CONTINENTAL MOTORS
A Teledyne Technologies Company

# Permold Series Overhaul Manual

## MODELS I0-550-A
## B
## C
## G
## N
## P
## R



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See “Manual Revisions,” in the introduction section for distribution procedure.

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## WARNING

**If the user of this manual is uncertain whether all current revisions have been incorporated into the manual, contact Teledyne Continental Motors. Do not perform any operation, maintenance, installation or other operation until the manual is confirmed current.**

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# WARNING

**Use only parts meeting the engine type design.**

## Replacement Parts

Beware of replacement parts, materials and accessories that may be sold as aircraft quality but whose origin and quality are not known. These parts may be deceptively advertised as "unused," "like new," or "remanufactured," and purchasers are often unaware that they are not eligible for use on certificated aircraft. The hazards involved in installing these types of parts on your aircraft are obvious.

## Know Your Supplier

Many original parts and components are copied and the copies are sold at discounted prices for installation on U.S. certified aircraft. An original manufacturer's part is often used as a guide to make duplicates that appear to be as good as the original, but there are many unknowns about the quality of design, materials, and workmanship. Other factors that go into quality parts are the degree of heat treating and plating, and inspections, tests, and calibrations. Unfortunately, a cheaply produced part that looked "as good as the original" is usually found out too late.

Federal Aviation Regulations FAR 43.13 and FAR 145.57 specify performance rules for replacement of parts and materials used in the maintenance and alteration of United States certificated aircraft. FAR 91.403, FAR 121.363, FAR 123.45, and FAR 135.143 (a) holds the owner/operator responsible for the continued airworthiness of the aircraft, and that includes the quality of replacement parts.

## Identifying Approved Parts

Approved serviceable replacement parts are identified by:

1. Federal Aviation Administration (FAA) Form 8130-3 Airworthiness Approval Tag. An Airworthiness Approval Tag identifies a part or group of parts that have been approved by an authorized FAA representative.
2. FAA Technical Standard Order (TSO) number and identification mark indicating that the part or appliance was manufactured in accordance with the requirements of FAR 21 Subpart O.
3. FAA Parts Manufacturer Approval (PMA) symbol with the manufacturer's name, part number, make and model of the type certified product on which the part can legally be installed stamped on the part. An FAA/PMA is issued under FAR 21.305. Make and model information may be on a tag attached to the part.
4. Shipping ticket, invoice, or other document which verifies that the part was manufactured by a facility that was holding an FAA Approved Production Inspection System Certificate issued under FAR 21 Subpart F, or by a manufacturer holding an FAA Production Certificate issued under FAR 21 Subpart G.
5. Certificate of airworthiness for export issued by governments in countries other than the United States of America under the provisions of FAR 21 Subpart N.

## It's Your Responsibility

The owner/operator is responsible for the continued airworthiness of the aircraft. In accordance with FAR, certification of materials, parts and appliances for return to service for use on aircraft is the responsibility of the person/agency who signs the approval. To insure the continued safe operation of your aircraft, you must exercise great care when inspecting, testing, and determining the acceptability of all parts and materials. A very important part of this is verifying the origin of all materials, parts, and accessories that are used on your aircraft .

## Notice to all users

This manual does not contain overhaul information for supplemental type certificated components or systems. This manual contains information on engines, components and systems designed, tested and certified by TCM in accordance with the pertinent type design data.

The following publication contains overhaul information only. All personnel involved with these functions must thoroughly read and understand the information provided; these instructions inform of the procedures necessary to overhaul an engine and they must be followed carefully.

This manual contains no warranties, either expressed or implied.

Publication Format

This publication is formatted for practical use and ease of reference. Due to the large volume of information necessary for maintenance, chapters are independently numbered. For example, chapter 1 begins on page 1; chapter 2 begins again with page 1, etc. To locate information easily, use the Publication Table of Contents and the Chapter Contents provided at each division.

## WARNING

**The Operator and Installation manual, Maintenance, manual, Overhaul manual, Service Documents and the Parts Catalog constitute the instructions for Continued Airworthiness prepared by TCM as approved by the FAA, pursuant to FAR Part 33. As required by FAR § 43.13, each person performing overhaul, maintenance, alteration or preventive maintenance on the engine or accessories must use the methods, techniques and practices prescribed in the Instructions for Continued Airworthiness. Failure to comply with the Instructions for Continued Airworthiness may result in engine malfunction, engine failure, injury or death.**

## The Mechanic

Prior to performing, maintenance, alteration, overhaul or preventive maintenance the mechanic must meet requirements of FAR 65 and must follow FAR Parts 43, 91 and 145 as applicable. Use this manual in conjunction with Teledyne Continental Motors (TCM) service documents, related publications, accessory manufacturer's instructions, FAR and FAA Advisory Circulars.

## Notes, *Cautions* and Warnings…

**NOTE...**
Special interest information which may facilitate performance of a procedure or operation of equipment.

***CAUTION...***
*Used to emphasize certain information or instructions which if disregarded may result in damage to engine or accessories.*

**WARNING**

**Used to provide warning with respect to information and/or instructions which if disregarded will endanger personnel and/or severely damage the engine resulting in subsequent engine malfunction or failure.**

Notes, cautions and warnings do not impose undue restrictions. They are inserted to obtain maximum safety, efficiency and performance. Abuse, misuse or neglect of equipment can cause eventual engine malfunction or failure.

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# CHAPTER 1

# INTRODUCTION

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## 1-1 INTRODUCTION

This overhaul manual and the publications listed in section 1-5, "Related Publications," contain the information necessary to overhaul an aircraft engine when it reaches it’s manufacturer’s specified time between overhaul (TBO).

For a list of chapters contained in this manual refer to the Chapter Index on page x.

For a list of subject matter, figures and tables contained in each chapter, see the first page of each chapter. The pages, figures and tables contained in this publication are numbered consecutively.

This manual covers the I0-550-A,B,C,G,N,P and R engines.

## 1-2 SCOPE

This publication contains the information necessary to disassemble, clean, inspect, repair and replace, reassemble, adjust and test the above model engines.

## 1-3 DEFINITION OF TERMS

In this manual, front, rear, left and right refer to the engine as viewed from the accessory end. The accessory end is the rear and the propeller flange is the front of the engine. Cylinders are numbered starting from the rear, with odd numbers on the right and even numbers on the left.

## 1-4 MANUAL REVISIONS

Teledyne Continental Motors manuals are revised as necessary. Revisions to this manual will be furnished to purchasers who fill out and return the registration post card located in the front of this manual.

Page iii, "Current Status Of Pages," is updated at each revision. Remove and discard the old page iii. Insert the new page iii as a record of which revisions have been incorporated into the manual.

### WARNING

**If for any reason the user of this manual is uncertain whether all current revisions have been incorporated into the manual, contact Teledyne Continental Motors or a TCM Distributor to confirm the manual is the most current revision. Do not use the manual and do not perform any operation, maintenance or installation procedures or other operations upon the engine or accessories until the manual has been confirmed to be current.**

**This manual is current and correct to the best of Teledyne Continental Motors knowledge at the time of publication. Teledyne Continental Motors solicits and encourages users comments regarding suggested changes to this manual (a post card is provided at the front of the manual for this purpose.) Routine recommended changes or questions should be sent to:**

**Teledyne Continental Motors**
**P.O. Box 90**
**Mobile, Alabama 36601**
**ATTN: Technical Publications Department**

**If the user observes incorrect information or mistakes in this publication that may affect safety in any manner, immediately call the Technical Publications Department of Teledyne Continental Motors at (334) 438-3411, or contact a Teledyne Continental Motors Distributor or the Federal Aviation Administration .**

## 1-5 RELATED PUBLICATIONS

The following is a listing of related manuals:

1. Maintenance Manual for I0-550-A,B,C,G,N,P and R, Form X30634A.
2. Illustrated Parts Catalog for I0-550-A,B,C,G,N,P and R Aircraft Engine, Form X30569A.
3. Operator and Installation Manual, Form X30565.
4. Teledyne Continental Motors Aircraft Engine Service Documents (including service bulletins).
5. Fuel Injection Manual, Form X30593A.
6. Starter Service Instructions, Form X30592.
7. TCM Ignition Systems Master Service Manual, Form X40000
8. Alternator Service Instructions, Form No. X30531-3.
9. Equipment Kit Catalog, Form X30687A.

The above publications can be ordered through your Teledyne Continental Motors Distributor or ordered directly, if prepaid, from:

Teledyne Continental Motors
P. 0. Box 90
Mobile, Alabama 36601
ATTN: Publication Sales Department
Telephone: (334) 438-3411

For price information on the above publications request TCM Publications Pricing Index of Current Publications and Optional Publications.

10. Slick Ignition Systems Master Service Manual Index and Order Form No. F-1100. Order through:

    Slick Aircraft Products, Unison Industries
    530 Blackhawk Park Avenue
    Rockford, Illinois 61104
    ATTN: Subscription Department
    Telephone: (815) 965-4700

11. American Society for Testing and Materials (ASTM). Order through:

    ASTM 1916 Race Street, Philadelphia, PA.
    19103-1187 USA
    Ph: (215) 299-5400

## 1-6 SERVICE DOCUMENTS

Teledyne Continental Motors service documents are divided into six categories: (1) Mandatory Service Bulletin, (2) Critical Service Bulletin, (3) Service Bulletin, (4) Service Information Directive (5) Service Information Letter and (6) Special Service Notice (SSN). See Section 1-5, "Related Publications," for service document ordering information.

### SERVICE DOCUMENT CATEGORY DEFINITIONS

**CATEGORY 1: "MANDATORY SERVICE BULLETIN" (MSB)-** Service documents relating to known or suspected hazards to safety that have been incorporated in whole or in part in an Airworthiness Directive (AD) issued by the FAA or have been issued, at the direction of FAA, by the manufacturer in order to require compliance with an already issued AD (or an equivalent issued by another country's airworthiness authority).

**CATEGORY 2: "CRITICAL SERVICE BULLETIN" (CSB)-** Service documents (not included in Category 1) that have been determined by the product manufacturer to constitute a threat to continued safe operation of an aircraft or to persons or property on the ground unless some specific action (inspection, repair, replacement, etc..) is taken by the product owner or operator. Documents in this category may be incorporated in an Airworthiness Directive issued by the FAA.

**CATEGORY 3: "SERVICE BULLETIN" (SB)-** Service documents (not included in Categories 1 and 2) considered by the product manufacturer to constitute a substantial improvement to the inherent safety of an aircraft or component of an aircraft. This "Service Bulletin" category also includes updates of instructions for continued airworthiness.

**CATEGORY 4: "SERVICE INFORMATION DIRECTIVE" (SID)-** Service documents (not included in Categories 1, 2 or 3) that have been determined by the manufacturer to be of value to an owner/operator in the use of a product by enhancing safety, maintenance or economy.

**CATEGORY 5: "SERVICE INFORMATION LETTER" (SIL)-** This category includes all information (not included in Categories 1 through 4) that may be of use to the owner/operator or maintainer of the aircraft.

**CATEGORY 6 “SPECIAL SERVICE NOTICE” (SSN)-**TCM may issue a Special Service Notice when a product condition can be rectified by direct contact with each customer to whom the product was delivered. Special service notices will be upgraded to Service Bulletins if confirmation of compliance with the Special Service Notice cannot be verified by TCM.

## 1-7 SERVICE REPORTS AND INQUIRIES

If for any reason you have an inquiry or require technical assistance, contact your local TCM distributor or TCM field representative. Requests for copies of Teledyne Continental Aircraft Engine service publications should be made through your distributor or Teledyne Continental Motors, P. 0. Box 90, Mobile, AL 36601, ATTN: Publications Sales Department.

## 1-8 ENGINE DESIGN FEATURES

For a complete description of the engine, systems, components and maintenance of the engine prior to engine overhaul see the I0-550 Permold Series Maintenance Manual, Form X30634A.

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# CHAPTER 2

# TOOLS AND EQUIPMENT

## 2-1 GENERAL INFORMATION

The mechanic should be equipped with a complete set of the necessary tools that include the following:

1. Wrenches - 1/4” through 1 1/4"
2. Common and Philips Head Screwdrivers
3. Pliers - Common, Diagonal Cutters, Needle Nose, Duck Bill, Snap Ring , Safety Wire
4. Ratchets 1/4", 3/8", 1/2" Drive
5. Sockets - 1/4”' Drive 5/32" through 1/2",- 3/8" Drive 3/8" through 1" - 1/2" Drive 7/16" through 1-1/ 4"
6. Sockets (Deepwell) -1/2" Drive, 7/6" through 1"
7. Feeler Gauges
8. Leather or Soft Plastic Mallet
9. Torque Wrenches* 0-500 In. Lbs. and 0-100 Ft. Lbs.
10. Micrometers*
11. Slide Hammer
12. Pullers
13. Thickness Gauges
14. Vernier Calipers*
15. Small Hole Gauges

* Must be currently calibrated, and the calibration must be traceable to the National Bureau of Standards.

## 2-2 POSSIBLE SPECIAL TOOL PROCUREMENT SOURCES

**—NOTICE—**

All tools in the "Special Tool" list are for reference only, and not for the purpose of promoting or suggesting tools to be purchased from the indicated sources. The following information is given as an aid for special tool procurement purposes.

| COMPANY | GENERAL PRODUCT SUMMARY |
|---|---|
| ALCOR<br>Box 32516 10130 Jones Maltsberger Rd.<br>San Antonio, TX 78284 Ph.512/349-3771 | Instruments for Light Powered Aircraft<br>Special Tools |
| KENT- MOORE<br>29784 Little Mack<br>Roseville, MI 48066-2298 Ph. 800/253-0138 | Precision Instruments<br>Measuring Instruments<br>Precision Tools, Special Tools |
| CHAMPION SPARK PLUG, CO.<br>Box 910, 900 Upton Ave.<br>Toledo, OH 43661 Ph. 419/535-2461 | Spark Plugs, Ignitors, Oil Filters<br>Special Tools |
| EASTERN ELECTRONICS, INC.<br>180 Roberts St.<br>East Hartford, CT 06108 Ph. 203/528-9821 | Fuel Pressure Test Equipment<br>Measuring Instruments<br>Precision Tools<br>Piston Position Indicators |
| FEDERAL TOOL SUPPLY CO., INC.<br>1144 Eddy St.<br>Providence, Rhode Island 02940 Ph. 800/343-2050 | Precision Inspection Instruments<br>Special Tools |
| AIRCRAFT TOOL SUPPLY<br>P.O. Box 4525, 2840 Breard St.<br>Monroe, LA 71201 Ph. 507/451 -5310 | Precision Tools<br>Special Tools |
| McMASTER-CARR SUPPLY CO.<br>P.O. Box 4355<br>Chicago, Illinois 60680 Ph. 312/833-0300 | Precision Tools<br>Special Tools |
| SNAP ON TOOLS<br>2611 Commerce Blvd.<br>Birmingham, Alabama 35210 Ph. 205/956-1722 | Precision Tools<br>Special Tools |
| KELL-STROM TOOL COMPANY, INC.<br>214 Church St.<br>Wethersfield, CT 06109 Ph: 860-529-6851 | Ignition Test Equipment |
| FAX CORPORATION<br>210 South King St.<br>Danbury, Connecticut 06813 Ph. 203/748-6117 | Ultrasonic Test Equipment |
| MERRIT PRODUCTS<br>201 W. Mansville<br>Compton, California 90224 Ph. 310/639-4242 | Special Tools |
| AERO TEST, INC.©<br>29300 Goddard Road<br>Romulus, Michigan 48174 Ph. 734/9465547 | Model 20 ATM-C Porta-Test Unit |
| PARKER RESEARCH CORPORATION<br>P.O. Box 1406 Dunedin Fla.<br>34697 Ph. 1-800-525-3935 Fax. 813-797-3941 | Model DA-200 Contour Probe |

## 2-3 SPECIAL TOOLS

Specific tools listed or equivalent tools marketed by other manufacturers are necessary for overhaul and maintenance of the aircraft engine.

| ITEM NO. | TOOL | SEE SECTION |
|---|---|---|
| | **GENERAL ENGINE RECIPROCATING** | |
| 1. | 646953 Master Orifice Tool for cylinder compression test available from Kent - | |
| | Moore. | 6-1 |
| 2. | 7251 Differential Pressure Cylinder Checker available from Kent - Moore. | 6-1 |
| | **IGNITION SYSTEM** | |
| 3. | Borrough's 3608A Protractor/Timing Indicator Disc or equivalent for setting | |
| | engine timing. | 18-18 |
| 4. | Model E25 Timing Indicator available from Eastern Electronics, Inc. | 18-18 |
| 5. | 11-9110-1 Magneto Timing Light available from KELL-STROM Tool Company | 18-18 |
| | Inc. | 9-1A through |
| 6. | **FUEL INJECTION** | 9-1D |
| | Borrough's 8165 Injector Nozzle Remover and Installer or equivalent. | |
| 7. | **CHARGING SYSTEM** | |
| | Borrough's 7726 Tork Band Tension Adjuster or equivalent for Gen./Alt. Belt | 18-9 |
| 8. | Tensioning. | 18-9 |
| 9. | BT-33-73F Belt Tension Gauge available from Kent - Moore. | 18-9 |
| 10. | Borrough's 4973 Generator Drive Holders or equivalent. | 18-9 |
| 11. | Borrough's 61-5 Pulley Puller or equivalent for gen./alt. sheave removal | 12-4 |
| 12. | Borrough's 8091 GEN./ALT. Output Tester or equivalent. | |
| | 647 Alternator Analyzer Voltage Regulator Tester available from Eastern | 12-4 |
| 13. | Electronics, Inc. | 12-4 |
| 14. | E100 Alternator/Regulator/Battery Tester available from Eastern Electronics, Inc. | 12-4 |
| | Model 29 Voltage & Circuit Tester available from Eastern Electronics, Inc. | |
| 15. | **STARTING SYSTEM** | 13-2B |
| 16. | Borrough's 8093C Bearing Puller or equivalent for needle bearing removal. | 13-6 |
| | TCM Needle Bearing Installer or equivalent (see 13-6 for specifications) | |
| 17. | **LUBRICATION SYSTEM** | 14-5 |
| | 8048 Oil Pressure Relief Spot Facer available from Kent - Moore. | |
| 18. | **CYLINDERS** | 15-1A, 15-1B |
| 19. | 68-3 Push Rod Spring Compressor available from Kent - Moore. | 15-1A, 15-1B |
| 20. | 5203, 5204 &8158A Cylinder Base Nut Wrenches available from Kent - Moore. | 15-1A, 15-1B |
| 21. | Borrough's 8079 Cylinder Base Nut Wrenches or equivalent. | 15-1A, 15-1B |
| 22. | 3882, 3882-2 Cylinder Base Nut Wrenches available from Kent - Moore. | 18-4 |
| 23. | 3601 Ring Compressor for cylinder installation available from Kent - Moore. | 15-1A, 15-1B |
| 24. | 8121 Piston Pin Removers available from Kent - Moore. | 15-2 |
| 25. | 3602 Valve Spring Compressor available from Kent - Moore. | 15-5 |
| 26. | 545-116 Dial Bore Gauges available from Federal Tool Supply Co., Inc. | 15-6 |
| 27. | CFL10 Cylinder Hone available from Snap On Tools. | |
| | No. 1675 Valve Seat Grinder Set "Sioux Brand" available from Aircraft Tool | |
| 28. | Supply. | |
| 29. | AEX 437 Valve Seat Grinder Pilot .437 Dia. available from Aircraft Tool Supply. | |
| | K106 Intake Valve Seat Grinding Stone (Roughening 45°) available from Aircraft | |
| 30. | Tool Supply. | |
| | K46 Intake Valve Seat Grinding Stone (Finishing 45°) available from Aircraft Tool | |
| 31. | Supply. | |
| | K95 Exhaust Valve Seat Grinding Stone (Roughening 45°) available from Aircraft | |
| 32. | Tool Supply. | 15-6 |
| | K25 Exhaust Valve Seat Grinding Stone (Finishing 45°) available from Aircraft | |
| | Tool Supply. | |

**NOTE…**

See possible sources on page 2-3 for tool procurement.

| ITEM NO | TOOL | SEE SECTION |
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| 33. | Borrough's 5221A Holding Fixture Adapters or equivalent. | 15-6 |
| 34. | Borrough's 5221 13A Cylinder Holding Fixture or equivalent. | |
| 35. | Borrough's 8156 Cylinder Heating Stand or equivalent. | |
| 36. | Borrough's 8086 Valve Seat Insert Remover & Replacer or equivalent. | |
| 37. | Borrough's 4910 Installer Valve Seat Insert or equivalent. | |
| 38. | Borrough's 4956 Installer Valve Seat Insert or equivalent. | |
| 39. | Borrough's 8116 Common Parts Kit or equivalent. | |
| 40. | Borrough's 8116-1 B through 15B Boring Bars or equivalent. | |
| 41. | Borrough's 8116-1 R through 15R Reamers or equivalent. | |
| 42. | Borrough's 8116-1 through 16 Expanding Guide Bodies or equivalent. | |
| 43. | 4909 Valve Seat (Straight Side) Insert Cutters available from Kent - Moore.<br>4954 Valve Seat (Straight Side) Insert Cutters available from Kent - Moore.<br>4985 Valve Seat (Straight Side) Insert Cutters available from Kent - Moore.<br>5224 Valve Seat (Straight Side) Insert Cutters available from Kent - Moore.<br>5225 Valve Seat (Straight Side) Insert Cutters available from Kent - Moore. | |
| 44. | 8135 Valve Seat (Step Side) Insert Cutters available from Kent - Moore.<br>8136 Valve Seat (Step Side) Insert Cutters available from Kent - Moore.<br>8138 Valve Seat (Step Side) Insert Cutters available from Kent - Moore. | |
| 45. | Borrough's 8122A Common Drive Handle or equivalent. | |
| 46. | 122 Valve Guide Cleaner available from Kent - Moore. | |
| 47. | 4981 Valve Guide Remover available from Kent - Moore. | |
| 48. | 2842 Valve Guide Replacer available from Kent - Moore. | |
| 49. | Borrough's 3170 Floating Holder or equivalent. | |
| 50. | 4981 Valve Guide Remover available from Kent - Moore. | |
| 51. | Borrough's 8116-24 through 29 Valve Stem Hole Reamers or equivalent. | |
| 52. | 2847-2CP Reamer (Carbide Tipped) available from Kent - Moore.<br>2847-1CP Reamer (Carbide Tipped) available from Kent - Moore.<br>2847-1HP Reamer (High Speed Steel) available from Kent - Moore<br>2847-2HP Reamer (High Speed Steel) available from Kent - Moore | |
| 53. | 2848-1 Plug Gauge for valve guide inspection available from Kent - Moore. | |
| 54. | 4943-1 HS through 5HS Reamers, Valve Guide Boss available from Kent - Moore. | |
| 55. | Borrough's 4918 Spark Plug Insert Replacer or equivalent. | |
| 56. | Borrough's 4919 Spark Plug Insert Remover or equivalent. | |
| 57. | Borrough's 445, 18mm Spark Plug Tap or equivalent for straightening out damaged | |
| 58. | 2769A13 Rosan® Stud Remover available from McMASTER-CARR Supply Co. | |
| 59. | Rosan® is a registered trademark of Fairchild Aerospace Fastener Division. . | |
| 60. | 8074 Rosan® Lock Ring Installer available from Kent - Moore. | |
| 61. | 8118 Rocker Arm Bushing Remover/Installer available from Kent - Moore. | |
| 62. | 7232 Reamer Rocker Arm Bushing available from Kent- Moore. | |
| 63. | DA-200 Contour Probe available from Parker Research Corporation | 15-6 |
| | **CRANKCASE** | |
| 64. | Borrough's 8114 Crankcase Through Bolt Removers or equivalent. | 16-1 |
| 65. | L423 Crankcase Splitter available from Kent - Moore. | 16-1 |
| 66. | Borrough's 505 Stud Drivers or equivalent. | 16-7 |
| | **ENGINE DRIVE TRAIN** | |
| 67. | Borrough's 8117A Runout Block Set or equivalent for crankshaft inspection. | 17-3 |
| 68. | Wheel Fax Jr. Mark IV Model O for Crankshaft Ultrasonic Testing available from Fax Corporation. **Operator must be certified by TCM standards.** | 17-3 |

## NOTE...

See possible sources on page 2-3 for tool procurement .

| ITEM NO. | TOOL | SEE SECTION |
|---|---|---|
| 69. | Borrough's 8087A Polishing Tools for Crankshaft Bearings or equivalent. | 17-4 |
| 70. | 4965A Crankshaft Blade and Damper Bushing Remover/Replacer available from Kent- Moore. | |
| 71. | Borrough's 8077A Bushing Remover & Replacer, Counterweight or equivalent. . | |
| 72. | Borrough's 8111A Connecting Rod Fixture or equivalent. | |
| 73. | Borrough's 8042C Adapter Kit or equivalent for connecting rod inspection | |
| 74. | 5008 Reamers for connecting rod bushing available from Kent - Moore | |
| 75. | D-4000 Federal Dimension Air Gauge for connecting rod bushing inspection available from Federal Tool Supply Co., Inc. | |
| 76. | 1.1268 Setting Ring for checking 1.1267 to 1.1269 tolerance available from Federal Tool Supply Co., Inc. | |
| 77. | 1.1268 Air Plug for checking 1.1267 to 1.1269 tolerance available from Federal Tool Supply Co., Inc. | |
| 78. | 5209 Propeller Shaft Oil Seal Installer available from Kent - Moore | 17-4 |
| | **OPERATIONAL INSPECTION** | |
| 79. | 85328 Alcor Portable Digital EGT Unit available from Alcor, Inc. | 19-14 |
| 80. | 85329 Alcor Portable Digital CHT available from Alcor, Inc. | 19-14 |
| 81. | Model 20 ATM-C Porta-Test Unit available from Aero Test, Inc.© | 19-16 |

**NOTE...**
See possible sources on page 2-3 for tool procurement.

**NOTE...**
The rights to manufacture Borrough's Tools has been acquired by Kent - Moore .

# CHAPTER 3

# SEALANTS AND LUBRICANTS

| Aviation Engine Oil Ashless Dispersant | |
|---|---|
| Recommended 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 |
| Manufacturer | Brand Name |
| BP Oil Corporation | BP Aero Oil |
| Castrol | Castrol Aero AD Oil |
| Castrol Limited (Australia) | Castrol Aero AD Oil |
| Chevron U.S.A., Inc. | Chevron Aero Oil |
| Continental Oil | Conco Aero S |
| Delta Petroleum Company | Delta Avoil Oil |
| Exxon Company, U.S.A. | Exxon Aviation Oil EE |
| Gulf Oil Company | Gulfpride Aviation AD |
| Mobil Oil Company | Mobil Aero Oil |
| NYCO S.A. | TURBONYCOIL 3570 |
| Pennzoil Company | Pennzoil Aircraft Engine Oil |
| Phillips Petroleum Company | Phillips 66 Aviation Oil, Type A |
| Phillips Petroleum Company | X/C Aviation Multiviscosity Oil SAE 2OW50, SAE 2OW60 |
| Quaker State Oil & Refining Company | Quaker State AD Aviation Engine Oil |
| Red Ram Limited (Canada) | Red Ram X/C Aviation Oil 2OW50 |
| Shell Australia | Aeroshell (R) W |
| Shell Canada Limited | Aeroshell Oil W, Aeroshell Oil W 15W50 Anti-Wear Formulation Aeroshell Oil W 15W50 |
| Shell Oil Company | Aeroshell Oil W, Aeroshell Oil W 15W50 Anti-Wear Formulation Aeroshell Oil W 15W15 |
| Sinclair Oil Company | Sinclair Avoil |
| Texaco Inc. | Texaco Aircraft Engine Oil - Premium AD |
| Total France | Total Aero DM 15W50 |
| Union Oil Company of California | Union Aircraft Engine Oil HD |

| **Break-in Oil** |
|---|
| MIL-C-6529 Type II Corrosion preventive mineral oil. |
| NOTE... Mineral oil conforming with 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. |

| Preservative Oil | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **MIL-C-6529 Type II** | (Aeroshell Fluid 2F or equivalent) | For Temporary storage (up to 90 days) |
| **MIL-P-46002, Grade 1 oil** | (NOX RUST VCI-105 or equivalent) May be purchased through: Rock Island Lubricant & Chemical Co. P.O. Box 5015 1320 1st Street Rock Island, Illinois 61204 Phone: 1 -800-522-1150 | For Indefinite storage |

| Lubricants | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **Molyshield Grease** | May be purchased through: American Lubricants<br>1227 Deeds<br>Dayton, Ohio **45401**<br>Phone: (513) 222 - 2851 | Needle bearings and ball bearings |
| | | Valve stems |
| | | All ACC. drive splines and couplings |
| | | Idler gear and pin |
| | | Fuel injection controls, o-rings, springs, shafts and bushings |
| | | Magneto rubber drive bushings |
| | | Oil pump and scavenge pump gear shafts, ends and teeth. Oil pump and scavenge pump housing and cover gear contact areas. |
| | | Starter worm gear drive teeth and bevel gear teeth |
| **Dow Corning® G-N Paste** [Dow Corning G-N Paste is a registered trademark of Dow Corning Corporation.] | For Distributor information call 1-800-248-2481, have state & city information available | Camshaft lobes and tappet faces |
| **Alvania (Shell #2)**<br>For Distributor information | Shell Product Information Center,<br>Phone: **1-800-231-6950** | Apply light coat at point of contact between nut seat and ferrule on ignition lead |
| **MIL-S-3545C Grease (Shell #5)** | Shell Product Information Center,<br>Phone: 1-800-231-6950 | Fuel injection linkage pivot points, Mixture shaft bushings |
| **Permatex Maintain® Lubricant** | For Distributor information call: Permatex Customer Service @ Phone: 1-800-641-7376 | Fuel injection linkage pivot points, throttle shaft bushings, lever bushings |

| Lubricants | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **646943 -** Anti Seize Lubricant or<br><br>**Loctite Anti-Seize Lubricant 76732** | May be purchased through your local TCM Distributor or For Distributor information: Loctite Customer Service @ Phone: **1-800-243-4874** | All fuel injector nozzles (at cylinder head) |
| | | Exhaust studs (nut end before torquing) |
| | | Oil temp. control valve (Vernatherm) |
| | | All .3125 and larger studs unless otherwise specified |
| | | All mechanical tach drive housing threads not through to an oil source Air reference fittings on all throttle bodies |



| Lubricants | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **Approved, Clean, 50 Weight Non-Compounded or Ashless Dispersant Oil** | See Aviation Engine Oil Ashless Dispersant Table | Cylinder stud and through bolt threads, connecting rod bolt and nut threads and engine accessory stud threads unless otherwise specified |
| **Approved Clean 50 Weight Break-In Non-Compounded Oil** | See Break-In Oil Table | Crankshaft bearings, connecting rod bearings, camshaft bearings, tachometer gears and adapters, accessory spur gear teeth, starter cone, bushing and nut, starter adapter clutch spring (ID & OD), sealing surface of valve guide seals, pistons, piston pins and piston rings, rocker arms, pivots, valves and tappets, thrust washers and o-rings, prop governor transfer collar and sleeve, oil filter adapter seals |
| **CHAMPION® - Spark Plug Thread Lubricant No. 2612** [CHAMPION® is a registered trademark of Cooper Industries.] | For Champion Products Distributor information: Phone: 803-843-5400 | Spark plugs |
| **WD-40 or Chesterton No. 4** | Chesterton Technical Product Information Phone: (508) 469-6783 | Induction system hose connections |
| **Dow Corning® No. 4** | For Distributor information call 1-800-248-2481, have state & city information available | Spin-on oil filter rubber seals Magneto adapter gaskets (both sides) Gasket, governor pad (both sides) |

| Sealants | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **LUBRIPLATE® 930 AA (P/N L0096-035)** | For Distributor information Call LUBRIPLATE® @ Phone: 1-800-733-4755 | Apply to the outside diameter of valve guides at installation |
| **TCM P/N 654514 CRC 3-36 Rust Preventative Compound** | May be purchased through your local TCM Distributor | Spray exhaust end of turbocharger for engine preservation |
| **Permatex Aviation Grade 3D** and **#641543 Silk Thread** and **#646942 Gasket Maker** or **Loctite Gasket Eliminator 515 Sealant** | For Distributor information call: Permatex Customer Service @ Phone: 1-800-641-7376<br>May be purchased through your local TCM Distributor<br>May be purchased through your local TCM Distributor<br>For Distributor information call: Loctite Customer Service @ Phone: 1-800-243-4874 | Crankcase parting face, oil pump covers, scavenge pump covers |
| **653692 - Primer** or **Loctite LocQuic Primer 7649** | May be purchased through your local TCM Distributor<br>For Distributor information: Loctite Customer Service @ Phone: 1-800-243-4874 | Crankcase crankshaft nose oil seal area |
| **#646942- Gasket Maker** or **Loctite Gasket Eliminator 515 Sealant** | May be purchased through your local TCM Distributor<br>For Distributor information: Loctite Customer Service @ Phone: 1-800-243-4874 | Engine nose seal, outside diameter of all uncoated oil seals except fuel pump adapter seal, between oil sump and oil sump gaskets |

| Sealants | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **#642188 - Gasket Sealant (TCM) 1.5 oz. tube** | May be purchased through your local TCM Distributor or **K & W Copper Coat** For Distributor information r-all: K & W Products Customer Phone: 1-800423-9446 | Cam bore cover gasket (except beaded gaskets), idler pin gasket, oil filler neck gasket, pressed in plugs, 2 bolt suction tube gasket, intake manifold gasket, all pressure type plugs (Hubbard etc.) |
| **Loctite Pipe Sealant with Teflon PS/T 592** | For Distributor information: Loctite Customer Service @ Phone: 1-800-243-4874 | Pipe threads (except fuel system fittings), pressure relief valve housing threads, stud holes that are exposed to oil (2 studs engine mount 1-3-5 side bottom) |

| Sealants | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **#646940 - F/I Sealant**<br><br>or<br><br>**Loctite Hydraulic Sealant 569** | May be purchased through your local TCM Distributor<br><br>For Distributor information: Loctite Customer Service, Phone: 1-800-243-4874 | All pipe thread fittings in fuel injection system (use sparingly on male threads only.) Apply in accordance with Figure 9-9. |
| **Miller Stephenson MS 122/CO2 Spray** | For Distributor information: Miller-Stephenson Customer Service, Phone: 1-800-992-2424 | Ignition harness terminals at magneto block end |

| Adhesives | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **646941 High Strength Adhesive Sealant or Loctite 271**<br><br>**653696 Primer or Loctite LocQuic Primer 7471** | May be purchased through your local TCM Distributor<br><br>For Distributor information: Loctite Customer Service, Phone: **1-800-243-4874** | Cylinder deck studs, squirt nozzles, fuel manifold valve diaphragm and plunger assembly, crankshaft nose seal retainer bolts |
| **649306 Sealant (optional 646940) or Loctite Adhesive Sealant 222 (optional Loctite Hydraulic Sealant 569)** | May be purchased through your local TCM<br><br>For Distributor information: Loctite Customer Service, Phone: 1-800-243-4874 | Through stud holes on accessory end of crankcase, manifold valve to bracket screws, studs .25 diameter and smaller |
| **3M Brand EC1252 White Spot Putty** | 3M | Cylinder deck stud nuts, through bolt nuts, magneto flanges, throttle body and fuel metering unit. All fuel pump, manifold valve, throttle and control fittings |

| Miscellaneous | | |
|---|---|---|
| **TYPE** | **SUGGESTED SOURCES** | **APPLICATION** |
| **TCM P/N 626531-1**<br>Enamel - Gold (1 qt)<br>**TCM P/N 626531-2**<br>Enamel - Gold (1 gal) | May be purchased through<br>your local TCM Distributor | High temp. paint for cosmetic and<br>corrosion protection |
| **TCM P/N 535011**<br>Lockwire -.032 inch dia. Steel, Corrosion Resistant | May be purchased through<br>your local TCM Distributor | Where applicable for lockwiring |
| **"ACCELAGOLD"**<br>Turco® Products<br>Tucker, GA 30084<br>[Accelagold is manufactured by Turco® Products, Inc.] | For sales and service: Elf Atochem<br>N.A. Turco® Products Div. P.O. Box<br>195 State Route 95 West Marion, Ohio, 43302,<br>215-419-5376 | Corrosion protection interior and<br>exterior aluminum parts |
| **ENGINE PRESERVATION KIT**<br>• dehydrator plugs<br>• desiccant bags<br>• streamers, warning sign<br>• preservative oils | May be purchased through:<br>***TANAIR***<br>P.O. BOX 117<br>Glenwood, MN 56334<br>(US & CAN) 1-800-4432136<br>(MN) 1-800-862-2443 | Engine Preservation |

# CHAPTER 4

# AIRWORTHINESS LIMITATIONS

This Airworthiness Limitations section has been FAA approved and specifies maintenance required under §§ 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved. Federal Aviation Regulations §§ 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 and the engine was type certificated based upon required owner/operator compliance with the limitations.

1. Mandatory Replacement Times.

   Subject to additional information contained in FAA Airworthiness Directives (AD) 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.

2. Mandatory Inspection Intervals.

   Subject to additional information contained in FAA Airworthiness Directives (AD) issued after the date of certification, the engine does not require specific intervals of inspection pursuant to type certification.

3. Other Related Procedures

   Subject to additional information contained in the Airworthiness Directives (AD) issued after the date of certification, there are no other related procedures required pursuant to the type certification for this engine.

4. Distribution of Changes to Airworthiness Limitations.

   Changes to the Airworthiness Limitations section constitute changes to the type design of this engine and require FAA approval. Such changes will be published in FAA Airworthiness Directives (AD).

**NOTE**

The limitations in this section apply only to specific limitations which are part of the engine design. Under the Federal Aviation Regulations numerous other additional limitations are applicable to this engine and it's accessories. For example Federal Aviation Regulation Parts 91 and 43, among other parts, define inspection criteria, maintenance requirements and procedures that are applicable to this engine. It is the responsibility of the owner / operator to maintain the engine in an airworthy condition by complying with all applicable Federal Aviation Regulations and by performing maintenance in accordance with TCM Instructions for Continued Airworthiness, which consist of TCM publications and service documents.

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# CHAPTER 5

# STANDARD PRACTICES

SECTION PAGE



FIGURE PAGE

## 5-1 GENERAL

To facilitate and insure proper reinstallation, tag or mark all parts and hardware as they are removed or disassembled.

Tag any unserviceable parts or units for investigation and possible repair. Take extreme care to prevent lockwire, nuts, washers, dirt, etc., from entering the engine on or off the aircraft. Make use of protective caps, plugs and covers to insure openings are unexposed.

*CAUTION…Dust caps used to protect open lines must be installed OVER the tube ends and NOT IN the tube ends. Flow through the lines will be blocked if lines are inadvertently installed with the dust caps in the tube ends.*

If anything is dropped into the engine work must be stopped immediately and the item removed.

Insure all parts are thoroughly clean and lubricated as specified before assembling.

All lockwire and 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 down flat against the nut in accordance with Section 5-4. Use only manufacturer specified corrosion resistant steel cotter pins. All lockwire utilized on TCM engines must conform to MS20995 Condition A.

When replacing gaskets, packings, or rubber parts use the type or composition specified by the manufacturer.

Make sure replacement nonmetallic and metallic parts show no sign of storage deterioration. Parts exceeding specified shelf life limitations must not be used.

When a hammer is required to come in direct contact with an engine part during assembly or disassembly, use a mallet made of plastic or rawhide material only.

Parts removed from the engine must be cleaned and inspected in accordance with the specified instructions located in the applicable system chapter.

## 5-2 LOCKWIRE PROCEDURE

Lockwiring is the securing together of two or more parts with lockwire installed in such a manner that any tendency for a part to loosen will be counteracted by additional tightening of the lockwire.

All lockwire utilized on TCM engines must conform to MS20995 Condition A. Most bolts utilized in TCM engines that require lockwiring will use .032 lockwire and require twisting at a rate of 7 to 10 twists per inch. Smaller lockwire (when specified or required) will require twisting at a rate of 9 to 12 twists per inch. Lockwire must be new at each application.

Lockwire must be pulled taut while being twisted and caution must be exercised during the twisting operation to keep the lockwire tight without overstressing. See Figure 5-1, "General Lockwire Procedure," for steps in applying lockwire.

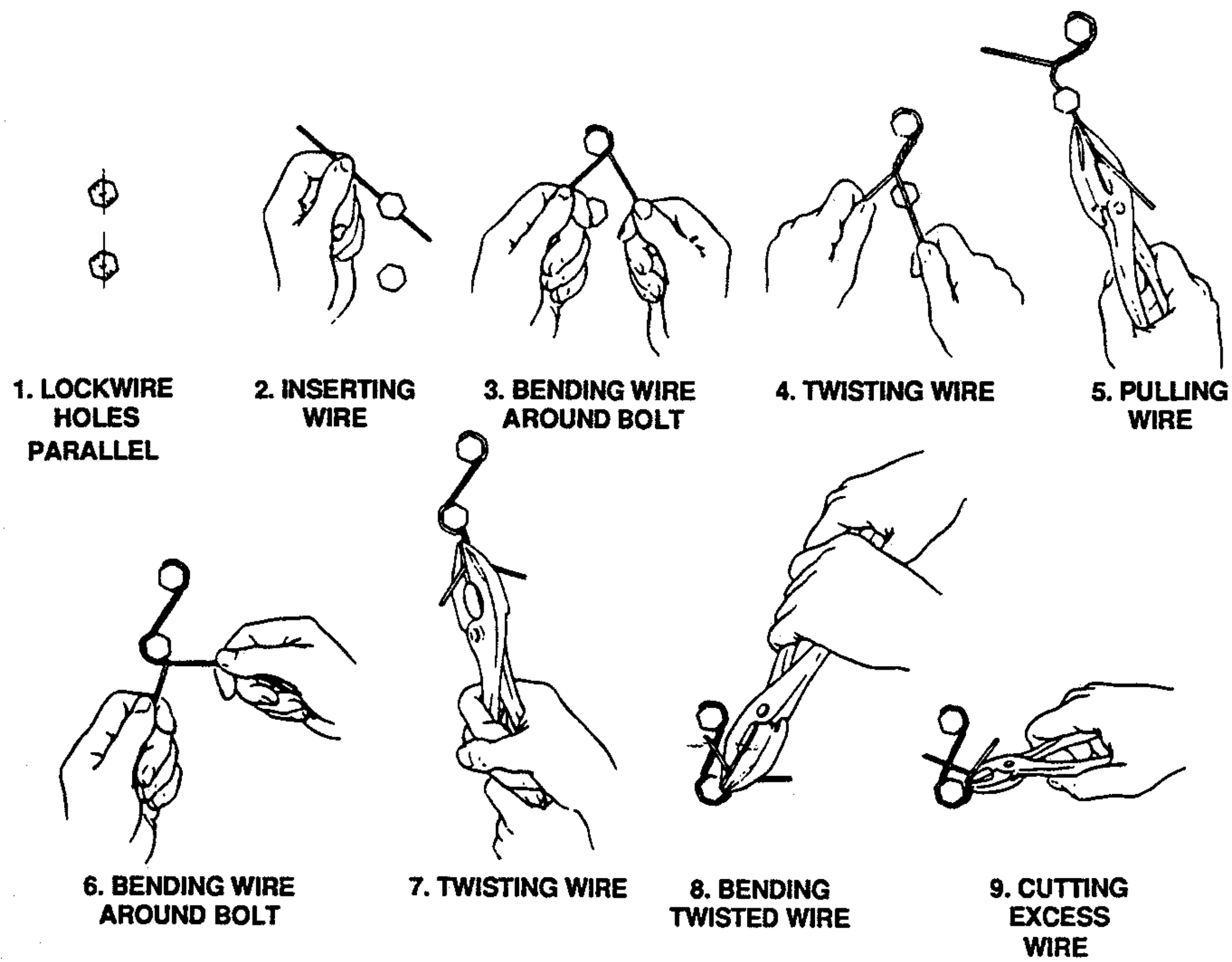


**FIGURE 5-1. GENERAL LOCKWIRE PROCEDURE**

Various examples of lockwiring are shown in Figure 5-2, "General Lockwire Patterns."

1. Check the units to be lockwired to insure they have been correctly torqued. Applying torque that is above or below specified limits to obtain alignment of the holes is not permitted.

2. It is desirable to have the holes parallel, but this is not a necessity. For right hand threads, the lockwire shall be installed in such a manner that the strand through the hole will have a tendency to pull the unit clockwise.

3. Insert half of the required length of lockwire through the first unit and bend around the head of the unit. The direction of wraps and twist of strands shall be such that the loop around the unit comes under the strand protruding from the hole so that the loop will stay down and will not tend to slip up and leave a slack loop.

4. Twist the strands while taut 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.

5. Insert the uppermost strand through the hole in the second unit and follow the rules in Paragraph three.

6. After lockwiring the last unit continue twisting the lockwire to form a pigtail, providing sufficient twists (four minimum) to assure that the pigtail will not unravel. Cut off the excess lockwire and bend the pigtail toward the part and against the bolt head flats. DO NOT ALLOW THE PIGTAIL TO EXTEND ABOVE THE BOLT HEAD.

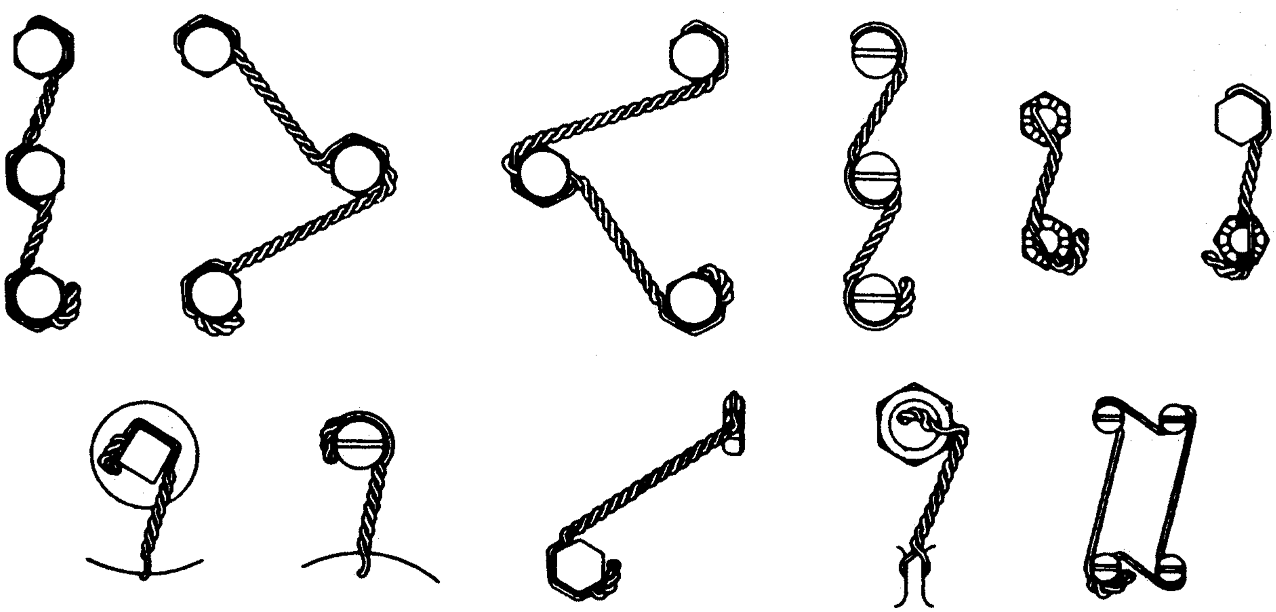

**FIGURE 5-2. GENERAL LOCKWIRE PATTERNS**

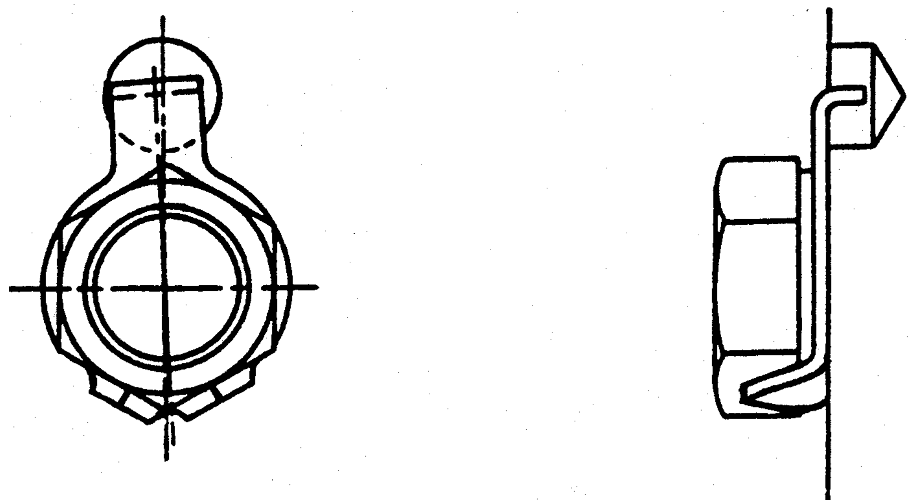

**FIGURE 5-3 GENERAL TAB WASHER INSTALLATION PROCEDURE**

## 5-3 TAB WASHER PROCEDURE

Tab washers are installed by fitting a tab in a tab slot and bending the remaining tabs firmly against the bolt or nut flat. Tab washers are used in various locations in TCM engines and must not be re-used after removal.

Tabs that are provided to be bent up against the head flats must be seated firmly with no scarring of the tabs. This provides proper locking of the unit and prevents tabs from breaking off.

1. Make certain the holding tab is located in the tab hole or slot.
2. Check the units to be secured and verify they have been correctly torqued in accordance with the specified instructions of the applicable system section.
3. Bend tabs against the head flats firmly by tapping them into place with a soft drift. See Figure 5-3, "General Tab Washer Installation Procedure."

## 5-4 COTTER PIN PROCEDURE

Cotter pins are installed by inserting the cotter pin through a hole in one part, slots in the other part and spreading the exposed ends.

Cotter pins are not reusable and must be replaced with a new cotter pin after removal.

1. Torque the nut to the lower limit of the torque specification. If the slots in the nut do not line up with one of the holes in the bolt continue torquing until one does. Do not exceed the upper limit of the torque specification. Change the nut if necessary.
2. Insert the cotter pin with the head seated firmly in the slot of the nut. Bend the ends over the flat on the nut and the end of the bolt. Trim the prong lengths as necessary.
3. Seat the prongs firmly against the bolt and nut. See Figure 5-4, "General Cotter Pin Installation."

*CAUTION…Do not use side-cutting type pliers to bend the ends over since the resulting nick could weaken the pin and allow a portion to become detached.*

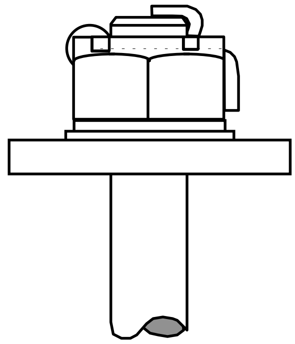

**FIGURE 5-4. GENERAL COTTER PIN INSTALLATION**

## 5-5 APPLICATION OF ADHESIVES

Adhesives and sealants will be used only in specific applications outlined in Chapter 3, "Table Of Sealants and Lubricants."

### WARNING

**The improper use of sealants and lubricants will cause engine malfunction or failure.**

Gasket Maker P/N 646942 - Surfaces must be clean and free of nicks, burrs, oil and grit. Apply a thin translucent coat of Gasket Maker not to exceed .010 inch thick to the surface specified in Chapter 3, "Table Of Sealants and Lubricants."

Gasket Maker is an easily workable tacky gel which can be extruded onto one side of a flange surface from a tube and evenly spread. Small parts can be covered adequately by pressing them into a saturated polyester urethane sponge or by roll coating them with a short nap roller. Once Gasket Maker has been applied evenly torque assembly into place. Excess material can be cleaned by wiping with chlorinated solvent. Material on hands can be cleaned with waterless mechanics hand soap followed by soap and water.

NOTE…TCM general purpose primer P/N 653160 must be used for surface preparation before applying Gasket Maker at the engine nose seal area.

## 5-6 INSTALLATION OF GASKETS

All gaskets must be new, of the proper material and visually inspected prior to installation.

Following visual inspection, if the gasket shows any indication of gouges, nicks, cuts or bend and fatigue marks replace with a new manufacturer specified gasket.

Gasket surfaces must be clean and free of nicks, burrs, oil and grit. Apply a thin coat of TCM Gasket Sealant P/N #642188-1 to both sides of gasket unless otherwise specified. See Chapter 3, "Table Of Sealants and Lubricants," for application of gasket sealant. Once TCM Gasket Sealant has been applied install gasket. Install assembly and evenly torque hardware to specified value. This will prevent over stressing gasket.

### WARNING

**Gaskets and components must be properly positioned, hardware torqued and safetied as required during assembly to prevent oil loss.**

## 5-7 HOSE AND TUBING INSTALLATION

It is required that the following procedure be used when hoses and tubing are removed, attached and torqued to fittings contained on components such as fuel, induction, lubrication and turbocharger systems.

## WARNING

**Failure to properly support component fittings can result in fitting and/or component damage and a resulting loss of system pressure.**

1. See Figures 4-5 and 4-6.
2. Select the proper size open end wrenches that will fit the fitting body and hose or tubing end fitting.
3. Torque or loosen (as required) the hose or tubing end fitting while maintaining sufficient force on the component fitting to prevent twisting and shear loads.
4. Components that contain multiple fittings coupled in one location must have the last fitting in the assembly properly supported as indicated in the preceding paragraphs.
5. DO NOT over torque fittings. Consult the appropriate manufacturer's manual for specific installation procedures and torque values.

Figure 4-5

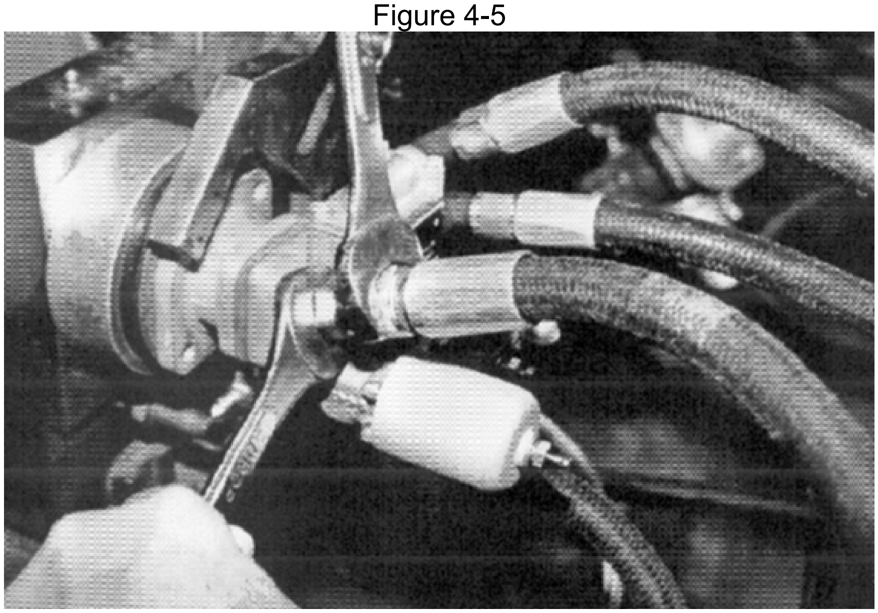

Figure 4-6

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# CHAPTER 6

# ENGINE OVERHAUL

## 6-1 GENERAL

**WARNING**

**Use only parts meeting the engine type design.**

Prior to engine removal, using a differential pressure gauge perform the following leak check on each cylinder. Record findings.

**LEAK CHECK**

This check serves as an identifier for conditions which may not be detectable by visual inspection.

1. Position the piston as close to bottom dead center on the compression stroke as possible, insuring that the intake valve remains closed to allow the cylinder to hold pressure.
2. With the compression tester connected, apply 5 PSI to the cylinder.

**WARNING**

**It will be necessary to hold the propeller stationary while pressure is applied to the cylinder. Use extreme caution to prevent injury to personnel or damage to equipment.**

**WARNING**

**During pressurization of cylinders do not stand or allow anyone else to stand in the propeller arc area.**

3. Increase the pressure slowly to a maximum value of 80 PSI. Saturate the entire cylinder assembly with a soap and water solution.
4. Inspect the complete cylinder for leakage. Leakage will be indicated by an accumulation of bubbles.
5. After complete cylinder inspection, relieve cylinder pressure and remove compression tester.
6. Perform this inspection on each cylinder.

Optional airframe manufacturer accessories and various engine components that obstruct engine removal must be removed from the engine and airframe. For airframe manufacturer supplied accessory removal and airframe to engine disconnection consult the appropriate airframe manufacturer's instructions.

Chapters 7 through 17 contain overhaul information for each of the engine systems. Chapter 18 contains final engine assembly procedures. Chapter 19 contains post overhaul adjustment and test procedures.

As the aircraft engine is being overhauled all engine parts and accessories must be overhauled. All engine parts and accessories must conform with the engine and accessory manufacturer's specifications after overhaul prior to re-installation on the engine. See the accessory manufacturer's overhaul instructions for accessories supplied by manufacturers other than Teledyne Continental Motors .

During Major Overhaul of Teledyne Continental Motors aircraft engines, all parts and components must conform with the manufacturer's new specifications or be replaced. See Section 6-16, "New Parts," for further information.

## 6-2 Engine Removal Instructions

As each part is disconnected and removed it must be identified. Photographs can be helpful for orientation of parts and components during engine re-assembly.

NOTE…If the engine is being removed to be placed in storage, prior to engine removal, accomplish the steps listed in the chapter on "Indefinite Storage," of the appropriate Maintenance Manual.

1. Insure all electrical switches, circuit breakers, ignition switches and fuel selector valves are in the OFF position.

2. Remove all cowling and nacelle access panels that obstruct engine removal in accordance with the airframe manufacturer's instructions.

3. Disconnect battery.

4. Disconnect the starter cable.

5. Remove the oil sump drain plug and washer. See Figures 14-3A, B, C, D, "Oil Sump" as applicable. Completely drain oil from engine and replace plug and washer.

**WARNING**

**Oil must be caught in an approved container and disposed of properly.**

6. Disconnect and tag the engine wiring bundles and other connections from the following components in accordance with the airframe manufacturer's instructions.

   a. Magneto ground terminal leads, sensor unit lead, if equipped
   b. Alternator
   c. Pneumatic pump
   d. Tach drive, if equipped
   e. Oil temperature connection
   f. Cylinder head temperature connection(s)
   g. Exhaust gas temperature connection(s)
   h. Remove all wiring bundle attaching clamps and hardware. Route wiring bundle clear of engine
   i. Miscellaneous airframe accessories

7. Disconnect the throttle and mixture control in accordance with the airframe manufacturer's instructions.
8. Remove manifold pressure gauge line, and airframe fuel supply hoses in accordance with the airframe manufacturer's instructions. Properly cap off lines and connections to prevent fuel spillage and the admittance of debris.
9. Removal of the exhaust system may be necessary prior to engine removal. See the applicable airframe manufacturer's instructions .

*CAUTION…Place a suitable stand under the aircraft tail at the proper load bearing area before removing the engine to prevent airframe damage due to the aircraft tail dropping.*

10. Attach an engine hoist to the engine. The engine hoist must be attached to the engine lifting eyes only. Extend the hoist relieving engine weight from the engine mounts.

11. Remove engine mount to airframe attaching hardware in accordance with the airframe manufacturer's instructions.

NOTE…Hoist the engine slowly making sure all wiring, lines, hoses and connections have been properly disconnected. Do not bump or drop engine.

12. Install the engine on an engine stand, transportation dolly or engine shipping container base as applicable. Install protective covers over all open lines and fittings. Do not use tape or plugs inside the lines or fittings.

## 6-3 PRELIMINARY CLEANING

Clean engine exterior by spraying or brushing with a solvent used for general cleaning of engine parts. Remove caked dirt on bolt heads and nuts. At the same time remove the oil sump drain plugs and drain any remaining oil.

*CAUTION…Do not use any alkaline cleaning solutions for external engine pre-cleaning, these solutions will remove the "alodized" finish of aluminum parts.*

## 6-4 EXTENT OF DISASSEMBLY

Exploded parts illustrations used in the engine system chapters are similar to those used in the parts catalog. Use the illustrations along with the written procedures to disassemble the engine, systems and components. Disassemble the engine systems and components to the extent specified in the written procedure of the applicable engine system chapter.

**WARNING**

**Do not attempt to identify components using the illustrations in this manual. Component identification must be accomplished using the nomenclature and part numbers in the related parts catalog.**

## 6-5 PARTS TO BE DISCARDED

Discard all parts listed in Section 6-6, "100% Replacement Parts" in such a manner they will not be used again inadvertently.

Care must be taken in removing gaskets from aluminum parts. Such removal should be delayed until the part is to be cleaned.

## 6-6 100 PERCENT(%) REPLACEMENT PARTS.

At assembly, during maintenance, preventive maintenance and engine or component overhaul replace all gaskets, seals, packings, hoses, "O" rings, cotter pins, retaining rings (snap rings), safety wire, self locking fasteners (including exhaust manifold nuts) and lock washers with new parts .

Engine mounted accessories not manufactured by TCM must be overhauled at engine overhaul and maintained in accordance with the instructions provided by the manufacturer.

Do not re-use any fasteners that are worn, deformed, or are designed to be used only once. Do not replate any cadmium plated fasteners or washers. If the cadmium plating has been removed discard the item and replace it with a new part.

At engine overhaul in addition to the previously listed items, the parts listed below must be discarded and replaced with new parts.

NOTE…If for any reasons hydraulic valve tappets are removed for inspection before the overhaul period has been reached, they must be placed back in the same location from which they were removed.

1. Hydraulic valve lifters (tappets)
2. Bearings: connecting rod, crankshaft main and thrust, needle, ball, and roller
3. Bushings: rocker arm, connecting rod, counter weight and crankshaft counter- weight blade
4. Counterweight pins, retaining plates and snap rings
5. Camshaft gear bolts
6. Crankshaft gear bolts
7. Woodruff keys
8. Crankshaft alternator face gear bolts and lock plates
9. Connecting rod bolts and nuts
10. Magneto drive rubber bushings
11. Exhaust valves
12. Roto-coils, exhaust valves
13. Intake and exhaust valve keepers
14. Inner and outer valve springs
15. Piston pins
16. Piston rings
17. Pistons
18. Rocker shafts
19. Rockers shaft thrust washers
20. Crankcase Through Bolts
21. Cylinder deck stud nuts and through bolt nuts
22. Ignition system wiring harness
23. Spark plugs
24. Alternator and air conditioning drive belts

## 6-7 GENERAL CLEANING

NOTE…Parts listed in Section 6-6, "100% Replacement Parts," must be replaced and therefore do not require cleaning.

**WARNING**

**During any cleaning process always follow the cleaning material manufacturer's instructions for use, and Material Safety Data Sheets for safety precautions and disposal information.**

Engine components must be thoroughly cleaned so they can be properly inspected. All surfaces must be protected from corrosion after cleaning by rinsing with a petroleum base solvent and applying a coat of clean 50 weight aviation engine oil.

*CAUTION…Cleaning methods other than the following may be destructive to engine parts and must not be used.*

Aluminum Alloy Parts: Degrease aluminum alloy components by spraying or brushing with any fortified mineral spirit solvent. Heavy grease or dirt deposits can be cleaned effectively by allowing parts to soak in this solvent for a short period of time. Carbon deposits and gum (oil varnish) may be removed easily by immersing the part in a hot bath of an inhibited, mild alkaline cleaning solution. Immersion time should be only as long as necessary to remove the deposit. Give special attention to cleaning studs, tapped holes and drilled holes. Caution must be exercised when cleaning aluminum alloy parts using any alkaline cleaning solutions. Immediately after removing soaked parts from inhibited, mild alkaline bath or hot soapy water, remove all traces of the alkaline by spraying the parts with a jet of steam, or brushing vigorously with a mineral spirit solvent. Cleaned parts may be dried by a jet of dry, compressed air to remove all solvent liquids.

*CAUTION…When using alkaline cleaning solutions, the cleaning solution manufacturer's usage, safety data and disposal information must be strictly followed. Alkaline etching solutions must not be used.*

*CAUTION…All alkaline residues must be removed from crevices, recesses and holes to prevent the formation of a foaming emulsion in the engine lubrication oil after reassembly. If Accelagold surface was removed by the cleaning process it must be re-applied in accordance with the procedure in section 6-19, "Application Of Accelagold." [Accelagold is manufactured by Turco® Products Inc.]*

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed.*

Carbon solvent should be employed only when carbon deposits are too hard or thick for removal by other solvents.

No polishing compound, abrasive paste or powder is needed for cleaning engine parts. Do not scrape parts or use wire brushes, sandpaper, abrasive cloth or abrasive wheels. Scratches resulting from such methods allow concentrated stress at the scratch and may cause fatigue failure.

Blasting techniques can be employed to remove hard carbon deposits if suitable equipment is available. Suitable types of grit for dry blasting are plastic pellets and processed natural materials such as wheat grains and crushed fruit pits or shells. Air pressure must be adjusted to the lowest setting that will produce the desired cleaning action. Small holes and machine finished surfaces must be protected from the blast by seals and covers.

**WARNING**

**All cleaning material must be removed from parts and components after cleaning.**

*CAUTION…Do not use sand, metal grit or glass beads for any type of cleaning. If water mixed degreasing solutions containing caustic compounds or soap are used to clean aluminum alloy components they must be thoroughly and completely rinsed with clear boiling water or steam to prevent corrosion.*

CASTINGS: Gasket surfaces must be thoroughly cleaned with a suitable hydrocarbon solvent such as acetone, naphtha, or methyl ethyl keytone (MEK) to remove dirt, oil and grease. Surfaces must be clean, dry and free of all old gasket material before applying new gaskets.

SMALL STEEL PARTS: Degrease steel parts by spraying or brushing with mineral spirit solvent. Heavy grease or dirt deposits can be cleaned effectively by allowing the part to soak in this solvent for a short period of time.

NOTE…See Chapters 7 through 17 for specific individual system component and part cleaning instructions.

## 6-8 VISUAL INSPECTION

All engine parts except those to be replaced 100% must be inspected visually with at least a 10 X (power) magnifying glass under good light for surface damage such as nicks, dents, deep scratches, visible cracks, distortion, burned areas, pitting, transfer of metal, corrosion, erosion and removal of enamel coating. Visual inspection should also determine the need for further cleaning of obscure areas. Inspect all studs for bending, looseness or partial removal. Inspect all threaded parts for nicks and other damage to the screw threads. After visual inspection place the engine parts in three groups: apparently serviceable parts, repairable parts and parts to be discarded.

NOTE...See Chapters 7 through 17 for specific individual system components and part visual inspection instructions.

## 6-9 MAGNETIC PARTICLE INSPECTION

*CAUTION…Before magnetic particle inspection of any part, it must be completely cleaned and free of dirt, carbon, varnish, gum and paint. Plug small holes leading to obscure cavities with tight-fitting wood plugs or with a hard grease which is soluble in lubricating oil. This will prevent particles from lodging in places where they would be difficult to remove and places not subject to visual inspection. After magnetic particle inspection remove all such plugs and clean the part thoroughly in solvent. Dry the part with compressed air. Check for complete demagnetization.*

Magnetic particle inspection must be conducted on all ferrous parts.

Where magnetic particle inspection is required use fluorescent method wet continuous procedure. Refer to the latest revision of ASTM E 1444 for specific methods and procedures based on the type of inspection being performed.

ACCEPT / REJECT CRITERIA

Rejectable discontinuities are any of the following: fatigue cracks, forming cracks, grinding and heat treat cracks, embrittlement cracks, seams, laps, burst.

Parts which contain linear indications which cannot be reworked or indications which break into comers, edges, holes, thread roots, fillets, gear tooth roots or keyways must be rejected.

The particular magnetic particle manufacturer's information regarding use, safety data and disposal must be followed carefully.

## 6-10 CRANKSHAFT ULTRASONIC INSPECTION PROCEDURE

The crankshaft must be ultrasonic inspected by individuals certificated to perform this detailed inspection. For approved inspection locations contact TCM at: (334) 438-3411.

## 6-11 CYLINDER BARREL ULTRASONIC INSPECTION PROCEDURE

Cylinders must be ultrasonic inspected by individuals certificated to perform this detailed inspection. For approved inspection locations contact TCM at: (334) 438-3411.

## 6-12 FLUORESCENT PENETRANT INSPECTION

Inspection by the fluorescent penetrant method must be conducted on all non-ferrous metal parts.

Where fluorescent penetrant inspection is required, it must be performed in accordance with ASTM E 1417. Specific process procedures are referenced in ASTM E 1208, E 1209, or E 1219. The penetrant method used must be Type I (fluorescent), Method A, B, C or D.

ACCEPT / REJECT CRITERIA

Rejectable discontinuities are any of the following: fatigue cracks, forming cracks, grinding and heat treat cracks, embrittlement cracks, seams, laps, burst.

Parts which contain linear indications which cannot be reworked or indications which break into comers, edges, holes, thread roots, fillets, gear tooth roots or keyways must be rejected.

NOTE…See Chapters 7 through 17 for specific individual system components and part fluorescent penetrant inspection instructions.

The particular fluorescent penetrant manufacturer's information regarding use, safety data and disposal must be followed carefully.

## 6-13 DIMENSIONAL INSPECTION

Inspect for manufacturer specified fit with mating parts by comparative linear measurements and alignment measurement using standard precision measuring instruments.

## 6-14 DIMENSIONAL LIMITS

After comparative measurement of mating parts and determination of running clearance refer to the limits section related to the part. Limits under the column heading **New Parts** are manufacturing limits. Clearances in the **New Parts** column apply to mating parts. Example: Check inside and outside diameters of mating part surfaces. Take the recorded dimensions and subtract the smaller from the larger. If the remainder falls within the **New Parts** minimum and maximum clearance the part may be re-used during overhaul provided it conforms with all other inspection requirements. Oversize parts are supplied in some instances to permit conformity to this requirement. See individual component or system sections as applicable for limits and fits.

## 6-15 ORIGINAL DIMENSIONS

Although comparative measurements of mating parts will determine the serviceability of the fit it may be difficult to determine which part has worn. In some instances (e.g., main journals in new bearing inserts) accurate dimensional measurements of fit are not always possible. While no limits of wear on critical dimensions have been assigned to specific parts it is helpful in determining wear to know the original dimensions. Therefore, consult the manufacturing limits, " New Parts Dimensions," in each individual system chapter when the serviceability of a specific part is in doubt.

## 6-16 PARTS LIMITS

TCM provides parts dimensions and assembly clearances in its publications which are considered essential to perform an overhaul of its engines. These values are termed "New Parts Limits." Values are taken from production drawings in effect at the time of publication. TCM also provides a list of items that must be replaced at overhaul. See section 6-6, "100% Replacement Parts."

**WARNING**

**Service limits must not be used when performing major overhaul of the engine.**

## 6-17 AUTHORIZED OVERSIZE AND AUTHORIZED UNDERSIZE PARTS

Replacement authorized oversize (AO) or authorized undersize (AU) parts must be used with the proper AO and AU mating parts. Example: Use .015 oversize piston and piston rings with .015 oversize cylinder assembly.

## 6-18 PROTECTIVE COATING

The manufacturer protects all aluminum alloy castings, sheet metal and tubing from corrosion by treating all surfaces of the parts with Accelagold aluminum conversion coating. [Accelagold is manufactured by Turco Products, Inc.] For sales and service contact Elf Atochem N.A. Turco® Products Div., P.O. Box 195, State Route 95, West Marion Ohio, 43302; (215) 419-5376.

## 6-19 APPLICATION OF ACCELAGOLD

After any machining or repair operation aluminum surfaces must be treated with an aluminum conversion coating. If the original aluminum conversion coating has been removed or deteriorated, it must be re-applied. The application of Accelagold solution must be performed in accordance with the manufacturer's Technical Data Bulletin Number 108-31 TURCOAT®) ACCELAGOLD ALUMINUM CONVERSION COATING.

Wrought or die cast smooth surface parts such as valve rocker covers and intake tubes are "tumble blasted" prior to machining to roughen surfaces before treatment. Tumble Blasting must not be applied at overhaul on parts with machined surfaces.

*CAUTION…Do not use enamel paint or primer for Internal parts. The paint or primer may flake or break off during engine run and contaminate lubricating oil.*

## 6-20 ENAMEL COATINGS

Ferrous parts when painted with gold enamel must be baked with infra-red equipment for 15 minutes at 275-300°F following the application of each coat.

NOTE…If a part which was originally alodized is to be refinished with enamel it is not necessary to apply zinc chromate primer unless surface areas have been completely stripped of Accelagold.

*CAUTION…Before application of primer and enamel to a part carefully mask all connection joints and mating surfaces. No primer or enamel is permissible on interior surfaces of any parts contacted by engine lubricating oil after assembly.*

## 6-21 HELICAL COIL INSERT REPLACEMENT

Helical coil inserts are installed at the factory in various tapped holes of some engine components. Stainless steel helical coil inserts of special design are installed in all spark plug holes. Any of these inserts may be replaced if damaged. Tools, inserts and information are available through HeliCoil®, Emhart Fastening Teknologies. Contact HeliCoil® Applications Engineering or customer service at: (203) 924-4737 for local distributor information. The manufacturer's Bulletins 959A, 995, 943, T4000 and 1000 latest revisions 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, 1 -1 /2 and 2 times nominal diameter and in pipe thread sizes. They are made of either 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.

Helical coil inserts are helical coils of wire with a diamond-shaped cross section forming both a male and female thread. 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 casting hole so the pitch diameter of the female thread of the installed insert conforms 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 installation of 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 should conform to the recommendations relative to inserts of length equal to 2 times nominal diameter, as tabulated in the manufacturer's Bulletin Numbers 1000 and T4000 latest revision. Helical coil tap drills and special taps must be run in perpendicular to the machined surface of the casting. Drilling must be done in a drill press after the casting is firmly supported, clamped and alignment checked. The tap will tend to follow the drilled 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.

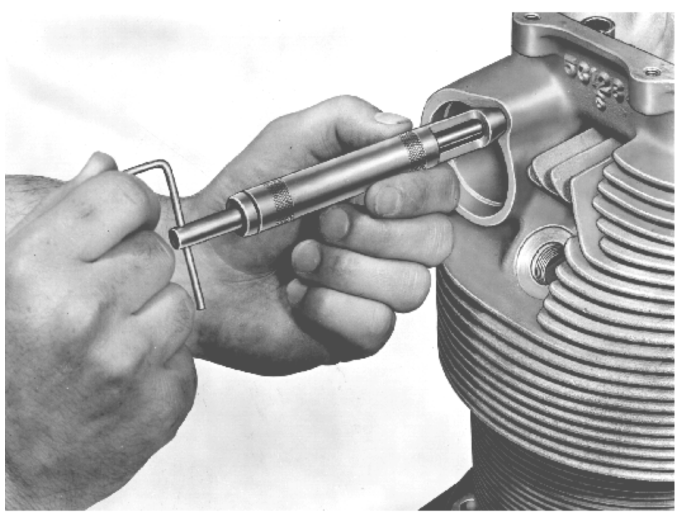


**FIGURE 6-1. INSTALLATION TYPICAL HELICAL COIL INSERT**

## 6-21 HELICAL COIL INSERT REPLACEMENT (cont'd)

To remove a damaged helical coil insert use the proper size of extracting tool for the nominal thread size. Tap it into the insert so the sharp edges get a good bite, then turn the tool to the left, and back out the helical coil until it is free. To install new insert in a properly tapped hole, after blowing out all liquid and chips, slide it over the slotted end of the driving mandrel of the proper size installing tool, and engage the driving tang (bent end) of the helical coil in the mandrel slot; then, wind the insert slowly into the tapped hole. See Figure 6-1, "Installing Typical Helical Insert." The outer end of the insert must lie within the first full thread of the hole. Break off the driving tang of a notched helical coil by bending back and forth across the hole with long-nose pliers, or with a special tang break-off tool.

After helical coil replacement the remaining wall thickness (edge distance) must not be less than one half the helical coil diameter or .08 minimum whichever is greater.

### WARNING

**The 2 and 4 o'clock cylinder deck stud positions must not be repaired by helical coil insert installation.**

## 6-22 STUD REPLACEMENT

Remove damaged whole studs with a stud remover turning slowly to avoid heating the casting. Remove broken studs which cannot be gripped with a standard stud extractor by drilling on center to the correct diameter and unscrewing with a splined stud extractor. Splined extractors and drills are usually sold in sets. Examine the course thread end of the damaged stud before discarding it to determine its size. Standard studs have no marking. For oversize stud identification, see Figure 6-2, "Standard And Oversize Stud Identification." Clean the casting tapped hole with solvent and blow dry with compressed air. Then examine the thread. If it is not torn install the next larger oversize stud. If the old stud was of the maximum oversize or if the thread is damaged the hole may be tapped and a helical coil insert installed for a standard-size stud provided sufficient stock is available.

NOTE…Cylinder rocker shaft retaining bolt positions are eligible for repair by helical insert provided that a minimum wall thickness of greater than 1/2 times thread diameter remains after tapping for helical coil insert. See Chapter 16 for specifications.

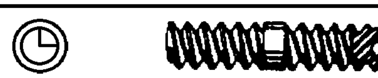
| Example Part Number | Oversize | Identification | Identification Color Code |
|---|---|---|---|
| XXXXXX | Standard |  | None |
| XXXXXXP003 | .003 |  | Red |
| XXXXXXP007 | .007 |  | Blue |
| XXXXXXP012 | .012 |  | Green |

**FIGURE 6-2. STANDARD AND OVERSIZE STUD IDENTIFICATION**

Coat the new stud's course thread with High Strength Adhesive P/N 646941 if the hole is blind or if the hole goes through to a cavity subject to leakage. Drive the new stud with a tee handle stud driver. Turn it slowly and compare the torque values listed in the Table 6-1A, "General Use Torques" Drive the stud in until it projects a distance equal to the specified setting height. See stud setting heights in the applicable component or system section.

## 6-23 CYLINDER EXHAUST PORT ®ROSAN STUD REPLACEMENT

®Rosan ring locked studs are installed in the cylinder exhaust ports. These studs are either "size on size" or "step type." Certain precautions must be taken during the removal of these studs to prevent damage to the cylinder.

### REMOVAL OF "SIZE ON SIZE STUDS."

The "size on size" captive lock ring studs utilize a small external diameter lock ring for usage in locations where edge distance is of concern. 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. Therefore, the following removal method must be used.

1. Using caution, cut the stud off as close as possible to flush with the cylinder head. Do not come in contact with or mark the cylinder head.
2. Center punch the remaining portion of the stud.
3. Locate the proper size primary removal drill directly over the center of the stud and drill to the specified depth.

NOTE…The primary removal drill size and specified depths are noted below.

4. Center the secondary removal drill over the small hole and drill to the specified depth.

NOTE…The secondary removal drill size and specified depths are noted below. This should cut the engagement between the stud serrations and the internal serrations of the lock ring.

5. The remaining lock ring will have a very thin wall. A sharp punch will easily break it away from the cylinder head.
6. Drive an "Ezy Out" into the small hole in the stud and apply removal torque.
7. After the stud has been removed, clean the hole .

| **Cylinder Exhaust Port Stud** | | **Primary Removal Drill** | | **Secondary Removal Drill** | |
|---|---|---|---|---|---|
| Basic Stud Number | | Diameter | Minimum Depth | Diameter | (+.015) Depth |
| (.164 dia.) | SFC164 | 1/16(.062) | .250 | 3/16(.188) | .080 |
| (.190 dia.) | SFC190 | 1/16(.062) | .250 | 7/32(.219) | .090 |
| (.250 dia.) | SFC250 | 3/32(.093) | .250 | 19/64(.29i) | .105 |
| (.312 dia.) | SFC312 | 1/8(.125) | .312 | R(.339) | .120 |
| (.375 dia.) | SFC375 | 1/8(.125) | .375 | 13/32(.406) | .120 |

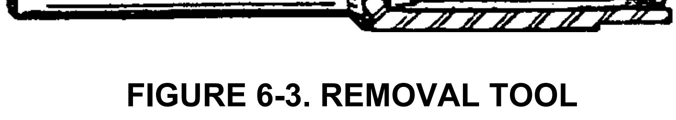


**FIGURE 6-3. REMOVAL TOOL**

REMOVAL OF "STEP" TYPE STUDS.

The "step" type captive lock ring studs have a larger lock ring than the "size on size" type and therefore can be removed any one of two ways.

Method 1: Using the appropriate ®Rosan removal tool as shown in Figure 6-3. "Removal Tool," mill the lock ring away to the appropriate depth. See Figure 6-4, "Stud Removal." Using the best suitable means, apply removal torque to the stud. The remaining portion of the lock ring should lift out as the stud is being removed. If not the remaining portion can be broken away from the cylinder head using a sharp punch.

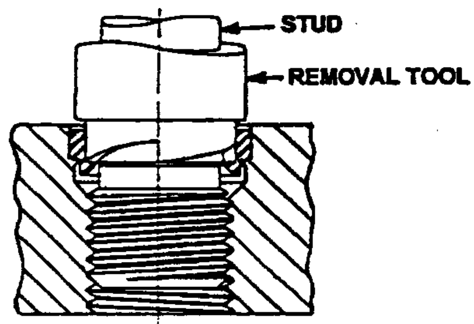



**FIGURE 6-4. STUD REMOVAL**

Method 2: Using the same procedure as the "size on size" type stud removal, select the appropriate removal drill sizes with regard to the stud end dimension. Example: To remove a "step" type stud with a .250 inch diameter nut end and a .312 inch diameter stud end, use the appropriate removal drills for a .312 inch diameter "size on size" stud.

STUD REINSTALLATION.

1. With the appropriate wrench, install the new stud to the depth specified in Figure 6-5." Stud Installation Dimensions."

NOTE…Location of the flange is important in preventing the lock ring drive tool from making contact with surface "A" in Figure 6-5. "Stud Installation Dimensions." Any impact or pressure on this surface may cause damage to the threads in the cylinder head resulting in a loose fit .

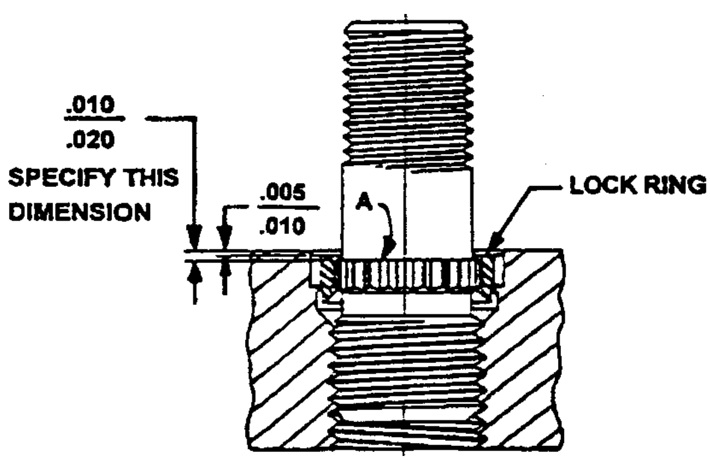



**FIGURE 6-5. STUD INSTALLATION DIMENSIONS**

Using the appropriate drive tool, install the new lock ring to the specified depth shown in Figure 6-5. "Stud Installation Dimensions."

NOTE…All special tools for installation and removal of ®Rosan lock ring studs including tool kits and prices can be obtained from: ®Rosan, Inc., 3130 West Harvard, Santa Ana, California 92704. Telephone (714/641-8800) for distributor information.

## 6-24 NEW PARTS

Parts which require protection from atmospheric dust and moisture are wrapped or boxed individually. These parts must not be unpacked until they are to be installed. This includes precision bearing inserts and anti-friction bearings. Check new parts on receipt for transit damage. All parts must be clean and lubricated as specified prior to installation. Refer to Form X30687A, Equipment Kit Catalog, for part numbers of the major overhaul kits (for example, Top, Gasket, Lower End and Overhaul Hardware Kits.) Refer to Chapter 3, "Tools, Equipment, Sealants And Lubricants," for approved products, all of which must be on hand when work is started. Use only new shakeproof or split lock washers, tab washers, elastic stop nuts, cotter pins and corrosion-resistant lockwire. Refer to Section 6-6, "100% Replacement Parts," before assembly. Measure clearances of running parts as they are assembled and compare with clearances listed in the applicable component or system chapter. During major engine overhaul use only NEW PARTS LIMITS. See Section 6-16, "Parts Limits."

The engine overhaul must be performed in a clean dust free environment, and engine sub-assemblies must be covered whenever they are not in the process of cleaning, inspection, repair or assembly.

## 6-25 TORQUE APPLICATIONS

Prior to torquing any hardware apply the specified lubricants in accordance with Chapter 3.

The accuracy of any torque indicating wrench depends on a smooth application of force and current calibration traceable to the National Bureau of Standards. If a nut slot cannot be aligned with a cotter pin hole within the specified limits, substitute another serviceable nut. If the cotter pin hole in stud lies beyond the nut slots, when the nut has been torqued properly check stud for proper installation or backing out. Check part to see if it has been reduced in thickness. Check to insure nut and washer are correct parts for that location. The situation must be corrected by whatever replacement is indicated by inspection.

NOTE…See Tables 6-1 through 6-5 on the following pages for, Bolt, Nut and Screw Torques, Driving Stud Torques, Pipe Plug Torques, Torque Specifications for Fittings, Hose Fittings and Specific Torques.

## GENERAL USE TORQUES

| ①TABLE 6-1. Bolt, Nut and Screw Torques | | |
|---|---|---|
| SIZE | INCH POUNDS | FOOT POUNDS |
| 8-32 | 17.5-22.5 | 1.5-1.9 |
| 10-24 | 21.0-25.0 | 1.7-2.0 |
| 10-32 | 36.0-50.0 | 3.0-4.2 |
| 1/4-20 | 75.0-85.0 | 6.3-7.1 |
| 1/4-28 | 90.0-110 | 7.5-9.2 |
| 5/16-18 | 155-175 | 12.9-14.6 |
| 5/16-24 | 180-220 | 15.0-18.3 |
| 3/8-16 | 220-260 | 18.3-21.7 |
| 3/8-24 | 275-325 | 22.9-27.1 |
| 7/16-14 | – | – |
| 7/16-20 | 400-450 | 33.3-37.5 |
| 1/2-20 | 550-600 | 45.8-50.0 |

NOTE…Torque loads listed are for use with oil on threads as specified in chapter 3.

| ①TABLE 6-1.A ②DRIVING STUD TORQUES | | |
|---|---|---|
| SIZE | INCH POUNDS | FOOT POUNDS |
| 1/4-20 | 50-70 | 4.2-5.8 |
| 5/16-18 | 100-150 | 8.3-12.5 |
| 3/8-16 | 200-275 | 16.7-22.9 |
| 7/16-14 | 300-425 | 25.0-35.4 |

NOTE…Stud driving torques apply when studs are coated with lubricant or sealer as specified in chapter 3.

| ①TABLE 6-2. PIPE PLUG TORQUES | | |
|---|---|---|
| **SIZE** | **INCH POUNDS** | **FOOT POUNDS** |
| 1 /8-27 | 60-80 | 5.0-6.7 |
| 1/4-18 | 130-150 | 10.8-12.5 |
| 3/8-18 | 185-215 | 15.4-18.0 |
| 1/2-14 | 255-285 | 21.3-23.8 |
| 3/4-14 | 310-350 | 25.8-29.2 |

| ①TABLE 6-3. TORQUE SPECIFICATIONS FOR FITTINGS | | | |
|---|---|---|---|
| SIZE | FITTING AND MATERIAL | TUBE O.D. | INCH POUNDS |
| 5/16-24 | #2 (Brass/Aluminum) | .125 | 15-30 |
| 5/16-24 | #2 (Steel) | .125 | 15-50 |
| 3/8-24 | #3 (Brass/Aluminum) | .188 | 40-65 |
| 3/8-24 | #3 (Steel) | .188 | 50-90 |
| 7/16-20 | #4 (Brass/Aluminum) | .250 | 60-80 |
| 7/16-20 | (Steel) | .250 | 70-120 |
| 7/16-24 | #4 (Steel) | .190 | 60-80 |
| 9/16-18 | #6 (Brass/Aluminum) | .375 | 75-125 |
| 9/16-18 | #6 (Steel) | .375 | 90-150 |
| 3/4-16 | #8 (Brass/Aluminum) | .500 | 150-250 |
| 3/4-16 | #8 (Steel) | .500 | 135-250 |
| 7/8-14 | #10 (Brass/Aluminum) | .625 | 200-350 |
| 7/8-14 | #10 (Steel) | .625 | 300-400 |

① Hardware requiring torque, not listed in Table Of Specific Torques, must be torqued in accordance with Bolt, Nut and Screw Torques, Driving Stud Torques, Pipe Plug Torques, Torque Specifications for Fittings, Hose Fittings and Specific Torques as applicable .

| ①TABLE 6-4. TORQUE SPECIFICATIONS FOR HOSE FITTINGS | | | |
|---|---|---|---|
| **HOSE SIZE** | **THREAD SIZE** | **FITTING MATERIAL** | **INCH POUNDS** |
| # 2 | (5/16-24) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 50-80<br>75-120 |
| # 3 | (3/8-24) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 70-105<br>95-140 |
| # 4 | (7/16-20) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 100-140<br>135-190 |
| # 5 | (1/2-20) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 130-180<br>170-240 |
| # 6 | (9/16-18) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 150-195<br>215-280 |
| # 8 | (3/4-16) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 270-350<br>470-550 |
| # 10 | (7/8-14) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 360-430<br>620-745 |
| # 12 | (1-1/16-12) | Hose End Fitting To Brass/Allum. Fitting<br>Hose End Fitting To Steel Fitting | 460-550<br>855-1055 |

## WARNING

**Failure to lubricate threads, apply the specific torque and follow the specific torquing procedure may result in damage and subsequent engine malfunction or failure.**

## TABLE 6-5. SPECIFIC TORQUES

| Location and hardware | | Model | Thread size | Qty. | ① Torque In. Lbs. | Ft. Lbs. |
|---|---|---|---|---|---|---|
| Cover tach drive to oil pump | Nut | All | .25-28 | 2 | 90-110 | 7.5-9.2 |
| Cover to tach drive | Nut | IO-550-A,B,C | .25-28 | 4 | 75-85 | 6.3-7.1 |
| | Screw | IO-550-A,B,C | 10-24x.50 | 4 | 21-25 | 1.7-2.0 |
| ② Cover to tach drive | Cover | IO-550-G,N,P,R | ③1.375-16 | 1 | 250-350 | 20.8-29.2 |
| Oil pressure relief valve | Housing | All | 1.12-18 | 1 | 240-260 | 20.0-21.7 |
| Starter adapter to crankcase | Nut | All | .31-24 | 2 | 180-220 | 15-18.3 |
| Starter motor to starter adapter | Nut | All | .375-24 | 2 | 200-220 | 16.7-18.3 |
| Starter gear to clutch spring | Screw | All | .25-20x.41 | 1 | 75-85 | 6.3-7.1 |
| Cover to starter adapter | Nut | IO-550-A,C,G | .375-16 | 3 | 200-220 | 16.7-18.3 |
| Cover to starter adapter | Nut | IO-550-B | .31-24 | 3 | 180-220 | 15.0-18.3 |
| Scavenge pump cover to scavenge pump housing | Nut | IO-550-B | .31-24 | 4 | 180-220 | 15.0-18.3 |
| Sheave to starter shaftgear | Nut, 12 point self locking | IO-550-B | .5625-18 | 1 | 450-500 | 37.5-41.6 |
| Alternator drive gear to crankshaft | Bolt | All | .31 -24 | 4 | 140-150 | 11.7-12.5 |
| Collar assembly governor oil transfer | Nut | All | .25-28 | 2 | 75-85 | 6.3-7.1 |
| Accessory drive gear to crankshaft | Bolt (Hardness $R^c$ 38-42) | All | .31-24 | 6 | 380-420 | 31.7-35.0 |
| Connecting rod | Nut 6 Point Hex | All | .44-20 | 2 | 550-600 | 45.8-50.0 |
| Connecting rod | Nut 12 Point | All | .44-20 | 2 | 690-710 | 57.5-59.2 |
| Camshaft | Plug(s) | All | .25-18 | 1 | 130-150 | 10.8-12.5 |
| Gear to camshaft | Bolt | All | .31 -24 | 4 | 240-260 | 20.0-21.7 |
| Oil filler/breather to crankcase | Bolt | All | .31-18 | 2 | 155-175 | 12.9-14.6 |
| Engine mount bracket to crankcase | Nut | All | .375-24 | 12 | 275-325 | 22.9-27.1 |
| Lever to throttle or mixture shaft | Nut | All | .31-24 | 1 | 100-120 | 8.3-10.0 |
| Throttle lever screw | Nut | All | 8-32 | 1 | 17.5-22.5 | 1.5-1.9 |
| ④Through bolt at cylinder flange | Nut (12 point) | All | .50-20 | 12 | 790-810 | 65.8-67.5 |
| Cylinder to crankcase | Nut | All | .44-20 | 36 | 490-510 | 40.8-42.5 |
| Cylinder to crankcase 7th stud | Nut | All | .44-20 | 6 | 490-510 | 40.8-42.5 |
| Bolt at lower camshaft boss | Nut | All | .31 -24 | 4 | 180-220 | 15.0.18.3 |
| Through bolt at cad plated washer | Nut | All | .50-20 | 4 | 615-635 | 51.2-52.9 |
| Through bolt above & below crankshaft at crankcase nose | Nut | All | .44-20 | 4 | 440-460 | 36.7-38.3 |
| R/H side crankcase below crankshaft | Bolt | All | .31-18 | 2 | 155-175 | 12.9-14.6 |
| Crankcase flange (backbone) | Nut | All with plain nut | .31 -24 | 12 | 180-220 | 15.0-18.3 |
| | Nut | Stainless Steel Nuts | .31 -24 | 12 | 240-280 | 20-23.3 |
| Through Bolt Crankcase Upper Rear | Nut | All | .38-24 | 2 | 275-325 | 22.9-27.1 |
| Tie Bolt Crankcase Rear | Bolt | All | .31-18 | 3 | 155-175 | 12.9-14.6 |
| Through stud at oil cooler | Nut | All | .31-24 | 1 | 180-220 | 15.0-18.3 |
| Spine below camshaft | Nut | All | .25-28 | 5 | 90-110 | 7.5-9.2 |
| Idler gear support pin | Nut | All | .25-28 | 2 | 90-110 | 7.5-9.2 |

| Location and hardware | | Model | Thread size | Qty. | ① Torque In. Lbs | Ft. Lbs. |
|---|---|---|---|---|---|---|
| Camshaft cover | Nut | All | .25-28 | 2 | 90-110 | 7.5-9.2 |
| Oil pump Housing | Nut | All | .25-28 | 2 | 90-110 | 7.5-9.2 |
| Oil filter adapter | Nut | All | .375-24 | 3 | 275-325 | 22.9-27.1 |
| Oil suction tube to oil pump | Plug | All | .625-18 | 1 | 190-210 | 15.8-17.5 |
| Oil suction tube to crankcase | Nut | All | .25-28 | 1 | 90-110 | 7.5-9.2 |
| Oil filter | | All | .75-16 | 1 | 192-216 | 16-18 |
| Alternator drive gear & hub to alternator | Nut | All | .625-32 | 1 | 300-450 | 25.0-37.5 |
| Alternator to crankcase | Nut | All | .31-24 | 4 | 180-220 | 15.0-18.3 |
| Oil cooler to crankcase | Nut (upper)<br>Nut (lower) | All | .375-24<br>.31-24 | 4<br>1 | 275-325<br>180-220 | 22.9-27.1<br>15.0-18.3 |
| Oil temperature control valve | ---- | All | 1”-4NS3A | 1 | 440-460 | 36.7-38.3 |
| Oil cooler bottom | Plug<br>Plug | IO-550-C,G,N,P,R | .125-27<br>.375-18 | 1 | 60-80<br>185-215 | 5.0-6.7<br>15.4-18.0 |
| Accessory drive adapter to crankcase | Nut<br>Nut | All | .31-24<br>.375-24 | 6<br>2 | 180-220<br>275-325 | 15.0-18.3<br>22.9-27.1 |
| ③ Rocker shaft hold down | Bolt | IO-550-A,B,C | .25-20 | 12 | 90-100 | 7.5-8.3 |
| Rocker shaft hold down | Bolt | IO-550-G,N,P,R | .31-18 | 24 | 190-210 | 15.8-17.5 |
| Rocker cover to cylinder | Screw | IO-550-A,B,C | .25-20 | 48 | 55-65 | 4.6-5.4 |
| Rocker cover to cylinder | Screw | IO-550-G,N,P,R | .25-20 | 60 | 55-65 | 4.6-5.4 |
| Oil Sump to crankcase | Bolt | All | .31 -18 | 32 | 155-175 | 12.9-14.6 |
| Oil sump drain | Plug | All | .625-18 | 1 | 190-210 | 15.8-17.5 |
| Exhaust pipe flange to cylinder | Nut | All | .25-28 | 24 | 100-110 | 8.3-9.2 |
| Support bracket to throttle | Nut | IO-550-A | .25-28 | 1 | 90-110 | 7.5-9.2 |
| Throttle support bracket to sump | Bolt | IO-550-A | .31-18 | 2 | 155-175 | 12.9-14.6 |
| Fuel control to throttle | Bolt | IO-550-A | .25-20 | 3 | 75-85 | 6.3-7.1 |
| Throttle to sump | Bolt | IO-550-B | .31-18 | 2 | 155-175 | 12.9-14.6 |
| Fuel control to throttle | Bolt | IO-550-B | .25-20 | 3 | 75-85 | 6.3-7.1 |
| Shroud to fuel control | Nut | IO-550-B | .25-28 | 3 | 90-110 | 7.5-9.2 |
| Lower support bracket to throttle | Nut | IO-550-C | .25-28 | 1 | 90-110 | 7.5-9.2 |
| Lower throttle support bracket to tach drive | Nut | IO-550-C | .25-28 | 1 | 90-110 | 7.5-9.2 |
| Upper throttle support brackets together | Nut | IO-550-C | .25-28 | 1 | 90-110 | 7.5-9.2 |
| Fuel control to throttle | Bolt | IO-550-C | .25-20 | 3 | 75-85 | 6.3-7.1 |
| Shroud to fuel control | Nut | IO-550-C | .25-28 | 2 | 90-110 | 7.5-9.2 |
| Throttle to intake manifold | Bolt | IO-550-G,N,P,R | .25-20 | 4 | 75-85 | 6.3-7.1 |
| Intake tube flange to cylinder | Bolt | IO-550-A,B,C | .25-20 | 24 | 85-110 | 7.0-9.2 |
| Intake tube flange to cylinder | Nut | IO-550-G,N,P,R | .25-28 | 18 | 90-110 | 7.5-9.2 |
| Fuel pump to crankcase | Nut | All | .31 -24 | 2 | 180-220 | 15-18.3 |
| Fuel nozzle to cylinder | Nozzle | IO-550-A,B,C | .125-27 (dry seal) | 6 | 55-65 | 4.6-5.4 |

| Location and hardware | | Model | Thread size | Qty. | ① Torque In. Lbs. | Ft. Lbs. |
|---|---|---|---|---|---|---|
| Fuel nozzle to cylinder | Nozzle | IO-550-G,N,P,R | .31-24 | 6 | 55-65 | 4.6-5.4 |
| Bracket to fuel manifold valve | Screw | IO-550-A | 10-24 | 2 | 21-25 | 1.7-2.0 |
| Cover and bracket to fuel manifold valve | Screw | IO-550-B,C,G,N,P,R | 8-32 | 4 | 17.5-22.5 | 1.5-1.9 |
| Fuel manifold valve and bracket to intake manifold | Bolt | IO-550-G,N,P,R | .31-18 | 2 | 155-175 | 12.9-14.6 |
| Harness plate to magneto | Screw | Slick | 10-32 | 6 | 20-22 | 1.7-1.8 |
| Lead to spark plug | `'B" nut | All | .75-20 | 12 | 110-120 | 9.2-10.0 |
| Spark plug | | All | 18mm | 12 | 300-360 | 25.0-30.0 |
| Fuel injection line to fuel nozzles | "B" Nut | All | .31-32 | 6 | 40-45 | 3.3-3.8 |
| Fuel injection line to manifold valve | Nut, union | All | .375-24 | 6 | 55-60 | 4.6-5.0 |
| Cover to magneto accessory drive | Nut | All | .25-28 | 8 | 90-110 | 7.5-9.2 |
| Cover or prop governor to crankcase | Nut | All | .31-24 | 4 | 180-220 | 15.0-18.3 |
| Magneto to crankcase | Nut | All | .31 | 4 | 100-120 | 8.3-10 |
| Harness plate to magneto | Screw | S20,S200 Series | 10-32 | 4 | 25-35 | 2.1-2.9 |
| Harness plate to magneto | Nut | S1200 Series | 10-32 | 4 | 17-19 | 1.4-1.6 |

① Torque loads listed are for use with oil on threads. If cotter pin holes must be aligned set torque wrench at low limit and torque nut to first hole beyond this torque. Stud driving torques apply when studs are coated with lubricant or sealer. Do not exceed the high limit torque.

② Housing utilizes left hand threads. When installing apply antiseize lubricant.

③ Must be reworked to through bolt rocker shaft configuration in accordance with Service Bulletin M92-6 or current revision as applicable.

④ (6 Point) nuts used at cylinder through bolt positions must be torqued to 690 – 710 inch pounds torque.

## WARNING

**Failure to lubricate threads, apply the specific torque and follow the specific torquing procedure may result in damage and subsequent engine malfunction or failure .**

INTENTIONALLY

LEFT

BLANK

# CHAPTER 7

# EXHAUST SYSTEM

## 7-1 EXHAUST SYSTEM

This chapter is reserved for engines utilizing an exhaust system and components supplied on some engine models by Teledyne Continental Motors. For I0-550-A,B,C,G,N,P & R exhaust system overhaul information see the airframe manufacturer's instructions.

INTENTIONALLY

LEFT

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# CHAPTER 8
# IGNITION SYSTEM AND
# MAGNETO ACCESSORY DRIVES

## 8-1A IGNITION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 8-1A)

1. Remove ignition harness assembly
   a. Remove ignition lead from each spark plug (6). Remove all cable ties (27).
   b. On each magneto, remove four screws (20) and lock washers (19) from cable outlet plate. Remove plates from magnetos (2).
   c. Remove ignition harness assembly from engine and discard.

2. Disconnect ground terminal and retard terminal kits (28, 29) from magnetos (2) in accordance with airframe manufacturer's instructions.
3. Remove nuts (5), lock washers (4), and magneto holding washers (3) from each magneto.
4. Remove both magnetos (2) from the engine. Discard cable ties (27) and lock washers (4, 19).

*CAUTION…Use care to avoid dropping magneto drive bushings and retainers into the engine. See Figure 8-2A .*

5. Magneto assemblies must be overhauled in accordance with the magneto manufacturer's instructions. see TCM ignition systems Master Service Manual, Form No. X40000. See Section 1-5, "Related Publications," for ordering information.

Nomenclature for Figure 8-1A.

| | | |
|---|---|---|
| 1. Gasket | 11. Lead, #3B | 21. Clamp |
| 2. Magneto | 12. Lead, #3T | 22. Clamp |
| 3. Washer, Holding | 13. Lead, #4B | 23. Nut |
| 4. Washer, Lock | 14. Lead, #4T | 24. Clamp |
| 5. Nut | 15. Lead, #5B | 25. Screw |
| 6. Sparkplug | 16. Lead, #5T | 26. Bracket |
| 7. Lead, #1B | 17. Lead, #6B | 27. Tie, Cable |
| 8. Lead, #1T | 18. Lead, #6T | 28. Kit, Ground Terminal |
| 9. Lead, #2B | 19. Washer, Lock | 29. Kit, Retard Terminal (Left Magneto) |
| 10. Lead, #2T | 20. Screw | |

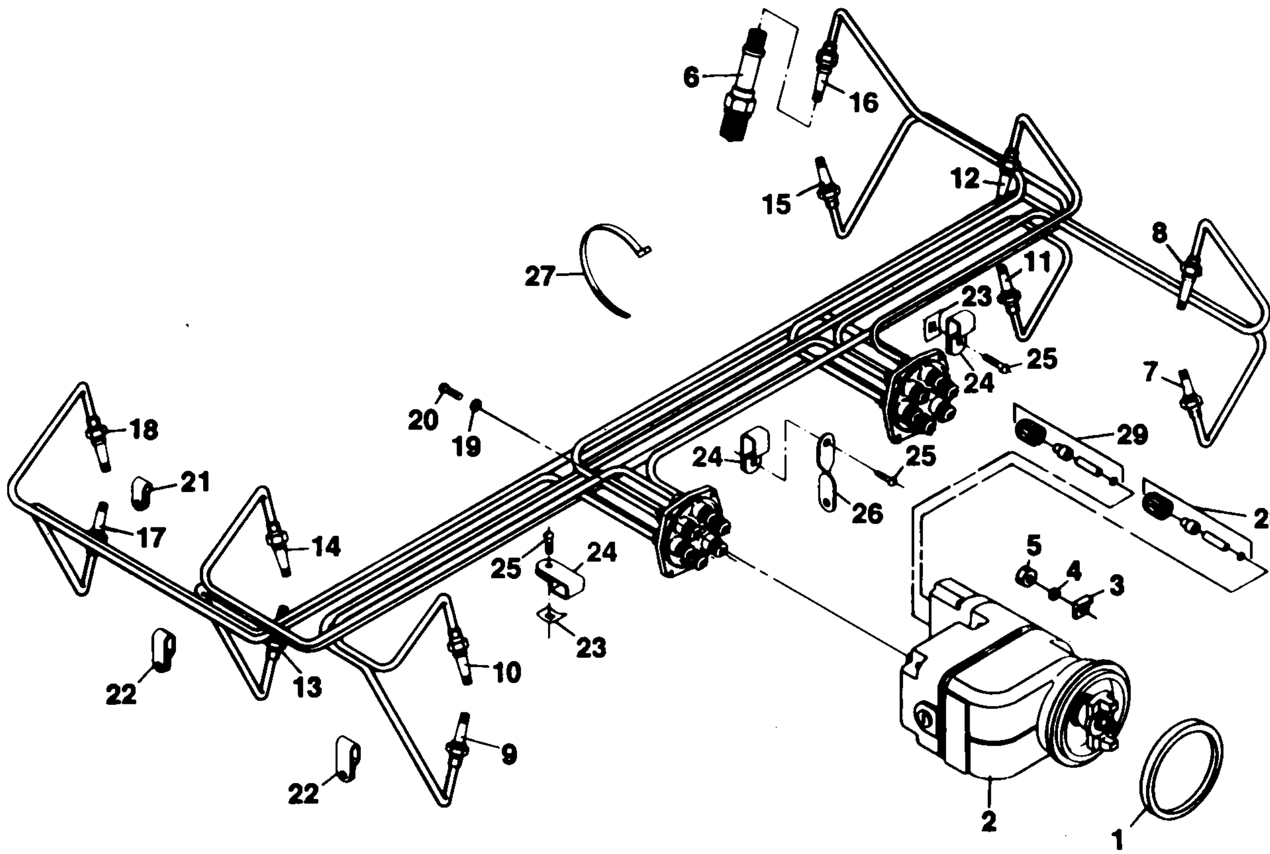



**FIGURE 8-1A. IGNITION SYSTEM FOR I0-550-A, A2B, A3B, A4B, A5B, A6B**

## 8-1B IGNITION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 8-1B)

1. Remove ignition harness assembly
   a. Remove ignition lead from each spark plug (8). Remove all cable ties (27).
   b. On each magneto, remove four lock washers (6) and four nuts (7) from cable outlet plate. Remove plates from magnetos (2).
   c. Remove ignition harness assembly from engine and discard.
2. Remove nuts (5), lock washers (4), and magneto holding washers (3) from each magneto.
3. Remove both magnetos (2) from the engine. Discard cable ties (27) and lock washers (4, 6).

*CAUTION…Use care to avoid dropping magneto drive bushings and retainers into the engine. See Figure 8-2A .*

4. Magneto assemblies must be overhauled in accordance with the magneto manufacturer's instructions. see TCM ignition systems Master Service Manual, Form No. X40000. See Section 1-5, "Related Publications," for ordering information.

Nomenclature for Figure 8-1B.

| | | |
|---|---|---|
| 1. Gasket | 11. Lead, #2B | 21. Clamp |
| 2. Magneto | 12. Lead, #2T | 22. Clamp |
| 3. Washer, Holding | 13. Lead, #3B | 23. Nut, Speed |
| 4. Washer, Lock | 14. Lead, #3T | 24. Clamp |
| 5. Nut | 15. Lead, #4B | 25. Screw |
| 6. Washer, Lock | 16. Lead, #4T | 26. Bracket |
| 7. Nut | 17. Lead, #5B | 27. Tie, Cable |
| 8. Sparkplug | 18. Lead, #5T | |
| 9. Lead, #1B | 19. Lead, #6B | |
| 10. Lead, #1T | 20. Lead, #6T | |

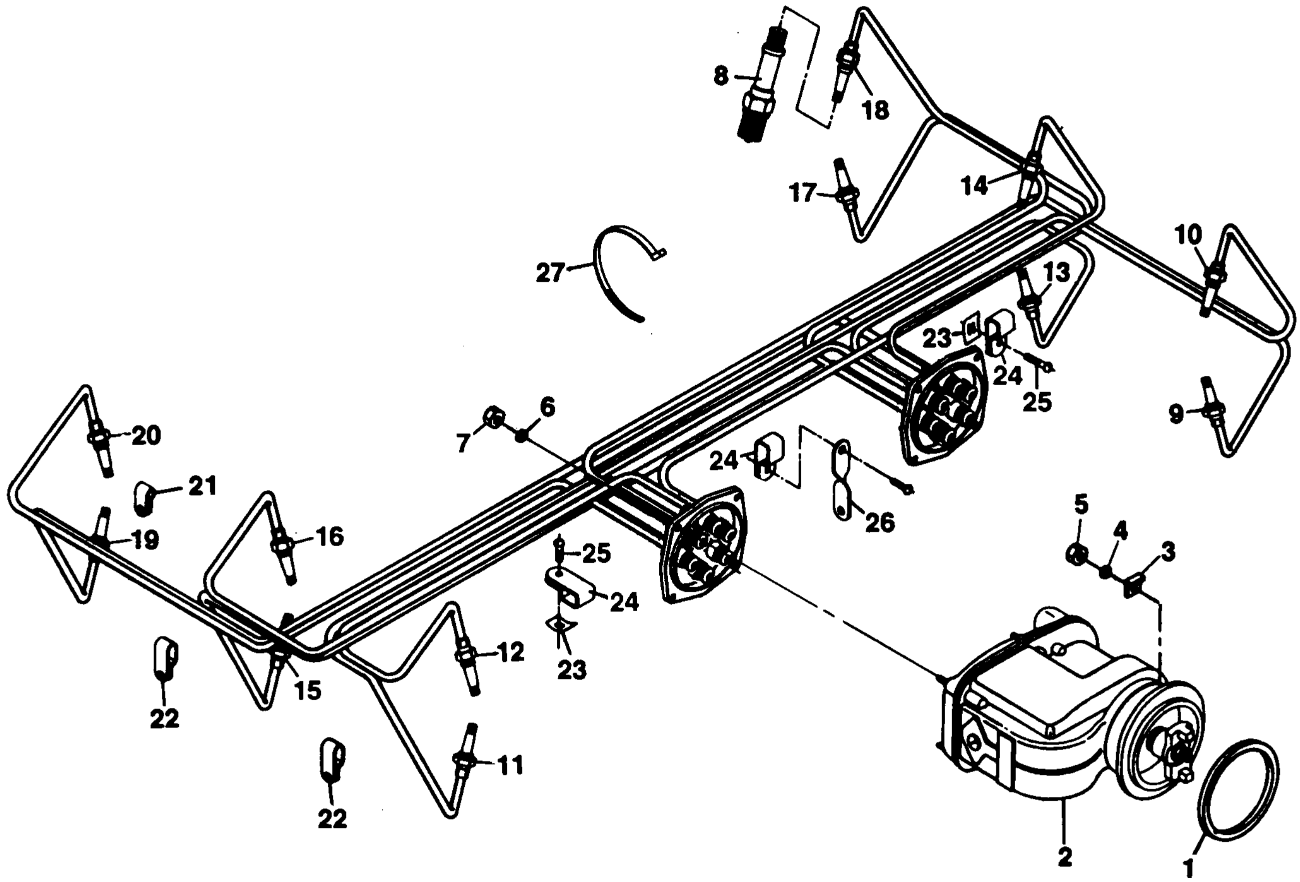



**FIGURE 8-1B. IGNITION SYSTEM FOR I0-550-A7B, I0-550-B, B1F, B2F, B3F, B4F, B9B, B20B, B21B, B22B, B26B, B30B, B31B, B33B, B34B, B36B, I0-550-C, C3F, C16B, C18B, C26B, C28B, C27B,C29B**

## 8-1C IGNITION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 8-1C)

1. Remove ignition harness assembly
   a. Remove ignition lead from each spark plug (6). Remove all cable ties (26).
   b. On each magneto, remove three screws (19) from cable outlet plate. Remove plates from magnetos (2).
   c. Remove ignition harness assembly from engine and discard.
2. Disconnect ground terminal kit from magnetos (2) in accordance with airframe manufacturer's instructions.
3. Remove nuts (5), lock washers (4), and magneto holding washers (3) from each magneto.
4. Remove both magnetos (2) from the engine. Discard cable ties (26) and lock washers (4).

*CAUTION…Use care to avoid dropping magneto drive bushings and retainers into the engine. See Figure 8-2A.*

5. Magneto assemblies must be overhauled in accordance with the magneto manufacturer's instructions. see Slick Ignition Systems Master Service Manual, Index and Order Form Number F-1100. See Section 1-5, "Related Publications," for ordering information.

Nomenclature for Figure 8-1C.

| | |
|---|---|
| 1. Gasket | 14. Lead, #4T |
| 2. Magneto | 15. Lead, #5B |
| 3. Washer, Holding | 16. Lead, #5T |
| 4. Washer, Lock | 17. Lead, #6B |
| 5. Nut | 18. Lead, #6T |
| 6. Sparkplug | 19. Screw |
| 7. Lead, #1B | 20. Clamp |
| 8. Lead, #1T | 21. Clamp |
| 9. Lead, #2B | 22. Nut, Speed |
| 10. Lead, #2T | 23. Clamp |
| 11. Lead, #3B | 24. Screw |
| 12. Lead, #3T | 25. Bracket |
| 13. Lead, #4B | 26. Tie, Cable |

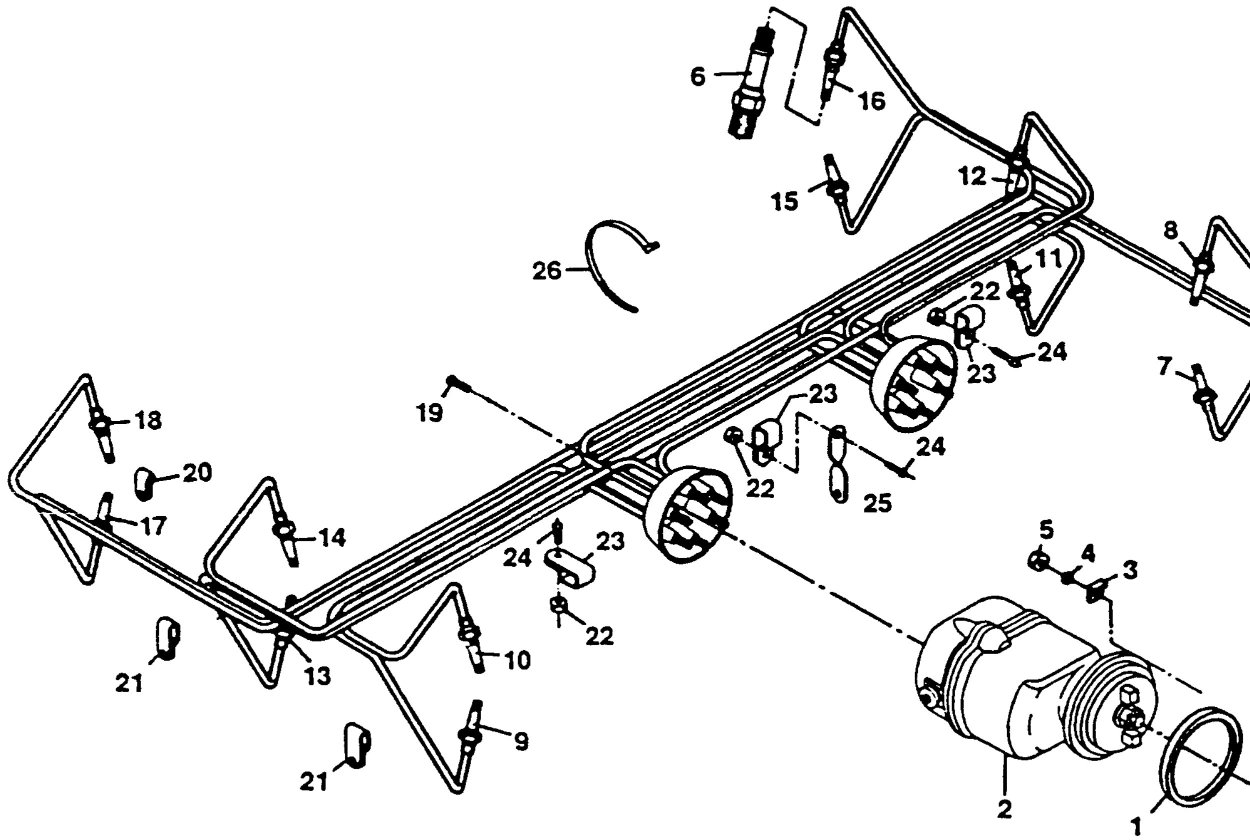



**FIGURE 8-1C. IGNITION SYSTEM FOR I0-550-B15B, B16B, B17B, B18B, B19B, B25B, B32B, B37B, I0-550-C12B, C13B, C15B, C22B, C27B, C30B**

## 8-1D IGNITION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 8-1D)

1. Remove ignition harness assembly
   a. Remove ignition lead from each spark plug (7). Remove all cable ties (12).
   b. On each magneto, remove three screws from cable outlet plate. Remove plates from magnetos (1).
   c. Remove ignition harness assembly from engine and discard.
2. Remove nuts (4), lock washers (5), and magneto holding washers (6) from each magneto.
3. Remove both magnetos (1) from the engine. Discard cable ties (12) and lock washers (5).

*CAUTION…Use care to avoid dropping magneto drive bushings and retainers into the engine. See Figure 8-2A.*

4. Magneto assemblies must be overhauled in accordance with the magneto manufacturer's instructions. see Slick Ignition Systems Master Service Manual, Index and Order Form Number F-1100. See Section 1-5, "Related Publications," for ordering information.

Nomenclature for Figure 8-1D.

| | |
|---|---|
| 1. Magneto | 7. Sparkplug |
| 2. Harness, Ignition | 8. Clamp |
| 3. Gasket | 9. Bracket |
| 4. Nut | 10. Screw |
| 5. Washer, Lock | 11. Nut, Speed |
| 6. Washer, Holding | 12. Tie, Cable |

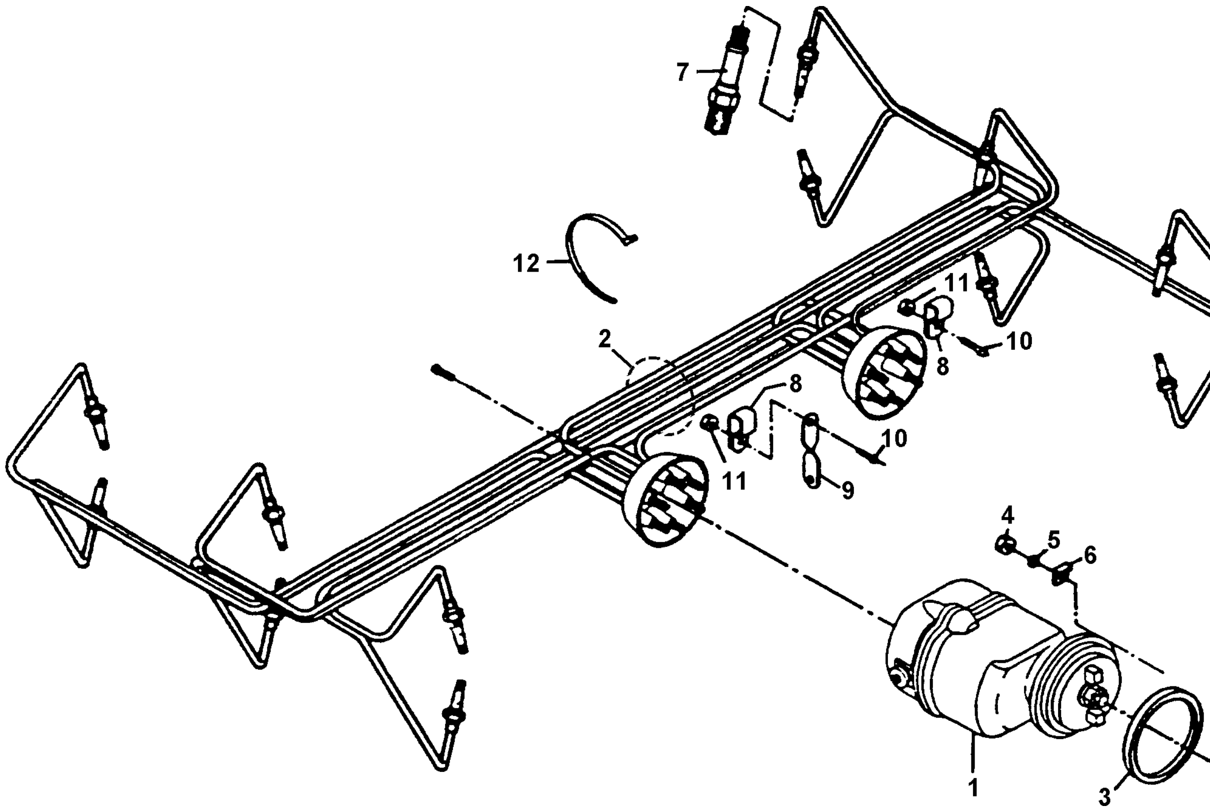



**FIGURE 8-1D. IGNITION SYSTEM FOR I0-550-B6A, B6F, B11B, B12B, B13B, B14B, B23B, B24B, B28B, B29B, B35B, I0-550-C6A, C6F, C8B, C9B, C11B, C17B, C19B, C21B, C25B**

## 8-1E IGNITION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 8-1E)

1. Remove ignition harness assembly
   a. Remove ignition lead from each spark plug (6). Remove all cable ties (27).
   b. On each magneto, remove four screws (20) and lock washers (19) from cable outlet plate. Remove plates from magnetos (2).
   c. Remove ignition harness assembly from engine and discard.
2. Disconnect ground terminal kit from magnetos (2) in accordance with airframe manufacturer's instructions.
3. Remove nuts (5), lock washers (4), and magneto holding washers (3) from each magneto.
4. Remove both magnetos (2) from the engine. Discard cable ties (27) and lock washers (4, 19).

