WOODWARD

Product Manual 40108
(Revision NEW)
Original Instructions

3145 Liquid Fuel Valve/TM-5L Actuator with Fuel Pressurizing Valve

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:

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 Out-of-date translations are marked with ⚠.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

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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. Description

The 3145 Liquid Fuel Valve is used with a TM-5 linear output actuator which receives position commands from the Woodward electronic control. The stainless steel valve is capable of metering 50 to 5000 lb/h (23 to 2268 kg/h) of liquid fuel. The linear movement of the metering plunger, regulates fuel flow as a function of engine demand, or fuel schedule limitation. A constant pressure drop is maintained across the metering port by the ΔP regulator acting on the bypass valve to control pump discharge pressure.

A pressurizing fuel valve is installed downstream between the Fuel Valve assembly and the fuel nozzle (Pn), to build and maintain minimum P2 pressure to ensure proper operation of the fuel valve.

The TM-5L Actuator is a two-stage integrating device using a dry coil torque motor and hydraulic supply pressure. The actuator is used to position a differential servo as a function of input current, with a linear variable differential transformer (LVDT) position feedback.

In the actuator, high pressure oil is supplied to one side of the torque motor flapper, and drain pressure is supplied to the other side. The flapper position between the two nozzles determines the position of the actuator output shaft by regulating the flow applied to the large servo area. Supply pressure is applied to the small servo area in minimum flow position direction. The torque motor flapper will move to the minimum fuel position upon loss of voltage.

The LVDT provides position feedback to the electronic control to close the actuator position loop, insuring accurate positioning and overcurrent fail safe. A minimum flow switch is provided to prevent engine start with an open fuel valve.

Hydraulic fluid is sealed from the torque motor by a preformed packing ring between the armature and the servo valve housing, eliminating the accumulation of magnetic contaminants. The hydraulic fitting incorporates a 40 µm filter screen. The inlet port and control port is supplied with a 70 µm filter screen for additional protection from contaminants, in the event of an upstream filter failure.

Chapter 2.
Installation

Introduction

⚠WARNING

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.

Be careful when handling and installing the valve/actuator. Abuse can damage seals, installation surfaces, and cause a change in the calibration of the unit. Hydraulic and fuel connections must be protected by plastic shipping caps or covers whenever the valve/actuator is not connected to the normal piping.

Receiving

The valve/actuator assembly is calibrated and drained of calibration fluid at the factory. It is then placed in a cardboard container filled with urethane foam for protection during delivery to the customer. Additional cleaning or calibration is not necessary before installation and operation of the unit.

Storage

The 3145 Liquid Fuel Valve/TM-5L Actuator may be stored as received from the factory.

Installation

Take care to keep the immediate area clean and free of dirt and other contaminants. See the outline drawing, Figure 2-1 for:

- Overall dimensions
- Location of installation holes
- Sizes of hydraulic fittings
- Dimension of output shaft
- Location of adjustments
- Electrical connections

The attitude in which the valve/actuator is installed does not affect the performance of the actuator.

Make provisions for proper filtration of the hydraulic fluid that is supplied to the TM-5L actuator. It is recommended that a 25 µm (nominal) filter be installed in the supply line to the actuator.

Make all hydraulic connections that are needed. The hydraulic supply pressure for the TM-5L is provided by a positive displacement type pump in the VSV control, and regulated by a pressure regulating valve. Woodward recommends the use of a pressure switch to ensure that correct supply pressure is established prior to startup, and continually there after.

Make all electrical connections that are required, using the applicable Woodward electronic control manuals. A plant wiring diagram will be supplied upon request. In applications where the TM-5L actuator is not used with a Woodward electronic control, electrical input requirements will also be supplied upon request.

Design Parameters

Positive Displacement Pump Application:

Maximum Metered Flow	3300 lb/h (1497 kg/h)
Minimum Metered Flow	300 lb/h (136 kg/h)
Maximum Bypass Flow	7000 lb/h (3175 kg/h)
Nominal ΔP	50 psi (345 kPa)
ΔP Adjustment	±10%
Linear Input	0.75 inch (19.0 mm) metering port 0.5 inch stroke
Flow vs Position Accuracy	3% of point
Proof Pressure Test Level	2000 psig (13 790 kPa)
Burst Pressure Test Level	3000 psig (20 685 kPa)
Minimum Discharge Pressure	100 psi (690 kPa) above bypass pressure
Two Stage ΔP Regulator Metering Valve Return Spring Force	8 to 17.5 lb(f) (36 to 78 N)

TM-5L Hydraulic Fluid Requirements

TM-5L Supply Characteristics:

Fluid Types	Mineral or synthetic based oil, diesel fuels, kerosenes, gasolines, or light distillate fuels
Specific Gravity	0.6 to 1.0
Recommended Viscosity	0.6 to 400 centistokes
External Filter	40 µm nominal
Supply Pressure	400 psi (2758 kPa) over boost

TM-5L Flow Requirements:

Supply Pressure Pressure	Steady State Flow	Max. Transient Flow	Max. Boost Pressure
450 ±25 psig	0.25 US gal/min	0.625 US gal/min	50 psig
3103 ±172 kPa	0.95 L/min	2.37 L/min	345 kPa

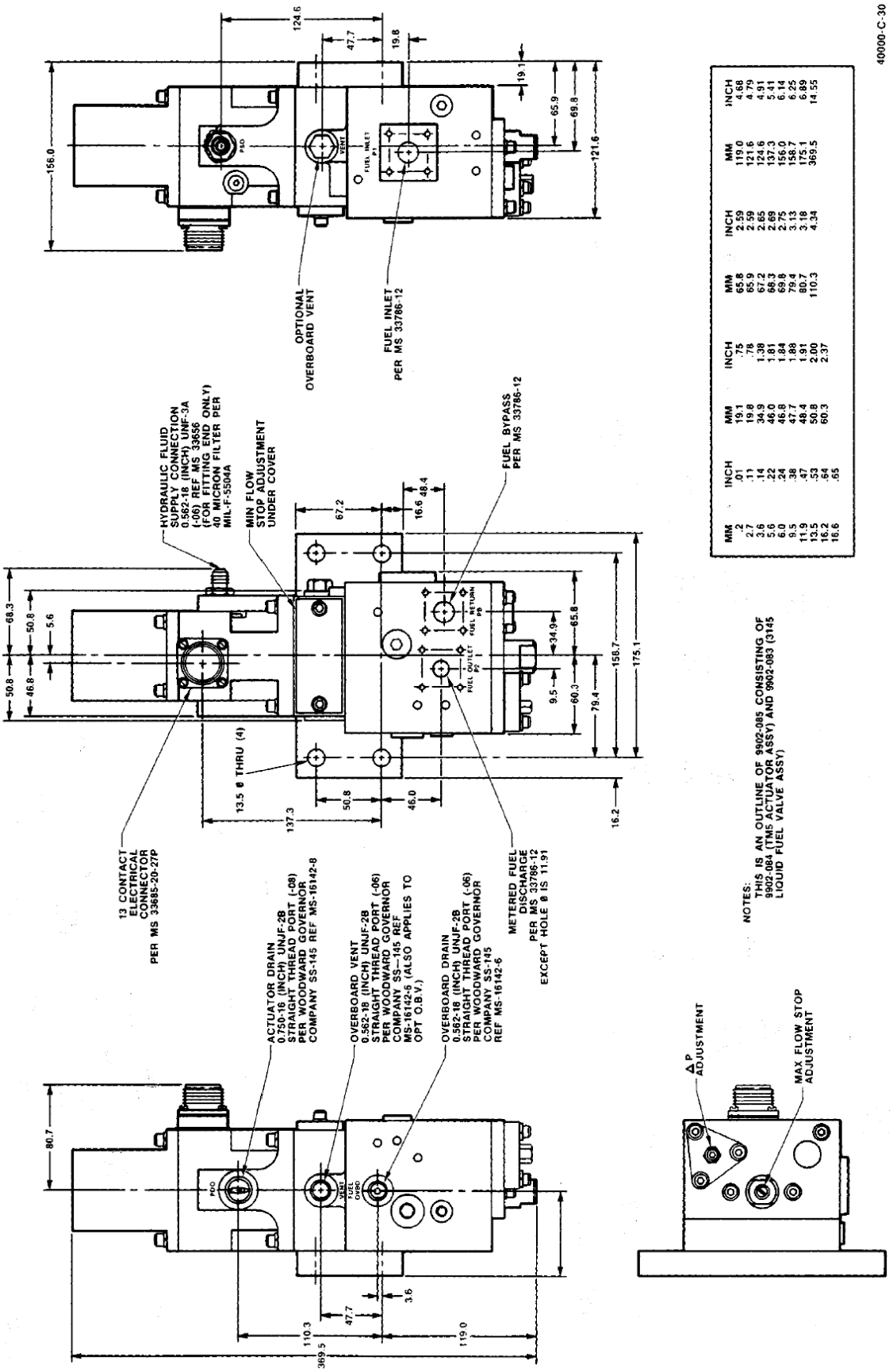

Figure 2-1. Outline of the 3145 Liquid Fuel Valve and TM-5L Actuator

Chapter 3.
Operation and Adjustments

Initial Operation

Before initial operation of the valve/actuator, be sure all previous installation and hookup steps are successfully accomplished, and all electrical connections and hydraulic and gas fittings are secure and properly attached.

Be sure the correct hydraulic supply pressure to the actuator is established before startup. Trapped air within the hydraulic system may cause erratic behavior of the actuator during the first few minutes of initial operation. Use applicable Woodward manuals for the particular Woodward electric control to begin prime mover operation.

⚠WARNING

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.

Adjustments

Normally, all operating adjustments are made to the 3145 Liquid Fuel Valve/ TM-5L Actuator during factory calibration. It is calibrated to specifications provided by the customer, and should not require further adjustment. Do not attempt adjustments to the actuator unless thoroughly familiar with the proper procedures.

