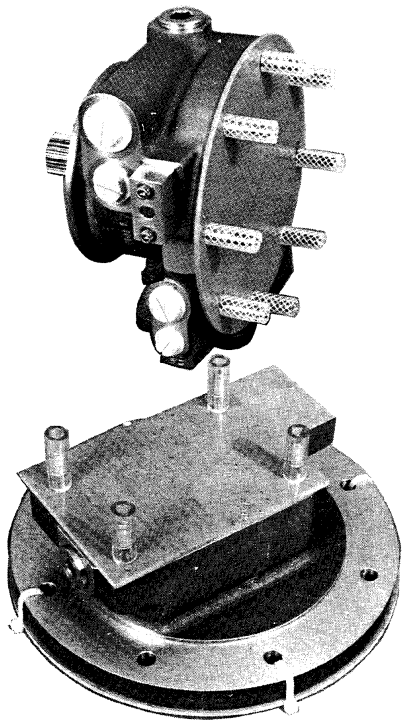
WOODWARD

Product Manual 40123
(Revision NEW)
Original Instructions



3055 Hydraulic Pump and Manifold Plate

9902-221 Hydraulic Pump Assembly
9902-237 Manifold Plate

Installation and Operation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Chapter 1.
General Information

Introduction

This manual describes the 9902-221 Hydraulic Pump and 9902-237 Manifold Plate.

The pump is a positive-displacement gear pump for use with an industrial gas turbine, supplying hydraulic pressure to the Fuel Metering Valve/Actuator (FMV/A) assembly and Variable Stator Vane (VSV) servovalve and actuator assemblies.

The pump is installed on the turbine's gearbox and is driven by the turbine through the pump's splined drive shaft.

The pump operates at speeds up to 6300 rpm. Discharge pressure is factory set at 750 psi (5171 kPa) nominal above supply pressure. Factory calibration is performed with MIL-L-23699 synthetic turbine oil.

The pump's oil supply is obtained from the turbine's lubrication oil system.

All components of the pump are capable of operation at temperatures from –40 to + 250 °F (–40 to +121 °C).

References

Manual 40122, 3055 Liquid Fuel Metering Valve/Actuator Assembly
Manual 40124, VSV Servovalve and VSV Actuator Assemblies

Chapter 2.
Principles of Operation

Figure 2-1 illustrates the operating principle of the gear pump.

The positive-displacement pump provides a given amount of output flow for every revolution. Except for leakage loss, this output flow remains proportional to speed and is independent of output pressure. Pump volume is provided by a drive gear and an idler gear of identical sizes.

A positive pressure is required on the oil inlet side of the pump to prevent cavitation.

When the pumps output flow capability exceeds output requirements, a pressure-regulating valve allows the excess oil to be bypassed back to the turbine lube oil system.

When the FMV/A and VSV components are operating in a transient condition, most of the output of the pump may be required, at which time a small amount of oil will flow through the pressure regulating valve. The pressure regulating valve establishes the output pressure of the pump. The spring loaded valve is adjustable, but the adjustment is set at the factory and should not be changed.

All output from the pump gears flows through an external oil filter attached to the pump housing, then back into the pump. Oil pressure taps are provided on both sides of the filter to monitor any pressure build-up which could be caused by a dirty filter. Oil to the FMV/A and to the VSV servovalve is taken from the flow of oil which has already gone through the filter.

The discharge port for the FMV/A is located on the pump housing.

A manifold plate is designed to bolt to the top of the pump. The manifold directs part of the output of the pump to the VSV servovalve assembly. There are no moving parts in the manifold plate. The top of the manifold plate has provisions for the attachment of the VSV servovalve.

Pump rotation is clockwise when facing the pump driveshaft.

