

# Wolverine<sup>®</sup> Chemical Injection Pump

334513U

EN

*An electric pump, consisting of a drive module and a fluid module, for injecting chemicals at well sites. For professional use only.*

**Not approved for use in explosive atmospheres or hazardous (classified) locations unless otherwise stated in the model approvals section.**

See page 3 for model information, including maximum working pressure and approvals.

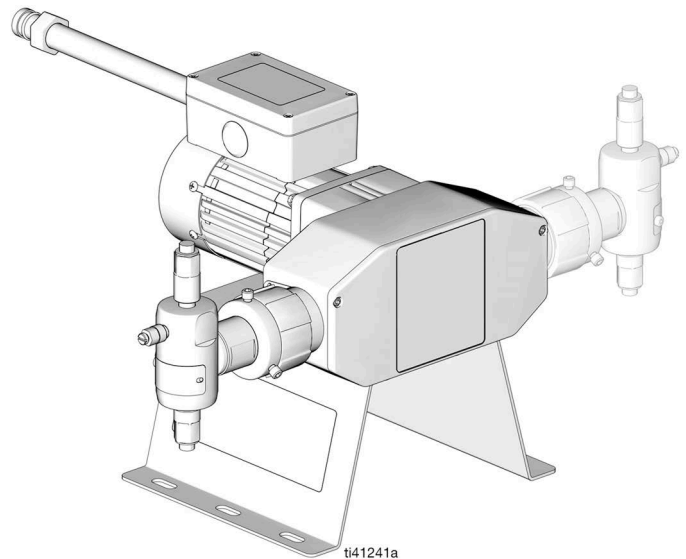


### Important Safety Instructions

Read all warnings and instructions in this manual and in Harrier Chemical Injection Controller manual and Harrier AC Chemical Injection Controller manual before using the equipment. Save all instructions.

## Related Manuals

Manual in English	Description
334993	Harrier Chemical Injection Controller
3A4047	Harrier AC Chemical Injection Controller
- - - - -	Bodine Manual, included with product




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# Models and Approvals

## Fluid Modules


Plunger Size	Maximum Working Pressure psi (MPa, bar)	Theoretical Volume for Full Stroke (cc/stroke)	Approvals
3/16 in.	10,000 (69, 690)	0.5	
1/4 in.	6000 (41.3, 413)	0.8	
3/8 in.	2500 (17.2, 172)	1.8	
1/2 in.	1250 (8.6, 86)	3.2	
5/8 in.	900 (6.2, 62)	5.0	
3/4 in.	600 (4.1, 41)	7.2	

## Drive Modules


### Drive Module Pressure Capability

Plunger Size	Motor Type		
	S - Small (CI-12S-xx-x)	J - Medium (CI-1AJ-xx-x)	L - Large (CI-xxL-xx-x) H - Hazardous Location C1D1 (CI-xxH-xx-x) B - Variable Speed Brushless (CI-xxB-xx-x) D - Variable Speed AC (CI-1AD-xx-x) X - ATEX (CI-xxX-xx-x)
	Maximum Working Pressure psi (MPa, bar)		
3/16 in.	7000 (48.2, 482)	8000 (55.2, 552)	10,000 (69.0, 690)
1/4 in.	3500 (24.1, 241)	4750 (32.8, 328)	6000 (41.3, 413)
3/8 in.	1500 (10.3, 103)	2000 (13.8, 138)	2500 (17.2, 172)
1/2 in.	800 (5.5, 55)	1000 (6.9, 69)	1250 (8.6, 86)
5/8 in.	500 (3.4, 34)	700 (4.8, 48)	900 (6.2, 62)
3/4 in.	350 (2.4, 24)	450 (3.1, 31)	600 (4.1, 41)



### Wolverine Advanced Drive Modules

Drive Configuration	Voltage	Motor	Approvals
CI-12S-xx-x	12 VDC	Small	 Not approved for use in European explosive atmospheres or hazardous locations
CI-12L-xx-x	12 VDC	Large	
CI-1AJ-xx-x	115 VAC	Medium	
CI-1AL-xx-x	115 VAC	Large	
CI-2AL-xx-x	230 VAC	Large	
CI-4AL-xx-x	230/460 VAC, 3 Phase	Large	
CI-1AD-xx-x	115 VAC	Variable Speed AC	




**Wolverine® Continuous Injection Drive Modules (C1 D2)**

Drive Configuration	Voltage	Motor	Motor Approvals
CI-12B-xx-x	12 VDC	Variable Speed Brushless	 Class I, Division 2 Groups A, B, C, D
CI-24B-xx-x	24 VDC	Variable Speed Brushless	

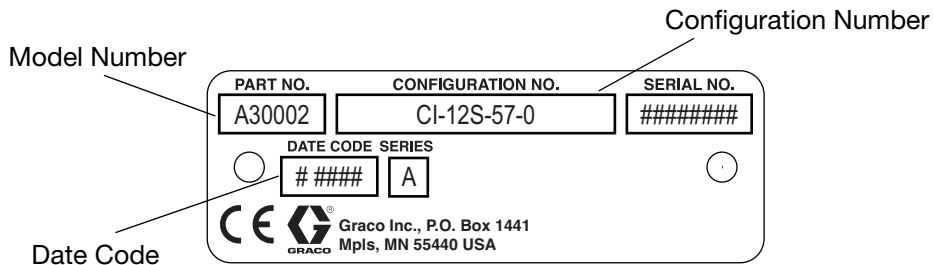
**Wolverine Hazardous Location Drive Modules (C1 D1)**

Drive Configuration	Voltage	Motor	Motor Approvals
CI-12H-xx-x	12 VDC	Hazardous Location	 Class I, Group C & D, Class II, Group F & G
CI-24H-xx-x	24 VDC	Hazardous Location	
CI-3AH-xx-x	115/230 VAC	Hazardous Location	 Class I, Group C & D, Class II, Group F & G, T3C
CI-4AH-xx-x	230/460 VAC 3 Phase	Hazardous Location	

### Wolverine ATEX Drive Modules

Drive Configuration	Voltage	Motor	Drive Module Approvals
CI-24X-xx-x	24 VDC	ATEX	 Ex d IIB T4 Gb -20°C ≤ Ta ≤ +60°C 
CI-2AX-xx-x	230 VAC	ATEX	 Ex d IIB T4 Gb -20°C ≤ Ta ≤ +60°C
CI-5AX-xx-x	230/400 VAC 3 Phase	ATEX	

# Drive Module Configuration Code



**FIG. 1: Example of the Drive Module Identification Plate**

**Sample Configuration Number: CI-12S-57-0**

<b>CI</b>	<b>12</b>	<b>S</b>	<b>5</b>	<b>7</b>	<b>0</b>
Chemical Injection	Voltage	Motor	Drive Side 1	Drive Side 2	Qualifier

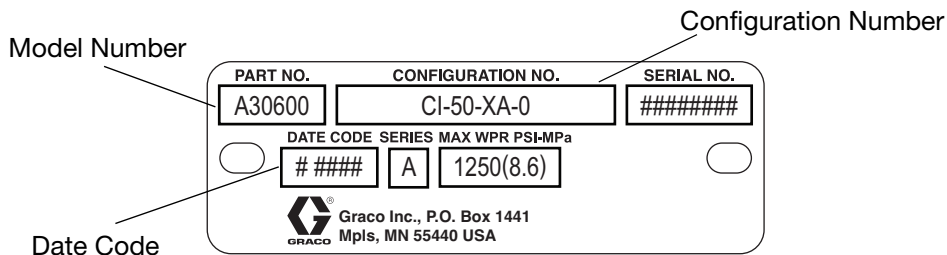
Voltage		Motor		Drive Side 1		Drive Side 2		Qualifier	
12	12 VDC	S	Small	5	Fluid Module Sizes 25 : 38 : 50	0	None (Simplex)	0	None
24	24 VDC	L	Large	7	Fluid Module Sizes 19 : 63 : 75	5	Fluid Module Sizes 25 : 38 : 50	B	Harrier AC Controller
1A	115 VAC	H	Hazardous Location CID1			7	Fluid Module Sizes 19 : 63 : 75		
2A	230 VAC	B	Continuous Injection Variable Speed, Brushless CID2						
3A	115/230 VAC	D	Variable Speed, AC						
4A	230/460 VAC, 3 Phase	X	ATEX						
5A	230/400 VAC, 3 Phase	J	Medium						

**NOTE:** Effective Date Code “X 2516” (FIG. 1). If the configuration does not match this format, it is an older drive module assembly configuration. See Wolverine Chemical Injection Pump manual, revision C.

