WELLMARK

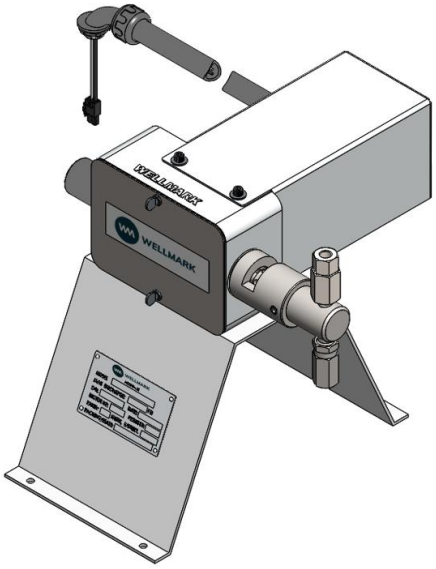
Wellmark Series EIP

Solar/Electric Chemical Injection Pumps

WELLMARK CHEMICAL INJECTION PRODUCTS
11122 WEST LITTLE YORK RD
HOUSTON, TX 77041
(713) 466-3552

INSTALLATION, OPERATIONS, & MAINTENANCE MANUAL

Contents



Overview

EIP pumps are environmentally friendly AC or DC gearmotor driven chemical injection pumps designed for use with harsh chemicals in high pressure injection applications.

For off the grid solar applications, Wellmark offers complete solar chemical injection packages including:

- AC or DC Powered Pump
- Solar Panels & Charging Equipment
- Battery Enclosure & Batteries
- Pump Controls
- Various Mounting Options

Pump Features:

- 3,16", 1/4", 3/8" and 1/2" Plunger Options
- Viton, Aflas, Buna, or PTFE Packing Materials
- 17-4 PH SST or Ceramic Coated Plungers
- Adjustable Plunger Displacement (3 Position)
- Single or Dual Head Configurations

Standard Materials of Construction

Part	Standard Material
Wetted Parts	316 SST
Plunger (Optional)	17-4PH SST H900 17-4PH SST Ceramic Coated
Seals	V-Ring Packing Standard Materials Available Viton / PTFE Aflas / PTFE Buna / PTFE PTFE
O-Rings	PTFE Standard
Check Seats	PTFE Standard
Check Ball (Optional)	316 SST Carbide

Specifications

Motor & Pump

Specification	Model			
	EIP Brushed DC	EIP AC Pumps	EIP Brushless DC	
	High Efficiency Motor (Option "A")	Bodine AC Motor (Option "B")	12VDC HYB Motor (Option "9")	24VDC HYB Motor (Option "C")
Motor Specifications				
Type	Permanent Magnet Brushed DC Gearmotor	Permanent Split Capacitor AC Gearmotor	Brushless DC Gearmotor	
Voltage	12VDC	115 VAC, 1 Phase 60 Hz	12VDC	24VDC[1]
Rated Horsepower	1/21 HP	1/5 HP	1/5 HP	
Rated Current (Max)	4.0 A	2.0 A	20.0 A	7.0 A
Rated Torque	42 in-lbs	150 in-lbs	150 in-lbs	
Rated Speed (Output Shaft)	59 RPM	60 RPM	67 RPM	
Duty	Continuous	Continuous	Continuous	
Insulation Class	B8	B6	B6	
Max Temp (Ambient)	40C	40C	40C	
Certifications	IP 44	IP40; UL E47177; E474208 – C1D2 Groups ABCD, Temp Class T3C	IP65; UL E47177; E474208 – C1D2 Groups ABCD, Temp Class T3C	
Pump Specifications				
Adjustable Stroke	3 Position Adjustable Stroke			
Stroke Length Details				
Pin Position 3	1.106”			
Pin Position 2	0.857”			
Pin Position 1	0.607”			
Variable Speed	No		Yes	
Minimum Output Speed	-		5 RPM	
Fluid End Specifications				
Suction Check Type	Gravity Check			
Suction Check Connection	1/4” FNPT			
Suction Head Required	6 in_H20 (12 in_H20 Recommended)			
Max Viscosity	1000 cps			
Discharge Connection	1/4" FNPT			

[1] *Note that some control options may not be available when using 24VDC motors*

Fluid End

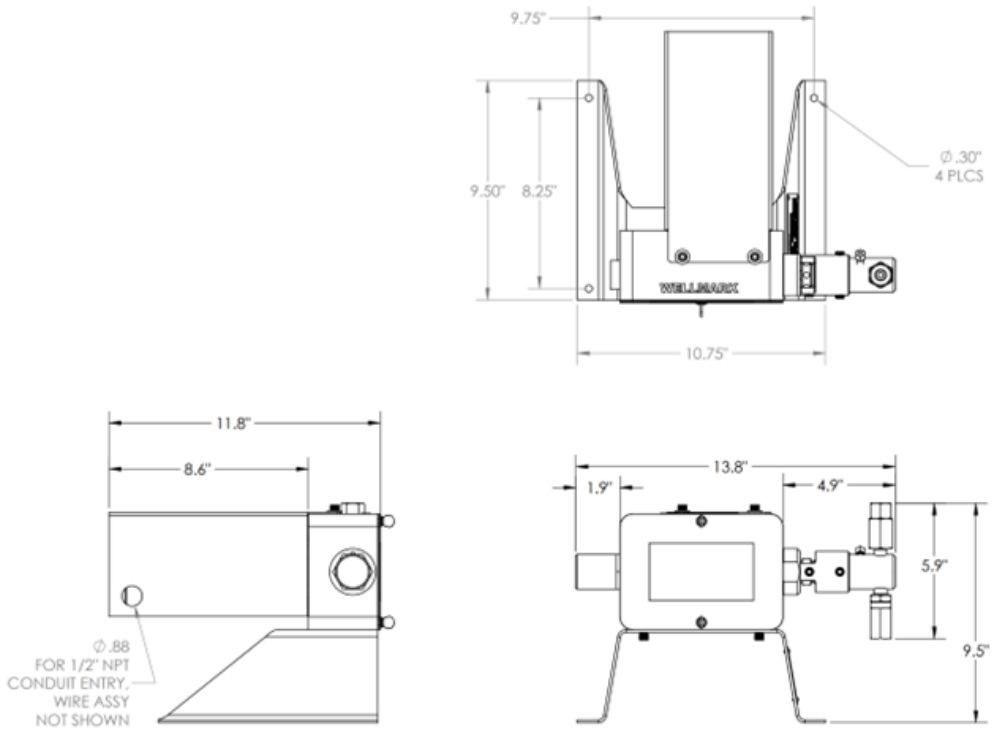
Fluid End Specification	Model			
	EIP Brushed DC	EIP AC	EIP Brushless DC	
	High Efficiency Motor (Option "A")	Bodine Motor (Option "B")	12VDC HYB Motor (Option “9”)	24VDC HYB Motor (Option “C”)
3/16” Plunger Pumps				
Max Displacement per Stroke	0.000529 Qts			
Max Injection Pressure	5,000 PSI	6,000 PSI	6,000 PSI	
Max Injection Rate[12]				
Gallons / Day	11	11	12	
Quarts / Day	45	45	51	
Liters / Day	43	43	48	
Minutes / Quart	32	32	28.2	
1/4” Plunger Pumps				
Max Displacement / Stroke	0.000940 Qts			
Max Injection Pressure	2,500 PSI	5,000 PSI	5,000 PSI	
Max Injection Rate				
Gallons / Day	20	20	22	
Quarts / Day	81	81	90	
Liters / Day	77	77	86	
Minutes / Quart	17.8	17.8	16	
3/8” Plunger Pumps				
Max Displacement per Stroke	0.002115 Qts			
Max Injection Pressure	1,500 PSI	2,500 PSI	2,500 PSI	
Max Injection Rate				
Gallons / Day	45	45	51	
Quarts / Day	182	182	204	
Liters / Day	173	173	193	
Minutes / Quart	7.9	7.9	7	
1/2” Plunger Pumps				
Max Displacement per Stroke	0.003760 Qts			
Max Injection Pressure	750 PSI	1,250 PSI	1,250 PSI	
Max Injection Rate				
Gallons / Day	81	81	90	
Quarts / Day	324	324	362	
Liters / Day	308	308	344	
Minutes / Quart	4.4	4.4	4	

[1] For dual head pumps, double max injection rate shown

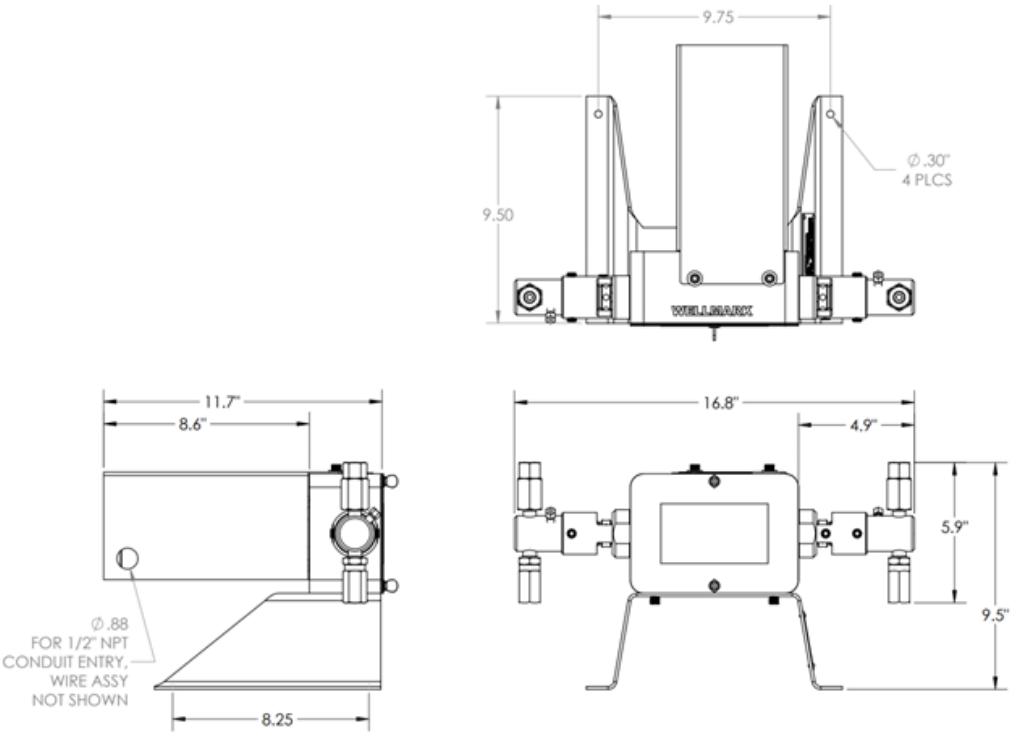
[2] Estimated max injection rate in atmospheric injection (no discharge pressure); applications for reference only

Pump Dimensions

EIP-DC, High Efficiency, Single Universal Fluid End (1/4” to 1/2”) Pumps



EIP-DC, High Efficiency, Dual Universal Fluid End (1/4” to 1/2”) Pumps

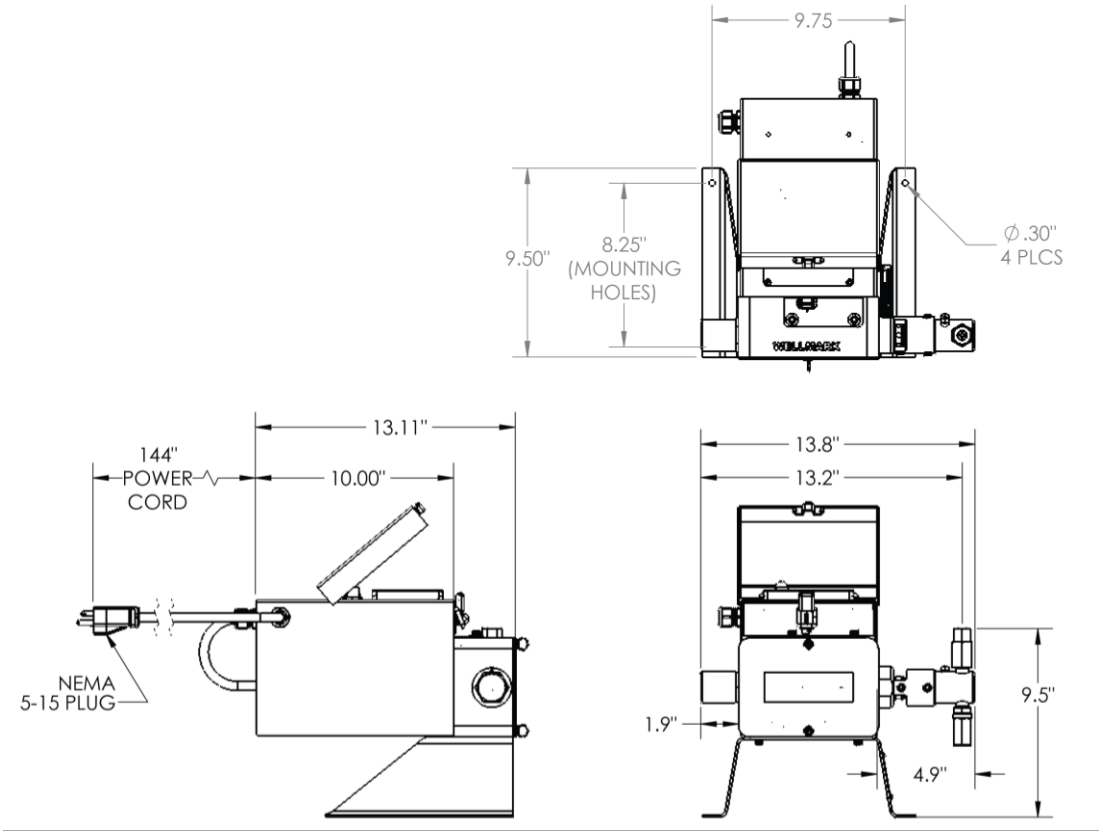


Note:

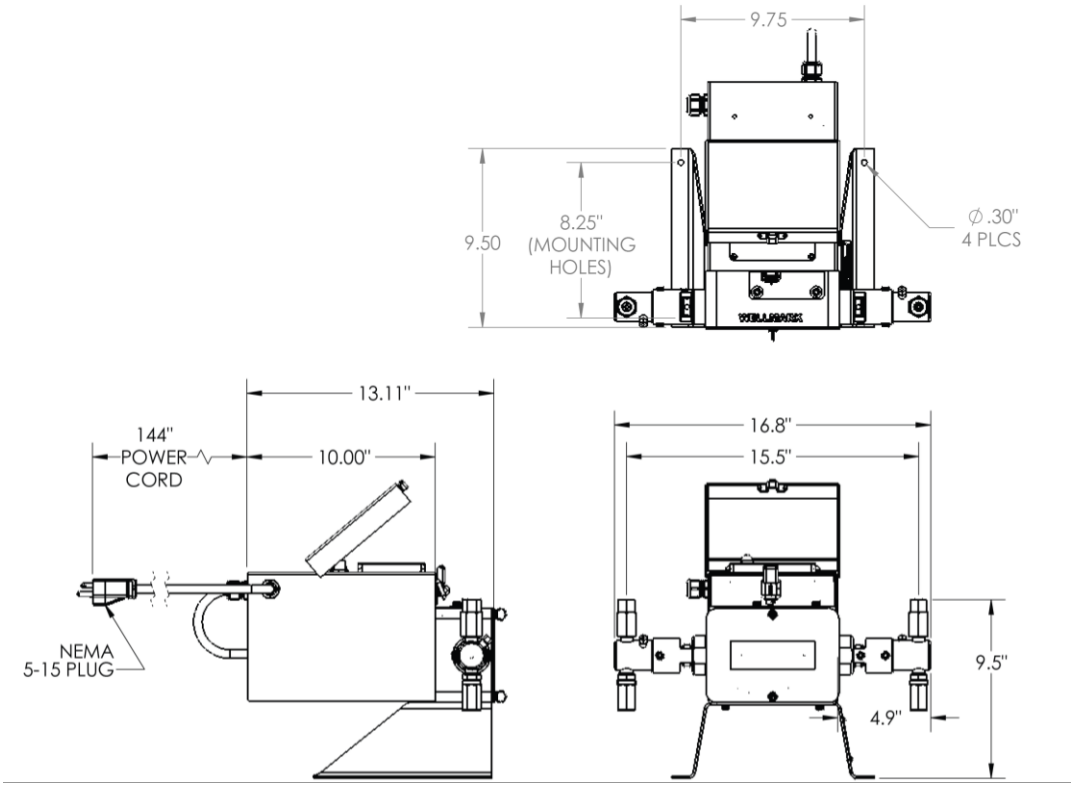
“Small” motor models include 5’ conduit & wire assemblies with plug connector for connection to DigiMax / DigiUltra controls

“High Efficiency” motor models include 8’ conduit & wire assemblies with plug connector for connection to DigiMax / DigiUltra controls

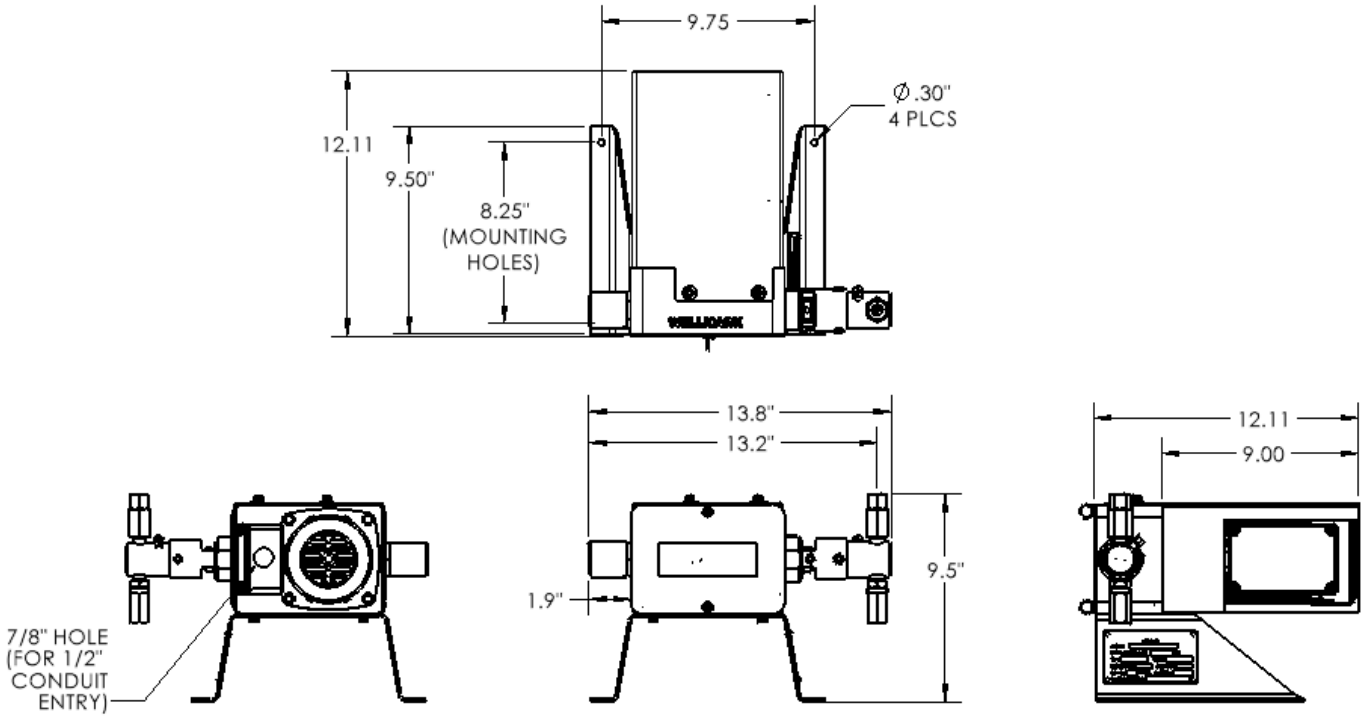
EIP-AC, DigiMax Controller, Bodine Motor, Single Universal Fluid End (1/4” to 1/2”) Pumps