*CAUTION…Use care to avoid dropping magneto drive bushings and retainers into the engine. See Figure 8-2A.*

5. Magneto assemblies must be overhauled in accordance with the magneto manufacturer's instructions. see TCM ignition systems Master Service Manual, Form No. X40000. See Section 1-5, "Related Publications," for ordering information.

Nomenclature for Figure 8-1E.

| | | |
|---|---|---|
| 1. Gasket | 11. Lead, #3B | 21. Clamp |
| 2. Magneto | 12. Lead, #3T | 22. Clamp |
| 3. Washer, Holding | 13. Lead, #4B | 23. Nut |
| 4. Washer, Lock | 14. Lead, #4T | 24. Clamp |
| 5. Nut | 15. Lead, #5B | 25. Screw |
| 6. Sparkplug | 16. Lead, #5T | 26. Bracket |
| 7. Lead, #1B | 17. Lead, #6B | 27. Tie, Cable |
| 8. Lead, #1T | 18. Lead, #6T | 28. Kit, Ground Terminal |
| 9. Lead, #2B | 19. Washer, Lock | |
| 10. Lead, #2T | 20. Screw | |

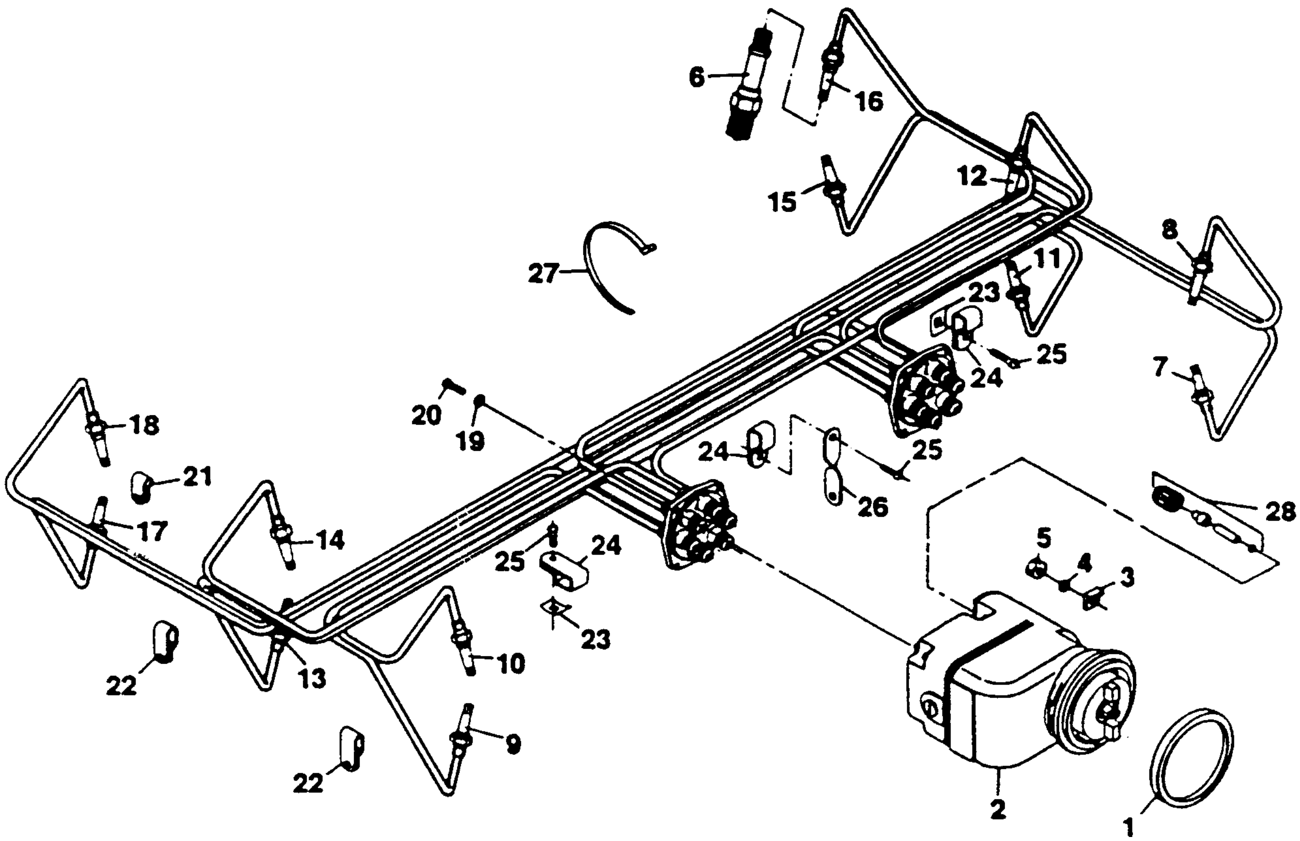



**FIGURE 8-1E. IGNITION SYSTEM FOR I0-550-G, G1B, G2B, G4B, I0-550-N, N1B, N7B, I0-550-P1B, I0-550-R1B**

## 8-1F IGNITION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 8-1F)

1. Remove ignition harness assembly
   a. Remove ignition lead from each spark plug (6). Remove all cable ties (27).
   b. On each magneto, remove four screws (20) and lock washers(19) from cable outlet plate. Remove plates from magnetos (2).
   c. Remove ignition harness assembly from engine and discard.
2. Disconnect magneto sensor unit (29) from airframe connector in accordance with the airframe manufacturer's instructions. Disconnect ground terminal kit (28) from magnetos (2) in accordance with airframe manufacturer's instructions.
3. Remove nuts (5), lock washers (4), and magneto holding washers (3) from each magneto.
4. Remove both magnetos (2) from the engine. Discard cable ties (27) and lock washers (4, 19).

*CAUTION…Use care to avoid dropping magneto drive bushings and retainers into the engine. See Figure 8-2B.*

5. Magneto assemblies must be overhauled in accordance with the magneto manufacturer's instructions. see TCM ignition systems Master Service Manual, Form No. X40000. See Section 1-5, "Related Publications," for ordering information.

Nomenclature for Figure 8-1F.

| | | |
|---|---|---|
| 1. Gasket | 11. Lead, #3B | 21. Clamp |
| 2. Magneto | 12. Lead, #3T | 22. Clamp |
| 3. Washer, Holding | 13. Lead, #4B | 23. Nut |
| 4. Washer, Lock | 14. Lead, #4T | 24. Clamp |
| 5. Nut | 15. Lead, #5B | 25. Screw |
| 6. Sparkplug | 16. Lead, #5T | 26. Bracket |
| 7. Lead, #1B | 17. Lead, #6B | 27. Tie, Cable |
| 8. Lead, #1T | 18. Lead, #6T | 28. Kit, Ground Terminal |
| 9. Lead, #2B | 19. Washer, Lock | 29. Mag. Sensor Unit |
| 10. Lead, #2T | 20. Screw | |

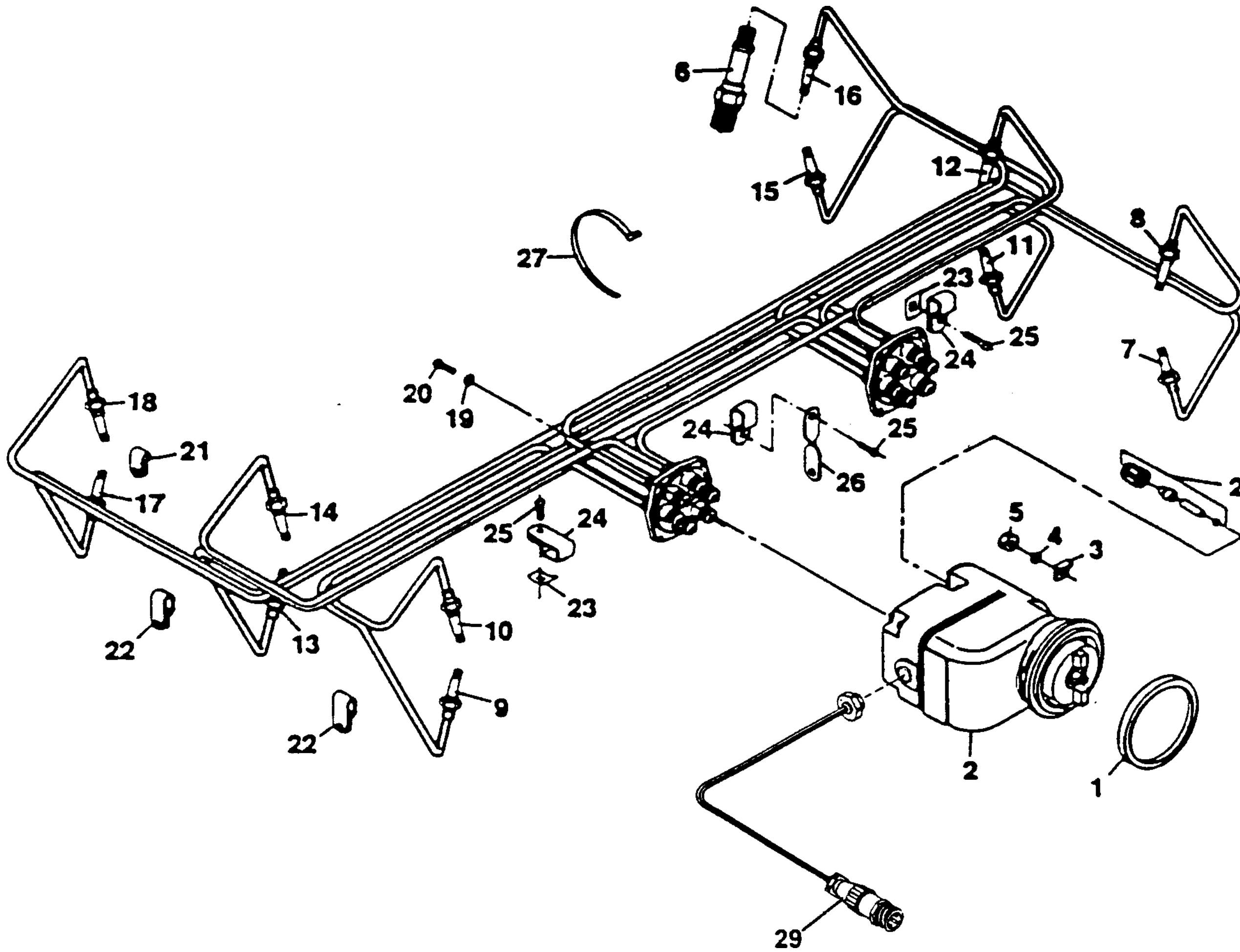



FIGURE 8-1F. IGNITION SYSTEM FOR I0-550-G5B, G6B, I0-550-N2B, N6B, N8B

## 8-2A ACCESSORY DRIVE PAD REMOVAL (See Figure 8-2A)

1. Remove both magneto accessory drive assemblies:
   a. Carefully slide each magneto drive gear assembly (12 through 15) out of accessory drive adapter.
2. Remove attaching hardware (6 through 11) and remove accessory drive assemblies from rear of crankcase.
3. Place the accessory drive components in a clean, protected area until they are to be overhauled.

Nomenclature for Figure 8-2A.

| | | |
|---|---|---|
| 1. Gasket | 8. Washer, Lock | 15. Bushing |
| 2. Adapter, Assembly | 9. Washer, Lock | 16. Gasket |
| 3. Bushing | 10. Nut | 17. Cover |
| 4. Seal, Oil | 11. Nut | 18. Washer, Plain |
| 5. Stud | 12. Gear, Assembly | 19. Washer, Lock |
| 6. Washer, Plain | 13. Sleeve | 20. Nut |
| 7. Washer, Plain | 14. Retainer | |

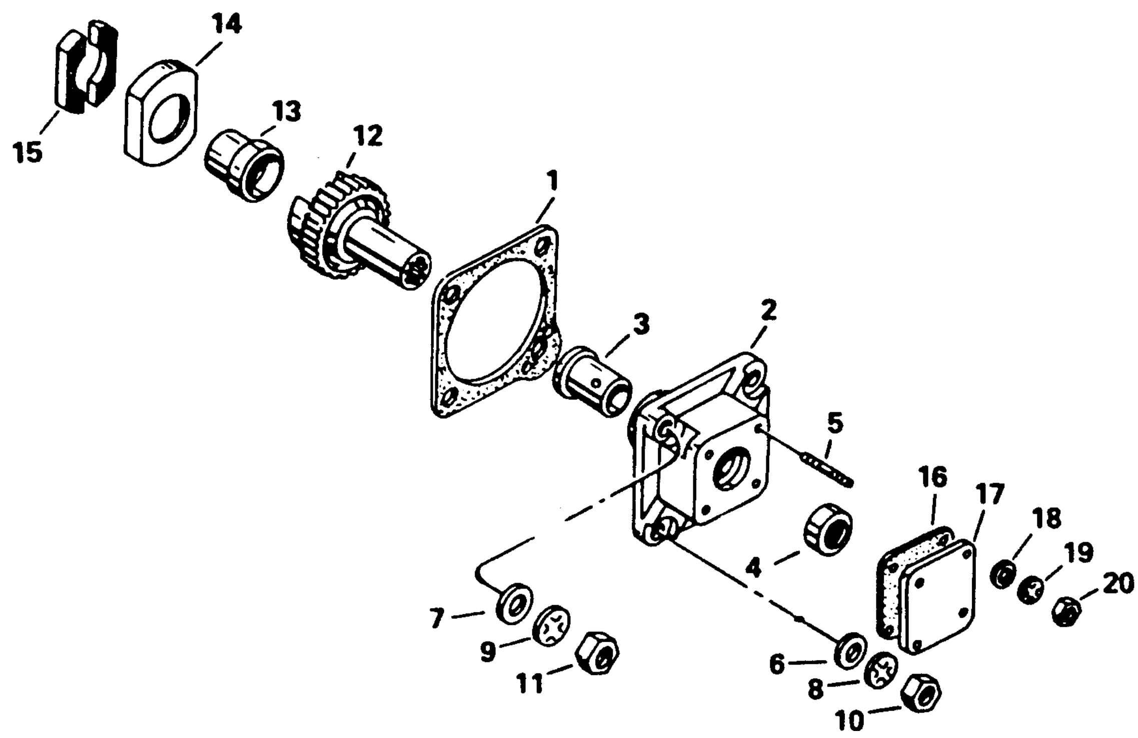



**FIGURE 8-2A. MAGNETO AND ACCESSORY DRIVE ASSEMBLY I0-550-A, B, C, G, G1B, G2B, G4B, G6B, I0-550-N, I0-550-P & I0-550-R**

## 8-2B ACCESSORY DRIVE PAD REMOVAL (See Figure 8-2B)

1. Remove both magneto accessory drive assemblies:
   a. Carefully slide each magneto drive gear assembly (16 through 19) out of accessory drive adapter.
2. Remove attaching hardware (10 through 15) and remove accessory drive assemblies from rear of crankcase.
3. Place the accessory drive components in a clean, protected area until they are to be overhauled.

Nomenclature for Figure 8-2B.

1. Gasket
2. Adapter, Assembly
3. Bushing
4. Seal, Oil
5. Stud
6. Adapter, Assembly
7. Bushing
8. Seal, Oil
9. Helical, Coil
10. Washer, Plain
11. Washer, Plain
12. Washer, Lock
13. Washer, Lock
14. Nut
15. Nut
16. Gear, Assembly
17. Sleeve
18. Retainer
19. Bushing
20. Gasket
21. Cover
22. Washer, Plain
23. Washer, Lock
24. Nut
25. Screw

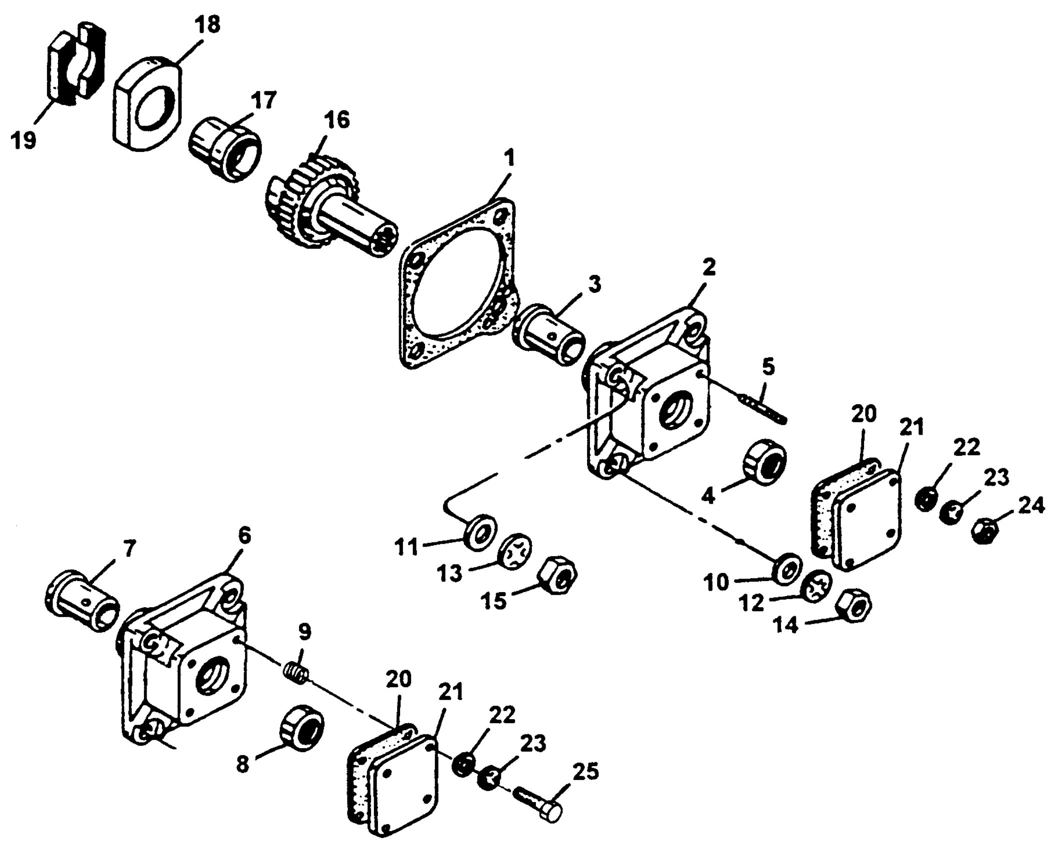



**FIGURE 8-2B. MAGNETO AND ACCESSORY DRIVE ASSEMBLY I0-550-G5B**

## 8-3A MAGNETO ACCESSORY DRIVE DISASSEMBLY

1. See Figure 8-2A. Remove attaching hardware (18, 19, 20) and remove covers, gaskets (16, 17) from accessory drive adapters. Discard gaskets (1, 16) and lock washers (8, 9, 19).
2. Separate rubber drive bushings (15), retainers (14), and drive gear assemblies (12). Discard rubber drive bushings (15).

## 8-3B MAGNETO ACCESSORY DRIVE DISASSEMBLY

3. See Figure 8-2B. Remove attaching hardware (22, 23, 24) and remove covers, gaskets (1, 20) from accessory drive adapters. Discard gaskets (1, 20) and lock washers (12, 13, 23).
4. Separate rubber drive bushings (19), retainers (18), and drive gear assemblies (16). Discard rubber drive bushings (19).

## 8-4 CLEANING.

1. Discard all magneto accessory drive parts listed in section 6-6, "100% Replacement Parts."

2. Clean the magneto drive gear assemblies and adapters using mineral spirit solvent or by immersion in an alkaline stripping bath if mineral spirits solvent is not effective. After cleaning with alkaline solution, the parts must be sprayed with steam to remove all traces of alkaline. After steam rinsing, the parts must be thoroughly flushed with mineral spirits solvent. Insure that the magneto drive adapter lubrication holes are clear and unobstructed.

*CAUTION...Alkaline cleaning solutions will cause corrosion on metals if not completely removed.*

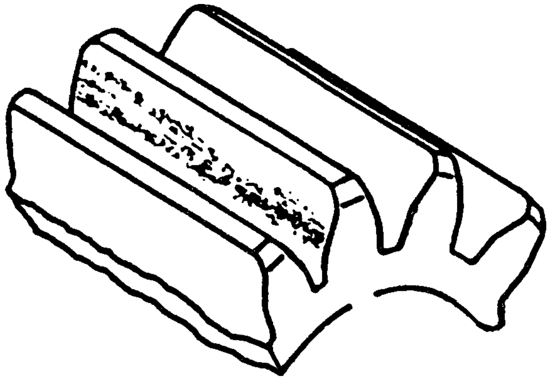
### WARNING

**Do not pressure blast gears with an abrasive media. Blasting will remove surface hardening.**

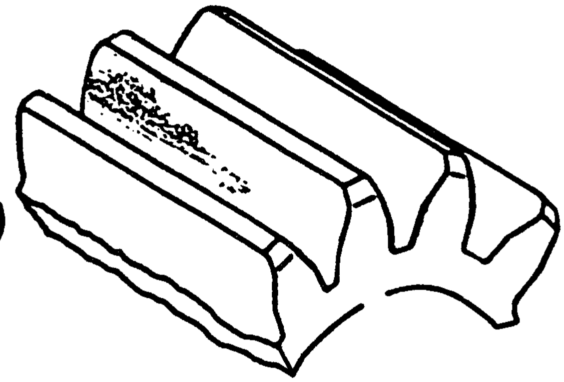
## 8-5 MAGNETO DRIVE GEAR INSPECTION

1. Inspect the magneto drive gear teeth for signs of overheating and excessive wear. Normal wear produces a fine polish on the tooth thrust faces. Gears that have alteration of the tooth profiles, score marks, burning, pitting, nicks, burrs or corrosion must be discarded. See Figure 8-3, “Gear Tooth Inspection,” for acceptable and unacceptable gear tooth wear.

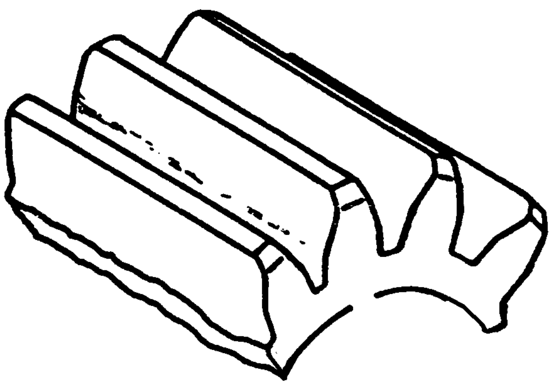
2. Using a flashlight visually inspect the magneto adapter oil seal and bushing bores for damage resulting from bushing and oil seal removal process. Inspect the adapter housing for cracks Magneto adapter housings with damaged oil seal bores, bushing bores, or that exhibit cracks must be discarded. Inspect all oil passages for restrictions. Magneto adapters with oil passages that cannot be cleared of obstructions must be discarded.



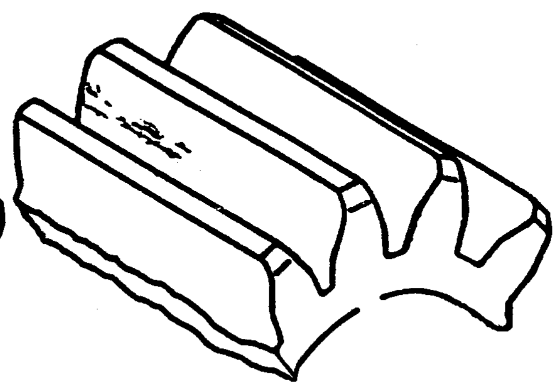
**UNACCEPTABLE**
**HEAVY WEAR, SPALLING AND PITTING**
**FULL TOOTH WIDE**



**UNACCEPTABLE**
**HEAVY WEAR, SPALLING AND PITTING**
**PARTIAL TOOTH WIDTH**



**ACCEPTABLE**
**LIGHT WEAR LINE,**
**FULL TOOTH WIDTH**
**UP TO 0.01" WIDE**



**ACCEPTABLE**
**MODERATE WEAR LINE,**
**NO MORE THAN 50% TOOTH**
**LENGTH AND 0.05" WIDE**

**FIGURE 8-3. GEAR TOOTH INSPECTION**

Inspect all studs for looseness and distorted or stripped threads. Inspect studs for corrosion pitting, incomplete threads and looseness. Replace studs with any of these indications.

Check studs with tool makers square for alignment. The magneto adapter studs must have their setting heights checked for indications of backing out. See Figure 8-4 for drive adapter stud setting heights.

| ITEM NO. | LOCATION | THREAD SIZE | SETTING HEIGHT | QUANTITY |
|---|---|---|---|---|
| 1 | Accessory to Adapter | 1/4-20 X 1/4-28 | .87-.90 | 4 |

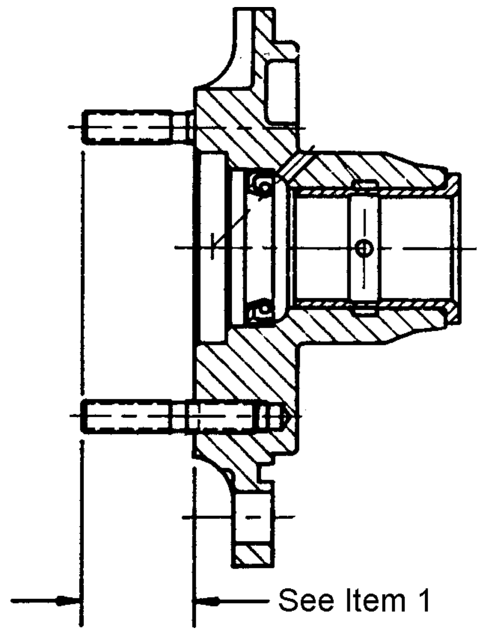



**FIGURE 8-4. ACCESSORY DRIVE ADAPTER STUD SETTING HEIGHTS**

## FLUORESCENT PENETRANT INSPECTION

Aluminum alloy components such as the magneto accessory drive adapters must be fluorescent penetrant inspected by a certified technician in accordance with section 6-12, "Fluorescent Penetrant Inspection." Adapters exhibiting cracks must be discarded.

## MAGNETIC PARTICLE INSPECTION

Magneto drive gears and drive bushing retainers must be inspected by a certified technician in accordance with section 6-9, "Magnetic Particle Inspection." Magneto drive gears and retainers that exhibit cracks must be discarded.

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.
All components must be thoroughly cleaned and air dried prior to dimensional inspection.

| Ref. No. | Description | New Parts Min. | New Parts Max. |
|---|---|---|---|
| 1. | Bushing in magneto and accessory drive adapter ...........Diameter: | 0.0010T | 0.0040T |
| 2. | Magneto and assy. 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 | 0.0040T |
| 5. | Magneto coupling retainer on magneto and accessory 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 | 0.0280L |
| 8. | Magneto coupling rubber bushings on magneto drive lugs.......................................... Side Clearance: | 0.014L | 0.052T |
| 9. | Magneto pilot in crankcase ..............................................Diameter: | 0.001L | 0.005L |

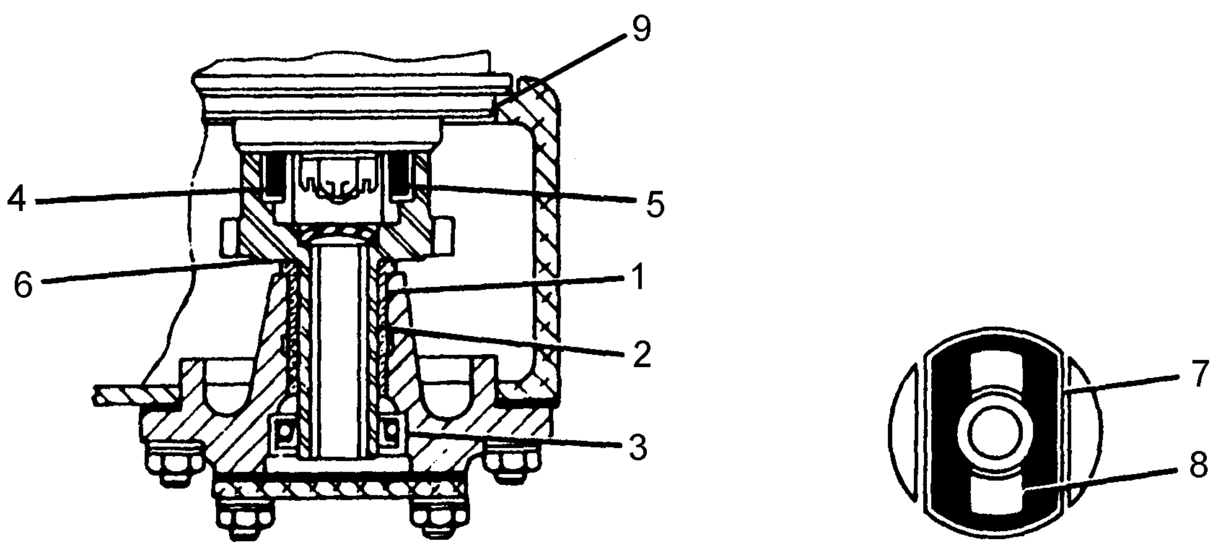



**FIGURE 8-5. MAGNETO DRIVE ADAPTER FITS AND LIMITS**

## 8-6 MAGNETO AND ACCESSORY DRIVE ADAPTER ASSEMBLY REPAIR

1. Remove the drive adapter bushings for inspection and replacement. Turn down the bushing flange to the body diameter of 0.939 of an inch and bore out the bushing to a thin shell that can be collapsed and removed. All boring operations must be on center. Take care to prevent cutting into the end of the adapter boss or marking the adapter bore.
2. The old magneto adapter oil seals must be removed by driving out with a 1/8 inch diameter pin punch inserted through the four oblique oil holes in the bushing boss alternately. if the seal is too tight for that method drill and tap two opposite machine screw holes in the exposed flange of the seal case that will match two screw clearance holes in a pressure plate. Do not allow drill to pass through the seal case into the adapter. Lay pressure plate on the adapter studs. Run nuts on two long machine screws; then insert the screws through the pressure plate holes and screw them into the holes tapped in the seal. To avoid unnecessary stoning of the seal bore tighten the nuts against the plate and pull the seal squarely from its recess.
3. After bushing removal clean the adapters using mineral spirit solvent. Insure that all lubrication passages are clear and unobstructed.
4. Bushings and oil seals must be installed in the magneto drive adapters using the following procedure and special tools:
   a. Arbor Press.
   b. Heavy Duty Drill Press.
   c. Size Range (25132-27132) Adjustable Blade Reamer Adjusted to .8150 Diameter.
   d. Large Spot facer
   e. 90° Countersink Bit

### MAGNETO ADAPTER BUSHING INSTALLATION

*CAUTION…Before reaming a new bushing, plug the oil holes with beeswax to exclude chips from the adapter groove. Be sure to remove the wax completely after the operation.*

1. Install the magneto drive adapter on an arbor press. The rear flange of the adapter rather than the studs must be supported on a parallel and flat block.
2. Press a new bushing into each magneto adapter after dipping in clean aviation lubricating oil.
3. Bore the bushing to 0.8145-0.8155 diameter using the specified reamer and heavy duty drill press.
4. If necessary, face the bushing flange until it projects forward 1.454-1.458 inch from the adapter parting surface.
5. If necessary, chamfer the bore at the flange end 1/16 inch deep on a 45° angle, and slightly break sharp edges at both ends. The bushing hole must be concentric with the adapter pilot shoulder within 0.002 inch per inch of length. Its flange thrust face must be parallel to the parting surface within 0.002 inch (full indicator reading).
6. Using the above procedure install new bushing in remaining magneto adapter. Smooth any scores in the adapter oil seal counterbore. Clean the magneto adapters removing all debris from boring process.

## MAGNETO ADAPTER OIL SEAL INSTALLATION

1. Re-install the magneto drive adapter on the arbor press. The front face of the adapter bushing must be supported on a parallel and flat block.
2. Coat the periphery of new oil seal with a thin translucent coat of TCM gasket maker P/N 646942.
3. Press the new oil seal into the magneto adapter using a flat end block of 1-3/8 inch diameter by 1/4 inch length. The oil seal is pressed in until it bottoms out. Do not crush the oil seal case.
4. Using the above procedure install a new oil seal in the remaining adapter.

## STUDS, HELICAL COILS AND PROTECTIVE COATING

1. Replace any damaged or loose studs in accordance with the procedure in section 6-22, "Stud Replacement."
2. Replace any damaged or loose helical coils in accordance with the procedure in section 6-21, "Helical Coil Insert Replacement."
3. Section 6-19, "Application Of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing.

## 8-7 SUB-ASSEMBLY.

1. Magneto assemblies must be sub-assembled in accordance with the magneto manufacturer's instructions. See Slick Ignition Systems Master Service Manual, Index and Order Form Number F-1100. See Section 1-5, "Related Publications," for ordering information.
2. The magneto drive gear and adapter assemblies and magnetos will be installed on the engine during final engine assembly. Store all components in a clean protected area until final engine assembly.

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# CHAPTER 9

# FUEL INJECTION SYSTEM

**SECTION** **PAGE**



**FIGURE** **PAGE**

## 9-1A FUEL INJECTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 9-1A)

1. Mark each fuel injection line (19) through (24) with its cylinder number to facilitate re-installation.

### 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 (19 through 24) from fuel nozzles (25).
    b. Disconnect other end of fuel lines from fuel manifold valve assembly (18) and remove fuel lines from engine.

3. Fuel Nozzle Removal:

    a. Remove fuel nozzles (25) from each cylinder.

4. Remove fuel hoses (35, 36) from fuel control unit and fuel pump. Remove fuel hose (35) from fuel control unit and manifold valve. Discard fuel hoses (35, 36).
5. Remove the throttle and fuel control unit in accordance with the airframe/STC holders instructions. Place the throttle and fuel control unit in a clean, protected area until it is to be overhauled.
6. Remove the crankcase backbone hardware that secures the fuel manifold valve to the engine and remove fuel manifold valve (18). Place the fuel manifold valve in a clean, protected area until it is to be overhauled.
7. Remove nuts (34), lock washers (33) and hold down washers (32). Remove fuel pump assembly (3) and gasket (2A). Reach into crankcase fuel pump cavity and remove drive coupling (2). Discard fuel pump gasket (2A) and lock washers (33). Place the fuel pump in a clean, protected area until it is to be overhauled.

Nomenclature for Figure 9-1A

| | | |
|---|---|---|
| 1. Fuel Injection System | 12. Spring | 25. Nozzle, Fuel |
| 2. Coupling | 13. Rod End | 26. Shield |
| 2A. Gasket | 14. Nut, Self Locking | 27. Screen |
| 3. Fuel Pump | 14A. Pin | 28. Jet |
| 4. Throttle Assembly | 15. Washer, Wave | 29. Nozzle |
| 4A. Throttle And Control Unit | 16. Washer | 30. Clamp |
| 5. Fuel Control Unit | 17. Pin, Cotter | 31. Bracket |
| 6. Lever | 18. Fuel Manifold Valve | 32. Washer, Hold Down |
| 7. Bushing | 19. Tube, Fuel, Cyl. 6 | 33. Washer, Lock |
| 8. Washer, Tab | 20. Tube, Fuel, Cyl. 4 | 34. Nut |
| 9. Screw | 21. Tube, Fuel, Cyl. 2 | 35. Hose |
| 10. Rod And Link | 22. Tube, Fuel, Cyl. 5 | 36. Hose |
| 10A. Rod And Link Assembly | 23. Tube, Fuel, Cyl. 3 | |
| 11. Nut, Plain | 24. Tube, Fuel, Cyl. 1 | |

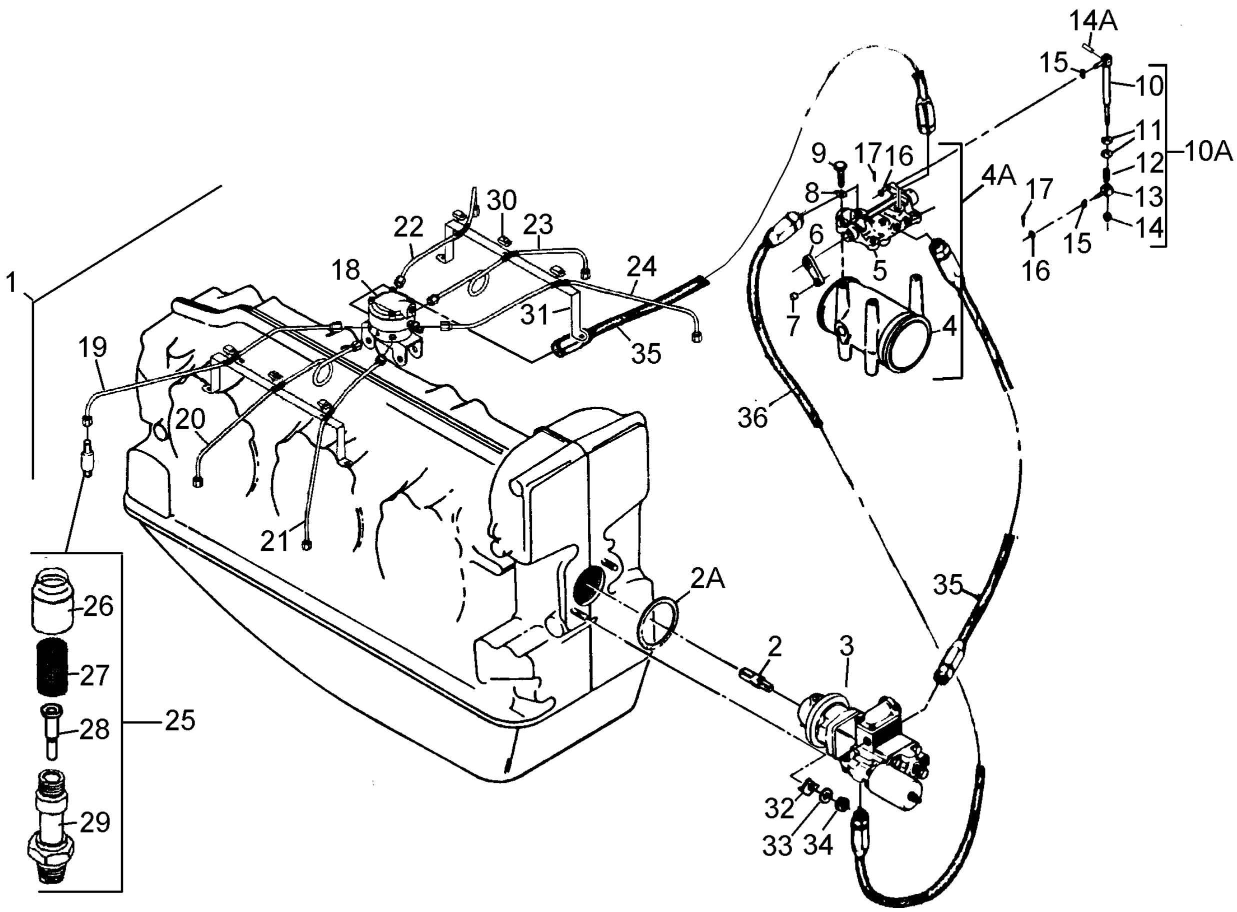



**FIGURE 9-1A. FUEL INJECTION SYSTEM FOR I0-550-A**

## 9-1B FUEL INJECTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 9-1B)

1. Mark each fuel injection line (30, 45, 46, 47) with its cylinder number to facilitate re-installation.

### 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 (30, 45, 46, 47) from fuel nozzles (31).
   b. Disconnect other end of fuel lines from fuel manifold valve assembly (27). Compress spring legs of each clamp (33) and remove fuel lines from engine.

3. Fuel Nozzle Removal:

   a. Remove fuel nozzles (31) from each cylinder.

4. Remove attaching hardware (14B, 40, 41, 42). Loosen and remove hose (29) from manifold valve (27) and fuel control (5). Loosen and remove hose assemblies (28) from fuel pump (3) and fuel control (5).
5. Remove bolts (13) and washers (12). Remove throttle and fuel control, as an assembly, from the engine oil sump. Remove cotter pins (15), linkage (14A, 14B, 16, 17, 18), spring (22) and wave washers (19) from throttle (4A) and fuel control (5).
6. Remove nuts (26), lock washers (25), washers (24) and shroud (23) from fuel control. Discard lock washers (25). Bend tab washers down and remove standoff bolts (11). Separate fuel control unit (5) from throttle (4A). Discard tab washers (10). Place the throttle and fuel control unit in a clean, protected area until they are to be overhauled.
7. Remove the crankcase backbone hardware that secures the fuel manifold valve to the engine and remove fuel manifold valve (27). Place the fuel manifold valve in a clean, protected area until it is to be overhauled.
8. Remove nuts (36), lock washers (35) and hold down washers (34). Remove fuel pump assembly (3) and gasket (3A). Reach into crankcase fuel pump cavity and remove drive coupling (2). Discard fuel pump gasket (3A) and lock washers (35). Place the fuel pump in a clean, protected area until it is to be overhauled.

Nomenclature for Figure 9-1B

1. Fuel Injection System
2. Coupling
3. Fuel Pump
3A. Gasket
4. Throttle Assembly
4A. Throttle And Control Unit
5. Fuel Control Unit
6. Shield
7. Screen
8. Jet
9. Nozzle
10. Washer, Tab
11. Screw
12. Washer
13. Screw
14. Rod And Link Assy.
A. Rod And Link
14B. Nut
15. Pin, Cotter
16. Spring
17. Rod End
18. Nut, Self Locking
19. Washer, Wave
20. Washer
21. Pin
22. Spring
23. Shroud
24. Washer
25. Washer, Lock
26. Nut
27. Fuel Manifold Valve
28. Hose
29. Hose
30. Tube, Fuel, Cyl. 1&6
31. Nozzle, Fuel
32. Bracket
A. Bracket
33. Clamp
34. Washer, Hold Down
35. Washer, Lock
36. Nut, Plain
37. Bracket
38. Clamp
39. Clamp
40. Screw
41. Washer
42. Washer, Lock
43. Shroud
44. Grommet
45. Tube, Fuel, Cyl. 2
46. Tube, Fuel, Cyl. 5
47. Tube, Fuel, Cyl. 3&4

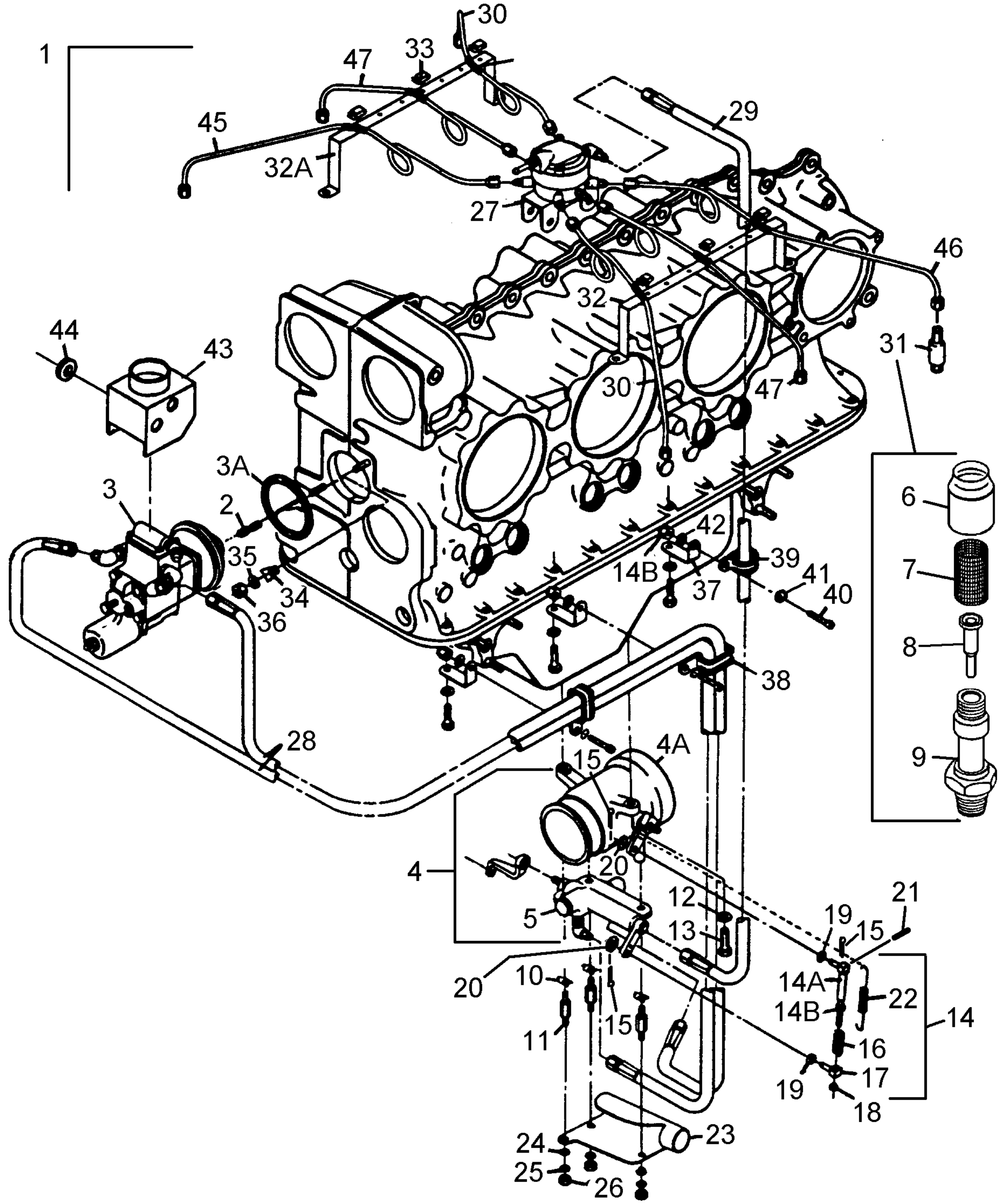



**FIGURE 9-1B. FUEL INJECTION SYSTEM FOR I0-550-B**

## 9-1C FUEL INJECTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 9-1C)

1. Mark each fuel injection line (26, 35, 36, 37) with its cylinder number to facilitate re-installation.

**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 (26, 35, 36, 37) from fuel nozzles (27).
   b. Disconnect other end of fuel lines from fuel manifold valve assembly (23) and remove fuel lines from engine.

3. Fuel Nozzle Removal:

   a. Remove fuel nozzles (27) from each cylinder.

4. Remove fuel hoses (24) from fuel control unit and fuel pump. Remove fuel hose (25) from fuel control unit and manifold valve. Discard fuel hoses (24, 25).
5. Remove attaching hardware (20, 21, 22) and fuel control shroud (19). Remove cotter pins (17) and washers (15, 16). Remove link rod assembly (10 through 14) and spring (18). Bend tabs of tab washers (7) down. Remove bolts (9), standoff bolts (8) and tab washers (7). Separate fuel control (5) from throttle body (4). Discard tab washers(7), lock washers (21), self locking nut (14), springs (12, 18), cotter pins (17) and wave washers (15). Loosen and remove nut, bolt (49, 50), brackets (47, 48), bushings (45) sleeve (46) from bracket (42). The hardware that attaches bracket (42) to engine was removed during magneto and accessory drive adapter disassembly. Remove bracket (42). Discard self locking nut (50). Remove nuts (22) and bracket (51). Remove throttle (4) from engine. Discard gasket (53). Place the throttle and fuel control unit in a clean, protected area until it is to be overhauled.
6. Remove the crankcase backbone hardware that secures the fuel manifold valve to the engine and remove fuel manifold valve (23). Place the fuel manifold valve in a clean, protected area until it is to be overhauled.
7. Remove nuts (32), lock washers (31) and hold down washers (30). Remove fuel pump assembly (3) and gasket (3A). Reach into crankcase fuel pump cavity and remove drive coupling (2). Discard fuel pump gasket (3A) and lock washers (31). Place the fuel pump in a clean, protected area until it is to be overhauled .

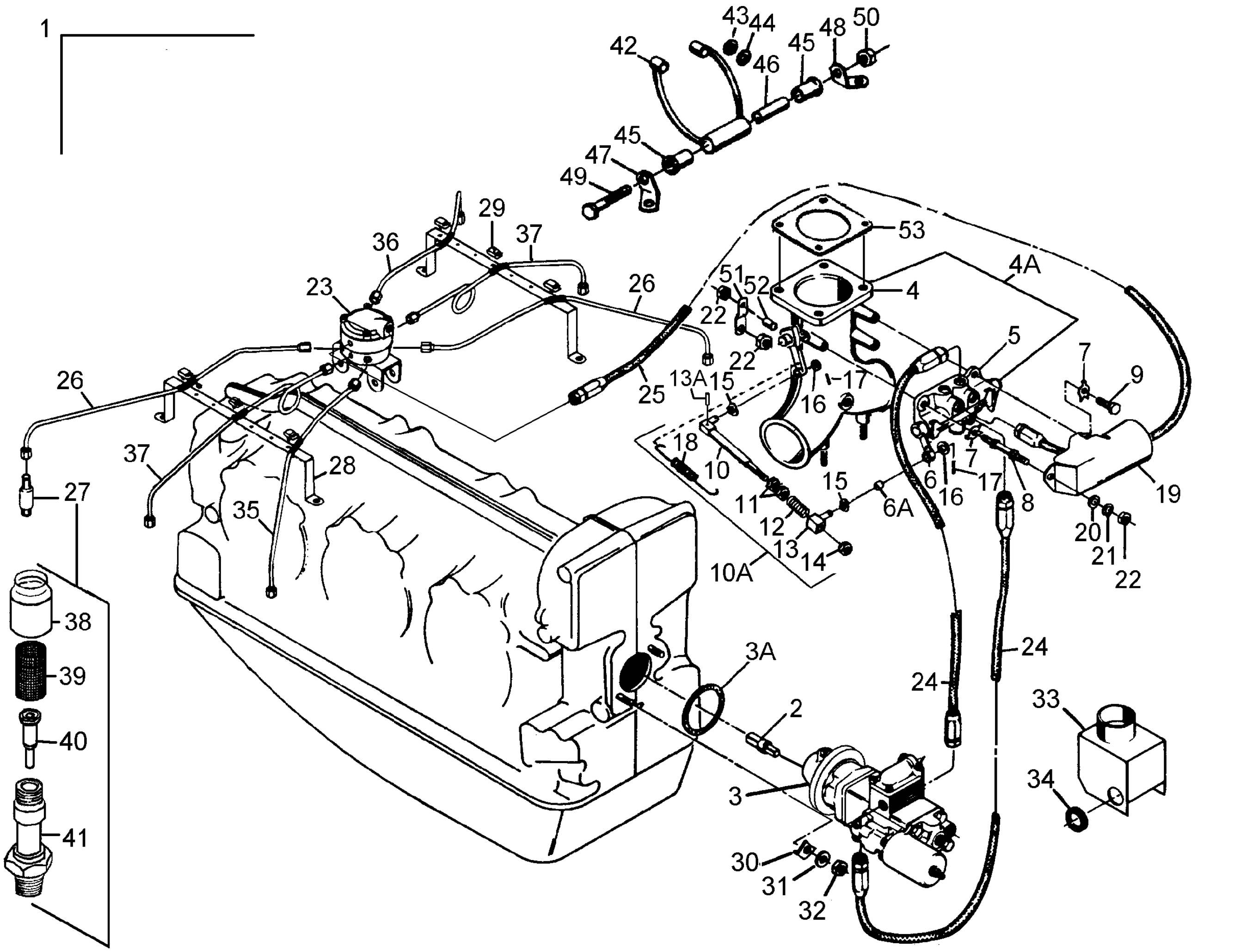



**FIGURE 9-1C. FUEL INJECTION SYSTEM FOR I0-550-C**

1. Fuel Injection System
2. Coupling
3. Fuel Pump
3A. Gasket
4. Throttle Assembly
4A. Throttle And Control Unit
5. Fuel Control Unit
6. Lever
6A. Bushing
7. Washer, Tab
8. Screw
9. Screw
10. Rod And Link
10A. Rod And Link Assembly
11. Nut, Plain
12. Spring
13. Rod End
A. Pin
14. Nut, Self Locking
15. Washer, Wave
16. Washer
17. Pin, Cotter
18. Spring
19. Shroud
20. Washer
21. Washer, Lock
22. Nut
23. Fuel Manifold Valve
24. Hose
25. Hose
26. Tube, Fuel, Cyl. 1&6
27. Nozzle, Fuel
28. Bracket
29. Clamp
30. Washer, Hold Down
31. Washer, Lock
32. Nut
33. Shroud
34. Grommet
35. Tube, Fuel, Cyl. 2
36. Tube, Fuel, Cyl. 5
37. Tube, Fuel, Cyl. 3&4
38. Shield
39. Screen
40. Jet
41. Nozzle
42. Bracket
43. Spacer
44. Washer
45. Bushing
46. Sleeve
47. Bracket
48. Bracket
49. Bolt
50. Nut, Self Locking
51. Bracket
52. Spacer
53. Gasket

## 9-1D FUEL INJECTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 9-1D)

1. Mark each fuel injection line (19) through (24) with its cylinder number to facilitate re-installation.

### 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 (19 through 24) from fuel nozzles (28).
   b. Disconnect other end of fuel lines from fuel manifold valve assembly (12). Compress spring legs of each clamp (27) and remove fuel lines from engine.

3. Fuel Nozzle Removal:

   a. Remove fuel nozzles (28) from each cylinder.

4. Remove fuel hose (37) from fuel metering unit and fuel pump. Discard fuel hose (37).
5. See Figure 10-1D. Remove four bolts (19), lock washers (14), and washers (15). Remove throttle and metering unit. Remove and discard gasket (1). Discard lock washers (14). Place the throttle and fuel metering unit in a clean, protected area until it is to be overhauled.
6. See Figure 9-1D. Remove bolts (18), washers (17), spacers (16) and remove fuel manifold valve from the induction air manifold. Place the fuel manifold valve in a clean, protected area until it is to be overhauled.
7. Remove nuts (6), lock washers (5) and hold down washers (4). Remove fuel pump assembly (3) and gasket (2A). Reach into crankcase fuel pump cavity and remove drive coupling (2). Discard fuel pump gasket (2A) and lock washers (5). Place the fuel pump in a clean, protected area until it is to be overhauled.

Nomenclature for Figure 9-1D

| | | | |
|---|---|---|---|
| 1. Fuel Injection System | 11. Elbow | 22. Tube, Fuel, Cyl. 3 | 35. Washer |
| 2. Coupling | 12. Fuel Manifold Valve | 23. Tube, Fuel, Cyl. 2 | 36. Washer, Copper |
| 2A. Gasket | 13. Bracket | 24. Tube, Fuel, Cyl. 1 | 37. Hose |
| 3. Fuel Pump | A. Bracket | 25. Bracket | 38. Elbow |
| 4. Washer, Hold Down | B. Bumper, Rubber | 26. Bracket | 39. Adapter |
| 5. Washer, Lock | 14. Washer | 27. Clamp | 40. Tube |
| 6. Nut | 15. Screw | 28. Nozzle | 40A. Sleeve |
| 7. Protector | 16. Spacer | 29. Jet | 41. Cap |
| 8. Throttle And Met. Unit | 17. Washer | 30. Nozzle, Fuel | 42. Tee |
| 8A. Lever | 18. Bolt | 31. O-Ring | |
| 8B. Bushing | 19. Tube, Fuel, Cyl. 6 | 32. Screen | |
| 9. Elbow | 20. Tube, Fuel, Cyl. 5 | 33. Shield | |
| 10. Cap | 21. Tube, Fuel, Cyl. 4 | 34. Washer | |

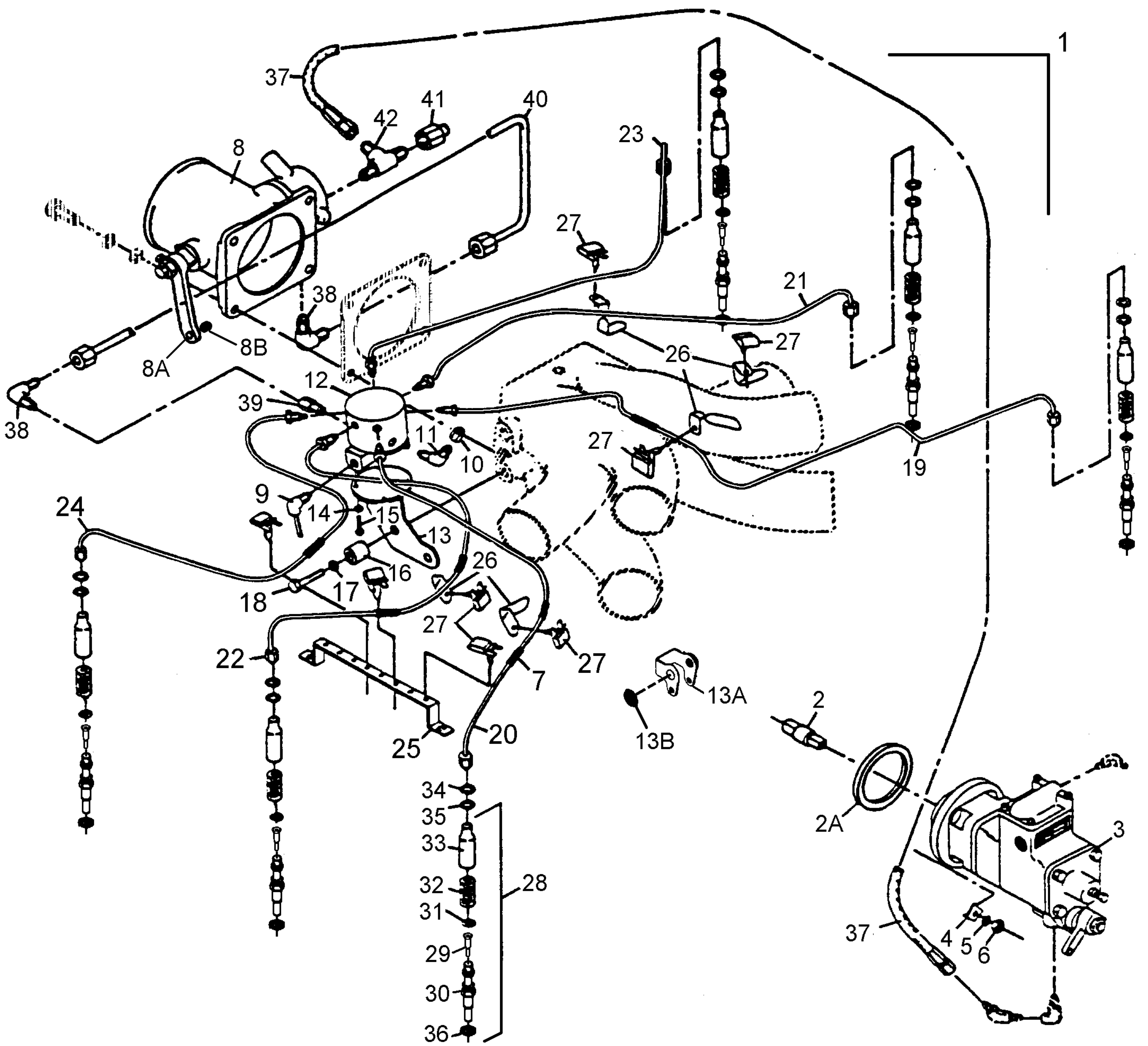



**FIGURE 9-1D. FUEL INJECTION SYSTEM FOR I0-550-G, N, P, R**

## 9-2 FUEL INJECTION SYSTEM COMPONENT DISASSEMBLY

### FUEL MANIFOLD VALVE

1. See Figures 9-2A, 2B & 2C as applicable. Remove fittings "A" through "C."

The fuel manifold valve must be overhauled in accordance with TCM Fuel Injection Systems Overhaul Manual and Parts Catalog, Form X30593A or replaced with a serviceable unit. See section 1-5, "Related Publications," for ordering information. Teledyne Continental Motors offers factory rebuilt fuel injection system components at exchange prices as an alternative to field overhaul of these units.

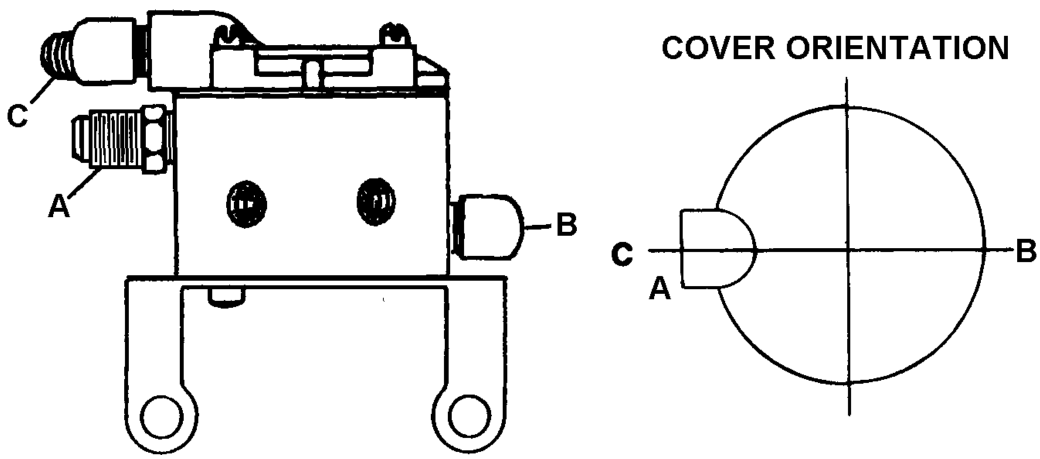



**FIGURE 9-2A. MANIFOLD VALVE FITTING ORIENTATION I0-550-A**

| ENGINE MODEL | Fitting "A" Metered Fuel Press. Conn. | Fitting "B" FUEL INLET | Fitting "C" Manifold Vent |
|---|---|---|---|
| I0-550-A | Connector | 90° Elbow @ (90°) | 45° Elbow @ (270°) |

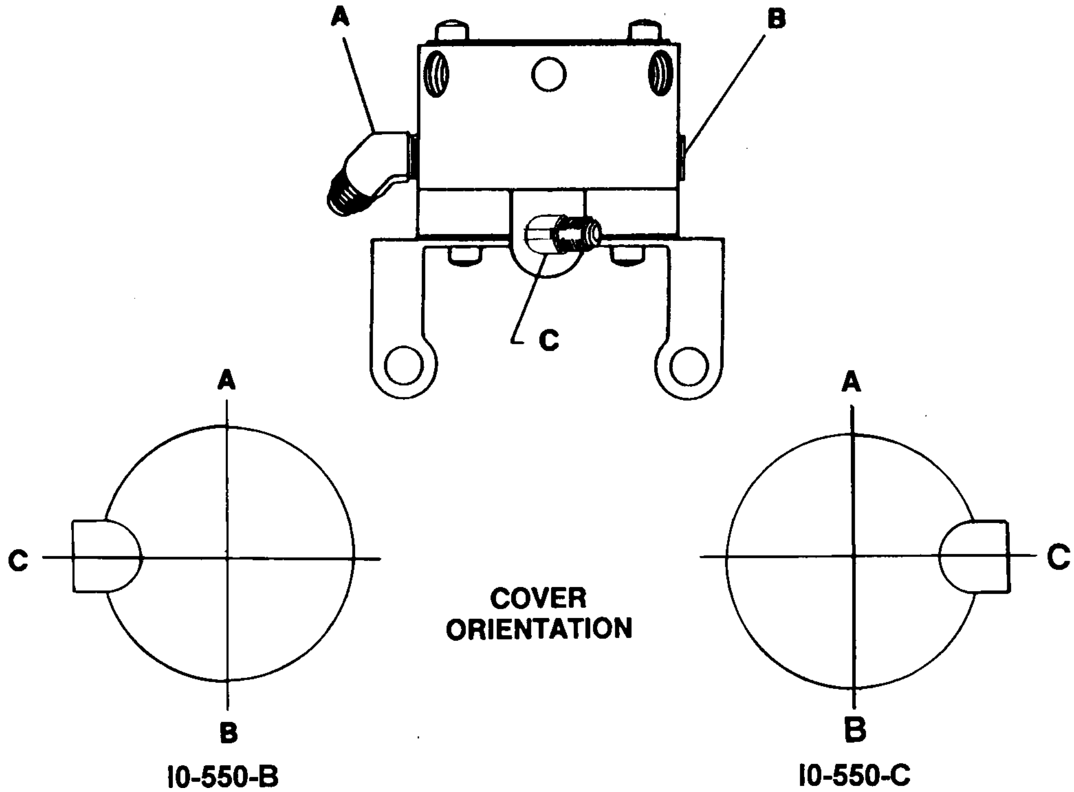



**FIGURE 9-2B. MANIFOLD VALVE FITTING ORIENTATION I0-550-B&C**

| ENGINE MODEL | Fitting "A" Metered Fuel Press. Conn. | Fitting "B" FUEL INLET | Fitting "C" Manifold Vent |
|---|---|---|---|
| I0-550-B | Plug | 45° Elbow @ (270°) | 45° Elbow @ (135°) |
| I0-550-C | Plug | 45° Elbow @ (270°) | 45° Elbow @ (225°) |

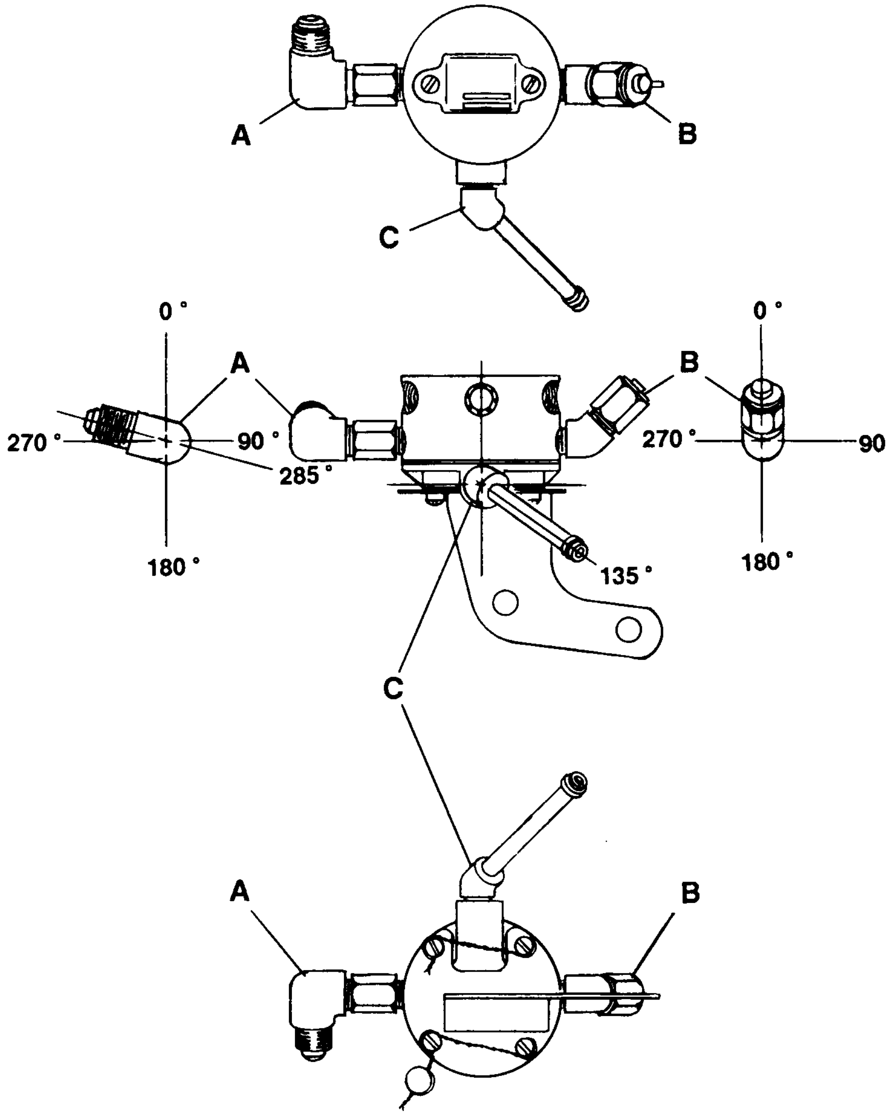



**FIGURE 9-2C. MANIFOLD VALVE FITTING ORIENTATION I0-550-G, N, P, R**

| ENGINE MODEL | Fitting "A" FUEL INLET | Fitting "B" Metered Fuel Press. Conn. | Fitting "C" Manifold Vent |
|---|---|---|---|
| I0-550-G, N, P & R | Adapter<br>90° Elbow @ (285°) | 45° Elbow @ (0°) | 45° Elbow @ (135°) |

## FUEL PUMP

1. See Figures 9-3A, B & C as applicable. Remove fittings "A" through "E."

The fuel pump must be overhauled in accordance with TCM Fuel Injection Systems Overhaul Manual and Parts Catalog, Form X30593A or replaced with a serviceable unit. See section 1-5, "Related Publications," for ordering information. Teledyne Continental Motors offers factory rebuilt fuel injection system components at exchange prices as an alternative to field overhaul of these units.

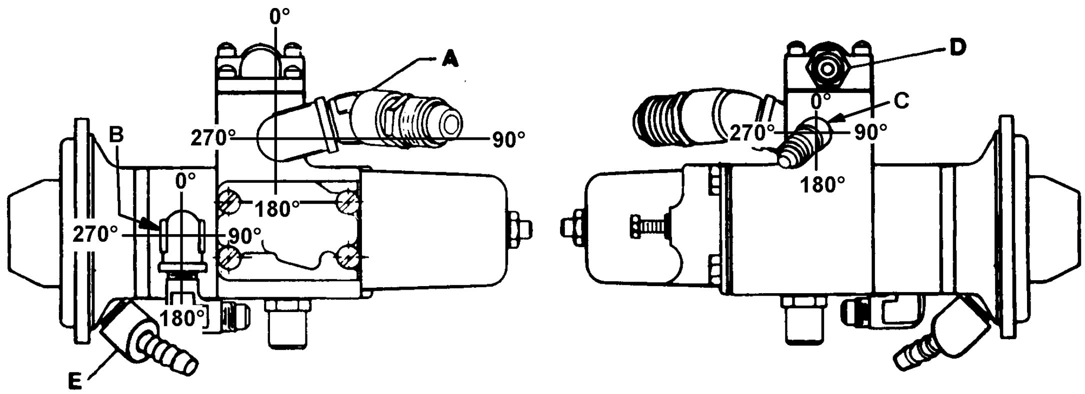



**FIGURE 9-3A. FUEL PUMP FITTING OREINTATION I0-550-A & C except I0-550-C30B, C31B, C32B**

| MODEL ENGINE | FITTING "A" INLET | FITTING "B" OUTLET | FITTING "C" MIXTURE RETURN | FITTING "D" VAPOR RETURN | FITTING "E" SEAL DRAIN |
|---|---|---|---|---|---|
| I0-550-A | 90°ELBOW @ 90°<br>45°ELBOW @ 180° | 90°ELBOW @ 180°<br>90°ELBOW @ 90° | 45°ELBOW @ 250° | 90°ELBOW @ 270° | 45° FITTING<br>HOSE @ 240° |
| I0-550-C | 90°ELBOW @ 93°<br>45°ELBOW @ 340°<br>Straight Fitting | 90°ELBOW @ 180°<br>90°ELBOW @ 90° | 45°ELBOW @ 225° | Straight Fitting | 45° FITTING<br>HOSE @ 330° |

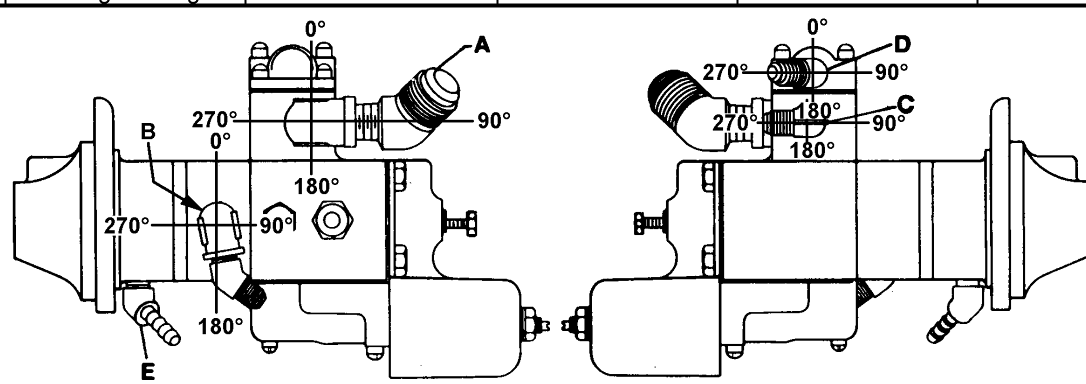



**FIGURE 9-3B. FUEL PUMP FITTING OREINTATION I0-550-B except I0-550-B37B, B38B, B39B, B40B, B41B, B42B, B43B, B45B, B46B, B48B, B49B, B51B, B52B**

| MODEL ENGINE | FITTING "A" INLET | FITTING "B" OUTLET | FITTING "C" MIXTURE RETURN | FITTING "D" VAPOR RETURN | FITTING "E" SEAL DRAIN |
|---|---|---|---|---|---|
| I0-550-B | 90°ELBOW @ 90°<br>45°ELBOW @ 330° | 90°ELBOW @ 170°<br>45°ELBOW @ 125° | 90°ELBOW @ 45°<br>45°ELBOW @ 270° | 45°ELBOW @ 270° | 45° FITTING<br>HOSE @ 45° |

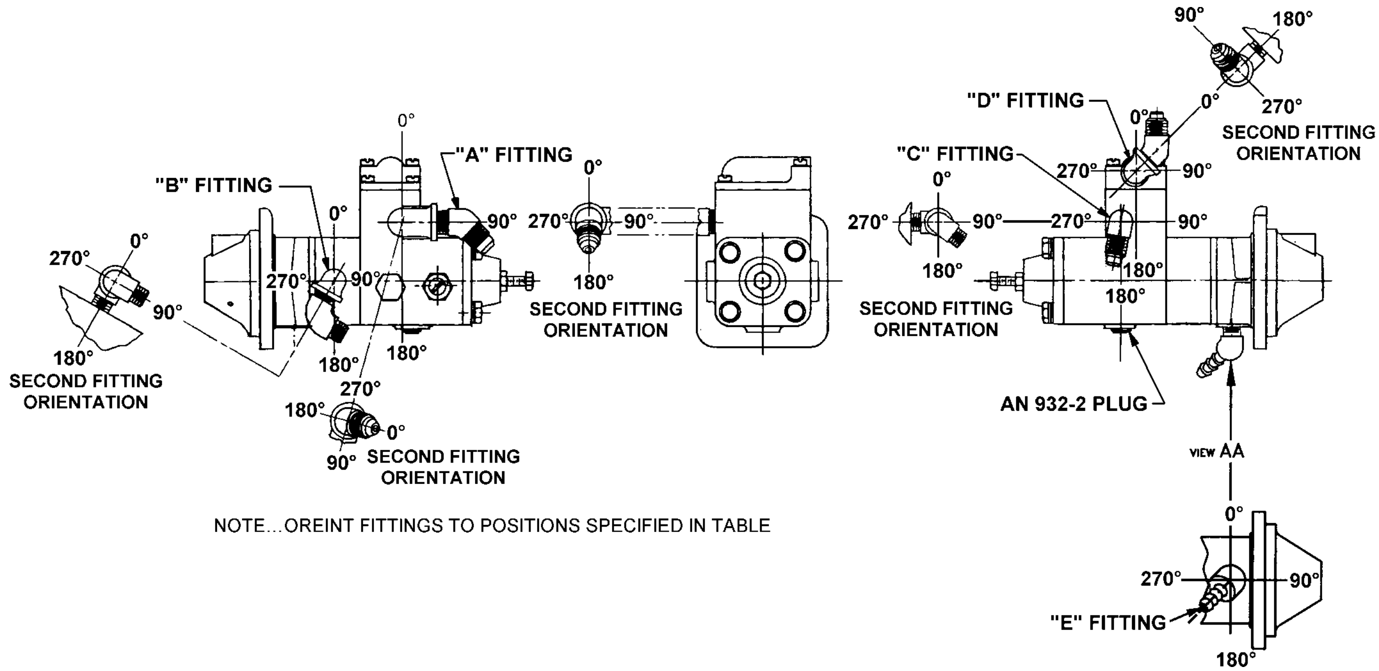



**FIGURE 9-3C. FUEL PUMP FITTING ORIENTATION FOR I0-550-B37B, B39B, B38B, B40B, B41B, B42B, B43B, B45B, B46B, B48B, B49B, B51B, B52B, I0-550-C30B, C31B and C32B**

| PUMP FITTING ORIENTATION | FITTING "A" INLET | FITTING "B" OUTLET | FITTING "C" MIXTURE RETURN | FITTING "D" VAPOR RETURN | FITTING "E" DRAIN |
|---|---|---|---|---|---|
| 642027-26 ① | 90°ELBOW @ 90°<br>45°ELBOW @ 225° | 90°ELBOW @ 170°<br>45°ELBOW @ 125° | 90°ELBOW @ 270°<br>90°ELBOW @ 135° | 45°ELBOW @ 270° | 45° HOSE FITTING @ 225° |
| 642027-27 ② | 90°ELBOW @ 90°<br>45°ELBOW @ 250°<br>STRAIGHT FITTING | 90°ELBOW @ 180°<br>90°ELBOW @ 90° | 45°ELBOW @ 225° | STRAIGHT FITTING | 45° HOSE FITTING @ 225° |
| 642027-28 ③ | 90°ELBOW @ 90°<br>45°ELBOW @ 330° | 90°ELBOW @ 170°<br>45°ELBOW @ 125° | 90°ELBOW @ 270°<br>90°ELBOW @ 45° | STRAIGHT FITTING | 45° HOSE FITTING @ 225° |

① Use on I0-550-B37B and B39B

② Use on I0-550-C30B, C31B and C32B

③ Use on I0-550-B38B, B40B, B41B, B42B, B43B, B45B, B46B, B48B, B49B, B51B and B52B

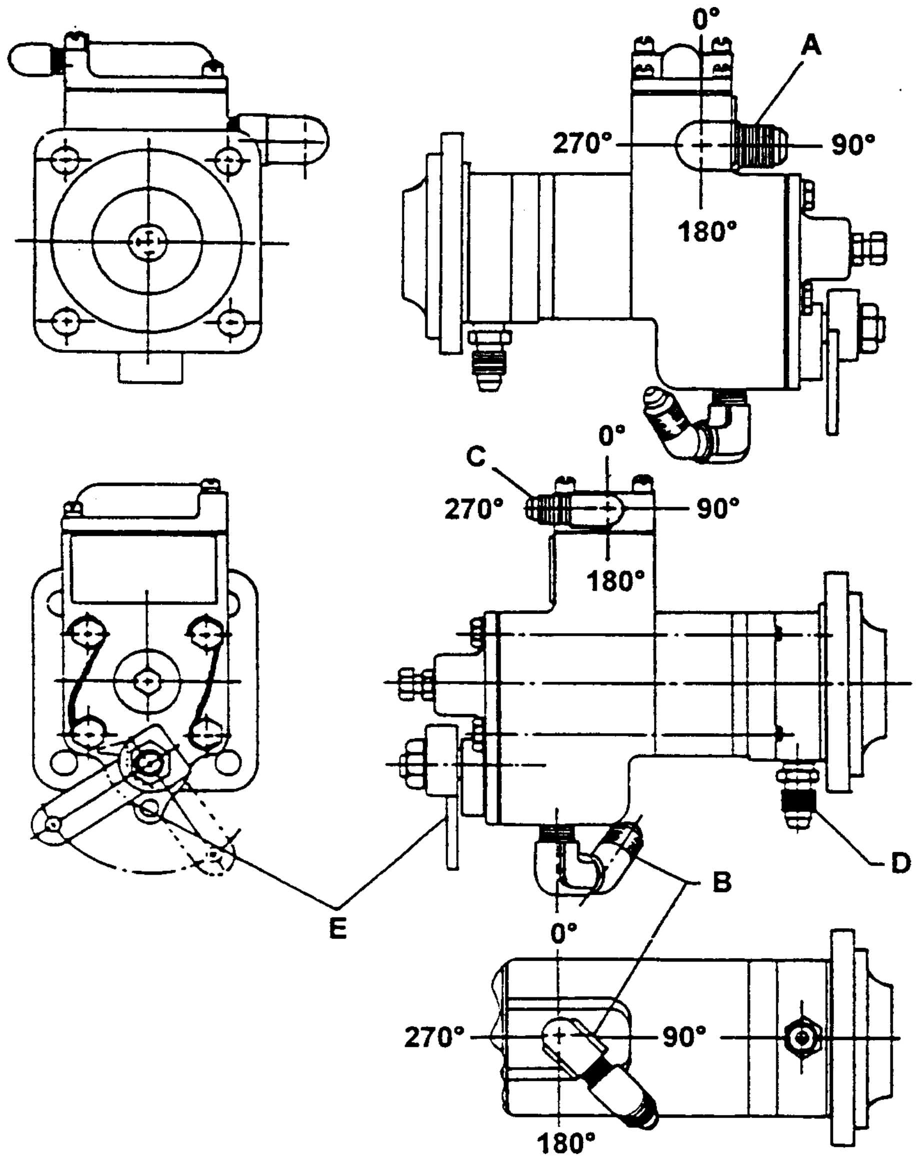



**FIGURE 9-3D. FUEL PUMP FITTING OREINTATION I0-550-G, G1B, G2B, G4B, I0-550-N, N1B, N2B, N6B, N7B, N8B, I0-550-P, I0-550-R**

| FITTING "A" INLET | FITTING "B" OUTLET | FITTING "D" VAPOR RETURN | FITTING "E" SEAL DRAIN |
|---|---|---|---|
| 90°ELBOW @ 90° | 90°ELBOW @ 135°<br>45°ELBOW | 90°ELBOW @ 270° | Straight<br>Fitting |

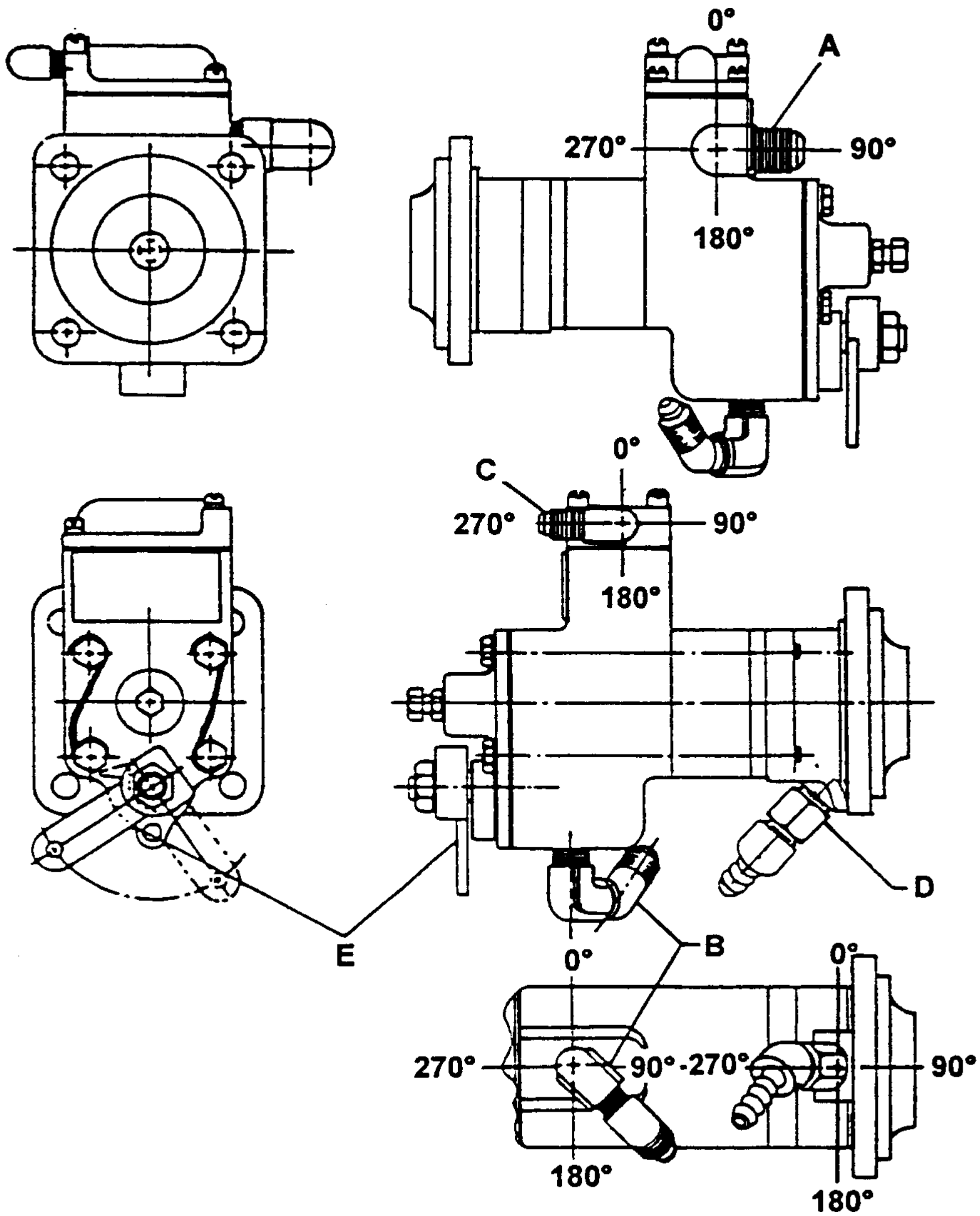



**FIGURE 9-3E. FUEL PUMP FITTING OREINTATION I0-550-G5B & G6B**

| FITTING "A" INLET | FITTING "B" OUTLET | FITTING "D" VAPOR RETURN | FITTING "E" SEAL DRAIN |
|---|---|---|---|
| 90°ELBOW @ 90° | 90°ELBOW @ 135°<br>45°ELBOW | 90°ELBOW @ 270° | Adapter, Elbow |

## FUEL CONTROL UNIT I0-550-A, B & C

1. See Figure 9-4. Remove fittings "A" through "E."

The fuel control unit must be overhauled in accordance with TCM Fuel Injection Systems Overhaul Manual and Parts Catalog, Form X30593A or replaced with a serviceable unit. See section 1-5, "Related Publications," for ordering information. Teledyne Continental Motors offers factory rebuilt fuel injection system components at exchange prices as an alternative to field overhaul of these units.

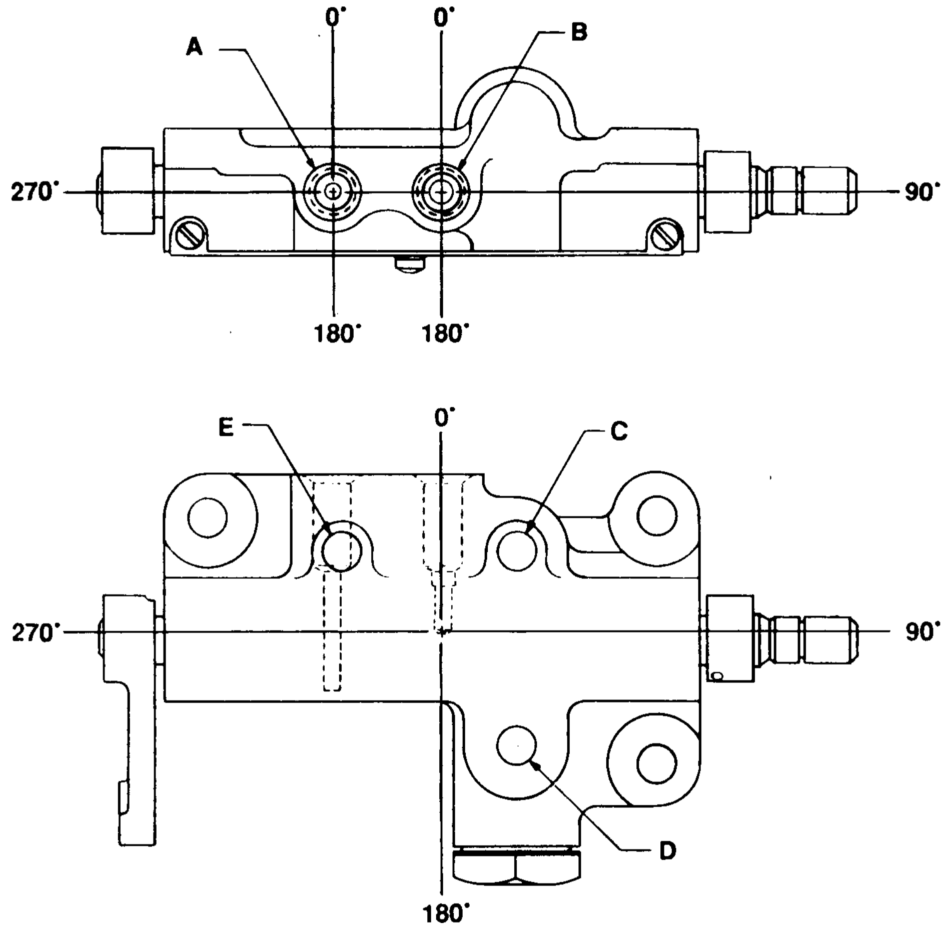



**FIGURE 9-4. FUEL CONTROL UNIT FITTING ORIENTATION**

| ENGINE MODEL | A<br>TO MANIFOLD VALVE | B<br>FUEL RETURN TO TANK | C<br>PRESSURE TAP | D<br>FUEL INLET | E<br>TO MANIFOLD VALVE |
|---|---|---|---|---|---|
| I0-550-A | PLUG | 90° ELBOW @ 240° | 90° ELBOW @ 235° | 90° ELBOW @150° | 90° ELBOW @ 260° |
| IO-550-B | PLUG | EXTENSION<br>90° ELBOW @ 165°<br>90° ELBOW @ 195° | PLUG | 90° ELBOW @ 225° | EXTENSION<br>90° ELBOW @ 315° |
| I0-550-C | PLUG | 90° ELBOW @ 115° | PLUG | 90° ELBOW @ 240° | 90° ELBOW @ 90° |

## THROTTLE AND FUEL METERING UNIT I0-550-G, N, P & R

1. See Figure 9-5. Remove fittings "2" through "4."

The throttle and fuel metering unit must be overhauled in accordance with TCM Fuel Injection Systems Overhaul Manual and Parts Catalog, Form X30593A or replaced with a serviceable unit. See section 1-5, "Related Publications," for ordering information. Teledyne Continental Motors offers factory rebuilt fuel injection system components at exchange prices as an alternative to field overhaul of these units.

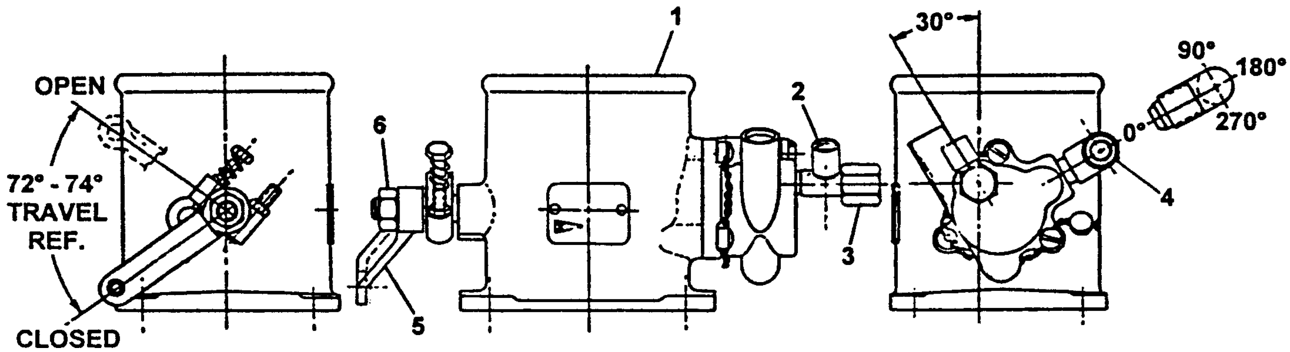



**FIGURE 9-5. FUEL METERING UNIT FITTING ORIENTATION**

| ITEM "1" | "2" FITTING FUEL INLET | "3" FITTING FUEL INLET | "4" FITTING FUEL OUTLET | ITEM "5" | ITEM "6" |
|---|---|---|---|---|---|
| THROTTLE | TEE @ 30° | CAP | 90° ELBOW @ 0° | LEVER | NUT |

## FUEL NOZZLES

1. The fuel nozzles must be overhauled in accordance with TCM Fuel Injection Systems Overhaul Manual and Parts Catalog, Form X30593A or replaced with a serviceable unit. See section 1-5, "Related Publications," for ordering information. Teledyne Continental Motors offers factory rebuilt fuel injection system components at exchange prices as an alternative to field overhaul of these units.

NOTE…Further disassembly of the fuel injection system components is not advised unless the proper flow test equipment is available.

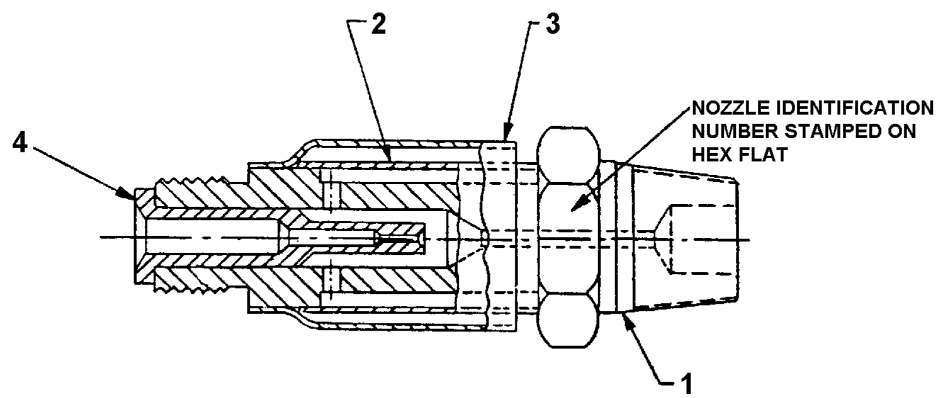



**FIGURE 9-6A. FUEL NOZZLE I0-550-A, B & C**

| | |
|---|---|
| 1. Nozzle | 3. Shield |
| 2. Screen | 4. Jet |

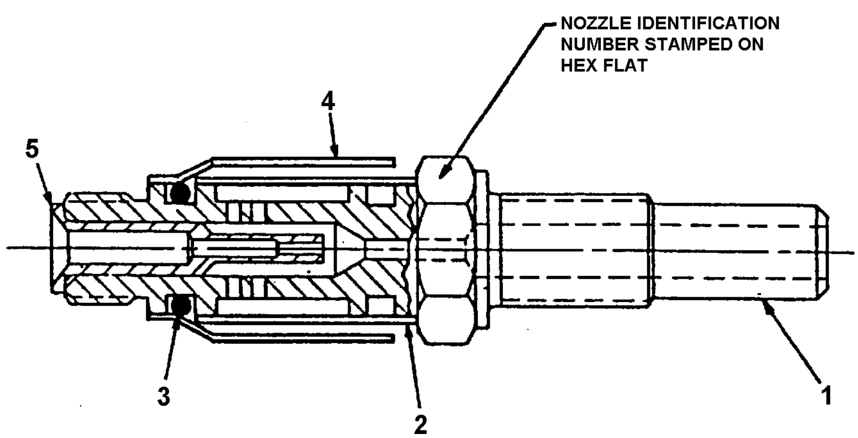



**FIGURE 9-6B. FUEL NOZZLE I0-550-G, N, P & R**

| | | |
|---|---|---|
| 1. Nozzle | 3. O-Ring | 5. Jet |
| 2. Screen | 4. Shield | |

## 9-3 FUEL INJECTION SYSTEM CLEANING

All fuel injection system components and associated hardware must be cleaned in accordance with the instructions in section 6-7, "General Cleaning," and the following special instructions:

All gaskets, packings, o-rings, seals, self locking nuts, wave washers, springs, cotter pins and lock washers removed from the fuel injection system and components must be replaced 100% at overhaul. Cleaning these parts is not required.

1. The fuel pump, fuel manifold valve, fuel control/metering unit and fuel nozzles must be cleaned, inspected, overhauled and tested in accordance with the instructions in TCM Fuel Injection Systems Overhaul and Parts Catalog, Form X30593A, unless factory rebuilt units are purchased for replacement.

## 9-4 FUEL INJECTION SYSTEM INSPECTION VISUAL INSPECTION

The visual inspection must be performed in accordance with the instructions in section 6-8, "Visual Inspection". Special attention must be given to the following components and areas:

1. Visually inspect all fuel injection system plumbing for cracks, dents, chafing, flared ends for cracks and out of roundness. Inspect fittings for distorted or stripped threads and damaged wrench flats. Components exhibiting any of the above indications must be discarded.
2. Inspect brackets for cracks, dents and wear. Inspect hardware for distorted, stripped threads and damaged wrench flats. Components exhibiting any of the above indications must be discarded.
3. Visually inspect the fuel pump, throttle/metering unit, manifold valve and fuel nozzle outside areas for evidence of wear, deterioration and leakage. Inspect tapped holes and helical coils for distorted or stripped threads. Inspect for cracks and dents. Further inspection of the fuel pump, throttle/metering unit, manifold valve and nozzles must be performed in accordance with the instructions in TCM Fuel Injection Systems Overhaul and Parts Catalog, Form X30593A.

### FLUORESCENT PENETRANT INSPECTION

Fluorescent penetrant inspection must be performed on applicable aluminum alloy fuel injection system components by a certified technician in accordance with the instructions in section 6-12, "Fluorescent Penetrant Inspection."

During overhaul of fuel injection system components in accordance with Form X30593A all aluminum alloy parts such as fuel pump body, vapor separator, manifold valve body, air throttle adapter body, covers and flanges must be fluorescent penetrant inspected by a certified technician in accordance with section 6-12, "Fluorescent Penetrant Inspection," of this manual. Any components exhibiting cracks must be discarded.

### MAGNETIC PARTICLE INSPECTION

The fuel pump drive shaft must be magnetic particle inspected by a certified technician in accordance with the instructions in section 6-9, "Magnetic Particle Inspection." Any components exhibiting cracks must be discarded.

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.

All components must be thoroughly cleaned and air dried prior to dimensional inspection.

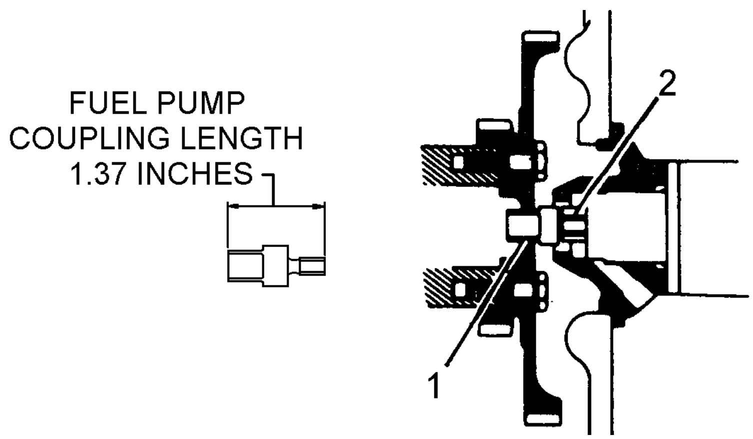



**FIGURE 9-7. FUEL PUMP DRIVE COUPLING FITS AND LIMITS**

| FITS & LIMITS | | | |
|---|---|---|---|
| REF. NO. | FUEL PUMP | NEW PARTS MIN. | NEW PARTS MAX. |
| 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 |

## 9-5 FUEL INJECTION SYSTEM REPAIR AND REPLACEMENT

Any fuel injection system component worn beyond new parts limits or failing to meet the inspection criteria in section 9-4 must be replaced unless repair is possible with the following instructions:

1. Any fuel system brackets, hardware, plumbing or couplings found to have any of the discrepancies listed in section 9-4 must be replaced.
2. Fuel system component lever bushings must be replaced during engine overhaul. Place the lever bushing over a ring that will allow the bushing to pass through. Using the correct size tool and an arbor press, remove the old bushing. Inspect the lever bushing bore for a diameter of .249 - .251. Discard levers that exceed the specified dimension. Using the correct size tool and an arbor press, install the new bushing in accordance with the specifications in Figure 9-8. The lever and bushing must have a press fit of .007T to .013T.

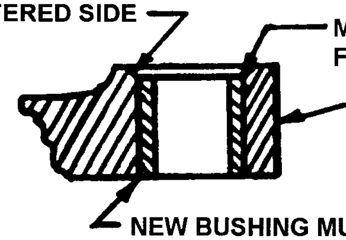



**FIGURE 9-8. GENERAL LEVER BUSHING REPLACEMENT**

3. Replace all fuel injection system parts listed in section 6-6, "100% Replacement Parts."
4. Section 6-19, "Application Of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing.

## 9-6 FUEL INJECTION SYSTEM SUB-ASSEMBLY

NOTE…All fuel injection system components must be overhauled or new, clean and free of debris before assembly.

1. The fuel pump, fuel control/throttle and metering unit, fuel manifold valve and fuel nozzles must be new, factory rebuilt or field overhauled and tested in accordance with TCM Form X30593A Fuel Injection Systems Overhaul and Parts Catalog.

NOTE…Before re-installation of fuel system component fittings insure they are free of any debris by screwing them into the proper size holes of a softwood block then thoroughly flushing them with an approved solvent.

**WARNING**

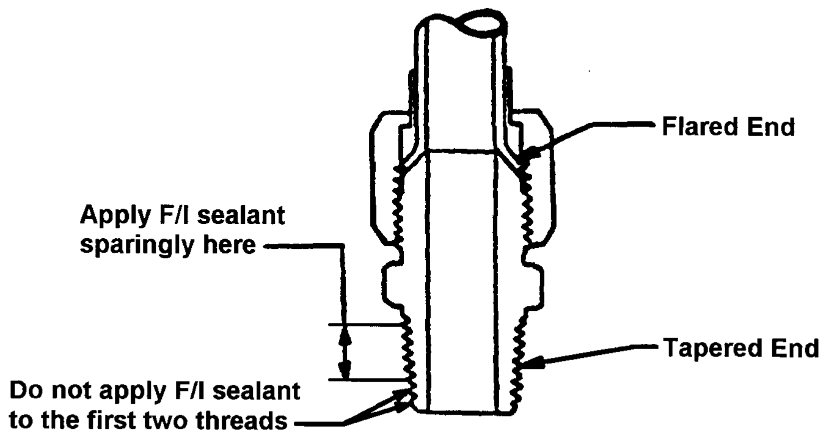
**Never use teflon tape on fuel injection component fittings.**

2. See Figures 9-2A through 9-2C. Sparingly apply TCM 646940 F/I sealant on fittings that have male tapered pipe threads in accordance with Figure 9-9, "General F/I Sealant Application." Install fittings “A” through “C” into fuel manifold valve at the proper locations and correct orientations.
3. See Figures 9-3A through 9-3D. Sparingly apply TCM 646940 F/I sealant on fittings that have male tapered pipe threads in accordance with Figure 9-9, "General F/I Sealant Application." Install fittings “A” through “E” into fuel pump at the proper locations and correct orientation.
4. See Figure 9-4. Sparingly apply TCM 646940 F/I sealant on fittings that have male tapered pipe threads in accordance with Figure 9-9, "General F/I Sealant Application." Install fittings “A” through “E” into fuel control unit.

5. See Figure 9-5. Sparingly apply TCM 646940 F/I sealant on fittings that have male tapered pipe threads in accordance with Figure 9-9, "General F/I Sealant Application." Install fittings “2” through “4” into fuel metering unit.

6. See chapter 10 for air throttle and fuel control or air throttle and fuel metering unit assembly.

7. Store all fuel injection components in a clean protected area until final engine assembly.




*CAUTION...*
*F/I Sealant 646940 must be applied to tapered end of fittings only.*

**FIGURE 9-9. GENERAL FUEL INJECTION SEALANT APPLICATION**

INTENTIONALLY

LEFT

BLANK

# CHAPTER 10

# INDUCTION SYSTEM

## 10-1A INDUCTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 10-1A)

1. Remove duct (24). Remove nut (23), washer (22), bolts (20), bracket (19) and spacers (21). Discard duct (24).
2. Loosen clamps (8) and remove elbows (10, 11) and manifold (13). Remove clamps and hoses (8, 9) from elbows (10, 11).
3. Remove screws that attach balance tube bracket (15) to oil sump and crankcase. Remove clamp (16) and bracket (15) from balance tube (17). Remove balance tube (17) from front hoses (9).
4. Remove screws (6), lock washers (5) and washers (4). Discard lock washers (5). Remove risers (2, 3) from cylinders. Remove hoses (9) and clamps (7, 8) from risers (2, 3). Discard all hoses (9).
5. Place the induction elbows and risers in a clean, protected area until they are ready to be overhauled.

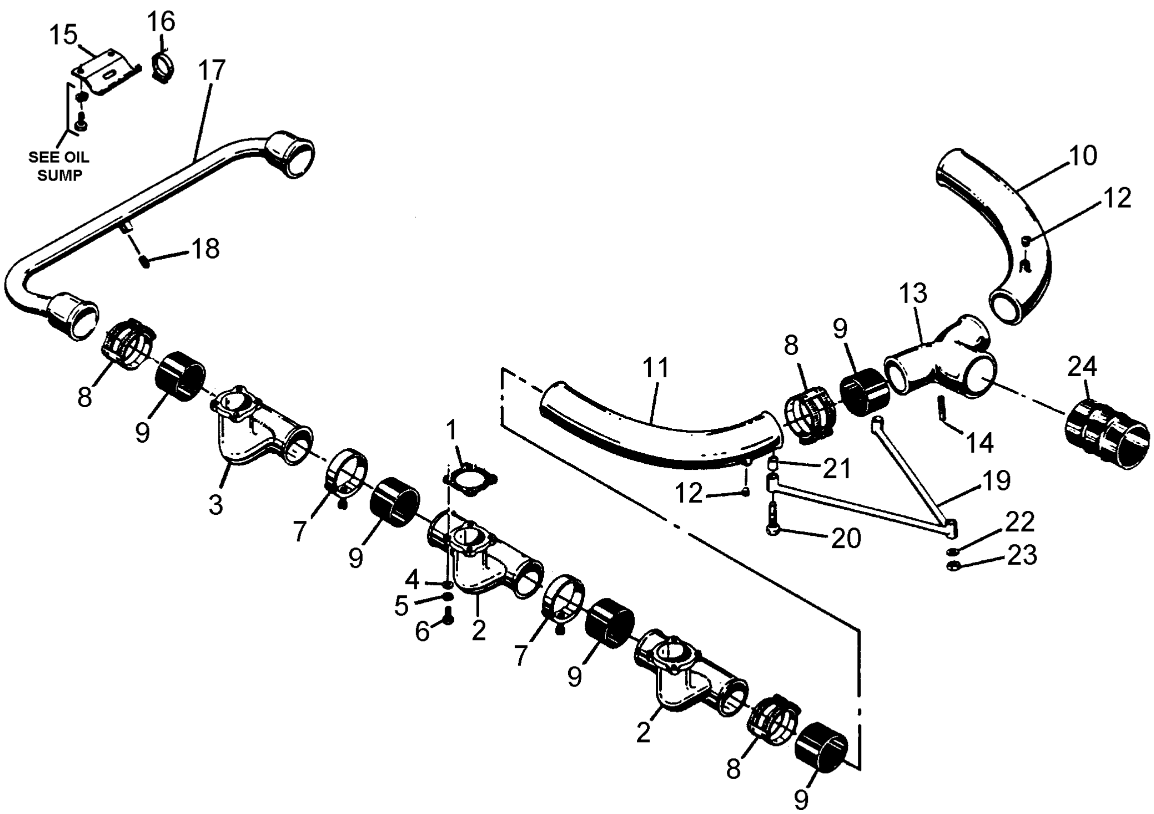



**FIGURE 10-1A. INDUCTION SYSTEM FOR I0-550-A**

| | | |
|---|---|---|
| 1. Gasket | 9. Hose | 17. Balance Tube |
| 2. Elbow | 10. Tube, Intake | 18. Plug |
| 3. Elbow | 11. Tube, Intake | 19. Bracket |
| 4. Washer | 12. Plug | 20. Screw |
| 5. Washer, Lock | 13. Riser | 21. Spacer |
| 6. Screw | 14. Stud | 22. Washer |
| 7. Clamp | 15. Bracket | 23. Nut |
| 8. Clamp | 16. Clamp | 24. Duct |

## 10-1B INDUCTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 10-1B)

1. Loosen clamps (7, 16) and remove manifold (10). Remove clamps and hoses (7, 9) from elbow riser (2).
2. Remove oil sump screws that attach balance tube bracket (12) to oil sump and crankcase. Remove clamp (13) and bracket (12) from balance tube (14). Loosen clamps (8). Remove balance tube (14) from front hoses (9).
3. Remove screws (6), lock washers (5) and washers (4). Discard lock washers (5). Remove risers (2, 3) from cylinders. Remove hoses (9) and clamps (7, 8) from riser elbows (2, 3). Discard all hoses (9).
4. Place the induction manifold and elbow risers in a clean, protected area until they are ready to be overhauled.

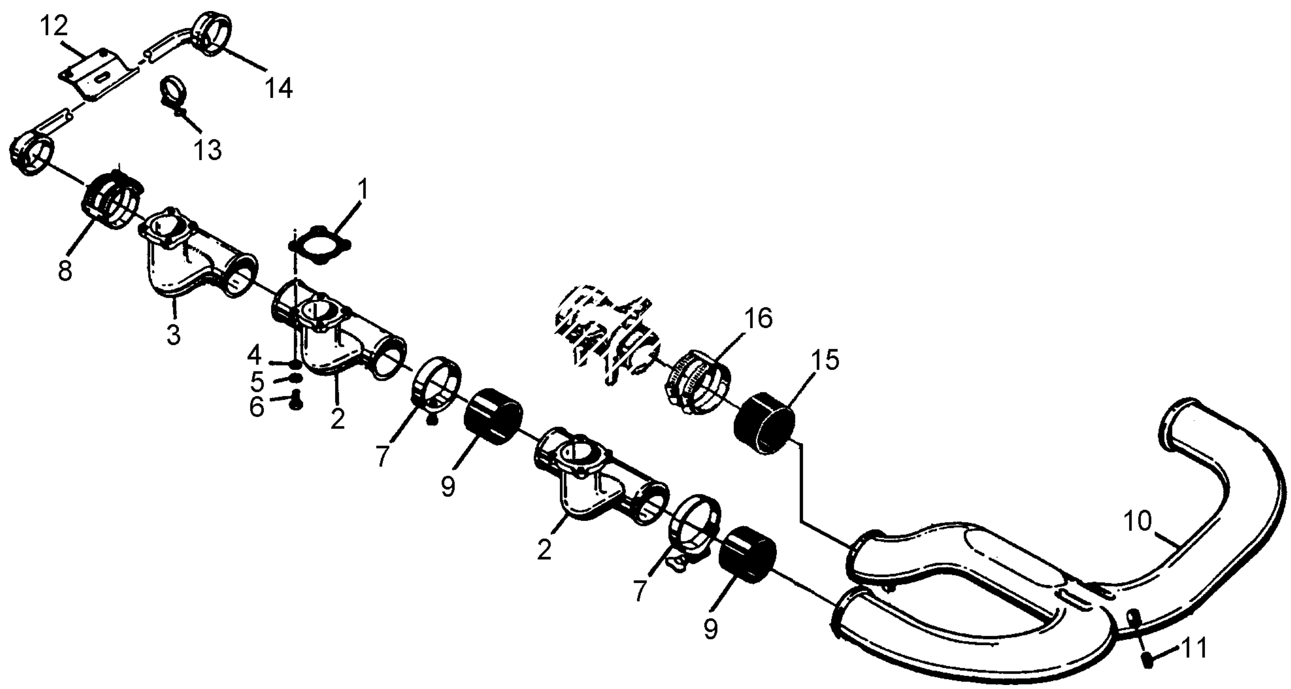



**FIGURE 10-1B. INDUCTION SYSTEM FOR I0-550-B**

1. Gasket
2. Elbow, Riser
3. Elbow, Riser
4. Washer
5. Washer, Lock
6. Screw
7. Clamp
8. Clamp
9. Hose
10. Manifold
11. Plug
12. Bracket
13. Clamp
14. Balance Tube
15. Hose
16. Clamp

## 10-1C INDUCTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 10-1C)

1. Loosen clamps (7, 8) and remove elbows (10, 11). Remove clamps and hoses (7, 9) from elbows (10, 11).
2. Remove oil sump screws that attach balance tube bracket (12) to oil sump and crankcase. Remove clamp (13) and bracket (12) from balance tube (14). Remove balance tube (14) from front hoses (9).
3. Remove screws (6), lock washers (5) and washers (4). Discard lock washers (5). Remove risers (2, 3) from cylinders. Remove hoses (9) and clamps (7, 8) from risers (2, 3). Discard all hoses (9).
4. Place the induction manifold and risers in a clean, protected area until they are ready to be overhauled.

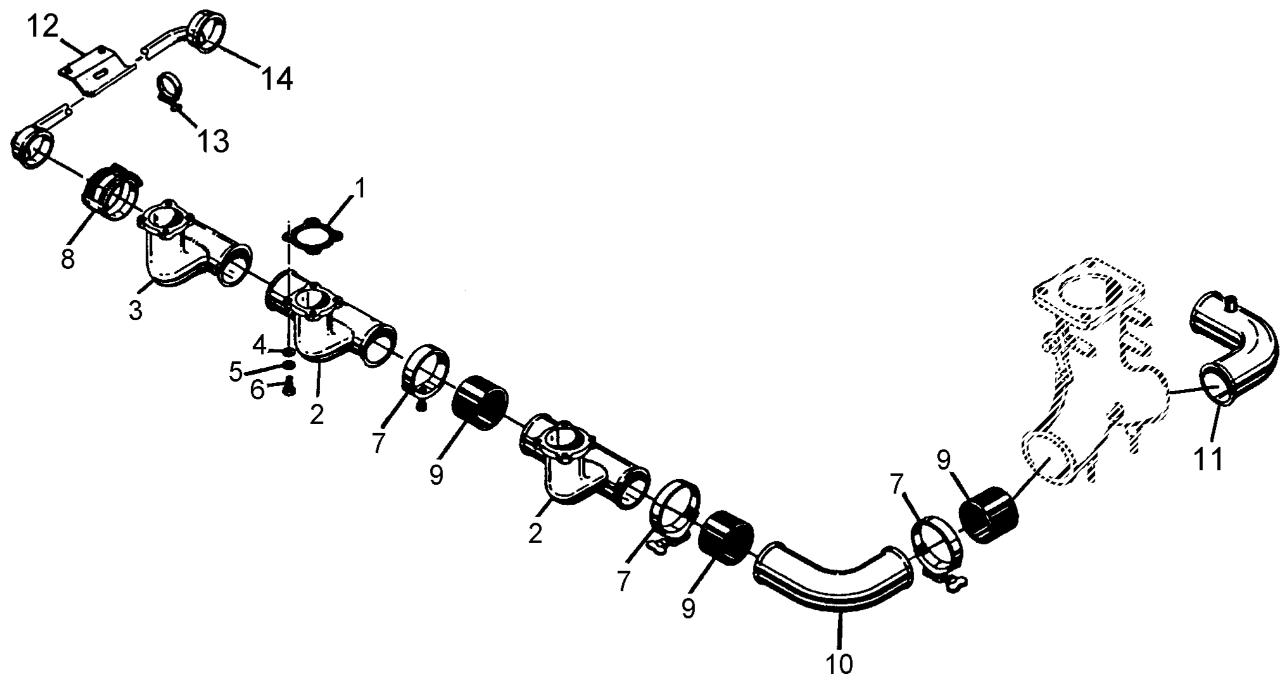



**FIGURE 10-1C. INDUCTION SYSTEM FOR I0-550-C**

| | |
|---|---|
| 1. Gasket | 8. Clamp |
| 2. Elbow, Riser | 9. Hose |
| 3. Elbow, Riser | 10. Tube, Elbow |
| 4. Washer | 11. Tube, Elbow |
| 5. Washer, Lock | 12. Bracket |
| 6. Screw | 13. Clamp |
| 7. Clamp | 14. Balance Tube |

## 10-1D INDUCTION SYSTEM REMOVAL AND DISASSEMBLY (See Figure 10-1D)

1. Remove attaching hardware (14, 15, 16) from all cylinders. Lift entire induction and throttle assembly from engine as a unit. Discard lock washers (15).
2. Loosen clamps (18) and remove induction tubes (6 through 11), hoses (17) and clamps (18) from balanced manifold (2). Discard all hoses (17).
3. Remove gaskets (12) from all cylinders and discard.
2. See Figure 9-1D. Remove crankcase backbone hardware that secures the air manifold support bracket to the engine and remove support bracket (13A). Remove and discard rubber bumpers (13B).

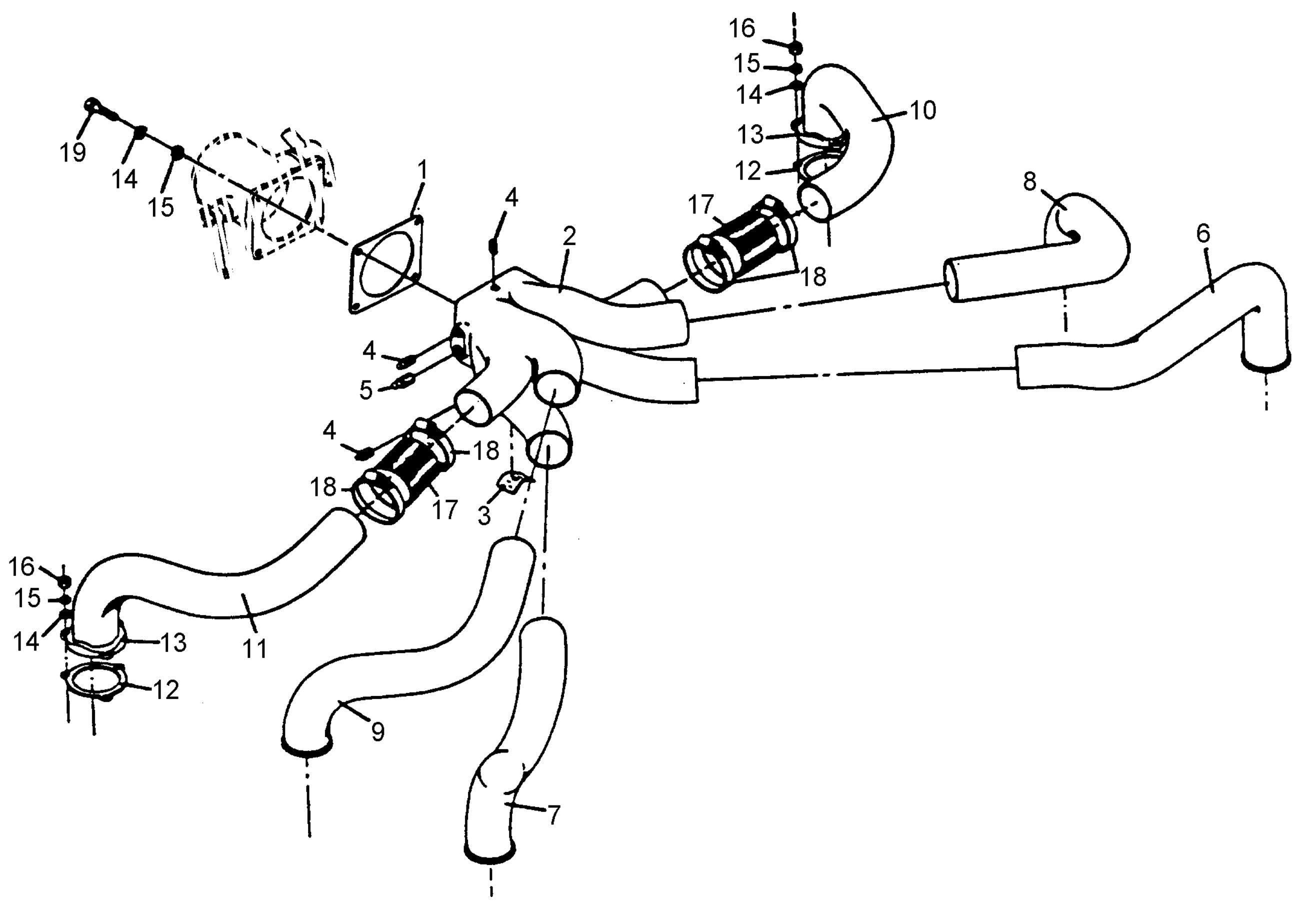



**FIGURE 10-1D. INDUCTION SYSTEM FOR I0-550-G, N, P & R**

| | |
|---|---|
| 1. Gasket | 11. Tube, Intake |
| 2. Manifold | 12. Gasket |
| 3. Bumper, Rubber | 13. Flange |
| 4. Plug | 14. Washer |
| 5. Plug | 15. Washer, Lock |
| 6. Tube, Intake | 16. Nut, Plain |
| 7. Tube, Intake | 17. Hose |
| 8. Tube, Intake | 18. Clamp |
| 9. Tube, Intake | 19. Screw |
| 10. Tube, Intake | |

## 10-2 INDUCTION SYSTEM COMPONENT DISASSEMBLY

### Throttle Assembly I0-550-A & B

1. Document lever orientation for reinstallation.
2. Drive pins (3) out using a 1/8 inch pin punch. Remove nut (13) and lever (12) as applicable. Remove collar (2) and washers (4, 5). Loosen nut (10) and remove lever (6). Remove screws (16) and plate (15). Slide throttle shaft (14) from throttle body. Discard pins (3), spring (8), screw (16), wave washer (4) and nut (13) if applicable.

NOTE...Airframe supplied parts, such as switch actuating cams, must be removed, inspected, repaired or replaced and re-installed in accordance with the applicable airframe manufacturer's instructions.

