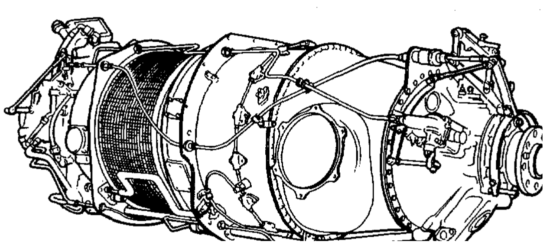
# TECHNICAL MANUAL

## AVIATION UNIT
## AND
## AVIATION INTERMEDIATE
## MAINTENANCE MANUAL

## TURBOPROP
## AIRCRAFT ENGINE



**MODEL T74-CP-700**
**NSN 2840-00-855-6100**

**This manual supersedes that portion of TM 55-2840-232-24, 2 July 1971, that pertains to Engine Model T74-CP-700.**



HEADQUARTERS, DEPARTMENT OF THE ARMY
15 SEPTEMBER 1986

**URGENT**

**TM 55-2840-251-23**
**C1**

CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 22 November 1994

Aviation Unit and Aviation Intermediate Maintenance Manual

**Engine, Assembly**
**Model T74-CP-700**
**NSN 2840-00-855-6100**

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited

TM 55-2840-251-23, 15 September 1986, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

| Remove pages | Insert pages |
|---|---|
| 1-79 and 1-80 | 1-79 and 1-80 |
| 1-101 and 1-102 | 1-101 and 1-102 |
| C-5 and C-6 | C-5 and C-6 |

2. Retain this sheet in front of manual for reference purposes.

**By Order of the Secretary of the Army:**

**Official:**

**MILTON H. HAMILTON**
*Administrative Assistant to the*
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DISTRIBUTION:
To be distributed in accordance with DA Form 12-31-E, block no. 0990, requirements for TM 55-2840-251-23.

**URGENT**

# WARNING AND FIRST AID DATA

**Warnings, cautions and notes emphasize important and critical instructions. They are defined as follows:**

**WARNING**

**An operating procedure or practice which, if not correctly followed, will result in personnel injury or loss of life.**

**CAUTION**

**An operating procedure or practice which, if not strictly observed, will result in damage or destruction of equipment.**

**NOTE**

**An operating procedure or condition which it is essential to highlight.**

**Personnel performing instructions involving operations, procedures, materials, and practices which are included or implied in this technical manual shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury or death. Refer to FM21-11 for first aid to treat injuries resulting from working on the engine.**

**WARNING**

**POISONOUS LEAD OXIDE**

**Poisonous lead oxide is a byproduct of fuels containing tetraethyl lead. Death or injury can result if this lead oxide is taken into the body through cuts or other external openings, or if inhaled.**

- **Wear gloves and goggles when handling contaminated parts.**
- **If accidental exposure occurs, drench affected areas with large amounts of clear water.**
- **OBTAIN IMMEDIATE MEDICAL ATTENTION.**

**WARNING**

**EXPLOSION HAZARD**

- **Magnesium powder or dust is explosive. Do not expose to naked flames.**

**WARNING**

**HANDLING ENGINE SHIPPING CONTAINER**

- **Be careful when working with engine shipping container. Make sure both sections of container are grounded.**
- **Make sure container is opened in well-ventilated area. Failure to do so could result in explosion.**
- **Shipping container is pressurized. Make certain that all air pressure has been released before removing valve stem or loosening nuts.**
- **If nuts are removed before pressure is released, internal pressure could blow cover off and cause serious injury.**
- **If injury occurs, GET MEDICAL ATTENTION.**

**WARNING**

**SODIUM DICHROMATE**

- **Sodium dichromate is highly toxic, do not take internally.**
- **Use only with adequate ventilation. Avoid prolonged or repeated contact with skin.**
- **Wear approved gloves and goggles, or face shield and apron, and wash hands thoroughly after handling.**
- **Wear respirator if sodium dichromate is in powdered form.**
- **In case of contact, immediately flush skin and eyes with water for at least 15 minutes.**
- **GET MEDICAL ATTENTION.**

**WARNING**

**NITRIC ACID**

- **Both nitric acid and its vapors are a personnel hazard.**
- **Avoid contact with skin, eyes or clothing. Avoid inhalation of vapors.**
- **In case of contact, immediately flush skin and eyes with water for at least 15 minutes.**
- **GET MEDICAL ATTENTION.**

**WARNING**

**LUBRICATING OILS**

- **Lubricating oils cause paralysis if swallowed. Prolonged contact with them may irritate the skin.**
- **Handle only in well-ventilated areas away from heat and flame.**
- **Drain and store in approved metal safety containers.**
- **Avoid prolonged or repeated contact with skin and do not take internally.**
- **Wash contacted areas of skin thoroughly after handling. If irritation of skin results, GET MEDICAL ATTENTION.**
- **GET MEDICAL ATTENTION FOR EYES.**

**WARNING**

**CORROSION PREVENTIVE COMPOUNDS**

- **These materials are flammable and toxic.**
- **Use only in well-ventilated area away from heat, sparks and open flames.**
- **If swallowed, do not induce vomiting. GET MEDICAL ATTENTION.**
- **In case of contact immediately flush skin and eyes with water for 15 minutes.**
- **GET MEDICAL ATTENTION FOR EYES.**

**WARNING**

**CLEANING SOLVENTS**

- **These materials are flammable and toxic. They can irritate skin and cause burns.**
  **Use only in well-ventilated area, away from heat, sparks and open flame.**
- **In case of contact, immediately flush skin and eyes with water for at least 15 minutes.**
- **GET MEDICAL ATTENTION FOR EYES.**

## WARNING

### WELDING OPERATIONS

- **Welding operations are hazardous. Harmful light rays may injure eyes and burn skin. Poisonous fumes may cause illness. Burns and fires may result from hot sparks.**
- **Wear approved protective clothing and equipment.**
- **Perform welding operations in well-ventilated areas away from flammable liquids and gases.**
- **If fire occurs, call for assistance and use proper extinguishing procedures.**
- **If injury or illness occurs, GET MEDICAL ATTENTION.**

## WARNING

- **Acids are injurious. Wear protective clothing and goggles when handling.**
- **If injury occurs, GET MEDICAL ATTENTION.**

## WARNING

### HANDLING OF HEATED PARTS

- **Wear asbestos gloves when handling heated parts for assembly and disassembly. Failure to comply may cause severe burns.**
- **GET MEDICAL ATTENTION FOR BURNS.**

## WARNING

### HANDLING OF PARTS TREATED WITH DRY ICE

- **Dry ice is very cold. It can cause severe burns.**
- **Wear approved protective equipment and handle only in well-ventilated areas.**
- **GET MEDICAL ATTENTION FOR BURNS.**

## WARNING

### HANDLING OF SPRING LOADED PARTS

- **Be careful when removing and installing retaining ring to spring loaded parts.**
- **Spring tension could cause parts to spring up and cause injury.**
- **If injury occurs, GET MEDICAL ATTENTION.**

**WARNING**

**HOISTING SHIPPING CONTAINER COVER**

- **Do not stand under cover while it is suspended from hoist, or while it is being moved from one area to another on a hoist.**
- **To prevent injury to personnel and damage to equipment during handling of cover, periodically check lifting sling.**
- **Do not use equipment which has signs of excessive wear or abuse. Do not use equipment which has unauthorized bolts, pins, etc. If equipment is defective or has unauthorized parts, notify local safety personnel.**
- **Be sure that working capacity of lifting device and sling exceeds 800 pounds, so lifting device will not fail if cover does not release.**
- **If injury occurs, GET MEDICAL ATTENTION.**

**HANDLING OF SHROUD GRINDER**

- **Contact with shroud grinder rotating parts could cause injury. Exposure to noise may cause ringing in ears, and temporary or permanent hearing loss.**
- **Keep hands and clothing away from rotating parts and wear approved hearing and eye protection.**
- **If injury occurs, or ringing in ears or loss of hearing persists, GET MEDICAL ATTENTION.**

**WARNING**

**USE OF ENGINE MAINTENANCE SLING**

- **Inspect sling prior to use for signs of abuse or wear.**
- **Failure to comply may cause injury to personnel and/or damage to engine.**
- **When using sling, make sure hoist lifting capacity is 800 pounds.**
- **In case of injury, GET MEDICAL ATTENTION.**

**WARNING**

**POWER GRINDING**

- **Power grinding is hazardous to personnel. Sparks and metal chips may injure eyes.**
- **Wear approved goggles.**
- **If injury occurs, GET MEDICAL ATTENTION.**

**WARNING**

**COMPRESSED AIR**

- **When using compressed air for cleaning, use approved protective equipment for eyes and face.**
- **Do not use more than 30 psig air pressure.**
- **Do not direct air toward yourself or another person. Failure to comply could result in injury to eyes or skin.**
- **In case of injury, GET MEDICAL ATTENTION.**

**WARNING**

**FUELS**

**Turbine fuels are very flammable. They may cause drying and irritation of skin or eyes.**

- **Handle only in well-ventilated areas away from heat and open flame.**
- **Drain and store in approved metal safety containers.**
- **Avoid prolonged or repeated contact with skin and do not take internally.**
- **Wash contacted area of skin thoroughly after handling. If irritation of skin results, GET MEDICAL ATTENTION.**
- **GET MEDICAL ATTENTION FOR EYES.**

Aviation Unit and Aviation Intermediate
Maintenance Manual

TURBOPROP AIRCRAFT ENGINE
(NSN 2840-00-855-6100)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, USAAVSCOM, ATTN: AMSAV-MPSD, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished to you.

## TABLE OF CONTENTS

**TABLE OF CONTENTS (Continued)**

**TABLE OF CONTENTS (Continued)**

## HOW TO USE THIS MANUAL

**1. Description of Manual.** This manual has ten chapters and five appendices. Chapter 1 is divided into sections, each section in Chapter 1 is divided into paragraphs. The paragraphs have specific information you will need to know. Chapters 2 through 10 are divided into tasks. The tasks tell you what you need and how to do each job. The appendices have general information you will need to know. They list references, maintenance allocation chart, expendable supplies and materials, manufactured items and torque limits.

a. Paragraph Tasks. Paragraphs make up sections in Chapter 1. They contain specific information about the engine. Tasks make up Chapters 2 through 10. It is the tasks that have the information you need to do any job. All paragraphs and tasks are numbered. This helps you find what you need when you need it. USE THE CHAPTER OVERVIEW AT THE BEGINNING OF EACH CHAPTER OR THE INDEX TO FIND THE PARAGRAPH OR TASK YOU NEED. Tasks and tables are identified by the number of the chapter in which it appears, followed by a dash and a number indicating the sequence in which it appears in the chapter.

Examples: Table 2-2 is the second table in Chapter 2.
Task 2-4 is the fourth task in Chapter 2.

b. Initial Setup. Initial setup is the first part of every task in the manual. It lists what tools, materials, and parts you will need before you can do the task. The following headings are used when they apply.

(1) Task Title. The task title after the paragraph number describes the job to be done in the task.

(2) Tools. Tools, tool kits, or shop sets needed to do the task are listed here. If tools from your repairman's tool kit are needed, the kit is listed. Tools you need that are not in the kit or set, are listed by name, type, and size. Special tools and test and support equipment are listed by a T-number. Find these items in Appendix B, Section III.

(3) Materials. Expendable items and support materials are listed under this heading. These are things like solvent, rags, grease, lockwire, etc. They are listed by an E-number:

Example: Varsol (E. 9)

Find these items in Appendix C.

(4) Parts. All mandatory replacement parts are listed. These are things like gaskets, packings, cotterpins, lockwashers, etc. They are listed by the Repair Parts and Special Tools List (RPSTL) name.

(5) Personnel Required. The people needed to do the task are listed under this heading. They are identified by their MOS. When more than one of any MOS is needed, the number needed is shown in parentheses. The text will tell you when a helper is needed.

(6) References. TM's you will need to do the task are listed under this heading.

(7) Equipment Condition. All the procedures to be done before you start the task are listed under this heading. The number of the task is given when applicable.

(8) General Safety Instructions. Warnings and Cautions that apply in general to the complete procedure are described here. They are not repeated in the step-by-step procedures. Make sure you understand and comply with them.

c. Locator Illustrations. When needed (for removal, installation and other procedures) a locator illustration is included in initial setup. They show you the area of the engine to be worked on. Parts involved in the task are called out.

d. Procedures. Step-by-step procedures tell you how to do the task. They are arranged in logical sequence to help you get the task done efficiently.

**2. How To Prepare For a Task.** Read the initial setup carefully before starting. It tells you what you need and what you have to know to start the task. DO NOT START A TASK UNTIL:

You understand the task.
You understand what you are to do.
You know what is needed to do the work.
You have the things you need.

a. If a tool has a T-code after it, go to the Tool and Test Equipment List in Appendix B, Section III. Read down the left-hand column to your T-code. This is the tool you need for your task.

b. If an expendable material has an E-number after it, go to the Expendable Supplies and Materials List in Appendix C. Read down the Item Number column to your E-number. This is the expendable you need for your task.

c. Before you start the task, check and make sure you can get the needed parts; National Stock Numbers (NSN) and part numbers are listed in the RPSTL, TM55-2840-251-23P.

d. Check for personnel required.

e. If preliminary procedures are listed under "Equipment Condition", BE SURE THE LISTED TASKS ARE DONE: then do this task.

**3. How To Do The Task.** Before starting, read the entire task. Familiarize yourself with the entire procedure before you begin the task. As you read, remember the following:

**a. PAY ATTENTION TO WARNINGS, CAUTIONS AND NOTES.**

b. When values are underlined or followed by the word INSPECT, an inspector must OK the completed step.

c. A GLOSSARY is provided. It lists the special words and unusual terms used in this manual and gives their meaning. Check it out. It may help you understand the instructions.

d. The following are considered standard maintenance practices. Instructions about these practices will not normally be included in task steps. Task steps will tell you when standard maintenance practices do not apply.

(1) Lines will be tagged before they are disconnected. Tubes and parts will be capped or plugged when they are disconnected.

(2) Used preformed packings, retainers, gaskets, cotterpins, lockwashers, etc. are discarded. New parts shall be installed.

(3) Packings are coated before installation in accordance with the following:

(a) Petrolatum (E. 20) for fuel system packings.

(b) Lubricating Oil (E. 2) or (E. 71) for lubricating system packings.

(4) Tubes and related parts will be tied out of the way with twine, not lockwire.

(5) In disassembly tasks, components are removed and wires disconnected.

(6) Disassembly procedures reflect disassembly needed to support total authorized repair. You may not need to disassemble a part as far as described in the task. Follow the steps to disassemble as far as needed to repair/replace worn or damaged parts.

(7) Before a component or the disassembled parts of a component are inspected, they are to be cleaned as required.

(8) Components and mating surface area will be inspected for serviceable condition before installation.

(9) Guide lines will be used when any item is hoisted overhead.

(10) When a nut is tightened or loosened on a bolt, the bolt head will be held with a wrench.

(11) A special torque will be cited when the words TORQUE TO are used. A standard torque is required when word install is used.

(12) When torquing hardware, observe compliance with drag torque as required. To determine drag torque, thread nut onto screw or bolt until at least two threads protrude. The nut shall not contact the mating part. The torque necessary to begin turning the nut is the drag torque.

(13) If additional setup tools are required, such as crowfoot wrenches, they will be listed in the task INITIAL SETUP.

(14) When cotterpin is required, cotterpin holes will be aligned within allowable torque range.

(15) Following installation, paint will be touched up as required.

(16) Following maintenance, inspect for foreign objects.

e. General maintenance procedures (e. g. , "replace studs and inserts") are not included in the maintenance instructions. A reference is made to General Aircraft Maintenance Manual (TM55-1500-204-25/1) for these procedures.

**4. Appendices.**

a. Appendix A -References. This appendix lists all referenced publications needed to perform the maintenance procedures in this manual.

b. Appendix B -Maintenance Allocation Chart (MAC). This appendix consists of four sections as follows:

Section I -Introduction. This section is a summary of what is in the MAC.

Section II. This section is the MAC. The MAC assigns maintenance functions in accordance with the Three Levels of Maintenance concept for Army Aviation. The MAC has six columns, containing the following information:

Columns 1 and 2 Functional Groups. These columns identify maintenance significant components, assemblies, subassemblies, and modules.

Column 3 -Maintenance Function. This column lists the maintenance functions to be peformed on the items listed in column 2.

Column 4 -Maintenance Categories. The maintenance categories (levels) AVUM, AVIM, and DEPOT are listed with individual columns. These columns identify the maintenance level at which each maintenance function is to be performed. Numbers in parentheses identify the corresponding numbered remarks in Section IV.

Column 5 -Tools and Equipment. This column lists the reference code identifying the tool or test equipment required, as listed in Section III.

Column 6- Remarks. Remarks identified by an alphabetical code, where applicable, are listed in Section IV and identified in column 6.

Section III -Tool and Test Equipment Requirements. This section consists of five columns, containing the following information:

Tool or Test Equipment Reference Code. This column lists the reference code listed in Column 5 Tools and Equipment in the MAC.

Maintenance Category. This column lists the maintenance category (level) authorized to use the tool or test equipment.

Nomenclature. This column lists the nomenclature of the tools and test equipment.

National/Nato Stock Number. This column lists the stock number applicable to each tool or test equipment.

Tool Number. The tool number is listed to aid in identifying the tool or test equipment.
Section IV Remarks. This section has two columns, containing the following information.

Reference Code. This column contains alphabetical codes or numbers in parentheses corresponding to the codes appearing in the applicable columns in the MAC.

Remarks/Notes. This column contains the actual notes as referenced by the reference codes to the MAC.

c. Appendix C -Expendable Supplies and Materials List. This appendix consists of two sections as follows:

Section I -Introduction. This section is a summary of what is in the Expendable Supplies and Materials List.

Section II - This Section is the Expendable Supplies and Materials List and has four columns, containing the following information:

Column 1 -Item Number. This is the E-number assigned to the expendable item. It is referred to in the detail procedures.

Example: Lockwire (E. 3)

Column 2 -National Stock Number. This is the National Stock Number (NSN) assigned to item. Use it to request or requisition the item.

Column 3 -Description. This column lists the name and, if required, a description to identify the item. The last line for each item shows the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if there is no NSN in Column 2.

Column 4 -U/M. This column lists the measure used in performing the maintenance function, expressed as a two-character alphabetical abbreviation (e.g., ea, in., pr).

d. Appendix D -Manufactured Items List. This appendix lists and illustrates any parts you may have to locally manufacture to do a task.

e. Appendix E -Locking Torque Values. This appendix details standard torque values.

5. Glossary. Definitions of abbreviations and unusual terms you find in the manual are listed here to help you.

6. Index. This appears at the end of the manual and lists all subjects in the manual in alphabetical order, according to Chapter/ Section/Paragraph.

# CHAPTER 1

# INTRODUCTION AND ENGINE GENERAL

## CHAPTER OVERVIEW

This chapter contains standard data and information about forms, records, reports, and general procedures. It also contains descriptions and other data about the engine and its major components. The chapter is divided into the following sections/ paragraphs:



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# CHAPTER 1

## INTRODUCTION AND ENGINE GENERAL

### CHAPTER OVERVIEW (Cont)



GO TO NEXT PAGE

# CHAPTER 1

## INTRODUCTION AND ENGINE GENERAL

### CHAPTER OVERVIEW (Cont)



**END OF OVERVIEW**

# CHAPTER 1

# INTRODUCTION

## Section I GENERAL INFORMATION

### 1-1 SCOPE

| | |
|---|---|
| Type of Manual: | Aviation Unit and Aviation Intermediate Maintenance Manual |
| Model Number and | Equipment Name: T74-CP-700 Turboprop Aircraft Engine |
| Purpose of Equipment: | Powers the U-21A/RU-21A Series Aircraft |

1-2 MAINTENANCE FORMS, RECORDS AND REPORTS

Department of the Army forms and procedures will be those prescribed by DA Pamphlet 738-751, Functional Users Manual for the Army Maintenance Management System - Aviation (TAMMS-A).

1-3 DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Refer to TM55-1520-209-23, Chapter 16, TM 750-244-1-5 and TM55-1510-215-23.

1-4 PREPARATION FOR STORAGE AND SHIPMENT

Refer to Chapter 1, Section IX for storage and shipment details.

1-5 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Refer to FM55-411.

1-6 NOMENCLATURE CROSS-REFERENCE

This listing includes nomenclature cross references used in this manual;

| COMMON NAME | NOMENCLATURE |
|---|---|
| PROPELLER GEARBOX | DRIVE SYSTEM |
| IGNITION HARNESS | ELECTRICAL HARNESS |

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**Section I GENERAL INFORMATION (Continued)**

## 1-7 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS

If your gas turbine engine needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know what you don't like about the design. Tell us why a procedure is hard to perform. Put it on SF 368 (Quality Deficiency Report). Mail it to us at: Commander, USAAVSCOM, ATTN: AMSAV-MEM, 4300 Goodfellow Blvd, St. Louis, MO 63120-1798. We'll send you a reply.

## 1-8 EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES

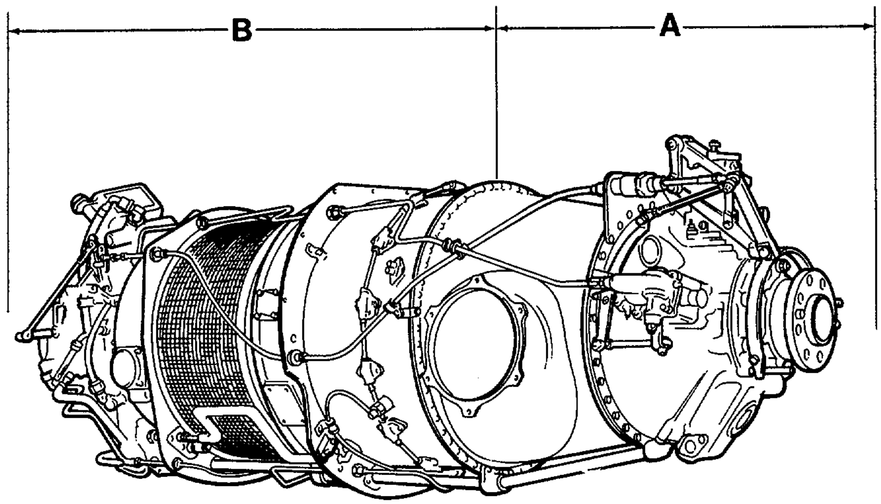
Characteristics: Modular construction, light weight, free turbine, short length, integral oil tank.

Capabilities and Features: Each module can he maintained separately.

**END OF SECTION**

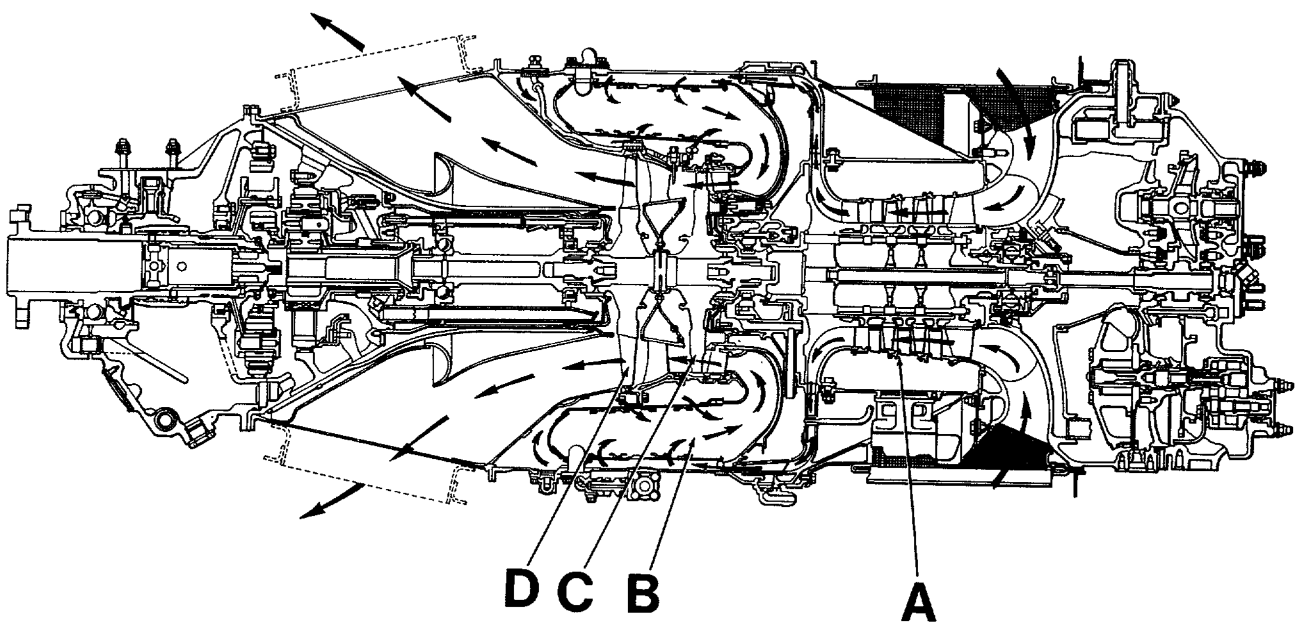
## Section II EQUIPMENT DESCRIPTION AND DATA.

### 1-9 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS




| | |
|---|---|
| A. POWER SECTION AND PROPELLER GEARBOX | Comprises:<br>Exhaust Duct<br>Power Turbine Assembly<br>Propeller Gearbox |
| B. GAS GENERATOR AND ACCESSORY GEARBOX | Comprises:<br>Compressor Section<br>Combustion Section<br>Accessory Gearbox |

## 1-9 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (Cont.)




| | |
|---|---|
| A. Compressor Section: | Axial and centrifugal compressors, rotated initially by starter, compress incoming air. |
| B. Combustion Section: | Compressed air is mixed with fuel and ignited, resulting in a rapidly expanding gas. |
| C. Compressor Turbine: | Turbine mounted on common shaft with compressors in compressor section and rotated by the expanding gases from combustion section. |
| D. Power Turbine: | Power turbine is rotated by the expanding gases and coupled to the propeller gearbox. |

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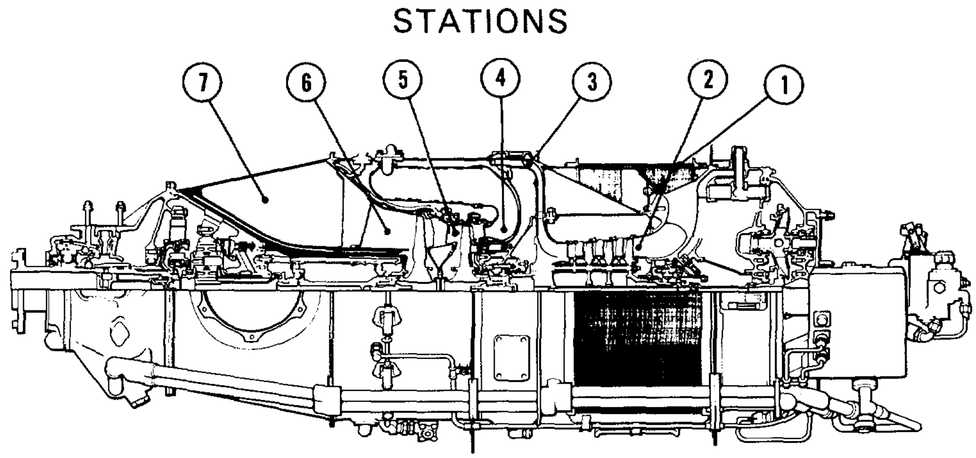
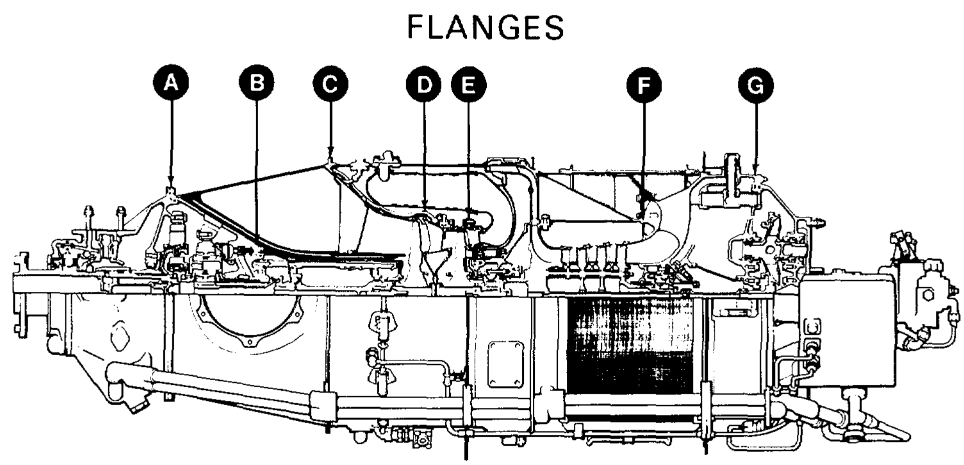



1. Engine Inlet
2. Compressor Inlet
3. Burner Inlet
4. Compressor Turbine Inlet
5. Interturbine
6. Exhaust
7. Exhaust Outlet




A. Propeller Gearbox to Exhaust Duct
B. Propeller Gearbox Rear Housing to Power Turbine Shaft Housing
C. Exhaust Duct to Gas Generator Case
D. Exhaust Duct to Power Turbine Housing
E. Inner (Small) Exit Duct to Compressor Turbine Housing
F. Gas Generator Case to Compressor Inlet Case
G. Oil Tank to Accessory Gearbox Diaphragm

Engine - Main Stations and Flanges

## 1-10 EQUIPMENT DATA

DIMENSIONS

| | |
|---|---|
| Weight | 275 Pounds* |
| Length | 62 inches |
| Diameter | 19 inches |

* Engines with Serial No. ending with A, 294 pounds approx.

MECHANICAL DEFINITIONS

| | |
|---|---|
| Compression ratio | 6.3 |
| Reduction ratio | 0.0668 |
| Propeller | CW |

LUBRICATION

| | |
|---|---|
| Oil | MIL-L-23699 or MIL-L-7808 |
| Oil tank capacity | 2.3 gallons, 1.5 gallons usable |
| Consumption | 0.2 lb/hr |
| Oil pressure | 40-84 psi |
| Operating temperature | 190-210°F |

FUEL

| | |
|---|---|
| JP4 or JP5 | MIL-T-5624 |
| Specific fuel consumption | 0.649 lb/shp/hr (nominal) |

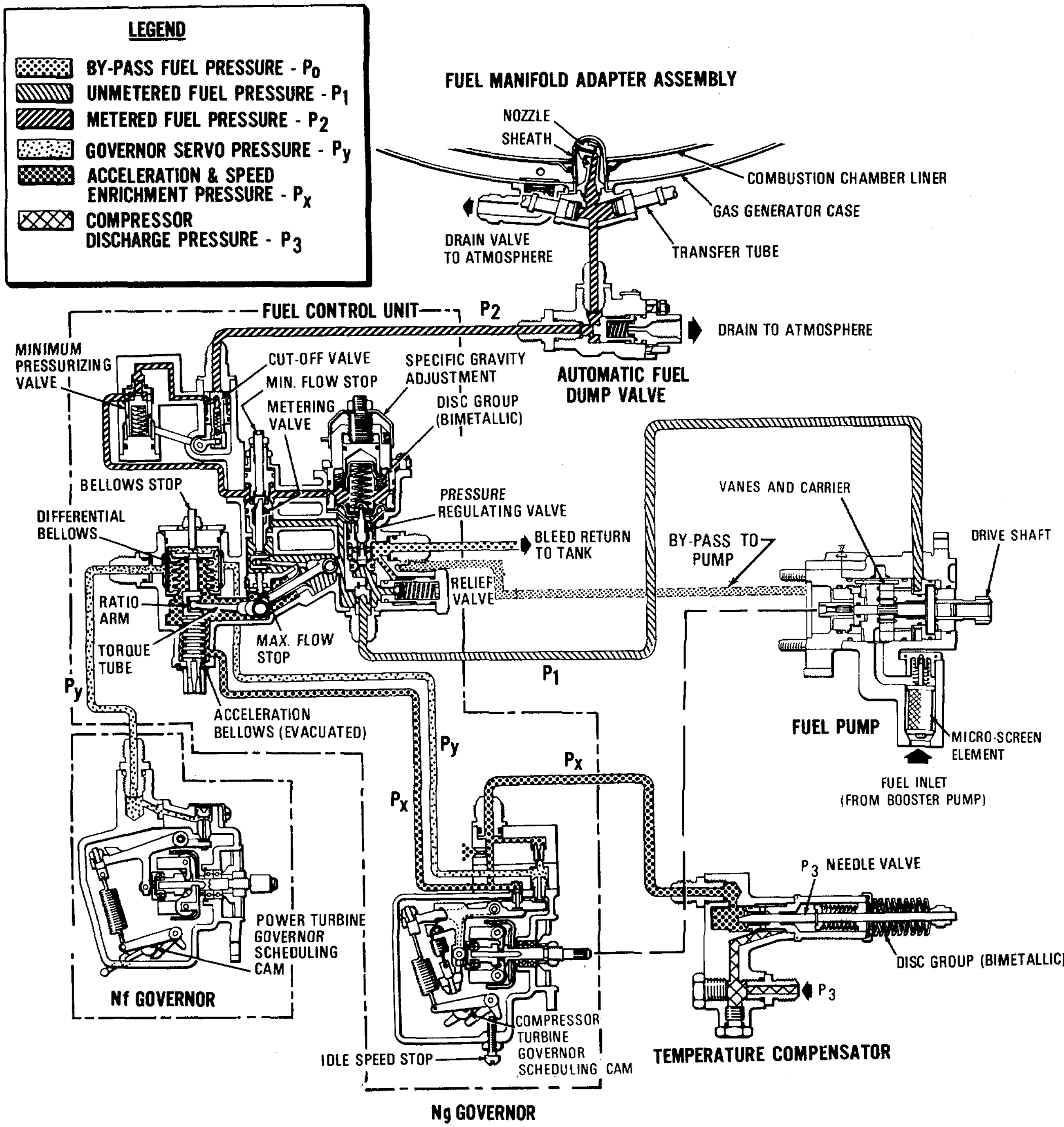
PERFORMANCE

| | |
|---|---|
| Shaft horsepower, shp | 550 |
| Compressor turbine speed, Ng | 38100 (101.5%) |
| Power turbine speed, Nf | 33000 (100%) |
| Propeller shaft speed, Np | 2200 rpm |

**END OF SECTION**

## Section III PRINCIPLES OF OPERATION

### 1-11 FUEL SYSTEM

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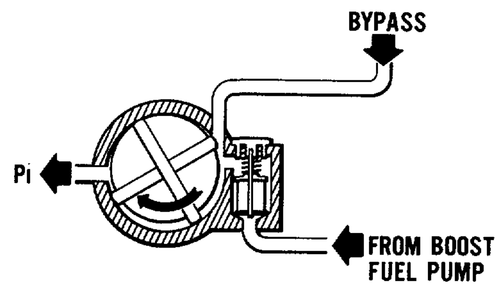
## 1-11 FUEL SYSTEM (Cont)

The fuel system is made up of a fuel pump, fuel control unit, temperature compensator, fuel manifold and nozzle assembly and an Nf governor. A fuel dump valve and two drain valves on the gas generator case insure drainage of unused fuel after engine shutdown. An oil-to-fuel heater uses engine oil to heat fuel entering pump.

Fuel Pump

The vane type fuel pump is mounted on the accessory gearbox and delivers fuel (P1) to the fuel control unit. Fuel bypass from the control unit is fed to the pump inlet.



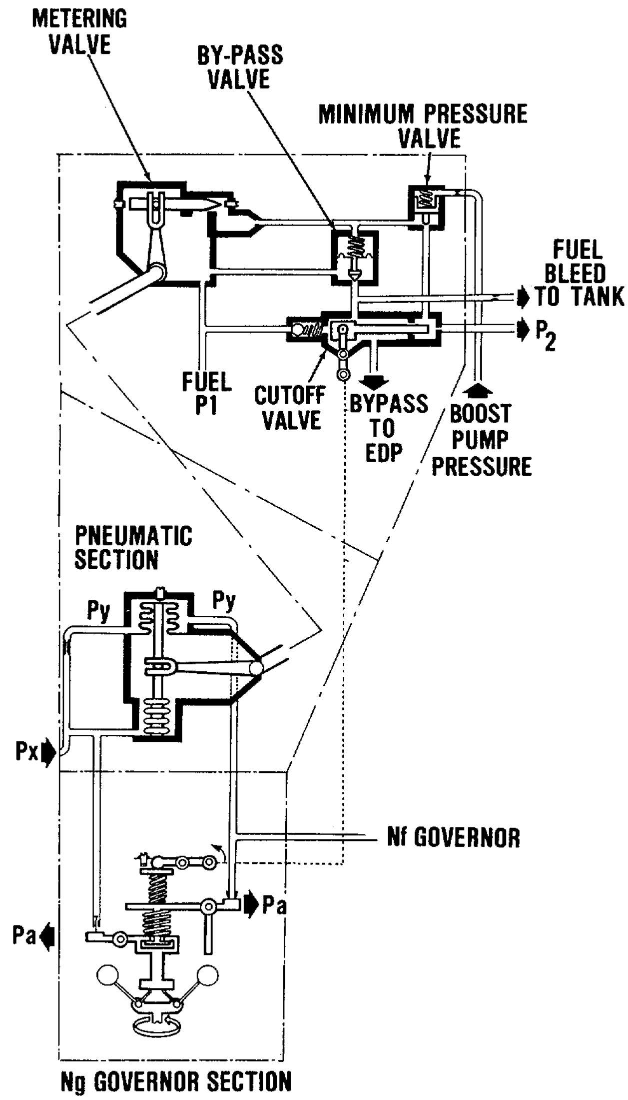
**1-11 FUEL SYSTEM (Cont)**

Fuel Control Unit

The fuel control unit, mounted on the fuel pump, determines the amount of fuel needed by the engine to meet the pilot's power control lever setting. Engine power output depends upon compressor turbine speed (Ng), which is controlled by regulating the amount of fuel supplied to the fuel manifold assembly nozzles.

Fuel under pressure (P1) is supplied to the metering valve, which controls the flow of fuel to the engine at pressure (P2). The bypass valve maintains a steady P1- P2 differential to enable the metering valve to meet varying power demands. A minimum pressure valve insures enough pressure at the fuel nozzles to obtain a correct spray pattern.

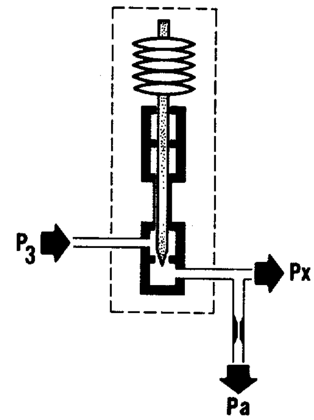
The Ng governor is driven at a speed proportional to Ng, thus any change in Ng causes the centrifugal weights to move to open or close valves, changing the pressure balance of the bellows in the pneumatic section. Bellows movement is mechanically linked to the metering valve, thus altering the fuel supply to the fuel nozzles. Air (Px) to the pneumatic section comes from the gas generator via the temperature compensator.



**1-11 FUEL SYSTEM (Cont)**

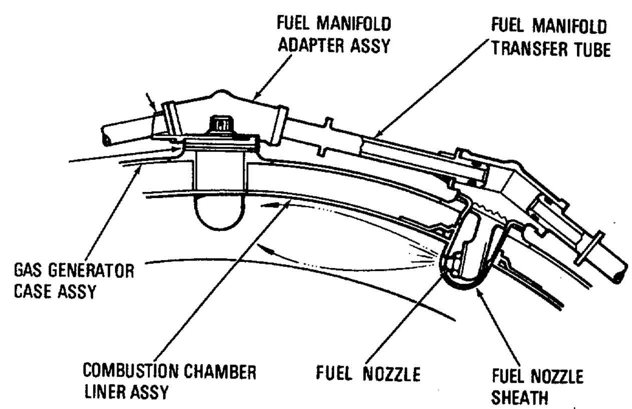
Temperature Compensator

The unit is mounted at the air inlet area of the engine and comprises a needle valve actuated by a temperature sensitive disk arrangement. P3 is supplied to the unit where its flow is affected by the position of the needle valve, which is, in turn affected by inlet air temperature. As inlet air temperature changes, varying modified P3 air pressure (Px) is delivered to the pneumatic section of the fuel control.



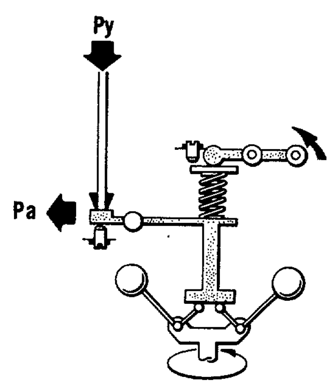

Fuel Manifold Adapter and Nozzle Assembly

The assembly consists of 14 fuel manifold adapter assemblies, inter-connected by 14 transfer tubes. Each adapter assembly is fitted with a simplex fuel nozzle assembly which is positioned on the adapter extension to give a continuous tangential spray from one nozzle to the next in the combustion chamber liner. Each fuel nozzle assembly has a spray nozzle and tip shielded from the heat by a sheath.

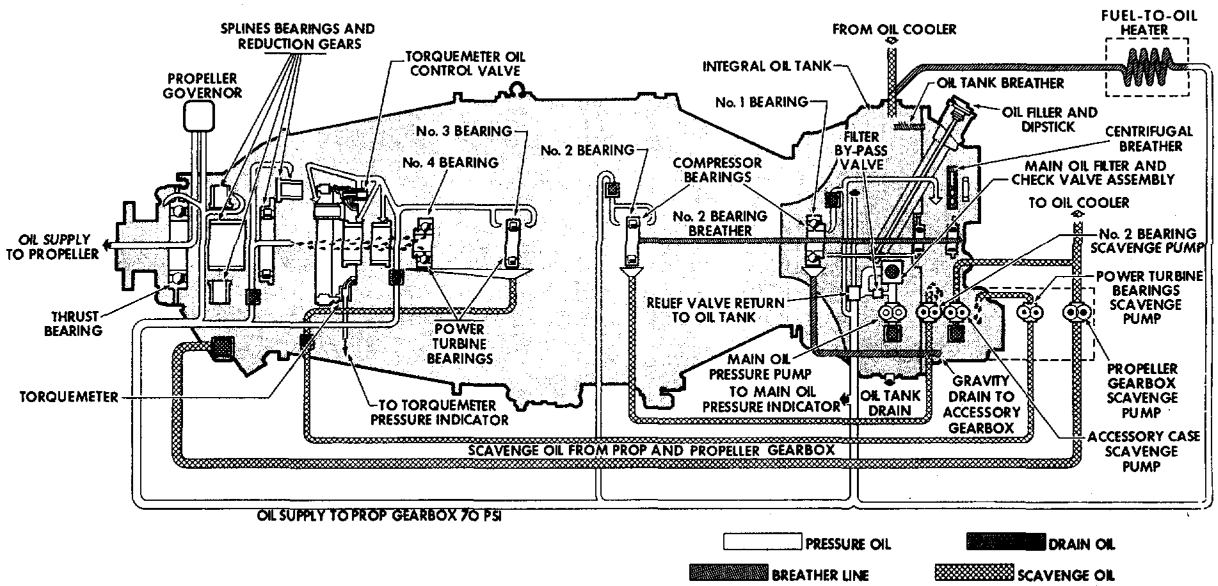



Nf Governor

The governor is driven at a speed proportional to the power turbine (Nf). Any change in Nf causes the centrifugal weights to move to open or close a valve varying Py pressure to the pneumatic section of the fuel control unit.



## 1-12 LUBRICATION SYSTEM




The lubrication system is designed to provide a constant supply of oil to cool and lubricate bearing surfaces of the engine and conduct debris to the oil filter. Oil pressure and temperature is measured by transmitters mounted on the accessory gearbox. Oil is drawn from the integral oil tank in the accessory gearbox by gear type pump and delivered under pressure to oil jets directed at bearings and gearshafts. Oil pressure is regulated by a relief valve situated in the inlet case.

Scavenge oil drainage from bearings and gearshafts is delivered by scavenge pumps to the oil tank, by way of the oil cooler.

Breather air from bearing compartments and gearboxes is vented through a centrifugal breather located in the accessory gearbox. Accessory gearbox internal pressure is normally higher than atmosphere, consequently, oil vapor in the gearbox tends to escape to atmosphere through the hollow gearshaft. Centrifugal action separates oil and air; the air passes, via the vent shaft, to the atmosphere and air-free oil is sprayed out to drain to the bottom of the gearbox to be scavenged.

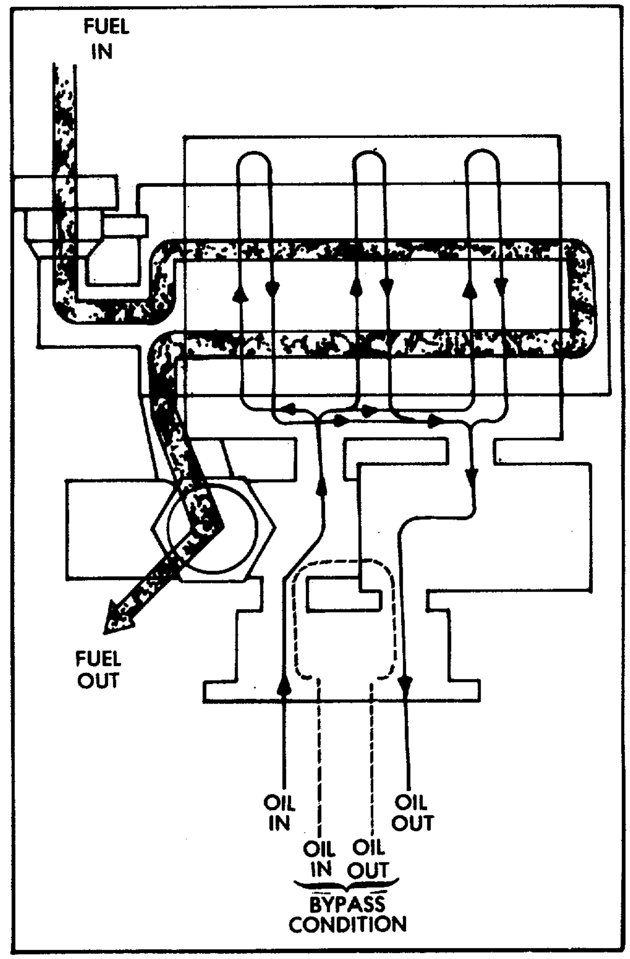
**GO TO NEXT PAGE**

## 1-12 LUBRICATION SYSTEM (Cont)

Oil-to-Fuel Heater

The oil-to-fuel heater is self-contained and is secured to flange G on the accessory gearbox. It functions as a heat exchanger, utilizing heat from the engine lubricating system to pre-heat fuel in the engine fuel system. The heater is only effective during periods when the engine is running and will automatically maintain the outlet fuel within a 70 degree F to 90 degree F (20 degree C to 32 degree C) temperature range. The system incorporates a two-pass engine oil circuit and two-pass fuel circuit each at right angles to the other (. refer to figure). A temperature control valve regulates the fuel temperature either by permitting oil through the heater core, or by-passing it through the valve back to the engine oil tank through an external line.

Hot engine oil enters the oil circuit through the oil inlet port of the heater under engine pressure. If the outlet fuel temperature is less than the ball valve setting the vernatherm plunger will retract and the ball will seal the by-pass port, forcing the engine oil to circulate through the walls of the heat exchanger to warm the engine fuel.



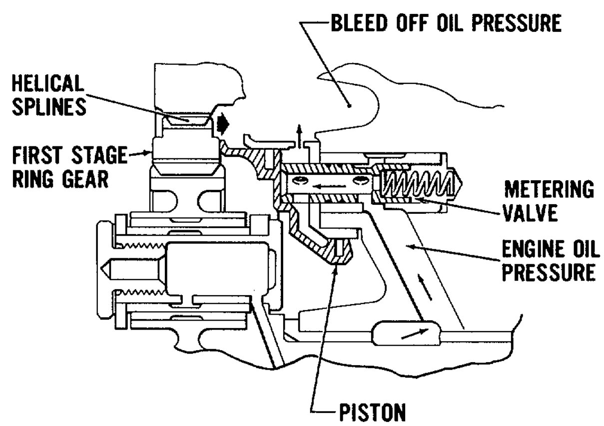
## 1-12 LUBRICATION SYSTEM (Cont)

Oil-To-Fuel Heater (Cont)

If the fuel outlet temperature is above the ball valve setting, the vernatherm plunger will be in an extended position and the ball will be lifted off its seat by the plunger. This permits the hot engine oil to flow through the by-pass port and oil outlet without circulating through the heat exchanger core. The fuel outlet temperature is accordingly reduced.

Torquemeter

The torquemeter is located in the propeller gearbox and the movement of its piston is controlled by the movement of the first-stage ring gear. Rotation of the ring gear is resisted by the helical splines, which impart an axial movement to the ring gear and the piston. This movement is felt by a metering valve, bleeding off oil pressure to a transducer, which compares bleed off pressure with engine oil pressure. The differential indicates the torque.

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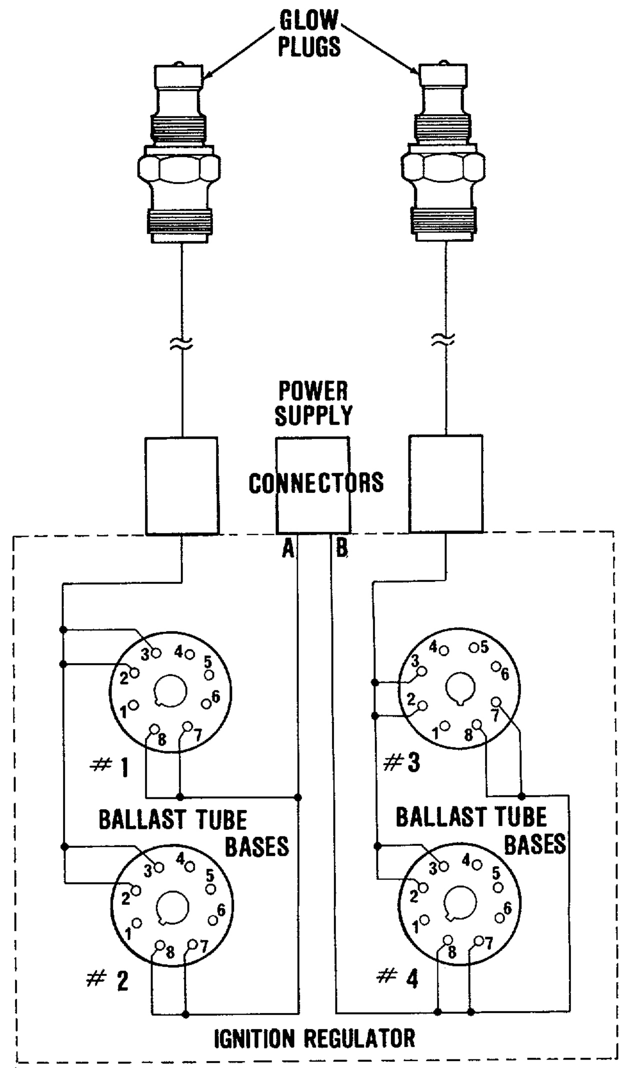
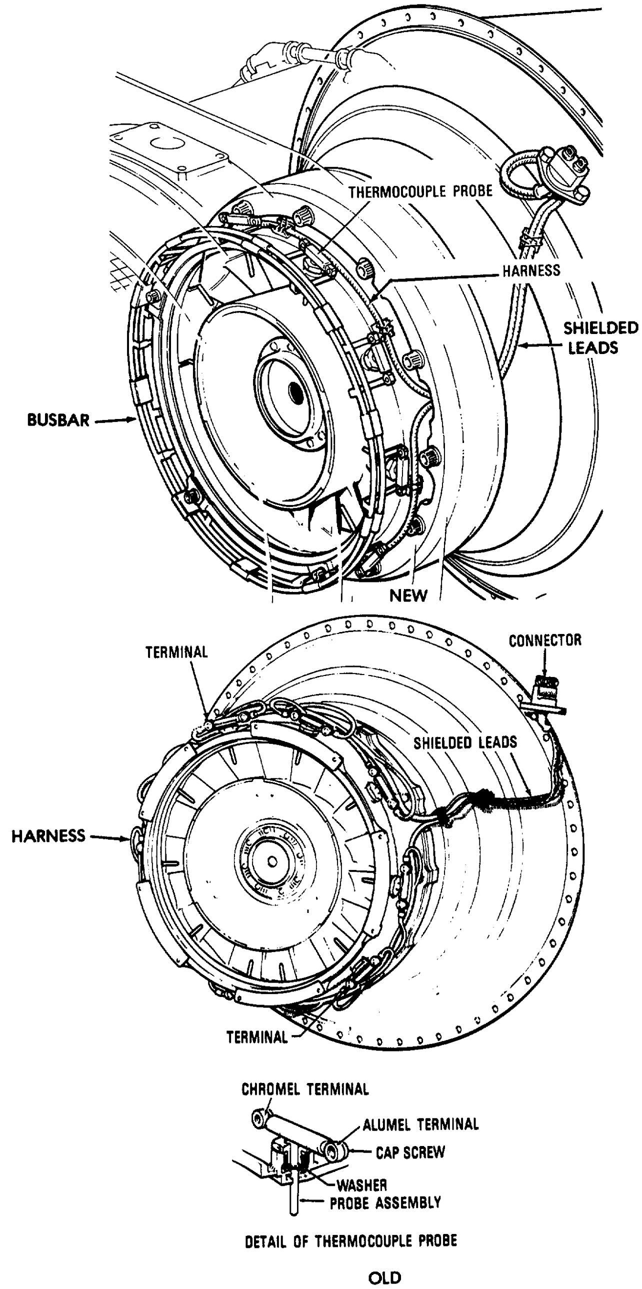
## 1-13 IGNITION CIRCUIT

The ignition circuit comprises: ignition regulator, ignition harness and glow plugs. The ignition regulator is mounted on the accessory gearbox and contains electron tubes, which regulate the current flow to the glow plugs. At low temperatures the resistance to current flow is low, insuring maximum supply to the plugs thus an initial current surge is provided to rapidly heat the plugs for fast engine "light up". The glow plugs, installed on the gas generator case, are essentially heating elements that ignite the fuel sprayed into the combustion chamber.



## 1-14 INTERTURBINE TEMPERATURE SENSING SYSTEM

The interturbine temperature sensing system comprises a number of thermocouples protruding into 'the area between the compressor and power turbines. The thermocouples produce a small electrical signal, proportional to the temperature of their environment, which is carried by a harness to a temperature indicator.

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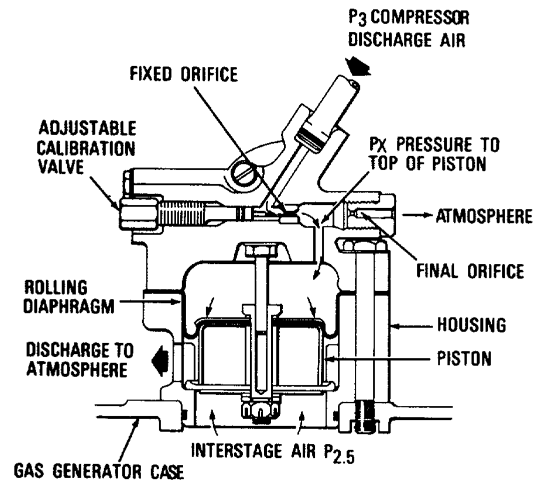
## 1-15 AIR SYSTEM

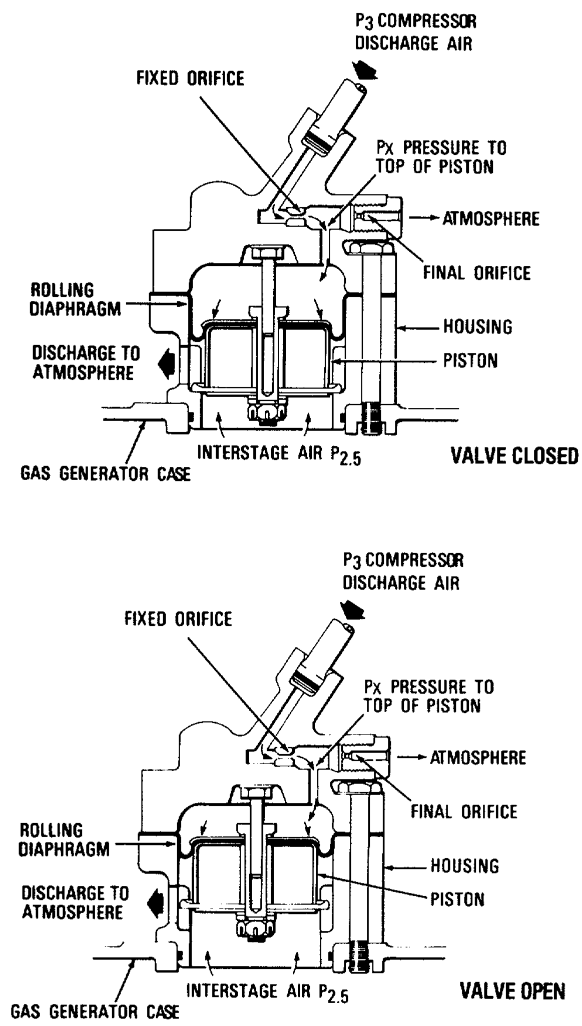
Pressure air is used to seal the bearing compartments and to cool internal parts of the engine.

Compressor discharge pressure (P3) is directed to the fuel control unit to provide a signal indicating change of condition within the engine.

Compressor stall is prevented by the compressor bleed valve. The bleed valve consists of a piston and rolling diaphragm operating within a housing under opposing pressures. The bleed valve is secured by two bolts to an outlet port on the gas generator case which provides a direct passage for the flow of compressor interstage air (P2.5) to the bottom of the valve. Compressor discharge air (P3) is tapped off and metered through an orifice (adjustable in earlier engines and fixed in later engines) in the cover of the unit, then passed through an intermediate passage and out to atmosphere through another orifice. The control pressure (Px) between the two orifices acts upon the upper side of the piston, so that when Px is greater than P2.5 the bleed valve closes.




EARLIER TYPE




LATER TYPES

END OF SECTION

## Section IV REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

### 1-16 COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

### 1-17 SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

Special tools are listed in Appendix B, Section III. Appendix D provides details of tools to be locally made.

### 1-18 REPAIR PARTS

Repair parts are listed and illustrated in the Repair Parts and Special Tools List ( RPSTL) TM55-2840-251-23P.

**END OF SECTION**

## SECTION V SERVICE UPON RECEIPT (Continued)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Sling (T.43)
Pressure Gage (0 to 10 psi)
Chain or Cable Sling
(Container)
Hoist

Materials:
None

Parts:
Cotterpin (E.1)

Personnel Required:
68B Powerplant Mechanic

References:
TB55-8100-200-24
DA Pamphlet 738-751
TM55-1510-209-23
TM55-1510-215-23
TM55-2840-251-23P
TM55-4920-328-13

General Safety Instructions

**WARNING**

**Before starting this procedure, make sure container is opened in well-ventilated area. Failure to do so could result in explosion.**

GO TO THE NEXT PAGE

1-19 SITE AND SHELTER REQUIREMENTS

Insure minimum of six feet overhead space for lifting container cover clear of engine.

1-20 SERVICE UPON RECEIPT OF MATERIEL

**CAUTION**

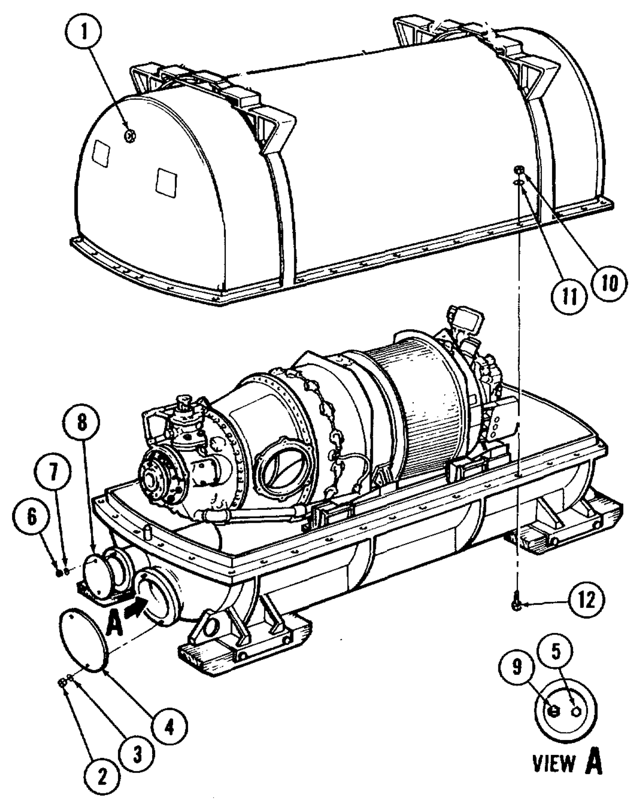
**An all-pink condition is considered unsafe and indicates that the desiccant must be changed and the container re-pressurized. Inspect engine for corrosion.**

1. The indicator (1) located at the service end of the engine container is provided to show internal moisture conditions. A safe condition is indicated by an all-blue color. As moisture content increases inside the container, the indicator color will change from blue to pink.

**NOTE**

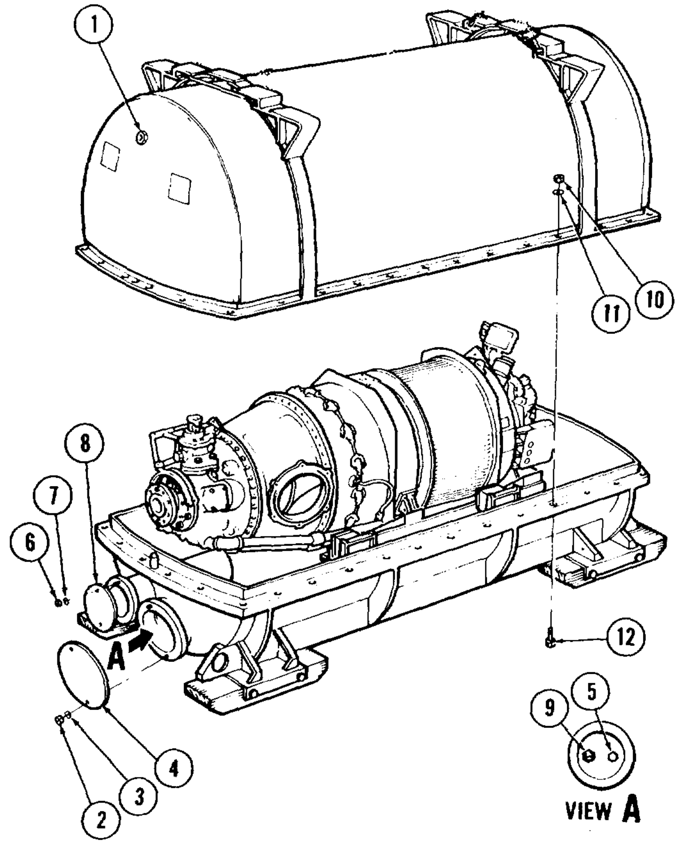
**Reuse of humidity indicator should be satisfactory since the element is reversible. Replace only if necessary.**

2. Remove nuts (2), washers (3) and cover (4). Attach pressure gage to charging valve (9). Check pressure.



## Section V SERVICE UPON RECEIPT (Continued)

1-21 UNPACKING




1. Remove nuts (6), washers (7) and cover (8).

2. Remove engine documents.

**WARNING**

**Insure all pressure is released before removing container cover.**

3. Depress air release valve (5) to release air pressure in container.

**WARNING**

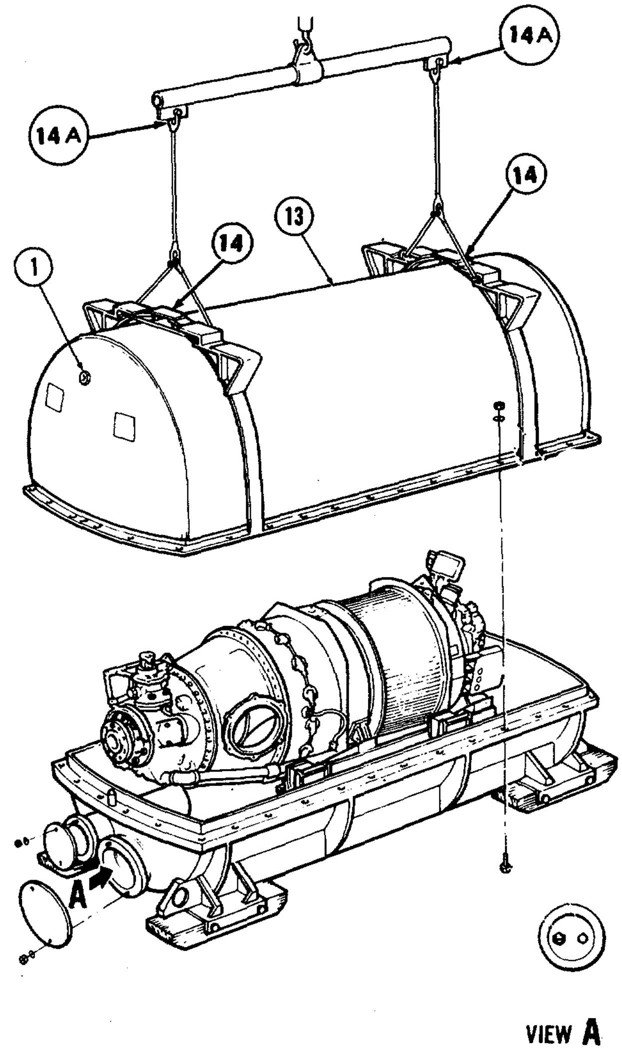
**To avoid getting injured, do not loosen nuts and bolts that secure cover until shipping container has been depressurized.**

4. Remove nuts (10), washers (11) and bolts (12).

GO TO NEXT PAGE

**Section V SERVICE UPON RECEIPT (Continued)**

1-21 UNPACKING (Cont)




**WARNING**
HOISTING SHIPPING CONTAINER

- Do not stand under cover while it is suspended from hoist, or while it is being moved from one area to another on a hoist.
- To prevent injury to personnel and damage to equipment during handling of cover, periodically check lifting sling.
- Do not use equipment, which has signs of excessive wear or abuse. Do not use equipment, which, has unauthorized bolts, pins, etc. If equipment is suspected to be defective or has unauthorized parts, notify your immediate supervisor.
- Be sure that safe working capacity of lifting device exceeds weight of container, cover and contents, so lifting device will not fail if cover fails to release.

5. Attach chain or cable sling (14A) to cover (13) lifting points (14) and remove cover using hoist attached to sling.

**CAUTION**

**Do not attempt to lift engine still attached to container.**

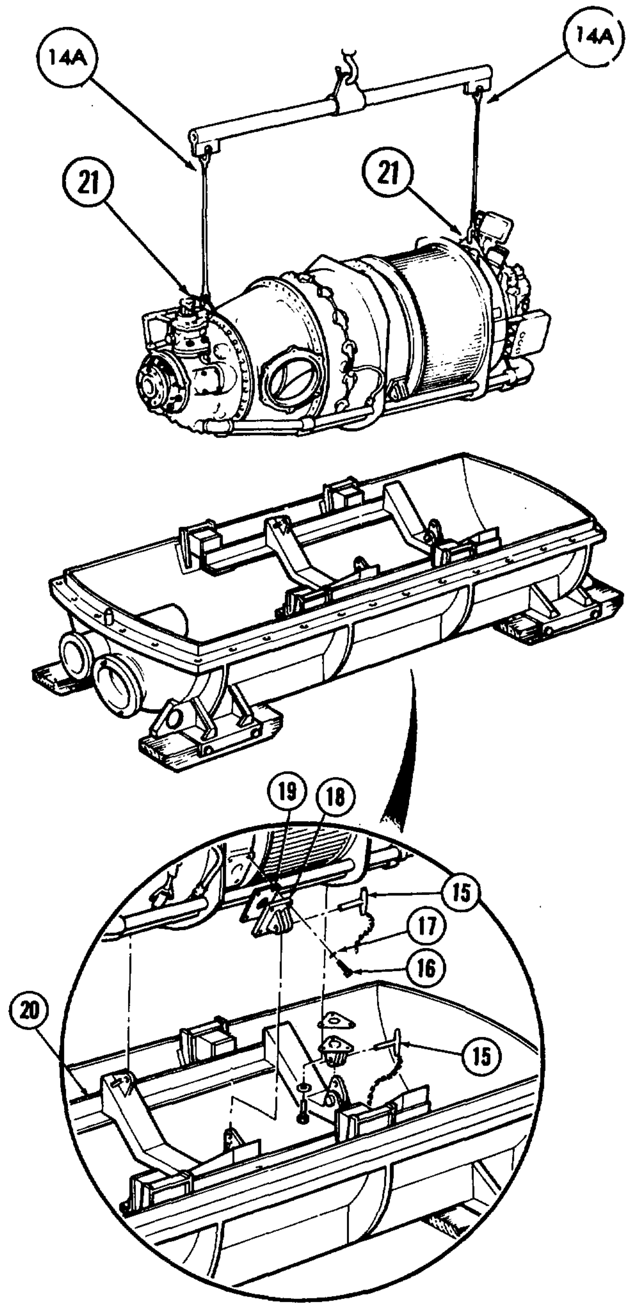
**GO TO NEXT PAGE**

**Section V SERVICE UPON RECEIPT (Continued)**

1-21 UNPACKING (Cont)

6. Attach Sling (T.43) (14A) and hoist to engine lifting points (14) and take weight of engine.

7. Remove quick release pins (15) securing engine to cradle (20).




**NOTE**

**Some engines will be secured to cradle by pins, washers and cotterpins.**

**WARNING**

**HOISTING ENGINE**

•Do not stand under engine while it is being moved from one area to another on a hoist.

•To prevent injury to personnel and damage to equipment during handling of power plant or engine, periodically check engine lifting sling.

•Do not use equipment, which has signs of excessive wear or abuse, or which has unauthorized bolts, pins, etc. If equipment is suspected to be defective or has unauthorized parts, notify your immediate supervisor.

•Be sure that lifting device capacity exceeds combined weight of engine and container.

8. Raise engine clear of container.

GO TO NEXT PAGE

**Section V SERVICE UPON RECEIPT (Continued)**

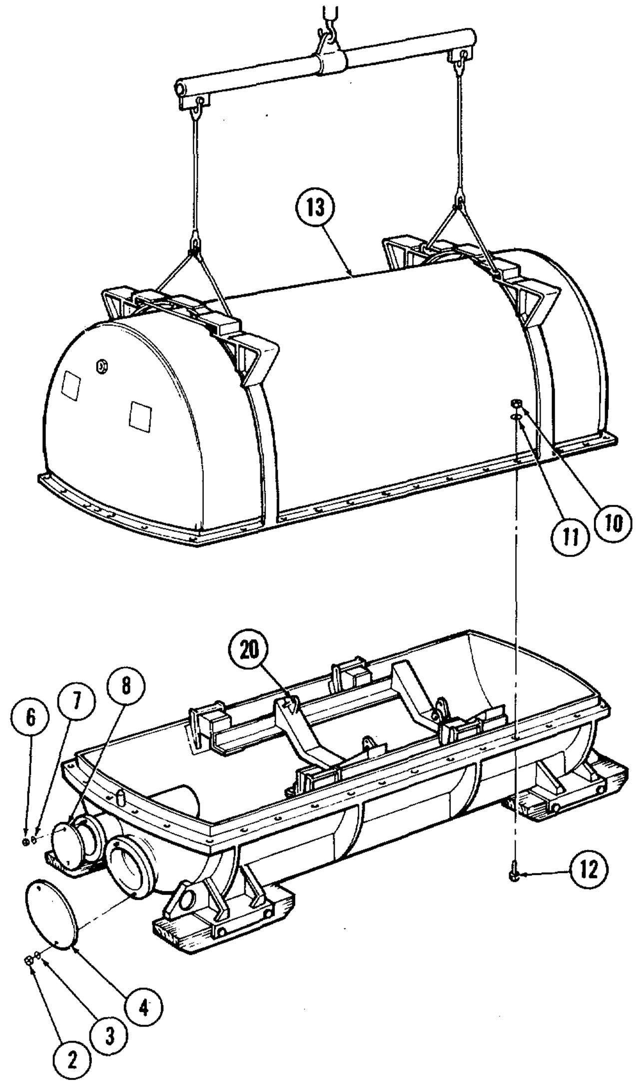
1-21 UNPACKING (Cont)

9. Remove bolts (16), washers (17), brackets (18) and gaskets (19).

10. Install quick release pins (pins, washers, Cotterpins) on cradle (20).

11. Install cover (13) and secure with bolts (12), washers (11) and nuts (10).

12. Install covers (4) and (8); secure with washers (3), (7) and nuts (2), (6).




GO TO NEXT PAGE

**Section V SERVICE UPON RECEIPT (Continued)**

1-22 CHECKING UNPACKED ENGINE

1. Inspect the engine for damage incurred during shipment. If the engine has been damaged, report the damage on DD Form 6, Packaging Improvement Report.

2. Check the engine against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pamphlet 738-751.

3. Check to see whether the engine has been modified.

1-23 INSTALLATION INSTRUCTIONS

1. To install engine in aircraft, refer to TM55-1510-209-23 or TM55-1510-215-23.

2. To install engine in METS, refer to TM55-4920-328-13.

3. To install engine in stands, refer to Chapter 1, Section VIII.

**END OF SECTION**

## Section VI SPECIAL INSPECTIONS

INITIAL SETUP

Applicable Configurations:
All

Tools:
Magnifying Glass 10X

Materials:
None

Personnel Required:
66G Aircraft Inspector

References:
TM55-1510-209-10

**NOTE**

**In the event of an engine being subjected to unusual conditions the following procedures should be followed.**

1-24 OVERSPEED

Ng in excess of 100% (37500) but not exceeding 102. 6% (38500) refer to Troubleshooting (1-47), Chapter 1, Section VII. Ng in excess of 102. 6% return engine to Depot.

Nf in excess of 100% (33000) but not exceeding 111% (36620) refer to Troubleshooting (1-46) Chapter 1, Section VII. Nf in excess of 111% return power section to Depot.

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Section VI SPECIAL INSTRUCTIONS (Continued)

1-25 ITT OVERTEMPERATURE

1. Starting

Area A: Determine and correct cause of over temperature. (Refer to Troubleshooting Chapter 1, Section VII). Visually inspect power turbine blades through exhaust ports. Record in log book.

Area B: Inspect hot section parts.

Area C: Return engine to Depot Maintenance.

**NOTE**

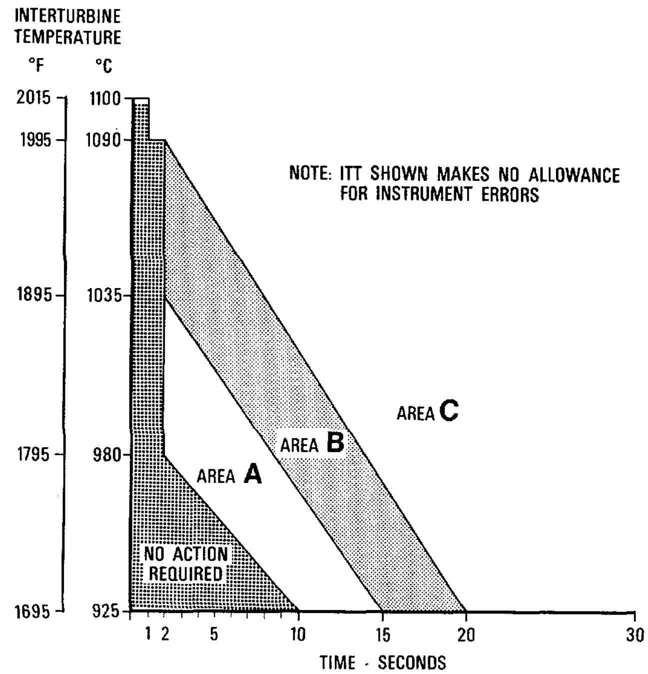
**During ITT over temperature, a 10OX magnifying glass must be used.**

2. Operating

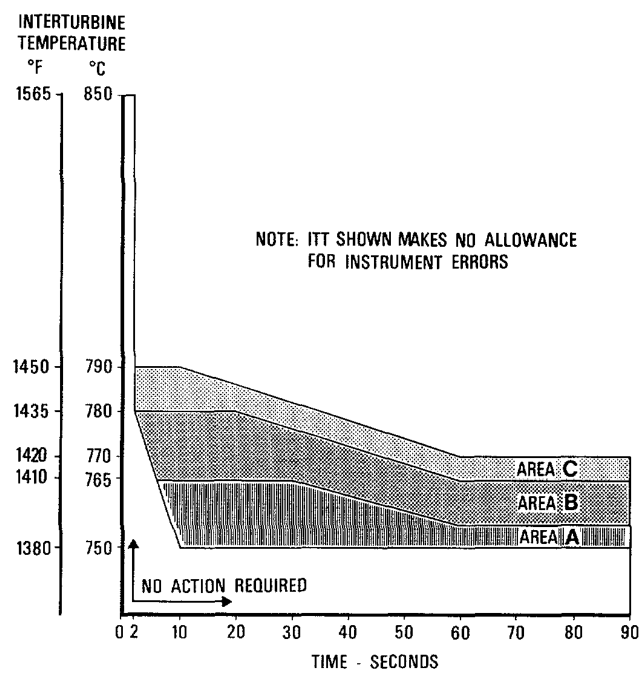
Area A: Determine and correct cause of over temperature. (Refer to Troubleshooting Chapter 1, Section VII). Visually inspect power turbine blades through exhaust ports. Record in log book.

Area B: Inspect hot section parts.

Area C: Return engine to Depot Maintenance.




Overtemperature limits (Starting)



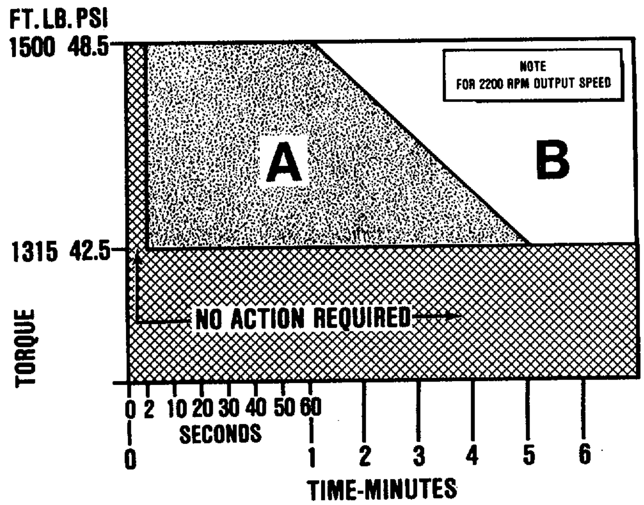

Over temperature limits (All conditions except starting)

GO TO NEXT PAGE

1-26 OVERTORQUE

Area A: Record in engine log book.

Area B: Return power section to Depot.




1-27 SUDDEN STOPPAGE

Engines are considered to have suffered a sudden stoppage when the propeller (whether rotating or stationary) has struck the ground or an object. Return engine to Depot.

1-28 LOSS OF OIL/OIL PRESSURE FAILURE

Refer to Troubleshooting (1-64) Chapter 1, Section VII.

1-29 LIGHTNING STRIKE

Return engine to Depot.

1-30 IMMERSION IN WATER

Thermal shock. Return engine to Depot.

1-31 DROPPED ENGINE
In or out of container. Return engine to Depot.

GO TO NEXT PAGE

## Section VI SPECIAL INSPECTIONS (Continued)

### 1-32 EXPOSURE TO FIRE EXTINGUISHING AGENTS

If engine is not operating and agent has not been ingested, thoroughly clean outside of engine. If agent has entered engine or engine was operating at the time, compressor wash immediately (Chapter 1, Section VIII) and return engine as soon as possible to Depot.

### 1-33 HOT SECTION INSPECTION (AVIM)

If troubleshooting (Chapter 1, Section VII) indicates hot section inspection, proceed as follows:

**NOTE**

**Before disassembly carry out compressor wash and performance check.**

1. Remove power section (Task 4-1-1).

2. Remove fuel nozzles (Task 6-7-1).

3. Remove glow plugs (Task 7-1-1).

4. Remove combustion chamber liner (Task 3-1-1).

**NOTE**

**Prior to removal of compressor turbine disk assembly measure turbine tip clearance (Refer to Task 2-3-1).**

GO TO NEXT PAGE

**Section VI SPECIAL INSPECTIONS (Continued)**

1-33 HOT SECTION INSPECTION (AVIM) (Cont)

5. Remove compressor turbine disk assembly (Task 2-3-1).

6. Inspect gas generator case for cracks, bulges or overheating. No repairs are permitted; any damage, return engine to Depot.

7. Inspect gas generator diffuser area blind rivets. The following conditions are acceptable without repair:

a. Four adjacent rivets or rivet heads are missing.

b. Six rivets or rivet heads are missing from the total of 14.

c. A total of eight loose rivets is permissible, provided no rivets are missing.

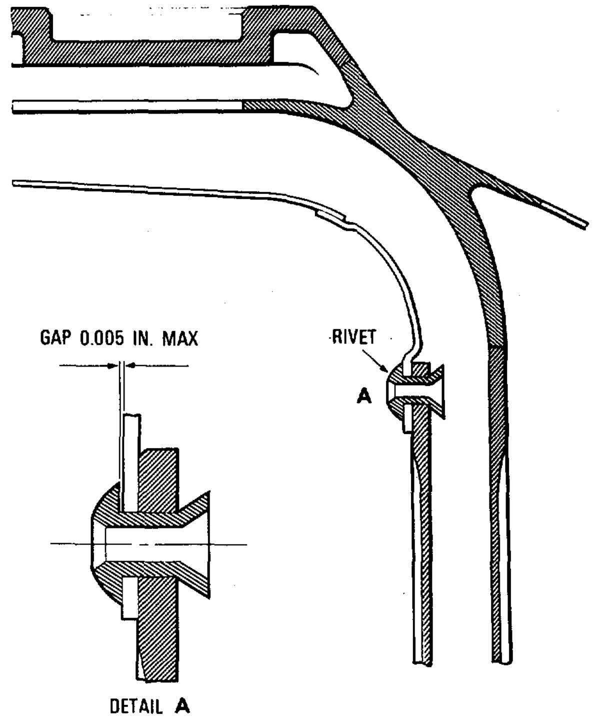
d. A total of six missing and two loose rivets, maximum.

**NOTE**

**A maximum gap of 0. 005 inch is acceptable between rivet head and sheet surface, as shown, provided that at least 40 percent of rivet head circumference is in contact with sheet surface.**

e. Loose or missing rivets beyond limits given in steps a. thru d. are not permitted and engine must be returned to Depot.

8. Inspect combustion chamber liner for damage (Task 3-1-2).



## Section VI SPECIAL INSPECTIONS (Continued)

1-33 HOT SECTION INSPECTION (AVIM) (Cont)

9. Inspect outer (large) exit duct for damage (Task 3-3-2).

10. Inspect inner (small) exit duct for damage (Task 3-2-3).

11. Inspect compressor turbine vane support, compressor turbine vanes, and compressor turbine shroud segments (Task 3-2-3).

12. Inspect compressor turbine assembly (Task 2-3-2).

13. Inspect ITT thermocouple probes, harness, and where installed, bus bar assembly (Tasks 7-5-2; 7-6-2, and 7-7-1).

14. Inspect power turbine rotor assembly (Task 4-4-2).

15. Inspect power turbine stator assembly (Task 4-3-2).

16. Inspect exhaust duct (Task 4-7-2).

17. Inspect fuel nozzles for differences in carbon buildup. Perform functional test (Task 6-7-3).

18. Inspect fuel nozzle sheaths for fretting wear, erosion or carbon buildup (Task 6-6-3).

**GO TO NEXT PAGE**

## Section V SPECIAL INSPECTIONS (Continued)

### 1-34 FOREIGN OBJECT DAMAGE

Inspect intake area and first stage compressor blades for impact damage (Tasks 2-1-2 and 2-1-4).

### 1-35 OIL OVERTEMPERATURE

1. Up to 269°F (132°C) above maximum for less than 10 minutes Determine cause and correct. (Refer to troubleshooting lubrication system, para 1-63. )

2. Up to 269°F (132°C) above maximum for more than 10 minutes Determine cause and correct. Replace engine oil, inspect oil filter element (Task 8-1-2), clean and flush airframe mounted oil cooler. (Refer to TM55-1520209-23 and troubleshooting lubrication system, para 1-63. )

3. Above 269°F (132°C) for more than 10 minutes Return engine to Depot; clean and flush airframe mounted oil cooler. (Refer to TM55-1520-209-23. )

**END OF SECTION**

## Section VII TROUBLESHOOTING

INITIAL SETUP

Applicable Configurations:
All

Tools:
None

Materials:
None

References:
TM55-1510-209-10
TM55-1510-209-23

GO TO NEXT PAGE

**Section VII TROUBLESHOOTING (.Continued)**

1-36 SYMPTOM INDEX

The following is a list of symptoms that may arise. Task and page numbers where corrective procedures can be found are included.



**GO TO NEXT PAGE**

**Section VI TROUBLESHOOTING (Continued)**

1-36 SYMPTOM INDEX (Cont)



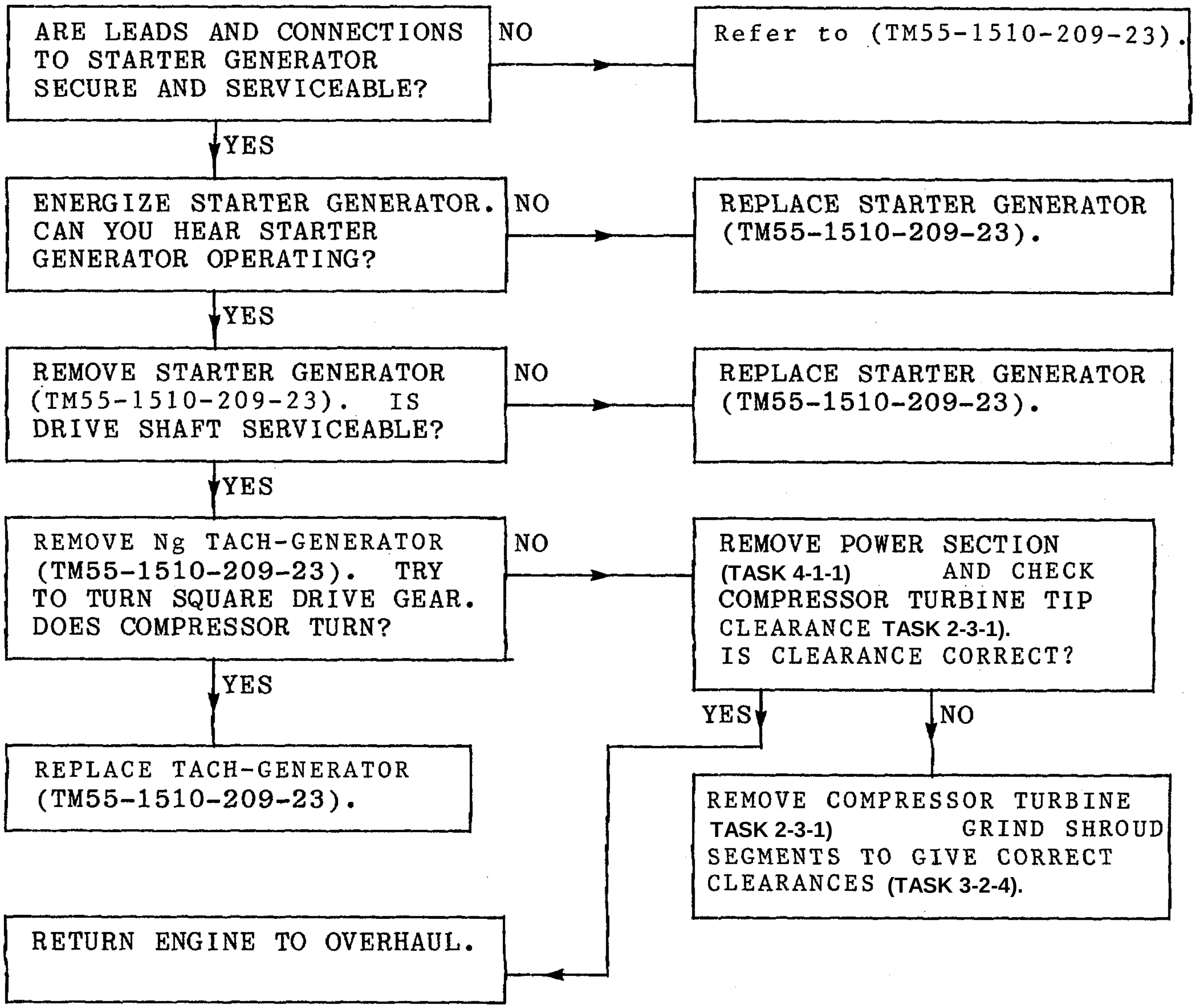
1-37 TROUBLESHOOTING PROCEDURES

To facilitate troubleshooting, the common engine troubles are divided into four types: Starting, Operating, Lubrication System, and Fluctuations. Each of these types is further sub-divided into the most common malfunctions. The possible cause (or causes) and the applicable corrective action are listed adjacent to each of the common malfunctions.

**GO TO NEXT PAGE**

A. STARTING

1-38 NO RPM DURING ATTEMPTED START

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A. STARTING (Cont)

1-39 INSUFFICIENT RPM AT START

ARE POWER SOURCES, LEADS AND CONNECTIONS SERVICEABLE?

NO → REFER TO TM55-1510-209-23.

YES

ENERGIZE STARTER GENERATOR. IS UNIT OPERATING?

NO → REPLACE STARTER GENERATOR (REFER TO TM55-1510-209-23).

YES

ARE THERE SCRAPING SOUNDS WHILE COMPRESSOR IS ROTATING?

NO → CHECK AIRFRAME INDICATING SYSTEM.

YES

TIP RUB IS INDICATED. PERFORM HOT SECTION INSPECTION
(CHAP. 1, SEC. VI)
FAULT CORRECTED?

NO → RETURN ENGINE TO DEPOT.

YES

CONTINUE TO OPERATE

1-40 EXCESSIVE RPM AT START

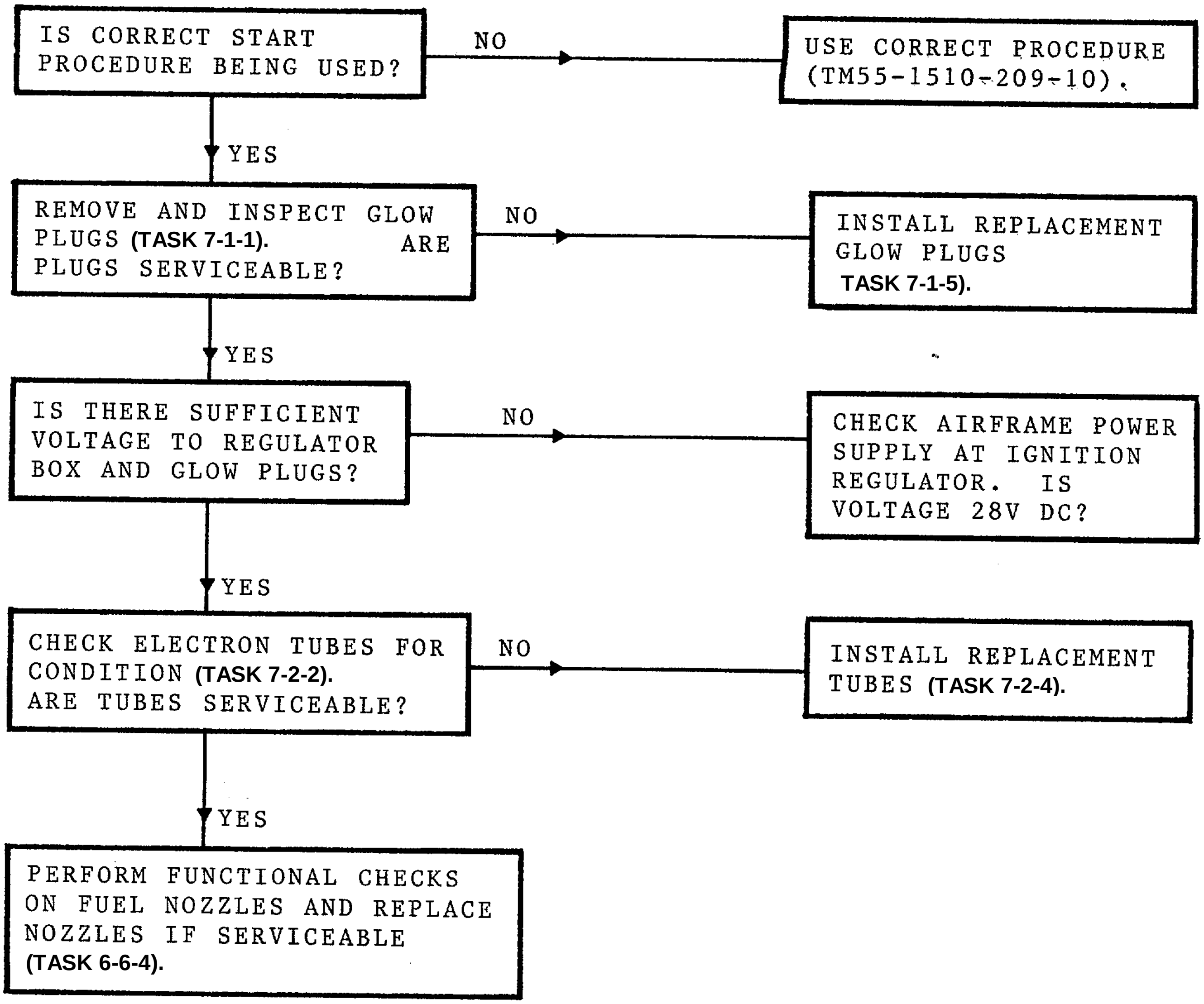
ACCESSORY GEARBOX INPUT SHAFT COUPLING DISENGAGED. RETURN ENGINE TO OVERHAUL.

**GO TO NEXT PAGE**

**Section VII TROUBLESHOOTING (Continued)**

A. STARTING (Cont)

1-41 DELAYED START

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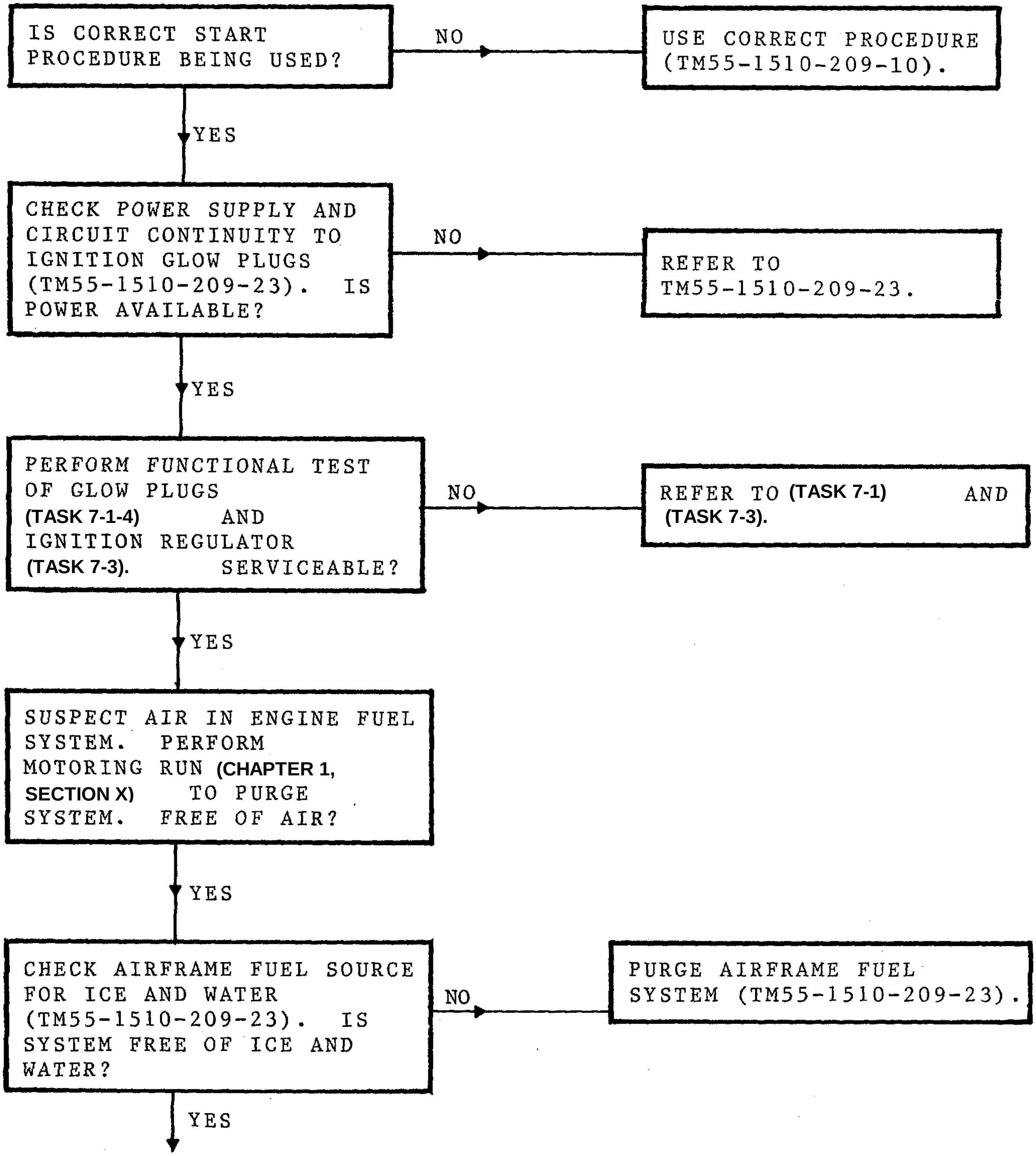
A. STARTING (Cont)

1-42 ENGINE FAILS TO IGNITE




**GO TO NEXT PAGE**

A. STARTING (Cont)

1-42 ENGINE FAILS TO IGNITE (Cont)

SUSPECT FUEL PUMP FAILURE. DISCONNECT FUEL DELIVERY TUBE BETWEEN FUEL PUMP AND FUEL CONTROL UNIT (FCU). PERFORM WET MOTORING RUN **(CHAPTER 1, SECTION X)** FUEL FROM OPEN TUBE?

NO → INSTALL REPLACEMENT FUEL PUMP **(TASK 6-3).**

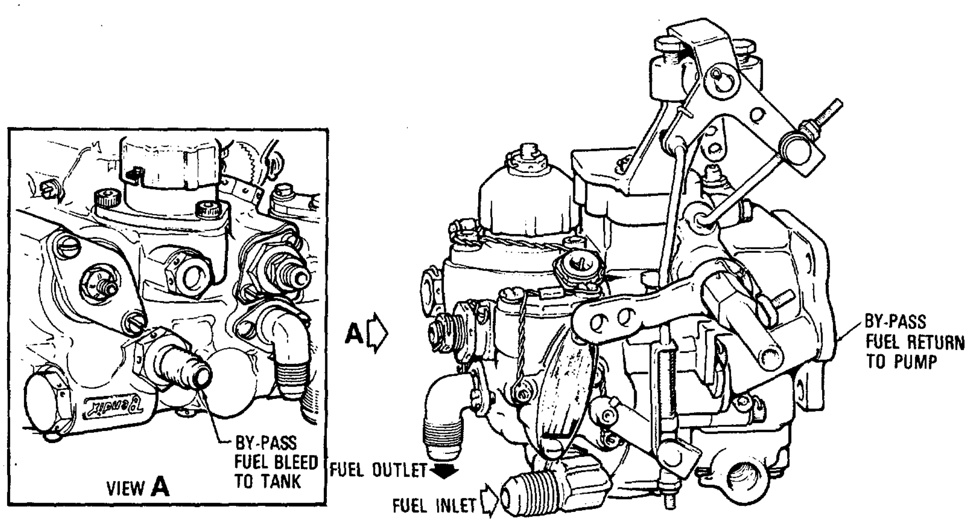
YES ↓

SUSPECT FCU CONTAMINATION. DISCONNECT FUEL DELIVERY TUBE AT DUMP VALVE. CARRY PERFORM WET MOTORING RUN **(CHAPTER 1, SECTION X).** FUEL FLOW FROM OPEN TUBE?

NO → CHECK IF FCU BYPASS VALVE IS CLOSING. CAP FUEL OUTLET AND BYPASS FUEL BLEED TO TANK (SEE BELOW). APPLY MAXIMUM 5 PSIG AIR PRESSURE TO BYPASS RETURN PORT AND CHECK FOR AIR ESCAPING FROM FCU INLET. IF AIR IS EVIDENCED, REPLACE BOTH FCU AND FUEL PUMP. IF AIR IS NOT EVIDENCED, REPLACE FCU ONLY.

YES ↓

SUSPECT FUEL NOZZLE CONTAMINATION. PERFORM FUNCTIONAL CHECK ON NOZZLES **(TASK 6-6-5).**

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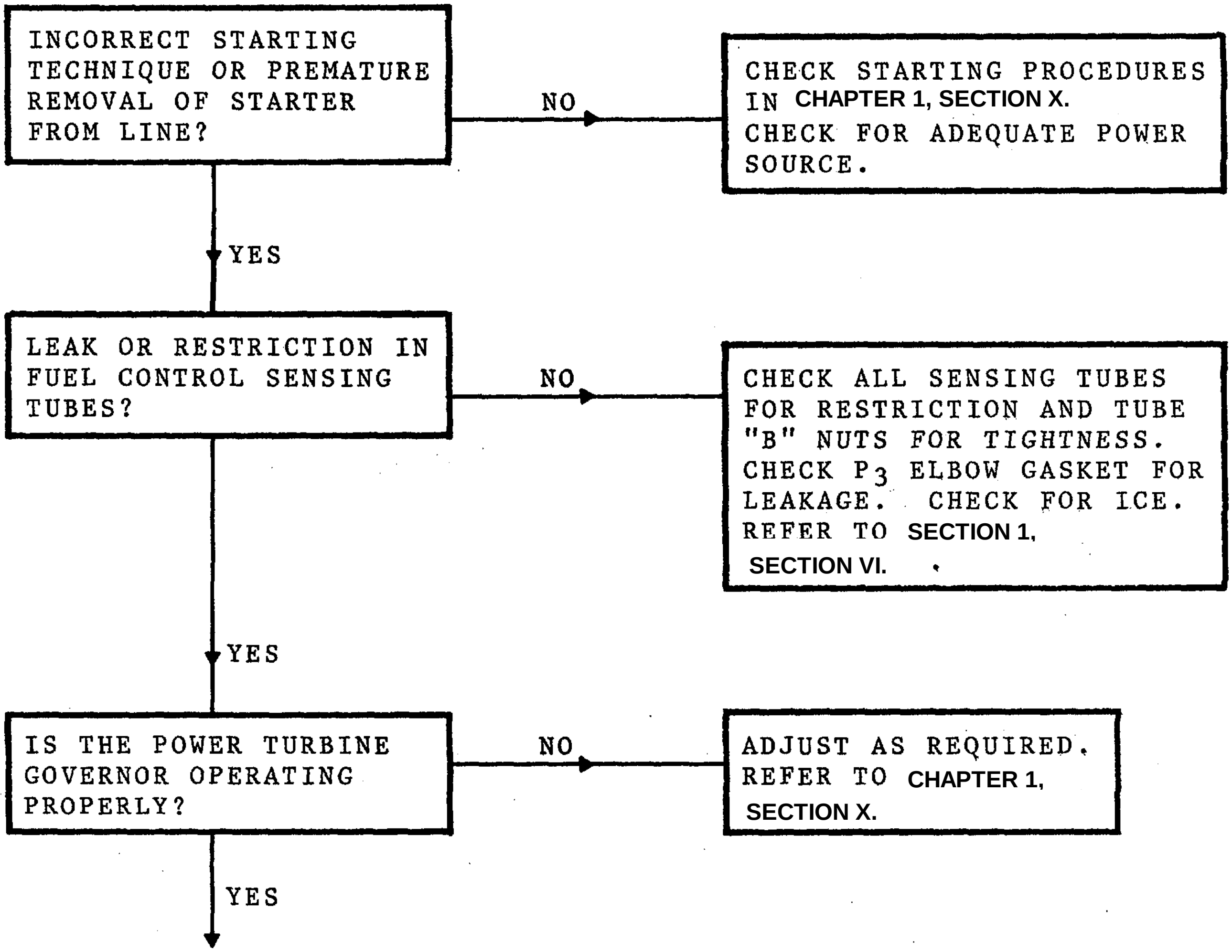
**Section VII TROUBLESHOOTING (Continued)**

A. STARTING (Cont)

1-43 ENGINE FAILS TO IDLE OR IS SLOW ACCELERATING TO IDLE Ng

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**Section VII TROUBLESHOOTING (Continued)**

A. STARTING (Cont)

1-43 ENGINE FAILS TO IDLE OR IS SLOW ACCELERATING TO IDLE Ng (Cont)

IS THE FUEL CONTROL UNIT OPERATING PROPERLY?

NO →

DISCONNECT FUEL CONTROL UNIT OUTLET TUBE TO DUMP VALVE AND CHECK FOR EVIDENCE OF FUEL FLOW WHILE MOTORING. DISCONNECT FCU OUTLET TUBE TO DUMP VALVE AND CHECK FOR EVIDENCE OF FUEL FLOW WHILE MOTORING ENGINE. IF NO FLOW, REMOVE FCU TO CHECK IF BY-PASS VALVE IS CLOSING BY APPLYING 5 PSI AIR PRESSURE (MAXIMUM) TO BY-PASS RETURN PORT AND CHECK FOR EVIDENCE OF AIR ESCAPING FROM FUEL CONTROL UNIT.
**(REFER TO FIG. ON PAGE 1-48.1)**
IF AIR IS EVIDENCED, REPLACE BOTH THE FCU AND FUEL PUMP **(REFER TO CHAPTER 1, SECTION VI).** IF AIR IS NOT EVIDENCED, REPLACE ONLY THE FUEL CONTROL UNIT.

YES ↓

**GO TO NEXT PAGE**

A. STARTING (Cont)

1-43 ENGINE FAILS TO IDLE OR IS SLOW ACCELERATING TO IDLE Ng (Cont)

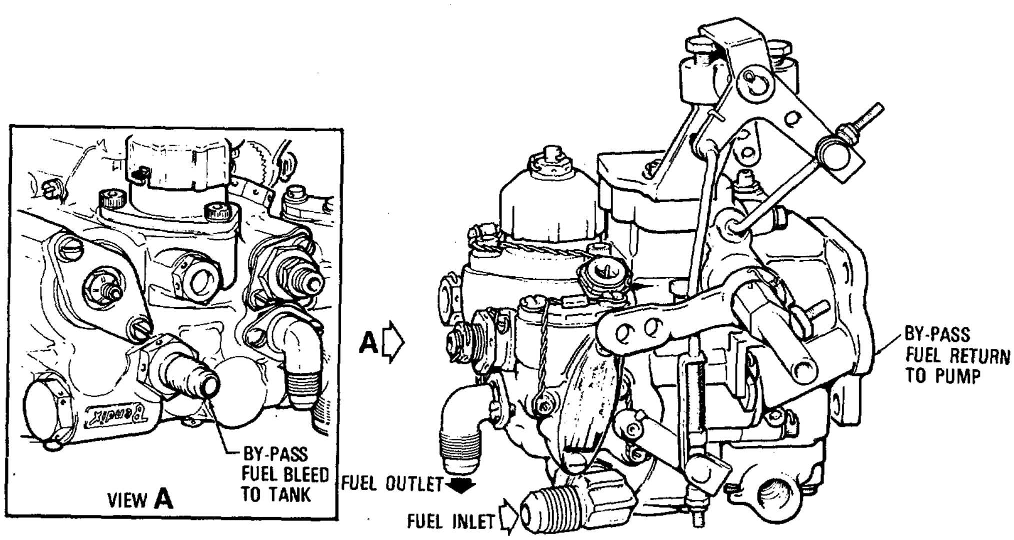
SUSPECT FCU CONTAMINATION. DISCONNECT FUEL DELIVERY TUBE AT DUMP VALVE. PERFORM WET MOTORING RUN (CHAPTER 1, SECTION X). FUEL FLOW FROM OPEN TUBE?

NO →

CHECK IF FCU BYPASS VALVE IS CLOSING. CAP FUEL OUTLET AND BYPASS FUEL BLEED TO TANK (SEE BELOW). APPLY MAXIMUM 5 PSIG AIR PRESSURE TO BYPASS RETURN PORT AND CHECK FOR AIR ESCAPING FROM FCU INLET. IF AIR IS EVIDENCED, REPLACE BOTH FCU AND FUEL PUMP. IF AIR NOT EVIDENCED, REPLACE FCU ONLY.

YES ↓

SUSPECT FUEL NOZZLE CONTAMINATION. PERFORM FUNCTIONAL CHECK ON NOZZLE (TASK 6-6-5).

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**Section VII TROUBLESHOOTING (Continued)**

A. STARTING (Cont)

1-44 ENGINE FAILS TO IDLE OR IS SLOW ACCELERATING TO IDLE Nf

SUSPECT OIL TRANSFER SLEEVE BINDING. RETURN ENGINE TO OVERHAUL.

1-45 HOT START

Refer to Chapter 1, Section VI, Paragraph 1-25

ARE CORRECT STARTING PROCEDURES OBSERVED?

NO → PERFORM CORRECT PROCEDURES (TM55-1510-209-10). **NOTE:** INSURE ENGINE 'CUTOFF' LEVER IS NOT IN 'OFF' POSITION.

YES ↓

IS THERE SUFFICIENT VOLTAGE AT STARTER GENERATOR?

NO → CHECK/REPAIR AIRFRAME POWER SOURCE (TM55-1510-209-23).

YES ↓

INSTALL REPLACEMENT STARTER GENERATOR (TM55-1510-209-23). FAULT PERSISTS?

YES ↓

PERFORM FUNCTIONAL TESTS ON GLOW PLUGS (TASK 7-1-4) AND IGNITION REGULATOR (TASK 7-3-3). SERVICEABLE?

NO → **PERFORM TASK 7-1-5 OR TASK 7-3-4**

YES ↓

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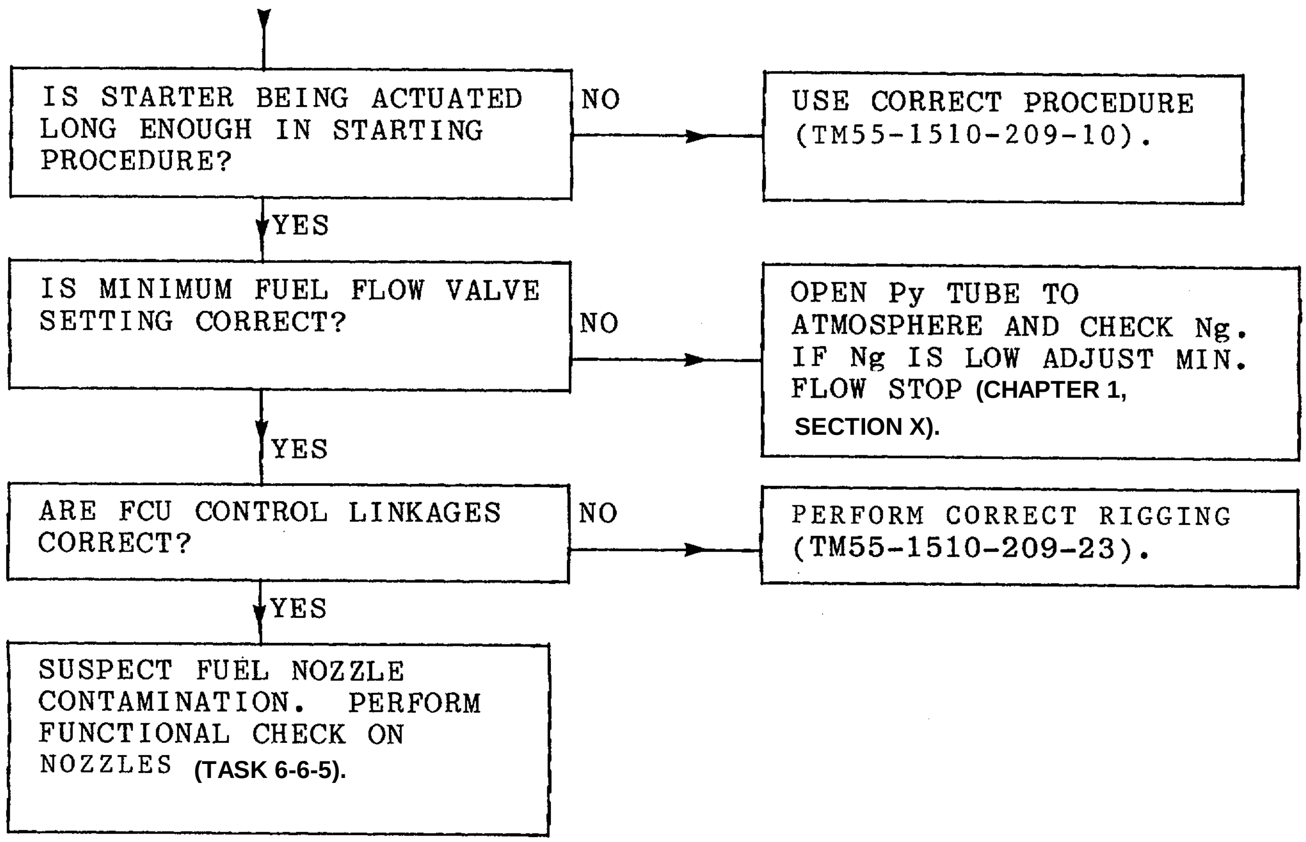
**Section VII TROUBLESHOOTING (Continued)**

A. STARTING (Cont)

1-45 HOT START (Cont)

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**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING

1-46 OVERSPEED (Nf)

Refer to Chapter 1, Section VI, Paragraph 1-24

CHECK SPEED SETTING PROPELLER GOVERNOR (TM55-1510-209-23) OVERSPEED PERSISTS?

YES

CHECK PROPELLER OVERSPEED GOVERNOR SPEED SETTING (TM55-1510-209-23) OVERSPEED PERSISTS?

YES

CHECK POWER TURBINE GOVERNOR ADJUSTMENT. ADJUST **(CHAPTER 1, SECTION X)** OVERSPEED PERSISTS?

YES

REPLACE POWER TURBINE GOVERNOR **(TASK 9-7-3).**

**GO TO NEXT PAGE**

**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING (Cont)

1-47 OVERSPEED (Ng)

REMOVE FCU (TASK 6-1-1).
CHECK FOR SHEARED SPLINED COUPLING. COUPLING O.K.?

NO → REPLACE COUPLING (TASK 6-1-3).

YES ↓

CHECK FCU DRIVE SPLINES. SPLINES O.K.?

NO → INSTALL REPLACEMENT FCU

YES ↓

SUSPECT FCU INTERNAL PROBLEM
INSTALL REPLACEMENT FCU
(TASK 6-1-3).

1-48 PROPELLER SLOW TO FEATHER/UNFEATHER

INSPECT FOR LEAKAGE AT PREFORMED PACKINGS ON TRANSFER TUBES OR TRANSFER HOUSING (TASKS 9-2-1 AND 9-3-1). PACKINGS O.K.?

NO → REPLACE PREFORMED PACKINGS (TASKS 9-2-2 AND 9-3-2).

YES ↓

CHECK PROPELLER GOVERNOR (TM55-1510-209-23).

**GO TO NEXT PAGE**

**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING (Cont)

1-49 HIGH FUEL FLOW AT ALTITUDE

CHECK FUEL FLOW INDICATION SYSTEM AND AIRFRAME BLEED TO TANK. SERVICEABLE?

NO → REPAIR SYSTEM (TM55-1510-209-23).

YES ↓

REMOVE COMPRESSOR BLEED VALVE (TASK 2-2-1). CHECK AS FOLLOWS: (REF. FIG.)

1. CHECK THAT PISTON MOVES FREELY THROUGH ITS FULL TRAVEL IN THE HOUSING BORE.

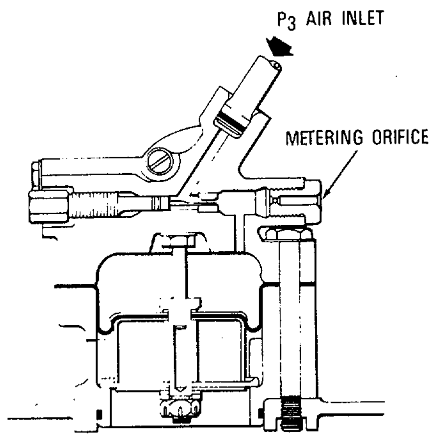
2. CAP P3 AIR INLET.

3. REMOVE METERING ORIFICE (0.3125-24 UNJF) AND PRESSURIZE UNIT TO 100 ± 15 PSI WITH FILTERED SHOP AIR OR NITROGEN. SEAL OFF VALVE AT THIS PRESSURE.

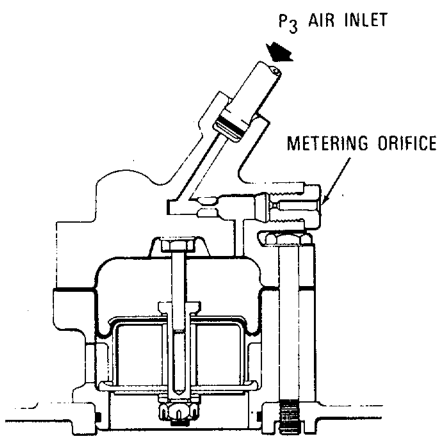
4. LEAKAGE FROM VALVE MUST NOT EXCEED 50 PSI IN FIVE MINUTES.

5. REPLACE METERING ORIFICE, TORQUE (REF. APPENDIX E) AND SECURE WITH LOCKWIRE (E.5).

6. REFER TO CHAPTER 1, SECTION VIII, FOR CLEANING OF LATER TYPE BLEED VALVES.




BLEED VALVE (EARLIER TYPE)




BLEED VALVE (LATER TYPE)

GO TO NEXT PAGE

B. OPERATING (Cont)

1-50 FUEL LEAKAGE FROM FCU VENT

REMOVE FCU (TASK 6-1-1). VERIFY WHETHER CAUSE IS PREFORMED PACKING AT MATING FACE BETWEEN FUEL CONTROL UNIT AND PUMP OR OR FUEL PUMP SHAFT SEAL.
IF PREFORMED PACKING:
THE LEAKAGE WILL RESULT IN LUBRICATION WASHOUT IN FUEL CONTROL UNIT BEARINGS - REPLACE FUEL CONTROL UNIT ONLY IF
SHAFT SEAL:
REPLACE BOTH FUEL CONTROL UNIT AND FUEL PUMP (TASKS 6-1-1 AND 6-3-1).

**NOTE:** FCU BEARING LUBRICATION WASHOUT IS EVIDENCED BY A BLUE STAIN EMITTING FROM FCU DRAIN PORT.

GO TO NEXT PAGE

B. OPERATING (Cont)

1-51 VIBRATION

IS PROPELLER UNDAMAGED AND IN BALANCE?

NO → REPAIR/REPLACE PROPELLER (TM55-1510-209-23).

YES

REMOVE INLET SCREEN (TASK 2-1-1). INSPECT FIRST-STAGE COMPRESSOR BLADES. IS DAMAGE WITHIN LIMITS? (TASK 2-4-1).

NO → RETURN ENGINE TO OVERHAUL.

YES

IF THERE IS INTERMITTENT OR STEADY "HUMMING" OR "HOOTING" SOUND AT LOW RPM, CHECK COMPRESSOR BLEED VALVE AS DETAILED IN PARAGRAPH 1-49. VIBRATION PERSISTS?

YES

CHECK COMPRESSOR TURBINE DISK AND BLADE ASSEMBLY FOR BLADE SHIFT (TASK 2-3-2). HAS BLADE RESULTED IN TIP RUB?

NO → RETURN TO DEPOT.

YES

REPLACE COMPRESSOR TURBINE DISK AND BLADE ASSEMBLY (TASK 2-3-3). VIBRATION PERSISTS?

YES

RETURN ENGINE TO OVERHAUL.

