GS-Series (GS40/50)

Fuel Metering Valves

Applications

The Woodward GS-Series gas fuel metering valve family is the latest version of rotary control valves utilizing an integrated actuator and on-board driver built on decades of application experience in the gas turbine market. The self-cleaning valve design is ideal for applications ranging from clean pipeline gas to wellhead gas. The valve features an on-board electric actuator driver for ease of packaging and installation. The on-board driver eliminates the need for costly climate-controlled terminal boxes and associated cabling. Each valve includes redundant position feedback resolvers and an integral failsafe spring to maximize reliability and safety. The integrated driver incorporates redundant signal conditioning, fault detection, and selectable failure management options. The multiple valve sizes and trims can be configured in single or multi-path systems to enable a wide range of applications.

Description

The GS-Series is an electrically actuated fuel valve with an on-board electronic driver. The self-cleaning, shear-type metering action keeps the metering port free from performance-limiting deposits of gas condensates, contaminants, and system debris. The valve minimizes the moving parts within the fuel metering element, actuator rotor, and redundant position feedback resolvers to maximize accuracy over the entire operating range. Available actuator torque has been increased to provide more robust performance in the harshest conditions. Accurate flow versus input signal characteristics is achieved on each valve version by precision forming of the valve metering port, the use of extended valve travels, and high precision resolvers for valve position feedback. The GS valves can achieve flow turn-down ratios in excess of 100 to 1. The positive flow shut-off rating meets the requirements of ANSI B16.104 Class IV across all valve sizes and ports.

On-board Driver

The valve driver and wiring terminal box are integral with the valve assembly, eliminating interconnecting wiring, reducing package size requirements, and lowering the installed cost. The on-board driver can be interfaced to the turbine control via redundant 4–20 mA input and feedback signals, through redundant CANopen control networks, or through redundant real-time Ethernet networks. The GS-Series can be configured to accept both the 4–20 mA signal and CANopen/RT Ethernet position command in a redundant configuration. With this arrangement, if either demand signal fails, the driver will switch to the healthy input demand signal. The valve driver operates with a 90-150 VDC or 18-32 VDC power supply, depending on the model.

- Electric actuation
- Integrated driver
- Robust self-cleaning valve
- Aluminum or stainless steel body
- Multiple trim sizes available
- -40°F to 350°F fuel range
- Fuel pressures to 1440 psig
- SAE and ANSI RF flange options
- 24 VDC or 125 VDC input voltage options
- IIoT ready
- Analog and digital I/O
- Models available with CE Marking to applicable directives, with IECEx Certification to Hazardous Locations, and North America
- 100% Hydrogen Compatible Model Available

The on-board valve driver performs the following functions:

- Fast and accurate closed loop position control of the gas valve in response to the 4–20 mA or CANopen/RT Ethernet input command signal
- Actual valve position feedback via 4–20 mA or CANopen/RT Ethernet
- Independent remote shutdown input
- Valve/driver fault output

The driver includes protection and alarm indications for the following faults:

- Analog input out of range
- Feedback—open wire and short
- Input power out of range
- Position error
- Internal driver faults
- Actuator open/short
- Driver overcurrent

All faults are available through the CANopen/RT Ethernet connection or through an Ethernet Service connection.

Fuel Flow

Gas fuel flow is normally achieved by the accurate scheduling of the metering valve port area, based on values for gas properties, operating pressures, and temperature. The GS-Series valve is factory calibrated under flow and pressure conditions to provide an accurate valve metering to the input demand signal. Flow equations for the valves are located in the O&M manual. These can be used to set up the valve for any site-specific conditions.

Port Sizes

The GS-Series is available with five different port sizes to optimize valve performance for various flow and pressure drop requirements. Standard port effective area sizes are:

GS40
- 0.30 in² (193.5 mm²)
- 0.75 in² (483.9 mm²)

GS50
- 1.0 in² (645.2 mm²)
- 1.5 in² (967.7 mm²)
- 2.0 in² (1290.3 mm²)

The standard metering ports are contoured to provide approximately square law relationships between commanded position and effective area.

