WOODWARD

Product Manual 26851
(Revision A, 10/2019)
Original Instructions

Woodward Gas Fuel Skid with GS16DR Metering Valves

For GE DLELM6000PF Turbines: LM6000PF, LM2500+DLE, LM2500+G4 DLE

Installation, Operation, and Maintenance 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 *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, on the *publications page* of the Woodward website:

http://www.woodward.com/

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 *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, 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 Out-of-date translations are marked with ⚠.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— A bold, black line alongside the text identifies changes in this publication since the last revision.

Manual 26851

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

This is the safety alert symbol 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.

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.

Regulatory Compliance

European Compliance for CE Marking:
These listings are limited only Woodward products bearing the CE Marking.

EMC Directive: Declared to Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC)

ATEX Directive: Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres

GS16DR: Zone 2, Category 3, Group IIG, Ex nA IIC T3 Gc
GSOV25HT: This assembly is ATEX compliant per the compliance of the individual components below:

- Solenoid Valve –
  - Zone 1, Category 2, Group IIG, Ex d IIB T3 Gb,
  - Zone 2, Category 3, Group IIG, Ex nA IIC T3 Gc
- Proximity Switch
  - Zone 1, Category 2, Group IIG, Ex d IIC Gb T3

Smart Pressure Transducer: Zone 1, Category 2, Group IIG, Ex d IIB T4 Gb

Pressure Equipment Directive: Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment.

GS16DR: PED Category II
GSOV25HT: PED Category II

PED Module H – Full Quality Assurance,
CE-0062-PED-H-WDI 001-19-USA, Bureau Veritas SA (0062)

Refer to Special Conditions for Safe Use at the end of this section.

Other European Compliance:
Compliance with the following European Directives or standards does not qualify this product for application of the CE Marking:

RoHS Directive: Restriction of Hazardous Substances 2011/65/EU:
Woodward Turbomachinery Systems products are intended exclusively for sale and use only as a part of Large Scale Fixed Installations per the meaning of Art.2.4(e) of directive 2011/65/EU. This fulfills the requirements stated in Art.2.4(c) and as such the product is excluded from the scope of RoHS2.

Machinery Directive: Compliant as partly completed machinery with Directive 2006/42/EC of the European Parliament and the Council of 17 May 2006 on machinery.

Special Conditions for Safe Use:

The Woodward GS16DR Gas Fuel Skid must be installed in an area protected from exposure to water and falling debris.

The end user must provide electrical emergency switch-off and means for electrical isolation of the equipment.

Refer to manual 26418 for complete wiring, installation, operation and maintenance instructions for the GS16DR valve.

Refer to manual 26080 for complete wiring, installation, operation and maintenance instructions for the Smart Pressure Transducer.

Refer to manual 26190 for complete wiring, installation, operation and maintenance instructions for the GSOV25HT valve.

Compliance with the Machinery Directive 2006/42/EC noise measurement and mitigation requirements is the responsibility of the manufacturer of the machinery into which this product is incorporated.

⚠WARNING

EXPLOSION HAZARD—Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

Substitution of components may impair suitability for Zone 2 applications.

⚠AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous situez bien dans une zone non explosive.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de applications Zone 2.

⚠WARNING

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the GS16DR Gas Fuel Skid.

⚠WARNING

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 this manual.

⚠WARNING

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.

Control Specifications

Electrical Characteristics:	
GS16DR Electrical Information:	Refer to GS16DR manual 26418
Smart Pressure Transducer Electrical Information:	Refer to Smart Pressure Transducer manual 26080
GSOV25HT Electrical Information:	Refer to GSOV25HT manual 26190
Mechanical Characteristics	
Weight:	408 kg / 900 lb for 3 valve 544 kg / 1200 lb for 5 valve
Mounting:	See installation drawings
Fuel Connections:	See installation drawings
Temperature	
Ambient Operating Temperature:	(–20 to +80) °C / (–4 to +176) °F
Fuel Temperature:	(–20 to +125) °C / (–4 to +257) °F
Pressure	
Maximum Fuel Pressure:	51.7 bar(g) / 750 psig
Proof Pressure:	62 bar(g) / 900 psig
Pipe Flanges	
ASME Designation:	2.00 inch, Class 600, RFWN per ASME B16.5 (flanges internally threaded)
Bolting:	8 x 0.625-11” UNC

Chapter 1.
General Information

The Woodward GS16DR Gas Fuel Skid is an integrated valve and pressure-sensing assembly that has the ability to meter gas fuel accurately for low-emissions turbines. To achieve accurate gas fuel metering, a digital position demand signal from the supervisory control must be used. The GS16DR valve is capable of CANopen digital communications protocols. The GS16DR valve flow characteristics are kept within the valve driver off-board the unit. The position demand from the supervisory control is generated by a calculation based on the pressures, temperature, and other properties of the gas fuel. The pressures are received from the Woodward Smart Pressure Transducer manifold affixed to the fuel skid. The pressure transmitter sends the pressure data digitally via an RS-422 protocol to the supervisory control.

Refer to manual 26418 for complete wiring, installation, operation, and maintenance instructions for the GS16DR valve.

Refer to manual 26080 for complete wiring, installation, operation, and maintenance instructions for the Smart Pressure Transducer.

Refer to manual 26190 for complete wiring, installation, operation and maintenance instructions for the GSOV25HT valve.

Chapter 2.
Installation

Introduction

⚠WARNING

The Woodward GS16DR Gas Fuel Skid weighs 544 kg / 1200 lb. In order to prevent injury, use a lifting strap when handling the flow leg. Do not lift or handle the unit by any conduit, cable or tubing.

⚠WARNING

Due to typical noise levels in the turbine environments, hearing protection should be worn when working on or around the Woodward GS16DR Gas Fuel Skid.

⚠WARNING

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 this manual.

⚠WARNING

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.

⚠WARNING

The engine, turbine, or other type of prime mover should be equipped with an overspeed, misfire, detonation detection shutdown device(s), that operate totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the system fail.

Mechanical Installation

Be careful when unpacking the gas fuel skid. Check the assembly for signs of damage, such as bent or dented covers, scratches, and loose or broken parts. Notify the shipper and Woodward if damage is found.

The Woodward GS16DR Gas Fuel Skid ships with covers on the inlet and discharge pipe flanges as well as the vent lines. The shipping covers ensure that debris is unable to enter the fuel skid before final assembly into the turbine baseplate. The shipping covers must be removed before installation into the piping system.

Vent Lines

The Woodward GS16DR Gas Fuel Skid contains customer connections for three vent lines. Each line must be connected by means of rigid steel piping to a fuel connection, purge, vent, or flare-off system so as not to be exposed to danger of obstruction or physical damage. The GS16DR overboard vent line must not be exposed to back pressure in excess of 69 kPa(g) / 10 psig. Vent line locations and descriptions are given in Figures 2-2 and 2-3.

Skid Mounting

See Figures 2-2 and 2-3 for overall dimensions, mounting hole locations, lifting eyes, and any fitting or plumbing connections. The gas fuel skid is mounted to the turbine baseplate through the four mounting feet located at the bottom of the gas fuel skid. Mechanical devices such as hydraulic or mechanical jacks, pulleys, chain-falls, or similar should never be used to force the piping system to align with the valve flanges.

Pipe Installation

ANSI/ASME Flanges—Inlet Connection

Inlet connection fastener material must meet or exceed ASTM A193 Grade B7 per ASME B16.5. The use of thread anti-galling lubricant is required on all bolted connections. The use of helical split washers is recommended. Flange gasket materials should conform to ASME B16.20. Type CGI gaskets must be used on the inlet connection. The user should select a gasket material which will withstand the expected bolt loading without injurious crushing, and which is suitable for the service conditions. When installing the skid into the process piping, it is important to properly torque the studs/bolts in the appropriate sequence in order to keep the flanges of the mating hardware parallel to each other. A two-step torque method is recommended. Rated torque for the inlet connection is (108 to 122) N·m / (80 to 90) lb-ft. Once the studs/bolts are hand tightened, torque the fasteners in a crossing pattern illustrated in Figure 2-1, to half the required torque value. Once all studs/bolts have been torque to half the appropriate value, repeat the pattern until the rated torque value is obtained.