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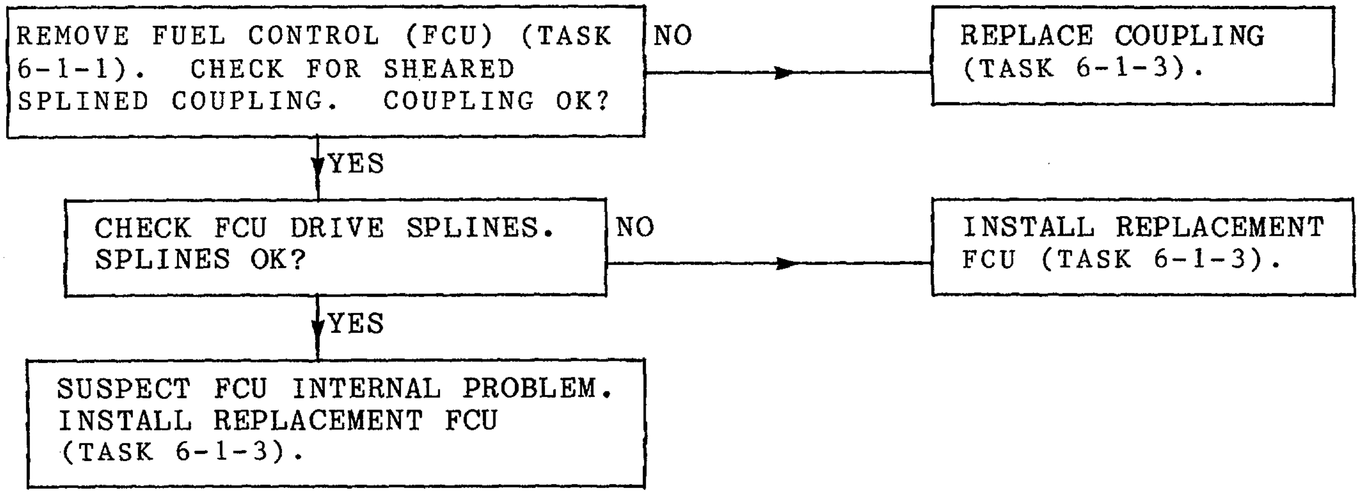
**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING (Cont)

1-51 UNCONTROLLED ACCELERATION

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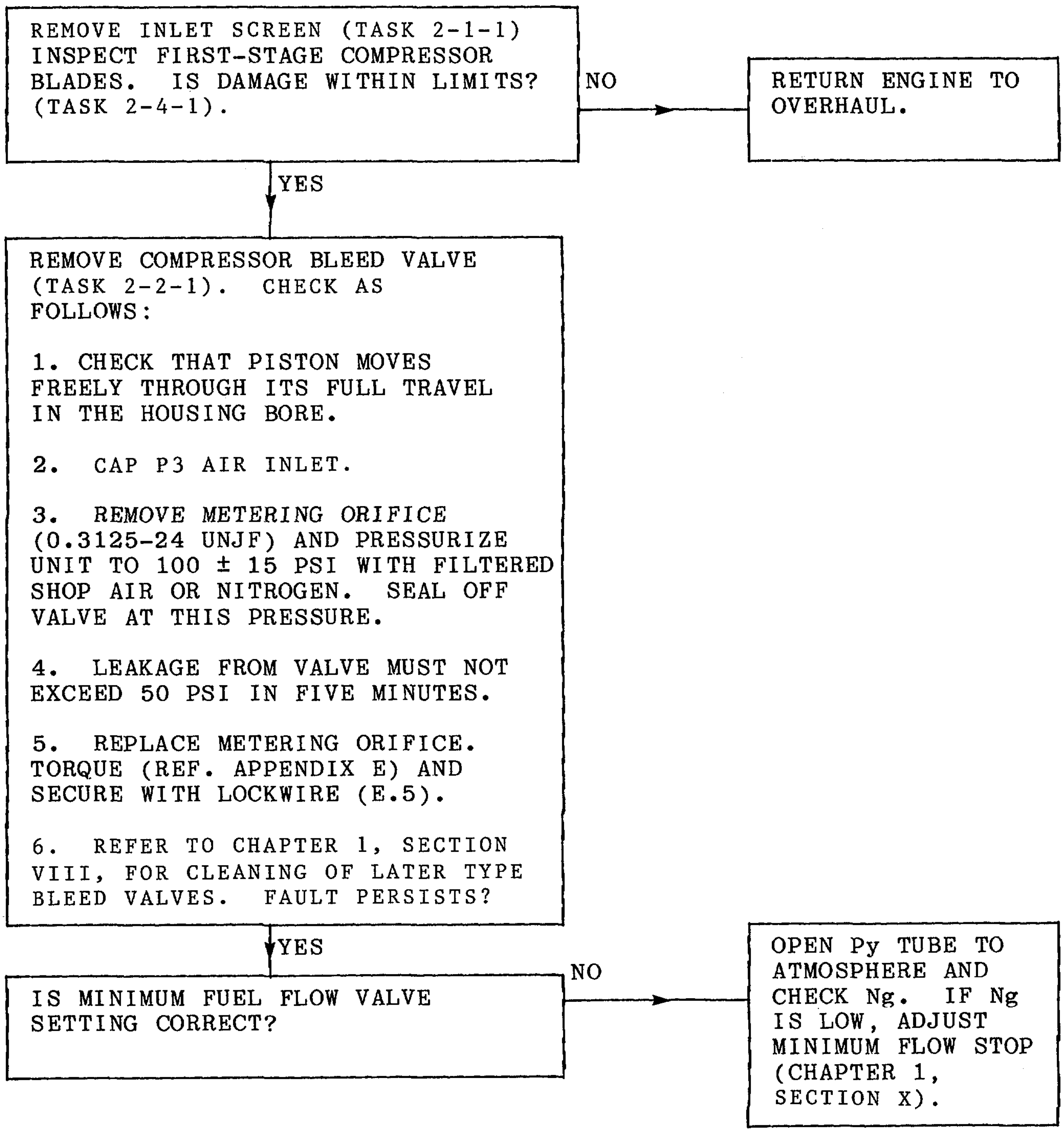
B. OPERATING (Cont)

1-53 SURGE DURING ACCELERATION

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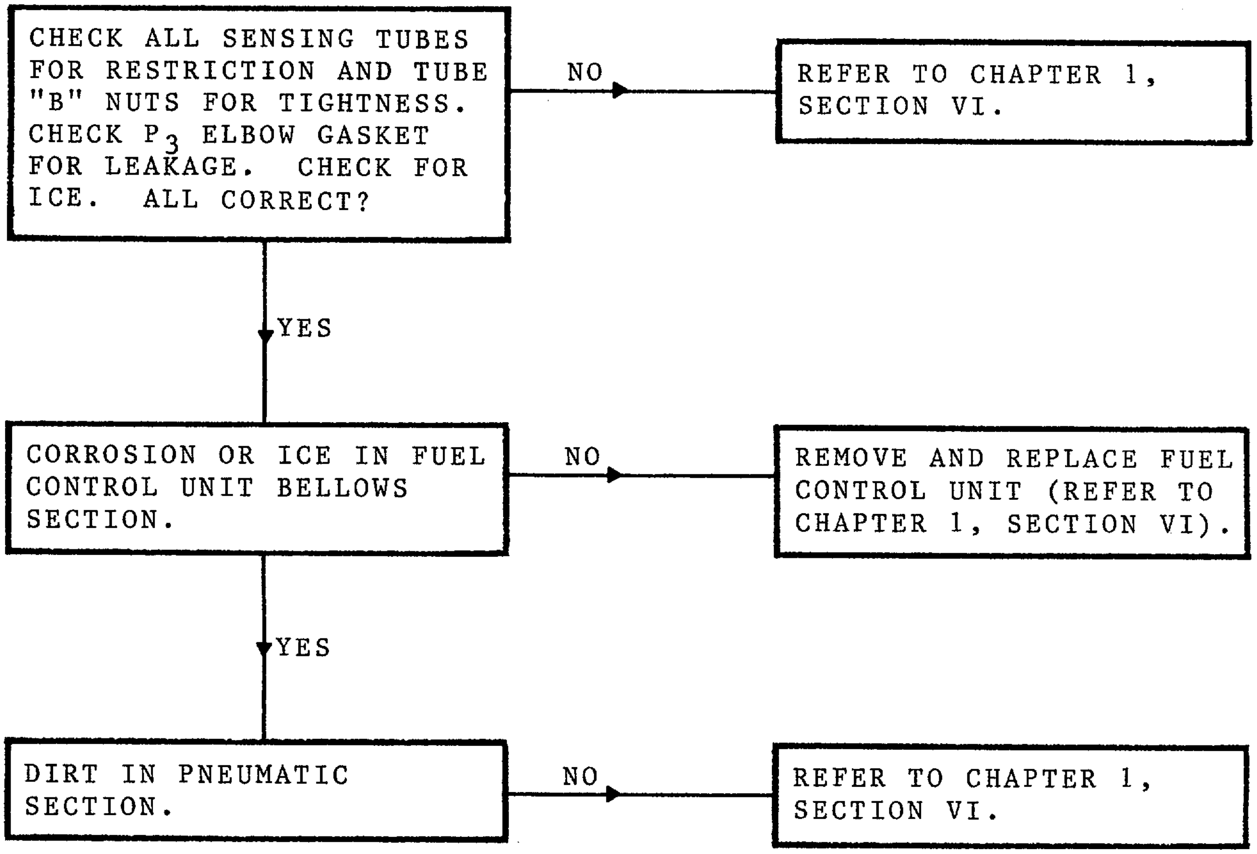
B. OPERATING (Cont)

1-54 FAILURE TO ACCELERATE PROPERLY

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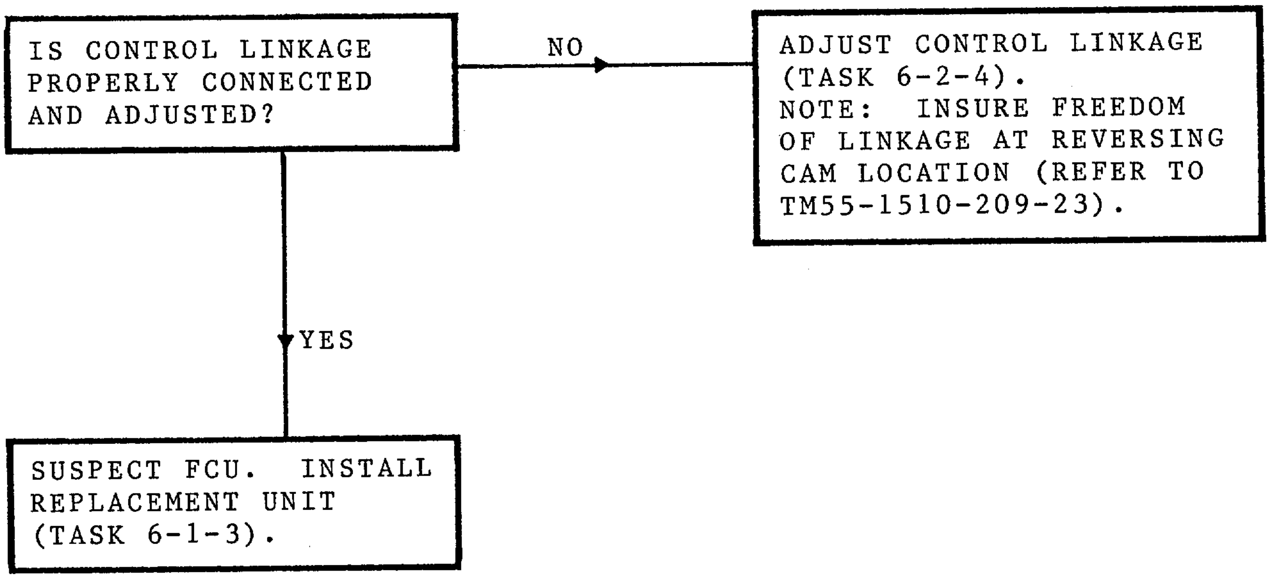
B. OPERATING (Cont)

1-55 FAILURE TO ACCELERATE PROPERLY

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B. OPERATING (Cont)

1-56 FLAME OUT

IS THERE FUEL SUPPLY TO ENGINE?

NO → INSURE AIRFRAME SOURCE IS NOT CONTAMINATED WITH WATER, ICE, ETC. (REFER TO TM55-1510-209-23.)

YES ↓

IS CONTROL LINKAGE PROPERLY CONNECTED AND ADJUSTED?

NO → ADJUST CONTROL LINKAGE (TASK 6-2-4).
**NOTE:** INSURE FREEDOM OF LINKAGE AT REVERSING CAM LOCATION.

YES ↓

IS BYPASS FUEL BLEED TO TANK (SEE FIG. BELOW). FREE OF RESTRICTIONS?

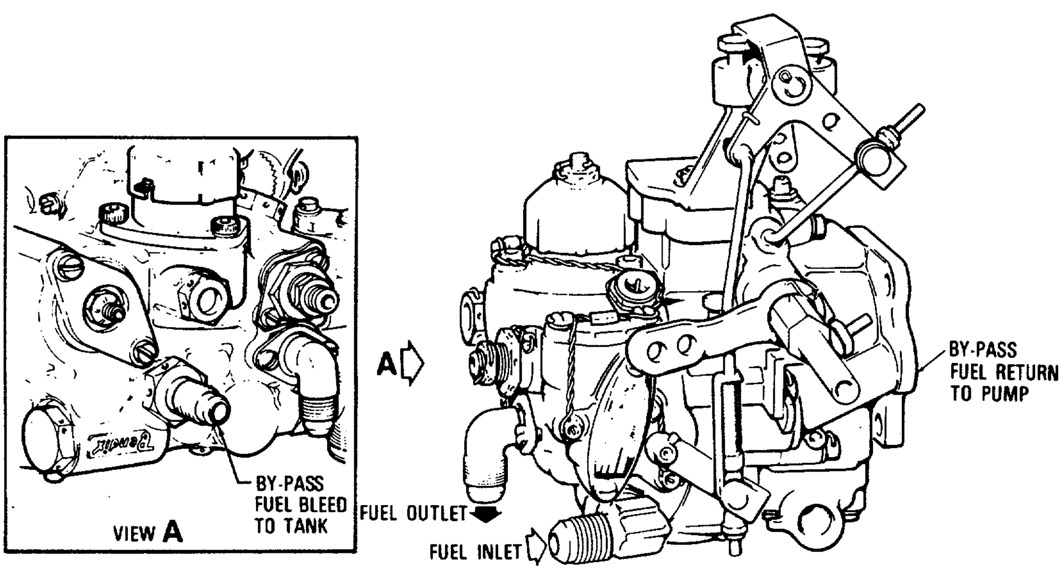
NO → CLEAR BLEED ORIFICE AND RESTART ENGINE TO CLEAR POSSIBLE AIR LOCK IN BY-PASS VALVE DIAPHRAGM AREA.

YES ↓

IS MINIMUM FUEL FLOW VALVE SETTING CORRECT?

NO → OPEN Py TUBE TO ATMOSPHERE AND CHECK Ng. IF Ng IS LOW, ADJUST MINIMUM FLOW STOP (CHAPTER 1, SECTION X).

YES ↓

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1-56 FLAME OUT (Cont)

DISCONNECT TUBE BETWEEN FUEL PUMP AND FCU AND CHECK FOR FLOW WHILE MOTORING ENGINE. FLOW EVIDENT?

NO → INSTALL REPLACEMENT FUEL PUMP (TASK 6-3-2).

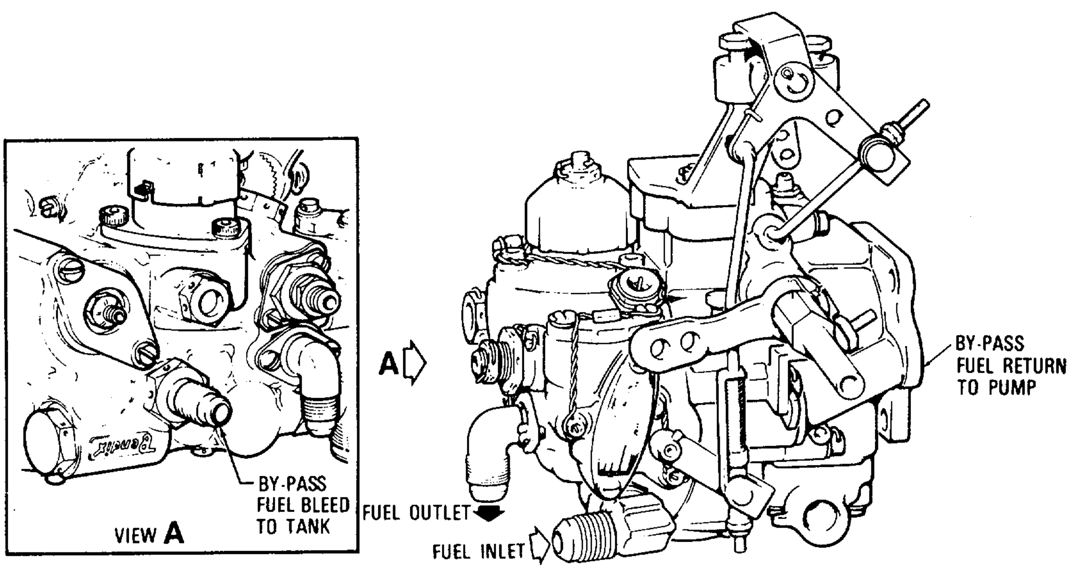
YES ↓

SUSPECT FCU CONTAMINATION. DISCONNECT FUEL DELIVERY TUBE AT DUMP VALVE. CARRY PERFORM WET MOTORING RUN (CHAPTER 1, SECTION X). FUEL FLOW FROM OPEN TUBE?

NO → CHECK IF FCU BYPASS VALVE IS CLOSING. CAP FUEL OUTLET AND BYPASS FUEL BLEED TO TANK. (SEE FIG. BELOW). APPLY MAXIMUM 5 PSIG AIR PRESSURE TO BYPASS RETURN PORT AND CHECK FOR AIR ESCAPING FROM FCU INLET. IF AIR IS EVIDENCED, REPLACE BOTH FCU AND FUEL PUMP. IF AIR IS NOT EVIDENCED, REPLACE FCU ONLY.

YES ↓

SUSPECT FUEL NOZZLE CONTAMINATION. PERFORM FUNCTIONAL CHECK ON NOZZLES (TASK 6-6-5).

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**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING (Cont)

1-57 IDLE SPEEDS INCORRECT

IDLE SPEED INCORRECT SETTING?

- NO → ADJUST AS REQUIRED. (REFER TO CHAPTER 1, SECTION X.)
- YES ↓

INCORRECT CONTROL LINKAGE RIGGING?

- NO → INSURE CUT-OFF LINKAGE AND CONTROL ARE CORRECTLY RIGGED.
- YES ↓

LEAK OR RESTRICTION IN FUEL CONTROL UNIT SENSING TUBES?

- NO → CHECK ALL SENSING TUBES FOR RESTRICTIONS AND TUBE NUTS FOR TIGHTNESS. CHECK $P_3$ ELBOW GASKET FOR LEAKAGE. CHECK FOR ICE (REFER TO CHAPTER 1, SECTION VI.)
- YES ↓

MINIMUM FUEL FLOW SETTING?

- NO → OPEN Py TUBE TO ATMOSPHERE AND CHECK Ng. IF Ng IS LOW ADJUST MINIMUM FLOW STOP. (REFER TO CHAPTER 1, SECTION X.)

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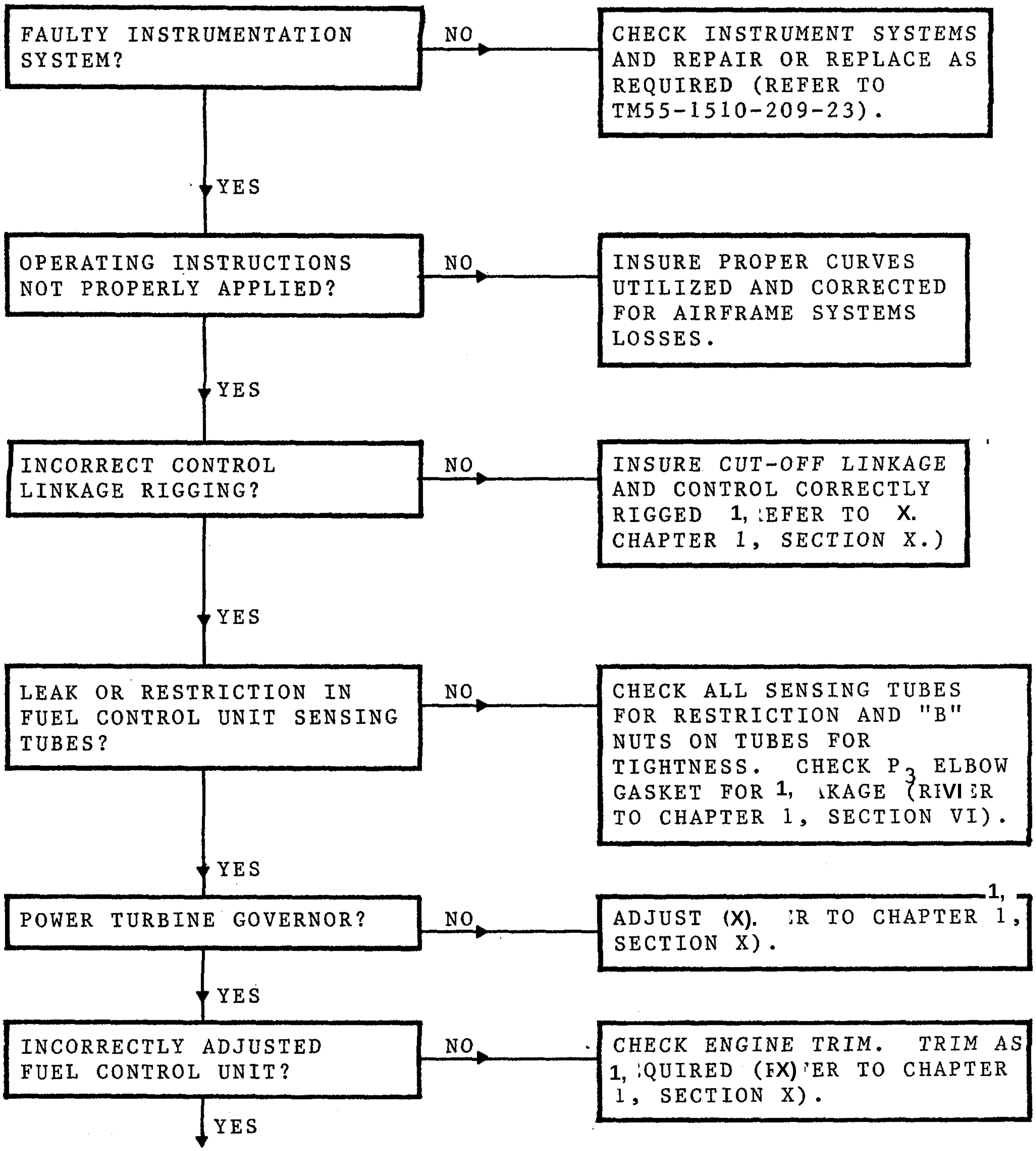
**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING (Cont)

1-58 **LOW POWER - ALL PARAMETERS ARE LOW**

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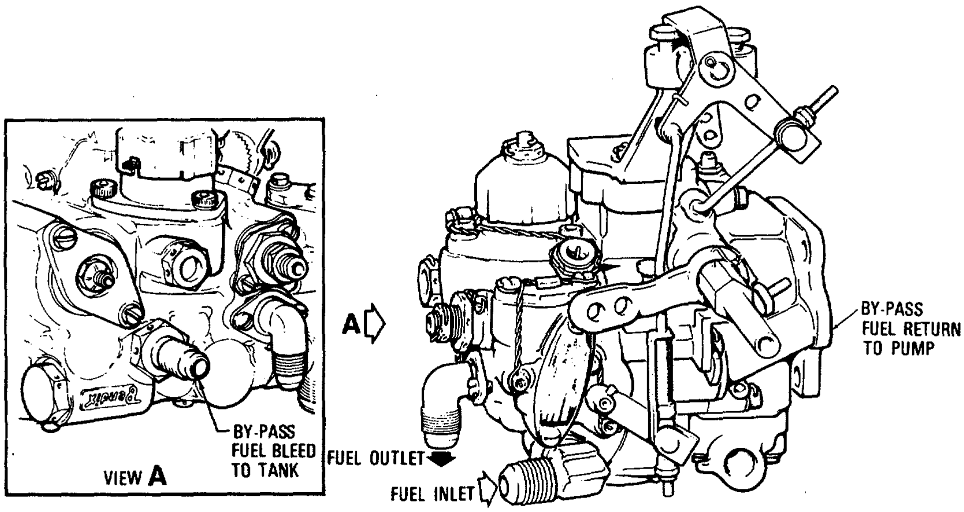
## Section VII TROUBLESHOOTING (Continued)

B. OPERATING (Cont)

### 1-58 LOW POWER - ALL PARAMETERS ARE LOW (Cont)




SUSPECT FCU CONTAMINATION. DISCONNECT FUEL DELIVERY TUBE AT DUMP VALVE. CARRY PERFORM WET MOTORING RUN (CHAPTER 1, SECTION X). FUEL FLOW FROM OPEN TUBE?

NO → CHECK IF FCU BYPASS VALVE IS CLOSING. CAP FUEL OUTLET AND BYPASS FUEL BLEED TO TANK (SEE ABOVE). APPLY MAXIMUM 5 PSIG AIR PRESSURE TO BYPASS RETURN PORT AND CHECK FOR AIR ESCAPING FROM FCU INLET. IF AIR IS EVIDENCED, REPLACE BOTH FCU AND FUEL PUMP. IF AIR IS NOT EVIDENCED, REPLACE FCU ONLY.

YES ↓

INSTALL SERVICEABLE FUEL CONTROL (TASK 6-1). STILL LOW POWER?

YES ↓

POSSIBLE DIRT IN PNEUMATIC SECTION. REPLACE TEMPERATURE COMPENSATOR (TASK 6-9). STILL LOW POWER?

YES ↓

GO TO NEXT PAGE

B. OPERATING (Cont)

1-58 **LOW POWER - ALL PARAMETERS ARE LOW (Cont)**

REMOVE COMPRESSOR BLEED VALVE (TASK 2-2-1). CHECK AS FOLLOWS: (REF. FIG. ).

1. CHECK THAT PISTON MOVES FREELY THROUGH ITS FULL TRAVEL IN THE HOUSING BORE.

2. CAP P3 AIR INLET.

3. REMOVE METERING ORIFICE (0.3125-24 UNJF) AND PRESSURIZE UNIT TO 100 ± 15 PSI WITH FILTERED SHOP AIR OR NITROGEN. SEAL OFF VALVE AT THIS PRESSURE.

4. LEAKAGE FROM VALVE MUST NOT EXCEED 50 PS1 IN FIVE MINUTES.

5. REPLACE METERING ORIFICE, TORQUE (REF. APPENDIX E) AND SECURE WITH LOCKWIRE (E.5).

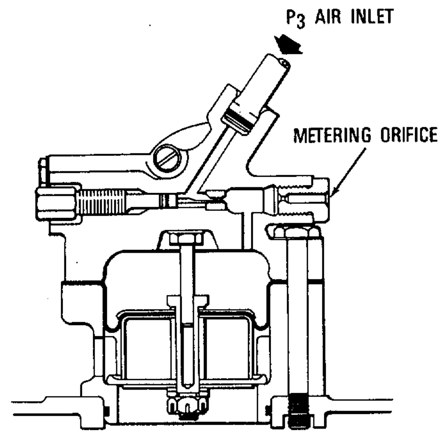
6. REFER TO CHAPTER1,1, SECTION VIII, FOR CLEANING OF LATER TYPE BLEED VALVES.

YES

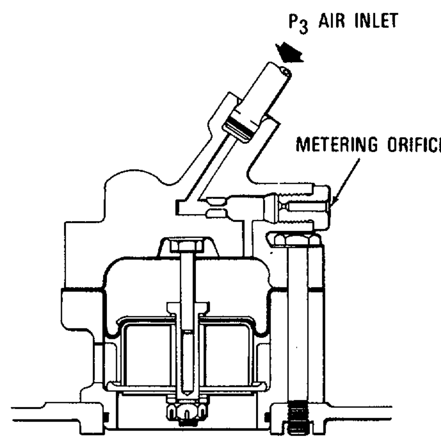
TORQUEMETER SYSTEM READING LOW?

YES

RETURN POWER SECTION TO OVERHAUL FOR INVESTIGATION.




BLEED VALVE (EARLIER TYPE)




BLEED VALVE (LATER TYPE)

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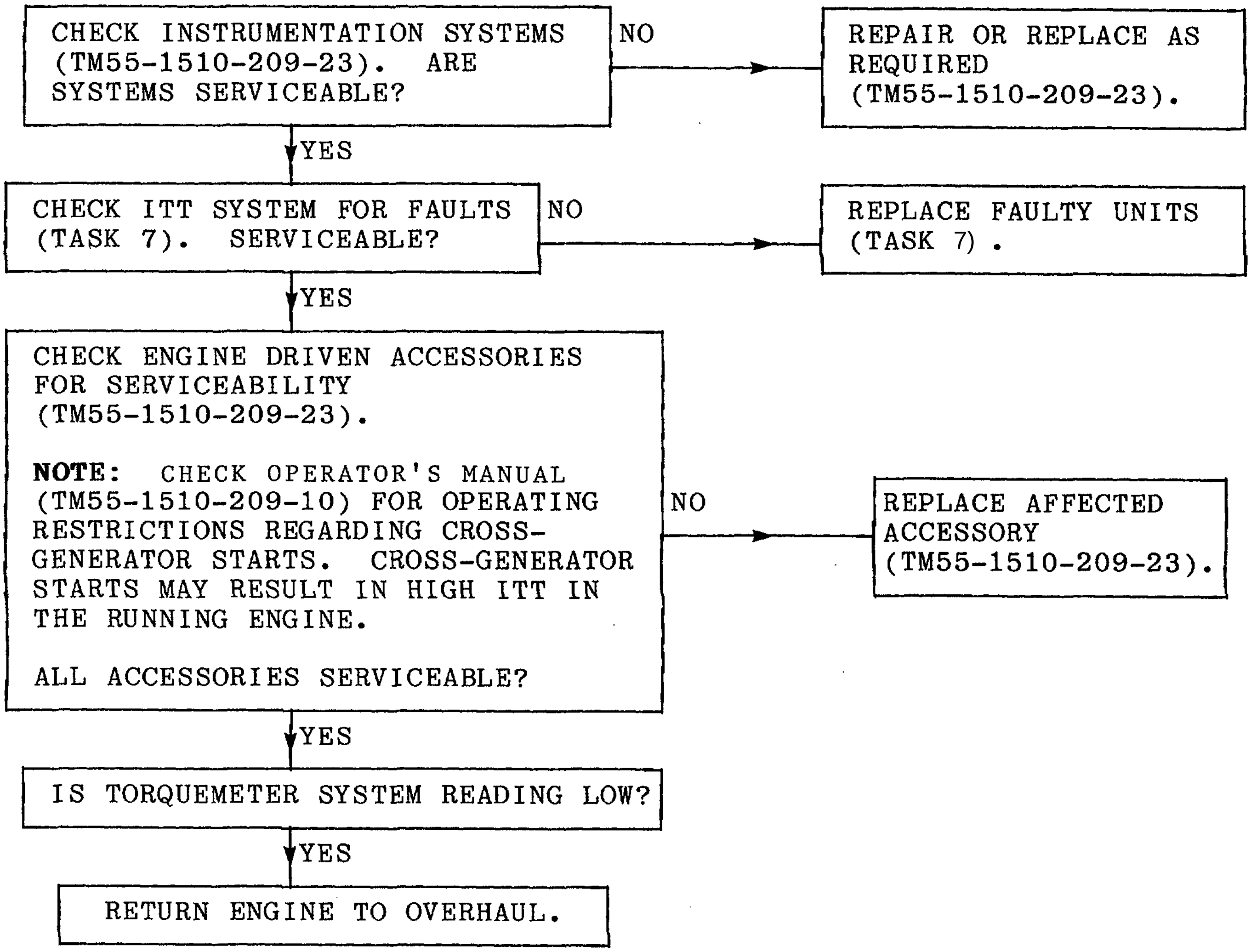
**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING (Cont)

## 1-59 OVERTEMPERATURE

Refer to Chapter 1, Section VI, Paragraph 1-25

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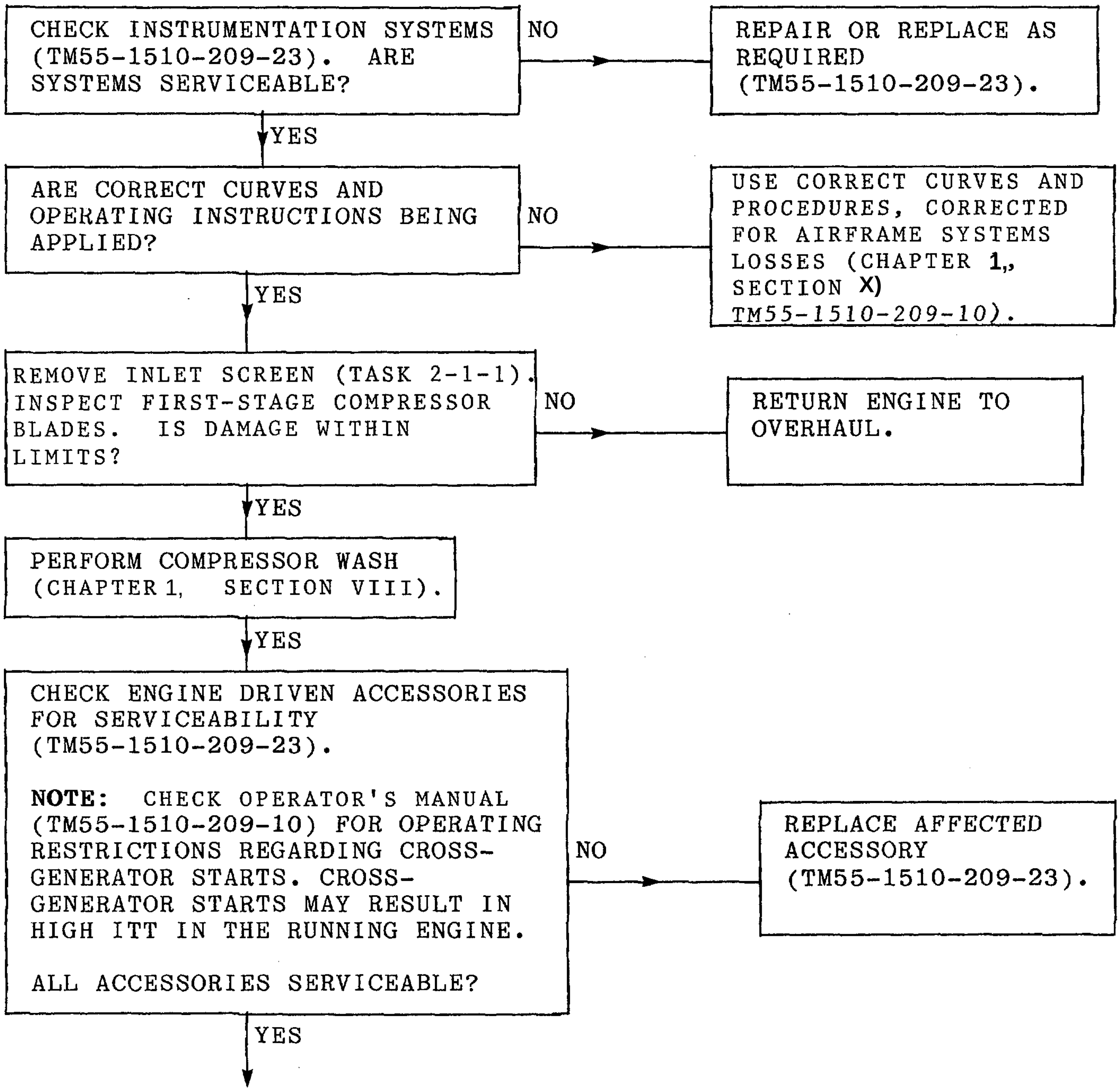
**Section VII TROUBLESHOOTING (Continued)**

B. OPERATING (Cont)

1-60 **TEMPERATURE LIMITED (ITT AT MAXIMUM BEFORE TARGET TORQUE IS REACHED**)

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B. OPERATING (Cont)

1-60 **TEMPERATURE LIMITED (ITT AT MAXIMUM BEFORE TARGET TORQUE IS REACHED) (Cont)**

REMOVE COMPRESSOR BLEED VALVE (TASK 2-2-1) CHECK AS FOLLOWS: (REF. FIG.)

1. CHECK THAT PISTON MOVES FREELY THROUGH ITS FULL TRAVEL IN HOUSING BORE.

2. CAP P3 AIR INLET.

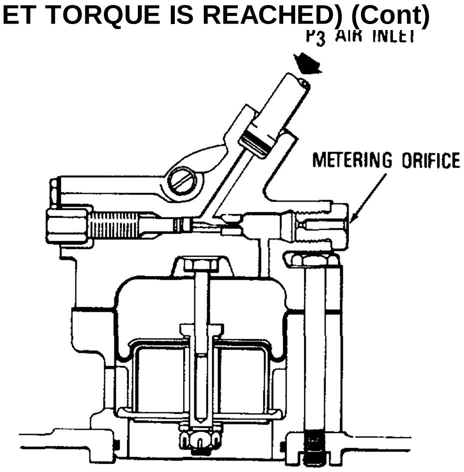
3. REMOVE METERING ORIFICE (0.3125-24UNJF) AND PRESSURIZE UNIT TO 100 ± 15 PSI WITH FILTERED SHOP AIR OR NITROGEN. SEAL OFF VALVE AT THIS PRESSURE.

4. LEAKAGE FROM VALVE MUST NOT EXCEED 50 PSI IN FIVE MINUTES.

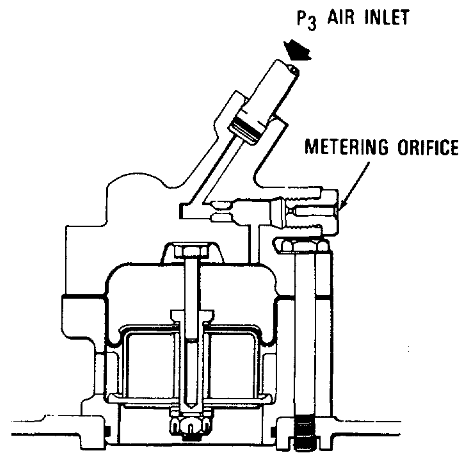
5. REPLACE METERING ORIFICE, TORQUE (REF. APPENDIX E) AND SECURE WITH LOCKWIRE (E.5).

6. REFER TO CHAPTER 1, SECTION VIII, FOR CLEANING OF LATER TYPE BLEED VALVES.

FAULT PERSISTS?




BLEED VALVE (EARLIER TYPE)




BLEED VALVE (LATER TYPE)

YES

CHECK FLANGES AND FITTINGS FOR AIR LEAKS. AIRTIGHT?

NO → SEAL AS REQUIRED.

YES

CHECK ITT SYSTEM FOR FAULTS (TASK 7). SERVICEABLE?

NO → REPLACE FAULTY UNITS (TASK 7).

YES

GO TO NEXT PAGE

B. OPERATING (Cont)

1-60 **TEMPERATURE LIMITED (ITT AT MAXIMUM BEFORE TARGET TORQUE IS REACHED) (Cont)**

PERFORM HOT SECTION INSPECTION. REFER TO CHAPTER 1, SECTION VI, PARAGRAPH 1-33. FAULT PERSISTS?

YES

TORQUEMETER SYSTEM READING LOW?

YES

RETURN ENGINE TO OVERHAUL.

C. LUBRICATION SYSTEM

1-61 **LOW OIL PRESSURE**

CHECK OIL SUPPLY. SUFFICIENT OIL?

NO → REPLENISH ( CHAPTER 1, SECTION VIII).

YES

CHECK INDICATING SYSTEM. SERVICEABLE?

NO → REFER TO TM55-1510-209-23).

YES

CHECK OIL COOLING SYSTEM. SERVICEABLE?

NO → REFER TO TM55-1520-209-23).

YES

SUSPECT HOT AIR LEAKAGE THROUGH HEAT SHIELDING. RETURN ENGINE TO OVERHAUL.

**GO TO NEXT PAGE**

C. LUBRICATION SYSTEM (Cont)

## 1-62 HIGH OIL PRESSURE

CHECK INDICATING SYSTEM. SERVICEABLE?

NO → REFER TO TM55-1510-209-23).

YES ↓

IS OIL PRESSURE RELIEF VALVE ACTUATING?

NO → REMOVE AND CLEAN RELIEF VALVE (TASKS 8-4-1 AND 8-4-2).

## 1-63 HIGH OIL TEMPERATURE

CHECK OIL SUPPLY. SUFFICIENT OIL?

NO → REPLENISH (CHAPTER 1, SECTION VIII).

YES ↓

CHECK INDICATING SYSTEM. SERVICEABLE?

NO → REFER TO TM55-1510-209-23).

YES ↓

CHECK OIL COOLING SYSTEM. SERVICEABLE?

NO → REFER TO TM55-1510-209-23).

YES ↓

SUSPECT EXCESSIVE IDLING WITH PROPELLER FEATHERED. RESTRICT IDLING TIME IN FEATHER. TEMPERATURE STILL HIGH?

YES ↓

SUSPECT HOT AIR LEAKAGE THROUGH HEAT SHIELDING. RETURN ENGINE TO OVERHAUL.

**GO TO NEXT PAGE**

**Section VII TROUBLESHOOTING (Continued)**

C. LUBRICATION SYSTEM (Cont)

1-64 EXCESSIVE OIL CONSUMPTION

**CAUTION**

**IF CONSUMPTION EXCEEDS 0.2 POUNDS PER HOUR, OR IF OIL HAS COLLECTED IN INLET AND EXHAUST AREAS, INDICATING AIR SEAL FAILURES, THE ENGINE MUST BE RETURNED FOR OVERHAUL. (REFER TO NOTE AT END OF SECTION VII.)**

ARE PRESSURE OIL TUBES LEAK-FREE?

NO → REPAIR/REPLACE AS REQUIRED.

YES ↓

ARE PREFORMED PACKING AND BACKUP RING ON OIL FILTER HOUSING IN GOOD CONDITION AND CORRECTLY ASSEMBLED?

NO → INSTALL NEW PARTS IN CORRECT ORDER OF ASSEMBLY (TASK 8-1-4).

YES ↓

PRESSURE CHECK OIL-TO-FUEL HEATER AS FOLLOWS:

1. CAP FUEL OUTLET USING SUITABLE PLUG (0.750-16UNF).

2. APPLY FILTERED SHOP AIR OR NITROGEN AT 100 PSI MAXIMUM TO FUEL INLET. IMMERSE UNIT IN PETROLEUM SOLVENT (ITEM E.8).

3. ANY EVIDENCE OF AIR BUBBLES AT OIL PORTS IS CAUSE FOR REJECTION OF UNIT.

IS UNIT LEAK-FREE?

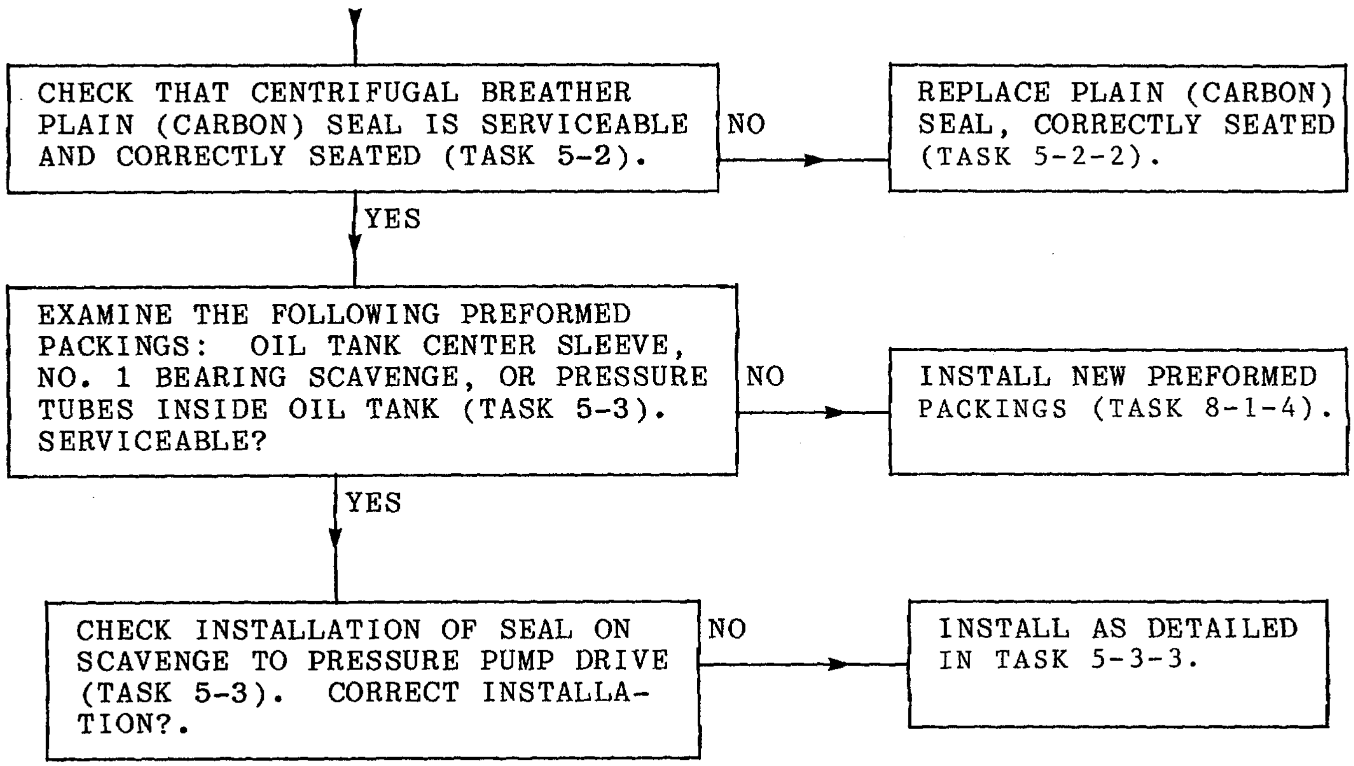
NO → REPLACE OIL-TO-FUEL HEATER (TASK 8-3-3).

YES ↓

**GO TO NEXT PAGE**

C. LUBRICATION SYSTEM (Cont)

**1-64 EXCESSIVE** OIL CONSUMPTION (Cont)

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**Section VII TROUBLESHOOTING (Continued)**

C. LUBRICATION SYSTEM (Cont)

1-65 **EXCESSIVE DISCHARGE OVERBOARD BREATHER**

CHECK THAT CENTRIFUGAL BREATHER PLAIN (CARBON) SEAL IS SERVICEABLE AND CORRECTLY SEATED (TASK 5-2).

NO → REPLACE PLAIN (CARBON) SEAL, CORRECTLY SEATED (TASK 5-2).

YES ↓

CHECK FOR RESTRICTION IN SCAVENGE LINES, PARTIALLY BLOCKED OIL-FUEL HEATER OR OIL COOLING SYSTEM. ALL CLEAR?

NO → REPAIR/REPLACE AS REQUIRED.

YES ↓

CHECK OIL FILTER HOUSING PREFORMED PACKING AND BACKUP RING ARE IN GOOD CONDITION AND CORRECTLY ASSEMBLED (TASK 8-1).

NO → INSTALL NEW PREFORMED PACKING AND BACKUP RING. ASSEMBLE IN CORRECT ORDER (TASK 8-1-4).

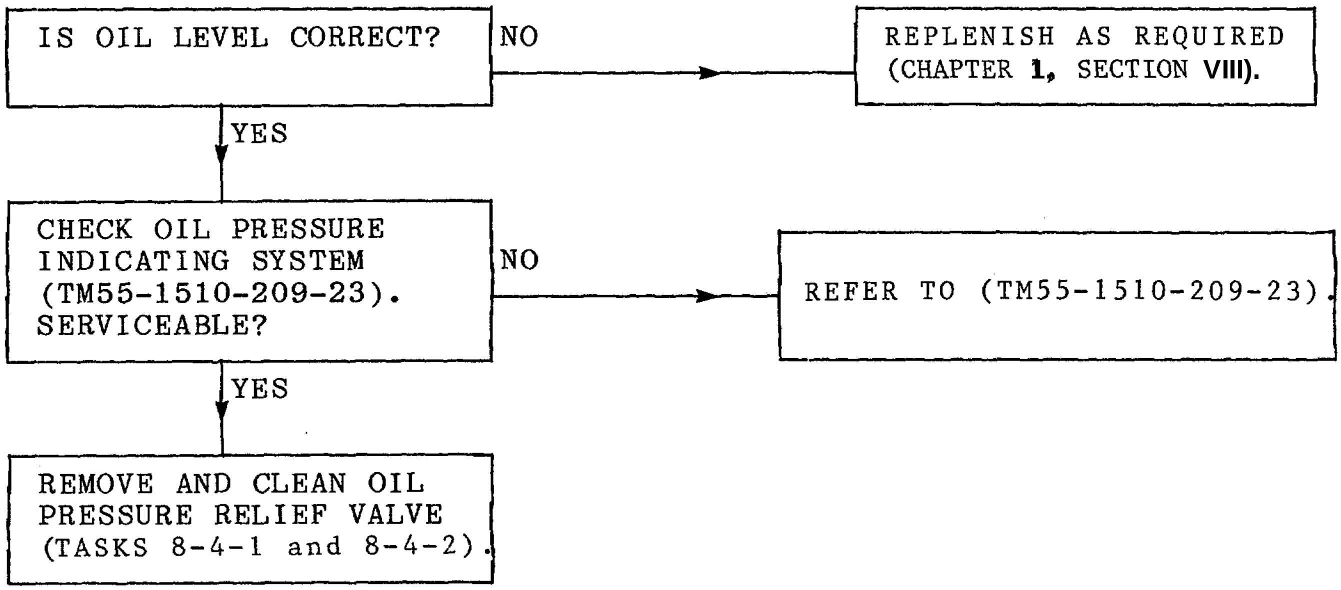
YES ↓

CHECK AND CORRECT OIL LEVEL IN SYSTEM (CHAPTER1,1, SECTION VIII).

GO TO NEXT PAGE

C. LUBRICATION SYSTEM (Cont)

### 1-66 FLUCTUATING OIL PRESSURE



**Section VII TROUBLESHOOTING (Continued)**

C. LUBRICATION SYSTEM (Cont)

1-67 **OIL LEAK - COMPRESSOR INLET**

CHECK OIL FILTER HOUSING PREFORMED PACKING AND BACKUP RING ARE IN GOOD CONDITION AND CORRECTLY ASSEMBLED (TASK 8-1).

NO → INSTALL NEW PREFORMED PACKING AND BACKUP RING. ASSEMBLE IN CORRECT ORDER (TASK 5-3-3).

YES ↓

EXAMINE THE FOLLOWING PREFORMED PACKINGS:
OIL TANK CENTER SLEEVE, NO. 1 BEARING SCAVENGE, OR PRESSURE TUBES INSIDE OIL TANK (TASK 5-3). SERVICEABLE?

NO → INSTALL NEW PREFORMED PACKINGS.

YES ↓

CHECK INSTALLATION OF SEAL ON SCAVENGE TO PRESSURE PUMP DRIVE (TASK 5-3). CORRECT INSTALLATION?

NO → INSTALL AS DETAILED IN TASK 5-3.

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D. FLUCTUATIONS

1-68 **TORQUE, FUEL FLOW, ITT, Ng**

IS INSTRUMENTATION SYSTEM SERVICEABLE?

NO → REFER TO (TM55-1510-209-23).

YES

CHECK IF CONTROL LEVER SETTING IS AFFECTED BY AIRFRAME RESONANCE. IS LEVER HOLDING ITS POSITION?

NO → REFER TO (TM55-1510-209-23).

YES

ADJUST POWER TURBINE GOVERNOR (TASK 9-7-2). STILL FLUCTUATING?

YES

POSSIBLE FUEL PUMP SHAFT SEAL LEAKAGE. REFER TO PARAGRAPH 1-50.0. STILL FLUCTUATING?

YES

CHECK AND ADJUST PROPELLER OVERSPEED GOVERNOR ADJUSTMENT (TM55-1510-209-23). STILL FLUCTUATING?

YES

INSTALL REPLACEMENT PROPELLER OVERSPEED GOVERNOR (TM55-1510-209-23). STILL FLUCTUATING?.

YES

REMOVE AND REPLACE PROPELLER GOVERNOR (TM55-1510-209-23). STILL FLUCTUATING?

YES

IS BETA MECHANISM MOVING FREELY.

NO → CHECK PROPELLER FEEDBACK RING FOR CONCENTRICITY AND RODS FOR FULL AND FREE TRAVEL.

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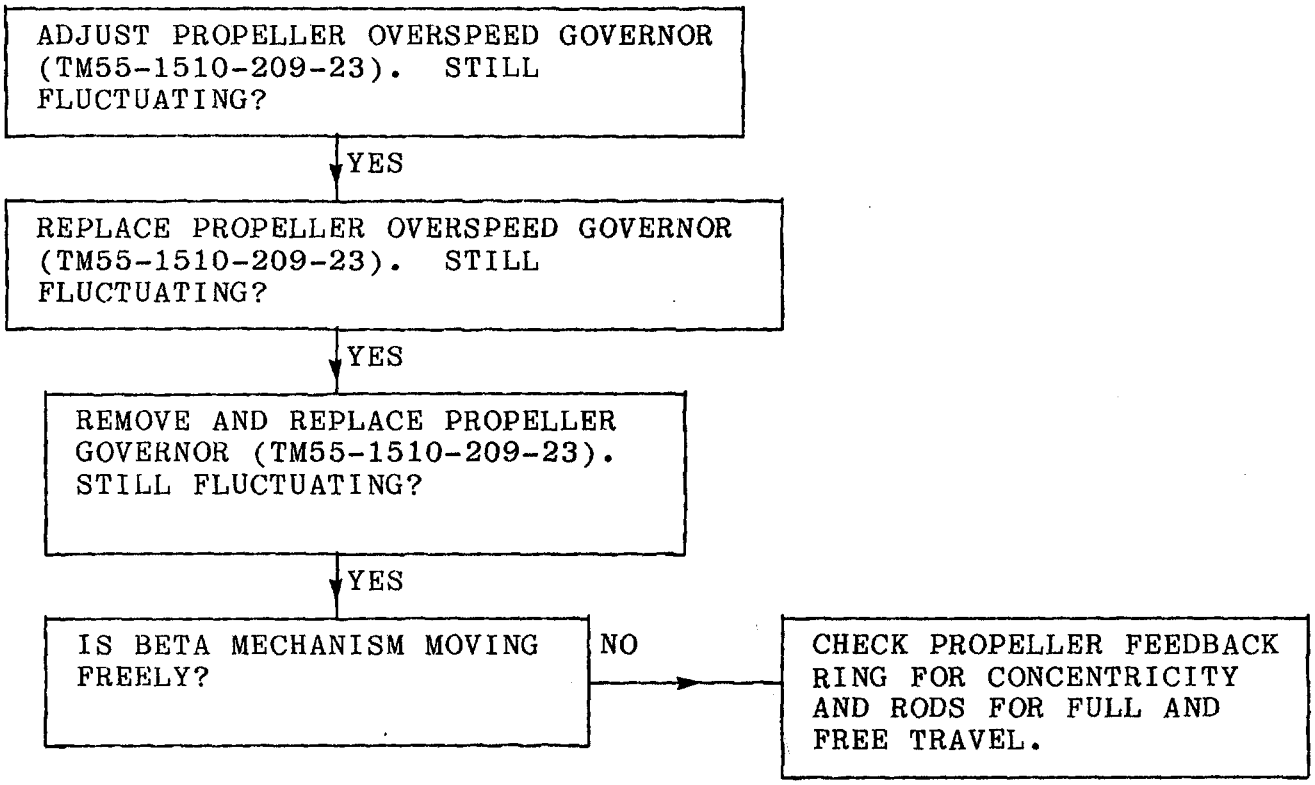
**Section VII TROUBLESHOOTING (Continued)**

D. FLUCTUATIONS (Cont)

1-69 **TORQUE AND Nf**




E. 1-70 SPECIFIC SYMPTOMS

**NOTE**

**SYMPTOMS OF AIR SEAL FAILURES ARE EXCESSIVE OIL CONSUMPTION, SMOKING STARTS AND EXCESSIVE VIBRATION LEVEL, BUT THESE SYMPTOMS ARE ALSO INDICATIVE OF:**

1. OIL LEVEL MAINTAINED TOO HIGH.

2. BLOCKAGE IN ENGINE SCAVENGE OR BREATHER SYSTEM.

THE ABOVE CONDITIONS SHOULD BE CHECKED BEFORE SUSPECTING AIR SEAL PROBLEMS.

**END OF SECTION**

## SECTION VIII GENERAL MAINTENANCE PROCEDURES

INITIAL SETUP

Applicable Configurations:
All

Tools:

Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 4920-00-165-1453
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114
Adapters (T.2)
Brackets (T.5)
Lifting Eye (T.9)
Puller (T.24)
Ring (T.38)
Ring (T.39)
Sling (T.41)
Sling (T.43)
Stand (T.50)
Stand (T.51)
Wash Wand (Refer to Appendix D)
5 gal. Container (2 required)
Mechanical Agitator
Pressure Gage (0 to 100 psi)
Air Supply Valves (2 required)
Fluid Shutoff Valves (2 required)
Flow Control Valves (2 required)

Materials:

| | |
|---|---|
| Cotterpin | (E.1) |
| Lubricating Oil | (E.2) |
| Lockwire | (E.4) |
| Lockwire | (E.5) |
| Demineralized Water | (E.6) |
| Penetrating Oil | (E.7) |
| Petroleum Solvent | (E.8) |
| Varsol | (E.9) |
| Kerosene | (E.10) |
| Hydrochloric Acid | (E 11) |
| Hydrochloric Acid | |
| Sulfuric Acid | (E.13) |
| Phosphoric Acid | (E.14) |
| Hydrogen Peroxide | (E.15) |
| Ammonium Bifluoride | (E.16) |
| Sodium Hydroxide | (E.17) |
| Ammonium Nitrate | (E.18) |
| Petrolatum | (E.20) |
| Molykote M77 | (E.21) |
| Plastilube No. 3 Grease | (E.22) |
| Molykote G or Z | 0E.23) |
| Feltwick Pen | (E.24) |
| Speedry Instant Dry Ink | (E.25) |
| Cado Marker | (E.26) |
| Brushpen No. 57 | (E.27) |
| Tex Rite Instant Dry Ink | (E.28) |
| Micro Supreme Dye | (E.29) |
| Phano Pencil | (E.30) |
| Colorbrite Pencil | (E.31) |
| Methanol | (E.32) |
| Triethanolamine | (E.33) |
| Solder | (E.47) |
| Turco 5884 | (E.49) |
| B&B 3100 | (E.51) |
| Magnus 1214 | (E.52) |
| Witco HE-59B | (E.53) |
| Witco P10-59B | (E.54) |
| Carbitol | (E.55) |
| Ardrox 624 | (E.56) |
| CLIX | (E.57) |
| Grit No. 180 | (E.58) |
| Turro Super Carb | (E.63) |
| Crocus Cloth | (E.64) |
| Lubricating Oil | (E.71) |
| Nitric Acid | (E.72) |
| Marks-A-Lot | (E.73) |
| MIL-C-85704, Type II or Type II Cleaners | (E.85, E.86, E.87, or E.88) |

Parts:
Cotterpin
Preformed Packings

Personnel Required
68B Powerplant Mechanic
68F Aircraft Electrician
66G Aircraft Inspector

References:
AR95-1
TM 1-42B-1-7
TM 55-1510-209-23
TM 55-1510-215-23
TM 55-2840-251-23P
TM 55-4920-328-13

INITIAL SETUP

General Safety Instructions

**Warning**

**Wash hands LUBRICATING OILS HAZARDOUS Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. thoroughly after handling.**

**Warning**

**TOXIC AND FLAMMABLE SOLVENTS**

**Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flames.**

**Use only in a well-ventilated area. Wear rubber gloves. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

**NOTE**

**B&B 3100 (MIL-C-85704, Type I) is the primary cleaner for Army turbine engines and remains an approved cleaner for locales where environmental restrictions permit. Engine cleaners that conform to MIL-C-85704, Type II and Type II are also acceptable engine cleaners and meet EPA environmental requirements. Continue use of B&B 3100 where not restricted. Where restrictions apply use MIL-C-85704, Type II and Type IIA cleaners. Approved Type II and Type IIA cleaners shall be used in accordance with the existing washing procedure. Type IRA cleaners do not require dilution with water. Both types of cleaners are less effective than Type I cleaners. Thereforemore frequent engine washes may be required to achieve satisfactory results.**

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## SECTION VIII GENERAL MAINTENANCE PROCEDURES (Continued)

1-71 SERVICING

1. To service oil tank, proceed as follows:

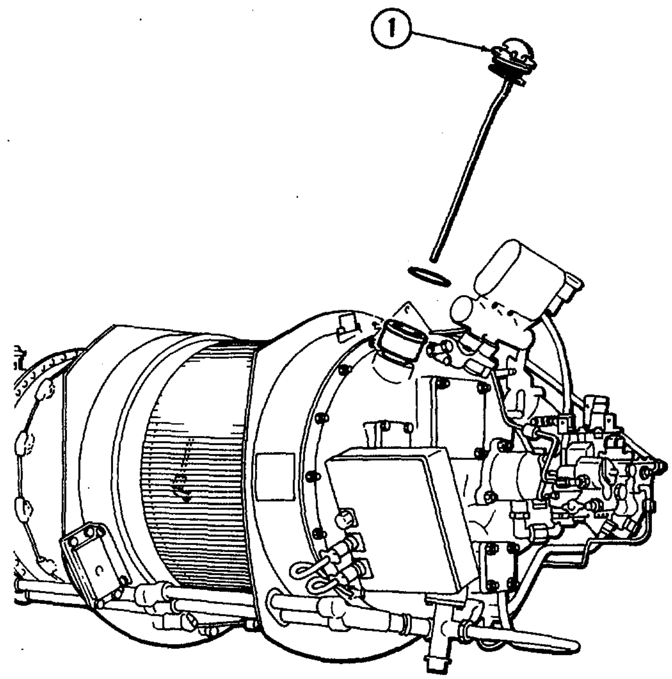
**NOTE**

**The recommended oil change is at 300 hours intervals.**

a. Check oil level by removing filler cap and dipstick assembly (1) from filler neck located on the accessory gearbox and check the contents against marking on level gage.

**NOTE**

**If engine has been stationary for more than twelve hours, or if more than 10 minutes is allowed to elapse before checking oil level, carry out dry motoring run (Chapter 1, Section X) prior to check.**



1-71 SERVICING (Cont)

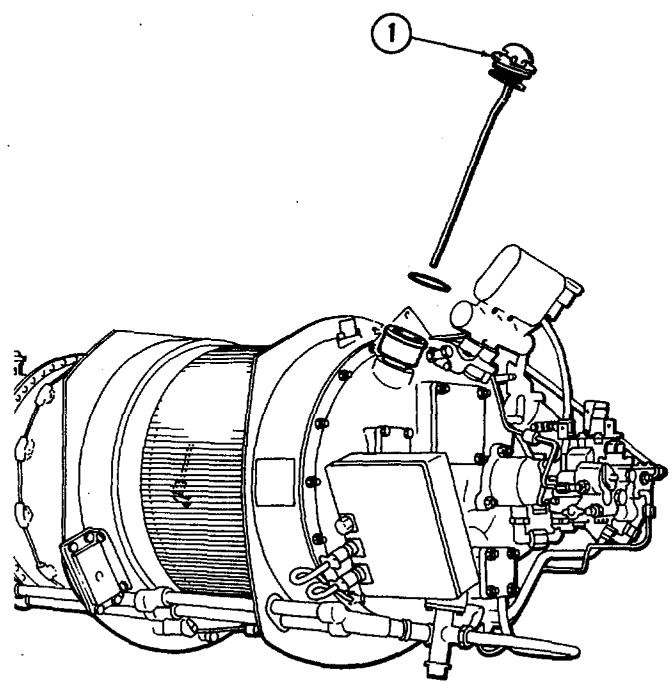
**CAUTION**

**Do not mix oil of different military specifications, since the chemical structure of different brands or specifications of synthetic oil may differ sufficiently to make them incompatible with each other. Should both types of oil become mixed, drain and flush oil system (subparagraphs 2 and 3) and refill with oil.**

b. Refill with Lubricating Oil (E. 2) or (E. 71) one quart below maximum level. Overfilling may cause a discharge of oil through accessory gearbox breather until a satisfactory level is reached.

c. Check oil filler cap and dipstick for condition and locking features. Install new preformed packing (2) on filler cap (1) and install assembly in accessory gearbox.

d. Check for and remedy any oil leaks.

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1-71 SERVICING (Cont)

2. To drain and refill oil tank proceed as follows:

a. Place a suitable container under compressor inlet case, extract cotterpin (3) from straight headed pin (4) and remove pin.

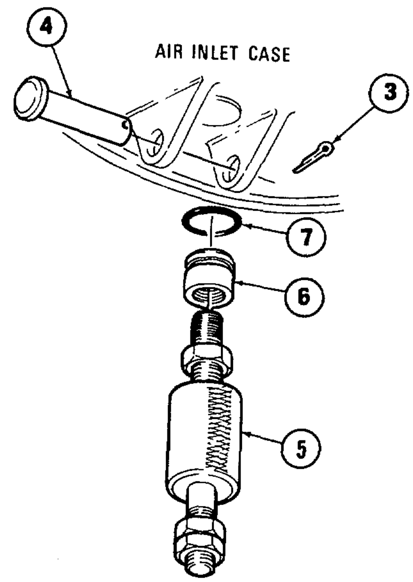
b. Using Puller (T. 24) (5) remove oil tank drain plug (6) from bottom of compressor inlet case. Remove and discard preformed packing (7). Drain oil.

c. Install new preformed packing (7) in recessed portion of drain plug (6) and install plug into bottom of compressor inlet case.

d. Remove puller (5).

e. Install straight headed pin (4) and secure with cotterpin (3).

f. Refill oil tank (subparagraph 1).

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## SECTION VIII GENERAL MAINTENANCE PROCEDURES (Continued)

1-71 SERVICING (Cont)

3. Should an engine oil system become contaminated it must be drained and refilled with oil:

a. Drain oil tank (subparagraph 2).

b. Cut lockwire and remove hexagon plug (8) or chip detector (9) and preformed packing (10) from 6 o'clock position in propeller reduction gearbox.

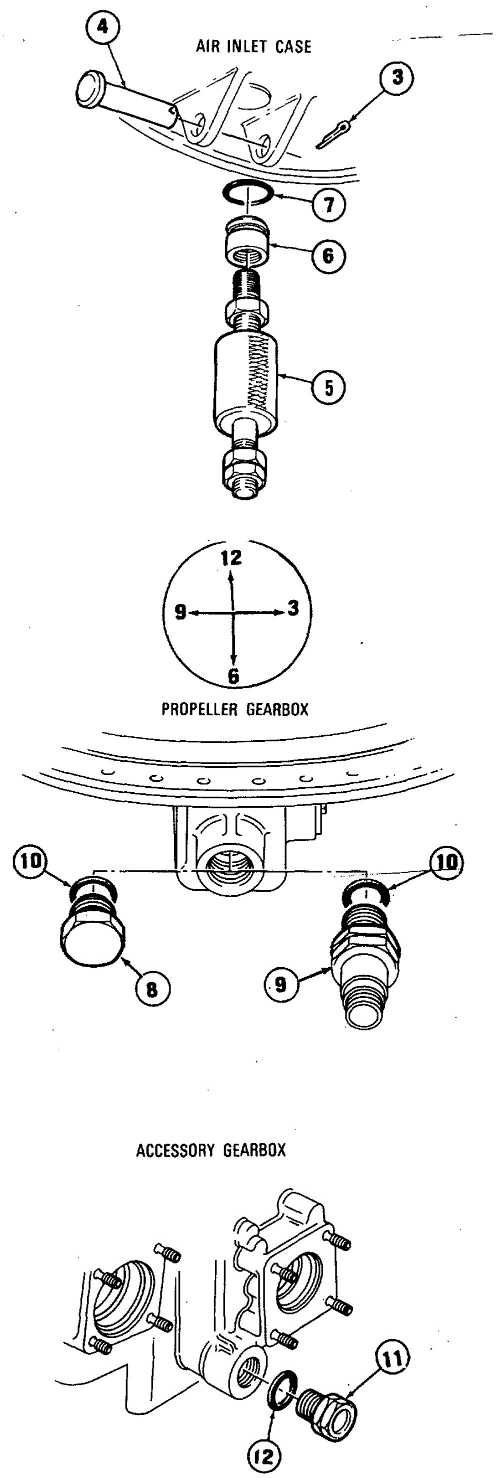
c. Cut lockwire and remove hexagon plug (11) and preformed packing (12) adjoining external scavenge pump mounting on accessory gearbox.

d. Drain oil from aircraft oil coolers (TM55-1510-209-23).

e. With drain plugs and drain plug removed, perform dry motoring run (Chapter 1, Section X). This permits the scavenge pumps to clear the engine.

**CAUTION**

**To prevent excessive operation with limited lubrication, limit rotation to shortest possible time needed to accomplish complete drainage.**

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1-71 SERVICING (Cont)

f. Reinstall drain plugs and preformed packings as follows:

(1) Install new preformed packing (10).

(2) Install reduction gearbox Hexagon plug (8) or chip detector (9). Torque plug (8) to 215 to 240 inch-pounds or chip detector to 45 to 55 inch-pounds. Secure with lockwire (E. 4).

(3) Install oil tank drain plug at 6 o'clock position on compressor inlet case (subparagraph 2), insert straight headless pin and secure pin with cotterpin.

(4) Install new preformed packing (12).

(5) Install packing accessory gearbox drain plug (11). Torque to 200 to 225 inch-pounds and lockwire (E. 5).

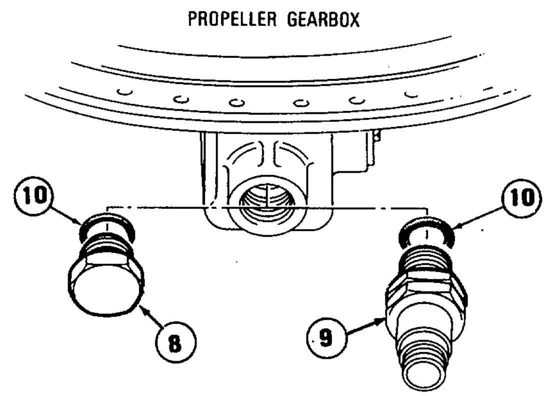
g. Replace drains in oil cooler (TM55-1510-209-23).

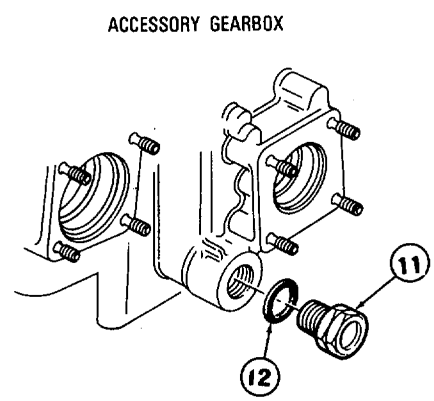
h. Refill oil tank with oil (Subparagraph 1).

i. Start engine (Chapter 1, Section X) and run at LO-IDLE for a minimum of two minutes.

j. Shut down engine (Chapter 1, Section X).

k. Accomplish subparagraphs a,b,c,d, and e.

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1-71 SERVICING (Cont)

l. Remove and discard preformed packing from each drain plug.

m. Install new disposable type oil filter or reinstall metal type oil filter after cleaning (Task 8-1-4).

n. Reinstall all drain plugs together with new preformed packings (subparagraph f).

o. Replace drains in aircraft oil cooler (TM55-1510-20923).

p. Accomplish subparagraphs h and i and check for oil leaks.

q. Accomplish subparagraph j and service oil tank to correct level (subparagraph 1).

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1-72 GROUND HANDLING

**WARNING**

**HOISTING ENGINE**

**Do not stand under engine while it is being moved from one area to another on a hoist. To prevent injury to personnel and damage to equipment during handling of demountable power plant or engine, periodically check engine lifting sling. Do not use equipment which has signs of excessive wear or abuse, or has unauthorized bolts, pins, etc. If equipment is defective or has unauthorized parts, notify local safety personnel. Be sure that capacity of lifting device exceeds combined weight of component and container to be lifted.**

1. If engine is installed in aircraft, refer to TM55-1510-20923 or TM55-1510-215-23 and remove engine.

2. If engine is installed in METS, refer to TM55-4920-328-13 and remove engine.

3. If engine is installed in a container remove as detailed in Chapter 1, Section V, Paragraph 1-21, Unpacking.

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1-73 INSTALLATION/REMOVAL OF ENGINE OR POWER SECTION IN/FROM STANDS

1. With engine suspended from hoist (1) (Chapter 1, Section V, Paragraph 1-21), install in Stand (T. 51) (3) as follows:

**NOTE**

**Pads must be left loose to facilitate alignment**

a. Install three engine mount Brackets (T. 5) (4) on the three engine mount pads on the gas generator case. Secure each bracket with four bolts (5). Torque bolts to 225 to 250 inch-pounds.

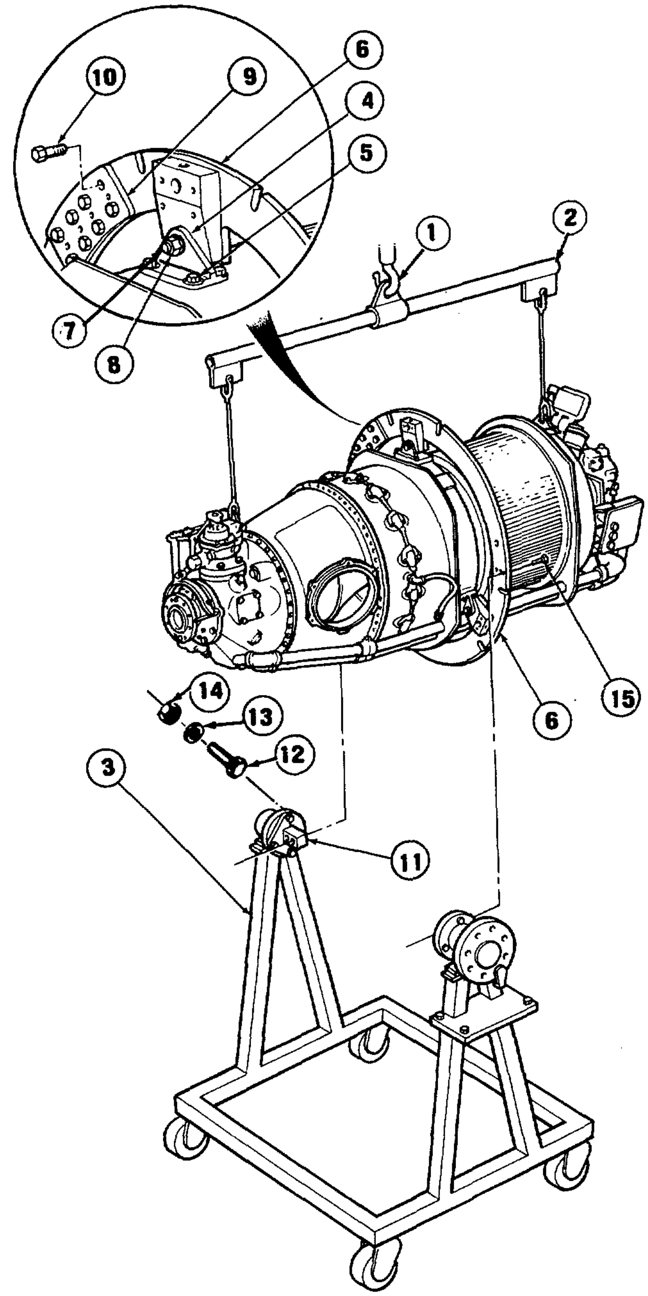
b. Secure the two-piece split mount Ring (T. 38) (6) to the mount brackets (2) with three bolts (7) and nuts (8). Torque nuts to 515 to 575 inch-pounds.

c. Secure the two overlap plates (9) with 16 bolts (10). Torque bolts to 225 to 250 inch-pounds and lockwire (E. 4).

d. Install two Adapters (11) on stand (T. 51) (3) using three bolts (12), washers (13) and nuts (14). Torque nuts to 600 to 650 inch-pounds.

e. Lower engine into stand aligning holes at the 3 and 9 o'clock positions on the mount ring with the holes in adapters (11). Secure with four washers (13) and cap screws (15). Torque screws to 250 to 270 inch-pounds.

f. Remove sling (2) and hoist (1).

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1-73 INSTALLATION/REMOVAL OF ENGINE OR POWER SECTION IN/FROM STANDS (Cont)

2. Remove engine from Stand (T. 51) (3) as follows:

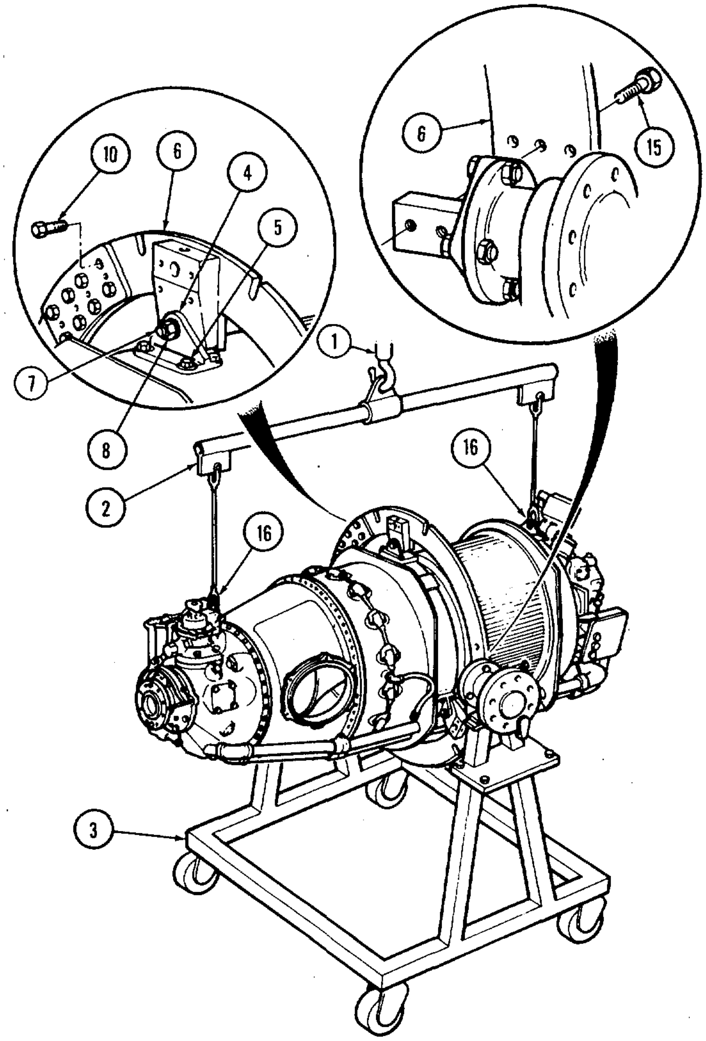
a. Attach Sling (T. 43) and hoist (1) to engine lifting points (16). Raise hoist enough to support engine weight.

b. Remove two screws and washers (15) from each of the 3 and 9 o'clock positions on mount ring (6).

c. Lift engine clear of stand (3).

d. Remove 16 bolts (10) and three nuts (8) and bolts (7) and remove split mount ring (6) from around engine.

e. Remove 12 bolts (5) and three engine mount brackets (4) from gas generator case.

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1-73 INSTALLATION/REMOVAL OF ENGINE OR POWER SECTION IN/FROM STANDS (Cont)

3. Install power section in Stand (T. 51) (3) as follows:

a. Remove power section from engine (Task 4-1-1).

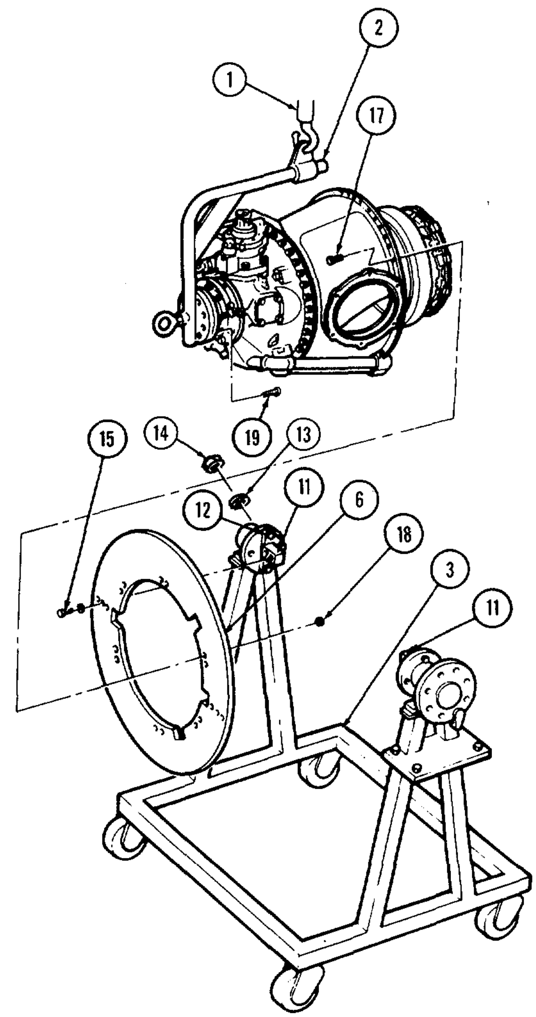
b. Install two Adapters (T. 2) (11) on Stand (T. 51) (3) using three bolts (12), washers (13) and nuts (14) on each. Torque nuts to 600 to 650 inch-pounds.

c. Install mount Ring (T. 39) (6) on stand (3) aligning holes at the 3 and 9 o'clock positions on mount ring with the holes in the adapters (11). Secure ring with four washers (13) and cap screws (15). Torque screws to 250 to 275 inch-pounds.

d. Lower power section and install through mount ring (6). Secure ring with 12 bolts (17) and nuts (18) . Torque nuts to 36 to 40 inch-pounds.

e. Remove hoist (1).

f. Remove capscrews (19) and sling (2).

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1-73 INSTALLATION/REMOVAL OF ENGINE OR POWER SECTION IN/FROM STANDS (Cont)

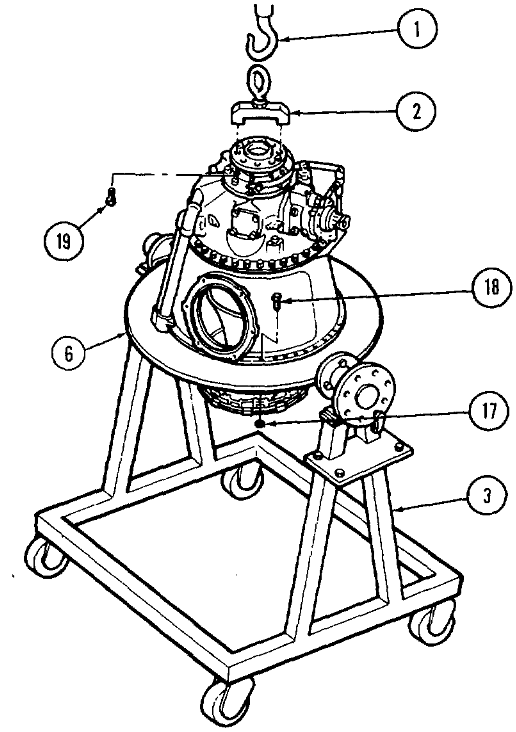
4. Transfer power section from Stand (T. 51) (3) to Stand (T. 50) (20) as follows:

a. Rotate mount ring (6) to position power section vertically.

b. Install Lifting Eye (T. 9) (2) on propeller shaft; secure with two capscrews (19). Torque capscrews to 675 to 750 inch-pounds.

c. Attach hoist (1) to lifting eye (2) and raise hoist enough to support power section weight.

d.

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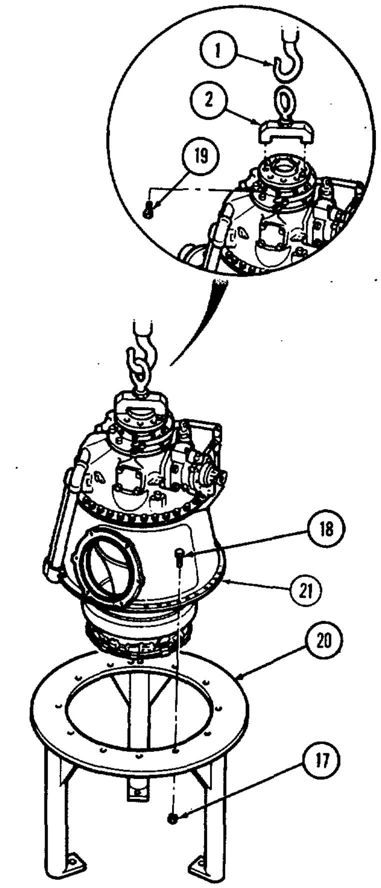
1-73 INSTALLATION/REMOVAL OF ENGINE OR POWER SECTION IN/FROM STANDS (Cont)

4. (Cont)

e. Lower power section on to Stand (T. 50) (20) aligning C flange holes (21) with holes in stand flange.

f. Secure power section with 12 bolts (18) and nuts (17). Torque nuts to 36 to 40 inch-pounds.

g. Unhook hoist (1); remove capscrews (19) and lifting eye (2).

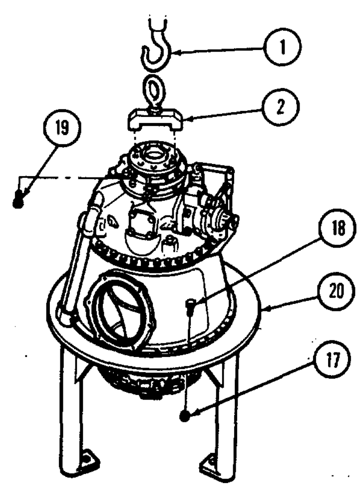



5. Transfer power section from Stand (T. 50) (20) to Stand (T. 51) (3) as follows:

a. Install Lifting Eye (T. 9) (2) on propeller shaft; secure with two capscrews (19). Torque capscrews to 675 to 750 inch-pounds.

b. Attach hoist (1) to lifting eye (2) and raise hoist enough to support power section weight.

c. Remove 12 nuts (17) and bolts (18); lift power section clear of stand.

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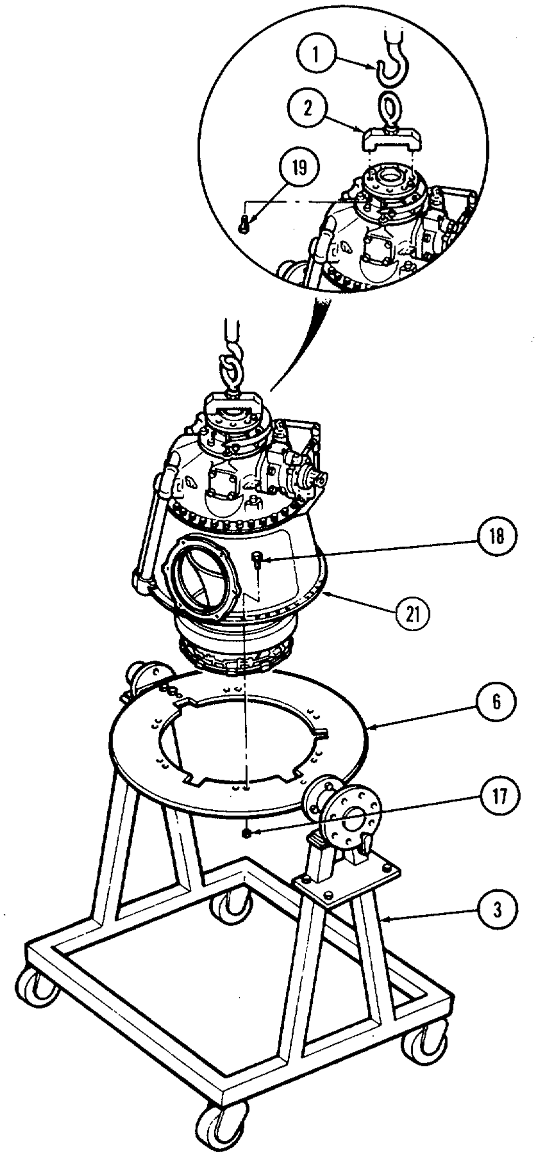
1-73 INSTALLATION/REMOVAL OF ENGINE OR POWER SECTION IN/FROM STANDS (Cont)

5. (Cont)

d. With mount ring (6) in the horizontal position on Stand (T. 51) (3), lower power section on to stand, aligning C flange holes (21) with holes on mount ring.

e. Secure power section with 12 bolts (18) and nuts (17). Torque nuts to 36 to 40 inch-pounds.

f. Unhook hoist (1); remove capscrews (19) and lifting eye (2).

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1-73 INSTALLATION/REMOVAL OF ENGINE OR POWER SECTION IN/FROM STANDS (Cont)

6. Remove power section from Stand (T. 51) (3) as follows:

a. With power section in horizontal position, install Sling (T. 41) (2) on propeller shaft. Secure with four capscrews (19). Torque capscrews to 600 to 650 inch-pounds.

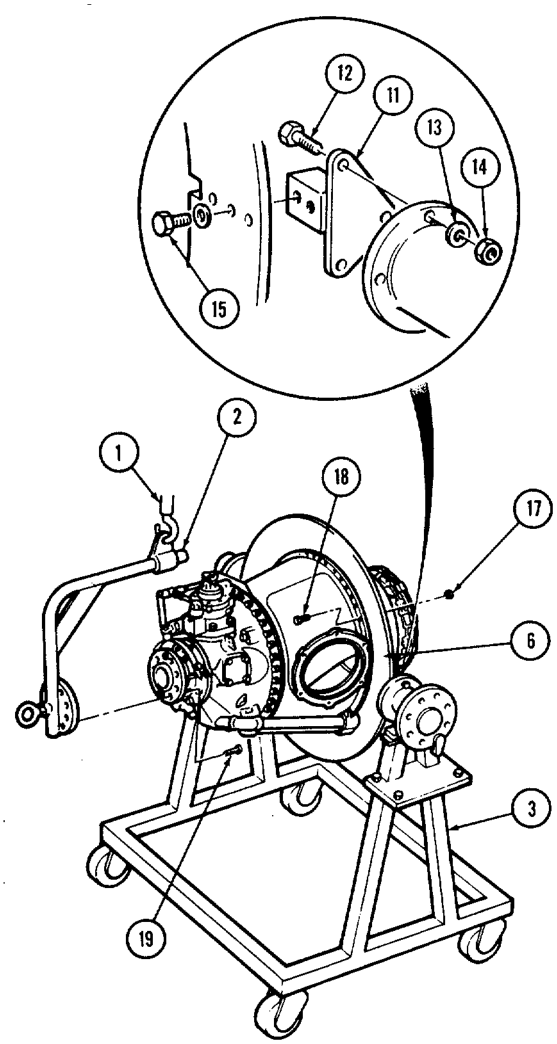
b. Hook up hoist (1) to sling (2) and raise hoist enough to support the weight of the power section.

c. Remove 12 nuts (17) and bolts (18) securing power section to mount ring (6) and move power section clear of stand (3).

d. Remove four capscrews and washers (15) securing mount ring to stand and remove ring.

e. Remove six nuts (14), washers (13) and bolts (12) and two adapters (11) from stand.

f. Refer to Task 4-1-2 Reinstall power section.




1-74 OPERATIONAL CHECK

Refer to Chapter 1, Section X or TM55-1510-209-23.

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## 1-75 INSPECTION OF INSTALLED ITEMS

Inspect engine for:
- damage,
- leaks,
- broken lockwire,
- loose or missing nuts or bolts,
- chafing of tube assemblies,
- full and free movement of controls,
- fraying of electrical harness,
- and loose electrical connections.

## 1-76 DISASSEMBLY

1. Refer to Chapters 2 thru 10 for removal/disassembly (where applicable) of engine components.

**WARNING**

- **When handling combustion chamber internal parts, that have been exposed to fuel containing tetraethyl lead, insure that the by-product (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.**
- **If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.**
- **Gloves and a face mask shall be worn at all times when handling contaminated parts.**

2. Extreme care must be taken to prevent dust, dirt, lockwire, nuts, washers or other foreign matter from entering the engine. If at any time such items are dropped, the disassembly process must stop until the dropped articles are located, even though this may require considerable time and labor.

3. The strength of material at lockwire holes is marginal, therefore lockwire should be cut, not pulled during removal of lockwire.

4. Discard all preformed packings, packing retainers (backup rings), keywashers, cotterpins and gaskets, and replace with new parts during assembly.

5. During the removal of tubes or engine parts look for indications of scoring, burning or other undesirable conditions. To facilitate reinstallation, tag and mark all parts, clips and brackets to indicate their locations.

**CAUTION**

**Dust caps used to protect open lines against contamination should always be installed over the tube ends and not inside. Fluid flow through the lines may be blocked off if lines are inadvertently installed with dust caps inside the tube**

6. Suitable caps, plugs and other sealing devices must be used to protect all openings as soon as they are exposed.

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1-76 DISASSEMBLY (Cont)

7. Use only a plastic or rawhide hammer when removing engine parts. Cover critical engine parts or areas, e. g. compressor or turbine disks, with protective material to safeguard them from scratches, nicks or tool marks.

8. Penetrating oil (E. 7) may be used to facilitate removal of turbines and other hot section parts.

**CAUTION**

**Never mark engine parts with a lead pencil. Such deposits can cause corrosion and burn-out of parts. Do not use either the electrolytic-etch or electric-arc scribe methods to mark engine parts.**

9. For temporary marking of parts, the following materials may be used.

a. Feltwick Pen (E. 24) and Speedry Instant Dry Ink (E. 25)

b. Cado Marker (E. 26)

c. Brushpen No. 57 (E. 27) and Tex Rite Instant Dry Ink (E. 28):

400-1 (Black)
400-2 (Red)
400-7 (Purple)

d. Micro Supreme No. 142 Purple Dye (E. 29)

e. Phano No. 71 Red Pencil (E. 30) f. Colorbrite Silver No.

2101 Pencil (E. 31)

g. Marks-A-Lot (E. 73).

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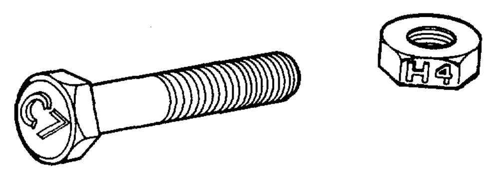
1-76 DISASSEMBLY (Cont)

10. Hardware Identification:

Correct engine reassembly procedures require that particular attention be paid to the material requirements for nuts and bolts used in the hot section of the engine. In those areas where parts must be of material which is resistant to high operating temperatures, special heat-resistant alloys are employed. It is imperative that at reassembly of the engine or its components, the properly identified part (if serviceable) be reassembled in its original location.

Code systems employ the use of the letter C for corrosion resistant steel for normal application and H for heat-resistant alloys in hot-section applications. The stamped or embossed letter will be followed by a number of one or more digits, e. g. CI, C8, H3 and H12, the digit signifying the material specification. Bolt code identification usually appears on the top of the head, and nut identification on one side of the hexagon. When the application is an AN or MS six-digit part number, the code identification C or H will be preceded by the letter E, e. g. EC3 or EK10.

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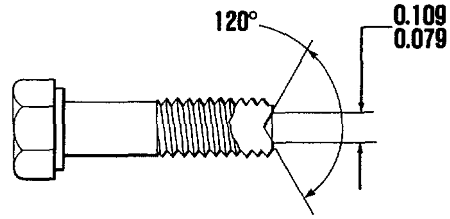
1-76 DISASSEMBLY (Cont)

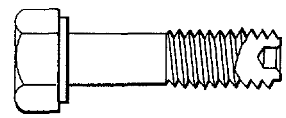
10. Hardware Identification:
(Cont)

The adoption of this program will make it possible for service activities to avoid the assembly of parts with similar physical appearance in locations, which require high heat-resistant parts. In this regard, it is a requirement at time of disassembly to segregate all coded parts, so that two or more will not be scrambled. This will insure that at subsequent reassembly, the coded parts are installed in their proper locations.

It is the practice to use bolts with reduced pitch diameter in the hot section of the engine, to minimize the possibility of bolt and nut seizure. This practice is standard with regard to all applications where the parts are subjected to elevated temperatures. To identify reduced pitch diameter bolts, check for a 120 degrees depression in the threaded end of the bolt. This identifying mark must not be confused with a grinding center which is common with ground thread bolts.




REDUCED PITCH DIAMETER BOLT



STANDARD BOLT

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1-77 CLEANING

1. General

a. Engine cleaning is basically confined to compressor salt removal or performance recovery washes (paragraph 1-77. 3). However, an external wash is recommended whenever the engine is contaminated with salt.

b. To perform a compressor wash, the engine is motored using the starter and washing fluids are sprayed into the engine intake through a wash wand or a high flow (2 to 3 gal. /min) 7. 57 to 11. 36 liters/min) spray ring.

c. Motoring washes are carried out at an Ng of 14 to 25% and the water or cleaning mixture, which is pressurized at 30 to 50 psi is sprayed into the compressor inlet via the high-flow spray ring or wash wand. Washing while motoring the engine insures that the cleaning mixture remains in liquid form.

d. Depending on the operating environment, it is recommended that the frequency of compressor washing follow the directives contained in Table 1.

e. For cleaning of Specific Parts, refer to paragraph 1-77. 4.

2. Engine External Wash

**CAUTION**

**Before performing an external wash, the engine must be allowed to cool for a minimum of 40 minutes after shutdown.**

An external wash with fresh water is recommended when the engine is contaminated with salt. The engine must never be left for an extended period, such as overnight, in a contaminated condition.

3. Compressor Wash

a. Equipment Required:

(1) Wash wand or ring, 2 to 3 gpm flow rate (refer to Appendix D)

(2) Two stainless steel 5 gal. containers

(3) Mechanical agitator

**WARNING**

COMPRESSOR AIR

Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face. Use goggles to protect eyes and face.

DO NOT exceed 30 psig.

DO NOT direct airstream towards yourself or another person.

(4) Compressed air or nitrogen supply regulated up to 50 psig

(5) Supply of drinking water. Criteria for drinking water is as follows:

**GO TO NEXT PAGE**

**SECTION VIII GENERAL MAINTENANCE PROCEDURES (Continued)**

1-77 CLEANING (Cont)

Appearance: Free of suspended solids

Total solids: 175 ppm maximum

Ph: 6.0 to 8.0 inclusive

Chlorides: 15 ppm maximum

Sulphates: 10 ppm maximum

TABLE 1 - WASH SCHEDULE

| OPERATING ENVIRONMENT | NATURE OF WASH | FREQUENCY | REMARKS |
|---|---|---|---|
| Continuously salt laden | Salt Removal | Daily | When the exterior of an engine is contaminated with salt, an external engine wash should be carried out, using fresh water. A salt-contaminated engine is not to be left for an extended period of time, such as overnight, without cleaning. |
| Occasionally salt laden | Salt Removal | Weekly | Adjust washing frequency to suit engine condition. |
| All | Performance Recovery | 100 to 200 hours | Performance recovery washes are required less frequently. Adjust washing frequency to suit engine operating conditions as indicated by engine condition trend monitoring system. A motoring wash for light soil or multiple motoring washes for heavy soil contamination is recommended. |

NOTE

Multiple motoring wash should be performed to the extent permitted by starter operating limitations. Observe starter cooling period. (Refer to TM 55-1520-209-10.)

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**SECTION VIII GENERAL MAINTENANCE PROCEDURES (Continued)**

1-77 CLEANING (Cont)

3. Compressor Wash (Cont)

   a. Equipment Required (Cont).

      (6) One pressure gage (O to 100 psi).

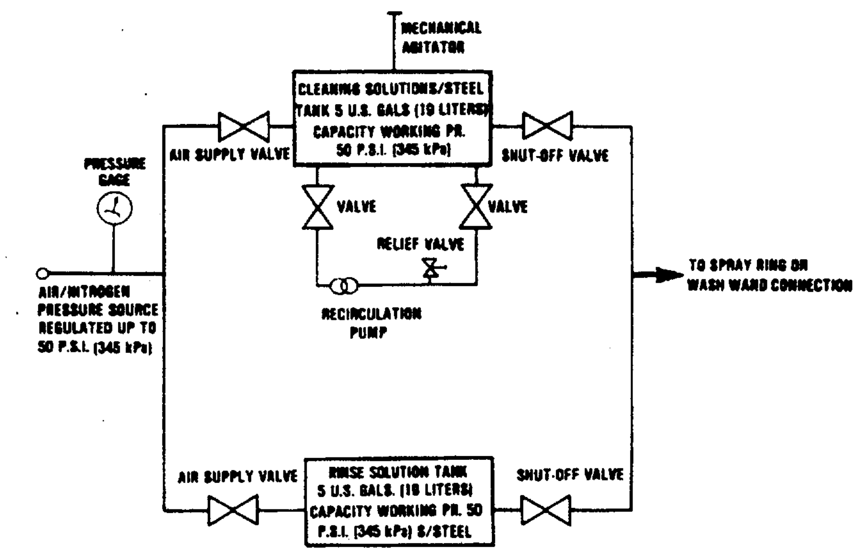
      (7) Two air supply valves.

      (8) Two fluid shutoff valves.

      (9) Suitable tubing-connections to be 5/16 inch minimum.

      (10) Two flow control valves for recirculation pump.

   b. Set up wash system as shown.

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1-77 CLEANING (Cont)

3. Compressor Wash (Cont)

c. Prepare 5 gal of cleaning solution using one of the following cleaning agents:

**Warning**

**TOXIC AND FLAMMABLE SOLVENTS**

**Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame.**

- **Use only in a well-ventilated area.**
- **Wear rubber gloves.**
- **In case of contact, immediately flush skin or eyes with water for at least 15 minutes.**
- **GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

(1) Turco 5884 (Concentrate) (E.49) (Mix as in Table 2).

(2) Ardrox 624 (Concentrate) (E.56) (Mix as in Table 2).

(3) Magnus 1214 (E.52) (Mix as in Table 3).

(4) B&B 3100(E.51) (Mix as in Table 3).

**NOTE**

**B&B 3100 (MIL-C-85704, Type I) is the primary cleaner for Army turbine engines and remains an approved cleaner for locales where environmental restrictions permit. Engine cleaners that conform to MIL-C-85704, Type II and Type IIA are also acceptable engine cleaners and meet EPA environmental requirements. Continue use of B&B 3100 where not restricted. Where restrictions apply use MIL-C-85704, Type II and Type IIA cleaners. Approved Type II and Type HA cleaners shall be used in accordance with the existing washing procedure. Type HA cleaners do not require dilution with water. Both types of cleaners are less effective than Type I cleaners. Thereforemore frequent engine washes may be required to achieve satisfactory results.**

(5) MIL-C-85704, Type II or Type IIA cleaners (items E.85, E.86, E.87. E.88, Appendix C).

1-77 CLEANING (Cont)

3. Compressor Wash (Cont)

(5) WCT.

**NOTE**

**Solution comprises:**
**2 parts Witco HE-59B (E.53)**
**or Witco P10-59B (E.54)**
**4 parts Carbitrol (E.55)**
**1 part Triethanolamine (E.33)**
**(Mix as in Table 3)**

(6) CLIX (E.57) (Mix as in Table 3).

**TABLE 2 - MIXING SOLUTIONS - % VOLUME**
(Refer to Subparagraphs 3c(1) and (2))

| AMBIENT TEMPERATURE | CLEANING AGENT | KEROSENE (E.10) (See Note) | METHANOL (E.32) | WATER (E.6) |
|---|---|---|---|---|
| + 36°F and up | 4% | 40% | - | 56% |
| - 12°F to + 36°F | 4% | 40% | 20% | 36% |
| Below - 12°F | 4% | 40% | 36% | 20% |

**NOTE:**
**To prevent separation of Kerosene (E.10), add 0.2 quart Witco HE-59B (E.53) and shake well.**

**TABLE 3 - MIXING OF SOLUTIONS -% VOLUME**
(Refer to Subparagraphs 3c(3) through (6)

| AMBIENT TEMPERATURE | CLEANING AGENT | KEROSENE (E.10) (See Note) | METHANOL (E.32) | WATER (E.6) |
|---|---|---|---|---|
| + 30°F and above | 25% | - | - | 75% |
| - 12'F to + 36°F | 25% | 15% | 20% | 40% |
| Below - 12'F | 25% | 15% | 40% | 20% |

**NOTE:**
**To prevent separation of Kerosene (E.10), add 0.2 quart Witco HE-59B (E.53) and shake well.**

GO TO NEXT PAGE

1-77 CLEANING (Cont)

3. Compressor Wash (Cont)

d. Prepare 5 gallons of rinse solution (Refer to Table 4).

**TABLE 4 MIXING OF RINSE SOLUTION (BY VOLUME)**

| AMBIENT TEMPERATURE | WATER | METHANOL |
|---|---|---|
| + 36°F and above | 100% | - |
| - 12°F to + 30°F | 50% | 50% |
| Below - 12°F | 40% | 60% |

e. Performance Recovery Motoring Wash

**WARNING**

**OPERATION OF AIRCRAFT ON GROUND Engines shall be started and operated only by authorized personnel.**

**CAUTION**

**Use of the correct mixture as specified in subparagraph 3.c., is very important, not only when the temperature is below freezing at the time of washing, but also if the temperature is expected to be low between the time of washing and the next start.**

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**CAUTION**

**Do not motor engine for more than 30 seconds. Observe starter cooling period.**

**NOTE**

**To prevent deposits caused by the use of hard water, engine must be allowed to cool to below 150°F. Minimum cooling period of 40 minutes must be allowed since the engine was last operated.**

(1) Connect wand or wash ring to supply from wash rig.

(2) Fill wash tank with prepared solution (Refer to subparagraph 3.c,).

(3) Pressurize tank at **30 to 50 psi** with air or nitrogen supply.

(4) Disconnect P3 air line from FCU (Task 10-4).

(5) Insure that the ignition switch is OFF.

(6) Insure that compressor bleed air is off or disconnected.

(7) Fuel boost pump ON.

(8) Throttle lever at idle.

(9) Shut off lever is in OFF position.

1-77 CLEANING (Cont) 3. Compressor Wash (Cont)
e. Performance Recovery Motoring Wash (Cont)

(10) Open supply valve and inject cleaning solution.

(11) Immediately commence motoring the engine with the starter, while injecting the fluid for a period not to exceed **30 seconds.**

(12) Allow a soaking period of **15 minutes (30 minutes maximum).**

(13) Open supply valve to inject **1-1/4 gallons** of rinse water. A rinse solution of equal parts potable water and alcohol is recommended for temperature of **35°F to -20°F.**

(14) Motor the engine over, while injecting rinse water for a maximum of **one minute.**

(15) Allow starter to cool for **3 minutes.**

(16) Repeat rinse cycle (steps (13)and (14))only one time.

(17) Allow starter to cool for **5 minutes.**

(18) Perform motoring cycle to dry out the engine for a maximum of **one minute.**

**CAUTION**

**Starter should be allowed to cool for at least 30 additional minutes prior to using again.**

f. Salt Removal Motoring Wash

**WARNING**

**OPERATION OF AIRCRAFT ON GROUND Engines shall be started and operated only by authorized personnel.**

**CAUTION**

**Use of correct mixture (Refer to Table 4) is very important, not only when the temperature is below freezing at the time of rinsing, but also if the temperature is expected to be low between the time of washing and the next start.**

**NOTE**

**To prevent deposits caused by the use of hard water, engine must be allowed to cool to below 150°F. Minimum cooling period of 40 minutes must be allowed since engine was last operated.**

(1) Connect wand or wash ring to supply from wash rig.

GO TO NEXT PAGE

1-77 CLEANING (Cont)

3. Compressor Wash (Cont)

f. Salt Removal Motoring Wash (Cont)

(2) Fill rinse tank with prepared solution (Refer to Table 4).

(3) Pressurize tank 30 to 50 psi with air or nitrogen supply.

(4) Disconnect P3 air line from FCU (Task 10-4).

(5) Insure that ignition switch is OFF.

(6) Insure that compressor bleed air is off or disconnected.

(7) Fuel boost pump ON.

(8) Throttle lever at idle.

(9) Shutoff lever in OFF position.

(10) Open supply valve and inject rinse solution.

(11) Immediately commence motoring the engine with the starter while injecting the fluid for a period not to exceed 30 seconds.

**CAUTION**

**Do not motor engine for more than 30 seconds. Observe starter cooling period.**

(12) When Ng falls to **5%,** close tank valve.

(13) Observe starter cooling period.

(14) If water/methanol solution has been used, carry out a **30-second** dry motoring run to purge the engine of volatile fumes.

(15) Remove wand or wash ring.

(16) Switch ignition ON and start engine. Run engine at 80% Ng for one minute or more to completely dry the engine.

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1-77 CLEANING (Cont)

4. Specific Parts

**WARNING**

**TOXIC AND FLAMMABLE SOLVENTS**
**Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame.**

- **Use only in a well-ventilated area.**
- **Wear rubber gloves.**
- **In case of contact, immediately flush skin or eyes with water for at least 15 minutes.**
- **GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

a. Air inlet screen (1) Clean with Petroleum Solvent (E.8).

**WARNING**

**COMPRESSOR AIR**

**Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face.**

**Use goggles to protect eyes and face.**

**DO NOT exceed 30 psig.**

**DO NOT direct airstream towards yourself or another person.**

(2) Dry with clean compressed air.

b. Thermocouple probes

(1) Blast with Grit (E.58) at **25 psi** with nozzle **3 inches** from probe; remove all deposits.

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1-77 CLEANING (Cont)

4. Specific Parts (Cont)

c. Oil Filter Metal Type element.

**CAUTION**

**No cleaning is permitted of Fiber Type elements.**

(1) Plug opening at each end with suitable rubber plugs.

(2) Shake in petroleum Solvent (E.8).

**WARNING**
**COMPRESSOR AIR**

**Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face.**

**Use goggles to protect eyes and face.**
**DO NOT exceed 30 psig.**
**DO NOT direct airstream towards yourself or another person.**

(3) Allow to dry in clean environment or dry with clean compressed air.

(4) Repeat procedure until element is clean.

d. Fuel manifold adapters.

(1) Immerse adapters in cold carbon remover (E.63) for 10 to 30 minutes.

**NOTE**

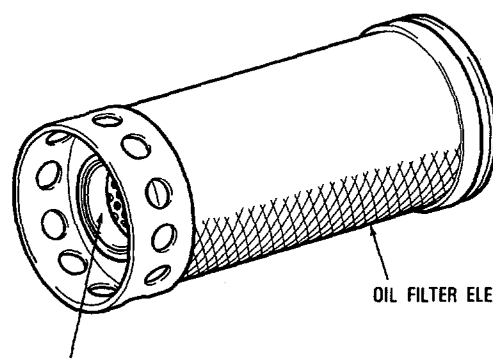
**It may be necessary to prolong soaking to remove all deposits.**

**WARNING**

**Avoid contact with hot water to prevent burns.**

(2) Rinse thoroughly in hot water 1500F to 2000F.

(3) If, after rinsing, any cleaning compound remains, pressure wash with Varsol (E.9) then remove excess fluid with clean compressed air.

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1-77 CLEANING (Cont)
4. Specific Parts (Cont)

e. Fuel nozzles

**CAUTION**

**Do not brush nozzles without air pressure as small carbon particles might enter and effectively block orifices.**

(1) Clean fuel nozzles that exhibit signs of carbon buildup by brushing lightly with a soft-bristled brush, at the same time directing clean, dry, filtered air into fuel inlets of nozzle.

f. Fuel pump inlet screen (1) Wash in Varsol (E.9).

(2) Dry using clean compressed air at 15 psig, blowing air inward through element.

g. Chip detector

**CAUTION**

**Refer to Inspection, Paragraph 1-78 before cleaning.**

GO TO NEXT PAGE

(1) Clean, using stiff brush and Varsol (E.9).

**WARNING**

**COMPRESSOR AIR Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face.**

**Use goggles to protect eyes and face.**
**DO NOT exceed 30 psig.**
**DO NOT direct airstream towards yourself or another person.**

(2) Dry with clean compressed air.

h. Glow plug

(1) Immerse element end of glow plug in cold carbon remover (E.63) for 10 to 30 minutes.

1-77 CLEANING (Cont)

4. Specific Parts (Cont)

(2) Remove from cold carbon remover and brush off loosened carbon deposit with soft nylon brush.

**WARNING**

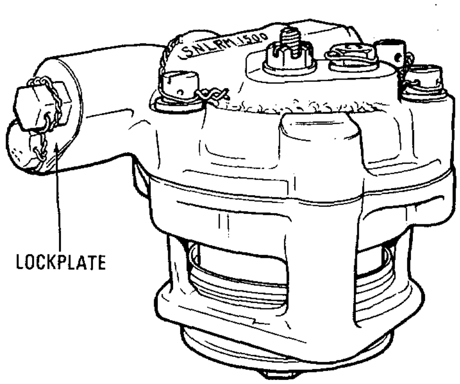
**Avoid contact with hot water to prevent burns.**

(3) Rinse element end in hot water 150°F to 200°F.

**WARNING.**

**COMPRESSOR AIR Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face.**

**Use goggles to protect eyes and face.**
**DO NOT exceed 30 psig.**
**DO NOT direct airstream towards yourself or another person.**




EARLIER CONFIGURATION

(4) Thoroughly dry using clean compressed air.

i. Compressor Bleed Valve

**CAUTION**

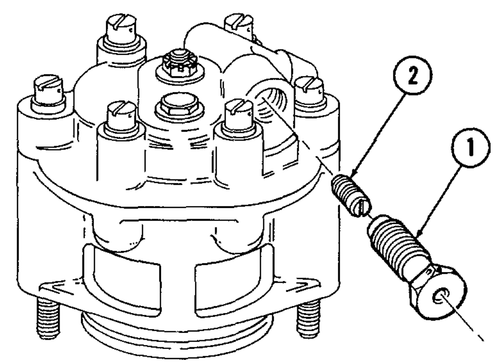
**Earlier configurations have calibration valves installed, easily recognized by the lockplate on the boss. These bleed valves shall not be disassembled at the AVIM level.**

(1) On later configurations, remove lockwire, remove metering plug (1) and nozzle (2).

(2) Wash plug and nozzle in Petroleum Solvent (E.8).

**NOTE**

**Use a wooden dowel to clean orifices.**




LATER CONFIGURATION

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**Section VIII GENERAL MAINTENANCE PROCEDURES (Continued)**

1-77 CLEANING (Cont)

4. Specific Parts (Cont)

**WARNING**
**COMPRESSOR AIR**

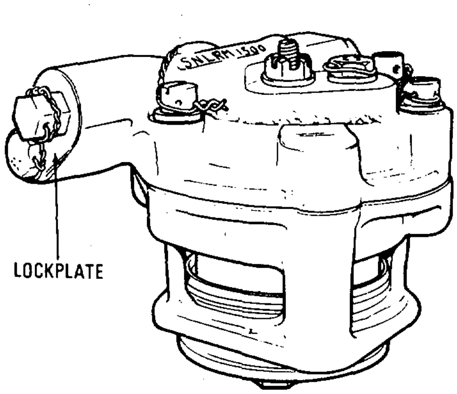
**Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face.**

**Use goggles to protect eyes and face.**
**DO NOT exceed 30 psig.**
**DO NOT direct airstream towards yourself or another person.**

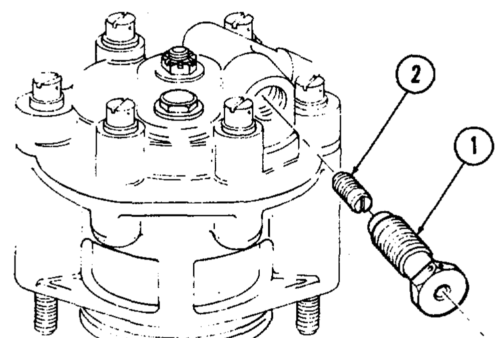
(3) Dry with clean compressed air.

(4) Install nozzle (2), torque to 10 to 15 inch-pounds.

(5) Install metering plug (1), torque to 40 to 50 inch-pounds and lockwire.




EARLIER CONFIGURATION




LATER CONFIGURATION

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1-77 CLEANING (Cont)

4. Specific Parts (Cont) j. P3 Air Filter Element (1) Remove filter element (Task 10-5).

(2) Shake element for 5 minutes in clean, unused Petroleum Solvent (E.8).

(3) Allow element to drain and dry in a clean environment.

(4) Inspect (Paragraph 1-78).

(5) Repeat cleaning and visual inspection until element is considered serviceable.

**NOTE**

**Use clean, unused Petroleum Solvent (E.8) each time.**

1-78 INSPECTION

1. General

Damage to engine parts may result from improper clearance, lack of lubrication, undesired movement of parts which are bolted or pressed together, uneven load distribution, heat, shock, extension of minor scratches, tool marks, grinding cracks, nicks, etc. Damage to engine parts may also result from the presence of foreign matter such as grit, chips, moisture, chemicals, etc., or from improper technique during assembly or disassembly.

While it is frequently possible to repair a damaged part so that it may be safely reinstalled, it is important that the cause of the damage be determined, and corrected if possible. Otherwise, more serious consequences may result.

2. Measuring Devices

When an inspection procedure requires a very accurate measurement, a micrometer, vernier or dial test indicator must be used. If a micrometer is to be used, check it for accuracy before taking a measurement. Make sure that the contacting surfaces of the part to be measured are clean and free from burrs. When using a depth micrometer, be sure to hold the anvil tightly and squarely against the contacting surface. If a dial test indicator is used, make sure that indicator support is firmly anchored and any swivel connections tightened securely. When using feeler gage or no-go gage, proceed as follows:

When taking measurements with a feeler gage, the final size of the feeler must be a reasonably snug fit. Both the plug type and flat type gages are to be used for measuring the amount of wearing of bushings and similar parts.

If the no-go end of a plug gage enters, the part is worn beyond the allowable limit, except when otherwise stated. Because certain parts do not always wear evenly, the flat type gage must be tried at several different

GO TO NEXT PAGE

1-78 INSPECTION (Cont)

2. Measuring Devices (Cont) diameters. If the gage enters at any point, the part is worn beyond the allowable limit.

Whenever rotor components, such as turbine assemblies, are returned to an overhaul facility for inspection and/or repair, a record of total operating hours or flight cycle (as applicable) must be included to enable an overhaul facility to determine service life of assembly.

3. Oil Filter Fiber Type Element.

**CAUTION**

**No cleaning is permitted on this type of element.**

**NOTE**

**Elements are to be inspected every 100 hours and replaced every 300 hours.**

a. Check that seal is properly seated in lower end of filter.

b. If seal is loose, discard element and install replacement.

4. Oil Filter Metal Type Element.

**NOTE**

**Elements are to be visually inspected every 100 hours and replaced every 1200 hours.**

a. If a stepped teflon spacer is installed on inner face of filter cover, check spacer condition and replace as necessary.

b. Inspect for visible metal contamination. If no contamination is evident, proceed as detailed in steps c thru f.

c. Clean element (Paragraph 1-77).

d. Using a 10 power (minimum) magnifying glass, inspect filter element for blocked passages and broken wire mesh.

e. If dents and /or broken wire mesh are found, the filter element must be replaced.

f. If more than. five percent of visible passages are found blocked after repeated cleaning, element must be returned to Depot Maintenance for ultrasonic cleaning and a bubble point test.

g. If a small amount of visible metal contamination is evident, proceed as detailed in steps h and i,

GO TO NEXT PAGE

1-78 INSPECTION (Cont)

4. Oil Filter Metal Type Element (Cont)

**NOTE**

**Examples of possible contaminants are:**

- **Small flakes of non-ferrous metal normally originating from plain bearings or bushings of babbit, tin, bronze or silver.**
- **Small flakes of ferrous metal normally originating from spalled anti-friction bearings, gear teeth or fretting.**
- **Slivers of steel normally originating from interference between steel parts or from heavy scoring.**
- **Fuzz or powdered material is cast iron and originates from the propeller shaft oil transfer sleeve.**

It can be assumed that less than 40 small particles of miscellaneous metal, largely nonferrous, can be discounted. In such cases the filter element should be cleaned and reinstalled. It must also be considered that new engines, or engines immediately after extensive shop work, may produce metal contamination at the oil filter. In such cases normal precautions apply. (Refer to TB 43-0106).

**CAUTION**

**In all instances of engine generated metal contamination, there exists the possibility of residual matter remaining in propeller and airframe oil systems. Residual matter could contribute to recontamination of newly installed engine. When an engine is to be replaced, due to metal contamination of the oil system, all airframe components associated with the engine oil system, propeller, propeller governors, tubes and hoses should be flushed according to TM55-1510-209-23 and TM55-1510-215-23. Airframe oil coolers shall be replaced in accordance with applicable airframe manual. Engine oil-to fuel heaters and governors shall be returned to Depot.**

GO TO NEXT PAGE

1-78 INSPECTION (Cont)

4. Oil Filter Metal Type Element (Cont)

h. White Metal

(1) On first discovery, clean oil filter ('Paragraph 1-7.7) and recheck for contamination after **10 hours**.

(2) On second discovery of similar amount of metal, clean oil filter, drain and change oil and recheck after **10 hours.**

(3) On third inspection, if the same amount of white metal continues to be generated, the engine should be shipped to Depot Maintenance for inspection.

i. Bronze or Steel

(1) On first discovery, if there are less than 20 pieces of steel or bronze, clean filter (Paragraph 1-77) and recheck for contamination after **5 to 10 hours.**

(2) On first discovery, if there are more than 20 pieces of steel or bronze, clean filter (Paragraph 1-77), drain oil system and change engine oil (Paragraph 1-71. Perform ground run (Chapter 1, Section X) for **one hour** and recheck.

(3) If on recheck after one hour of ground run, a greater quantity of steel or bronze is found, the engine should be shipped to Depot Maintenance for inspection.

(4) If on recheck after one hour ground run, a smaller quantity of metal is present, clean filter (Paragraph 1-77) and recheck after **5 to 10 hours.**

(5) If recheck after **5 to 10 hours** reveals presence of similar quantity of steel or bronze metal, the engine should be shipped to an Depot Maintenance for inspection.

5. Chip Detectors If chip detector light has indicated electrical continuity, proceed as follows:

a. Remove chip detector (Paragraph 1-71).

b. If only a single chain of metal slivers bridges gap, clean (Paragraph 1-77) and reinstall detector.

c. If more than 10 small particles are present replace engine.

d. If small amount of fuzz is present:

(1) On first discovery, clean (Paragraph 1-77) and recheck after **10 hours** engine running.

(2) On second discovery, repeat Step (1).

(3) On third discovery, replace engine.

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1-79 REPAIR OR REPLACEMENT

Surface to be welded must be free from protective coatings, dirt, grease, oil, foreign matter, and oxides. Wire brushes and abrasives may be used to remove protective coating and oxides, except that the final step in removing oxides from aluminum and aluminum alloys preferably should consist of chemical treatment taking place as close as practical to the time of welding. Wire brushes must have bristles of austenitic corrosion-resistant steel. No deposit or residue must remain on surface to be welded after cleaning operations.

Because a high percentage of steel parts used on the engine are fabricated from 12 percent chromium corrosion-resistant steels, which are characterized by their susceptibility to air hardening, field repair of cracks by fusion welding is a special problem. The high temperatures at which fusion weld repairs are made and the subsequent air cooling of the part, or parts, from these temperatures usually result in an increase in material hardness and a loss of ductility. Parts on which fusion weld repairs have been made have a tendency to crack because the steel structure becomes unstable, brittle and highly stressed. The structure of the material can be improved by reheating the parts and controlling the cooling rate.

After welding, flux must be removed. If complete removal is not practical, the assemblies should be suitably treated to prevent corrosion by residual flux. After the welding is completed, clean out any holes with a rotary file, then polish with No. 400 Crocus Cloth (E.64).

Components which are not highly stressed may be repaired by fusion welding to restore the original properties of such welded components through the use of local heat treatment. The localized heat may be applied by the neutral flame of an oxyacetylene torch. Extend the stress relief one inch minimum beyond the welded area. After the desired heat has been applied to the component for the proper length of time, reduce temperature gradually.

Inspect the weld for quality, uniformity, undercutting, cracking and flux removal. Welds must blend into the adjacent metal in gradual, smooth curves. Welds must be sound, clean, free from foreign material, and from internal and external defects that would adversely affect the strength of the weld.

