cowan dynamics

White Paper

E²H & E²HR Series

Electro-hydraulic Valve Actuator Technology Explained

Product Introduction
E²H SERIES

Cowan Dynamics Inc. E²H series electro-hydraulic actuators provide a compact, reliable and versatile solution to valve automation and flow control. An electro-hydraulic actuator is an actuator that operates a valve via pressured hydraulic fluid however, its main source of energy is solely electric power. The unit consists of an electrically driven hydraulic power source, a hydraulic actuator and a control system.

The supplied electric power is used to energize a motor that runs a hydraulic pump which then supplies the pressurized fluid to operate a hydraulic actuator for the control valve.

The complete system is self-contained which eliminates the need for separated hydraulic power unit, simplifying the system construction and improving safety and reliability.

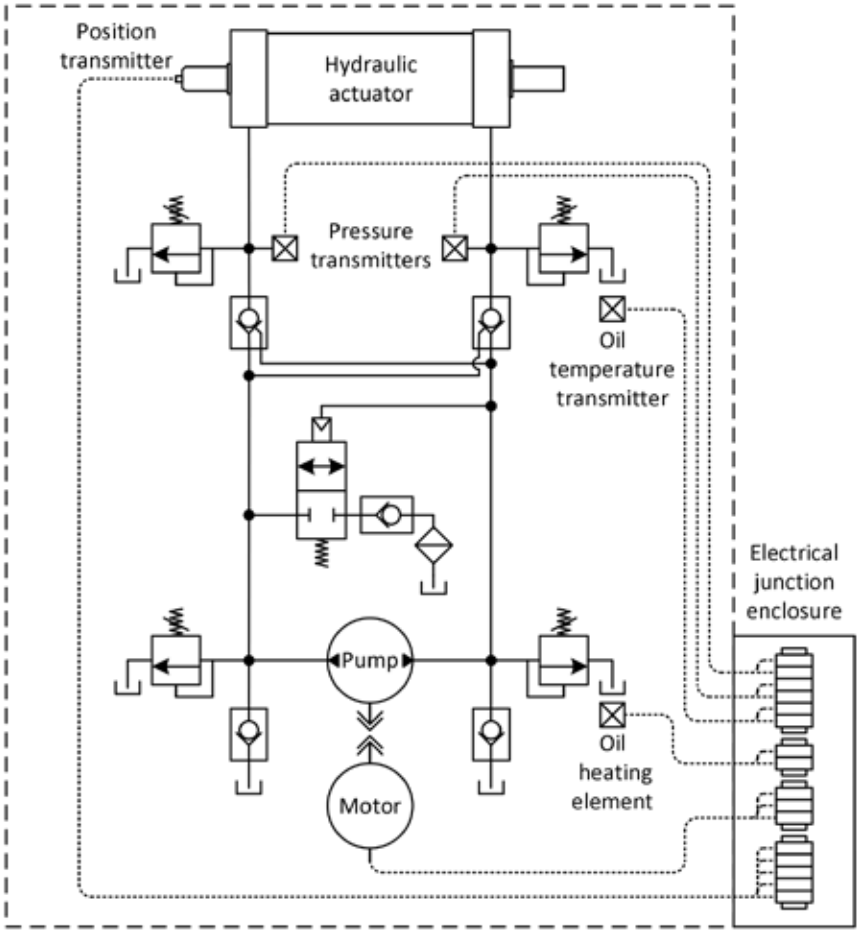
This solution replaces the old style bulky hydraulic power units by eliminating the need for any tubing with an all-in-one design. E²H series electro-hydraulic actuators provide solution for both linear (E²H Series) and rotary (E²HR Series) valve actuation needs.

Resulting from their versatile manifold integrated design of the E²H series electro-hydraulic actuators can be mounted in horizontal or vertical positions to suit the orientation of the valve stem.

Valve interface comes per any standard ISO and MSS pattern. Other custom requirements can be accommodated by consulting Cowan Dynamics Inc.

Hydraulic manual override is available as an integrated manifold block module that can be added to the E²H series actuators. This module includes a hydraulic hand pump and a directional hand valve. The manual override function can be activated/de-activated by simply opening/closing two needle valves.

