WOODWARD

Product Manual 89008
(Revision A)
Original Instructions

Hydraulic Amplifier (Mechanical Input Control)

(1-13/16” P.V.)

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 Out-of-date translations are marked with ⚠.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.

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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

The mechanically controlled hydraulic amplifier is a pilot-operated linear servo actuator used in conjunction with a governor having a mechanical output. The governor controls the position taken by the amplifier. The amplifier is capable of operating control mechanisms requiring relatively large forces and work capacity beyond that of the governor, such as the control valves of steam turbines or fuel control linkages of large engines.

Standard Features

This model, available with 5 1/4” (133 mm) diameter servo piston only, is suitable for use with SG, PSG, UG, or PG mechanical hydraulic governors. It is fitted with input and output shaft scales, servo return spring and remote starting as standard features. Various return springs with preloads of 50 lb (222 N) and upwards are available to counterbalance external forces in the opening direction and ensure shutdown on loss of system oil pressure.

Chapter 2.
Installation and Specifications

Installation

The hydraulic amplifier should normally be mounted upright. If a transient response (piston movement in the order of 7.5 inches/second [190 mm/s]) is required, it is essential that the amplifier be provided with an adequate supply of oil. This rate of movement requires a flow of 80 in^3/s (1311 mm^3/s) or 20 US gal/min (76 L/min). Accumulators will normally be required to provide the necessary flow rate if it is impractical to do so directly from a pump. Connecting lines should be as large, short and straight as possible. Elbows should be avoided. The drain line should receive equal consideration. If the prime mover mounting pad has integral provisions for drain to sump or reservoir, the sealing cup in bottom of amplifier case may be removed to provide direct draining through the mounting pad.

The amplifier is provided with input and output shaft scales as standard. A 30° movement of the input shaft corresponds to 2.500” (63.50 mm) stroke of the output. To avoid internal damage, the amplifier is provided with a collapsible link. However care should be taken, when setting up governor to amplifier linkage to avoid overstressing this link. When the governor is at shutdown the amplifier input shaft scale should be set to approximately 1° below zero.

NOTICE **Considerable oil spray over a large area will occur if the cover is removed while in operation.**

Specifications

Input

Shaft:	0.500” (12.70 mm) diameter 36 serrations x 0.500” (12.70 mm) long
Angular Travel:	30° available CW to increase
Min. Work Required:	1 ft-lb (1.4 J)

Output

Rod:	1.00” (25.4 mm) diameter with 0.625”—18 x 0.875” UNJF-2A thread
Max. Stroke:	2.5” (64 mm) (shorter strokes can be supplied to customers’ requirements)
Max. Stalling Force at 300 psi (2068 kPa):	2800 lb (12.5 kN) differential servo 6000 lb (26.7 kN) single-acting
Useful Work Capacity:	
Differential Servo–	100 psi (690 kPa), 200 ft-lb (271 J) 300 psi (2068 kPa), 600 ft-lb (814 J)
Single-acting–	100 psi (690 kPa), 400 ft-lb (542 J) 300 psi (2068 kPa), 1200 ft-lb (1627 J)

Control Qualities

Time Constant:	0.3 s, 300 psi (2068 kPa)
(with Return Spring)	0.5 s, 100 psi (690 kPa)
Hysteresis:	Within 0.1%
Linearity:	Within 0.2%

Construction

Cover:	Cast aluminum
Case:	Cast ductile iron
Weight:	approx. 100 lb (45 kg)

Mounting

Attitude:	Vertical or horizontal
Bolts:	0.562 dia. (4)