1-80 TESTING

Test of assemblies is detailed in Chapter 2 thru 10.

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1-81 PAINTING

Refer to repairs detailed in Chapters 2 thru 10.

1-82 LUBRICATION

Refer to TM1-42B-1-7.

1-83 REASSEMBLY

1. Use only a plastic or rawhide hammer, if necessary, when installing engine parts. Cover critical engine parts or areas, e.g. compressor or turbine disks, with protective material to safeguard them from scratches, nicks or tool marks.

2. Whenever adhesive tape has been applied to any part, the tape must be removed and the part thoroughly cleaned of all tape residue with Petroleum Solvent (E.8), prior to being subjected to elevated temperatures during engine run. Test results indicate that all tapes are capable of causing surface attack, and/or reduction in tensile ductility as temperature is increased. Do not, under any circumstances, leave tape or tape residue on engine parts.

3. Preformed Packings

Replace with new parts during assembly. Insure that correct parts are used by checking part numbers, also confirm that replacement packings show no signs of damage or deterioration due to storage. Inspect all parts for burrs or sharp edges that may damage preformed packings and gaskets during subsequent assembly. Avoid the use of sharp-pointed or sharp edged tools. Where packing retainers are to be fitted, insure concave face of retainer faces toward preformed packing. Prior to installation, new O-ring type preformed packings should be coated with a thin film of lubricant to the following specifications:

a. Packings used in engine fuel system: Lubricating Oil (E.2) or (E.71) or Petrolatum (E.20).

b. Packings used in engine oil system: Lubricating Oil (E.2) or (E.71).

c. Packings used in engine pneumatic system, Petrolatum (E.20).

4. Antigalling and Anti-seize Compounds

The following compounds are recommended for specific applications:

a. Molykote M77 (E.21) should be used on all loose fit accessory spline drives, which are external to the engine and have no other means of lubrication. Plastilube No. 3 Grease (E.22) may be used if Molykote M77 is not available.

GO TO NEXT PAGE

1-83 REASSEMBLY (Cont)

4. (Cont)

b. Molykote G or Z (E.23) in either its paste form (Type G) or powdered form (Type Z) mixed with engine oil or grease may be used for turbine shaft splines and threads during assembly of these and other components which are subjected to operating temperatures in excess of **(800°F) (327°C) .**

5. Locking Devices

a. Lockwire, lockwashers, tablocks, tabwashers, keywashers and cotterpins must never be reused. All lockwire and cotterpins must fit snugly in the drilled holes provided in bolts and studs for locking purposes. Install a cotterpin so that the head fits into the castellation of the nut and, unless otherwise specified, bend one end of the cotterpin back over the stud or bolt and the other end flat against the nut. Bushings and plugs must be lockwired to the boss or case. Do not lockwire the plug to the bushing.

b. The terms keywasher, tabwasher and cupwasher are interchangeable, as used in this manual. These types of washers must only be used once. New washers must always be used at each assembly. When bending or setting the tabs on these washers, do not use sharp-pointed tools. Use of such tools can lead to subsequent failure of the locking tabs which, on becoming detached, can pass through the engine, causing extensive damage.

c. Retaining rings must be installed using approved retaining ring pliers. Internal type rings must not be compressed beyond the point where ends of the ring would meet. External type rings must be expanded only enough to allow installation without becoming bent. After installation, insure each retaining ring is completely seated in its groove, without looseness or distortion.

d. Effective locking of slotted steel locknuts on bolts or studs requires full engagement of all locknut threads. The chamfered part of the locknut ID does not exert force on the bolt or stud.

e. There are many combinations of lockwiring techniques; however, certain basic rules apply to all. The basic rules are as follows:

(1) Lockwire must be tight after installation to prevent failure due to rubbing or vibration.

(2) Lockwire must be installed in a manner that tends to tighten and maintain a part locked in position, thus counteracting natural tendency of part to loosen due to vibration.

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1-83 REASSEMBLY (Cont)

5. Locking Devices (Cont)

(3) Lockwire must never be overstressed. It will break under vibration if twisted too tight on installation. The lockwire should be pulled taut when being twisted, but should have minimum tension, if any, when secured.

(4) Lockwire ends must -be bent, after cutting, toward the engine or part, to avoid sharp or projecting ends which may present a safety hazard or vibrate in the airstream.

(5) Internal lockwiring must not cross over or protrude into flow passages when an alternative wiring method can be used.

(6) Before installing lockwire, confirm that all parts of components to be lockwired are correctly torqued and that the associated wiring holes are positioned correctly with respect to each other. When there are two or more parts, it is desirable that the holes in the parts be in the same relative positions.

**CAUTION**

**Parts must never be overtorqued or loosened to facilitate correct alignment. It should however, be possible to obtain correct alignment within the specified torquing limits for the part. If it is not possible to obtain correct alignment within specified torque limits, remove part and install replacement.**

(7) To prevent damage to twisted portion of wiring, when using pliers or twisting device, grasp wire at the ends or at a point on wire which will not be twisted.

**CAUTION**

**Lockwire must not be nicked, kinked or damaged in any form. Never twist the wire ends off with pliers, and when cutting off surplus, insure at least three complete turns remain after locking part. Insure no surplus lockwiring falls into engine. The strength of lockwire holes on parts is marginal; therefore, when removing lockwire, never twist wire off to remove; always cut.**

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**Section VIII GENERAL MAINTENANCE PROCEDURES (Continued)**

1-84 TEST PROCEDURES

Refer to Chapter 1, Section X, and Chapters 2 thru 10.

1-85 INSTALLATION

Refer to TM55-1510-209-23 for installation of engine in aircraft.

Replacement or reinstallation of engine or assemblies will require adjustment, servicing, testing or operational check of the engine.

1-86 ADJUSTMENT

Refer to Chapter 1, Section X.

1-87 OPERATIONAL CHECK

Refer to TM55-1510-209-10 and TM55-1510-209-23.

1-88 PLACE IN SERVICE

Refer to TM55-1510-209-23.

END OF SECTION

## Section IX PREPARATION FOR STORAGE AND SHIPMENT

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Puller (T.24)
Sling (T.43)
Pressure Gage (0 to 10 psi)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.4)
Preservative Oil (E.34)
Anti-corrosion Compound (E.35)
Polyethylene Sheet (E.36)
Desiccant (E.37)
Waterproof Envelope (E.59)
Humidity Indicator (E.76)

Parts:
Packings
Cotterpin

Personnel Required:
68B Powerplant Mechanic

References:
TM55-2840-251-23P
TM55-1510-209-23
TM55-1510-215-23
TM55-4920-328-13
MIL-STD-129

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

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1-89 PRESERVATION

1. Disconnect aircraft or METS fuel supply line at oil-to-fuel heater (1).

2. Connect a supply of filtered (10 micron) Preservative Oil (E.34) to oil-to-fuel heater (1). Supply oil at **5 to 25 psi** at a temperature of **60 °F**.

3. Remove lockwire and disconnect inlet tube (2) from dump valve (3).

4. Advance power control lever.

5. Motor engine until preservative oil issues from dump valve inlet port.

**NOTE**
**Use a suitable container to receive oil.**

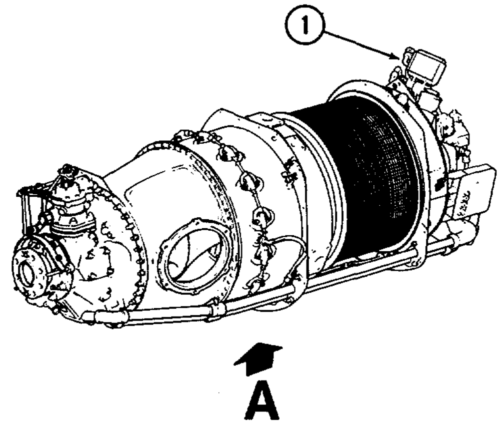
6. Move power control lever back to CUT OFF.

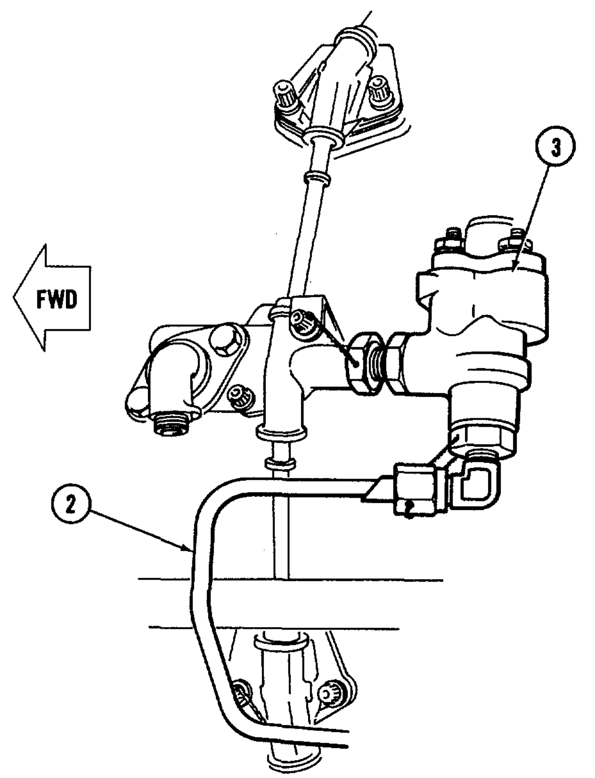
7. Remove preservative oil supply from heater and cap heater inlet port.

8. Reconnect dump valve inlet tube (2), torque **to 65 to 75 inch-pounds** and secure with Lockwire (E.4).

9. Drain engine oil to slow drip (Chapter 1, Section VIII, 1-71).

10. Remove oil filter for drainage (Task 8-1-1).




VIEW ON ARROW A

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**SECTION IX PREPARATION FOR STORAGE AND SHIPMENT**

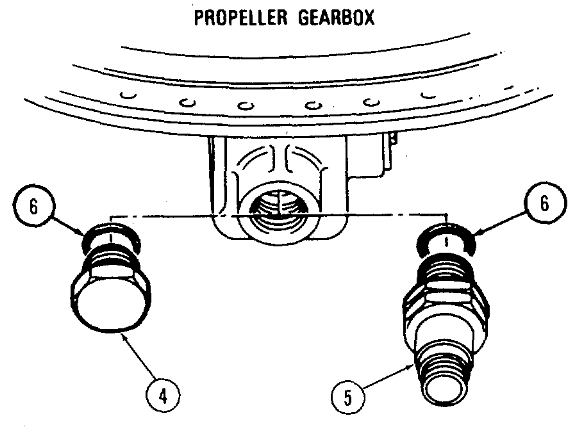
1-89 PRESERVATION (Cont)

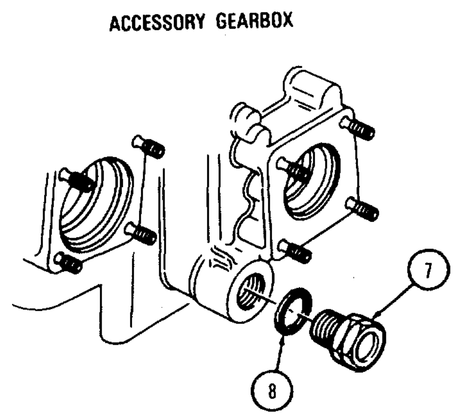
11. Remove lockwire and plug (4), and chip detector (5) and preformed packing (6). Discard packing. Drain oil to a slow drip, into a suitable container.

12. Install packings (6) on plug (4) and chip detector (5). Install plug or chip detector in propeller gearbox; torque plug to 215 to 240 inch-pounds or chip detector to 45 to 55 inch-pounds. Secure with Lockwire (E.4).

13. Remove lockwire and plug (7). Discard preformed packing (8). Drain oil to a slow drip, into a suitable container.

14. Install preformed packing (8) on plug (7). Install plug in accessory gearbox. Torque plug to 215 to 240 inch-pounds and lockwire (E.4).

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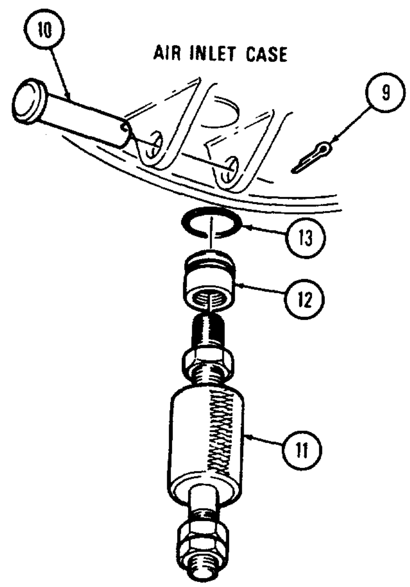
**Section IX PREPARATION FOR STORAGE AND SHIPMENT (Continued)**

1-89 PRESERVATION (Cont)

15. Remove cotterpin (9) from straight headed pin (10) and withdraw pin (10) from compressor inlet case. Discard cotterpin.




16. Using Puller (T.24) (11), remove plug (12). Remove and discard packing (13).

17. Drain oil to a slow drip, into a suitable container.

18. Install preformed packing (13) on plug (12). Install plug (12) into compressor inlet case.

19. Secure with pin (10) and new cotterpin (9).

20. If engine is to remain in aircraft:

a. Install eight bags of Desiccant (E.37) in each of the air inlet and exhaust ducts.

b. Install a Humidity Indicator (E.76) in each of the air inlet and exhaust ducts.

c. Seal air inlet and exhaust ducts with Polyethylene Sheet (E.36).

21. If engine is to be installed in a shipping container:

a. Remove engine (TM55-1510-209-23 or TM55-1510-215-23 if airframe installed, TM55-4920-328-13 if METS installed).

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## Section IX PREPARATION FOR STORAGE AND SHIPMENT (Continued)

1-89 PRESERVATION (Cont)

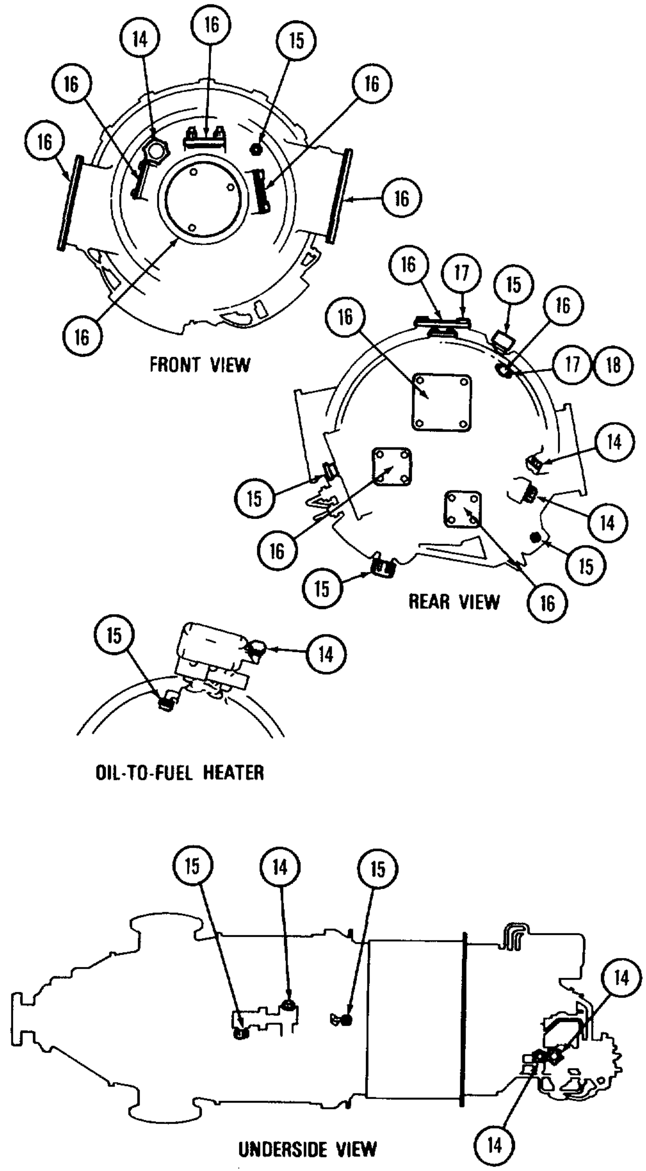
21. If engine is to be installed in a shipping container: (Cont)

b. Remove cover plates from accessory drives not in use. Spray exposed surfaces and gearshafts with Preservation Oil (E.34). Replace cover plates and torque nuts to 65 to 85 inch-pounds.

c. Install shipping plugs (14), caps ( 15), covers (16), bolts (17) and washers (18).

**NOTE**

**Refer to TM55-2840-251-23P for part numbers.**

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1-90 INSTALLATION IN CONTAINER

**WARNING**

**Insure all pressure released before removing container covers.**

**WARNING**

**HOISTING SHIPPING CONTAINER COVER**

- **Do not stand under cover while it is suspended from hoist or while it is being moved from one area to another on a hoist.**
- **To prevent injury to personnel and damage to equipment during handling of cover, periodically check lifting sling.**
- **Do not use equipment which has signs of excessive wear or abuse. Do not use equipment which has unauthorized bolts, pins, etc. If equipment is defective or has unauthorized parts, notify local safety personnel.**
- **Be sure that capacity of lifting device exceeds weight of container, cover and contents, so lifting device will not fail if cover does not release.**

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## SECTION IX PREPARATION FOR STORAGE AND SHIPMENT (Continued)

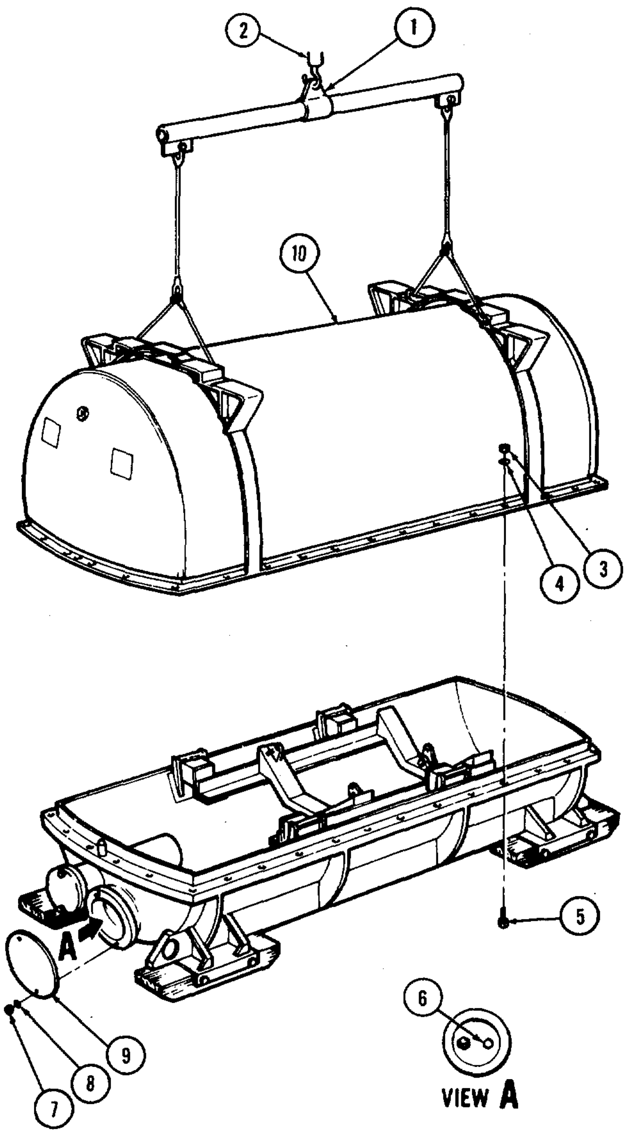
1-90 INSTALLATION IN CONTAINER
(Cont)

1. Remove nuts (7), washers (8) and cover (9).

2. Depress valve (6) to release air pressure from container.

3. Remove nuts (3), washers (4) and bolts (5) from container.

4. Attach sling (T43)(1) and hoist (2) to container cover (10) lifting points and remove cover.

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1-90 INSTALLATION IN CONTAINER
( Cont)

5. Remove shipping brackets (12), gaskets (11), bolts (14) and washers (13) from cloth bag in container.

**NOTE**

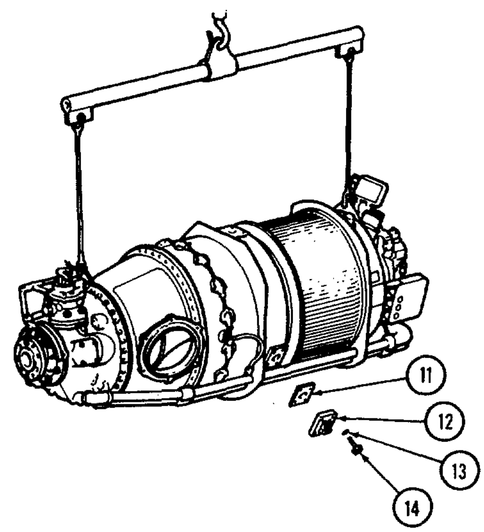
**Insure no loose items are in container.**

**CAUTION**

**Do not use standard commercial hardware to fasten support brackets to engine or container. Use of lower strength hardware, other than specified, could cause serious engine damage during shipping or handling.**

6. Install brackets (12) and gaskets (11) on engine. Secure with washers (13) and bolts (14), torque to 225 to 250 inch-pounds and lockwire (E.4).

7. Insure that inside of container is free of dirt, water, oil or other contaminants and check mating faces of container flanges for distortion or other unserviceable conditions that may affect airtight sealing of flange joints.

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1-90 INSTALLATION IN CONTAINER
(Cont)

**WARNING**

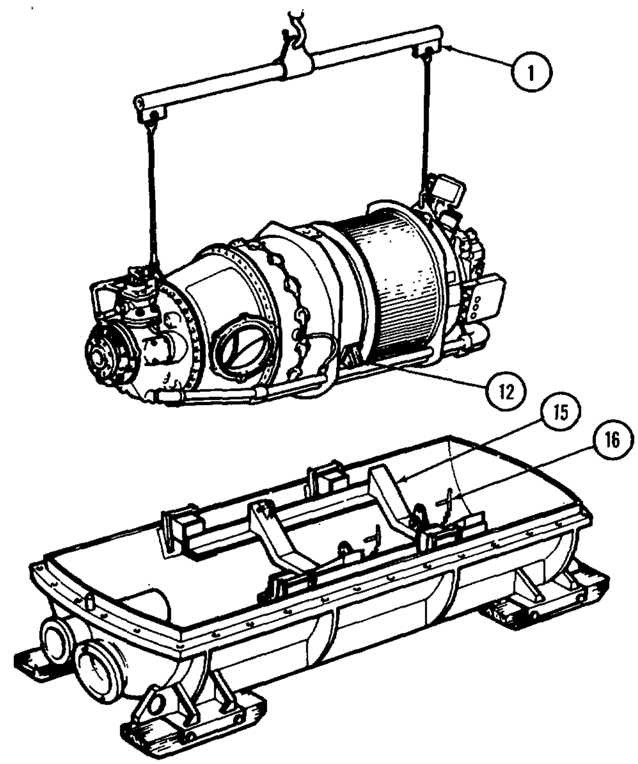
**HOISTING ENGINE**

- **Do not stand under engine while it is being moved from one area to another on a hoist.**

- **To prevent injury to personnel and damage to equipment during handling of engine, periodically check engine lifting sling.**

- **Do not use equipment which has signs of excessive wear or abuse, or which has unauthorized bolts, pins, etc. If equipment is defective or has unauthorized parts, notify local safety personnel.**

- **Be sure that lifting device capacity exceeds combined weight of engine and container.**




8. Install engine in container, attaching brackets (12) to cradle (.15) using quick-release pins (16).

9. Remove sling (1) from engine.

10. Install eight bags Desiccant (E.37) in cage in container. Close cage door and lockwire (E.4).

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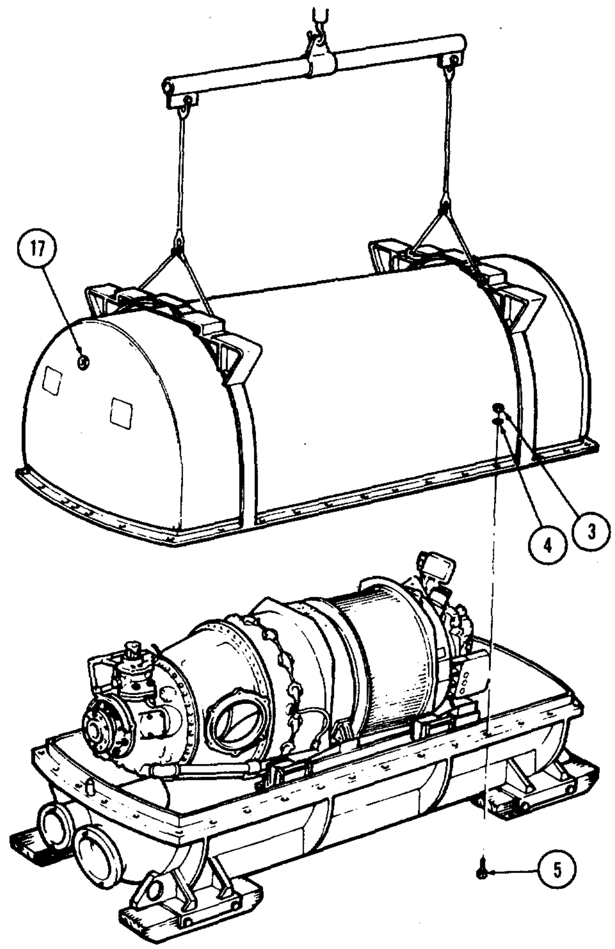
**Section IX PREPARATION FOR STORAGE AND SHIPMENT (Continued)**

1-90 INSTALLATION IN CONTAINER
(Cont)

11. Check that humidity indicator (17) is blue. Replace indicator if pink.

12. Wipe mating flanges and gasket of container halves with clean cloth to remove any dirt or particles, which could prevent pressure sealing. Lower hoist until container halves are joined.

13. Lubricate bolts (5) with Lubricating Oil (E.2) or (E.71) and secure cover to base with bolts (5), washers (4) and nuts (3). Torque nuts to 270 to 300 inch-pounds, progressively.

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**Section IX PREPARATION FOR STORAGE AND SHIPMENT (Continued)**

1-90 INSTALLATION IN CONTAINER
(Cont)

14. Remove nuts (7), washers (8) and cover (9).

**WARNING**

**COMPRESSOR AIR**

**Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face.**

**Use goggles to protect eyes and face.**
**DO NOT exceed 30 psig.**
**DO NOT direct airstream towards yourself or another person.**

15. Connect compressed clean dry air to air charging valve (18) and pressurize container according to ambient temperature.

| AMBIENT TEMPERATURE | | REQUIRED PSI GAGE PRESSURE |
|---|---|---|
| -20°F | (-28.9°C) | 2.000 |
| -10°F | (-23.3°C) | 2.375 |
| 0°F | (-17.8°C) | 2.750 |
| 20°F | (- 6.7°C) | 3.500 |
| 40°F | ( 4.4°C) | 4.250 |
| 60°F | ( 15.6°C) | 5.000 |
| 80°F | ( 26.7°C) | 5.750 |
| 100°F | ( 37.8°C) | 6.500 |

16. Check container for leaks.

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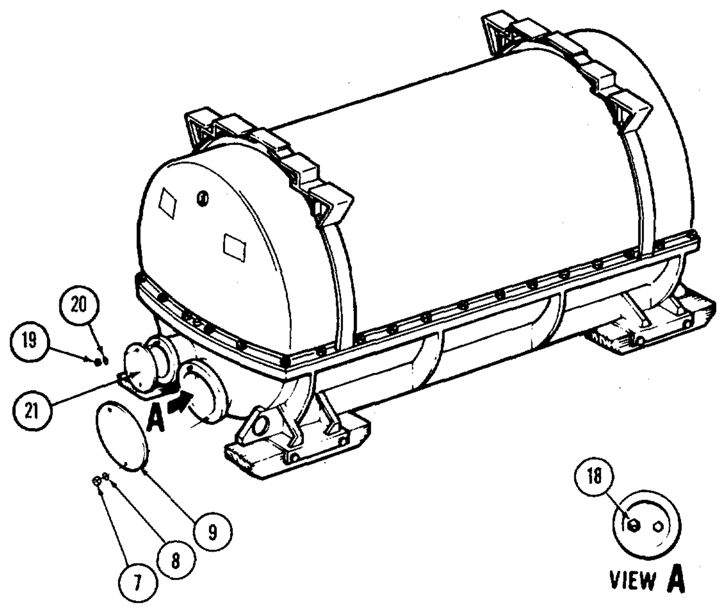


1-90 INSTALLATION IN CONTAINER (Cont)

17. Recheck container pressure after 24 hours, pressure to be within ± 0.5 psig of pressure for ambient temperature.

18. Install cover (9), washers (8) and nuts (7).

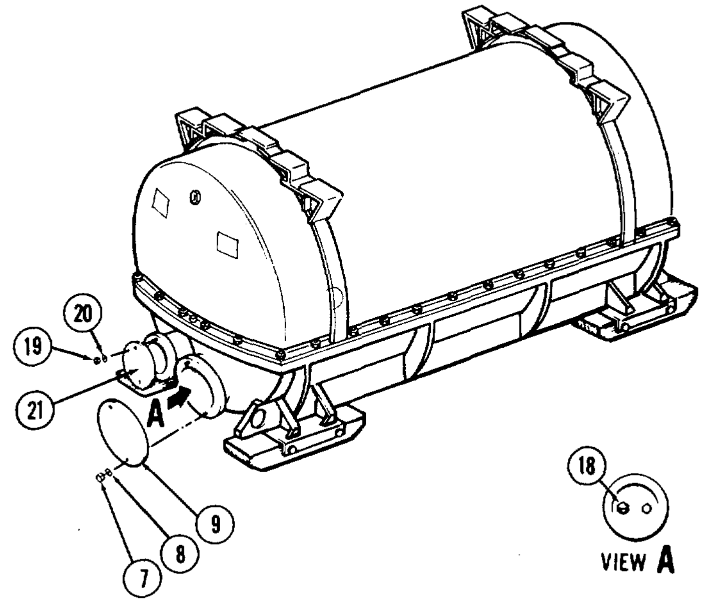
19. Remove nuts (19), washers (20) and cover (21).

20. Wrap engine documents in Waterproof Envelope (E.59) and install in document receptacle.

21. Install cover (21), washers (20) and nuts (19). Lockwire (E.4) nuts.

22. Coat exposed threads with Anti-corrosion Compound (E.35).

23. Mark container with identity of contents and date of installation in accordance with MIL-STD-129.

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1-91 ENGINE STORAGE INSTALLED IN AIRCRAFT

If engine condition is satisfactory, replace Desiccant (E.37) and reseal ducts.

1-92 ENGINE STORAGE IN CONTAINER

1. Inspect humidity indicator and pressure in container every 90 days.

2. If pressure is less than 1 psig, repressurize (Para 1-90.14). Recheck after 7 days; if pressure is not maintained, remove engine to a serviceable container.

3. If humidity indicator is not completely blue, inspect engine for external corrosion. If satisfactory, replace Desiccant (E.37) and reseal container (Para 1-90.9 thru 22).

4. If humidity indicator is completely pink, inspect engine for external corrosion. If severe, return engine to Depot Maintenance.

END OF SECTION

## Section X ENGINE TESTING

INITIAL SETUP

Applicable Configurations:
All

Test Equipment:
NSN 4910-00-167-9178

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.4) and (E.5)
Petrolatum Solvent (E.8)
Engine Fuel (E.19)

References:
TM55-4920-328-13
TM55-1510-109-10/2

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

General Safety Instructions:

**WARNING**
**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

### 1-93. GENERAL

1. For testing engines installed in airframe, follow the procedures in paragraph 1-94. Applicable TMs must be used for engine trim adjustments and performance checks when the engine is installed in the airframe. Refer to related task for removal and installation of pneumatic sense tubes when required during certain checks in this section.

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**Section X ENGINE TESTING (Continued)**

1-93 GENERAL (Cont)

2. For testing engines after maintenance to determine engine flight readiness, using mobile trailer assembly, proceed as in paragraph 1-95. Instructions for preparing engines for test, installing test engines on mobile trailer assembly, prestarting checks, and mobile trailer assembly operation are provided in TM55-4920-328-13.

3. Symbols have been designated for the working variables used in connection with engine testing. The symbols, referenced to the various stations within the engine, and their meanings are described as follows:

| | |
|---|---|
| Pamb | - Ambient pressure |
| Pt2 | - Total pressure - compressor inlet screen |
| P3 | - Compressor discharge air |
| P2.5 | - Compressor interstage air |
| Px | - Enrichment pressure |
| Py | - Governing pressure |
| Tamb | - Ambient temperature |
| Tt2 | - Total temperature - Compressor inlet screen |
| ITT | - Total temperature - interturbine |
| Tt7 | - Total temperature - exhaust |

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**Section X ENGINE TESTING (Continued)**

1-93 GENERAL (Cont)

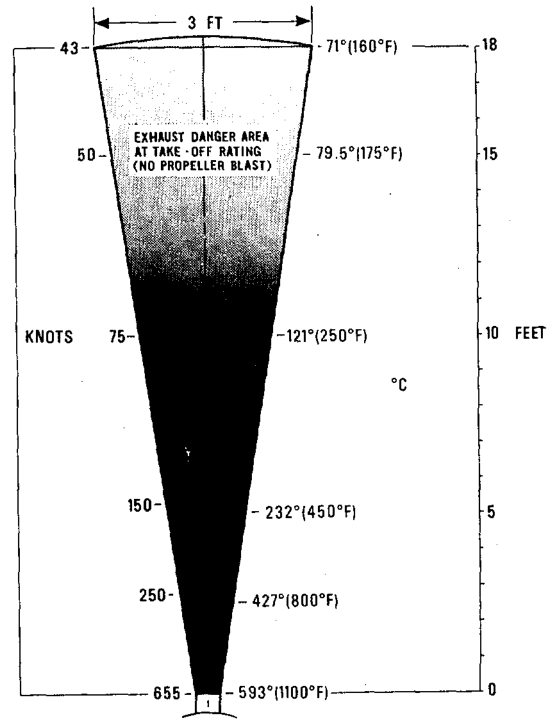
3. (Cont)

| | | |
|---|---|---|
| Wf | - | Fuel flow |
| Ng | - | Gas generator rpm |
| Nf | - | Power turbine rpm |
| Np | - | Propeller rpm |
| shp | - | Shaft horsepower |
| T | - | Torque |
| **d** (delta) | - | Pressure observed/ pressure standard |
| **q** (theta) | - | Temperature observed tempera- ture standard |
| SHP | - | Shaft horsepower corrected |
| **s** (sigma) | - | Atmospheric density ratio |

4. The following ground safety precautions shall be observed:

a. General. To prevent injury to personnel and damage to property, handling and working procedures must be carefully followed. When handling or working on turbine powered aircraft, not only must the propeller area be avoided, but allowances must also be made for the hot, high velocity exhaust gases discharged from the exhaust stubs (see figure).

b. Air Intake. The compressor inlet case design is such that the air intake velocity is very low. Nevertheless, the immediate area of the engine inlet should be free of loose objects, sand, grit, rags, and spilled fluids which could enter through the compressor inlet screen and contaminate or damage the compressor blades.

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1-93 GENERAL (Cont)

4. (Cont)

c. Propeller Windmilling. Propeller must be restrained from windmilling when aircraft is not in use. Windmilling, with zero oil pressure, can cause power section deterioration.

d. Engine Exhaust. At takeoff power settings, the propeller may pick up and throw loose dirt, gravel, and other debris over a considerable distance. Precautionary measures must be taken during the ground running of engines to avoid injury to personnel and damage to property of other aircraft. Occasionally, during the starting of a turbine engine, excess fuel accumulates in the exhaust ducting, and when ignited, causes long flames to be blown from the exhaust stubs. Personnel must insure that the run-up area is clear of inflammable materials and ground equipment.

**CAUTION**

**Continuous exposure to noise can be harmful to hearing. Ear plugs should be used during all engine operations.**

e. Exhaust Gases. The carbon monoxide content of exhaust gases is relatively low, but other gases are present which have a disagreeable odor and are irritating in effect. Exposure normally results in watering of the eyes, accompanied by a burning sensation. Less noticeable, but equally hazardous, is the possibility of respiratory irritation. For both these reasons, exposure should be avoided whenever possible, particularly in confined spaces.

f. Cool Down. After engine operation, allow sufficient cool down time before inspecting or working on the exhaust case.

**WARNING**

**Prolonged contact with Lubricating Oil (E.2) or .(E.71) may cause skin rash. Those areas of skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Saturated clothing should be removed immediately. Areas in which lubricating oil is used should be adequately ventilated to keep mist and fumes to a minimum.**

**CAUTION**

**Lubricating Oil (E.2) and (E.71) may soften paint upon contact. If lubricating oil is spilled on painted surfaces, these surfaces should be thoroughly washed with Petroleum Solvent (E.8).**

GO TO NEXT PAGE

1-93 GENERAL (Cont)

**CAUTION**

**Do not mix oil of different military specifications, since the chemical structure of different brands or specifications of synthetic oil may differ sufficiently to make them incompatible with each other. Should both types of oil become mixed, drain and flush oil system (Section VIII, Paragraph 1-71) and refill with oil.**

g. Use lubricating Engine Fuel (E.19) and Lubricating Oil (E.2) or (E.71).

5. The following test information is relevant:

a. General. The performance of a turbine engine is greatly affected by surrounding atmospheric conditions. For this reason, it is absolutely essential that accurate barometric pressure (not corrected to seal level) and ambient temperature are obtained for the immediate area at the time of engine trimming and performance checks be carried out at low wind velocity with the engine intake facing into wind. Even this precaution will not prevent an unstable trim at moderate-to-high wind velocities.

b. Precipitation. Performance and trim checks should not be attempted during moderate to heavy precipitation or fog. Water entering the engine inlet changes the power output of the engine, the change being proportional to the amount of water ingested. Any form of moisture in the air causes the engine to ingest water. This includes the occasions when water or snow is blown into the air inlet by the propeller or sucked in by the compressor. Freezing rain or slushy snow has exactly the same effect on power output as water ingestion, and in addition may cling to inlet ducts or the inlet screen and upset the flow of air to the engine.

c. Fuel. All trims must be made using the normal Engine Fuel (E.19) used in servicing.

d. Ground Operating Limits. The limits shown in tables 1.9.1 and 1.9.2 are provided as a guide and are based on sea level pressure and temperatures as specif ied.

e. Engine Overtemperature. Overtemperature conditions are usually preceded by an excessively rapid rise in fuel flow, compressor speed, and/or interturbine temperature. Several momentary high overtemperatures affect engine service life just as seriously as a single prolonged lower overtemperature condition. The higher the temperature, the sooner serious engine damage occurs and the more extensive is the inspection required. When an

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**Section X ENGINE TESTING (Continued)**

1-93 GENERAL (Cont)

5. (Cont)

overtemperature condition is anticipated, or has occurred, perform a normal engine shutdown (refer to TM55-1510-20910/2). Avoid an emergency shutdown unless it is obvious that continued operation will result in more than overtemperature damage. For overtemperature limits and corresponding inspection procedures, refer to Section VI, Paragraph 1-25.

f. Engine Unusual Conditions. The unusual conditions referred to are associated with either overspeed, sudden stoppage or lightning strike (Section VI, Paragraph 1-24, 1-27 and 1-29).

g. Engine Overtorque. For overtorque limits, refer to Section VI, Paragraph 1-36.

1-94 GROUND TESTING OF ENGINE INSTALLED IN AIRCRAFT

1. Ground Testing.

Ground testing is intended to give an engine a thorough test for mechanical soundness and for correct indications of operating parameters. To eliminate unnecessary ground testing, the ground test procedure or checks are divided as follows:

Check No. 1 - Pre-start
Check No. 2 - Engine start
Check No. 3 - Part power trim stop
Check No. 4 - Engine performance check
Check No. 5 - Reverse thrust performance
Check No. 6 - Engine shutdown

2. Check No. 1 - Pre-start.

a. Thoroughly inspect engine inlet and insure that it is clear of loose nuts, bolts, tools, and other objects which could cause engine damage and possible subsequent engine failure.

b. Inspect run-up area in vicinity of engine inlet and exhaust and remove any loose object which might possibly be ingested by the engine, or be blown rearward by the velocity of exhaust gases and propeller blast.

c. Check level in oil tank. If engine has remained stationary for a period of more than 12 hours, carry out a motoring run (TM55-1510-209-10/2) and check level of oil before servicing oil tank.

d. Check for signs of oil in exhaust duct and for evidence of oil leaking into air intake.

e. Check for signs of oil in exhaust duct and for evidence of oil leaking into air intake.

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1-94 GROUND TESTING OF ENGINE INSTALLED IN AIRCRAFT (Cont)

2. Check No. 1- Pre-start.
(Cont)

**CAUTION**

**As movement of the fuel cut-off lever unseats the cut-off valve in the fuel control unit, insure that engine fuel shutoff switch is OFF, and fuel boost pump is OFF. This will prevent premature entry of fuel into the engine.**

f. Check engine and propeller controls for full travel, freedom of movement, and correct response.

**CAUTION**

**Do not select reverse with the propeller static as damage will occur to the reversing linkage.**

3. Check No. 2 Engine Start.

a. Introduction. For engine starting procedure, refer to TM 55-1510-209-10/2.

**CAUTION**

**Before attempting engine start, read subparagraph 3.c., following, for procedures to be followed in the event of an unsatisfactory start.**

b. Satisfactory Start. A satisfactory start will be insured providing all the following conditions are met:

(1) Ignition takes place within approximately 10 seconds after moving fuel cut-off lever to OPEN. An ignition is indicated by a rise in interturbine temperature.

**NOTE**

**Actual ignition time is dependent upon the ambient temperature and the amount of torque supplied by the starter. The 10-second time interval is an arbitrary value.**

(2) Engine accelerates to ground idle rpm.

(3) Interturbine temperature does not exceed maximum starting temperature during transition period to ground idle rpm (refer to Operating Limits table).

(4) Oil pressure is 40 psig minimum.

c. Unsatisfactory Start. An unsatisfactory start will occur if one or more of the following conditions take place:

(1) Hot Start Interturbine temperature exceeds starting limit. If greater than normal fuel flow is observed when fuel cut-off lever is moved to open, a hot start may be anticipated and operator should be prepared to abort start before

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1-94 GROUND TESTING OF ENGINE INSTALLED IN AIRCRAFT (Cont)

3.c.(1) (Cont)

interturbine starting limits are exceeded. Hot starts may also be caused by a false start or hung start.

**CAUTION**

**If the interturbine temperature continues to rise, the operator should be prepared to abort the start before the interturbine temperature limits are exceeded.**

(2) False or Hung Start After ignite has occurred, rpm remains at lower than ground idle rpm.

**CAUTION**

**Whenever engine fails to ignite within ten. seconds of moving fuel cut-off lever to open, switch off fuel and ignition. Allow a thirty-second fuel draining period, followed by a motoring run, before attempting another start.**

d. No Start. Engine does not ignite within ten seconds of moving fuel cut-off lever to open. If interturbine temperature gage does not indicate a rise in temperature, or if there is no increase in rpm, place fuel cut-off lever to OFF.

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## Section X ENGINE TESTING (Continued)

### 1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

OPERATING LIMITS

| Power setting | SHP | Gas generator (Ng) 100% = 37,500 rpm % | Gas generator (Ng) rpm | Propeller (Np) 100% = 2,200 rpm % | Propeller (Np) rpm | Maximum observed ITT | Maximum torque ft.lb. | Maximum torque psi | SFC lb/shp/hr | Normal oil pressure psig | Oil temperature range MIL-L-23699 | Oil temperature range MIL-L-7808 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Take-off (8) | 550 | 101.5 | 38,100 | 100 | 2,200 | 1382°F (750°C) | 1315 | 42.5 | 0.683 | 65 to 85 | 50°F to 210°F (10°C to 99°C) | 50°F to 185°F (10°C to 85°C) |
| Military | 538 | | | | | 1338°F (725°C) | 1284 | 41.6 | 0.688 | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |
| Normal | 495 | | | 100 | 2,200 | 1301°F (705°C) | 1122 1178 | 38.2 | 0.705 | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |
| Hi-idle | | | 23,250 ± 250 | | | | 217 TYPICAL | 7.0 | | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |
| Lo-idle | | 50.6 | 19,500 ± 500 | | | 1265°F (685°C)(7) | 115 TYPICAL | 5.0 | | 40 MIN. | -40°F to 210°F (-40°C to 99°C) | -40°F to 185°F (-40°C to 85°C) |
| Starting | | | | | | 1994°F (1090°C) (6) (9) | | | | | -40° MIN. | -40° MIN. |
| Momentary Acceleration | | 102.6 (6) | 38,500 | 110 | 2,420 | 1562°F (850°C) (6) | 1500 (6) | 48.5 (6) | | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |
| Maximum Reverse | 500 | 99.5 | 37,350 | 95 | 2,090 | 1382°F (750°C) | 1263 | 40.8 | | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |

NOTES

1. All limits are based on sea level pressure and ambient temperatures, as specified.
2. Accessory drive seal leakage should not exceed 3 cc per hour.
3. Maximum acceleration time from Hi-idle to 95% take-off power
4. Minimum oil pressure above 28,000 Ng is 65 psig.
5. For rpm, ITT and torque limits, refer to Section VI.
6. These figures are time limited to two seconds.
7. Increase Ng to maintain this limit.
8. This rating is limited to 5 minutes. However, it should be noted that this rating is flat-rated to 70°F (21°C) and that it can be used continuously in an emergency.
9. Nominal ITT for starting is 1697°F (925°C).
10. The maximum limits only are shown. For specific ratings and limitations refer to specific airframe manuals.

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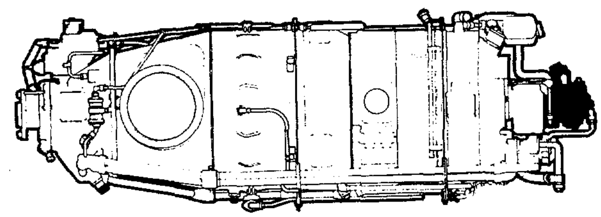
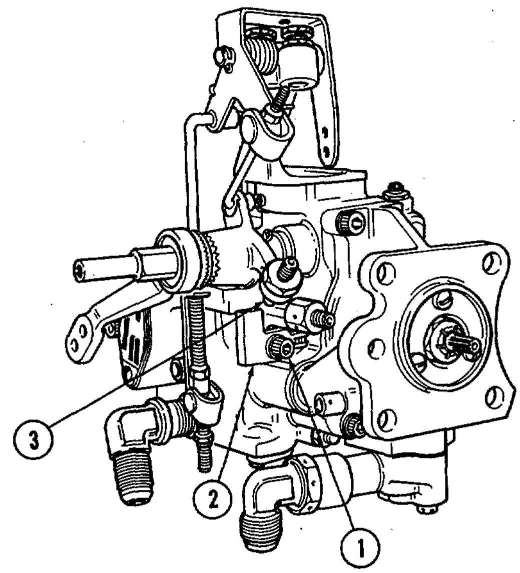
1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT
(Cont)

4. Check No. 3 Part Power Trim.

a. Introduction. Prior to trimming, engine must be brought up to its part power trim output and allowed to run approximately five minutes to bring the engine to normal operating temperatures.



b. Part Power Trim Stop. Fuel control units are calibrated during bench test to insure maximum flow is obtained. The trim stop must be adjusted to individual engines on installation to insure maximum power on a 71°F (21°C) day. If engine inlet temperature is other than this, it would not be possible to set the maximum speed stop without first reaching either an interturbine temperature or a torque limit. To overcome this, a part power trim stop is provided. The stop is a movable spacer placed between gas generator maximum speed (Ng) stop and power lever anvil, and represents a 1700 rpm (Ng) speed drop. This stop is permanently attached to the fuel control unit and is moved from the stowed position for engine trimming.




(1) Loosen screw (1) securing part power trim stop (2) to gas generator maximum speed stop anvil.

(2) Position part power trim stop so that it is between power lever anvil and maximum gas generator speed stop (3).

(3) Tighten screw (1).

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1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

4. Check No. 3 - Part Power Trim. (Cont)

c. Part Power Trim Check.

(1) Engine is trimmed by adjusting gas generator maximum speed stop to part power trim check curve supplied by aircraft manufacturer. This curve allows setting of maximum Ng at reduced power and at all off-standard atmospheric conditions.

**CAUTION**

**Observed gas generator speed should not exceed 97.1% Ng (36400 rpm) during part power trim check and subsequent gas generator maximum speed adjustments. Interturbine temperatures should not exceed the value shown by maximum uptrim line on aircraft manufacturer's part power trim check curve.**

(2) To determine expected power output for an engine under static conditions, proceed as follows:

(a) Obtain ambient air temperature.

(b) Obtain field barometric pressure (not corrected to sea level).

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1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

4.c.(2) (Cont)

(c) Enter part power trim check curve with ambient temperature and proceed vertically upward to intersect field barometric pressure line. From this intersection proceed horizontally to the left and read torquemeter pressure. Record value obtained.

(d) Enter curve with ambient temperature and proceed vertically upward to intersect interturbine temperature line. From this inter- section, proceed horizontally to right to read interturbine temperature. Record value obtained.

(e) Perform pre-start check (subparagraph 2).

(f) Position part power trim stop to limit power lever travel.

(g) Accomplish satisfactory start (refer to TM 55-1510-209-10/2.

(h) Advance power lever to part power trim stop and allow engine to stabilize at this setting for approximately **five minutes at 100% (2200 rpm) Np.**

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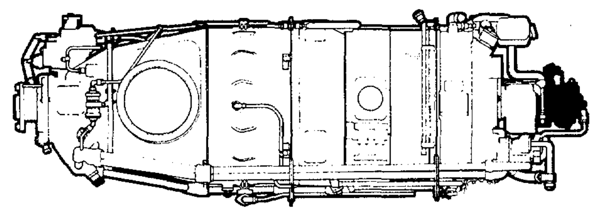
1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

4.c.(2) (Cont)

(i) Check that torquemeter pressure is within 0 to + 31 ft. lb. of value obtained from curve and adjust gas generator maximum speed stop (3). (Refer to Part Power Trim Curve Chart.)

(j) Perform engine shutdown check (subparagraph 7).



**CAUTION**

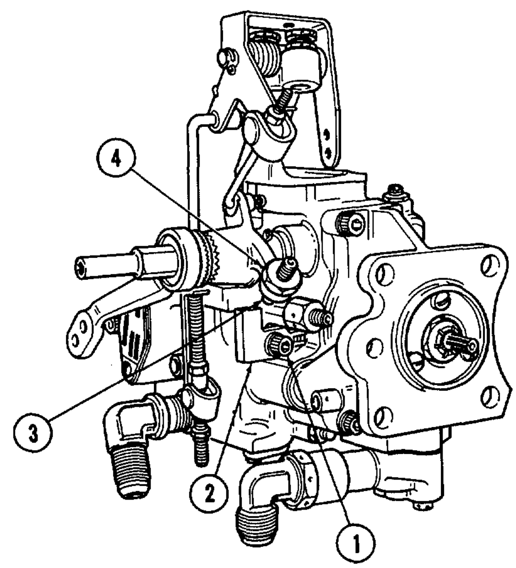
**Part power trim stop must be properly stowed after completion of part power trim checks. Insure that attaching screw is tightened and lockwired.**

(k) Loosen screw

(1) place part power trim stop

(2) in stowed position, tighten screw and secure with Lockwire (E.5).

(1) Lockwire (E.5) gas generator maximum speed stop locknut (4).




d. Data Plate Speed. Data plate speed is gas generator speed (Ng) obtained with engine running at reference power on a standard day **(59°F) (15°C)**. This value is determined from acceptance running, and each engine has its individual value stamped on data plate speed plate in rpm and a percentage of maximum gas generator speed. The reference power in shp $/\delta\sqrt{\theta}$ (Shp corrected) is also stamped on the data plate.

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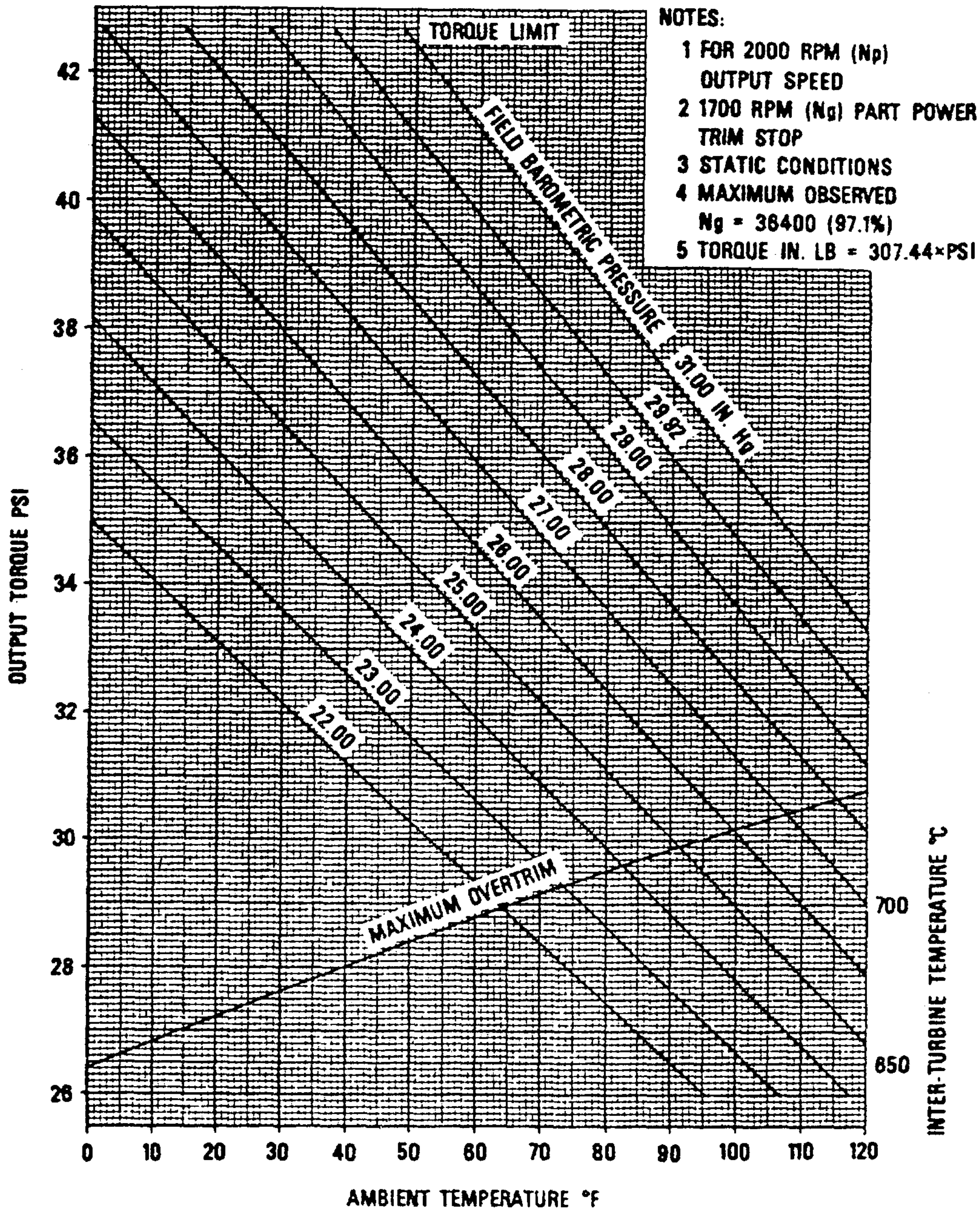
1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

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1-94 **GROUND TEST ON ENGINE INSTALLED IN AIRCRAFT (Cont)**

5. Check No. 4 - Engine Performance Check (Turbine Engine Analysis Check).

a. Periodic engine performance checks must be performed and changes in engine performance noted. The engine performance check curve (refer to figure opposite) is presented as constant torque versus ambient temperature so that engine performance can be checked over a wide range of ambient temperatures without overtorquing the reduction gear- box.

b. All forms of engine deterioration are accompanied by an increase in interturbine temperature and fuel flow at a given power. Compressor deterioration is, in most cases, due to dirt deposits and causes an increase in gas generator speed at a given power setting. This form of deterioration can be remedied by compressor wash (Section VIII, Paragraph 1-77).

c. Hot section deterioration results in decreased gas generator speed at a given power setting. To determine engine performance check parameters, proceed as follows (see aircraft manufacturer's engine performance check curve):

(1) Obtain ambient air temperature.

(2) Obtain field barometric pressure (not corrected to sea level).

(3) Obtain reference rpm from engine data plate.

(4) Enter engine performance check curve with ambient temperature and proceed vertically upward to intersect appropriate field barometric pressure line. From this intersection, proceed horizontally to left to read torquemeter pressure. Record desired torquemeter pressure.

(5) Enter curve with ambient temperature and proceed vertically upward to intersect appropriate field barometric pressure line. From this inter- section, proceed horizontally to left to read fuel flow in lbs/hr. Record desired fuel flow.

(6) Enter curve with ambient temperature and proceed vertically upward to intersect gas generator data plate speed line. From this intersection, proceed horizontally to left to read desired ratio (gas generator speed + data plate speed). Record desired ratio.

(7) Enter curve with ambient temperature and proceed vertically upward to intersect interturbine temperature line. From this intersection, proceed horizontally to left to read interturbine temperature. Record desired interturbine temperature.

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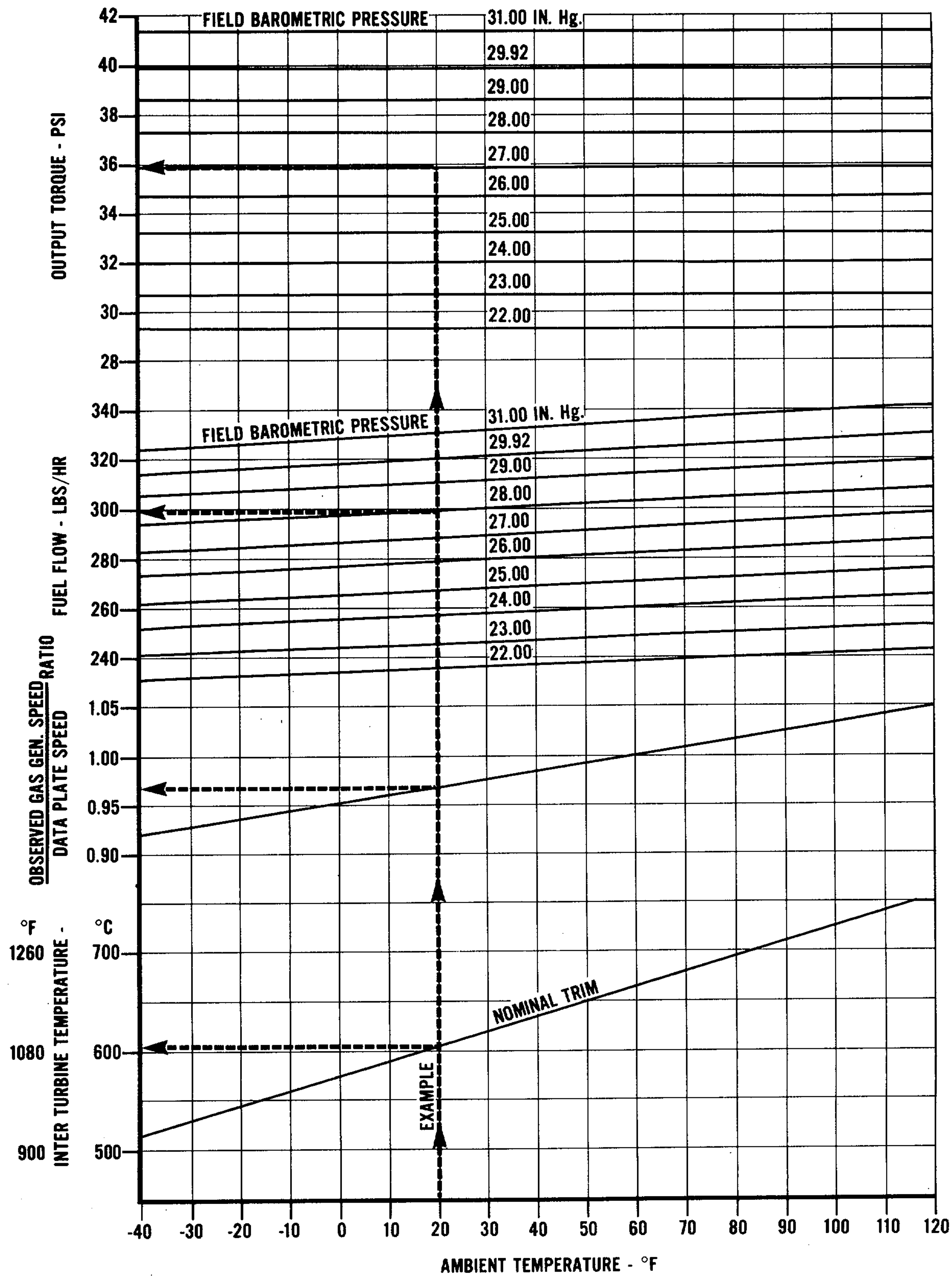
1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**



1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

5. (Cont)

d. Having determined values of these parameters, proceed with engine performance check, as follows:

**NOTE**

This check should be carried out without bleed air on power extraction for operation of aircraft auxiliaries.

(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory start (refer to TM55-1510-209-10/2.

(3) Run engine at FLIGHT-IDLE to warm up engine and to stabilize engine instruments.

(4) Set propeller control lever to maximum output speed **91% (2000 rpm**) and power lever to torque setting previously determined from engine performance curve.

(5) Compare observed fuel flow, gas generator speed and interturbine temperature with values previously recorded.

(6) Insure that values observed during engine performance and data plate speed check are within the following limits:

a. ± 15 lbs. hr/fuel flow.

b. ± 2% maximum gas generator speed data plate speed ratio. (Ratio = observed gas generator speed - data plate speed.)

c. Interturbine temperature of ± 30°C. If temperature is more than 30°C below target temperature check instrumentation.

**NOTE**

If observed values deviate from the preceding limits, an instrument or engine fault is indicated (refer to Section VII).

(7) Carry out an engine shutdown check (subparagraph 7).

6. Check No. 5 - Reverse Thrust Performance Check.

a. This check should be carried out whenever propeller reversing controls have been disconnected or adjusted and whenever fuel control, power turbine governor, or constant speed unit (propeller) have been re-placed.

b. Propeller reversing system is normally adjusted to provide a flat rated power of 400 shp at all ambient temperatures. The system may be adjusted to provide varying reverse powers as defined in TM55-1510-209-10/2.

c. Information supplied by TM55-1510-209-10/2 is used to determine desired reverse power by providing corresponding torque pressure values and related propeller speeds.

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1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

6. (Cont)

d. Make final adjustments (subparagraph 10).

7. Check No. 6 - Engine Shut- down.

Perform engine shutdown in accordance with TM55-1510-209-10/2.

8. Test after Component Repair - Replacement.

a. General. The following checks should be carried out after repair or replacement of each major component. The adjustments required during engine trim and/or engine performance checks and setting up of the reversing system are also given (refer to following table).

Ground Checks after Component Replacement

| Component Replaced | 1 | 2 | 3 | 4 | 5 | 6 | Component Check Reference |
|---|---|---|---|---|---|---|---|
| Power turbine governor | x | x | | x | x | x | Subparagraph 8.c * |
| Compressor bleed valve | x | x | x | | x | x | Subparagraph 8.d * |
| Propeller constant speed unit | x | x | | x | x | x | Subparagraph 8.b * |
| Starter generator | x | x | | | | x | |
| Ignition system components | x | x | | | | x | |
| Fuel nozzles | x | x | x | x | x | x | |
| Fuel dump valve, manifold or fuel lines | x | x | | x | | x | |
| Fuel control unit | x | x | x | x | x | x | Subparagraph 8.e * |
| Fuel pump | x | x | x | x | x | x | Subparagraph 8.e * |
| Power section | x | x | x | x | x | x | Subparagraph 8.c * |
| Compressor turbine rotor assy | x | x | x | x | x | x | |

* Checks in these Subparagraphs are required in addition to checks 1 thru 6.

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1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

8. (Cont)

b. Propeller Feathering Check. If the propeller constant speed/governor unit (airframe supplied) has been changed, carry out propeller feathering check as follows:

(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory engine start (subparagraph 3).

(3) Allow engine to warm up to operating temperature, and engine instruments to stabilize at idle rpm.

(4) Feather propeller two or three times to purge all air from system.

(5) With power control lever at HI-IDLE, move propeller control lever to feathering position. A considerable reduction in power turbine speed should be observed indicating that satisfactory feathering of propeller has been accomplished.

(6) Return propeller control lever to the INCREASED position and observe that propeller shaft speed is regained.

**NOTE**

Parts removed to gain access to other parts or areas shall invoke the same penal- ties as parts removed to correct deficiencies and malfunctions (refer to pre- ceding table). If more than one penalty is invoked, the most severe shall apply.

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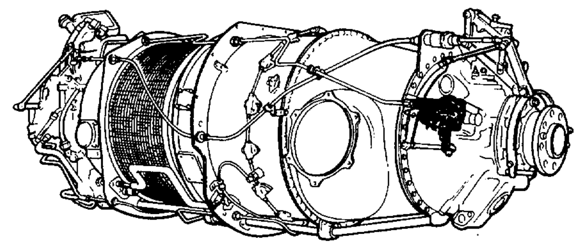
1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)



8. (Cont)

c. Power Turbine Governor Check. If the power turbine governor has been replaced or its operation is suspect proceed as follows (see figure).

**WARNING**

Adjustment screws (6) and (7) are the only screws permitted to be adjusted.

(1) Minimum Governing Speed:

(a) Remove propeller overspeed governor and re- place with a blanking plate.

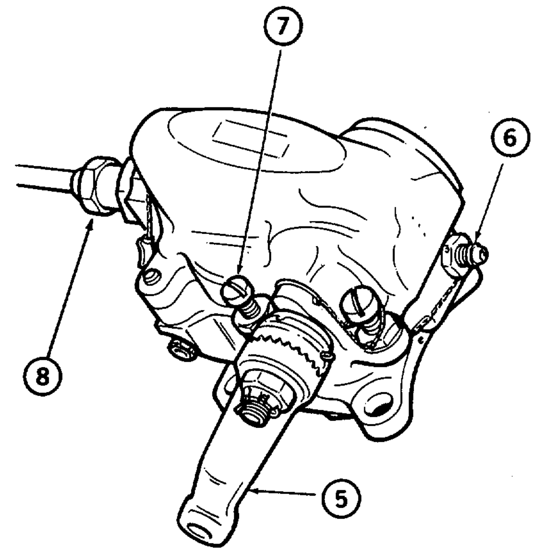
(b) Disconnect and secure reversing linkage from power turbine governor arm if applicable.

(c) Move governor control arm (5) counterclockwise to minimum speed and secure in this position.

(d) Perform pre- start check (subparagraph 2).

(e) Accomplish satisfactory engine start (sub- paragraph 3).

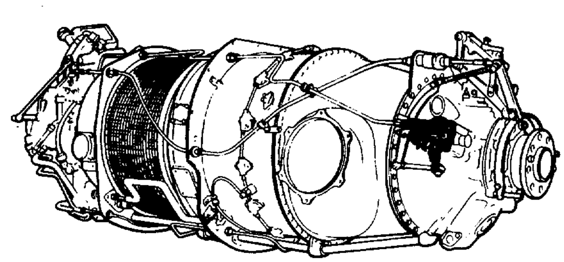
(f) Warm engine to operating temperature, and allow engine instruments to stabilize.



1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

8.c.(1) (Cont)

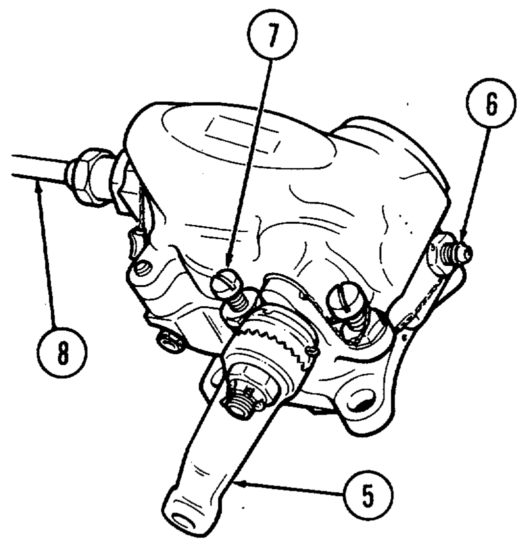
(g) With propeller control lever in INCREASE position, advance power control lever and observe for governing action at 94% (± 1%) propeller shaft speed (Np). The governing point is reached when further movement of power control lever produces no increase in propeller shaft speed. Adjust power turbine governor minimum governing speed adjustment screw (7) to obtain desired limits.



**NOTE**

Adjust in extremely fine increments only.

(h) Move power turbine governor control arm (5) clock- wise to maximum governing speed stop and secure in this position.




**NOTE**

If power turbine governor has been replaced, a reverse thrust performance check (subparagraph 6) must be carried out in addition to power turbine governor check.

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1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

8.c. (Cont)

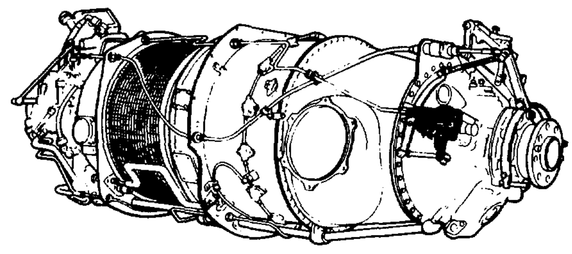
(2) Maximum Governing Speed: As on most aircraft installations, either the propeller fine pitch setting restricts the propeller speed (Np) at static conditions or the travel of the maximum governor speed stop is limited, making it impossible to check the overspeed setting. However, if the govern- or maximum setting is suspected of limiting engine power, it may be checked as follows:

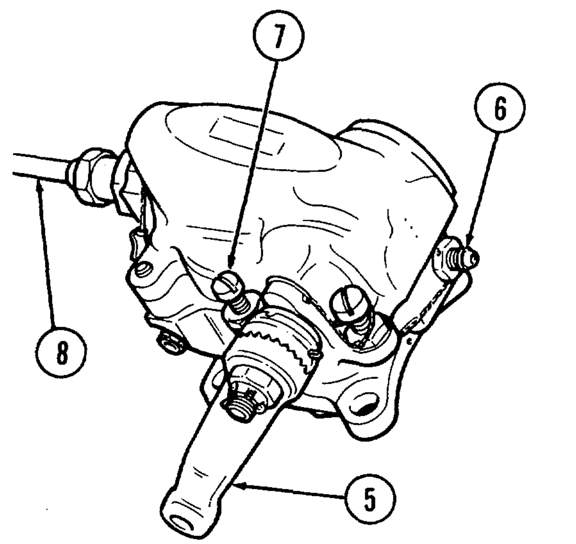
(a) Run engine to trim stop with propeller in full fine pitch and record Ng. Shut down engine.

(b) Disconnect governor air pressure tube from power turbine governor and install blanking plug in tube.

(c) Rerun engine to trim stop and insure Ng has not increased. Shut down engine. Record Ng obtained.

(d) If Ng has increased, remove blanking plug and reconnect tube (1). Rerun engine to trim stop and adjust power turbine governor maximum speed adjustment (2) counter- clockwise in 1/8-turn increments until Ng recorded in step (c) is obtained.



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1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

8. (Cont)

d. Compressor Bleed Valve. Unsatisfactory part power and performance checks may indicate compressor bleed valve malfunction. For symptoms of compressor bleed valve malfunction, refer to Chapter 1, Section VII.

**CAUTION**

**Adjustments to compressor bleed valve are only carried out at overhaul under controlled conditions.**

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1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

8. (Cont)

e. Fuel Control Unit (FCU) and/or Fuel Pump check. Check unit as follows:

(1) If fuel control un- it or fuel pump have been re- placed they must be depreserved as follows:

(a) Remove lock- wire and disconnect inlet tube (8) from fuel dump valve (9).

(b) Advance power control lever.

(c) Motor engine until clear fuel issues from dump valve inlet port.

**NOTE**

**Use a suitable container to receive preservation oil and fuel.**

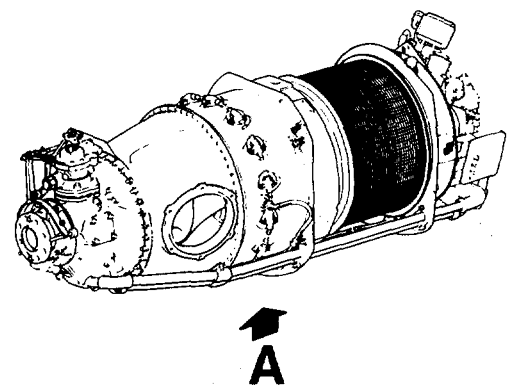
(d) Move power control lever back to CUTOFF.

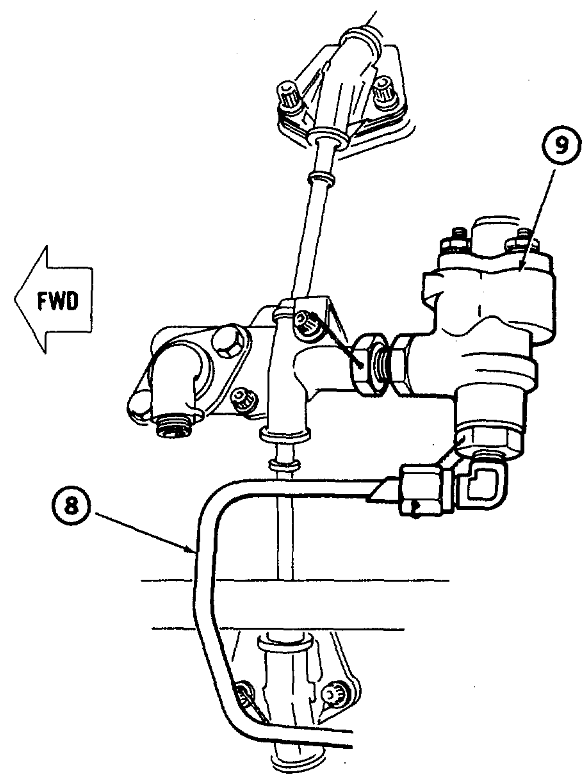
(e) Reconnect dump valve inlet tube (1), torque to 65 to 75 inch-pounds and secure with Lockwire (E.4).

(2) Carry out motoring run with fuel cut-off lever in OPEN position to check for fuel system leaks.

(3) With fuel cut off carry out a motoring run to dry out engine.

(4) Perform checks No. 1 thru 6 (subparagraphs 1-94, 2 thru 7).




VIEW ON ARROW A

1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

8. (Cont)

f. Checks after Accessory Replacement. Perform ground checks as detailed in table (refer to table following subparagraph 8.a.). The pneumatic portion of fuel control system must be pressure tested whenever leakage in any portion of system is suspected (refer to Task 10-1).

9. Idle Speed Adjustments.

a. General. Since the gas generator speed at minimum fuel flow varies with the barometric pressure as shown on graph on opposite page, the engine will either govern at the idle speed setting or run on the minimum fuel flow stop, depending on the barometric pressure. Moreover, in the barometric pressure range from **26.25 in. Hg. to 28.65 in. Hg.** since Ng at minimum fuel flow may be anywhere between the limits shown on graph, it must first be determined whether the engine is governing at idle speed or running on minimum fuel flow before the idle speed adjustment can be checked. Consequently, the procedure for checking the idle speed adjustment depends on barometric pressure.

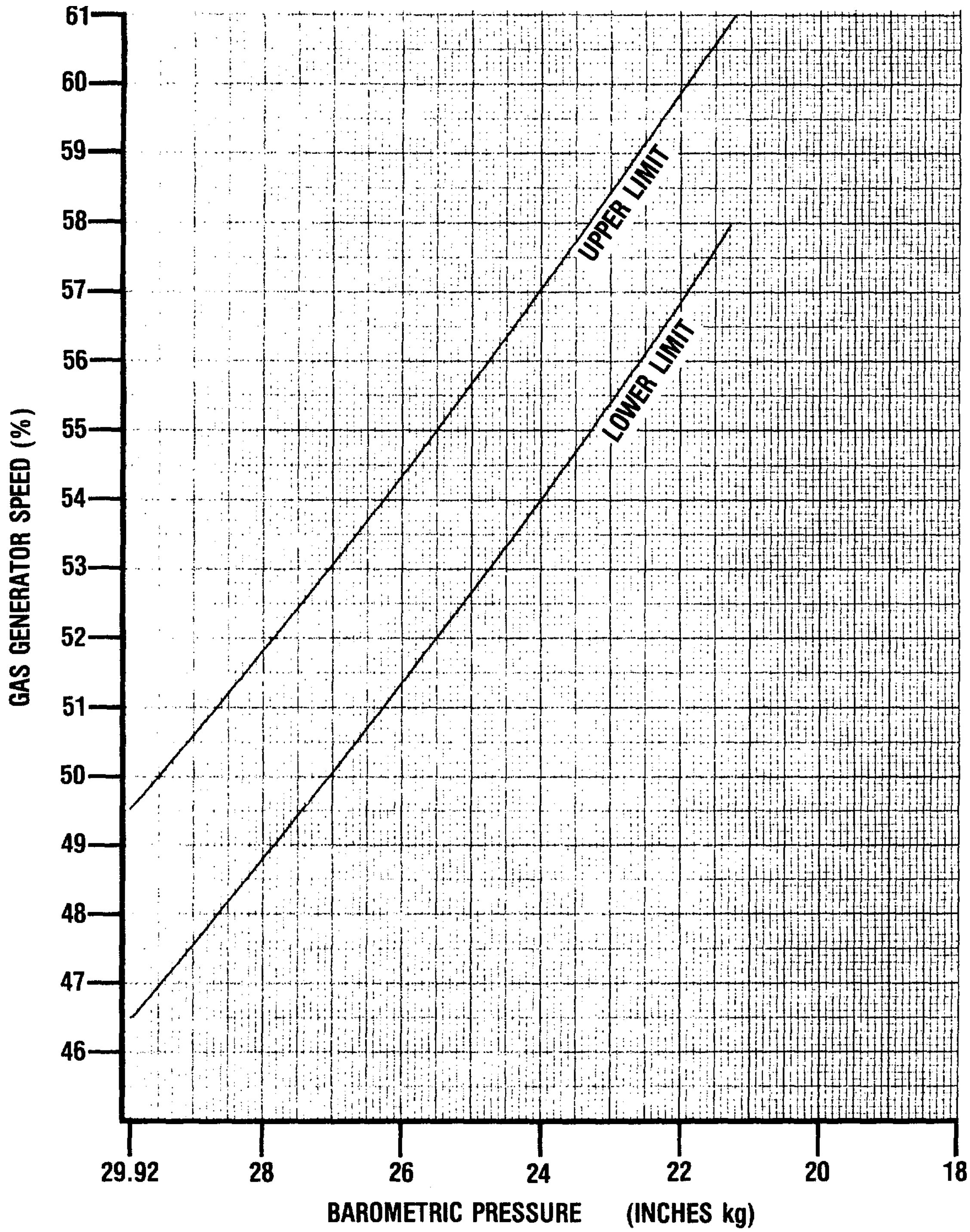
b. Barometric Pressure above 28.65 in. Hg. At barometric pressures **above 28.65 in. Hg**., check idle speed as follows:

(1) Perform pre-start check (subparagraph 2).

**GO TO NEXT PAGE**

1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

**GAS GENERATOR SPEED V/S BAROMETRIC PRESSURE ENGINE ON MIN. FUEL FLOW (Wf)**




Gas Generator Speed at Minimum Fuel Flow

GO TO NEXT PAGE

1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)

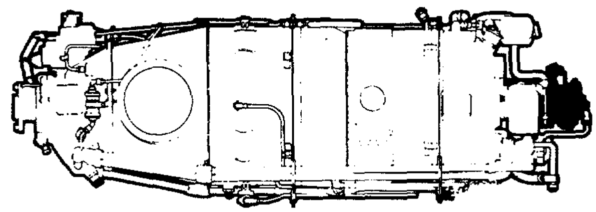
9.b. (Cont)

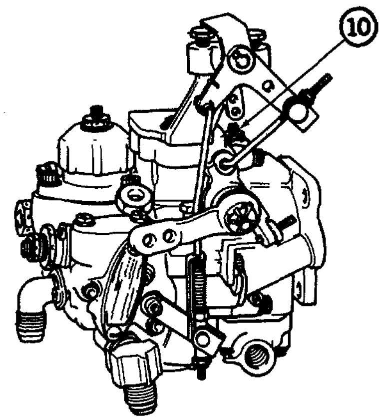
(2) Accomplish satisfactory engine start (subpara- graph 3).

(3) Allow engine to warm up to operating temperature and instruments to stabilize.

(4) With propeller in fine pitch, and oil temperature at **100'F (38'C**) minimum, observe Ng at idle speed. Observed Ng should be 51% minimum.

(5) If idle speed is incorrect, adjust Lo-idle speed adjustment (10) as required. (Turn clockwise to increase speed and counterclockwise to decrease speed.)






**CAUTION**

**Turn screw in minute increments, as adjustment is extremely sensitive.**

c. Barometric Pressure Between 28.65 and 26.25 in. Hg. At barometric pressure between 28.65 and 26.25 in. Hg., check idle speed adjustment as follows:

(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory engine start (subpara- graph 3).

(3) Allow engine to warm up to operating temperature and allow instruments to stabilize.

GO TO NEXT PAGE

1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

9.c. (Cont)

(4) With propeller in fine pitch and oil temperature at **100'F (38'C)** minimum, observe and record Ng at idle speed.

(5) Disconnect Py sense tube between FCU and power turbine governor at the FCU, and check if Ng drops from the value recorded in subparagraph c.(4). Reconnect Py sense tube.

**NOTE**

During this check the engine will not respond to power control lever movement. Leave the controls in the Lo-idle position.

**CAUTION**

**Carry out this check with zero power extraction. Should the minimum fuel flow stop be adjusted too low, an excessive drop in Ng will result and the operator must be prepared to shut down the engine if necessary.**

(6) If Ng, with Py sense tube disconnected, was less than Ng recorded in subparagraph c.(4), then engine was governing at the idle speed setting and the idle speed may be adjusted in accordance with subparagraph b.(5).

**GO TO NEXT PAGE**

1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

9.c. (Cont)

(7) If Ng, with Py sense tube disconnected, was the same as Ng recorded in subparagraph c.(4), then the engine was running on the minimum fuel flow stop and the idle speed must be checked as in subpara- graph d.

d. Barometric Pressure Below 26.25 in. Hg. At barometric pressure below 26.25 in. Hg., check idle speed adjustment as follows:

**CAUTION**

**The idle speed must not be adjusted at barometric pressures below 28.58 in. Hg.**

(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory engine start (subpara- graph 3).

(3) Allow engine to warm up to operating temperature and allow instruments to stabilize. Record Ng at idle.

GO TO NEXT PAGE

1-94 **GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

10. Final Adjustments.

To make final adjustments, proceed as follows:

**NOTE**

All adjustments must be made with engine stopped.

a. Perform pre-start check (subparagraph 2).

b. Accomplish satisfactory engine start (subparagraph 3).

c. Allow engine to warm up to operating temperature and stabilize to ground idle rpm.

**CAUTION**

**Turn screw in minute increments as adjustment is extremely sensitive.**

d. Advance fuel cut-off lever slowly to HI-IDLE position and check that speed is within required range. If speed is incorrect, adjust HI-IDLE adjustment screw (14) as required.

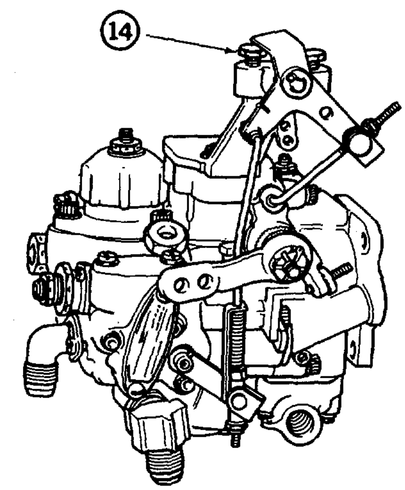
**NOTE**

Turn the HI-IDLE stop clockwise to increase speed and counterclockwise to decrease speed.

**CAUTION**

**Power lever should not be moved to REVERSE position when engine is static.**

e. Perform Check No. 5, reverse thrust performance check (subparagraph 6.)



**Section X ENGINE TESTING (Continued)**

**1-94 GROUND TEST OF ENGINE INSTALLED IN AIRCRAFT (Cont)**

10. (Cont)

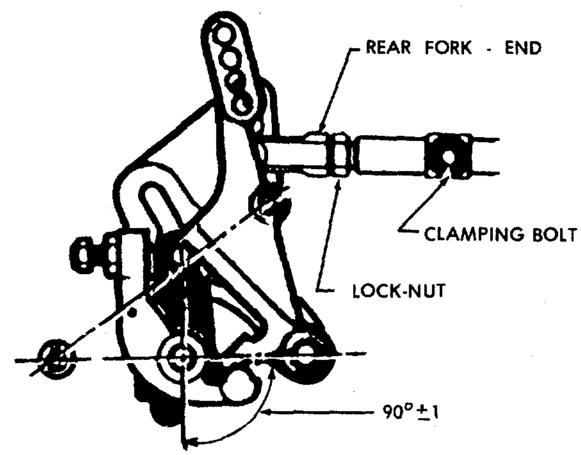
f. If power in reverse is not sufficient, position rear forkend to next higher hole on propeller control cam, or to a lower hole if torque is excessive. Fine adjustments can be made by adjusting reverse adjusting screw.

**NOTE**

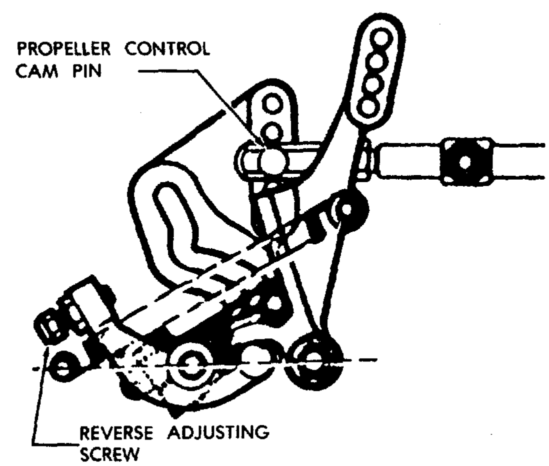
After rear forkend has been correctly repositioned, lengthen linkage by rotating forkend one additional turn to eliminate play in linkage. Insure that fork- end is in same hole on propeller control cam of each engine to provide equal power response in reverse.

g. Insure threaded rod ends are within witness hole limits. Front and rear forkends may have a maximum of three threads showing beyond locknuts. Adjustable stop may have a maximum of twelve threads showing beyond locknut. Check security and safety of all adjustments and connections after adjustments to control linkage have been completed.

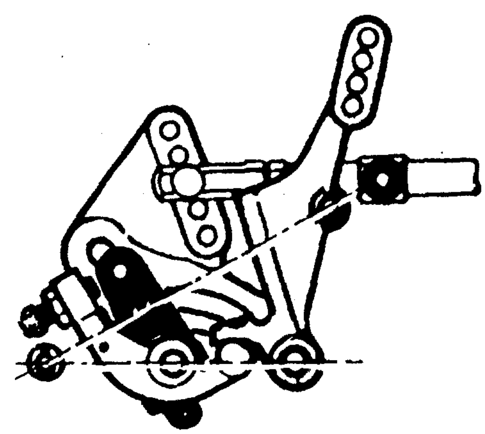
h. Preserve the engine in accordance with Section' IX.




**LO - IDLE POSITION**




**TAKE - OFF POSITION**



**REVERSE POSITION**

GO TO NEXT PAGE

**Section X ENGINE TESTING (Continued**

## 1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM)

1. Ground Testing. Ground testing of engine, using mobile trailer assembly, is intended to give an engine a thorough test for mechanical soundness and for correct indications of operating parameters prior to installation in the aircraft. To eliminate unnecessary ground testing, the ground test procedures or checks are divided as follows:

Check No. 1 - Pre-start.

Check No. 2 - Engine start.

Check No. 3 - Part power trim stop.

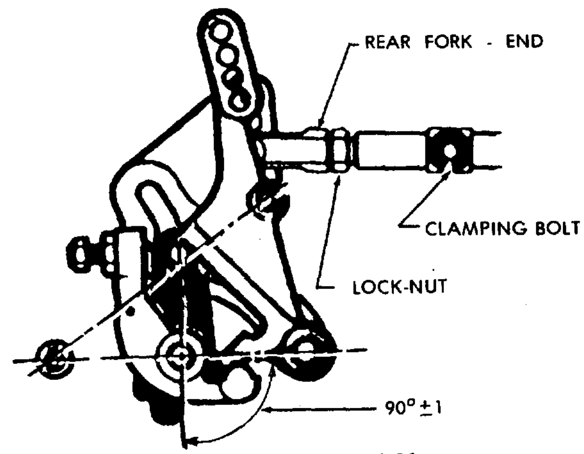
Check No. 4 - Engine performance check.

Check No. 5 - Engine shut- down. 2.

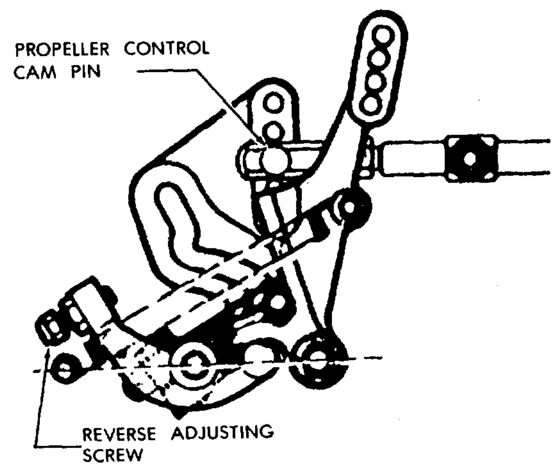
2. Check No. 1 - Pre-start.

a. Install engine in mobile test trailer in accordance with instructions contained in TM55-4920-328-13.

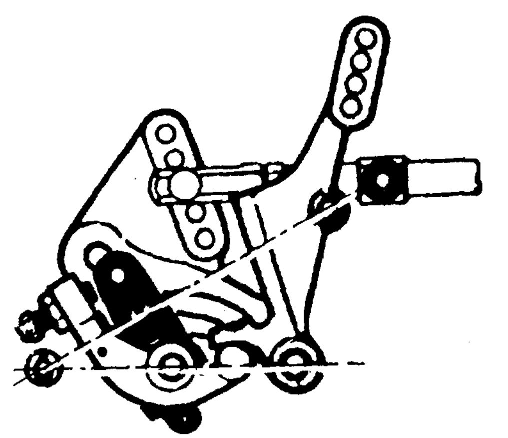
b. Thoroughly inspect engine inlet and trailer to insure that it is clear of loose nuts, bolts, tools and other objects which could cause engine damage and possible subsequent engine failure.




LO - IDLE POSITION




TAKE - OFF POSITION



REVERSE POSITION

GO TO NEXT PAGE

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

2. (Cont)

c. Inspect run-up area in vicinity of trailer and remove any loose objects particularly lockwire which might be ingested by the engine. Insure all covers are removed.

d. Inspect engine and test stand interconnect linkage for security, directional movement and full travel of controls.

e. Check all lines for security.

f. Check level in engine oil tank (Section VIII). Carry out engine motoring run as follows:

(1) Position DC switch to ON. Fuel shut-off lever to cut-off position.

(2) Ignition switch to off position and test stand master switch to on position.

(3) Test stand fuel system and fuel booster pump switch to on position.

(4) Engine starter switch to on position and motor engine until a gas generator speed of approximately 7000 rpm (19%) is attained, then open fuel shut-off lever for 10 seconds duration.

(5) Check for oil pressure indications, evidence of fuel and oil leaks and leakage (if any) from fuel dump valve and gas generator case drain valves (closed). For permissible leakage refer to following table.

Engine Oil and Fuel Permissible Leakage

| Location of Drain Line | Maximum Leakage During Engine Operation |
|---|---|
| Fuel Pump | 0.5 cc/min. |
| Dump Valve | 0.2 cc/min. |
| Starter Cavity | 3 cc/hr. |
| Gas Generator Case (2) | Nil |

**GO TO NEXT PAGE**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

2.f. (Cont)

(6) On run down, check operation of dump valve and combustor drain valves (open). Listen for evidence of any unusual noise, such as scraping, rubbing or grinding. Determine source and correct as required. Note and record run-down time.

(7) Clear engine ( sub- paragraph g).

(8) Check oil level and replenish tank as necessary (Section VIII).

g. Clear engine of trapped fuel or vapors as follows:

(1) Position DC switch to on position, ignition switch to off position and test stand master switch to on position.

(2) Fuel shut-off lever to off position.

(3) Test cell fuel system and fuel booster pump switches on position.

(4) Starter switch to on position, and motor engine for ten seconds.

(5) All switches to off position.

3. Check No. 2 - Engine Start.

a. To insure a satisfactory engine start, carry out the following instructions in their sequence:

(1) Position DC switch to on position. Position test cell MASTER SWITCH to on position.

(2) Test stand fuel system and fuel booster pump switch to on position.

(3) Fuel shut-off lever to off position.

(4) Move power control master hydronic control lever to idle position.

(5) Position W/B PUMP and W/B AIR switches to on position. Position chip detector switch to on position.

**CAUTION**

**Energize W/B AIR switch when water brake water-in pressure reaches 30 psi.**

(6) Place engine starter, ignition and timer start switches to on position simultaneously and check for oil pressure rise.

**GO TO NEXT PAGE 3**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

3.a. (Cont)

(7) After approximately 5 seconds of motoring or at a minimum sustained gas generator speed (N1) of 7000 rpm (19%), advance fuel shut-off lever to idle.

(8) Observe that engine ignites and accelerates smoothly to idle. Note and record time to ignite and time to idle.

**CAUTION**

**Observe the ITT reading closely for a rapid rise in temperature. If temperature is rising rapidly when nearing 1600 °F (870 °C), shut down engine immediately to prevent over temperature.**

(9) Engine starter and ignition switches off position.

b. Satisfactory start. A satisfactory start will be insured providing all the following conditions are met:

(1) Ignition takes place within ten seconds after moving fuel cut-off lever to idle. Ignition will be evidenced by a rise in turbine exhaust and interturbine temperature.

**NOTE**

The ten-second time interval is an arbitrary value. The actual ignition time may be less, depending on the ambient temperature and amount of torque supplied by starter.

(2) Engine accelerates smoothly to idle.

(3) Interturbine temperature does not exceed maximum starting temperature during transition period to idle (refer to Ground Operating Limits table, following).

(4) Oil pressure is at minimum (refer to table).

**CAUTION**

**Should the fuel cut-off lever be inadvertently moved to cut-off position, do not reselect the lever in an attempt to regain light up. Introducing unburned fuel into the engine creates a fire hazard; therefore, a fuel draining period of at least 30 seconds must be allowed and the complete starting sequence repeated.**

c. Unsatisfactory Start. An unsatisfactory start will occur if one or more of the following conditions takes place:

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1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

**GROUND OPERATING LIMITS - (WHEN INSTALLED IN MOBILE TEST STAND)**

| Power Setting | SHP | Gas generator(Ng) 100% = 37,500 rpm % | Gas generator(Ng) rpm | Propeller (Np) 100% = 2,200 rpm % | Propeller (Np) rpm | Maximum observed ITT | Maximum torque in.lb. | Maximum torque psi | SFC lb/shp/hr | Fuel pressure psig. | Normal oil pressure psig | Oil temperature range MIL-L-23699 | Oil temperature range MIL-L-7808 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Take-off | 550 | 101.5 | 38,100 | 100 | 2,200 | 1382°F (750°C) | 15780 | 42.5 | 0.683 | 15 to 30 | 65 to 85 | 50°F to 210°F (10°C to 99°C) | 50°F to 185°F (10°C to 85°C) |
| Military | 538 | | | | | 1338°F (725°C) | 15508 | 41.6 | 0.688 | 15 to 30 | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |
| Hi-idle | | | 23,250 ± 250 | | | | 2604 TYPICAL | 7.0 | | 15 to 30 | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |
| Lo-idle | | 50.6 | 19,500 ± 500 | | | 1265°F (685°C) | 1380 | 5.0 | | 15 to 30 | 40 Min | -40°F to 210°F (-40°C to 99°C) | -40°F to 185°F (-40°C to 85°C) |
| Starting | | | | | | 1994°F (1090°C) (6) (8) | | | | 15 to 30 | | -40° MIN | -40° MIN |
| Momentary Acceleration | | 102.6 (6) | 38,500 | 110 | 2,420 | 1562°F (850°C) (6) | 18000 (6) | 48.5 | | 15 to 30 | 65 to 85 | 32°F to 210°F (0°C to 99°C) | 32°F to 185°F (0°C to 85°C) |

**NOTES**

1. All limits are based on sea level pressure and ambient temperatures, as specified.
2. Accessory drive seal leakage should not exceed 3 cc per hour.
3. Minimum oil pressure above 28,000 Ng is 65 psig.
4. Run down time 20 seconds minimum (from ground idle).
5. For rpm, ITT and torque limits, refer to Section VI.
6. These figures are time limited to two seconds.
7. Increase ITT for starting is 1697°F (925°C).
8. Nominal ITT for starting is 1697°F (925°C).

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1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)
3.c. (Cont)

(1) Hot start. Interturbine temperature limits. If interturbine temperature is rising rapidly when nearing 1600°F (870°C), a hot start shall be anticipated, and operator shall abort start to prevent overtemperature of engine. A hot start may also be caused by a false or a hung start.

**CAUTION**

Interturbine temperature may continue to rise during false start or hung start and operator shall abort start before interturbine gas temperatures are exceeded.

(2) False start or hung start. After ignition has occurred, rpm remains at lower idle speed.

(3) No start. If interturbine temperature gage does not indicate a rise in temperature, or if there is no increase in rpm, place fuel cutoff lever to cut-off position as ignition has not been obtained.

4. Check No. 3 - Part Power Trim Check.

a. Introduction. Prior to trimming, engine must be brought up to its part power trim output and allowed to run approximately five minutes to bring the engine to normal operating temperatures.

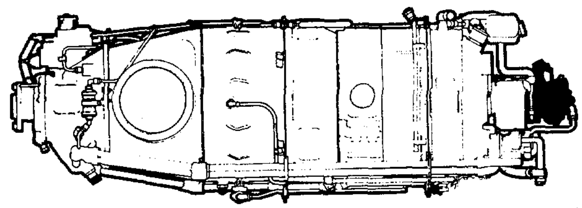
b. Part Power Trim Stop. Fuel control units are calibrated during bench test to insure maximum flow is obtained. The trim stop must be adjusted to individual engines on installation to insure maximum power on a **71°F (21°C)** day. If engine inlet temperature is other than this, it would not be possible to set the maximum speed stop without first reaching either an interturbine temperature or a torque limit. To overcome this, a part power trim stop is provided. The stop is a movable spacer placed between gas generator maximum speed (Ng) stop and power lever anvil, and represents a 1700 rpm (Ng) speed decrement. This stop is permanently attached to the fuel control unit and is moved from the stowed position for engine trimming.

**GO TO NEXT PAGE**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

4.b. (Cont)

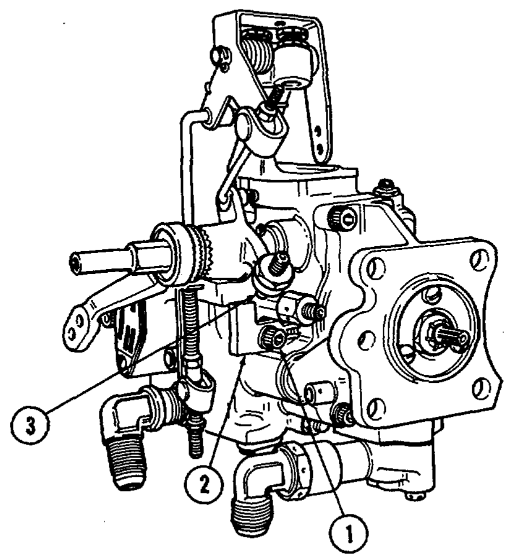
(1) Loosen screw (1) securing part power trim stop (2) to gas generator maximum speed stop anvil.



(2) Position part power trim stop so that it is inter- posed between power lever anvil and maximum gas generator speed stop (3).

(3) Tighten screw.

c. Part Power Trim Check.




(1) Engine is trimmed by adjusting gas generator maxi- mum speed stop to part power trim check curve (refer to Part Power Trim Curve opposite). These curves allow setting of maximum Ng at reduced power and at all off-standard atmospheric conditions.

**CAUTION**

**Observed gas generator speed should not exceed 97.1% Ng (36400 rpm) during part power trim check and subsequent gas generator maximum speed adjust- ments. Interturbine temperatures should not exceed the value shown by maximum uptrim line on part power trim check curve.**

(2) To determine expected power output for an engine under static conditions, proceed as follows:

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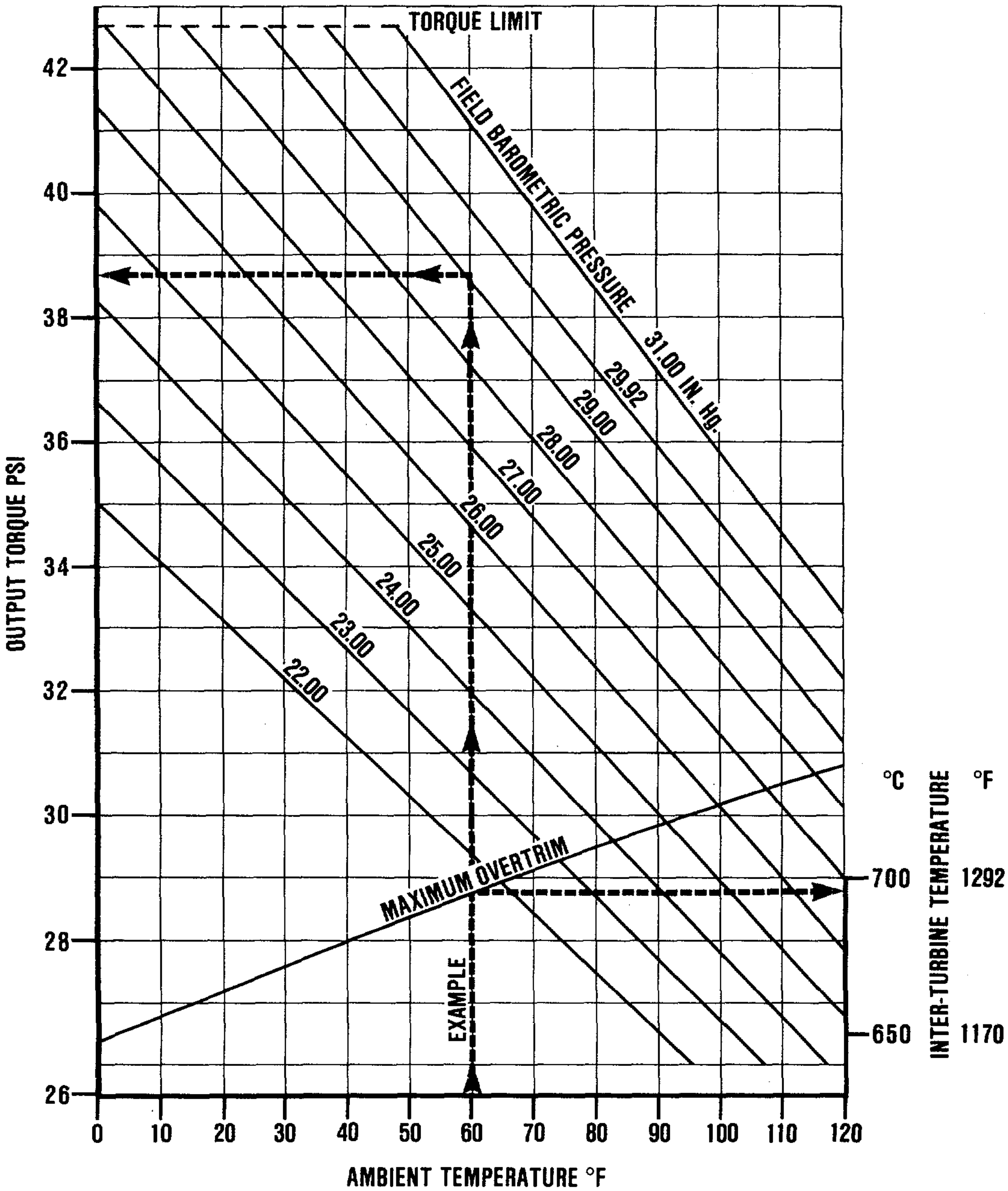
1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)




**Part Power Trim Curve**

**GO TO NEXT PAGE**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

4.c.(2) (Cont)

(a) Obtain ambient air temperature.

(b) Obtain field barometric pressure (not corrected to sea level).

(c) To determine target torque enter part power trim check curve with ambient temperature and proceed vertically upward to intersect field barometric pressure line. From this intersection proceed horizontally to the left and read target torquemeter pressure. Record value obtained.

(d) To obtain maximum ITT at which target torque can be achieved enter curve with ambient temperature and proceed vertically upward to intersect max overtrim line. From this intersection, proceed horizontally to right to read interturbine temperature. Record value obtained.

(e) Carry out prestart check (subparagraph 2).

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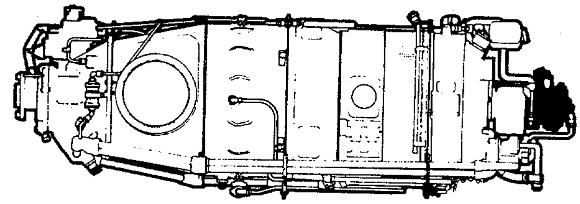
1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

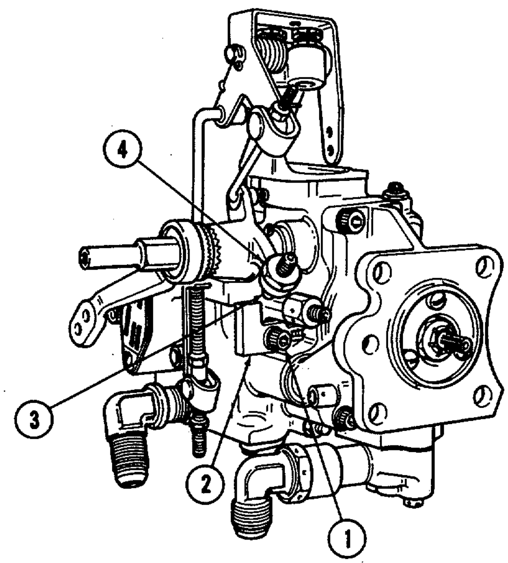
4.c.(2) (Cont)



(f) Position part power trim stop to limit power lever travel.

(g) Effect a satisfactory start (subparagraph 3).

(h) Advance power lever to part power trim stop and allow engine to stabilize at this setting for approximately five minutes at 100% (2200 rpm) Np.




(i) Check that torquemeter pressure is within 0 to 31 lb ft of value obtained from curve and adjust gas generator maximum speed stop (3) as required.

(j) Carry out engine shutdown (Subparagraph 6).

(k) Loosen screw (1), place trim stop (2) in stowed position, tighten screw. Torque to **20 to 30 inch-pounds** and lockwire (E.5).

(l) Lockwire maximum speed adjustment locknut (4) using Lockwire (E.5).

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1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

4. Check No. 3 - Part Power Trim Check. (Cont)

**CAUTION**

**Part power trim stop must be properly stowed after completion of part power trim checks. Insure that attaching screw is tightened and lockwired.**

d. Data Plate Speed. Data plate speed is gas generator speed (Ng) obtained with engine running at reference power on a standard day (59°F) (15°C). This value is determined from acceptance running, and each engine has its individual value stamped on data plate speed plate in rpm and a percentage of maximum gas generator speed. The reference power in shp/(Shp corrected) is also stamped on the data plate.

5. Check No. 4 - Engine Performance Check.

a. Engine performance check should be carried out and changes in engine performance noted prior to installation in airframe. The engine performance check curve is presented as constant torque versus ambient temperature so that engine performance can be checked over a wide range of ambient temperatures without overtorquing the reduction gearbox.

**NOTE**

The performance check curve is presented on page opposite paragraph 1-94.5a.

b. All forms of engine deterioration are accompanied by an increase in interturbine temperature and fuel flow at a given power. Compressor deterioration is, in most cases, due to dirt deposits and causes an increase in gas generator speed at a given power setting. This form of deterioration can be remedied by compressor wash (Section VIII, Paragraph 1-77).

c. Hot section deterioration results in decreased gas generator speed at a given power setting. To determine engine performance check parameters, proceed as follows (see curve).

(1) Obtain ambient air temperature.

(2) Obtain field barometric pressure (not corrected to sea level).

(3) Obtain reference rpm from engine data plate.

(4) Enter engine performance check curve with ambient temperature and proceed vertically upward to intersect appropriate field barometric pressure line. From this intersection, proceed horizontally to left to read torquemeter pressure. Record desired torque pressure.

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

5.c. (Cont)

(5) Enter curve with ambient temperature and proceed vertically upward to intersection appropriate field barometric pressure line. From this intersection, proceed horizontally to left to read fuel flow in lbs/hr. Record desired fuel flow.

(6) Enter curve with ambient temperature and proceed vertically upward to intersect gas generator data plate speed line. From this intersection, proceed horizontally to left to read desired ratio (gas generator speed data plate speed). Record desired ratio.

(7) Enter curve with ambient temperature and proceed vertically upward to intersect interturbine temperature line. From this intersection, proceed horizontally to left to read interturbine temperature. Record desired interturbine temperature.

d. Having determined values of these parameters, proceed with engine performance check, as follows:

(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory start (subparagraph 3).

(3) Run engine at FLIGHT-IDLE to warm up engine and to stabilize engine instruments.

(4) Set water brake hyronic lever to control maximum output speed of 91% Ns (2000 rpm) and power lever to torque setting previously determined from engine performance curve.

(5) Compare observed fuel flow, gas generator speed and interturbine temperature with values previously recorded.

(6) Insure that values observed during engine performance and data plate speed check are within the following limits:

(a) ±15 lbs/hr fuel flow.

(b) ±2% maximum gas generator speed data plate speed ratio. (Ratio = observed gas generator speed data plate speed.)

(c) Interturbine temperature of + 30°C. If temperature is more than +30° C below target temperature, check instrumentation.

**NOTE**

If observed values deviate from preceding limits, an instrument or engine fault is indicated (refer to Section VII, Troubleshooting).

**GO TO NEXT PAGE**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

5.d. (Cont)

(7) Carry out an engine shutdown check (subparagraph 6).

6. Check No 5 - Engine Shutdown. Carry out engine shutdown check as follows:

(1) Retard power lever to idle position.

(2) Operate engine at not more than **1130°F (610°C)** interturbine temperature for a period of at least 1 minute to insure adequate internal cooling.

**NOTE**

In the event of engine shutdown from high temperature, immediately carry out motoring cycle (subparagraph 2f).

(3) Fuel shut-off lever to cut-off position.

(4) Set water-in master hydropic control to shut-off position.

(5) Listen for evidence of any unusual engine noise, such as scraping, rubbing or grinding during rundown. Note and record any change in normal compressor run-down time (Operating Limits Table).

(6) Check dump valve and gas generator case drain valves for proper operation (open).

(7) After compressor has run down, set fuel boost pump switch to off position.

**NOTE**

Do not switch the boost pump off position before the compressor has run down, as cavitation of the fuel pump may occur.

(8) Position test cell fuel system switch to off position.

(9) Press W/B PUMP and W/B AIR IN switches to off position.

(10) Position DC switch to off position.

(11) Shut down testing unit subassembly.

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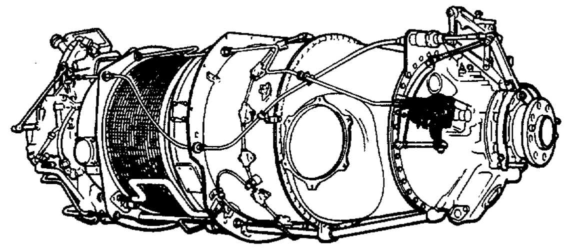
1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)



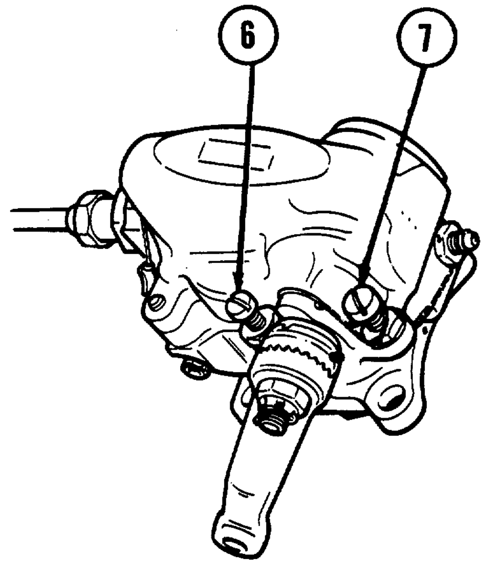
7. Test After Component Repair/ Replacement.

a. General. The following adjustment should be carried out after repair or replacement of each major component. The adjustments required during engine trim and/or engine performance checks and setting up of the reversing system are also given.

b. Power Turbine Governor Check. If the power turbine governor has been replaced or its operation is suspect, proceed as follows:

**WARNING**

Adjustment screws (6) and (7) are the only screws permitted to be adjusted.




(1) Maximum Governing Speed: As on most aircraft installations, either the propeller fine pitch setting restricts the propeller speed (Np) at static conditions or the travel of the maximum governor speed stop is limited, making it impossible to check the overspeed setting. However, if the governor maximum setting is suspected of limiting engine power, it may be checked as follows:

**GO TO NEXT PAGE**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

7.b.(1) (Cont)

(a) Run engine to trim stop with propeller in full fine pitch and record Ng. Shut down engine.

(b) Disconnect governor air pressure tube (5) from power turbine governor and install blanking plug in tube.

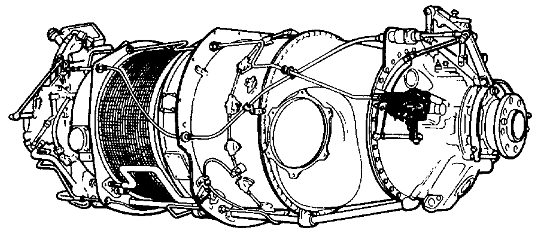
(c) Rerun engine to trim stop and insure Ng has not increased. Shut down engine. Record Ng obtained.

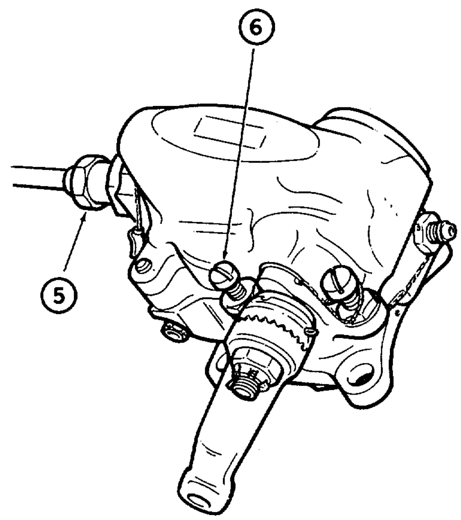
(d) If Ng has increased, remove blanking plug and reconnect tube (5). Rerun engine to trim stop and adjust power turbine governor maximum speed adjustment (6) counterclockwise in 1/8-turn increments until Ng recorded in step (c) is obtained.

c. Compressor Bleed Valve. Unsatisfactory part power and performance checks may indicate compressor bleed valve malfunction. For malfunction symptoms, refer to Section VII, Troubleshooting.

**CAUTION**

Adjustments to compressor bleed valve are only carried out at overhaul under controlled conditions.



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1-95 GROUND TESTING OF ENGINE MOBILE TRAILER ASSEMBLY (AVIM) (Cont)
.
7. (Cont)

d. Fuel Control Unit Check. Check fuel control unit as follows:

**CAUTION**

If fuel control unit has been replaced, preservative oil must be removed before test. Refer to paragraph 1-94, subparagraph 8e(1) for depreserving procedure.

(1) Carry out a motoring run with fuel cut-off lever in OPEN position to check for fuel system leaks.

(2) With fuel cutoff carry out a motoring run to dry out engine.

(3) Perform checks No. 1 through 5 (subparagraphs 2 thru 6).

e. Checks after Accessory Replacement. Carry out ground checks as referenced in table below. The pneumatic portion of fuel control system must be pressure tested whenever leakage in any portion of the system is suspected. Any leakage will adversely affect operation of fuel control. For fuel control pneumatic system pressure

Ground Checks after Component Replacement

| Component Replaced | Component Check 1 | 2 | 3 | 4 | 5 | 6 | Reference |
|---|---|---|---|---|---|---|---|
| Power turbine governor | x | x | | x | x | x | Subparagraph 7.b |
| Compressor bleed valve | x | x | x | x | | x | Subparagraph 7.c |
| Starter generator | x | x | | | | x | |
| Ignition system components | x | x | | | | x | |
| Fuel nozzles | x | x | x | x | x | x | |
| Fuel dump valve, manifold or fuel lines | x | x | | x | | x | |
| Fuel control unit | x | x | x | x | x | x | Subparagraph 7.d |
| Fuel pump | x | x | x | x | x | x | |
| Power section | x | x | x | x | x | x | |
| Compressor rotor assembly | x | x | x | x | x | x | |

**GO TO NEXT PAGE**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

8. Idle Speed Adjustments

a. General. Since the gas generator speed at minimum fuel flow varies with the barometric pressure (as shown on graph) the engine will either govern at the idle speed setting or run on the minimum fuel flow stop, depending on the barometric pressure. Moreover, in the barometric pressure range from 26.26 in. Hg. to 28.65 in. Hg., since Ng at minimum fuel flow may be anywhere between the limits shown on graph, it must first be determined whether the engine is governing at idle speed or running on minimum fuel flow before the idle speed adjustments can be checked. Consequently, the procedure for checking the idle speed adjustment depends on the barometric pressure.

b. Barometric Pressure above 28.65 in. Hg. At barometric pressure above 28.65 in. Hg., check idle speed as follows:

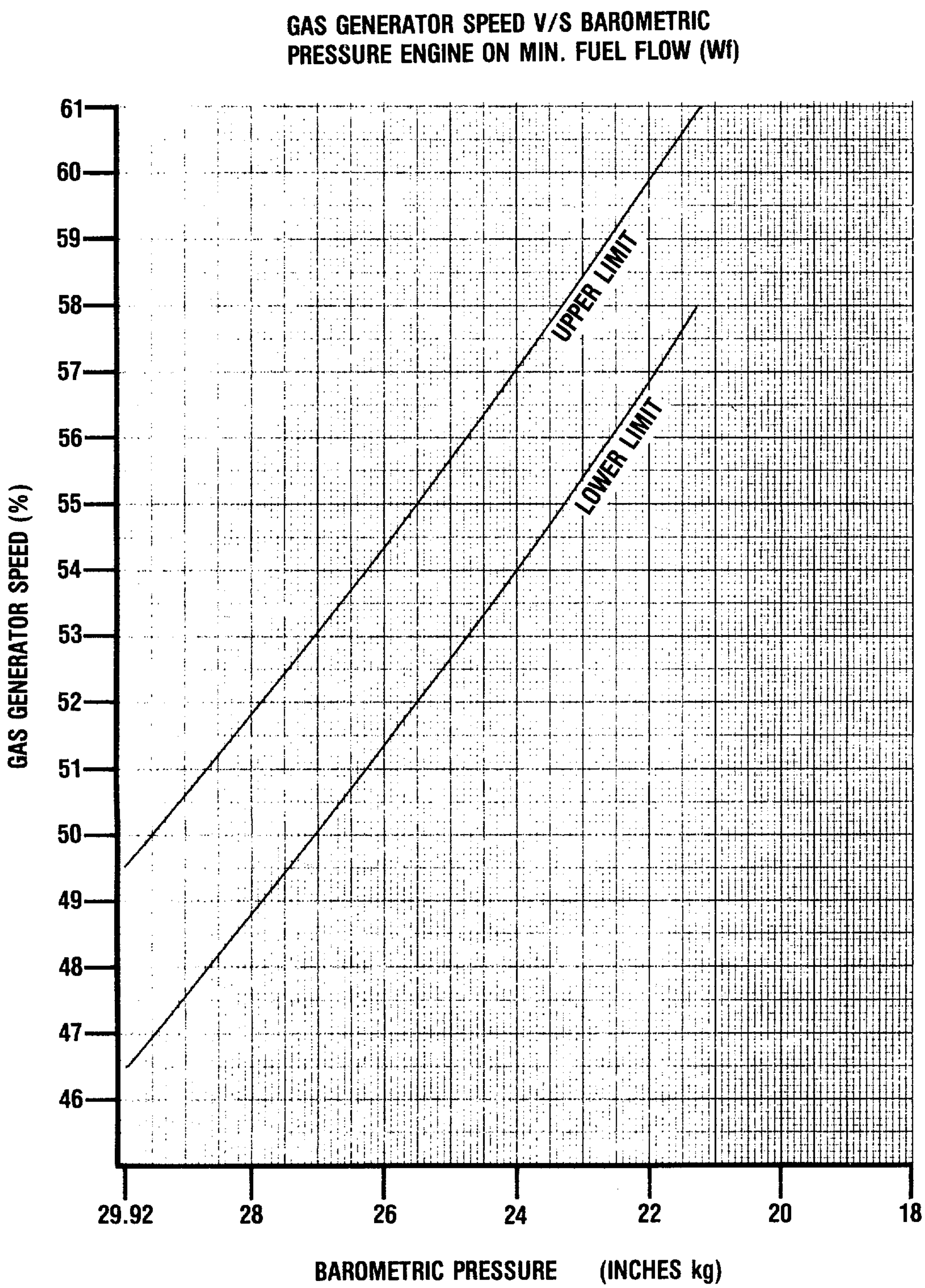
(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory start (subparagraph 3).

(3) Allow engine to warm up to operating temperature and instruments to stabilize.

