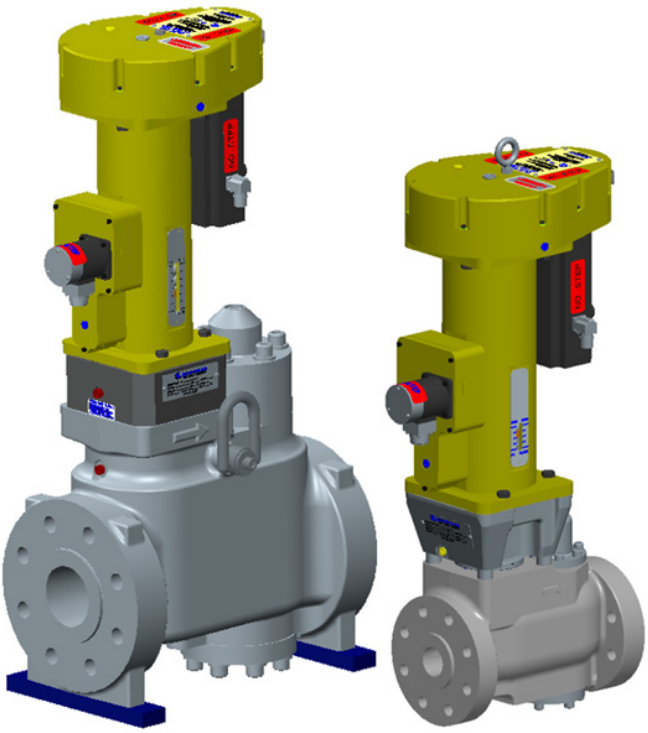
WOODWARD

# Product Manual 35032
# (Revision L, 7/2025)
**Original Instructions**



# Electric Liquid Metering Valve (ELMV-HD)
# Electric Water Metering Valve (EWMV-HD)

## Installation and Operation Manual

**General Precautions**

**Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.**

**Practice all plant and safety instructions and precautions.**

**Failure to follow instructions can cause personal injury and/or property damage.**

**Revisions**

**This publication may have been revised or updated since this copy was produced. The latest version of most publications is available on the Woodward website.**

**Woodward Industrial Support: Get Help**

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

**Woodward Industrial Support: Get Help**

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

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**Revisions— A bold, black line alongside the text identifies changes in this publication since the last revision.**



**Manual 35032**

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

# Regulatory Compliance

**European Compliance for CE Marking:**

| | |
|---|---|
| **Pressure Equipment Directive:** | Certified to Pressure Equipment Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to making pressure equipment available on the market.<br>Electric Liquid Metering Valve: PED Category II<br>Electric Water Metering Valve: PED Category SEP<br>PED Module H – Full Quality Assurance |
| **ATEX – Potentially Explosive Atmospheres 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.<br>Zone 2, Category 3, Group II, Ex nA IIC T3 Gc |
| **EMC Directive:** | 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) |

**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:<br>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. |
| **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. |

**Other International Compliance:**

| | |
|---|---|
| **IECEx LELA Actuator:** | Certified for use in explosive atmospheres per certificate:<br>IECEx CSA 14.0013X, Ex nA IIC T3 Gc |

**North American Compliance:**

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

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

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


ExMV-HD Electric Metering Valve – 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 in this Installation and Operation Manual, Chapter 5 – Safety Management – Safe Position Fuel Shutoff Function. SIL Certificate WOO 1908007 C001.

## Special Conditions for Safe Use:

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

To be used only with the Woodward Digital Valve Positioner (DVP).

Wiring must be in accordance with North American Class I, Division 2 or international Zone 2 wiring methods, and in accordance with the authority having jurisdiction.

IP55 is dependent upon use of the proper mating electrical connectors. This product is designed for use with dedicated cables that connect the Digital Valve Positioner to the ELMV-HD or EWMV-HD assembly. Please contact Woodward for the appropriate cable configuration.

**⚠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.**

**⚠WARNING**

**HOT SURFACE HAZARD – T3 reflects the surface temperature conditions of the LELA actuator. The surface temperature of valve body approaches the maximum temperature of the applied process media. It is the responsibility of the user to ensure that the external environment contains no hazardous gases capable of ignition in the range of the process media temperatures.**

**⚠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.**

## Safety Symbols


Direct Current


Alternating Current


Both Alternating and Direct Current


Caution, risk of electrical shock


Caution, refer to accompanying documents


Protective conductor terminal


Frame or chassis terminal

# Chapter 1.
# General Information

## Introduction

The High Differential Electric Liquid Metering Valve (ELMV-HD) and the High Differential Electric Water Metering Valve (EWMV-HD) controls 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, resolvers 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. These valves utilize a device (ID Module) containing all the configuration and calibration information that is read by the Woodward Digital Valve Positioner (DVP) when the valve/actuator is connected and powered up.

For applications requiring extreme accuracy, add the throttling regulator characteristics to the control system to compensate for minor changes due to the total pressure drop across the valve. Please contact Woodward to obtain the proper control characteristic tables. These tables vary by valve part number. The control structure for using these tables is very specific. Please contact Woodward for more information about the control structure required.

**⚠WARNING**

**Failure to use the proper tables or control structure could result in improper valve operation that could cause property damage, or personal Injury.**

### ELMV-HD

The ELMV-HD 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 design provides 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, add the throttling regulator characteristics to the control system to compensate for minor changes due to the total pressure drop across the valve.

### EWMV-HD

The EWMV-HD controls the flow rate of water to various stages of an industrial gas turbine combustion system. The valve is similar to the ELMV-HD 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.

These valves operate only with a DVP. Contact your sales person for part numbers for your specific applications.

# Cavitation

The valves are designed for use in a high differential environment where cavitation will occur. The cavitation index as defined by ISA-RP75.23 should be used to evaluate the severity of cavitation allowing the user to understand the potential for valve damage from excessive cavitation. All valves can be operated indefinitely with a cavitation index above 1.1. Operation with a cavitation index below 1.1 should be limited because operation will potentially cause the erosion of regulator components. The erosion rate will increase dramatically as the cavitation index decreases until the operating fluid flashes across the regulator at an index of 1. The erosion rate is also much more severe with water than with fuel due to the nature of these operating fluids. Excessive erosion of the regulator components can lead to loss of regulation function as well as component debris downstream of the metering valves.

Cavitation Index per ISA-RP75.23 is defined as: (valve inlet pressure – fluid vapor pressure)/(valve inlet pressure – valve outlet pressure)

**⚠WARNING**

**Extended operation of EWMVs or ELMVs below a cavitation index of 1.1 may cause loss of valve function and debris downstream of valves.**

# Chapter 2.
# Description

## Electrical Mechanical Actuator Assembly

The electrical-mechanical actuator consists of a brushless dc motor that provides torque, dual integral resolvers 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. Additional internal features of the actuator include:

- 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
  - The 2 inch valves include a lifting eye on top of the gearbox (refer to outline drawing in Figure 2-1 and model in Figure 2-2).
  - The 3 inch valves include hoist rings on either side of the valve body (refer to outline drawing in Figure 2-3a and model in Figure 2-4).
  - The 4 inch valves include hoist rings on either side of the valve body (refer to outline drawing in Figure 2-3c and model in Figure 2-4).

## Brushless DC Motor

The actuator uses a permanent magnet, electrically commutated, brushless dc motor with a Class H (180°C) insulation system. The motor is a permanently lubricated assembly

## Resolver Position Feedback Sensors

The primary position feedback transducers are the resolvers that are 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 resolvers are 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, as the actuator approaches the mechanical minimum stop the positioner also decelerates the actuator. Under the control of the positioner, the actuator will 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 use of a throttling regulator provides a nearly constant differential pressure across the flow metering section under a wide variety of upstream and downstream pressure conditions, allowing for accurate flow metering. A characteristic lookup table is provided for use in the turbine control system to correct for droop in the regulator pressure control, further improving its accuracy. 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-HD and EWMV-HD) are contoured to provide an approximately equal percent flow characteristic. These valves are designed to provide a highly accurate effective area.

The regulator section of each valve consists of a piston, sleeve, spring(s), and covers. 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.

Highly accurate position sensing and control allow 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.

Table 2-1. ELMV-HD and EWMV-HD Mechanical Specifications

| | |
|---|---|
| Description | 2 inch electrically actuated liquid fuel metering valve<br>2 inch electrically actuated water metering valve<br>3 inch electrically actuated water metering valve<br>3 inch electrically actuated liquid fuel metering valve<br>4 inch electrically actuated liquid fuel metering valve<br>4 inch electrically actuated water metering valve |
| Ambient Temperature Range | -29°C to 93°C (-20°F to 200°F) |
| | **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 Closed) |
| 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 = 350 msec for 1.5:1 gear ratio (2” valves) and 700 msec for 3.0:1 gear ratio (4” valves), for 10% to 90% or 90% to 10% movements. |
| Visual Position Indication | Yes |
| Ambient Temperature Range | -29˚ C to +93 °C (–20˚ F to +200 °F) |
| Ingress Protection | IP55 |
| DVP Voltage (typical) | 125 Vdc |
| DVP Voltage (max) | 150 Vdc |
| DVP Voltage (min) | 90 Vdc |
| Maximum Continuous Input Current | 12A |
| Maximum Transient Current | 40A |
| External Grounding Stud | Suitable for wire size 10 $mm^2$ to 4 $mm^2$ (8 AWG to 12 AWG) |

**VALVE**

| | |
|---|---|
| Noise level | 2 Inch ELMV-HD: Less than 60 dBA calculated**<br>2 Inch EWMV-HD: Less than 60 dBA calculated**<br>3 Inch ELMV-HD: Less than 80 dBA calculated**<br>3 Inch EWMV-HD: Less than 80 dBA calculated**<br>4 Inch ELMV-HD: Less than 80 dBA calculated**<br>4 Inch EWMV-HD: Less than 80 dBA calculated**<br>**Calculations based on EN 60534-8-3:2011 and EN60534-8-4:2005. |
| 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 |
| Operating Fluid Filtration | Fuel: 5~10 µm, beta ratio of 75 (98.7% efficiency)<br>Demineralized Water: 20 µm, beta ratio of 75 (98.7% efficiency) |
| Connections | ANSI Class 1500 # RF flanges |
| Nominal Piping Size | 2 Inch – DN 50 mm<br>3 Inch - DN 80 mm<br>4 Inch – DN 100 mm |
| Min Fluid Temperature | The greater of: –29 °C (–20 °F) and 11 °C (20 °F) above the wax point temperature at the supply pressure, or the temperature required to achieve fuel viscosity of 12 centistokes maximum<br>0 deg C (32 deg F) for water valves |
| Max Fluid Temperature | 121 °C (250 °F) ELMV-HD and EWMV-HD |
| Max Static Pressure | 24,821 kPa at 38 °C (3,600 psid at 100 °F)<br>23,076 kPa at 66 °C, (3,347 psid at 150 °F)<br>20,305 kPa at 121 °C (2,945 psid at 250 °F).<br>Interpolate per ASME B16.34 Table 2-2.2 or Table VII-2-2.2 for class 1500 flanges and temperatures/pressures between these points. |
| Max Forward Differential Pressure | 24,821 kPa (3,600 psid)<br>**Note:** Does not apply to units with a Ceramic Alumina Regulator. Contact Woodward for differential pressure information on units with a Ceramic Alumina Regulator. |
| Max Reverse Differential Pressure: | 13,790 kPa (2,000 psid)<br>**Note:** Does not apply to units with a Ceramic Alumina Regulator. Contact Woodward for differential pressure information on units with a Ceramic Alumina Regulator. |
| Max Cyclic Pressure | 12,065 kPa (1,750 psid) cyclic pressure fluctuations to ensure infinite life of valve housing and internal components. |
| Min Pressure | 1,034 kPa (150 psig) for ELMV-HD and EWMV-HD |
| Proof Test Pressure | 37,231 kPa (5,400 psig) |
| Burst Test Pressure | 59,571 kPa (8,640 psig) min |
| Overboard Leakage | 1 $cm^3$/min new, 10 $cm^3$/min at end of service period |
| Minimum Required ΔP | 1,034 kPa (150 psid) Dynamic performance will be reduced as the valve ΔP is reduced. |

