction Systems vary by engine model. Refer to the associated subsections to locate the appropriate installation instructions. See Section 17-10.1 for the IO-550-A, Section 17-10.2 for the IO-550-B, Section 17-10.3 for the IO-550-C, or Section 17-10.4 for the IO-550-G, N, P, or R induction systems.

17-10.1. IO-550-A Induction System Installation A

1. Install new gaskets (Figure 17-39) (1) on all cylinder intake flanges.
2. Lubricate the cylinder intake flange studs with clean grade 50 aviation engine oil.
3. Loosely assemble left and right cylinder bank intake manifolds using risers (2, 3), new hoses (9) and clamps (7, 8).
4. Position the left and right cylinder bank manifolds on cylinders.
5. Secure the intake manifold to the cylinders with washers (4), new lock washers (5), and screws (4). Torque the fasteners to Appendix B specifications.
6. Apply F/I sealant to the plug (18) threads; install the plug in the balance tube (17). Torque the plug to Appendix B specifications.
7. Push new hoses (9) and clamps (8) on the front risers (3), connect the balance tube assembly (17) to hoses (9). Torque the clamps (7, 8) to Appendix B specifications.
8. Secure the balance tube to oil sump flange bracket (12) with two hose clamps (16).
9. Apply F/I sealant to the plug (12) threads and install the plugs (12) in elbows (10, 11).
10. Push new hoses (9) and clamps (8) on rear of risers (2).
11. Connect the elbows to the manifold (13) with new hoses (9) and clamps (8). Connect the assembled elbows and manifold to the hoses (9) and clamps (8) at the end of the risers (2). Torque the clamps (7, 8) to Appendix B specifications.
12. Secure the bracket (19) to the manifold with washers (22) and nuts (22, 23); torque the nut to Appendix B specifications.
13. Slide a new flexible duct (24) on the manifold (13) and secure with a clamp.

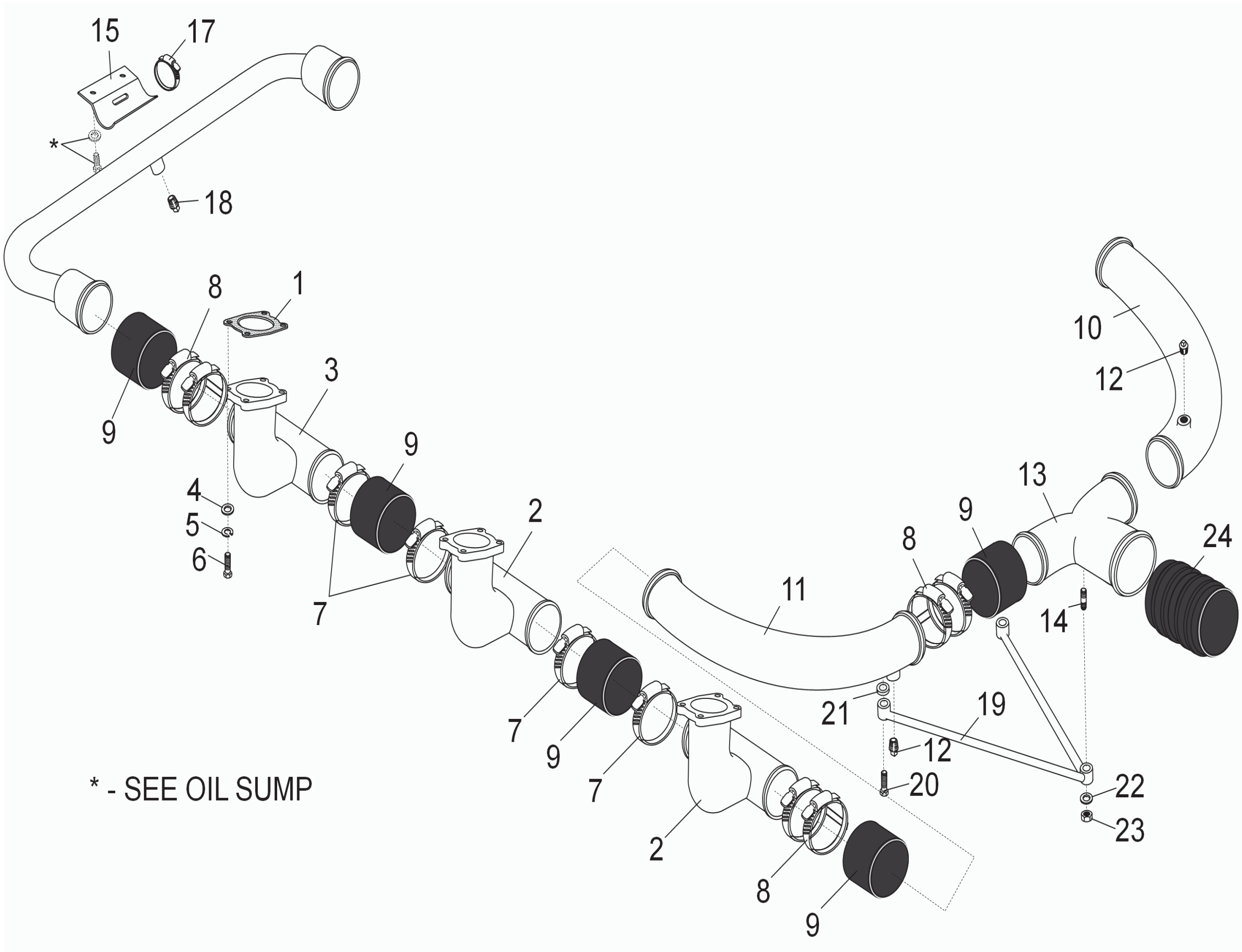


Figure 17-39. IO-550-A Induction Assembly A

1	Gasket	7	Clamp	13	Riser	19	Bracket
2	Elbow	8	Clamp	14	Stud	20	Screw
3	Elbow	9	Hose	15	Bracket	21	Spacer
4	Washer	10	Intake Tube	16	Clamp	22	Washer
5	Lock Washer	11	Intake Tube	17	Balance Tube	23	Nut
6	Screw	12	Plug	18	Plug	24	Duct

17-10.2. IO-550-B Induction System Installation B

1. Install new gaskets (Figure 17-40) (1) on all cylinder intake flanges.
2. Lubricate the cylinder intake flange studs with clean grade 50 aviation engine oil.
3. Loosely assemble left and right cylinder bank intake manifolds using risers (2, 3), new hoses (9) and clamps (7, 8).
4. Position the left and right cylinder bank induction tube assemblies on cylinders.
5. Secure the intake risers to the cylinders with washers (4), new lock washers (5), and screws (4). Torque the fasteners to Appendix B specifications.
6. Push new hoses (9) and clamps (8) on front of risers (3).
7. Insert the balance tube assembly (14) into hoses. Torque clamps (8) as specified in Appendix B.
8. Secure balance tube to oil sump flange bracket (12) with clamps (13).
9. Apply F/I sealant to the plug (11) threads; install the plug in the intake manifold (11). Torque the plug (11) to Appendix B specifications.
10. Install new hoses (9) and two clamps (7) half way on the upper induction manifold (10) flanges. Secure one side of the hose to the manifold with a clamp (7) and tighten to Appendix B specifications.
11. Install a new hose (Figure 17-40) (4D) on the lower end of the manifold assembly with a clamp (4C). Tighten and torque the clamp (4C) at the manifold to Appendix B specifications.
12. Align the assembled induction manifold, hoses and clamps (7, 9 & 10) with the aft risers (2) and push the assembly (7, 9 & 10) on to rear of risers (2). Secure the hoses at the risers (2) with clamps (7) and torque the clamps (7) at the three intersections to Appendix B specifications.
13. Install the throttle and control assembly (Figure 17-40) (4) on the hose (Figure 17-35) (4D) at the lower end of the manifold (10) and secure with a clamp (4C). Secure the throttle and control assembly (Figure 17-40) (10) to the oil sump with bolts (13) and washers (12). Torque the bolts (12) to Appendix B specifications and safety wire the bolts (12) to one another according to instructions in Appendix C.

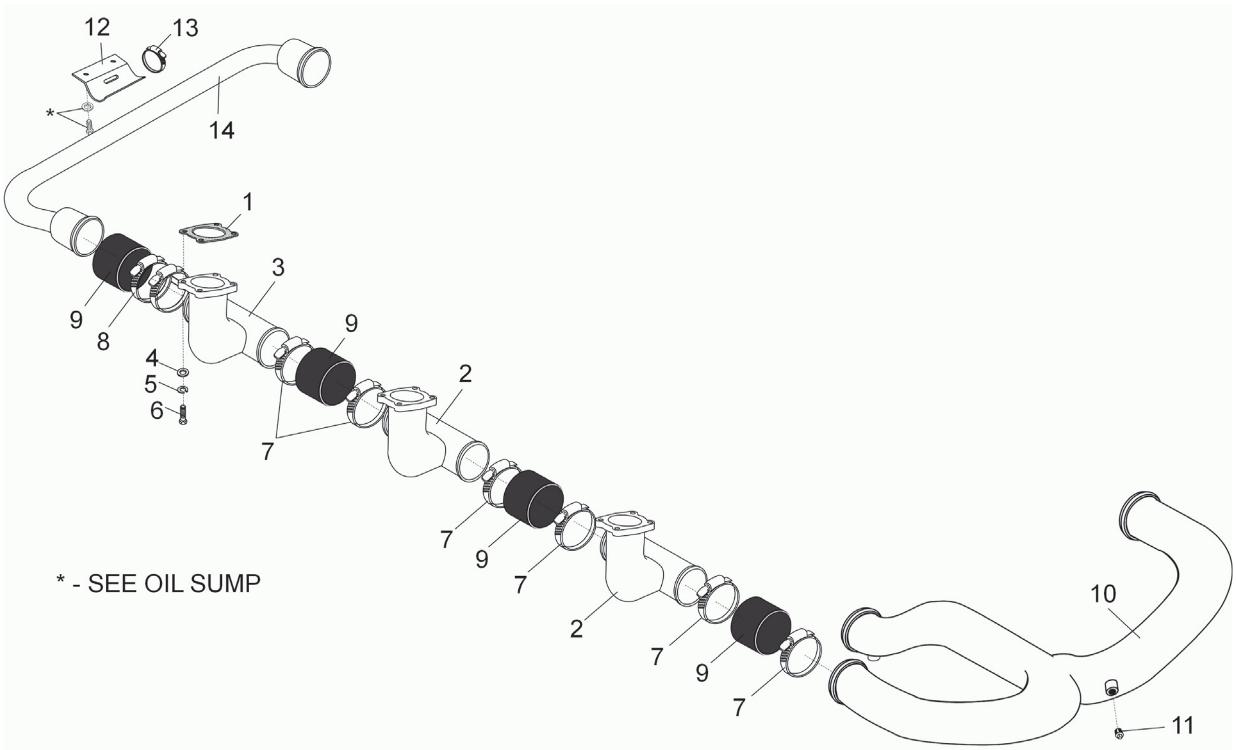


Figure 17-40. IO-550-B Induction Assembly B

1	Gasket	5	Lock Washer	8	Clamp	11	Plug
2	Elbow, Riser	6	Screw	9	Intake Hose	12	Bracket
3	Elbow, Riser	7	Hose Clamp	10	Riser Manifold Assembly	13	Clamp
4	Washer					14	Balance Tube

17-10.3. IO-550-C Induction System Installation C

1. Lubricate the cylinder intake flange studs with clean grade 50 aviation engine oil.
2. Loosely assemble left and right cylinder bank intake manifolds using risers (Figure 17-41) (2, 3), new hoses (9) and clamps (7, 8).
3. Position the left and right cylinder bank induction tube assemblies on cylinders.
4. Secure the intake risers to the cylinders with washers (4), new lock washers (5), and screws (4). Torque the fasteners to Appendix B specifications.
5. Push new hoses (9) and clamps (8) on front of risers (3).
6. Install balance tube assembly (14) into hoses (9).
7. Torque clamps (7, 8) to Appendix B specifications.
8. Secure balance tube to oil sump flange bracket (12) with two clamps (13).
9. Install new hoses (9) and clamps (7) on rear of risers (2).
10. Install elbows (10, 11) into hoses (9). Torque the clamps (7) to Appendix B specifications.
11. Install new hoses (9) and clamps (7) on ends of elbows (10 & 11).

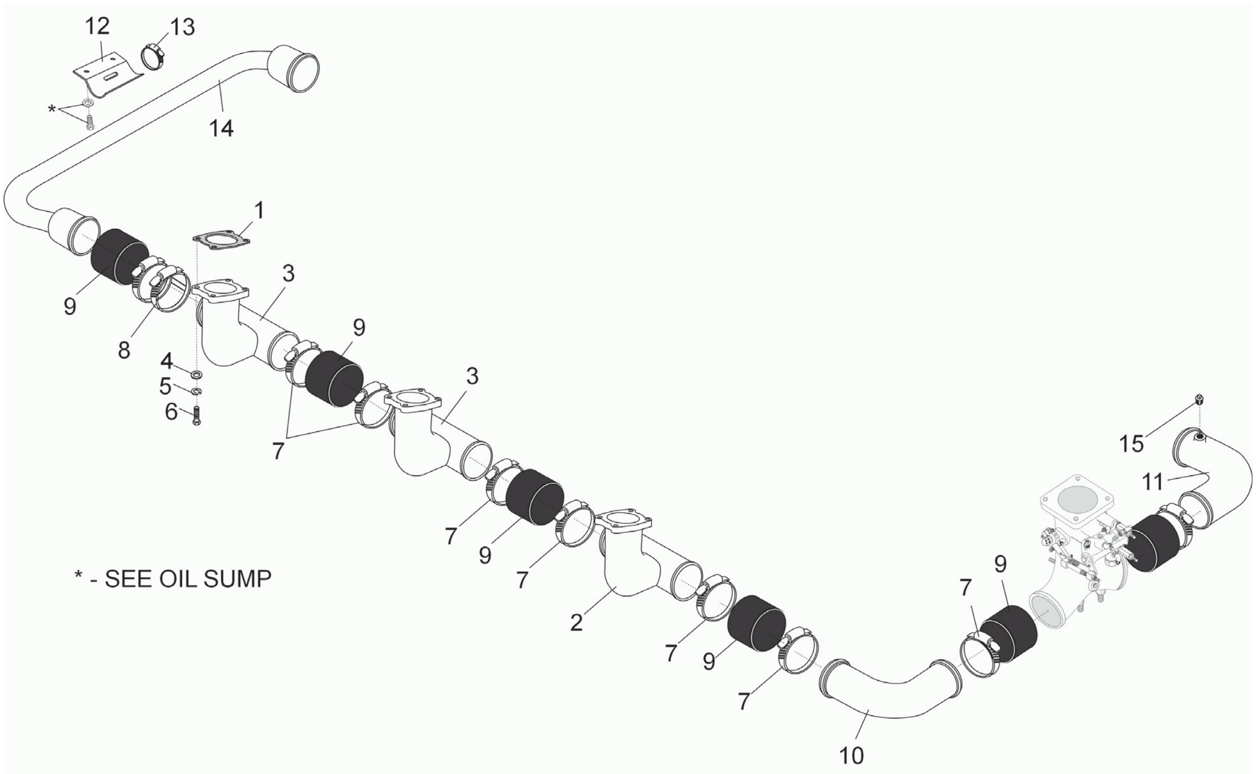


Figure 17-41. IO-550-C Induction Assembly C

1	Gasket	5	Lock Washer	9	Hose	12	Bracket
2	Elbow Riser	6	Screw	10	Tube Assy.	13	Clamp
3	Elbow Riser	7	Clamp	11	Tube Assy.	14	Balance Tube
4	Washer	8	Clamp			15	Plug

17-10.4. IO-550-G, N, P & R Induction System Installation G N P R

1. Apply F/I sealant to the fittings (18, 19 & 20) threads; install the fittings (Figure 17-42) (18, 19 & 20) in induction manifold (1). Torque the fittings to Appendix B specifications.
2. If the manifold support bracket (Figure 17-42) (25) was not installed during crankcase assembly, install it now at crankcase (Figure 17-8) position 55.
3. Connect the throttle and metering assembly to the induction manifold (Figure 17-42) (1) with a new gasket (1). Secure with bolts (17), new lock washers (14), and washers (15). Torque bolts (17) to Appendix B specifications.
4. Loosely assemble induction tubes and flanges (3 through 8) to the induction manifold (1) using new hoses and clamp assemblies (9 & 10). Place new gaskets (12) on the cylinder intake flanges.
5. With the aid of an assistant, place the induction spider assembly on top of engine and adjust induction tubes so they seat squarely on the cylinder flanges and secure with washers (14), new lock washers (15), and nuts (16). Torque the induction flange nuts (16) to Appendix B specifications.
6. Reposition hoses (9), if necessary, to relieve stress; torque the hose clamps (10) to Appendix B specifications.

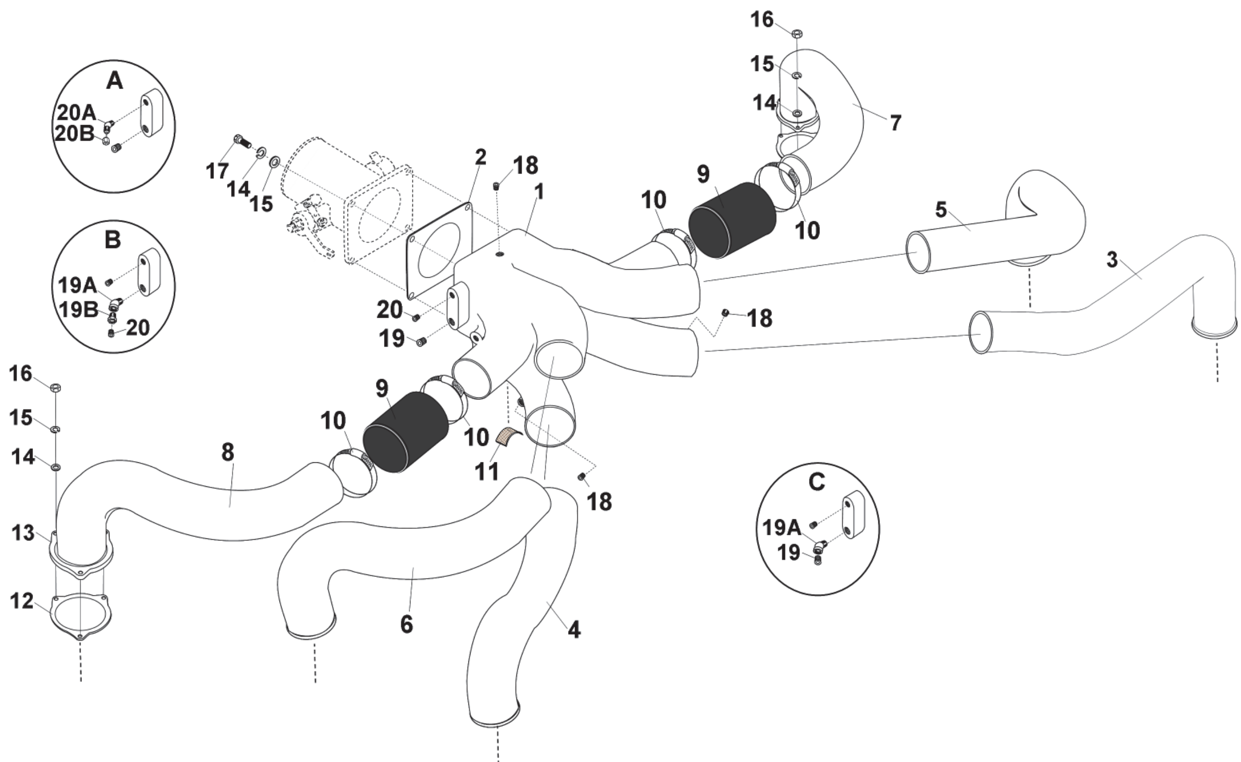


Figure 17-42. IO-550-G, N, P & R Induction Assembly G N P R

1	Manifold	7	Intake Tube	13	Flange	19	45° Fitting
2	Gasket	8	Intake Tube	14	Washer	19A	Plug
3	Intake Tube	9	Hose	15	Lock Washer	19B	Reducer Bushing
4	Intake Tube	10	Hose Clamp	16	Nut	20	Plug
5	Intake Tube	11	Rubber Bumper	17	Screw	20A	90° Fitting
6	Intake Tube	12	Gasket	18	Plug	20B	Cap

17-11. Fuel Injection System Installation

17-11.1. IO-550-A 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. Apply Part No. 642188 Gasket Sealant to (fuel pump side only) a new gasket (3) and align the gasket with the fuel pump (1).
2. Liberally coat a new drive coupling (Figure 17-44) (2) with Molyshield Grease.
3. Install the new lubricated drive coupling (2) in the fuel pump (3) drive.
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 (14), new lock washers (15), and nuts (16). Torque the nuts (16) to Appendix B specifications.

   CAUTION: Never use Teflon tape on fuel injection system fittings.

6. Apply anti seize lubricant (Figure 17-43) to the male tapered fuel nozzle threads.

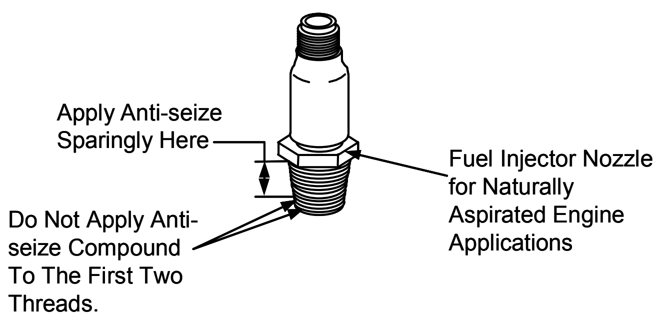


Figure 17-43. Anti-Seize Application

7. Install the position tuned fuel nozzles (12A- 12F) in the cylinder matching the four character code stamped on the wrench flat. Torque the fuel injector nozzles to Appendix B specifications.

WARNING

Fuel injection lines must not be bent or deformed. The fuel injection lines must be securely clamped to the fuel line support brackets. Do not assemble in a binding configuration.

8. Install fuel injection lines (6 through 11) between the injector nozzles (12) and fuel manifold valve (5). Torque fuel line “B” nuts at nozzles to Appendix B specifications. Torque the fuel line “B” nuts at manifold valve to Appendix B specifications.

9. Attach clamps (19) to fuel injection lines and snap the clamps (19) into brackets (20).
10. Connect a fuel hose (18) between the fuel pump outlet fitting and the fuel mixture and control assembly (4) inlet fitting and torque to Appendix B specifications.
11. Connect a fuel hose (17) between the fuel pump return fitting and the fuel mixture and control assembly (4) return fitting and torque to Appendix B specifications.
12. Connect the fuel hose (17) between the fuel mixture and control assembly outlet and the fuel manifold valve (5) inlet fitting and torque to Appendix B specifications.

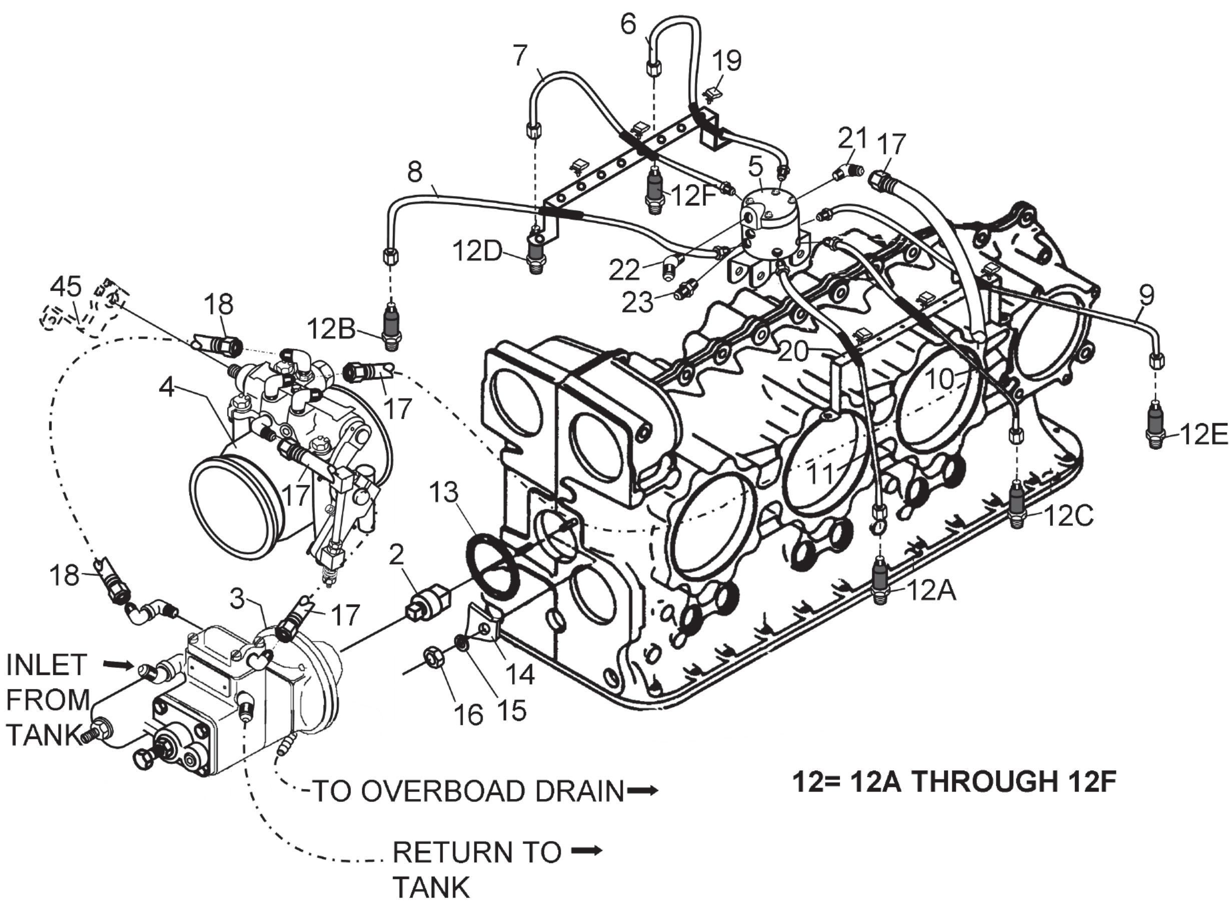


Figure 17-44. IO-550-A Fuel Injection Assembly A

1	Fuel Injection Kit	7	Tube Bend Assy	13	Gasket	19	Clamp Assy
2	Coupling	8	Tube Bend Assy	14	Washer	20	Bracket
3	Pump Assy.	9	Tube Bend Assy	15	Lock Washer	21	Elbow
4	Throttle Assy	10	Tube Bend Assy	16	Nut	22	Elbow
5	Fuel Manifold Assy.	11	Tube Bend Assy	17	Hose Assy	23	Tube Fitting
6	Tube Bend Assy	12	Tuned Injector Nozzle Kit	18	Hose Assy	45	Airframe Part

17-11.2. IO-550-B Fuel Injection System Installation B

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. Apply Gasket Maker to silk thread and split line of crankcase at fuel pump bore. Place silk thread ends into the split line of fuel pump bore.
2. Liberally coat a new drive coupling (Figure 17-45) (2) with Molyshield Grease.
3. Insert the new lubricated drive coupling (2) in the fuel pump (3) drive.
4. Install a new gasket (6) on the fuel pump.
5. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil.
6. Install the fuel pump (3) on the crankcase with hold-down washers (34), new lock washers (35), and nuts (36). Torque the nuts (36) to Appendix B specifications.

   CAUTION: Never use Teflon tape on fuel injection system fittings.

7. Apply anti seize lubricant (Figure 17-43) to the male tapered fuel nozzle threads.

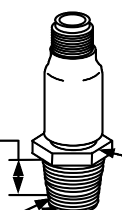


Figure 17-43 repeated for reference

8. Install the position tuned fuel nozzles (Figure 17-45)(31A-31F) in the cylinder matching the four character code stamped on the wrench flat. Torque the fuel injector nozzles to Appendix B specifications.

WARNING

Fuel injection lines must not be bent or deformed. The fuel injection lines must be securely clamped to the fuel line support brackets. Do not assemble in a binding configuration.

9. Install fuel injection lines (14, 15, 16 & 17) between nozzles (31) and fuel manifold valve (4). Torque the fuel line “B” nuts at nozzles according to Appendix B. Torque fuel line “B” nuts at manifold valve to Appendix B specifications.

Procedure continues after Figure 17-45

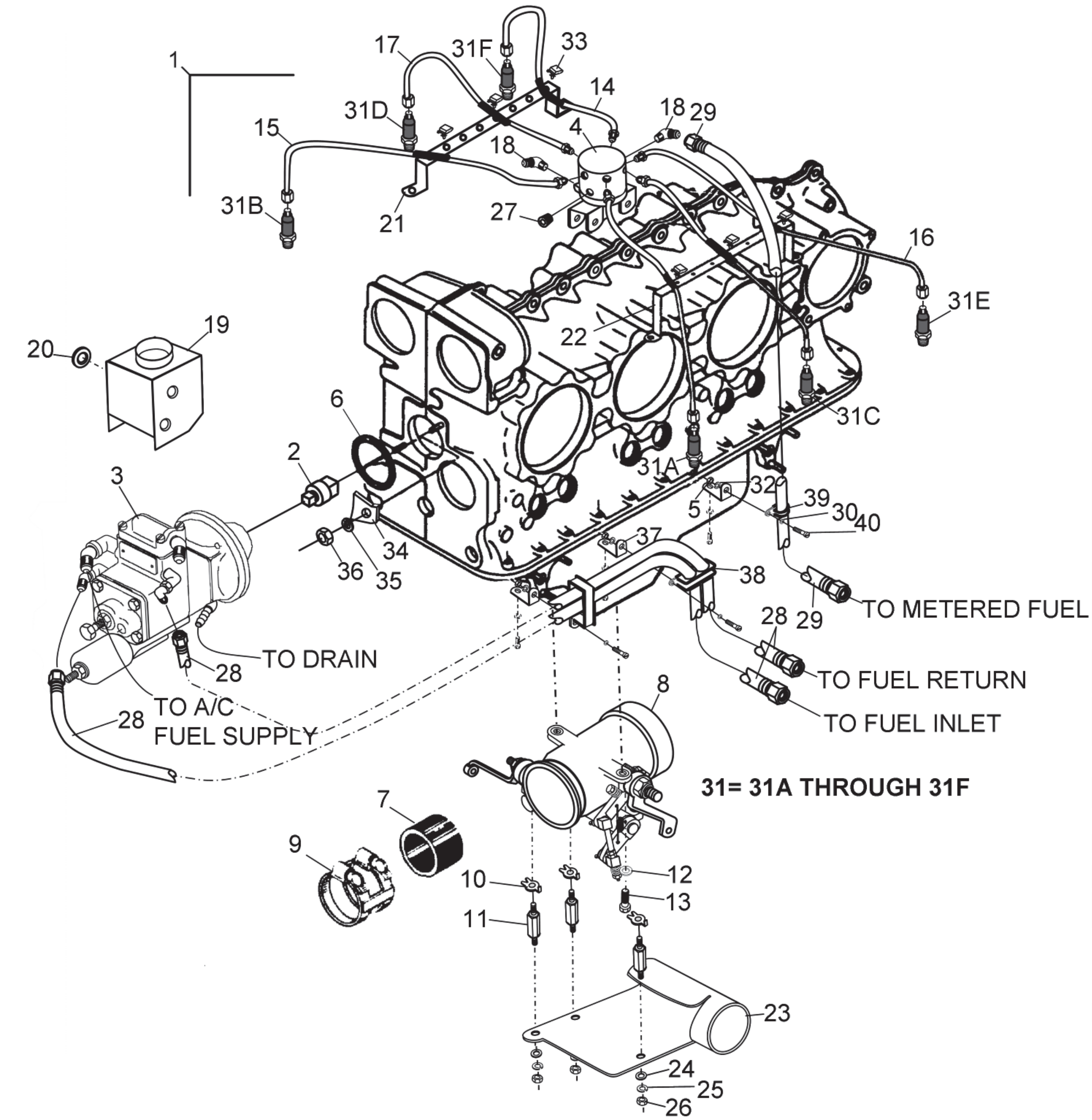


Figure 17-45. IO-550-B Fuel Injection Assembly B

1	Fuel Injection System	11	Screw	21	Fuel Dist. Tube Bracket	31	Tuned Injector Nozzle Kit
2	Coupling	12	Washer	22	Fuel Dist. Tube Bracket	32	Lock Washer
3	Fuel Pump Assy.	13	Screw	23	Shroud	33	Clamp
4	Fuel Manifold Valve Assy	14	Tube Assy	24	Washer	34	Hold Down Washer
5	Nut	15	Tube Assy	25	Washer	35	Lock Washer
6	Gasket	16	Tube Assy	26	Nut	36	Nut
7	Hose	17	Tube Assy	27	Plug	37	L Bracket
8	Throttle & Control Assy	18	45° Elbow	28	Hose Assy	38	Clamp
9	Clamp Assy	19	Shroud	29	Hose Assy	39	Clamp
10	Washer	20	Grommet	30	Washer	40	Screw

10. Install the fuel distribution tube brackets (21 & 22) on the baffle supports.
11. Attach clamps (33) to fuel injection lines (14, 15, 16 & 17); snap clamps (30) into brackets (21 & 22).
12. Connect a fuel hose (28) between the fuel pump (3) fuel return fitting and fuel control unit fuel return fittings. Torque hose “B” nuts to Appendix B specifications.
13. Connect a fuel hose (28) between the fuel pump (3) outlet and fuel control unit inlet fittings. Torque hose “B” nuts to Appendix B specifications.
14. Connect a fuel hose (29) between the fuel control unit metered fuel outlet fitting and the fuel manifold valve inlet fitting (27). Torque hose “B” nuts to Appendix B specifications.
15. Secure the fuel hose (29) to the bracket (37) with a clamp (39), screw (40), washer (30), and a new lock nut (32), torque the fasteners to Appendix B specifications.
16. Secure the fuel hoses (28) to bracket (38) with clamps (38), screws (40), washers (30), and new lock nuts (32), torque the fasteners to Appendix B specifications.

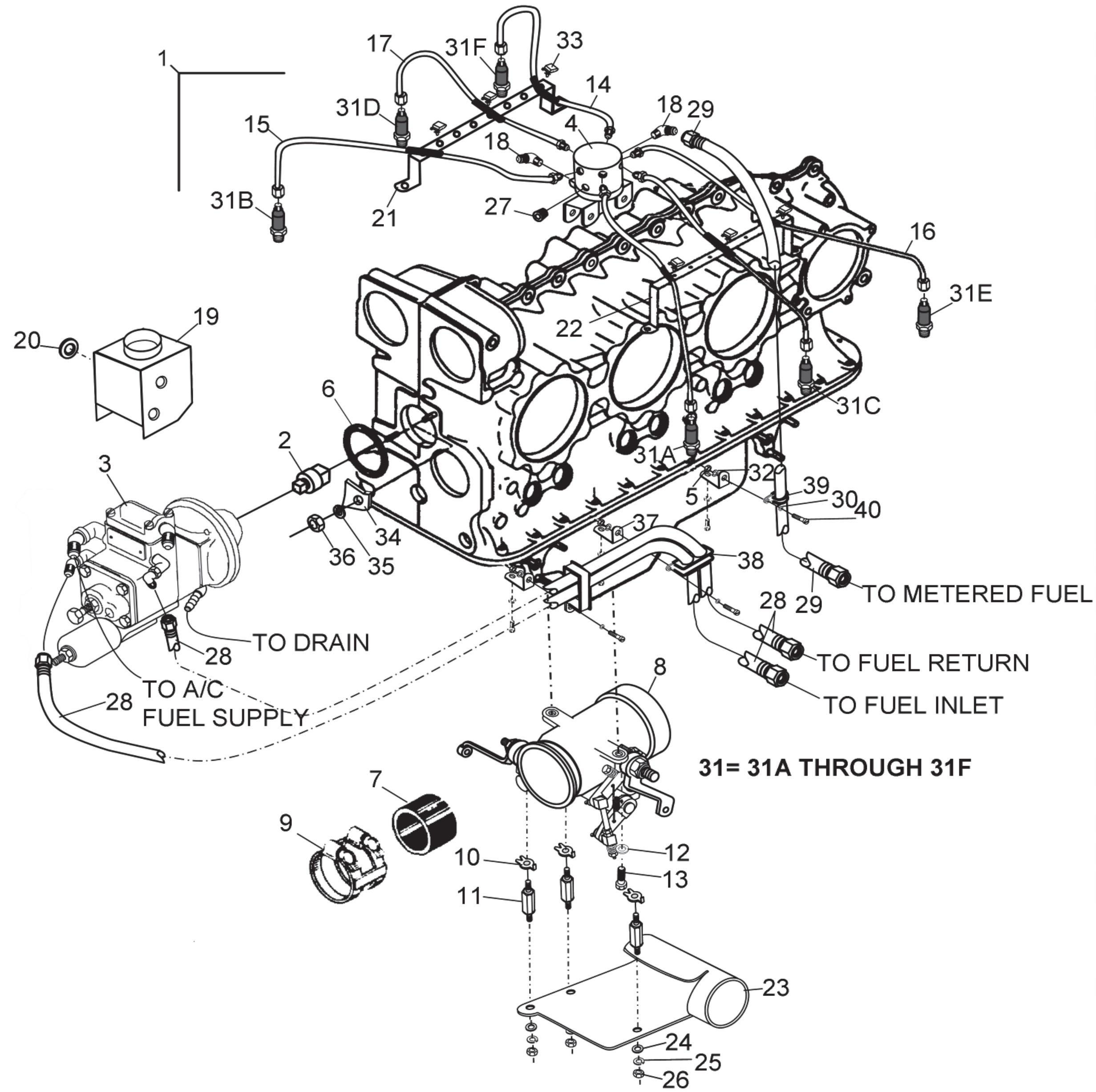


Figure 17-45 repeated for reference

17-11.3. IO-550-C Fuel Injection System Installation C

WARNING

Open fuel sources are flammable. Keep ignition sources out of the work area while fuel lines are disconnected.

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. Apply Gasket Maker to silk thread and split line of crankcase at fuel pump bore. Place silk thread ends into split line of fuel pump bore.
2. Liberally coat a new drive coupling (Figure 17-46) (2) with Molyshield Grease and insert the drive coupling (2) in the fuel pump (3) drive.
3. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil. Install the fuel pump (3) with new gasket (4) with hold-down washers (15), new lock washers (16), and nuts (17); torque to Appendix B specifications.

   CAUTION: Never use Teflon tape on fuel injection system fittings.

4. Apply anti-seize lubricant (Figure 17-43) to the male tapered fuel nozzle threads.
5. Install the position tuned fuel nozzles (Figure 17-46)(12A-12F) in the cylinder matching the four character code stamped on the wrench flat. Torque the fuel injector nozzles (12) to Appendix B specifications.

WARNING

Fuel injection lines must not be bent or deformed. The fuel injection lines must be securely clamped to the fuel line support brackets. Do not assemble in a binding configuration.

6. Install fuel injection lines (8, 9, 10 & 11) between nozzles (12) and fuel manifold valve (7). Torque the fuel line “B” nuts at nozzles according to Appendix B. Torque fuel line “B” nuts at manifold valve to Appendix B specifications.
7. Fasten the brackets (13) to the baffle supports.
8. Attach clamps (14) to fuel lines and snap clamps (14) into brackets (13).
9. Install a fuel hose (18) between the fuel pump outlet and the fuel control unit inlet fittings. Torque hose “B” nuts to Appendix B specifications.
10. Install a fuel hose (18) between the fuel pump return and the fuel control unit return fittings. Torque hose “B” nuts to Appendix B specifications.
11. Install a fuel hose (19) between the fuel control unit (5) metered pressure output fitting and the fuel manifold valve (7) inlet fitting. Torque hose “B” nuts to Appendix B specifications.
12. Connect the throttle assembly (4) to the induction hoses (Figure 17-41) (9). Center the hose over the tube assembly (10) and the throttle body. Secure the assembly with clamps (7). Torque the clamps to Appendix B specifications.

13. Insert new bushings (Figure 17-46) (29) in each side of the support bracket (26). Align the left bracket (31) with the support bracket (26) and install the bolt (33) with sleeve (30) through the left bracket (31), support bracket (42) and right bracket (32) and secure with a nut (34); torque nut (34) and bolt (33) to Appendix B specifications.
14. Secure the throttle body to the brackets (31 & 32) with spacers (35) and nuts (22).
15. Connect lower bracket (36) to tachometer drive assembly with nuts (22).
16. Torque the nuts (22) to Appendix B specifications.