Hydraulic Supply

Source:	Prime mover lubricating system or external pressure system
Normal Operating Supply Pressure:	50 to 300 psi (345 to 2068 kPa). Pressures outside this range not recommended.
Flow:	20 US gal/min (76 L/min) during transients (requiring accumulators) less than 1 US gal/min (3.8 L/min) during steady-state
Filter:	40 µm
Viscosity:	Up to 2000 SSU but normal performances based on 1000 SSU and below
Operating Temperature:	60 to 240 °F (16 to 116 °C)
Drain:	1.312”-12 UN2B x 0.812” deep (2) each side of case 2.50” (63.5 mm) diameter hole (optional) bottom of case
Supply Inlet:	1.312”-12 UN2B x 0.812” deep

Pilot Valve

Diameter:	1.187” (30.15 mm)
Plunger Movement:	Position balanced by floating lever between input lever position and output rod position
Starting Oil Port:	0.250-18 NPT 20–30 psi (138–207 kPa) starting oil pressures required

Servo

Diameter:	5.25” (133.4 mm)
Return Spring:	50–1400 lb (222–6227 N) depending on operating conditions
Transfer Valve:	45–60 psi (310–414 kPa) sensed, transfers from single-acting to differential

Chapter 3.
Description of Operation

General Description

Refer to Figure 3-1. The input shaft of the hydraulic amplifier is connected to the mechanical output of a governor, such as a Woodward PG, UG, or PSG governor. Any change in position of the governor output shaft is transmitted through linkage to the amplifier input shaft. The amplifier input shaft, in turn, is connected to a floating lever by an input lever and collapsible link. The movement of the floating lever is transmitted to a pilot valve plunger which controls the flow of oil to and from the servo cylinder. A 30 degree rotation of the amplifier input shaft gives full stroke of the servo piston. Each degree of input shaft rotation is equal to 0.083 inch (2.11 mm) stroke.

The pressurized oil from the external supply is directed from the amplifier inlet to the pilot valve plunger and also to the close (decrease) side of the servo piston.

When the governor senses an underspeed condition and signals for an increase in speed (power), the amplifier input shaft is rotated CW (facing outboard end of shaft). This raises one end of the floating lever which lifts the pilot valve plunger, admitting oil at supply pressure (less the pressure drop occurring across the pilot valve) to the open (increase) side of the servo piston. Although the oil pressure on the open side of the piston is lower than that on the close (decrease side, it acts over a much larger surface area and causes the servo piston to move in the open direction (increase power). As the piston moves, the end of the floating lever connected to the piston rod also moves in the same direction until the land on the pilot valve plunger is re-centered over the oil control port, stopping further movement of the servo piston. The reverse of the above occurs during an overspeed condition. The yield spring on the piston rod over the floating lever (if used does not have any function other than during starting and only where there is a requirement to open the steam or fuel valve before the prime mover can be started.

During an on-speed condition, the amplifier input shaft is maintained in a given position by the governor and the pilot valve plunger land is held in the centered position over the control port. With flow to the open side of the servo piston blocked, except to compensate for leakage, the servo piston will maintain its position in relation to the speed setting of the governor and load on the prime mover.

Special Features

The amplifier has an internal oil transfer passage designed to receive a plug, a sleeve, or a pressure sensing transfer valve. The plug is used if normal operating pressure is supplied independent of running the prime mover. The sleeve is used if it is required to convert the differential servo to a single-acting spring-return type to increase its opening capability. The transfer valve is used to assist in starting if the normal pressure supply is dependent on the prime mover running and an auxiliary source of low pressure oil is required.

The starting oil port in front of the amplifier case provides a means for hydraulic starting and must be used in conjunction with the user's external 3-way valve. When an independent normal supply pressure is used, the 3-way valve directs oil through the starting oil port to the underside of the pilot valve and raises it. After the prime mover has started, the 3-way valve position must be changed to block the supply from and vent to drain the underside of the pilot valve. The area under the pilot valve plunger is internally drained in amplifiers which do not have this requirement.

The pressure sensing transfer valve is used with the starting oil port and 3-way valve when an auxiliary source of low pressure oil is required. The transfer valve blocks pressure oil from the closing side of the servo while venting it to drain thus converting the servo to single-acting operation to provide the opening force required. After the prime mover has started and builds up the supply pressure (45 to 60 psi [310 to 414 kPa]) the valve senses the increased pressure and transfers position, opening the closing side to the supply oil so that the servo reverts to differential operation.