Installation

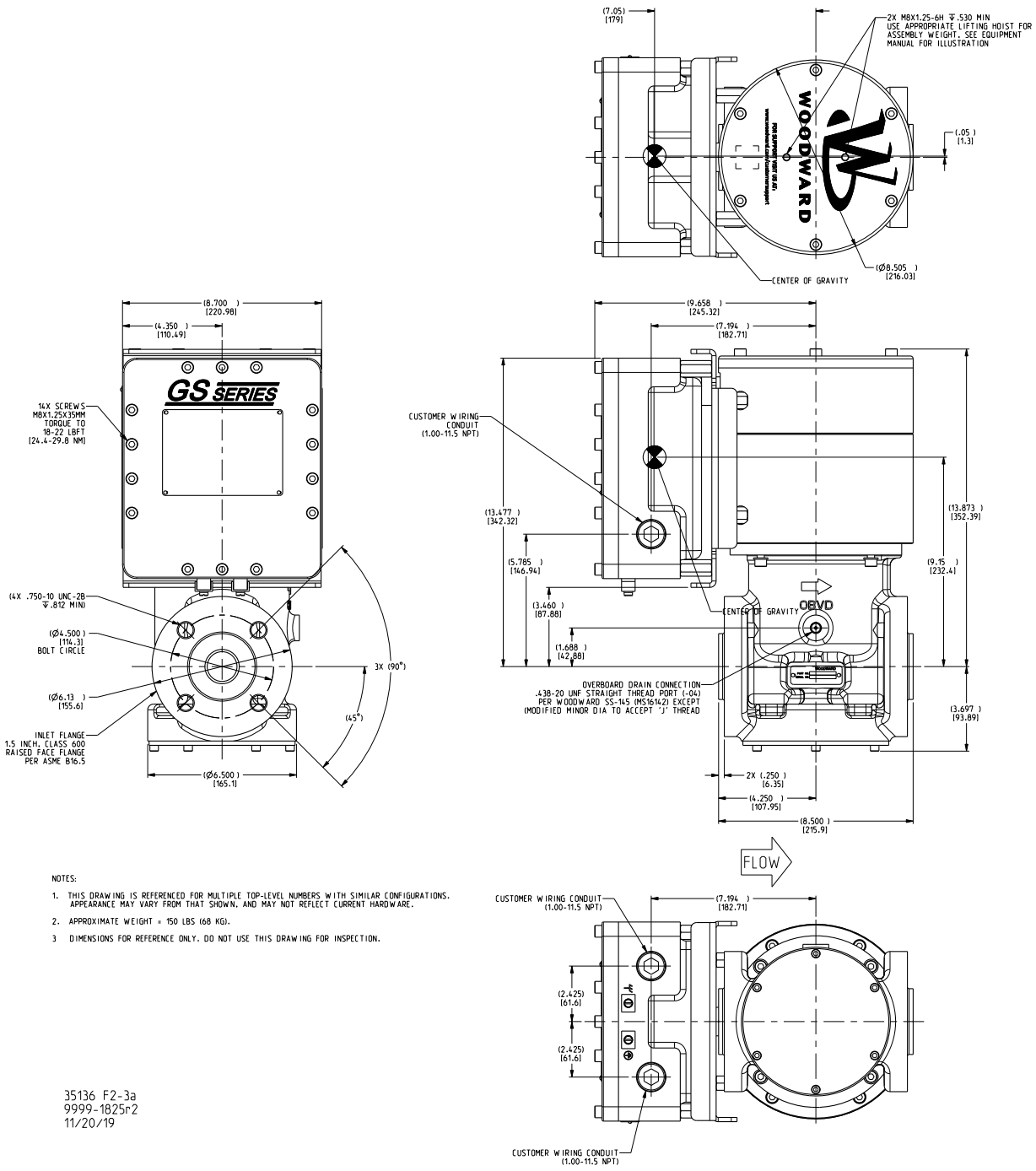


Figure 1. GS40 Outline Drawing A