**NOTE:** Not all combinations are possible.

**NOTE:** Variable speed AC drive module configurations are not rated for continuous duty applications.

## Fluid Module Configuration Code



**FIG. 2: Example of the Fluid Module Identification Plate**

**Sample Configuration Number: CI-50-XA-0**

<b>CI</b>	<b>50</b>	<b>X</b>	<b>A</b>	<b>0</b>
Chemical Injection	Plunger Size	Plunger Coating	Seal Material	Qualifier

Plunger Size		Plunger Coating		Seal Material		Qualifier	
19	3/16 in.	C	Ceramic	A	FKM	0	None
25	1/4 in.	X	Chromex	B	FKMETP	ND	No Drip
38	3/8 in.	Z	Full Ceramic	C	HNBR	T	Severe Duty
60	1/2 in.			D	FFKM		
63	5/8 in.			E	TFE/P		
75	3/4 in.						

**NOTE:** Effective Date Code “X 2516” (FIG. 2). If the configuration does not match this format, it is an older fluid module assembly configuration. See Wolverine Chemical Injection Pump manual, revision C.

**NOTE:** See **Drive Module Configuration Code**, page 6, for drive module side 1 and side 2 compatibility with the fluid module.

**NOTE:** See **Reconnect Fluid Module**, page 34, for fluid section installation instructions.

**NOTE:** Fluid module approvals information is found on 3.

**NOTE:** For seal material chemical compatibility: [https://www.graco.com/content/dam/graco/ong/literature/chem-comp/ONG\\_ChemCompGuideEN-A.pdf](https://www.graco.com/content/dam/graco/ong/literature/chem-comp/ONG_ChemCompGuideEN-A.pdf).

## Key Points

### Motors

- DC motors are available in small or large frame sizes.
- Small DC motors are more efficient for low to medium pressure applications.
- Large DC and AC motors produce a higher torque output for medium to high pressure applications.
- AC motors are available as medium or large.

### Wolverine Advanced

- Advanced drive modules are higher quality, modular, and easily serviceable drive modules. These are available in numerous configurations.
- Advanced drive modules are available for use with one or two fluid modules and 12 VDC, 24 VDC, 115/230 VAC 1 Phase, and 230/460 VAC 3 Phase.

### Wolverine Hazardous Location (C1 D1)

- Hazardous Location drive modules are available as 12 VDC, 24 VDC, 115/230 VAC 1 Phase, and 230/460 VAC 3 Phase.

### Wolverine ATEX

- Explosive Atmosphere Zone 1 drive modules are available as 24 VDC, 230 VAC, and 230/460 VAC 3 Phase




### Wolverine Continuous Injection Variable Speed (12 VDC and 24 VDC) (C1 D2)




- Continuous injection drive modules do not require a controller for operation. They feature an integral variable speed controller and are adjustable from 0-67 cpm.












# Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual or on warning labels, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

 <b>DANGER</b>	
 	<p><b>SEVERE ELECTRIC SHOCK HAZARD</b></p> <p>This equipment can be powered by more than 240 V. Contact with this voltage will cause death or serious injury.</p> <ul style="list-style-type: none"> <li>• Turn off and disconnect all power before disconnecting any cables and before servicing equipment.</li> <li>• This equipment must be grounded. Connect only to grounded power source.</li> <li>• All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.</li> </ul>

 <b>WARNING</b>	
 	<p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>When flammable fluids are present in the work area, such as gasoline and windshield wiper fluid, be aware that flammable fumes can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> <li>• Use equipment only in well-ventilated area.</li> <li>• Eliminate all ignition sources, such as cigarettes and portable electric lamps.</li> <li>• Ground all equipment in the work area.</li> <li>• Keep work area free of debris, including rags and spilled or open containers of solvent and gasoline.</li> <li>• Do not plug or unplug power cords or turn lights on or off when flammable fumes are present.</li> <li>• Use only grounded hoses.</li> <li>• <b>Stop operation immediately</b> if static sparking occurs or you feel a shock. Do not use equipment until you identify and correct the problem.</li> <li>• Keep a working fire extinguisher in the work area.</li> </ul>

# ⚠️ WARNING

    	<p><b>SKIN INJECTION HAZARD</b></p> <p>High-pressure fluid from dispensing device, hose leaks, or ruptured components will pierce skin. This may look like just a cut, but it is a serious injury that can result in amputation. <b>Get immediate surgical treatment.</b></p> <ul style="list-style-type: none"> <li>• Do not point dispensing device at anyone or at any part of the body.</li> <li>• Do not put your hand over the fluid outlet.</li> <li>• Do not stop or deflect leaks with your hand, body, glove, or rag.</li> <li>• Follow the <b>Pressure Relief Procedure</b> when you stop dispensing and before cleaning, checking, or servicing equipment.</li> <li>• Tighten all fluid connections before operating the equipment.</li> <li>• Check hoses and couplings daily. Replace worn or damaged parts immediately.</li> </ul>
 	<p><b>MOVING PARTS HAZARD</b></p> <p>Moving parts can pinch, cut or amputate fingers and other body parts.</p> <ul style="list-style-type: none"> <li>• Keep clear of moving parts.</li> <li>• Do not operate equipment with protective guards or covers removed.</li> <li>• Equipment can start without warning. Before checking, moving, or servicing equipment, follow the <b>Pressure Relief Procedure</b> and disconnect all power sources.</li> </ul>
	<p><b>TOXIC FLUID OR FUMES HAZARD</b></p> <p>Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.</p> <ul style="list-style-type: none"> <li>• Read Safety Data Sheets (SDSs) to know the specific hazards of the fluids you are using.</li> <li>• Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.</li> </ul>
	<p><b>BURN HAZARD</b></p> <p>Equipment surfaces and fluid that is heated can become very hot during operation. To avoid severe burns:</p> <ul style="list-style-type: none"> <li>• To reduce the risk of injury due to burns, allow adequate time for the motor to cool before performing any troubleshooting tasks.</li> <li>• Do not touch hot fluid or equipment.</li> </ul>



# WARNING



## EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.



- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Specifications** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Technical Specifications** in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request Safety Data Sheets (SDSs) from distributor or retailer.
- Turn off all equipment and follow the **Pressure Relief Procedure** when equipment is not in use.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.



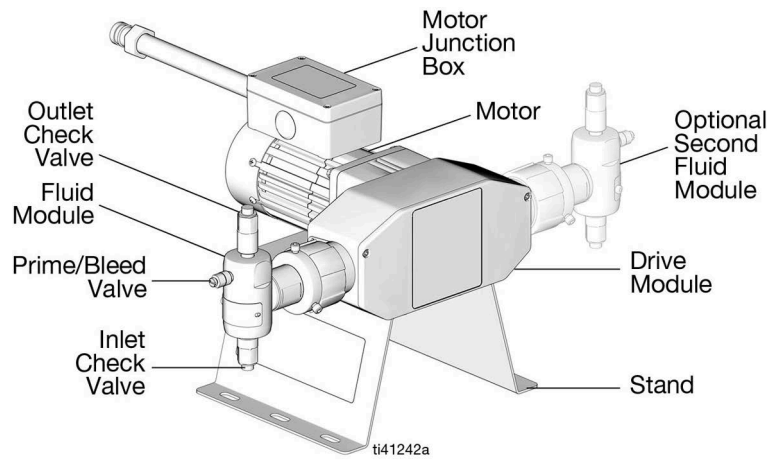
## PERSONAL PROTECTIVE EQUIPMENT

Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. Protective equipment includes but is not limited to:

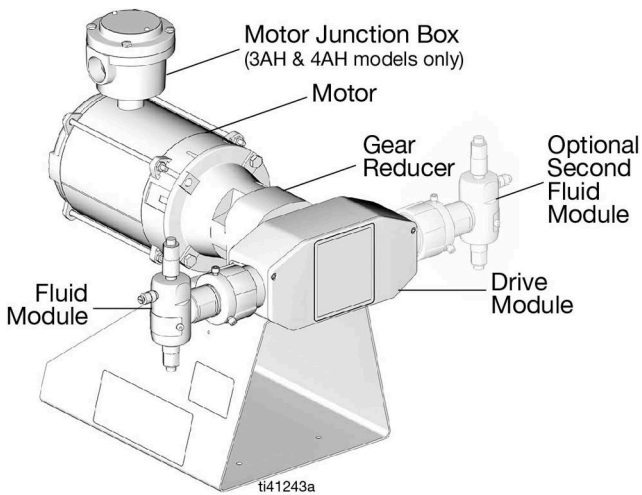
- Protective eyewear, and hearing protection.
- Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.