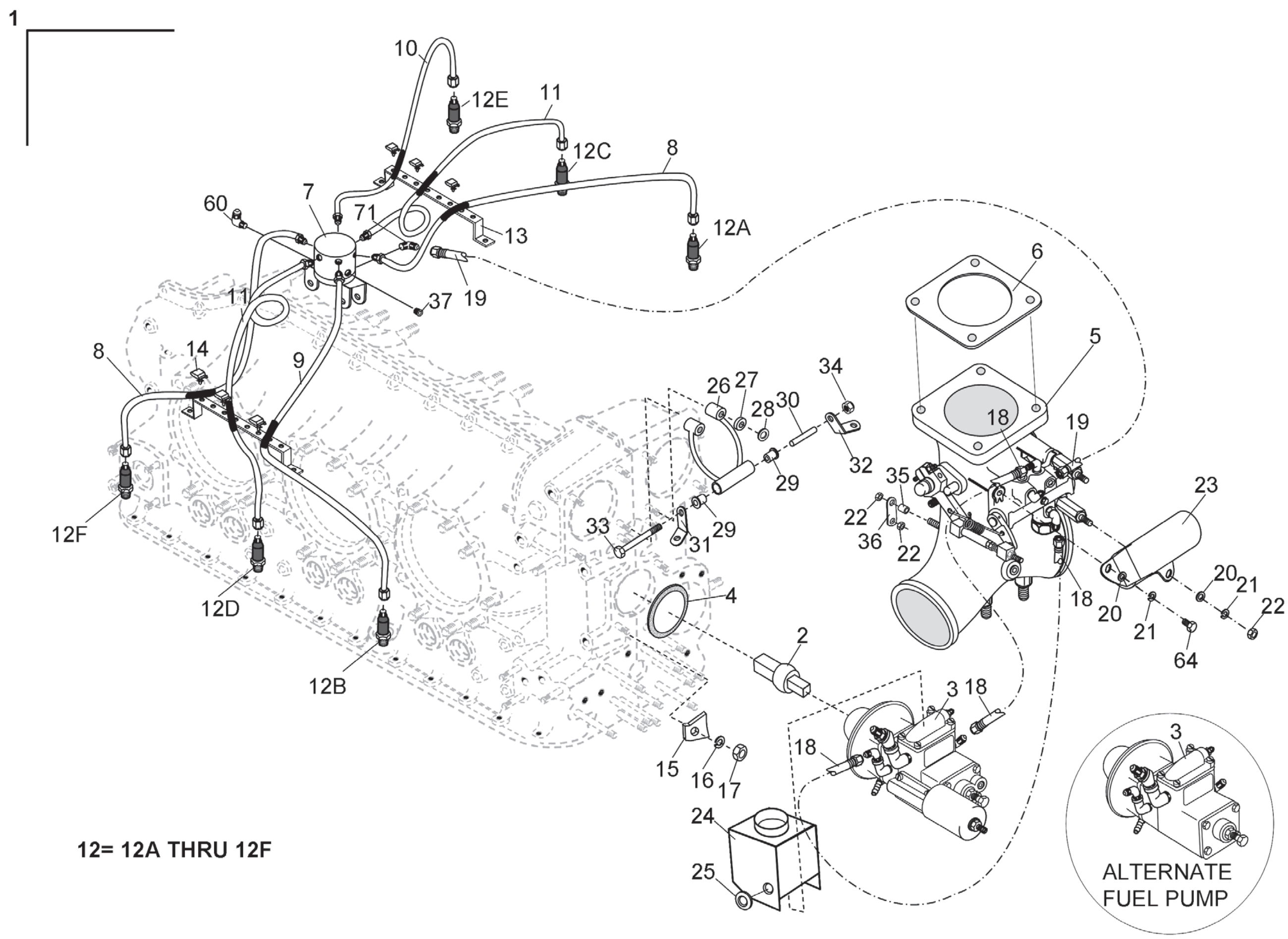


Figure 17-46. IO-550-C Fuel Injection Assembly C

1	Fuel Injection System	11	Tube Assy	21	Lock Washer	31	Bracket
2	Coupling	12	Tuned Nozzle Assy	22	Nut	32	Bracket
3	Fuel Pump.	13	Bracket	23	Fuel Control Unit Shroud	33	Bolt
4	Gasket	14	Clamp	24	Fuel Pump Shroud	34	Lock Nut
5	Throttle and Control Assy	15	Washer	25	Grommet	35	Spacer
6	Gasket	16	Lock Washer	26	Bracket Assy	36	Bracket
7	Fuel Manifold Valve Assy	17	Nut	27	Screw	37	Plug
8	Tube Assy	18	Hose Assy	28	Washer	60	90° Elbow
9	Tube Assy	19	Hose Assy	29	Bushing	64	Bolt
10	Tube Assy	20	Washer	30	.Sleeve		

17-11.4. IO-550-G, N, P & R Fuel Injection System Installation G N P R

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. Apply Gasket Maker to silk thread and split line of crankcase at fuel pump bore. Place silk thread ends into split line of fuel pump bore.
2. Liberally coat a new drive coupling (Figure 17-47) (16) with Molyshield Grease and install the drive coupling (16) in the fuel pump (2).
3. Lubricate the fuel pump cavity with clean, 50-weight aviation engine oil. Install the fuel pump (2) with new gasket (15) with hold-down washers (17), new lock washers (18), and nuts (19); torque to Appendix B specifications.

   CAUTION: Never use Teflon tape on fuel injection system fittings.

4. Apply anti-seize lubricant (Figure 17-43) to the male tapered fuel nozzle threads.
5. Install the position tuned fuel nozzles (Figure 17-47) (5A-5F) in the cylinder matching the four character code stamped on the wrench flat. Torque the fuel injector nozzles to Appendix B specifications.

WARNING

Fuel injection lines must not be bent or deformed. The fuel injection lines must be securely clamped to the fuel line support brackets. Do not assemble in a binding configuration.

6. Install the throttle body (3) and a new gasket (Figure 17-47) (1) on the induction manifold with bolts (19), new lock washers (14) and washers (15); torque the bolts to Appendix B specifications.
7. Install fuel injection lines (19-24) between nozzles (28A-28F) and fuel manifold valve (12). Torque the "B" nuts to Appendix B specifications.
8. Position clamps (28) on the fuel line protector sleeves (33). Snap the clamps into the brackets (25, 26)

WARNING

Fuel injection lines must not be bent or deformed. The fuel injection lines must be securely clamped to the fuel line support brackets. Do not assemble in a binding configuration.

NOTE: If a fuel flow transducer is installed inline with the fuel supply, consult the airframe manufacturer's manual for transducer and fire shield installation instructions.

9. Assemble hoses (20, 21 & 22) with two union fittings (23). Connect the assembled hose segments between to the fuel pump outlet fitting. and the tee fitting on the 1-3-5 side of the throttle body (3). Torque hose "B" nuts to Appendix B specifications.

10. Connect the fuel tube assembly (24) between the throttle body (3) metering unit outlet fitting and the fuel manifold valve (4) inlet fitting. Torque the fuel tube assembly "B" nuts to Appendix B specifications.

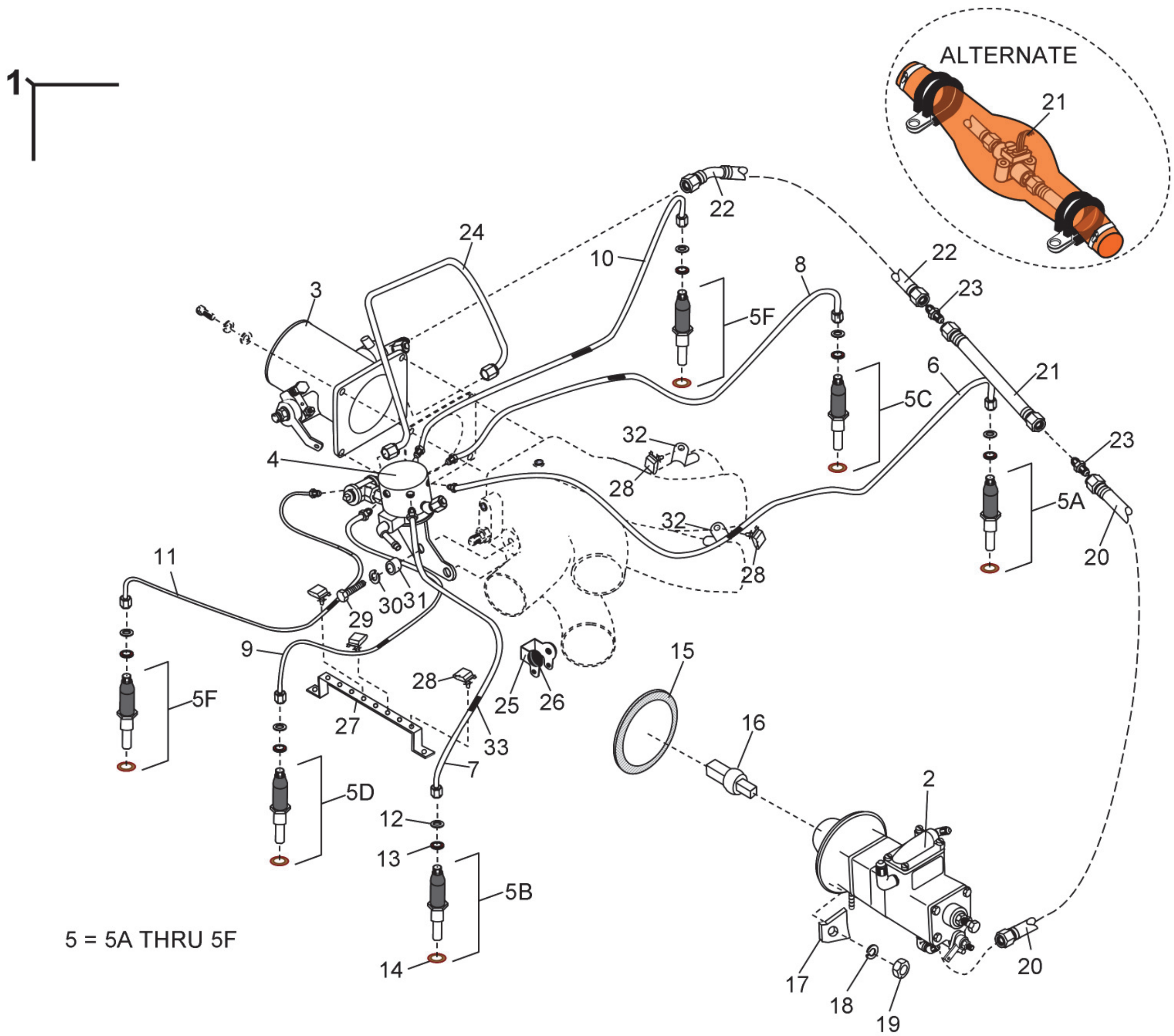


Figure 17-47. IO-550-G, N, P & R Fuel Injection Assembly G N P R

1	Fuel Injection System	10	Tube Assy	19	Nut	27	Bracket
2	Fuel Pump	11	Tube Assy	20	Hose Assy	28	Clamp
3	Throttle and Metering Assy	12	Washer	21	Hose Assy	29	Bolt
4	Fuel Manifold Valve Assy	13	Washer	21	Transducer	30	Washer
5	Position Tuned Nozzle	14	Copper Washer	22	Hose Assy	31	Spacer
6	Tube Assy	15	Gasket	23	Coupling	32	Bracket
7	Tube Assy	16	Coupling	24	Tube Assy	33	Protector
8	Tube Assy	17	Hold Down Washer	25	Bracket Assy		
9	Tube Assy	18	Lock Washer	26	Bumper		

17-12. Ignition System Installation

CAUTION: Magnetos must be overhauled according to the manufacturer's instruction prior to installation.

17-12.1. Continental Ignition System Installation

1. Complete “Crankshaft Top Dead Center Alignment” procedure in Section 6-3.9.1.1.
2. Remove inspection hole plugs from the magneto(s). Turn the impulse coupling backward so latches will not engage until timing pointer inside inspection hole is aligned with marked distributor gear tooth.
3. Without turning the magneto coupling, hold the magneto in the position it will occupy when installed.
   a. Align the gear coupling slot and impulse coupling lugs by pulling the magneto gear out and turning it to the desired position.
   b. Push the gear back into the meshed position.
   c. Verify the magneto drive coupling bushings and retainers are properly installed.
4. Install a new gasket (Figure 17-48)(4) on the magneto flange.
5. Carefully insert the magneto in the crankcase, aligning the drive coupling lugs with the drive bushing slot. Install four sets of hold-down washers (7), new lock washers (6) and nuts (5); hand-tighten the nuts at this time.
6. Complete “Magneto to Engine Timing” procedure in Section 6-3.9.1.2. Torque nuts to Appendix B specifications upon completion of magneto timing.
7. Disconnect the timing light from magnetos.
8. Connect the cable outlet plates to the magnetos; secure with screws (106) and torque to Appendix B specifications.
9. Connect magneto tachometer sensor (Figure 17-49) to the bottom of one of the magnetos, if equipped (determined by airframe manufacturer's instructions) and torque to Appendix B specifications.

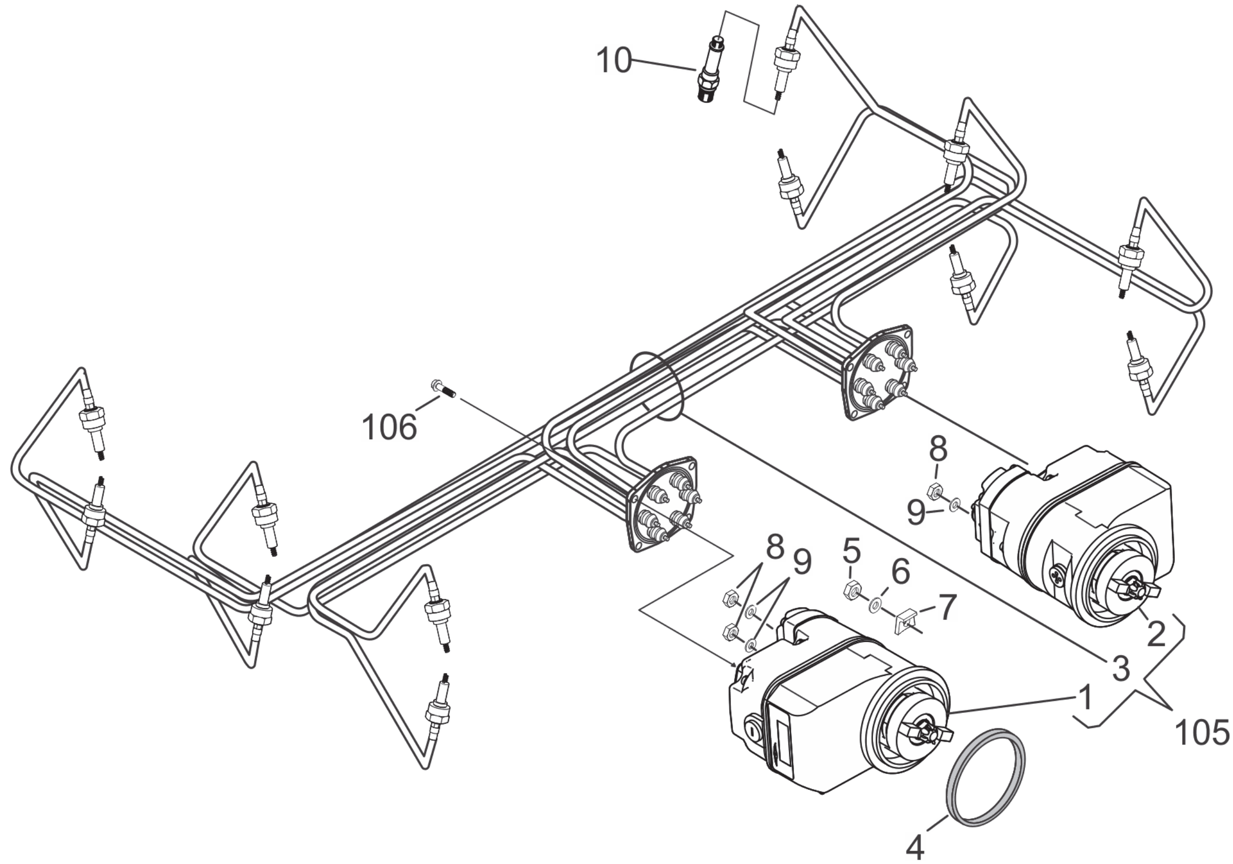


Figure 17-48. Continental Ignition Assembly

1	Magneto (2-4-6)	4	Gasket	7	Retainer, Magneto	10	Spark Plug
2	Magneto (1-3-5)	5	Nut	8	Nut	105	Ignition System Kit
3	Ignition Harness	6	Lock washer	9	Lock Washer	106	Screw

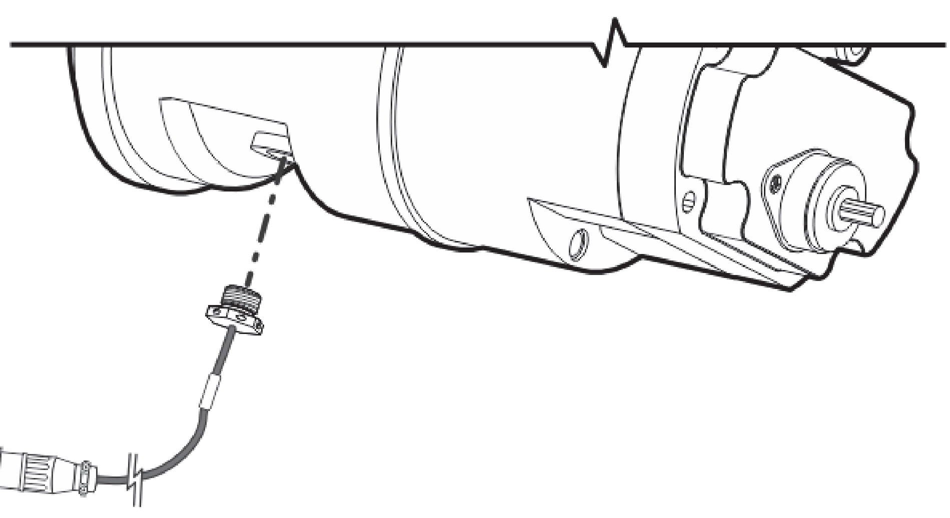


Figure 17-49. Magneto Sensor

17-12.2. Champion (Slick) Ignition System Installation

1. Complete "Crankshaft Top Dead Center Alignment" in Section 6-3.9.1.1.
2. Remove inspection hole plugs from the magneto(s). Turn the impulse coupling backward so latches will not engage until timing pointer inside inspection hole is aligned with marked distributor gear tooth.
3. Insert T118 timing pin in "L" or "R" hole (depending on magneto rotation) in the distributor block. Turn rotor in the opposite direction of rotation until pin engages the gear.
4. Without turning the magneto coupling, hold the magneto in the position it will occupy when installed.
   a. Align the gear coupling slot and impulse coupling lugs by pulling the magneto gear out and turning it to the desired position.
   b. Push the gear back into the meshed position.
   c. Verify the magneto drive coupling bushings and retainers are properly installed.
   d. Remove the T118 timing pin from the magneto.
5. Install a new gasket (Figure 17-50) (2) on the magneto flange.
6. Carefully insert the magneto in the crankcase, aligning the drive coupling lugs with the drive bushing slot. Install Secure the magneto with hold-down washers (6), new lock washers (5) and nuts (4); hand-tighten the nuts at this time.
7. Complete "Magneto to Engine Timing" in Section 6-3.9.1.2. Upon completion of magneto timing, torque the nuts (4) to Appendix B specifications.
8. Disconnect timing light from magnetos.
9. Connect the cable outlet plate to the magneto; secure with screws (not numbered in illustration) and torque to Appendix B specifications.
10. Connect magneto tachometer sensor (Figure 17-49) to the bottom of one of the magnetos, if equipped (determined by airframe manufacturer's instructions) and torque to Appendix B specifications.

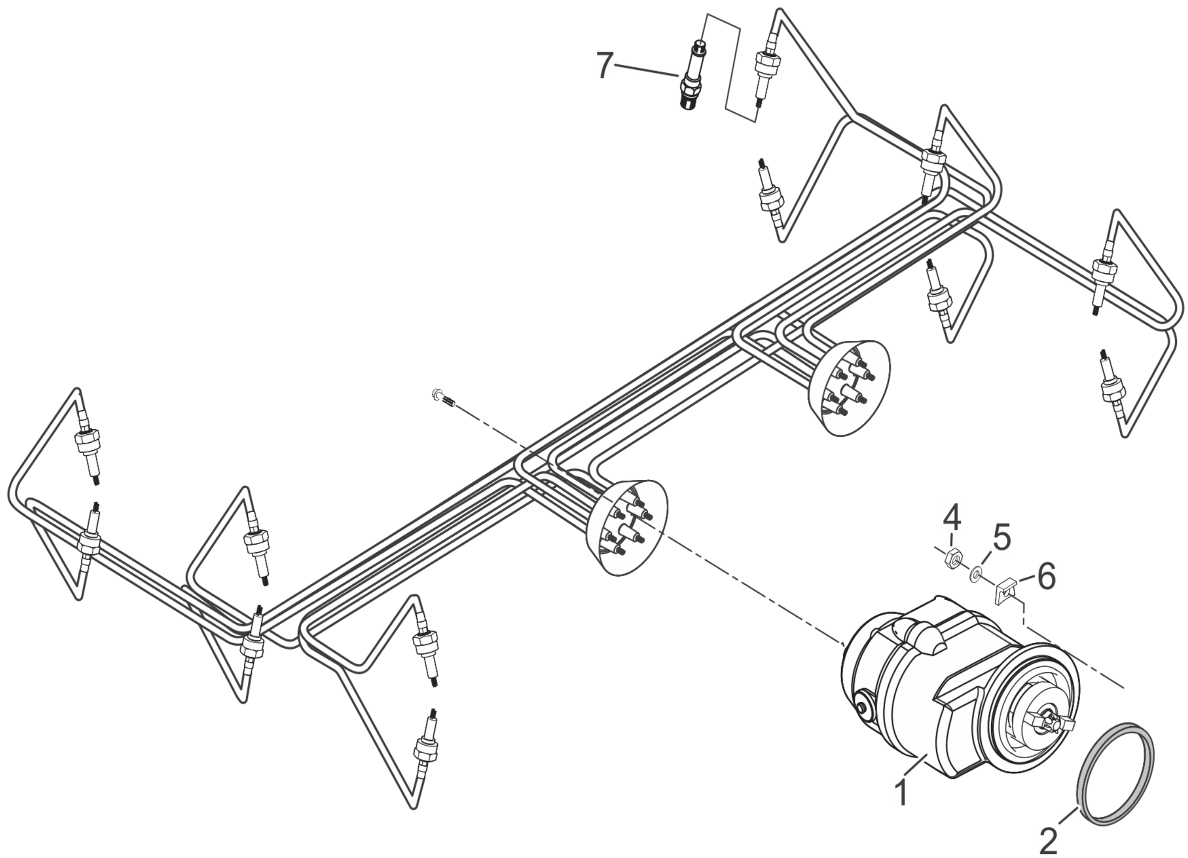


Figure 17-50. Slick Ignition Assembly

1	Magneto	3	Ignition Harness	5	Lock washer	7	Spark Plug
2	Gasket	4	Nut	6	Retainer, Magneto		

17-13. Compressor (Optional) Mount Installation

1. Remove the self-locking 12-point nut (Figure 17-51) (20) (item 16 in Figure 17-29) and spacer (15) from the starter adapter PTO shaft.
2. Discard the spacer (Figure 17-29) (15) and install a drive sheave (Figure 17-51) (19) in place of the spacer.
3. Temporarily secure the drive sheave with a new self-locking 12-point nut (20). Do not torque at this time.
4. Remove the nut (Figure 17-9) (54), washer (53) and spacer (52) from the 1-3-5 side of the crankcase; discard the spacer (52).
5. Replace the O-ring (51) with a new one (51).
6. Install the mounting bracket (Figure 17-51) (1) on the crankcase upper through-bolt (50).
7. Loosely install a washer (Figure 17-9) (53) and nut (54).
8. Align the lower mounting bracket (Figure 17-51) (1) bolt holes with the crankcase bolt bosses.
9. Lubricate the bolt threads (Figure 17-51) (16) with 50 weight aviation engine oil and install the bolts (16) with washers (17) through the mount (1) into the crankcase.

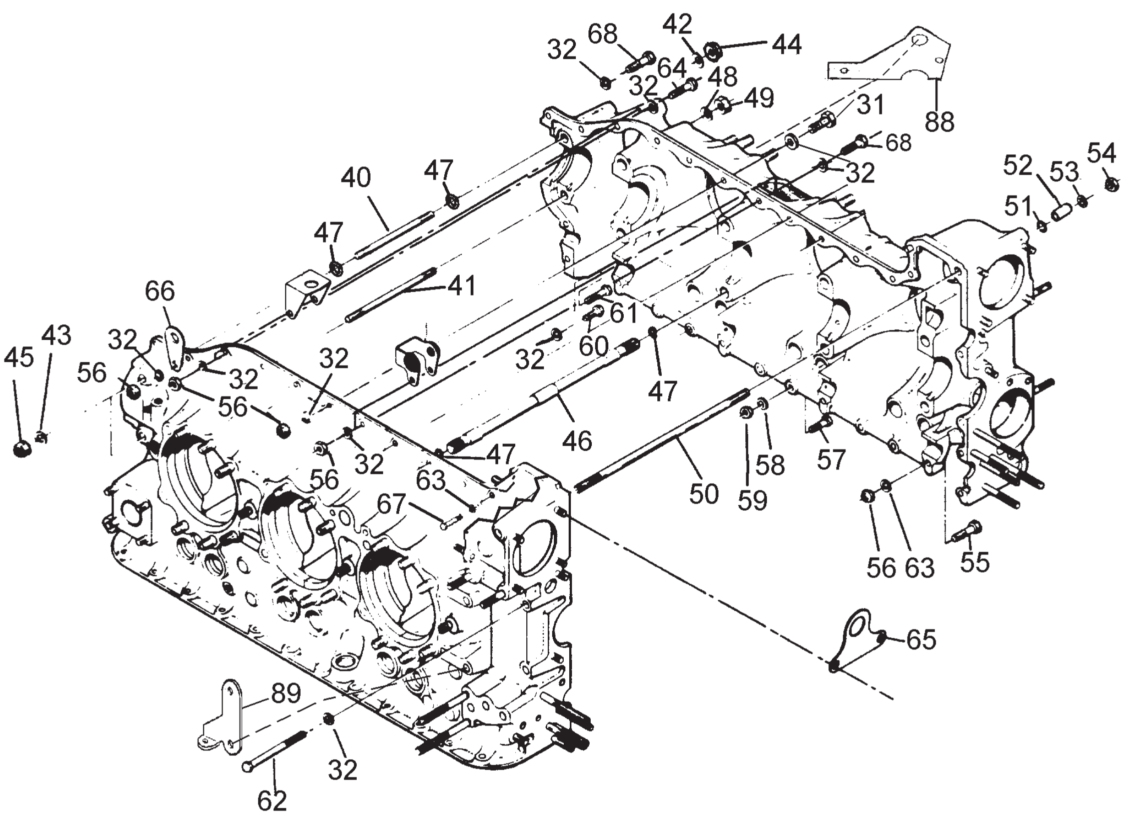


Figure 17-9 repeated for reference

10. Begin with the through-bolt nut (54), torque the nut (Figure 17-9) (54) and two bolts (Figure 17-51) (16) in a counterclockwise sequence, to Appendix B specifications.
11. Install the customer-supplied air conditioning compressor using kit supplied bolts (Figure 17-51) (15), plain washer (14) and nuts (13). Torque the nuts (13) and bolts (15) to Appendix B specifications. Proceed with the remaining refrigerant compressor installation according to the airframe manufacturer's instructions.

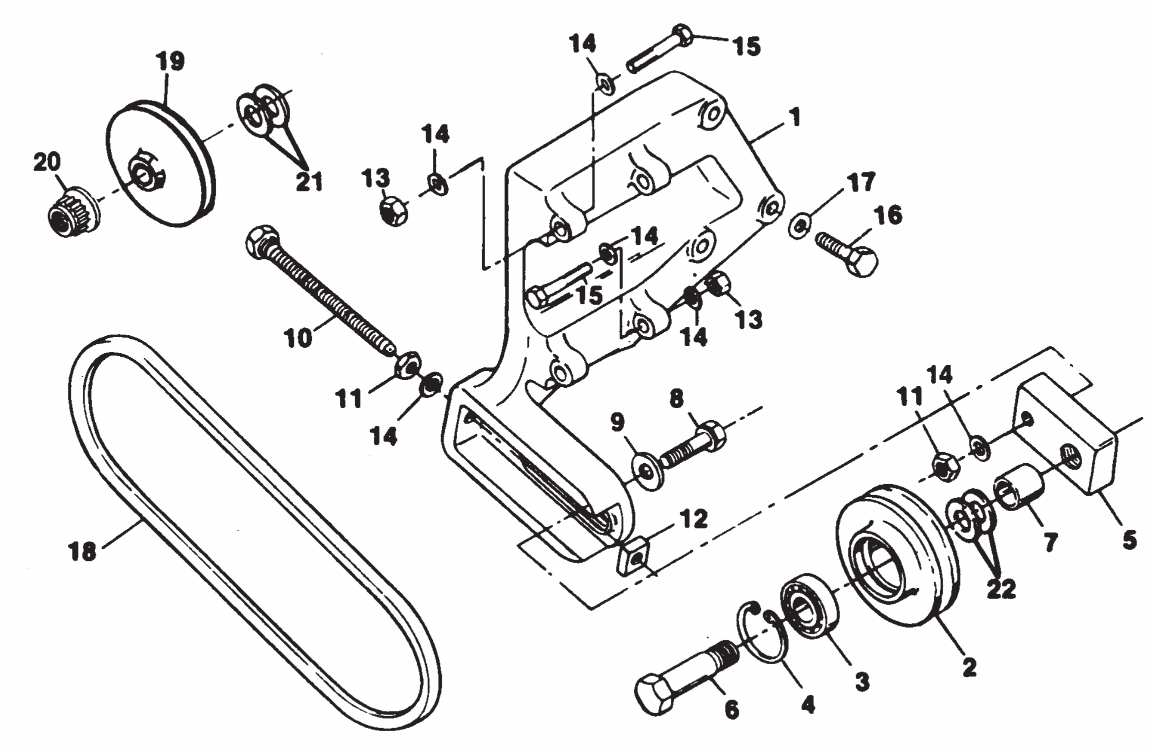


Figure 17-51. Refrigerant Compressor Mounting Assembly

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 inch, 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 (Figure 17-52) (Ideal Aviation Part No. 8082IA, or equivalent ("Special Tools" in Chapter 3).
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 17-52) 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 sheave (19) or idler sheave (2) is misaligned, install up to five 0.020-inch shims (Figure 17-51)(21 or 22) to align the sheaves. Do not install more than five shims in either location (Figure 17-53).
18. Lubricate the sheave support bolt (Figure 17-51) (6)with clean, 50-weight aviation engine oil. The sheave support bolt (6) must extend beyond the threads of the block assembly (5) when installed.

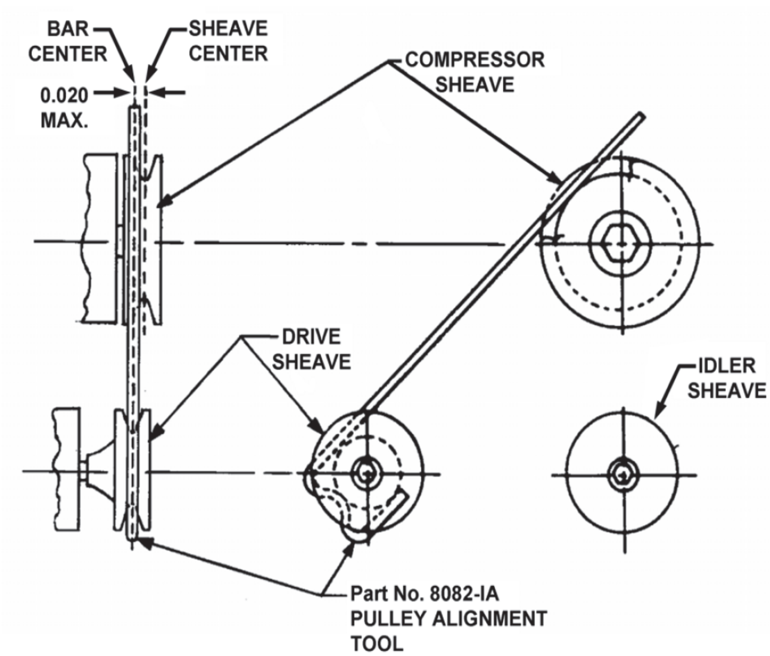


Figure 17-52. Sheave Alignment

19. When the idler sheave is aligned, prevent the engine from turning and torque the sheave support bolt (6) and new 12-point self locking nut (20) to Appendix B specifications.
20. Loosen the jam nut (11) and unscrew the tensioning bolt (10) far enough to install the new drive belt (18).
21. Slide the idler sheave (2) snugly against the new drive belt (18) tighten the tensioning bolt (10) finger-tight into its socket. In this position the idler sheave should rotate by hand under the belt.
22. Tighten the tensioning bolt (10) 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 (Ideal Aviation Part No. BT-33-73FIA, or equivalent (“Special Tools” in Chapter 3)).

b. Measure the belt deflection under a 5-pound load at the center of the longest belt span (Figure 17-54). Acceptable deflection is 0.30 to 0.40 inches.

NOTE: A full turn of the adjusting screw will change the belt tension by approximately 10 pounds.

23. Adjust the tensioning bolt (Figure 17-54) (10) for proper belt tension and tighten the jam nut (11). Torque the tensioning bolt jam nut (11) and the idler sheave bracket slide bolt (8) and nut (11) to Appendix B specifications.

24. After approximately 5 hours of operation, check the belt tension and adjust as required to maintain 50 to 70 pounds of belt tension.

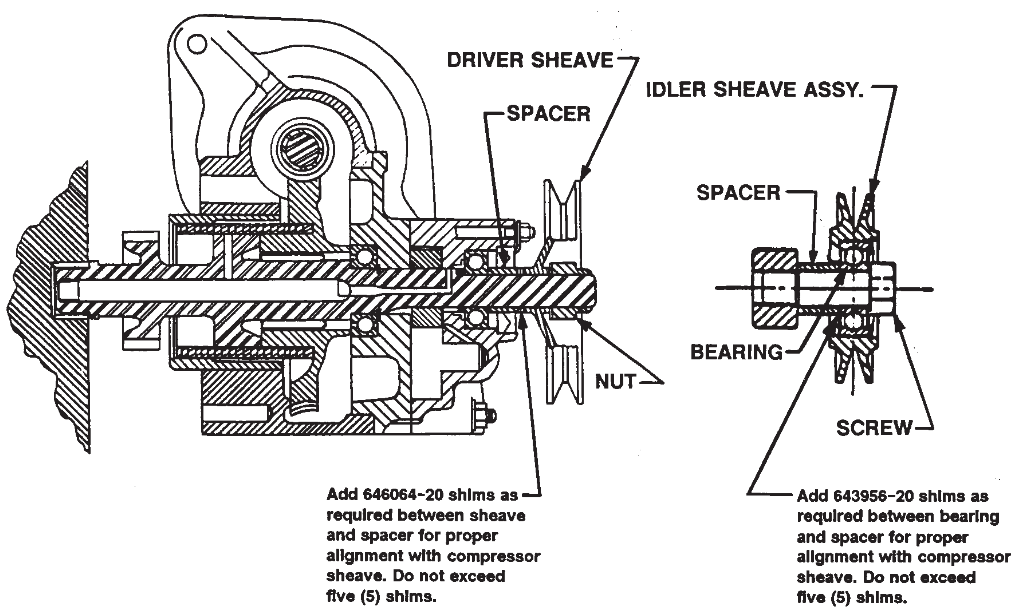


Figure 17-53. Starter Adapter Belt Sheave Alignment

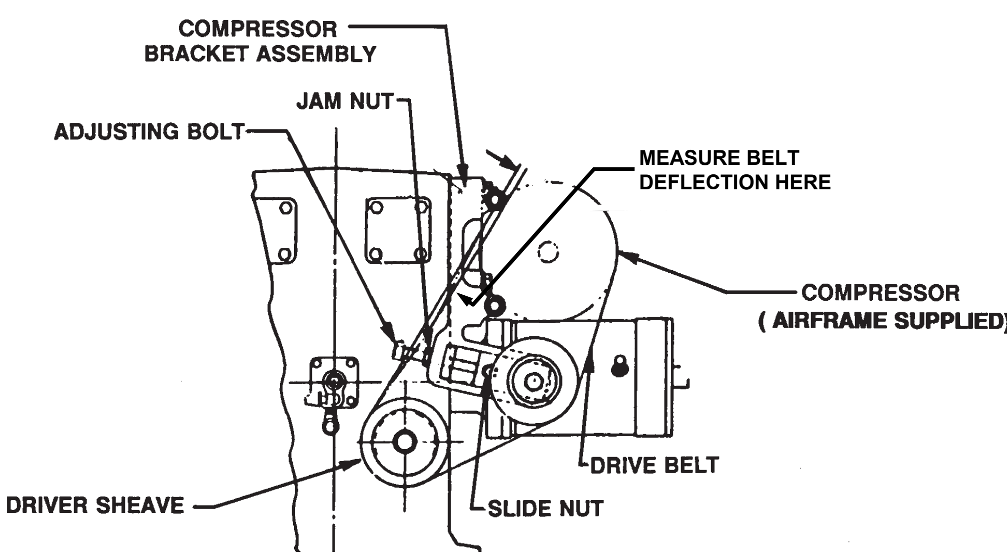


Figure 17-54. Belt Tension Adjustment

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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 6-3.7.2
2	Maintenance Test Run	“Standard Acceptance Test” in Section 18-4
3	Complete Operational Checklist	“Engine Operational Checklist” in Section 6-11
4	Check Oil Consumption	“Oil Consumption Test” in Section 18-5
5	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 airframe 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 6-3.8.

  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 o 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 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 airframe 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 a suitable manifold pressure connection on the induction manifold
  - An exhaust gas 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 fittings 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 return line to the upper elbow projecting from the right side of the fuel pump.
3. Connect a fuel pressure gauge in line with the fuel distribution block fuel outlet.

18-3. Post-Overhaul Test Operating Limits

Post-overhaul test limits are the same as the “IO-550 Engine Operating Limits”found in Table 6-3.

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	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° Max. CHT at shut down.)[3]
7	---	Stop engine and perform leak check.[4]
8	10	75% Power RPM
9	5	Idle RPM

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 channel alone at 1700 RPM. Clear the spark plugs by operating with both magnetos on for a few seconds between checks.
3. Do not shut engine down until oil temperature is below 200°F (93°C) and cylinder temperatures are below 300°F (149°C).
4. 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

The Oil Consumption Test may be accomplished in addition to the Standard Acceptance Test. Use Table 18-3 to determine engine oil consumption.

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 five hours of engine operation, check the belt tension of newly installed drive belts according to the "Belt Tension Check and Adjustment" instructions in Section 6-3.10.4.

Appendix A. Glossary

A-1. Acronyms

The following acronyms are commonly used throughout Continental Motors' technical publications.