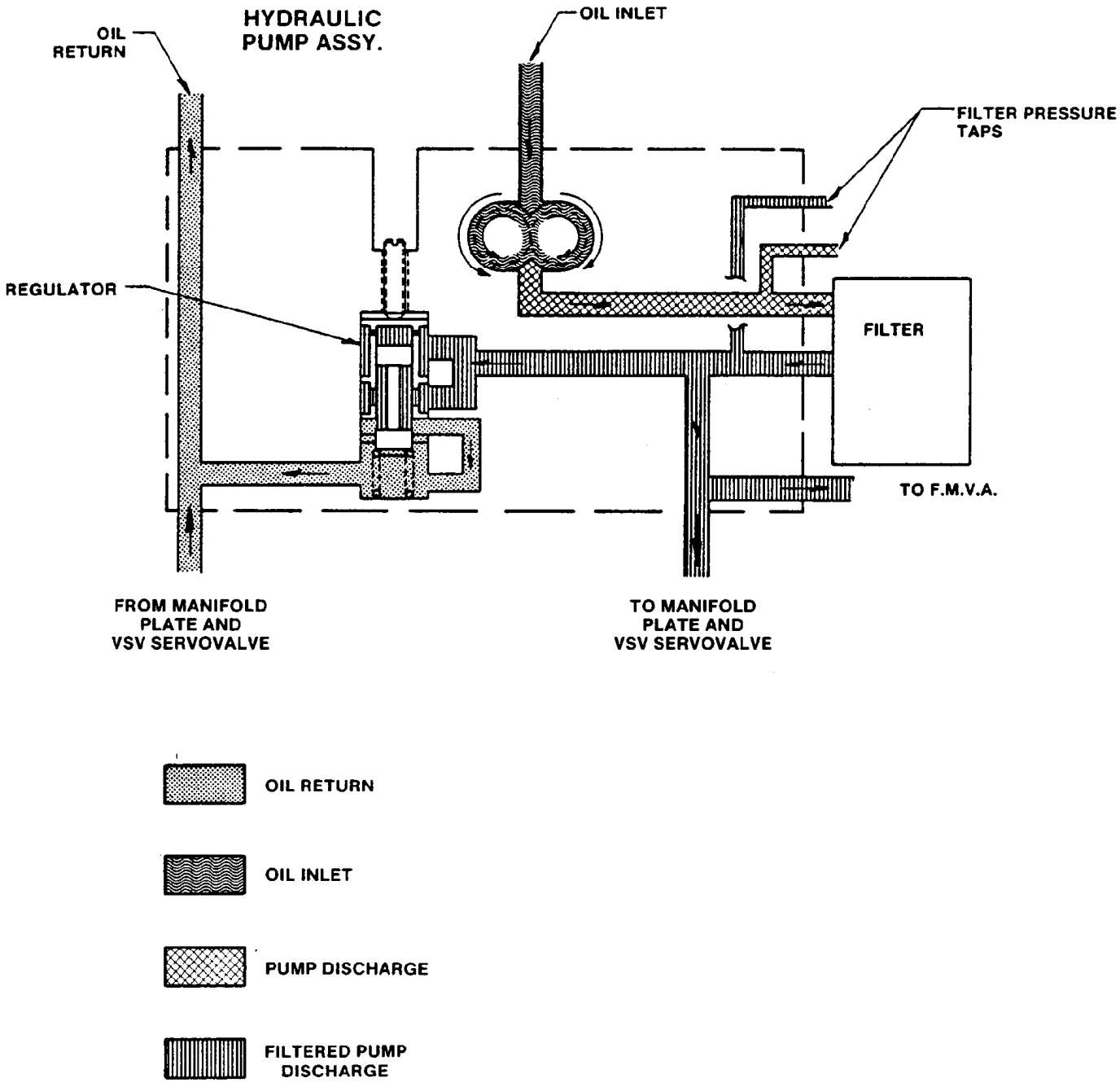


Figure 2-1. Gear Pump Schematic

Chapter 3.
Installation

The pump is installed on the gearbox drive of the turbine with a “Vee” band clamp around the flange of the pump. Radial location of the pump on the gearbox drive flange is determined by a single 0.312” (~7.92+ mm) diameter pin, extending from the mounting surface of the pump and fitting into a location hole in the gearbox. Gaskets are not provided with the pump or manifold plate. However, gasket plates from the turbine manufacturer or other supplier should be used between the pump and filter, between the pump and manifold plate, and between the manifold plate and servovalve assembly. The turbine manufacturer specifies installation of an O-ring on the pump drive shaft to prevent leakage from the spline into the gearbox. A small amount of oil leakage can be expected at the shaft seal near the pump drive spline. This minimal leakage will drain into the turbine gearbox.

The manifold plate should be bolted to the eight 0.312-24 stainless-steel studs with a gasket plate between the two parts. The fasteners are supplied by the turbine manufacturer. Radial location of the manifold flange and the pump body is determined by the fit of the installation holes in the manifold plate.

