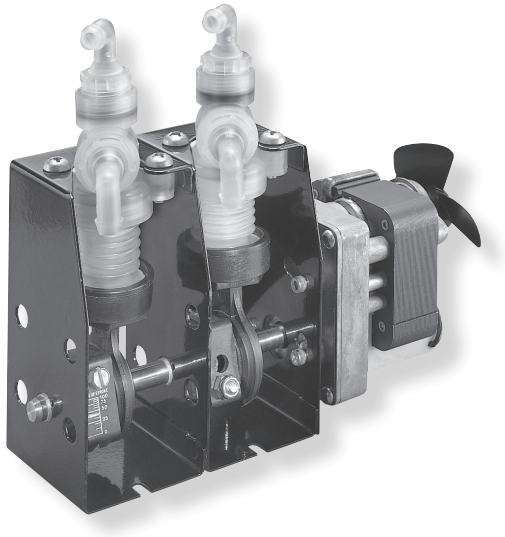
Compact Bellows Pumps

GRI PUMPS
A GORMAN-RUPP COMPANY
The Pump People



Compact Bellows Metering Pumps were specifically designed for metering applications requiring low discharge pressures. Compact pumps have been successfully applied in photo, X-ray and dental film processors; silver recovery; and scientific and analytical instruments.

The compact bellows pumps utilize GRI's proven bellows and valving technology to provide an accurate and economical metering pump with long life. The proprietary blended polypropylene materials of construction and a wide selection of valve and O-ring elastomers produce chemical resistant pumps capable of handling a wide range of fluids.

Features:

- Average repeatability from stroke-to-stroke to ± 0.75%
- Dry run capability
- Self-priming
- No dynamic seals
- Corrosion resistant
- Long, maintenance-free operation
- Simple Flow adjustment

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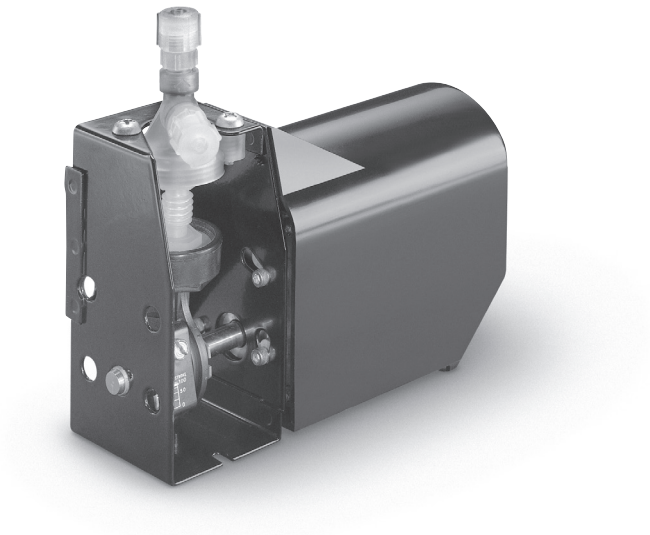

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Compact Bellows Metering Pumps Overview

GRI's line of Compact Bellows Metering Pumps were specifically designed for metering applications requiring low discharge pressures. Compact pumps have been successfully applied in photo, X-ray and dental film processors; silver recovery; and scientific and analytical instruments.

The compact bellows pumps utilize GRI's proven bellows and valving technology to provide an accurate and economical metering pump with long life. The proprietary blended polypropylene materials of construction and a wide selection of valve and O-ring elastomers produce chemical resistant pumps capable of handling a wide range of fluids.

Compact Bellows Metering Pump Operation:

The Compact Bellows Metering Pumps operate on a positive displacement principle. The rotation of the motor shaft is transmitted into an up and down linear motion through an adjustable concentric crank mechanism. This motion provides a continuous compressing and relaxing force on the bellows module, forcing fluid between two check valves located in the module's valve body. Up to four separate bellows modules can be operated by single motor for proportioning up to four separate fluid mediums. The flow rate of each module is independently adjustable. Multiple bellows modules operate out-of-phase with each other for most efficient power usage.

Any combination of ½", ¾", 1", 1-1/2" and 2" bellows may be used in a pump. However, the total output must be limited to a maximum flow rate of 3000 ml/min.