Double-Acting Electro-Hydraulic Actuator Connection Diagram



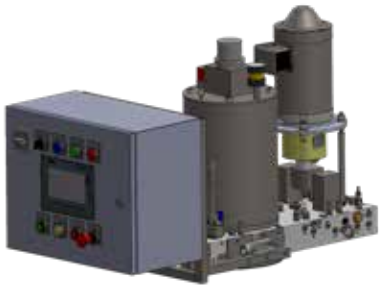
Hydraulic fluid used for operating Cowan Dynamics Inc. electro-hydraulic actuators is inherently and readily biodegradable which is non-toxic, recyclable and free of heavy metals.

E²H Series anodized aluminium manifold block results in light weight and great durability while eliminating all challenges with paint fading, peeling, corrosion and abrasion.

Hydraulic System Design & Capabilities

In E²H series electro-hydraulic actuators all hydraulic components and sensors are **integrated** into a single **compact manifold block** that also houses the actuator and an integral oil reservoir. This results in space saving, ease of installation and eliminating all leak and break points by removing all tubing which could lead to reduction in downtime.

Helical gear technology provides very **high force-density** and achieves the **most compact** solution to generate the torque (comparing to rack & pinion and scotch yoke rotary actuators).

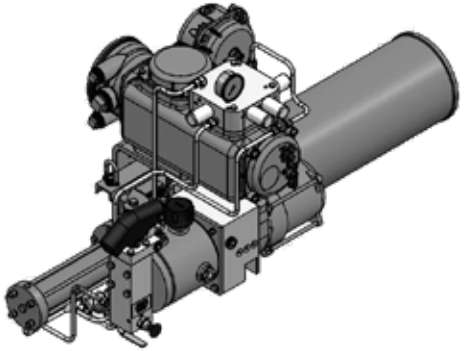


Cowan's E²HR Rotary Series

The E²HR is up to **30% lighter** and **45% smaller** than a comparable scotch-yoke based actuator.

Cowan's E²H Linear Series

The E²H is up to up to **45% lighter and 50%** shorter than our competitors.



Typical scotch-yoke based unit.

E²H Series electro-hydraulic actuators are **sealed units** to prevent the ingress of environmental contaminations.

While this goes a long way to protect the integrity of the hydraulic oil, this alone will not ensure the oil is contaminant free. All hydraulic systems will eventually pull in contaminants from seals, rotating or sliding components. While other manufacturers rely on a closed system only, Cowan takes the extra step of providing an **integrated cartridge filter** to prolong the service life of the hydraulic oil.

This filter is located in the hydraulic manifold block and oil passes through it every cycle.

This filter is easily accessible and replacable to increase system longevity. Hydraulic circuit design and filter type selection ensure there is no pressure drop and back pressure in the hydraulic circuit.

Performance Data

Voltages

Below options are available as standard offering. Please consult Cowan Dynamics Inc. if required option is not listed below.

HP	VOLTAGE			
	200-240Vac		380-480Vac/ 3 phase	500-690Vac/3 phase
	1-phase	3-phase		
1	•		•	
1.5	•		•	
3	•		•	
5	•		•	
7.5		•	•	
10		•	•	•
15		•	•	•

Area Classification

E²H series electro-hydraulic actuators can be configured with different area classification environments.

Option 1	Standard
Option 2	CSA approved Cl. 1, Div. 2, groups A, B, C, & D
Option 3	CSA approved Cl. 1, Div. 1, groups C, & D
Option 4	ATEX Ex db. IIB, Flameproof, Zone 1 and 2, Gas group IIB

Performance Metrics

Dead band*	Min 0.1% of stroke, adjustable for higher values
Positioning Error	Max 0.1% of stroke
Duty Cycle**	100%
Overshoot	Max 0.15% of stroke
Resolution	0.01% of travel
Response	As low as 50 ms
Linear Speed (in/sec)	0.16 to 1.25 ***
Rotary Speed (deg/sec)	1.26 to 45 ***
Outputs	Up to 282,600 lbs.
	Up to 300,000 in. lbs.