Chapter 4.
Principles of Operation

TM-5L Integrating Actuator

TM-5L is a two stage integrating type actuator with:

- Torque motor input (nominal 150 mA)
- 5 ft-lb (6.8 J) linear output
- Differential servo
- Linear variable differential transformer (LVDT) position feedback
- Minimum flow switch

The essential element of the TM-5L is the torque motor servovalve, which uses hydraulic supply pressure and a flapper to control flow of fluid to the differential servo piston. The torque motor receives dc current signals from the electric control, and applies torque to a single piece armature and flapper, which is supported on a torsion flexure. The servovalve uses the flapper as a variable flow restrictor, and throttles the flow of hydraulic fluid from a nozzle on the inlet side of the flapper, and to a drain port on the bottom side of the flapper. During steady state operation, the flapper is positioned so the flow from Ps to Pc is equal to the flow from Pc to Pd.

The integrating actuator is used with an electronic position control circuit, which compares position demand (Vc) and feedback (Vk) signals and output motor coil current. When the actuator output shaft is stationary, coil current is at the null value. Any change in position demand voltage will result in a change in coil current, until the output shaft of the actuator moves to the required position. When position demand signal is increased, there will be a positive position error, causing an increase in coil current.

The increased current positions the flapper and increases hydraulic flow from the upper nozzle, while flow to the drain nozzle is restricted. The resulting pressure is applied to the large area of the differential servo piston, and the output shaft is moved in the increase direction. As the output shaft moves to an increase fuel position, the voltage output of the LVDT also increases. This increase is sensed by the control circuit, and reduces the coil current back to the null value.

3145 Liquid Fuel Valve

The linear movement of the output shaft from the TM-5L, moves the metering plunger to regulate fuel flow as a function of engine demand or fuel schedule limitation. A constant pressure drop is maintained across the metering port by the ΔP regulator acting on the bypass valve, to control pump discharge pressure.

Pump discharge pressure (P1) enters the control through the inlet port and is directed to the metering port, the bypass valve, the ΔP regulator, and to the bypass valve servo. The bypass valve is positioned by the servo pressure (P4) acting on the large area, which is spring loaded to close the valve against P1 on the small area.

P4 pressure is regulated by sensing P1 on the inside of the bellows assembly and P2, plus a spring load on the outside of the bellows assembly, which controls a bleed valve to bleed P1 restricted supply to the P4 area to valve bypass (Pb). P4 is then regulated between P1 and Pb to position the bypass valve to maintain a constant ΔP across the metering port.

Stability orifices are required in the P1 and P4 supply to the bypass servo areas. The orifice in the P4 line is built into a lightly loaded check to permit free flow in the decrease fuel direction, and prevent any lag in the bypass valve on throttle chop.

The metering plunger is spring loaded closed against the actuator opening force.

Fuel Pressurizing Valve Assembly

The fuel pressurizing valve is used to maintain minimum P2 pressure. P2 is maintained at a minimum of 150 psi (1034 kPa) so that the bypass valve servo has the required dynamic response. The valve also maintains a level high enough to ensure that bypass flow requirements can be met at low metered flows and low back pressures (Pn).

The pressurizing valve plunger is spring loaded closed to create back pressure. As pressure P2 reaches 150 psi (1034 kPa) minimum, the plunger moves against the spring opening the port in the pressurizing valve, allowing fuel to flow through the fuel nozzle (Pn) to the turbine.