Acronym	Definition
A & P	Airframe & Powerplant
AD	Airworthiness Directive
AFM	Airplane Flight Manual
AO	Authorized Oversize
APU	Auxiliary Power Unit
AR	As Required
AU	Authorized Undersize
BHP	Brake Horsepower
BSOC	Brake Specific Oil Consumption
BTC	Before Top Dead Center
CFM	Cubic Feet per Minute
CHT	Cylinder Head Temperature
CSB	Critical Service Bulletin
DMM	Digital Multimeter
DVM	Digital Volt-ohm Meter
EGT	Exhaust Gas Temperature
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FBO	Fixed Base Operator
HP	Horsepower
IAW	In accordance with
ICA	Instructions for Continued Airworthiness
MAP	Manifold Air Pressure
MAT	Manifold Air Temperature
MEK	Methyl Ethyl Ketone
MHS	Material Handling Specifications
MJ	Main Journal
MSB	Mandatory Service Bulletin
OEM	Original Equipment Manufacturer
NATO	North Atlantic Treaty Organization

Acronym	Definition
POH	Pilot's Operating Handbook
PMA	Parts Manufacture Approval
RMS	Root Mean Square
RPM	Revolutions per Minute
SB	Service Bulletin
SID	Service Information Directive
SIL	Service Information Letter
STANAG	Standardization Agreement (STANAG)
STC	Supplemental Type Certificate
TBO	Time Between Overhauls
TC	Type Certificate
TDC	Top Dead Center
TIT	Turbine Inlet Temperature
TSO	Technical Standard Order
TSMOH	Time Since Major Overhaul
WOT	Wide Open Throttle

A-2. Terms and Definitions

Term	Definition
Airworthiness Approval Tag	FAA Tag 8130-3 that identifies a part or group of parts that has been deemed airworthy by an authorized FAA representative.
Burning	In reference to the engine valves, indicates roughening or erosion due to high temperature gases escaping past valve faces. In other instances, it indicates drawing of the temper of steel parts to a soft (blue) condition, as a result of overheating, during an absence of lubrication on moving surfaces, such as gear teeth subject to high loading.
Burr	Sharp or rough projection of metal.
Chafing	Condition caused by a rubbing action between adjacent or contacting parts under light pressure which results in wear.
Crack	Partial separation of material usually caused by vibration, overloading, internal stresses, improper assembly, or fatigue.
Critical Service Bulletin	Service document based on determination by the product manufacturer to constitute a threat to continued safe operation of an aircraft or to persons or property on the ground unless the owner or operator takes some specific action (inspection, repair, replacement, etc.). Documents in this category are candidates for incorporation into an Airworthiness Directive issued by the FAA.
Dent	Rounded depressed, pushed-in area on a surface.

Term	Definition
Dynamic Seal	Vital seal in the engine cylinder that consists of valve-to-valve seat seals, spark plug-to-spark plug port seals, and cylinder head-to-barrel seal.
Elongate	To stretch out or lengthen.
Erosion	Wearing away of material due to flow, hot gases, grit, or chemicals.
Fretting	Surface erosion caused by slight movement between two parts that are fastened together.
Galling	Severe chafing or fretting that results in transfer of metal from one part to another; usually caused by slight movement of mated parts that have limited relative motion and are under heavy loads.
Grooved Surface	Shallow channels, wider than scratches and usually smooth resulting from wear affected by concentrated contact stress.
Hydraulic Lock	Condition where fluid accumulates in the induction system or the cylinder assembly. The liquid restricts the piston from traveling during the compression stroke. Damage to the engine occurs when the other cylinders fire, which forces the piston in the fluid-filled cylinder through the compression stroke. Damage to an engine from hydraulic lock can be extensive due to the extreme stress load and can adversely affect connecting rods, pistons, cylinder assemblies, piston pins, the crankcase, and the crankshaft.
Mandatory Service Bulletin	Service document relating to known or suspected hazards to safety that have 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).
Nick	Sharp-sided gouge or depression with a V-shaped bottom.
Peening	Series of blunt depressions in a surface.
Pitting	Formation of pockets of corrosion products on the surface of a metal.
Propeller Strike	Any incident that requires repair (other than minor dressing of the blade) to a propeller blade. Either the propeller strikes an object or an object strikes the propeller and causing a propeller imbalance. Propeller strikes are serious because they can result in engine failure. Even if the propeller still continues to rotate, other components critical to engine operation may be damaged.
Runout	Eccentricity or wobble of a rotating part; eccentricity of two bored holes or two shaft diameters; a hole or bushing out of square with a flat surface. Runout is usually measured with a dial indicator, and limits stated indicate full deflection of indicator needle in one revolution of part or indicator support.
Scoring	Deep grooves in a surface caused by abrasion from fine hard particles wedged between moving surfaces, as in a bearing and journal, or caused by galling when a moving part is not supplied with lubricant.

Term	Definition
Service Bulletin	Service document that contains information considered by the product manufacturer to constitute a substantial improvement to the inherent safety of an aircraft or component of an aircraft; also includes updates of instructions for continued airworthiness.
Service Information Directive	Service document that contains information determined by the manufacturer to be of value to an owner/operator in the use of a product by enhancing safety, maintenance, or economy.
Service Information Letter	Service information document 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
Spalling	Distress to a loaded surface where chips of the hardened surface are broken out.
Static Seal	Cylinder seal that consists of the piston rings to the cylinder wall seal.
Technical Standard Order	FAA-designated number and identification mark indicating that the part or appliance meets applicable design standards and was manufactured in accordance with the requirements of FAR 21 Subpart O.

Appendix B. Torque Specifications

B-1. General Information

Tables in this appendix list torque values for Continental Motors' aircraft engine hardware. Refer to the appropriate manufacturer's maintenance and overhaul instructions for airframe or engine accessory torque specifications. Table B-1 is for bolts, nuts, screws, driving studs, and pipe plugs; Table B-2 is for fittings; Table B-3 is for hose fittings; Table B-4 lists specific component torque values. Torque values provided in Table B-5 must be used for the listed applications.

WARNING

Torque values listed are for use with clean 50 weight aviation engine oil applied to the threads, unless otherwise specified in Table B-5, which lists specific torque values for non-lubricated hardware.

Confirm items identified in Section C-2.3, "100% Parts Replacement Requirements" or Section C-2.4, "Mandatory Overhaul Replacement Parts" are replaced prior to assembly. Prior to torquing any hardware, unless otherwise specified, apply SAE 50 weight aviation oil to hardware listed in Table B-1 through Table B-4. If an application is not listed in the specific torque limits tables (Table B-4 and Table B-5), use the general torque limits in Table B-1 through Table B-3.

WARNING

Before installing nuts and bolts, verify the fastening hardware is lubricated according to instructions. Inspect all fasteners for proper plating and thread form. Failure to verify a fastener's serviceability or to correctly lubricate the fastener prior to installation will result in the fastener not being properly pre-loaded. Subsequent failure of the fastener may occur.

B-1.1. Torque Tips

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.

- Check Table B-4 and Table B-5 first to determine if the hardware to be torqued requires a specific torque or treatment other than those for general hardware sizes listed in Table B-1 through Table B-3.

- Before installing hardware, verify the fastener size is correct.
- The accuracy of any torque indicating wrench depends on a smooth application of force and current calibration traceable to the National Institute of Standards and Technology (NIST), verifiable by the calibration data label affixed to the tool.
- If cotter pin holes must be aligned, set the torque wrench at the low limit and tighten the nut to the first hole beyond this torque, but do not exceed the maximum specified torque limit. This torquing procedure must be followed for all applications requiring cotter pin hole alignment except for connecting rod nuts.
- If a nut slot cannot be aligned with a cotter pin hole within the specified limits, substitute another serviceable nut to attain alignment.
- If the cotter pin hole in a stud lies beyond the nut slots, when the nut has been torqued properly, check the stud for proper installation or for backing out.
- Check studs for necking.
- Check the part for reduced thickness resulting from wear or incorrect part.

B-2. Cylinder Torque Procedure

Proper cylinder installation requires the bolts be torqued in multiple stages. Replace all through bolts and nuts at overhaul. Cylinder base stud threads, through bolt threads and nuts must be lubricated with clean 50 weight aviation oil. Through bolt nuts at cadmium plated washers require a lower torque value to achieve the same through-bolt pre-load since the lubricity of the cadmium plating reduces joint friction.

1. Torque cylinder through bolt nuts and cylinder base nuts to ½ of the specified torque value for the fastener.
2. Torque the cylinder through bolt nuts and cylinder base nuts to the specified value for the cylinder base stud nuts. Through bolt nuts must be torqued on both sides of the engine, even if only one cylinder is being installed.

WARNING

Failure to torque through bolt nuts on both sides of the engine can result in a loss of main bearing crush with main bearing shift and subsequent engine failure.

NOTE: Through-bolt nuts P/N 634505 and 649496 have been superseded by P/N 652541.

Nut P/N 634505 is a flanged six-point (hex) nut requiring a torque value of 690-710 inch-pounds. Nut P/N 649496 is a flanged six-point (hex) nut requiring a torque value of 790-810 inch-pounds. At engine overhaul, all P/N 634505 and P/N 649496 flanged through bolt nuts must be replaced with 652541 flanged twelve-point nuts. If replacing P/N 634505 and P/N 649496 with 652541 in less than a complete set prior to engine overhaul, torque the 652541 twelve-point nuts to the torque value of the original fastener (P/N 634505 or P/N 649496).

3. Torque through-bolt nuts on both sides of the engine to the specified torque value.
4. For engines which incorporate the seventh cylinder deck stud, install the seventh stud cylinder bracket and conical stud nut. Torque the stud nut to the value specified for the fastener.

B-3. Torque Wrench and Extension Calculations

Torque wrenches measure the force applied to the fastener on the axis of the square drive socket adapter.

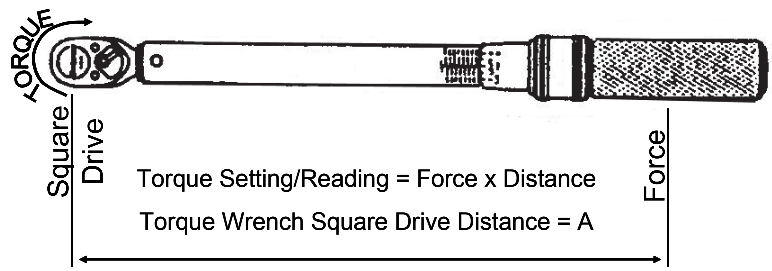


Figure B-1. Torque Wrench

Straight extensions and wobble extensions up to 15 degrees, which extend the square drive length, do not alter the amount of force applied to the square drive enough to cause concern. An offset adapter may be used with a torque wrench without affecting applied torque if the extension is positioned at a 90 degree angle in relation to the square drive adapter. In any other orientation, the extension alters the force applied to the fastener.

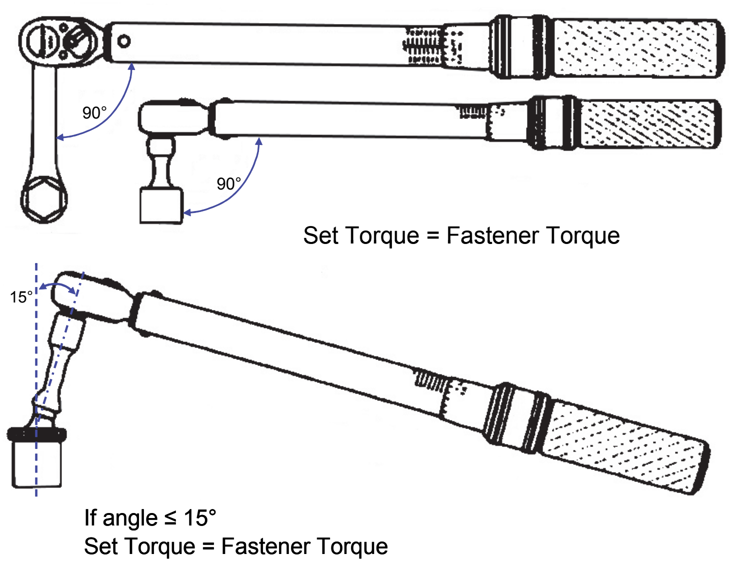
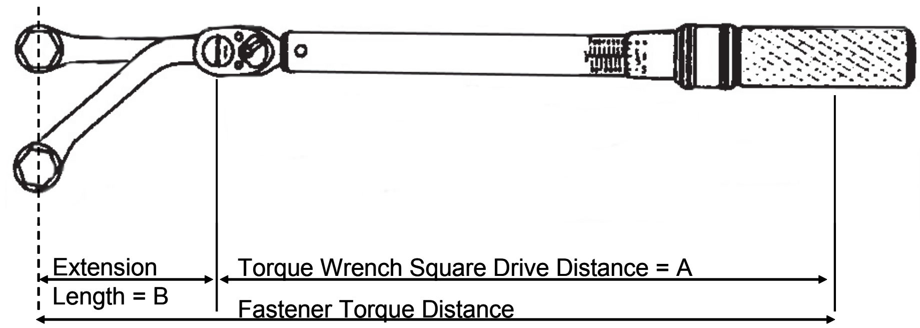


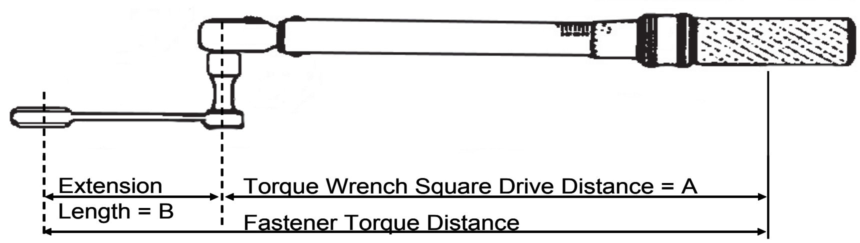
Figure B-2. Drive extensions

Apply the formula below to determine the appropriate torque wrench setting when using an extension:

$$S = \frac{T}{A + B} \times A$$

Where:
S = desired torque setting or reading
T= torque applied at square drive adapter
A= length of handle in inches
B= length of extension in inches



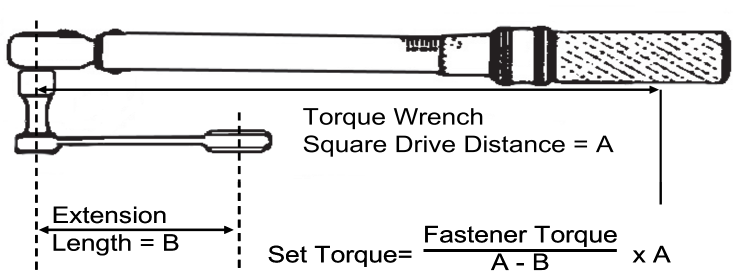


$$\text{Set Torque} = \frac{\text{Fastener Torque}}{A + B} \times A$$

Figure B-3. Extension increases applied torque

Examples in Figure B-3 and Figure B-4 illustrate how extensions can alter the torque applied to the fastener. Examples in Figure B-3 adds the length of the extension to the torque wrench, increasing the leverage applied to the fastener. The position of the extension in Figure B-4 reduces the effective length of the handle and the applied leverage. The length of the extension (variable B) is subtracted from variable A in Figure B-4.

Let's assume the torque wrench has an effective length of 12 inches and the extension measures six inches from the center of the drive adapter to the center of the wrench. If we need to torque a nut and bolt to 45 inch-pounds, we set the dial on the wrench in Figure B-3 to 30 (45 ÷ (12+6) x 12). The same torque wrench, used with the extension in Figure B-4 must be set to 90 (45 ÷ (12-6) x 12) to apply 45 inch pounds of torque to the same nut and bolt.



$$\text{Set Torque} = \frac{\text{Fastener Torque}}{A - B} \times A$$

Figure B-4. Extension decreases applied torque

Table B-1. General Torque Specification

Bolts, Nuts, Screws		
Size	Torque	
	In. lbs.	Ft. lbs.
#2-56	1.4-2.6	N/A
#4-40	2.9-5.5	N/A
#6-32	5.3-10.1	N/A
#8-32	17.5-22.5	1.5-1.9
#10-32	36-50	3.0-4.2
#10-24	21-25	1.7-2.0
.250-20	75-85	6.3-7.1
.250-28	90-100	7.5-8.3
.3125-18	155-175	12.9-14.6
.3125-24	180-220	15.0-18.3
.375-16	220-260	18.3-21.7
.375-24	275-325	22.9-27.1
.44-20	400-450	33.3-37.5
.50-20	550-600	45.8-50.0
Driving Studs		
.250-20	50-70	4.2-5.8
.3125-18	100-150	8.3-12.5
.375-16	200-275	16.7-22.9
.44-14	300-425	25.0-35.4
Pipe Plugs		
.062-27	30-40	2.5-3.3
.125-27	60-80	5.0-6.7
.250-18	130-150	10.8-12.5
.375-18	185-215	15.4-18.0
.500-14	255-285	21.3-23.8
.750-14	310-350	25.8-29.2

Table B-2. Tube Fitting Torque Specifications

Size	Hose Assembly	Tube O.D.	Torque (In-lbs)
.31-24	#2 Brass / Aluminum	.125	15-30
.31-24	#2 Steel	.125	15-50
.38-24	#3 Brass / Aluminum	.188	40-65
.38-24	#3 Steel	.188	50-90
.44-20	#4 Brass / Aluminum	.250	60-80
.44-20	#4 Steel	.250	70-120
.44-24	Steel	.190	60-80
.56-18	#6 Brass / Aluminum	.375	75-125
.56-18	#6 Steel	.375	90-150
.75-16	#8 Brass / Aluminum	.500	150-250
.75-16	#8 Steel	.500	135-250
.88-14	#10 Brass / Aluminum	.625	200-350
.88-14	#10 Steel	.625	300-400

Table B-3. Hose Fitting (“B” Nut) Torque Specification

Hose Size	Hose End Fitting Material	Torque (In-lbs)
#2 (.31-24)	Brass/Aluminum Fitting	50-80
#2 (.31-24)	Steel Fitting	75-120
#3 (.38-24)	Brass/Aluminum Fitting	70-105
#3 (.38-24)	Steel Fitting	95-140
#4 (.4375-20)	Brass/Aluminum Fitting	100-140
#4 (.4375-20)	Steel Fitting	135-190
#5 (.500-20)	Brass/Aluminum Fitting	130-180
#5 (.500-20)	Steel Fitting	170-240
#6 (.5625-18)	Brass/Aluminum Fitting	150-195
#6 (.5625-18)	Steel Fitting	215-280
#8 (.750-16)	Brass/Aluminum Fitting	270-350
#8 (.750-16)	Steel Fitting	470-550
#10 (.875-14)	Brass/Aluminum Fitting	360-430
#10 (.875-14)	Steel Fitting	620-745
#12 (1.063-12)	Brass/Aluminum Fitting	460-550
#12 (1.063-12)	Steel Fitting	855-1055

Table B-4. Component Specific Torque Specifications

Size	Fastener	Torque Value In-Lbs	Torque Value Ft-Lbs	Models Affected
Crankcase				
.25-28	Nut, Crankcase Flange-bottom	90-110	7.5-9.9	All Models (AR)
.31-18	Bolt, Oil Sump Flange	155-175	12.9-14.6	All Models (AR)
.31-24	Nut-Crankcase Flange	180-220	15.0-18.3	All Models (AR)
.31-24	Nut-Crankcase Backbone	240-280	20.0-20-3	(AR) Stainless Steel hardware Only
.31-24	Nut, Magneto to Crankcase	100-120	8.3-10.0	All Model (AR)
.38-16	Bolt-Engine Mount to Crankcase	220-260	18.3-21.7	IO-550-G
.38-24	Nut-Crankcase Through Bolts, Upper Rear	275-325	22.9-27.1	All Models (AR)
.38-24	Nut-Crankcase Tie Bolts	370-390	30.8-32.5	All Models (AR)
.38-24	Nut-Mounting Bracket to Crankcase	275-325	22.9-27.1	All Models (AR)
.44-20	Nut-Crankcase Tie-Bolts-Nose & Below Camshaft	440-460	36.7-38.3	All Models (AR)
.44-20	Nut-Cylinder to Crankcase Studs (including 7th stud)	490-510	40.8-42.5	All Models (AR)
.44-20	Nut-Through Bolt at Cadmium Plated Washer	440-460	36.7-38.3	All Models (AR)
.44-20	Nut-Through Bolt at Cylinder Flange	490-510	40.8-42.5	All Models (AR)
.44-20	Nut-Through Bolt at Front Mount Belt-Driven Alternator	490-510	40.8-42.5	All Models (AR)
.50-20	Nut-Crankcase Through Bolt at Cadmium Plated Washer	615-635	51.2-52.9	All Models (AR)
.50-20	Nut-Crankcase Through Bolt at Cylinder Flange, 6 point/0.33" tall (Part No. 634505)	690-710	57.5-59.2	All Models (AR)
.50-20	Nut-Crankcase Through Bolt at Cylinder Flange, 12 point (Part No. 652541)	790-810	65.8-67.5	All Models (AR)
.50-20	Nut-Crankcase Nose Tie Bolts	640-660	53.5-55.0	All Models (AR)
.62-18	Plug (with crush washer)	190-210	15.8-17.5	All Models (AR)
Gears				
.31-24	Bolt-Gear to Camshaft	240-260	20.0-21.7	All Models (AR)
.31-24	Bolt-Gear to Crankshaft (Bolt Hardness Rc 38-42)[1]	380-420	31.7-35.0	All Models (AR)
.31-24	Bolt, Face Gear to Crankshaft	140-150	11.7-12.5	All Models (AR)

Table B-4. Component Specific Torque Specifications

Size	Fastener	Torque Value		Models Affected
		In-Lbs	Ft-Lbs	
Connecting Rods				
.44-20	Nut, Connecting Rod (Spiralock) (Nut P/N 643215 w/bolt P/N 643112)	550-600	45.8-50.0	All Models (AR)
.44-20	Nut, Connecting Rod (Spiralock (12 point nut P/N 654490)	690-710	57.5-59.2	For Specific Application, See Footnote[2]
Miscellaneous Fuel Injection				
#8-32	Screw, Aneroid Body Hold Down (AN500-8-14)	17.5-22.5	1.5-1.9	All Fuel Injected Model (AR) with Aneroid Pump
#8-32	Screw, Manifold Cover Hold Down (AN503-8-12)	22-26	1.8-2.2	All Fuel Injected Model (AR)
.125-27	Fitting, Vapor Separator Fuel Pump Cover	60-80	5.0-6.7	All Fuel Injected Model (AR)
.125-27	Nozzle, Fuel Injector (w/anti-seize compound)	55-65	4.6-5.4	All Fuel Injected Model (AR)
.19-24	Through Bolt, Fuel Pump	29-31	2.4-2.6	All Fuel Injected Model (AR)
.25-28	Ejector, Fuel Pump Cover (Vapor Separator)	90-100	7.5-8.3	All Fuel Injected Model (AR)
.25-48	Aneroid Stem Jam Nut	25-30	2.1-2.5	All Fuel Injected Model (AR) with Aneroid Pump
.31-24	Nozzle, Fuel Injector (w/anti-seize compound)	55-65	4.6-5.4	All Fuel Injected Model (AR)
.31-24	Nut, Throttle and Mixture Control Levers to Shaft	100-120	8.3-10.0	All Fuel Injected Model (AR)
.31-32	Nut, Fuel Injection Line	40-45	3.3-3.7	All Fuel Injected Model (AR)
.38-24	Nut, Fuel Injection Line	55-60	4.5-5.0	All Fuel Injected Model (AR)
.62-18	Plug & Screen Assembly Metering Unit w/New Gasket	120-130	10.0-10.8	All Fuel Injected Model (AR)
Miscellaneous Lubrication System Fasteners				
.25-20	Bolt, Oil Cooler to Adapter	100-110	8.3-9.2	All Models (AR)
.25-20	Bolt, Oil Pump Cover to Crankcase	75-85	6.3-7.1	All Models (AR)
.25-28	Nut, Governor Oil Transfer Collar Assembly	75-85	6.3-7.1	All Models (AR)
.62-18	Plug, Oil Cooler (w/crush washer)	190-210	15.8-17.5	All Models (AR)
.62-18	Plug, Oil Suction Tube (w/crush washer)	190-210	15.8-17.5	All Models (AR)
.62-18	Plug, Oil Sump Drain	190-210	15.8-17.5	All Models (AR)
.62-18	Oil Filter, Cartridge	180-216	15.0-18.0	All Models (AR)

Table B-4. Component Specific Torque Specifications

Size	Fastener	Torque Value		Models Affected
		In-Lbs	Ft-Lbs	
.75-16	Oil Filter, Disposable	192-216	16.0-18.0	All Models (AR)
.88-16	Plug, Oil Bypass	240-260	20.0-21.7	All Models (AR)
1.00-14	Oil Temperature Control Valve (Vernatherm)	440-460	36.7-38.3	All Models (AR)
1.12-18	Housing, Oil Pressure Relief Valve	240-260	20.0-21.7	All Models (AR)
1.25-18	Plug, Special Oil Temperature Control Valve (Vernatherm)	310-320	20.8-29.2	All Models (AR)
1.25-18	Oil Temperature Control Valve (Vernatherm)	410-420	34.2-35.0	All Models (AR)
1.375-16 LH	Housing, Tachometer Drive	250-350	20.8-29.2	All Models (AR)
1.75-16	Oil Filter Screen (w/new crush gasket) (Install Gasket with parting line against screen face)	500-520	41.6-43.3	All Models (AR)
Miscellaneous Cylinder Hardware				
.071 (18mm)	Spark Plug [3]	300-360	25.0-30.0	All Models
.125-27	Connector, Cylinder Drain	60-80	5.0-6.7	All Models (AR)
.19-32	Screw, Cylinder Baffle	10-20	.84-1.7	All Models (AR)
.25-20	Screw, Rocker Cover	55-65	4.6-5.4	All Models (AR)
.25-20	Screw, Intake Flange	85-110	7.1-9.2	All Models (AR)
.25-20	Bolt, Through Bolted Rocker Shaft	90-100	7.5-8.3	IO-550-A, B & C
.25-28	Nut, Exhaust (self locking)	120-130	10.0-10.8	All Models (AR)
.25-28	Nut, Exhaust Manifold Flange (Spirotallic Gasket)	100-110	8.3-9.2	All Models (AR)
.31-18	Bolt, Rocker Shaft Hold Down [4]	190-210	15.8-17.5	IO-550-G, N, P & R
.31-24	Bolt, Rocker Shaft Hold Down[5]	85-110	7.1-9.2	IO-550-A, B & C
.31-24	Nut, Exhaust Manifold Flange (Spirotallic Gasket)	200-210	16.7-17.5	All Models (AR)

Table B-4. Component Specific Torque Specifications

Size	Fastener	Torque Value In-Lbs	Torque Value Ft-Lbs	Models Affected
Miscellaneous Fasteners				
---	Clamp, Induction Hose	25-35	2.0-2.9	All Models (AR)
.25-62	Clamp, Magneto Pressurization Hose	10-14	0.8-1.17	All Models with Pressurized Magnetos
.31-18	Bolt, Alternator Mounting	150-180	12.5-15.0	All Models (AR)
.38-24	Bolt, Refrigerant Compressor Bracket Mount	275-325	22.9-27.1	All Models (AR)
.38-24	Jam Nut, Refrigerant Compressor Belt Tension Adjustment	275-325	22.9-27.1	All Models (AR)
.38-24	Nut, Refrigerant Compressor to Bracket Mount	275-325	22.9-27.1	All Models (AR)
.38-24	Slide Nut, Refrigerant Compressor Belt Tension Adjustment	300-350	25.0-29.2	All Models (AR)
.38-24	Nut, Starter to Adapter	200-220	16.7-18.3	All Models (AR)
.56-18	Nut, Starter Shaft Gear[6]	450-500	37.5-41.6	IO-550-B & C
.56-18	Nut, Generator Pulley Drive	450-500	37.5-41.7	All Models (AR)
.56-18	Screw, Shoulder, Refrigerant Compressor Idler Sheave	800-850	66.6-70.8	All Models (AR)
.56-24	Tach Sensor, Magneto	35-40	2.9-3.3	All with Magneto Tach Sensor
.62-32	Nut, Alternator Hub Assembly	300-450	25.0-37.5	All Models (AR)
.66-20	Nut, Alternator or Generator Pulley	450-500	37.5-41.7	All Models (AR)
.68-24	Tach Sensor, Magneto	35-40	2.9-3.3	All with Magneto Tachometer Sensor

1. Heat crankshaft gear to 300°F; install on crankshaft immediately for shrink fit. Ensure the gear seats tightly against the end of the crankshaft by tapping lightly with a brass hammer.
2. Connecting Rod Application:

Rod 655001 Superseded by 655911 (Nut 654490 & Bolt 643112)	IO-550-A, B, C, D, E, F, G, L, N, P, R;
Rod 655503 Superseded by 655913 (Nut 654490 & Bolt 643112)	IO-550-B, C Special Edition Only
Rod 655913	IO-550-B, C, D, F, G, N Special Edition & Platinum

3. Lubricate spark plug threads with spark plug manufacturer's recommended lubricant.
4. Do not realign hex cap screw to mate with tab washer.
5. Must be reworked to through bolt rocker shaft configuration according to most current revision of Service Document M92-6.
6. Align and tension belt according to most current revision of Service Document M89-6.

Table B-5. Specific Torque for Non-Lubricated Hardware

Size	Fastener	Torque Value		Model Affected
		In-lbs	Ft-lbs	
#6-32	Alternator Field Terminal	6-8	0.50-.66	HET 100 Amp Alternator
#8-32	Alternator Aux Terminal	14-16	1.1-1.3	HET 70 Amp Alternator
#8-32	Screw, Throttle Lever	17.5-22.5	1.5-1.9	All
#10-32	Alternator Field & Aux Terminals	15-18	1.25-1.5	CMI 60 Amp Alternator
#10-32	Alternator Field, Aux & Ground Terminals	25-30	2.0-2.5	HET 85 Amp Alternator
#10-32	Alternator Field & Aux Terminals	15-18	1.25-1.5	CMI 100 Amp Alternator
#10-32	Alternator Field Terminal	20-25	1.6-2.0	HET 70 Amp Alternator
#10-32	Alternator Ground Terminal	20-25	1.6-2.0	HET 70 Amp Alternator
#10-32	Alternator Aux Terminal	25-30	2.0-2.5	HET 100 Amp Alternator
#10-32	Alternator Ground Terminal	25-30	2.0-2.5	HET 100 Amp Alternator
#10-32	Nut, Magneto Ground Terminal	17-19	1.41-1.58	S-1200 Series Magnetos
#10-32	Nut, Magneto Ground Terminal	15-17	1.25-1.41	S-20/200 Series Magnetos
Various	Nut, Magneto Ground Terminal	13-15	1.08-1.25	Slick Magnetos
Various	Nut, Ignition Harness Cable Outlet Plate	18-22	1.5-1.8	S-1200 Series Magnetos
Various	Screw, Ignition Harness Cable Outlet Plate	18-22	1.5-1.8	S-20/200 Series Magnetos
Various	Screw, Ignition Harness Cable Outlet Plate	18-25	1.5-2.08	Slick Magnetos
0.125-27 (dry seal)	Fuel Injector Nozzle to Cylinder[1]	55-65	4.6-5.4	All
0.31-32	B-Nut, Fuel Injection Line to Fuel Injector Nozzle	40-45	3.3-3.8	All
0.375-24	B-Nut, Fuel Injection Line to Fuel Manifold Valve[1]	55-60	4.6-5.0	All Non-FADEC Fuel Injected
0.625-24	B-Nut, Ignition Lead to Spark Plug	90-95	7.5-7.91	All
0.75-20	B-Nut, Ignition Lead to Spark Plug	110-120	9.2-10.0	All
1.00-14	Oil Temperature Control Valve[2]	440-460	36.7-38.3	All
1.12-18	Oil Pressure Relief Valve Housing	240-260	20.0-21.7	All

1. Apply P/N 646943 Anti-Seize Lubricant
2. Apply Loctite Pipe Sealant 592

Appendix C. Standard Practices

C-1. Handling Parts

When removing, replacing, or re-installing parts, heed the following precautions, warnings, and tips:

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.

- If the engine is installed, disconnect engine electrical (battery) power and verify the Ignition Switch is turned OFF. Confirm continuity between the magneto capacitor and aircraft ground before commencing engine maintenance.
- Inspect replacement parts for deterioration or wear. Do not install parts that appear worn, deteriorated, or beyond published (service or overhaul) limits.
- Prevent safety wire, nuts, washers, dirt, etc. from entering the engine.
- If any foreign object accidentally falls into the engine, stop working on the engine immediately and retrieve the dropped object(s).
- Tag unserviceable parts or units for investigation and possible repair.
- To ensure proper re-installation of usable parts, tag or mark all parts and hardware as they are removed or disassembled.
- Use protective caps, plugs, and covers to ensure openings are unexposed. Install dust caps **over** the tube ends of open lines and **NOT IN** the tube ends. Be sure to remove the dust caps and covers after the maintenance or repair work is complete.
- Cover stored engine sub-assemblies.
- Inspect new parts for transit damage. **Do not install damaged or non-conforming parts**. Re-seal or rewrap the new part until the part is ready to be cleaned, prepared, and installed.
- Check the shelf life of new parts to be installed. Do not install parts with an expired shelf life.
- Thoroughly clean parts according to instructions in Chapter 14.
- Use only a plastic or rawhide mallet made to tap engine parts during assembly; never use a hammer.
- Always install new gaskets, o-rings, rubber components, seals, packing, cotter pins, tab washers, safety wire, and lock washers when servicing components.
- Use only new, shake proof or split lock washers, tab washers, elastic stop nuts, cotter pins, and corrosion-resistant safety wire.
- Do not replate cadmium-plated fasteners or washers. If the cadmium plating has been removed, discard the item and replace it with a new part.
- Do not re-install any worn, deformed, or single use fasteners.

- Torque hardware to Appendix B torque specifications.

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.

- Before installing nuts and bolts, verify the fastening hardware is lubricated according to Chapter 3 and Appendix B instructions. Inspect all fasteners for proper plating and thread form. Failure to verify a fastener's serviceability or to correctly lubricate the fastener as instructed prior to installation will result in the fastener not being properly pre-loaded. Subsequent fastener failure may occur.

C-2. Replacement Parts

C-2.1. Background

An increasing amount of replacement parts (including standard parts), materials, appliances, and instruments are represented as being of aircraft quality when actually the quality and origin of these units is unknown. Users of such units are usually not aware of the potential hazards involved with replacement parts that are <u>not</u> eligible for use on certified aircraft. Frequently, such units are deceptively advertised or presented as "unused," "like new," or "remanufactured," implying the quality of such units is equal to an original or appropriately repaired or overhauled unit.

The performance rules for replacement of parts and materials used in the maintenance and alteration of U.S.-certified aircraft are specified in Federal Aviation Regulations (FAR) 43.13 and FAR 145.205. The responsibility for the continued airworthiness of the aircraft, which includes the replacement of parts, is the responsibility of the owner/operator as outlined in FAR 91.7, FAR 121.363, and FAR 135.419.

C-2.2. Acceptable Replacement Parts

Continental Motors provides Instructions for Continued Airworthiness (ICAs) 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). These instructions, which include maintenance, repair limits, overhaul, and installation are applicable only to engines and parts supplied by Continental Motors. Continental Motors does not provide instructions relating to the installation or use of parts not manufactured or supplied by Continental Motors. Instructions provided by other engine parts manufacturers or resellers should be used for their parts. Continental Motors has not participated in design, test, or certification in regards to aftermarket parts manufacturers and has no experience with respect to such parts.

FAA regulations require only FAA-approved parts be used on a type certified product. FAA-approved parts may be identified in accordance with the information given below. Continental Motors does not play any role in the FAA approval of such parts; does not have any responsibility for the design, certification, service life, repair, overhaul, or quality of such parts; and has made no determination regarding the effect, if any, that using such parts may have on Continental Motors supplied engines or parts.

C-2.2.1. Know Your Supplier

Some reproduced parts and components, particularly instruments, have been manufactured by entities other than the original equipment manufacturer and are available for purchase and installation on U.S.-certified aircraft. Often, an original part is used as a sample to produce duplicates. The reproduced parts *appear* to be as good as the original part. However, there are many unknown factors to be considered that may not be readily apparent to the purchaser, such as heat-treating, plating, inspections, tests, and calibrations. All too often, the faulty part is not discovered until a malfunction or an accident occurs.

Therefore, in accordance with FARs, certification of materials, parts, and appliances for aircraft return to service is the responsibility of the person or agency who signs the approval. The owner/operator is responsible for the continued airworthiness of the aircraft. To ensure continued safety in aircraft operation, it is essential that great care be used when inspecting, testing, and determining the acceptability of all parts and materials. Particular caution should be exercised when the identity of materials, parts, and appliances cannot be established or when their origin is in doubt.

C-2.3. 100% Parts Replacement Requirements

NOTE: Service documents published or revised subsequent to the issuance of this publication may mandate the replacement of components and parts not included in these instructions. At engine overhaul, the technician must review all service bulletins to ensure compliance with the manufacturer’s requirements for continued airworthiness.

Replace all gaskets, seals, packing, hoses, O-rings, cotter pins, retaining rings (snap rings), safety wire, self locking fasteners (including exhaust nuts), and lock washers with new parts during assembly, regardless of the type of maintenance.

Do not re-use worn, damaged or deformed fasteners. Do not replate cadmium plated fasteners or washers. If the cadmium plating has been removed, discard the item and replace it with a new part.

Engine mounted accessories must be maintained in accordance with the manufacturer’s instructions. Additionally, accessories must be overhauled during engine overhaul, or more frequently, in accordance with the manufacturer’s instructions.

At engine overhaul the starter, starter adapter, alternator, magnetos and engine fuel system must be replaced with a new, factory rebuilt or FAA approved overhauled unit. All engine baffles must be repaired or replaced and all flexible baffle seals must be replaced.

Replace items such as spark plugs, alternator drive belts and air-conditioning drive belts on condition.

C-2.4. Mandatory Overhaul Replacement Parts

In addition to the items listed in Section C-2.4, the following parts must be discarded and replaced with new parts during engine overhaul.

• Bearings: connecting rod, crankshaft main and thrust, needle, ball, and roller • Bushings: rocker arm, connecting rod, counter weight and crankshaft counterweight blade • Camshaft gear part numbers; 537432, 631845, 655430, 655516 and 656031 must be replaced at overhaul with 656818 or subsequent part number • Camshaft gear bolts • Cold Start primer diverter valves • Connecting rod bolts and nuts • Counterweight pins, retaining plates and snap rings • Crankshaft alternator face gear bolts and lock plates • Crankshaft gear Part No. 536421 or 653631 with Part No. 657175 or later • Crankshaft gear bolts • Crankcase through bolts • Cylinder deck stud nuts and through bolt nuts • Exhaust flange studs & nuts	• Exhaust and Intake Valves • Intake and Exhaust valve rotocoils (Replace intake valve rotocoils with solid valve retainers) • Fuel pump drive coupling Part No. 631263 with Part No. 653359 in accordance with Continental Motors' Mandatory Service Bulletin MSB 95-6 or latest revision • Hydraulic valve lifters (tappets) • Ignition system harness • Intake and exhaust valve keepers • Inner and outer valve springs • Magneto and alternator rubber drive bushings • Pistons • Piston pins • Piston rings • Rocker shafts • Rockers shaft thrust washers • Woodruff keys

C-2.5. Authorized Oversize/Undersize Parts

Replacement authorized oversize (AO) or authorized undersize (AU) parts must be used with the proper AO and AU mating parts. Example: use 0.015 oversize piston and piston rings with 0.015 oversize cylinder assembly.

C-3. Torque

Torque hardware with calibrated torque wrenches to Appendix B specifications.

C-4. Safety Wiring Hardware

Safety wiring secures two or more parts together so any tendency of the parts to loosen will be counteracted by increasing the tension on the safety wire attached to the other part(s). The only way to loosen the fasteners is to remove the safety wire. Always use new safety wire to secure hardware. Safety wire on these engines must conform to MS20995 Condition A.

CAUTION: Do not apply torque above or below specified limits to align holes.