| | |
|---|---|
| Flow Capability | 2 Inch ELMV w/ stainless steel regulator:<br>Minumum Flow: 1044 lbm/hr (.84 Sg fuel)<br>Maximum Flow: 62,667 lbm/hr (.84 Sg fuel)<br><br>2 Inch ELMV w/ aluminum regulator:<br>Minumum Flow: 3133 lbm/hr (.84 Sg fuel)<br>Maximum Flow: 62,667 lbm/hr (.84 Sg fuel)<br><br>3 Inch ELMV:<br>Minumum Flow: 3360 lbm/hr (.84 Sg fuel)<br>Maximum Flow: 183303 lbm/hr (.84 Sg fuel)<br><br>3 Inch EWMV:<br>Minumum Flow: 4000 lbm/hr (1.0 Sg water)<br>Maximum Flow: 200,000 lbm/hr (1.0 Sg water)<br><br>4 Inch ELMV:<br>Minumum Flow: 6415 lbm/hr (.84 Sg fuel)<br>Maximum Flow: 210798 lbm/hr (.84 Sg fuel)<br><br>4 Inch EWMV:<br>Minumum Flow: 7000 lbm/hr (1.0 Sg water)<br>Maximum Flow: 200,000 lbm/hr (1.0 Sg water) |
| Dynamic performance (bandwidth) | 15 rad/sec with no more than 3dB attenuation between commanded input to flow, at the following flow and valve ΔP conditions:<br><br>2 Inch ELMV-HD and 2 Inch EWMV-HD<br>15101 PPH at ΔP= 1,444 psid<br>30203 PPH at ΔP = 1,045 psid<br>45304 PPH at ΔP= 750 psid<br><br>3 & 4Inch ELMV-HD<br>46311 PPH at ΔP= 1,171 psid<br>96921 PPH at ΔP = 934 psid<br>138932 PPH at ΔP= 454 psid<br><br>3 & 4 Inch EWMV-HD<br>63161 PPH at ΔP= 1,171 psid<br>126323 PPH at ΔP = 934 psid<br>189484 PPH at ΔP= 454 psid |
| Approximate Weight | 2" ELMV-HD valve: 180 kg (400 lb.)<br>2" EWMV-HD valve: 180 kg (400 lb.)<br>3” EWMV-HD valve: 373 kg (822 lb.)<br>3” ELMV-HD valve: 366 kg (807 lb.)<br>4” EWMV-HD valve: 428 kg (943 lb.)<br>4” ELMV-HD valve: 421 kg (928 lb.) |

## Power and I/O Requirements

Each of the ELMV-HD / EWMV-HD valve and actuator assemblies is designed to operate with a Woodward DVP. For power requirements, see Woodward Manual 26329 (DVP) or 26773 (DVP5000/10000) as applicable.