The 0.562-18 straight-thread ports on the pump housing marked “Filter In” and “Filter Out” are provided for gauges and are not used for filter connections. The pump will operate correctly with the two ports plugged.

A 0.750-16 straight-thread port in the pump housing is provided for the oil supply connections to the FMV/A. The FMV/A return oil is directed back to the turbine lube oil system.

A 0.875-14 straight-thread port is provided for return to the turbine lube oil system from the pump. The return plumbing should provide an unimpeded flow of oil.

A 1.062-12 straight-thread port is provided for the supply of oil to the Woodward pump. The supply line should provide a positive pressure supply of oil during all pump operating condition.

Chapter 4.
Maintenance and Storage

Maintenance

The pump is not field adjustable. The flow rate is set by design. The regulating valve pressure is factory calibrated and should not be changed.

Storage

Short Term

Flush the unit with a corrosion resistant oil (MIL-C-6529, Type 3, or equivalent).

Record the date the pump was prepared and identify the oil used on two identification tags. Attach one tag to the pump and one tag to the exterior of the storage container.

Place protective closures in open ports, wrap and seal the pump in barrier material (MIL-B-121, Type 1, Grade A, Class 1, or equivalent).

Cushion the unit and place in the container.

Long Term

Perform all steps outlined in short-term storage instructions. In addition, place a proper amount of desiccant (MIL-D-3464, Class 1,or equivalent) with the pump before wrapping it in the barrier material.

IMPORTANT **Once the pump has been properly prepared for storage, it does not require periodic flushing.**

Chapter 5.
Replacement Parts

Give the following information when ordering parts:

- The pump type, serial number, and part number (shown on the nameplate)
- Manual number (this is manual 40123)
- Part reference number given in the parts list and part name or description

Parts List for Pump Drive (Figure 5-1)

Ref. No.	Part Name	Quantity
40123-1	Housing Assy, VSV Pump	1
40123-1a	Pin, 0.125 x 0.375 Rn 11	3
40123-1b	O-ring, 0.144 x 0.070	2
40123-2	Plug, 6 Str Thrd Sst	1
40123-2a	O-ring, 0.468 x 0.078	1
40123-3	Drive Shaft	1
40123-4	Bearing, 1.125 x 0500 x 0.250	1
40123-5	Spacer	1
40123-6	Sleeve	1
40123-6a	O-ring, 1.114 x 0.070	1
40123-7	Seal, 0.500 Carbon Fale	1
40123-7a	O-ring, 0.864 x 0.070	1
40123-8	Screw, 10-32 x 0.625	3
40123-9	Seat, Seal	1
40123-9a	O-ring, 0.612 x 0.103	1
40123-9b	O-ring, .0364 x 0.070	1
40123-10	Drive Sleeve	1
40123-11	Splined Drive	1
40123-12	Washer, 0.266 x 0812 x 0.120	1
40123-13	Lock Nut	1
40123-14	Spring, Relief Valve	1
40123-15	Plunger, Relief Valve	1
40123-16	Sleeve, Relief Valve	1
40123-16a	O-ring, 0.551 x 0.070	1
40123-16b	O-ring, 0.614 x 0.070	1
40123-17	Block Assy	1
40123-18	Screw, 0.250-28 x 0.625 Oval	1
40123-19	Plug, Expansion	1
40123-20	Washer, 0.203 x 0.438 x 0.032	2
40123-21	Screw, 10-32 x 1.250	2