1. Verify the hardware (bolts or nuts) to be safety wired has been correctly torqued to Appendix B specifications.
2. Insert half of the required length of new safety wire through the first piece of hardware and do the following:
   a. For *right-hand* threaded hardware, install the safety wire so the strand will pull and lock *clockwise*.
   b. For *left-hand* threaded hardware, install the safety wire so the strand will pull and lock *counter-clockwise*

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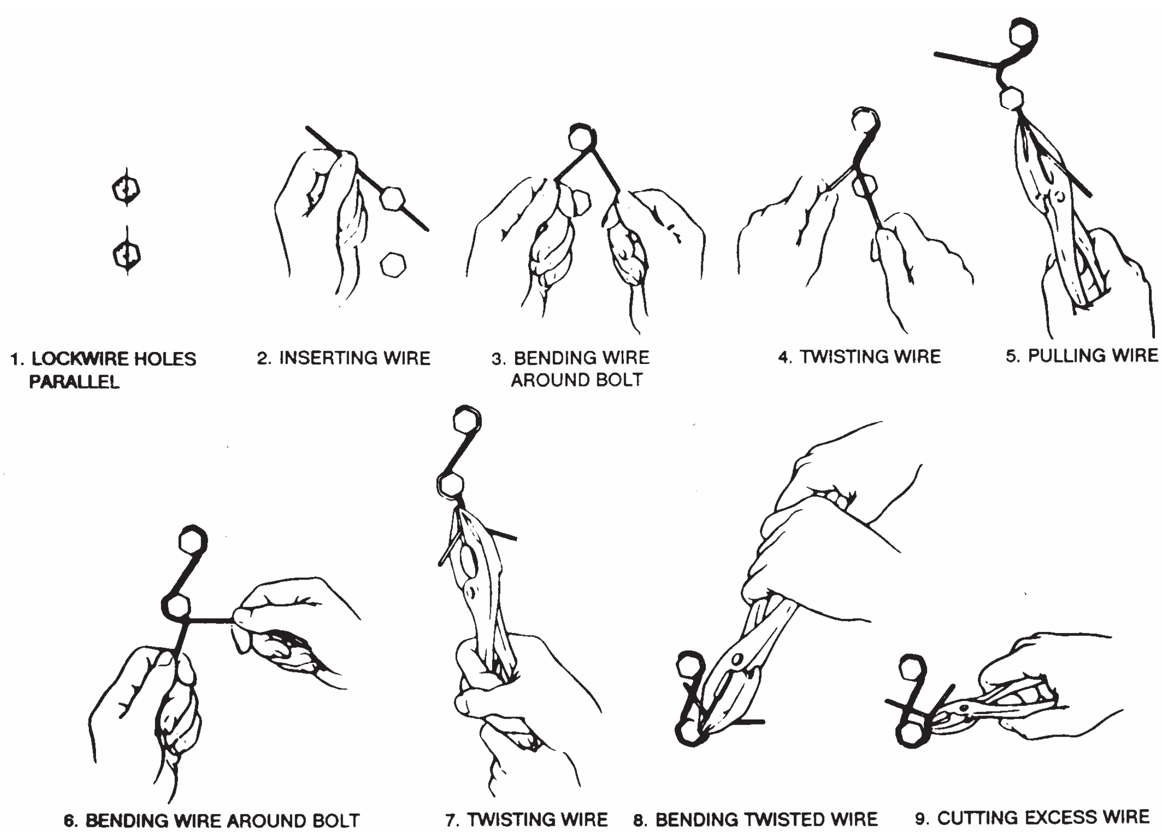

Figure C-1. Right-hand-thread safety wire installation

(Reverse application for left hand threads)

3. As shown in Figure C-1, bend the safety wire to tightly loop around the head of the hardware to exert force in the tightening direction. Ensure there is no slack in the loop and the loop is under the protruding strand that will wrap around the opposing piece of hardware to ensure the loop is held in place on the first device. Pull the protruding strand of safety wire with pliers until it is taut (but not overstressed).
4. While keeping the protruding strand of safety wire taut, twist the strands (based on the wire gauge specified below) until the twisted part is just short of a hole in the next unit. The twisted portion should be within one-eighth (1/8) inch from the hole in either unit:
   a. Twist 0.032” diameter safety wire at a rate of 7 to 10 twists per inch.
   b. Twist smaller diameter safety wire at a rate of 9 to 12 twists per inch.
5. Pull the braided safety wire strand with pliers until it is taut (but not overstressed).
6. Insert the uppermost strand through the hole in the second piece of hardware.
7. Bend and wrap the twisted wire braid around the second piece of hardware, pulling the wire taut as described in the previous steps, which will counter-lock the hardware joined by the safety wire. Repeat the previous steps for any subsequent hardware to be safety wired by this strand. Refer to Figure C-2 for various safety wire patterns. All safety wire must fit snugly.
8. After safety wiring the last piece of hardware, continue twisting the safety wire to form a pigtail, providing sufficient twists (four minimum) to ensure the pigtail will not unravel.

   CAUTION: Do not allow the safety wire pigtail to extend above the bolt head.
9. Trim excess safety wire and bend the pigtail toward the hardware and against the bolt head flats.

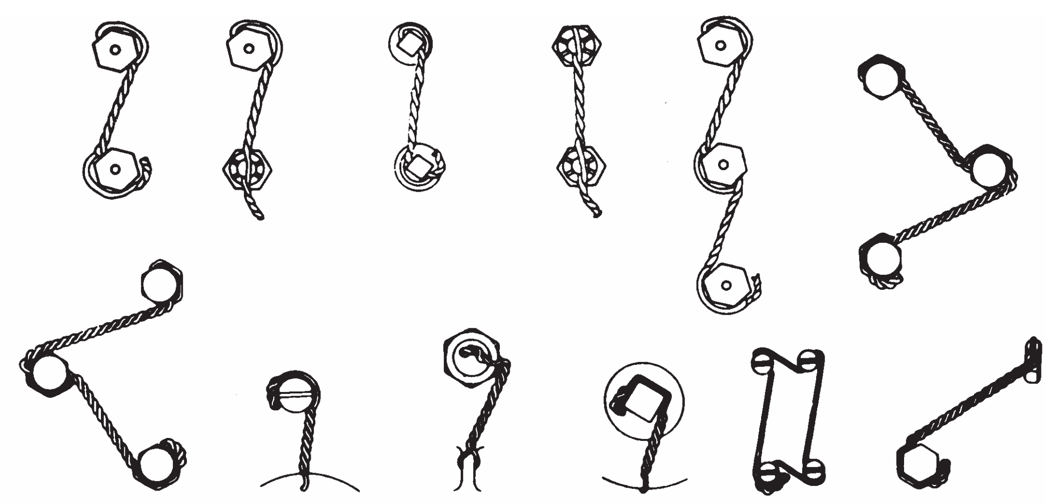

Figure C-2. Safety wire Patterns for Right-Hand Threads

(Reverse the wire orientation for left-hand threads)

C-5. Tab Washer Installation

Tab washers are used in various locations in Continental Motors engines. Do not re-use tab washers. Always install new tab washers.

1. Insert the locator tab (bent part of the tab washer) in the predrilled hole.
2. Lubricate and torque hardware to Appendix B specifications.
3. Using a soft drift, bend the locking tabs up to rest against the bolt or nut flats as shown in Figure C-3. Ensure the lock tabs rest firmly against the hardware as shown in top and side views of Figure C-3 to properly lock the fastener in place and prevent the lock tabs from breaking off.

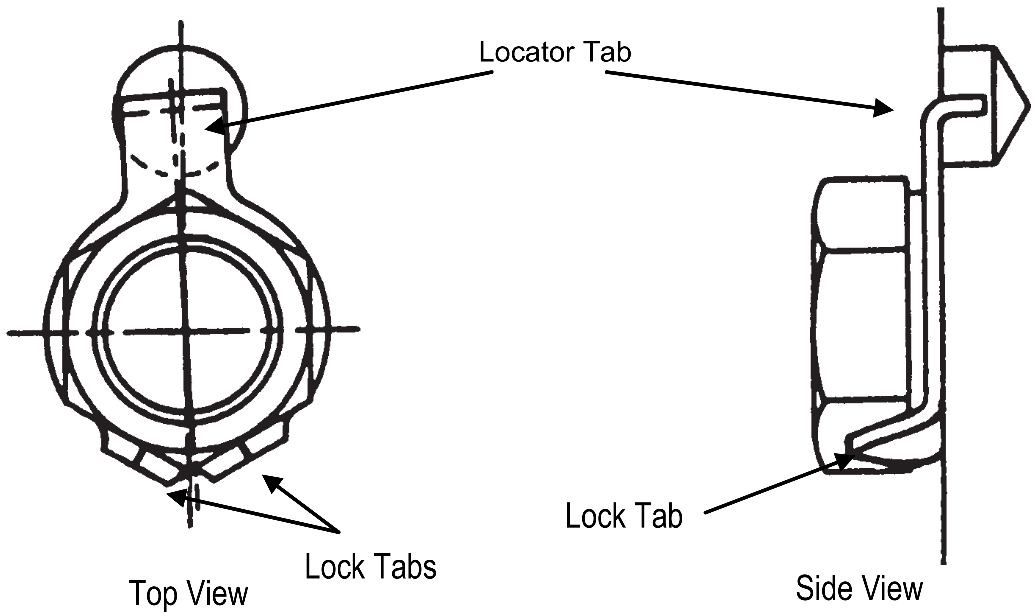

Figure C-3. Tab Washer Installation

C-6. Helical Coil Insert Replacement

Helical coil inserts are made of wire with a diamond-shaped cross section forming both a male and female thread. Helical coil inserts are factory-installed in various tapped holes of some engine components. Stainless steel helical coil inserts of special design are installed in all spark plug holes.

Tools, inserts, and information are available through HeliCoil®, Emhart Fastening Teknologies. The latest revision of the manufacturer's bulletins 959A, 995, 943, T4000, and 1000 list manual and power-driven installing tools, tang break-off tools, special taps, plug gauges, and tap/drill information.

Helical coil inserts are available in both National Course and National Fine series in lengths equal to 1, 1½, and 2 times nominal diameter and in pipe thread sizes. They are made of carbon steel, phosphor bronze, or stainless steel, as specified by part number. They are supplied with or without a notch above the driving tang. The notch is provided to facilitate breaking off the tang in open holes.

When compressed into a special tapped hole at the widest part of the wire between male and female threads, the diameter of the insert is equal to the nominal screw size. The special finishing taps size the threaded hole to allow the pitch diameter of the female thread of the installed insert to conform to Class 3 fit with standard bolt threads or Class 4 (tight) fit with standard-size studs. The difference in fit is due to a difference in pitch diameters of bolts and studs.

Only one set of helical coil special taps is required for installing these inserts in both bolt holes and stud holes. Tap drilling depths and tapping depth for helical coil inserts to be installed in blind holes must conform to the recommendations relative to inserts of length equal to 2 times nominal diameter, as tabulated in the latest revision of the manufacturer's bulletin numbers 1000 and T4000.

Run helical coil tap drills and special taps perpendicular to the machined surface to follow the alignment of the existing hole.

For drilling and tapping aluminum alloy castings, use a commercial-grade cutting lubrication oil to prevent overheating of the metal and tearing of the thread.

Helical coils are prohibited in certain areas; verify that a helical coil repair for a certain area is approved prior to installing the helical coil.

Replace helical coils in approved areas when they are damaged in accordance with the manufacturer's instructions.

C-6.1. Helical Coil Removal

1. Use the proper size extracting tool (Figure C-4) for the nominal thread size.
2. Tap the extracting tool into the helical coil insert until the sharp edges of the tool dig firmly into the helical coil insert.
3. Turn the tool to the left and back out the helical coil until it is free.

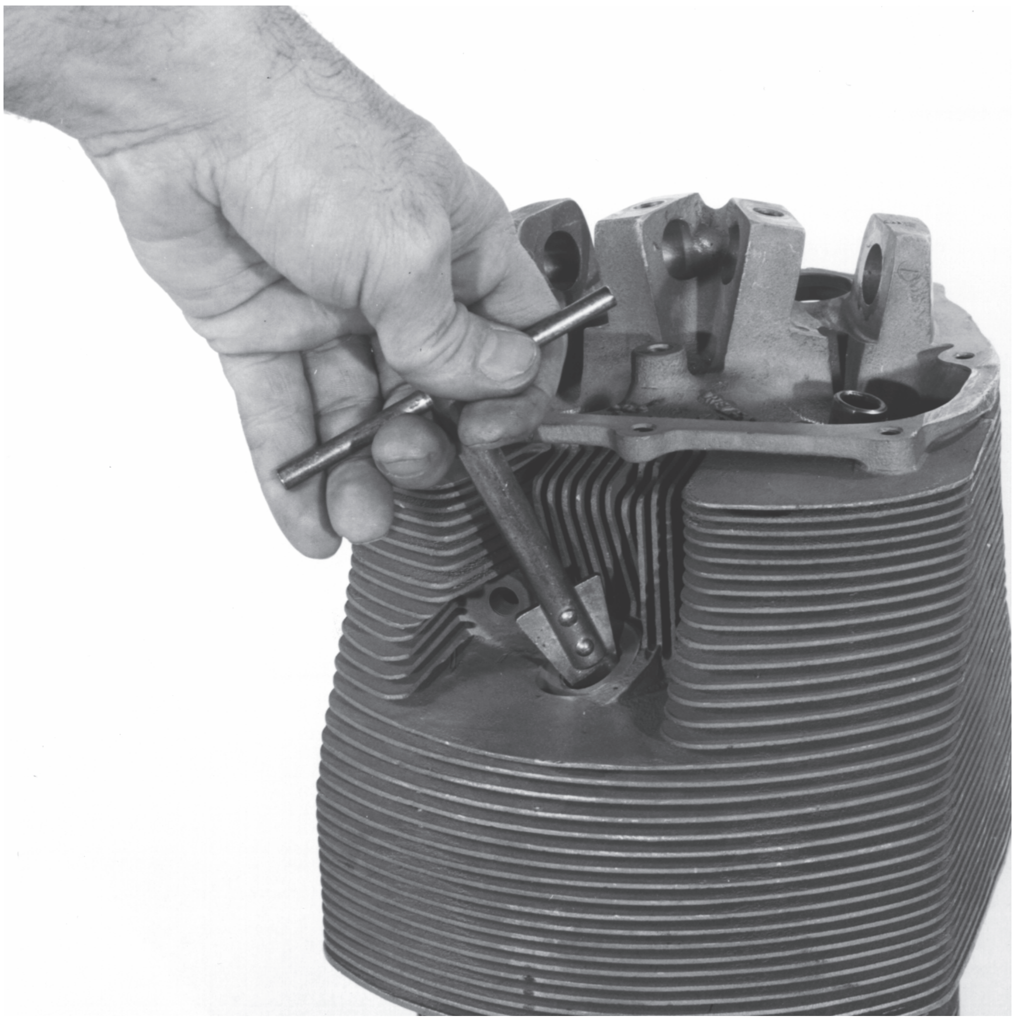

Figure C-4. Helical Coil Extraction Tool

C-6.2. Helical Coil Insertion

1. Blow all debris and liquid out of the tapped hole.
2. Use a proper size installation tool and slide the new helical coil insert over the slotted end of the driving mandrel of the tool.
3. Engage the driving tang (bent end) of the helical coil in the mandrel slot.
4. Wind the insert slowly into the tapped hole (as shown in Figure C-5).
5. The outer end of the insert must lie within the first full thread of the hole.
6. Break off the driving tang of a notched helical coil by bending it back and forth across the hole with long, needle nose pliers or with a special tang break-off tool.
7. Once the helical coil insert is installed, the remaining wall thickness (edge distance) to the helical coil must not be less than one half the helical coil diameter or 0.08 inches, whichever is greater.

WARNING

On the crankcase, it is prohibited to repair the 2 and 4 o'clock cylinder deck stud positions by helical coil insert installation.

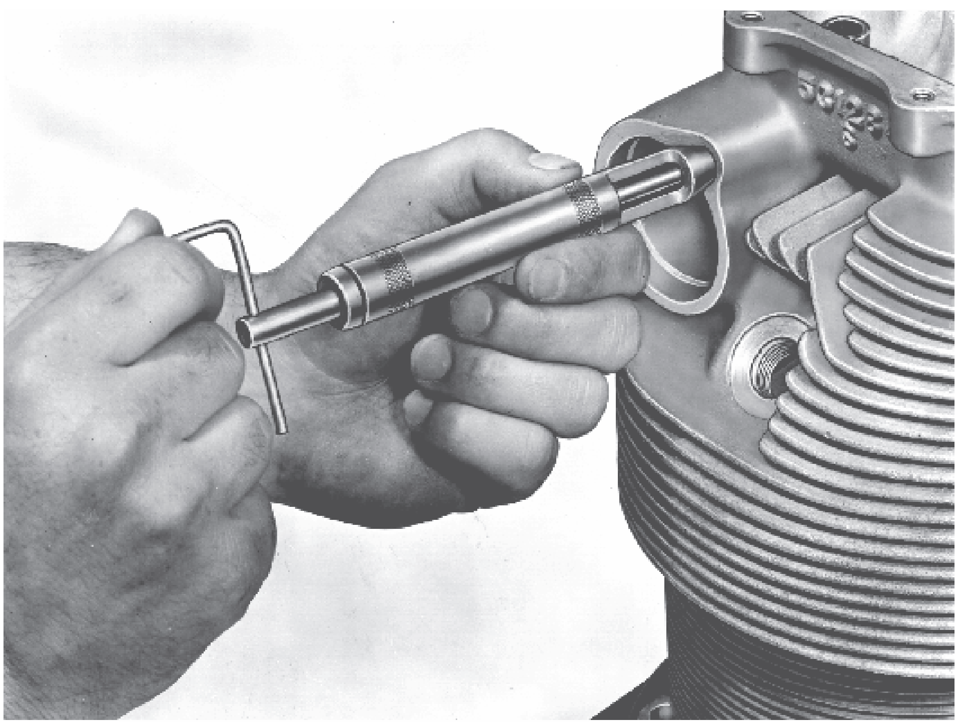

Figure C-5. Installing a Helical Coil Insert

C-7. Stud Replacement

Studs that are damaged or broken must be replaced. Rosan® ring-locked studs are installed in the cylinder exhaust ports. These studs are either “size-on-size” or “step type.”

The step type captive lock ring studs have a larger lock ring than the size-on-size type. The size-on-size captive lock ring studs utilize a small external diameter lock ring for applications where edge distance is a factor. The lock ring is so small in diameter that the use of a typical Rosan® “SM” or “BT” series-milling tool is impractical and could cause unwanted removal of cylinder head material in the lock ring area.

C-7.1. Stud Removal

NOTE: To remove Rosan® Size-on-Size Studs, refer to instructions in Section C-7.1.1. To remove Rosan® Step-Type Studs, refer to instructions in Section C-7.1.2.

For standard stud removal:

1. Place a stud extractor tool on the stud to be removed and turn the tool slowly to avoid heating the casting.
2. To remove a stud which cannot be removed with a standard stud extractor tool, drill a hole matching the diameter of a splined stud extractor tool through the center of the stud. Insert the splined stud extractor through the drilled center of the stud and unscrew the stud.
3. Examine the course thread end of the damaged stud before discarding it to determine the correct stud size for oversize replacement stud.

C-7.1.1. Size-on-Size Rosan® Stud Removal

To prevent damage to the engine cylinder, take precautions when removing a Size-on-Size Rosan® stud:

1. Carefully cut the damaged stud flush with the cylinder head. Do not come in contact with or mark the cylinder head.
2. Score the remaining portion of the stud with a center punch.
3. Locate the proper size primary removal drill directly over the center of the stud and drill to the “Primary Removal Drill” depth specified depth in Table C-1.
4. Center the secondary removal drill over the initial hole and drill to the “Secondary Removal Drill” depth specified in Table C-1. This method should cut the engagement between the stud serrations and the internal serrations of the lock ring.

Table C-1. Rosan® Stud Primary & Secondary Bore Specifications

Cylinder Exhaust Port Stud		Primary Removal Drill		Secondary Removal Drill	
Basic Stud Number		Diameter	Minimum Depth	Diameter	(+0.015) Depth
(0.164 dia.)	SFC164	1/16(0.062)	0.250	3/16(0.188)	0.080
(0.190 dia.)	SFC190	1/16(0.062)	0.250	7/32(0.219)	0.090
(0.250 dia.)	SFC250	3/32(0.093)	0.250	19/64(0.296)	0.105
(0.312 dia.)	SFC312	1/8(0.125)	0.312	R(0.339)	0.120
(0.375 dia.)	SFC375	1/8(0.125)	0.375	13/32(0.406)	0.120

5. The remaining lock ring will have a very thin wall. Carefully use a sharp punch to break away the remainder of the lock ring from the cylinder head.
6. Drive an “Ezy Out” bolt extraction tool into the small hole in the stud and apply removal torque.
7. Remove the stud and clean the hole.

C-7.1.2. Step-Type Rosan® Stud Removal

There are two methods for removing step-type Rosan® studs. Each of these methods is described below. The first uses a special tool; the second provides machining instructions to cut the stud, drill a pilot hole and remove the stud with an bolt extractor.

C-7.1.2.1. Step-Type Rosan® Stud Removal Method 1

1. Use the Rosan® Stud Remover (Figure C-6 and Figure C-7) to mill the lock ring to the appropriate depth.
2. Apply removal torque to remove the stud.
3. Lift out the remaining portions of the lock ring.

4. Carefully use a sharp punch to break away the remaining portion of the stud from the cylinder head.

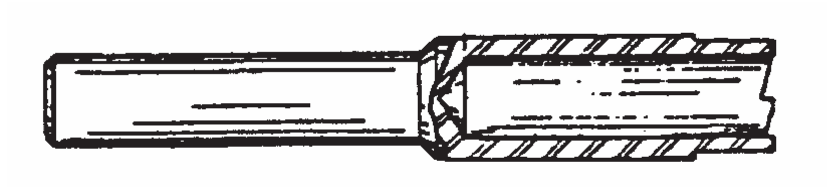

Figure C-6. Rosan® Stud Removal Tool

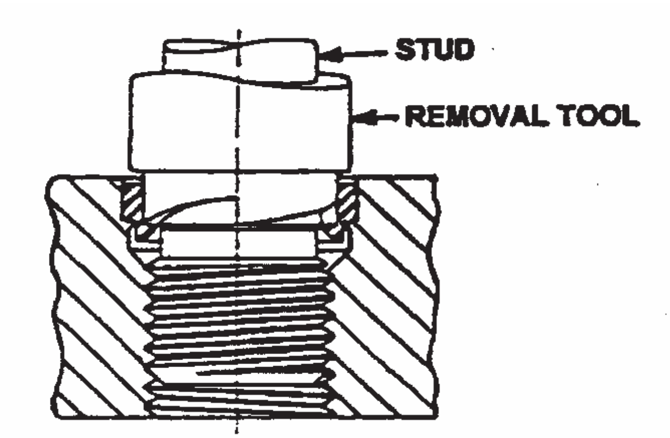

Figure C-7. Rosan® Stud Removal Tool Installed on Stud

C-7.1.2.2. Step-Type Rosan® Stud Removal Method 2

1. Follow the procedure in Section C-7.1.1, "Size-on-Size Rosan® Stud Removal."
2. Select the appropriate removal drill sizes with regard to the stud end dimension.

   Example: To remove a step-type stud with a 0.250-inch diameter nut end and a 0.312-inch diameter stud end, use the appropriate removal drill for a 0.312-inch "size-on-size" stud.

C-7.2. Stud Installation

Replace standard studs according to the instructions in this section. For “Rosan® Stud Installation”, refer to instructions in Section C-7.2.1.

1. Standard studs have no marking. Refer to Figure C-8 to determine the proper stud size required or to identify oversize studs.

Example Part Number	Oversize	Identification	Identification Color Code
XXXXXX	Standard		None
XXXXXXP003	0.003		Red
XXXXXXP007	0.007		Blue
XXXXXXP012	0.012		Green

Figure C-8. Stud Sizes

2. Clean the casting tapped hole with solvent and use compressed air to remove any remaining debris or liquid out from the hole.
3. Examine the tapped threads. If the threads are intact, obtain the next larger oversize stud. If the old stud was of the maximum oversize or if the thread is damaged, tap the hole and insert a helical coil insert according to instructions in Section C-6.2 on page 10.

WARNING

Helical coils can only be installed where authorized.

4. A helical coil insert (Figure C-9) can be used on a rocker shaft retaining stud provided that a minimum wall thickness of more than half of the helicoil diameter remains after tapping the new hole for the helical coil insert.
5. If the hole is blind or if the hole goes through to a cavity subject to leakage, coat the new stud’s course threads with Continental Motors High Strength Adhesive (Part No. 646941).
6. Drive the new stud with a tee handle stud driver. Turn it slowly and compare the torque values listed in Appendix B.
7. Drive the stud in until it reaches the desired length specified in Appendix D.

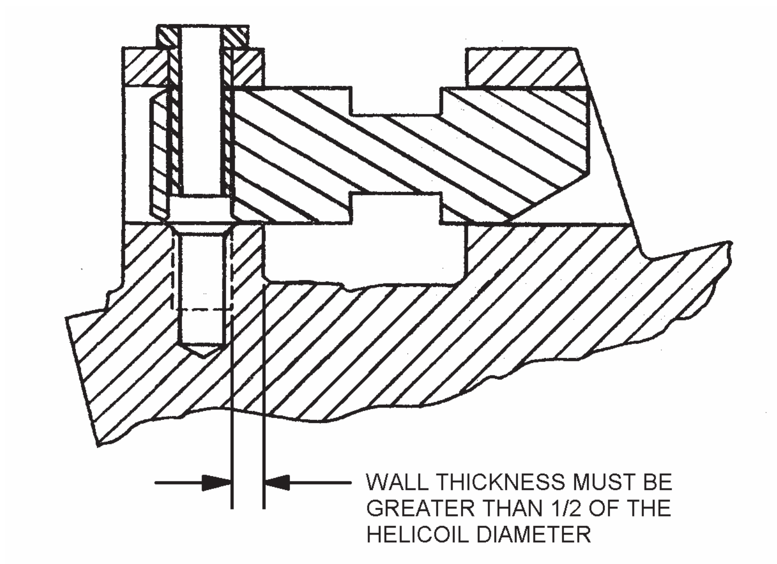

Figure C-9. Minimum Material Thickness for Helical Coil insertion

C-7.2.1. Rosan® Stud Installation

Any type of Rosan® stud (Size-on-Size or Step-type) may be installed using the appropriate wrench. Install the stud to the dimensions specified in Figure C-10.

CAUTION: Location of the flange is important in preventing the lock ring drive tool from making contact with surface "A" in Figure C-10. Any impact or pressure on surface "A" may damage the threads in the cylinder head resulting in a loose fit.

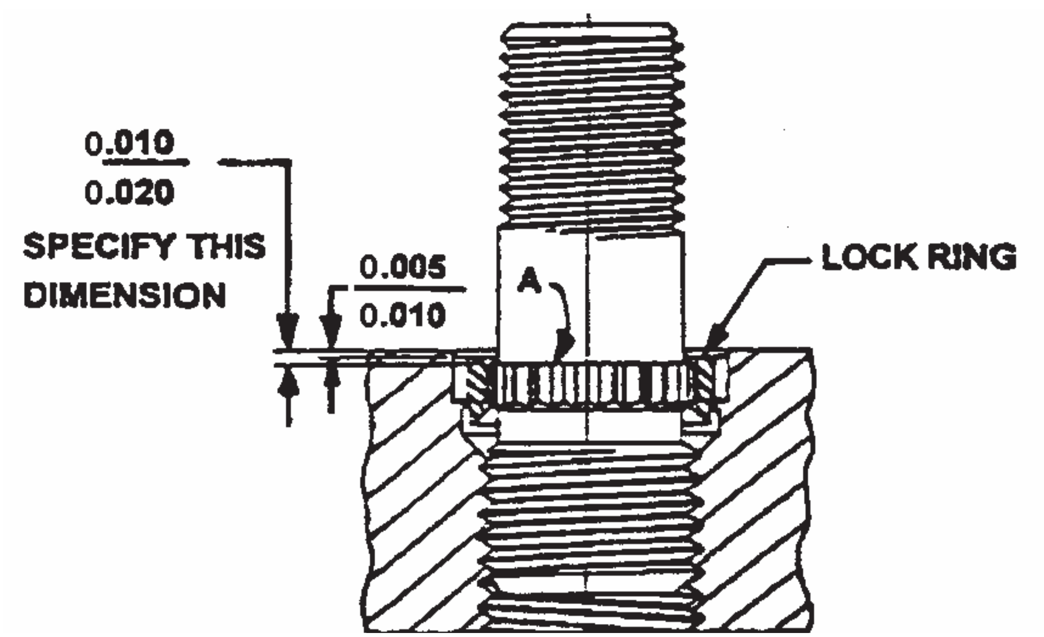

Figure C-10. Rosan® Stud Installation Dimensions

C-8. Cotter Pin Installation

Cotter pins are not reusable. Replace used cotter pins with the specified new cotter pins made of corrosion-resistant steel.

1. Install the nut on the bolt.
2. Torque the nut where the cotter pin is to be inserted to the lowest torque setting for the fastener specified in Appendix B.
3. If the slots in the nut do not align with drilled hole in the bolt, gradually increase the torque until the slot and hole align. Do not exceed the maximum fastener torque specified in Appendix B; change the nut if necessary.
4. Insert the cotter pin through the slotted nut and bolt hole with the head seated firmly in the slot of the nut.
5. Spread the exposed ends of the cotter pin. Bend the ends over the flat on the nut and the end of the bolt.

   CAUTION: Do not use side-cutting type pliers to bend back the cotter pin ends. These pliers cause nicks which can weaken the cotter pin to the extent that it can become detached.

6. Seat the ends firmly against the bolt and nut (Figure C-11).
7. Trim the protruding ends, if necessary to avoid interference with mating assemblies.
8. All cotter pins must fit snugly in holes drilled in specific hardware. On castellated nuts, unless otherwise specified, the cotter pin head must fit into a recess of the nut with the other end bent such that one leg is back over the stud and the other is bends flat against the nut as shown in Figure C-11.

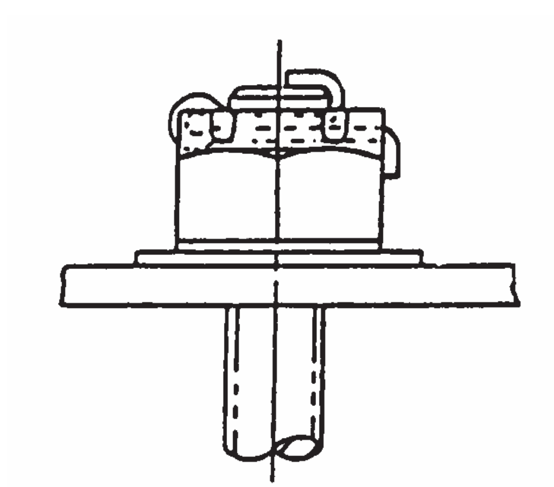

Figure C-11. Cotter Pin Installation

C-9. Fuel System Service

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.

Fuel system service includes any inspection, service or repair action which requires opening fuel system connections, including engine operational checks. Avoid introducing contaminants into the fuel system:

- Exercise caution when installing fuel injection system parts
- Clean surrounding component surfaces and fittings before removing parts or disconnecting hoses or fittings
- Cap or plug open fuel system hoses or fittings immediately upon disconnection. Caps and plugs should remain in place until the time of reassembly
- Use only clean tools and test equipment
- Purge fuel system components, regardless of source, at the time of installation

C-9.1. Fuel System Purge

1. Remove the cap from the fuel inlet fitting of the fuel system component (hose, pump, distribution block, inline filter, or test equipment).
2. Connect the aircraft or engine fuel supply to the inlet fitting and tighten to prevent leakage.

   CAUTION: The receptacle used to collect the fuel sample must be free of dust, debris, water, oil, or other particulates or contaminants for valid inspection results.

3. Connect a clean section of fuel hose to the component fuel outlet(s) and direct the end of the hose into a suitable, clean, one-half gallon (two liter) fuel receptacle.
4. Turn the fuel selector valve ON.
5. Turn the aircraft boost pump ON.
6. Allow at least one quart (.95L) of fuel to flow through the component(s) into the clean fuel receptacle. If the component being purged features a mixture or throttle control lever, cycle the lever through the full range of operation several times while fuel is flowing through the component.
7. Turn the aircraft boost pump OFF.
8. Allow at least two minutes for particulates to settle in the container. Visually inspect the fuel in the container for contamination. If contamination is found, isolate and correct the source of the contamination before proceeding with component installation.
9. Repeat steps 4 through 8 until no contamination is found in the receptacle.
10. Proceed with component installation according the appropriate instructions in the manual.

C-10. Gasket Maker® Application

Gasket Maker is an easily workable tacky gel which can be applied onto one side of a flange surface from a tube and evenly spread.

WARNING

Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, cylinder fastener threads or crankcase main bearing bosses. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure. USE ONLY CLEAN 50 WEIGHT AVIATION ENGINE OIL ON SURFACES LISTED.

1. Verify the surface where the sealant will be applied is clean and free of nicks, burrs, oil, and grit.
2. For the engine nose seal, apply Continental Motors' General Purpose Primer (Part No. 653692) to prepare the sealant surface before applying Gasket Maker at the engine nose seal area.
3. Apply and spread a thin, translucent coat of Gasket Maker (not to exceed 0.010 inches in thickness) to the surface directly from the tube. For small parts, use a polyester urethane sponge or a short nap roller saturated with Gasket Maker to apply the sealant to the part.
4. Once Gasket Maker has been applied, evenly torque the assembly into place.
5. Wipe away excess sealant with chlorinated solvent.
6. To remove Gasket Maker from your hands, apply waterless mechanics hand soap followed by soap and water.

C-11. Gasket Installation

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.

Gaskets and components must be properly positioned with the hardware torqued and safety wired, as required, during assembly to prevent oil loss.

Install only new gaskets; gaskets may not be reused. Prior to installation, inspect each gasket for brittleness, cracks, wrinkles, damage, or deformities. Do not use a gasket with obvious defects, even if new; replace with a new manufacturer-specified gasket. Verify that gasket surfaces are clean and free of nicks, burrs, oil, and grit.

CAUTION: Do not install brittle, dirty, cracked, or wrinkled gaskets. Never reuse a gasket removed during disassembly.

1. Apply a thin coat of Gasket Sealant (Continental Motors Part No.642188) to both sides of the gasket unless otherwise specified.
2. Install the gasket, following the contour of the mating surface.
3. Install the assembly and evenly torque the hardware to Appendix B specifications to prevent damage to the gasket.
4. Safety wire the hardware where indicated.

C-12. Hose and Tubing Installation

Hoses and tubing to fuel, induction and lubrication system fittings must be properly installed.

WARNING

Failure to properly support component fittings can result in fitting and/or component damage and a resulting loss of system pressure or fluid.

1. Use a wrench on both mating connections to avoid applying excessive torque to the fittings. Securely tighten fittings and torque to the specified value in Appendix B. Torque the hose or tubing end fitting while maintaining sufficient force on adjacent fittings to prevent twisting and shear loads.

   CAUTION: Do not exceed specified torque values

2. Support the last fitting in the assembly on components that contain multiple fittings coupled in one location. DO NOT over-torque fittings.

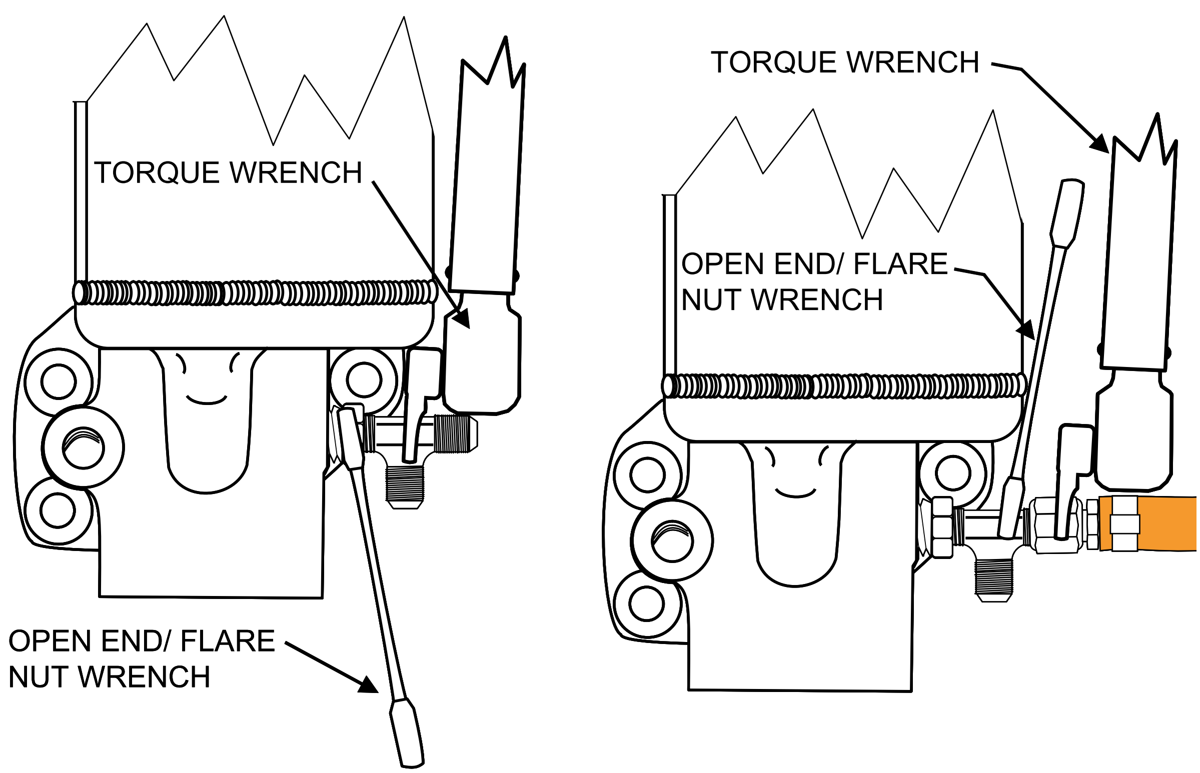

Figure C-12. Installing Hoses and Fittings

C-13. Harness Routing

1. Inspect all proposed harness routes. Consider normal movement and relative motion of the various engine or aircraft parts that will be attached to the harness.
2. Do not route harnesses near belts or pulleys without the use of belt guards; belt failure may damage the wiring harness.
3. Do not secure wiring harnesses to fuel lines.
4. Use cushion clamps, with stand-off spacers, where necessary to secure the harness to existing baffle supports and brackets where practical.
5. Secure harnesses to minimize the possibility of chafing, vibration, and excessive heat exposure.
6. The largest allowable unsecured segment of wiring harnesses is eight inches (20.32 cm).
7. Route the wiring harnesses through baffles where necessary. All baffle penetrations by a harness must be lined with a suitable grommet to prevent damage.

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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 Chapter 14,"Engine Cleaning"instructions before performing the dimensional inspection. Discard and replace any parts that do not conform to the specified new part dimensional specifications.

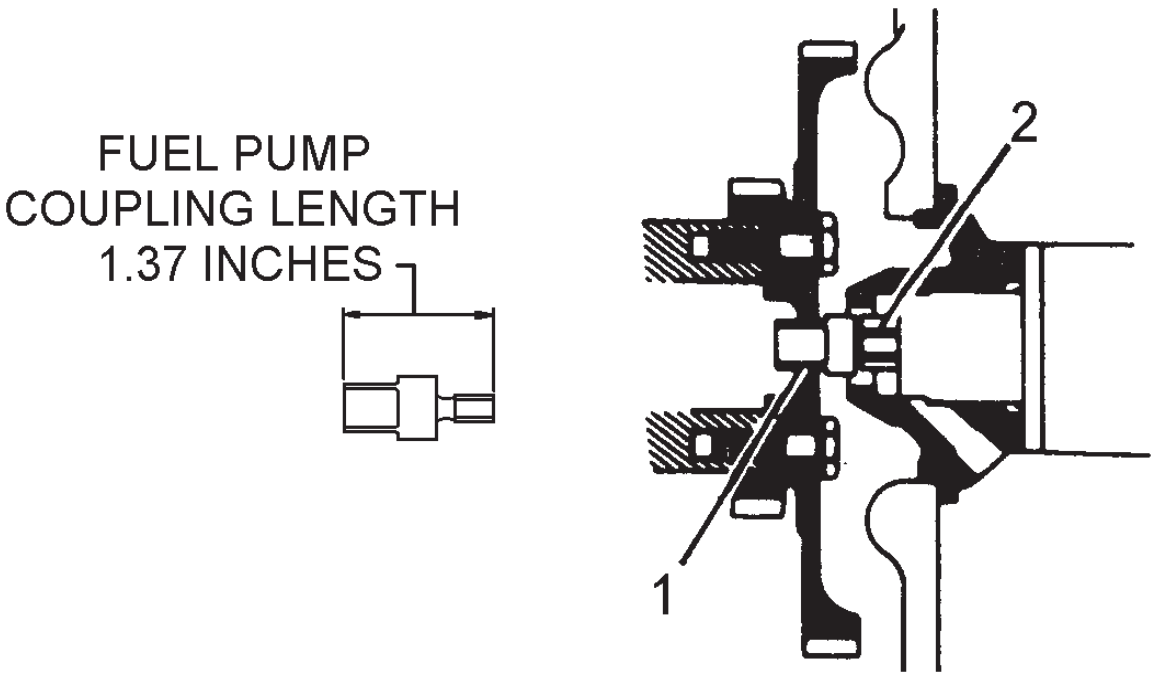


Figure D-1. Fuel Pump Drive Coupling Fits & Limits

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 and Mixture Control Lever

NOTE: Mixture control levers on the fuel control assembly of IO-550-A, B, and C engine models, secured to the shaft with a pin, are unaffected by this mandatory replacement.

CAUTION: Current production levers on the fuel pump and the integrated throttle and control assembly are constructed of stainless steel. If the throttle or mixture control lever is constructed of any material other than stainless steel (i.e. bronze), replace the lever during overhaul with the current production stainless steel version.

If the serrated mating surfaces of the throttle or mixture control lever is deformed or will not install correctly on the throttle or mixture control shaft, replace the lever.

If a bronze control lever is removed for <u>any</u> reason, regardless of condition, replace it with the current production stainless steel lever on fuel pumps and throttle bodies.