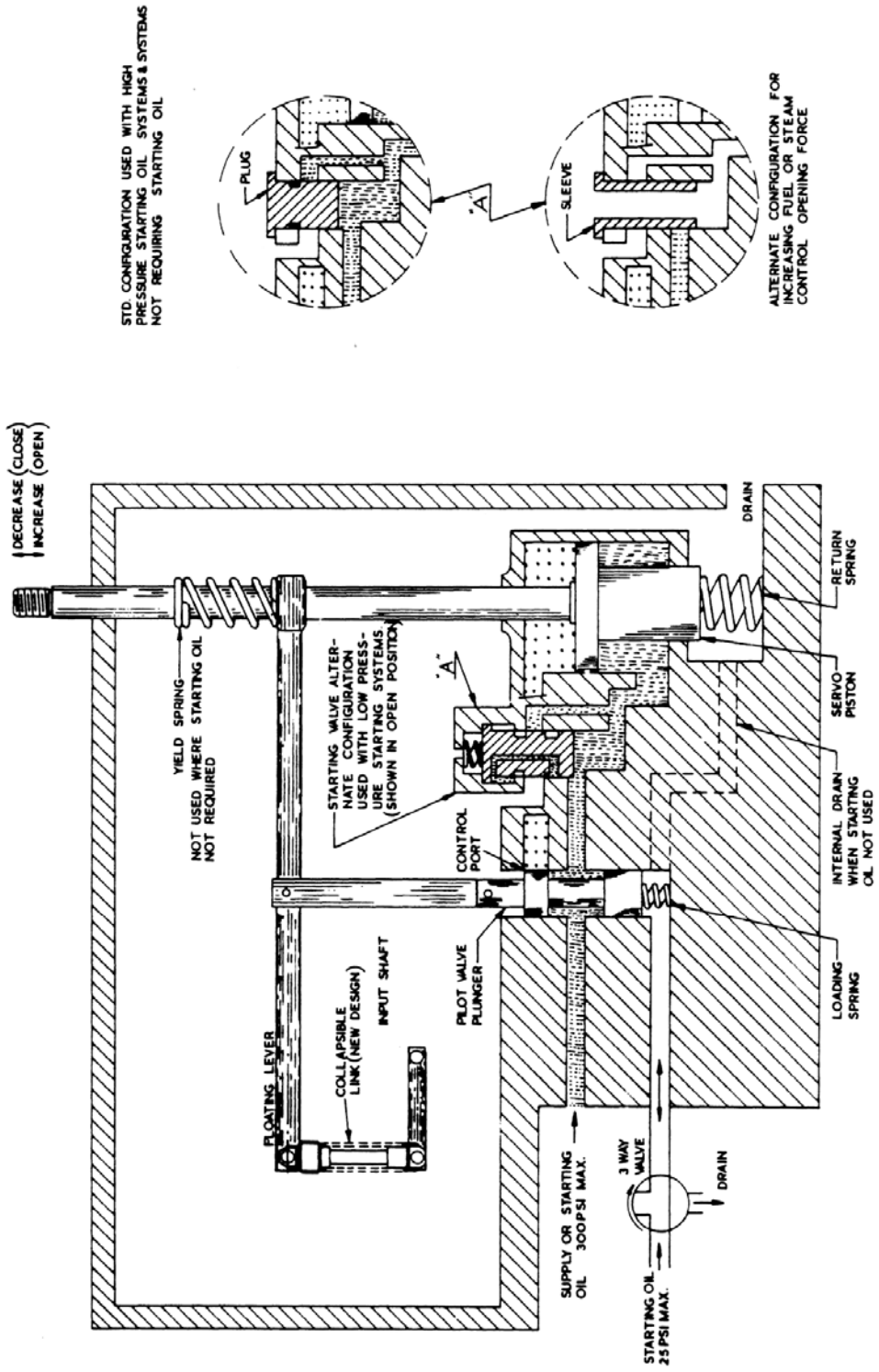

Figure 3-1. Hydraulic Amplifier Schematic

Chapter 4.
Troubleshooting and Maintenance

Troubleshooting

The following chart may be used in determining probable causes and corrective actions for common troubles which may be encountered in the field. Every possible problem which may be experienced cannot be anticipated and may, in some instances, be due to faulty operation of auxiliary equipment. The effect of the governor, oil supply system, and prime mover power control mechanism must be considered when troubleshooting apparent malfunctions of the hydraulic amplifier.

Trouble	Probable Cause	Correction
No servo response to movement of input shaft.	Low or no oil pressure to amplifier.	Check prime mover lubricating oil or external oil supply system for proper operation.
	Fuel control or steam valve sticking.	Disconnect linkage and check operation of fuel control or steam valve. Check steam valve unbalance forces.
	Internal amplifier linkage components damaged or disconnected.	Replace damaged components or make connections as required.
Erratic or lagging servo response to movement of input shaft.	Fluctuating oil supply pressure pump cavitation.	Check prime mover lubricating oil or external oil supply system for proper operation.
	Fuel control or steam valve sticking.	Disconnect linkage and check operation of fuel control or steam valve. Check steam valve unbalance forces.
	Pilot valve plunger loading spring broken or missing.	Replace loading spring.
Input shaft jammed.	Internal amplifier loading components damaged.	Replace damaged components as required.
	Pilot valve sticking—oil supply contaminated with foreign particles.	Disassemble and clean amplifier, drain, flush, and refill oil supply system. Replace filters.
	Pilot valve plunger cocked in bore—input lever stop broken, bent or missing.	Replace damaged components required.
Amplifier input shaft locked in full CW position or will not rotate fully CCW.	Starting oil port not connected to drain or internal drain passages clogged.	Make proper connections to drain. Disassemble amplifier and clean drain passages.