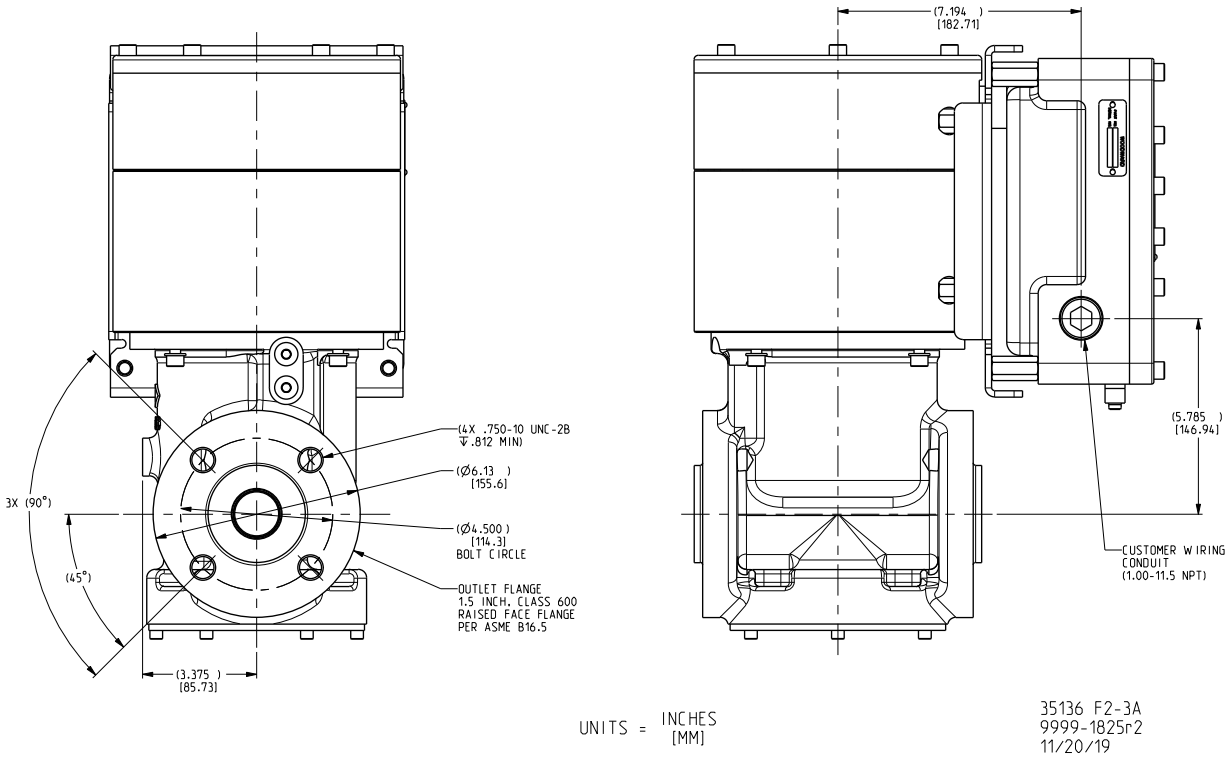


Figure 2. GS40 Outline Drawing B