If the facility performing engine overhaul elects to overhaul the integrated throttle and control assembly or fuel pump in the field, the facility must discard and replace the bronze control levers, regardless of condition, with the current production stainless steel lever.

D-3. Starter and Starter Adapter

For the basic starter adapter overhaul limits, refer to **Figure D-2** and **Table D-2** for overhaul dimensional limits.For the starter adapter with accessory drive limits, refer to **Figure D-3** and **Table D-3** for overhaul dimensional limits. Index numbers in the left columns of the tables correspond with the numbers in the associated illustrations. Discard and replace any parts that do not conform to the new part dimensions. **Figure D-4** and **Table D-4** contain worm wheel drum dimensions and limits. **Figure D-5** and **Table D-5** contain shaft gear drum dimensions and limits.

Clean and dry parts thoroughly according to the "Engine Cleaning" instructions in Chapter 14 before performing the dimensional inspection. Discard and replace any parts which do not conform to the new part tolerances.

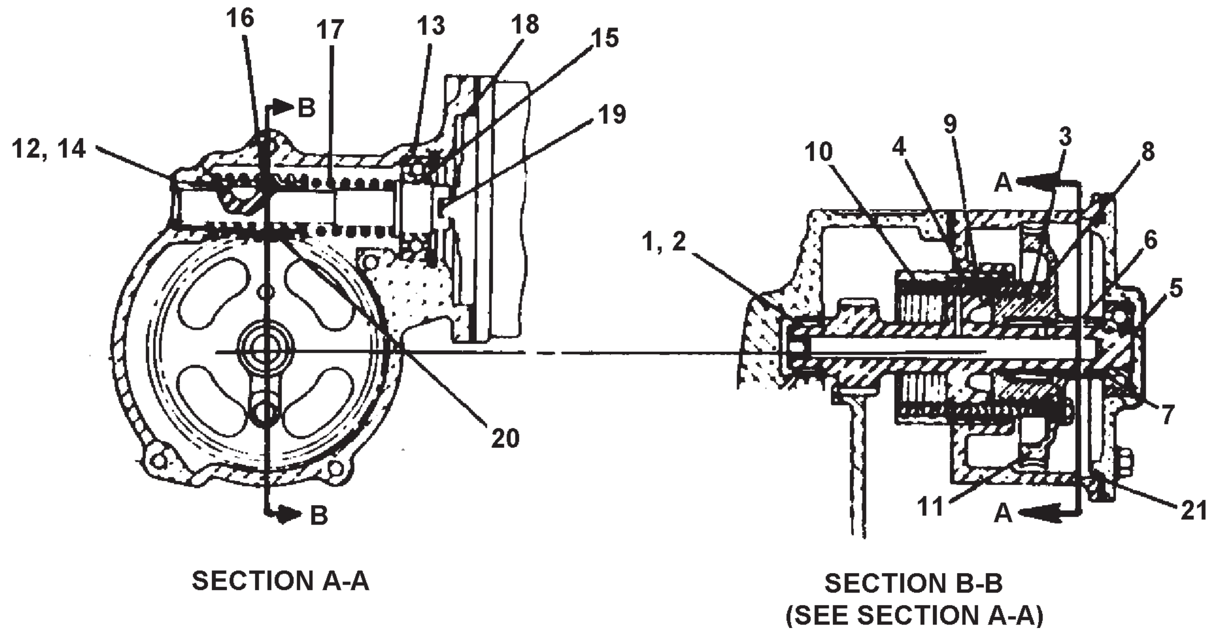


Figure D-2. Basic Starter Adapter

Table D-2. Basic Starter Adapter Overhaul Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Starter shaft gear needle bearing hole 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 .... diameter:	0.0030T	0.0050T
5	Starter shaft gear in ball bearing .... diameter:	0.0001T	0.0005L
6	Bearing in starter adapter cover .... diameter:	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] .... diameter:	0.0310T	0.0380T
11	From center line of worm gear shaft to starter adapter thrust pads... clearance:	0.2460	0.2480
12	Needle bearing hole starter adapter .... diameter:	0.7485	0.7495
13	Ball bearing in starter adapter .... diameter:	0.0001T	0.0010L
14	Worm gear shaft in needle bearing area .... diameter:	0.5615	0.5625
15	Worm gear shaft in ball bearing .... diameter:	0.0001L	0.0007T
16	Starter worm gear on shaft .... diameter:	0.0005L	0.0025L
17	Starter spring on worm drive shaft .... diameter:	0.0050L	0.0250L
18	Starter pilot to starter drive adapter .... diameter:	0.0010L	0.0070L
19	Starter drive tongue to worm shaft drive slot...................side clearance:	0.0100L	0.0210L
20	Starter worm wheel gear and worm gear ....backlash:	0.0090	0.0110
21	Starter adapter cover pilot in adapter housing .... clearance	0.0010L	0.0040L
T= Tight L= Loose			

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

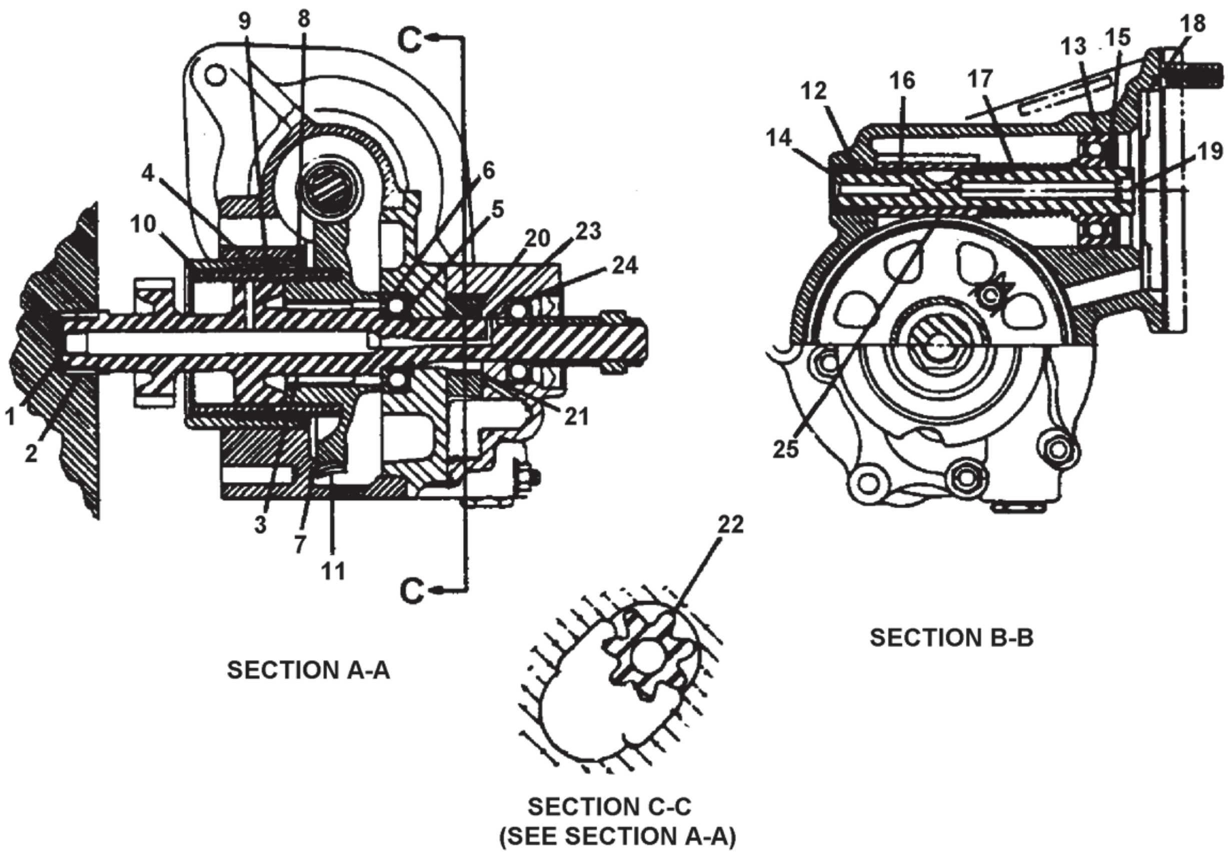


Figure D-3. Starter and Starter Adapter with Scavenge Pump Dimensions

Table D-3. Starter/Starter Adapter with Scavenge Pump Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Starter shaft gear needle bearing bore 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 .... diameter:	0.0030T	0.0050T
5	Starter shaft gear in ball bearing .... diameter:	0.0001T	0.0005L
6	Bearing in starter adapter cover .... diameter:	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] .... diameter:	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 .... diameter:	0.0001T	0.0013L
14	Worm gear shaft in needle bearing area .... diameter:	0.5615	0.5625
15	Worm gear shaft in ball bearing... diameter:	0.0001L	0.0007T
16	Starter worm gear on shaft .... diameter:	0.0005L	0.0025L
17	Starter spring on worm drive shaft .... diameter:	0.0050L	0.0250L
18	Starter pilot to starter drive adapter .... diameter:	0.0010L	0.0070L
19	Scavenge pump driven gear on shaft .... diameter:	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 diameter:	0.0118L	0.0143L
22	Bushing in scavenge pump driven gear .... diameter:	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

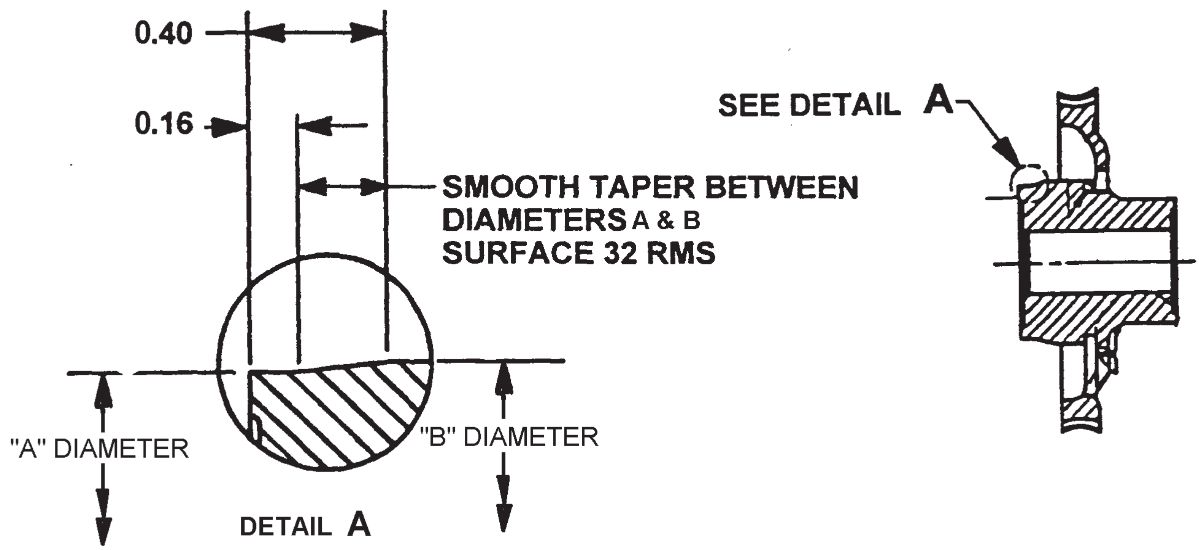


Figure D-4. Worm Wheel Drum Dimensions

Table D-4. 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

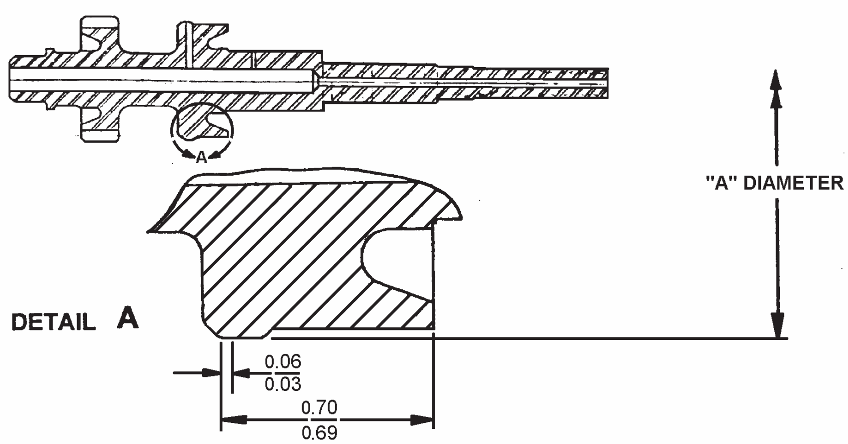


Figure D-5. Shaft Gear Drum Dimensions

Table D-5. 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 magneto overhaul limits, refer to the applicable Magneto Service Manual.

Refer to **Figure D-6** and **Table D-6** for the accessory drive adapter overhaul limits (new part tolerances). The numbers in the index column of **Table D-6** correspond to the numbered items in **Figure D-6**.

Clean and dry parts thoroughly according to the "Engine Cleaning" instructions in Chapter 14 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-6. Ignition System Dimensional

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Bushing in magneto and accessory drive adapter ....diameter:	0.0010T	0.0040T
2	Magneto and accessory drive gear in adapter bushing............diameter:	0.0015L	0.0035L
3	Oil seal in adapter ....diameter:	0.0010T	0.0070T
4	Sleeve in magneto and accessory drive gear ....diameter:	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.. diameter:	0.001L	0.005L
T= Tight L= Loose			

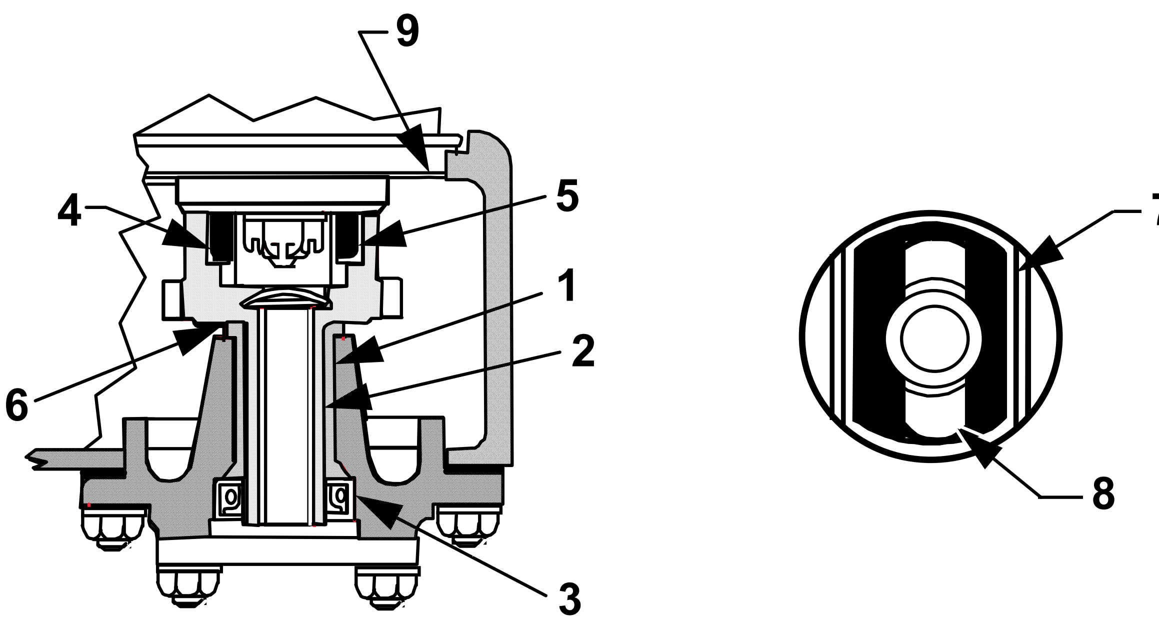


Figure D-6. Accessory Drive Adapter Dimensions

D-5. Lubrication System

Refer to **Figure D-7** and **Table D-7** for lubrication system dimensions. Numbers in the index column of **Table D-7** correspond to the numbered items in **Figure D-7**. Additional lubrication system dimensions are listed in **Table D-8**.

Clean and dry parts thoroughly according to the "Engine Cleaning" instructions in Chapter 14 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-7. 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 ....diameter:	0.0040L	0.0060L
4	Oil pump driver gear shaft in pump housing ....diameter:	0.0015T	0.0030L
5	Oil pump driven gear to driven gear shaft ....diameter:	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 pin in tachometer drive housing ......diameter:	0.0015L	0.0030L
9	Oil pump driver gear shaft pin in bevel gear.............................diameter:	0.0005L	0.0025L
10	Oil pump driven gear in housing ....diameter:	0.0040L	0.0060L
11	Tachometer drive shaft in housing..diameter:	0.0015L	0.0030L
12	Oil seal in mechanical tachometer drive housing ....diameter:	0.003T	0.005T
13	Oil seal in electrical tachometer drive housing ....diameter:	0.0015T	0.0065T
Gear Backlash			
14	Oil pump driver and driven gears .... backlash:	0.0090	0.0130
15	Tachometer drive and driven gears .... backlash:	0.0040	0.0080
Spring Test Data			
16	Oil press. relief valve spring compressed to 1.25 inch length ....load:	32 lbs.	37 lbs.
17	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-8. 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: Driver Gear Shaft Hole ....diameter: Gear Chamber....depth:	0.5640 0.5620 1.9985	0.5650 0.5630 2.0000
Oil Pump Driver Gear	Shaft ....diameter:	0.5600	0.5605
Oil Pump Driven Gear	Bushing .... inside diameter:	0.5655	0.5665

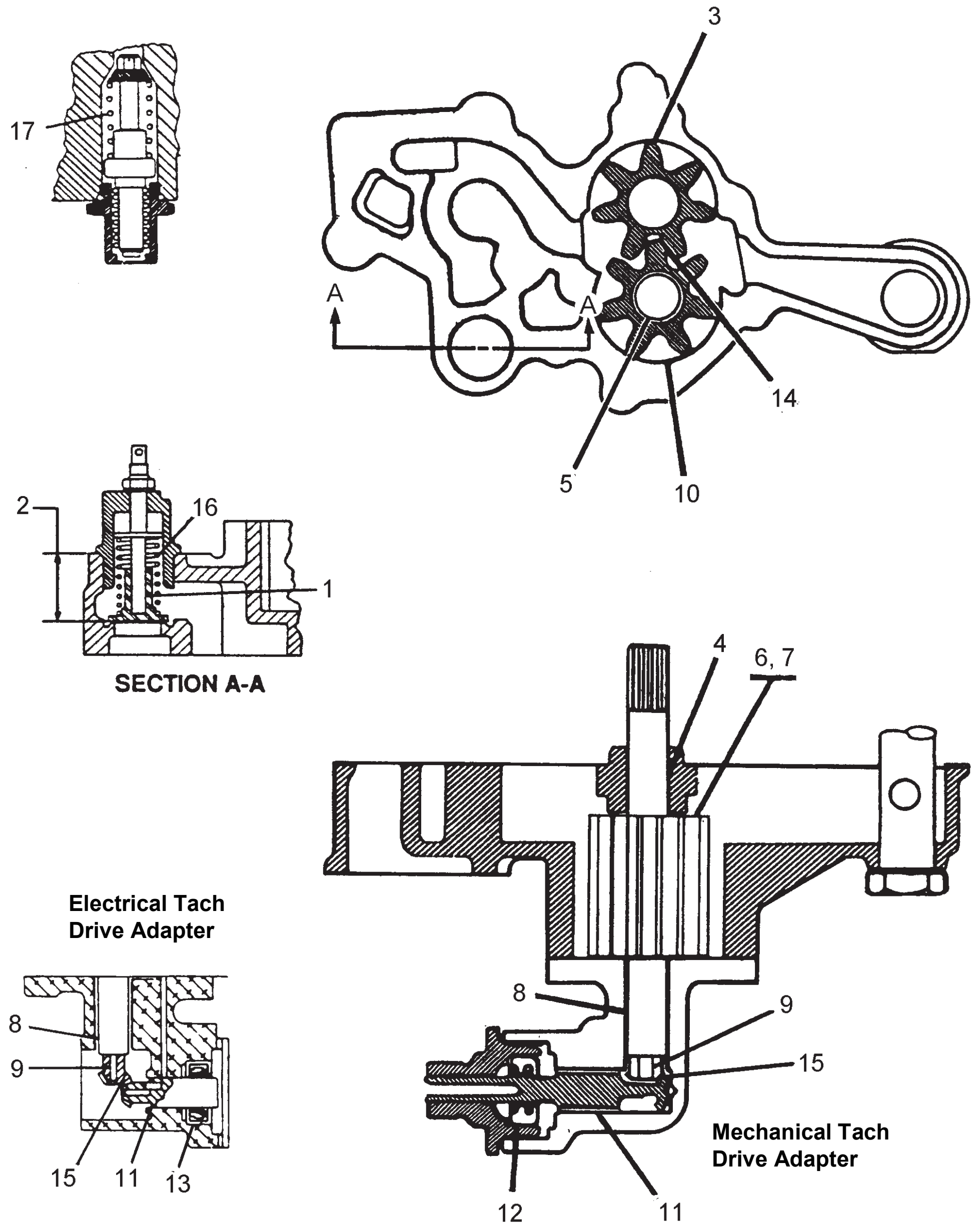


Figure D-7. Oil Pump Dimensions

D-6. Engine Cylinder Overhaul Dimensions

Refer to **Figure D-9** and **Table D-11** for IO-550-A, B & C cylinder overhaul dimensional limits or **Figure D-9** and **Table D-11 for** IO-550-G, N, P & R cylinder overhaul dimensional limits. 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 in Chapter 14 before performing the dimensional inspection. Discard and replace parts that do not conform to the dimensional specifications in the tables.

Table D-9. Cylinder Assembly Dimensions
Not illustrated in Figure D-8

Part Name	Inspection Item	Dimensions (inches)	
		Minimum	Maximum
Cylinder Assembly	Rocker Shaft Boss Bore diameter	0.7495	0.7510
Rocker Arm Bushings	Inside Diameter	0.7505	0.7515
Rocker Shaft	Outside Diameter	0.7483	0.7488
Intake Valve	Stem Diameter	0.4334	0.4341
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)	5.205	5.220
Rocker Arm	Thrust Width	1.030	1.033

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.

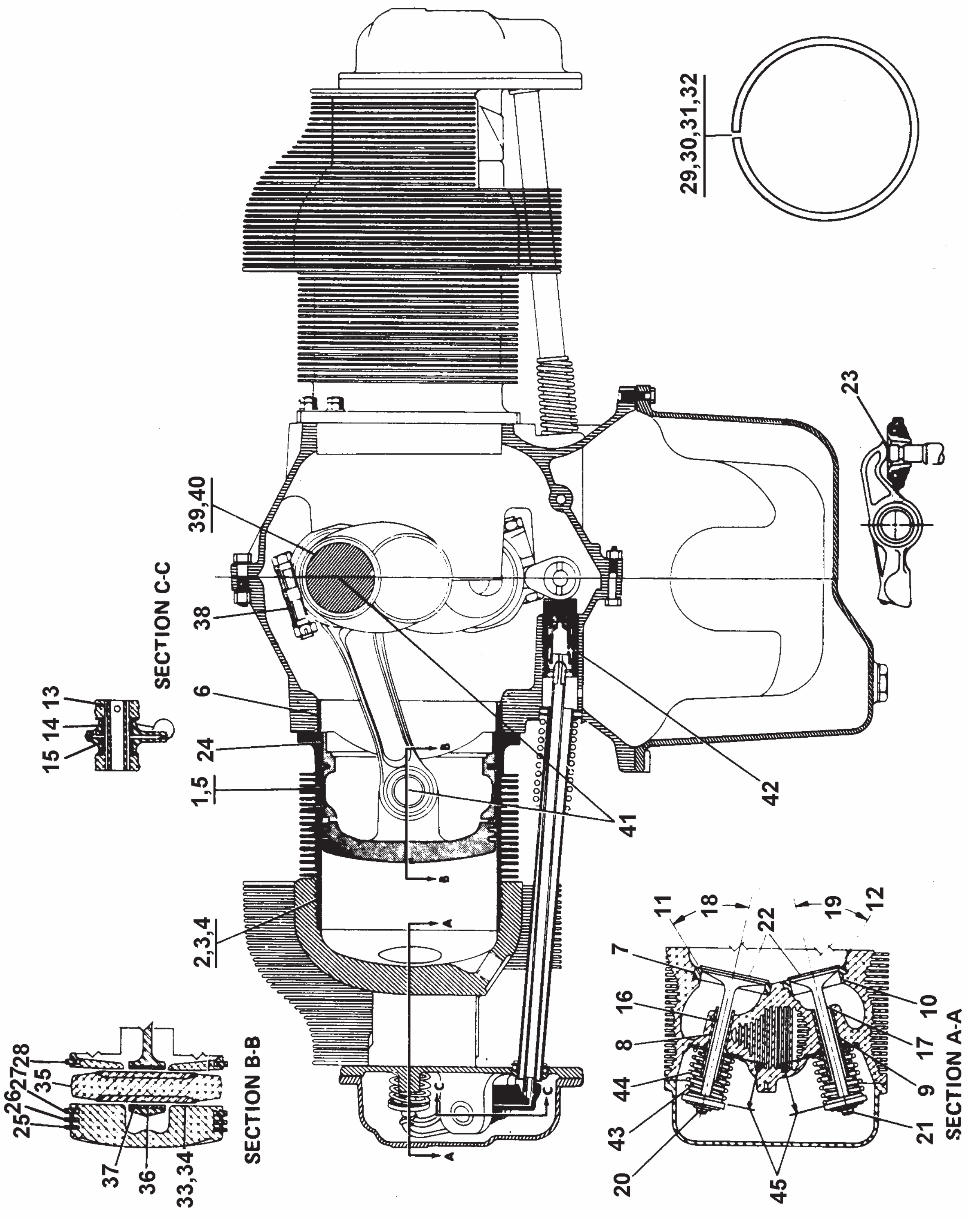


Figure D-8. IO-550-A, B & C Updraft Cylinder Dimensions

Table D-10. Updraft Engine Cylinder Assembly Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
	Cylinders		
1	Cylinder bore (lower 4-1/2 inch of barrel) ....diameter:	See Figure D-10 and Table D-13	
2	Cylinder bore choke (5.75 inch into barrel)................................choke:	See Figure D-10 and Table D-13	
3	Cylinder bore ....out-of-round:	See Figure D-10 and Table D-13	
4	Cylinder bore .... allowable oversize	See Figure D-10 and Table D-13	
5	Cylinder bore surface (Nitrided Barrels) Cross hatch angle Finish in micro-inches R_a	 22° - 32° 35	 — 60
6	Cylinder barrel in crankcase ....diameter:	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head...................................diameter:	0.009T	0.012T
8	Intake valve guide in cylinder head...diameter:	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head ....diameter:	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head................................diameter:	0.0070T	0.0100T
11	Intake valve seat.. width:	Figure D-11	
	Intake valve face-to-stem.. axis angle:	45°00’	--
12	Exhaust valve seat.. width:	Figure D-12	
	Intake valve face-to-stem... axis angle:	59°45’	60°15’
	Rocker Arms and Shafts		
13	Rocker shaft in cylinder boss...diameter:	0.0002L	0.0025L
	Rocker shaft in rocker arm bushing ....diameter:	0.0010L	0.0028L
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	0.4362
	Intake valve in guide ....diameter:	0.0010L	0.0032L
17	Exhaust valve guide.. inside diameter:	0.4370	0.4380
	Exhaust valve in guide...diameter:	0.0029L	0.0046L
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-13 (Replace 100%)	
21	Exhaust valve face-to-stem ....length:	Figure D-14 (Replace 100%)	
22	Intake valve seat-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, moly coated (bottom of skirt) in cylinder ....diameter:	0.0078L	0.0108L
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
29	Top ring at 1.00 ± 0.50” depth (in cylinder barrel).............................gap:	0.029	0.043
30	Second ring at 1.00 ± 0.50” depth (in cylinder barrel) ....gap:	0.035[1]	0.049
31	Oil control ring at 1.00 ± 0.50” depth (in cylinder barrel) ....gap:	0.015	0.031
32	Fourth ring at 1.00 ± 0.50” depth (in cylinder barrel) ....gap:	0.015	0.031

Table D-10. Updraft Engine Cylinder Assembly Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
33	Piston pin in piston .... diameter:	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 .... diameter:	0.0022L	0.0026L
37	Bushing in connecting rod................ diameter:	0.0025T	0.0050T
38	Bolt in connecting rod .... diameter:	0.0000L	0.0018L
39	Connecting rod bearing on crankpin .... diameter:	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 Figure D-25	
42	Hydraulic tappet in crankcase................ diameter:	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. Gap for second ring is nominally 0.006” larger than the top ring

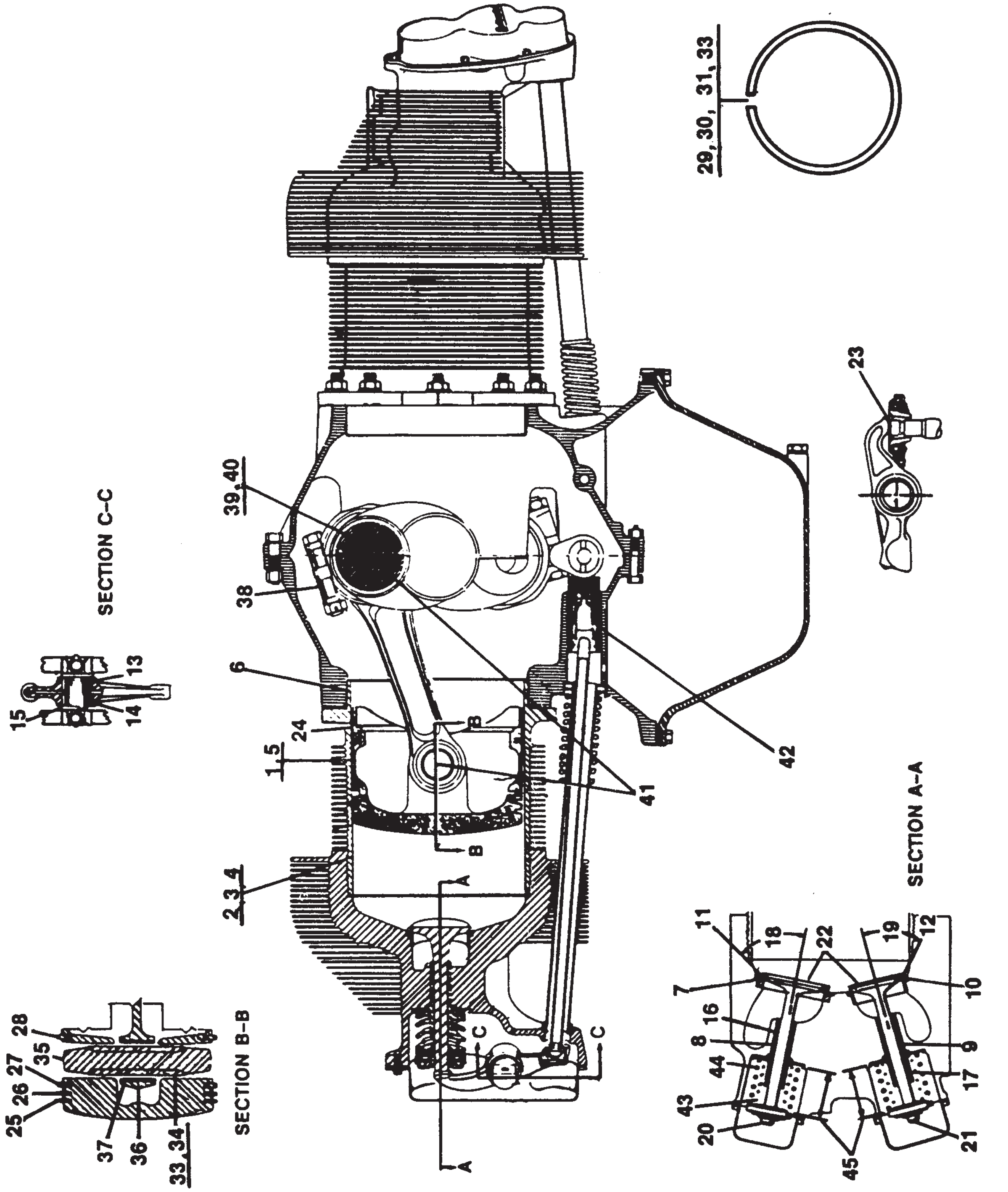


Figure D-9. Cylinder Assembly Dimensions

Table D-11. Crossflow Cylinder Assembly Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
	Cylinders		
1	Cylinder bore (lower 4-1/2 inch of barrel) .... diameter:	See Figure D-10 and Table D-13	
2	Cylinder bore choke (5.75 inch into barrel) .... choke:	See Figure D-10 and Table D-13	
3	Cylinder bore .... out-of-round:	See Figure D-10 and Table D-13	
4	Cylinder bore .... allowable oversize	See Figure D-10 and Table D-13	
5	Cylinder bore surface (Nitrided Barrels) Cross hatch angle Finish in micro-inches R_a	 22° - 32° 35	 — 60
6	Cylinder barrel in crankcase .... diameter:	0.0040L	0.0100L
7	Intake valve seat insert in cylinder head .... diameter:	0.007T	0.010T
8	Intake valve guide in cylinder head .... diameter:	0.0010T	0.0025T
9	Exhaust valve guide in cylinder head .... diameter:	0.0010T	0.0025T
10	Exhaust valve seat insert in cylinder head .... diameter:	0.0070T	0.0100T
11	Intake valve seat .... width:	Figure D-11	
12	Exhaust valve seat .... width:	Figure D-12	
	Rocker Arms and Shafts		
13	Rocker shaft in cylinder head boss .... diameter:	0.0005L	0.0033L
	Rocker shaft in rocker arm bushing .... diameter:	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 .... diameter:	0.0010L	0.0042L
17	Exhaust valve guide .... inside diameter:	0.4375	0.4395
	Exhaust valve in guide .... diameter:	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-13 (Replace 100%)	
21	Exhaust valve face-to-stem .... length:	Figure D-14 (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-graphite coated (bottom of skirt) in cylinder .... diameter:	0.008L	0.011L
	Piston, graphite coated (bottom of skirt) in cylinder .... diameter:	0.006L	0.010L
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
29	Top ring at 1.00 ± 0.50" depth (in cylinder barrel) .... gap:	0.029	0.043
30	Second ring at 1.00 ± 0.50" depth (in cylinder barrel) .... gap:	0.035[1]	0.049
31	Oil control ring at 1.00 ± 0.50" depth (in cylinder barrel) .... gap:	0.015	0.031
32	Fourth ring at 1.00 ± 0.50" depth (in cylinder barrel) .... gap:	0.015	0.031
33	Piston pin in piston .... diameter:	0.0001L	0.0007L

Table D-11. Crossflow Cylinder Assembly Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
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...............diameter:	0.0022L	0.0026L
37	Bushing in connecting rod..........................diameter:	0.0025T	0.0050T
38	Bolt in connecting rod.............................diameter:	0.0000L	0.0018L
39	Connecting rod bearing on crankpin.................diameter:	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 Figure D-25	
42	Hydraulic tappet in crankcase......................diameter:	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. Gap for second ring is nominally 0.006” larger than the top ring

Table D-12. Cylinder Assembly Dimensions
Not illustrated in Figure D-10

Part Name	Inspection Item	Dimensions (inches)	
		Minimum	Maximum
Rocker Arm Bushings	Inside Diameter	0.7505	0.7515
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)	5.205	5.220
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.