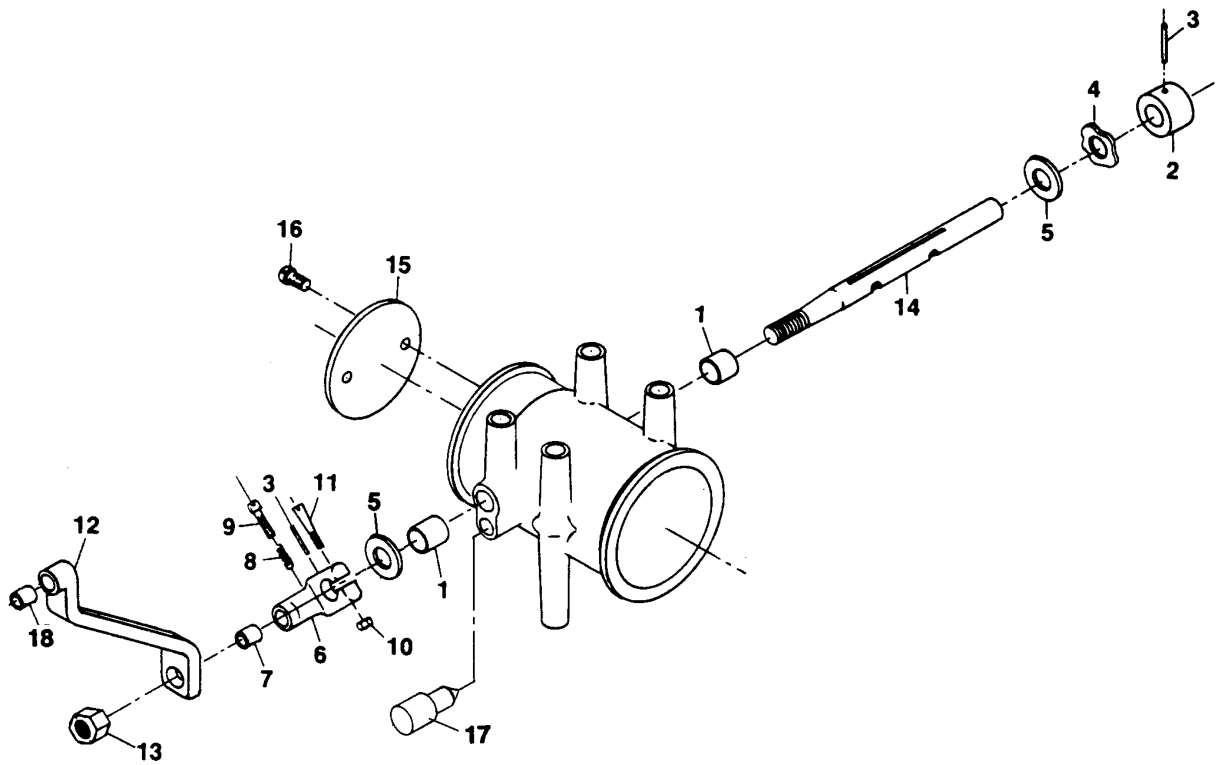



**FIGURE 10-2A. THROTTLE ASSEMBLY I0-550-A & B**

| | | |
|---|---|---|
| 1. Bushing | 7. Bushing | 13. Nut |
| 2. Collar | 8. Spring | 14. Shaft, Throttle |
| 3. Pin | 9. Screw Adjusting | 15. Plate, Throttle |
| 4. Washer, Wave | 10. Nut | 16. Screw |
| 5. Washer, Plain | 11. Screw, Set | 17. Pin, Stop |
| 6. Lever | 12. Lever | 18. Bushing, Lever |

## Throttle Assembly I0-550-C

1. Document lever orientation for reinstallation.
2. Drive pins (3) out using a 1/8 inch pin punch. Remove nut (8) and lever (6). Remove collar (2), plain washer (5) and wave washer (4). Remove nut (13) and set screw (14). Remove lever (9) and plain washer (5). Remove screws (17) and plate (16). Slide throttle shaft (15) from throttle body. Discard pins (3), spring (11), screws (17) and wave washer (4).

NOTE...Airframe supplied parts, such as switch actuating cams, must be removed, inspected, repaired or replaced and re-installed in accordance with the applicable airframe manufacturer's instructions.

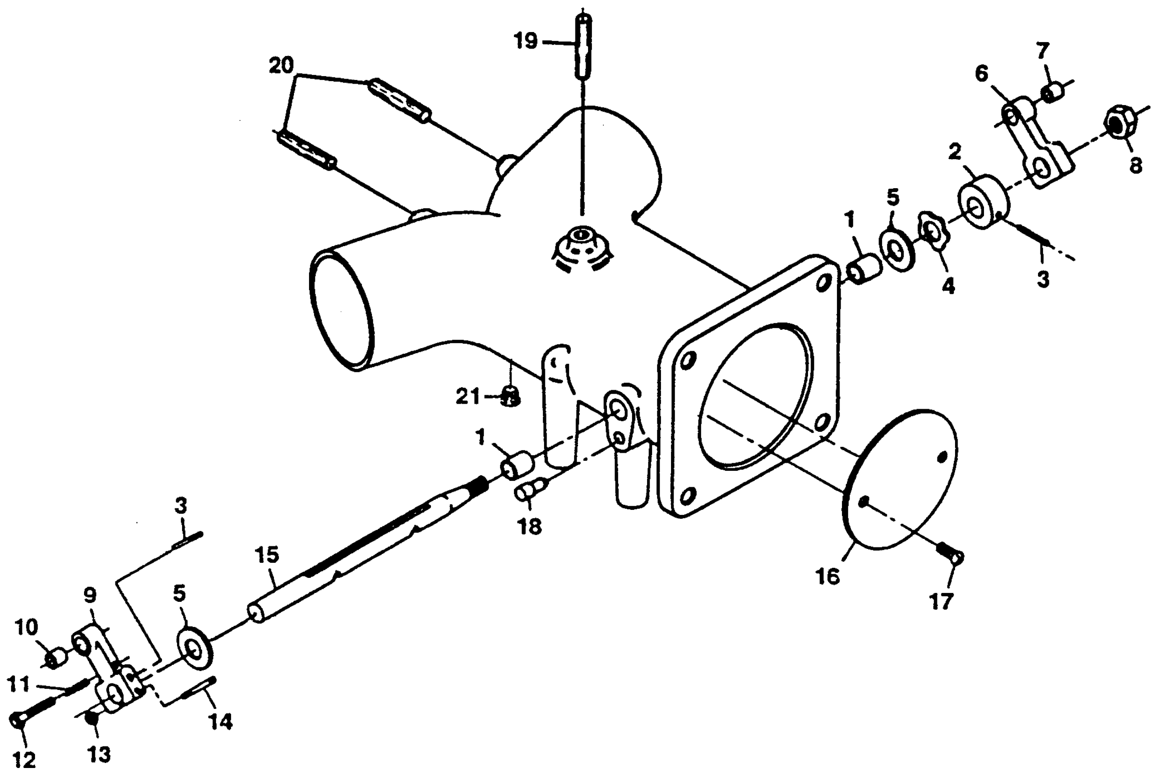



**FIGURE 10-2B. THROTTLE ASSEMBLY I0-550-C**

1. Bushing
2. Collar
3. Pin
4. Washer, Wave
5. Washer, Plain
6. Lever
7. Bushing
8. Nut
9. Lever
10. Bushing
11. Spring
12. Screw, Adjusting
13. Nut
14. Screw, Set
15. Shaft, Throttle
16. Plate, throttle
17. Screw
18. Pin, Throttle Stop
19. Stud
20. Stud
21. Plug

**Throttle Assembly I0-550-G, N, P & R**

1. Document lever orientation for reinstallation.
2. Drive pin (12) out using a 1/8 inch pin punch. Loosen nut (11) and remove lever (8). Remove screws (16) and cover (15). Remove o-ring (17), spring (18), o-ring (19) and plug (20). Remove screws (7) and plate (6). Slide throttle shaft (3) from throttle body. Remove o-rings (4), washer (5) and o-ring (17). Discard pin (12), o-rings (4, 17, 19), screws (7) and spring (18).

NOTE...Airframe supplied parts, such as switch actuating cams, must be removed, inspected, repaired or replaced and re-installed in accordance with the applicable airframe manufacturer's instructions.

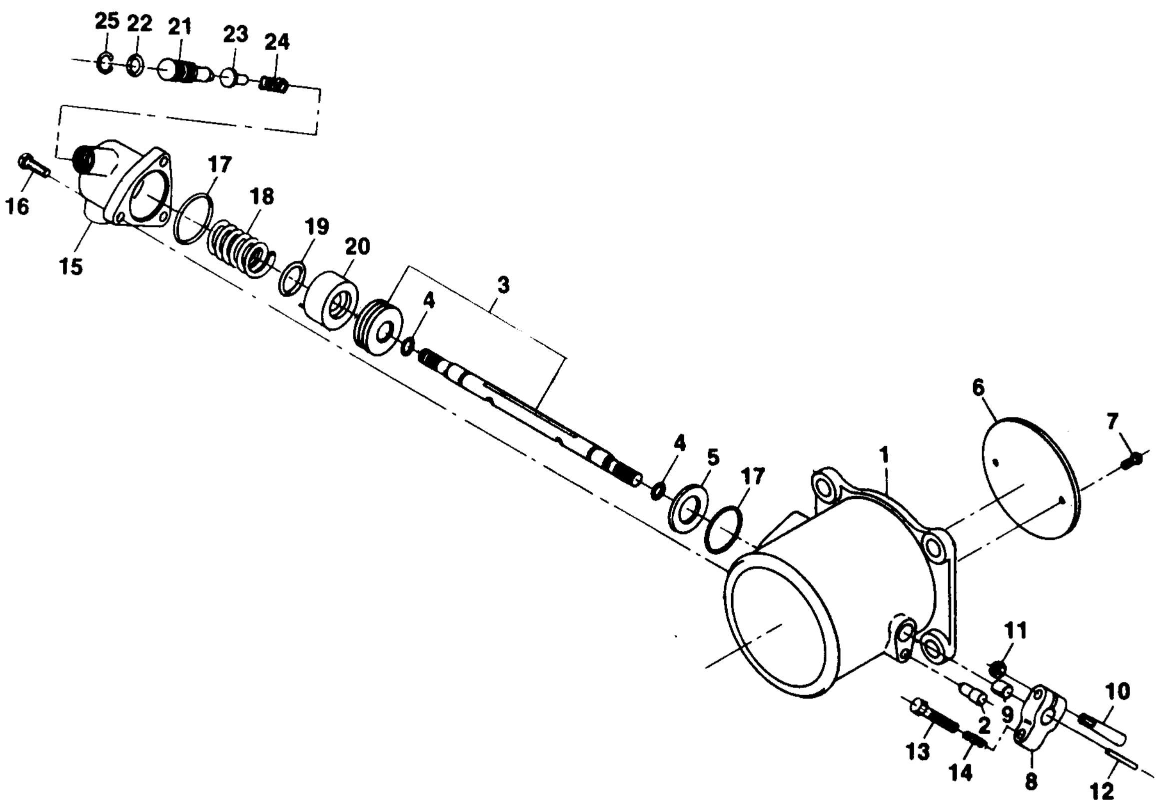



**FIGURE 10-2C. THROTTLE ASSEMBLY I0-550-G, N, P & R**

| | | |
|---|---|---|
| 1. Body, Throttle | 10. Screw | 19. O-ring |
| 2. Pin, Stop | 11. Nut | 20. Plug, Fuel Metering |
| 3. Shaft, Throttle | 12. Pin | 21. Screw, Idle Adjust |
| 4. O-ring | 13. Screw, Adjusting | 22. O-ring |
| 5. Washer | 14. Spring | 23. Bushing |
| 6. Plate, Throttle | 15. Cover | 24. Spring |
| 7. Screw | 16. Screw | 25. Ring, Retaining |
| 8. Lever | 17. O-ring | |
| 9. Bushing | 18. Spnng | |

## 10-3 INDUCTION SYSTEM CLEANING.

1. All induction system components and associated hardware must be cleaned in accordance with the instructions in section 6-7, "General Cleaning," and the following:
2. All gaskets, hoses, lock washers and self locking nuts removed from the induction system and components must be replaced 100% at overhaul. Cleaning these parts is not required.

## 10-4 INDUCTION SYSTEM INSPECTION

### VISUAL INSPECTION

1. The visual inspection must be performed in accordance with the instructions in section 6-8, "Visual Inspection" and the following:
2. Visually inspect induction tubes, risers and intake manifold for cracks, dents and chafing. Check tube ends and flanges on a surface plate for warpage and out of roundness. Components exhibiting cracks, dents, chafing, warpage or out of roundness must be discarded.
3. Inspect tapped holes and helical coils for distorted or stripped threads.
4. Inspect all induction system clamps for cracks, corrosion and damaged screw threads. The screw mechanism must operate without any binding. Inspect the clamp for broken/loose rivets or spot welds. Clamps exhibiting any of the above conditions must be discarded.

### FLUORESCENT PENETRANT INSPECTION

Fluorescent penetrant inspection must be performed on all aluminum alloy induction system components by a certified technician in accordance with the instructions in section 6-12, "Fluorescent Penetrant Inspection."

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.

All components must be thoroughly cleaned and air dried prior to dimensional inspection.

| REF. NO. | DESCRIPTION | NEW PARTS MIN. | MAX. |
|---|---|---|---|
| 1. | Bushing to Throttle Body ........................................................ Diameter: | 0.0020T | 0.0040T |
| 2. | Throttle Shaft to Bushing (Installed) ...................................... Diameter: | 0.0005L | 0.0025L |
| 3. | Throttle Plate to Shaft ........................................................... Clearance: | 0.0010L | 0.0060L |

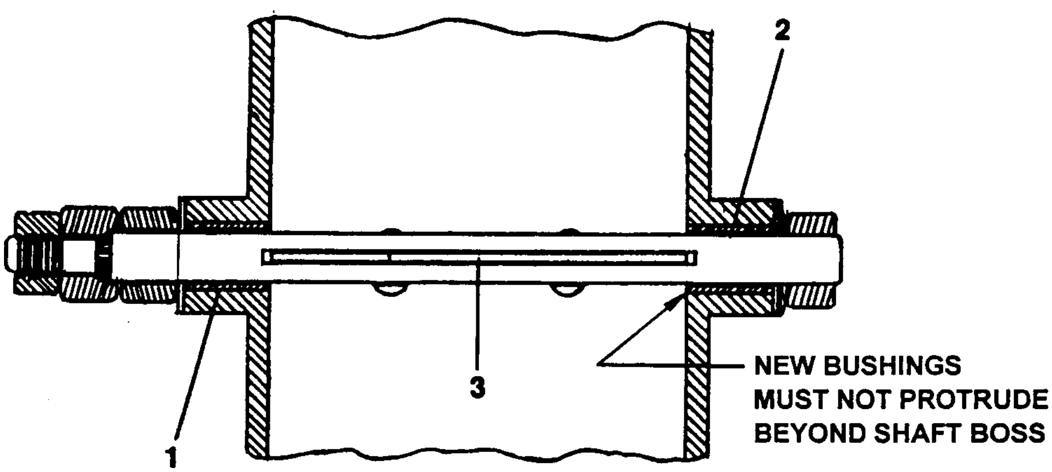



**FIGURE 10-3. THROTTLE BODY FITS AND LIMITS I0-550-A, B & C**

## 10-5 INDUCTION SYSTEM REPAIR AND REPLACEMENT

Any induction system component worn beyond new parts limits or failing to meet the inspection criteria in section 10-4 must be replaced unless repair is possible with the following instructions:

1. Throttle assemblies may be re-bushed providing the throttle body bushing bore is not damaged during bushing removal. Remove the throttle body bushings using the correct size tool and an arbor press. Inspect the bushing bore. The bushing bore maximum diameter must not exceed 0.4385 when old bushing is removed. After new bushing is installed its inside diameter must be .3745 min. to .3760 max.
2. The throttle lever bushings, as used, must be replaced during engine overhaul. Place the lever bushing over a ring that will allow the bushing to pass through. Using the correct size drift and an arbor press, remove the old bushing. Inspect the lever bushing bore for a diameter of .249 .251. Discard levers that exceed the specified dimension. Using the correct size drift and an arbor press, install the new bushing in accordance with the specifications in Figure 10-4. The lever and bushing must have a press fit of .007T to .013T.

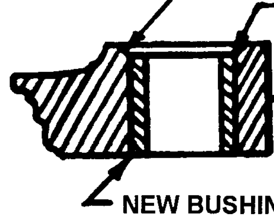



**FIGURE 10-4. GENERAL LEVER BUSHING REPLACEMENT**

3. Section 6-19, "Application Of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing.

## 10-6 INDUCTION SYSTEM SUB-ASSEMBLY (See Figure 10-6).

**WARNING**

**Never use teflon tape on induction system component fittings.**

Note...All induction system components must be clean and free of debris before assembly.

The throttle must be assembled using the following procedures and special tool:

1. Staking Tool conforming with the specifications in Figure 10-6 .

See Figure 10-2A, "Throttle Assembly I0-550-A & B." Slide throttle shaft (14) into throttle body. Using SHELL #5 grease or LUBRIPLATE #630M or equivalent, lubricate shaft at both bushings. Install plate (15) into shaft. Secure using new screws (16). Snug screws (16) hand tight using a screwdriver. The throttle plate screws are designed with a hollow end that must be expanded to safety the throttle plate screws in place. Using a staking tool conforming with the specifications in Figure 10-6 stake both throttle plate screws in accordance with the instructions in Figure 10-5. Install new washers (4,5) on the throttle shaft. Install collar (2).

Secure collar with new pin (3). Spread both ends of pin (3) using a pin punch and a ball peen hammer. Install adjusting screw and spring (8,9) in lever (6). Install new washer (5) and lever (6) on shaft. Secure lever with new pin (3). Spread both ends of pin (3) using a pin punch and a ball peen hammer. Adjust set screw (11) to position throttle plate (15) full open when set screw is contacting stop pin (17). Hold set screw (11) in position using a screw driver and torque nut (10) to 17.5-22.5 inch pounds. Install lever (12) on throttle shaft and secure using new nut (13). Adjust lever (12) as required. Torque nut (13) to 100-120 inch pounds torque

See Figure 10-2B, "Throttle Assembly I0-550-C." Slide throttle shaft (15) into throttle body. Using SHELL #5 grease or LUBRIPLATE #630M or equivalent, lubricate shaft at both bushings. Install plate (16) into shaft. Secure using new screws (17). Snug screws (17) hand tight using a screwdriver. The throttle plate screws are designed with a hollow end that must be expanded to safety the plate screw in place. Using a staking tool conforming with the specifications in Figure 10-6, stake both throttle plate screws in accordance with the instructions in Figure 10-5. Install a plain washer (5) and new wave washer (4) on the throttle shaft. Install collar (2). Secure collar with new pin (3). Spread both ends of pin (3) using a pin punch and a ball peen hammer. Install adjusting screw and spring (12, 11) in lever (9). Install new washer (5) and lever (9) on shaft. Secure lever with new pin (3). Spread both ends of pin (3) using a pin punch and a ball peen hammer. Adjust screw (12) to position throttle plate (16) full open when set screw is contacting stop pin (18). Hold set screw (14) in position using a screw driver and torque nut (13) to 17.5-22.5 inch pounds. Install lever (6) on throttle shaft and secure using new nut (8). Adjust lever (6) as required. Torque nut (8) to 100-120 inch pounds.

See Figure 10-2C, "Throttle Assembly I0-550-G,N,P,R." Install new o-rings (4) and new washer (5) on shaft assembly (3). Coat o-rings (4) with a small amount of grade 50 MHS 27 oil. Slide throttle shaft assembly (3) into throttle body. Using a few drops of clean 50 wt. aviation engine oil lubricate shaft at both throttle shaft bosses. Install plate (6) into shaft. Secure using new screws (7). Snug screws (7) hand tight using a screw driver. The throttle plate screws are designed with a hollow end that must be expanded to safety the plate screw in place. Using a staking tool conforming with the specifications in Figure 10-6, stake both throttle plate screws in accordance with the instructions in Figure 10-5. Install adjusting screw and spring (13,14) in lever (8). Install lever (8) on shaft. Secure lever with new pin (12). Spread both ends of pin (12) using a pin punch and a ball peen hammer. Adjust set screw (10) to position throttle plate (6) full open when set screw is contacting stop pin (2). Hold set screw (10) in position using a screwdriver and tighten nut (11) with a wrench. Coat o-rings (17) with Parker "O" Lube. Install o-rings (17) on throttle shaft fuel metering disc and on fuel metering cover boss. Install spring (24) and bushing (23) in bottom most position of cover (15). Hold cover (15) with opening upright and install spring (18) into recess at the bottom of cover. Place o-ring (19) in metering plug (20). Install metering plug (20) into cover (15) with metering plug pin aligned with mixture adjustment pin opening in cover. Depress plug assembly in cover to determine proper alignment of plug pin in mixture- adjustment recess. When assembly is complete, the pin on the metering plug must be positioned between bushing (23) and mixture adjustment screw (21). Holding parts (15 through 20) together carefully mate them to the air throttle assembly (1). Install screws (16) securing fuel metering assembly to throttle body. Tighten screws (16) to 21-25 inch pounds torque. Lock wire screws (16) in accordance with Chapter 5, "Lockwire Procedure." Install mixture adjustment screw (21) with a new o-ring (22). After calibration the mixture adjustment screw must be secured using a new retaining ring (25). After overhaul, this unit must be calibrated in accordance with the data in Table 10-1 and the Fuel Metering Unit Calibration Instructions in the TCM Fuel Injection Parts And Overhaul Manual, Form X30593A.

**TABLE 10-1. THROTTLE AND FUEL METERING UNIT CALIBRATION**

| SETTINGS | | LIMITS | | |
|---|---|---|---|---|
| PART NUMBER | THROTTLE ANGLE | INLET PRESSURE PSI ± .25 | FUEL FLOW LBS./HR. | METERED PRESSURE PSI AMBIENT |
| I0-550-G<br>653353-1 | 0° | 15.0 | 14.0-14.5 | 0.0 |
| | 9° | 15.0 | 35.5-40.1 | 0.0 |
| | 18° | 15.0 | 64.5-68.5 | 0.0 |
| | 30° | 15.0 | 102.0-107.0 | 0.0 |
| | 47° | 15.0 | 145.8-150.8 | 0.0 |
| | 55° | 15.0 | 162.4-166.9 | 0.0 |
| | FULL THROTTLE | 15.0 | 180.0-187.0 | 0.0 |

| SETTINGS | | LIMITS | | |
|---|---|---|---|---|
| PART NUMBER | THROTTLE ANGLE | INLET PRESSURE PSI ± .25 | FUEL FLOW LBS./HR. | METERED PRESSURE PSI AMBIENT |
| I0-550-N,P,R<br>653353-1 | 0° | 4.4 | 7.4-7.9 | 0.0 |
| | 9° | 8.5 | 29.7-33.7 | 0.0 |
| | 18° | 10.0 | 51.5-55.5 | 0.0 |
| | 30° | 9.8 | 85.0-90.0 | 0.0 |
| | 47° | 9.5 | 124.3-129.3 | 0.0 |
| | 55° | 10.5 | 148.3-153.3 | 0.0 |
| | FULL THROTTLE | 13.2 | 194.0-202.0 | 0.0 |

Store all induction system components in a clean protected area until final engine assembly.

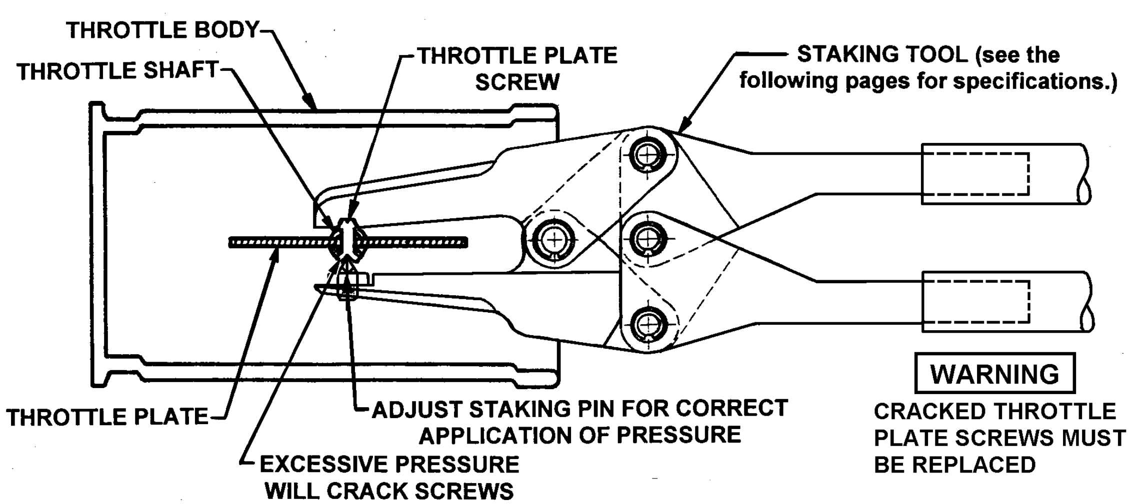
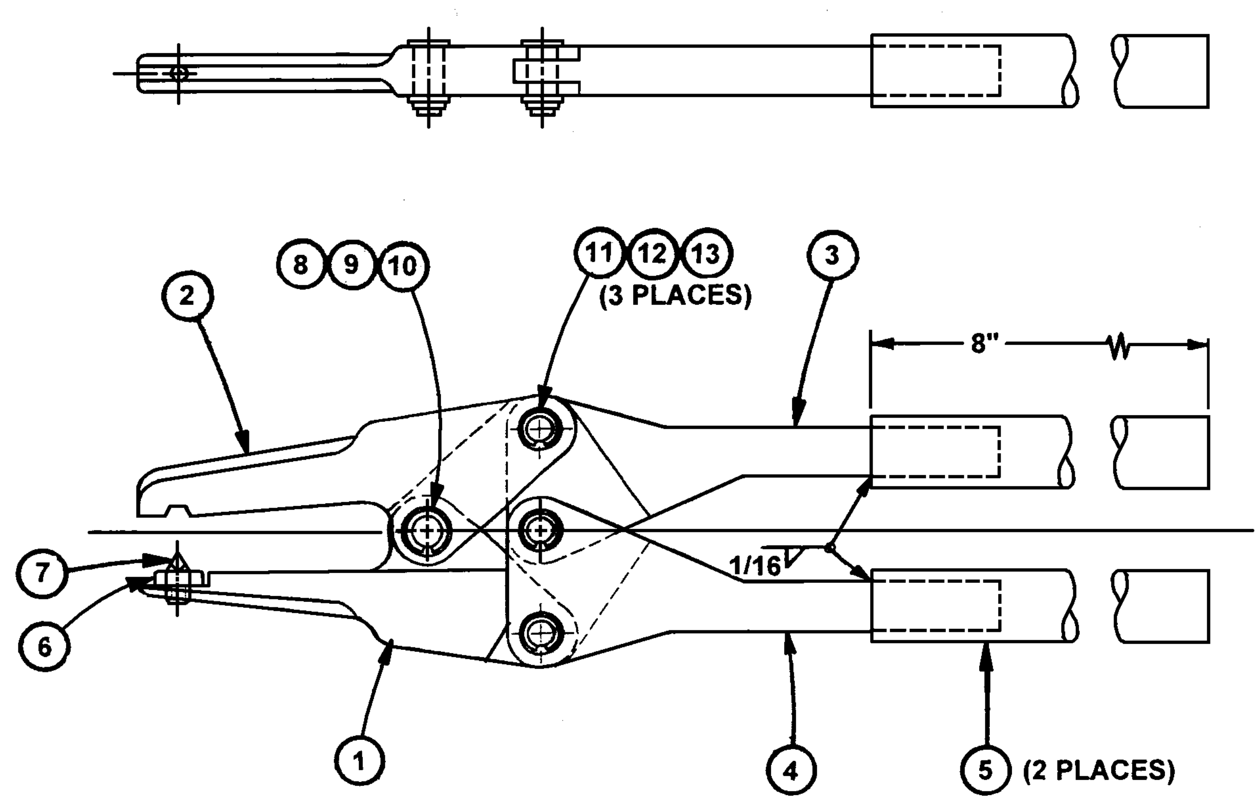



**FIGURE 10-5. STAKING THROTTLE PLATE SCREWS**

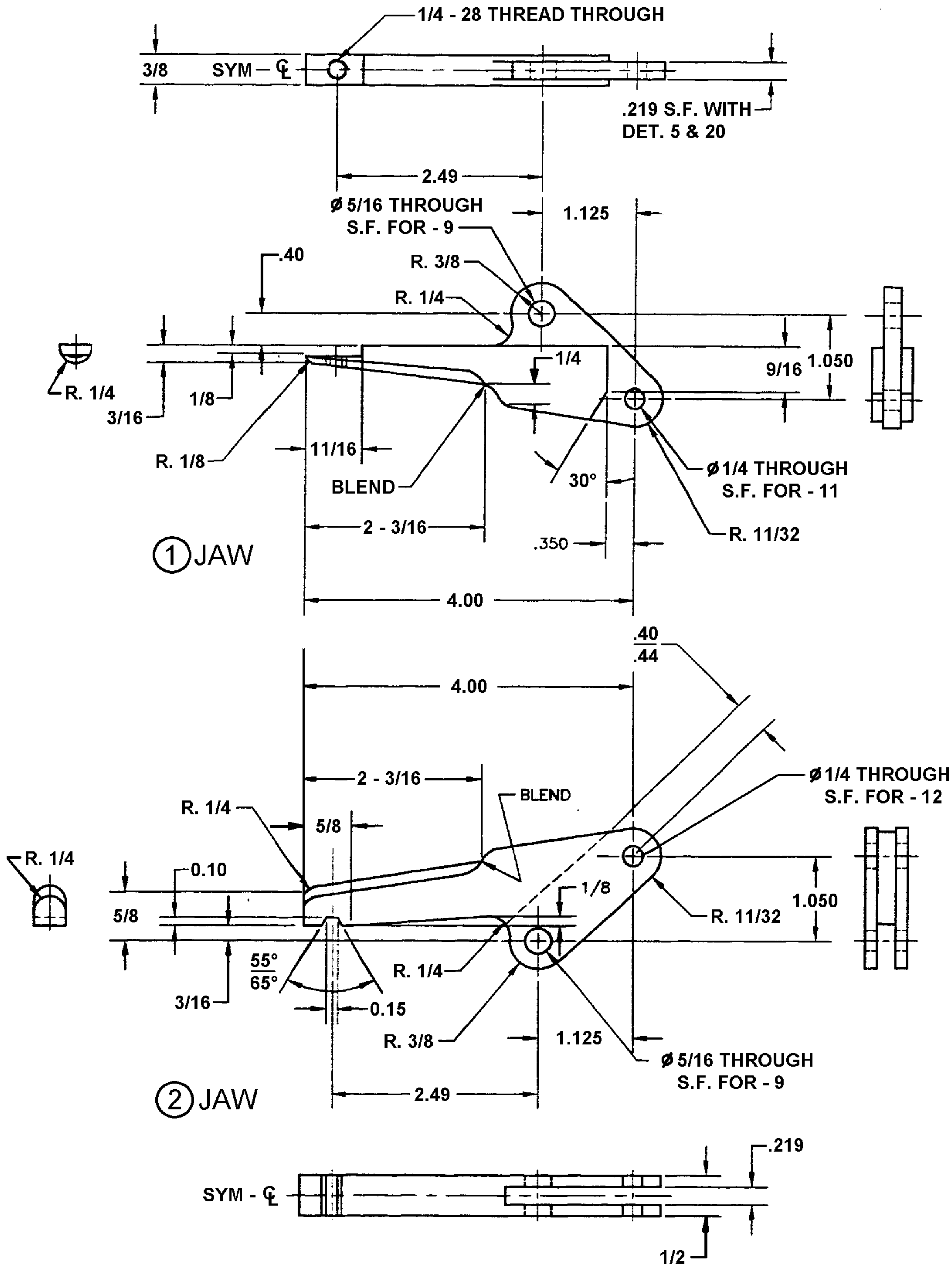


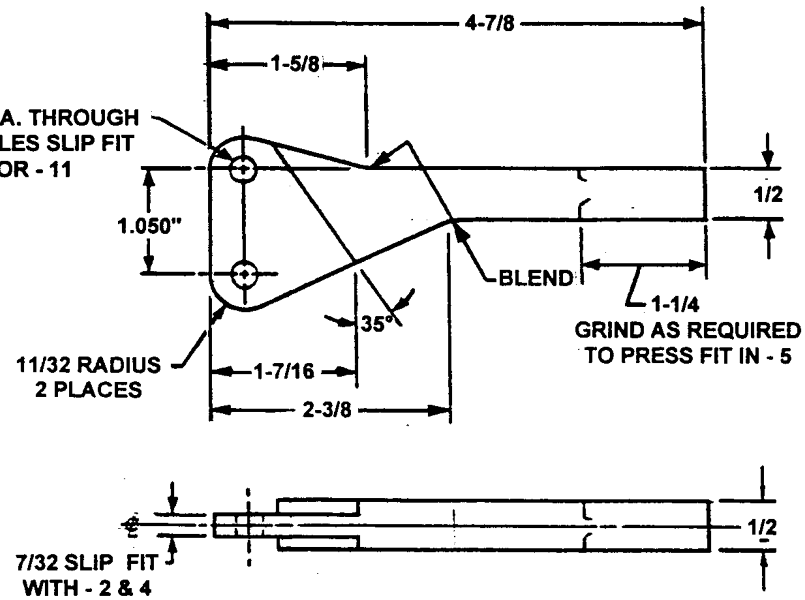

### STAKING TOOL BILL OF MATERIAL

| ITEM NUMBER | QUANTITY | PART NAME | MATERIAL | STOCK SIZE (INCHES) |
|---|---|---|---|---|
| -1 | 1 | JAW | 4130 STEEL | 2 X 4-1/2 X 1/2 |
| -2 | 1 | JAW | 4130 STEEL | 2 X 4-1/2 X 1/2 |
| -3 | 1 | JAW, ACTUATOR | 4130 STEEL | 1/2 X 1-3/4 X 4-7/8 |
| -4 | 1 | JAW, ACTUATOR | 4130 STEEL | 1/2 X 1-3/4 X 4-7/8 |
| -5 | 2 | HANDLE, TUBING | 1020 STEEL | 3/4 O.D. X 12 GA. X 8 |
| -6 | 1 | NUT, HEX | STD. STEEL | 1/4 X 28 |
| -7 | 1 | SOCKET, SET SCREW | STD. STEEL | 1/4 X 28 X 5/8 |
| -8 | 1 | PIN, FLAT HEAD | STD. STEEL | 5/16 DIA. X 3/4 LONG |
| -9 | 1 | WASHER, FLAT | STD. STEEL | 5/16 I.D. X 1/16 THK. |
| -10 | 1 | RETAINING, RING | STD. STEEL | "E" TYPE 5/16 |
| -11 | 3 | PIN, FLAT HEAD | STD. STEEL | 1/4 DIA. X 3/4 LONG |
| -12 | 3 | WASHER, FLAT | STD. STEEL | 1/4 I.D. X 1/16 THK. |
| -13 | 3 | RETAINING, RING | STD. STEEL | "E" TYPE 1/4 |

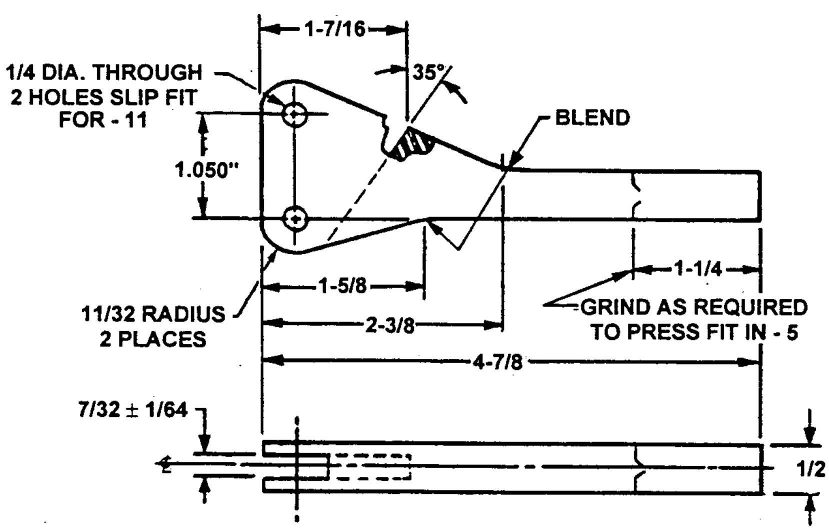
Note...See the following pages for machining specifications.

**FIGURE 10-6. STAKING TOOL SPECIFICATIONS**


1/4 - 28 THREAD THROUGH
3/8
SYM - ℄
.219 S.F. WITH
DET. 5 & 20
2.49
ø 5/16 THROUGH
S.F. FOR - 9
1.125
.40
R. 3/8
R. 1/4
1/4
9/16
1.050
R. 1/4
3/16
1/8
R. 1/8
11/16
BLEND
30°
ø 1/4 THROUGH
S.F. FOR - 11
2 - 3/16
.350
R. 11/32
1 JAW
4.00
.40
.44
4.00
2 - 3/16
BLEND
ø 1/4 THROUGH
S.F. FOR - 12
R. 1/4
5/8
R. 1/4
0.10
1/8
5/8
1.050
R. 11/32
55°
65°
R. 1/4
3/16
0.15
R. 3/8
1.125
ø 5/16 THROUGH
S.F. FOR - 9
2 JAW
2.49
.219
SYM - ℄
1/2




(3) JAW, ACTUATOR




(4) JAW, ACTUATOR

8 & 11

PIN, FLAT HEAD

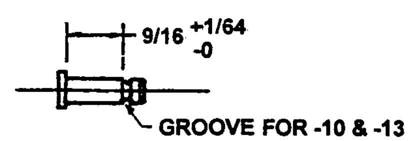



**FIGURE 10-6. STAKING TOOL SPECIFICATIONS (continued )**

## Throttle And Fuel Control Unit Assembly

NOTE...TCM requires that the air throttle/fuel control unit be assembled and calibrated by an FAA approved fuel injection system repair facility. The air throttle/fuel control unit must be assembled and calibrated, after overhaul, in accordance with the following instructions and the instructions, specifications and calibration data contained in the Teledyne Continental Fuel Injection System Overhaul Manual and Parts Catalog, Form X30593A.

### WARNING

**The improper installation of fuel control to throttle linkage and attaching hardware will cause excessive wear and eventual failure.**

See Figure 9-1A, "Fuel Injection System I0-550-A," as used. Install fuel control unit (5) on throttle assembly (4). Secure using new tab lock washers (8) and bolts (9). Torque bolts (9) to 75-85 inch pounds. Bend tab of washer (8) up against bolt hex flat to safety. See section 5-3, "Tab Washer Procedure." Using SHELL #5 grease or LUBRIPLATE #630M or equivalent, lubricate all lever and link rod pivot points prior to assembly. Using new wave washers and plain washers (15,16) install link rod assembly between throttle and fuel control. See Figure (10-7). Secure rod ends using new cotter pins (17). See section 5-4, "Cotter Pin Procedure."

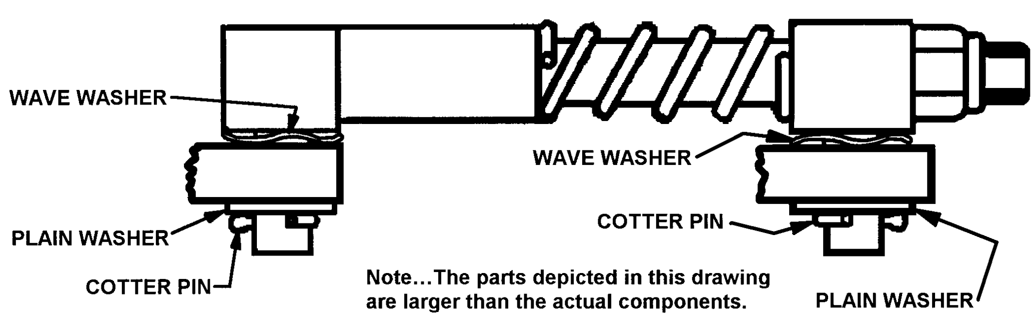
See Figure 9-1B, "Fuel Injection System I0-550-B," as used. Install fuel control unit (5) on throttle assembly (4A). Secure using new tab lock washers (10) and stand off bolts (11). Torque bolts (11) to 75-85 inch pounds torque. Bend tab of washers (10) up against bolt hex flat to safety. See section 5-3, "Tab Washer Procedures." Using SHELL #5 grease or LUBRIPLATE #630M or equivalent, lubricate all lever and link rod pivot points prior to assembly. Using new wave washers (19) install link rod assembly between throttle and fuel control. See Figure (10-7). Secure rod ends using new plain washers (20) and cotter pins (19). See section 5-4, "Cotter Pin Procedure."

See Figure 9-1C, "Fuel Injection System I0-550-C," as used. Install fuel control unit (5) on throttle assembly (4). Secure using new tab lock washers (7) and bolts (8). Torque bolts (8) to 75-85 inch pounds torque. Bend tab of washers (7) up against bolt heads to safety. See section 5-3, "Tab Washer Procedures." Using SHELL #5 grease or LUBRIPLATE #630M or equivalent, lubricate all lever and link rod pivot points prior to assembly. Using new wave washers and plain washers (15,16), install link rod assembly between throttle and fuel control. See Figure (10-7). Secure rod ends using new cotter pins (17). See section 5-4, "Cotter Pin Procedure."

Store the fuel control and throttle assembly in a clean protected area until final engine assembly.

**WARNING**

**Install new wave washers, plain washers and new cotter pins as shown.**




**Note...The parts depicted in this drawing are larger than the actual components.**

**FIGURE 10-7. GENERAL LINK ROD ASSEMBLY I0-550-A, B & C**

INTENTIONALLY

LEFT

BLANK

# CHAPTER 11

# AIR CONDITIONING

## 11-1 AIR CONDITIONING SYSTEM DISASSEMBLY (See Figure 11-1)

1. Loosen attaching hardware (8,9,13,14,15). Turn tensioning bolt (10) counterclockwise and relieve belt tension. Remove compressor drive belt (18). Remove attaching hardware (13,14,15) and separate compressor (not shown) from mounting bracket (1). Further compressor removal must be performed in accordance with the airframe manufacturer's instructions.

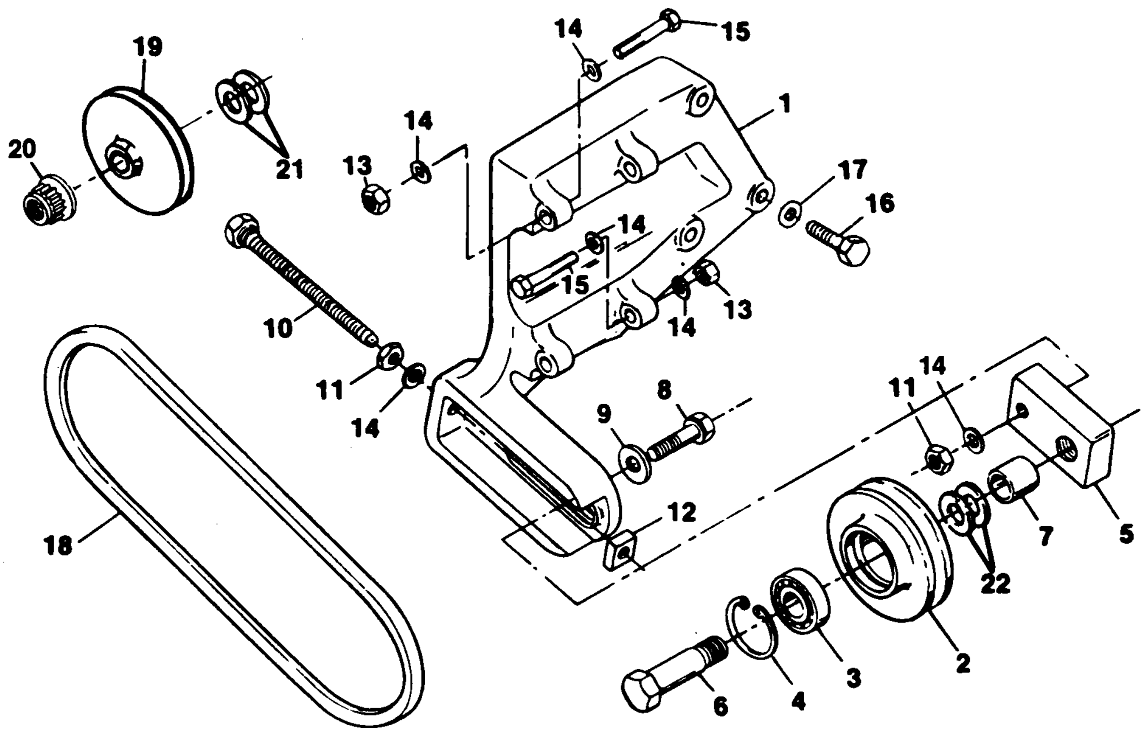



**FIGURE 11-1. OPTIONAL AIR CONDITIONING COMPRESSOR MOUNTING BRACKET**

1. Bracket
2. Sheave
3. Ball Bearing
4. Retaining Ring
5. Bracket, Idler Sheave
6. Sheave Support Bolt
7. Spacer
8. Bolt
9. Washer, special
10. Bolt, Special
11. Nut
12. Nut, Rectangular
13. Nut
14. Washer, Plain
15. Bolt
16. Bolt
17. Washer
18. Belt, Drive
19. Sheave
20. Nut, 12 Point Self Locking
21. Shim
22. Shim

## 11-2 OPTIONAL AIR CONDITIONING COMPRESSOR MOUNTING KIT DISASSEMBLY

1. Remove the through bolt nut and washer (not shown) and attaching hardware (16,17). Separate bracket assembly from engine. Remove tensioning hardware (10,11,12,14) from bracket. Remove hardware (1 through 8) and separate idler sheave (2) and block assembly (5) from bracket. Separate components (2 through 7) and (22). Discard ball bearing (3), retaining ring (4), drive belt (18) and 12 point self locking nut (20) .

## 11-3 COMPRESSOR MOUNTING KIT CLEANING

1. See section 6-6, "100% Replacement Parts," and discard all compressor mounting kit components listed. Clean all brackets and attaching hardware in accordance with the applicable instructions in section 6-7, "General Cleaning."

## 11-4 COMPRESSOR MOUNTING KIT INSPECTION

**VISUAL INSPECTION—**The visual inspection must be performed in accordance with instructions in section 6-8, "Visual Inspection," and the following special instructions.

1. Mounting Bracket Kit—Visually inspect compressor mounting bracket for cracks and elongated holes. Inspect idler sheave bracket for wear and cracks. Check mounting bracket flange for wear. Check mounting bracket on a surface plate for warpage. Inspect sheave for warpage, wear in belt grooves and bearing seats. Inspect the idler sheave support bolt for wear on the support shank. Inspect hardware for distorted or stripped threads.

NOTE...Components exhibiting any of the above listed indications must be discarded.

**FLUORESCENT PENETRANT INSPECTION**—Inspect all aluminum air conditioning compressor mounting kit components in accordance with instructions in section 6-12, "Fluorescent Penetrant Inspection." Any components exhibiting cracks must be discarded.

**MAGNETIC PARTICLE INSPECTION—**The idler sheave support bolt (6) must be magnetic particle inspected in accordance with the instructions in section 6-9, "Magnetic Particle Inspection." Support bolts exhibiting cracks must be discarded.

## 11-5 COMPRESSOR MOUNTING KIT REPAIR AND REPLACEMENT

1. Replace all compressor mounting kit parts that require 100% replacement at overhaul.
2. Any component failing to meet inspection requirements listed in section 11-4 must be discarded.
3. Section 6-19, "Application Of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing. "Accelagold," is manufactured by Turco® Products, Inc.

## 11-6 OPTIONAL COMPRESSOR MOUNTING KIT SUB-ASSEMBLY

NOTE...All parts must be clean and free of debris before assembly.

1. Install a new ball bearing (3) into sheave (2) and secure with new retaining ring (4). Using bolt (6), shims (22) and spacer (7) install sheave (2) on bracket (5). Do not torque bolt (6) at this time.
2. Loosely assemble tensioning bolt and hardware (10,11,12,14) on bracket (1). Install sheave and bracket assembly (2,5) on bracket (1) using attaching hardware (8,9,13,14,15). Do not torque at this time.
3. Store the compressor mounting bracket and related hardware in a clean protected area until final engine assembly.

INTENTIONALLY

LEFT

BLANK

# CHAPTER 12

# ELECTRICAL CHARGING SYSTEM

## 12-1 ALTERNATOR REMOVAL

1. Remove four sets of attaching parts (8, 9, 10). Pull alternator (2) from crankcase. Remove and discard gasket (1).

2. Remove cotter pin (7) and nut (4). Pull hub assembly (5) from alternator shaft. Remove woodruff key (3). Discard cotter pin (7) and woodruff key (3).

3. Separate thrust washer (6) and gear driven hub assembly (5).

NOTE…Further disassembly of Alternator is not advised unless proper test equipment is available. For overhaul information, see Teledyne Continental Motors' Alternator Service Instructions Form, X30531.

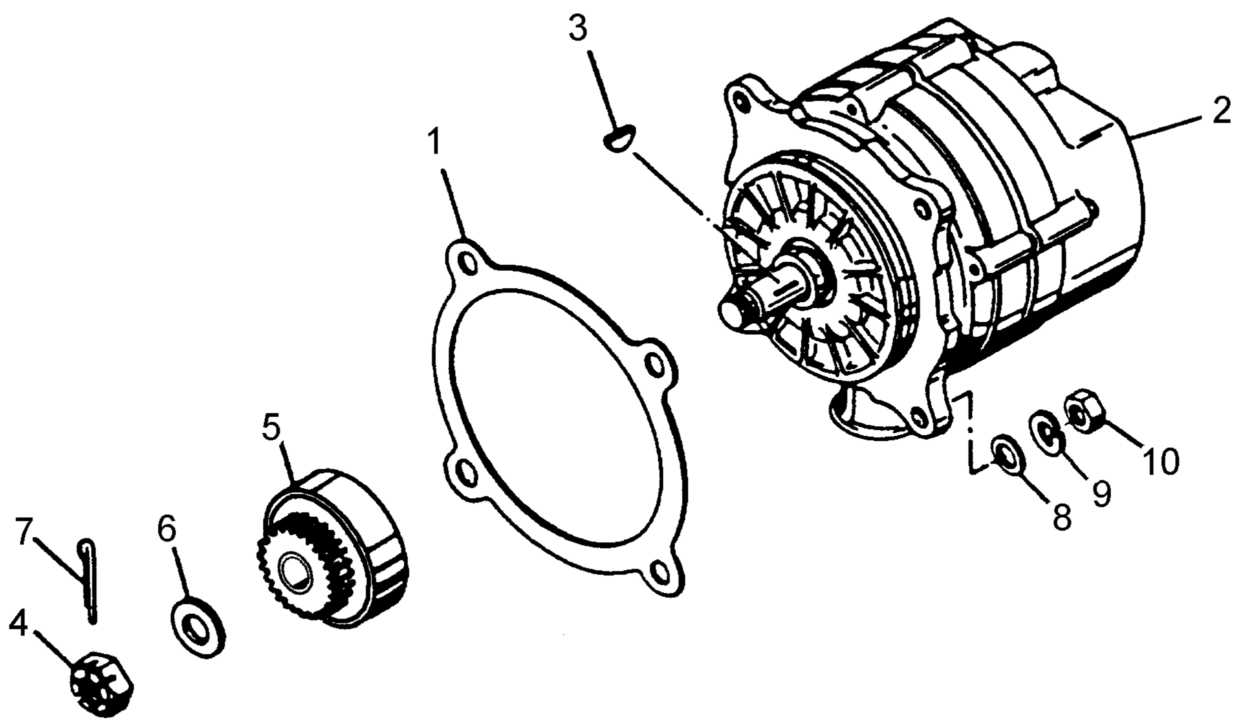



**FIGURE 12-1. ALTERNATOR ASSEMBLY**

| | |
|---|---|
| 1. Gasket | 6. Washer Thrust |
| 2. Alternator | 7. Pin, Cotter |
| 3. Key, Woodruff | 8. Washer, Plain |
| 4. Nut, Slotted | 9. Washer, Lock |
| 5. Hub, Drive | 10. Nut |

## 12-2 ALTERNATOR DISASSEMBLY

1. The alternator assembly must be overhauled in accordance with the alternator manufacturer's instructions or Alternator Service Instructions X30531-3.

## 12-3 ELECTRICAL CHARGING SYSTEM COMPONENT CLEANING

1. All electrical charging system components and associated hardware must be cleaned in accordance with the instructions in section 6-7, "General Cleaning," and the following special instructions:

2. All gaskets, lock washers, woodruff keys and self-locking nuts removed from the electrical charging system must be replaced 100% at overhaul. Cleaning these parts is not required.

3. Clean gears that have bushings using mineral spirit solvent and a brass wire brush. Gears with bushings must not be cleaned using alkaline solutions. Gears that do not have bushings can be cleaned using mineral spirit solvent or by immersion in an alkaline stripping bath if mineral spirit solvent is not effective. After cleaning with alkaline solution the gears must be sprayed with steam removing all traces of alkaline. After steam rinsing, the gears must be thoroughly flushed with mineral spirit solvent.

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed.*

**WARNING**

**Do not pressure blast gears with an abrasive media. Blasting will remove surface hardening.**

## 12-4 ELECTRICAL CHARGING SYSTEM COMPONENT INSPECTION

### VISUAL INSPECTION

1. The visual inspection must be performed in accordance with the instructions in section 6-8, "Visual Inspection." Special attention must be given to the following components and areas:

2. Drive Hub
   Inspect gear teeth for signs of overheating and excessive wear. Normal wear produces a fine polish on the tooth thrust faces. Gears that have alteration of the tooth profiles, score marks, burning or pitting must be discarded. See Figure 8-3. “Gear Tooth Wear,” for acceptable and unacceptable gear tooth wear.

### FLUORESCENT PENETRANT INSPECTION

Fluorescent penetrant inspection must be performed by a certified technician on all aluminum alloy charging system components in accordance with the instructions in section 6-12, "Fluorescent Penetrant Inspection."

During overhaul of the alternator in accordance with the alternator manufacturer's instructions, the alternator housings must be fluorescent penetrant inspected in accordance with section 6-12, "Fluorescent Penetrant Inspection," of this manual. Any components exhibiting cracks must be discarded .

## MAGNETIC PARTICLE INSPECTION

The alternator drive hub (gear) assembly must be magnetic particle inspected by a certified technician in accordance with instructions in section 6-9, "Magnetic Particle Inspection." Alternator drive hubs exhibiting cracks must be discarded.

## ALTERNATOR DRIVE HUB SLIPPAGE INSPECTION

1. The torque required to slip the elastomer coupling when new must be 180 inch pounds (15 foot pounds) torque minimum measured after 45° of revolution at a rate of 1 to 2 degrees per second. Slippage must occur at the outside diameter of elastomer with no damage to the elastomer. Couplings which have been in service for more than 25 hours slippage torque must not be less than 140 inch pounds (11.7 foot pounds) torque.

2. Drive hubs that do not conform with the above specifications must be discarded.

# 12-5 ELECTRICAL CHARGING SYSTEM COMPONENT REPAIR AND REPLACEMENT

Any electrical charging system component failing to meet the inspection criteria in section 12-4 must be replaced unless repair is possible with the following instructions:

1. Repair and replacement procedures for the alternator assembly must be performed in accordance with the alternator manufacturer's instructions.

2. Replace all electrical charging system parts listed in section 6-6, "100% Replacement Parts."

3. Section 6-19, "Application Of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing.

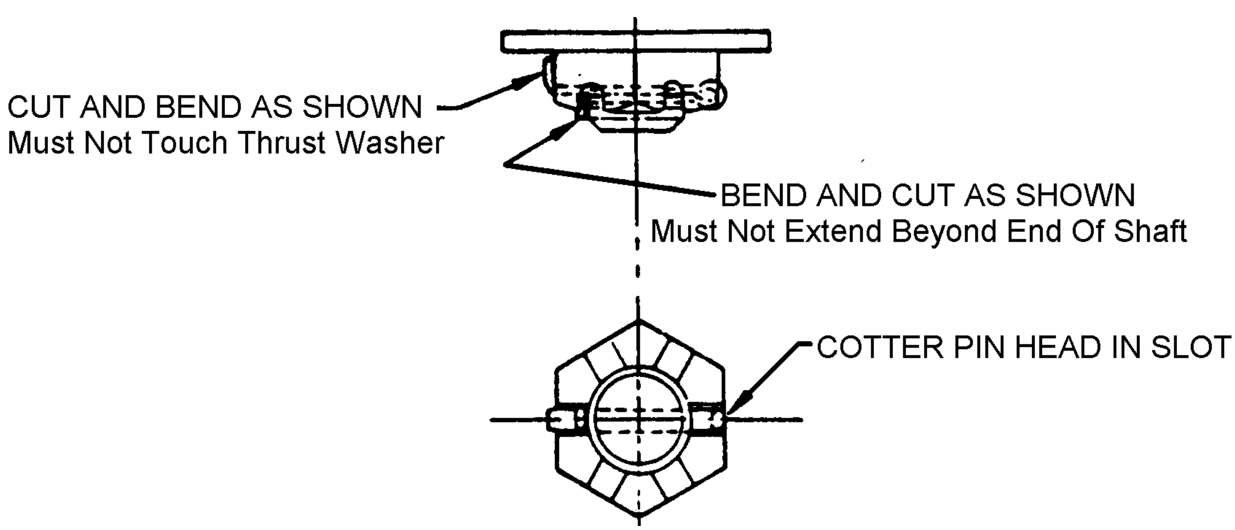



**FIGURE 12-2. COTTER PIN INSTALLATION**

## 12-6 ELECTRICAL CHARGING SYSTEM COMPONENT SUB-ASSEMBLY

NOTE…All electrical charging system components must be clean and free of debris before assembly.

1. See Figure 12-1, "Alternator Assembly." Install new woodruff key (3), coupling assembly (5) and washer (6). The washer is a special thrust washer and must be installed with the bearing surface (copper color) toward the alternator. Install nut (4). Place the toothed portion of drive hub gear in shielded vise jaws and tighten vise only enough to prevent rotation during torquing of nut. Using a currently calibrated torque wrench, torque nut (4) to 300 inch pounds torque. If slots of nut do not align with cotter pin hole in alternator shaft, the nut may be torqued further but must not exceed 450 inch pounds. Do not back off nut to align holes. Install cotter pin as shown in Figure 12-2, "Cotter Pin Installation," to insure clearance when alternator is installed on engine.
2. If assembling a new TCM alternator remove shipping spacer and washer from the alternator shaft and discard. Follow the applicable manufacturer's instructions on alternators other than TCM.

### WARNING

**Installation of the drive coupling assembly on TCM alternators with the shipping washer in place will cause interference with the face gear on the crankshaft, and will result in damage to the engine and alternator.**

3. Store the alternator and attaching hardware in a clean protected area until final engine assembly.

INTENTIONALLY

LEFT

BLANK

# CHAPTER 13

# STARTING SYSTEM

## 13-1A STARTER AND STARTER ADAPTER REMOVAL (See Figure 13-1A)

1. Remove attaching parts (31, 32) and pull starter (30) from starter adapter. Remove and discard o-ring (29). Place the starter motor in a clean, protected area until it is ready to be overhauled.

2. Remove four sets of attaching parts (2, 3, 4). (two on outside of crankcase between cylinder No. 1 and starter, and two on cover assembly.) remove starter adapter assembly from crankcase. Discard lock washers (3). Place the starter adapter in a clean, protected area until it is ready to be overhauled.

Nomenclature for Figure 13-1A

| | | |
|---|---|---|
| 1. Gasket | 12. Bearing, Needle | 23. Bearing Ball |
| 2. Washer, Plain | 13. Shaftgear | 24. Ring, Retainer |
| 3. Washer, Lock | 14. Spring, Clutch | 25. O-Ring |
| 4. Nut | 15. Washer, Tab | 26. Cover |
| 5. Adapter, Housing | 16. Screw, Special | 27. Washer, Plain |
| 6. Stud | 17. Bearing, Ball | 28. Nut |
| 7. Stud | 18. Ring, Retainer | 29. O-Ring |
| 8. Stud | 19. Shaft | 30. Motor, Starter |
| 9. Stud | 20. Spring | 31. Washer |
| 10. Bearing, Needle | 21. Key, Woodruff | 32. Nut |
| 11. Gear, Worm Wheel | 22. Gear, Worm | |

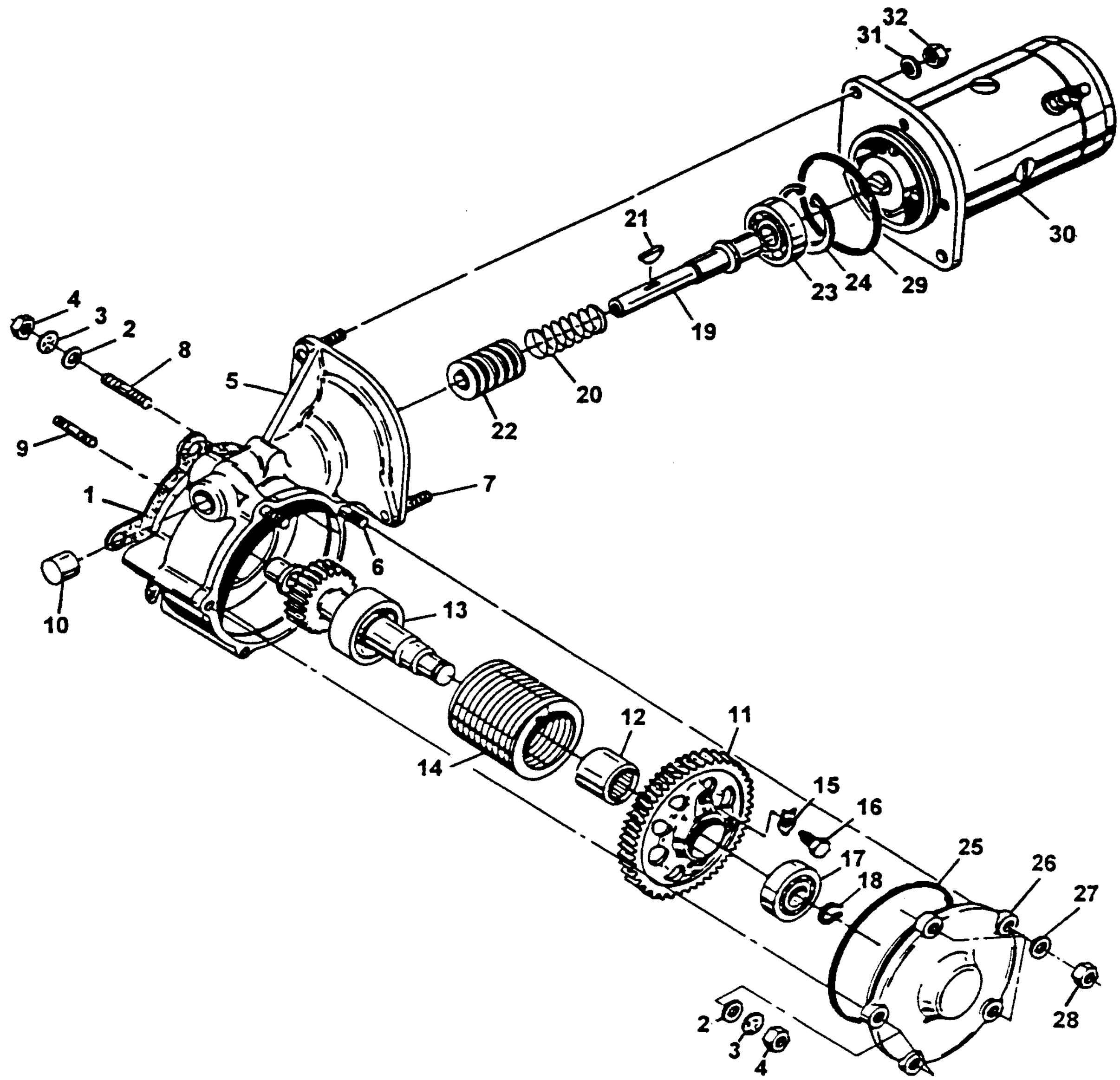



**FIGURE 13-1A. STARTER AND STARTER ADAPTER FOR I0-550-A, I0-550-B9A, B9B, B9F, B14B, B19B, B30B, B35B, B36B, I0-550-C, I0-550-G, I0-550-N, I0-550-P, I0-550-R**

## 13-1B STARTER AND STARTER ADAPTER REMOVAL (See Figure 13-1B)

1. Remove attaching parts (49, 50) and pull starter (48) from starter adapter. Remove and discard o-ring (47). Place the starter motor in a clean, protected area until it is ready to be overhauled.

2. Remove two sets of attaching parts (2, 3, 4). (on outside of crankcase between cylinder No. 1 and starter). Remove two sets of attaching parts (28, 29) from cover (27) and remove starter adapter assembly from crankcase. Discard lock washers (3). Remove and discard gasket (1). Place the starter adapter in a clean, protected area until it is to be overhauled.

Nomenclature for Figure 13-1B

1. Gasket
2. Washer
3. Washer, Lock
4. Nut
5. Housing, Adapter
6. Stud
7. Stud
8. Stud
9. Stud
10. Stud
11. Bearing, Needle
12. Gear, Worm
13. Spring
14. Shaft, Worm
15. Key, Woodruff
16. Bearing, Ball
17. Ring, Retaining
18. Shaft Gear
19. Spring
20. Gear, Worm Wheel
21. Washer, Tab
22. Screw, Special
23. Bearing, Roller
24. Bearing, Ball
25. Ring, Retaining
26. O-Ring
27. Cover
28. Washer
29. Nut
30. Stud
31. Stud
32. Stud
33. Plug
34. Gear
35. Body
36. Washer, Plain
37. Washer, Lock
38. Nut
39. Plug
40. Plug
41. Bearing, Ball
42. Spacer
43. Seal, Oil
44. Sleeve
45. Spacer
46. Nut 12Point Self Locking
47. O-Ring
48. Starter
49. Washer
50. Nut
51. Clip, Seal Retainer

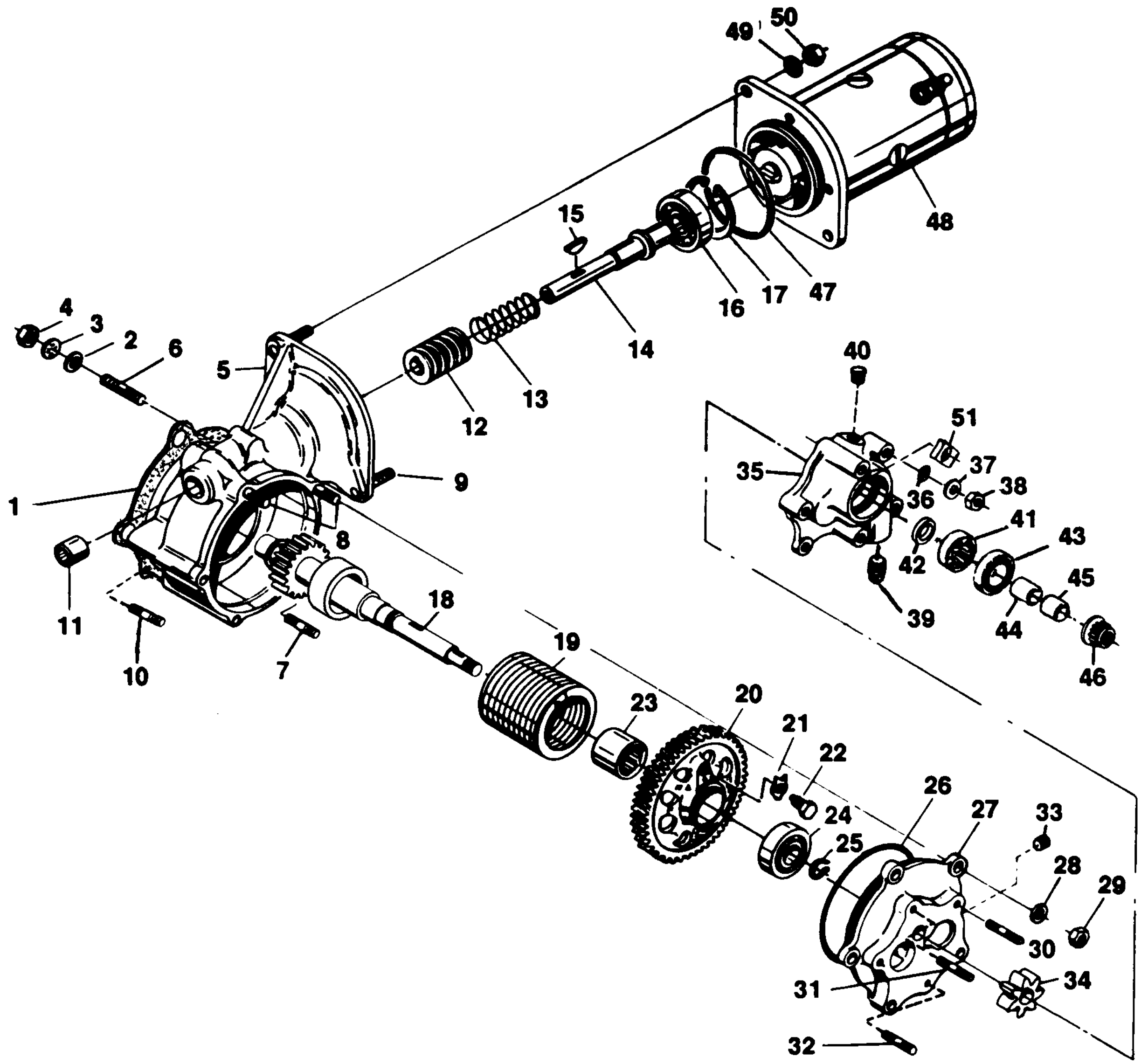



**FIGURE 13-1B. STARTER AND STARTER ADAPTER FOR I0-550-B, B1F, B2F, B3F, B4F, B5F, B6F, B11F, B12B, B13B, B15B, B16B, B17B, B18B, B20B, B21B, B22B, B23B, B24B, B25B, B26B, B27B, B28B, B29B, B31B, B32B, B33B, B34B, B37B**

## 13-2A STARTER AND STARTER ADAPTER DISASSEMBLY (See Figure 13-1A)

1. Place the starter adapter shaftgear in a shielded vise. Remove retaining ring (24), using snap ring pliers. Insert worm shaft tool into the worm shaft slot and rotate the shaft counterclockwise to break bearing (23) loose from the housing. Remove bearing (23) and shaft assembly (19 through 23). Separate worm gear (22), spring (20), woodruff key (21) and shaft (19). It may be necessary to use an arbor press to remove ball bearing (23) from shaft (19). Discard retaining ring (24), bearing (23), spring (20) and woodruff key (21).

2. Remove attaching parts (27, 28) and remove starter adapter cover (26).

3. Clamp starter shaftgear teeth in shielded vise jaws. Remove and discard retaining ring (18). Use a starter adapter disassembly tool as shown in Figure 13-2. Rotate the worm wheel gear in counterclockwise direction at the same time pull axially on the worm wheel and spring to separate it from the starter shaft gear. Remove starter shaft gear (13) from vise.

4. Clamp worm wheel in shielded vise. Remove clutch spring retaining screw (16) and tab washer (15). Place a straight slot screw driver through a hole in the worm wheel (11) to catch the end of spring (14). Rotate spring (14) clockwise to release it from the land in the worm wheel gear. Separate spring (14) from worm wheel gear (11). Remove roller bearing (12) from worm wheel gear (11).

5. Use a slide hammer and Borrough's 8093C or equivalent to remove needle bearing (10) from adapter housing (5).

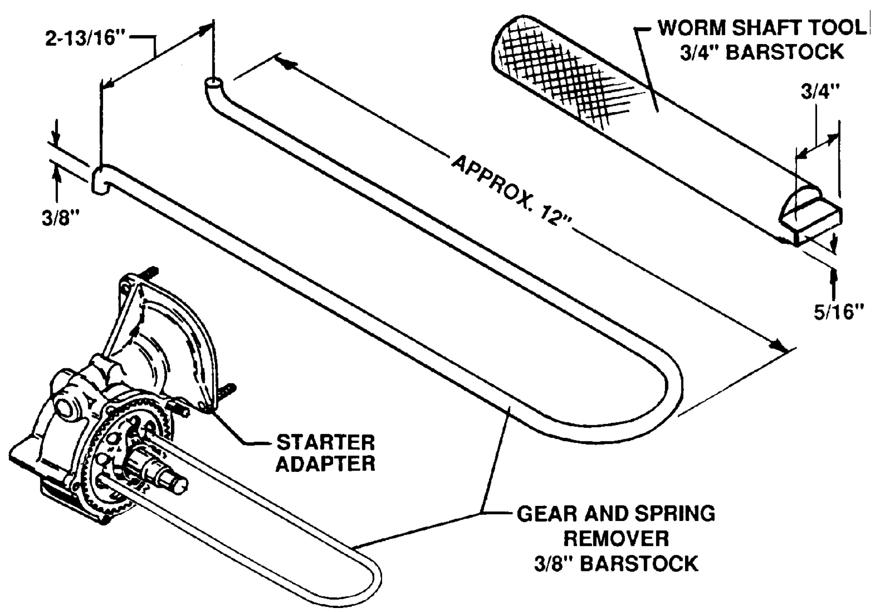



**FIGURE 13-2. STARTER ADAPTER DISASSEMBLY TOOL**

## 13-2B STARTER AND STARTER DRIVE ADAPTER (See Figure 13-1B)

1. Place the starter adapter shaftgear in a shielded vise. Remove retaining ring (17), using snap ring pliers. Insert worm shaft tool into the worm shaft slot and rotate the shaft counterclockwise to break bearing (16) loose from the housing. Remove bearing (16) and shaft assembly (12 through 16). Separate worm gear (12), spring (13), woodruff key (15) and shaft (14). It may be necessary to use an arbor press to remove ball bearing (16) from shaft (14). Discard retaining ring (17), bearing (16), spring (13) and woodruff key (15).
2. Clamp shaft gear (18) in shielded vise jaws and remove 12 point self locking nut (46). Remove sleeve (44) and spacer (45) or airframe supplied sheave, as used, from shaft. Remove four sets of attaching parts (36, 37 & 38) and oil seal retainer clip (51). Tap scavenge pump body (35) using a plastic or rawhide mallet and remove. Remove gear (34), oil seal (43), ball bearing (41) and spacer (42). Discard 12 point self locking nut (46), lock washers (37), oil seal (43) and ball bearing (41).

NOTE... Do not clamp adapter housing in vise.

3. Remove three sets of attaching parts (28 & 29). Using an inertia puller or other suitable tool, detach cover assembly (27) and o-ring (26) from starter adapter. Discard o-ring (26).
4. Clamp starter shaftgear teeth in shielded vise jaws. Remove and discard retaining ring (25). Use a starter adapter disassembly tool as shown in Figure 13-2. Rotate the worm wheel gear in counterclockwise direction at the same time pull axially on the worm wheel and spring to separate it from the starter shaft gear. Remove starter shaft gear (18) from vise. Separate shaftgear (18) from housing (5).
5. Clamp worm wheel in shielded vise. Remove clutch spring retaining screw (22) and tab washer (21). Place a straight slot screw driver through a hole in the worm wheel (20) to catch the end of spring (19). Rotate spring (19) clockwise to release it from the land in the worm wheel gear. Separate spring (19) from worm wheel gear (20). Remove roller bearing (23) from worm wheel gear (20).
6. Use a slide hammer and Borrough's 8093C Bearing Puller or equivalent to remove needle bearing (11) from housing (5).

## 13-3 STARTER MOTOR OVERHAUL

1. The starter motor assembly must be overhauled in accordance with the manufacturer's instructions. See TCM Form X30592 for TCM starters. See section 1-5, "Related Publications," for ordering information.

## 13-4 STARTER ADAPTER CLEANING

1. All starter adapter components and associated hardware must be cleaned in accordance with the instructions in section 6-7, "General Cleaning," and the following special instructions:
2. All bushings, bearings, sleeves, spacers, springs, gaskets, o-rings, oil seals, lock washers, tab lock washers, retainers, self locking nuts, and starter clutch spring removed from the starter adapter must be replaced 100% at overhaul. Cleaning of these parts is not required.
3. The starter adapter housing and covers (27, 35) cavities and oil passages must be flushed with mineral spirit solvent.

4. If the starter adapter housing or covers are immersed in an alkaline bath, when removed, they must be sprayed with steam removing all traces of alkaline. After the housing dries inspect for any alkaline residues and if necessary re-spray with steam. The housing exterior, cavities and all oil passages must be thoroughly flushed with mineral spirit solvent after any alkaline cleaning process has been used.

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed*.

5. Clean the worm shaft using mineral spirit solvent.
6. Clean gears that have bushings using mineral spirit solvent and a brass wire brush. Gears with bushings must not be cleaned using alkaline solutions. Gears that do not have bushings can be cleaned using mineral spirit solvent or by immersion in a alkaline stripping bath if mineral spirit solvent is not effective. After cleaning with alkaline solution the gears must be sprayed with steam removing all traces of alkaline. After steam rinsing the gears must be thoroughly flushed with mineral spirit solvent.

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed.*

**WARNING**

**Do not pressure blast gears with an abrasive media. Blasting will remove surface hardening.**

## 13-5 STARTER AND STARTER ADAPTER INSPECTION

### VISUAL INSPECTION

1. The starter adapter components must be visually inspected in accordance with instructions in section 6-8, "Visual Inspection." Special attention must be given to the following components and areas:
2. The starter motor assembly must be overhauled in accordance with the starter manufacturer's instructions. See TCM Form X30592 for TCM starters. See section 1-5, "Related Publications," for ordering information.
3. Using a flashlight and a 10X magnifying glass visually inspect the exterior and the cavity of the starter adapter housing for cracks. Housings exhibiting cracks must be discarded. Inspect the starter adapter covers for cracks. Adapter covers exhibiting cracks must be discarded. Inspect all oil passages for restrictions. Starter adapter housing oil passages must be clear and free flowing. Housings with clogged oil passages that cannot be opened must be discarded.
4. Inspect the shaft gear, worm wheel gear, worm gear and bevel gear teeth for signs of overheating and excessive wear. Normal wear produces a fine polish on the tooth thrust faces. Gears that have alteration of the tooth profiles, score marks, burning or pitting must be discarded. See Figure 8-3, “Gear Tooth Wear,” for acceptable and unacceptable gear tooth wear.

5. Inspect the starter adapter housing and accessory drive adapter housing studs for distorted or stripped threads. Inspect studs for corrosion, pitting, incomplete threads and looseness. Replace studs with any of these indications. Check studs with a tool makers square for alignment. The starter adapter housing studs must have their setting heights checked for indications of backing out. See the following for stud setting heights.

| ITEM NO. | LOCATION | THREAD SIZE | SETTING HEIGHT | QTY. |
|---|---|---|---|---|
| 1. | Stud, Starter Adapter to Crankcase | 5/16-18 X 5/16-24 | 1.32 | 1 |
| 2. | Stud, Starter Adapter to Crankcase | 5/16-18 X 5/16-24 | 1.00 | 1 |
| 3. | Stud, Cover to Adapter | 5/16-18 X 5/16-24 | .72 | 3 |
| 4. | Stud, Cover to Adapter | 5/16-18 X 5/16-24 | 1.32 | 1 |
| 5. | Stud, Starter Motor to Adapter | 3/8-16 X 3/8-24 | 1.00 | 2 |

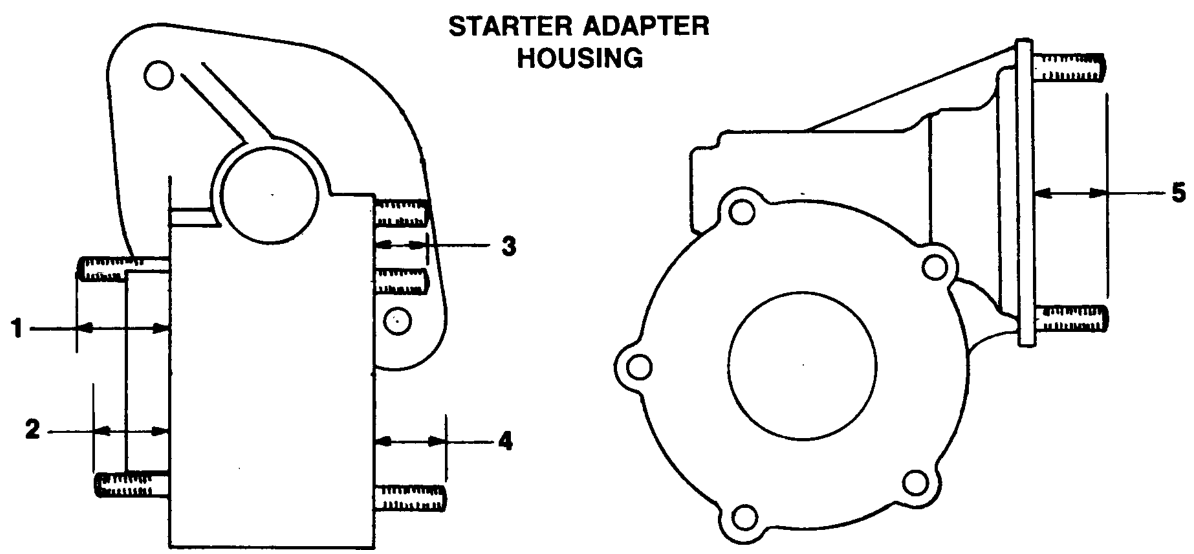



**FIGURE 13-3A. STARTER AND ACCESSORY DRIVE ADAPTER STUD SETTING HEIGHTS FOR I0-550-A, I0-550-B9A, B9B, B9F, B14B, B19B, B30B, B35B, B36B, I0-550-C, I0-550-G, I0-550-N, I0-550-P, I0-550-R**

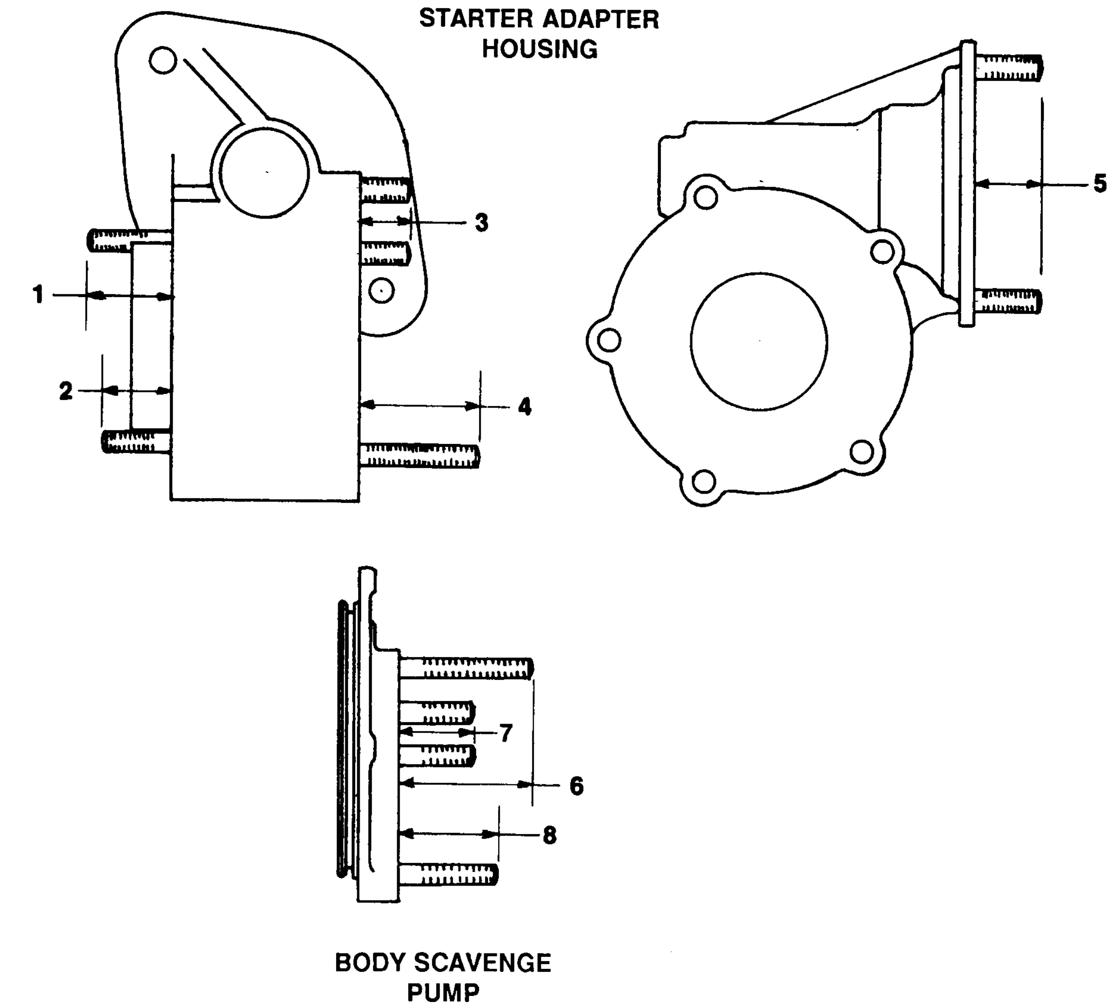



**FIGURE 13-3B. STARTER AND ACCESSORY DRIVE ADAPTER STUD SETTING HEIGHTS FOR I0-550-B, B1F, B2F, B3F, B4F, B5F,B6F, B11F, B12B, B13B, B15B, B16B, B17B, B18B, B20B, B21B, B22B, B23B, B24B, B25B, B26B, B27B, B28B, B29B, B31B, B32B, B33B, B34B, B37B**

| ITEM NO. | LOCATION | THREAD SIZE | SETTING HEIGHT | QTY. |
|---|---|---|---|---|
| 1. | Stud, Starter Adapter to Crankcase | 5/16-18 X 5/16-24 | 1.32 | 1 |
| 2. | Stud, Starter Adapter to Crankcase | 5/16-18 X 5/16-24 | 1.09 | 1 |
| 3. | Stud, Cover to Adapter | 5/16-18 X 5/16-24 | .67 | 3 |
| 4. | Stud, Cover & Scavenge Body to Adapter | 5/16-18 X 5/16-24 | 2.13 | 1 |
| 5. | Stud, Starter Motor to Adapter | 3/8-16 X 3/8-24 | 1.00 | 2 |
| 6. | Stud, Cover to Scavenge Body | 5/16-18 X 5/16-24 | 2.25 | 1 |
| 7. | Stud, Cover to Scavenge Body | 5/16-18 X 5/16-24 | 1.25 | 2 |
| 8. | Stud, Cover to Scavenge Body | 5/16-18 X 5/16-24 | 1.55 | 1 |

## FLUORESCENT PENETRANT INSPECTION

Aluminum alloy components such as the starter adapter housing, scavenge pump body and adapter covers must be fluorescent penetrant inspected by a certified technician in accordance with section 6-12, "Fluorescent Penetrant Inspection." Housings or covers exhibiting cracks must be discarded.

## MAGNETIC PARTICLE INSPECTION

The shaft gear, worm shaft and worm gear must be inspected by a certified technician in accordance with the instructions in section 6-9, "Magnetic Particle Inspection." Gears or shafts exhibiting cracks must be discarded.

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.

All components must be thoroughly cleaned and air dried prior to dimensional inspection.

| REF. | DESCRIPTION | NEW PARTS MIN. | MAX. |
|---|---|---|---|
| 1. | Starter shaftgear needle bearinq hole crankcase ....... Diameter: | 0.9995 | 1.0005 |
| 2. | Starter shaft gear front (bearinq) journal .................... Diameter: | 0.7495 | 0.7500 |
| 3. | Starter shaftgear in clutch drum bearinq .................... Diameter: | .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 13-5B | |
| 9. | Starter Shaft gear drum............................................. Diameter: | See Figure 13-5A | |
| 10. | ① Clutch spring in clutch sprinq sleeve ........................ Diameter: | 0.0310T | 0.0380T |
| 11. | From center line of worm gearshaft to starter adapter thrust pads ........................................................: | 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 gearshaft in needle bearing area..................... Diameter: | 0.5615 | 0.5625 |
| 15. | Worm gearshaft in ball bearing ................................. Diameter: | 0.0001T | 0.0007L |
| 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 | 0.0130 |
| 21. | Starter adapter Cover Pilot In Adapter Housing ......... Diameter: | 0.0010L | 0.0040L |

① When sand blasted diameter finish is smoother than 75 RMS, replace sleeve .

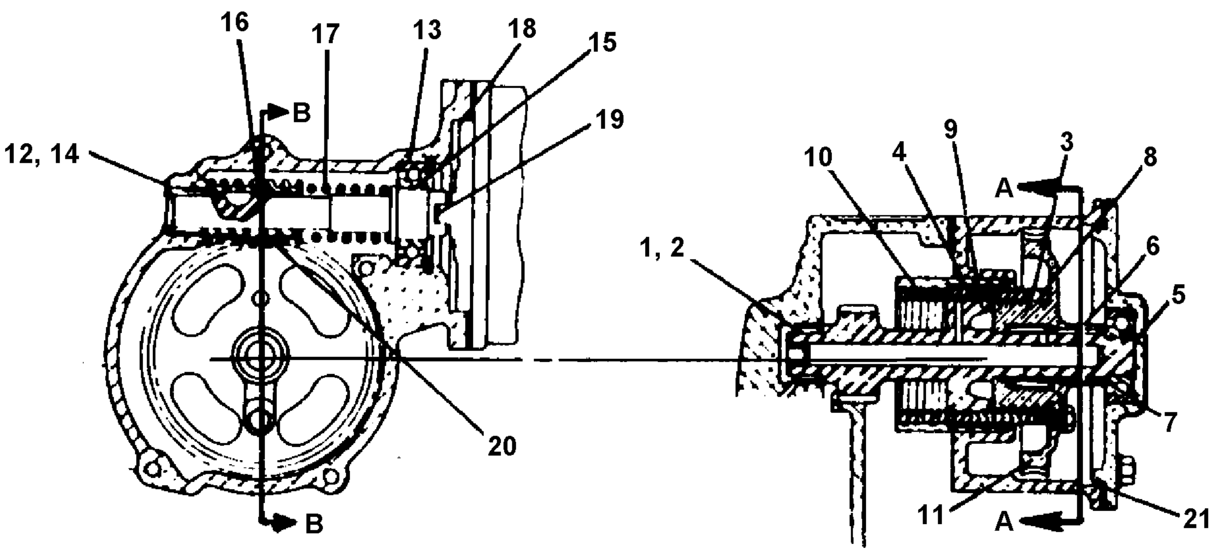
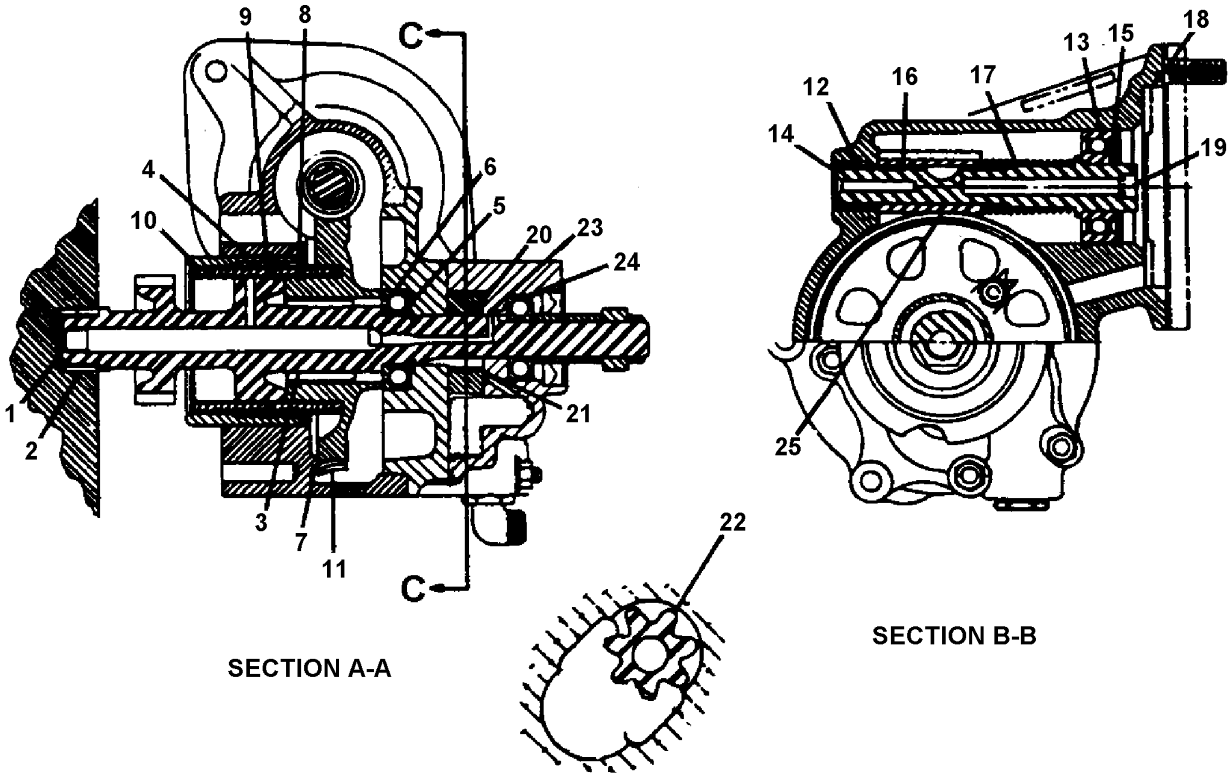



**FIGURE13-4A. STARTER ADAPTER FITS AND LIMITS FOR I0-550-A, I0-550-B9A, B9B, B9F, B14B, B19B, B30B, B35B,B36B, I0-550-C, I0-550-G, I0-550-N I0-550-P, I0-550-R**

| REF. | DESCRIPTION | NEW PARTS MIN. | MAX. |
|---|---|---|---|
| 1. | Starter shaftgear needle bearing hole crankcase......... Diameter: | 0.9995 | 1.0005 |
| 2. | Starter shaftgear front (bearing) journal ....................... Diameter: | 0.7495 | 0 7500 |
| 3. | Starter shaftgear in clutch drum bearing area .............. Diameter: | .9995 | 1.0000 |
| 4. | Clutch spring sleeve in starter adapter ......................... Diameter: | 0.0030T | 0.0050T |
| 5. | Starter shaftgear in ball bearing ................................. Diameter: | 0.0001T | 0.0007L |
| 6. | Bearing in starter adapter cover .................................. Diameter: | 0.0001T | 0.0010L |
| 7. | Worm wheel gear ............................................. End Clearance: | 0.0020 | 0.0170 |
| 8. | Worm wheel drum ..................................................... Diameter: | See Figure 13-5B | |
| 9. | Starter Shaftgear Drum .............................................. Diameter: | See Figure 13-5A | |
| 10. | ① Clutch spring in clutch spring sleeve ...................... Diameter: | 0.0340T | 0.0380T |
| 11. | From center line of worm gearshaft to starter adapter thrust pads ..........................................................: | 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 gearshaft in needle bearing area ...................... Diameter: | 0.5615 | 0.5625 |
| 15. | Worm gearshaft in ball bearing.................................... Diameter: | 0.0001T | 0.0007L |
| 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: | 0.0120L | 0.0340L |
| 20. | Scavenge pump driver gear on starter gear shaft ....... Diameter: | 0.0001L | 0.0018L |
| 21. | Scavenge pump driver gear in body ................... End Clearance: | 0.0015 | 0.0040 |
| 22. | Scavenge pump driver gear in body ............................ Diameter: | 0.0018L | 0.0143L |
| 23. | Starter gearshaft in scavenge pump body ................... Diameter: | 0.0001T | 0.0005L |
| 24. | Ball bearinq in scavenge pump body ........................... Diameter: | 0.0000T | 0.0011L |
| 25. | Starter worm wheel gear and worm gear...................... Backlash: | 0.0090 | 0.0130 |

① When sand blasted diameter finish is smoother than 75 RMS, replace sleeve.




SECTION A-A

SECTION B-B

SECTION C-C
(SEE SECTION A-A)

**FIGURE 13-4B. STARTER ADAPTER FITS & LIMITS FOR I0-550-B, B1F, B2F, B3F, B4F, B5F,B6F, B11F, B12B, B13B, B15B, B16B, B17B, B18B, B20B, B21B, B22B, B23B, B24B, B25B, B26B, B27B, B28B, B29B, B31B, B32B, B33B, B34B, B37B**

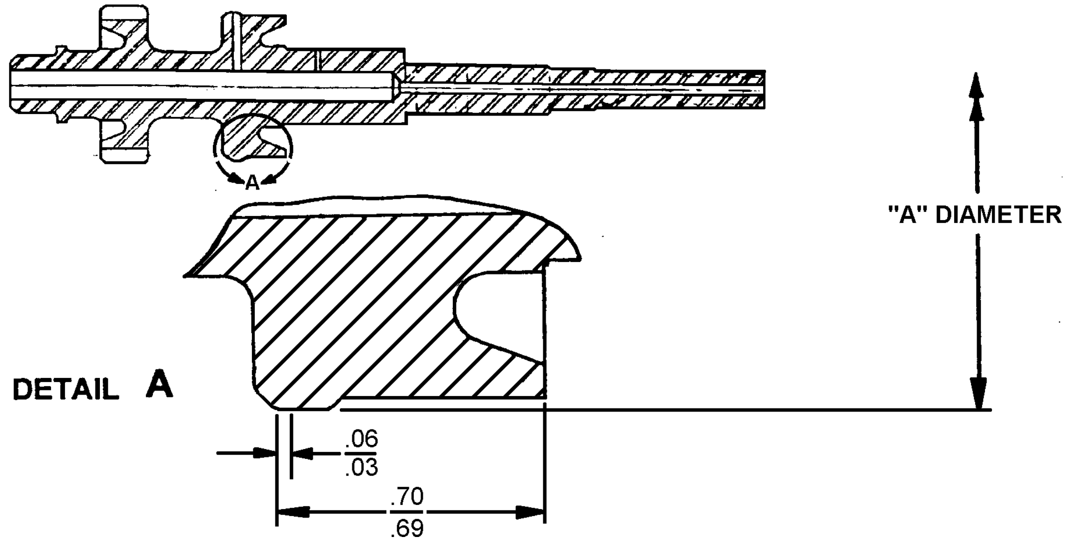



**FIGURE 13-5A. SHAFTGEAR DRUM DIMENSIONS**

| DESCRIPTION | "A" DIAMETER | |
|---|---|---|
| | MIN. | MAX. |
| New Shaftgear Drum | 1.931 | 1.932 |
| 0.015 Undersize | 1.916 | 1.917 |

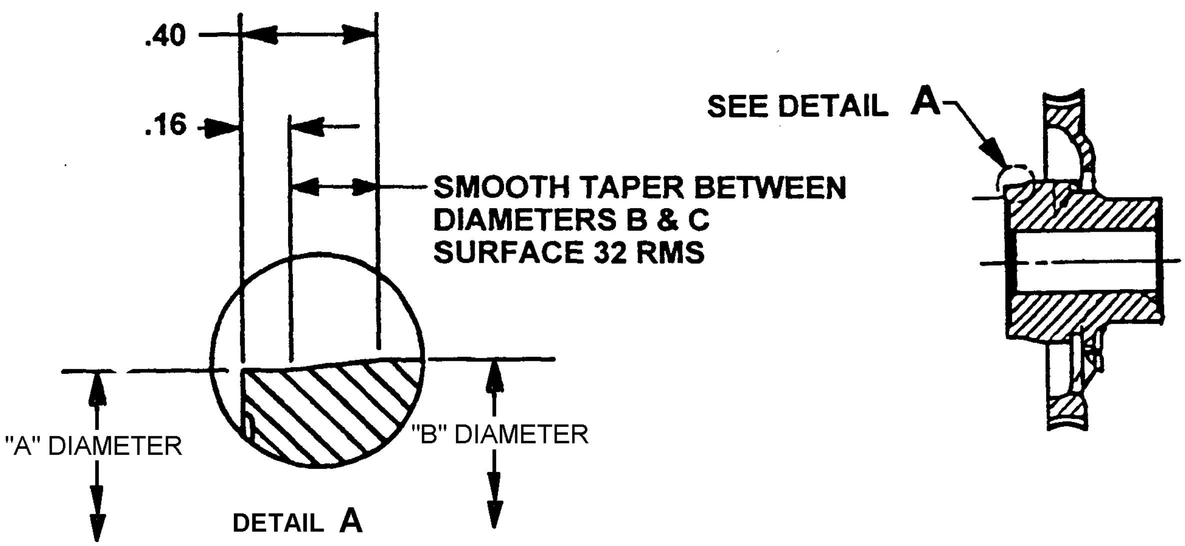



**FIGURE 13-5B. WORM WHEEL DRUM DIMENSIONS**

| DESCRIPTION | "A" DIAMETER | | "B" DIAMETER | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| New Wormwheel Drum | 1.931 | 1.932 | 1.955 | 1.960 |
| 0.015 Undersize | 1.916 | 1.917 | 1.940 | 1.945 |

## 13-6 STARTER AND STARTER ADAPTER REPAIR AND REPLACEMENT

1. Any starter or starter adapter component found to be worn beyond new parts limits or failing to meet the inspection criteria in section 13-5 must be replaced unless repair is possible with the following instructions:

2. The starter motor assembly must be overhauled in accordance with the manufacturer's instructions. See TCM Form X30592 for TCM starters. See section 1-5, "Related Publications," for ordering information.

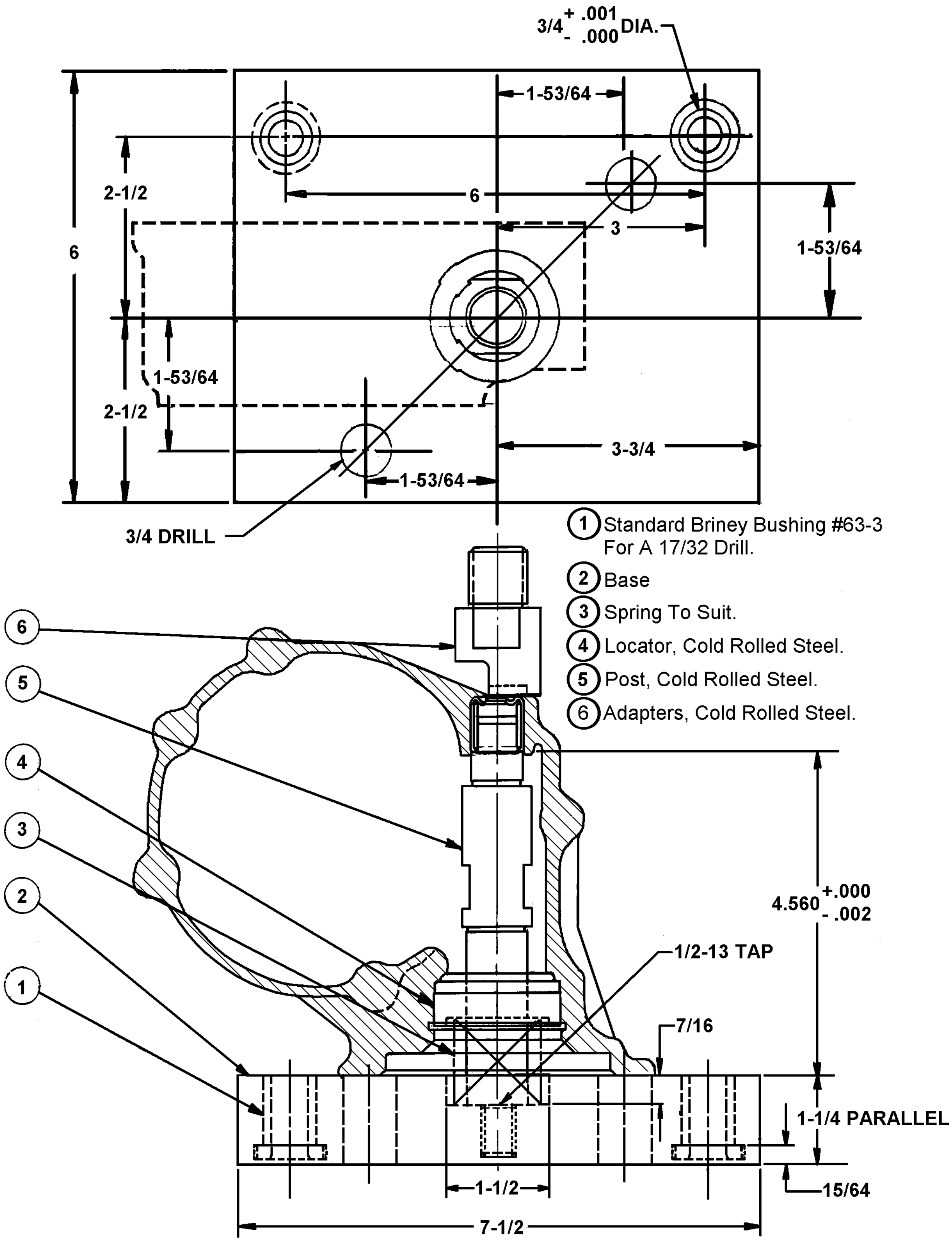
3. Starter adapter housings, accessory drive adapter housings, adapter covers, shaft gears, worm wheel gears, worm gears or worm gear shafts exhibiting cracks must be discarded and replaced. Scavenge pump covers and bushings with any indications of wear must be discarded and replaced.

4. The starter adapter housing worm shaft needle bearing must be replaced using the following procedure and special tools:
   a. Arbor Press.
   b. TCM Starter Adapter Housing Needle Bearing Installer or equivalent.

5. See Figure 13-6," Starter Adapter Needle Bearing Installer." See Figures 13-1 & 13-2, "Starter and Starter Adapter." Using the specified tools install a new needle bearing (10 or 11) as applicable into the starter adapter housing. Press the new bearing in until it is 0.03 thousandths of an inch below inner surface.

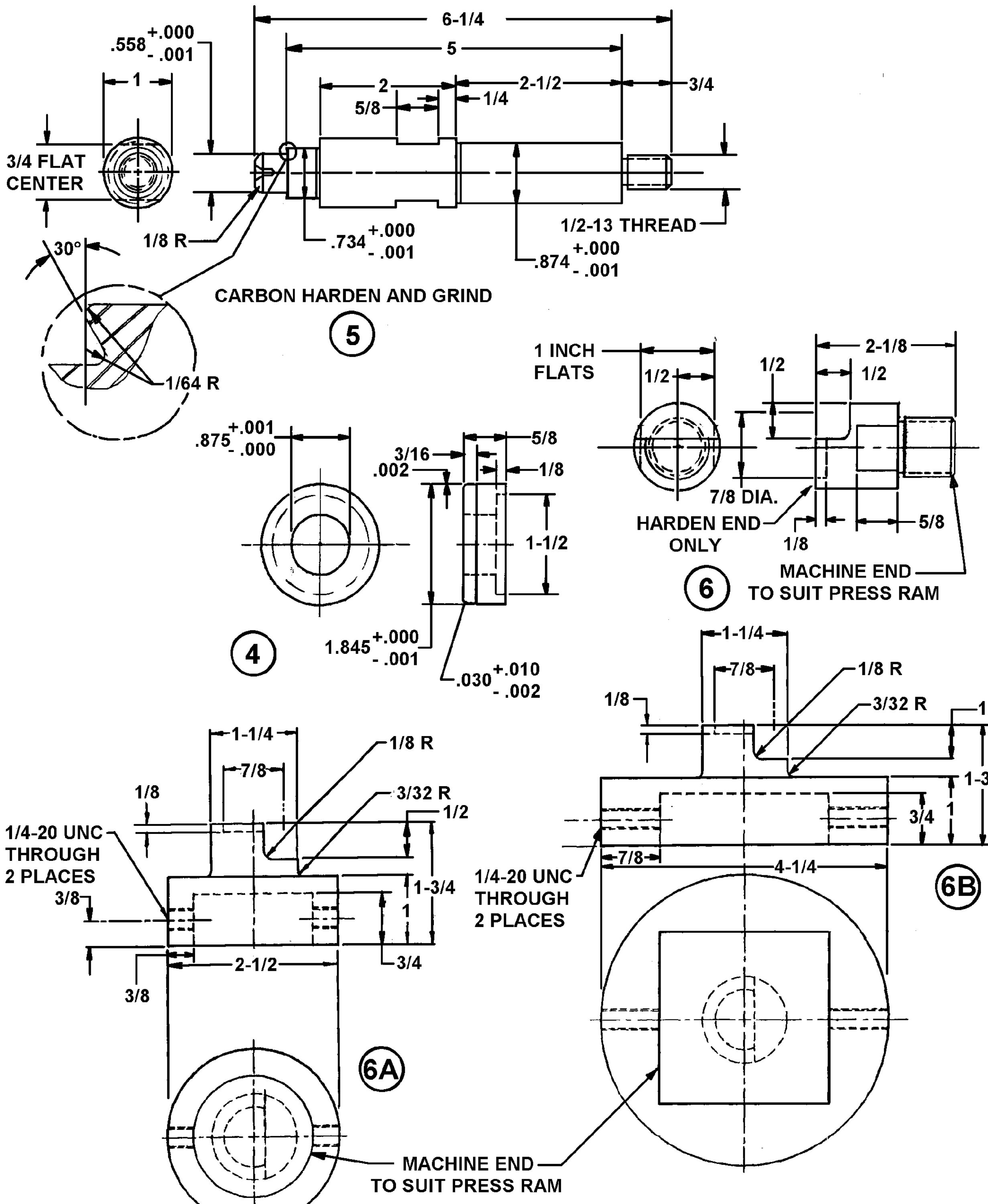
6. Any studs found to be damaged or loose must be replaced in accordance with the instructions in section 6-22. See Figures 13-3A or 13-3B," Starter and Accessory Drive Adapter Stud Setting Heights," as applicable for proper stud setting heights.

7. Section 6-19," Application Of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing.




NOTE…DIMENSIONS ARE IN INCHES.

**FIGURE 13-6. STARTER ADAPTER NEEDLE BEARING INSTALLER**




NOTE...DIMENSIONS ARE IN INCHES

6 Hydraulic Ram Adapter, Cold Rolled Steel.

6A Hydraulic Ram Adapter, Cold Rolled Steel.

6B Hydraulic Ram Adapter, Cold Rolled Steel.

**FIGURE 13-6. STARTER ADAPTER NEEDLE BEARING INSTALLER (continued)**

A= 1/64" (0.4mm) Less Than Housing Bore
B= .003 (0.08mm) Less Than Shaft Diameter
C= Pilot Length Should Be Length of Bearing Less 1/32" (0.8mm)

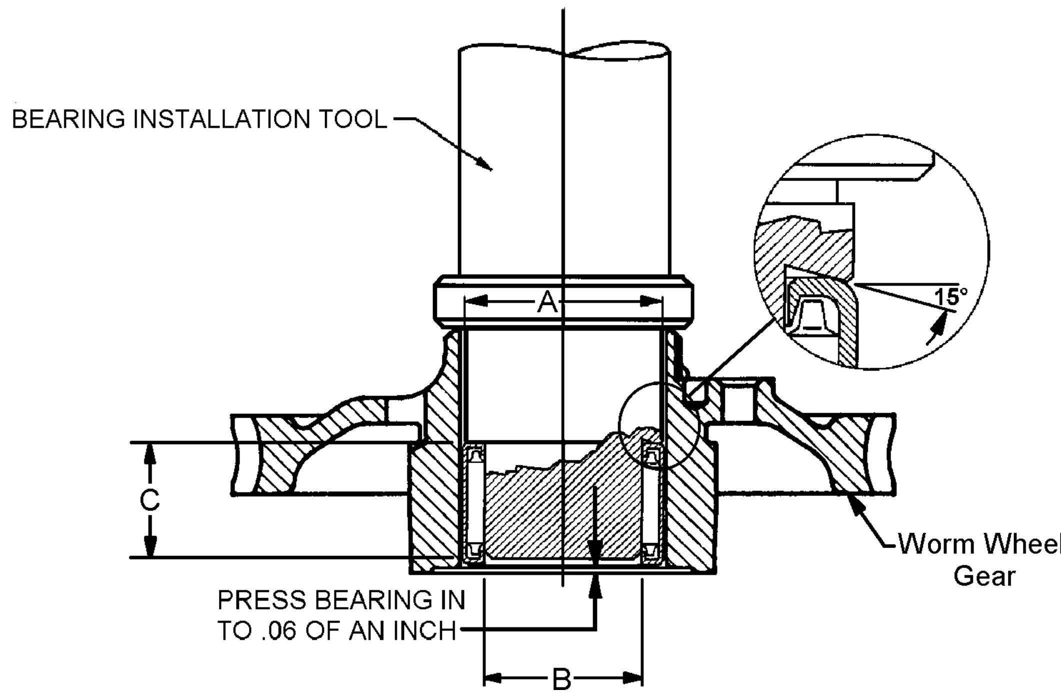



**FIGURE 13-7. WORM WHEEL GEAR ROLLER BEARING INSTALLATION**

## 13-7A STARTER ADAPTER ASSEMBLY (See Figure 13-1A)

1. Press new bearing (23) onto worm shaft (19). Press bearing until seated against flange. Assemble shaft (19), new woodruff key (21), new spring (20) and worm gear (22). Coat the worm gear teeth with clean molyshield grease. Insert assembly into adapter housing and install new retaining ring (24). Insure that retaining ring (24) is properly seated.
2. Using an arbor press and an installation tool conforming with the specifications in Figure 13-7," remove roller bearing (12) from worm wheel (11) and discard. Install a new roller bearing (12) in worm wheel (11) to the required specifications. Install new clutch spring (14) on worm wheel (11). Turn spring so it tends to unwind until offset end drops into the worm wheel gear land. Position spring on gear so screw notch is aligned with screw hole in gear web. Install new tab washer (15) and screw (16). Torque screw (16) to 75.0-85.0 inch pounds torque, and bend tab up against screw head.
3. Lubricate spring and shaft gear liberally with clean 50 weight. aviation engine oil. Press worm wheel and spring assembly onto shaft gear (13). Install new ball bearing (17) on shaftgear (13) and secure with new retaining ring (18). Make sure retaining ring seats properly in it's groove. Insert shaft gear and worm wheel assembly into adapter. Make sure worm wheel and worm gear teeth are aligned.

4. Install new o-ring (25) on cover (26). Install cover (26) on starter adapter housing (5). Secure using three sets of attaching hardware (27, 28). Torque nuts (28) to 180-220 inch pounds.
5. Test adapter assembly for slippage by installing adapter in fixture and apply torque to input shaft. Minimum allowable non slippage torque is 300 inch pounds.
6. Store the starter and starter adapter in a clean protected area until final engine assembly.

## 13-7B STARTER ADAPTER ASSEMBLY (See Figure 13-1B)

1. Press new bearing (16) onto worm shaft (14). Press bearing until seated against flange. Assemble shaft (14), new woodruff key (15), new spring (13) and worm gear (12). Coat the worm gear teeth with clean molyshield grease. Insert assembly into adapter housing and install new retaining ring (17). Insure that retaining ring (17) is properly seated.
2. Using an arbor press and an installation tool conforming with the specifications in Figure 13-7," remove roller bearing (23) from worm wheel (20) and discard. Install a new roller bearing (23) in worm wheel (20) to the required specifications. Install new clutch spring (19) on worm wheel (20). Turn spring so it tends to unwind until offset end drops into the worm wheel gear land. Position spring on gear so screw notch is aligned with screw hole in gear web. Install new tab washer (21) and screw (22). Torque screw (22) to 75.0-85.0 inch pounds torque, and bend tab up against screw head.

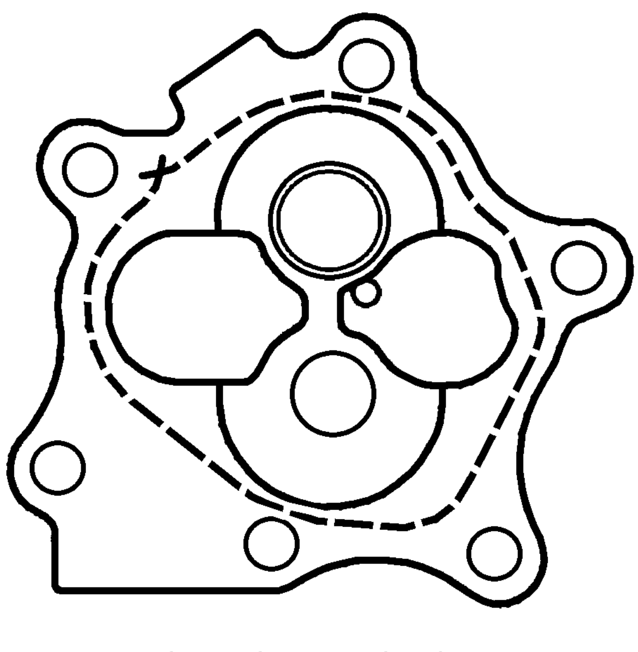


**FIGURE 13-8A. THREADING DIAGRAM FOR STARTER ADAPTER COVER**

3. Lubricate spring and shaft gear liberally with clean 50 weight. aviation engine oil. Press worm wheel and spring assembly onto shaft gear (18). Install new ball bearing (24) on shaftgear (18) and secure with new retaining ring (25). Make sure retaining ring seats properly in it's groove. Insert shaft gear and worm wheel assembly into adapter. Make sure worm wheel and worm gear teeth are aligned.

4. Install new o-ring (26) on cover (27). Install cover (27) on starter adapter housing (5). Secure using three sets of attaching hardware (28, 29). Torque nuts (29) to 180-220 inch pounds. Install scavenge pump gear (34) and spacer (42) on shaftgear.

5. Install a new ball bearing (41) and new oil seal (43) into body (35). The thrust side of bearing (41) must be facing forward toward the propeller. Care must be taken to insure that oil seal (43) is inserted into the body housing to a depth of .0 to .03" below the casting surface.

6. See Figure 13-8A. Apply permatex to cover (27) flange and apply silk thread to flange. Position thread as shown in Figure 13-8A. Install body (35) and secure with three sets of attaching hardware (37,38). See Figure 13-8B. On the attaching stud adjacent to the oil seal bore, install retainer (51), washer (37), and nut (38). Torque nuts (38) to 180 - 220 inch pounds torque. See Figure 13-8B, "Oil Seal Installation."

7. Install sleeve (44), spacer or sheave (45), as used, and new nut (46). Torque nut (46) to 450-500 inch pounds. Check shaft gear for freedom of rotation. Install adapter in fixture and apply torque to starter shaft gear.

8. Test adapter assembly for slippage by installing adapter in fixture and apply torque to input shaft. Minimum allowable non slippage torque is 300 inch pounds.

9. Store the starter and starter adapter in a clean protected area until final engine assembly.

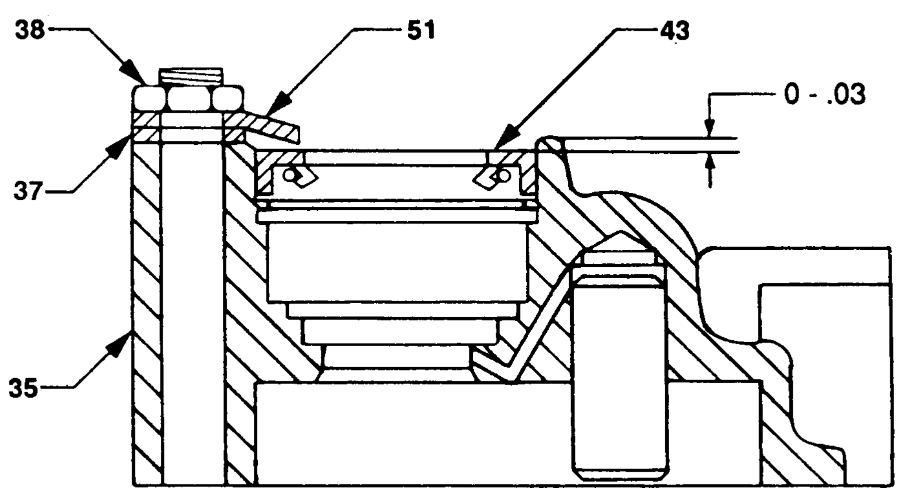



**FIGURE 13-8B. OIL SEAL INSTALLATION**

# CHAPTER 14

## LUBRICATION SYSTEM

## 14-1A OIL PUMP REMOVAL (See Figure 14-1A)

1. Cut lockwire and remove oil filter (35). Remove attaching parts (37, 38, 39). Separate adapter (36) and gasket (34) from oil pump housing (2). Discard lock washers (38) and gasket (34).

2. Remove attaching hardware (22, 23, 24) and tach drive assembly (18). Discard lock washers (23).

3. Remove shaftgear (15) and bevel gear (17). Remove driven gear assembly (4, 5) from oil pump housing.

4. Remove oil pressure relief valve (6 through 14) from oil pump housing (2). Discard spring (7), gasket (10) and self locking nut (14).

5. Remove plug (42) and gasket (41). Discard gasket (41). Remove remaining attaching parts (22, 23, 24) and remove oil pump housing (2) from crankcase studs. Remove and discard gasket (20).