GO TO NEXT PAGE

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)



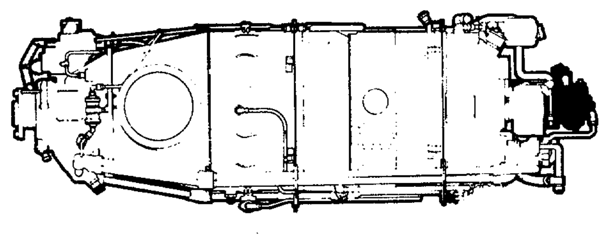

Gas Generator Speed at Minimum Fuel Flow

GO TO NEXT PAGE

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

8.b. (Cont)

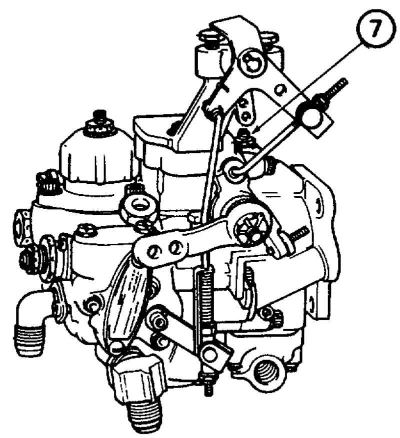
(4) With the water brake unloaded (water pressure off), and oil temperature at 100° F (38°C) minimum, observe Ng at idle speed. Observed Ng should be 51% minimum.



**CAUTION**

**Turn screw in minute increments as adjustment is extremely sensitive.**

(5) If idle speed is incorrect, adjust Lo-idle speed adjustment (7) as required. Turn clockwise to increase speed and counterclockwise to decrease speed.




c. Barometric Pressure between 28.65 and 26.25 in. Hg. At barometric pressure **between 28.65 and 26.25 in. Hg.,** check idle speed adjustment as follows:

(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory engine start (subparagraph 3).

(3) Allow engine to warm up to operating temperature and allow instruments to stabilize.

**GO TO NEXT PAGE**

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

8.c. (Cont)

(4) With the water brake unloaded and oil temperature at **100°F (38°C)** minimum, observe and record Ng at idle speed.

(5) Disconnect Py sense tube between FCU and power turbine governor at the FCU, and check if Ng drops from the value recorded in subparagraph 8.c.(4), preceding. Reconnect Py sense tube.

**NOTE**

During this check, the engine will not respond to power control lever movement. Leave the controls in the Lo-idle position.

**CAUTION**

**Carry out this check with zero power extraction. Should the minimum fuel flow stop be adjusted too low, an excessive drop in Ng will result and the operator must be prepared to shut down the engine if necessary.**

(6) If Ng, with Py sense tube disconnected, was less than Ng recorded in subparagraph 8.c.(4), then engine was governing at the idle speed setting and the idle speed may be adjusted in accordance with subparagraph 8.b.(5).

(7) If Ng, with Py sense tube disconnected, was the same as Ng recorded in subparagraph 8.c.(4), then the engine was running on the minimum fuel flow stop and the idle speed must be checked as in subparagraph 8.d.

d. Barometric Pressure Below 26.25 in. Hg. At barometric pressure below 26.25 in. Hg., check idle speed as follows:

**CAUTION**

**The idle speed must not be adjusted at barometric pressure below 20.58 in. Hg.**

(1) Perform pre-start check (subparagraph 2).

(2) Accomplish satisfactory engine start (subparagraph 3).

(3) Allow engine to warm up to operating temperature and allow instruments to stabilize. Record

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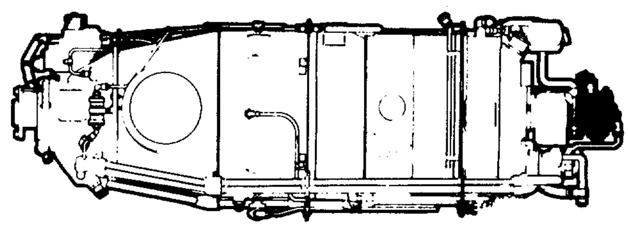
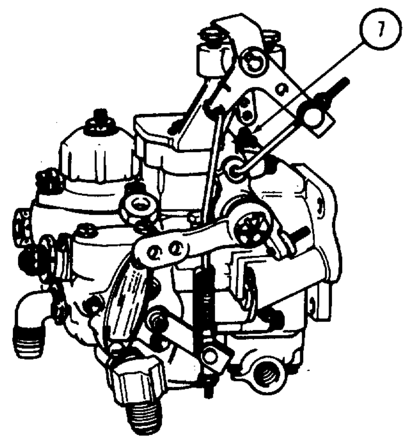
1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

8.d. (Cont)






**CAUTION**

**Turn screw in minute increments as adjustment is extremely sensitive.**

(4) With the water brake unloaded and oil temperature at **100°F (38°C)** minimum, adjust idle speed to 51% minimum, allowed by means of Lo-idle adjustment (7), if required. (Turn clockwise to increase speed and counterclockwise to decrease speed.)

(5) Check security and safety of all adjustments after engine final check-out has been completed

9. Final Adjustments. To make final adjustments, proceed as follows:

**NOTE**

**All adjustments must be made with engine stopped.**

a. Perform pre-start check (subparagraph 2).

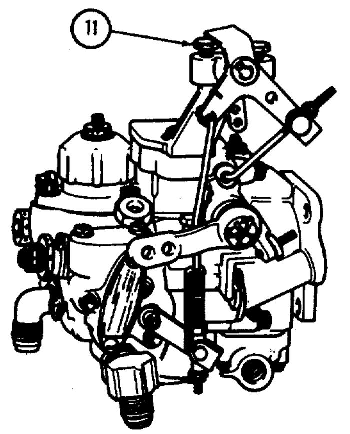
GO TO NEXT PAGE

1-95 GROUND TESTING OF ENGINE ON MOBILE TRAILER ASSEMBLY (AVIM) (Cont)

9. (Cont)

b. Accomplish satisfactory engine start (subparagraph 3).

c. Allow engine to warm up to operating temperature and stabilize to ground idle rpm.




**CAUTION**

**Turn screw in minute increments as adjustment is extremely sensitive.**

d. Advance fuel cutoff lever slowly to HI-IDLE position and check that speed is within required range. If speed is incorrect, adjust HI-IDLE adjustment screw (11) as required.

**NOTE**

**Turn the HI-IDLE stop on FCU clockwise to increase speed, and counterclockwise to decrease speed.**

f. If engine is not to be installed in aircraft preserve in accordance with Section IX.

**END OF SECTION**

# CHAPTER 2

# COMPRESSOR SECTION

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Compressor Section. It is divided into the following sections.



**END OF OVERVIEW**

## Section I AIR INLET SCREEN

2-1 AIR INLET SCREEN

This task covers:

a. Removal (2-1-1)

b. Inspection (2-1-2)

c. Cleaning (2-1-3)

d. Repair (2-1-4)

e. Installation (2-1-5)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114
Torque Wrench (O to 100 inch-pounds)

Materials:
Petroleum Solvent (E.8)
Petrolatum (E.20)
Silastic (E.39)
Methyl-Ethyl-Ketone (E.75)
Bonding Compound (E.78)
Accelerator (E.79)
Polyurethane (E.80)

Personnel Required:

68B Powerplant Mechanic
66G Aircraft Inspector

General Safety Instructions:

**WARNING**

**TOXIC AND FLAMMABLE SOLVENTS**

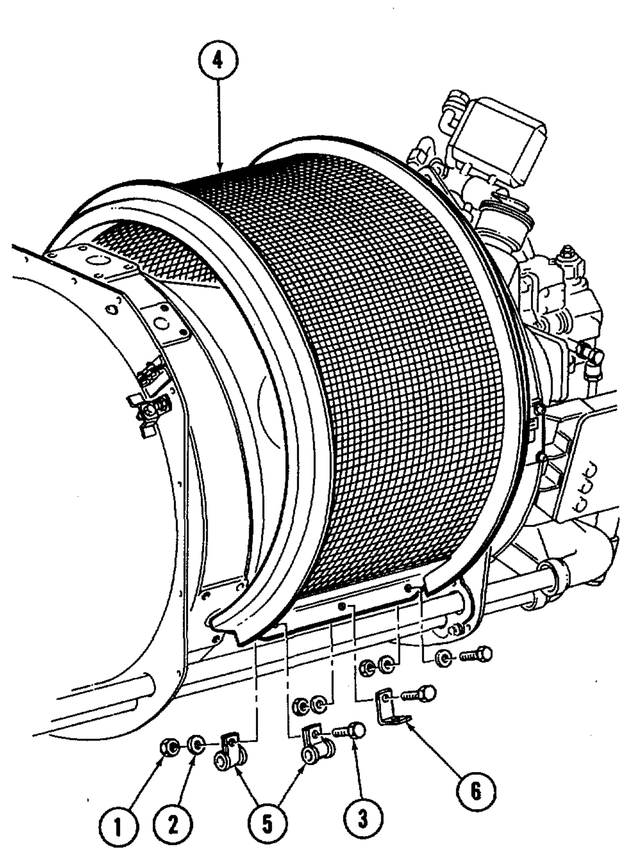
**Solvents used for cleaning are toxic and flammable, They irritate skin and cause burns, Fire can result from use near heat or Open flame, Use only in a well-ventilated area. Wear rubber gloves, In case of contact, immediately flush skin or eyes with water for at least 15 minutes, GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

**GO TO NEXT PAGE**

## 2-1-1 REMOVAL

**CAUTION**

**When air inlet screen is removed, keep intake area clear of all foreign objects which could be ingested by engine and cause serious internal damage. If object is dropped inside ducting, cease all removal or installation procedures until object is located and removed.**



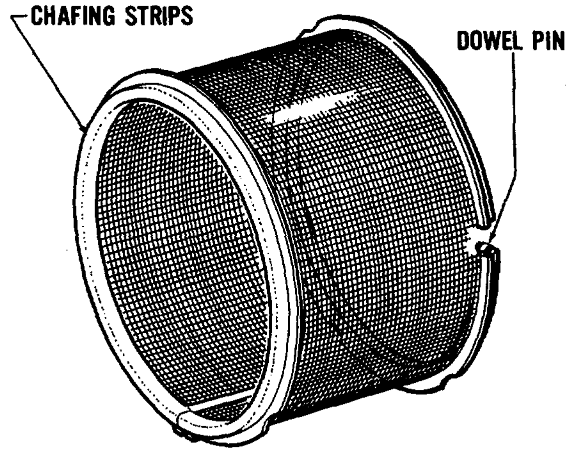

1. Remove three nuts (1), four washers (2), three bolts (3), bracket (6) and two loop clamps (5), from flanges.

2. Carefully part screen (4) at flanges and remove from engine.

**GO TO NEXT PAGE**

## 2-1 AIR INLET SCREEN (Continued)

2-1-2 INSPECTION




Inspect screen for:

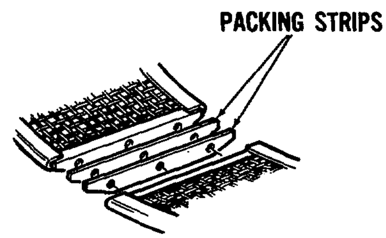
a. Broken mesh, no breaks permitted.

b. Detached or cracked chafing strips, repair as necessary (Task 2-1-4).

c. Detached flange packing strips, repair as necessary (Task 2-1-4).

**NOTE**

**Damaged locating dowel pin, replace if necessary (Task 2-1-4).**




2-1-3 CLEANING

1. Clean screen in Petroleum Solvent (E.8)

**WARNING**

COMPRESSOR AIR

**Compressed air is dangerous when directed toward yourself or another person. The airstream or material blown by the airstream can cause injury particularly to the eyes or face. Use goggles to protect eyes and face. DO NOT exceed 30 psig. DO NOT direct airstream towards yourself or another person.**

2. Dry with clean compressed air.

**GO TO NEXT PAGE**

## 2-1 AIR INLET SCREEN (Continued)

2-1-4 REPAIR

**CAUTION**

**Do not repair strips if wire mesh is broken or detached from flange.**

1. Fill cracks in chafing strips using Bonding Compound (E.78) and Accelerator (E.79).

2. Rebond chafing strips to flanges, using Silastic (E.39). Allow to dry at room temperature for 72 hours.

3. Paint chafing strips as follows:

a. Mask adjacent screen areas.

b. Clean chafing strips using Methyl-Ethyl-Ketone (E.75) and allow to dry.

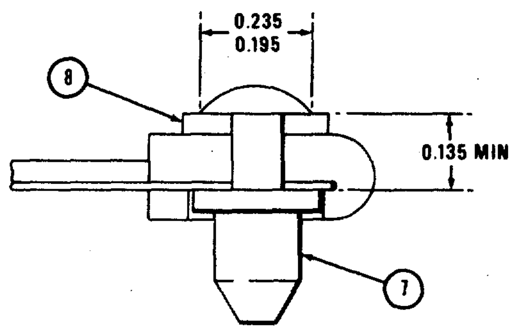
c. Apply three coats of Polyurethane (E.80). Allow to dry between each application.

4. Rebond packing strips using Silastic (E.39). Allow to dry at room temperature for 72 hours.

5. Replace damaged locating dowel pins as follows;

a. File off pin head to release washer. Remove pin.

b. Install new pin (7) with flat washer (8). Secure by peening pin head to dimensions shown.




GO TO NEXT PAGE

**2-1 AIR INLET SCREEN (Continued)**

2-1-5 INSTALLATION

**CAUTION**

**When air inlet screen is removed, keep intake area clear of all foreign objects which could be ingested by engine and cause serious internal damage. If object is dropped inside ducting, cease all removal or installation procedures until object is located and removed.**

1. Smear chafing strips with Petrolatum (E.20).

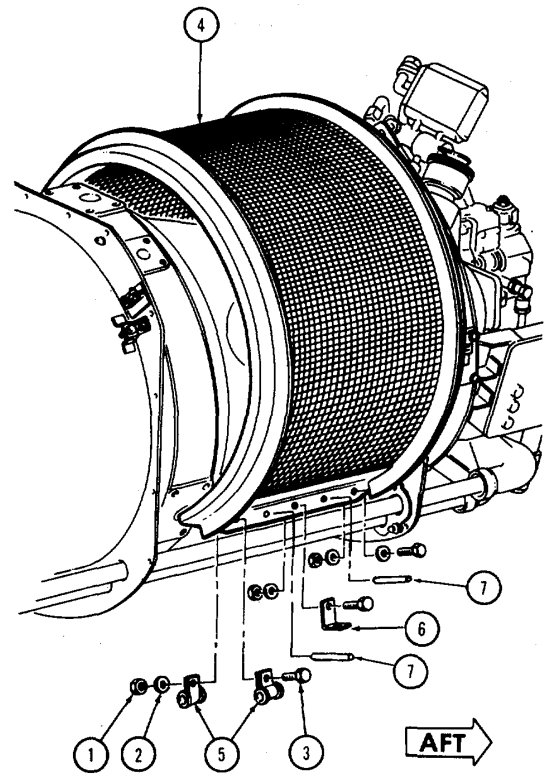
2. Install air inlet screen on compressor inlet case, insuring locating dowel (7) fits into associated hole on rear fireseal mounting ring.

3. Secure flanges, at 6 o'clock position, as follows:

a. Install bolt (3), with washer (2), through aft bolt holes. Secure with second washer (2) and nut (1).

b. Install bolt (3) through fuel pressure tube bracket (6) and center bolt holes. Secure with washer (2) and nut (1).

c. Install bolt (3) through ignition harness loop clamp (5), through front bolt holes and second loop clamp (5). Secure with washer (2) and nut (1).




d. Torque nuts to 36 to 40 inch-pounds.

FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section II COMPRESSOR BLEED VALVE

2-2 COMPRESSOR BLEED VALVE

This task covers:

a. Removal

b. Inspection (2-2-2)

c. Installation (2-2-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114
Torque Wrench (O to 100 inch-pounds)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)

Parts:
Packings
Gasket

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:.
Air Inlet Screen Removed
(Task 2-1-1)

General Safety Instructions:

**WARNING**

LUBRICATING OILS HAZARDOUS

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation, Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

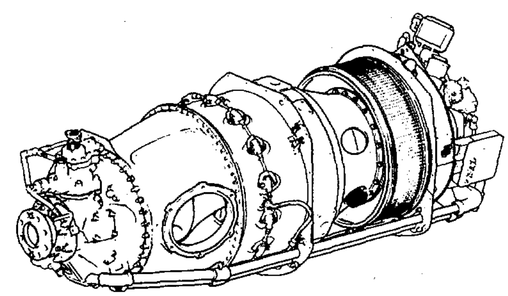
**GO TO NEXT PAGE**

## 2-2 COMPRESSOR BLEED VALVE (Continued)

2-2-1 REMOVAL

**CAUTION**

**When air inlet screen is removed, keep intake area clear of foreign objects which could be ingested into engine and cause internal damage. If object is dropped inside ducting, cease all removal or installation procedures until object is located and removed.**



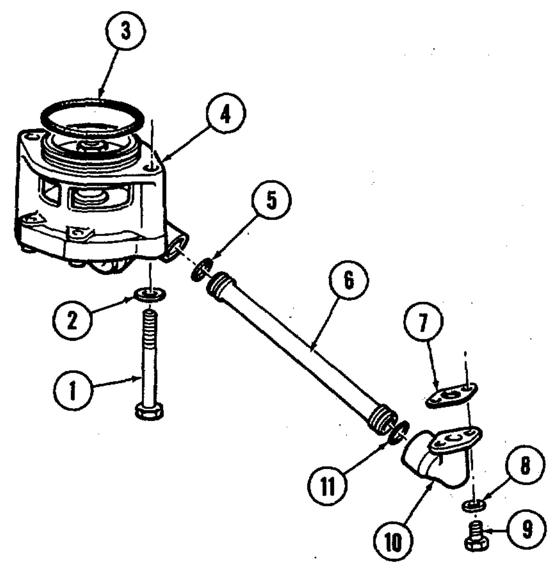
1. Remove bleed valve as follows:

a. Cut lockwire and remove two bolts (9) and washers (8) securing engine elbow (10) to gas generator case assembly.

b. Cut lockwire and remove two bolts (1) and washers (2) securing bleed valve (4) to gas generator case assembly.

c. Withdraw bleed valve assembly complete with transfer tube (6) and engine elbow (10) from gas generator case assembly.

d. Remove transfer tube (6) and engine elbow (10) from airbleed valve. Remove preformed packing (3) from bleed valve base and transfer tube preformed packings (5) and (11) and discard. Remove gasket (7) from base of engine elbow and discard. (Refer to Chapter 1, Section VIII, for cleaning instructions.)



## 2-2 COMPRESSOR BLEED VALVE (Continued)

2-2-2 INSPECTION

1. Insure piston is free to travel within valve housing without sticking. If piston sticks, reject bleed valve.

2. Excessive sideways play of piston indicates guide pin wear and valve should be rejected.

3. Inspect.

2-2-3 INSTALLATION

1. Lubricate new preformed packings (3), (5) and (11) with Lubricating Oil (E.2) or (E.71).

2. Install preformed packing (3) on base of bleed valve (4).

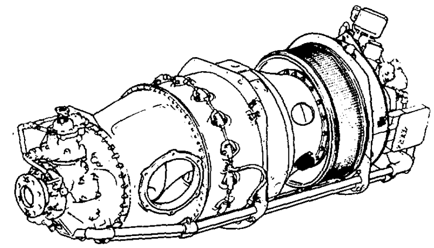
3. Install preformed packings (5) and (11) on transfer tube (6).

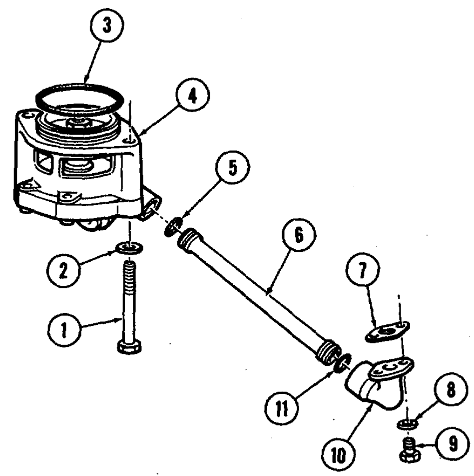
4. Install transfer tube (6) in bore of bleed valve (4) and elbow (10).

5. Install new gasket (7) on elbow (10).

6. Carefully install bleed valve through gas generator outer case and seat on inner case. Insure correct seating and secure with two bolts (1) and washers (2). Do not torque at this stage.

7. Locate elbow (10) on gas generator boss and secure with two bolts (9) and washers (8).






8. Torque bolts (1) and (.9) to 32 to 36 inch-pounds. Lockwire (E.5) each pair of bolts.

FOLLOW ON MAINTENANCE:

Installation Air Inlet Screen
(Task 2-1-5)

**END OF TASK**

## Section III COMPRESSOR TURBINE ASSEMBLY

### 2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM)

This task covers:

a. Removal (2-3-1)

b. Inspection (2-3-2)

c. Installation (2-3-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114

| | |
|---|---|
| Adapter | (T.1) |
| Cover | (T.6) |
| Gage | (T.14) |
| Protector | (T.19) |
| Puller | (T.31) |
| Spreader | (T.47) |
| Squeezer | (T.48) |
| Wrench | (T.53) |

Outside Micrometer (0 to 10 inch)
Torque Wrench (0 to 100 inch-pounds)
Torque Wrench (0 to 700 inch-pounds)

Materials:
Molykote G (E.23)
Lint-free Cloth (E.74)

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Power Section Removed
(Task 4-1-1)

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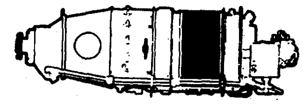
## 2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM) (Continued)



2-3-1 REMOVAL

1. Before removal, measure and record compressor turbine tip clearance, using suitable feeler gage, at center and butt ends of each shroud segment. The average tip clearance of the recorded readings shall be 0.011 to 0.018 inch. Clearance in excess of 0.018 inch will require replacement of shroud (Task 3-2-5).

**NOTE**

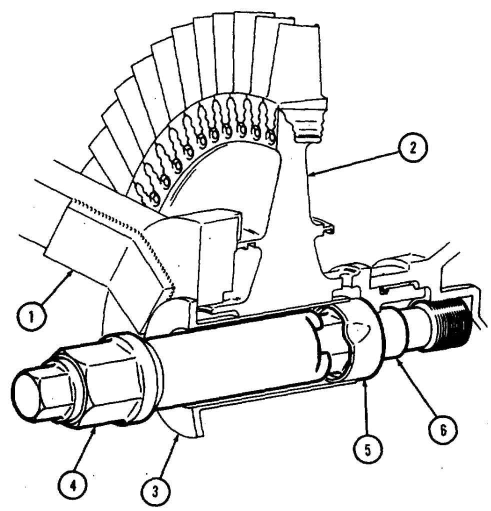
**The clearance at any one location must not exceed 0.020 inch or be less than 0.009 inch.**

2. If clearances are less than 0.009 inch at any location due to high spots, the shroud segments shall be ground over a length not exceeding one inch per segment (Task 3-2-4).

3. Install Wrench (T53)(1) at C flange of gas generator case to prevent compressor turbine disk (2) from turning.

4. Insert Protector (T19)(3) into centerbore of disk (2).

5. Using Spreader (T.47)(4) open up keywasher (5). Remove spreaders.

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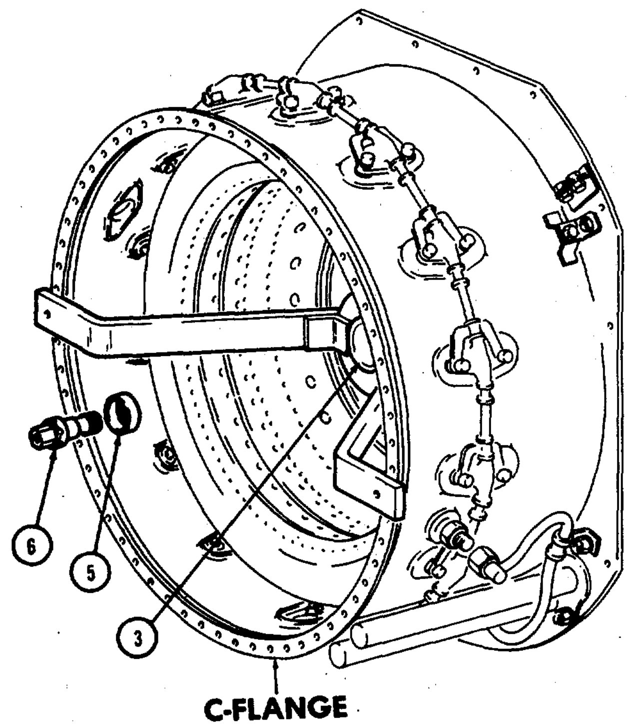
## 2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM) (Continued)

2-3-1 REMOVAL (Cont)

6. Using conventional socket wrench, remove compressor shaft bolt (6) and keywasher (5). Discard keywasher.

7. Remove protector (3).

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## 2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM) (Continued)

2-3-1 REMOVAL (Cont)

8. Remove turbine disk as follows:

**CAUTION**

**When handling disk assembly take extreme care not to damage blade tips.**

**CAUTION**

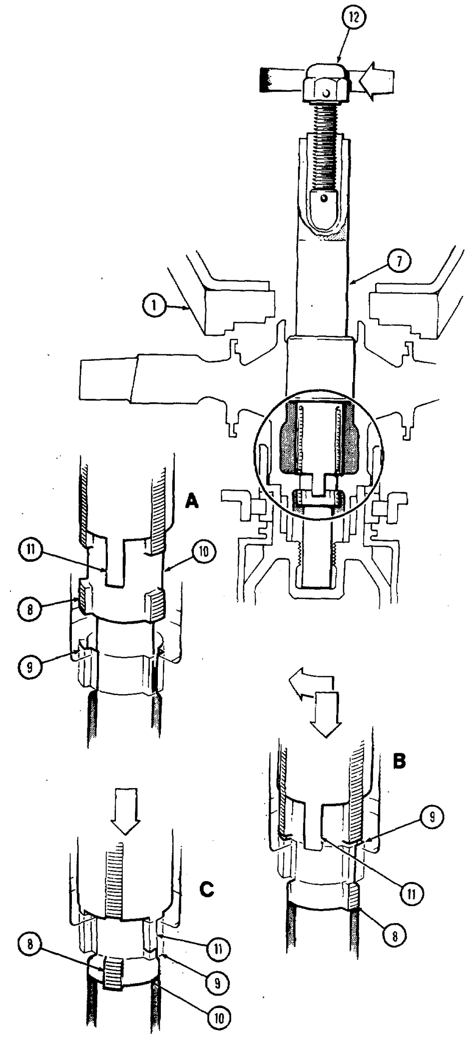
**Continued operation of puller may damage shroud or blades if contacted.**

a. Insert Puller (T.31)(7) in disk centerbore, and engage lugs (8) with slots (9) in disk (refer to View A).

b. Ease body (10) downward until lug (8) is below slot (9) (refer to View B), then turn body with lug to contact underside of disk (refer to View C).

c. Position lock (11) in disk slot (9), and using a conventional wrench, turn nut (12) to break turbine disk snapfit only, as evidenced by freedom of puller operation. Remove Wrench (T.53)(1) from C flange.

d. Carefully lift turbine disk from splines on shaft. Place disk on bench and remove puller (7)



**2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM) (Continued)**

2-3-2 INSPECTION

**CAUTION**

**Do not remove blades from disk.**

1. Inspect turbine assembly for scaling due to oxidation. Evidence of scaling is cause for rejection of assembly.

2. Inspect blades, in original position, as follows:

a. Blade shift. If more then **0.010 inch** return assembly to Depot Maintenance.

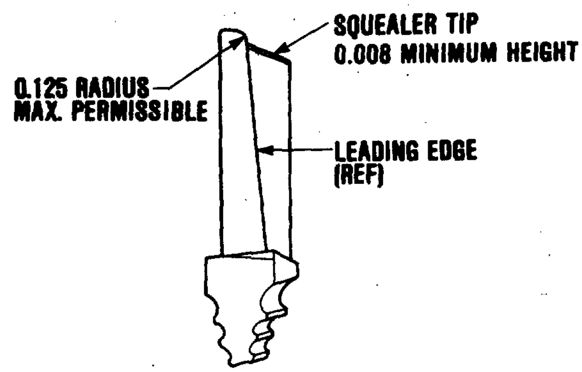
b. Check minimum squealer tip height. If less than **0.008 inch**, reject assembly.

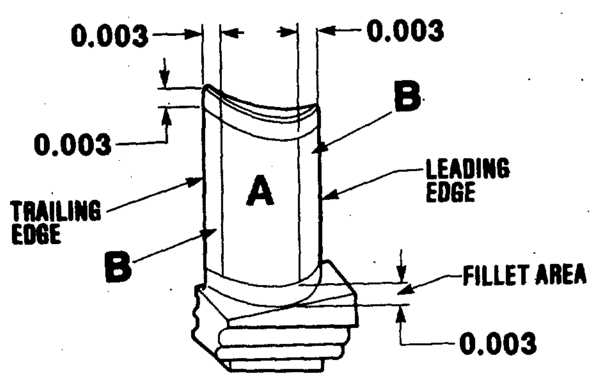
c. Area A: If any cracks are present or there are more than three nicks, dents or pits up to **0.003 inch** deep the assembly must be returned to Depot Maintenance.

d. Area B: If any cracks are present or there is more than one nick, dent or pit up to **0.003 inch** deep the assembly must be returned to Depot Maintenance.

e. Leading and trailing edges: If any cracks are present or there is more than one nick, dent or pit up to **0.010 inch** deep, or leading edge tip radius exceeds **0.125 inch** the assembly must be returned to Depot Maintenance.

f. No damage is permitted in fillet area.

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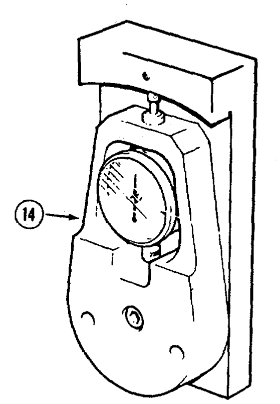
## 2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM) (Continued)

2-3-3 INSTALLATION



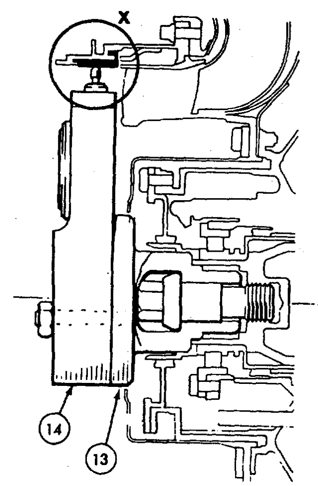

**CAUTION**

When handling disk assembly take extreme care not to damage blade tips.

1. Using an outside micrometer measure diameter of turbine disk assembly in at least four places and determine largest diameter. Record this diameter.

2. Turn gas generator assembly to vertical position and install Cover (T.6) and Adapter (T.1)(13) on compressor stub shaft. Secure with mounting bolt.

3. Set indicator of Gage (T.14)(14) to zero and install gage on adapter (13). Secure with two nuts, torque nuts to 20 to 30 inch-pounds.




4. Measure shroud ID using gage (14). Subtract this diameter from previously noted disk OD and divide by 2 to give blade tip clearance which shall be 0.014 to 0.020 inch.

5. Remove gage (14).

6. If clearance is under limits, grind shroud segments (Task 3-2-4).

7. If clearance is over limits, replace shrouds with a suitable class (Task 3-2-5).

GO TO NEXT PAGE

## 2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM) (Continued)

2-3-3 INSTALLATION (Cont)

8. Lightly coat splines of turbine disk (2) with Molykote G (E.23).

**CAUTION**

When aligning splines, insure compressor turbine rotor assembly is held steady to avoid damaging blade tips on shroud segments.

9. Align splines and install turbine disc (2).

10. Check keywasher (5) is clean, dry and free from burrs.

11. Lightly coat inside surface of keywasher (5) and threads of bolt (6) with Molykote G (E.23).

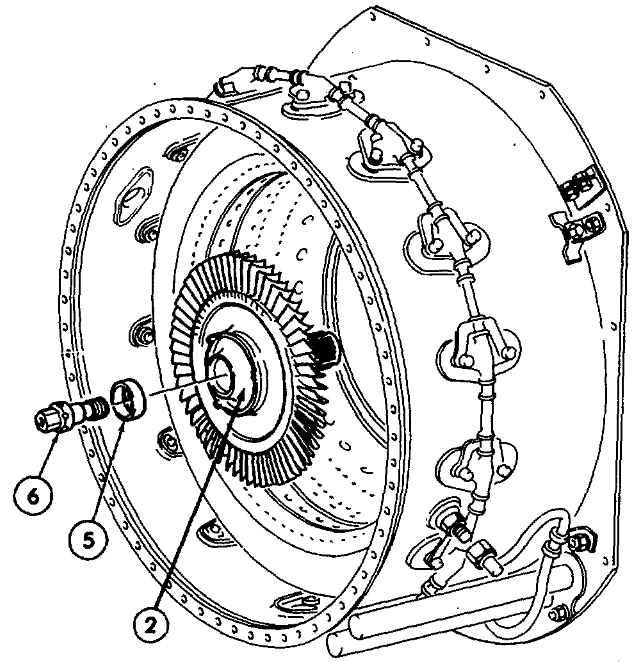
12. Install keywasher (5) and bolt (6).

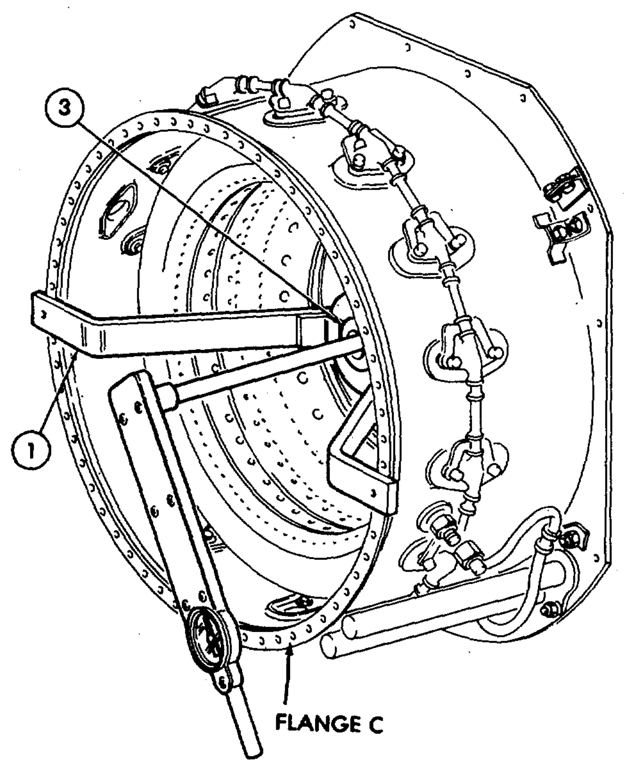
13. Install Wrench (T.53)(1) and Protector (T.19)(3). Insure that locating dowels on outer arms of wrench are located in two diametrically opposed flange C bolt holes.

14. Using a standard torque socket wrench, torque bolt (6) to 600 to 650 inch-pounds, loosen to zero and retorque to 420 to 460 inch-pounds.

15. Remove protector (3).

16. Check blade tip clearance (Task 2-1-3). Inspect.



## 2-3 COMPRESSOR TURBINE ASSEMBLY (AVIM) (Continued)

2-3-3 INSTALLATION (Cont)

17. Lock keywasher as follows:

a. Unscrew nut (15) of Squeezer (.T.48)(16) to top of threads (17) and install squeezer (16) in centerbore of turbine -disk (2). Tighten screw (18) until resistance is felt. Do not use excessive force.

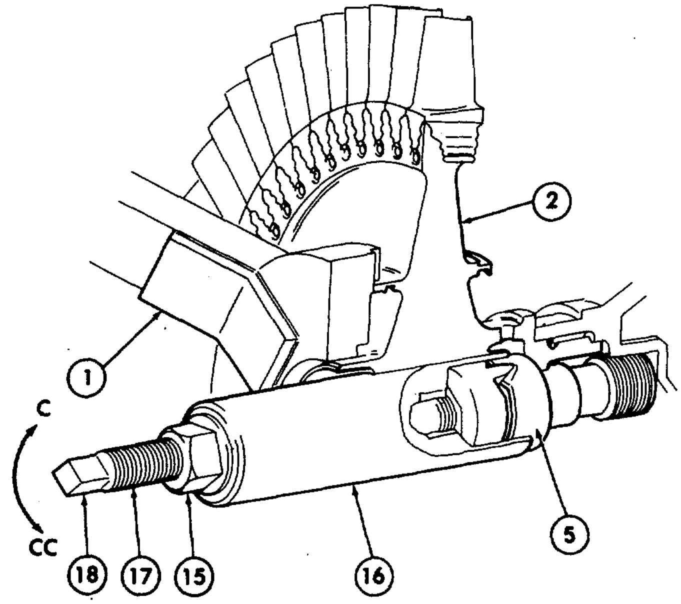
b. Tighten nut (15) clockwise until keywasher (5) is crimped. Remove squeezer (16) by slackening nut (15) and turning screw (18) counterclockwise.

c. Remove wrench (1).

d. Inspect centerbore for evidence of metal chips and, if found, remove with a clean Lint-free Cloth (E.74).

FOLLOW ON MAINTENANCE:

Installation Power Section
(Task 4-1-2)




**END OF TASK**

## Section IV COMPRESSOR ROTOR BLADES

### 2-4 COMPRESSOR ROTOR BLADES (FIRST-STAGE) INSPECTION (AVIM)

This task covers:

Inspection (2-4-1)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114

Materials:
None

Personnel Required:
66G Aircraft Inspector

Equipment Condition:
Air Inlet Screen Removed
(Task 2-1-1)

### 2-4-1 INSPECTION

1. The maximum acceptable damage and erosion limits, without repair, are detailed in the following subparagraphs. If damage or erosion exceeds acceptable limits, complete engine must be returned to Depot Maintenance.

GO TO NEXT PAGE

**2-4 COMPRESSOR ROTOR BLADES (FIRST-STAGE) INSPECTION (AVIM) (Continued)**

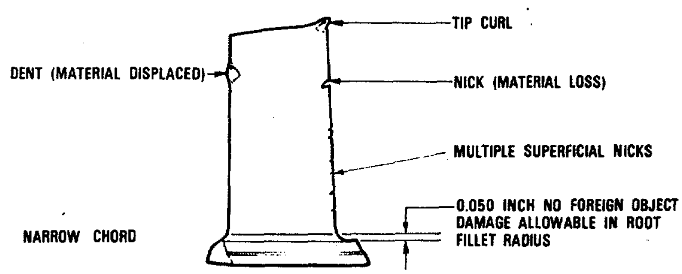
2-4-1 INSPECTION (Cont)

**NOTE**

**There are two configurations of blades; narrow chord or wide chord**

2. Damage limits for narrow chord blades are as follows:

a. Multiple superficial leading edge nicks, **0.010 inch maximum** depth, on any number of blades.




b. Leading or trailing edge dents, **0.030 inch** deep by **0.040 inch** long. **Four dents** per blade on either leading or trailing edge on any number of blades.

**NOTE**

**A dent is considered to be an indentation caused by impact, in which the parent metal contour has been displaced.**

c. Leading or trailing edge tip curl without signs of tearing. Maximum permissible deformation is **0.050 inch on one edge on six blades only.**

d. Leading or trailing edge nicks **0.020 inch maximum** depth. No more than **two nicks**, on either leading or trailing edge, on any number of blades.

**NOTE**

**A nick is considered to be a sharp indentation caused by impact, resulting in parent metal loss.**

e. Cracks are not allowed on any blade.

**GO TO NEXT PAGE**

## 2-4 COMPRESSOR ROTOR BLADES (FIRST-STAGE) INSPECTION (AVIM) (Continued)

2-4-1 INSPECTION (Cont)

3. Erosion limits for narrow chord blades are as follows:

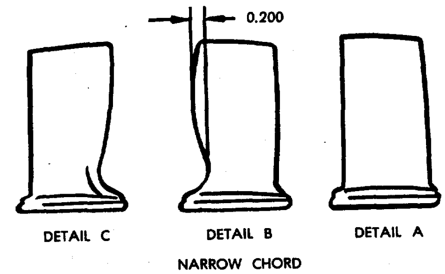
a. Detail A shows new blade for comparison.

b. Acceptable leading edge erosion is **0.100 inch maximum** parent metal loss (Detail B) with no erosion on underside of airfoil section.

c. Unacceptable leading edge erosion is more than **0.100 inch** parent metal loss plus erosion on underside of airfoil section (Detail C).

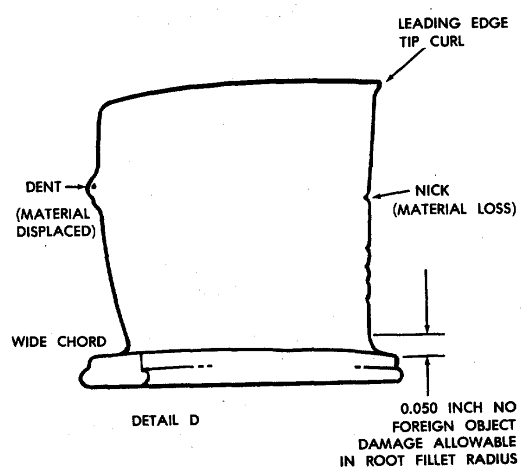
4. Damage limits for wide chord blades are as follows(Detail D):

a. Multiple superficial leading edge nicks **0.030 inch maximum** depth on any number of blades.




**NOTE**

**Nicks in leading and trailing edges become increasingly critical toward the root of the blade. Damage is not permitted within 0.050 inch of the blade root fillet radius.**

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## 2-4 COMPRESSOR ROTOR BLADES (FIRST-STAGE) INSPECTION (AVIM) (Continued)

2-4-1 INSPECTION (Cont)

b. Leading or trailing edge dents 0.055 inch deep by 0.080 inch long. Four dents per blade on either leading or trailing edge on any number of blades (Detail D).

**NOTE**

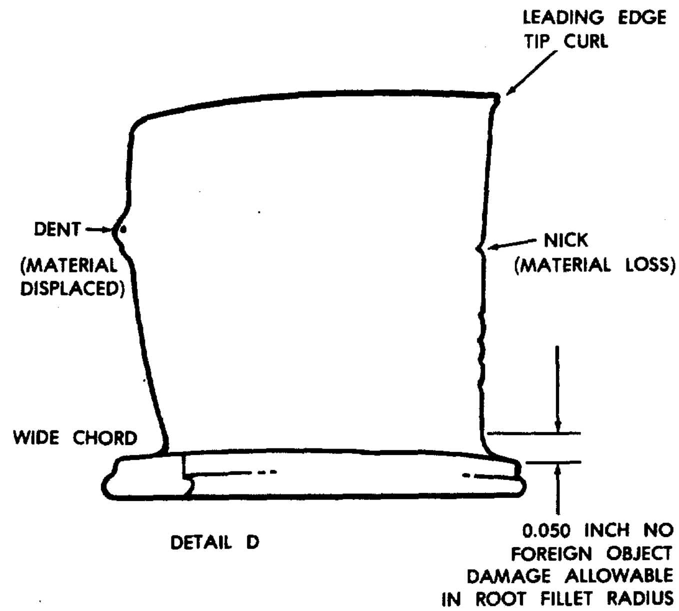
**A dent is considered to be an indentation caused by impact in which the parent metal has been displaced.**

c. Leading or trailing edge tip curl without presence of tear. Maximum allowable deformation **0.100 inch** on one edge, **four blades only**.

d. Leading or trailing nicks **0.050 inch maximum** depth. **Four nicks maximum** per blade on either leading or trailing edge on any number of blades.

**NOTE**

**A nick is considered to be a sharp surface indentation caused by impact, resulting in parent metal loss. No cracks permitted.**

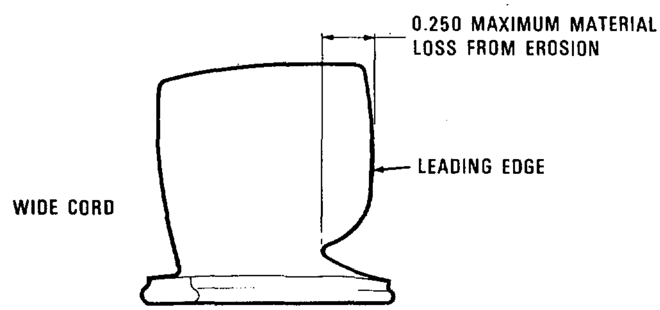


## 2-4 COMPRESSOR ROTOR BLADES (FIRST-STAGE) INSPECTION (AVIM) (Continued)

2-4-1 INSPECTION (Cont)

5. Erosion limits for wide chord blades are as follows:

Maximum material loss from leading edge to highest point of erosion, must not exceed 0.250 inch.




DETAIL D

FOLLOW ON MAINTENANCE:

Installation Air Inlet Screen
(Task 2-1-5)

**END OF TASK**

# CHAPTER 3

# COMBUSTION SECTION (AVIM)

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Combustion Section. It is divided into the following sections.



**END OF OVERVIEW**

## Section I LINER ASSEMBLY

3-1 LINER ASSEMBLY (AVIM)

This task covers:

a. Removal (3-1-1)

b. Inspection (3-1-2)

c. Repair (3-1-3)

d. Installation (3-1-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114
Drill and Brace (1/16 inch)

Materials:
Welding Wire (E.60)
Inert Gas (E.61)

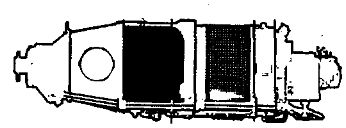
Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector
44B Welder

Equipment Condition:
Power Section Removed
(Task 4-1-1)
Fuel Manifold Assembly Removed
(Task 6-5-1)
Glow Plugs Removed (Task 7-1-1)

GO TO NEXT PAGE

## 3-1 LINER ASSEMBLY (AVIM) (Continued)

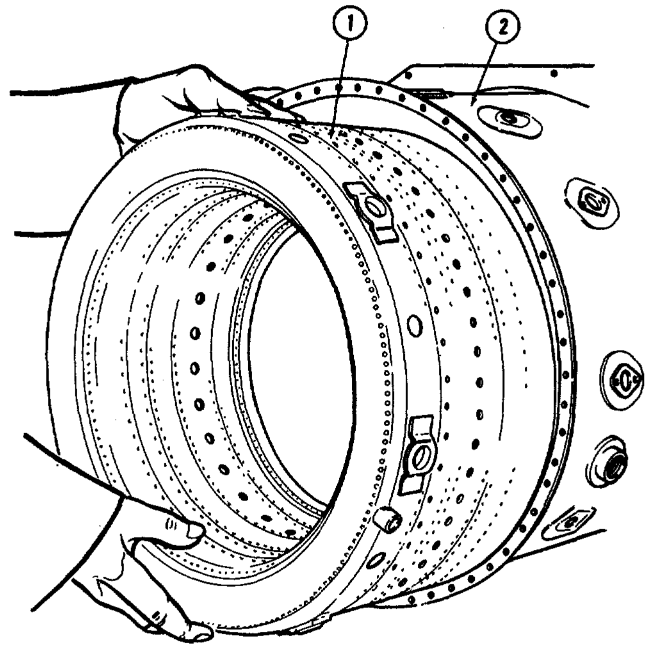
3-1-1 REMOVAL



**CAUTION**

**Do not attempt to pry liner loose with tools.**

Using light hand pressure only, withdraw liner (1) from gas generator case (2).




3-1-2 INSPECTION

1. General

Inspect combustion chamber liner for cracks, buckling and/or burning. Cracks in liner surfaces are usually of stress-relieving nature and as such, are not serious in that rate of growth decreases as crack lengthens. Heat stresses, in effect, relieve original stress conditions. It is considered normal to observe a given type of deterioration repeated from liner to liner in the same engine or engines of same model. Typical liner distress consists of buckling at the inner wall adjacent to the dome.

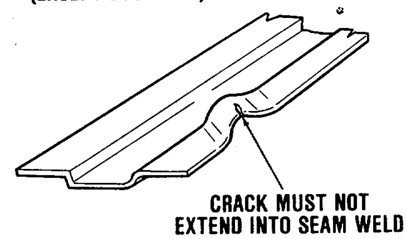
**GO TO NEXT PAGE**

**3-1 LINER ASSEMBLY (AVIM) (Continued)**

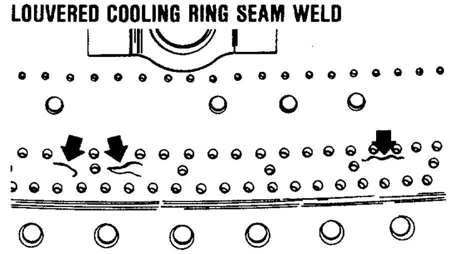
3-1-2 INSPECTION (Cont)

2. Acceptable Conditions Not Requiring Repair:

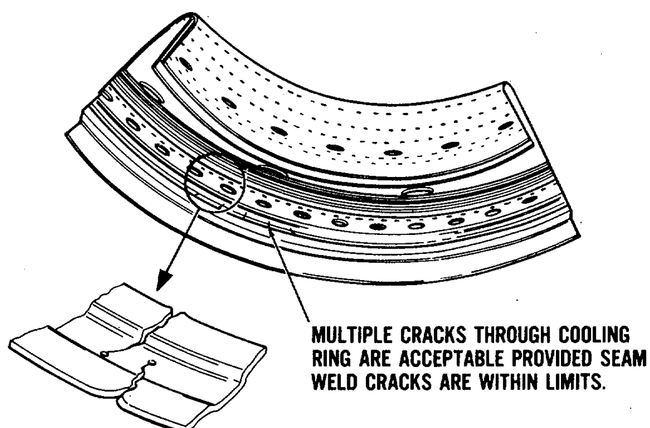
a. Localized buckling and/or burning of all cooling rings, other than louvered type, accompanied by cracking is permissible provided the cracks do not extend into seam weld.




b. Circumferential cracks in the louvered cooling ring seam weld are permissible, provided they do not exceed 0.300 inch in length and are stop-drilled using a 1/16 inch drill.




c. Cracks in the louvered cooling ring, other than those described in subparagraph b. preceding, are permissible.

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**3-1 LINER ASSEMBLY (AVIM) (Continued)**

3-1-2 INSPECTION (Cont)

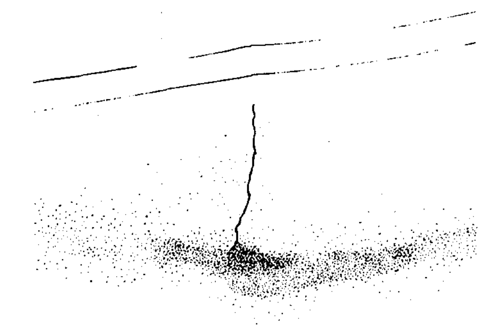
2. Acceptable Conditions Not Requiring Repair: (Cont)

d. Straight line cracks between two adjacent cooling holes.

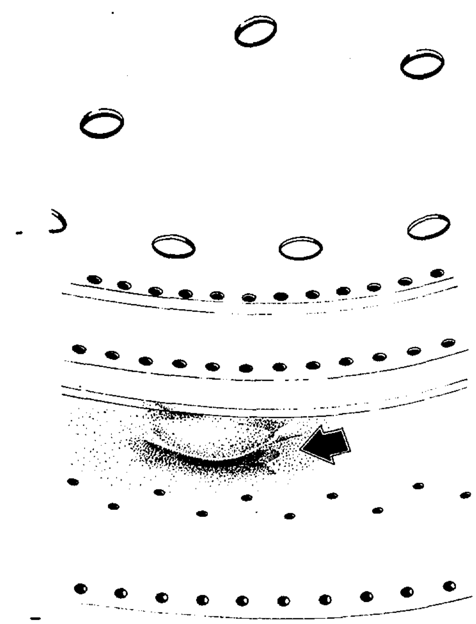
**CAUTION**

**Cracks running in the same direction, such that they could join, are not permissible, unless they are separated by at least three inches of sound liner.**

e. A maximum of seven cracks, each crack not exceeding one inch in length, is permissible in the liner adjacent to the dome end.



f. Localized areas that have been heated to an extent to buckle the liner, are considered acceptable, provided buckling is shallow and not associated with burning, which would reduce liner wall thickness, thus weakening the structure.



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**3-1 LINER ASSEMBLY (AVIM) (Continued)**

3-1-2 INSPECTION (Cont)

3. Acceptable Conditions Requiring Repair:

a. Buckled cooling rings, where cooling air gap has been eliminated, must be reworked (Task 3-1-3) to restore uniform air cooling gap.

b. Cracks not exceeding two inches in length must be welded (Task 3-1-3).

c. Circumferential cracks adjacent to seam welds must be repaired by welding (Task 3-1-3).

**NOTE**

**Cracks in excess of 0.030 inch wide must not be repaired. Discard liner and install replacement. Return discarded liner to Depot Maintenance.**

d. Cracks progressing from a free edge, so that their meeting is imminent and could allow a piece of liner to break loose, must be repaired by welding (Task 3-1-3).

**GO TO NEXT PAGE**

**3-1 LINER ASSEMBLY (AVIM) (Continued)**

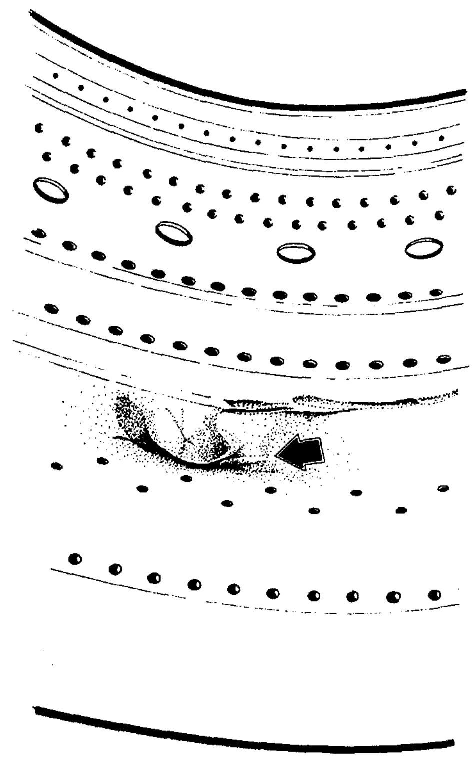
3-1-2 INSPECTION (Cont)

4. Unacceptable Conditions - No Repairs Permissible:

**NOTE**

**Discarded combustion chamber liners should be returned to Depot Maintenance for further evaluation. Install replacement liner.**

a. Severe buckling, as shown, causing kinking of metal.



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**3-1 LINER ASSEMBLY (AVIM) (Continued)**

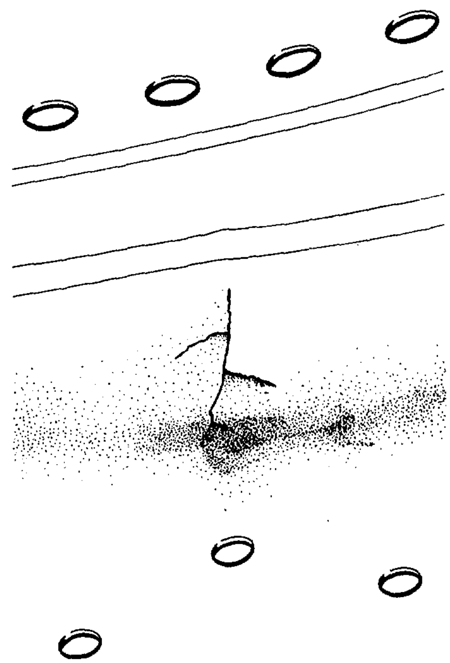
3-1-2 INSPECTION (Cont)

4. Unacceptable Conditions - No Repair Permissible: (Cont)

b. Cracks exceeding two inches in length.

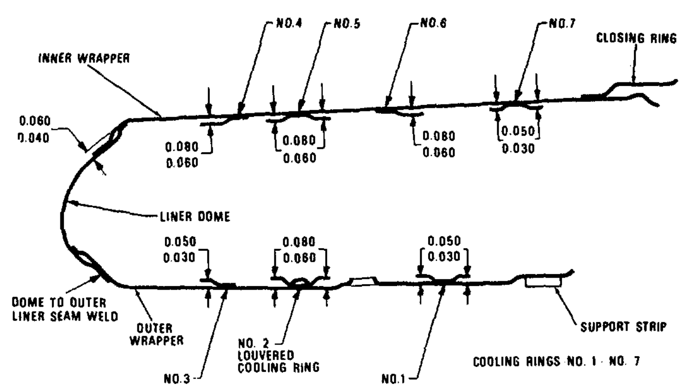
c. Circumferential cracks adjacent to seam welds, which are in excess of 0.030 inch wide.

d. Multiple cracks, as shown.



**3-1-3 REPAIR**

1. Restore cooling ring gaps to dimensions shown, using a locally manufactured tool.



## 3-1 LINER ASSEMBLY (AVIM) (Continued)

3-1-3 REPAIR (Cont)

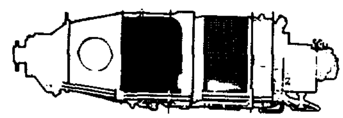
2. Liner cracks not associated with burning, buckling, or deformation must be repaired by stop drilling both ends of crack, using 1/16 inch drill. Vee-out crack and fusion weld, using Welding Wire (E.60).

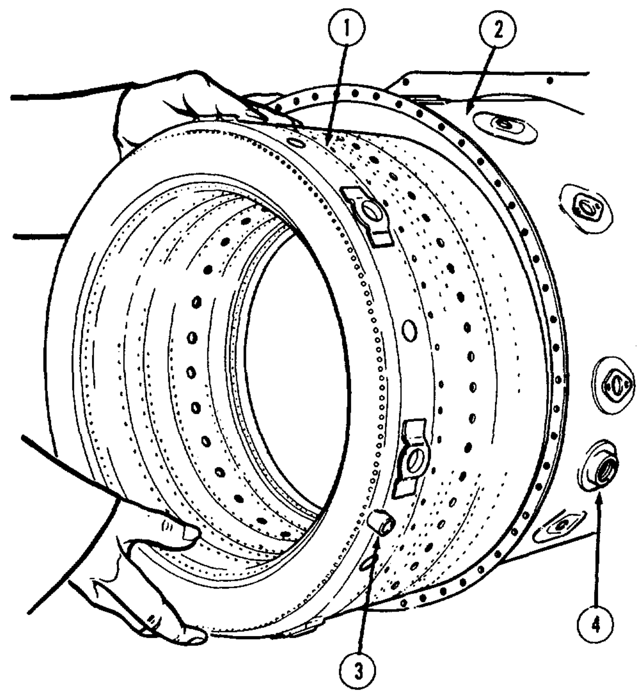
**NOTE**

**Do not dress welds on completion of welding process. A copper backup plate should be used to reduce distortion, with recommended addition of inert gas.**

3-1-4 INSTALLATION

Carefully install liner (1) into gas generator case (2) aligning glow plug locating hole (3) with mounting boss (4).






FOLLOW ON MAINTENANCE:

Installation Fuel Manifold
Assembly (.Task 6-5-2)
Installation Power Section
(Task 4-1-2)
Installation Glow Plugs
(Task 7-1-5)

**END OF TASK**

## Section II INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY

### 3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM)

This task covers:

a. Removal (3-2-1)
b. Disassemble (3-2-2)
c. Inspection (3-2-3)
d. Repair (3-2-4)
e. Assemble (3-2-5)
f. Installation (3-2-6)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114
Torque Wrench (O to 100 inch-pounds)
Grinder (T.16)
Spreader (T.46)
Wheel (T.52)

Materials:
Lubricating Oil (E.2)
Lockwire (E.4)
Petroleum Solvent (E.8)
Colorbrite Pencil (E.31)
Gloves (E.82)

Parts:
Vee-packing
Ceramic Cord
Slave Preformed Packing

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Liner Assembly Removed (Task 3-1-1)
Compressor Turbine Assembly Removed (Task 2-3-1)

General Safety Instructions

**WARNING**

LUBRICATING OILS HAZARDOUS

Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.

GO TO NEXT PAGE

**3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Cont)**

INITIAL SETUP (Cont)

General Safety Instructions (Cont)

**WARNING**

TOXIC AND FLAMMABLE SOLVENTS

Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame. Use only in a well-ventilated area. Wear rubber gloves. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. GET IMMEDIATE MEDICAL ATTENTION FOR EYES.

**GO TO NEXT PAGE**

## 3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)

3-2-1 REMOVAL

**WARNING**

- **When handling combustion chamber internal parts that have been exposed to fuel containing tetraethyl lead, insure that the by-product (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.**
- **If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.**
- **Gloves and eye goggles shall be worn at all times when handling contaminated parts.**

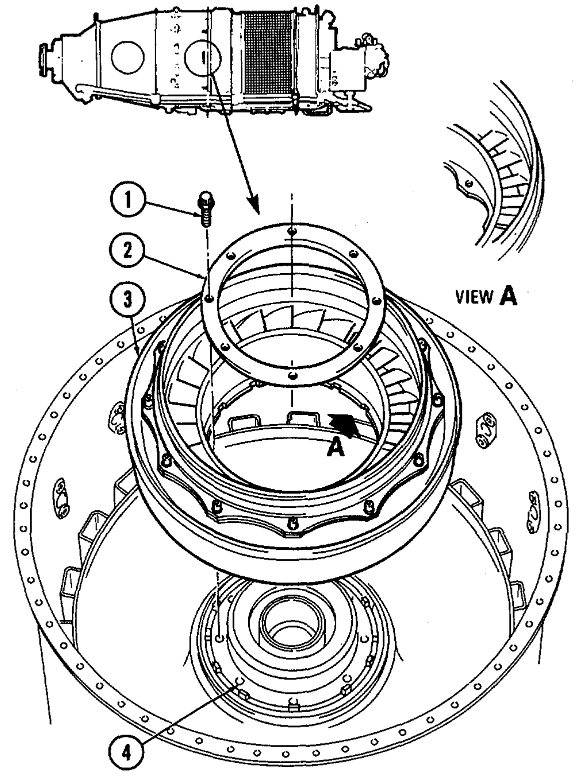
Remove assembly as follows:

a. Remove eight bolts (1) securing clamp (2) and assembly (3) to compressor bearing cover flange (4).

**NOTE**

**Some engines do not include clamp plate. The configuration of the flange of the compressor turbine vane support on these engines is shown as view A.**

b. Remove assembly from gas generator case.




### 3-2-2 DISASSEMBLE

1. For ease of reassembly, suitably index-mark, at 12 o'clock position on flanges of shroud housing, outer vane support and inner (small) exit duct using a Colorbrite Pencil (E.31).

GO TO NEXT PAGE

## 3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM)(Continued)

3-2-2 DISASSEMBLE (Cont)

2. Identify vane adjacent to offset hole at 12 o'clock position as number 1, using a Colorbrite Pencil (E.31). Identify remaining 29 vanes in a clockwise direction.

3. Remove 12 bolts (5) and separate shroud housing (6) complete with shield (7) and segments (8), outer vane support (14) complete with vane ring assembly and clamp plate (9) (if fitted) and inner (small) exit duct (15).

4. Remove segments (8) and shield (7) from shroud housing (6).

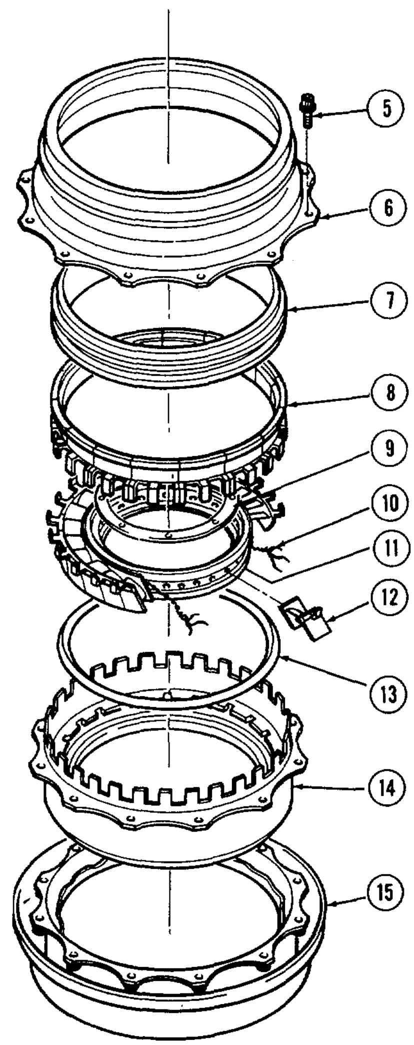
**NOTE**

**Some engines have four segments and others 14.**

5. Remove compressor turbine vane support (11), complete with vanes (12) from outer vane support (14).

6. Remove and discard veepacking (13). Remove 29 vanes (12) from vane support (11). Store vanes in a suitable container to prevent contamination and damage. Remove plate (9) from support.

7. Remove and discard ceramic cord (10).

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## 3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)

3-2-3 INSPECTION

1. Inspect vanes as follows:

a. For loss of coating. Loss in excess of **0.300 inch square** is cause for rejection. No repair permissible.

b. For erosion of parent metal. Erosion deeper than **0.010 inch** on any surface is cause for rejection. No repair permissible.

c. For cracks in trailing edge. Multiple hairline cracks up to **0.100 inch long** are permitted. In excess of **0.100 inch**, vane is to be rejected. A maximum of five cracks over **0.185 inch long** are permitted, providing they do not open up in excess of **0.020 inch** and any two in excess of **0.125 inch** must be separated by at least **0.100 inch.**

2. Inspect shroud segments as follows:

a. For cracks. None allowed (refer to NOTE).

**NOTE**

**On engines with four long segments installed, two through cracks are permitted.**

b. For distortion or erosion. None permitted.

c. For metal buildup. Grind off buildup (Task 3-2-4).

**GO TO NEXT PAGE**

**3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)**

3-2-3 INSPECTION (Cont)

3. Inspect inner (small) exit duct as follows:

a. For cracks, burning and distortion. No damage permitted. Return duct to Depot Maintenance.

b. For looseness of, or damage to, shank nuts. Repair (Task 3-2-4).

3-2-4 REPAIR

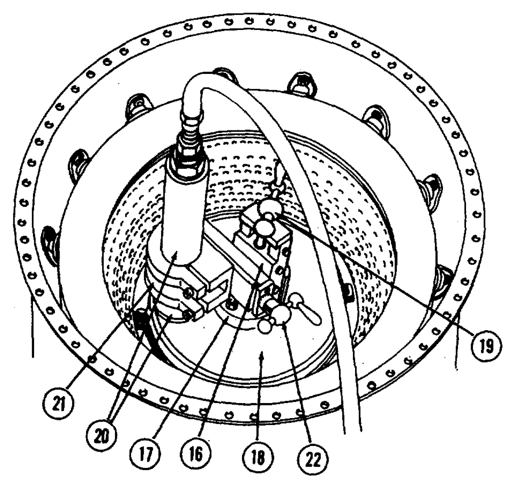
1. Grinding of shroud segments:

**CAUTION**

**Prior to installation of compressor turbine shroud grinder and associated adapter in gas generator case, insure all airflow openings are blanked-off to prevent dust, caused by grinding, from entering the engine.**

a. Install shroud grinder (T16) (16) over adapter (17) and cover (18), already installed in gas generator case. Adjust vertical vernier (19) until abrasive wheel (T.52) (20) contacts outer edge of shroud segments (21).

b. Adjust side vernier (22) until abrasive wheel contacts thickest segment section, back off vernier one turn.

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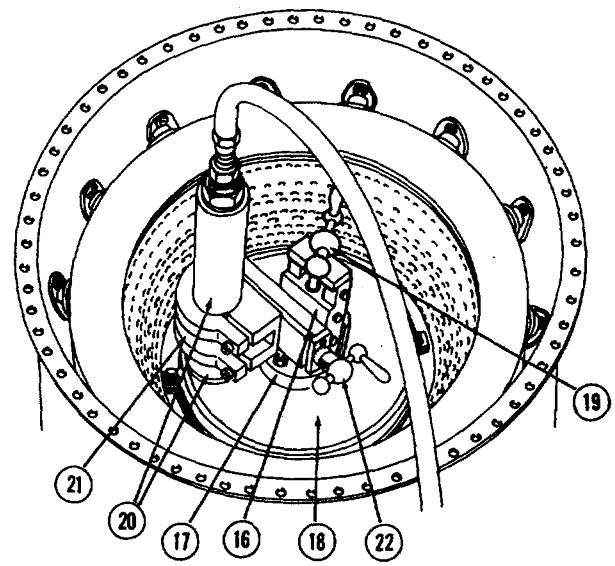
**3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)**

3-2-4 REPAIR (Cont)

1. Grinding of shroud segments: (cont)

c. Start air grinder and adjust side vernier (22) until abrasive wheel contacts shroud segment (21). Adjust vertical vernier (19) one turn inwards at completion of each grinder revolution. Repeat operation until wheel contacts inner edge of shroud segments.




d. Adjust side vernier (22) until abrasive wheel (20) contacts shroud segments (21). Adjust vertical vernier (19) one turn outwards at completion of each grinder revolution. Repeat until abrasive wheel contacts outer edge of shroud segments.

e. Repeat steps c. and d. until required clearance is obtained. (Refer to Task 2-3-3.) f. Remove shroud grinder (16), associated adapter (17) and cover (18) from gas generator case.

g. Using suitable vacuum cleaner, remove all dust particles from casing.

h. Remove airflow opening blanking-off material and clean off any material adhesive using Petroleum Solvent (E.8).

GO TO NEXT PAGE

**3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)**

3-2-4 REPAIR (Cont)

2. Replace shank nuts on inner (small) exit duct as follows:

a. Drill out flared portion of shank nut (23).

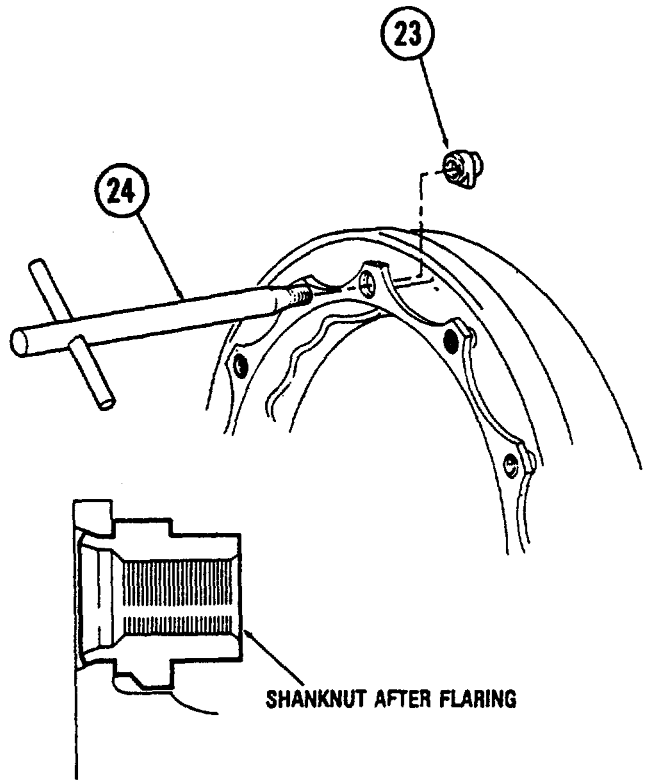
b. Punch out nut.

c. Insert replacement shank nut.

d. Lubricate with engine Lubricating Oil (E.2) and install Spreader (T.46)(24).

e. Screw in Spreader (T.46) (24) until flare is secure.

f. Inspect.




3-2-5 ASSEMBLE

1. Select vanes as follows:

**NOTE**

**If replacement vanes are to be installed, it is desirable that replacements be of the same class as original vanes. If the original class is not known, the following general rules will apply.**

a. Classes 9 thru 14 vanes are to be installed. Determine class average by adding together class markings of all vanes and dividing the total by 29, which is the number of blades.

**GO TO NEXT PAGE**

3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM)
(Continued)

**3-2-5 ASSEMBLE (Cont)**

1. Select vanes as follows:
(Cont)
b. The average class (step a.) shall be within 11.9 and 12.6.

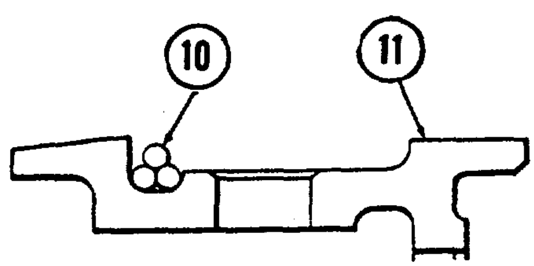
c. If average is too high, substitute a sufficient number of vanes of a lower classification to reduce the class average within specified limits.

d. Conversely, if average is too low, substitute a sufficient number of vanes of a higher classification to increase the class average within specified limits.

e. If more than one classification of vane (meaning of full class, eg., CL11, CL12, CL13) is required in a vane assembly, a maximum of three consecutive full classes may be used, provided the spread between adjacent vanes is not more than two classes. Vanes of the same class should be distributed as equally as possible around the vane assembly.

2. Install vanes as follows:

a. Cut three lengths of ceramic fiber cord (10), each longer than circumference of front outer groove of compressor turbine vane support (11). Lay cords side-by-side so that ends are staggered, then entwine together. Install entwined cords in front outer groove of support (11), insuring that there is no gap where cord ends meet.

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3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)

**3-2-5 ASSEMBLE (Cont)**

2. Install vanes as follows: (Cont)

b. On engines with clamp plate configuration, install plate (9), spigot leading, into compressor turbine vane support (11), locating plate against slotted flange.

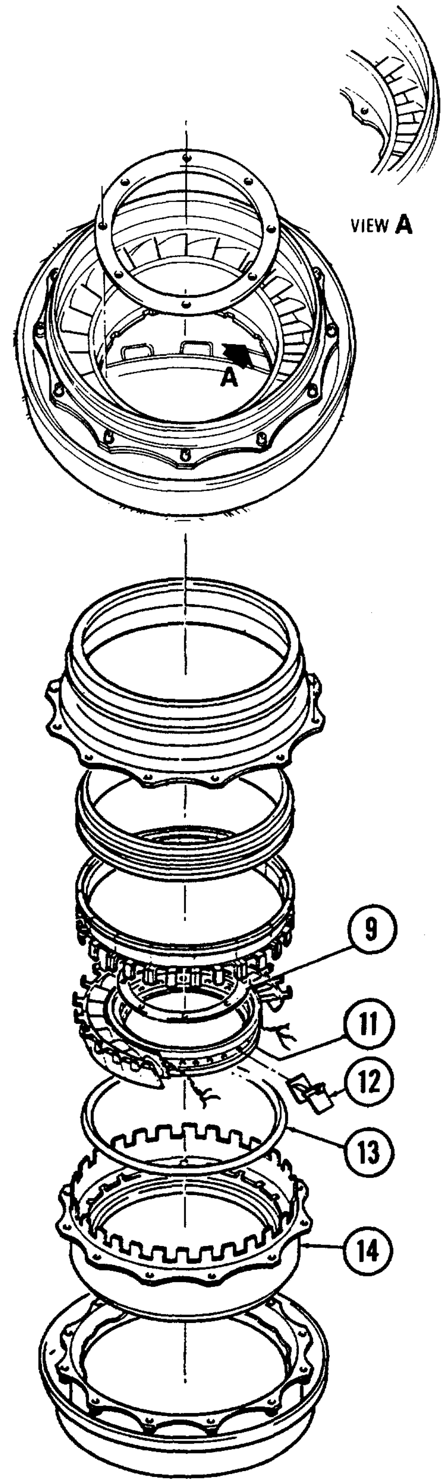
c. Install vanes (12), in clockwise numerical sequence, with No. 1 vane adjacent (View A) to offset hole in vane support (11) flange. Insure that vane locating fins project through holes provided in turbine vane support. When vanes are installed, temporarily secure with slave preformed packing around vanes.

**NOTE**

**Use previously marked (Task 3-2-2) sequence when original vanes are being reinstalled. Leading edges of all vanes must face towards rear of engine.**

d. Install vee-packing (13) strip over outer vane (14) platform, insuring that vee-opening faces towards rear of engine.

e. Install vane support (11), complete with assembled vanes, in outer vane support (14) aligning small lugs on vane outer platforms to locate in mating slots in outer vane support. Cut and remove slave preformed packing.

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3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM)
(Continued)

**3-2-5 ASSEMBLE (Cont)**

2. Install vanes as follows:
(Cont)

f. Install outer vane support, complete with vane assembly, in inner (small) exit duct (15), aligning grooved lugs.

3. On engines with only four shroud segments installed, proceed as follows:

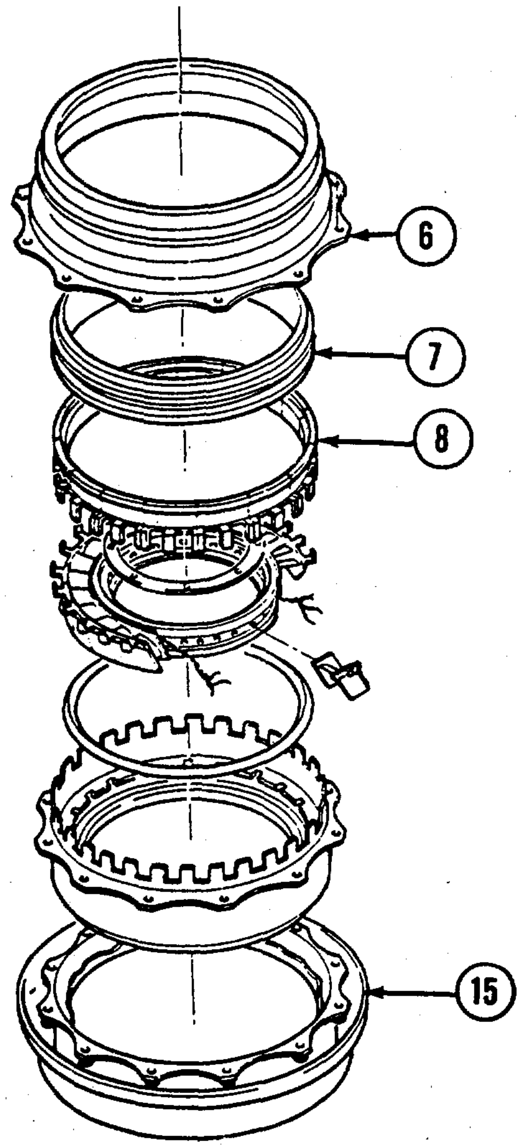
a. Select appropriate class of shroud to match diameter of compressor turbine (Task 2-3-1).

b. Install four segments (8) (one long, three short) on vane outer platform, locating segment lugs between vane lugs. Insure that one end of long segment aligns with top of vane support (offset hole) and the other end runs counterclockwise when looking at the trailing edges of the vanes.

c. Install heat shield (7) over segments, locate shroud housing (6) over assembly, align bolt holes and press into position.

NOTE

Light tapping with soft-face hammer is permissible to drive housing fully home.

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## 3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)

### 3-2-5 ASSEMBLE (Cont)

4. On engines with 14 shroud segments installed, proceed as follows:

a. Select appropriate class of shroud to match diameter of compressor turbine (Task 2-3-1).

b. Install 14 segments (one long, 13 short) on vane outer platform, locating segment lugs between vane lugs. Insure that one end of long segment aligns with grooved lug on outer support flange and that other end runs counterclockwise when looking at trailing edges of vanes.

c. Install heat shield (7) on lip of segments, straightening segments to conform with heat shield.

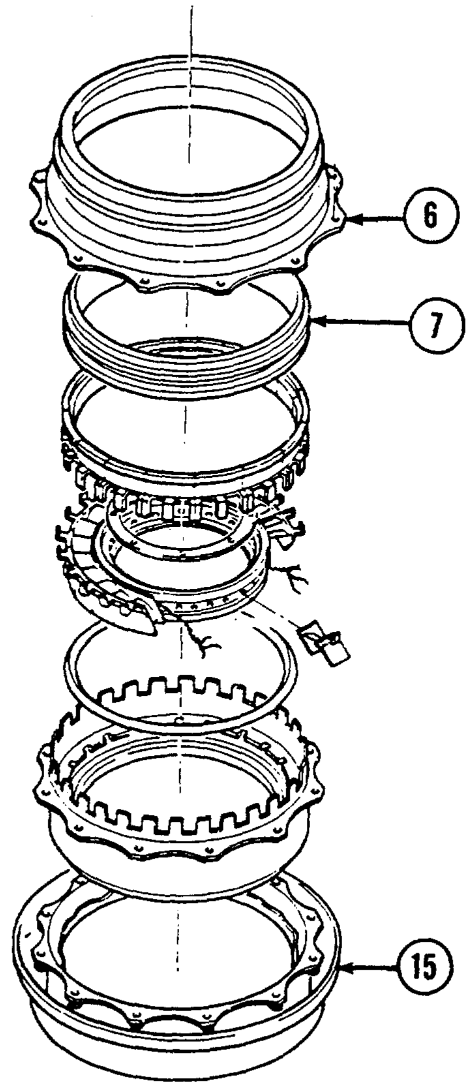
d. Using clean engine Lubricating Oil (E.2), lightly lubricate groove in inner diameter of shroud housing (6).

e. Install shroud housing (6) over segments, lightly tapping into position with a soft-faced hammer.

f. Invert assembly and check that heat shield is positioned correctly on housing lip.

g. Using a small pick or screwdriver, adjust segments until shroud lips drop into position behind heat shield (7).

h. Strike inner (small) exit duct (15) sharply by hand to seat flange fully on shroud housing (6).

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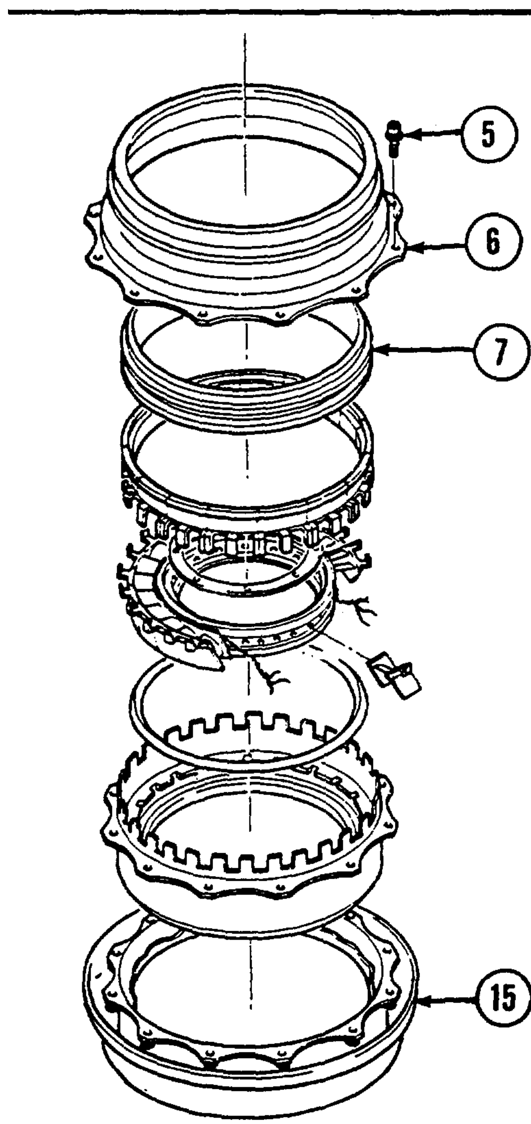
3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM)
(Continued)

**3-2-5 ASSEMBLE (Cont)**

4. On engines with 14 shroud segments installed, proceed as follows: (cont)

i. Install 12 bolts (5) and secure shroud housing to inner (small) exit duct (15). Torque bolts 20 to 30 inch pounds and lockwire (E.4).

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3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM) (Continued)

### 3-2-6 INSTALLATION

1. If clamp plate is not installed, proceed as follows:

a. Install assembly (3) so that grooved lug on inner (small) exit duct flange is at 12 o'clock position and offset holes in vane support flange and compressor bearing cover flange (4) are aligned.

NOTE

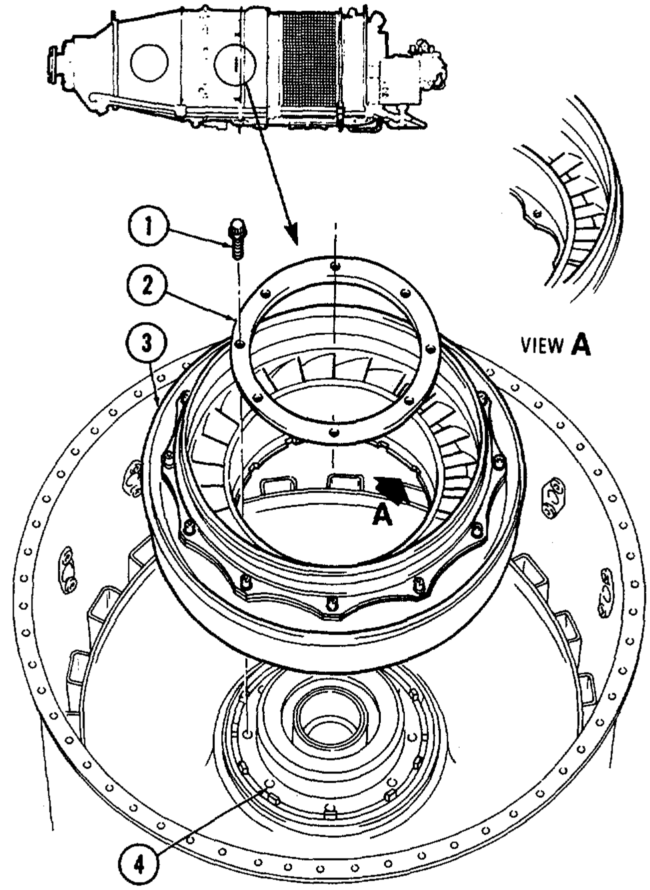
Later bearing covers have eight extra mounting holes which are not used in this configuration.

b. Secure assembly to compressor bearing cover flange (4) with eight silver-plated bolts (1). Tighten bolts, torque to 32 to 36 inch-pounds and lockwire (E.4) in pairs.

c. Using a 0.001 feeler gage, insure correct seating of vane support assembly.

2. If clamp plate is installed, proceed as follows:

a. Install assembly (3) so that grooved or x-marked lugs of vane outer support and inner (small) exit duct are at 12 o'clock position. Rotate assembly in each direction until engagement of lugs on outer (large) exit duct with slots in inner vane support is felt.

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3-2 INNER (SMALL) EXIT DUCT, SHROUD AND VANE ASSEMBLY (AVIM)
(Continued)

**3-2-6 INSTALLATION (Cont)**

2. If clamp plate is installed, proceed as follows: (Cont)

NOTE

Observe through holes in clamp plate that lugs are engaged and inner support is correctly seated.

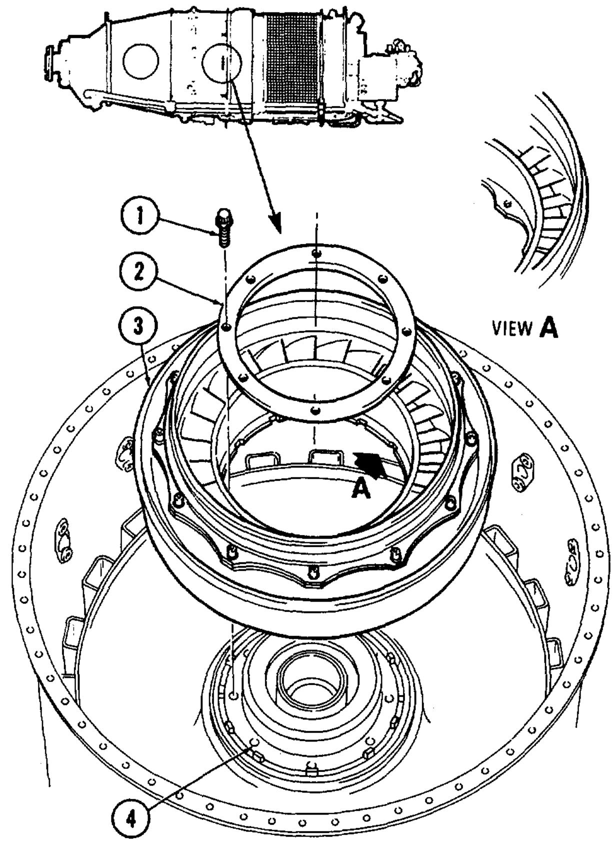
b. Insure there is no clearance between clamp plate and outer (large) exit duct.

c. Align offset hole in clamp plate (3) with similar hole in compressor bearing cover flange (4).

NOTE

Later bearing covers have eight extra holes which are not used in this configuration.

d. Secure assembly with eight silver-plated bolts (1). Torque bolts to 32 to 36 inch-pounds and lockwire (E.4) in pairs.




FOLLOW ON MAINTENANCE:

Installation Compressor Turbine Assembly (Task 2-3-3)
Installation Liner Assembly (Task 3-1-4)

**END OF TASK**

Section III OUTER (LARGE) EXIT DUCT

## 3-3 OUTER (LARGE) EXIT DUCT (AVIM)

This task covers:

a. Removal (3-3-1)

c. Inspection (3-3-2)

d. Installation (3-3-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114

Materials:
Penetrating Oil (E-7)

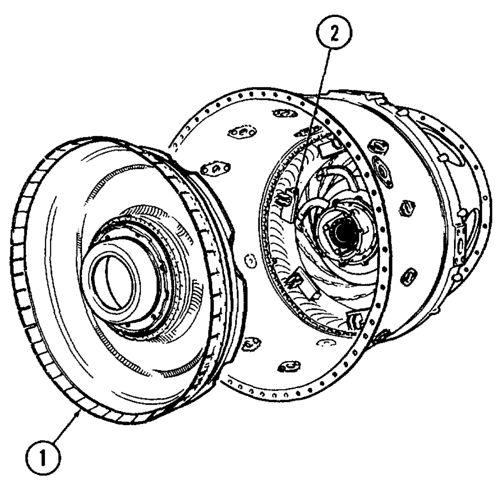
Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Power Section Removed (Task 4-1-1)
Glow Plugs Removed (Task 7-1-1)
Fuel Manifold Assembly Removed (Task 6-5-1)
Compressor Turbine Assembly Removed (Task 2-3-1)
Liner Assembly Removed (Task 3-1-1)
Inner (Small) Exit Duct, Shroud and Vane Assembly Removed (Task 3-2-1)
Reinstall In Reverse Order of Removal

### 3-3-1 REMOVAL

1. Spray penetrant oil (E-7). Apply hand pressure evenly on each side of outer (large) exit duct (1) centerbore and rotate exit duct counterclockwise approximately 20 degrees to free duct from brackets (2) on gas generator case.

2. Remove outer (large) exit duct.

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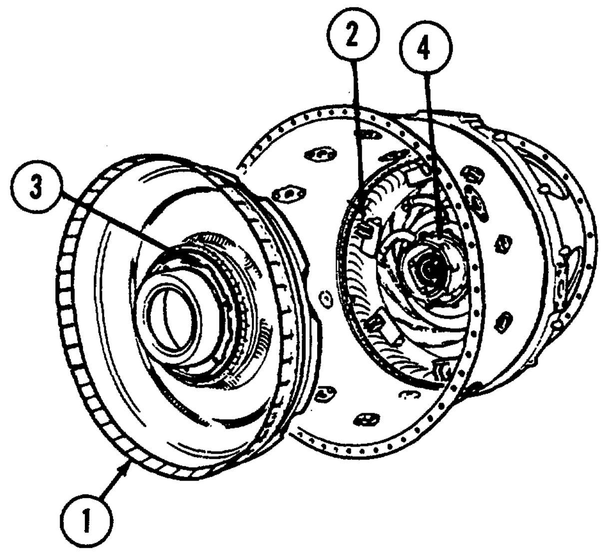
3-3 OUTER (LARGE) EXIT DUCT (AVIM) (Continued)

3-3-2 INSPECTION

1. Inspect for cracks, burning or distortion. Evidence of damage is cause for rejection of exit duct.

2. No repairs permissible.




3-3-3 INSTALLATION

1. Install outer (large exit duct (1) with offset hole (3) approximately 20 degrees counter-clockwise from offset hole (4) in compressor bearing cover flange.

2. Turn exit duct approximately 20 degrees clockwise to align offset holes (3) and (4) and lock exit duct in gas generator case brackets.

3. Inspect.

FOLLOW ON MAINTENANCE:

Installation Inner (Small) Exit
Duct, Shroud and Vane Assembly
(Task 3-2-6)

END OF TASK

# CHAPTER 4

# POWER SECTION (AVIM)

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Power Section. It is divided into the following sections.



END OF OVERVIEW

Section I POWER SECTION (AVIM)

## 4-1 POWER SECTION (AVIM)

This task covers:

a. Removal (4-1-1)

b. Installation (4-1-2)

INITIAL SETUP

Applicable Configurations:
- All

Tools:
- Powerplant Mechanic's Tool Kit NSN 5180-00-323-4944
- Aircraft Inspector's Tool Kit NSN 5180-00-323-5114
- Torque Wrench (O to 100 inch-pounds)
- Sling (T.41)
- Stand (T.50)
- Ohmmeter

Materials:
- Lockwire (E.5)
- Phano Pencil (E.30)
- Colorbrite Pencil (E.31)

Parts:
- Seals
- Packing Retainers
- Cotterpins
- Gaskets

Personnel Required:
- 68B Powerplant Mechanic (2)
- 66G Aircraft Inspector

Equipment Condition:
- Engine Installed in Stand (T.51) (Chapter 1, Section VIII)
- Oil Drained (Chapter 1, Section VIII)

General Safety Instructions:

**WARNING**

Hoisting Engine or Power Section

- Do not stand under engine or power section while it is being moved from one area to another on a hoist.
- To prevent injury to personnel and damage to equipment during handling, periodically check lifting sling.
- Do not use equipment which has signs of abuse or excessive wear or has unauthorized bolts, pins, etc. If equipment is suspected to be defective or has unauthorized parts, notify your immediate supervisor.
- Be sure that capacity of lifting device exceeds weight of load to be lifted.

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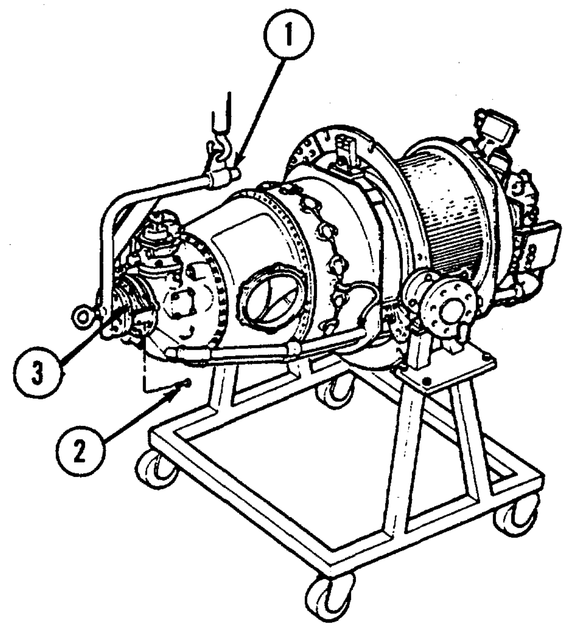
4-1 POWER SECTION (AVIM) (Continued)

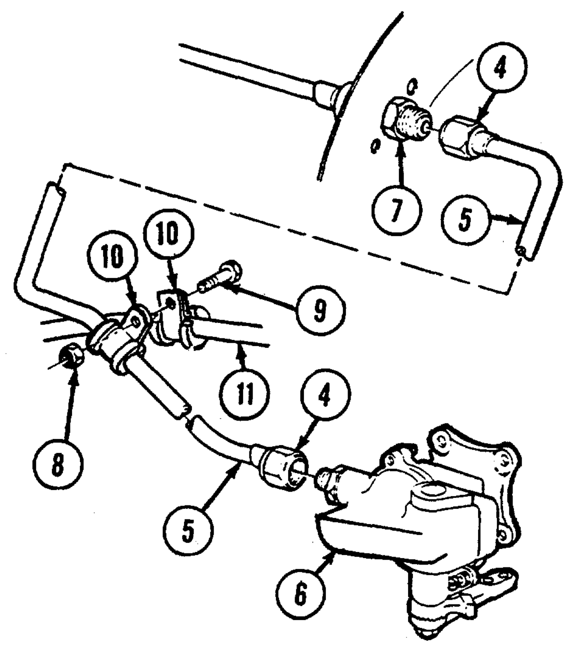
4-1-1 REMOVAL

1. Install Sling (T.41) (1) with four bolts (2), on propeller shaft flange (3).




2. Cut lockwire, disconnect coupling nuts (4) of power turbine governor sensing tube (5) at power turbine governor (6) and center fireseal bulkhead coupling (7). Cap open connections.

3. Remove nut (8) from bolt (9) to release loop clamps (10) that secure governor sensing tube (5) and push-pull cable casing (11).

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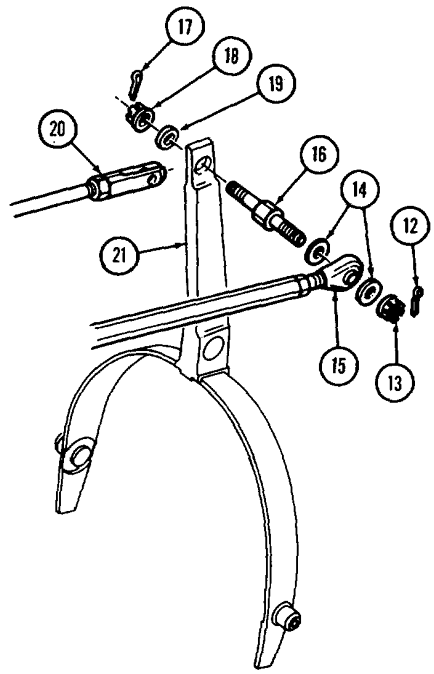
4-1 POWER SECTION (AVIM) (Continued)

4-1-1 REMOVAL (Cont)

4. Remove cotterpin (12). Hold shouldered stud (16). Remove nuts (13), two washers (14) and rod end connector (15) from shouldered stud (16).

5. Remove cotterpin (17) and nut (18). Hold shouldered stud (16). Remove cable end clevis (20) from reversing lever (21).

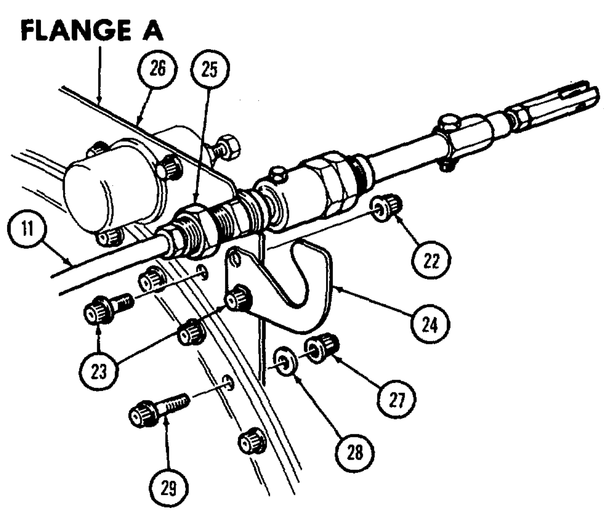
6. Remove spacer (19) from reversing lever (21).




7. Remove inboard nut (22) and bolt (23) holding retaining plate (24) and slacken outboard nut (22). Cut locking wire, then slacken nut (25) to release push-pull cable (11) from lifting bracket (26).

8. Where no retaining plate (24) is fitted, remove seven nuts (27) , washers (28) and bolts (29), then remove lifting bracket (26) from flange "A" with push-pull cable (11) attached.

9. Rotate engine in stand so that propeller gearbox is upper most.

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4-1. POWER SECTION (AVIM) (Continued)

4-1-1 REMOVAL (Cont)

10. Cut lockwire and remove two bolts (30) securing ITT terminal block (31). Carefully push terminal block into gas generator case (32). Remove gasket (33), leaving ITT leads (34) hanging.

11. Remove dee-head bolts (35) and nuts (36) at flange C, and push-pull cable clamp bracket (37).

12. Slowly lift power section (38) and disengage coupling (39) and oil transfer tubes (40) with seals (41) and packing retainer (42).

CAUTION

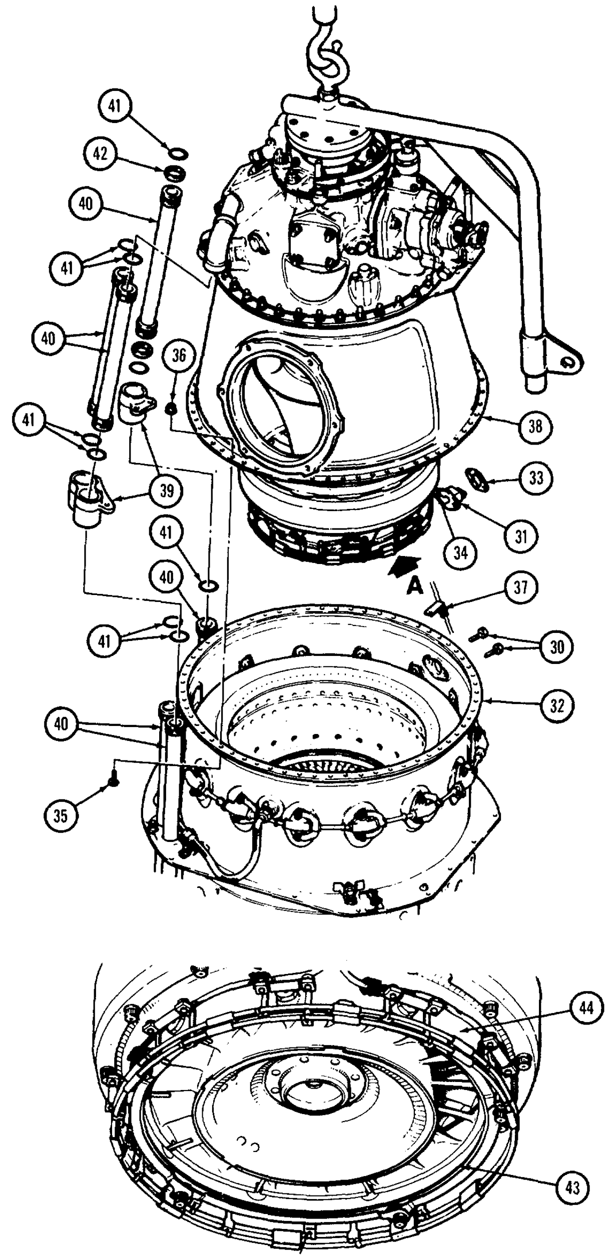
Take care not to disturb seal ring(s) in rear of the power turbine stator housing.

13. Using suitable marking Pencil (E.30) or (E. 31), mark location(s) of ring(s) (43), gap on power turbine stator housing (44).

4-1-2 INSTALLATION

1. With power section (38) hanging vertically from Sling (T.41), lower power section into gas generator case (32) until mating flanges are about six inches apart.

2. Place gasket (33) on ITT terminal block (31) and insert terminal block through gas generator case (32), insuring that gasket (33) is positioned correctly.




VIEW A

GO TO NEXT PAGE

4-1-2 INSTALLATION (Cont)

3. Secure terminal block with two bolts (30), torque bolts to 32 to 36 inch-pounds.

4. Using an ohmmeter, insure that ITT leads (34) are not grounded.

5. Lockwire (E.5) bolts (30).

6. Install new seals (41), and packing retainers (42), if appropriate, to pressure oil transfer tube (40). Where packing retainers (42) are required, insure they are fitted first and that concave side faces mating seal (41).

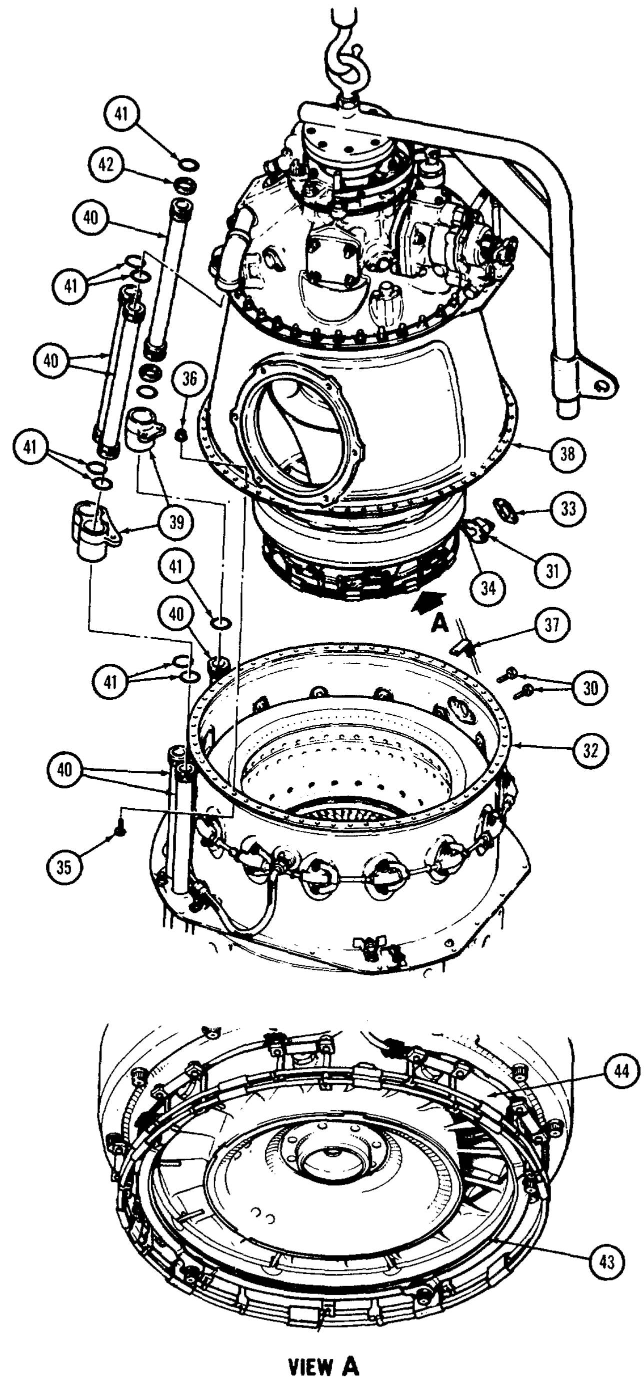
7. Install new seals (41) to scavenge oil transfer tubes (40). and to the exposed end of pressure oil transfer tube (40) and scavenge oil transfer tubes (40).

8. Fit couplings (39) to center section oil transfer tubes (40).

9. Carefully lower power section (38) into gas generator case (32) and guide front section oil transfer tubes (40) into couplings (39).

CAUTION

Ensure that sealing rings (43) are centered in housing.

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4-1-2 INSTALLATION (Cont)

10. Continue lowering power section (38) until flange C faces are mated. Install dee-head bolts (35) from gas generator case side and fit push-pull cable clamp bracket (37) and self-locking nuts (36). Torque nuts (36) to 36 to 40 inch-pounds.

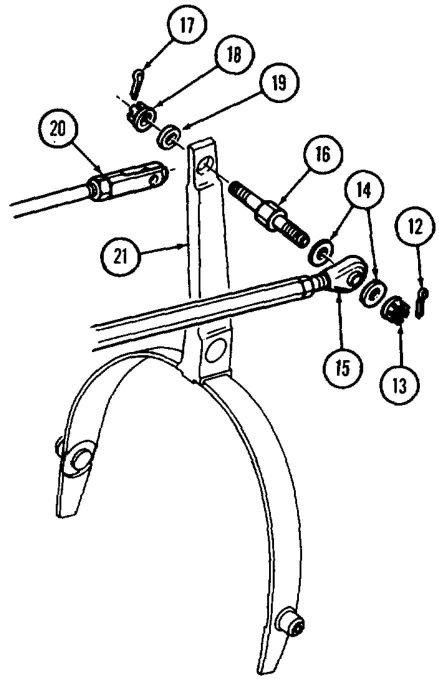
11. If lifting bracket (26) was removed from flange A, refit bracket (26) with seven bolts (29), nuts (27) and washers (28). Torque nuts (27) to 36 to 40 inch-pounds.

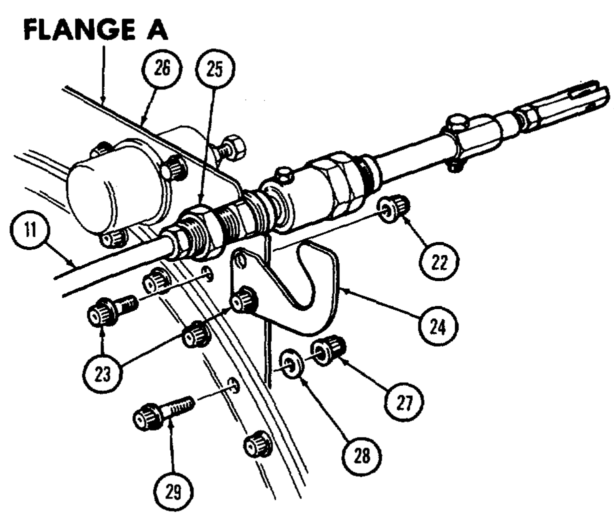
12. If retaining plate (24) is to be fitted to lifting bracket (26), ease push-pull cable (11) into lifting bracket, then secure retaining plate (24) with two bolts (23) and nuts (22). Torque nuts (22) to 36 to 40 inch-pounds.

13. Tighten nut (25), torque to 80 to 100 inch-pounds and lockwire (E.5).

14. Insert spacer (19) in hole at top of reversing lever (21), fit clevis (20) over lever (21) and pass shouldered stud (16) through. Secure with spacer (19) and nut (18). Torque nut (18) to 12 to 18 inch-pounds and fit cotterpin (17).

15. Assemble rod end connector (15), with one washer (14) each side, to shouldered stud (16). Fit nut (18), torque to 12 to 18 inch-pounds and lock with cotterpin (17).

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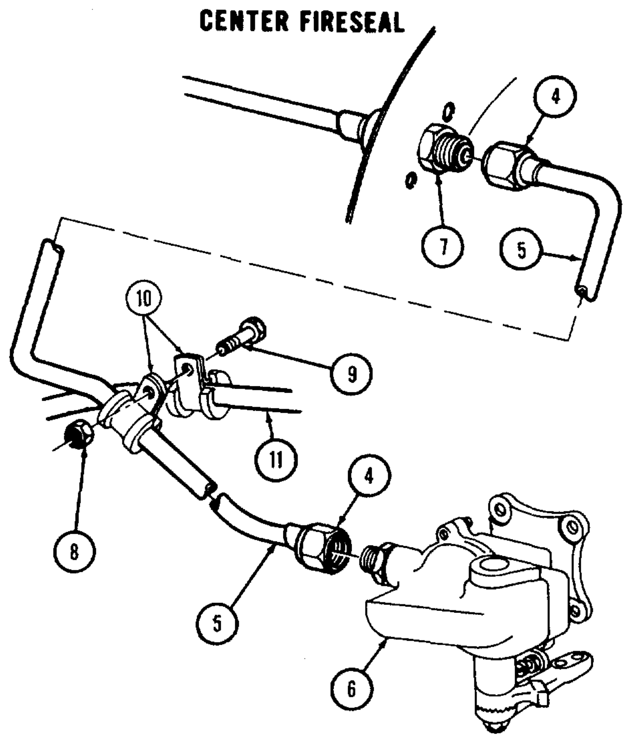
4-1-2 INSTALLATION (Cont)

16. Connect power turbine governor sensing tube (5). Torque tube nuts (4) to 90 to 100 inch-pounds and lockwire (E.5).

17. Install bolt (9) through two loop clamps (10) on power turbine governor (6), sensing tube (5) and reversing push-pull cable (11). Fit nut (8) and torque to 36 to 40 inch-pounds.




FOLLOW ON MAINTENANCE:

Oil System Servicing
(Chapter 1, Section VIII)
Engine Testing
(Chapter 1, Section X)

**END OF TASK**

## Section II POWER TURBINE STATOR HOUSING

### 4-2 POWER TURBINE STATOR HOUSING (AVIM)

This task covers:

a. Removal (4-2-1)
b. Inspection (4-2-2)
c. Installation (4-2-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114
Torque Wrench (O to 100 inch-pounds

Materials:
Lockwire (E.5)

Personnel Required:
6MB Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Power Section Removed (Task 4-1-1)
Power Turbine Case Sealing Ring(s) Removed (Task 4-8-1)
Thermocouple Harness (P/N 3012150) Removed (Task 7-5-1)
Thermocouple Busbar Removed (Task 7-6-1)

General Safety Instructions:

**WARNING**

- When handling combustion chamber internal parts that have been exposed to fuels containing tetra-ethyl lead, insure that the byproduct (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.
- If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.
- Gloves and goggles shall be worn at all times when handling contaminated parts.

GO TO NEXT PAGE

4-2 POWER TURBINE STATOR HOUSING (AVIM) (Continued)

4-2-1 REMOVAL

1. Remove lockwire and bolts (1).

NOTE

Index containment ring(s) (2) to exhaust duct flange (6) for proper reassembly.

2. If fitted, carefully work containment ring(s) (2) over ITT wiring harness P/N's 3012074, 3019383 or 3028289.

3. Remove bolts or pins (3), as fitted, then detach ring halves (4) and stator housing (5) from exhaust duct flange (6).

4-2-2 INSPECTION

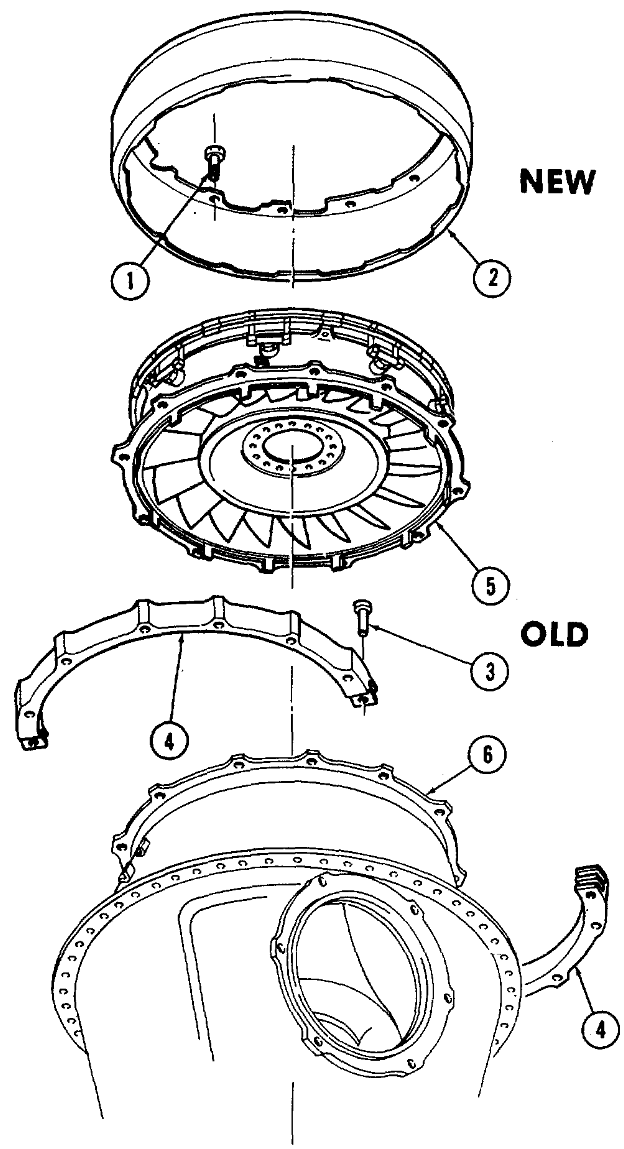
If anti-rotation lugs are worn below 0.195 inch in width, return housing to Depot Maintenance for repair.

4-2-3 INSTALLATION

1. Align bolt holes and install stator housing (5) on exhaust duct flange (6).

2. Install ring halves (4).

3. Install bolts (3) at 1 o'clock and 7 o'clock positions, or install pins (3) at 4 o'clock and 10 o'clock positions as appropriate.

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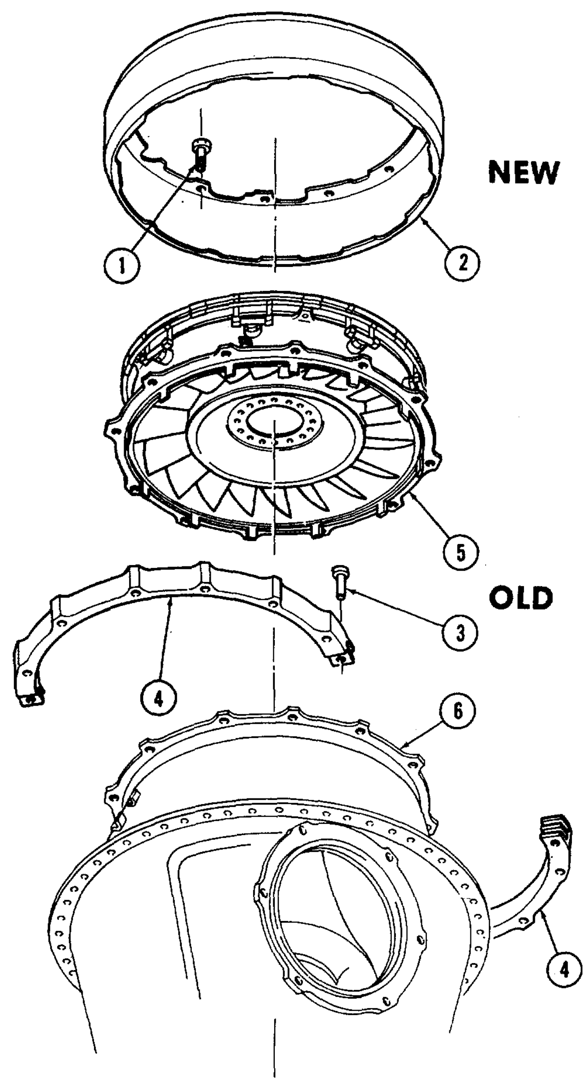
4-2 POWER TURBINE STATOR HOUSING (AVIM) (Continued)

4-2-3 INSTALLATION (Cont)

4. Install busbar (Task 7-6-4) and/or thermocouple harness (Task 7-5-5).

5. Install ring (2), if fitted, with diametrically opposed scallops at 1 o'clock and 7 o'clock positions. Align index marks on containment ring (2) to index marks on exhaust duct flange (6) carefully installing ring. Do not damage stator housing (5).

6. Install bolts (1). Torque bolts to 23 to 26 inch-pounds and lockwire (E.5).




FOLLOW ON MAINTENANCE:

Installation Thermocouple Busbar (Task 7-6-4)
Installation Thermocouple Harness (Task 7-5-5)
Installation Power Turbine Case Sealing Ring(s) (Task 4-8-3)
Installation Power Section (Task 4-1-2)

END OF TASK

## Section III POWER TURBINE STATOR ASSEMBLY

### 4-3 POWER TURBINE STATOR ASSEMBLY (AVIM)

This task covers:

a. Removal (4-3-1)

b. Inspection (4-3-2)

c. Installation (4-3-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114

Materials:
None

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Power Section Removed (Task 4-1-1)
Power Turbine Stator Housing Removed (Task 4-2-1)
Power Turbine Case Sealing Ring(s) Removed (Task 4-8-1)
Thermocouple Harness (P/N 3012150) Removed (Task 7-5-1)
Thermocouple Busbar Removed (Task 7-6-1)
Thermocouple Probes Removed (Task 7-7-1)

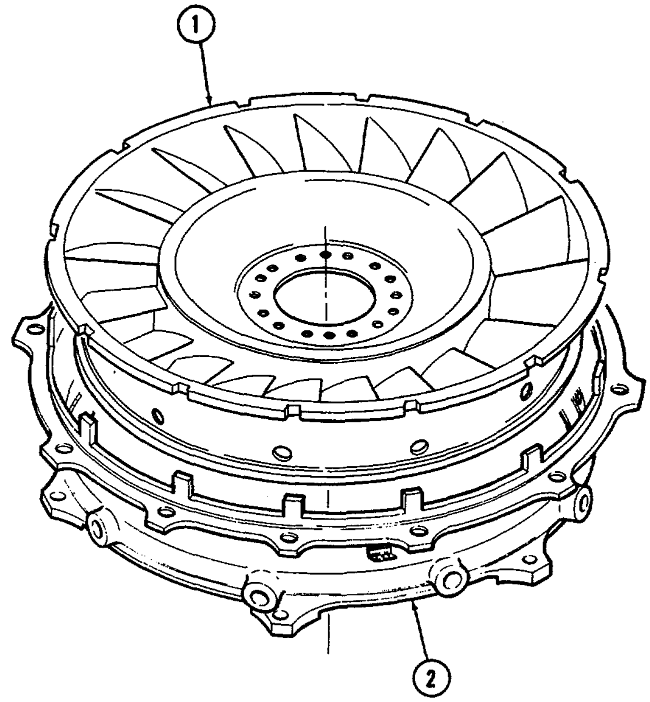
General Safety Instructions:

**WARNING**

- When handling combustion chamber internal parts that have been exposed to fuels containing tetra-ethyl lead, ensure that the byproduct (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.
- If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.
- Gloves and goggles shall be worn at all times when handling contaminated parts.

GO TO NEXT PAGE

4-3 POWER TURBINE STATOR ASSEMBLY (AVIM) (Continued)




4-3-1 REMOVAL

Lift stator assembly (1) from stator housing (2).

4-3-2 INSPECTION

1. Inspect stator assembly for:

a. Erosion or pitting in vane surfaces exceeding 0.250 inch square, 0.010 inch deep.

b. Cracks in vane leading/ trailing edges over 0.400 inch in length.

c. Cracks in outer ring over 0.600 inch in length.

d. Cracks in inner ring over 0.400 inch in length.

2. Damage not exceeding these limits is acceptable without repair. The assembly shall be rejected if the limits are exceeded.

4-3-3 INSTALLATION

Place stator assembly (1) in stator housing.

FOLLOW ON MAINTENANCE:

Installation Thermocouple Probes (Task 7-7-4)
Installation Thermocouple Busbar (Task 7-6-4)
Installation Thermocouple Harness (P/N 3012150) (Task 7-5-5)
Installation Power Turbine Case Sealing Ring(s) (Task 4-8-3)
Installation Power Turbine Stator Housing (Task 4-2-3)
Installation Power Section (Task 4-1-2)

GO TO NEXT PAGE

## Section IV POWER TURBINE ROTOR ASSEMBLY

### 4-4 POWER TURBINE ROTOR ASSEMBLY (AVIM)

This task covers:

a. Removal (4-4-1)

b. Inspection (4-4-2)

c. Installation (4-4-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 700 inch-pounds)
Protector (T.19)
Puller (T.31)
Wrench (T.54)
Spreader (T.47)
Squeezer (T.48)
Outside micrometer
(0 to 10 inch)

Materials:
Molykote M77 (E.21)

Parts:
Keywasher

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Power Section Removed
(Task 4-1-1)
Power Turbine Stator Housing
Removed (Task 4-2-1)
Exhaust Duct Removed
(Task 4-7-1)

General Safety Instructions:

WARNING

- When handling combustion chamber internal parts that have been exposed to fuels containing tetra-ethyl lead, insure that the byproduct (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.
- If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.
- Gloves and goggles shall be worn at all times when handling contaminated parts.