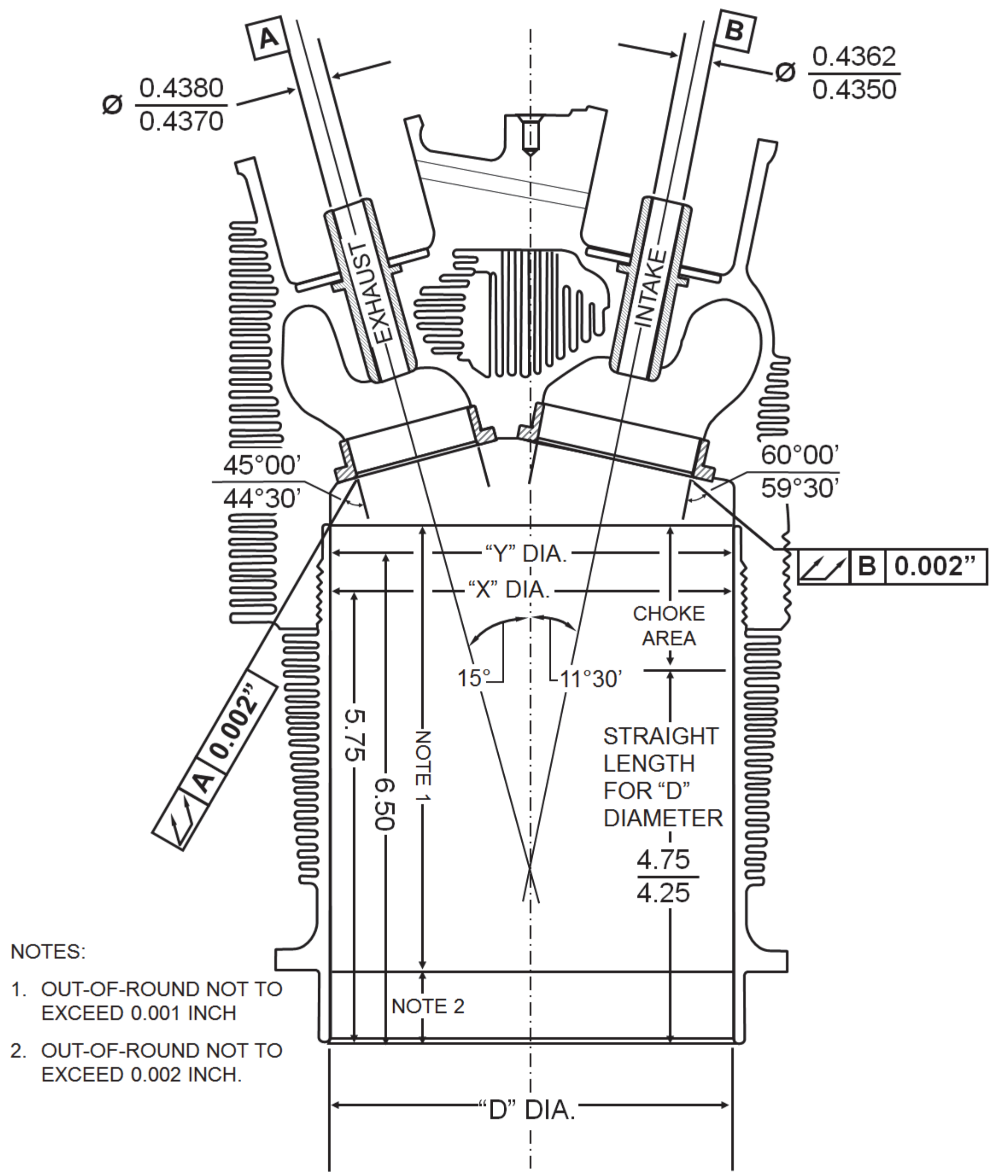
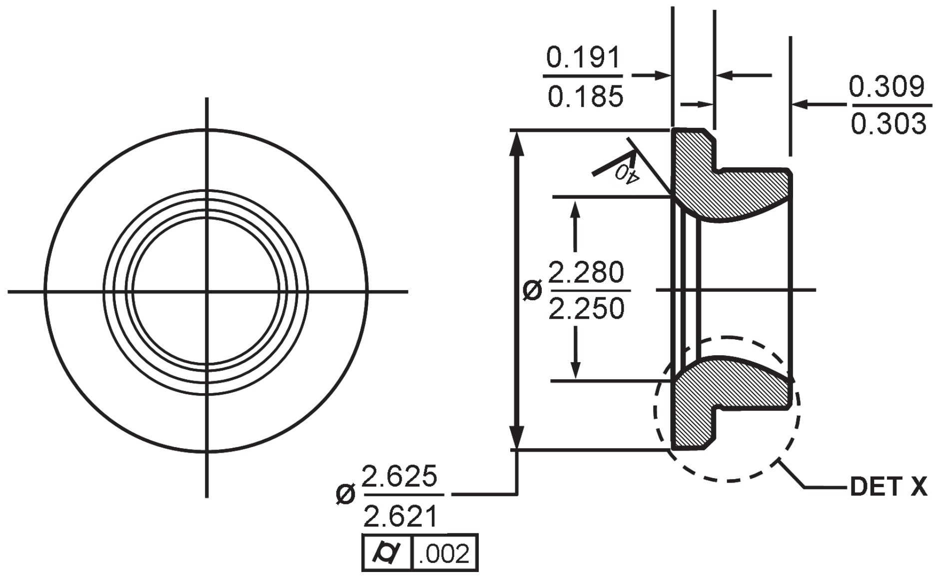
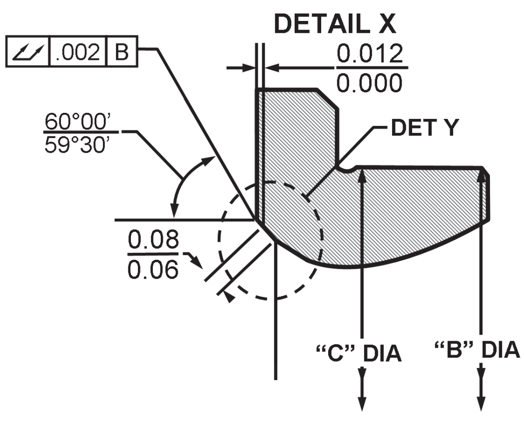


Figure D-10. Cylinder Barrel Dimensions

Table D-13. Cylinder Barrel Dimensions

	"D" Diameter (inches)		"X" Diameter (inches)		"Y" Diameter (inches)	
Size	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
STD.	5.251	5.253	5.247	5.250	5.244	5.247
.005	5.256	5.258	5.252	5.255	5.249	5.252
.010	5.261	5.263	5.257	5.260	5.254	5.257
.015	5.266	5.268	5.262	5.265	5.259	5.262





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

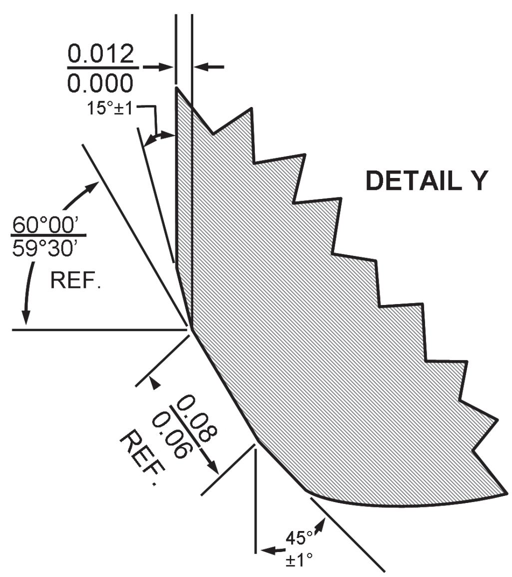
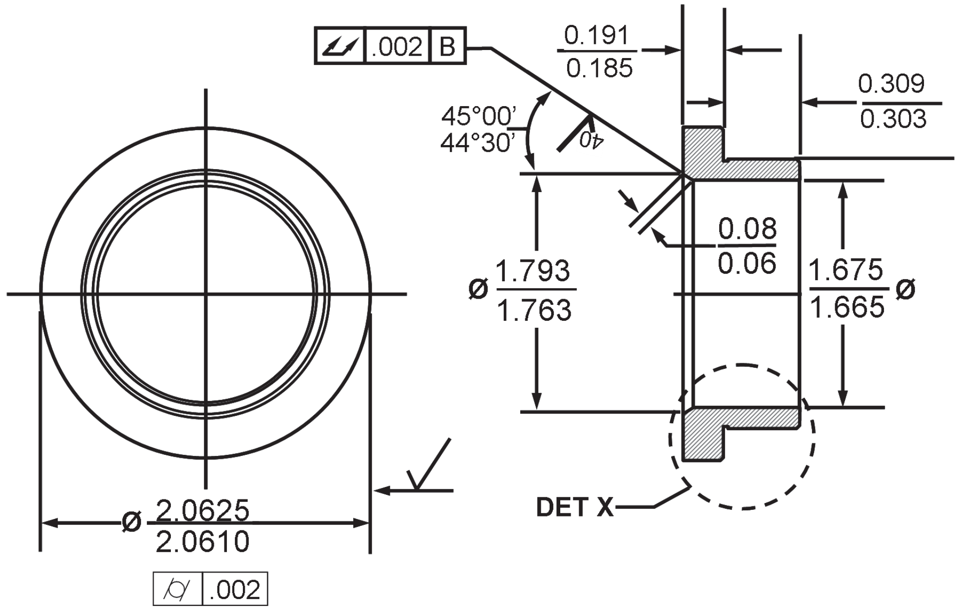
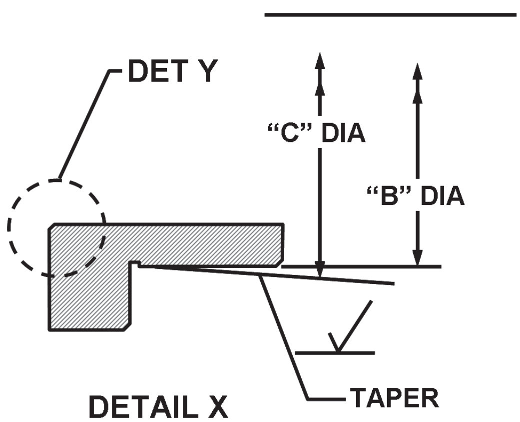


Figure D-11. Intake Valve Seat Dimensions





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

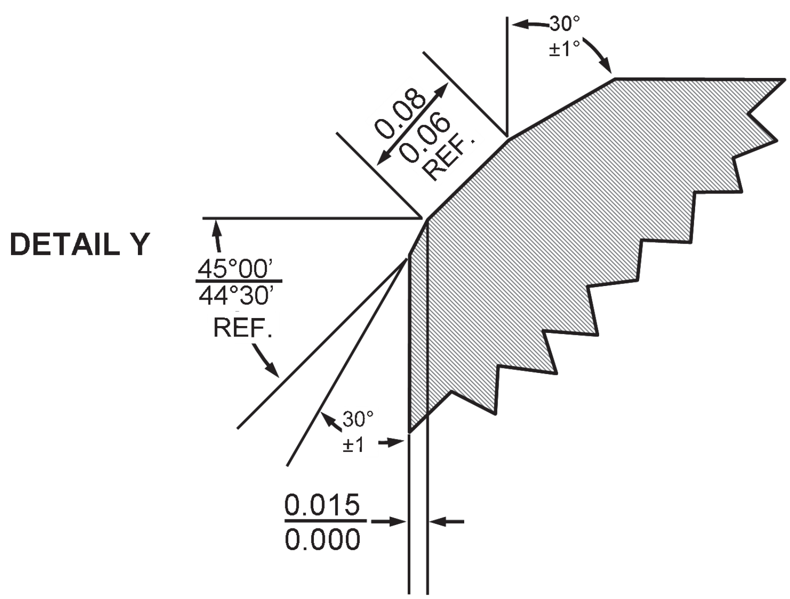


Figure D-12. Exhaust Valve Seat Dimensions

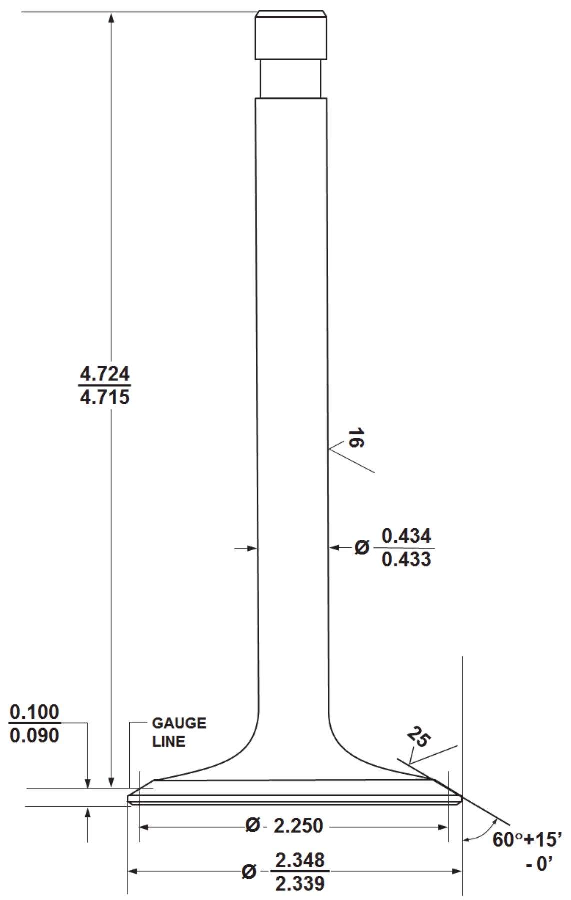


Figure D-13. Intake Valve Dimensions

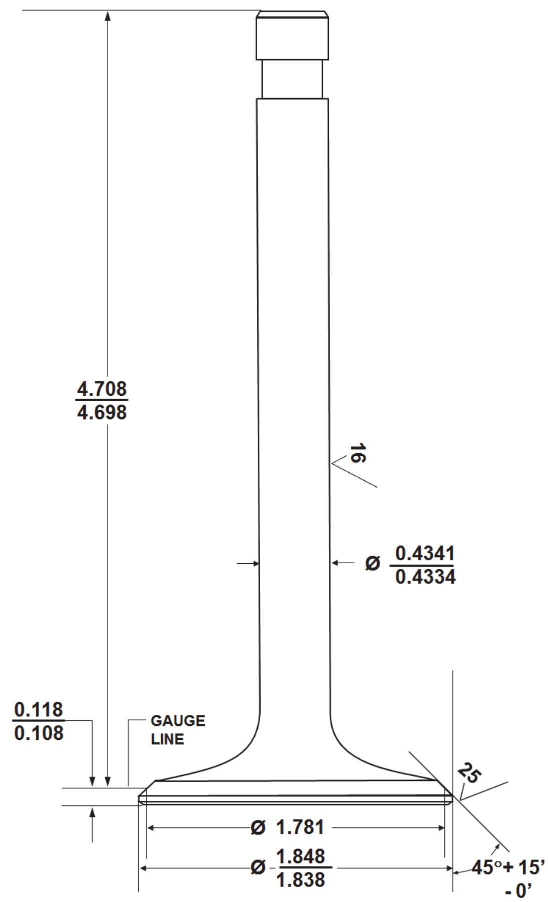


Figure D-14. Exhaust Valve Dimensions

D-7. Crankcase

Refer to **Figure D-16** and **Table D-15** for crankcase dimensional limits. Index numbers in the first column of **Table D-15** correspond to the numbered items in **Figure D-16**. For items not illustrated in **Figure D-16,** refer to **Table D-14.**

Clean and dry parts thoroughly according to the "Engine Cleaning" instructions in Chapter 14 before performing the dimensional inspection. Discard and replace any parts that do not conform to the specified new part tolerances.

Table D-14. Additional Crankcase Dimensions Not depicted in Figure D-16

Part Name/Feature	Dimensions (inches) Minimum	Maximum
Crankshaft Journal Bore ....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

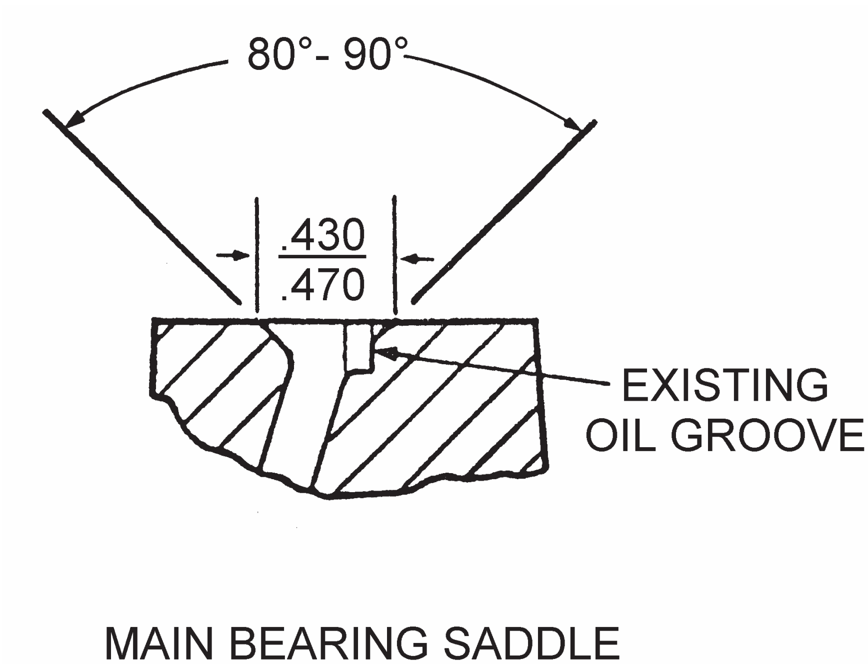


Figure D-15. Crankcase Main Bearing Oil Feed Hole Chamfer

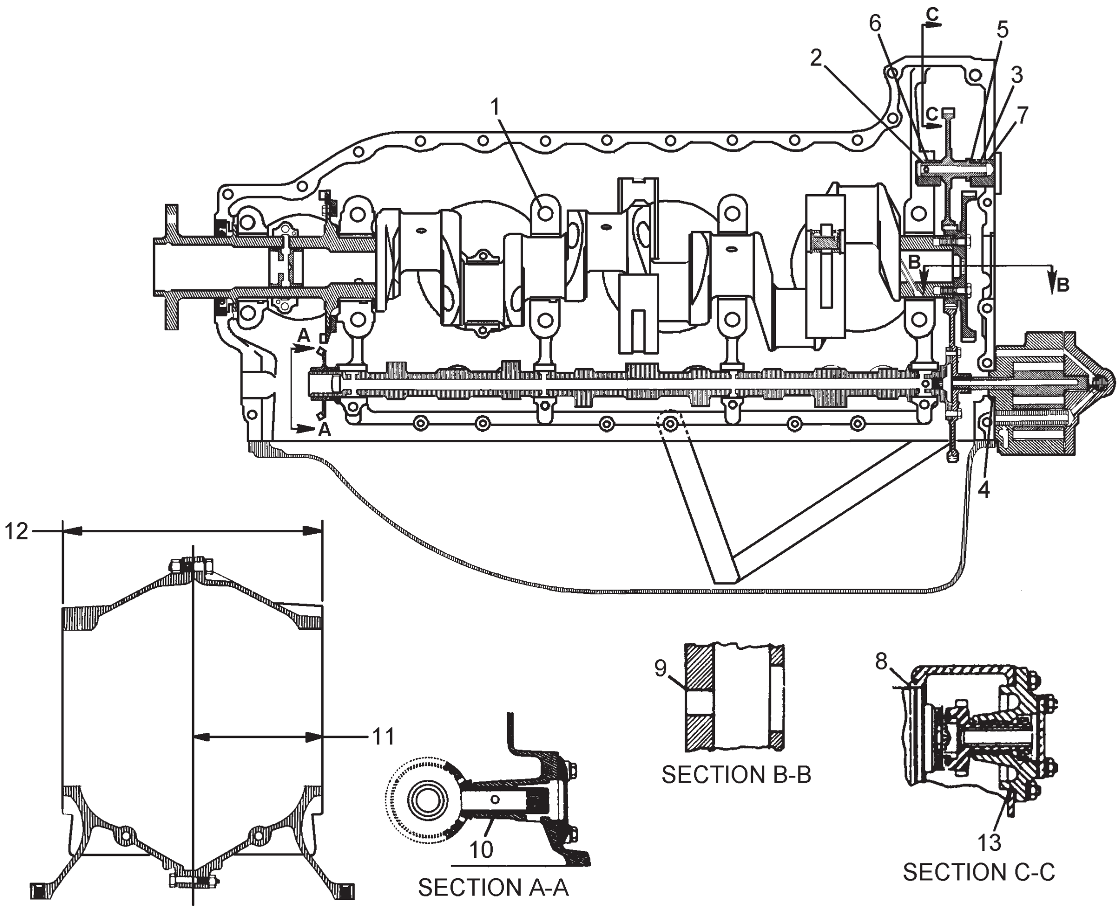


Figure D-16. Crankcase Dimensions

Table D-15. Crankcase Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
1	Through bolt in crankcase.. diameter:	0.0000	0.0015L
2	Idler gear support in crankcase (front) .... diameter:	0.0005L	0.0015T
3	Idler gear support in crankcase (rear)....................................... diameter:	0.0015L	0.0035L
4	Oil pump housing pilot in crankcase .... diameter:	0.0010L	0.0040L
5	Idler gear..end clearance:	0.0300	0.0770
6	Idler gear in support bushing (front)... diameter:	0.0010L	0.0030L
7	Idler gear in support bushing (rear).. diameter:	0.0010L	0.0030L
8	Magneto pilot in crankcase .... diameter:	0.0015L	0.0060L
9	Starter shaft gear roller bearing hole.. diameter:	0.9995	1.0005
10	Governor drive shaft in crankcase .... diameter:	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 .... diameter:	1.0000T	0.0040L
T= Tight L= Loose			

D-8. Engine Drive Train

Refer to **Figure D-17** and **Table D-17** for engine drive train dimensional limits. Index numbers in the first column of **Table D-17** correspond to the numbered items in **Figure D-17**. Additional dimensions are listed in **Table D-16.**

Clean and dry parts thoroughly according to the "Engine Cleaning" instructions in Chapter 14 before performing the dimensional inspection. Discard and replace parts that do not meet the specified dimensions.

Table D-16. Additional Engine Drive Train Dimensions Not depicted in Figure D-17

Part Name	Feature	Dimensions (inches) Minimum	Maximum
Crankshaft Ctrwt. Hanger	Blade Bushing .... Inside Diameter	See Figure D-24	
Camshaft	Journal... Diameter	0.9980	0.9990

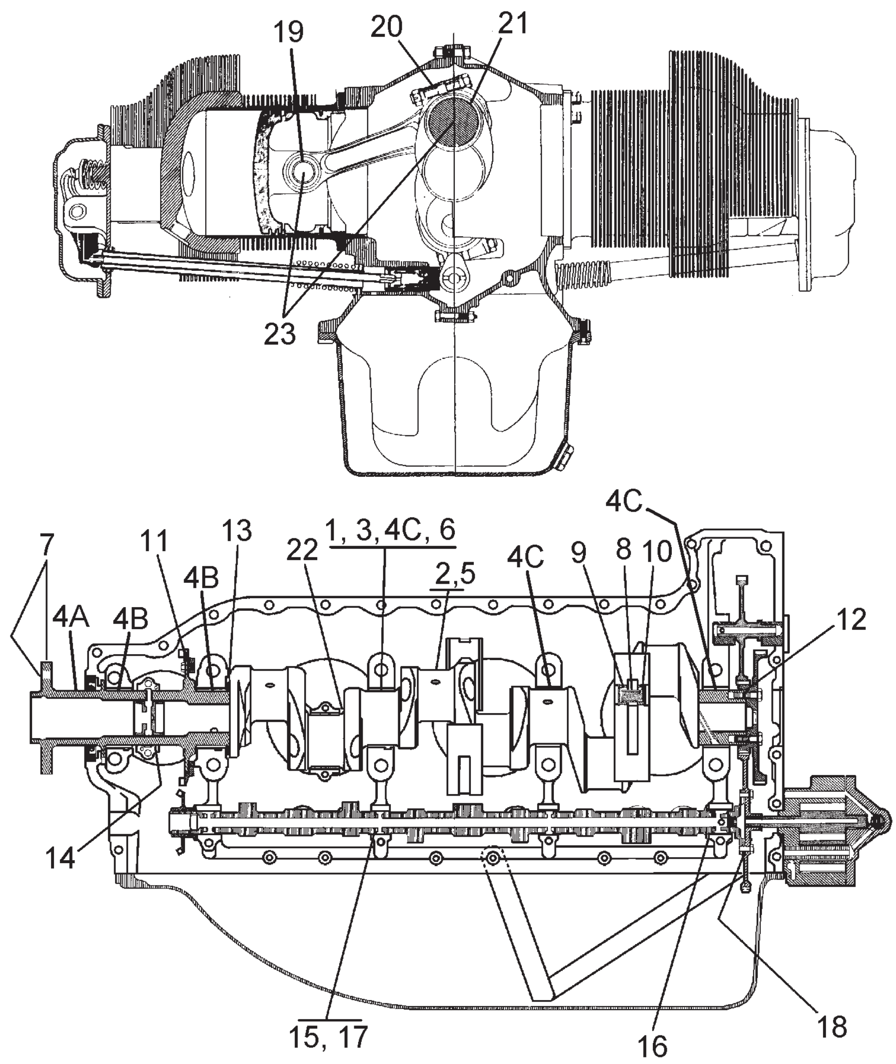


Figure D-17. Engine Drive Train Dimensions

Table D-17. Engine Drive Train Dimensions

Index	Part	Dimensions (inches)	
		Minimum	Maximum
Crankshaft			
1	Crankshaft in main bearing........diameter:	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 Front Journal........diameter: #5 & #4 Journals........diameter: Rear & Intermediate Journals........diameter:	 2.372 2.374 2.624	 2.376 2.375 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........diameter:	0.0015T	0.0030T
9	Damper pin bushing in counterweight........diameter:	0.0015T	0.0030T
10	Damper pin in counterweight........end clearance:	0.0090L	0.0390L
11	Alternator gear on crankshaft........diameter:	0.0005T	0.0035T
12	Crankshaft gear on crankshaft........diameter:	0.0000	0.0020T
13	Crankshaft in thrust bearing........end clearance:	0.004	0.016
14	Governor oil transfer collar on crankshaft........diameter:	0.0005L	0.0018L
Camshaft			
15	Camshaft journals in crankcase........diameter:	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........diameter:	0.0005T	0.0015T
Connecting Rod			
19	Bushing in connecting rod........diameter:	0.0025T	0.0050T
20	Bolt in connecting rod........diameter:	0.0000	0.0018L
21	Connecting rod bearing on crank pin........diameter:	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 Figure D-25	
24	Connecting rod bushing bore........diameter:	See Figure D-25	
25	Bushing center to crankpin center	See Figure D-25	
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.

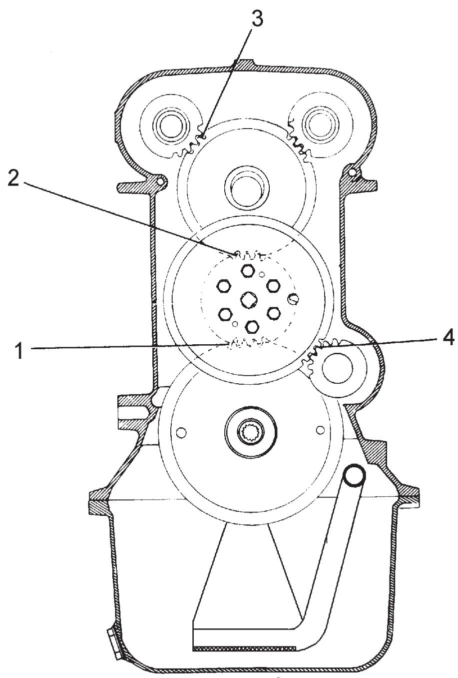
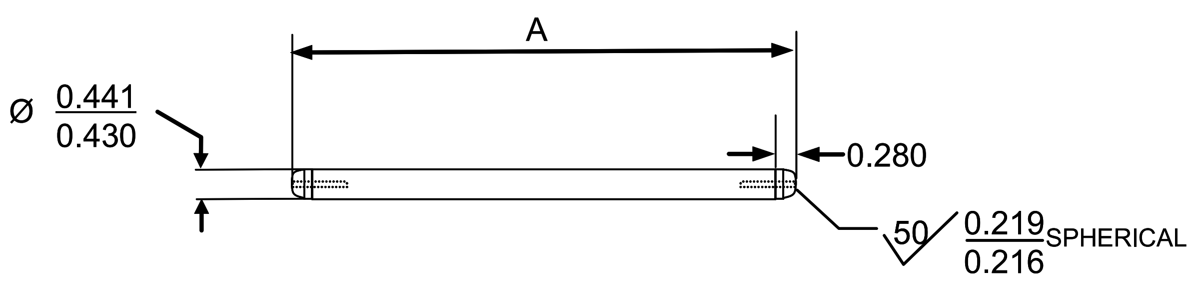


Figure D-18. Crankshaft, Camshaft, and Idler Gear Backlash

Table D-18. Crankshaft, Camshaft, and Idler Gear Backlash

Index	Part (See Figure D-18)	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-19. Pushrod Dimensions

D-8.1. Crankshaft Counterweight Assemblies

Refer to **Figure D-20** for crankshaft counterweight dimensions.

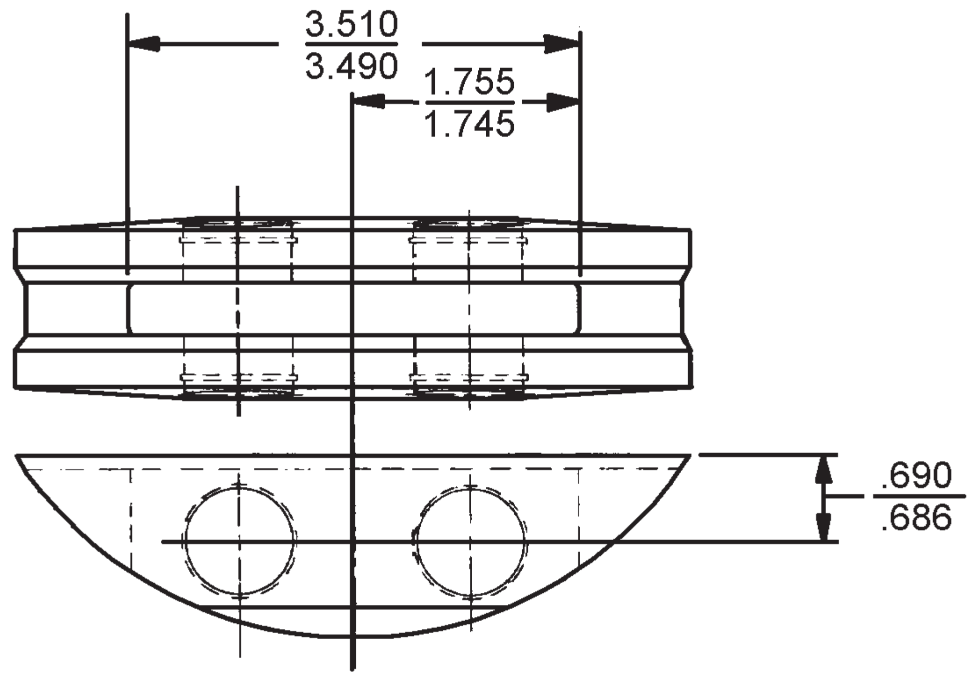


Figure D-20. Counterweight Assembly

D-8.2. Counterweight Pins

The chart below indicates the order of counterweight pins and outer diameter dimension. The pin outer diameter increases with the counterweight order number

Table D-19. Counterweight Pin Part Numbers

Order	Outer Diameter (inches)
4th Order Pin	0.474 to 0.475
5th Order Pin	0.527 to 0.528
6th Order Pin	0.565 to 0.566

D-8.3. Crankshaft Hanger Blade and Counterweight Bushing Dimensions

Refer to **Table D-20 and Figure D-21** through **Figure D-24** for crankshaft counterweight bushing and hanger blade bushing dimensions.

Table D-20. Crankshaft Counterweight Blade Bushing Dimensions

Index	Part (See Figure D-18)	Dimensions (inches)	
		Minimum	Maximum
A	Counterweight bushing bore (standard)......................... inside diameter:	0.8745	0.8755
	Counterweight bushing bore (A.O.) .... inside diameter:	0.8745	0.8785
B	Counterweight bushing (installed).. diameter:	0.622	0.626
C	Crankshaft hanger blade bushing bore...........................inside diameter:	0.8745	0.8755
D	Crankshaft hanger blade bushing ....inside diameter:	0.622	0.626

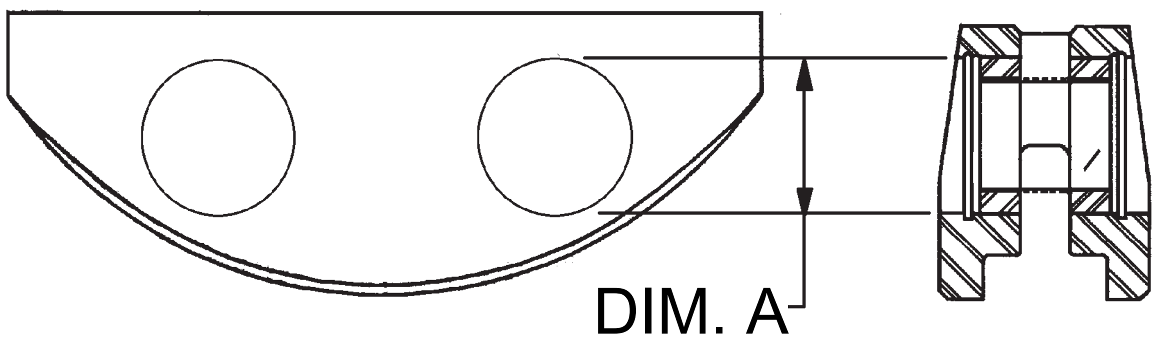


Figure D-21. Crankshaft Counterweight Bushing Bore Dimensions

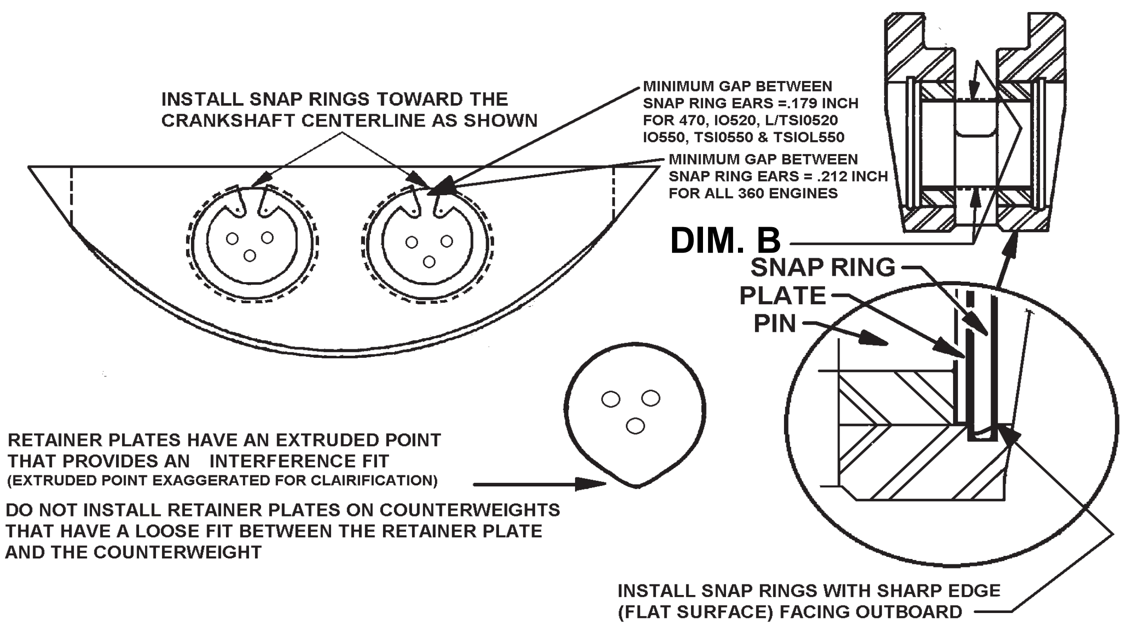


Figure D-22. Crankshaft Counterweight Bushing Dimensions

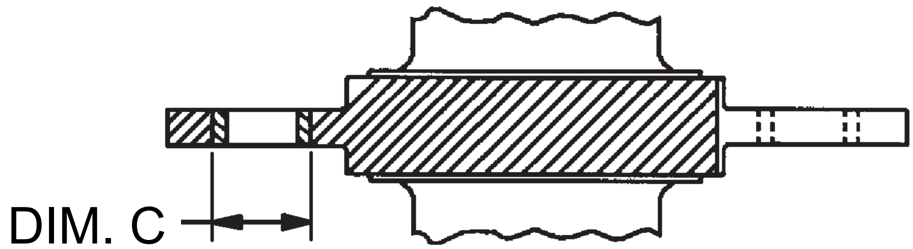


Figure D-23. Crankshaft Hanger Blade Bushing Bore

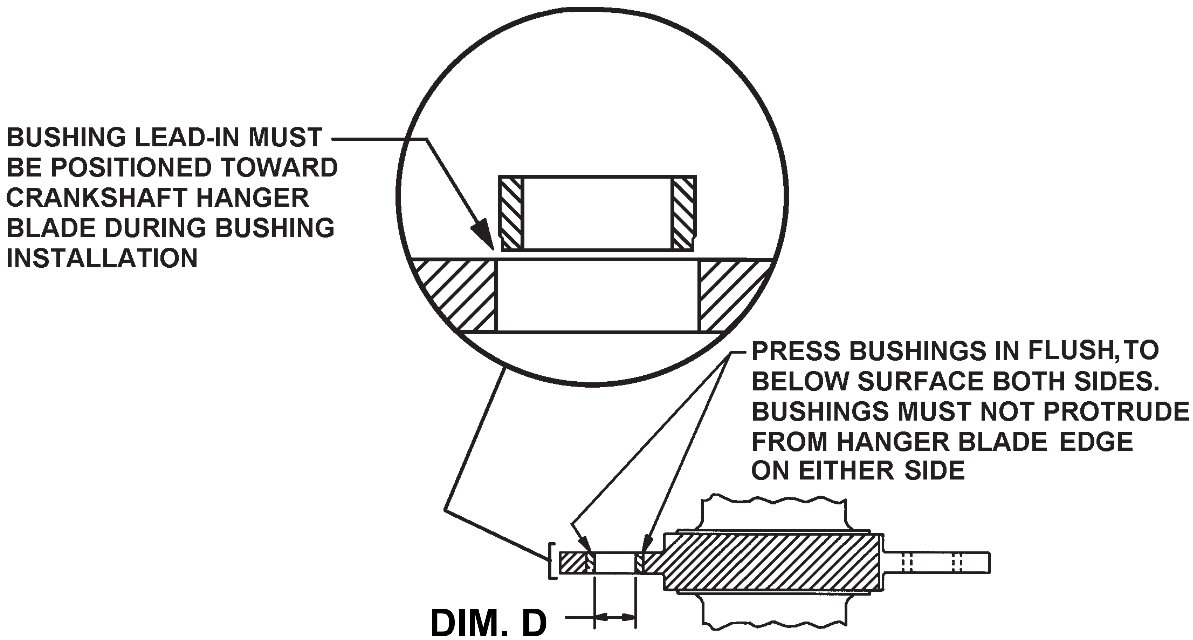


Figure D-24. Crankshaft Hanger Blade Bushing

D-8.4. Connecting Rod Dimensions

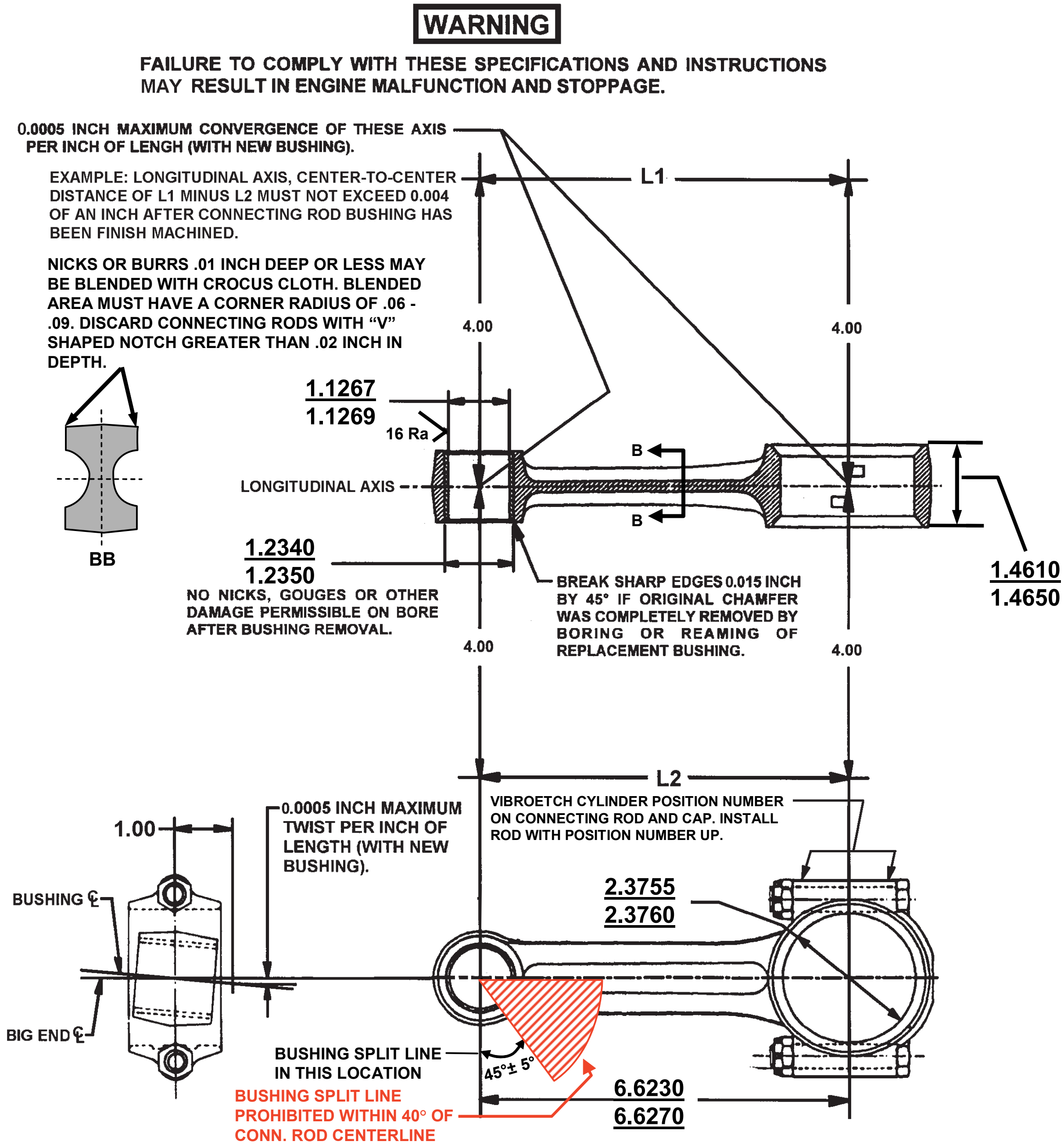


Figure D-25. Connecting Rod Dimensions

D-9. Stud Height Settings

D-9.1. Starter Adapter Stud Height Settings

Refer to **Figure D-27 and Table D-22** depict stud height settings for the starter adapter with accessory drive unit. Stud heights for the basic starter adapter are in **Figure D-26 and Table D-21**. Index numbers in the tables match the numbers in the accompanying illustrations.