	Faulty external linkage or governor operation.	Check linkage for binding. Check governor for adjustment and operation.
Fuel control or steam valve will not close or closes too slowly.	Fuel control or steam valve sticking.	Disconnect linkage and check operation of fuel control or steam valve.
	Starting valve plunger sticking in closed position opening decrease side of servo piston to drain.	Disassemble and clean amplifier. Check oil supply for contamination.
	Fatigued or broken servo piston return spring—excessive leakage past servo piston.	Disassemble and replace the return spring and/or servo piston.

Trouble	Probable Cause	Correction
Fuel control or steam valve will not open for starting (low starting oil pressure systems).	Fuel control or steam valve sticking.	Disconnect linkage and check operation and force requirements of fuel control or steam valve.
	Starting valve plunger sticking in open position—plunger spring broken or missing.	Disassemble and clean amplifier. Check oil supply for contamination. Replace plunger spring.
	Starting oil pressure too low.	Increase starting oil pressure to a minimum of 20 psi (138 kPa). Do not exceed 25 psi. (172 kPa).
Servo piston will not hold position—erratic over or undershoot.	Yield spring (if used) broken or missing, piston rod ring not properly secured.	Replace yield spring and/or retaining rings as required.
Servo piston goes to full increase when input shaft rotated CCW.	Foreign particle wedged between land on pilot valve plunger and sleeve causes sleeve to move down with plunger.	Cycle input lever CW to remove particle by increasing flow. If condition persists, disassemble and clean amplifier. Replace plunger and/or sleeve if sharp edges have been damaged.

Maintenance

Disassembly

Refer to Figure 4-1 for disassembly of the hydraulic amplifier.

1. Do not disassemble to a greater degree than necessary for replacement of worn parts.

2. When replacing wiper (33) and seal (34), pry out with a screwdriver taking care not to nick the edges or seating surface of the bore.