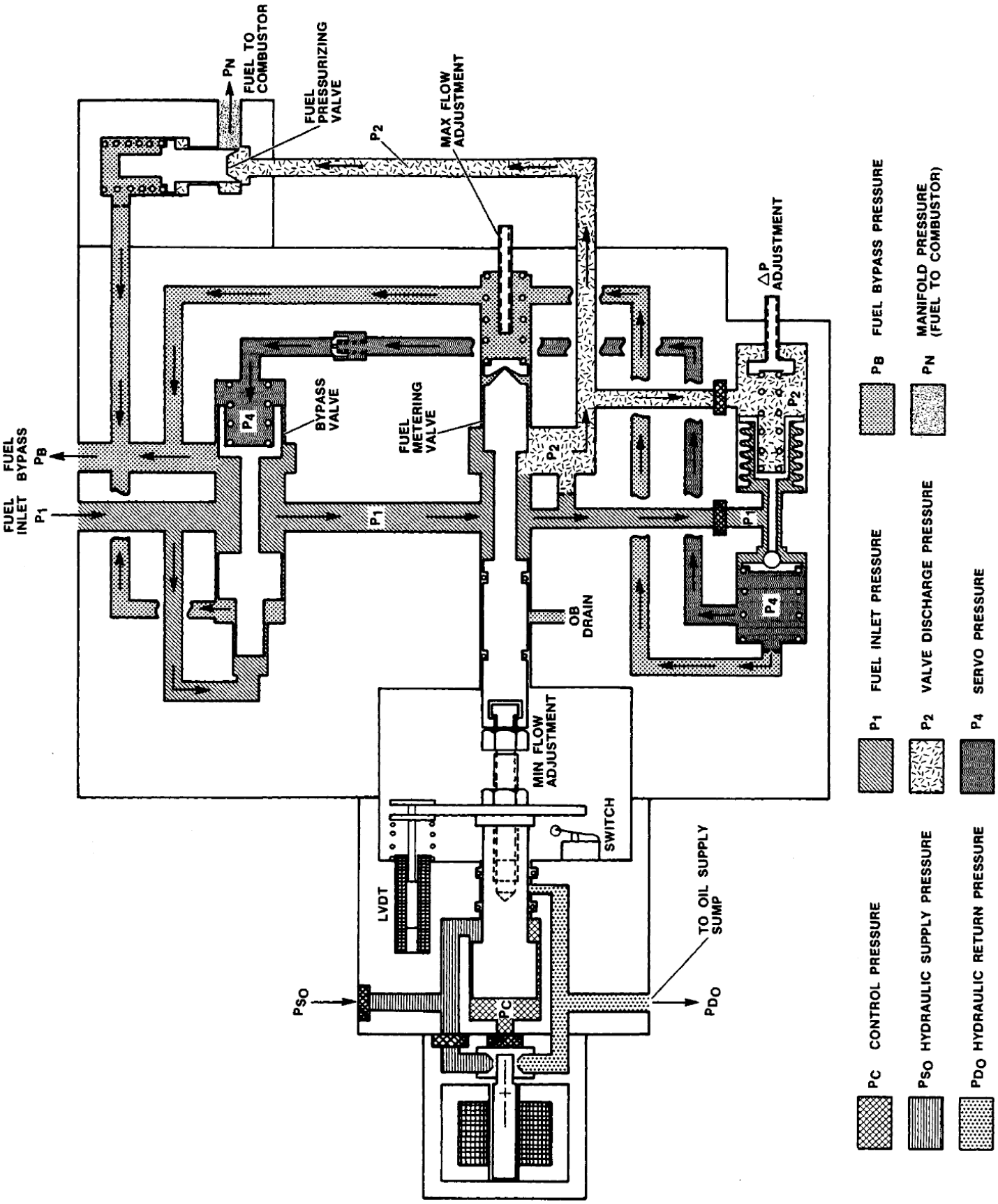

Figure 4-1. Schematic of the 3145 Liquid Fuel Valve and TM-5L Actuator

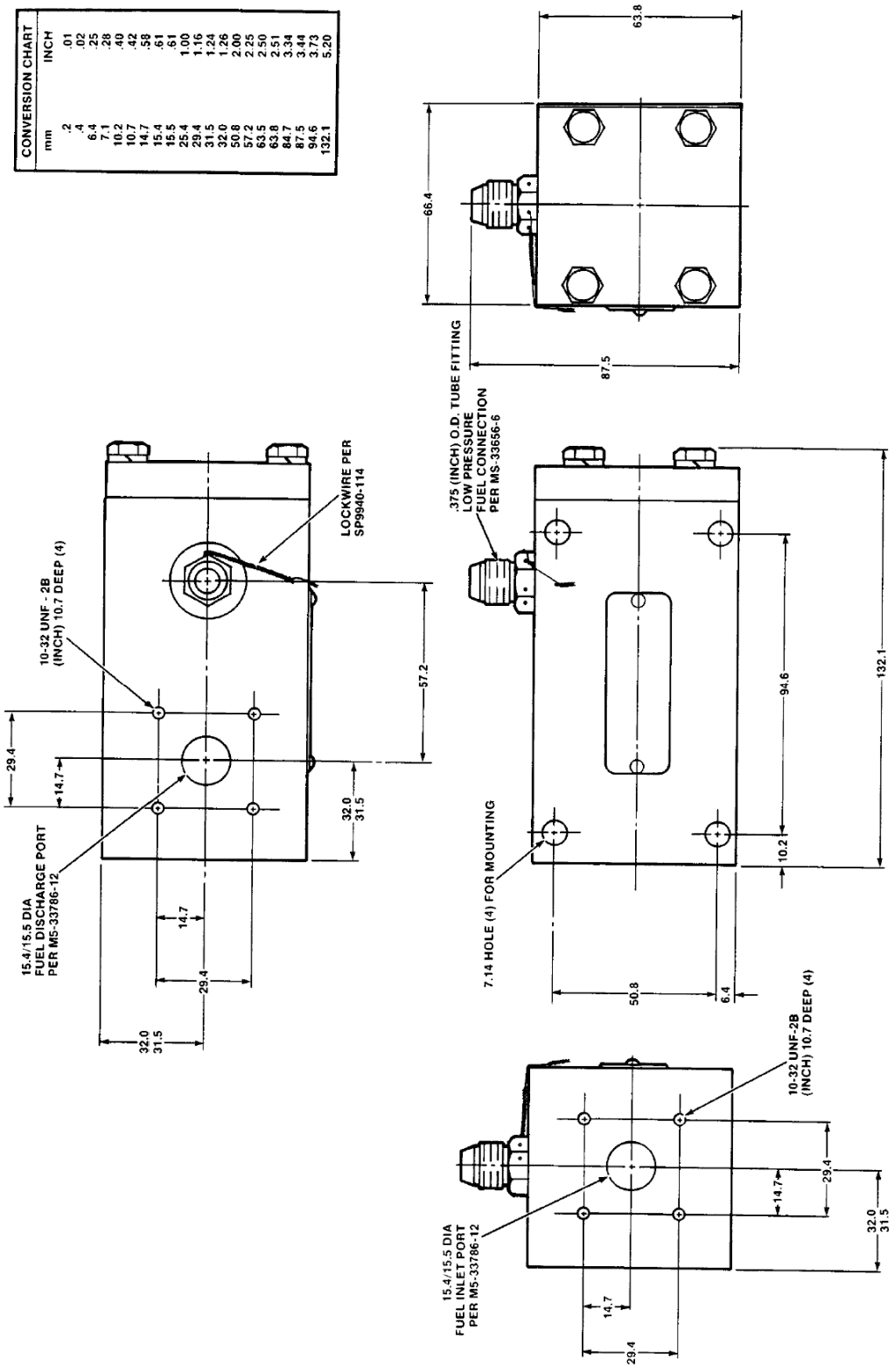

Figure 4-2. Outline of the Pressurizing Valve

Chapter 5. Maintenance

Filter Cleaning

The TM-5L Actuator is equipped with a 40 µm filter fitting at the supply inlet. See the outline drawing, Figure 2-1, for its location. If the filter becomes clogged as evidenced by sluggish response, it may be cleaned ultrasonically and back-flushed with a light solvent.

Troubleshooting

Faults in the governing system are usually revealed as speed variations of the prime mover, but it does not necessarily follow that such speed variations indicate governing system faults. Therefore, when improper speed variations appear, check all components including the turbine for proper operation. Refer to applicable Woodward electronic control manuals for assistance in isolating the trouble. If the actuator does not respond to electronic control input, check the actuator pressure supply and supply filters.

Disassembly of the TM-5L Actuator or 3145 Liquid Fuel Valve in the field is not recommended. Under unusual circumstances where disassembly becomes necessary, all work and adjustments should be made only by personnel thoroughly trained in the proper procedures.

When requesting information or service, include the part number and serial number of the fuel valve/actuator in your communications.

Chapter 6.
Replacement Parts

When ordering parts, give the following information:

- The fuel valve/actuator type, serial number and part number (shown on nameplate)
- Manual number (this is manual 40108)
- Part reference number given in parts list and part name or description.

⚠CAUTION **Injury may result if compressed springs are released suddenly. Use the proper equipment to remove springs and spring covers.**

Figure 6-1 illustrates parts for the 3145 Liquid Fuel Valve, Figure 6-2 illustrates parts for the TM-5L Actuator, and Figure 6-3 illustrates parts for the pressurizing valve.

Parts List for Figure 6-1, 3145 Liquid Fuel Valve

