WOODWARD

Product Specification **03463**
(Revision -, 5/2019)

VariStroke-DX Skid

Dual Redundant Hydraulic Servo Skid

Applications

The VariStroke-DX (dual-transfer) skid is a dual redundant hydraulic servo system which allows on-line servo repairs and replacement. This skid utilizes two Woodward VariStroke-GI based servo valves to maximize turbine up-time and decrease the number of unscheduled shutdowns due to actuation failures.

The VariStroke-GI is a family of linear electro-hydraulic actuators that are designed to provide the linear actuation force to operate steam turbine control valves, valve racks and Trip & Throttle Valves. This single-acting actuator family is intended for use on mechanical drive or generator-drive steam turbines, and uses a low-pressure hydraulic oil source (typically turbine lube oil) to provide its output shaft force. Refer to VariStroke-GI Product Specification 03464 for more information.

The VariStroke-DX skid is designed to be used in combination with Woodward's single-acting VariStroke Hydraulic Power Cylinders (VHPC). Depending on the application, users can order and pair the correct size (bore, stroke length, return spring force, etc.) VHPC with the VariStroke-DX skid to meet their specific application's requirements. Since every application may require a different size and model of VHPC they are sold separately. Refer to VHPC Product Specification 03465 for size and ordering information.

The combined VariStroke-DX and VHPC system is specifically designed for use on critical API612 steam turbine applications where system uptime is essential. The utilized VariStroke-GI servos' superb accuracy and resolution make it ideal for steam turbine valve control. As a result of this servo's integrated redundancy and when used with the VariStroke-DX skid these servos can be repaired or replaced while the turbine is on-line operating normally ensuring a high level of system reliability and availability.

This VariStroke-DX skid's compact and integrated design provides users with a simple cost effective package to install and service with all the benefits of a fully segmented hydraulic servos. Hand isolation valves are included to give users the capability to easily repair, replace, test and calibrate each individual servo valve. VHPCs are connected to this skid via available hydraulic porting which facilitates connection to a remotely mounted VHPC to position the system's control.

Designed as a stand-alone skid, servo-to-servo communication and automatic fail-over logic is included within each servo forcing automatic transfers to the healthy servo with no external control logic or interface required. Optionally, users can use a local switch or control driven relay connected to the skid to routinely select and switch servo functions as the master and as the slave.

Integrated oil pressure gauges allow users to visually understand which servo is in control and verify the skid's output oil header pressure level. Discrete output relay contacts can also be connected to system indication (lights, lamps, plant DCS) to assist with system status and health monitoring.

- Standard API612 (7th Edition) Compliant
- Automatic & manual transfers
  - Fast transfer times minimizes system disturbances
  - Includes Master/Slave control indication
- Increased reliability
  - Redundant On-line replaceable Servos
  - Master/Slave logic
  - Accepts redundant inputs
- Included isolation valves
  - With tag-out lock protection
- Included knife-switch electrical terminal blocks
  - For ease of replacement and isolation
- Large pressure gauges
  - On-line replaceable
- Designed for low pressure systems
  - 3.44 to 35 bar (50 to 500 psi)
- Included electrical junction box
  - Zone 2 models only
- Compact size
- Models available for Zone1 or Zone 2 hazardous locations