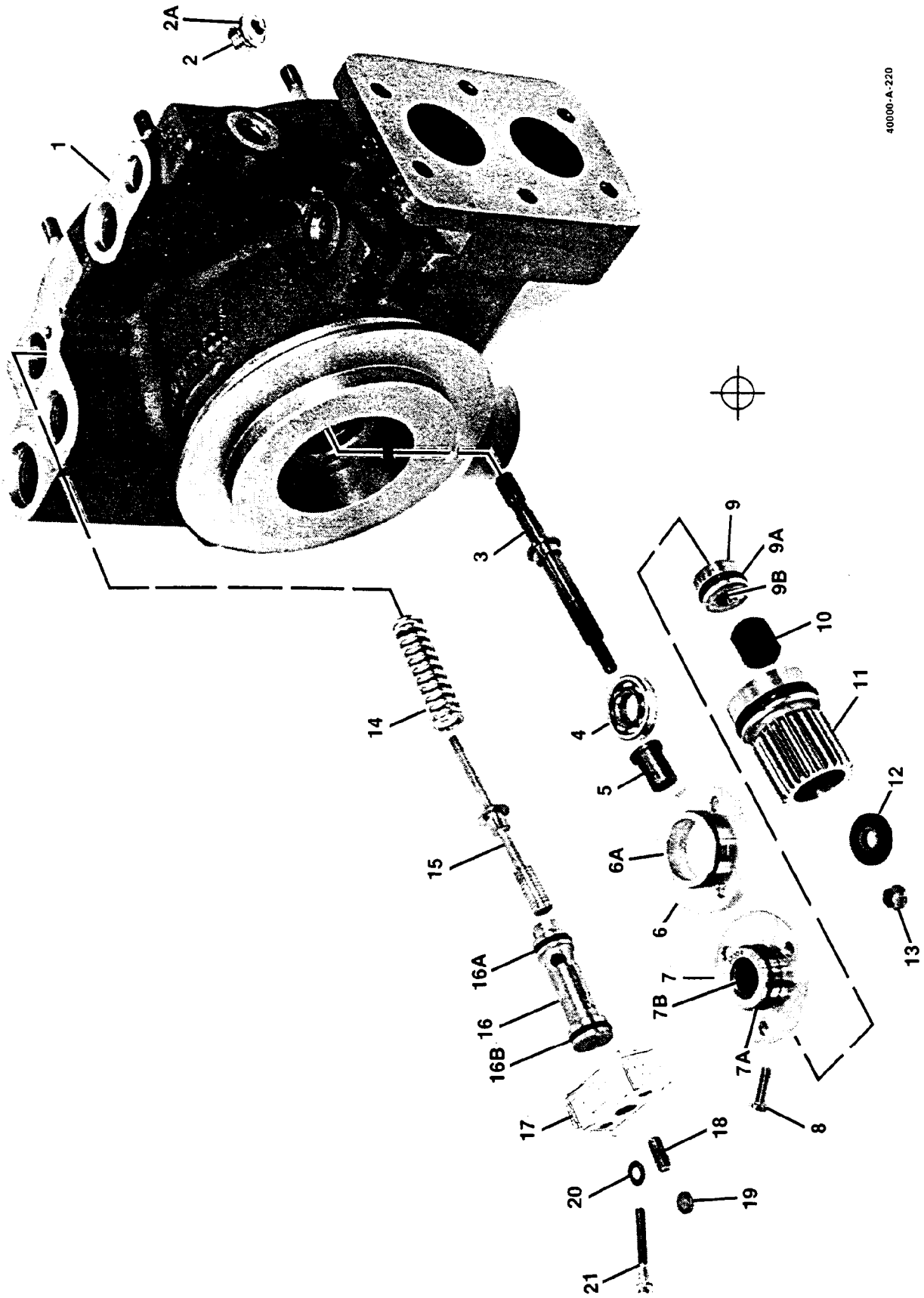


Figure 5-1. Gear Pump Drive

Parts List for Gear Pump Assembly (Figure 5-2)

Ref. No.	Part Name	Quantity
40123—26	Plug, 12 Str. Thd. O-ring	1
40123—26a	O-ring, 0.924 x 0.116	1
40123—27	Plug, 12 Str. Thd. O-ring	1
40123—27a	O-ring, 0.924 x 0.116	1
40123—28	Gear, Drive	1
40123—29	Gear, Idler	1
40123—30	Seal, Pressure Plate	2
40123—31	Pressure Plate 1	1
40123—32	Pressure Plate 2	1
40123—33	Pressure Plate 3	1
40123—34	Pressure Plate 4	1
40123—35	Cover Assy	1
40123—36	Piston	2
40123—36a	O-ring, 0.426 x 0.070	2
40123—37	Washer, Shakeproof Spring	2
40123—38	Piston	1
40123—38a	O-ring, 0.676 x 0.070	1
40123—39	Washer	1
40123—40	Screw, #10-32 x 1.250	4
40123—41	Manifold Plate Assy	1
40123—42	Plug, 8 Str. Thd. O-ring	2
40123—42a	O-ring, 0.644 x 0.087	2

