WOODWARD

Product Manual 26226
(Revision T, 11/2023)
Original Instructions

Liquid Bypass and Stop Valves

Three-way Fuel Oil Bypass Control Valve
Three-way Fuel Oil Stop Valve

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.

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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.

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

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

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

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Important Definitions

This is the safety alert symbol used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER** - Indicates a hazardous situation, which if not avoided, will result in death or serious injury.
- **WARNING** - Indicates a hazardous situation, which if not avoided, could result in death or serious injury.
- **CAUTION** - Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.
- **NOTICE** - Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT** - Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

IMPORTANT

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

Regulatory Compliance

Three-way Fuel Oil Bypass Control Valve

European Compliance for CE Marking:
These listings are limited only to those units bearing the CE Marking.

Pressure Equipment Directive: Directive Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to making pressure equipment available on the market.
PED Category II
PED Module H – Full Quality Assurance,
CE-0041-PED-H-WDI 001-16-USA, Bureau Veritas UK Ltd (0041)

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.
Zone 2, Category 3, Group II G, Ex nA IIC T4X Gc IP54

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

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

EMC Directive: Not applicable to this product. Electromagnetically passive devices are excluded from the scope of the 2014/30/EC Directive.

ATEX: Exempt from the non-electrical portion of the ATEX Directive 2014/34/EU due to no potential ignition sources per EN13463-1.

IECEx: Where IECEx compliance is claimed, suitability is the result of IECEx compliance of the individual components as follows:
Junction box per IECEx PTB 08.0006 for Ex e ia II, IIC T6, T5, T4
Servo valve per IECEx KEM 10.0041X for Ex nA IIC T3
LVDT per IECEx SIR 11.0084X for Ex nA IIC T4 Gc

EAC Customs Union
These listings are limited only to those units with labels, marking, and manuals in Russian language to comply with their certificates and declaration.

EAC Customs Union (Marked): Certified to Technical Regulation CU 012/2011 for use in potentially explosive atmospheres per Certificate RU C-US.МШ06.B.00084 as 2Ex nA IIC T4 Gc for electrical and II Gb c T3…T5 for non-electrical portions of the valve.

EAC Customs Union: Declared to Technical Regulation CU 032/2013 On the safety of equipment operating under excessive pressure. Declaration of Conformity Registration No: RU Д-US. МЮ62.B.01513

EAC Customs Union: Declared to Technical Regulation CU 010/2011 On the safety of machinery and equipment. Declaration of Conformity Registration No: RU Д-US.МШ06.B.00011

North American Compliance:
Suitability for use in North American Hazardous Locations is the result of compliance of the individual components:

Servo Valve: FM Certified for Class I, Division 2, Groups A, B, C, & D at 135 °C Ambient. For use in the United States.

CSA Certified for Class I, Division 2, Groups A, B, C, and D. Models with MS-style connectors are certified as components only for use in other equipment subject to acceptance by CSA or Inspection Authority having jurisdiction.

LVDT: CSA Certified for Class I, Divisions 1 and 2, Groups C & D. For use in Canada and the United States. Per CSA 151336-1090811

Junction Box: UL Certified for Class I, Zone 1, Group II. For use in Canada and the United States. Per UL E203312.

Three-way Fuel Oil Stop Valve

European Compliance for CE Marking:
These listings are limited only to those units bearing the CE Marking:

Pressure Equipment Directive: Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment.
PED Category II
PED Module H – Full Quality Assurance,
CE-0041-PED-H-WDI 001-16-USA, Bureau Veritas UK Ltd (0041)

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.
Zone 2, Category 3, Group II G, Ex nA IIC T4X Gc IP54

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

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

EMC Directive: Not applicable to this product. Electromagnetic, EMC, passive devices are excluded from the scope of the 2014/30/EU Directive.

ATEX: Exempt from the non-electrical portion of the ATEX Directive 2014/34/EU due to no potential ignition sources per EN13463-1.

IECEx: Where IECEx compliance is claimed, suitability is the result of IECEx compliance of the individual components as follows:
Where IECEx compliance is claimed, suitability is the result of IECEx compliance of the individual components as follows:
Proximity switch per IECEx BAS 08.0122X for Ex db IIC T6 Gb

EAC Customs Union
These listings are limited only to those units with labels, marking, and manuals in Russian language to comply with their certificates and declaration.

EAC Customs Union (Marked) Certified to Technical Regulation CU 012/2011 for use in potentially explosive atmospheres per Certificate RU C-US.МШ06.B.00084 as 2Ex nA IIC T4 Gc for electrical and II Gb c T3…T5 for non-electrical portions of the valve.

EAC Customs Union: Declared to Technical Regulation CU 032/2013 On the safety of equipment operating under excessive pressure. Declaration of Conformity Registration No: RU Д-US. МЮ62.B.01513

EAC Customs Union: Declared to Technical Regulation CU 010/2011 On the safety of machinery and equipment. Declaration of Conformity Registration No: RU Д-US.МШ06.B.00011

North American Compliance:
Suitability for use in North American Hazardous Locations is the result of compliance of the individual components:

Proximity Switch: CSA Certified for Class I, Groups A, B, C, & D. For use in Canada and the United States. Per CSA 1372905.

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

Field Wiring must be suitable for at least 82 °C.

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

The risk of electrostatic discharge is reduced by permanent installation of the valve, proper connection to the protective earth (PE) terminals, and care when cleaning. The valve should not be cleaned unless the area is known to be non-hazardous.

⚠WARNING

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

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

⚠AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.

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

Chapter 1.
General Information

Three-way Fuel Oil Bypass Control Valve

The Three-way Fuel Oil Bypass Control Valve is used to control the flow of liquid fuel to a gas turbine. The valve can be configured with either a visual indicator alone or it can include a LVDT for position feedback. In either case, the feedback is not intended for fuel control, so the valve relies on external flow measurement as a form of feedback to control the flow of fuel to the turbine. Upon loss of electrical command signal or hydraulic pressure, the valve will divert fuel to the bypass port for a safe turbine shutdown. The valve utilizes a fully integrated valve and actuator design. The design is equivalent to a dual acting electrohydraulic actuator and a three-way bypassing valve.

The fluid inlet is to the center portion of a double piston arrangement. Fuel control is accomplished by modulating the actuation/metering piston in the valve metering bushing. The metering piston is controlled by the hydraulic control pressures acting on each end of the double piston. The resulting integrating actuator is controlled closed loop via the digital control system by measuring downstream fuel flow out of the valve. A triple coil torque motor servo valve is energized by the gas turbine electronic control to modulate the hydraulic control pressures across the actuation pistons. Control pressure 1 (PC1) acts on one side of the piston, while control pressure 2 (PC2) acts on the other side of the piston. When the piston moves to the right, the valve opens and sends the fuel to the turbine port. When the piston moves to the left, the valve closes and sends the fuel to the bypass port. The metering ports in the valve/actuator bushing are precision cut using a wire EDM. This ensures that the desired Cv profile is maintained without the deadband and non-linearities associated with drilled cages.

Figure 1-1. Three-way Fuel Oil Bypass Control Valve

The fuel oil inlet is through the bottom of the valve, and the bypass and turbine ports are out the side of the valve. All inlet and outlet ports are either 2 inch (50 mm) or 3 inch (75 mm) SAE flanges per SAE J518 Code 61. All seals between the fuel oil and hydraulic oil are of a dual seal design with a vent port between the two seals. This arrangement prevents any fuel oil from leaking into the hydraulic oil as well as prevents any hydraulic oil from leaking into the fuel oil. All external seals are static elastomeric seals so there is no danger of fluid leakage to the ambient environment.

The internal metering cage and sliding metering piston are made from hardened stainless steel materials and electroless nickel plated and hardened materials respectively for wear and corrosion resistance.