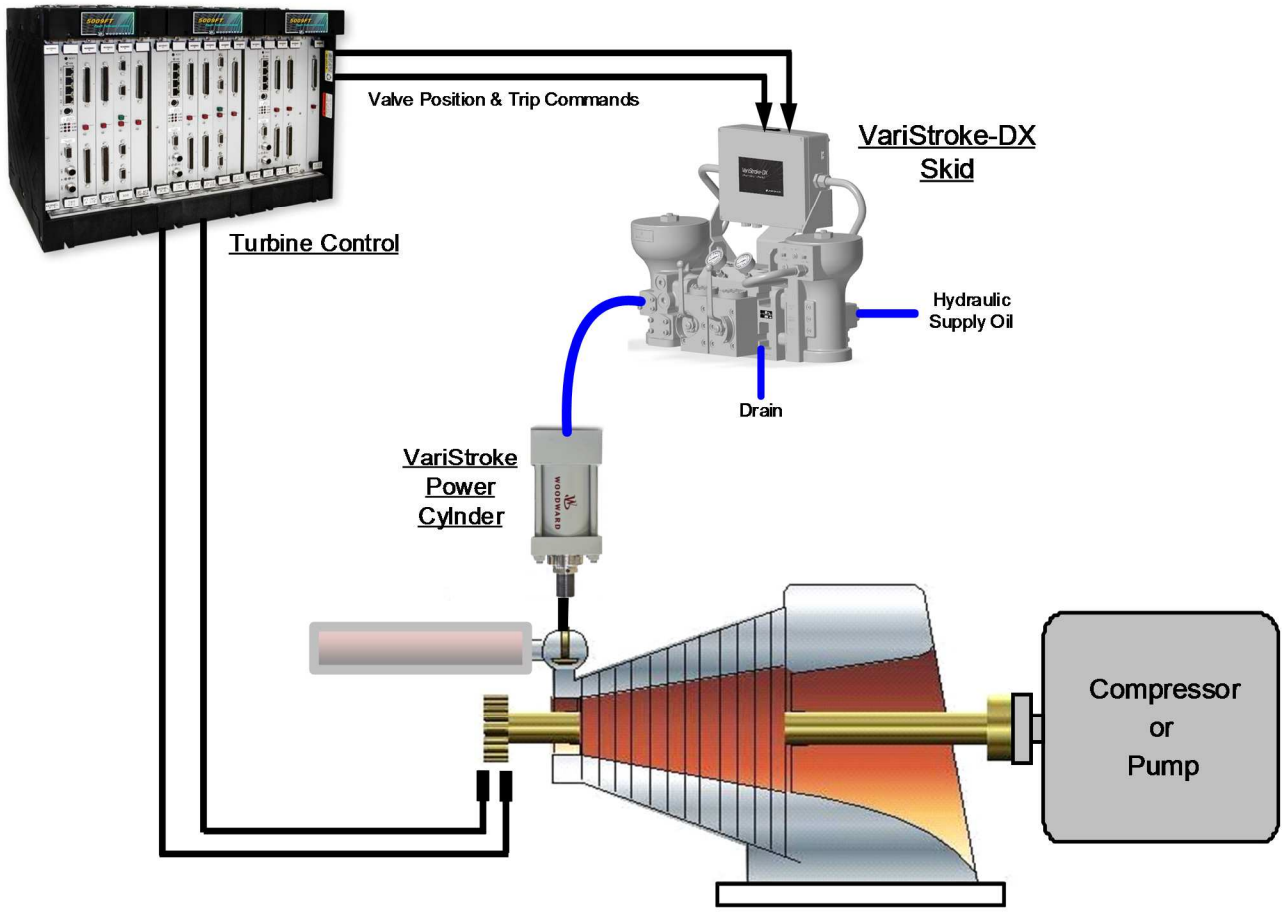


Figure 1. Typical VariStroke-DX Skid Applications

Description

The VariStroke-DX (dual transfer) skid is a complete packaged and tested assembly which consists of two Woodward VariStroke-GI servo valves connected together on a single manifold with all interconnect isolation valves, piping, gauges, and wiring included and tested.

The VariStroke-GI is a linear electro-hydraulic actuator that utilizes a power cylinder with a fail-safe return internal spring (optional) to force the actuator and connected valve closed during normal operation as well as during a turbine shutdown event. This actuator's integrated electronic driver module, servo valve, and position feedback sensors (MLDTs) function together to precisely control steam turbine control and trip valves.

