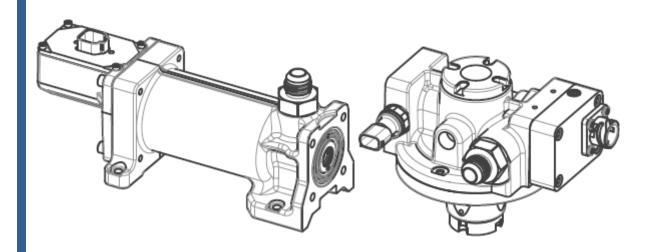


Product Manual 35221 (Revision -, 1/2024) Original Instructions



PFAV SERVICE KITS ASSEMBLY INSTRUCTIONS

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. The latest version of most publications is available on the Woodward website.

http://www.woodward.com

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.



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

Translated

The original source of this publication may have been updated since this translation was made. The latest version of most publications is available on the Publications Woodward website.

www.woodward.com/publications

Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

If your publication is not on the Woodward website, please contact your customer service representative to get the latest copy.

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

Woodward reserves the right to update any portion of this publication at any time. Information provided by Woodward is believed to be correct and reliable. However, no responsibility is assumed by Woodward unless otherwise expressly undertaken.

> **Manual 35221** Copyright © Woodward, Inc. 2024 **All Rights Reserved**

Contents

Warnings and Notices	3
ELECTROSTATIC DISCHARGE AWARENESS	5
REGULATORY COMPLIANCE	6
CHAPTER 1. GENERAL INFORMATION	7
CHAPTER 2. INSTALLATION INSTRUCTIONS	
CHAPTER 3. PRODUCT SUPPORT AND SERVICE OPTIONS Product Support Options Product Service Options Returning Equipment for Repair Replacement Parts Engineering Services Contacting Woodward's Support Organization Technical Assistance	
REVISION HISTORY	16

The following are trademarks of Woodward, Inc.: PFAV (Proportional Flow Area Valve) Woodward

The following are trademarks of their respective companies: RLA (Regulator and Lockoff Assembly) NORGREN (IMI) Sensata MOLYKOTE (DuPont)

Illustrations and Tables

Figure 2-1. Fuel Fitting Outlet Size	8
Figure 2-2. Fuel Fitting Hex Size	
Figure 2-3. NGITP Sensor Hex Size	
Figure 2-4. Regulator Installation Schematic	
Figure 2-5. Regulator Fastening Screw Hex Size	
Figure 2-6. Metering Valve Installation Schematic	

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.

MARNING

Lockout / Tagout LOTO Ensure that personnel are fully trained on LOTO procedures prior to attempting to replace or service the PFAV on a "live" running engine. All safety protective systems (overspeed, over temperature, overpressure, etc.) must be in proper operational condition prior to the start or operation of a running engine. Personnel should be equipped with appropriate personal protective equipment to minimize the potential for injury due to release of hot hydraulic fluids, exposure to hot surfaces and/or moving parts, or any moving parts that may be activated and are located in the area of the PFAV.



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.



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.



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.



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.



The PFAV should not be backflushed. Backflushing the PFAV may result in fluid retention in the actuator and could cause internal damage.

Do Not Backflush

NOTICE

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.

Battery Charging Device

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.

- 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 since 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. After removing the old PCB from the control cabinet, immediately place it in the antistatic protective bag.



External wiring connections for reverse-acting controls are identical to those for direct-acting controls.

Regulatory Compliance

International Compliance:

These listings are limited only to those units bearing the appropriate marking.

UNECE:

Certified to United Nations Regulation No. 110 Part I, Uniform Provisions Concerning the Approval of Specific Components of Motor Vehicles Using Compressed Natural Gas (CNG) and / or Liquefied Natural Gas (LNG) in Their Propulsion System. Approval Mark E13 110 R-040448 "C".

Consult Woodward engineering for options of ECE or non-ECE certified units.



External fire protection is not provided in the scope of this product. It is the responsibility of the user to satisfy any applicable requirements for their system.

External Fire Protection

Chapter 1. General Information

Introduction

The proportional flow area valve (PFAV) is intended for use on CNG and LNG engines. It consists of two fuel fittings, a NGITP sensor, a regulator, a lockoff assembly, and a metering valve assembly.