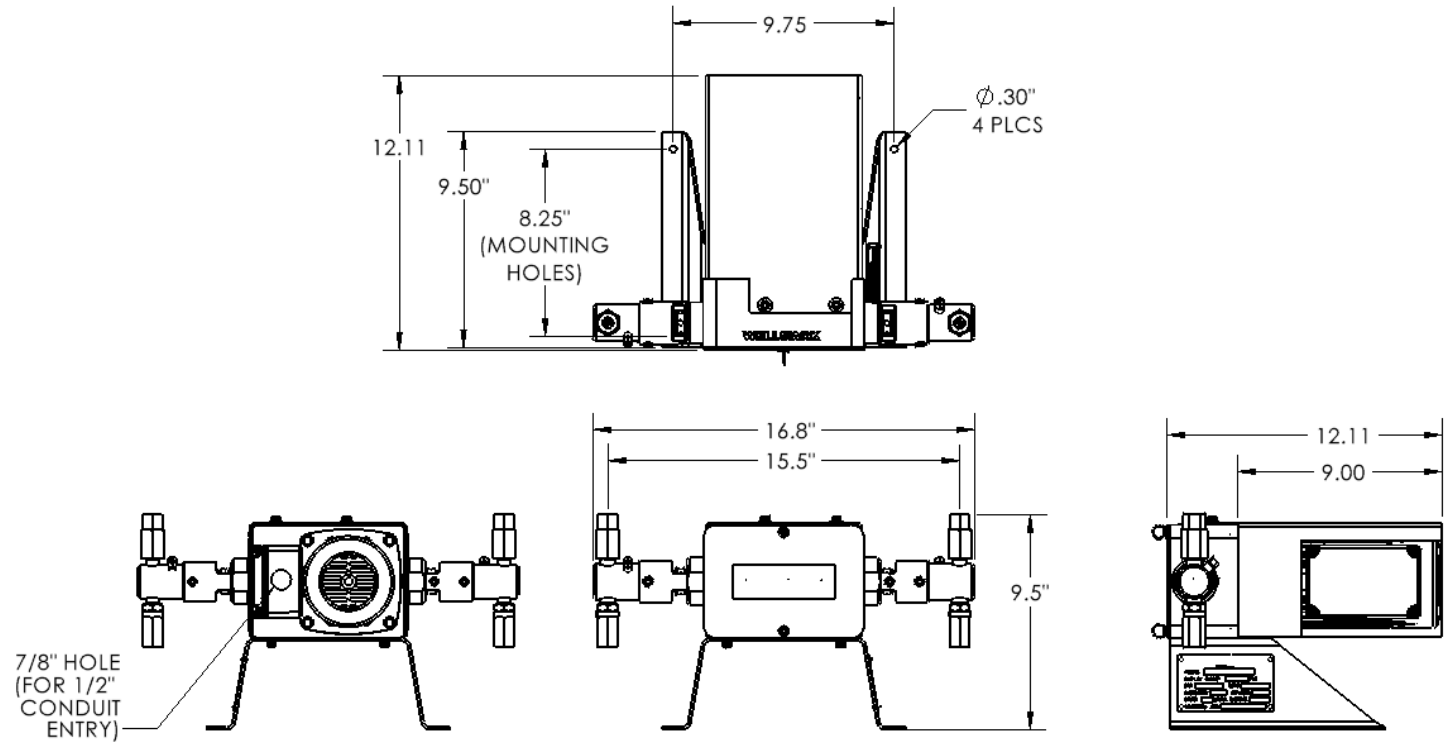
EIP-AC, DigiMax Controller, Bodine Motor, Dual Universal Fluid End (1/4” to 1/2”) Pumps



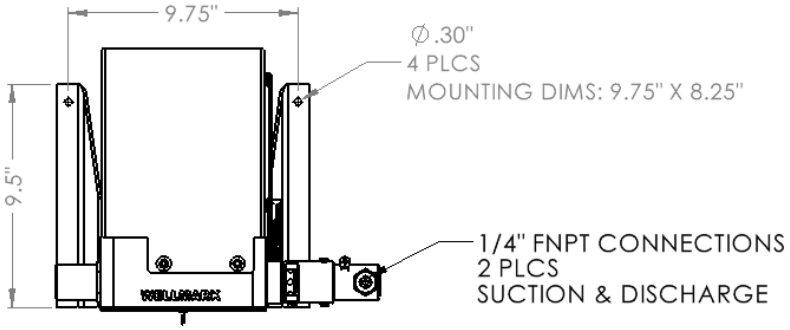
EIP-AC, No Controller, Bodine Motor, Single Universal Fluid End (1/4” to 1/2”) Pumps

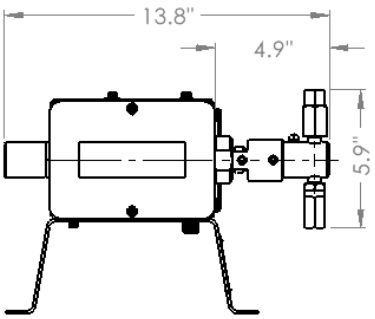


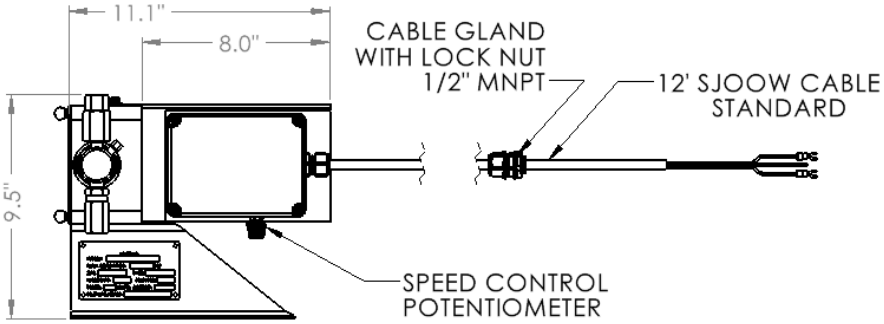
EIP-AC, No Controller, Bodine Motor, Dual Universal Fluid End (1/4” to 1/2”) Pumps



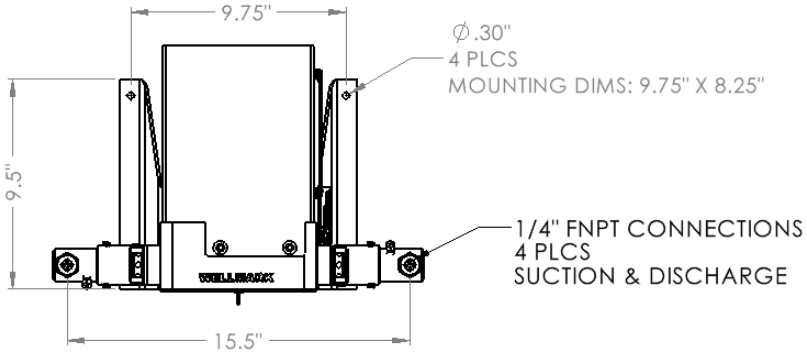
EIP-Brushless, Single Universal Fluid End (1/4” to 1/2”) Pumps (12 & 24 VDC)

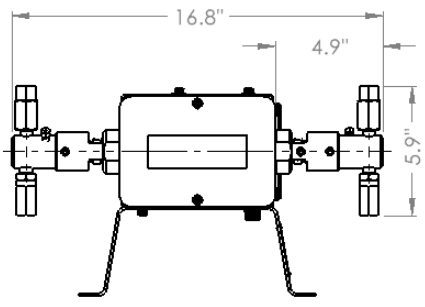


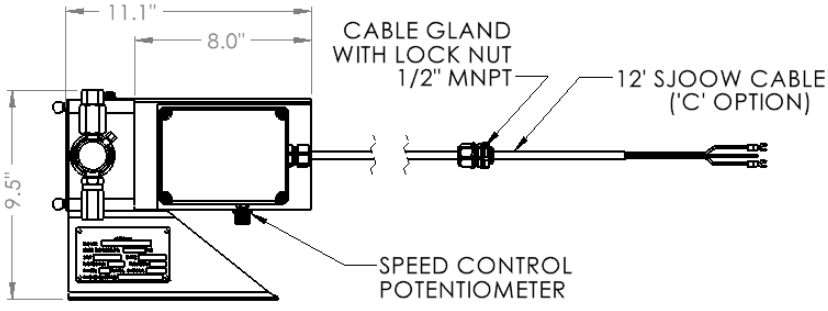




EIP-Brushless, Dual Universal Fluid End (1/4” to 1/2”) Pumps (12 & 24 VDC)

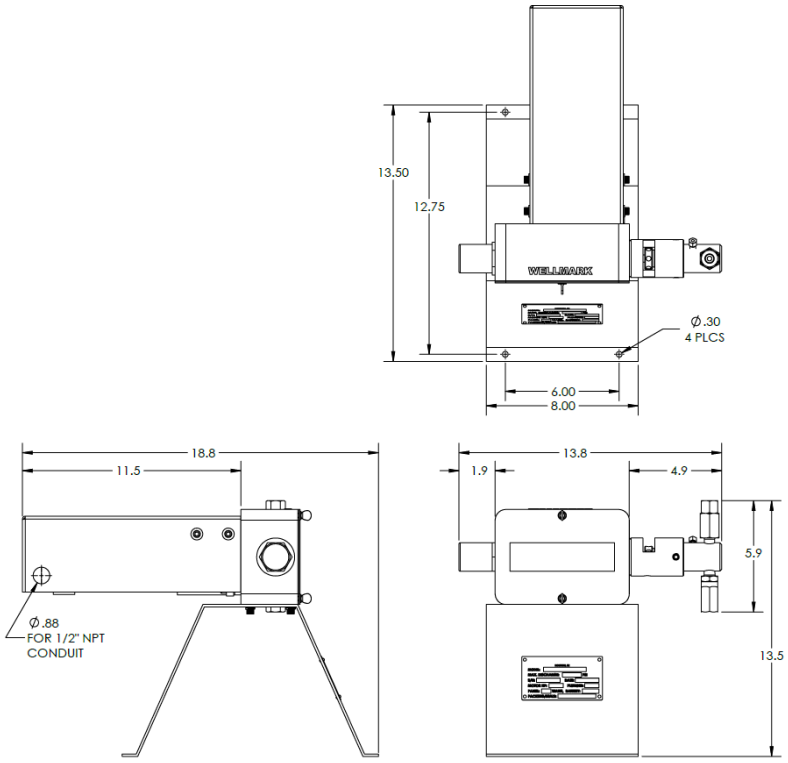




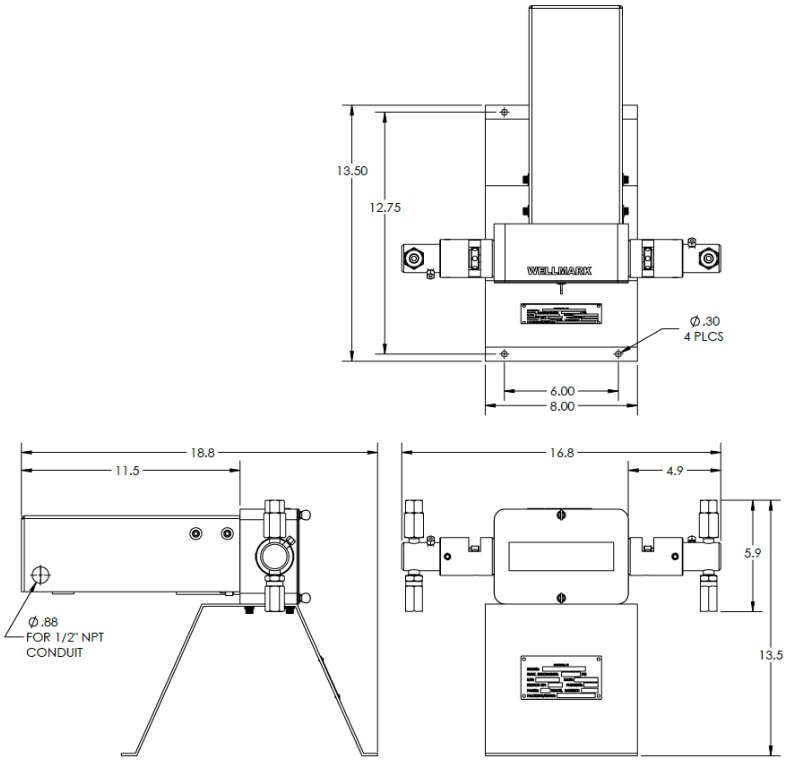


Legacy Pump Dimensions

EIP-DC, “Large” Motor, Single Universal Fluid End (1/4” to 1/2”) Pumps

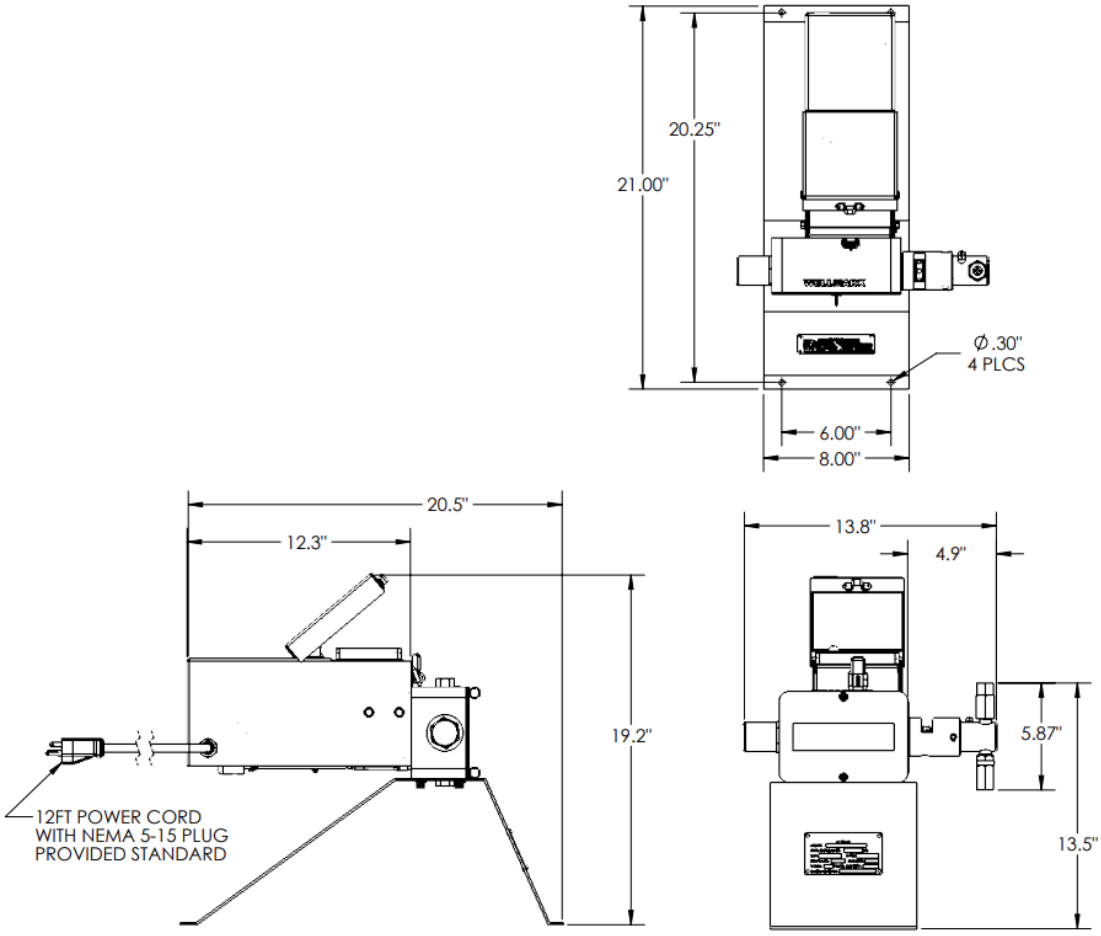


EIP-DC, “Large” Motor, Dual Universal Fluid End (1/4” to 1/2”) Pumps



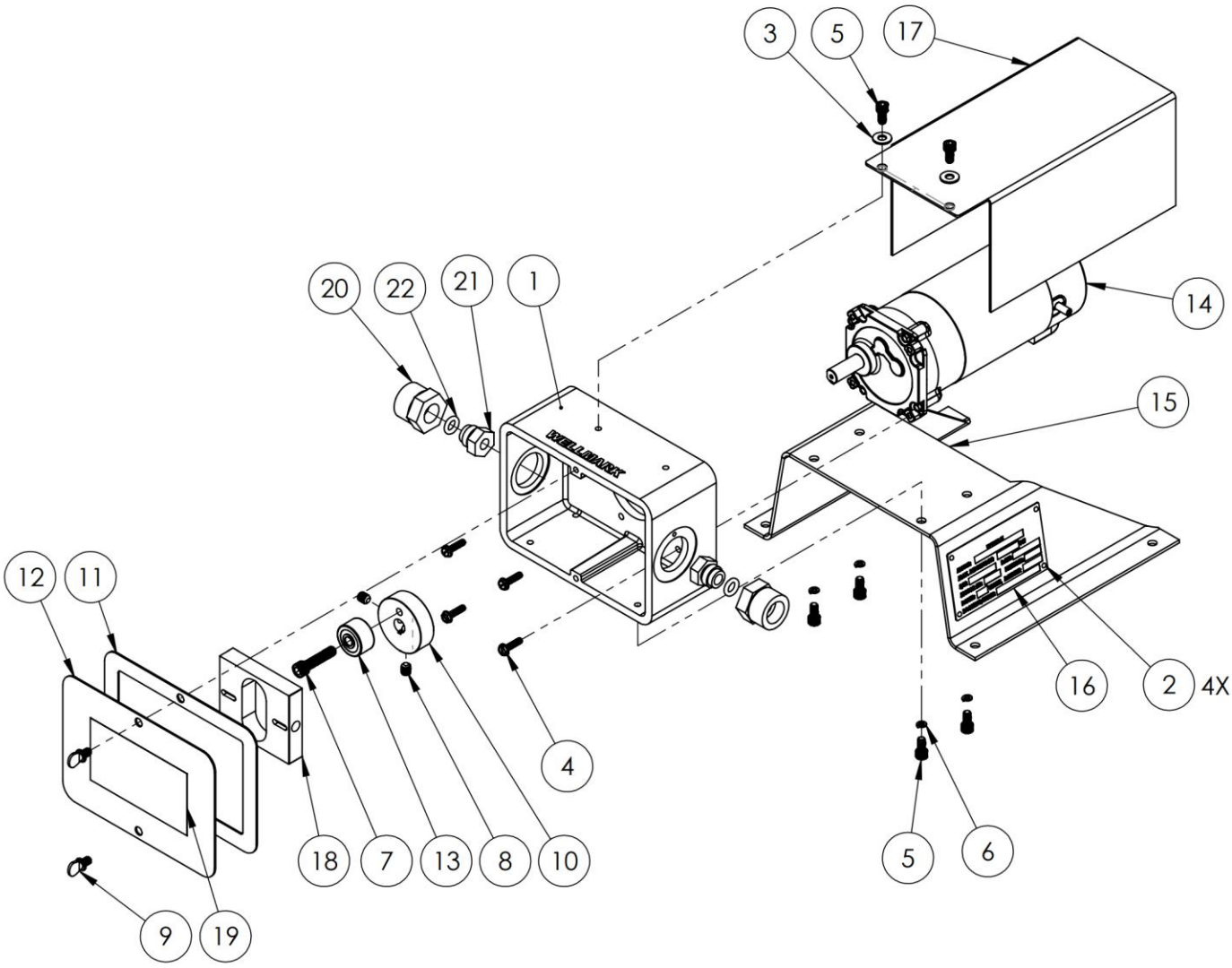
Note: *Headless pump conduit whip not shown; standard models include 5’ conduit length with plug connector for connection to DigiMax / DigiUltra controls.*

EIP-AC, Leeson Motor, Single Universal Fluid End (1/4” to 1/2”) Pumps



Pump Assemblies & Parts Lists

Series EIP DC “High Efficiency” Motor



Headless Assembly PN# 1178306

Item	Part Number	Description	Qty
1	1145922	Housing	1
2	1119089	Drive Screw	4
3	1121161	Flat Washer	2
4	1126185	Screw, Slotted Hex Washer Head	4
5	1145876	Screw, Socket Head	6
6	1145886	Washer, Split Lock	4
7	1169785	Screw, Socket Head Cap	1
8	1169777	Set Screw	2
9	1145897	Thumb Screw	2
10	1145912	Eccentric Wheel	1
11	1145917	Cover Gasket	1

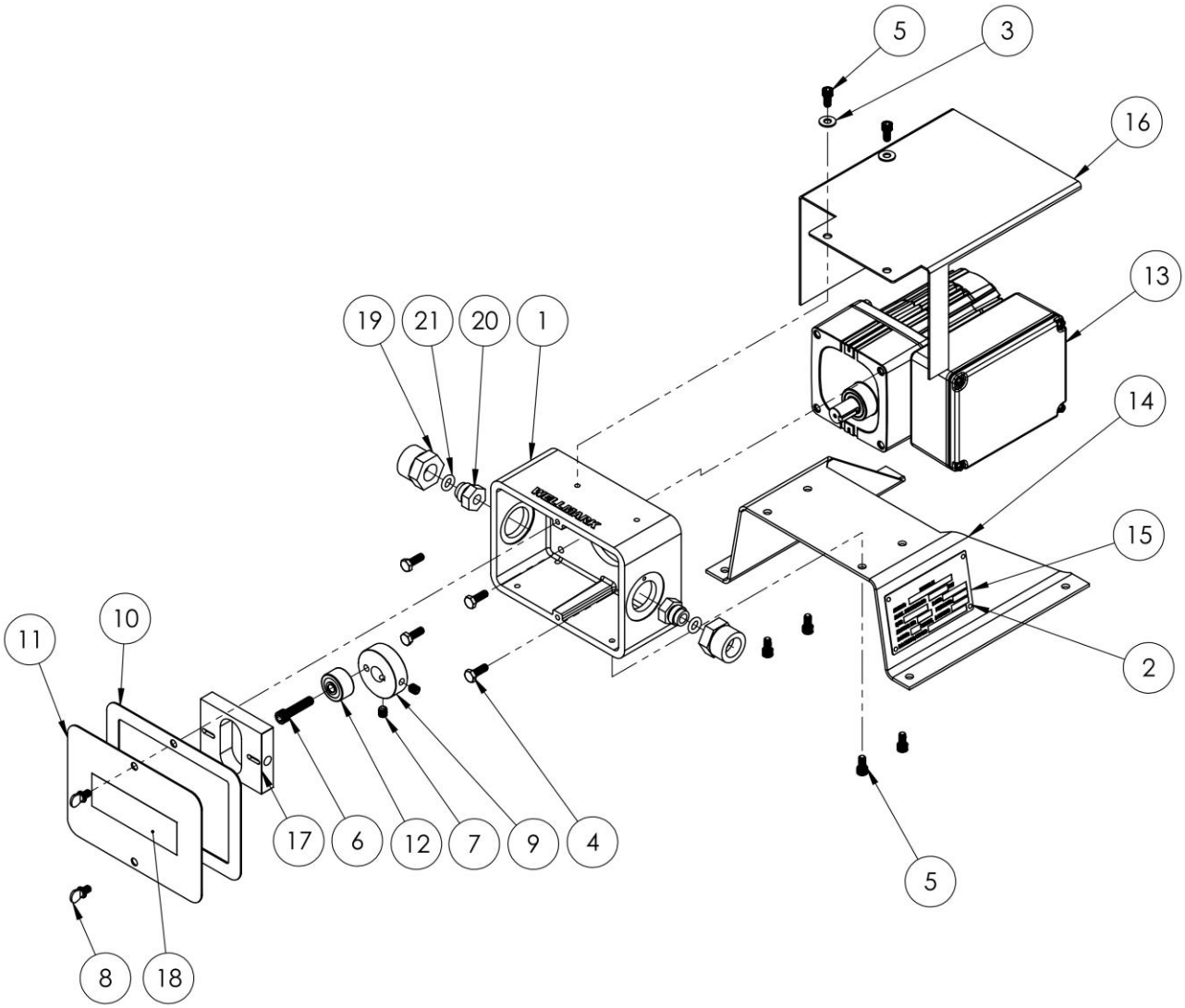
Item	Part Number	Description	Qty
12	1145921	Housing Cover	1
13	1145988	Bearing	1
14	1148285	Motor	1
15	1204434	Baseplate	1
16	1149281	Nameplate	1
17	1149282	Motor Cover	1
18	1149298	Reciprocating Block	1
19	1168020	Sticker	1
20	1149264	Bushing	2
21	1149266 *	Guide Nut	2
22	1011581 *	O-Ring	2

** Recommended Spare Part*

Motor Replacement Parts

- Bodine Motor 33A5BEPM-Z2
  - Motor Brush (Set) PN# 1148958
  - Brush springs PN# 1148956
  - Brush cap PN# 1159395

Series EIP 12 & 24VDC Brushless Motor



Headless Assembly PN# 1187288 (12VDC) / 1187290 (24VDC)

Item	Part Number	Description	Qty
1	1178941	Housing	1
2	1119089	Drive Screw	4
3	1121161	Washer, Flat	2
4	1179091	Screw, Hex Head	4
5	1145876	Screw, Socket Head Cap	6
6	1169785	Screw, Socket Head Cap	1
7	1169777	Set Screw	2
8	1145897	Thumb Screw	2
9	1149272	Eccentric Wheel	1
10	1145917	Cover Gasket	1
11	1145921	Housing Cover	1

Item	Part Number	Description	Qty
12	1145988	Roller Bearing	1
13	1178968	12VDC Brushless DC IntegraMotor	1
	1178971	24VDC Brushless DC IntegraMotor	
14	1204434	Baseplate	1
15	1149281	Nameplate	1
16	1186978	Motor Cover	1
17	1149298	Reciprocating Block	1
18	1168020	Sticker, Housing Cover	1
19	1149264	Bushing	2
20	1149266 *	Guide Nut	2
21	1011581 *	O-Ring	2

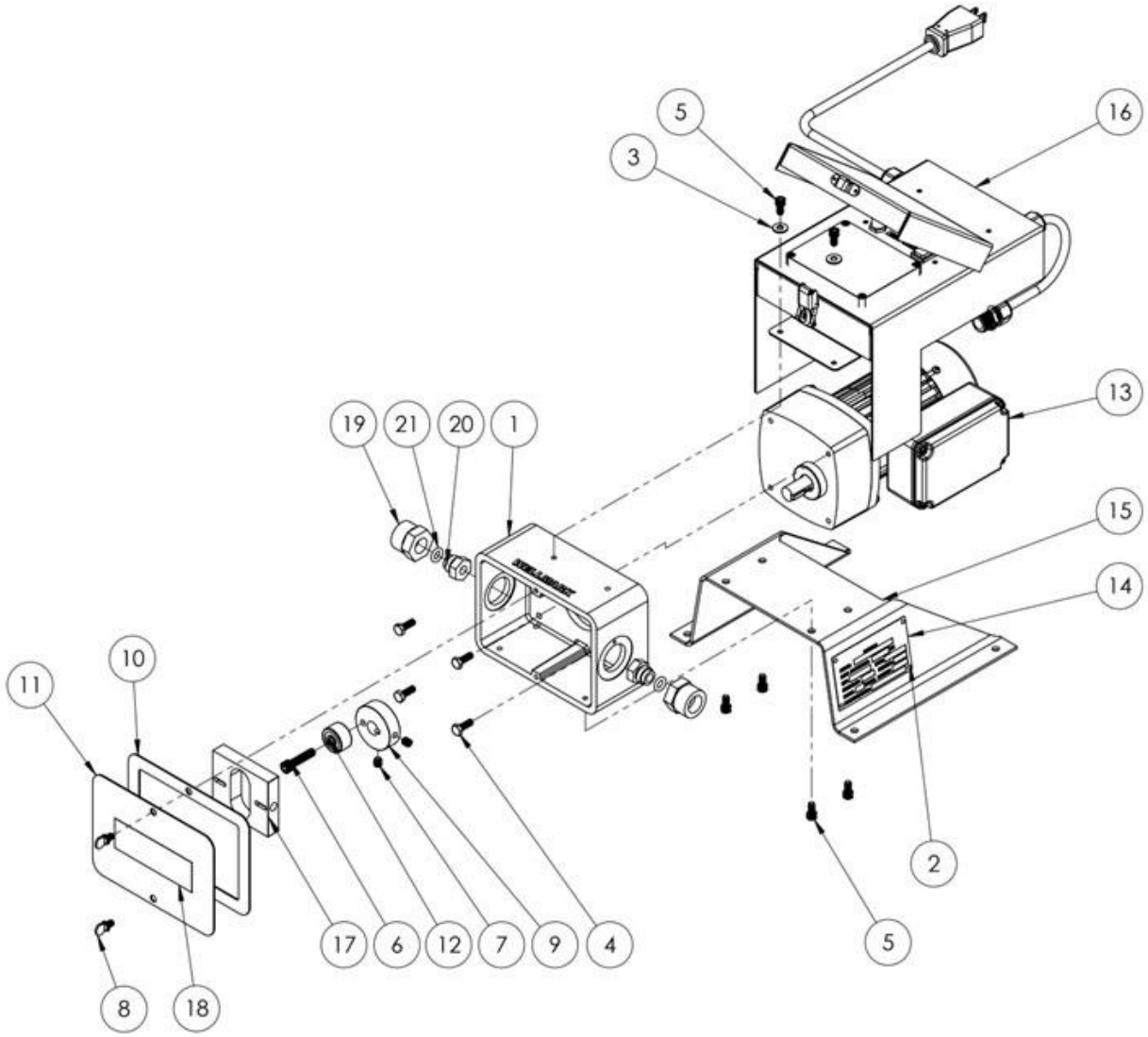
** Recommended Spare Part*

Related Part Numbers

- **1193431** 12VDC HEADLESS PUMP SUBASSEMBLY, 12' SJOOW CABLE INSTALLED, FLYING LEADS
- **1193433** 12VDC HEADLESS PUMP SUBASSEMBLY, 5' LFNC-B CONDUIT & WIRING, FLYING LEADS

Consult factory for 24VDC control options

Series EIP AC with DigiMax (Bodine Motor)



Headless Assembly PN# 1180134

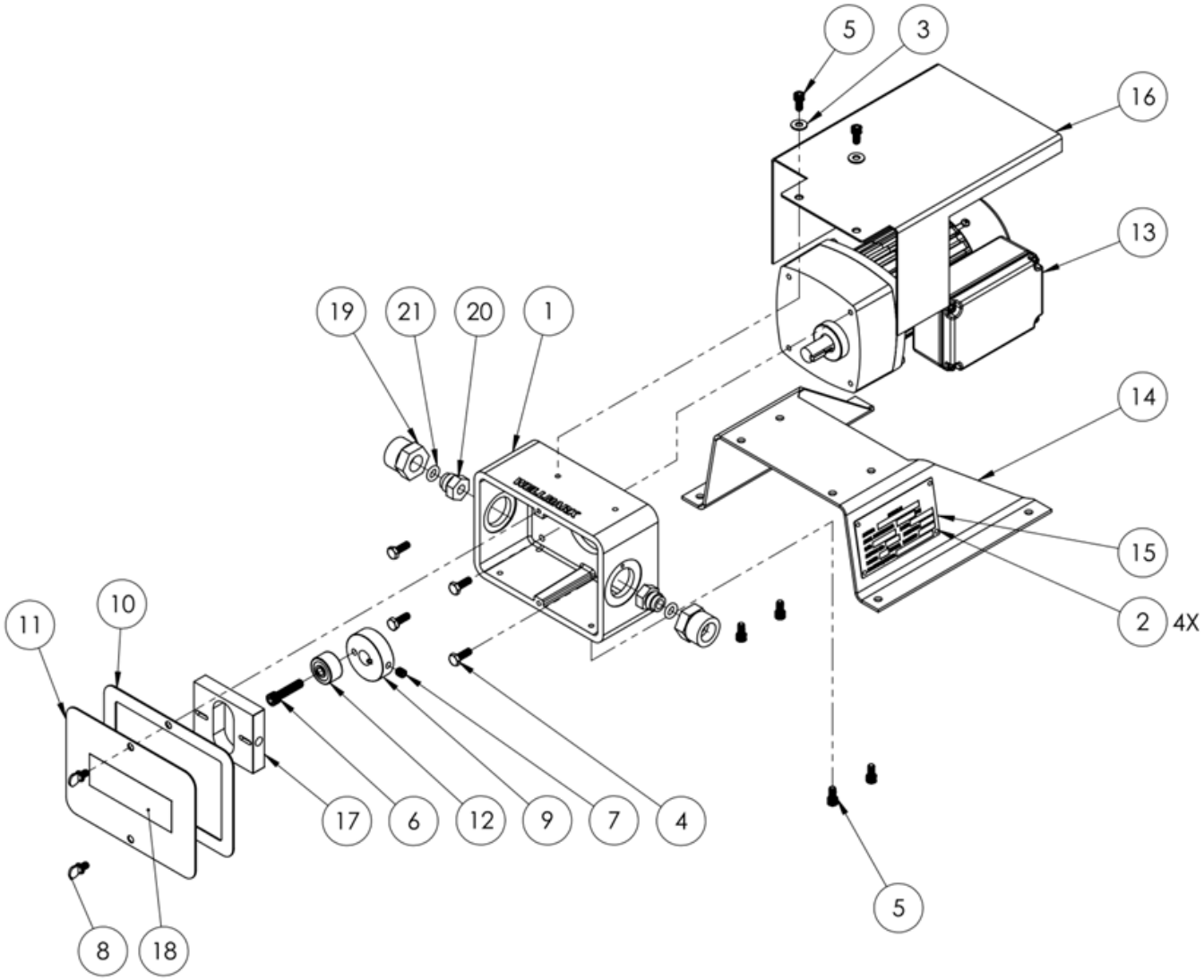
Item	Part Number	Description	Qty
1	1178941	Housing	1
2	1119089	Drive Screw	4
3	1121161	Flat Washer	2
4	1179091	Hex Head Screw	4
5	1145876	Socket Head Cap Screw	6
6	1169785	Socket Head Cap Screw	1
7	1169777	Set Screw	2
8	1145897	Thumb Screw	2
9	1149272	Eccentric Wheel	1
10	1145917	Cover Gasket	1
11	1145921	Cover	1

Item	Part Number	Description	Qty
12	1145988	Roller Bearing	1
13	1176407	Motor	1
14	1149281	Nameplate	1
15	1204434	Baseplate	1
16[1]	1180090	Pump Controller & Motor Cover	1
17	1149298	Reciprocating Block	1
18	1168020	Sticker	1
19	1149264	Bushing	2
20	1149266 *	Guide Nut	2
21	1011581 *	O-Ring	2

** Recommended Spare Part*

[1] Pump Controller & Motor Cover 1180090 includes 12’ AC Power Cord (not shown) & Connectors to Install into Pump Terminal Box

Series EIP AC, No Controller (Bodine Motor)



Headless Assembly PN# 1179092

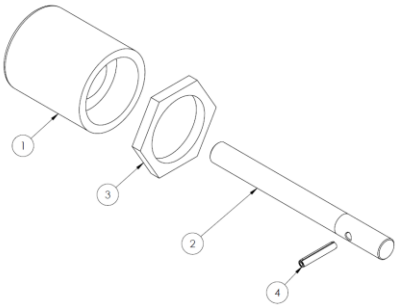
Item	Part Number	Description	Qty
1	1178941	Housing	1
2	1119089	Drive Screw	4
3	1121161	Flat Washer	2
4	1179091	Hex Head Screw	4
5	1145876	Socket Head Cap Screw	6
6	1169785	Socket Head Cap Screw	1
7	1169777	Set Screw	2
8	1145897	Thumb Screw	2
9	1149272	Eccentric Wheel	1
10	1145917	Cover Gasket	1
11	1145921	Cover	1

Item	Part Number	Description	Qty
12	1145988	Roller Bearing	1
13	1176407	Motor	1
14	1204434	Baseplate	1
15	1149281	Nameplate	1
16	1179036	Motor Cover	1
17	1149298	Reciprocating Block	1
18	1168020	Sticker	1
19	1149264	Bushing	2
20	1149266 *	Guide Nut	2
21	1011581 *	O-Ring	2

** Recommended Spare Part*

Fluid End Assemblies

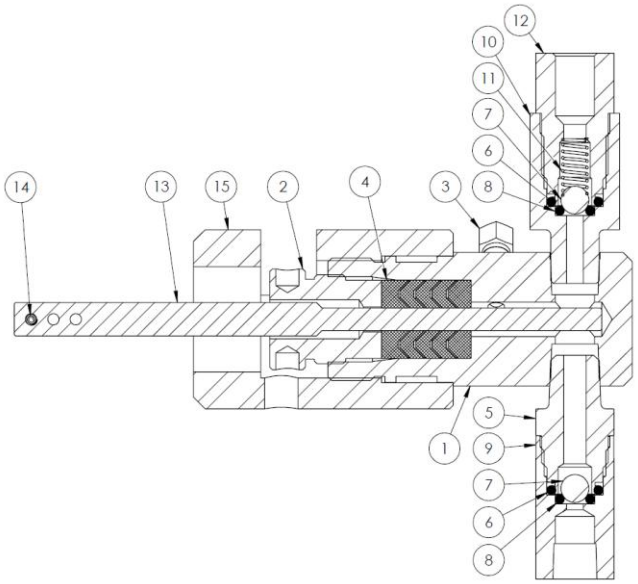
Single Head Cap Assembly



Item	Part Number	Description	Qty
1	1149035	Cap	1
2	1149258 *	Guide	1
3	1149250	Jam Nut	1
4	1145894 *	Spring Pin	1

** Recommended Spare Part*

1/4", 3/8", and 1/2" Universal Body & Yoke Assembly



Item	Description	Material [1]	Part Number by Fluid End Plunger Size			Qty
			1/4"	3/8"	1/2"	
1	Body	316 SST	1145777		1147025	1
2	Packing Nut	303 SST	1147923	1147016	1147019	1
3	Bleed Screw	316 SST	1145902			1
4	Packing *	(K) Aflas (Fiber Reinforced) / PTFE	1148868	1148870	1148872	1
		(L) Viton (Fiber Reinforced) / PTFE	1179861	1179862	1148878	
		(M) Buna / PTFE	1179857	1179858	-	
		(Z) FFKM / PTFE	1188957	1188953	1188958	
5	Suction Check Body Outlet	316 SST	1147922			1
6	Check Seal O-Ring *	PTFE	1145769			2
7	Check Ball *	316 SST	1146485			2
		Carbide	1146487			
8	Check Seat O-Ring *	PTFE	1148786			2
9	Suction Check Body Inlet	316 SST	1147924			1
10	Discharge Check Body Inlet	316 SST	1147310			1
11	Discharge Check Spring *	302 SST	1146445			1
12	Discharge Check Body Outlet	316 SST	1147316			1
13	Plunger *	17-4PH SST H900	1149252	1149254	1149256	1
		17-4PH SST Cer. Coated	1149111	1149109	1149115	
14	Spring Pin *	18-8 SST	1145894			1
15	Yoke	303 SST	1148263		1147833	1
16	Set Screw	18-8 SST	1148789			2

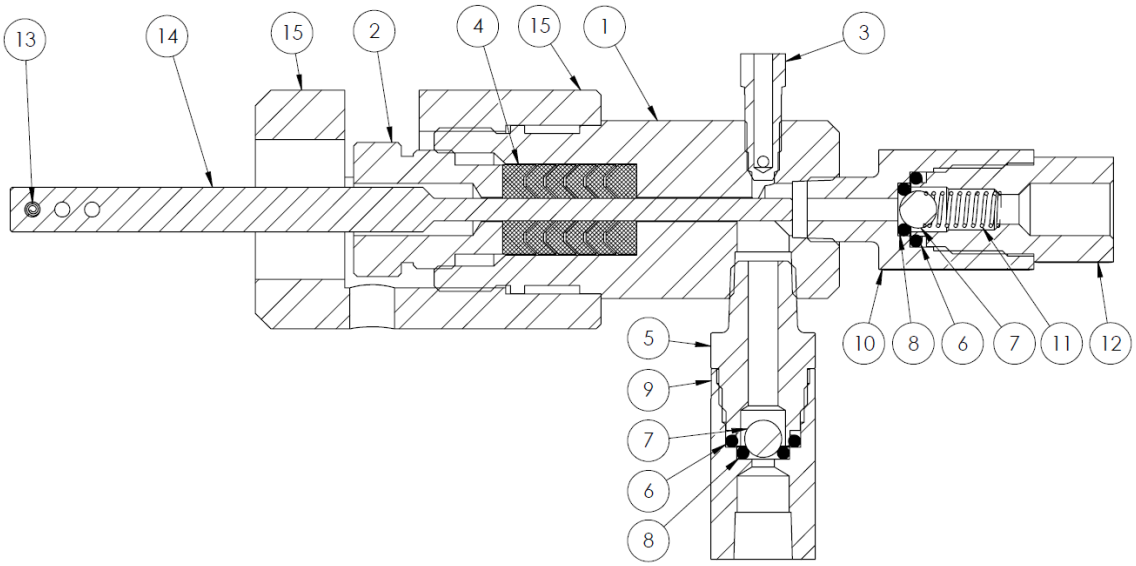
Item 16 (Set Screw) not shown.