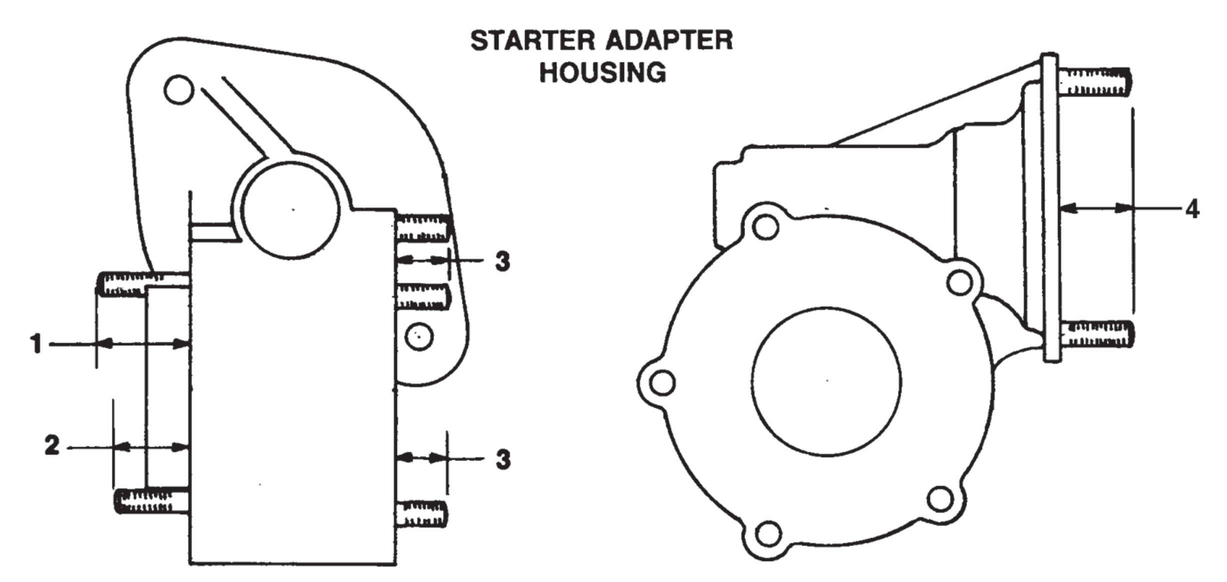


Figure D-26. Basic Starter Adapter Studs

Table D-21. Basic Starter Adapter Stud Heights

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Starter Adapter to Crankcase	0.31-18 X 0.31-24	1.37	1
2	Stud, Starter Adapter to Crankcase	0.31-18 X 0.31-24	1.14	1
3	Stud, Cover to Adapter	0.31-18 X 0.31-24	0.72	3
4	Stud, Starter Motor to Adapter	0.38-16 X 0.38-24	1.00	1

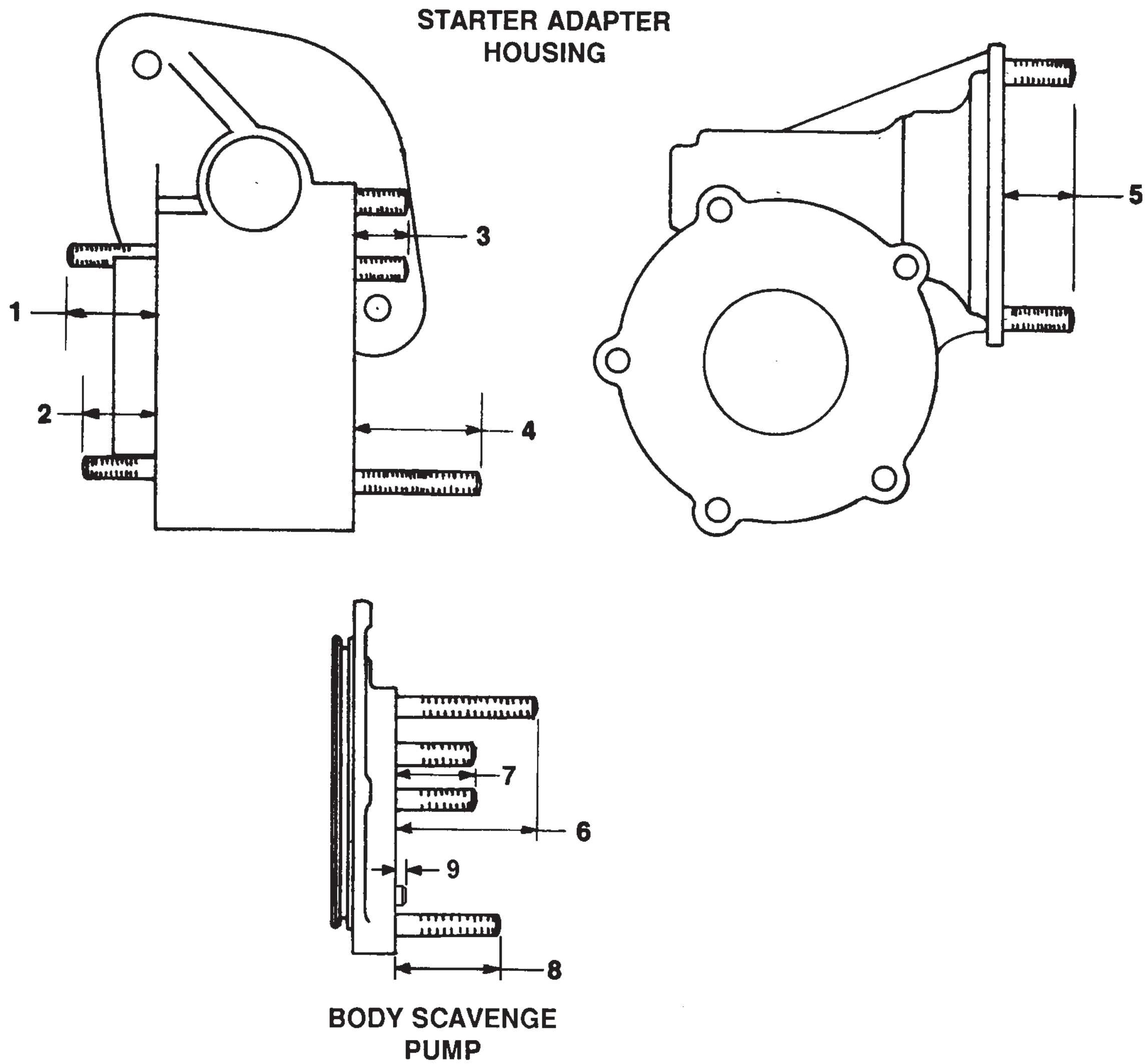


Figure D-27. Starter Adapter with Accessory Drive Studs

Table D-22. Starter Adapter with Accessory Drive Stud Heights

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Starter Adapter to Crankcase	0.31-18 X 0.31-24	1.32	1
2	Stud, Starter Adapter to Crankcase	0.31-18 X 0.31-24	1.09	1
3	Stud, Cover to Adapter	0.31-18 X 0.31-24	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	0.31-18 X 0.31-24	1.00	2
6	Stud, Cover to Scavenge Body	0.31-18 X 0.31-24	2.25	1
7	Stud, Cover to Scavenge Body	0.31-18 X 0.31-24	1.31	2
8	Stud, Cover to Scavenge Body	0.31-18 X 0.31-24	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-28 and the accompanying table show stud settings on the oil pump housing, oil filter adapter and associated parts. **Figure D-29** depicts IO-550-B & R oil sump stud heights. Inspect studs for corrosion, distortion, stripped or incomplete threads, or looseness. Check stud alignment using a tool maker's square. No stud shall exceed the specified settings.

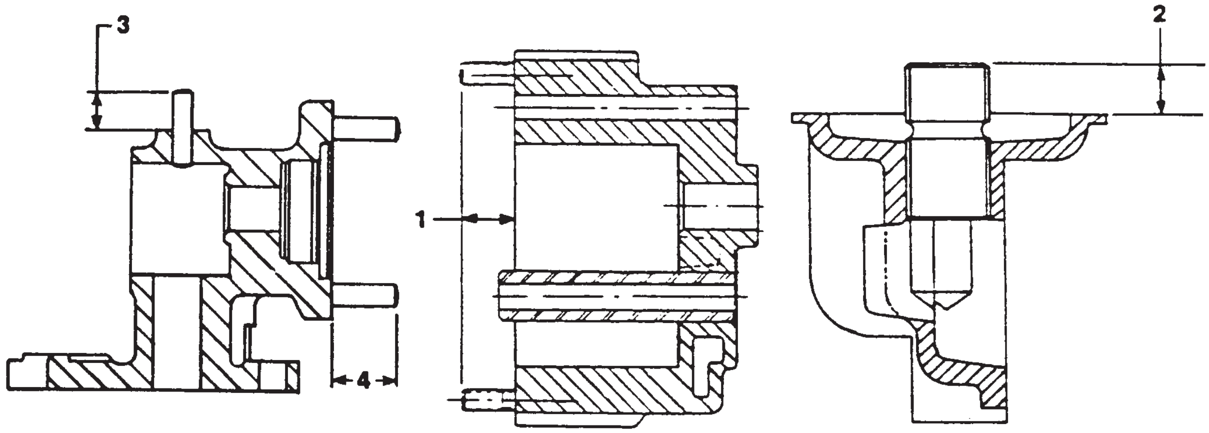


Figure D-28. Lubrication System Stud Height Settings

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	0.75-6 X 0.81-6	0.500-0.700	1
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- 8	0.75	4

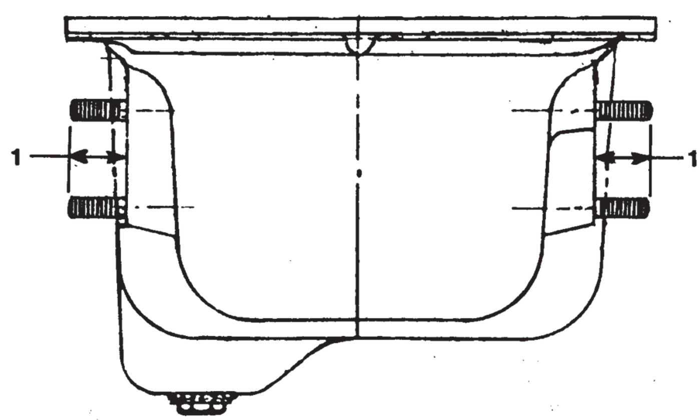


Figure D-29. IO-550-B & -R Oil Sump Stud Height Setting

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Stud, Cover to Housing	0.25-20 X 0.25-28	0.65	2

D-9.3. Accessory Drive Adapter Stud Height

Figure D-30 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.

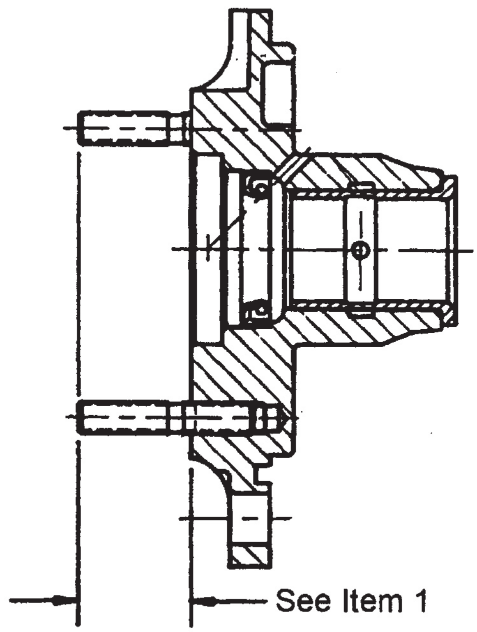


Figure D-30. Accessory Drive Adapter

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

D-9.4. Cylinder Stud Height Settings

Figure D-31 and Table D-23 show cylinder head stud height settings for the two cylinder configurations. Check stud alignment using a tool maker's square.

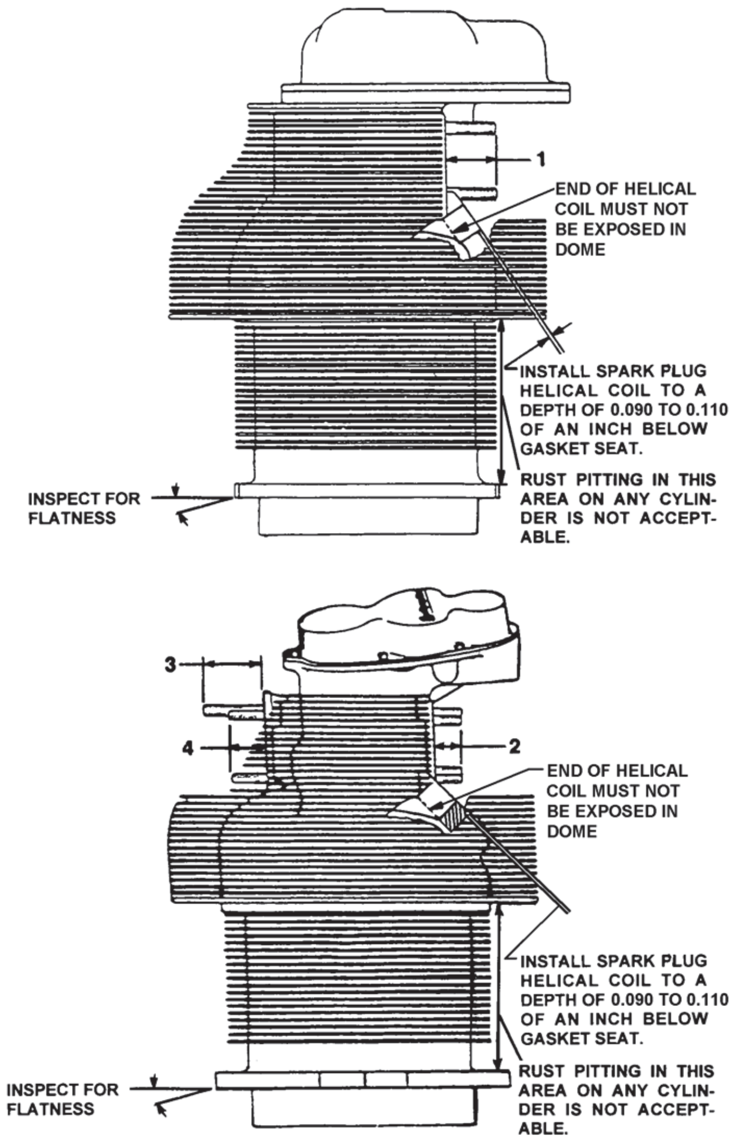


Figure D-31. Cylinder Stud Heights

Table D-23. Cylinder Stud Heights

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Exhaust flange stud	0.25-20 x 0.25-28	0.865-0895	4
2	Exhaust flange stud (ring-locked)	0.25-20 x 0.25-28	0.865-0895	4
3	Intake flange stud	0.25-20 x 0.25-28	1.00	1
4	Intake flange stud	0.25-20 x 0.25-28	0.78	2

D-9.5. Oil Control Collar Stud Height Settings

Figure D-32 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-32**.

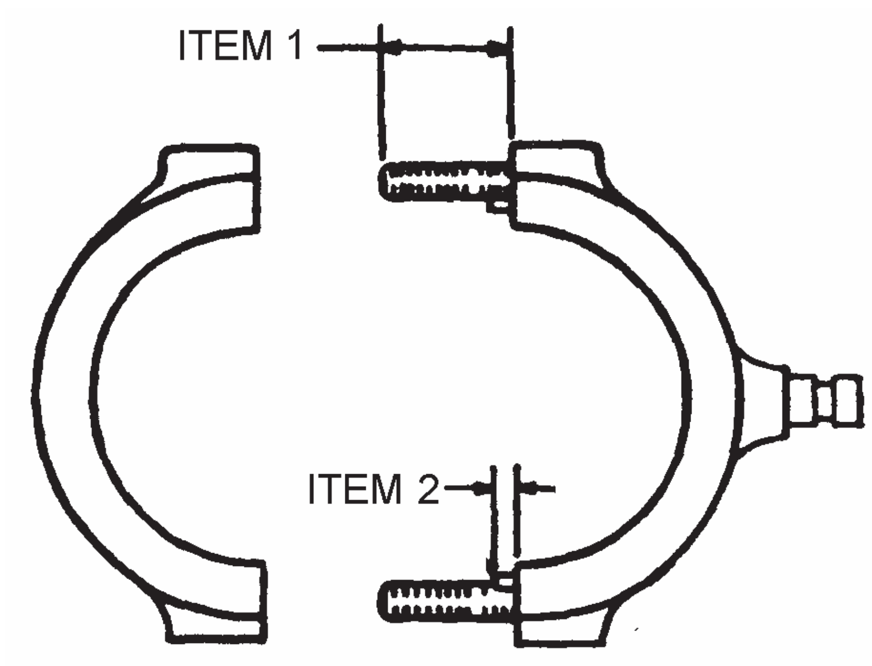


Figure D-32. Oil Control Collar Stud Height Settings

Index	Location	Thread Size	Stud Height (inches)	Quantity
1	Oil Control Collar Stud	0.25 X1.25	0.94	2
2	Dowel	0.12 X 0.43	0.15	2

D-9.6. Crankcase Plugs and Fittings

Refer to **Table D-24** to locate the plugs and fittings that need to be removed to allow pressure flushing of the crankcase. Tag the removed plugs and fittings for re-installation reference.

Table D-24. Crankcase Plugs

Fitting(s) (13)
Plug (17)
Plug (18)
Plug (19)
Plug (21)
Plug (24)
Plug (29)
Plug (46) or (47)

D-9.7. Crankcase Stud Height Settings

Table D-25. 656619-1 & -5 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	6.35	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.84	2
8	Accessory Pad	0.31 X 18-24	1.76	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	1.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	1.88	2
38	Engine Mount	0.38 X 16-24	1.51	1
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	1.81	1
45	Nut, Backbone	0.31 X 18-24	---	1

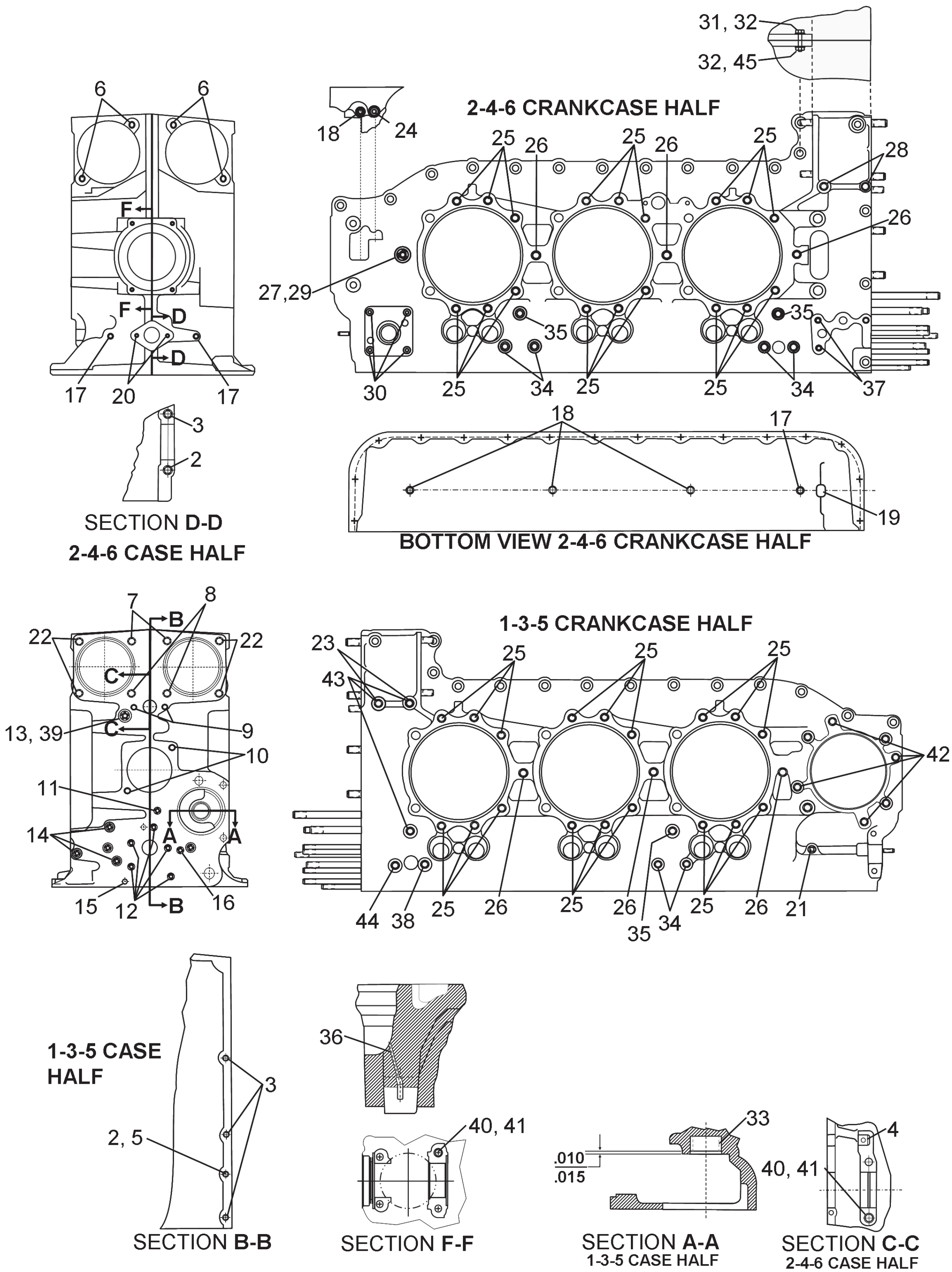


Figure D-33. Crankcase Stud Detail

Detail

Table D-26. 656619-2 and -6 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.84	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.27	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	0.00 Flush	1
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	0.00 Flush	1
45	Nut, Backbone	0.31 X 18-24	---	1

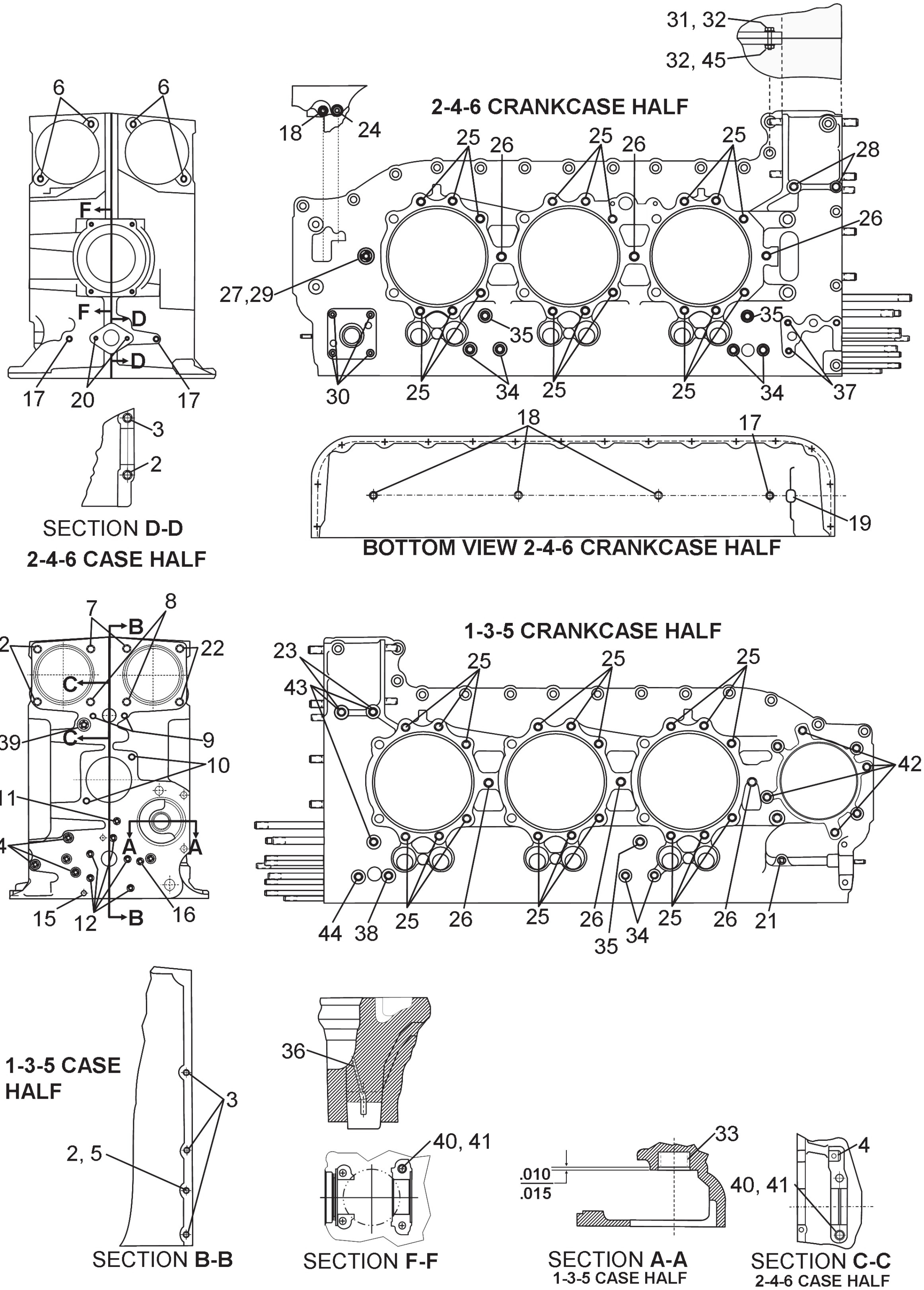


Figure D-33 repeated for reference

Table D-27. 656619-3 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.84	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	0.00 Flush	1
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	0.00 Flush	1
45	Nut, Backbone	0.31 X 18-24	---	1

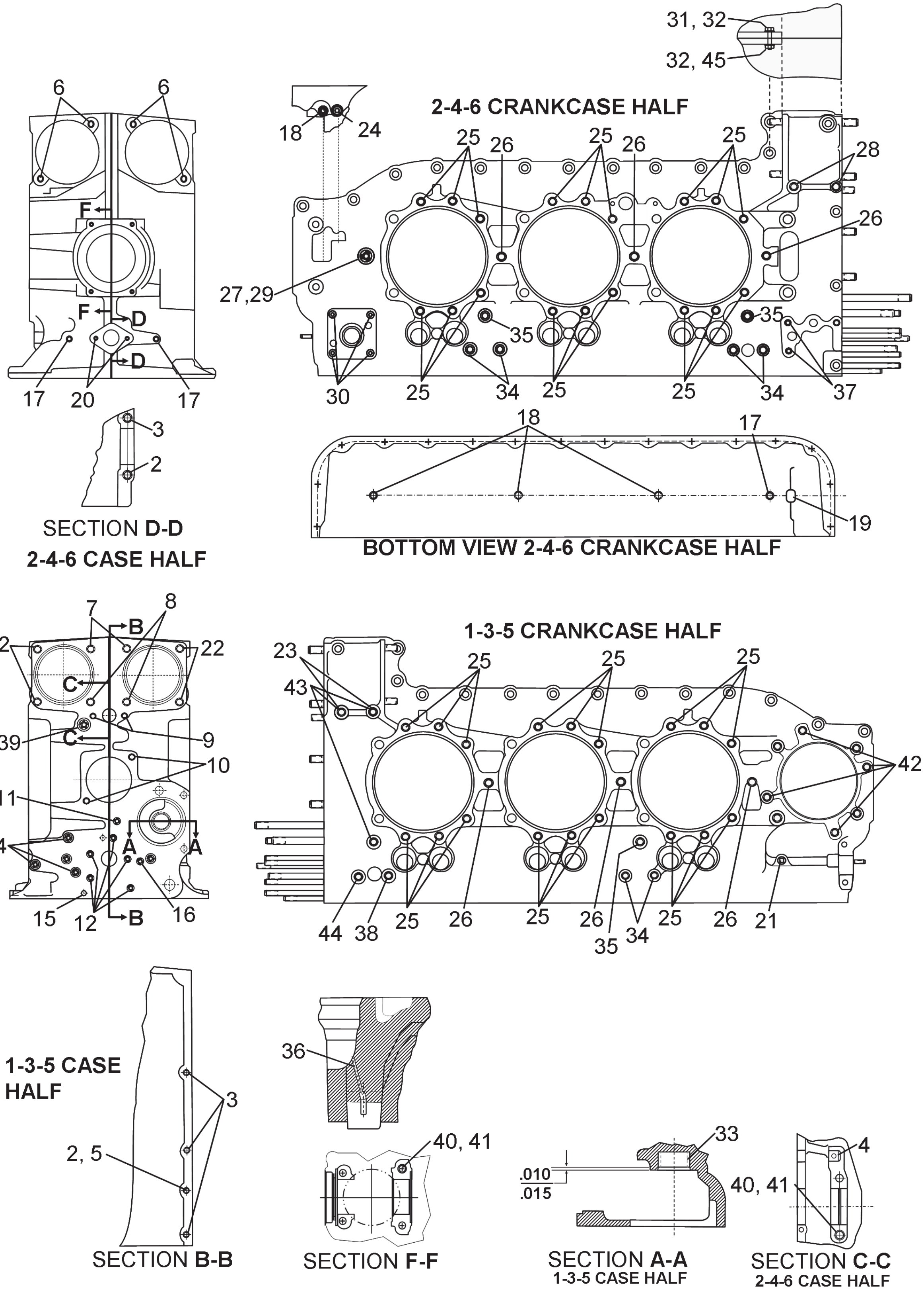


Figure D-33 repeated for reference

Table D-28. 656619-4 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.34	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.84	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	3.32	6
35	Engine Mount	0.38 X 16-24	1.50	3
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	3.32	1
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	1.50	3
44	Engine Mount	0.38 X16-24	3.32	1
45	Nut, Backbone	0.31 X 18-24	---	1

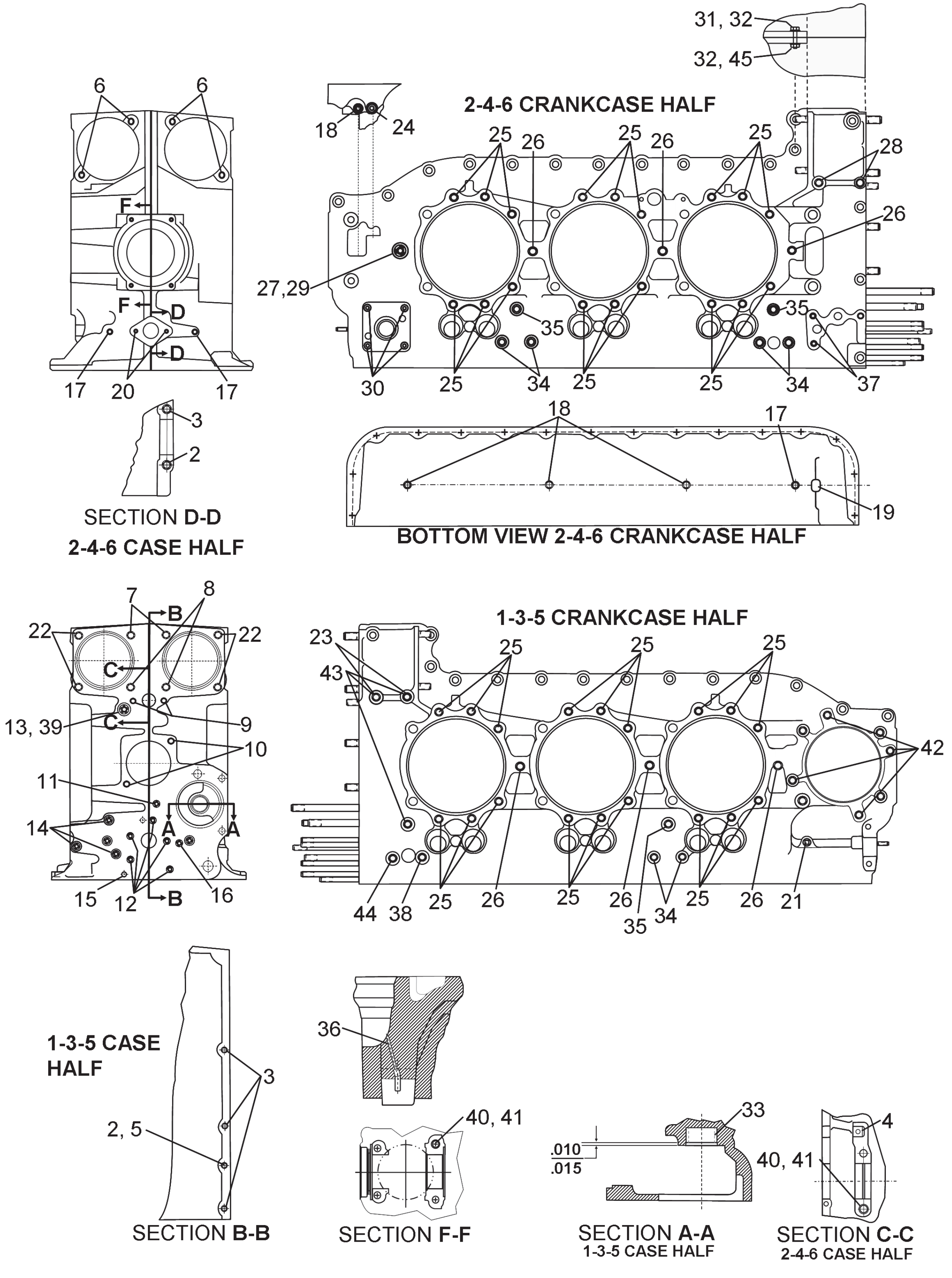


Figure D-33 repeated for reference

Table D-29. 656619-7 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.31	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1

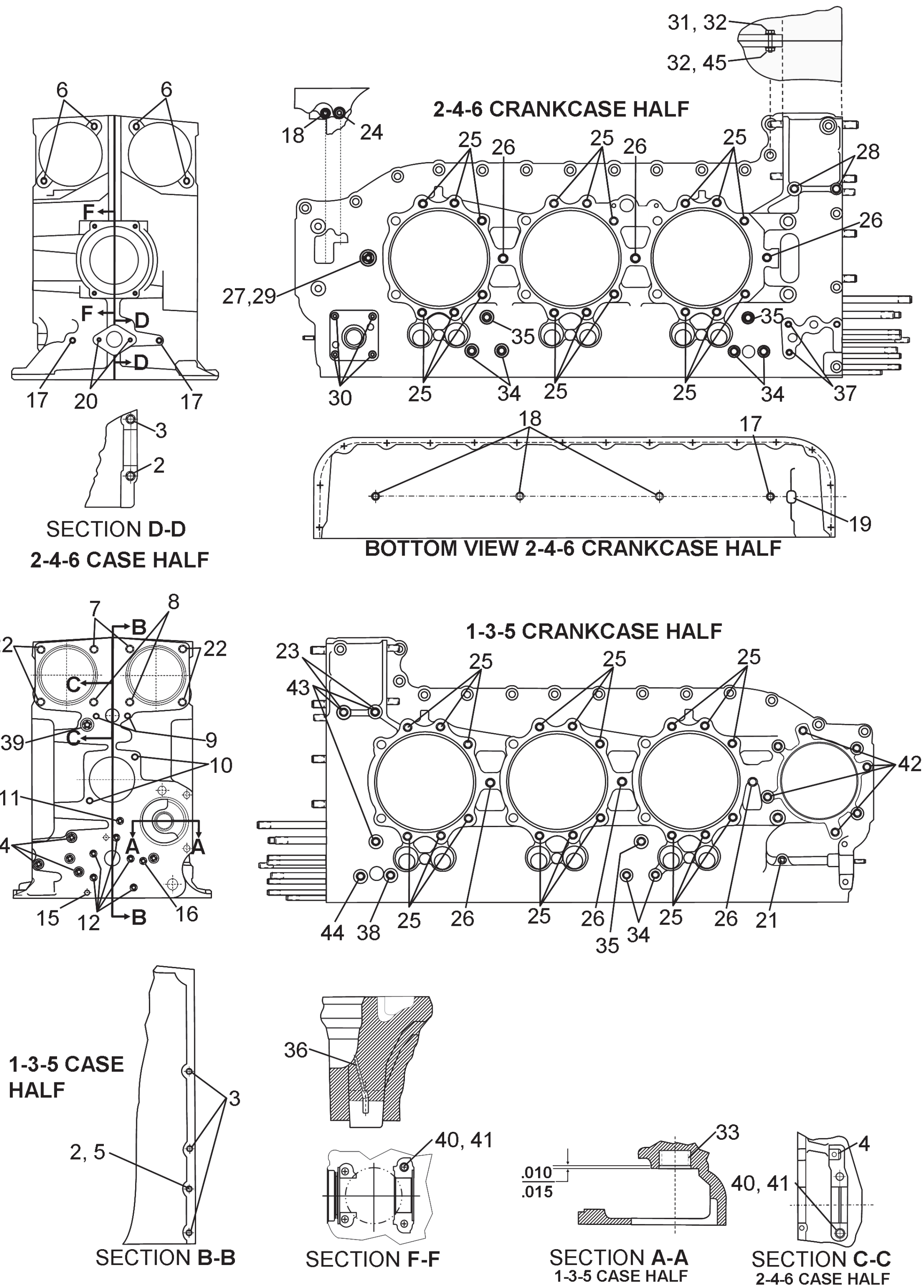


Figure D-33 repeated for reference

Table D-30. 656619-8 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1

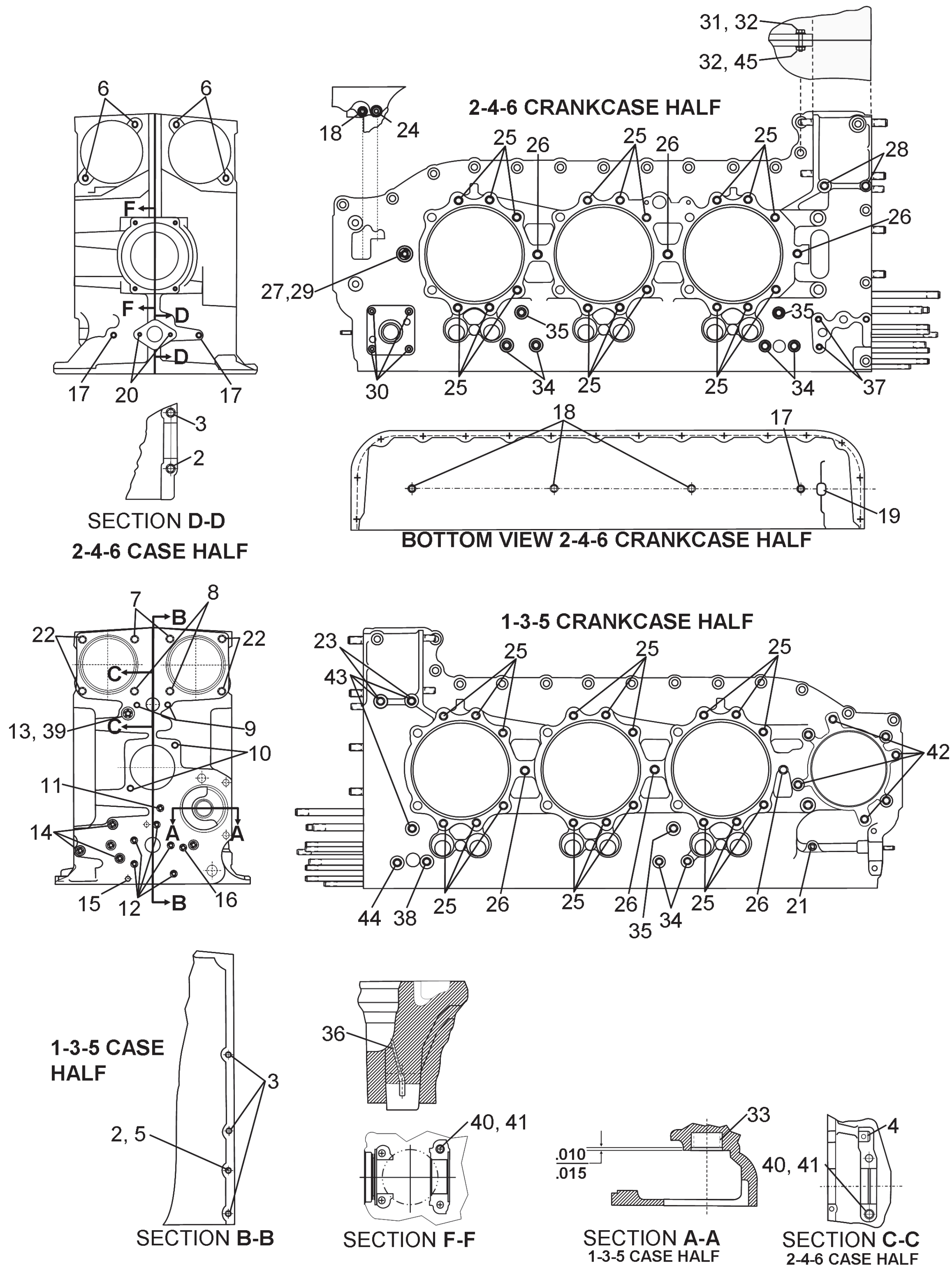


Figure D-33 repeated for reference

Table D-31. 656619-9 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-34	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.31	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	0.61	2
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1
46	Engine Mount	0.38 X16-24	0.64	3

