WOODWARD

Product Manual 26306
(Revision L, 9/2022)
Original Instructions

Electric Liquid Metering Valve (ELMV)
Electric Water Metering Valve (EWMV)
Electric Liquid Bypass Valve (ELBV)

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 Out-of-date translations are marked with ⚠.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

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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 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.

Regulatory Compliance

European Compliance for 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)

Pressure Equipment Directive: Certified to Pressure Equipment 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.
Electric Liquid Metering and Bypass Valves: PED Category II
Electric Water Metering Valve: PED Category SEP
PED Module H – Full Quality Assurance,
CE-0062-PED-H-WDI 001-22-USA. Bureau Veritas SAS (0062)

ATEX – Potentially Explosive Atmospheres Directive (Actuator): 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.
Zone 2, Category 3, Group II G, Ex nA IIC T3 Gc

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

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.

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.

ATEX Directive: Exempt from the non-electrical portion of the ATEX Directive 2014/34/EU due to no potential ignition sources per EN ISO 80079-36:2016 for Zone 2 installation.

Other International Compliance:

IECEx LELA Actuator: Certified for use in explosive atmospheres per Certificate:
IECEx CSA 14.0013X, Ex nA IIC T3 Gc

North American Compliance
These listings are limited only to those units bearing the CSA identification

CSA LELA Actuator: CSA Certified for Class I, Division 2, Groups A, B, C, & D, T3 at 93 °C Ambient
For use in Canada and the United States Certificate 1635932

Actuator is certified for North America as on-engine systems component connected to the certified Digital Valve Positioner.

Wiring must be in accordance with North American Class I, Division 2, or European Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

SIL Compliance:
SIL certification is available for specific Woodward item numbers. Please contact a Woodward Representative for assistance.

ELMV, EWMV, and ELBV-HD Electric Metering Valves – Certified SIL 3 Capable for safe position fuel shutoff function in safety instrumented systems. Evaluated to IEC 61508 Parts 1-7. Refer to the instructions of this Installation and Operation Manual, Chapter 5 – Safety Management – Safe Position Fuel Shutoff Function. SIL Certificate WOO 1908007 C001

Special Conditions for Safe Use:
- Connect the ground terminal to earth ground.
- Maximum ambient temperature 93 °C (200 °F).
- Use supply wires suitable for 10 °C (18 °F) above surrounding ambient.

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 Class I, Division 2 or Zone 2.

⚠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 vous situez bien dans une zone non explosive.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2 ou Zone 2.

Chapter 1.
General Information

Introduction

The Electric Liquid Metering Valve (ELMV), Electric Water Metering Valve (EWMV), and Electric Liquid Bypass Valve (ELBV) control the flow of liquid fuel and water to the combustion system of an industrial or utility gas turbine. The integral electric actuator consists of a brushless dc motor, resolver for motor commutation and position sensing, valve stem resolver for redundant position sensing, fail safe spring for fail-safe operation, and a soft stop for fail-safe operations. Later versions of these valves utilize a device (ID Module) containing all the configuration and calibration information that is read by the Digital Valve Positioner (DVP) when the valve/actuator is connected and powered up.

ELMV—The Electric Liquid Metering Valve (ELMV) controls the flow rate of liquid fuel to various stages of an industrial gas turbine combustion system. The unique design integrates the valve, actuator and a throttling regulator into a cost-effective, compact assembly. The valve is designed to provide a highly accurate flow-versus-stroke characteristic independent of pressure drop across the valve. The integral throttling regulator maintains a nearly constant pressure drop across the metering plug over a wide pressure range allowing the valve to directly meter flow. For applications requiring extreme accuracy the throttling regulator characteristics can be added to the control system to compensate for minor changes due to the total pressure drop across the valve.

EWMV—The Electric Water Metering Valve (EWMV) controls the flow rate of water to various stages of an industrial gas turbine combustion system. The valve is similar to the ELMV except that the throttling regulator is made from a specially selected ceramic to meet the harsh cavitation environment when controlling water across a high pressure drop.

ELBV—The Electric Liquid Bypass Valve (ELBV) controls the liquid fuel system pressure of an industrial gas turbine combustion system. The unique design integrates the valve, actuator and a cavitation control regulator into a cost-effective, compact assembly. The valve is designed to bypass fuel from the discharge side of the positive displacement pump in order to control system pressure. The integral regulator allows the valve to operate with a low outlet pressure and a high differential pressure without cavitation damage. The valve utilizes the common integrated actuator design as the other liquid valves but with a normally open valve configuration.

These valves are intended to operate only with a Woodward Digital Valve Positioner (DVP). Contact your sales person for part numbers for your specific applications.

ELMV, EWMV, and ELBV Specifications

Descriptions:	2” electrically actuated liquid fuel metering valve 2” electrically actuated water metering valve 2” electrically actuated liquid bypass valve
Mean Time Between Failure (MTBF):	149 000 hrs operation combined metering valve per valve/actuator/DVP/cable subsystem

ACTUATOR

Description:	Brushless dc motor with dual position feedback sensors
Coil:	Class H insulation
Failure Mode:	Spring type to drive valve to safe position with loss of signal (Fail Close: ELMV & EWMV; Fail Open: ELBV)
Bandwidth:	40 rad/s with no more than 6 dB attenuation and less than 180 degrees phase loss at ±0.5% to ±2% magnitude and minimum supply voltage at DVP
Response Time:	Power slew rate = 500%/s (minimum) in the closed direction for the ELMV and EWMV and in the open direction for the ELBV, 100%/s (minimum) in the open direction for the ELMV and EWMV and in the closed direction for the ELBV
Visual Position Indication:	Yes
Ambient Temperature Range:	–40 to +93 °C (–40 to +200 °F)
Ingress Protection:	IP55 per EN60529
Voltage (typical):	125 Vdc
Voltage (max):	152 Vdc
Voltage (min)	90 Vdc

VALVE

Operating Fluid:	Diesel fuel, kerosene, or naphtha (lubricity = 0.825 mm wear scar diameter max per ASTM D5001) - filtered to 5~10 µm or demineralized water filtered to 20 µm
Connections:	ANSI Class 900 # RF flanges
Nominal Piping Size:	2”– DN 50 mm
Max Fluid Temperature:	66 °C (150 °F) ELMV and ELBV 121 °C (250 °F) EWMV
Max Pressure:	14 893 kPa at 38 °C, 13 859 kPa at 66 °C, 12 204 kPa at 121 °C (2160 psid at 100 °F, 2010 psid at 150 °F, 1770 psid at 250 °F). Interpolate per ASTM B16.34 Table 2-2.2 or Table VII-2-2.2 for temperatures/pressures between these points.
Min Pressure:	690 kPa (100 psig) for ELMV and EWMV 1724 kPa (250 psig) for ELBV
Proof Test Pressure:	Production 22409 kPa (3250 psig) min
Overboard Leakage:	1 cm^3/min
Minimum Required ΔP:	690 kPa (100 psid) ELMV and EWMV
ELBV Regulator Back Pressure:	1103 kPa (160 psid) nominal 1034 kPa (150 psid) min at low flows 1379 kPa (200 psid) max at 757 L/min (200 US gal/min)
Approximate Weight	180 kg (400 lb)

Table 1-1. ELMV Flow

Valve Maximum Cv: 20.8

Operating mode	Min Flow	Sub-Idle Flow	Max Flow
P1 (psig)	500	500	1200
P2 (psig)	15	55	1100
Flow (pph)	1000 (2.3 gpm)	2000 (4.7 gpm)	49,425 (116 gpm)
Plug dP (psid)	53	51	39
Plug Cv	0.3	0.6	17.1
Valve Stroke (%)	13%	17%	82%
Accuracy (% of point)	±10.00%	±5.00%	±5.00%

Typical diesel fuel properties used in calculations (0.85 SG)

Table 1-2. EWMV Flow

Valve Maximum Cv: 20.8

Operating mode	Min Flow	Sub-Idle Flow	Max Flow
P1 (psig)	1200	1200	1200
P2 (psig)	15	55	1100
Flow (pph)	1150 (2.3 gpm)	2300 (4.6 gpm)	60,000 (120 gpm)
Plug dP (psid)	60	59	45
Plug Cv	0.3	0.6	17.9
Valve Stroke (%)	13%	17%	84%
Accuracy (% of point)	±10.00%	±5.00%	±5.00%

Typical water properties used in calculations (1.0 SG)

Table 1-3. ELBV Flow

Valve Maximum Cv: 18.7

Operating mode	Min Flow	Max Flow
P1 (psig)	1200	350
P2 (psig)	0	50
Flow (USGPM)	10 max*	200
Regulator Back Pressure (psid)	160	183
Cage dP	1040	117
Cage Cv	N/A*	17
Valve Stroke (%)	0%	79%

Typical diesel fuel properties used in calculations (0.85 SG)
* Flow dominated by fluid viscosity (0.5 to 12 cSt)

2 Inch ELBV Operating Range: The 2 Inch ELBV is a contoured plug valve. Actuation forces for this type of valve are a function of inlet pressure and valve position. Actuation forces can become very large if the inlet pressure is very high at high valve openings (these large forces tend to open the valve). This is not expected to occur when this valve is used to control fuel system pressure from a positive displacement pump for a turbine. The flow (Percent Open) through the ELBV is typically only high at low system pressures during startup and as the system pressure increases to provide flow to the turbine the ELBV flow is decreased. Additionally, positive displacement pumps cannot maintain high pressures at high flows. This operating range should be considered if the valve is used for some other application. The outlet pressure from the valve is assumed to be low at all times (< 50 psig). If this is not the case the inlet pressure can be replaced with the valve differential pressure in the table below.