** Recommended Spare Part*

[1] 316SST standard; consult factory for Hastelloy body assemblies

3/16” Universal Body & Yoke Assembly

Discharge check orientation is designed for low flow plunger pump applications—vertical position allows for more complete bleeding of body chamber when compared to 1/4" to 1/2" size fluid ends.



Item	Description	Material [1]	Part Number	Qty
1	Body	316 SST	1147022	1
2	Packing Nut	303 SST	1147919	1
3	Bleed Screw	316 SST	1145902	1
4	Packing *	Aflas (Fiber Reinforced) / PTFE	1148864	1
		Viton (Fiber Reinforced) / PTFE	1148866	
		FFKM / PTFE	1188959	
5	Suction Check Body Outlet	316 SST	1147922	1
6	Check Seal O-Ring *	PTFE	1145769	2
7	Check Ball *	316 SST	1146485	2
		Carbide	1146487	
8	Check Seat O-Ring *	PTFE	1148786	2
9	Suction Check Body Inlet	316 SST	1147924	1
10	Discharge Check Body Inlet	316 SST	1147310	1
11	Discharge Check Spring *	302 SST	1146445	1
12	Discharge Check Body Outlet	316 SST	1147316	1
13	Spring Pin *	18-8 SST	1145894	1
14	Plunger *	17-4PH SST H900	1148715	1
		17-4PH SST Cer. Coated	1147960	
15	Yoke	303 SST	1148263	1
16	Set Screw	18-8 SST	1148789	2

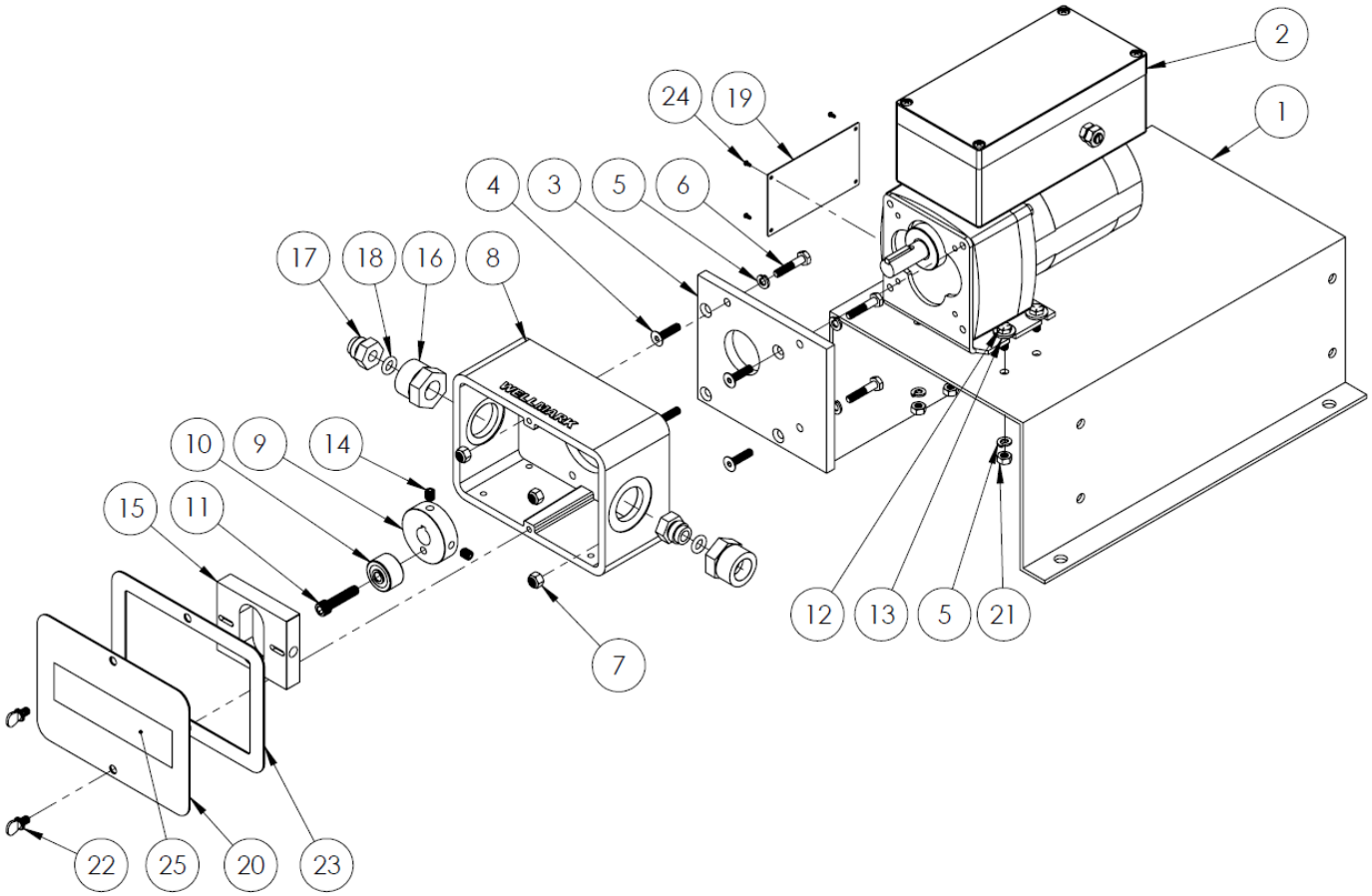
Item 16 (Set Screw) not shown.

** Recommended Spare Part*

[1] 316SST standard; consult factory for Hastelloy body assemblies

Legacy Assemblies & Parts Lists

Series HYB Brushless Motor[1]



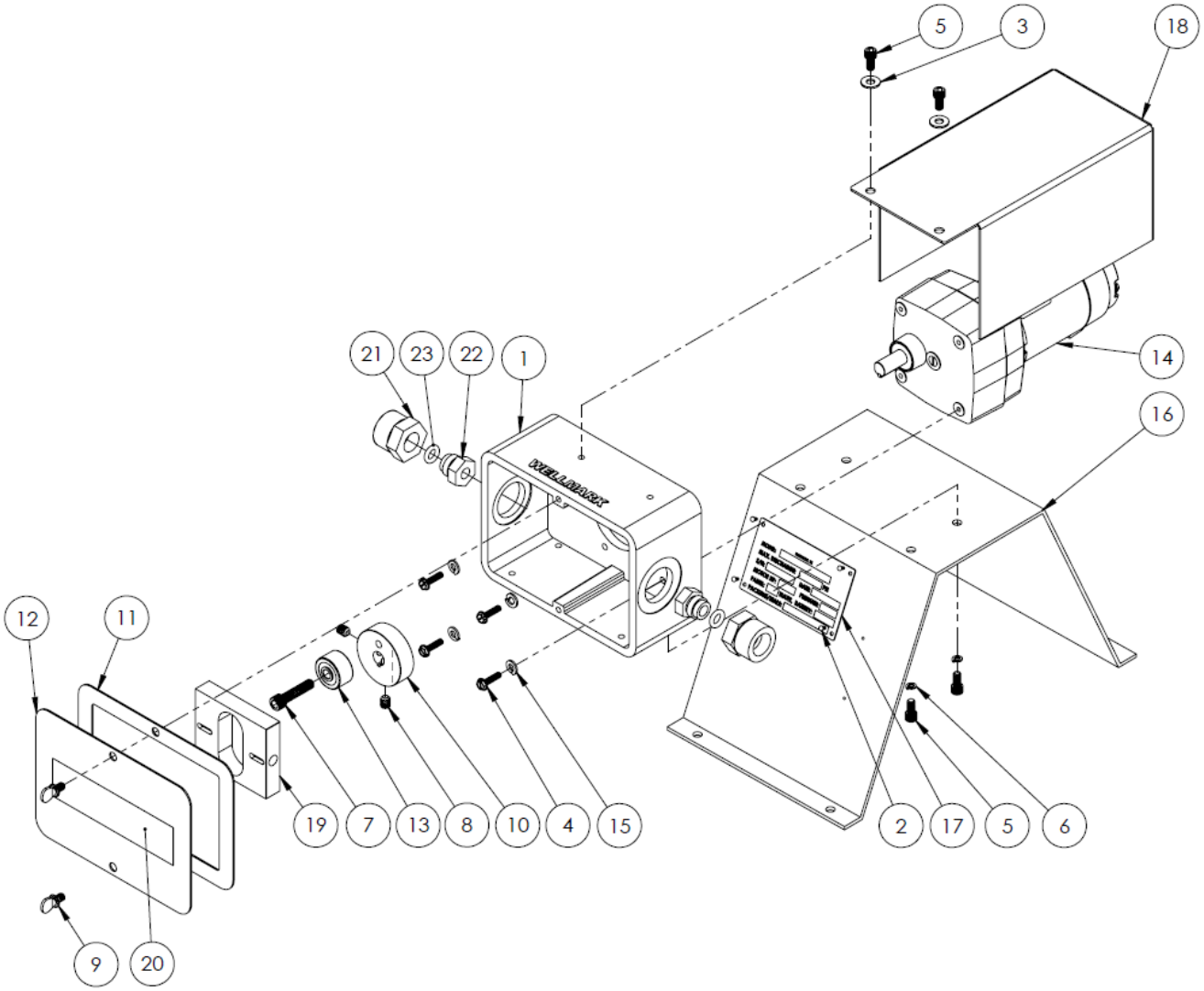
Item	Part Number	Description	Qty
1	1146066	Baseplate	1
2	1146510	Motor (with Brushless Controller)	1
3	1148921	Motor Mounting Adapter	1
4	1147084	Screw, Countersunk	4
5	1146117	Washer, Split Lock	7
6	1176244	Screw, Hex Head	3
7	1123280	Nut, Nyloc	3
8	1169442	Housing	1
9	1149032	Eccentric Wheel	1
10	1145988	Roller Bearing	1
11	1169785	Screw, Socket Head Cap	1
12	1146115	Screw, Hex Head	4
13	1148882	Washer, Flat	4

Item	Part Number	Description	Qty
14	1169777	Set Screw	2
15	1149298	Reciprocating Block	1
16	1149264	Bushing	2
17	1149266 *	Guide Nut	2
18	1011581 *	O-Ring	2
19	1149281	Nameplate	1
20	1145921	Housing Cover	1
21	1124549	Nut, Hex	4
22	1145897	Thumb Screw	2
23	1145917	Cover Gasket	1
24	1119089	Drive Screw	4
25	1168020	Sticker, Housing Cover	1

** Recommended Spare Part*

[1] Superseded by the 'Brushless EIP' pump Q1 2025

Series EIP DC "Small" Motor[1]



Item	Part Number	Description	Qty
1	1145922	Housing	1
2	1119089	Drive Screw	4
3	1121161	Flat Washer	2
4	1126185	Screw, Slotted Hex Washer Head	4
5	1145876	Screw, Socket Head	6
6	1145886	Washer, Split Lock	4
7	1169785	Screw, Socket Head Cap	1
8	1169777	Set Screw	2
9	1145897	Thumb Screw	2
10	1145912	Eccentric Wheel	1
11	1145917	Cover Gasket	1
12	1145921	Housing Cover	1

Item	Part Number	Description	Qty
13	1145988	Bearing	1
14	1145993	Motor	1
15	1146040	Washer, Split Lock	4
16	1149276	Baseplate	1
17	1149281	Nameplate	1
18	1149282	Motor Cover	1
19	1149298	Reciprocating Block	1
20	1168020	Sticker	1
21	1149264	Bushing	2
22	1149266 *	Guide Nut	2
23	1011581 *	O-Ring	2

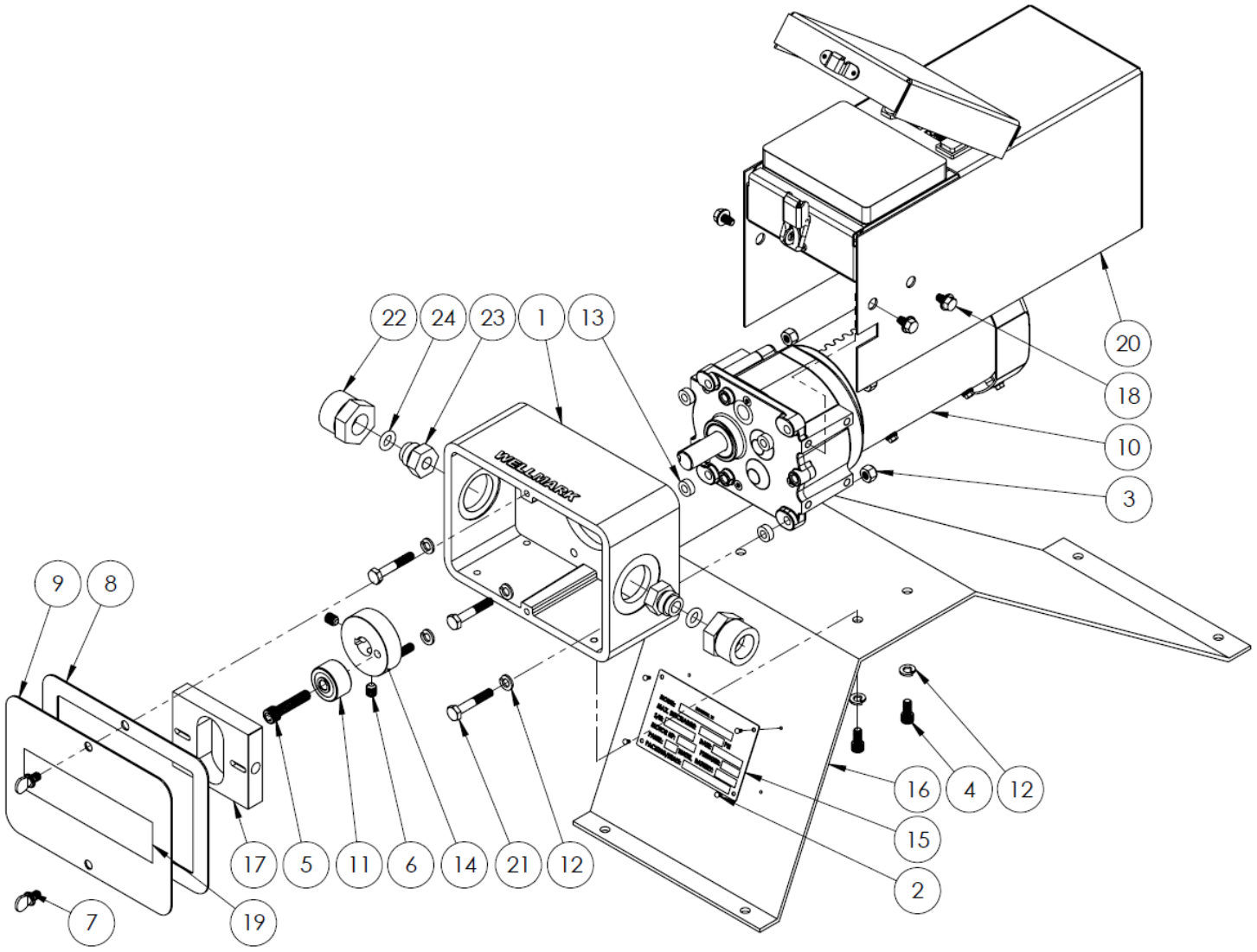
** Recommended Spare Part*

Motor Replacement Parts

- Bodine Motor 33A3BEPM-Z3
  - Motor Brush (Set) PN# 1148958
  - Brush springs PN# 1148956
  - Brush Cap PN# 1159395
- Leeson Motor Brush Set PN# 1160074
- Bison 011-190-6371 Motor Brush Set PN# 1145994

[1] Superseded by the 'High Efficiency' pump Q3 2024

Series EIP AC with DigiMax (Leeson Motor) [1]



Headless Assembly PN#: 1147476

Item	Part Number	Description	Qty
1	1169442	Housing	1
2	1119089	Drive Screw	4
3	1123280	Lock Nut (Nyloc)	4
4	1145876	Socket Head Screw	4
5	1169785	Socket Head Cap Screw	1
6	1169777	Set Screw	2
7	1145897	Thumb Screw	2
8	1145917	Cover Gasket	1
9	1145921	Cover	1
10	1145972	Motor	1
11	1145988	Roller Bearing	1
12	1146040	Lock Washer	8

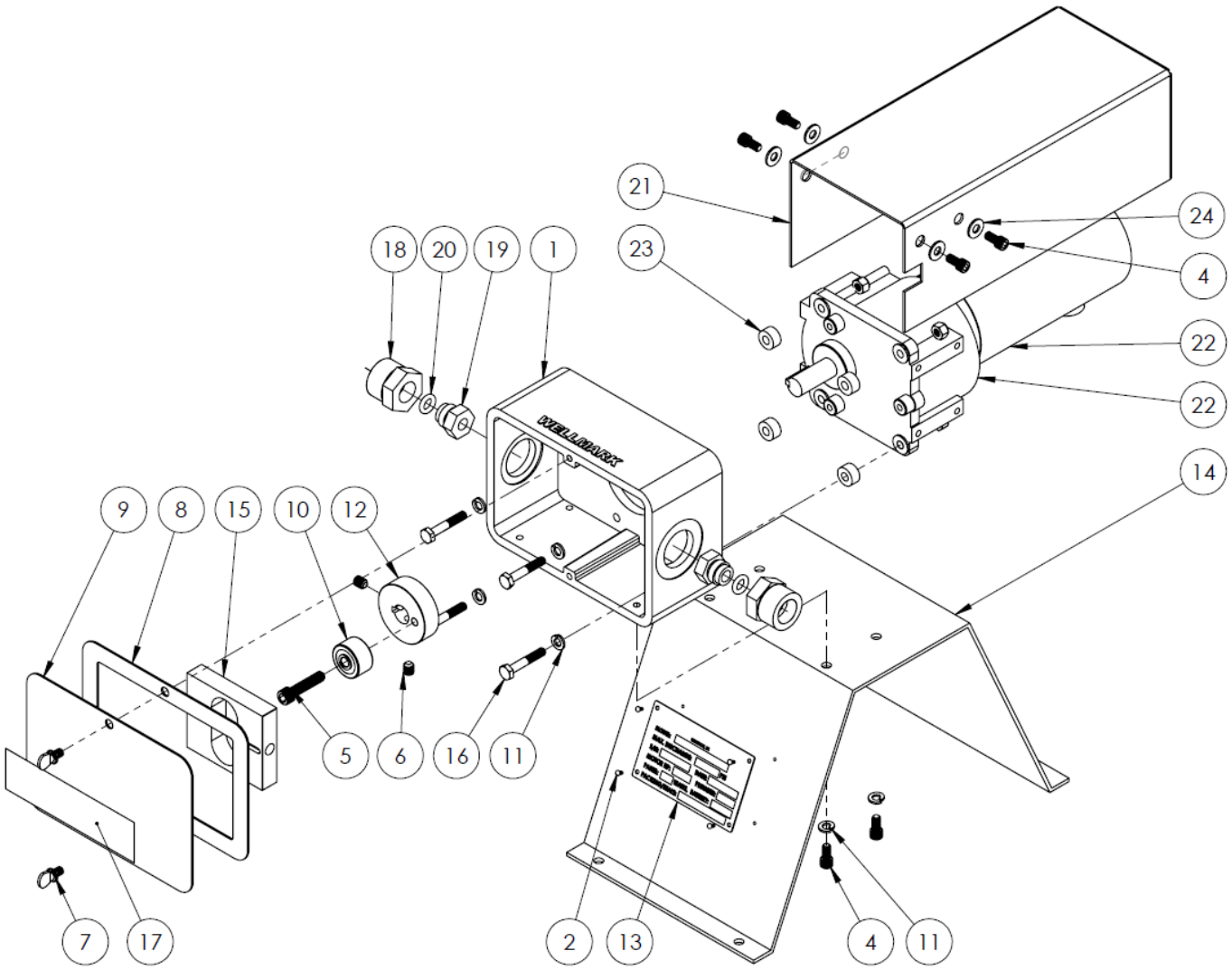
Item	Part Number	Description	Qty
13	1169480	Spacer	4
14	1149272	Eccentric Wheel	1
15	1149281	Nameplate	1
16	1149290	Baseplate	1
17	1149298	Reciprocating Block	1
18	1167044	Screw, Self-Tapping	4
19	1168020	Sticker	1
20[2]	1145935	Pump Controller & Motor Cover	1
21	1120285	Screw, Hex Head	4
22	1149264	Bushing	2
23	1149266 *	Guide Nut	2
24	1011581 *	O-Ring	2

** Recommended Spare Part*

[1] Headless assembly superseded by 1180134 Q1 2024

[2] Pump Controller & Motor Cover 1145935 includes 12’ AC Power Cord (not shown)

Series EIP DC “Large” Motor



Item	Part Number	Description	Qty
1	1169442	Housing	1
2	1119089	Drive Screw	4
3	1123280	Nut, Nyloc	4
4	1145876	Screw, Socket Head Cap	8
5	1169785	Screw, Socket Head Cap	1
6	1169777	Set Screw	2
7	1145897	Thumb Screw	2
8	1145917	Cover Gasket	1
9	1145921	Housing Cover	1
10	1145988	Roller Bearing	1
11	1146040	Washer, Split Lock	8
12	1149272	Eccentric Wheel	1

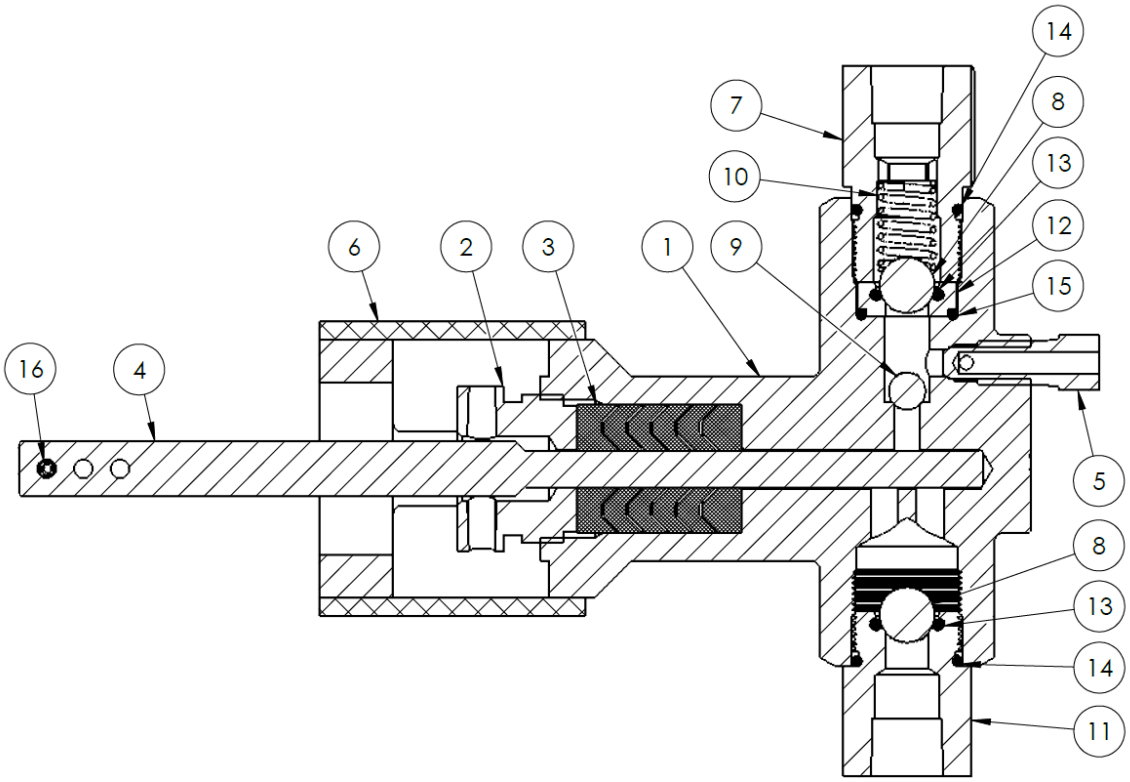
Item	Part Number	Description	Qty
13	1149281	Nameplate	1
14	1149276	Pump Baseplate	1
15	1149298	Reciprocating Block	1
16	1120285	Screw, Hex Head	4
17	1168020	Sticker, Housing Cover	1
18	1149264	Bushing	2
19	1149266 *	Guide Nut	2
20	1011581 *	O-Ring	2
21	1149280	Motor Cover (Large)	1
22	1149205	Pump Motor	1
23	1149105	Spacer	4
24	1121161	Washer, Flat	4

** Recommended Spare Part*

Motor Replacement Parts

- Bison 100-336-6030 Motor Brush Set PN# 1127246

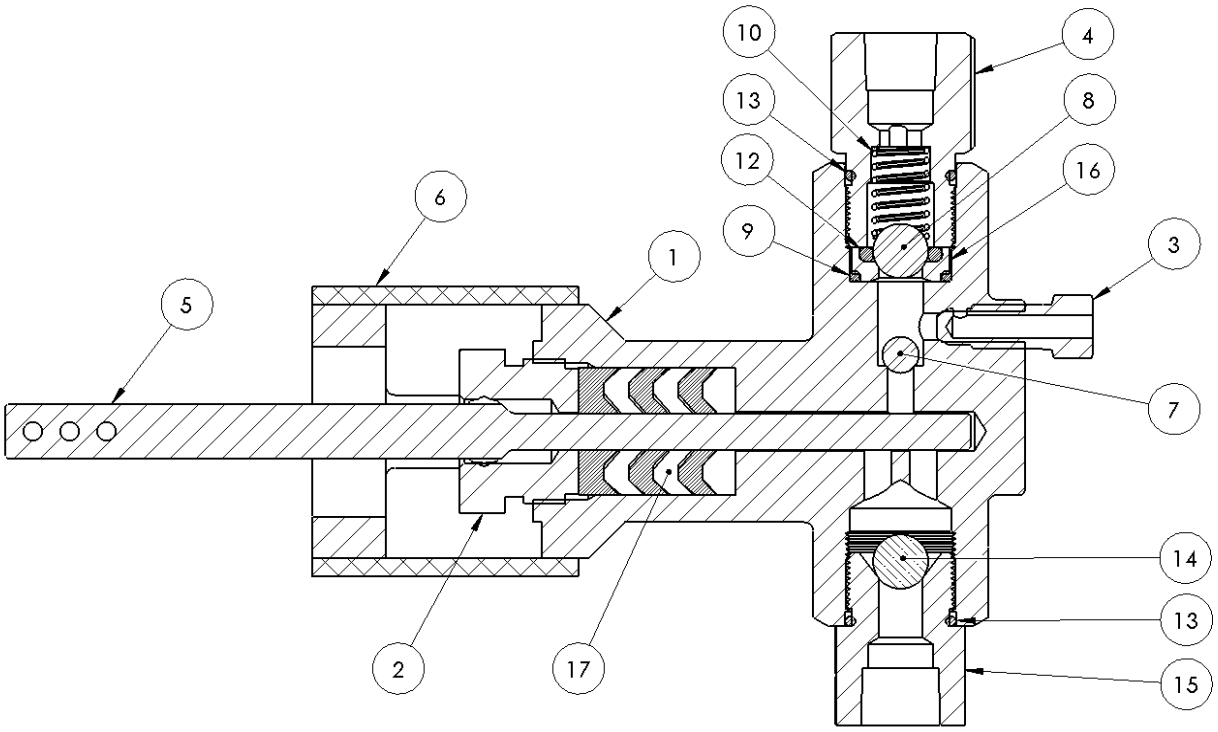
Wellmark One-Piece Fluid End Assembly (Cast)



Item	Description	Material	Part Number by Fluid End Size			Qty
			1/4" Pumps	3/8" Pumps	1/2" Pumps	
1	Fluid End Body	ASTM A-351 Gr. CF8M	1146810	1149025	1146808	1
2	Packing Nut	303 SST	1149262	1149260	1149030	1
3	Packing *	NBR	1145968	1145969	1145970	1
		NBR/PTFE	1149285	1149287	1149289	
		FKM	1145974	1145975	145976	
		FKM/PTFE	1145964	1145965	1145966	
		PTFE	1149199	1149201	1145973	
		PTFE, Bronze Filled	1145990	1127158	1127311	
4	Plunger *	17-4PH SST H900	1149252	1149254	1149256	1
		17-4PH SST Cer. Coated	1149111	1149109	1149115	
5	Bleed Screw	316 SST	1145902			1
6	Yoke Cover	Acrylic (Clear)	1149288			1
7	Discharge Check Body	316 SST	1149246			1
8	Check Ball, 3/8" *	316 SST	1145927			2
9	Check Ball, 1/4" *	316 SST	1145926			1
10	Discharge Check Spring *	316 SST	1146030			1
11	Suction Check Body	316 SST	1149244			1
12	Discharge Check Seat Body	316 SST	1149248			1
13	Check Seat O-Ring *	NBR	1033890			2
		FKM	1040435			
		Aflas	1152582			
		FFKM	1145899			
14	Check Sealing O-Ring *	NBR	1119527			2
		FKM	1119237			
		Aflas	1145895			
		FFKM	1124562			
15	Discharge Seat Sealing O-Ring *	PTFE	1120604			1
16	Coiled Spring Pin *	1070-1095 Steel	1145894			1

** Recommended Spare Part*

Wellmark One-Piece "Ceramic Hard Seat" Fluid End Assembly (Cast)



Item	Part Number	Material	Description	Qty
1	Multiple	316 SST	Fluid End	1
2	Multiple	316 SST	Gland Nut	1
3	1145902	316 SST	Bleed Screw	1
4	1149246	316 SST	Discharge Valve Body	1
5	Multiple	Options Available	Plunger	1
6	1149288	Plastic	Packing Cover	1
7	1145926	316 SST	Discharge Check Ball (Bottom)	1
8	1145927	316 SST	Discharge Check Ball (Top)	1
9	1120604	Teflon	Discharge Check Seat Sealing O-Ring	1
10	1146030	316 SST	Discharge Check Spring	1
11	1145894	Steel	Spring Pin (Not Shown)	1
12	1145898	Teflon	Discharge Check Seat O-Ring	1
13	Multiple	Options Available	Check Sealing O-Ring	2
14	1146121	Ceramic	Suction Check Ball	1
15	1145915	316 SST	Suction Check Valve Body (Hard Seat)	1
16	1145916	316 SST	Discharge Check Valve Seat (For Teflon O-Ring)	1
17	Multiple	Options Available	Packing Set	1

Additional Notes:

- Standard assembly includes only ceramic hard seat suction check, discharge check balls are 316 SST
- Standard Discharge Check O-Rings are PTFE
- Suction check O-Ring material varies

Selecting the Correct Chemical Injection Pump

Sizing for Flow Rate

Care should be taken to size a pump that meets all application requirements.

Required Sizing Information

- Minimum, Maximum, and Average Injection Rates
- Minimum, Maximum, and Average Injection Pressures

Sizing for Application Best Practices

- Size pump and fluid end such that desired injection rate is within 25-75% of the maximum allowable flow rate, while still accommodating for the full range of injection rates and pressures.
- Use 1/4" or 3/8" fluid ends for interchangeability of parts where possible and to allows for conversion to 3/16" or 1/2" size fluid ends if an increased injection rate range is needed.
- If maximum injection rates are significantly higher than average injection rates, consider installing the pump as a dual head configuration during startup, and replacing second fluid end assembly with a cap assembly when injection rate requirements are reduced.

Sizing for Efficiency Best Practices

- Selecting the smallest motor size (horsepower) available that suits your application will increase motor and overall pump efficiency
- For intermittent control applications, selecting a pump and fluid end assembly size that will result in lower ON TIME per cycle to achieve the application rates will greatly increase efficiency

See Specifications section to find the appropriate pump based on flow values.

Selecting Materials

Seals and O-Ring Materials

Material	Material Available for	Temp Min (F) Temp Max (F)	Usage Notes
PTFE	Solar Pump Packing Fluid End Check Seats & O-Rings	-300 300	Common Trade Name : Teflon Plastic material with extreme chemical resistance and temperature properties *Composite materials recommended for increased wear properties in seal applications*
FKM	Solar Pump Packing WM Cast Fluid End Check Seat & O-Rings	-15 200	Common Trade Name: Viton (A) Broad chemical resistance elastomer option *Not recommended for use in methanol / ethyl alcohol applications*
NBR	Solar Pump Packing WM Cast Fluid End Check Seat & O-Rings	-40 200	***Common Trade Names : Buna-N, Nitrile*** Elastomer seal material commonly recommended for methanol/ethyl alcohol applications Not recommended for harsh chemical applications
FFKM	WM Cast Fluid End Check Seat & O-Rings	0 500	***Common Trade Names : Kalrez, Simriz, Parker Parofluor 200*** Elastomer material with extreme chemical resistance and temperature properties *While useful in almost all applications, cost is prohibitive*
FEPM	Solar Pump Packing	10 300	***Common Trade Name: Aflas*** Excellent chemical resistance Recommended for use in 'amine inhibitor' fluids and sour H2S environments

Plunger Materials

Material	Usage Notes
17-4PH SST H900	General chemical compatibility similar to 304 SST 44 HRC hardness for increased wear resistance over 300 series stainless materials in dynamic applications
17-4PH SST Ceramic Coated	Excellent chemical resistance to all acids, bases, and solvents Hardness rated between Sapphire and Diamond

Selecting Control & Automation Options

Wellmark offers the following standard pump controllers[1]

DigiMax — Available in AC and DC options

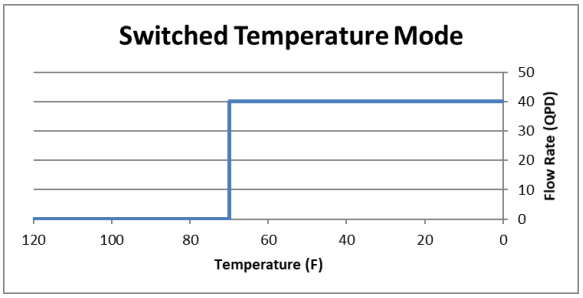
- Intermittent pump control
- ***Injection Modes*** **-**
  - Manual Mode—enter pump ON and OFF times manually to achieve desired injection rate target
  - Auto-Mode—Controller allows for entry of physical pump characteristics to calculate ON time per cycle (~60 second cycle frequency) based on fluid end and motor characteristics.
- ***Temperature Based Injection*** **-** "Switched" Temperature mode to enable injection only when temperature falls below user-defined setpoint. Ambient temperature sensor included standard with all DigiMax controls.
- Modbus RTU Communication via RS485 2-wire serial connection
  - Read & Write—Flow rates, temperature setpoints, pump characteristics, etc.
  - Read Only – Voltage, Cycle Count

DigiUltra — Available in DC option only

- Intermittent pump control
- ***Injection Modes*** **-**
  - Manual Mode—enter pump ON and OFF times manually to achieve desired injection rate target
  - Auto-Mode—Directly enter QPD setpoint and let the controller determine ON time per cycle to achieve target injection rate. Select from 30 second, 1 minute, and 5 minute cycle times.
  - Real Time Mode—Enter ON and OFF times based on time of day values (24-hour cycle)
- Pump Calibration—Quickly run a rate test to determine maximum flow rates. Adjusts auto mode cycle times based on actual pump output.
- ***Temperature Based Injection*** – all DigiUltra controllers include a thermistor used for ambient temperature sensing and injection control.

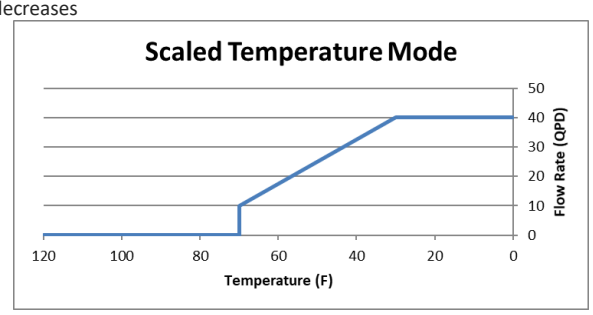
Switched Temperature Mode

Enable injection only when the temperature falls below a user defined setpoint on the controller



Scaled Temperature Mode

Allows for linear, increasingly scaled flow rate as temperature decreases



- Additional IO
  - 2x Analog Inputs for tank level monitoring and/or local proportional control from signal.
  - 1x Auxiliary relay output allows for time-based control of additional equipment
  - 1x Discrete input to override or enable pump output on signal
- Modbus RTU Communication via RS485 2-wire serial connection
  - Read & Write—Flow rates, temperature setpoints, pump characteristics, etc.
  - Read Only – Alarms, tank level information, controller status, cycle counts, etc.