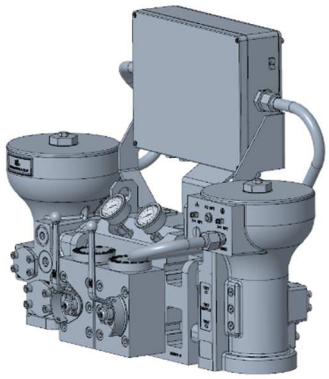
The VariStroke-DX skid uses a specially designed fast-switching hydraulic shuttle valve to switch between servo valves ensuring minimal switchover time and minimal system disturbance. This special shuttle valve allows the servo valve selected as the "master" to control the VHPC and connected steam turbine control valve, while blocking the output pressure of the servo valve selected as the "slave" unit. Using a master/slave based logic, the skid's designated master servo valve controls all aspects of the VHPC/control valve, while the slave servo valve simply tracks the master servo valve's health condition. This type of logic ensures smooth system operations in all stages of operation as it minimizes oil header pressure disturbances (bumps) during unit-to-unit transfers.

The total installed cost for this fully integrated hydraulic skid is low because it has been completely assembled and tested at the factory. This greatly reduces OEM and end-user fabrication, installation, and testing times.

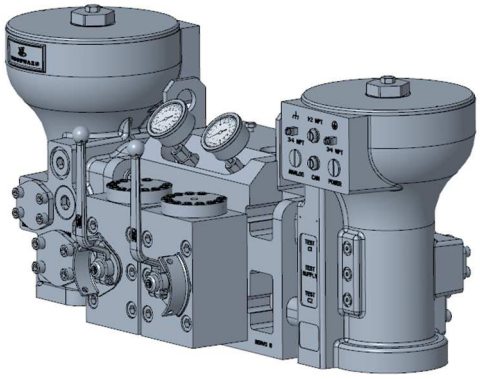
Depending on the application, the VariStroke-DX skid can be ordered with Zone 1 or Zone 2 hazardous environment classifications.

> **Note:** the Zone 2 rated skid model includes an electrical junction box located on the top of the skid which include all control interface and interconnecting wires and terminal blocks. However, the Zone 1 rated skid model includes no electrical junction box.

For Zone 1 applications it is recommended that users install a special Zone 1 rated junction box or connect directly to each servo valve (which are rated for Zone 1 locations) and provide related interface and interconnect wiring in a nearby non-hazardous location. Refer to product manual for more information.



Zone-2 Certified VariStroke-DX Skid



Zone-1 Certified VariStroke-DX Skid

Figure 2. Available VariStroke-DX Models

Features

Redundancy/Availability: Designed for use in critical steam turbine applications where turbine up-time is important, the VariStroke-DX skid uses the following methods to ensure long term system operation:

- Two isolated VariStroke-GI servo valves
- Fast acting shuttle valve to ensure to ensure smooth transfers
- Online servo valve repair/replacement
- Automatic transfer logic (upon master servo valve failure)
- Accepts two redundant power supply inputs
- Accepts two redundant 4–20 mA demand inputs
- Accepts two redundant power cylinder position signals
- Accepts external master servo valve selection

Compatible with Different Power Cylinders: Depending on the application, users can order and pair the correct size (bore, stroke length, return spring force, etc.) power cylinder with the VariStroke-DX skid to meet their specific application's requirements. Refer to VHPC Product Specification 03465 for size and ordering information.

Low Cost and Complexity: The VariStroke-DX skid is a fully packaged hydraulic assembly which includes automatic and manual switchover capability. This skid's automatic switchover logic greatly simplifies the overall turbine control design and lowers system cost as no external switching logic or related wiring is required (not true with competing products).

Pressure Gauges: Pressure gauges are integrated into this skid to assist operators with verification of servo valve operation and control.

Isolation Valves: Integrated isolation valves allow operators to easily isolate each servo valve for repair, replacement, and calibration without affecting the controlling servo valve or turbine operation.

Remote Master/Slave Indication: Each servo valve includes a discrete output relay contact which can be used to remotely indicate which servo valve is in control of the steam control valve/rack. A closed relay contact indicates which servo valve is currently functioning as the master unit.