Table 1-1. Fuel Oil Bypass Valve Technical Specifications

Functional Requirement	**Three-way Bypass Control Valve (3”) (9904-574 & similar)**
Valve Type	Three Way—Modulating Metering Plug
Trim Configuration	Linear—Diverging
Type of Operation	Trip—Plug Left–Inlet to Bypass Run—Plug Right–Inlet to Turbine
Number of Control Valves	1 per Engine
Fluid Ports	2 inch (50 mm) or 3 inch (75 mm) Ports per SAE J518 Code 61
Flowing Media	Light Distillate Fuel SG= 0.82 to 0.85 Viscosity = 32 to 58 SSU (1.8 to 10 cST)
Maximum Fluid Supply Pressure	1200 psig (8274 kPa)
Proof Test Fluid Pressure Level	1800 psig (12 411 kPa) minimum for 2 minutes per ANSI B16.34
Minimum Burst Fluid Pressure	6000 psig (41 370 kPa) minimum for 1 minute
Fuel Filtration Standard	25 µm at Beta 200
Fuel Temperature	0 to +200 °F (–18 to +93 °C)
Ambient Temperature	–20 to +180 °F (–29 to +82 °C)
Storage Temperature	–40 to +180 °F (–40 to +82 °C)
Dry Weight	approx. 280 lb (127 kg)
Maximum Fluid Flow Rate	300 US gal/min (1136 L/min) (inlet to either outlet port)
Flow Characteristic	Cv ±3% of Point (see installation drawing) (between 5 &100% of stroke for turbine port) (between 0 & 80% of stroke for bypass port)
Failure Mode	To Bypass on loss of electrical signal
Shut-off Classification	Standard–Less than 2 US gal/min (7.6 L/min) OR Low Leakage–Less than 1 US gal/min (3.8 L/min) to turbine port at 210 psig (1448 kPa) Standard–Less than 5 US gal/min (18.9 L/min) OR Low Leakage–Less than 3 US gal/min (11.4 L/min) to bypass port at 977 psig (6736 kPa)
Hydraulic Filtration	10 to 15 µm at Beta 75 (or 10 µm at Beta 200)
Hydraulic Pressure Proof Burst	1200 to 1900 psig (8274 to 13 100 kPa) 2850 psig (19 650 kPa) 8000 psig (55 160 kPa) (except servo)
Hydraulic Fluid Temperature	+50 to +180 °F (+10 to +82 °C)
Servo Input Current Rating	–7.2 to +8.8 mA (null bias 0.8 ±0.32 mA)
Slew Time	1.1 to 1.5 seconds in either direction (at 1600 psig hydraulic pressure)
Design Availability Objective	Better than 99.5%
Noise Emission	78 dB(A) to 91.3 dB(A) from 80% to 5% open

Three-way Fuel Oil Stop Valve

The Three-way Fuel Oil Stop Valve is a two position valve used to shut off the flow of liquid fuel to the turbine and divert it to the fuel pump suction. The valve position is controlled by a low level trip pressure acting on the pilot operated trip circuit integrated into the valve. The valve uses a failsafe spring to ensure the shutoff of fuel from the turbine on loss of hydraulic control pressure or hydraulic actuation pressure. The valve utilizes a fully integrated valve and actuator design. This design is equivalent to a single acting hydraulic actuator and a three-way shut-off valve.

The fluid inlet is to the center portion of a double piston arrangement. Fuel shut-off control is accomplished by shuttling the actuation/metering piston in the metering bushing. The piston is actuated via the hydraulic pressure acting on one side of the piston and the failsafe spring acting on the other. When the piston moves to the left, the valve opens and sends the fuel to the turbine port. When the piston moves to the right, the valve closes and sends the fuel to the bypass port.

The return spring forces the piston to move to the bypass position upon loss of hydraulic trip pressure or hydraulic supply pressure. The actuator control interface is accomplished through the hydraulic trip circuit. When the trip oil pressure drops below 22 ± 6 psid (152 ± 41 kPa) [or 600 ±100 psid (4137 ±690 kPa) in the high pressure trip version] relative to hydraulic return pressure, the three-way pilot operated valve shuttles to dump the oil from the actuation side of the piston to drain. This removes the force opposing the spring and allows the spring to force the valve to full bypass position. An integrated orifice allows the valve to have a controlled rate of opening and a faster controlled rate of closing.

Figure 1-2. Three-way Fuel Oil Stop Valve

The fuel oil inlet is through the bottom of the valve, and the bypass and control are out the side of the valve. All inlet and outlet ports are either 2 inch (50 mm) or 3 inch (75 mm) SAE flanges per SAE J518 Code 61. All seals between the fuel oil and hydraulic oil are of a dual seal design with a vent port between the two seals. This arrangement prevents any fuel oil from leaking into the hydraulic oil as well as prevents any hydraulic oil from leaking into the fuel oil. All external seals are static elastomeric seals so there is no danger of fluid leakage to the ambient environment.

The internal metering cage and sliding metering piston are made from hardened stainless steel materials and electroless nickel plated and hardened materials respectively for wear and corrosion resistance.

Table 1-2. Fuel Oil Stop Valve Technical Specifications

Functional Requirement	**Fuel Oil Stop Valve (3”) (9904-518 & similar)**
Valve Type	Three Way—Two Position Metering Plug
Trim Configuration	On/Off
Type of Operation	Trip—Plug Right–Inlet to Bypass Run—Plug Left–Inlet to Turbine
Number of Control Valves	1 per Engine
Fluid Ports	2 inch (50 mm) or 3 inch (75 mm) Ports per SAE J518 Code 61
Flowing Media	Light Distillate Fuel SG= 0.82 to 0.85 Viscosity = 32 to 58 SSU (1.8 to 10 cST)
Maximum Fluid Supply Pressure	1200 psig (8274 kPa)
Proof Test Fluid Pressure Level	1800 psig (12 411 kPa) minimum for 2 minutes per ANSI B16.34
Minimum Burst Fluid Pressure	6000 psig (41 370 kPa) minimum for 1 minute
Fuel Filtration Standard	25 µm at Beta 200
Fuel Temperature	0 to +200 °F (–18 to +93 °C)
Ambient Temperature	+50 to +150 °F (+10 to +66 °C)
Storage Temperature	–40 to +150 °F (–40 to +66 °C)
Dry Weight	approx. 300 lb (136 kg)
Maximum Fluid Flow Rate	400 US gal/min (1514 L/min) (7 psid/48 kPa) (inlet to either outlet port)
Flow Characteristic	Cv of 60 minimum (inlet to either outlet port) with 2 inch ports. Cv of 140 minimum (inlet to either outlet port) with 3 inch ports.
Failure Mode	To Bypass
Shut-off Classification	Class IV per ANSI B16.104 between turbine & inlet port and bypass to inlet port in both flow directions.
Hydraulic Filtration	10 to 15 µm at Beta 75
Hydraulic Pressure Proof Burst	1200 to 1600 psig (8274 to 11 032 kPa) 2400 psig (16 548 kPa) 8000 psig (55 160 kPa) (except servo)
Hydraulic Fluid Temperature	+50 to +180 °F (+10 to +82 °C)
Slew Time	1.5 to 2.0 seconds–Opening (at 1600 psig hydraulic pressure) 0.25 to 0.4 seconds–Closing 0.2 to 0.4 seconds for HP Trip version
Trip Pressure (relative to hydraulic return pressure) Standard Trip Version	24 ±6 psid (165 ±41 kPa)–Pickup 22 ±6 psid (152 ±41 kPa)–Dropout
Trip Pressure (relative to hydraulic return pressure) High Pressure Trip Version	750 ±100 psid (5171 ±690 kPa)–Pickup 750 ±100 psid (5171 ±690 kPa)–Dropout
Hydraulic Pressure to Actuate	100 psig (690 kPa)
Switch Rating	2 A @ 240 Vac, 0.5 A @ 24 Vdc
Design Availability Objective	Better than 99.5%