6. Place the oil pump components in a clean, protected area until they are to be overhauled.

Nomenclature for Figure 14-1A

| | | | |
|---|---|---|---|
| 1. Oil Pump Assembly | 12. Helical Coil | 23. Washer, Lock | 34. Gasket |
| 2. Housing, Oil Pump | 13. Washer, Copper | 24. Nut | 35. Filter, Oil |
| 3. Stud | 14. Nut Self Locking | 25. Gear, Bevel | 36. Adapter, Oil Filter |
| 4. Gear, Bushing | 15. Gear | 26. Gasket | 37. Washer |
| 5. Bushing | 16. Pin | 27. Cover | 38. Washer, Lock |
| 6. Plunger | 17. Gear, Bevel | 28. Washer | 39. Nut |
| 7. Spring | 18. Housing, Tach Drive | 29. Washer, Lock | 40. Stud |
| 8. Seat | 19. Seal, Oil | 30. Screw | 41. Plug |
| 9. Screw | 20. Gasket | 31. Gasket | 42. Gasket |
| 10. Gasket | 21. Stud | 32. Cover | 43. Thread, Silk |
| 11. Housing | 22. Washer | 33. Washer | 44. Wire, Lock |

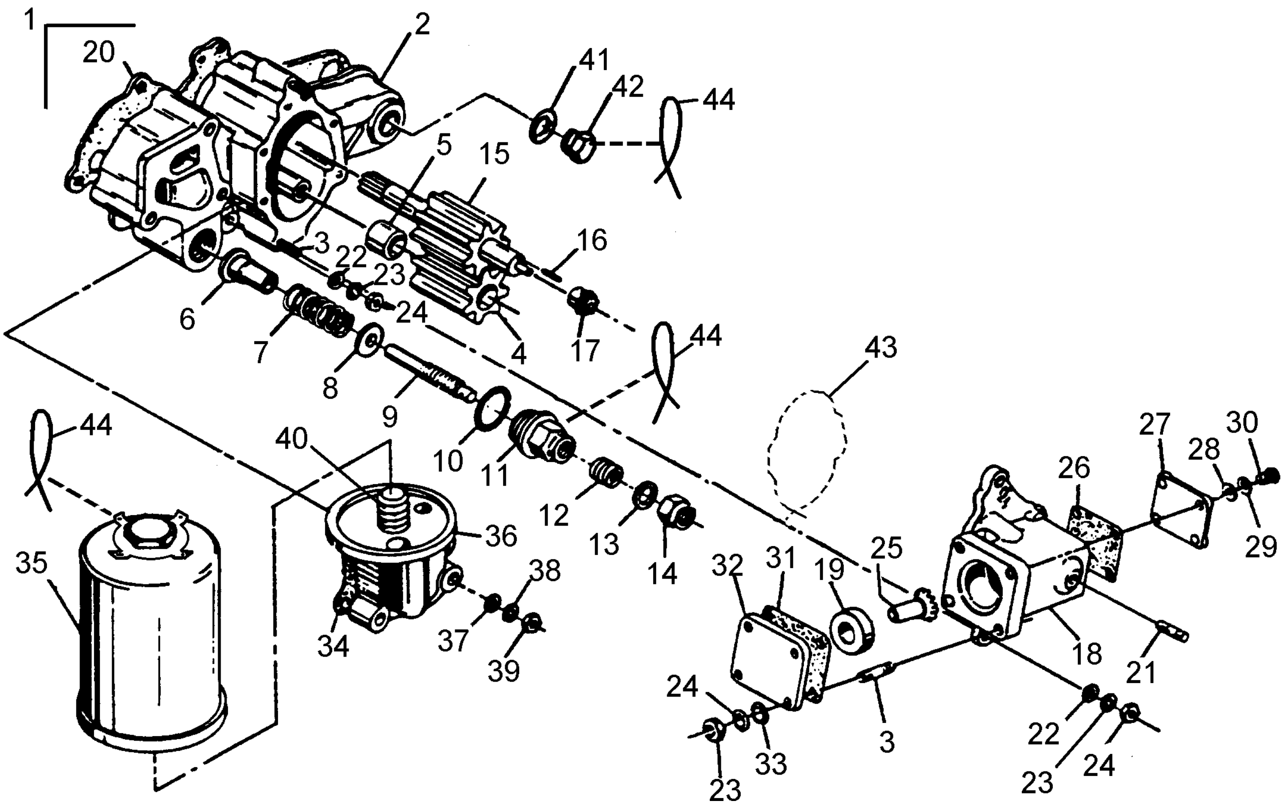



**FIGURE 14-1A. OIL PUMP ASSEMBLY FOR I0-550-A, A2B, A3B, I0-550-B, B1F, B2F, B3F, B4F, B5F, B6F, B9B, B11B, B14B, B15B, B16B, B19B, B21B, B23B, B29B, B30B, B32B, B35B, B37B, I0-550-C, C1F, C2F, C2U, C3F, C6F, C8B, C9B, C11B, C12B, C13B, C15B, C18B, C19B, C25B, C26B, C27B, C28B, C29B, C30B**

## 14-1B OIL PUMP REMOVAL (See Figure 14-1B)

1. Cut lockwire and remove oil filter (28). Remove attaching parts (30, 31, 32). Separate adapter (29) and gasket (27) from oil pump housing (2). Discard lock washers (31) and gasket (27).

2. Remove attaching hardware (22, 23) and tach drive assembly (18). Discard lock washers (22).

3. Remove shaftgear (15) and bevel gear (17). Remove driven gear assembly (4, 5) from oil pump housing.

4. Remove oil pressure relief valve (6 through 14) from oil pump housing (2). Discard spring (7), gasket (10) and self locking nut (14).

5. Remove plug (34) and gasket (33). Discard gasket (33). Remove remaining attaching parts (21, 22, 23) and remove oil pump housing (2) from crankcase studs. Remove and discard gasket (20).

6. Place the oil pump components in a clean, protected area until they are to be overhauled.

Nomenclature for Figure 14-1B

| | | | |
|---|---|---|---|
| 1. Oil Pump Assembly | 11. Housing | 21. Washer | 31. Washer, Lock |
| 2. Housing, Oil Pump | 12. Helical Coil | 22. Washer, Lock | 32. Nut |
| 3. Stud | 13. Washer, Copper | 23. Nut | 33. Gasket |
| 4. Gear, Bushing | 14. Nut Self Locking | 24. Shaft | 34. Plug |
| 5. Bushing | 15. Gear | 25. Gasket | 35. Stud |
| 6. Plunger | 16. Pin | 26. Housing | 36. Thread, Silk |
| 7. Spring | 17. Gear, Bevel | 27. Gasket | 37. Wire, Lock |
| 8. Seat | 18. Housing, Tach Drive | 28. Filter, Oil | |
| 9. Screw | 19. Seal, Oil | 29. Adapter, Oil Filter | |
| 10. Gasket | 20. Gasket | 30. Washer | |

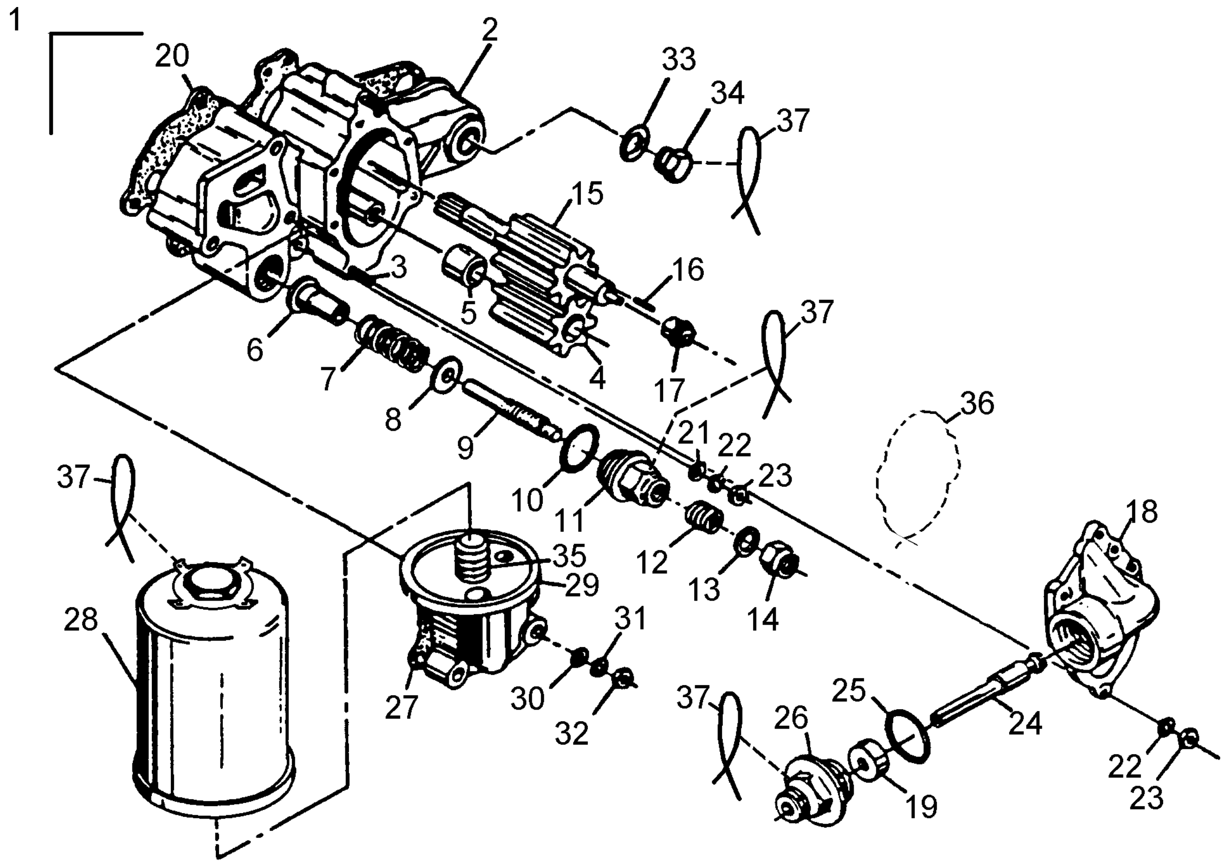



**FIGURE 14-1B. OIL PUMP ASSEMBLY FOR I0-550-A4B, A5B, A6B, A7B I0-550-B5F, B12F, B13F, B17B, B18B, B20B, B22B, B24B, B25B, B26B, B27B, B28B, B31B, B34B, B36B, I0-550-C16B, C17B, |C21B, C22B, I0-550-G, G1B, G2B, G4B, I0550-N, N1B, I0-550-P, I0-550-R**

## 14-1C OIL PUMP REMOVAL (See Figure 14-1C)

1. Cut lockwire and remove oil filter (22). Remove attaching parts (24, 25, 26). Separate adapter (23) and gasket (21) from oil pump housing (2). Discard lock washers (25 and gasket (21).

2. Remove attaching hardware (18, 20) and cover (16).

3. Remove shaftgear (15) and driven gear assembly (4, 5) from oil pump housing.

4. Remove oil pressure relief valve (6 through 14) from oil pump housing (2). Discard spring (7), gasket (10) and self locking nut (14).

5. Remove plug (28) and gasket (27). Discard gasket (27). Remove remaining attaching parts (18, 19, 20) and remove oil pump housing (2) from crankcase studs. Remove and discard gasket (17).

6. Place the oil pump components in a clean, protected area until they are to be overhauled.

Nomenclature for Figure 14-1C

1. Oil Pump Assembly
2. Housing, Oil Pump
3. Stud
4. Gear
5. Bushing
6. Plunger
7. Spring
8. Seat
9. Screw
10. Gasket
11. Housing
12. Helical Coil
13. Washer, Copper
14. Nut Self Locking
15. Gear
16. Cover
17. Gasket
18. Washer
19. Washer, Lock
20. Nut
21. Gasket
22. Filter, Oil
23. Adapter, Oil Filter
24. Washer
25. Washer, Lock
26. Nut
27. Gasket
28. Plug
29. Stud
30. Thread, Silk
31. Wire, Lock

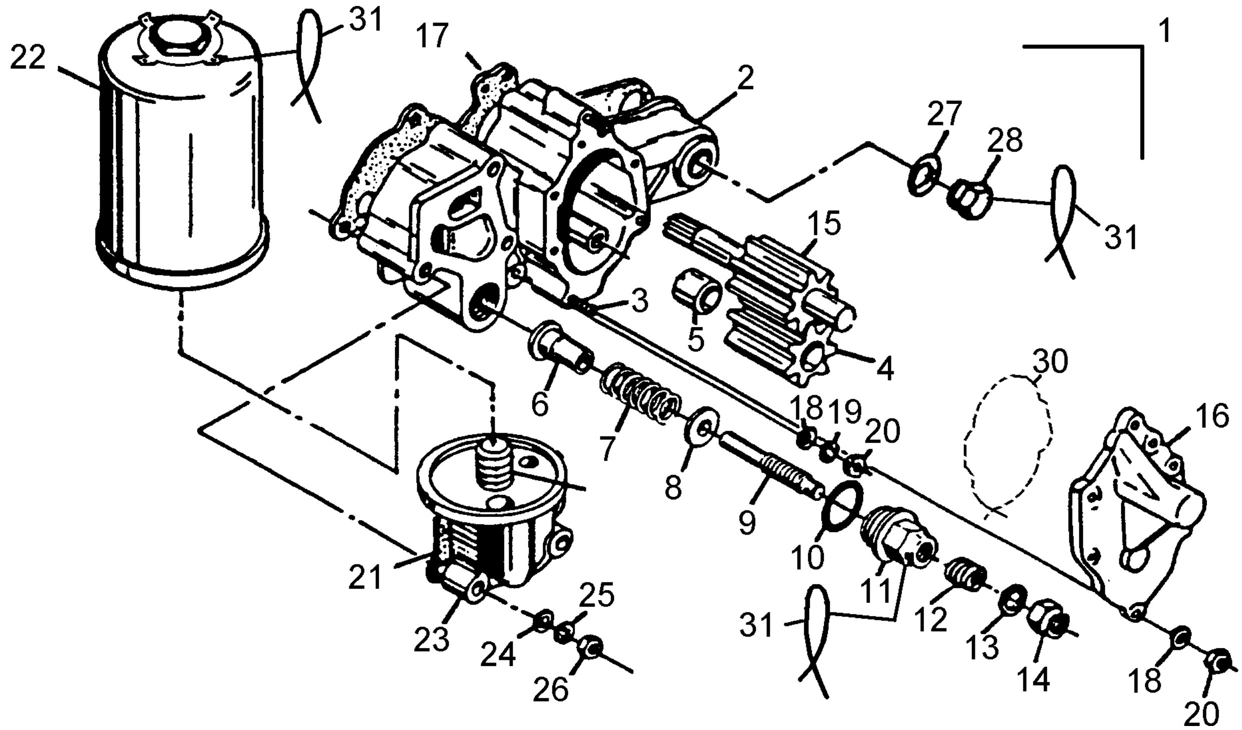



**FIGURE 14-1C. OIL PUMP ASSEMBLY FOR I0-550-G5B, G6B, I0550-N2B**

## 14-2A OIL COOLER REMOVAL (See Figure 14-2A)

1. Remove attaching hardware (5 through 11). Remove cooler (3) from crankcase studs Remove and discard gaskets (1, 2).

2. Place the oil cooler in a clean, protected area until it is to be overhauled.

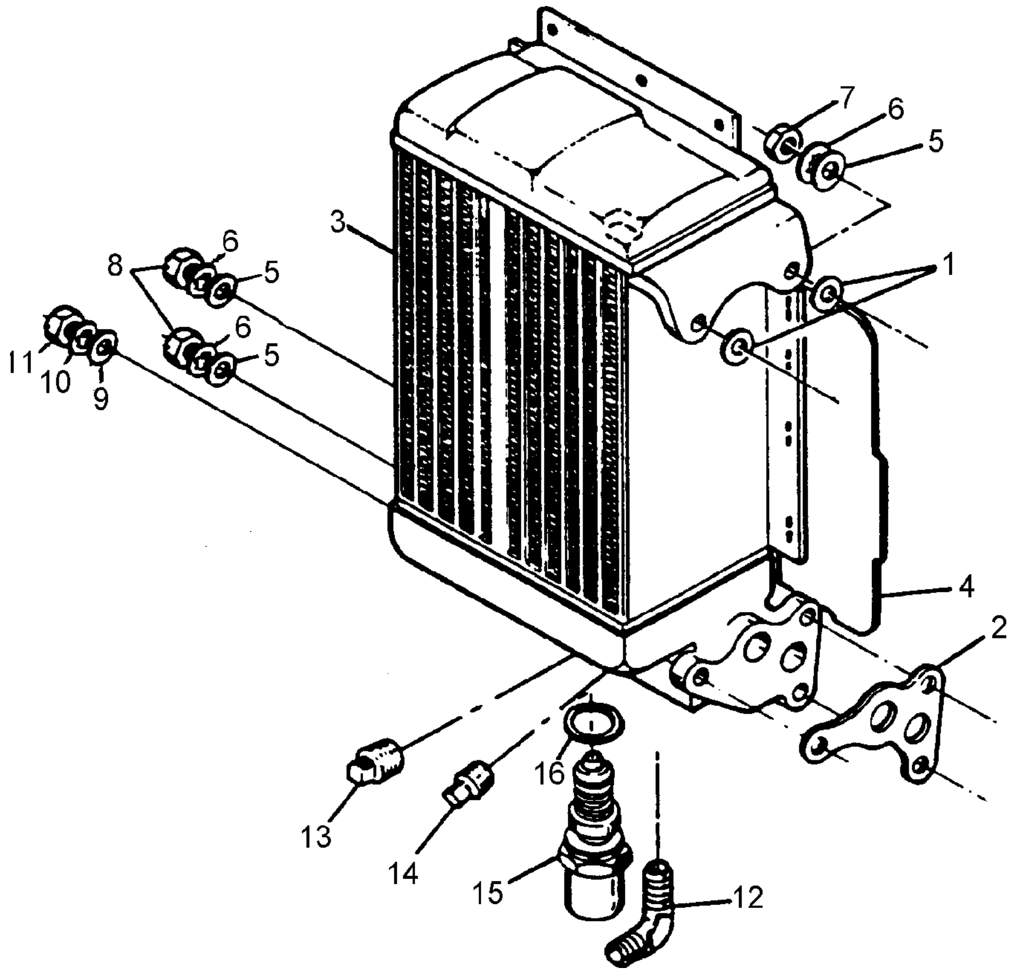



**FIGURE 14-2A. OIL COOLER ASSEMBLY FOR I0-550-A, I0-550-B, I0-550-G, G1B, G2B, G4B**

1. Gasket
2. Gasket
3. Oil Cooler
4. Baffle
5. Washer
6. Washer, Lock
7. Nut, Plain
8. Nut, Plain
9. Washer
10. Washer, Lock
11. Nut, Plain
12. Elbow
13. Plug
14. Plug
15. Oil Temp. Control Valve (Vernatherm)
16. Gasket

## 14-2B OIL COOLER REMOVAL (See Figure 14-2B)

1. See Figure 16-3A. Remove attaching hardware (8, 9, 10, 11) from lower oil cooler mount flange and engine mount studs. See Figure 14-2B. Remove attaching hardware (5, 6, 7). Remove oil cooler (3) from crankcase studs. Remove and discard gaskets (1, 2) and lock washers (6).

2. Place the oil cooler in a clean, protected area until it is to be overhauled.

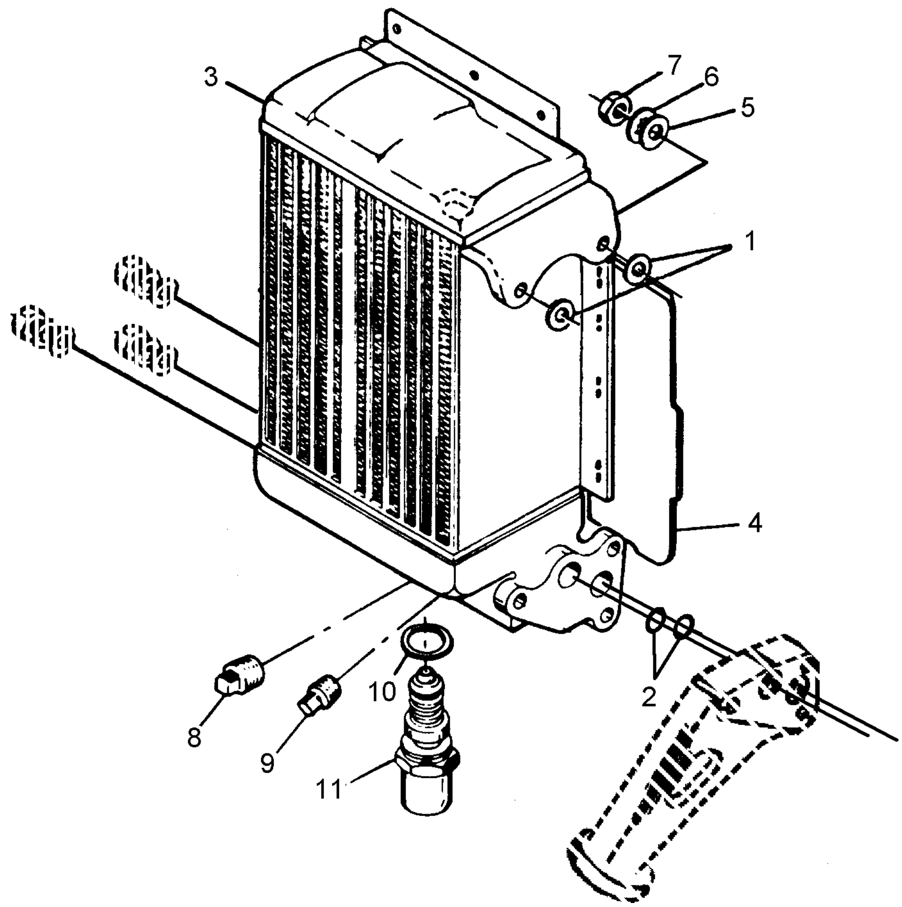



**FIGURE 14-2B. OIL COOLER ASSEMBLY FOR I0-550-C**

1. Gasket
2. Gasket, O-ring
3. Oil Cooler
4. Baffle
5. Washer
6. Washer, Lock
7. Nut, Plain
8. Plug
9. Plug
10. Gasket
11. Oil Temp. Control Valve (Vernatherm)

## 14-2C OIL COOLER REMOVAL (See Figure 14-2C)

1. Remove attaching hardware (5 through 11). Remove cooler (3) from crankcase studs Remove and discard gaskets (1, 2).

2. Place the oil cooler in a clean, protected area until it is to be overhauled.

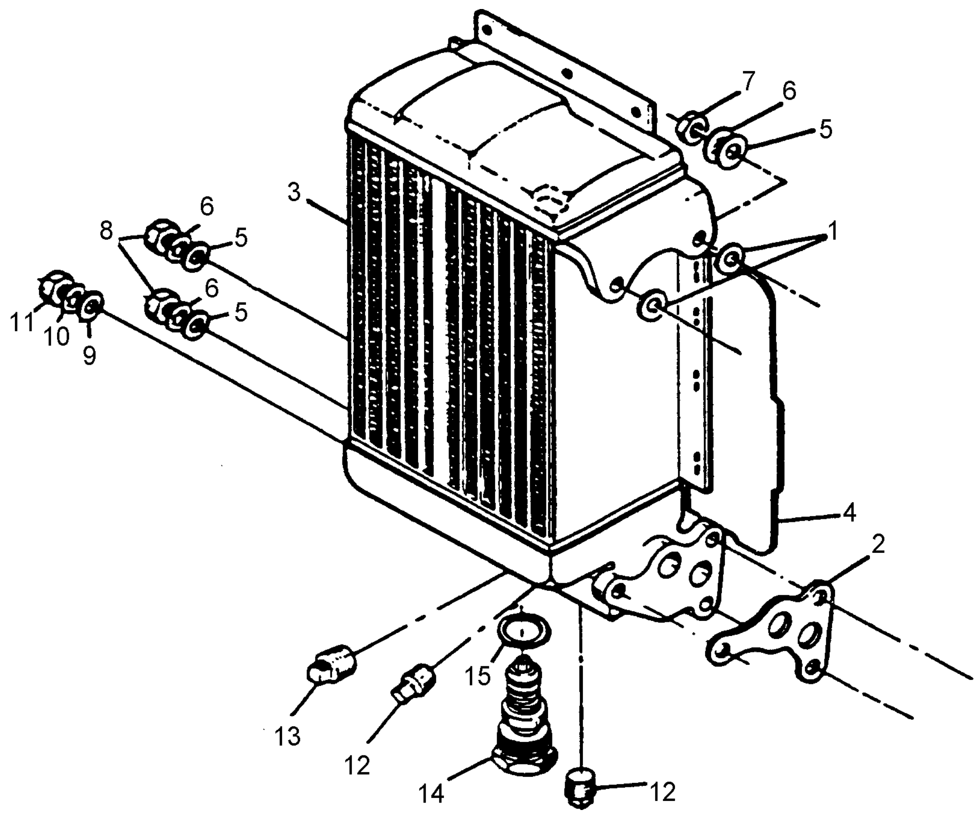



**FIGURE 14-2C. OIL COOLER ASSEMBLY FOR I0-550-G5B, G6B, I0-550-N I0-550-P, I0-550-R**

| | |
|---|---|
| 1. Gasket | 9. Washer |
| 2. Gasket | 10. Washer, Lock |
| 3. Oil Cooler | 11. Nut, Plain |
| 4. Baffle | 12. Plug |
| 5. Washer | 13. Plug |
| 6. Washer, Lock | 14. Oil Temp. Control Valve (Vernatherm) |
| 7. Nut, Plain | |
| 8. Nut, Plain | 15. Gasket |

## 14-3A OIL SUMP AND SUCTION TUBE REMOVAL (See Figure 14-3A)

1. Remove attaching hardware (11, 12, 13).
2. Lightly bump 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 (2, 4) and bolt (3).
5. Remove oil suction tube assembly from crankcase. Remove gasket (6) from oil suction tube and discard.

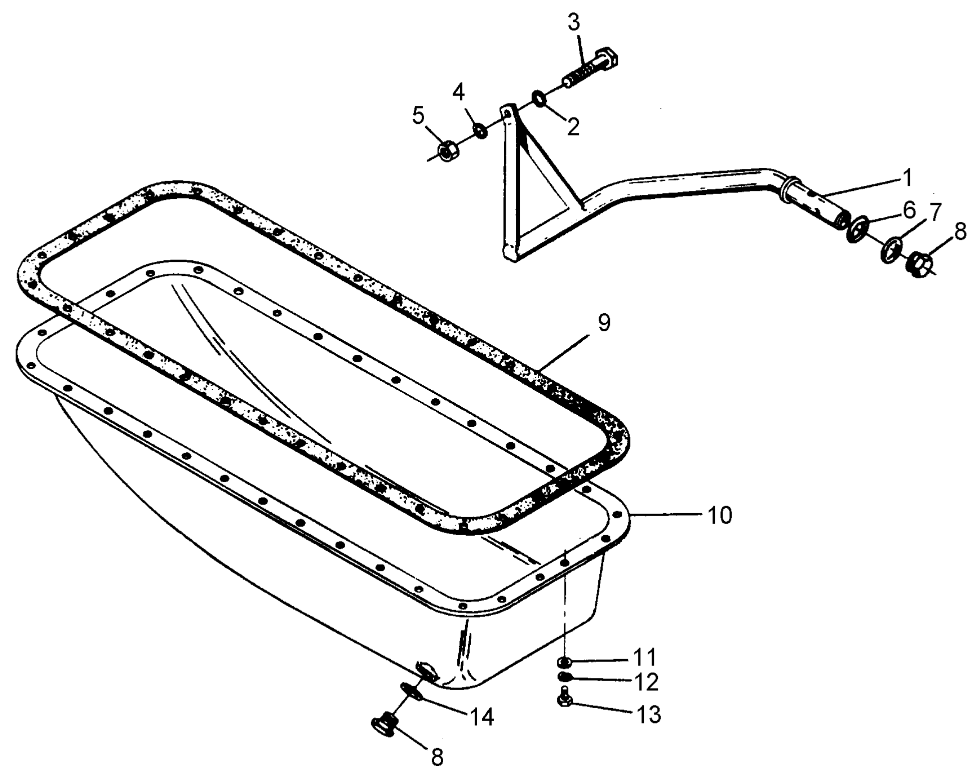



**FIGURE 14-3A. OIL SUMP FOR I0-550-A & C**

| | |
|---|---|
| 1. Oil Suction Tube | 8. Plug |
| 2. Washer | 9. Gasket |
| 3. Bolt | 10. Oil Sump |
| 4. Washer | 11. Washer |
| 5. Nut | 12. Washer, Lock |
| 6. Gasket, Copper | 13. Screw |
| 7. Gasket, Copper | 14. Gasket, Copper |

## 14-3B OIL SUMP AND SUCTION TUBE REMOVAL (See Figure 14-3B)

1. Remove attaching hardware (10, 11, 12).
2. Lightly bump oil sump (7) using a soft mallet and remove from crankcase.
3. Remove gasket (6) from crankcase/oil sump and discard.
4. Cut and remove lock wire from bolts (2). Remove bolts (2).
5. Remove oil suction tube assembly from crankcase. Remove gasket (3) from oil suction tube and discard.

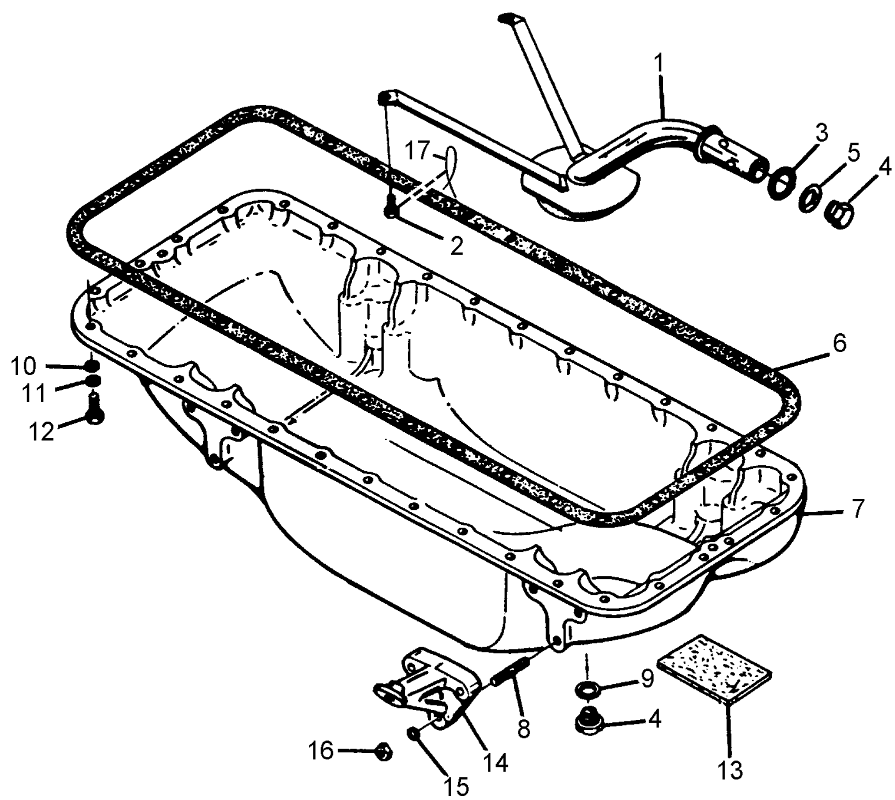



**FIGURE 14-3B. OIL SUMP FOR I0-550-B, I0-550-R**

1. Oil Suction Tube
2. Bolt
3. Gasket, Copper
4. Plug
5. Gasket, Copper
6. Gasket
7. Oil Sump
8. Stud
9. Gasket, Copper
10. Washer
11. Washer, Lock
12. Screw
13. Felt
14. Bracket
15. Washer
16. Nut
17. Wire, Lock

## 14-3C OIL SUMP AND SUCTION TUBE REMOVAL (See Figure 14-3C)

1. Remove attaching hardware (11, 12, 13).
2. Lightly bump 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).
5. Remove oil suction tube assembly from crankcase. Remove gasket (6) from oil suction tube and discard.

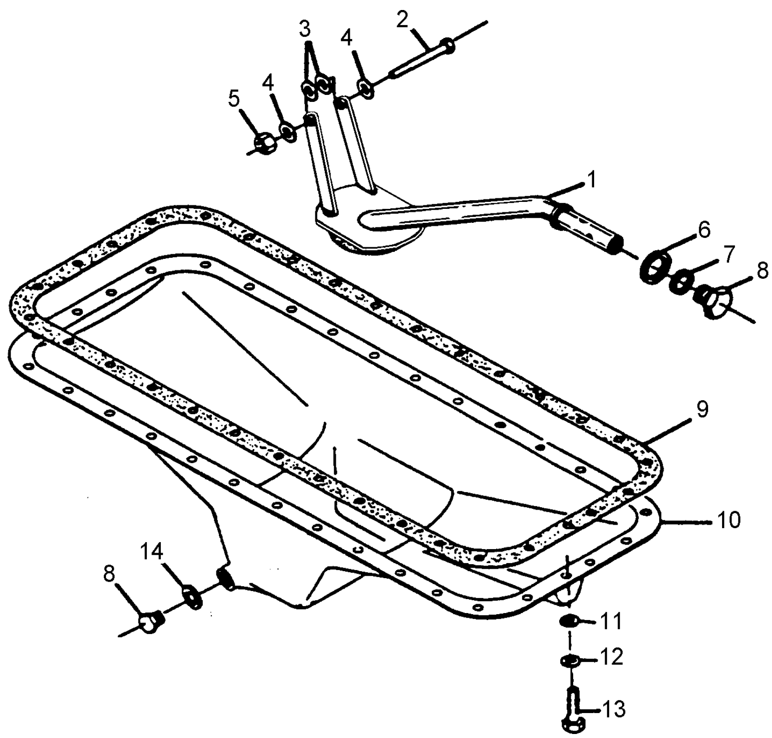



**FIGURE 14-3C. OIL SUMP FOR I0-550-G, I0-550-N**

| | |
|---|---|
| 1. Oil Suction Tube | 8. Plug |
| 2. Bolt | 9. Gasket |
| 3. Washer | 10. Oil Sump |
| 4. Washer | 11. Washer |
| 5. Nut | 12. Washer, Lock |
| 6. Gasket, Copper | 13. Screw |
| 7. Gasket, Copper | 14. Gasket, Copper |

## 14-3D OIL SUMP AND SUCTION TUBE REMOVAL (See Figure 14-3D)

1. Remove attaching hardware (11, 12, 13).
2. Lightly bump 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 (2, 4) and bolt (3).
5. Remove oil suction tube assembly from crankcase. Remove gasket (6) from oil suction tube and discard.

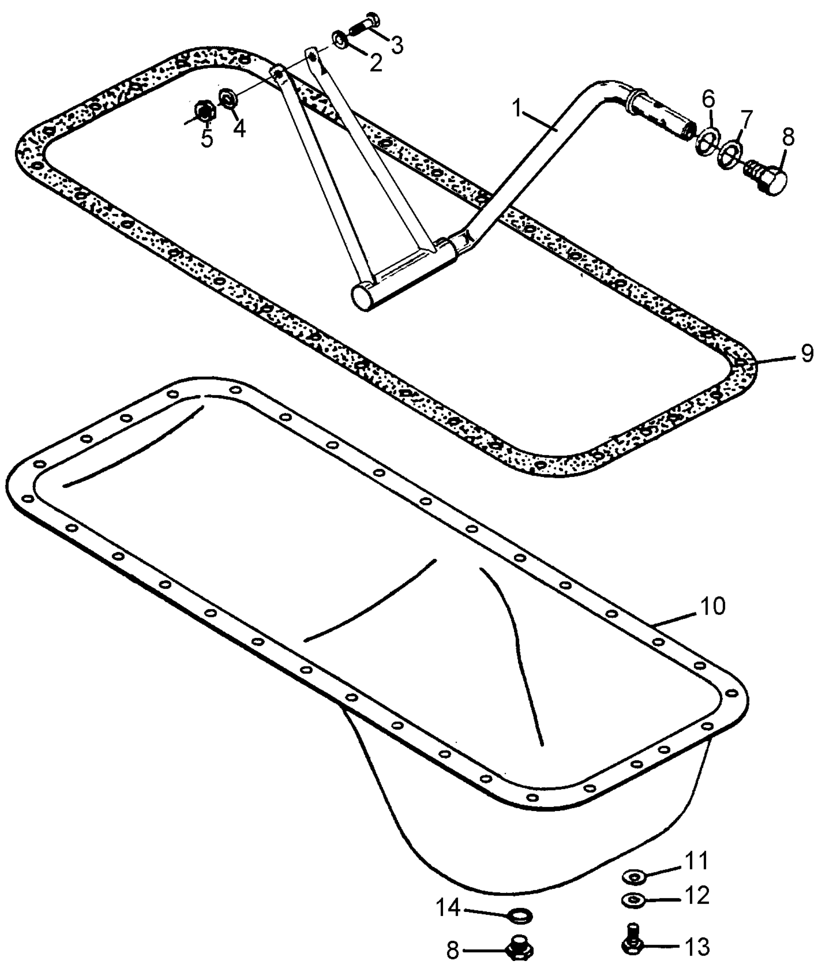



**FIGURE 14-3D. OIL SUMP FOR I0-550-P**

| | |
|---|---|
| 1. Oil Suction Tube | 8. Plug |
| 2. Washer | 9. Gasket |
| 3. Bolt | 10. Oil Sump |
| 4. Washer | 11. Washer |
| 5. Nut | 12. Washer, Lock |
| 6. Gasket, Copper | 13. Screw |
| 7. Gasket, Copper | 14. Gasket, Copper |

## 14-4 LUBRICATION SYSTEM COMPONENT CLEANING

1. All lubrication system components and associated hardware must be cleaned in accordance with the instructions in section 6-7, "General Cleaning," and the following special instructions:

2. All oil pressure springs, gaskets, packings, o-rings, seals, lock washers, and self- locking nuts removed from the lubrication system components must be replaced 100% at overhaul. Cleaning these parts is not required.

3. Internal cleaning, flushing and pressure testing of the oil cooler requires special adapters, gauges, tanks and circulating pump. Oil cooler overhaul must be accomplished by adequately equipped and qualified cooler repair facilities.

4. Clean the oil sump assembly using mineral spirit solvent.

5. If the oil sump is immersed in an alkaline bath, when removed, it must be sprayed with steam removing all traces of alkaline. After the sump dries, inspect it for any alkaline residue and if necessary re-spray with steam to remove. The sump exterior, cavities and all oil passages must be thoroughly flushed with mineral spirit solvent after any alkaline cleaning process has been used.

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed.*

6. Clean the oil pump housing, oil filter adapter or tach drive adapter using mineral spirit solvent. All oil passages must be clear and free flowing.

7. If the oil pump housing, oil filter adapter or tach drive adapter are immersed in an alkaline bath, when removed, they must be sprayed with steam removing all traces of alkaline. After the parts dry, inspect them for any alkaline residues and if necessary re-spray with steam to remove. The oil pump housing, oil filter adapter and oil cooler adapter exterior, cavities and all oil passages must be thoroughly flushed with mineral spirit solvent after any alkaline cleaning process has been used.

8. Clean the oil suction tube assembly using mineral spirit solvent. All oil passages must be clear and free flowing.

9. Clean gears that have bushings using mineral spirit solvent and a brass wire brush. Gears with bushings must not be cleaned using alkaline solutions. Gears that do not have bushings can be cleaned using mineral spirit solvent or by immersion in a alkaline stripping bath if mineral spirit solvent is not effective. After cleaning with alkaline solution the gears must be sprayed with steam removing all traces of alkaline. After steam rinsing the gears must be thoroughly flushed with mineral spirit solvent.

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed.*

## WARNING

**Do not pressure blast gears with an abrasive media. Blasting will remove surface hardening.**

## 14-5 LUBRICATION SYSTEM INSPECTION

### VISUAL INSPECTION

The lubrication system components must be visually inspected in accordance with instructions in section 6-8, "Visual Inspection." Special attention must be given to the following components and areas:

1. Using a flashlight and a 10X (power) magnifying glass, visually inspect the exterior and the cavity of the oil pump, oil pump cover and tach drive housing for cracks and indications of cracks. Inspect for scratches on machined surfaces. Housings exhibiting any of the above indications must be discarded. Inspect the oil pump housing, cover and tach drive housing flanges for warpage. Oil pump housings, covers or tach drive housings exhibiting warpage must be discarded. Inspect all oil passages for restrictions. Oil pump housings or tach drive housings with restricted oil passages that cannot be cleared by solvent action must be discarded. Inspect the oil pump housing gear shaft for security and scoring. Housings with loose or scored gear shafts must be discarded. Inspect the oil pressure relief valve plunger for scoring, nicks and the face for roughness. Any oil pressure relief valve with scoring, nicks or roughened face must be discarded.

2. Inspect oil pump gear teeth for signs of overheating and excessive wear. Normal wear produces a fine polish on the tooth thrust faces. Gears that have alteration of the tooth profiles, score marks, burning or pitting must be discarded. See Figure 8-3. “Gear Tooth Wear,” for acceptable and unacceptable gear tooth wear.
   Check the oil pump drive gear shaft and shaft splines for wear and damage. Discard drive gears with any of these indications.
3. Using a flashlight and a 10X magnifying glass inspect all areas of the oil filter adapter for cracks and indications of cracks. Discard any oil filter adapter with cracks or crack indications. Inspect the oil filter adapter flanges for warpage. Adapters exhibiting warpage must be discarded.

4. Visually inspect the oil sump bolt holes for cracks. Inspect mounting surface for scratches, warpage and cracks. Warped, cracked or leaking oil sumps must be discarded. Inspect the oil drain plug boss and drain plug for damaged threads. Inspect the drain plug for damaged wrench flats. Discard oil drain plugs if damaged.

5. Visually inspect the oil suction tube assembly for dents, cracks and distorted or restricted openings. Oil suction tubes exhibiting dents, cracks or distorted openings must be discarded.

6. Using an 8048 Oil Pressure Relief Spot Facer reface the pressure relief valve seat in the oil pump housing. See section 2-3, "Tools." Do not exceed the specified limit, Item 2, in Figure 14-6.

*CAUTION…Reface pressure relief valve seat using light finger pressure when turning refacing tool.*

*CAUTION…Thoroughly clean oil pressure relief valve cavity after refacing procedure.*

7. Inspect oil pump housing, oil filter adapter and tach drive housing studs for distorted or stripped threads. Inspect studs for corrosion, pitting, incomplete threads and looseness. Replace studs with any of these indications. Check studs with a tool makers square for alignment. Oil pump housing, oil filter adapters and tach drive housings must have their setting heights checked for indications of backing out. See the following for stud setting heights.

| ITEM NO. | LOCATION | THREAD SIZE | SETTING HEIGHT | QTY. |
|---|---|---|---|---|
| 1. | Stud, Cover to Housing | 1/4 - 20 X 1/4 - 28 | .65 | 2 |
| 2. | Stud, Oil Filter To Adapter | 3/4-16X 13/16-16 | .500-.700 | 1 |
| 3. | Stud, Throttle Support | 1/4 - 20 X 1/4 - 28 | .44 | 1 |
| 4. | Stud, Cover to Housing | 1/4 - 20 X 1/4 - 28 | .75 | 4 |

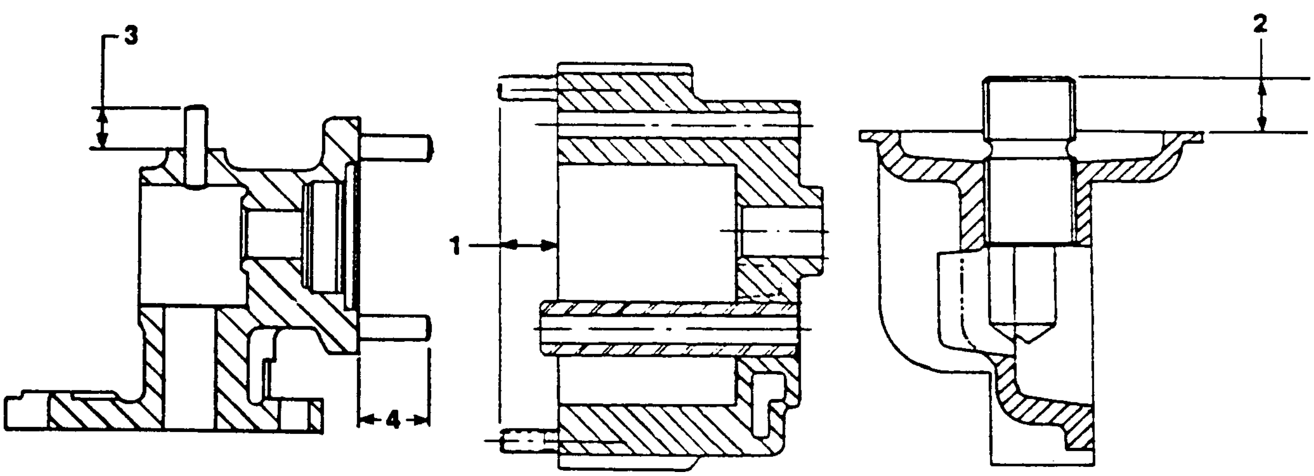



**FIGURE 14-4. OIL PUMP, OIL FILTER ADAPTER AND ELECTRICAL TACH DRIVE HOUSING STUD SETTING HEIGHTS**

8. Inspect IO-550-B and IO-550-R oil sump studs for distorted or stripped threads. Inspect studs for corrosion, pitting, incomplete threads and looseness. Replace studs with any of these indications. Check studs with a tool makers square for alignment. The oil sump must have it's setting heights checked for indications of backing out. See the following for stud setting heights.

| ITEM NO. | LOCATION | THREAD SIZE | SETTING HEIGHT | QTY. |
|---|---|---|---|---|
| 1. | Stud, Engine Mount to Oil Sump | 3/8 - 16 X 1.56 | .97 | 12 |

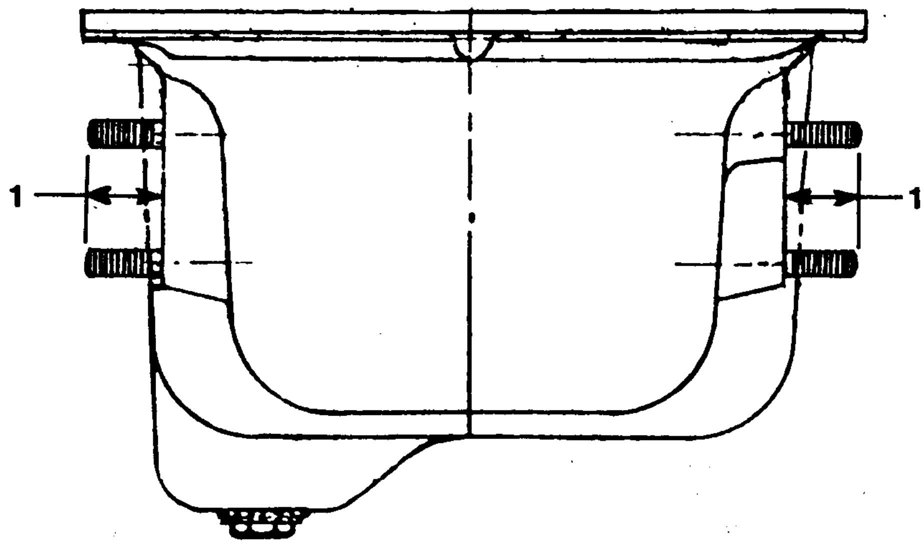



**FIGURE 14-5. OIL SUMP STUD SETTING HEIGHTS IO-550-B, IO-550-R**

## FLUORESCENT PENETRANT INSPECTION

Aluminum alloy components such as the oil pump housing, oil pump cover, oil filter adapter, tach drive housing and oil sump must be fluorescent penetrant inspected by a certified technician in accordance with section 6-12, "Fluorescent Penetrant Inspection." Pump housings, adapters, tach drive housings or sumps exhibiting cracks must be discarded.

## MAGNETIC PARTICLE INSPECTION

Oil pump gears, bevel gears and tach drive shafts must be magnetic particle inspected by a certified technician in accordance with instructions in section 6-9, "Magnetic Particle Inspection." Gears or shafts exhibiting cracks must be discarded.

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.
All components must be thoroughly cleaned and air dried prior to dimensional inspection.

| REF. NO. | DESCRIPTION | NEW PARTS | |
|---|---|---|---|
| | | MIN. | MAX. |
| | **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: | — | 1.060 |
| | **OIL PRESSURE 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: | 0.0015L | 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: | 0.0016 | 0.0041 |
| 7. | Oil pump driven gear in pump housing ........................End Clearance: | 0.0016 | 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: | 0.0040L | 0.0060L |
| 11. | Tach drive shaft in tach drive housing ..................................Diameter: | 0.0015L | 0.0030L |
| 12. | Oil seal in tach drive housing................................................Diameter: | 0.000 | 0.003L |
| 13. | Oil seal in 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: | 32 lbs. | 37 lbs. |
| 17. | Oil temperature control valve 0.090 inches minimum travel at ..........................................Oil Temperature: | 120° | 170° |
| | Oil temperature control valve 0.090 inches minimum travel at ..........................................Oil Temperature: | 168° | 172° |

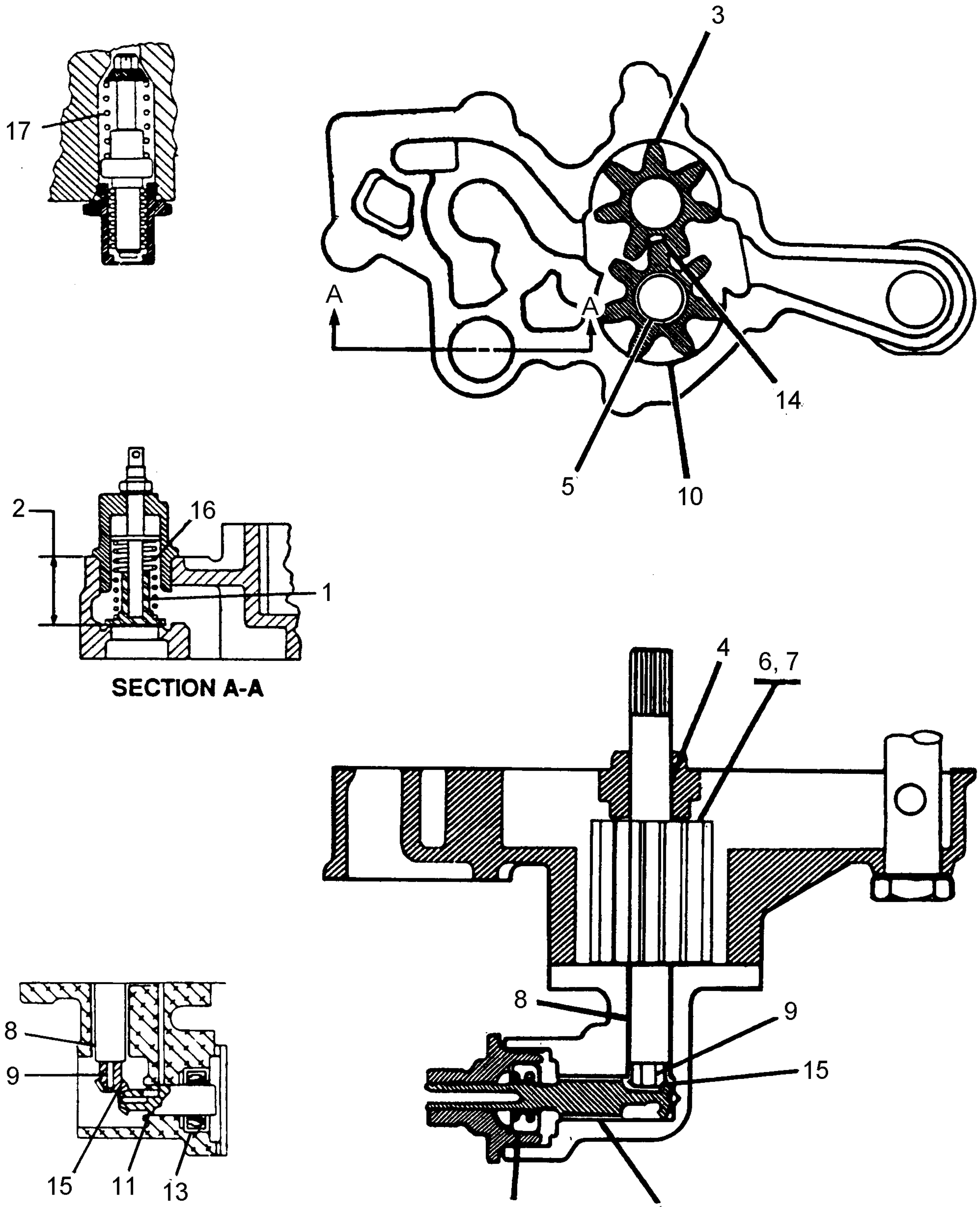



**FIGURE 14-6. OIL PUMP AND TACH DRIVE FITS AND LIMITS**
**New Parts Dimensions**

| PARTS NAME | FEATURE | NEW DIMENSION (INCH) |
|---|---|---|
| Oil Pump Housing and Shaft Assembly | Driven Gear Shaft Diameter<br>Driver Gear Shaft Hole Diameter<br>Gear Chamber Depth | 0.5640-0.5650<br>0.5620-0.5630<br>1.9985-2.0000 |
| Oil Pump Driver Gear | Shaft Diameter | 0.5600-0.5605 |
| Oil Pump Driven Gear | Bushing Inside Diameter (installed) | 0.5655-0.5665 |

## 14-6 LUBRICATION SYSTEM COMPONENT REPAIR AND REPLACEMENT

Any lubrication system component worn beyond new parts limits or failing to meet the inspection criteria in section 14-5 must be replaced unless repair is possible with the following instructions:

1. Oil pump housings with gear shafts that exceed the specifications in section 14-5 must be discarded. The oil pump housing driven gear shaft is pressed into the pump housing and is not field replaceable.
2. Oil pump housings that are cracked must be discarded. Oil pump housings with enlarged or scored gear chambers must be discarded.
3. Oil pump covers with scored gear contact surfaces must be discarded, unless the parting surface can be lapped smooth and made perfectly flat.
4. Oil pump covers, tach drive housings and oil filter adapters exhibiting cracks must be discarded.
5. Oil pump drive gears worn beyond specifications must be discarded. Oil pump driven gears with bushings that are worn beyond specifications must be discarded. See section 14-5 "New Parts Dimensions."
6. Oil sumps that leak or that are cracked must be discarded. IO-550-B, IO-550-R oil sump studs that are damaged or loose must be replaced in accordance with section 6-22. Studs must be installed to the setting height specified in Figure 14-5.
7. Section 6-19, "Application of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing.
8. Oil pump and tach drive housing studs that are damaged or loose must be replaced in accordance with instructions in section 6-22. Studs must be installed to the specified height in Figure 14-4.
9. A new oil filter adapter stud P/N 653490 must be installed if the old stud is a plain steel color with a length of 1.440" inch, if it is found to be loose or it is installed beyond the stud setting height specified in Figure 14-8, "Oil Filter Adapter Stud Replacement." If required, install new stud in accordance with the following procedure:
    a. Remove old stud and inspect the threads in the adapter housing for damage. Replace the adapter housing if any thread damage is evident.

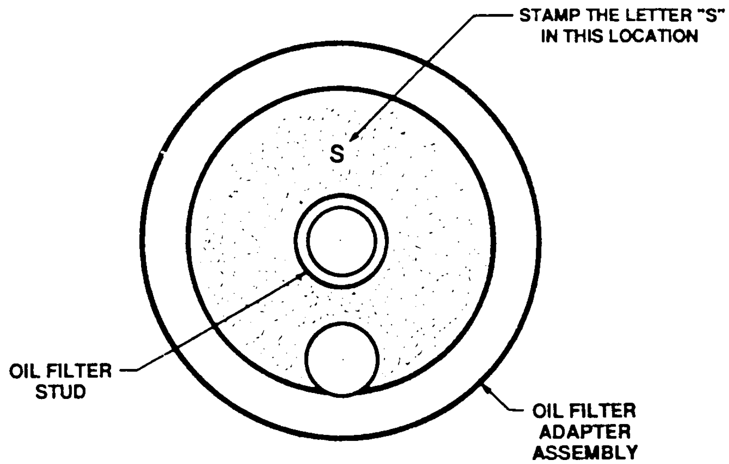



**FIGURE 14-7. STUD IDENTIFICATION**

NOTE…Oil filter adapters that incorporate this modification can be determined by the letter “S” stamped into the adapter housing see Figure 14-7, “Stud Identification.”

b. Clean the adapter housing threads thoroughly to remove any remaining thread adhesive and oil.

c. Install the applicable new stud (P/N 653490) and confirm that the incomplete thread on the stud stops at the first thread in the adapter housing and does not continue into the housing below the minimum 0.500 inch extension. See Figure 14-8, "Oil Filter Adapter Stud Replacement." Replace the adapter housing if the extension is less than the specified 0.500 inch minimum.

d. After extension height inspection, remove the stud from the adapter. Clean the threads of the adapter housing and stud with Loctite "Primer T" (TCM P/N 646944) and allow to dry.

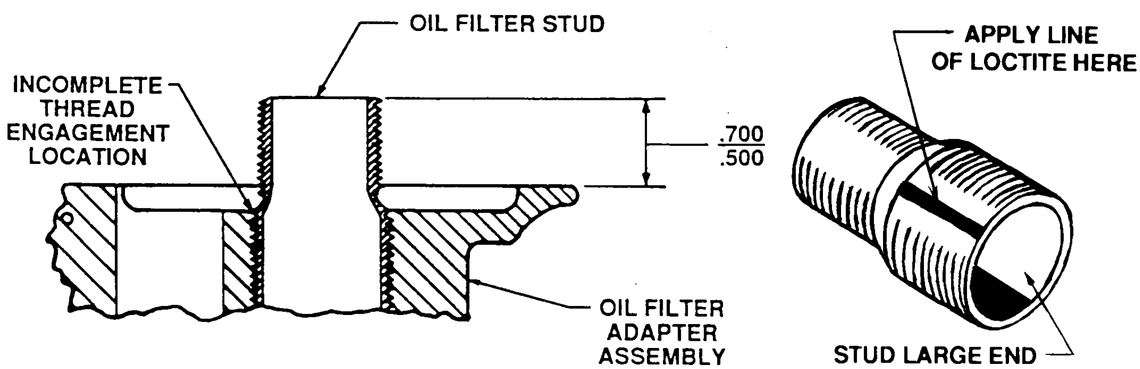



**FIGURE 14-8. OIL FILTER ADAPTER STUD REPLACEMENT**

e. Apply a line of Loctite 271 (TCM P/N 646941) along the large threads (.8125-16 end) of the stud and install into the adapter finger tight to 30 inch pounds torque. Check for proper stud extension height in accordance with Figure 14-8. (continued )

f. Allow the parts to cure a minimum of 30 minutes prior to installation of the oil filter.

*CAUTION…Curing times may vary depending on ambient temperature. Consult Loctite instructions.*

g. After installation of a new oil filter adapter stud, stamp a 0.125 inch high letter “S” in the location shown in Figure 14-7, “Stud Identification.”

## 14-7 LUBRICATION SYSTEM SUB-ASSEMBLY

NOTE…All lubrication system components must be clean and free of debris before assembly.

NOTE…Before assembly insure all parts listed in section 6-6, "100% Replacement Parts," have been replaced.

### OIL PUMP FOR I0-550-A, A2B, A3B, I0-550-B, B1F, B2F, B3F, B4F, B5F, B6F, B9B, B11B, B14B, B15B, B16B, B19B, B21B, B23B, B29B, B30B, B32B, B35B, B37B, I0-550-C, C1F, C2F, C2U, C3F, C6F, C8B, C9B, C11B, C12B, C13B, C15B, C18B, C19B, C25B, C26B, C27B, C28B, C29B, C30B

1. See Figure 14-1A. “Oil Pump.” Install oil pump housing (2) in a suitable fixture. Lubricate cavity, gear contact areas and oil pump gears (4, 15) with clean Molyshield grease. Install oil pump drive and driven gears in oil pump housing. Using a new pin (16) install bevel gear (17) on oil pump drive gear (15).
2. Assemble pressure relief valve housing (11) and adjusting screw (9). Turn adjusting screw into housing about halfway. Secure adjusting screw using new copper washer(13) and new nut (14). Assemble plunger (6), new spring (7), new washer (8) and slide into relief valve opening in oil pump housing. Install new gasket (10) on pressure relief valve housing (11). Coat housing threads with TCM P/N 646943 Anti-Seize Lubricant. Insure that adjusting screw aligns with plunger, spring and washer. Screw relief valve housing into oil pump housing. Torque housing to 240-260 inch pounds. Safety wire housing (11) in accordance with section 5-2, "Lockwire Procedure."
3. To assemble the electrical tach drive housing to the oil pump housing, press a new oil seal (19) into electrical tach drive housing until it bottoms out using an arbor press and proper driving tool. Coat the inside diameter of oil seal (19) with with clean Molyshield grease. Make sure oil seal is squarely seated before pressing. Coat tach drive shaft gear (25) with with clean Molyshield grease. Install tach drive shaft gear (25) into tach drive housing through end opposite of oil seal.
4. Coat oil pump gear cavity flange with #3 aviation permatex. Apply silk thread to oil pump housing flange as shown in Figure 14-9**.** Apply TCM gasket maker to the portion of the tach drive housing that will mate with the oil pump housing where the Permatex and silk thread is applied. Install electrical tach drive housing on oil pump making sure tach gear shaft and bevel gear properly mesh. As tach drive housing is being installed, make sure silk thread is not displaced. Secure using washers (22), new lock washers (23) & nuts (24). Torque nuts (24) to 90-110 inch pounds.
5. Using new gaskets (26, 31) install covers (27, 32), secure with washers (28, 33), new lock washers (24, 29) & nuts (23), screws (30). Torque nuts (23) to 75-85 inch pounds torque. Torque screws (30) to 21-25 inch pounds torque.
6. Oil pump, filter adapter and oil filter assembly will be installed during final engine assembly. Cover components and store in a clean protected area until final assembly.

## 0IL PUMP FOR I0-550-A4B, A5B, A6B, A7B I0-550-B5F, B12F, B13F, B17B, B18B, B20B, B22B, B24B, B25B, B26B, B27B, B28B, B31B, B34B, B36B, I0-550-C16B, C17B, C21B, C22B, I0-550-G, G1B, G2B, G4B, I0-550-N, I0-550-P, I0-550-R

1. See Figure 14-1B. "Oil Pump." Install oil pump housing (2) in a suitable fixture. Lubricate cavity, gear contact areas and oil pump gears (4, 15) with clean Molyshield grease. Install oil pump drive and driven gears in oil pump housing. Using a new pin (16) install bevel gear (17) on oil pump drive gear (15).
2. Assemble pressure relief valve housing (11) and adjusting screw (9). Turn adjusting screw into housing about halfway. Secure adjusting screw using new copper washer (13) and new nut (14). Assemble plunger (6), new spring (7), new washer (8) and slide into relief valve opening in oil pump housing. Install new gasket (10) on pressure relief valve housing (11). Coat housing threads with TCM P/N 646943 Anti-Seize Lubricant. Insure that adjusting screw aligns with plunger, spring and washer. Screw relief valve housing into oil pump housing. Torque housing to 240-260 inch pounds. Safety wire housing (11) in accordance with section 5-2, "Lockwire Procedure."
3. To assemble the mechanical tach drive housing to the oil pump housing, lightly coat new oil seal (19) outside diameter with TCM Gasket maker P/N 646942 and install using an arbor press and correct size driving tool. Press seal in flush. Make sure new oil seal is squarely seated before pressing. Coat the inside diameter of oil seal (19) with with clean Molyshield grease.
4. Coat oil pump gear cavity flange with #3 aviation permatex. Apply silk thread to oil pump housing flange as shown in Figure 14-9. Apply TCM gasket maker to the portion of the tach drive housing that will mate with the oil pump housing where the Permatex and silk thread is applied. Coat tach drive shaft gear (24) with with clean Molyshield grease. Place shaft (24) into mechanical tach drive housing (18) and install on oil pump housing (2). Shaft gear may have to be turned slightly to insure proper meshing with bevel gear (17). As tach drive housing is being installed, make sure silk thread is not displaced. Secure with washers (22) and nuts (23). Torque nuts (23) 90-110 inch pounds.
5. Coat cover (26) threads with Loctite Pipe Sealant with Teflon and TCM P/N 646943 Anti-Seize Lubricant. Place a new gasket (25) on mechanical tach drive cover (26). Turning counterclockwise, install left hand threaded cover (26). Torque cover (26) to 250 - 350 inch pounds. Safety wire cover (26) in accordance with Section 5-2, "Lockwire Procedure."
6. Oil pump, filter adapter and oil filter assembly will be installed during final engine assembly. Cover components and store in a clean protected area until final assembly.

## OIL PUMP I0-550-G5B, G6B AND I0-550-N2B

1. See Figure 14-1C. "Oil Pump." Install oil pump housing (2) in a suitable fixture. Lubricate cavity, gear contact areas and oil pump gears (4, 15) with clean Molyshield grease. Install oil pump drive and driven gears in oil pump housing.

2. Assemble pressure relief valve housing (11) and adjusting screw (9). Turn adjusting screw into housing about halfway. Secure adjusting screw using new copper washer(13) and new nut (14). Assemble plunger (6), new spring (7), new washer (8) and slide into relief valve opening in oil pump housing. Install new gasket (10) on pressure relief valve housing (11). Coat housing threads with TCM P/N 646943 Anti-Seize Lubricant. Insure that adjusting screw aligns with plunger, spring and washer. Screw relief valve housing into oil pump housing. Torque housing to 240-260 inch pounds. Safety wire housing (11) in accordance with section 5-2, "Lockwire Procedure."
3. Coat oil pump gear cavity flange with #3 aviation permatex. Apply silk thread to oil pump housing flange as shown in Figure 14-9. Apply TCM gasket maker to the portion of the tach drive housing that will mate with the oil pump housing where the Permatex and silk thread is applied. As the oil pump cover is being installed, make sure silk thread is not displaced. Secure with two sets of attaching hardware (18, 20). Torque nuts (20) to 90-110 inch pounds.
4. Oil pump, filter adapter and oil filter assembly will be installed during final engine assembly. Cover components and store in a clean protected area until final assembly.

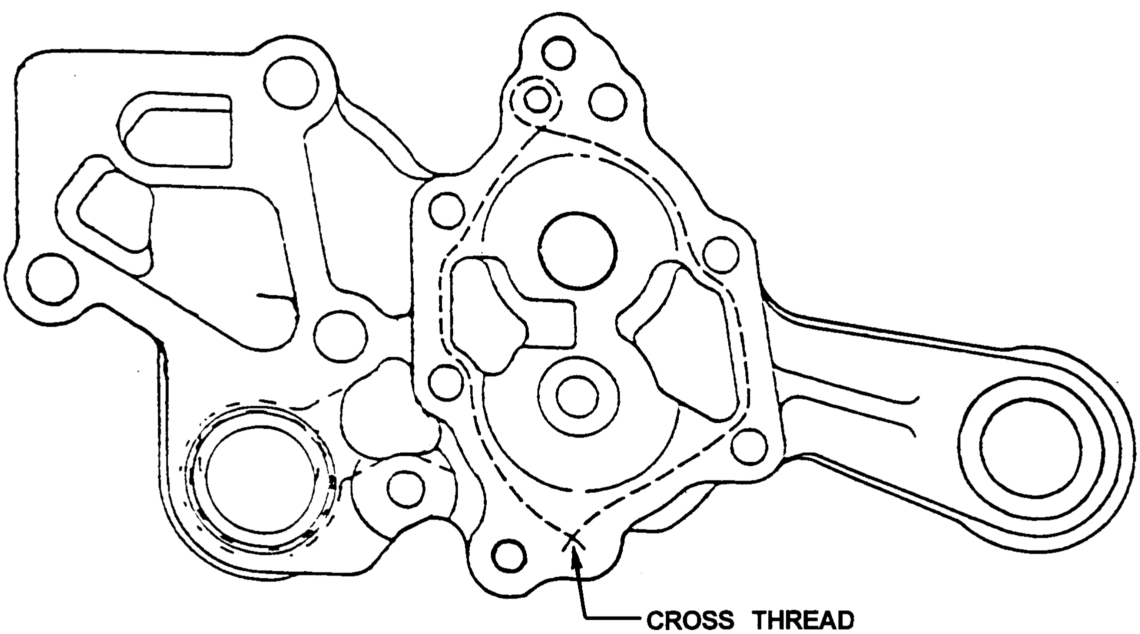



**FIGURE 14-9. OIL PUMP HOUSING THREADING DIAGRAM**

### Oil Cooler I0-550-A, I0-550-B, I0-550-G, G1B, G2B & G4B (See Figure 14-2A)

NOTE...Before installing fittings in oil cooler, insure they are free of any debris by thoroughly flushing them with an approved solvent.

## WARNING

**Never use teflon tape on lubrication system fittings.**

1. Install fitting (12), plugs (13 & 14), new gasket (16) and new oil temperature control valve (15) into oil cooler (3). Torque plugs (13,14) in accordance with Table 6-2, "Pipe Plug Torques." Torque fitting (12) in accordance with Table 6-3, "Torque Specifications for Fittings." Torque oil temperature control valve to 440-460 inch pounds. Safety wire oil temperature control valve in accordance with section 5-2, "Lockwire Procedure."
2. The oil cooler will be installed on the engine during final engine assembly. Cover oil cooler and store in a clean protected area until final engine assembly.

### Oil Cooler I0-550-C (See Figure 14-2B)

NOTE...Before installing fittings in oil cooler, insure they are free of any debris by thoroughly flushing them with an approved solvent.

## WARNING

**Never use teflon tape on lubrication system fittings.**

1. Install plugs (8 & 9). Install new gasket (10) and new oil temperature control valve (11) into oil cooler (3). Torque plugs (8, 9) in accordance with Table 6-2, "Pipe Plug Torques." Torque oil temperature control valve (11) to 440-460 inch pounds. Safety wire oil temperature control valve in accordance with section 5-2, "Lockwire Procedure."
2. The oil cooler will be installed on the engine during final engine assembly. Cover oil cooler and store in a clean protected area until final engine assembly.

### Oil Cooler I0-550-G5B, G6B, I0-550-N, I0-550-P, I0-550-R (See Figure 14-2C)

NOTE...Before installing fittings in oil cooler, insure they are free of any debris by thoroughly flushing them with an approved solvent.

## WARNING

**Never use teflon tape on lubrication system fittings.**

1. Install plugs (12, 13). Install new gasket (15) and new oil temperature control valve (14) into oil cooler (3). Torque plugs (12, 13) in accordance with Table 6-2, "Pipe Plug Torques." Torque oil temperature control valve (14) to 440-460 inch pounds. Safety wire oil temperature control valve in accordance with section 5-2, "Lockwire Procedure."
2. The oil cooler will be installed on the engine during final engine assembly. Cover oil cooler and store in a clean protected area until final engine assembly.

### Oil Sump I0-550-B, I0-550-R (See Figure 14-3B)

1. Install the four engine mount legs (14) and secure with four sets of attaching hardware (15, 16). Torque nuts (16) to 275-325 inch pounds torque.
2. The oil sump will be installed on engine during final engine assembly. Cover sump assembly and store in a clean protected area until final engine assembly.

# CHAPTER 15

# CYLINDERS AND PISTONS

## 15-1A CYLINDER ASSEMBLY REMOVAL (See Figure 15-1A)

1. Remove attaching hardware (30, 31, 32) and remove rocker covers (29) from all cylinders. Remove and discard gaskets (28).

2. Position the crankshaft so the piston is at top dead center and both intake and exhaust valves of cylinder to be removed are closed. Remove screws (20) and washers (19). Slide the rocker shafts (18) out far enough to remove the rocker arms (21, 24) and thrust washers (27). Repeat for all six cylinders.

3. Rotate the engine stand placing the engine in the inverted position. Withdraw pushrods (39) from housings. Grasp pushrod housing (35) and push inward toward the crankcase while lifting the cylinder end to remove. Remove all pushrod housings (35). Remove springs (38), washers (36) and packings (37). Discard all packings (37) and springs (38).

4. Rotate the engine stand placing the engine in the upright position. Make sure piston in cylinder being removed is at the top dead center position. Using the specified wrenches remove flange nuts (40, 41, 44) from cylinder base flange and seventh stud locations. Cradle cylinder in arm and withdraw it straight outward. Catch the piston with free hand as it clears the cylinder to prevent damage to the crankcase. Remove the cylinder base packing (25).

5. Remove piston pin (53) and piston (48) from connecting rod. Install the cylinder base packing in a figure "8" pattern around the cylinder deck studs and connecting rod for support. See Figure 15-1A1, "Connecting Rod Support." Remove all of the cylinders and pistons using the above instructions.

6. Place cylinders upright on a workbench. Remove rocker shafts (18) from cylinders and discard. Discard thrust washers (27). Discard all piston pins (53), pistons (48) and piston rings (49 through 52).

   Using a retrieval magnet, remove all of the hydraulic tappets (45, 46) from the crankcase tappet bores. Discard hydraulic tappets (45, 46).

Nomenclature for Figure 15-1A

1. Cylinder, Assembly
2. Cylinder
3. Insert, Spark Plug
4. Guide Intake
5. Guide, Valve Exhaust
6. Stud
7. Insert, Intake Flange
8. Insert, Intake Valve
9. Insert, Exhaust Valve
10. Valve, Intake
11. Valve, Exhaust
12. Spring, Inner
13. Spring, Outer
14. Retainer, Lower
15. Seal
16. Roto Coil
17. Key, Retainer
18. Shaft, Valve Rocker
19. Washer, Plain
20. Screw, Hex Head
21. Rocker
22. Bushing, Valve Rocker
23. Screw, Drive
24. Rocker
25. O-Ring, Cylinder Base
26. Retainer, Intake Valve
27. Washer, Thrust
28. Gasket, Rocker Cov.
29. Cover, Valve Rocker
30. Washer
31. Washer, Lock
32. Screw
33. Gasket, Exh. Flange
34. Nut
35. Housing, Push Rod
36. Washer
37. Packing
38. Spring
39. Push Rod
40. Nut, Flanged
41. Nut, Flanged
42. Bracket, 7th Stud
43. Bracket, 7th Stud
44. Nut, Flanged
45. Tappet, Hyd. Exh.
46. Tappet, Hyd. Int.
47. Insert, Helical Coil
48. Piston
49. Ring, Comp.
50. Ring, Comp.
51. Ring, Oil Control
52. Ring, Scraper
53. Pin, Piston

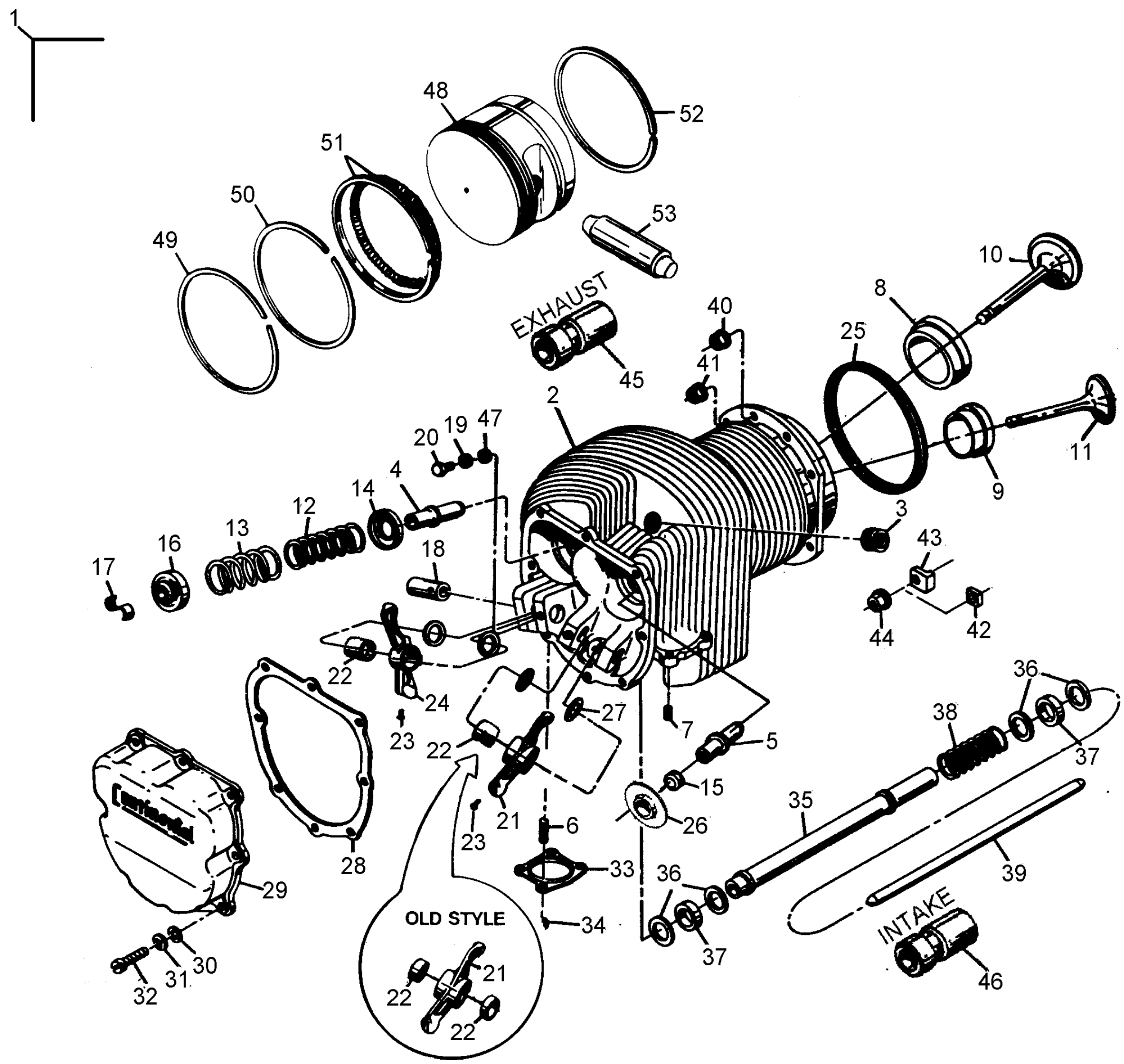



**FIGURE 15-1A. CYLINDER AND PISTON ASSEMBLY FOR IO-550-A, B, C**

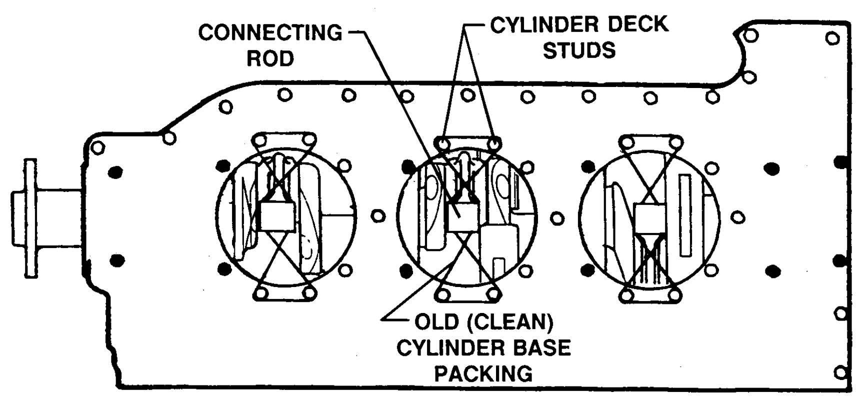



**FIGURE 15-1A1. CONNECTING ROD SUPPORT**

## 15-1B CYLINDER ASSEMBLY REMOVAL (See Figure 15-1B)

1. Loosen and remove cylinder drain tubes (45). Remove and discard drain tube seals (46). Remove drain tube fittings (16).
2. Remove attaching hardware (30, 31, 32) and remove rocker covers (29) from all cylinders. Remove and discard gaskets (28).
3. Position the crankshaft so the piston is at top dead center and both intake and exhaust valves of cylinder to be removed are closed. Bend tab of washers (26) down and remove screws (27), tab washers (26) and retainers (25). Remove rocker arms (20), shafts (24) and thrust washers (23) from cylinder studs. Discard tab washers (26), rocker shafts (24), thrust washers (23) and retainers (25). Withdraw pushrods (40) from housings. Repeat for all six cylinders.
4. Rotate the engine stand placing the engine in the inverted position. Remove all pushrod housings (35) by pushing in toward the crankcase while lifting the cylinder end. Remove springs (39), washers (36), seals (37) and packings (38). Discard all seals (37), packings (38) and springs (39).
5. Rotate the engine stand placing the engine in the upright position. Make sure piston in cylinder being removed is at the top dead center position. Using the specified wrenches remove flange nuts (41, 42, 49) from cylinder base flange and seventh stud locations. Remove brackets (47, 48). Cradle cylinder in arm and withdraw it straight outward. Catch the piston with free hand as it clears the cylinder to prevent damage to the crankcase. Remove the cylinder base packing (52).
6. Remove piston pin (60) and piston (55) from connecting rod. Install the cylinder base packing in a figure "8" pattern around the cylinder deck studs and connecting rod for support. See Figure 15-1A1, "Connecting Rod Support." Remove all of the cylinders and pistons using the above instructions.
7. Place cylinders upright on a workbench. Discard all piston pins (60), pistons (55) and piston rings (56 through 59).
8. Using a retrieval magnet, remove all of the hydraulic tappets (53, 54) from the crankcase tappet bores. Discard hydraulic tappets (53, 54).

### Nomenclature for Figure 15-1B

1. Cylinder, Assembly
2. Cylinder
3. Insert, Spark Plug
4. Guide Intake
5. Guide, Valve Exhaust
6. Stud
7. Stud
8. Stud
9. Insert, Helical Coil
10. Insert, Intake Valve
11. Insert, Exhaust Valve
12. Valve, Intake
13. Valve, Exhaust
14. Spring, Inner
15. Spring, Outer
16. Sleeve
17. Retainer, Lower
18. Key, Retainer
19. Roto Coil
20. Rocker
21. Bushing, Valve Rocker
22. Screw, Drive
23. Washer, Thrust
24. Shaft, Valve Rocker
25. Retainer
26. Washer, Tab
27. Screw
28. Gasket, Rocker Cover
29. Cover, Valve Rocker
30. Washer
31. Washer, Lock
32. Screw
33. Gasket, Exh. Flange
34. Nut
35. Housing, Push Rod
36. Washer
37. Seal, O-Ring
38. Packing
39. Spring
40. Push Rod
41. Nut, Flanged
42. Nut, Flanged
43. Baffle
44. Spring
45. Tube, Drain
46. Seal
47. Bracket, 7th Stud
48. Bracket, 7th Stud
49. Nut, Flanged
50. Seal
51. Retainer
52. O-Ring, Cyl. Base
53. Tappet, Hyd. Int.
54. Tappet, Hyd. Exh.
55. Piston
56. Ring, Comp.
57. Ring, Comp.
58. Ring, Oil Control
59. Ring, Scraper
60. Pin, Piston
61. Bolt
62. Washer
63. Support
64. Screw
65. Washer
66. Baffle
67. Baffle
68. Spring

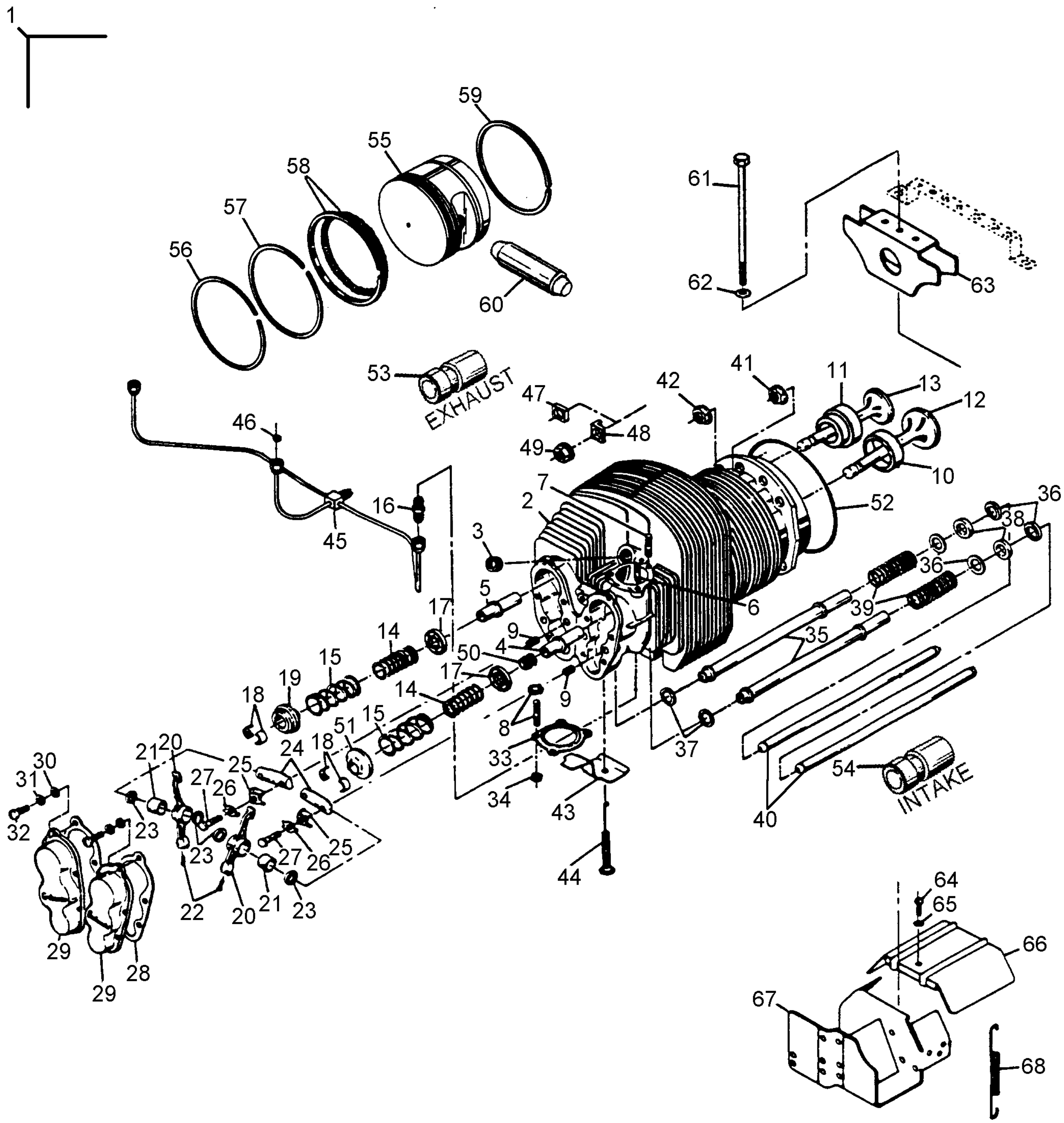



**FIGURE 15-1B. CYLINDER AND PISTON ASSEMBLY FOR I0-550-G, N, P, R**

## 15-2 CYLINDER AND ASSOCIATED PARTS DISASSEMBLY

1. See Figures 15-1A & 15-1B, "Cylinder And Piston Assembly." Place the cylinder to be disassembled on a cylindrical block of wood anchored to a work bench.

2. See Figure 15-1A as applicable. Using a valve spring compression tool, carefully compress valve springs (do not cock the rotocoil or retainer and score the valve stem.) Remove retaining keys (17) with a retrieval magnet and discard. Remove and discard rotocoil (16). Remove steel retainer (26), outer springs (13) and inner springs (12). Remove inner retainers (14). Remove and discard intake valve guide seal (15). Hold the valve stems while lifting the cylinder from its support and place the cylinder on its side. Remove any nicks on the valve stems using an emery stone or cloth before removing valves. Discard exhaust valves (11).

   See Figure 15-1B as applicable. Using a valve spring compression tool, carefully compress valve springs (do not cock the rotocoil or retainer and score the valve stem.) Remove retaining keys (18) with a retrieval magnet and discard. Remove and discard rotocoil (19). Remove retainer (51), outer springs (15) and inner springs (14). Remove inner retainers (17). Remove and discard intake valve guide seal (50). Hold the valve stems while lifting the cylinder from its support and place the cylinder on its side. Remove any nicks on the valve stems using an emery stone or cloth before removing valves. Discard exhaust valves (13).

3. Remove the cylinder exhaust flange studs in accordance with section 6-23, “Cylinder Exhaust Port Stud Replacement.” Discard studs.

4. Support the rocker arm on a ring that will allow the old bushings to pass through. Press the worn bushings out using the proper size tool. Discard the bushings.

5. Disassemble the remaining cylinders and rocker arms using the above procedure.

## 15-3 PRECLEANING INSPECTION

1. Prior to cleaning the cylinder assemblies, inspect them for any signs of head to barrel leakage, leaking oil, fuel, exhaust or combustion residue and any condition that could indicate loss of integrity of the cylinder assembly or the cylinder head to barrel junction. Inspect the cylinder barrel fins and fin tips for rust pitting and damage in the power stroke stress areas. Discard any cylinder with the above described conditions. Inspect the remainder of the cylinder barrel, barrel fins, fin tips and cylinder base flange for rust pitting and damage that cannot be repaired in accordance with the instructions in section 15-6. Discard all cylinders which cannot be repaired.

2. Discolored or burnt paint may indicate piston and piston pin scoring of the cylinder bore caused by overheating. Scored cylinder barrel bores and barrel bores that have been overheated must be discarded and replaced. Do not attempt to remove overheating damage by grinding cylinder bore to the next allowable oversize. Cylinder barrel overheating can destroy the strength of the material.

3. If the cylinder deck stud nuts have been properly torqued during operation, when the cylinder is removed, a contact pattern can be observed around the stud holes and between the stud holes of the cylinder contact flange. If the engine has operated with loose cylinder deck studs fretting and galling will be present in this area. Inspect the cylinder to crankcase mating flange for fretting and galling indicating cylinder movement. If movement has occurred, replace all cylinder deck studs on the corresponding cylinder deck of the crankcase.

## 15-4 CYLINDER AND ASSOCIATED PARTS CLEANING

**WARNING**

**Do not use sand, glass shot or metal grit for cleaning.**

1. Clean cylinder assemblies and associated parts in accordance with the instructions in section 6-7, "General Cleaning," and the following special instructions:
2. Precautions applicable to both aluminum and steel must be exercised in cleaning the cylinder assembly. Remove oil and loose material with a mild alkaline cleaner by spraying or brushing. Remove all traces of the alkaline by spraying with steam. After the cylinder dries, inspect it for any alkaline residues and, if necessary, respray with steam to remove.

*CAUTION…Alkaline cleaning solutions will corrode metals if not completely removed.*

3. Remove all paint, varnish and carbon from the cylinder assembly to allow complete inspection. The cylinder assembly may be dry blasted. Use blasting techniques to remove hard carbon deposits with the lowest air pressure that will produce the desired results. All machine surfaces, the cylinder mount flange nut seats, cylinder barrel wall, small holes and finished surfaces must be protected from the blast by seals and covers. Suitable types of materials for dry blasting are plastic pellets and processed natural materials such as wheat grains and crushed fruit pits or shells.

4. After any blasting process, blow off all dust with dry compressed air and insure that no blasting material has lodged in crevices, recesses or holes. Clean the cylinder with hot, soapy water and a stiff bristled scrub brush to remove all blasting material from the cylinder. After washing, remove all soap residue by thoroughly rinsing with hot water. Dry the cylinder completely and coat all bare steel surfaces thoroughly with clean 50 weight aviation engine oil. Failure to clean and protect the cylinder in this manner could result in cylinder bore damage from rust and contamination.

5. Degrease the intake valves with mineral spirits. Remove all carbon, varnish and gum from the intake valves using a carbon solvent or by dry blasting.

   Use blasting techniques to remove hard carbon deposits with the lowest air pressure that will produce the desired results. Suitable types of materials for dry blasting are plastic pellets and processed natural materials such as wheat grains and crushed fruit pits or shells.

   After dry blasting, clean with mineral spirits and air dry.

   Clean all pushrods and rocker arms using mineral spirits. Using a small squirt bottle, insure all pushrod and rocker arm oil passages are open by flushing with mineral spirits. Discard any pushrod or rocker arm that has obstructed oil passages that cannot be cleared by solvent action. DO NOT CLEAN PUSHRODS AND ROCKER ARMS BY BLASTING.

Dry all components completely and thoroughly coat with clean 50 weight aviation engine oil.

6. Clean all cylinder baffles and associated hardware using mineral spirits.

## 15-5 CYLINDER AND ASSOCIATED PARTS INSPECTION

### VISUAL INSPECTION

Visually inspect the cylinder assembly and associated components in accordance with the instructions in section 6-8, "Visual Inspection," and the following special instructions:

### CYLINDER BARREL

1. Power Stroke Stress Area of the cylinder barrel- Visual inspection must include a detailed external inspection of the areas of the cylinder barrel which experience the highest operational stresses from the piston power stroke. These areas are the 12 o'clock area of the first six fins below the head on one side of the engine, and the 6 o'clock area on the other side as described in Figure 15-2.
2. Power Stroke Stress Area of the cylinder barrel- Inspect the cylinder barrel areas including the cylinder barrel fins and the areas between and adjacent to the fins for cracks, sharp indentations, rust, pitting, broken or bent fins, (including bent fins that have been straightened) and chafing damage that alter the original barrel surface contour, fin tip contour or reduce the thickness of the barrel fins. Cylinder barrels with any of the above conditions must be discarded.
3. Remaining Cylinder Barrel Areas - Thoroughly inspect the remaining cylinder barrel areas including the cylinder barrel fins and the areas between and adjacent to the fins for cracks, sharp indentations, chafing damage, rust and pitting. Inspect the cylinder barrel flange and flange radius for rust and pitting. Cylinder barrels with bent fins in this area may continue in use, provided that the fin is not bent more than one-half of the distance to the next fin, that no attempt is made to straighten the bent fin and there are no cracks or evidence of cracks. Minor fin tip damage repair may be accomplished on fin tips in this area as described in section 15-6. OTHERWISE CYLINDER REPLACEMENT IS REQUIRED.

## WARNING

**Corrosion pits reduce wall thickness and will cause stress concentrations and subsequent fracture. Damage or removal of external barrel material that results in a reduction of the barrel wall thickness is strictly prohibited regardless of location and requires cylinder replacement.**

4. Inspect the entire cylinder barrel for electrical arc pitting or weld repairs. Electrical arc pitting or weld repairs of any surface on the cylinder barrel is strictly prohibited. if such conditions are present discard cylinder.

5. Inspect the cylinder bore for overheating or high temperature operation, detonation, piston scoring, or piston pin damage to the cylinder bore. Discard all such cylinders.

**CYLINDER HEAD**

1. Inspect the external surfaces of the cylinder head including the exhaust port cylinder head fins, in between the fins, exhaust ports, top and bottom spark plug bosses and fuel nozzle boss for cracks or indications of cracks. Discard any cylinder with cracks or indications of cracks.
2. Minor cooling fin cracks that do not extend into the cylinder head structure may be repaired in accordance with section 15-6.
3. Heat checks in the exhaust port that are 1/8" inch in length or less may continue in service.

## WARNING

**Welding of the cylinder head structure can destroy the assembly preloads and casting strength resulting in cylinder assembly failure.**

4. Inspect the intake flange studs for damaged, distorted or stripped threads. Inspect studs for corrosion, rusting, pitting, incomplete threads and security. Replace studs with any of these indications.
5. Inspect the cylinder exhaust flange studs and rocker shaft hold down stud holes for distorted and stripped threads. Repair damaged, distorted and stripped threads in accordance with section 6-21.
6. Check all studs with a tool maker's square for perpendicularity. Check all studs for security and correct setting height. See Figure 15-3 for stud setting heights.
7. Damage to threaded bores - Inspect rocker cover flange screw holes for complete threads. Inspect all helical coils for damage. The spark plug helical coil outer ends must lie in the first full thread of the tapped holes in which they are installed. The helical coil teeth at the outer end of the helical coil must not be visible. Repair threaded bores in accordance with section 6-21 and Figure 15-3.

**INTAKE VALVES**

Visually inspect the intake valves using a 10X magnifying glass. Inspect the intake valve stems for scoring, damage in valve retainer grooves and spalling on stem tips. Place the valve head on a one inch wide precision parallel bar and inspect for distortion with a .001" feeler stock. Discard valves that are damaged, distorted, cracked, burned, pitted or rusted. Valve faces may be machined to the dimensions specified in Figure 15-9, "Intake Valve Refacing."

**ROCKER ARMS**

Visually inspect all rocker arm foot contact areas for wear, galling, spalling, scoring or grooves. Inspect rocker arm ball seats for smoothness. Discard rocker arms with any signs of wear, galling, spalling, scoring or grooves. Inspect the thrust surfaces of the rocker shaft bore for displaced metal, galling and spalling. Discard all rocker arms with these conditions. Inspect for, and discard any rocker arm that has peeling copper plating. Inspect for and discard rocker arms with loose or missing oil passage rivets. Inspect oil passages for obstruction. Use an oil squirt bottle and clean 50 weight aviation engine oil to check oil passages for free flow. Rocker arms with blocked oil passages that cannot be cleared by solvent action must be discarded.

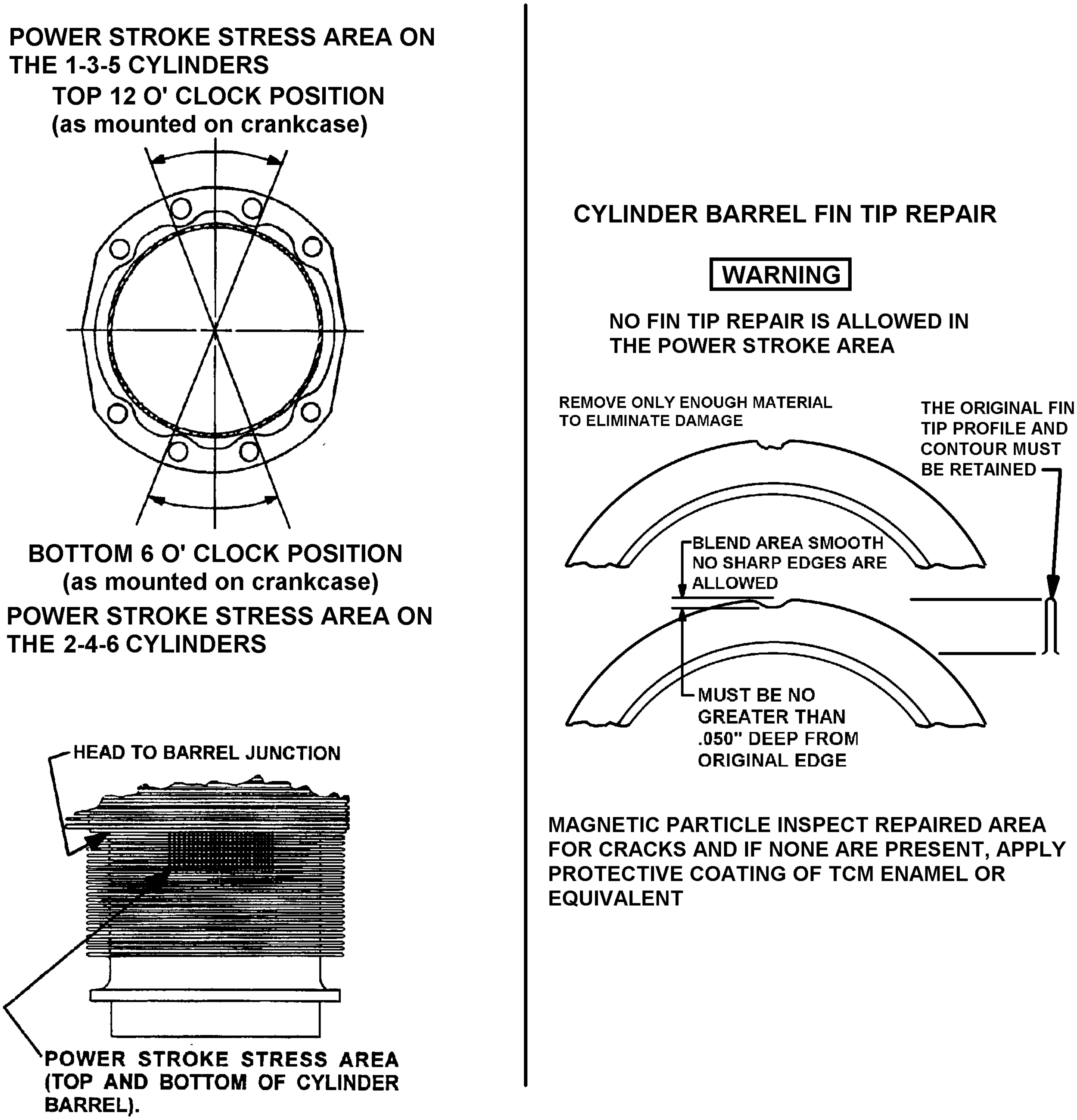
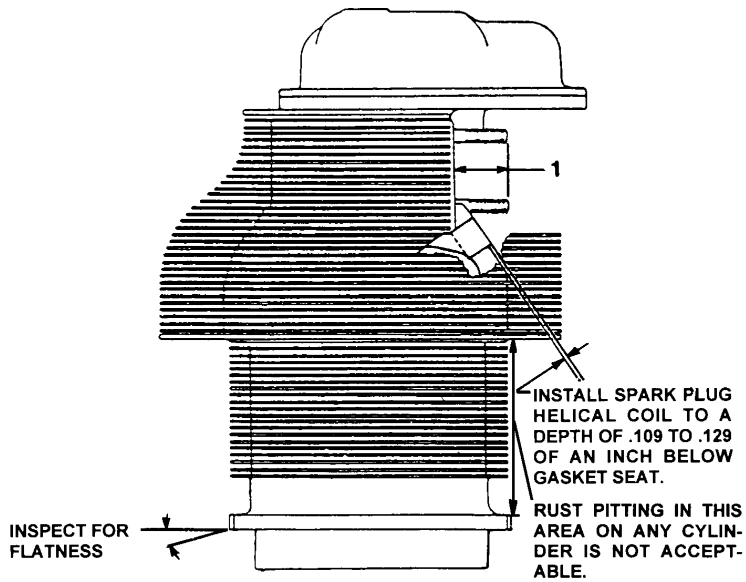
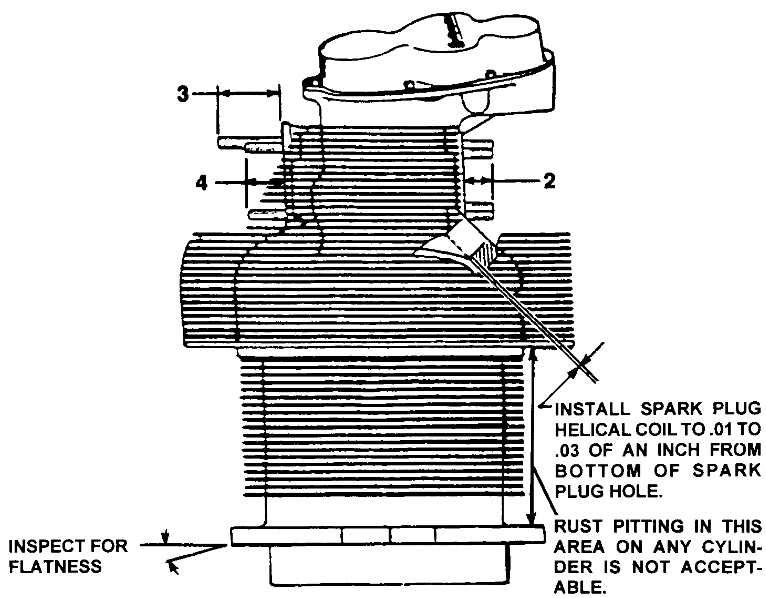



**FIGURE 15-2. CYLINDER INSPECTION**




I0-550-A, B & C CYLINDER




I0-550-G,N,P,R CYLINDER

**FIGURE 15-3. CYLINDER STUD SETTING HEIGHTS**

| ITEM NO. | LOCATION | THREAD SIZE | SETTING HEIGHT | OTY. |
|---|---|---|---|---|
| 1. | Stud, Exhaust Flange (Ring Locked) | 1/4-20 x 1/4-28 | 25/32 | 4 |
| 2. | Stud, Exhaust Flange (Ring Locked) | 1/4-20 x 1/4-28 | 7/8 | 4 |
| 3. | Stud, Intake Flange | 1/4-20 x 1/4-28 | 1.00 | 1 |
| 4. | Stud, Intake Flange | 1/4-20 x 1/4-28 | 25/32 | 2 |

### PUSHRODS

Visually inspect pushrod ball ends for smoothness, cracks, galling, scoring, spalling and security. Inspect pushrods for bending and warping. Discard pushrods with any signs of wear, cracks, galling, scoring, spalling, bending or warpage. Inspect pushrod oil passages for obstructions. Use an oil squirt bottle and clean 50 weight aviation engine oil to check oil passages for free flow. Pushrods with blocked oil passages that cannot be cleared by solvent action must be discarded.

### PUSHROD HOUSINGS

Visually inspect pushrod housings for cracks, dents, bending and chafing damage. Discard cracked, dented, bent or chafed pushrod housings. Discard any pushrod housings with rust pitting and missing cadmium plating.

### CYLINDER BAFFLES

Visually inspect all cylinder baffles for cracks, loose rivets, chafing damage and inspect anchor nuts for security and damaged threads. Baffling that has chafing damage caused by cylinder barrel fins indicates that cylinder barrel fin damage may have occurred. At this time inspect the corresponding cylinder barrel fins for damage in accordance with the cylinder assembly inspection procedure of this section. Discard any baffles exhibiting cracks and chafing damage. Replace damaged anchor nuts and loose rivets.

## FLUORESCENT PENETRANT INSPECTION

The cylinder assembly must be thoroughly cleaned prior to fluorescent penetrant inspection. All oil and preservative material must be removed.

The cylinder heads must be fluorescent penetrant inspected by a certified technician in accordance with section 6-12, "Fluorescent Penetrant Inspection." Cracks in the cylinder head structure are not acceptable or repairable. Cylinder heads that exhibit cracks or indications of cracks in the cylinder head structure must be discarded. See section 15-6 for repair of cracked cylinder head fins.

## MAGNETIC PARTICLE INSPECTION

The cylinder assembly must be thoroughly cleaned prior to magnetic particle inspection. All oil and preservative material must be removed.

The cylinder barrel must be magnetic particle inspected by a certified technician in accordance with section 6-9, "Magnetic Particle Inspection." Inspect the inner and outer surfaces of the cylinder barrel using circular and longitudinal magnetization. Cylinder barrels with cracks or crack indications are not acceptable or repairable. Discard all such cylinder assemblies.

The intake valves and rocker arms must be magnetic particle inspected by a certified technician in accordance with section 6-9, "Magnetic Particle Inspection." Inspect the intake valves and rocker arms using circular and longitudinal magnetization. Intake valves and rocker arms with cracks or crack indications are not acceptable or repairable. Discard all such valves and rocker arms.

## ULTRASONIC INSPECTION

Cylinders must be ultrasonic inspected in accordance with section 6-11.

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.

All components must be thoroughly cleaned and air dried prior to dimensional inspection.

**CYLINDER AND ASSOCIATED PARTS FITS AND LIMITS IO-550-A, B & C**

| Ref. No. | Description | NEW PARTS MIN. | MAX. |
|---|---|---|---|
| | **CYLINDERS** | | |
| 1. | Cylinder bore (lower 4-1/4 inch of barrel) ............................ Diameter: | See Figure 15-4A1 | |
| 2. | Cylinder bore choke (at 5.75 inch from open end of barrel) Taper: | See Figure 15-4A1 | |
| 3. | Cylinder bore out-of-round.......................................................: | 0.0000 | 0.001 |
| 4. | Cylinder bore................................................Allowable Oversize: | See Figure 15-4A1 | |
| 5. | Cylinder bore surface (Nitrided Barrels)<br>Cross hatch.......................................................................Angle:<br>Finish (in micro inches)...........................................................$R_a$: | <br>22° - 32°<br>30 | <br>—<br>50 |
| 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: | See Figure 15-5A | |
| 12. | Exhaust valve seat............................................................Width: | See Figure 15-5B | |
| | Exhaust valve seat-to-valve guide axis .............................Angle: | 45° 00' | - |
| | Intake valve seat-to-valve guide axis................................Angle: | 59° 45' | 60° 15' |
| | **ROCKER ARMS AND SHAFTS** | | |
| 13. | Rocker shaft in cylinder head bosses..................................Diameter: | 0.0007L | 0.0027L |
| | Rocker shaft in rocker arm bushing.....................................Diameter: | 0.0017L | 0.0032L |
| 14. | Rocker arm bushing bore ....................................................Diameter:<br>Rocker arm bushing (inside)............................Finish Bore Diameter: | .8725<br>0.7505 | .8755<br>0.7515 |
| 15. | Rocker arm .............................................................Side Clearance: | 0.0020 | 0.0150 |
| 16. | Intake valve guide.................................................... Inside Diameter:<br>Intake valve in guide .........................................................Diameter: | .4350<br>0.0010L | .4377<br>0.0042L |
| 17. | Exhaust valve guide................................................. Inside Diameter:<br>Exhaust valve in guide.......................................................Diameter: | .4375<br>0.0035L | .4395<br>0.0062L |
| 18. | Intake valve face (to stem axis)..................................................Angle: | 59°45' | 60°15' |
| 19. | Exhaust valve face (to stem axis)...............................................Angle: | 45°00' | 45°30' |
| 20. | Intake valve gauge line-to-stem ............................................Length: | See Figure 15-9 | |
| 21. | Exhaust valve face-to-stem ..................................................Length: | Replace 100% | |
| 22. | Intake valve face-to-stem ......................................................Runout: | 0.0000 | 0.0015 |
| 23. | Rocker arm foot to valve stem (dry valve gear lash)...........................: | 0.060 | 0.200 |
| | **PISTONS, RINGS AND PINS** | | |
| 24. | Piston, moly coated (bottom of skirt) in cylinder...................Diameter:<br>Piston, non moly coated (bottom of skirt) in cylinder............Diameter: | 0.006L<br>0.008L | 0.010L<br>0.011L |
| 25. | Top piston ring in groove .......................................... Side Clearance: | 0.0015 | 0.0040 |
| 26. | Second piston ring in groove .................................... Side Clearance:, | 0.0015 | 0.004 |
| 27. | Third piston ring in groove ........................................ Side Clearance: | 0.0035 | 0.0055 |

| Ref. No. | Description | NEW PARTS MIN | MAX. |
|---|---|---|---|
| 28. | Fourth piston ring in groove ........................................ Side Clearance: | 0.0060 | 0.0080 |
| 29. | Top ring gap at 1.00 ± .50 depth (in cylinder barrel)..................... Gap: | 0.028 | 0.044 |
| 30. | Second ring gap at 1.00 ± .50 depth (in cylinder barrel)............... Gap:<br>Gap for second ring must be at least .006 larger than gap for top ring. | 0.034 | 0.050 |
| 31. | Third ring gap at 1.00 ± .50 depth (in cylinder barrel) .................. Gap: | 0.020 | 0.036 |
| 32. | Fourth ring gap at 1.00 ± .50 depth (in cylinder barrel) ................ Gap: | 0.015 | 0.031 |
| 33. | Piston pin in piston .............................................................. Diameter: | 0.0003L | 0.0007L |
| 34. | Piston Pin .......................................................................... Diameter:<br>Piston Pin (0.005 oversize) .................................................. Diameter: | 1.1243<br>1.1293 | 1.1245<br>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 bearing and bushing twist or convergence<br>per inch of length...................................................................................... : | 0.0000 | 0.0005 |
| 42. | Hydraulic tappet in crankcase................................................ Diameter: | 0.0010L | 0.0025L |
| | **SPRING TEST DATA** | | |
| 43. | Inner valve spring 631521 compressed to 1.230 in. length.......... Load: | 87 Lbs. | 97 Lbs. |
| | Inner valve spring 631521 compressed to 1.746 in. length.......... Load: | 32 Lbs. | 38 Lbs. |
| 44. | Outer valve spring 637837 compressed to 1.275 in. length......... Load: | 126 Lbs. | 140 Lbs. |
| | Outer valve spring 637837 compressed to 1.791 in. length......... Load: | 49 Lbs. | 55 Lbs. |
| 45. | Installed outer valve spring ...................................................... Height: | 1.791 | |

NOTES: T=Tight L=Loose

## CYLINDER DIMENSIONAL INSPECTION

1. Inspect cylinder bore dimensions in accordance with Figure 15-4A1, "Cylinder Dimensions." Cylinders bores that do not conform to the standard size dimensions after honing must be ground to the next oversize dimension.
2. Inspect the cylinder base flanges for flatness. If cylinder base flange exceeds .001" out of flat, the cylinder must be discarded.
3. Dimensionally inspect the cylinder exhaust flange stud and rocker shaft hold down stud holes using a thread gauge and determine the appropriate oversize stud for replacement.
4. If intake flange studs have been removed for replacement, dimensionally inspect the intake flange stud hole(s) using a thread gauge and determine the appropriate oversize stud for replacement.
5. Dimensionally inspect the valve guides inside diameter. Guide dimensions must be within specifications the entire length of the guide. Replace all valve guides that are worn beyond the required specifications in accordance with the procedures in section 15-6.
6. Visually inspect the valve seats for any indication of burning, pitting, erosion or cracks. Determine if the valve seat dimensions exceed the specifications in Figures 15-5A and 15-5B . Any valve seats that are burned, pitted eroded, cracked or that do not conform with the specifications in Figures 15-5A and 15-5B must be replaced.

## INTAKE VALVE DIMENSIONAL INSPECTION

1. Inspect the entire length of the valve stem outside diameter with a micrometer. Discard valves with stems less than 0.4335 diameter.
2. Using a micrometer inspect the valve head outside diameter. Intake valves with heads smaller than 2.339 diameter must be discarded.

## ROCKER ARM DIMENSIONAL INSPECTION

1. Dimensionally inspect the rocker arm bushing bore. The bushing bore must be .8725 to .8755 inch diameter.
2. Dimensionally inspect the rocker arm thrust width. The rocker arm width must be 1.030 to 1.033.

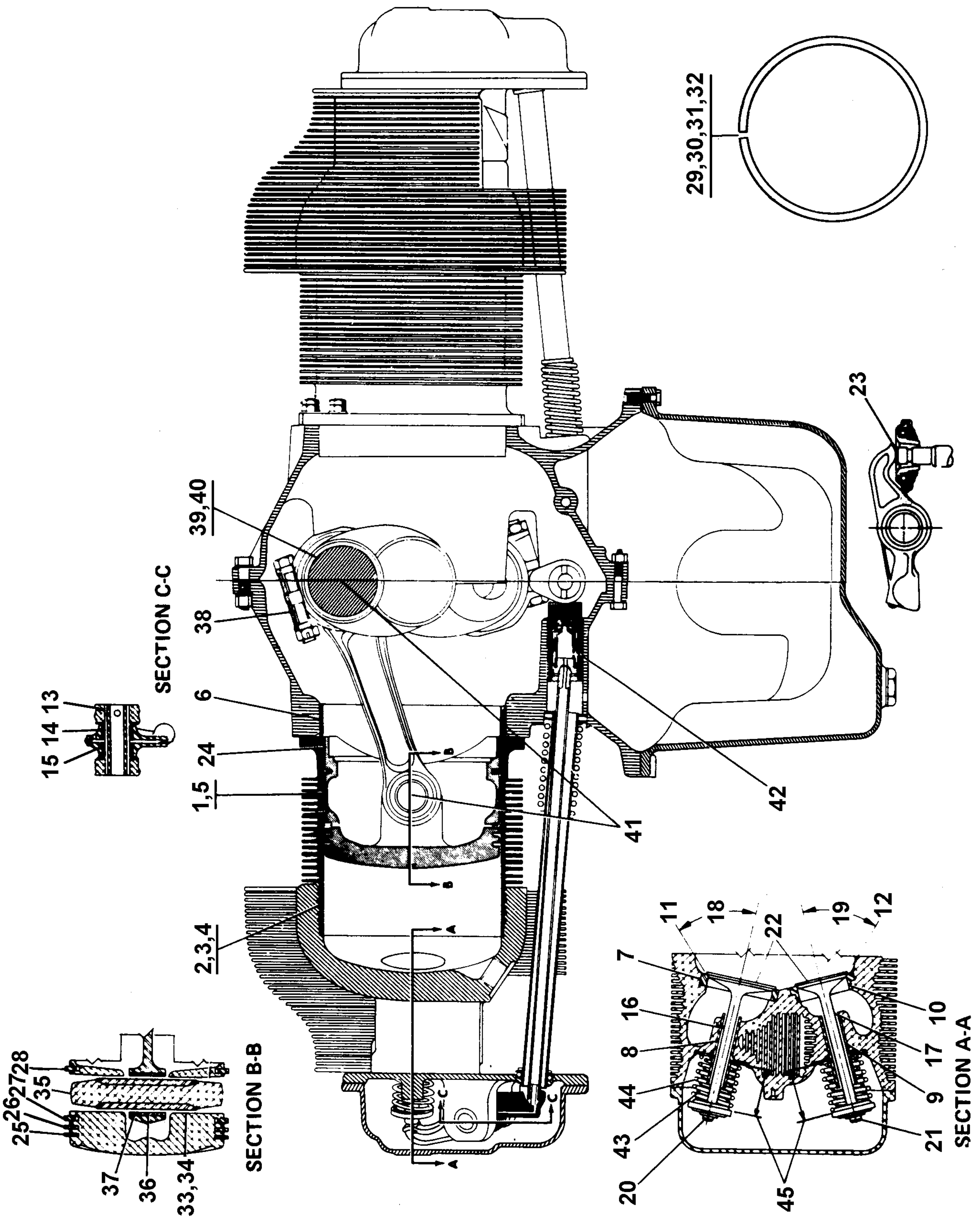



**FIGURE 15-4A. CYLINDER FITS AND LIMITS I0-550-A, B & C**

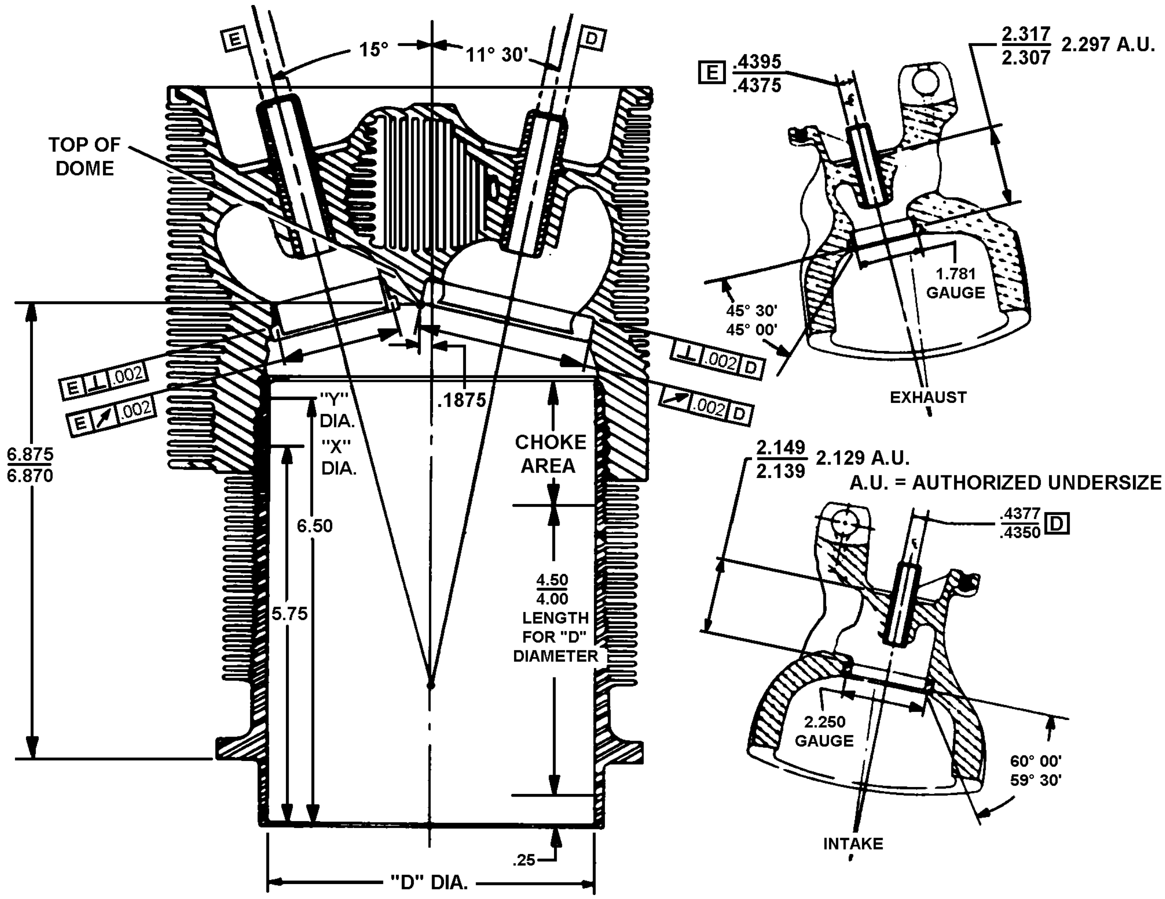



**FIGURE 15-4A1. CYLINDER DIMENSIONS I0-550-A, B & C**

| SIZE | "D" DIAMETER NEW | | "X" DIAMETER NEW | | "Y" DIAMETER NEW | |
|---|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. |
| STD. | 5.251 | 5.253 | 5.248 | 5.250 | 5.245 | 5.247 |
| .005 | 5.256 | 5.258 | 5.253 | 5.255 | 5.250 | 5.252 |
| .010 | 5.261 | 5.263 | 5.258 | 5.260 | 5.255 | 5.257 |
| .015 | 5.266 | 5.268 | 5.263 | 5.265 | 5.260 | 5.262 |

**NOTE…Dimensions shown are finish size after honing.**

**Cylinder bore out of round not to exceed (new) .002 (service) .003.**

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.
All components must be thoroughly cleaned and air dried prior to dimensional inspection.