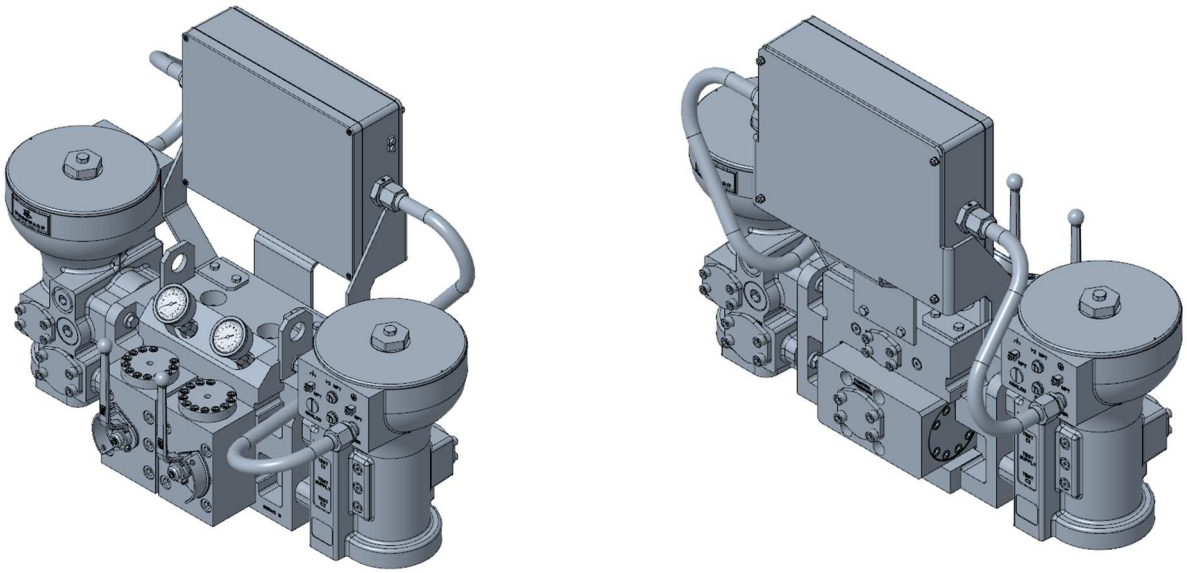


Figure 3. Front and Back Views of Skid (Zone 2 Model)