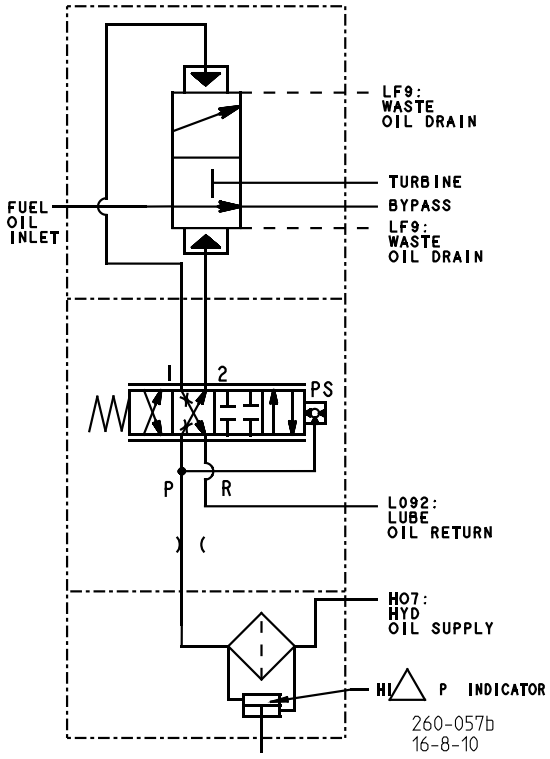


Figure 1-3a. Hydraulic Schematic Circuit—Bypass Valve

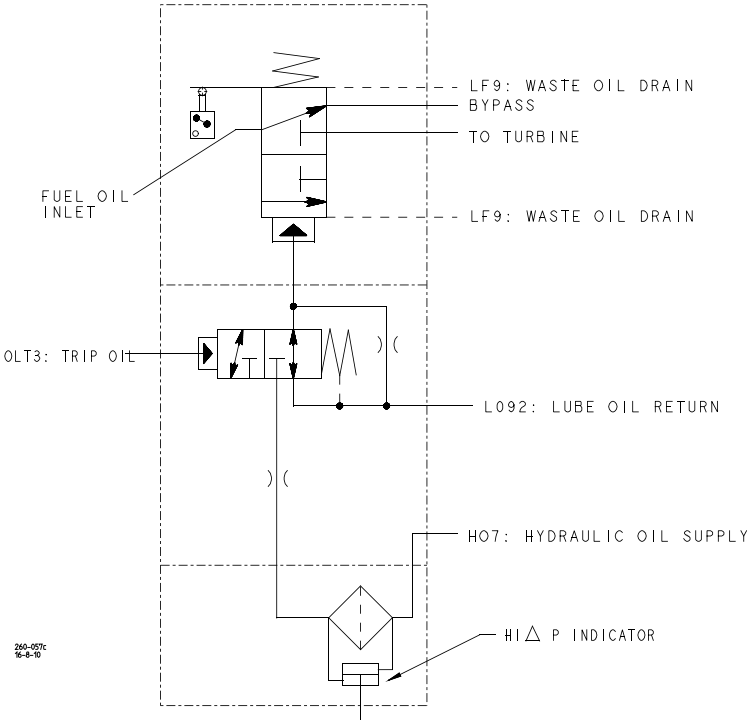


Figure 1-3b. Hydraulic Schematic Circuit—Stop Valve

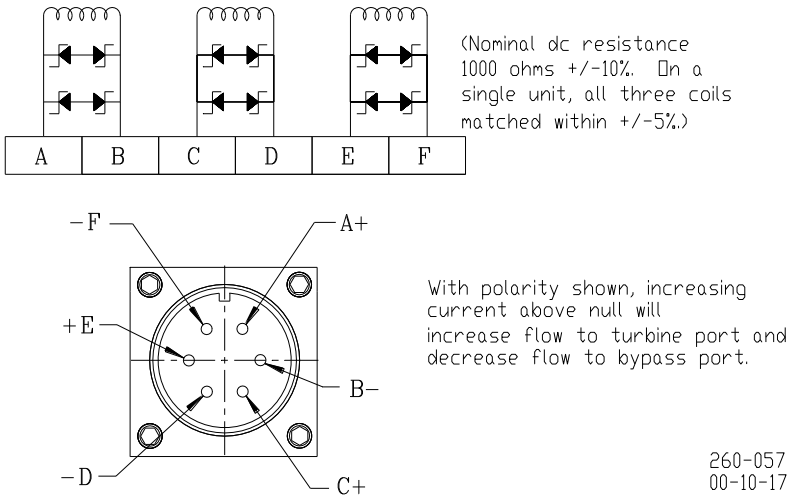


Figure 1-4a. Wiring Diagram—Bypass Valve Servo (without Optional LVDT)

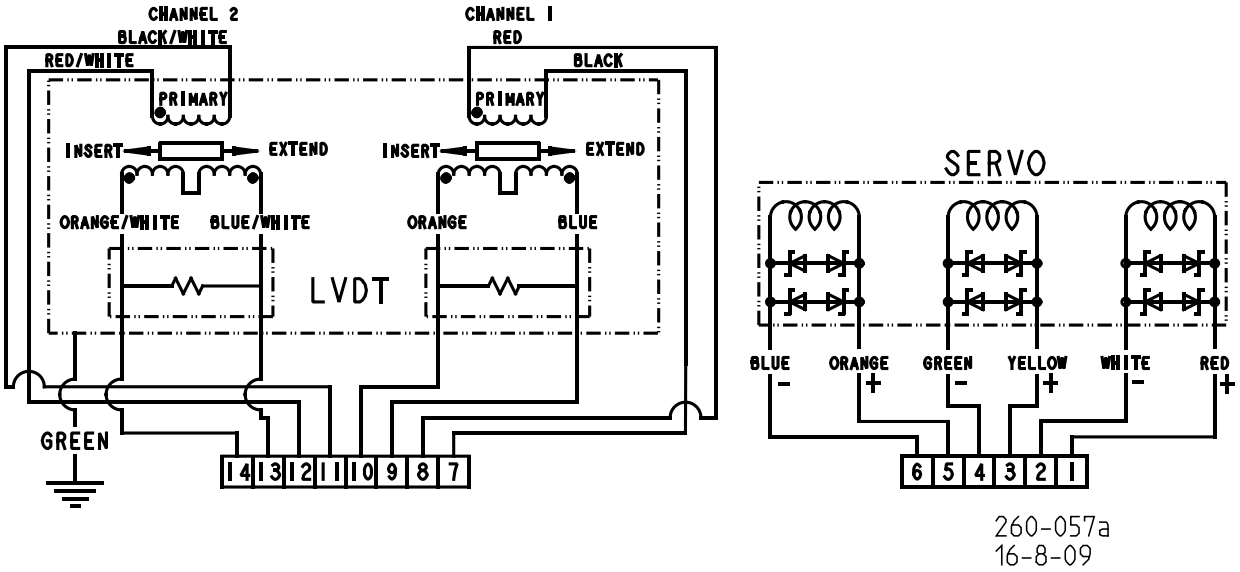


Figure 1-4b. Wiring Diagram—Bypass Valve Servo and LVDT

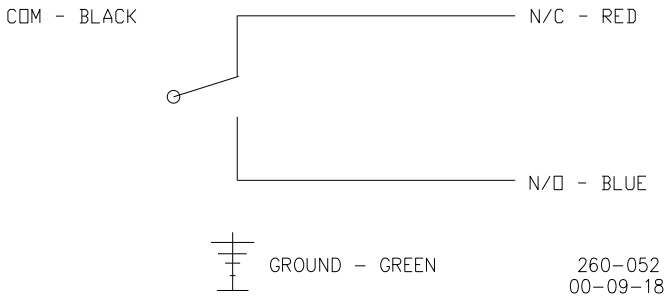


Figure 1-4c. Wiring Diagram—Stop Valve Proximity Switch

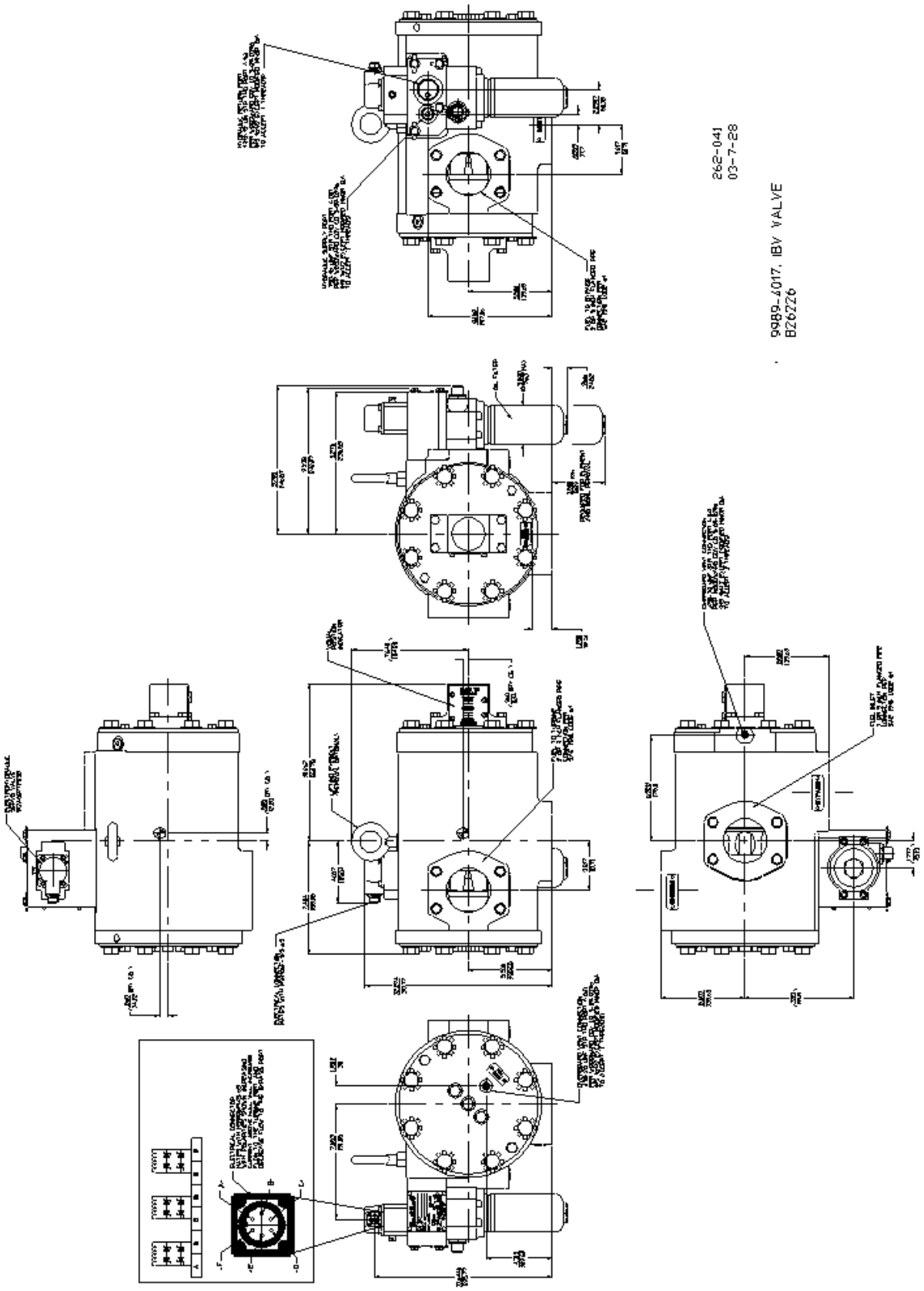


Figure 1-5a. Outline Drawing—Bypass Valve (without optional LVDT)