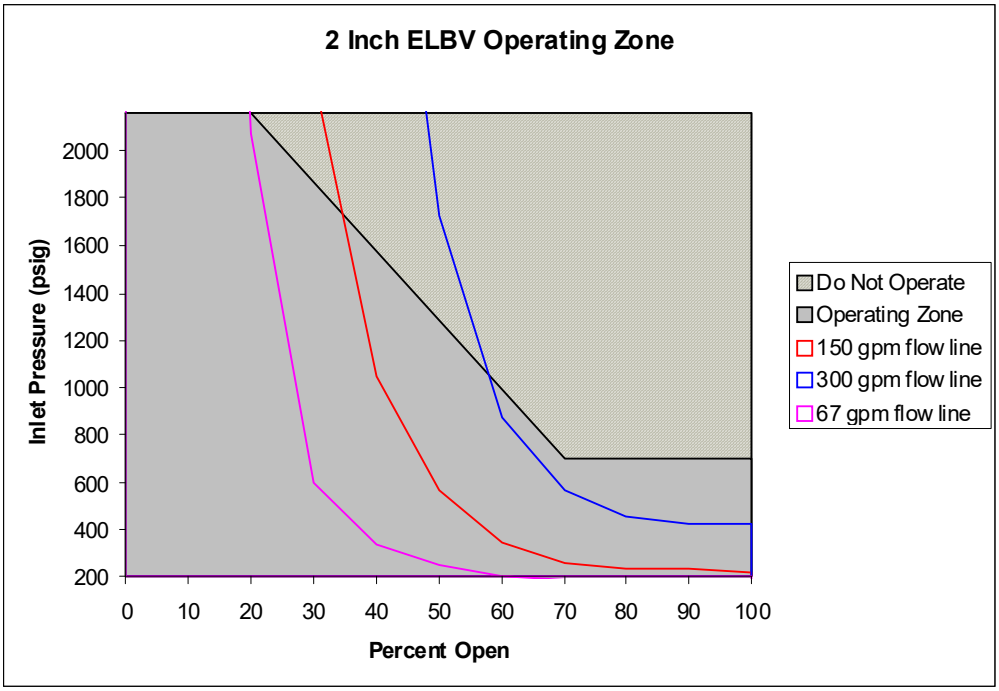


Figure 1-1. 2 Inch ELBV Operating Zone

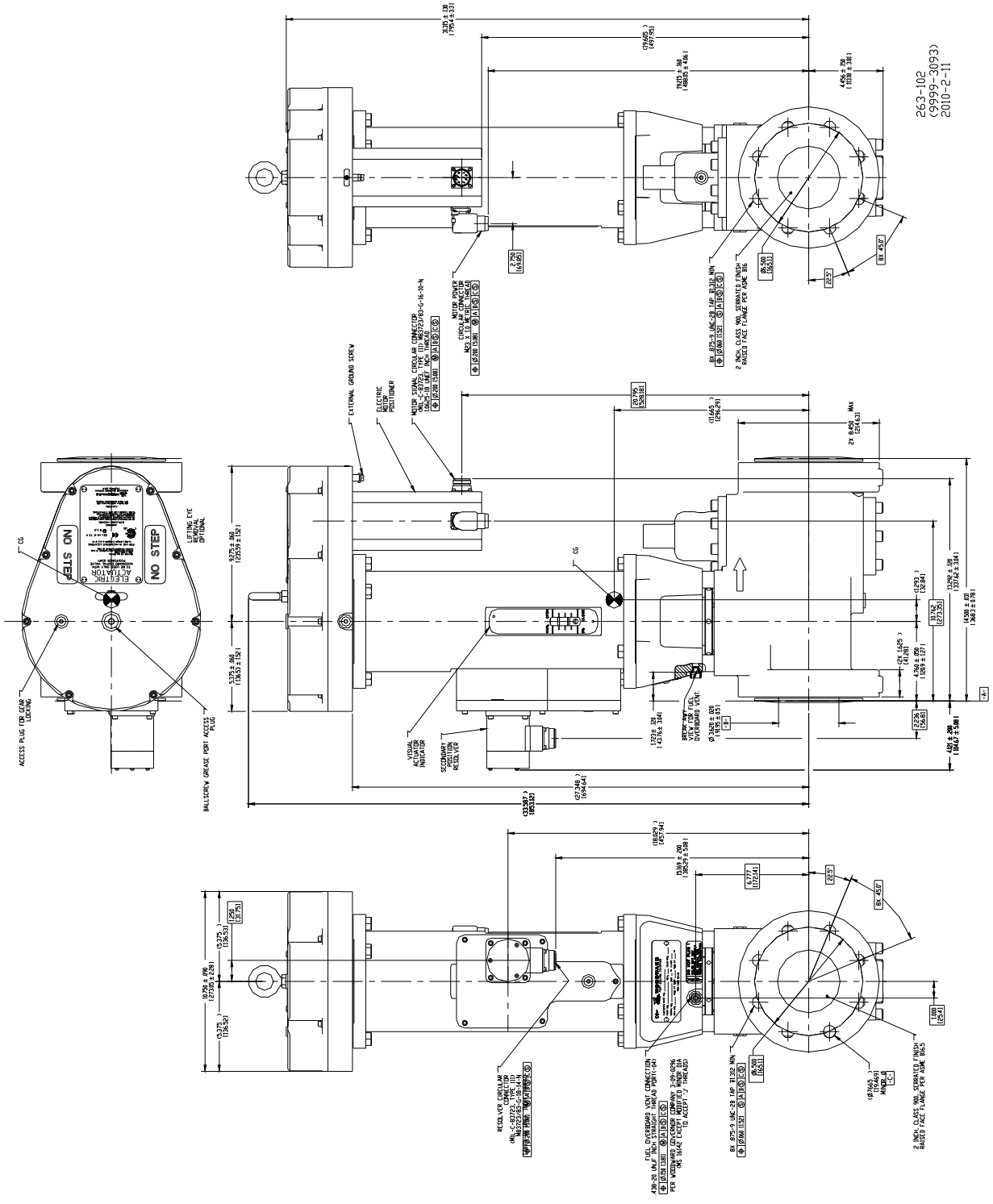


Figure 1-2. Outline Drawing (2” ELMV)