### CYLINDER AND ASSOCIATED PARTS FITS AND LIMITS IO-550-G,N,P,R

| Ref. No. | Description | NEW PARTS MIN. | MAX. |
|---|---|---|---|
| | **CYLINDERS** | | |
| 1. | Cylinder bore (lower 4-1/4 inch of barrel)............................ Diameter: | See Figure 15-4B1 | |
| 2. | Cylinder bore choke (at 5.75 inch from open end of barrel)...... Taper: | See Figure 15-4B1 | |
| 3. | Cylinder bore out-of-round ..................................................................: | 0.0000 | 0.001 |
| 4. | Cylinder bore .....................................................Allowable Oversize: | See Figure 15-4B1 | |
| 5. | Cylinder bore surface (Nitrided Barrels)<br>Cross hatch ........................................................................... Angle:<br>Finish (in micro inches) ................................................................. $R_a$: | <br>22° - 32°<br>30 | <br>—<br>50 |
| 6. | Cylinder barrel in crankcase................................................ Diameter: | 0.0040L | 0.0100L |
| 7. | Intake valve seat insert in cylinder head.............................. Diameter: | 0.006T | 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: | See Figure 15-5A | |
| 12. | Exhaust valve seat ................................................................. Width: | See Figure 15-5B | |
| | Exhaust valve seat-to-valve guide axis..................................... Angle: | 45° 00' | - |
| | Intake valve seat-to-valve guide axis....................................... Angle: | 59° 45' | 60° 15' |
| | **ROCKER ARMS AND SHAFTS** | | |
| 13. | Rocker shaft in rocker arm bushing ..................................... Diameter: | 0.0017L | 0.0032L |
| 14. | Rocker arm bushing bore..................................................... Diameter:<br>Rocker arm bushing (inside)............................ Finish Bore Diameter: | .8725<br>0.7505 | .8755<br>0.7515 |
| 15. | Rocker arm.............................................................Side Clearance: | 0.0020 | 0.0150 |
| 16. | Intake valve guide ...................................................Inside Diameter:<br>Intake valve in guide ........................................................ Diameter: | .4350<br>0.0010L | .4377<br>0.0042L |
| 17. | Exhaust valve guide ..................................................Inside Diameter:<br>Exhaust valve in guide ...................................................... Diameter: | .4375<br>0.0035L | .4395<br>0.0062L |
| 18. | Intake valve face (to stem axis)................................................. Angle: | 59°45' | 60°15' |
| 19. | Exhaust valve face (to stem axis) ............................................ Angle: | 45°00' | 45°30' |
| 20. | Intake valve gauge line-to-stem ........................................... Length: | See Figure 15-9 | |
| 21. | Exhaust valve face-to-stem .................................................. Length: | Replace 100% | |
| 22. | Intake valve face-to-stem .................................................... Runout: | 0.0000 | 0.0015 |
| 23. | Rocker arm foot to valve stem (dry valve gear lash) ...........................: | 0.060 | 0.200 |
| | **PISTONS, RINGS AND PINS** | | |
| 24. | Piston, moly coated (bottom of skirt) in cylinder .................. Diameter:<br>Piston, non moly coated (bottom of skirt) in cylinder ............ Diameter: | 0.006L<br>0.008L | 0.010L<br>0.011L |
| 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 |

| Ref. No. | Description | NEW PARTS MIN | MAX. |
|---|---|---|---|
| 28. | Fourth piston ring in groove ........................................Side Clearance: | 0.0060 | 0.0080 |
| 29. | Top ring gap at 1.00 ± .50 depth (in cylinder barrel) .................... Gap: | 0.028 | 0.044 |
| 30. | Second ring gap at 1.00 ± .50 depth (in cylinder barrel) .............. Gap:<br>Gap for second ring must be at least .006 larger than gap for top ring. | 0.034 | 0.050 |
| 31. | Third ring gap at 1.00 ± .50 depth (in cylinder barrel) ................ Gap: | 0.020 | 0.036 |
| 32. | Fourth ring gap at 1.00 ± .50 depth (in cylinder barrel) ................ Gap: | 0.015 | 0.031 |
| 33. | Piston pin in piston ...............................................................Diameter: | 0.0003L | 0.0007L |
| 34. | Piston Pin ...........................................................................Diameter:<br>Piston Pin (0.005 oversize)..................................................Diameter: | 1.1243<br>1.1293 | 1.1245<br>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 bearing and bushing twist or convergence<br>per inch of length .....................................................................................: | 0.0000 | 0.0005 |
| 42. | Hydraulic tappet in crankcase ............................................... Diameter: | 0.0010L | 0.0025L |
| | **SPRING TEST DATA** | | |
| 43. | Inner valve spring 631521 compressed to 1.230 in. length ......... Load: | 87 Lbs. | 97 Lbs. |
| | Inner valve spring 631521 compressed to 1.746 in. length ......... Load: | 32 Lbs. | 38 Lbs. |
| 44. | Outer valve spring 637837 compressed to 1.275 in. length ........ Load: | 126 Lbs. | 140 Lbs. |
| | Outer valve spring 637837 compressed to 1.791 in. length ........ Load: | 49 Lbs. | 55 Lbs. |
| 45. | Installed outer valve spring ...................................................... Height: | 1.791 | |

NOTES: T=Tight L=Loose

### *CYLINDER DIMENSIONAL INSPECTION*

1. Inspect cylinder bore dimensions in accordance with Figure 15-4, "Cylinder Dimensions." Cylinders bores that do not conform to the standard size dimensions after honing must be ground to the next oversize dimension.
2. Inspect the cylinder base flanges for flatness. If cylinder base flange exceeds .001" out of flat, the cylinder must be discarded.
3. Dimensionally inspect the cylinder exhaust flange stud and rocker shaft hold down stud holes using a thread gauge and determine the appropriate oversize stud for replacement.
4. If intake flange studs have been removed for replacement, dimensionally inspect the intake flange stud hole(s) using a thread gauge and determine the appropriate oversize stud for replacement.
5. Dimensionally inspect the valve guides inside diameter. Guide dimensions must be within specifications the entire length of the guide. Replace all valve guides that are worn beyond the required specifications in accordance with the procedures in section 15-6.
6. Visually inspect the valve seats for any indication of burning, pitting, erosion or cracks. Determine if the valve seat dimensions exceed the specifications in Figures 15-5 and 15-6 . Any valve seats that are burned, pitted eroded, cracked or that do not conform with the specifications in Figures 15-5 and 15-6 must be replaced.

### INTAKE VALVE DIMENSIONAL INSPECTION

1. Inspect the entire length of the valve stem outside diameter with a micrometer. Discard valves with stems less than 0.4335 diameter.
2. Using a micrometer inspect the valve head outside diameter. Intake valves with heads smaller than 2.339 diameter must be discarded.

### ROCKER ARM DIMENSIONAL INSPECTION

1. Dimensionally inspect the rocker arm bushing bore. The bushing bore must be .8725 to .8755 inch diameter.
2. Dimensionally inspect the rocker arm thrust width. The rocker arm width must be .937 to .940.

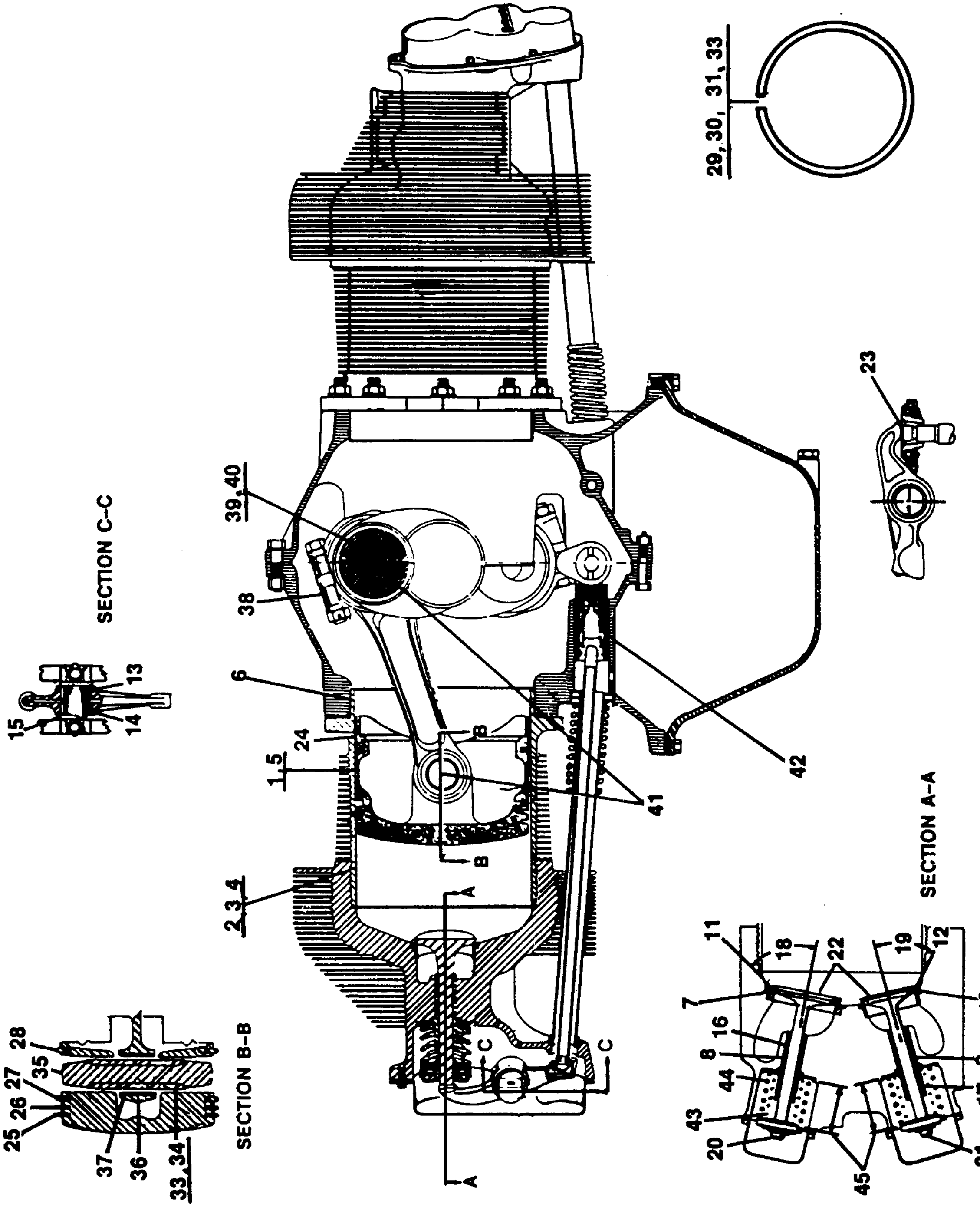



**FIGURE 15-4B. CYLINDER FITS AND LIMITS I0-550-G,N,P,R**

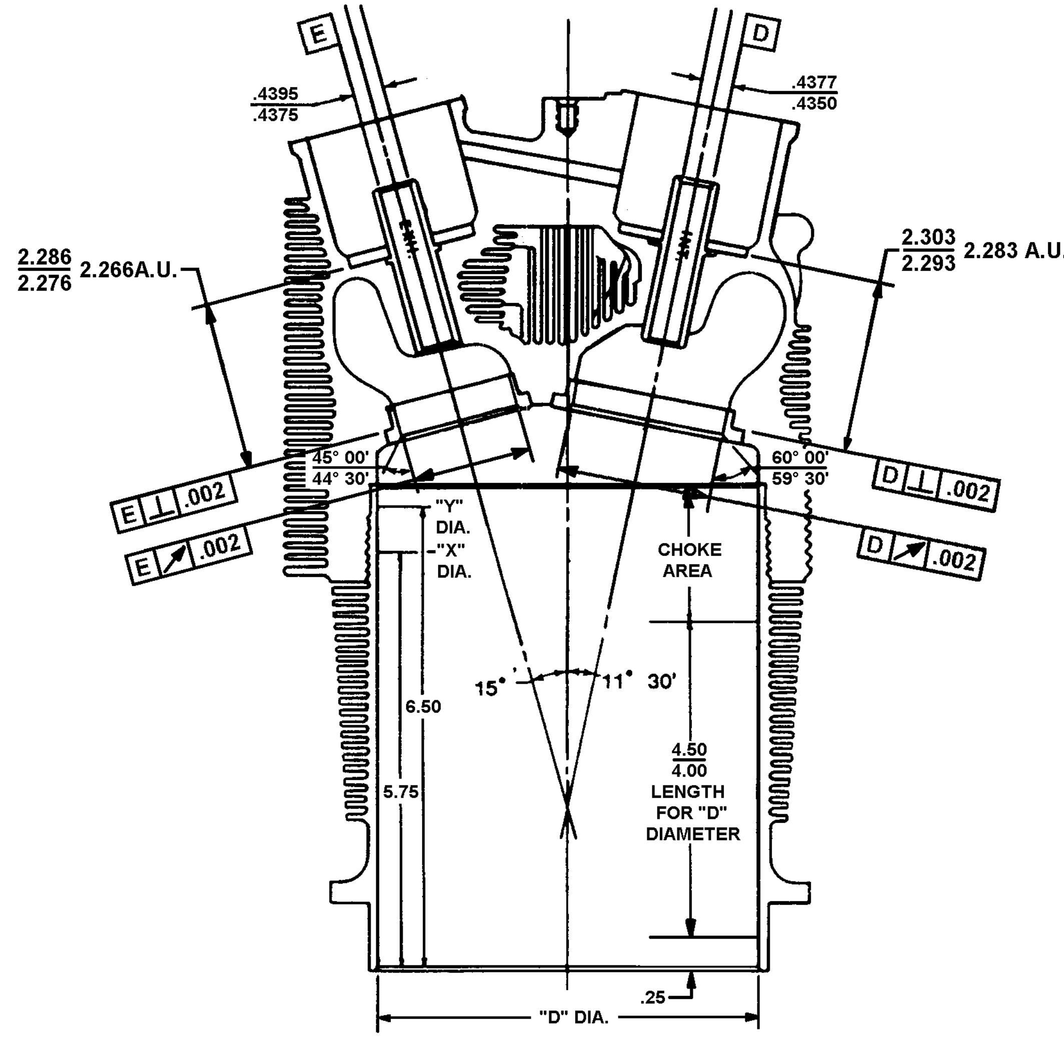



FIGURE 15-4B1. CYLINDER DIMENSIONS I0-550-G,N,P,R

| SIZE | "D" DIAMETER NEW | | "X" DIAMETER NEW | | "Y" DIAMETER NEW | |
|---|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | MIN. | MAX. |
| STD. | 5.251 | 5.253 | 5.248 | 5.250 | 5.245 | 5.247 |
| .005 | 5.256 | 5.258 | 5.253 | 5.255 | 5.250 | 5.252 |
| .010 | 5.261 | 5.263 | 5.258 | 5.260 | 5.255 | 5.257 |

NOTE…Dimensions shown are finish size after honing.

Cylinder bore out of round not to exceed (new) .002 (service) .003 .

## NEW PARTS DIMENSIONS FOR IO-550-A, B & C

| Part Name | Feature | New Dimension (inches) |
|---|---|---|
| Cylinder Assembly | Rocker Shaft Boss Bore<br>Intake Valve Guide Bore<br>Exhaust Valve Guide Bore | 0.7495 - 0.7510<br>0.4350 - 0.4377<br>0.4375 - 0.4395 |
| Rocker Arm Bushings | Inside Diameter | 0.7505 - 0.7515 |
| Valve Rocker Shaft | Outside Diameter | 0.7483 - 0.7488 |
| Intake Valve | Stem Diameter | 0.4335 - 0.4340 |
| Piston (Standard) | ① Diameter at Top<br>① Diameter Below 1st Groove<br>①② Diameter at Bottom<br>Pin Bore Diameter<br>Third Ring Groove Width<br>Fourth Ring Groove Width | 5.2126 - 5.2166<br>5.2157 - 5.2197<br>5.2414 - 5.2424<br>1.1246 - 1.1250<br>0.1910 - 0.1920<br>0.1000 - 0.1010 |
| Piston Pin Assembly | Length (including plugs)<br>Diameter | 5.205 - 5.220<br>1.1243 - 1.1245 |

① Measure piston diameter at right angles to pin bore.
② Measurement must be made at .165 inch from bottom of piston.

## NEW PARTS DIMENSIONS FOR IO-550-G,N,P,R

| Part Name | Feature | New Dimension (inches) |
|---|---|---|
| Cylinder Assembly | Intake Valve Guide Bore<br>Exhaust Valve Guide Bore | 0.4350 - 0.4377<br>0.4375 - 0.4395 |
| Rocker Arm Bushings | Inside Diameter | 0.7505 - 0.7515 |
| Valve Rocker Shaft | Outside Diameter | 0.7482 - 0.7500 |
| Intake Valve | Stem Diameter | 0.4335 - 0.4340 |
| Piston (Standard) | ① Diameter at Top<br>① Diameter Below 1st Groove<br>①② Diameter at Bottom<br>Pin Bore Diameter<br>Third Ring Groove Width<br>Fourth Ring Groove Width | 5.2126 - 5.2166<br>5.2157 - 5.2197<br>5.2414 - 5.2424<br>1.1246 - 1.1250<br>0.1910 - 0.1920<br>0.1000 - 0.1010 |
| Piston Pin Assembly | Length (including plugs)<br>Diameter | 5.205 - 5.220<br>1.1243 - 1.1245 |

① Measure piston diameter at right angles to pin bore.
② Measurement must be made at .165 inch from bottom of piston.

## 15-6 CYLINDER ASSEMBLY REPAIR AND REPLACEMENT

### CYLINDER HEAD WELD REPAIR

Only minor non-structural weld repairs are permitted. TCM allows welding repairs of the intake and exhaust port flanges, rocker cover flange and threaded holes (other than spark plug) and requires that these repairs be performed under carefully controlled conditions using an approved procedure and process which meets the requirements of the applicable federal aviation regulations. No structural weld repairs are allowed. TCM does not allow weld repairs to the combustion chamber, head structure and rocker shaft bosses Any cylinder head that is cracked or damaged in a structural area must be replaced.

**WARNING**

**Welding the cylinder head structure may destroy the assembly preloads and casting strength resulting in cylinder assembly failure.**

### CYLINDER HEAD FIN REPAIR

Do not attempt to straighten cylinder head cooling fins. If it becomes necessary to cut out a vee notch to stop a head fin crack, use a slotted drill bushing to fit over the fin and a 3/16 inch twist drill to cut the notch. Its apex and edges must be rounded. If such repairs and previous breakage have removed 10% or more of the total cylinder head fin area, the cylinder has reached its limit of cooling fin repair and must be replaced.

### CYLINDER BARREL FINS

Repairs can be accomplished only on fin tips which are outside of the power stroke stress area of the cylinder barrel. Reference Figure 15-2.

Pitting, sharp indentations or chafing damage in the fin tip LESS than .050 inch deep - Remove only enough material to eliminate the damage with a small hand-held grinder and fine grit disk or stone, or by turning the cylinder on a lathe. Precautions must be taken to prevent damage to adjacent fins and localized fin heating during the material removal process. Blend the area smooth so that no sharp edges remain and insure that original fin profile and contours are retained. Inspect the area for cracks.

**WARNING**

**Do not weld cylinder barrel or barrel fins.**

### CYLINDER BARREL

Any cylinder or cylinder associated parts worn beyond new parts limits or failing to meet the inspection criteria in sections 15-2 through 15-5 must be replaced unless repair is possible with the following instructions:

Cylinder machining may be accomplished by a repair facility certified for specialized cylinder repairs.

The cylinder bore may be ground and honed to, but must not exceed, the maximum allowable oversize dimension specified in Figures 15-4A1, 15-4B1 as applicable. Grind the cylinder bore with a cam controlled grinder. Use grinding stones that will produce an $R_a$ finish of 50 micro inches or less. Magnetic particle inspect cylinder bore after grinding in accordance with section 6-9. Identify the cylinder with the correct bore size by steel stamping the cylinder barrel flange with the appropriate oversize designation in accordance with Figure 15-11 .

**VALVE SEAT REPLACEMENT**

Valve seats that are damaged or have worn beyond acceptable specifications must be replaced using the following special tools and procedures.

Special Tools Required

1. Borrough's valve seat remover and replacer 8086 or equivalent.
2. Borrough's 5221B cylinder holding fixture and 5221-13A adapter or equivalent.
3. Borrough's 8122A common drive handle or equivalent.
4. Valve stem or valve guide hole pilot of correct size.
5. Valve seat boss cutter of correct size. Use the cutter size required for new valve seat outside diameter.
6. Universal drive from Borrough's 8116 common parts kit or equivalent.
7. Heavy duty drill press.

## WARNING

**Do not use a torch to heat the cylinder assembly. The heating process must be performed using uniform heating methods only. After cylinder has been heated, do not bump the head or barrel.**

To establish an inspection point for head to barrel movement, mask off a 1/4” wide x 1” high area across the cylinder head to barrel junction on the intake port side of the cylinder. Apply a heavy coat of high temperature paint and allow the paint to dry thoroughly. Remove the masking material.

After a cylinder assembly has been subjected to a heating operation, always inspect the cylinder assembly and insure that the head has not turned in relation to the barrel. Movement of the head in relation to the barrel will destroy the assembly preload. Discard any cylinder with indications of head to barrel movement.

**VALVE SEAT REMOVAL**

Heat the cylinder assembly to 450°F maximum. Heat soak one hour. Using the correct remover from the list above, remove the worn valve seat or seats. Allow cylinder to cool to room temperature. Inspect the seat bore for cracks and erosion. Discard any cylinder with a cracked valve seat bore or a valve seat bore that has eroded beyond the allowable valve seat oversize bore repair.

**VALVE SEAT BORE MACHINING**

Measure the new valve seat insert outside diameter and select the proper size valve seat bore cutter. Install the cylinder in the holding fixture. Using the specified tools machine the valve seat bore(s) to the correct diameter. Do not exceed the tolerances specified in Figures 15-4A1 or 15-4B1 as applicable. Deburr the valve seat bore and clean the cylinder removing all debris from machining procedure. Inspect and record the valve seat bore inside diameter and new valve seat outside diameter. On I0-550-A, B & C engine cylinders an interference fit of 0.007T to 0.010T is required for exhaust valve seats. An interference fit of 0.009T to 0.012T is required for intake valve seats. On I0-550-G,N,P,R engine cylinders an interference fit of 0.007T to 0.010T is required for exhaust valve seats. An interference fit of 0.006T to 0.012T is required for intake valve seats.

### VALVE SEAT INSTALLATION

Heat the cylinder assembly to 450°F maximum. Heat soak one hour. Using the specified tools, install the new valve seat(s). The valve seat(s) must be installed firmly against the bottom of the valve seat bore. Valve seat(s) that are not seated properly or that are misaligned will cause valve leakage and burning.

### FLUORESCENT PENETRANT INSPECTION AFTER VALVE SEAT INSTALLATION

After valve seat installation, the cylinder head must be fluorescent penetrant inspected in accordance with section 6-12, "Fluorescent Penetrant Inspection." Structural cracks in the cylinder head are not acceptable or repairable. Cylinder heads that exhibit cracks must be discarded.

NOTE…If valve guides are being replaced this inspection may be delayed until the valve guides have been installed.

### VALVE GUIDE REPLACEMENT

Valve guides worn beyond specification must be replaced using the following procedure and special tools:

1. Borrough's 5221b cylinder holding fixture and 5221-15a adapter or equivalent.
2. Borrough's 4981 remover or equivalent.
3. Valve guide replacer.
4. Proper size Valve guide stem hole reamer.
5. Proper size morse adapter.
6. Borrough's 3170 floating holder or equivalent.
7. Heavy duty drill press.

### VALVE GUIDE REMOVAL

## WARNING

**Do not use a torch to heat the cylinder assembly. The heating process must be performed using uniform heating methods only. After cylinder has been heated, do not bump the head or barrel.**

Install proper size head on removing tool. Attach to cold water supply. Heat the cylinder to 450° F. Heat soak one hour. Install cylinder in the holding fixture. Install pilot into guide. Hold valve guide removal tool down firmly into guide bore with hand on water release button. Use other hand to work sliding hammer. Release the water and hammer out guide while water is running. Both guides can be removed with one heating. Allow cylinder to cool to room temperature.

## VALVE GUIDE BORE MACHINING

*CAUTION…Always ream guide bore to the proper oversize. Never install an oversize guide in the old bore.*

Measure valve guide bore and select proper size reamer. Install cylinder in holding fixture. Ream valve guide bore to required oversize. Guide bore must be free of grooves. Deburr the valve guide bore and clean the cylinder removing all debris from the machining procedure. Inspect the valve guide bore new inside diameter and new valve guide outside diameter. An interference fit of 0.001T to 0.0025T is required for exhaust valve guides and an interference fit of 0.0015T to 0.0030T is required for intake valve guides.

## VALVE GUIDE INSTALLATION

*CAUTION…The intake and exhaust valve guides are different and must be installed in the correct positions.*

Apply a small amount of LUBRIPLATE® 930AA to the outside diameter of the guide to reduce the chance of binding during installation. Heat the cylinder assembly to 450°F maximum. Heat soak for one hour. Using the specified installation tool install the new valve guides.

Allow the cylinder to stabilize to room temperature and inspect the valve guide inside diameter. If necessary ream the valve guide inside diameter to the required specifications.

## CYLINDER HEAD FLUORESCENT PENETRANT INSPECTION

After valve guide installation, the cylinder head must be fluorescent penetrant inspected in accordance with section 6-12, "Fluorescent Penetrant Inspection." Structural cracks in the cylinder head are not acceptable or repairable. Cylinder heads exhibiting cracks in the structure must be discarded.

## REAMING VALVE GUIDES

The intake and exhaust valve guide bore inside diameters are prefinished and will conform to the required specifications when installed under controlled production procedures. However, field repair conditions may vary and some valve guide bores may require a finish reaming operation in accordance with the following procedures.

**WARNING**

**Do not attempt this procedure with a hand held power tool.**

Install the holding fixture into drill press. Index fixture to proper angle and install cylinder into fixture. Zero in guide with dial indicator. Using the proper size reamer, ream the valve guides. Ream at 400 RPM for high speed steel reamers and 700 RPM for Carbide tip reamers using plenty of lubricant.

Inspect finished bore size to the required specification. Refer to Figure(s) 15-4A1, 15-4B1 as applicable for correct stem hole finished sizes.

The valve guide finish must be 32 RMS inspect finish with a profilometer.

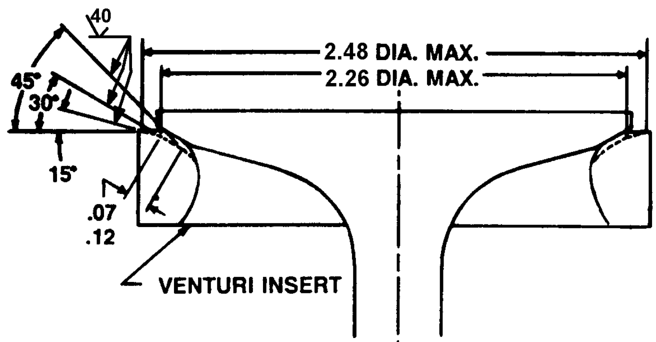
**VALVE SEAT REFACING**

Valve seat refacing must be performed in accordance with the specifications shown in Figures 15-5A and 15-5B, "Intake and Exhaust Valve Seat Refacing," using the following special tools:

1. Sioux Brand" Valve Seat Grinder Set No. 1675 or equivalent.
2. Valve Seat Grinder Pilot- check valve guide inside dia. for proper size.
3. Grinding Stones K106 roughening and K46 finishing for intake valve seats

   K95 roughening and K25 finishing for exhaust valve seats.
4. Borrough's 5221B Cylinder Holding Fixture and 5221-13A Adapter or equivalent.

*CAUTION…Valve seats and valves may be lapped after refacing if desired. Lapping compounds are extremely abrasive and must be completely removed from the valves, valve seats and cylinder by cleaning thoroughly using hot soapy water and a stiff bristled scrub brush. All lapping compound must be removed from cylinder. After washing, all soap residue must be removed by thoroughly rinsing with hot water. The cylinder must be dried completely and all bare steel surfaces thoroughly coated with clean 50 weight aviation engine oil .*




**INTAKE SEAT GRINDING**

NOTE...USE STONES THAT WILL PRODUCE A 40 $R_a$ FINISH.

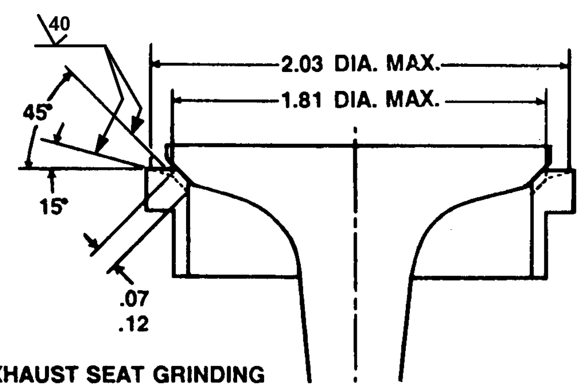
**PROCEDURE:**

1. CLEAN UP SEAT WITH 30° STONE.
2. TOP OFF WITH 15° STONE TO ESTABLISH 2.26 MAX SEAT O.D. AS REQUIRED.

NOTE...SEAT MUST BE REPLACED IF 2.48 DIA. MAX. IS EXCEEDED.

3. UNDERCUT SEAT WITH 45° STONE TO ESTABLISH .07–.12 SEAT WIDTH AS REQUIRED.

## FIGURE 15-5A. INTAKE VALVE SEAT REFACING




**EXHAUST SEAT GRINDING**

NOTE...USE STONES THAT WILL PRODUCE A 40 $R_a$ FINISH.

**PROCEDURE:**

1. CLEAN UP SEAT WITH 45° STONE.
2. TOP OFF WITH 15° STONE TO ESTABLISH 1.81 MAX SEAT O.D.

NOTE...SEAT MUST BE REPLACED IF 2.03 DIA. MAX. IS EXCEEDED.

## FIGURE 15-5B. EXHAUST VALVE SEAT REFACING

## CYLINDER BORE FINISH

### EQUIPMENT

Use a wet honing process and hone stones that will produce a surface finish as specified below.

After honing the cylinder barrel to the required specifications, inspect the cylinder barrel wall for corrosion, pitting and scoring. Discard cylinders exhibiting any of the above indications.

Surface finish measurements are to be made with a Hommel Tester T500 part number 191800. The software for receiving data from the tester is Hommel America TIOOO Turbo. Both the tester and software are available from Hommel America, New Britain, CT. The tester is to be set to inch units, traverse lengths Lt of .19 and Lm of .16, a cutoff length (Lc) of 0.03, MI filter, and R profile (Prof).

### CROSS HATCH PATTERN

The bore finish shall show a cross hatch pattern produced by a wet honing process. The included angle of the cross hatch measured perpendicular to the axis of the cylinder shall be 22 to 32 degrees. Hone turn around areas up to 0.5 inch from the skirt and barrel stop are exempt from cross hatch angle requirements

### SURFACE FINISH SPECIFICATION

The surface finish of the cylinder barrel bore must meet the values listed in the table below.

The hone pattern as taken by fax film and viewed at 100X shall be cleanly cut and substantially free of torn and folded metal.

The cylinder bore must be cleaned thoroughly using hot soapy water and a stiff bristled scrub brush. All honing material must be removed from cylinder. After washing, all soap residue must be removed by thoroughly rinsing with hot water. The cylinder must be dried completely and all bare steel surfaces thoroughly coated with clean 50 weight aviation engine oil.

| ITEM | SYMBOL | NAME | RANGE |
|---|---|---|---|
| 1. | $R_a$ | Arithmetic average surface roughness | 30 - 50 micro inches |
| 2. | Sk | Skew, a measure of plateau | -1. to -3.5 |
| 3. | R3Z | Three point height, distance between third highest peak and third lowest valley | 130 - 275 micro inches |
| 4. | RPM/Rz | Ratio of mean peak to total depth of pattern | $<$ .35 |

## SPARK PLUG HELICAL COIL INSERT REPLACEMENT

Spark plug helical coil inserts that require replacement as determined by the inspection procedures in section 15-5 must be replaced using the following instructions. Before attempting to back out a damaged insert, use a sharp pointed tool to pry the teeth at the outer helical coil end away from the cylinder head metal. Tap a helical coil extracting tool into the insert until it has a good bite. See Figure 15-6A, "Removing Spark Plug Hole Helical Coil Insert." Using the proper size mandrel on installing tool, place a new helical coil in the cutout side of the installing tool and engage the driving tang toward the threaded end. Engage the tang with the slotted end of the driving mandrel and wind the insert into the sleeve thread compressing the insert. Hold the sleeve so the helical coil can be seen through the slot in the threaded end. 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 sleeve and mandrel and turn until the sleeve touches lightly. See Figure 15-6B, "Installing Spark Plug Hole Helical Coil Insert." 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. 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.

Coat a Heli-Coil Corporation Number 520-2 expanding tool, threaded end, with Alcoa thread lube or a mixture of white lead and oil. Screw the expanding tool into the new insert until its final thread forces the teeth firmly into the cylinder head metal. See Figure 15-6C, "Expanding Spark Plug Hole Helical Coil Insert." See Figure 15-3, "Cylinder Stud Setting Heights," for proper spark plug helical coil depth.

*CAUTION…Replacement helical coils must be stainless steel.*

## WARNING

**The helical coil insert end must not protrude into the combustion chamber after it has been installed .**

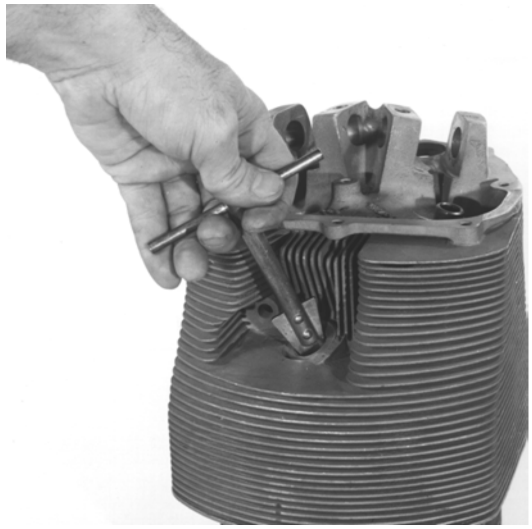


**FIGURE 15-6A. REMOVING SPARK PLUG HOLE HELICAL INSERT**

**FIGURE 15-6B. INSTALLING SPARK PLUG HELICAL COIL**

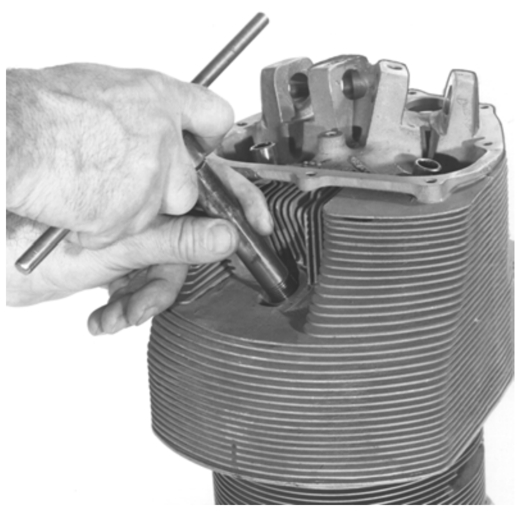


**FIGURE 15-6C. EXPANDING SPARK PLUG HOLE HELICAL INSERT**

## CYLINDER STUD INSTALLATION

Install new exhaust flange studs, rocker shaft hold down studs and new intake flange studs of the appropriate oversize as determined by dimensional inspection in accordance with Figure 15-3 and sections 6-22, 6-23.

## ROCKER SHAFT RETENTION IMPROVEMENT PROCEDURE

The latest cylinder assembly part numbers that are not required to comply with the cylinder modification instructions and have had this operation performed are:

a. Cylinder assembly part numbers: 652953 and higher. This would also include any of these numbers which have a letter or number suffix such as 652953A1.

b. Any cylinder assemblies which are identified with the letter "B" stamped on the cylinder rocker cover flange. See Figure 15-6E.

| | |
|---|---|
| Parts Required: For One (1) Cylinder: | Helicoil, 2 ea. MS21209C4-15 ¼”-20<br>Bolt, 2 ea. MS90725-12<br>Flat Washer, 2 ea. 652947<br>Rockershaft, 2 ea. 652984 |
| Tools Required: | Drill, .266 (H)<br>Helicoil Installer, ¼”-20<br>Drill Guide Kit P/N 8181 includes (1 each drill guide P/N 8181-1 and 1 each drill guide pilot P/N 8181-2.)<br>Tap, ¼”-20 Helicoil<br>Chamfer Tool, .339 Drill and “T" Handle Drive. |

Prior to performing the modification, clean the rocker shaft bosses and inspect for cracks using an approved method of dye penetrant inspection.

1. Remove the existing rocker shafts and attaching hardware and inspect shaft bores for proper size .7495 - .7510.
2. Install drill guide kit, P/N 8181 into rocker boss using the existing screw bore as shown in Figure 15-6D.
3. Using a .266 drill, drill to a depth of 1.820 - 1.850 as measured from the top of the drill guide as illustrated in Figure 15-6D, in two places.
4. Remove the drill guide and chamfer each bore 120°, .34 - .31 diameter by hand using a .339 drill and "T" handle drive. Deburr as necessary.
5. Turn drill guide pilot 90° from original position and tap hole using ¼”- 20 helicoil tap, .430 deep.
6. Remove helicoil installation tool body and use its threaded portion only. Install P/N MS21209C4-15, ¼”-20 self locking helicoil per MS33537 using the helicoil installation tool. Insure that the helicoil is installed below the surface of the rocker shaft bore. Break and remove the helicoil tang.
7. Insure that the rocker shaft bore is clean and free of any burrs. Clean the entire cylinder assembly using an approved method to remove all of the shavings and debris.
8. Identify cylinder with steel stamp letter “B” as indicated in Figure 15-6E.

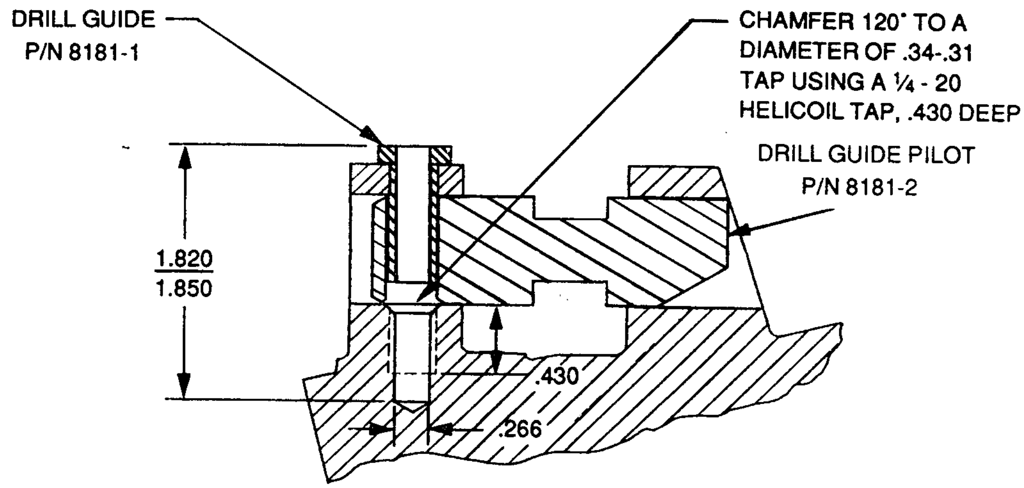



**FIGURE 15-6D. ROCKER SHAFT RETENTION IMPROVEMENT**

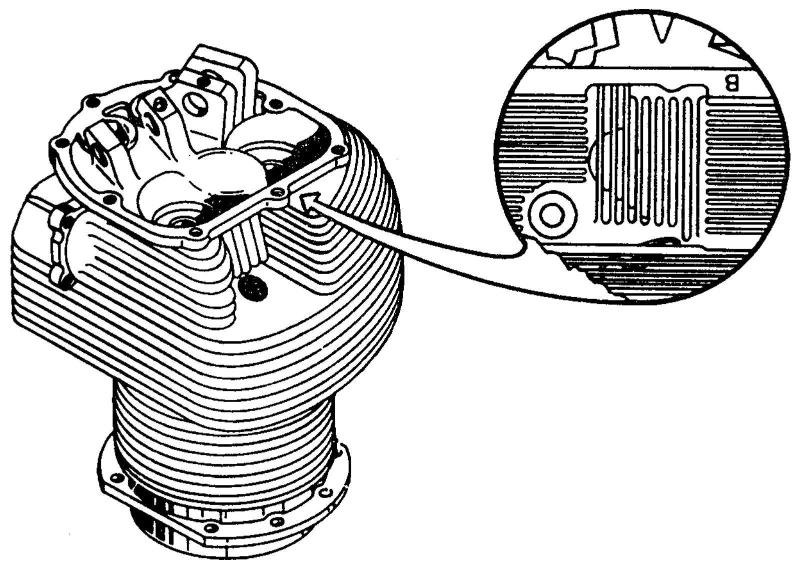


**FIGURE 15-6E. CYLINDER IDENTIFICATION**

### CYLINDER PROTECTIVE COATING

1. Clean the exterior cylinder head surface and apply a protective coating of Accelagold aluminum conversion in accordance with section 6-19.

## WARNING

**Do not paint the cylinder flange nut seats, skirt or flange to crankcase mating surface.**

2. Thoroughly clean the entire cylinder with mineral spirits and air dry. Mask the cylinder flange nut seat contact surfaces, cylinder skirt and flange to crankcase mating surfaces. Apply a protective coating of specified TCM enamel paint or equivalent to the cylinder barrel in accordance with section 6-20.
3. After the paint has dried completely, remove all masking materials and coat all bare steel surfaces with clean 50 weight aviation engine oil. Store the cylinder assembly in a clean protected area until cylinder subassembly.

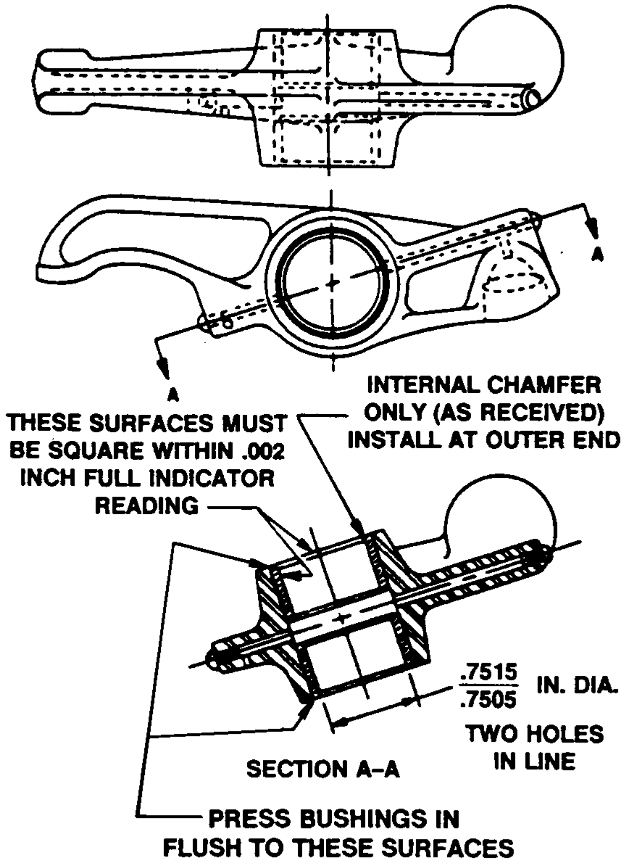



**FIGURE 15-7A. OLD STYLE ROCKER ARM BUSHING REPLACEMENT**

## OLD STYLE ROCKER ROCKER ARM BUSHING REPLACEMENT

1. The same tool used to remove the old bushings from the rocker arm(s), if properly designed, can be used to install the new bushings in the rocker arm(s).
2. Oil the new bushings with clean 50 weight aviation engine oil and press the new bushings in to the specifications in Figure 15-7A.

*CAUTION…Before reaming rocker arms plug the oil passages with beeswax.*

3. Ream the new bushings to the diameter specified in Figure 15-7A, "Rocker Arm Bushing Replacement." Lightly break the sharp edge at each end of new bushings. Inspect the bushing size and RMS finish to the required specifications.

*CAUTION…After reaming, clean and flush the oil passages using clean solvent. Insure that the oil passages are clear of any debris, contamination or beeswax.*

4. Any rocker arms with obstructed oil passages must be cleared by flushing with mineral spirits. Any rocker arm with obstructed oil passages that cannot be cleared must be discarded .

## NEW STYLE ROCKER ARM BUSHING REPLACEMENT

*CAUTION…Before reworking rocker arms plug the oil passages with beeswax.*

1. The same tool used to remove the old bushing, if properly designed, can be used to install the new bushing.
2. Measure rocker arm bushing bore I.D. and insure that it conforms to the dimensions specified in Figure 15-7B or 15-7C as applicable.
3. Measure the new bushing O.D. and insure that it conforms to the dimensions specified in Figure 15-7B or 15-7C as applicable.
4. Insure that the bushing oil passages are positioned as illustrated in Figure 15-7B or 15-7C as applicable.

## WARNING

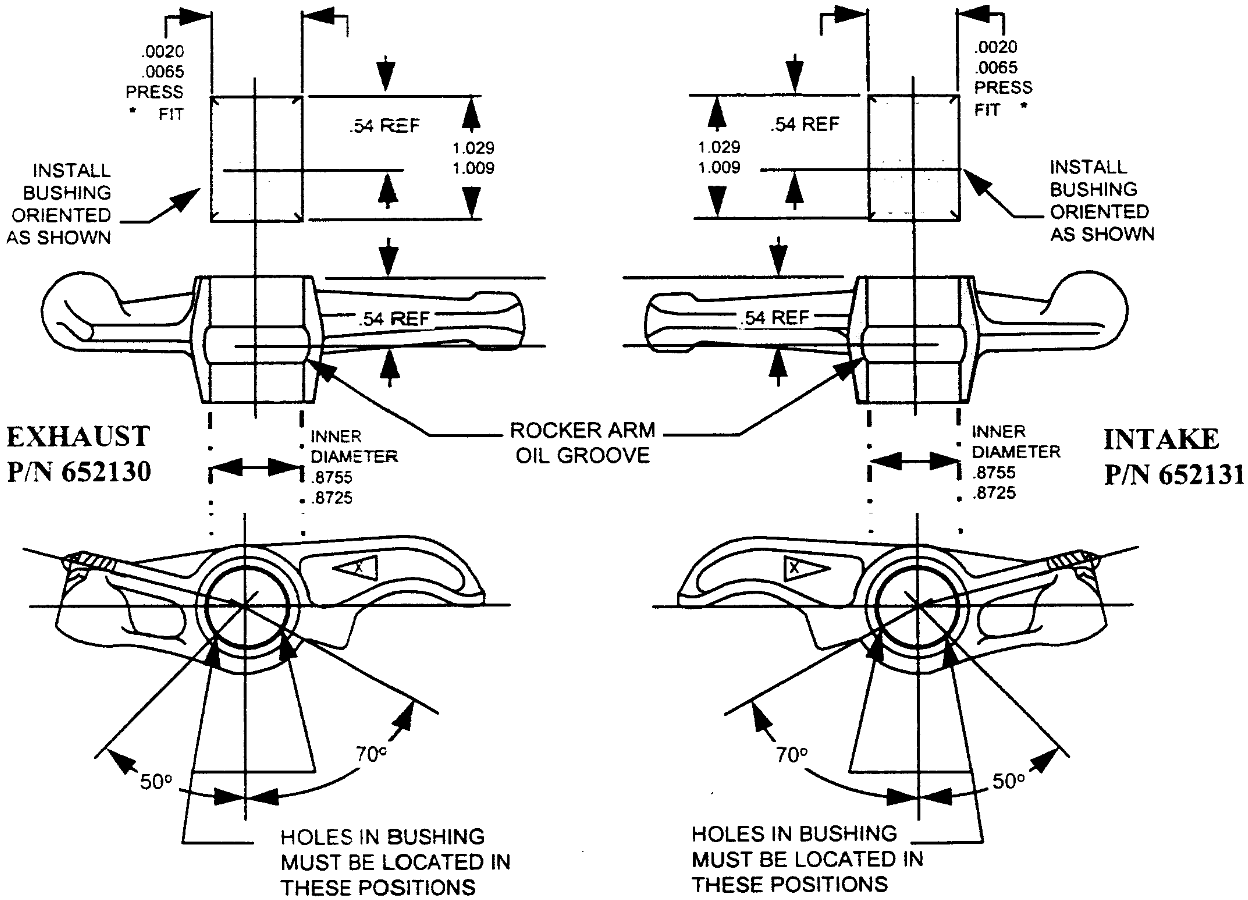
**Incorrectly positioned bushing oil passages will result in a loss of lubrication to the rocker arm shaft, severe rocker arm bushing, shaft and valve guide wear and possible engine failure.**

5. Thoroughly lubricate the bushing with clean 50 weight aviation engine oil.
6. Using Borroughs Tools P/N 8118 (Rocker Arm Bushing Remover/Installer Set) or equivalent and an arbor press carefully press the bushing into the rocker arm bushing bore. Bushing must be installed flush to .020 below surface. See Figure 15-7B or 15-7C as applicable.
7. Prior to reaming bushing to size, fill the two bushing oil holes with beeswax to prevent debris from entering the oil passages.
8. Ream bushing I.D. to .7505 - .7515 with a surface finish of 32 RMS. Refer to Figure 15-7B or 15-7C as applicable.
9. After reaming clean and flush the oil passages with clean solvent removing beeswax and making certain that all passages are clear of any debris.

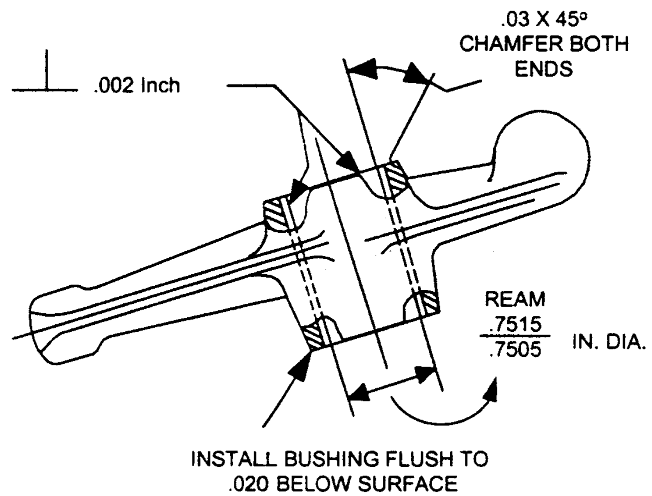
*CAUTION…After reaming, clean and flush the oil passages using clean solvent. Insure that the oil passages are clear of any debris or contamination.*

10. Perform a visual and magnetic particle inspection of rocker arm assembly in-accordance with section 15-5.

11. Any rocker arms or pushrods with obstructed oil passages must be cleared by soaking in an approved solvent and blowing compressed air through them. Any rocker arm or pushrod with obstructed oil passages that cannot be cleared must be discarded.



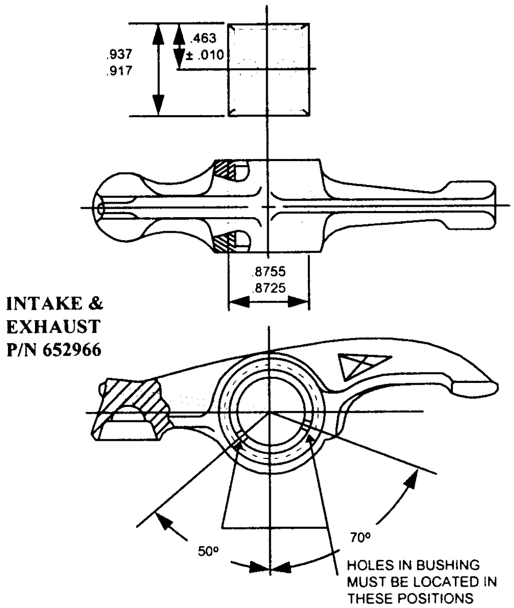

* Bushing O. D. must maintain a .0020 - .0065 Press Fit in a .8755 - .8725 Rocker Arm Bushing Bore.



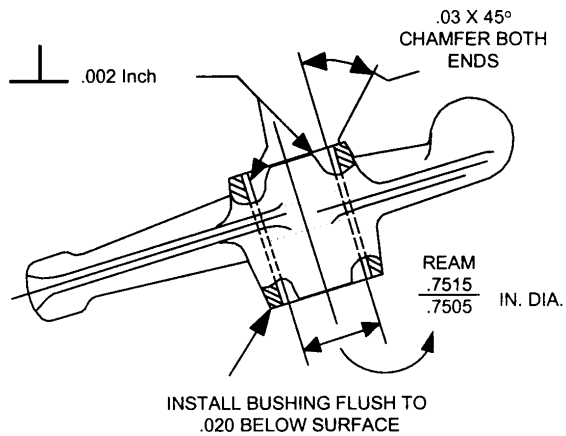

Bushing must have a surface finish of 32 RMS after reaming.

⊥ These surfaces must be square within the center line of the bushing bore within .002 inch full indicator reading.

**FIGURE 15-7B. NEW STYLE ROCKER ARM BUSHING REPLACEMENT IO-550-A, B & C**




* Bushing O. D. must maintain a .0020 - .0065 Press Fit in a .8755 - .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 .002 inch full indicator reading.

**FIGURE 15-7C. NEW STYLE ROCKER ARM BUSHING REPLACEMENT IO-550-G,N,P,R**

## ROCKER ARM TO ROTOCOIL CLEARANCE MACHINING

1. See Figure 15-8. A minimum clearance of .020 inch must be maintained between the rocker arm and rotocoil at the time of assembly.

   If the minimum clearance of .020 is not present at the time of assembly, it is permissible to smoothly grind across the forging flash line on the underside of the rocker arm to obtain the specified clearance. Prior to grinding, the rocker arm bushing bore and oil passage must be protected to prevent debris entry. The grind must not exceed the width illustrated in Figure 15-8. If the required clearance cannot be obtained without exceeding this grind width, the rocker arm must be replaced.

2. The grind must be smooth and uniform. All of the ground surface must be polished to remove all grinding marks. Remove the protective coverings from the rocker arm and clean thoroughly. The rocker arm must be magnetic particle inspected for cracks following the polishing operation.

## WARNING

**The presence of grinding marks or cracks in the rocker arm may cause the rocker arm to fail.**

3. Thoroughly clean the rocker arm(s) before assembly on the engine.

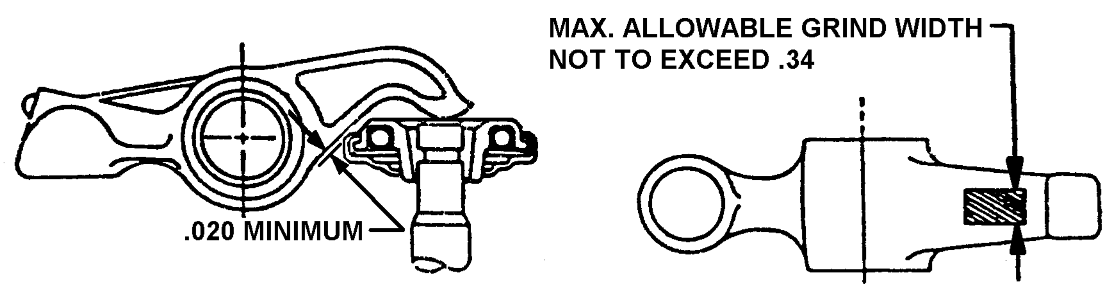



**FIGURE 15-8. ROCKER ARM TO ROTOCOIL CLEARANCE**

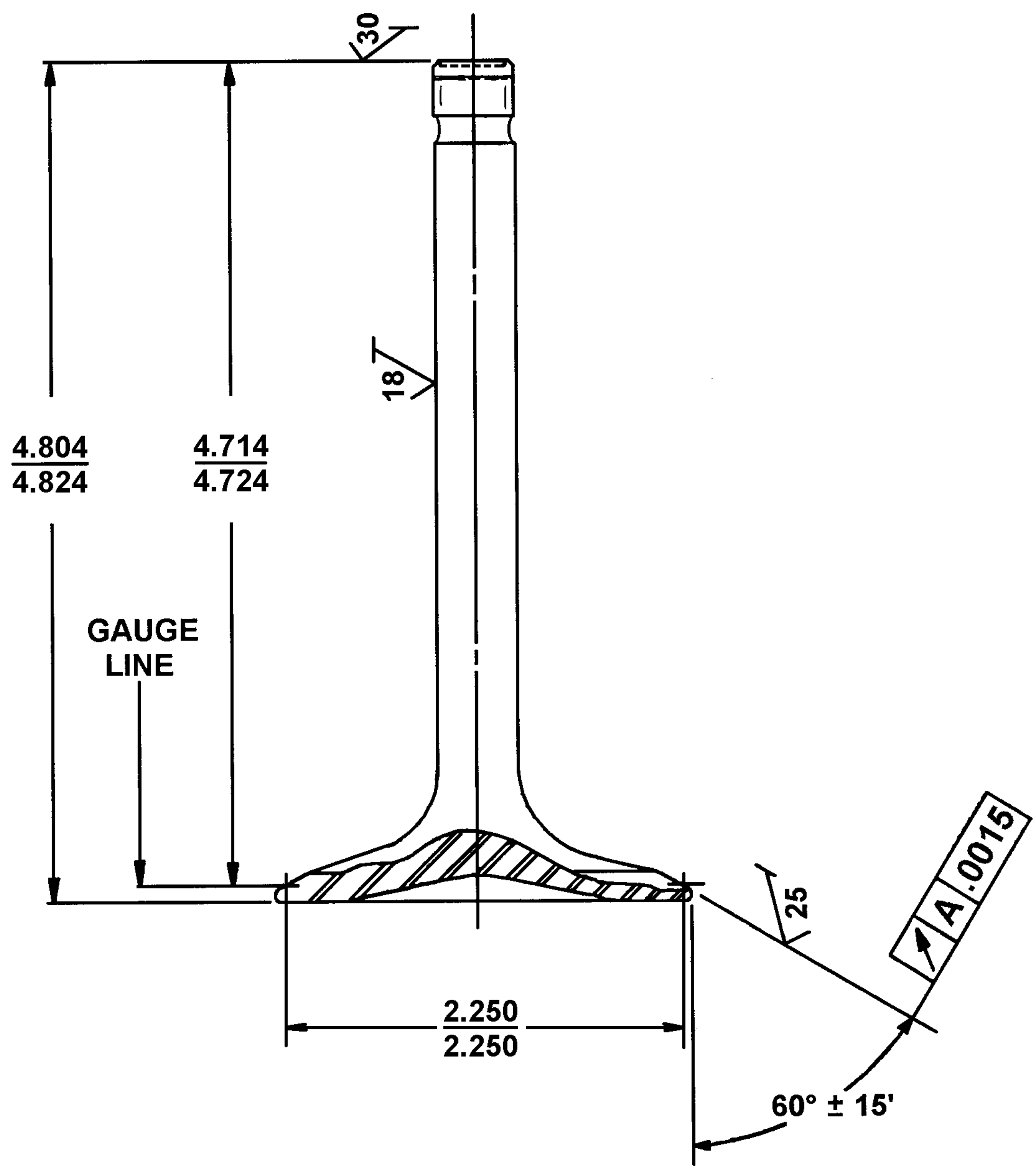



**FIGURE 15-9. INTAKE VALVE REFACING**

## INTAKE VALVE GRINDING

1. Clean the intake valves with mineral spirits.

2. Using a valve grinding machine and proper valve grinding wheel, grind the intake valve contact seat at 59°- 45' to 60°-15' to remove any indication of wear. This will increase the distance from the new gauge line to the valve stem tip. See Figure 15-9, "Intake Valve Refacing."

3. Clean the valve using mineral spirits.

4. Using the gauge line inspection fixture, measure the dimension from the gauge line to the bottom of the valve. This dimension must be no less than .100". Reground valves not conforming to this criteria must be discarded. Valves conforming to this criteria must have the tip ground to maintain the tip to gauge line dimension of 4.714" to 4.724".

5. After valve tip grinding, measure the intake valve overall length. The valve overall length cannot be less than 4.804". Discard valves that are less than 4.804" in length.

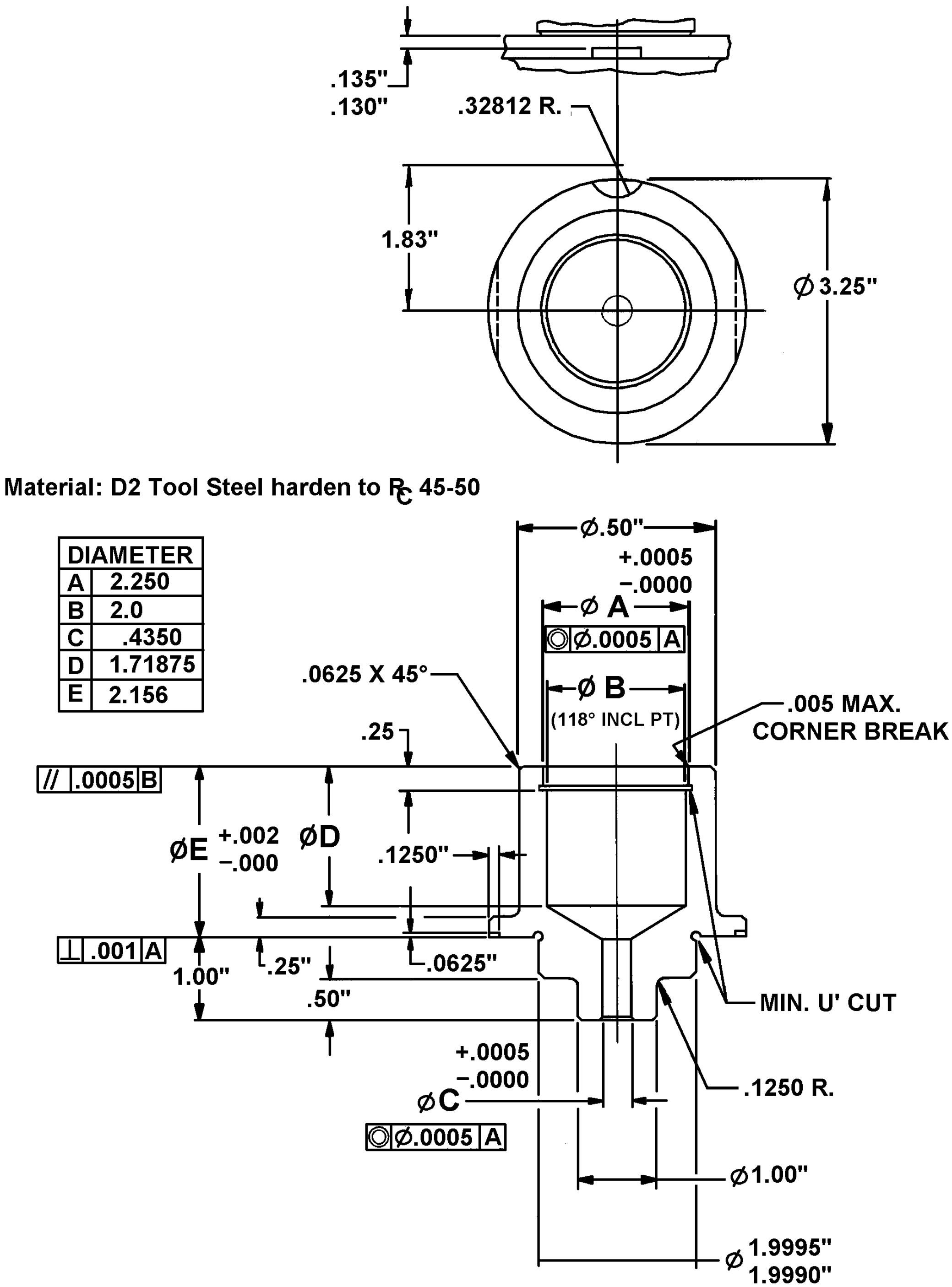
6. After grinding process thoroughly clean the valve with mineral spirits and air dry.

7. Using a vee block with a surface plate and a dial indicator, inspect each intake valve face for run-out (eccentricity). Intake valves exceeding .0015" total indicator reading must be discarded.

8. Using an optical comparator, inspect the valve contact seat angle. Intake valve face angles which do not conform to 59°- 45' to 60°-15' must be discarded.

9. Using a profilometer, inspect the valve contact seat finish. Intake valves exceeding 25 RMS must be discarded.

10. Perform magnetic particle inspection on the valves. Discard any valve with cracks or indications of cracks. Clean the valves using mineral spirits and air dry. Coat all surfaces thoroughly with clean 50 weight aviation engine oil.




| DIAMETER | |
|---|---|
| A | 2.250 |
| B | 2.0 |
| C | .4350 |
| D | 1.71875 |
| E | 2.156 |

VALVE GAUGE TOOL ADAPTER

**FIGURE 15-10. VALVE GAUGE LINE INSPECTION FIXTURE**

## 15-7 CYLINDER AND PISTON SUBASSEMBLY

Original cylinders have a position number stamped on the edge of the base flange. New cylinders must have a position number (1 through 6), as used, stamped in the location shown in Figure 15-11."
New pistons must have a position number (1 through 6) stamped in the location shown in Figure 15-11, "Cylinder And Piston Position Number."

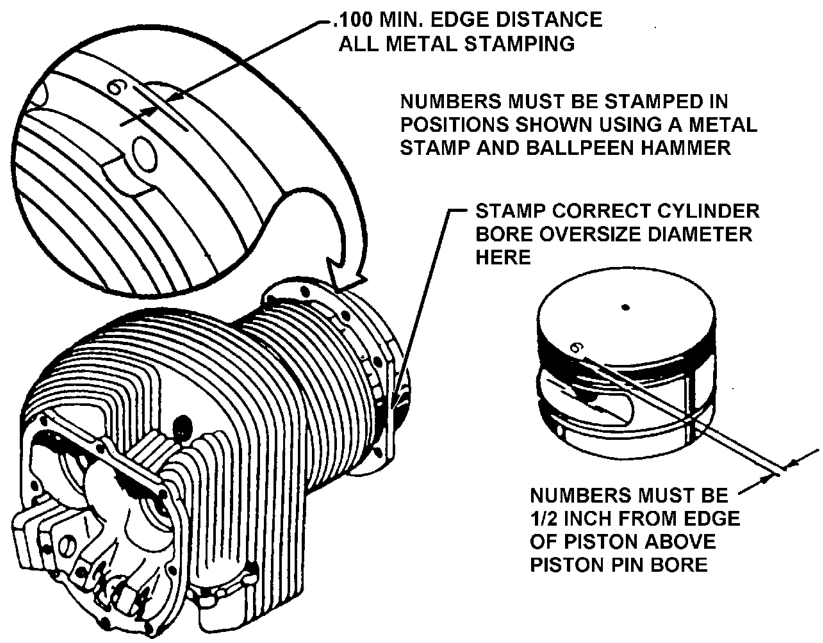



**FIGURE 15-11. CYLINDER AND PISTON POSITION NUMBER**

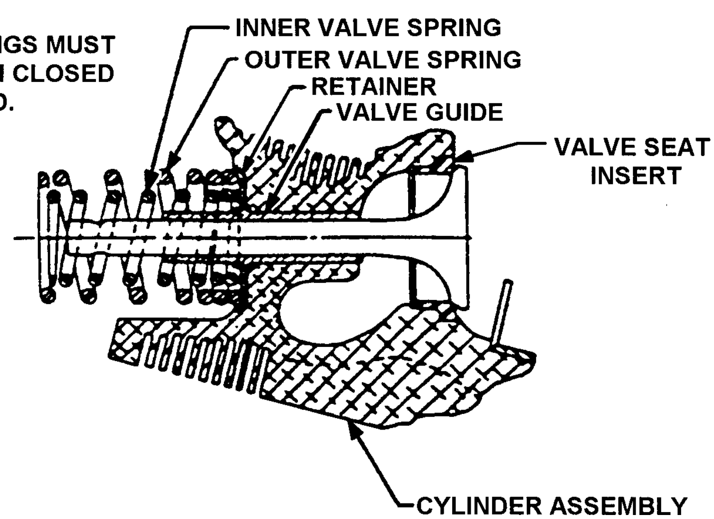



**FIGURE 15-12. VALVE AND SPRING INSTALLATION**

## WARNING

**Improper use of sealants and lubricants may cause engine malfunction or failure.**

1. Insure the piston and piston rings are the correct size for the cylinder bore size. Inspect the piston to cylinder clearance of each matching piston and cylinder in accordance with Figure(s) 15-4A1 or 15-4B1 as applicable.

   Each piston ring must be inspected for proper gap in the cylinder bore in which it will be assembled. Insert one ring at the time into the cylinder bore and push it to the position specified in the table of limits using the piston. Remove the piston and inspect the ring gap using a leaf type feeler gauge. If the ring gap is smaller than specified, record actual gap size and remove the ring from the cylinder bore. Mount a fine toothed flat file in a vise. Holding the ring ends firmly and squarely against the file, remove the desired amount of material. Deburr the ring gap ends using crocus cloth. Thoroughly clean the ring with mineral spirits and air dry. Install the ring in the cylinder bore to the correct position and inspect the ring gap. Repeat the above procedure until all ring gaps meet the required specification. Do not use rings that are not within the specified ring gap dimensions.

NOTE…Gap for second ring must be at least .006 larger than gap for top ring.

2. Thoroughly clean the cylinder baffles, cylinder, valves, valve springs, retainers, rotocoils, valve spring retainer keys, pistons, piston rings, piston pins, pushrod housings, springs and washers with mineral spirits and air dry. Inspect all parts for any damage that may have occurred during handling or shipment.

3. See Figure 15-1B. Install baffles (43) and springs (44) on all I0-550-G,N,P,R engine

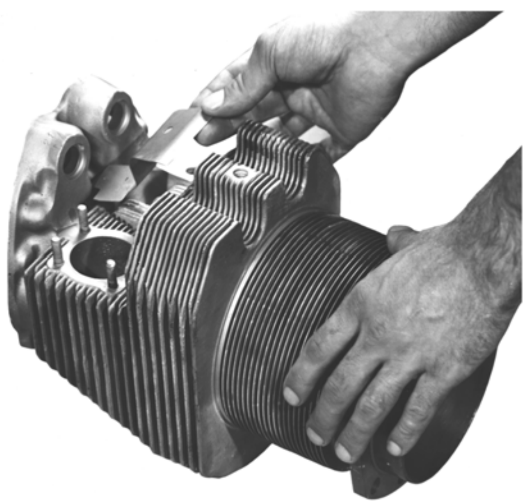


**FIGURE 15-13A. INSTALLING BAFFLE**

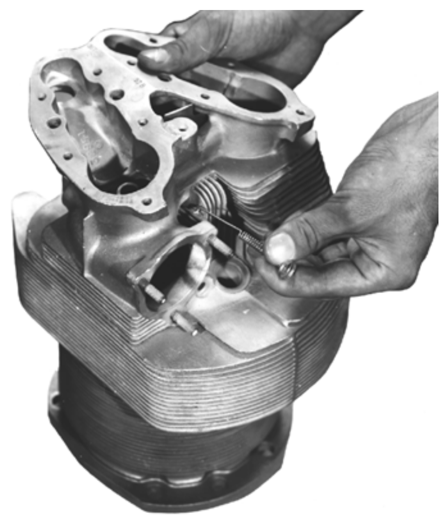


**FIGURE 15-13B. SECURING BAFFLE**

   cylinders. Install baffle as shown in Figures 15-13A and 15-13B. Insert the spring through cylinder. Using another spring or a hook fashioned from stiff wire, hook and pull the spring end over the cylinder fin.

4. Immediately before cylinder subassembly, thoroughly clean the cylinder bore using hot soapy water and a hard bristled scrub brush. After washing, all soap residue must be

removed by thoroughly rinsing with hot water. The cylinder must be dried completely and all bare steel surfaces thoroughly coated with clean 50 weight aviation engine oil.

5. Cylinder Subassembly For the IO-550-A, B & C model engines."

   a. See Figure 15-1A, "Cylinder and Piston Assembly for IO-550-A, B & C." Using the following instructions, assemble each of the six cylinders. If the valves have been lapped, they must be installed into the positions for which they were lapped. Spread a film of Molyshield grease on the intake valve stem (10) and the exhaust valve stem (11). Install valves into the correct location. Grasp the valve stems and install the cylinder on a cylindrical block of wood anchored to a work bench. Again apply Molyshield grease to valve stems. Place valve spring retainers (14) over valve guides (4 and 5), cupped side up. Coat the sealing surface of a new intake valve guide seal with clean 50 weight aviation engine oil. Install new seal (15) on the intake valve guide by hand. See Figure 15-14 for valve guide seal installation tool and correct installation. Using the specified installation tool and a plastic mallet tap the seal on to the guide until it is firmly seated. Install new inner and outer valve springs (12, 13), new rotocoil (16) on the exhaust valve springs and retainer (26) on the intake valve springs. The valve springs must be installed with the closed coils toward the cylinder head as shown in Figure 15-12, "Valve And Spring Installation."

*CAUTION…Do not allow the valve spring compressing tool to cock the rotocoils. Contact between the rotocoils and valve stems will cause damage to the valve stems.*

   b. Using a valve spring compressor, compress the valve springs and insert the valve stem retainer keys (17). The springs should be depressed only enough to admit the keys to seat into the valve stem grooves. If keys drop too far, they may become fouled. This condition could cause them to damage the stem when the springs are released. Make sure the keys are properly seated into the grooves of the valve stem before releasing pressure on springs. Remove the cylinder from fixture and set it upright on the workbench. Place a plastic mallet squarely on the end of the valve stem and strike the plastic mallet sharply with a rawhide mallet to insure correct seating of valve retainer keys. DO NOT STRIKE ROTOCOIL. Insure the valve spring retainer keys are properly positioned.

   c. Carefully position each cylinder assembly so the cylinder bore is facing upward and the cylinder is resting on the rocker shaft mounting bosses. Place a new cylinder base packing (25) on the cylinder skirt and push it against the base flange. Make sure the cylinder base packing is not twisted. Using clean 50 weight aviation engine oil, coat the cylinder barrel wall thoroughly. Assemble the remaining five cylinders using the above instructions.

   d. Using the following instructions, assemble each of the six new pistons and rings.

e. Install all rings with the part number toward the top of the piston. Install the expander into the third ring groove first by disconnecting it and then reconnecting it fully. With a ring expander place the oil ring (51) over the expander with the ring gap positioned 180° from the expander joint. With a ring expander, install ring (50) into the second ring groove, install ring (49) into the first ring groove and install ring (52) into the fourth ring groove.

f. Inspect all ring side clearances with the ring edge flush with the piston outside diameter. All ring side clearances must conform with the dimensions in “Cylinder And Associated Parts Fits And Limits.”

NOTE…Weight differences of piston pairs in opposing bays must not exceed 1/2 ounce or 14.175 grams.

g. Lubricate the piston pin and piston and ring assemblies with clean 50 weight aviation engine oil. Place the new piston and ring assembly with the cylinder assembly for which it was previously sized and gapped. Place a new piston pin with each piston and ring assembly. Install the piston pins in the piston pin bores. The piston pins must slide freely in the piston pin bores.

h. Position the rings so the ring gaps are 180° apart with the first or top ring gap toward top of the piston Using a ring compressor, install each piston into it's cylinder so that the top three rings are in the cylinder barrel and the piston pin is accessible for installation on the connecting rod. Install the piston and ring assemblies into the cylinder bore with the piston position number toward the propeller flange when the cylinder is installed on the engine.

i. Place the cylinders on a clean protected work bench in position order and cover until final engine assembly.

j. Install washers (36), new packing (37) and second washer (36) on cylinder end of pushrod housings (35). Place two each, pushrod housings (35), new springs (38), washers (36), new packings (37) and second washer (36) with each cylinder.

7. Cylinder Subassembly For the IO-550-G,N,P,R model engines."

a. See Figure 15-1B, "Cylinder and Piston Assembly for IO-550-G,N,P,R." Using the following instructions, assemble each of the six cylinders. If the valves have been lapped, they must be installed into the positions for which they were lapped. Spread a film of Molyshield grease on the intake valve stem (12) and the exhaust valve stem (13). Install valves into the correct location. Grasp the valve stems and install the cylinder on a cylindrical block of wood anchored to a work bench. Again apply Molyshield grease to valve stems. Place valve spring retainers (17) over valve guides (4 and 5), cupped side up. Coat the sealing surface of a new intake valve guide seal with clean 50 weight aviation engine oil. Install new seal (50) on the intake valve guide by hand. See Figure 15-14 for valve guide seal installation tool and correct installation. Using the specified installation tool and a plastic mallet tap the seal on to the guide until it is firmly seated. Install new inner and outer valve springs (14, 15), new rotocoil (19) on the exhaust valve springs and retainer (51) on the intake valve springs. The valve springs must be installed with the closed coils toward the cylinder head as shown in Figure 15-12, "Valve And Spring Installation."

*CAUTION…Do not allow the valve spring compressing tool to cock the rotocoils. Contact between the rotocoils and valve stems will cause damage to the valve stems.*

b. Using a valve spring compressor, compress the valve springs and insert the valve stem retainer keys (18). The springs should be depressed only enough to admit the keys to seat into the valve stem grooves. If keys drop too far, they may become fouled. This condition could cause them to damage the stem when the springs are released. Make sure the keys are properly seated into the grooves of the valve stem before releasing pressure on springs. Remove the cylinder from fixture and set it upright on the workbench. Place a plastic mallet squarely on the end of the valve stem and strike the plastic mallet sharply with a rawhide mallet to insure correct seating of valve retainer keys. DO NOT STRIKE ROTOCOIL. Insure the valve spring retainer keys are properly positioned.

c. Carefully position each cylinder assembly so the cylinder bore is facing upward and the cylinder is resting on the rocker shaft mounting bosses. Place a new cylinder base packing (52) on the cylinder skirt and push it against the base flange. Make sure the cylinder base packing is not twisted. Using clean 50 weight aviation engine oil, coat the cylinder barrel wall thoroughly. Assemble the remaining five cylinders using the above instructions.

d. Using the following instructions, assemble each of the six new pistons and rings.

e. Install all rings with the part number toward the top of the piston. Install the expander into the third ring groove first by disconnecting it and then reconnecting it fully. With a ring expander place the oil ring (58) over the expander with the ring gap positioned 180° from the expander joint. With a ring expander, install ring (57) into the second ring groove, install ring (56) into the first ring groove and install ring (59) into the fourth ring groove.

f. Inspect all ring side clearances with the ring edge flush with the piston outside diameter. All ring side clearances must conform with the dimensions in "Cylinder And Associated Parts Fits And Limits."

NOTE…Weight differences of piston pairs in opposing bays must not exceed 1/2 ounce or 14.175 grams.

g. Lubricate the piston pin and piston and ring assemblies with clean 50 weight aviation engine oil. Place the new piston and ring assembly with the cylinder assembly for which it was previously sized and gapped. Place a new piston pin with each piston and ring assembly. Install the piston pins in the piston pin bores. The piston pins must slide freely in the piston pin bores.

h. Position the rings so the ring gaps are 180° apart with the first or top ring gap toward top of the piston Using a ring compressor, install each piston into it's cylinder so that the top three rings are in the cylinder barrel and the piston pin is accessible for installation on the connecting rod. Install the piston and ring assemblies into the cylinder bore with the piston position number toward the propeller flange when the cylinder is installed on the engine.

i. Place the cylinders on a clean protected work bench in position order and cover until final engine assembly.

j. Install new gasket (37) on cylinder end of pushrod housings (35). Place two each, pushrod housings, new springs (39), washers (36), new packings (38) and second washer (36) with each cylinder.

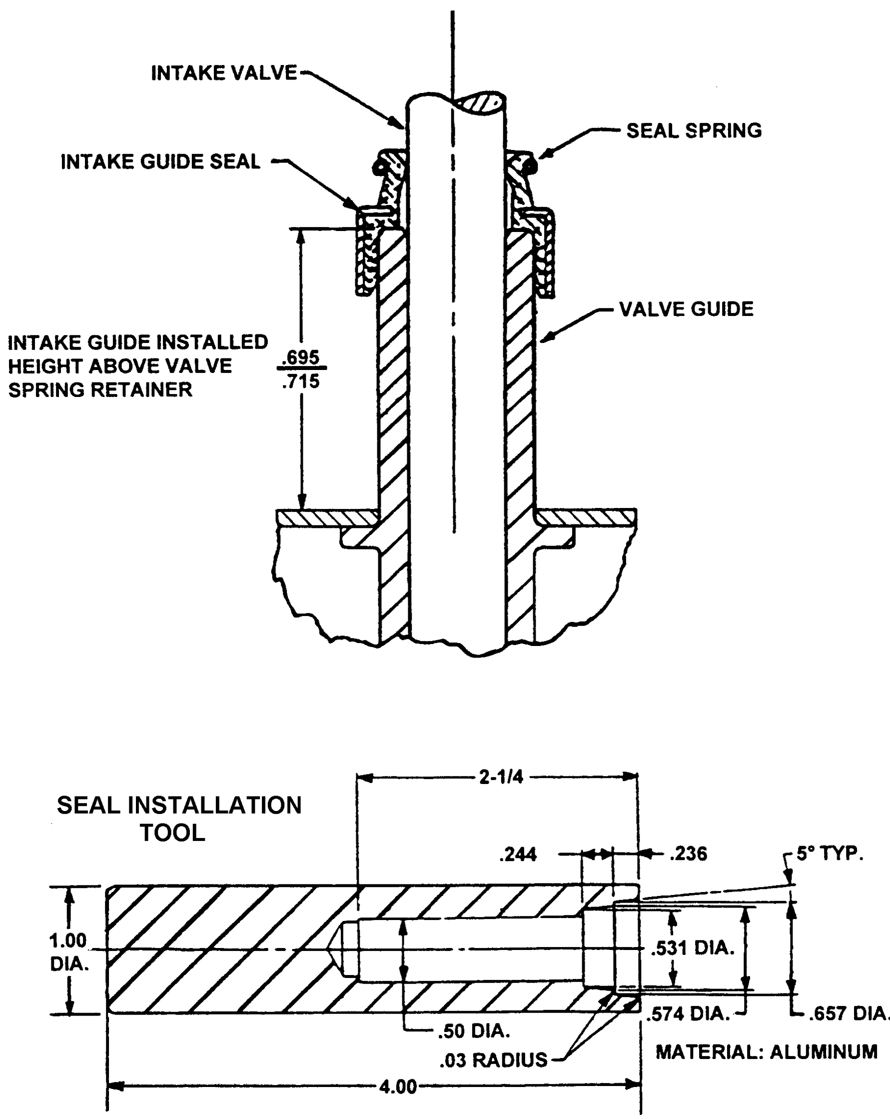



**FIGURE 15-14. VALVE GUIDE SEAL INSTALLATION**

INTENTIONALLY

LEFT

BLANK

# CHAPTER 16

# CRANKCASE

## 16-1A CRANKCASE DISASSEMBLY AND DRIVE TRAIN REMOVAL IO-550-A, B &C

1. See Figure 16-2, "Oil Filler, Idler Support Pin & Camshaft Cover." Remove attaching hardware (13, 14, 15). Remove cover (12) and gasket (11). Discard gasket (11). Remove attaching hardware (19, 20). Remove idler gear support pin (18), gasket (17) and bushing (16). Discard gasket (17) and bushing (16).

2. See Figure 16-1A, "Crankcase Attaching Parts IO-550-A, B & C." Remove crankcase backbone attaching hardware (1 through 6). Remove lifting eye (8), ignition bracket (9) and fuel manifold valve (7). Remove attaching hardware (22, 23, 24). Carefully tap through bolts (21, 25) and remove. Remove three bolts (15) and washers (5).

NOTE... Do not attempt to remove bolt and washer adjacent to right magneto upper stud. The bolt and washer are installed before the upper magneto mounting stud and cannot be removed without causing damage to the bolt hole.

Rotate the engine stand placing the right crankcase half downward. Support the engine with a prop under the right crankcase half. A length of 2 X 4 lumber with the end supporting the crankcase padded, may be used.

Remove remaining half inch nuts (19) and washers (18). Remove baffle supports (20, 34). Tap half inch through bolts (16) with a plastic or rawhide mallet and pull from opposite side of crankcase to remove. Do not damage through bolt threads. Remove and discard o-rings (17).

Remove attaching hardware (12 through 14). Tap 3/8 through bolt (10) with a plastic or rawhide mallet. Remove through bolt carefully to prevent thread damage.

Remove support and rotate stand so that engine is in inverted position. Remove attaching hardware (29 through 33), attaching hardware (26, 27, 28) and attaching hardware (35, 36, 5). Rotate engine stand placing left crankcase half downward. Replace support prop.

3. See Figure 16-3A, "Engine Mounts, Crankshaft Seal Retainer & Governor Cover IO-550-A, B & C." Remove bolts (19) and oil seal retainer plates (18).

Disconnect right crankcase engine mounts from engine stand. Carefully lift right crankcase half from left crankcase half to prevent connecting rods from hitting cylinder decks. Using the proper fixtures and dial indicators, check and record gear backlash before removing drive train. See Chapter 17, "Gear Backlash Fits and Limits."

Lift out camshaft and governor driven gear. Remove idler gear, hydraulic tappets and crankshaft assembly.

Place the camshaft and crankshaft assemblies on the proper holding fixtures to prevent damage. Remove and discard crankshaft bearings and thrust washers.

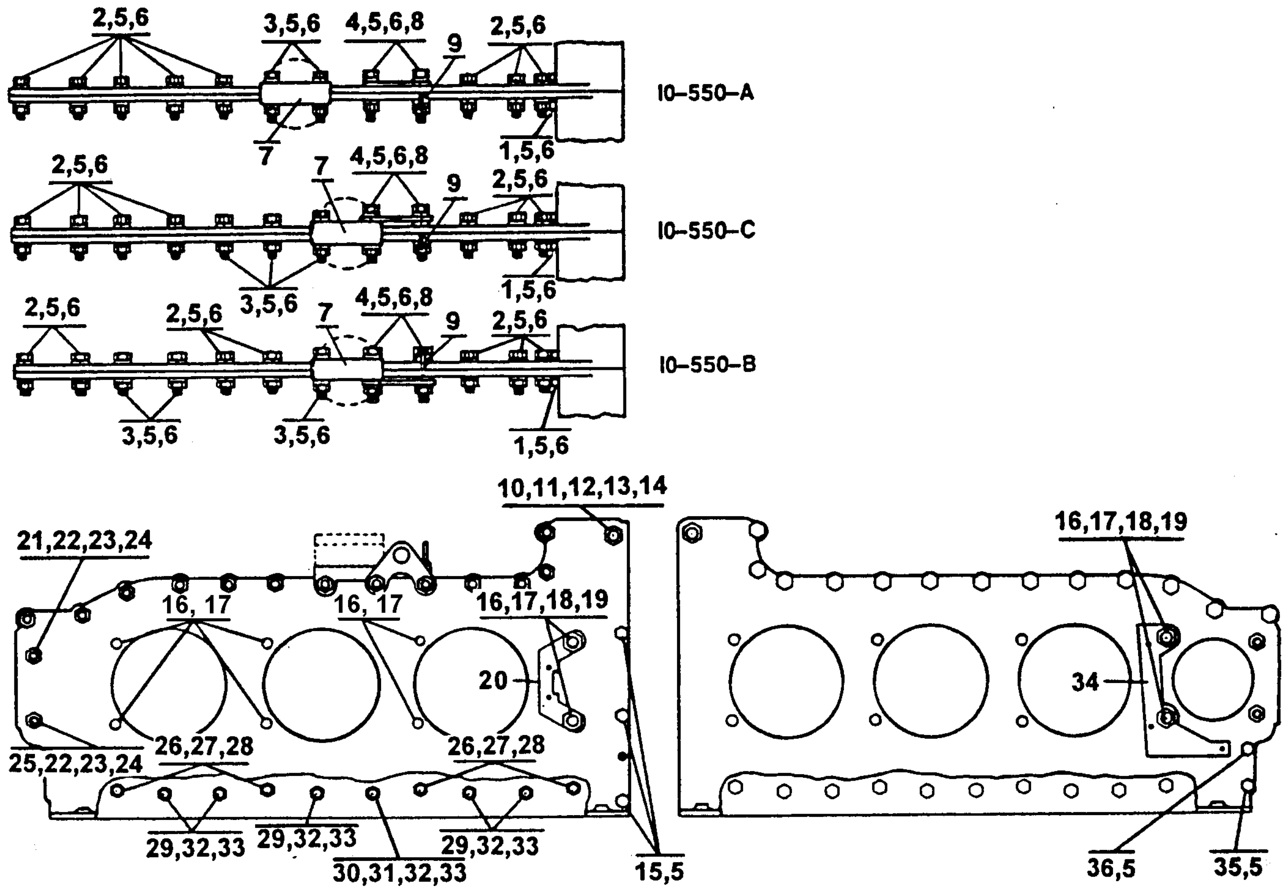



**FIGURE 16-1A. CRANKCASE ATTACHING PARTS IO-550-A, B & C**

1. Bolt
2. Bolt
3. Bolt
4. Bolt
5. Washer
6. Nut
7. Fuel Manifold Valve
8. Eye Lifting
9. Bracket, Ignition
10. Bolt, Through
11. O-Ring
12. Spacer
13. Washer
14. Nut
15. Bolt
16. Bolt, Through
17. O-Ring
18. Washer
19. Nut
20. Support, Baffle
21. Bolt, Through
22. Washer
23. Washer
24. Nut
25. Bolt, Through
26. Bolt
27. Washer
28. Nut
29. Bolt
30. ①Bolt
31. ①Spacer
32. Washer
33. Nut
34. Support Baffle
35. Bolt
36. Bolt

① This hardware attaches oil suction tube assembly to crankcase

## 16-1B CRANKCASE DISASSEMBLY AND DRIVE TRAIN REMOVAL IO-550-G,N,P,R

1. See Figure 16-2, "Oil Filler, Idler Support Pin & Camshaft Cover." Remove attaching hardware (13, 14, 15). Remove cover (12) and gasket (11). Discard gasket (11). Remove attaching hardware (19, 20). Remove idler gear support pin (18), gasket (17) and bushing (16). Discard gasket (17) and bushing (16).

2. See Figure 16-3B, "Engine Mounts, Crankshaft Seal Retainer & Governor Cover IO-550-G,N,P,R." Remove bolts (14) and oil seal retainer plates (13).

3. See Figure 16-1B, "Crankcase Attaching Parts IO-550-G,N,P,R." Remove crankcase backbone attaching hardware (2 through 6). Remove lifting eyes (7, 8), ignition bracket (9) and fuel manifold valve. Remove attaching hardware (21,22,23). Carefully tap through bolts (20,24) and remove. Remove three bolts (14) and washers (4).

NOTE... Do not attempt to remove bolt and washer adjacent to right magneto upper stud. The bolt and washer are installed before the upper magneto mounting stud and cannot be removed without causing damage to the bolt hole.

   Rotate the engine stand placing the right crankcase half downward. Support the engine with a prop under the right crankcase half. A length of 2 X 4 lumber with the end supporting the crankcase padded, may be used.

   Remove remaining half inch nuts (18) and washers (17). Remove baffle support (19). Tap half inch through bolts (15) with a plastic or rawhide mallet and pull from opposite side of crankcase to remove. Do not damage through bolt threads. Remove and discard o-rings (16).

   Remove attaching hardware (11 through 13). Tap 3/8 through bolt (10) with a plastic or rawhide mallet. Remove through bolt carefully to prevent thread damage.

   Remove support and rotate stand so that engine is in inverted position. Remove six sets of attaching hardware (28,29,30) and four sets of attaching hardware (25,26,27). Rotate engine stand placing left crankcase half downward. Replace support prop.

4. See Figure 16-3B, "Engine Mounts, Crankshaft Seal Retainer & Governor Cover IO-550-G,N,P,R." Disconnect right crankcase engine mounts from engine stand. Carefully lift right crankcase half from left crankcase half to prevent connecting rods from hitting cylinder decks. Using the proper fixtures and dial indicators, check and record gear backlash before removing drive train. See Chapter 17, "Gear Backlash Fits and Limits."

   Lift out camshaft and governor driven gear. Remove idler gear, hydraulic tappets and crankshaft assembly. Place the camshaft and crankshaft assemblies on the proper holding fixtures to prevent damage. Remove and discard crankshaft bearings and thrust washers.

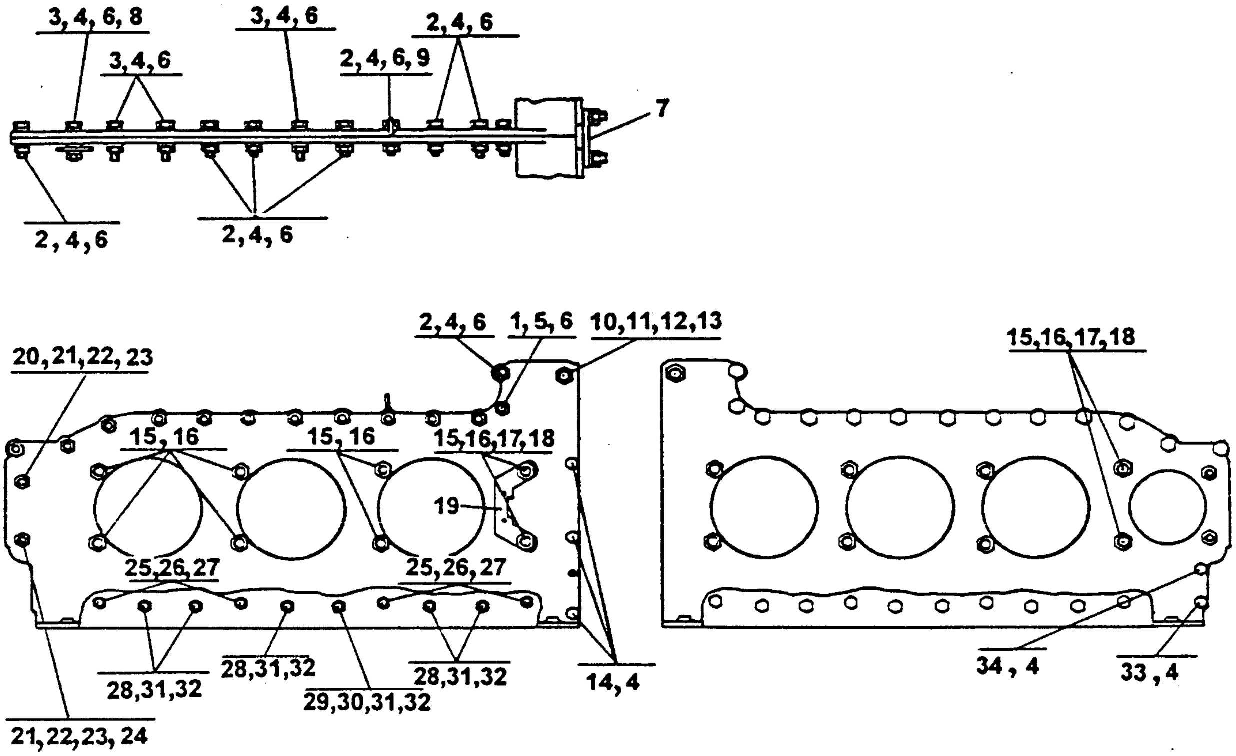



**FIGURE 16-1B. CRANKCASE ATTACHING PARTS IO-550-G,N,P,R**

| | | | |
|---|---|---|---|
| 1. Bolt | 10. Bolt, Through | 19. Support, Baffle | 28. Bolt |
| 2. Bolt | 11. O-Ring | 20. Bolt, Through | 29. Washer |
| 3. Bolt | 12. Washer | 21. Washer | 30. Nut |
| 4. Washer | 13. Nut | 22. Washer | 31. Bolt |
| 5. Washer | 14. Bolt | 23. Nut | 32. Bolt |
| 6. Nut | 15. Bolt, Through | 24. Bolt, Through | 33. Screw |
| 7. Eye Lifting | 16. O-Ring | 25. Bolt | 34. Screw |
| 8. Eye Lifting | 17. Washer | 26. Washer | |
| 9. Bracket, Ignition | 18. Nut | 27. Nut | |

## 16-2 OIL FILLER AND GAUGE HOUSING REMOVAL (See Figure 16-2)

1. Remove attaching hardware (6, 7, 8) lift oil filler assembly (5) from engine, remove oil filter adapter (3) and discard o-rings (1, 2). Remove and discard gasket (4). Separate oil gauge assembly (9) from oil filler.

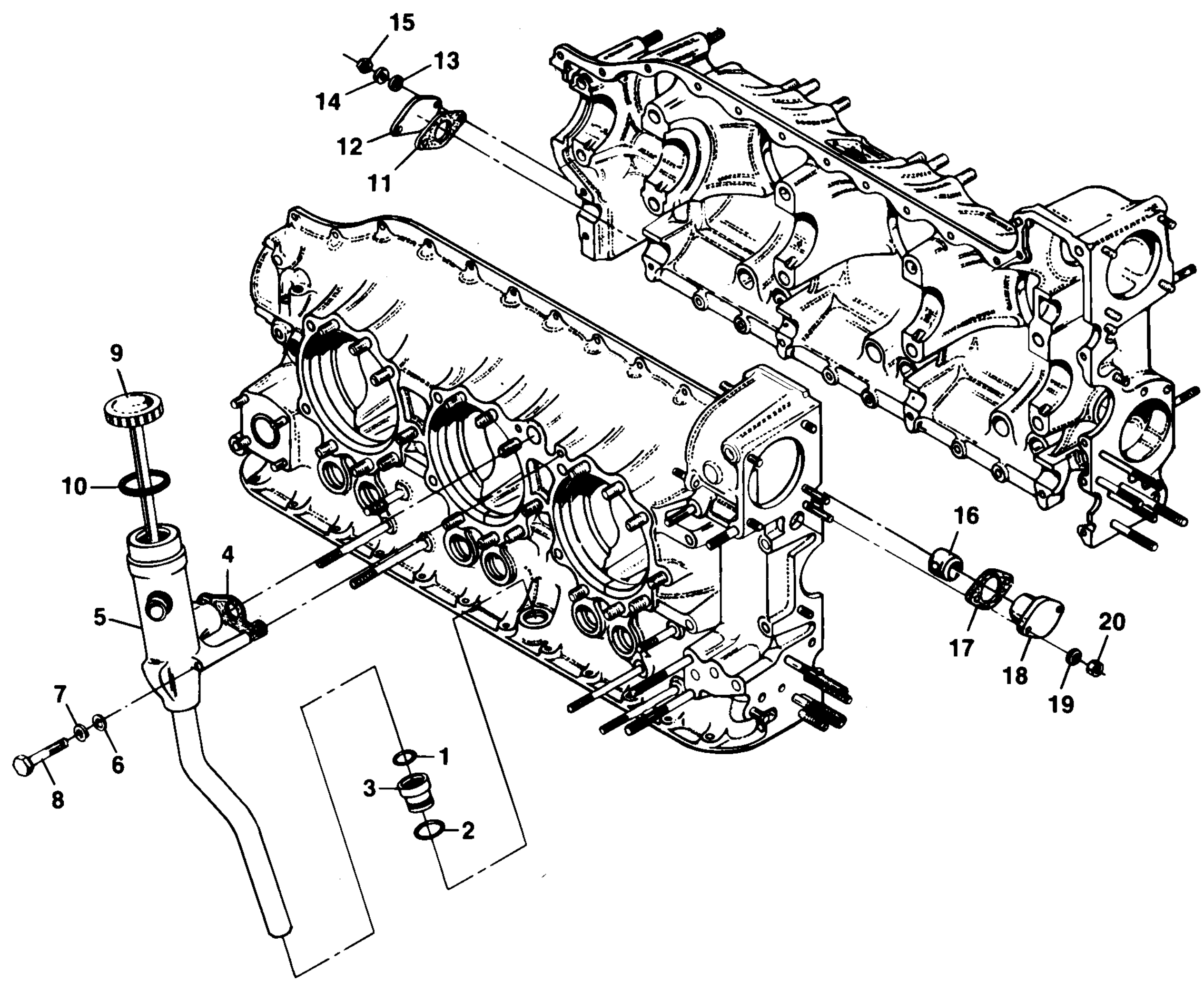



**FIGURE 16-2. OIL FILLER, IDLER SUPPORT PIN & CAMSHAFT COVER**

| | | | |
|---|---|---|---|
| 1. O-Ring | 6. Washer, Plain | 11. Gasket | 16. Bushing, Idler Gear |
| 2. O-Ring | 7. Washer, Lock | 12. Cover, Cam Hole | 17. Gasket, Flange |
| 3. Adapter, Oil Filter | 8. Bolt | 13. Washer, Plain | 18. Pin, Idler Support |
| 4. Gasket, Oil Filter | 9. Gauge & Cap Assy | 14. Washer, Lock | 19. Washer, Lock |
| 5. Oil Filler Assy. | 10. Gasket | 15. Nut, Plain | 20. Nut, Plain |

## 16-3A ENGINE MOUNTS AND GOVERNOR COVER REMOVAL IO-550-A, B & C (See Figure 16-3A)

1. On IO-550-A engines, remove attaching hardware (8, 9) and engine mounts (6, 7)
2. On IO-550-C engines, engine mount (3) attaching hardware was removed with oil cooler. Remove mount (3) and o-rings (1). Discard o-rings (1). Remove remaining hardware (8 through 11). Remove engine mount legs (2, 4 & 5).
3. On IO-550-B engines, the engine mount legs were removed during oil sump disassembly.
4. Remove attaching hardware (14 through 17). Remove cover (13) and gasket (12). Discard gasket (12).

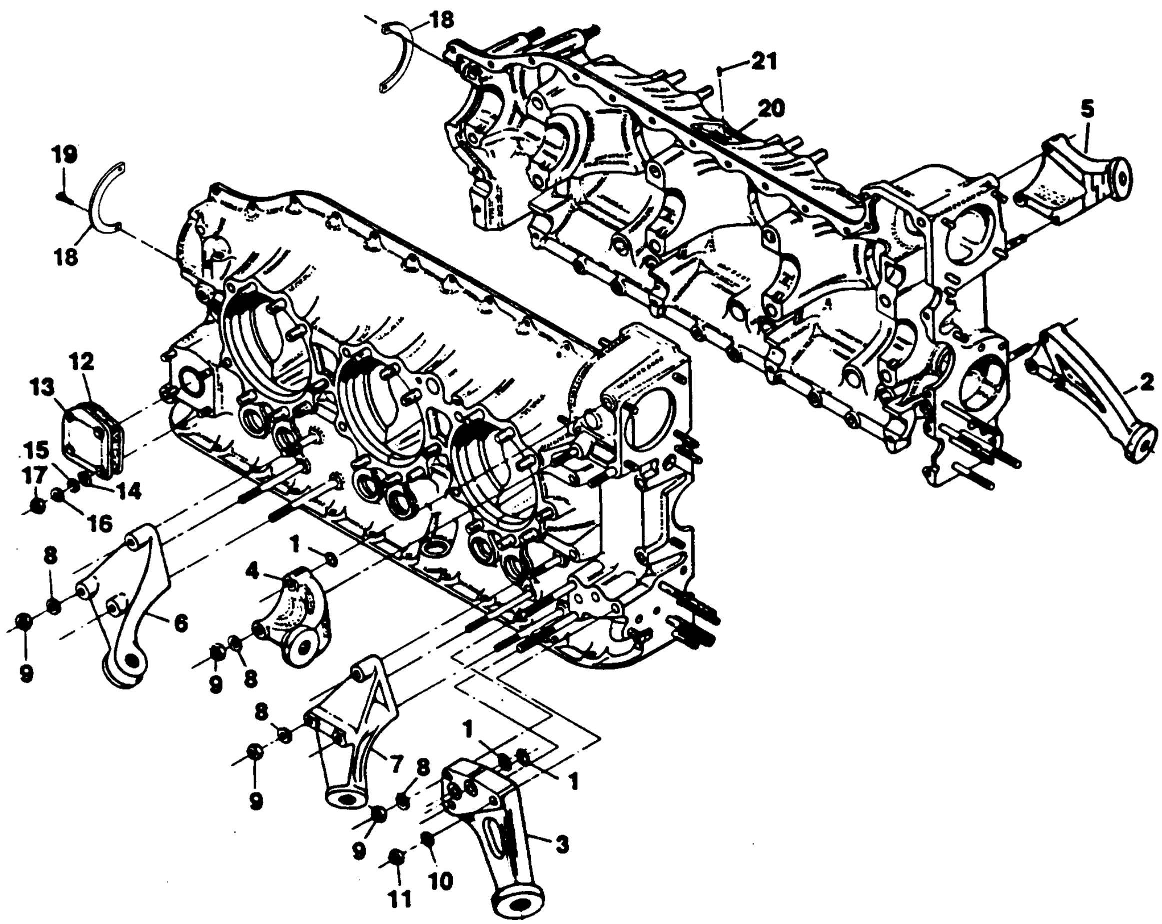
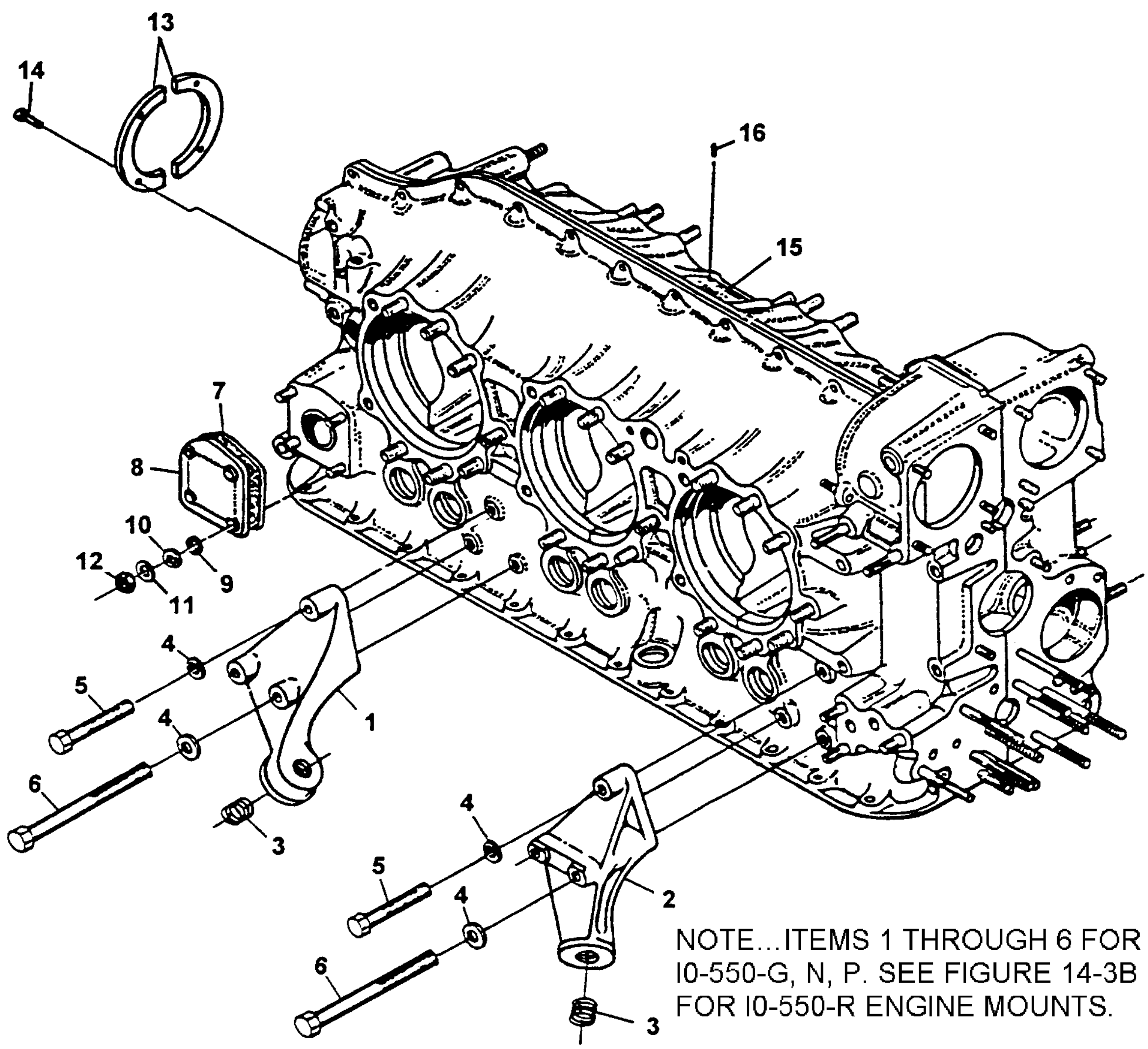



**FIGURE 16-3A. ENGINE MOUNTS, CRANKSHAFT SEAL & GOVERNOR COVER IO-550-A, B & C**

| | | |
|---|---|---|
| 1. O-Ring | 8. Washer | 15. Washer |
| 2. Mount, Engine | 9. Nut | 16. Washer, Lock |
| 3. Mount, Engine | 10. Washer | 17. Nut |
| 4. Mount, Engine | 11. Nut | 18. Retainer |
| 5. Mount, Engine | 12. Gasket | 19. Bolt |
| 6. Mount, Engine | 13. Cover | 20. Plate ID. |
| 7. Mount, Engine | 14. Spacer | 21. Screw, Drive |

## 16-3B ENGINE MOUNTS AND GOVERNOR COVER REMOVAL IO-550-G,N,P,R (See Figure 16-3B)

1. Remove attaching hardware (4, 5, 6) and engine mounts (1, 2).
2. Remove attaching hardware (9 through 12). Remove cover (8) and gasket (7). Discard gasket (7)




NOTE...ITEMS 1 THROUGH 6 FOR I0-550-G, N, P. SEE FIGURE 14-3B FOR I0-550-R ENGINE MOUNTS.

**FIGURE 16-3B. ENGINE MOUNTS, CRANKSHAFT SEAL & GOVERNOR COVER IO-550-G,N,P,R**

1. Mount, Engine
2. Mount, Engine
3. Insert
4. Washer
5. Screw
6. Screw
7. Gasket
8. Cover, Governor Pad
9. Spacer
10. Washer
11. Washer, Lock
12. Nut
13. Retainer
14. Bolt
15. Plate ID.
16. Screw, Drive

## 16-4 CRANKCASE STUDDING DISASSEMBLY (See Figure 6-4)

1. Crankcase studs, dowels and helical inserts should only be removed for replacement when they are found to be loose, corroded, pitted or damaged.
2. Remove starter shaft gear roller bearing (2).
3. Crankcase plugs (20, 23 through 27 and 32) must be removed to allow pressure flushing of crankcase.
4. Do not attempt to remove oil squirt nozzles (29). Field replacement is not possible.

NOTE...When plugs are removed they must be identified by tagging. During crankcase sub-assembly all plugs must be placed back in the same crankcase location from which they were removed to prevent oil pressure loss.

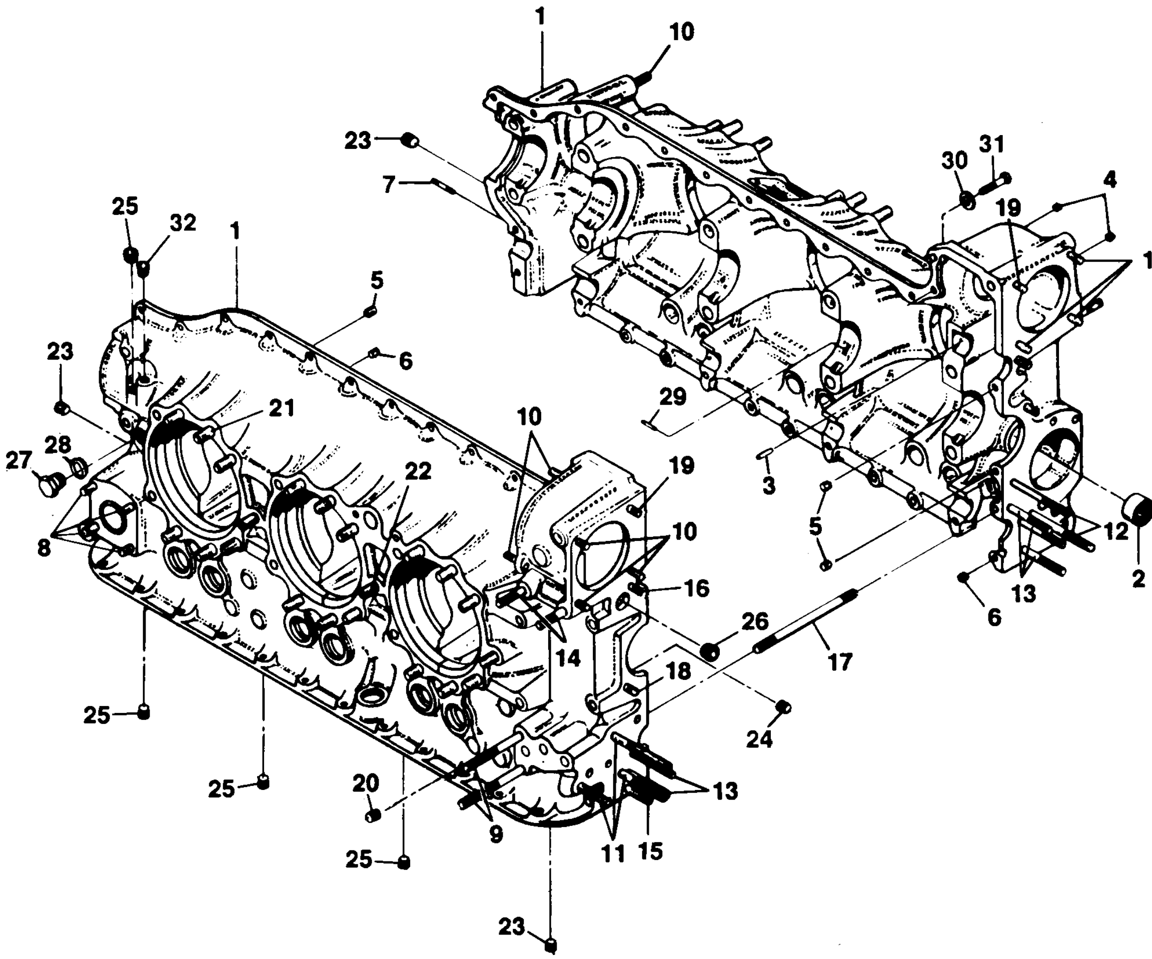



**FIGURE 16-4. CRANKCASE STUDDING ASSEMBLY**

| | | | | |
|---|---|---|---|---|
| 1. Crankcase | 8. Stud | 15. Stud | 22. Stud | 29. Nozzle, Squirt |
| 2. Bearing, Needle | 9. Stud | 16. Stud | 23. Plug | 30. Washer Plain |
| 3. Dowel | 10. Stud | 17. Stud | 24. Plug | 31. Bolt |
| 4. Helical Coil | 11. Stud | 18. Stud | 25. Plug | 32. Plug |
| 5. Helical Coil | 12. Stud | 19. Stud | 26. Plug | |
| 6. Helical Coil | 13. Stud | 20. Plug | 27. Plug | |
| 7. Stud | 14. Stud | 21. Stud | 28. Gasket | |

## 16-5 CRANKCASE AND ASSOCIATED PARTS CLEANING

1. The crankcase halves must be cleaned in accordance with the instructions in section 6-7, "General Cleaning," and the following special instructions:

2. All through bolts, bushings, bearings, thrust washers, gaskets, packings, o-rings, seals, lock washers and self locking nuts removed from the crankcase must be replaced 100% at overhaul. Cleaning these parts is not required.

3. The crankcase oil passages must be pressure flushed with mineral spirit solvent and inspected with the aid of a flashlight. The crankcase oil squirt nozzles must be flushed with mineral spirit solvent to insure they are not obstructed. Use caution when flushing the oil squirt nozzles because they are not field replaceable.

4. The engine mount brackets must be cleaned using mineral spirit solvent.

5. If the crankcase castings are immersed in an alkaline bath, they must be sprayed with steam to remove all traces of alkaline. After the castings dry, inspect them for any alkaline residues. If necessary, re-spray with steam to remove remaining residue. The crankcase and all oil passages must be thoroughly flushed with mineral spirit solvent after any alkaline cleaning process has been used.

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed.*

## 16-6 CRANKCASE AND ASSOCIATED PARTS INSPECTION

### VISUAL INSPECTION

The crankcase and associated components must be visually inspected in accordance with instructions in section 6-8, "Visual Inspection," and the following special instructions:

1. Visually inspect the inside and outside of both crankcase halves for cracks. Pay particular attention to areas on and adjacent to the cylinder mount flanges, tappet guides, case flange, nose seal land and bearing bosses. Look for scoring in the old crankshaft bearings. Look for scoring in the tappet guides and camshaft bearings. Inspect main bearing boss parting surfaces for fretting. Inspect the bearing saddles for bearing lock slot elongation and any indication of bearing movement. Visually inspect all machined surfaces for nicks and roughness.

2. Use the following inspection to determine if a cracked crankcase can be repaired. See Figures 16-5 and 16-6.

   If a crack is observed in any non-critical (shaded) area that is more than two (2) inches in length, or if a previously observed crack has progressed to two (2) or more inches in length, the crankcase must be repaired or replaced. If any crack is observed in a critical (white) area the crankcase must be discarded.

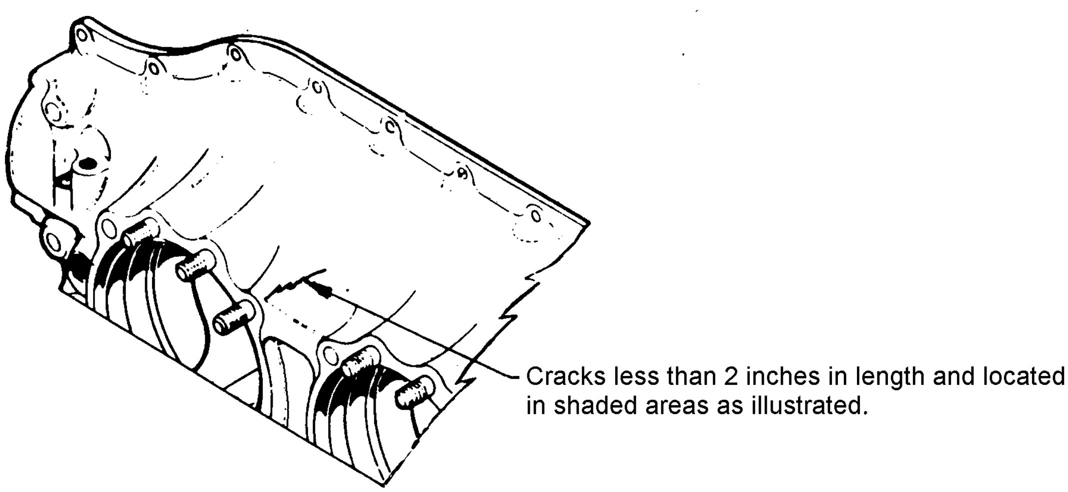



**FIGURE 16-5. INSPECTION OF CRANKCASE NON-CRITICAL AREA**

Reasons for crankcase replacement:

1. Any crack in the critical (white) areas.
2. Any crack two (2) inches or more in length in the non-critical (shaded) areas.
3. Any crack that is leaking oil (not seeping).

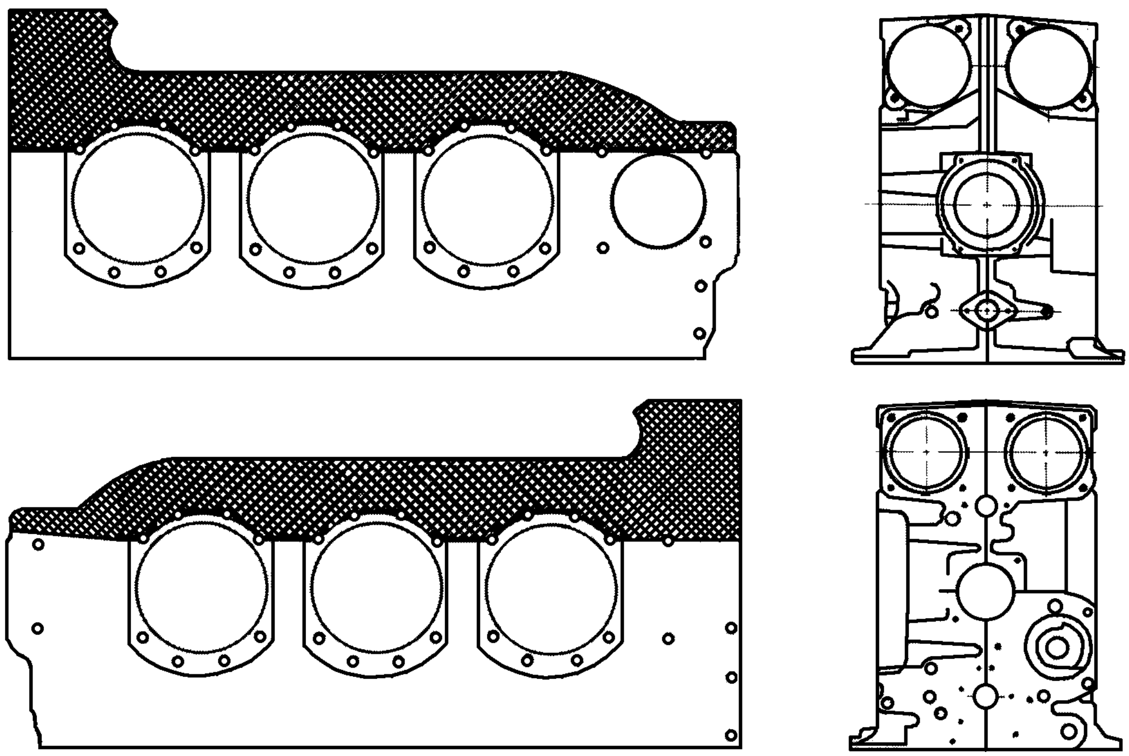


**FIGURE 16-6. INSPECTION OF CRANKCASE CRITICAL (WHITE) AND NON-CRITICAL (SHADED) AREAS**

3. Visually inspect the breather for cracks and dents. Inspect tube ends for scoring and out of roundness that may have caused a bad seal and oil leakage. Discard components with any of these indications.

4. Visually inspect all pipe plugs for stripped or distorted threads and damaged wrench flats. Pipe plugs exhibiting damaged threads or wrench flats must be discarded.

5. Inspect engine mount brackets for cracks, dents and wear. Inspect hardware for distorted, stripped threads and damaged wrench flats. Components exhibiting any of the above indications must be discarded. Inspect tapped holes and helical coils for distorted or stripped threads.

6. Visually inspect all crankcase helical coils and studs for stripped or distorted threads. Inspect studs for corrosion, rusting, pitting, incomplete threads and looseness. Check all studs with a tool maker's square for alignment. Check studs for looseness. All studs must have their setting heights checked for indications of backing out. See Figure(s) 16-7A through 16-7D for crankcase stud setting heights.