*Dead band is defined as maximum allowable position deviation from the setpoint (positioning will be triggered once passed the dead band)

** Duty cycle is defined as $\frac{On\ Time}{On\ Time + Off\ Time}$

(i.e., with 100% duty cycle no down time is required between operations)

*** Other options available, please consult Cowan Dynamics Inc. for customized speeds.

Environmental

Operational Temperatures

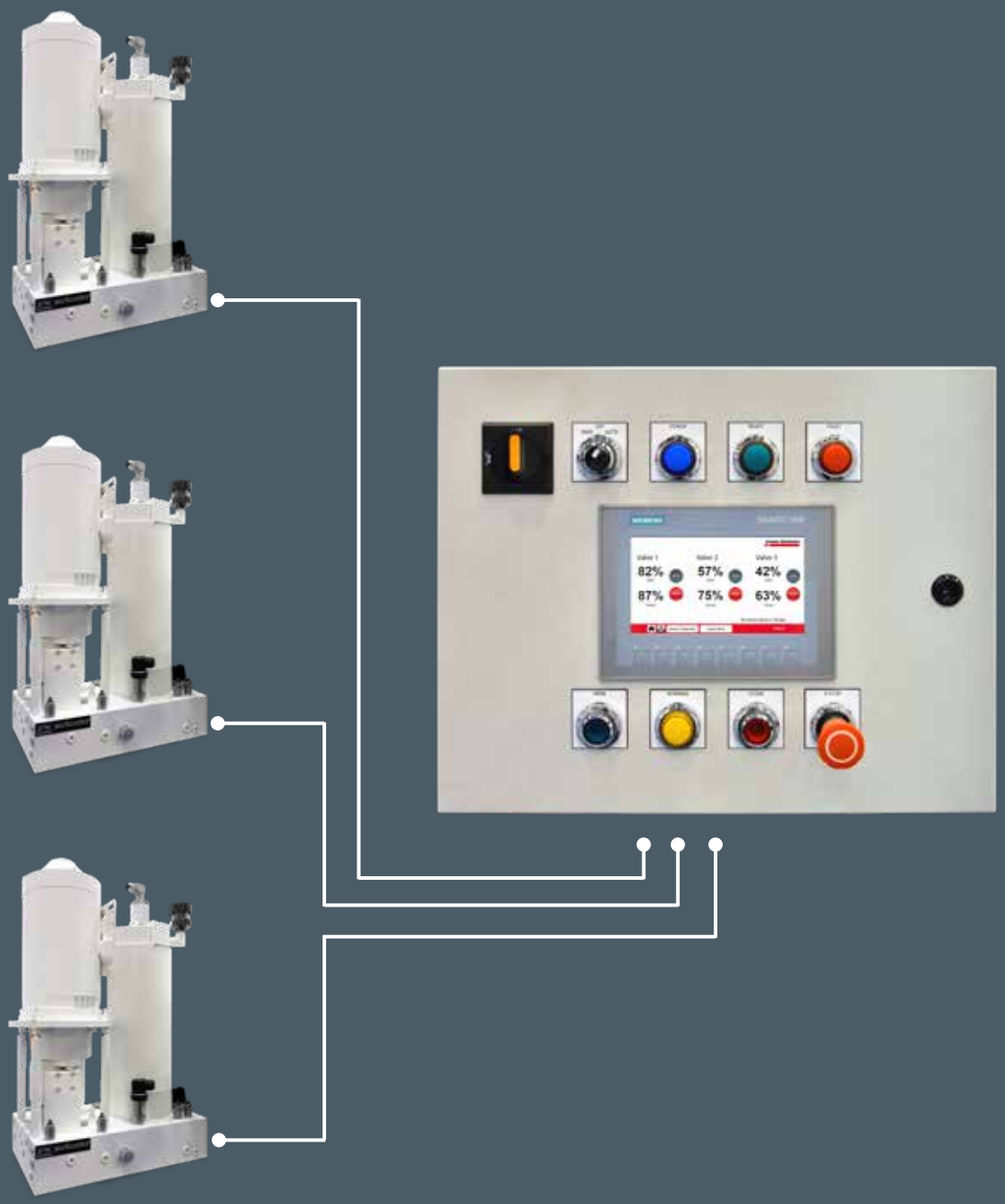
Wide range of temperature ratings make E²H series electro-hydraulic actuators suitable for use in a variety of applications in all climates. Using an integral **cartridge element heater** prevents performance degradation caused by variations in the oil viscosity and eliminates the need for external thermal insulation (i.e., blankets).

Standard	-15 TO 25 C (5 TO 77 F)
Low Temperature	-50 to 25 C (-58 to 77 F)
High Temperature	0 to 40 C (32 to 104 F)
Arctic Service	-50 to 40 C (-58 to 104 F)

Storage Temperatures

Note, the above temperatures are for operation only. The unit must be powered at all times. If the unit is to be left unpowered, it must be stored at a temperature between -30 to 60 C. Consult Cowan's storage procedure for additional information and recommendations for start-up.

E²H low temperature test in Cowan's R&D lab

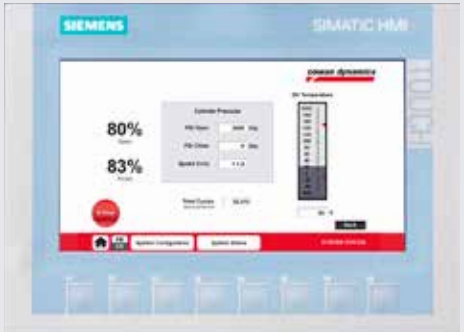


Controls & Monitoring

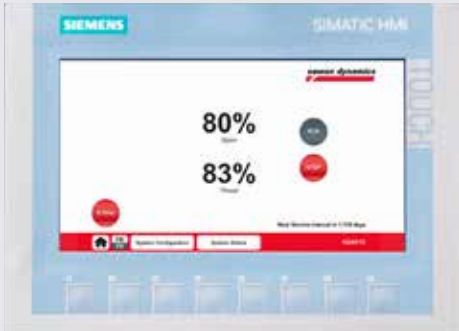
The electrical control panel can be mounted directly on the unit providing a **self-contained compact** design and leading to space savings. When required, the panel can be mounted completely **remote** or in addition to the local integrated panel a **remote station** with control panel can be added in the areas where the unit cannot be accessed easily due to height, environmental conditions, etc.

Moreover, to provide cost savings and ease of status monitoring for the operators in case of **multiple electro-hydraulic actuators**, a central control panel can be mounted remotely to control multiple units (Up to 16 units can be connected).

Controls & Monitoring



Status Screen: The E²H status screen gives you a quick overview of your system status. Available from the touch screen* or via Ethernet.



Remote Screen: Operate your E²H remotely using one of the communication protocols below.

All units come with **sensors** required to monitor the status of the system, including 2 pressure transmitters (4-20 mA), one temperature transmitter (4-20 mA), one position transmitter (4-20 mA) and one oil level switch.

E²H Series electrical control panels come with a multi-color touch screen (HMI) **operator interface** that provides the status of the unit (temperature, pressure, position, oil level, etc.). The interface can be used to send commands such as position setpoint to the actuator. Status of all faults and warnings are available on the HMI (low oil level, high oil temperature, low pressure, low accumulator pre-charge, time-out of operation, failure to open/close, etc.).

This accelerates and facilitates troubleshooting and service of the unit. Typical systems from our competitors use manual gauges. The user must have direct access to the panel to monitor critical parameters such as oil level. The E²H allows the user to access this data from the comfort of the control room.

Cowan Dynamics Inc. electro-hydraulic actuators are available with various **communication protocols** such as standard 4-20 mA, PROFINET, Profibus, ASI and HART.

Additionally, push buttons and LEDs are available on the control panel for **sending local commands** and **quick status monitoring** which can also be used in case of explosion proof applications. For temperatures lower than -30 C an HMI is not available.

Furthermore, ethernet connection to the programmable logic controller (PLC) provides full access to the system settings and status (monitoring faults and warnings) via a customized webpage easily accessible from any standard web browser.

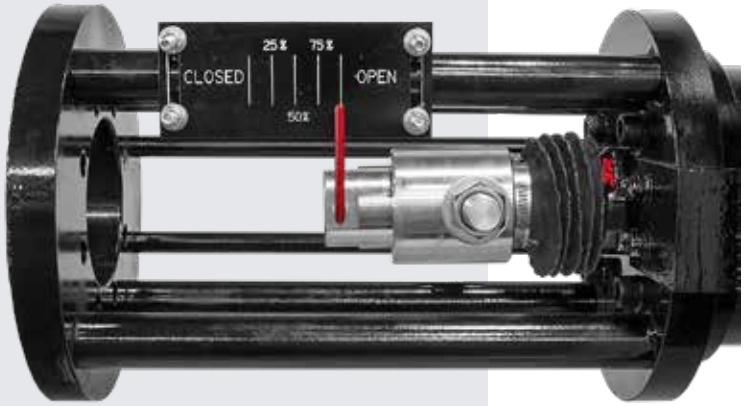
Controls & Monitoring

E²H series can be used in **on-off** and **modulating** applications. To provide accurate and fast positioning, PID controller method is used to move the valve to the position set-point received from 4-20 mA remote signal or HMI.

Emergency shutdown **(ESD)** can be programmed to perform desired action per application specifications and move the valve to the desired position (fully open/close) within specified time.

In case of power loss, the **fail-safe function** gets activated. Actuator moves the valve to the safe position (open/close depending on the application) using stored pressure in the hydraulic accumulator or using **spring-return** canisters.

For fail-last applications the actuator locks in place maintaining the pressure using piloted check valves. The fail-safe function can be programmed to take over in different scenarios (i.e., customized faults). In addition to the fail-safe function, a mushroom twist-release pushbutton, **emergency stop**, installed on the control panel provides easy access for the operators to achieve the fail-safe position., (i.e., 'E-Stop').



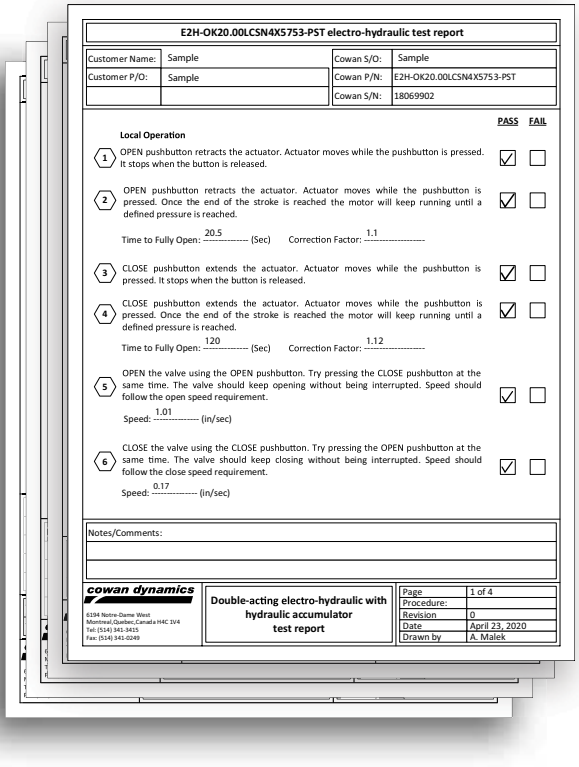
Example of Visual Position Indicator

*Valve Adaptation or pedestals are available to suit your valve. Options include anti-turn guides, lockouts, **visual position indicators** and mechanical stroke adjustments in both open and closed positions.*

E²H Series electro-hydraulic actuators are shipped filled with oil, fully tested and ready for operation. User friendly menu structure on the HMI enables **quick and easy commissioning.**

A remote troubleshooting module is available as an option. Together with a VPN connection, Cowan Technicians can connect to units **anywhere in the world** from our factory in Montreal Canada. This eliminates expensive and time-consuming site visits from factory service technicians.

Factory QA & Testing Section



E2H-OK20.00LCSN4X5753-PST electro-hydraulic test report

Customer Name:	Sample	Cowan S/O:	Sample
Customer P/O:	Sample	Cowan P/N:	E2H-OK20.00LCSN4X5753-PST
		Cowan S/N:	18069902

		PASS	FAIL
	Local Operation		
1	OPEN pushbutton retracts the actuator. Actuator moves while the pushbutton is pressed. It stops when the button is released.	☑	☐
2	OPEN pushbutton retracts the actuator. Actuator moves while the pushbutton is pressed. Once the end of the stroke is reached the motor will keep running until a defined pressure is reached. Time to Fully Open: 20.5 (Sec) Correction Factor: 1.1	☑	☐
3	CLOSE pushbutton extends the actuator. Actuator moves while the pushbutton is pressed. It stops when the button is released.	☑	☐
4	CLOSE pushbutton extends the actuator. Actuator moves while the pushbutton is pressed. Once the end of the stroke is reached the motor will keep running until a defined pressure is reached. Time to Fully Open: 120 (Sec) Correction Factor: 1.12	☑	☐
5	OPEN the valve using the OPEN pushbutton. Try pressing the CLOSE pushbutton at the same time. The valve should keep opening without being interrupted. Speed should follow the open speed requirement. Speed: 1.01 (in/sec)	☑	☐
6	CLOSE the valve using the CLOSE pushbutton. Try pressing the OPEN pushbutton at the same time. The valve should keep closing without being interrupted. Speed should follow the close speed requirement. Speed: 0.17 (in/sec)	☑	☐

Notes/Comments:

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Double-acting electro-hydraulic with hydraulic accumulator test report

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Procedure:	
Revision	0
Date	April 23, 2020
Drawn by	A. Malek

Every Unit goes through rigorous testing at our factory including Pressure and Functional tests.
Each unit has a unique serial number and test report

Reliability (Safety Integrity Level)

The **Safety Integrity Level (SIL)** of E²H Series electro-hydraulic actuators is dependent on de-energizing the solenoid valve to allow the accumulator discharge and move the actuator to the fail-safe position. Therefore, the control function is out of the loop in case of fail-safe function. This makes the unit a non-complex (Type A) component based on the definition of IEC 61508 (device with well-defined failure modes, well known failure rates, and behavior under fault conditions that can be completely determined), in achieving SIL certification.

If required by the plant, to bring **reliability** to the next level, redundant PLC and I/O cards, motor and pump can be provided all integrated to the main electro-hydraulic actuator.

Cowan Dynamics Inc. electro-hydraulic actuators come with pre-programmed **tight shut-off** function that monitors the pressure and position once the actuator is commanded to stay in fully open/close position and acts quickly to compensate for any pressure drop or deviation in the position from fully open/close. This is important due to inherent leakage of hydraulic components.

E²H series electro-hydraulic actuators can be programmed to perform **partial stroke test** (PST). The PST command can be initiated from the remote signal or HMI.

Upon request, **data logging** function can be programmed to capture the actuator data for further analysis. This information can be particularly helpful for **diagnostic** and root cause analysis in case of failure and implementing measures to prevent future failures. The data logging can be triggered manually or automatically upon specific condition and it can capture specified data from different sensors and functions (pressure, position, speed, temperature, torque or thrust, etc.). The data will be accessible by downloading a .CSV file from PLC.

Competitor Matrix

Feature	Cowan	Competition	Benefit	Advantage
Oil Level	Digital Sensors	Manual level gauges	Monitor critical operation parameters such as oil level from the comfort of the control room	Cowan
Artic Service Option	Built in Oil Heater	End User must design and install custom blankets	Blankets are expensive and time consuming to install and remove for simple maintenance	Cowan
Filtration	Closed system with accessible cartridge type filter	Filter non accessible. Unit must be removed to access	Simple and easy filter change	Cowan
Hydraulic System	Manifold Based Design with built-in Reservoir	External reservoir connected with tubing and fittings	All leak and break points are eliminated which leads to reduction in down time required for service	Cowan
Speed Control	Variable Speed Motor	Needle Valve	Custom open & closing times can be program electronically and are repeatable. Needle valves flow control is depending on oil temperature.	Cowan
Size - Linear	Single-Ended Actuator	Double-Ended Actuator	Up to 45% lighter and 50% shorter.	Cowan
Size - Rotary	Helical-Gear Actuator	Stoch-Yoke actuator	Up to 30% lighter and 45% smaller.	Cowan

Related materials

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