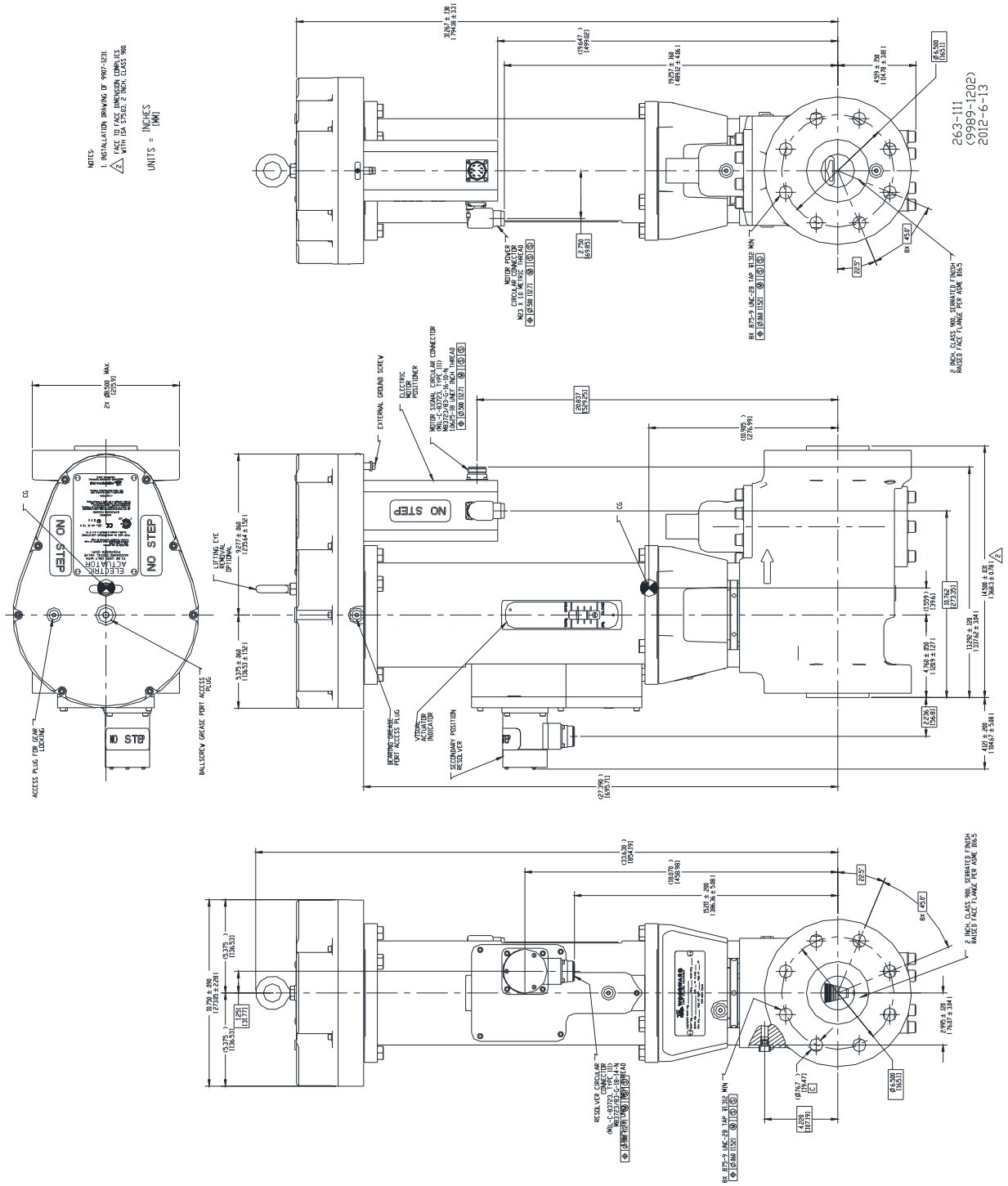


Figure 1-3. Outline Drawing (2” EWMV)

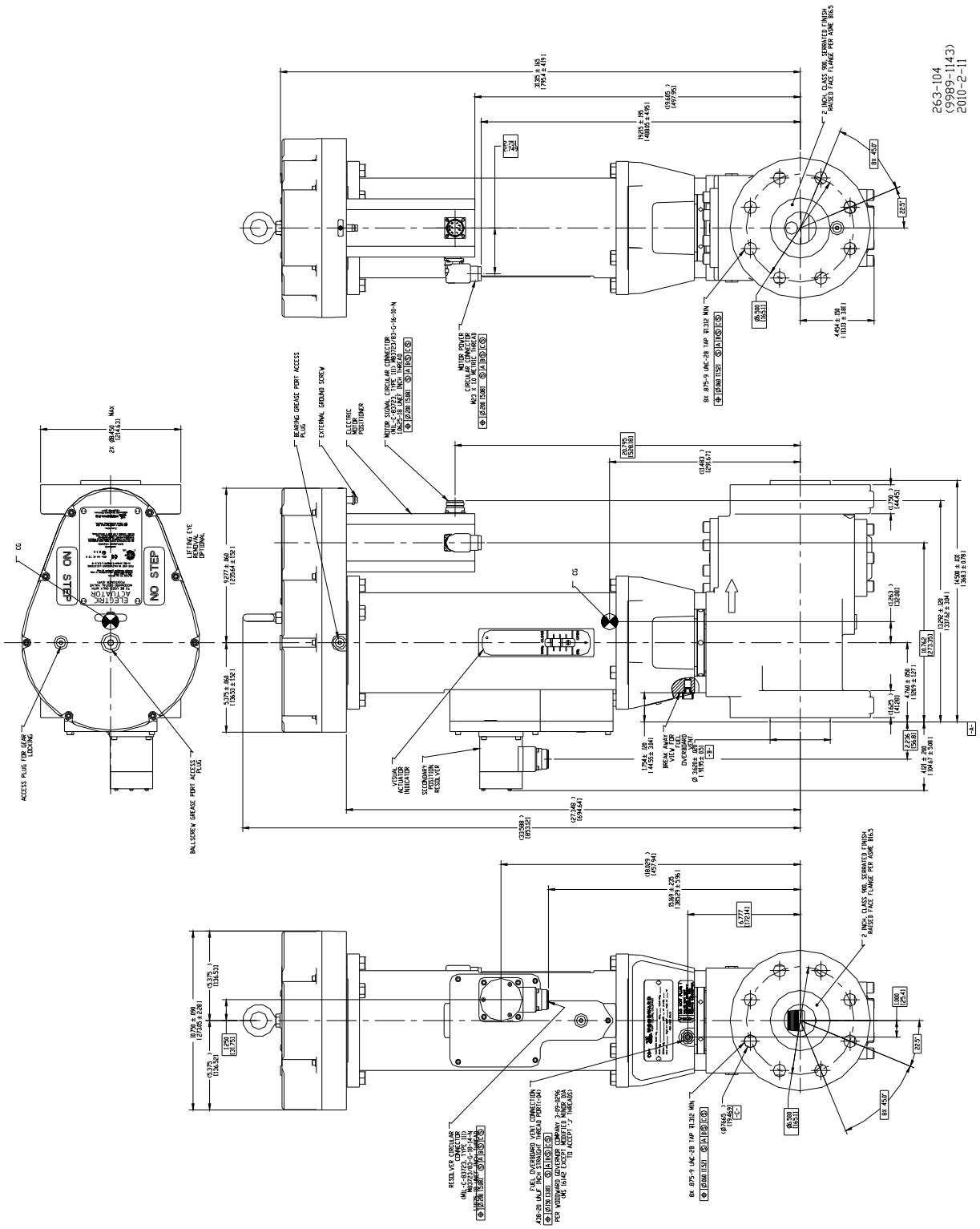


Figure 1-4. Outline Drawing (2” ELBV)

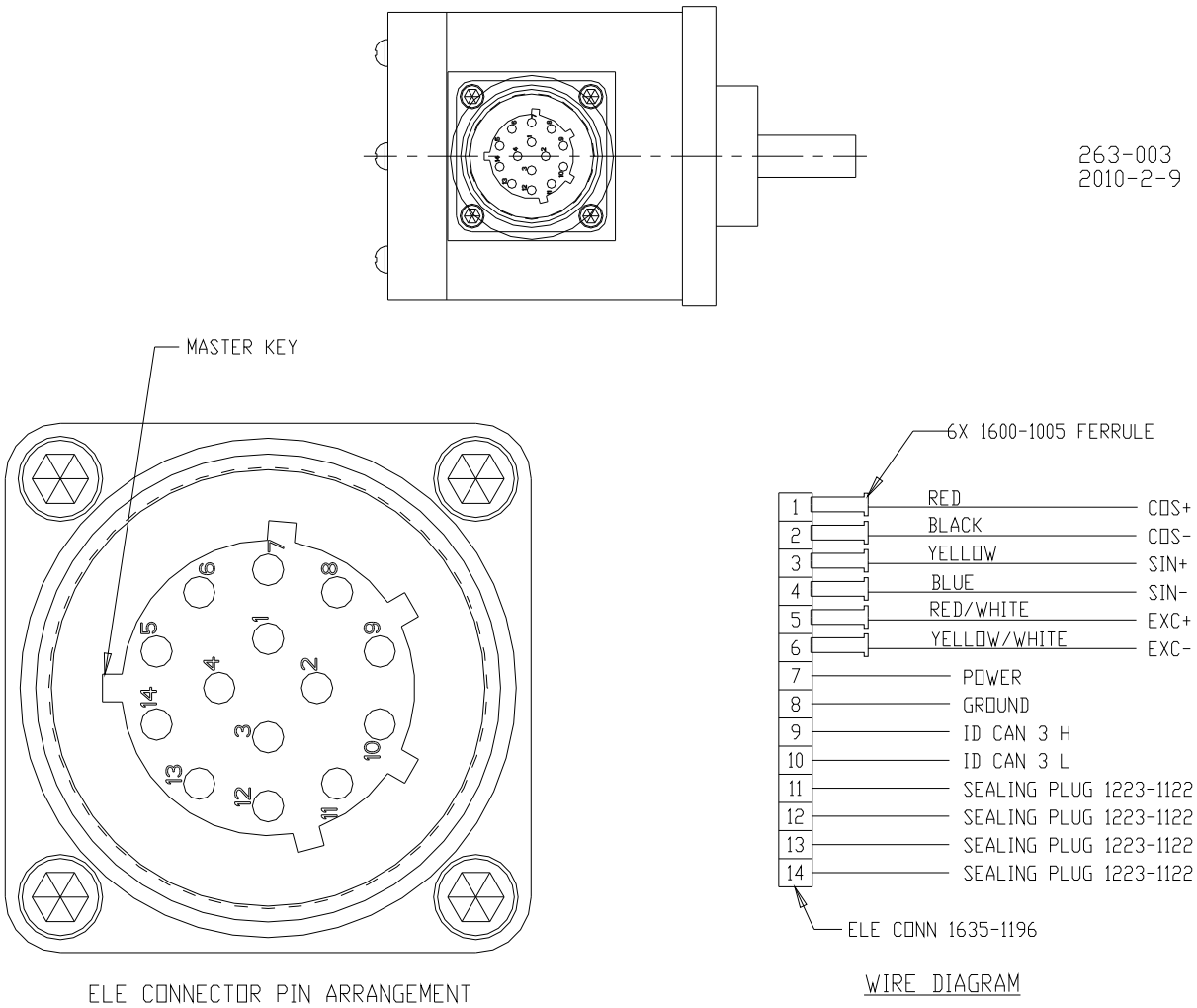


Figure 1-5a. Valve Stem Resolver Wiring Diagram (all valves)