This manual provides installation instructions for the above service kits.



Hot / Cold Surfaces

The surface of this product can become hot enough or cold enough to be a hazard. Use protective gear for product handling in these circumstances. Temperature ratings are included in the specification section of manual *35055*.

Chapter 2. Installation Instructions

Fuel Fitting

If the sealing surface of the inlet or outlet fuel fitting of the PFAV is damaged and does not seal, the fitting needs to be replaced.

PFAV has three sizes of fuel fitting outlets (-8, -10, -12), but they all have the same hex head. Please select the correct fitting according to your application. The following illustrations are all based on -10 fitting as an example.

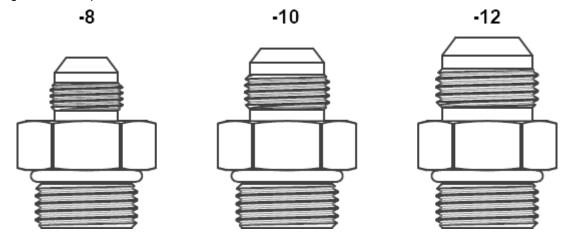


Figure 2-1. Fuel Fitting Outlet Size

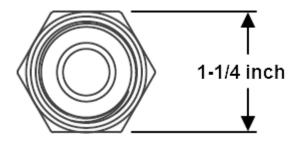


Figure 2-2. Fuel Fitting Hex Size

Replacement Process:

- Use a 1-1/4-inch wrench to remove the damaged fitting.
- Clean the thread hole.
- Lubricate the new fitting O-ring with a full circle of grease.
- Turn the new fitting in the hole by hand for 2 to 3 teeth.
- Use a torque wrench to tighten the fitting to 67.5 ± 2.5 lbf-ft (91.5 ± 3.5 N·m).



Contaminants falling into the PFAV inlet or outlet will result in a risk of sticking.



Woodward recommends MOLYKOTE EM-30L grease if unavailable, otherwise, specified natural gas engine oil can be used instead.

NGITP Sensor

If the OBD system reports a NGITP sensor failure, it needs to be replaced.

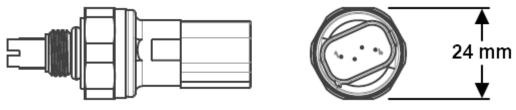
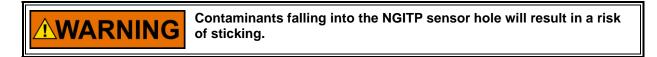


Figure 2-3. NGITP Sensor Hex Size

Replacement Process:

- Use a 24-mm wrench to remove the failed sensor.
- Clean the thread hole.
- Lubricate the new sensor O-ring with a full circle of grease.
- Turn the new sensor in the hole by hand for 2 to 3 teeth.
- Use a torque wrench to tighten the sensor to 14 ± 1 lbf-ft (19 ± 1.3 N·m).





Woodward recommends MOLYKOTE EM-30L grease if unavailable, otherwise, specified natural gas engine oil can be used instead.

Regulator and Lockoff Assembly

If the OBD system reports a regulator failure, it needs to be replaced.

Whether the regulator kit integrates NGITP sensor depends on the manufacturer's definition. The following illustration is based on none-sensor kit as an example.

The regulator has been set at the factory. Usually, there is no need for adjustment but in case a pressure adjustment is needed, please refer to Manual 35055, Chapter 2, Setting the PFAV Pressure.

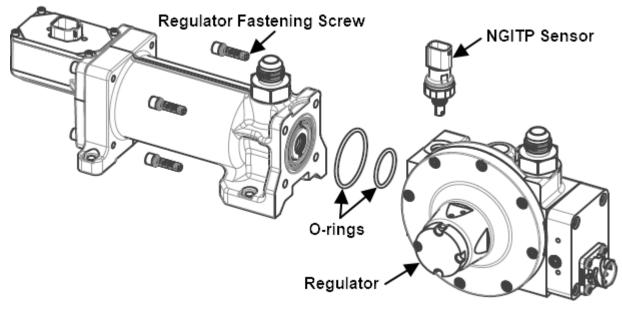


Figure 2-4. Regulator Installation Schematic



Figure 2-5. Regulator Fastening Screw Hex Size

Replacement Process:

- Refer to the previous chapter; remove the sensor and install it on the new regulator.
- Use a 3/16-inch wrench to remove the 4 regulator fastening screws and washers.
- Remove the two O-rings on the end surface of metering valve and clean the surface.
- Re-insert the lubricated O-rings from the kit into the grooves on the end surface of the metering valve.
- Keeping the original orientation, turn the new screws from the kit through the metering valve holes in the regulator by hand for 2 to 3 teeth.
- Use a torque wrench to tighten the screws to 96 \pm 5 lbf·in (10.8 \pm 0.5 N·m).



Contaminants falling into the O-ring grooves will result in a risk of leaking.

Metering Valve Assembly

If the OBD system reports a metering valve failure, it needs to be replaced.

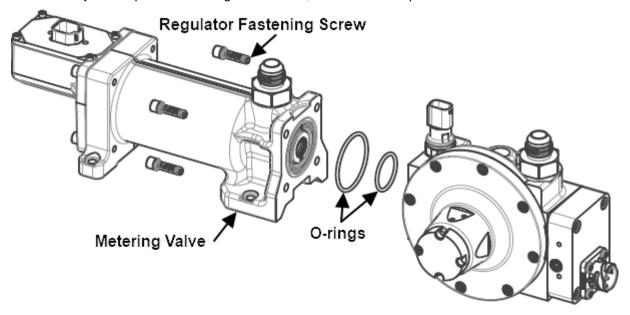
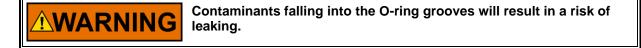


Figure 2-6. Metering Valve Installation Schematic

Replacement Process:

- Use a 3/16-inch wrench to remove the four regulator fastening screws and washers.
- · Clean the end surface of regulator.
- Re-insert the lubricated O-rings from the kit into the grooves on the end surface of the metering valve.
- Keeping the original orientation, turn the new screws from the kit through the metering valve holes in the regulator by hand for 2 to 3 teeth.
- Use a torque wrench to tighten the screws to 96 ± 5 lbf·in (10.8 ± 0.5 N·m).



Chapter 3. Product Support and Service Options

Product Support 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 or 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 current list of Woodward Business Partners is available at: https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner

Product Service 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 (5-09-0690) 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 5-09-0690).

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 5-09-0690) 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 5-09-0690). 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



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 one of the Full-Service Distributors listed at www.woodward.com/local-partner.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at https://www.woodward.com/support, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	-+49 (711) 78954-510
India	+91 (124) 4399500
	+81 (43) 213-2191
Korea	+82 (32) 422-5551
Poland	+48 (12) 295 13 00
United States-	+1 (970) 482-5811

Products Used in Engine Systems

<u>Facility</u> <u>Ph</u>	<u>one Numbe</u>
Brazil+55 (1	9) 3708 4800
China+86 (51)	2) 8818 5515
Germany +49 (71	1) 78954-510
India+91 (1	124) 4399500
Japan+81 (43) 213-2191
Korea+ 82 (32) 422-5551
The Netherlands -+31	(23) 5661111
United States+1 (9	70) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility ------ Phone Number
Brazil ------+ +55 (19) 3708 4800
China ------+ +86 (512) 8818 5515
India ------+ +91 (124) 4399500
Japan -----+ +81 (43) 213-2191
Korea -----+ +82 (32) 422-5551
The Netherlands -+31 (23) 5661111
Poland ------+ +48 (12) 295 13 00
United States ----+ 1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General
Your Name
Site Location
Phone Number
Fax Number
Prime Mover Information
Manufacturer
Turbine Model Number
Type of Fuel (gas, steam, etc.)
Power Output Rating
Application (power generation, marine, etc.)
Control/Governor Information
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
Symptoms
Description
-

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.

Revision History

Revision -

New manual

THIS PAGE INTENTIONALLY LEFT BLANK

Released

We appreciate your comments about the content of our publications.

Send comments to: industrial.support@woodward.com

Please reference publication 35221.





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

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.