Ref. No.	Part Name	Quantity
40108-1	Drive screw	2
40108-2	Nameplate	1
40108-3	Plug 0.750-16	1
40108-4	O-ring 0.644 x 0.087	1
40108-5	Check valve spacer	1
40108-6	Retaining ring	1
40108-7	Spring seat	1
40108-8	Check valve spring	1
40108-9	Check valve orifice	1
40108-10	O-ring 0.489 x 0.070	1
40108-11	Check valve bushing	1
40108-12	Pipe plug	1
40108-13	Screw 6-32 x 0.375	2
40108-14	Washer #6	2
40108-15	Position scale	1
40108-16	Access cover	1
40108-17	Screw 0.250-20 x 1.0	5
40108-18	Washer 0.250	8
40108-19	O-ring 1.989 x 0.070	1
40108-20	O-ring 0.468 x 0.078	3
40108-21	Plug 0.562-18 UNF 2 A	1
40108-22	Case	1
40108-23	Orifice plug	1
40108-24	Plug 0.562-18 UNF 2A	2
40108-25	Valve mounting plate	1
40108-26	Screw 0.375-24 x 0.750	4
40108-27	Washer 0.375	4
40108-28	Loading spring	1
40108-29	O-ring 0.989 x 0.070	14
40108-30	Bypass valve sleeve	1
40108-31	Bypass valve piston	1
40108-32	Loading spring	1
40108-33	Bypass valve cap	1
40108-34	Metering valve plunger	1
40108-35	O-ring 0.301 x 0.70	2
40108-36	Glyd ring seal 0.500	2
40108-37	Metering valve sleeve	1
40108-38	Loading spring	1
40108-39	Spring seat	1
40108-40	Loading spring	1
40108-41	Retaining ring	1
40108-42	Orifice plug	1
40108-43	O-ring 0.551 x 0.070	1
40108-44	Loading spring	1
40108-45	Spring seat	1
40108-46	Bellows	1
40108-47	O-ring 0.739 x 0.070	1
40108-48	O-ring 0.676 x 0.070	1
40108-49	O-ring 0.614 x 0.070	1
40108-50	Spring	1
40108-51	Valve sleeve	1
40108-52	Filter plug	1
40108-53	Inline filter	1
40108-54	Flange filter	1
40108-55	Filter plug	1
40108-56	O-ring 0.755 x 0.097	1
40108-57	Plug 0.875-14 UNF 2A	1
40108-58	O-ring 1.114x 0.070	1
40108-59	Valve cap	1
40108-60	Cover plate	1
40108-61	Wire seal	1
40108-62	Lock wire	1
40108-63	O-ring 0.364 x 0.070	1
40108-64	Stop screw	1
40108-65	Screw 0.250-20 x 0.875	2
40108-66	Cover	1
40108-67	Adjuster	1
40108-68	Screw 10-32 x 0.875	2
40108-69	Expansion plug	1
40108-70	Screw 0.250-20 x 1.5	1
40108-71	Detent	1
40108-72	Roll pin 0.062 dia x 0.312	1
40108-73	Detent spring	1
40108-74	Seal block	1
40108-75	O-ring 0.239 x 0.070	1
40108-76	Spring seat	1