## CRANKCASE STUD SETTING HEIGHTS IO-550-A

NOTE…All studs, helical coils and plugs must be installed in accordance with the instructions in sections 6-21, 6-22 and 6-25. See Figure 6-2, "Standard And Oversize Stud Identification."

| ITEM NO | LOCATION | THREAD SIZE | SETTING HEIGHT (IN INCHES) | QTY. |
|---|---|---|---|---|
| 1. | Bearing, Starter Shaft Gear | --- | See section A-A | 1 |
| 2. | Helical Coil | --- | Install in accordance with section 6-21 | 1 |
| 3. | Helical Coil | --- | Install in accordance with section 6-21 | 4 |
| 4. | Dowel | --- | .09 | 1 |
| 5. | Stud, Through | 5/16-18x5/16-24 | 5.34 | 1 |
| 6. | Magneto Mount Pad | 5/16-18x5/16-24 | .67 | 4 |
| 7. | Accessory Drive (rear) | 3/8-16x3/8-24 | .84 | 2 |
| 8. | Accessory Drive (rear) | 5/16-18x5/16-24 | .75 | 3 |
| 9. | Idler Pin Pad | 5/16-18x5/16-24 | .56 | 2 |
| 10. | Fuel Pump Pad | 5/16-18x5/16-24 | .75 | 2 |
| 11. | Starter Adapter Pad | 5/16-18x5/16-24 | 3.69 | 1 |
| 12. | Oil Pump Pad | 1/4-20x1/4-28 | 3.38 | 4 |
| 13. | Plug | 3/8 | --- | 1 |
| 14. | Oil Pump Pad | 3/8-16x3/8-24 | 2.94 | 2 |
| 15. | Oil Pump Pad | 1/4-20x1/4-28 | 1.77 | 1 |
| 16. | Oil Pump Pad | 5/16-18x5/16-24 | 3.71 | 1 |
| 17. | Plug | 1/8-27 | --- | 3 |
| 18. | Plug | 1/16-27 | --- | 4 |
| 19. | Plug | 1/8-27 | --- | 2 |
| 20. | Camshaft Cover Pad | 1/4-20x1/4-28 | .69 | 2 |
| 21. | Plug | 1/8-27 | --- | 1 |
| 22. | Alternator Pad | 5/16-18x5/16-24 | .81 | 4 |
| 23. | Helical Coil | --- | Install in accordance with section 6-21 | 2 |
| 24. | Plug | 1/8-27 | --- | 1 |
| 25. | Cylinder Mount Pad | 7/16-14x7/16-20 | .81 | 36 |
| 26. | Cylinder 7th Stud | 7/16-14x7/16-20 | .95 | 6 |
| 27. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | .81 | 2 |
| 28. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | .88 | 2 |
| 29. | Plug | 5/8-18 | --- | 1 |
| 30. | Propeller Governor Pad | 5/16-18x5/16-24 | 1.38 | 4 |
| 31. | Bolt, Backbone | 5/16-24 | Must be installed prior to installing studs (item no. 6) | 1 |
| 32. | Washer | 5/16 I.D. | Must be installed prior to installing studs (item no. 6) | 1 |
| 33. | Stud, Engine Mount | 3/8-16x3/8-24 | 3.32 | 8 |
| 34. | Stud, Engine Mount | 3/8-16x3/8-24 | 1.50 | 6 |

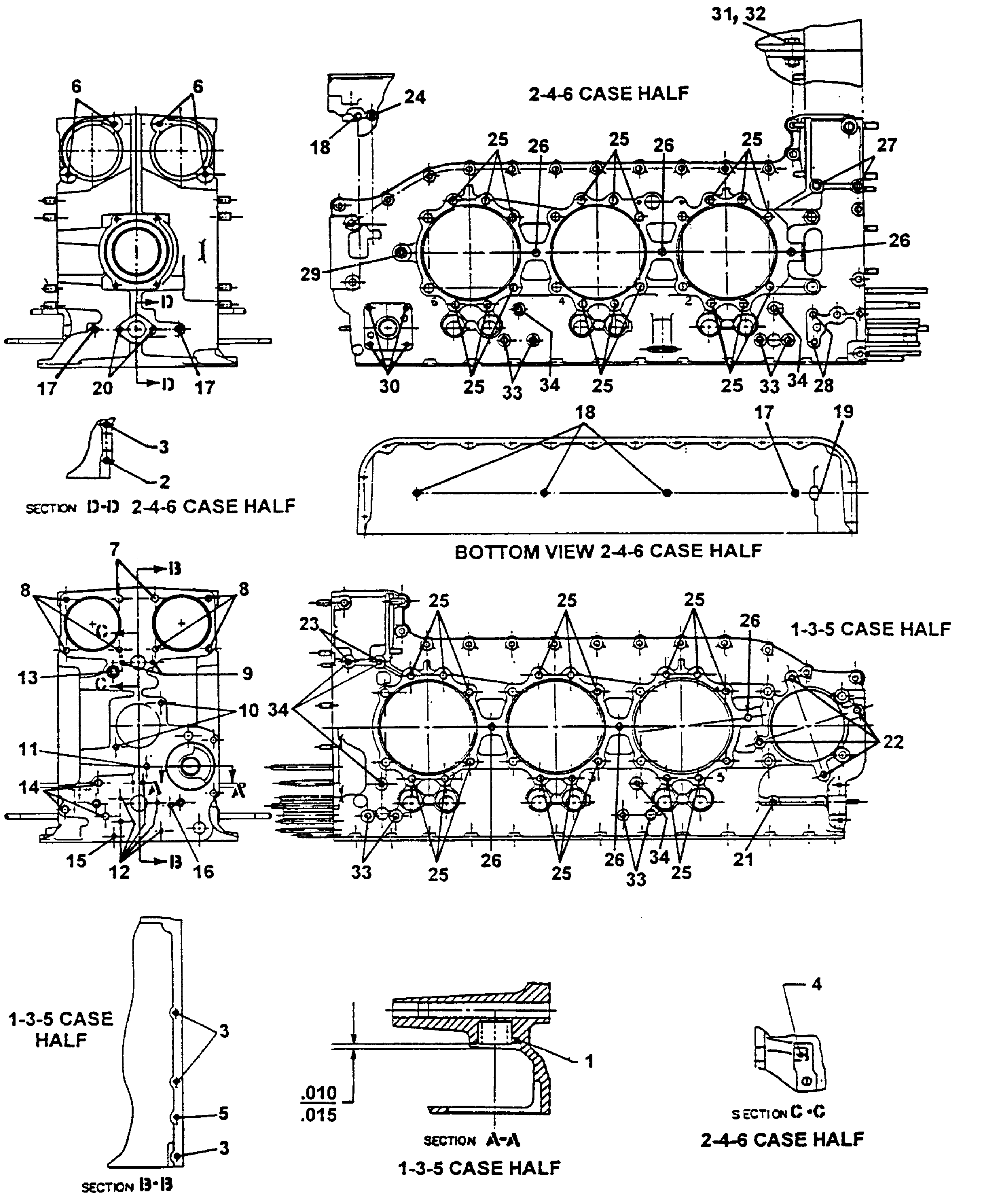



**FIGURE 16-7A. CRANKCASE STUD SETTING HEIGHTS IO-550-A**

## CRANKCASE STUD SETTING HEIGHTS ALL IO-550-B EXCEPT IO-550-B9F, B14B, B19B, B30B

NOTE…All studs, helical coils and plugs must be installed in accordance with the instructions in sections 6-21, 6-22 and 6-25. See Figure 6-2, "Standard And Oversize Stud Identification."

| ITEM NO | LOCATION | THREAD SIZE | SETTING HEIGHT (IN INCHES) | QTY. |
|---|---|---|---|---|
| 1. | Bearing, Starter Shaft Gear | --- | See section A-A | 1 |
| 2. | Helical Coil | --- | Install in accordance with section 6-21 | 1 |
| 3. | Helical Coil | --- | Install in accordance with section 6-21 | 4 |
| 4. | Dowel | 3/16 | .09 | 1 |
| 5. | Stud, Through | 5/16-18x5/16-24 | 5.41 | 1 |
| 6. | Magneto Mount Pad | 5/16-18x5/16-24 | .84 | 4 |
| 7. | Accessory Drive (rear) | 3/8-16x3/8-24 | .84 | 2 |
| 8. | Accessory Drive (rear) | 5/16-18x5/16-24 | .75 | 6 |
| 9. | Idler Pin Pad | 1/4-20x1/4-28 | .56 | 2 |
| 10. | Fuel Pump Pad | 5/16-18x5/16-24 | .75 | 2 |
| 11. | Starter Adapter Pad | 5/16-18x5/16-24 | 3.69 | 1 |
| 12. | Oil Pump Pad | 1/4-20x1/4-28 | 3.38 | 5 |
| 13. | Plug | 3/8 | --- | 1 |
| 14. | Oil Pump Pad | 3/8-16x3/8-24 | 2.94 | 3 |
| 15. | Oil Pump Pad | 1/4-20x1/4-28 | 1.77 | 1 |
| 16. | Oil Pump Pad | 5/16-18x5/16-24 | 4.27 | 1 |
| 17. | Plug | 1/8-27 | --- | 3 |
| 18. | Plug | 1/16-27 | --- | 4 |
| 19. | Plug | 1/8-27 | --- | 2 |
| 20. | Camshaft Cover Pad | 1/4-20x1/4-28 | .69 | 2 |
| 21. | Plug | 1/8-27 | --- | 1 |
| 22. | Alternator Pad | 5/16-18x5/16-24 | .81 | 4 |
| 23. | Helical Coil | --- | Install in accordance with section 6-21 | 6 |
| 24. | Plug | | --- | 1 |
| 25. | Cylinder Mount Pad | 7/16-14x7/16-20 | .81 | 36 |
| 26. | Cylinder 7th Stud | 7/16-14x7/16-20 | .95 | 6 |
| 27. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | .76 | 2 |
| | ①Oil Cooler Mount Pad | 3/8-16x3/8-24 | .81 | 2 |
| 28. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | .85 | 2 |
| | ①Oil Cooler Mount Pad | 3/8-16x3/8-24 | .88 | 2 |
| 29. | Plug | 5/8-18 | --- | 1 |
| 30. | Propeller Governor Pad | 5/16-18x5/16-24 | 1.38 | 4 |
| 31. | Bolt, Backbone | 5/16-24 | Must be installed prior to installing studs (item no. 6) | 1 |
| 32. | Washer | 5/16 I.D. | Must be installed prior to installing studs (item no. 6) | 1 |

①For IO-550-B, B31B, B36B, B39B, B46B, B48B, B49B, B51B, B52B, B53B, B54B, B56B, B58B, B59B, B60B, B62B

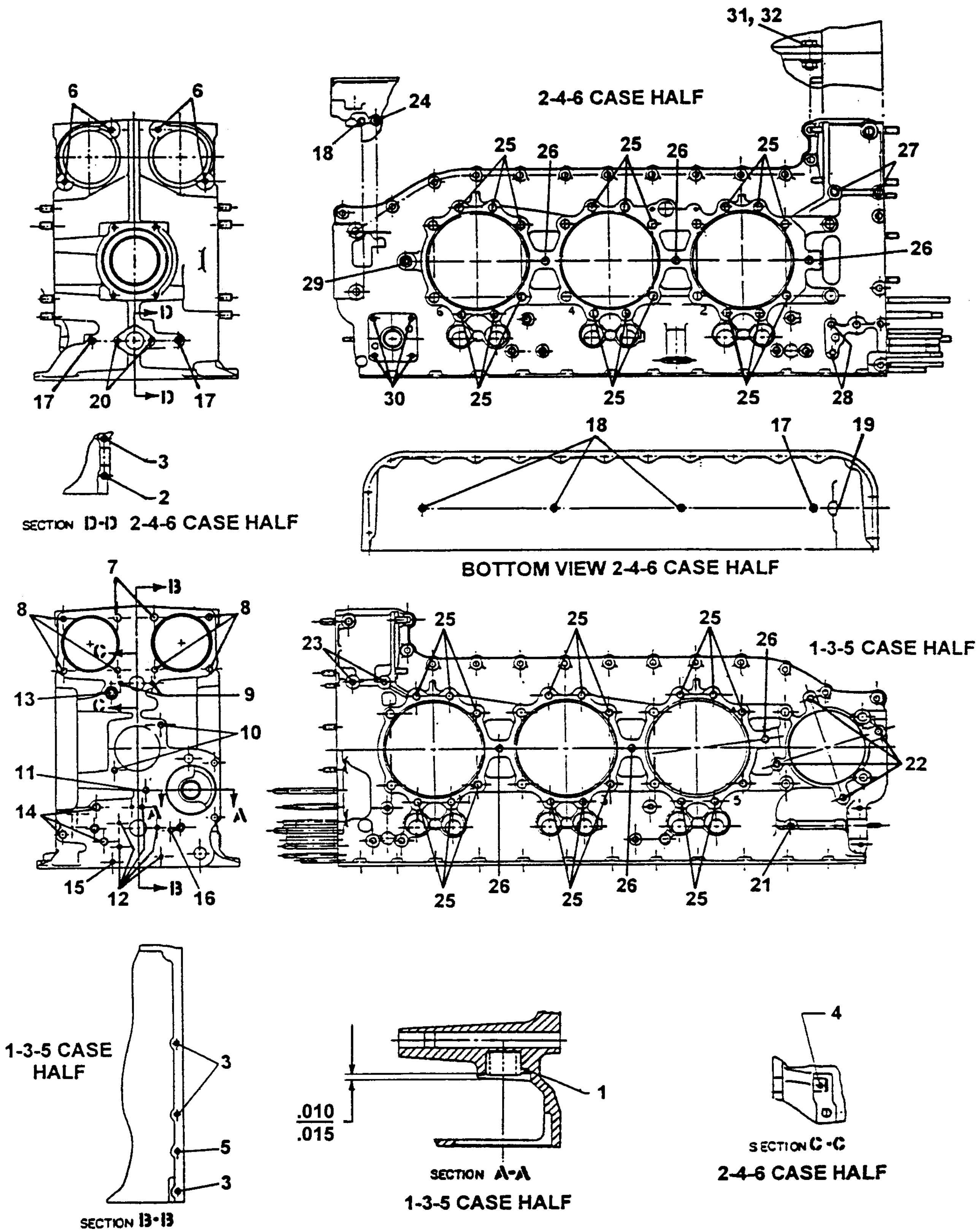



**FIGURE 16-7B. CRANKCASE STUD SETTING HEIGHTS ALL IO-550-B EXCEPT IO-550-B9F, B14B, B19B, B30B**

**CRANKCASE STUD SETTING HEIGHTS IO-550-C**

NOTE…All studs, helical coils and plugs must be installed in accordance with the instructions in sections 6-21, 6-22 and 6-25. See Figure 6-2, "Standard And Oversize Stud Identification."

| ITEM NO | LOCATION | THREAD SIZE | SETTING HEIGHT (IN INCHES) | QTY. |
|---|---|---|---|---|
| 1. | Bearing, Starter Shaft Gear | --- | See section A-A | 1 |
| 2. | Helical Coil | --- | Install in accordance with section 6-21 | 1 |
| 3. | Helical Coil | --- | Install in accordance with section 6-21 | 4 |
| 4. | Dowel | --- | .09 | 1 |
| 5. | Stud, Through | 5/16-18x5/16-24 | 6.34 | 1 |
| 6. | Magneto Mount Pad | 5/16-18x5/16-24 | .67 | 4 |
| 7. | Accessory Drive (rear) | 3/8-16x3/8-24 | .84 | 2 |
| 8. | Accessory Drive (rear) | 5/16-18x5/16-24 | .75 | 3 |
| 9. | Accessory Drive (rear) | 5/16-18x5/16-24 | 1.76 | 2 |
| 10. | Idler Pin Pad | 1/4-20x1/4-28 | .56 | 2 |
| 11. | Fuel Pump Pad | 5/16-18x5/16-24 | .75 | 2 |
| 12. | Starter Adapter Pad | 5/16-18x5/16-24 | 3.69 | 1 |
| 13. | Oil Pump Pad | 1/4-20x1/4-28 | 3.38 | 5 |
| 14. | Plug | 3/8 | --- | 1 |
| 15. | Oil Pump Pad | 3/8-16x3/8-24 | 2.94 | 3 |
| 16. | Oil Pump Pad | 1/4-20x1/4-28 | 1.77 | 1 |
| 17. | Oil Pump Pad | 5/16-18x5/16-24 | 3.71 | 1 |
| 18. | Plug | 1/8-27 | --- | 3 |
| 19. | Plug | 1/16-27 | --- | 4 |
| 20. | Plug | 1/8-27 | --- | 2 |
| 21. | Camshaft Cover Pad | 1/4-20x1/4-28 | .69 | 2 |
| 22. | Plug | 1/8-27 | --- | 2 |
| 23. | Alternator Pad | 5/16-18x5/16-24 | .81 | 4 |
| 24. | Helical Coil | --- | Install in accordance with section 6-21 | 2 |
| 25. | Plug | | --- | 1 |
| 26. | Cylinder Mount Pad | 7/16-14x7/16-20 | .81 | 36 |
| 27. | Cylinder 7th Stud | 7/16-14x7/16-20 | .95 | 6 |
| 28. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | 1.76 | 2 |
| 29. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | 1.88 | 2 |
| 30. | Plug | 5/8-18 | --- | 1 |
| 31. | Propeller Governor Pad | 5/16-18x5/16-24 | 1.38 | 4 |
| 32. | Bolt, Backbone | 5/16-24 | Must be installed prior to installing studs (item no. 6) | 1 |
| 33. | Washer | 5/16 I.D. | Must be installed prior to installing studs (item no. 6) | 1 |
| 34. | Stud, Engine Mount | 3/8-16x3/8-24 | 3.32 | 1 |
| 35. | Stud, Engine Mount | 3/8-16x3/8-24 | 1.51 | 4 |

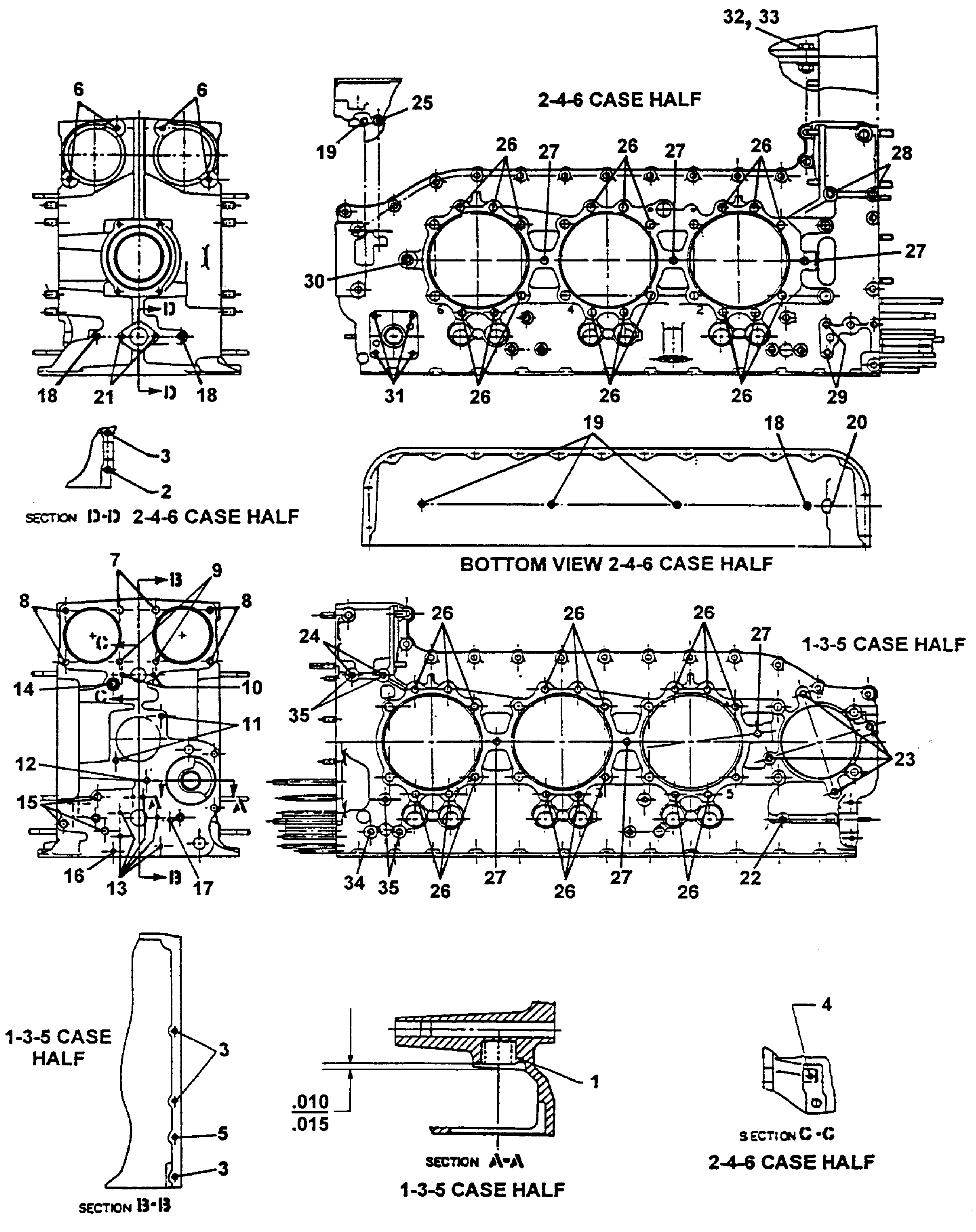



FIGURE 16-7C. CRANKCASE STUD SETTING HEIGHTS IO-550-C

**CRANKCASE STUD SETTING HEIGHTS IO-550-G, N, P, R AND IO-550-B9F, B14B, B19B, B30B**

NOTE…All studs, helical coils and plugs must be installed in accordance with the instructions in sections 6-21, 6-22 and 6-25. See Figure 6-2, "Standard And Oversize Stud Identification."

| ITEM NO | LOCATION | THREAD SIZE | SETTING HEIGHT (IN INCHES) | QTY. |
|---|---|---|---|---|
| 1. | Bearing, Starter Shaft Gear | --- | See section A-A | 1 |
| 2. | Helical Coil | --- | Install in accordance with section 6-21 | 1 |
| 3. | Helical Coil | --- | Install in accordance with section 6-21 | 4 |
| 4. | Dowel | 3/16 | .09 | 1 |
| 5. | Stud, Through | 5/16-18x5/16-24 | 5.41 | 1 |
| 6. | Magneto Mount Pad | 5/16-18x5/16-24 | .84 | 4 |
| 7. | Accessory Drive (rear) | 3/8-16x3/8-24 | .84 | 2 |
| 8. | Accessory Drive (rear) | 5/16-18x5/16-24 | .75 | 6 |
| 9. | Idler Pin Pad | 1/4-20x1/4-28 | .56 | 2 |
| 10. | Fuel Pump Pad | 5/16-18x5/16-24 | .75 | 2 |
| 11. | Starter Adapter Pad | 5/16-18x5/16-24 | 3.69 | 1 |
| 12. | Oil Pump Pad | 1/4-20x1/4-28 | 3.38 | 5 |
| 13. | Plug | 3/8 | --- | 1 |
| 14. | Oil Pump Pad | 3/8-16x3/8-24 | 2.94 | 3 |
| 15. | Oil Pump Pad | 1/4-20x1/4-28 | 1.77 | 1 |
| 16. | Oil Pump Pad | 5/16-18x5/16-24 | 3.71 | 1 |
| 16. | Oil Pump Pad (I0-550-N2B Only) | 5/16-18x5/16-24 | 4.31 | 1 |
| 17. | Plug | 1/8-27 | --- | 3 |
| 18. | Plug | 1/16-27 | --- | 4 |
| 19. | Plug | 1/8-27 | --- | 2 |
| 20. | Camshaft Cover Pad | 1/4-20x1/4-28 | .69 | 2 |
| 21. | Plug | 1/8-27 | --- | 2 |
| 22. | Alternator Pad | 5/16-18x5/16-24 | .81 | 4 |
| 23. | Helical Coil | --- | Install in accordance with section 6-21 | 2 |
| 24. | Plug | 1/8-27 | --- | 1 |
| 25. | Cylinder Mount Pad | 7/16-14x7/16-20 | .81 | 36 |
| 26. | Cylinder 7th Stud | 7/16-14x7/16-20 | .95 | 6 |
| 27. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | .76 | 2 |
| | ①Oil Cooler Mount Pad | 3/8-16x3/8-24 | .81 | 2 |
| 28. | Oil Cooler Mount Pad | 3/8-16x3/8-24 | .85 | 2 |
| | ①Oil Cooler Mount Pad | 3/8-16x3/8-24 | .88 | 2 |
| 29. | Plug | 5/8-18 | --- | 1 |
| 30. | Propeller Governor Pad | 5/16-18x5/16-24 | 1.38 | 4 |
| 31. | Bolt, Backbone | 5/16-24 | Must be installed prior to installing studs (item no. 6) | 1 |
| 32. | Washer | 5/16 I.D. | Must be installed prior to installing studs (item no. 6) | 1 |

① For IO-550-B9B, B14B, B19B, B30B, IO-550-G, G7B, IO-550-N, N2B, N6B, N8B, IO-550-R

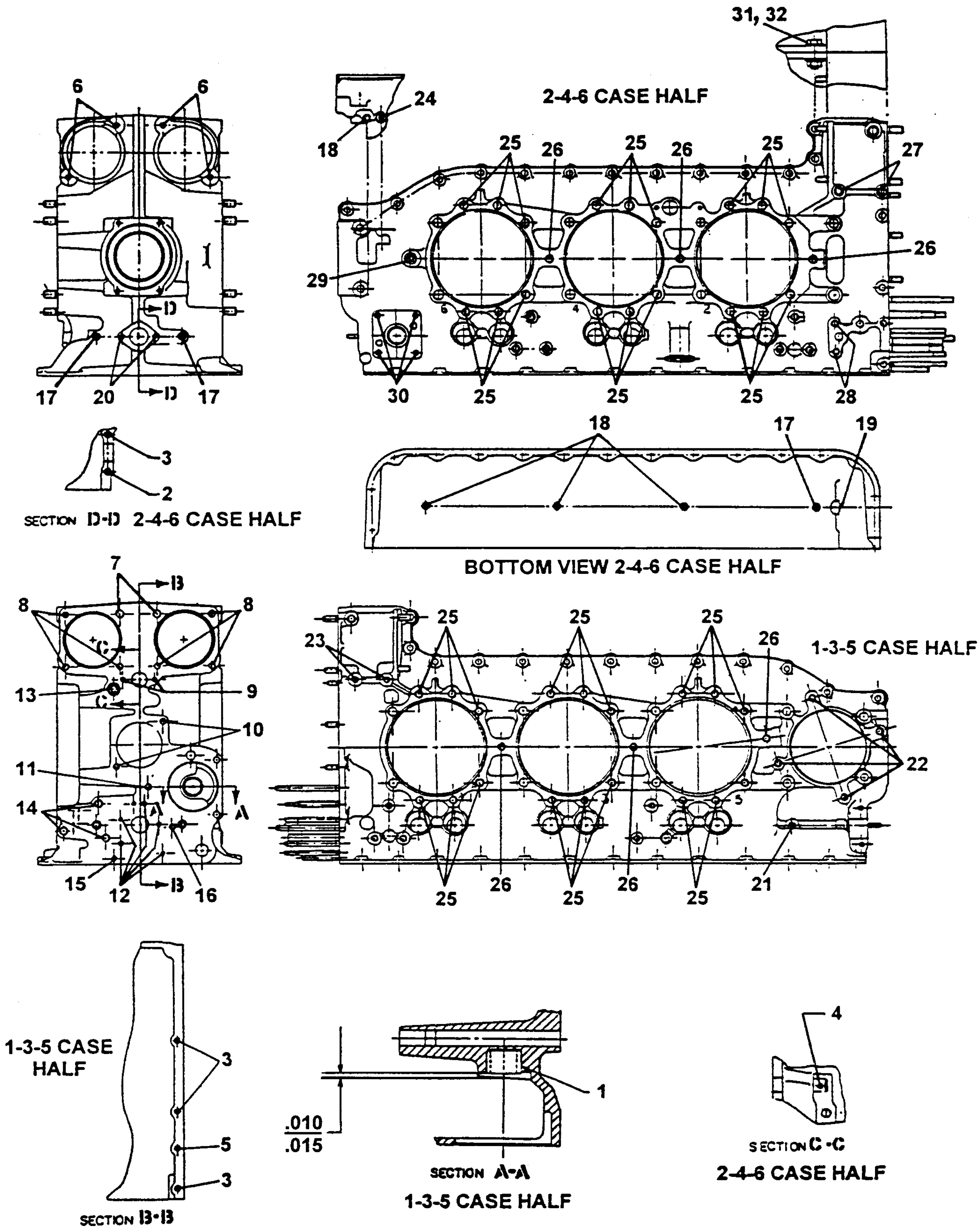



**FIGURE 16-7D. CRANKCASE STUD SETTING HEIGHTS IO-550-G, N, P, R AND IO-550-B9F, B14B, B19B , B30B**

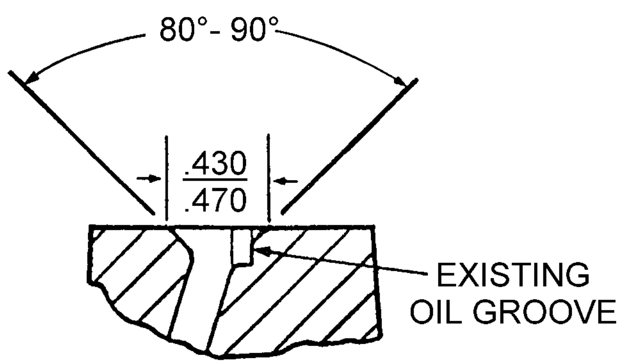
7. A proper chamfer at the crankcase main bearing oil feed holes must be maintained to reduce the possibility of crankcase cracking in that area.

   INSTRUCTIONS:

   a. Inspect the number one, two and three main bearing oil feed passages and determine if they conform to the illustration in Figure 16-8. The subject passages are located in the left (2-4-6) case half and begin in the rear main bearing saddle, counting forward.

   b. Any of the above mentioned oil feed passages which do not conform to the illustration in Figure 16-8 must be modified to conform. Deburr sharp edges after modification for smooth transition.

After the modification has been accomplished, clean crankcase and flush oil passages using mineral spirit solvent. All debris from modification procedure must be removed.




MAIN BEARING SADDLE

**FIGURE 16-8. CRANKCASE MAIN BEARING OIL FEED HOLE CHAMFER**

## FLUORESCENT PENETRANT INSPECTION

The crankcase halves and all aluminum alloy brackets must be fluorescent penetrant inspected by a certified technician in accordance with the instructions in section 6-12, "Fluorescent Penetrant Inspection. Crankcase halves that exhibit cracks must be discarded or repaired in accordance with the instructions in section 16-7.

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.

All components must be thoroughly cleaned and air dried prior to dimensional inspection.

NOTE... Prior to dimensional inspection of the case crankshaft and camshaft bores the crankcase must be assembled and torqued in accordance with the following:

1. All crankcase attaching hardware must be torqued to the sequence specified below.
2. Use 1/4 inch cadmium plated washers at cylinder 1/2 inch through bolt locations.
3. Torque 1/2 inch nuts to a preliminary torque of 350 inch pounds.
4. Torque 7/16 inch nuts to a preliminary torque of 225 inch pounds.
5. Torque 3/8 inch nuts to a preliminary torque of 190 inch pounds.
6. Torque 5/16 inch nuts to a preliminary torque of 100 inch pounds.
7. Torque 1/2 inch nuts to a final torque of 750 inch pounds.
8. Torque 7/16 inch nuts to a final torque of 450 inch pounds.
9. Torque 3/8 inch nuts to a final torque of 300 inch pounds.
10. Torque 5/16 inch nuts to a final torque of 160 inch pounds.

NOTE...See "New Parts Dimensions of this section for crankcase bore diameters.

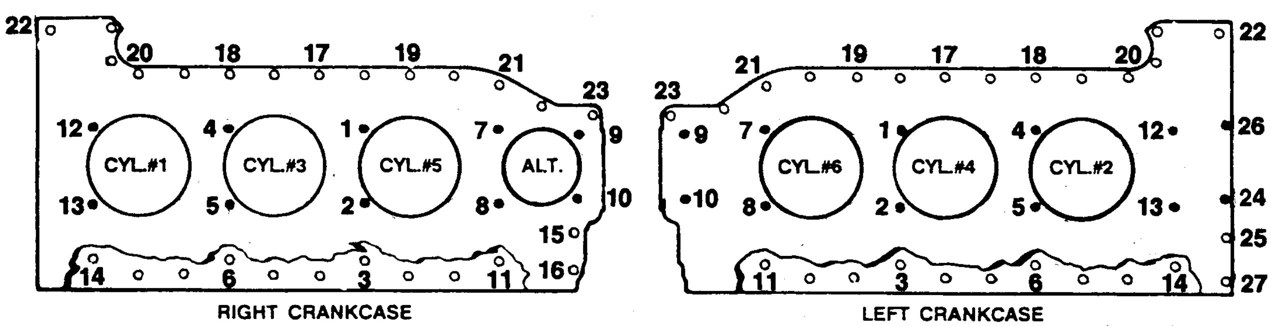



**FIGURE 16-9. DIMENSIONAL INSPECTION TORQUING SEQUENCE**

## CRANKCASE FITS AND LIMITS (see Figure 16-10)

| Ref. No. | Description | New Parts | |
|---|---|---|---|
| | | Min., | Max. |
| | CRANKCASE | | |
| 1. | Through bolt in crankcase ............ Diameter: | 0.0000L | 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: | 0.030 | 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: | 0.0010L | 0.0050L |
| 9. | Starter shaftgear roller bearing hole ............ Diameter: | 0.9995 | 1.0005 |
| 10. | Governor drive shaft in crankcase ............ Diameter: | 0.0014L | 0.0034L |
| 11. | Crankcase (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 |

## NEW PARTS DIMENSIONS

| Part Name | Feature | New Dimension (inches) |
|---|---|---|
| Crankcase | Crankshaft Journal Bore diameter | 2.5625 - 2.5635 |
| | Camshaft Journal Bore Diameter | 1.0000- 1.0010 |
| | Tappet Guides Diameter | 1.0005- 1.0015 |
| | Governor Driven Gear Bearing Diameter | 0.8750 - 0.8760 |
| | Starter Shaft Needle Bearing Hole Diameter | 0.9995- 1.0005 |
| | | |
| Idler Gear Support Pin | Crankcase Support Diameter (front) | 0.9990- 1.0000 |
| | Crankcase Support Diameter (rear) | 1.0620- 1.0630 |
| | | |
| Camshaft | Journal Diameter (4) | 0.9980 - 0.9990 |
| | | |
| Hydraulic Valve Tappets | Outside Diameter | 0.9990 - 0.9995 |

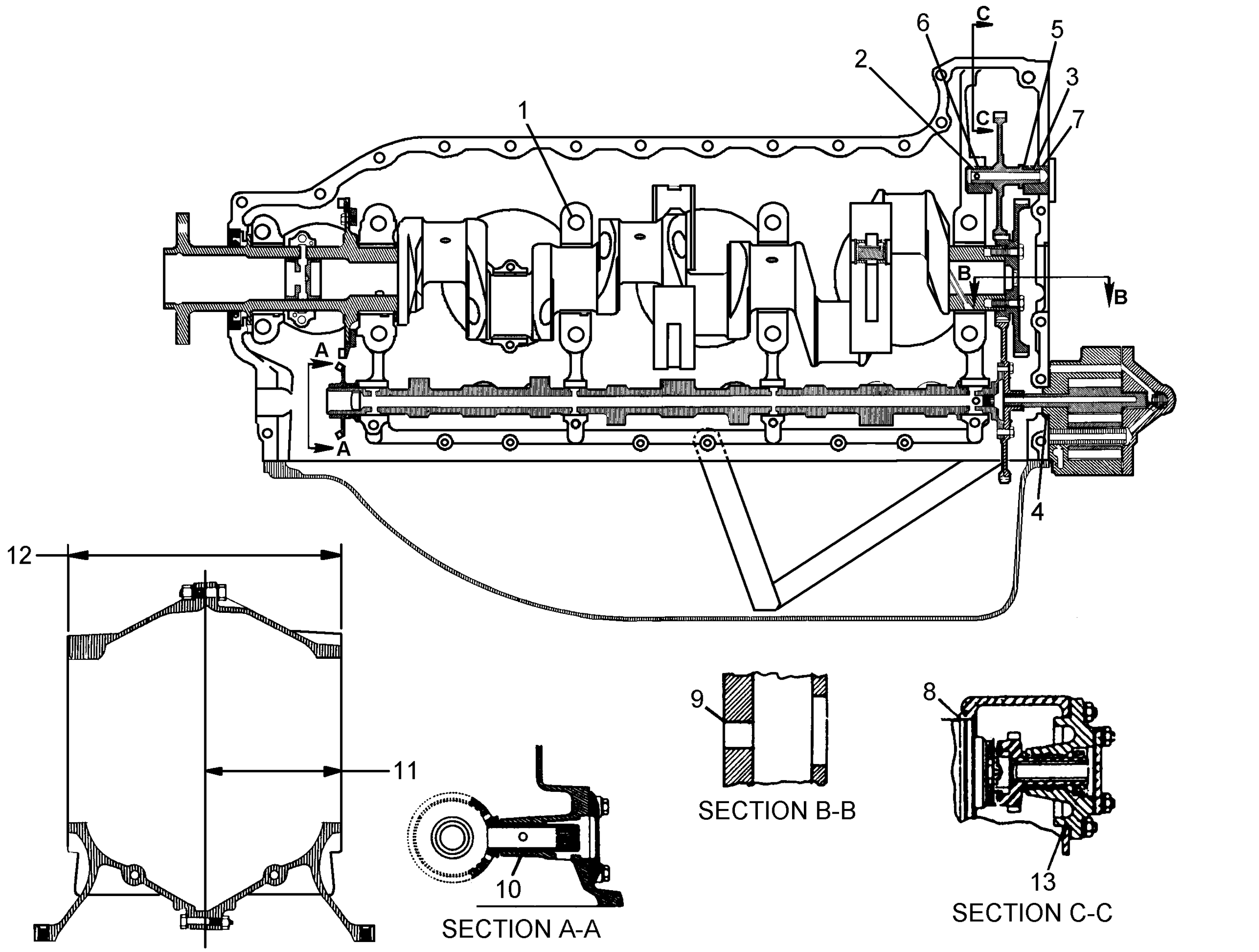



**FIGURE 16-10. CRANKCASE FITS AND LIMITS**

## 16-7 CRANKCASE AND ASSOCIATED PARTS REPAIR AND REPLACEMENT

Any crankcase or associated parts worn beyond new parts limits or failing to meet inspection criteria in section 16-6 must be replaced 100% unless repair is possible with the following instructions:

1. Crankcases with cracks must be replaced or repaired. Teledyne Continental Motors has established that welding of crankcases is an acceptable repair process. Weld repairs in the crankcase non critical areas shown in Figures 16-6 may be accomplished by a repair facility certified for specialized crankcase repairs.

   The dimensional integrity of the crankcase must be maintained.

**WARNING**

**No weld repairs are allowed in the critical areas shown in Figure 16-6**.

2. Installation of crankcase cylinder deck stud hole helical coils must be accomplished in accordance with the specifications in Figure 16-11 and the instructions in section 6-21, "Helical Coil Insert Replacement."

**WARNING**

**The 2 and 4 o'clock crankcase cylinder deck stud positions must not be repaired by helical coil insert installation .**

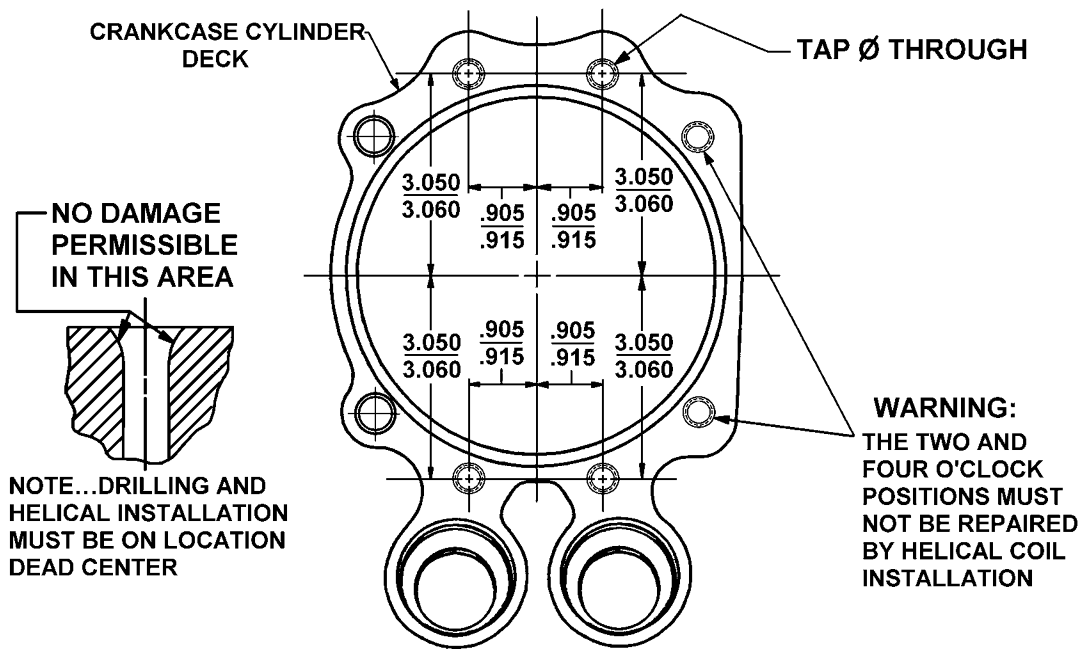



**FIGURE 16-11. CRANKCASE CYLINDER DECK HELICAL COIL INSTALLATION**

3. Any crankcase stud found to be damaged or loose must be replaced in accordance with the instructions in section 6-22. See Figure(s) 16-7A through 16-7D, "Crankcase Stud Setting

Heights," for proper stud setting heights. See the following for crankcase cylinder mount deck studs.

NOTE…Crankcase cylinder mount deck studs requiring replacement must be replaced in accordance with the following instructions:

a. Studs and tapped holes must be clean and dry.

b. Apply Lockquick Primer grade "N" to stud and cylinder deck threads and allow to dry.

c. Apply Loctite grade 271 to both threads.

d. Install studs to appropriate setting height. See Figures 16-7A through 16-7D.

e. Wipe excess Loctite from cylinder deck.

f. Allow two hours minimum setting time before testing stud break away torque.

g. Test studs after they have cured. The studs must not break away under a torque load of 100 inch pounds.

h. Studs conforming with the break away toque test can be utilized for cylinder installation.

4. Crankcases with crankshaft or camshaft bearing bores that exceed the specified critical new parts diameter must be discarded or line bored oversize. Line boring may be accomplished by a repair facility certified for specialized crankcase repairs. See section 16-6 for new parts dimensions.

5. Crankcase halves exhibiting fretting must be discarded or machined. Crankcase machining may be accomplished by a repair facility certified for specialized crankcase repairs. The crankcase parting line to cylinder deck new parts dimension is 4.560 minimum to 4.565 maximum. After machining process the service minimum cylinder deck height dimension must not exceed 4.5540 minimum. Crankcase halves exceeding this dimension must be discarded.

*CAUTION…Gear backlashes must not be less than the specified minimum after machining.*

6. The case half parting line surface must be flat within .005 true indicator reading but not to exceed cumulative of .008 true indicator reading with mating crankcase half. Crankcase halves exceeding these dimensions must be discarded. After all machining procedures have been completed the crankcase halves must be fluorescent penetrant inspected by a certified technician as specified in section 16-6 in accordance with section 6-12, "Fluorescent Penetrant Inspection."

7. Section 6-19, "Application Of Accelagold," applies to all aluminum alloy castings, sheet metal and tubing .

## 16-8 CRANKCASE SUB-ASSEMBLY

NOTE…All crankcase components must be clean and completely free of debris before assembly.

1. See Figures 16-7A through 16-7D as applicable, "Crankcase Stud Setting Heights." Install all pipe plugs that were removed in accordance with the specifications in Figures 16-7A through 16-7D as applicable. Before installation, apply Loctite Pipe Sealant with Teflon (PS/T) sparingly on the pipe plug male threads. Install and torque plugs to the specified values in Table 6-2, "Pipe Plug Torques."

**WARNING**

**Use the proper installation tool when installing bearing.**

2. See Figure 16-4. Using an arbor press and a TCM crankcase roller bearing installer or equivalent as shown in Figure 16-12, stand the 1-3-5 crankcase on it's nose end and press a new roller bearing (2) with P/N facing outward into the bearing bore Press the bearing into case until it bottoms out.

3. See Figure 16-2, "Oil Filler, Idler Support Pin & Camshaft Cover." Install new o-ring (2) on oil filler adapter (3). Install new o-ring (1) in oil filler adapter (3). Lightly coat o-rings (1, 2) with clean 50 wt. aviation engine oil. Install adapter into left crankcase half. Make sure o-rings are not pinched or twisted. Insert oil filler tube (5) into adapter (3). Do not displace o-ring (1). Using a new gasket (4), attach oil filler assembly to left case half and secure with attaching hardware (6, 7, 8). Torque bolts (8) to 155-175 inch pounds.
4. See Figure 16-3A, "Engine Mounts, Crankshaft Seal Retainer & Governor Cover IO-550-A, B & C." On IO-550-A crankcase, install engine mounts (6, 7) and secure using attaching hardware (8, 9). Torque nuts (9) to 275-325 inch pounds.

NOTE…On I0-550-C use right lower engine mount bracket P/N 653306 which replaces P/N 630695.

On IO-550-C crankcase, install engine mounts (2, 4 & 5) and secure using attaching hardware (8, 9 & 10). Torque nuts (9) to 275-325 inch pounds torque. Engine mount (3) will be installed with the oil cooler during final engine assembly. IO-550-B and IO-550-R engine mounts are installed in section 14-7, "Oil Sump."

5. See Figure 16-3B, "Engine Mounts, Crankshaft Seal Retainer & Governor Cover IO-550-G, N, P & R." Install engine mounts (1, 2) on crankcase halves and secure using attaching hardware (4, 5 & 6). Torque bolts (5, 6 ) to 220-260 inch pounds.

6. Cover and store crankcase halves and associated parts in a clean protected area until final engine assembly.

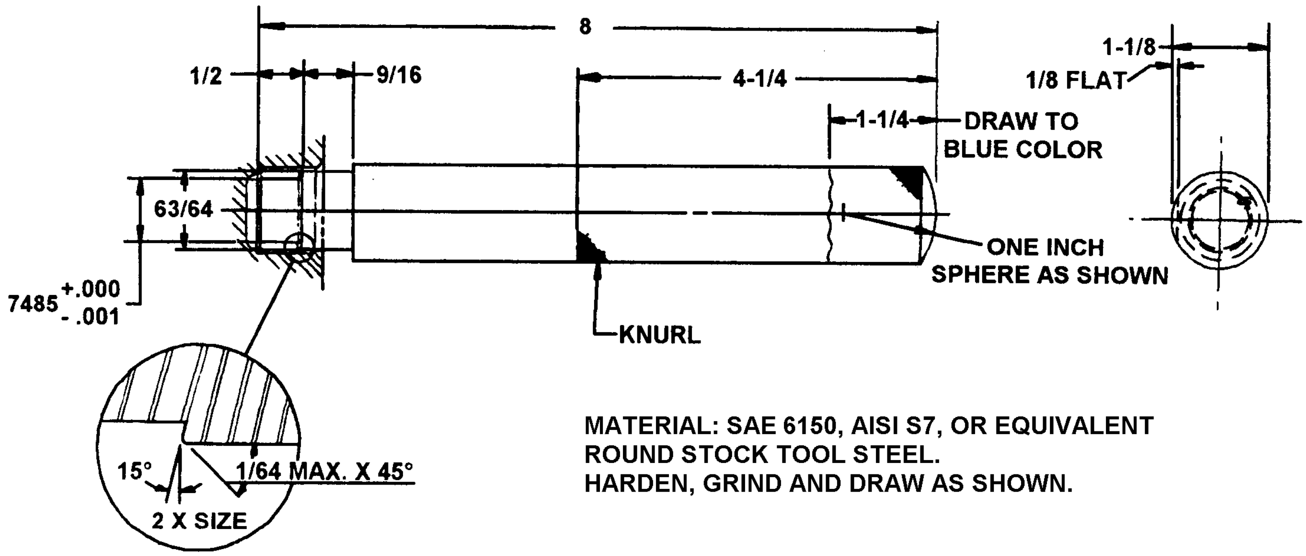



**FIGURE 16-12. CRANKCASE NEEDLE BEARING INSTALLER**

INTENTIONALLY

LEFT

BLANK

# CHAPTER 17

# ENGINE DRIVE TRAIN

## 17-1 CAMSHAFT AND CRANKSHAFT DISASSEMBLY

### CAMSHAFT

1. See Figure 17-1A, "Camshaft Assembly (Old Style)." Remove the governor drive gear (7) and woodruff key (6). Cut and remove lockwire from bolts (5). Remove four bolts (5) and camshaft gear (4). Remove rear 1/4-18 brass plug. Using a 30 inch long section of 3/8 diameter round bar stock and a non marring hammer, carefully drive front camshaft plug out. The camshaft must now be magnetic particle inspected in accordance with section 6-9. During magneflux inspection pay particular attention to front plug and keyway area. Camshafts with evidence of cracks must be discarded.

## WARNING

**Failure to replace camshaft plugs at reassembly will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.**

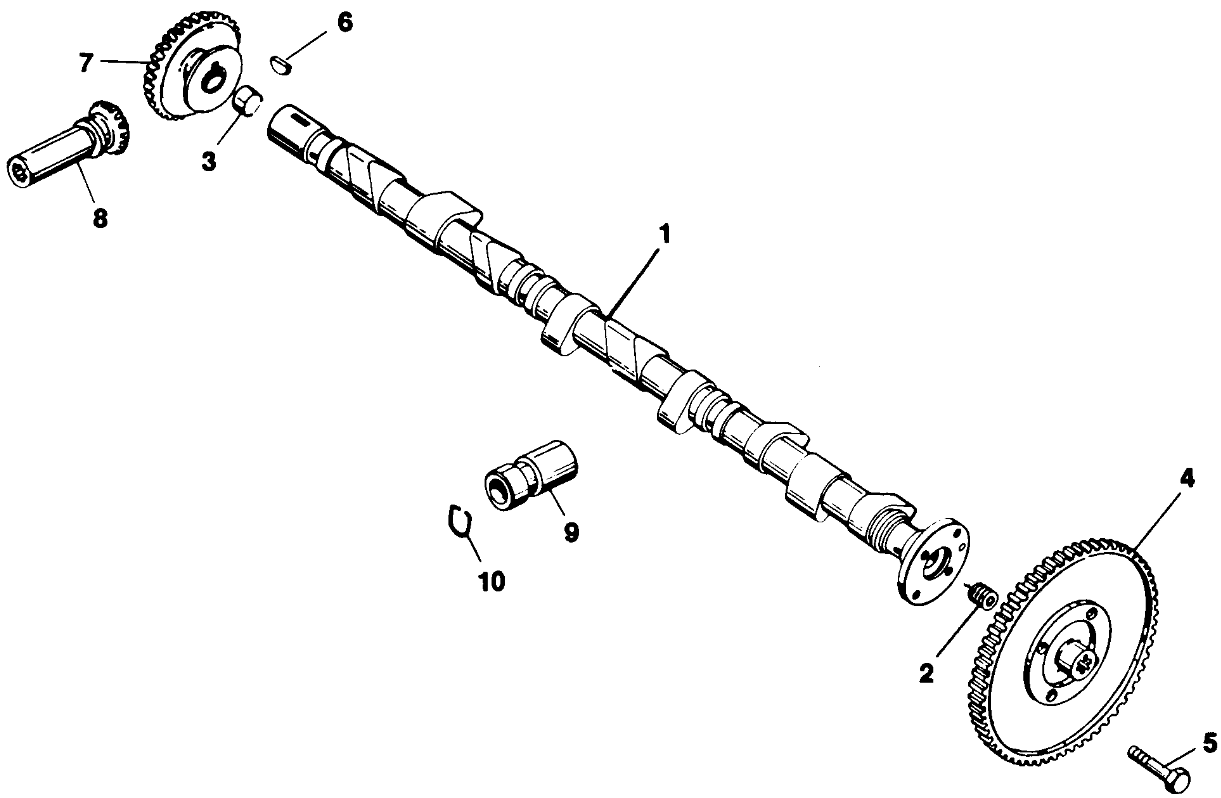



**FIGURE 17-1A. CAMSHAFT ASSEMBLY (OLD STYLE)**

1. Camshaft Assembly
2. Plug, Pipe
3. Plug, Expansion
4. Gear, Camshaft
5. Bolt
6. Key, Woodruff
7. Gear, Governor Drive
8. Gear, Governor Driven
9. Tappet, Hydraulic
10. Ring, Retaining

1. See Figure 17-1B, "Camshaft Assembly (New Style)." Remove the governor drive gear (6). Cut and remove lockwire from bolts (5). Remove four bolts (5) and camshaft gear (4). Using the correct size tool remove the front and rear plug.

## WARNING

**Failure to replace camshaft plugs at reassembly will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.**

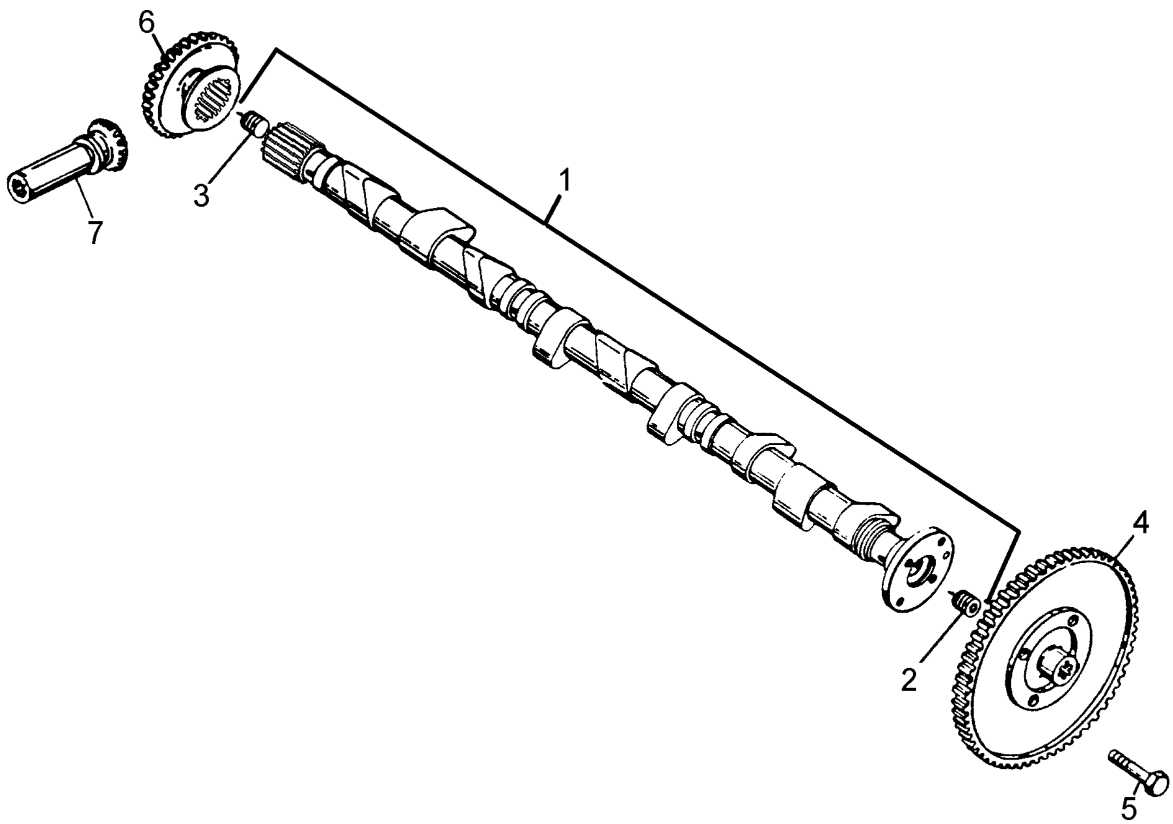



**FIGURE 17-1B. CAMSHAFT ASSEMBLY (NEW STYLE)**

1. Camshaft Assembly
2. Plug
3. Plug
4. Gear, Camshaft
5. Bolt
6. Gear, Gov. Drive
7. Gear Gov. Driven

**CRANKSHAFT**

1. See Figure 17-2, "Crankshaft Assembly." Use wooden support blocks under the front and rear main journals of the crankshaft during disassembly.
2. Remove nuts (4) and bolts (5). Separate connecting rod caps (6) and rod (7). Remove bearing inserts (8). Loosely reassemble rods, caps, bolts and nuts with their position numbers matched.
3. Remove and discard retaining rings (10), plates (11) and pins (12, 13, 14). Lift counterweight assemblies (15) from crankshaft.
4. Remove nuts(17) and separate oil transfer collar assembly (18 through 21) from crankshaft. Remove and discard o-ring (21).
5. Cut safety wire and remove six bolts (22) and gears (23, 24). Tap circumference on gear using a rawhide mallet and remove.
6. Remove four bolts (25), lockplates (26) and alternator drive gear (27). Discard lockplates (26).
7. Twist and remove split reinforcing ring (29) from oil seal (30). Work oil seal spring (28) from oil seal groove and detach from seal. Twist and remove oil seal from crankshaft. Discard reinforcing ring (29), oil seal (30) and spring (28).

## WARNING

**The counterweights and crankshaft must not be punch marked or scribed for location identification. Use tagging or ink methods to identify.**

8. Discard connecting rod bearings (8), retaining rings (10), retaining plates (11) and counterweight pins (12, 13, 14).

| | | |
|---|---|---|
| 1. Washer, Thrust | 12. Pin, Cwt., 6th Order | 23. Gear, Cluster, Large |
| 2. Bearing, Crankshaft Main | 13. Pin, Cwt., 4th Order | 24. Gear, Cluster, Small |
| 3. Gear, Idler | 14. Pin, Cwt., 5th Order | 25. Bolt |
| 4. Nut, Spiral Lock | 15. Counterweight Assembly | 26. Plate, Tab Lock |
| 5. Bolt, Connecting Rod | 16. Bushing, Counterweight | 27. Gear, Alternator Drive |
| 6. Cap, Connecting Rod | 17. Nut, Marsden | 28. Spring |
| 7. Rod, Connecting | 18. Pin, Dowel | 29. Ring, Reinforcing |
| 8. Bearing, Connecting Rod | 19. Collar, 1-3-5 Side | 30. Seal, Oil |
| 9. Bushing, Piston Pin | 20. Collar, 2-4-6 Side | 31. Bushing, Damper |
| 10. Ring, Retaining | 21. O-Ring | 32. Dowel, Crankshaft |
| 11. Plate, Counterweight | 22. Screw, Drilled Head | 33. Crankshaft |

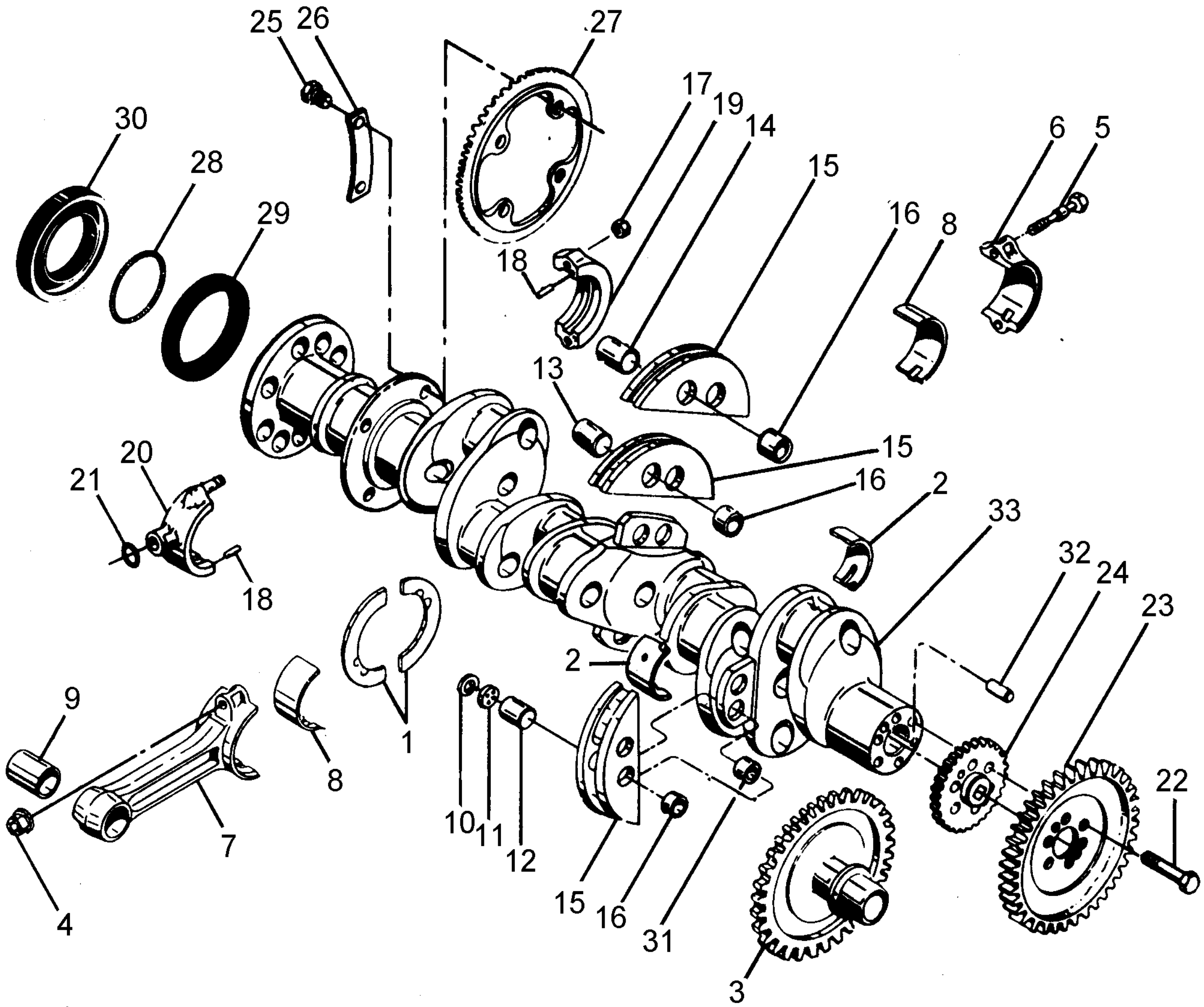



**FIGURE 17-2. CRANKSHAFT ASSEMBLY**

## 17-2 ENGINE DRIVE TRAIN CLEANING

1. The camshaft, crankshaft, connecting rods and their associated parts must be cleaned in accordance with the instructions in section 6-7, "General Cleaning," and the following special instructions:
2. All hydraulic tappets, rubber oil seals, springs, crankshaft main bearings, thrust washers, connecting rod bearings, counterweight pins, retainer plates and snap rings removed from the crankhaft and o-rings removed from the oil transfer collar must be replaced 100% at overhaul. Cleaning of these parts is not required.
3. Crankshaft counterweight hanger blade bushings, counterweight bushings and connecting rod bushings must also be replaced 100% at overhaul.
4. All areas of the camshaft and crankshaft must be degreased by brushing or spraying with mineral spirit solvent. The crankshaft crank pins, main journals, oil seal race, oil transfer collar area and camshaft journals and gear mount flange must be smoothed with crocus cloth moistened in mineral spirits. This is to be accomplished while the shaft is rotated in a lathe at approximately 100 RPM. All gum (varnish) deposits must be removed to permit reliable magnetic indications during magnetic particle inspection.
5. Flush the internal portion of the camshaft using mineral spirit solvent. Insure that all threads, oil passages and recesses are clean and free of debris.
6. Flush the internal portion of the crankshaft using mineral spirit solvent. Insure that all threads, oil passages and recesses are clean and free of debris.
7. Clean the counterweights using mineral spirits.

**WARNING**

**Do not pressure blast counterweights with an abrasive media. Blasting will remove surface hardening.**

8. Remove the connecting rod bolts and nuts but do not discard at this time. All areas of the connecting rods must be degreased by brushing or spraying with mineral spirit solvent. Insure all bolt holes, oil passages and recesses are clean and free of debris. All gum (varnish) deposits must be removed to permit reliable magnetic indications during magnetic particle inspection.
9. Clean gears that have bushings using mineral spirit solvent and a brass wire brush. Gears with bushings must not be cleaned using alkaline solutions. Gears that do not have bushings can be cleaned using mineral spirit solvent or by immersion in a alkaline stripping bath, if mineral spirit solvent is not effective. After cleaning with alkaline solution, the gears must be sprayed with steam removing all traces of alkaline. After steam rinsing the gears must be thoroughly flushed with mineral spirit solvent.

*CAUTION…Alkaline cleaning solutions will cause corrosion to metals if not completely removed.*

**WARNING**

**Do not pressure blast gears with an abrasive media. Blasting will remove surface hardening.**

## 17-3 ENGINE DRIVE TRAIN INSPECTION

### WARNING

**Use only crankshafts that are manufactured from VAR forgings identified by the letters VAR forged into a crankshaft cheek.**

### VISUAL INSPECTION

The crankshaft, camshaft, connecting rods and associated engine drive train components must be visually inspected in accordance with the instructions in section 6-8, "Visual Inspection," and the following special instructions.

1. Visually inspect the camshaft journals and lobes using a 10X magnifying glass. Inspect the camshaft journals and lobes for scoring, pitting, corrosion and any indications of wear. Camshafts exhibiting scoring pitting, corrosion or wear indications must be repaired or discarded. Inspect the camshaft gear splines for wear. Discard camshafts with worn splines. Inspect the camshaft gear flange for nicks, peening and other irregularities. The flange must be smooth to align gear. Inspect the camshaft gear flange bolt holes for distorted or stripped threads. Camshaft repairs must be accomplished using a procedure and process which meets the requirements of the applicable federal aviation regulations.
2. Using a Borrough's 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. Dimensionally inspect the crankshaft mains and crank pins for required specified size.
3. Visually inspect the crankshaft main journals, crankpins and oil seal area for scoring and burning. Inspect the gear bolt holes for distorted or stripped threads. Check oil passages for obstructions and loose oil tubes. Check the gear dowel for a tight fit. Inspect the oil control plug for presence, obstructed oil hole and tight fit. Visually inspect the entire crankshaft for rust and pitting. Crankshafts exhibiting any of the above indications must be repaired or replaced. Crankshaft repairs must be performed under carefully controlled conditions using an approved procedure and process which meets the requirements of the applicable federal aviation regulations.

### WARNING

**The counterweights and crankshaft must not be punch marked or scribed for location identification. Use tagging or ink methods to identify.**

4. Using a 10X magnifying glass, visually inspect counterweights for cracks, nicks, evidence of contact between bottom of counterweight and crankshaft. Counterweights exhibiting these indications must be discarded.
5. Using a 10X magnifying glass, visually inspect the crankshaft gear and idler gear drive gear teeth for signs of overheating and wear. Normal wear produces a fine polish on the tooth thrust faces. Gears that have alteration of the tooth profiles, score marks, pitting or galling must be discarded. See Figure 8-3, “Gear Tooth Wear,” for acceptable and unacceptable gear tooth wear.
6. Insure that connecting rod and cap mate marks are adjacent to each other and that the position numbers stamped on or adjacent to the bolt boss match. **Scrap connecting rods and caps that do not meet this criteria.**

   Visually inspect connecting rod for corrosion pitting, rust, discoloration (bluing), galling, impact damage, nicks, bending and twisting. **Scrap connecting rods with any of these indications.**

Remove nuts and bolts from connecting rod and separate rod and cap. Visually inspect connecting rod and cap parting surface. Contact signatures resulting from assembly forces are normal and acceptable. However, connecting rods exhibiting fretting signatures that have resulted in the loss of metal as indicated by removal of the original machining marks, either locally or over the entire surface, are not acceptable for continued service.

NOTE…Scrap connecting rods with fretting at the parting surfaces, DO NOT REWORK.

Visually inspect nut seat area. Excessive fretting signatures indicating loss of material or signatures of edge loading of the bolt under head surface contact area is cause for rejection and scrap.

Visually inspect dowel surfaces at rod and cap bolt holes. Indications of distortion or scoring are cause for rejection and scrap.

Insuring that the mate marks are adjacent to each other and the position numbers match, assemble the connecting rod and cap by installing one bolt through 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 not meeting this criteria.**

Lubricate connecting rod bolt and nut threads with clean 50 weight aviation oil. On assemblies using the 643112 bolts and 643215 nuts, torque the nuts to 550-600 inch pounds. On assemblies using the 654490 bolts and 643215 nuts, torque the nuts to 690-710 inch pounds.

Inspect the inside diameter joint of the rod to cap with both bolts and nuts installed and torqued. Mismatch (or a step) of more than 0.001 inch is not acceptable. An acceptable method of checking mismatch is to use a dial indicator as follows:

Place the rod on a surface plate so that the splitline is at the 6 and 12 o'clock position. Use vee blocks to hold the rod in place. Using a dial indicator mounted on a height gauge, zero out on one side of the splitline. Move the indicator across the splitline. There must be no more than 0.001 indicator movement.

Remove piston pin bushing from connecting rod in accordance with section 17-4.

Inspect piston pin bushing bore and surrounding area for nicks, gouges and mechanical damage. **Scrap connecting rods with any of these indications.**

Using precision measuring equipment, such as dial bore gauge or air gauge, verify that the connecting rod meets the dimensional specifications provided in Dimensional Inspection, New Parts Dimensions and Figures 17-4A and 17-5. Measure the connecting rod big bore diameter 15 to 30 degrees either side of connecting rod split line and 90 from the first measurement. Difference between the two measurements must not exceed .0015. **Connecting rods and caps not meeting these specifications must be scrapped.**

Inspect the rod channel rails for damage such as nicks, gouges or mechanical damage. Scrap rods with any of these indications.

Visually inspect oil transfer collar assembly for cracks and scoring. Discard cracked or scored oil control collars. Visually inspect oil control collar inside diameter area to insure tin plating is intact. If tin plating has worn away discard oil control collar. Inspect studs for distorted or stripped threads. Inspect studs for corrosion, pitting, incomplete threads and looseness. Replace studs with any of these indications. Studs and dowels must be checked for security and proper setting height. See the following for oil transfer collar stud setting heights

| ITEM NO | LOCATION | THREAD SIZE | SETTING HEIGHT | QTY. |
|---|---|---|---|---|
| 1. | Stud, Oil Control Collar | 1/4x1-1/4 Lg. | 15/16 | 2 |
| 2. | Dowel | 1/8x7/16 Lg. | 5/32 | 2 |

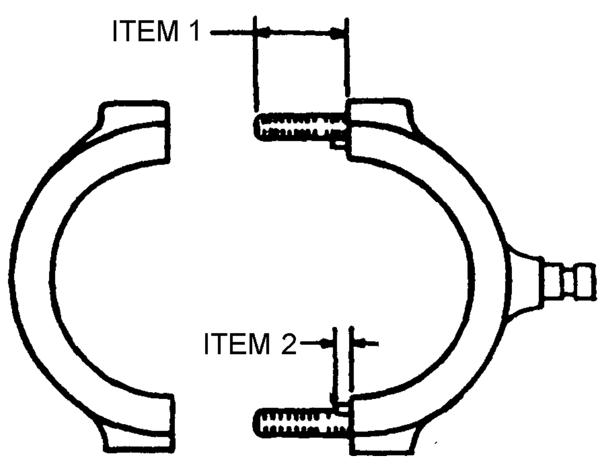



**FIGURE 17-3. OIL CONTROL COLLAR STUD AND DOWEL SETTING HEIGHTS**

## MAGNETIC PARTICLE INSPECTION

NOTE…The standard magnetic particle inspection procedure found in the latest revision of ASTM Standards on nondestructive testing describes the method of magnetization, inspection and demagnetization.

The crankshaft, counterweights, camshaft, crankshaft gears, camshaft gear, idler gear and governor drive gear must be magnetic particle inspected by a certified technician in accordance with the instructions in Section 6-9, "Magnetic Particle Inspection."

Crankshafts, camshafts, crankshaft gears, camshaft gears, idler gears or drive gears exhibiting cracks must be discarded.

The connecting rod parts must be magnetic particle inspected by a certified technician in accordance with the instructions in Section 6-9, "Magnetic Particle Inspection."

The connecting rod parts must be clean and free of rust, scale, oil or other residue that may affect reliability of magnetic particle inspection. Connecting rods will be inspected using both the circular and longitudinal method of magnetization.

Acceptable indications must be associated with steel inclusions or shallow imperfections on the forging surface. Accept light indications running parallel to the rod axis or around the pin boss and cap ends less than 1/2 inch in length.

Indications associated with forging laps or with heat treatment are deemed cracks and are not acceptable.

The area of blend between the piston pin boss extending one inch into the channel section of the connecting rod, the bolt spot face areas and the channel rail edges are critical and must be free of any indications.

Any indication transverse to the rod axis is not acceptable.

**Reject and scrap connecting rods exhibiting unacceptable indications.**

## CRANKSHAFT ULTRASONIC INSPECTION

The crankshaft must be ultrasonic inspected by a certified technician in accordance with section 6-10.

## DIMENSIONAL INSPECTION

The following new parts limits must be used for dimensional inspection. Components that do not meet the following specifications must be discarded.
All components must be thoroughly cleaned and air dried prior to dimensional inspection.

| Ref. No. | | Description | New Parts Min. | New Parts Max. |
|---|---|---|---|---|
| | | **CRANKSHAFT** | | |
| 1. | | Crankshaft main bearings ........................................ Diameter: | 0.0010L | 0.0040L |
| 2. | ① | Crank pins ........................................ Out-of-Round: | 0.0000 | 0.0005 |
| 3. | ① | Main journals ........................................ Out-of-Round: | 0.0000 | 0.0005 |
| 4. | | Crankshaft | | |
| A. | | Front........................................ Diameter: | 2.352 | 2.376 |
| B. | | #5 & #4 Journals ........................................ Diameter: | 2.373 | 2.375 |
| C. | | Rear & Intermediate Journals ........................................ Diameter: | 2.623 | 2.625 |
| 5. | | Crank pins Diameter: | 2.248 | 2.250 |
| 6. | | Crankshaft run-out at center main journals (shaft supported at thrust and rear journals) full indicator reading ........................................ : | 0.0000 | 0.0070 |
| 7. | | Crankshaft run-out at propeller flange (when supported at front and rear main journals) full indicator reading ........................................ Pilot: | 0.0000 | 0.0020 |
| | | ........................................ Face: | 0.000 | 0.003 |
| 8. | | Damper pin bushing in crank cheek ext. ........................................ 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: | 0.005 | 0.012 |
| 17. | | Camshaft run-out at center journals (shaft support at end journals) full indicator reading........................................ : | 0.0000 | 0.0010 |
| 18. | | Camshaft gear on camshaft flange........................................ Diameter: | 0.0005T | 0.0015T |
| 19. | | Governor drive gear on camshaft ........................................ Diameter: | 0.0010L | 0.0030L |
| | | **ACCESSORY DRIVE IDLER** | | |
| 20. | | Idler gear support bushing in crankcase (front) ........................................ Diameter: | 0.0000L | 0.0015L |
| 21. | | Idler gear support bushing, flanged, in crankcase (rear) ........................................ Diameter: | 0.0005L | 0.0015T |
| 22. | | Idler gear........................................ End Clearance: | 0.030 | 0.0770 |
| | | **CONNECTING ROD** | | |
| 23. | | Bushing in connecting rod ........................................ Diameter: | 0.0025T | 0.0050T |
| 24. | | Bolt in connecting rod ........................................ Diameter: | 0.0000 | 0.0018L |
| 25. | | Connecting rod bearing on crank pin........................................ Diameter: | 0.0009L | 0.0034L |
| 26. | | Connecting rod on crank pin ........................................ End Clearance: | 0.0060 | 0.0110 |
| 27. | | Connecting rod bearing and bushing twist or convergence per inch of length........................................ : | 0.0000 | 0.0005 |

NOTES:

① If crankshaft is worn beyond these limits it may be repaired by grinding crank pins and journals to 0.010" under new shaft limits and re-nitriding. Crankshaft machining may be accomplished by a repair facility certified for specialized crankshaft repairs .

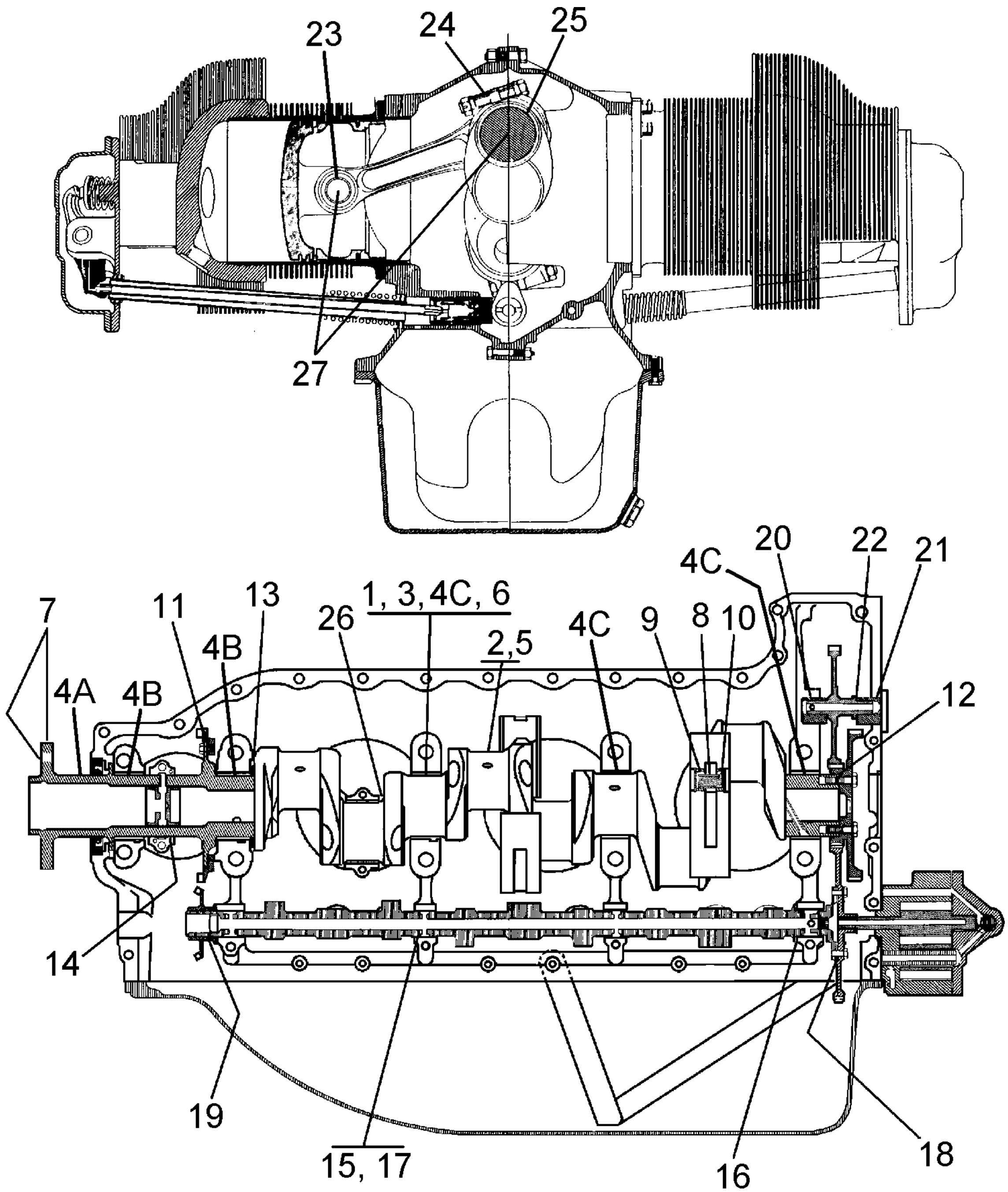



**FIGURE 17-4A. CRANKSHAFT, CAMSHAFT AND CONNECTING ROD FITS AND LIMITS**

During dimensional inspection the camshaft must be mounted on matched vee blocks supporting the front and rear main journals. The crankshaft must be mounted on matched vee blocks supporting the #3 and rear main journals. The vee blocks must be mounted on a surface plate. Rotate the shafts under a dial indicator placed on the center main journal to detect bending (runout). Rotate the crankshaft prop flange under a dial indicator to detect bending (runout). See items (2, 3, 17) of Figure 17A-, "Crankshaft and Camshaft Fits and Limits," for camshaft and crankshaft runout tolerances.

| Ref. No. | Description | New Parts | |
|---|---|---|---|
| | | Min. | Max. |
| | GEAR BACKLASH | | |
| 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 shaftgear and crankshaft gear .......................................Backlash: | 0.0080 | 0.0120 |

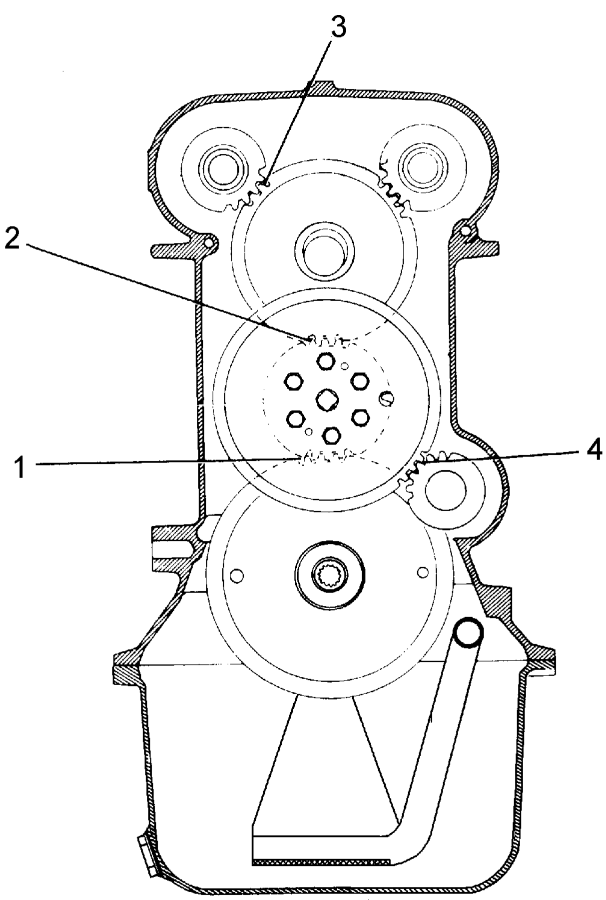



**FIGURE 17-4B. CRANKSHAFT, CAMSHAFT AND IDLER GEAR BACKLASH**

## DIMENSIONAL INSPECTION (continued)

The connecting rod piston pin bushing alignment must be checked 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 long. A surface plate, two matched vee blocks, and two blocks of ground flat steel stock of equal height are required. To measure twist, insert the arbors into the rod bores. Then place the big end arbor (crank pin end) in the vee blocks on the surface plate. Place the ground steel blocks under the ends of the bushing arbor (piston pin end) a measured distance apart. Use a leaf type feeler gauge to detect any clearance under the arbor ends. This divided by the separation of the blocks in inches will give the twist per inch of length. To measure bushing and bearing convergence 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. Pass the indicator over the bushing arbor on both sides of the connecting rod at points an exact number of inches apart. For exact parallelism the two measurements must be the same. See Figure 17-5, "Connecting Rod Dimensions."

### WARNING

**FAILURE TO COMPLY WITH THESE SPECIFICATIONS AND INSTRUCTIONS MAY RESULT IN ENGINE MALFUNCTION AND STOPPAGE.**

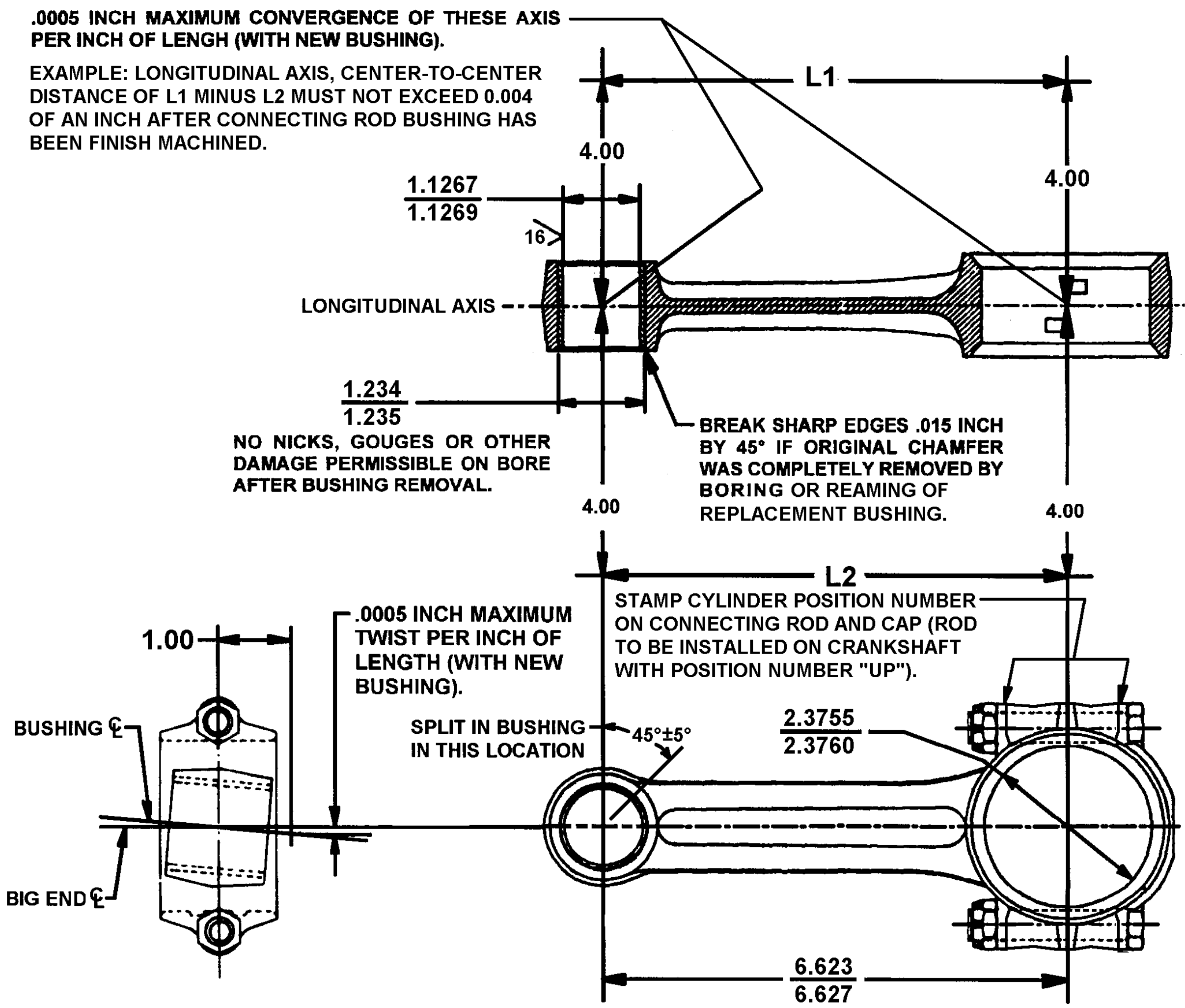



**FIGURE 17-5. CONNECTING ROD DIMENSIONS**

**NEW PARTS DIMENSIONS**

| Part Name | Feature | New Dimension (Inches) |
|---|---|---|
| Crankshaft | Front<br>Rear & Intermediate Journals<br>#5 & #4 Journals<br>Crank pins | 2.352 - 2.376<br>2.623 - 2.625<br>2.373 - 2.375<br>2.248 - 2.250 |
| Crankshaft Counterweight Hanger | Blade Bushing Inside Diameter | 0.622 - 0.626 |
| Camshaft | Journal Diameter | 0.9980 - 0.9990 |
| Connecting Rod | Bushing Bore Diameter<br>Bushing Center to Crank pin Center | 1.1267 - 1.1269<br>6.6230 - 6.6270 |

## 17-4 ENGINE DRIVE TRAIN REPAIR AND REPLACEMENT

1. Any engine drive train component found to be worn beyond new parts limits or failing to meet the inspection criteria in section 17-3 must be replaced 100% unless repair is possible with the following instructions:
2. The crankshaft can be repaired by grinding crank pins and journals to 0.010" under new shaft limits and re-nitriding. Crankshaft machining may be accomplished by a repair facility certified for specialized crankshaft repairs.

NOTE…Reground crankshafts must be re-nitrided.

3. Do not attempt to remove scoring or indications of overheating which render the crankshaft unserviceable .
4. The crankshaft hanger blade and counterweight bushings must be replaced 100% at engine overhaul regardless of condition. Crankshaft hanger blade bushing replacement must be performed using the specified procedure and the following special tool:

   a. Borrough's 8077A Crankshaft Hanger Blade Bushing Removal/Installation Set or equivalent.

### WARNING

**Removing and replacing bushings with makeshift tools and methods may result in irreparable damage to the crankshaft and crankshaft malfunction.**

**CRANKSHAFT COUNTERWEIGHT HANGER BLADE BUSHING REMOVAL**

Using the specified tool remove the crankshaft counterweight hanger blade bushings.

**CRANKSHAFT COUNTERWEIGHT HANGER BLADE BUSHING HOLE INSPECTION**

After removal of the crankshaft counterweight hanger blade bushings measure the inside diameter of the bushing holes. The replacement bushings must have an interference fit of .0015 to .003 inch into the bushing holes. The bushing holes must be smooth. Crankshafts with worn, pitted, fretted or out of round bushing holes must be discarded.

## CRANKSHAFT COUNTERWEIGHT HANGER BLADE BUSHING INSTALLATION

After serviceability of crankshaft has been determined new bushings must be installed in the crankshaft counterweight hanger blades. Install the new bushings using the same tools that were used for bushing removal. The new bushings must be installed in accordance with the specifications in Figure 17-6, "Crankshaft Hanger Blade Bushing Replacement." Replacement bushings are available in standard size only.

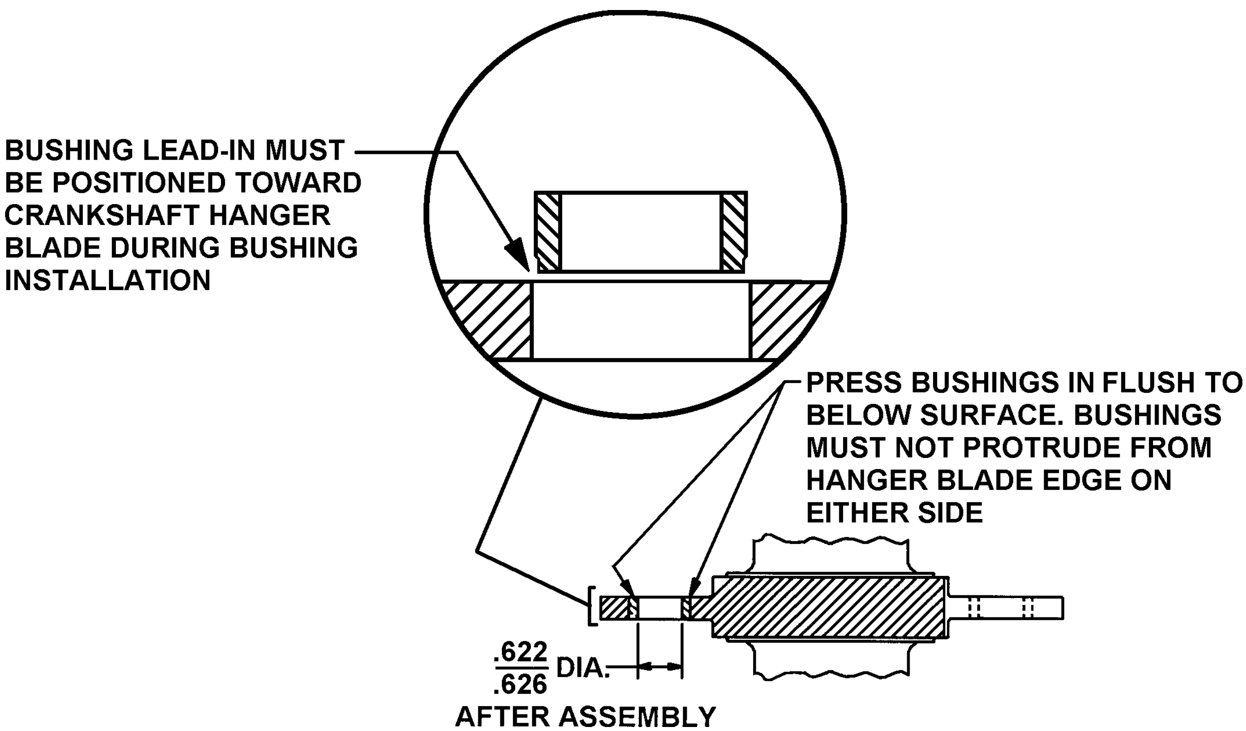



**FIGURE 17-6. CRANKSHAFT HANGER BLADE BUSHING REPLACEMENT**

NOTE…After installation of new bushings the crankshaft counterweight hanger blades must be magnetic particle inspected in accordance with section 6-9, "Magnetic Particle inspection." Discard crankshafts with cracked counterweight hanger blades. Inspect the new, installed, bushing inside diameter using an air gauge and with correct air plug and setting ring. See Figure 17-6 for correct dimension.

No finishing operation is required. The new installed bushings are made to final dimensions.

5. The counterweight bushings must be replaced 100% at engine overhaul regardless of condition. The bushing replacement must be performed using the specified procedure and the following special tools:

   a. Borrough's 8077C Counterweight Bushing Removal/Installation Fixture or equivalent.

   b. Arbor Press.

## WARNING

**Removing and replacing bushings with makeshift tools and methods may result in irreparable damage to the counterweight and counterweight, crankshaft malfunction.**

### COUNTERWEIGHT BUSHING REMOVAL

Using the specified tools remove the counterweight bushings.

### COUNTERWEIGHT BUSHING HOLE INSPECTION

After removal of the counterweight bushings measure the inside diameter of the bushing holes. The replacement bushings must have an interference fit of .0015 to .003 inch into the bushing bores. The bushing holes must be smooth. Counterweights with worn, pitted, fretted or out of round bushing holes must be discarded. Carefully inspect the counterweight counterbores for signs of wear in the wall that retains the counterweight pin retaining plates. The area referred to is immediately adjacent to the inside edge of the retaining ring groove. It may appear as an additional step and/or a taper of the hole into the retaining ring groove. If any wear is evident the counterweight must be discarded. See Figure 17-7, "Counterweight Inspection, Repair and Installation." If no plate wear is evident, check the retaining ring groove in each hole for distorted width, depth or other types of wear patterns which can affect the seating of the retaining ring. Any worn condition that may affect retaining ring seating will require replacement of the counterweight. Crankshaft counterweights are matched in pairs with a maximum weight variation of two grams, and the complete crankshaft/counterweight assembly is dynamically balanced. As a result, if either counterweight is damaged, a matched pair must be procured and replaced on that cheek.

### COUNTERWEIGHT BUSHING INSTALLATION

After serviceability of the counterweights has been determined, new bushings must be installed in the counterweight assemblies. Using the same tools that were used for bushing removal, install the new bushings. The new bushings must be installed into the same positions as the original bushings. Replacement bushings are available in standard size only. Inspect the new, installed, bushing inside diameter using an air gauge and with correct air plug and setting ring. See Figure 17-7 for correct dimension.

NOTE…After installation of new bushings the counterweights must be magnetic particle inspected in accordance with section 6-9, "Magnetic Particle inspection."

No finishing operation is required. The new installed bushings are made to final dimensions.

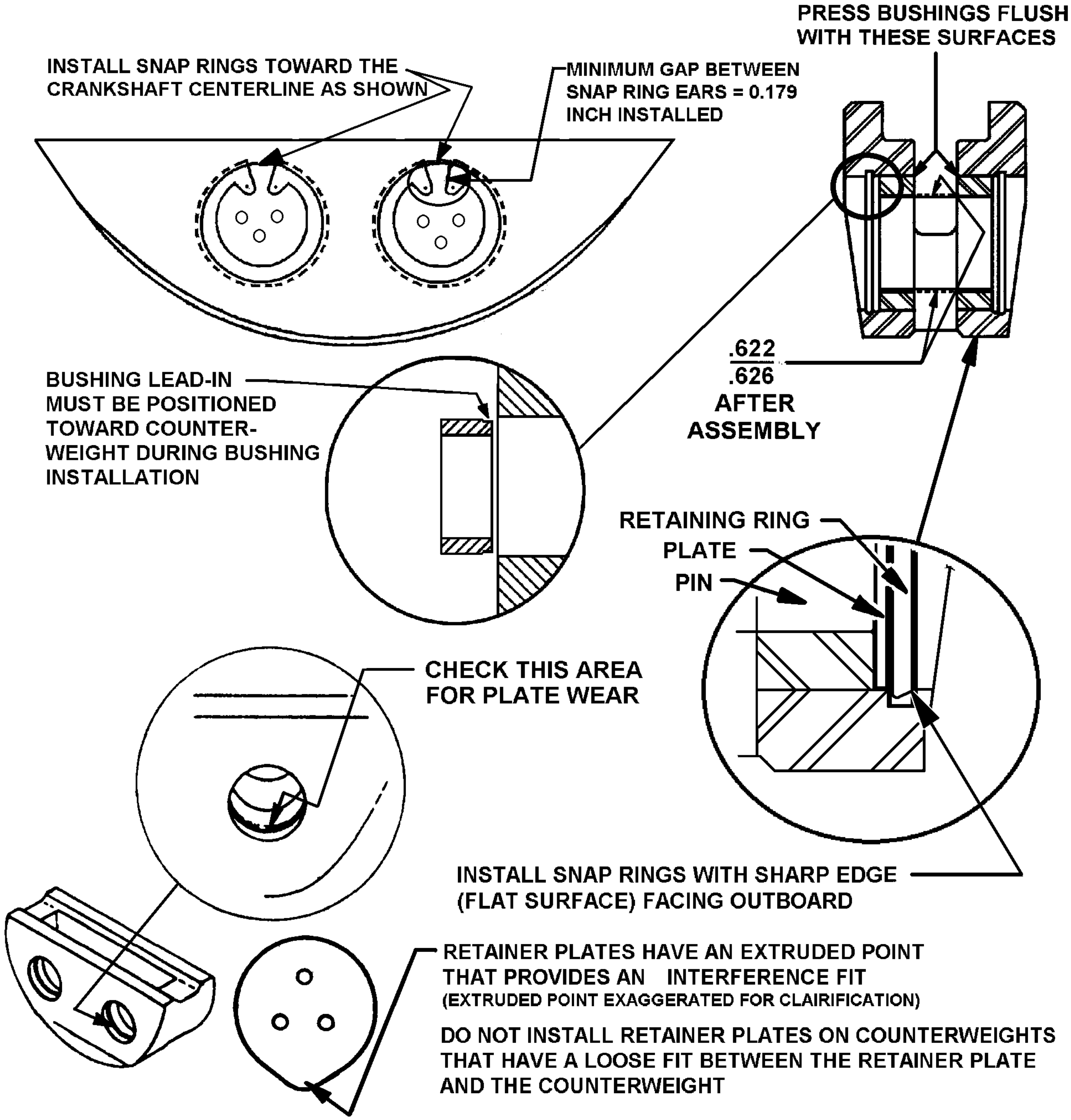



**FIGURE 17-7. COUNTERWEIGHT INSPECTION, REPAIR AND INSTALLATION**

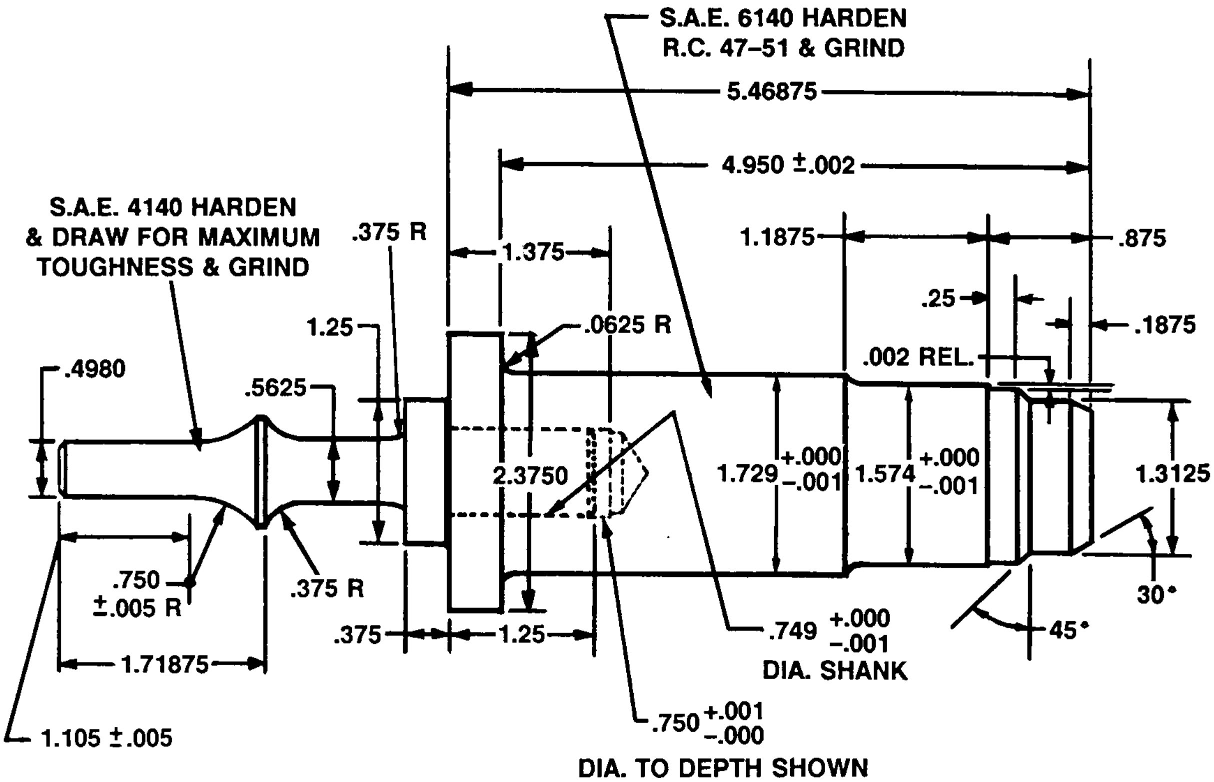



**FIGURE 17-8. OIL CONTROL PLUG INSTALLATION TOOL**

6. Loose or leaking crankshaft oil control plugs must be replaced. The oil control plug replacement must be performed using the specified procedure and the following special tools:

   a. A .4375 - 20 diameter bolt approximately eight inches long with .4375 - 20 NF threads.

   b. An installation tool conforming with the specifications shown in Figure 17-8, "Oil Control Plug Installation Tool."

   c. Two inch Merrit Wheel.

   d. A leak test fixture conforming with the specifications shown in Figure 17-9, "Oil Control Plug Leak Test Fixture."

## WARNING

**Removing and replacing the crankshaft oil control plug with makeshift tools and methods may result in irreparable damage to the crankshaft and crankshaft malfunction.**

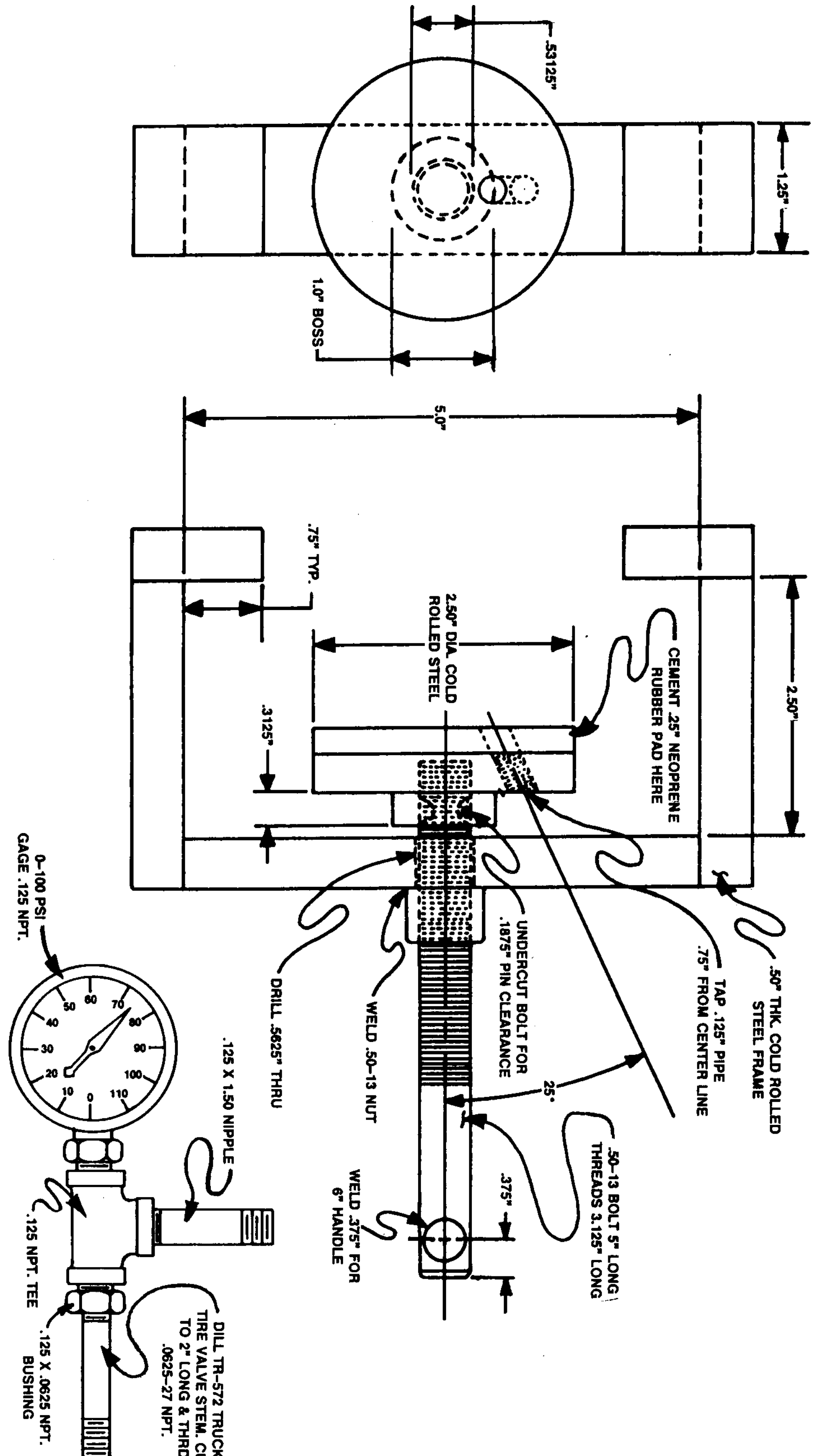



**FIGURE 17-9. OIL CONTROL PLUG LEAK TEST FIXTURE**

## CRANKSHAFT OIL CONTROL PLUG REMOVAL

Remove crankshaft oil control plug using a .4375 - 20 diameter bolt approximately eight inches long with .4375 - 20 NF threads and a slide hammer.

## OIL CONTROL PLUG HOLE CLEANING

Inspect the inside diameter of the crankshaft for rust and rust pits. Discard crankshafts with rust or rust pits. The inside diameter of the crankshaft must be clean and free of any sludge residue prior to new plug installation. Clean crankshaft inside diameter using a pneumatic drill and a two inch Merrit Wheel.

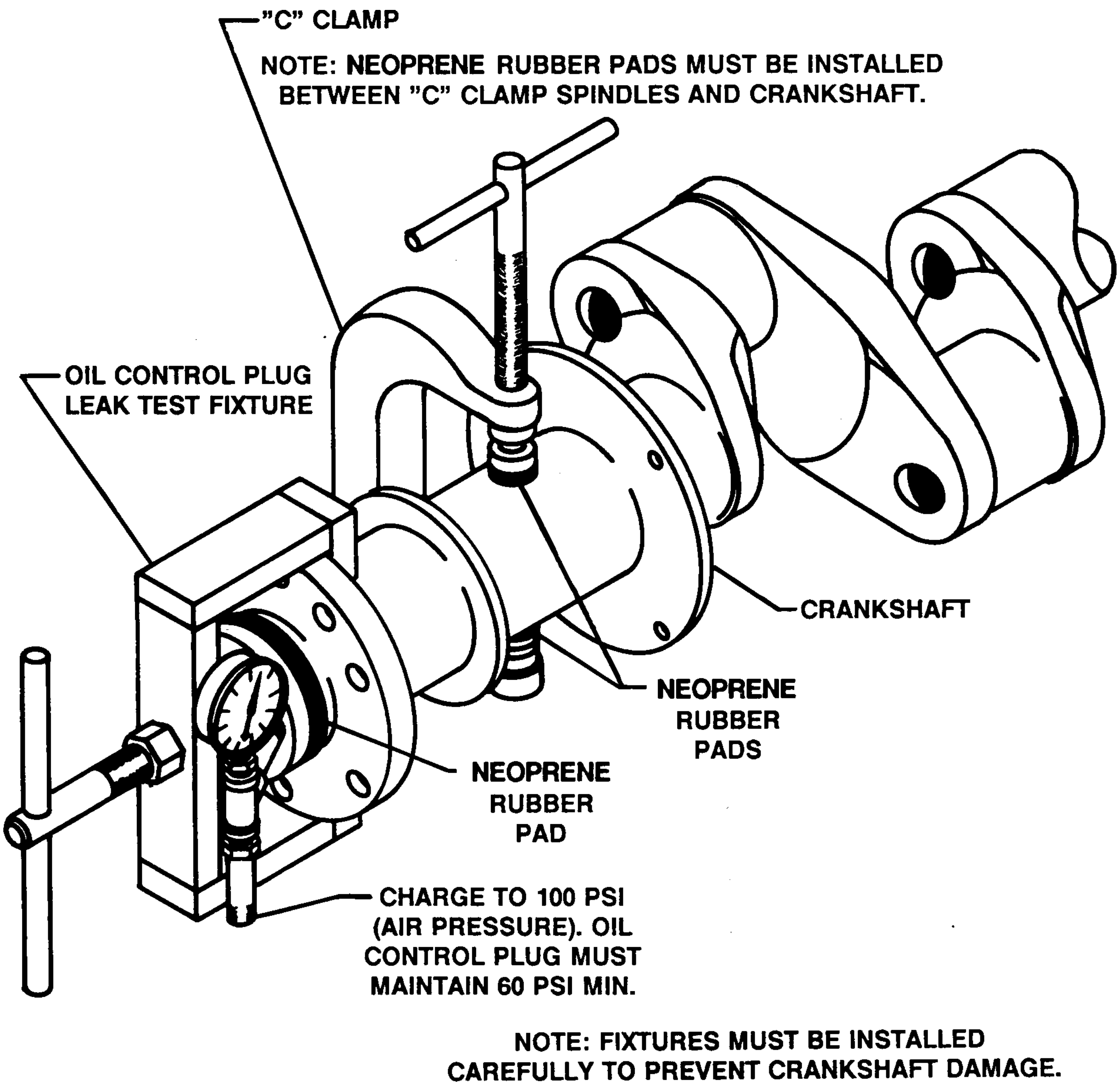



**FIGURE 17-10. CRANKSHAFT LEAK TEST**

## OIL CONTROL PLUG INSTALLATION

Using an air impact tool and the special oil control plug installation tool, carefully drive in the new oil control plug.

## WARNING

**The use of makeshift tools not conforming with the specifications in Figure 17-8, "Oil Control Plug Installation Tool," may cause damage to oil control plug or crankshaft during installation. The 2.375 inch diameter collar at the rear of installation tool prevents driving oil control plug beyond the specified depth of 4.69 - 4.75 inches.**

## OIL CONTROL PLUG INSPECTION

Using the special leak test fixture shown on previous page and a "C" clamp that has its spindle and foot protected by neoprene rubber pads, pressure test the crankshaft. See Figure 17-10, "Crankshaft Leak Test." The oil control plug must maintain 60 PSI minimum air pressure.

7. After all crankshaft repairs have been completed, use a strip of 180 grit emery cloth approximately 1/2 inch wide and apply a helix to the crankshaft as shown in Figure 17-11, "Helix Pattern Application." Apply helix to approximately 1/4 of the surface indicated at a time. The pattern is applied by stroking the cloth outward toward the propeller flange in the direction of rotation, CCW towards you using maximum hand pressure, which will result in a 30° pattern as shown. After doing the first portion, rotate the crankshaft so that the next portion is visible. Apply the same pattern again and continue completely around crankshaft in this manner. The helix is applied to insure proper seating of the crankshaft oil seal. After helix application, the crankshaft must be re-cleaned. After the helix has been applied the helix area must be tin plated. See section 17-2, "Engine Drive Train Cleaning."

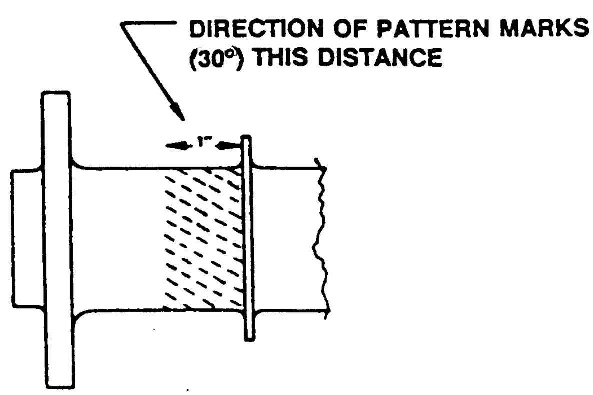



**FIGURE 17-11. HELIX PATTERN APPLICATION**

## WARNING

**The camshaft plugs must be installed and torqued before final engine assembly.**

8. CAMSHAFT

   Old Style Camshaft - Using the correct size tool install new front plug to correct position shown in Figure 17-12, "Old Style Camshaft Plug Installation." Apply TCM Loctite Pipe Sealant 592 to the rear camshaft plug. Install new 1/4 -18 rear, brass camshaft plug and torque to 130-150 inch pounds. The camshaft must again be magnetic particle inspected in accordance with section 6-9.

   New Style Camshaft - Apply TCM Loctite Pipe Sealant 592 to the front and rear camshaft plug. Using the correct size tool, install the new 1/4 -18, brass camshaft plugs and torque to 130-150 inch pounds. The camshaft must again be magnetic particle inspected in accordance with section 6-9.

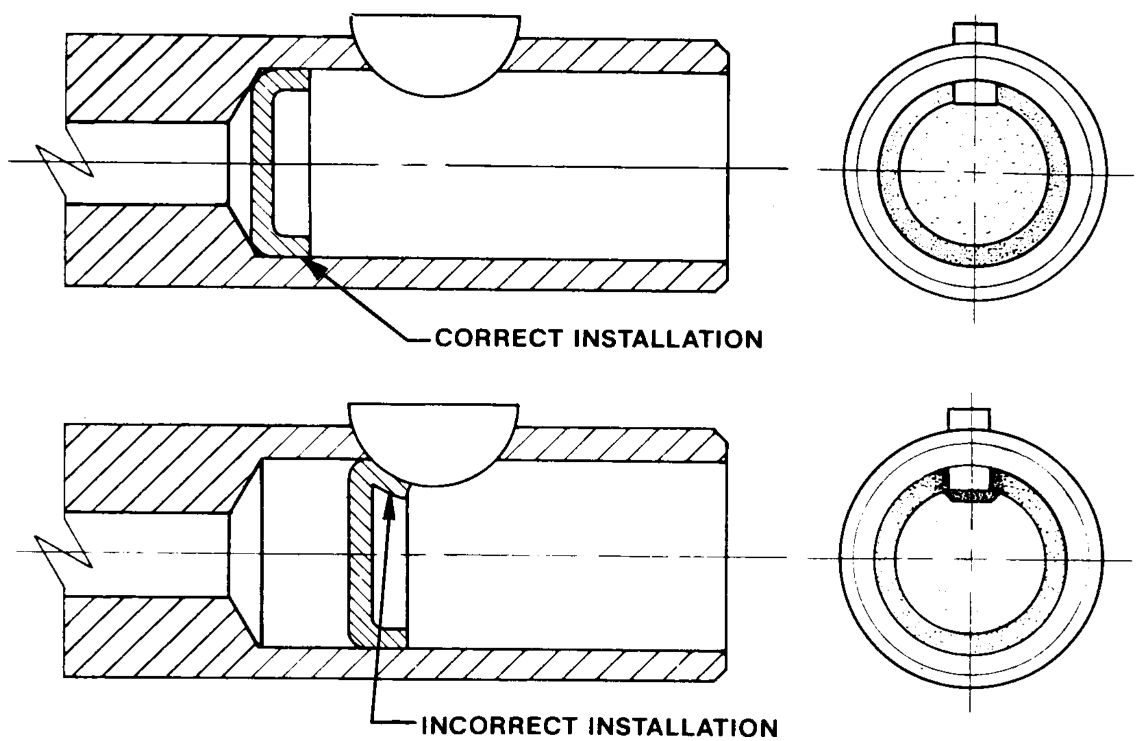



**FIGURE 17-12. OLD STYLE CAMSHAFT PLUG INSTALLATION**

9. All connecting rod piston pin bushings must be replaced 100% at overhaul. The connecting rod piston pin bushing replacement must be performed using the specified procedure and the following special tools:

   a. Arbor press.
   b. Borrough's 8098 Connecting Rod Bushing Removal/Installation Set or equivalent.
   c. Borrough's 8111A Connecting Rod Boring and Alignment Fixture or equivalent.
   d. High Speed Borer of the correct size.
   e. Borrough's 8042C Adapter Kit or equivalent.
   f. Vertical Mill or equivalent capable of maintaining 1750 RPM.
   g. Federal Dimension Air Gauge with a 1.1268 Setting Ring and 1.1268 Air Plug or equivalent.
   h. Profilometer.

## WARNING

**Removing and replacing the connecting rod piston pin bushings with makeshift tools and methods may result in irreparable damage to the connecting rods and connecting rod/crankshaft malfunction.**

### CONNECTING ROD BUSHING REMOVAL

Press out old bushing using connecting rod bushing removal/installation set and an arbor press. No nicks, gouges or other damage is permissible on the bore after bushing removal. Connecting rods exhibiting any of the above must be discarded.

### CONNECTING ROD BUSHING INSTALLATION

Make sure that the rod bore is smooth. Dip the new bushing in clean 50 wt. aviation engine oil before placing it in position. Verify bushing part number. The bushing may be chilled slightly to aid installation. Install as follqws:

a. Position connecting rod over the pilot so the mate marks and piston pin bore chamfer are facing up.
b. Place the bushing on the pilot so that the bushing split is located 45 degrees from the center line of the connecting rod, facing the crankpin end. See Figure 17-5, "Connecting Rod Dimensions."
c. Position the ram onto the pilot.
d. Using the arbor press, carefully press the bushing flush with the piston pin bore.

### CONNECTING ROD BUSHING FINISHING

Bore the new bushing to the specified diameter of 1.1267 - 1.1269 inches as follows:

a. Place the connecting rod on the base plate and secure with retainers provided.
b. Select the correct adapter kit and boring tool for the connecting rod.
c. Using a vertical mill, or equivalent, bore the connecting rod bushing to size. Maintain 1750 RPM during boring process.

### CONNECTING ROD INSPECTION

Using a profilometer inspect the piston pin bushing finish. The required surface finish is 16 $R_a$.

Because of the close tolerances required, the replaced bushings must be inspected using an air gage with correct size air plug and setting ring. The bushing bore I.D. must be 1.1267 – 1.1269. After connecting rod bushing inspection, the connecting rod bushing alignment with the big end bearing seat must be inspected in accordance with Section 17-3, "Dimensional Inspection," Connecting Rod Convergence and Twist.

*CAUTION…In order to assure good dynamic balance, connecting rod assemblies are selected in pairs with a maximum weight variation of 1/2 ounce in opposite bays. Therefore, rods are supplied in matched sets only*.

**WARNING**

**Never remove material from any connecting rod .**

10. Insure that all engine drive train associated parts listed in section 6-6, "100% Replacement Parts," have been replaced.

## 17-5 ENGINE DRIVE TRAIN SUBASSEMBLY

NOTE…All engine drive train components must be clean and free of debris before assembly.

NOTE…Before assembly the crankshaft and camshaft must be checked for remaining magnetism from inspection procedures. If found, demagnetize.

NOTE…The standard magnetic particle inspection procedure found in the latest revision of ASTM standards on nondestructive testing describes the method of magnetization, inspection and demagnetization.

**WARNING**

**Failure to replace plugs before the camshaft is assembled in the engine will result in loss of internal oil pressure with little or no lubrication of internal moving engine parts and engine failure.**

### OLD SYLE CAMSHAFT

1. See Figure 17-1A, "Camshaft Assembly (Old Style)." Install the camshaft in a suitable holding fixture. Using a rawhide mallet tap a new woodruff key (6) into camshaft groove and tap governor drive gear (7) onto camshaft.
2. Install gear (4) on camshaft (1). The gear bolt holes are off-set to insure proper positioning for timing. Install four new bolts (5) and torque to 240-260 inch pounds. Safety wire bolt heads in accordance with section 5-2, "Lockwire Procedure." After assembly coat camshaft with clean 50 wt. aviation engine oil.

### NEW STYLE CAMSHAFT

1. See Figure 17-1B, "Camshaft Assembly (New Style)." Install the camshaft in a suitable holding fixture. Lubricate gear and camshaft splines with clean 50 weight engine oil. Install governor drive gear (6) onto camshaft.
2. Install gear (4) on camshaft (1). The gear bolt holes are off-set to assure proper positioning for timing. Install four new bolts (5) and torque to 240-260 inch pounds. Safety wire bolt heads in accordance with section 5-2, "Lockwire Procedure." After assembly coat camshaft with clean 50 weight aviation engine oil.

## CRANKSHAFT

### WARNING

**Use only crankshafts that are manufactured from VAR forgings identified by the letters VAR forged into a crankshaft cheek.**

1. See Figure 17-2, "Crankshaft Assembly." Place the crankshaft on a bench with a notched wood block under front and rear journals. Attach two sixth order counterweights (15) to crank cheek No. 2 hanger blade with new pins (12). Install new plates and retaining rings (10, 11) with sharp edge outboard. Attach one fourth order and one fifth order counterweight to crank cheeks No. 5. Install pins (13, 14). Install new plates and retaining rings (10, 11) with sharp edge outboard. Pins with the same part number and dash number must be installed in each counterweight.

*CAUTION…The retaining rings, plates and pins must be installed as shown in Figure 17-7, "Counterweight Inspection, Repair and Installation."*

The counterweight plates have a small extruded point which provides an interference fit of .001 to .007. During installation, check the counterweight plates for an actual interference fit in the bushing bore. An interference fit is required.

### WARNING

**Do not use plates that have a loose fit.**

NOTE…Counterweight pins are identified by dash numbers stamped on one end. Because the counterweight order is controlled by the pin diameter it is imperative only the correct pin, properly identified, be used. The 4th order 643626-103 pin has an O.D. of .474-.475. The 5th order 643626-104 pin has an O.D. of .527 -.528. The 6th order 643626-105 pin has an O.D. of 0.565 - 0.566.

### WARNING

**Do not exceed ten minutes at 350°F during crankshaft gear heating process. Do not use a torch to heat the crankshaft gear. The heating process must be performed using uniform heating methods only.**

2. Heat crankshaft gear (24) to 300°F for 5 to 10 minutes. Use thick gloves to handle gear. Align gear dowel hole with crankshaft dowel and install gear on crankshaft. Attach crankshaft large gear (23) to crankshaft small gear and to crankshaft using four new bolts (22). Torque bolts to 380 - 420 inch pounds in a criss-cross pattern. Install lock wire on bolts (22) in accordance with section 5-2, "Lockwire Procedure."

3. Install alternator gear (27) over propeller flange. With holes aligned, install tab lock plates (26) and four bolts (25). Torque bolts (25) to 140 - 150 inch pounds. Using a brass drift, bend tabs of lock plates up against bolt head flats to safety.

## WARNING

**Do not over torque bolt(s) in an attempt to line up head flat with lock tab. If head flat will not line up replace the bolt(s).**

4. Lubricate oil transfer collar (19, 20) with clean 50 weight aviation engine oil and install on crankshaft. Use new pins (18) and secure with new nuts (17). Torque nuts (17) alternately in 20 inch pound increments to 75-85 inch pounds. Care must be taken in assembling the collar to the crankshaft because of the close running clearance involved. The collar must rotate freely to prevent frictional heating. Check for a running clearance of .0005L to .0018L between the collar and crankshaft this will insure good oil pressure to the propeller.