3. Removal of the cylinder cover (62) is not recommended except in unusual circumstances. The spring (51) maybe preloaded up to 900 lb (4.0 kN) and should only be removed under a press with a minimum stroke of 7” (178 mm).

4. Do not disassemble the servo piston and piston rod as these are ground concentrically.

Cleaning

Clean in oil or fuel or kerosene. Commercial solvents may damage gaskets and seals.

Repair

Superficial corrosion may be removed with a light crocus paper and oil. DO NOT remove sharp edges from piston, bushings, etc.

Reassembly

1. Always use new roll or cotter pins.

2. Take great care when reinstalling the servo piston to get the correct alignment. The use of a press should be avoided if possible so that the operator can “feel” the piston in place.

3. Seals (33 and 34) must be installed in correct attitude as shown.

Parts Replacement

When ordering replacement parts it is essential that the following information be given.

- Serial number and designation number of amplifier
- Manual cross reference number (this manual is 89008)

Parts List for Figure 4-1

Ref. No.	Part Name	Quantity
89008-1	Input shaft	1
89008-2	Retaining ring	2
89008-3	Oilite bushing 0.689 O.D.	2
89008-4	Packing, 0.693 O.D.	1
89008-5	Spacer	1
89008-6	Screw, 6-32 UNF skt. hd.	1
89008-7	Angle indic. plate assembly	1
89008-8	Backing plate	1
89008-9	Pointer	1
89008-10	Bushing	1
89008-11	Straight pin	1
89008-12	Cotter pin	6
89008-13	Straight pin	1
89008-14	Headed pin	1
89008-15	Input lever	1
89008-16	Screw 5/16”-18 x 1” hex hd.	4
89008-17	Washer 5/16” splitlock	4
89008-18	Dowel pin	2
89008-19	Lockwire	1
89008-20	Warning plate	1
89008-21	Drive screw	4
89008-22	Pivot screw	2
89008-23	Lockwire	2
89008-24	Plug	1
89008-25	O-ring	1
89008-26	Plug 1/2” NPT	2
89008-27	Collapsible link assembly	1
89008-28	Nyloc screw	1
89008-29	Plug	1
89008-30	0-ring	1
89008-31	Screw 10-32 x 1 1/8”	4
89008-32	Seal plate	1
89008-33	Wiper scraper seal	1
89008-34	Vee block seal	1
89008-35	Gasket	1
89008-36	Piston rod sleeve	1
89008-37	Yield spring	1
89008-38	Piston rod ring	1
89008-39	Retaining ring	1
89008-40	Cover assembly	1
89008-41	Screw 1/4-28 x 1.750	7
89008-42	Lock washer	7
89008-43	Washer 1/2 O.D.	7
89008-44	Screw 1/4-28 x 1”	1
89008-45	Gasket	1
89008-46	O-ring 5.259 O.D.	1
89008-47	Nameplate	1
89008-48	Piston assembly	1
89008-49	Case	1
89008-50	Sealing cup	1
89008-51	Servo return spring	1
89008-52	P.V. bushing spring	1
89008-53	Retaining ring	1
89008-54	P.V. load spring	1
89008-55	Plug 1/2” NPT (used only with starting oil)	1
89008-56	Plug 1/4” NPT	1
89008-57	P.V. sleeve	1
89008-58	P.V. plunger	1
89008-59	Straight pin	1
89008-60	P.V. lever	1
89008-61	Floating lever	1
89008-62	Cylinder cover	1
89008-63	Bushing	1
89008-64	Retaining ring	1
89008-65	Spring seat	1
89008-66	Valve spring	1
89008-67	Valve plunger	1
89008-68	Valve sleeve	1
89008-69	Shipping plug	1