[1] *Not all control options may be available for all pumps – contact manufacturer for more information*

Ordering & Model Code Information

Example Model Code

EIP	-	2	0	L	0	A	2	0	2	8	-
Pump Series		Head 1 Plunger	Head 2 Plunger	Head 1 Packing & Seals	Head 2 Packing & Seals	Motor	Solar Panel(s)	Batteries & Enclosure	Mounting	Control	Additional Options

Model Code Options

Pump Series	
Code	**Pump Description**
EIP	General Purpose Electric Injection Pump

Head 1 Plunger Options	
Code	**Plunger Size**
17-4 PH SST H900 Plunger Options	
1	1/4" Plunger
2	3/8" Plunger
3	1/2" Plunger
7	3/16" Plunger
17-4 SST Ceramic Coated Plunger Options	
4	1/4" Plunger
5	3/8" Plunger
6	1/2" Plunger
8	3/16" Plunger

Head 2 Plunger Options	
Code	**Plunger Size**
0	No Head 2 (Standard)
17-4 PH SST H900 Plunger Options	
1	1/4" Plunger
2	3/8" Plunger
3	1/2" Plunger
7	3/16" Plunger
17-4 SST Ceramic Coated Plunger Options	
4	1/4" Plunger
5	3/8" Plunger
6	1/2" Plunger
8	3/16" Plunger

Head 1 & 2 Packing & Seals Options		
Code	**Packing Material**	**Seal Material (Check Valves)**
One Piece Fluid Ends		
C/F	*Consult Factory for Legacy One-Piece Fluid End Options*	
Universal Fluid Ends		
0	No Head *(Head 2 Option Only)*	
K	Aflas/Teflon	PTFE
L	Viton/Teflon	PTFE
M[1]	Buna/Teflon	PTFE
Z	FFKM/Teflon	PTFE

Motor Options	
Code	**Description**
DC Injection Pumps	
A [2]	12VDC "High Efficiency" Motor
9	12VDC Brushless IntegraMotor
C	24VDC Brushless IntegraMotor
AC Injection Pumps	
B[3]	115VAC, Single Phase AC Gearmotor (Bodine)

Solar Panel Options		
Code	**Wattage**	**# of Panels**
DC Injection Pumps		
0	No Solar Power System	
1[4]	50-60W	Single Panel
2	80-90W	Single Panel
3	135-150W	Single Panel
7	270-300W	Dual Panel
AC Injection Pumps		
0	No Solar Power System	

Batteries & Enclosure Options [5]		
Code	**Batteries**	**Enclosure**
DC Injection Pumps		
0	-	Single Battery Box
1	-	Dual Battery Box
2	1x 110 Ah Sealed	Single Battery Box
4	2x 110 Ah Sealed	Dual Battery Box
A	1x 110Ah FLA	Single Battery Box
B	2x 110Ah FLA	Dual Battery Box
C/F	*Consult Factory if Larger Power System is Required*	
AC Injection Pumps		
8	External 115VAC Power Provided by End User	

Mounting Options	
Code	**Type of Mounting**
DC Injection Pumps	
0	No Mounting
2	Quad Leg Mast
A	No Mounting, 6' Post Only (for Solar Panel Mounting)
AC Injection Pumps	
3	Standard A-Frame

Control Options	
Code	**Type of Mounting**
DC Injection Pumps	
0	No Pump Controller
2	DigiMax Pump Controller
8	DigiUltra Pump Controller
AC Injection Pumps	
0 [6]	No Controls
2	DigiMax Pump Controller
C/F	*Consult Factory for AC DigiUltra Pump Controller Options*

Additional Options	
Code	**Option**
DC Injection Pumps	
1	Ext Pump to Batt Box Cable (Specify Length, 1' Incr. Only)
P	Ext Solar Mounting Post (Specify Length, 1' Incr. Only)
C	12' SJOOW Cable Connection from Pump

[1] Only available with 1/4" & 3/8" size fluid ends

[2] Motor option "A" supersedes legacy option "1" Q3 2024

[3] Motor option "B" supersedes legacy option "7" Q1 2024

[4] Motor options "9" & "C" (Brushless) require 90W or higher solar panel

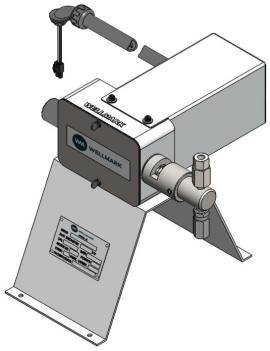
[5] Due to hazardous materials used in batteries, shipping of systems with batteries included may not be available in all areas

[6] Only available when Motor Option "B" is selected

Standard Models

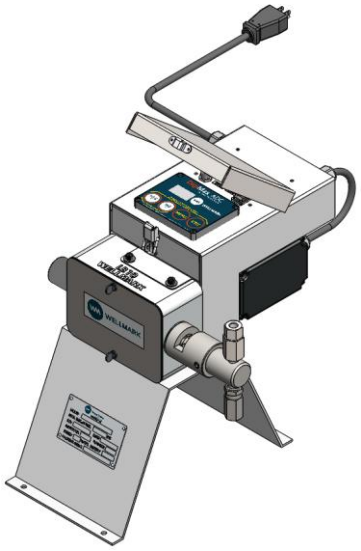
DC Solar Pump System: EIP – 2 0 L 0 A 2 0 2 8

System Includes:

	**Chemical Injection Pump** • Single Head 3/8” 17-4PH SST H900 Stainless Plunger Pump • Viton/Teflon Packing Material with PTFE Check Valve O-Rings • High Efficiency 59 RPM Motor
	**Solar Power and Control System** • 80-90W Solar Panel Assembly • Quad Leg Mast Assembly with 4 ft Solar Mounting Pipe • Single Battery Enclosure (No Battery, to be supplied by end user) • DigiUltra Pump Control Panel with Solar Charge Regulator • Required Wires and Connectors to Connect Pump to Power and Control System ***Note:*** *Control Panel includes charge regulator when ordered in combination with solar power system*

AC Injection Pump System: EIP – 1 0 K 0 B 0 8 3 2

System Includes:

	**Chemical Injection Pump** • Single Head 1/4" 17-4PH SST H900 Stainless Plunger Pump • Aflas/Teflon Packing Material with PTFE Check Valve O-Rings • 115VAC Single Phase AC Motor • Integrated DigiMax Controller with 12’ Power Cable

Assembly

Prior to installation, unpack pump and/or fluid ends and inspect for any damage. Notify your sales representative if any components are damaged or missing upon arrival.

Warning! *Before performing any work on the pump, ensure pump power is disabled, or damage to equipment and/or serious injury may occur!*

Before attempting to run the pump, review this section and ensure all components are properly greased prior to operation.

General Notes

Most pumps are sold as a complete assembly with pump and fluid end, but if a headless pump and fluid end are purchased separately, installation only requires a few steps.

For proper function, both Timberline and Wellmark Headless Pump Assemblies require purchase and installation of either:

- 1x Fluid End Assembly + 1x Cap Assembly (Single Head Assemblies)
- 2x Fluid End Assemblies (Dual Head Assemblies)

If a Wellmark Headless Pump Assembly is purchased without fluid ends, the following items are packed loose inside of the pump housing for final assembly:

- 1x reciprocating block
- 2x guide bushing assemblies
- 1x unmarked nameplate (with 4x drive screws)

Before installation, remove pump housing cover and confirm above parts are included.

Warning! *Do not attempt to run the headless pump until components included inside the housing have been installed! This may cause serious damage to the pump.*

Fluid End Cap Installation

Note: *Wellmark pumps require a Fluid End Cap Assembly for reciprocating block alignment when used in a single head configuration. Pump will fail to operate if either a cap or second fluid end is not installed on pump before use.*

Included parts:

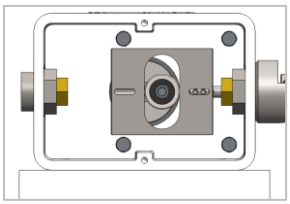
- (1x) Guide
- (1x) Spring Pin
- (1x) Jam Nut
- (1x) Fluid End Cap

Recommended tools for installation:

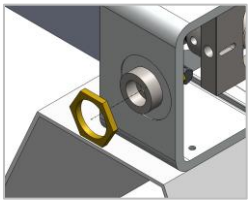
- 1-1/4” Wrench
- 1-1/2” Wrench
- Needle Nose Pliers
- Hammer
- 1/4” Hex Key

Installation Steps:

1. Locate the second guide bushing assembly that was included in the headless pump housing and insert loosely into side wall opposite of fluid end installed previously.

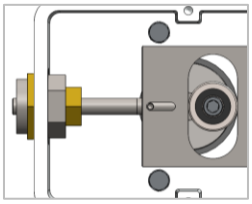


2. Thread Jam Nut onto guide bushing assembly and tighten using 1-1/2” (Jam Nut) and 1-1/4” (Bushing) wrenches to secure guide bushing assembly to housing.

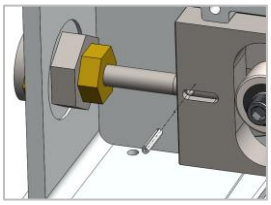


3. From outside of the pump housing, insert guide through guide bushing assembly and into reciprocating block.

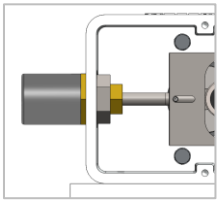
   Ensure guide is inserted such that the hole used to pin to reciprocating block is on the inside of the pump housing.



4. When guide is fully inserted into reciprocating block, use needle nose pliers to hold the Spring Pin in position over the guide hole and hammer into place.



5. Thread Cap onto Guide Bushing Assembly hand tight.



6. Apply grease to reciprocating block, bearing, and guide before use.

   Warning! *Headless pump assemblies are shipped without lubrication, as parts are shipped inside of pump housing.*

   Failure to grease interior pump components prior to use will result in increased wear and shortened lifespan of pump.

Universal Fluid End Assembly Installation

Included parts:

- (1x) Plunger
- (1x) Spring Pin
- (1x) Body Assembly
- (1x) Yoke
- (2x) Body Assembly Set Screws

Recommended tools for installation:

- Channel Locks
- Needle Nose Pliers
- 1-1/4” Wrench
- Hammer
- 3/16” Hex Key
- 1/4" Hex Key

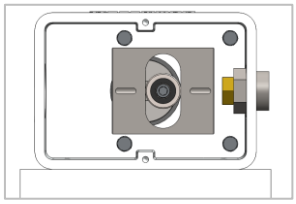
Installation Steps:

1. Remove plunger from body, apply grease liberally to fluid end side of plunger, and reinsert plunger into body assembly prior to installation.

   Plunger should be inserted such that only a small part of the plunger is contacting the packing seal, with as much of the plunger protruding from body as possible to facilitate reciprocating block installation.

2. Open pump housing and locate one of the two included guide bushing assemblies, and reciprocating block.

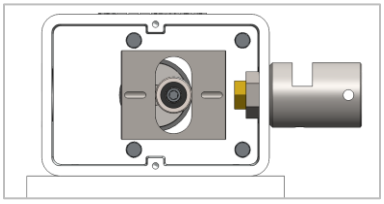
   Insert one guide bushing assembly (loose) into side wall of pump housing. Insert reciprocating block loosely onto eccentric wheel bearing.



   Note: *Nameplate, drive screws, and second guide nut assembly included with pump may be removed from pump housing at this point as well.*

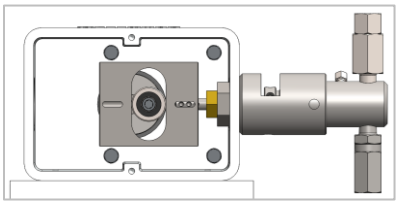
3. Thread yoke onto guide nut assembly.

   Tighten yoke onto guide nut assembly by holding yoke in position with window facing vertically upwards as shown below. Channel locks may be required to hold the yoke in position while the guide nut bushing is tightened using a 1-1/4” wrench.



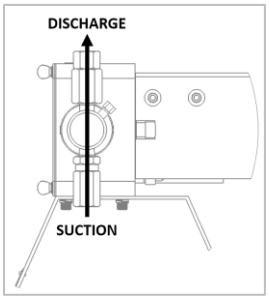
4. Thread body assembly into yoke until body assembly stops. **Do not tighten at this point!**

   While installing fluid end, align plunger such that it inserts into reciprocating block during assembly.



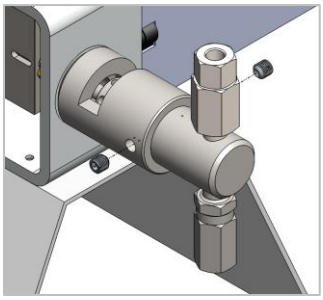
   Note: *If reciprocating block is not in a position to allow for the plunger to install into reciprocating block as shipped, a 1/4” hex key may be inserted into the eccentric wheel bearing to manually rotate eccentric wheel and reposition the reciprocating block. Always rotate eccentric wheel bearing clockwise to prevent loosening of assembly.*

5. Rotate the Fluid End Assembly counterclockwise in relation to the yoke such that the body assembly is oriented vertically with the suction check pointing straight down and discharge check straight up.

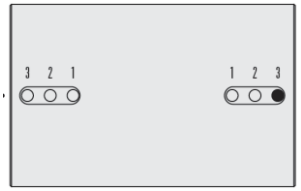


   Note: *If the pump is not installed on an even surface, adjustment of the Fluid End Assembly may be required to ensure gravity suction check is able to function.*

6. Using 3/16” hex key, Install and tighten Body Assembly set screws to fix Body Assembly to Yoke.

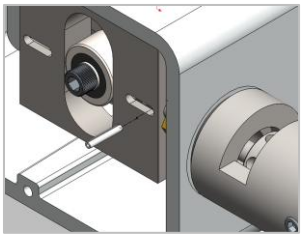


7. If needed, slide plunger into reciprocating block until it is far enough to pin in the desired position.



8. Use needle nose pliers to hold the pin in position over desired pin position hold and hammer into plunger.

   Note: *Factory default pin position for pumps is position 3 (full stroke)*



9. Apply grease to reciprocating block, bearing, and end of plunger that contacts guide bushing assembly prior to operation.

   Warning! *Headless pump assemblies are shipped without lubrication, as parts are shipped inside of pump housing.*

   Failure to grease interior pump components prior to use will result in increased wear and shortened lifespan of pump!

10. For single head pumps, see next section on Fluid End Cap Installation to complete fluid end installation.

    For dual head assemblies, repeat these steps on the opposite side of pump housing and reinstall pump housing cover to complete fluid end installation.

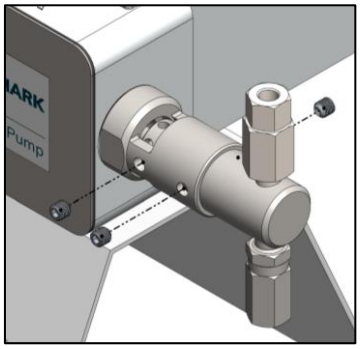
Universal Fluid End Removal

Recommended tools for removal:

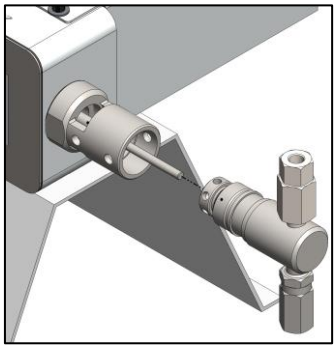
- Vice Grips
- 1-1/4” Wrench
- 3/16” Hex Key

Removal Steps:

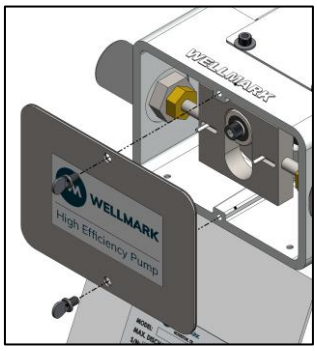
11. Using 3/16” Hex Key, remove set screws from yoke assembly.



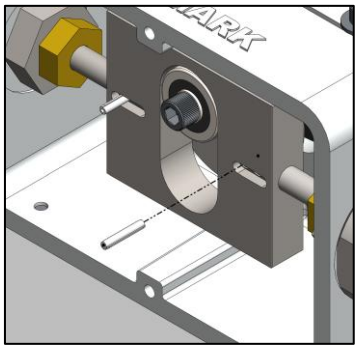
12. Unscrew body (counterclockwise) from yoke assembly.



13. Unscrew the two thumb screws located on pump housing and remove the housing cover.

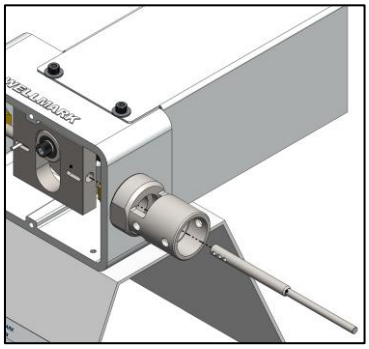


14. Using vice grips to securely hold the spring pin, pull to remove spring pin from plunger.



Note: *For installation of new fluid ends, use of a new spring is recommended.*

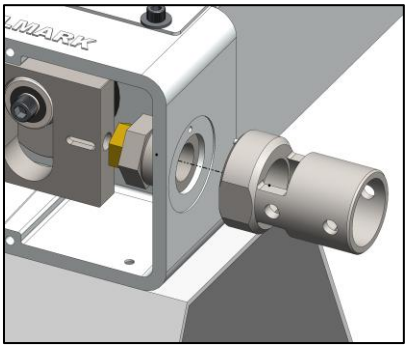
15. Plunger is now free to be removed from the reciprocating block.



16. Using a 1-1/4” wrench, unscrew internal guide nut and bushing assembly from yoke.

Note: *Newer style yokes include alignment pin which prevents yoke from rotating during assembly/disassembly.*

If reciprocating block is not in a position to allow for removal of guide nut and bushing assembly, a 1/4” hex key may be inserted into the eccentric wheel bearing to manually rotate eccentric wheel and reposition the reciprocating block. Always rotate eccentric wheel bearing clockwise to prevent loosening of assembly.



Pump Installation

System Requirements

1. **Pump Setting Gauge and Isolation Valves** to allow for field calibration of chemical injection rate
2. **Y-strainer** (or similar filtration) installed between chemical supply and pump suction check

   140 mesh (100 micron) filtration minimum is recommended. Higher levels of filtration may reduce chemical supply pressures and lead to pump cavitation.

   ***Note**: Failure to filter supply side chemical will greatly reduce the lifespan of your pump and seals!*
3. **Inline Check Valve** at injection point
4. **Pressure Relief Valve** between pump discharge check outlet and inline check valve at injection point.

   Relief valve should be set based on the component with lowest pressure rating in the system.

   Warning! ALWAYS use a pressure relief valve with positive displacement pump –Failure to do so may result in catastrophic failure or personal injury!
5. **Block Valves** installed for pump disconnection between:

   Chemical tank and suction check of pump

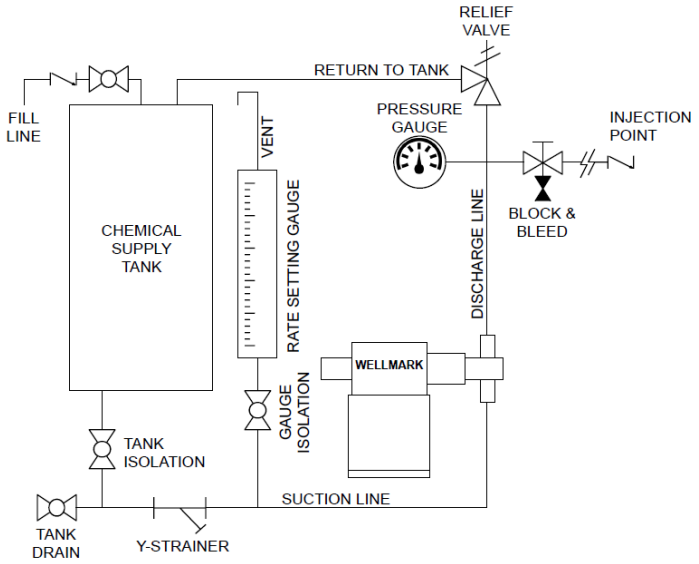
   Discharge check and injection point inline check valve

   ***Note:** All block valves must remain open while the pump is in operation!*
6. Suction tubing should be sized to allow for application flow rate

   For especially viscous chemicals, increased suction tubing size may be required.
7. All tubing and components between the chemical supply and injection point must be bubble tight and compatible with the chemical being used.
8. **Adequate power system and controls for the pump and application requirements (Solar or AC Electric)**

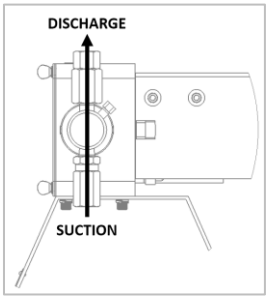
System components in bold above are available through Wellmark Chemical Injection Solutions. Contact your local sales rep for assistance if any additional system components are needed for your application

Example System



Pump Connections

1. Pump must be installed vertically (suction check pointing down) and such that the suction check is 6-12 inches below the chemical supply level at startup. Timberline Series 4000 and Wellmark Series EIP chemical injection pump suction checks are not designed for suction lift operation.