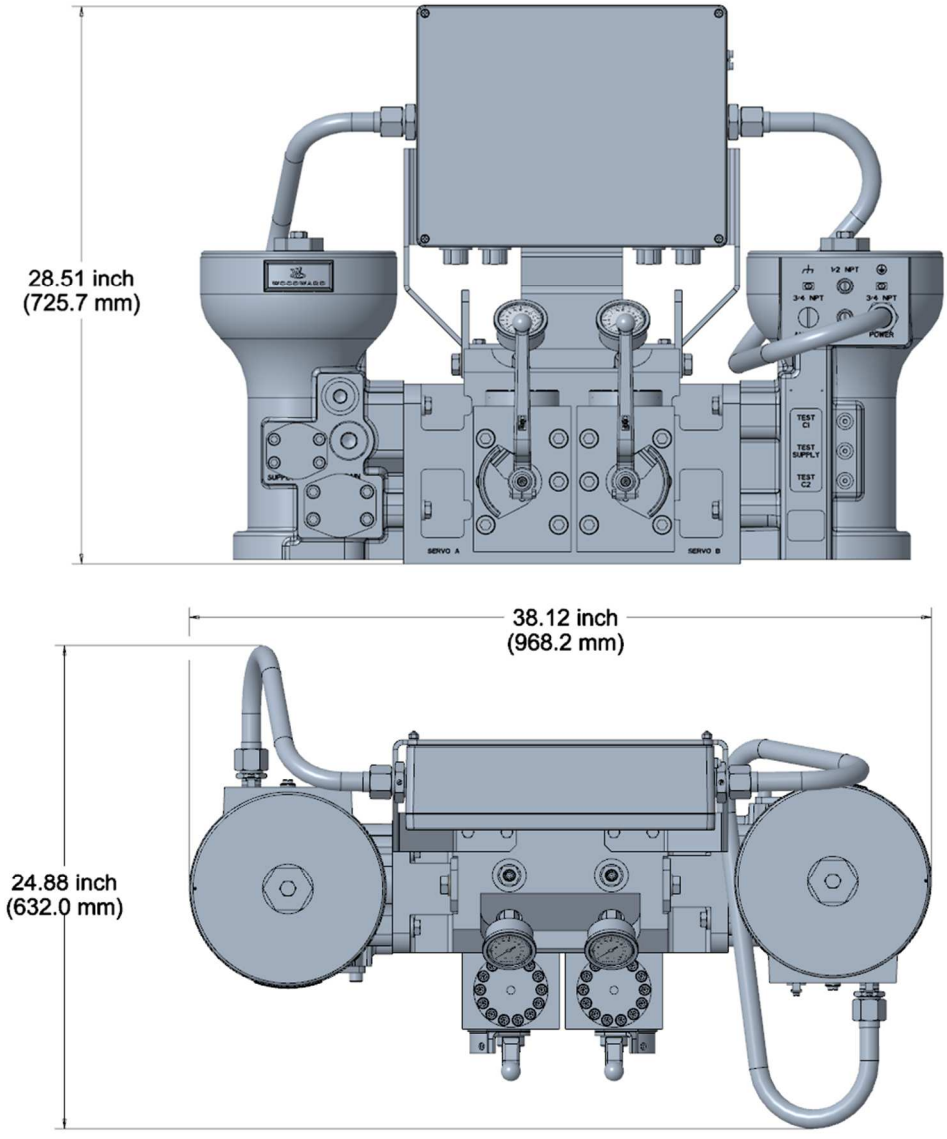


Figure 4. Skid Outline Dimensions (Zone 2 Model)