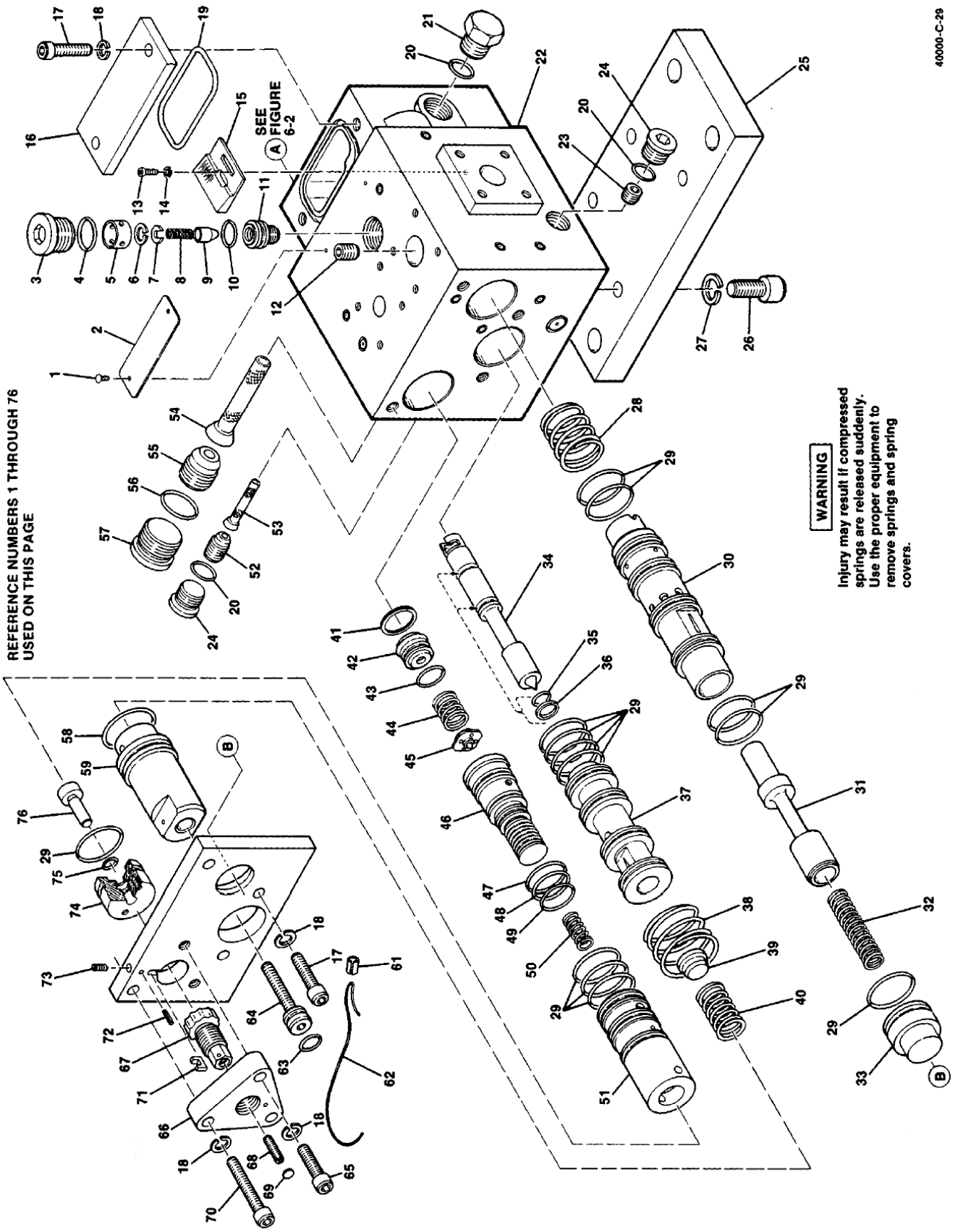

Figure 6-1. Parts for the 3145 Liquid Fuel Valve

Parts List for Figure 6-2, TM-5L Actuator

Ref. No.	Part Name	Quantity
40108-101	Screw 0.250-20 x 1.0	4
40108-102	Washer #6	4
40108-103	Connector 14 pin	1
40108-104	Gasket	2
40108-105	Boot	1
40108-106	Spacer	1
40108-107	Cover	1
40108-108	Screw 0.250-20 x 1.0	4
40108-109	Washer	4
40108-110	Torque motor	1
40108-111	Screw 10-32x 1.0	4
40108-112	Washer #10	9
40108-113	O-ring 2.989 x 0.070	1
40108-114	Screw 6-32 x 0.188	1
40108-115	O-ring 0.239 x 0.064	1
40108-116	Plug 0.312-24	1
40108-117	O-ring 0.468 x 0.078	1
40108-118	Filter fitting	1
40108-119	Lock wire	1
40108-120	Actuator body	1
40108-121	O-ring 3.487 x 0.103	1
40108-122	Servo piston	1
40108-123	O-ring 1.489 x 0.070	1
40108-124	Step seal 0.625	2
40108-125	O-ring 0.676 x 0.070	2
40108-126	Servo bushing	1
40108-127	O-ring	1
40108-128	Screw 2-56 x 0.625	2
40108-129	Position switch	1
40108-130	Switch bracket	1
40108-131	Washer #2	2
40108-132	Nut 2-56	2
40108-133	Washer 0.149 x 0.375 x 0.032	2
40108-134	Washer #6	2
40108-135	Screw 6-32 x 0.375	2
40108-136	Cover clamp	1
40108-137	Position indicator	1
40108-138	Coupling	1
40108-139	Screw 10-32 x 0.625	5
40108-140	Loading spring	1
40108-141	LVDT support	1
40108-142	Position sensor	1