   ***Note:** If the pump is not installed on an even surface, adjustment of the Fluid End Assembly may be required to ensure gravity suction check is able to function.*
2. Connect chemical supply line to pump suction check. Use PTFE tape on suction check of pump and any tapered pipe threads for bubble-tight installation.

   ***Note:** Wellmark Series EIP chemical metering pumps utilize a gravity suction check design, so proper orientation and height of pump installation is critical to pump operation*!
3. Connect injection discharge line to discharge check of pump. A block and bleed valve should be used to isolate pump from the injection line for disconnection if needed.

Wiring

Warning! *Before performing any wiring, ensure power is disconnected! Damage to equipment and/or serious injury may occur*

115VAC Pumps (Bodine Motor)

Note: *115VAC Pumps with DigiMax controls will come prewired with a NEMA 5-15 Plug included standard for AC connections.*

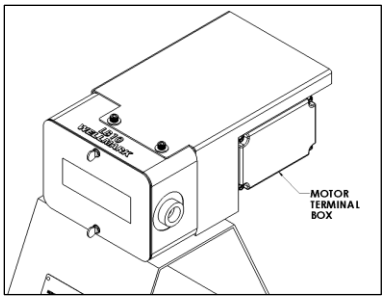
Recommended tools:

- 1/4” nut driver or socket
- 1/8” width flathead screwdriver

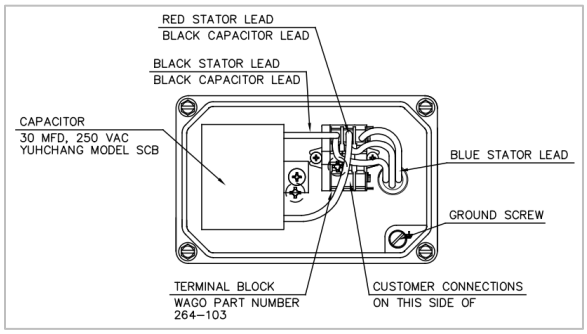
Wiring Instructions

1. Remove terminal box cover using 1/4" nut driver or socket

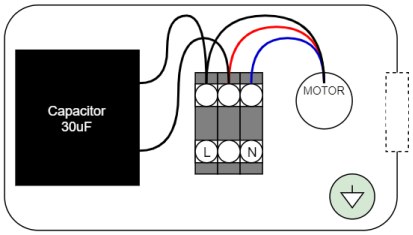
   Warning! *Open circuit before removing cover. Keep cover tight while circuits are alive.*



Terminal Box Interior Detail

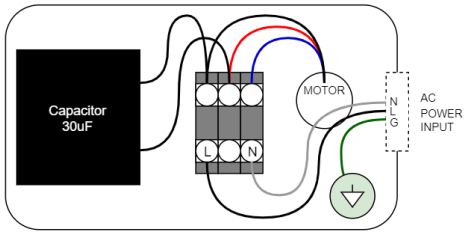


Manufacturer wiring reference



2. Terminate Load, Neutral, and Ground wires inside of terminal box enclosure.

   Standard wiring shown below *(clockwise motor output)*

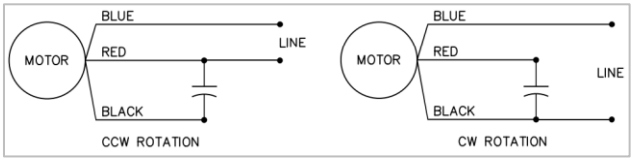


   Insert screwdriver into terminal as lever to open cage clamp connection before inserting wires.

   ,

   Note: *With ferruled conductors, it is necessary to use a terminal block one size smaller than the conductor's nominal cross-section*

Wiring Motor Shaft Output Direction Details



3. Replace terminal box cover with provided 8-32 screws and tighten to 14-18 lb-in torque using a 1/4” nut driver or socket.

12/24VDC Brushless Integra-Motor Pumps

Preface

This section serves to contain the basic information needed to install and operate a Bodine INTEGRAmotor 34B4/SR-WX brushless DC gearmotor & control system used in Brushless motor chemical injection pumps. This motor is certified for Class I, Division 2 hazardous locations.

This manual does not profess to cover all the details or variations in equipment, nor to provide for every possible contingency associated with installation, operation, or maintenance. No warranty of fitness for purpose is expressed or implied.

It is the responsibility of the user to determine whether the installation location is hazardous, and to what degree it is hazardous. Should further information be desired, or should particular problems arise which are not covered sufficiently for the user's purpose, the matter should be referred to Wellmark.

Important Safety Precautions

The use of electric motors and gearmotors, like the use of all electronically powered equipment, is potentially dangerous. The degree of the hazard can be greatly reduced by proper design, selection, installation, and use, but hazards cannot be completely eliminated.

The Bodine type 34B motor was evaluated by the Underwriters Laboratories (UL) for compliance to UL standards 508C and 1004-1 and CSA standards C22.2 No. 14 and C22.2 No. 100. Motor construction recognition is documented in UL file E47177. The gearmotor is also a UL listed product, documented in UL file E474208 for hazardous locations. This product was also evaluated by UL for compliance to UL standard 1836, CSA standard C22.2 No. 213, and ISA standard 12.12.01. The motor is suitable for use in Class I, Division 2, Groups A, B, C, D hazardous locations or unclassified (non-hazardous locations) and bears the mark shown above.

Please read through this operation manual in detail and observe those paragraphs with safety warnings.

Warning! *Explosion hazard. Do not disconnect while circuit is live or unless the area is known to be free of ignitable concentrations.*

Avertissement! *Risque d'explosion – avant de deconnecter l'equipment, couper le courant ou s'assurer que l'emplacement est designe non dangereux.*

Warning! *Explosion hazard. Substitution of components may impair suitability for Class I, Division 2.*

Avertissement! *Risque d'explosion–La substitution de composants peut render cet equipement inadapte a une utilization en environnement de Class I, Division 2.*

Installation

Note: *This product should only be installed by a qualified person familiar with its operation and associated hazards, and knowledgeable about the special requirements for installation in hazardous locations if used in such an application.*

The National Electrical Code (NEC), local electrical and safety codes, and when applicable, the Occupational Safety and Health Act (OSHA) should be observed to reduce hazards to personnel and property.

Read this manual completely and carefully before making any connections. Pay special attention to all warnings, cautions, and safety rules. Failure to follow the instructions could produce safety hazards which could injure personnel or damage the control, gearmotor, pump, or other equipment. If you have any doubts about to connect the control or gearmotor, refer to the detailed sections of this manual.

Warning! *Explosion hazard. Do not disconnect while circuit is live or unless the area is known to be free of ignitable concentrations.*

Avertissement! *Risque d'explosion – avant de deconnecter l'equipment, couper le courant ou s'assurer que l'emplacement est designe non dangereux.*

Warning! *Explosion hazard. Substitution of components may impair suitability for Class I, Division 2.*

Avertissement! *Risque d'explosion – La substitution de composants peut render cet equipement inadapte a une utilization en environnement de Class I, Division 2.*

1. **Remove the Control Enclosure Cover**

   Warning! *Open circuit before removing cover. Keep cover tight while circuits are alive.*

   Avertissement! *Coupez l'alimentation avant de retirer le couvercle. Ce couvercle doit être en place pendant que le circuit est sous tension.*

   The cover of the control enclosure is fastened with 4 provided screws, one at each corner. Use a ¼" nut driver of flat head screwdriver to loosen screws and remove the cover.

2. **Connect Cable/Conduit**

   Motors used with Wellmark chemical injection pumps come standard with a 7/8 diameter hole in the side of the enclosure. A UL listed 1/2" NPT conduit hub/gland should be installed per the manufacturers specification.

   Caution: *Conduit hub/gland used may affect the IP rating of the motor and allow for dust/water ingress. Always select a conduit hub/cable gland suitable for the application requirements.*

3. **Make Electrical Connections**

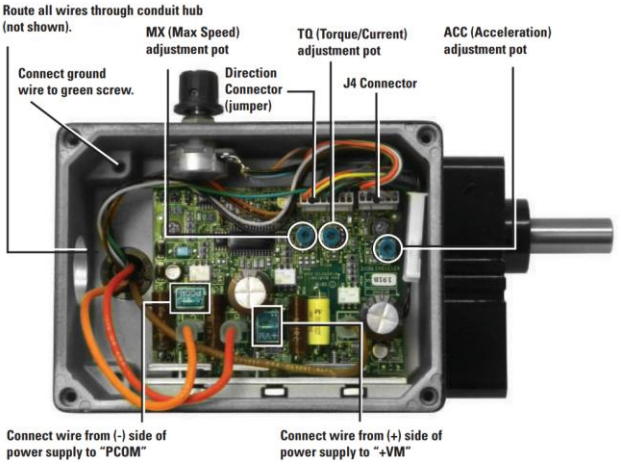
   Gearmotors used in Wellmark pumps are factory wired such that drive is enabled as soon as power is applied. Speed is controlled using the potentiometer located on the side of the control enclosure.

   Additional control options are covered in more detail in the following sections.

   Power and ground connections are made using three wires routed through the conduit/gland and into the 34B4/SR-WX gearmotor and control enclosure. The power wires must be terminated with ¼" quick disconnect receptacles.

   Connect the (+) side of the power supply to the tab labeled "+VM" on the circuit board inside the control enclosure. Connect the (-) side of the power supply to the tab labeled "PCOM". Use the green ground screw in the bottom of the control enclosure to attach the ground wire. See figure below for location of the three connections.

   Caution: *If using a DigiMax/DigiUltra controller for pump control, a fuse is included. All other motor/control applications must be protected by their own user-supplied fuse with a maximum 15A rating.*



4. **Attach the Control Enclosure Cover**

   The cover of the control enclosure is fastened with four 8-32 hex washer head screws, one at each corner. Either a ¼" nut driver or a flat screwdriver can be used to tighten the screws to 14-18 lb-in and attach the cover.

5. **Operating the 34B4/SR-WX Gearmotor**

   - Recheck all connections & that the gearmotor/pump is securely mounted.
   - Check that all rotating members are free from obstruction and in proper alignment.
   - Test the pump/gearmotor in an unloaded application first.
   - Do not remove cover over electronics when power is ON to avoid personal injury caused by electrical shock.
   - Do not attempt to install or remove electrical connector when the power supply is turned on.

Brushless Control Details

The integrated controls provide the necessary electronic commutation and phase current switching to operate Bodine low-voltage brushless DC motors.

Speed can be controlled by an external or on-board MAX speed trim potentiometer, or a 0 to 5VDC analog input signal.

Other features include adjustable maximum speed settings, torque, and accelerations/ deceleration times.

Feature	Specification	
	12 VDC	24 VDC
Product Type	ABL 3906C	
Model	3908	3909
Input Voltage	12 to 14VDC	24 to 35VDC
Output Voltage	0 to 12VDC	0 to 24VDC
Output as % of Input Voltage	Up to 95%	
Max Current (Input)	20.0 A (DC)	18.0 A (DC)
Max Current (Output)	20.0 A (DC)	18.0 A (DC)
Speed Regulation	2% at 2500 RPM	
Speed Control Method	Pulse Width Modulation (PWM)	
PWM Frequency	20 kHz	
Input Levels	0 to 5 VDC	
Acceleration Time	0.35 to 8.0 Seconds	
Ambient Temperature	0° to 50°C (Operating)	

The Bodine type ABL-3906C control as evaluated by Underwriters Laboratories (UL) for compliance to UL standard 508 and CSA standard C22.2 No. 14. I tis a UL recognized component, documented in UL file number E44529, and bears the mark shown above.

The Bodine type ABL-3906C control is manufactured with materials and processes that comply with European directive 2002/95/EC on the Restriction of Hazardous Substances (RoHS).

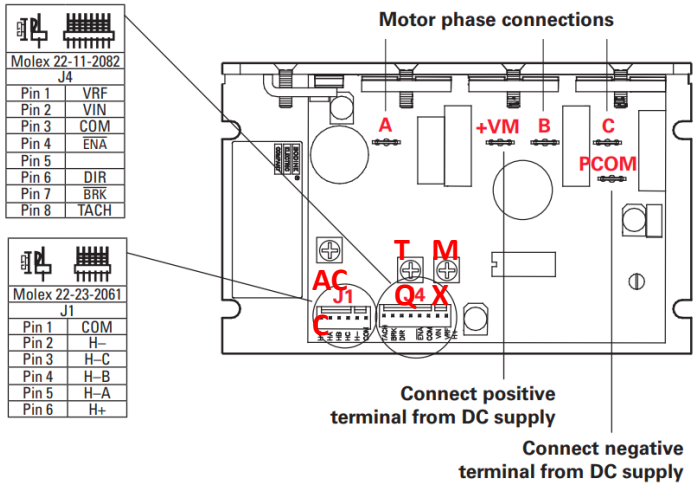


Figure 1: Control Circuit Board Detail

Control Speed Signal Connections

Motor speed can be controlled in one of three ways:

1. **Control with External Speed Potentiometer (Standard):** An external 10kΩ potentiometer is used to manually control motor speed. Turning this clockwise will increase motor speed. As shipped, this potentiometer is set to 100% speed.

   In addition to this potentiometer, the on-board "MX" trim potentiometer located on the control board may be used to limit the maximum motor speed attainable by this external potentiometer.

2. **Controlling Speed with On-Board Trim Potentiometer:** Motor speed may be controlled using the on-board "MX" potentiometer. In order for the "MX" potentiometer to function as a speed control, a jumper is placed across terminals VRF and VIN on the interface connector as a standard, indicated by the dashed line below.

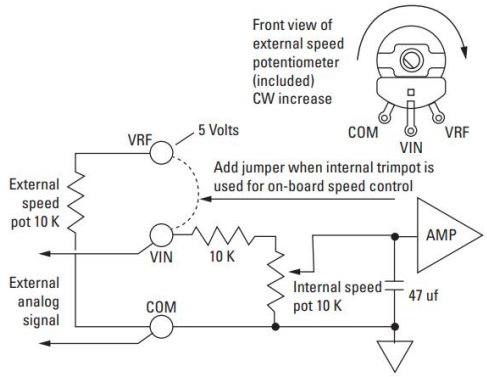


Figure 2: Internal and External Speed Potentiometer Connections

3. **Control with Analog Input Voltage:** Motor speed can be controlled with an external 0 to 5 VDC analog input signal. Apply the 0-5 VDC signal across the VIN and COM terminals on the interface connector J4.

   Speed is increased by increasing the voltage applied to VIN (Pin J4-2).

   0 VDC = 0 RPM; 5 VDC = Max RPM.

On-Board Trim Potentiometer Adjustments

Warning! *Use a non-metallic or insulated adjustment tool for internal adjustments. Circuit components are not at ground potential and accidental short circuiting and shock hazard may occur with conduction tools. Adjustment should be made only qualified service personnel.*

Note: *when adjusting the onboard potentiometers, lightly turn until detent stop is felt. Potentiometers can overrate*

1. **MX - Maximum Speed Trim Potentiometer**

   When used in conjunction with an external speed potentiometer, the lowest MX trim potentiometer setting corresponds to zero speed and the highest MX trim potentiometer setting corresponds to approximately 120% rated speed.

2. **TQ - Torque (Current) Limiting Adjustment**

   The TQ trim potentiometer as shipped limits the control output current to 150% of the control's nameplate rating (e.g. for 12VDC models, this is factory set to 30A).

   In most cases it may be desirable to reduce the peak current limit to a level less than the factory setting in order to protect drive mechanisms from damage due to overloading. Turn the TQ pot counterclockwise to decrease the torque and clockwise to increase torque.

3. **ACC - Acceleration Adjustment**

   The ACC trim potentiometer can be used to adjust the motor's acceleration time. This is set to the minimum acceleration time of 0.35 seconds as shipped (fully counterclockwise).

   Adjusting the potentiometer clockwise can increase the time required to accelerate up to a maximum of approximately 8 seconds.

Control Logic Connections

Manual switches, relays, or logic signals can be used to control motor braking, enable, and direction of rotation. The figure below shows the pin-out of the interface connector J4, as well as interface information for the logic inputs.

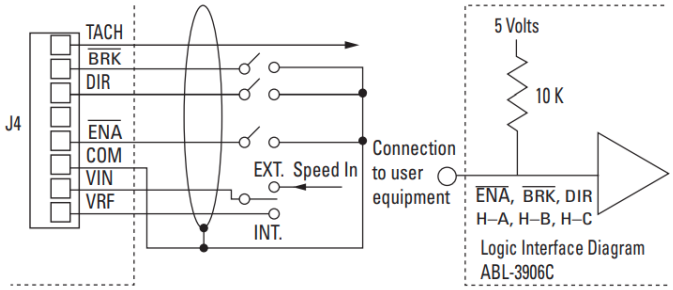


Figure 3: Brushless Motor Control Logic Inputs

This chart lists the condition of the control input based on the open or closed condition of the relay contact or switch and the high or low state of the input signal.

Designation	Closed-Switch or Low Voltage State[1]	Open-Switch or High Voltage State
ENA[2]	Drive Enabled	Drive Disabled
DIR[3]	CCW Direction	CW Direction
BRK	Brake	Run

1. *Logic Low = 0.0 - 0.4 V; Logic High = 3.0 - 5.0 V*
2. *When ENA goes high the motor will coast to a stop*
3. *The output shafts of gearmotors with odd numbers of stages will rotate in opposite direction. A "smart reverse" circuit prevents plug reversing if the switch is opened or closed while the motor is running. The motor will coast to low speed before changing direction. However, it is best to stop the motor before changing the DIR input to avoid over-speeds when accelerating back to the set speed.*

Warning! *Never rely on logic circuitry as a means of disabling the motor or control. To prevent mechanical motion and potential injury, the power source should always be disconnected whenever logic circuits or the driven equipment are serviced.*

Tachometer Connections

The ABL-3906C control provides a digital tachometer output at the TACH terminal (J4, Pin 8) for monitoring motor speed.

The 5VDC output pulse levels are low to high to low. The pulse width is fixed at 0.55 msec each. Twelve pulses correspond to one motor revolution (multiply by gear ration for pulses per output shaft revolution). The buffered output requires no external pull-up resistor to produce the 5 VDC pulses.

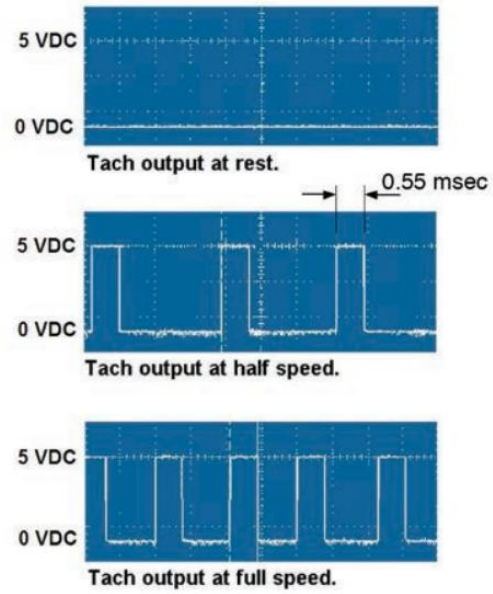


Figure 4: Example Pulse Output Snapshots

When used with DigiUltra 12VDC controllers, the TACH output (J4, Pin 8) may be connected to the Strokes Input to monitor motor revolutions for more accurate injection rates.