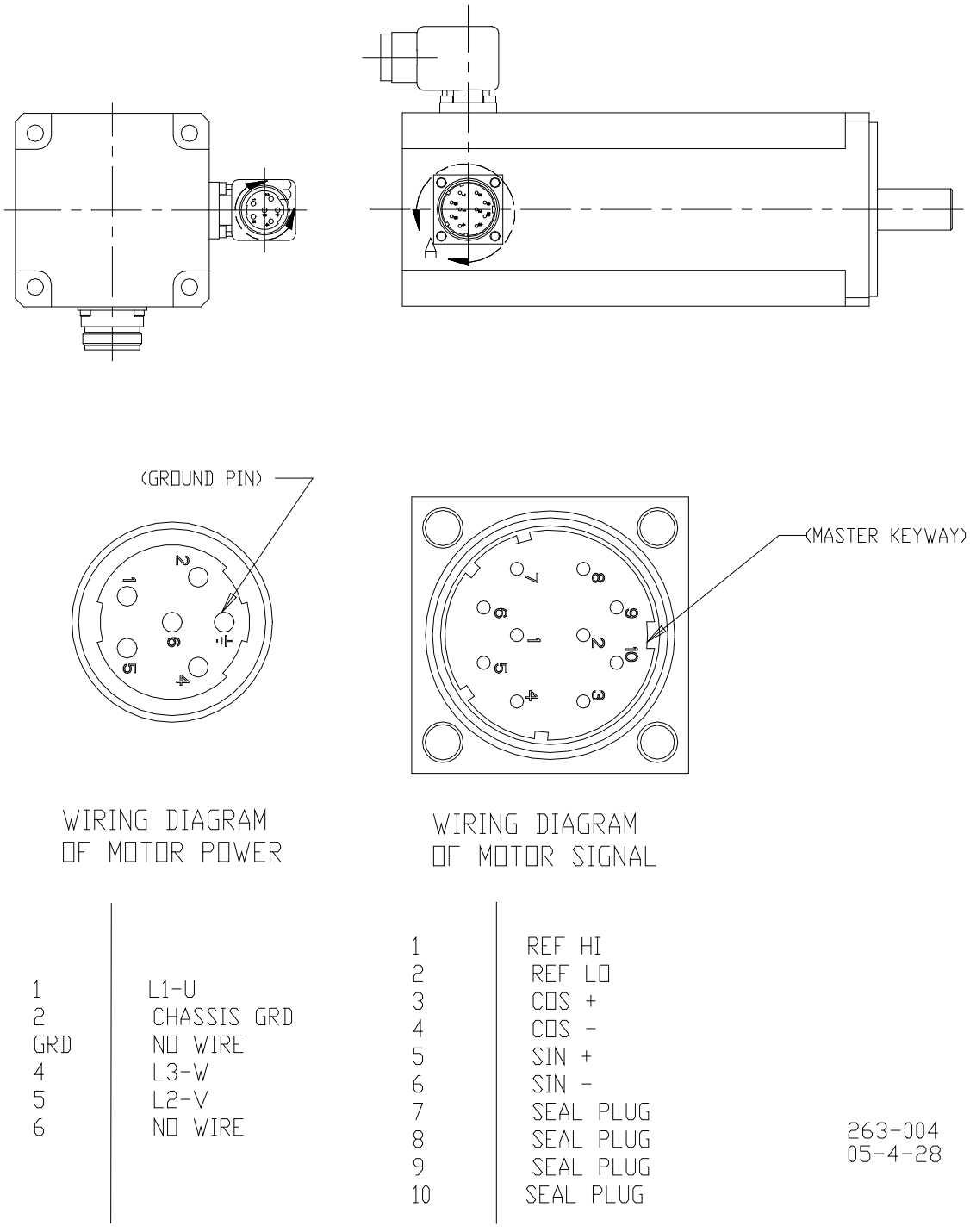


Figure 1-5b. Motor and Motor Resolver Wiring Diagram (all valves)

Chapter 2.
Description

Electrical Mechanical Actuator Assembly

The electrical-mechanical actuator consists of a brushless dc motor that provides torque, an integral resolver for motor commutation and position feedback to the controller, a valve stem resolver for motor resolver verification, and a high-efficiency ball screw for rotary-to-linear motion conversion. The actuator also contains a fail-safe spring designed to extend the actuator if power is removed from the actuator.

- A soft-stop spring to dissipate motor rotor inertia during fail-safe shutdown and prevent ball screw damage
- A cam follower to provide apposing torque during slew operations
- A lifting eye to aid installation

Brushless DC Motor

The actuator uses a permanent magnet, electrically commutated, brushless dc motor. The components used in the motor are rated for service from –40 to +155 °C (–40 to +311 °F). The motor is a permanently lubricated assembly with a sealed enclosure rating of IP 55.

Resolver Position Feedback Sensors

The primary position feedback transducer is the resolver that is integral to the dc brushless motor. The actuator also has a valve stem resolver. This resolver is used as a watchdog function of the primary motor control, to prevent runaway conditions, and to ensure that the primary motor resolver is reading correctly. Linear shaft motion is converted to angular rotation for the valve stem resolver through a linkage. Parameter files are loaded onto the DVP to specifically match the valve characteristics in order to obtain the most accurate position sensing.

Soft Stop Spring

Integral to the actuator is a soft stop spring. This provides a bumper-like action if the actuator is driven hard into the fully extended position. This will occur only on loss of power, certain wiring faults, and in rare cases, internal fault conditions within the positioner. The soft stop mechanism is not used when the positioner is controlling the actuator. Although the positioner will rapidly drive the actuator toward the minimum position, it also decelerates the actuator as the actuator approaches the mechanical minimum stop. Under the control of the positioner, the actuator should not reach the mechanical minimum stop at a high velocity.

Valve

All valve configurations share a common modular design consisting of a flow metering section and a pressure regulating section. The metering valves (ELMV and EWMV) use a throttling regulator to maintain a constant differential pressure across the flow metering section for accurate flow metering while the bypass valve (ELBV) uses a pressure increasing regulator for cavitation mitigation. The metering sections of the valves control the flow schedule as required for the specific valve application.

The metering section of each valve consists of a housing, plug, seat, sleeve, and bonnet. The metering elements of this valve are a contoured plug and a matching seat. The plugs in the metering valves (ELMV and EWMV) are contoured to provide an approximately equal percent flow characteristic. These valves are designed to provide a highly accurate effective area. The metering section of the bypass vale (ELBV) is contoured to provide the opposite flow characteristic to the metering valves. This opposite flow characteristic allows the bypass valve to have a fail-safe open feature while the metering valves have a fail-safe close feature.

The regulator section of each valve consists of a piston, sleeve, spring(s), and covers. In the metering valves the spring and intermediate pressure balances the inlet pressure across the piston in order to maintain a constant differential pressure across the metering section. The regulator in the water metering valve is made from a specially selected ceramic to meet the harsh cavitation environment when controlling water across a high pressure drop. In the bypass valve the springs and outlet pressure balance the intermediate pressure across the piston in order to maintain sufficient backpressure to the metering section for cavitation mitigation.

Highly accurate position sensing and control permit for all valves to achieve extremely accurate flow control. Each valve is flow tested before shipment.

Shaft seals are elastomer energized PTFE. There is no packing that would require periodic maintenance or compression checks.

Chapter 3.
Installation

General

See the outline drawings (Figures 1-1, 1-2, 1-3) for:

- Overall dimensions
- Process piping flange locations
- Electrical connections
- Lift points and center of gravity

Installation attitude does not affect actuator or fuel valve performance, but a vertical position is generally preferred to conserve floor space as well as ease of making electrical and fluid connections. The valves are designed for support by the piping flanges alone; additional supports are neither needed nor recommended. Do not use this valve to provide support to any other component in the system. The piping should be aligned and adequately supported such that excessive piping loads are not transmitted to the valve body.

⚠WARNING

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the Electric Metering or Bypass Valves.

⚠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.

NOTICE

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.

Piping Installation

Refer to ANSI B16.5 for details of flange, gasket, and bolt types and dimensions. Verify that the process piping face-to-face dimensions meet the requirements of the outline drawings (Figures 1-1, 1-2, 1-3) within standard piping tolerances. The valve should mount between the piping interfaces such that the flange bolts can be installed with only manual pressure applied to align the flanges. Mechanical devices such as hydraulic or mechanical jacks, pulleys, chain-falls, or similar equipment should never be used to force the piping system to align with the valve flanges.