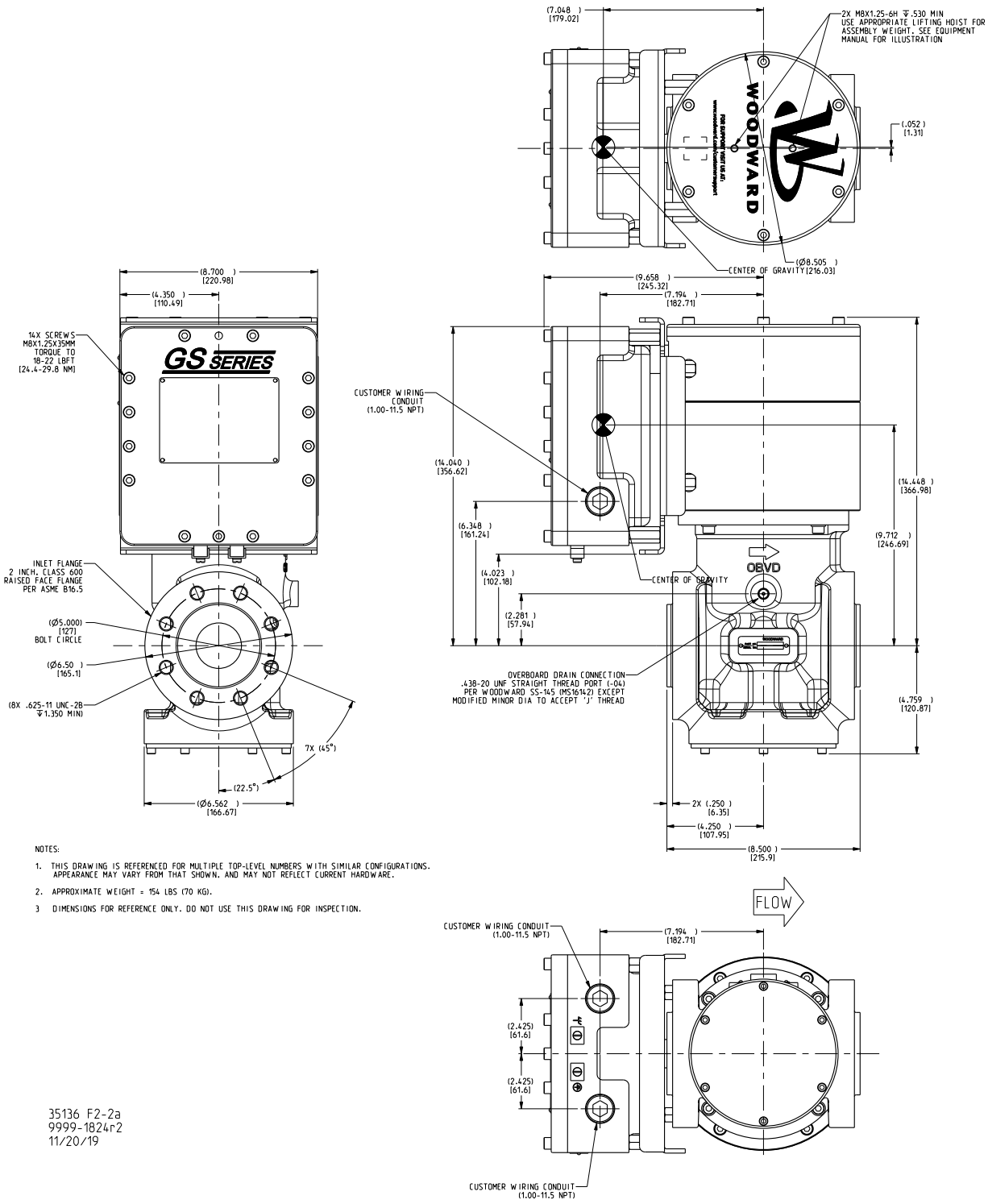


Figure 3. GS50 Outline Drawing A

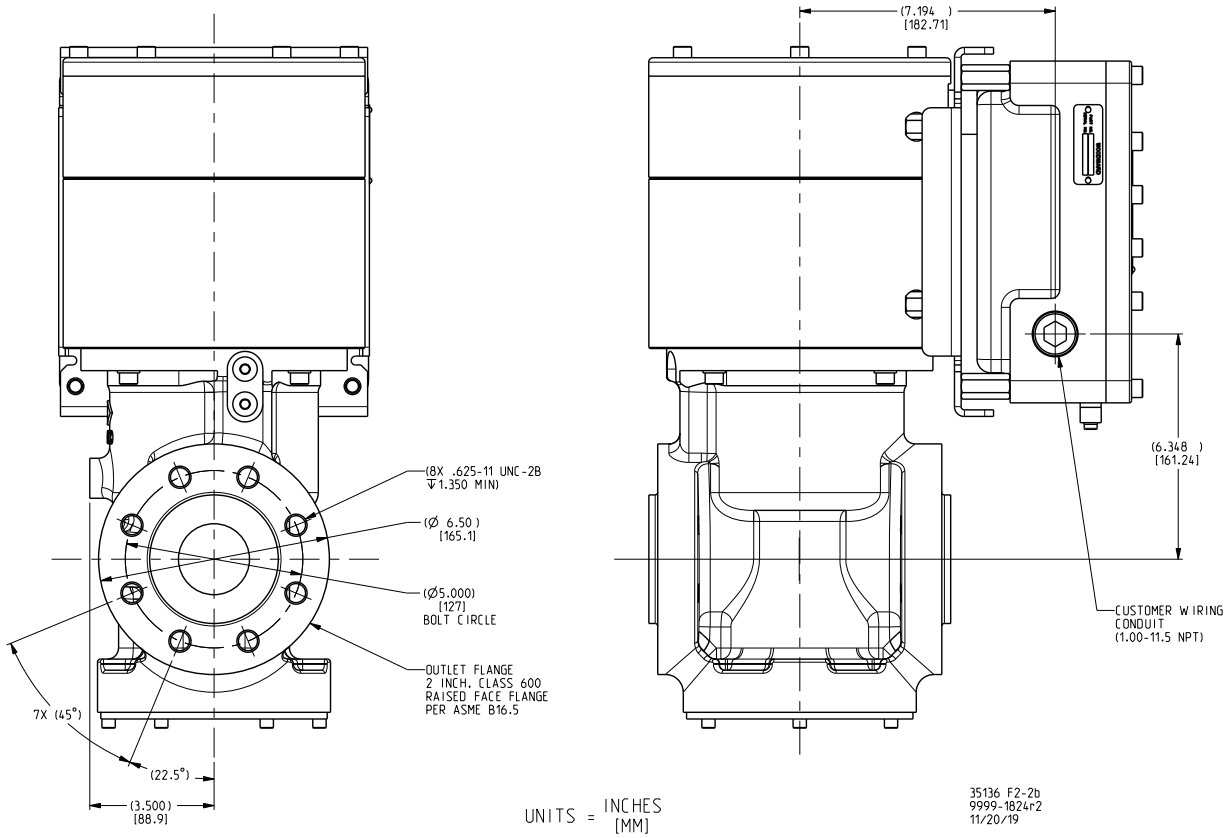