Optimum Operating Conditions:

Optimum operating conditions consist of a 6" minimum suction life and a discharge head of not less than 6". Pumps must be mounted vertically with the valve body at the top to obtain maximum metering accuracy. For conditions where a positive suction head condition exists, an anti-siphon spring or anti-siphon spring kit can be added to aid the poppet valve seal properly during operation. See pages 9 and 10 for Accessories.

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Flow Rates:

The flow rate of each pump is regulated by three factors:

1. Diameter of the bellows,
2. Speed of the gearmotor,
3. Adjustment of the module stroke length.

The full stroke displacement and discharge pressure of the pump is dependent on the size of the bellows as shown below. If higher discharge pressure is required, please consult factory for an OEM solution.*

COMPACT BELLOWS MODULE FLOW RATE CHART											
Bellows Size		½"		¾"		1"		1½"		2" *	
Full Stroke Displacement (ml)		.5		1.8		5		10.5		18	
Max Discharge Pressure (psi)		5		5		5		5		5	
Motor RPM	**HZ**	**Max Flow per Module (ml/min)**									
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
38	50	3.8	19	13.7	68.4	19	190	39.9	399	68.4	684
45	60	4.5	22.8	16.4	82.1	22.8	228	47.8	478.8	82.1	820.8
75	50	7.5	37.5	27	135	37.5	375	78.8	787.5	135	1350
90	60	9	45	32.4	162	45	450	94.5	945	162	1620

Flow Adjustment:

The ½" and ¾" bellows modules can be adjusted to 20% of maximum stroke length, while 1", 1-1/2" and 2" bellows modules can be adjusted down to 10% of maximum stroke.

Note: Best priming and metering accuracy occurs when the stroke length is 50% or greater.

Standard Crank - Adjustment cannot be made while pump is operating. An adjusting screw changes the stroke length of an eccentric crank.

Compact Bellows Metering Pump Specifications:

Flow Rates - Range from 3.8 ml/min to 1620 ml/min, Tandem flow rates to 3,000 ml/min.
Max Discharge Pressure - 5 psi
Max Fluid Temperatures - To 140°F (60°C)

Note: Reduce pressure rating by 50% for fluid temperatures over 120°F (49°C).

Viscosity/Slurries - Maximum fluid viscosity is 5,000 centistokes. Poppet valves can handle fine slurries.

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MAXIMUM DRY AND WET PRIMING SPECIFICATIONS • Feet (Meters)				
Bellows Sizes	Dry Prime 50% of Full Stroke	Dry Prime 100% of Full Stroke	Wet Prime 50% of Full Stroke	Wet Prime 100% of Full Stroke
½"	2.5 (.76)	8.67 (2.64)	5.83 (1.78)	17.17 (5.23)
¾"	1.08 (.33)	3.75 (1.14)	2.5 (.76)	6.25 (1.91)
1"	3.08 (.94)	8.33 (2.54)	6.25 (1.19)	14.25 (4.34)
1½"	4.33 (1.32)	11.00 (3.35)	9.58 (2.92)	20.58 (6.27)
2" *	8.08 (2.46)	16.67 (5.08)	12.75 (3.89)	23.50 (7.16)

Note: All testing is done with water at an ambient temperature of 80 degree F. If specific gravity or viscosity of fluid being pumped is significantly greater than water (1.0), please consult factory.

Gearmotors:

Catalog gearmotors are available in 115V, 50/60 Hz or 220V, 50/60 Hz. Standard motor speeds are 45.6 and 90 RPM at 60 Hz and 38 and 75 RPM at 50 Hz. Motors are UL recognized and continuous duty rated with a minimum life expectancy of 2000 hours. Perpetual running of motor is not recommended. If a non-stop application is encountered, the Gorman-Rupp Industries Heavy-Duty Bellows Metering Pump is recommended.

Materials in Contact with Solution:

Connectors - Polypropylene
O-Rings (Elastomers) - EPT/EPDM or Viton®/Fluoroelastomer
Poppet - EPT/EPDM or Viton®/Fluoroelastomer
Bellows - Standard Polypropylene Materials
Additional materials available, refer to OEM Section for details.

Compact Bellows Metering Pump Selection:

The pump selection procedure is detailed in the Pump Selection Guide on the following two pages, (5 & 6).