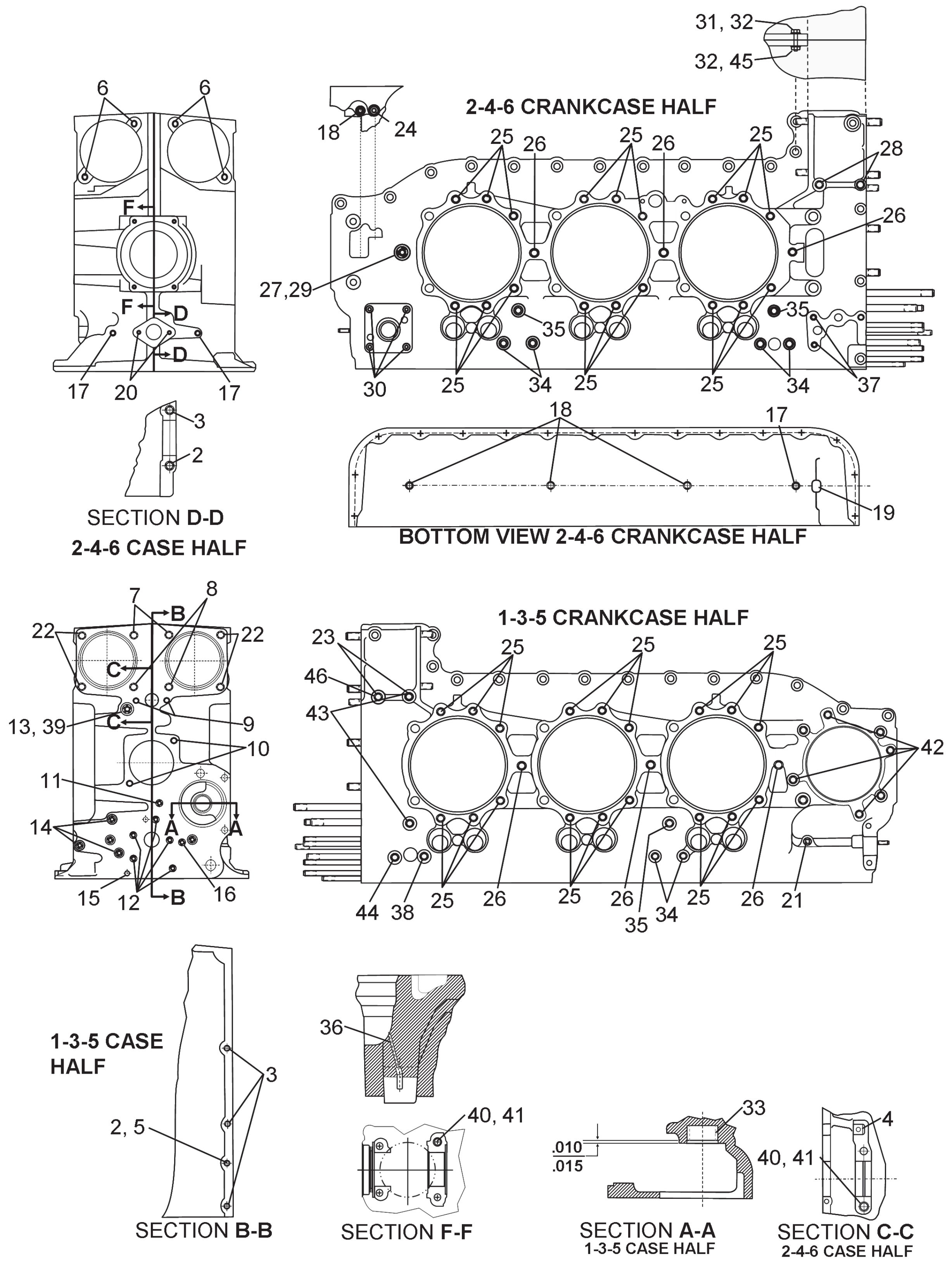


Figure D-34. 656619-9 Crankcase Stud Detail

Table D-32. 656619-10 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-35	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1
46	Plug	0.12-27	---	1

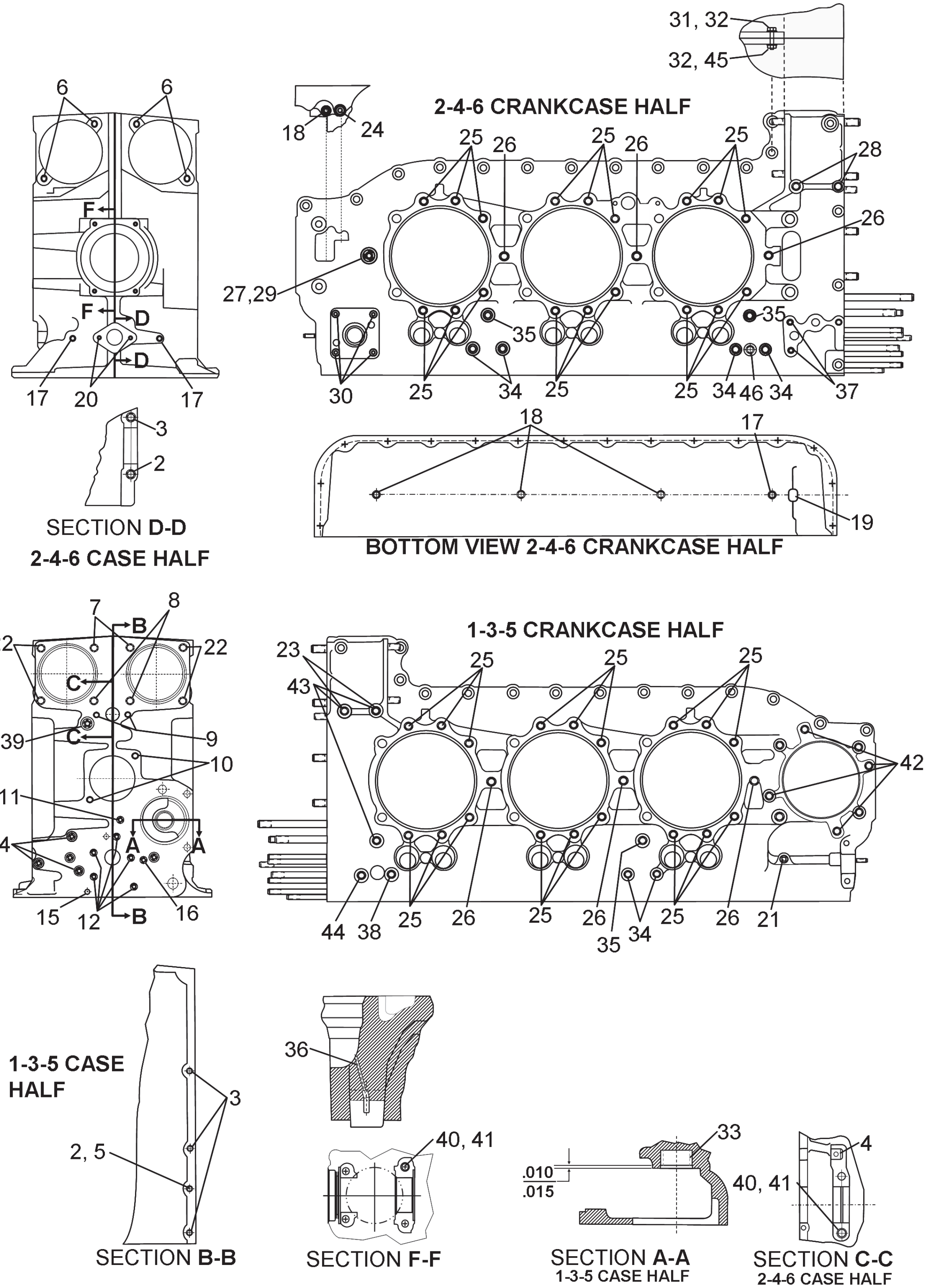


Figure D-35. 656619-10 Crankcase Stud Detail

Table D-33. 656619-11 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	0.00 Flush	1
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	0.00 Flush	1
45	Nut, Backbone	0.31 X 18-24	---	1

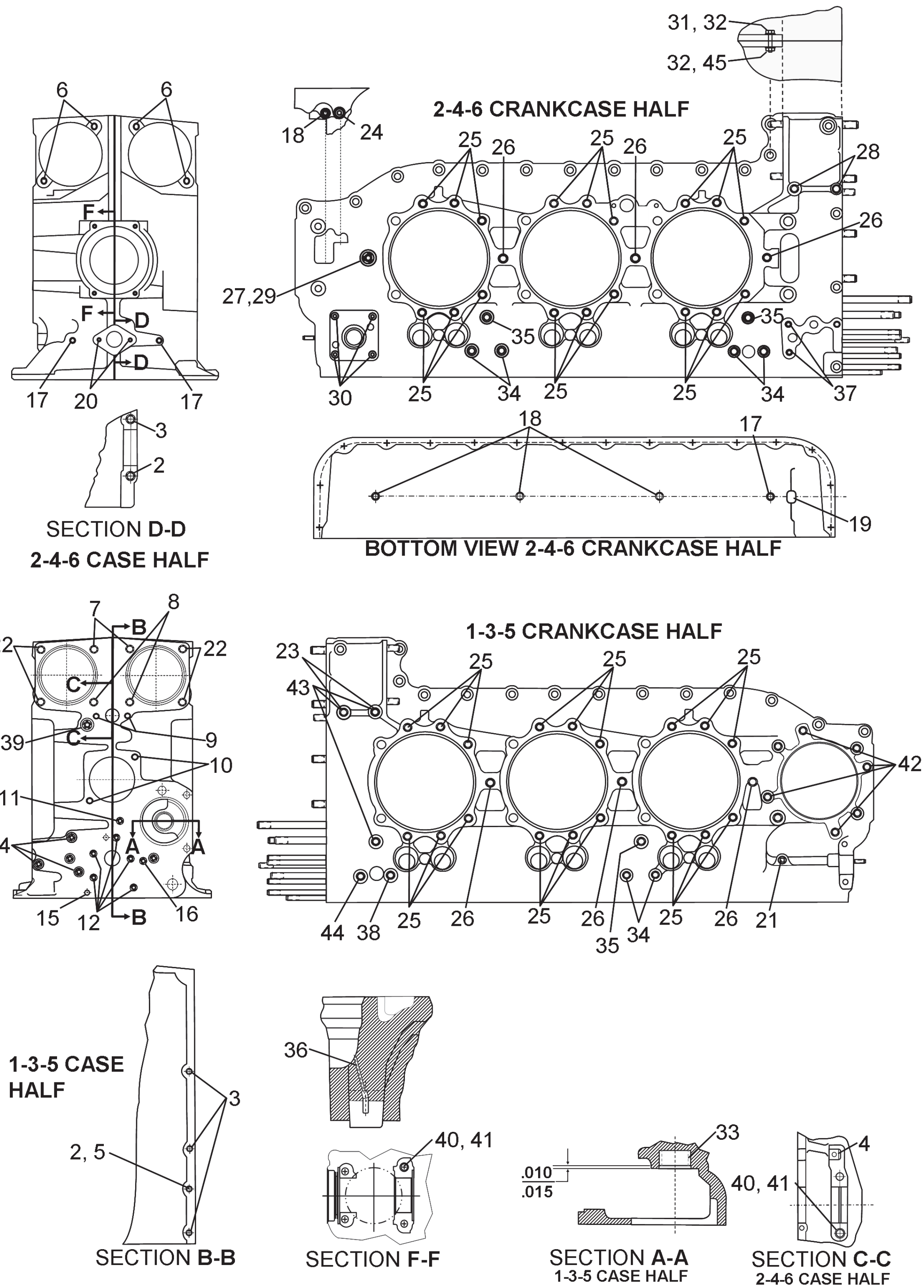


Figure D-33 repeated for reference

Table D-34. 656619-12 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.85	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1

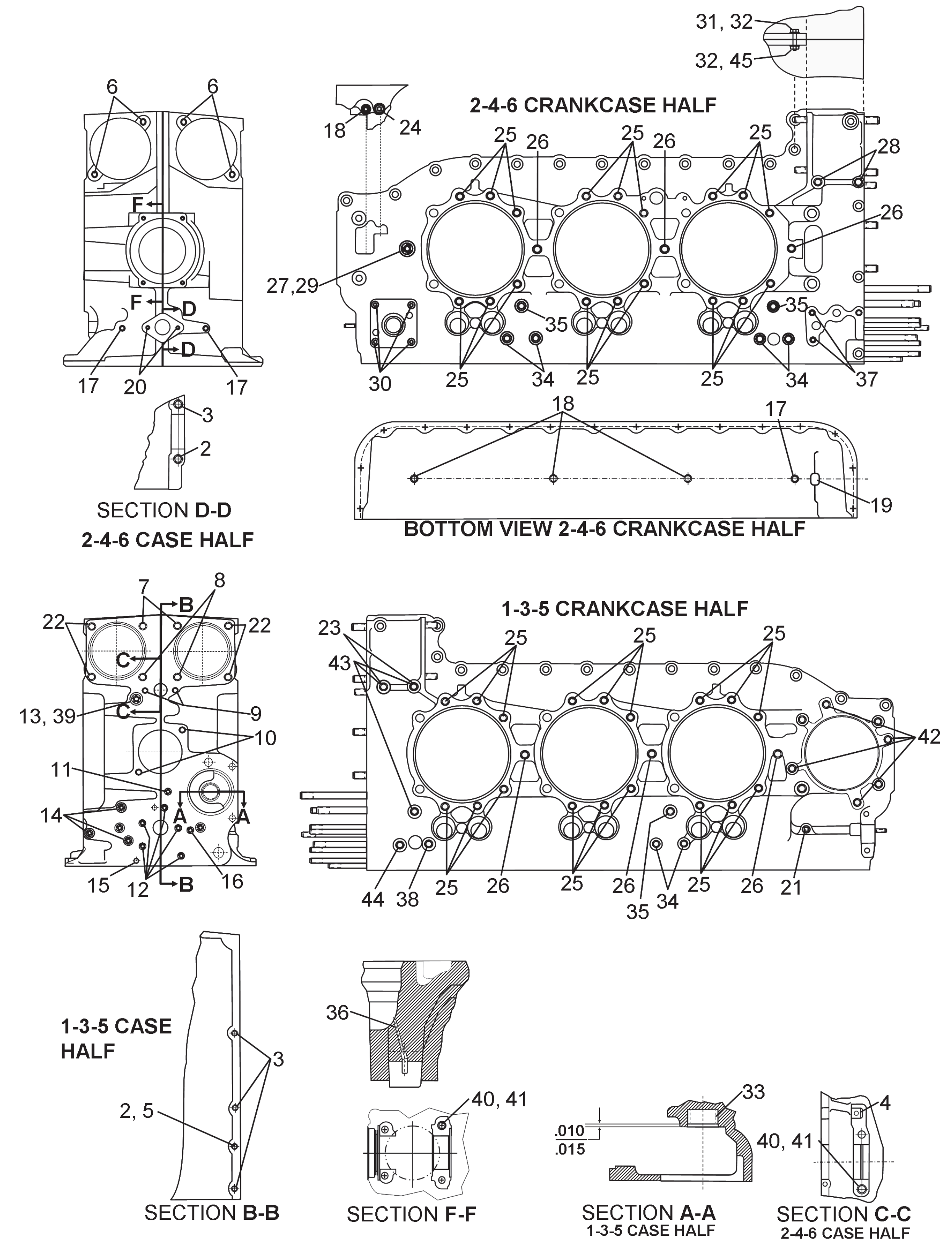


Figure D-33 repeated for reference

Table D-35. 656619-13 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	6.35	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	3.71	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	1.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	1.88	2
38	Engine Mount	0.38 X 16-24	1.51	1
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	1.81	1
45	Nut, Backbone	0.31 X 18-24	---	1

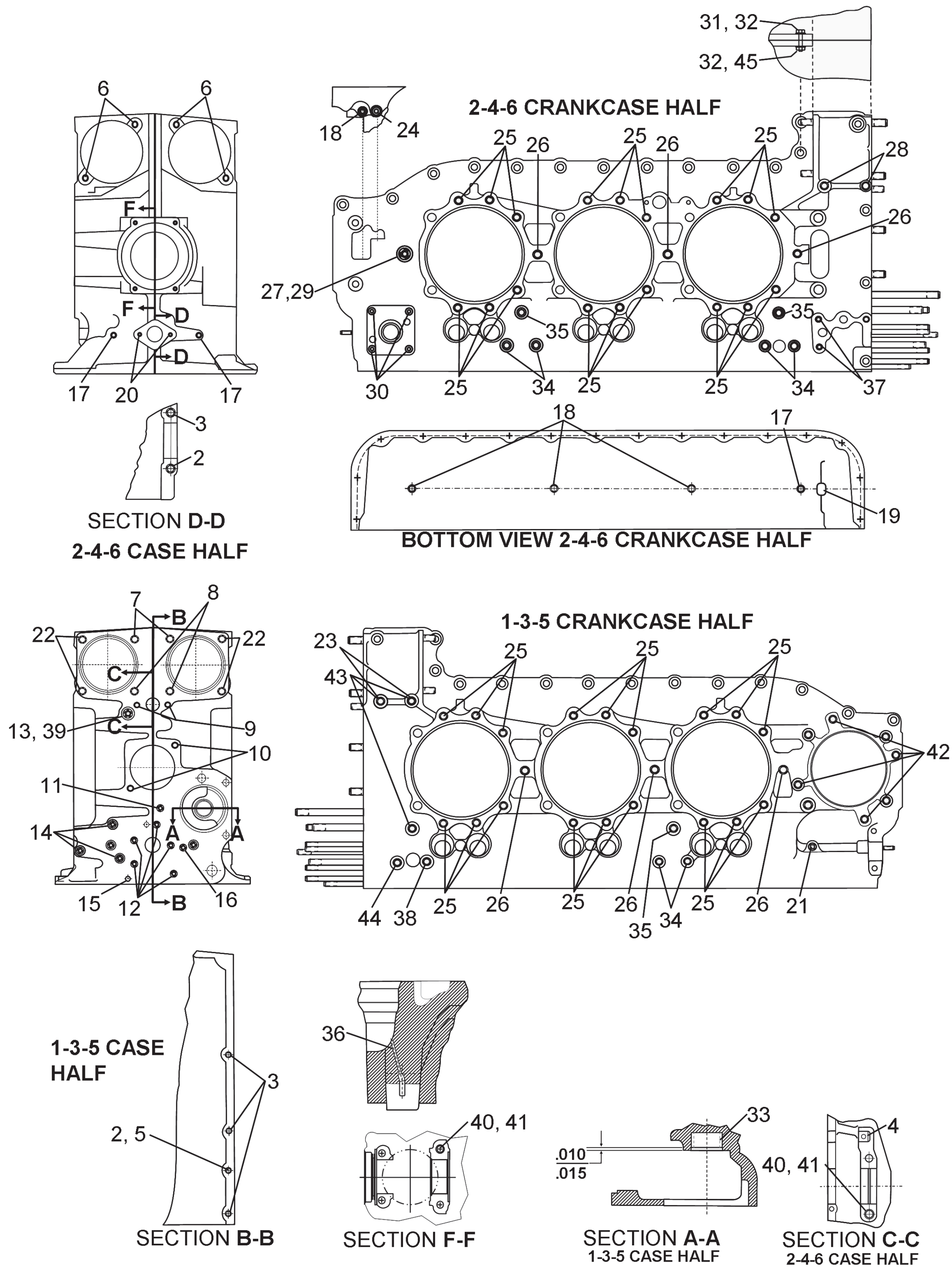


Figure D-33 repeated for reference

Table D-36. 656619-14 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-33	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.27	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	4
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	---	0
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1

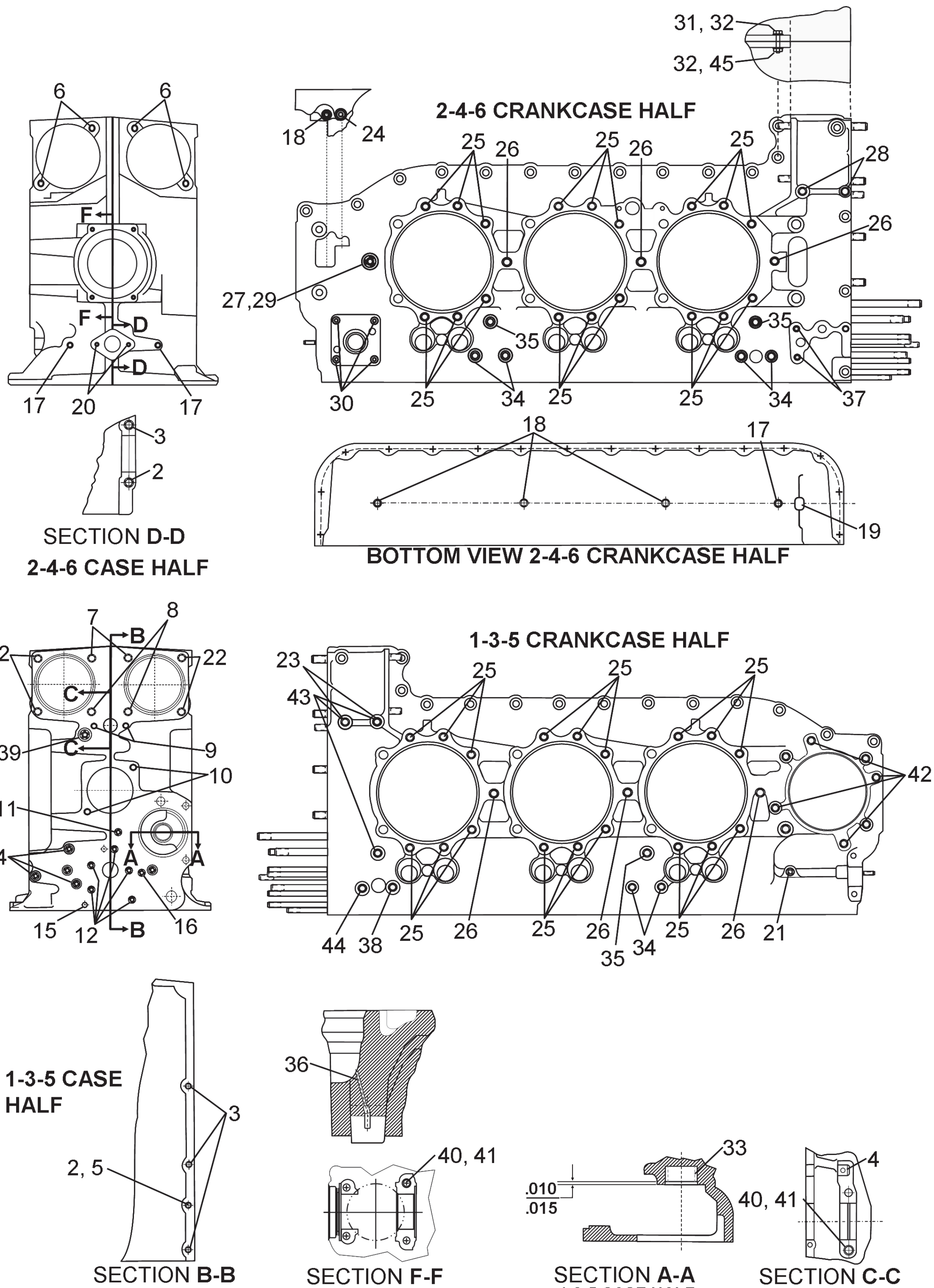


Figure D-33 repeated for reference

Table D-37. 656619-15 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-36	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.31	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	2
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	0.64	3
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1
46	Plug	0.12-27	---	1
47	Propeller Governor Pad	0.31 X 18-24	1.94	2

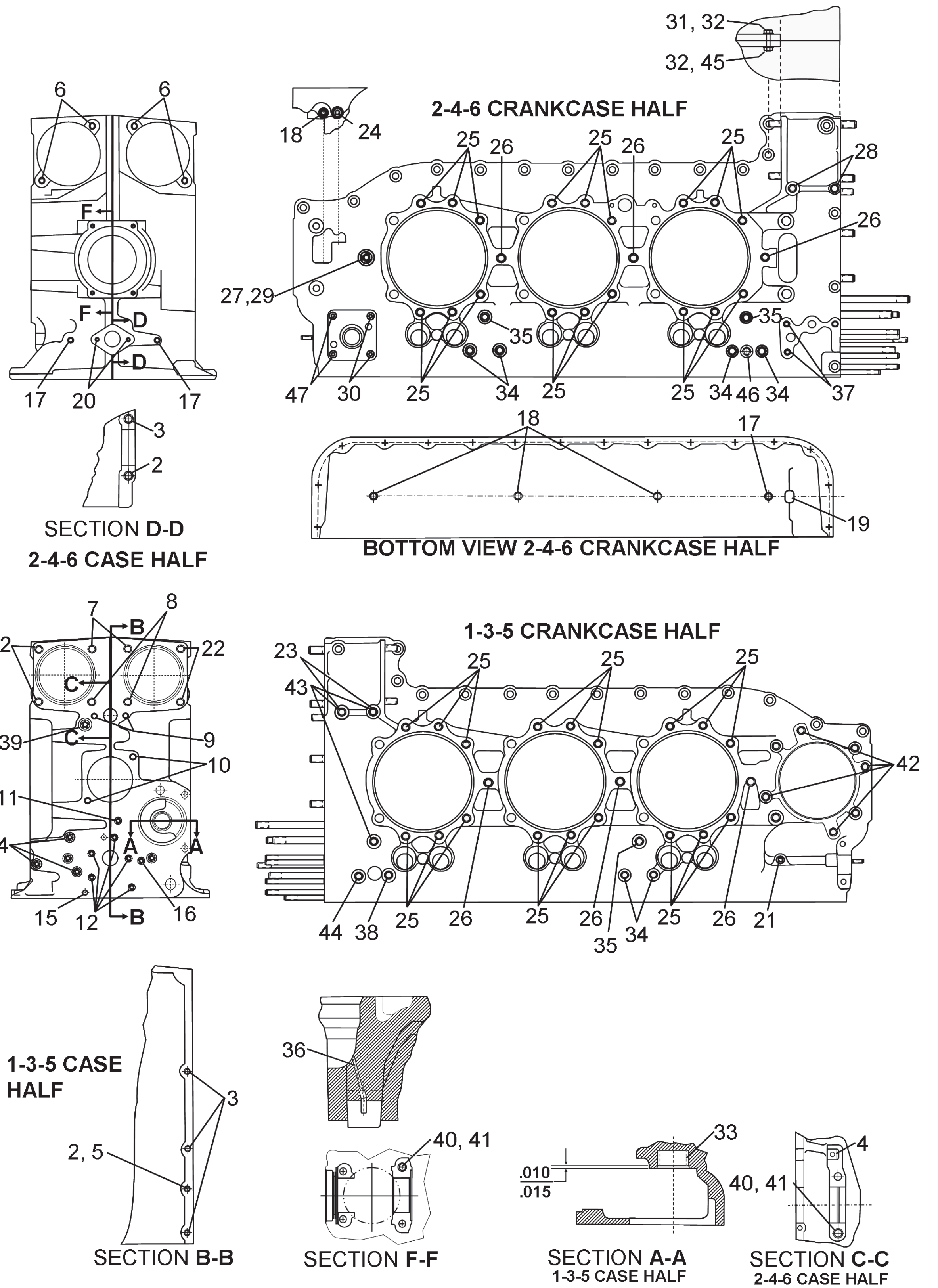


Figure D-36. 656619-15, -17 & -24 Crankcase Stud Detail

Table D-38. 656619-16 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-37	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.31	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	2
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	0.64	3
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1
46	Propeller Governor Pad	0.31 X 18-24	1.94	2

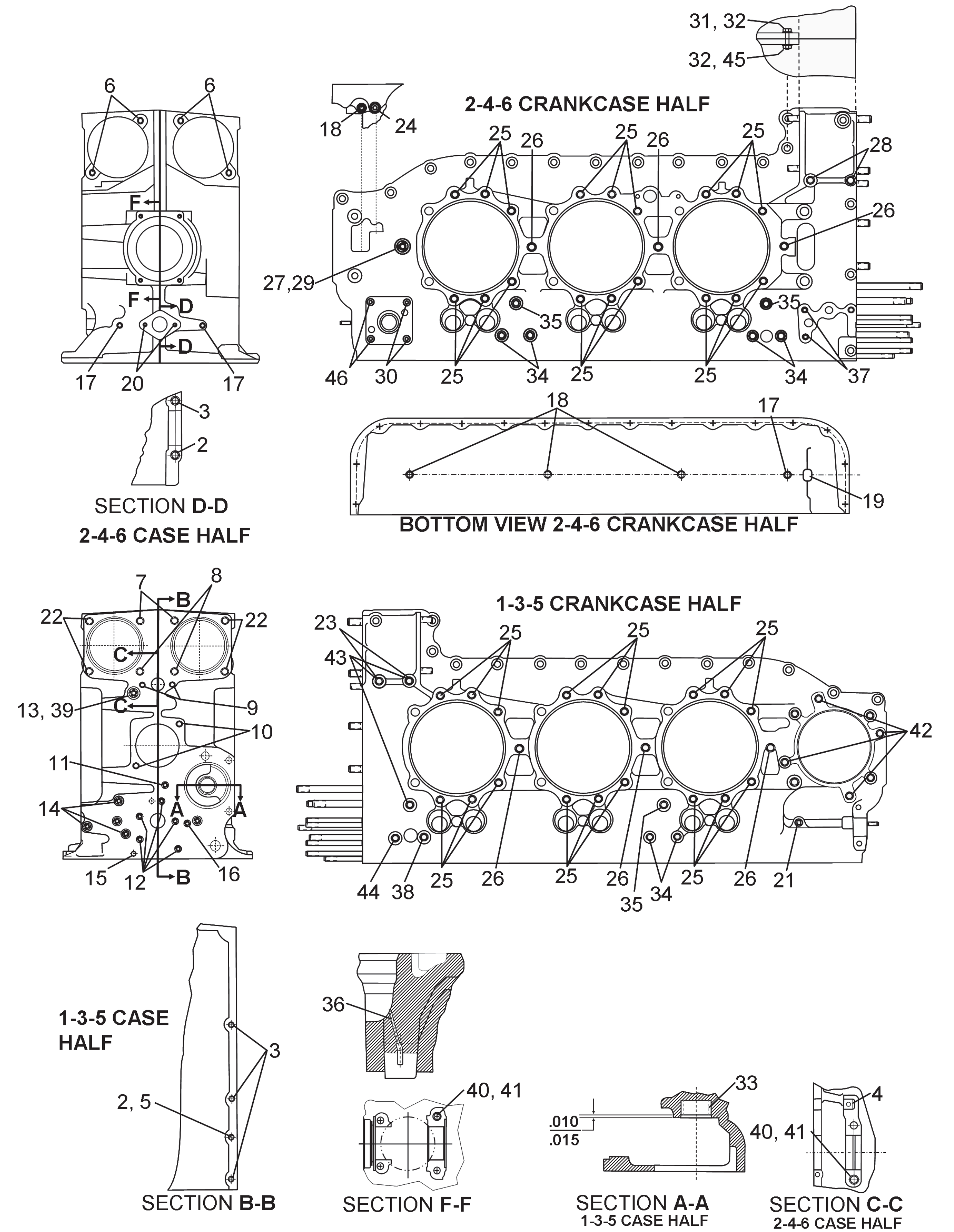


Figure D-37. 656619-16 & -18 Crankcase Stud Detail

Table D-39. 656619-17 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-36	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.27	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	2
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	0.64	3
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1
46	Plug	0.12-27	---	1
47	Propeller Governor Pad	0.31 X 18-24	1.94	2

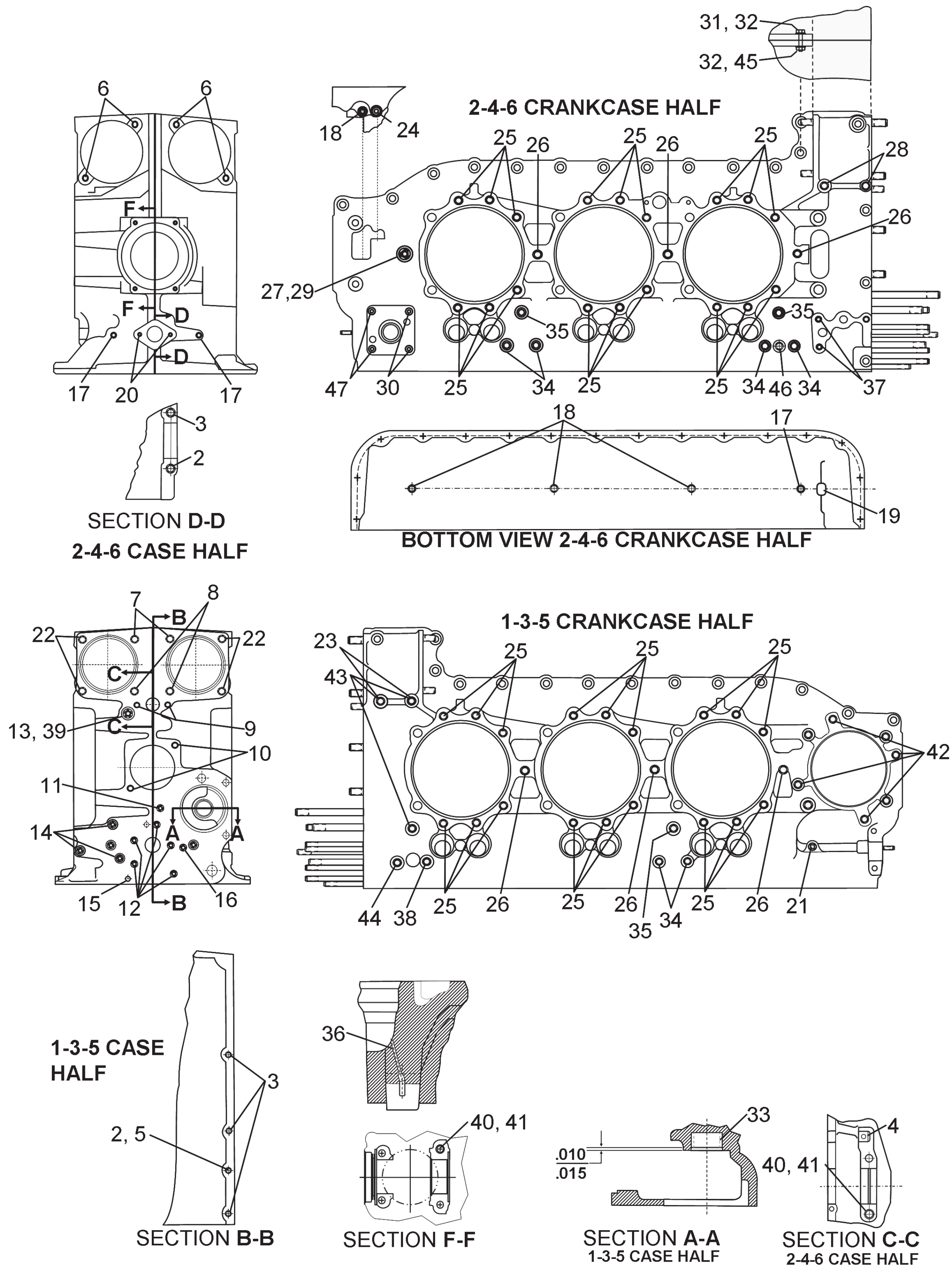


Figure D-36 repeated for reference

Table D-40. 656619-18 Crankcase Stud Heights

Index	Location	Thread Size	Setting Height	Quantity
1	Crankcase Assembly with Studs	---	Figure D-36	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	0.19 X 0.50	0.17 - 0.19	1
5	Stud, Through	0.31 X 18-24	5.41	1
6	Magneto Mount Pad	0.31 X 18-24	0.72	4
7	Accessory Pad	0.38 X 16-24	0.97	2
8	Accessory Pad	0.31 X 18-24	0.75	2
9	Idler Pin Pad	0.25 X 20-28	0.56	2
10	Fuel Pump Pad	0.31 X 18-24	1.50	2
11	Starter Adapter Pad	0.31 X 18-24	3.71	1
12	Oil Pump Pad	0.25 X 20-28	3.38	5
13	Fitting (Plug)	0.38 X18	--	1
14	Oil Pump Pad	0.38 X16-24	2.94	3
15	Oil Pump Pad	0.25 X 20-28	1.77	1
16	Oil Pump Pad	0.31 X 18-24	4.27	1
17	Plug	0.12 X 27	---	3
18	Plug	0.062 X 27	---	4
19	Plug	0.12 X 27	---	2
20	Camshaft Cover Pad	0.25 X 20-28	0.69	2
21	Plug	0.12 X 27NPTF	---	1
22	Accessory Drive	0.31 X 18-24	0.75	4
23	Helical Coil	---	Install per Appendix C	3
24	Plug	0.25 X 27	---	1
25	Cylinder Mount Pad	0.43 X 14-20	0.81	36
26	Cylinder, 7th Stud	0.43 X 14-20	0.95	6
27	Gasket	--	--	1
28	Upper Oil Cooler Mount Pad	0.38 X 16-24	0.81	2
29	Plug	0.63-18	--	1
30	Propeller Governor Pad	0.31 X 18-24	1.38	2
31	Bolt, Backbone	0.31 X 18-24	Install prior to studs (6)	10
32	Washer	0.31 I.D.	Install prior to studs (6)	2
33	Bearing	--	Section A-A	1
34	Engine Mount	0.38 X 16-24	--	0
35	Engine Mount	0.38 X 16-24	--	0
36	Squirt Nozzle	---	***Not field replaceable***	6
37	Lower Oil Cooler Mount	0.38 X 16-24	0.88	2
38	Engine Mount	0.38 X 16-24	---	0
39	Accessory Pad	0.31 X 18-24	---	0
40	Dowel	0.62 X 1.00	0.47	2
41	O-ring	--	--	8
42	Alternator Pad	0.31 X18-24	0.81	4
43	Engine Mount	0.38 X16-24	0.64	3
44	Engine Mount	0.38 X16-24	---	0
45	Nut, Backbone	0.31 X 18-24	---	1
46	Plug	0.12-27	---	1
47	Propeller Governor Pad	0.31 X 18-24	1.38	2

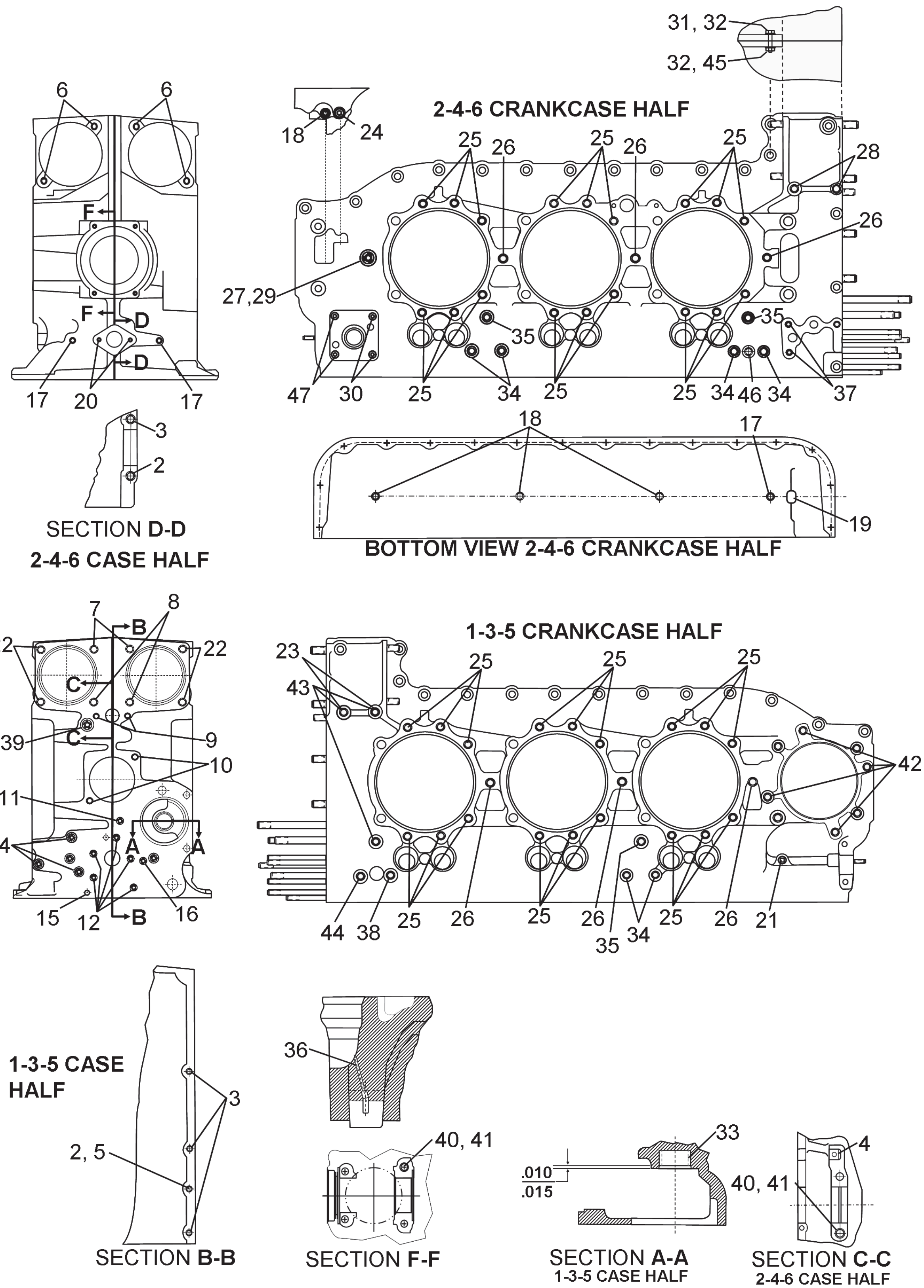


Figure D-36 repeated for reference

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