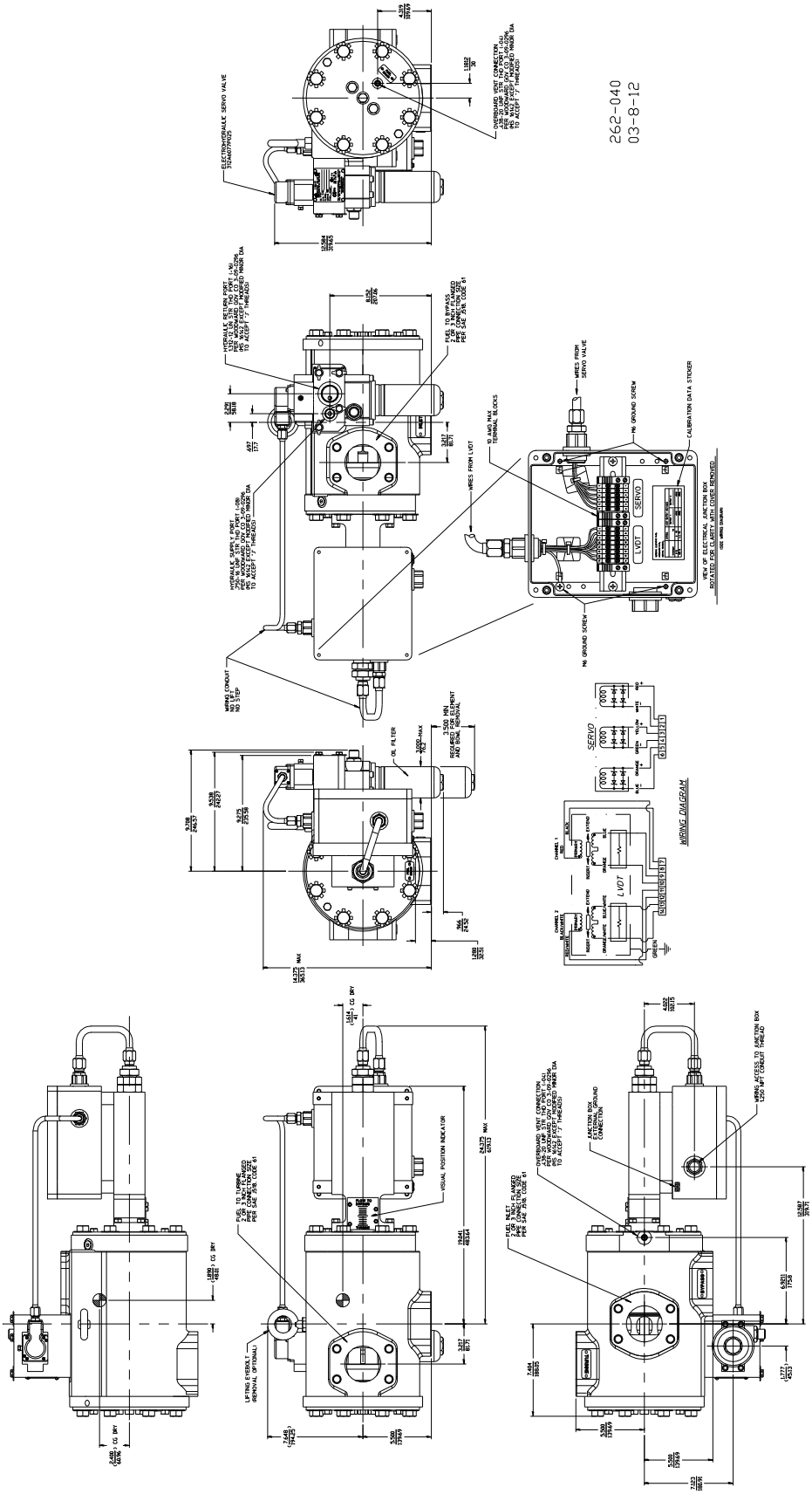


Figure 1-5b. Outline Drawing—Bypass Valve with Integrated LVDT

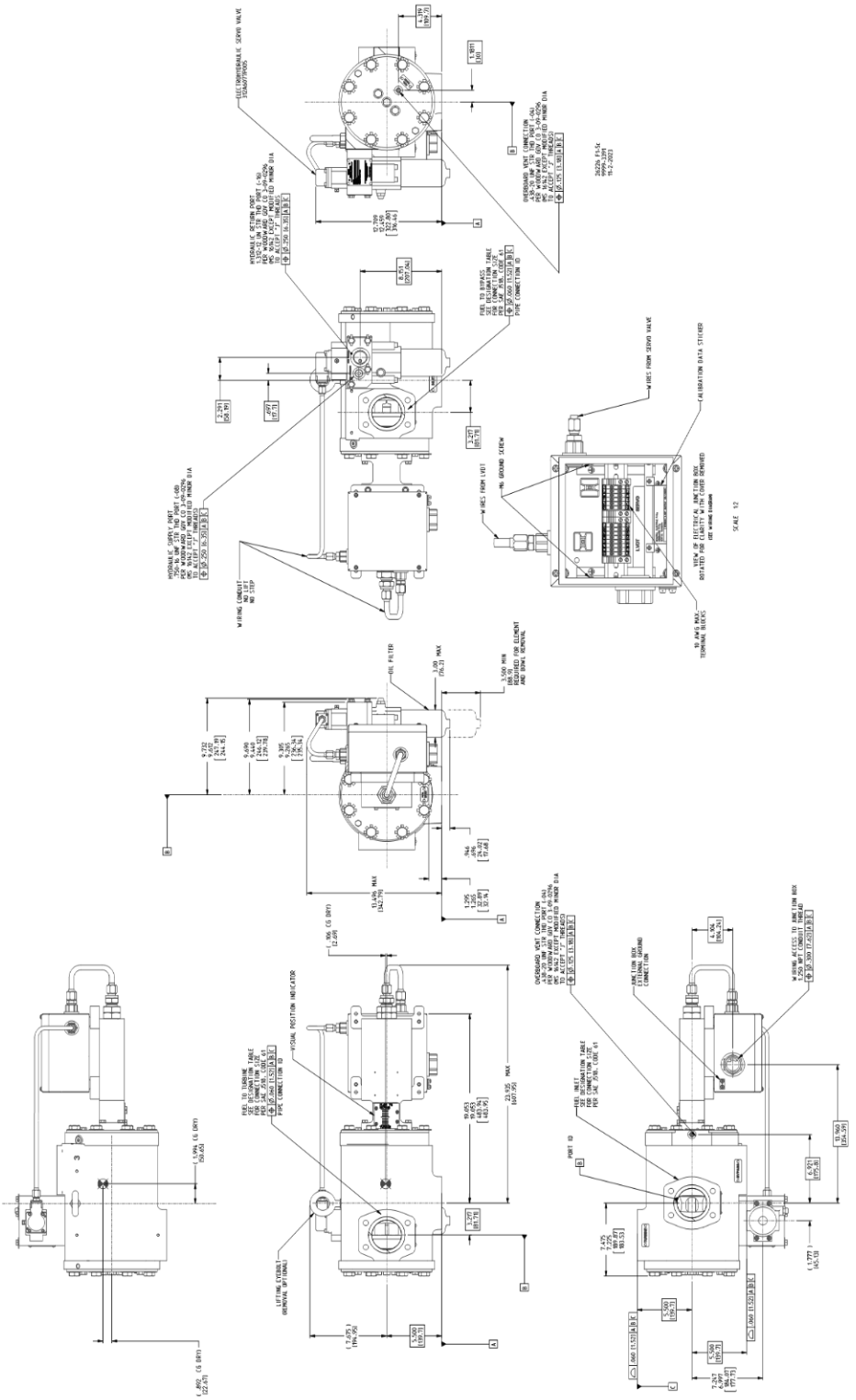


Figure 1-5c. Outline Drawing—Bypass Valve with Integrated LVDT, SST Junction Box

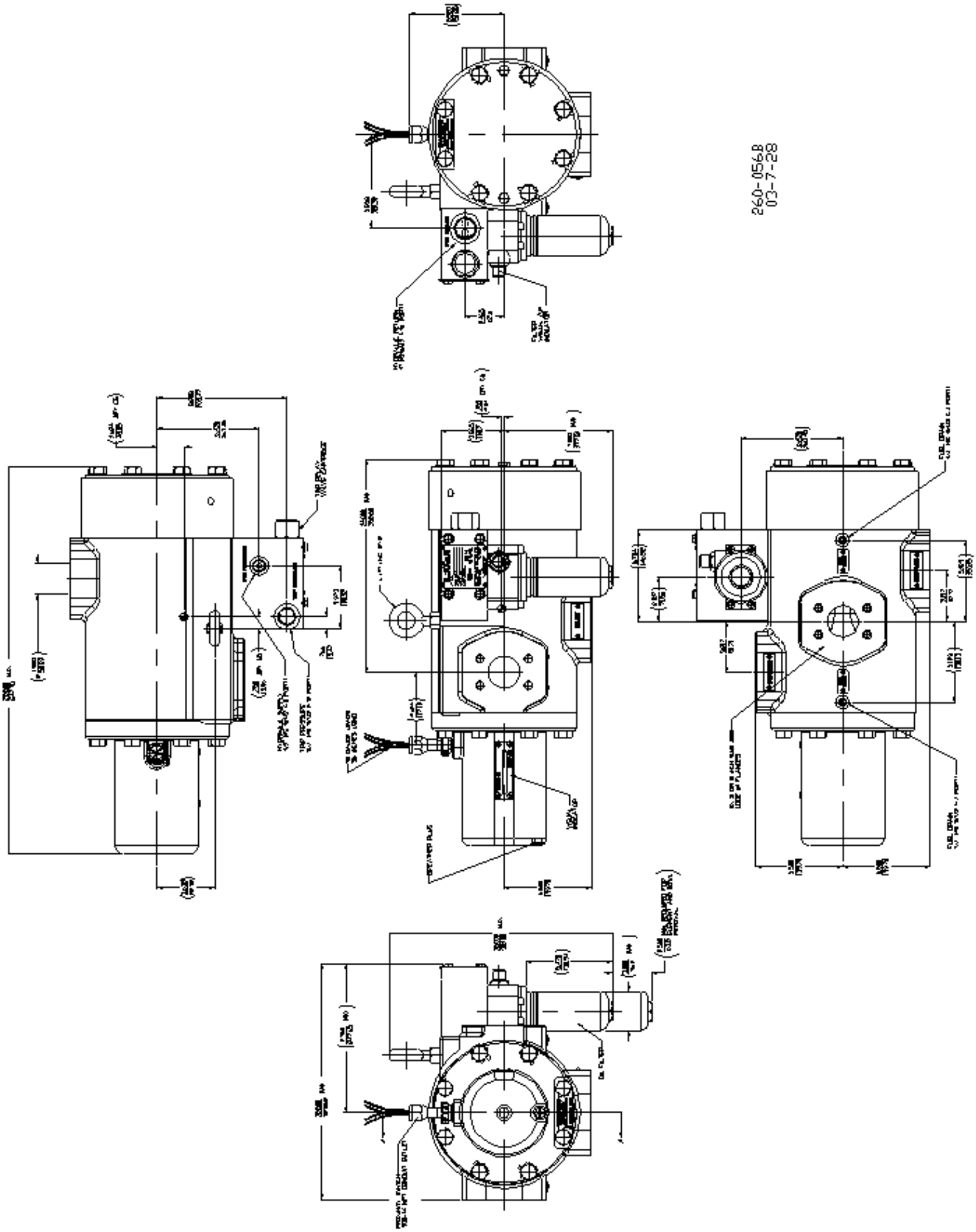


Figure 1-5d. Outline Drawing—Low Pressure Trip Stop Valve

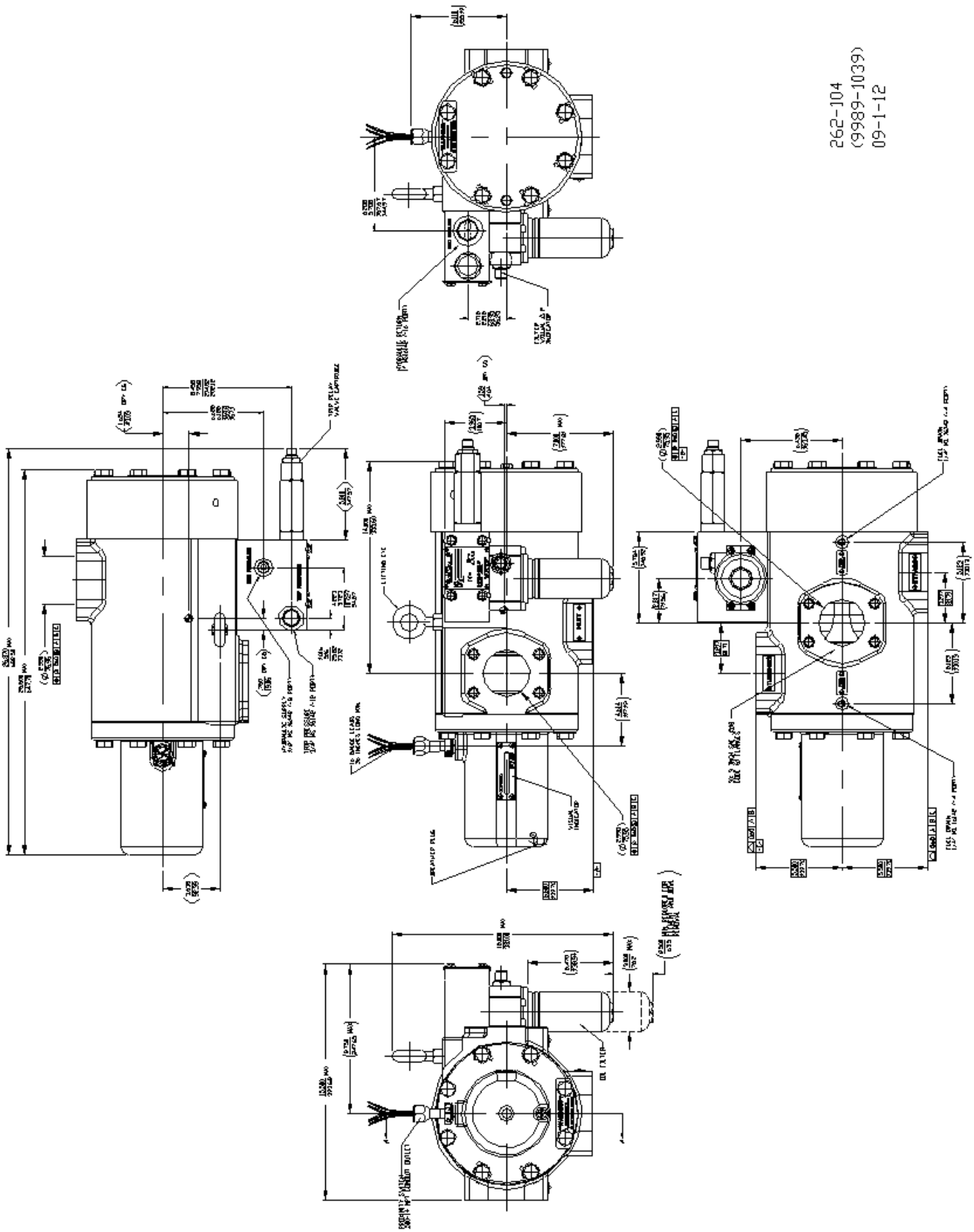


Figure 1-5e. Outline Drawing—High Pressure Trip Stop Valve

Chapter 2.
Standard Component Details

Triple Coil Electrohydraulic Servo Valve Assembly

The Three-way Bypass Control Valve utilizes a two stage hydraulic servo valve to modulate the position of the metering piston. The first stage torque motor utilizes a triple-wound coil which controls the position of the first and second stage valve in proportion to the total electrical current applied to the three coils.

If the control system requires a rapid movement of the piston to send more fuel to the turbine, the total current would be increased well above the null current. In such a condition, control port PC1 is connected to supply pressure, and control port PC2 is connected to the hydraulic drain circuit. The flow rate delivered to the left piston cavity of the actuator is proportional to the total current applied to the three coils. Thus, the opening velocity is also proportional to the current (above null) supplied to the torque motor above the null point.

If the control system requires a rapid movement of the piston to bypass more fuel, the total current is reduced well below the null current. In such a condition, port PC1 is connected to the hydraulic drain circuit, and port PC2 is connected to the hydraulic supply. The flow rate delivered to the right piston