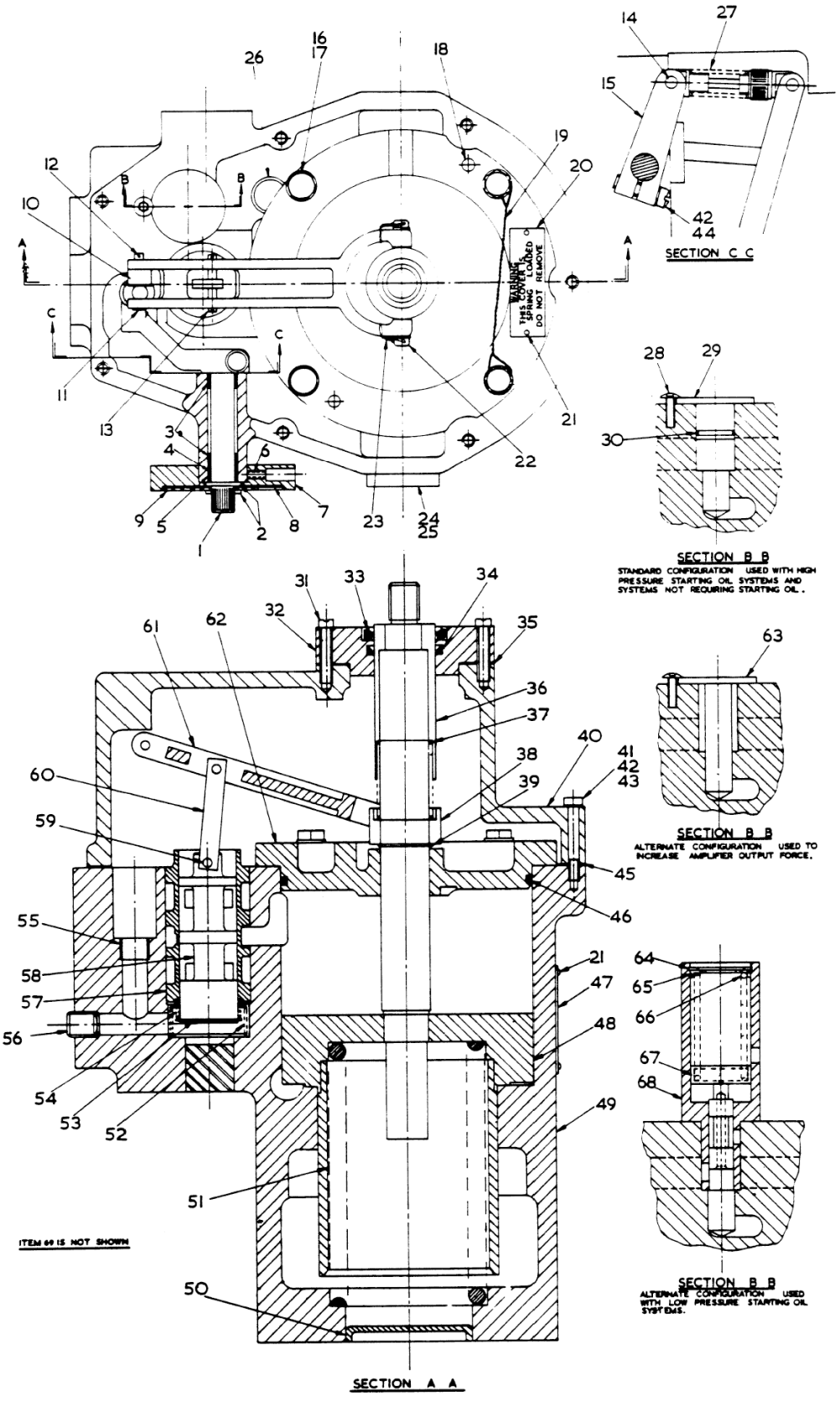

Figure 4-1. Hydraulic Amplifier Assembly Drawing

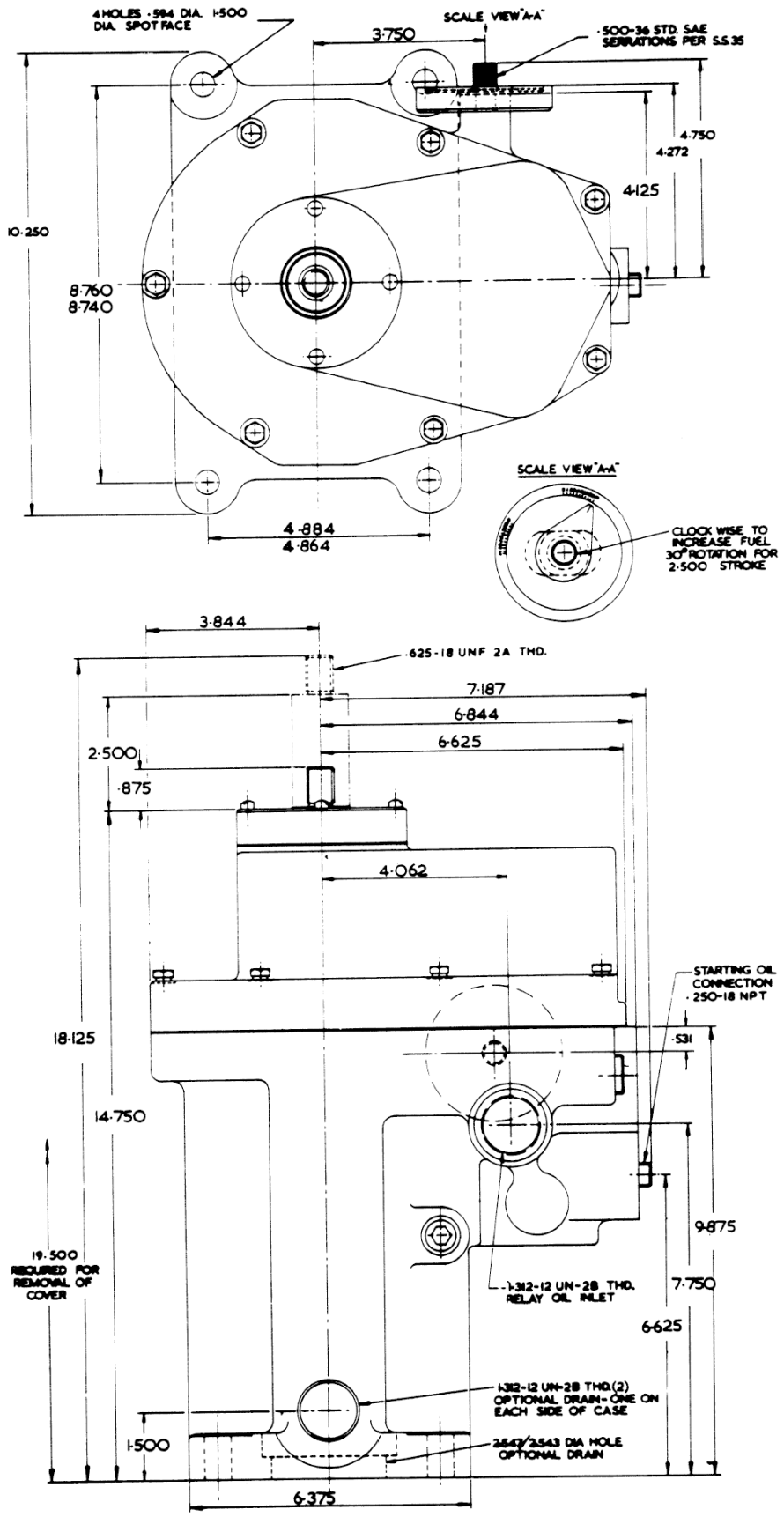

Figure 4-2. Hydraulic Amplifier Outline Drawing

Chapter 5.
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 89008A.

PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

Email and Website—www.woodward.com

**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.

2013/1/Colorado