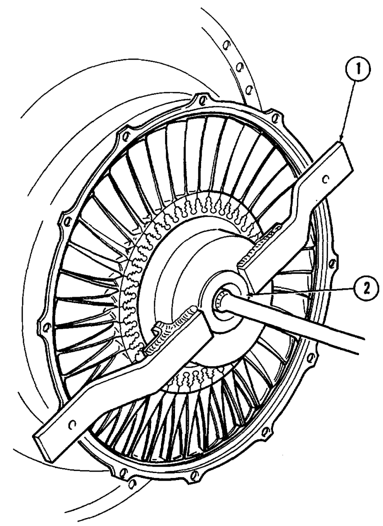
GO TO NEXT PAGE

4-4 POWER TURBINE ROTOR ASSEMBLY (AVIM) (Continued)

4-4-1 REMOVAL

1. Measure rotor/shroud clearance in four places at 90 degrees apart without moving rotor to determine whether shroud needs to be ground.

2. Install Wrench (T.54) (1) on Power Turbine Assembly and Protector (T.19) (2).



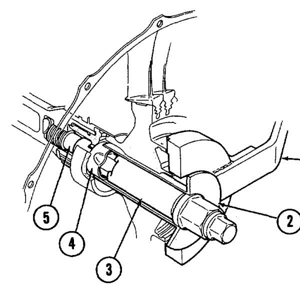

NOTE

If determined that shroud needs to be grounded or replaced, refer to Tasks 4-6-1 and 4-6-3.

3. Install Spreader (T.47) (3) and uncrimp keywasher (4).

4. Remove spreader (3).

5. Remove bolt (5), keywasher (4), protector (2) and wrench (1).

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4-4-1 REMOVAL (Cont)

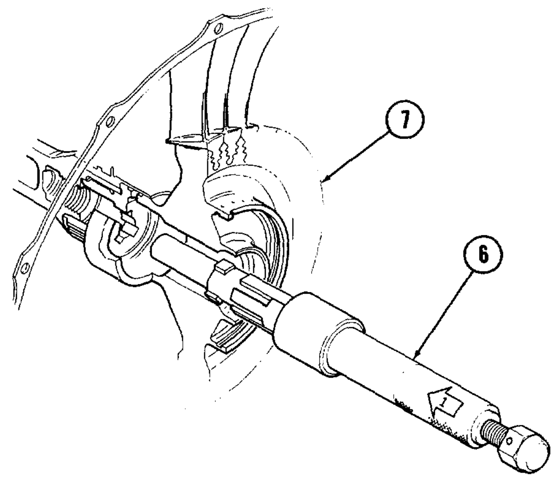
**CAUTION**

To avoid damage, do not continue to operate bolt of Puller (T.31) after rotor is released (indicated by sudden decrease in torque).

**CAUTION**

Be careful of tips.

6. Install and operate Puller (T.31) (6) with four movements as shown and release rotor (7).




7. Remove puller (6) and rotor (7).

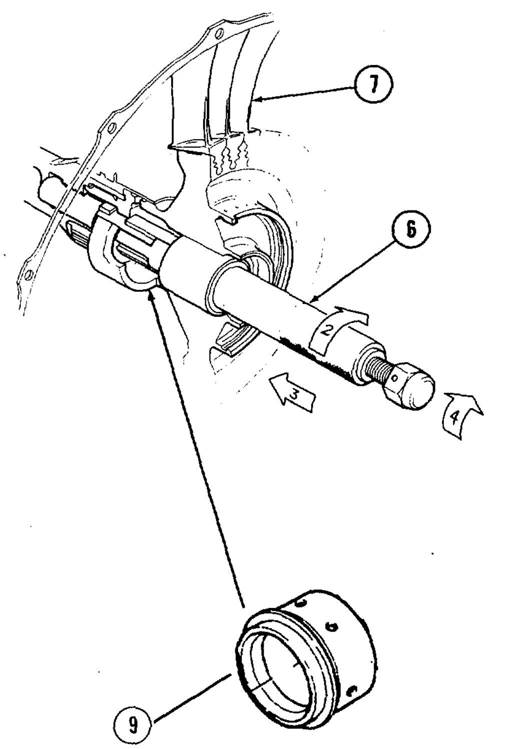
8. Using outside micrometer, measure replacement rotor diameter at four locations 90 degrees apart. Record average measurement.

9. Measure shroud radius (Task 4-6-1).

10. Determine rotor/shroud clearance by deducting turbine rotor diameter from shroud diameter.

11. Grind to obtain required 0.016 to 0.018 inch clearance (Task 4-6-3).

12. Remove power turbine rotor air seal (9).

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4-4 POWER TURBINE ROTOR ASSEMBLY (AVIM) (Continued)

4-4-2 INSPECTION

1. Inspect power turbine rotor for:

a. Loose or damaged blade retaining rivets.

b. Scaling.

c. Blade shift in excess of 0.010 inch axially.

2. Replace assembly if defects found.

4-4-3 INSTALLATION

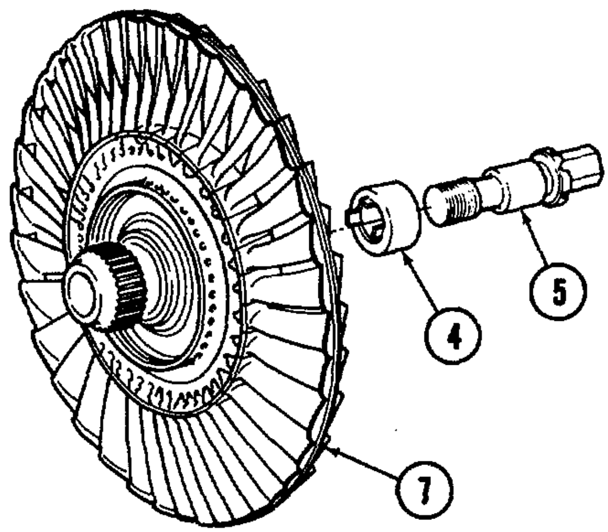
1. Lightly coat splines of rotor (7) with Molykote M77 (E.21).

2. Align master splines and install rotor.

3. Insure keywasher (4) is dry and free of burrs.

4. Lightly coat keywasher and bolt (5) with Molykote M77 (E.21).

5. Assemble and install keywasher and bolt.

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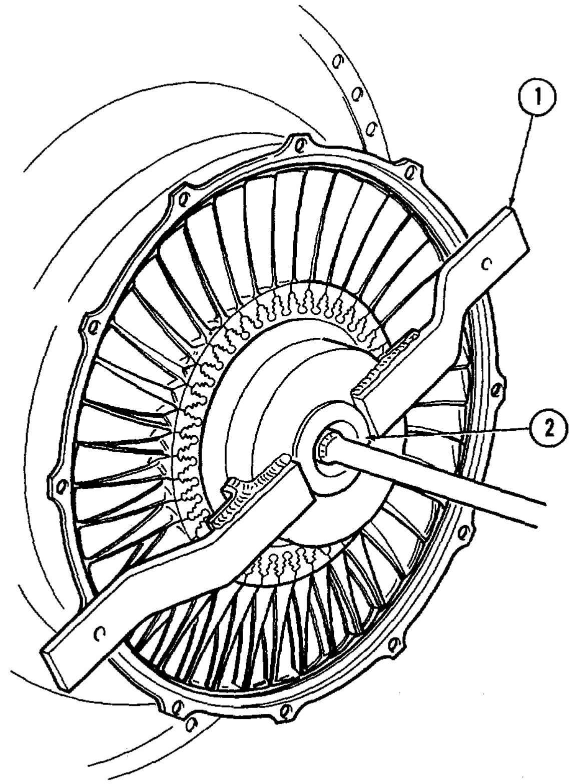
4-4 POWER TURBINE ROTOR ASSEMBLY (AVIM) (Continued)

4-4-3 INSTALLATION (Cont)

6. Install Wrench (T.54) (1) and Protector (T.19) (2).

7. Torque bolt to 600 to 650 inch-pounds, loosen to zero, retorque to 420 to 460 inch-pounds.

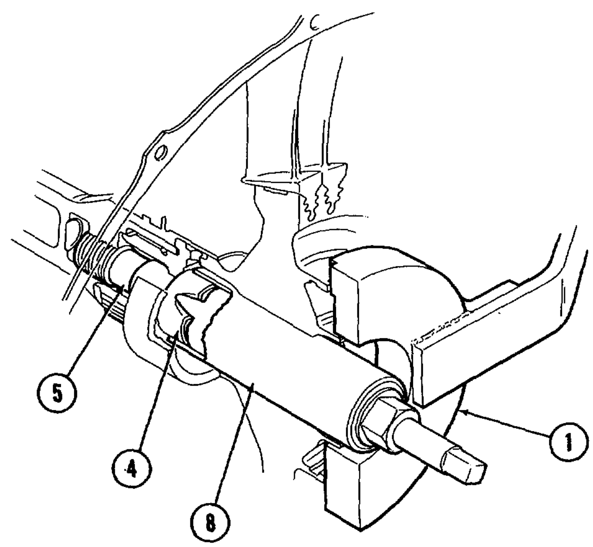



8. Remove protector (2).

9. Install Squeezer (T.48) (8) and crimp keywasher (4) to bolt (5).

10. Remove squeezer and wrench (1).

11. Inspect (TI).




FOLLOW ON MAINTENANCE:

Installation Power Turbine Stator Housing (Task 4-2-3)
Installation Power Section (Task 4-1-2)

END OF TASK

Section V POWER TURBINE BLADES

4-5 POWER TURBINE BLADES (AVIM)

This task covers:

a. Inspection (4-5-1)

b. Repair (4-5-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
None

Materials:
Crocus Cloth (E.64)

Personnel Required:
68B Powerplant Mechanic
68G Aircraft Inspector

Equipment Condition:
Power Turbine Rotor Assembly Removed (Task 4-4-1)

General Safety Instructions:

WARNING

- When handling combustion chamber internal parts that have been exposed to fuels containing tetra-ethyl lead, insure that the byproduct (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.
- If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.
- Gloves and goggles shall be worn at all times when handling contaminated parts.

GO TO NEXT PAGE

4-5-1 INSPECTION

**CAUTION**

**Do not remove power turbine blades.**

1. The power turbine rotor assembly shall be rejected for:

a. Axial blade shift in excess of 0.010 inch

b. Cracks

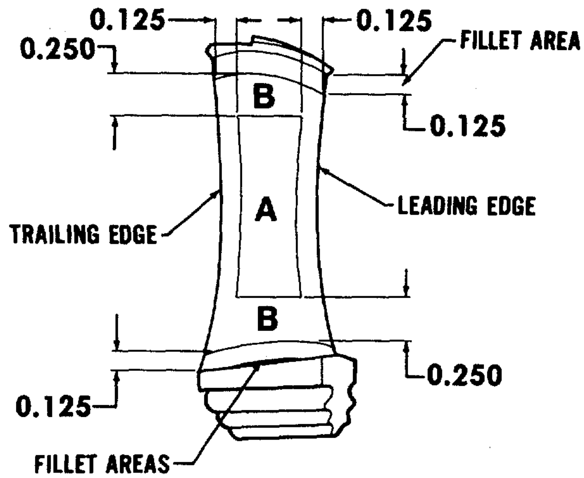
c. Rippling of blade trailing edge

d. Damage in fillet area of any blade.

2. Blades may be repaired if, only three nicks, not more than **0.015** inch long and **0.005** inch deep, and/or three dents not more than **0.010** inch deep are found in area A.

3. Blades may be further repaired if, only one nick, dent or pit, less than **0.020** inch deep, is found in area B and/or in leading or trailing edges.

4. Damage not mentioned previously, or damage in excess of limits given, shall be cause for rejection of power turbine rotor assembly.




**4-5-2 REPAIR**

Blend out defects using Crocus Cloth (E.64). **Inspect**.

FOLLOW ON MAINTENANCE:

Installation Power Turbine Rotor Assembly (Task 4-4-3)

END OF TASK

Section VI POWER TURBINE SHROUD

## 4-6 POWER TURBINE SHROUD (AVIM)

This task covers:

a. Inspection (4-6-1)

b. Removal (4-6-2)

c. Installation (4-6-3)

**INITIAL SETUP**

Applicable Configurations:
    All

Tools:
    Powerplant Mechanic's Tool Kit
        NSN 5180-00-323-4944
    Adapter (T.1)
    Cover (T.6)
    Gage (T.13)
    Grinder (T.16)
    Puller (T.28)
    Wheel (T.52)
    Vacuum Cleaner
    Ear Plugs
    Goggles

Materials:
    Colorbrite Pencil (E.31)
    Masking Tape (E.42)

Personnel Required:
    68B Powerplant Mechanic
    66G Aircraft Inspector

Equipment Condition:
    Power Section Removed (Task 4-1-1)
    Power Turbine Stator Housing Removed (Task 4-2-1)
    Power Turbine Rotor Assembly Removed (Task 4-4-1)

General Safety Instructions:

**WARNING**

- When handling combustion chamber internal parts that have been exposed to fuels containing tetra-ethyl lead, insure that the byproduct (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.
- If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.
- Gloves and goggles shall be worn at all times when handling contaminated parts.

GO TO NEXT PAGE

4-6-1 INSPECTION

1. Inspect shroud for:

a. Wear

b. Metal pick up on knife edge lands.

**WARNING**

Power grinding is hazardous to personnel. Sparks and metal chips may injure eyes. Wear approved goggles and hearing protectors. If injury occurs, get medical attention.

2. Grind shroud (Task 4-1-6) if pick up present.

3. Replace shroud (Tasks 4-1-6 and 4-7-6) if wear is excessive, or if grinding to remove pick up will result in excessive shroud/ rotor clearance.

4. Install Adapter (T.1)(1) and Cover (T.6)(2).

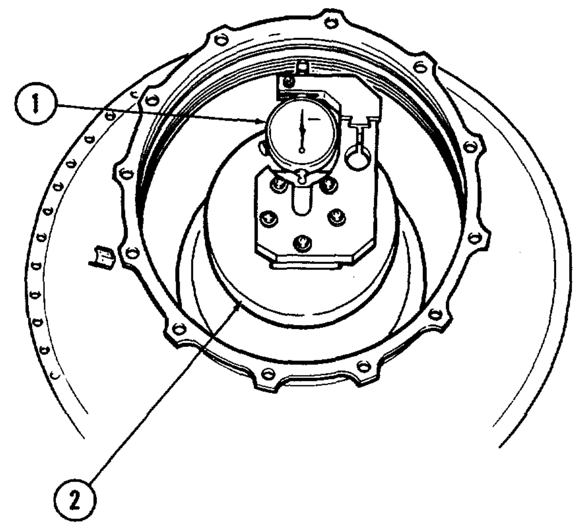
5. Install Gage (T.13)(1) to measure upstream lands of shroud and set to zero.

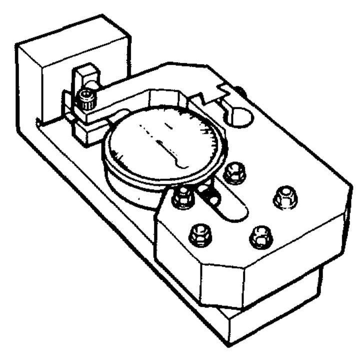
6. Install Gage (T.13)(1) and measure smallest diameter of upstream lands.

NOTE

Replace shroud (Tasks 4-1-6 and 4-7-6) if not concentric within 0.003 inch.

7. Measure largest diameter of upstream lands. Remove Gage (T.13)(1).



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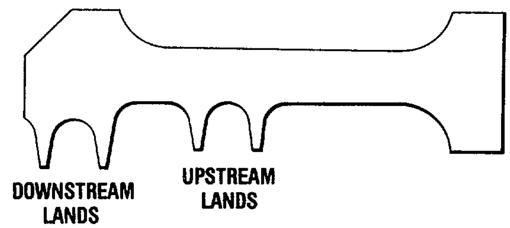
4-6 POWER TURBINE SHROUD (AVIM) (Continued)

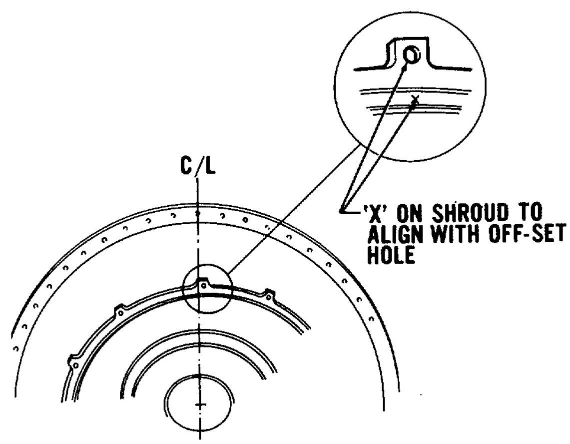
4-6-1 INSPECTION (Cont)

8. Subtract rotor dimension (Task 4-4-1) from shroud dimension to determine clearance. Rotor to shroud clearance shall be **0.016 to 0.028** inch.



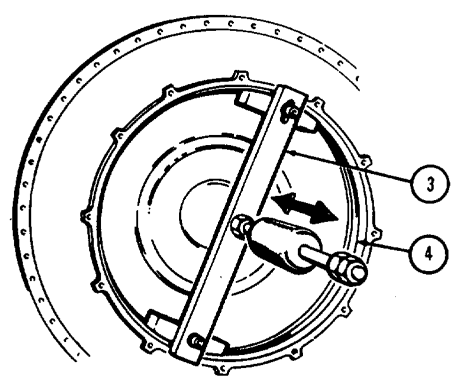

9. Repeat steps 5 thru 8 for downstream lands. Rotor to shroud clearance shall be **0.016 to 0.028 inch.**

10. If the clearance at either the upstream or downstream lands exceeds **0.028 inch**, replace shroud (Tasks 4-6-2 and 4-6-3) and recheck clearance.




4-6-2 REMOVAL

1. Index mark shroud, using Colorbrite Pencil (E.31), in relation to exhaust duct to insure installation in original position.




2. Install Puller (T.28)(3) and remove shroud (4).

4-6-3 INSTALLATION

1. Align index marks on old shroud and exhaust duct and install shroud in exhaust duct. Where a new shroud is installed, make index mark to align with existing "X" on exhaust duct flange.

2. Repeat Task 4-6-1, steps 4 through 7.

**WARNING**

Power grinding is hazardous to personnel. Sparks and metal chips may injure eyes. Wear approved goggles and hearing protectors. If injury occurs, get medical attention.

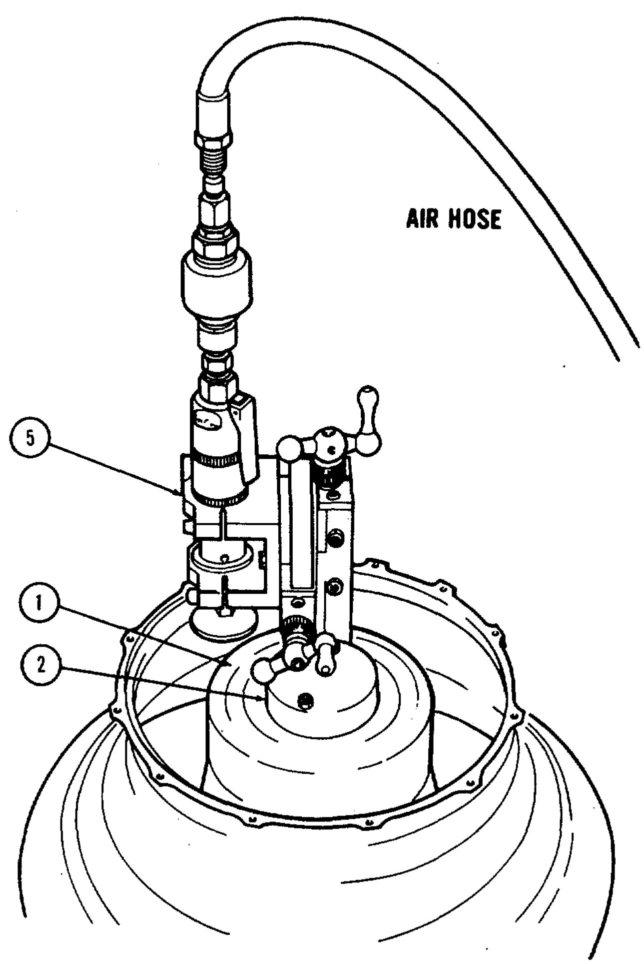
**CAUTION**

Prior to installation of power turbine grinder insure all airflow openings are blanked off to prevent dust, caused by grinding, from entering engine.

3. Remove Gage (T.13)(1) and install Grinder (T.16)(5) fitted with Abrasive Wheel (T.52) and grind shroud lands to give 0.016-0.028 inch shroud/rotor clearance.

4. Vacuum work area, remove masking, grinder, adapter and cover. Inspect.

5. Inspect

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4-6-3 INSTALLATION (Cont)

FOLLOW ON MAINTENANCE:

Installation Power Turbine Rotor
Assembly (Task 4-1-4)
Installation Power Turbine Stator
Housing (Task 4-1-2)
Installation Power Section
(Task 4-1-1)

END OF TASK

Section VII EXHAUST DUCT

4-7 EXHAUST DUCT

This task covers:

a. Removal (4-7-1)

b. Inspection (4-7-2)

c. Repair (4-7-3)

d. Installation (4-7-4)

**INITIAL SETUP**

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Lifting Eye (T.9)

Materials:
Welding Wire (E.62)

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Power Section Removed (Task 4-1-1)
Power Turbine Stator Housing Removed (Task 4-2-1)
Power Turbine Rotor Assembly Removed (Task 4-4-1)
Power Turbine Shroud Removed (Task 4-6-2)

**WARNING**

- When handling combustion chamber internal parts that have been exposed to fuels containing tetraethyl lead, insure that the byproduct (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings.
- If accidental exposure occurs, drench affected area with large amounts of clear water and obtain immediate medical attention.
- Gloves and goggles shall be worn at all times when handling contaminated parts.

GO TO NEXT PAGE

4-7 EXHAUST DUCT (Continued)

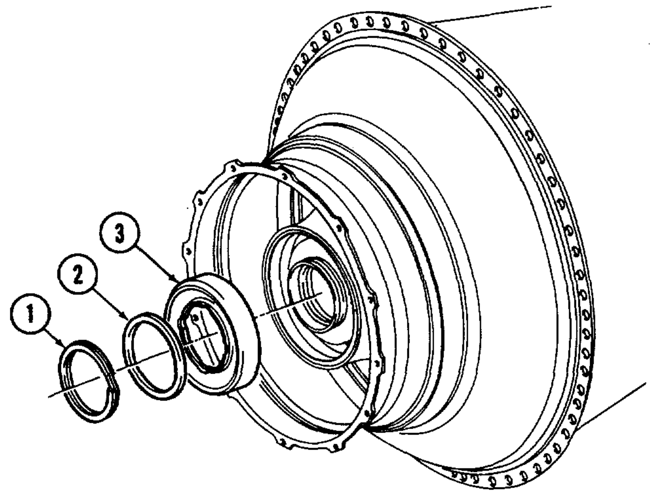
4-7-1 REMOVAL

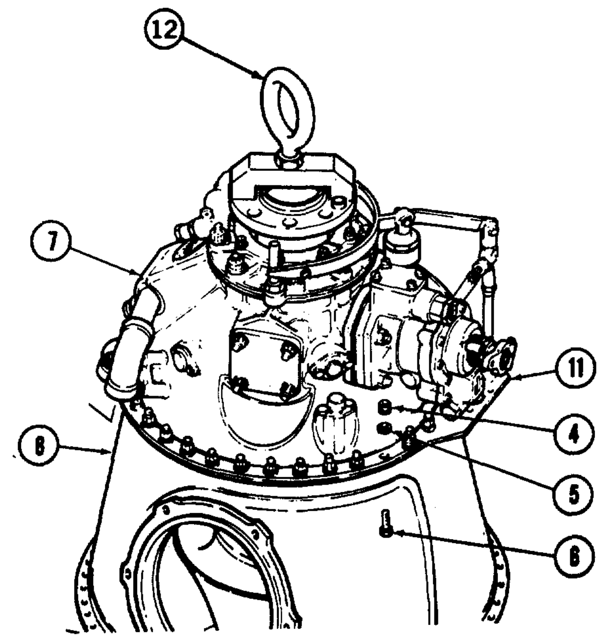
1. Remove retaining ring (1), spacer (2), if fitted and No. 3 bearing cover (3).

2. Remove power turbine rotor air seal (Task 4-4-1).

3. Install Lifting Eye (T.9) (12) on propeller gearbox (7) with the two capscrews provided.

4. Remove nuts (4), washers (5), and bolts (6) securing propeller gearbox (7) and lifting bracket (11) to exhaust duct (8).

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4-7 EXHAUST DUCT (Continued)

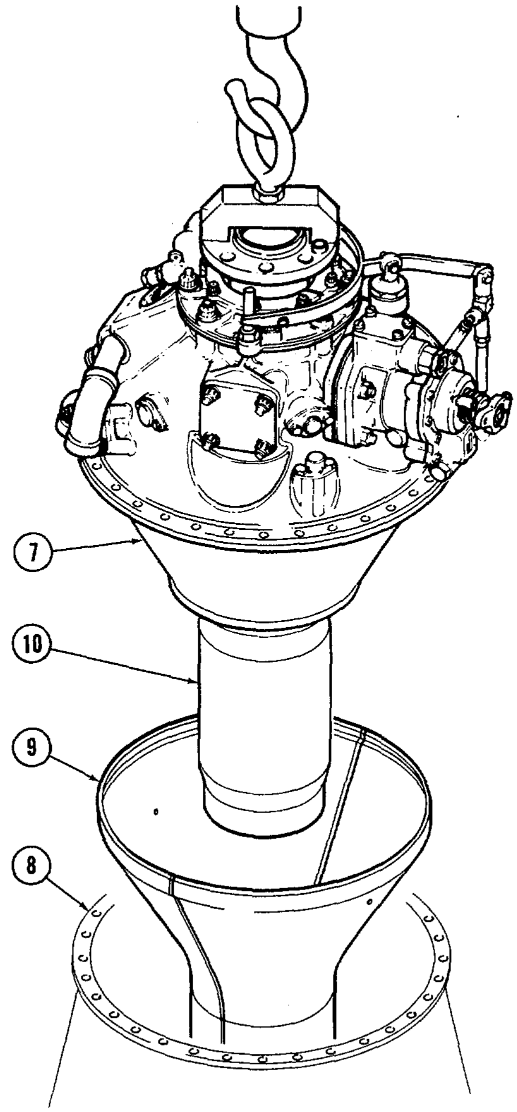
4-7-1 REMOVAL (Cont)

**CAUTION**

Raise propeller gearbox approximately 3 inches. Install two bolts with nuts 1800 apart to hold two halves together.

5. Lift propeller gearbox (7) with power turbine shaft housing (10) attached, from exhaust duct (8).

6. Lift one or two piece insulation blanket (9) from exhaust duct (8).




4-7-2 INSPECTION

1. Reject exhaust duct if cracked or distorted, or if corrosion has resulted in excessive thinning of the metal, and return to Depot Maintenance for possible repair.

2. Defective ITT harness clips may be repaired (Task 4-7-3).

4-7-3 REPAIR

Repair at next higher level.

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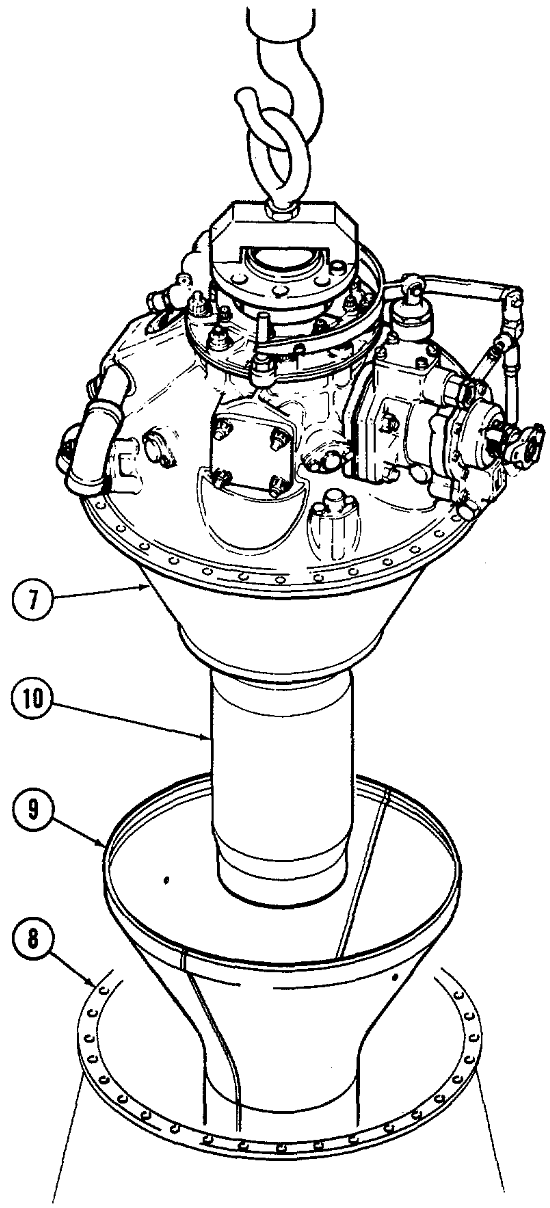
4-7-4 INSTALLATION

1. Install insulating blanket (9) in exhaust duct (8).

2. Install propeller gearbox (7) and power turbine shaft housing (10) on exhaust duct.

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4-7-4 INSTALLATION (Cont)

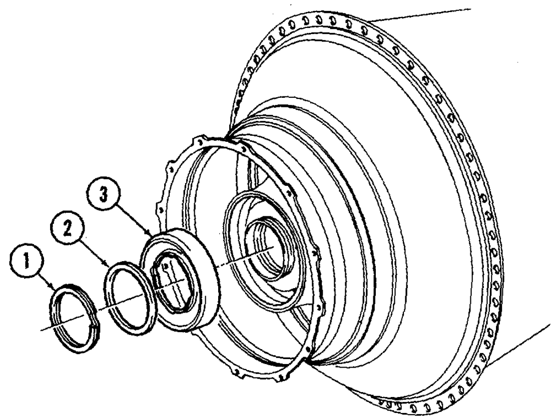
3. Fit lifting bracket (11) and
Cc-/ bolts (6), washers (5) and nuts (4). Torque nuts to 36 to 40 inch-pounds.

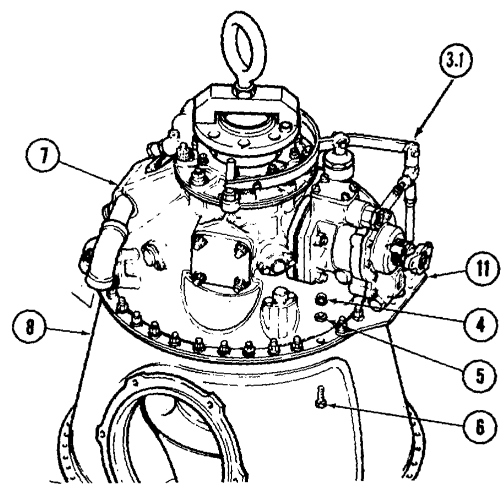
4. Install reversing push pull cable in or through forward lifting bracket. Attach to reversing linkage (3.1).

5. Align any dimples in cover (3) with scallops on shaft housing and install cover (3) and spacer (2), if fitted, with bevel side of spacer facing the bearing cover.

6. Install ring (1).

7. Install power turbine rotor air seal (Task 4-4-1).




FOLLOW ON MAINTENANCE:
Installation Power Turbine Shroud (Task 4-6-3)
Installation Power Turbine Rotor Assembly (Task 4-4-3)
Installation Power Turbine Stator Housing (Task 4-2-3)
Installation Power Section (Task 4-1-2)

END OF TASK

## Section VIII POWER TURBINE CASE SEALING RING(S) (AVIM)

### 4-8 POWER TURBINE CASE SEALING RING(S) (AVIM)

This task covers:

a. Removal (4-8-1)

b. Inspection (4-8-2)

c. Installation (4-8-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944

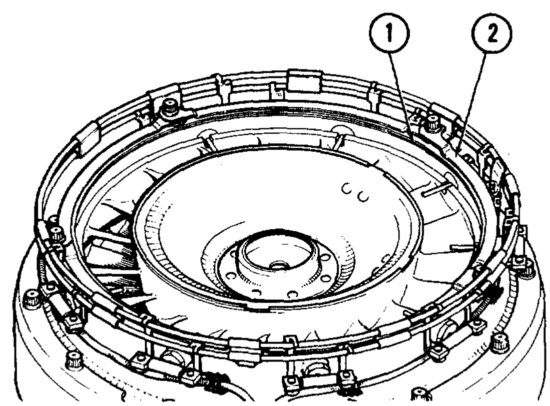
Materials:
None

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Power Section Removed
(Task 4-1-1)

### 4-8-1 REMOVAL

If necessary by reason of poor condition, remove spring sealing ring(s) (1) and carefully ease from behind ring retaining plates (2).

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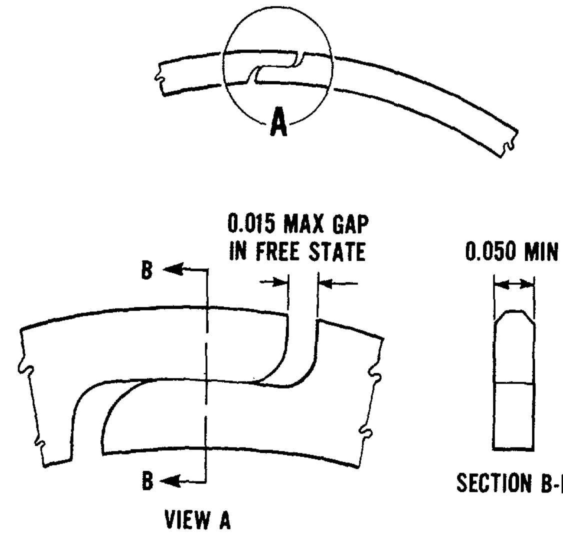
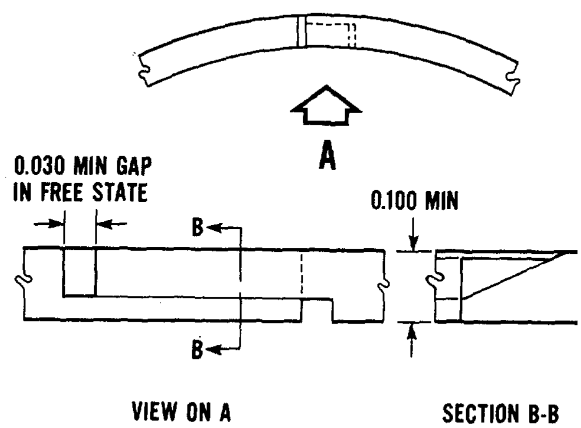
## 4-8 POWER TURBINE CASE SEALING RINGS(S) (AVIM) (Continued)

### 4-8-2 INSPECTION

The minimum thickness and maximum permissible free gap of each ring shall be as shown.




TWIN RINGS




SINGLE RING

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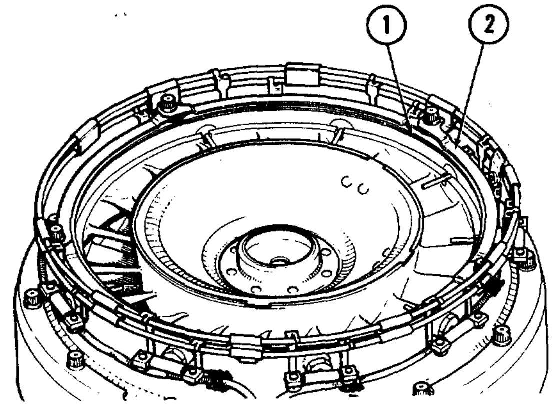
## 4-8 POWER TURBINE CASE SEALING RING(S) (AVIM) (Continued)

### 4-8-3 INSTALLATION

1. Where two thinner rings (1) are installed, carefully compress each ring slightly so that the ends overlap, then fit behind retaining plates (2) with gaps staggered at 180 degrees.

2. Where a single thick ring (1) is installed, insure that the side marked "Press" faces the rear of the engine.




FOLLOW ON MAINTENANCE:

Installation Power Section
(Task 4-1-2)

END OF TASK

# CHAPTER 5

# ACCESSORY GEARBOX

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Accessory Gearbox. It is divided into the following sections.



END OF OVERVIEW

## Section I ACCESSORY GEARBOX

### 5-1 ACCESSORY GEARBOX

This task covers:

Inspection (5-1-1)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Gage (T.15)

Materials:
None

Personnel Required:
68B Powerplant Mechanic

Equipment Condition:
Starter-generator Removed
(TM55-1510-209-23)

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## 5-1 ACCESSORY GEARBOX (Continued)

### 5-1-1 INSPECTION

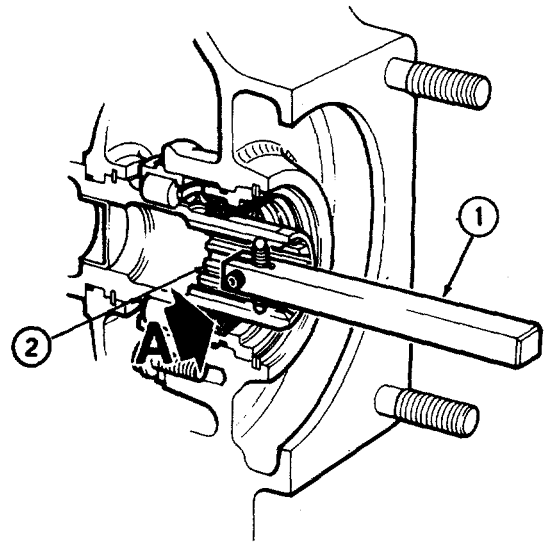
1. Using Gage (T.15)(1) set to 0.660 inch, insure that gage is self-supporting in starter-generator drive gearshaft (2).

2. If gage is not self-supporting, repair (Task 5-3-2).

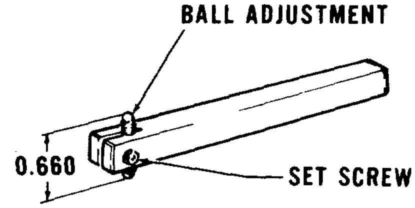
3. Inspect externally for:

- Burns
- Nicks
- Corrosion
- Damaged paint
- Deformed studs and
- Damaged helicoils

(Task 5-3-2).




ALLOW GAGE TO SUPPORT ITSELF




VIEW A

FOLLOW ON MAINTENANCE:

Installation Starter-Generator
(TM55-1510-209-23)

END OF TASK

## Section II ACCESSORY GEARBOX ACCESSORY DRIVE SHAFT SEALS

### 5-2 ACCESSORY GEARBOX ACCESSORY DRIVE SHAFT SEALS (AVIM)

This task covers:

a. Removal (Task 5-2-1)

b. Installation (Task 5-2-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Drift (T.8)
Puller (T.20)
Puller (T.21)
Puller (T.45)
Puller (T.49)
Puller (T.73)

Materials:
Lubricating Oil (E.2) or (E.71)

Parts:
Packings
Seals

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Starter-generator Removed (TM55-1510-209-23)
Fuel Control Unit Removed (Task 6-1-1)
Fuel Pump Removed (Task 6-3-1)
Ng Tachometer-generator Removed (TM55-1510-209-23)

General Safety Instructions:

**WARNING**

LUBRICATING OILS HAZARDOUS

Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.

GO TO NEXT PAGE

## 5-2 ACCESSORY GEARBOX ACCESSORY DRIVE SHAFT SEALS (AVIM) (Continued)

### 5-2-1 REMOVAL

1. At starter-generator drive pad (5), remove retaining ring (1).

a. Using Puller (T.45), extract seal carrier (2) complete with seals (3) and preformed packing (4).

b. Remove packing (4).

c. Using Puller (T.73), extract seal (3) from seal carrier (2).

2. At fuel control unit drive pad (6), remove retaining ring (1).

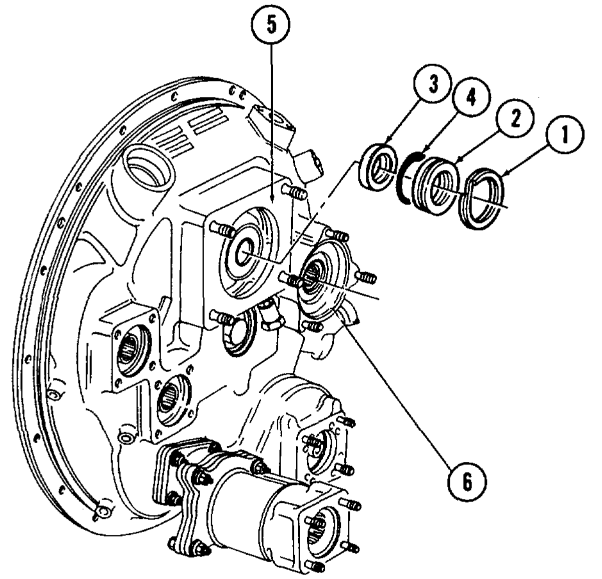
a. Using Puller (T.45), extract seal carrier (2) complete with seals (3) and preformed packing (4).

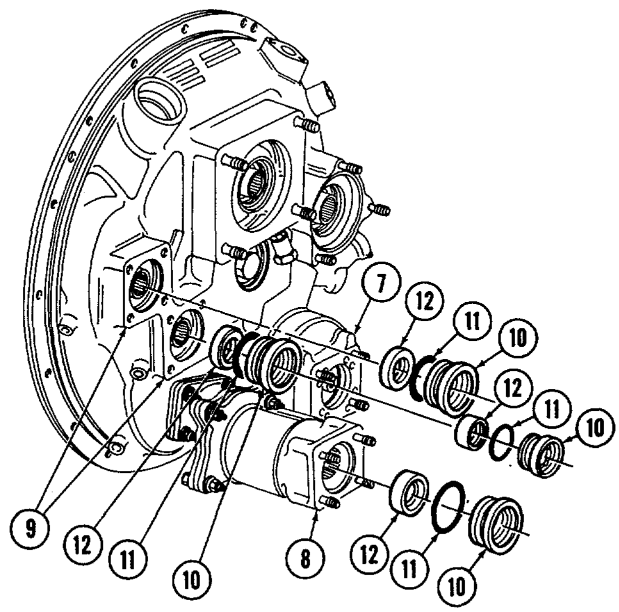
b. Remove packing (4).

c. Using Puller (T.73) extract seal (3) from seal carrier (2).

3. At Ng tachometer-generator drive pad (7), vacuum pump drive pad (8), or power take-off drive pads (9), remove seal carrier (10), complete with preformed packing (11) and seal (12), using Puller (T.20) at pad (7), Puller (T.21) at pad (8), and Puller (T.45) at pads (9).

Remove preformed packing (11) and use Puller (T.73) to remove seal (12), except from Ng tachometer-generator drive seal carrier (10), use Puller (T.49).

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## 5-2 ACCESSORY GEARBOX ACCESSORY DRIVE SHAFT SEALS (AVIM) (Continued)

### 5-2-2 INSTALLATION

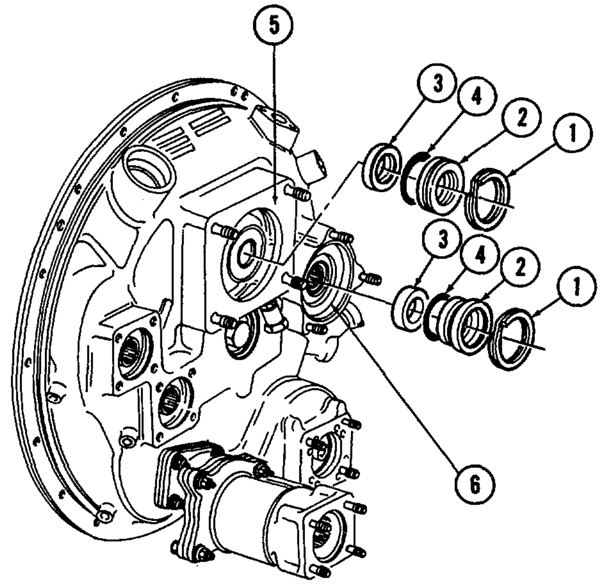
1. At starter-generator drive pad (5) or fuel control unit drive pad (6), immerse seal (3) in Lubricating Oil (E.2) or (E.71) at **175° to 195°F (79° to 91°C)** until seal is pliable.

2. Install seal in carrier (2), lip of seal trailing, using hand pressure or Drift (T.8).

3. Install preformed packing (4) on seal carrier (2).

4. Install carrier (2), using Drift (T.8) and hand pressure only.

5. Install retaining ring (1).

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## 5-2 ACCESSORY GEARBOX ACCESSORY DRIVE SHAFT SEALS (AVIM) (Continued)

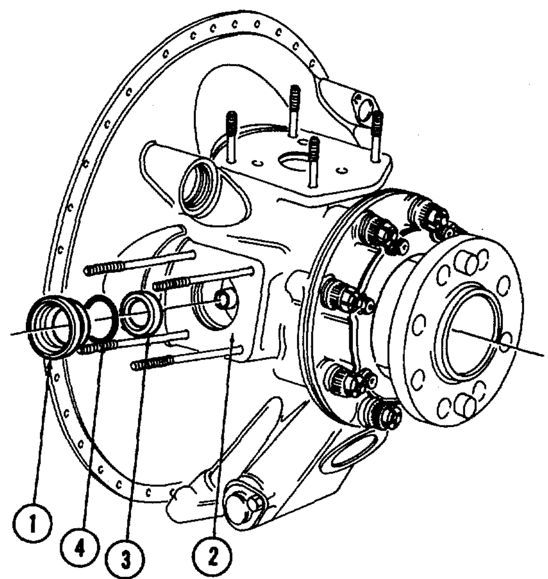
### 5-2-2 INSTALLATION (Cont)

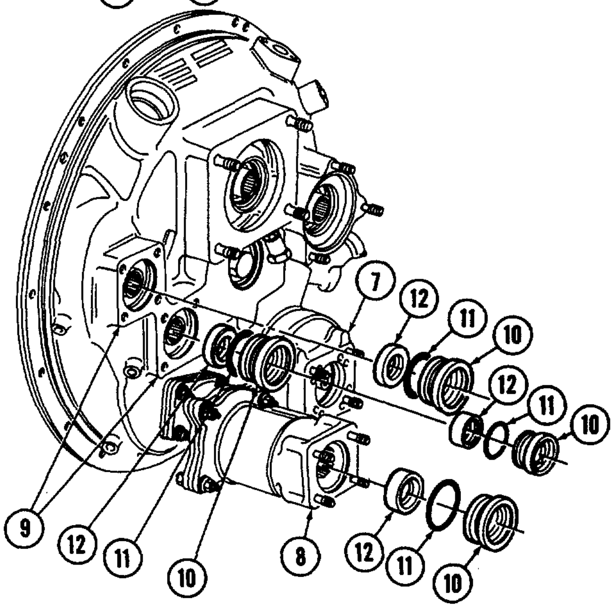
6. To install seal (12) at Ng tachometer-generator drive pad (7), vacuum pump drive pad (8) or power take-off drive pads (9), immerse seal (12) in Lubricating Oil (E.2) or (E.71) at **175° to 195°F (79' to 91°C)** until seal is pliable.

7. Install seal in carrier (10), lip of seal trailing, using hand pressure or Drift (T.8).

8. Install preformed packing (11) on seal carrier (10).

9. Install carrier (10), using Drift (T.8) and hand pressure only.




FOLLOW ON MAINTENANCE:

Installation Ng Tachometer-
generator (TM55-1510-209-23)
Installation Fuel Pump
(Task 6-3-2)
Installation Fuel Control Unit
(Task 6-1-3)
Installation Starter-generator
(TM55-1510-209-23)

END OF TASK

## Section III ACCESSORY GEARBOX

### 5-3 ACCESSORY GEARBOX (AVIM)

This task covers:

a. Removal (Task 5-3-1)

b. Repair (Task 5-3-2)

c. Installation (Task 5-3-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)
Drift And Base (T.3)
Drift (T.7)
Gage (T.15)
Puller (T.23)
Puller (T.27)
Puller (T.29)
Puller/Pusher (T.30)
Screw (T.40)
Wrench (T.55)
Wrench (T.75)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)
Petrolatum (E.20)
Chromic Acid (E.43)
Enamel (E.44)

Parts:
Seals
Cotterpins
Packings
Retainer
Coupling Shaft

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-25 1-23P

Equipment Condition:
Oil Drained (TM55-1510-209-23) or (TM55-4920-328-13)
Oil Drained (Chapter 1, Section VIII)
Temperature Compensator Removed (Task 6-9-1)
Oil Filter Element Removed (Task 8-1-1)
Oil-to-fuel Heater Removed (Task 8-3-1)
Starter-generator Removed (TM55-1510-209-23)
Fuel Control Linkage Removed (Task 6-2-2)
Fuel Control Unit Removed (Task 6-1-1)
Fuel Pump Removed (Task 6-3-1)
Ignition Regulator Removed (Task 7-3-1)
Oil Pressure and Scavenge Lines From Gearbox Removed (Task 8-2-1)
Reversing Gear, Propeller Removed (Task 10-3-1)
Ignition Cables Removed (Task 7-4-1)

GO TO NEXT PAGE

## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

INITIAL SETUP (Cont)

General Safety Instructions

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

GO TO NEXT PAGE

## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

### 5-3-1 REMOVAL

**CAUTION**

**Do not turn engine in a horizontal position.**

1. Remove lockwire and disconnect tube assemblies (1), (2) and (3).

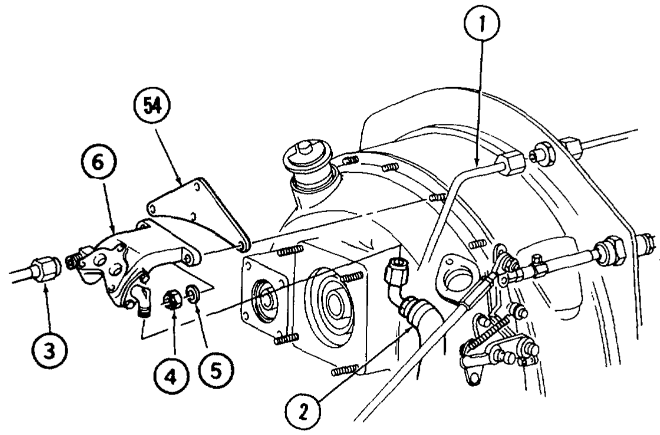
2. Remove nuts (4), using Wrench (T.55), washers (5) and FWD brackets (6) and lifting brackets (54).

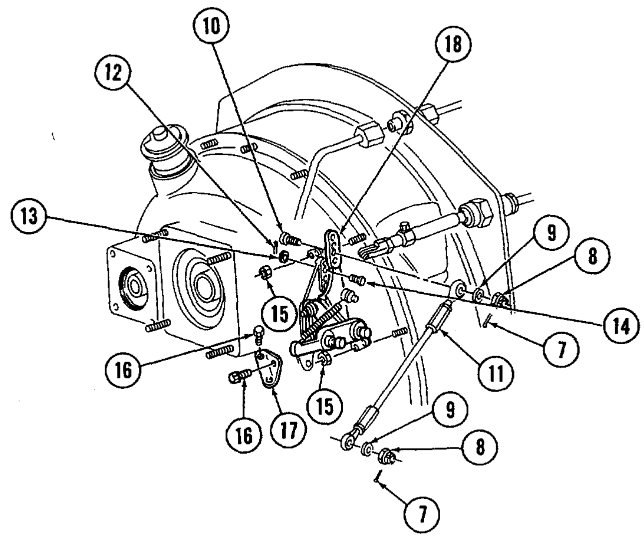
3. The accessory gearbox diaphragm is secured to the accessory gearbox housing by four countersunk screws, plain washers and self-locking nuts, which must nor be removed at this stage. The four screws are located at the following positions: 4th, 8th, 14th and 18th in clockwise rotation, assuming 1st to be at the 12 o'clock position.

4. Remove cotterpins (7), nuts (8), washers (9), bolt (10) and disconnect control rod (11).

5. Remove cotterpin (12), washers (13) and pin (14).

6. Remove nuts (15), using Wrench (T.55), bolts (16), plate (17) and lever assembly (18).

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## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

### 5-3-1 REMOVAL (Cont)

7. Remove oil filter body (19), using Puller (T.29).

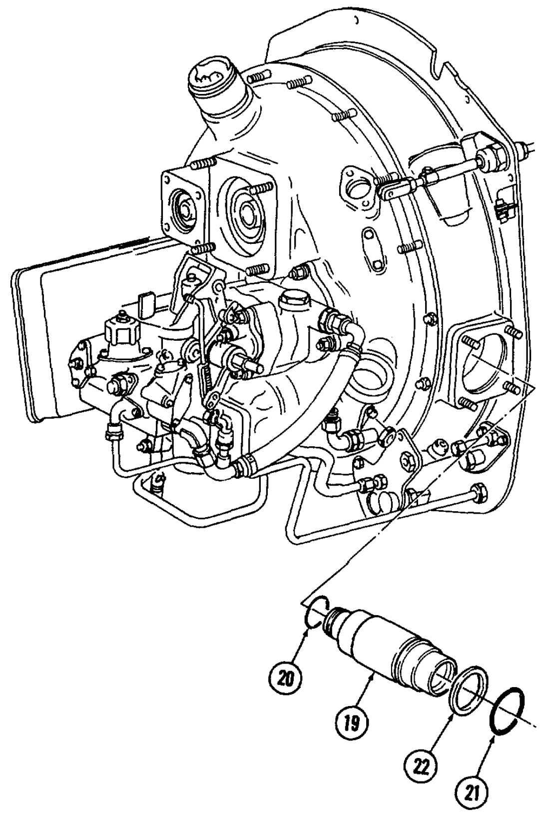
8. Remove packings (20), (21) and retainer (22).

9. Remove nut (31) and bolt (32).

10. Disconnect ignition harness (33) from ignition regulator (34).

11. Cap receptacles and ignition harness connectors.

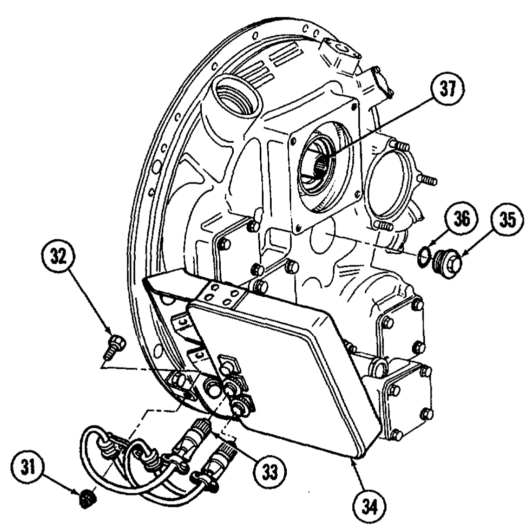
12. Remove plug (35) and packing (36).




**CAUTION**

**Make certain that the washer in the centerboss hole is in the 3 o clock position so that ball (53) will not drop out when accessory gearbox is removed.**

13. Turn starter-generator gearshaft (37), until notched washer (viewed through aperture created by removal of plug (35)) is in 3 o'clock position.

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## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

### 5-3-1 REMOVAL (Cont)

14. Install Holder (T.75) through center-boss and into rear end of input gearshaft. Tighten nut on puller, until all end play is removed. This prevents unnecessary loading of accessory gearbox roller bearings during gearbox removal.

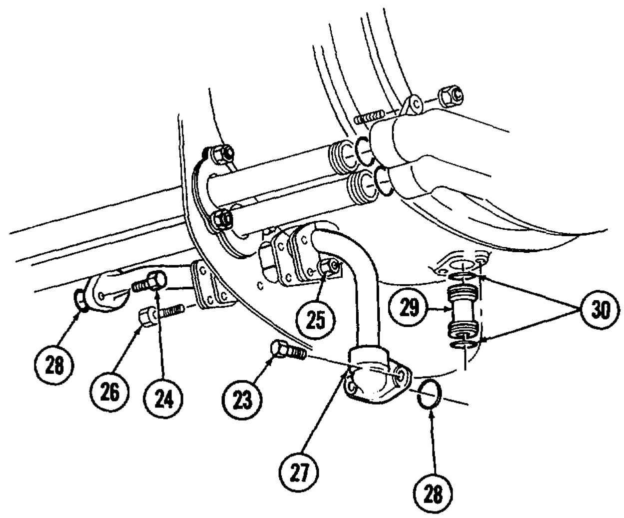
15. Remove bolts (23) and (24).

16. Remove nuts (25) and bolts (26).

17. Swing scavenge tube (27) clear. Remove packings (28).

18. Remove transfer tube (29), using Puller (T.27).

19. Remove packings (30).

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## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

### 5-3-1 REMOVAL (Cont)

20. Remove remaining nuts (38), using Wrench (T.55), washers (39) and spacers (40).

21. Using four Screws (T.40), separate accessory gearbox housing and accessory gearbox diaphragm from compressor inlet case mounting studs, withdrawing assembly slowly rearward and maintaining a horizontal position until completely clear.

22. Remove packings (43), (44) and (45).

23. Remove transfer tube (46) and packings (47).

24. Remove transfer tube (48) and packings (49).

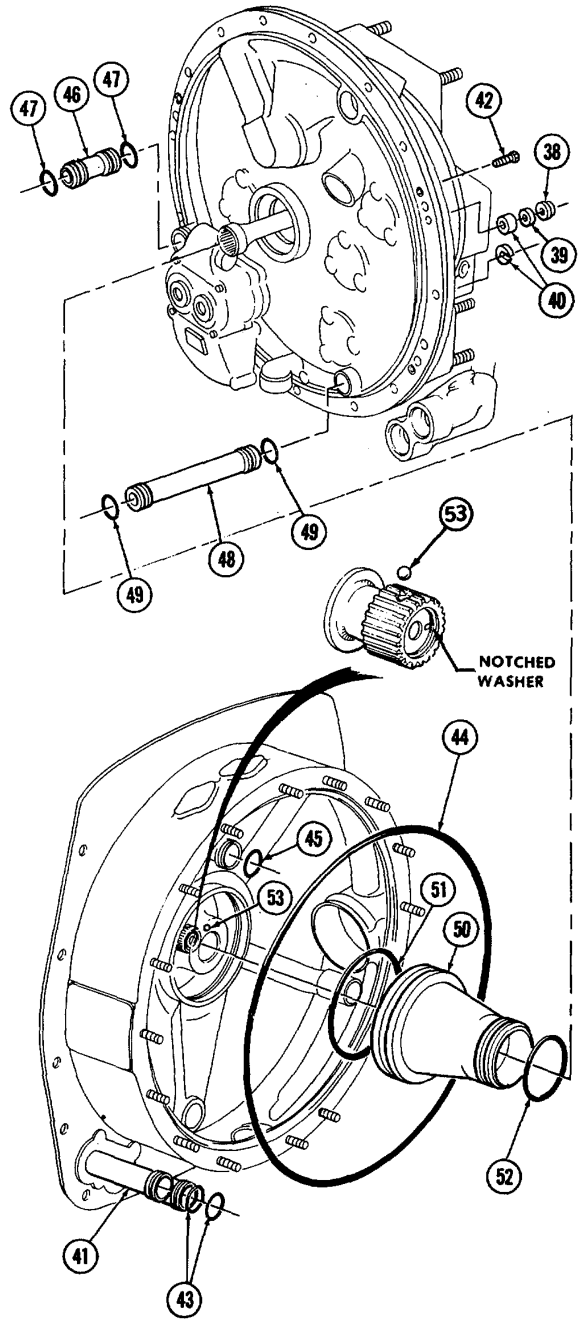
25. Remove oil tank tube (50) and packings (51) and (52).

26. Retrieve ball (53), which may have fallen into No. 1 bearing housing or oil scavenge passage in inlet case.

27. Remove fuel control unit (Task 6-1-1).

28. Remove ignition regulator (Task 7-3-1).

29. Remove oil pressure and scavenge lines from gearbox (Task 8-2-1).

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## 5-3-2 REPAIR

1. Blend burrs, nicks, and scratches.

**WARNING**

**CHROMIC ACID**

- **Solution is poisonous.**
- **Do not allow this solution to touch skin.**
- **Serious illness will result if the poison enters the body through cuts or bruises.**
- **Immediately remove any solution from the skin.**
- **Thoroughly wash the contacted area with soap and water.**

2. Remove corrosion with Chromic Acid (E.43).

3. Repair damaged paint with Enamel (E.44).

4. Replace damaged studs, using appropriate stud drivers (refer to Appendix F).

5. Replace damaged helicoil inserts, insuring that reworked hole is treated with Chromic Acid (E.43).

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**5-3-2 REPAIR (Cont)**

6. Replace defective carbon seal as follows:

a. Remove accessory gearbox (Task 5-3-1).

b. With diaphragm (1) resting on bench, remove nuts (2), washers (3) and screws (4).

c. Remove rear housing (5).

d. Remove gearshaft assembly (6).

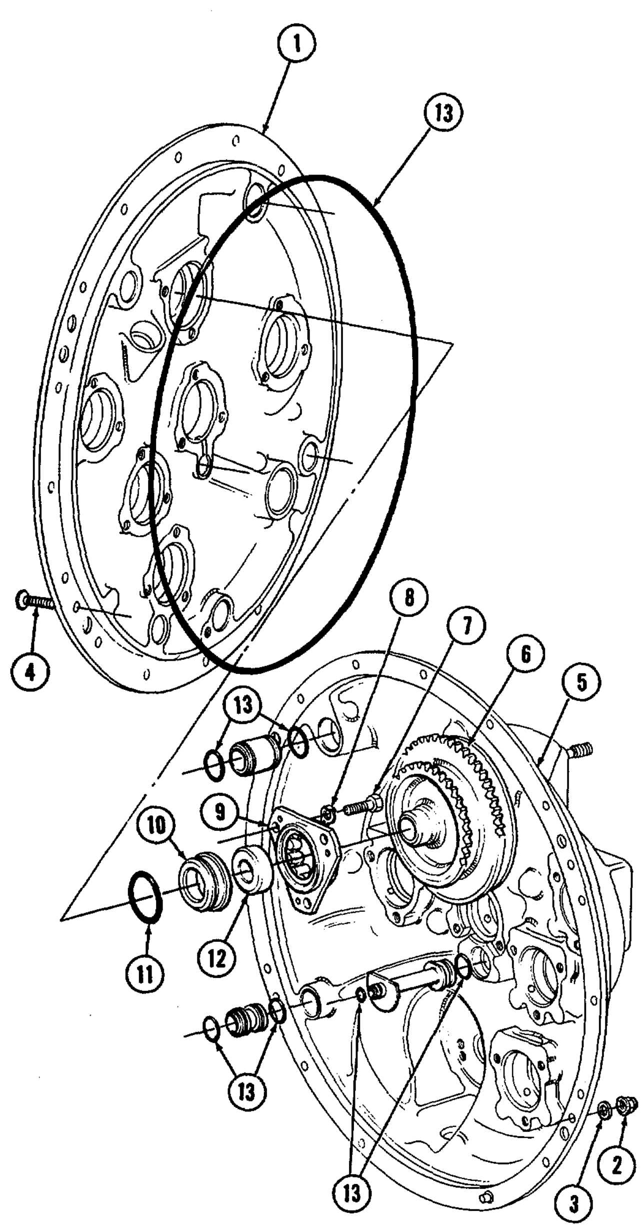
e. Remove bolts (7), keywashers (8) and bearing (9).

f. Remove seal carrier (10), using Puller (T.23).

g. Remove packing (11).

h. Remove carbon seal (12) from seal carrier (10), using Drift and Base (T.3).

i. Remove exposed packings (13).

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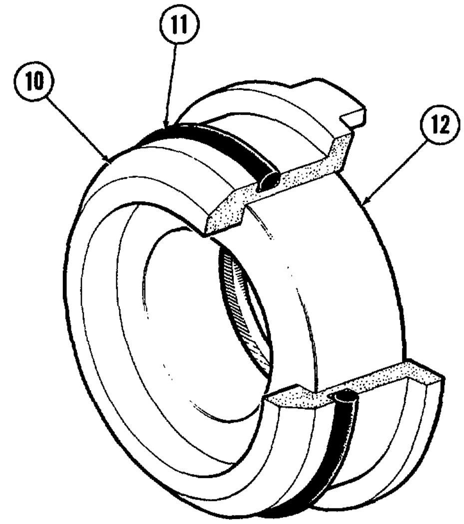
**5-3-2 REPAIR (Cont)**

6. Replace defective carbon seal as follows: (Cont)

j. Immerse carbon seal (12) in Lubricating Oil (E.2) or (E.71) and work carbon element in and out to insure freedom of movement.

k. Immerse seal carrier (10) for **two minutes** in Lubricating Oil (E.2) or (E.71) heated to **175° to 195°F (79° to 91°C).** Remove seal carrier (10) from lubricating oil, press carbon seal (12) into seal carrier (10), using Drift (T.7).

l. Install preformed packing (11) on seal carrier (10).

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## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

### 5-3-2 REPAIR (Cont)

6. Replace defective carbon seal as follows: (Cont)

m. Using Drift (T.7) install seal carrier (10) assembly into accessory gearbox diaphragm (1).

n. Install bearing (9), keywashers (8) and bolts (7). Torque bolts to **32 to 36 inch-pounds** and secure with keywashers.

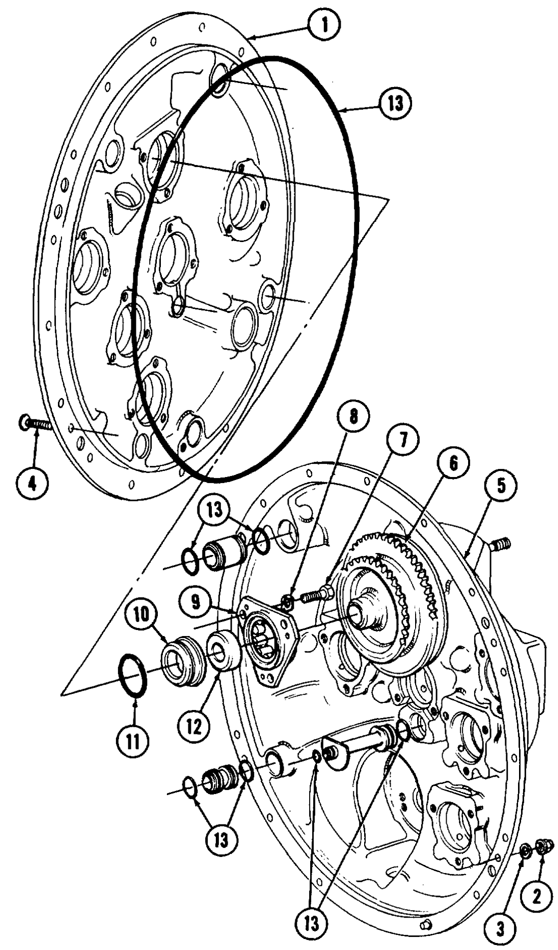
o. Install packings (13).

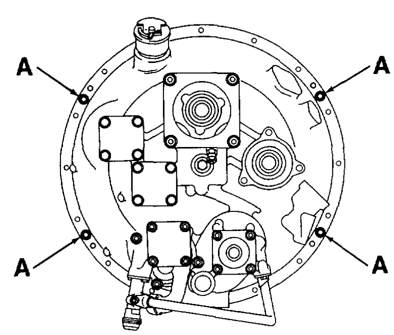
p. Install gearshaft assembly (6).

q. Install rear housing (5), screws (4), washers (3) and nuts (2). Torque nuts to **36 to 40 inch-pounds**.

**NOTE**

**For position of screws see locator diagram.**




A DIAPHRAGM LOCATING SCREWS

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## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

### 5-3-2 REPAIR (Cont)

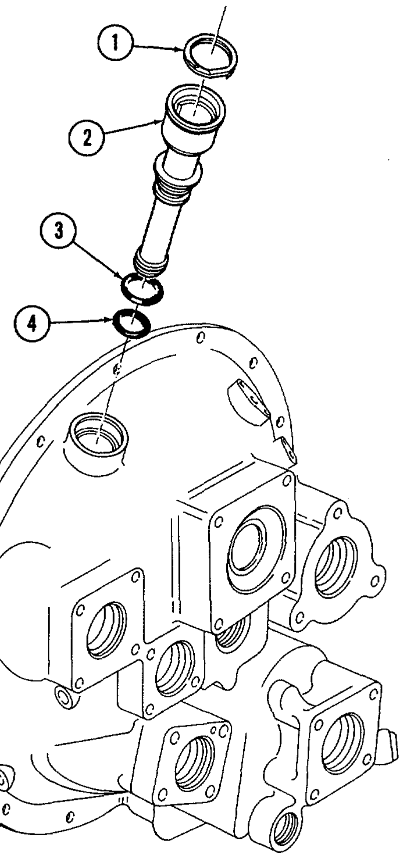
7. Replace oil filler tube assembly as follows:

a. With dipstick removed (refer to Chapter 1, Section VIII). Remove retaining ring (1).

b. Withdraw filler tube (2) and packings (3) and (4). Discard packings.

c. Install packings (3) and (4) on filler tube (2).

d. Install filler tube (2) and retaining ring (1).

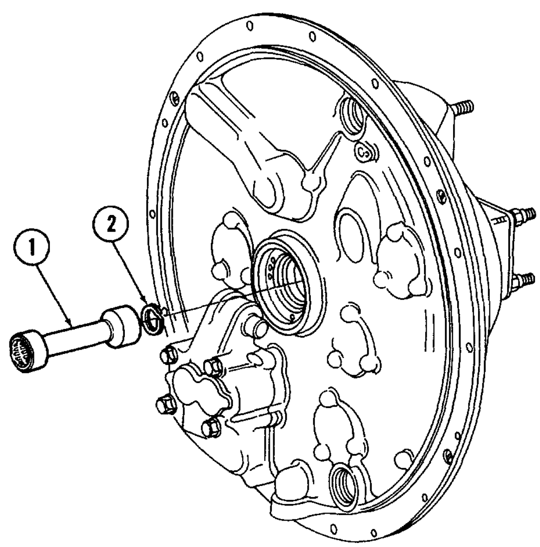



8. Replace coupling shaft (1), as follows:

a. Remove retaining ring (2) and pull coupling shaft (1) from input gearshaft in accessory gearbox.

b. Place retaining ring (2) on input gearshaft and install coupling shaft (1).

c. Install retaining ring (2) in coupling shaft (1).




**Inspect.**

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## 5-3-3 INSTALLATION

1. Install packings (43), (44) and (45).

2. Install packings (49) on transfer tube (48). Install assembly.

3. Install packings (47) on transfer tube (46). Install assembly.

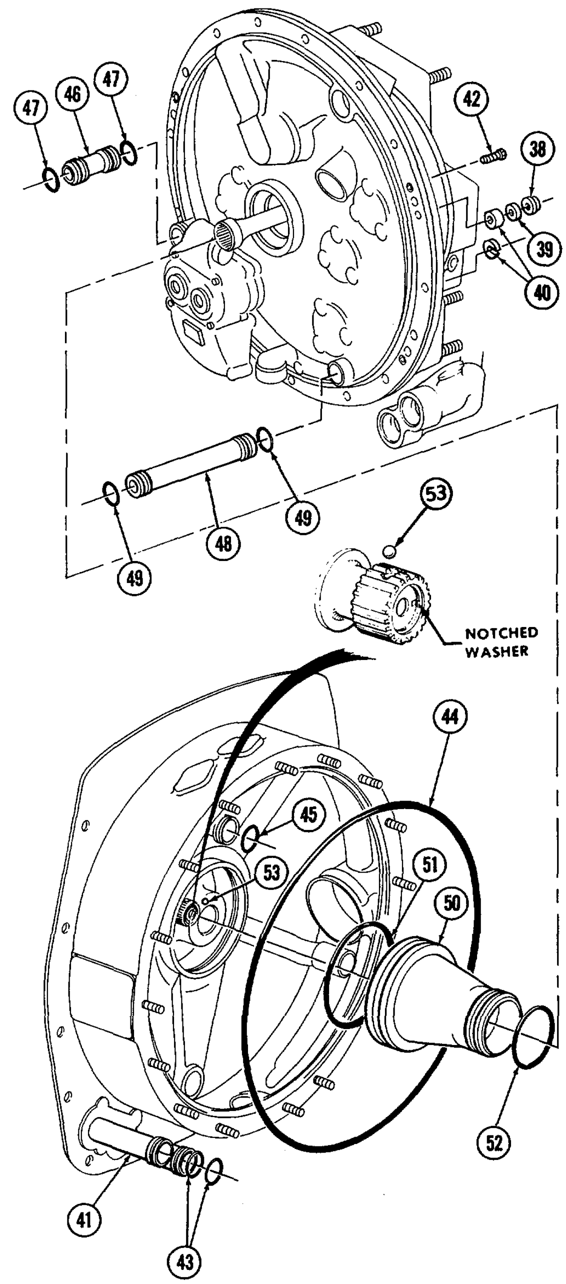
4. Rotate compressor until hole in splined shaft is at 12 o'clock. Coat ball (53) with Petrolatum (E.20) and install in hole.

5. Install packings (51) and (52) on oil tank tube (50). Install assembly.

6. Install Puller/Pusher (T.30), with nut unscrewed well back toward the handle, through gearbox housing center-boss into the input gearshaft and screw home. Thread loose tool body into center-boss, finger-tight only. Push-pull tool handle to establish end float in the input gearshaft, then run nut and washer along the tool thread up to the tool body. Carefully tighten nut while holding the tool handle still, to remove end float.

7. Align oil pressure and scavenge tubes (41) and install accessory gearbox on compressor inlet case.

8. Install washers (39) and nuts (38) on the short studs.

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### 5-3-3 INSTALLATION (Cont)

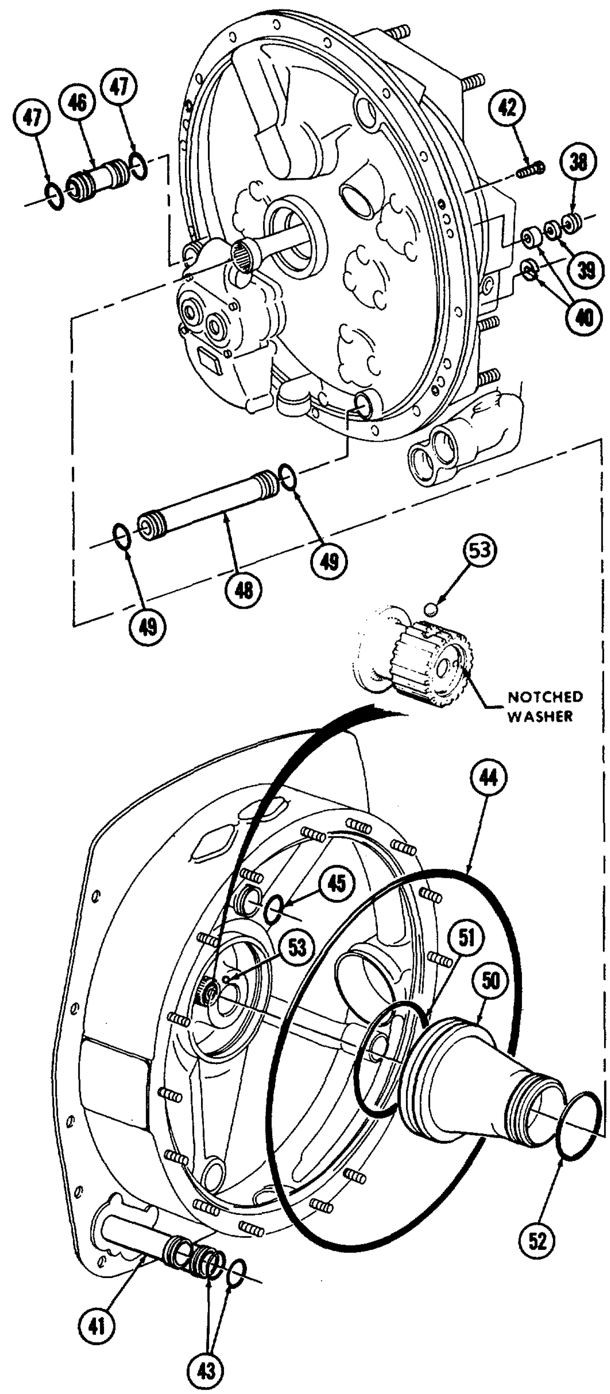
9. Install slotted spacer (40) on long studs at 9 o'clock position and five plain spacers (40) on remaining long studs.

10. Install nuts (38) and torque, using Wrench (T.55), to **32 to 36 inch-pounds.**

11. Unscrew nut on Puller/Pusher (T.30) and push on tool handle to engage stubshaft ball (53) with coupling shaft.

12. Check that ball is engaged, indicated by minimal end float when tool handle is push-pulled.

**Inspect.**

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## 5-3 ACCESSORY GEARBOX (AVIM) (Continued)

### 5-3-3 INSTALLATION (Cont)

13. Remove Puller/Pusher (T.30).

14. Assemble packing (36) on plug (35). Install assembly. Torque to 150 to 160 inch-pounds and lockwire (E.5) plug.

15. Install scavenge tubes (Task 8-2-5).

16. Install ignition harness bracket on bolt (13) counting clockwise. (Task 7-4-4).

17. Install straight adapter at 6 o'clock position on starter mount pad.

18. Install ignition regulator (Task 7-3-5). Connect ignition harness (33) to regulator (34). Torque fingertight plus 45 degrees and lockwire (E.5) connectors.

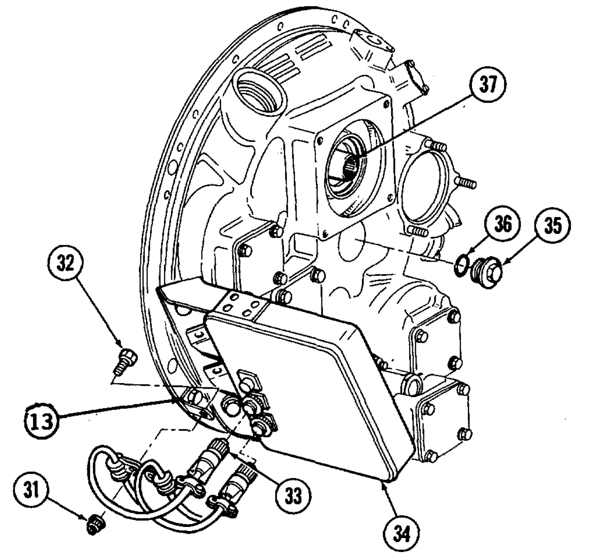
19. Install bolt (32) and nut (31). Torque nut to 32 to 36 inch-pounds.

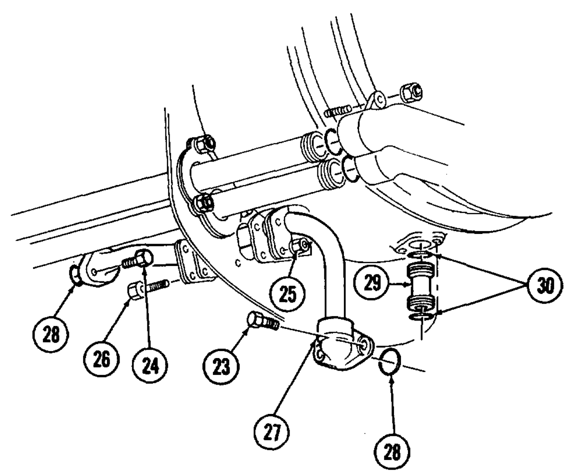
20. Assemble packings (30) on transfer tube (29) and install, using Puller (T.27).

21. Assemble packings (28) on scavenge tube (27).

22. Install scavenge tube and bolts (23) and (24). Torque to 20 to 30 inch-pounds and lockwire (E.5) bolts. Install main scavenge line (Task 8-2-5).

23. Install bolts (26) and nuts (25). Torque nuts to firm contact plus 180 degrees.

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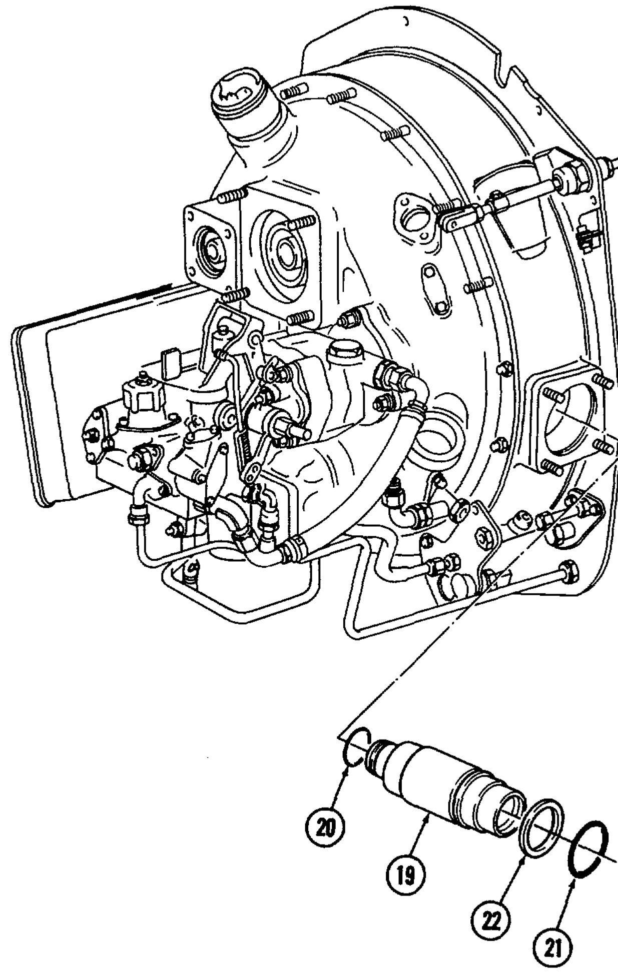
**5-3 ACCESSORY GEARBOX (AVIM) (Continued)**

**5-3-3 INSTALLATION (Cont)**

24. Lubricate packings (20), (21) and retainer (22).

25. Assemble packings, retainer, oil filter body (19) and install.

26. Install oil filter (Task 8-1-4).

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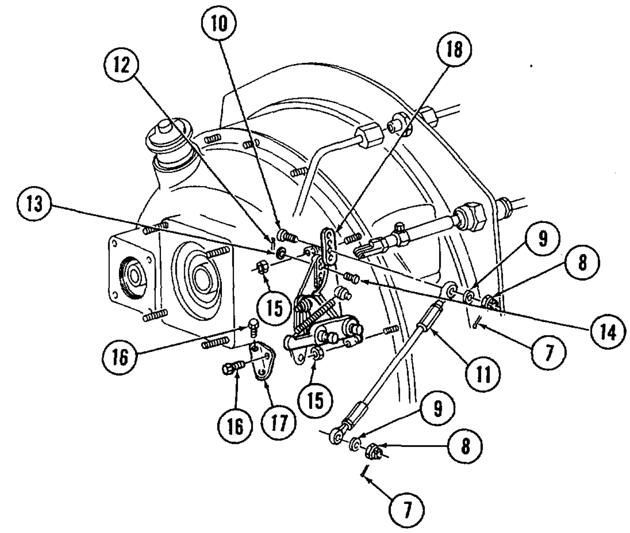
**5-3-3 INSTALLATION (Cont)**

27. Install assembly (18), plate (17), nuts (15), using Wrench (T.55) and bolts (16). Torque nuts and bolts to **32 to 36 inch-pounds**. Lockwire (E.5) bolts.

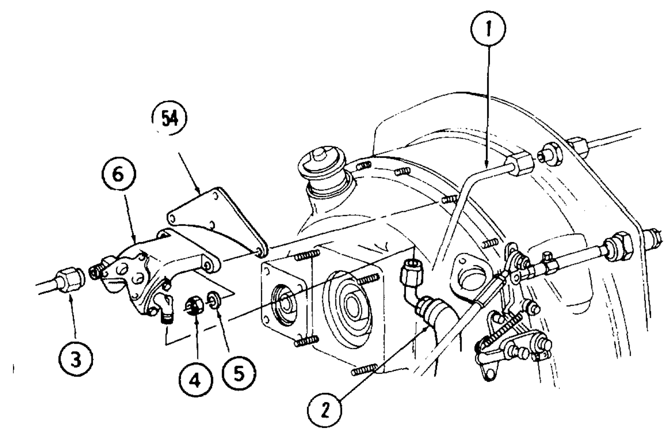
28. Connect propeller reversing gear with pin (14), washer (13) and cotterpin (12).

29. Reconnect control rod (11), bolt (10), washers (9) and nuts (8). Torque nuts to **24 to 36 inch-pounds** and secure with cotterpins (7).




30. Install brackets (6) and (54), washers (5) and nuts (5) using Wrench (T.55). Torque nuts to 24 to 36 inch-pounds.

31. Connect tube assemblies (1), (2) and (3). Torque to 90 to 100 inch-pounds and lockwire (E.5) tube nuts.




FOLLOW ON MAINTENANCE:

Installation Fuel Pump (Task 6-3-2)
Installation Fuel Control Unit (Task 6-1-3)
Installation Fuel Control Linkage (Task 6-2-3)
Installation Starter-generator (TM55-1510-209-23)
Installation Oil-to-fuel Heater (Task 8-3-3)
Installation Oil Filter Element (Task 8-1-4)
Installation Temperature Compensa tor (Task 6-9-2)
Service Oil System (Chapter 1, Section VIII)

END OF TASK

# CHAPTER 6

# FUEL CONTROL ASSEMBLY

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Fuel Control Assembly. It is divided into the following sections.



END OF OVERVIEW

## Section I FUEL CONTROL ASSEMBLY

### 6-1- FUEL CONTROL ASSEMBLY

This task covers:

a. Removal (6-1-1)

b. Inspection (6-1-2)

c. Installation (6-1-3)

d. Adjustment (6-1-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Inspector's Tool Kit
NSN 5180-00-323-5114
Torque Wrench (0 to 200 inch-pounds)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)
Lint-free Disposable Gloves

Parts:
Preformed Packings
Backup Rings
Coupling
Cotterpin
Protection Caps

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P
TM55-1500-204-25

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## 6-1 FUEL CONTROL ASSEMBLY (Cont)

INITIAL SETUP (Cont)

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

**WARNING**

**Turbine fuels are flammable. They cause drying and irritation of skin or eyes. Handle only in well ventilated areas away from heat and open flames. Drain and store in approved metal safety containers. Avoid prolonged or repeated contact with skin, and do not take internally. Wash contacted areas of skin thoroughly after handling. If irritation of the skin results, get medical attention.**

**Get medical attention for eyes.**

**Fuel/Air discharge during purging is irritating and highly flammable. Take suitable measures to protect eyes and prevent fire.**

GO TO NEXT PAGE

## 6-1 FUEL CONTROL ASSEMBLY (Continued)

### 6-1-1 REMOVAL

1. Remove cotterpin (1), castellated nut (2), washer (3) and bolt (4) securing control rod (5) to fuel control unit actuating arm.

2. Remove lockwire and disconnect air pressure line (6) and fuel inlet hose (7).

3. Remove lockwire and disconnect fuel delivery tube (8 and air pressure tube (9).

4. Remove four nuts (10) and plain washers (11) securing fuel control unit (12) to fuel pump.

Remove control unit.

5. Remove and discard preformed packing (13).

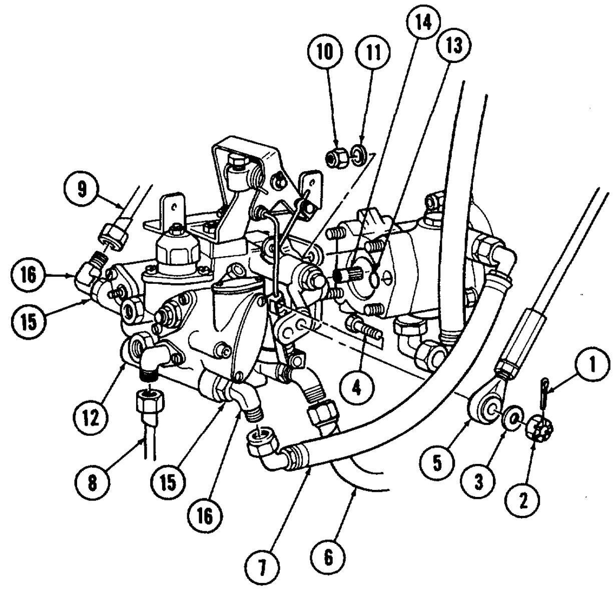
6. Remove/replace coupling (14 if necessary.

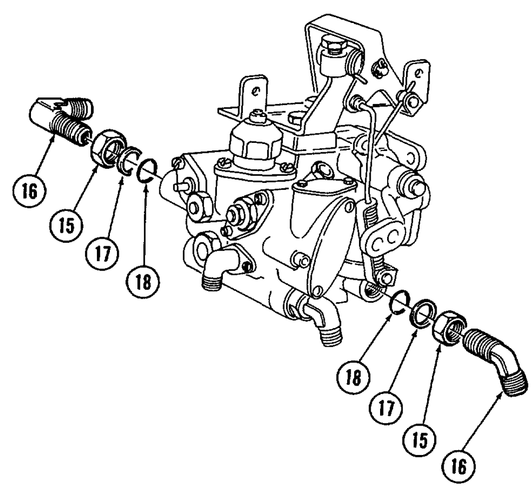
**NOTE**
**Coupling may remain attached to fuel control unit.**

7. If fuel control unit is to be replaced, loosen locknuts (15), and remove elbow assemblies (16).

8. Remove and discard preformed packings (18) and backup rings (17).

9. Cap all exposed orifices an tubes.

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## 6-1 FUEL CONTROL ASSEMBLY (Continued)

### 6-1-2 INSPECTION

1. Inspect for signs of external damage.

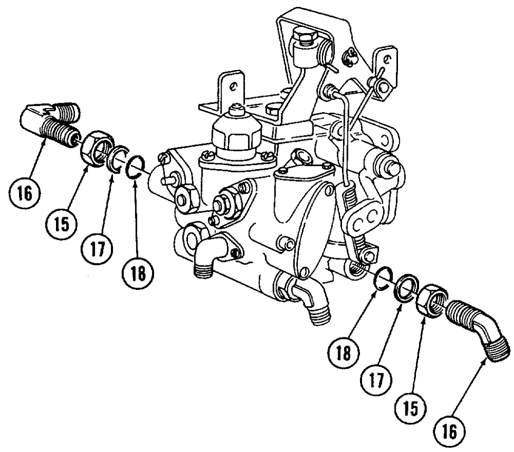
2. Insure that all seals on sealed lockwire are intact and wire is not broken. Any disturbed seals, or broken wire is cause for replacement of fuel control unit.

3. Inspect.

### 6-1-3 INSTALLATION

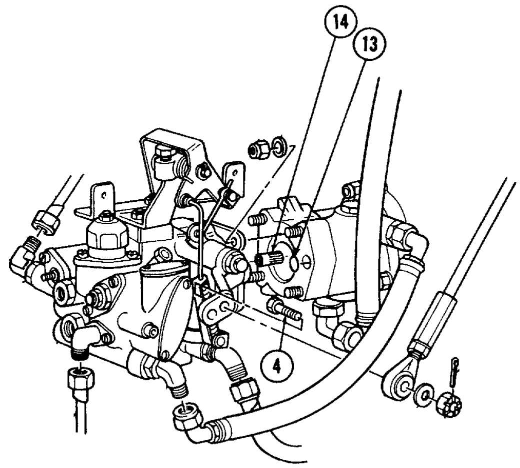
**NOTE**
**Lubricate all new preformed packings with Lubricating Oil (E.2) or (E.71).**

1. If replacement unit is to be installed assemble elbows (16) (refer to TM55-1500-204-25) with new preformed packings (18) and backup rings (17). Install elbow assemblies into unit, tighten locknuts, finger-tight only at this stage.




2. Install new preformed packing (13) on fuel pump mating face.

3. Install new coupling (14) over shaft, counterbore towards fuel control unit. Press coupling to secure on shaft.

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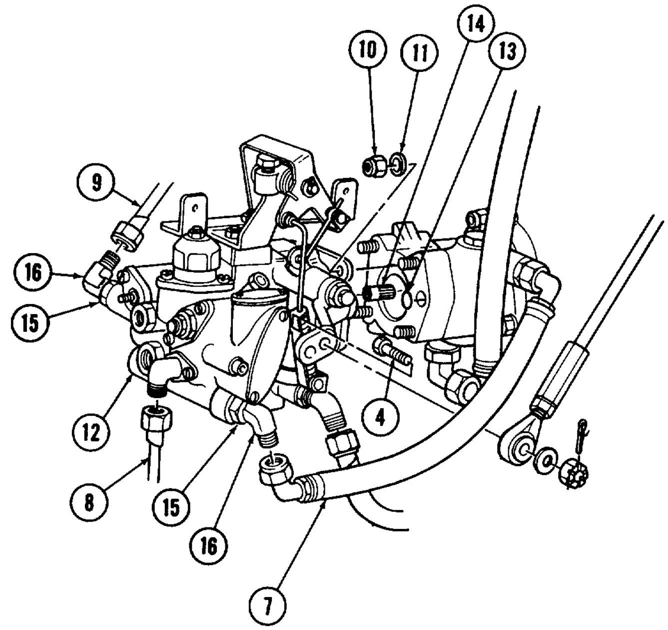
### 6-1-3 INSTALLATION (Cont)

**CAUTION**

**Do not force fuel control unit into engagement. If necessary rotate drive shaft to line up with coupling splines.**




4. Install fuel control unit carefully on fuel pump mounting studs, insure preformed packing (13) is correctly seated and that drive shaft splines mesh correctly with splines in coupling (14).

5. Secure unit (12) to fuel pump studs with four plain washers (11) and nuts (10). Torque nuts to **75 to 85 inch-pounds.**

6. Remove protection caps from orifices and tube ends.

7. Align elbow (16) and connect fuel inlet hose (7) to elbow. Torque locknut (15) to **38 to 42 inch-pounds** and hose (7) connection to **170 to 200 inch-pounds**. Lockwire (E.5) locknut and hose connection.

8. Connect fuel delivery tube (8) to elbow on control unit. Torque to **90 to 100 inch-pounds** and lockwire (E.5).

9. Align elbow (16) and connect air pressure tube (9). Torque locknut (15) to **38 to 42 inch-pounds** and tube (9) connector to **90 to 100 inch-pounds**. Lockwire (E.5) locknut and tube connector.

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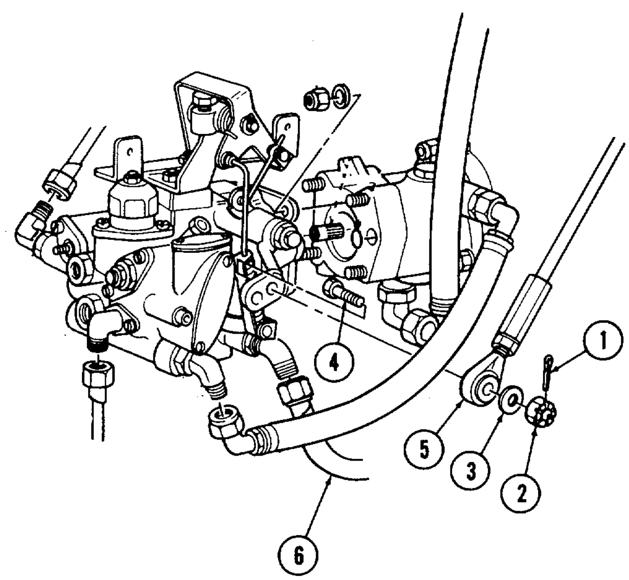
### 6-1-3 INSTALLATION (Cont)

10. Connect air pressure line (6) to 45 degree elbow on fuel control unit. Torque connector to **90 to 100 inch-pounds** and lockwire (E.5).

11. Connect internally threaded control rod (5) to fuel control actuating arm and secure with bolt (4), plain washer (3) and castellated nut (2). Torque nut to **20 to 30 inch-pounds**, aligning locking hole within these limits. Lock with cotterpin (1).




**CAUTION**

**If fuel control assembly has been replaced, preservation oil must be removed.**

### 6-1-4 ADJUSTMENTS

Adjustments shall be performed at Testing only (Chapter 1, Section X).

FOLLOW ON MAINTENANCE:

Test in Accordance with
Chapter 1, Section X

END OF TASK

## Section II FUEL CONTROL LINKAGE

### 6-2 FUEL CONTROL LINKAGE

This task covers:

a. Removal (6-2-1)

b. Inspection (6-2-2)

c. Installation (6-2-3)

d. Adjustment (6-2-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
None

Materials:
None

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

### 6-2-1 REMOVAL

Refer to TM55-1510-209-23 or TM55-1510-215-23.

### 6-2-2 INSPECTION

1. Visually inspect for:

- Broken or missing cotterpins
- Elongated bolt holes in clevis
- Cracked clevis
- Bent or damaged control rods.

2. If any damage is found refer to TM55-1510-209-23 or TM55-1510-215-23.

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### 6-2-3 INSTALLATION

Refer to TM55-1510-209-23 or TM55-1510-215-23.

### 6-2-4 ADJUSTMENT

Refer to TM55-1510-209-23 or TM55-1510-215-23.

FOLLOW ON MAINTENANCE:

None

END OF TASK

## Section III FUEL PUMP

### 6-3 FUEL PUMP

This task covers:

a. Removal (6-3-1)

b. Installation (6-3-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 500 inch-pounds)
Gage (T.15)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)

Parts:
Preformed Packings
Backing Ring
Gasket
Coupling
Protection Caps

Personnel Required:
68B Powerplant Mechanic

References:
TM55-2840-251-23P

Equipment Condition:
Fuel Control Unit Removed
(Task 6-1-1)

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

GO TO NEXT PAGE

## 6-3 FUEL PUMP (Continued)

### 6-3-1 REMOVAL

1. Remove lockwire, disconnect and remove fuel delivery tube (2) from adapter (7). Install protection caps.

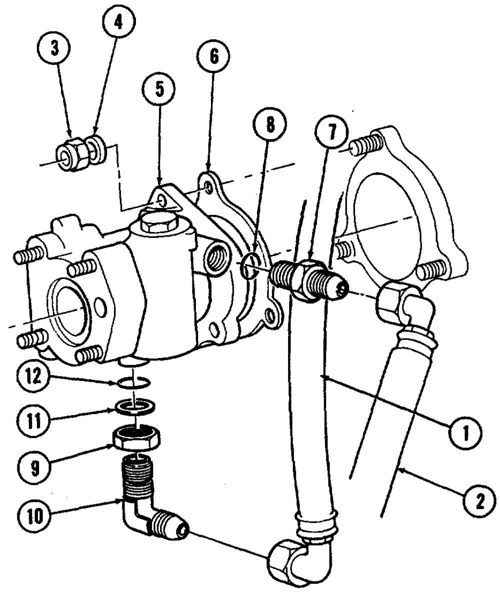
2. Remove lockwire and disconnect fuel inlet tube (1) from elbow (10). Install protection caps.

3. Remove nuts (3) and washers (4).

4. Remove pump (5). Remove and discard gasket (6).

5. If replacement pump is to be installed:

a. Remove lockwire, unscrew and remove adapter (7). Remove and discard preformed packing (8).

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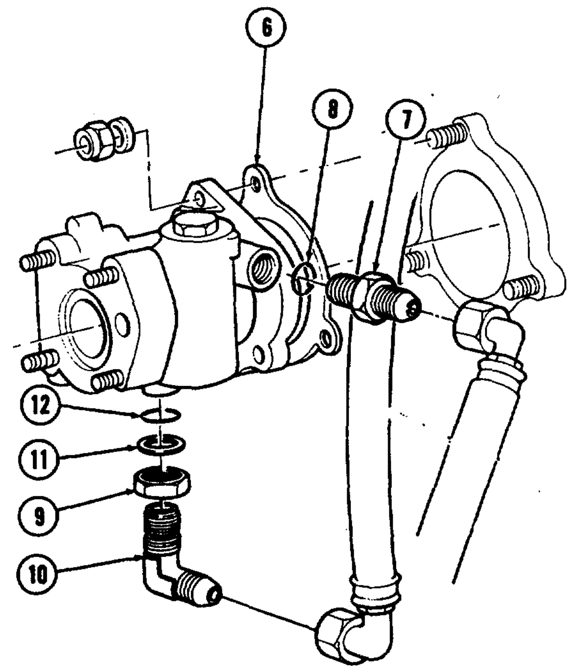
## 6-3 FUEL PUMP (Continued)

### 6-3-1 REMOVAL (Cont)

b. Remove lockwire, back off locknut (9), unscrew and remove elbow (10). Remove and discard preformed packing (12) and backup ring (11). Remove locknut (9).




### 6-3-2 INSTALLATION

**NOTE**
**Lubricate preformed packings with Lubricating Oil (E.2) or (E.71).**

1. If new fuel pump is being installed: a. Install new preformed packing (8) on adapter (7). Install adapter into fuel outlet port. Torque to 110 to 120 inch-pounds. Do not lockwire at this stage.

b. Install locknut (9), new backup ring (11) and preformed packing (12) on elbow (10). Install elbow into fuel inlet port until packing contacts mating face. Hold nut stationary and turn elbow another one and one-half turns. Align elbow in correct position and tighten locknut.

**NOTE**
**Do not torque or lockwire at this stage.**

2. Install new gasket (6) over fuel pump mounting studs.

GO TO NEXT PAGE

**6-3-2 INSTALLATION (Cont)**

**CAUTION**

**It is essential that splines are aligned correctly.**

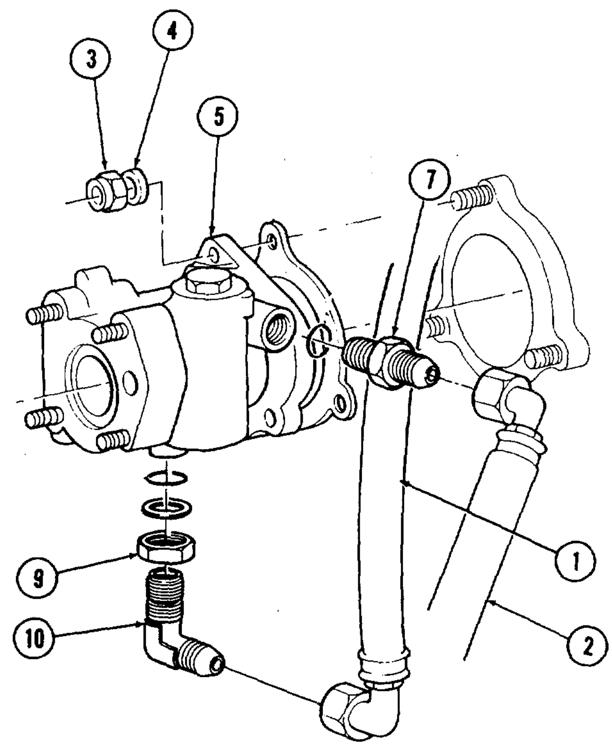
3. Lightly coat pump input splines with Lubricating Oil (E.2) or (E.71). Install pump (5) over studs, align splines with accessory gearbox internal splined gearshaft. Secure pump with washers (4) and nuts (3). Torque nuts to 65 to 85 inch-pounds.

4. Remove protection caps and connect fuel inlet tube (1) to elbow (10). Torque locknut (9) to 200 to 225 inch-pounds and tube connecting nut to 450 to 500 inch-pounds. Lockwire (E.5) locknut and connecting nut.

5. Remove protection caps and connect fuel delivery tube (2) to straight adapter (7). Torque connecting nut to 170 to 200 inch-pounds. Lockwire (E.5) connecting nut to adapter.

**CAUTION**

**If fuel pump has been replaced, preservation oil must be removed (Chapter 1, Section X).**




FOLLOW ON MAINTENANCE:

Installation Fuel Control Unit
(Task 6-1-3)

END OF TASK

## Section IV FUEL PUMP FILTER ELEMENT

### 6-4 FUEL PUMP FILTER ELEMENT

This task covers:

a. Removal (6-4-1)

b. Inspection (6-4-2)

c. Cleaning (6-4-3)

d. Installation (6-4-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 500 inch-pounds)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)
Varsol (E.9)

Parts:
Preformed Packings

Personnel Required:
68B Powerplant Mechanic

References:
TM55-2840-251-23P

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate venti-lation. Wash hands thoroughly after handling.**

**TOXIC AND FLAMMABLE SOLVENTS**

Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame. Use only in a well-ventilated area. Wear rubber gloves. In case of contact, immediately flush skin or eyes with water for at least 15 minutes.
GET IMMEDIATE MEDICAL ATTENTION FOR EYES.

## 6-4 FUEL PUMP FILTER ELEMENT (Continued)

### 6-4-1 REMOVAL

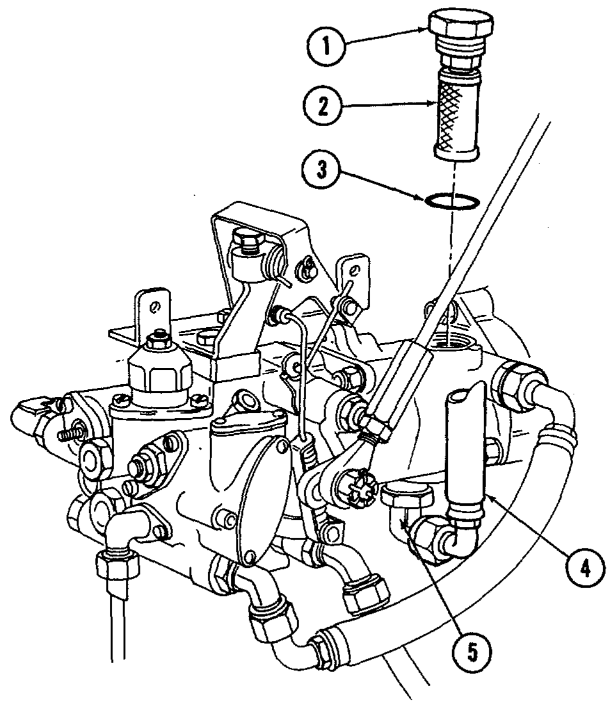
**CAUTION**

**Lift filter vertically to avoid damage to element.**

1. Remove lockwire, unscrew filter cap nut (1) and remove, together with fuel filter element (2).

2. Remove and discard preformed packing (3).

3. If fuel pump is installed on engine, remove lockwire and disconnect fuel inlet hose (4) from pump inlet elbow (5), to drain residual fuel. Cap orifices.




### 6-4-2 INSPECTION

1. Inspect element for cracks, punctures and general condition.

2. Any damage is cause for rejection.

GO TO NEXT PAGE

## 6-4 FUEL PUMP FILTER ELEMENT (Continued)

6-4-3 CLEANING

1. Agitate element in Varsol (E.9).

**WARNING**

**When using compressed air for cleaning, use approved protective equipment for eyes and face. Do not use more than 30 psig air pressure. Do not direct air toward yourself or another person. Failure to comply could result in injury to eyes or skin. In case of injury, get medical attention.**

2. Dry by blowing compressed air at 15 psig through element from outside.

**NOTE**

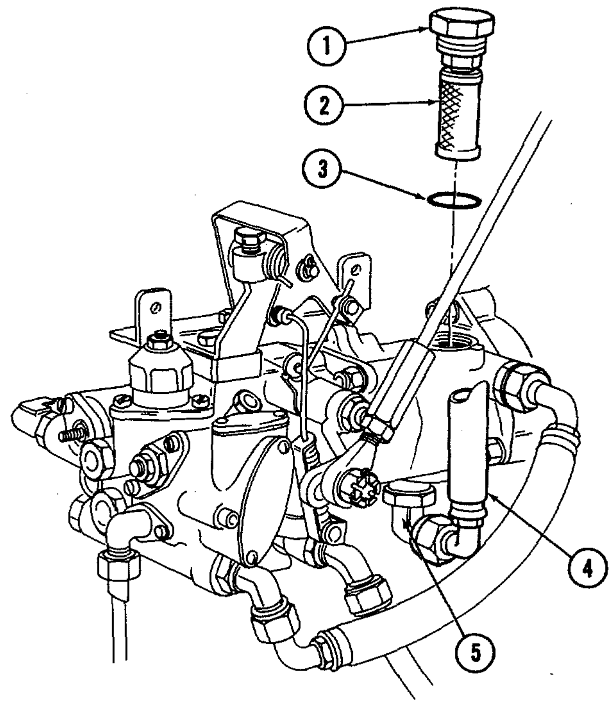
**All compressed air used for cleaning must be clean, filtered, dehydrated air.**

**GO TO NEXT PAGE**

## 6-4 FUEL PUMP FILTER ELEMENT (Continued)

6-4-4 INSTALLATION

1. Lubricate new preformed packing (3) with Lubricating Oil (E.2) or (E.71) and install in element capnut recess.




**CAUTION**

**Extreme care must be observed to avoid damage to element at installation.**

2. Remove protective cap and install filter element (2) into fuel pump housing. Torque capnut (1) to **75 to 100 inch-pounds** and lockwire (E.5).

3. Remove protective cap from fuel inlet hose (4) and connect to elbow (5). Torque connection to **450 to 500 inch-pounds** and lockwire (E.5) to elbow locknut.

FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section V FUEL MANIFOLD ASSEMBLY

### 6-5 FUEL MANIFOLD ASSEMBLY

This task covers:

a. Removal (6-5-1) b. Installation (6-5-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)

Materials:
Lockwire (E.5)
Petrolatum (E.20)
Colorbrite Pencil (E.31)

Parts:
Preformed Packings
Gaskets

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Ignition Cables Removed (Task 7-4-1)

GO TO NEXT PAGE

## 6-5 FUEL MANIFOLD ASSEMBLY (Continued)

6-5-1 REMOVAL

**NOTE**

**The fuel dump valve must be removed with the inlet adapter.**

1. Disconnect harnesses from glow plugs to give easier access (Task 7-4-1).

2. Index mark each manifold adapter with its position in gas generator case as shown, with Colorbrite Pencil (E.31).

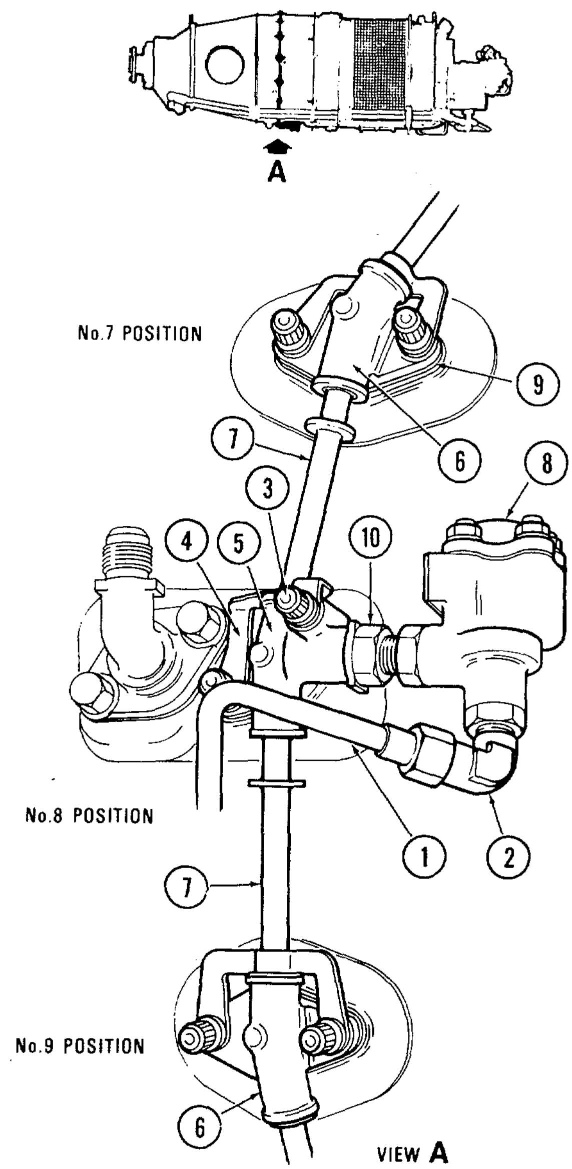
3. Remove lockwire and disconnect fuel delivery tube (1) at dump valve elbow (2).

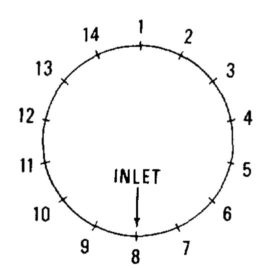
4. Remove attachment bolts (3) and lockplates (4) from inlet adapter (5), located at 6 o'clock position on gas generator case and from the two adjacent manifold adapters (6).

5. Remove fuel manifold transfer tubes (7).

6. Remove fuel dump valve (8) and inlet adapter (5) as an assembly. Remove and discard gasket (9).

7. Remove lockwire, back off locknut (10) and unscrew and remove dump valve from inlet adapter.




ADAPTER POSITIONS LOOKING TOWARDS ACCESSORY GEARBOX

**GO TO NEXT PAGE**

## 6-5 FUEL MANIFOLD ASSEMBLY (Continued)

6-5-1 REMOVAL (Cont)

**CAUTION**

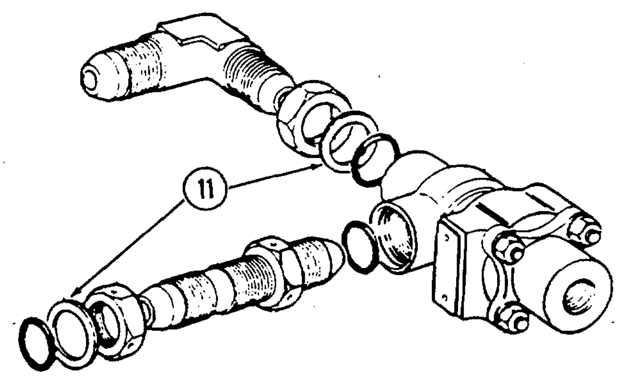
**Unless glow plugs remain installed, do not attempt to remove all fuel manifold adapter assemblies at any one time, since seven of the assemblies serve to locate the combustion chamber liner and alignment problems may be encountered at reassembly.**

8. Remove bolts and lockplates from remaining manifold adapters and withdraw transfer tubes and adapters. Remove and discard gaskets between adapters and gas generator case.

**NOTES**

1. **If manifold assemblies are to be shipped to an overhaul facility, or stored, they must be individually wrapped and securely packaged in a manner to prevent their relative movement and possible damage to orifice faces.**
2. **If manifold assemblies are not to be reinstalled in engine immediately, they should be placed in a clean, covered container to prevent exposure to dirt and dust.**

9. Remove and discard preformed packing retainer (11).

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## 6-5 FUEL MANIFOLD ASSEMBLY (Continued)

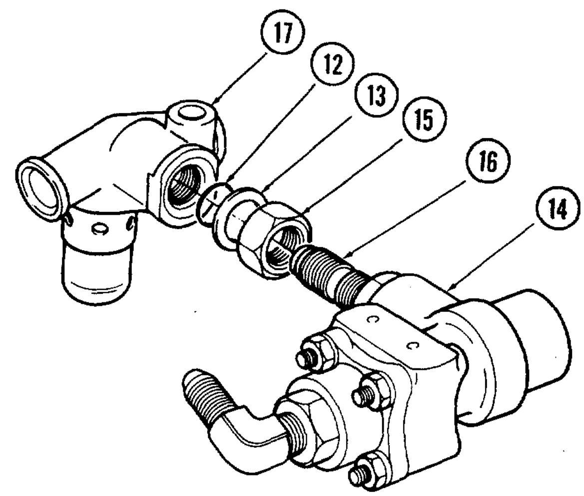
6-5-2 INSTALLATION

**CAUTION**

**Extreme care must be exercised when handling fuel nozzles and sheaths. Wear clean, lint-free, disposable gloves while handling components; fingerprints left on orifice may produce a poor spray pattern.**

1. Lubricate new preformed packing (12), packing retainer (13) and external thread of coupling (14) with Petrolatum (E.20). Assemble locknut (15), packing retainer (13) and preformed packing (12) onto coupling. Work retainer (13) into counterbore of locknut (15). Turn nut until packing is pushed against outer thread of coupling.

2. Screw coupling (16) and dump valve assembly (14) into boss of fuel inlet adapter (17), keep locknut (15) turning with coupling (16) until packing (12) contacts adapter boss, easily felt by in- creased resistance to turning. Hold locknut stationary and screw in dump valve assembly (14) one and one-half turns. Position dump valve (14) to correct angle of 6 degrees down from horizontal centerline by screwing in no more than one more complete turn.




3. Hold coupling and inlet adapter stationary, tighten lock- nut (15) until metal to metal con- tact is made with adapter boss. Torque locknut to 38 to 42 inch-pounds.

4. Lockwire (E.5) locknut to coupling.

**GO TO NEXT PAGE**

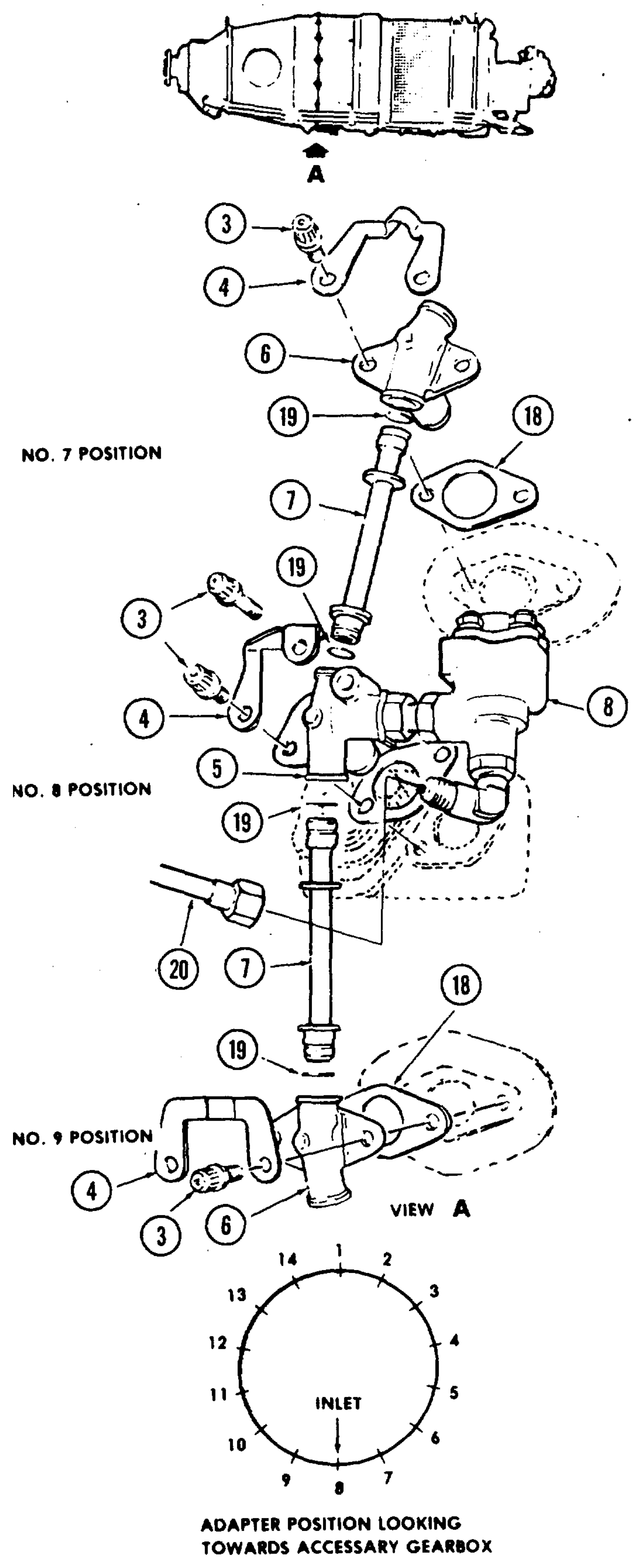
## 6-5 FUEL MANIFOLD ASSEMBLY (Contin ued)

6-5-2 INSTALLATION (Cont)

5. Install assembly of fuel inlet adapter (5) and dump valve (8), with new gasket (18), on gas generator case boss at 6 o'clock position. Loosely secure with two bolts (3).

6. Lubricate 28 new preformed packings (19) with Petrolatum (E.20) and install one on each end of the 14 fuel transfer tubes (7).

7. Install transfer tube (7) in each inlet adapter (5) orifice, as shown. Install previously index-marked adapters (Task 6-5-1), complete with new gaskets, at No. 7 and 9 positions, over the free end of installed transfer tubes. Align adapters with relevant gas generator case bosses and continue installing transfer tubes (7) and manifold adapters (6), complete with new gaskets, in the sequence 6,5,4,3,2,10,11,12,13,14.

