WOODWARD

Product Specification **03465** (Revision -, 6/2021)

VariStroke Hydraulic Power Cylinders

Applications

VariStroke Hydraulic Power Cylinders (VHPCs) are a family of heavy-duty hydraulic power cylinders designed for use in extreme hazardous locations within oil & gas, petrochemical or power generation-based applications.

This product family is designed to be used in combination with Woodward's VariStroke servos and VariStroke-DX hydraulic skids. Woodward's VariStroke family of linear electro-hydraulic actuators that are designed to utilize a low-pressure hydraulic oil source

(typically turbine lube oil) to provide its output shaft force for positioning steam turbine control valves, valve racks and trip & throttle valves.

VHPCs are available in many different sizes and configurations, allowing users to customize their VHPC order to ensure their ordered cylinder has the correct bore, length, configuration, shaft threads, feedback sensor, and return spring force to meet their specific application. To ensure proper operation, performance and leak free action every VHPC is individually tested before shipment. Designed for long life every VHPC is backed by Woodward's comprehensive 18-month warranty as well.

Optionally users can order single-acting VHPCs with or without integrated return springs, feedback sensors, dump valve ports, and or integrated fast-acting dump valves. When used, the fast-acting dump valves quickly dump oil from one side of the VHPC's internal piston to the other side. Depending on the application these dump valves can be driven directly from the VariStroke-GI servo driver or from the turbine shutdown system. Currently double-acting VHPC models cannot be ordered with fast-acting dump valves or dump valves.

Optionally VHPCs can be ordered with or without internally mounted/packaged MLDTs (magnostrictive linear displacement transducer) position sensors. To ensure extend operating run-times high resolution dual-redundant MLDT sensors provide accurate shaft position sensing while operating in extreme ambient temperatures up to 85-105°C, depending on hydraulic oil supply temperature.

Depending on the application and need, users can order stand-alone "remote" VHPC models or spare/replacement models for use in replacing an existing power cylinder on their existing integrated or remote VariStroke actuator model.

Description

VariStroke Hydraulic Power Cylinders (VHPCs) are a family of linear hydraulic power cylinders, which can be ordered in many different sizes and configurations. These cylinders are designed for use in combination with Woodward's different VariStroke servos in low pressure (50-500psi) applications. VariStroke-I and II servos are only compatible with double-acting VHPC models (pressure applied to both sides of piston), while VariStroke-GI servos and VariStroke-DX skids are only compatible with single-acting VHPC models (pressure applied to only one of piston). Refer to below matrix of ordering options.



- Designed for use with the following VariStroke servos:
 - ∘ VS-I
 - ∘ VS-II
 - VS-GI
 - o VS-DX
- Applications
 - Steam Turbine Control Valves
 - Steam Turbine Trip & Throttle Valves
- Selectable sizes
 - Piston Bore
 - Stroke length
 - \circ Return spring
- Available with and without
 - Dump valves
 - Dump valve ports
 - Feedback sensors
- Side-load tolerant

 Shaft & piston
 bearings
 - Triple seal technology
- Optional MLDT position sensors
- Zone 1 & Zone 2 Hazardous Location rated models available
- Global/regional repair
 - Via Woodward's Authorized Service Network

Released

The VHPC family utilizes superior materials and high-quality manufacturing practices to ensure long and trouble-free service life and reduced operating costs. Design features such as chrome plated piston rods, internal and protected feedback sensors, stepped cushions, and triple shaft seal technology provide a robust cylinder capable of being used in extreme operating conditions for extended service periods. Shaft and piston bearings as well as Woodward's triple seal technology ensures that these cylinders can withstand side loads of up to 5% of the output force while delivering dry shaft performance for the long term.

Optionally users can order single-acting VHPCs with/without integrated fast-acting dump valves, or with/without dump valve ports. Depending on the application VHPCs can be ordered in in a variety of configurations. Refer to Figure 2 below to understand the available configurations.