# Component Identification

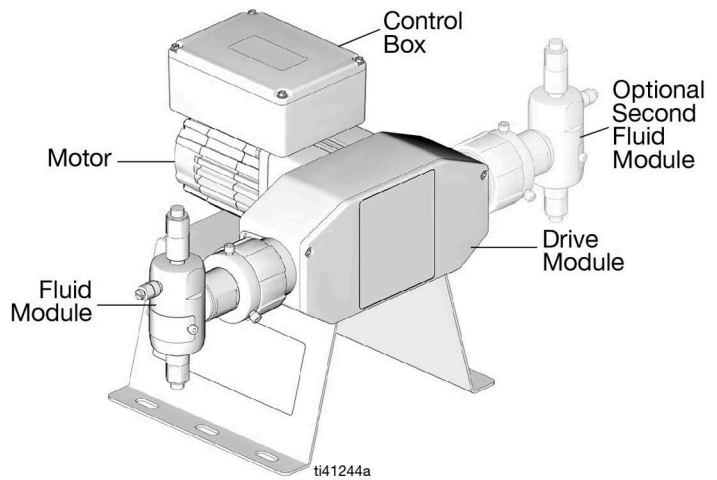
## Wolverine Advanced



## Wolverine Hazardous Location (C1 D1)



## Wolverine Continuous Injection (C1 D2)



## Wolverine ATEX

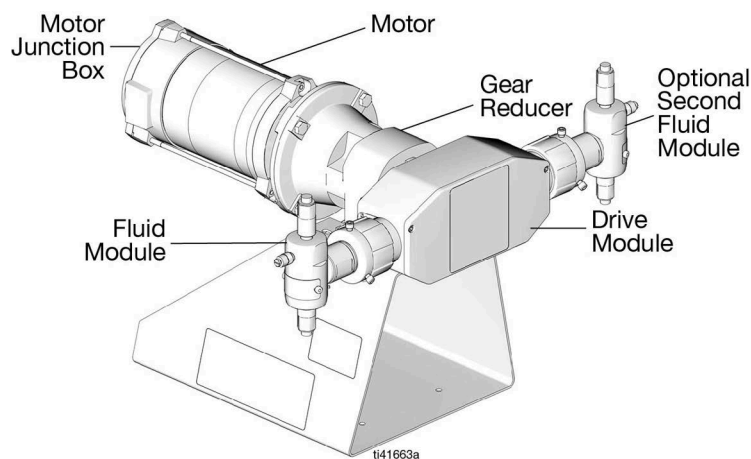
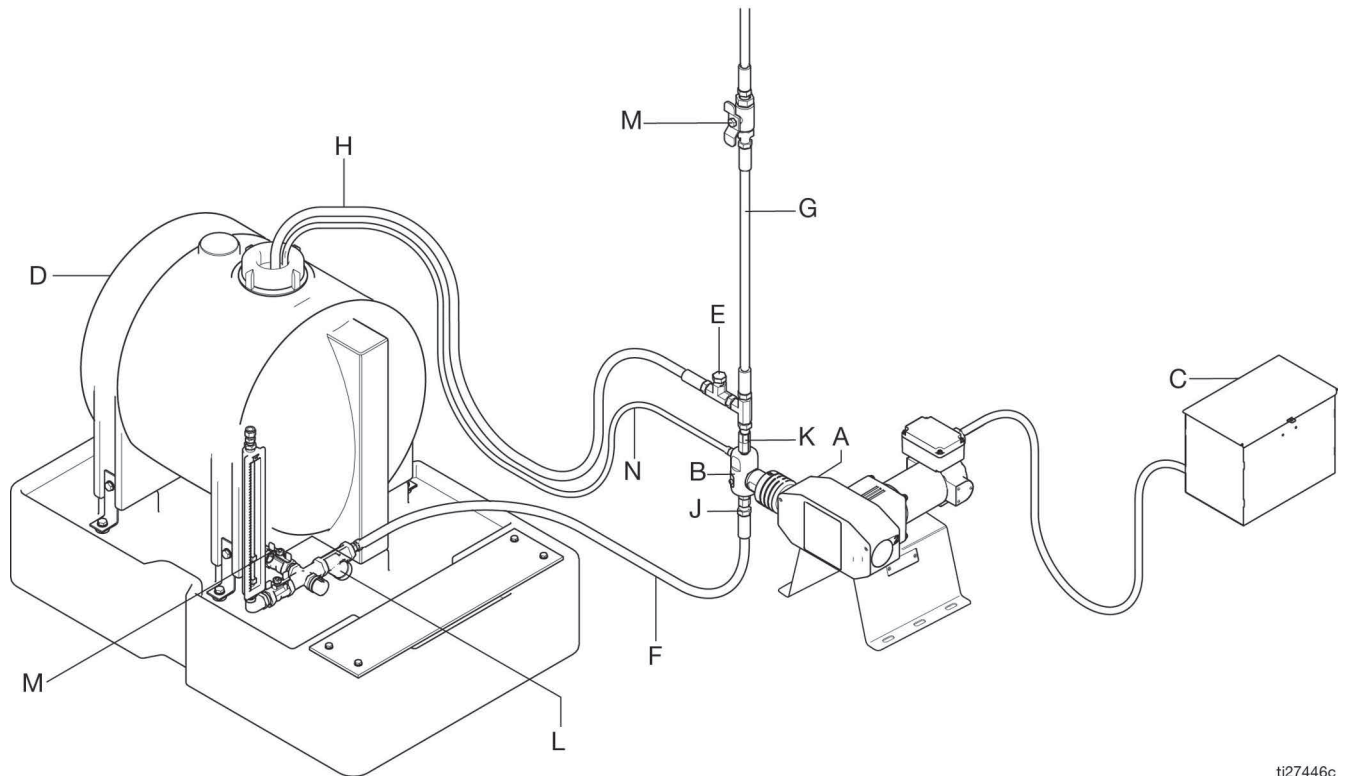


FIG. 3: Component Identification

# Typical Installation

## Ordinary Locations (Generic Power Source)



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**FIG. 4: Typical Installation: Ordinary Locations (Generic Power Source)**

**Key:**

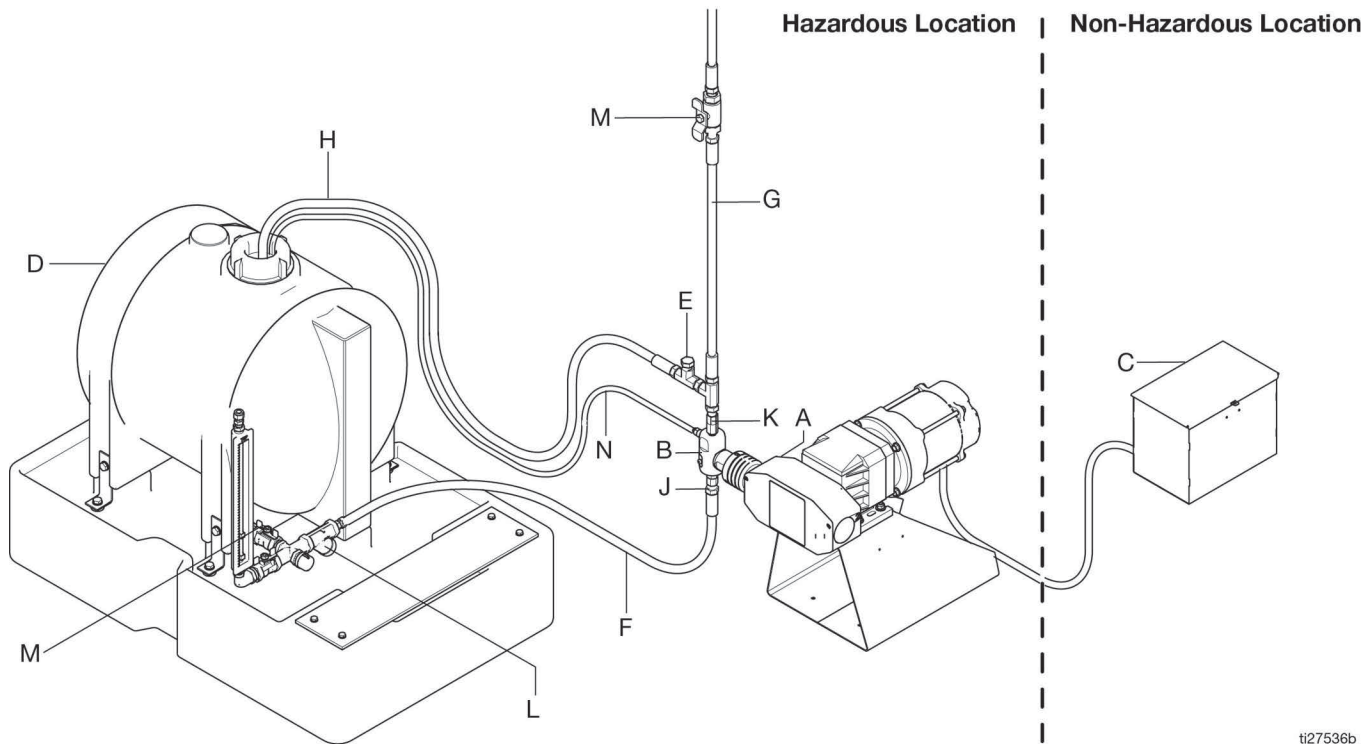
- A Drive Module
- B Fluid Module
- C Power source
- D Tank
- E Pressure relief valve
- F Inlet Line
- G Outlet Line
- H Pressure relief line
- J Inlet port
- K Outlet port
- L Manifold assembly (includes Y-strainer and fluid shut off valve (N))
- M Fluid shut off valve (inlet and outlet)
- N Bleed/prime waste line