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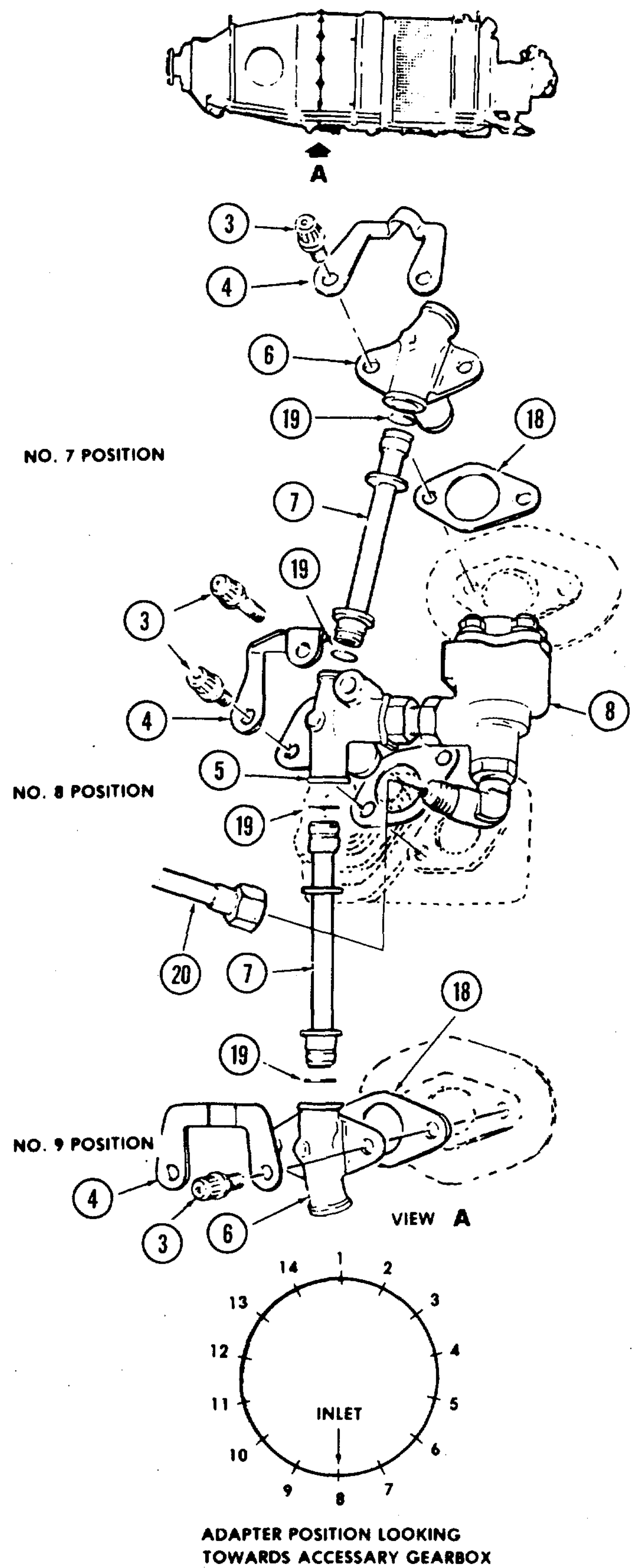
## 6-5 FUEL MANIFOLD ASSEMBLY (Continued)

6-5-2 INSTALLATION (Cont)

8. Install No. 1 manifold adapter in boss on gas generator case. Align transfer tubes (7) already installed in adapters at No. 2 and 14 positions and push into No. 1 adapter.

**NOTE**

**If difficulty is experienced in aligning transfer tubes, lift adapters at No. 2 and 14 locations, approximately one half inch away from gas generator case or until transfer tubes enter No. 1 adapter.**

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## 6-5 FUEL MANIFOLD ASSEMBLY (Continued)

6-5-2 INSTALLATION (Cont)

9. Remove temporary bolts (3) from inlet manifold adapter (5).

10. Secure each manifold adapter with locking plate (4) and two bolts (3). Torque bolts (3) to 32 to 36 inch-pounds. Do not lockwire at this stage.

**NOTE**

**Bolts must be retorqued after engine test and secured with lockwire (Chapter 1, Section X).**

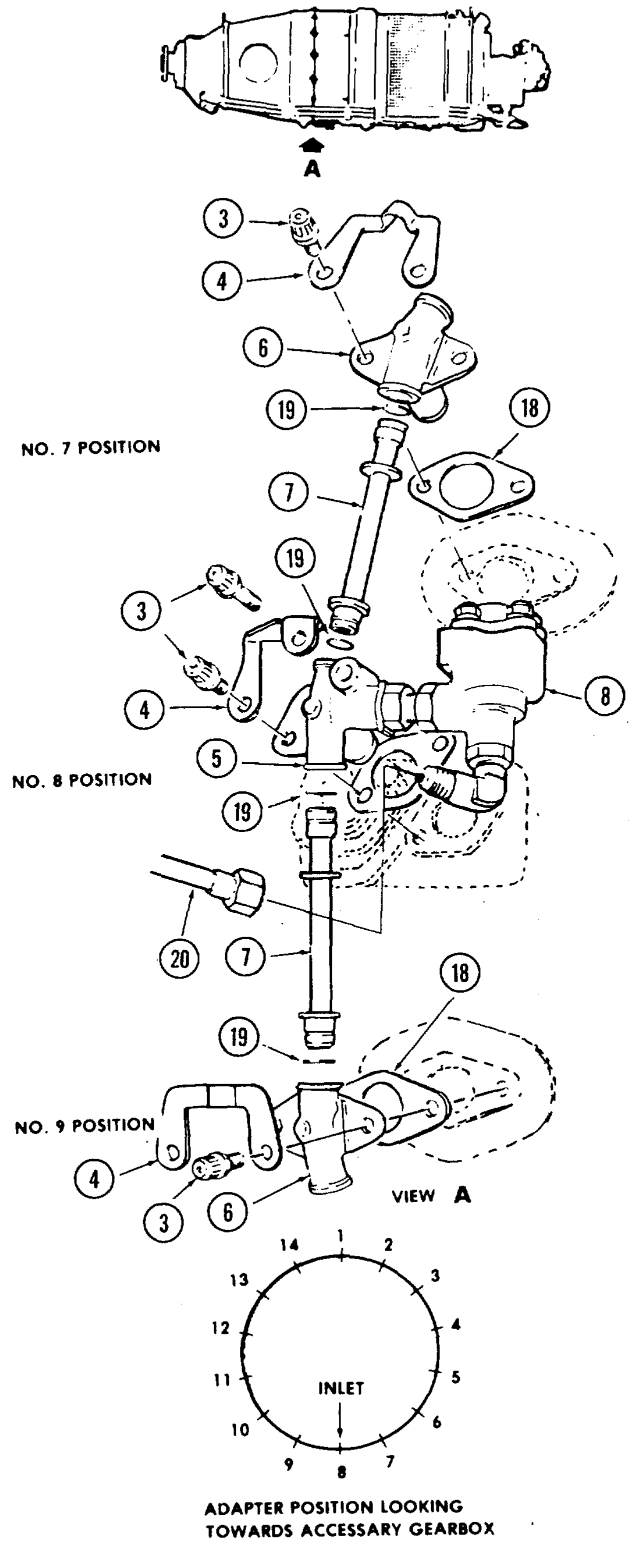
11. Connect fuel delivery tube (20) to dump valve elbow. Torque connection to **90** to **100 inch-pounds**, check torque locknut on dump valve elbow to **38 to 42 inch-pounds** and lockwire (E.5) together.

12. Connect ignition harness to glow plug (Task 7-4-4).

13. **Inspect**.

FOLLOW ON MAINTENANCE:

None




**END OF TASK**

## Section VI FUEL ADAPTER AND NOZZLE ASSEMBLY

### 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM)

This task covers:

a. Disassembly (6-6-1)
b. Cleaning (6-6-2)
c. Inspection (6-6-3)
d. Assembly (6-6-4)
e. Testing (6-6-5)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Fixture (T.11)
Fixture (T.12)
Plug (T.18)
Puller (T.32)
Test Rig (T.37)

Materials:
Engine Fuel (E.19)
Calibrating Fluid (E.45)
Turco Super Carb (E.63)
Soft Brush
Lint-free Disposable Gloves

Parts:
Keywasher

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Fuel Manifold Assembly Removed (Task 6-5-1)

GO TO NEXT PAGE

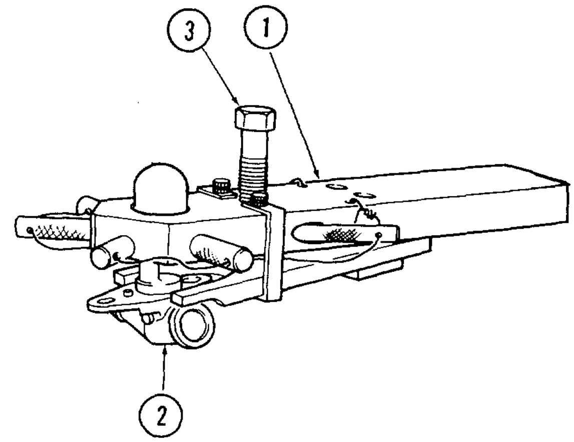
## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-1 DISASSEMBLY

**CAUTION**

**Extreme care must be exercised when handling fuel nozzles and sheaths. Wear clean, lint-free, disposable gloves while handling components; fingerprints left on orifice may produce a poor spray pattern.**

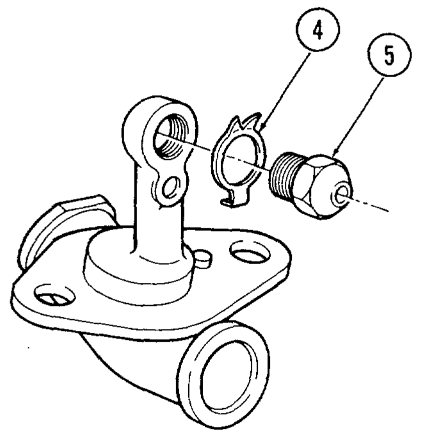
1. Install Puller (T.32) (1) on adapter assembly (2), align holes in sheath. Using a conventional wrench, screw in bolt (3) and remove adapter from sheath. Remove sheath from puller.




**NOTE**

**Remove fuel nozzle only if functional check (Task 6-6-5) indicates that replacement is necessary.**

2. Unlock keywasher (4) and using a conventional wrench, remove nozzle (5). Discard keywasher.

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## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-2 CLEANING

**CAUTION**

**Extreme care must be exercised when handling fuel nozzles and sheaths. Wear clean, lint-free, disposable gloves while handling components; fingerprints left on orifice may produce a poor spray pattern.**

**WARNING**

**When using compressed air for cleaning, use approved protective equipment for eyes face. Do not use more than 30 psig air pressure. Do not direct air toward yourself or another person. Failure to comply could results in injury to eyes or skin. In case of injury, get medical attention.**

1. Clean carbon buildup from each fuel nozzle sheath with cold Turco Super Carb (E.63). Use a soft brush. Dry using filtered, compressed air.

**CAUTION**

**Do not brush nozzles without air pressure, as small carbon particles might enter and block orifices.**

**GO TO NEXT PAGE**

## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-2 CLEANING (Cont)

2. Clean nozzles that exhibit signs of.carbon buildup by directing clean, dry compressed air into fuel inlet and brushing lightly with a soft-bristled brush.

6-6-3 INSPECTION

Inspect sheaths for fretting wear. Up to 0.010 inch fretting is permitted. Replace sheaths if over limit.

GO TO NEXT PAGE

## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-4 ASSEMBLY

**CAUTION**

**Extreme care must be exercised when handling fuel nozzles and sheaths. Wear clean, lint-free, disposable gloves while handling components; fingerprints left on orifice may produce a poor spray pattern.**

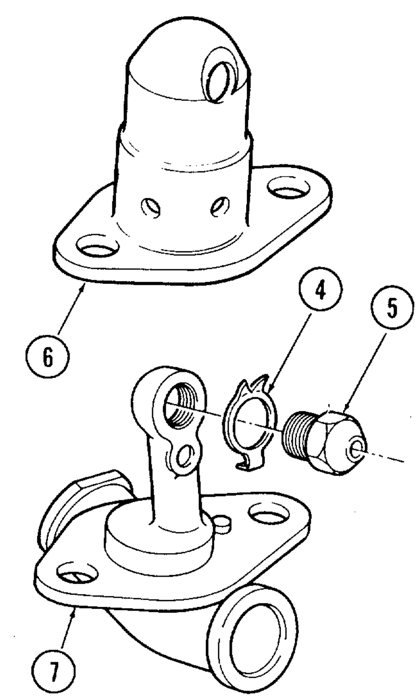
1. If fuel nozzle has been replaced, lubricate thread of adapter (2), nozzle assembly (5) and new keywasher (4) with Calibrating Fluid (E.45). Install keywasher on fuel nozzle and screw nozzle into adapter. Torque nozzle to **45 to 50 inch-pounds**. Do not lock keywasher at this stage.

2. Perform fuel nozzle leakage test (Task 6-6-5).

3. Perform functional check (Task 6-6-5).

4. If tests prove satisfactory, lock keywasher (4). If unsatisfactory, replace nozzle (5) then repeat steps 2 and 3.

5. Install sheath (6) on manifold adapter (7), insuring mating hole in sheath flange engages with locating pin on adapter.




**NOTE**

**Insure that sheath for the No. 8 inlet fuel nozzle adapter is not used in any other position. The locating hole is peculiar to No. 8 fuel nozzle adapter.**

GO TO NEXT PAGE

## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-5 TESTING

**CAUTION**

**Extreme care must be exercised when handling fuel nozzles and sheaths. Wear clean, lint-free, disposable gloves while handling components; fingerprints left on orifice may produce a poor spray pattern.**

1. Leakage test.

**NOTE**

**This test is accomplished with sheath removed.**

a. Install plug (8) in adapter assembly (9) and mount assembly on post at base of Fixture (T.11)(10).

**NOTE**

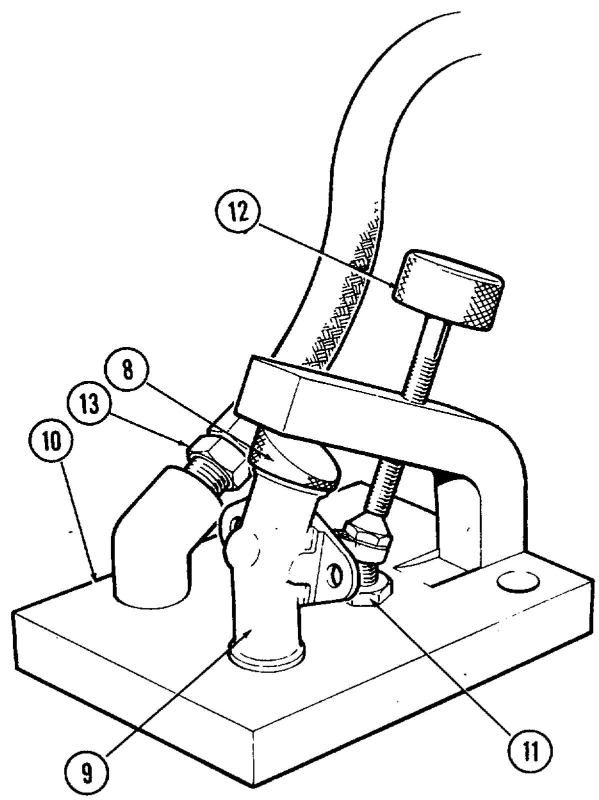
**For inlet manifold adapter assembly leak test, blank off fuel inlet with Plug (T.18).**

b. Swing adapter round until fuel nozzle aligns with set screw (11) and torque screw (12).

**NOTE**

**Insure sloped head of plug is tight against fixture arm.**

c. Tighten torque screw (12) fingertight.

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## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-5 TESTING (Cont)

1. Leakage test. (Cont)

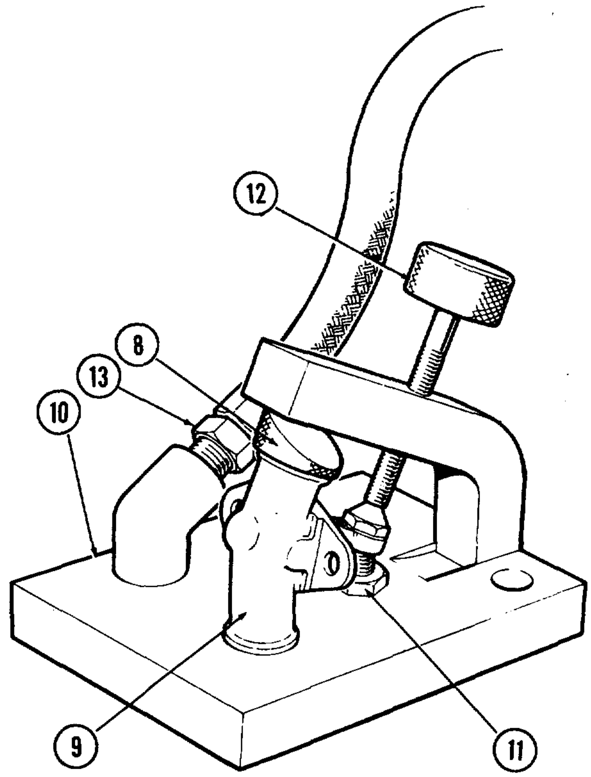
d. Connect supply of Calibrating Fluid (E.45) to fixture inlet fitting (13). Torque connection to **90 to 100 inch-pounds**.

e. Pressure test adapter assembly at **500 psig** at a room temperature of **68°F (20°C).**

f. No leakage is permitted at nozzle.

g. **Inspect**.

h. After satisfactory test, remove adapter assembly from fixture.

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## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-5 TESTING (Cont)

2. Functional check.

**CAUTION**

**To eliminate danger of electrostatic discharge, cable must be grounded.**

**NOTE**

**This test is accomplished with sheath removed.**

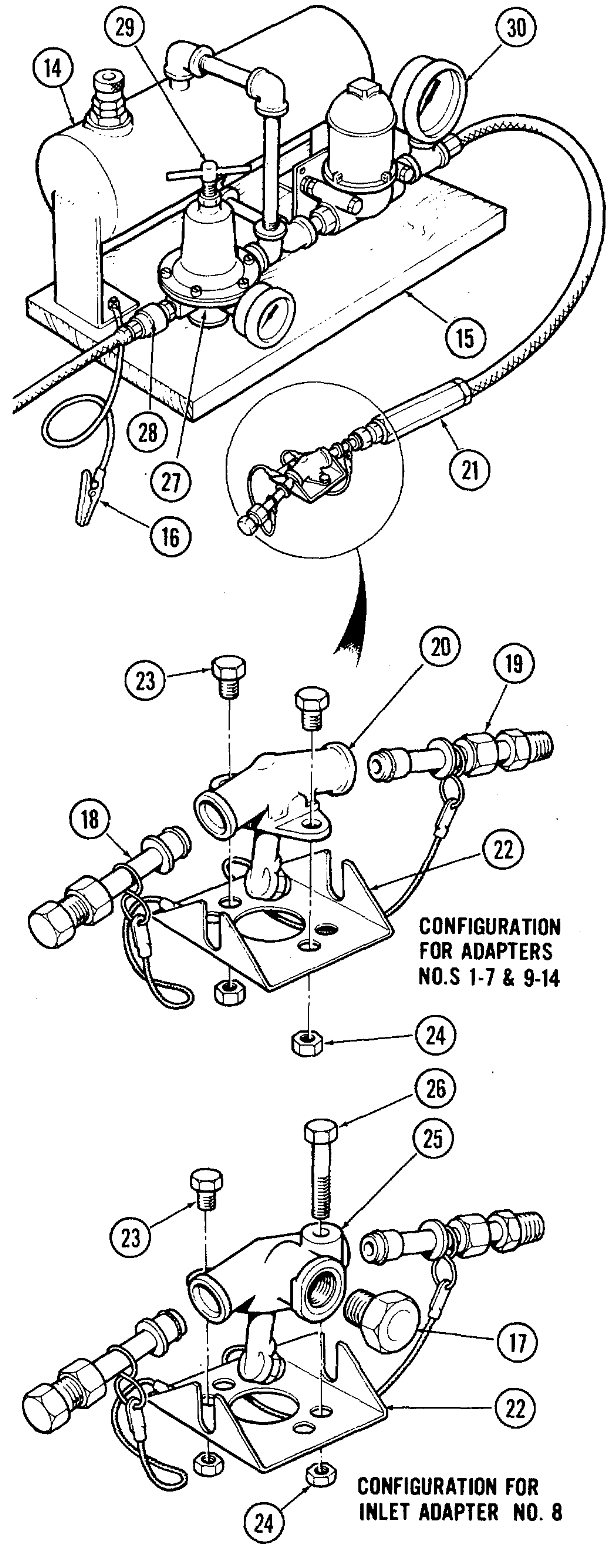
a. Partially fill container (14) of Test Rig (T.37) (15) with clean Engine Fuel (E.19). Ground test rig with cable (16).

b. On inlet manifold assembly only, install Plug (T.18) (17) in fuel inlet port.

c. Carefully insert blanking tube (18) and connecting tube (19), (parts of Fixture (T.12)), in fuel manifold adapter (20) and connect hose assembly (21) to connecting tube (19). Tighten coupling nut securely.

d. Locate fuel manifold adapter on Fixture (T.12) (22), secure with two bolts (23) and nuts (24). On inlet manifold adapter (25), bolt (26) is required in lieu of one bolt (23).

e. Position suitable drip tray below fixture.

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## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-5 TESTING (Cont)

2. Functional check. (Cont)

f. Connect **100 psig** filtered air at regulator (27). Tighten connection (28) securely.

g. Operate pressure regulating valve (29) gradually until pressure gage (30) indicates **12.5 psig**.

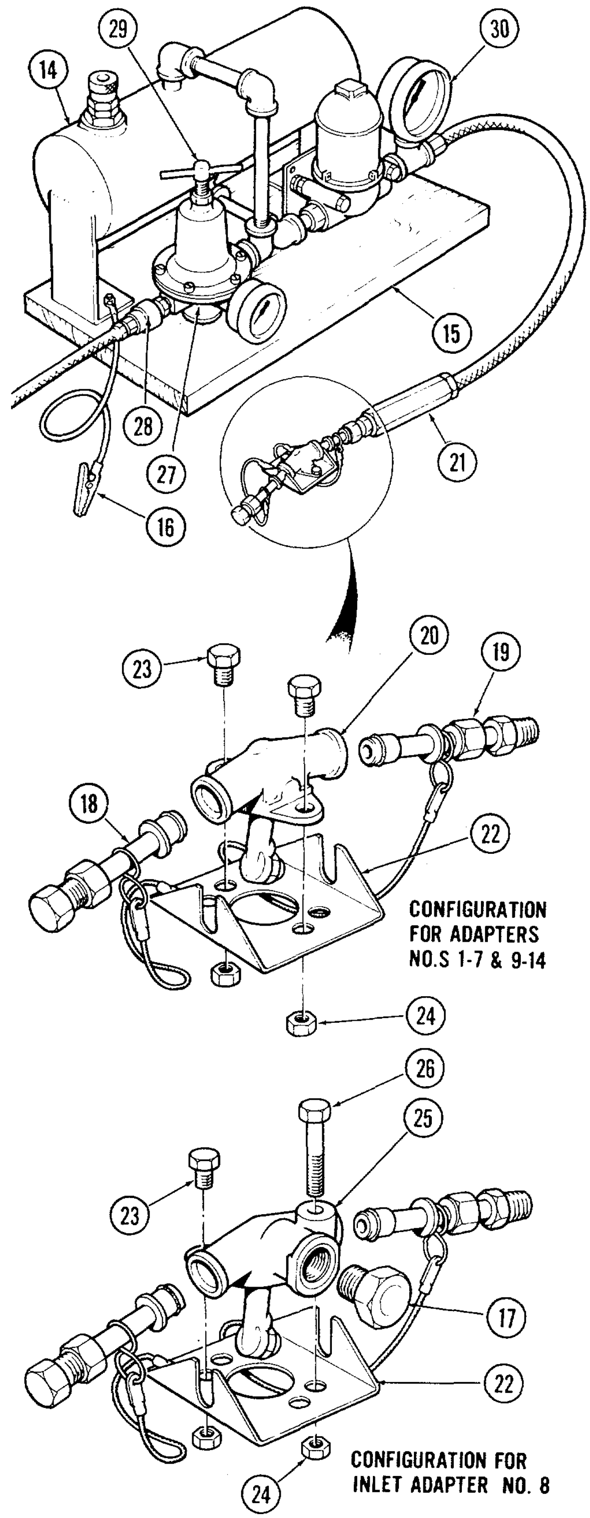
h. A full conical spray, free of spitting or drooling, should appear at, or below **12.5 psig**. An 'onion' formation may or may not appear. **Inspect**.

i. Adjust pressure regulating valve (29) to increase the fuel pressure to **60 psig**. The volume of spray should increase and be evenly spread about the center axis of the fuel nozzle orifice. **Inspect**.

j. Spitting or drooling at **12.5 psig** or more than **20 percent** streakiness at **60 psig** is reason for rejection.

**NOTE**

**Streakiness is defined as variations of spray quantity in different parts of the spray cone, showing up as darker streaks in the spray.**

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## 6-6 FUEL ADAPTER AND NOZZLE ASSEMBLY (AVIM) (Continued)

6-6-5 TESTING (Cont)

2. Functional check. (Cont)

k. Remove external carbon deposits on the fuel nozzle by lightly brushing orifice face with a brush having either bronze or non-metallic bristles.

**NOTE**

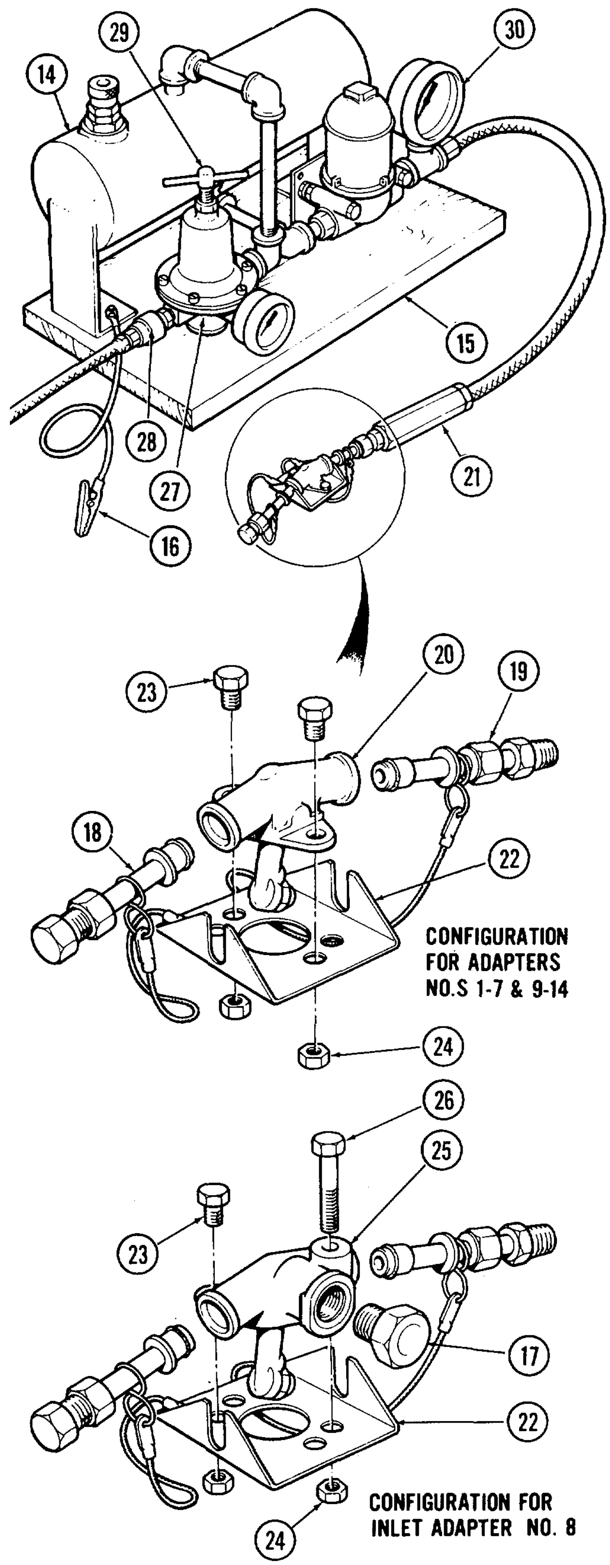
**Fuel must be flowing through nozzle while brushing.**

l. Close pressure regulating valve (30). Allow pressure gage to decrease to zero.

m. Uncouple hose assembly (21) from connecting tube (19).

n. Remove manifold adapter (20) or (25) from fixture (22) and withdraw blanking tube (18) and connecting tube (19).

o. On inlet manifold adapter (25) only, remove blanking plug (17).




FOLLOW ON MAINTENANCE:

Installation Fuel Manifold Assembly (Task, 6-5-2)

**END OF TASK**

## Section VII FUEL NOZZLES

### 6-7 FUEL NOZZLES (AVIM)

This task covers:

a. Cleaning (6-7-1) b. Inspection (6-7-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Test Rig (T.37)
Suitable Ultrasonic Cleaner
Flushing Fixture (Local Manufacture - Refer to Appendix D)
Stainless Steel Container

Materials:
Magnus 611 (E.50)

Personnel Required:
68B Powerplant Mechanic

Equipment Condition:
Fuel Adapter and Nozzle Assembly Disassembled (Task 6-6-1)

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## 6-7 FUEL NOZZLES (AVIM) (Continued)

6-7-1 CLEANING

1. Place as many nozzles as possible into stainless steel container.

2. Boil approximately **two pints** of carbon removing compound, Magnus 611 (E.50) and pour into stainless steel container.

**NOTE**

**Subsequent operation of ultrasonic cleaner will maintain temperature at 140°F (60°C).**

3. Insure nozzles are completely covered in container and place container in ultrasonic cleaner tank.

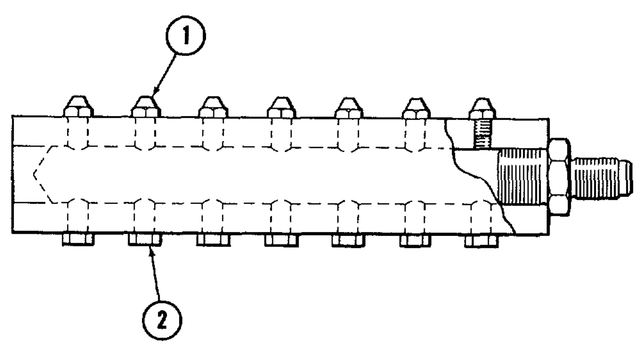
4. Cover cleaner tank and activate cleaner for **one hour**.

5. Remove container from cleaner tank and wash nozzles thoroughly in **very hot water**.

**CAUTION**

**Flushing must be accomplished immediately following conclusion of cleaning process to avoid damage to nozzles by residual carbon remover solution.**

6. Install nozzles (1) on Flushing Fixture (refer to Appendix D). Use suitable blanking plugs (2), if all positions are not filled.

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## 6-7 FUEL NOZZLES (AVIM) (Continued)

6-7-1 CLEANING (Cont)

7. Connect hot tapwater hose to fixture and flush very **hot water** at tap pressure for at least **one minute**.

8. Disconnect water supply.

9. Connect fixture to supply of clean, filtered compressed air. Insure nozzles are thoroughly dry.

10. With nozzles still installed in fixture, connect fixture to Test Rig (T.37) and flow fuel through nozzles for **one minute at 30 psig.**

11. Remove fixture from test rig and nozzles from fixture.

**NOTE**

**If nozzles are not required for immediate installation, store in covered container to prevent exposure to dirt.**

6-7-2 INSPECTION

Inspect components for signs of obvious damage. No damage permitted.

FOLLOW ON MAINTENANCE:

Installation Fuel Nozzles into Adapters (Task 6-6-4)

**END OF TASK**

## Section VIII COMBUSTOR DRAIN VALVE

### 6-8 COMBUSTOR DRAIN VALVE

This task covers:

a. Removal (6-8-1) c. Inspection (6-8-3)

b. Cleaning (6-8-2) d. Installation (6-8-4)

---

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
No. 58 Drill (0.042 inch)
Gage Rod (0.530 inch dia.)
Gage Tube (0.600 inch dia.)
Torque Wrench (O to 100 inch-pounds)

Materials:
Lockwire (E.4)
Varsol (E.9)

Parts:
Gaskets

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

General Safety Instructions:

**WARNING**

**TOXIC AND FLAMMABLE SOLVENTS**

**Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame.**

**Use only in a well-ventilated area. Wear rubber gloves. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

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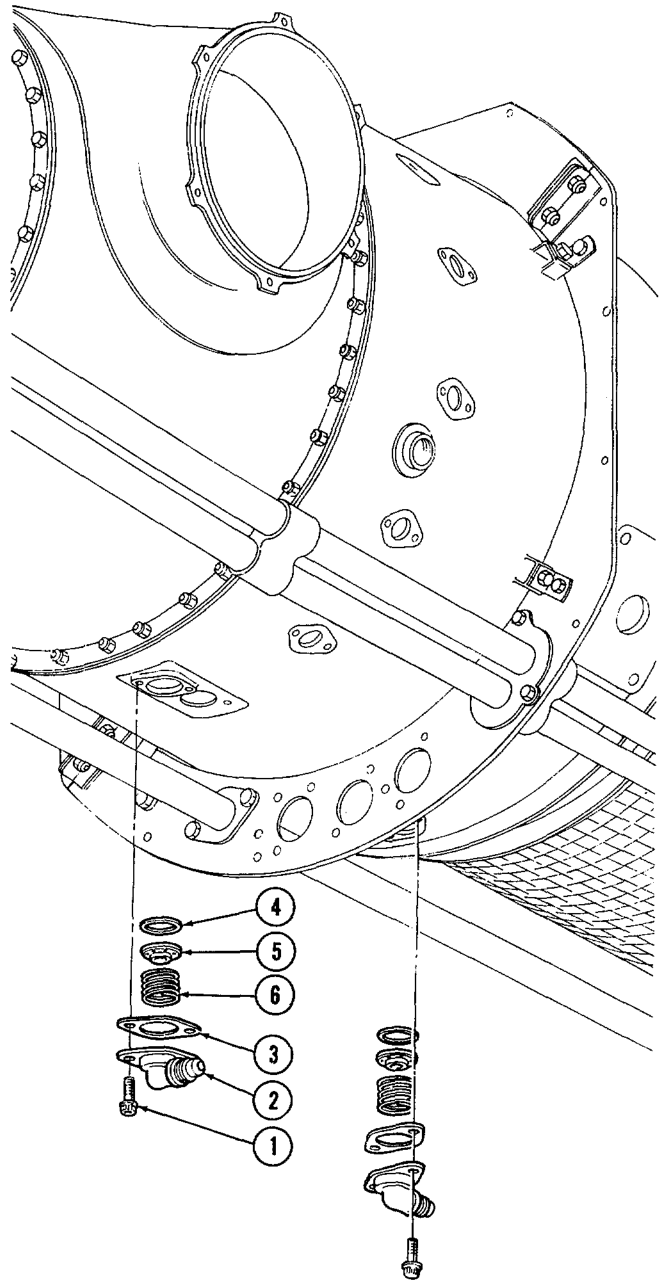
## 6-8 COMBUSTOR DRAIN VALVE (Continued)

6-8-1 REMOVAL

1. Remove lockwire and bolts (1)

2. Remove drain valve assembly and gasket (3). Discard gasket.

3. Remove retaining ring (4), valve (5) and spring (6) from drain valve body (2).




6-8-2 CLEANING

1. Clean drain valve body, spring and valve using Varsol (E.9).

**WARNING**

**When using compressed air for cleaning, use approved protective equipment for eyes and face. Do not use more than <u>30 psig</u> air pressure. Do not direct air toward yourself or another person. Failure to comply could result in injury to eyes or skin. In case of injury, get medical attention.**

2. Dry using clean, filtered, dehydrated compressed air.

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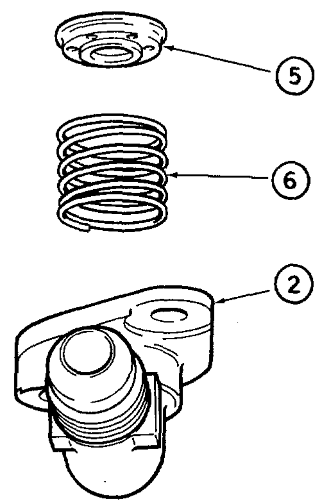
## 6-8 COMBUSTOR DRAIN VALVE (Continued)

6-8-3 INSPECTION




1. Inspect surface of valve (5) for nicks, gouges, scores, scratches and burrs. Particular attention must be given to sealing surface around counterbore in spring side of valve.

2. Check for blockage of six holes in valve. Holes which are blocked, may be cleared by passing a No. 58 drill (0.042 inch) through by hand.

3. Check for blockage in valve body (2). Clear any blockage with clean, filtered, dehydrated compressed air.

4. Check large bore of valve body for surface defects, especially on sealing surface of projection.

5. Check spring (6) for distortion. Spring must pass freely over a **0.530 inch dia gage rod** and through a **0.600 inch gage tube**. Reject spring if distorted.

6. Check compression loading of spring. Load required to compress spring to **0.250 inch** length should be **4 oz. to 8 oz.** Reject spring if not within limits.

7. Examine spring for uniformity of coil spacing and insure that surfaces are free from pits, scratches, nicks and other defects, which may be detrimental to the fatigue resistance of the spring.

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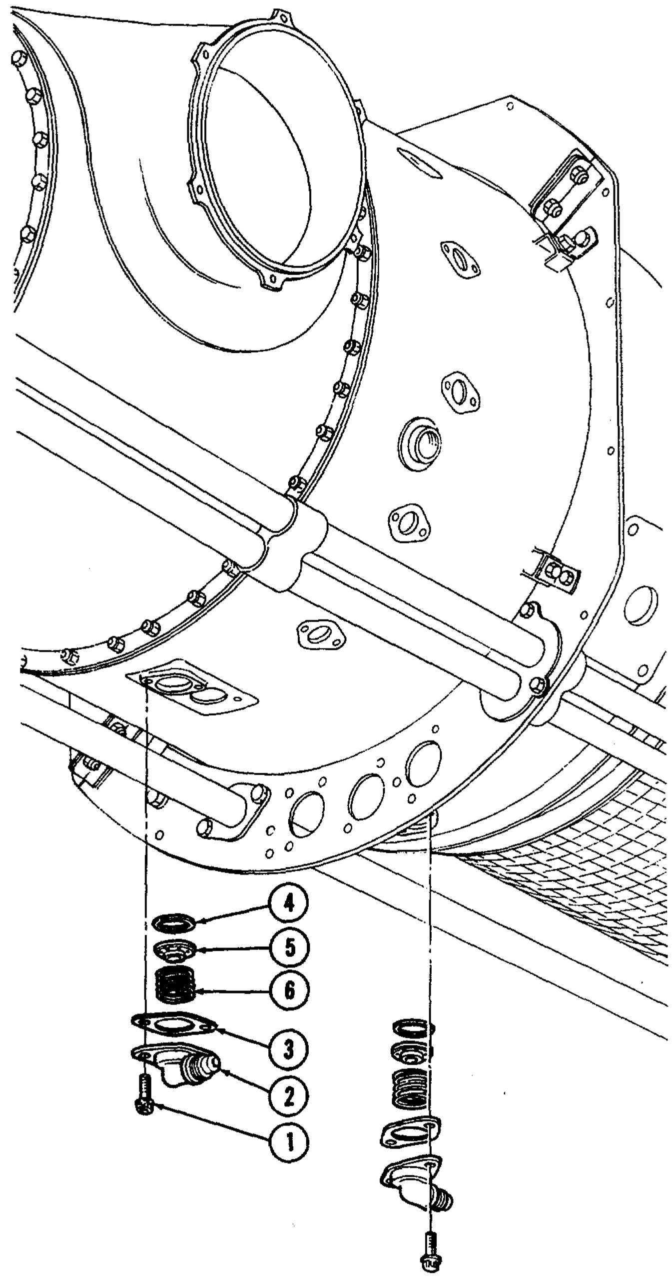
## 6-8 COMBUSTOR DRAIN VALVE (Continued)

6-8-4 INSTALLATION

1. Install spring (6) and valve (5) into valve body (2). Secure with retaining ring (4). Check valve movement in body.

2. Install new gasket (3) on valve body and locate in gas generator case boss.

3. Secure with two bolts (1). Torque bolts to **32 to 36 inch-pounds** and lockwire (E.4).




FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section IX TEMPERATURE COMPENSATOR

### 6-9 TEMPERATURE COMPENSATOR

This task covers:

a. Removal (6-9-1)
b. Inspection (6-9-2)
c. Installation (6-9-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)

Materials:
Lockwire (E.5)

Parts:
Preformed Packings

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

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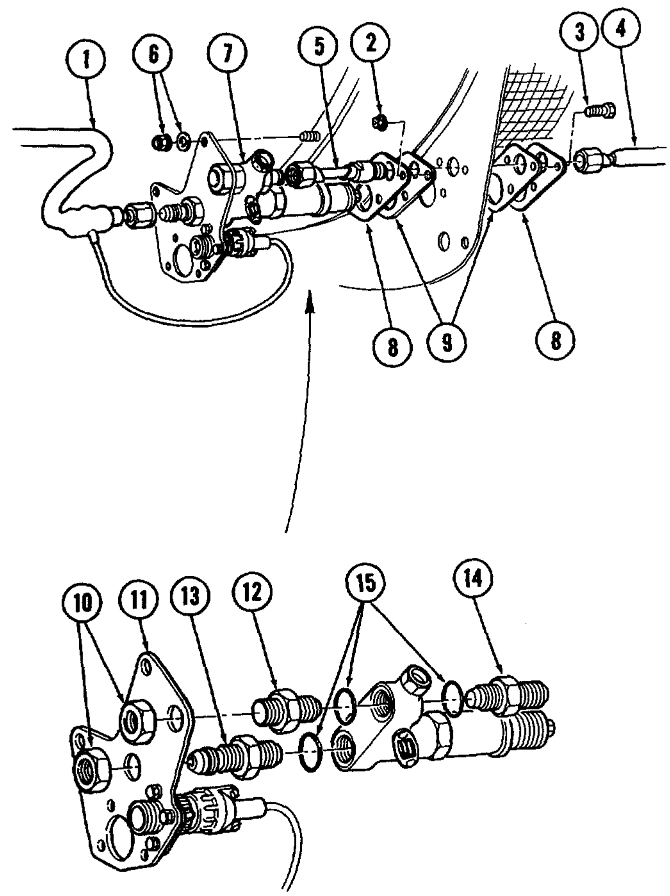
## 6-9 TEMPERATURE COMPENSATOR (Continued)

6-9-1 REMOVAL




1. Remove tube assembly (1) coupling from coupling (13).

**NOTE**

**It is not necessary to disconnect electrical harness or to remove electrical connector from compensator bracket.**

2. Remove lockwire and disconnect air pressure tube (4) from tube assembly (5).

3. Loosen four nuts (2) and bolts (3) securing rear fireseal seals (9) and retaining plates (8).

4. Remove two nuts and washers (6) securing compensator bracket to flange G.

## 6-9 TEMPERATURE COMPENSATOR (Continued)

6-9-1 REMOVAL (Cont)

**CAUTION**

**Take special care to avoid damaging bimetallic disk assembly when passing through rear fireseal mount ring.**

5. Remove compensator bracket (11), complete with compensator (7) and tube assembly (5).

6. If temperature compensator is to be replaced:

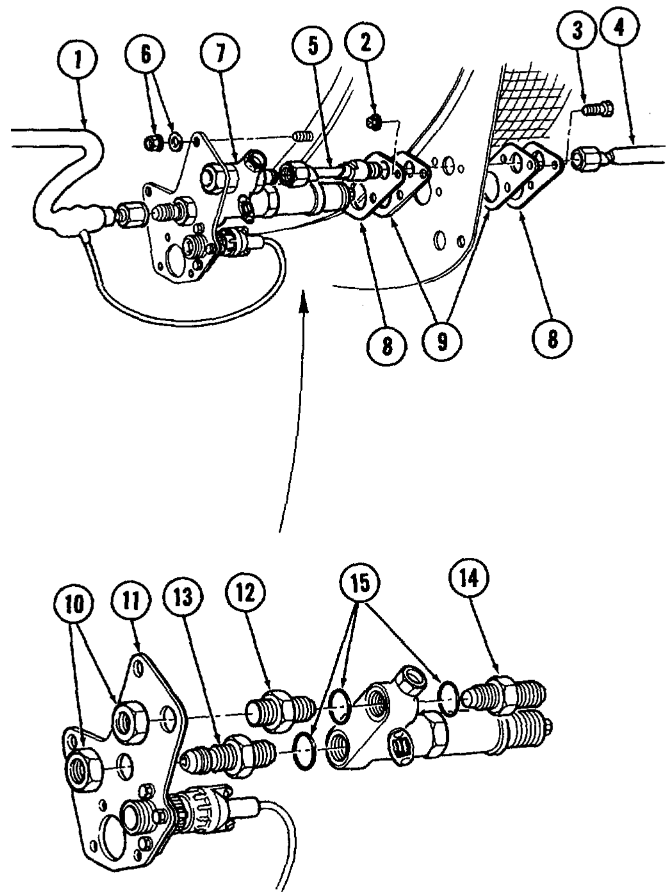
a. Disconnect tube assembly (5) coupling from straight nipple (14). Remove tube assembly (5).

b. Remove two nuts (10) and compensator bracket (11), complete with electrical harness.

**NOTE**

**To avoid damage to harness, temporarily secure compensator bracket to engine.**

c. Remove tube coupling (13), plug (12) and straight nipple (14). Discard preformed packings (15).

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## 6-9 TEMPERATURE COMPENSATOR (Continued)

6-9-2 INSPECTION

1. Inspect all threads for damage. Replace damaged components.

2. Inspect compensator for external damage. No damage allowed.

6-9-3 INSTALLATION

1. If replacement temperature compensator is being installed:

a. Install new preformed packings (15) on straight nipple (14), tube coupling (13) and plug (12).

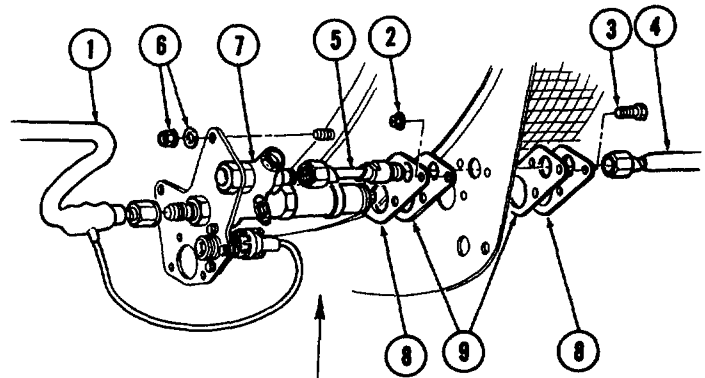
b. Install nipple (14) into compensator, torque to **65 to 75 inch-pounds.**

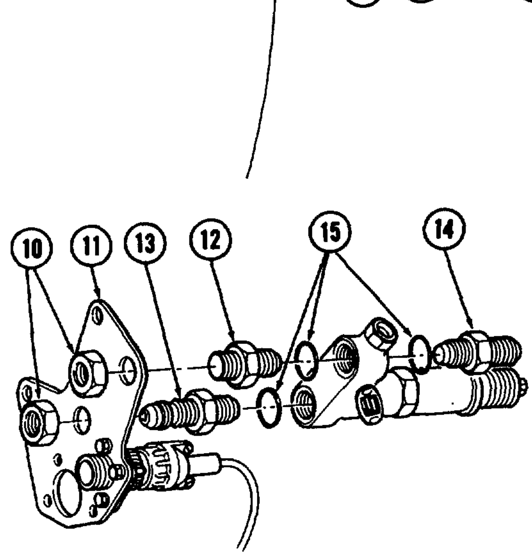
c. Install tube coupling (13) into compensator, torque to 65 to 75 inch-pounds.

d. Install plug (12) in compensator, torque to **65 to 75 inch-pounds.**

e. Lockwire (E.5) coupling (13) and plug (12) together.

f. Connect tube assembly (5) to nipple (14). Torque connection to **90 to 100 inch-pounds** and lockwire (E.5) to nipple.

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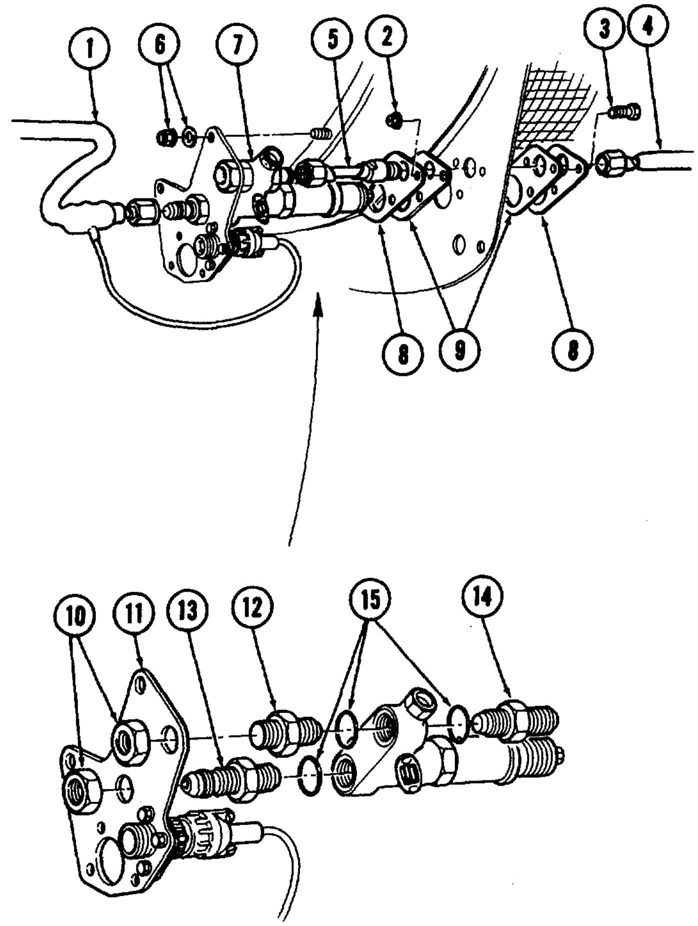
## 6-9 TEMPERATURE COMPENSATOR (Continued)

6-9-3 INSTALLATION (Cont)

2. Install compensator bracket (11), complete with electrical harness and tube assembly (1), to temperature compensator over coupling (13) and plug (12). Secure with nuts (10). Torque nut on plug (12) to **60 to 70 inch-pounds** and nut on coupling (13) to **38 to 42 inch-pounds**. Lockwire (E.5) nuts (10).




**NOTE**
**Insure tube assembly is supported during preceding step.**

**CAUTION**

**Take special care to avoid damaging bimetallic disk assembly, when passing it through rear fireseal mount ring.**

3. Carefully install assembled compensator to engine, passing tube assembly (5) and bimetallic disk assembly through retaining plates (8) and seals (9) on rear fireseal mount ring. Locate compensator bracket (11) on two studs at flange G.

4. Secure compensator bracket (11) to flange G with two plain washers and self-locking nuts (6). Torque nuts to **32 to 36 inch-pounds.**

5. Tighten nuts (2) and bolts (3) to secure seals (9) and retaining plates (8). Torque to **36 to 40 inch-pounds**.

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## 6-9 TEMPERATURE COMPENSATOR (Continued)

6-9-3 INSTALLATION (Cont)

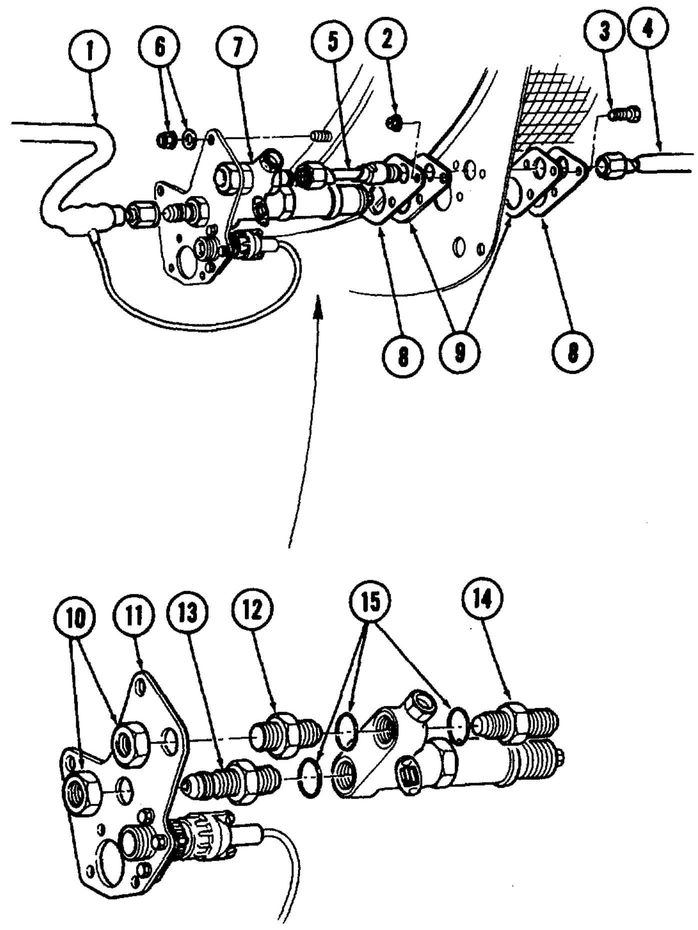
6. Connect tube assembly (1) to coupling (13) (Task 10-4-5).

7. Connect tube assembly (4) to tube assembly (5).

8. Torque connections for tubes (1) and (4) to **90 to 100 inch-pounds** and lockwire (E.5).

9. Carry out pneumatic lines leak test (Task 10-4-7).

10. **Inspect**.




FOLLOW ON MAINTENANCE:

None

**END OF TASK**

**Section X FUEL DUMP VALVE**

6-10 FUEL DUMP VALVE

This task covers:

a. Removal (6-10-1) c. Installation (6-10-3)

b. Inspection (6-10-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)

Materials:
Lockwire (E.5)
Petrolatum (E.20)

Parts:
Preformed Packings
Retainer

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-1500-204-25
TM55-2840-251-23P

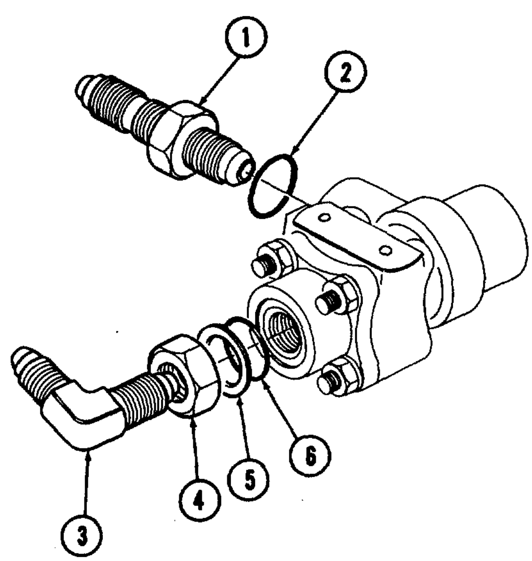
6-10-1 REMOVAL

1. Remove fuel inlet manifold adapter and dump valve as a complete unit. Separate dump valve from manifold adapter (Task 6-5-1, steps 3.thru 7).

2. If dump valve is to be replaced:

a. Remove coupling (1) and discard preformed packing (2).

b. Back off locknut (4); unscrew elbow (3), complete with locknut. Remove and discard retainer (5) and preformed packing (6).

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## 6-10 FUEL DUMP VALVE (Continued)

6-10-2 INSPECTION

1. Inspect threads on elbow and coupling. Reject component if threads are damaged.

2. Inspect dump valve for external damage and obvious signs of leakage. No defects permitted.

6-10-3 INSTALLATION

If dump valve has been replaced:

a. Lubricate new preformed packing (2) with Petrolatum (E.20) and install on coupling (1).

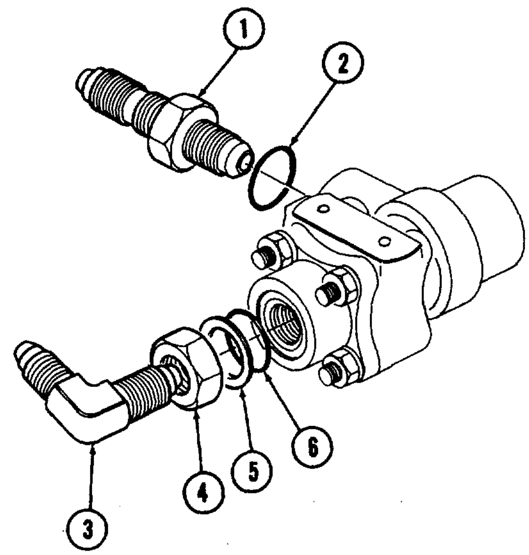
b. Install coupling in dump valve, torque to **65 to 75 inch-pounds** and lockwire (E.5).

c. Lubricate new preformed packing (6) and install with new retainer (5) on elbow (3). Install elbow assembly in dump valve. Do not torque or lockwire locknut (4) at this stage.

d. Install dump valve on inlet manifold adapter and assemble on engine (Task 6-5-2, steps 1 thru 4).

e. Reconnect fuel delivery tube (Task 6-5-2, step 11).

f. **Inspect**.




FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section XI FUEL LINES AND FITTINGS

### 6-11 FUEL LINES AND FITTINGS

This task covers:

a. Removal (6-11-1) c. Inspection (6-11-3)

b. Cleaning (6-11-2) d. Installation (6-11-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 500 inch-pounds)

Materials:
Lockwire (E.5)
Varsol (E.9)
Crocus Cloth (E.41)
Turco Super Carb (E.63)

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

General Safety Instructions:

**WARNING**

**TOXIC AND FLAMMABLE SOLVENTS**

**Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame.**

**Use only in a well-ventilated area. Wear rubber gloves. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

**GO TO NEXT PAGE**

## 6-11 FUEL LINES AND FITTINGS (Continued)

6-11-1 REMOVAL

1. Remove lockwire and disconnect flexible fuel line (11) from fuel pump and from oil-to-fuel heater.

2. Remove lockwire and disconnect flexible fuel line (3) from fuel pump and fuel control unit.

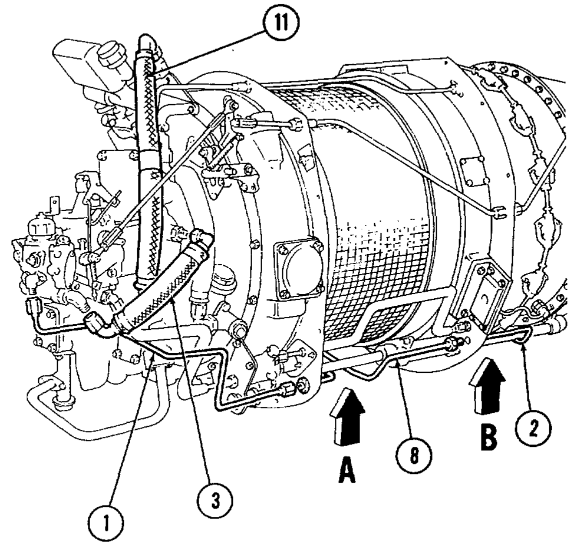
3. Remove lockwire and disconnect tube (1) from fuel control unit and tube (8) at rear fireseal. Remove tube (1).

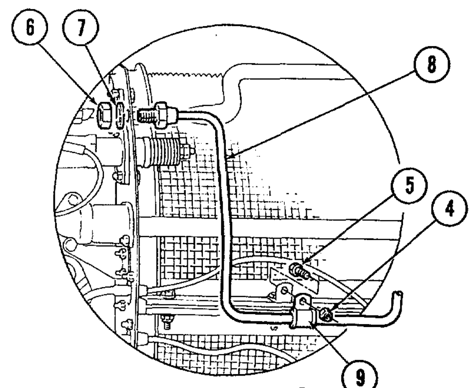
4. Remove lockwire and disconnect fuel tube (2) from drain valve (10) and tube (8) at center fireseal. Remove tube (2).

5. Remove nut (4), bolt (5) and clamp (9).

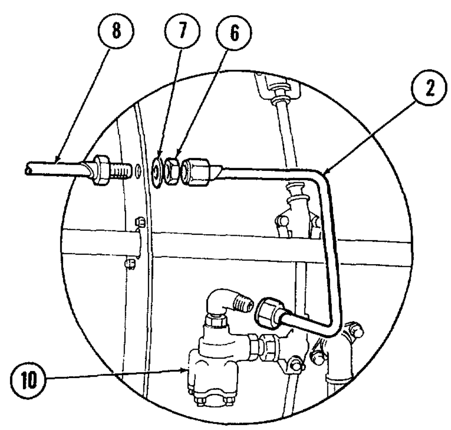
6. Remove lockwire and two nuts (6) and washers (7) from rear and center fireseals.

7. Remove tube (8).




VIEW ON ARROW A




VIEW ON ARROW B

GO TO NEXT PAGE

## 6-11 FUEL LINES AND FITTINGS (Continued)

6-11-2 CLEANING

1. Clean all tubes with Varsol (E.9) .

2. If hard-to-clean soils are encountered on rigid stainless steel tubes, immerse tube in cold Turco Super Carb (E.63) for 10 to 30 minutes, as required. After soaking, thoroughly rinse in hot water at 150° to 200°F (65° to 93°C). If it is necessary to remove cleaning compound after rinsing, pressure wash tube with Varsol (E.9).

**WARNING**

**When using compressed air for cleaning, use approved protective equipment for eyes and face. Do not use more than 30 psig air pressure. Do not direct air toward yourself or another person. Failure to comply could result in injury to eyes or skin. In case of injury, get medical attention.**

3. Thoroughly dry all tubes and fittings with filtered, clean, dehydrated compressed air.

**GO TO NEXT PAGE**

## 6-11 FUEL LINES AND FITTINGS (Continued)

6-11-3 INSPECTION

1. Inspect tube assemblies for cleanliness. If necessary, clean (Task 6-11-2).

2. Inspect for scratches. Minor scratches to a depth of 0.003 inch are acceptable.

3. Inspect for nicks and chafing. Minor nicks and chafing acceptable.

4. Inspect for dents. Round bottom dents are permissible, provided the depth is not greater than 10% of the normal outside diameter of the tube. No more than three dents to the maximum depth, are permitted for every 12 inch length of tube and such dents shall be separated by at least 0.250 inch. No dents are permitted within 0.250 inch of ferrules or fittings.

5. Inspect for pitting. Minor isolated pitting is permitted, provided that it is not deeper than 0.003 inch.

6. Inspect for corrosion. Rust and stains are acceptable, if removed by light polishing with Crocus Cloth (E.41).

7. Inspect end fittings for condition of threads.

**GO TO NEXT PAGE**

## 6-11 FUEL LINES AND FITTINGS (Continued)

6-11-4 INSTALLATION

1. Install rigid tube (8) through center and rear fireseals and temporarily secure with washers (7) and nuts (6).

2. Install loop clamp (9) on tube assembly (8) and secure to bracket on air inlet screen flange with bolt (5) and self-locking nut (4). Torque nut to **36 to 40 inch-pounds**.

3. Torque nuts (6) to **65 to 75 inch-pounds**. Do not lockwire at this stage.

4. Install rigid tube (2) on fuel dump valve (10) elbow and on tube (8) at center fireseal. Check torque locknut on dump valve elbow to **38 to 42 inch-pounds**, torque tube (2) connections to **30 to 100 inch-pounds** and lockwire (E.5) to locknut on elbow and to nut (6).

5. Install rigid tube on fuel control unit and on tube (8) at rear fireseal. Torque connections to **90 to 100 inch-pounds** and lockwire (E.5) to nut (6) and fuel control elbow.

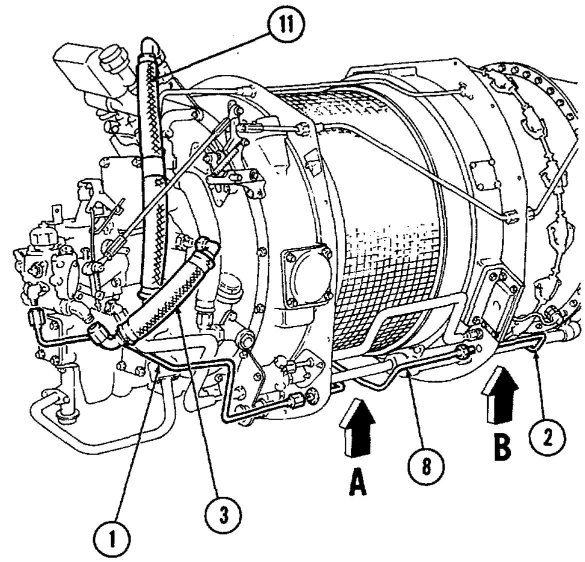
6. Install flexible tube (3) on fuel pump adapter and on fuel control unit elbow. Torque connections to **270 to 300 inch-pounds** and lockwire (E.5).

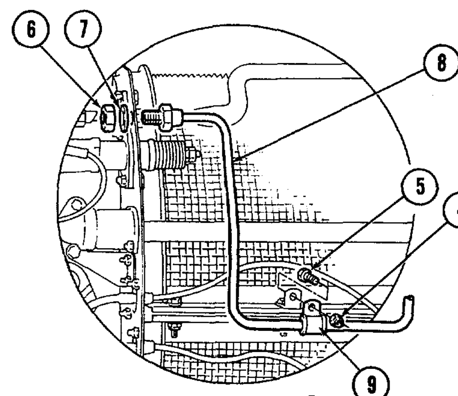
7. Install flexible tube (11) on fuel pump and oil-to-fuel heater elbow. Torque connections to **450 to 500 inch-pounds** and lockwire (E.5).

8. **Inspect**.

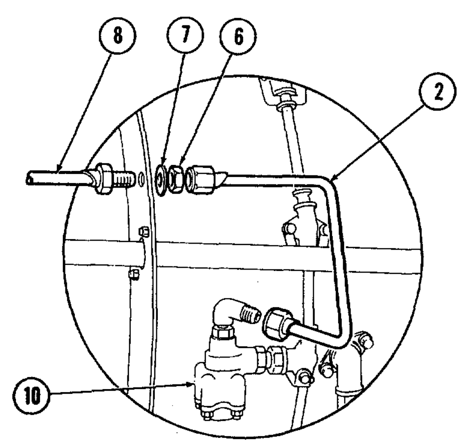
FOLLOW ON MAINTENANCE:

None




VIEW ON ARROW A




VIEW ON ARROW B

**END OF TASK**

# CHAPTER 7

# ELECTRICAL SYSTEM

CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Electrical System. It is divided into the following sections.



END OF OVERVIEW

## Section I GLOW PLUGS

### 7-1 GLOW PLUGS

This task covers:

a. Removal (7-1-1)

b. Cleaning (7-1-2)

c. Inspection (7-1-3)

d. Testing (7-1-4)

e. Installation (7-1-5)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Aircraft Electrician's Tool Kit
NSN 5180-00-323-4915
Torque Wrench (0 to 400 inch-pounds)
Ignition Test Set (Appendix D)

Materials:
Turco 5884 (E.49)
Soft Nylon Brush

Parts:
Gaskets

Personnel Required:
68B Powerplant Mechanic
68F Aircraft Electrician

References:
TM 55-2840-251-23P

GO TO NEXT PAGE

## 7-1 GLOW PLUGS (Continued)

### 7-1-1 REMOVAL

Remove glow plug and gasket from gas generator case.

### 7-1-2 CLEANING

1. Brush off carbon with a soft nylon brush or equivalent.

2. Blow element with a jet of low pressure, filtered dry air.

### 7-1-3 INSPECTION

1. Check for fused areas on firing end, which shall not exceed one area of 1/8 inch x 1/32 inch. The presence of a larger area or more than one area shall be cause for rejection.

2. Check for damaged threads, which may be cleaned up with a 0.5625-18 UNF chaser.

### 7-1-4 TESTING

1. Place test set switch SW1 to position 3.

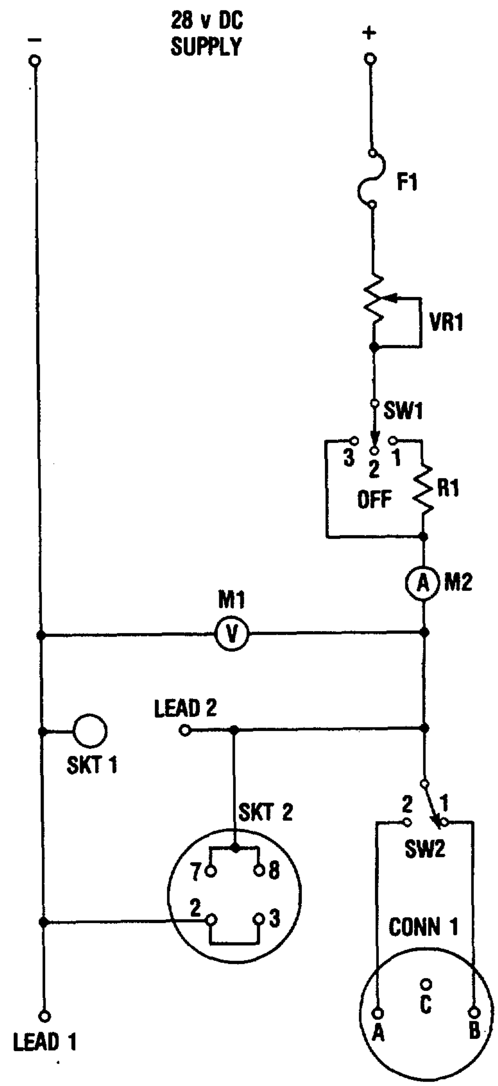
2. Adjust rheostat VR1 to show 19.5 ± 0.5 volts at the voltmeter M1.

3. Place test set switch SW1 to OFF.

4. Screw glow plug into test set SKT1.

5. Connect test set LEAD 2 to glow plug.

6. Place test set switch SW1 to position 3.

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## 7-1 GLOW PLUGS (Continued)

### 7-1-4 TESTING (Cont)

7. Glow plug shall attain an even overall orange yellow color within eight seconds.

8. Place test set switch SW1 to OFF.

**CAUTION**

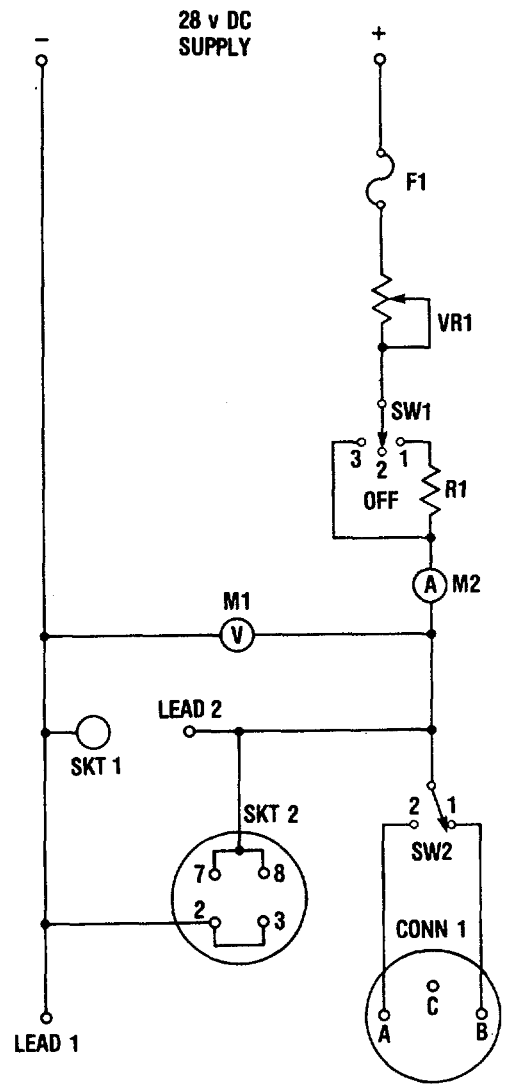
**Allow glow plugs to cool before handling.**

### 7-1-5 INSTALLATION

1. Fit gasket to glow plug. Do not lubricate glow plug thread or internal thread in gas generator case.
2. Install glow plug and gasket into gas generator case.
3. Torque glow plug to 300-360 inch-pounds, loosen to zero and retorque to 300 inch-pounds.

FOLLOW ON MAINTENANCE:

None




**END OF TASK**

## Section II ELECTRON TUBES

### 7-2 ELECTRON TUBES

This task covers:

a. Removal (7-2-1)

b. Inspection (7-2-2)

c. Testing (7-2-3)

d. Installation (7-2-4)

INITIAL SETUP

Applicable Configurations:

All

Tools:
Aircraft Electrician's Tool Kit
NSN 5180-00-323-4915
Ignition Test Set (Appendix D)
Torque Wrench (0 to 100 inch-pounds)

Materials:
Lockwire (E,4)
Heat-resisting Gloves

Personnel Required:
68F Aircraft Electrician

**GO TO NEXT PAGE**

## 7-2 ELECTRON TUBES (Continued)

### 7-2-1 REMOVAL

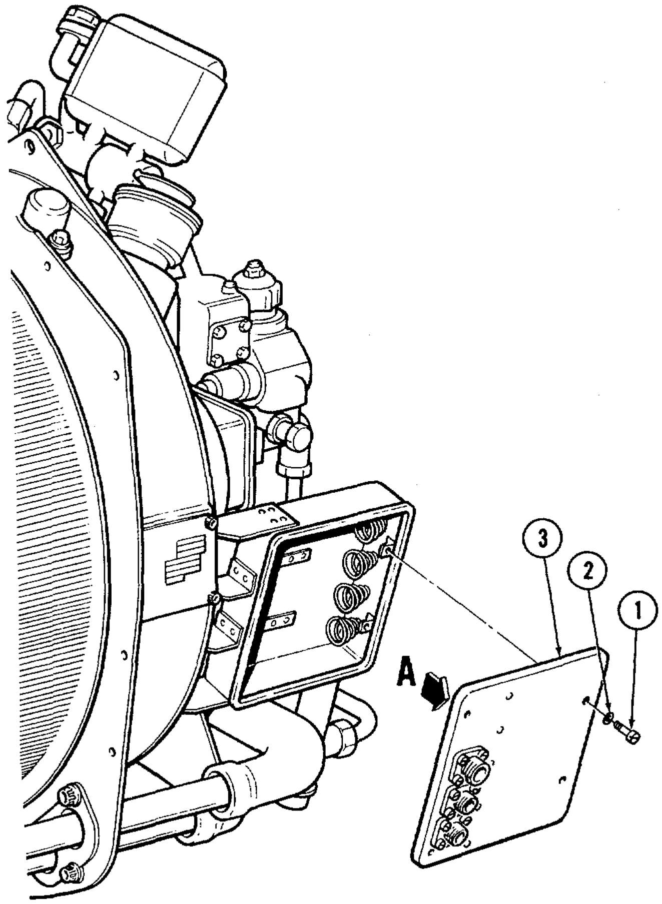
1. Cut lockwire and remove four screws (1) and preformed packings (2), then detach cover (3).

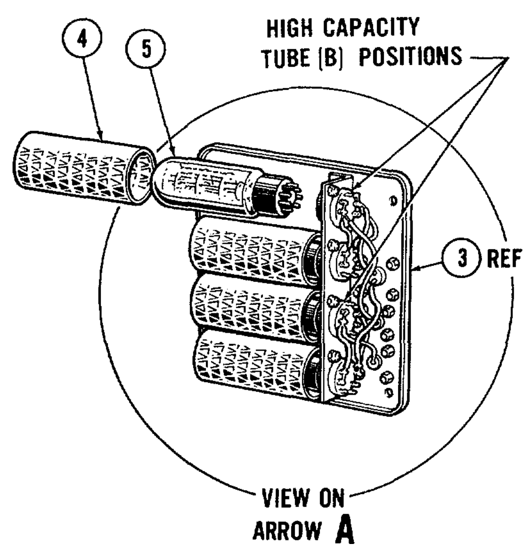
2. Note locations of individual tubes (5) and remove tubes and shields (4) by pulling covers from tubes and tubes from sockets.

### 7-2-2 INSPECTION

1. Inspect glass envelope for cracks or looseness at the base, either of which fault shall be cause for rejection.

2. Examine base pins for looseness or bending; slight bends may be carefully straightened, loose pins shall be cause for rejection.

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## 7-2 ELECTRON TUBES (Continued)

### 7-2-3 TESTING

1. lace test set switch SW1 to OFF.

2. Install electron tube in test set socket SKT2.

3. Place test set switch SW1 to position 1.

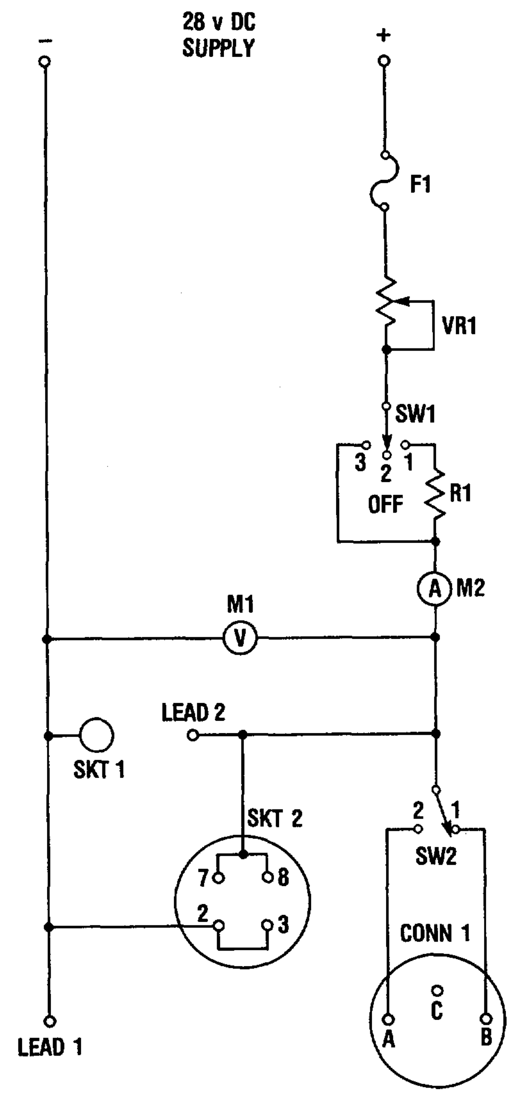
4. Adjust test set rheostat VR1 until voltmeter reads **6.5 ± 0.5** volts at Mi.

5. After three minutes, check reading on test set ammeter M2. For electron tubes P/N 3008040, the reading shall be 3.0 to 3.5 amps, and for tubes P/N 3014055, 3.3 to 3.8 amps. If not, replace tube.

6. Adjust test set rheostat VR1 until voltmeter reads 19.5 ± 0.5 volts.

7. After three minutes, check reading on test set ammeter M2. For electron tubes P/N 3008040, the reading shall be 3.7 to 4.1 amps, and for tubes P/N 3014055, 4.2 to 4.6 amps. If not, replace tube.

8. Put test set switch SW1 to OFF.

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## 7-2 ELECTRON TUBES (Continued)

### 7-2-4 INSTALLATION

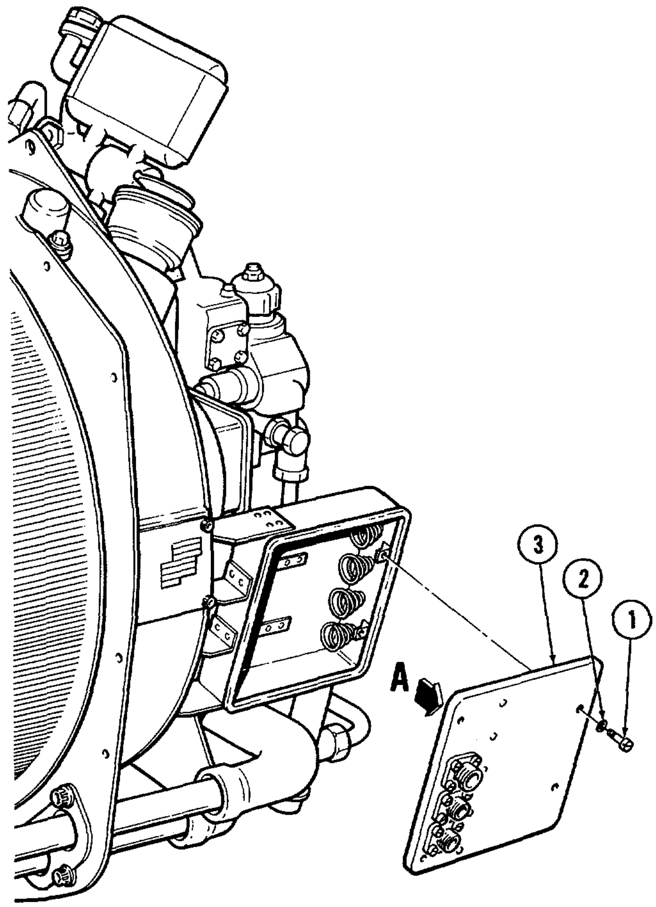
1. Install tubes (5) and shields (4), tubes P/N 3014055 in high-capacity positions shown.

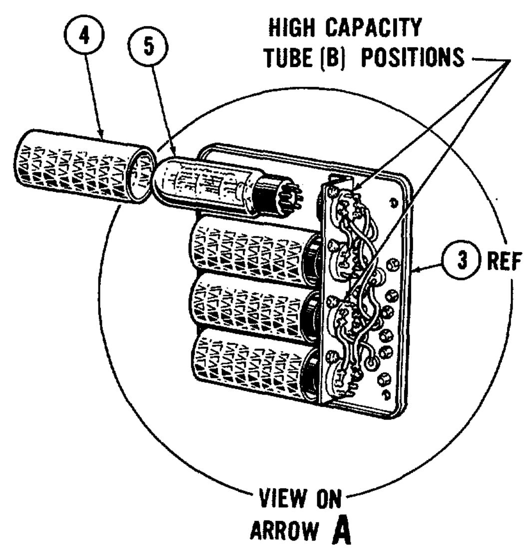
2. Install cover (3), preformed packings (2) and screws (1).

3. Torque screws (1) to 10 to 12 inch-pounds and lockwire (E.4).

FOLLOW ON MAINTENANCE:

None




**END OF TASK**

## Section III IGNITION REGULATOR

### 7-3 IGNITION REGULATOR

This task covers:

a. Removal (7-3-1)

b. Inspection (7-3-2)

c. Testing (7-3-3)

d. Repair (7-3-4)

e. Installation (7-3-5)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Aircraft Electrician's Tool Kit NSN 5180-00-323-4915
Torque Wrench (O to 100 inch-pounds)
Ignition Test Set (Appendix D)

Materials:
Lockwire (E.4)
Trichlorethane (E.46)
Solder (E.47)
Crocus Cloth (E.64)
Adhesive (E.65)

Parts:
Rivet

Personnel Required:
68F Aircraft Electrician

References:
TM 55-2840-251-23P

General Safety Instructions:

**WARNING**

**TOXIC AND FLAMMABLE SOLVENTS**

**Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame.**

**Use only in a well-ventilated area. Wear rubber gloves. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

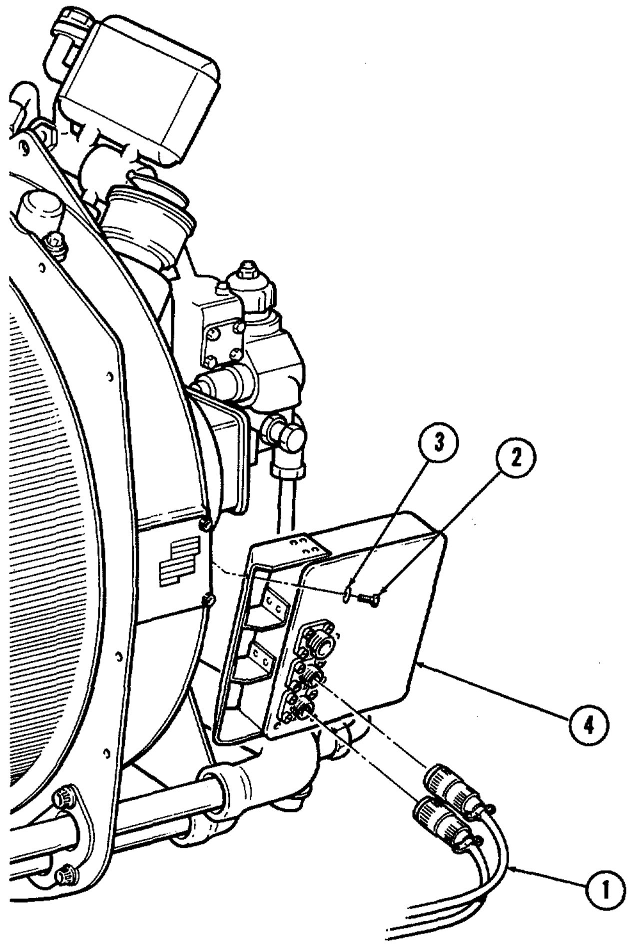
**GO TO NEXT PAGE**

## 7-3 IGNITION REGULATOR (Continued)

### 7-3-1 REMOVAL

1. Remove lockwire and disconnect ignition cables (1) at regulator cover.

2. Remove lockwire, bolts (2), washers (3) and regulator (4).




### 7-3-2 INSPECTION

1. Carefully examine mounting bracket weld for cracking, which may be repaired (Task 7-3-4).

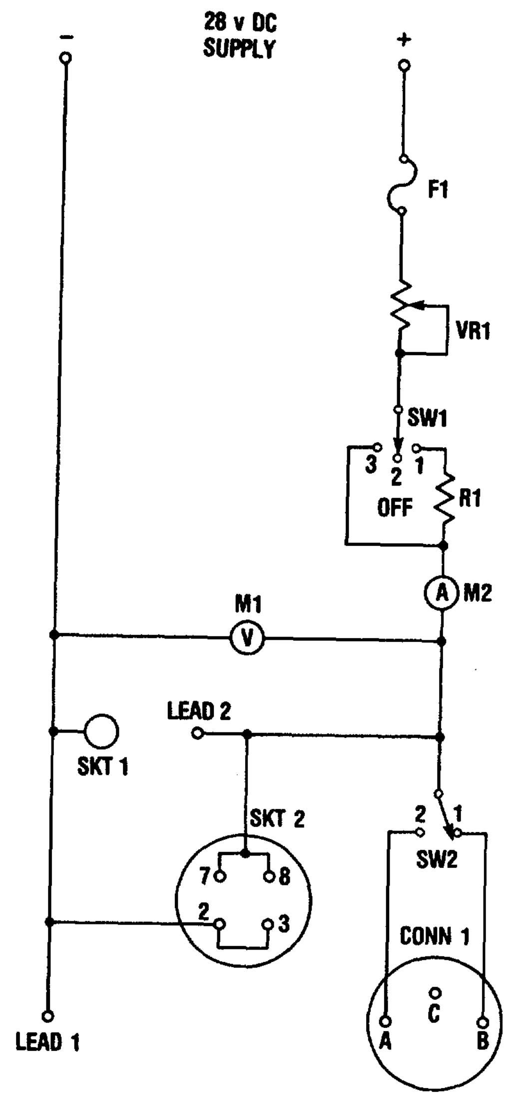
2. Examine the three electrical connectors, which may be removed (Task 7-3-4).

GO TO NEXT PAGE

## 7-3 IGNITION REGULATOR

### 7-3-3 TESTING

1. Put test set switch SW1 to OFF.
2. Mate test set connector CONN 1 to regulator.
3. Mate test set LEAD 1 to one of two regulator sockets.
4. Put test set switch SW1 to position 1, and check for reading at test set ammeter M2. If no reading, move test set switch SW2 to alternate position.
5. Adjust test set rheostat VR1 to give **6.5 ± 0.5** volts at test set voltmeter M1.
6. After three minutes, check that ammeter reading is 6.3 to 7.3 amps M2. If not, send both tubes for testing (Task 7-2-3).
7. Adjust test set rheostat VR1 to give **19.5 ± 0.5 volts** at test set voltmeter.
8. After **three minutes,** check that ammeter reading is **7.9 to 8.7 amps.** If not, send both tubes for testing (Task 7-2-3).
9. Put test set switch SW2 to alternate position.
10. Move test set LEAD 1 to adjacent socket on regulator.
11. Repeat steps 5 through 8 for second pair of tubes.

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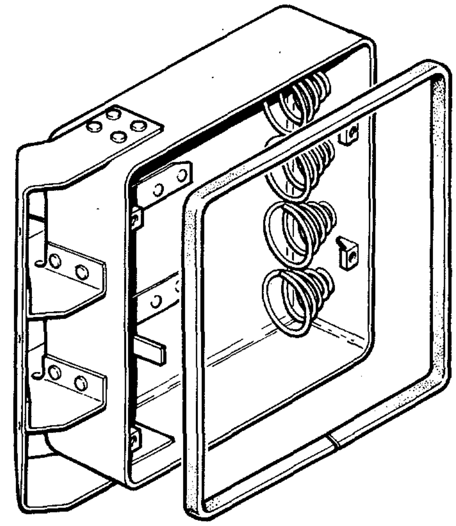
## 7-3 IGNITION REGULATOR (Continued)

### 7-3-4 REPAIR

Gasket



1. Remove cover (Task 7-2-1).

2. Remove gasket from box and clean off old adhesive using Trichlorethane (E.46).

3. Roughen bonding surface of box with Sand Paper (E.84).

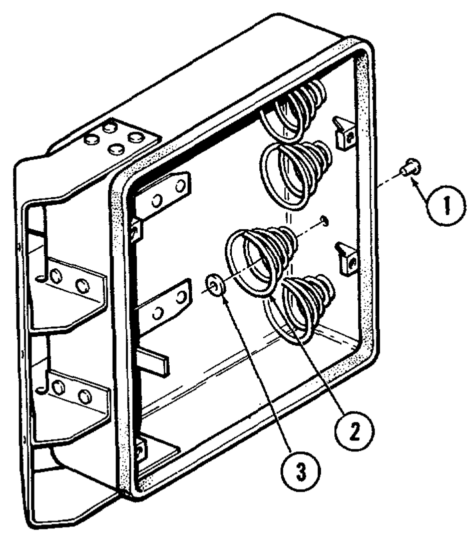
4. Bond gasket to box with Adhesive (E.65). Insure gasket joint is located at 6 o'clock position and slanting 30 degree cut is employed to effect joint. A 90 degree cut is not acceptable.

5. Allow to dry minimum two hours.

Springs

1. Remove rivet (1), washer (3) and spring (2).

2. Install replacement spring and secure with washer (3) and rivet (1).

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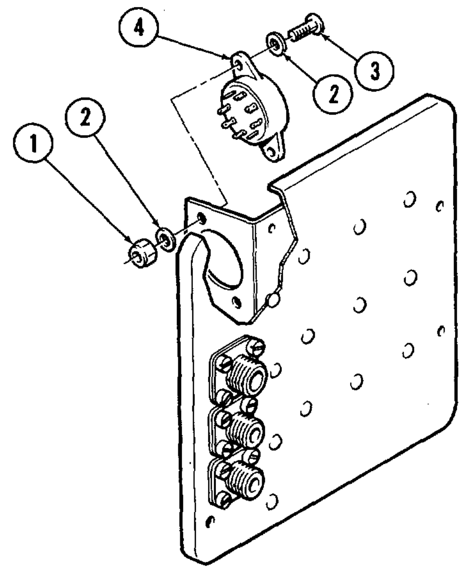
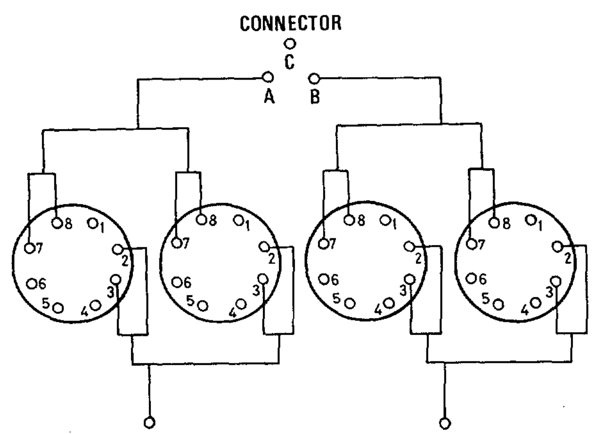
## 7-3 IGNITION REGULATOR (Continued)

### 7-3-4 REPAIR (Cont)

Electron Tube Socket

1. Unsolder wiring from socket.
2. Remove nuts (1), washers (2), screws (3) and socket (4).
3. Install replacement socket and secure with screws, washers and nuts. Torque nuts to **4 to 6 inch-pounds.**
4. Connect wiring to socket using Solder (E.47).
5. Install tube and functionally test (Task 7-3-3).

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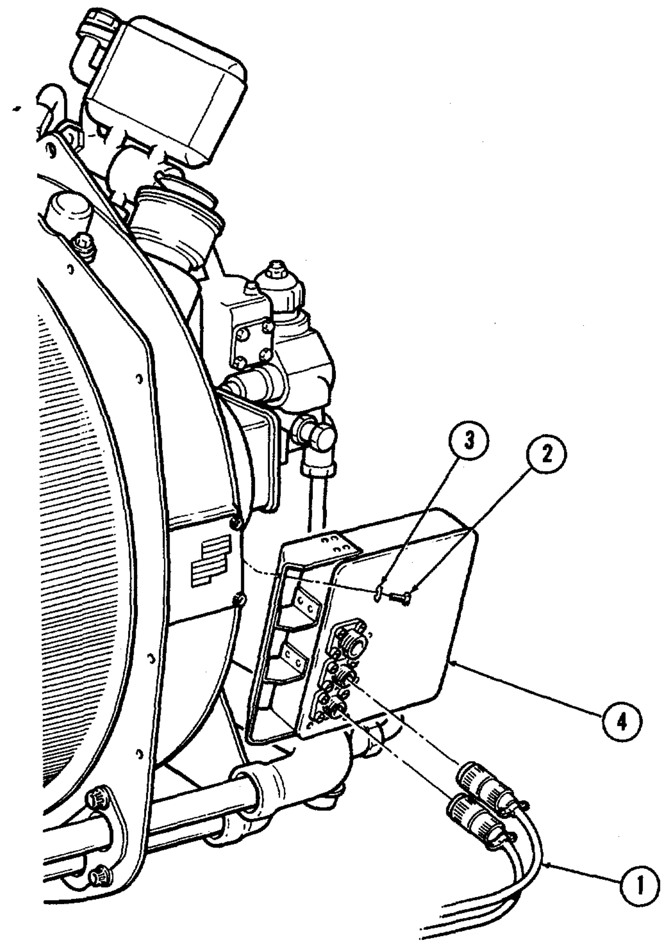
**7-3 IGNITION REGULATOR (Continued)**

**7-3-5 INSTALLATION**

1. Install regulator (4), washers (3) and bolts (2). Torque to 20 to 30 inch-pounds and lockwire (E.4) bolts.

2. Install electron tubes (Task 7-2-4).

3. Connect ignition harness (1). Torque finger tight plus five degrees and lockwire (E.4) connections.




FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section IV IGNITION CABLES

### 7-4 IGNITION CABLES

This task covers:

a. Removal (7-4-1)

b. Inspection (7-4-2)

c. Testing (7-4-3)

d. Installation (7-4-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Aircraft Electrician's Tool Kit
NSN 5180-00-323-4915
Torque Wrench (O to 100 inch-pounds)
Ohmmeter

Materials:
Lockwire (E.4)

Personnel Required:
68B Powerplant Mechanic
68F Aircraft Electrician

**GO TO NEXT PAGE**

## 7-4 IGNITION CABLES (Continued)

### 7-4-1 REMOVAL

1. Remove nuts (1), bolts (2), nuts (3), bolts (4), nut (5), bolt (6), nut (7) and bolt (8).

2. Remove lockwire and disconnect cable (9) connectors from regulator cover (10) and glow plugs (11).

3. Remove clamps and cables (9).

### 7-4-2 INSPECTION

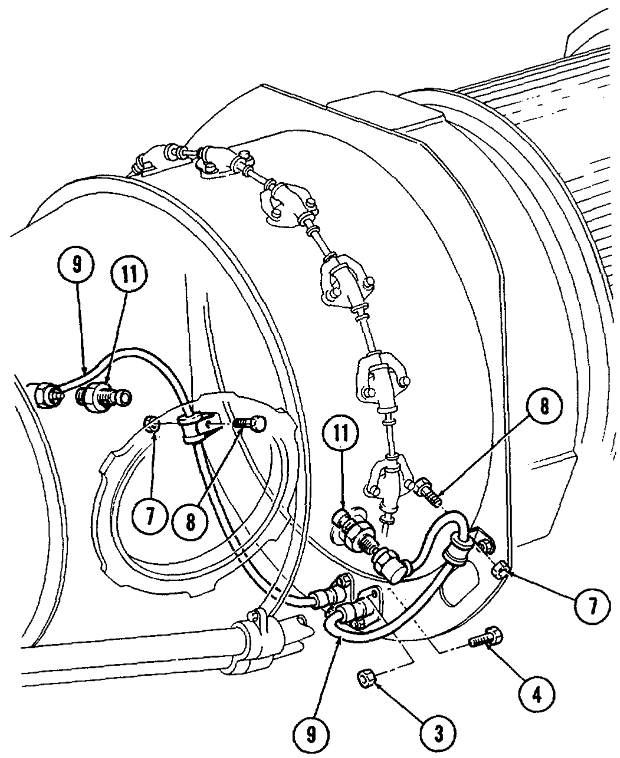
1. Inspect cables for frayed or broken braiding, which shall be cause for rejection.

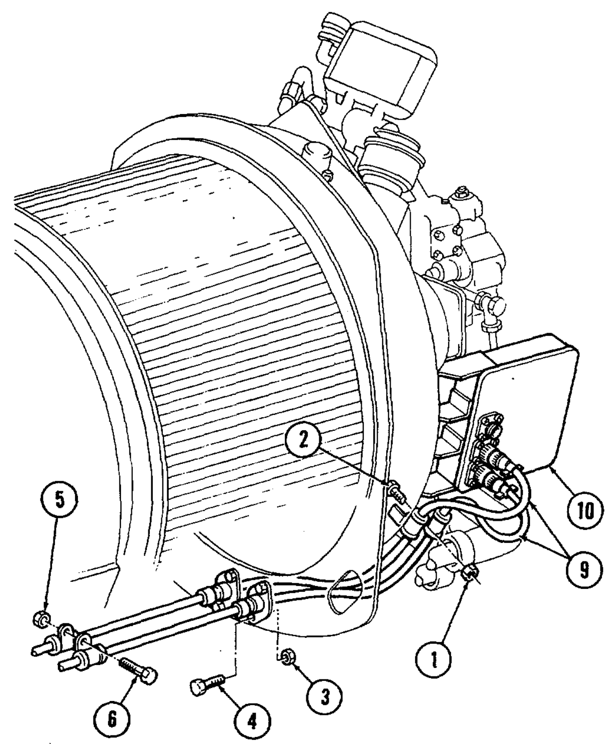
2. Inspect cables for damaged threads which may be cleaned up, otherwise reject cable.

### 7-4-3 TESTING

1. Insure insulation resistance is not less than **10 megohms at 100 volts,** otherwise reject cable.

2. Check conductors for continuity - resistance shall not exceed **0.025 ohms.**

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## 7-4 IGNITION CABLES (Continued)

### 7-4-4 INSTALLATION

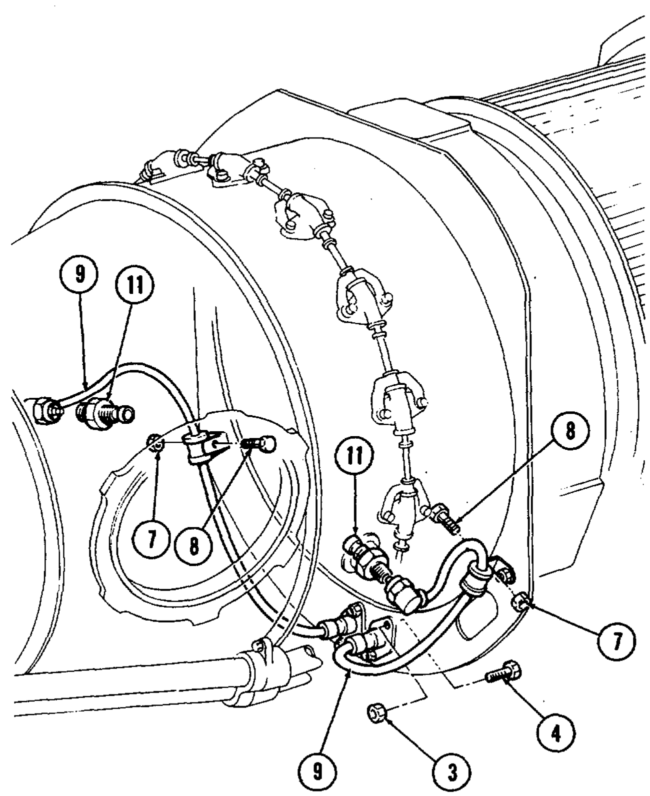
1. Install cable (9) at glow plugs (11) and regulator cover (10). Torque connectors at regulator **fingertight plus five degrees,** then lockwire (E.4).

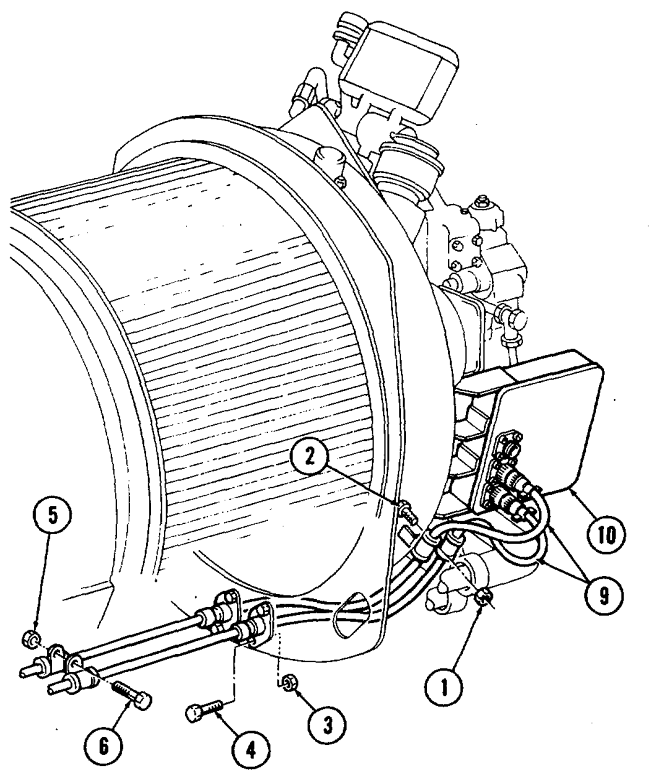
2. Torque connectors at plugs (11) **fingertight plus 45 degrees,** then lockwire (E.4).

3. Install bolts (2), (4), (6) and (8), and nuts (1), (3), (5) and (7). Torque nuts to **32 to 36 inch-pounds.**

FOLLOW ON MAINTENANCE:

None




**END OF TASK**

## Section V THERMOCOUPLE HARNESS

7-5 THERMOCOUPLE HARNESS (AVIM)

This task covers:

a. Removal (7-5-1)

b. Inspection (7-5-2)

c. Testing (7-5-3)

d. Repair (7-5-4)

e. Installation (7-5-5)

INITIAL SETUP

Applicable Configurations:
Some Engines (also see Task 7-6)

Tools:
Powerplant Mechanic's Tool Kit NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Simpson Tester
Pliers (T.17)
Pliers (T.74)

Materials:
Lockwire (E.4)
Tape (E.48)
Crocus Cloth (E.64)
Cement (E.66)
Filler (E.67)
Tubing (E.68)
Rod (E.69)
Methyl-Ethyl-Ketone (E.75)

Personnel Required:
68B Powerplant Mechanic
68F Aircraft Electrician

Equipment Condition:
Power Section Removed (Task 4-1-1)
Containment Ring Removed (Task 4-2-1)

General Safety Instructions:

**WARNING**

**TOXIC AND FLAMMABLE SOLVENTS**

**Solvents used for cleaning are toxic and flammable. They irritate skip and cause burns. Fire can result from use near heat or open flame,**

**Use only in a well-ventilated area. Wear rubber gloves, In case of contact, immediately flush skin or eyes with water for at least 15 minutes. GET IMMEDIATE MEDICAL ATTENTION FOR EYES.**

**GO TO NEXT PAGE**

**7-5 THERMOCOUPLE HARNESS (AVIM) (Continued)**

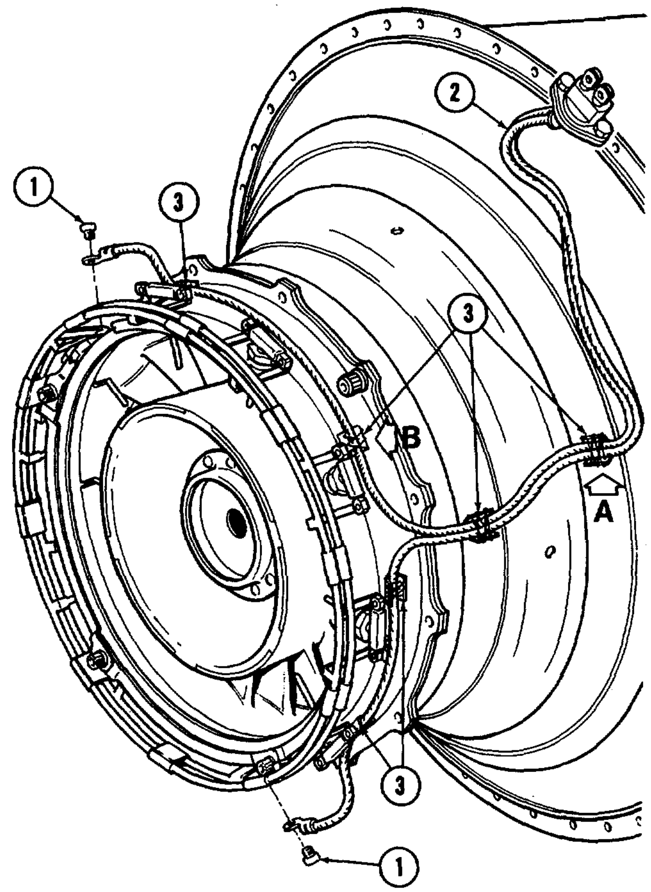
### 7-5-1 REMOVAL

Busbar Type

Remove bolts (1), cut lockwire at clips (3) and remove harness (2).

Integral Harness Type

1. Cut lockwire lacings and release thermocouple terminal wire on exhaust duct.

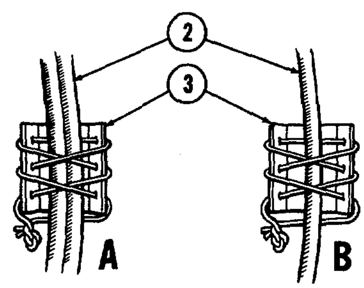



**CAUTION**

**Thermocouple terminal bars are insulated with baked ceramic which is extremely fragile. Do not hold thermocouple by the body and avoid twisting terminals when removing screws. Use 9/64 inch Allen head wrench for alumel terminal screws and 7/64 inch Allen head wrench for chromel terminal screws.**

2. Cut lockwire, hold terminal bar of each thermocouple with long-nosed Pliers (T.74) and remove screws from thermocouple terminals. Disconnect harness from thermocouple terminals.

3. Cut lockwire and release harness ring from clips. Carefully withdraw harness assembly.

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## 7-5 THERMOCOUPLE HARNESS (AVIM) (Continued)

### 7-5-2 INSPECTION

1. Inspect harness for:

- Frayed or broken braiding
- Loose terminal post
- Broken terminal lugs

2. Replace harness if:

- Braiding frayed or broken

3. Repair harness (Task 7-5-4) if:

- Terminal post loose
- Terminal lugs broken

### 7-5-3 TESTING

Busbar Type

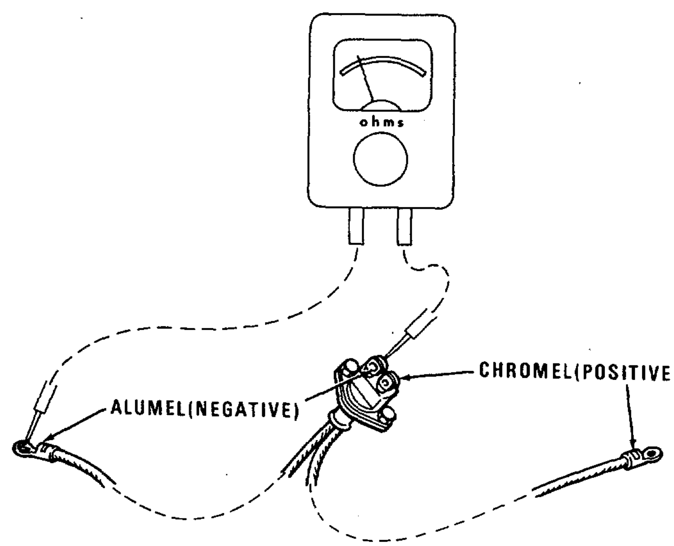
1. Check insulation resistance is not less than **10 megohms at 100 volts AC or DC** after drying for **1 hour at 500°F.**

2. Check that resistance between alumel to alumel terminals is **0.178 to 0.218 ohms.**

3. Check that resistance between chromel to chromel **terminals is 0.389 to 0.475 ohms.**

4. Connect center zero meter negative lead to alumel post, positive lead to chromel post on terminal block.

5. Heat thermocouple probes with soldering iron and check that meter shows **positive (+)** deflection for each probe.

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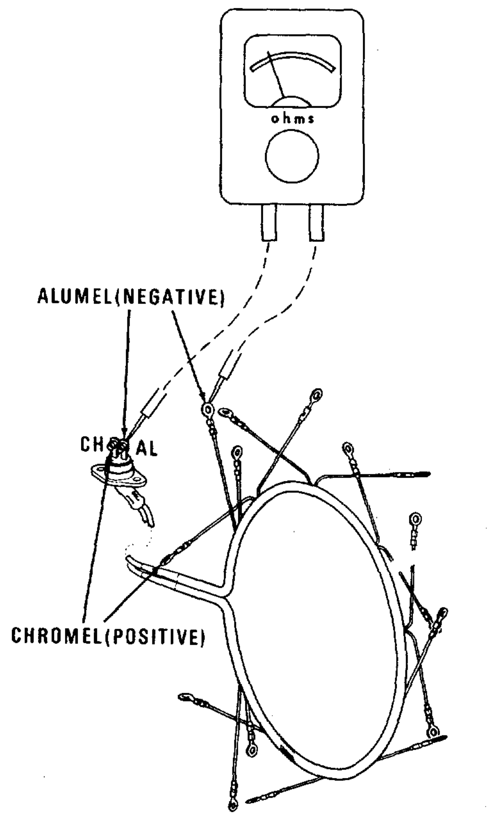
## 7-5 THERMOCOUPLE HARNESS (AVIM) (Continued)

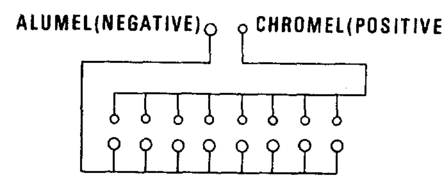
### 7-5-3 TESTING (Cont)

Integral Harness Type

1. Resistance between either terminal and connector body shall be **10 megohms minimum at 100 volts AC or DC,** after drying for **1 hour at 250°F.**

2. Continuity resistance between connector terminals for each probe circuit, when probe wire terminals are shorted together in turn, shall be **1.38 to 1.84 ohms.**




### 7-5-4 REPAIR

Terminal Posts

Repair loose terminal posts as follows:

1. Thoroughly clean area.

2. Apply Cement (E.66).

3. Oven dry at **149 to 199°F (65 to 93°C)** for half hour or air dry at room temperature for 24 hours. Replace missing insulation as follows:

1. Thoroughly clean area.

2. Apply mixture of Cement (E.66) and Filler (E.67).

3. Dry assembly at **100°F (38°C) for half hour.**

4. Cure **149 to 199°F (65 to 93°C)** for 2 hours or air dry at room temperature for **24 hours.**

**GO TO NEXT PAGE**

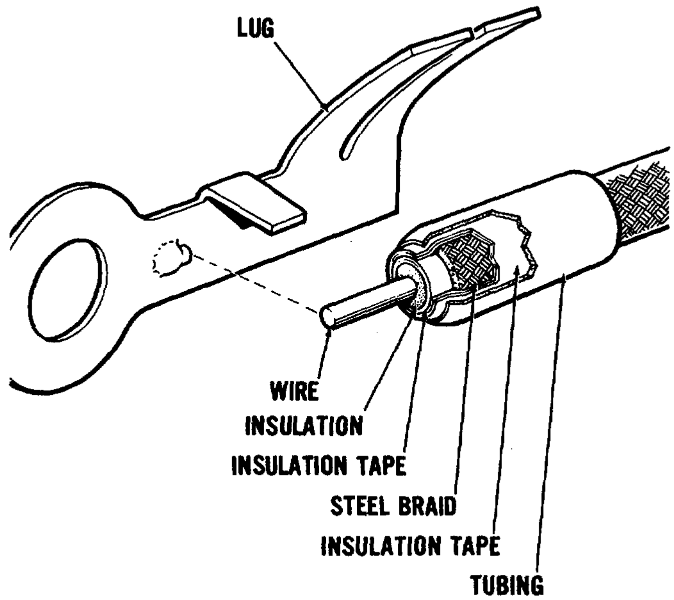
## 7-5 THERMOCOUPLE HARNESS (AVIM) (Continued)

### 7-5-4 REPAIR (Cont)

Terminal Lugs

Replace terminal lugs as follows:

1. Cut wire close to weld.
2. Open ears of lug and remove lug.
3. Work braid back 1-1/2 inches.
4. Wrap two turns of Tape (E.48) around exposed insulation.
5. Trim insulation to 3/16 inch from end of wire.
6. Return braid and trim to 5/16 inch from end of wire.
7. Wrap two turns Tape (E.48) around braid.
8. Install Tubing (E.68) to ¼ inch from end of wire.
9. Install appropriate material terminal lug.

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## 7-5 THERMOCOUPLE HARNESS (AVIM) (Continued)

### 7-5-4 REPAIR (Cont)

10. Crimp small ear of lug around wire using Pliers (T.17) so that 1/16 inch wire exposed.

11. TIG weld wire to lug using Rod (E.69).

12. Test weld by gently pulling on lug.

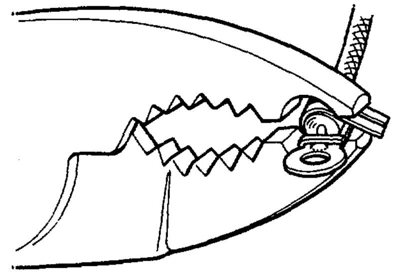
13. Clean both sides of lug using Crocus Cloth (E.64).

14. Crimp large ear of lug over tubing using Pliers (T.17) as shown in steps 1 through 4.

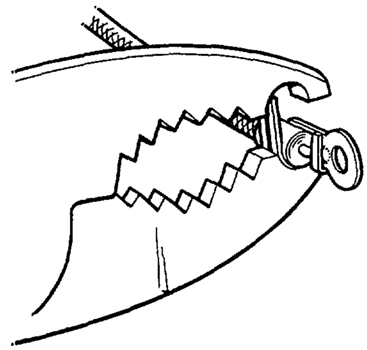
15. Check continuity.

16. Check insulation value of lug from braiding.

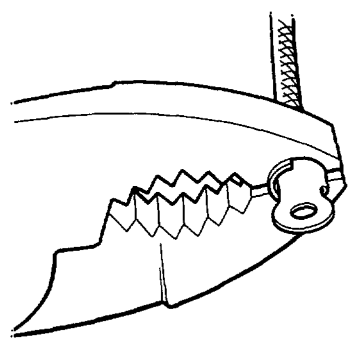
16. Check that there is no electrical continuity between the lug and braiding.



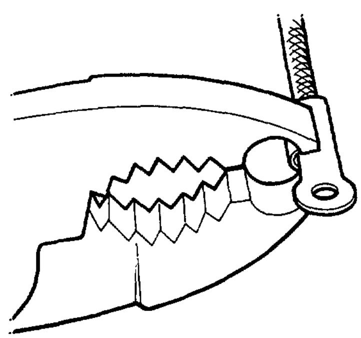
STEP 1



STEP 2



STEP 3



STEP 4

GO TO NEXT PAGE

## 7-5 THERMOCOUPLE HARNESS (AVIM) (Continued)

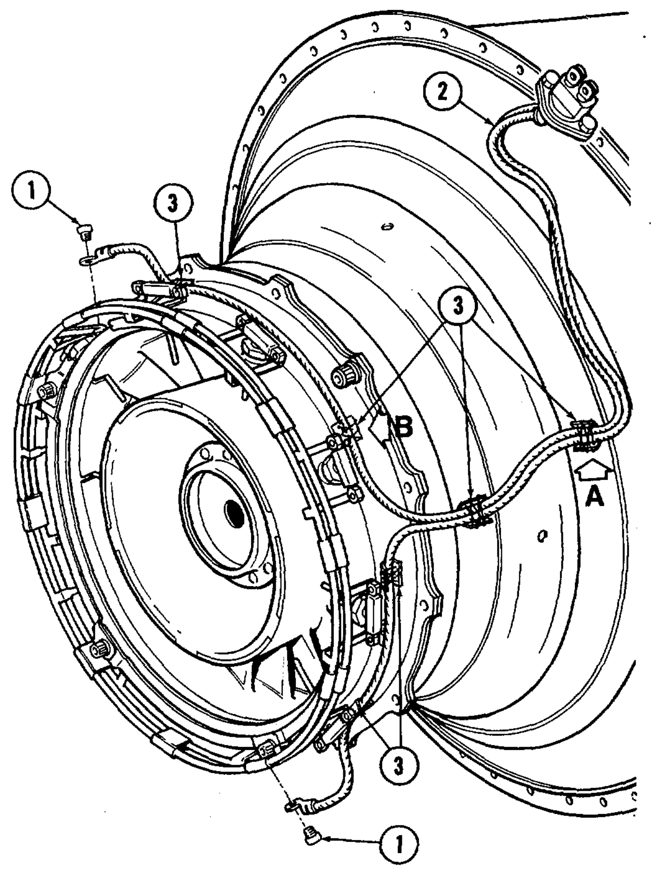
### 7-5-5 INSTALLATION

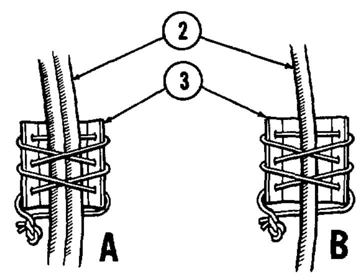
Busbar Type

1. Install harness (2) and bolts (1). Torque to **9 to 12 inch-pounds** and lockwire bolts.

2. Lace harness to six clips (3).

3. Carry out resistance check (Task 7-5-3).




Integral Harness Type

1. Position thermocouple harness over stator housing and secure harness in clips with lockwire lacing (E.4). Insure alumel terminal lug (larger) is at 10 o'clock position and chromel lug (smaller) is at 5 o'clock position.

2. Carry out resistance check (Task 7-5-3).

GO TO NEXT PAGE

**7-5-5 INSTALLATION (Cont)**

Integral Harness Type (Cont)

**CAUTION**

**Probe terminal bars are insulated with baked ceramic which is extremely fragile. Do not hold probe by the body and avoid twisting terminals when tightening screws. Use 9/64 inch Allen head wrench for alumel terminal screws and 7/64 inch for chromel terminal screws.**

3. Connect smaller of harness terminals to chromel terminal of thermocouple probe and insert smaller screw, insuring screw heads face outward. Connect larger terminal lead of harness to alumel terminal of probe and insert large screws, insuring that heads face outwards. Hold thermocouple probe with Pliers (T.74) and using Allen head wrenches, torque screws to 9 to 12 inch-pounds and individually secure each screw with Lockwire (E.4) to its crimped terminal.

FOLLOW ON MAINTENANCE:

Installation Containment Ring
(Task 4-2-3)
Installation Power Section
(Task 4-1-2)

**END OF TASK**

## Section VI THERMOCOUPLE BUSBAR

### 7-6 THERMOCOUPLE BUSBAR (AVIM)

This task covers:

a. Removal (7-6-1)

b. Inspection (7-6-2)

c. Testing (7-6-3)

d. Installation (7-6-4)

---

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Simpson Meter
Pliers (T.74)

Materials:
Lockwire (E.4)

Personnel Required:
68B Powerplant Mechanic
68F Aircraft Electrician

Equipment Condition:
Power Section Removed (Task 4-1-1)
Thermocouple Harness Disconnected (Task 7-5-1)

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GO TO NEXT PAGE

## 7-6 THERMOCOUPLE BUSBAR (AVIM) (Continued)

### 7-6-1 REMOVAL

1. Remove bolts (1) and retaining plates (2), if fitted.

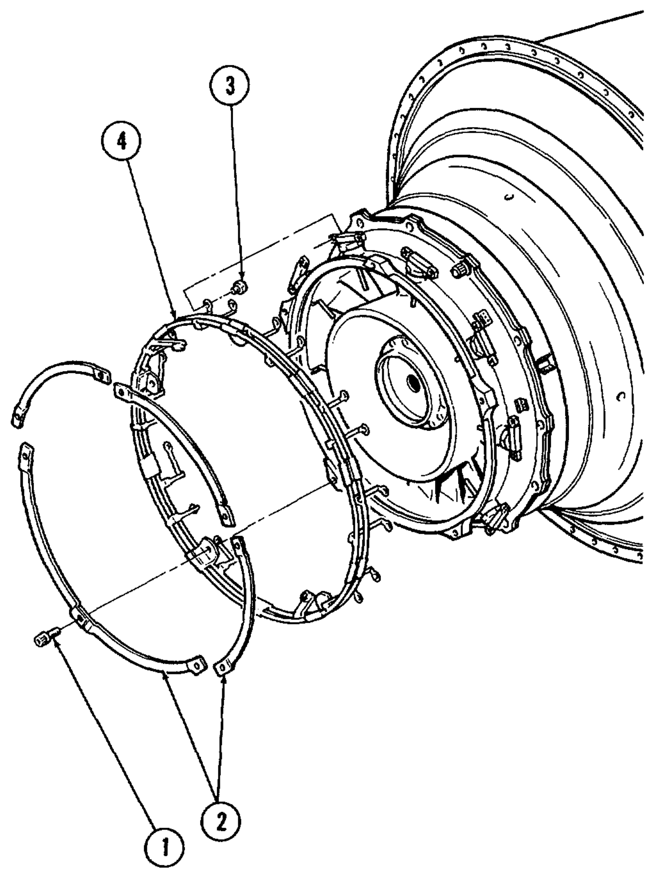
**CAUTION**

**Engine thermocouple terminal bars are insulated with baked ceramic which is extremely fragile; therefore, avoid twisting terminals when loosening screws. Use 9/64 inch Allen head wrench for alumel terminal screws and 7/64 inch Allen head wrench for chromel terminal screws.**

2. Hold terminal bars of thermocouples with long-nosed Pliers (T.74) and remove screws from thermocouple terminals.

3. Remove busbar (4).

4. Install bolts (3). Torque to **9 to 12 inch-pounds** and lockwire (E.4).




### 7-6-2 INSPECTION

1. Inspect busbar for:

   - Damaged threads
   - Broken strips or lugs

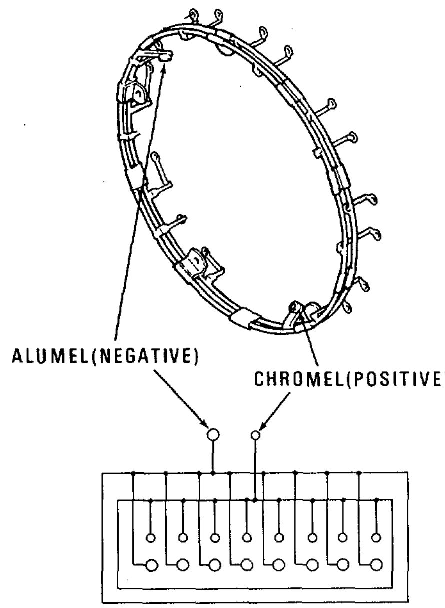
2. Replace damaged items.