Figure 1. Available VHPC Models

Features

Fast Acting Dump Valves — Optionally users can order single-acting VHPCs with integrated fast-acting dump valves. Fast acting dump valves can be used to both increase the slew rate of the actuators requiring fast slew rates during large position changes as well as for applications requiring separation of turbine control and turbine safety system.

Fast Acting Dump Valve Ports — Optionally users can order single-acting VHPCs with dump valve ports only. When ordered in this configuration, the VHPC includes ports with removable blanking plates allowing users to install and or connect their own dump valve assembly.

Note: this configuration allows users of more critical applications to easily connect dual or triple redundant trip block assemblies.

Side Load Capability — A common problem with hydraulic power cylinders is leaking oil from worn shaft seals due to side load force being applied to the output shaft. Designed for a continuous side load of up to 5% of actuator output, the VHPC incorporates a high-force precision bearing and special seal technology on its output shaft to solve this typical application problem.



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Specifications

Environmental

Operating Temperature Range: Operating Oil Temperature	-40 to +105 °C (-40 to +221 °F) (supply oil temperature dependent)
Range: Shock:	+15 to +70 °C (+59 to +158 °F) US MIL-STD-810C method 516.2, procedure 1 (10 G peak, 11 ms duration, saw tooth waveform)
Vibration: Ingress Protection:	US MIL-STD-810F, M514.5A, Cat. 4 (0.015 G²/Hz, 10–500 Hz, 1.04 Grms) IP66 per IEC/EN 60529

Electrical –

Models with MLDT Feedback Sensors:

Input Supply:	20.4 – 28.8 Vdc @ 100 mA
Analog Output Signal:	2 channels, 4–20 mA, max load = 500 ohms,
Linearity:	<u>+</u> 0.02% of full stroke

Models with LVDT Feedback Sensors:

Excitation:	3.0 VRMS (@, 5000 Hz
Sum Voltage:	Va + Vb = 1.2 VRMS
Output Voltage Ratio:	(Va – Vb)/ (Va + Vb) = +0.5 VRMS
Ľinearity:	+0.5% of full stroke

Models with Fast Acting Dump Valves:

Input Supply:	24 Vdc, 20W
Full Öpen Time:	< 250 milliseconds
Full Close Time:	< 2.0 seconds

Hydraulic

Supply Pressure Range:	3.44 to 34.5 bar (50 to 500 psi)
Fluid Types:	Mineral or synthetic or Fyrquel EHC-based oils may be used
Recommended Oil Cleanliness:	24 to 40 pm nominal, β75 (ISO 4406 code 20/18/16 Class) max
Recommended Viscosity:	20 to 100 centistokes
Fluid Ports:	SAE J518 Code 61
Return/Drain Pressure:	Maximum: 2 bar (29 psi)

Regulatory Compliance: "CERTIFICATIONS PENDING FOR NEW VARISTROKE MODEL

(Listings are limited only to those units bearing the appropriate Marking or Agency Information. See model number Compliance code)

European Compliance for CE Marking:

EMC Directive: ATEX Directive:	2014/30/EU 2014/34/EU Zone 1: II 2 G Ex db IIB T4 Gb Zone 2: II 3 G, Ex nA IIC T4 Gc
Other European Compliance:	

Machinery Directive: Pressure Equipment Directive:	Compliant as a partly completed machinery per 2006/42/EC Compliant as "SEP" per Article 4.3 to 2014/68/EU

International Compliance:

IECEx: Certified for use in hazardous locations Zone 1: Ex db IIB T4 Gb Zone 2: II 3 G, Ex nA IIC T4 Gc

North American Compliance: CSA:

: For use in Canada and the United States. Class 1, Div. 1 Groups C,D T4 Class I, Div. 2 Groups A,B,C,D T4



Figure 3. Available Single-Acting VHPC Models / Ordering Number Encoder





Figure 4. Available Double-Acting VHPC Models / Ordering Number Encoder