Figure 4. GS50 Outline Drawing B

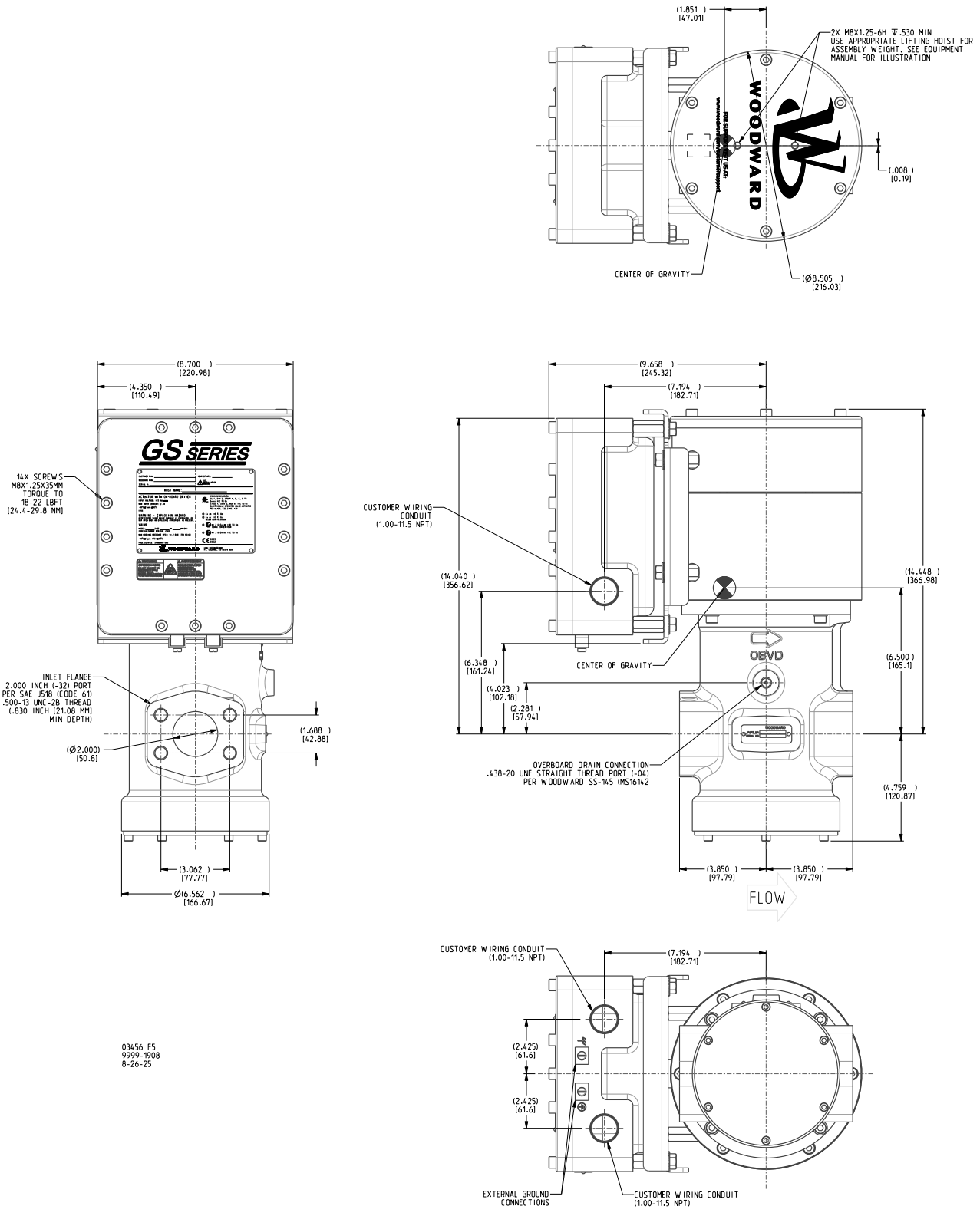