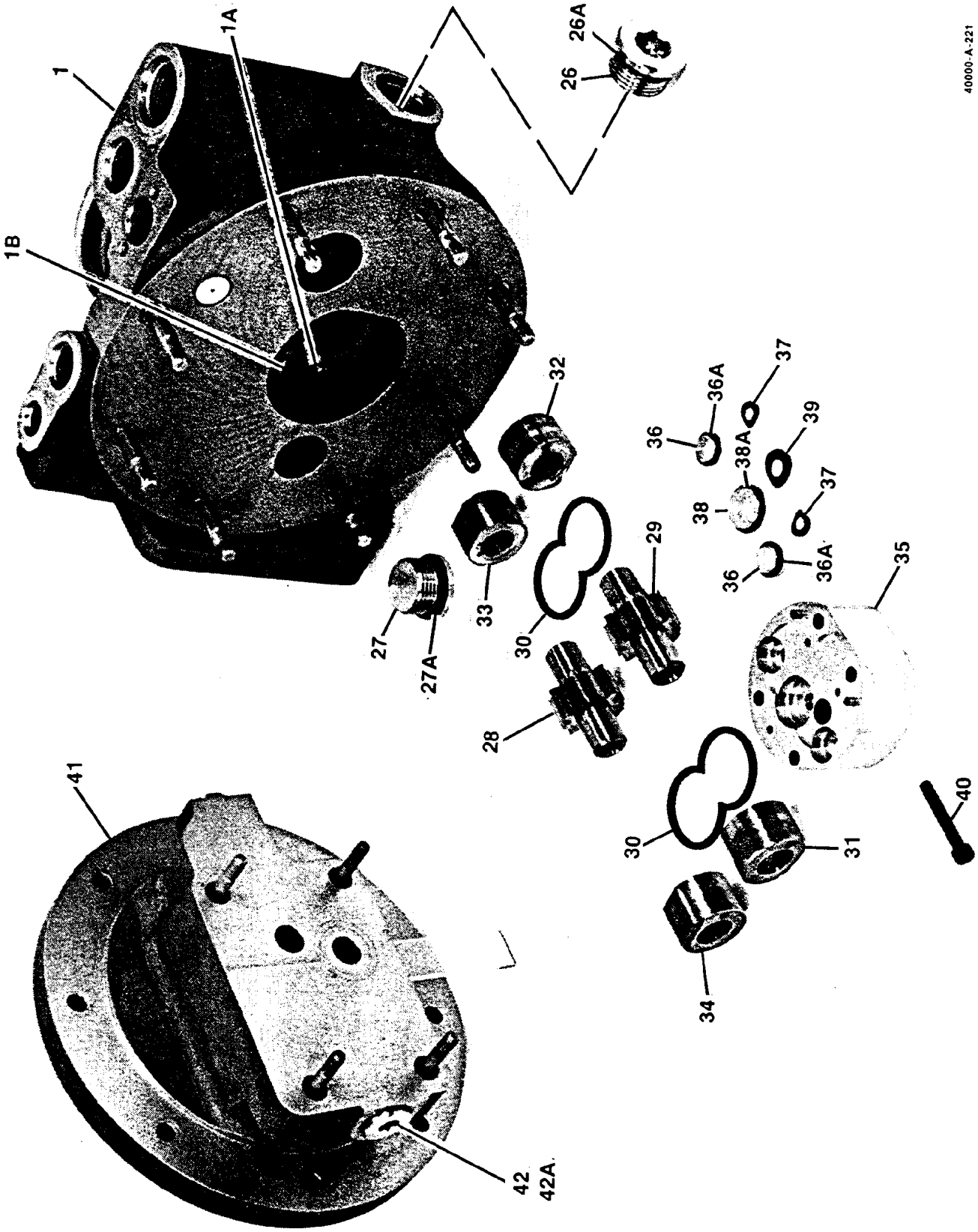


Figure 5-2. Gear Pump Parts

Chapter 6.
Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

How to Contact Woodward

For assistance, call one of the following Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Turbine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Your Name	
Site Location	
Phone Number	
Fax Number	
Engine/Turbine Model Number	
Manufacturer	
Number of Cylinders (if applicable)	
Type of Fuel (gas, gaseous, steam, etc)	
Rating	
Application	
Control/Governor #1	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #2	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	
Control/Governor #3	
Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 40123.

WOODWARD

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**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.

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