Warning! *Control logic connections must be fully isolated from the pump power supply. Failure to isolate circuit will result in damage to motor controller.*

Legacy 115VAC Pumps (Leeson Motor)

Note: *115VAC Pumps with DigiMax controls will come prewired to motor and include a 12' power cord with a NEMA 5-15 Plug.*

Recommended tools:

- 3/8" nut driver or socket
- Phillips Head Screwdriver
- Wire Strippers

Warning! *Open circuit before removing cover or attempting any wiring steps. Cover should always be installed while circuit is live.*

Wiring Instructions

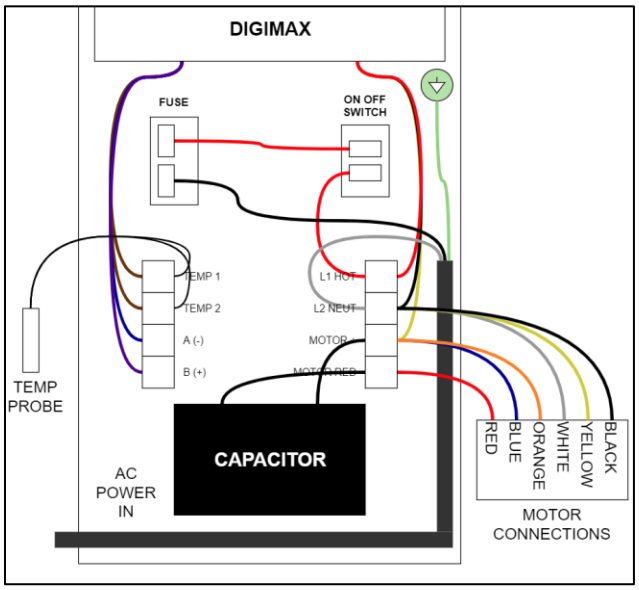
1. Remove motor cover/controller housing using 3/8" nut driver or socket
2. Controller is pre-wired and only requires terminating motor and capacitor connections prior to use:

a. Connector Motor black/yellow/white wires to terminal block labeled L2 NEUT

b. Connect motor orange/blue wires and one capacitor lead to terminal block MOTOR +

c. Connect motor red wire and remaining capacitor lead to terminal block MOTOR RED

Connections Diagram



Operations

Starting and Priming Pump

1. Open any block valves installed on the suction, discharge.
2. Apply power to the pump to begin pump operation.

   For DigiMax and DigiUltra pump controllers, enabling pump output can be accomplished easily by pressing the two left-most buttons on the controller labeled “PUMP OVERRIDE” to manually run the pump during priming.
3. Use a 3/8” wrench to loosen the bleed screw located on the fluid end of the pump. Allow air to bleed from chamber until no air is present in chemical stream and re-tighten bleed screw.

   ***Note**: Bleed screw should only be tightened as needed to prevent chemical flow, as overtightening may permanently damage the metal to metal seal used.*

   Extended discharge lines should be bled prior to pump connection.

Calibrating and Adjusting Pump Flow Rate

***Note:** Calibrating rates may vary based on controls used – for controller specific calibration instructions, see the associated pump controller manual.*

DigiUltra controls include a full step by step injection rate calibration routine directly on the controller.

1. Calibrating injection flow rate requires a pump setting gauge and isolation valves installed such that the pump setting gauge may be used as the sole chemical injection supply during calibration.

   ***Note:** This document will cover typical applications using a pump setting gauge with calibration marks noted as 1 quart per day per 1 minute test (e.g. Kenco 929 Pump Setting Gauge)*
2. With the chemical supply isolation valve open, open pump setting gauge isolation valve until chemical is near the highest visible level and then close chemical supply isolation valve.

   Take note of this mark representing the high level of chemical in the rate setting gauge, or use included sliders to mark the level of chemical at start of rate test.

   At this point, the rate setting gauge is acting as the sole chemical injection supply for calibration.
3. Begin pump operation as defined by the controller and timing simultaneously.

   With each stroke of the pump, the volume in the pump setting gauge should drop—if not, see Troubleshooting Section.
4. As the chemical level nears the bottom of the sight glass or after 1 minute, close the pump setting gauge valve and stop timing.
5. Note the overall time of the test and beginning/end readings from the pump setting gauge calibration column.
6. Calculate the injection rate (units based on calibration column scale) using the formula:

$$Injection\ Rate = \frac{[High\ Reading] - [Low\ Reading]}{Test\ Time\ (Seconds)} \times\ 60\ sec$$

   ***Note**: Reopen the chemical supply tank in between tests to avoid running the pump dry! If pump does run dry, re-bleeding will likely be required before performing another test.*
7. Depending on results, increase or decrease the pump control logic as needed and re-perform test until desired flow rate is achieved.

Maintenance

Monthly

1. Perform rate test to confirm pump output.

   See Troubleshooting section for more information if rate test is not successful.
2. Inspect pump and check valve for any leaks, including any check valves at the injection point.

   Note: Fluid End Packing may leak slightly over time – tighten packing 1/8 to 1/4 turn at a time while pump is off until leak subsides.

   Note that packing may leak more during initial packing break-in period.

   ***Note**: Never tighten packing more than 1/8 to 1/4 turn at a time – overtightening will lead to increased wear and significantly increased pump power consumption!*
3. Check all fuses and breakers on battery leads and controller.

   ***Warning!** Always diagnose root cause of fuse failure before replacing any fuses. Damage to equipment may occur.*
4. Check any connected pump controls for proper programming.
5. Ensure solar panels are facing south, in an unshaded area, and free of dust/dirt/snow/debris. Clean with mild detergent.
6. Check battery connections and wires for corrosion. Clean/replace accordingly.

Quarterly Maintenance Recommendations

1. Grease pump areas defined below.
   - Plunger where it contacts fluid end packing
   - Internal eccentric wheel and bearing assembly
   - Reciprocating block where the plunger is pinned
2. Clean out any strainers or filters used in the chemical injection system.
3. Apply dielectric grease to battery terminals.
4. For brushed motor DC pumps, blow out motor brush compartment to remove excess brush dust.

   AC and Brushless motor DC pumps (HYB Pumps) do not require additional maintenance to remove brush dust from motor housing.

   ***Note**: The lifespan of a brushed motor pump is generally the lifespan of the motor itself. Removing excess brush dust will reduce commutator wear and significantly increase the lifespan of the motor.*

2-Year Maintenance

1. Replace pump soft goods such as pump packing and check valve O-Rings

   Inspect plunger for scarring / excess wear and replace if needed.

   ***Note**: These may require more frequent replacement in especially harsh chemical applications.*
2. Replace brushes on brushed motor pumps.

General Best Practices

1. Avoid running the pump dry (no fluid in suction line) if at all possible. This will cause excess friction, reducing the life of the primary seal and plunger.
2. For solar powered applications, align solar panels based on season.
3. Batteries may require replacement after 2-4 years of service dependent on discharge cycling depth & frequency. Replace prior to cold season to avoid power failures in lower temperatures.

Troubleshooting

Pump Troubleshooting

Problem	Possible Causes	Corrective Action
Chemical Leak from Fluid End	Threaded connections not sealed properly	• Always use PTFE tape for bubble-tight sealing with tapered threads • Check tightness of connections – NPT threads should be tightened hand tight +2-3 turns maximum. Do not overtighten connections to avoid damage to threads
	Primary seal failure/wear	• Check seal material compatibility with fluid and replace fluid end packing if necessary • Ensure proper filtration of chemical supply to tank to avoid damage to seals due to abrasive material entering through the pump suction check
	Damage/scoring to plunger or other loss of plunger material	• Check plunger material compatibility with fluid and replace plunger • Ensure proper filtration of chemical supply to tank to avoid damage to plunger due to abrasive material entering through the pump suction check • Upgrade to more durable 17-4PH Ceramic Coated plunger for increased plunger lifespan
Low Pump Output	Viscosity of chemical too high	• Increase suction and discharge line size to reduce friction • Replace 316 SST check balls with carbide option to help with speed of suction check seating
No Fluid Movement – Pump does not Bleed Properly	Chemical solidified in pump from previous use and extended period of non-use	• Clean dried chemical from fluid end
	Isolation Valve Closed	• Check that all block valves between chemical supply and suction check are open
	Chemical Level too Low	• Ensure pump is installed at least 6 inches below chemical supply level (12 inches recommended)
No Fluid Movement – "Bouncing" fluid level in Rate Setting Gauge during Operation	Debris in suction check valve	• Disassemble suction check and inspect/remove debris • Install filter between pump and chemical supply
	Suction check valve seat damaged	• Replace suction check valve seat O-ring • While disassembled, replacing suction check valve sealing O-ring is also recommended • Install filter between pump and chemical supply
	Fluid end suction not installed vertically	• Reorient pump fluid end such that suction check is facing directly down to allow gravity suction check to seal properly
	Excess pressure on discharge line causing relief valve return to rate gauge	• Install return line from relief valve to chemical supply tank directly (before tank isolation valve) • Troubleshoot excessive line pressure causing relief valve to open • Increase relief valve pressure setpoint as needed (Warning – always make sure the relief valve is set based on the lowest pressure rated item in the discharge line)
No Fluid Movement – No Movement Observed in Rate Setting Gauge during Operation	Air or vapor trapped in pump fluid end	• Bleed pump per startup procedure • Check for potential air traps in discharge line; bleeding discharge line separately from pump may be required • Evaluate system to prevent supply chemical from running dry or below 6-12" height above suction check • If PSV is used and routine air locking is an issue, ensure PSV chemical return is allowed to vent any gasses caused by cavitation during normal operation to atmosphere. PSV return line directly to supply tank is recommended, however rate gauge should also allow for venting of supply line gasses
	Insufficient supply pressure	• Mount pump such that suction check is a minimum of 6" below lowest chemical supply level. 12" minimum recommended

Motor Troubleshooting

Problem	Possible Causes	Corrective Action
No Motor Output	Blown Fuse on Controller	Confirm no mechanical issues that would cause fuse to blow again and replace fuse Confirm pump/motor are not overloaded and reduce load if necessary ***Always diagnose root cause before fuse is replaced to prevent damage to motor/system***
	Incorrect Wiring	Check that power source is switched on Ensure wires are not reversed (does not affect brushed DC motors) Check for loose/missing/shorted connections and repair as required
	Gearbox Failure	Diagnose by decoupling motor from assembly and attempting to turn by hand • If motor shaft will not turn, this is likely due to sheared tooth in gearbox • If motor shaft spins freely, this is likely due to a slipped pinion in gearbox In either situation, motor requires replacement/repair by original manufacturer
	No Speed Signal (Brushless or Continuous Run Variable Speed Systems Only)	Check if speed potentiometer is working properly Check wiring for speed potentiometer
Slow Motor Output	Speed Potentiometer (External) Turned Down	• For brushless motors, turn potentiometer located on side of motor/controller assembly clockwise to increase output speed • For brushed DC motors with continuous run variable speed control systems, turn potentiometer located control panel assembly clockwise to increase output speed
	Max Potentiometer (Internal) Turned Down	Verify above steps for Speed Potentiometer before attempting these steps: • For brushless motors, verify the "MAX" potentiometer located inside the motor/control housing is turned fully clockwise to allow for maximum output speed • For brushed DC motors with continuous run variable speed control systems, verify the "MAX" speed potentiometer on the chassis mount controller is turned fully clockwise Note that the potentiometer may be easily rotated past fully clockwise—take care not to over torque the potentiometer past the maximum setpoint

Related Parts

Repair Kits

Repair Kit	Part Number	Includes
Universal Fluid End Suction Check Repair Kit	1148480	• 1x 1145769 Check Seal O-Ring (PTFE) • 1x 1148786 Check Seat O-Ring (PTFE) • 1x 1146485 Check Ball (316 SST)
Universal Fluid End Discharge Check Repair Kit	1147191	• 1x 1145769 Check Seal O-Ring (PTFE) • 1x 1148786 Check Seat O-Ring (PTFE) • 1x 1146485 Check Ball (316 SST) • 1x 1146445 Check Spring

Accessories

Accessories		
Kenco 929 Pump Setting Gauge	1146656	1 Qt/Day per 1 Minute Test rate, 1/4” MNPT mounting, 1/4” FNPT Vent
Ball Valve, 1/4" (Low Pressure)	1148271	Low pressure 1/4” FNPT x 1/4” FNPT ball valve used for rate gauge isolation on suction side of pump 316 SST, 1000 PSI max
Ball Valve, 3/4" (Low Pressure)	1148274	Low pressure 3/4” FNPT ball valve designed to fit most chemical injection tank nipple outlets 316 SST, 1000 PSI max
Tank Level Transducer	1167633	Transducer designed for use with DigiUltra pump controller 0-5 PSI, 0.5-4.5 VDC output, ¼” MNPT process connection, 316 SST ⟨Ex⟩ II 1 G Ex ia IIC T4 Ga
Power Supply Hazardous Locations	1148928	Power supply to convert 115/230VAC input to 12VDC output to power DC chemical injection pumps **Sola SDN-16-12-100P** • 85-132/176-264 VAC Input Range, 47-63 Hz • 4A Input @ 115VAC, 16A Output @ 12VDC • Class 1 Division 2, Groups ABCD Alternate: PULS CP10.121 • 85-132/176-264 VAC Input Range, 47-63 Hz • 16A Output @ 12VDC • Class 1 Division 2, T4 Groups ABCD
Y – Strainer Filter	1146266	Inline Y-Strainer filter, 1/4” FNPT x 1/4” FNPT connections, 100 micron filter, 316 SST, 800 PSI max
High Pressure Relief Valves	C/F	Multiple options available depending on application to match required set pressure range and material requirements
Dual Head Manifold	1186822	Connects heads together in dual head assemblies for single connection points (EIP Pumps)

Related Parts

Part	Part #	Description
Battery Enclosures		
Single Battery Enclosure	1145918	Fits 1x 12VDC 100-110Ah Battery (15.1" Width x 11.3" Ht x 9.1" Depth Compartment Size)
Dual Battery Enclosure	1145920	Fits 2x 12VDC 100-110Ah Batteries (15.1" Width x 11.3" Ht x 14.8" Depth Compartment Size)
Pump Controllers		
DigiMax Controller – Wellmark DC Pumps	1145932	Firmware accommodates calculations for Wellmark pumps when calculating AUTO mode ON and OFF times
DigiMax Controller – Timberline DC Pumps	1147519	Firmware accommodates calculations for Timberline pumps when calculating AUTO mode ON and OFF times
DigiMax Controller – Wellmark AC Pumps (Leeson Motor)	1145935	Full motor cover/housing assembly that includes DigiMax controller for use with 115VAC EIP AC pumps (Leeson Motor option "7" only)
DigiMax Controller – Wellmark AC Pumps (Bodine Motor)	1180090	Full motor cover/housing assembly that includes DigiMax controller for use with 115VAC EIP AC pumps (Bodine Motor option "B" only)
DigiUltra Controller (TL & WM DC Pumps)	1146507	Firmware accommodates both Wellmark and Timberline chemical injection pumps
Replacement Motors		
12VDC Small ("1")	1145993	Small 12VDC Motor, 1/17HP, ~30 RPM output **Superseded by 1148285**
12VDC Large ("3")	1149205	Large 12VDC Motor, 1/6 HP, ~60 RPM output
12VDC High Efficiency ("A")	1148285	High Efficiency 12VDC Motor, 1/21HP, ~60 RPM output
12VDC BLDC ("9")	1178968	Brushless 12VDC Motor, 1/5 HP, ~60 RPM output
24VDC BLDC ("C")	1178971	Brushless 24VDC Motor, 1/5 HP, ~60 RPM output
115VAC Leeson ("7")	1145972	115VAC Motor, 1/6 HP, ~60 RPM output **Superseded by 1176407**
115VAC Bodine ("B")	1176407	115VAC Motor, 1/6 HP, ~60 RPM output
Solar Panel Assemblies		
50-60W Gen Purpose	1167745	***Includes*** • Solar Panel(s) • All Mounting Hardware (for installation on top of 1-1/4" pipe) • 10' PV Cable with 1/2" NPT Cable Gland for Enclosure Entry
85-100W Gen Purpose	1167267	
135-150W Gen Purpose	1167251	
Dual 135-150W Gen Purpose	1167277	
Replacement Solar Panels		
50-60W Gen. Purpose	1167228	***Includes*** • Solar Panel with 3' Pigtail Connector from Rear Terminal Enclosure
85-100W Gen. Purpose	1167231	
135-150W Gen Purpose	1167232	
Solar Panel Assembly Parts		
Cord Grip for PV Cable	1146632	2-Hole cord grip for ½" NPT enclosure entry, fits 12AWG PV cable wires included with panel assembly
10' PV Cable Set	1165908	PV cable set (red & black wires), 12AWG, with MC4 connector x flying lead terminations
Pipe Clamp	1149189	Strut mount pipe clamp, for 1-1/4" pipe (2x required per panel)
Structural Pipe Tee	1146637	Structural pipe tee, for mounting solar panels on top of 1-1/4" trade size pipe (1.66" OD)
Branch MC4 Connector Set	1148916	Branch MC4 connector, male/female pair, for connecting dual solar panels in parallel
Solar Charge Regulators		
Sunsaver 12V, 10A	1149195	Use with solar panel assemblies where combined I_{sc} is less than or equal to 10A
Sunsaver 12V, 20A	1149191	Use with solar panel assemblies where combined I_{sc} is greater than 10A and less than or equal to 20A
Control Panel Assemblies (For use with Wellmark Single/Dual Battery Enclosures 1145918 & 1145920)		
DigiMax Control Panel – Standard Wellmark Pump Solar Applications (10A)	1149306	***Includes*** • 1x 1145932 DigiMax Controller • 1x 1149195 Sunsaver Charge Regulator, 10A • 1x 1147220 Mounting Plate for WM Battery Enclosures • Battery Connection Wires and Spare Fuses
DigiMax Control Panel - Standard Wellmark Pump Solar Applications (20A)	1149307	***Includes*** • 1x 1145932 DigiMax Controller • 1x 1149191 Sunsaver Charge Regulator, 20A • 1x 1147220 Mounting Plate for WM Battery Enclosures • Battery Connection Wires and Spare Fuses
DigiUltra Control Panel - Standard Solar Applications (10A)	1164772	***Includes*** • 1x 1160587 DigiUltra Pump Controller • 1x 1149195 Sunsaver Charge Regulator, 10A • 1x 1147220 Mounting Plate for WM Battery Enclosures • Battery Connection Wires and Spare Fuses
DigiUltra Control Panel – Standard Solar Applications (20A)	1164773	***Includes*** • 1x 1160587 DigiUltra Pump Controller • 1x 1149191 Sunsaver Charge Regulator, 20A • 1x 1147220 Mounting Plate for WM Battery Enclosures • Battery Connection Wires and Spare Fuses

Revisions

Revision Date	Changes	By
2023-02-03	Initial revision and release	JC
2024-01-03	Added Bodine AC Motor Specifications, parts list drawings, wiring notes Dual head manifold accessory part added Added Maintenance notes Changed formatting in specifications section	JC
2024-01-08	1/4" & 3/8" Universal Body Assembly drawing parts list changes- Added Buna/PTFE packing options Updated Viton Packing PN#'s from 1148874 & 1148876 to 1179861 & 1179862 respectively	JC
2024-01-24	Minor formatting updates	TL
2024-01-29	Added brushless motor wiring & control sections. Noted option "0" for mounting includes 4' post standard	JC
2024-06-06	Removed 'small' DC and Leeson AC motor option from specifications table, and model code builder Drawings to remain for repair/rework information; footnotes added on parts list drawings	JC
2025-03-26	Ordering & Model Code Information • Removed PTFE Only packing option • Added FFKM/PTFE packing option Pump Assemblies & Parts Lists • Added EIP Brushless pump parts list • Removed fluid end cast vs universal notes page • Added FFKM / PTFE part options to fluid end assemblies • Reorganized obsolete / deprecated assemblies into their own section	JC
2025-08-14	Added section for Universal Fluid End Removal Removed section of legacy Cast Fluid End Installation Split Assembly & Installation Sections	JC
2025-11-11	Added EIP Brushless pump dimensions	JC
2026-03-04	Updated all drawings and parts lists to new 4" standard baseplate design Removed "Large" motor pump from specifications table Moved "Large" motor pump dimensions to legacy drawings sections Added AC Pump, no controller dimensional drawings Added 24VDC BLDC motor information to specifications table Added 24VDC BLDC motor PN# to assembly drawing Added 24VDC BLDC motor control specifications to brushless DC controls table	JC