cavity of the actuator is proportional to the magnitude of the total current below the null value. Thus, the closing velocity is also proportional to the current (below null) supplied to the torque motor. The flow rate and closing velocity of the actuator is in this case proportional to the total current below the null point.

Near the null current, the four landed valve nearly isolates both control ports PC1 and PC2 from the hydraulic supply and drain, and the left and right piston pressures are balanced to maintain a constant position. The control system, which regulates the amount of current delivered to the coils, modulates the current supplied to the coil to obtain proper closed loop operation of the system.

LVDT Position Feedback Sensors

The Bypass valves use an optional dual-coil, dual-rod LVDT for position feedback. The LVDT is factory set to give 0.7 Vrms feedback at minimum position and 3.5 Vrms feedback at maximum position, when supplied with 7 Vrms excitation at 3000 Hz.

Trip Relay Valve Assembly

The Fuel Oil Stop Valve utilizes a three-way, two-position, hydraulically operated valve to switch the position of the stop valve. When the trip circuit pressure increases above 24 ±6 psid (165 ±41 kPa) [900 ±100 psid (6206 ±690 kPa) in the high pressure trip version] relative to hydraulic return pressure, the three way trip relay valve shifts position such that the common port is connected to supply pressure through a rate-limiting orifice, and isolated from the hydraulic drain circuit. Actuation pressure is routed from the control pressure circuit of the trip relay valve to the piston cavity of the actuator. This moves the piston from the fuel bypass position to the running position.