## Hazardous Locations (C1 D1) and ATEX

An example of an installation with a Wolverine Hazardous Location chemical injection pump is shown in FIG. 5. Your installation may differ from what is shown. See **Kits and Accessories**, page 49. The Wolverine pump (A) is the only component shown in FIG. 5 supplied by Graco. All other components are supplied by the customer.

### NOTICE

The pump is heavy. Always use two people to lift or move the pump to prevent damage from being dropped.



ti27536b



**FIG. 5: Typical Installation: Hazardous Locations (C1 D1) and ATEX**

### Key:





- A Drive Module
- B Fluid Module
- C Power source
- D Tank
- E Pressure relief valve
- F Inlet Line
- G Outlet Line
- H Pressure relief line
- J Inlet port
- K Outlet port
- L Manifold assembly (includes Y-strainer and fluid shut off valve (N))
- M Fluid shut off valve (inlet and outlet)
- N Bleed/prime waste line

# Installation

The Wolverine Chemical Injection pump consists of a fluid module and a drive module. Both of the modules are required for this installation.

				
All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.				

## Grounding

				
The equipment must be grounded to reduce the risk of static sparking and electric shock. Electric or static sparking can cause fumes to ignite or explode. Improper grounding can cause electric shock. Grounding provides an escape wire for the electric current.				

**Pump:** use ground instructions in **Motor Electrical Connections**, page 16.

**Fluid hoses:** use only electrically conductive hoses.

**Fluid supply container:** follow local code.

## Accessories

Install the required following accessories in the order shown in FIG. 4 and FIG. 5. See **Kits and Accessories**, page 49.

### Fluid Line

- **Fluid filter (Y-strainer) (included in K):** with a 60 mesh (250 micron) stainless steel element to filter particles from the fluid before reaching the pump.
- **Fluid shutoff valve (L):** shuts off fluid flow.
- **Pressure relief valve (D):** overload protection.

## Flush Before Using Equipment

The equipment was tested with lightweight oil, which is left in the fluid passages to protect parts. To avoid

contaminating your fluid with oil, flush the equipment with a compatible solvent before using the equipment. See **Flush the Equipment**, page 20.





## Choose an Installation Location

- Select a location that adequately supports the weight of the pump, the plumbing, and electrical connections.
- Refer to the mounting hole layout provided in **Dimensions**, starting on page 60.
- Always mount the pump upright.
- For mounting configurations that require installation different than depicted in FIG. 4 and FIG. 5, contact your Graco distributor for assistance.

## Fluid Connections

1. Remove and discard the plugs on the check valves.
2. Connect a 1/4 NPT(F) fluid line from the fluid source to the inlet check valve (H) (see FIG. 4, page 13 or FIG. 5, page 14). For No Drip fluid modules, connect a 1/4 NPT(F) fluid line from the fluid source to the tee fitting on the inlet check valve.
3. Install a pressure relief valve (D) on the outlet side of the pump.

**NOTE:** A pressure relief valve is available from Graco and can be connected back to the tank or directly to the inlet side of the pump. See **Kits and Accessories**, page 49.

				
In the event of an injection line blockage, reduce the risk of skin injection and damage to the pump by making sure that the pressure relief valve is set at or below the maximum working pressure of the pump.				

4. Set the pressure relief valve at or below the maximum working pressure of the pump.
5. Connect a 1/4 NPT(F) fluid line from the outlet check valve (J) to the injection point.

- Connect a 10-32 UNF fluid outlet from the prime/bleed valve (213) to the fluid source or waste reservoir.

## Motor Electrical Connections



To reduce the risk of electrical shock:

- All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.
- Install the pump with a dedicated means to disconnect the main power to the pump.

### NOTICE

Branch circuit protection (user supplied) is required on all models. To avoid equipment damage:

- Do not operate the pump without branch circuit protection installed.
- Branch circuit protection of the correct voltage and amperage must be installed in line with the power entry to the system.
- Branch circuit protection should be UL248 approved.
- See table for branch circuit protection rating.

Configuration	Minimum Voltage	Branch Circuit Protection Rating
CI-12S-xx-x	12 VDC	15 A
CI-12L-xx-x	12 VDC	20 A
CI-12B-xx-x	12 VDC	20 A
CI-12H-xx-x	12 VDC	25 A
CI-24H-xx-x	24 VDC	15 A
CI-24B-xx-x	24 VDC	15 A
CI-1AJ-xx-x	115 VAC	3 A
CI-1AL-xx-x	115 VAC	3 A
CI-1AD-xx-x	115 VAC	4 A
CI-2AL-xx-x	230 VAC	2 A
CI-3AH-xx-x	115 VAC (Single Phase)	5 A
CI-3AH-xx-x	230 VAC (Single Phase)	3 A
CI-4AL-xx-x	230 VAC (3 Phase)	1 A
CI-4AL-xx-x	460 VAC (3 Phase)	1 A
CI-4AH-xx-x	230 VAC (3 Phase)	1.25 A
CI-4AH-xx-x	460 VAC (3 Phase)	1 A
CI-24X-xx-x	24 VDC	15 A
CI-2AX-xx-x	230 VAC	2 A
CI-5AX-xx-x	230 VAC (3 Phase)	2 A
CI-5AX-xx-x	400 VAC (3 Phase)	1 A



### For DC and AC Ordinary Location Single Phase Units

The drive module has 10 ft (3 m) of 1/2 in. flexible conduit connected to the motor with 12 ft (3.7 m) of motor leads.

1. Connect the conduit to the power source enclosure (B) with the included conduit fitting.
2. Connect the green motor wire to a ground location.
3. Connect the white motor wire to the positive (+) output of the power source.
4. Connect the black motor wire to the negative (-) output of the power source.

### For Continuous Injection Variable Speed DC (C1 D2) (Model CI-xxB)

Refer to the motor manual included with continuous injection models for wiring instructions and motor operation.

### For Variable Speed AC (Models CI-1AD-xx-x)

The drive module has 12 ft (3.7 m) of motor cable included.

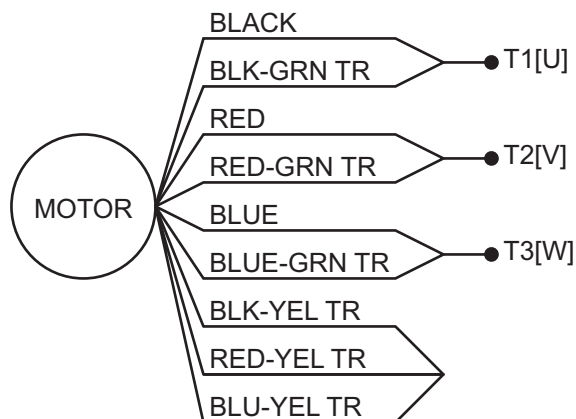
1. Connect the green motor wire to a ground location.
2. Connect the white motor wire to the neutral output of the power source.
3. Connect the black motor wire to the line output of the power source.

### For Hazardous Location (C1 D1) Phase Units (Model CI-4AL)

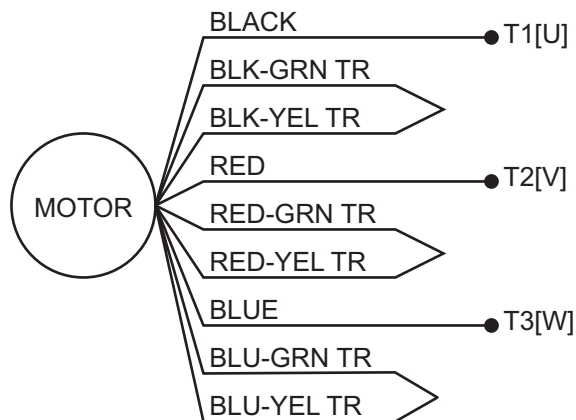
The drive module has nine (9) motor leads housed inside of the motor junction box. See FIG. 3, page 12.