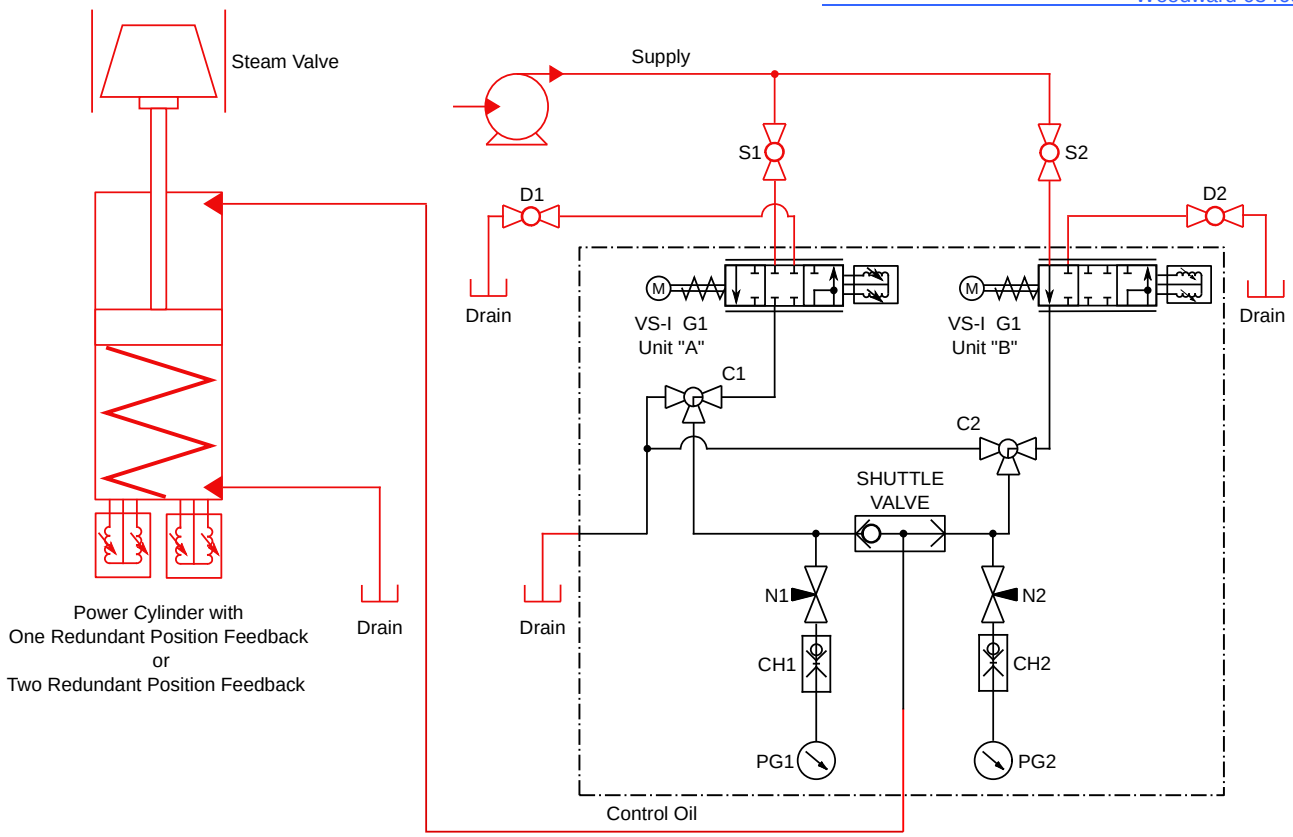


Figure 5. VariStroke-DX Skid Functional Diagram

Specifications

Performance

Refer to VariStroke-GI Product Specification 03464 for related actuator specifications (accuracy, slew rate, etc.)

Manual (commanded) Transfer time:	60 milliseconds maximum
Automatic Master Fail Transfer time:	70 milliseconds maximum

Physical

Maximum Distance from Power Cylinder:	10 meters (32.8 feet)
Skid Dimensions – Zone 2 Model:	24.8 inch -L x 38.12 inch -W x 28.54 inch -H (629.9 x 968.2 x 724.9 mm)
Skid Dimensions – Zone 1 Model:	15.8 inch -L x 38.12 inch -W x 17.03 inch –H (401.3 x 968.2 x 432.6 mm)
Weight:	400 lbs (200 kg)
Mounting:	Horizontal

Environmental

Operating Temperature Range:	–40 to +85 °C (–40 to +185 °F)
Operating Oil Temperature Range:	+15 to +70 °C (+59 to +158 °F)
Shock:	US MIL-STD-810C method 516.2, procedure 1 (10 G peak, 11 ms duration,

Electrical

Refer to VariStroke-GI Product Specification 03464 for related specifications (power, control interface signals, etc.)

Hydraulic

Refer to VariStroke-GI Product Specification 03464 for related specifications (max flow rates, supply pressures, etc.)

Fluid Types:	Mineral or synthetic based oils may be used
Recommended Oil Cleanliness:	24 to 40 pm nominal, β_{75} (ISO 4406 code 20/18/16 Class) max
Recommended Viscosity:	20 to 100 centistokes
Fluid Ports:	SAE J518 Code 61

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:	2014/30/EU
ATEX Directive:	2014/34/EU Zone 1: II 2 G, Ex db IIB T4 Gb Zone 2: II 3 G, Ex nA IIC T4 Gc IP66
Other European Compliance:	
Machinery Directive:	Compliant as a partly completed machinery per 2006/42/EC
Pressure Equipment Directive:	Compliant as “SEP” per Article 4.3 to 2014/68/EU
International Compliance:	
IECEx:	Certified for use in hazardous locations Zone 1: II 2 G, Ex db IIB T4 Gb Zone 2: II 3 G, Ex nA IIC T4 Gc IP66
North American Compliance:	
CSA:	For use in Canada and the United States. Class I, Div. 1, Groups C&D T4 and Class I, Div. 2 Groups A,B,C,D T4

See Technical Manuals 35119 (estimated publishing date 8/20/2019) and 35132 (estimated publishing date 10/15/2019) for additional information on Regulatory Compliance.

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