As the trip circuit supply pressure reduces below 22 ±6 psid (152 ±41 kPa) [600 ±100 psid (4137 ±690 kPa) in the high pressure trip version], the three-way trip relay valve shifts position such that the common port is connected to the hydraulic drain circuit through a rate limiting orifice, and is isolated from the hydraulic supply. As the pressure falls within the piston cavity, the return spring returns the valve plug to the bypass position within 0.4 to 0.5 second, switching the fuel circuit from the running position to the bypass position.

Position Indicator Switch Assembly

The Fuel Oil Stop Valve requires a position indication at the full bypass position. The limit switch is magnetically actuated when the ferrous target on the piston comes within the switch's sensing range.

Hydraulic Filter Assembly

The valves are supplied with an integrated, high-capacity filter. The broad range filter protects the internal hydraulic control components from large oil-borne contaminants that might cause the hydraulic components to stick or operate erratically. The filter is supplied with a visual indicator which indicates when the recommended pressure differential has been exceeded indicating that replacement of the element is necessary.

Chapter 3
Installation and Maintenance

Installation

See the outline drawings (Figure 1-5) for overall dimensions, installation hole locations, hydraulic fitting sizes, and electrical connections.

Installation attitude does not affect valve performance. A vertical position of the hydraulic filter is recommended for ease of making electrical, fuel, and hydraulic connections, and changing the hydraulic filter element. Additionally, a vertical position will prevent retention of fuel in the overboard drains.

These valves are designed for support by the piping flanges alone; additional supports are neither needed nor recommended.

⚠WARNING

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

⚠WARNING

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around these valves.

⚠WARNING

To prevent possible personal injury, always lift or move the valve using the lifting eye and a proper lifting device.

⚠WARNING

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

NOTICE

To prevent possible equipment failure, the valve must not be subjected to impact or shock loads.

NOTICE

There are two fuel drain ports on each of the Bypass and Stop valves (one port on each end) that must be vented to a safe location. During normal operation, these vents should have less than 2 cm^3/min leakage.

Hydraulic Fluid

Make provisions for proper filtration of the hydraulic fluid that supplies the valves. A 10 µm (nominal) metal filter is recommended and must be installed in the supply line to the valves. The filter included with the valves is not meant to provide adequate filtration over the life of the valves. The absolute rating of the filter should not exceed 30 µm.

Make all hydraulic connections as shown in the outline drawing (Hydraulic Supply and Hydraulic Drain). The hydraulic supply pressure should be 1200 to 1600 psig (8274 to 11 032 kPa). The drain pressure should not exceed 25 psig (172 kPa).

Electrical Connection

Make all electrical connections that are required based on the wiring diagrams (Figure 1-4).

WARNING

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

WARNING

Protective earth (PE) ground must be connected on the junction box per the installation drawing to reduce the risk of electrostatic discharge in an explosive atmosphere.

NOTICE

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

The use of cable with individually shielded twisted pairs is recommended. All signal lines should be shielded to prevent picking up stray signals from nearby equipment. Installations with severe electromagnetic interference (EMI) may require shielded cable run in conduit, double-shielded wire, or other precautions. Connect the shields at the control system side or as indicated by the control system wiring practices, but never at both ends of the shield such that a ground loop is created. Wires exposed beyond the shield must be less than 2 inches (51 mm). The wiring should provide signal attenuation to greater than 60 dB.

The Three-way Liquid Fuel Bypass Control Valve's servo valve cable should consist of three individually shielded twisted pairs. Each pair should be connected to one coil of the servo valve as indicated in Figure 1-4.

LVDT Calibration

Inside the electrical enclosure of the valve, there is an adhesive label that contains the appropriate valve position (as a percent of full stroke), the physical stroke (inches), and the corresponding LVDT feedback signals. The LVDTs are factory set to correspond to the correct percentage stroke and should not be readjusted to the minimum position as is common with other products. Due to the valve overtravel, the maximum and minimum positions of the valve correspond to above and below 100% and 0% stroke positions respectively. If the LVDTs are ever replaced or adjusted, the procedure in the Replacement of Standard Components section must be followed to maintain flow accuracy. The following chart shows the relationship between stroke, physical travel, and the LVDT signal for a typical valve.

After the control system has been connected, verify that the valve moves to the proper positions by commanding the control to 0% and 100%, and visually check the physical positions. See Figure 3-1.

Long Term Storage

In order to protect the valve from damage caused by rust or corrosion, certain storage procedures must be followed when the valves must be stored for long periods.

Use rust- and oxidation-inhibiting oil such as Texaco Regal R & O oil, or other oil that meets US MIL-H-17672 (hydraulic fluid, petroleum inhibited) specifications, to coat all internal surfaces of the device. If the valve is operated with oil other than rust- and oxidation-inhibiting oil, flush the unit with rust- and oxidation-inhibiting oil during operation before storage.

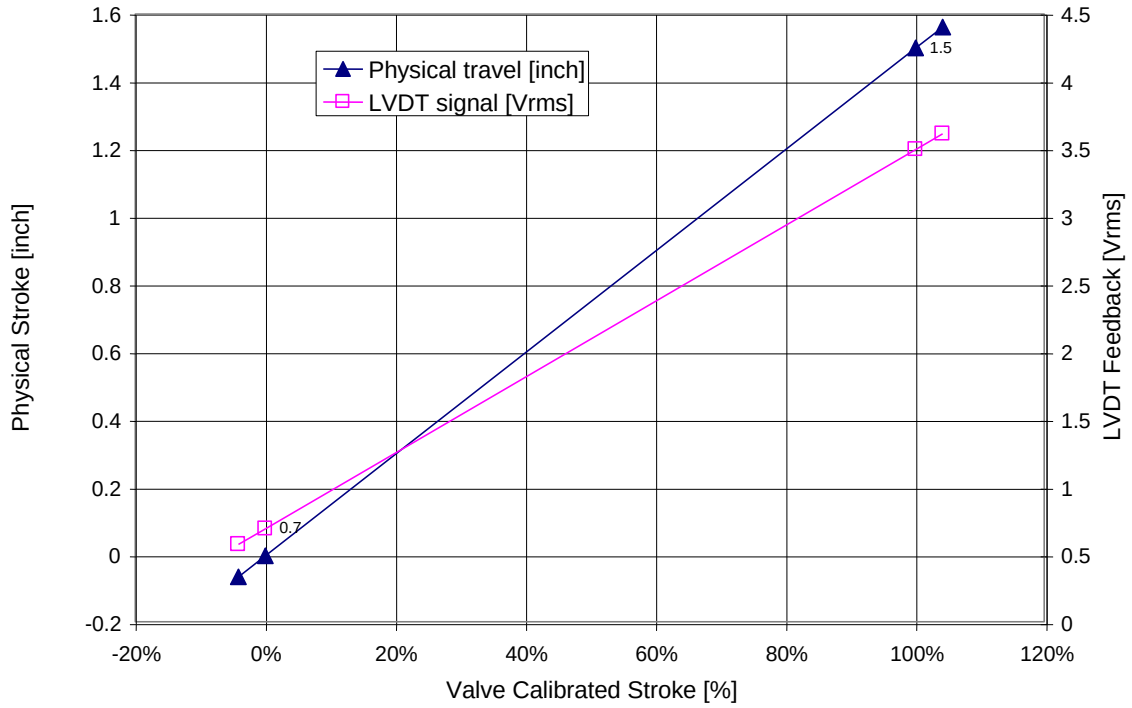


Figure 3-1. Physical Travel and LVDT Signal vs Valve Stroke for Typical Valve

Plug all external openings to prevent contamination by solvents, cleaning agents, moisture, or other elements.

Wrap the valve in a cushioning material to prevent projections, sharp corners, and sharp edges from damaging the barrier bag.

Enclose the valve in a barrier bag just large enough to fully enclose it. Enclose the valve in a second heat-sealed barrier bag of the same material as the inner bag with the calculated amount of desiccant.

Calculate the amount of desiccant required by using the following formula:

U = AC + DX

where:

U = The number of units of desiccant required
A = Area (square inches) of barrier material to be used
C = 0.011
D = The number of pounds of packing material, other than metal, used within the barrier
X = 8 for cellulosic material, including wood, use as packing material. See US MIL-P-116 for other materials.

Use desiccants which meet the requirements of US MIL-D-3464 Type I or Type II. One producer of such desiccants is the Eagle Chemical Company, Inc.

Position the desiccant in bags of standard unit size and in appropriate locations in order to expose all voids in the valve to the dehydrating action of the desiccant.

Use a heat-sealable barrier bag that meets the requirements of Type I material per US MIL-B-22191 (latest revision).

Visually inspect the barrier material to see if the heat seal is complete and that no tears or damages are present. Pad the storage or shipping crate sufficiently to prevent tearing the barrier material.

Maintenance

⚠WARNING

Any cleaning by hand or with water spray must be performed while the area is known to be non-hazardous to prevent an electrostatic discharge in an explosive atmosphere.