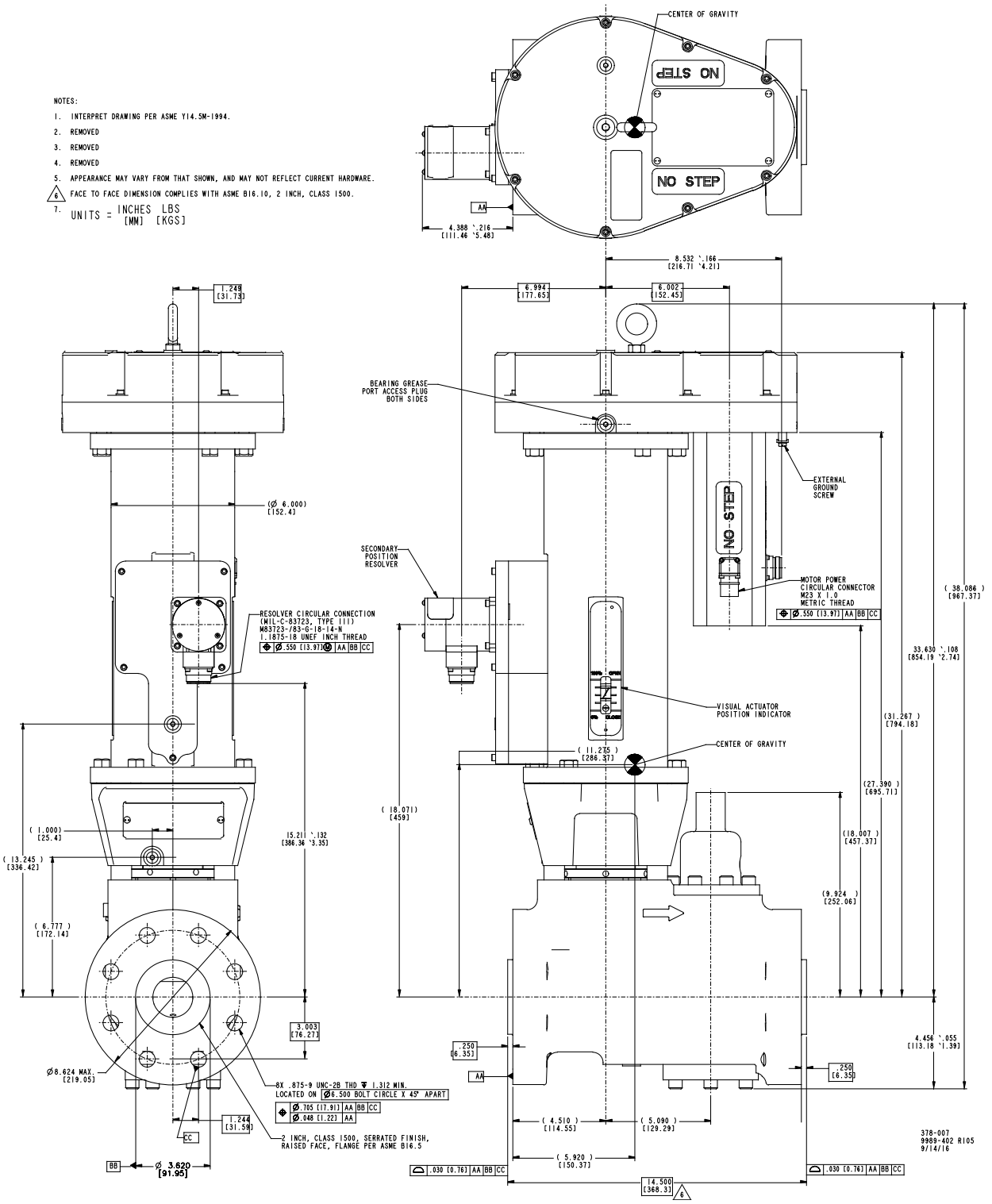



Figure 2-1a. Outline drawing of 2” ELMV-HD and EWMV-HD

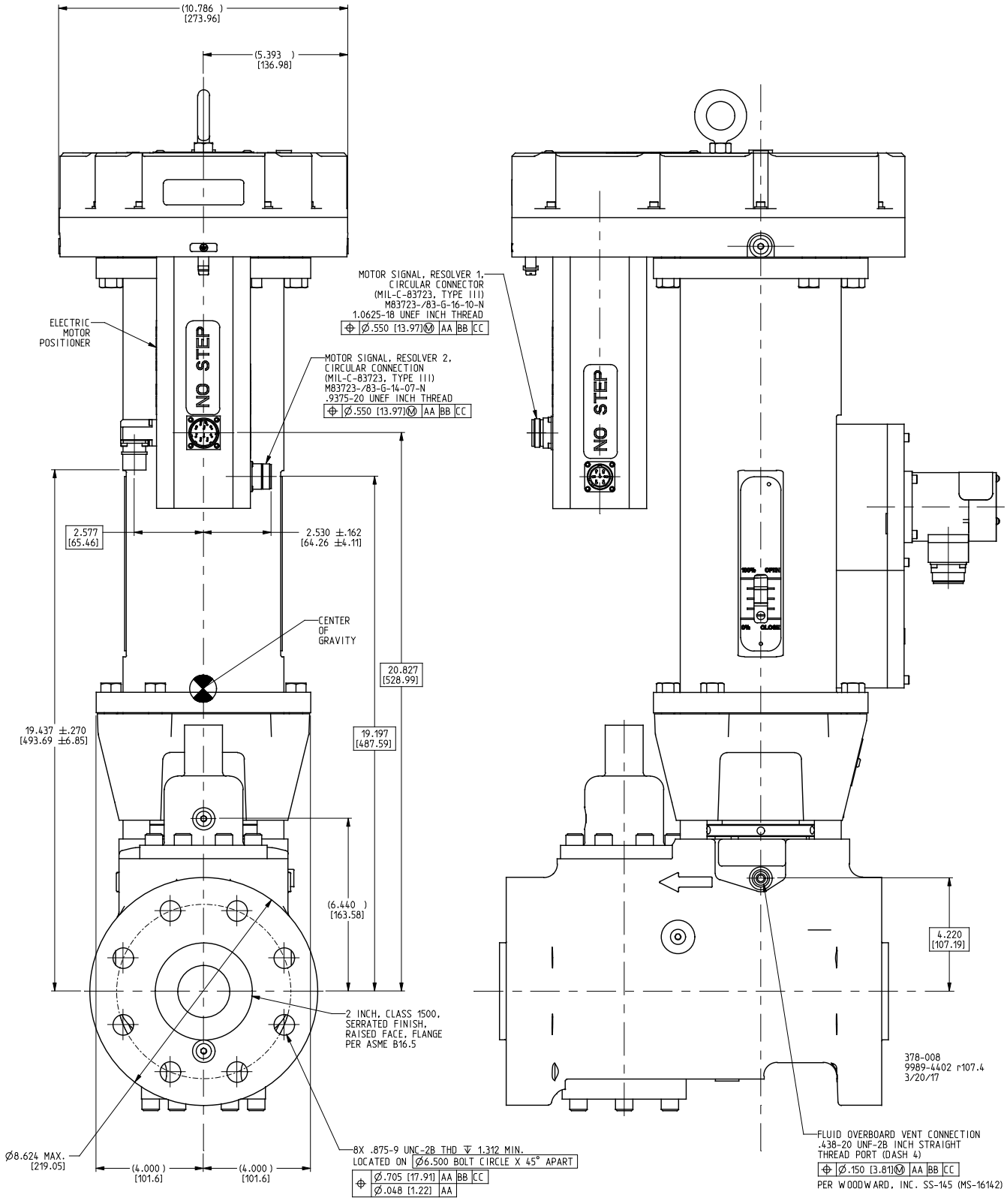



Figure 2-1b. Outline drawing of 2” ELMV-HD and EWMV-HD

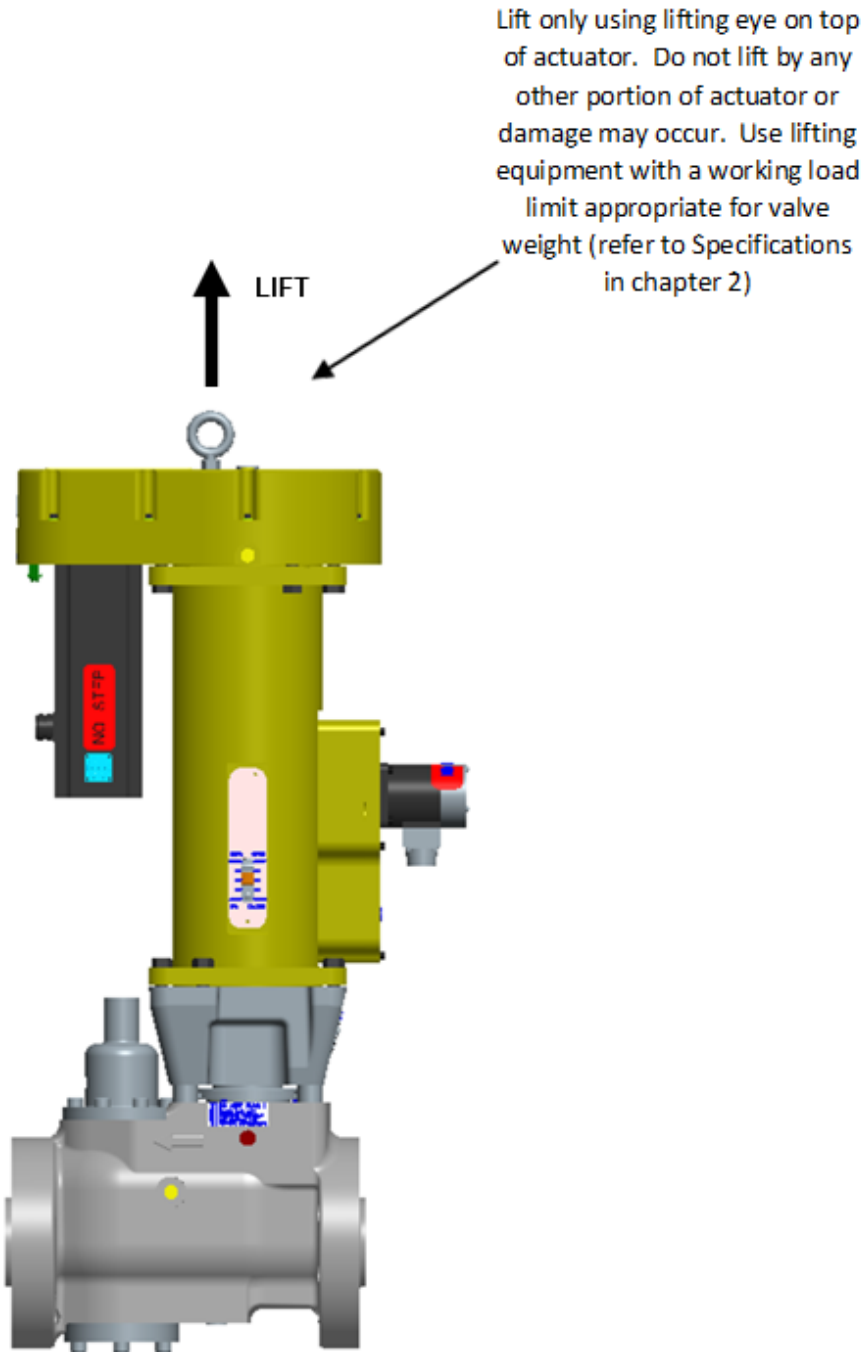



Figure 2-2. Lifting Diagram for 2” ELMV-HD and EWMV-HD

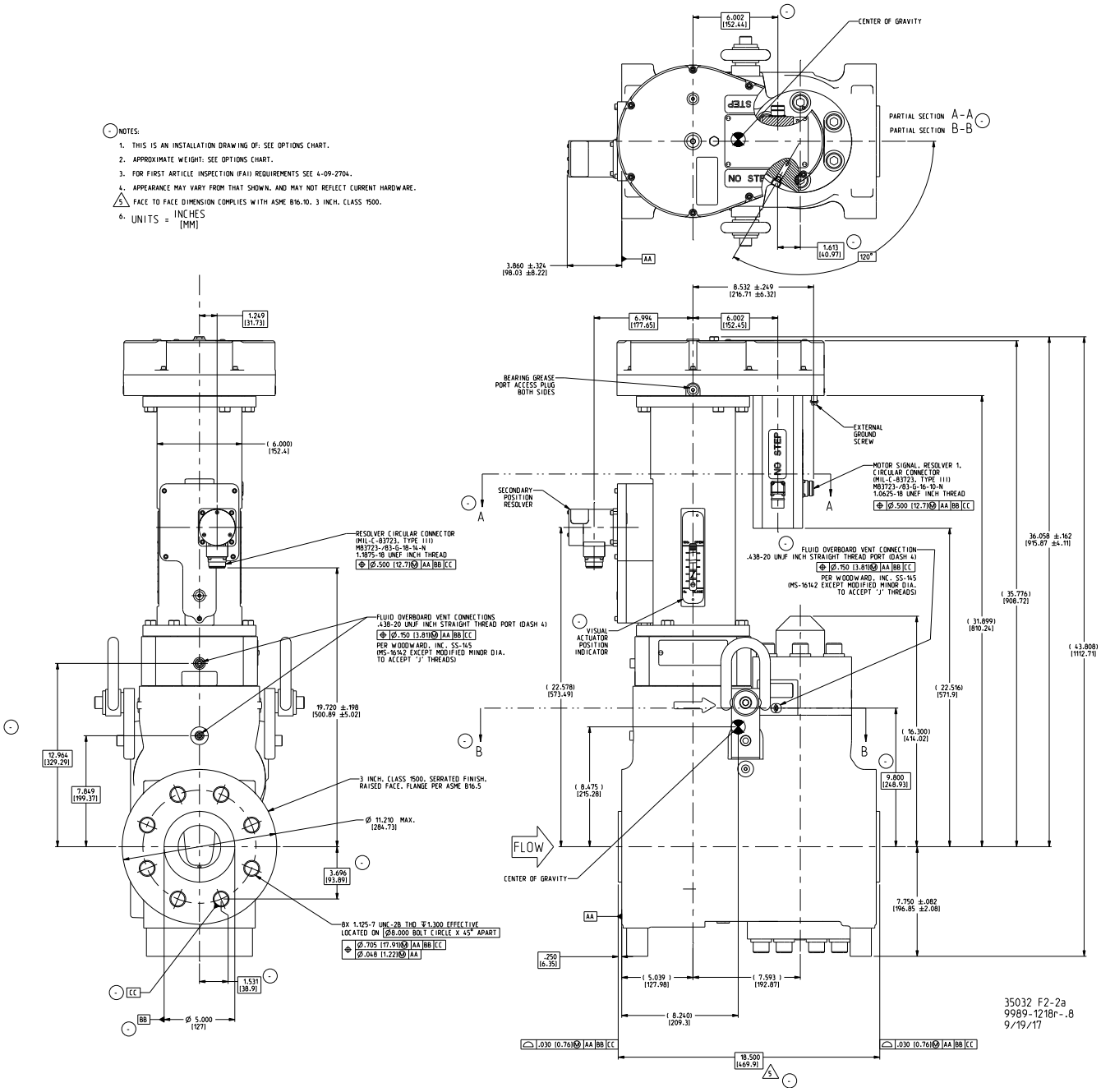



Figure 2-3a. Outline Drawing of 3” ELMV-HD

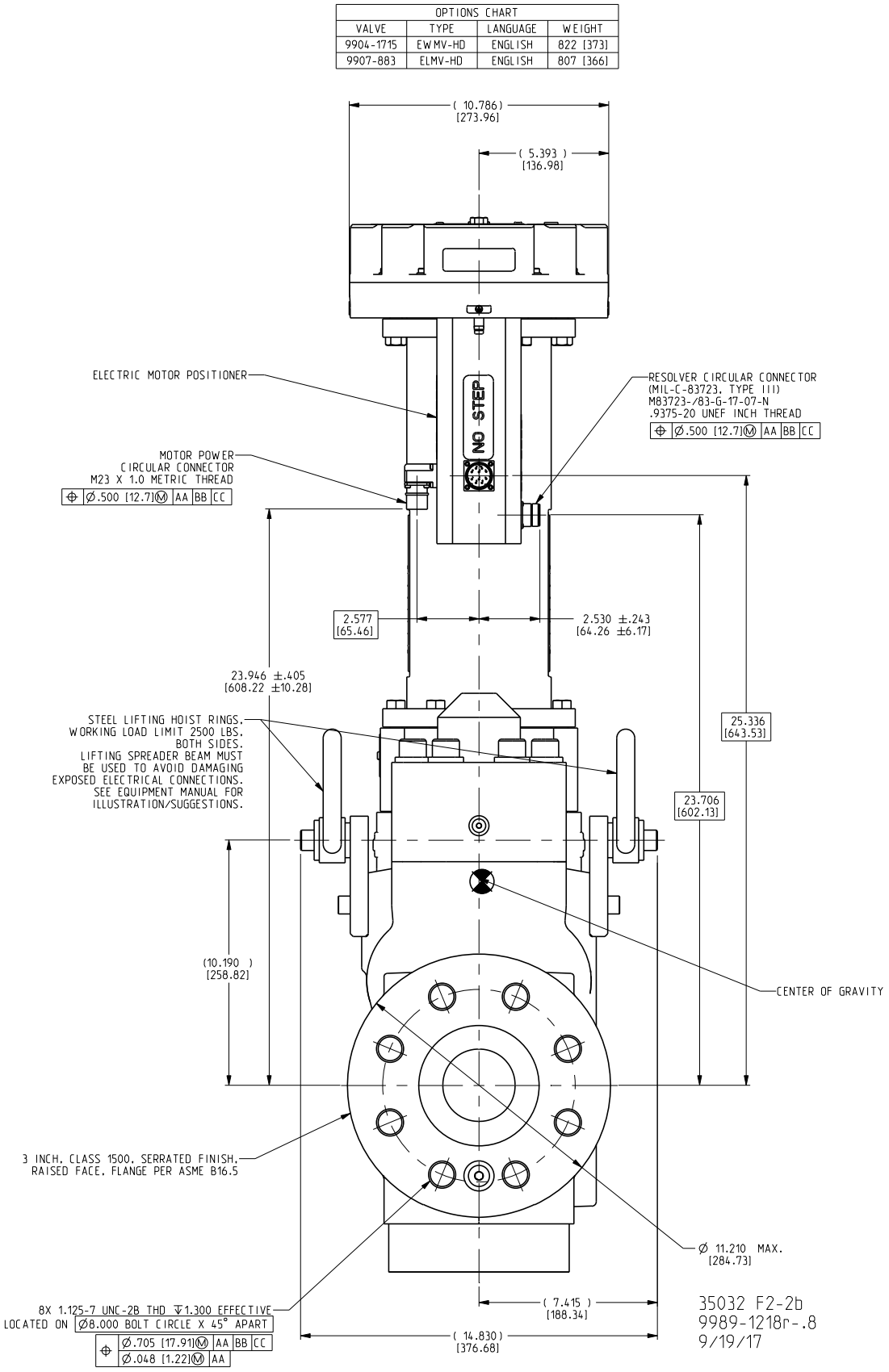



Figure 2-3b. Outline Drawing of 3” ELMV-HD

NOTES:

1. INTERPRET DRAWING PER ASME Y14.5M-1994.
2. REMOVED
3. REMOVED
4. REMOVED
5. APPEARANCE MAY VARY FROM THAT SHOWN, AND MAY NOT REFLECT CURRENT HARDWARE.
6. FACE TO FACE DIMENSION COMPLIES WITH ASME B16.10, 4 INCH, CLASS 1500.
7. UNITS = INCHES [MM] LBS [KGS]

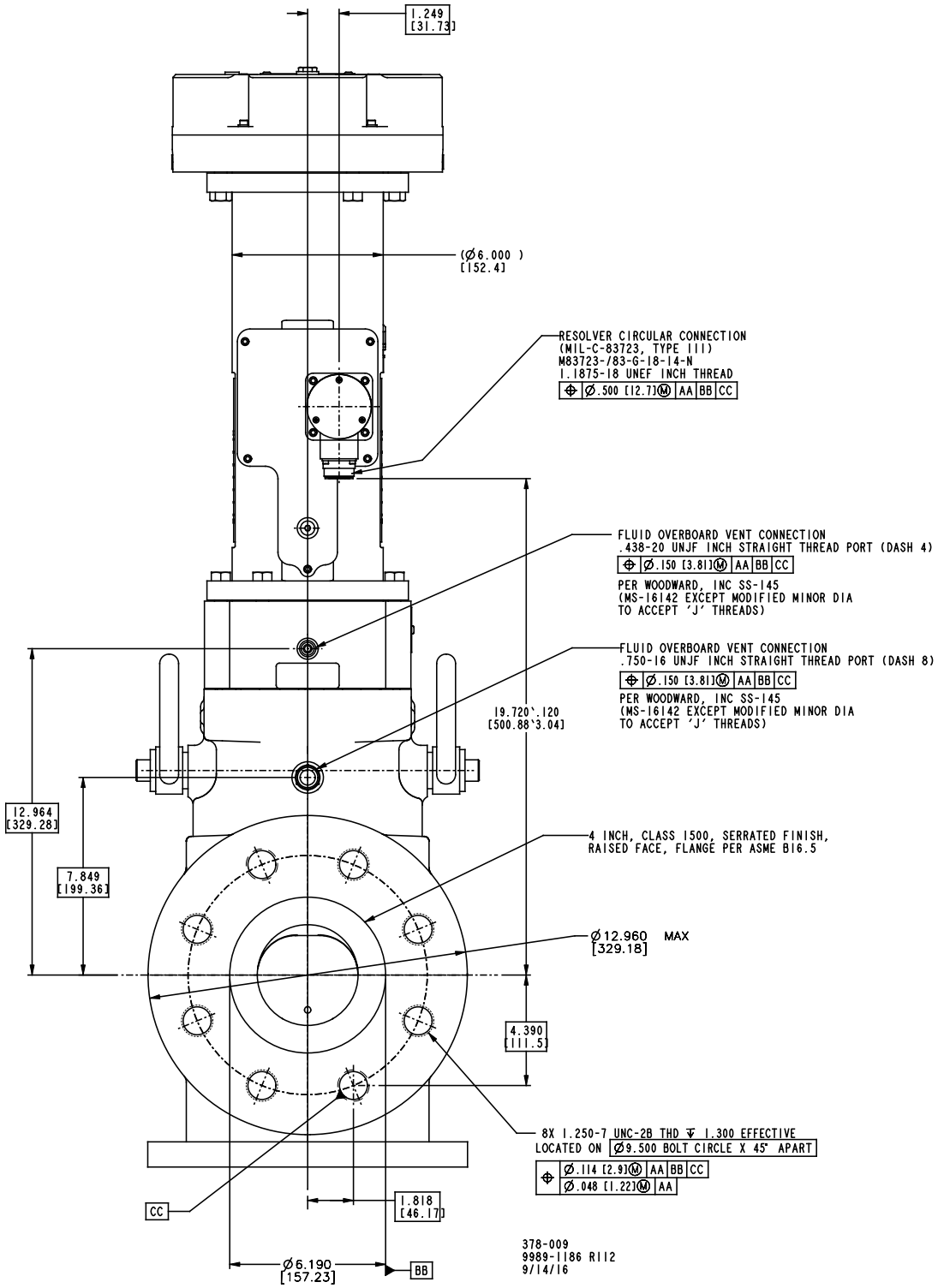



Figure 2-4a. Outline Drawing of 4" ELMV-HD and EWMV-HD

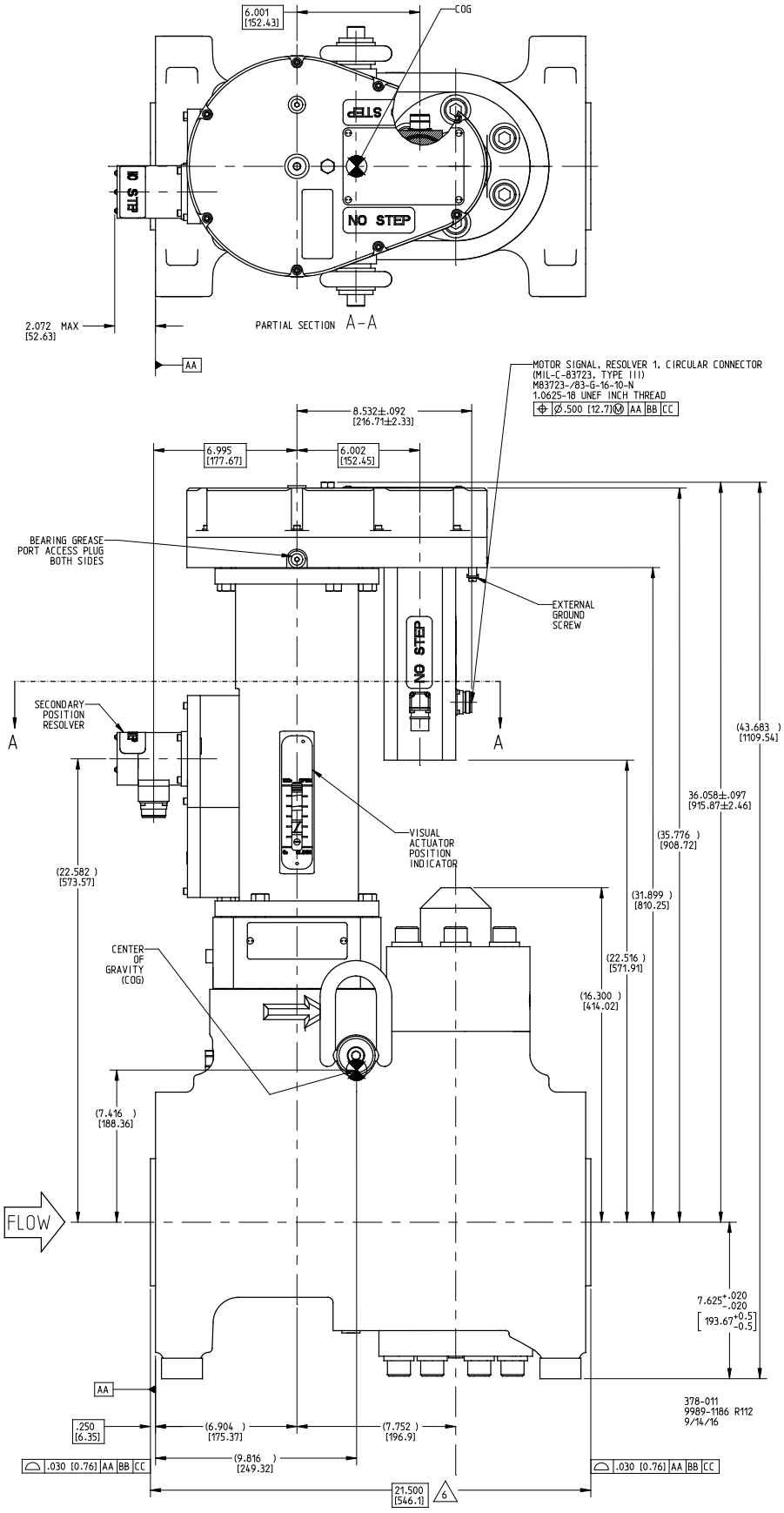



Figure 2-4b. Outline drawing of 4” ELMV-HD and EWMV-HD

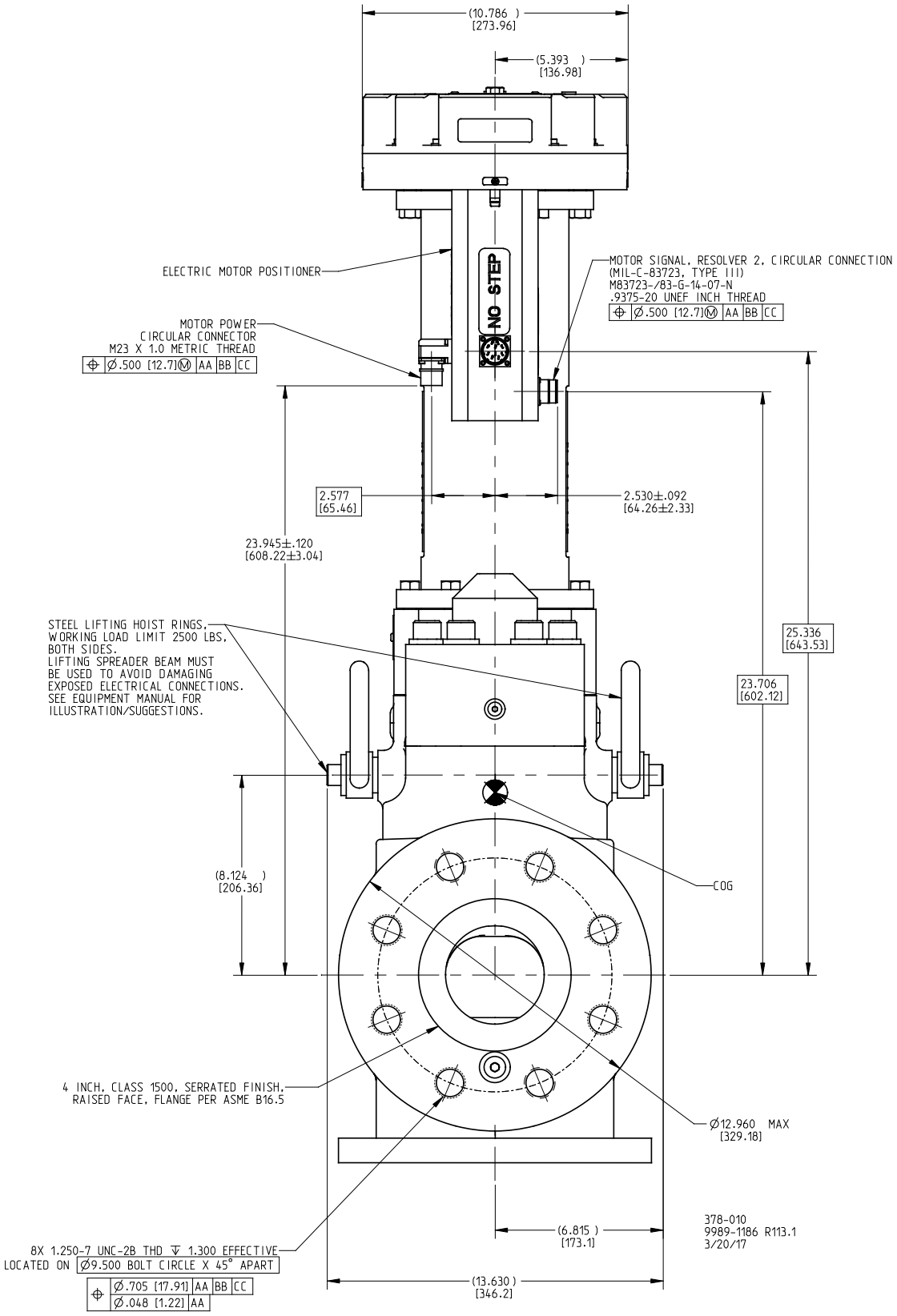



Figure 2-4c. Outline drawing of 4” ELMV-HD and EWMV-HD

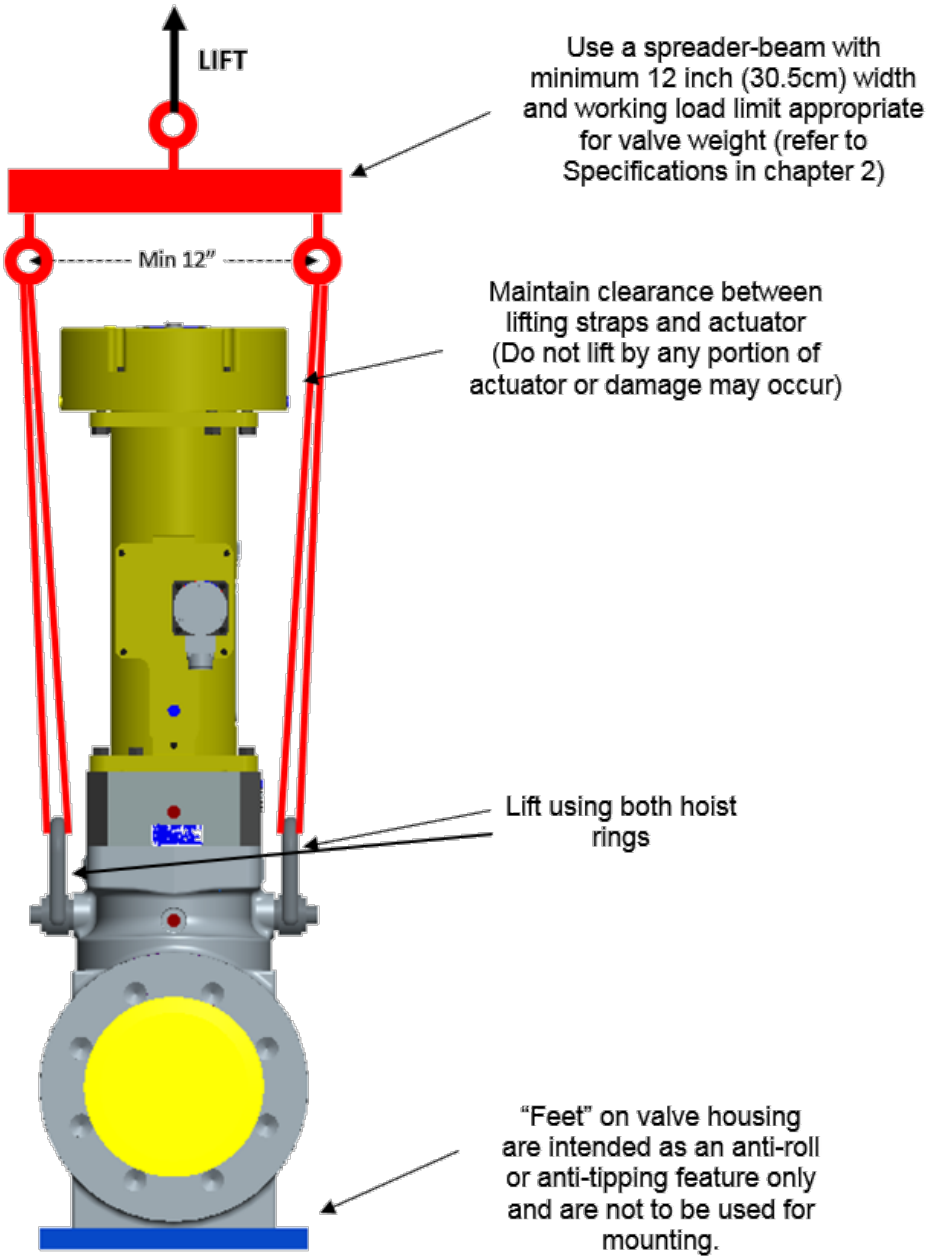



Figure 2-5. Lifting Diagram for 3" and 4" ELMV-HD/EWMV-HD

# Chapter 3.
# Installation

## General

For installation details associated with the DVP, please refer to Woodward Manual 26329 (DVP) or 26773 (DVP5000/10000).

See the outline drawings (Figures 2-1 through 2-5) for:

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

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 to be supported 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**

**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.**

**⚠WARNING**

**Due to typical noise levels in turbine environments, wear hearing protection when working on or around the Electric Metering 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.**

**⚠WARNING**

**Do not lift or handle the ELMV-HD or EWMV-HD by the actuator. Lift or handle the valve only by using the supplied eyebolt (for the 2" valve), or using the supplied hoist rings (for the 3" valve and the 4" valve) and a spreader-beam to avoid damaging exposed electrical connections. The product weight is stated in the Specifications Section. Refer to figures 2-2 through 2-4 for specific lifting information.**

**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 2-1 and 2-3) 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.

The ELMV-HD and EWMV-HD are designed for support by the piping flanges alone; additional supports are neither needed nor recommended.

ASTM/ASME grade bolts or studs should be used to install the valve into the process piping. The length and diameter for Class 1500 flanges shall conform to ASME B16.5 according to the valve flange size. 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.

## Bolt Tightening Sequence for 8-Bolt Flanges

During all of the following steps, keep any gap between flanges even all around the circumference.