ASTM/ASME grade bolts or studs should be used to install the valve into the process piping. The length and diameter for Class 900 flanges shall conform to the following table according to the valve flange size.

Table 3-1. Class 900 Fastener Specifications

Nominal Pipe Size	Number of Bolts	Diameter of Bolts	Stud Length	Machine Bolt Length
51 mm/ 2 inch	8	22 mm/ 7/8 inch	114.3 mm/ 4.5 inch	82.55 mm/ 3.25 inch

Flange gasket materials should conform to ANSI B16.20. 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 valve 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. Once the studs/bolts are hand-tightened, torque the studs/bolts in a crossing pattern to half the torque value listed in the following table. Once all studs/bolts have been torqued to half the appropriate value, repeat the pattern until the rated torque value is obtained.

Table 3-2. Bolt Size and Torque Value

Bolt Size	Torque
22 mm/	508–529 N·m/
7/8 inch	375–390 lb-ft/

Electrical Connections

⚠WARNING

Due to the hazardous location listings associated with this product, proper wire type and wiring practices are critical to operation.

NOTICE

Do not connect any cable grounds to "instrument ground", "control ground", or any non-earth ground system. Make all required electrical connections based on the wiring diagrams (Figures 1-4a and 1-4b).

This product is designed for use with three specific General Electric cables that connect the DVP to the valve/actuator assembly. These cables must be used for the system to meet all CSA, ATEX, EMC, and LVD requirements. Make sure that the cable connectors are fully engaged and tightened.

Process Fluid Vent Port

There is a process fluid vent port that must be vented to a safe location. In normal operation, this vent should have very low leakage. However, if excessive leakage is detected from this vent port, contact a Woodward representative for assistance. NEVER PLUG THE VENT PORT. Plugging the fuel vent port may cause the valve to malfunction or operate improperly. The process fluid vent port connection is in a different physical location in the water metering valve (EWMV) as compared to the fuel metering valve (ELMV) and the bypass valve (ELBV). The difference in locations is depicted in the outline drawings (Figures 1-1 through 1-3).

The vent system must never produce more than 50 psig (345 kPa) backpressure to the valve vent ports. The maximum leakage through the vent ports upon complete seal failure is 9 US gal/min (34 L/min) with a fluid supply pressure of 1340 psig (9239 kPa) (11 US gal/min at 2160 psig) (42 L/min at 14 893 kPa). The vent system tubing should be sized such that the failure of one valve seal system will not produce excessive pressure on any valve connected to the same vent system.

Valve Characteristic Data

Flow testing is conducted on every metering valve before shipment. Results from this flow testing produce flow characteristics of the valve. Each valve must demonstrate predetermined flow characteristics before it can be shipped.

Calibration

The actuator and positioner perform an automatic rigging procedure. When the actuator positioner is activated, it performs an automatic rigging procedure that checks system health and verifies the value is in the proper position. No additional steps are required from the operator.

Valve/Actuator Configuration Settings

The Digital Valve Positioner (DVP) must be configured with the proper settings for the valve/actuator to which it will be connected. Modification of these settings is performed via the PC Service Tool. A list of the required settings and their descriptions are given below. A more comprehensive overview of the DVP and PC Service Tool is given in the DVP manual.

Newer valves utilizes a device (ID Module) containing all the configuration and calibration information that is read by the Digital Valve Positioner (DVP) when the valve/actuator is connected and powered up. Initial configuration settings for the valve/actuator do not need to be entered into the DVP due to the ID Module communicating directly with the positioner. However, in the event the configuration settings must be entered manually, either due to having a legacy version or in the unlikely event the ID Module is not functioning correctly, the following instructions can be used to add the necessary configuration settings for these valves into the DVP. Please see the DVP manual for more details and Service Tool instructions.

Flow Rig Offset:

Flow testing is conducted on every valve prior to shipment. Results from this flow testing produce effective area characteristics of the valve. A reference effective area is checked for each S/N valve and the difference in stroke required to match the test unit's flow performance to the nominal valve performance is determined. This difference value is the Flow Rig Offset. This value corrects for unit/unit variation in flow performance (particularly low flow positions). This value must be entered for each unit using the DVP Service Tool.

Example: An EGMV (Electric Gas Metering Valve) 0.6 in² valve is flow rigged at a reference Effective area of 0.02108 in². The nominal map indicates that this should occur at 3% stroke. During flow testing, this effective area is found at 3.12% travel. The difference is +0.12. Therefore the Flow Rig Offset value for this particular S/N is +0.12%.

Motor Resolver Offset:

Each valve/actuator has a somewhat unique motor resolver reading at the 0% position. This value is determined and recorded for each valve/actuator system during production testing. For multi-turn motor operated actuators, incremental positions above 0% are determined by counting the number of turns from this reference position. For limited angle actuators, the position will be scaled based on a specified range of a single rotation above this offset value. This value is specific for each S/N and must be entered using the DVP Service Tool.

Feedback 1 and Feedback 2 Start-up Range Settings:

Min. and Max. Current Settings:

During the start-up check for 3-phase actuators, the positioner performs a sequence of pre-start checks. A controlled current level is applied in both the open and closed directions. The current setting results in a torque sufficient to move the actuator (to remove any geartrain backlash), but not enough to overcome the spring preload. As a result, the valve remains in its seated (0%) position. During each reset, the 0% motor resolver reading and the backlash in the geartrain is measured and compared against the upper and lower limit values. If the actuator does not repeat the 0% position, or if too much backlash is measured (within the specified limits), a start-up fault will occur and will be annunciated.

The amount of motor current applied is dependent on two variables: the gear ratio and motor torque constant Kt. The table below lists the appropriate motor current for each actuator set-up.

Table 3-3. Actuator Motor Current

Start-up Current Setting (Amps)	
1.5:1 Gears	3:1 Gears
2.000	1.000

P/N Specific Settings:

Motor Turns:
The value of this parameter determines the number of turns the motor makes to travel to full stroke. This value is dependent upon the type of valve and the gear ratio of the actuator. The table below lists the appropriate motor turns for each actuator-valve set-up. This value is determined by uploading the correct parameter file for the application.

NOTICE

If this value is incorrectly set, the performance of the valve will not match the specified characteristics. Also, if the valve stroke parameter is too large for the given application, damage to the valve or operated load may occur.

Table 3-4. Physical Stroke and Motor Rotations at 100%

Product Type	Body/Trim Classification	Stroke Range (in)	Min to Max Turns 1.5:1 Gear Ratio
EGMV *	2” Class 600 ACd - 0.6 in^2	1.500	9.525
	3” Class 600 ACd - 3 in^2	2.000	12.700
ELMV	2” Class 900 Cv - 20.71	1.500	9.525
EWMV	2” Class 900 Cv - 20.71	1.500	9.525
ELBV	2” Class 900 Cv - 18.7	1.500	9.525

*—EGMV = Electric Gas Metering Valve

Zero Cut-off Settings:
When the Zero Cut-off function is enabled from the mode selection, position control is disabled when the demand setpoint drops below the Lower Limit setting and remains below this value for the value specified by the time delay. While in the zero-cutoff mode, the return spring applies the required force on the valve closure element to minimize seat leakage. With the spring providing proper closing force, there is virtually no variation of seat leakage over temperature. When the demand setpoint exceeds the Upper Limit setting, the valve resumes normal position control. There is no time delay when switching out of the zero-cutoff mode. The recommended values indicated in the table below are based on typical application requirements, however the user can modify the zero-cutoff settings if necessary using the settings wizard.

IMPORTANT

If the Zero-cutoff function is disabled, there may be noticeable variation in valve leakage at the 0% setpoint. This is a result of thermal expansion effects, which can change effective loading on the seat when the device is in closed-loop control at or near 0% setpoint.

Table 3-5. Recommended Zero Cut-off Settings

Product Type	Body/Trim Classification	Low Limit Setting	High Limit Setting
EGMV	2” Class 600 ACd - 0.6 in^2	0.25%	0.75%
	3” Class 600 ACd - 3 in^2	2.00%	4.00%
ELMV	2” Class 900 Cv - 20.71	4.00%	6.00%
EWMV	2” Class 900 Cv - 20.71	11.00%	13.00%
ELBV	2” Class 900 Cv - 18.7	Inactive	

Secondary Feedback Calibration:
The secondary feedback system provides a second verification of actuator position. For three-phase, geared ball screw actuators, this secondary resolver is installed at the output of the linear actuator. The secondary feedback system includes a linkage to the rotary resolver transducer. To accurately convert the rotary reading of the resolver to the linear displacement of the actuator unit a calculation is used which requires unit specific angles and linkage lengths which are determined during production testing. The calibration values of a given S/N are listed in the secondary feedback calibration block of variables.

