

## Liquid Feed Systems

# Encore<sup>®</sup> 700 Diaphragm Metering Pump

The Encore<sup>®</sup> 700 diaphragm metering pump combines the robustness of hydraulic diaphragm pumps with the unparalleled economy, simplicity, and serviceability of a mechanical pump. The Encore<sup>®</sup> 700 pump is engineered to handle industrial and municipal metering applications in water and wastewater treatment, swimming pools, food processing, chemical processing, brewing and distillation, and agriculture.

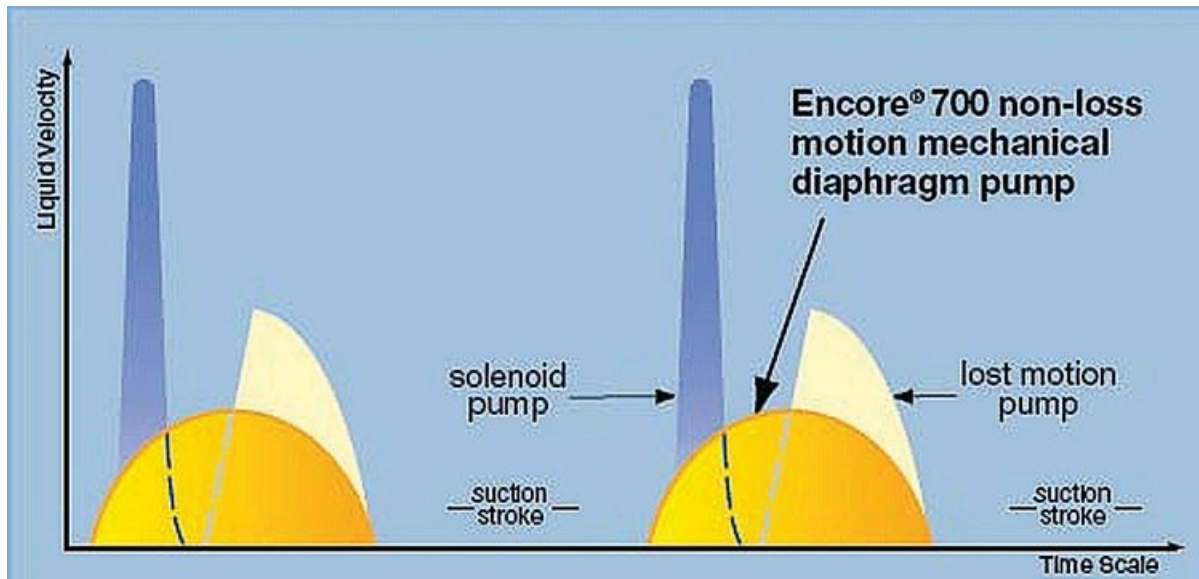
- Handles capacities to 2500 l/h (660 US GPH), back pressures to 12 bar (175 psi)
- Non-loss-motion (amplitude modulation) variable eccentric stroke adjust mechanism renders efficiency, longevity, and reliability, as well as a smooth discharge pattern.
- Flexibility of direct coupled or pulley driven, for an additional 4:1 turndown on stroke frequency with a standard induction motor
- Precision-engineered liquid ends meter mild solutions, aggressive chemicals, high-viscosity polymers, and slurries with greater efficiency than conventional liquid ends
- Clear PVC cartridge valves for fast service with no piping disturbances and built-in visual indication of operation
- Premium composite diaphragm design ensures high metering accuracy, even at varying discharge pressures

### Key Benefits

- *Efficient, reliable and smooth discharge pattern through the use of a variable non-loss-motion eccentric stroke adjustment*
- *High metering accuracy even at varying discharge pressures*
- *Choice of direct coupled or pulley driven, for an additional 4:1 turndown on stroke frequency*
- *Fast and easy service of valve assemblies without disturbing the suction and discharge piping*
- *Visual indication of operation with standard clear PVC valves housing*
- *Choice of configurations:- simplex, duplex and double simplex*



## Technical Data



This graph shows the velocity profiles for each pump type. For any given output, the areas circumscribed by each curve are identical. Note the difference in non-loss-motion designs.

Metering Pump manufacturers generally use one of three diaphragm action methods.

### Solenoid Pumps

The most simple and economical type of pump, these provide a pulsed flow with huge pressure spikes, considerable noise and wear.

### Loss Motion Pumps

These motor-driven pumps are higher in capacity than solenoid pumps, but also give rapid acceleration to the liquid at rest in the pump head due to non-continuous diaphragm motion.

### Non-Loss-Motion Pumps

Unlike solenoid or loss of motion pumps, the Encore<sup>®</sup> 700 diaphragm metering pump is driven by a rotating crankshaft, where the eccentricity can be smoothly adjusted during operation. There are no return springs, and the diaphragm moves with simple harmonic motion. The fluid velocity profile is sinusoidal at all stroke lengths; adjusting stroke length simply alters the amplitude of the sine wave. This design provides reliability and longevity, and pump valves operate with far greater efficiency and minimal system vibration.

## Features

### 1.

Short suction and discharge ports minimize friction losses and cavitation, improving hydraulic characteristics and providing far more efficient fluid metering than conventional liquid end designs.

### 2.

Our premium composite diaphragm is manufactured to stringent specifications to ensure long life even with the most demanding applications. The design incorporates Teflon<sup>®</sup> facing, for the highest degree of chemical resistance, and nylon reinforcements, all bonded to a pre-formed elastomeric support. We've added convolutions for unconstrained rolling action, a steel backing plate to assure volumetric accuracy even at varying discharge pressures, and an O-ring groove in the head's diaphragm cavity for complete sealing.

### 3.

A secondary diaphragm seal completely separates the pump head from the drive unit. This double diaphragm isolating design eliminates the risk of cross-contaminating gear box lubricant and process fluid.

**4.** High precision guided, ball and seat, clear PVC cartridge valves are available to provide built-in sight flow indication and fast, foolproof service. The patented design includes wide flow paths and four-point guides to control ball rise and assure proper seating. The valve housing is compression-sealed to the pump head and pipe connectors by O-rings and is easily removed for service or replacement without disturbing the external piping.

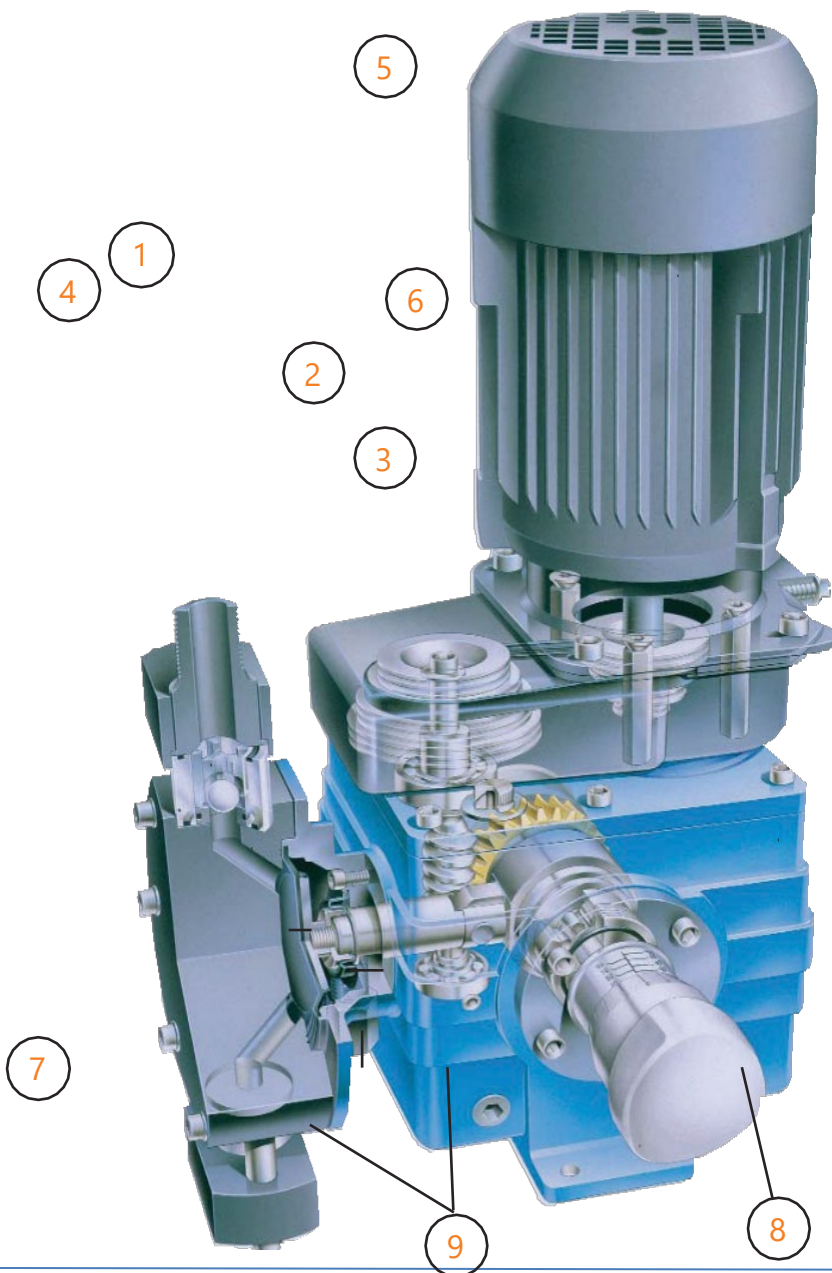
**5.** Available with standard induction, variable speed, or inverter duty motors for wider operating ranges and automatic process control.

**6.** This patented robust mechanical assembly features liberal use of heavy-duty parts, including an epoxy-painted cast iron gearbox for superior corrosion resistance, stainless steel fasteners, load-absorbing tapered roller bearings, robust gears, and steel and nodular iron drive components.

**7.** An optional diaphragm leak detection system senses the early stages of diaphragm failure. The system consists of a solid-state, electro-optic sensor that mounts to the liquid end and a control box. This box, which can be mounted at the pump, or up to 30m (100ft) away, can monitor two liquid ends. LED's and a relay provide both local and remote indication of failure.

**8.** Obtain precise and highly repeatable feed rate settings with a 10-turn, micrometer-type stroke length adjuster. A percent scale and vernier indicate stroke length in 0.25% increments. Feed rate is infinitely adjustable from 0 to 100%. Optional automatic capacity control via stroke length is also available.

**9.** Patented drive and control mechanism with precision liquid end design offer superior metering and process control performance.



The Encore® 700 diaphragm metering pump is available in two compact drive arrangements: direct drive or pulley drive for an additional 4:1 range ability on stroke frequency with a standard induction motor. When the pulley drive arrangement is combined with a DC variable speed motor, total operating turndown can be as high as 800:1.

## Configurations

### Simplex Pump

Offers single head design on single gear box with stroke control.

### Duplex Pump

Offers two identical sized heads on single gear box with common stroke length control, and a direct drive arrangement

### Double Simplex

Offers two heads with two gear boxes each with independent stroke length control, and a common motor.



*Simplex*



*Double Simplex*



*Duplex*

## Controls

The Encore® 700 diaphragm metering pump can be controlled by varying the stroke length or stroke frequency. The following control schemes are available:

- Manual or Automatic Control
- Start-Stop Control where the motor is wired into the circuit of a transfer pump, switch, timer, or controller.
- Flow Proportional Control from a single process variable
- Residual, Compound Loop, or Set point Control using one or two process variables

### Manual Stroke Length Control

A 10-turn micrometer gives continuous feed rate adjustment over a 10:1 range. A percent scale and vernier indicate stroke length setting to 1 part in 400. Each revolution of the knob changes feed rate by 10%. Stroke length is infinitely adjustable from 0 to 100%. The stroke control mechanism provides positive positioning and locking of the stroke mechanism, eliminating the need for external manual locks.

### Automatic Stroke Length Control

For automatic capacity control via stroke length, our NEMA® 4X (IP66) actuator is used in conjunction with either of two process-variable controllers or direct mA input. The compact, field-retrofitable actuator easily installs on the pump and features local manual override and a window for clear indication of stroke length.

## Single Function Controller - Signal Control (SFC-SC)

The economical SFC-SC gives automatic process control in response to one process variable, typically flow rate. Housed in a NEMA® 4X (IP66) enclosure, the SFC-SC features an alphanumeric LCD display with nine-button keypad and menu-driven operator prompts for simple operation, setup, and calibration. Input flow scaling and output dosage adjustment allow independent scaling from 10 to 400%.



## Single Function Controller - Process Control (SFC-PC)

The SFC-PC is a full-feature setpoint controller. It provides automatic process control in response to two process inputs, typically flow rate and chlorine residual.

The SFC-PC can operate in any of four different control modes, including residual feedback, compound loop, dual signal feed forward (for dechlorination), and flow proportional. Housed in a NEMA® 4X (IP66) enclosure, the SFC-PC features a large alphanumeric display bar graph to indicate flow input or actuator position, a nine-button keypad, and menu-driven operator prompts for simple operation, setup, and calibration.



## Direct mA Input

For remote or automatic control, the optional stroke length controller accepts a direct 4-20 mA control signal, typically from a SCADA or centralized control system. Stroke length is linear and proportional to the mA input. See CF.040.050.000.IE.PS for more details.

Variable Speed or Variable Frequency Control Precise and accurate feed rate control via stroke speed control of a DC motor or a variable frequency drive for inverter duty motor is available. Stroke frequency can be regulated manually by potentiometer setting, or automatically via a 4-20 mA process variable input signal (optional). Closed loop speed regulation provides feed rate control accurate to 1% of full scale. Dosing or scaling of a process variable can be accomplished by means of an SFC-SC used in conjunction with a variable speed or variable frequency drive.

For more complex control, an SFC-PC can be used to provide setpoint control in response to two process variables, such as plant flow and chlorine residual.



## Technical Information

### Accuracy

Repeatable metering accuracy is  $\pm 2\%$  of full scale, at constant hydraulic conditions, over a 10:1 operating range.

### Liquid Ends

Diaphragm sizes are 35mm (1-3/8"), 50mm (2"), 75mm (3"), 100mm (4"), 125mm (5"), and 165mm (6-1/2").

### Feed Rate Adjustment

Feed rate is infinitely adjustable from 0 through 100%. A percent scale and vernier indicate stroke length setting in 0.25% increments. Each revolution of the knob changes stroke length by 10%.

### Operating Range

#### Direct Drive Arrangement:

Stroke length is adjustable over a 10:1 range; stroke frequency is adjustable over a 20:1 range (using an optional variable speed drive and DC motor) and 10:1 (using an optional variable frequency drive and inverter duty motor). Total combined maximum operating turndown can be as high as 200:1. Above 100:1 continuous turndown, total available operating range should be evaluated against specific chemicals being metered.

#### Pulley Drive Arrangement:

Stroke length is adjustable over a 10:1 range; stroke frequency is adjustable over an 80:1 range (using an optional variable speed drive), and 40:1 range (using an optional variable frequency drive). Total combined maximum operating turndown can be as high as 800:1. Above 100:1 continuous turndown, total available operating range should be evaluated against specific chemicals being metered.

#### Speed of Response

Automatic stroke length control response time is 100 seconds from 0 to 100%.

Variable speed control response time is under three seconds from 0 to 100%.

#### Suction Lift

The pump will self-prime with a 3m (10ft) of water suction lift (wetted valves, zero back pressure, full stroke and speed, water-like solutions). Once primed, the pump will operate with a 3m (10ft) suction lift. Flooded suction is recommended.

#### Weight and Shipping Weight

Single simplex 50 kg; 58 kg (110 lb; 127 lb); double simplex 73kg; 84kg (160 lb; 184 lb) duplex 64 kg (140 lb). For arrangements with automatic stroke length control add 5.5 kg; 7.3 kg (12 lb; 16 lb).

Single Head Capacities and Discharge Pressures

Diaphragm Size mm (inches)	50 Hz Stroke Frequency SPM	1450 RPM		60 Hz Stroke Frequency SPM	1750 RPM		Pulley Steps**	Maximum Discharge Pressure bar (PSI)			Connections BSP (NPT) [tubing]		
		Capacity*			Capacity*			Motor Kilowatts (Horsepower) @ 1750 rpm {Variable speed}					
		l/h	U SG PH		l/h	U SG PH		.19(1/4)	.37 (1/2)	.55(3/4)			
35 (1 3/8")	30	3.9	1	36	4.7	1.3	1	{.37 (1/2)}	{.56 (3/4)}	{.75 (1)}	R 1/2(1/2") [1/4" IDx3/8" OD]		
	60	7.9	2.1	72	9.5	2.6							
	120	15.8	4.2	144	18.9	5							
	144	18.9	5										
50 (2")	30	20.5	5.4	36	24.6	6.5		1	{.37 (1/2)}	{.56 (3/4)}	{.75 (1)}	R 1/2(1/2") [1/4" IDx3/8" OD]	
	60	41	10.8	72	49.2	13							
	120	82	21.7	144	98.4	26							
	144	98.4	26										
75 ( 3")	30	39.5	10.4	36	47	12.5			1	10(150)	10(150)	10(150)	R1/2(1/2")
	60	79	21	72	95	25				7(100)			
	120	158	41	144	190	50				3(50)	8(120)	8(120)	
	144	190	50.2							3(50)	8(120)	10(150)	
100 (4")	30	60.7	16	36	72.9	19.3	1			9(130)	9(130)	9(130)	R3/4(3/4")
	60	121.4	32.1	72	145.7	38.6				5(75)			
	120	242.9	64.2	144	291.4	77.2				2(30)	5(75)	5(75)	
	144	291.4	77							2(30)	5(75)	9(130)	
125 (5")	30	141.9	37.5	36	170.3	45		1		5(75)	5(75)	5(75)	R1(1")
	60	283.9	75	72	340.7	90				3(40)			
	120	567.8	150	144	681.4	180				1.4(20)	3(40)	5(75)	
	144	681.3	180							1.4(20)	3(40)	5(75)	
165 (6 1/2")	30	260	68.7	36	312.3	82.5			1	3(45)	3(45)	3(45)	R 1 1/2 (1 1/2")
	60	520	137.4	72	624.6	165				1.7(25)			
	120	1040	275	144	1250	330				1(15)	1.7(25)	3(45)	
	144	1250	330							1(15)	1.7(25)	3(45)	

\* Reflects simplex capacities, double-simplex arrangements must be configured with the same stroke frequency on both liquid ends.

\*\* For pulley drive arrangements capacities listed are for pulley step 1. Capacities for steps 2, 3 and 4 are 75%, 50% and 25% respectively. Note: Minimum motor horsepower for 6-1/2" head is 1/2 Induction (1 variable spe

## Temperature Limits

**With PVC liquid end:** ambient temperatures from 2-52°C (35-125°F), process fluid temperatures up to 52°C (125°F).

**With Kynar® and Stainless Steel liquid end:** process fluid temperatures up to 82°C (180°F).

## Electrical Requirements

Standard induction motor arrangement is 1450 rpm (50 Hz)/1725 rpm (60Hz), single phase, TEFC, UL® Listed, CSA® Approved. Motors with other electrical characteristics are available as an option. Diaphragm leak detector requires 115/230 Volts. Relay rating 5 Amps @ 250 Volts, 30 VDC. NEMA® 4X (IP66) enclosure. Variable speed drive control unit requires 115/230 Volts, 50/60 Hz, single phase, 200 mA (115V, 100 mA (230V)). Variable Frequency Drive requires 230 or 460 Volt, 3-phase power. Automatic stroke length actuator - three alarm contacts (high, low, actuator disengaged) N.O., rated 5 Amps @ 250 Volts.

## Materials of Construction

**Gear box and liquid end adapter:** epoxy painted, cast iron

**Actuator enclosure:** epoxy painted, cast aluminum

**Pump head:** PVC, Kynar®, or Stainless Steel

**Suction and discharge valve housings:** clear PVC, grey PVC, Kynar®, or stainless steel

**Valve balls:** 316 stainless, TFE, ceramic, glass, and polyurethane (for slurry service)

**Valve seals:** Hypalon®, Viton®, and EPDM

**Valve seats:** PVC, Kynar®, 316 SS, ceramic (for slurry service)

**Diaphragm:** TFE-faced, fabric reinforced, elastomer backed, with a steel backing plate

**Mounting base:** A mounting base is available with single simplex pumps and standard with double simplex and duplex pumps. The pump is UV resistant

### Polymer and Slurry Handling Capabilities

Polymer solutions at viscosities up to 5,000 cPs at 144 spm. Viscosities measured with a Brookfield® Viscometer with No. 2 spindle at 3 rpm

Hydrated lime slurries up to 455kg/m<sup>3</sup> (3.8 lbs per US gallon) of water; activated carbon slurries up to 131kg/m<sup>3</sup> (1.1 lbs per US gallon of water); diatomaceous earth slurries up to 204kg/m<sup>3</sup> (1.7 lbs per US gallon) of water.

### Chemical Metering Integrated Skid System

To simplify liquid feed system design, installation, and startup, integrated pump skid packages are available from stock components. All systems are laid out on an easily accessible and open frame design with a small foot print. Skid systems also include standard metering pump control panels that are pre-tested and fully integrated with the liquid feed system. They are pre-piped and include many installation accessories, such as back pressure and relief valves, pulsation dampeners, and calibration chambers. Multiple sizes provide a unit tailored to meet a wide range of flows and pressures.





## Accessories

### Metering Pump Control Panel

A metering pump control panel is available that is specifically designed for control of Encore® 700 diaphragm metering pumps. The panel utilizes variable speed AC or DC controllers housed in NEMA® 4X (IP66) enclosure. The panel includes pilot lights for indication of pump status, a digital speed indicator, and a standard isolator.



### Auto Degas Valve

An optional auto degas valve is available for metering liquids, for capacities up to 91 l/h (24 GPH US), such as sodium hypochlorite, that tend to gas off especially at low chemical feed rates and/or start-stop operation. With the auto degas valve installed; the pump can be restarted under high back pressure conditions without the need for manually priming the liquid end. This can be a major advantage especially for unmanned stations. The valve has a PVDF housing, Viton® and EPDM O-rings, a PTFE diaphragm, and a Hastelloy® C spring. Retrofit kits are available for existing installations. For more information see publication CF.470.250.000.PS



### Diaphragm Leak Detector

An optional diaphragm leak detector system is available. It senses the early stages of diaphragm failure. The system contains an electro-optic sensor mounted to the liquid end and a NEMA® 4X (IP66) control box. It can monitor two liquid ends and it includes a relay for remote indication of diaphragm failure.



### Optional Installation Accessories

Available accessories include back pressure valves, pressure relief valves, anti-syphon suction demand valves, main connections, suction line strainers, pulsation dampeners, calibration columns, solution tanks, mixers, and level switches.

cleanwater1

1901 West Garden Road | Vineland, NJ 08360  
Tel: 856.896.2160 | Email: info@cleanwater1.com  
cleanwater1.com

© 2023 cleanwater1, inc. Subject to change without prior notice.