1. Assemble the valve in the pipework and hand-tighten all the nuts and bolts.
2. First time around, tighten the nuts to 25% recommended torque following the sequence in Figure 3-1.
3. Second time around, tighten the nuts to 75% recommended torque following the sequence in Figure 3-1.
4. Third time around, tighten the nuts to 100% recommended torque following the sequence in Figure 3-1.
5. Continue tightening nuts all around until nuts do not move under 100% recommended torque.

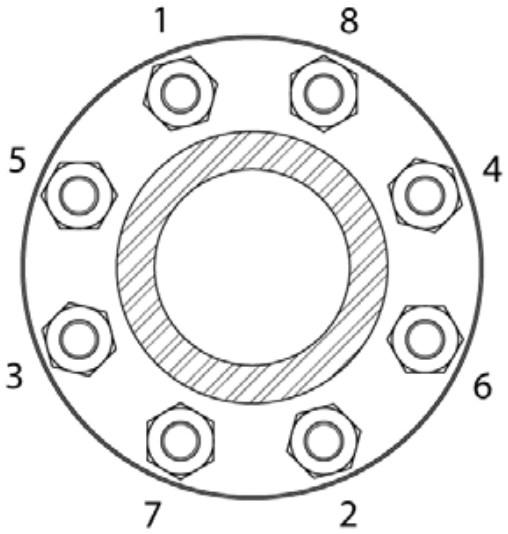



Figure 3-1. Bolt Tightening Sequence (8-Bolt Flanges)

Piping loads that can be considered “typical” have been used in the design of the housing to ensure that there is not an adverse effect from the stresses applied to the housing from the inlet and outlet piping. The loads which were used in the design of these housings are (and should not be exceeded):

Table 3-1. Piping Loads According to Valve Size

| Valve size | Max axial pipe force | Max pipe moment |
|---|---|---|
| 50 mm (2 inch) | 3600 N (809.3 lbs.) | 2200 N-m (1622.6 lb-ft) |
| 80 mm (3 inch) | 5400 N (1214 lbs) | 3300 N-m (2434 lb-ft) |
| 100 mm (4 inch) | 7200 N (1618 lbs.) | 4400 N-m (3245.3 lb-ft) |

# Electrical Connections

Connect external ground terminal of actuator to the earth ground. This must be the same grounding system as the driver's earth ground.

**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.**

**WARNING**

**The ELMV-HD and EWMV-HD are to be used only with the Woodward Digital Valve Positioner (DVP).**

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

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

Refer to the outline drawings (Figures 2-1 through 2-4) for location of grounding lug in order to properly earth ground the ELMV-HD and EWMV-HD.

**WARNING**

**Electrical circular connectors must be properly seated and tightened in order to provide correct performance, to eliminate potential shock hazard, and to maintain the ELMV-HD and EWMV-HD IP rating.**

Connect external ground terminal of actuator to the earth ground. This must be the same grounding system as the driver's earth ground.

Firmly seat all electrical connections on the appropriate connector. A seating torque of 22 inch pounds (2.5 N*m) should be applied to the power connector to ensure proper connection.

## Power Connector

The mating power cable connector shall be installed hand-tight followed by a final torque of 2.5 Nm (22 lb.-in) to meet the IP rating.