Chapter 4.
Maintenance and Hardware Replacement

Maintenance

The only maintenance required for the Electric Metering or Bypass Valves is lubricating the ball screw and bearings every 12 months, in accordance with the descriptions below.

Should any of the standard components of the valve become inoperative, field replacement is possible. Contact the turbine manufacturer (primary contact) or Woodward (secondary contact) representative for assistance. Do not attempt to service the return spring.

Hardware Replacement

⚠WARNING

EXPLOSION HAZARD—Substitution of components may impair suitability for Class I, Division 2 or Zone 2 applications.

⚠WARNING

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

⚠WARNING

Lift or handle the valve only by using the eyebolts.

⚠WARNING

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the Electric Metering or Bypass Valves.

⚠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.

To facilitate field replacement of items, spare parts should be kept on-site. See the outline drawings (Figures 1-1, 1-2, 1-3) for the locations of items. Contact Woodward for a complete list of field-replaceable parts and additional instructions for their replacement.

NOTICE

Use only Woodward-approved grease to lubricate the ball screw and bearing in this actuator. Use of any other grease will reduce performance and reliability. Woodward lubrication kits are available as part number 8923-1186.

Ball Screw Lubrication Procedure

Lubricating the Ball Screw Assembly

1. Clean the outside of the actuator to ensure that no debris gets inside the actuator during the lubrication process. Any debris on the ball screw will reduce its life.
2. Remove the ball screw access plug located on the top of the gear cover with a 5/16 inch hex wrench (Figure 4-1).
3. Remove the ball screw port plug with a 3/16 inch hex wrench (Figure 4-2).
4. Set the ball screw access and port plugs aside and keep clean, ensuring that they are not scratched or marred.
5. Attach the thread connector of the grease syringe to the threaded grease port of the ball screw. The fitting should be fully seated (Figure 4-3).
6. Inject 2 cm^3 of Woodward approved grease (8923-1186) into the ball screw grease port.
7. Remove the grease syringe from the ball screw grease port and install the ball screw port plug. Do not torque the port plug (Figure 4-4).
8. Remove the plug that is adjacent to the ball screw port, set aside, and keep clean, ensuring that the plug is not scratched or marred (Figure 4-5).
9. Using a permanent marker or tape, mark a 5/32 inch Allen wrench at 2.75 inches from the bottom. Make sure the top of the marking is at 2.75 inches (Figure 4-6).
10. Insert the Allen wrench into the port located adjacent to the ball screw port. The Allen wrench is seated if the marking is below the top surface of the gear cover (Figure 4-7).
11. If the Allen wrench is not seated, rotate the gears using a 3/16 inch hex wrench on the ball screw port plug and rotate clockwise until the 5/32 inch Allen wrench is seated.
12. Once the 5/32 inch Allen wrench is seated, torque the ball screw port plug to 38–42 lb-in (4.3–4.7 N·m) (Figure 4-8).
13. Remove the 5/32 inch Allen wrench from the port, install the plug into the port located adjacent to the ball screw port, and torque to 38–42 lb-in (4.3–4.7 N·m) (Figure 4-9).
14. Install the ball screw access plug and torque to 145–155 lb-in (16.4–17.5 N·m) (Figure 4-10).

Figure 4-1

Figure 4-2

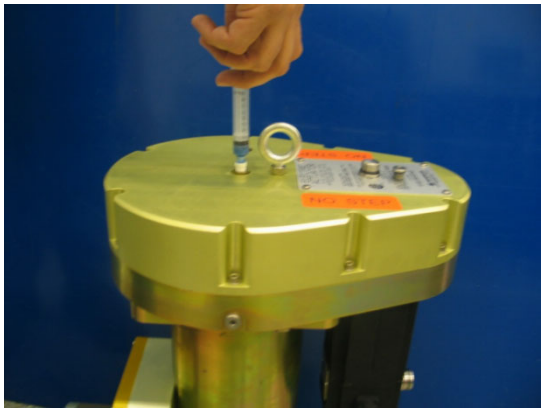


Figure 4-3

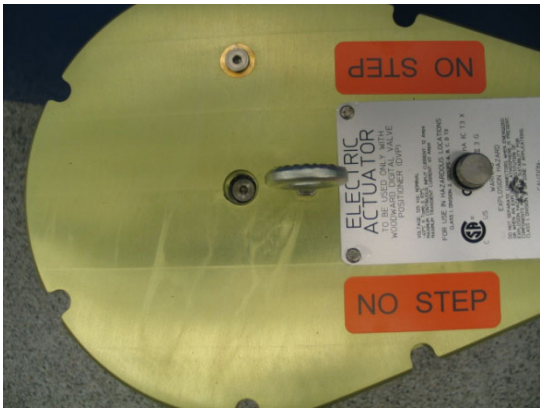


Figure 4-4

Figure 4-5

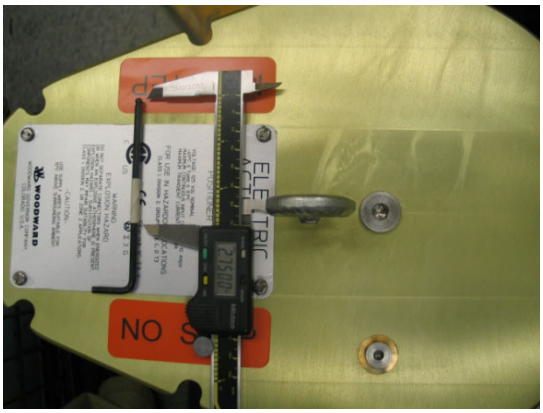


Figure 4-8

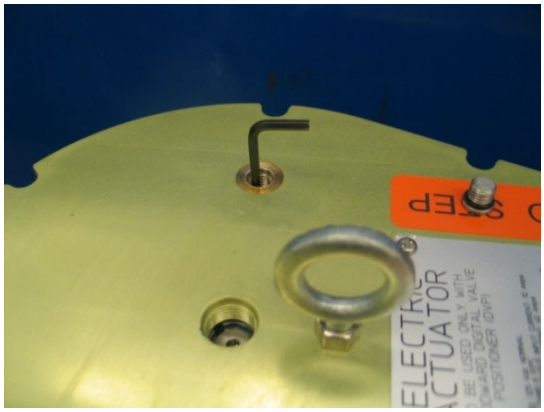


Figure 4-7

Figure 4-8

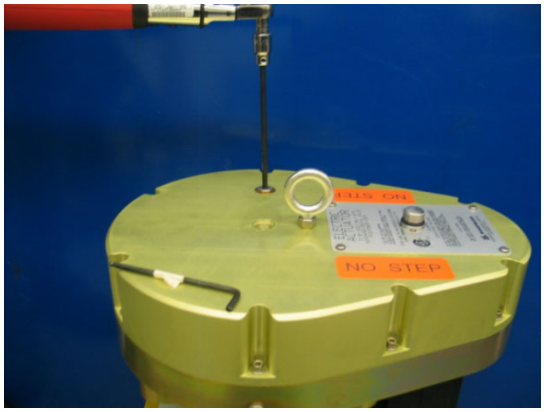


Figure 4-9

Figure 4-10

Bearing Lubrication Procedure

Lubricating the Bearing Assembly

1. Clean the outside of the actuator to ensure that no debris gets inside the actuator during the lubrication process. Any debris in the bearing will reduce its life.
2. Remove the bearing port plug with a 3/16 inch hex wrench (Figure 4-11).
3. Set the plug aside and keep clean, ensuring that the inside plug surface is not scratched or marred.
4. Attach the thread connector of the grease syringe to the threaded bearing grease port. The fitting should be fully seated (Figure 4-12).
5. Inject 2 cm^3 of Woodward approved grease into the bearing grease port.
6. Remove the grease syringe from the bearing port and install the bearing port plug. Torque to 38–42 lb-in (4.3–4.7 N·m) (Figure 4-13).

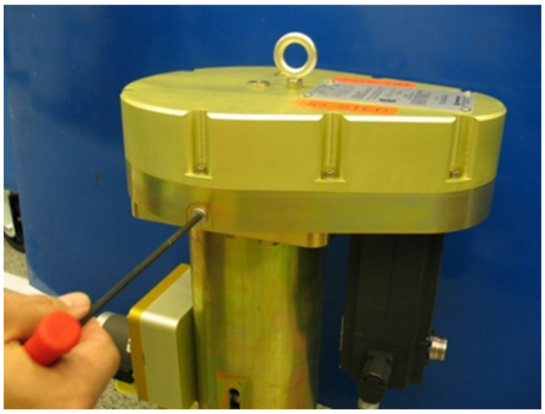


Figure 4-11

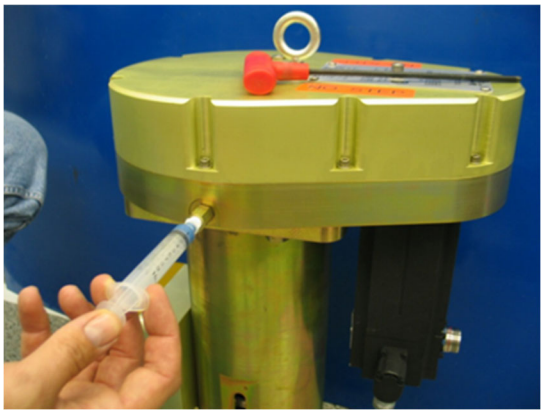


Figure 4-12

Figure 4-13

Chapter 5. Troubleshooting

Faults in the fuel control or governing system are often associated with speed variations of the prime mover, but such speed variations do not always indicate fuel control or governing system faults. Therefore, when improper speed variations occur, check all components, including the engine or turbine, for proper operation. Refer to the applicable electronic control manuals for assistance in isolating the trouble. The following steps describe troubleshooting for the control valves.