The Bypass and Stop valves require no maintenance or adjustment for operation. However, if excessive leakage is detected from either of the fuel drain ports, consider valve replacement or overhaul by an authorized Woodward repair facility.

Woodward recommends routine checks of the DP gauge on the filter assembly to verify that the filter is not partially clogged. If the DP indicator shows red, the filter element needs to be replaced.

If any of the standard components (see Section 2) of the valve become inoperative, field replacement is possible. See the detailed replacement instructions that follow.

Replacement of Standard Components

⚠WARNING

To prevent possible serious injury, be sure all electric power, hydraulic pressure, and fuel pressure has been removed from the valve before maintenance or repairs are to begin.

⚠WARNING

To prevent possible personal injury, do NOT remove the spring cover (which is spring-loaded to 1000 lb/4448 N).

See the outline drawing (Figure 1-5) for the location of items.

Hydraulic Filter Assembly/Cartridge

The hydraulic filter on both valves is located on the bottom of the hydraulic manifold (Figure 1-5).

Replacement of Filter Assembly:

1. Remove the four .312-18 socket head cap screws.
2. Remove the filter assembly from the manifold block. The filter will contain a large amount of hydraulic fluid—be cautious when handling.
3. Verify that two O-rings are present in the interface between the filter and the manifold.
4. Obtain a new filter assembly.
5. Verify that two new O-rings are present in the new filter assembly.
6. Install the filter onto the manifold assembly. Be sure to place the filter in the correct orientation (Figure 1-5).
7. Install four .312-18 cap screws through the filter and torque them into the manifold to 18-22 lb-ft (24.4–29.8 N·m).

Replacement of Filter Cartridge:

1. Loosen and remove the bowl from the filter assembly by turning counter clockwise (CCW).
2. The filter bowl will contain a large amount of hydraulic fluid—be cautious when handling.
3. Remove the filter element by pulling straight down from the rest of the assembly.
4. Obtain a new filter element.
5. Lubricate the O-ring on the ID of the cartridge with hydraulic fluid.
6. Install the cartridge into the assembly by sliding the open end of the cartridge onto the nipple.
7. Re-install the filter bowl onto the assembly by turning clockwise (CW). For steel filter bowls (Western or Donaldson) see Figure 3-2, tighten the bowl by hand only. For aluminum filter bowls with face seal O-ring see Figure 3-3, tighten the bowl to 30-35 lb-ft.

Figure 3-2. Steel Filter Bowl

Figure 3-3. Aluminum Filter Bowl

Trip Relay Valve Cartridge

The trip relay valve cartridge of the stop valve is located in the hydraulic manifold block (Figure 1-5).

1. Using a 1-1/2 inch wrench (approx. 38+ mm), loosen the trip relay valve from the hydraulic manifold.
2. Slowly remove the cartridge from the manifold. There could be a substantial amount of hydraulic fluid upon removal—be cautious when handling.
3. Obtain a new trip relay valve cartridge and verify the part number and revision with the existing unit.
4. Verify that all O-rings and backup rings are present on new cartridge (kit available, including all cartridge O-rings and backup rings, if required).
5. Lubricate the O-rings with hydraulic fluid or petroleum jelly.
6. Install the cartridge into the manifold housing.
7. Torque to 80–90 lb-ft (108–122 N·m).

Servo Valve

The servo valve of the liquid bypass valve is located on the hydraulic manifold directly above the filter assembly (Figure 1-5a and 1-5b).

For Valves without LVDT and Junction Box:

1. Disconnect the servo valve connector.
2. Remove the four #10-32 UNF socket head cap screws holding the servo valve to the manifold.
3. Verify that all four O-rings are removed from the interface between the manifold and the servo valve.
4. Obtain a replacement servo valve and verify the part number and revision with the existing unit.
5. Remove the protective plate from the replacement servo valve and verify that there are O-rings on all four counter bores of the servo valve.
6. Place the replacement servo valve onto the hydraulic manifold. Be sure to orient the servo valve to match the original orientation. Be sure that all four O-rings remain in their proper location during assembly.
7. Install four #10-32 UNF socket head cap screws and torque to 32–35 lb-in (3.6–4.0 N·m).
8. Connect the servo valve connector.

For Valves with LVDT and Junction Box:

1. Remove the cover to the electrical junction box.
2. Disconnect the servo valve wires from the connector blocks labeled 1-6.
3. Loosen the conduit fittings from the electrical box and the servo valve.
4. Carefully remove the conduit from the servo valve and pull the wiring out of the conduit.
5. Remove the four #10-32 UNF socket head cap screws holding the servo valve to the manifold.
6. Verify that all four O-rings are removed from the interface between the manifold and the servo valve.
7. Obtain a replacement servo valve from Woodward and verify the part number and revision with the existing unit.
8. Remove the protective plate from the replacement servo valve and verify that O-rings are on all four counter bores of the servo valve.
9. Place the replacement servo valve onto the hydraulic manifold. Be sure to orient the servo valve to match the original orientation. Be sure that all four O-rings remain in their proper location during assembly.
10. Install four #10-32 UNF socket head cap screws and torque to 55–60 lb-in (6.2–6.8 N·m).
11. Install wiring through the conduit and into the electrical box.
12. Connect the conduit to the servo valve and torque to 22–25 lb-ft (30–34 N·m).
13. Torque the conduit to the electrical box to 22–25 lb-ft (30–34 N·m).
14. Install wires into the servo valve connector blocks labeled 1-6 as shown in the wiring diagram (Figure 1-4b). If it is necessary to cut wires for installation, be sure to retain at least one service loop of wiring.
15. Replace the cover onto the junction box and tighten the screws.
16. Check for external leakage upon pressurizing the hydraulic system.

LVDT

The LVDT is located on the end of the valve by the junction box. See the outline drawing (Figure 1-5b).

1. Remove the cover to the electrical junction box.
2. Disconnect the LVDT wires from the connector blocks labeled 7-14.
3. Loosen the conduit fittings from the electrical box and the LVDT.
4. Carefully remove the conduit from the LVDT and pull the wiring out of the conduit.
5. Using a 1-1/4 inch (~32– mm) wrench, remove the two 1.125-12 jam nuts from the LVDT housing.
6. Remove the LVDT from the housing.
7. Insert tool 1009-4037 into the LVDT cavity so that it engages the flats on the LVDT core rod.
8. Remove the center SAE-6 port plug from the opposite end of the valve. Use caution, as hydraulic fluid will leak out.
9. Using a 0.312 Allen wrench inserted into the open SAE-6 port to stop the piston from rotating unscrew and remove the LVDT core rod. Be sure not to mix the old LVDT core rod and body with the replacement parts.
10. If the visual position washer falls off the end of the piston, remove the visual scale and hold the washer with pliers or tweezers while installing the new LVDT core rod.

11. Install the new core rod into actuator piston using tool 1009-4037 and the Allen wrench to hold the piston. Make sure the visual position washer is properly registered on the short pilot diameter on the end of the piston. Torque to 58–78 lb-in (6.6–8.8 N·m).
12. Reinstall the center SAE-6 port plug into the opposite end of the valve. Torque to 70–80 lb-in (8–9 N·m).
13. If required, replace the visual scale, making sure not to torque the screws above 18 lb-in (2 N·m) to avoid damage to the scale.
14. Notice on the base of the core rods that one of them is labeled with an “A”. One of the core rod openings in the LVDT housing is also labeled with an “A”. Be sure that the core rod labeled with the “A” is placed in the corresponding hole.
15. Install the new LVDT into the housing and replace the two jam nuts. Do not tighten the jam nuts yet; the LVDT will need to be adjusted prior to use.
16. Carefully replace the LVDT wires back through the conduit and into the electrical box.
17. Connect the conduit to the LVDT. Do not tighten.
18. Connect the LVDT wires to the connector blocks labeled 7-14 as shown in the wiring diagram (Figure 1-4b).
19. Verify that the excitation voltage to each LVDT is 7.00 ±0.10 Vrms (measured across terminals 7 & 8 and 11 & 12).
20. Supply the actuator with hydraulics at 1200–1700 psig (8274–11 722 kPa).
21. Measure the LVDT output voltage using a high-quality digital voltmeter (select AC measurement mode).
22. Calculate the correct LVDT setpoint at the valve minimum position by the following formula: LVDT reading [Vrms] = 0.7 – 1.8667*min stroke in inches. The min stroke in inches can be found on the label inside the junction box and on the paperwork supplied with the valve.
23. With the valve at minimum position (full bypass), the output of the LVDT (measured across terminals 9 & 10 and 13 & 14) should match the value calculated above (typically 0.580 ±0.1 Vrms). If the readout is not within these specifications, adjust the LVDT in or out of the actuator by screwing the LVDT housing in or out of the top block. NOTE—a small rotation of the LVDT will cause a substantial change in the readout.
24. Once the correct value is obtained, carefully torque the bottom nut to 50–75 lb-ft (68–102 N·m). Then torque the remaining nut to 25-37 lb-ft (34–50 N·m).
25. Torque the conduit onto the LVDT to 37–45 lb-in (4–5 N·m).
26. Replace the cover to the electrical box.