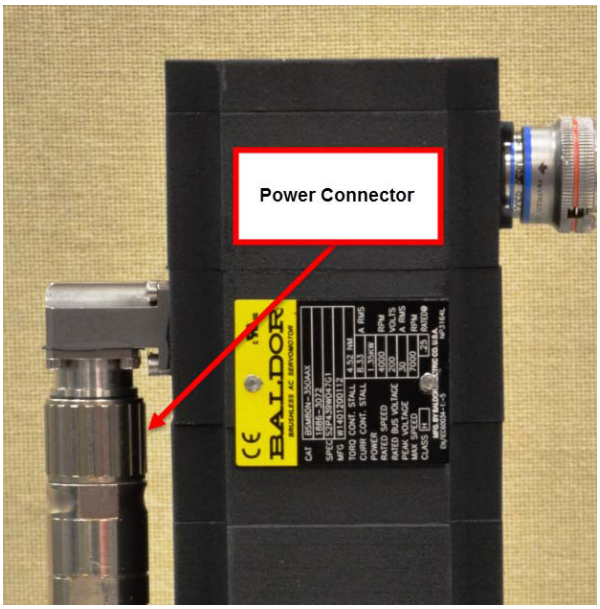



Figure 3-2. Power Connector

**Note:** Actual connector orientation on motor may appear different than that shown.

## Motor Resolver Connectors (Two Resolvers)

Install these two mating cable connectors by hand, so that the red line is no longer visible and the connector cannot be turned any further.

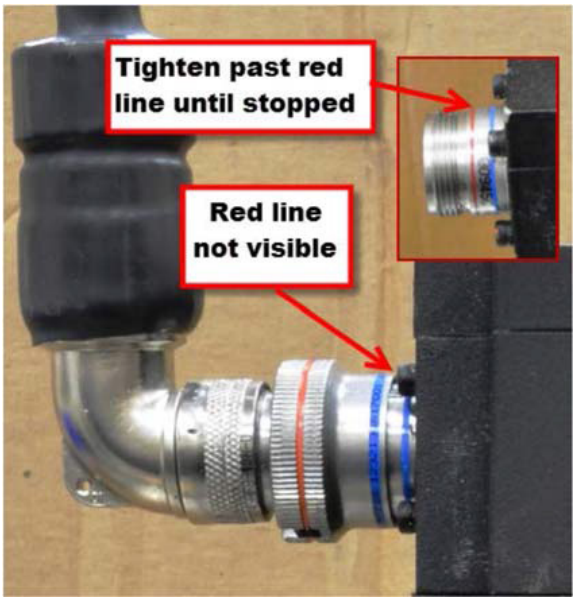



Figure 3-3. Motor Resolver Connectors

### ID Module/Shaft Resolver Actuator Connector

Install the mating cable connector by hand, so that the red line is no longer visible and the connector cannot be turned any further.

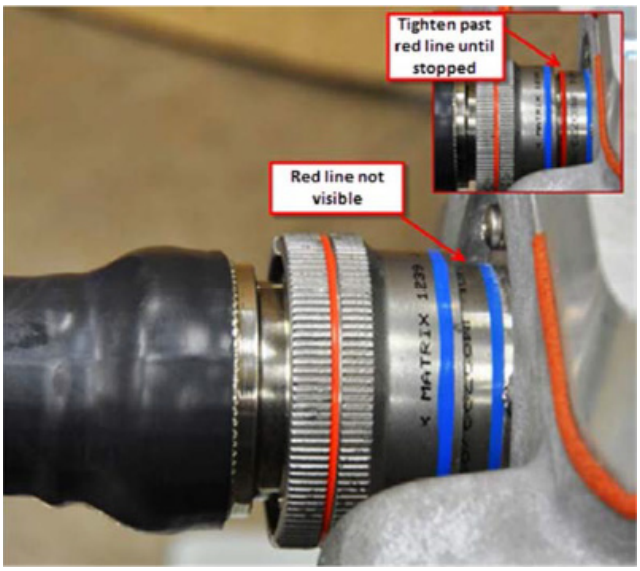



Figure 3-4. ID Module/Shaft Resolver Actuator Connector

**Note:** Actual connector orientation on motor may appear different than that shown.

## Process Fluid Overboard Vent Port

There are several process fluid overboard vent ports 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.

**⚠WARNING**

**NEVER PLUG THE VENT PORT. Plugging the vent port may cause the valve to malfunction or operate improperly. Plugging the vent port may also cause process fluid to escape to the ambient environment.**

The process fluid overboard vent port connection is in a different physical location in the 2” water and fuel metering valve (2-Inch ELMV-HD and 2-Inch EWMV-HD) as compared to the 4” water and fuel metering valves (4-Inch EWMV-HD and 4-Inch ELMV-HD) and the 3” water and fuel metering valves (3-Inch EWMV-HD and 3-Inch ELMV-HD). The difference in locations is depicted in the outline drawings (Figures 2-1, 2-2, and 2-3).

The vent system must never produce more than 50 psig (345 kPa) backpressure to the valve vent ports. 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 define the flow characteristics of the valve. Each valve must demonstrate predetermined flow characteristics before it can be shipped. This valve characteristic data is contained in the Valve’s ID module, and no additional setup steps are required.

For applications requiring extreme accuracy, add the throttling regulator characteristics to the control system to compensate for changes due to the total pressure drop across the valve. Please contact Woodward to obtain the proper control characteristic tables. These tables vary by valve part number. The control structure for using these tables is very specific. Please contact Woodward for more information about the control structure required.

**WARNING**

**Failure to use the proper tables or control structure could result in improper valve operation that could cause property damage, or personal Injury.**

## Calibration

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

## Valve/Actuator Configuration Settings

The ELMV-HD and EWMV-HD utilize a device (ID Module) containing all the configuration and calibration information that is needed to operate the valve and actuator. The Digital Valve Positioner (DVP) reads this information 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 unlikely event the configuration settings must be entered manually, the following tables outline the necessary configuration settings for the ELMV-HD / EWMV-HD. These configuration settings are broken up into three groups: User Configuration Parameters, Valve Part Number Specific Parameters, and Valve Serial Number Specific Parameters. Some of the configuration settings include factory calibration information. Please contact Woodward with the valve part number and serial number for the data containing the specific calibration and configuration settings if the need arises. Many of these parameters are accessible via the Woodward Service Tool.

### User Configuration Parameters

The User Configuration Parameters are used in the DVP to define the interface between the DVP and the turbine control system. Examples of these include the demand type selection, analog input scaling, discrete input and output configurations, etc. For a complete description of all the options for the User Configuration Parameters, please see the DVP product manual.

## Installation and Application Pre-Start Checks

Every ELMV-HD and EWMV-HD installation should include, as a minimum, the recommended checks outlined in table below.

**WARNING**

**All prime mover OEM recommendations and all required plant safety checks must always be followed and supersede any recommended actions. It is the responsibility of the end user to ensure all procedures are carried out in a safe manner.**

**WARNING**

**Never put your hands into the valve housing. There are moving components with tight clearances, and large closing forces. Valve position should only be verified by using the visual position indicator on the side of the valve actuator.**

Table 3-2. Commissioning Procedure

**Recommended commissioning procedures, electrically actuated liquid and water control valves**

| | |
|---|---|
| **Commissioning Phase: Installation**<br>(Before fuel or power are applied to system) | |
| **Wiring** | Connectors<br>Shielding<br>Point to point verification<br>Wire rating / gage / type<br>Wire routing / length<br>Power source - voltage / current<br>Power redundancy<br>Hazardous Location compliance<br>CAN termination applied correctly |
| **Physical / Mechanical Installation** | Flush system prior to installation of control valve<br>3 way shutoff valve recommended<br>Valve and DVP mounting - torque, vibration isolation<br>Pipe sizes<br>Pump flow rate / pressure<br>OBVD vents connected properly<br>Piping connections / loads<br>Flange bolt torques and seals<br>Verify product rating (Pressure, Environment, Listings<br>No piping obstructions<br>Fuel system flushing |
| **Turbine Control Integration** | Verify independent overspeed system |
| **Commissioning Phase: Pre-operational checks**<br>(Before applying fuel to system) | |
| **Wiring** | |
| **Physical / Mechanical Installation** | Verify fuel compatibility / quality |
| **Turbine Control Integration** | Configure DVP for control system<br>Verify communications<br>Verify fault and diagnostic behavior (trip setting)<br>Demand and feedback loop check 0-100%<br>Visual check of correct valve movement<br>Verify internal shutdown operation and annunciation<br>Verify independent shutdown function and annunciation<br>Recommend demand is 0% at shutdown<br>Verify low demand signal noise<br>Verify voltage at DVP within limits during full valve step<br>Verify shutdown from safety system including overspeed<br>Document and archive DVP configuration settings |
| **Commissioning Phase: Pre-start**<br>(before turbine lightoff) | |
| **Wiring** | |
| **Physical / Mechanical Installation** | Verify no leaks<br>Verify dP performance<br>Verify no signs of cavitation (audible) |

| | |
|---|---|
| **Turbine Control Integration** | Wet motor test recommended<br>Verify purge sequence operation<br>Flow rate verification (manifold pressure)<br>Verify internal shutdown operation and annunciation<br>Verify independent shutdown function and annunciation<br>Verify shutdown from safety system including overspeed |
| **Commissioning Phase: Operational** (before turbine lightoff) | |
| **Wiring** | |
| **Physical / Mechanical Installation** | Verify dP performance<br>Verify no signs of cavitation (audible)<br>Verify operating temperatures, Valve and DVP |
| **Turbine Control Integration** | Verify fuel flow stability (manifold pressure)<br>Flow rate verification (manifold pressure and/or flow meter)<br>Verify transient performance<br>Verify low demand signal noise<br>Verify fuel schedule and emissions compliance |

# Chapter 4.
# Troubleshooting

**⚠WARNING**

**Never put your hands into the valve housing. There are moving components with tight clearances, and large closing forces. Valve position should only be verified by using the visual position indicator on the side of the valve actuator.**

**⚠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.**

**⚠WARNING**

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

**⚠WARNING**

**Do not lift or handle the ELMV-HD or EWMV-HD by the actuator. Lift or handle the valve only by using the supplied eyebolt (for the 2” valve), or using the supplied hoist rings (for the 4” valve) and a spreader-beam to avoid damaging exposed electrical connections. The product weight is stated in the Specifications Section. Refer to figures 2-1 through 2-4 for specific lifting information.**

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.

**⚠WARNING**

**Do not disassemble the ELMV-HD or EWMV-HD due to dangerous forces contained in the springs. All disassembly shall be performed only by Woodward or an Authorized Service Center.**

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.

Table 4-1. Troubleshooting Procedure

| 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 |
| | Power supply inadequate | Ensure that proper voltage and current capability is provided to the DVP from the DC power supply (refer to DVP manual 26329) |
| **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. Return valve to Woodward for service. |
| | 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. |
| **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 valve to Woodward for service. |
| | Drive train failure | Return valve to Woodward for service. |
| **High overboard vent leakage** | Internal seals damaged | Return valve to Woodward for service. |
| **High minimum flow** | Damage to valve seat or plug | Remove valve and inspect flow elements. Return valve to Woodward for service. |
| | Contamination buildup in seat or plug | Remove valve and inspect flow elements. Return valve to Woodward for service. |
| | Valve not fully closed | Remove valve and verify plug is not properly seated. Return valve to Woodward for service. |
| | 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. |

| Symptom | Possible Causes | Remedies |
|---|---|---|
| **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 5.
# Safety Management – Safe Position Fuel Shutoff Function

## Safety Function

The ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve configurations listed in Table 5-1.