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Pump Selection Guide
Compact Bellows Pumps

The Compact Bellows Metering Pumps are designed for applications with low pressure requirements. Maximum discharge pressure to 5 psi. Pumps are only available with standard crank mechanism. Pumps with up to four (4) bellow modules are available. Flow rate for each module is independently adjustable.

Order Notes: When ordering a compact bellows model, refer to the Pump Selection Process steps 1 through 6 and follow the example provided below.

Example: The model number and code for a 4-Tandem Pump with 1-1/2", 1", 1, and 1/2" bellows, Viton® elastomers for the first two bellows modules and EPT/EPDM for the last two, all with 3/8" elbow swivel barbed tube connectors except for the 1/2" using 1/8" ID compression fittings, driven by a 230V-AC, 50/60 Hz, 45 RPM motor would be: 16004-004 F-009 T-008, F-006 T-008, F-004 T-008, F-001 T-001.

Pump Selection Process:

1. Using Chart A, select a bellows module and motor RPM combination whose maximum output meets or exceeds your flow requirements. Best metering accuracy occurs when bellows are adjusted at 50% or more of their maximum output.
2. Using Chart B, determine base model module configuration.
3. Using Chart C, select appropriate 3-digit dash number to add to base model number according to the desired motor voltage and RPM determined in Chart A.

CHART A: Compact Bellow Module Flow Rate Chart

Bellows Size		1/2"		3/4"		1"		1 1/2"		2"	
Full Stroke Displacement (ml)		0.5		1.8		5		10.5		18	
Max Discharge Pressure (psi)		5		5		5		5		5	
Motor RPM	Hz	Flow per Module (ml/min)									
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
38	50	3.8	19	13.7	68.4	19	190	39.9	399	68.4	684
45	60	4.5	22.8	16.4	82.1	22.8	228	47.8	478.8	82.1	820.8
75	50	7.5	37.5	27	135	37.5	375	78.8	787.5	135	1350
90	60	9	45	32.4	162	45	450	94.5	945	162	1620

CHART B: Base Model Configuration

Base Model Number	Base Model Description
16001-xxx	Single Pump
16002-xxx	2 - Tandem Pump
16003-xxx	3 - Tandem Pump
16004-xxx	4 - Tandem Pump

CHART C: Motor Voltage / RPM

Base Model Number	115V-Ac 38 RPM @ 50 Hz 45 RPM @ 60 Hz	115V-AC 75 RPM @ 50 Hz 90 RPM @ 60 Hz	230V-AC 38 RPM @ 50 Hz 45 RPM @ 60 Hz	230V-AC 75 RPM @ 50 Hz 90 RPM @ 60 Hz	12V-DC		24V-DC	
					45 RPM	90 RPM	45 RPM	90 RPM
16001	-002	-003	-004	-005	-007	-008	-009	-010
16002	-002	-003	-004	-005	—	—	—	—
16003	-002	-003	-004	-005	—	—	—	—
16004	-002	-003	-004	-005	—	—	—	—

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Pump Selection Process:

4. Using Chart D, select appropriate F-Code according to each bellow's module size, valve type and elastomer. Note: The largest bellows module will be configured closest to the motor.
5. Using Chart E, select one T-Code for each F-Code chosen from Chart D.
6. Optional: Place desired H-Code from Chart F at end of model number. Without an H-Code, the pump will be have exposed motor and bare wire leads.

CHART D: F-Codes – Bellows, Valve Type and O-ring Material Selection Options

Bellows Size	Poppet EPT/EPDM	Poppet Viton®
1/2"	F-001	F-003
3/4"	F-035	F-037
1"	F-004	F-006
1 1/2"	F-007	F-009
2"	F-031	F-033

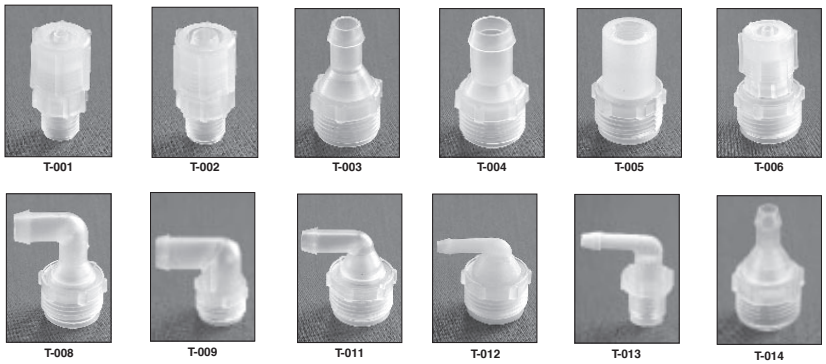
CHART E: T-Codes – Tubing Connector Selection Options