GO TO NEXT PAGE

## 7-6 THERMOCOUPLE BUSBAR (AVIM) (Continued)

### 7-6-3 TESTING

Check insulation resistance between alumel and chromel terminals in turn and power section is not less than **10 megohms at 100 volts.**

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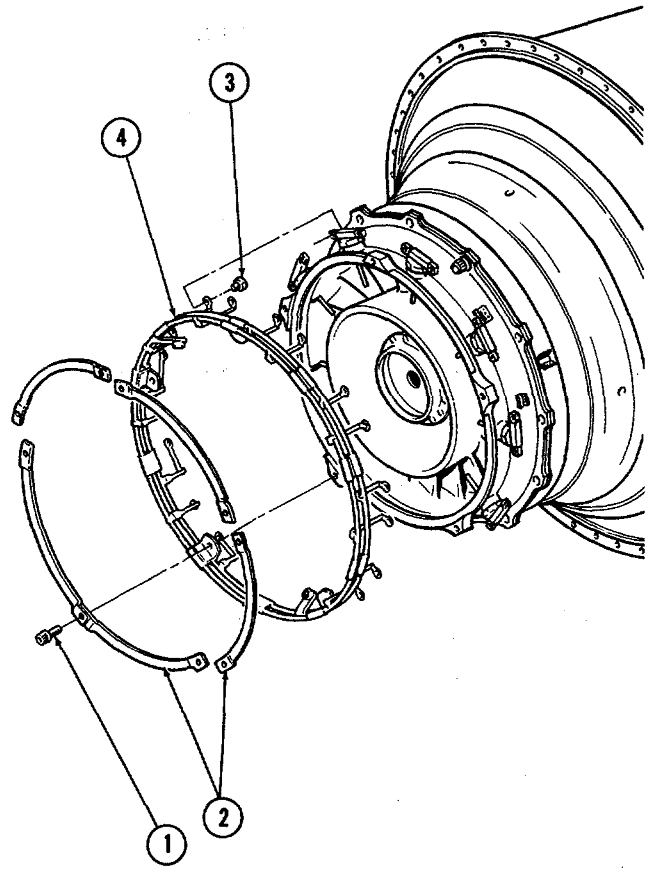
## 7-6 THERMOCOUPLE BUSBAR (AVIM) (Continued)

### 7-6-4 INSTALLATION

1. Install busbar (4), plates (2), if fitted, and bolts (1). Where plates (2) are fitted, torque bolts to 15 to 20 inchpounds otherwise to 20 to 30 inch-pounds.




**CAUTION**

**Thermocouple probe terminal bars are insulated with baked ceramic, which is extremely fragile. Do not hold probe by the body and avoid twisting terminal when tightening screws. Use 9/64 inch Allen head wrench for alumel terminal screws and 7/64 inch for chromel terminal screws.**

2. Insert smaller terminal screw in chromel terminals of thermocouple probe and larger screws in alumel terminals of probe. Insure that screw heads face towards front of engine. Hold each terminal bar with Pliers (T.74) and using Allen head wrenches, torque screws and individually secure each screw with Lockwire (E.4) to its terminal strap.

FOLLOW ON MAINTENANCE:

Connect Thermocouple Harness (Task 7-5-5)
Installation Power Section (Task 4-1-2)

GO TO NEXT PAGE

## Section VII THERMOCOUPLE PROBES

### 7-7 THERMOCOUPLE PROBES (AVIM)

This task covers:

a. Inspection (7-7-1)

b. Testing (7-7-2)

c. Removal (7-7-3)

d. Installation (7-7-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Wrench (T.56)
Wrench (T.57)
Simpson Meter

Materials:
Lockwire (E.4)

Parts:
Washer

Personnel Required:
68B Powerplant Mechanic
66F Aircraft Electrician

References:
TM 55-2840-251-23P

Equipment Condition:
Power Section Removed (Task 4-2-1)
Thermocouple Harness Disconnected (Task 7-5-1)
Thermocouple Busbar Removed (Task 7-6-1)

**GO TO NEXT PAGE**

## 7-7 THERMOCOUPLES PROBES (AVIM) (Continued)

### 7-7-1 INSPECTION

Replace probes if cracked, bent or if probes do not meet electrical test requirements (Task 7-7-2).

### 7-7-2 TESTING

1. Check resistance between each probe terminal is **0.24 to 0.46 ohm,** otherwise reject thermocouple.

2. Check insulation resistance between either terminal and sheath is not less than **10 megohms at 100 volts,** otherwise reject thermocouple.

### 7-7-3 REMOVAL

1. Remove lockwire and unscrew nut (3) using Wrench (T.56) or (T.57).

2. Remove probe (2) and washer (1). Discard washer.

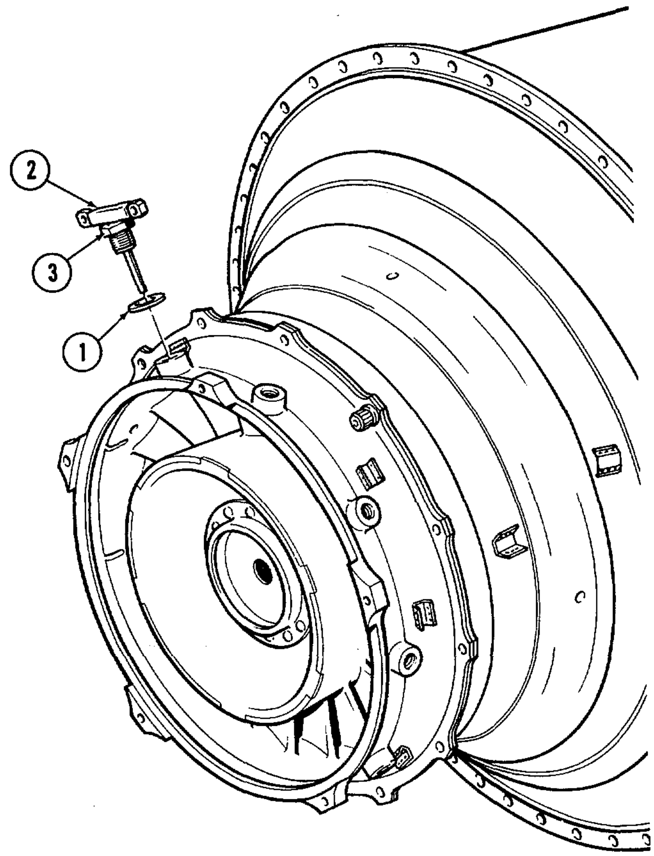
### 7-7-4 INSTALLATION

1. Install washer (1), nut (3) and probe (2). Torque nut to **40 to 50 inch-pounds** using Wrench (T.56) or (T.57).

2. Lockwire (E.4) nuts in pairs.

FOLLOW ON MAINTENANCE:

Installation Thermocouple Bushbar (Task 7-6-4) and/or
Connect Thermocouple Harness (Task 7-5-5)
Installation Power Section (Task 4-2-3)




**END OF TASK**

# CHAPTER 8

# OIL SYSTEM

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Oil System. It is divided into the following sections.:



**END OF OVERVIEW**

## Section I OIL FILTER ELEMENT

### 8-1 OIL FILTER ELEMENT

This task covers:

a. Removal (8-1-1)

b. Inspection (8-1-2)

b. Cleaning (8-1-3)

c. Installation (8-1-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Puller (T.33)

Materials:
Lubricating Oil (E.2) or (E.71)

Parts:
Preformed Packings

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
Chapter 1, Section VIII
TM 55-2840-251-23P

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

**GO TO NEXT PAGE**

## 8-1 OIL FILTER ELEMENT (Continued)

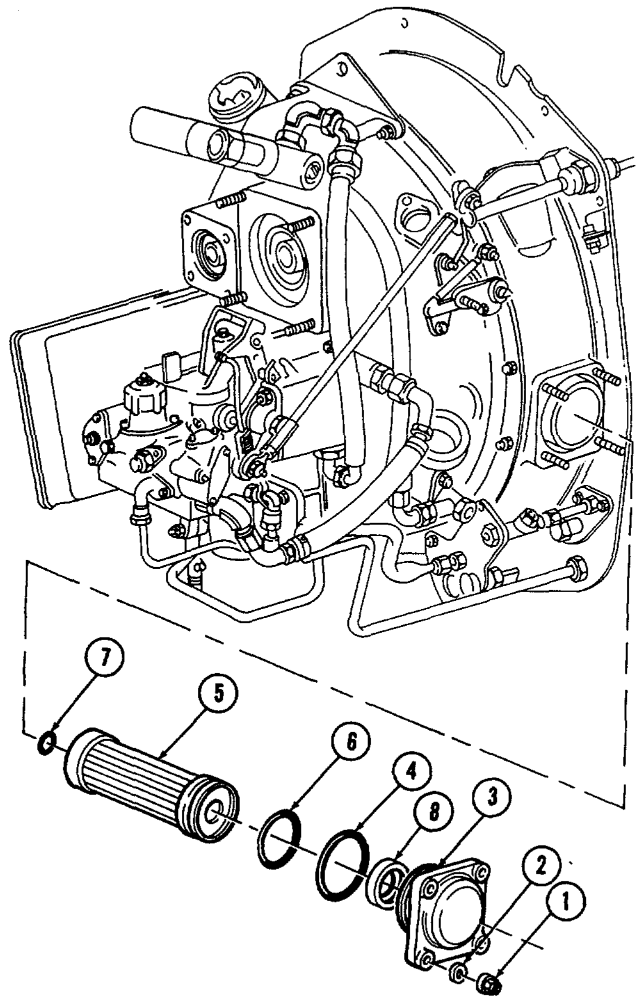
### 8-1-1 REMOVAL

1. Remove four self-locking nuts (1) and plain washers (2) securing filter cover (3). Remove cover and stepped teflon spacer (8).

2. Remove and discard preformed packing (4).

3. Using Puller (T.33), withdraw filter element (5) from filter body. Remove and discard preformed packing (6).

4. On engines with metal filters installed, remove and discard preformed packing (7).




### 8-1-2 INSPECTION

Inspect in accordance with Chapter 1, Section VIII, Paragraph 1-78.

### 8-1-3 CLEANING

Clean in accordance with Chapter 1, Section VIII, Paragraph 1-77.

GO TO NEXT PAGE

**8-1 OIL FILTER ELEMENT (Continued)**

### 8-1-4 INSTALLATION

1. If metal filter element is installed, lubricate (E.2) or (E.71) new preformed packing (7) and install in inner end of element.

2. Lubricate (E.2) or (E.71) and install new preformed packing (6) on outer end of element.

3. Insert element, perforated end leading, into filter body in compressor inlet case.

4. Lubricate (E.2) or (E.71) and install new preformed packing (4) on filter cover (3).

5. Install filter cover on compressor inlet case mounting pad studs and secure with four plain washers (2) and self-locking nuts (1). Torque nuts to **32 to 36 inch-pounds.**

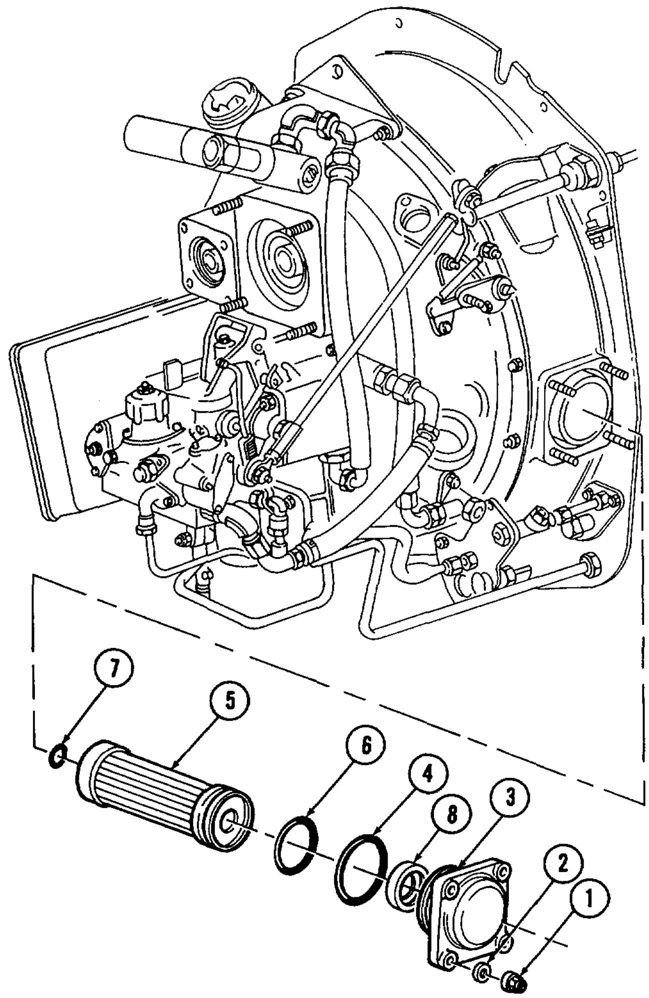
**NOTE**

**When installing cover, insure preformed packing is not trapped or damaged**

6. Inspect.

FOLLOW ON MAINTENANCE:,

None




**END OF TASK**

## Section II OIL LINES AND FITTINGS

### 8-2 OIL LINES AND FITTINGS

This task covers:

a. Removal (8-2-1)

b. Cleaning (8-2-2)

c. Inspection (8-2-3)

d. Repair (8-2-4)

e. Installation (8-2-5)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)
Puller (T.27)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)
Varsol (E.9)
Alodine (E.40)
Crocus Cloth (E.41)

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

Equipment Condition:
Oil Drained
(TM55-1510-214-23)

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

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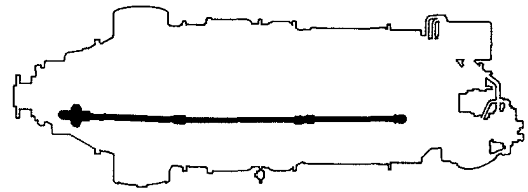
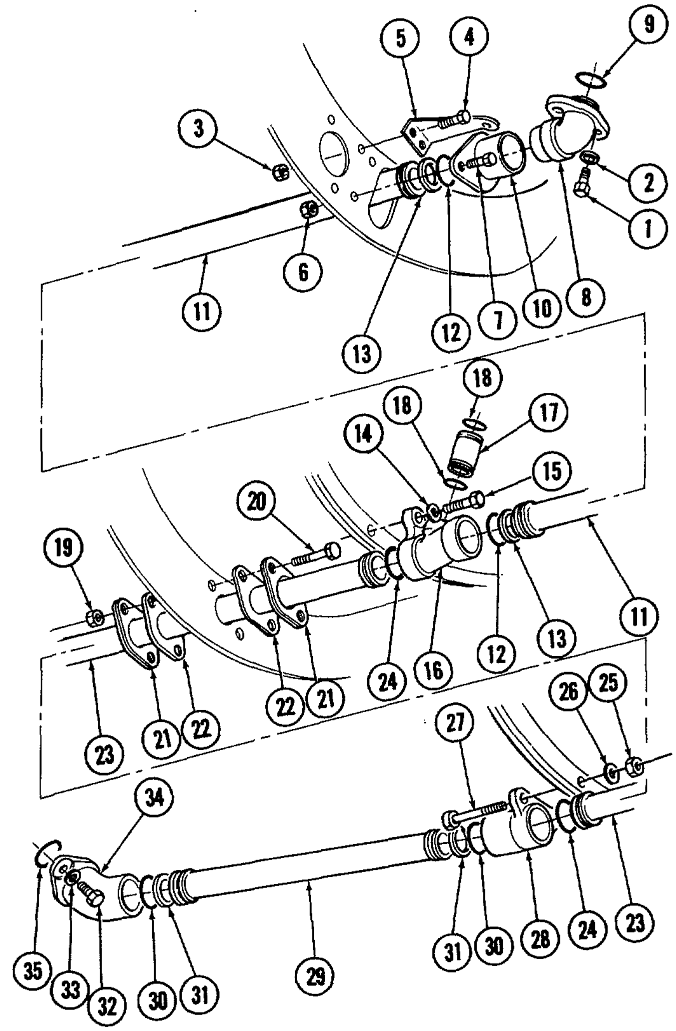
## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-1 REMOVAL






**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames.**

- **Use only in areas with adequate ventilation.**
- **Wash hands thoroughly after handling.**

**CAUTION**

**All pressure and scavenge oil tubes must be handled with care. When tubes and fittings are removed from the engine, they must be capped and individually labeled to facilitate reinstallation.**

1. Cut lockwire and remove bolts (32) and plain washers (33) securing reduction gearbox elbow (34) to boss on gearbox case.
2. Remove self-locking nuts (25), washers (26) and deeheaded bolts (27) securing oil transfer coupling assembly (28) to flange C.
3. Withdraw reduction gearbox elbow (34) from gearbox case. Remove and discard preformed packing (35).

GO TO NEXT PAGE

## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-1 REMOVAL (Cont)

4. Remove front section of pressure oil tube (29) from coupling assembly (28). Remove and discard preformed packings (30), and on engines with stainless steel tube (29) installed, remove packing retainers (31) from each end of tube (29).

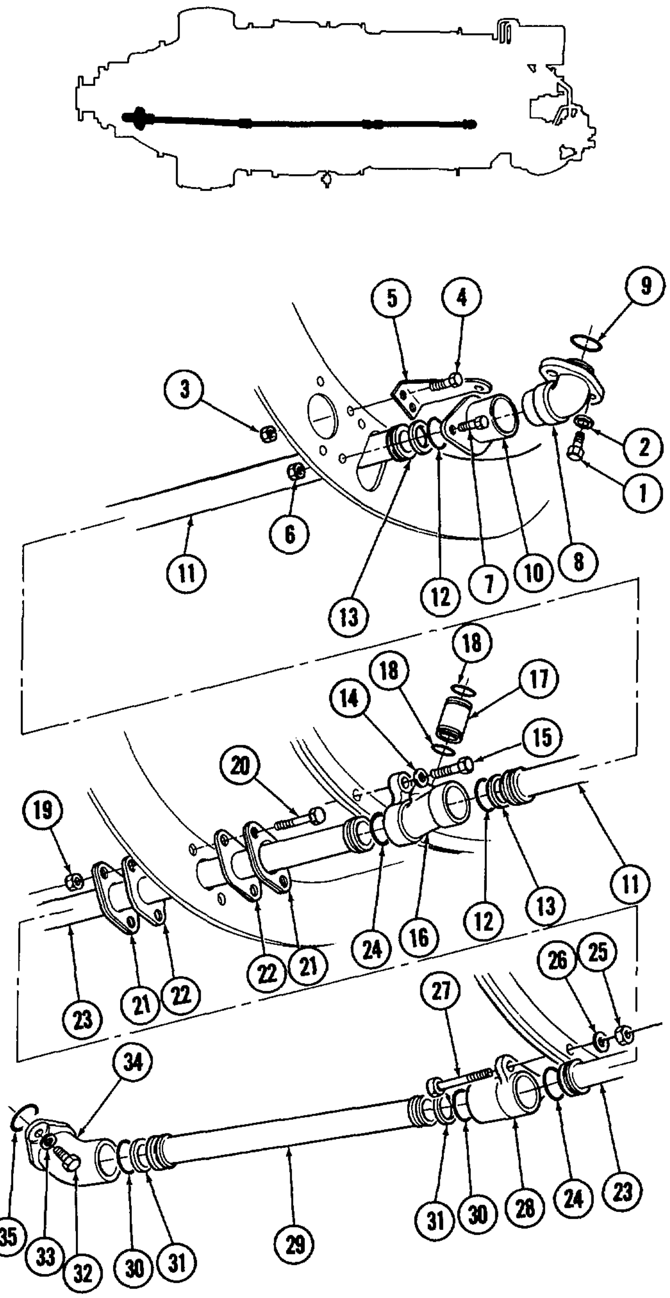
5. Remove coupling assembly (28) from flange C.

6. Remove self-locking nuts (19) and bolts (20), securing seal retaining plates (21) and seals (22) to center fireseal mount ring. Remove pressure oil tube center section (23) and seal plates. Remove and discard preformed packings (24).

7. Cut lockwire and remove bolts (15) and washers (14), securing tee assembly (16) to gas generator case.

8. Remove self-locking nuts (6) and bolts (7), securing flanged sleeve sealing assembly (10) to rear fireseal mount ring.

9. Remove tee coupling (16) and withdraw oil tube rear section (11) and, using Puller (T.27), remove No. 2 bearing internal oil pressure transfer tube (17). Remove and discard preformed packings (12) and (18); on engines with stainless steel tube (11) installed, remove packing retainers (13).



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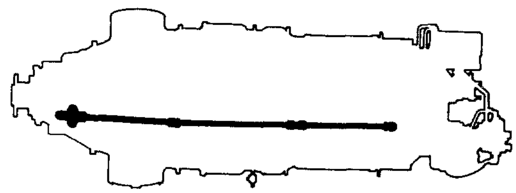
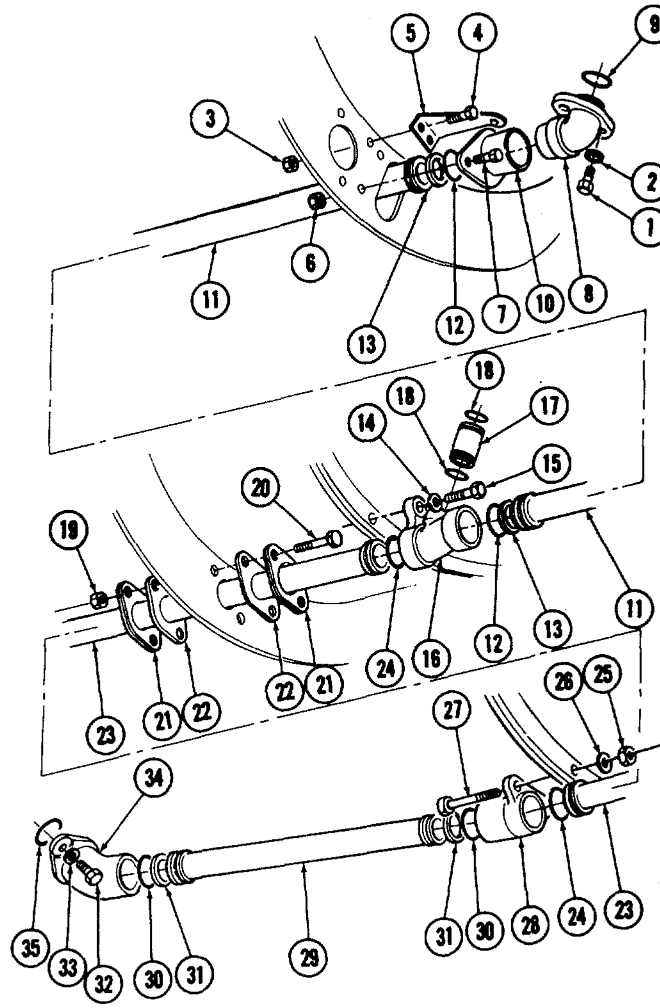
## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-1 REMOVAL (Cont)

10. Cut lockwire and remove two bolts (1), one washer (2), two self-locking nuts (3) and bolts (4), bracket (5), elbow (8) and sealing sleeve (10). Remove sleeve (10) from elbow (8), remove and discard preformed packing (9).



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## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-1 REMOVAL (Cont)

11. Cut lockwire and remove bolts (38) and plain washers (39) securing scavenge oil elbow (40) to reduction gearbox case.

12. Remove elbow (40), oil transfer sleeve (42) and two transfer tubes (36). Remove and discard preformed packings (37) and (44) from transfer tubes and oil transfer sleeve. Remove preformed packing (43) and sealing sleeve (41) from elbow (40) and discard preformed packing.

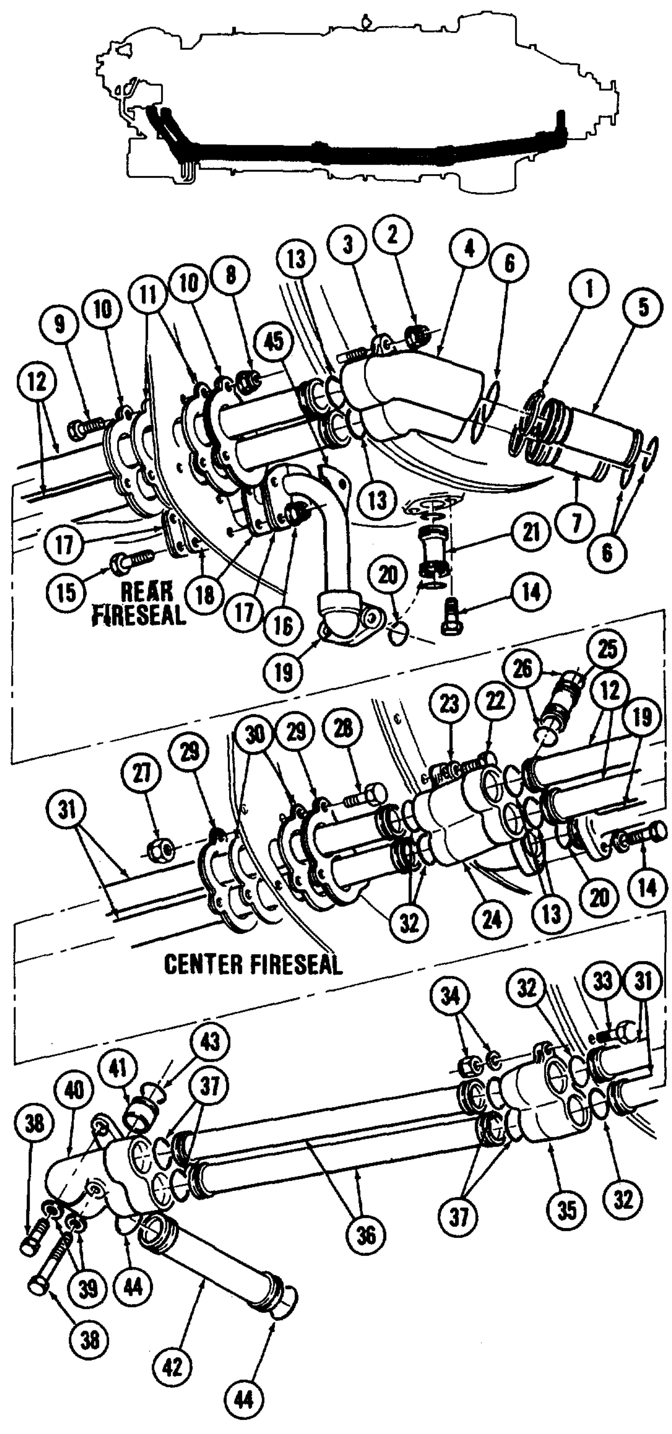
13. Remove two self-locking nuts and washers (34) and two deeheaded bolts (33), securing scavenge coupling assembly (35) to flange C. Remove coupling assembly.

14. Remove self-locking nuts (27) and bolts (28), securing seals (30) and retaining plates (29) to center fireseal mount ring. Remove oil transfer tubes (31), seals (30) and plates (29). Remove and discard four preformed packings (32).

15. Cut lockwire and remove two bolts (14) securing No. 2 bearing scavenge tube assembly (19) to coupling (24).

16. Remove self-locking nuts (16) and bolts (15), securing seals (18) and half-plates (17) and (45), to both sides of rear fireseal mount ring.

17. Cut lockwire and remove bolts (14), securing No. 2 bearing scavenge tube assembly (19) to compressor inlet case.

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## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-1 REMOVAL (Cont)

18. Remove tube assembly (19), seals (18) and half-plates (17) and (45). Remove and discard preformed packings (20).

19. Remove internal transfer tube (21) (Task 5-3).

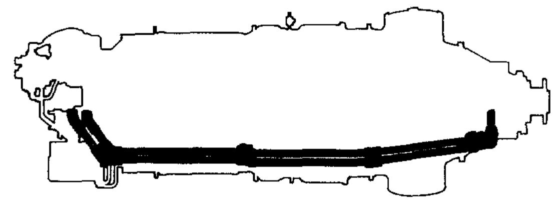
20. Cut lockwire and remove bolts (22) and washers (23),securing coupling (24) to gas generator case.

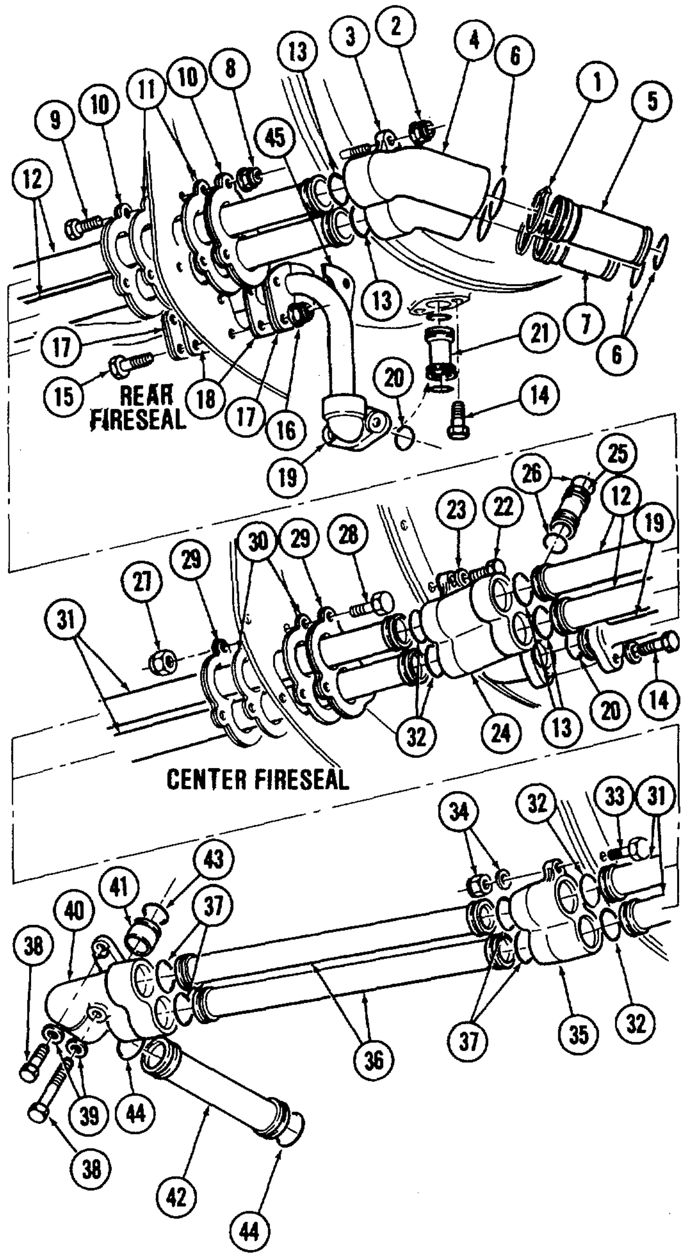
21. Remove coupling (24), complete with No. 2 bearing internal scavenge tube (25). Remove tube (25) from coupling and discard preformed packings (26).

22. Remove three self-locking nuts (8) and bolts (9), securing seals (11) and retaining plates (10), to rear fireseal mount ring. Remove transfer tubes (12), seals (11) and retaining plates (10). Remove and discard preformed packings (13).

23. Remove retaining rings (1), securing transfer tubes (5) and (7). Push tubes into elbow (4) to clear scavenge pump ports.

24. Remove self-locking nuts (2) and washers (3), securing oil scavenge tube elbow (4) to flange G. Remove elbow and transfer tubes (5) and (7). Remove tubes from elbow and discard four preformed packings (6).



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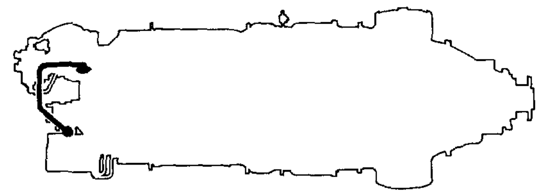
## 8-2 OIL LINES AND FITTINGS (Cont inued)

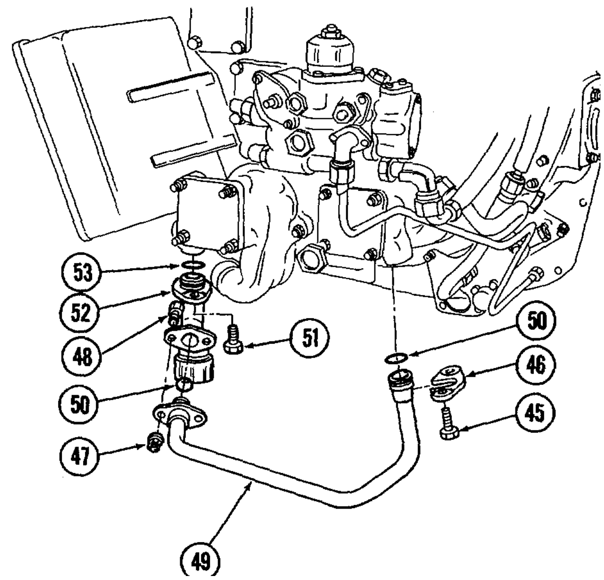
### 8-2-1 REMOVAL (Cont)

25. Remove self-locking nuts (47) and bolts (48), securing scavenge oil tube assembly (49) to external scavenge pump tee (52).

26. Cut lockwire and remove two bolts (45) and oil tube retaining plate (46), securing scavenge oil tube (49) to accessory gearbox case. Remove scavenge oil tube assembly (49) and discard preformed packings (50).

27. Cut lockwire and remove two bolts (51), securing scavenge oil tee (52) to external scavenge pump. Remove tee and discard preformed packing (53).






### 8-2-2 CLEANING

**WARNING**

**When using compressed air for cleaning, use approved protective equipment for eyes and face. Do not use more than 30 psig air pressure. Do not direct air toward yourself or another person. Failure to comply could result in injury to eyes or skin. In case of injury, get medical attention.**

1. Clean all external oil tubes and fittings by flushing internally and spraying externally with Varsol (E.9).

2. Dry all cleaned tubes and fittings with filtered, clean, dehydrated compressed air.

3. After cleaning and drying, install caps or plugs to all tubes and fittings to prevent entry of foreign matter.

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### 8-2-3 INSPECTION

1. Inspect for:

a. Scratches. Circumferential scratches are acceptable, providing they do not exceed 45 degree segment on circumference. Any number of scratches are permissible. Longitudinal scratches must not exceed 0.500 inch in length; any number of scratches within these limits are permissible. Blend out either type of scratch formation, providing depth of blend does not exceed 0.005 inch.

b. Nicks and Chafing. Acceptable, providing 75% of wall thickness remains after blending. Each blended area must not exceed one-half square inch.

c. Dents. Round bottom dents are permissible, provided the depth is not greater than 10% of the normal outside diameter of the tube. No more than three dents to the maximum depth per 12 inch length of tube is permissible, and such dents shall be separated by at least 0.250 inch. No dents are to be within 0.250 inch of ferrules or fittings.

**NOTE**

**Dents are unacceptable within one inch of ferrule scarf-welds, or in the area of a bend.**

d. Pits. Minor isolated pitting is allowed, if pitting is not greater than 0.003-inch in depth. Clusters of pits should be blended out to a maximum depth of 0.005-inch.

e. Corrosion. Rust and stains are acceptable, providing they can be removed by light polishing with Crocus Cloth (E.41).

### 8-2-4 REPAIR

1. Scratches, nicks, chafing, and pits which are within the requirements of Task 8-2-3. After blending, touch-up the reworked area as follows:

a. Wash affected area with a solution of mild soap and fresh water. Wipe dry with a clean, soft lint-free cloth.

b. Apply Alodine (E.40) solution liberally with a swab. Allow solution to remain on surface for not less than three minutes, but not more than five minutes.

c. Rinse treated area with clean, fresh water and wipe dry with a clean, lint-free cloth.

**NOTE**

**After alodine treatment, affected area will appear to have a rust stain.**

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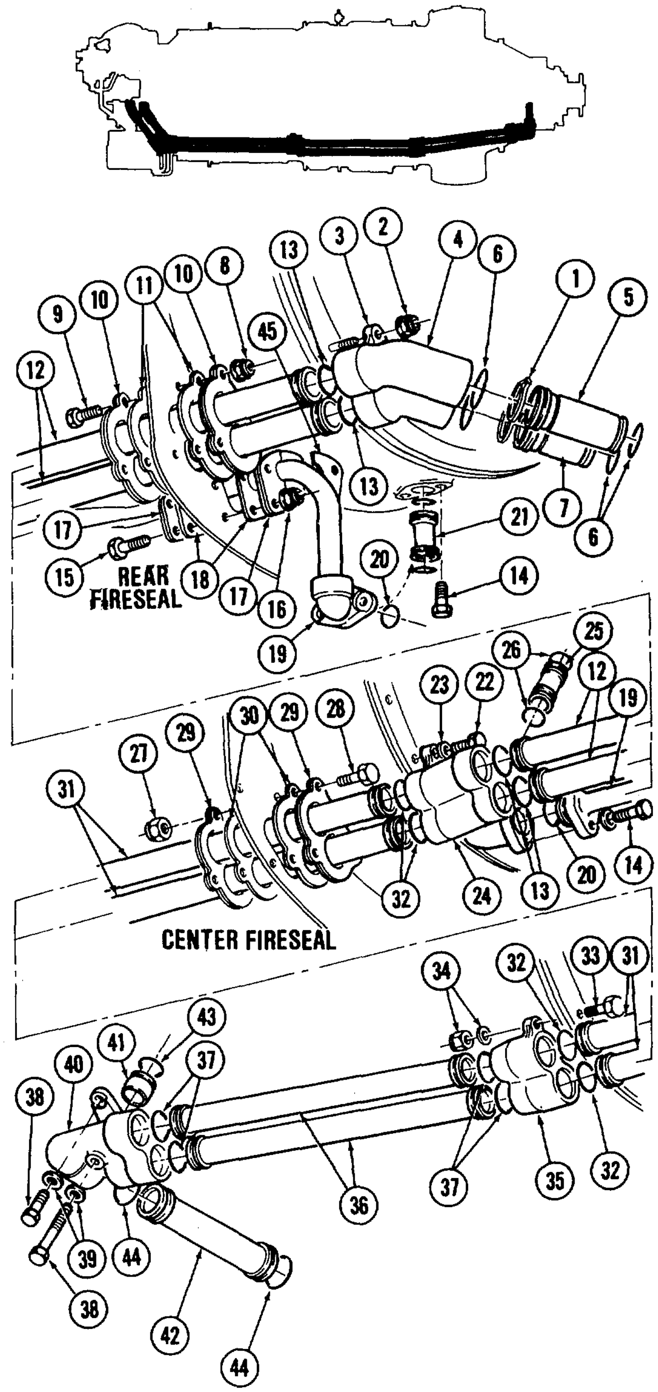
## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-5 INSTALLATION




**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames.**

- **Use only in areas with adequate ventilation.**
- **Wash hands thoroughly after handling.**

**NOTE**

**1. Lightly smear Lubricating Oil (E.2) or (E.71) on all preformed packings before installation.**

**2. Install all fireseal mount ring seal and bracket securing nuts and bolts with bolt head on side of mount ring nearest air inlet case.**

1. Install two new preformed packings (44) on oil transfer tube (42) and insert tube into scavenge oil elbow (40). Insert new preformed packing (43) and sealing sleeve (41) into port in elbow (40).

**GO TO NEXT PAGE**

## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-5 INSTALLATION (Cont)

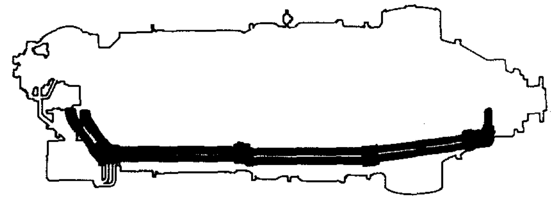
2. Install oil transfer tube (42) into port in reduction gearbox and secure elbow (40) to gearbox mount pad with three bolts (38) and washers (39). Torque bolts to **36 to 40 inch-pounds** and lockwire (E.5).

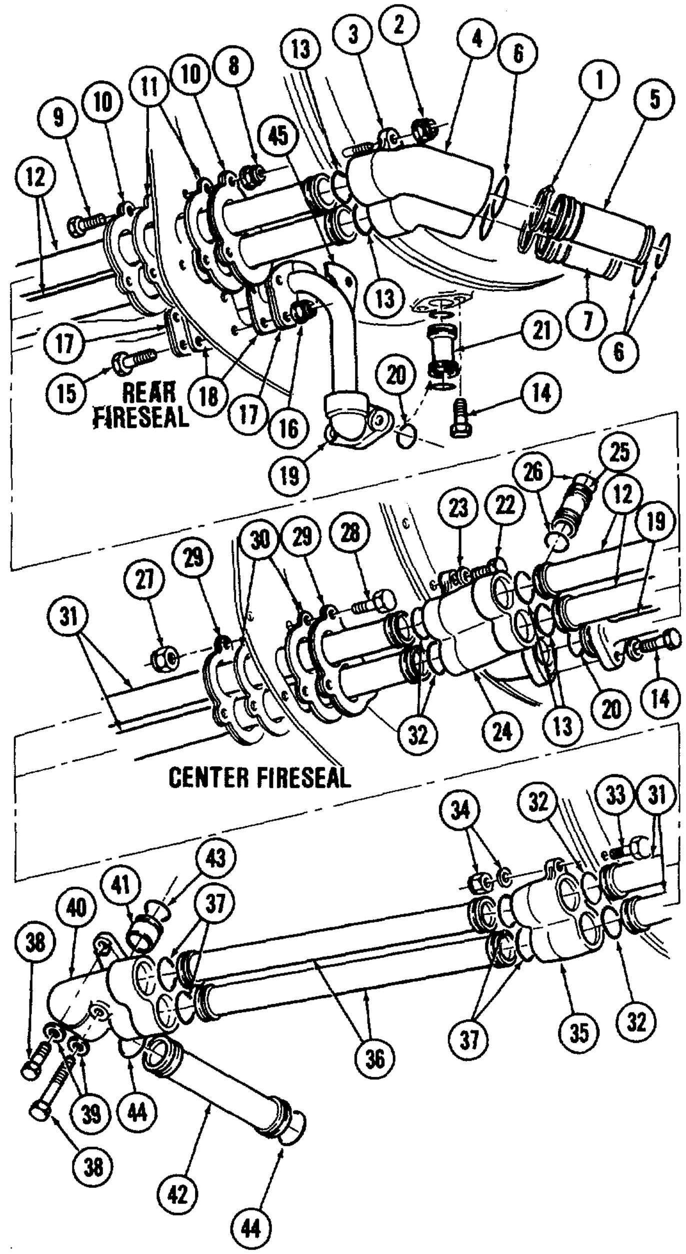
3. Install two new preformed packings (37) on each transfer tube (36) and insert one end of each tube into elbow (40).

4. Slide scavenge coupling assembly (35) over the two transfer tubes (36) and locate coupling assembly on front face of flange C, insuring that locating pin on coupling engages locating hole in flange. Secure coupling to flange C with three D-bolts (33), washers and self-locking nuts (34). Torque nuts to **36 to 40 inch-pounds.**

5. Install two new preformed packings (32) on both transfer tubes (31). Carefully insert tubes (31) through center fireseal mount ring towards the reduction gearbox. Install one seal (30) and retaining plate (29) on forward end of tubes (31) and insert tubes into coupling (35).

6. Install one seal (30) and retaining plate (29) on rear end of tubes (31). Secure plates (29) and seals (30) to center fireseal mount ring with three bolts (28) and self-locking nuts (27). Torque nuts **fingertight plus 180 degrees**.





## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-5 INSTALLATION (Cont)

7. Install two new preformed packings (26) on No. 2 bearing internal scavenge tube (25) and install into gas generator case.

8. Install coupling (24) over rear ends of transfer tubes (31). Install coupling (24) on gas generator case split line and secure with plain washers (23) and bolts (22). Torque bolts to **36 to 40 inch-pounds** and lockwire (E.5).

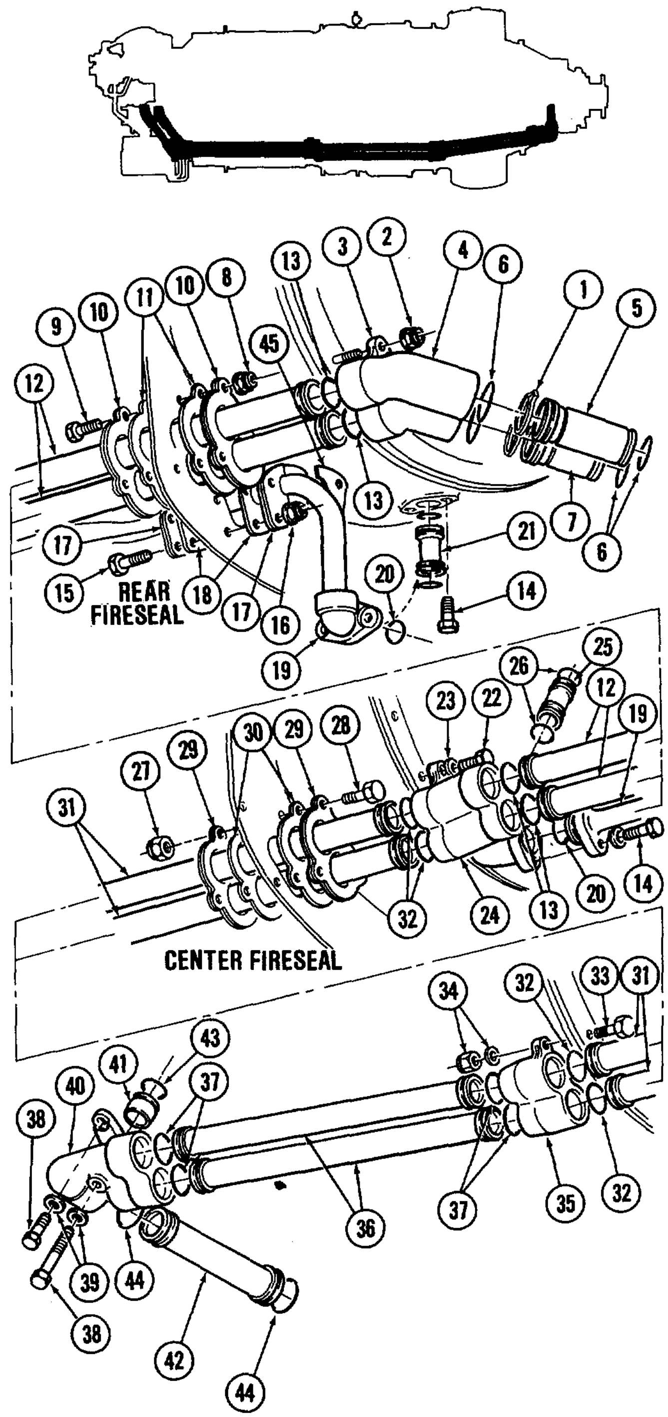
9. Install internal transfer tube (21) (Task 5-3).

10. Install two new preformed packings (20) on No. 2 bearing scavenge oil tube (19) flanges, insert forward flange through rear fireseal mount ring and secure to coupling (24) with two bolts (14). Torque bolts to **36 to 40 inch-pounds** and lockwire (E.5).

11. Secure rear flange of tube (19) to pad on inlet case with two bolts (14). Torque bolts to **36 to 40 inch-pounds** and lockwire (E.5).

12. Install split seals (18) and half-plates (17) and (45) over tube (19) on either side of rear fireseal mount ring. Secure seals and plates with bolts (15) and self-locking nuts (16). Torque nuts **fingertight plus 180 degrees**.

13. Install new preformed packings (13) on both ends of transfer tubes (12).

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## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-5 INSTALLATION (Cont)

14. Install tubes, from air inlet case side, through one retaining plate (10), one seal (11), rear fireseal mount ring, another seal (11) and retaining plate (10), into ports in coupling (24).

15. Secure seals and retaining plates to rear fireseal mount ring with three bolts (9) and self-locking nuts (8). Torque nuts **fingertight plus 180 degrees**.

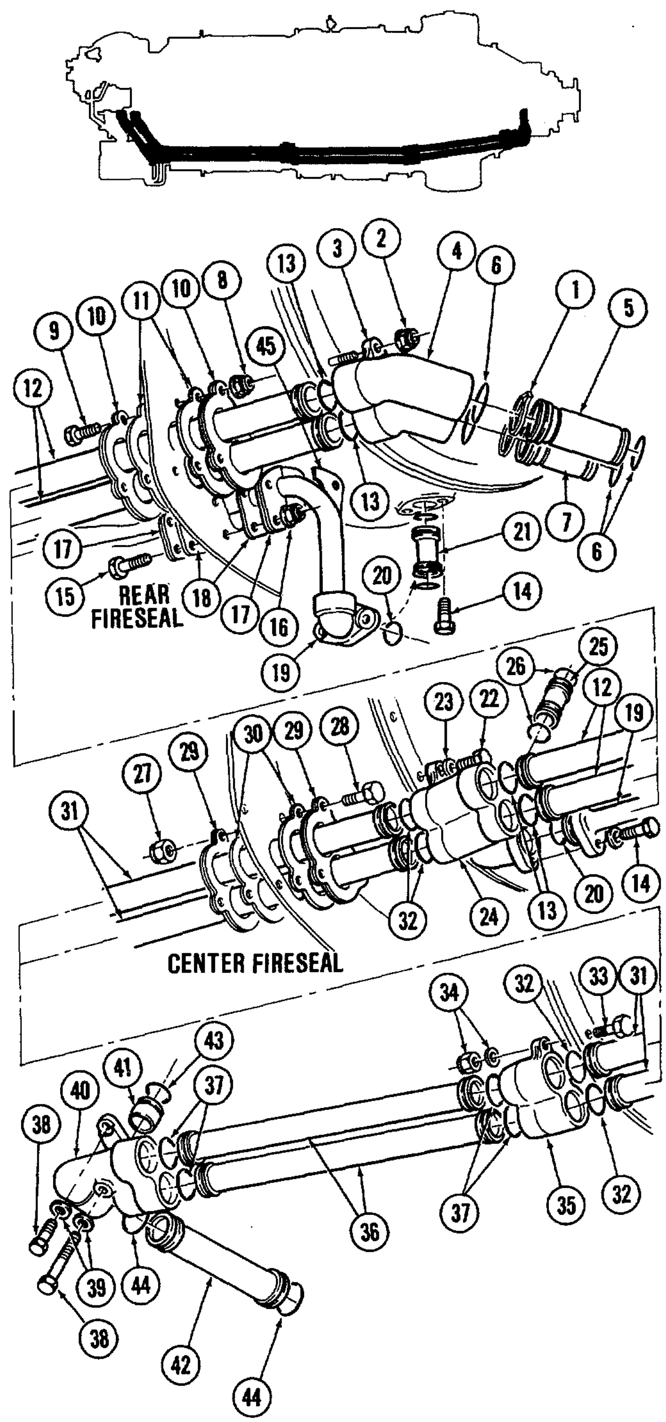
16. Install retaining rings (1) and two new preformed packings (6) on transfer tubes (5) and (7). Locate retaining rings on center section of tubes, not in their retaining grooves.

17. Insert transfer tube (5), retaining ring groove end, leading into outboard port in elbow (4); push in to full depth of counterbore.

18. Insert transfer tube (7), retaining ring groove end, leading into inboard port in elbow (4); push in to full depth of counterbore.

19. Install oil transfer elbow (4) onto two transfer tubes (12). Locate elbow on flange G studs and secure with two plain washers (3) and self-locking nuts (2). Torque nuts to **32 to 36 inch-pounds**.

20. Slide transfer tubes (5) and (7) out of elbow (4) and engage them in external scavenge pump ports. Slide retaining rings (1) along tubes (5) and (7) and engage in grooves on tubes.

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**8-2 OIL LINES AND FITTINGS (Continued)**

**8-2-5 INSTALLATION (Cont)**

21. Assemble two new preformed packings (30) and, only on engines incorporating stainless steel tubes, two packing retainers (31) on transfer tube (29). Insert tube into elbow (34).

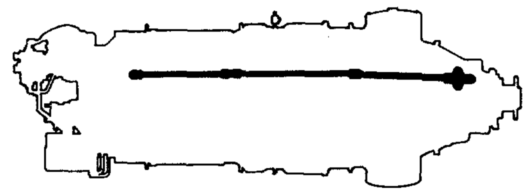
**NOTE**

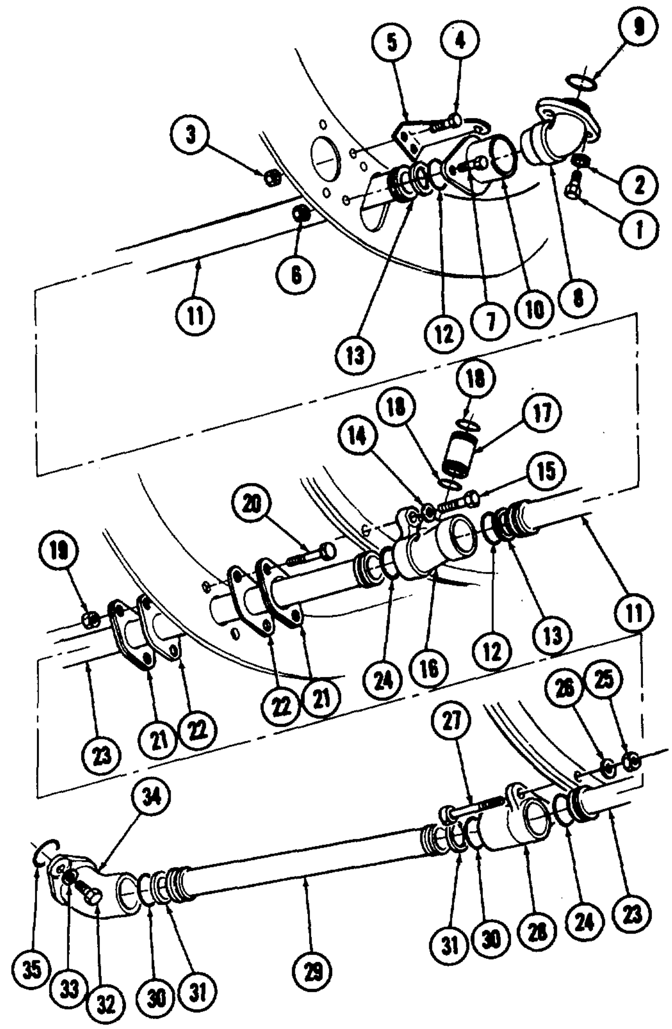
**Insure preformed packings are nearest tube ends as shown.**

22. Install new preformed packing (35) on elbow (34) flange. Locate elbow on reduction gearbox mounting boss and secure with two plain washers (33) and bolts (32). Torque bolts to **36 to 40 inch-pounds** and lockwire (E.5).

23. Carefully install coupling (28) over rear end of transfer tube (29) and locate on flange C, insuring locating pin engages correctly with hole in flange C. Secure coupling to flange C with two dee-head bolts (27), plain washers (26) and self-locking nuts (25). Torque nuts to **36 to 40 inch-pounds.**

24. Install two new preformed packings (24) on center transfer tube (23). Install tube (23) from the rear through one retaining plate (21), one seal (22), center fireseal mount ring, another seal (22) and retaining plate (21) into rear end of coupling (28). Secure plates and seals to center fireseal mount ring with two bolts (20) and self-locking nuts (19). Torque nuts **fingertight plus 180 degrees.**



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## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-5 INSTALLATION (Cont)

25. Install two new preformed packings (18) on No. 2 bearing internal transfer tube (17) and insert tube into gas generator case.

26. Locate pressure oil transfer tee (16) on gas generator case rear split line. Mate internal transfer tube (17) and end of transfer tube (23) to their respective ports. Secure tee (16) to gas generator case with two plain washers (14) and bolts (15). Torque bolts to **32 to 36 inch-pounds** and lockwire (E.5).

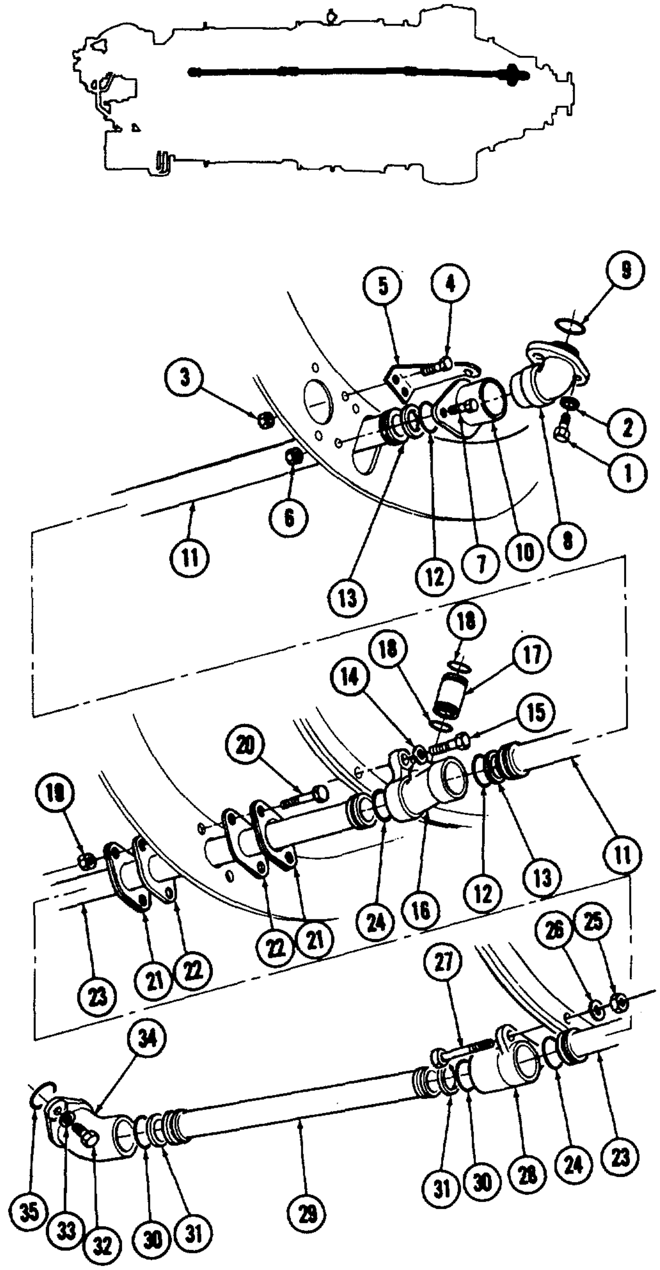
27. Install new preformed packing (12) and, only on engines incorporating stainless steel transfer tube, two packing retainers (13) on each end of transfer tube (11) and insert tube through rear fireseal mount ring into tee (16).

**NOTE**

**Preformed packings are installed nearest tube ends as shown.**

28. Install sealing sleeve (10) on plain end of elbow (8) and new preformed packing (9) on flanged end. Install sleeve (10) over transfer tube (11) and flanged end of elbow into boss on inlet case.

29. Secure sleeve (10) to rear fireseal mount ring with two bolts (7) and self-locking nuts (6). Torque nuts to **36 to 40 inch-pounds.**



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**8-2 OIL LINES AND FITTINGS (Continued)**

**8-2-5 INSTALLATION (Cont)**

30. Install locating bracket (5) on rear fireseal locating over bolt hole in elbow (8) flange. Secure bracket to mount ring with two bolts (4) and self-locking nuts (3). Torque nuts to **36 to 40 inch-pounds**.

31. Secure elbow (8) to inlet case with two bolts (1), one washer (2) and already installed bracket (5). Torque bolts to **36 to 40 inch-pounds** and lockwire (E.5).

**GO TO NEXT PAGE**

## 8-2 OIL LINES AND FITTINGS (Continued)

### 8-2-5 INSTALLATION (Cont)

32. Install new preformed packing (53) on scavenge oil tee (52) and install tee in external oil scavenge pump boss. Secure tee with two bolts (51). Torque bolts to **36 to 40 inch-pounds** and lockwire (E.5).

33. Install new preformed packings (50) on each end of tube assembly (49). Install flanged end of tube assembly in tee and plain end into accessory gearbox boss.

34. Secure flanged end to tee with two bolts (48) and self-locking nuts (47). Torque nuts to **36 to 40 inch-pounds**.

35. Secure plain end to accessory gearbox with retaining plate (46) and two bolts (45). Torque bolts to **36 to 40 inch- pounds** and lockwire (E.5).

36. Inspect.

FOLLOW ON MAINTENANCE:

Perform Engine Motoring Run (Chapter 1, Section VIII) and Check for Leaks and Security

**END OF TASK**

## Section III OIL-TO-FUEL HEATER

### 8-3 OIL-TO-FUEL HEATER

This task covers:

a. Removal (8-3-1)

b. Inspection (8-3-2)

c. Installation (8-3-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 500 inch-pounds)

Materials:
Lockwire (E.5)
Petroleum (E.20)

Parts:
Preformed Packings
Packing Retainer

References:
TM55-1510-209-23

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

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## 8-3 OIL-TO-FUEL HEATER (Continued)

### 8-3-1 REMOVAL

1. Disconnect fuel inlet hose from inlet connection (12).

2. Cut lockwire and disconnect fuel outlet hose connection (1) from elbow (7).

3. Remove three bolts (2) and washers (3) securing oil-to-fuel heater (4) to heater mounting bracket (13). Remove heater (4).

4. Withdraw two packing transfer tubes (10). Remove and discard preformed packings (5) and (11).

5. If oil-to-fuel heater is to be replaced, back off locknut (6) and remove elbow (7). Remove and discard preformed packing (9) and backup ring (8). Remove locknut (6).

### 8-3-2 INSPECTION

1. Inspect all inlet and outlet ports for general condition.

2. Inspect threads for cleanliness and freedom from burrs.

3. Inspect mating faces for surface damage. No damage allowed.

GO TO NEXT PAGE

**8-3 OIL-TO-FUEL HEATER (Continued)**

### 8-3-3 INSTALLATION

1. If replacement heater is to be installed, proceed as follows:

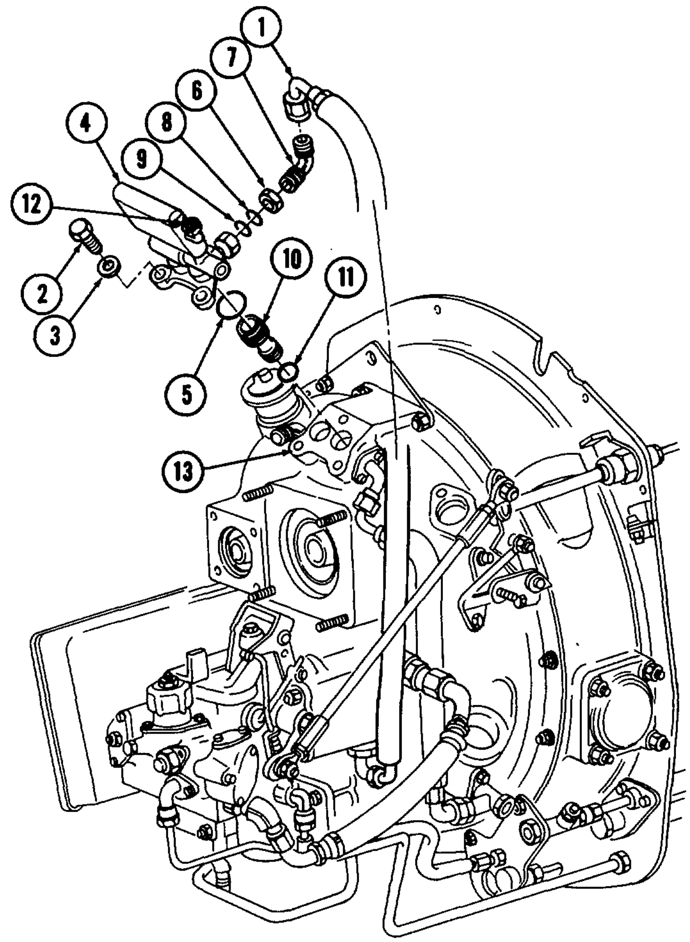
a. Coat new preformed packing (9) and packing retainer (8) and threads of elbow (7) and locknut (6) with Petroleum (E.20).

b. Install packing retainer (8) in recess of locknut (6) and screw locknut onto elbow (7). Install preformed packing (9) into recess on threaded portion of elbow (7).

c. Install elbow into fuel output port of fuel heater (4) and screw in until preformed packing contacts port face. Hold nut stationary and turn elbow one and one-half turns inwards. Position elbow for correct alignment with fuel output hose connection (1). Hold elbow stationary and torque locknut to **145 to 155 inch-pounds** and lockwire (E.5).

2. Install new preformed packings (5) and (11) in large and small diameter grooves of packing transfer tubes (10), respectively. Install tubes into ports of fuel heater (4), large diameter leading.

3. Carefully install fuel heater and transfer tubes onto mounting bracket (13), locating tubes in bracket port housing ports. Secure with three plain washers (3) and bolts (2). Torque bolts (2) to **32 to 35 inch-pounds** and lockwire (E.5).

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## 8-3 OIL-TO-FUEL HEATER (Continued)

### 8-3-3 INSTALLATION (Cont)

4. Connect fuel outlet hose connection (1) to fuel heater elbow (7). Torque connection to **450 to 500 inch-pounds** and lockwire (E.5).

5. Connect fuel inlet hose to inlet connection (12) (TM55-1510-209-23).

6. Inspect.

FOLLOW ON MAINTENANCE:

Perform Engine Motoring Run (Chapter 1, Section VIII) and Check for Leakage.

**END OF TASK**

**Section IV OIL PRESSURE RELIEF VALVE**

## 8-4 OIL PRESSURE RELIEF VALVE

This task covers:

a. Removal (8-4-1)

b. Cleaning (8-4-2)

c. Installation (8-4-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)
Puller (T.22)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)
Varsol (E.9)

Parts:
Preformed Packings

Personnel Required:
68B Powerplant Mechanic

References:
Chapter 1, Section X, Testing
TM55-2840-251-23P

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

**GO TO NEXT PAGE**

## 8-4 OIL PRESSURE RELIEF VALVE (Continued)

### 8-4-1 REMOVAL

1. Remove two bolts (1) and flat washers (2) securing cover (3) to compressor inlet case.

2. Insert head of Puller (T.22) in top of cover (3) and turn head 90 degrees. Use weight on puller to remove cover. Remove and discard preformed packing (4).

3. Remove valve spring (5), spacer(s) (6), bypass valve (7) and relief valve body (8). Remove and discard preformed packing (9).

**NOTE**

**Record number of spacers removed.**

### 8-4-2 CLEANING

1. Clean all components in Varsol (E.9).

**<u>WARNING</u>**

**When using compressed air for cleaning, use approved protective equipment for eyes and face. Do not use more than 30 psig air pressure. Do not direct air toward yourself or another person. Failure to comply could result in injury to eyes or skin. In case of injury, get medical attention.**

2. Dry with clean, filtered, dehydrated compressed air.

### 8-4-3 INSTALLATION

**NOTE**

**Lightly smear all new preformed packings with Lubricating Oil (E.2) or (E.71).**

1. Install new preformed packing (9) in recess on base of relief valve body (8). Install bypass valve (7) in valve body and insert quantity of spacers (6) recorded in Task 8-4-1. Install valve spring (5).

GO TO NEXT PAGE

## 8-4 OIL PRESSURE RELIEF VALVE (Continued)

### 8-4-3 INSTALLATION (Cont)

2. Install new preformed packing (4) on cover (3) and install cover on compressor inlet case. Secure with two flat washers (2) and bolts (1). Torque bolts to **32 to 35 inch-pounds** and lockwire (E.5).

FOLLOW ON MAINTENANCE:,

Test Engine for Correct Valve Function (Chapter 1, Section x).

**END OF TASK**

# CHAPTER 9

# PROPELLER GEARBOX

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for the Propeller Gearbox. It is divided into the following sections.



**END OF OVERVIEW**

## Section I PROPELLER GEARBOX

### 9-1 PROPELLER GEARBOX

This task covers:

a. Removal (9-1-1)

b. Inspection (9-1-2)

c. Repair (9-1-3)

d. Installation (9-1-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powertrain Mechanic's Tool Kit NSN 5180-00-003-5267
Torque Wrench (0 to 100 inch-pounds)
Lifting Eye (T.9)

Materials:
Lubricating Oil (E.2) or (E.71)
Crocus Cloth (E.41)
Chromic Acid (E.43)
Enamel (E.44)
Chemical Resistance Gloves (E.82)

Parts:
Packings

Personnel Required:
68D Powertrain Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Power Section Removed (Task 4-1-1)
Power Turbine Rotor Assembly Removed (Task 4-4-1)
Exhaust Duct Removed (Task 4-7-1)

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.

**WARNING**

Acids are injurious. Wear protective clothing and goggles when handling. If injury occurs, GET MEDICAL ATTENTION.

**GO TO NEXT PAGE**

## 9-1 PROPELLER GEARBOX (Continued)

### 9-1-1 REMOVAL

Remove nuts (1) from studs on propeller gearbox rear housing (2) and remove power turbine shaft housing (3). Discard packings (4), (5) and (6).

### 9-1-2 INSPECTION

1. Inspect all studs for bending or damaged threads, which shall be cause for replacement (Task 9-1-3).

2. Inspect mounting faces for minor burrs or nicks, which may be dressed out (Task 9-1-3).

3. Inspect gearbox front case and rear housing for corrosion, which shall be removed (Task 9-1-3).

4. Inspect paint work for defects, which shall be repaired (Task 9-1-3).

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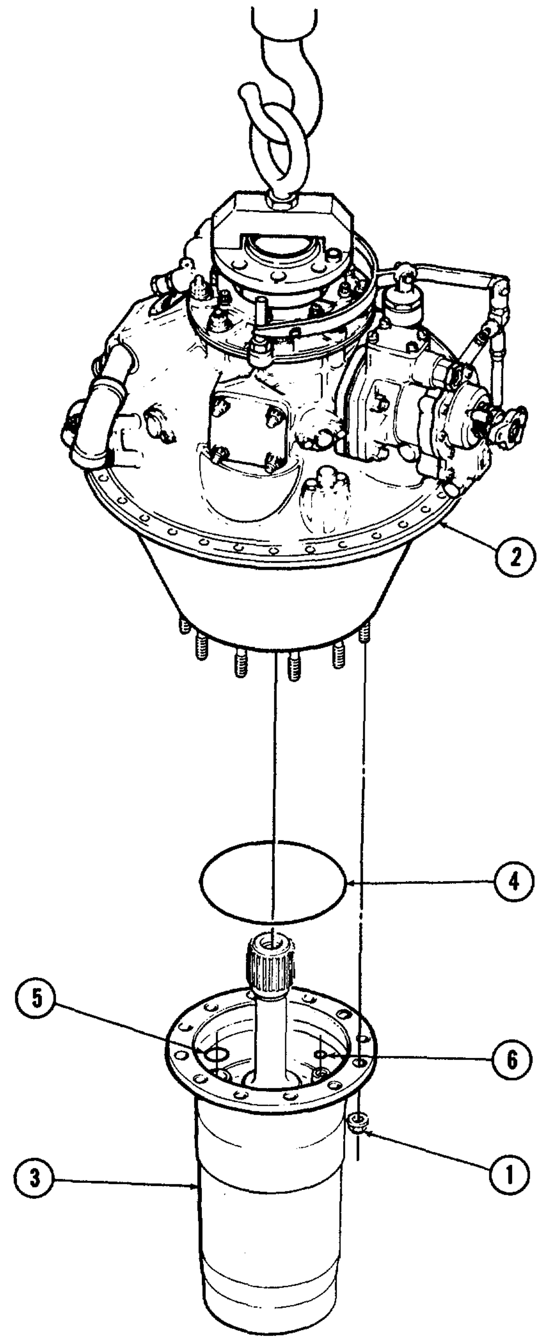


## 9-1-3 REPAIR

**WARNING**

**Acids are injurious. Wear protective clothing and goggles when handling. If injury occurs, get medical attention.**

1. Remove any damaged stud and fit a suitable replacement.

2. Clean up any minor burrs, nicks or corrosion with Crocus Cloth (E.41) and Lubricating Oil (E.2) or (E.71).

3. Swab cleaned-up areas using chemical resistance gloves and wearing eye goggles with Chromic Acid (E.43) solution.

4. Touch-up damaged paint with Enamel (E.44).

## 9-1-4 INSTALLATION

1. Install packings (4), (5) and (6) to power turbine shaft housing (3).

2. Assemble power turbine shaft housing (3) to propeller gearbox (2) with nuts (1).

3. Torque nuts to **75 to 85 inch-pounds**.

FOLLOW ON MAINTENANCE

Installation Exhaust Duct (Task 4-7-4)
Installation Power Turbine Rotor Assembly (Task 4-4-3)
Installation Power Section (Task 4-1-2)

**END OF TASK**

## Section II  TRANSFER HOUSING TRANSFER TUBE SEALS

### 9-2 TRANSFER HOUSING TRANSFER TUBE SEALS (AVIM)

This task covers:

a. Removal (9-2-1)

b. Installation (9-2-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powertrain Mechanic's Tool Kit
NSN 5180-00-003-5267
Torque Wrench (0 to 100 inch-pounds)
Puller (T.10)
Puller (T.26)
Puller (T.58)

Materials:
Lockwire (E.5)

Parts:
Retainers
Seals

Personnel Required:
68D Powertrain Mechanic

References:
TM55-2840-251-23P

**GO TO NEXT PAGE**

## 9-2 TRANSFER HOUSING TRANSFER TUBE SEAL (AVIM) (Continued)

### 9-2-1 REMOVAL

**CAUTION**

**To avoid possibility of losing axial and radial location of transfer housing inside propeller gearbox, remove only one transfer tube at a time, then install that tube before removing other tube.**

1. At the 11 o'clock position, remove lockwire, bolts (2), washers (3), cover (4) and packing (5).

2. Using Puller (T.10), remove transfer tube (6) with packings (7) and retainers (8).

3. Install transfer tube (6) (Task 9-2-2).

4. At the 8 o'clock position, remove lockwire (E.5), bolts (2), and washers (3), if fitted.

5. Where washers (3) are found, remove cover (4) with seal (5), then extract tube (9) with seals (10), using Puller (T.26).

6. Where no washers (3) are fitted, remove transfer tube (11) with seals (10), using Puller (T.58).

### 9-2-2 INSTALLATION

1. At the 11 o'clock position, fit retainers (8) and seals (7) to transfer tube (6), then insert transfer tube (6) into propeller gearbox (1).

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## 9-2 TRANSFER HOUSING TRANSFER TUBE SEALS (AVIM) (Continued)

### 9-2-2 INSTALLATION (Cont)

2. Fit cover (4) with seal (5) and secure with washers (3) and bolts (2). Torque bolts (2) to **32 to 36 inch-pounds** and lockwire (E.5).

3. At the 8 o'clock position, fit transfer tube (9) or (11) with seals (10) and insert into propeller gearbox (1).

4. Where transfer tube (11) is fitted, secure with bolts (2). Torque bolts to **32 to 36 inch-pounds** and lockwire (E.5).

5. Where transfer tube (9) is fitted, fit cover (4) with seal (5) and secure with washers (3) and bolts (2). Torque bolts to **32 to 36 inch-pounds** and lockwire (E.5).

FOLLOW ON MAINTENANCE:

Check Engine Oil Level after First Ground Run (Chapter 1, Section VIII)

**END OF TASK**

## Section III PROPELLER SHAFT SEAL (AVIM)

### 9-3 PROPELLER SHAFT SEAL (AVIM)

This task covers:

a. Removal (9-3-1)

b. Installation (9-3-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)

Materials:
Lubricating Oil (E.2) or (E.71)
Lockwire (E.5)
Polyethylene Sheet (E.36)
2 in. x 18 in.

Parts:
Seal
Gasket

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E,71) contain materials hazardous to health, They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate - ventilation, Wash hands thoroughly after handling.**

GO TO NEXT PAGE

## 9-3 PROPELLER SHAFT SEAL (AVIM) (Continued)

### 9-3-1 REMOVAL

1. Cut lockwire and remove eight bolts (1) and washers (2) securing oil seal retaining ring (3) to thrust bearing cover (4) and move ring forward toward flange (5), or remove both halves of retaining ring (3).

2. If fitted, slide gasket (6) forward to abut retaining ring (3).

3. Carefully work out seal (7) from cover (4).

4. Cut garter spring (8) and seal (7) from shaft.

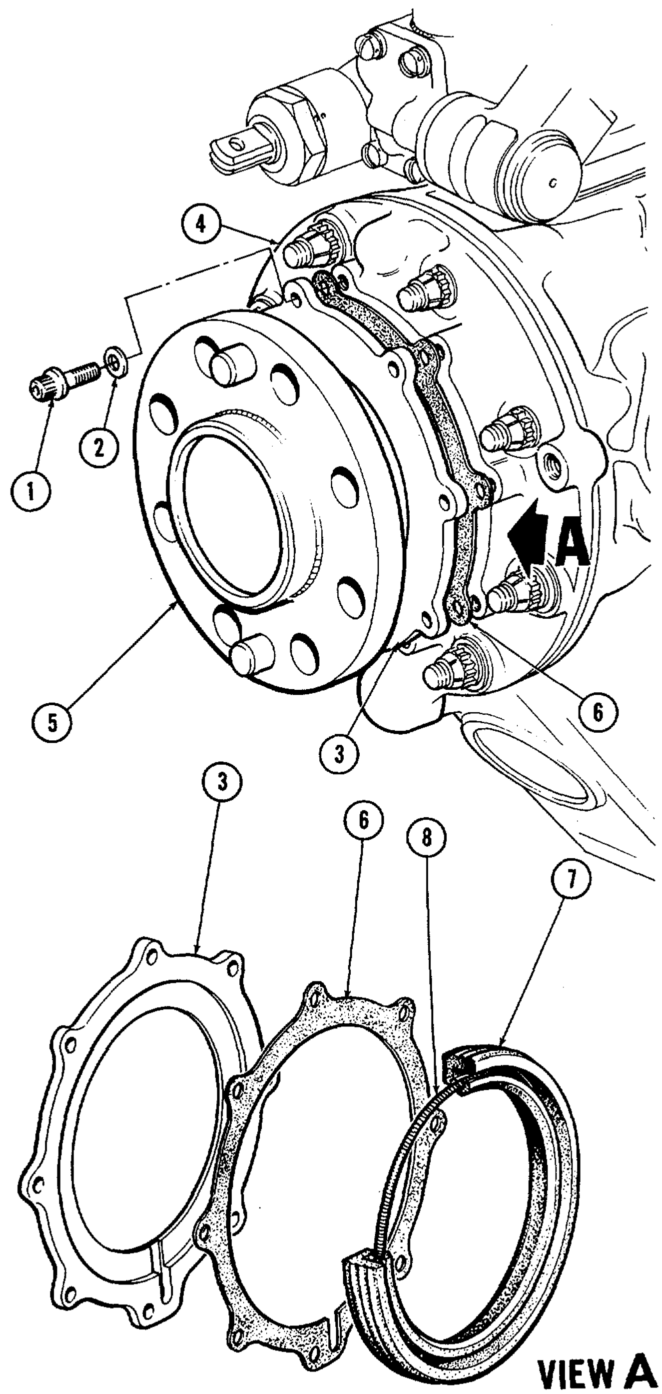
### 9-3-2 INSTALLATION

1. Insure that propeller shaft flange (5) and interior of retaining ring or ring halves (3) are free of nicks and burrs. Check thrust bearing cover (4) seal cavity for possible damage caused during removal of old seal.

2. Tape a strip of Polyethylene Sheet (E.36) over the propeller shaft flange.

**NOTE**

**The sheet will enable the seal to be slipped, without undue stress, over the flange, retaining ring and, if fitted, gasket.**

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**9-3 PROPELLER SHAFT SEAL (AVIM) (Continued)**

**9-3-2 INSTALLATION (Cont)**

**CAUTION**

**Avoid applying loads locally' to lip of seal. Seal element is soft and has low tear resistance. It must be handled with care at all times to prevent nicking or any form of damage.**

3. Install seal (7) on top of propeller mount flange in a horizontal position and gently stretch it over shaft with vee-side facing cavity in thrust bearing cover (4).

**NOTE**

**New seals shall be heated in Lubricating Oil (E.2) or (E.71) at 200°F (93°C) maximum, for approximately 20 minutes. This makes the seal more flexible as it is being stretched over propeller shaft flange.**

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## 9-3 PROPELLER SHAFT SEAL (AVIM) (Continued)

### 9-3-2 INSTALLATION (Cont)

4. Grasp spring (8) such that narrow end is in right hand and straight end in left. Holding left end firmly, rotate narrow end two turns in a counterclockwise direction (spring helix is right handed).

5. Insert narrow end (right hand) into other end. Rotate narrow end two turns clockwise to secure ends together, and spring is then assembled.

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**9-3-2 INSTALLATION (Cont)**

6. Install garter spring (8) into vee-side of seal (7).

7. Gently press seal (7) into cavity in thrust bearing cover (4) and work around with thumb pressure until seal is correctly seated.

8. Locate retaining ring (3) or ring halves (3) on thrust bearing cover (4) with split line on halves as close as possible to horizontal plane, trapping gasket (6). Secure with eight bolts and washers. Tighten bolts in diametrical sequence, torque to **36 to 40 inch-pounds** and lockwire (E.5).

FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section IV Nf TACHOMETER-GENERATOR DRIVE SHAFT SEAL

### 9-4 Nf TACHOMETER-GENERATOR DRIVE SHAFT SEAL (AVIM)

This task covers:

a. Removal (9-4-1)

b. Installation (9-4-2)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Puller (T.20)
Puller (T.49)

Materials:
Lubricating Oil (E.2) or (E.71)

Parts:
Seals

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Nf Tachometer-generator Removed (Task 10-1-1)

General Safety Instructions:

**WARNING**

**LUBRICATING OILS HAZARDOUS**

**Lubricating Oils (E.2) and (E.71) contain materials hazardous to health. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flames. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.**

GO TO NEXT PAGE

## 9-4 Nf TACHOMETER-GENERATOR DRIVE SHAFT SEAL (AVIM) (Continued)

### 9-4-1 REMOVAL

1. Using Puller (T.20), remove seal carrier (1) from drive pad (2).

2. Using Puller (T.49), remove oil seal (3) from seal carrier (1).

3. Remove preformed packing (4) from seal carrier (1).

### 9-4-2 INSTALLATION

1. Immerse oil seal (3) in Lubricating Oil (E.2) or (E.71) and insert into seal carrier (1). Inspect.

2. Install preformed packing (4) on seal carrier (1) and press seal carrier into drive pad (2). Inspect.

FOLLOW ON MAINTENANCE:

Installation Nf Tachometer-generator (Task 10-1-3)

**END OF TASK**

## Section V POWER TURBINE GOVERNOR

### 9-5 POWER TURBINE GOVERNOR

This task covers:

a. Inspection (9-5-1)

b. Adjustment (9-5-2)

c. Removal (9-5-3)

d. Installation (9-5-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)

Materials:
Lockwire (E.5)
Plastilube No. 3 Grease (E.22)

Parts:
Gasket
Packing
Cotterpin

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

### 9-5-1 INSPECTION

1. Inspect for obvious leaks and damage.

2. Replace if defects found.

### 9-5-2 ADJUSTMENT

Refer to Chapter 1, Section X.

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## 9-5 POWER TURBINE GOVERNOR (Continued)

### 9-5-3 REMOVAL

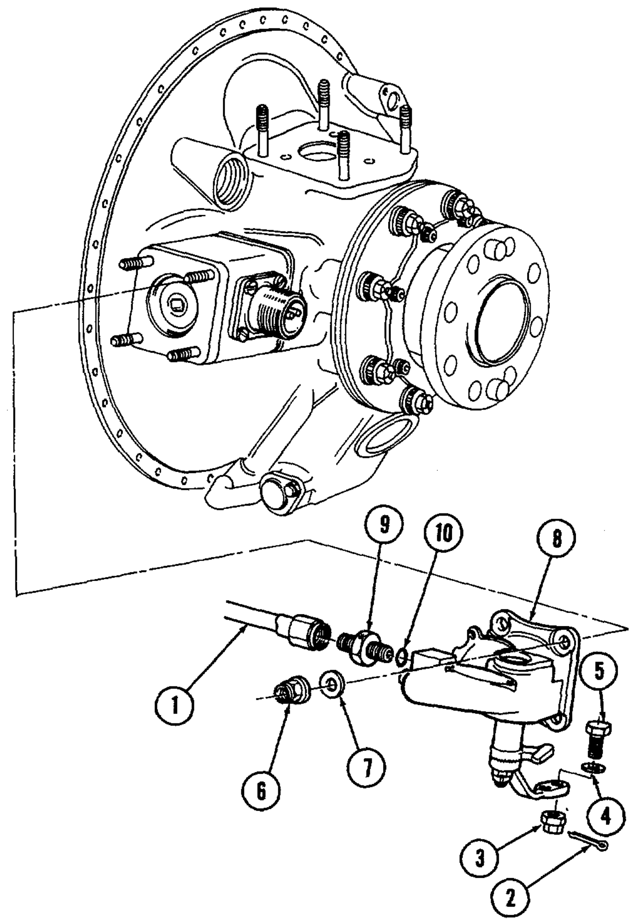
1. Disconnect tube assembly (1).

2. Remove cotterpin (2) and discard.

3. Remove nut (3), washer (4) and bolt (5).

4. Remove nuts (6), washers (7) and governor (8).

5. Remove adapter (9) and packing (10). Discard packing.




### 9-5-4 INSTALLATION

1. Lubricate (E.22) packing (10) and install packing and adapter (9). Torque to **15 to 20 inch-pounds** and lockwire (E.5) adapter.

2. Lubricate (E.22) drive shaft and install governor (8).

3. Install washers (7) and nuts (6). Torque nuts to **75 to 85 inch-pounds**.

4. Connect control rod with bolt (5), washer (4) and nut (3). Torque nut to **24 to 36 inch-pounds** and install cotterpin (2).

5. Connect tube assembly (1). Torque to **90 to 100 inch-pounds** and lockwire (E.5) tube nut.

FOLLOW ON MAINTENANCE:

Test Engine (Chapter 1, Section X)

**END OF TASK**

# CHAPTER 10

# MISCELLANEOUS EQUIPMENT

## CHAPTER OVERVIEW

This chapter contains maintenance procedures for Miscellaneous Equipment. It is divided into the following sections.



**END OF OVERVIEW**

## Section I Nf TACHOMETER-GENERATOR

### 10-1 Nf TACHOMETER-GENERATOR

This task covers:

a. Removal (10-1-1)

b. Inspection (10-1-2)

c. Installation (10-1-3)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)

Materials:
Plastilube No. 3 Grease (E.22)

Parts:
Gasket

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Power Turbine Governor Removed (Task 9-5-3)

GO TO NEXT PAGE

## 10-1 Nf TACHOMETER-GENERATOR (Continued)

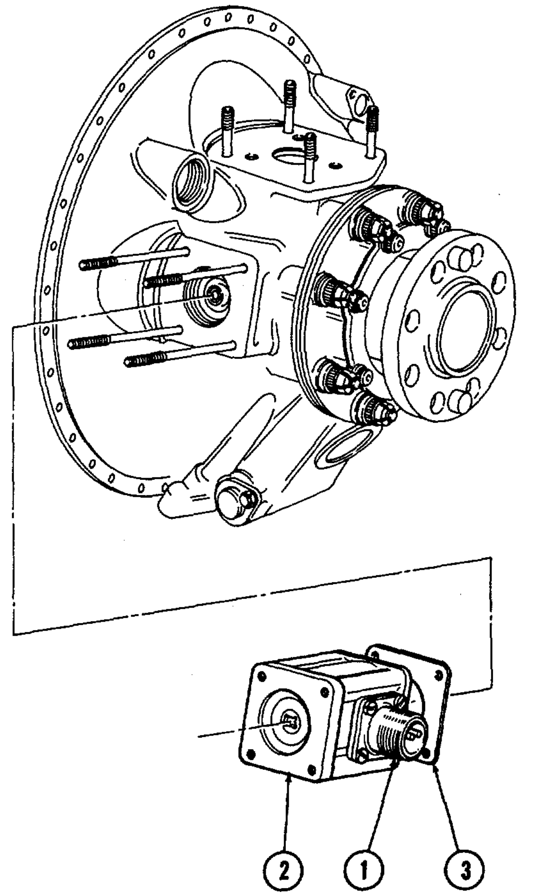
### 10-1-1 REMOVAL

1. Disconnect electrical connector at receptacle (1) on tachometer-generator (2) and cap receptacle and connector.

2. Slide tachometer-generator off mounting studs and discard gasket (3).

### 10-1-2 INSPECTION

Inspect for physical damage or obviously worn bearings; either condition shall be cause for rejection.




### 10-1-3 INSTALLATION

1. Smear tachometer-generator (2) drive shaft with a small amount of Plastilube No. 3 Grease (E.22).

2. Fit new gasket (3) to tachometer-generator (2).

3. Slide tachometer-generator (2) on to mounting studs, electrical receptacle facing forward.

4. Connect electrical connector to tachometer-generator.

FOLLOW ON MAINTENANCE:

Installation Power Turbine Governor (Task 9-5-4)

**END OF TASK**

## Section II ROTATION OF COMPRESSOR TURBINE ROTOR BY HAND

10-2 ROTATION OF COMPRESSOR TURBINE ROTOR BY HAND

This task covers:

a. Rotation (10-2-1)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)

Materials:
None

Parts:
Gasket

Personnel Required:
68B Powerplant Mechanic

References:
TM55-1510-215-23

Equipment Condition:
Ng Tachometer-generator Removed (TM55-1510-215-23)

### 10-2-1 ROTATION

Insert 1/4 inch square drive crank handle into tachometer-generator drive shaft and turn to rotate compressor turbine assembly.

FOLLOW ON MAINTENANCE:

Installation Ng Tachometer-generator (TM55-1510-215-23)

**END OF TASK**

## Section III PROPELLER REVERSING GEAR

### 10-3 PROPELLER REVERSING GEAR

This task covers:

a. Removal (10-3-1)

b. Inspection (10-3-2)

c. Installation (10-3-3)

d. Adjustment (10-3-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)

Materials:
Lockwire (E.5)
Molykote G or Z (E.23)
Grease (E.81)

Parts:
Cotterpins

Personnel Required:
68B Powerplant Mechanic
66G Aircraft Inspector

References:
TM55-2840-251-23P
TM55-1510-215-23

GO TO NEXT PAGE

**10-3 PROPELLER REVERSING GEAR (Continued)**

**10-3-1 REMOVAL**

1. Remove and discard cotterpins (1).

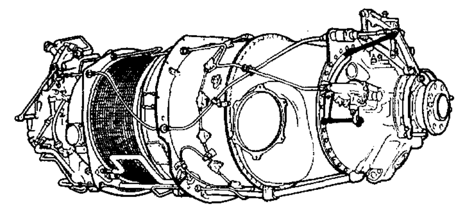
2. Remove nuts (2), washers (3), bolts (4) and rod assembly (5).

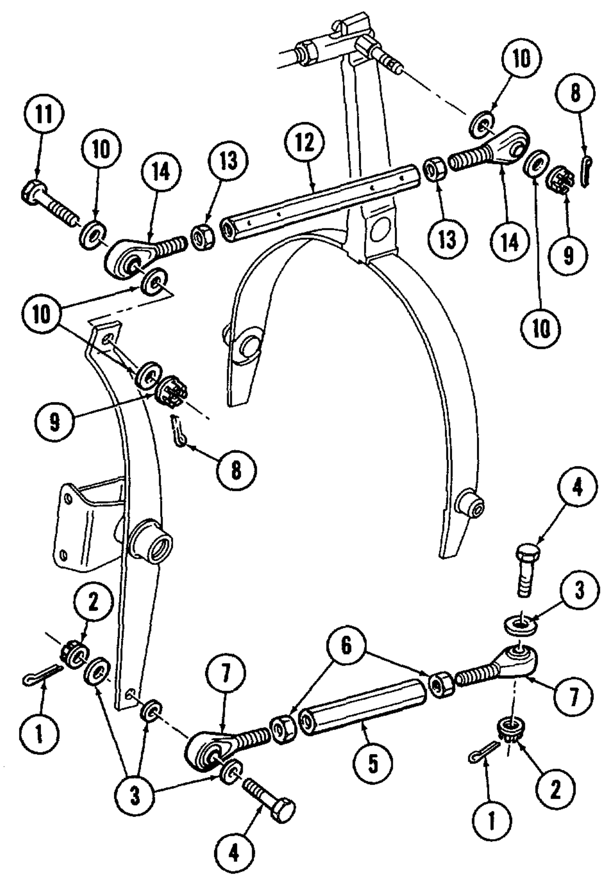
3. Measure and record distance between bolt hole centers of rod assembly (5). Remove Lockwire, loosen locknuts (6) and remove rod ends (7).

4. Remove and discard cotterpins (8).

5. Remove nuts (9), washers (10), bolt (11) and rod assembly (12).

6. Measure and record distance between bolt hole centers of rod. Remove lockwire, loosen locknuts (13) and remove rod ends (14).



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## 10-3 PROPELLER REVERSING GEAR (Continued)

### 10-3-1 REMOVAL (Cont)

7. Remove and discard cotterpin (15).

8. Remove nut (16), stud (18) and withdraw clevis (19) and spacer (17).

9. Remove lockwire, loosen locknut (20) and remove clevis (19).

10. Remove nut (21), bolt (22) and lever (23).

11. Remove sleeves (24).

12. Remove nuts (25), bolts (26), washers (40) and bracket (27).

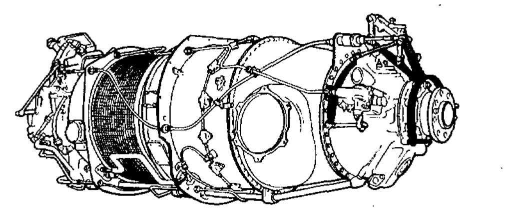
13. Remove guides (28) and washers (29).

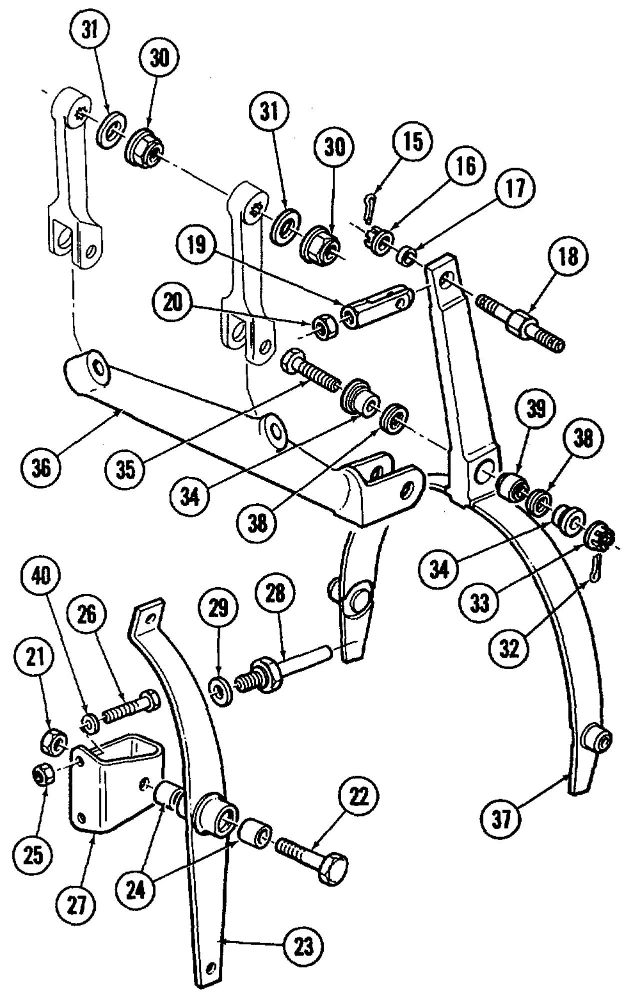
14. Remove nuts (30) and washers (31).

15. Remove and discard cotterpin (32).

16. Remove nut (33), bushings (34), bolt (35) and levers (36) and (37).

17. Remove retaining rings (38) and bearings (39).



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## 10-3 PROPELLER REVERSING GEAR (Continued)

### 10-3-1 REMOVAL (Cont)

18. Remove and discard cotterpin (40).

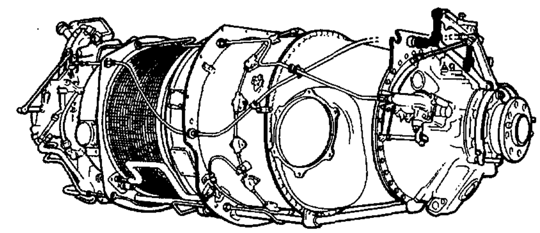
19. Remove nuts (41), washers (42), bolts (43), levers (44) and shield (45).

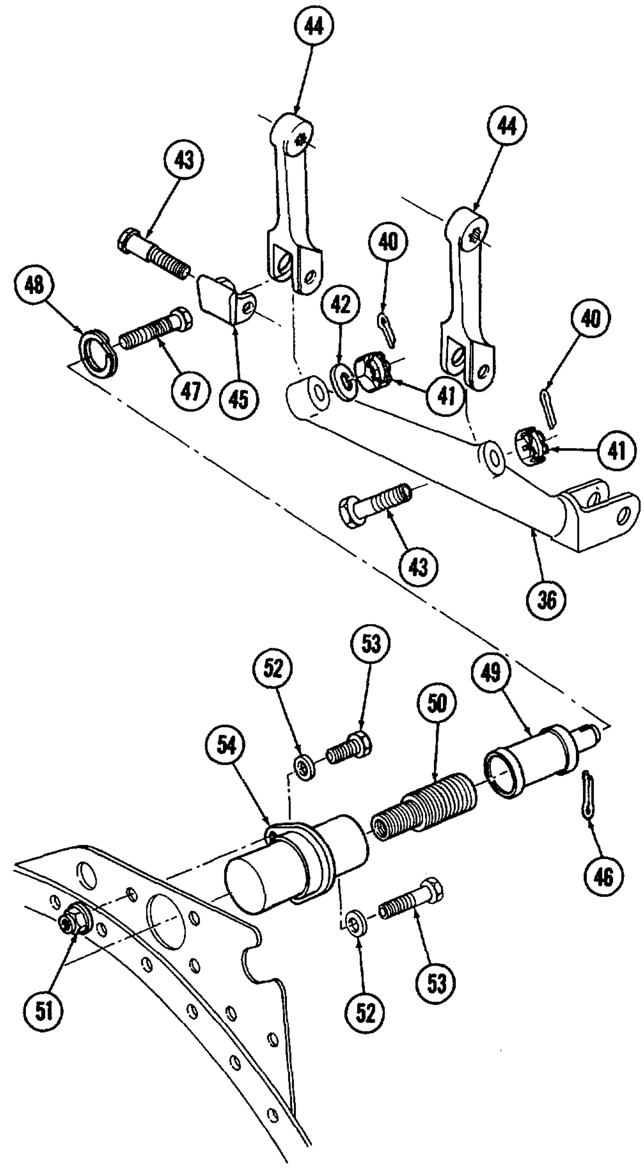
20. Remove and discard cotterpin (46).

21. Note and record number of turns to remove bolt (47).

22. Remove ring (48), piston (49) and springs (50).

23. Remove nuts (51), washers (52), bolts (53) and cylinder (54).



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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-1 REMOVAL (Cont)

24. Remove nut (55) and washer (56).

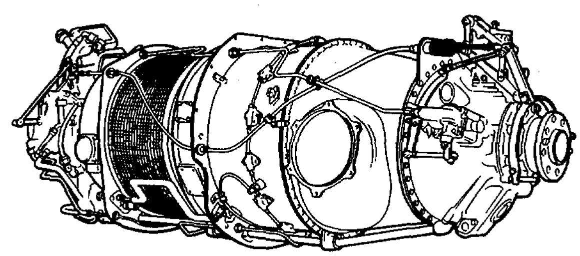
25. Withdraw terminal (57) and remove clamp (58).

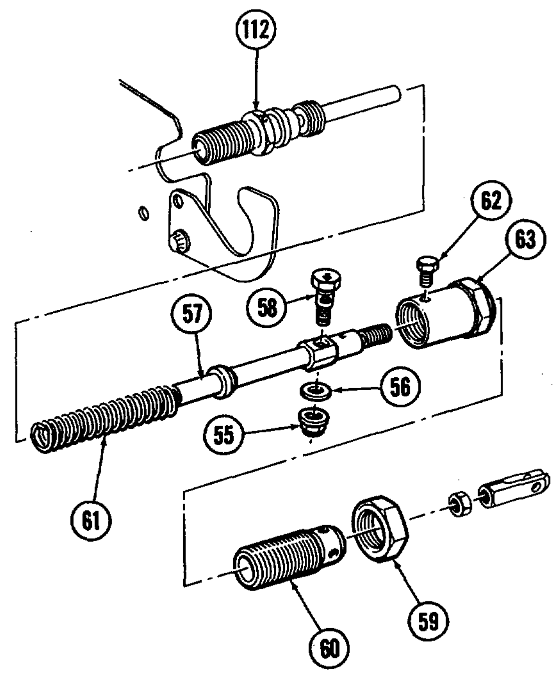
26. Loosen locknut (59).

27. Count and record number of turns to remove stop (60).

28. Remove terminal (57) and springs (61).

29. Remove bolt . (62) and adjuster (63).





## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-1 REMOVAL (Cont)

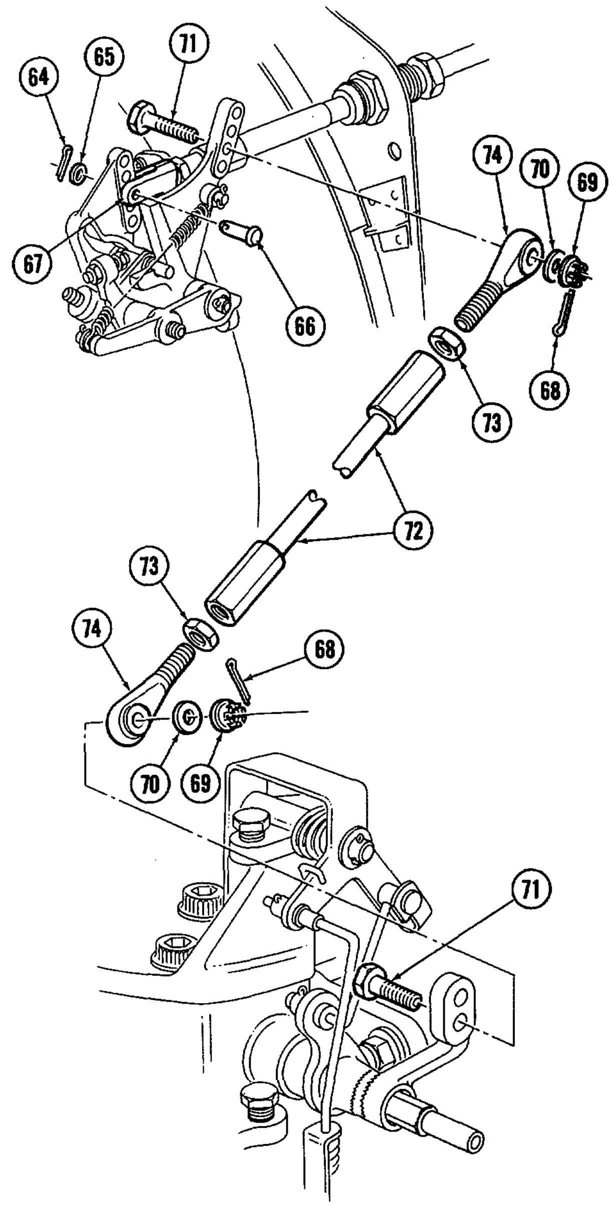
30. Remove and discard cotterpin (64).

31. Note position of pin (66) in lever and remove washer (65) and pin (66). Disconnect clevis (67).

32. Remove and discard cotterpin (68).

33. Note position of bolts (71) in lever and remove nuts (69), washers (70), bolts (71) and rod assembly (72).

34. Remove lockwire and loosen locknuts (73) and remove rod ends (74).

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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-1 REMOVAL (Cont)

35. Remove and discard cotterpin (75).

36. Remove washer (76) and pin (77).

37. Note relationship of grooved pin (79) with levers (80) and (81), then remove bolt (78), grooved pin (79) and levers (80) and (81).

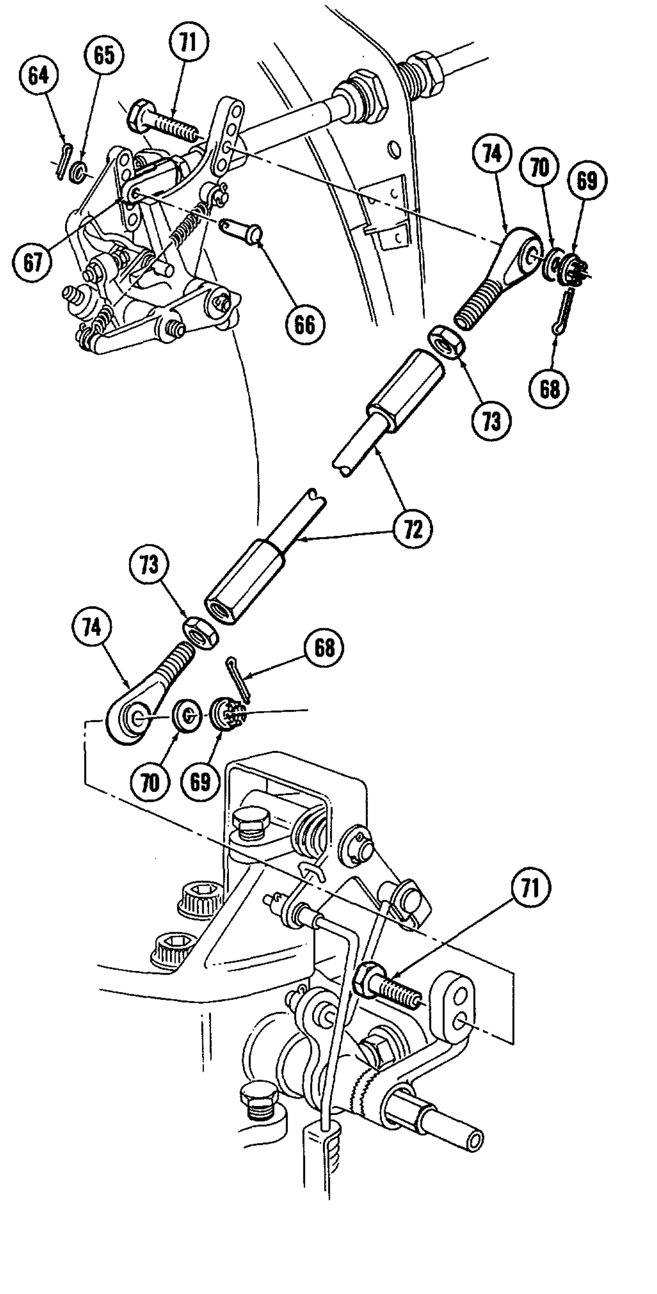
38. Remove and discard cotterpins (82).

39. Remove washers (83) and spring (84).

40. Remove and discard cotterpin (85).

41. Remove washer (86), pin (87), cam (88) and lever (89).

42. Remove nuts (90), bolts (91), brackets (92) and (93).

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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-1 REMOVAL (Cont)

43. Remove lockwire, loosen locknut (94) and remove clevis (95).

44. Withdraw terminal (96) and wire rope (97).

45. Remove lockwire, nut (98) and washer (99).

46. Separate terminal (96) and wire rope (97) by unscrewing wire rope out of internal left-hand thread in clamp (100).

47. Remove clamp (100).

48. Remove casing (101).

49. Remove lockwire, nut (102), washer (103) and swivel (104).

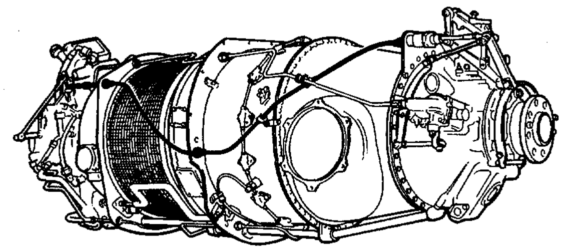
50. Remove nuts (105), bolts (106) and casing (107).

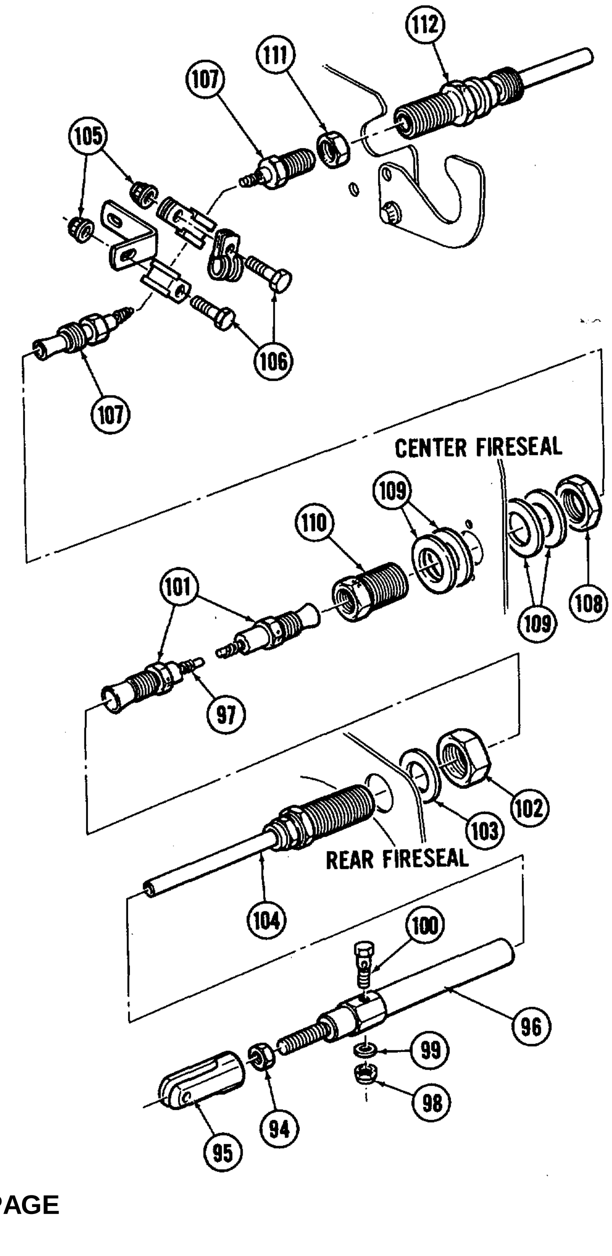
51. Remove lockwire, nut (108), washers (109) and bushing (110).

52. Remove lockwire, nut (111) and swivel (112).

10-3-2 INSPECTION

Inspect all parts for damage, wear or corrosion, which shall be cause for rejection.



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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-3 INSTALLATION

1. Lubricate (E. 81) and install swivel (112) and nut (111). Torque to **80 to 100 inch-pounds** and lockwire (E. 5).

2. Install bushing (110), washers (109) and nut (108). Torque bushing and nut to **80 to 100 inch-pounds** and lockwire (E. 5).

3. Install casing (107). Torque casing to **40 to 60 inch-pounds** and lockwire (E. 5).

4. Install bolt (106) and nut (105). Torque nut to **32 to 36 inch-pounds.**

5. Install swivel (i04), washer (103) and nut (102). Torque nut to **80 to 100 inch-pounds** and lockwire (E. 5).

6. Install casing (101). Torque casing to **40 to 60 inch-pounds** and lockwire (E. 5).

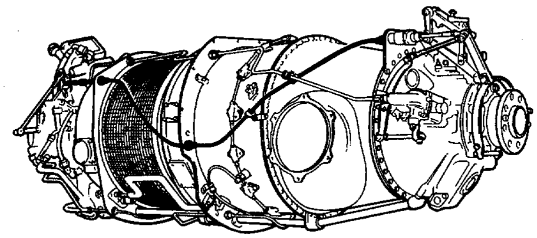
7. Install clamp (100), wire rope (97) in terminal (96) insuring that wire rope passes safety hole in terminal. **Inspect.**

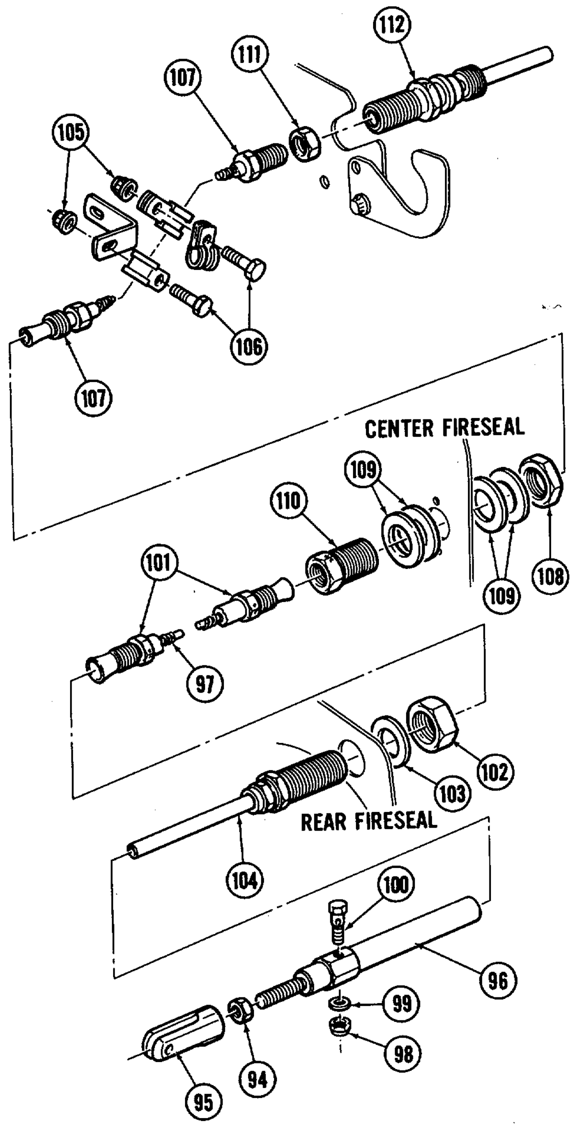
8. Install washer (99) and nut (98). Torque nut to **32 to 36 inch-pounds**.

9. Feed wire rope into swivel (104).

10. Install clevis (95) and locknut (94). Insure that threads of terminal pass safety hole in clevis. **Inspect.**

11. Torque locknut (94) to **16 to 18 inch-pounds** and lockwire (E. 5).



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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-3 INSTALLATION (Cont)

12. Install bracket (93) and nuts (90). Torque nuts to **32 to 36 inch-pounds**.

13. Install bracket (92) and bolts (91). Torque bolts to **32 to 36 inch-pounds** and lockwire (E. 5).

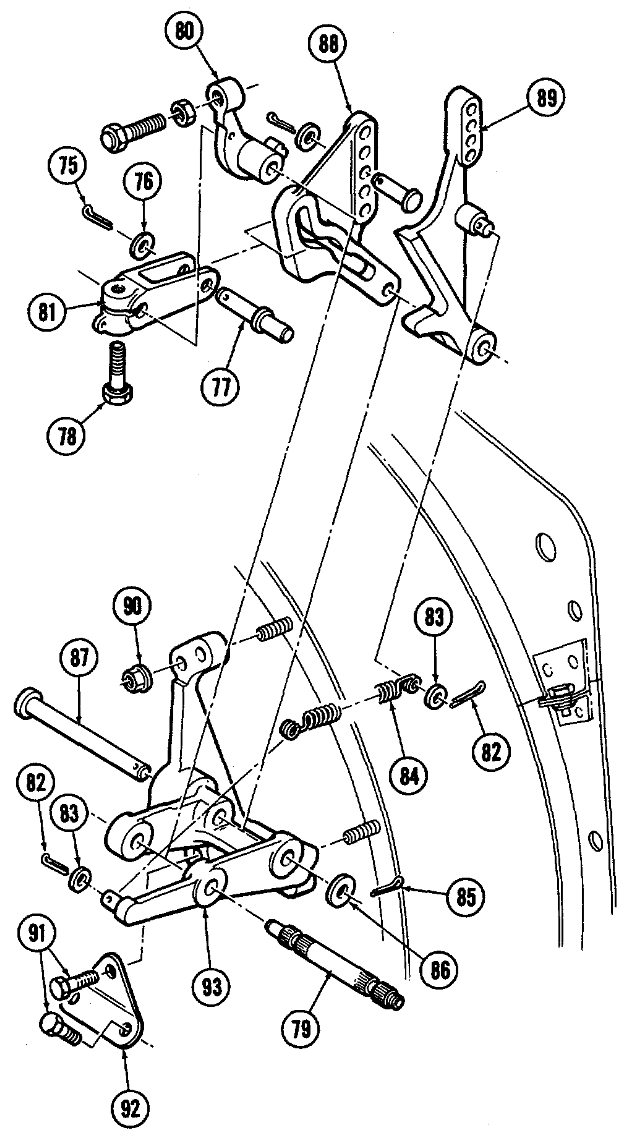
14. Install lever (89), cam (88), pin (87), washer (86) and cotterpin (85).

15. Install spring (84), washers (83) and cotterpin (82).

16. Install grooved pin (79), lever (80) and lever (81) in previously noted position on grooved pin.

17. Install bolt (78). Torque bolt to **32 to 36 inch-pounds** and lockwire (E. 5).

18. Install pin (77), washer (76) and cotterpin (75).

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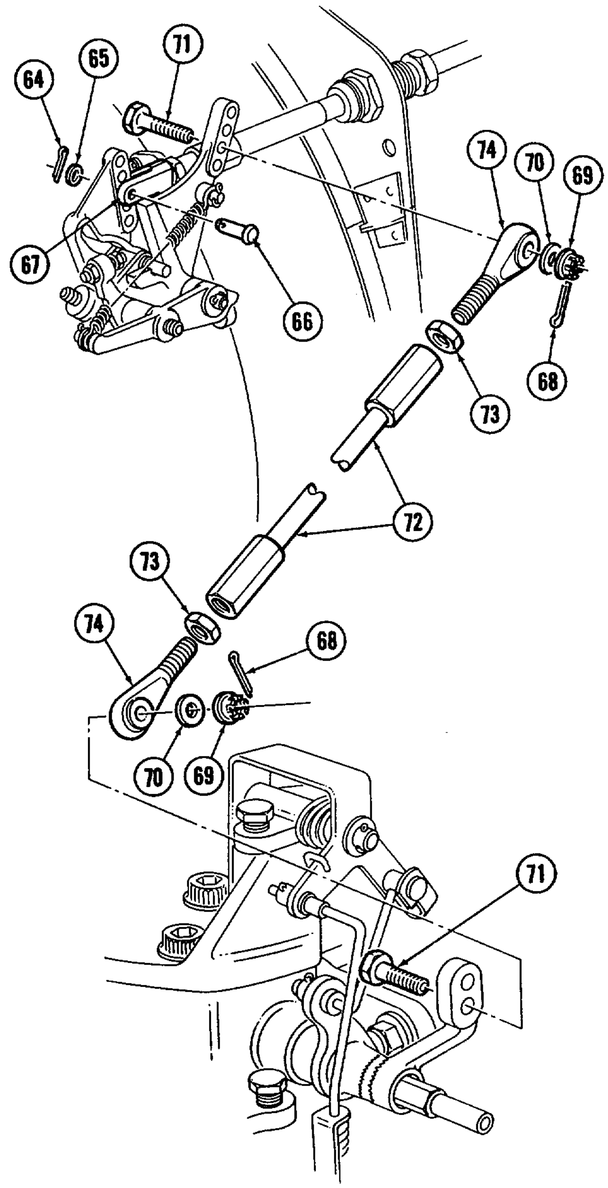
## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-3 INSTALLATION (Cont)

19. Connect clevis (67) to cam (87) in previously noted position using pin (66), washer (65) and cotterpin (64), then assemble rod (72), rod ends (74) and locknuts (73) to previously recorded minimum, insuring threads of rod ends pass safety hole in rod. Inspect. Torque locknuts and rod ends to **16 to 18 inch-pounds** and lockwire (E. 5).

20. Install bolts (71) (in previously noted positions), rod (72), washers (70) and nuts (69). Torque nuts to **24 to 36 inch-pounds** and install cotterpins (68).

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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-3 INSTALLATION (Cont)

21. Install adjuster (63). Align bolt hole with hole in swivel (112).

22. Install bolt (62). Torque to **32 to 36 inch-pounds** and lockwire (E. 5).

23. Install springs (61).

24. Install stop (60) and nut (59) on terminal (57).

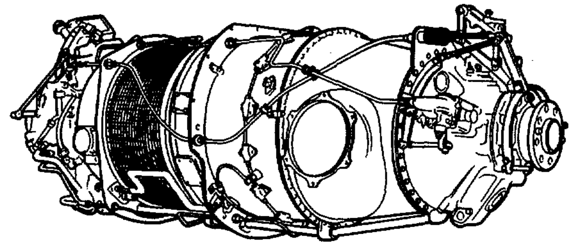
25. Install clamp (58).

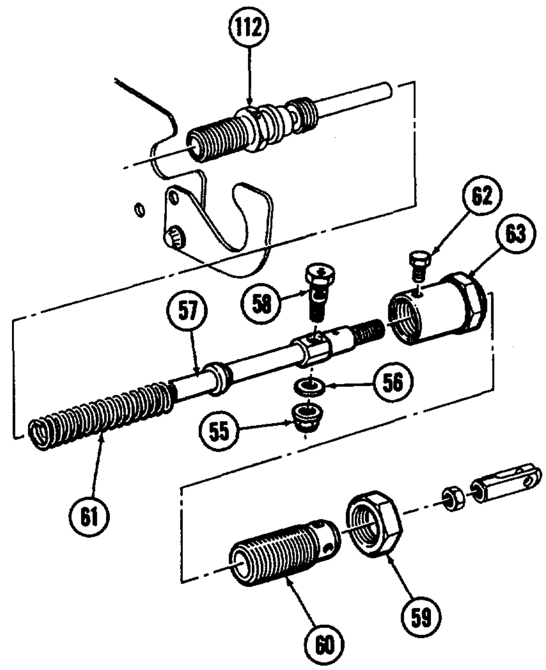
26. Install assembly on protruding end of wire rope insuring wire rope passes safety hole in terminal.