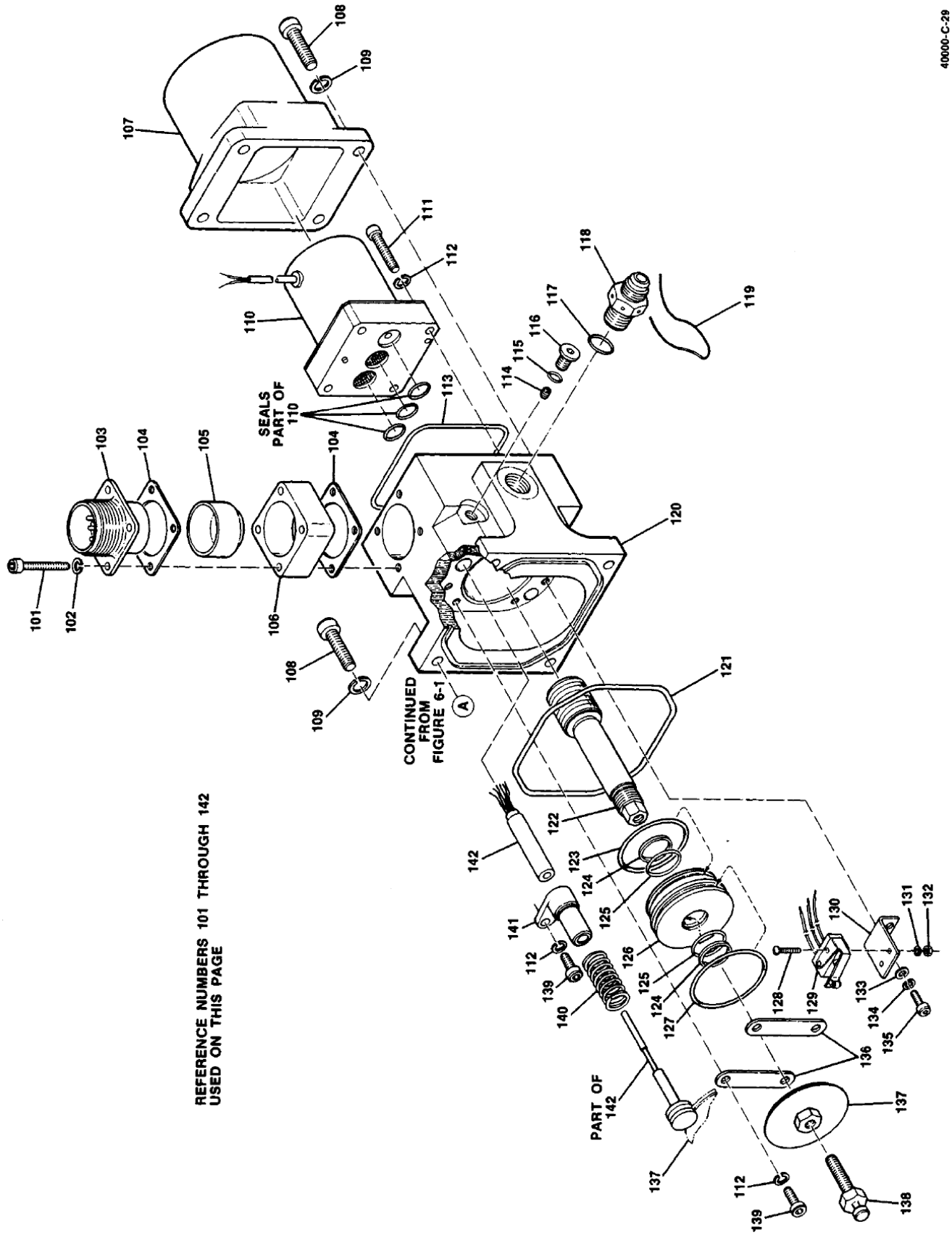

Figure 6-2. Parts for the TM-5L Actuator

Parts List for Figure 6-3, Fuel Pressurizing Valve

Ref. No.	Part Name	Quantity
40108-201	Nameplate	1
40108-202	Drive screw #2 x 0.188	2
40108-203	O-ring 0.426 x 0.070	1
40108-204	Pressurizing valve orifice	1
40108-205	Lockwire	1
40108-206	Valve body	1
40108-207	O-ring 0.864x 0.070	1
40108-208	O-ring 1.364 x 0.070	1
40108-209	Valve sleeve	1