T-Code	Connector Size	Connector Type	Bellows Size
T-001	1/8" ID x 1/4" OD	Barbed Compression	1/2"
T-002	1/4" ID x 3/8" OD	Barbed Compression	1/2"
T-003	3/8" ID	Barbed	3/4", 1", 1 1/2", 2"
T-004	1/2" ID	Barbed	3/4", 1", 1 1/2", 2"
T-005	1/8" Pipe Thread	Female NPT (FTP)	3/4", 1", 1 1/2", 2"
T-006	1/8" ID x 1/4" OD	Barbed Compression	3/4", 1", 1 1/2", 2"
T-007	1/4" ID x 3/8" OD	Barbed Compression	3/4", 1", 1 1/2", 2"
T-008	3/8" ID	Elbow Swivel, Barbed	3/4", 1", 1 1/2", 2"
T-009	1/2" ID	Elbow Swivel, Barbed	3/4", 1", 1 1/2", 2"
T-011	1/4" ID	Elbow Swivel, Barbed	3/4", 1", 1 1/2", 2"
T-012	4mm (5/32") ID	Elbow Swivel, Barbed	3/4", 1", 1 1/2", 2"
T-013	4mm (5/32") ID	Elbow Swivel, Barbed	1/2" , 3/4"
T-014	1/4" ID	Barbed	3/4", 1", 1 1/2", 2"

CHART F: H-Codes – Motor Cover Options

H-Code	H-Code Description
H-001	Cover Only
H-003	Cover with On/Off Switch, 6' Cord with Plug, 115V
H-004	Cover with On/Off Switch, 6' Cord with Plug, 230V
H-005	Cover, 6' Cord without Plug, 115V
H-006	Cover, 6' Cord without Plug, 230V
H-008	Cover, 6' Cord with Plug, 115V

Tubing Connectors (T-Codes)



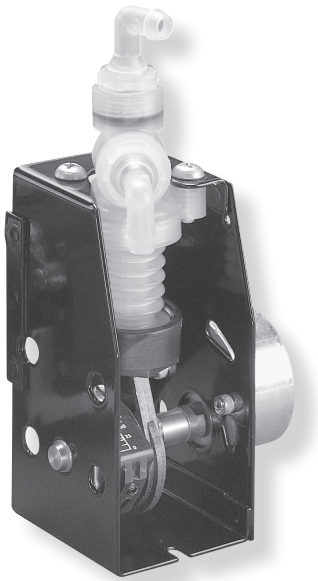
Options
Compact Bellows

GRI specializes in the adaptation of standard models to meet the ever-changing needs of the Original Equipment Market. Contact us if one of our standard models does not meet your specific requirements.

Motors

- **Speeds**
  Standard motor speeds are 45.6 and 90 RPM at 60 Hz. Motors can be supplied in virtually any speed up to a maximum of 120 RPM.
- **Voltages**
  Standard voltages are 115V, 50/60 Hz, or 230V, 50/60 Hz. However, the following special voltages are also available: 12 and 24VDC, or 24VAC.
- **Designs**
  The standard motor is an open, shaded pole gearmotor. Motors are also available in steppers, and DC.
- **Options**
  Motors can be supplied with microswitches for stroke counting and cork brakes. Units without motors (pedestal models) are also available on some models.

Shaded Pole Motor with Microswitch



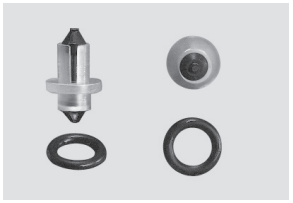
Synchronous motor

Miscellaneous Options
Compact Bellows

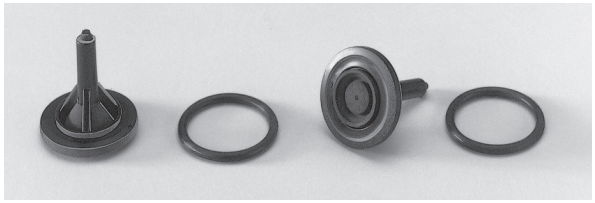
Other options available for the compact bellows pumps include duckbill valves, miniature switches to count strokes, stainless steel mounting brackets and splash covers.

Poppet Valves & O-Rings

The standard elastomers for the poppet valves and O-rings are EPT/EPDM and Viton®/Fluoroelastomer. These elastomers have historically been able to handle the vast majority of the applications in which we've been involved. However, Butyl, Hydrin, Kel-F®, Silicone and Nitrile can be supplied for chemicals requiring such materials.



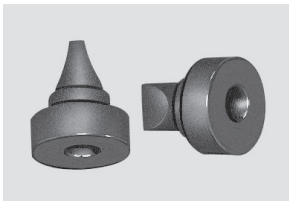
1/2" Poppet Kit



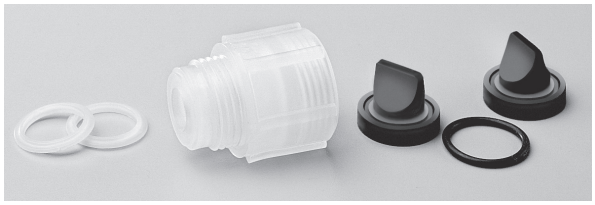
3/4", 1", 1 1/2", and 2" Poppet Kit

Duckbill Valves & O-Rings

Duckbill valves are required in those applications where heavy slurries and fibrous materials are being pumped. Heavy slurries should be flushed from the bellows before pump is shut down. Duckbill valves are available in the same elastomers as the poppet valves.



1/2" Duckbill Valve Kits



3/4", 1", 1 1/2", and 2" Duckbill Valve Kits

Valve Bodies

Standard valve body on the compact pump is a 90° valve body. Vertical and T-head valve bodies can be substituted on all bellows sizes except the 1/2" bellows.

Pump Covers

In addition to the standard options listed, cover options can also include different wire or cord lengths and terminations, strain reliefs and ground wires.

Check and Foot Valves

Check and foot valves are used to maintain a pump's prime or to prevent backflow through a pump in applications with long suction lengths. Check valves can be positioned in-line on the suction or discharge side of the pump; foot valves on the suction side only. To order, refer to the chart on this page.

Elastomer	Single Check Valves		Dual Check Valves	Foot Valves	
	⅜" I.D. Tubing	½" I.D. Tubing	⅜" I.D. Tubing	⅜" I.D. Tubing	½" I.D. Tubing
EPT/EPDM	15099-002	15099-018	12171-004	15101-002	15101-018
Viton®/ Fluoro-elastomer	15099-006	15099-022	—	15101-006	15101-022

Single Check Valve

Opening Pressure: 1 psi (spring loaded)
Materials in Contact with Solution:
- Body, valve seat, connectors, screen (149 Micron) - Polypropylene
- O-rings - EPT/EPDM, Viton®/Fluoro-elastomer
- Spring - Hastelloy® C

Options: ½" or ⅜" I.D. tubing connectors

Dual Check Valve

Opening Pressure: .2 psi (two poppets located in series)
Materials in Contact with Solution:
- Body, connectors - Polypropylene
- Poppet valves & O-rings — EPT/EPDM

Foot Valve

Opening Pressure: 1 psi (spring loaded)
Materials in Contact with Solution:
- Body, valve seat, connectors, screen (149 Micron) - Polypropylene
- O-rings - EPT/EPDM, Viton®/Fluoro-elastomer
- Spring - Hastelloy® C

Options: ½" or ⅜" I.D. tubing connectors

Anti-Siphon Spring Kits

Anti-siphon springs are available to springload poppet valves. Use of these springs produces more positive shutoff of poppet valves and permits use of the pump where there is a positive pressure on the suction side. Available for the 1", 1½"
and 2½" models. To order, select the proper spring material and O-ring by referring to the Chemical Resistance Section. The appropriate kit can then be chosen based on the blow-off pressure (PSI) required.

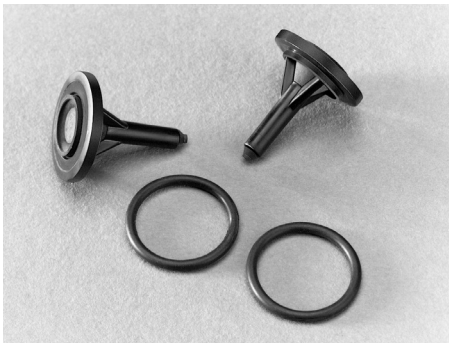
(Valve extension required only on suction port.)

Spring	O-Ring (Elastomer) Material			
	EPT/EPDM		Viton®/Fluoroelastomer	
	.5 PSI	5 PSI	.5 PSI	5 PSI
Monel	02501-112	02501-113	02501-124	02501-525
316 S.S.	02501-114	02501-115	02501-126	02501-127
Hastelloy® C	02501-116	02501-117	02501-128	02501-129

Kits include valve extension for suction port. Kits do not include poppet valve.

Replacement Kits
Compact Bellows

Duckbill valve kit includes two duckbill valves, two seal washers, one valve extension and one O-ring.



Poppet valve kit includes two poppet valves and two O-rings.

Tubing Connector kit includes two connectors and two connector nuts.

Bellows module kits include connecting rod assembly, bellows module, displacement cup, screws and O-rings.

Compact Crank Kit includes one set screw, one retaining ring and one crank assembly.

Ordering Kits

To order, refer to Replacement Kit charts on following page.

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Replacement Kits
Compact Bellows

1/2" & 3/4" Bellows Module Kits				
Base Model Number	1/2" Bellows		3/4" Bellows	
	F-001	F-003	F-035	F-037
	EPT/EPDM	Viton®/ Fluoroelastomer	EPT/EPDM	Viton®/ Fluoroelastomer
16001	02501-185	02501-187	02501-250	02501-252
16002	02501-185	02501-187	02501-250	02501-252
16003	02501-185	02501-187	02501-250	02501-252
16004	02501-185	02501-187	02501-250	02501-252

1" & 1 1/2" Bellows Module Kits				
Base Model Number	1" Bellows		1 1/2" Bellows	
	F-004	F-006	F-007	F-009
	EPT/EPDM	Viton®/ Fluoroelastomer	EPT/EPDM	Viton®/ Fluoroelastomer
16001	02501-188	02501-190	02501-191	02501-193
16002	02501-188	02501-190	02501-191	02501-193
16003	02501-188	02501-190	02501-191	02501-193
16004	02501-188	02501-190	02501-191	02501-193

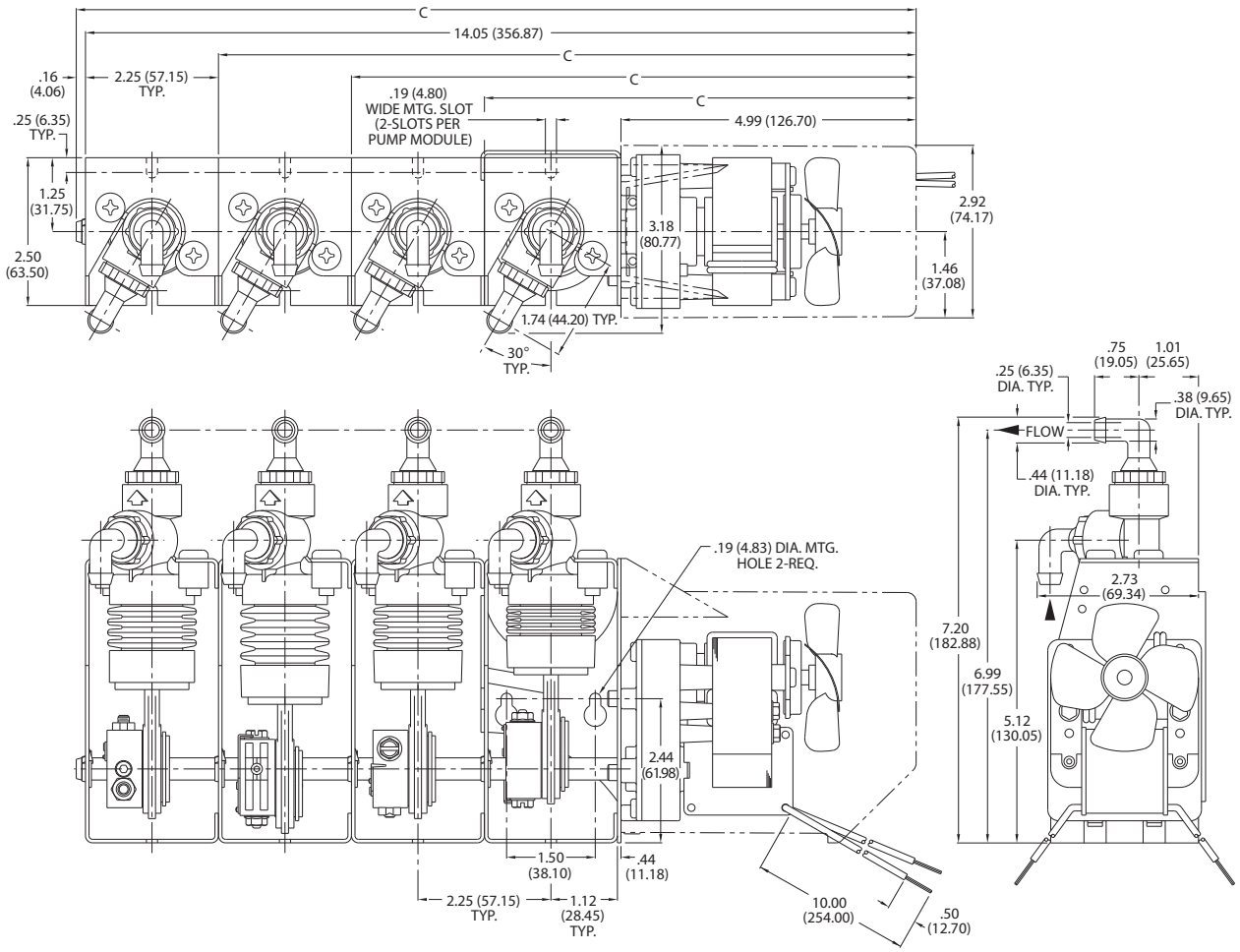
2" Bellows Module Kits		
Base Model Number	2" Bellows	
	F-031	F-033
	EPT/EPDM	Viton®/ Fluoroelastomer
16001	02501-247	02501-249
16002	02501-247	02501-249
16003	02501-247	02501-249
16004	02501-247	02501-249

Crank Kits	
Bellows Size	Kit Part Number
1/2"	02501-222
3/4"	02501-327
1"	02501-223
1 1/2"	02501-223
2"	02501-223

Poppet Valve & O-Ring Kits				
Base Model Number	1/2" Bellows		3/4", 1", 1 1/2", 2" Bellows	
	F-001	F-003	(3/4") F-035 (1") F-004 (1 1/2") F-007 (2") F-031	(3/4") F-037 (1") F-006 (1 1/2") F-009 (2") F-033
	EPT/EPDM	Viton®/ Fluoroelastomer	EPT/EPDM	Viton®/ Fluoroelastomer
16001	02500-318	02500-317	02500-605	02500-609
16002	02500-318	02500-317	02500-605	02500-609
16003	02500-318	02500-317	02500-605	02500-609
16004	02500-318	02500-317	02500-605	02500-609

Tubing Connector Kits	
T-Code	Kit Part Number
T-001	02500-312
T-002	02500-635
T-003	02500-352
T-004	02500-353
T-005	02500-258
T-006	02500-259
T-007	02500-260
T-008	02500-261
T-009	02500-354
T-011	02501-337
T-012	02501-246
T-013	02501-541
T-014	02501-673

Typical Dimensions
Compact Bellows



DIMENSION C						
Model	Without Cover				With Cover	Weight
	45.6 RPM		90 RPM			
	115V	230V	115V	230V		
Single	6.04 (153.4)	6.04 (153.4)	6.54 (166.1)	6.79 (172.4)	7.30 (185.4)	3.61 lbs.
2-Tandem	8.29 (210.5)	8.29 (210.5)	8.79 (223.2)	9.04 (229.6)	9.55 (242.6)	4.33 lbs.
3-Tandem	10.54 (267.7)	10.54 (267.7)	11.04 (280.4)	11.29 (286.7)	11.80 (299.7)	4.98 lbs.
4-Tandem	12.95 (328.9)	12.95 (328.9)	13.45 (341.6)	13.70 (348.0)	14.21 (360.9)	5.94 lbs.

Note: Dimensions include .16" bearing extension.

Dimensions in Inches
(Dimensions in Millimeters)

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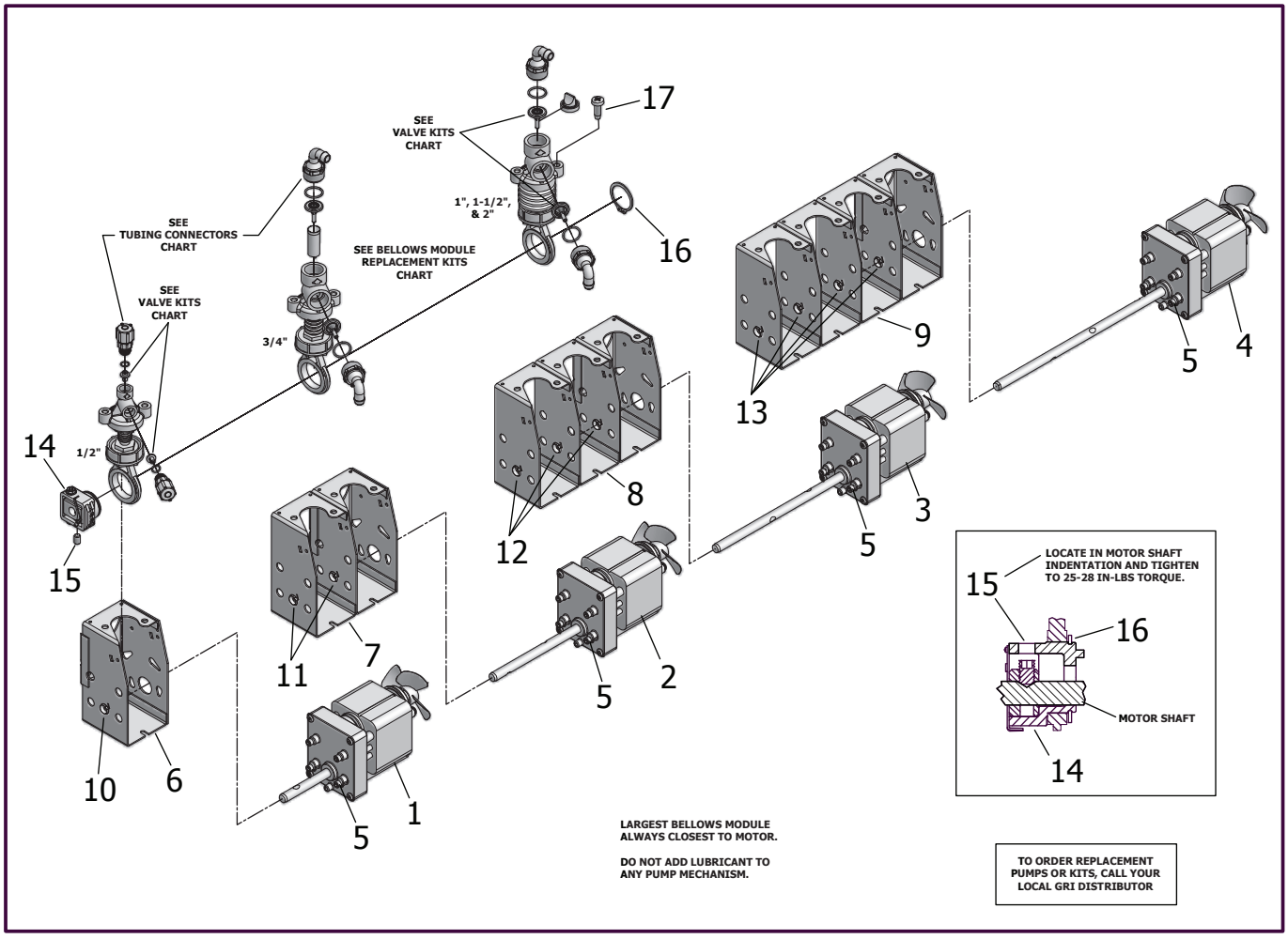
Exploded View
Compact Bellows



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