The ExMV-HD Electric Metering Valve configurations listed in Table 5-1 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 ExMV-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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve 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 = λSD + λSU + λDD / λTOTAL
- Where λTOTAL = λSD + λSU + λDD + λDU

The failure rates listed below, for only the ExMV-HD Electric Metering Valve, do not include failures due to wear-out of any components and are only valid for the useful lifetime of the ExMV-HD Electric Metering Valve. 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 5-1. 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 | $\lambda_{SD}$ | $\lambda_{SU}$[4] | $\lambda_{DD}$ | $\lambda_{DU}$ | # | 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 | $\lambda_{SD}$ | $\lambda_{SU}$ | $\lambda_{DD}$ | $\lambda_{DU}$ | # | 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 5-1.

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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve is 250,000 hours of operation. Under "normal" operating conditions ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve after initial installation, and after any modification of the overall safety system. No modification shall be made to the ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve.

## Installation and Site Acceptance Testing

Installation and use of the ExMV-HD Electric Metering Valve must conform to the guidelines and restrictions included in this manual.

## Functional Testing after Initial Installation

A functional test of ExMV-HD Electric Metering Valve 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 ExMV-HD Electric Metering Valve. For guidance on the functional test, see the Proof Test procedure below.

## Functional Testing after Changes

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

## Proof Test (Functional Test)

The ExMV-HD Electric Metering Valve 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 5-2. 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 ExMV-HD Electric Metering Valve to force the actuator/valve assembly to the Fail-Safe state and confirm that the Safe State was achieved and within the correct time.<br>**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 ExMV-HD Electric Metering Valve is given in the table below.

Table 5-3. 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.

# Terms and Definitions

| | |
|---|---|
| **Safety Freedom** | Freedom from unacceptable risk of harm |
| **Basic Safety** | The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition |
| **Functional Safety** | The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system |
| **Safety Assessment** | The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems |

| | |
|---|---|
| **Element** | Part of a subsystem comprising a single component or any group of components that performs one or more element safety functions |
| **Fail-Safe State** | State of the process when safety is achieved; A loss or significant decrease of inlet supply pressure establish high volume reverse flow exhaust |
| **Fail Safe** | Failure that causes the hydraulic interface valve to go to the defined fail-safe state without a demand from the process |
| **Fail Dangerous** | Failure that does not permit the SIF to respond to a demand from the process (i.e. being unable to go to the defined fail-safe state) |
| **Fail Dangerous Undetected** | Failure that is dangerous and that is not being diagnosed by automatic testing |
| **Fail Dangerous Detected** | Failure that is dangerous but is detected by automatic testing |
| **Fail Annunciation Undetected** | Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic and is not detected by another diagnostic |
| **Fail Annunciation Detected** | Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic or false diagnostic indication |
| **Fail No Effect** | Failure of a component that is part of the safety function but that has no effect on the safety function |
| **Low Demand Mode** | Mode where the safety function is only performed on demand, to transfer the EUC into a specified safe state, and where the frequency of demands is no greater than one per year and no greater than twice the proof test frequency |
| **High Demand Mode** | Mode where the safety function is only performed on demand, to transfer the EUC into a specified safe state, and where the frequency of demands is greater than one per year or greater than twice the proof test frequency |
| **Continuous Mode** | Mode where the safety function maintains the EUC in a safe state as part of normal operation |

## 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 6.
# Maintenance

## Maintenance

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

After each 3 year interval (approx. 25,000 hours of run time), the ELMV-HD and EWMV-HD valves should be removed from service and sent back to the factory to have the internal dynamic seals replaced. Dynamic seals are not serviceable in the field.

Leakage from the process fluid overboard vent port is the main indicator of the need for the dynamic seals to require replacement. If the leakage rate is at an acceptable level, there is no need to have the seals replaced. However, seal leakage rate increases exponentially as a function of operating time, so care and planning should be taken to ensure that service is done before the leakage rate exceeds maximum system parameters. Refer to the Specification Chapter for leakage rates.

Should the valve or actuator become inoperative, refer to Chapter 8 for return instructions. Do not attempt to service any part of the unit.

**⚠WARNING**

**Do not disassemble the ELMV-HD or EWMV-HD due to dangerous forces contained in the springs. All disassembly shall be performed only by Woodward or an Authorized Service Center.**

**⚠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**

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

**⚠WARNING**

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

**WARNING**

**Do not lift or handle the ELMV-HD or EWMV-HD by the actuator. Lift or handle the valve only by using the supplied eyebolt (for the 2" valve), or using the supplied hoist rings (for the 4" valve) and a spreader-beam to avoid damaging exposed electrical connections. The product weight is stated in the Specifications Section. Refer to figures 2-1 through 2-4 for specific lifting information.**

**WARNING**

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

**WARNING**

**Never put your hands into the valve housing. There are moving components with tight clearances, and large closing forces. Valve position should only be verified by using the visual position indicator on the side of the valve actuator.**

**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**

**Typical installations should include heat tracing on all process piping and the valve should be housed inside an environmentally controlled enclosure. The valves should be fully drained to avoid any freezing of process fluid during shutdown. Freezing of process fluid inside the valve may result in damage to internal components.**

**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

**CAUTION**

**Wear protective eyewear and protective gloves during this maintenance 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 6-1a).
3. Remove the ball screw port plug with a 3/16 inch hex wrench (Figure 6-1b).
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 6-1c).
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 6-1d).
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 6-1e).
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 6-1f).
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 6-1g).
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 6-1h).
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 6-1i).
14. Install the ball screw access plug and torque to 145–155 lb.-in (16.4–17.5 N·m) (Figure 6-1j).


Figure 6-1a.


Figure 6-1b.


Figure 6-1c.

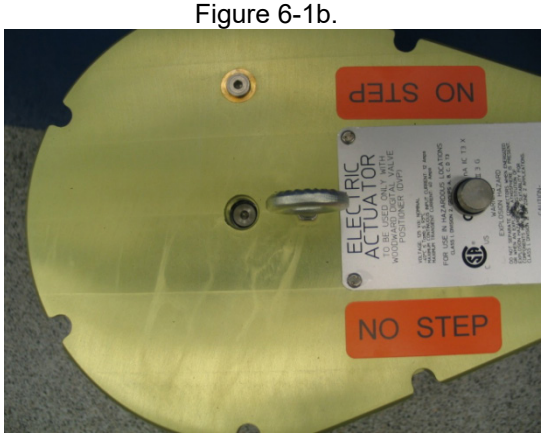



Figure 6-1d.


Figure 6-1e.

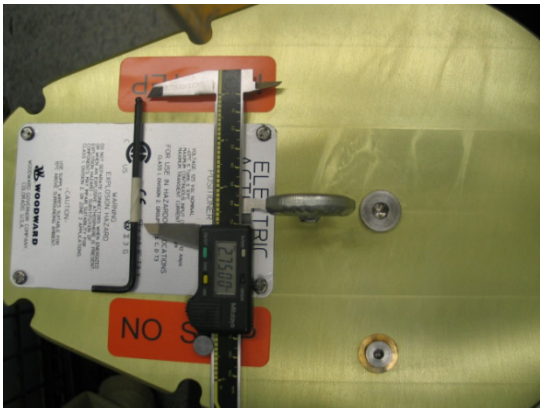



Figure 6-1f.

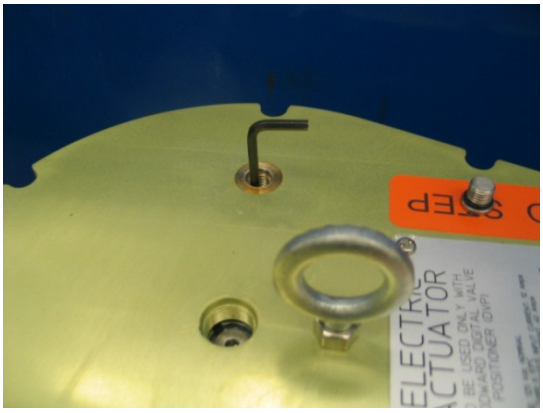


Figure 6-1g.


Figure 6-1h.

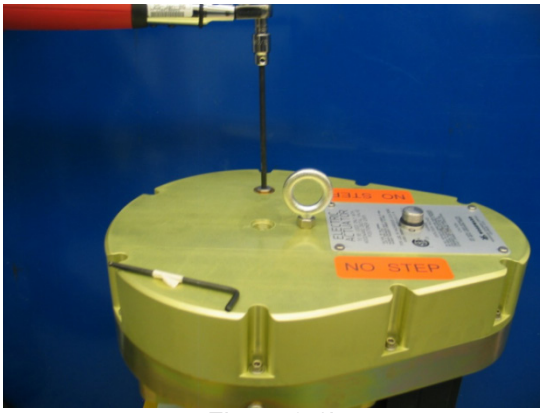



Figure 6-1i.


Figure 6-1j.

Figure 6-1. Ballscrew Lubrication Procedure

# 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 6-2a).
   **Note:** Some actuator models have bearing port plugs on both sides of the gearbox housing to allow for access from either side. For these models, the following greasing procedure only needs to be performed on one grease port. Leave the plug installed in the other port that is not being greased.
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 6-2b).
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 6-2c).

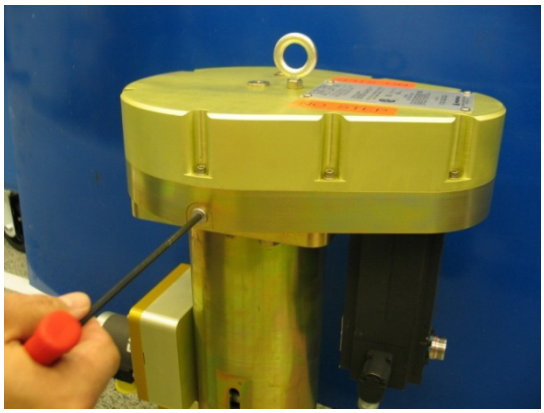


Figure 6-1a.


Figure 6-2b.

Figure 6-2c.

Figure 6-2. Bearing Lubrication Procedure

# Chapter 7.
# Long-Term Storage Requirements

## New in Original Packaging

This product is shipped from the factory in a state that can be stored outdoors for up to 1 year, or indoors for up to 4 years. For storage periods exceeding these timeframes, the product should be returned to the factory for inspection, re- conditioning and re-packaging.

## ELMV-HD/EWMV-HD Decommissioning From Service

ELMV-HD/EWMV-HD designations require a decommissioning procedure before storage. The product requires removal of process fluid that remains in the valve after removal from system. Failure to follow these procedures can result in valve damage due to freezing liquid potential inside the valve. The following procedure is applicable to all valve sizes.