1. Connect the conduit to the power source enclosure (B) with a conduit fitting.
2. Remove the motor junction box cover.
3. Connect user supplied wires, rated per local electrical code. See FIG. 6 for the wiring diagram, and **Dimensions**, page 60, for current ratings.

### 230V / 3 Phase (Low Voltage)



### 460V / 3 Phase (High Voltage)



**FIG. 6: Electrical Connections for 3 Phase Motor**

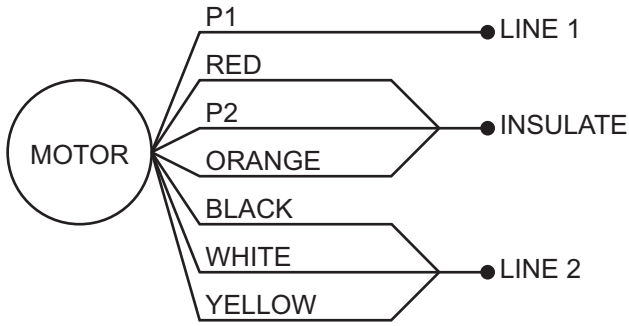
4. Connect a user supplied ground wire to the ground stud inside of the motor junction box.
5. Reinstall the motor junction box cover.

### For Hazardous Location (C1 D1) (Models CI-xxH)

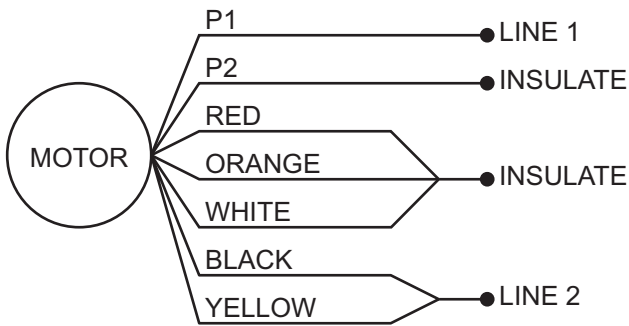
The drive module has motor leads housed inside of the motor junction box. See FIG. 3, page 12.

1. Remove the motor junction box cover.
2. Connect user supplied wires and user supplied related conduit, rated per local electrical code. See FIG. 7 and FIG. 8 for wiring diagrams, and **Technical Specifications**, page 64, for current ratings.

**115V / Single Phase (Low Voltage)**



**230V / Single Phase (High Voltage)**



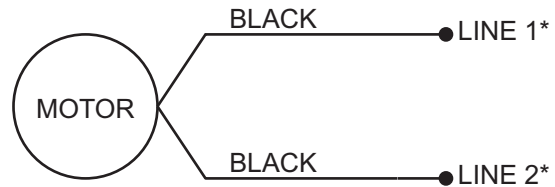
**Fig. 7: Electrical Connections for Single Phase Motor**

3. Connect a user supplied ground wire to the ground stud inside of the motor junction box.
4. Reinstall the motor junction box cover.

**For ATEX AC (Models CI-2AX and CI-5AX)**

The drive module has motor leads housed inside of the back cover plate of the motor. See FIG. 3, page 12.

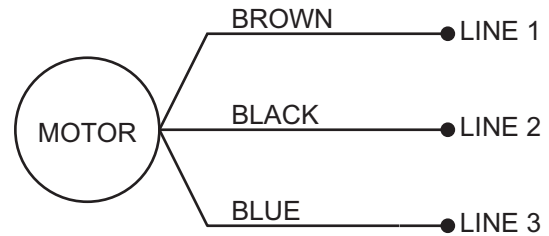
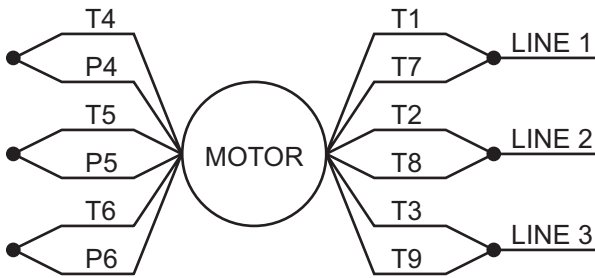
1. Remove the rear cover plate of the motor.
2. Connect user supplied wires and user supplied related conduit, rated per local electrical code. See FIG. 9 and FIG. 10 for wiring diagrams, and **Technical Specifications**, page 64, for current ratings.



\*Order does not matter

**Fig. 9: Electrical Connections for Single Phase Motor**

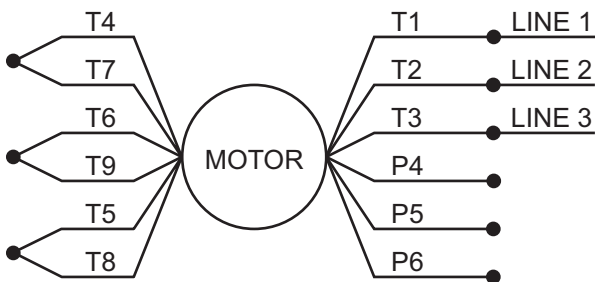
**230V / 3 Phase (Low Voltage)**



**Fig. 10: Electrical Connections for 3 Phase Motor**

3. Connect a user supplied ground wire to the ground stud inside of the motor junction box.
4. Reinstall the motor junction box.

**460V / 3 Phase (High Voltage)**

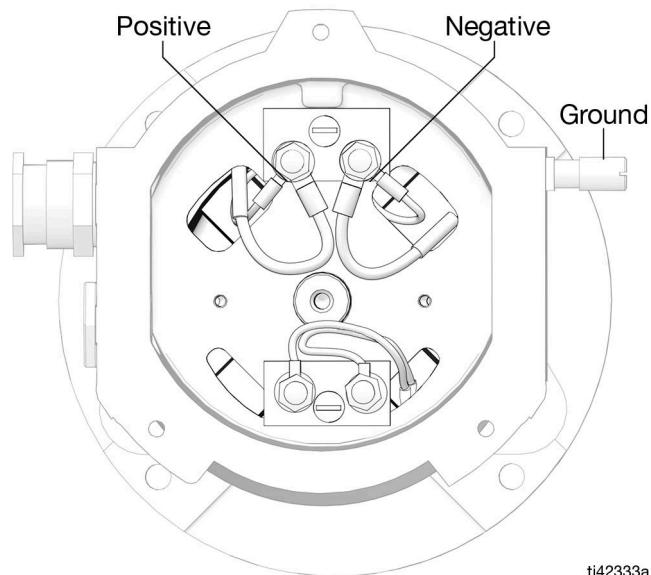


**Fig. 8: Electrical Connections for 3 Phase Motor**

## For ATEX DC (Models CI-24X)

The drive module has terminals housed inside of the back cover plate of the motor. See FIG. 3, page 12.

1. Remove the rear cover plate of the motor.
2. Connect user supplied wires and user supplied related conduit, rated per local electrical code. See FIG. 11 for wiring diagram, and **Technical Specifications**, page 64, for current ratings.

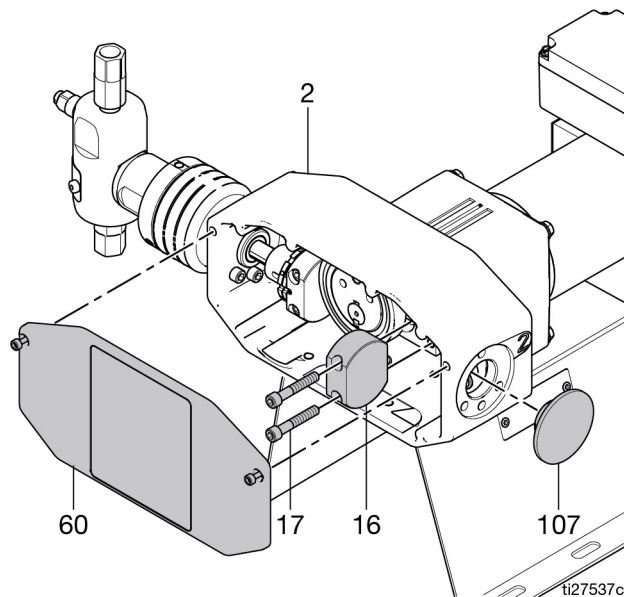


**FIG. 11: Electrical Connections for DC Motor**

3. Replace the motor junction box.
4. Connect a user supplied ground wire to the ground stud on the opposite side of the motor (exterior) from the motor wire exit.