Position Indicator Switch

The position indicator switch of the stop valve is located on the spring end of the valve (Figure 1-5c).

1. Disconnect the switch wires from the closest field connection point.
2. Holding the switch hex with a 1 inch wrench (approx. 25+ mm) loosen the conduit from the switch.
3. Carefully remove the conduit from the switch and pull the wiring out of the conduit.
4. Loosen the #10-32 UNF socket head cap screw clamping the locking collar and save for reuse with the new switch.
5. Using a 1 inch wrench (approx. 25+ mm), remove the switch.
6. Remove the locking collar from the switch and save for reuse on the replacement switch.
7. Obtain replacement switch and verify part number and revision with existing unit.
8. Remove two 0.625-18 jam nuts from the switch, and discard.
9. Reinstall the locking collar onto the new switch to the top of the threads by hand tightening only. The locking collar must be as high as possible on the switch to ensure that the switch can be installed to the correct depth.
10. Look into the switch port (using a flashlight or other illuminating source) and ensure that the piston step covers at least half of the port diameter. If the port diameter is not at least half covered, the stop valve is not fully closed and should be returned for factory service and repair.
11. Apply Loctite 242 to the switch threads where the threads will enter the switch port.
12. Install the replacement switch all the way into the switch port by hand tightening only until it contacts the piston step.
13. Back the switch out 3/4 turn to correctly set the sensing distance.
14. Hold the switch with a 1 inch wrench to ensure that it does not rotate during the following steps.
15. Screw the locking collar down until it contacts the housing.

16. Insert the Allen wrench into the locking collar #10-32 UNF socket head cap screw and by using the Allen wrench as a lever tighten the locking collar against the housing.
17. Torque the locking collar #10-32 UNF socket head cap screw to 32–35 lb-in (3.6–4.0 N·m).
18. Using a 1 inch wrench (approx. 25+ mm), torque the switch to 25–30 lb-ft (34–41 N·m). Ensure that the switch does not move more than one-quarter turn while torqueing. The switch's final position must be between one half and three quarters of a turn away from the piston step to ensure proper switch functioning and proper valve operation.

⚠WARNING

If the switch is less than one half turn away from the piston step, the valve could fail to close when commanded, possibly resulting in personal injury or damage to equipment.

19. Install wiring through the conduit to the field connection point.
20. Hold the switch with a 1 inch wrench (approx. 25+ mm) to ensure that it does not rotate. Connect the conduit to the switch and torque to 150 lb-ft (203 N·m) max. Ensure that the switch does not move while torqueing. The switch's final position must be between one half and one turn away from the piston step to ensure proper switch functioning and proper valve operation.

⚠WARNING

If the switch is less than one half turn away from the piston step, the valve could fail to close when commanded, possibly resulting in personal injury or damage to equipment.

21. Reconnect the switch wires to the closest field connection point.

Chapter 4.
Product Support and Service Options

Product Support Options

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

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

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

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

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

A current list of Woodward Business Partners is available at **www.woodward.com/local-partner**

Product Service Options

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

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

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

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

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

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

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

Returning Equipment for Repair

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

When shipping the item(s), attach a tag with the following information:
- Return authorization number
- Name and location where the control is installed
- Name and phone number of contact person
- Complete Woodward part number(s) and serial number(s)
- Description of the problem
- Instructions describing the desired type of repair

Packing a Control

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

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 www.woodward.com/local-partner.

Contacting Woodward's Support Organization

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

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

Products Used in Electrical Power Systems

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

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (32) 422-5551
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

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

Technical Assistance

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

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number _____

Prime Mover Information

Manufacturer _____

Turbine Model Number _____

Type of Fuel (gas, steam, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Revision History

Changes in Revision T—
- Added new Figure 1-5c “Outline Drawing—Bypass Valve with Integrated LVDT, SST Junction Box”
- Renumbered Figures 1-5d and 1-5e

Changes in Revision R—
- Changed torque values in Replacement of Filter Assembly procedure in Chapter 3
- Changed content in Steps 1 and 7 of the Replacement of Filter Cartridge section in Chapter 3
- Installed Aluminum and Steel Filter Bowl images in Figures 3-2 and 3-3, plus captions
- Updated Declarations

Changes in Revision P—
- Updated directives and certifications in compliance section
- Updated Declarations

Changes in Revision N—
- Added IECEx language to Regulatory Compliance section of the manual for Three-way Fuel Oil Bypass Control Valve and for Three-way Fuel Oil Stop Valve.

Changes in Revision M—
- Updated EAC Customs Union information

Changes in Revision L—
- Updated Declarations

Changes in Revision K—
- Updated ATEX listings (pages iv, v)
- Updated Declarations

Changes in Revision J—
- Updated Compliance information and added warnings required by ATEX changes (pages iv, v, 14, 16)
- Updated Declarations

Declarations

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

File name:	00154-04-CE-02-01
Manufacturer's Name:	WOODWARD INC.
Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Names:	Three Way Fuel Oil Bypass Valve 9904-519, 9904-558, 9904-574, 9904-575, 9904-1228, 9904-1277, 9904-1374, 9904-1375, 9904-1570, 9904-1604, 9904-1937
This product complies, where applicable, with the following Essential Requirements of Annex I:	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

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:

Position: Dominik Kania, Managing Director at Woodward Poland Sp. z o.o
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

Christopher Perkins
Full Name

Engineering Manager
Position

Woodward Inc., Fort Collins, CO, USA
Place

12 - APR - 2016
Date

Document: 5-09-1182 (rev. 16)

EU DECLARATION OF CONFORMITY

EU DoC No.:	00154-04-CE-02-03
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Name(s)/Number(s):	Three Way Fuel Oil Bypass Valves 9904-519, 9904-558, 9904-574, 9904-575, 9904-1228, 9904-1277, 9904-1374, 9907-1375, 9904-1570, 9904-1604, 9904-1937
The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:	Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment PED Category II
Markings in addition to CE marking:	Ex Category II 3 G, Ex nA IIC T4X Gc IP54
Applicable Standards:	ASME B31.3 Process Piping (2008) ASME Boiler and Pressure Vessel Code VIII (2010) EN 60079-0 :2012, Electrical apparatus for explosive atmospheres - Part 0: General Requirements EN 60079-15:2010, Electrical apparatus for explosive gas atmospheres Part 15: Type of protection 'n' EN 13463-1:2009 Non-Electrical equipment for use in potentially explosive atmospheres
Conformity Assessment:	PED Module H – Full Quality Assurance, CE-0041-PED-H-WDI 001-16-USA, Bureau Veritas UK Ltd (0041) Parklands, 825a Wilmslow Road, Didsbury, M20 2RE Manchester

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

Christopher Perkins
Full Name

Engineering Manager
Position

Woodward, Fort Collins, CO, USA
Place

26-APR-2016
Date

5-09-1183 Rev 26

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

File name: 00155-04-CE-02-01
Manufacturer's Name: WOODWARD INC.

Contact Address: 1041 Woodward Way
Fort Collins, CO 80524 USA

Model Names: Three Way Fuel Oil Stop Valve
9904-268, 9904-518, 9904-1345, 9904-1353, 9904-1605, 9904-1569, 9904-1938

This product complies, where applicable, with the following Essential Requirements of Annex I: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

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

Christopher Perkins
Full Name

Engineering Manager
Position

Woodward Inc., Fort Collins, CO, USA
Place

12-APR-2016
Date

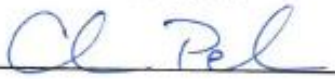
Document: 5-09-1182 (rev. 16)

EU DECLARATION OF CONFORMITY

EU DoC No.:	00155-04-CE-02-02
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Name(s)/Number(s):	Three Way Fuel Oil Stop Valves 9904-268, 9904-518, 9904-1345, 9904-1353, 9904-1605, 9904-1569, 9904-1938
The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:	Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment PED Category II
Markings in addition to CE marking:	Ⓔx Category II 3G, Ex nA IIC T4X Gc IP54
Applicable Standards:	ASME B31.3 Process Piping (2008) ASME Boiler and Pressure Vessel Code VIII (2010) EN 60079-0 :2012, Electrical apparatus for explosive atmospheres - Part 0: General Requirements EN 60079-15:2010, Electrical apparatus for explosive gas atmospheres - Part 15: Type of protection 'n' EN 13463-1:2009 Non-Electrical equipment for use in potentially explosive atmospheres
Conformity Assessment:	PED Module H – Full Quality Assurance, CE-0041-PED-H-WDI 001-16-USA, Bureau Veritas UK Ltd (0041) Parklands, 825a Wilmslow Road, Didsbury, M20 2RE Manchester

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

Christopher Perkins

Full Name

Engineering Manager

Position

Woodward, Fort Collins, CO, USA

Place

22-APR-2016

Date

5-09-1183 Rev 26

Released

We appreciate your comments about the content of our publications.

Send comments to: industrial.support@woodward.com

Please reference publication 26226.

B 2 6 2 2 6 : T

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Email and Website—www.woodward.com

Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world.

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