5. Original connecting rods have a position number stamped on the end cap and rod bolt boss. New connecting rods must have a position number, 1 through 6 as applicable, vibro etched in the location shown in Figure 17-13, " Connecting Rod Position Number." Remove the bolts and nuts from the connecting rods and discard. Place a sheet of crocus cloth on a flat surface plate and dampen with solvent. Lightly rub the parting surface of the rod cap and rod across the crocus cloth to remove any burrs or nicks. Inspect the parting surfaces, bolt holes and bolt hole edges to insure there are no nicks burrs or sharp edges. Clean rods, caps, bolts and nuts thoroughly, blow dry and place on a clean cloth. Clean the new bearing inserts in solvent and blow dry. Inspect the bearings for damage and insure each bearing is the correct size and part number for the connecting rod/crankshaft to be used. Install a new bearing in each rod cap and rod. Insure that the bearing ends project the same distance even with the parting surface and that they are properly seated. Closely examine for and remove any metal that may have shaved from the bearing back onto the parting surface during installation. Coat the rod bolt completely with clean 50 weight aviation engine oil. Align the matching numbers on the connecting rod and cap and hand press the new bolts into the connecting rod. Do not force bolts through the cap or rod bolt holes. The connecting rod and cap must be completely seated and both bolt heads must be completely seated against the connecting rod cap seats. Any connecting rod assembly requiring more than hand pressure to seat the connecting rod, caps and bolts must be discarded. Remove the connecting bolts and separate the connecting rod and cap. Inspect each connecting rod assembly for correct fit.
6. Insure that the new bearings are properly seated. Using clean 50 wt. aviation oil, lubricate and install each rod, cap and bearing assembly at the correct position on the crankshaft. Install the connecting rod and cap with their numbers on top when odd number rods are extended to the right and even number rods are to the left viewing crankshaft from the rear (gear end) forward. Lubricate the new connecting rod bolt and nut threads using clean 50 weight aviation engine oil. Secure rods and caps using new special bolts and nuts (4 & 5). On assemblies using the 643112 bolts and 643215 nuts, torque the nuts to 550-600 inch pounds. On assemblies using the 654490 bolts and 643215 nuts, torque the nuts to 690-710 inch pounds.

## WARNING

**Both bolts and nuts on each connecting rod must be the same type and part number.**

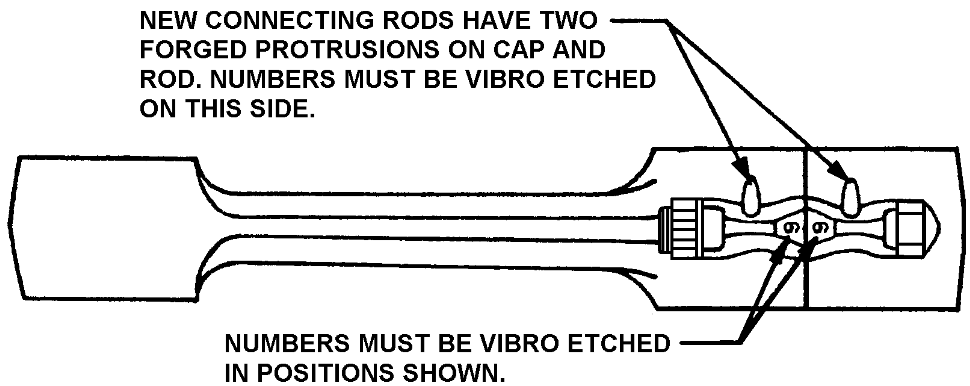



**FIGURE 17-13. CONNECTING ROD POSITION NUMBER**

10. Remove spring (28) and reinforcing ring (29) from oil seal (30). Unhook spring ends using an unwinding motion. Place spring around crankshaft in oil seal area and turn spring ends in an unwinding direction then join and allow one end to wind into the other end. Apply Alvania ™ (Shell #2) to lip of oil seal and prop flange only. Squeeze oil seal until egg shaped and start over flange. A special tool P/N5209 is available from Kent Moore to assist in oil seal installation. After oil seal is on shaft wipe all grease from oil seal and shaft. The oil seal outside diameter must be clean and dry before installation in the crankcase. Press the reinforcing spring into the oil seal recess by moving fingers in both directions from split. Insure spring is in deepest part of recess all the way around. Install reinforcing ring on crankshaft and press into oil seal.

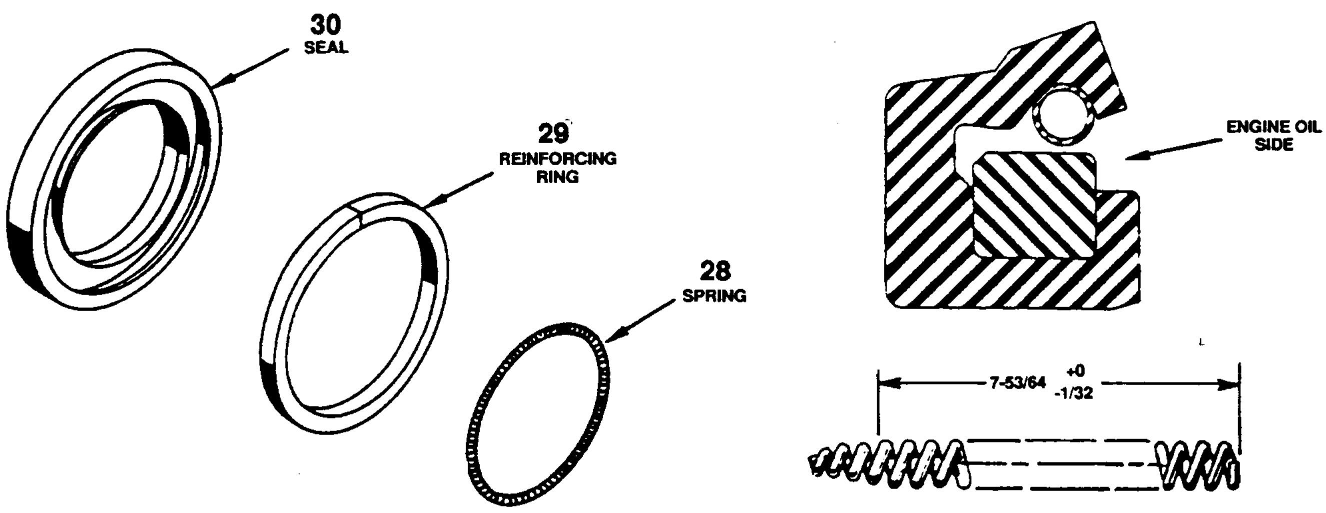



**FIGURE 17-14. OIL SEAL INSTALLATION**

11. Store engine drive train components in a clean protected area until final engine assembly.

# CHAPTER 18

# FINAL ASSEMBLY

## 18-1 GENERAL

**WARNING**

**Use only parts meeting the engine type design.**

Apply clean 50 weight aviation engine oil liberally to all bare steel surfaces, journals, bearings and bushings before and after installation, except where special lubricants are required. See Chapter 3, "Sealants and Lubricants."

During assembly the mechanic must measure clearances of running parts as they are installed and compare with clearances listed in Fits and Limits of the applicable system or component section. During engine overhaul use only NEW PARTS LIMITS. See section 6-16, "Parts Limits." Also TCM requires certain parts be replaced 100% at overhaul. See section 6-6, "100% Replacement Parts."

Engine assembly must be performed in a clean dust free environment. All engine openings must be covered as soon as possible to prevent admittance of debris or small parts.

## 18-2 CRANKCASE (See Figures as indicated in paragraphs)

1. Uncover crankcase halves. Using clean 50 wt. aviation engine oil, thoroughly coat all crankcase camshaft bearing surfaces, prop governor gear bearing surface, starter shaft gear bushing and idler gear bushing. The crankcase, crankshaft bearing saddles must be dry prior to installing the crankshafts bearings do not coat them with oil.
2. Install left crankcase half on engine stand open side up. Place right crankcase half on bench open side up. Using clean 50 weight aviation engine oil, thoroughly lubricate all surfaces that were lubricated on the right crankcase half. Do not lubricate the crankshaft bearing saddles.
3. See Figure 17-2, "Crankshaft Assembly." Install crankshaft bearings (2) in crankcase crankshaft bearing saddles. Apply clean 50 wt. aviation engine oil to thrust washer lands in crankcase to prevent thrust washer halves from falling out during final assembly. Install thrust washer halves (1). Insure that the bearing and thrust washer ends project equally and are properly seated. Lubricate bearings with clean 50 wt. aviation engine oil.
4. See Figure 17-2. Install new o-ring (21) on oil transfer collar (20) and lubricate thoroughly with clean 50 wt. aviation oil. With the aid of an assistant, lift crankshaft assembly by No. 1 connecting rod and propeller flange. Have assistant hold #3 and #5 connecting rods upward, carefully lower assembly into position guiding oil transfer collar sleeve into it's hole, make sure o-ring is seated properly. Check to make sure bearings and thrust washers are still seated properly. The connecting rod position numbers, if properly installed, will be toward the upper case flange. Carefully place odd numbered connecting rods on the upper case flange.
5. See Figure(s) 17-1A, 17-1B and 18-2 as applicable. Using clean 50 wt. aviation engine oil, lubricate and install governor driven gear (8 or 7) and camshaft (1) into crankcase. Make sure that timing marks on camshaft and crankshaft align as gears mesh. Number 1 connecting rod on crankshaft should be in its fully extended (TDC) position. Governor driven gear may have to be turned slightly to allow camshaft to seat in its bearings properly. Check governor driven gear backlash it must be 0.002 to 0.012.

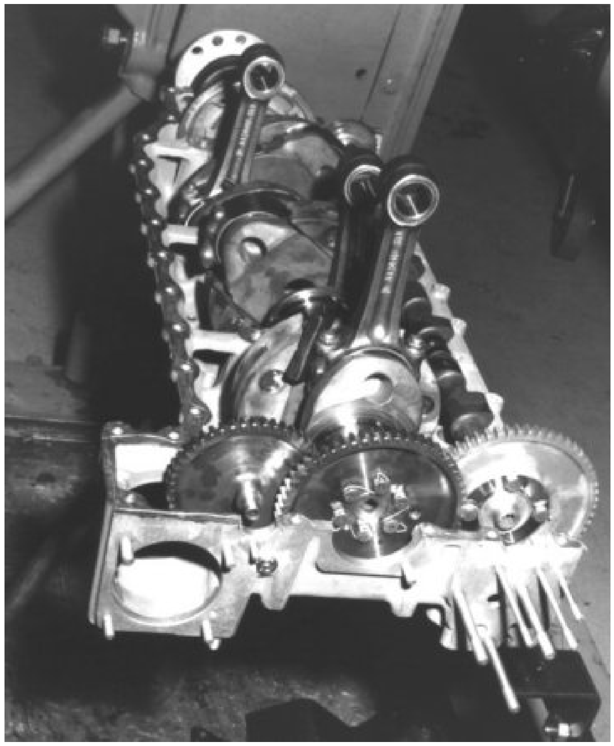


FIGURE 18-1. LEFT CRANKCASE AND SHAFTS ASSEMBLED ON STAND

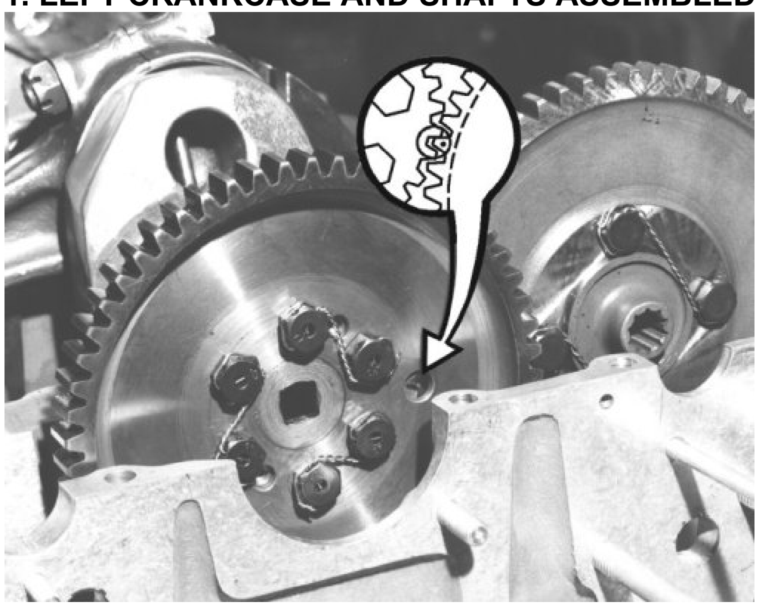


FIGURE 18-2. ALIGNMENT OF TIMING MARKS

*CAUTION…If the crankcase has been machined, gear backlashes must not be less than the specified minimum after machining.*

6. Measure crankshaft end clearance using a dial indicator set at zero against the propeller flange it must be 0.004 to 0.016. Measure camshaft end clearance at either end of its rear main bearing it must be 0.005 to 0.012.

7. See Figure 16-2, "Oil Filler, Idler Support Pin & Camshaft Cover." Install bushing (16) into crankcase. See Figure 17-2, "Crankshaft Assembly." Using clean 50 wt. aviation engine oil, lubricate and install idler gear (3) in crankcase. See Figure 16-2, "Oil Filler, Idler Support Pin & Camshaft Cover." Temporarily secure idler gear using new gasket (17) and support pin (18).

NOTE…Idler gear thrust flange must be to the rear and the support pin eccentric shoulder must be away from crankshaft.

Using a dial indicator check crankshaft and camshaft gear backlash it must be 0.008 to 0.012.

8. Coat camshaft lobes with Dow Corning G-N Paste. [Dow Corning® is a registered trademark of Dow Corning Corporation.]

## 18-3 CRANKCASE SEALANT AND THREADING PROCEDURE

1. Use full strength non-thinned Permatex aviation grade 3D. Shake or mix well before using.

**WARNING**

**Apply thread and permatex only as illustrated.**

2. See Figure 18-3. Apply Permatex Number 3D to the 2-4-6 case half. Apply Permatex only in areas where thread is shown. When applying, use short light brush strokes until an even thin coat is obtained. The Permatex should be viscous enough that most of the brush marks disappear; if not, use a new can of Aviation Permatex. Allow the Permatex to air dry to a tacky condition before threading.

NOTE…Do not apply Permatex to crankshaft nose seal area.

3. Apply a thin translucent coat of TCM Gasket Maker P/N 646942 to 1-3-5 case half. Apply Gasket Maker in all areas that will mate with areas where Permatex was applied on 2-4-6 case half.

4. Apply grade D silk thread P/N 641543 on 2-4-6 case half only. Apply thread as shown in illustration. Be sure free ends of thread are covered by gaskets except at the nose oil seal.

5. Clean crankcase crankshaft front oil seal land with Locquic Primer “N” and apply a thin translucent coat of gasket maker.

6. Assemble crankcase halves in accordance with the following paragraphs. Install and torque all crankcase hardware in proper sequence in accordance with section 18-4 as soon as possible.

7. Stand odd numbered connecting rods straight up. Have an assistant balance and guide connecting rods through 1-3-5 case half cylinder openings as crankshaft assembly is installed.

8. Back idler gear support pin partially out to clear studs.

9. Place 1-3-5 (right) crankcase half on 2-4-6 (left) case half. Push idler gear support pin back onto studs. See Figure 16-2. Install support pin attaching hardware (19, 20) but do not torque at this time. Take care to prevent displacement or damage to the crankshaft oil seal and silk thread. Insure thrust washer halves and bearing halves remain in place.

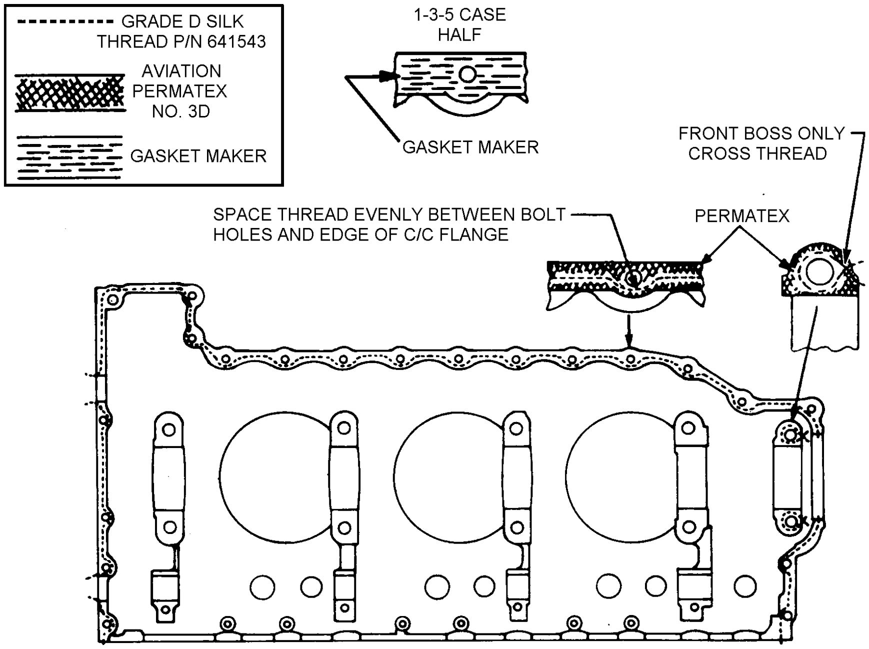



**FIGURE 18-3. CRANKCASE SEALANT AND THREADING PROCEDURE**

## 18-4 CRANKCASE THROUGH BOLT INSTALLATION AND TORQUING SEQUENCE

*CAUTION…All studs and through bolts must be lubricated in accordance with Chapter 3, "Sealants and Lubricants."*

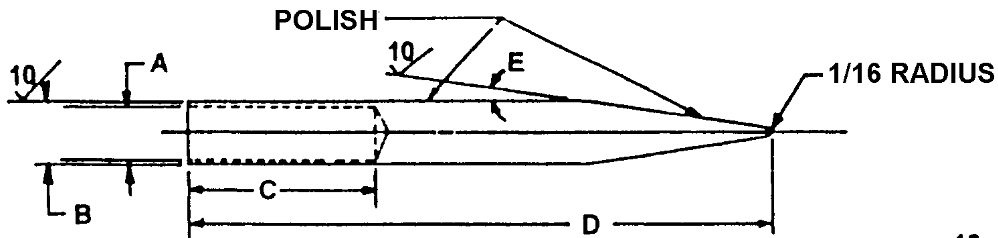
NOTE…See Figure(s) 16-1A or 16-1B, "Crankcase Attaching Parts," as applicable and Figure 18-8, "Torquing Sequence."

**WARNING**

**Failure to lubricate threads, apply the specific torque and follow the specific torquing procedure may result in crankcase bearing bore damage, crankshaft bearing damage, crankshaft damage and subsequent engine malfunction or failure.**

### IO-550-A, B & C CRANKCASE ASSEMBLY

1. See Figures 16-1A, "Crankcase Attaching Parts IO-550-A, B & C" and 18-8, "Torquing Sequence." Using an o-ring installation tool conforming with the specifications in Figure 18-4," O-Ring Installation Tool," install eight 1/2 x 10.75 through bolts (16) with new o-rings (17) into positions (37R/L through 44R/L).
2. Install three 5/16 x 4.00 inch tie bolts (15), washers (5) in positions (69, 71 & 72). Install one 7/16 inch through bolt (25) in position (46R/L) and one 7/16 inch through bolt (21) in position (45R/L). Install one 5/16 X 1.12 screw in position (54) and one 5/16 X 1.38 screw in position (53).
3. Tap the through bolt in to a position that will allow installation of hardware. Install one 3/8 x 10.44 through bolt (10), two o-rings (11), two washers(13) and two nuts (14) in position (64) on I0-550-A crankcase. Install one 3/8 x 11.67 through bolt (10), two o-rings (11), one spacer (12), two washers (13) and two nuts (14) in position (64) on I0-550-B crankcase. Install one 3/8 x 12.14 through bolt (10), two o-rings (11), two washers(13) and two nuts (14) in position (64) on I0-550-C crankcase .




MATERIAL: COLD ROLLED STEEL POLISH OUTSIDE DIAMETER 10

| | | | | | |
|---|---|---|---|---|---|
| 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 18-4. O-RING INSTALLATION TOOL**

4. Snug tie bolts (15), install and snug attaching hardware (22 through 24) on through bolts (21, 25).
5. This hardware will hold crankcase halves and internal mechanism together during assembly and torquing sequence. Rotate engine stand to place engine in upright position as shown in Figure 18-6 with connecting rods supported by old (clean) cylinder o-rings. Secure 1-3-5 side engine mounts to engine stand.
6. Place fuel manifold valve/bracket (7), lifting eye (8) and ignition bracket (9) at crankcase backbone position specified in Figure 16-1A. Install backbone bolts (1 through 4) with washers (5) and nuts (6). Finger tighten nuts (6). Do not torque at this time.
7. Install remaining bolts, washers and nuts (1 through 6) in hole positions specified in Figure 16-1A. Finger tighten but do not torque at this time.
8. Install four 5/16 bolts (26) in hole positions (73, 74, 75, 76), install and finger tighten attaching hardware (27, 28).
9. Lower crankcase hardware and suction tube installation.

See Figure 14-3A, "Oil Sump For I0-550-A & C". See Figure 14-3A, install gasket (6) with split line toward crankcase on suction tube (1). Insert threaded end of tube through hole provided in crankcase. Install gasket (7) and plug (8) on protruding, threaded end of suction tube. Attach suction tube bracket to crankcase with bolt (3), spacer (2) and washer (4) and nut (5) at position (78) in Figure 18-8. Install remaining 1/4 bolts (29) in hole positions specified in Figure 16-1A, install and finger tighten attaching hardware (32, 33).

See Figure 14-3B, "Oil Sump For I0-550-B". Install gasket (3) with split line toward crankcase on suction tube (1). Insert threaded end of tube through hole provided in crankcase. Install gasket (5) and plug (4) on protruding, threaded end of suction tube. Do not tighten plug at this time. See Figure 14-3B, attach suction tube bracket to crankcase with bolts (2). Torque bolts (2) to 155-175 inch pounds. Lockwire bolts (2) in accordance with section 5-2, "Lockwire Procedure." See Figure 16-1A, install and finger tighten hardware (29 through 33).

Proceed to I0-550-A, B & C cylinder installation.

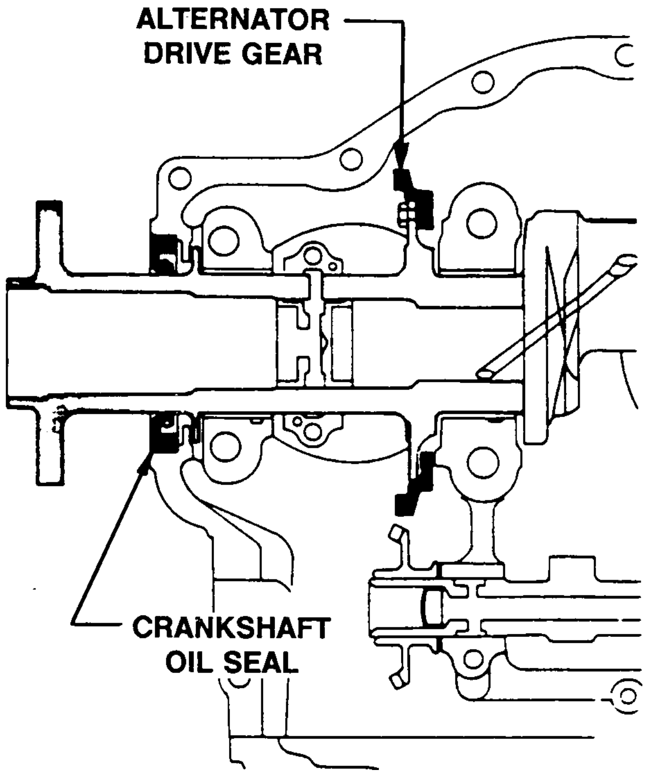



**FIGURE 18-5. ALTERNATOR DRIVE GEAR AND CRANKSHAFT OIL SEAL INSTALLED**

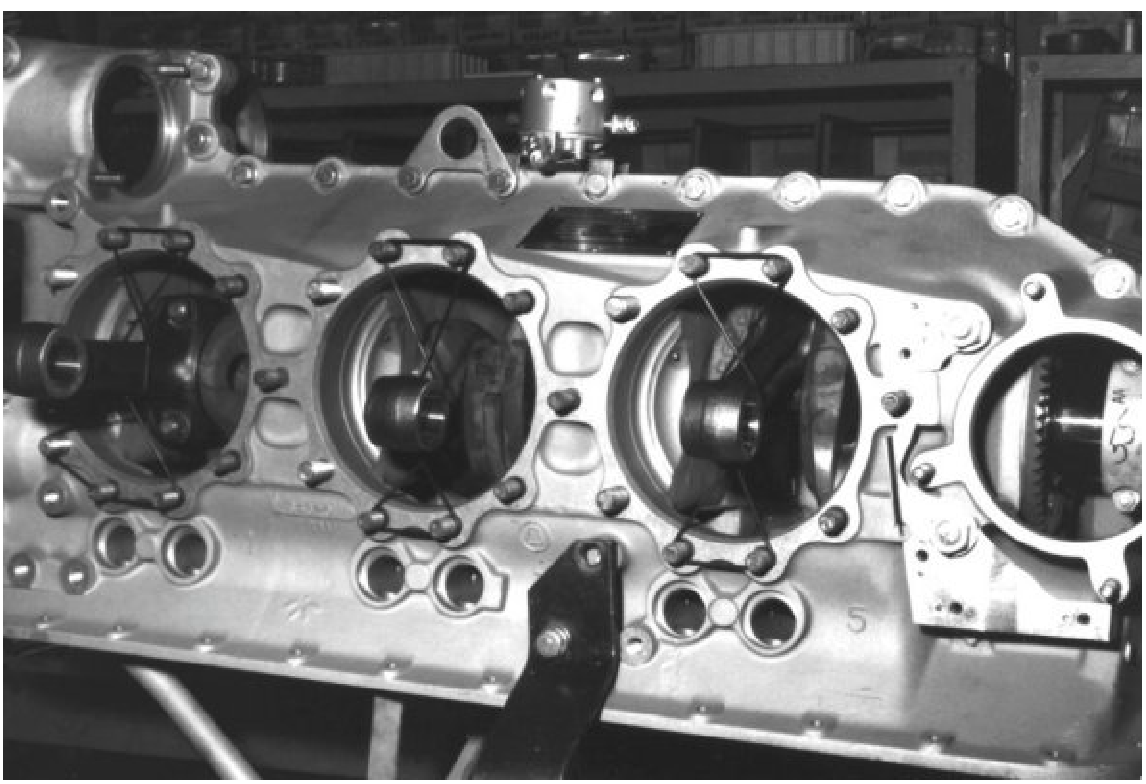


**FIGURE 18-6. CRANKCASE ASSEMBLED ON STAND**

## I0-550-A, B, C Cylinder Installation

NOTE…See Chapter 3 for lubricant specifications and suppliers.

**WARNING**

**The improper use of sealants and lubricants may cause engine malfunction or failure.**

a. Insure that the rocker shafts are temporarily installed in their boss bores prior to installing the cylinders. Verify that all cylinder valve keepers have been properly installed.

b. Insure that each cylinder has a new cylinder base packing properly installed as described in section 15-7.

c. Carefully rotate the crankshaft placing the number 1 and number 2 connecting rods in their outer most position. Lubricate all cylinder through bolt and deck stud threads using clean 50 weight aviation engine oil.

d. Back the number 1 piston pin far enough out to allow the piston to be installed on the number 1 connecting rod. Place the number 1 cylinder and piston assembly on the number 1 connecting rod and slide the piston pin into the connecting rod and piston. Using a ring compressor, compress the number 4 piston ring and push the cylinder until the number 4 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.

e. Install the cylinder deck and through bolt nuts but do not torque at this time .

f. Back the number 2 piston pin far enough out to allow the piston to be installed on the number 2 connecting rod. Place the number 2 cylinder and piston assembly on the number 2 connecting rod and slide the piston pin into the connecting rod and piston. Using a ring compressor, compress the number 4 piston ring and push the cylinder until the number 4 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.

g. Install the cylinder deck and through bolt nuts but do not torque at this time.

h. Carefully rotate the crankshaft placing the number 3 and number 4 connecting rods in their outer most position.

i. Using the same procedure that was used to install the number 1 and number 2 cylinder and piston assemblies, install the number 3 and number 4 cylinder and piston assemblies.

j. Carefully rotate the crankshaft placing the number 5 and number 6 connecting rods in their outer most position.

k. Using the same procedure that was used to install the number 1 and number 2 cylinder and piston assemblies, install the number 5 and number 6 cylinder and piston assemblies.

l. Install the 7th stud brackets and nuts but do not torque at this time.

NOTE…The 7th stud nuts have a conical seat.

m. See Figure 16-1A, install baffle support (20) on through bolts at positions (43L & 44L). Install attaching hardware (18, 19) do not torque at this time. On 1-3-5 side of crankcase install baffle support (34) on through bolts at positions (41R & 42R). Install attaching hardware (18, 19) do not torque at this time.

n. Apply Champion® thread lubricant to spark plugs in accordance with the manufacturer's instructions. Install gaskets and spark plugs in bottom cylinder spark plug holes. Do not Torque at this time.

o. Proceed to “TORQUING.”

## IO-550-G,N, P & R CRANKCASE ASSEMBLY

1. See Figures 16-1B, "Crankcase Attaching Parts IO-550-G & N" and 18-8, "Torquing Sequence." Using an o-ring installation tool conforming with the specifications in Figure 18-4," O-Ring Installation Tool," and new o-rings (16), install eight 1/2 x 10.75 through bolts (15) with new o-rings (16) into positions (37R/L through 44R/L).
2. Install three 5/16 x 4.00 inch tie bolts (14), washers (4) in positions (69, 71 & 72). Install one 7/16 inch through bolt (24) in position (46R/L) and one 7/16 inch through bolt (20) in position (45R/L). Install one 5/16 X 1.12 screw in position (54) and one 5/16 X 1.38 screw in position (53).
3. Tap the through bolt in to a position that will allow installation of hardware. Install one 3/8 x 10.44 through bolt (10), two o-rings (11), two washers(12) and two nuts (13) in position (64).
4. Snug tie bolts (14), install and snug attaching hardware (21 through 23) on through bolts (20, 24).
5. This hardware will hold crankcase halves and internal mechanism together during assembly and torquing sequence. Rotate engine stand to place engine in upright position as shown in Figure 18-6 with connecting rods supported by old (clean) cylinder o-rings. Secure 1-3-5 side engine mounts to engine stand.
6. Place lifting eye (8) and ignition bracket (9) at crankcase backbone position specified in Figure 16-1B. Install backbone bolts (1 through 3) with washers (4, 5) and nuts (6). Finger tighten nuts (6) do not torque at this time.
7. Install remaining bolts, washers and nuts (1 through 6) in hole positions specified in Figure 16-1B. Finger tighten but do not torque at this time.
8. Rotate stand to place engine in inverted position. Install four 5/16 bolts (25) in hole positions (73, 74, 75, 76), install and finger tighten attaching hardware (26, 27).
9. See Figure 14-3C Oil Sump For I0-550-G & N. Install gasket (6) with split line toward crankcase on suction tube (1). Insert threaded end of tube through hole provided in crankcase. Install gasket (7) and plug (8) on protruding, threaded end of suction tube. Attach suction tube bracket to crankcase with bolt (31), washers (29) and nut (30) at position (78) in Figure 18-8. Install remaining 1/4 bolts (28) in hole positions specified in Figure 16-1B, install and finger tighten attaching hardware (29, 30).

   See Figure 14-3D Oil Sump For I0-550-P. Install gasket (6) with split line toward crankcase on suction tube (1). Insert threaded end of tube through hole provided in crankcase. Install gasket (7) and plug (8) on protruding, threaded end of suction tube. Attach suction tube bracket to crankcase with bolt (3) and washers (2, 4) at position (78) in Figure 18-8. Install remaining 1/4 bolts (30) in hole positions specified in Figure 16-1A, install and finger tighten attaching hardware (32, 33).

   See Figure 14-3B Oil Sump For I0-550-R. Install gasket (3) with split line toward crankcase on suction tube (1). Insert threaded end of tube through hole provided in crankcase. Install gasket (5) and plug (4) on protruding, threaded end of suction tube. Do not tighten plug at this time. See Figure 14-3B, attach suction tube bracket to crankcase with bolts (2). Torque bolts (2) to 155-175 inch pounds. Lockwire bolts (2) in accordance with section 5-2, “Lockwire Procedure.” See Figure 16-1A, install and finger tighten hardware (29 through 33).

## I0-550-G, N, P, R Cylinder Installation

Rotate engine to upright position. Install the cylinder and piston assemblies in accordance with the following procedure.

NOTE…See Chapter 3 for lubricant specifications and suppliers.

## WARNING

**The improper use of sealants and lubricants may cause engine malfunction or failure.**

a. Verify that all cylinder valve keepers have been properly installed.

b. Insure that each cylinder has a new cylinder base packing properly installed as described in section 15-7.

c. Carefully rotate the crankshaft placing the number 1 and number 2 connecting rods in their outer most position. Lubricate all cylinder through bolt and deck stud threads using clean 50 weight aviation engine oil.

d. Back the number 1 piston pin far enough out to allow the piston to be installed on the number 1 connecting rod. Place the number 1 cylinder and piston assembly on the number 1 connecting rod and slide the piston pin into the connecting rod and piston. Using a ring compressor, compress the number 4 piston ring and push the cylinder until the number 4 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.

e. Install the cylinder deck and through bolt nuts but do not torque at this time.

f. Back the number 2 piston pin far enough out to allow the piston to be installed on the number 2 connecting rod. Place the number 2 cylinder and piston assembly on the number 2 connecting rod and slide the piston pin into the connecting rod and piston. Using a ring compressor, compress the number 4 piston ring and push the cylinder until the number 4 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.

g. Install the cylinder deck and through bolt nuts but do not torque at this time.

h. Carefully rotate the crankshaft placing the number 3 and number 4 connecting rods in their outer most position.

i. Using the same procedure that was used to install the number 1 and number 2 cylinder and piston assemblies, install the number 3 and number 4 cylinder and piston assemblies.

j. Carefully rotate the crankshaft placing the number 5 and number 6 connecting rods in their outer most position.

k. Using the same procedure that was used to install the number 1 and number 2 cylinder and piston assemblies, install the number 5 and number 6 cylinder and piston assemblies.

l. Install the 7th stud brackets and nuts but do not torque at this time.

NOTE…The 7th stud nuts have a conical seat.

m. See Figure 16-1B, on 2-4-6 side of crankcase install baffle support (19) on through bolts at positions (43L & 44L). Install attaching hardware (17, 18) do not torque at this time. On 1-3-5 side of crankcase install attaching hardware (17, 18) on through bolts at positions (41R & 42R) do not torque at this time.

n. Apply Champion® thread lubricant to spark plugs in accordance with the manufacturer's instructions. Install gaskets and spark plugs in bottom cylinder spark plug holes. Do not Torque at this time.

o. Proceed to “TORQUING.”

**TORQUING**

*CAUTION…Before torquing the crankcase, using a straight edge, insure that the rear crankcase half ends are flush with each other.*

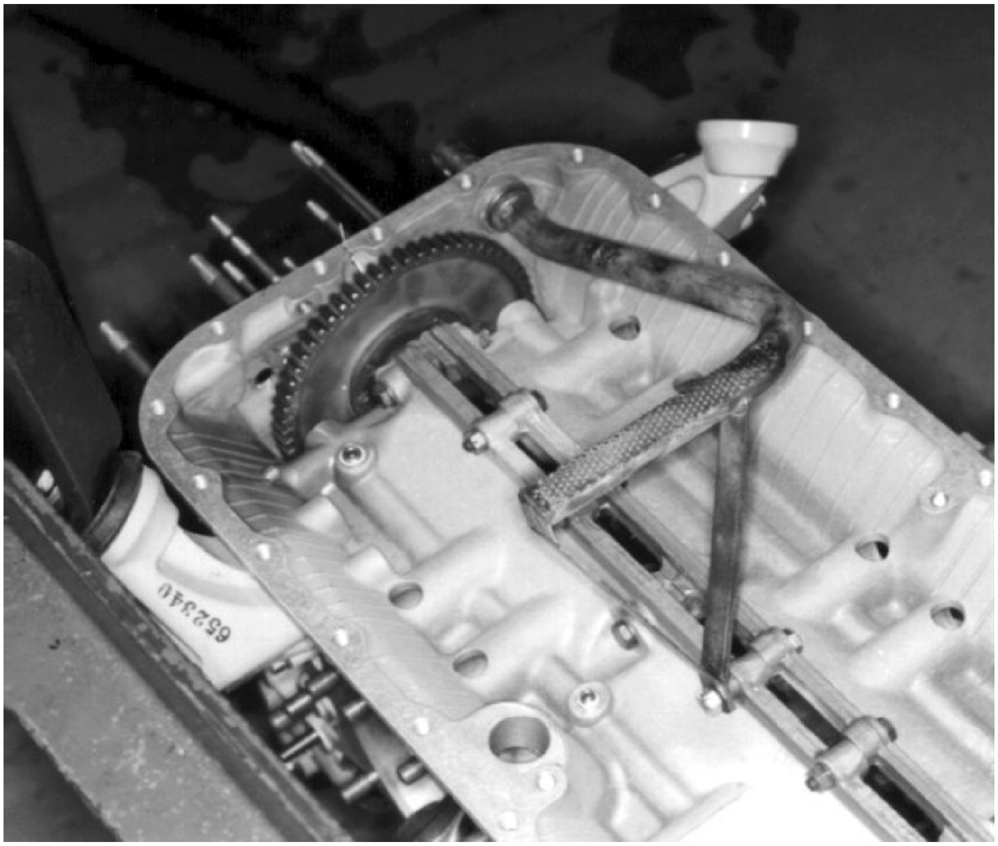



**FIGURE 18-7. GENERAL BOTTOM VIEW WITH OIL SUCTION TUBE INSTALLED**

NOTE…Have an assistant hold nuts on opposite side of cylinder when torquing through bolt hardware. Through bolt nuts on both sides of crankcase must be torqued to the specified values.

1. After all cylinders have been installed, using the sequence shown in Figure 18-8 torque nuts at positions (1 through 52) to the following preliminary torques:

NOTE…Crankcase and cylinder torquing requires two people.

## WARNING

**The torque values specified for engine reassembly are for use with clean nuts, bolts and studs with threads that are free of damage, distortion and that have been pre-lubricated with clean 50 weight aviation engine oil prior to torquing. The torque wrench used for torquing must be currently calibrated and traceable to the National Bureau of Standards. Incorrect through bolt torque may result in subsequent engine malfunction and failure.**

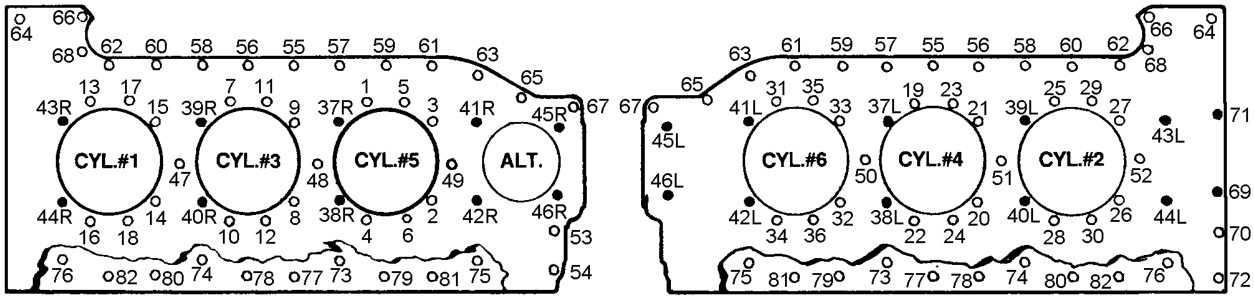



**FIGURE 18-8. TORQUING SEQUENCE**

## CRANKCASE PRELIMINARY TORQUE VALUES

| Preliminary Torques (inch pounds) | Sequence Number |
|---|---|
| 250 | 1 through 36 |
| 350 (6 point nut) | 37R/L, 38R/L, 39R/L, 40R/L |
| 400 (12 point nut) | 37R/L, 38R/L, 39R/L, 40R/L |
| 350 (6 point nut) | 41L, 42L, 43R, 44R |
| 400 (12 point nut) | 41L, 42L, 43R, 44R |
| 312 | 41R, 42R, 43L, 44L |
| 225 | 45R/L, 46R/L |
| 250 | 47, 48, 49, 50, 51, 52 |

Using the sequence shown in Figure 18-8, torque nuts at positions (1 through 70) to the following final torques:

## CRANKCASE FINAL TORQUE VALUES

| Final Torques (inch pounds) | Sequence Number |
|---|---|
| 490-510 | 1 through 36 |
| 690-710 (6 point nut) | 37R/L, 38R/L, 39R/L, 40R/L |
| 790-810 (12 point nut) | 37R/L, 38R/L, 39R/L, 40R/L |
| 690-710 (6 point nut) | 41L, 42L, 43R, 44R |
| 790-810 (12 point nut) | 41L, 42L, 43R, 44R |
| 615-635 | 41R, 42R, 43L, 44L |
| 440-460 | 45R/L, 46R/L |
| 490-510 | 47, 48, 49, 50, 51, 52 |
| 155-175 | 53, 54 |
| 190-210 | 55 through 63, 65, 66, 67, 68 |
| 275-325 | 64 |
| 155-175 | 69, 70, 71, 72 |
| 180-220 | 73 through 76 |
| 90-110 | 77 through 82 |

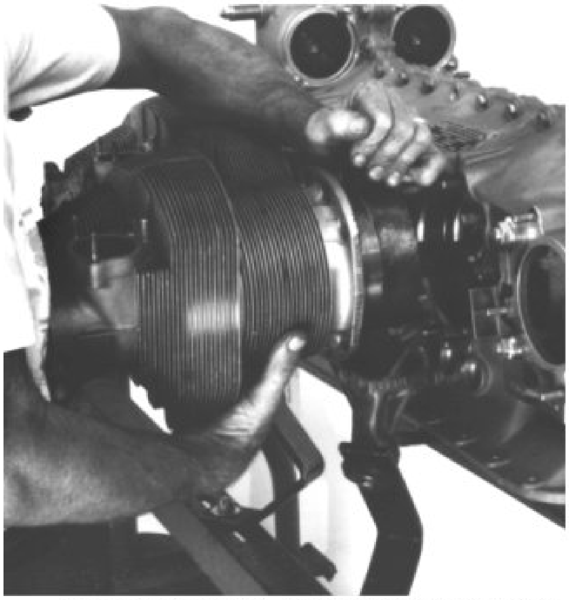


**FIGURE 18-9A. INSTALLING NO. 3 CYLINDER**

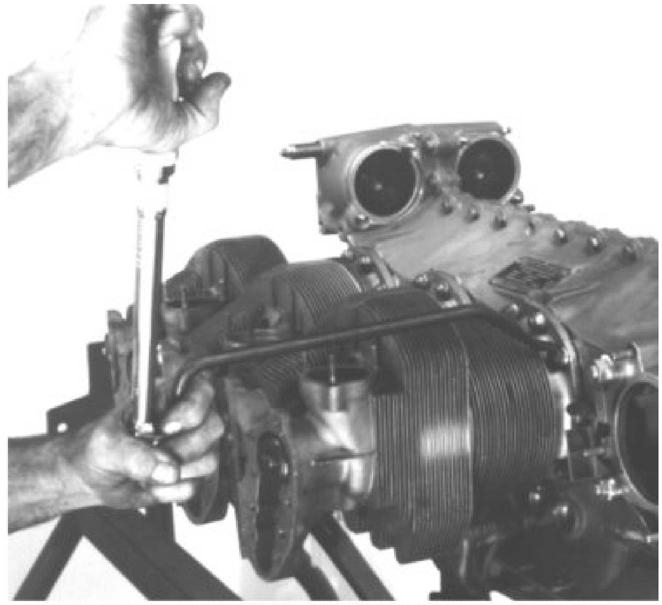


**FIGURE 18-9B. TORQUING CYLINDER BASE NUT**

2. Install engine oil coolers using the following instructions:

   Oil Cooler IO-550-A, B, IO-550-G, G1B, G2B & G4B

   See Figure 14-2A, slide gaskets (1) and gasket (2), onto crankcase studs. Install oil cooler (3), with baffle (4) attached, onto crankcase studs. Secure with attaching hardware (5 through 11). Torque 3/8 nuts to 275-325 inch pounds. Torque 5/16 nuts to 180-220 inch pounds.

   Oil Cooler IO-550-C

   NOTE…Use engine mount bracket P/N 653305 which replaces P/N 630694.

   See Figure 16-3A, install o-rings (1) and engine mount leg (3) on crankcase engine and oil cooler mount studs. See Figure 14-2B, install gaskets (1) and o-rings (2) onto crankcase studs. Install oil cooler (3), with baffle (4) attached, onto crankcase studs. Secure with attaching hardware (5 through 7) in Figure 14-2B and (8 through 11) in Figure 16-3A. Torque 3/8 nuts to 275-325 inch pounds. Torque 5/16 nuts to 180-220 inch pounds.

   Oil Cooler IO-550-G5B, G6B, IO-550-N, IO-550-P, IO-550-R

   See Figure 14-2C, slide gaskets (1) and gasket (2), onto crankcase studs. Install oil cooler (3), with baffle (4) attached, onto crankcase studs. Secure with attaching hardware (5 through 11). Torque 3/8 nuts to 275-325 inch pounds. Torque 5/16 nuts to 180-220 inch pounds.

## 18-5 IDLER GEAR SUPPORT PIN, CAMSHAFT COVER, CRANKSHAFT OIL SEAL RETAINER AND OIL FILLER TUBE

NOTE…Silk thread ends must be under idler pin and cam cover gaskets.

1. Oil Filler, Idler Support Pin & Camshaft Cover
   See Figure 16-2, torque idler gear support pin nuts (20) to 90-110 inch pounds. Using a new gasket (11) install camshaft cover (12) and secure with attaching hardware (13, 14, 15). Torque nuts (15) to 90-110 inch pounds.

### WARNING

**Oil pressure is applied to the face of the governor drive pad. If gasket, accessory or cover is not properly installed and hardware is not properly torqued oil leakage will occur.**

2. Oil Seal Retainer and Governor Cover IO-550-A, B, C
   See Figure 16-3A, install crankshaft oil seal retainer (18) and secure with bolts (19). Torque bolts (19) to 21.0-25.0 inch pounds. Using new gasket (12) install cover (13) and secure with attaching hardware (14 through 17) or install propeller governor, using the correct gasket, in accordance with the airframe manufacturer's Instructions. Torque nuts (17) to 180-220 inch pounds.
3. Oil Seal Retainer and Governor Cover IO-550-G, N, P & R
   See Figure 16-3B, install crankshaft oil seal retainer (13) and secure with bolts (14). Torque bolts (14) to 21.0-25.0 inch pounds. Using new gasket (7) install cover (8) and secure with attaching hardware (9 through 12) or install propeller governor, using the correct gasket, in accordance with the airframe manufacturer's Instructions. Torque nuts (12) to 180-220 inch pounds.

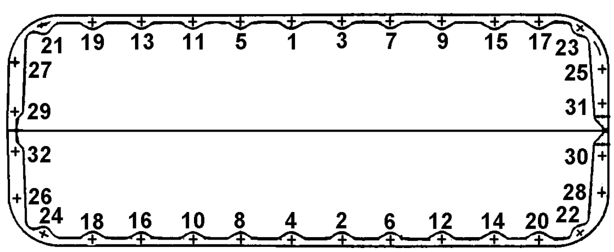



**FIGURE 18-10. OIL SUMP TORQUE SEQUENCE**

## 18-6A OIL SUMP IO-550-A & C

See Figure 14-3A. Coat oil sump flange with TCM gasket sealant 642188-1. Install new gasket (9) and oil sump (10) on crankcase. If using beaded style gasket (9) install it with beaded side toward sump. See Figure 10-1A, install balance tube bracket (15) centered on front oil sump flange. See Figure 14-3A. Secure oil sump and brackets with attaching hardware (11 through 13), install new gasket (14) (splitline toward sump) and plug (8). Using the sequence in Figure 18-10 torque bolts (13) to 83 inch pounds preliminary torque. Torque bolts (13) to 155-175 inch final torque. Torque plug (8) to 190 - 210 inch pounds. Safety wire plug in accordance with section 5-2, “Lockwire Procedure. ”

## 18-6B OIL SUMP IO-550-B, IO-550-R

See Figure 14-3B. Coat oil sump flange with TCM gasket sealant 642188-1. Install new gasket (6) and oil sump (7) on crankcase. If using beaded style gasket (6) install it with beaded side toward sump. See Figure 10-1B, install balance tube bracket (12) centered on front oil sump flange. See Figure 14-3B. Secure oil sump and bracket with attaching hardware (10, 11, 12), install new gasket (9) (splitline toward sump) and plug (4). Using the sequence in Figure 18-10 torque bolts (12) to 83 inch pounds preliminary torque. Torque bolts (12) to 155-175 inch final torque. Torque plug (4) to 190 - 210 inch pounds. Safety wire plug in accordance with section 5-2, “Lockwire Procedure.” Install new felt pad (13).

## 18-6C OIL SUMP IO-550-G, N & P

See Figure 14-3C. Coat oil sump flange with TCM gasket sealant 642188-1. Install new gasket (9) and oil sump (10) on crankcase. If using beaded style gasket (9) install it with beaded side toward sump. Secure oil sump with attaching hardware (11 through 13), install new gasket (14) (splitline toward sump) and plug (8). Using the sequence in Figure 18-10 torque bolts (13) to 83 inch pounds preliminary torque. Torque bolts (13) to 155-175 inch final torque. Torque plug (8) to 190 - 210 inch pounds. Safety wire plug in accordance with section 5-2, “Lockwire Procedure.”

## 18-7A OIL PUMP I0-550- A, A2B, A3B, I0-550-B, B1F, B2F, B3F, B4F, B5F, B6F, B9B, B11B, B14B, B15B, B16B, B19B, B21B, B23B, B29B, B30B, B32B, B35B, B37B, I0-550-C, C1F, C2F, C2U, C3F, C6F, C8B, C9B, C11B, C12B, C13B, C15B, C18B, C19B, C25B, C26B, C27B, C28B, C29B, C30B (See Figure 14-1A)

1. Remove plug (42), gasket (41) from protruding end of oil suction tube.
2. Apply TCM gasket maker to silk thread and split line of crankcase at oil pump bore. Place silk thread ends into split line of oil pump bore.
3. Place new oil pump gasket (20) and oil pump assembly (1) on crankcase studs. Secure with attaching hardware (22, 23, 24).
4. Torque nuts (24) to 90 - 110 inch pounds. Install new gasket (34) and oil filter adapter (36) on oil pump housing studs. Torque nuts (39) to 275 - 325 inch pounds. Secure with attaching hardware (37, 38, 39).
5. Apply a thin coat of Dow Corning No. 4 to the oil filter seal. Fill new oil filter with clean Type II corrosion preventative mineral oil conforming with MIL-C6529. Install new spin-on filter (35) and torque to 192-216 inch pounds. Safety wire oil filter in accordance with section 5-2, “Lockwire Procedure.”
6. Re-install gasket (41) and plug (42). Torque plug (42) to 190-210 inch pounds. Safety wire plug in accordance with section 5-2, “Lockwire Procedure.”

## 18-7B OIL PUMP IO-550- A4B, A5B, A6B, A7B I0-550-B5F, B12F, B13F, B17B, B18B, B20B, B22B, B24B, B25B, B26B, B27B, B28B, B31B, B34B, B36B, I0-550-C16B, C17B, C21B, C22B, I0-550-G, G1B, G2B, G4B, I0550-N, N1B, I0550-P, I0550-R (See Figure 14-1B)

1. Remove plug (34), gasket (33) from protruding end of oil suction tube.

2. Apply TCM gasket maker to silk thread and split line of crankcase at oil pump bore. Place silk thread ends into split line of oil pump bore.

3. Place new oil pump gasket (20) and oil pump assembly (1) on crankcase studs. Secure with attaching hardware (21, 22, 23).

4. Torque nuts (23) to 90 - 110 inch pounds. Install new gasket (27) and oil filter adapter (29) on oil pump housing studs. Torque nuts (32) to 275 - 325 inch pounds. Secure with attaching hardware (30, 31, 32).

5. Apply a thin coat of Dow Corning No. 4 to the oil filter seal. Fill new oil filter with clean Type II corrosion preventative mineral oil conforming with MIL-C6529. Install new spin-on filter (28) and torque to 192-216 inch pounds. Safety wire oil filter in accordance with section 5-2, “Lockwire Procedure.”

6. Re-install gasket (33) and plug (34). Torque plug (34) to 190-210 inch pounds. Safety wire plug in accordance with section 5-2, “Lockwire Procedure.”

## 18-7C OIL PUMP IO-550-G5B, G6B, I0550-N2B (See Figure 14-1C)

1. Remove plug (28), gasket (27) from protruding end of oil suction tube.

2. Apply TCM gasket maker to silk thread and split line of crankcase at oil pump bore. Place silk thread ends into split line of oil pump bore.

3. Place new oil pump gasket (17) and oil pump assembly (1) on crankcase studs. Secure with attaching hardware (18, 19, 20).

4. Torque nuts (20) to 90 - 110 inch pounds. Install new gasket (21) and oil filter adapter (23) on oil pump housing studs. Torque nuts (26) to 275 - 325 inch pounds. Secure with attaching hardware (24, 25, 26).

5. Apply a thin coat of Dow Corning No. 4 to the oil filter seal. Fill new oil filter with clean Type II corrosion preventative mineral oil conforming with MIL-C6529. Install new spin-on filter (22) and torque to 192-216 inch pounds. Safety wire oil filter in accordance with section 5-2, “Lockwire Procedure.”

6. Re-install gasket (27) and plug (28). Torque plug (28) to 190-210 inch pounds. Safety wire plug in accordance with section 5-2, “Lockwire Procedure.”

## 18-8A STARTER AND STARTER ADAPTER IO-550-A, I0-550-B9A, B9B, B9F, B14B, B19B, B30B, B35B, B36B, IO-550-C, IO-550-G, IO-550-N, IO550-P, IO550-R (See Figure 13-1A)

1. Apply a thin translucent coat of TCM Gasket Maker 646942 to the starter adapter gasket crankcase mating surface only.

2. Install gasket (1) on crankcase.

*CAUTION…Sealant must be applied sparingly to prevent contamination of the engine oil system.*

3. Lubricate teeth on starter shaftgear with clean 50 weight aviation engine oil and mesh with crankshaft gear as starter adapter is placed in position. Seat adapter against gasket. Secure adapter assembly to crankcase with washers (2, 27), new lock washers (3) and nuts (4, 28). Torque 5/16-24 nuts to 180-220 inch pounds. Torque 3/8 16 nuts to 200-220 inch pounds.

4. Lubricate o-ring (29) with clean 50 wt. aviation engine oil and install on starter pilot. Turn starter shaft until tongue aligns with worm drive shaft slot. Mount starter (30) and secure with washers (31) and nuts (32). Torque nuts (32) to 200-220 inch pounds.

## 18-8B STARTER AND STARTER ADAPTER IO-550-B, B1F, B2F, B3F, B4F, B5F, B6F, B11F, B12B, B13B, B15B, B16B, B17B, B18B, B20B, B21B, B22B, B23B, B24B, B25B, B26B, B27B, B28B, B29B, B31B, B32B, B33B, B34B, B37B (See Figure 13-1B)

1. Apply a thin translucent coat of TCM Gasket Maker 646942 to the starter adapter gasket crankcase mating surface only.

2. Install gasket (1) on crankcase.

*CAUTION…Sealant must be applied sparingly to prevent contamination of the engine oil system .*

3. Lubricate teeth on starter shaftgear with clean 50 weight aviation engine oil and mesh with crankshaft gear as starter adapter is placed in position. Seat adapter against gasket. Secure adapter assembly to crankcase with washers (2, 28), new lock washers (3) and nuts (4, 29). Torque 5/16-24 nuts to 180-220 inch pounds. Torque 3/8 16 nuts to 200-220 inch pounds.

4. Lubricate o-ring (47) with clean 50 wt. aviation engine oil and install on starter pilot. Turn starter shaft until tongue aligns with worm drive shaft slot. Mount starter (48) and secure with washers (49) and nuts (50). Torque nuts (50) to 200-220 inch pounds.

## 18-9 OPTIONAL COMPRESSOR BRACKET

1. If optional air conditioning compressor is to be utilized see Figure 13-1B. Remove nut (46) and spacer (45). Install drive sheave in place of spacer (45). Discard spacer (45). Temporarily secure drive sheave with nut (46). Do not torque at this time.
2. See Figure 16-1A. Remove nut (14), washer (13) and spacer (12). Inspect o-ring (11) and replace if necessary. See Figure 11-1. Install bracket (1) on crankcase upper hole to through bolt. See Figure 16-1. Loosely install washer (13) and nut (14). Discard spacer (12). See Figure 11-1. Align lower bracket bolt holes with crankcase bolt bosses. Install two each kit supplied washers (17) and bolts (16). In a counterclockwise sequence starting with the through bolt nut, torque nut and two bolts to 220 - 260 inch pounds.
3. See Figure 11-1, "Optional Compressor Mounting Bracket." Install customer supplied air conditioning compressor using kit supplied bolts (15), washer (14) and nuts (13). Torque nuts (13) and bolts (15) to 275 - 325 inch pounds. Further installation must be accomplished using the airframe manufacturer's instructions.
4. With all components installed the alignment of compressor, starter adapter and idler sheaves must be checked using a calibrated alignment tool Borroughs Tool No. 8082 or equivalent. see Chapter 2, "Tools." Check tool flatness (calibration) by laying it on a surface table. Place the alignment tool around the drive sheave with the extended end overlaying the upper portion of the compressor sheave. When the alignment is correct the alignment tools extended end (bar center) will fall within 0.020 inch of the center of the sheave. Use this same procedure to check the idler sheave, except the extended end of alignment tool will overlay the lower portion of the compressor sheave. See Figure 18-11, "Checking Sheave Alignment."

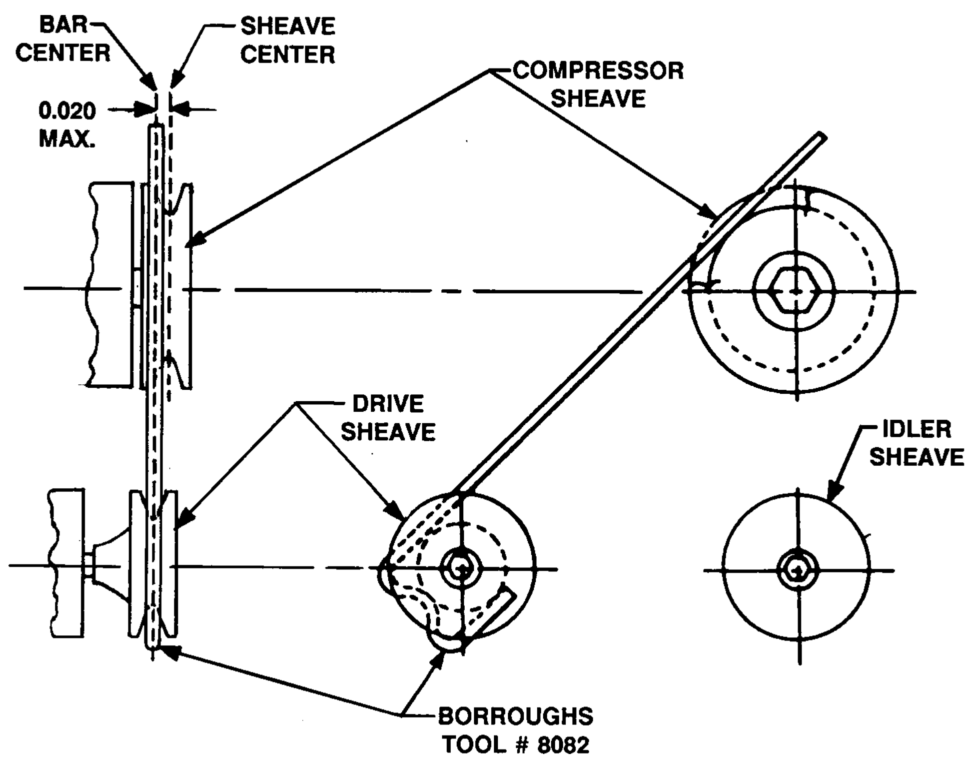



**FIGURE 18-11. CHECKING SHEAVE ALIGNMENT**

5. If drive or idler sheaves are not in alignment, remove sheaves and install up to but not to exceed five 0.020 shims P/N 643956-20 to achieve the correct alignment. See Figure 18-12, "Sheave Alignment." When idler sheave is properly adjusted, torque sheave screw to 800-850 inch pounds. When drive sheave is properly adjusted, torque sheave 12 point self locking nut to 450-500 inch pounds. Nuts must be lubricated with clean 50 wt. aviation engine oil. All threads of the sheave nut must be engaged.

*CAUTION…Prevent engine from turning when torquing nut.*

6. See Figure 18-13, "Belt Tensioning," on next page. Loosen the jam nut, adjusting bolt and slide nut. The slide nut should be loosened only enough to allow the slide to move freely and the adjusting bolt should be turned out far enough to allow Installation of the belt.
7. Install the drive belt. Slide the idler sheave snugly against the belt and torque the adjusting bolt finger tight into its socket. In this position the idler sheave should rotate by hand under the belt. Torque the adjusting bolt two full turns. Torque the adjusting bolt jam nut to 275-375 inch pounds. Torque the idler sheave bracket slide nut to 300-350 inch pounds.

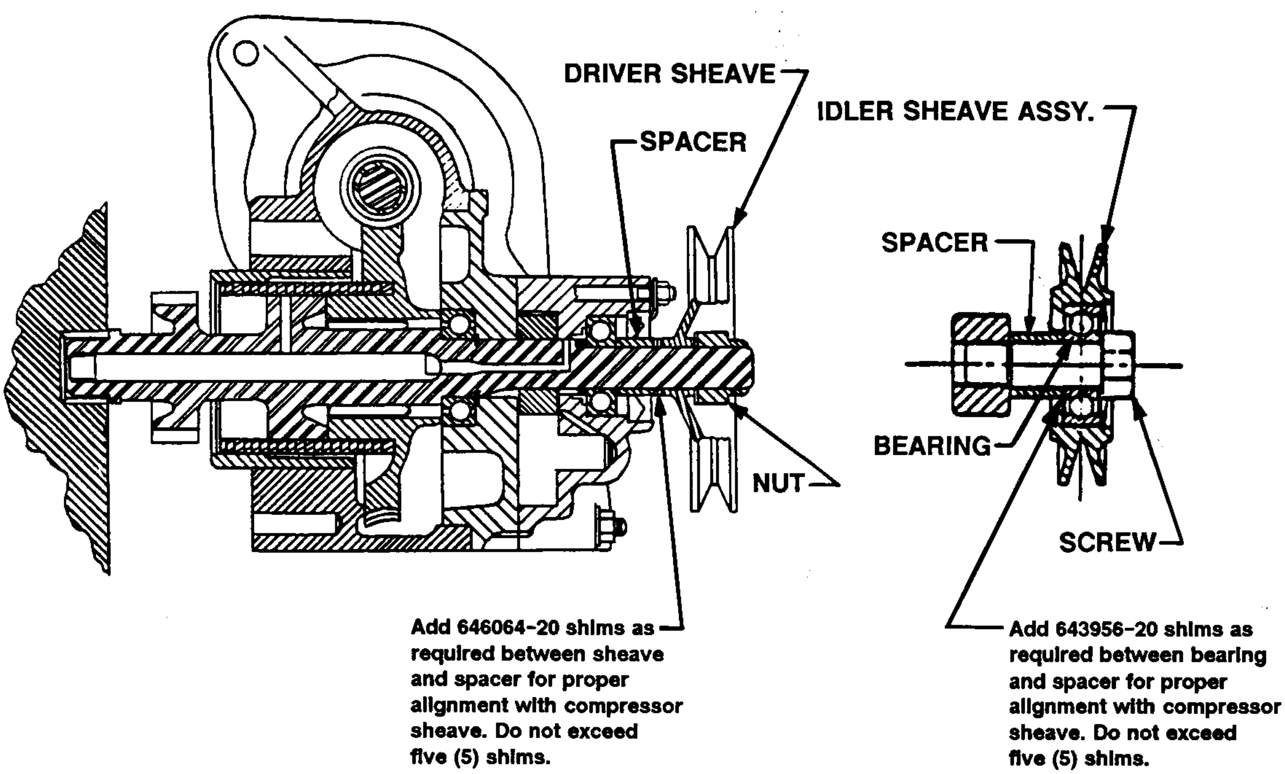



**FIGURE 18-12. SHEAVE ALIGNMENT**

8. Confirm that belt tension is 50-70 lbs. by one of the following methods:
   a. Use a direct reading belt tension gage such as Borroughs Tool No. BT-33-73F.
   b. Measure belt deflection under a five pound load at the center of the longest belt span. Correct deflection is 0.30-0.40 inch.

If belt tension is not within the above tolerance, loosen jam nut and slide nut and readjust belt tension. One full turn of adjusting screw will give approximately ten pounds change in belt tension.

*CAUTION…Do not over torque drive belt .*

After approximately five hours of operation, recheck belt tension and adjust as required to maintain 50-70 pounds belt tension.

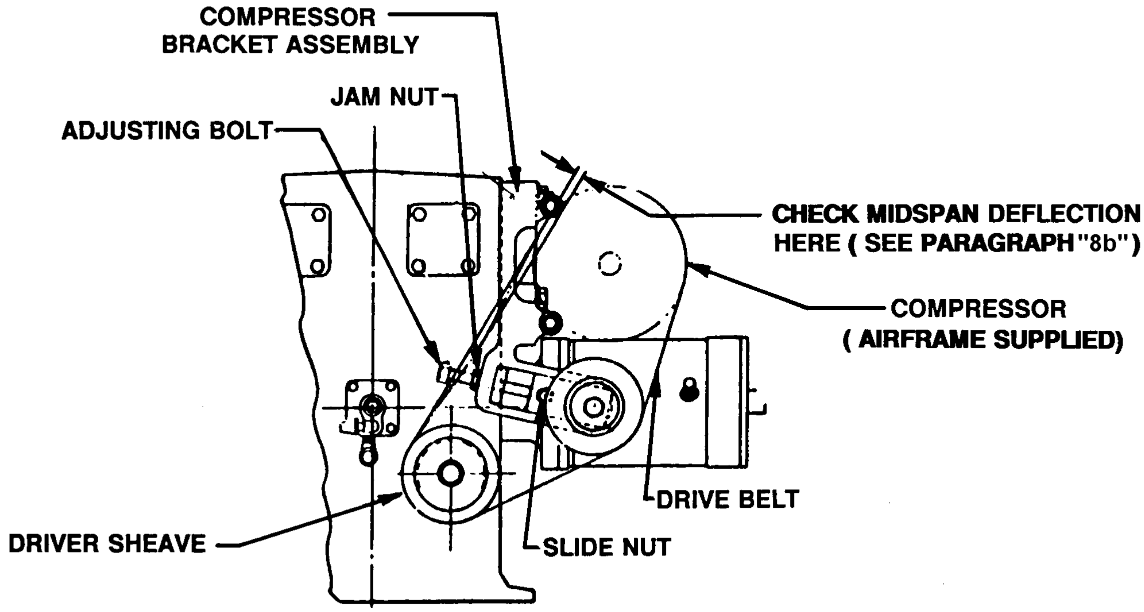



**FIGURE 18-13. BELT TENSIONING**

### 18-10 ALTERNATOR ASSEMBLY (See Figure 12-1)

1. Install new gasket (1) on crankcase alternator flange.

2. Insure that the alternator slips onto the crankcase without binding and that the mounting flange is properly seated against the crankcase. Do not force the alternator into position.

3. If there is stud interference with the mounting lug holes while mounting the alternator, do not force the alternator over the studs. Installation of the alternator in a binding configuration can cause mount lug failure. If interference exists, it is permissible to enlarge the mount lug stud holes by drilling or reaming to a maximum diameter of .387. Standard hole size is .337-.347 inch diameter.

4. Insure that the alternator pilot enters the crankcase pilot bore squarely. Forcing entry with the attaching nuts will stress the lugs causing cracking and malfunction.

5. Install alternator (2) onto the engine. With the alternator pilot properly engaged in the pilot bore, install washers (8), lock washers (9) and nuts (10). Finger tighten nuts evenly and snug. Torque nuts (10) to 180-220 inch pounds.

See NOTE on next page.

NOTE…If Installing a new or rebuilt 60 amp 24 volt alternator and interference occurs between one of the crankcase through bolts and the alternator drive end housing, perform the following:

a. Using an appropriate grinding tool or a .750 - .812 diameter end mill cutter, contour housing as specified in Figure 18-14. Insure a minimum radius at all corners of .005" and wipe away chips or dust. Treat with Accelagold Aluminum Conversion Coating, and apply enamel paint.

b. Reinstall alternator in accordance with the previous installation procedure. Verify through bolt does not contact housing.

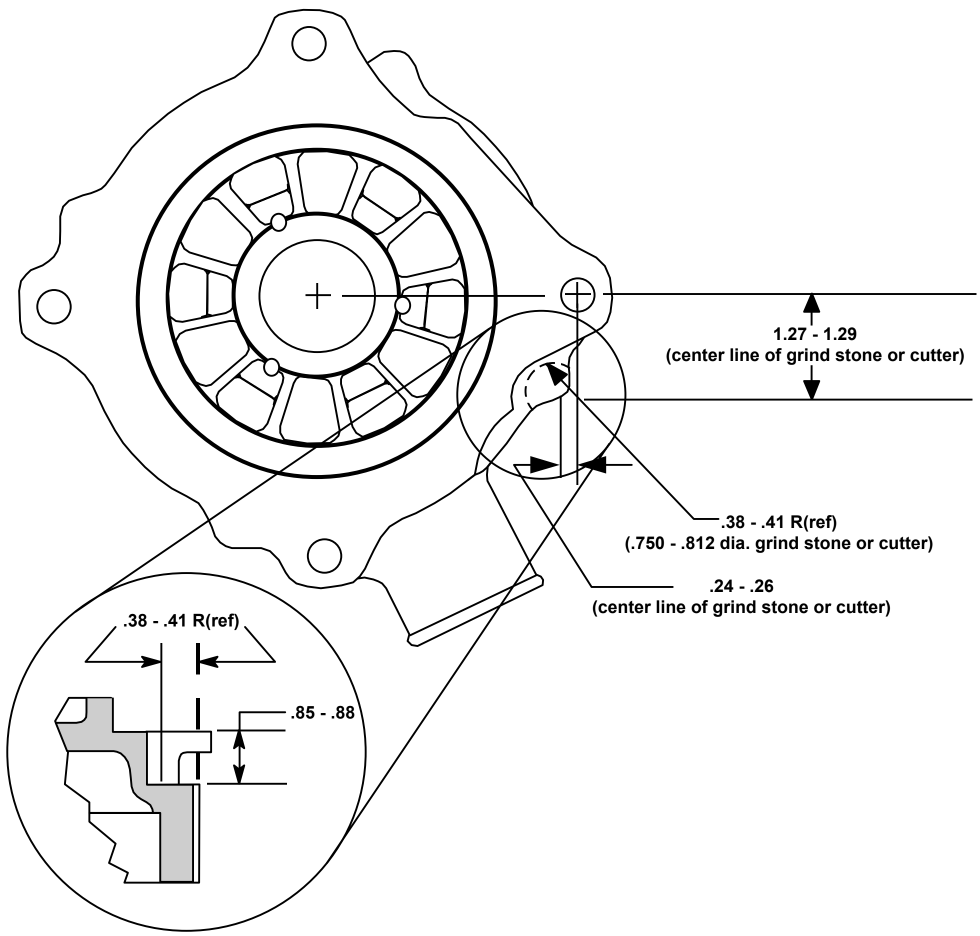



**FIGURE 18-14. ALTERNATOR HOUSING MODIFICATION**

## 18-11A MAGNETO AND ACCESSORY DRIVE ADAPTERS IO-550-A, B, C, G, G1B, G2B, G4B, G6B, IO-550-N, IO-550-P, IO-550-R (See Figure 8-2A)

## WARNING

**Oil pressure is applied to the face of the accessory drive pads. Apply proper gasket and torquing procedures .**

1. Place two new gaskets (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.
2. Install two adapter assemblies (2) on the crankcase mount pads. The adapter oil holes must be aligned with the crankcase oil outlet holes. Attach both adapters to crankcase using plain washers (6, 7), lock washers (8, 9) and nuts (10, 11). Torque 5/16 nuts to 180 - 220 inch pounds and 3/8 nuts to 275 - 325 inch pounds.
3. Using new gaskets (16), install covers (17) and secure using attaching hardware (18, 19 & 20). Torque nuts (20) to 90-110 inch pounds. If installing an airframe supplied accessory, insure that the proper gasket is used and install in accordance with the airframe manufacturer's instructions.

## 18-11B MAGNETO AND ACCESSORY DRIVE ADAPTERS I0-550-G5B (See Figure 8-2B)

### WARNING

**Oil pressure is applied to the face of the accessory drive pads. Apply proper gasket and torquing procedures.**

1. Place two new gaskets (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.
2. Install two adapter assemblies (2, 6) on the crankcase mount pads. Adapter (2) oil hole must be aligned with the crankcase oil outlet hole. Attach both adapters to crankcase using plain washers (10, 11), lock washers (12, 13) and nuts (14, 15). Torque 5/16 nuts to 180 - 220 inch pounds and 3/8 nuts to 275 - 325 inch pounds.
3. Using new gaskets (20), install covers (21) and secure using attaching hardware (22, 23, 24 or 22, 23, 25) as applicable. Torque nuts (24) to 90-110 inch pounds. Torque bolts (25) to 75-85 inch pounds. If installing an airframe supplied accessory, insure that the proper gasket is used and install in accordance with the airframe manufacturer's instructions.

## 18-12A VALVE MECHANISM I0-550-A, B & C (See Figure 15-1A)

1. Lubricate all tappet faces using Dow Corning® G-N Paste or equivalent. [Dow Corning® is a registered trademark of Dow Corning Corporation.]
2. Install new exhaust tappets into exhaust side tappet guides. Install new intake tappets into intake side tappet guides.
3. Install twelve pushrod housings. Using a Borrough's 68-3 Rod Spring Compressor or equivalent compress new spring (38). Place a new packing (37) between two steel washers (36), and install on the crankcase end of pushrod housing. Place a new packing (37) between two steel washers (36), and install on the cylinder end of pushrod housing. Insert housing into crankcase guide until other end with washers (36) and packing (37) can be aligned with cylinder head opening. Move assembly outward until gasket has entered cylinder hole. Release spring slowly until it is free. Remove spring compressor. See Figure 18-17, "Installing Pushrod Housing." Install the pushrod housings nearest to engine mount brackets first. The spring compressor tool must lie close to horizontal in order to clear the crankcase flange. Place engine in upright position.
4. Lubricate pushrods (39) with clean 50 wt. aviation engine oil and install through cylinder openings into housings (35).

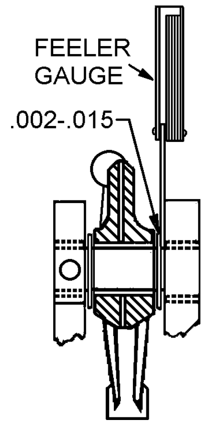



**FIGURE 18-15A. CHECKING ROCKER ARM SIDE CLEARANCE**

5. Before installing valve actuating parts on each cylinder turn the crankshaft until pushrods are at their lowest position. Lubricate rocker assemblies, new thrust washers and new rocker shafts using clean 50 wt. aviation engine oil. The rocker shaft beveled side must be installed facing toward the cylinder base. Slide rocker arm shafts to side to allow rocker arm installation. Install rocker assemblies (21, 24) and thrust washers (27) in rocker bosses. Slide rocker shafts (18) into place and secure with washers (19) and bolts (20), check side clearance between rocker boss and rocker arms it must be .002 - .015. See Figure 18-15A, “Checking Rocker Arm Clearance.” Torque bolts (20) to 90 - 100 inch pounds.
6. Measure exhaust rocker arm to rotocoil clearance. See Figure 18-16, "Rocker Arm To Rotocoil Clearance.
7. Measure dry valve gear lash at valve tip to rocker foot and compare with limits given in Figure 15-4A or 15-4B, "Cylinder Fits and Limits," as applicable.
8. Install valve actuating parts on remaining cylinders using the above procedure.
9. Using new gaskets (28), install rocker covers (29) and secure with attaching hardware (30, 31 & 32). Do not torque screws (32) at this time. The rocker covers will be removed for engine pre-oiling during post overhaul adjustment and test.

## 18-12B VALVE MECHANISM IO-550-G, N, P & R (See Figure 15-1B)

1. Lubricate all tappet faces using Dow Corning® G-N Paste or equivalent. [Dow Corning® is a registered trademark of Dow Corning Corporation.]
2. Install new exhaust tappets into exhaust side tappet guides. Install new intake tappets into intake side tappet guides.
3. Install twelve pushrod housings. Using a Borrough's 68-3 Rod Spring Compressor or equivalent, compress spring (39). Place a new packing (38) between two steel washers (36) and install on the crankcase end of pushrod housing. Place a new gasket (37) on the cylinder end of pushrod housing. Insert housing into crankcase guide until other end can be aligned with cylinder head opening. Move assembly outward until gasket has entered cylinder hole. Release spring slowly until it is free. Remove spring compressor. See Figure 18-17, "Installing Pushrod Housing." Install the pushrod housings nearest to engine mount brackets first. The spring compressor tool must lie close to horizontal in order to clear the crankcase flange. Place engine in upright position.
4. Lubricate pushrods (40) with clean 50 wt. aviation engine oil and install through cylinder openings into housings (35).

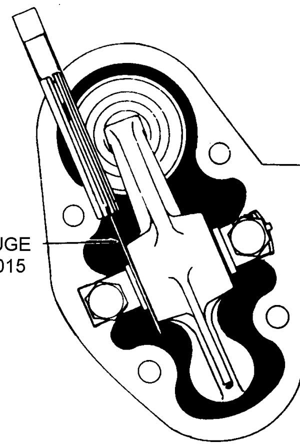



**FIGURE 18-15B. CHECKING ROCKER ARM SIDE CLEARANCE**

5. Before installing valve actuating parts on each cylinder, turn the crankshaft until pushrods are at their lowest position. Lubricate rocker assemblies, new thrust washers and new rocker shafts using clean 50 wt. aviation engine oil. Install rocker assemblies (20) and thrust washers (23) on rocker shafts (24). Install rocker and shaft assemblies on cylinder in correct positions. Install retainers (25), new tab washers (26) and bolts (27). Check side clearance between retainers and rocker arms. See Figure 18-15B, "Checking Rocker Arm Side Clearance." Torque bolts (27) to 190 - 210 inch pounds.
6. Measure exhaust rocker arm to rotocoil clearance. See Figure 18-16, "Rocker Arm To Rotocoil Clearance.
7. Measure dry valve gear lash at valve tip to rocker foot it must be 0.060 to 0.200
8. Bend tab washers (26) flat up against head of bolts (27) to safety. See section 5-3, "Tab Washer Procedure."
9. NOTE…Do not realign bolt head to suit tab washer.
10. Install valve actuating parts on remaining cylinders using the above procedure.

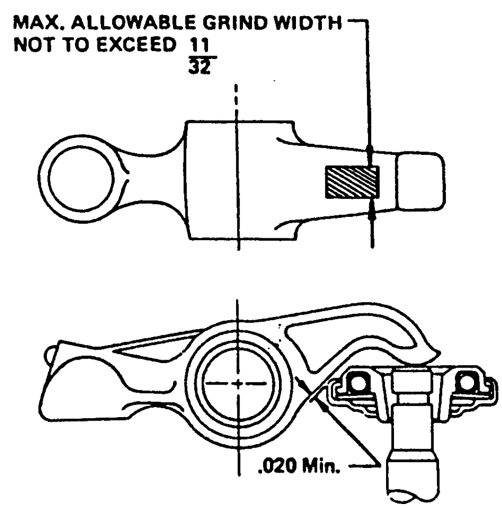



**FIGURE 18-16. ROCKER ARM TO ROTOCOIL CLEARANCE**

11. Using new gaskets (28), install rocker covers (29) and secure with attaching hardware (30, 31, 32). Do not torque screws (32) at this time. The rocker covers will be removed for engine pre-oiling in section 19-2.

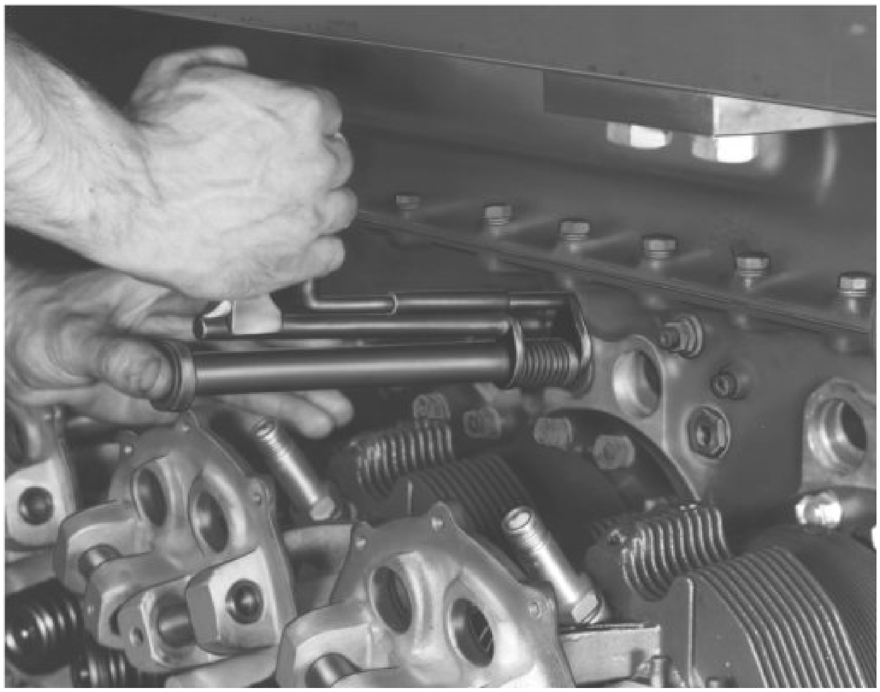


**FIGURE 18-17. INSTALLING PUSHROD HOUSING**

## 18-13 CYLINDER BAFFLING IO-550-G, N, P & R (See Figures 15-1B & 9-1D)

1. See Figure 15-1B. Assemble baffle (67) and baffle base using screw and washer (64, 65).
2. Position baffle assembly (66, 67) below and between cylinders 4 and 6. Place baffle support (63) above and between cylinders 4 and 6. Line up bolt holes on bracket (25) of Figure 9-1D with bolt holes on baffle support (63) of Figure 15-1B so that they are centered with anchor nuts on lower baffle assembly (67) of Figure 15-1B. Install bolt and washer (61, 62) securing lower baffle assembly (66, 67) to baffle support and fuel injection line bracket. Using same procedure as above, install remaining baffles between cylinders (2, 4), (5, 3) and (1, 3).

## 18-14 CYLINDER DRAIN ASSEMBLY IO-550-G, N, P & R (See Figure 15-1B)

1. Coat the male tapered threads of fittings (16) with Loctite pipe sealant with teflon P S/T. Coat the male tapered threads only. Install fittings (16) in cylinders. Torque to limit specified in Table 6-3, "Torque Specifications for Fittings."
2. Install cylinder drain tube assembly (45) on cylinders. Torque drain tube "B" nuts to the limit specified in Table 6-3, "Torque Specifications for Fittings." Drain valve assemblies must be installed in accordance with the airframe manufacturer's instructions .

## 18-15 EXHAUST SYSTEM

1. Exhaust system may now be installed in accordance with the airframe manufacturer's instructions.

## 18-16A INDUCTION SYSTEM IO-550-A

1. See Figure 10-1A. Install new gaskets (1) on all cylinder intake flanges. Assemble left and right cylinder bank intake manifolds using risers (2, 3), new hoses (9) and clamps (7, 8). Install left and right cylinder bank manifolds on cylinders. Secure with attaching hardware (4, 5, 6). Torque bolts (6) to 90 - 110 inch pounds.
2. Insure plug (18) has been installed in balance tube (17). Push new hoses (9) and clamps (8) on front of risers (3). Install balance tube assembly (17) into hoses (9). Torque clamps (7, 8) to 40-50 inch pounds. Secure balance tube to oil sump flange bracket using clamp (16).
3. Insure plugs (12) have been installed in elbows (10, 11). Push new hoses (9) and clamps (8) on rear of risers (2). Install elbows (10, 11). Install new hoses (9) and clamps (8) on ends of elbows and install manifold (13). Torque clamps (8) to 40-50 inch pounds. Slide new flexible duct (24) on manifold (13). Install bracket (19) on oil sump using attaching hardware (21, 20). Torque bolts (20) to 155 - 175 inch pounds. Secure bracket (19) to manifold using attaching hardware (22, 23). Torque nut (23) to 90 - 110 inch pounds.
4. The air throttle and fuel control assembly must be installed in accordance with the airframe manufacturer's instructions.

## 18-16B INDUCTION SYSTEM IO-550-B

1. See Figure 10-1B. Install new gaskets (1) on cylinder intake flanges. Assemble left and right cylinder bank intake manifolds using risers (2, 3), new hoses (9) and clamps (7, 8). Install left and right cylinder bank manifolds on cylinders. Secure with attaching hardware (4, 5, 6). Torque bolts (6) to 90 - 110 inch pounds.
2. Push new hoses (9) and clamps (8) on front of risers (3). Install balance tube assembly (14) into hoses. Torque clamps (8) to 40-50 inch pounds. Secure balance tube to oil sump flange bracket using clamp (13)
3. Insure plug (11) has been installed in manifold (10). Push new hoses (9) and clamps (7) on rear of risers (2). See Figure 9-1B. Install throttle (4A) on oil sump and secure with attaching hardware (12, 13). Torque bolts (13) to 155 - 175 inch pounds. Safety wire bolts (13) in accordance with section 5-2, "Lockwire Procedure." See Figure 10-1B. Install intake manifold (10) into hoses (9) and (15). Torque clamps (7 & 16) to 40-50 inch pounds.

## 18-16C INDUCTION SYSTEM IO-550-C

1. See Figure 10-1C. Install new gaskets (1) on cylinder intake flanges. Assemble left and right cylinder bank intake manifolds using risers (2, 3), new hoses (9) and clamps (7, 8). Install left and right cylinder bank manifolds on cylinders. Secure with attaching hardware (4, 5, 6). Torque bolts (6) to 90 - 110 inch pounds.
2. Push new hoses (9) and clamps (8) on front of risers (3). Install balance tube assembly (14) into hoses. Torque clamps (8) to 40-50 inch pounds. Secure balance tube to oil sump flange bracket using clamp (13)
3. Install new hoses (9) and clamps (7) on rear of risers (2). Install elbows (10, 11) into hoses (9). Torque clamps (7) to 40-50 inch pounds. Install new hoses (9) and clamps (7) on ends of elbows (10 & 11). Install throttle assembly into hoses. See Figure 9-1C. Install bracket (42) on accessory drive adapter studs using existing hardware. Torque adapter nuts to 180 - 220 inch pounds. Install brackets (47, 48) on bracket (42) using new bushings (45), sleeve (46) and attaching hardware (49, 50). Torque nut and bolt (49, 50) to 90 -110 inch pounds. Install spacer (52) and lower bracket (51) on throttle. Secure using attaching hardware (22). Torque nut (22) to 90 - 110 inch pounds. Connect lower bracket (51) to tach drive assembly using nut (22). Torque nut (22) to 90 - 110 inch pounds.

## 18-16D INDUCTION SYSTEM IO-550-G, N, P & R

1. See Figure 10-1D. Install plugs (4, 5) into intake manifold (2). Torque plugs (4, 5) to the specified torque in Table 6-2, "Pipe Plug Torques." Attach new bumper (3) below manifold where it will contact crankcase backbone.
2. Using new gasket (1), assemble throttle and metering assembly to intake manifold (2). Secure with attaching hardware (14, 15, 19). Torque screws (19) to 75 - 85 inch pounds. Loosely assemble intake tubes and flanges (6 through 13) to intake manifold (2) using new hoses and clamp assemblies (17, 18). Place new gaskets (12) on cylinder intake flanges. With the aid of an assistant, place intake spider assembly on top of engine. Adjust intake tubes so they seat squarely on cylinder flanges and secure with attaching hardware (14, 15, 16). Torque nuts (16) to 90 - 110 inch pounds. Torque clamps (18) to 40-50 inch pounds .

## 18-17A FUEL INJECTION SYSTEM IO-550-A

NOTE…All fuel injection system parts must be clean and free of debris before assembly.

1. See Figure 9-1A. Apply TCM 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. Apply molyshield grease to fuel pump drive coupling (2). Install fuel pump drive coupling (2) in fuel pump (3). Install new gasket (2A) on fuel pump. Lubricate fuel pump cavity with clean 50 weight aviation engine oil. Install fuel pump on crankcase. Secure fuel pump using attaching hardware (32, 33, 34). Torque nuts (34) to 180-220 inch pounds.
3. Apply 646943 anti seize lubricant to fuel nozzle threads (cylinder end) in accordance with Figure 9-9, "General F/I Sealant Application." Install new fuel nozzles (25) in cylinders 1 through 6. Torque nozzles to 55-65 inch pounds.

*CAUTION…Never use teflon tape on fuel injection system fittings.*

### 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.**

4. Install fuel injection lines (19 through 24) between nozzles (25) and fuel manifold valve (18). Torque fuel line "B" nuts at nozzles to 40- 45 inch pounds. Torque fuel line "B" nuts at manifold valve to 55-60 inch pounds.
5. Attach clamps (30) to fuel lines Snap clamps (30) into brackets (31). Install fuel hoses in accordance with the airframe manufacturer's instructions.

## 18-17B FUEL INJECTION SYSTEM IO-550-B

1. See Figure 9-1B. Apply TCM 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. Apply molyshield grease to fuel pump drive coupling (2). Install fuel pump drive coupling (2) in fuel pump (3). Install new gasket (3A) on fuel pump. Lubricate fuel pump cavity with clean 50 weight aviation engine oil. Install fuel pump on crankcase. Secure fuel pump using attaching hardware (34, 35 & 36). Torque nuts (36) to 180-220 inch pounds.
3. Apply 646943 anti seize lubricant to fuel nozzle threads (cylinder end) in accordance with Figure 9-9, "General F/I Sealant Application." Install new fuel nozzles (31) in cylinders 1 through 6. Torque nozzles to 55-65 inch pounds.

*CAUTION…Never use teflon tape on fuel injection system fittings.*

### 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 .**

4. Install fuel injection lines (30, 45, 46, 47) between nozzles (31) and fuel manifold valve (27). Torque fuel line "B" nuts at nozzles to 40- 45 inch pounds. Torque fuel line "B" nuts at manifold valve to 55-60 inch pounds.
5. Attach clamps (33) to fuel lines. Snap clamps (33) into brackets (32, 32A). Install fuel hoses (28) between fuel pump and fuel control unit fittings. Torque hose "B" nuts to the specified limit in Table 6-4, "Torque Specifications for Hose Fittings." Install brackets (37) using existing oil sump bolts. Using clamps (38) secure fuel hoses (28) to brackets (37) using attaching hardware (40, 41, 42).
6. Install fuel hose (29) between fuel manifold valve (27) and fuel control unit (5) fittings. Torque hose "B" nuts to the specified limit in Table 6-4, "Torque Specifications for Hose Fittings." Using clamp (39), secure fuel hose (29) to bracket (37) using attaching hardware (40, 41, 42).

## 18-17C FUEL INJECTION SYSTEM IO-550-C

1. See Figure 9-1C. Apply TCM 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. Apply molyshield grease to fuel pump drive coupling (2). Install fuel pump drive coupling (2) in fuel pump (3). Install new gasket (3A) on fuel pump. Lubricate fuel pump cavity with clean 50 weight aviation engine oil. Install fuel pump on crankcase. Secure fuel pump using attaching hardware (30, 31 & 32). Torque nuts (32) to 180-220 inch pounds.
3. Apply 646943 anti seize lubricant to fuel nozzle threads (cylinder end) in accordance with Figure 9-9, "General F/I Sealant Application." Install new fuel nozzles (27) in cylinders 1 through 6. Torque nozzles to 55-65 inch pounds.

*CAUTION…Never use teflon tape on fuel injection system fittings.*

### 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.**

4. Install fuel injection lines (26, 35, 36, 37) between nozzles (27) and fuel manifold valve (23). Torque fuel line "B" nuts at nozzles to 40- 45 inch pounds. Torque fuel line "B" nuts at manifold valve to 55-60 inch pounds.
5. Attach clamps (29) to fuel lines. Snap clamps (29) into brackets (28). Install fuel hoses (24) between fuel pump and fuel control unit fittings. Torque hose "B" nuts to the specified limit in Table 6-4, "Torque Specifications for Hose Fittings."
6. Install fuel hose (25) between fuel manifold valve (23) and fuel control unit (5) fittings. Torque hose "B" nuts to the specified limit in Table 6-4, "Torque Specifications for Hose Fittings." Install fuel control unit shroud (19) on fuel control (5). Secure using attaching hardware (7, 9, 20, 21 & 22). Torque bolt (9) to 75 - 85 inch pounds. Torque nuts (22) to 90 - 110 inch pounds. Bend tab of tab washer up against bolt (9) to safety .

## 18-17D FUEL INJECTION SYSTEM IO-550-G, N, P & R

1. See Figure 9-1D. Apply TCM 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. Apply molyshield grease to fuel pump drive coupling (2). Install fuel pump drive coupling (2) in fuel pump (3). Install new gasket (2A) on fuel pump. Lubricate fuel pump cavity with clean 50 weight aviation engine oil. Install fuel pump on crankcase. Secure fuel pump using attaching hardware (4, 5 & 6). Torque nuts (6) to 180-220 inch pounds.
3. Apply 646943 anti seize lubricant to fuel nozzle threads (cylinder end) in accordance with Figure 9-9, "General F/I Sealant Application." Install new fuel nozzles (28) in cylinders 1 through 6. Torque nozzles to 55-65 inch pounds.

*CAUTION…Never use teflon tape on fuel injection system fittings.*

4. Install manifold valve and bracket (12, 13) on intake manifold secure with attaching hardware (16, 17, 18). Torque bolts (18) to 155 - 175 inch pounds.
5. Install brackets (26) between induction tube hoses and clamps relative to the fuel lines they will support. Position brackets so they will align properly with fuel line clamps (27).

**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 lines (19 through 24) between fuel manifold valve (12) and nozzles (28). Torque fuel line "B" nuts at nozzles to 40- 45 inch pounds. Torque fuel line "B" nuts at manifold valve to 55-60 inch pounds.
7. Attach clamps (27) to fuel lines (19 through 24). Insure that fuel line clamps are installed on fuel line insulators. Snap clamps into brackets (25, 26). Install fuel hose (37) between fuel pump and fuel metering unit. Torque hose "B" nuts to the specified limit in Table 6-4, "Torque Specifications for Hose Fittings."

## 18-18 MAGNETO TO ENGINE TIMING

NOTE…The engine is equipped with a right angle drive starter adapter. If it does not freely turn in the opposite direction of normal rotation the starter motor must be removed from the starter adapter. Some right angle starter drive adapters incorporate an over-riding spring clutch design that restricts engine rotation in the opposite direction of normal rotation.

Use the following basic timing procedure to insure that timing is accomplished in accordance with the required specifications.

NOTE…Whenever positioning the crankshaft for magneto installation, always turn the crankshaft steadily in the direction of rotation to eliminate any backlash error.

In conducting magneto timing check, use a top dead center locator, protractor and pointer such as the Eastern Electronics Model E25 Timing Indicator or equivalent.

Ignition Timing (Compression stroke, breaker opens)
Right Magneto, degrees BTC................ 22° ±1°
Left Magneto, degrees BTC.................. 22° ±1°

1. Remove all top spark plugs. Rotate the crankshaft in the direction of normal rotation until the number one piston is at top dead center on the compression stroke. Rotate the crankshaft in the opposite direction of normal rotation until the piston is far enough down the barrel to allow the TDC locator to be installed.
2. Install the top dead center locator into No. 1 cylinder top spark plug hole.
3. Install timing disc of indicator being used on the crankshaft flange.
4. Turn crankshaft slowly in direction of normal rotation until piston lightly touches TDC locator.
5. Rotate disc of timing indicator until the 0 degree mark aligns with the pointer.
6. Slowly turn crankshaft in opposite direction of normal rotation until the piston lightly touches TDC locator.

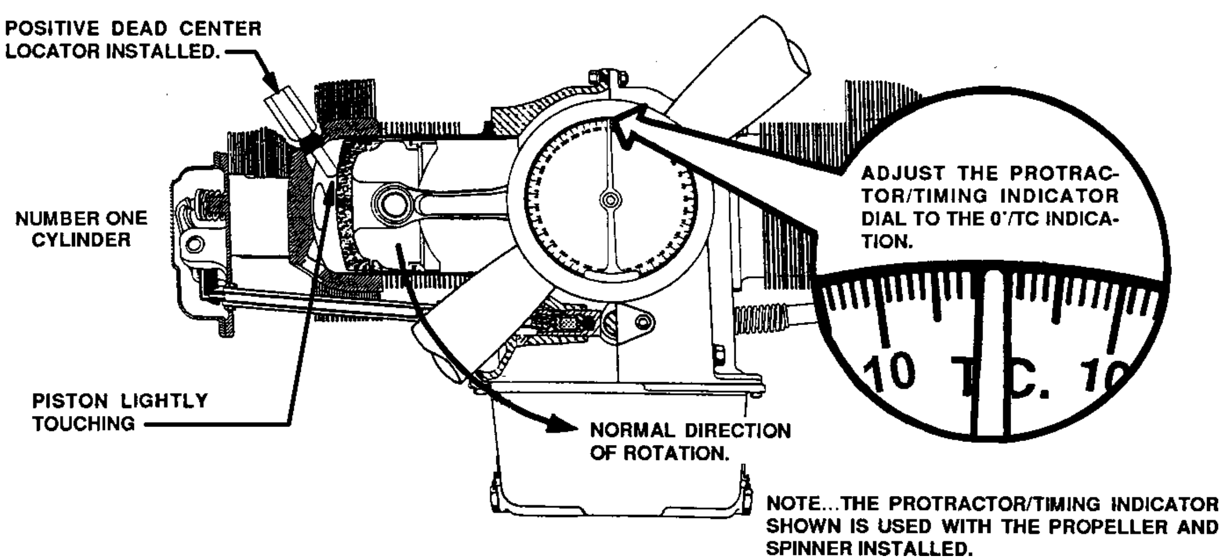



**FIGURE 18-18A. TIMING PROCEDURE STEP 1**

7. Observe reading on the disc under the pointer and move the disc, to exactly one-half of the number of degrees observed, toward the top center mark.

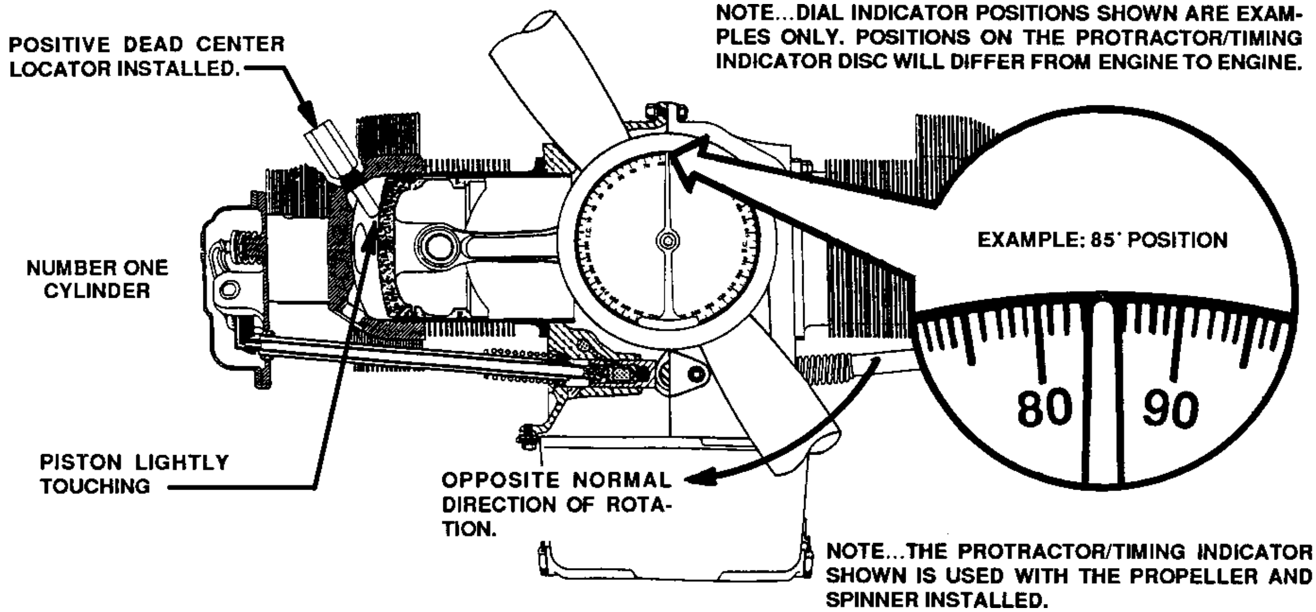



**FIGURE 18-18B. TIMING PROCEDURE STEP 2**

8. This will be approximately one-half the number of degrees remaining of 360 degrees of crankshaft rotation. You have now positioned the timing disc to locate top dead center.
9. Remove the TDC locator from the cylinder and find the compression stroke on No. 1

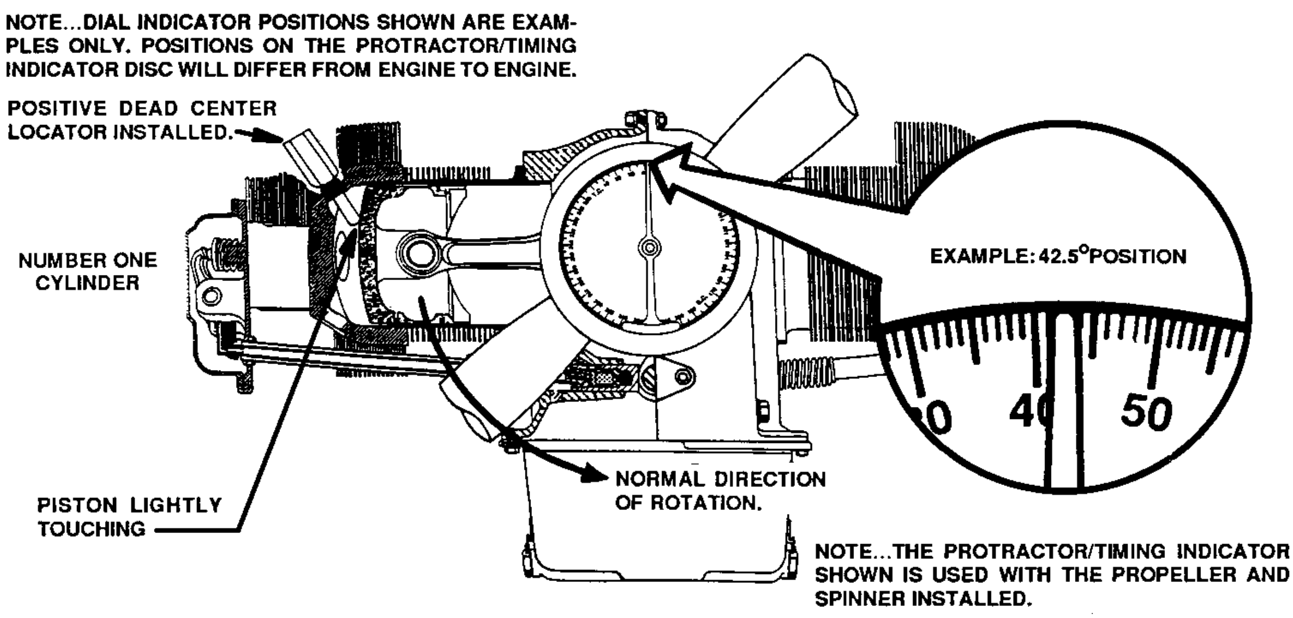



**FIGURE 18-18C. TIMING PROCEDURE STEP 3**

cylinder by placing a finger over the spark plug hole, or any other adequate method. As you come up on compression, stop the pointer at the TDC location.

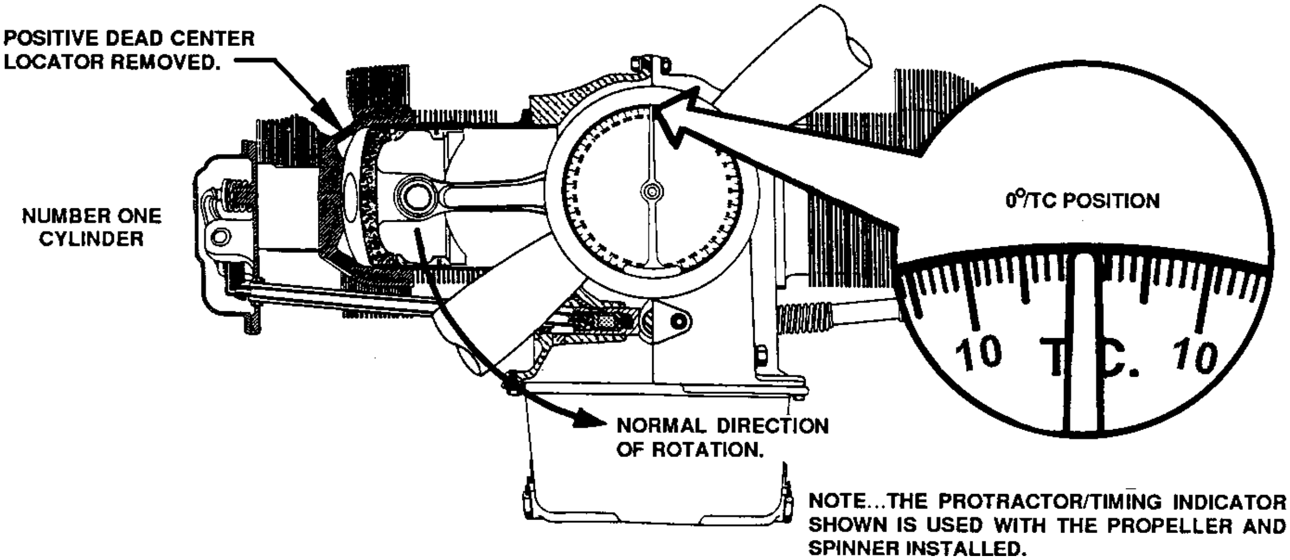



**FIGURE 18-18D. TIMING PROCEDURE STEP 4**

10. To place the crankshaft in the correct timing position for magneto installation, move the crankshaft in the opposite direction of normal rotation past the specified magneto timing setting and then back in the direction of normal rotation until the desired setting before top dead center is under the pointer. (This removes gear backlash).

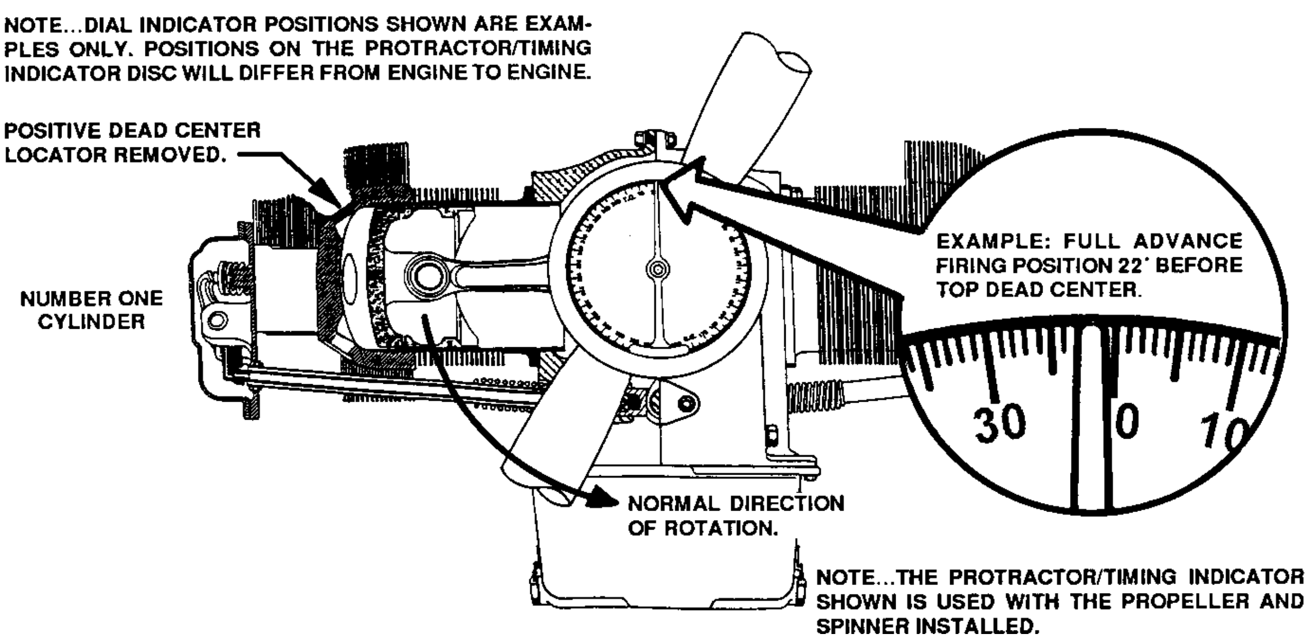



**FIGURE 18-18E. TIMING PROCEDURE STEP 5**

## MAGNETO TIMING AND INSTALLATION ON ENGINE

### WARNING

**Prior to any engine or magneto timing procedure disconnect all ignition harness spark plug leads from the spark plugs. Do not attach any ignition harness spark plug leads to the spark plugs until all magneto, engine timing procedures and magneto to switch connections have been entirely completed. The magneto is in a SWITCH ON condition when the switch wire is disconnected. To prevent possibility of serious bodily injury or death, before moving the propeller accomplish the following:**

**a. Disconnect all spark plug leads.**

**b. Verify magneto switches are connected to magnetos, that they are in the "OFF" Position and "P" leads are grounded.**

**c. Throttle position "CLOSED."**

**d. Mixture control "IDLE-CUT-OFF."**

**e. Set brakes and block aircraft wheels.**

**f. Insure that aircraft tie-downs are installed and verify that the cabin door latch is open.**

**g. Do not stand within the arc of the propeller blades while turning the propeller.**

1. MAGNETOS

   TCM magnetos: Remove the inspection hole plug from the magneto. Turn the impulse coupling backward so that the latches will not engage. Turn until timing pointer inside inspection hole is aligned with the marked distributor gear tooth.

   Slick Magnetos: Insert the T118 timing pin, going in "L" or "R" hole (depending on magneto rotation) in the distributor block. Turn rotor in the opposite rotation of magneto until pin engages the gear.

2. ACCESSORY DRIVE ASSEMBLIES

   See Figure 8-2A for all IO-550 permold engines except IO-550-G5B. Clean and dry the retainers (14) and bushings (15). Apply Molyshield grease to the rubber drive bushings. Install two magneto drive bushings into each retainer with the radius (rounded) edges facing outward. Install a retainer and bushing assembly firmly into each magneto drive gear assembly.

   See Figure 8-2B for IO-550-G5B. Clean and dry the retainers (18) and bushings (19). Apply Molyshield grease to the rubber drive bushings. Install two magneto drive bushings into each retainer with the radius (rounded) edges facing outward. Install a retainer and bushing assembly firmly into each magneto drive gear assembly .

3. Install both of the magneto drive gear assemblies in their accessory drive adapters.

## WARNING

**Any debris that falls into the engine interior must be removed prior to engine operation.**

## WARNING

**Incorrect magneto to engine timing will cause detonation, engine failure, injury or death.**

4. Insure that the crankshaft is positioned in accordance with section 18-18 "Magneto To Engine Timing."

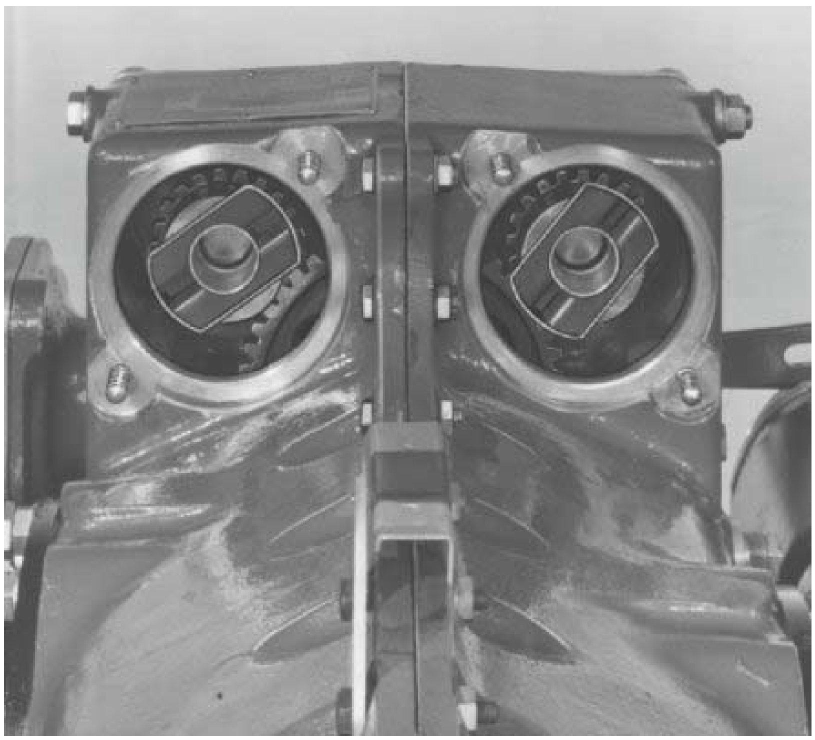


**FIGURE 18-19. POSITION OF MAGNETO COUPLINGS**

5. Without turning the magneto coupling, hold the magneto in the position it will occupy when installed. Check the alignment of the gear coupling slot and impulse coupling lugs. If not aligned, pull the magneto drive gear out of mesh and turn to position needed. Push gear back into mesh.

6. Place a new gasket on the magneto flange and install magneto carefully so that the drive coupling lugs mate with the slots of the drive bushings.

7. Install holding clamps, lock washers and nuts. Snug nuts but do not torque. This will allow turning of the magnetos for final timing. Remove the T118 timing pins from Slick magnetos.

8. Using the above procedure install the remaining magneto.

9. The magneto timing light breaker point leads are connected to the ground terminals of the magnetos. The timing light breaker point leads are connected so that the light on the right side of the timing light box represents the right magneto and the light on the left side of the timing light box represents the left magneto. The timing lights should indicate that the points in both magnetos are closed. Tap the right magneto up with a non-marring hammer until the light indicates points just opening. Tap the left magneto down until the light indicates points just opening. Secure magnetos.

10. Watch the lights on the magneto timing light. Turn the crankshaft a few degrees counterclockwise then clockwise until the timing indicator's pointer is pointing to the correct degree. As the pointer aligns with the correct degree both lights on the magneto timing light must indicate that the points just open within one-degree of crankshaft rotation. If timing light does not indicate the above adjust the magnetos.

NOTE…Point opening is indicated by light illumination on some timing lights while other timing lights operate in the reverse manner, i.e., the light goes out when the points open.

*CAUTION…When installing the magneto on the engine using the specified nuts and clamps, take the following precautions. Tighten both nuts by hand to finger tightness. Torque each nut alternately to 100 to 120 inch pounds. Exceeding 120 inch pounds torque may cause the mounting flange to crack.*

11. Torque the magneto attaching hardware to 100-120 inch pounds.

12. Disconnect timing light from magnetos. Insure that connections between magneto and ignition switch are secure.

## IGNITION HARNESS PRE-INSTALLATION INSTRUCTIONS

1. The ignition harness assembly must be replaced 100% at engine overhaul.

2. Clean the mating surfaces (grommets and inside of the outlet plate) with a lint free cloth moistened with isopropyl alcohol. Apply MS 122DF Spray before installing harness on magneto. MS 122DF Spray, Miller-Stephenson Chemical Co., Inc., 16 Sugar Hollow Road, Danbury, Connecticut 06810. Carefully place the harness outlet plate onto the magneto insuring the grommets enter the distributor block towers. Install and torque nuts around plate alternately to seat cover squarely on magneto. For TCM S-200 series magnetos apply 25 to 35 inch pounds to screws. For TCM S-1200 series magnetos apply 18-22 inch pounds to nuts. On Slick Magnetos, torque screws according to the magneto manufacturer's instructions.

3. The harness assemblies are constructed of a lightweight, flexible, silicone coated cable. Because the harness assemblies are lightweight and flexible the following must be observed when installing the harness on an engine:

    a. Support leads with the necessary clamps and cable ties to prevent any whipping or chafing action .

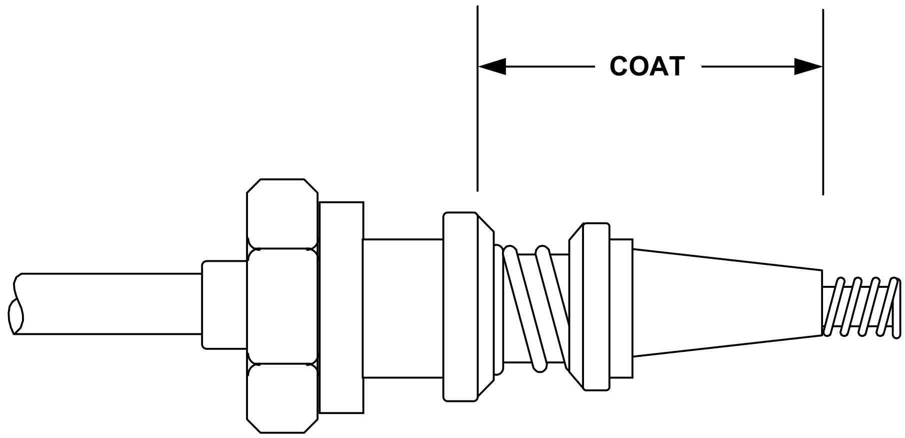



**FIGURE 18-20. COATING INSULATING SLEEVE**

b. Route leads as far away as possible from exhaust manifold to insure they are not exposed to temperatures in excess of 400°F.

c. To prevent sticking of sleeves and to minimize twisting of ferrule coat insulating sleeves, use MS 122DF Spray, Miller-Stephenson Chemical Co., Inc., 16 Sugar Hollow Road, Danbury, Connecticut 06810. See Figure 18-20, "Coating Insulating Sleeve."

NOTE…Hold ferrules while torquing or loosening spark plug coupling nuts to protect against twisting conduit or cable.

d. Clamp harness leads as required.

**IGNITION HARNESS INSTALLATION**

1. The cable outlet plates can be attached to either magneto in only one position. The shortest ignition cable is for No. 1 upper spark plug. The ignition lead to spark plug positions are stamped on the ignition lead to spark plug nuts.

2. Apply Champion® thread lubricant to spark plug threads in accordance with the manufacturer's instructions see Chapter 3. Install all spark plugs and torque to 300-360 inch pounds.

3. Secure the ignition leads to the cylinder rocker covers using the ignition lead clamps and rocker cover screws. Use caution routing and attaching leads. Keep leads away from high heat sources such as the exhaust manifold. Keep the leads away from any engine component that may cause chafing.

4. Connect the right magneto switch ground wire to the right magneto and the left magneto switch ground wire to the left magneto in accordance with the magneto manufacturer's instructions.

5. Install the ignition leads on the proper spark plugs and screw on. Torque ignition lead coupling nuts to 110 - 120 inch pounds .

The mechanic must consult all related service information issued by the ignition harness manufacturer.

| Spark Plug Coupling Thread | Torque (inch pounds) |
|---|---|
| 5/8-24 | 90 - 95 |
| 3/4-20 | 110 - 120 |

**TABLE 19-1 COUPLING NUT TORQUE VALUES**

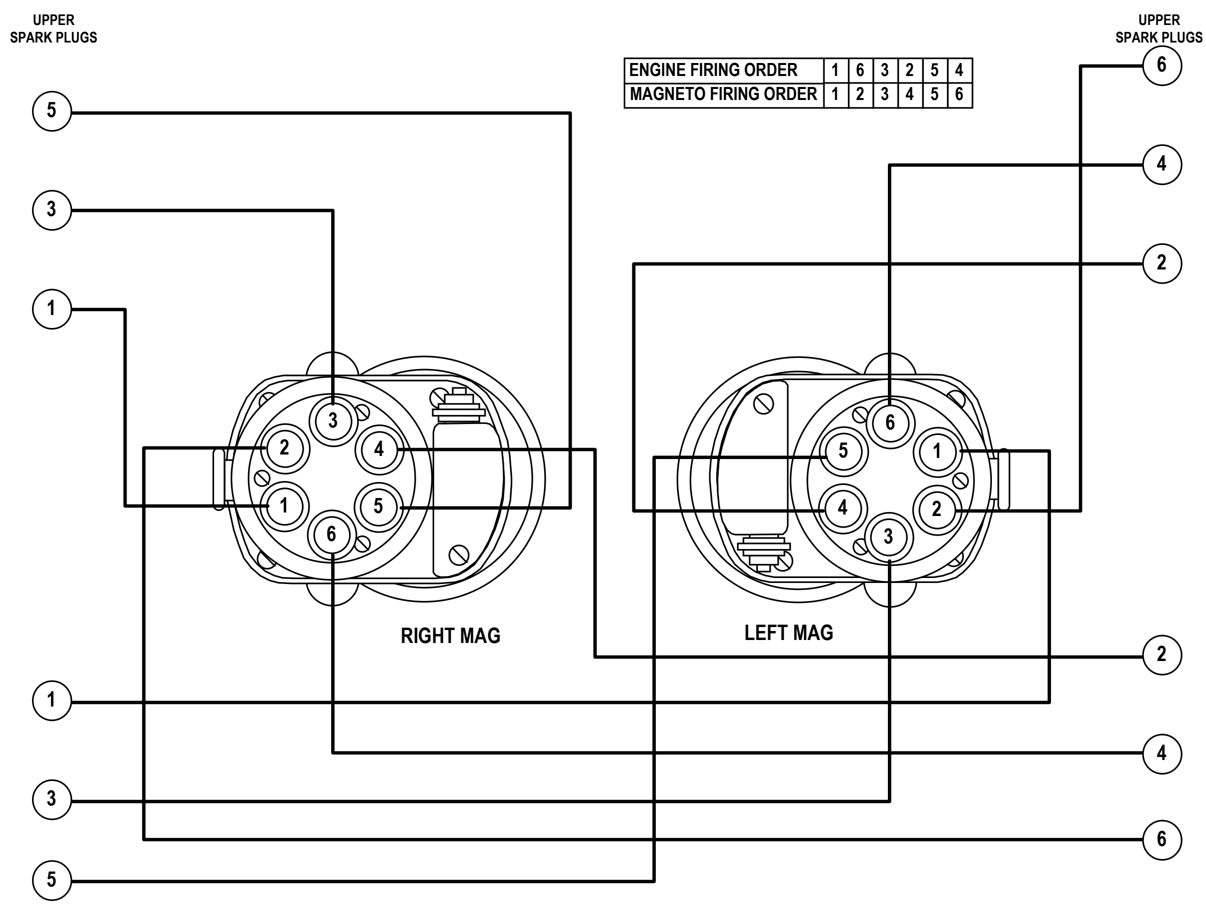



**FIGURE 18-21. IGNITION WIRING DIAGRAM**

**INTENTIONALLY**

**LEFT**

**BLANK**

# CHAPTER 19

# POST OVERHAUL ADJUSTMENT AND TEST

## 19-1 TESTING AFTER OVERHAUL

**WARNING**

**During engine test run do not stand, or allow anyone else to stand in the propeller arc area.**

## 19-2 ENGINE PRE-OILING

All engine internal moving parts must be properly lubricated before initial running of engine after overhaul. Pre-oil the engine upon completion of engine re-assembly. Engine pre-oiling must be accomplished in accordance with the following procedure:

1. Pre-oiling may be accomplished using a bladder type pressure pot capable of holding at least 1 gallon of clean aviation engine oil with an output pressure of 50 not to exceed 60 pounds per square inch. See chapter 3 for proper oil grade and for approved oil products.