Disassembly of the control valve in the field is not recommended due to the dangerous forces contained in the springs. Under unusual circumstances, where disassembly becomes necessary, all work and adjustments should be made by personnel thoroughly trained in the proper procedures.

When requesting information or service help from Woodward, it is important to include the part number and serial number of the valve assembly in your communication.

Symptom	Possible Causes	Remedies
Valve will not move because positioner will not reset	Motor wires not properly connected between positioner and actuator	Connect wires according to diagram in this manual. Conduct continuity check.
	Resolver wires not properly connected between positioner and actuator	Connect wires according to diagram in this manual. Conduct continuity check.
Positioner will reset but valve will not move	Resolver sine wires high and low are flipped	Connect wires according to diagram in this manual. Conduct continuity check.
	Resolver cosine wires high and low are flipped	Connect wires according to diagram in this manual. Conduct continuity check.
	Resolver sine and cosine wires are swapped	Connect wires according to diagram in this manual. Conduct continuity check.
Upon enabling, valve will move and then return to fail-safe position	Resolver sine and cosine wires are swapped, and sine wires high and low are flipped	Connect wires according to diagram in this manual. Conduct continuity check.
	Resolver sine and cosine wires are swapped, and cosine wires high and low are flipped	Connect wires according to diagram in this manual. Conduct continuity check.
Poor flow accuracy	Characterization data in engine control does not match the valve	Verify characterization data matches the valve serial number.
	Build-up of contamination on the seat	Remove valve and inspect flow elements.
	Regulator spring out of adjustment	Return valve to Woodward for service.
	Regulator spring broken	Return valve to Woodward for service.
	Regulator piston stuck	Return valve to Woodward for service.
	Regulator worn	Return valve to Woodward for service.
Poor position stability	One motor wire disconnected	Connect wires according to diagram in this manual. Conduct continuity check.

Symptom	Possible Causes	Remedies
Valve stem resolver indicates position error	Incorrect parameter file loaded	Verify the parameter file matches the valve serial number.
	Valve stem resolver wires not properly connected between DVP and actuator	Contact manufacture for instructions or return to manufacturer for repair.
	Faulty resolver	Return to manufacturer for repair.
	Drive train failure	Return to manufacturer for repair.
High overboard vent leakage	Internal seals damaged	Return to manufacturer for repair.
High minimum flow	Damage to valve seat or plug	Remove valve and inspect flow elements. Return to manufacturer for repair.
	Contamination buildup in seat or plug	Remove valve and inspect flow elements. Return to manufacturer for repair.
	Valve not fully closed	Remove valve and verify plug is not properly seated. Return to manufacturer for repair.
	Regulator spring out of adjustment	Return valve to Woodward for service.
	Regulator piston stuck	Return valve to Woodward for service.
	Regulator worn	Return valve to Woodward for service.
External leakage	Piping flange gaskets missing or deteriorated	Replace gaskets.
	Piping flanges improperly aligned	Rework piping as needed to achieve alignment requirements detailed in Chapter 3.
	Piping flange bolts improperly torqued	Rework bolts as needed to achieve torque requirements detailed in Chapter 3.
	Packing missing or deteriorated	Return actuator to Woodward for service.

Chapter 6
Safety Management – Safe Position Fuel Shutoff Function

Safety Function

The ELMV, EWMV, and ELBV-HD Electric Metering Valves will move to the closed position within the full stroke trip time
listed in this manual.

Product Variations Certified

The SIL (Safety Integrity Level) rated ELMV, EWMV, and ELBV-HD Electric Metering Valves for fuel shutoff are designed and certified to the functional safety standards according to IEC 61508, Parts 1 through 7. Reference the exida FMEDA report: WOO 19-08-007 R001, and Certification: WOO 1908007 C001 . The exida FMEDA report is available on a per request basis from Woodward.

The functional safety requirements in this chapter apply to all ELMV, EWMV, and ELBV-HD Electric Metering Valves configurations listed in Table 6-1.

The ELMV, EWMV, and ELBV-HD Electric Metering Valves configurations listed in Table 6-1 are certified for use in applications up to SIL 3 according to IEC 61508. The SIL of an entire SIF (Safety Instrumented Function)must be verified via calculation of Average PFD (Probability of Failure on Demand) considering redundant architectures, proof test interval, proof test effectiveness, any automatic diagnostics, average repair and the specific failure rates of all products included in the SIF. Each element must be checked to assure compliance with the minimum HFT (Hardware Fault Tolerance) requirements.

The ELMV, EWMV, and ELBV-HD Electric Metering Valves are classified as a device that is part Type A element according to IEC 61508, having a HFT of 0.

The ELMV, EWMV, and ELBV-HD Electric Metering Valves are designed and verified to withstand the worst-case (or greater) expected environmental conditions as listed in other sections of this manual.

SFF (Safe Failure Fraction) for ExMV-HD Electric Metering Valve – Over Speed SIF

The ELMV, EWMV, and ELBV-HD Electric Metering Valves is only one part of a shutoff system that supports an over-speed shutdown SIF. This system consists of a speed sensor, a processing unit and a fuel shutoff actuation subsystem of which ELMV, EWMV, and ELBV-HD Electric Metering Valves is a component.

The SFF (Safe Failure Fraction) for each subsystem should be calculated. The SFF summarizes the fraction of failures which lead to a safe state plus the fraction of failures which will be detected by diagnostic measures and lead to a defined safety action. This is reflected in the following formulas for SFF:

$SFF = \lambda SD + \lambda SU + \lambda DD / \lambda TOTAL$
Where $\lambda TOTAL = \lambda SD + \lambda SU + \lambda DD + \lambda DU$

The failure rates listed below, for only the ELMV, EWMV, and ELBV-HD Electric Metering Valves, do not include failures due to wear-out of any components and are only valid for the useful lifetime of the ELMV, EWMV, and ELBV-HD Electric Metering Valves. They reflect random failures and include failures due to external events such as unexpected use. Reference the exida FMEDA report: WOO 19-08-007 R001 for detailed information concerning the SFF and PFD.

Table 6-1. Failure Rates according to IEC 61508 in FIT

Failure Rates for Static Applications[1] with Good Maintenance Assumptions in FIT @ SSI=2

Application/Device/Configuration	λ_{SD}	λ_{SU}[4]	λ_{DD}	λ_{DU}	#	E
Full Stroke, Clean Service	0	130	0	714	957	634
Full Stroke with PVST, Clean Service	0	130	276	438	957	634

Failure Rates for Dynamic Applications[1] with Good Maintenance Assumptions in FIT @ SSI=2

Application/Device/Configuration	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}	#	E
Full Stroke, Clean Service	0	130	0	568	963	668
Full Stroke with PVST, Clean Service	0	130	190	378	963	668

According to IEC 61508 the architectural constraints of an element must be determined. This can be done by following the 1H approach according to 7.4.4.2 of IEC 61508 or the 2H approach according to 7.4.4.3 of IEC 61508. Reference the exida FMEDA report: WOO 19-08-007 R001 for additional information, including the assumptions used for the calculated FIT (Failure in Time) values in Table 6-1.

To claim diagnostic coverage for Partial Valve Stroke Testing (PVST), the PVST must be automatically performed at a rate at least ten times faster than the demand frequency with inclusions of position detection from the actuator's LVDT(s). Additionally, the PVST of the safety instrumented function must provide a full cycle test of the solenoid and/or hydraulic pilot valve depending on the device configuration. In cases where this is not true, another method must be used to perform a full solenoid/pilot valve cycle during automated diagnostics in order to use the PVST numbers.

Response Time Data

The ELMV, EWMV, and ELBV-HD Electric Metering Valves full stroke trip time is as listed in this manual.

Limitations

When proper installation, maintenance, proof testing, and environmental limitations are observed, the design life of the ELMV, EWMV, and ELBV-HD Electric Metering Valves is 250,000 hours of operation. Under "normal" operating conditions ELMV, EWMV, and ELBV-HD Electric Metering Valves should be serviced with a factory or authorized service center overhaul every 25,000 hours not to exceed 3 years in service. Refer to service bulletin 01614 for additional service guidelines.