## Decommissioning Process

### Required Tools and Services

- Pressurized air source and air hose with shut off valve
- Allen wrench's US Inch 3/16, 1/4, 5/16
- Adaptor fitting from air source to -4 Plug (SAE J514)
- Air nozzle or blow gun.
- Watertight catch basin – approximately 2 gallon (7.6 Liters).

**⚠WARNING**

**Do not disassemble the ELMV-HD or EWMV-HD due to dangerous forces contained in the springs. All disassembly shall be performed only by Woodward or an Authorized Service Center.**

**⚠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**

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

**WARNING**

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

**WARNING**

**Do not lift or handle the ELMV-HD or EWMV-HD by the actuator. Lift or handle the valve only by using the supplied eyebolt (for the 2" valve), or using the supplied hoist rings (for the 4" valve) and a spreader-beam to avoid damaging exposed electrical connections. The product weight is stated in the Specifications Section. Refer to figures 2-1 through 2-4 for specific lifting information.**

**WARNING**

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

**WARNING**

**Never put your hands into the valve housing. There are moving components with tight clearances, and large closing forces. Valve position should only be verified by using the visual position indicator on the side of the valve actuator.**

**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**

**Typical installations should include heat tracing on all process piping and the valve should be housed inside an environmentally controlled enclosure. The valves should be fully drained to avoid any freezing of process fluid during shutdown. Freezing of process fluid inside the valve may result in damage to internal components.**

## Procedure

1. Power down the DVP Driver and remove valve from system. The DVP will be required later to cycle the valve, and the cables can remain connected.
2. Position the ELMV-HD/EWMV-HD in the vertical position and place a catch basin under the ports shown in Figure 7-2.

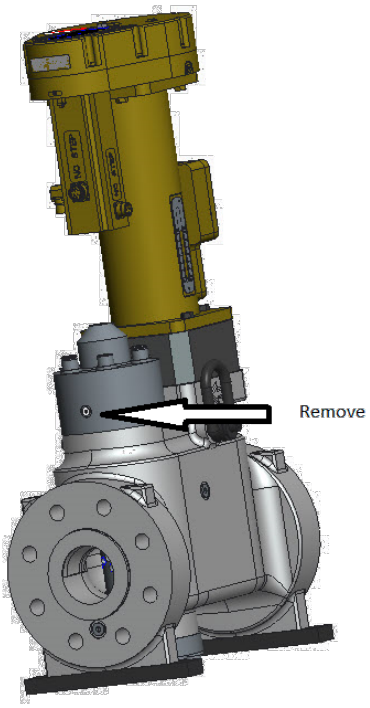



Figure 7-1. Air Blow Down Port

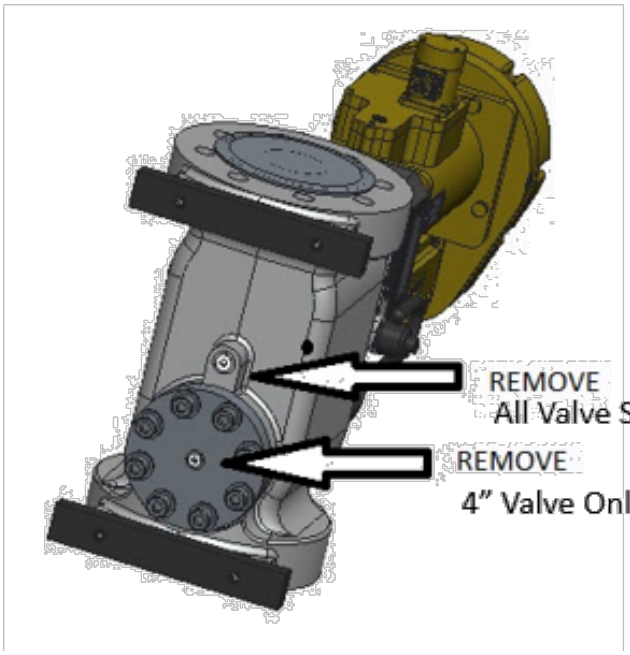



Figure 7-2. Water Drain Ports

3. Remove the -4,-6,-8 SAE fittings at locations shown in Figures 7-1 and 7-2.
4. Connect the isolated air source to the port shown in 7-1.
5. Power the DVP, and with the service tool place the valve in manual position mode.
6. Position the valve at 90% open.
7. Gradually increase airflow and pressure at the port shown in Figure 7-1. Water will begin to drain from the ports shown in Figure 7-2.
8. Cycle the valve from 90% position to 10% position a minimum of five times.
9. Maintain airflow until water ceases from the water drain ports.
10. Remove airflow and pressure.
11. Power down the DVP and Valve.
12. Remove the air source and attach an air nozzle to the air source.
13. Use pressurized air to dry the flanges and inlet/outlet areas and remove/dry any water from the exterior of the valve.

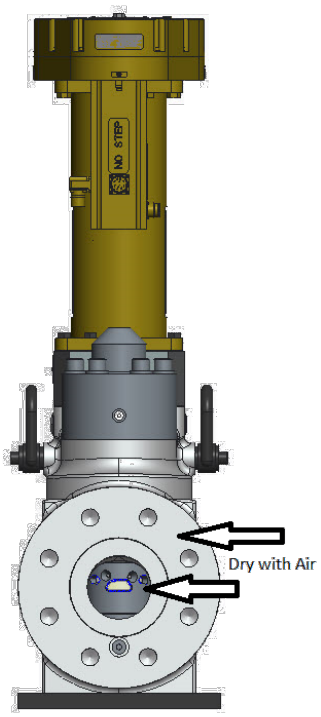



Figure 7-3. Flange Ends

14. Disconnect DVP cables.
15. Package the valve in a VCI (Vapor Corrosion Inhibitor) type bag and store in a clean dry place.

# Chapter 8.
# Product Support and Service Options

## Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

**OEM or Packager Support:** Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

**Woodward Business Partner Support:** Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.

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

## Product Service Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

**Replacement/Exchange:** Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

**Flat Rate Repair:** Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) on replaced parts and labor.

**Flat Rate Remanufacture:** Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690). This option is applicable to mechanical products only.

## Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- Return authorization number
- Name and location where the control is installed
- Name and phone number of contact person
- Complete Woodward part number(s) and serial number(s)
- Description of the problem
- Instructions describing the desired type of repair

### Packing a Control

Use the following materials when returning a complete control:

- Protective caps on any connectors
- Antistatic protective bags on all electronic modules
- Packing materials that will not damage the surface of the unit
- At least 100 mm (4 inches) of tightly packed, industry-approved packing material
- A packing carton with double walls
- A strong tape around the outside of the carton for increased strength

**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 one of the Full-Service Distributors listed at **https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner**

# Contacting Woodward's Support Organization

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

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

### Products Used in Electrical Power Systems

| Facility | Phone Number |
|---|---|
| Brazil | +55 (19) 3708 4800 |
| China | +86 (512) 8818 5515 |
| Germany | +49 (711) 78954-510 |
| India | +91 (124) 4399500 |
| 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) 8818 5515 |
| 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) 8818 5515 |
| 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

**Revision L**
- Updated EI DoC

**Revision K**
- Removed CE line under Pressure Equipment Directive
- Updated EU DoC

**Revision J**
- Revised the Pressure Equipment Directive in the Regulatory Compliance section
- Revised the EMC Directive in Regulatory Compliance section
- Replaced Declarations

**Revision H**
- Revised the following directives in the Regulatory Compliance section
  - Pressure Equipment Directive
  - ATEX Potentially Explosive Atmospheres Directive
  - ATEX Directive
- Added RoHS Directive to the Regulatory Compliance section
- Added SIL 3 Compliance to the Regulatory Compliance section
- Added Chapter 5 Safety Management
- Replaced Declarations

**Revision G**
- Replaced Max Differential Pressure with Max Forward Differential Pressure, Max Reverse Differential Pressure, and Max Cyclic Pressure to specifications table
- Added 3-inch notation in Warning box (page 24)
- Added new paragraphs and Warning box (page 26)
- Added new notes below Figures 3-2 and 3-4
- Added note to Step 2 in Lubricating the Bearing Assembly procedure (page 39)
- Added 3-inch Information to Table 3-1

**Revision F**
- Additional paragraph added to Chapter 1 Introduction
- Added 3-inch EMLV-HD information to Chapter 2
- Added 3-inch Outline Drawings to Figures 2-2a and 2-2b
- Added Flow Capability Data to Valve section of Table 2-1
- Added 3-inch Lifting Information to Figure 3-3
- Added 3-inch Information to Table 3-1
- Additional content added to Process Fluid Overboard Vent Port and Valve Characteristic sections of Chapter 3
- Renumbered existing Figures for 4-inch Outline Drawings and Lifting Information
- Replaced EU Declaration of Conformity to Declarations Section

**Revision E**
- Added Cavitation section to Chapter 1
- Added Chapter 6, Long-Term Storage Requirements
- Added 2-inch EWMV information
- Removed Options Charts from Fig. 2-1b and Fig 2-3c
- Removed notes from Fig. 2-1a and Fig. 2-3a

**Revision D**
- Certifications updated in the Regulatory and Compliance Section
- New DOI and DOC added to Declarations section

**Revision C**

- Changed ELMV and EWMV to ELMV-HD and EWMV-HD, the HD stands for High Differential
- New DOI and DOC added to Declarations section

**Revision B**

- Added new certifications to the Regulatory and Compliance section
- New DOI and DOC added to Declarations section

**Revision A**

- Changed part numbers on the cover page

# 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<br>Fort Collins, CO 80524 USA |
| **Model Name(s)/Number(s):** | Electric Liquid Metering Valve – ELMV, ELMV-HD<br>Electric Liquid Bypass Valve – ELBV, ELBV-HD<br>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:<br>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<br>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)<br>Valves:<br>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.<br>Electric Liquid Metering Valve: PED Category II<br>Electric Liquid Bypass Valve: PED Category II<br>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<br>EN 60079-15, 2010 - Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection 'n'<br>EN 61000-6-4, 2011: EMC Part 6-4: Generic Standards - Emissions for Industrial Environments<br>EN 61000-6-2, 2005: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments<br>ASME Boiler and Pressure Vessel Code VIII, Div. 2, Part 5, 2013 |
| **Conformity Assessment (PED Category II):** | PED Module H – Full Quality Assurance<br>CE-0062-PED-H-WDI 001-25-USA-rev-A Bureau Veritas SAS (0062)<br>4 Place des Saisons, 92400 COURBEVOIE, 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** | 14 April 2025 |
| **Date** | |

5-09-1183 Rev 43

**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<br>Fort Collins, CO 80524 USA |
| **Model Names:** | Electric Liquid Metering Valve – ELMV, ELMV-HD<br>Electric Water Metering Valve – EWMV, EWMV-HD<br>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.

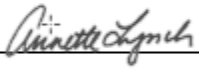
The person authorized to compile the technical documentation:

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**

**Document**: 5-09-1182 (rev. 21) **PAGE** 1 of 1

Released

**We appreciate your comments about the content of our publications.**

**Send comments to: industrial.support@woodward.com**

**Please reference publication 35032.**

B 3 5 0 3 2 : L

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**

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**Complete address / phone / fax / email information for all locations is available on our website.**