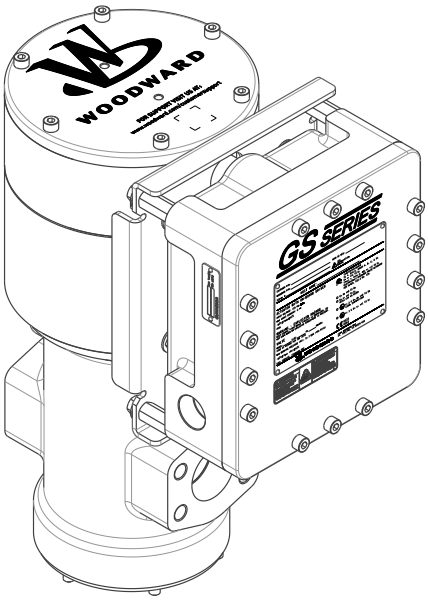
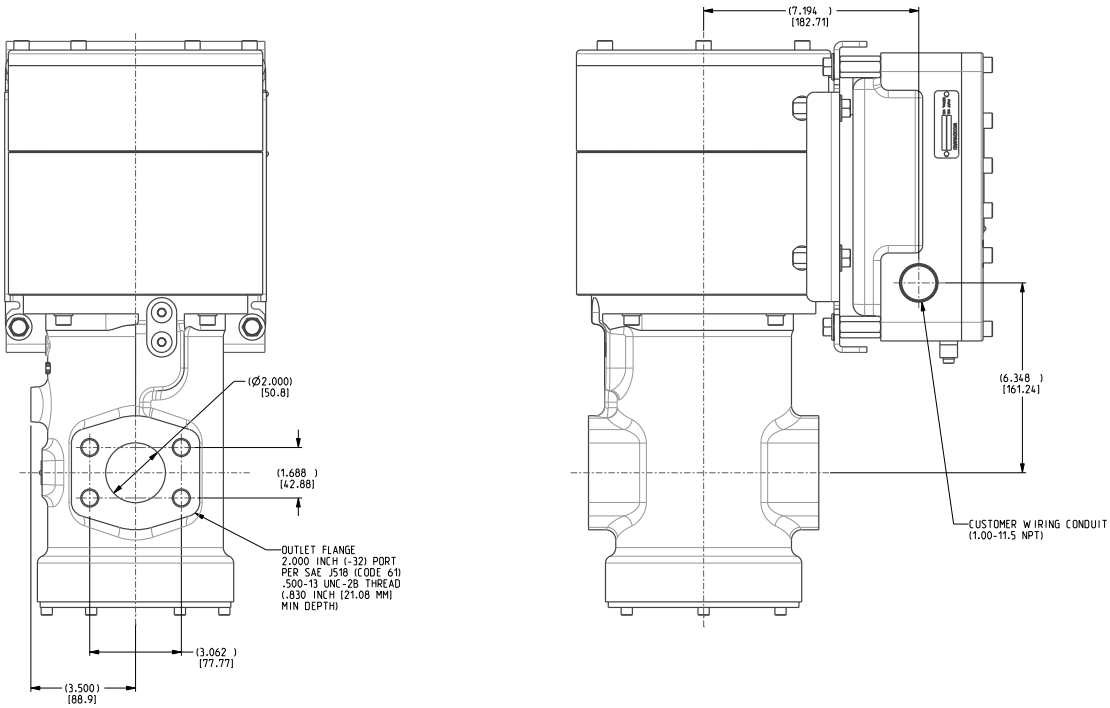