Management of Functional Safety

The ELMV, EWMV, and ELBV-HD Electric Metering Valves is intended for use according to the requirements of a safety lifecycle management process such as IEC 61508 or IEC 61511. The safety performance numbers in this chapter can be used for the evaluation of the overall safety lifecycle.

[1] Static Application failure rates are applicable if the device is static for a period of more than 200 hours.
[2] It is important to realize that the No Effect failures are no longer included in the Safe Undetected failure category according to IEC 61508, ed2, 2010.

Restrictions

The user must complete a full functional check of the ELMV, EWMV, and ELBV-HD Electric Metering Valves after initial installation, and after any modification of the overall safety system. No modification shall be made to the ELMV, EWMV, and ELBV-HD Electric Metering Valves unless directed by Woodward. This functional check should include as much of the safety system as possible, such as sensors, transmitters, actuators, and trip blocks. The results of any functional check shall be recorded for future review.

Competence of Personnel

All personnel involved in the installation and maintenance of the ELMV, EWMV, and ELBV-HD Electric Metering Valves must have appropriate training. Training and guidance materials are included in this manual. These personnel shall report back to Woodward any failures detected during operation that may impact functional safety.

Operation and Maintenance Practice

A periodic proof (functional) test of the ELMV, EWMV, and ELBV-HD Electric Metering Valves is required to verify that any dangerous faults not detected by safety controller internal run-time diagnostics are detected. More information is in the “Proof Test” section below. The frequency of the proof test is determined by the overall safety system design, of which the ELMV, EWMV, and ELBV-HD Electric Metering Valves is part of the safety system. The safety numbers are given in the following sections to help the system integrator determine the appropriate test interval.

No special tools are required for operation or maintenance of the ELMV, EWMV, and ELBV-HD Electric Metering Valves.

Installation and Site Acceptance Testing

Installation and use of the ELMV, EWMV, and ELBV-HD Electric Metering Valves must conform to the guidelines and restrictions included in this manual.

Functional Testing after Initial Installation

A functional test of ELMV, EWMV, and ELBV-HD Electric Metering Valves is required prior to use in a safety system. This should be done as part of the overall safety system installation check and should include all I/O interfaces to and from the ELMV, EWMV, and ELBV-HD Electric Metering Valves. For guidance on the functional test, see the Proof Test procedure below.

Functional Testing after Changes

A functional test of the ELMV, EWMV, and ELBV-HD Electric Metering Valves is required after making any changes that affect the safety system. Although there are functions in the ELMV, EWMV, and ELBV-HD Electric Metering Valves that are not directly safety related, it is recommended that a functional test be performed after any change.

Proof Test (Functional Test)

The ELMV, EWMV, and ELBV-HD Electric Metering Valves must be periodically proof tested to ensure there are no dangerous faults present that are not detected by on-line diagnostics. This proof test should be performed at least once per year.

Suggested Proof Test

The suggested proof test consists of a full stroke of the valve, shown in the table below.

Table 6-2. Suggested Proof Test

Step	Action
1	Bypass the safety function and take appropriate action to avoid a false trip.
2	Issue a trip command to the ELMV, EWMV, and ELBV-HD Electric Metering Valves to force the actuator/valve assembly to the Fail-Safe state and confirm that the Safe State was achieved and within the correct time. **Note:** This tests for all failures that could prevent the functioning of the control valve as well as the rest of the final control element.
3	Inspect the actuator and valve for any leaks, visible damage or contamination.
4	Re-store the original supply/input to the actuator and confirm that the normal operating state was achieved.
5	Remove the bypass and otherwise restore normal operation.

For the test to be effective the movement of the valve must be confirmed. To confirm the effectiveness of the test both the travel of the valve and slew rate must be monitored and compared to expected results to validate the testing.

Proof Test Coverage

The Proof Test Coverage for the ELMV, EWMV, and ELBV-HD Electric Metering Valves is given in the table below.

Table 6-3. Proof Test Coverage

Proof Test Results – ExMV-HD Valve Static Application

Device	$\lambda_{DU}PT^7$ (FIT)	Proof Test Coverage	
		No PVST	with PVST
ExMV-HD Valve	311	56%	29%

Proof Test Results – ExMV-HD Valve Dynamic Application

Device	$\lambda_{DU}PT$ (FIT)	Proof Test Coverage	
		No PVST	with PVST
ExMV-HD Valve	295	48%	22%

The suggested proof test and proof test coverage is referenced in exida FMEDA report;
WOO 19-08-007 R001.

Acronyms

EUC	Equipment Under Control
FMEDA	Failure Modes, Effects and Diagnostic Analysis
HFT	Hardware Fault Tolerance
MOC	Management of Change. These are specific procedures to follow for any work activities in compliance with government regulatory authorities or requirements of a standard
PFDavg	Average Probability of Failure on Demand
PFH	Probability of Failure per Hour
SFF	Safe Failure Fraction, the fraction of the overall failure rate of an element that results in either a safe fault or a diagnosed dangerous fault
SIF	Safety Instrumented Function, a set of equipment intended to reduce the risk due to a specific hazard (a safety loop)
SIL	Safety Integrity Level, discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 is the highest level and Safety Integrity Level 1 is the lowest
SIS	Safety Instrumented System – Implementation of one or more Safety Instrumented Functions. A SIS is composed of any combination of sensor(s), logic solver(s), and final element(s)

Chapter 7.
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**, 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
Japan	+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

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (32) 422-5551
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) 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

Changes in Revision L—
- Revised Pressure Equipment Directive PED Module H in Regulatory Compliance Section
- Updated Declarations

Changes in Revision K—
- Replaced 100% of the Directives and Certifications in the Regulatory Compliance section
- Added RoHS Directive to the Regulatory Compliance Section
- Added SIL 3 Compliance to the Regulatory Compliance Section
- Added Chapter 6 Safety Management
- Replaced Declarations

Changes in Revision J—
- Updated Declaration of Incorporation

Changes in Revision H—
- Updated Regulatory Compliance information and Declarations

Changes in Revision G—
- Updated EWMV outline drawing (Figure 1-2)
- Updated information about Process Fluid Vent Port (page 13)

Declarations

EU DECLARATION OF CONFORMITY

EU DoC No.:	00269-04-EU-02-11
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Name(s)/Number(s):	Electric Liquid Metering Valve – ELMV, ELMV-HD Electric Liquid Bypass Valve – ELBV, ELBV-HD Electric Water Metering Valve – EWMV, EWMV-HD
The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:	LELA Actuator: 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 Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (EMC) Valves: Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonization of the laws of the Member States relating to the making available on the market of pressure equipment. Electric Liquid Metering Valve: PED Category II Electric Liquid Bypass Valve: PED Category II Electric Water Metering Valve: PED Category SEP
Markings in addition to CE marking:	Ⓔx II 3 G, Ex nA IIC, T3 Gc
Applicable Standards:	EN IEC 60079-0, 2018: Electrical apparatus for explosive gas atmospheres – Part 0: General Requirements EN 60079-15, 2010 - Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection 'n' EN 61000-6-4, 2011: EMC Part 6-4: Generic Standards - Emissions for Industrial Environments EN 61000-6-2, 2005: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments ASME Boiler and Pressure Vessel Code VIII, Div. 2, Part 5, 2013
Conformity Assessment (PED Category II):	PED Module H – Full Quality Assurance, CE-0062-PED-H-WDI 001-22-USA. Bureau Veritas SAS (0062) 8 Cours du Triangle, 92800 Puteaux – La Defense, France

This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Signature

Annette Lynch

Full Name

Engineering Manager

Position

Woodward, Fort Collins, CO, USA

Place

01-August-2022

Date

5-09-1183 Rev 34

DECLARATION OF INCORPORATION
Of Partly Completed Machinery
2006/42/EC

File name:	00269-04-EU-02-12
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Names:	Electric Liquid Metering Valve – ELMV, ELMV-HD Electric Water Metering Valve – EWMV, EWMV-HD Electric Liquid Bypass Valve - ELBV
This product complies, where applicable, with the following Essential Requirements of Annex I:	1.1, 1.2, 1.3, 1.5, 1.6, 1.7
Applicable Standards:	EN 12100:2010

The relevant technical documentation is compiled in accordance with part B of Annex VII. Woodward shall transmit relevant information if required by a reasoned request by the national authorities. The method of transmittal shall be agreed upon by the applicable parties.

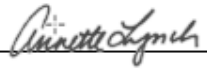
The person authorized to compile the technical documentation:

Name: Dominik Kania, Managing Director
Address: Woodward Poland Sp. z o.o., ul. Skarbowa 32, 32-005 Niepolomice, Poland

This product must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of this Directive, where appropriate.

The undersigned hereby declares, on behalf of Woodward Inc. of Loveland and Fort Collins, Colorado that the above referenced product is in conformity with Directive 2006/42/EC as partly completed machinery:

MANUFACTURER



Signature

Annette Lynch

Full Name

Engineering Manager

Position

Woodward, Fort Collins, CO, USA

Place

04 August 2022

Date

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Released

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26306.

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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.