Applications

The Electrohydraulic Power Cylinder (EHPC) is designed to use a low-pressure hydraulic oil source (typically turbine lube oil) to provide the linear actuation force to operate steam turbine control valves or valve racks. The EHPC is intended for use on mechanical-drive or generator-driven steam turbines, and incorporates a servo actuator, pilot valve, power cylinder, and feedback device into a single package, eliminating linkage, associated bracketing, and greatly reducing hydraulic plumbing.

The EHPC’s modular design allows it to be custom configured to the specific application’s force and stroke requirements. Standard bore diameters and strokes are also available. This actuator is applicable in 2 to 12 inch (51 to 305 mm) linear stroke and up to 19635 lb-force (87 kN) applications.

In retrofit applications, the EHPC can be used to directly replace the existing servo system. This saves costly repairs to existing and aging servos, eliminates difficulties obtaining spare parts for obsolete equipment, and reduces calibration time and difficulty. The total installed cost for this package is low because it has been completely assembled and tested at the factory. This greatly reduces OEM shop floor fabrication time, testing time, and site assembly time. For both OEMs and end-users, the EHPC is designed for ease of application and use, and provides the final integrated element in the control system.

Description

The EHPC is a linear integrating actuator typically used for steam turbine control-valve or valve-rack positioning. This actuator uses a low-pressure (80–250 psi / 552–1724 kPa) hydraulic oil source and then uses three amplification stages to create the required output shaft force. As a custom (made to order) actuator, the EHPC is an actuator that is configured / designed and manufactured specifically for the application. The EHPC has the flexibility to be ordered with the following configuration options:

- Single or double acting cylinder action
- Stroke & cylinder bore options
- Extend or retract current to position direction
- Top or bottom mounting attachment
- Single or dual coil input actuator torque motor
- With or without return spring
- 4–20 mA or 0–10 Vdc cylinder feedback signal
- Optional 1st & 2nd stage oil supply
- 2nd stage spring bias option
- 3rd stage spring bias option

This actuator accepts a 0–200 mA (100 mA null, with an optional 15 mA null) input control signal, to position its output cylinder shaft, and outputs a 4–20 mA or 0–10 Vdc servo position indication feedback signal. An integrating actuator driver (such as a MicroNet™ actuator controller module) or an external servo position driver (such as the Woodward SPC servo position controller) is required to drive and position the EHPC.

The EHPC includes electrical position sensing on the output of the large power cylinder—a combination that, when used with a compatible electronic or digital control, results in powerful steam valve movement with pinpoint accuracy. The EHPC is driven by oil pressure supplied by either the turbine’s lubricating-oil supply or from an external independent oil supply and can be operated in any attitude.
Typical EHPC Outline Drawing (Single or Dual Configuration)
(Do not use for construction)
**Specifications**

**OUTPUT SHAFT**
- Diameter: 1.750 inch (44.45 mm)
- Material: Hardened 17-4 PH stainless steel
- Thread size: 1.250 inch—12 UNF-2A

**MAXIMUM STALLING FORCE**
- Retract direction: \([\text{Bore area} - 2.4 \text{ in}^2 (1548 \text{ mm}^2)] \times (\text{supply pressure})\)
- Extend direction: \((\text{Bore area}) \times (\text{supply pressure})\)

**SERVO CYLINDER**
- Standard bore diameters: 6.0, 8.0, or 10.0 inches (152, 203, or 254 mm)
  - Note: Other bore diameters available as required, contact Woodward for more information.
- Stroke length: 2.0—12.0 inches (51—305 mm)
  - Note: Other stroke lengths available as required, contact Woodward for more information.
- Rod cross-sectional area: 2.4 in² (1548 mm²)
- Stroke direction: Extend or retract on increasing current input

**WEIGHT**
- 900 to 1200 lb (408 to 544 kg)

**OPERATING TEMPERATURE RANGE**
- –20 to +200 °F (–29 to +93 °C)

**MOUNTING**
- Attachment: Mounted by either cylinder end cap

**BOLT HOLE PATTERN**
- Eight 1-1/16 inch (27.0 mm) bolts on 15.375 inch (390.52 mm) circle per National Fluid Power (NFP) Configuration MF-6 and MF-5.

**BOLT HOLE SIZE**
- 1.063—1.073 inch (27.00—27.25 mm)

**CONFIGURATION**
- Does not affect operation
  - Note: While this unit can be operated in any attitude, it is very heavy, and adequate support must be provided, especially if it is operated horizontally. If not properly supported, cylinder deformation will cause side loading resulting in excessive cylinder wear and/or cylinder failure.

**Electrical Specifications**

**INPUT POWER**
- 24 Vdc ±10% @ 2 A

**INPUT SIGNAL**
- 0–200 mA integrating input signal (100 mA null)

**EHPC POSITION FEEDBACK SIGNAL**
- 4–20 mA, 20–4 mA, 0–10 Vdc, or 10–0 Vdc output signal for min to max cylinder position

**Hydraulic Specifications**

**SUPPLY PRESSURE**
- 80 to 250 psi (552 to 1724 kPa)
  - 250 psi (1724 kPa) is the absolute maximum and is not to be exceeded.

**PRESSURE SENSITIVITY**
- Supply and return—less than 2%

**MINIMUM SUPPLY FLOW (STEADY STATE)**
- 9 US gal./min at 200 psi (34 L/min at 1379 kPa)
- 7 US gal./min at 80 psi (26 L/min at 552 kPa)

**MAXIMUM SUPPLY FLOW (TRANSIENT)**
- Use accumulators—up to 175 US gal./min (662 L/min)

**FLOW TOLERANCE**
- ± 10%

**REQUIRED FILTRATION**
- 10 µm nominal, 25 µm absolute

**CONNECTION SIZE**
- 2.0 pipe size, Class 600 raised face flanges per ANSI B16.5

**HYDRAULIC FLUID**
- Types:
  - Mineral or synthetic based oils
  - Note: Contact Woodward for specific oil recommendations.
- Viscosity (recommended):
  - 0.6 to 400 centistokes
- Specific gravity:
  - 0.6 to 1.0
- Source:
  - Turbine lubricating system or external independent supply

**Regulatory Compliance**

North American Compliance: These listings are limited only to those units bearing the UL agency identification.

UL: UL Listed for Class I, Division 2, Groups A, B, C, and D, T4 at 40 °C ambient. For use in Canada and the United States.