Figure 5. GS50 Outline Drawing Aluminum with Conduit Entries A





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NOTES:

1. THIS DRAWING IS REFERENCED FOR MULTIPLE TOP-LEVEL NUMBERS WITH SIMILAR CONFIGURATIONS. APPEARANCE MAY VARY FROM THAT SHOWN, AND MAY NOT REFLECT CURRENT HARDWARE.
2. APPROXIMATE WEIGHT = 116 LBS [52.6 KG].
3. DIMENSIONS FOR REFERENCE ONLY. DO NOT USE THIS DRAWING FOR INSPECTION.

UNITS = INCHES [MM]

Figure 6. GS50 Outline Drawing Aluminum with Conduit Entries B

Specifications

Valve Characteristics

Maximum Gas Supply Pressure:	750 psig (5170 kPa) aluminum body 1440 psig (9928 kPa) stainless steel body
Minimum Pressure Differential:	20 psid (138 kPa) recommended for accurate flow characteristics
Maximum Pressure Differential:	Full valve pressure rating
Fuel Temperature:	-40 to +200 °F (-40 to +93°C) – aluminum body -40 to +350°F (-40 to +177°C) – stainless steel body
Gas Filtration Recommendations:	25 µm Absolute
Metering Port (ACd):	GS40 – 0.30 in² (194 mm²), 0.75 in² (484 mm²) GS50 – 1.0 in² (645 mm²), 1.5 in² (968 mm²), and 2.0 in² (1290 mm²)
Metering Valve Leakage:	ANSI B16.104 Class IV Seat Leakage – Forward Direction ANSI B16.104 Class IV Seat Leakage – Reverse Direction
Materials:	ASTM B26 356-T6 Aluminum housing with stainless steel (SST) wetted parts, ASTM A351 CF8M Stainless steel housing with SST wetted parts NACE MR0103-2012 and MR0175-2015 compliant

Weight:		
	GS40 aluminum	Approx. 110 lbs (50 kg)
	GS50 aluminum	Approx. 120 lbs (54 kg)
	GS40 stainless steel	Approx. 150 lbs (68 kg)
	GS50 stainless steel	Approx. 156 lbs (71 kg)

Gas Connections

Inlet and Discharge:	2.0 inch SAE flanges per J518 Code 61 (aluminum body) 1.5 inch SAE flanges per J518 Code 61 (aluminum body) 2.0 inch ANSI 600# RF Flanges (stainless steel body) 1.5 inch ANSI 600# RF Flanges (stainless steel body)
Overboard Vent:	Per SAE J1926/1-4

Flow Accuracy

0.30 ACD GS40:	The greater of ±20pph (Air) or 2.5% of point
0.75 ACD GS40:	The greater of ±34pph (Air) or 2.5% of point
1.0 ACD GS50:	The greater of ±40pph (Air) or 2.5% of point
1.5 ACD GS50:	The greater of ±50pph (Air) or 2.5% of point
2.0 ACD GS50:	The greater of ±60pph (Air) or 2.5% of point