27. Install washer (56) and nut (55). Torque nut to **32 to 36 inch-pounds.**

28. Install stop (60) on adjuster (63), number of turns previously noted.

29. Torque to **32 to 36 inch-pounds** and lockwire (E. 5) nut (59) and stop (60).



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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-3 INSTALLATION (Cont)

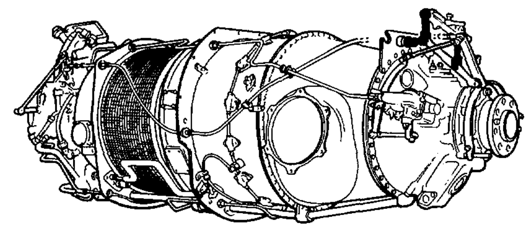
30. Lubricate (E. 23) and install cylinder (54), bolts (53), washers (52) and nuts (51). Torque nuts to **32 to 36 inch-pounds.**

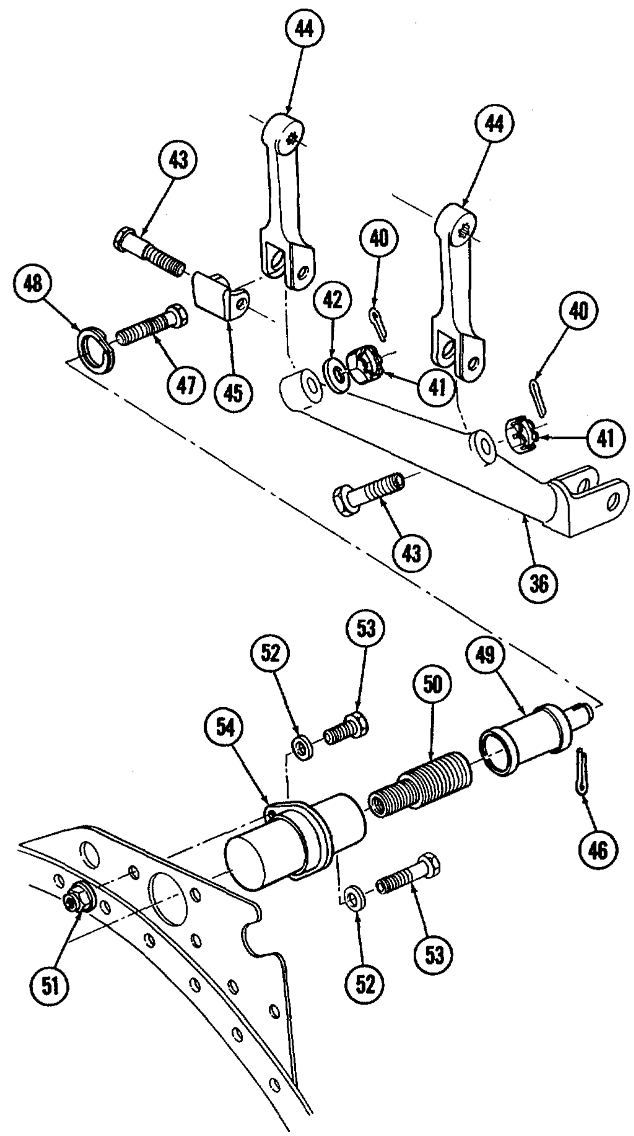
31. Install springs (50), cylinder (49) and ring (48).

32. Install bolt (47), number of turns previously noted.

33. Install cotterpin (46).

34. Assemble levers (44) and (36), shield (45), bolts (43), washers (43) and nuts (41). Torque nuts to **24 to 36 inch-pounds.** Install cotterpins (40).



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## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-3 INSTALLATION (Cont)

35. Install bearing (39) and retaining rings (38) in lever (37).

36. Assemble levers (36) and (37), bushings (34), bolt (35), and nut (33). Torque nut to **24 to 36 inch-pounds.** Install cotterpin (32).

37. Install assembly on prop governor with washers (31) and nuts (30). Torque nuts to **24 to 36 inch-pounds.**

38. Install washers (29) and guides (28). Torque guides to **32 to 36 inch-pounds.**

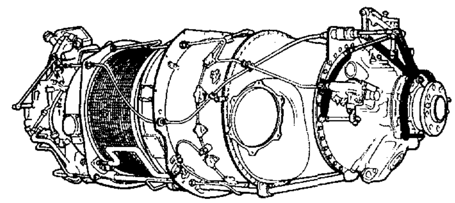
39. Install locknut (20) and clevis (19) on terminal (57). Insure threads of terminal pass safety hole in clevis. **Inspect.** Torque locknut to **16 to 18 inch-pounds.** Lockwire (E. 5) clevis and locknuts.

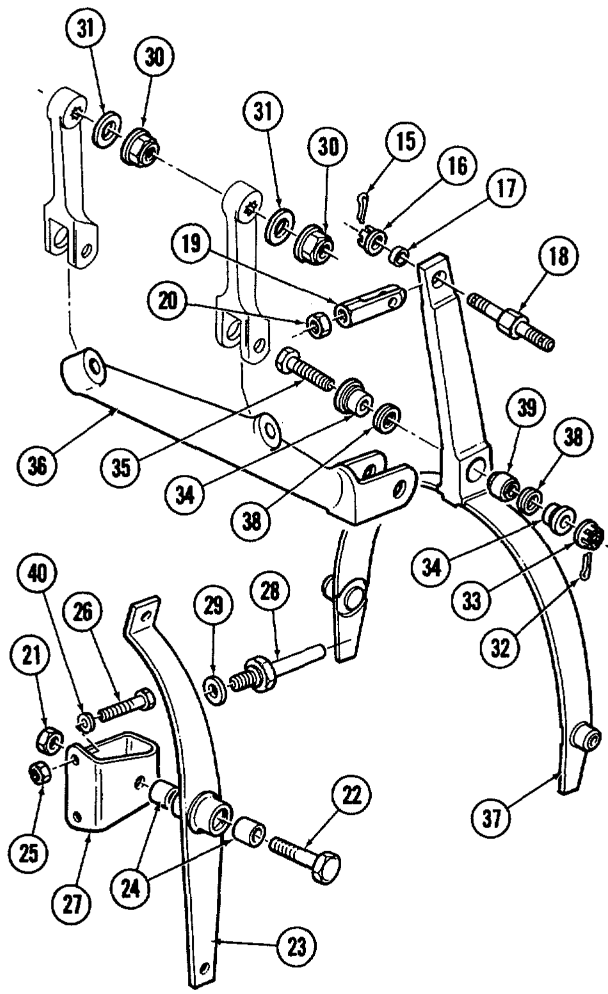
40. Install stud (18), clevis (19), washer (17) and nut (16). Torque nut to **24 to 36 inch-pounds.** Install cotterpin.

41. Install bracket (27), bolts (26), washers (40) and nuts (25). Torque nuts to 32 to 36 inch-pounds.

42. Install bushings (24) in lever (23).

43. Install lever (23), bolt (22) and nut (21). Torque nut to **32 to 36 inch-pounds.**



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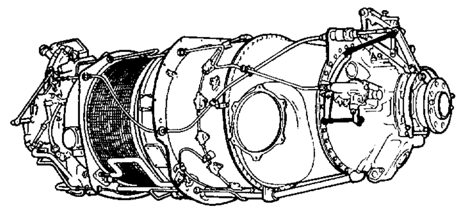
## 10-3 PROPELLER REVERSING GEAR (Continued)

10-3-3 INSTALLATION (Cont)



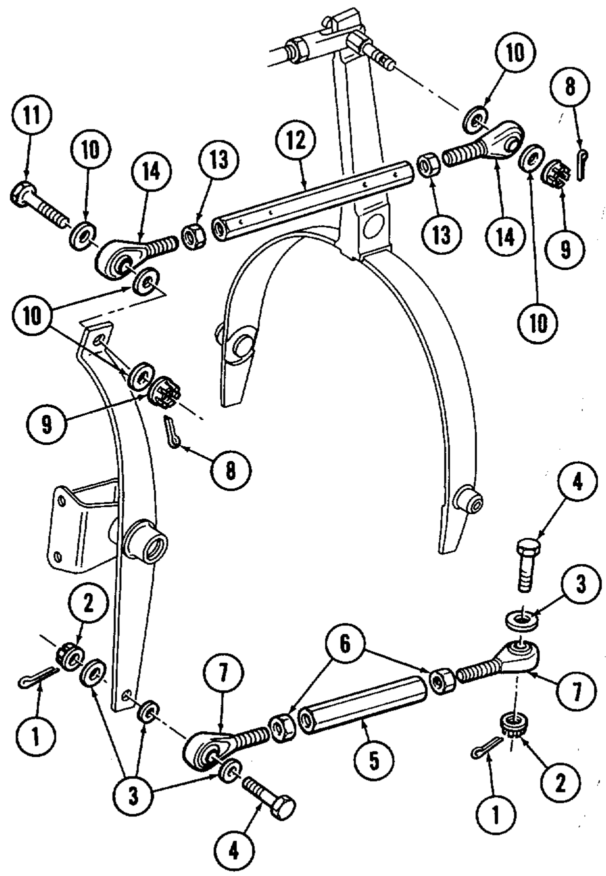
44. Assemble rod (12), locknuts (13) and rod ends (14) to previously measured dimension. Insure threads of rod ends pass safety holes in rod. Torque locknuts (13) to **25 to 35 inch-pounds.**

45. Install bolt (11), washers (10), rod assembly (12) and nuts (9). Torque nuts to **24 to 36 inch-pounds.** Install cotterpins (8).

46. Assemble rod (5), locknuts (6) and rod ends (7) to previously measured dimension insuring rod ends threads pass safety holes in rod. **Inspect.**

47. Torque locknuts (6) to **16 to 18 inch-pounds**. Lockwire (E. 5) nuts and rod ends.

48. Install bolts (4), washers (3), rod assembly (5) and nuts (2). Torque nuts to **24 to 36 inch-pounds.** Install cotterpins (1).



10-3-4 ADJUSTMENT

Refer to TM55-1510-215-23.

FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section IV AIR LINES AND FITTINGS

10-4 AIR LINES AND FITTINGS

This task covers:

a. Inspection (10-4-1)

b. Removal (Without P3 Filter) (10-4-2)

c. Removal (With P3 Filter) (10-4-3)

d. Repair (10-4-4)

c. Installation (Without P3 Filter) (10-4-5)

f. Installation (Without P3 Filter) (10-4-6)

g. Testing (10-4-7)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)
Ohmmeter
Soldering Iron

Materials:
Lockwire (E.5)
Leaktec 372 (E.38)
Silastic (E.39)
Crocus Cloth (E.41)
Solder (E.47)

Parts:
Packings
Gasket
Retainer
No. 4 Union

Personnel Required:.
68B Powerplant Mechanic
66F Aircraft Electrician
66G Aircraft Inspector

References:
TM55-2840-251-23P

Equipment Condition:
Temperature Compensator
Removed (Task 6-9-1)

GO TO NEXT PAGE

## 10-4 AIR LINES AND FITTINGS (Continued)

10-4-1 INSPECTION

1. Inspect air lines and fittings for:

- Scratches
- Nicks
- Chafing
- Dents
- Pitting
- Corrosion and burrs
- Cuts

2. Repair lines and fittings if:

- Scratches and pits not in excess of 0.005 inch deep.

- Nicks and chafing not deeper than 25% of wall thickness.

3. Repair rubber sheating cuts not more than 3 inches long.

4. Accept corrosion removable by polishing with Crocus Cloth (E.41).

5. Round bottom dents are permissible, provided the depth is not greater than 10% of the normal outside diameter of the tube. No more than three dents to the maximum depth per 12 inch length of tube are permissible and such dents shall be separated by at least 0.250 inch. No dents are to be within 0.250 inch of ferrules or fittings.

**NOTE**

**Dents are unacceptable within one inch of ferrule scarf-welds, or in the area of a bend.**

6. Check resistance value of heating element plus lead is 20 ± 1.4 ohms for assembly without P3 filter assembly. Check resistance of P3 filter outlet tube heating element plus lead is 39.0 ± 2.0 ohms and resistance of P3 filter inlet tube heating element plus lead is 41.2 ± 2 ohms.

**GO TO NEXT PAGE**

## 10-4 AIR LINES AND FITTINGS (Continued)

10-4-2 REMOVAL (Without P3 Filter)

1. Loosen screws (1).

2. Unscrew clamp (2).

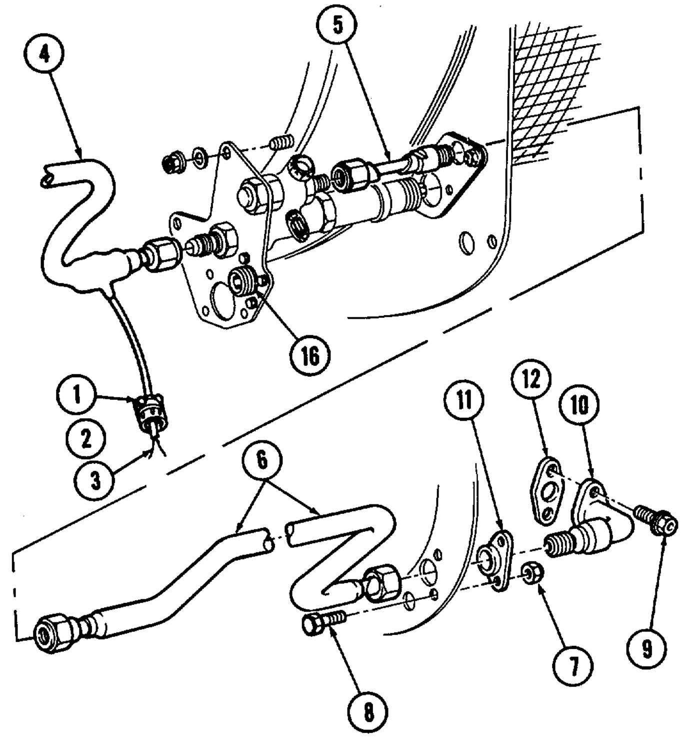
3. Unsolder wires (3) from connector (16).

4. Remove lockwire and tube assembly (4).

5. Remove temperature compensator (Task 6-9-1).

6. Remove tube assemblies (5), (6).

7. Remove nuts (7), bolts (8), bolts (9), elbows (10), sleeve (11) and gasket (12). Discard gasket.

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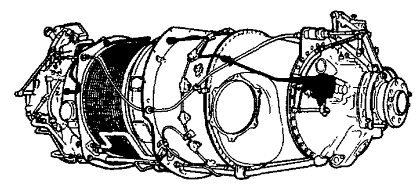
## 10-4 AIR LINES AND FITTINGS (Continued)

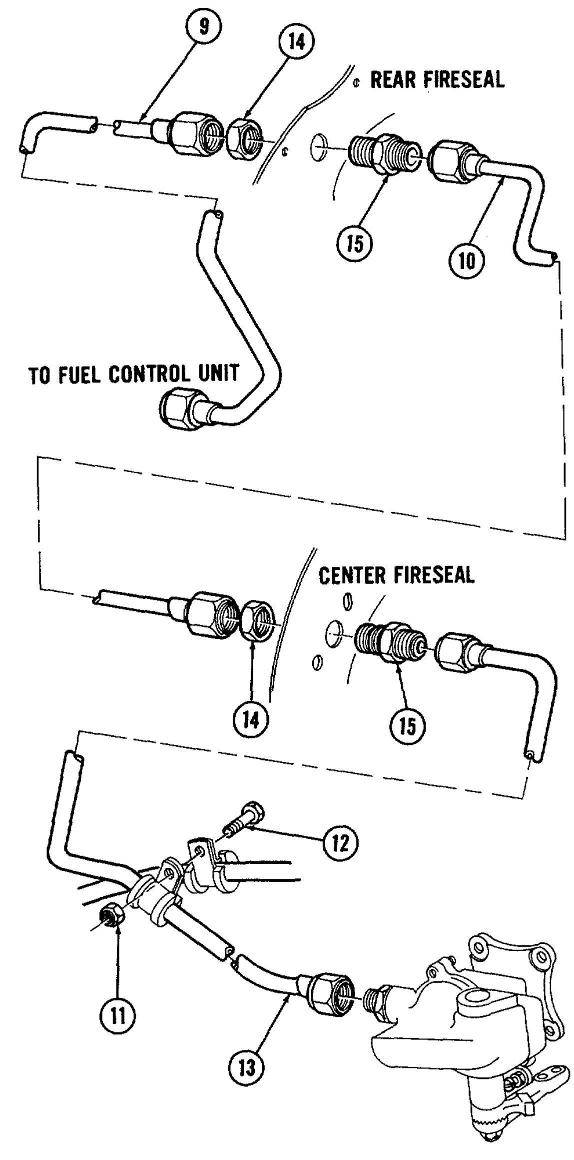
10-4-2 REMOVAL (Without P3 Filter) (Cont)

8. Remove lockwire and tube assemblies (9) and (10).

9. Remove nut (11), bolt (12) and tube assembly (13).

10. Remove lockwire and nuts (14) and couplings (15).



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## 10-4 AIR LINES AND FITTINGS (Continued)

10-4-3 REMOVAL (With P3 Filter)

1. Remove nuts (1), washers (2) and bolts (3).

2. Remove nuts (4) and bolts (5).

3. Remove tube assemblies (6) and (7) and electrical connector (8).

4. Remove nuts (9), washers (10), filter assembly (11), spacers (12) and bolts (13).

5. Loosen locknut (14) and remove elbow (15), locknut, packing (16) and retainer (17). Discard packing retainer.

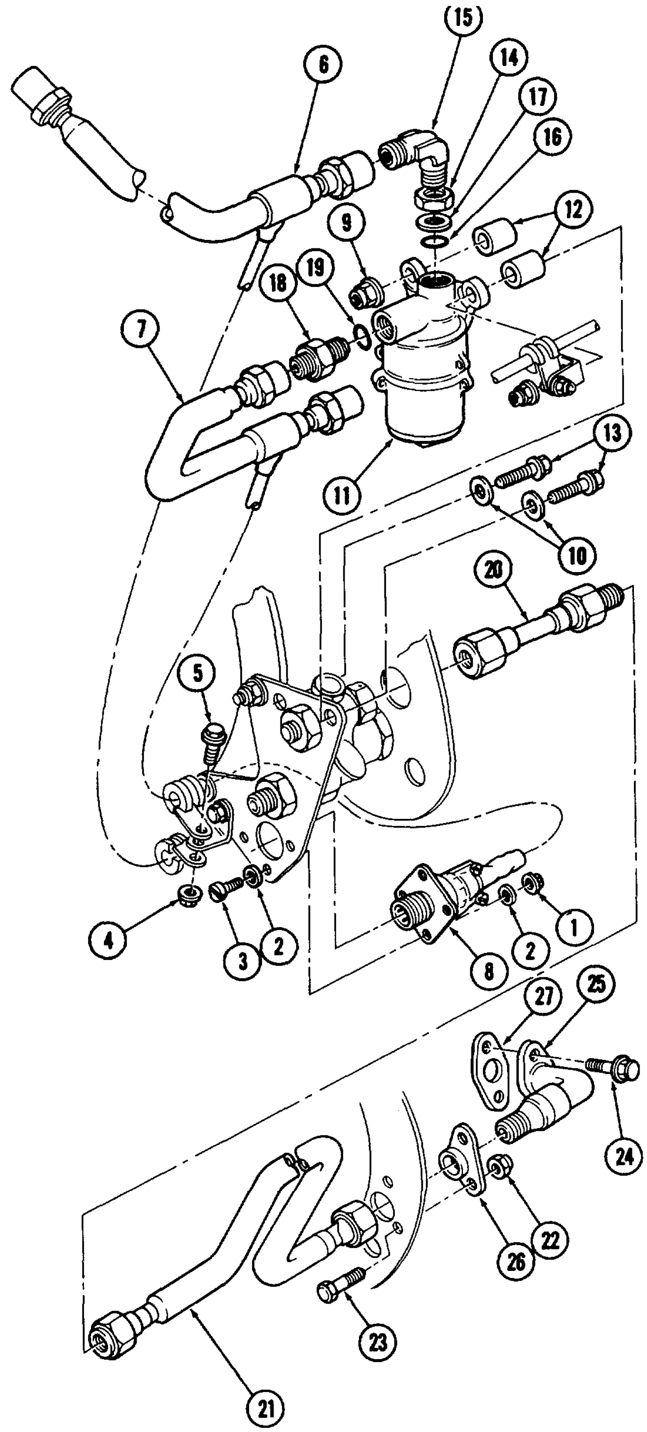
6. Remove adapter (18) and packing (19). Discard packing.

7. Remove temperature compensator (Task 6-9-1).

8. Remove lockwire and tube assemblies (20) and (21).

9. Remove nuts (22) and bolts (23).

10. Remove bolts (24), elbow (25), sleeve (26) and gasket (27). Discard gasket.

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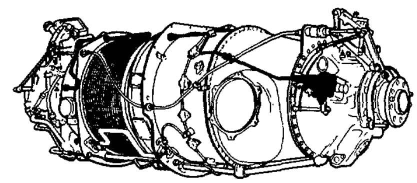
## 10-4 AIR LINES AND FITTINGS (Continued)

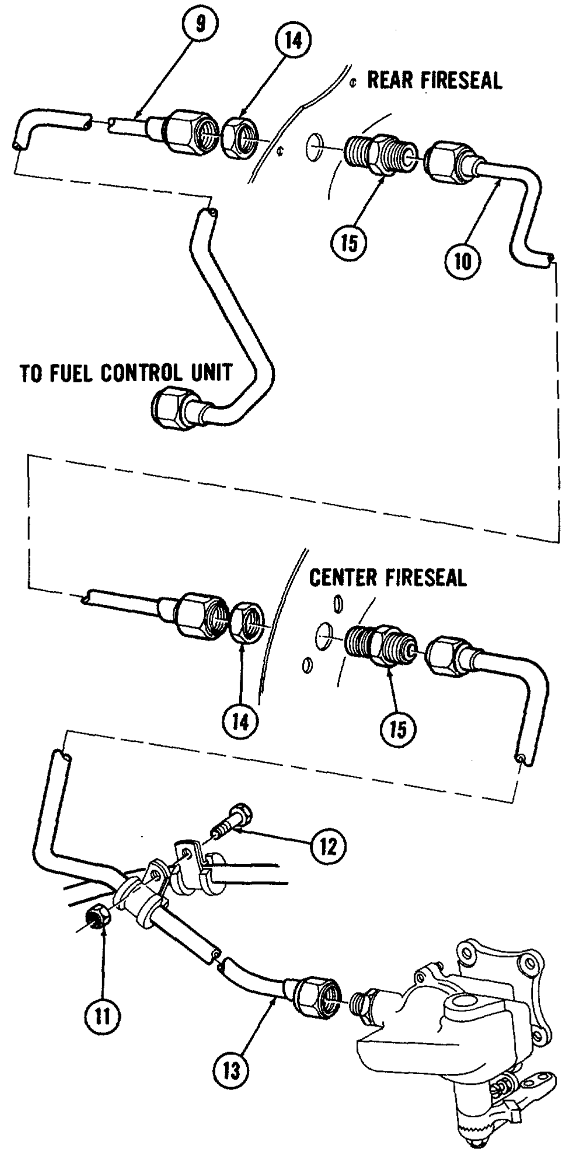
10-4-3 REMOVAL (With P3 Filter) (Cont)

11. Remove lockwire and tube assemblies (9) and (10).

12. Remove nut (11), bolt (12) and tube assembly (13).

13. Remove lockwire and nuts (14) and couplings (15).






### 10-4-4 REPAIR

1. Blend scratches and pits having maximum depth of **0.005 inch.**

2. Blend nicks and chafing not deeper than 25% of wall thickness.

3. Corrosion removable by polishing with Crocus Cloth (E. 41) is acceptable.

4. Repair cuts less than **3 inch long** in rubber sheathing as follows:

a. Apply Silastic (E. 39) to cut.

b. Bind cut area with plastic coated wire.

c. Allow Silastic to cure at room temperature for 24 hours.

d. Remove wire.

GO TO NEXT PAGE

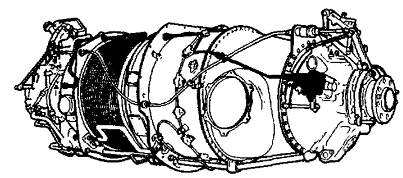
## 10-4 AIR LINES AND FITTINGS (Continued)

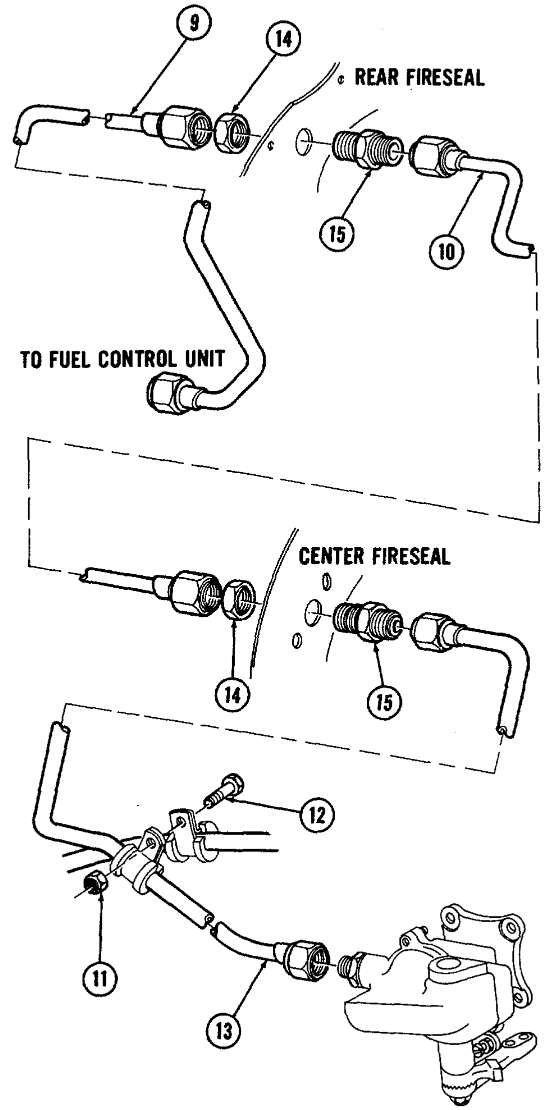
10-4-5 INSTALLATION (Without P3 Filter)

1. Install couplings (15) and nuts (14). Torque to **65 to 75 inch-pounds** and lockwire.

2. Install tube assemblies (9), (10) and (13). Torque tube nuts to **90 to 100 inch-pounds** and lockwire (E. 5).

3. Install bolt (12) and nut (11). Torque nut to **32 to 36 inch-pounds.**



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## 10-4 AIR LINES AND FITTINGS (Continued)

10-4-5 INSTALLATION (Without P3 Filter) (Cont)

4. Install gasket (12), elbow (10), sleeve (11), bolts (9), bolts (8) and nuts (7). Torque nuts to 32 to 36 inch-pounds and lockwire (E. 5) bolts.

5. Install tube assemblies (5) and (6). Torque to 90 to 100 inch-pounds and lockwire (E. 5).

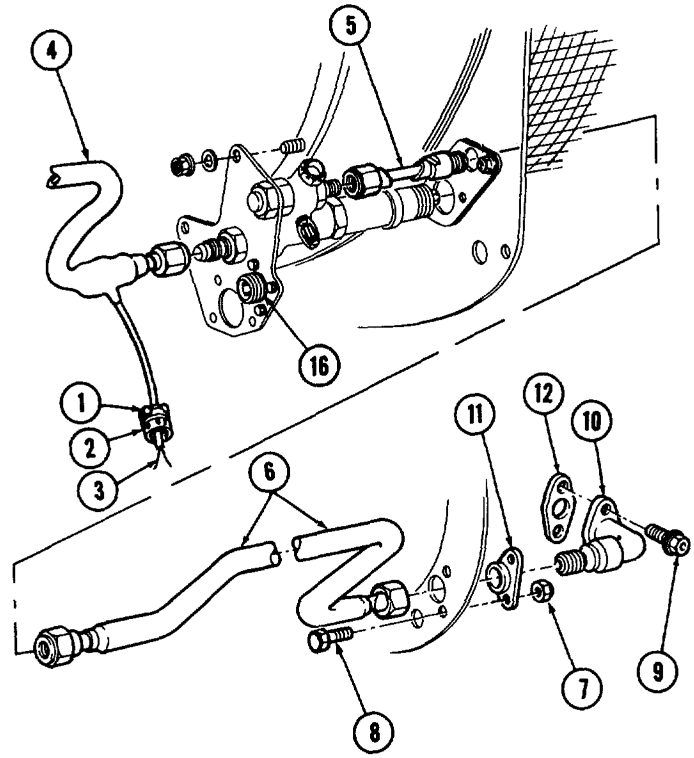
6. Install temperature compensator (Task 6-9-3).

7. Install tube assembly (4).

8. Solder (E. 47) wire (3) to connector (16).

9. Install clamp (2). Torque fingertight plus 5 degrees.

10. Torque screws (1) to 32 to 36 inch-pounds.

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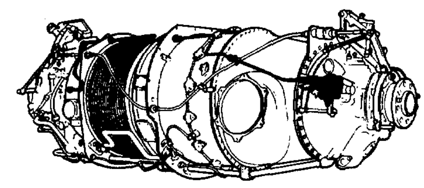
## 10-4 AIR LINES AND FITTINGS (Continued)

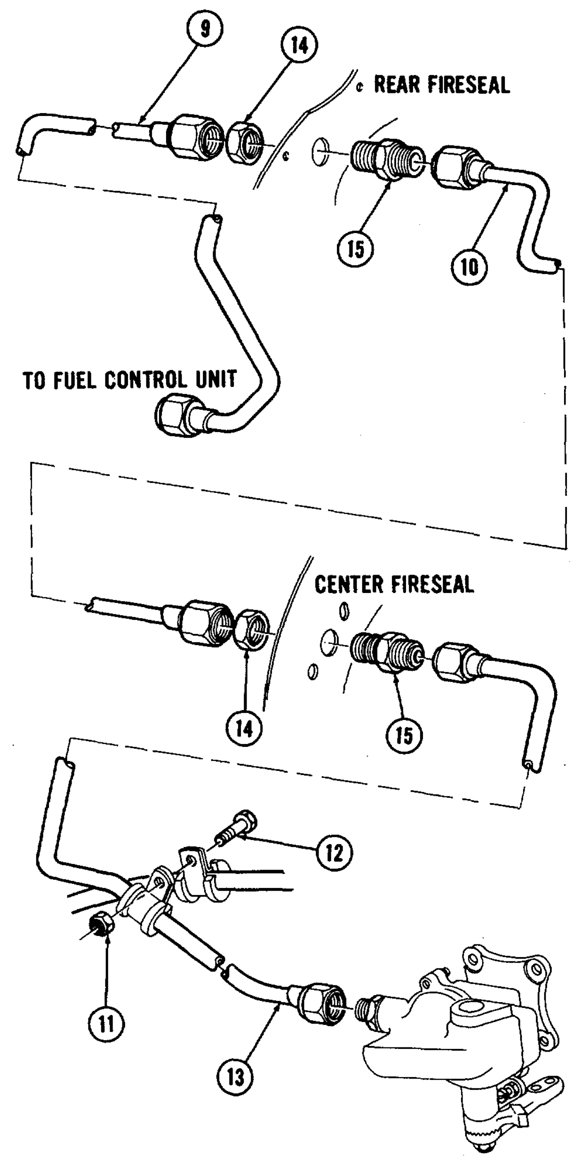
10-4-6 INSTALLATION (With P3 Filter)

1. Install couplings (15) and nuts (14). Torque to **65 to 75 inch-pounds** and lockwire (E. 5).

2. Install tube assemblies (9), (10) and (13). Torque tube nuts to **90 to 100 inch-pounds** and lockwire (E. 5).

3. Install bolt (12) and nut (11). Torque nut to **32 to 36 inch-pounds.**



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## 10-4 AIR LINES AND FITTINGS (Continued)

10-4-6 INSTALLATION (With P3 Filter) (Cont)

4. Install gasket (27), elbow (25), sleeve (26), bolts (24) and (25) and nuts (22). Torque nuts (22) to **32 to 36 inch-pounds**. Lockwire (E. 5) bolts.

5. Install tube assemblies (20) and (21). Torque tube nuts to **90 to 100 inch-pounds** and lockwire (E. 5).

6. Install temperature compensator (Task 6-9-3).

7. Lubricate packing (19).

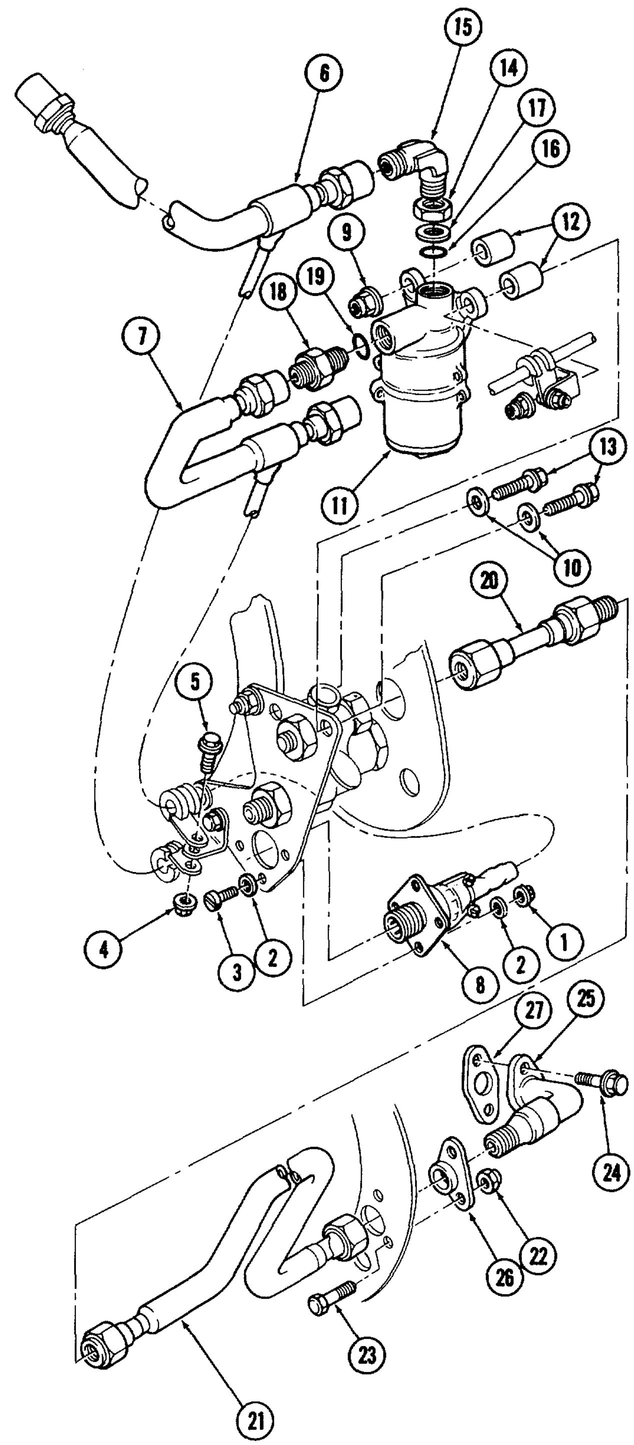
8. Install packing (19) and adapter (18). Torque . adapter to **65 to 75 inch-pounds** and lockwire (E. 5).

9. Install elbow (15), locknut (14), retainer (17) and packing (16). Torque locknut to **38 to 42 inch-pounds** and lockwire (E. 5).

10. Install bolts (13), washers (10), spacers (12), filter assembly (11) and nuts (9). Torque nuts to **32 to 36 inch-pounds.**

11.Install tube assemblies (6) and (7). Torque tube nuts to 90 to 100 inch-pounds and lockwire (E. 5).

12.Install electrical connector (8), bolts (3), washers (2), nuts (1), bolts (5) and nuts (4). Torque to **32 to 36 inch-pounds.**

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## 10-4 AIR LINES AND FITTINGS (Continued)

10-4-7 TESTING

1. Remove lockwire and disconnect tube nut (1) at elbow (2).

2. Install No. 4 union to tube nut (1) and torque tube nut to 90 to 100 inch-pounds.

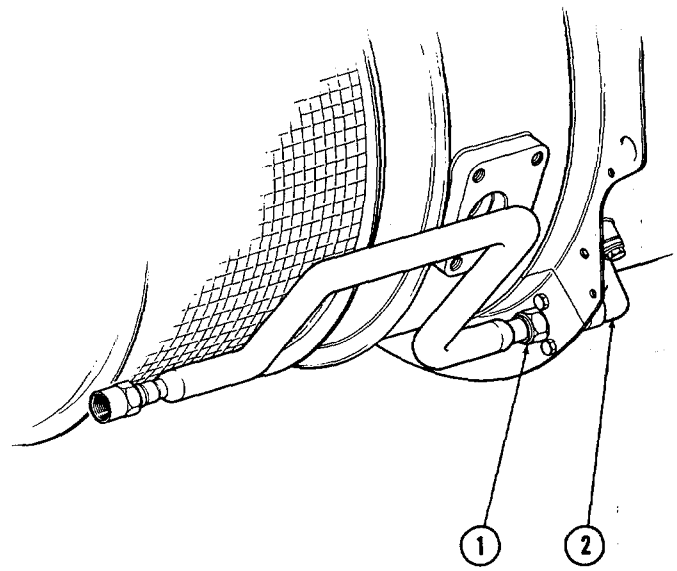
**WARNING**

**When using compressed air for cleaning, use approved protective equipment for eyes and face. Do not use more than 30 psig air pressure. Do not direct air toward yourself or another person. Failure to comply could result in injury, get medical attention.**

3. Connect an 80 ± 5 psi dry, clean air supply to No. 4 union.

4. Allow five minute stabilization period, then apply fluid (E. 38) to entire surface of all connections throughout pneumatic system to check for leaks.

5. No leaks are permitted, other than that from constant bleed hole at base of fuel control unit.




**NOTE**

**Leak testing fluid has a low viscosity and readily forms an unbroken film around connections. Any air leaks at connections will produce distinct bubbles under film.**

6. Wipe all fluid from connections if no leaks are detected. If leaks are detected, disconnect faulty connection and inspect for condition of associated parts. Install replacement parts as necessary. Retorque and lockwire.

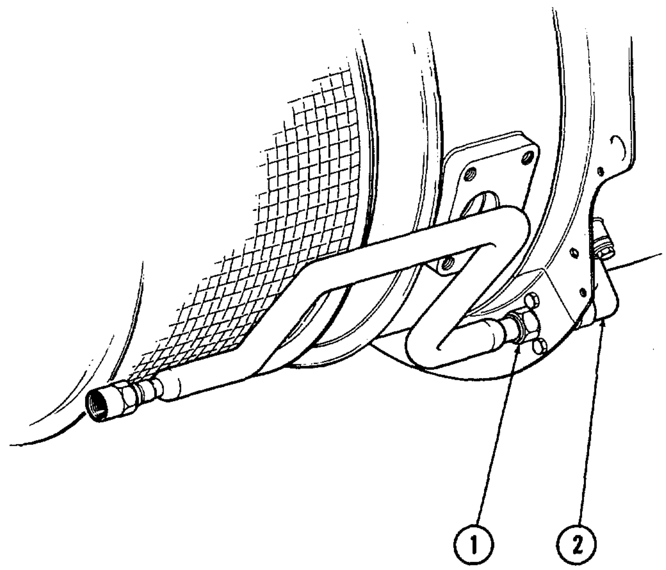
GO TO NEXT PAGE

## 10-4 AIR LINES AND FITTINGS (Continued)

10-4-5 TESTING (Cont)

7. When leaks have been detected and rectified, repeat pressure test to check particular connection(s). Disconnect air supply and remove No. 4 union.

8. Install tube nut (1) to elbow (2). Torque tube nut to **90 to 100 inch-pounds** and lockwire (E. 5).




FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section V P3 FILTER ELEMENT

### 10-5 P3 FILTER ELEMENT

This task covers:

a. Inspection (10-5-1)

b. Removal (10-5-2)

c. Cleaning (10-5-3)

d. Installation (10-5-4)

INITIAL SETUP

Applicable Configurations:
Some Engines

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (0 to 100 inch-pounds)

Materials:
Lockwire (E.5)
Petroleum Solvent (E.8)

Parts:
Packings
Filter Element

Personnel Required:
68B Powerplant Mechanic

References:
TM55-2840-251-23P

General Safety Instructions:

**WARNING**

**TOXIC AND FLAMMABLE SOLVENTS**

**Solvents used for cleaning are toxic and flammable. They irritate skin and cause burns. Fire can result from use near heat or open flame.**

**Use only in a well-ventilated area. Wear rubber gloves. In case of contact, immediately flush skin or eyes with water for at least 15 minutes. GET IMMEDIATELY MEDICAL ATTENTION FOR EYES.**

### 10-5-1 INSPECTION

1. Inspect air filter for contamination and obvious defects.

2. Replace if defective or contamination impossible to remove.

3. Insure bleed hole in cover is clear.

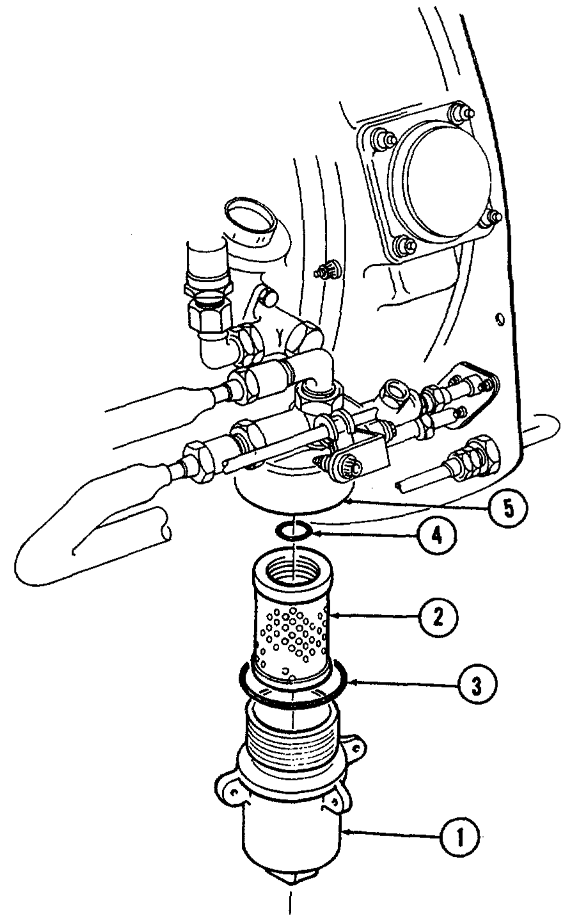
**GO TO NEXT PAGE**

## 10-5 P3 FILTER ELEMENT (Continued)

10-5-2 REMOVAL

1. Remove lockwire and unscrew cover (1).

2. Remove filter element (2) and packings (3) and (4). Discard packings.




10-5-3 CLEANING

Refer to Chapter 1, Section VIII.

10-5-4 INSTALLATION

Install packing (4), element (2), packing (3) and cover (1). Torque (not to exceed **25 inch-pounds)** cover until metal to metal contact with filter housing (5) is obtained. Lockwire (E. 5) cover.

FOLLOW ON MAINTENANCE:

None

**END OF TASK**

## Section VI CENTER FIRESEAL MOUNT RING

### 10-6 CENTER FIRESEAL MOUNT RING

This task covers:

a. Removal (10-6-1)

b. Inspection (10-6-2)

c. Repair (10-6-3)

d. Installation (10-6-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)

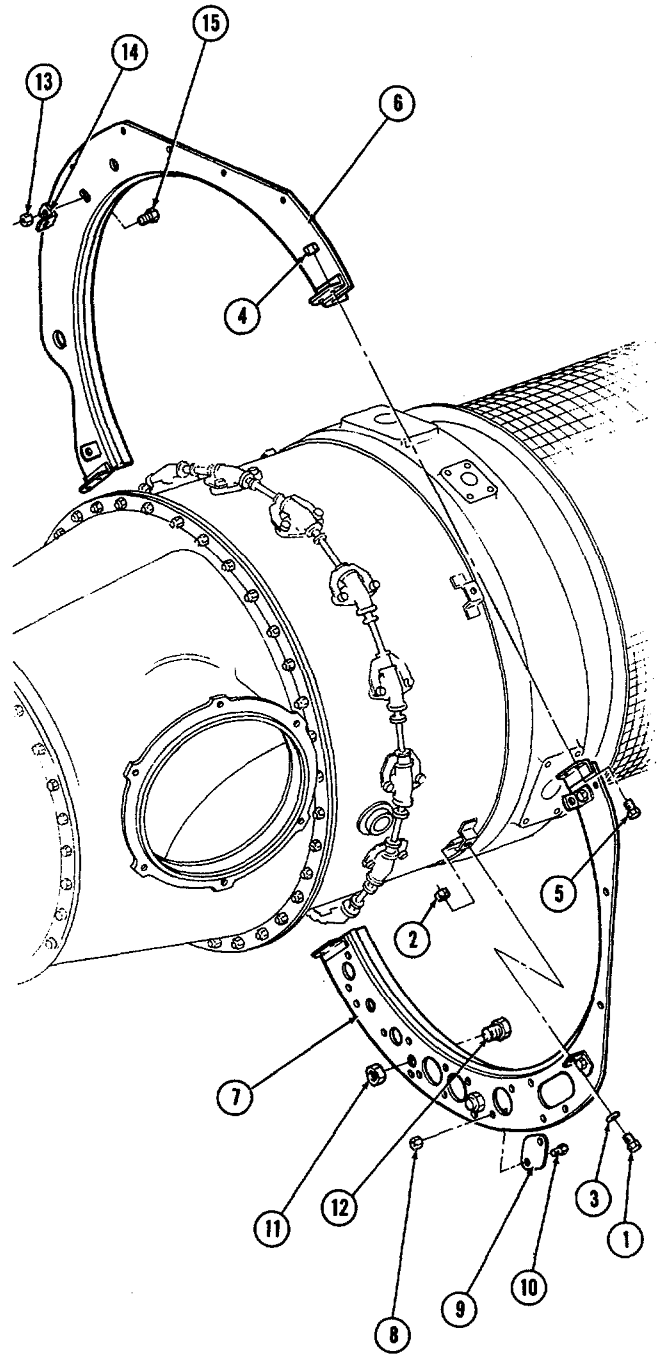
Materials:
Silastic (E.39)
Crocus Cloth (E.64)
Magnus 61C (E.70)

Personnel Required:
68B Powerplant Mechanic

GO TO NEXT PAGE

## 10-6 CENTER FIRESEAL MOUNT RING (Continued)

10-6-1 REMOVAL




1. Disconnect P3 air tube from elbow, then remove elbow from gas generator case and center fireseal mount ring (Task 10-4-2 or 10-4-3, as appropriate).

2. Disconnect power turbine governor sensing tube from union at center fireseal mount ring. Remove union (Task 10-4-2 or 10-4-3, as appropriate).

3. Remove wire rope and casing between rear fireseal mount ring and front lifting bracket (Task 10-3-1).

4. Remove pressure and scavenge oil tubes, seals and plates at center fireseal mount ring (Task 8-2-1).

5. Break fuel pressure tube at center fireseal mount ring (Task 6-11-1).

6. Remove ignition cable assemblies (Task 7-4-1).

7. Remove bolts (1), nuts (2) and washers (3).

8. Remove nuts (4), bolts (5) and fireseal halves (6) and (7).

9. Remove nuts (8), plates (9), bolts (10), nuts (11), plugs (12), nuts (13), brackets (14) and bolts (15).

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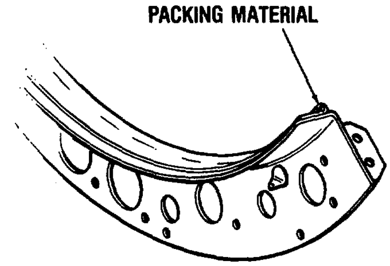
## 10-6 CENTER FIRESEAL MOUNT RING (Continued)

10-6-2 INSPECTION

Inspect for worn packing material, which shall be replaced.

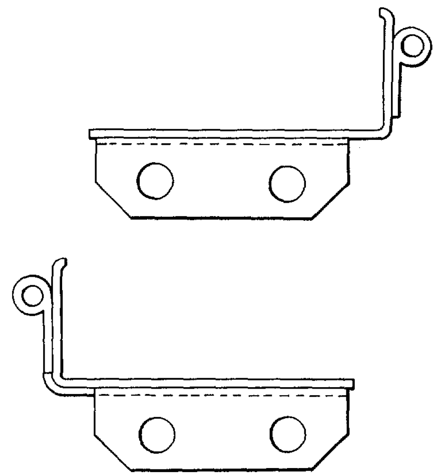



### 10-6-3 REPAIR

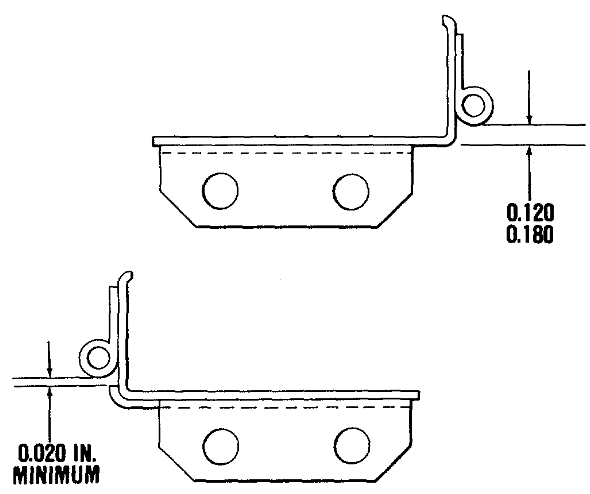
1. Clean off old packing material, and cement using Magnus 61C (E. 70).

2. Roughen bonding surfaces with Crocus Cloth (E. 64).

3. Bond packing material with Silastic (E. 39). Install packing material in reverse position for improved fit.



CENTER FIRESEAL
BEFORE REWORK




CENTER FIRESEAL
AFTER REWORK

GO TO NEXT PAGE

## 10-6 CENTER FIRESEAL MOUNT RING (Contin ued)

10-6-4 INSTALLATION

1. Install brackets (14), bolts (15) and nuts (13). Torque nuts to **32 to 36 inch-pounds**.

2. Install plugs (12) and nuts (11). Torque nuts to **32 to 36 inch-pounds.**

3. Install plates (9), bolts (10) and nuts (8). Torque nuts to **32 to 36 inch-pounds.**

4. Loosely install fireseal halves (6) and (7), bolts (5) and nuts (4). Torque nuts (4) to **32 to 36 inch-pounds.**

5. Install bolts (1), washers (3) and nuts (2). Torque nuts to **32 to 36 inch-pounds.**

6. Install ignition cable assemblies (Task 7-4-4).

7. Install fuel pressure tube at center fireseal mount ring (Task 6-11-4).

8. Install pressure and scavenge oil tubes, seals and plates (Task 8-2-5).

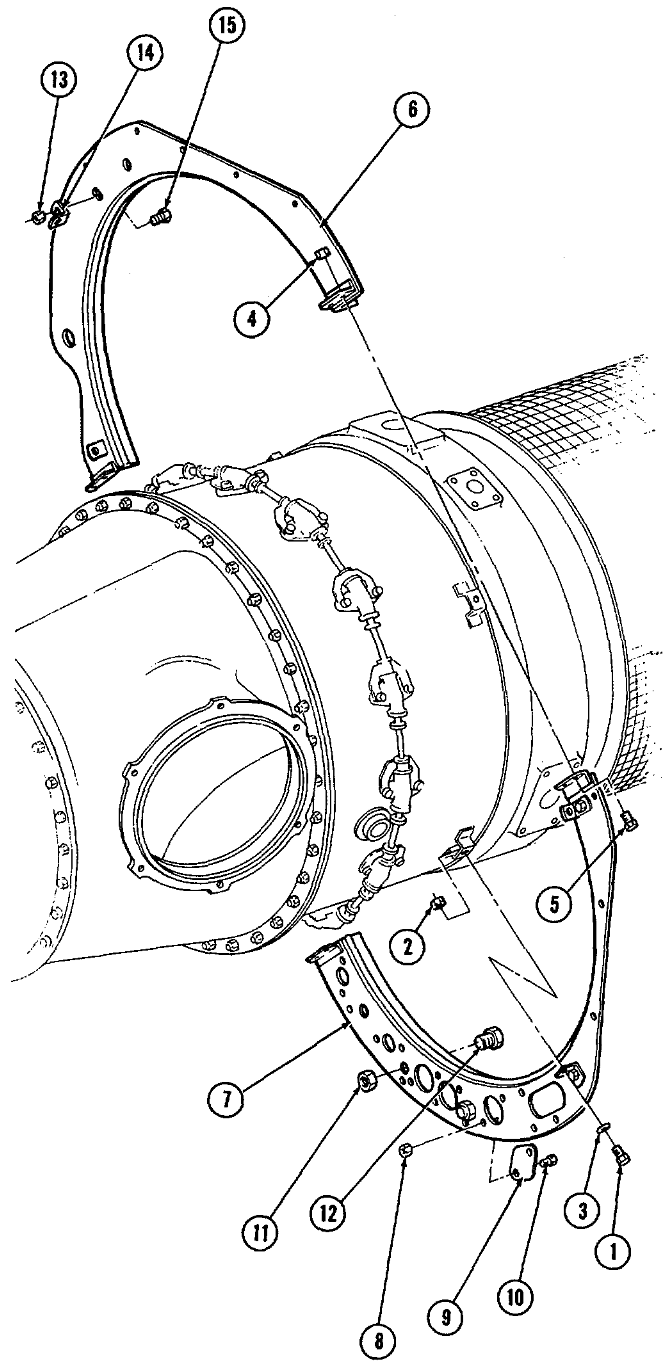
9. Install reversing wire rope and linkage (Task 10-3-3).

10. Install power turbine governor sensing tube and union (Task 10-4-5 or 10-4-6, as appropriate).

11. Install P3 elbow and tube (Task 10-4-5 or 10-4-6, as appropriate).

FOLLOW ON MAINTENANCE:

None




**END OF TASK**

## Section VII REAR FIRESEAL MOUNT RING

### 10-7 REAR FIRESEAL MOUNT RING

This task covers:

a. Removal (10-7-1)

b. Inspection (10-7-2)

c. Repair (10-7-3)

d. Installation (10-7-4)

INITIAL SETUP

Applicable Configurations:
All

Tools:
Powerplant Mechanic's Tool Kit
NSN 5180-00-323-4944
Torque Wrench (O to 100 inch-pounds)

Materials:
Silastic (E.39)
Crocus Cloth (E.64)
Adhesive (E.65)
Magnus 61C (E.70)

Personnel Required:
68B Powerplant Mechanic

GO TO NEXT PAGE

## 10-7 REAR FIRESEAL MOUNT RING (Continued)

10-7- REMOVAL

1. Remove oil pressure and scavenge tubes, seals and plates (Task 8-2-1).

2. Disconnect clevis at propeller control cam, then disassemble wire rope and casing at rear fireseal mount ring (Task 10-3-1).

3. Disconnect power turbine governor sensing tube and remove union (Task 10-4-2 or 10-4-3, as appropriate).

4. Disconnect P3 pressure tube (Task 10-4-2 or 10-4-3, as appropriate).

5. Remove fuel pressure tube, nut and washer (Task 6-11-1).

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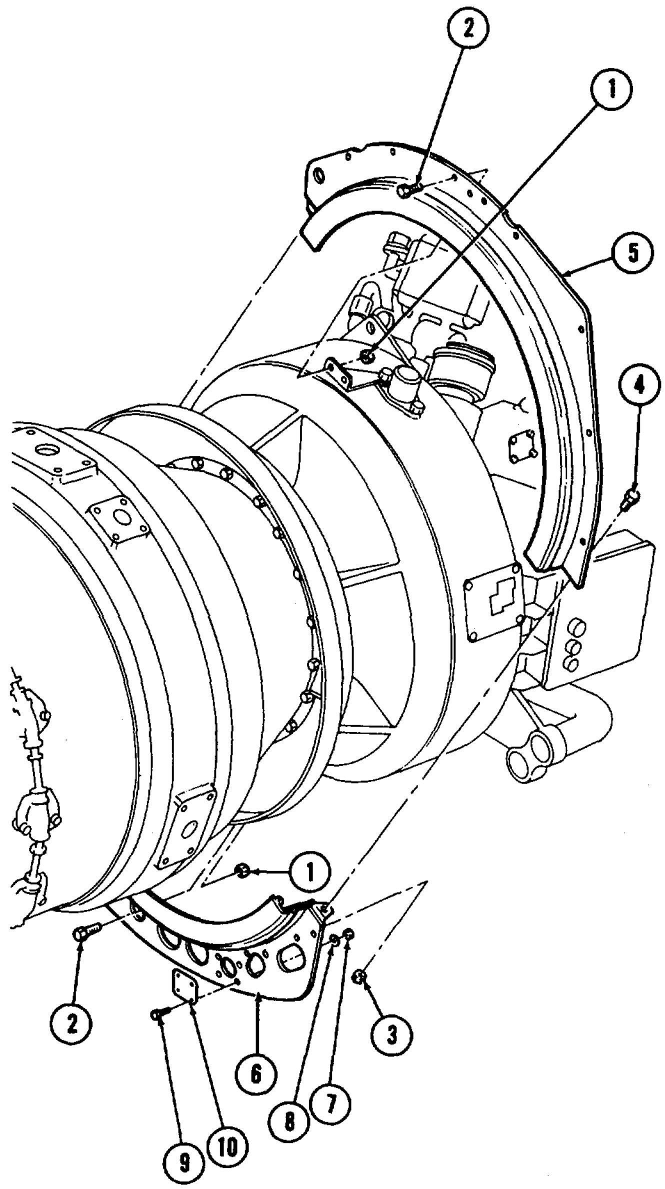
## 10-7 REAR FIRESEAL MOUNT RING (Continued)

10-7-1 REMOVAL (Cont)

6. Remove nuts (1) and bolts (2).

7. Remove nuts (3), bolts (4) and fireseal halves (5) and (6).

8. Remove nuts (7), washers (8), bolts (9) and plate (10).

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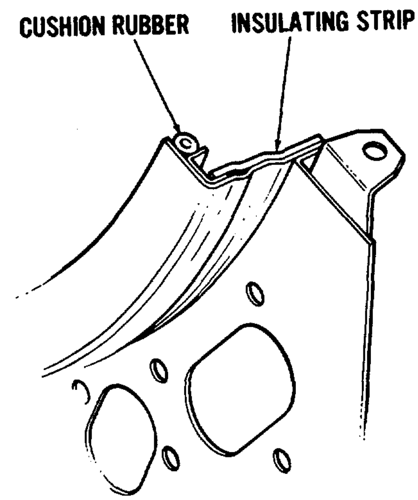
## 10-7 REAR FIRESEAL MOUNT RING (Continued)

10-7-2 INSPECTION

Inspect for worn insulating strip or deteriorated cushion rubber, which shall be replaced.




**10-7-3 REPAIR**

1. Clean off old insulating strip, cushion rubber and cement using Magnus 61C (E. 70).

2. Roughen bonding surfaces with Crocus Cloth (E. 64).

3. Bond cushion rubber with Adhesive (E. 65).

4. Bond insulating strip with Silastic (E. 39).

GO TO NEXT PAGE

## 10-7 REAR FIRESEAL MOUNT RING (Continued)

10-7-4 INSTALLATION

1. Install plate (10), bolts (9), washers (8) and nuts (7).

2. Loosely install fireseal halves (5) and (6), bolts (4) and washers (3).

3. Install bolts (2) and nuts (1).

4. Torque nuts (3) and (7) to **32 to 36 inch-pounds.**

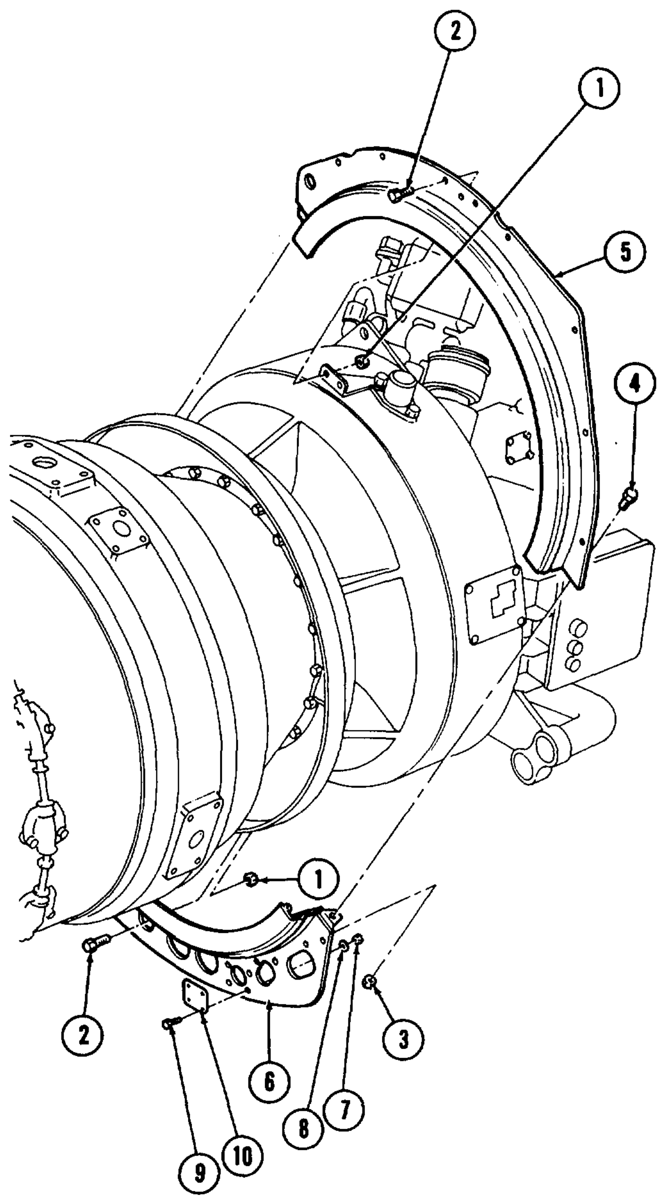
5. Install fuel pressure tube, nut and washer (Task 6-11-4).

6. Connect P3 pressure tube (Task 10-4-5 or 10-4-6, as appropriate).

7. Install union and power turbine sensing tube (Task 10-4-5 or 10-4-6, as appropriate).

8. Install reversing linkage, wire rope, casing and clevis (Task 10-3-3).

9. Install oil pressure and scavenge tubes, seals and plates (Task 8-2-5).




FOLLOW ON MAINTENANCE:

None

**END OF TASK**

# APPENDIX A

# REFERENCES

## A-1. DA Technical Bulletins

| | |
|---|---|
| TB43-0106 | Aeronautical Equipment Army Oil Analysis Program (AOAP) |
| TB55-8100-200-24 | Maintenance of Specialized Reusable Containers for Aircraft Equipment |

## A-2. DA Technical Manuals

| | |
|---|---|
| TM1-42B-1-7 | General Use of Aircraft and Electronic Lubricants |
| TM43-0002-1 | Procedure for Destruction of Air Delivery Equipment to Prevent Enemy Use |
| TM55-1500-340-PMS | Preventive Maintenance Check Services |
| TM55-1500-204-25/1 | General Aircraft Maintenance Manual |
| TM55-1510-209-10 | Operators Manual; U-21A Aircraft |
| TM55-1510-209-23 | Organizational Maintenance Manual |
| TM55-1510-215-10 | Operators Manual; U-21G Aircraft |
| TM55-1510-215-23-1 | Aviation Unit and Aviation Intermediate Maintenance Manual; Army Models U-21G, RU-21E and RU-21H |
| TM55-1510-215-23-2 | Aviation Unit and Aviation Intermediate Maintenance Manual; Army Models U-21G, RU-21E and RU-21H |
| TM55-2840-251-23P | Repair Parts and Special Tools List |
| TM55-4920-328-13 | Operators, Organizational DS and GS Maintenance Manual Modular Engine Test System |

## A-3. DA Pamphlets

| | |
|---|---|
| DA Pamphlet 738-751 | Functional Users Manual for the Army Maintenance Management System Aviation (TAMMS-A) |

APPENDIX A

REFERENCES (Continued)

A-4. DA Field Manuals

| | |
|---|---|
| FM21-11 | First Aid for Soldiers Maintenance |
| FM55-411 | Maintenance, Quality Control, and Technical Inspection Guide for Army Aircraft |

A-5. Specifications and Standards

| | |
|---|---|
| MIL-B-121 | Barrier Material, Greaseproofed, Waterproofed, Flexible |
| MIL-B-15395 | Brazing Alloy, Silver |
| MIL-S-23190 | Strap, Cable, Adjustable, Plastic |
| MIL-L-23699 | Lubricating Oil, Aircraft Turbine Engines, Synthetic Base |
| MIL-D-3464 | Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification |
| MIL-E-5607 | Preservation |
| MIL-STD-129 | Identification |
| MIL-G-4343 | Grease, Pneumatic System |
| MIL-C-5646 | Cloth, Airplane, Cotton |
| MIL-F-7516 | Fluxes, Welding, Corrosion and Heat Resistant Alloy |
| MIL-L-7808 | Lubricating Oil, Aircraft Turbine Engines, Synthetic Base |
| H-B-00621 | Brush, Stencil |
| O-F-499 | Flux, Brazing, Silver Alloy, Low Melting Point |
| P-D-680 | Dry Cleaning Solvent |
| P-S-624 | Soap, Toilet, Liquid and Paste |

APPENDIX A

REFERENCES (Continued)

A-5. Specifications and Standards (Cont)

| | |
|---|---|
| TT-M-261 | Methyl-Ethyl-Ketone |
| UU-T-106 | Tape, Pressure-Sensitive Adhesive, Masking, Paper |
| VV-P-216 | Penetrating Oil |
| VV-P-236 | Petrolatum, Technical |

# APPENDIX B

## Section I INTRODUCTION

### B-1. MAINTENANCE ALLOCATION CHART

a. This Maintenance Allocation Chart (MAC) (Section II) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for Army Aircraft. These maintenance levels, Aviation Unit Maintenance (AVUM), Aviation Intermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as:

AVUM which corresponds to the O Code in the RPSTL
AVIM which corresponds to the F Code in the RPSTL
DEPOT which corresponds to the D Code in the RPSTL

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM) activities will be staffed and equipped to perform high frequency "On-Aircraft" maintenance tasks required to retain or return aircraft to a serviceable condition. The maintenance capability of the AVUM will be governed by the Maintenance Allocation Chart (MAC) and limited by the amount and complexity of ground support equipment (GSE), facilities required, and number of spares and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignments of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources and air mobility requirements. )

(a) COMPANY SIZE AVIATION UNITS.

Company size Aviation Units perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of aircraft operational readiness. Perform maintenance inspections and servicing to include preflight, daily, intermediate, periodic and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, built-in-test equipment (BITE), installed aircraft instruments, or easy to use/interpret diagnostic/fault isolation devices (TMDE). Replace worn or damaged modules/components which do not require complex adjustments or system alignment and which can be removed/installed with available skills, tools and equipment. Perform operational and continuity checks and make minor repairs to the electrical system. Inspect, service and make operational capacity and pressure checks to hydraulic system. Perform servicing, functional adjustments, and minor repair/ replacement to the flight control, propulsion, power train and fuel system. Accomplish airframe repair which does not require extensive disassembly, jigging, or alignment. The manufacture of airframe parts will be limited to those items which can be fabricated with tools and equipment found in current air mobile tool and shop sets. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

## APPENDIX B

### Section I INTRODUCTION (Continued)

(b) Less Than Company Size Aviation Units.

Aviation elements organic to brigade, group, battalion headquarters and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by these units will be those which can be accomplished by the aircraft crew chief or assigned aircraft repairman and will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, application of nonstress patches, minor adjustments, module/components fault diagnosis and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

(2) Aviation Intermediate Maintenance (AVIM) provides mobile, responsive "One Stop" maintenance support. (Maintenance functions which are not conducive to sustaining air mobility will be assigned to depot maintenance). Performs all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and end items which can be accomplished efficiently with available skills, tools, and equipment. Establishes the Direct Exchange (DX) program for AVUM units by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. Inspects, troubleshoots, test diagnoses, repairs, adjusts, calibrates, and aligns aircraft system modules/components. 'AVIM units will have capability to determine the serviceability of specified modules/ components removed prior to the expiration of the Time Between Overhaul (TBO) or finite life. Module/components disassembly and repair will support the DX program and will normally be limited to tasks requiring cleaning and the replacement of seals, fittings and items of common hardware. Air frame repair and fabrication of parts will be limited to those maintenance tasks which can be performed with available tools and test equipment. Unserviceable repairable modules/ components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. This level will perform aircraft weight and balance inspections and other special inspections which exceed AVUM capability. Provides quick response maintenance support, including aircraft recovery and air evacuation, on-the-job training, and technical assistance through the use of mobile maintenance contact teams. Maintains authorized operational readiness float aircraft. Provides collection and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 750-50. (The aircraft maintenance company within the maintenance battalion of a division will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resource. Additional intermediate maintenance support will be provided by the supporting nondivisional AVIM unit. )

## APPENDIX B

### Section I INTRODUCTION (Continued)

### B-2. USE OF THE MAINTENANCE ALLOCATION CHART

a. The Maintenance Allocation Chart assigns maintenance functions based on past experience and the following considerations:

(1) Skills available.
(2) Time required.
(3) Tools and test equipment required and/or available.

b. The assigned levels of maintenance authorized to perform a maintenance function are indicated.

c. A maintenance function assigned to a lower maintenance level will automatically be authorized to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts in stock. Information to requisition or otherwise secure the necessary repair parts will be as specified in the Repair Parts and Special Tools List.

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a higher maintenance level may on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the higher level of maintenance to which the function is assigned. The special tools, equipment, etc. required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance will provide technical supervision and inspection of the function being performed at the lower level.

g. Maintenance of the U. S. Army Electronics Material Readiness Command equipment will be performed by designated U. S. Army Electronics Command personnel.

h. Changes to the Maintenance Allocation Chart will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

## APPENDIX B

### Section I INTRODUCTION (Continued)

### B-3. DEFINITIONS

Maintenance functions. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of any item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i. e. to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunctions, or failure in a part, subassembly, module (component or assembly), end item, or system.

## APPENDIX B

### Section I INTRODUCTION (Continued)

j. Overhaul. The maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e. DMWR) in the appropriate technical publication. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero, those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

### B-4 STANDARD GROUPS

The standard groupings shown below are used, as applicable, throughout this MAC. Maintenance manuals and RPSTLs will reflect these standard groupings as individual chapters with sections in each chapter relative to the individual complete systems, subsystems, modules, components, assemblies, or specific parts noted.

### B-5 SYMBOLS

The letters "AVUM, AVIM, and DEPOT" as placed on the Maintenance Allocation Chart indicate the level of Maintenance responsible for performing the particular maintenance function based upon assigned skills, tools and test equipment and time required to accomplish maintenance.

### B-6 FUNCTIONAL GROUPS

| GROUP NUMBER | DESCRIPTION |
|---|---|
| 0400 | ENGINE SYSTEM |
| 0401 | ENGINE GENERAL |
| | Servicing, handling, inspection requirements, lubrication charts, overhaul & retirement schedules. (As applicable). |
| 0402 | COMPRESSOR SECTION |
| | Rotor, blades, vanes, impeller, stators, inlet guide vanes, main frame, particle separator, bleed valve, bearings, seals, external lines & hoses. |

**APPENDIX B**

**Section I INTRODUCTION (Continued)**

**B-6 FUNCTIONAL GROUPS (Cont)**

| GROUP NUMBER | DESCRIPTION |
|---|---|
| 0403 | COMBUSTION SECTION |
| | Liners, nozzles, stators, rotor seals, couplings, blades. |
| 0404 | POWER TURBINE |
| | Nozzles, rotors,. blades, exit guide vanes, exhaust frame, drive shaft, bearings, seals, external lines & hoses. |
| 0405 | ACCESSORY GEARBOX |
| | Input/and output gears, seals, chip detector, housings, drive shaft, bearings, seals. |
| 0406 | FUEL SYSTEM |
| | Fuel control, fuel boost pump, governors, fuel filter assembly, sequence valve, fuel manifold, fuel nozzle, external lines & hoses. |
| 0407 | ELECTRICAL SYSTEM |
| | Electrical control units, exciters, thermocouples, ignition harness, electrical cables, history recorders, torque overspeed sensor, Np sensor, alternate stator, blowers. |
| 0408 | OIL SYSTEM |
| | Tanks, oil filter, oil cooler, lube and scavenge pumps, oil filter bypass sensor, external lines & hoses. |
| 0409 | PROPELLER GEARBOX |
| | Propeller reduction gear assembly, output shaft, seal, bearing |
| 0410 | MISCELLANEOUS EQUIPMENT |
| | Tachometer generator, fire seal mount rings, propeller reversing gear, air lines and fittings, P3 filter element. |

## APPENDIX B

### Section I INTRODUCTION (Continued)

#### B-7 WORK TIME

The symbol -.-identifies the level of Maintenance authorized to perform a maintenance function and indicates that work time figures are being developed and will be entered at a later date. When developed, this time will appear for example, as 0.1 instead of the -.-symbol.

#### B-8 TOOLS, TEST EQUIPMENT AND SHOP SETS

Special tools, test, and support equipment (Section III) required to do maintenance functions are given a reference number to permit cross-referencing to column 5 of the MAC. In addition, the maintenance category authorized to use the device is listed along with the item National Stock Number and, if applicable, the part number to identify the tool/device.

#### B-9 REMARKS

Column 6 (RMK) of the MAC contains alphabetic reference codes A through D which are explained in Section II of this appendix.

**APPENDIX B**

**Section II**

**MAINTENANCE ALLOCATION CHART**

| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY AVUM | AVIM | DEPOT | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
|---|---|---|---|---|---|---|---|

**NOTE**

The AVUM maintenance functions identified herein are restricted to company size units. These units are authorized SC 4920-99-CL-A92 (AVUM #2) Tool Set and have 10 or more aircraft assigned. Refer to paragraph B-1 (1) (a).

| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | AVUM | AVIM | DEPOT | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
|---|---|---|---|---|---|---|---|
| 0400 | Engine System | | | | | | |
| 0401 | Engine Assembly General | Inspect | -.- | | | 60 | |
| | | Test | -.- | -.- | | 60,62,68, | A,B |
| | | Service | -.- | | | 24,60,62 | |
| | | Remove/ Install | | -.- | | 5,38,43, 51,68,69 | |
| | | Repair | -.- | | | 2,24,38, 49,60,62 | C |
| | | Overhaul | | | | | |
| 0402 | Compressor Section (cold section module) | | -.- | | | 60 | |
| 040201 | Air Inlet Screen | Inspect | -.- | | | 60,62 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Repair | | | | | |
| 040202 | Compressor Bleed Valve | | -.- | | | 60 | |
| | | Inspect | -.- | | | 60,62 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Repair | | | | | |

## APPENDIX B

### Section II

| MAINTENANCE ALLOCATION CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY | | | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
| | | | AVUM | AVIM | DEPOT | | |
| 040203 | Compressor Turbine Assembly | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- -.- | | 1,14,19,31, 41,42,47,48, 53,68,69 | |
| 04020301 | Compressor Rotor Blades (first-stage) | Inspect | | -.- | | 69 | D |
| 0403 | Combustion Section | | | | | | |
| 040301 | Liner Assembly | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 68,69 | |
| | | Repair | | -.- | | 68,69,70 | |
| 040302 | Large Exit Duct | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 68,69 | |
| 040303 | Small Exit Duct Shroud and Vane Assembly | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 68,69 | |
| | | Repair | | -.- | | 46,68 | |
| 0404 | Power Turbine | | | | | | |
| 040401 | Power Turbine Stator Housing | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 68,69 | |
| 040402 | Power Turbine Stator Assembly | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 68,69 | |

**APPENDIX B**

**Section II**

| MAINTENANCE ALLOCATION CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY | | | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
| | | | AVUM | AVIM | DEPOT | | |
| 040403 | Power Turbine Rotor Assembly | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 19,31,47, 48,54,68, 69 | |
| 040404 | Power Turbine Blades | Inspect | | -.- | | 69 | |
| | | Repair | | -.- | | 68,69 | |
| 040405 | Power Turbine Shroud | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 28,68,69 | |
| | | Repair | | -.- | | 1,6,13,16, 28,52,68, 69 | |
| 040406 | Exhaust Duct | Inspect | -.- | | | 60 | |
| | | Remove/ Install | | -.- | | 4,40,68, 69 | |
| | | Repair | | -.- | | 10,67,68, 69,70 | |
| 0405 | Accessory Gearbox | Inspect | -.- | | | 15,60 | |
| | | Remove/ Install | | -.- | | 30,40,55, 68,69 | |
| | | Repair | | -.- | | 3,7,23,55 68,69 | |
| | | Overhaul | | | -.- | | |
| 040501 | Accessory Drive Shaft | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 68,69 | |

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## Section II

| MAINTENANCE ALLOCATION CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY AVUM | AVIM | DEPOT | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
| 040502 | External Accessory Drive Seals | Inspect | | -.- | | 69 | |
| | | Remove/ Install | | -.- | | 8,20,21,45 49,68,69, 73 | |
| 0406 | Fuel System | | | | | | |
| 040601 | Fuel Control Assembly | Inspect | -.- | | | 60 | |
| | | Adjust | -.- | | | 60,62 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Overhaul | | | -.- | | |
| 04060101 | Fuel Control Linkage | Inspect | -.- | | | 60 | |
| | | Adjust | -.- | | | 60,62 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| 040602 | Fuel Pump Assembly | Remove/ Install | -.- | | | 60,62 | |
| | | Overhaul | | | -.- | | |
| 04060201 | Fuel Pump Filter Element | Inspect | -.- | | | 60 | |
| | | Clean | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| 040603 | Fuel Manifold Assembly | Remove/ Install | -.- | | | 60,62 | |

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### Section II

| MAINTENANCE ALLOCATION CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY | | | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
| | | | AVUM | AVIM | DEPOT | | |
| 04060301 | Fuel Nozzle and Adapter Assembly | Inspect | | -.- | | 60 | |
| | | Clean | | -.- | | | |
| | | Test | | -.- | | 11,12,18, 37 | |
| | | Disassemble | | -.- | | 68,69 | |
| | | Assemble | | -.- | | 32,60,62 | |
| 04060302 | Fuel Nozzle | Inspect | | -.- | | 69 | |
| | | Disassemble /Assemble | | -.- | | 68,69 | |
| | | Clean | | -.- | | 37 | |
| 040604 | Fuel Drain Valve | Inspect | -.- | | | 60 | |
| | | Clean | -.- | | | | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Overhaul | | | -.- | | |
| 040605 | Temperature Compensator | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Overhaul | | | -.- | | |
| 040606 | Fuel Dump Valve | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Overhaul. | | | -.- | | |

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## Section II

| MAINTENANCE ALLOCATION CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY | | | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
| | | | AVUM | AVIM | DEPOT | | |
| 040607 | Fuel Lines and Fittings | Inspect | -.- | | | 60 | |
| | | Clean | | | | | |
| | | Remove/ Install | -.- | | | 60,62 | |
| 0407 | Electrical System | | | | | | |
| 040701 | Igniter Plugs | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| 040702 | Ignition Regulator | Inspect | -.- | | | 60,61 | |
| | | Test | -.- | | | 60,61,62 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Repair | | -.- | | 60,61,62, 67 | |
| | | Overhaul | | | -.- | | |
| 04070201 | Electron Tubes | Inspect | -.- | | | 60,61 | |
| | | Test | | -.- | | 64,68,69 | |
| | | Remove/ Install | | -.- | | 60,62 | |
| 040703 | Electrical Harness (Ignition) | Inspect | | -.- | | 60,61 | |
| | | Remove/ Install | | -.- | | 60,62 | |

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## Section II

### MAINTENANCE ALLOCATION CHART

| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY AVUM | AVIM | DEPOT | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
|---|---|---|---|---|---|---|---|
| 040704 | Thermocouple Harness | Inspect | | -.- | | 69 | |
| | | Test | | -.- | | 64,68,69 | |
| | | Remove/ Install | | -.- | | 68,69 | |
| | | Repair | | -.- | | 17,69 | |
| 040705 | Thermocouple Bus Bar | Inspect | | -.- | | 69 | |
| | | Test | | -.- | | 64,68,69 | |
| | | Remove/ Install | | -.- | | 68,69,74 | |
| 040706 | Thermocouple Probes | Inspect | | -.- | | 69 | |
| | | Test | | -.- | | 64,68,69 | |
| | | Remove/ Install | | -.- | | 17,56,57, 68,69 | |
| 0408 | Oil System | | | | | | |
| 040801 | Oil Filter Element | Inspect | -.- | | | 33,60 | |
| | | Clean | -.- | | | 62 | |
| | | Remove/ Install | -.- | | | 33,60,62 | |
| 040802 | Oil Lines and Fittings | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 27,60,62 | |
| | | Repair | -.- | | | 60,62 | |
| | | Clean | -.- | | | | |

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## Section II

| MAINTENANCE ALLOCATION CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY AVUM | AVIM | DEPOT | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
| 040803 | Oil-to-Fuel Heater | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Overhaul | | | -.- | | |
| 040804 | Oil Pressure Relief Valve | Clean | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 22,60,62 | |
| 0409 | Propeller Gearbox | | | | | | |
| 040901 | Propeller Gearbox Assembly | Inspect | -.- | | | 60 | |
| | | Remove/ Install | | -.- | | 41,62 | |
| | | Repair | | -.- | | 4,40,41, 58,59,62, 68,69 | |
| | | Overhaul | | | -.- | | |
| 040902 | Transfer Housing Seals | Inspect | | | | 60 | |
| | | Remove/ Install | | -.- | | 4,25,26, 34,35,36, | |
| | | | | -.- | | 40,41,44, 68,69 | |
| 040903 | Propeller Shaft Seal | Inspect | -.- | | | 60 | |
| | | Remove/ Install | | -.- | | 68,69 | |

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## Section II

| MAINTENANCE ALLOCATION CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY AVUM | AVIM | DEPOT | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
| 040904 | Power Turbine Governor | Inspect | -.- | | | 60 | |
| | | Adjust | -.- | | | 60,62 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Overhaul | | | -.- | | |
| 0410 | Miscellaneous Equipment | | | | | | |
| 041001 | Tachometer Generator | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| 041002 | Fireseal Mount Rings | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Repair | -.- | | | 60,62 | |
| 041003 | Propeller Reversing Mechanism | Inspect | -.- | | | 60 | |
| | | Adjust | -.- | | | 60,62 | |
| | | Repair | | -.- | | 60,62 | |
| 041004 | Air Lines and Fittings | Inspect | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |
| | | Repair | -.- | | | 60,62 | |
| 041005 | P3 Air Filter Element | Inspect | -.- | | | 60 | |
| | | Service | -.- | | | 60 | |
| | | Remove/ Install | -.- | | | 60,62 | |

# APPENDIX B

## Section II

## MAINTENANCE ALLOCATION CHART (Continued)

**REMARKS (RMK)**

| REFERENCE CODE | REMARKS |
|---|---|
| A | Functional Test at AVUM - Engine in Airframe |
| B | Functional Test at AVIM - Engine METS |
| C | Repair limited to replacement of external lines, hoses and accessories |
| D | Inspection of 1st stage only. |

## APPENDIX B

### Section III

### TOOL AND TEST EQUIPMENT REQUIREMENTS

**NOTE**

**Part number prefix PWC may still show as CPWA on some tools. This is a 'logistics only' change and does not alter the tool or its purpose.**

| TOOL OR TEST EQUIPMENT REFERENCE CODE | MAINTENANCE CATEGORY | NOMENCLATURE | NATIONAL/NATO STOCK NUMBER | TOOL NUMBER |
|---|---|---|---|---|
| 1 | AVIM | Adapter - Turbine Shaft | 5120-00-882-6615 | PWC30409 |
| 2 | AVUM | Adapter, Engine Stand | 4920-01-070-1182 | PWC33232 |
| 3 | AVIM | Drift and Base, Centrifugal Breather Shaft Seal | 5120-00-837-9351 | PWC30051 |
| 4 | AVIM | Base, Propeller Gearbox | 4920-00-840-9931 | PWC30322 |
| 5 | AVIM | Bracket, Engine Mount | 4920-01-119-3225 | PWC33289 |
| 6 | AVIM | Cover, Power Grind | 3640-00-838-5671 | PWC30237 |
| 7 | AVIM | Drift, Carbon Seal | 5120-00-837-9338 | PWC30054 |
| 8 | AVIM | Drift, Accessory Gearbox Shaft Oil Seal | 5120-00-841-9433 | PWC30075 |
| 9 | AVUM | Eye, Power Section Lifting | 4920-00-840-9941 | PWC30040 |
| 10 | AVIM | Puller, Oil Transfer Tube | 5120-00-837-9314 | PWC30128-1 |
| 11 | AVIM | Fixture, Fuel Leak Check | 4920-00-840-9955 | PWC30270 |
| 12 | AVIM | Fixture, Fuel Nozzle Flow | 4920-00-446-8906 | PWC30521 |
| 13 | AVIM | Gage, Power Turbine Shroud Radius | 5220-00-837-9207 | PWC30169 |
| 14 | AVIM | Gage, Comp. Turbine Shroud Radius | 5220-00-105-2775 | PWC30417 |
| 15 | AVUM | Gage, Starter Gearshaft Spline | 4920-00-451-5927 | PWC30499-50 |
| 16 | AVIM | Grinder, Shroud | 3450-00-838-5650 | PWC30122 |
| 17 | AVIM | Plier, Terminal Lug | | PWC33425 |
| 18 | AVIM | Plug, No. 8 Fuel Inlet Adapter | 4730-00-837-9852 | PWC30099 |
| 19 | AVIM | Protector, Shroud Grinding | 5120-00-837-9308 | PWC30336 |
| 20 | AVIM | Puller, Accessory Seal Carrier | 5120-00-837-9263 | PWC30046-51 |
| 21 | AVIM | Puller, Accessory Seal Carrier | 5120-00-837-9297 | PWC30046-52 |
| 22 | AVUM | Puller, Oil Relief Valve | 5120-00-840-4836 | PWC30046-53 |
| 23 | AVIM | Puller, Carbon Seal Carrier | 5120-00-837-9198 | PWC30052 |
| 24 | AVUM | Puller, Oil Drain Plug | 5120-00-837-9333 | PWC30077 |
| 25 | AVIM | Puller, Second Stage Gear Carrier | 5120-00-837-9331 | PWC30127 |
| 26 | AVIM | Puller, Oil Transfer Tube | 5120-00-837-9344 | PWC30128-2 |
| 27 | AVUM | Puller, Oil Transfer Tube | 5120-00-837-9212 | PWC30128-4 |
| 28 | AVIM | Puller, Power Turbine Shroud | 5120-00-837-9262 | PWC30139 |

**APPENDIX B**

**Section III**

**TOOL AND TEST EQUIPMENT REQUIREMENTS**

| TOOL OR TEST EQUIPMENT REFERENCE CODE | MAINTENANCE CATEGORY | NOMENCLATURE | NATIONAL/NATO STOCK NUMBER | TOOL NUMBER |
|---|---|---|---|---|
| 29 | AVUM | Puller, Oil Filter Housing | 5120-00-837-9634 | PWC30328 |
| 30 | AVIM | Pusher/Puller, Accessory Gearbox | 5120-00-837-9179 | PWC30373 |
| 31 | AVIM | Puller, Turbine Disk | 5120-00-883-1729 | PWC30403 |
| 32 | AVIM | Puller, Fuel Nozzle Sheath | 5120-00-168-2407 | PWC30416 |
| 33 | AVUM | Puller, Oil Filter Element | 5120-01-085-4749 | PWC33253 |
| 34 | AVIM | Pusher, Prop. Shaft Transfer Sleeve | 5120-00-837-9525 | PWC30224 |
| 35 | AVIM | Pusher, Second Stage Gear Carrier | 5120-00-837-9232 | PWC30323 |
| 36 | AVIM | Retainer, Second Stage Bearing | 5120-00-837-9285 | PWC30062 |
| 37 | AVIM | Rig, Fuel Adapter | 4920-00-446-8908 | PWC30506 |
| 38 | AVUM | Ring, Engine Stand | 4920-00-840-9925 | PWC30266 |
| 39 | AVIM | Ring, Exhaust Duct | 4920-00-840-9924 | PWC30269 |
| 40 | AVIM | Screw, Gearbox Removal | 5120-00-837-9523 | PWC30226 |
| 41 | AVIM | Sling, Power Section | 4920-00-840-9949 | PWC30037 |
| 42 | AVIM | Sling, Power Section | 1730-01-115-9926 | PWC33238 |
| 43 | AVIM | Sling, Engine Assy. Complete | 1730-01-115-3959 | PWC33227 |
| 44 | AVIM | Socket, Second Stage Nut | 5120-00-837-9229 | PWC30324 |
| 45 | AVIM | Puller, Accessory Seal Carrier | 5120-00-837-9268 | PWC30046-50 |
| 46 | AVIM | Spreader, Shank Nut | 5120-00-840-9836 | PWC30271 |
| 47 | AVIM | Spreader, Turbine Keywasher | 5120-00-837-9306 | PWC30335 |
| 48 | AVIM | Squeezer, Turbine Keywasher | 5120-00-110-4541 | PWC30458 |
| 49 | AVIM | Puller, Oil Seal | 5120-00-837-9341 | PWC30048 |
| 50 | AVIM | Stand, Power Section | 4920-00-840-9942 | PWC30039 |
| 51 | AVUM | Stand, Engine | 4920-01-078-5721 | PWC33200 |
| 52 | AVIM | Wheel, Shroud Grinding | 5345-01-094-5742 | PWC33282 |
| 53 | AVIM | Wrench, Compressor Turbine | 5120-00-837-9180 | PWC30331 |
| 54 | AVIM | Wrench, Power Turbine | 5120-00-837-9167 | PWC30332 |
| 55 | AVIM | Wrench, Accessory Gearbox Inlet Case | 5120-01-095-7732 | PWC33226-03 |
| 56 | AVIM | Wrench, ITT Probe | 5120-01-095-7734 | PWC33226-05 |
| 57 | AVIM | Wrench, ITT Probe | 5120-01-095-7735 | PWC33226-08 |
| 58 | AVIM | Puller, Oil Transfer Tube | | PWC32072 |
| 59 | AVIM | Fixture, Pressure Test | | PWC30935 |

## APPENDIX B

## Section III

## TOOL AND TEST EQUIPMENT REQUIREMENTS

| TOOL OR TEST EQUIPMENT REFERENCE CODE | MAINTENANCE CATEGORY | NOMENCLATURE | NATIONAL/NATO STOCK NUMBER | TOOL NUMBER |
|---|---|---|---|---|
| 60 | AVUM | Tool Set, AVUM Set No. 2 | 4920-00-567-0476 | SC492099CLA92 |
| 61 | AVUM | Tool Kit, Aircraft Electrician | 5180-00-323-4915 | SC518099CLA06 |
| 62 | AVUM | Tool Kit, Powerplant Mechanic | 5180-00-323-4944 | SC518099CLA07 |
| 63 | AVUM | Tool Kit, Powertrain Mechanic | 5180-00-003-5267 | SC518099CLA13 |
| 64 | AVIM | Shop Set, AVIM, Electrical, Instrument | 4920-00-165-1453 | SC492099CLA91ELAM |
| 65 | AVIM | Shop Set, AVIM, Machine Shop | 4920-00-405-9279 | SC492099CLA91MAAM |
| 66 | AVIM | Shop Set, AVIM, PTAM | 4920-00-001-4132 | SC492099CLA91PTAM |
| 67 | AVIM | Shop Set, AVIM, Sheet Metal | 4920-00-166-5505 | SC492099CLA91SMAM |
| 68 | AVIM | Shop Set', AVIM, Tool Crib | 4920-00-472-4183 | SC492099CLA91TCAM |
| 69 | AVIM | Shop Set, AVIM, Turbine Engine | 4920-00-224-3684 | SC492099CLA91ENTAM |
| 70 | AVIM | Shop Set, AVIM, Welding | 4920-00-163-5093 | SC492099CLA91WEAM |
| 71 | AVIM | METS | 4910-00-167-9178 | LTCT10465-02 |
| 72 | AVUM | Tool Kit, Aircraft Inspector | 5180-00-323-5114 | |
| 73 | AVUM | Puller, Oil Seal | 5120-00-837-9345 | PWC30049 |
| 74 | AVUM | Pliers, Thermocouple | 5120-00-890-7676 | PWC30406 |

# APPENDIX C

## EXPENDABLE SUPPLIES AND MATERIALS LIST

### Section I INTRODUCTION

**C-1. SCOPE** This appendix lists expendable supplies and materials you will need to operate and maintain the engine. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

**C-2. EXPLANATION OF COLUMNS**

a. Column 1 Item E Number. This number is assigned to the entry in the listing and is referenced in the maintenance Tasks to identify the material (e.g., Use Lockwire (E.5)).

b. Column 2 - National Stock Number. This is the National Stock Number assigned to the item; use it to request or requisition the item.

c. Column 3 - Description. Indicates the item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if there is no NSN in column 2.

d. Column 4 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

## APPENDIX C

### Section II

### EXPENDABLE SUPPLIES AND MATERIALS LIST (Continued)

| (1) Item E Number | (2) National Stock Number | (3) Description | (4) U/M |
|---|---|---|---|
| 1 | | Cotterpin 0.88 x 1.00 inch | 3 |
| 2 | 9150-00-985-7099 | Lubricating Oil, Aircraft Turbine Engines, Synthetic Base, MIL-L-23699 | pt |
| 3 | 9505-00-865-9694 | Lockwire, MS9226-01 | rl |
| 4 | 9505-00-878-2958 | Lockwire, MS9226-03 | rl |
| 5 | 9505-00-995-3177 | Lockwire, MS9226-04 | rl |
| 6 | 6810-01-070-1784 | Demineralized Water | bt |
| 7 | 9150-00-261-7899 | Penetrating Oil, VV-P-216 | pt |
| 8 | | Petroleum Solvent, AMS3160 | |
| 9 | 6850-00-285-8011 | Varsol, P-D-680 | |
| 10 | 9140-00-242-6748 | Kerosene, WK211 | |
| 11 | 6810-00-222-9641 | Hydrochloric Acid, 50%, MS36043-3 | |
| 12 | 6810-00-543-4012 | Hydrofluoric Acid | gl |
| 13 | 6810-00-227-1845 | Sulfuric Acid | bt |
| 14 | 6810-01-150-0339 | Phosphoric Acid | bt |
| 15 | 6810-00-233-1711 | Hydrogen Peroxide, 3 to 10% | bt |
| 16 | 6810-00-975-2504 | Crystalline Ammonium Bifluoride | |
| 17 | 6810-00-270-8177 | Sodium Hydroxide (Solid), MS36037-3 | |

## APPENDIX C

### Section II

### EXPENDABLE SUPPLIES AND MATERIALS LIST (Continued)

| (1)<br>Item E<br>Number | (2)<br>National<br>Stock Number | (3)<br>Description | (4)<br>U/M |
|---|---|---|---|
| 18 | 6810-00-222-9679 | Ammonium Nitrate | |
| 19 | 9130-00-256-8613 | Engine Fuel, JP4,<br>MIL-T-5624 | |
| 20 | 9150-00-250-0926 | Petrolatum, Technical,<br>VV-P-236 | oz |
| 21 | 9150-00-076-1582 | Molykote M77 | |
| 22 | 9150-00-141-4481 | Plastilube No.3 Grease | |
| 23 | 6810-00-264-6715 | Molykote G or Z | |
| 24 | | Feltwick Pen | |
| 25 | | Speedry Instant Dry Ink | |
| 26 | | Cado Marker | |
| 27 | | Brushpen No.57 | |
| 28 | | Tex Rite Instant Dry Ink | |
| 29 | | Micro Supreme Dye | |
| 30 | | Phano Pencil, No.71 (Red) | |
| 31 | | Colorbrite Pencil, No.2101 | |
| 32 | 6810-00-275-6010 | Methanol | |
| 33 | 6580-00-754-2437 | Triethanolamine | |
| 34 | 9150-00-273-2388 | Preservative Oil,<br>MIL-F-6081 | |
| 35 | 6850-00-209-7230 | Anti-corrosion Compound,<br>MIL-C-10578 | |
| 36 | Polyethylene Sheet, 6 mil | | |

**APPENDIX C**

**Section II**

**EXPENDABLE SUPPLIES AND MATERIALS LIST (Continued)**

| (1) Item E Number | (2) National Stock Number | (3) Description | (4) U/M |
|---|---|---|---|
| 37 | 6850-00-264-6571 | Desiccant | lb |
| 38 | 6850-00-935-4068 | Leaktec 372 | |
| 39 | 8040-00-251-2312 | Silastic RTV 733 | |
| 40 | 8030-00-811-3723 | Alodine 600 | |
| 41 | 5350-00-221-0872 | Crocus Cloth, A-A-1206 | |
| 42 | 7510-00-948-9543 | Masking Tape, 4116 | |
| 43 | | Chromic Acid, MIL-M-3171, Type 3 | |
| 44 | 8010-00-298-2302 | Enamel, MIL-E-7729, Colour 513 | |
| 45 | 6850-00-264-5771 | Calibrating Fluid, MIL-C-7024, Type II | |
| 46 | 6810-00-292-9625 | Trichlorethane | |
| 47 | 3439-00-224-3567 | Solder, QQ-S-571 | |
| 48 | 5970-00-419-4291 | Tape, MIL-I-24391 | |
| 49 | | Turco 5884 (61102) | |
| 50 | | Magnus 611 | |
| 51 | | B & B 3100 | |
| 52 | | Magnus 1214 | |
| 53 | | Witco HE-59B | |
| 54 | 6850-01-158-8769 | Witco P10-59B | |
| 55 | 6850-01-089-5514 | Carbitol | |
| 56 | | Ardrox 624 | |

## APPENDIX C

### Section II

### EXPENDABLE SUPPLIES AND MATERIALS LIST (Continued)

| (1) Item E Number | (2) National Stock Number | (3) Description | (4) U/M |
|---|---|---|---|
| 57 | | CLIX | |
| 58 | 5350-00-721-8117 | 180 Grit | |
| 59 | | Waterproof Envelope | |
| 60 | | Welding Wire, Electrode, AMS5799 | |
| 61 | 6830-00-782-2637 | Inert Gas (Argon) | |
| 62 | | Welding Wire, AMS5675 | |
| 63 | 6850-00-543-7801 | Turco Super Carb (61102) | |
| 64 | 5350-00-224-7201 | Crocus Cloth, No. 400 | |
| 65 | 8040-00-165-8614 | Gasket Adhesive, 3M EC1357 | |
| 66 | | Ceramic Cement, No.29 | |
| 67 | | Ceramic Filler, No.29 | |
| 68 | | Tubing, H-C-2 | |
| 69 | | Welding Rod, Type K, 20 AWG | |
| 70 | | Magnus 61C | |
| 71 | 9150-00-782-2627 | Lubricating Oil, Aircraft Turbine, MIL-L-7808 | Pt |
| 72 | 6810-00-222-9655 | Nitric Acid | |
| 73 | | Marks-A-Lot | ea |
| 74 | 8305-00-191-3977 | Lint-free Cloth. Cotton, MIL-C-5646 | yd |
| 75 | 6810-00-281-2762 | Methyl-Ethyl-Ketone | Pt |
| 76 | | Humidity Indicator | ea |
| 77 | 9150-00-754-0064 | Moly-Spray-Kote, MIL-L-2398, Type II | cn |
| 78 | 8030-00-322-6928 | Compound, Bonding 3M EC 801 (Minnesota Mining and Manufacturing) | gl |
| 79 | 804(000 142-9305 | Compound, Accelerator 3M EC 807 (Minnesota Mining and Manufacturing) | bt |
| 80 | 8010-00-181-8276 | Paint, Polyurethane, Black, 801, MIL-C-81773 | qt |
| 81 | 9150400-985-7245 | Grease, MIL-G-23827A | tb |
| 82 | | Gloves | |
| 83 | | Face Mask | |
| 84 | | Sandpaper 320 grit | |

**APPENDIX C**

**Section II**

**EXPENDABLE SUPPLIES AND MATERIALS LIST (Continued)**

| (1) Item E Number | (2) National Stock Number | (3) Description | (4) U/M |
|---|---|---|---|
| 85 | 6850-01-372-8303 | Cleaner (MIL-C-85704, Type II) | 5 Gal |
| 86 | 6850-01-372-8304 | Cleaner (MIL-C-85704. Type II) | 55 Gal |
| 87 | 6850-01-370-5245 | Cleaner (MIL-C-85704, Type IIA) | 5 Gal |
| 88 | 6850-01-370-5244 | Cleaner (MIL-C-85704, Type IIA) | 55 Gal |

# APPENDIX D

## ILLUSTRATED LIST OF MANUFACTURED ITEMS

This appendix includes complete instructions for making items authorized to be manufactured or fabricated at organizational maintenance (or aviation unit maintenance, if applicable).

An index is provided for cross-referencing the item to be manufactured to the figure which covers fabrication criteria.

## APPENDIX D

## ILLUSTRATED LIST OF MANUFACTURED ITEMS (Continued)

### COMPRESSOR WASH WAND

Figure D1 provides details for manufacturing a compressor motoring wash wand used for internal washing of engine suffering from performance deterioration or operating in polluted environment.

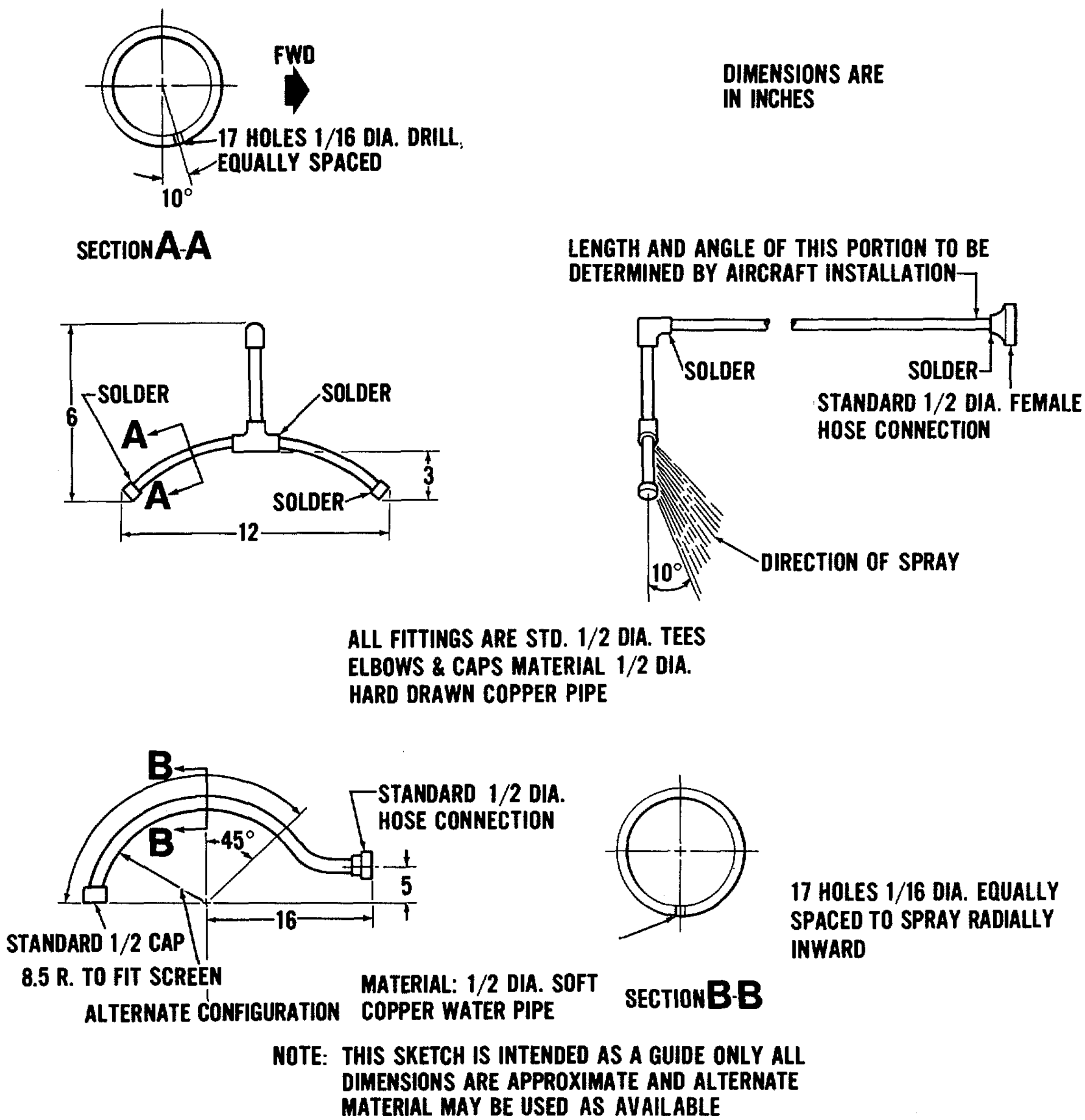


**Figure D1. Two Types of Compressor Motoring Wash Wand**

## APPENDIX D

## ILLUSTRATED LIST OF MANUFACTURED ITEMS (Continued)

### COMPRESSOR WASH RIG

Figure D2 provides details of compressor wash rig circuit used in conjunction with compressor wash wand.

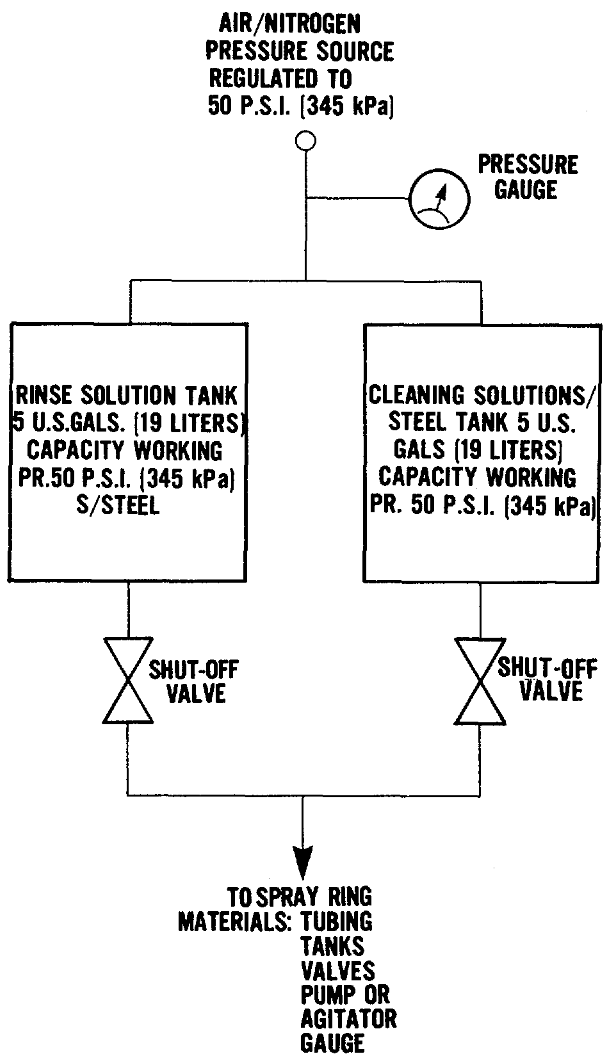


**Figure D2. Compressor Wash Rig**

## APPENDIX D

## ILLUSTRATED LIST OF MANUFACTURED ITEMS (Continued)

### FUEL NOZZLE FLUSH FIXTURE

Figure D3 provides details -for manufacturing a fixture for flushing fuel nozzles.

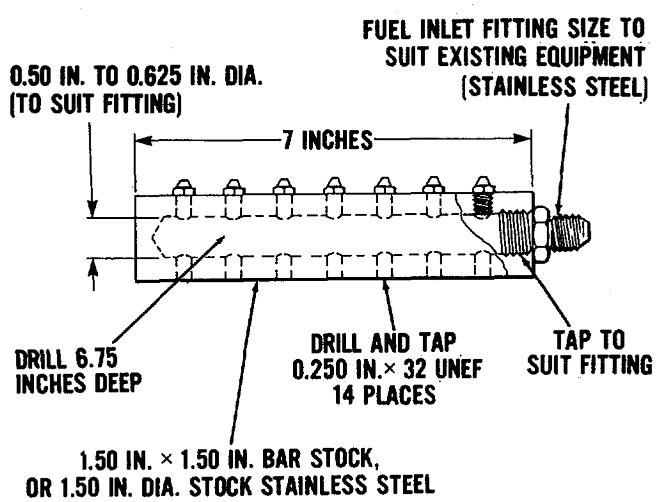


**Figure D3. Fuel Nozzle Flush Fixture**

APPENDIX D

ILLUSTRATED LIST OF MANUFACTURED ITEMS (Continued)

**IGNITION TEST SET CIRCUIT DIAGRAM**

**NOTES**

1. All fixed wiring shall be 12 AWG Copper.

2. LEAD 1 and LEAD 2 may be made from one serviceable ignition lead.

3. SKT 1 is threaded 0.5625-18 UNBG.

4. SKT 2 is NSN 5935-00-891-1470.

5. CONN. 1 is MS3106R 10S 2S.

6. SW1 and SW2 are 10A DC.

7. Fl is 10A fuse or circuit breaker.

8. VR1 is 5 ohm, 10A.

9. R1 is 1 ohm, 10A.

10. M1 is 0-30V DC.

11. M2 is 0-10A DC.

12. Pins 2-3 and 7-8 are common in electron tubes.

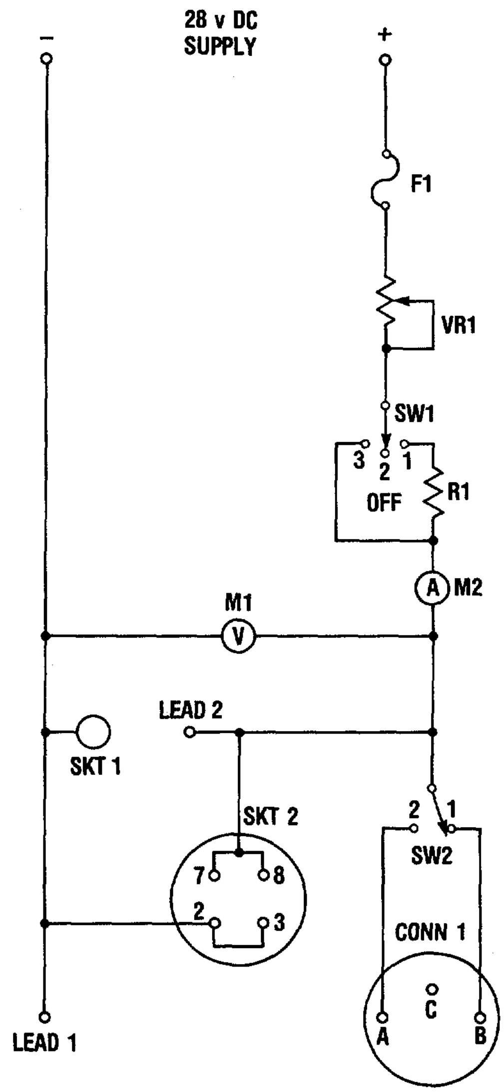


Figure D4. Ignition Test Set Circuit Diagram

**APPENDIX D**

**ILLUSTRATED LIST OF MANUFACTURED ITEMS (Continued)**

**INDEX**

This index lists the parts called for in APPENDIX D in alpha sequence for each figure.

| NOMENCLATURE | QTY | FIGURE |
|---|---|---|
| Copper Fittings (1/2 inch) | AR | D1 |
| Copper Tubing (1/2 inch) | AR | D1 |
| Hose Connection (1/2 inch female) | 1 | D1 |
| Gage, Pressure 0 to 100 psi | 1 | D2 |
| Tank, Steel (5 U.S. Gals) | 2 | D2 |
| Tubing | AR | D2 |
| Valves, Shut-off | 2 | D2 |
| Bar Stock, 1-1/2 X 1-1/2 inch stock or 1-1/2 inch dia stock Stainless Steel | 7 inch length | D3 |
| Fitting, Stainless Steel | 1 | D3 |
| Ammeter M2, 0 to 10A DC | 1 | D4 |
| Connector CONN 1 (P/N MS3106R-10S-25) | 1 | D4 |
| Fuse or Circuit Breaker FI, 10A | 1 | D4 |
| Leads, make from P/N 3010201 or 3010199 | 2 | D4 |
| Resistance R1, 1 ohm, 10A | 1 | D4 |
| Socket SKT 1, 0.5625-18 UNBG | 1 | D4 |
| Socket SKT 2, NSN 5935-00-891-1470 | 1 | D4 |
| Switches S1 and S2, 10A DC | 2 | D4 |
| Variable Resistance VR1, 5 ohms, 10A | 1 | D4 |
| Voltmeter M1, 0 to 30V DC | 1 | D4 |
| Wiring, 12 AWG, Copper | AR | D4 |

# APPENDIX E

## TORQUE AND DIMENSIONAL LIMITS, OVERHAUL AND RETIREMENT SCHEDULE

Minimum Locking Torque Values of Self-Locking Nuts and Helical Coil Inserts.

The locking torque shall be checked at each reassembly. This check is necessary to insure that the self-locking feature still causes a tight frictional hold on the mating threads. The locking torque shall, unless otherwise specified, be not less than that shown in Table. When checking the self-locking torque, care must be taken to insure the fastener is unseated so that only the torque necessary to overcome the frictional hold on the screw thread is measured. Torque values specified are applicable only when locking torque is checked with a part similar to the intended assembly application (size, material, coating, etc.).

**Table E-1. Recommended Torque Wrench Sizes**

| Required Torque | Torque Wrench |
|---|---|
| 0 to 25 pound-inches<br>(0.0 to 0.3 kg/m) | 30 pound-inches<br>(0.3 kg/m) |
| 25 to 140 pound-inches<br>(0.3 to 1.6 kg/m) | 150 pound-inches<br>(1.7 kg/m) |
| 140 to 550 pound-inches<br>(1.6 to 6.3 kg/m) | 600 pound-inches<br>(6.9 kg/m) |
| 30 to 140 pound-feet<br>(4.1 to 19.4 kg/m) | 150 pound-feet<br>(20.7 kg/m) |
| 140 to 240 pound-feet<br>(19.4 to 33.2 kg/m) | 250 pound-feet<br>(34.6 kg/m) |
| 240 to 1000 pound-feet<br>(33.2 to 138.2 kg/m) | 1000 pound-feet<br>(138.2 kg/m) |

APPENDIX E (Continued)

Procedure For Applying Torque. Clean parts to be tightened in drycleaning solvent. Unless instructed otherwise, do not lubricate parts. Torque should be applied slowly and evenly until the specified torque value is reached and then held at this value until the nut, bolt, or screw has stopped turning.

**NOTE**

**When no special torque values are given in an assembly and/or installation procedure, standard torque values shall apply. All torque values are in pound-inches. Threads shall be clean and undamaged. Unless instructed otherwise, do not lubricate parts.**

**Table E-2. Standard Torque Values**

STANDARD STEEL SCREWS, BOLTS, AND NUTS (POUND-INCHES)*

| Thread Size | Slotted-Head Screws | Hexagon-Head Bolts and Nuts |
|---|---|---|
| 2.56 | 2 to 3<br>(0.02 to 0.03kg/m) | |
| 3-48 | 3 to 4<br>(0.03 to 0.05kg/m) | |
| 4-40 | 5 to 6<br>(0.05 to 0.07kg/m) | |
| 5-40 | 6 to 7<br>(0.07 to 0.08kg/m) | |
| 6-32 | 7 to 9<br>(0.08 to 0.1kg/m) | |
| 8-32 | 10 to 12<br>(0.12 to 0.14kg/m) | |
| 10-32 | 18 to 20<br>(0.21 to 0.23kg/m) | 40 to 45<br>(0.46 to 0.52kg/m) |
| 7/32-24 | 22 to 25<br>(0.25 to 0.29kg/m) | 65 to 70<br>(0.7 to 0.8kg/m) |
| 1/4-28 | 30 to 35<br>(0.3 to 0.4kg/m) | 70 to 95<br>(0.8 to 1.lkg/m) |

*Metric equivalent appears in parentheses( ).

**Table E-2. Standard Torque Values (Continued)**

STANDARD STEEL SCREWS, BOLTS, AND NUTS (POUND-INCHES)*

| Thread Size | Slotted-Head Screws | Hexagon-Head Bolts and Nuts |
|---|---|---|
| 5/16-24 | 40 to 45<br>(0.46 to 0.52kg/m) | 120 to 165<br>(1.4 to 1.9kg/m) |
| 3/8-24 | 55 to 60<br>(0.63 to 0.69kg/m) | 250 to 325<br>(2.9 to 3.7kg/m) |
| 7/16-20 | 80 to 90<br>(0.9 to 1.0kg/m) | 400 to 475<br>(4.6 to 5.5kg/m) |
| 1/2-20 or -13 | 100 to 110<br>(1.2 to 1.3kg/m) | 500 to 700<br>(5.8 to 8.1kg/m) |
| 9/16-18 | | 750 to 1000<br>(8.6 to 11.5kg/m) |
| 5/8-18 | | 1000 to 1400<br>(11.5 to 16.lkg/m) |

*Metric equivalent appears in parentheses( ).

**Table E-2. Standard Torque Values (Continued)**

JAMNUTS, BOLTS, AND FITTINGS USED WITH GASKETS (POUND-INCHES)*

| Thread Size | Nuts (MS9099, MS9100, MS9200, MS9201) Plug (MS9015) union (AN815) Bolts-Universal (BANJO) Fitting (AN774 and AN775) |
|---|---|
| 5/16-24 | 45 to 50 (0.5 to 0.6 kg/m) |
| 3/8-24 | 60 to 70 (0.7 to 0.8 kg/m) |
| 7/16-20 | 90 to 100 (1.0 to 1.2 kg/m) |
| 1/2-20 | 120 to 130 (1.4 to 1.5 kg/m) |
| 9/16-18 | 150 to 160 (1.7 to 1.8 kg/m) |
| 3/4-16 | 275 to 300 (3.2 to 3.5 kg/m) |
| 7/8-14 | 375 to 400 (4.3 to 4.6 kg/m) |
| 1-1/16-12 | 550 to 600 (6.3 to 6.9 kg/m) |
| 1-5/16-12 | 800 to 900 (9.2 to 10.4 kg/m) |
| 1-5/8-12 | 900 to 1000 (10.4 to 11.5 kg/m) |
| 1-7/8-12 | 900 to 1000 (10.4 to 11.5 kg/m) |

*Metric equivalent appears in parentheses( ).

# GLOSSARY

## Section I ABBREVIATIONS

| | |
|---|---|
| A | Amperes |
| AC | Alternating Current |
| AR | As Required. |
| CW | Clockwise |
| CCW | Counterclockwise |
| DC | Direct Current |
| gal | Gallon |
| hr | Hour |
| in | Inch |
| ITT | Interturbine Temperature |
| MAX. | Maximum |
| MIN. | Minimum |
| Nf | Power Turbine Speed |
| Ng | Compressor Turbine Speed |
| Np | Propeller Shaft Speed |
| Ns | Output Shaft Speed |
| °C | Degrees Celsius |
| °F | Degrees Fahrenheit |
| Pa | Ambient Pressure, Barometric |
| Po | Returned Fuel to Pump Inlet |
| ppm | Parts per Million |
| PSI | Pounds per Square Inch |
| PSIA | Pounds per Square Inch, Absolute |
| PSIG | Pound per Square Inch, Gage |
| Px | Acceleration and Enrichment Pressure |
| Py | Governor Pressure |
| P1 | Fuel Pressure at Pump |
| P2 | Metered Fuel Pressure |
| P2.5 | Interstage Compressed Air Pressure |
| P3 | Compressor Discharge Air Pressure |
| RPM | Revolutions per Minute |
| SFC | Specific Fuel Consumption |
| SHP | Shaft Horsepower |
| T1 | Air Inlet Temperature |
| V | Volts |
| Wf | Fuel Flow |

# GLOSSARY

## Section II DEFINITION OF UNUSUAL TERMS

Axial - Along the axis .or line around. which -rotation occurs..

Bulge - An area on a sheet metal part that has. Swelled Outward.

Compressor stall - Stumbling of the 'engine accompanied by noise ranging from a rumble to a bang,

Convex - Rounded like the exterior of a sphere.

Desiccant - A drying agent.

Fretting - Wearing away of metal by rubbing against another metal (generally associated with press fit or close fitting parts).

Hot section - Components in path of burning gases.

Match Mark - Procedure for marking adjacent parts to insure realignment.

Micron - One thousandth of a millimeter.

Orifice - Small hole as :in a nozzle.

Residual - Remaining,. such as 'fluids left after draining.

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**By Order of the Secretary of the Army:**

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***Chief of Staff***

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# The Metric System and Equivalents

*Linear Measure*

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

*Weights*

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

*Liquid Measure*

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

*Square Measure*

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

*Cubic Measure*

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

# Approximate Conversion Factors

| *To change* | *To* | *Multiply by* | *To change* | *To* | *Multiply by* |
|---|---|---|---|---|---|
| inches | centimeters | 2.540 | ounce-inches | newton-meters | .007062 |
| feet | meters | .305 | centimeters | inches | .394 |
| yards | meters | .914 | meters | feet | 3.280 |
| miles | kilometers | 1.609 | meters | yards | 1.094 |
| square inches | square centimeters | 6.451 | kilometers | miles | .621 |
| square feet | square meters | .093 | square centimeters | square inches | .155 |
| square yards | square meters | .836 | square meters | square feet | 10.764 |
| square miles | square kilometers | 2.590 | square meters | square yards | 1.196 |
| acres | square hectometers | .405 | square kilometers | square miles | .386 |
| cubic feet | cubic meters | .028 | square hectometers | acres | 2.471 |
| cubic yards | cubic meters | .765 | cubic meters | cubic feet | 35.315 |
| fluid ounces | milliliters | 29,573 | cubic meters | cubic yards | 1.308 |
| pints | liters | .473 | milliliters | fluid ounces | .034 |
| quarts | liters | .946 | liters | pints | 2.113 |
| gallons | liters | 3.785 | liters | quarts | 1.057 |
| ounces | grams | 28.349 | liters | gallons | .264 |
| pounds | kilograms | .454 | grams | ounces | .035 |
| short tons | metric tons | .907 | kilograms | pounds | 2.205 |
| pound-feet | newton-meters | 1.356 | metric tons | short tons | 1.102 |
| pound-inches | newton-meters | .11296 | | | |

# Temperature (Exact)

| | | | | |
|---|---|---|---|---|
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |

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