## Second Fluid Module Add On

1. Follow the **Pressure Relief Procedure**, page 20.




**FIG. 12**

2. Remove the drive guard (60).
3. Remove the plug (107) on the side of the housing (2) opposite of the existing fluid module.
4. Remove the two (2) shoulder screws (17).
5. Remove the plunger return block (16).
6. Follow the instructions from **Drive Module Repair** (steps 8 - 10), page 33.
7. Replace the drive guard (60).

# Operation

## Pressure Relief Procedure

 Follow the Pressure Relief Procedure whenever you see this symbol.

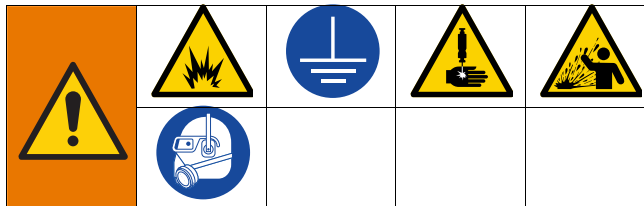


This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from pressurized fluid, such as skin injection and splashing fluid, follow the Pressure Relief Procedure when you stop dispensing and before cleaning, checking, or servicing the equipment.

**NOTE:** Always discharge fluid into an approved container or location.

1. Disconnect main power from the pump.
2. Turn off the inlet and outlet lines using the shutoff valve (L).
3. Slowly loosen the fitting connected to the outlet check valve (216) to relieve downstream fluid pressure.
4. Open the bleed valve (214) by turning the needle counter-clockwise with a flathead screwdriver to relieve internal pump fluid pressure.
5. Disconnect and cap the inlet and outlet fluid lines.

## Flush the Equipment



To avoid fire and explosion, always ground equipment and waste container. To avoid static sparking and injury from splashing, always flush at the lowest possible pressure.

- Check fittings for leaks and tighten as necessary.
  - Flush with fluid that is compatible with the fluid being dispensed and with the equipment's wetted parts.
1. Follow the **Pressure Relief Procedure**, page 20.
  2. Connect the inlet to the supply source of the flushing fluid.
  3. Connect the inlet to the waste reservoir.
  4. Run the pump until the dispensed fluid is predominantly flushing fluid.
  5. Follow the **Pressure Relief Procedure**, page 20.

## Prime the Pump



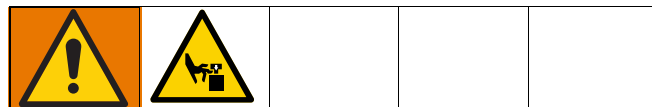
1. Verify that all of the connections and fluid lines are tight.
2. Prime the pump by turning the prime valve (214) counter-clockwise.
3. Turn the pump on and begin cycling.
4. The pump is primed when the discharge from the prime valve (214) has transitioned from air, to a bubbly liquid chemical, to pure liquid chemical.
5. Close the prime valve (214) tightly and verify that fluid has stopped draining from the port.

## Calibrate Chemical Dosage



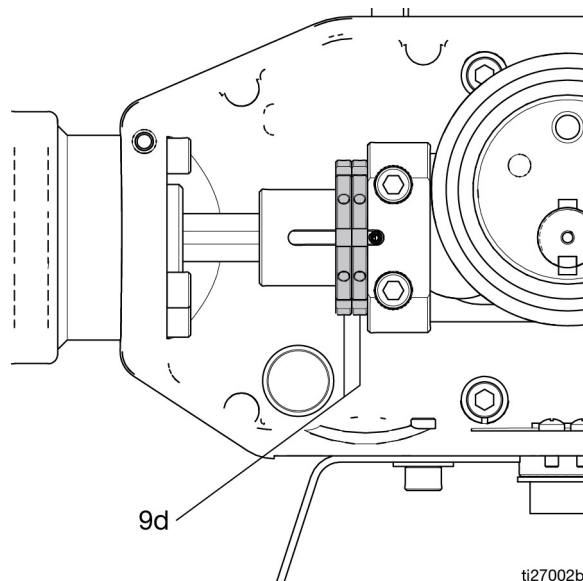
1. Set the cycle rate and/or stroke adjustment of the pump to the estimated setting for a desired flow rate. See **Baseline Chemical Dosage Settings**, page 22, for tables of cycles per minute (CPM), and corresponding gallons per day (GPD) and liters per day (LPD).
2. Follow the instructions provided with your calibration gauge in conjunction with the **Baseline Chemical Dosage Settings**, page 22.
3. Adjust the cycle rate and/or stroke adjustment accordingly after the test is performed:
  - Increasing the pump cycle rate and/or stroke adjustment increases the pump flow rate.
  - Decreasing the pump cycle rate and/or stroke adjustment decreases the pump flow rate.
4. Repeat the instructions provided with your calibration gauge to verify changes.
5. Repeat steps 3 and 4, as necessary, until the desired flow rate is achieved.

## Stroke Adjustment



This pump has infinite stroke adjustment positions between full stroke and half stroke.

1. Disconnect the main power from the pump.
2. Expose the drive shaft (9c) by loosening the cap screws (61) and removing the drive guard (60). The cap screws (61) remain with the drive guard.
3. Loosen the stroke adjustment nuts (9d), and move to desired stroke location and re-tighten:
  - Moving the adjustment nuts (9d) toward the pump decreases the stroke.
  - Moving the adjustment nuts (9d) toward the cam increases the stroke.
4. Reassemble the drive guard (60) to the pump.



**FIG. 13: Wolverine stroke adjustment**

## Baseline Chemical Dosage Settings

See **Stroke Adjustment**, page 21, for changing the stroke adjustment settings. Cycles per minute (CPM) is determined by controller settings for On/Off Time, or Cycles, if using a Harrier family chemical injection controller. Adjust the controller settings to change the CPM. Motor speed is also affected by voltage and back pressure. Find the flow rate above the desired injection rate for the correct sized plunger, then adjust the stroke and controller settings accordingly for the corresponding CPM.

**NOTE:** Double the values in the charts for configurations using two fluid modules.

**NOTE:** CI-12H pumps have a maximum CPM of 30, which translates to a 50 percent duty cycle.

**NOTE:** For continuous injection pumps (CI-xxB), pump CPM is determined by the knob setting on the integrated motor controller. Motor speed is set with the knob. Refer to the motor manual included with continuous injection models for motor operation.

CPM	3/16 in. Fluid Plunger			1/4 in. Fluid Plunger			3/8 in. Fluid Plunger		
	GPD (LPD)			GPD (LPD)			GPD (LPD)		
	Full Stroke	3/4 Stroke	1/2 Stroke	Full Stroke	3/4 Stroke	1/2 Stroke	Full Stroke	3/4 Stroke	1/2 Stroke
5	0.9 (3.4)	0.6 (2.3)	0.4 (1.5)	1.5 (5.8)	1.1 (4.3)	0.8 (2.9)	2.8 (10.4)	2.1 (7.8)	1.4 (5.2)
10	1.7 (6.5)	1.3 (4.9)	0.9 (3.4)	3.1 (11.6)	2.3 (8.7)	1.5 (5.8)	5.5 (20.8)	4.1 (15.6)	2.8 (10.4)
15	2.6 (9.8)	1.9 (7.2)	1.3 (4.9)	4.6 (17.4)	3.4 (13.0)	2.3 (8.7)	8.3 (31.3)	6.2 (23.5)	4.1 (15.6)
20	3.4 (13.0)	2.6 (9.8)	1.7 (6.5)	6.1 (23.2)	4.6 (17.4)	3.1 (11.6)	11.0 (41.7)	8.3 (31.3)	5.5 (20.8)
25	4.3 (16.3)	3.2 (12.1)	2.2 (8.3)	7.6 (29.0)	5.7 (21.7)	3.8 (14.5)	13.8 (52.1)	10.3 (39.1)	6.9 (26.1)
30	5.2 (19.5)	3.9 (14.8)	2.6 (9.8)	9.2 (34.7)	6.9 (26.1)	4.6 (17.4)	16.5 (62.5)	12.4 (46.9)	8.3 (31.3)
35	6.0 (22.7)	4.5 (17.0)	3.0 (11.4)	10.7 (40.5)	8.0 (30.4)	5.4 (20.3)	19.3 (73.0)	14.5 (54.7)	9.6 (36.5)
40	6.9 (26.1)	5.2 (19.5)	3.4 (13.0)	12.2 (46.3)	9.2 (34.7)	6.1 (23.2)	22.0 (83.4)	16.5 (62.5)	11.0 (41.7)
45	7.7 (29.3)	5.8 (22.0)	3.9 (14.8)	13.8 (52.1)	10.3 (39.1)	6.9 (26.1)	24.8 (93.8)	18.6 (70.4)	12.4 (46.9)
50	8.6 (32.6)	6.5 (24.6)	4.3 (16.3)	15.3 (57.9)	11.5 (43.4)	7.6 (29.0)	27.5 (104.2)	20.7 (78.2)	13.8 (52.1)
55	9.5 (36.0)	7.1 (26.9)	4.7 (17.8)	16.8 (63.7)	12.6 (47.8)	8.4 (31.9)	30.3 (114.7)	22.7 (86.0)	15.1 (57.3)
60	10.3 (39.1)	7.7 (29.3)	5.2 (19.5)	18.4 (69.5)	13.8 (52.1)	9.2 (34.7)	33.0 (125.1)	24.8 (93.8)	16.5 (62.5)