Repeatability

Digital Input:	±0.1% of full scale

Performance

Slew Rate:	<100 ms (1s unpowered)
Position Loop Bandwidth:	40 rad/s at –6 dB

Electrical Specifications

Input Power:	24 VDC (18-32 VDC) or 125 VDC (90-150 VDC)
Steady State Current:	< 2.1 A typical
Maximum Transient Current:	7.5 A for 250 ms (125V version) 8 A for 400 ms (24V version)

Electrical Connections

Field wires enter junction through dual 1.00-11.5 NPT threaded conduit connections.

Terminal blocks in integral junction box, stud for external ground.

Circular connectors available for some applications (See Hazardous Location Details).

Valve Position Demand Signal:	4–20 mA current signal into 249 Ω impedance

	CANopen/RT Ethernet interface Real-time Ethernet option
Valve Position Feedback Signal:	4–20 mA current signal into < 500 Ω impedance CANopen/RT Ethernet interface Real-time Ethernet option
Shut-down/Reset Command:	Close contact to run, open to shut down
System Fault Output:	Isolated FET for direct control connection with or without interposing relays
Maximum Current:	500 mA (10 µA leakage)
Discrete Inputs:	3x inputs for Run/Shutdown, Reset, Security Lockout 1ms delay, 5mA wetting current provided, 1500 VAC isolation from input power, 500 VAC isolation from chassis
Discrete Outputs:	2x outputs for Alarm and Fault signals 0.5A max current rating, 32V max contact rating, inductive load rated, 1500 VAC isolation from input power, 500 VAC isolation from chassis

Ambient Temperature

Ambient:	–40 to +93 °C (–40 to +200 °F)

Environmental Specifications

Electromagnetic Compatibility (EMC):	EN 61000-6-2:2019: Immunity for Industrial Environments EN 61000-6-4:2019: Emissions for Industrial Environments
Shock:	US MIL-STD-810C method 516.2, procedure 1 (10 G Peak, 11 ms duration, sawtooth waveform)
Vibration:	US MIL-STD-810C, Method 514.2, Procedure I, Figure 514.2-2, Curve AR (2 G test from 10 to 2000 Hz)
Humidity:	MIL-STD 810D, M507.2, PIII (60ºC, 95% RH)
Salt Fog:	600hr Salt Spray Test per ASTM B117
Ingress Protection:	IP66 per EN 60529

Regulatory Compliance

European Compliance for CE Marking:

EMC Directive:	2014/30/EU
Pressure Equipment Directive:	2014/68/EU, (Category II)
ATEX Directive:	2014/34/EU Conduit: II 2 G, Ex db IIB T3 Gb CSANe per 20ATEX1196X All Models: II 3 G, Ex ec IIC T3 Gc

Other European and International Compliance:

Compliance with the following European Directive does not qualify this product for application of the CE Marking:

Machinery Directive:	2006/42/EC: Compliant as Partly Completed Machinery
RoHS:	2011/65/EU: Exclusion per Art. 2.4(c)
IECEx:	IECEx CSA 19.0038X Conduit: II 2 G, Ex db IIB T3 Gb All Models: II 3 G, Ex ec IIC T3 Gc
Special Country:	Certifications available. Contact Woodward. China (CCCEx), Japan Ex (JPEx), EAC, INMETRO, UKCA

North American Compliance:

CSA:	All Versions: Class I, Div 2, Groups A, B, C & D T3 for North America Ex ec IIC T3 Gc for Canada Class I, Zone 2, AEx ec IIC T3 Gc for United States Certificate 70218547 Note: See Technical Manual for UL 429 and CSA 139 limitations Special-order Conduit Versions: Class I, Div 1, Groups C, D T3 for North America Class I, Div 2, Groups A, B, C & D T3 for North America Ex ec IIC T3 Gc for Canada Class I, Zone 2, AEx ec IIC T3 Gc for United States Certificate 70218547
Technical Manual:	35136

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Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world. Complete address / phone / fax / email information for all locations is available on our website.

For more information contact: