Released

WOODWARD

Product Manual 35163
(Revision B, 11/2022)
Original Instructions

VariStroke Power Cylinder

Installation and Operation Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, on the *publications page* of the Woodward website:

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The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to receive the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside of its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty, thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

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

Manual 35163

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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*.

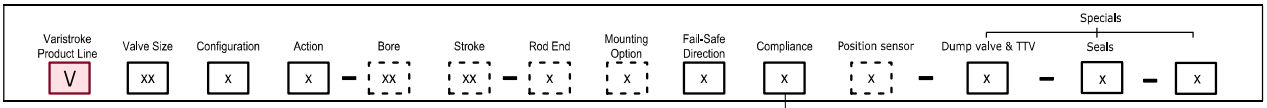
Follow these precautions when working with or near the control:

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, as these do not store static electric charges as much as synthetics.

Regulatory Compliance

Product Compliance Code: Product certifications are dictated by the product model number, and traceable per the product serial number. For information on which hazardous locations any VariStroke is rated for, refer to the model number and the Model Number Information diagram below. Find the model number on the nameplate of the VariStroke.

Model Number Information



Code	Description
S	Zone 2 Self Declared
0	CE Mark for Ordianry Location
1	Zone 1&2 / Division 1&2
2	Zone 2 / Division 2
3	Zone 1&2 / Division 1&2 / EAC
4	Zone 2 / Division 2 / EAC
5	Zone 1&2 / Division 1&2 / INMETRO
6	Zone 2 / Division 2 / INMETRO
7	Zone 1&2 / Division 1&2 / TIIS
8	Zone 2 / Division 2 / TIIS
9	Zone 1&2 / Division 1&2 / CCOE
A	Zone 2 / Division 2 / CCOE
B	Zone 1&2 / Division 1&2 / KCs Mark
C	Zone 2 / Division 2 / KCs Mark

Not all options are available for each configuration.
Please contact Woodward for more details.

European Compliance for CE Marking:
These listings are limited only to those units bearing the CE Marking. Review the Compliance Code table for more information.

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

ATEX Directive: Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres
Zone 1: II 2 G Ex db IIB T4 Gb, Sira 14ATEX1028X
Zone 2: II 3 G Ex nA IIC T4 Gc

Note: ATEX EU-Type Certificate is limited to Category 2 (Zone 1). See Declaration of Conformity for clarification.

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

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 1 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.

Pressure Equipment Directive: Compliant as “SEP” per Article 4.3 to Pressure Equipment Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making pressure equipment available on the market.

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

Other International Compliance
These listings are limited only to those units bearing the appropriate marking. Review the Compliance Code table for more information.

IECEx: Certified for use in explosive atmospheres per Certificate:
IECEx CSA 13.0041X
Zone 1: Ex db IIB T4 Gb
Zone 2: Ex nA IIC T4 Gc

CCOE (PESO) India: Certified for explosive atmospheres under Petroleum Rules 2002. Zone 1 and Zone 2 per the IECEx certificate above.

North American Compliance:
These listings are limited only to those units bearing the appropriate marking. Review the Compliance Code table for more information.

CSA: Certified for Class I, Div.1 Groups C, D T4 or Class I, Div. 2 Groups A, B, C, D T4. For Use in Canada and the United States. Certificate 2669905.

Special Conditions for Safe Use

Wiring must be in accordance with North American, European, or other international wiring methods as applicable, and in accordance with the authority having jurisdiction.

A conduit seal must be installed within 457 mm (18 inches) of the conduit entry when the product is used in Zone 1 or Class I, Division 1 hazardous locations. When a VS-I Remote Cylinder is used in Zone 1 or Class I, Division 1 hazardous locations, conduit seals are also required at the cylinder and the servo for the feedback wiring so that they are separated flameproof / explosionproof enclosures. Conduit barriers are not required for Zone 2 or Class I, Division 2 installation.

Field wiring must be suitable for at least +85 °C and 10 °C above the maximum fluid and ambient temperatures.

The maximum hydraulic oil temperature is 70 °C continuous.

The flameproof joints are not intended to be repaired. Contact Woodward for information on the dimensions of the flameproof joints, if needed. Return to Woodward for repair and maintenance.

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.

Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore, do not install the equipment in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. Proper grounding in a fixed installation mitigates this risk. In addition, only clean the equipment with a damp cloth.

Transient protection for the cylinder is provided by connection to the VariStroke servo.

The installation of the product shall only be within a Pollution Degree 2 environment as defined in IEC 60664-1.

VS-I Remote Cylinders shall only be used with Woodward VariStroke servos (e.g., VS-I, VS-GI, or VS-DX).

⚠WARNING

EXPLOSION HAZARD—Do not remove covers or connect/disconnect electrical circuits 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 applications.

⚠AVERTISSEMENT

Risque d'explosion -- Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous situez bien dans une zone non explosive.
La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, applications Division 2 ou Zone 2.

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

Table 1-1. Woodward Reference Literature

Manual 35148:	VariStroke-I Customer Service Tool
Manual 25071:	Oils for Hydraulic Controls
Manual 25075:	Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls
Manual 26455:	Woodward Energy Segment Customer Publications: Cross-Reference by Application Revision Status & Distribution Restrictions
Manual 35132:	VariStroke-DX Duplex Hydraulic Servo Skid
Manual 35133:	VS-DX VariStroke-DX Duplex Hydraulic Servo Skid, VS-GI Servo Unit Replacement Procedure
Manual 35119:	VariStroke-GI (VS-GI) Electro-hydraulic Actuator (Single Acting)
Manual 26727:	VariStroke-I (VS-I) Electro-hydraulic Actuator (Double Acting)
Manual 82715:	Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, & Modules
Manual 51629:	Observed Field Installation Issues with VariStroke-I
CMM-03002:	VariStroke-I (VS-I) Family - Bronze Level Component Maintenance Manual
Customer Service Tool Training Videos:	YouTube - Woodward Inc, Training and Products channel: https://www.youtube.com/channel/UC0Ogv5ntWU2OXxshcYYt6Mg
9927-2915	VariStroke Sizing Tool (software to select the proper size of VS based on load, supply and drain pressure, application stroke and fail direction)

Table 1-2. Abbreviations and Definitions

VSPC	VariStroke Power Cylinder
VS-I	VariStroke-I Servo Product Family (Double Acting)
VS-GI	VariStroke-I Single Acting
Customer Service Tool	The PC software providing capabilities to configure, monitor, and diagnose the VariStroke-I servo
AISF	Authorized Independent Service Facility
OVBD	Overboard Drain
DX	DX Skid – Redundant servo for critical applications

The VariStroke Power Cylinders (VSPC) have a typical construction of square head industrial hydraulic cylinders. The bottom and top plates along with the cylinder tube are clamped with threaded tie rids. These cylinders can operate as single or double acting (with or without an internal spring). Therefore, output shaft force is generated by hydraulic pressure in one direction (or both directions for double acting), while the internal spring causes or assists in the piston movement in the other direction (fail direction). The spring can be mounted either on the piston or rod side and generates force toward the failsafe position. Actuators with fail retract direction have the spring mounted on the rod side, while actuators working as fail extend have springs on the piston side.

The piston contains two bleed orifices that maintain oil circulation in the cylinder. This minimal oil flow helps to dissipate heat, especially for the cylinder working in an elevated ambient temperature.

A common problem with turbine actuators is oil leaking from the output shaft due to the connection to valve rack linkages, which have an arc-type of motion. This motion results in side-loading of the actuator shaft, and after long periods may result in shaft-seal wear and resultant oil leakage. Designed for a continuous side load of up to 10% of the actuator output, the VSPC actuators incorporate a high-force precision-bearing and triple-seal technology on its output shaft to solve this typical application problem.

The actuator's output shaft position is precisely measured by a Magnetostrictive Linear Displacement Transducer (MLDT)— an internally mounted redundant position feedback sensor.

The simple and robust design of the VSPC hydraulic cylinder is capable of consistent performance for extended periods in challenging environments. Hydraulic cylinders are designed to operate in a wide range of hydraulic pressures and ambient temperatures, and with high oil contamination.

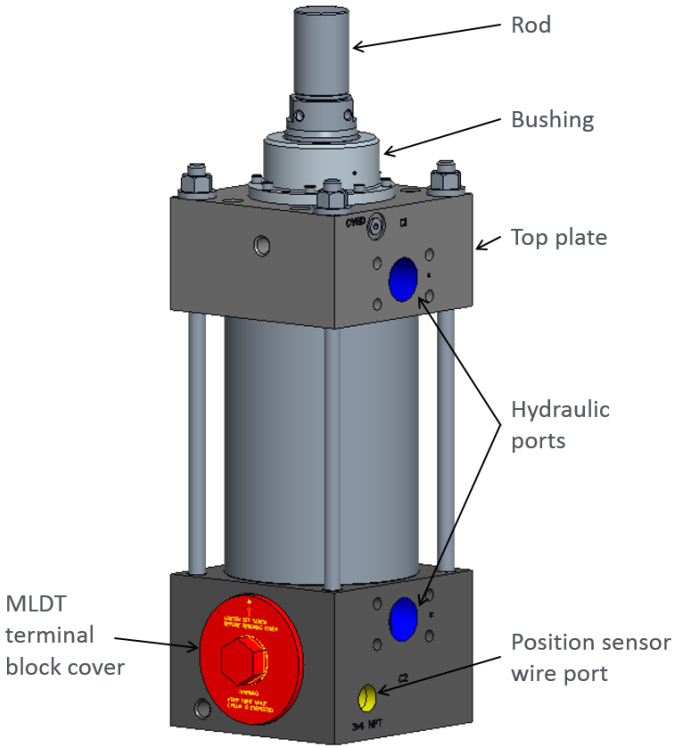


Figure 1-1. VSPC Key Features

Chapter 2. Specifications

Physical and Performance Specifications

Table 2-1. Bore and Rod Diameters

Bore Diameter (OD)	Rod Diameter (ID)
4 inches (101.6 mm)	1.75 inches (44.5 mm)
5 inches (127.0 mm)	1.75 inches (44.5 mm)
6 inches (152.4 mm)	2.5 inches (63.5 mm)
8 inches (203.2 mm)	3.5 inches (88.9 mm)
10 inches (254.0 mm)	4.5 inches (114.3 mm)

Table 2-2. Available Springs for Spring Assist Cylinders (Standard Sizes)

			Spring			
Bore in (mm)	**Stroke in (mm)**	**Spring force kgf (lbf)**	**K or S**	**L or T**	**M or U**	**N or V**
6 (152.4)	3 (76.2)	MIN	49 (108)	107 (235)	236 (520)	-
		MAX	98 (216)	214 (471)	472 (1040)	-
	4 (101.6)	MIN	49 (108)	107 (235)	236 (520)	-
		MAX	98 (216)	214 (471)	472 (1040)	-
8 (203.2)	3 (76.2)	MIN	126 (276)	240(529)	477 (1052)	883 (1946)
		MAX	231 (510)	479 (1057)	954 (2104)	1835 (4046)
	4 (101.6)	MIN	110 (242)	239 (528)	477 (1052)	918 (2023)
		MAX	247 (544)	450 (1058)	954 (2104)	1836 (4047)
10 (254.0)	3 (76.2)	MIN	201 (443)	364 (803)	744 (1640)	1156 (3430)
		MAX	321 (708)	583 (1286)	1190 (2624)	2489 (5488)
	4 (101.6)	MIN	161 (354)	291 (642)	595 (1312)	1245 (2744)
		MAX	321 (708)	583 (1286)	1190 (2624)	2489 (5488)

Table 2-3. Springs Loads (Not Standard Spring Load), Special Cylinders

VS Bore (in)	VS Stroke (in)	Part Number	Spring Force ± 10% (lbf) (Reference Spring Rate [lbf/in]) L1	L2
6	4	9907-2016	108 (27)	216
	8.346	9907-2018	100 (13)	209
	12	9907-2014	165 (30)	520
8	2.3	9907-2015	528 (176)	934

Note: L1 - spring force at cylinder fail safe position, L2 – spring force at fully open cylinder position

Table 2-4. Environmental Specifications

Ambient Temperature:	(–40 to +85) °C / (–40 to +185) °F
Vibration Resistance:	MIL-STD 810F, M514.5A, Cat. 4 (0.015 G^2/Hz, 1.04 Grms)
Shock Resistance:	US MIL-STD-810C method 516.2, procedure 1 (10 G peak, 11 ms duration, saw tooth)
Corrosion resistance:	Two-part epoxy paint coating. Designed for outdoor conditions.
Ingress Protection (IEC 60529, IEC 60079-0)	IP66

Table 2-5. Electrical Specifications

Feedback Device (integrated):	MLDT (Magnetostrictive Linear Displacement Transducer)
Input Voltage:	15 Vdc (power provided by VariStroke)
Output Signal:	Redundant analog: 4–20 mA
Cylinder Position Feedback Signals #1, 2:	(4 to 20) mA into 235 Ω. >70 dB CMRR. Common Mode Voltage Range ±50 V (dc)
Linearity:	±0.04% Full Stroke (minimum ± 50µm)
Update Rate:	≤ 1 ms
Hysteresis:	±0.1mm
Current Drain:	<100 mA per channel
Connections:	Removable terminal suitable for 0.14 to 2.5 mm² or 12 to 24 AWG stranded wire
Cable Entry for MLDT position sensor:	0.750”-14 NPT

Table 2-6. Hydraulic Specifications

Fluid Type:	Petroleum-based hydraulic fluids as well as fire resistant hydraulic fluids such as Fyrquel EHC
Minimum Supply Pressure:	3.45 bar (50 psig)
Maximum Supply Pressure:	34.5 bar (500 psig)
Proof Pressure:	51.7 bar (750 psig)
Burst Pressure:	86.2 bar (1250 psig)
Fluid Temperature:	(15 to 70) °C / (59 to 158) °F continuous
Fluid Cleanliness Level:	ISO 4406 code 20/18/16 or cleaner
Output Cylinder Action:	Single or Double Acting
Hydraulic Connections:	- Hydraulic Supply and Drain Port: 1.500 SAE Code 61 Flange - OVBD 0.438-20 UNF Straight Thread Port or - Hydraulic Supply and Drain Port: 1.000 SAE Code 61 Flange - OVBD 0.438-20 UNF Straight Thread Port (bore size 4 and 5 inch - OVBD 0.312-24 UNF)

Special Ambient Temperature Specifications / Allowances

⚠WARNING

The following information applies only to a VariStroke Power Cylinder installed in a non-hazardous (Ordinary) location. If the VSPC is installed in a Hazardous (Zones or Divisions) environment, the Special Ambient Temperature Allowances dot NOT apply. Maximum ambient and hydraulic fluid temperatures must be kept within the standard ratings.

The VSPC comes equipped with a feature that allows hydraulic fluid to constantly flow through the power cylinder during normal operation. This allows the hydraulic fluid to act as a coolant on many of the critical components. The table below shows that the VSPC can be safely operated above the standard ambient temperature rating so long as the hydraulic fluid supplied to the VariStroke Power Cylinder can be reliably maintained at the specified temperatures.

Table 2-7. Special Ambient Temperature Specifications/Allowances

Hydraulic Fluid Temperature	Allowable Ambient Temperature for Remote Cylinder
50 °C	105 °C
60 °C	105 °C
70 °C	95 °C

VSPC Hydraulic Schematic

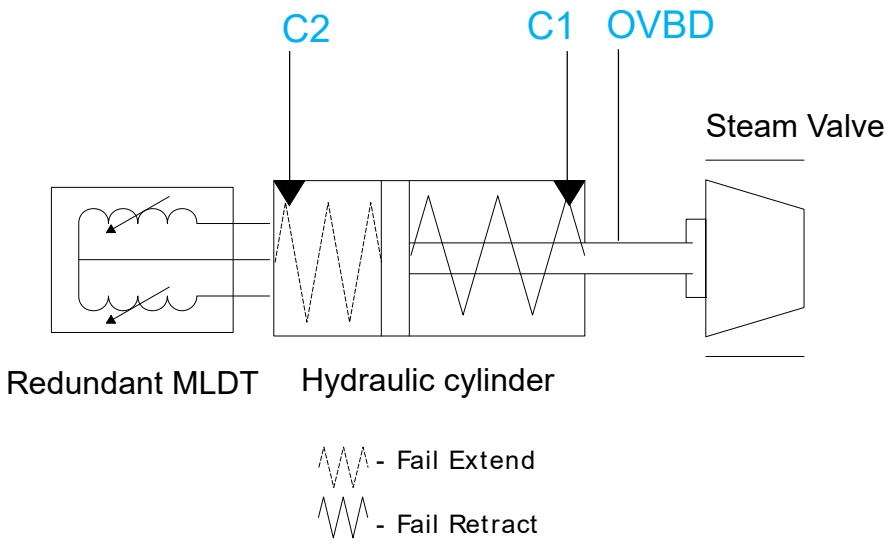


Figure 2-1. VSPC Hydraulic Schematic

Outline dimensions and installation features for specific models are in the appropriate pictures according to Table 2-8.

Table 2-8. VSPC Installation Drawings

Woodward Model Number	Description	Figure Number
VSPC 6x12 (9907-2014)	Power Cylinder, 6 inch Bore x 12 inch Stroke	A-1a & A-1b
VSPC 8x2.30 (9907-2015)	Power Cylinder, 8 inch Bore x 2.30 inch Stroke	A-2a & A-2b
VSPC 6x8.346 (9907-2018)	Power Cylinder, 6 inch Bore x 8.346 inch Stroke	A-3a & A-3b
VSPC 6x4 (9907-2016)	Power Cylinder, 6 inch Bore x 4 inch Stroke	A-4a & A-4b

Notes:

1. These general reference outline drawings apply to Woodward VSPC only. Consult Woodward for the latest outline drawing.

2. Installation Orientation:
   Cylinder - Any orientation is acceptable.

3. Service Manual Replacement Parts:
   Rod Seals Kit(s) - Refer to Chapter 4 for additional details.

Chapter 3.
Installation

Receiving Instructions

The VSPC is carefully packed at the factory to protect it from damage during shipping; however, careless handling during shipment can result in damage. If any damage to the VSPC is discovered, immediately notify both the shipping agent and Woodward.

Unpacking Instructions

Carefully unpack the VSPC and remove it from the shipping container. Do not remove the hydraulic, covers and hydraulic power cylinder's output threaded shaft mesh until you are ready to mount the unit.

⚠WARNING

Make sure that the VSPC hydraulic connections are installed correctly. Equipment damage is possible if the hydraulic connections are attached incorrectly (backwards). Reversed hydraulic connects will cause the actuator to operate backwards, making the fail-safe position opposite of where the user expects it to be.

⚠WARNING

Overspeed / Overpressure

Never close the drain line when supply pressure is present on the VSPC unit, otherwise the control output pressure can increase suddenly and cannot be controlled by the input setpoint. This could cause the turbine to overspeed.

⚠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

Take care not to damage cover sealing surfaces or threads during removal or installation. Damage to these joints may compromise the ingress or explosion protection ratings of the product. Prior to replacing the cover(s), inspect the seal and mating faces on each part. Clean the surfaces with rubbing alcohol if necessary.
Proper torque is critical for the function of these joints. Refer to figures in the Installation chapter and drawings in the Appendices for the correct torque procedure of all covers.

⚠WARNING

For lifting and transportation, use lifting straps fitted through both lifting lugs provided with the product. Support the VSPC in a vertical position during transportation.

⚠CAUTION

Due to typical noise levels in engine and turbine environments, hearing protection should be worn when working on or around the VSPC.

⚠CAUTION

The surface of this product can become hot 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.

Installation Instructions

General

See the outline drawings and specifications for:

- Outline dimensions
- Hydraulic connections and fitting sizes
- Electrical connections
- VSPC weight

A vertical actuator position is generally preferred to conserve floor space as well as ease of making electrical and hydraulic connections. However, the VSPC can be mounted in any angle.

Allow space for removal of the sensor terminal block cover for access to the terminals.

If the VSPC is to be installed in close proximity to uninsulated/unshielded steam valves or piping, radiation heat shields should be installed between the actuator and these hot surfaces.

The VSPC is designed for support by the mating bottom or top surface. For each individual VSPC actuator bolt pattern, bolts and bolting torque recommendations should be followed as per Table 3-1.

Installation Interface

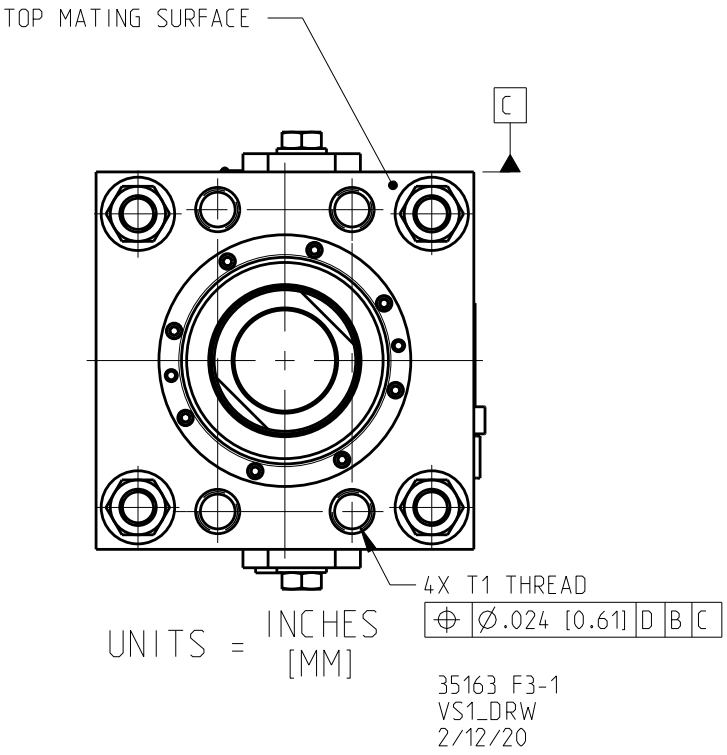


Figure 3-1. Installation Interface, Top Plate

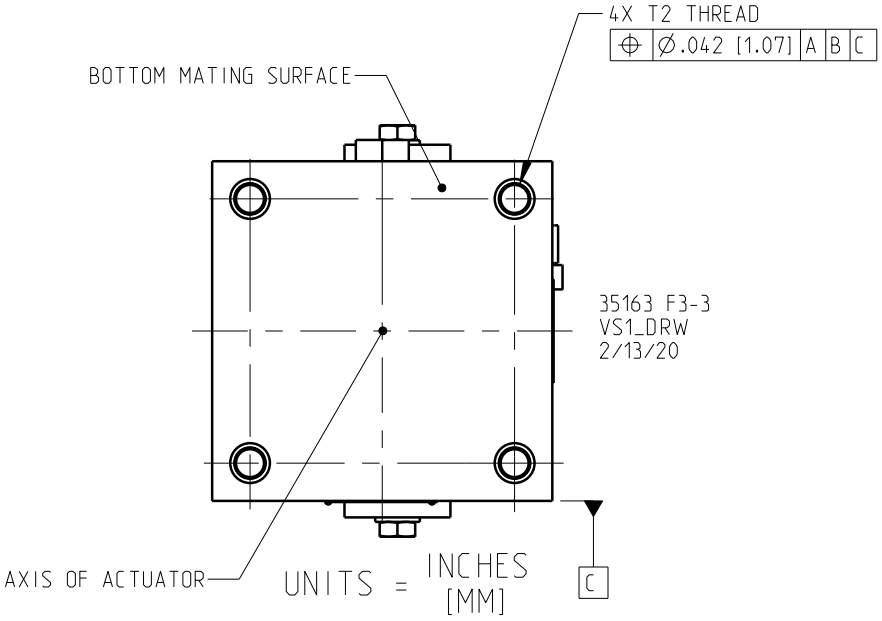


Figure 3-2. Installation Interface – Bottom Plate

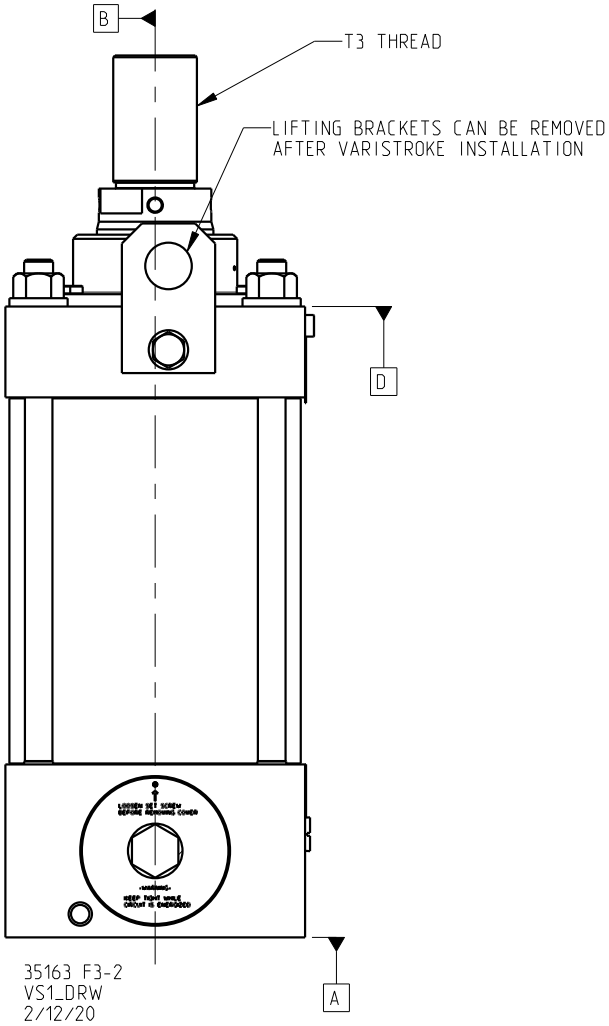


Figure 3-3. Installation Interface – Piston Rod Thread

Table 3-1. VSPC Installation Bolts and Bolting Torques Recommendation

VariStroke Cylinder Bore Size inch (mm)	Size *M=Male F=Female*	Min Thread Engagement inch (mm)	Min Bolt Grade	Bolting Torque lbf-ft. (Nm)	Thread Tol. Class Male/Female
Thread "T1" & "T2"					
4 (100)	M14x2	1.20 (30.5)	10.9	50-55 (68-75)	6H
5 (127)	M16x2	1.60 (40.6)	10.9	110-120 (149-163)	6H
6 (152)	M16x2	1.60 (40.6)	10.9	110-120 (149-163)	6H
8 (200)	M24x3	1.60 (40.6)	10.9	270-300 (366-407)	6H
10 (254)	M30x3.5	1.60 (40.6)	10.9	365-400 (495-542)	6H
Thread "T3"					
4 (100)	M–M30x2 F–M26x1.5	1.40 (35.6)	N/A	N/A	6g/6H
5 (127)	M–M30x2 F–M26x1.5	1.40 (35.6)	N/A	N/A	6g/6H
6 (152)	M-M48x2 F-M33x2	1.80 (45.7)	N/A	N/A	6g/6H
8 (200)	M-M64x3 F-M48x2	2.20 (55.9)	N/A	N/A	6g/6H
10 (254)	M-M64x3 F-M48x2	2.20 (55.9)	N/A	N/A	6g/6H

Fail extend, spring assist cylinders with no hydraulics have the cylinder rod in the fully extended position. For all fail retract spring assist cylinders, the hydraulic rod is in retract position without hydraulic pressure.

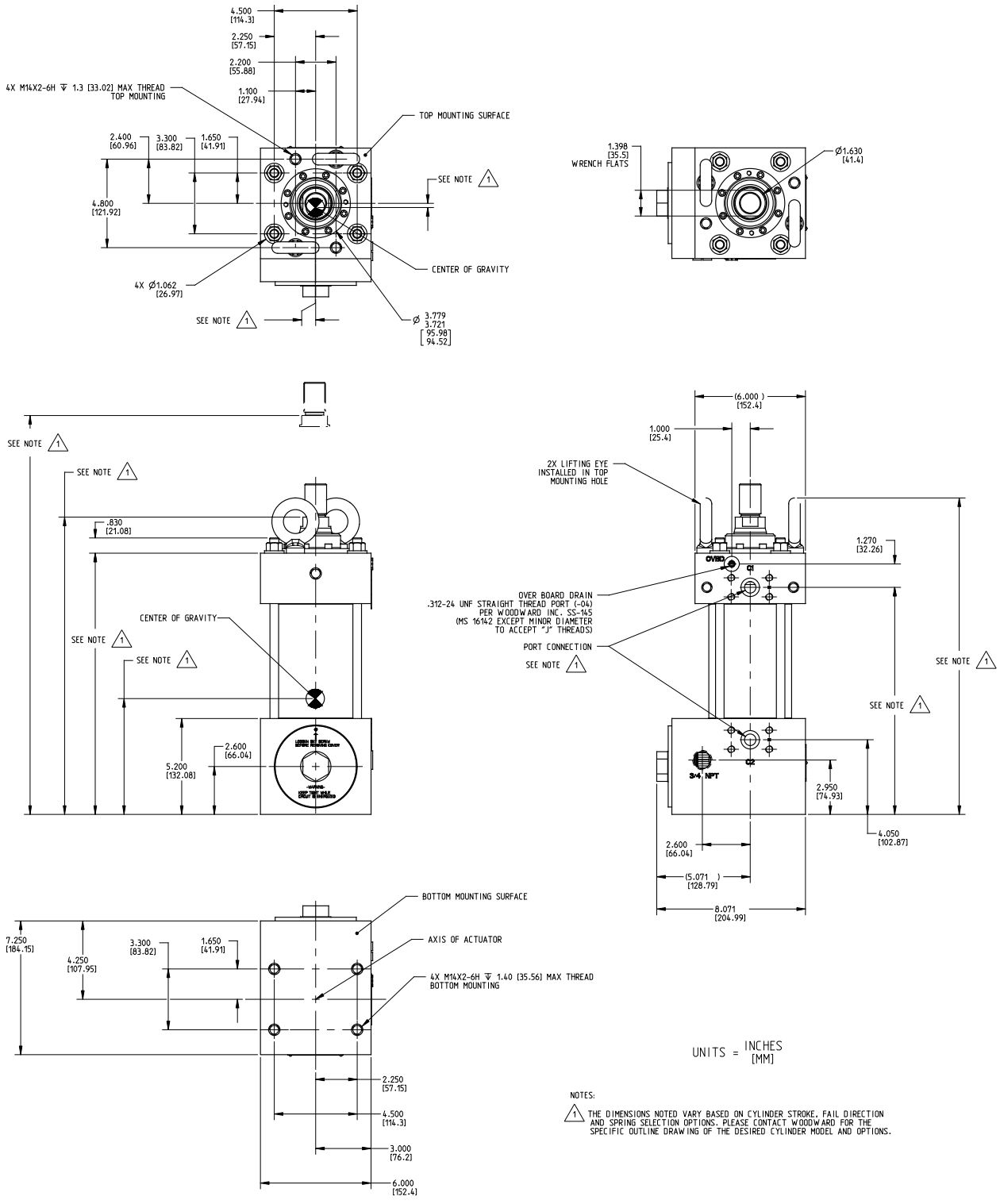


Figure 3-4. VSPC 4 inch bore, Installation Dimensions for Remote Cylinder

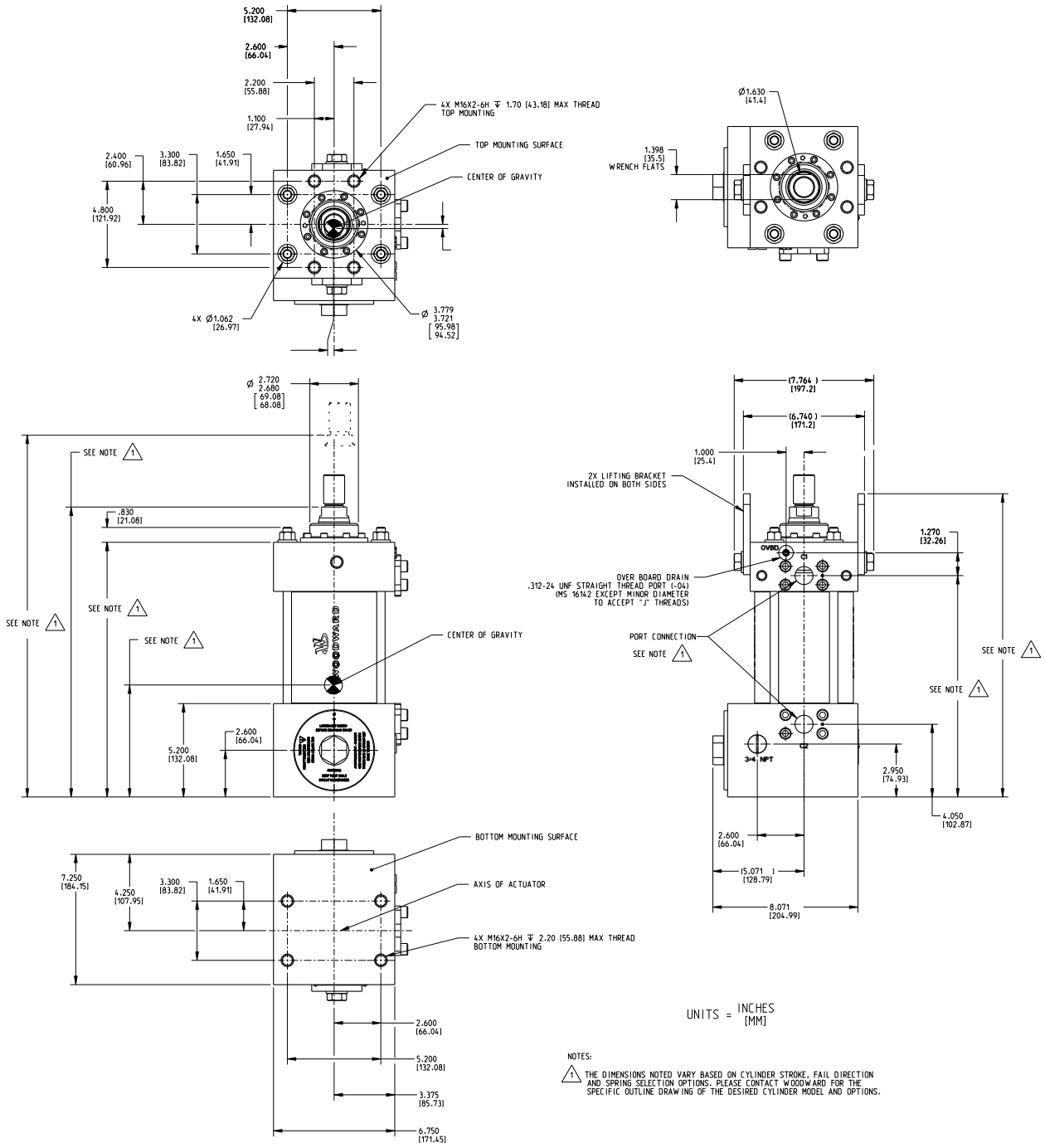


Figure 3-5. VSPC 5 inch bore, Installation Dimensions for Remote Cylinder

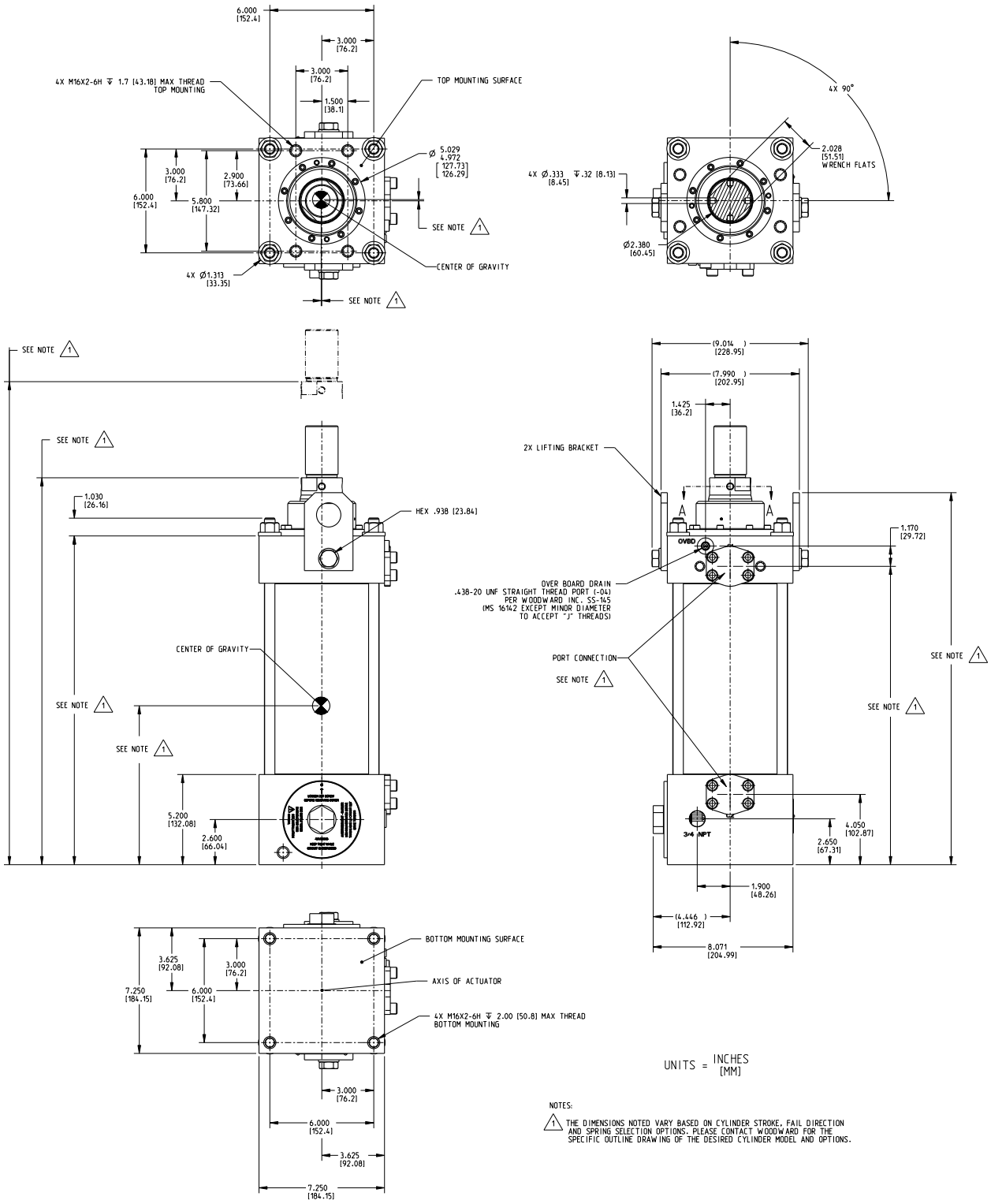


Figure 3-6. VSPC 6 inch bore, Installation Dimensions for Remote Cylinder

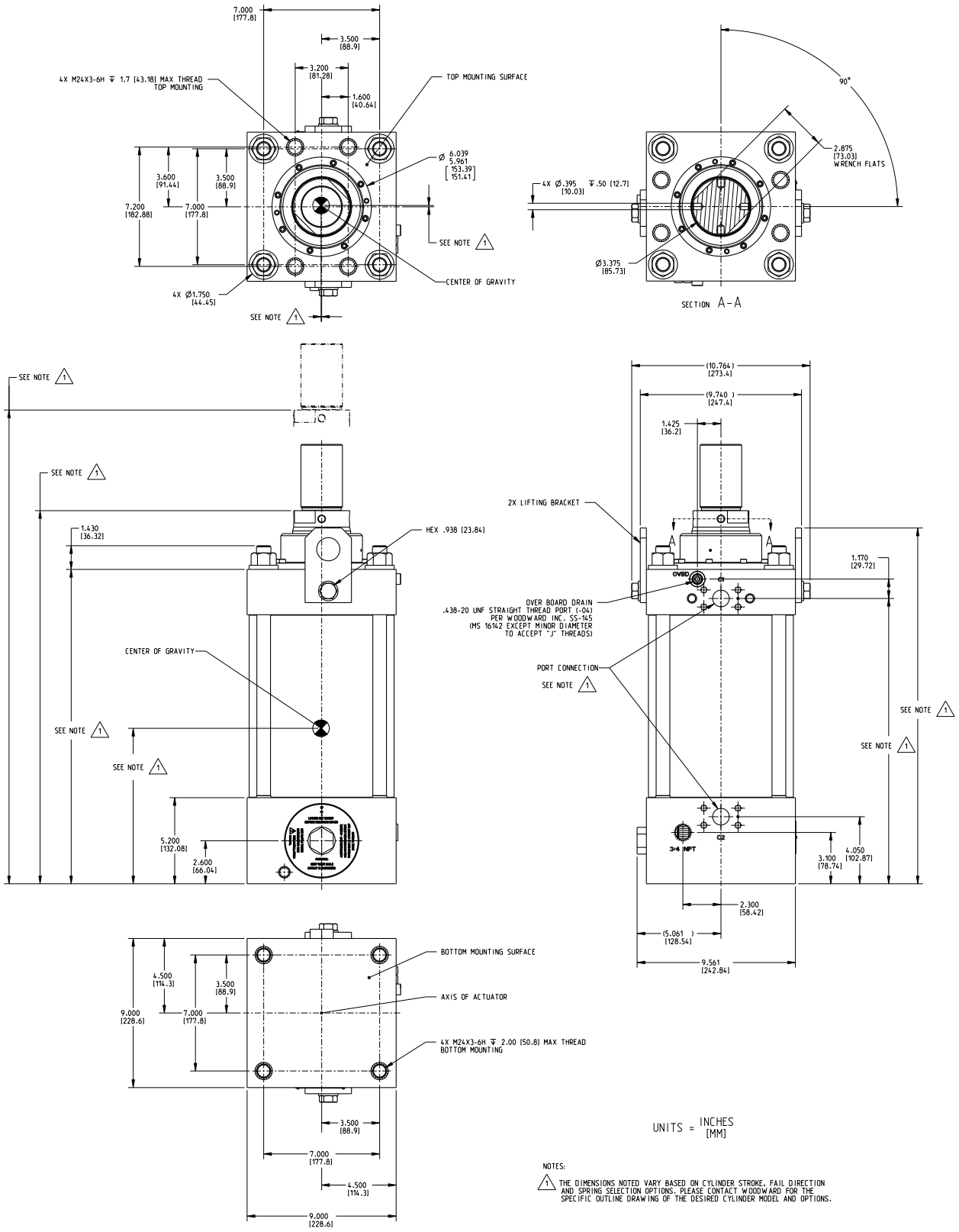


Figure 3-7. VSPC 8 inch bore, Installation Dimensions for Remote Cylinder

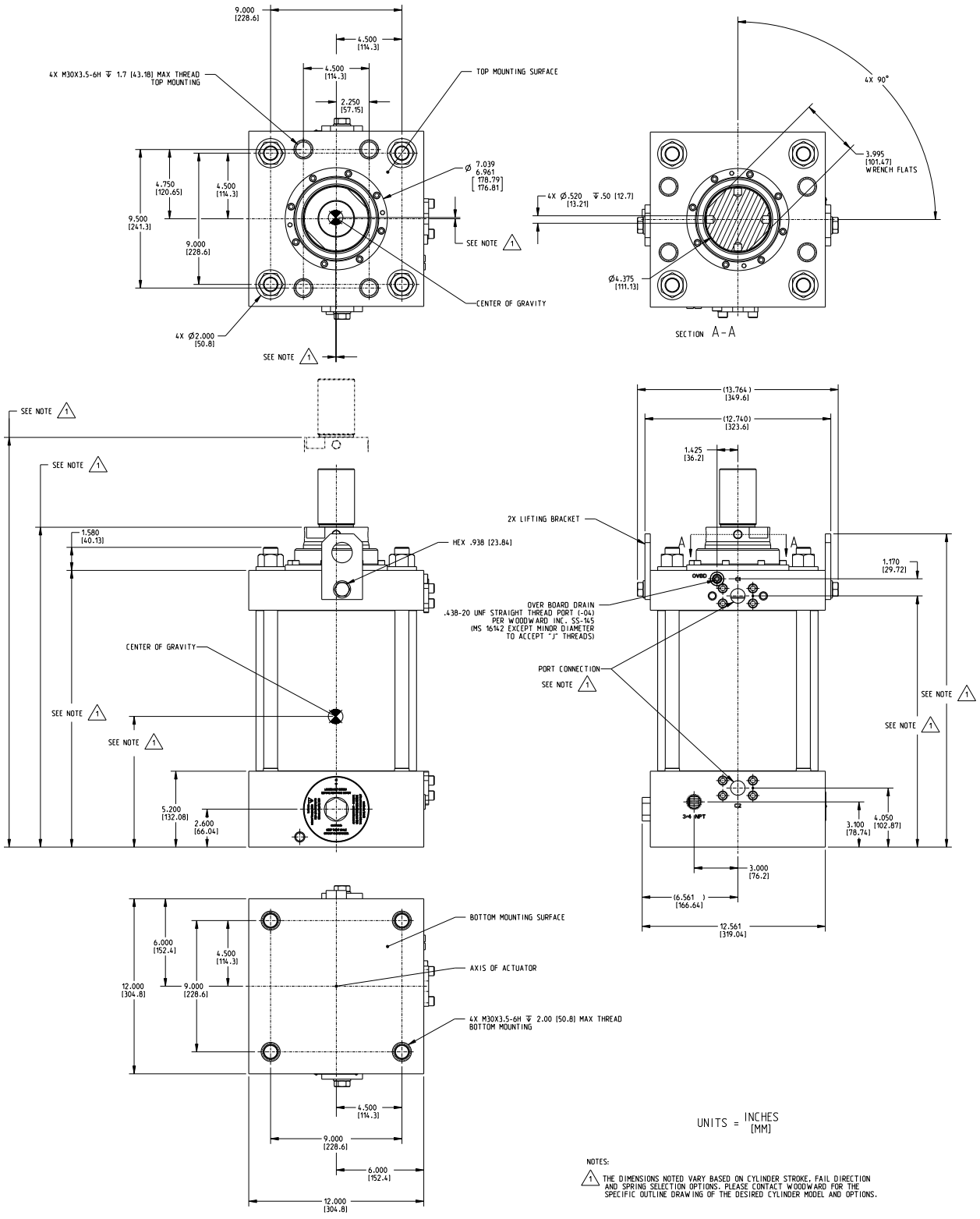


Figure 3-8. VSPC 10 inch bore, Installation Dimensions for Remote Cylinder

Lifting

VSPC comes equipped with lifting brackets for vertical lifting. When transporting, use both brackets as shown below. Additional lateral threaded holes can also be used.

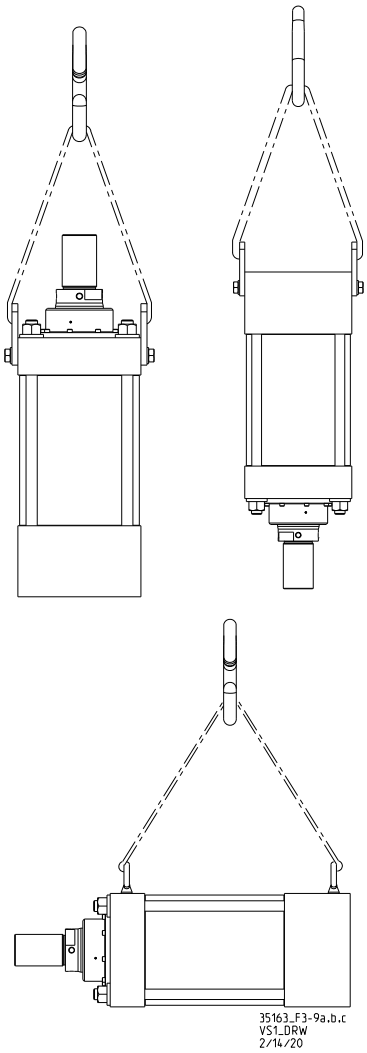


Figure 3-9. VSPC Lifting Positions

⚠WARNING

The VSPC actuator is designed to be supported on the bottom or top mating surface. Additional supports are neither needed nor recommended.

Any mounting deviation from Woodward's recommendation may cause assembly damage, improper performance, or operator injury risk.

Improper mounting may be considered as a violation of warranty conditions.

⚠WARNING

Maximum allowable linkage misalignment is 5°. It is highly recommended that the customer strictly warns the installer of this. Assure required pattern tolerance is adhered to based on interface as shown in Figures 3-1 and 3-2.

⚠WARNING

Ensure that the linkages and couplings connecting the VSPC output shaft to the turbine are appropriately sized and can withstand the stall force and dynamic loads.

⚠WARNING

Ensure that the crane, cables, straps, and all other lifting equipment used for VSPC lifting is able to support the VSPC weight. See outline drawings for VSPC weights.

Hydraulic Connections

For each actuator, both C1 and C2 ports must be connected:

- 1.500 SAE J518 Code 61 Flange for Hydraulic C1 and C2
  or
- 1.000 SAE J518 Code 61 Flange for Hydraulic C1 and C2

Additionally, for actuators with fail extend safe position, the OVBD port must be connected to the drain line:

- .438-20 UNF Straight Thread Port (bore size 4 and 5 inch - OVBD 0.312-24 UNF)

Note: SAE J518, JIS B 8363, ISO/DIS 6162 AND DIN 20066 are interchangeable, except for bolt sizes/threads. The VSPC uses metric bolt sizes.

Note: For the fail retract actuator type, connect C2 to control oil line and C1 to drain line.

Note: For the fail extend actuator type, connect C1 to control oil line and both C2 and OVBD to drain line.

Table 3-2. Hydraulic Connection Tightening Torques

	Hydraulic Connections	Fitting	Bolt Size	Torque
	OVBD	.438-20 UNF Straight Thread Port	N/A	(7 – 8) Nm, (65 - 69 lbf-in)
Option 1 (see installation drawing)	Hydraulic Control Port C1 and C2	1.000 SAE J518 Code 61 Flange	4x M10x1.5 Screws	(34 to 48) N·m, (25 to 35 lb-ft)
Option 2 (see installation drawing)	Hydraulic Control Port C1 and C2	1.500 SAE J518 Code 61 Flange	4x M12x1.75 Screws	(48 to 61) N·m, (35 to 45 lb-ft)

⚠CAUTION

Before installing the VSPC, all hydraulic lines must be thoroughly flushed.

Make provisions for proper filtration of the hydraulic fluid that will supply the actuator. Design the system filtration to assure a supply of hydraulic oil with a target cleanliness level of ISO 4406 code 20/18/16 or cleaner.

Construct the tubing connected to the actuator and actuator-servo to eliminate any transfer of vibration or other forces to the actuator.

The hydraulic drain:

- For cylinders with 1.5 inch port, the hydraulic drain should be at least 38 mm (1.5 inches) of tubing or larger and must not restrict the flow of fluid from the actuator.
- For cylinders with 1.0 inch port, the hydraulic drain should be at least 25 mm (1.0 inches) of tubing or larger and must not restrict the flow of fluid from the actuator.

The drain pressure:

- For double acting applications, must not exceed 10% of supply pressure or 3.4 bar (50 psig), whichever is less, under any condition.
- For single acting applications, must not exceed 5% of supply pressure or 1.7 bar (25 psig), whichever is less, under any condition.

IMPORTANT

Review also the max drain pressure for the installed servo. Make sure that working conditions are fulfilled for servo and cylinder.

Maximize pipe diameters to both the supply and drain connections, within reason, to ensure minimal flow loss and restrictions. For the same reason, keep pipe lengths to a minimum.

WARNING

Do not remove any OVBD plugs. All required hydraulic connections must be made before hydraulic pressure is applied.

IMPORTANT

For step demands and/or trip movements, the actuator may generate pressure spikes in supply line due to water hammer effect. A hydraulic accumulator in the supply line installed close to the servo can considerably reduce or eliminate this effect.

Electrical Connections

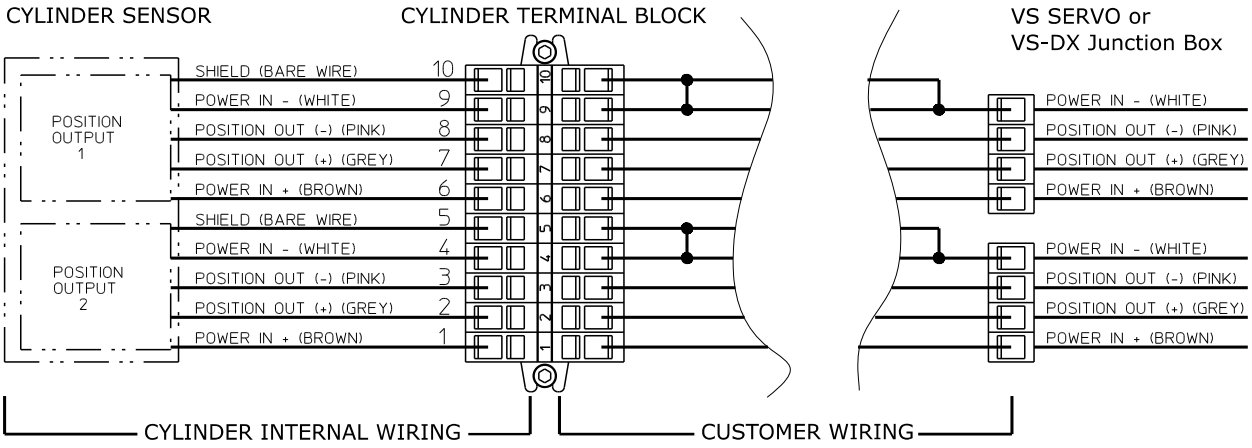


Figure 3-10. Cylinder Position Sensor Connection Scheme

Cylinder Position Feedback Analog Output Wiring Requirements:

- Individually shielded twisted pair cable
- Keep this and all other low level signal cables separated from input power cables to avoid unnecessary coupling (noise) between them.
- Wire Gauge Range: (0.14 to 1.5) mm² / (16 to 24) AWG
- Shielding: Per drawing above
- Cable length: Less than 10 m (32.8 feet)

⚠WARNING

RISK OF SHOCK AND DECREASED EMC PERFORMANCE

All bare shield wires of the field wiring cable must be isolated from the power cylinder chassis, or any conduit used. Woodward recommends using suitably rated heat shrink tubing on the shield wire when connecting at the terminal block, as well as tubing over the length of the customer cable. Failure to isolate the shield wire results in a connection of BAT- to the cylinder chassis.

An electrical short of the bare shield wire to chassis could lead to:

- **Decreased EMC performance and read-out accuracy.**
- **A hazardous accessible voltage on the external cylinder chassis which could result in electric shock. The severity of this shock risk is dependent upon each installation, configurations of servo battery supply and grounding, and the bonding provided by installation of the power cylinder.**

Wiring

The VSPC has one NPT wiring entry in ¾ inch size.

WARNING

A conduit seal must be installed within 457 mm (18 inches) of the conduit entry when the product is used in Zone 1 or Class I, Division 1 hazardous locations. When a VS-I Remote Cylinder is used in Zone 1 or Class I, Division 1 hazardous locations, conduit seals are also required at the cylinder and the servo for the feedback wiring so that they are separated flameproof / explosionproof enclosures.

When wiring using cable and cable glands, the gland fitting must meet the same hazardous locations criteria as the VSPC. Follow all installation recommendations and special conditions for safe use that are supplied with the cable gland. The cable insulation must have a temperature rating of at least 85 °C and 10 °C above the maximum ambient and fluid temperature.

Strip the cable insulation (not the wire insulation) to expose 12 mm (1/2 inch) of the conductors. Strip the wire insulation 5 mm from each conductor. Mark wires according to their designation and install connectors, if required.

Loosen the M3 set screw in the VSPC terminal access cover and remove the cover. Pass the wires through the cable gland (not provided) or conduit fitting and attach to terminal blocks in accordance with their wiring diagram (Figure 3-9). Apply anti-seize paste on the cover thread. Tighten access cover until the O-ring seal is compressed and the cover is fully seated against the housing. Apply final 40-50 lbf-ft assembly torque. Next, secure the cover with M3 metric set screw (5.5-6.2 lbf-in). Tighten the cable gland fitting per manufacturer's instructions or pour the conduit seal to provide strain relief for the cable and to seal the interface between the wiring cable and the VSPC.

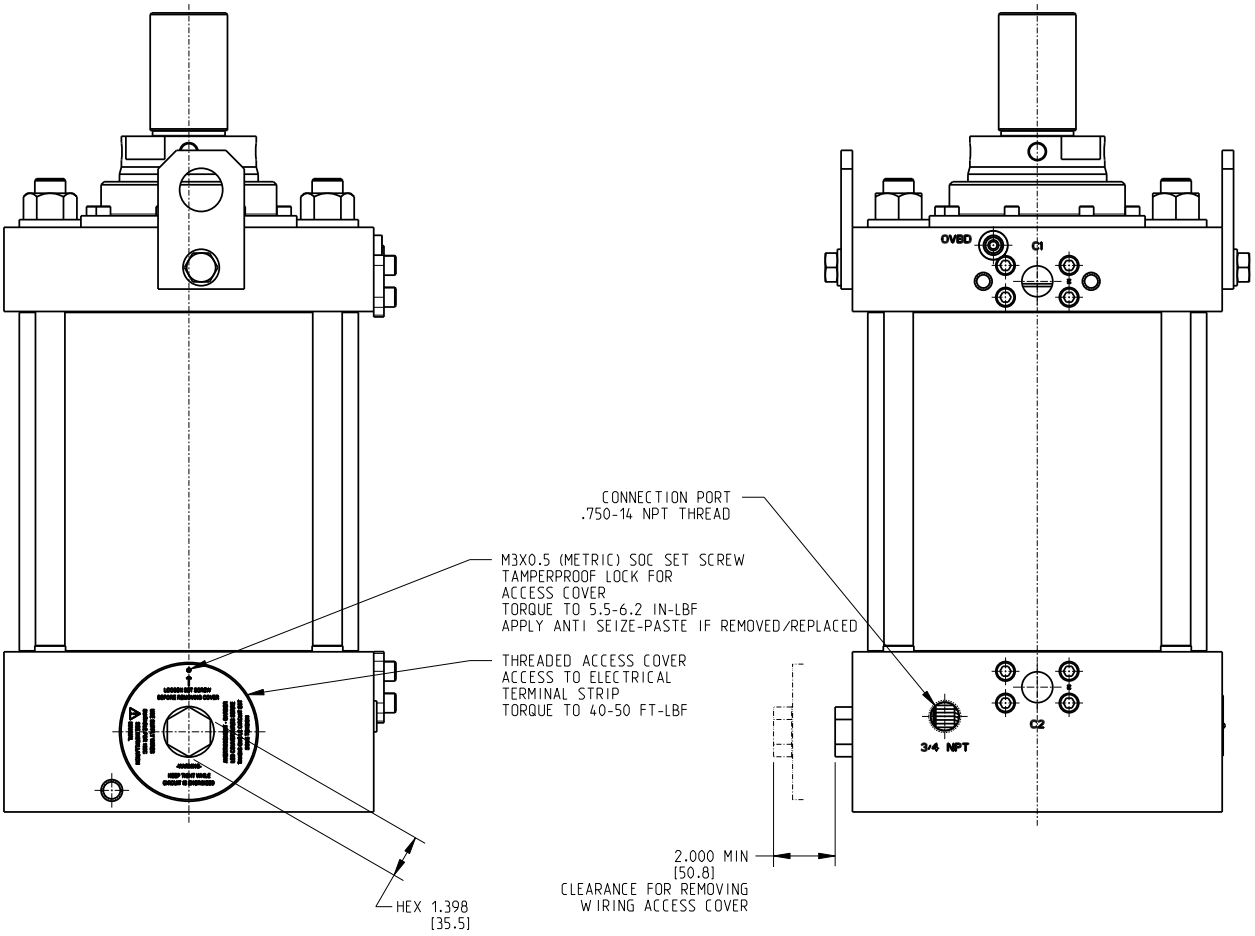


Figure 3-11. Electrical Access Cover

Cylinder Position Sensor

VSPC comes equipped with internal cylinder position sensor. For proper cylinder configuration use the following data:

Table 3-3. Cylinder and Sensor Dimensions

Bore Diameter (OD)	Rod Diameter (ID)
4 in (101.6 mm)	1.75 in (44.5 mm)
5 in (127.0 mm)	1.75 in (44.5 mm)
6 in (152.4 mm)	2.5 in (63.5 mm)
8 in (203.2 mm)	3.5 in (88.9 mm)
10 in (254.0 mm)	4.5 in (114.3 mm)

Cylinder Stroke	Position Sensor Length for Each Stroke
50.8 mm (2 in)	2.1654 [55 mm]
76.2 mm (3 in)	3.1496 [80 mm]
101.6 mm (4 in)	4.1338 [105 mm]
152.4 mm (6 in)	6.2992 [160 mm]
203.2 mm (8 in)	8.2677 [210 mm]
254.0 mm (10 in)	10.2362 [260 mm]
304.8 mm (12 in)	12.2047 [310 mm]

For proper VS Servo configuration, review manual 35148. Use the Customer Service Tool to set the cylinder parameters.

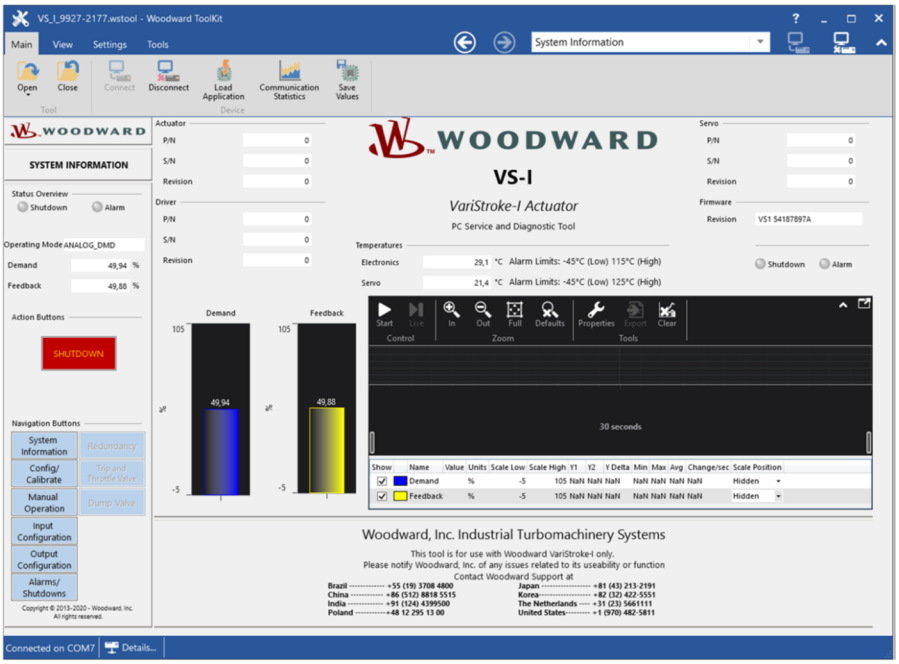


Figure 3-12. Customer Service Tool Screen

Short configuration instruction for the cylinder:

- Launch the Customer Service Tool (for more info see manual 35148)
- Navigate to the "**Config/Calibrate**" screen. Then press "**Remote Cylinder Setup**".

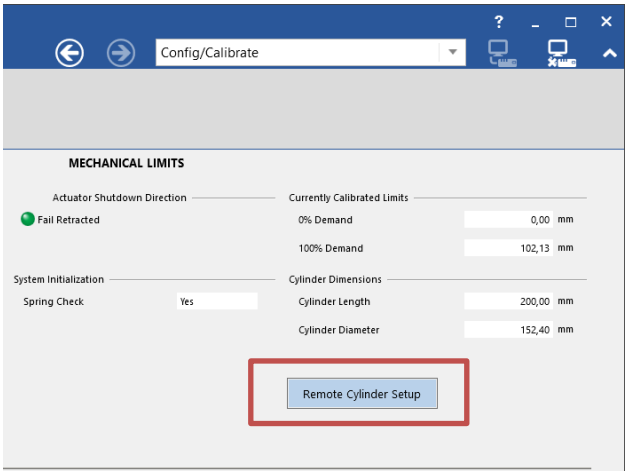


Figure 3-13. Configuration/Calibration Screen

- Fill in the correct values for **cylinder length, diameter,** and **rod diameter**. See table above.

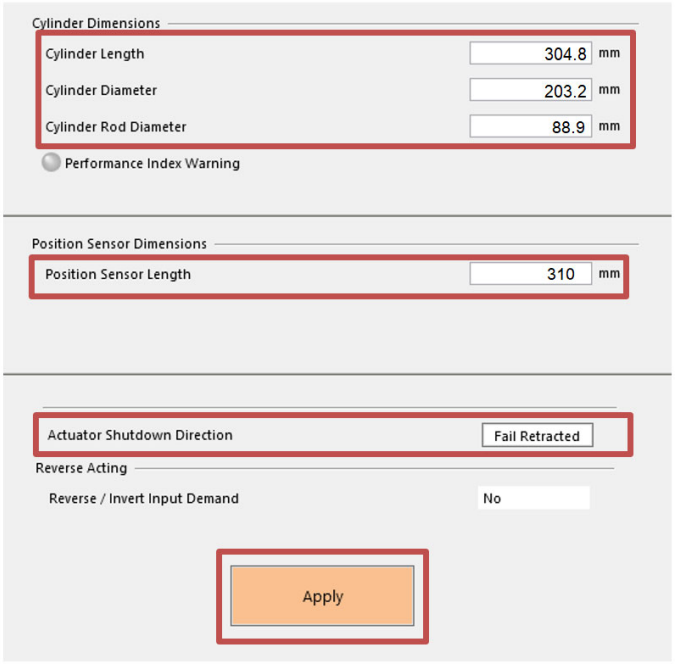


Figure 3-14. Set Correct Cylinder Parameters

- Fill in the correct value for **Position Sensor Length**. Position sensor length should be longer than physical cylinder stroke. See table above.
- Press the "**Apply**" button to save all changes.
- In section "**Actuator Shutdown Direction**" set the correct fail direction as either fail extend or fail retract.
- Check the "Reverse Acting" option and modify if necessary. This option is only available for the double acting version. Recommended settings are:
  - For fail retract, ReverseActing=NO,
  - For fail extend, ReverseActing=YES,

- Press the **"Apply"** button to save all changes.

Chapter 4.
Repair and Troubleshooting

⚠WARNING **To prevent possible serious personal injury or damage to equipment, be sure all electric power, hydraulic pressure, and rod end force have been removed from the actuator before beginning any maintenance or repairs.**

⚠WARNING **INTERNALY SPRING LOADED ASSEMBLY. To prevent possible personal injury, do NOT unscrew any tie nut.**

⚠WARNING **Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the VSPC actuator.**

General

The VSPC is warranted to be free from defects in materials and workmanship when installed and used in the manner for which it was intended for a period of 36 months from the date of shipment from Woodward.

It is recommended that all repairs and servicing of the VSPC be performed by Woodward or its authorized service facilities.

Use of a cable gland or stopping plug that does not meet the hazardous area certification requirements, thread form, or thread size will invalidate the suitability for hazardous locations.

Never remove or alter the nameplate as it bears important information, which may be necessary to service or repair the unit.

Spare Parts

Before performing any repairs or replacement procedures to the cylinder, all Product Support Options listed in Chapter 5 should be understood and considered.

If it is determined that unit components must be replaced, replacement procedures can be found in **Component Maintenance Manual CMM-03002**.

Level of Service (review each kit for available service level, see tables below):

- Gold Level – Can be performed only by Woodward
- Silver Level – Can be performed only by Woodward or AISF
- **Bronze Level** - Can be performed by Woodward, AISF, and **End User (customer)**

Table 4-1. Cylinder Rod Seals – Replacement Kits

Cylinder Rod Seals

Replacement Kit Number	Replacement Kit Description	Component Maintenance Manual (CMM)	Installation Drawing Number	Cylinder Size	Level of Service
8935-1216-10	Cylinder Rod Seals	CMM-03002	9999-1590-7	4 inch bore	
8935-1216-12				5 inch bore	
8935-1216-15				6-inch bore	Gold, Silver, Bronze
8935-1216-20				8-inch bore	
8935-1216-25				10-inch bore	

Table 4-2. Cylinder Seals – Replacement Kits

Cylinder Seals (No Spring Assist Version)

Replacement Kit Number	Replacement Kit Description	Component Maintenance Manual (CMM)	Installation Drawing Number	Cylinder Size	Level of Service
8935-1215-10	Seal Kits (soft components) Standard Version	CMM-02003	9999-1590-7	4 inch bore	Gold, Silver
8935-1215-12				5 inch bore	
8935-1215-15 935-1380-15 (CR)				6-inch bore	
8935-1215-20 8935-1380-20 (CR)				8-inch bore	
8935-1215-25 8935-1380-25 (CR)				10-inch bore	

Table 4-3. Cylinder Seals, Spring Assist – Replacement Kits

Cylinder Seals, Spring Assist

Replacement Kit Number	Replacement Kit Description	Component Maintenance Manual (CMM)	Installation Drawing Number	Cylinder Size	Level of Service
8935-1215-10	Seal Kits (soft components) Spring Assist Versions	CMM-02003	9999-1590-14	4 inch bore	Gold, Silver
8935-1215-15				6-inch bore	
8935-1215-20				8-inch bore	
8935-1215-25				10-inch bore	

Table 4-4. Position Sensor – Replacement Kits

Position Sensor

Replacement Kit Number	Replacement Kit Description	Component Maintenance Manual (CMM)	Installation Drawing Number	Cylinder Stroke	Level of Service
8935-1211-05	CYLINDER MTS REPLACEMENT KIT (Position Sensor)	CMM-02003	9999-1590-8	2-inch	Gold, Silver
8935-1211-07				3-inch	
8935-1211-10				4-inch	
8935-1211-15				6-inch	
8935-1211-20				8-inch	
8935-1211-25				10-inch	
8935-1211-30				12-inch	

IMPORTANT **The replacement kits from Silver Level can be ordered by the customer, but replacements can be only performed by Service Centers or Woodward.**

Hydraulic Cylinder Replacement

Before performing any repairs or replacement procedures to the VSPC, all Product Support Options listed in Chapter 6 should be understood and considered.

Troubleshooting

General

The following troubleshooting guide will help you isolate trouble with the servo valve, hydraulic power cylinder, control circuit board, wiring, and system problems. Troubleshooting beyond this level is ONLY recommended when complete facility control testing is available.

Troubleshooting Procedure

This table is a general guide for isolating system problems. In general, most problems are a result of incorrect wiring or installation practices. Make sure that the system wiring, input/output connections, controls and contacts are correct and in good working order. Complete the checks in order. Each check assumes completion of the preceding checks and correcting any problems.

⚠WARNING

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

⚠WARNING

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

⚠WARNING

ELECTRICAL SHOCK HAZARD—Follow all local plant and safety instructions/precautions before proceeding with troubleshooting the VSPC.

Table 4-5. VSPC General Troubleshooting Guide

Problem	Cause	Remedy
Servo returns problem with cylinder position output	Feedback sensor wiring fault or failed sensor channel or position sensor loop power output overloaded.	Ensure position sensor wiring and power supply are connected correctly. Check if position sensor wiring and power supply are connected correctly. See Chapter 3.
Actuator does not move toward commanded position	Hydraulic improperly connected, cylinder overloaded or too small supply pressure.	Check all hydraulic connections to the cylinder; check for any impediment to motion, check supply and drain lines.

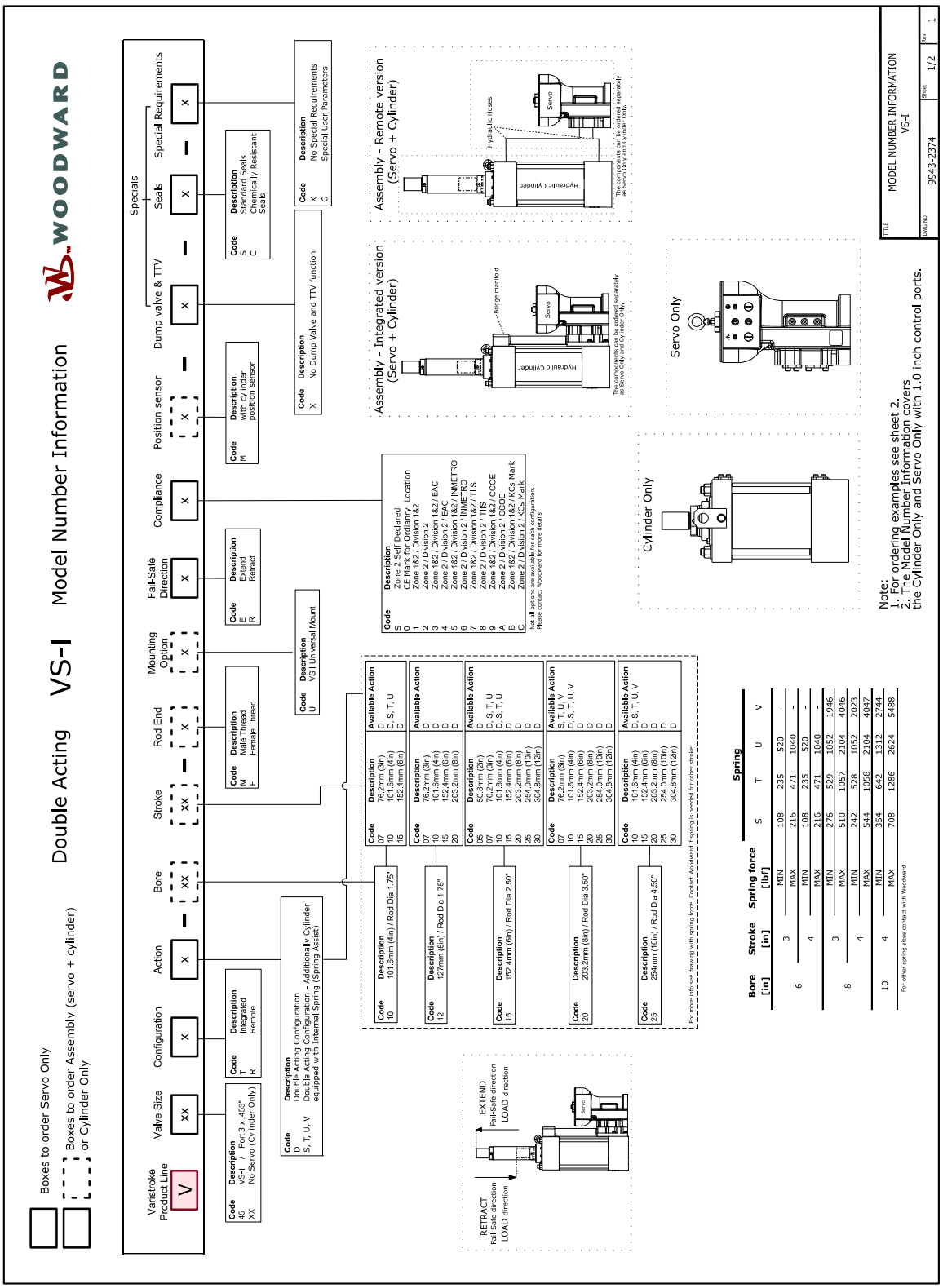
Table 4-6. Feedback Faults

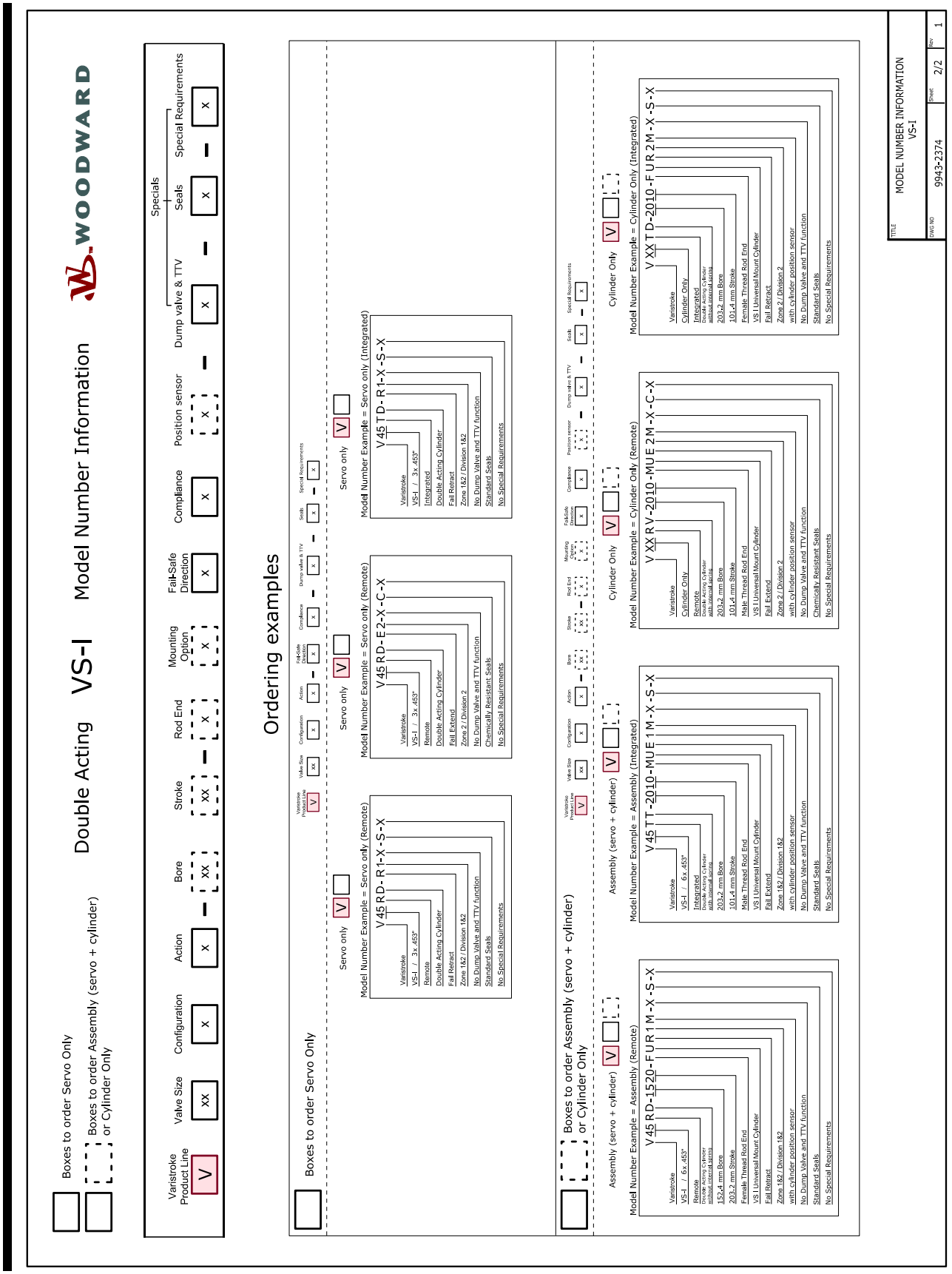
Problem	Cause	Remedy
Position 1 or 2 Feedback Low Detection: Power cylinder feedback 1 or 2 below Low threshold Typically 2 mA.	Feedback sensor wiring fault or failed sensor channel.	Check all connections to the final cylinder, check for any impediment to motion. If problem persists, service will be required.
Position 1 or 2 Feedback High Detection: Power cylinder feedback 1 or 2 above High threshold Typically 21 mA.		
Position Feedback Spread Alarm Detection: The difference between the redundant power cylinder feedback signals is greater than the set limits.	Sensors incorrectly calibrated	Complete the calibration procedure based on manual 35148.
Both Position Feedbacks Failed Detection: Both power cylinder feedback signals are out of usable range.	Feedback sensor wiring fault or failed sensor channel(s).	Check all connections to the final cylinder, check for any impediment to motion. If problem persists, service will be required.
Position Feedback 1 or 2 Readings are Negative or Much Greater 100% Detection: Service tool readings of Position Feedback 1 or 2.	Sensor temperature is too high. **Note:** This fault will typically clear after the actuator has cooled.	Ensure that the environment AND the mounting location are within the environmental specifications listed in chapter 2.
Stroke / Position In Service Tool Does Not Match Actual Stroke / Position Detection: Compare actual measurements (using external measurement device) with % feedback as shown in the VariStroke service tool.	Incorrect “Position Sensor Length” input into Service Tool.	Ensure that the “Position Sensor Length” input into the Customer Service Tool equals the full, 4–20 mA range of the position sensor.
	Position sensor requirements for accuracy and linearity are not fulfilled.	If greater accuracy is desired, consider replacing the cylinder position sensor with a more accurate sensor.

Maintenance

To maximize the life of the VSPC, please refer to the maintenance recommendation in Chapter 6: Asset Management and Refurbishment Scheduling Period.

Chapter 5.
Ordering Code




Boxes to order Servo Only
Boxes to order Assembly (servo + cylinder) or Cylinder Only
Double Acting VS-I Model Number Information
WOODWARD
Varistroke Product Line
Valve Size
Configuration
Action
Bore
Stroke
Rod End
Mounting Option
Fail-Safe Direction
Compliance
Position sensor
Specials
Dump valve & TTV
Seals
Special Requirements
Ordering examples
Boxes to order Servo Only
Servo only
Model Number Example = Servo only (Remote)
V 45 RD- R1-X-S-X
Varistroke
VS-I / 3x .453"
Remote
Double Acting Cylinder
Fail Retract
Zone 1&2 / Division 1&2
No Dump Valve and TTV function
Standard Seals
No Special Requirements
Model Number Example = Servo only (Remote)
V 45 RD- E2-X-C-X
Varistroke
VS-I / 3x .453"
Remote
Double Acting Cylinder
Fail Extend
Zone 2 / Division 2
No Dump Valve and TTV function
Chemically Resistant Seals
No Special Requirements
Servo only
Model Number Example = Servo only (Integrated)
V 45 TD- R1-X-S-X
Varistroke
VS-I / 3x .453"
Integrated
Double Acting Cylinder
Fail Retract
Zone 1&2 / Division 1&2
No Dump Valve and TTV function
Standard Seals
No Special Requirements
Boxes to order Assembly (servo + cylinder) or Cylinder Only
Assembly (servo + cylinder)
Model Number Example = Assembly (Remote)
V 45 RD-1520-FUR1M-X-S-X
Varistroke
VS-I / 6x .453"
Remote
Double Acting Cylinder
without Internal Inertia
152.4 mm Bore
203.2 mm Stroke
Female Thread Rod End
VS I Universal Mount Cylinder
Fail Retract
Zone 1&2 / Division 1&2
with cylinder position sensor
No Dump Valve and TTV function
Standard Seals
No Special Requirements
Assembly (servo + cylinder)
Model Number Example = Assembly (Integrated)
V 45 TT-2010-MUE1M-X-S-X
Varistroke
VS-I / 6x .453"
Integrated
Double Acting Cylinder
without Internal Inertia
203.2 mm Bore
101.4 mm Stroke
Male Thread Rod End
VS I Universal Mount Cylinder
Fail Extend
Zone 1&2 / Division 1&2
with cylinder position sensor
No Dump Valve and TTV function
Standard Seals
No Special Requirements
Cylinder Only
Model Number Example = Cylinder Only (Remote)
V XX RV-2010-MUE2M-X-C-X
Varistroke
Cylinder Only
Remote
Double Acting Cylinder
without Internal Inertia
203.2 mm Bore
101.4 mm Stroke
Male Thread Rod End
VS I Universal Mount Cylinder
Fail Extend
Zone 2 / Division 2
with cylinder position sensor
No Dump Valve and TTV function
Chemically Resistant Seals
No Special Requirements
Cylinder Only
Model Number Example = Cylinder Only (Integrated)
V XX TD-2010-FUR2M-X-S-X
Varistroke
Cylinder Only
Integrated
Double Acting Cylinder
without Internal Inertia
203.2 mm Bore
101.4 mm Stroke
Female Thread Rod End
VS I Universal Mount Cylinder
Fail Retract
Zone 2 / Division 2
with cylinder position sensor
No Dump Valve and TTV function
Standard Seals
No Special Requirements
TITLE
MODEL NUMBER INFORMATION
VS-I
DWG NO
9943-2374
Sheet
2/2
Rev
1

Chapter 6.
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 **http://www.woodward.com**.

Product Service Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

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

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

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

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

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

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

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

Packing a Control

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

NOTICE

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

Replacement Parts

When ordering replacement parts for controls, include the following information:
- The part number(s) (XXXX-XXXX) that is on the enclosure nameplate
- The unit serial number, which is also on the nameplate

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.
- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

Contacting Woodward's Support Organization

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

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

Products Used in Electrical Power Systems

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

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 +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 +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.

Chapter 7.
Asset Management and Refurbishment Scheduling Period

The following recommendations regarding the Woodward designed and manufactured VSPC actuator are to assist in properly managing the reliability, availability, and “safety of operation” expectations established for turbines. While there are electronic control systems designed to monitor and diagnose the operational performance of these components, control monitoring cannot replace normal preventative maintenance practices. It is important to follow these recommendations in order to avoid unnecessary and unscheduled shutdowns.

This product is designed for continuous operation under normal industrial operating conditions. Periodic service is not required on any components. It is recommended to perform service during major turnarounds, scheduled every five to eight years depending on the site and application. During major outages, Woodward recommends the VSPC be sent back to Woodward or a Woodward Authorized Independent Service Facility (AISF) for inspection, component servicing, and to take advantage of related product software and hardware improvements.

Installations that do not meet “normal” industrial operating conditions may require customized maintenance cycles to maximize reliability, performance, and asset life. Contact your local Woodward representative for a detailed evaluation of your site conditions to determine the right maintenance cycles for your installation.

Woodward’s overhaul services will return the unit to “like new” condition ready for another full operating cycle, lasting until the next planned maintenance outage. Upon reaching the recommended maintenance cycle of the auxiliary component, please contact either the sites turbine OEM service representative, local Woodward Distributor or Woodward Authorized Independent Service Facility to facilitate services. See Chapter 5 for Product Support and Services Options.

Chapter 8.
Long-Term Storage Requirements

Units that will not be put into service within twelve months should be packaged for long-term storage as described in Woodward manual 25075, *Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls*.

Appendices
Outline Drawings and Installation Features

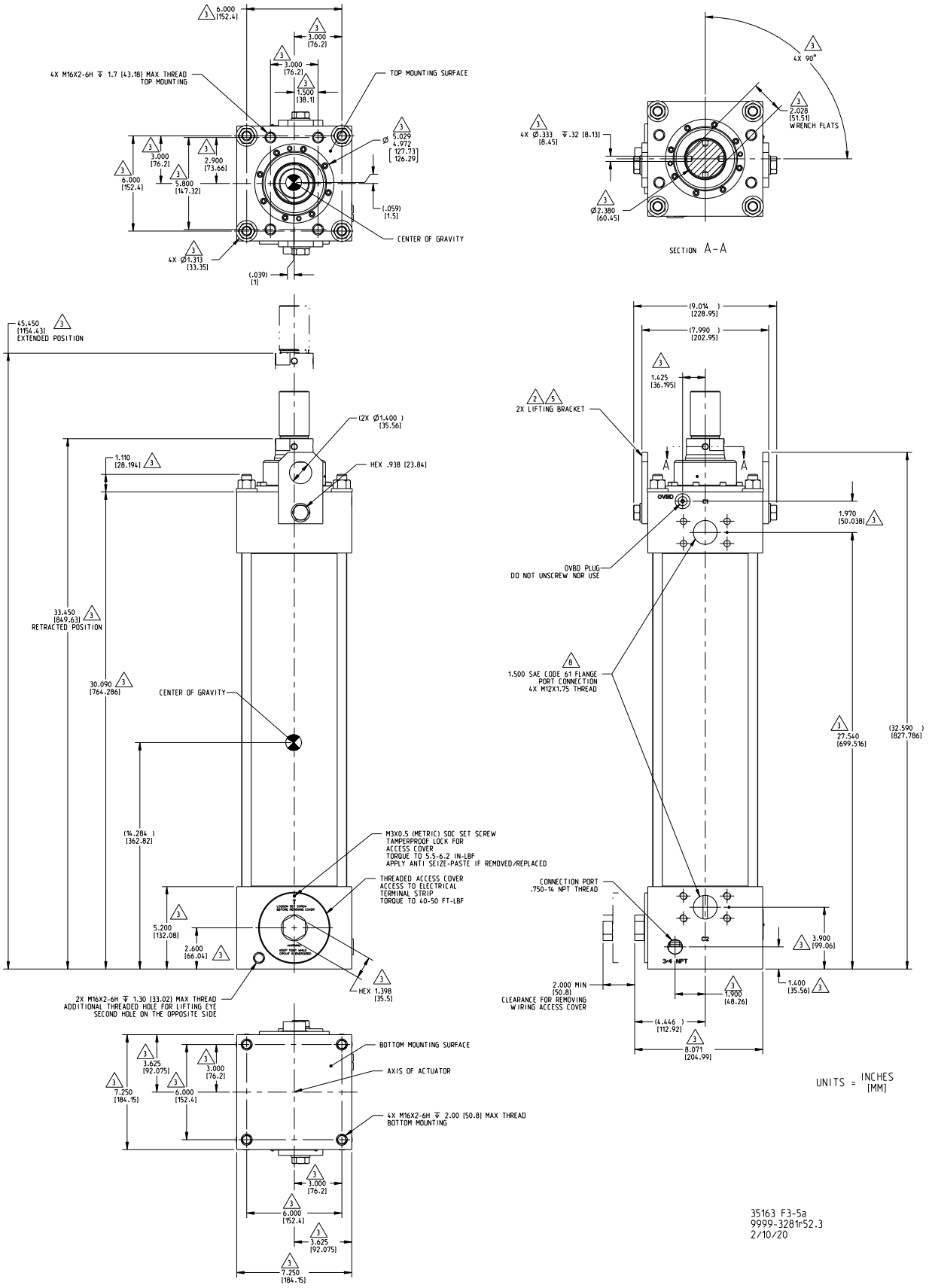


Figure A-1a. VSPC 6x12 Installation Dimensions

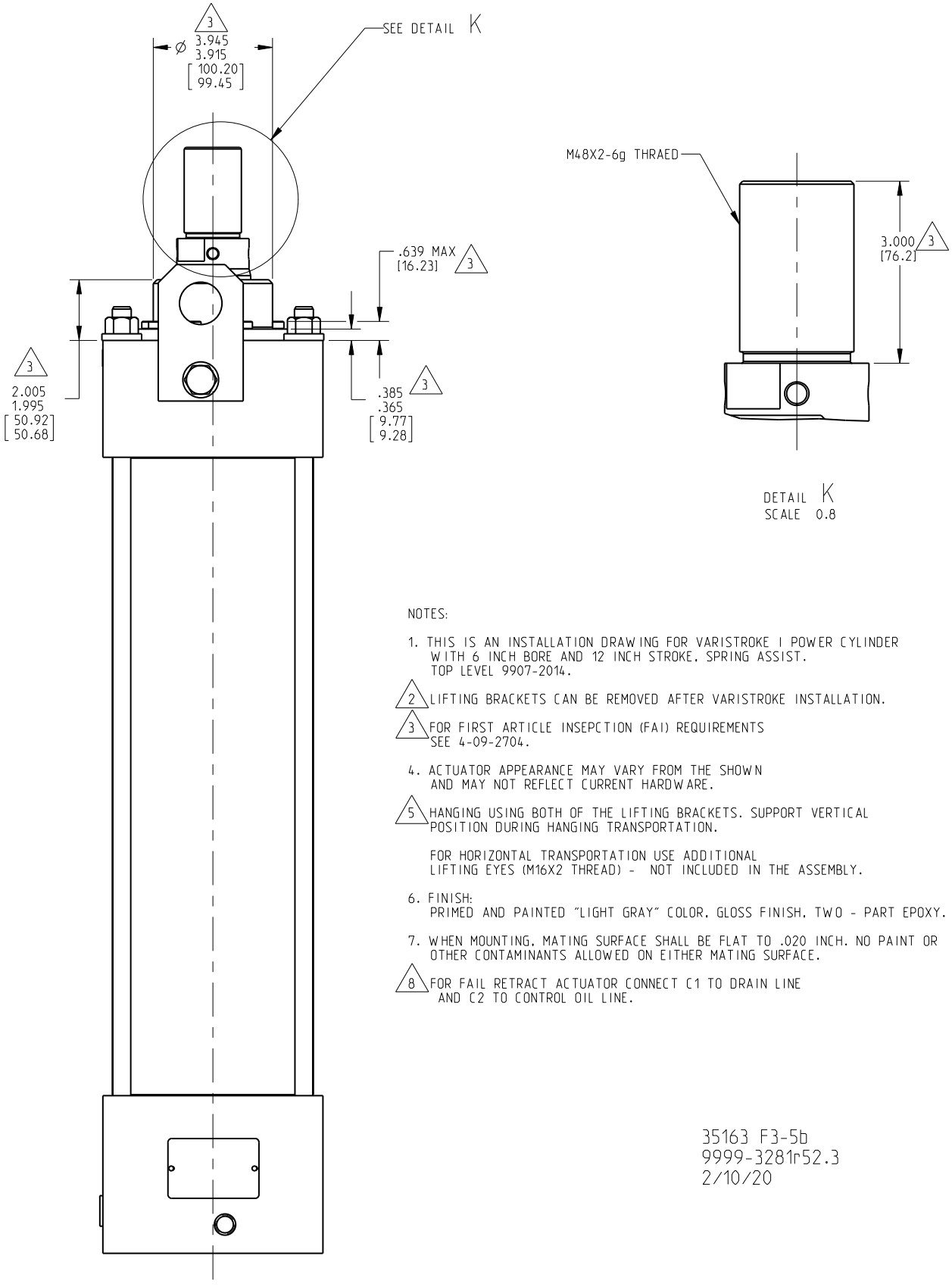


Figure A-1b. VSPC 6x12 Installation Dimensions

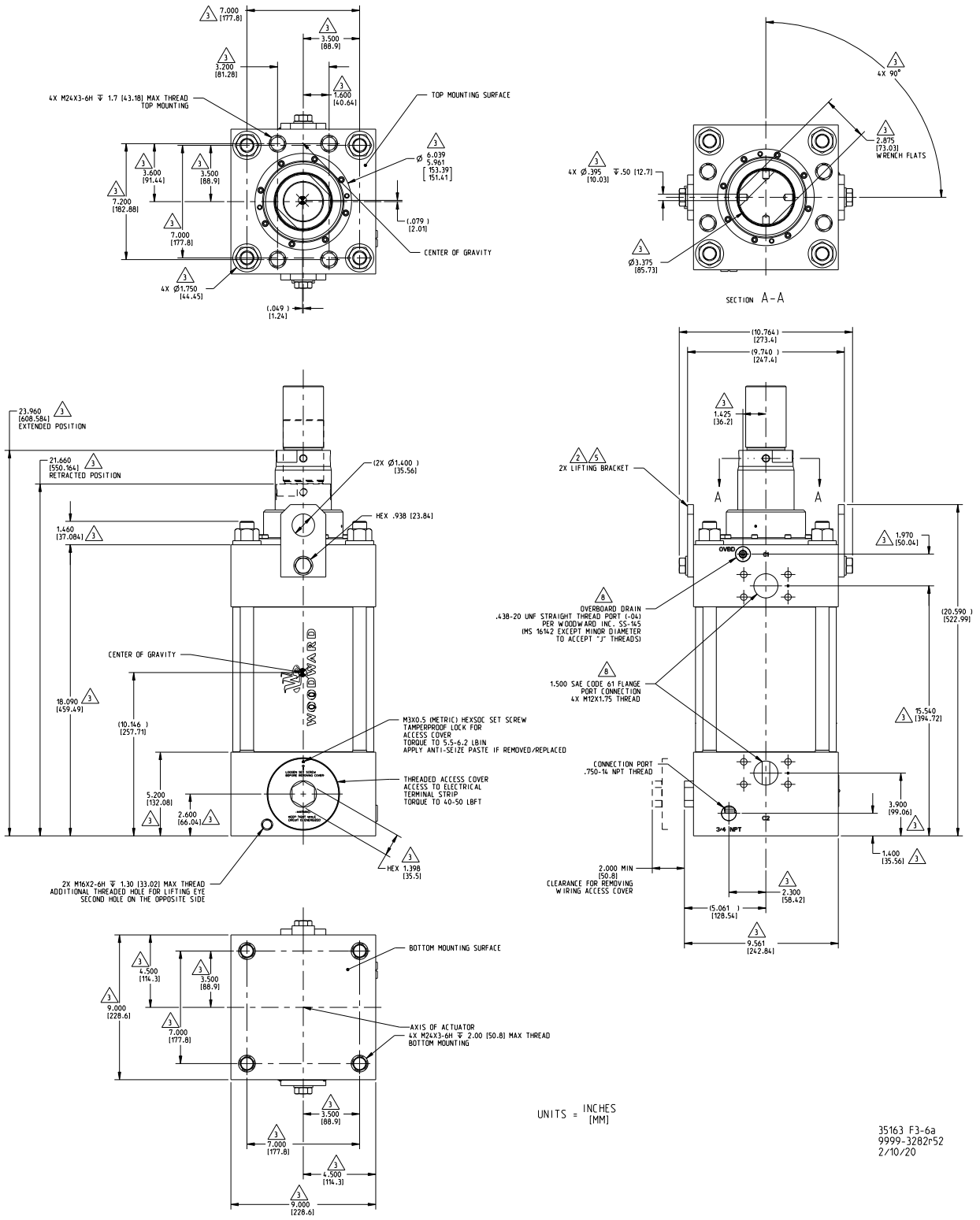


Figure A-2a. VSPC 8x2.30 Installation Dimensions

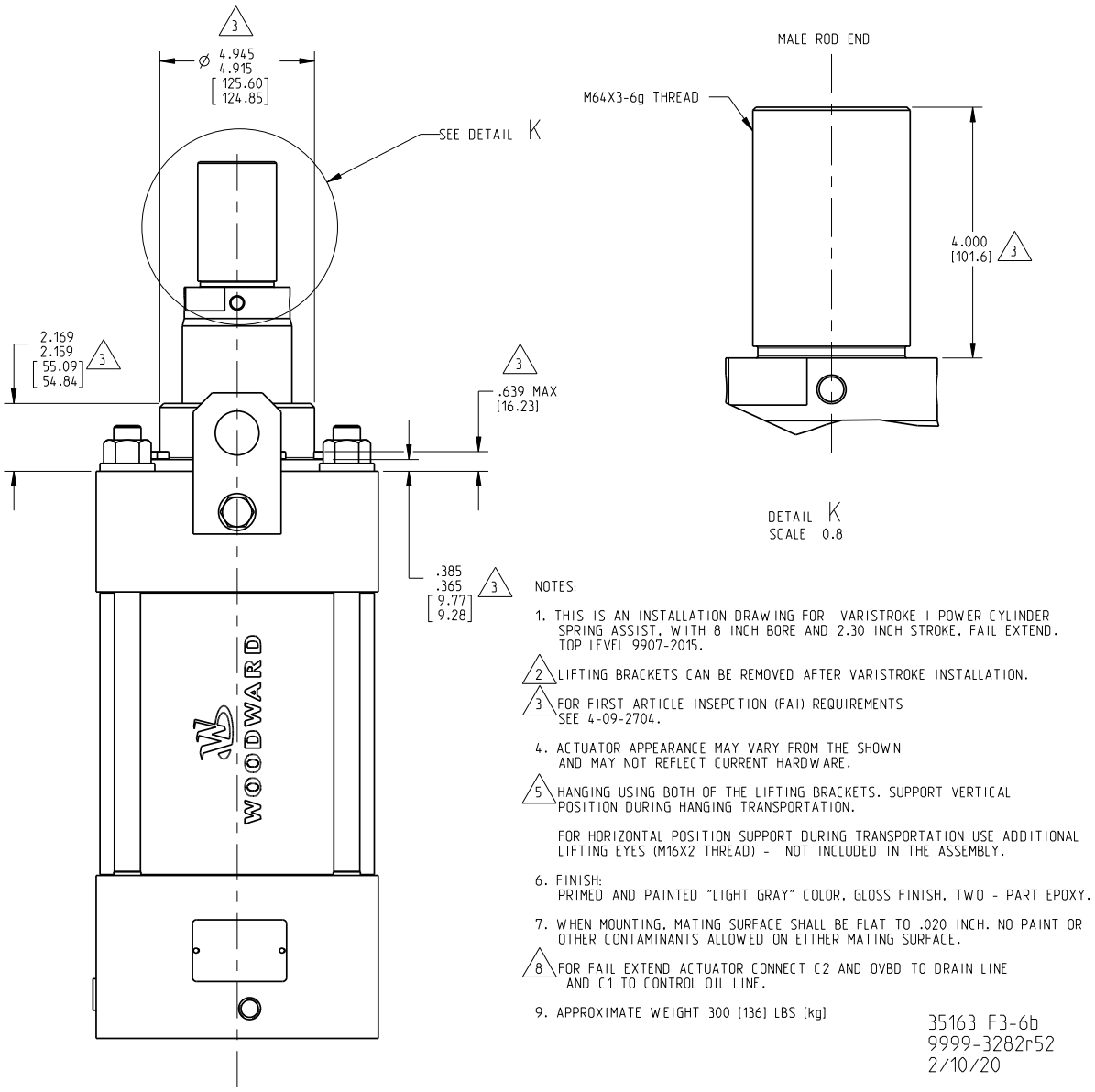


Figure A-2b. VSPC 8x2.30 Installation Dimensions

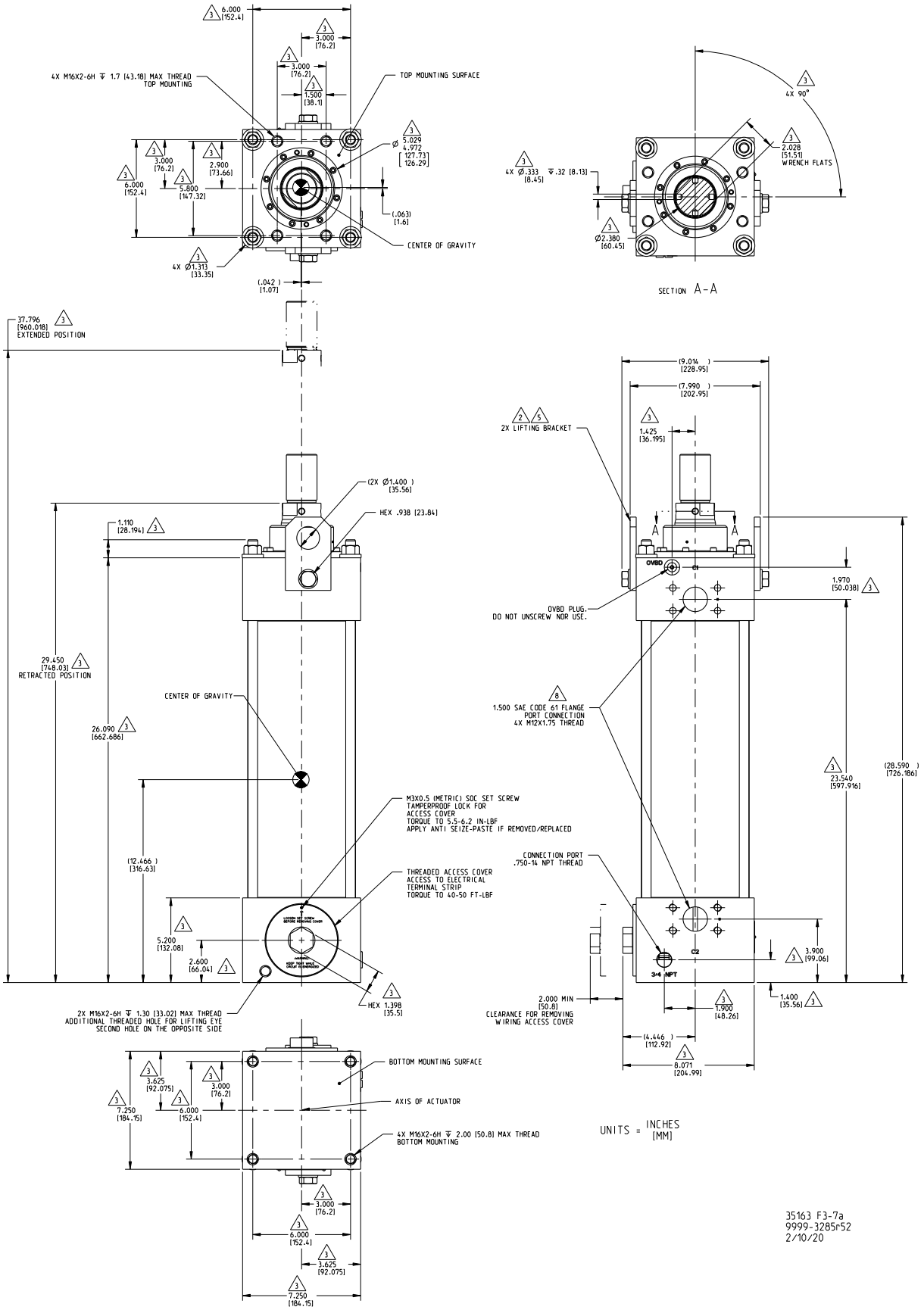


Figure A-3a. VSPC 6x8.346 Installation Dimensions

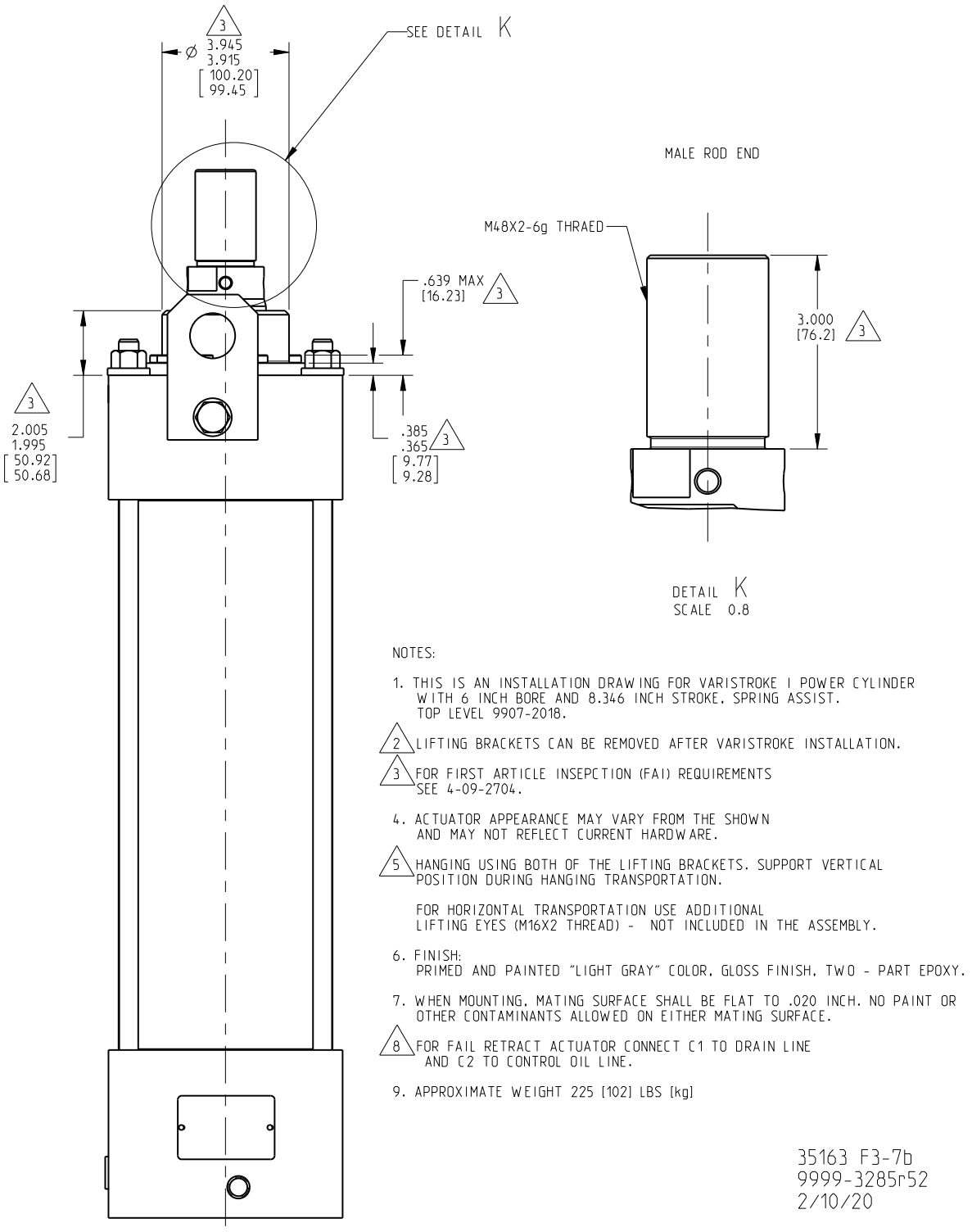


Figure A-3b. VSPC 6x8.346 Installation Dimensions

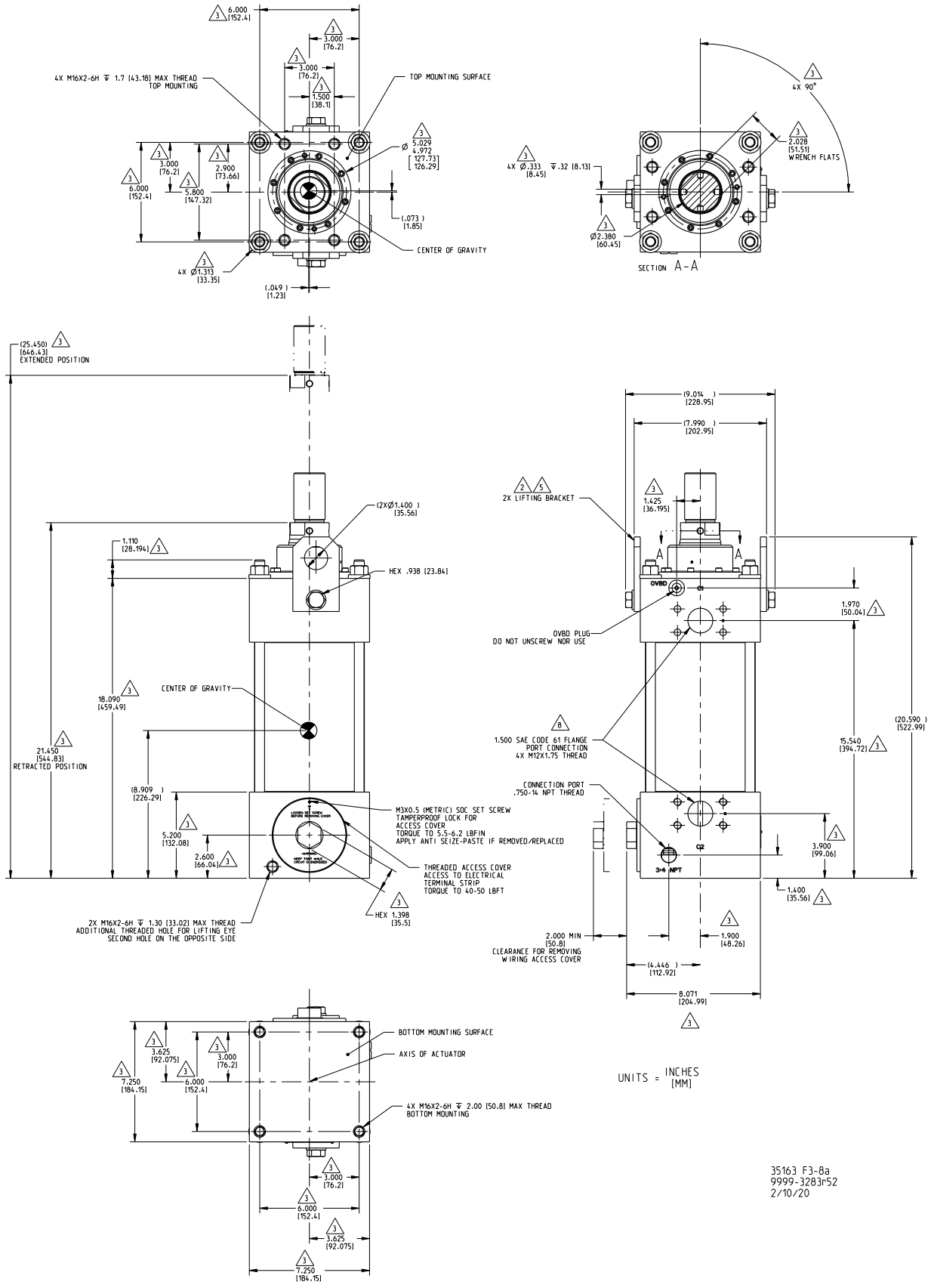


Figure A-4a. VSPC 6x4 Installation Dimensions

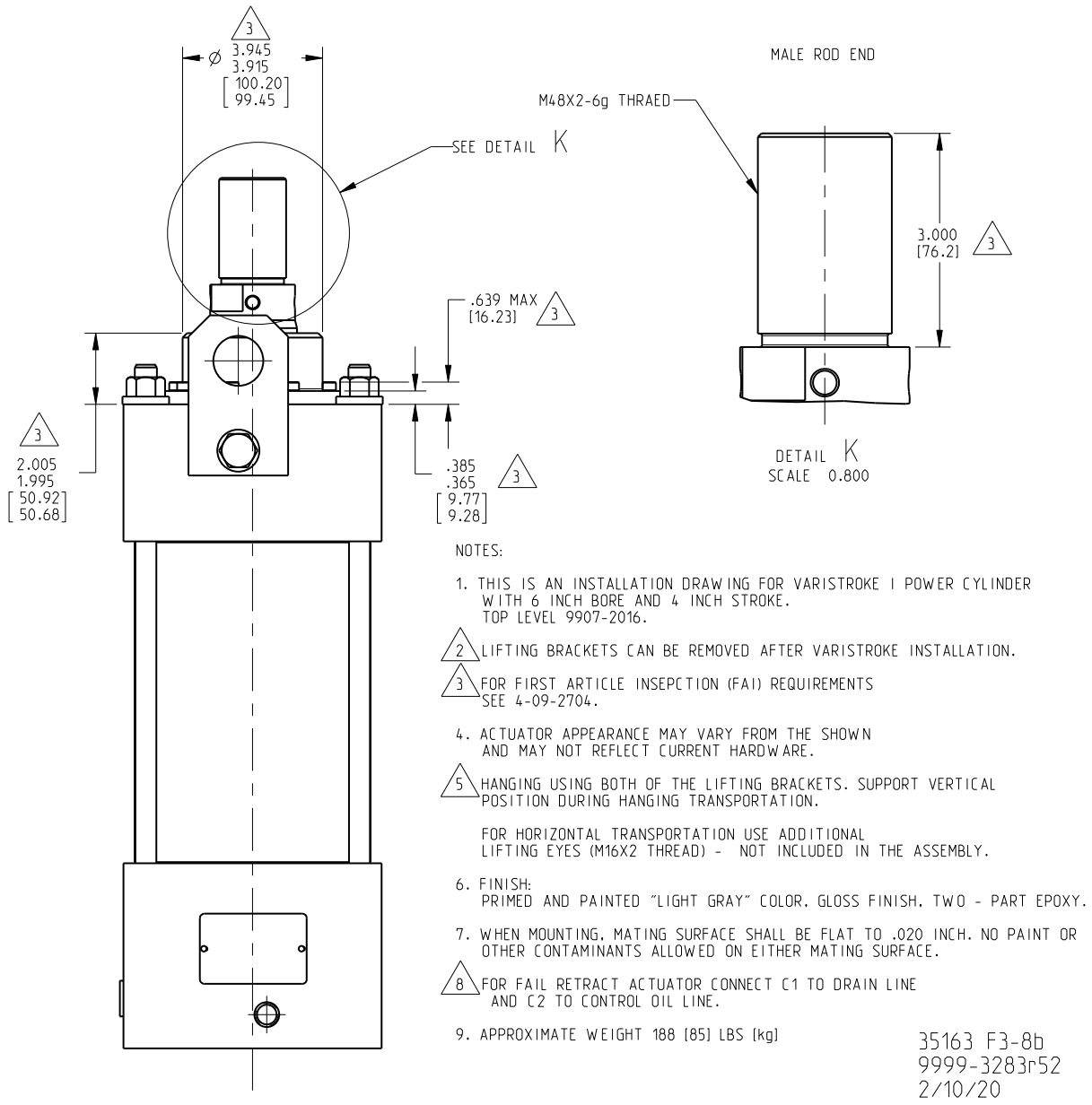


Figure A-4b. VSPC 6x4 Installation Dimensions

Revision History

Revision B—

- Updated Model Number Information in Chapter 5

Revision A—

- Updated Regulatory Compliance section
- Added Tables 1-1, 1-2
- Revised Tables 2-1, 2-2, 2-3, 2-6, 2-8
- Revised Warning box (page 14)
- Revised Figures 3-2 through 3-14
- Added Tables 3-2, 3-3
- Added hydraulic connections and hydraulic drain content (page 24)
- Added Important boxes (page 25) and Warning box (page 27)
- Added “Cylinder Position Sensor” section (page 29)
- Added spare parts content to Chapter 4
- Added Tables 4-1, 4-2, 4-3, 4-4
- Added Important box (page 34)
- Revised remedy for position feedback spread alarm (Table 4-6)
- Added Ordering Code (Chapter 5)

New Manual—

Declarations

EU DECLARATION OF CONFORMITY

EU DoC No.:	00420-04-EU-02-01
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Name(s)/Number(s):	Varistroke Electro Hydraulic Actuators: VS-I, VS-II, VS-GI, VS-DX
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 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC)
Markings in addition to CE marking: (Marking depends on model code. See Product Manual)	(no additional marking for Ordinary Location code 0 models) Ⓔx Category 2 Group II G, Ex db IIB T4 Gb Ⓔx Category 3 Group II G, Ex nA IIC T4 Gc
Applicable Standards:	EN 61000-6-4, 2007/A1:2011: EMC Part 6-4: Generic Standards – Emissions for Industrial Environments EN 61000-6-2, 2005: EMC Part 6-2: Generic Standards – Immunity for Industrial Environments EN IEC 60079-0:2018 - Explosive Atmospheres - Part 0: Equipment – General requirements (A review against EN IEC 60079-0:2018, which is harmonized, shows no significant changes relevant to this equipment so EN 60079-0 :2012/A11 : 2013 continues to represent "State of the Art") EN 60079-1:2014 - Explosive Atmospheres – Part 1 : Equipment protection by flameproof enclosures "d" (A review against EN IEC 60079-1:2014, which is harmonized, shows no significant changes relevant to this equipment so EN 60079-1:2007 continues to represent "State of the Art") EN 60079-15: 2010 - Explosive Atmospheres - Part 15: Equipment protection by type of protection "n"
Third Party Certification: (VS-I, VS-II only)	Zone 1: SIRA 14ATEX1028X CSA Group Netherlands B.V. (NB 2562) Utrechseweg 310, 6812 AR, Arnhem, Netherlands
Conformity Assessment: (VS-I, VS-II only)	Zone 1: ATEX Annex IV - Production Quality Assessment, 01 220 113542 TUV Rheinland Industrie Service GmbH (0035) Am Grauen Stein, D51105 Cologne

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	**Annette Lynch**
Position	**Engineering Manager**
Place	**Woodward, Fort Collins, CO, USA**
Date	04-Oct-2021

5-09-1183 Rev 33

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

File name:	00420-04-EU-MD-02-01
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Names:	Varistroke Electro Hydraulic Actuators: VS-I, VS-II, VS-GI
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

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

Annette Lynch
Signature

Annette Lynch
Full Name

Engineering Manager
Position

Woodward Inc., Fort Collins, CO, USA
Place

March 18, 2022
Date

Document: 5-09-1182 (rev. 17) **PAGE** 1 of 1

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Released

We appreciate your comments about the content of our publications.

Send comments to: industrial.support@woodward.com

Please reference publication 35163.

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Phone +1 (970) 482-5811

Email and Website—www.woodward.com

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

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