CPM	1/2 in. Fluid Plunger			5/8 in. Fluid Plunger			3/4 in. Fluid Plunger		
	GPD (LPD)			GPD (LPD)			GPD (LPD)		
	Full Stroke	3/4 Stroke	1/2 Stroke	Full Stroke	3/4 Stroke	1/2 Stroke	Full Stroke	3/4 Stroke	1/2 Stroke
5	5.2 (19.7)	3.9 (14.8)	2.6 (9.8)	8.6 (32.6)	6.5 (24.4)	4.3 (16.3)	12.4 (46.9)	9.3 (35.2)	6.2 (23.5)
10	10.4 (39.4)	7.8 (29.5)	5.2 (19.7)	17.2 (65.2)	12.9 (48.9)	8.6 (32.6)	24.8 (93.8)	18.6 (70.4)	12.4 (46.9)
15	15.6 (59.1)	11.7 (44.3)	7.8 (29.5)	25.8 (97.7)	19.4 (73.3)	12.9 (48.9)	37.2 (140.7)	27.9 (105.6)	18.6 (70.4)
20	20.8 (78.8)	15.6 (59.1)	10.4 (39.4)	34.4 (130.3)	25.8 (97.7)	17.2 (65.2)	49.6 (187.6)	37.2 (140.7)	24.8 (93.8)
25	26.0 (98.5)	19.5 (73.8)	13.0 (49.2)	43.0 (162.9)	32.3 (122.2)	21.5 (81.4)	62.0 (234.6)	46.5 (175.9)	31.0 (117.3)
30	31.2 (118.1)	23.4 (88.6)	15.6 (59.1)	51.6 (195.5)	38.7 (146.6)	25.8 (97.7)	74.4 (281.5)	55.8 (211.1)	37.2 (140.7)
35	36.4 (137.8)	27.3 (103.4)	18.2 (68.9)	60.2 (228.0)	45.2 (171.0)	30.1 (114.0)	86.8 (328.4)	65.1 (246.3)	43.4 (164.2)
40	41.6 (157.5)	31.2 (118.1)	20.8 (78.8)	68.8 (260.6)	51.6 (195.5)	34.4 (130.3)	99.1 (375.3)	74.4 (281.5)	49.6 (187.6)
45	46.8 (177.2)	35.1 (132.9)	23.4 (88.6)	77.5 (293.2)	58.1 (219.9)	38.7 (146.6)	111.5 (422.2)	83.7 (316.7)	55.8 (211.1)
50	52.0 (196.9)	39.0 (147.7)	26.0 (98.5)	86.1 (325.8)	64.5 (244.3)	43.0 (162.9)	123.9 (469.1)	92.9 (351.8)	62.0 (234.6)
55	57.2 (216.6)	42.9 (162.5)	28.6 (108.3)	94.7 (358.4)	71.0 (268.8)	47.3 (179.2)	136.3 (516.0)	102.2 (387.0)	68.2 (258.0)
60	62.4 (236.3)	46.8 (177.2)	31.2 (118.1)	103.3 (390.9)	77.5 (293.2)	51.6 (195.5)	148.7 (562.9)	111.5 (422.2)	74.4 (281.5)

# Maintenance

## Preventive Maintenance Schedule

The operating conditions of the pump determines how often maintenance is required.

Record when and what type of maintenance is needed, then establish a regular schedule for checking the pumps.

## No Drip Fluid Module Rebuild Schedule

While the Wolverine ND has been tested and qualified for extended pump life, establishing a yearly rebuild schedule ensures seal and pump performance. See **No Drip Fluid Module Repair**, page 32, for rebuild instructions.

## Tighten Threaded Connections

Check that all of the threaded connections are tight at routine intervals.

## Tighten Packings

The packings included with the fluid module have the ability to be adjusted to stop leaks that develop when the seals are worn.

If a leak develops in the fluid module, tighten the packing nut clockwise 1/16th of a turn, or lower, until leak is eliminated.

The life of the packing can be affected by over tightening the packings. If the packing nut needs to be tightened repeatedly after short intervals, replace the packing,


## Storage

For pumps being stored by long periods, it is recommended that the fluid module be flushed with a light weight oil or rust prohibiter to protect the components. Store the fluid module with the protective fluid inside whenever possible.

# Recycling and Disposal

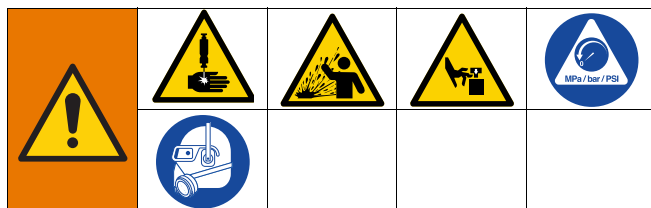
## End of Product Life

At the end of the product's useful life, dismantle and recycle it in a responsible manner.

- Perform the **Pressure Relief Procedure**, page 20.
- Drain and dispose of fluids according to applicable regulations. Refer to the material manufacturer's Safety Data Sheet.
- Remove motors, batteries, circuit boards, LCDs (liquid crystal displays), and other electronic components. Recycle according to applicable regulations.
- Do not dispose of batteries or electronic components with household or commercial waste.  

- Deliver remaining product to a recycling facility.



# Troubleshooting



To reduce the risk of injury due to burns, allow adequate time for the motor to cool before performing any troubleshooting tasks.

Follow **Pressure Relief Procedure**, page 20, before checking or repairing the pump.

**NOTE:** Check all possible problems and causes before disassembling the pump.

Problem	Cause	Solution
Pump runs, but chemical does not discharge at the correct rate.	Inlet check is clogged with debris (Fluid in calibration column is “bouncing” during calibration)	Remove debris from the check valve. Follow disassembly steps in <b>Check Valve Repair</b> , page 35
	Inlet check o-ring is damaged (Fluid in calibration column is “bouncing” during calibration)	Evaluate o-ring chemical compatibility and replace as required. See page 7 for a link to the chemical compatibility guide.  See <b>Kits and Accessories</b> , page 49, for check valve repair kits. Follow the directions in <b>Check Valve Repair</b> , page 35.  Inspect o-rings for signs of mechanical wear (chips, cracks, deformation, etc.), and replace as needed.
	Air in fluid module	Ensure the suction lines are tight and then prime the pump. See <b>Prime the Pump</b> , page 20, for the correct priming procedure.  Injection into a gas line: Inspect the outlet check valve to ensure gas is not back feeding into the fluid module. Repair or replace the check valve if damaged.  See <b>Kits and Accessories</b> , page 49, for check valve repair kits. Follow the directions in <b>Check Valve Repair</b> , page 35. See <b>Table 10: Inlet Check Valve</b> on page 47 and <b>Table 11: Outlet Check Valve</b> on page 48 for the replacement inlet and outlet check valves by seal type and plunger size.
	Packing leak	Tighten the packing nut by following the procedure in <b>Tighten Packings</b> , page 23. If the leak persists, evaluate packing chemical compatibility and replace. See page 7 for a link to the chemical compatibility guide.  Inspect the plunger for signs of damage to the coating, scratches in the finish, or any other imperfections. Replace the plunger if damage to the coating or rod exists.
	Inadequate chemical supply	Ensure the chemical tank is filled.  Inspect and replace the chemical supply filter.
	Incorrect calibration	Ensure the calibration gauge is functioning properly with good venting. Follow the procedure in <b>Calibrate Chemical Dosage</b> , page 21. Use the table of <b>Baseline Chemical Dosage Settings</b> , page 22, as a reference.