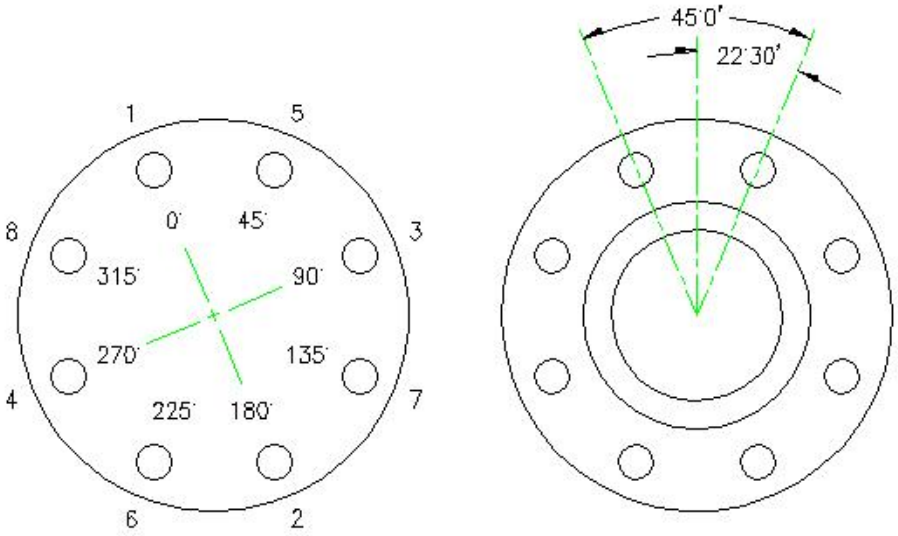

Figure 2-1. Bolt Tightening Sequence

WARNING **Leak check all gaseous fuel connections. Leaking gaseous fuel can cause explosion hazards, property damage, or loss of life.**

Electrical Installation

WARNING

EXPLOSION HAZARD—Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

WARNING

Take care not to damage the threads when removing or replacing the covers. Damage to threads or flat surfaces may result in moisture ingress, fire or explosion. Clean the surface with rubbing alcohol if necessary. Inspect the threads to ensure that they are not damaged or contaminated.

WARNING

Detailed specifications, requirements and warnings are included in each component's respective manual.

Refer to manual 26418 for complete wiring, operation, installation and maintenance instructions for the GS16DR Valve.

Refer to manual 26080 for complete wiring, operation, installation and maintenance instructions for the Smart Pressure Transducer.

Refer to manual 26190 for complete wiring, installation, operation and maintenance instructions for the GSOV25HT valve.

GS16DR Valve Setup/Configuration

Refer to manual 26418 for complete Service Tool setup instructions.

Water Ingress Protection

The following are considerations for protecting the Woodward GS16DR Gas Fuel Skid from water damage:

Turbine Water Wash Process: Some customers perform a water wash of the turbine compressor section which can result in incidental water spray directed onto the gas fuel skid. The gas fuel skid should be properly protected from this water spray.

Power Wash: The gas fuel skid should NOT be pressure / power washed. If there is other equipment in the vicinity that is being pressure washed, the gas fuel skid should be adequately protected from incidental water spray.

LM6000PF Gas Fuel Skid

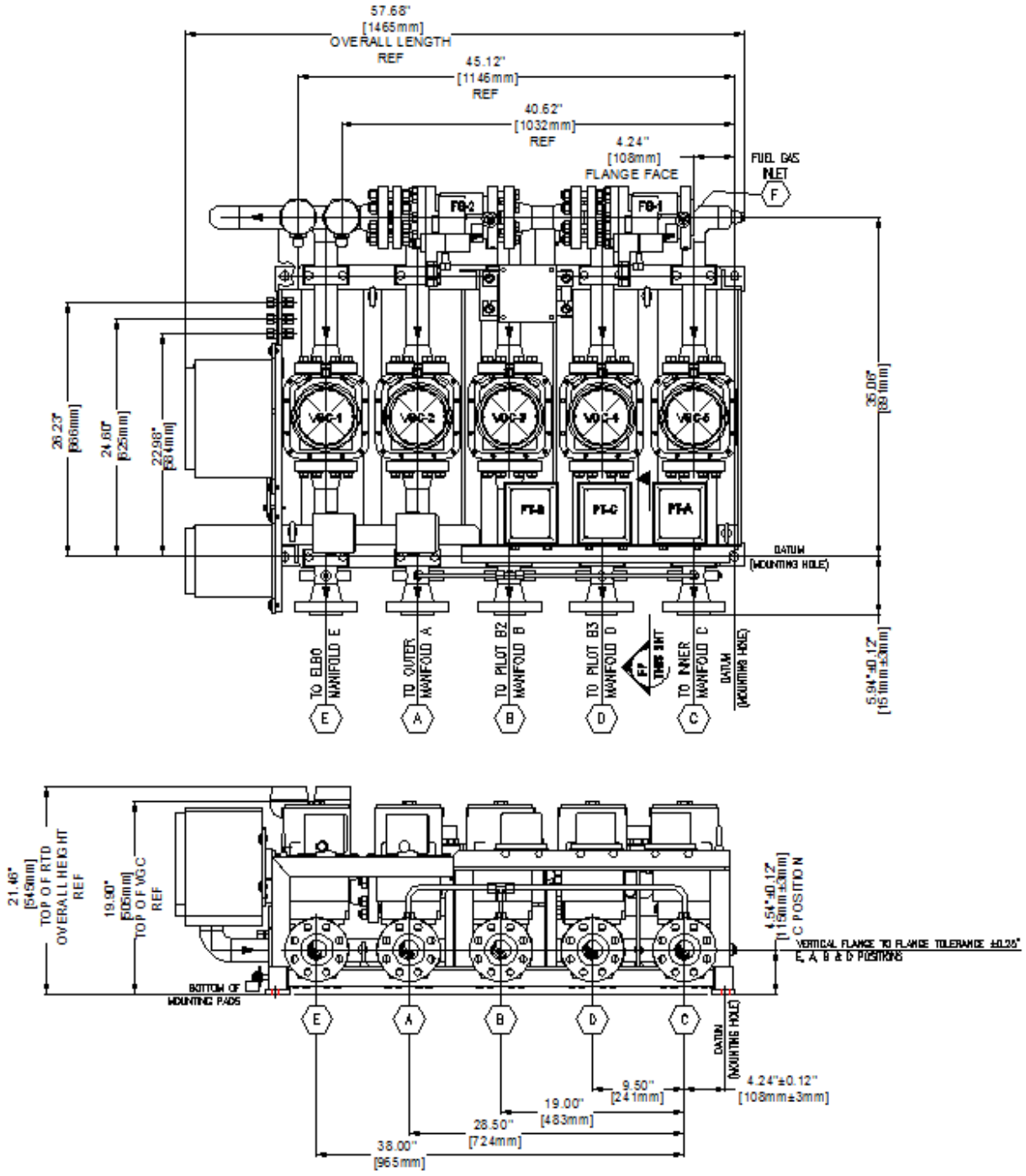

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Figure 2-2a. Standard Woodward GS16DR Gas Fuel Skid LM6000PF

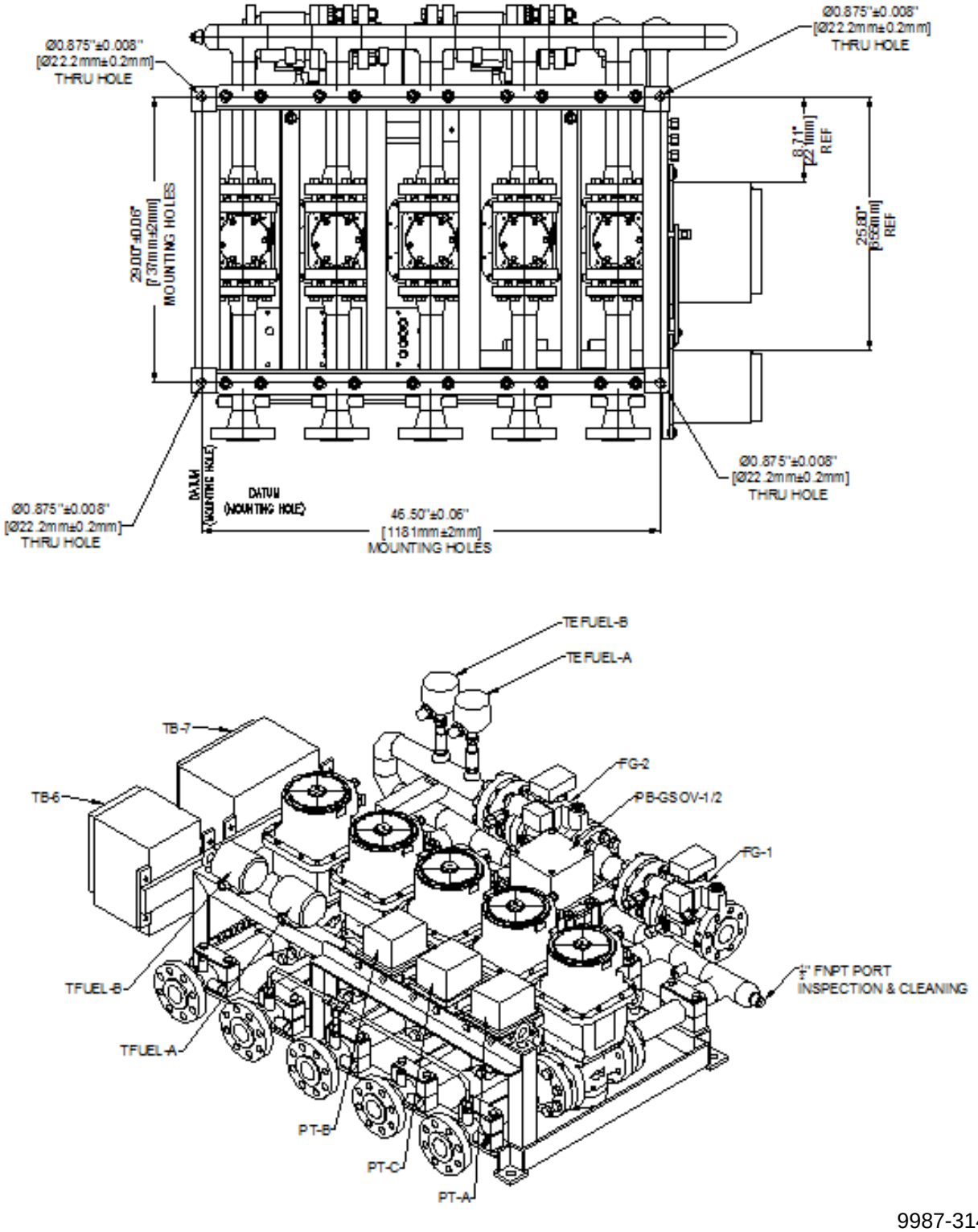

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Figure 2-2b. Standard Woodward GS16DR Gas Fuel Skid LM6000PF

	A	B	C
1	CUSTOMER CONNECTIONS		
2	CONN	SIZE/TYPE	DESCRIPTION
3	A	2" ANSI 600# RAISED FACE FLANGE	FUEL GAS TO OUTER MANIFOLD 'A'
4	B	2" ANSI 600# RAISED FACE FLANGE	FUEL GAS TO PILOT B2 MANIFOLD 'B'
5	C	2" ANSI 600# RAISED FACE FLANGE	FUEL GAS TO INNER MANIFOLD 'C'
6	D	2" ANSI 600# RAISED FACE FLANGE	FUEL GAS TO PILOT B3 MANIFOLD 'D'
7	E	2" ANSI 600# RAISED FACE FLANGE	FUEL GAS TO ELBO MANIFOLD 'E'
8	F	2" ANSI 600# RAISED FACE FLANGE WITH 8 x 5/8-11 HOLES	FUEL GAS INLET
9	G	1/4" BULKHEAD COMPRESSION TUBE FITTING	INTER SOV VENT
10	H	1/2" BULKHEAD COMPRESSION TUBE FITTING	FG-1 AND FG-2 VENT
11	J	3/4" BULKHEAD COMPRESSION TUBE FITTING	VGC OVERBOARD VENT

	A	B	C
1	GAS PATH FASTENERS		
2	QTY	SIZE/TYPE	DESCRIPTION
3	88	5/8-11 UNC X 2.75" HVY HEX BOLT	VGC INLET & DISCHARGE FASTENERS FG-1 & FG-2 INLET FASTENERS
4	120	5/8 HELICAL SPIRAL LOCKWASHER	ALL PRESSURE CONNECTIONS
5	16	5/8-11 UNC X 4.50" STUD	FG-1 & FG-2 DISCHARGE FASTENERS
6	32	5/8-11 UNC HEAVY HEX NUT	FG-1 & FG-2 DISCHARGE FASTENERS

NOTES:
1. RAISED FACE FLANGES ARE PER ANSI/ASME B16.5
2. PRIMARY DIMENSIONS ARE INCHES, SECONDARY DIMENSIONS ARE MILLIMETERS
3. TOLERANCES ARE +/- 0.25" FOR FRAME-TO-FRAME AND PIPE-TO-PIPE DIMENSIONS, UNLESS NOTED OTHERWISE
4. TOLERANCES ARE +/- 0.37" FOR PIPE-TO-FRAME DIMENSIONS, UNLESS NOTED OTHERWISE
5. APPROXIMATE WEIGHT OF FUEL GAS SKID IS 900LBS [625 KG]
6. TUBING SMALLER THAN 1/2" NOMINAL HAS BEEN OMITTED FOR CLARITY

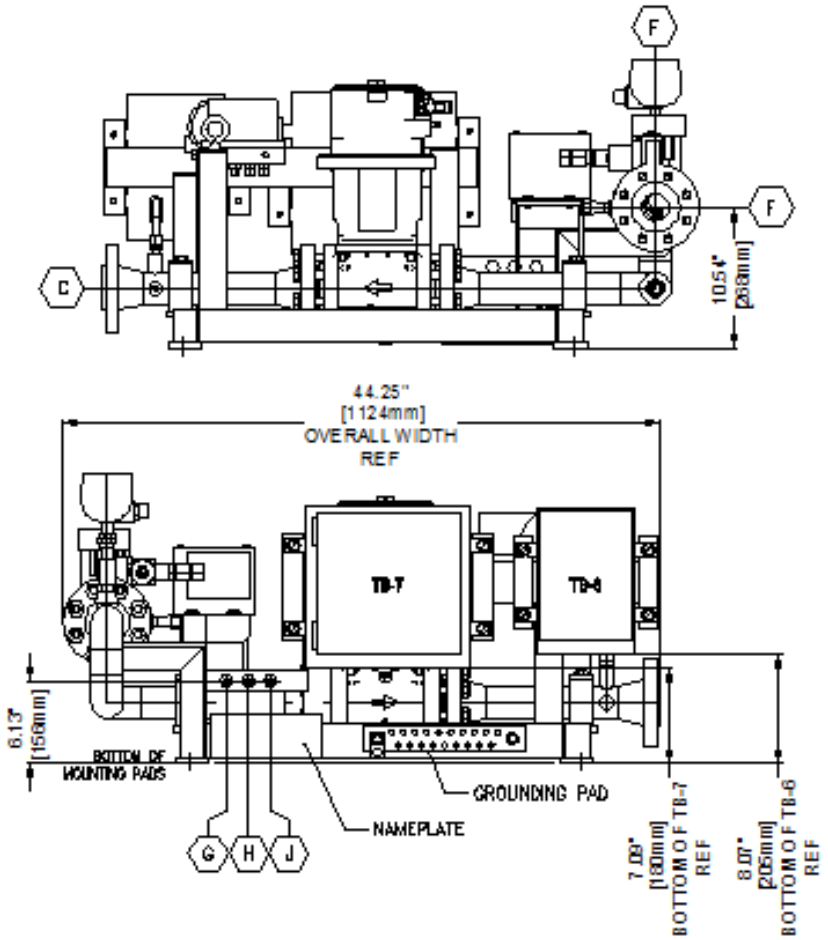

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Figure 2-2c. Standard Woodward GS16DR Gas Fuel Skid LM6000PF

LM2500+DLE Gas Fuel Skid

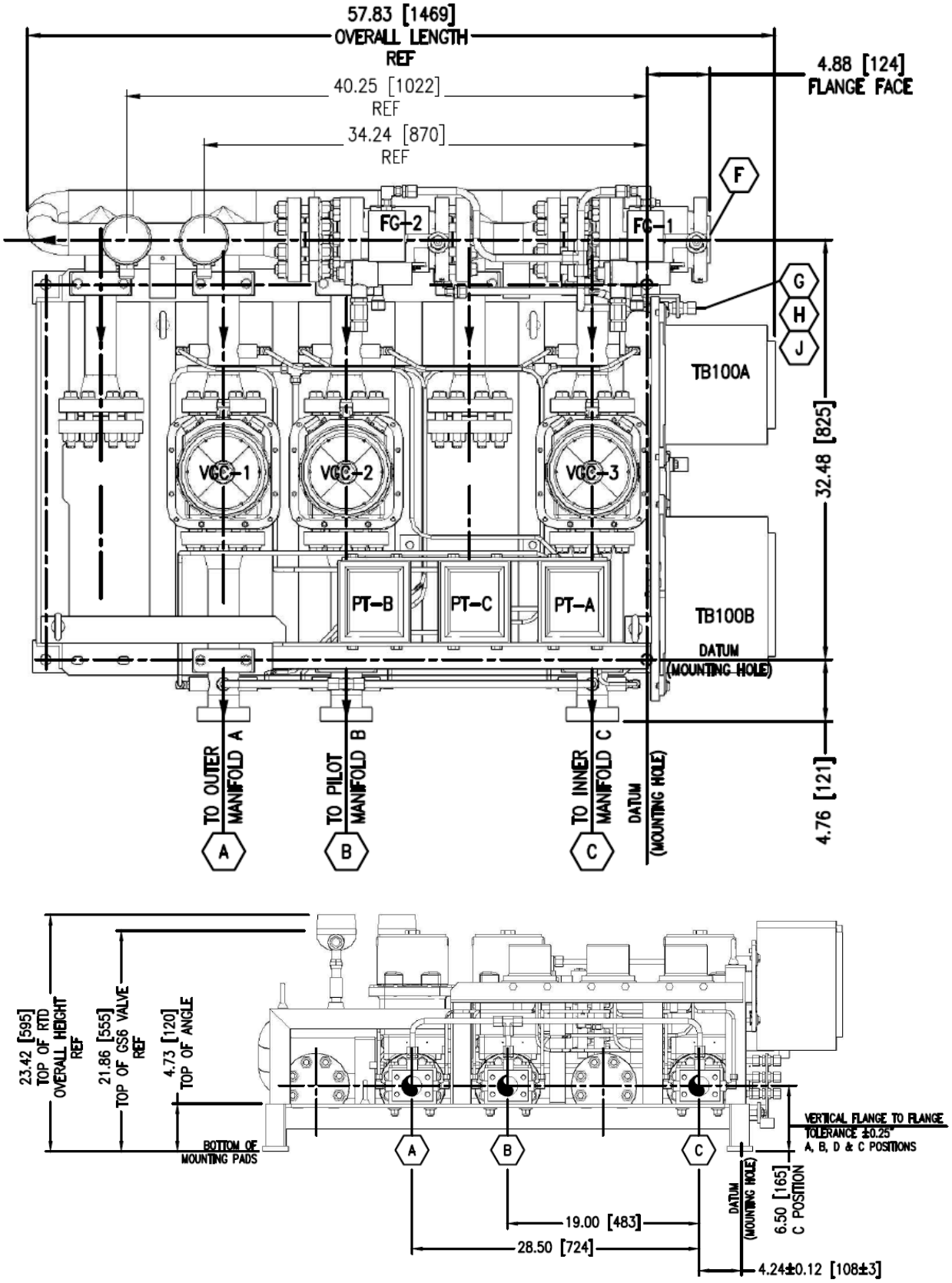

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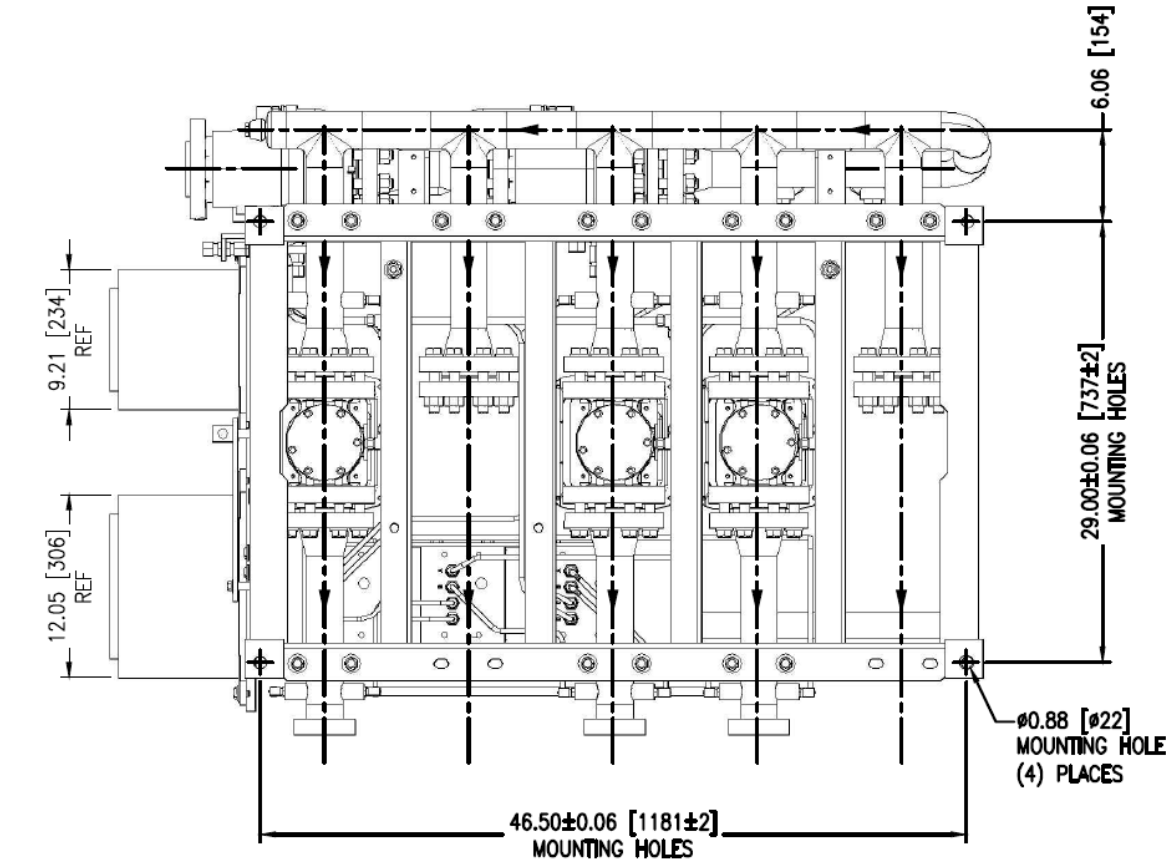
Figure 2-3a. Standard Woodward GS16DR Gas Fuel Skid LM2500+DLE



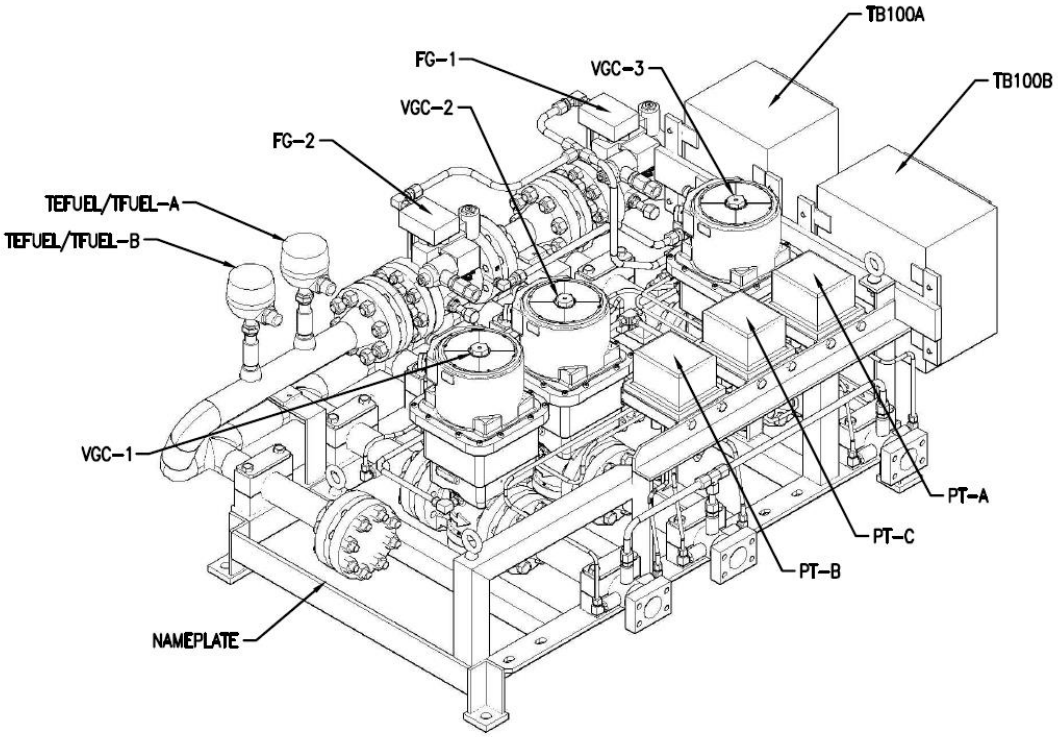


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Figure 2-3b. Standard Woodward GS16DR Gas Fuel Skid LM2500+DLE

CUSTOMER CONNECTIONS		
CONN	SIZE / TYPE	DESCRIPTION
A	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO OUTER MANIFOLD A
B	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO PILOT B2 MANIFOLD B
C	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO INNER MANIFOLD C
F	2"ANSI 600# SS RF FLANGE WITH 8x.625-11 HOLES	FUEL GAS INLET
G	1/2" S.S TUBE FITTING	OVERBOARD BACKPRESSURE VENT
H	1/2" S.S TUBE FITTING	INTER SOV VENT
J	1/2" S.S TUBE FITTING	TO GSOV-1 AND GSOV-2 VENT

TUBE WALL THICKNESS TABLE	
TUBE O.D.	WALL THICKNESS
0.2500	0.0490
0.3750	0.0490
0.5000	0.0650
0.7500	0.0950

NOTES:
1. RAISED FACE FLANGES ARE PER ANSI/ASME B16.5
2. PRIMARY DIMENSIONS ARE INCHES, SECONDARY DIMENSIONS ARE MILLIMETERS
3. TOLERANCES ARE +/- 0.25" FOR FRAME-TO-FRAME AND PIPE-TO-PIPE DIMENSIONS, UNLESS NOTED OTHERWISE
4. TOLERANCES ARE +/- 0.37" FOR PIPE-TO-FRAME DIMENSIONS, UNLESS NOTED OTHERWISE
5. APPROXIMATE WEIGHT OF FUEL GAS SKID IS 1200LBS [544 KG]
6. TUBING SMALLER THAN ½" NOMINAL HAS BEEN OMITTED FOR CLARITY
7. SKID DISCHARGE FLANGES ARE INTERNALLY THREADED 1/2-13 THREADS

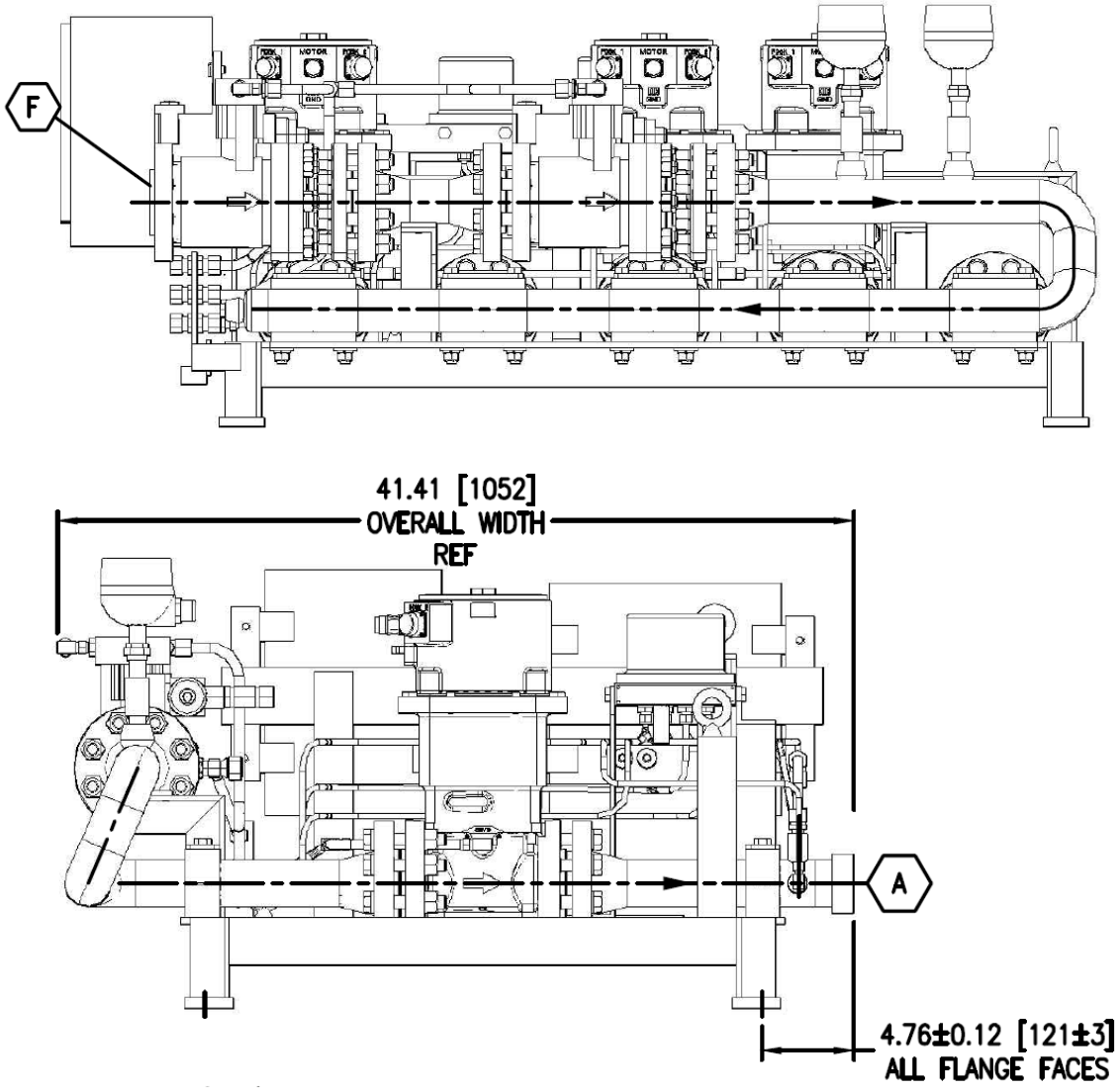

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Figure 2-3c. Standard Woodward GS16DR Gas Fuel Skid LM25000+DLE

LM2500+G4 DLE Gas Fuel Skid

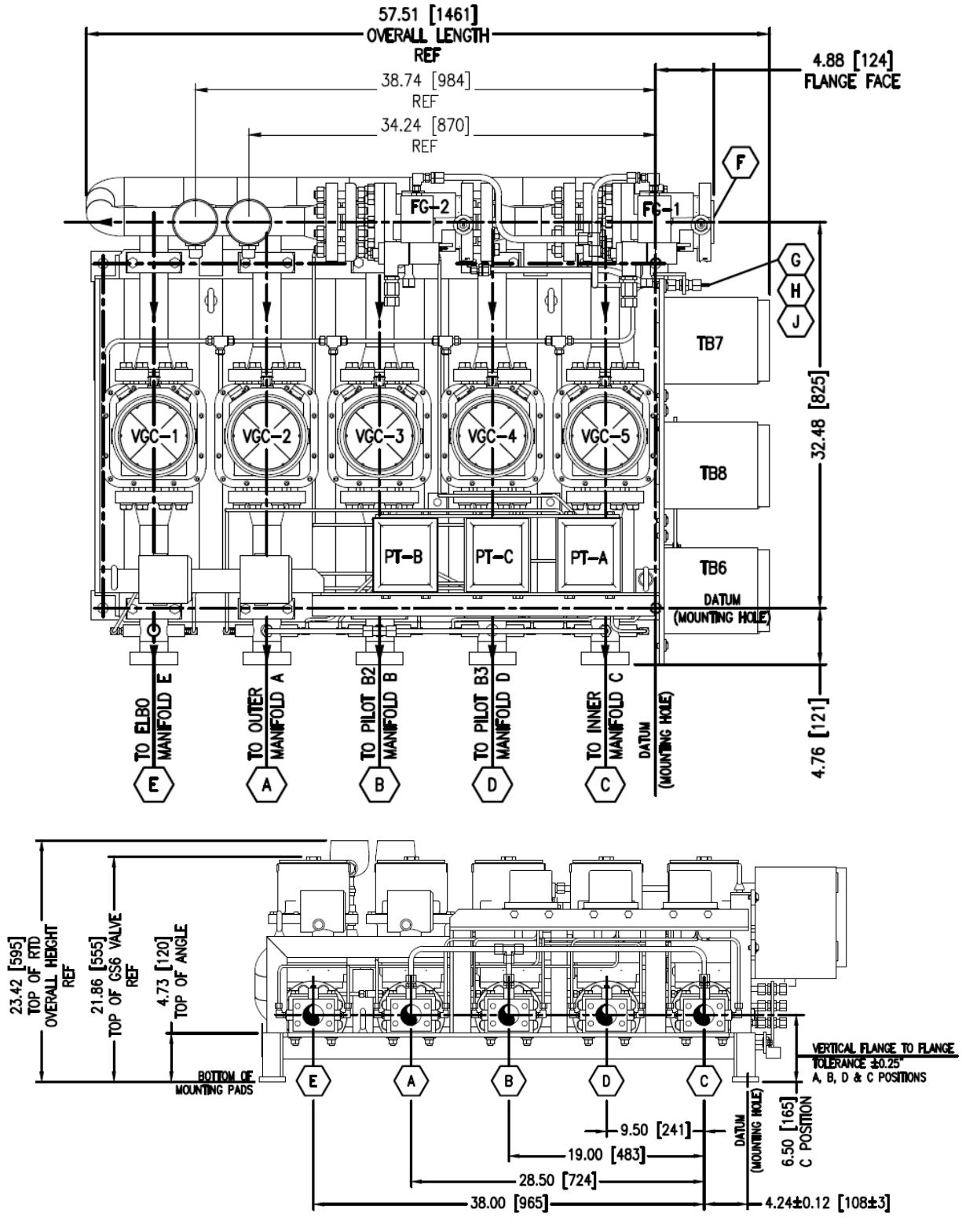

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Figure 2-4a. Standard Woodward GS16DR Gas Fuel Skid LM2500+G4 DLE

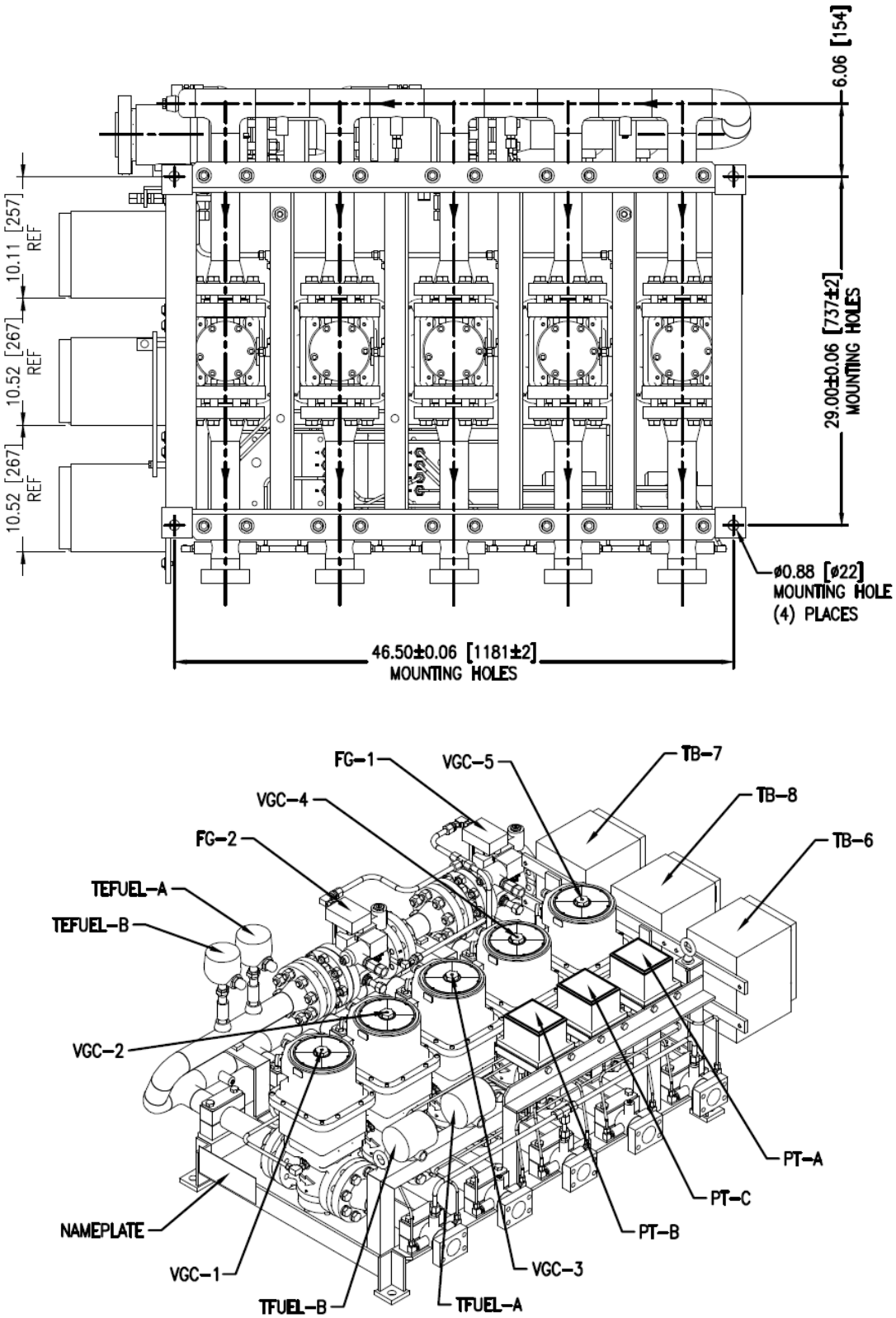

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Figure 2-4b. Standard Woodward GS16DR Gas Fuel Skid LM2500+G4 DLE

CUSTOMER CONNECTIONS		
CONN	SIZE / TYPE	DESCRIPTION
A	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO OUTER MANIFOLD A
B	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO PILOT B2 MANIFOLD B
C	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO INNER MANIFOLD C
D	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO PILOT B3 MANIFOLD D
E	2" CODE 61 SAE F.F. FLANGE	FUEL GAS TO ELBO MANIFOLD E
F	2"ANSI 600# SS RF FLANGE WITH 8x.625-11 HOLES	FUEL GAS INLET
G	1/2" S.S TUBE FITTING	OVERBOARD BACKPRESSURE VENT
H	1/2" S.S TUBE FITTING	INTER SOV VENT
J	1/2" S.S TUBE FITTING	TO GSOV-1 AND GSOV-2 VENT

TUBE WALL THICKNESS TABLE	
TUBE O.D.	WALL THICKNESS
0.2500	0.0490
0.3750	0.0490
0.5000	0.0650
0.7500	0.0950

NOTES:
1. RAISED FACE FLANGES ARE PER ANSI/ASME B16.5
2. PRIMARY DIMENSIONS ARE INCHES, SECONDARY DIMENSIONS ARE MILLIMETERS
3. TOLERANCES ARE +/- 0.25" FOR FRAME-TO-FRAME AND PIPE-TO-PIPE DIMENSIONS, UNLESS NOTED OTHERWISE
4. TOLERANCES ARE +/- 0.37" FOR PIPE-TO-FRAME DIMENSIONS, UNLESS NOTED OTHERWISE
5. APPROXIMATE WEIGHT OF FUEL GAS SKID IS 1200LBS [544 KG]
6. TUBING SMALLER THAN ½" NOMINAL HAS BEEN OMITTED FOR CLARITY
7. SKID DISCHARGE FLANGES ARE INTERNALLY THREADED 1/2-13 THREADS

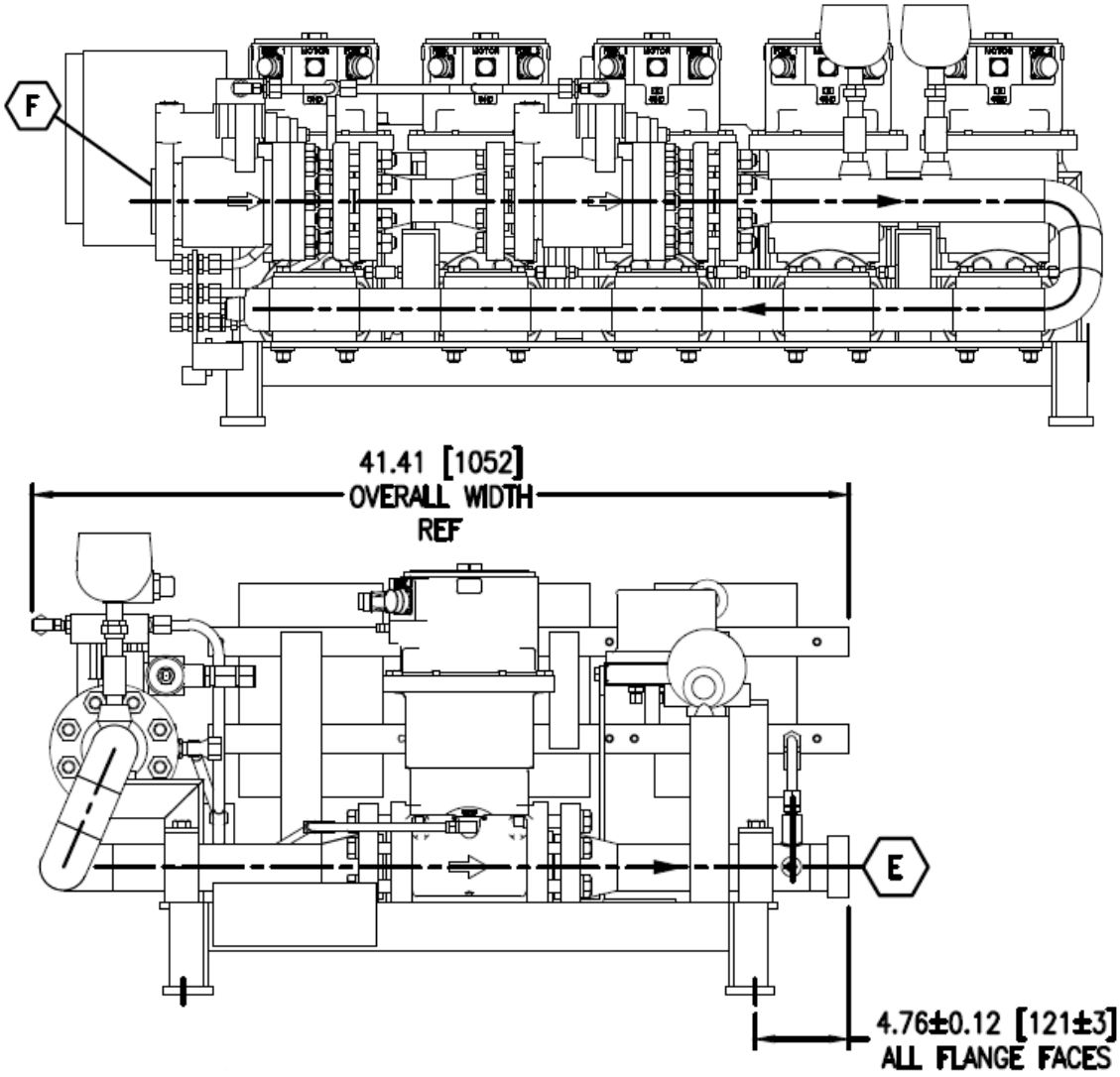

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Figure 2-4c. Standard Woodward GS16DR Gas Fuel Skid LM25000+G4 DLE

Chapter 3.
Maintenance

Introduction

This product is designed for continuous operation in a typical industrial environment and includes no components that require periodic service. The following maintenance checks should be completed in order to ensure the correct operation of the gas fuel skid. Refer to the individual component manuals for detailed information and drawings of the individual fuel skid components.

To take advantage of related product software and hardware improvements, it is recommended that your product be sent back to Woodward or to a Woodward authorized service facility after every five to ten years of continuous service for inspection and component upgrades. Please refer to the service options chapter when returning products.

⚠WARNING

Substitution of components may impair suitability for hazardous locations applications.

Refer to manual 26418 for complete troubleshooting and maintenance instructions for the GS16DR Valve.

Refer to manual 26080 for complete field servicing and maintenance instructions for the Smart Pressure Transducer.

Refer to manual 26190 for complete field servicing and maintenance instructions for the GSOV25HT valve.

GS16DR Maintenance

No maintenance is required for the GS16DR valve; however, periodic cleaning may be performed. A petrochemical solvent is recommended to clean (wash and brush) the valve. High-pressure power washing is not recommended. When cleaning the metering element and the inside of the valve body, do not use sharp objects that may scrape or dent the metering element, as this could degrade the accuracy of the valve.

When using solvent or water to clean the valve, be certain that all access points into the enclosure are closed or covered (electronics cover, conduit entry, OBVD port).

⚠WARNING

REMOVE INPUTS—To prevent possible serious personal injury, or damage to equipment, be sure that all electric power, hydraulic pressure, and gas pressure have been removed from the valve before beginning any maintenance or repairs.

⚠WARNING

LIFTING—The GS16DR valve weighs 47.6 kg / 105.0 lb. In order to prevent injury, use a lifting strap when handling the GS16DR valve. Do not lift or handle the GS16DR valve by any conduit or cable.

⚠WARNING

NOISE—Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the GS16DR Valve.

WARNING

BURN HAZARD—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 this manual.

WARNING

Explosion Hazard—Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

GSOV25HT Maintenance

WARNING

Prior to performing any maintenance on the GSOV25HT, inlet and outlet gas pressure must be relieved. Failure to remove gas pressure from the inlet and discharge of the valve may result in equipment damage, personal injury, or death.

WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Electrical power must be removed from the GSOV25HT whenever working on or near the solenoid or proximity switch.

Pilot Filter

To ensure optimum performance of the valve, the pilot-section filter should be removed and cleaned at least once per year or more often if system contamination levels are higher than normal. Remove the pilot filter by turning counterclockwise on the 1.000 inch (25.40 mm) hex head nut. The filter may be cleaned ultrasonically or back-flushed with light solvent. Inspect the O-ring seals and replace as necessary. The upper O-ring is Woodward part number 1355-169, and the lower O-ring is part number is 1355-111. Lightly lubricate the O-rings with petroleum jelly and torque pilot filter nut to 23 N·m / 200 lb-in after re-assembly.

Vent Leakage

Diligent monitoring of the vent connection leakage can provide early warning of seal degradation or internal contamination of the valve which may result in unreliable valve operation.

If vent leakage exceeds 1000 cm^3/min when the valve is closed, either the solenoid, the second stage ball seat, or the internal seals are leaking. If a spare solenoid is available, replace it to determine its effect on leakage. If replacing the solenoid does not correct the leakage problem, the valve should be returned to Woodward for repair.

If vent leakage exceeds 1000 cm^3/min when the valve is open, the most likely cause is a damaged second-stage face seal. This face seal can be removed and inverted 180 degrees to provide a new sealing surface. See the maintenance section on the second stage seal for this procedure. The solenoid is a possible secondary cause and can be replaced to determine its effect.

Solenoid Valve

There is no regular maintenance required on the solenoid valve, but the following information can be used to troubleshoot problems related to the solenoid valve.

IMPORTANT

Currently there are two solenoid voltages available: 24 V (dc) and 125 V (dc). Be sure to specify the correct part number for the top-level valve when ordering a replacement solenoid.

The typical dc resistance of the 24 V (dc) coil is 56 Ω and 1.5 kΩ for the 125 V (dc) version. Nominal current draw of the 24 V (dc) coil is 400 mA and 80 mA for the 125 V (dc) coil.

The solenoid valve can be replaced in the field if necessary. Remove the solenoid from the GSOV25HT by unscrewing the two 0.250-28 Allen head screws that hold the solenoid to the valve housing. Replace the three O-ring seals if necessary (Woodward part number 1355-101). The poppet section of the solenoid can be disassembled further and cleaned if necessary but this action is beyond the scope of this manual. If further disassembly is undertaken, take extreme care to insure proper re-assembly. Lightly lubricate the O-rings with petroleum jelly and torque the solenoid mounting screws to 9.2 N·m / 81 lb-in after re-assembly.

Routinely check the shutdown switches or relays to be sure they are capable of terminating the electrical supply to the solenoid. The shutoff valve should be used whenever possible to be sure it is operating satisfactorily.

Second Stage Face Seal

The second stage piston face seal is only actively sealing when the valve is in the open position. If excessive vent leakage is observed while the valve is open, the second stage face seal may be damaged. The face seal can be inverted inside its housing to allow a new sealing surface to be used.

1. Remove piping from the overboard vent connection.
2. Remove only two of the 0.250-28 screws from the overboard vent cap. With the help of another person, slowly unscrew the remaining two screws, which will unload the spring force beneath the cap. The other person should preload the cap and spring slightly to prevent the cap from popping off at the end of the screw's engagement with the housing.
3. Turn the vent cap over and remove the circular face seal retainer. Remove the face seal from its groove, invert it to expose the new sealing surface, and re-install it in the groove.
4. Re-install the face seal retainer in the body housing, not in the vent cap. The face seal retainer should sit firmly in a counter bore in the top of the body housing.
5. Re-install the vent cap onto the housing. With the help of another person, slightly compress the spring to allow initial screw engagement. It may be necessary to lightly lubricate the underside of the face seal to keep it secure in its groove during this step. Pay close attention while the vent cap is engaging the face seal retainer to assure proper fit. Torque the four screws in a cross pattern to 9.2 N·m / 81 lb-in.
6. Re-install the vent piping connections.

Proximity Switch

There is no regular maintenance required on the proximity switch, but the following information can be used to troubleshoot problems related to the proximity switch.

The switch contains a Form C contact with four leads extending from the switch. Red is the normally closed contact, blue is the normally open contact, black is common, and green is the case ground.

When the valve is closed, the dc resistance across the contacts should read:

- Normally closed (NC): open circuit
- Normally open (NO): 0.1 to 1.0 Ω

When the valve is open, the dc resistance across the contacts should read:

- Normally closed (NC): 0.1 to 1.0 Ω
- Normally open (NO): open circuit

If an erroneous or intermittent switch indication is observed, check the continuity of each switch contact as described above. Lightly tap the proximity switch with a wrench or small hammer. The proximity switch should not be affected by these small mechanical disturbances. If the contacts change state with a light tap or do not read the correct dc resistance as given above, replace the switch.

The proximity switch can be replaced in the field if necessary. The valve must be in the closed position to replace and set the new switch position.

1. Disconnect any wiring or conduit attached to the proximity switch.
2. Use an adjustable wrench on the 1.000 inch (25.40 mm) hex of the proximity switch head and back the switch out of the body by turning counterclockwise.
3. Remove thread seal, washer, and jam nuts from the old switch and install them on the new switch. The Woodward part number for the thread seal is 1386-181.
4. Apply a small amount of Loctite 242 (removable) to the new switch threads and thread into the valve body until in bottoms out against main piston.
5. Mark the position of the switch relative to the body and then back the switch out 1/2 to 5/8 of a turn.
6. Torque the first jam nut to 20 N·m / 15 lb-ft while holding the hex head on the end of the proximity switch. Apply Loctite 242 on the threads just after the first jam nut. Torque the second jam nut against the first to 20 N·m / 15 lb-ft, again while holding the switch hex head.
7. Re-assemble the switch wiring and conduit connections.

Component Replacement

Woodward has prepared detailed guides and installation kits to ease the replacement of skid component hardware. Contact Woodward for gas fuel skid component replacement kits, including detailed instructions.

Chapter 4.
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 **www.woodward.com/directory**.

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 (5-01-1205) 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**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **www.woodward.com/directory**, 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) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (124) 4399500
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

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

Changes in Revision A—

- Changed GE Turbine designations on front cover
- Much of Regulatory Compliance section replaced to include:
  - European Compliance for CE Marking
  - EMC Directive
  - ATEX Directive
  - Pressure Equipment Directive
  - RoHS Directive (Added)
- Inserted heading above figures 2-2, 2-3, 2-4
- Added LM2500+DLE Gas Fuel Skid Figures 2-3a, 2-3b, and 2-3c
- Added LM2500+G4 DLE Gas Fuel Skid Figures 2-4a, 2-4b, and 2-4c

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Released

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26851.

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PO Box 1519, Fort Collins CO 80522-1519, USA
1041 Woodward Way, Fort Collins CO 80524, 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.