2. Remove rocker box covers from cylinders. Connect pre-oiler supply hose to engine oil pressure gauge line connection (fitting). Open pre-oiler valve and watch cylinder rocker areas for indication of oil flow. Some engines may take as long as 20 minutes for oil indication depending on oil temperature.

3. After oil flow has been confirmed, re-install gaskets and rocker box covers. Torque rocker cover screws to 55-65 inch pounds. Close valve on pre-oiler. Disconnect pre-oiler supply hose and cap or re-install engine oil pressure gauge on pressure gauge line connection (fitting) as applicable.

4. Check engine oil quantity and service to correct capacity. See the I0-550 Permold Series Maintenance Manual, Form X30634A, for oil sump capacity. Engine is now ready for initial run-up and test after overhaul.

## 19-3 TEST STAND

After each major overhaul, engine performance must be tested. The engine stand must be constructed in a way to permit accessibility to all engine line and instrument connections and to permit frequent inspection of all points of possible leakage. All tubes, wires, rods and cables used to connect instruments and controls should be well supported, and of sufficient flexibility to permit them to be moved out of the way during installation and removal of the engine.

NOTE…When necessary, the airframe can be considered a suitable test stand for running in overhauled engines with the use of a test propeller and equipped with a suitable shroud or scoop to gather and direct cooling air over the cylinders. Engine must be equipped with all the calibrated instruments listed in "Instruments" of this section.

## 19-4 TEST CLUB

It will be necessary to install a test club such as those supplied by the Hartzell Propeller Fan Co., Piqua, Ohio or the flight propeller if the engine is installed in the aircraft. Test clubs are customarily supplied in standard diameters, so that the blade length is reduced by the "cut and try" method. The club will absorb the BHP at the RPM specified in Table 19-1. Use the test club in combination with the cell, test stand and operating limits for which it was calibrated.

## 19-5 COOLING AIR SCOOP

An air scoop must be 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 are necessary to direct cooling air to the center cylinder and the oil cooler. CHT should not vary more than 50°F between coolest and hottest cylinders. Provide an air duct to the alternator vent tube.

## 19-6 INDUCTION AIR INTAKE

An air filter and housing must be attached to the intake flange. The filter area must be sufficient to avoid restriction of air flow. Always clean filter before each test, calculations of filter area should be based on approximately 389 c.f.m. of air required by the engine at full throttle and on the filter capacity per unit of area. The calculated area of a clean filter should be increased by at least 50% to allow for dirt accumulation.

## 19-7 EXHAUST

The exhaust system supplied by the airframe manufacturer or STC holder, as applicable, must be installed for testing purposes.

## 19-8 CONTROLS

The controls required are a mixture control and throttle control capable of operating the fuel mixture and throttle shafts through their complete ranges, and a magneto switch connected to the magneto ground terminals. If a flight propeller is used, a proper governor and governor control is also required.

## 19-9 ELECTRICAL WIRING

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.

## 19-10 INSTRUMENTS

The control panel must be equipped with the following calibrated engine instruments.

1. An electrical or mechanical tachometer compatible with the tach drive assembly used.
2. An oil pressure gauge and tube connection.
3. An oil temperature gauge.
4. A cylinder head temperature gauge and wiring to each cylinder.
5. A water manometer with rubber hose connection to the vacuum pump oil return hole at the rear of the crankcase.
6. An ammeter connected in the alternator circuit.
7. Fuel flow gauge or fuel pressure gauge.
8. An exhaust gas temperature gauge.
9. Manifold pressure gauge.

## 19-11 BREATHER

A clean, substantial hose of 3/4 inch inside diameter must be installed on the crankcase breather elbow and support so it leads to a point above and to the rear of engine.

## 19-12 FUEL SYSTEM

The test stand fuel system is to incorporate an auxiliary pump capable of delivering fuel to and through engine system at a pressure of 2 to 2-1/2 psi indication on fuel pressure gauge. Connect fuel supply line to upper elbow projecting from left side of fuel pump. Connect fuel pump-to-supply tank return line to upper elbow projecting from right side of fuel pump. Connect fuel pressure gauge line to the fitting projecting from the center rear of fuel manifold valve.

## 19-13 GOVERNOR PAD COVER

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 purposes 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.

### WARNING

**Oil pressure is applied to the face of the governor drive pad. If gasket, accessory or cover is not properly installed and hardware is not properly torqued oil leakage will occur.**

## 19-14 ENGINE TEST

### WARNING

**Over priming can cause hydrostatic lock and subsequent engine failure.**

*CAUTION…Insure propeller area is clear before initiating starting sequence.*

NOTE…Before starting engine, insure that fuel tanks contain proper type of fuel (100LL-blue or 100 green). Check engine oil sump for proper servicing. See chapter 3 for oil type and specification

Start the engine in accordance with the airframe manufacturer's Airplane Flight Manual (AFM.) Operate the engine at 750 RPM for one minute, gradually increasing RPM to 1000 RPM in three minutes.

Check the magneto circuit for proper grounding prior to a normal shut-down. Allow the engine to cool adequately and make a visual inspection for any discrepancies. If engine exhibits any discrepancies, return to the applicable chapter to correct the discrepancy. All discrepancies must be corrected prior to engine adjustment.

Oil Pressure-Check, If no oil pressure is noted within 30 seconds, shut engine down and investigate.

*CAUTION…Operation of engine without oil pressure may result in engine malfunction or failure.*

When propeller stops rotating, place ignition switch, master switch and fuel selector in off position.

## 19-15 OIL PRESSURE ADJUSTMENT

The adjusting screw is turned clockwise to increase oil pressure and counterclockwise to decrease oil pressure. With normal operating oil temperature, adjust oil pressure to 10 pounds per square inch idle minimum 30-60 pounds per square inch normal operation. Torque locknut and safety as required.

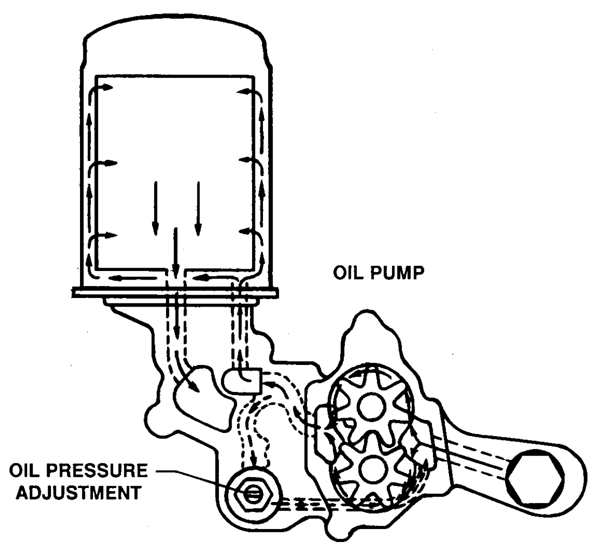



**FIGURE 19-1. OIL PRESSURE ADJUSTMENT**

## 19-16 Fuel System Adjustment

**WARNING**

**The procedures and values provided apply to TCM fuel injected engines that have not been modified from their type design. Refer to supplemental type certificate (STC) holder information and instructions for aircraft and engines that have been modified.**

*CAUTION...Engine performance, service life and reliability will be compromised if the engine's fuel injection system is neglected.*

The following adjustment procedures are presented in a sequential format that must be followed to insure proper fuel system adjustment. Reference the applicable Aircraft Maintenance Manual for detailed fuel system adjustment and maintenance procedures.

Any fuel system that can not be adjusted to meet the specified values will require repair or replacement of the affected components prior to further engine operation.

*CAUTION...Refer to chapter 6 Tables 6-4 and 6-5 for specified values when torquing all hose connections and fittings.*

### Adjustment Tools And Equipment Required

A complete set of tools and test equipment is essential for correct setup of TCM fuel injection systems. Various combinations of these tools and equipment will be used, depending on the engine model. A proper inventory of tools and equipment for fuel system adjustment will include the following:

1. TCM recommends the Model 20 ATM - C Porta Test Unit P/N **630045-20 ATM-C** or equivalent to insure the fuel injection system meets all pressure and flow specifications. **An alternative procedure would be to use calibrated gauges.** You may acquire a Model 20 ATM-C Porta Test Unit by contacting the following company:

   **AERO TEST, Inc.**
   29300 Goddard Road
   Romulus, Michigan 48174
   (734) 946-9000

   a. One (1) calibrated 0-60 PSI gauge, graduated in 1 PSI increments. This gauge will be used for unmetered pressure measurement.

   b. One (1) calibrated 0-30 PSI gauge, graduated in 1 PSI (maximum) increments. This gauge will be used for metered pressure measurements and verification of aircraft fuel flow gauge indications.

2. Two (2) P/N MS51523-B4 swivel tee. These fittings will be used to tee into fuel lines for unmetered and metered pressure reference.
3. Hoses of appropriate diameters and sufficient lengths to keep personnel and equipment away from propeller arc area.
4. Common hand tools including: 7/8”, 11/16”, 9/16”, 1/2”, 3/8”, 7/16”, 11/32”, and 5/16” wrenches. A 1/4” drive: ratchet and sockets, universal swivel, extension and a 5/32” allen wrench, common screw driver, a calibrated torque wrench, an oil can, mirror and flashlight. Safety equipment including hearing and eye protection.
5. Tachometer verification instrument - various types are available. Verify aircraft tachometer accuracy prior to fuel system adjustment.

## Pre-Setup Procedures

1. Insure that the test stand fuel supply is not contaminated. If the engine is installed in the airframe for testing, flush the aircraft fuel system by first removing the engine driven fuel pump inlet hose and terminating the end into a large clean container. Operate the aircraft boost pump and allow a minimum of one gallon fuel to flow through the system. Take necessary precautions to prevent a fire hazard. If contamination is present, locate and correct the source, and repeat this step prior to proceeding.
2. Prior to any checks or adjustments, verify the accuracy of the tachometer, manifold pressure gauge and fuel flow gauge. Any gauge found to be inaccurate must be repaired or replaced prior to adjusting the fuel system.

### WARNING

**Use of inaccurate gauges will result in incorrect adjustment of the engine fuel system, possible cylinder wear due to lean operation, pre-ignition, detonation, overheating, loss of power and severe engine damage.**

3. Insure that all fuel system components are of the correct part number and installed properly. Correct any discrepancies noted.
4. Remove, inspect, clean and reinstall the engine test stand or aircraft and engine fuel screens in accordance with the manufacturer's instructions.
5. If the engine is installed in the airframe for testing, inspect the aircraft induction air filter and alternate air system for condition, operation and cleanliness. Repair or replace any component that is not operating properly in accordance with the airframe manufacturer's instructions.
6. Inspect the test stand or aircraft vapor return system for proper operation in accordance with the manufacturers instructions. Correct any discrepancies noted .
7. Insure the fuel manifold valve vent and fuel pump drain lines are properly installed, open and free of obstruction. Correct any discrepancies noted.

8. Inspect all engine control rod ends for wear, freedom of movement, proper installation and security in accordance with the test stand or aircraft manufacturer's instructions. Correct any discrepancies noted.

9. Insure all engine controls operate freely throughout their full range of travel and are properly adjusted in accordance with the test stand or aircraft manufacturer's instructions.

10. Lubricate all control rod ends and fuel system components in accordance with the latest revision of the IO-550 Permold Maintenance Manual, Form X30634A and the test stand or aircraft manufacturer’s instructions.

## WARNING

**Failure to correctly install and maintain engine controls can result in loss of system control and engine power.**

11. Inspect the exhaust and induction systems for proper installation, security and leaks. Correct any discrepancies noted.

12. Inspect all lines, hoses and wire bundles for chafing, loose connections, leaks and stains. Correct any discrepancies noted.

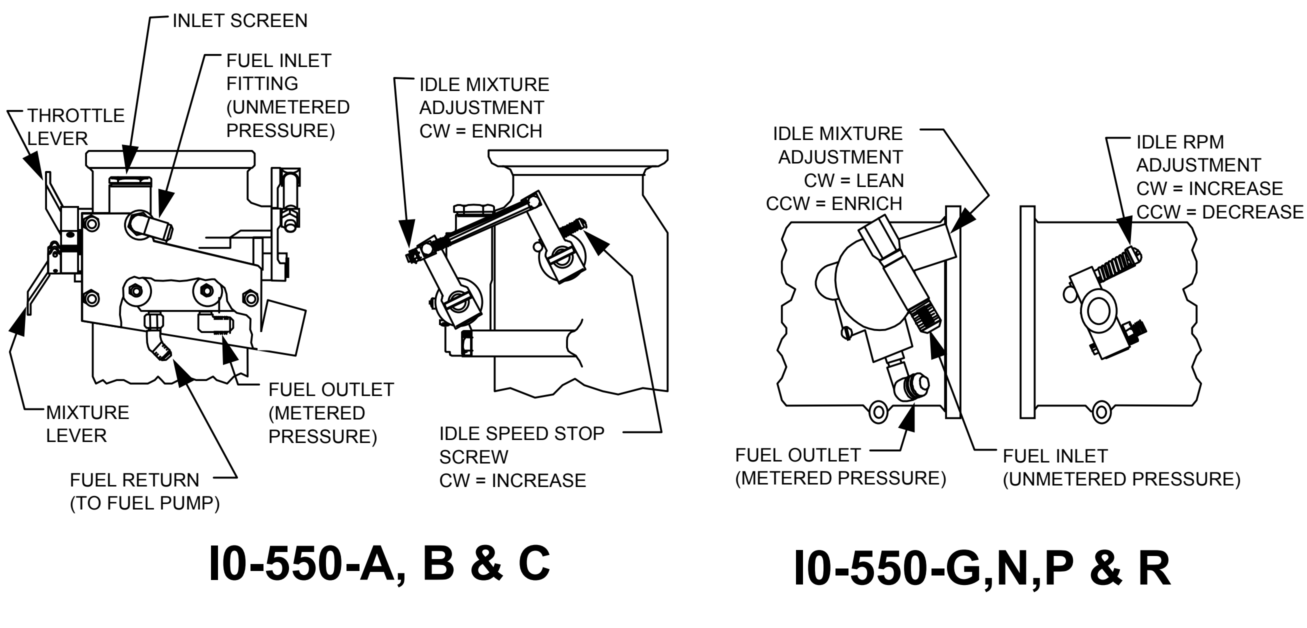



**FIGURE 19-2. THROTTLE, FUEL CONTROL AND METERING UNIT ADJUSTMENTS**

## Setup Procedures

1. Locate the IDLE speed stop screw on the throttle body and turn it counter-clockwise two complete turns. See Figure 19-2. During fuel system adjustment, IDLE RPM will be controlled manually using the cockpit throttle control.

## WARNING

**During removal and installation of fuel lines and hoses, failure to properly support component fittings can result in fitting and/or component damage and loss of system pressure. See chapter 5, "Standard Practices."**

2. Loosen and remove the unmetered fuel supply hose from either the fuel pump outlet fitting or the fuel metering unit inlet fitting, whichever is most accessible.

3. Install and torque the MS51523-B4 swivel tee directly to the fuel pump outlet fitting or to the fuel metering unit inlet fitting as applicable.

NOTE...Installation may require combinations of different fittings and hoses to facilitate installation of unmetered and metered test equipment connections.

4. Attach the unmetered fuel supply hose to the straight end of the tee connector and torque.

5. Connect the Unmetered test hose from the ***Porta Test Unit*** to the tee fitting and torque. If using the alternative procedure, connect the 0-60 PSI gauge to the swivel tee using a length of hose which will provide proper clearance from the engine cowling and propeller arc. Torque all connections.

6. Loosen and remove the metered fuel supply hose from the manifold valve inlet fitting.

7. Install and torque the second MS51523-B4 swivel tee directly to the fuel manifold valve inlet fitting.

8. Attach the metered fuel supply hose to the straight end of the tee connector and torque.

9. Connect the metered pressure test hose from the ***Porta Test Unit*** to this second tee connector and torque. If using the alternative procedure, connect the 0-30 PSI gauge to the swivel tee using a hose long enough to provide proper clearance from the engine cowling and propeller arc. Torque all connections.

10. Position the throttle control in the FULL OPEN position and the mixture control to FULL RICH. Operate the aircraft boost pump in accordance with the aircraft manufacturer's instructions. Following the instructions provided with the Porta Test Unit, bleed all air from the test unit and hoses. If using the alternative calibrated test gauges, loosen the test connections at each gauge to bleed the lines of any air. Operate the boost pump only long enough to allow purging of air from the installed test equipment. Verify that all fuel lines, hoses and fittings are secured and torqued and that no fuel leaks exist before proceeding. Insure test hoses have been routed clear of the exhaust system and are supported their entire length to preclude inaccurate gauge readings.

## WARNING

**Make certain all fuel has drained from the induction system and properly disposed of prior to attempting engine start. Failure to do so could cause hydraulic lock and subsequent engine failure .**

11. Install the engine cowling or cooling shroud during ground operation.
12. The Operational Test Form on page 19-33 may be reproduced for use in recording adjustments and test indications. Record the applicable IDLE and FULL POWER adjustment points: RPM, fuel pressure, fuel flows, manifold pressure and fuel/air mixture rise from "Test Operating Specifications" on page 19-13 on the operational test form. See pages 19-15 through 19-32 of this chapter for:

    a. Constant Speed Sea Level Performance Curves

    b. Fuel Flow Vs. Brake Horsepower Performance Curves

    c. Fuel Flow Vs. Metered Pressure Performance Curves

    d. Auto Leaning Schedule Performance Curves

## WARNING

**Before starting the engine insure that the aircraft wheels are chocked and brakes are set.**

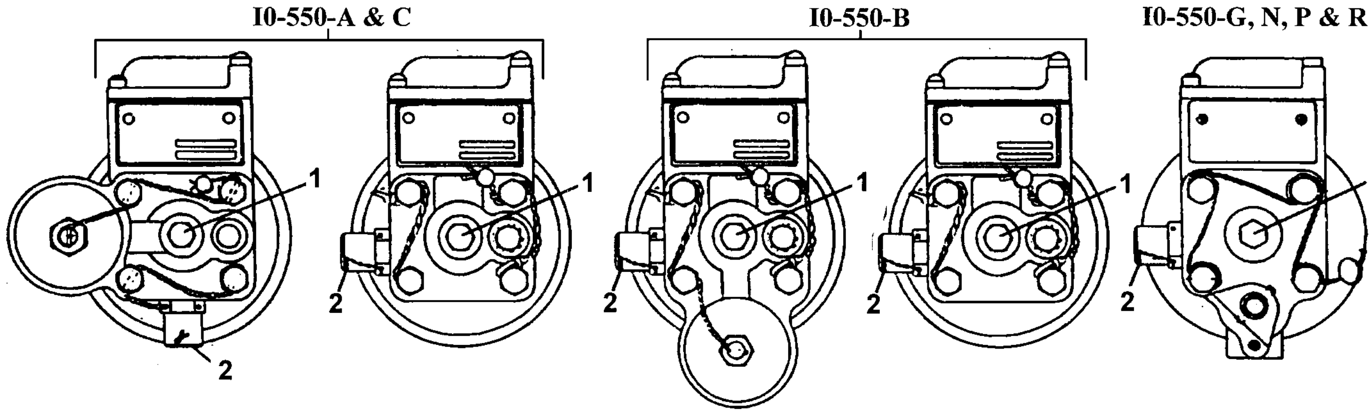
13. Prepare the engine test stand or aircraft for ground run and start the engine in accordance with the aircraft manufacturer's instructions.
14. Advance the throttle to 1500 to 1800 RPM. While monitoring all engine gauges, operate the engine at this speed until the engine temperatures and pressures have stabilized in the operational range. Use the operational test form to record the gauge indications.
15. With the mixture control in the FULL RICH position, reduce the throttle to the specified IDLE RPM. Record the unmetered pressure indicated on the gauge. Slowly move the mixture control toward the IDLE CUT-OFF position and record the maximum RPM rise. Return the mixture control to FULL RICH.
16. Monitoring all engine gauges, slowly advance the throttle control to full rated power for the engine and allow the engine to stabilize for 15 seconds. Record all engine and test gauge indications. **DO NOT ALLOW ENGINE TEMPERATURES TO EXCEED 420°F CYLINDER HEAD TEMPERATURE AND 210°F OIL TEMP.** Retard throttle control to 800 to 1000 RPM.

NOTE… Engine driven fuel pump output pressures vary with engine RPM. If the engine will not achieve full power rpm during static ground operational test run use Table 19-2 to correct the metered fuel pressure specification for the actual rpm achieved.

NOTE…Insure that all engine and aircraft systems are adjusted and functioning properly before making any adjustment to the fuel system.

17. Compare the recorded IDLE fuel pressure, IDLE RPM fuel/air mixture rise and full power RPM, manifold pressure (as applicable), unmetered fuel pressure, metered fuel pressure and fuel flow indications with the specified values recorded on the operational test form. If all recorded values are within specifications, proceed to paragraph 23.

## FUEL PUMP REAR VIEWS




1. IDLE UNMETERED PRESSURE ADJUSTMENT SCREW (CENTERLINE)

2. ADJUSTABLE ORIFICE ADJUSTING SCREW

**FIGURE 19-3. FUEL PUMP ADJUSTMENTS**

18. If any of the recorded readings are not within specifications, the fuel system will require complete adjustment. ALL READINGS MUST BE TAKEN WITH MIXTURE CONTROL IN THE FULL RICH POSITION. Install the engine cowling or cooling shroud during all ground operation.

NOTE...Insure that the manifold pressure is adjusted in accordance with the aircraft manufacturer's instructions.

## WARNING

**Make all adjustments with the engine stopped and the ignition and master switches in the off position!**

19. To adjust the IDLE RPM unmetered pump pressure, loosen the lock nut on the low pressure relief valve. See Figure 19-3. Turning the adjustment clockwise (CW) will increase pressure and counterclockwise (CCW) will decrease pressure. Operate the engine at 1500 - 1800 RPM for 15 seconds after each adjustment, then retard the throttle to the specified IDLE RPM. Repeat this step until pressure is within specified limits.

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

20. With engine operating at the specified IDLE RPM and unmetered fuel pressure, slowly move the mixture control from the FULL RICH position toward IDLE CUT-OFF to check fuel/air mixture. A rise of 25 to 50 RPM should be obtained. An RPM change greater than 50 indicates the mixture is too rich and a change that is less than 25 indicates the mixture is too lean. Any mixture conditions that are too rich or too lean will be adjusted as follows:

    a) Adjust idle mixture in accordance with Figure 19-2, “Throttle and Fuel Metering Adjustments.”
    b) Perform an IDLE fuel/air mixture check and observe RPM rise. If the RPM rise is not within specifications, advance the throttle control to 1500 - 1800 RPM for 15 seconds after each adjustment to clear the engine. Retard the throttle control to IDLE RPM and repeat mixture check. Make the necessary adjustment. Repeat this procedure until the specified RPM rise is achieved.
    c) Recheck IDLE RPM unmetered pump pressure. If pressure in not within limits, repeat Steps 18, 19, 20-a and 20-b before continuing.

21. See Table 19-1, “Test Operating Specifications.” Adjust the full power fuel flow to the specified value by turning the adjustable orifice screw clockwise to increase fuel flow and counterclockwise to decrease fuel flow. See Figure 19-3 for fuel pump adjustments.
22. When full power fuel flow has been adjusted to the specified values, recheck the IDLE RPM unmetered fuel pressure and fuel/air mixture. If any values are not within specified limits, repeat the adjustment procedures.
23. With the fuel system set to the specified pressure and flow values, set the IDLE RPM to the airframe manufacturers specified value by turning the Idle Speed Stop screw clockwise to increase RPM and counterclockwise to decrease RPM. See Figure 19-2.

## Post Setup Procedures

1. Insure that the master switch, ignition switch and fuel selector are in the off position.
2. Remove the engine cowling or cooling shroud in accordance with the aircraft manufacturer's instructions. Remove all test gauges, fittings and hoses that were installed for fuel system setup. Reconnect all fuel hoses to their original locations, support and torque all fittings to the specified value.
3. Perform a complete fuel system leak check in accordance with the aircraft manufacturer’s instructions. Correct any discrepancies noted.
4. Install engine cowling or cooling shroud in accordance with the test stand or aircraft manufacturer's instructions.
5. Perform a complete operational ground run-up and verify that all fuel system performance specifications are achieved.
6. Repeat the setup and adjustments as required until the fuel injection system is performing within the published specification for the aircraft and engine.

**TABLE 19-1. TEST OPERATING SPECIFICATIONS**

For your convenience we have tabulated the following fuel system pressure and flow values to facilitate proper adjustment and optimum performance. All top end values are shown for maximum rated RPM and manifold pressure.

| ITEM | SPECIFICATION | | | | |
|---|---|---|---|---|---|
| | IO-550-A | IO-550-B | IO-550-C | IO-550-G | IO-550-N,P,R |
| Full Throttle Speed - RPM | 2700 | 2700 | 2700 | 2500 | 2700 |
| Idle Speed-RPM | 600 | | | | |
| Manifold Air Pressure at Idle (in. Hg.) Max. | 18.5 | | | | |
| Fuel Grade (Octane) | 100LL/100 | | | | |
| Fuel Flow at Full Throttle (Lbs. /Hr.) | 142-150 | 146-156 | 152-160 | 125-130 | 150-160 |
| Fuel Flow at Full Throttle (Gallons Per Hour.) | 24.2-25.6 | 24.9-26.6 | 25.9-27.3 | 21.3-22.1 | 25.6-27.3 |
| Metered Fuel Pressure at Full Throttle | 17.7-20.0 | 16.5-18.4 | 17.6-19.6 | 14.7-16.0 | 19.0-21.3 |
| Fuel Pump Pressure at Idle (Unmetered) | 8.0-10.0 | | | | |
| Fuel Pump Pressure at Full Throttle (Unmetered) | 32.0-36.0 | 29.2-36.2 | 31.6-37.8 | 22.0-26.0 | 28.0-32.0 |
| Mixture Rise at Idle Cutoff - RPM | 25-50 | | | | |
| Oil Temperature Limit | 240°F | | | | |
| Oil Pressure (Max. Oil Cold) | 100 | | | | |
| Minimum Oil Pressure at Idle | 10 | | | | |
| Oil Sump Capacity (Quarts) | 12 | 12 | 12 | 8 | I0-550-N 8<br>I0-550-P 10<br>I0-550-R 12 |
| Magneto Drop | 150 RPM | | | | |
| (Max.) Magneto Spread | 50 RPM | | | | |
| Cylinder Head Temperature with Bayonet Thermocouple (Limit) | 460°F | | | | |

Proceed to standard acceptance and oil consumption determination as required for engine overhaul.

NOTE…Test flight and documentation of all test flight operating parameters is MANDATORY before engine can be returned to service. See section 19-20, "Test Flight. "

**Table 19-2. Compensation Table For Static Ground Setup**

| Metered Pressure Vs. RPM @ 70°F Fuel Temperature | | |
|---|---|---|
| **Static Engine RPM** | **Correction Factor** | **Corrected Metered Pressure (Metered Pressure x Correction Factor)** |
| Rated RPM | 1 | |
| -20 | .991 | |
| -40 | .982 | |
| -60 | .973 | |
| -80 | .964 | |
| -100 | .955 | |
| -120 | .946 | |

**NOTE:** All values are approximate. Variations may be noticed due to engine and installation specific influences.

Example: I0-550-B, Maximum Rated RPM = 2700
Metered Fuel Pressure Limits = 16.5 - 18.4

If maximum static engine RPM = 2640, (-60 RPM) use Correction Factor .973

Metered Fuel Pressure Limits x Correction Factor = Corrected Metered Pressure Limits

16.5 x .973 = 16.0545 (Minimum Metered Pressure Limit) @ 2640 RPM

18.4 x .973 = 17.9032 (Maximum Metered Pressure Limit) @ 2640 RPM

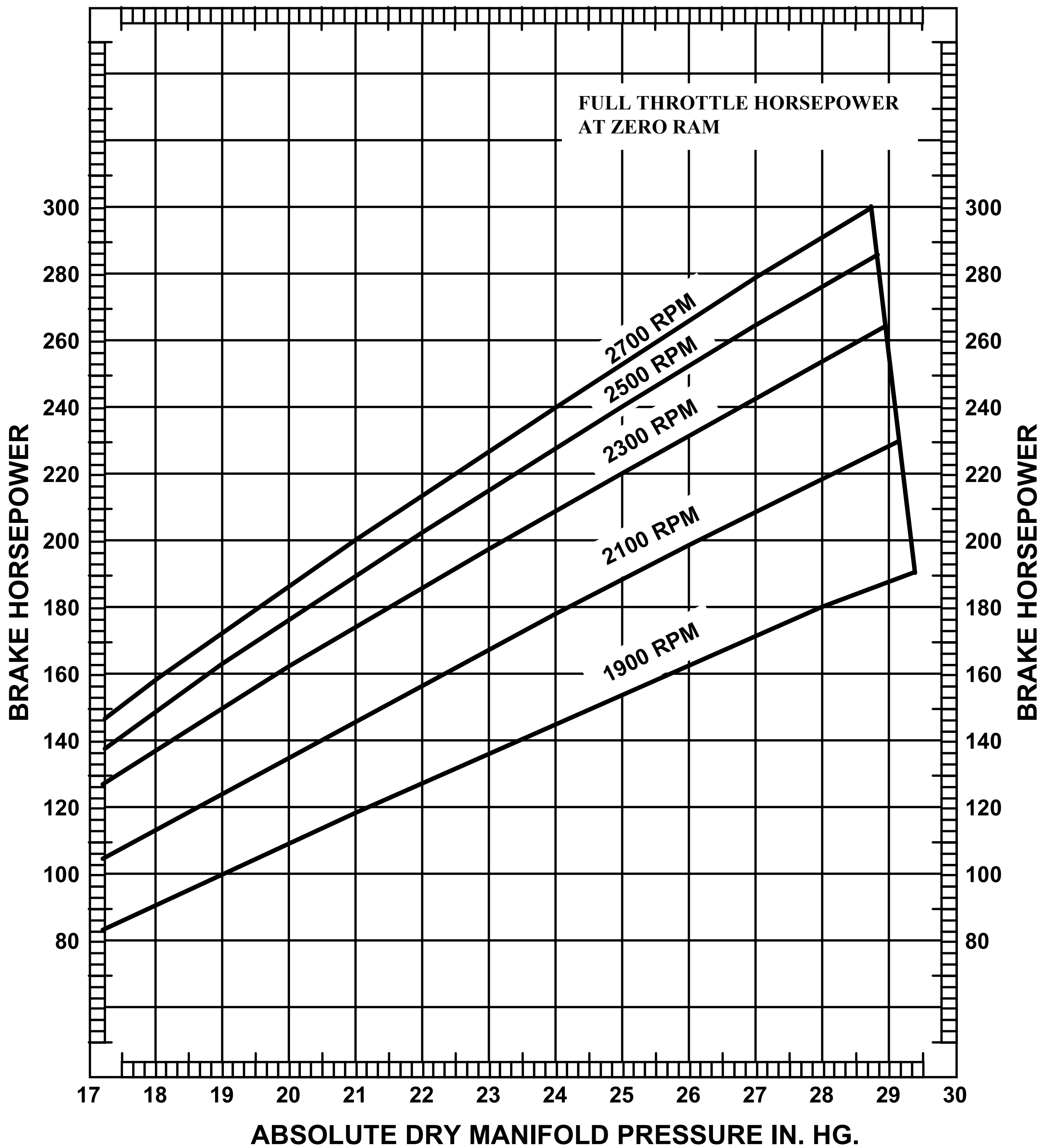



**FIGURE 19-4. SEA LEVEL PERFORMANCE IO-550-A**

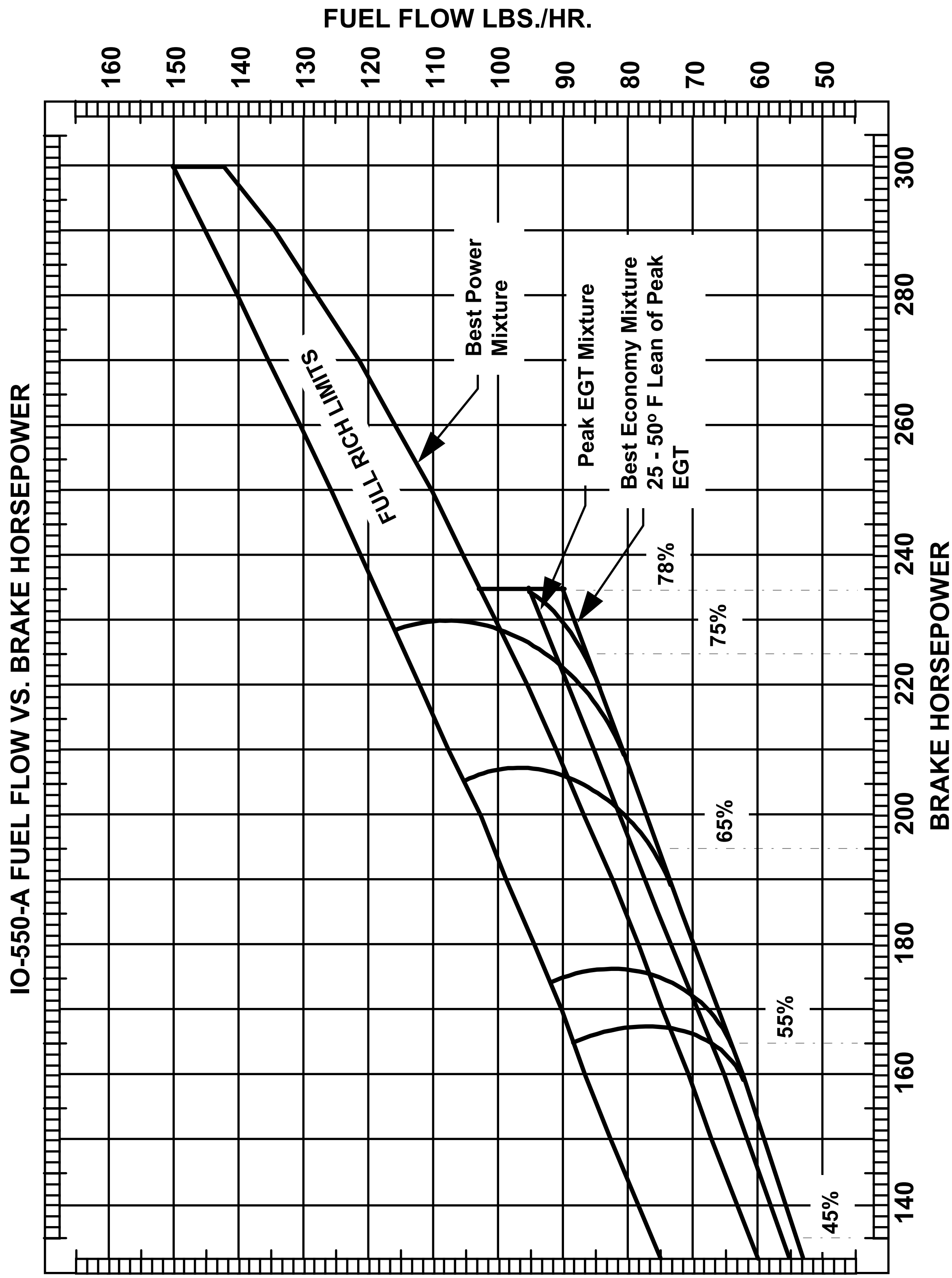



FIGURE 19-5. FUEL FLOW VS. OBSERVED BRAKE HORSEPOWER IO-550-A

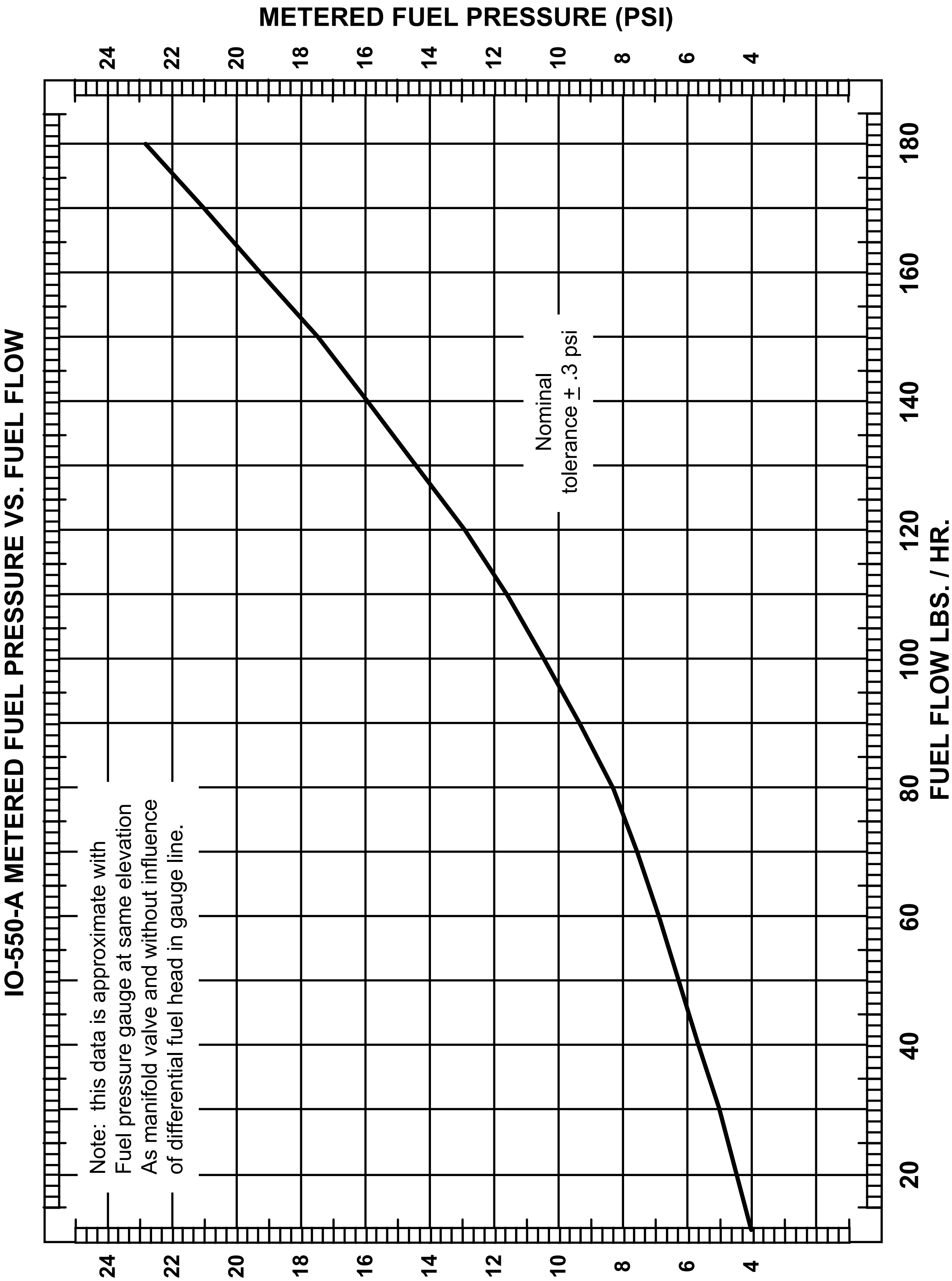



FIGURE 19-6. FUEL FLOW VS. METERED PRESSURE IO-550-A

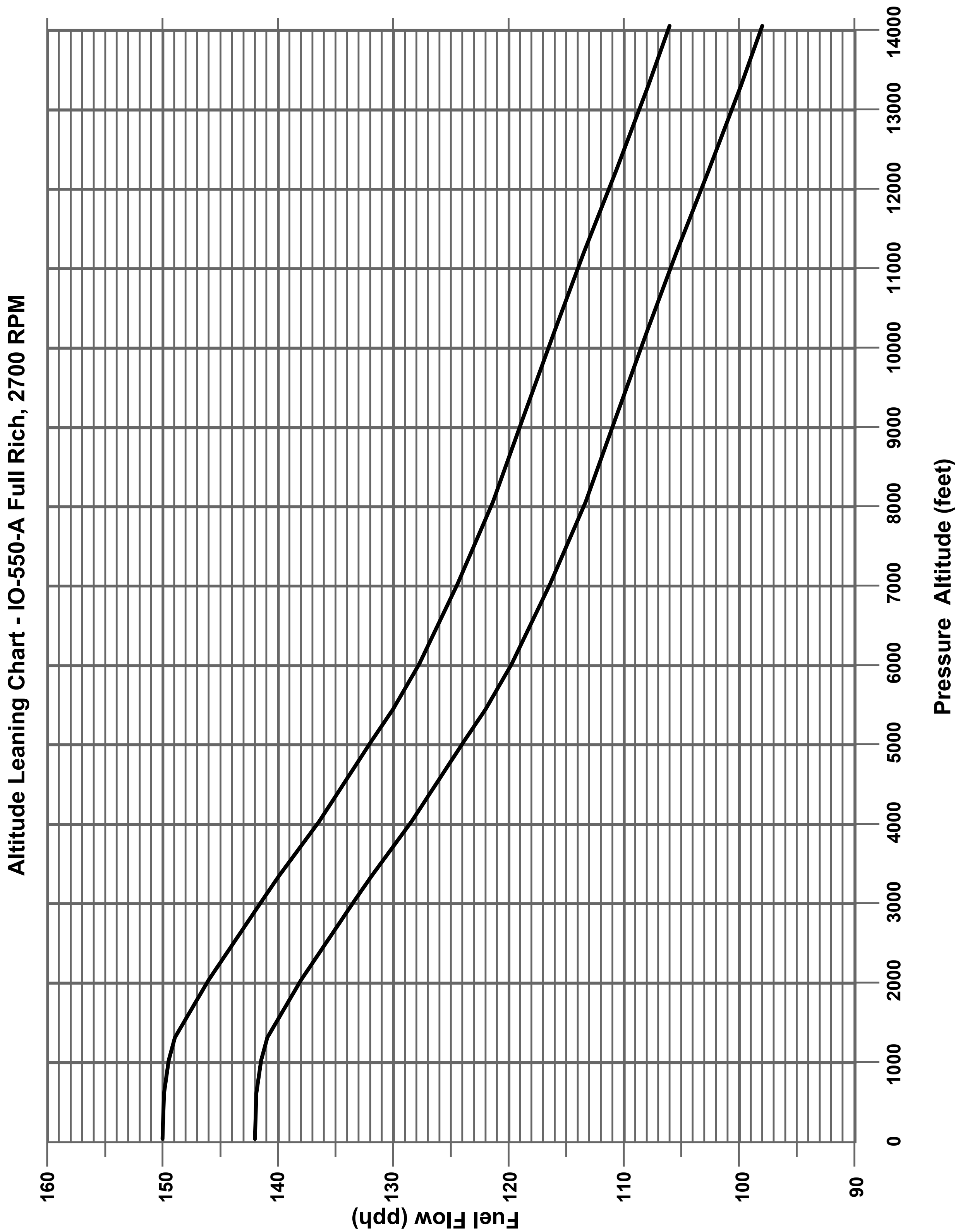



**FIGURE 19-7. AUTO LEANING SCHEDULE IO-550-A WITH ALTITUDE COMPENSATING FUEL PUMP**

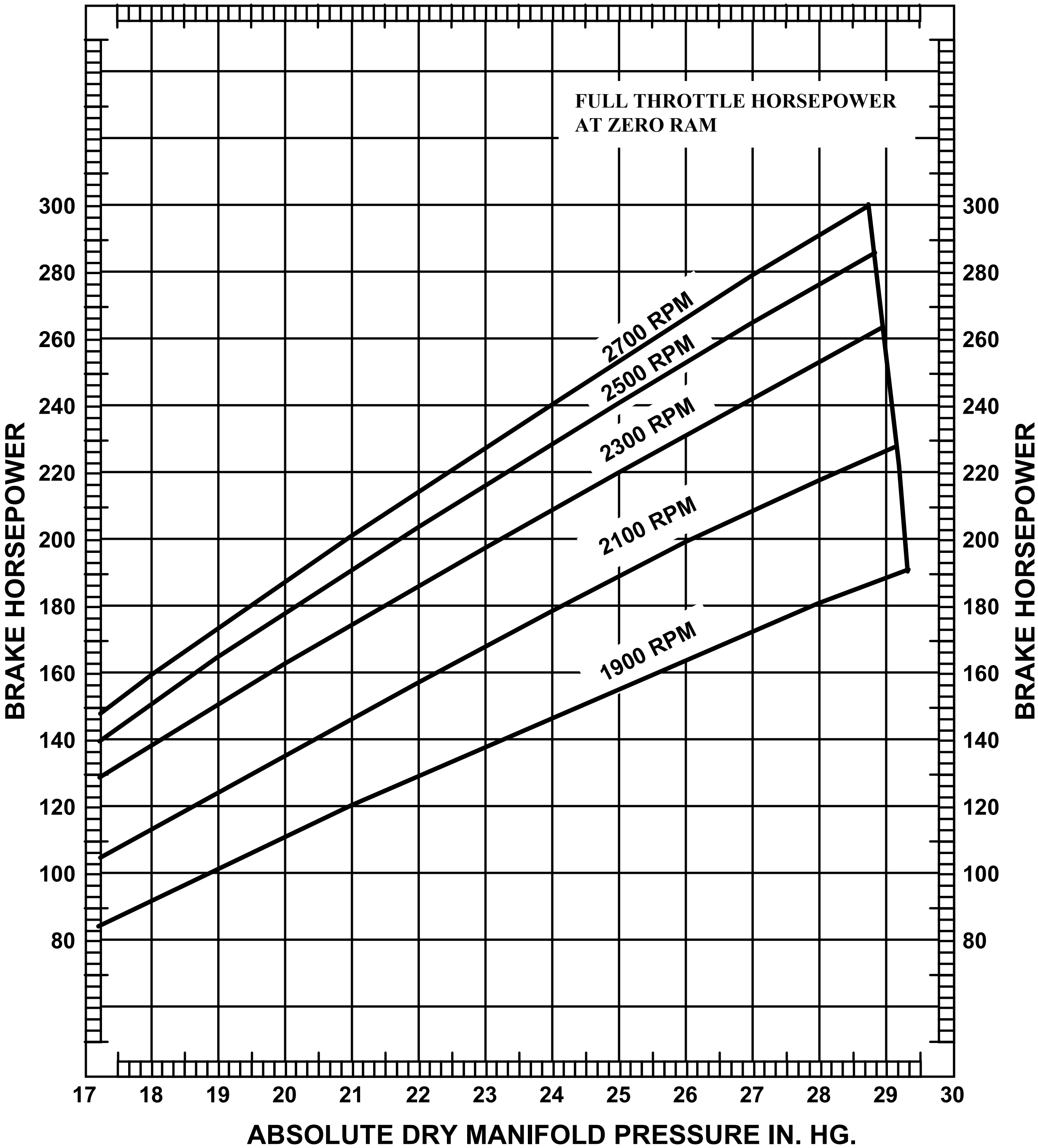



FIGURE 19-8. SEA LEVEL PERFORMANCE IO-550-B

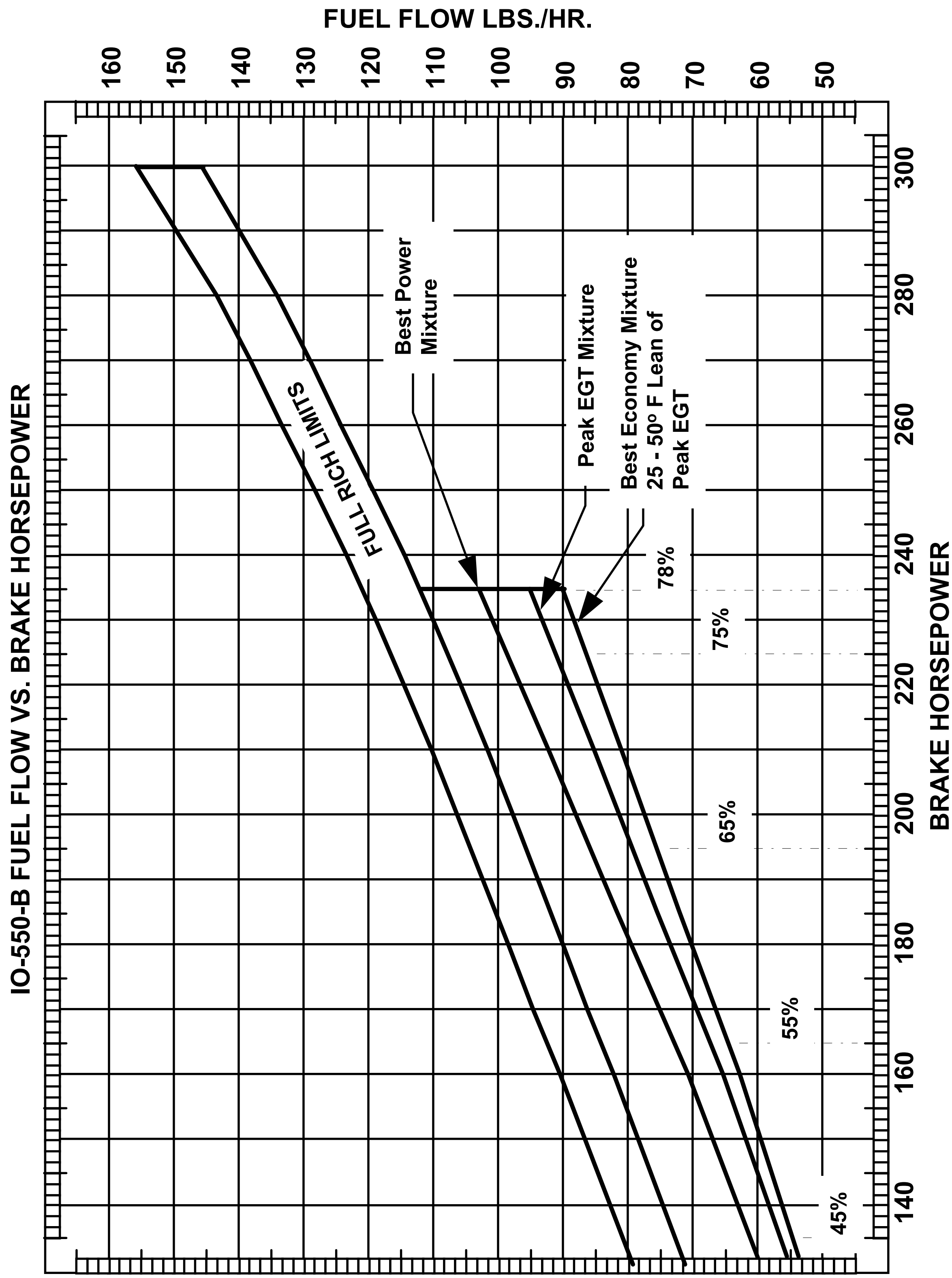



FIGURE 19-9. FUEL FLOW VS. OBSERVED BRAKE HORSEPOWER IO-550-B

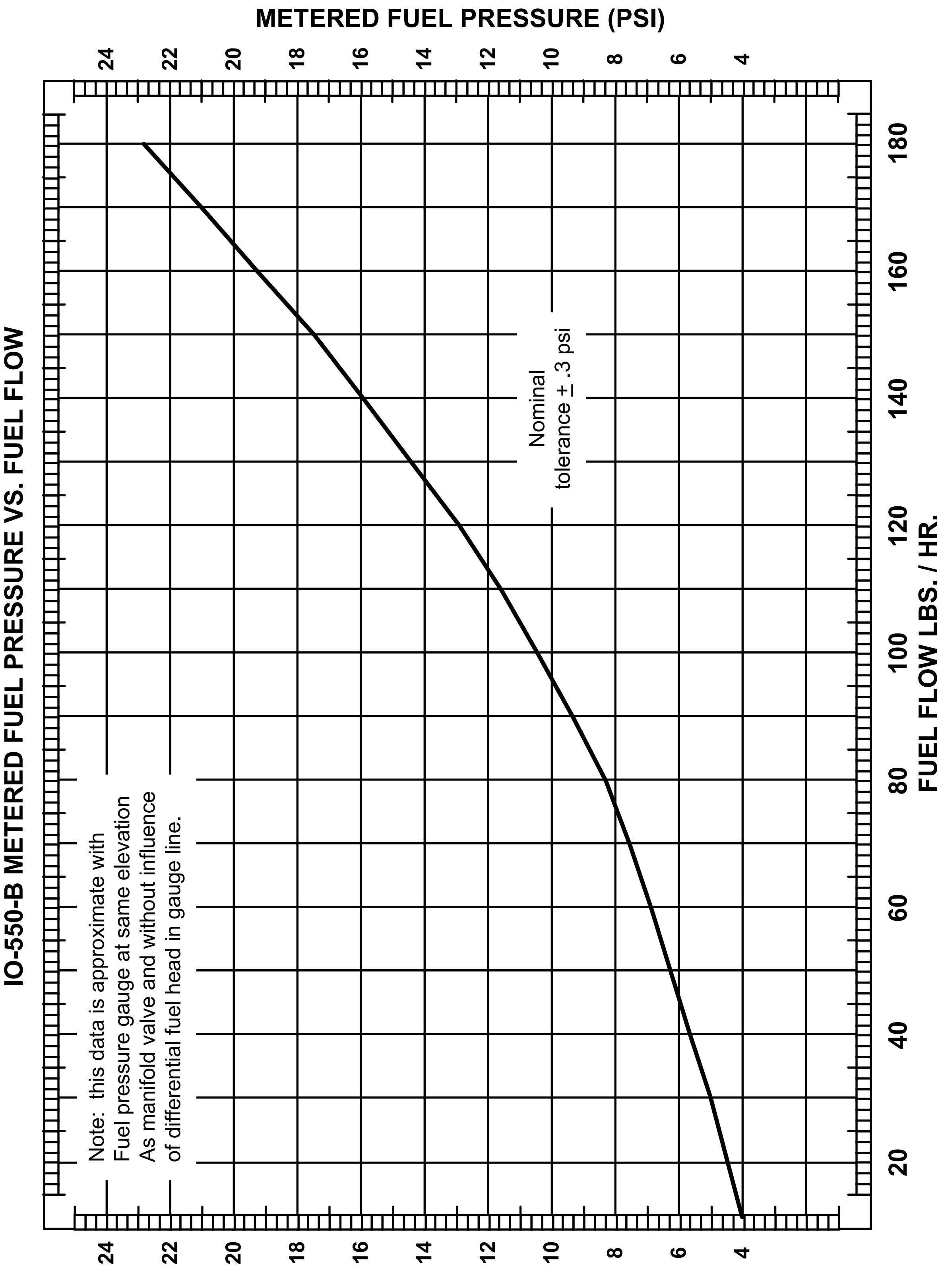



**FIGURE 19-10. FUEL FLOW VS METERED PRESSURE IO-550-B**

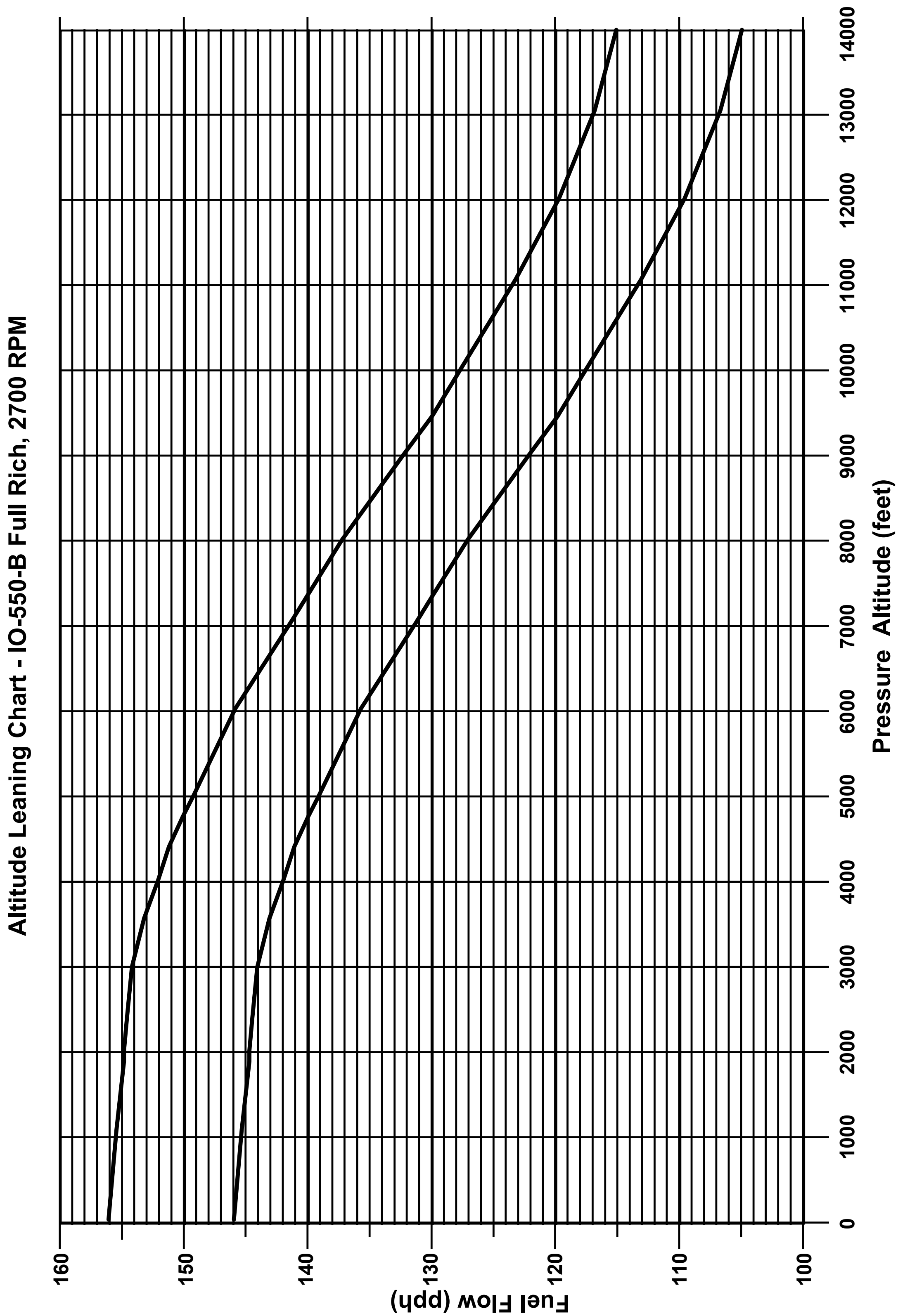



**FIGURE 19-11. AUTO LEANING SCHEDULE IO-550-B WITH ALTITUDE COMPENSATING FUEL PUMP**

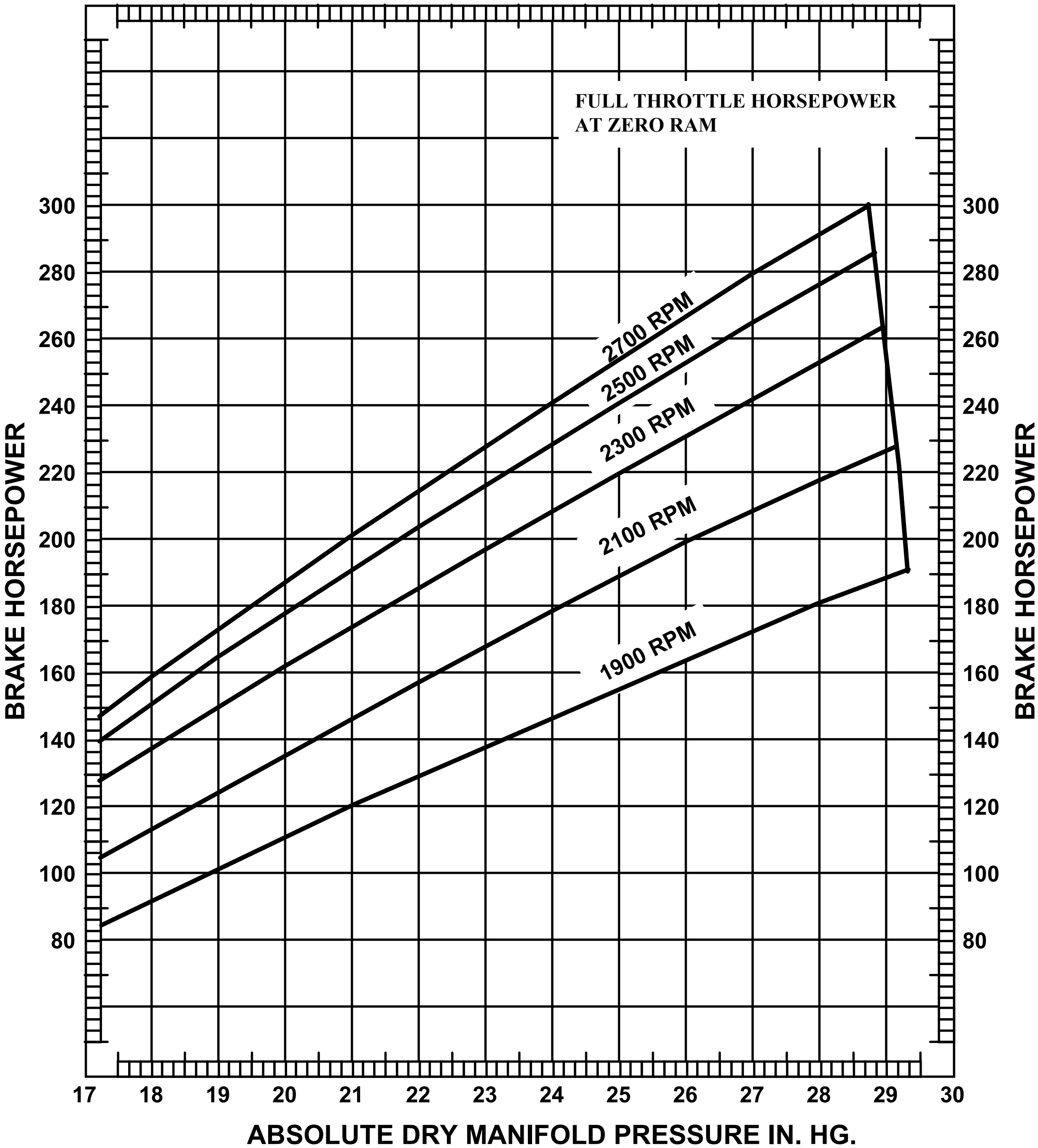



FIGURE 19-12. SEA LEVEL PERFORMANCE IO-550-C

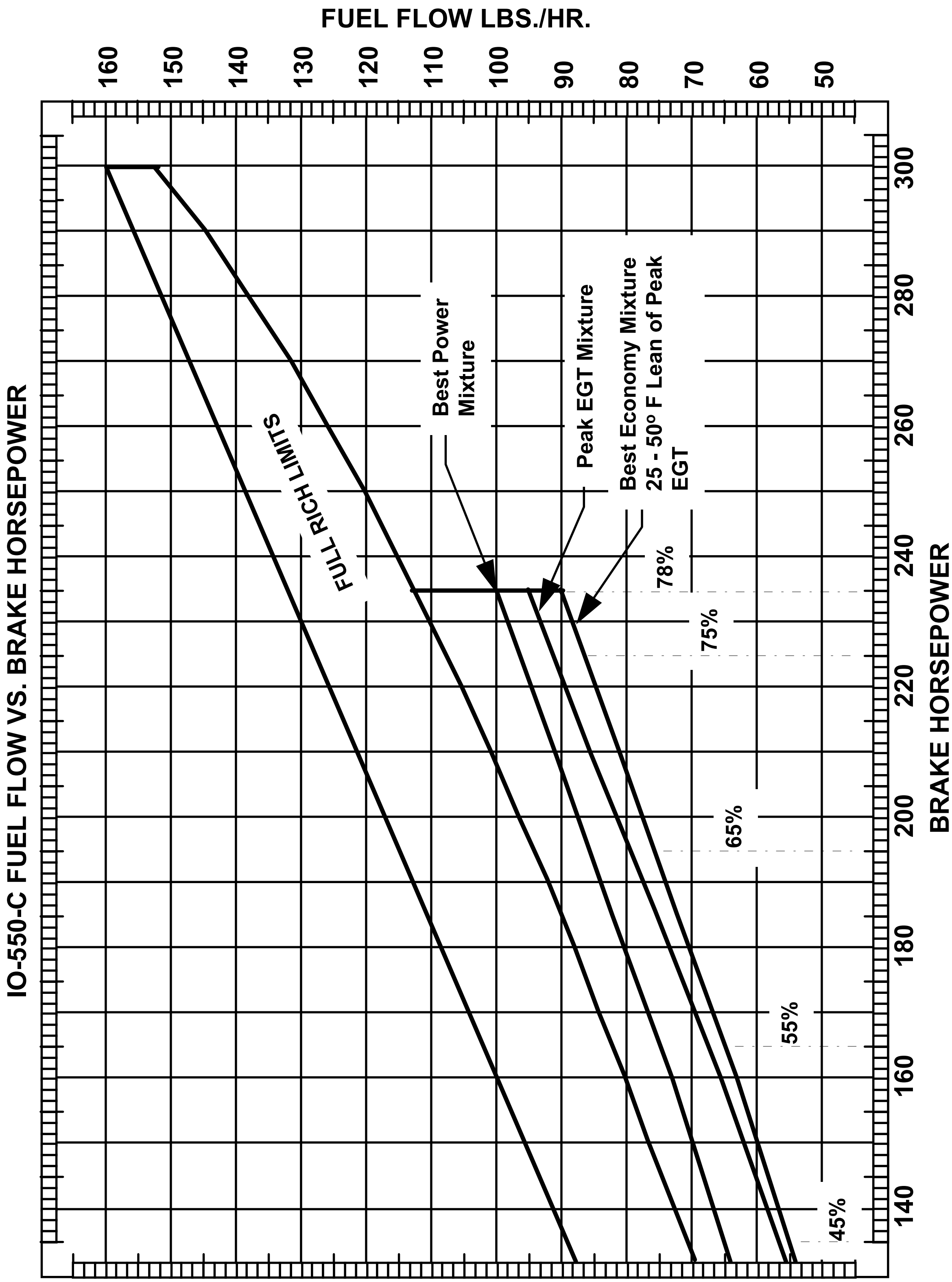



FIGURE 19-13. FUEL FLOW VS. OBSERVED BRAKE HORSEPOWER IO-550-C

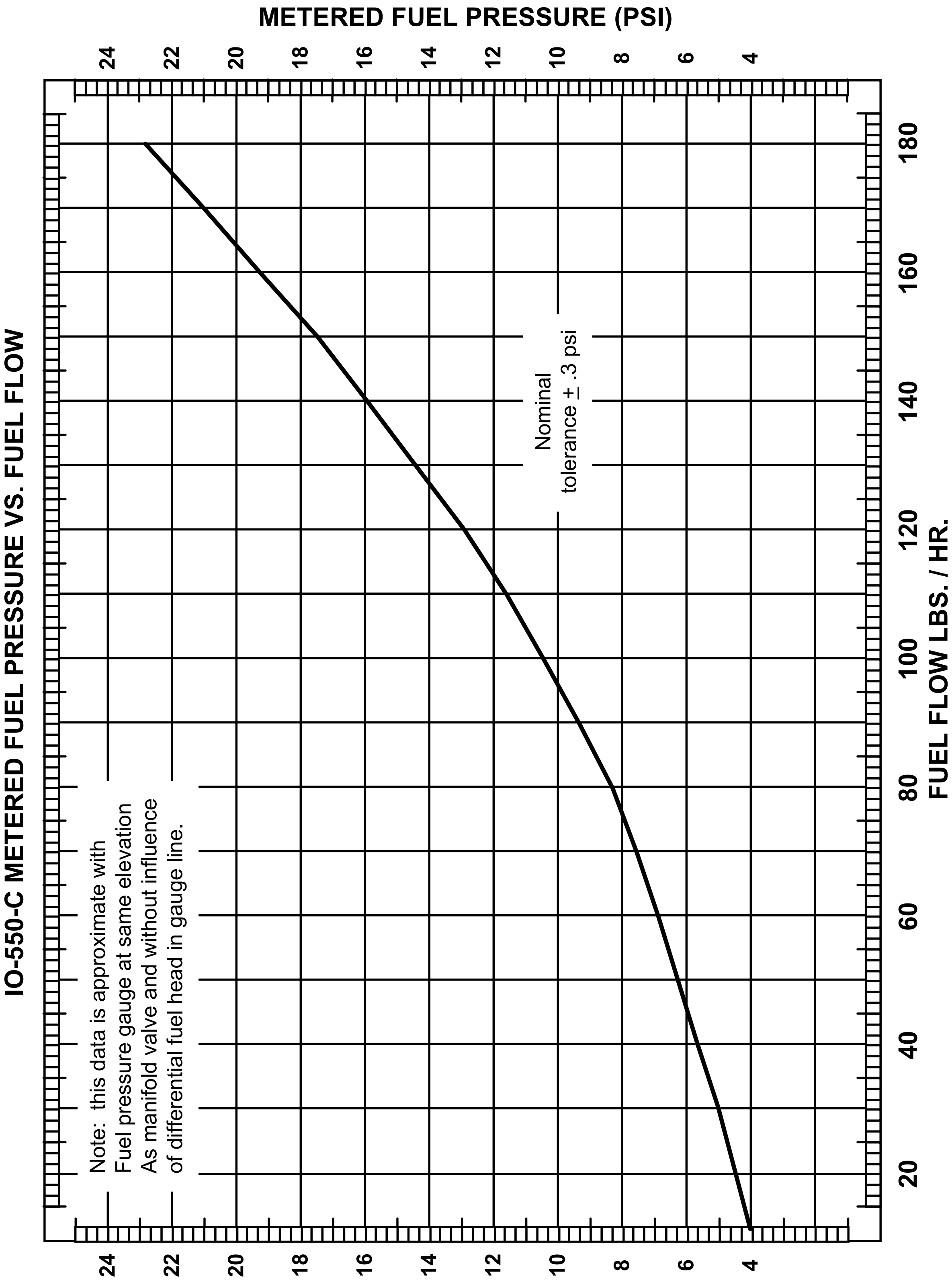



FIGURE 19-14. FUEL FLOW VS METERED PRESSURE IO-550-C

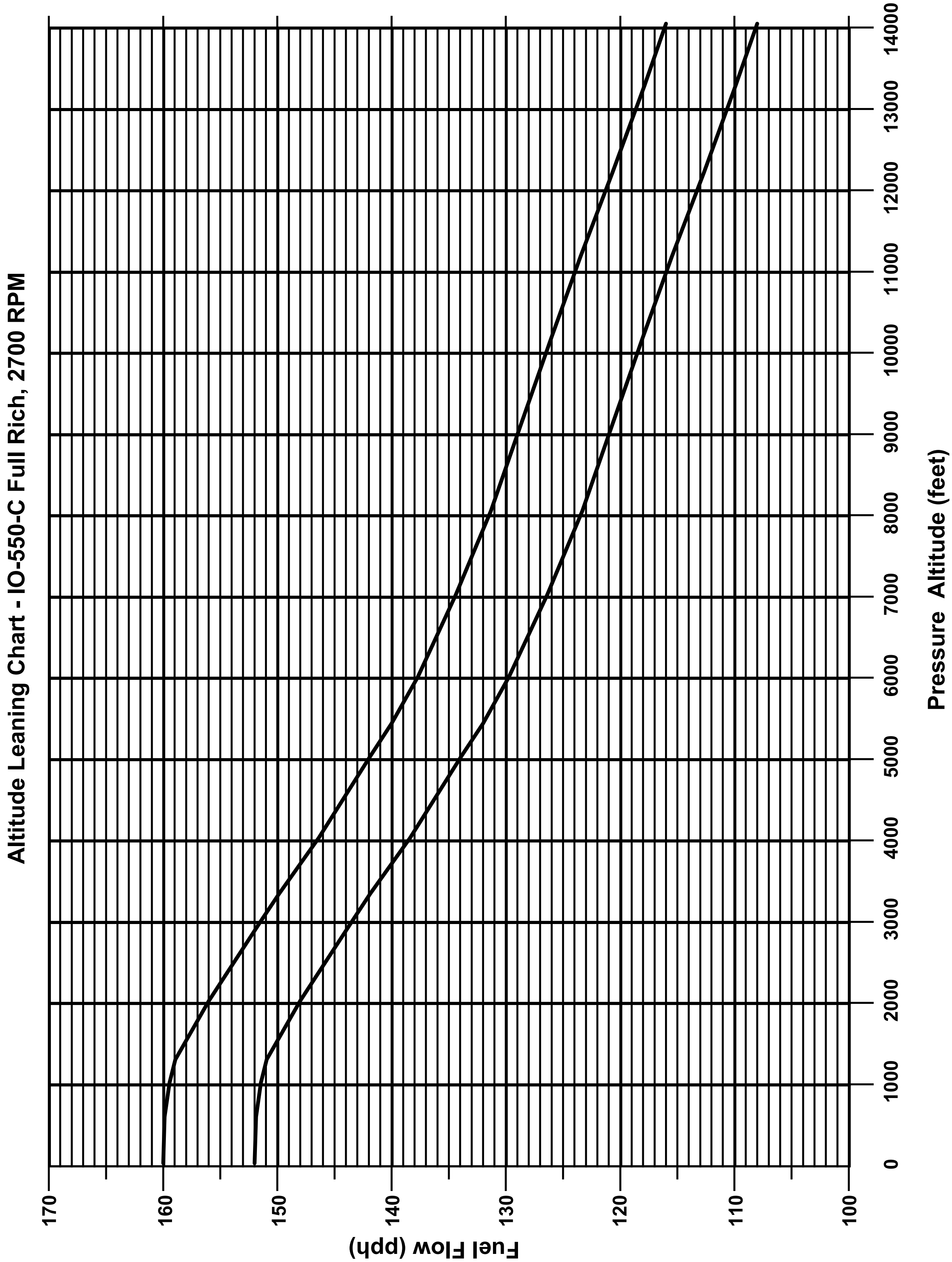



**FIGURE 19-15. AUTO LEANING SCHEDULE IO-550-C WITH ALTITUDE COMPENSATING FUEL PUMP**

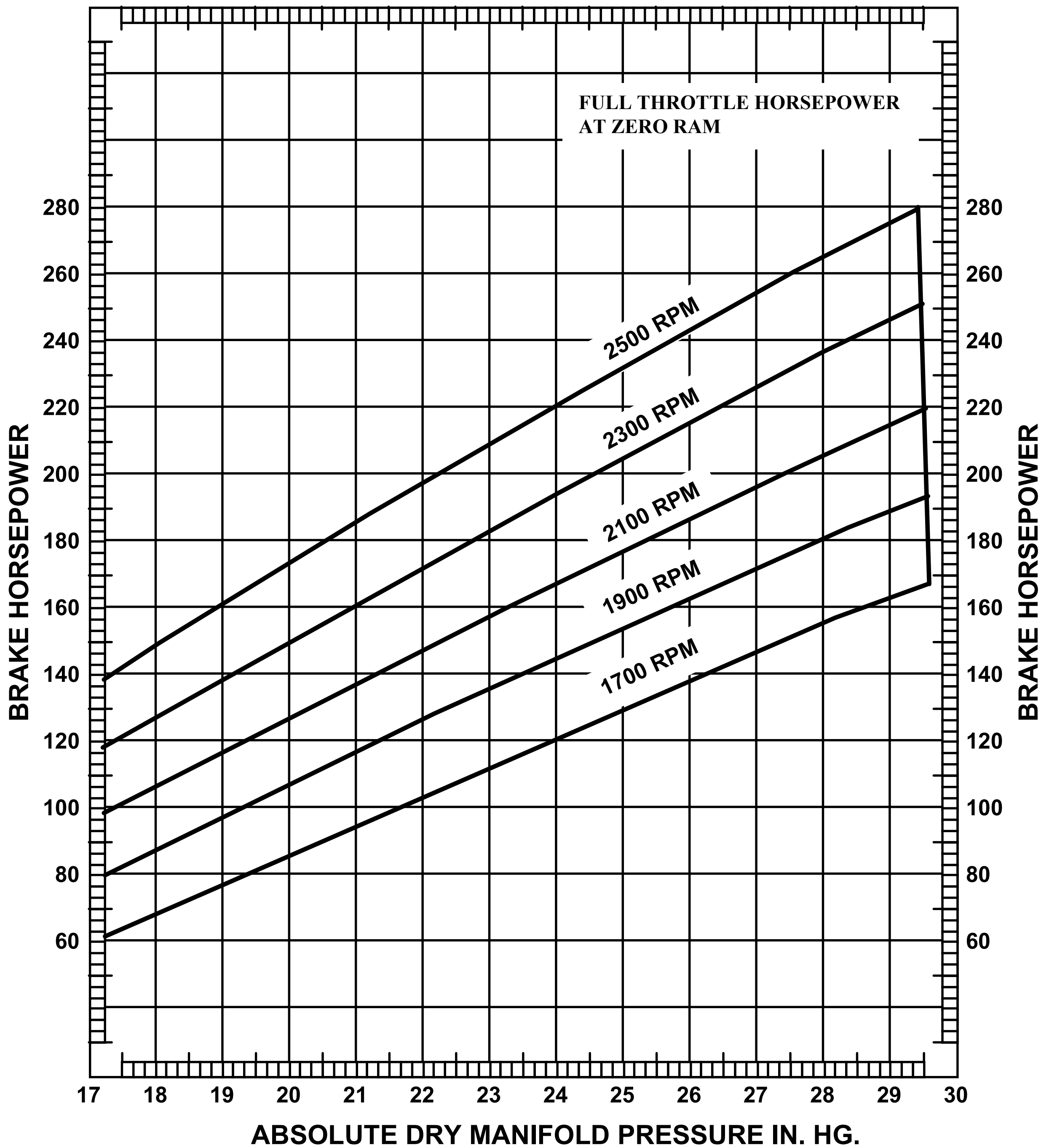



**FIGURE 19-16. CONSTANT SPEED SEA LEVEL PERFORMANCE IO-550-G**

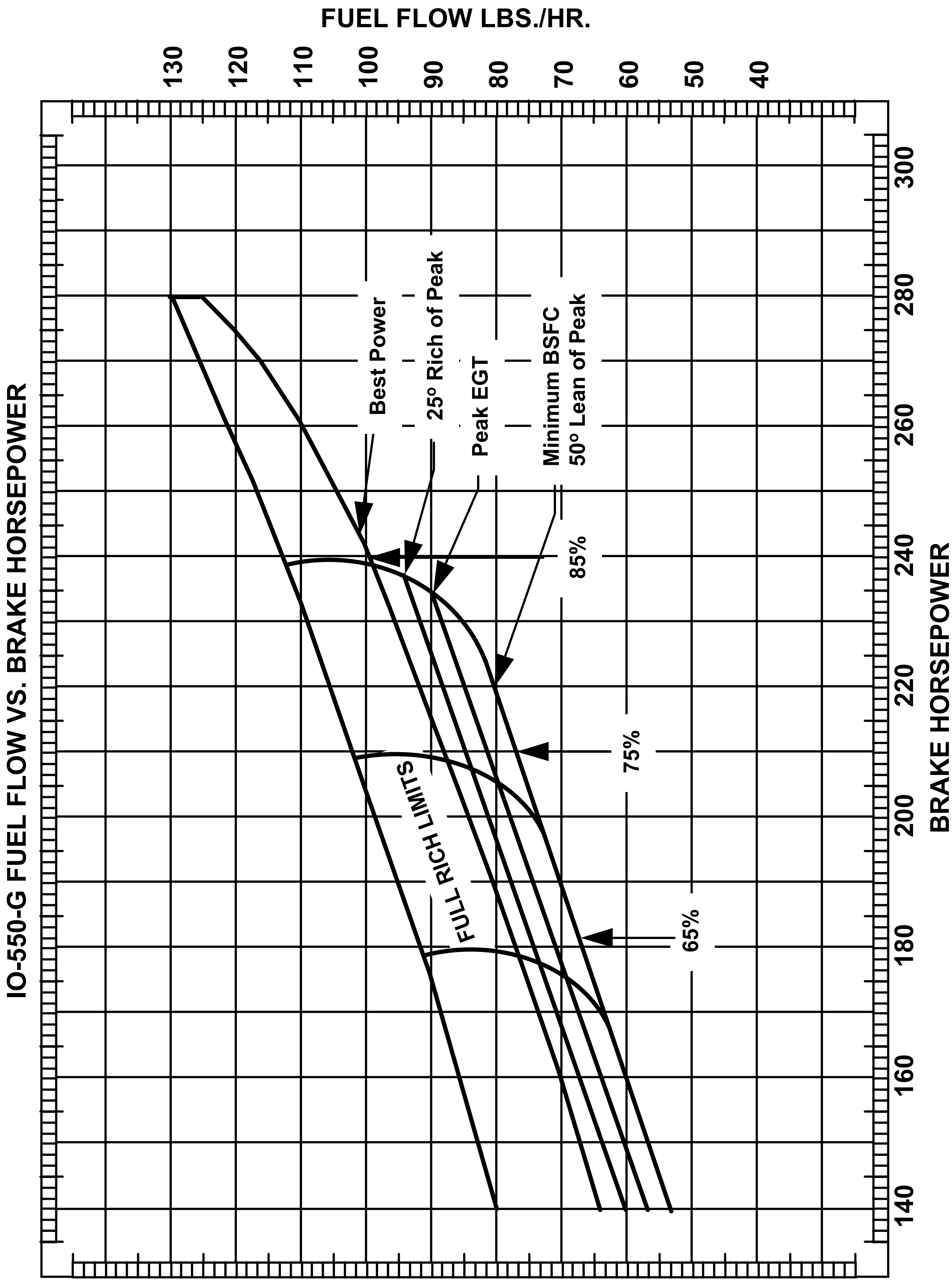



**FIGURE 19-17. FUEL FLOW VS. OBSERVED BRAKE HORSEPOWER IO-550-G**

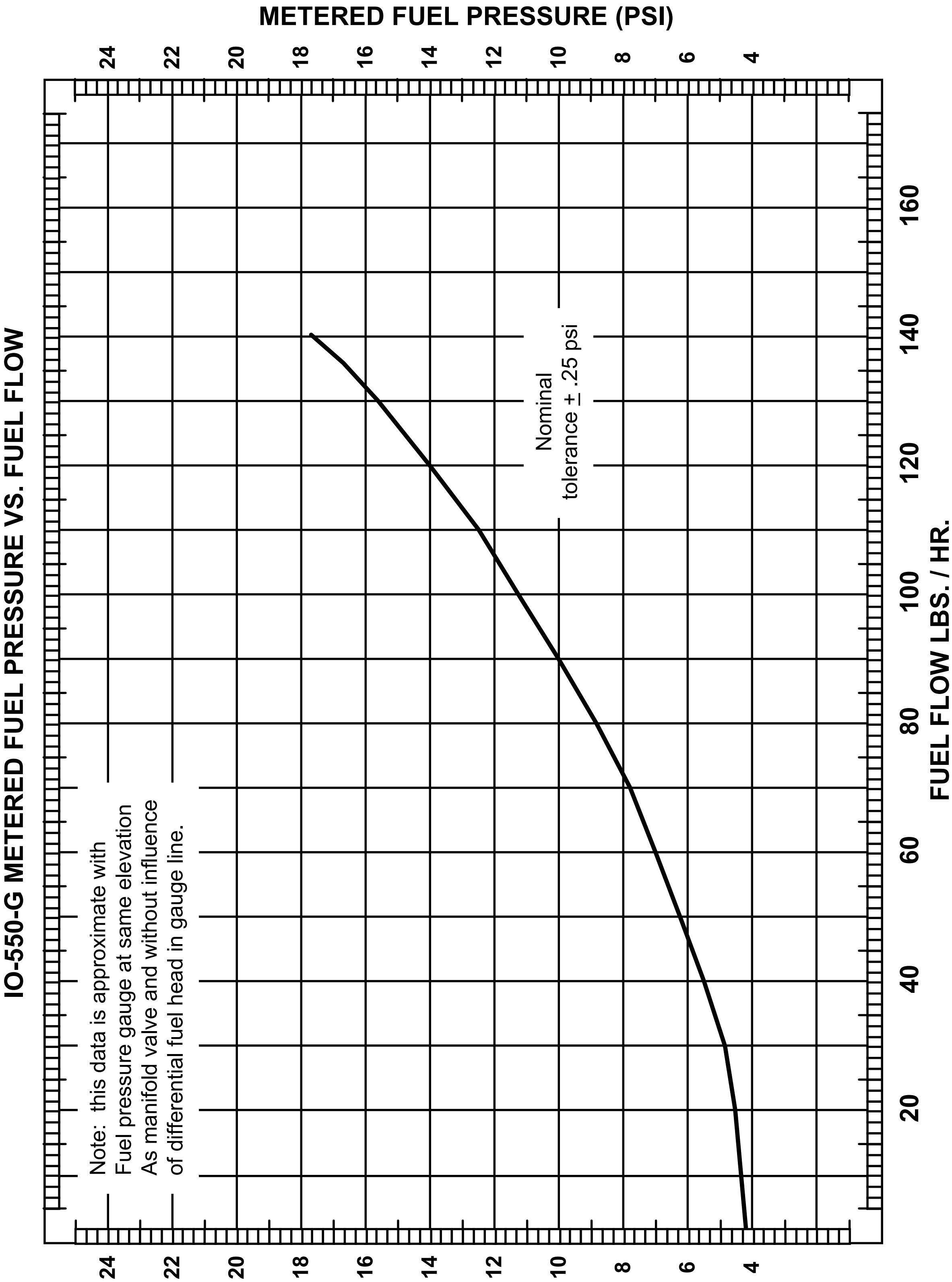



FIGURE 19-18. FUEL FLOW VS METERED PRESSURE IO-550-G

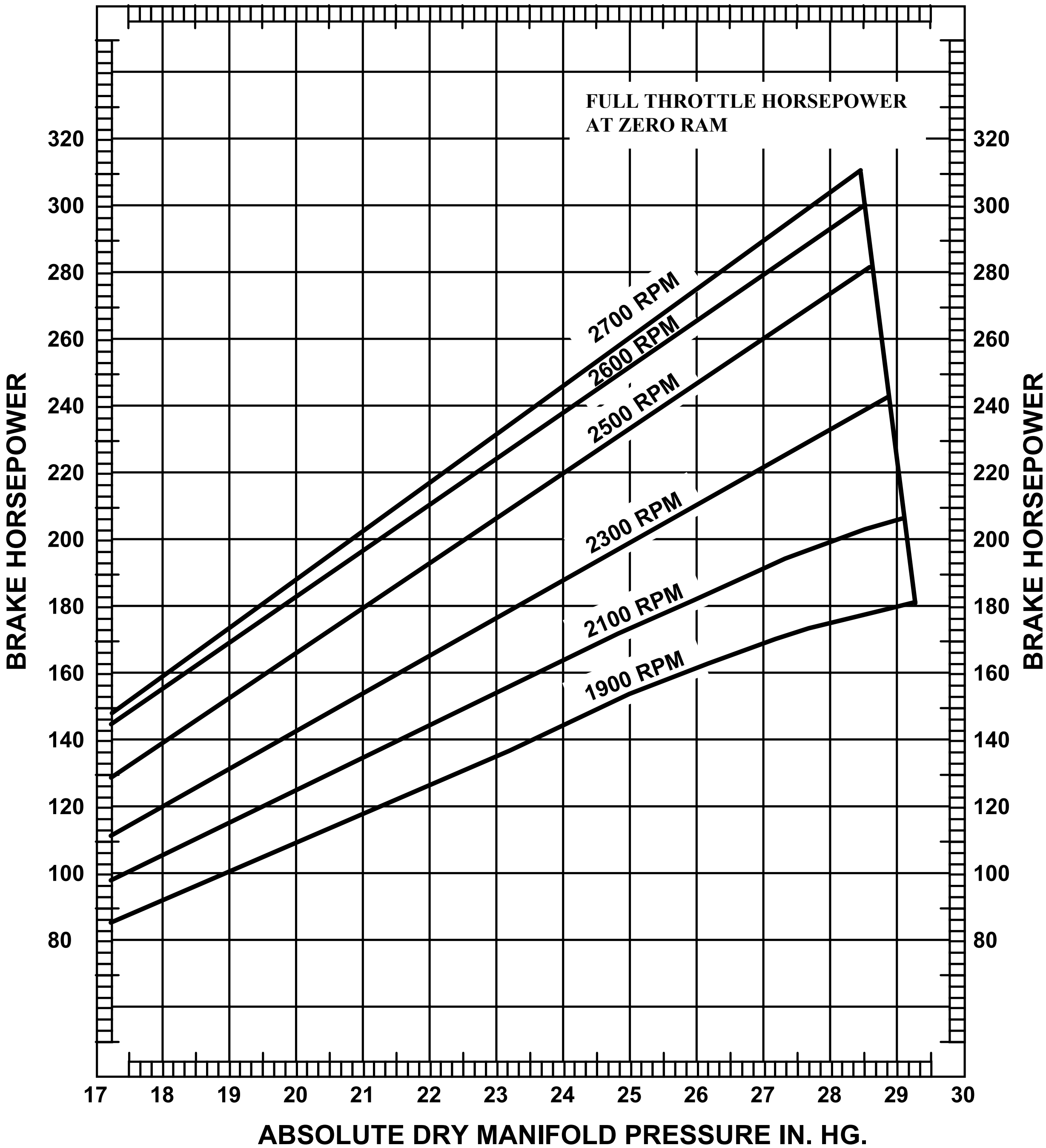



FIGURE 19-19. CONSTANT SPEED SEA LEVEL PERFORMANCE IO-550-N, P, R

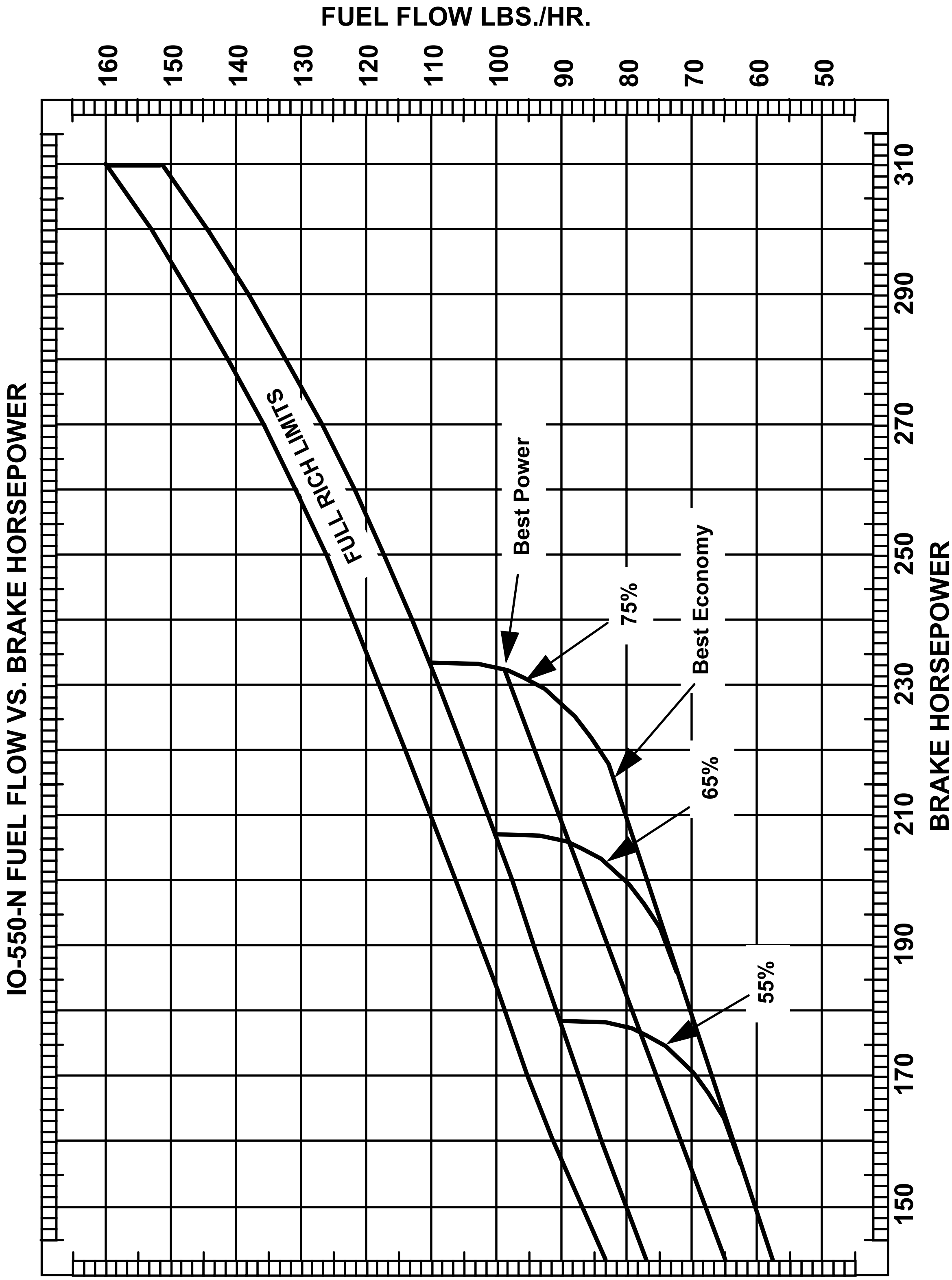



FIGURE 19-20. FUEL FLOW VS. OBSERVED BRAKE HORSEPOWER IO-550-N, P, R

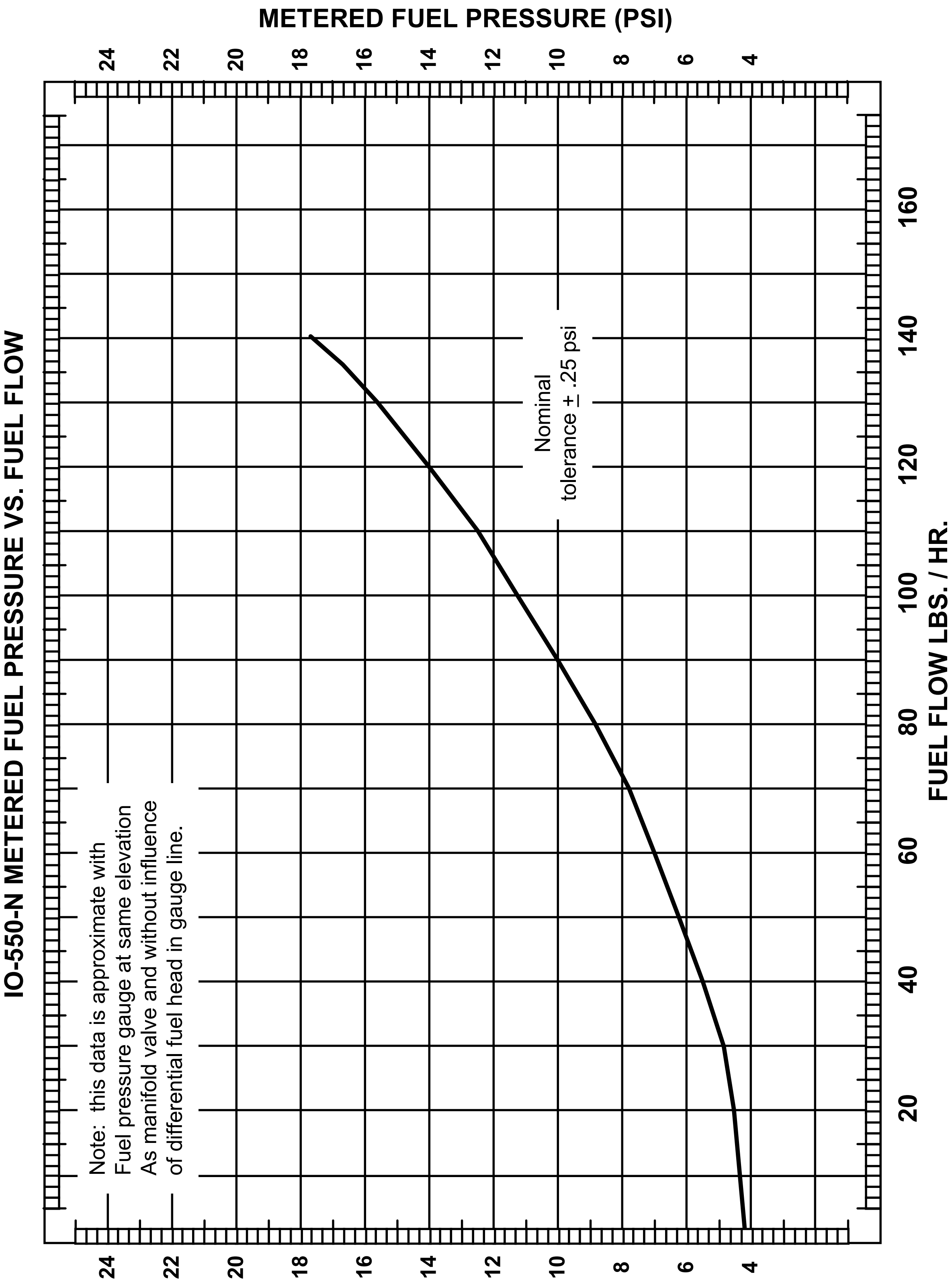



**FIGURE 19-21. FUEL FLOW VS METERED PRESSURE IO-550-N, P, R**

# OPERATIONAL TEST FORM

| | | | | |
|---|---|---|---|---|
| Date: | Location: | Elevation: | OAT: | Field "Hg: |
| **Aircraft Make & Model:** | | **Aircraft Registration #:** | | |
| **Engine Model:** | | **Engine Position:** Left Right Front Rear | | |
| **Engine Serial Number:** | | **Engine Total Time - New - Overhaul** | | |

## Fuel System Adjustment - Record engine specifications and actual gauge indications.

| | | | | Fuel Pressure | | | | | | | | | | | | | | | | Adjustment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R.P.M. | | M.A.P. | | Unmetered | | Metered | | Fuel Flow | | EGT | TIT | Cylinder Head Temp. - °F | | | | | | Oil | | # of turns | |
| Spec | Actual | Spec | Actual | Spec | Actual | Spec | Actual | Spec | Actual | °F | °F | 1 | 2 | 3 | 4 | 5 | 6 | PSI | °F | CW | CCW |
| | | | | | | | | | | | | | | | | | | | | | |
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## Flight Test Data - Record gauge indications

| R.P.M. | | M.A.P. | | Pressure Altitude - (Set altimeter to 29.92" Hg) | Fuel Flow | | EGT °F | | TIT °F | | CHT °F | | Oil PSI | | Oil Temp. °F | | I.A.S. knots | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spec | Actual | Spec | Actual | | Spec | Actual | Spec | Actual | Spec | Actual | Spec | Actual | Spec | Actual | Spec | Actual | | |
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**Remarks:** (Idle RPM mixture rise, magneto drop, etc.)

Signature:______________________________

## 19-17 OVERHAUL TEST RUN STANDARD ACCEPTANCE TEST

| PERIOD | TIME-MINUTES | RPM |
|---|---|---|
| 1 | 5 | 1200±25 RPM |
| 2 | 5 | 1600±25 RPM<br>①② 2100±25 RPM |
| 3 | 5 | 2400±25 RPM |
| 4 | 10 | Rated Power RPM |
| | | |
| 5 | 10 | 75% Power RPM Check Fuel and Oil Pressures. Check Temperatures. |
| 6 | 5 | ③ Idle RPM (cooling period) Re-check idle adjustments. |
| Stop engine and perform leak check. | | |
| | | |
| 7 | 15 | ④ 75% Power RPM |
| 8 | 15 | ④ 75% Power RPM |

**NOTES:**

① Make one check on performance of each magneto alone at 2100 RPM. Clear spark plugs by operating with both magnetos on for a few seconds between checks. Check fuel flow.

② Do not run engine above 1800 RPM until oil temperature has reached 160°F and cylinder head temperatures have reached 200°F.

③ Do not shut engine down until oil temperature is below 200°F and cylinder head temperatures are below 300°F.

④ Fuel and oil leaks are not acceptable.

Engines failing to pass 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, correction of all discrepancies and complete re-test.

See next page for oil consumption determination test run .

## 19-18 OIL CONSUMPTION DETERMINATION

| PERIOD | TIME-MINUTES | RPM |
|---|---|---|
| 1 | 5 | Warm up to 2000±25 RPM<br>①② 2100±25 RPM |
| 2 | 5 | Rated Power RPM |
| 3 | 5 | 75% Power RPM Check Fuel and Oil Pressures. Check Temperatures. |
| | | |
| 4 | 5 | ③ Idle RPM (cooling period) Re-check idle adjustments. |
| Stop engine, drain and weigh oil in for oil consumption determination. | | |
| 5 | 15 | ④ 75% Power RPM |
| 6 | 15 | ④ ⑤ 75% Power RPM |

**NOTES:**

① Make one check on performance of each magneto alone at 2100 RPM. Clear spark plugs by operating with both magnetos on for a few seconds between checks. Check fuel flow.

② Do not run engine above 1800 RPM until oil temperature has reached 160°F and cylinder head temperatures have reached 200°F.

③ Do not shut engine down until oil temperature is below 200°F and cylinder head temperatures are below 300°F.

④ Fuel and oil leaks are not acceptable.

Engines failing to pass 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, correction of all discrepancies and complete re-test.

⑤ Oil consumption of 1 lb. is considered acceptable for this test. One repeat of this test run is acceptable. Oil consumption in excess of 1.0 pound return engine to overhaul shop for a complete recheck of construction .

## 19-19 ENGINE PRESERVATION FOR STORAGE OR INSTALLATION AFTER OVERHAUL

The engine must be preserved for storage or installed in the airframe in accordance with the IO-550 Permold Series Maintenance Manual, Form X30634A and the airframe manufacturer's information. If the engine is installed for return to service, proceed to, "Test Flight."

## 19-20 TEST FLIGHT

Refer to the aircraft manufacturer's or Supplemental Type Certificate (STC) holders POH/AFM for specific operational information.

NOTE…I0-550-A, B & C engines that have an altitude compensating fuel pump require the auto lean operation inspection below during test flight.

Ambient air and engine operating temperatures are of major concern during this test flight. Do a normal pre-flight run-up in accordance with the Airplane Flight Manual. Conduct a normal take-off with full power and monitor the fuel flow, RPM, oil pressure, cylinder head temperatures and oil temperatures. Reduce to climb power in accordance with the Airplane Flight Manual. The manual mixture control should be set in the full rich position for all operations except leaning for field elevation to maintain smoothness (unless engine is equipped with an altitude compensating fuel pump). Leaning operations must be performed in accordance with the Airplane Flight Manual.

NOTE…New, rebuilt and overhauled engines or engines that have had new or repaired cylinders installed must be flown in accordance with the following procedure for the first two hours of operation.

Level flight cruise should be at 75% power with best power or richer mixture for the first hour of operation. The second hour power settings should alternate between 65% and 75% power with the appropriate best power mixture settings. The best power mixture setting is 100° to 125° rich of peak exhaust gas temperature. Engine controls or aircraft attitude should be adjusted as required to maintain engine temperatures and pressures within specifications.

Descent from high altitude should be accomplished at low cruise power settings. During descent engine pressures and temperatures must be carefully monitored. Avoid long descents with cruise RPM and manifold pressure below 18" Hg.

*CAUTION…Rapid descents at high RPM and low manifold pressure are to be avoided.*

During descent monitor cylinder head and oil temperatures maintaining above the minimum recommended operating range .

NOTE…Avoid long descents at low manifold pressure, which can result in excessive engine cooling. Satisfactory engine acceleration may not occur when power is applied.

Any discrepancies detected during test flight must be corrected and the aircraft again test flown prior to approval of engine for return to service. The appropriate logbook entries must be made in accordance with Part 43 of the Federal Aviation Regulations (FAR) before the engine can be returned to service.

### AUTO LEAN OPERATION FOR ENGINES WITH ALTITUDE COMPENSATING FUEL PUMPS

In addition to the above I0-550-A, B & C engines with altitude compensating fuel pumps require a flight test every 100 hours or annual inspection and anytime an adjustment is made to the fuel injection system to insure proper operation of the fuel pump auto leaning feature.

1. Tables 19-2, 19-3, 19-4 and the Auto Leaning Charts, Figures 19-7, 19-11, 19-15 provide fuel flow vs. pressure altitude specifications.
2. Insure the accuracy of aircraft fuel flow gauge and tachometer have been verified. These gauges must be accurate or the data recorded during flight test will not be valid.
3. Locate the correct table and auto leaning chart for the aircraft and engine. On the operational test form provided in this chapter, record all pressure altitudes and corresponding minimum and maximum fuel flows as specified.
4. In accordance with the aircraft manufacturer's instructions perform a complete pre-flight inspection, engine start and ground run up.
5. Set the aircraft altimeter to 29.92 inches Hg.
6. In accordance with the aircraft manufacturer's instructions make a normal take-off.
7. Climb must be accomplished at full throttle, FULL RICH mixture and 2700 RPM at the best rate of climb airspeed or higher for the aircraft.
8. Using the aircraft fuel flow gauge and altimeter record the fuel flows at all pressure altitudes specified.
9. Compare the recorded fuel flows with the specified fuel flows for all pressure altitudes. If fuel flows are within the minimum and maximum limits at all altitudes no adjustments are required.
10. If the fuel flows are not within the specified limits at all pressure altitudes the fuel injection system auto leaning schedule will require adjustment.

## TABLE 19-2. ALTITUDE FUEL SCHEDULE

| IO-550-A ENGINE FULL OPEN THROTTLE, FULL RICH MIXTURE 300 BHP @ 2700 RPM | | | | | | |
|---|---|---|---|---|---|---|
| **Pressure Altitude (Set Altimeter at 29.92 in. Hg.)** | **Fuel Flow (lbs/hr)** | | **Fuel Flow (gals/hr)** | | **Metered Fuel Pressure PSID** | |
| | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** |
| Sea Level | 142 | 150 | 24.2 | 25.6 | 16.5 | 17.2 |
| 1000 | 141 | 149 | 24.0 | 25.4 | 16.3 | 17.1 |
| 2,000 | 138 | 146 | 23.5 | 24.9 | 15.9 | 16.6 |
| 3000 | 133 | 141 | 22.6 | 24.0 | 15.1 | 15.7 |
| 4,000 | 128 | 136 | 21.8 | 23.2 | 14.3 | 14.9 |
| 5000 | 123 | 131 | 21.0 | 22.3 | 13.6 | 14.1 |
| 6,000 | 120 | 128 | 20.4 | 21.8 | 13.2 | 13.7 |
| 8,000 | 113 | 121 | 19.2 | 20.6 | 12.3 | 12.7 |
| 10,000 | 108 | 116 | 18.4 | 19.8 | 11.6 | 12.1 |
| 12,000 | 103 | 111 | 17.5 | 18.9 | 11.0 | 11.4 |
| 14,000 | 98 | 106 | 16.7 | 18.1 | 10.4 | 10.7 |
| Gasoline = 5.87 lbs per gallon @ 70° F. | | | | | | |

## TABLE 19-3. ALTITUDE FUEL SCHEDULE

| IO-550-B ENGINE FULL OPEN THROTTLE, FULL RICH MIXTURE 300 BHP @ 2700 RPM | | | | | | |
|---|---|---|---|---|---|---|
| **Pressure Altitude (Set Altimeter at 29.92 in. Hg.)** | **Fuel Flow (lbs/hr)** | | **Fuel Flow (gals/hr)** | | **Metered Fuel Pressure PSID** | |
| | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** |
| Sea Level | 146 | 156 | 24.9 | 26.6 | 17.2 | 18.3 |
| 1000 | 145.5 | 155.5 | 24.8 | 26.5 | 17.1 | 18.2 |
| 2,000 | 145 | 155 | 24.7 | 26.4 | 17.0 | 18.1 |
| 3000 | 144 | 154 | 24.5 | 26.3 | 16.9 | 17.9 |
| 4,000 | 142 | 152 | 24.2 | 25.9 | 16.5 | 17.5 |
| 5000 | 139 | 149 | 23.7 | 25.4 | 16.1 | 17.0 |
| 6,000 | 135.5 | 145.5 | 23.1 | 24.8 | 15.5 | 16.5 |
| 8,000 | 127 | 137 | 21.6 | 23.3 | 14.2 | 15.1 |
| 10,000 | 117 | 127 | 19.9 | 21.6 | 12.8 | 13.6 |
| 12,000 | 110 | 120 | 18.7 | 20.4 | 11.9 | 12.6 |
| 14,000 | 105 | 115 | 17.9 | 19.6 | 11.3 | 11.9 |
| Gasoline = 5.87 lbs per gallon @ 70° F. | | | | | | |

## TABLE 19-4. ALTITUDE FUEL SCHEDULE

| IO-550-C ENGINE FULL OPEN THROTTLE, FULL RICH MIXTURE 300 BHP @ 2700 RPM | | | | | | |
|---|---|---|---|---|---|---|
| **Pressure Altitude (Set Altimeter at 29.92 in. Hg.)** | **Fuel Flow (lbs/hr)** | | **Fuel Flow (gals/hr)** | | **Metered Fuel Pressure PSID** | |
| | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** |
| Sea Level | 152 | 160 | 25.9 | 27.2 | 18.2 | 18.9 |
| 1000 | 151 | 159 | 25.7 | 27.1 | 18.0 | 18.7 |
| 2,000 | 148 | 156 | 25.2 | 26.6 | 17.5 | 18.2 |
| 3000 | 143 | 151 | 24.4 | 25.7 | 16.7 | 17.4 |
| 4,000 | 138 | 146 | 23.5 | 24.9 | 15.9 | 16.5 |
| 5000 | 134 | 142 | 22.8 | 24.2 | 15.3 | 15.9 |
| 6,000 | 130 | 138 | 22.1 | 23.5 | 14.7 | 15.3 |
| 8,000 | 123 | 131 | 21.0 | 22.3 | 13.6 | 14.1 |
| 10,000 | 118 | 126 | 20.1 | 21.5 | 12.9 | 13.4 |
| 12,000 | 113 | 121 | 19.3 | 20.6 | 12.3 | 12.7 |
| 14,000 | 108 | 116 | 18.4 | 19.8 | 11.7 | 12.1 |
| Gasoline = 5.87 lbs per gallon @ 70° F. | | | | | | |

## ADJUSTMENT PROCEDURES:
### Fuel Pump Auto Leaning Schedule

NOTE...On IO-550-A and C model engines do not attempt to adjust the auto leaning schedule if the aircraft is at a field with a pressure altitude greater than 1000 feet.

On IO-550-B model engines do not attempt to adjust the auto leaning schedule if the aircraft is at a field with a pressure altitude greater than 3000 feet.

Refer to Fuel System Adjustment (Setup Procedures) of this chapter for installation of the required test equipment.

1. If not previously accomplished, adjust the engine fuel injection system in accordance with Fuel System Adjustment of this chapter using the appropriate table for the engine and aircraft.
2. Adjustments to the engine driven fuel pump variable orifice (aneroid) will result in a change to the auto leaning schedule. One complete revolution of the aneroid adjustment will increase or decrease the auto leaning schedule approximately 1000 feet.
3. Refer to Figures 19-7, 19-11, 19-15 as applicable. The variable orifice (aneroid) adjustment will move you horizontally across the chart. The adjustable orifice will move you vertically.
4. Adjustments to the variable orifice (aneroid) will affect the FULL POWER unmetered fuel pressures (adjustable orifice), metered pressures and fuel flows. It is important to maintain the balance between these adjustments in order to achieve the specified fuel system parameters.

*CAUTION…Exercise caution when adjustments to the aneroid are accomplished. The aneroid stem has an extra fine thread and over torquing of the lock nut will damage either the stem or housing threads.*

NOTE...It will be necessary to cut and remove the safety wire and manufacturer's seal from the variable orifice adjustment. Cut the safety wire as close to the variable orifice stem as possible. This will provide a pig tail for the fuel pump through bolts. It is not necessary to re-safety the aneroid after adjustments have been completed.

5. By reviewing the data recorded on the operational test flight form we can determine if the auto leaning schedule is above or below the specified limits at the various pressure altitudes.
6. Adjustment of the variable orifice (aneroid) clockwise will decrease the altitude (move horizontally to the left on the chart) while counter-clockwise adjustments will increase the altitude (move horizontally to the right on the chart) at a given pressure altitude.
7. As an example, looking at Figure 19-11 (IO-550-B engine) at a pressure altitude of 4000 feet the recorded fuel flow was 140 PPH (point A) The fuel flow specified for this pressure altitude is 142 PPH to 152 PPH. The recorded fuel flow of 140 PPH would be correct if we were between 5000 feet and 7000 feet. To achieve the specified fuel flow verses pressure altitude we must adjust the variable orifice out. Adjustment of the variable orifice (aneroid) two complete revolutions will move point A two thousand feet to the right to 6000 feet.

8. After making any adjustment to the variable orifice, torque the lock nut to 25 - 30 inch pounds.

9. Perform a complete ground run up and verify that unmetered and metered pressures and fuel flows are within the limits specified in appropriate table for the pressure altitude. If these parameters are not within the limits specified make adjustments in accordance with "Fuel System Adjustment" of this chapter to achieve the specified values.

NOTE...The adjustable orifice tapered needle may be damaged if forced against it's seat. The adjustment should move freely. Do not continue adjustments if rotational resistance increases suddenly.

10. Once the adjustments are completed, remove the test equipment in accordance with "Fuel System Adjustment" (Post Setup Procedures) of this chapter.

11. Perform a flight test in accordance with "Test Flight. "

Repeat these procedures until the engines fuel injection system meets all published specifications.

## 19-21 CONTINUED AIRWORTHINESS INSTRUCTIONS

After engine installation, test and approval for return to service the engine must be kept in an airworthy status. The engine must be kept airworthy in accordance with the engine maintenance instructions in the IO-550 Maintenance Manual, Form X30634A, and related publications as listed in section 1-5 of this manual.

# Special Instructions For I0-550-B39B and I0-550-C31B

Overhaul Instructions for the I0-550-B39B are the same as the overhaul instructions for the I0-550-B37B and overhaul instructions for the I0-550-C31B are the same as the overhaul instructions for the I0-550-C30B except for the following:

1. The torque's listed in tables 6-1 through 6-5 are applicable to the I0-550-B39B and I0-550-C31B except for the crankcase flange (backbone) stainless steel nuts and bolts which are torqued to 240 to 280 inch pounds.

2. The cylinder valve springs are matched to within 5 pounds across all cylinders at the factory.

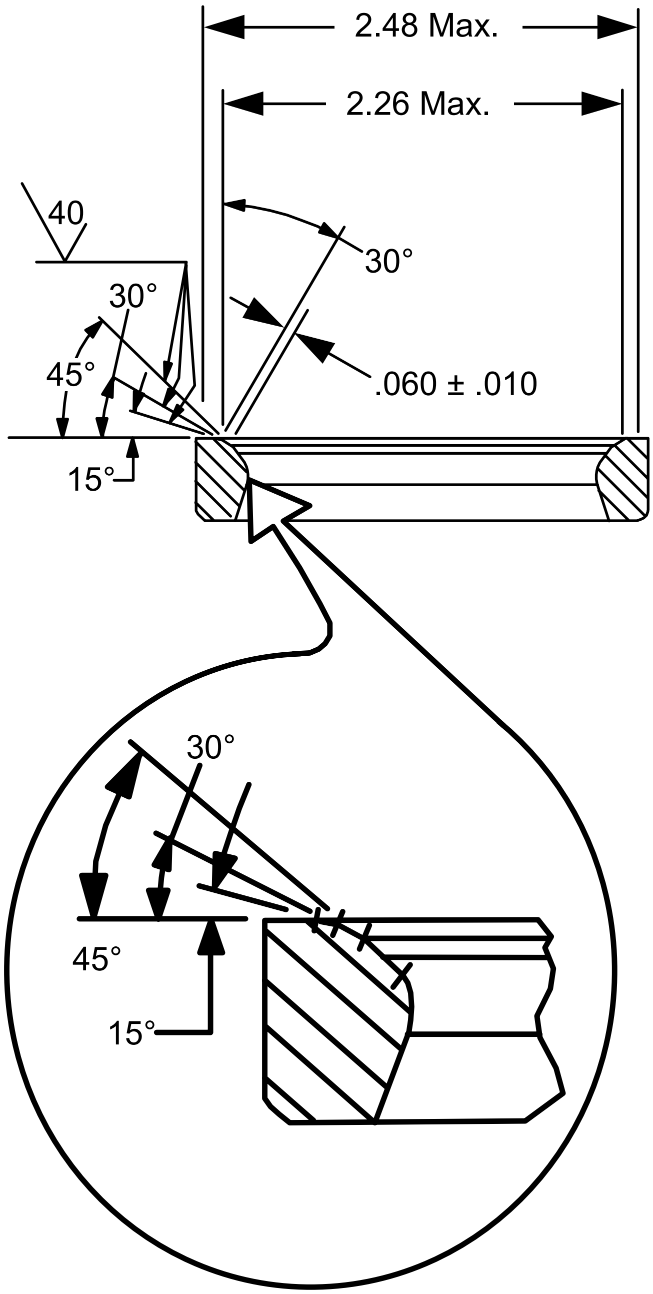
3. The six connecting rods are balanced to within 2 grams - inch at the factory.

4. The crankshaft assembly is dynamically balanced to within 12 grams - inch at the factory.

5. The six pistons are weight matched to within 2 grams - inch at the factory.

6. During disassembly a Kent-Moore Crankcase Splitter Part Number L-423 is required.

NOTE…See the following pages for cylinder intake valve seat rework information and crankcase studding assembly additions.




INTAKE SEAT GRINDING PROCEDURE:

NOTE: USE STONES THAT WILL PRODUCE 40 $R_a$ FINISH.

1. GRIND SEAT WITH 30° STONE TO SPECIFIED FINISH.
2. NARROW SEAT OUTSIDE DIAMETER WITH 15° STONE TO ESTABLISH OUTSIDE DIAMETER.
3. NARROW SEAT INSIDE DIAMETER WITH 45° STONE TO ESTABLISH 60 ± .010.

**FIGURE 20-1. I0-550-B39B AND I0-550-C31B INTAKE VALVE SEAT REFACING**

THE I0-550-39B (654130-6) STUDDING ASSEMBLY IS THE SAME AS FIGURE 16-7B AND THE I0-550-C31B (654130-5) STUDDING ASSEMBLY IS THE SAME AS FIGURE 16-7C EXCEPT FOR THE FOLLOWING ADDITIONS:

1. 654638 DOWEL, 8 EACH (SETTING HEIGHT .47")
2. MS9021-016 O-RING, 8 EACH

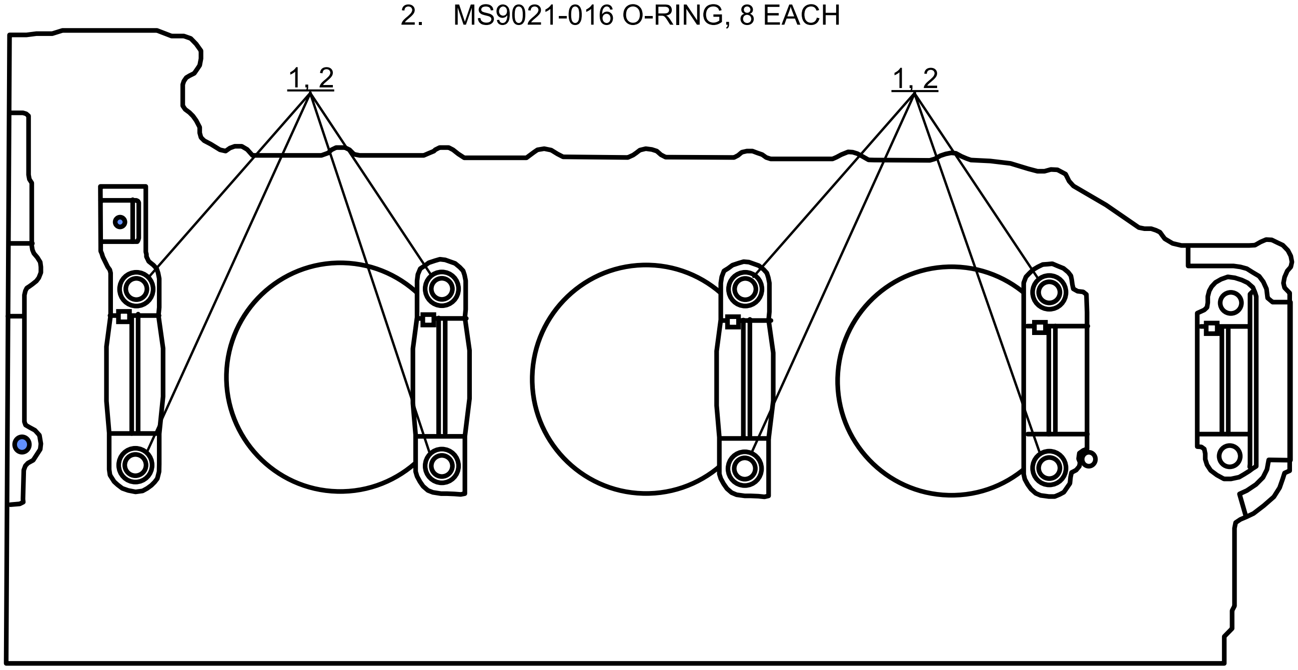



**FIGURE 20-2. I0-550-B39B AND I0-550-C31B CRANKCASE STUDDING ASSEMBLY ADDITIONS**

INTENTIONALLY

LEFT

BLANK