40108-210	Valve plunger	1
40108-211	Spring	1
40108-212	O-ring 1.489 x 0.070	1
40108-213	Cap	1
40108-214	Washer 0.250	4
40108-215	Screw 0.250-20 x 0.88	4

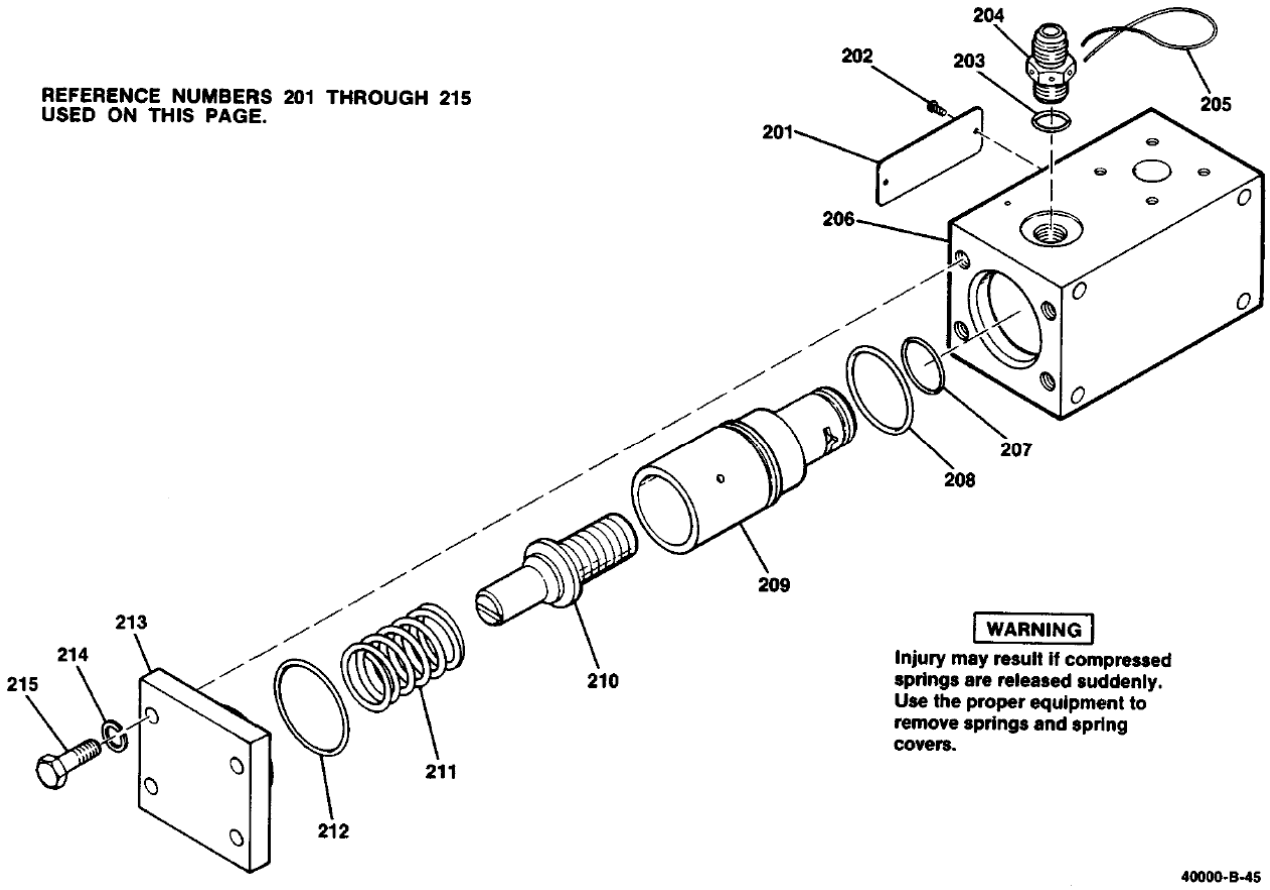

Figure 6-3. Parts for the Pressurizing Valve

Chapter 7.
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 40108.

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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