Problem	Cause	Solution
Pump does not stroke	No power	Using a voltage meter or multimeter, ensure the motor has proper incoming power from the power source.
		Ensure a fuse or circuit breaker has not blown or tripped. Replace fuse or reset breaker as needed. If the fuse or circuit breaker trips immediately following power up, first ensure that the correct size of fuse or breaker is installed. Look for potential shorts on the motor leads or circuit boards, if applicable.  See <b>Motor Electrical Connections</b> , page 16, for the correct circuit protection rating of each motor (fuse or circuit breaker).
		Using a voltage meter or multimeter, ensure the pump controller is supplying power to the motor at the motor leads of the controller.
	Incorrect power	Using a voltage meter or multimeter, ensure the pump power voltage is correct.
		Ensure the pump power polarity is correct. (variable speed DC). See <b>Motor Electrical Connections</b> , pages 16 through 23 for the wiring directions, or the included manual from the motor manufacturer (12VDC or 24 VDC variable speed).
	Pump stalled	Ensure the discharge pressure does not exceed the pump's maximum working pressure. Readjust the pressure relief valve to be under the pump's maximum working pressure if it is over.
		Ensure the pressure relief valve is set properly and is functional. Try reducing the set point to see if the pump will turn on.
		Ensure the check valve and shutoff valve at the point of injection are open.
		Ensure the motor shaft spins freely by running the pump with the prime port open. If not, replace motor or gearbox (Gearbox is only replaceable on Hazardous Location (C1D1 and ATEX motors. All other motors have integrated gearboxes, and replacement will consist of a new motor.  -For ordinary location and continuous injection see <b>Wolverine Drive Module Parts List for AC, DC, and Continuous Injection Pumps (C1 D2)</b> , page 39, for replacement motors (ref. 1).  -For Hazardous Location (C1D1) and ATEX see <b>Wolverine Drive Module Parts List for Hazardous Location (C1 D1) and ATEX Pump</b> , page 41 for replacement gearbox (gear reducer ref. 101).  -Follow <b>Drive Module Repair</b> , page 33, steps 1-5, and then proceed to remove the four (4) screws holding the motor or gearbox in the drive housing.

Problem	Cause	Solution
Pump does not stroke	Drive cam, motor shaft, or gearbox keyway is damaged	<p>Inspect the keyway for signs of rounded edges or widening of the slot, and replace the motor, gearbox, or cam as required. For ordinary location and continuous injection see <b>Wolverine Drive Module Parts List for AC, DC, and Continuous Injection Pumps (C1 D2)</b>, page 39 for replacement motors (ref. 1) and cam (ref. 13).</p> <p>For Hazardous Location (C1D1) and ATEX see <b>Wolverine Drive Module Parts List for Hazardous Location (C1 D1) and ATEX Pump</b>, page 41 for the replacement gearbox (gear reducer ref. 101) and cam (ref. 13).</p>
	Water ingress	<p>Ensure the motor junction box electrical connection and conduit are water-tight. Ensure the plastic conduit seal is properly installed on the outside of the junction box if applicable.</p>
		<p>Inspect the motor and replace as required. Water ingress will damage the motor internals and rust the bearings, causing the motor shaft and internals to seize.</p> <p>See <b>Wolverine Drive Module Parts List for AC, DC, and Continuous Injection Pumps (C1 D2)</b>, page 39 and <b>Wolverine Drive Module Parts List for Hazardous Location (C1 D1) and ATEX Pump</b>, page 41 for replacement motors.</p>
	Worn motor brushes (DC only)	<p>Remove brush dust. With the motor removed, follow the process for <b>DC Motor Brush Repair (not Hazardous Location (C1 D1) or ATEX)</b>, page 35. Tip the motor on its side and shake out the excess brush dust. Repeat on the other side. Inspect the brushes at this time for excessive wear, and replace them if needed.</p> <p><b>NOTE:</b> Running the pump above rated pressure decreases motor life and results in additional brush wear and dust build up.</p>
		<p>Inspect brushes and replace as required. See <b>Wolverine Advanced, Hazardous Location (C1 D1), ATEX, and Continuous Injection (C1 D2) Drive Module Kits</b>, page 52, for details</p>
	Motor control board failure (variable speed only)	<p>Inspect the board for damaged or blown components. Incorrect wiring or branch circuit protection, or pressure above maximum rated pressure can damage the circuitry. Replace the control board if damage is noted. See <b>Kits and Accessories</b>, page 49, for replacement circuit boards.</p>
Motor gearbox failure (Motor shaft has excessive side to side movement or rough, gritty feel).	<p>Replace the motor. For ordinary location and continuous injection, see <b>Wolverine Drive Module Parts List for AC, DC, and Continuous Injection Pumps (C1 D2)</b>, page 39, for replacement motors (ref. 1).</p>	
	<p>Replace the gearbox. (Hazardous Location (C1D1) and ATEX only.)</p> <p>For Hazardous Location (C1D1) and ATEX, see <b>Wolverine Drive Module Parts List for Hazardous Location (C1 D1) and ATEX Pump</b>, page 41 for replacement gearbox (gear reducer reference 101).</p>	

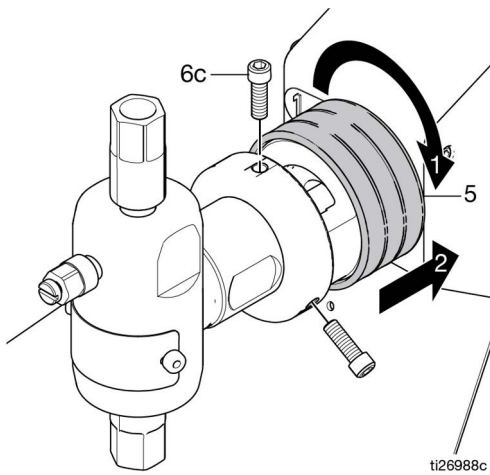
Problem	Cause	Solution
<p>Pump is excessively noisy</p>	<p>Worn drive train components</p>	<p>Inspect the stroke adjust blocks for grooves or wear to the stroke adjust shafts. Replace the drive components as required.</p> <p>Inspect the sleeve bearing in the drive cylinder for ovaling or a loose fit of the stroke adjust shaft. Replace as necessary.</p> <p>Running the pump above the rated pressure can result in excessive wear to the stroke adjust blocks.</p> <p>See <b>Kits and Accessories</b>, page 49.</p> <p>Follow the procedure on <b>Drive Module Repair</b>, page 33.</p>
	<p>Motor gearbox wear</p>	<p>Replace the motor.</p> <p>For ordinary location and continuous injection, see <b>Wolverine Drive Module Parts List for AC, DC, and Continuous Injection Pumps (C1 D2)</b>, page 39 for replacement motors (ref. 1).</p> <p>Replace the gearbox. (Hazardous Location (C1D1) and ATEX only.)</p> <p>For Hazardous Location (C1D1) and ATEX, see <b>Wolverine Drive Module Parts List for Hazardous Location (C1 D1) and ATEX Pump</b>, page 41 for replacement gearbox (gear reducer ref. 101).</p>
<p>Chemical leaking from packing</p>	<p>Worn packing</p>	<p>Tighten the packing nut by following the procedure in <b>Tighten Packings</b>, page 23. If the leak persists, replace the packing or plunger, as necessary.</p> <p>(The packing nut is set from the factory and does not require tightening when first installed.)</p> <p>Chemical compatibility: Consult the seal selection guide to ensure the seal in use is designed to operate with the chemicals being pumped.</p> <p>See page 7 for a link to the chemical compatibility guide.</p> <p>Temperature: Consult the seal selection guide to ensure the seal in use is designed to operate in the recommended temperature range.</p> <p>See page 7 for a link to the chemical compatibility guide.</p> <p>Plunger coating: Inspect the plunger for coating failure due to chemical or abrasive attack (flaking of coating, scratches, wear through). Replace as required.</p> <p>If the plunger is uncoated, inspect for scratches due to abrasion, or breakdown due to chemical attack. Replace as required.</p> <p>See <b>Table 9: Fluid Plunger</b>, page 47, for replacement fluid plungers.</p>

# Repair

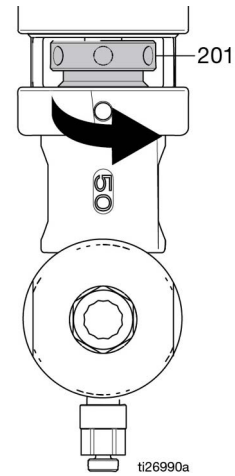


## Disconnect Fluid Module

1. Follow the **Pressure Relief Procedure**, page 20.
2. Expose the packing nut (201) by loosening the dust cover (5) and sliding it towards the drive housing (2). On No Drip fluid models, the packing nut is referenced by 301.
3. Loosen, but do not remove, packing nut (201). On No Drip fluid models, the packing nut is referenced by 301.

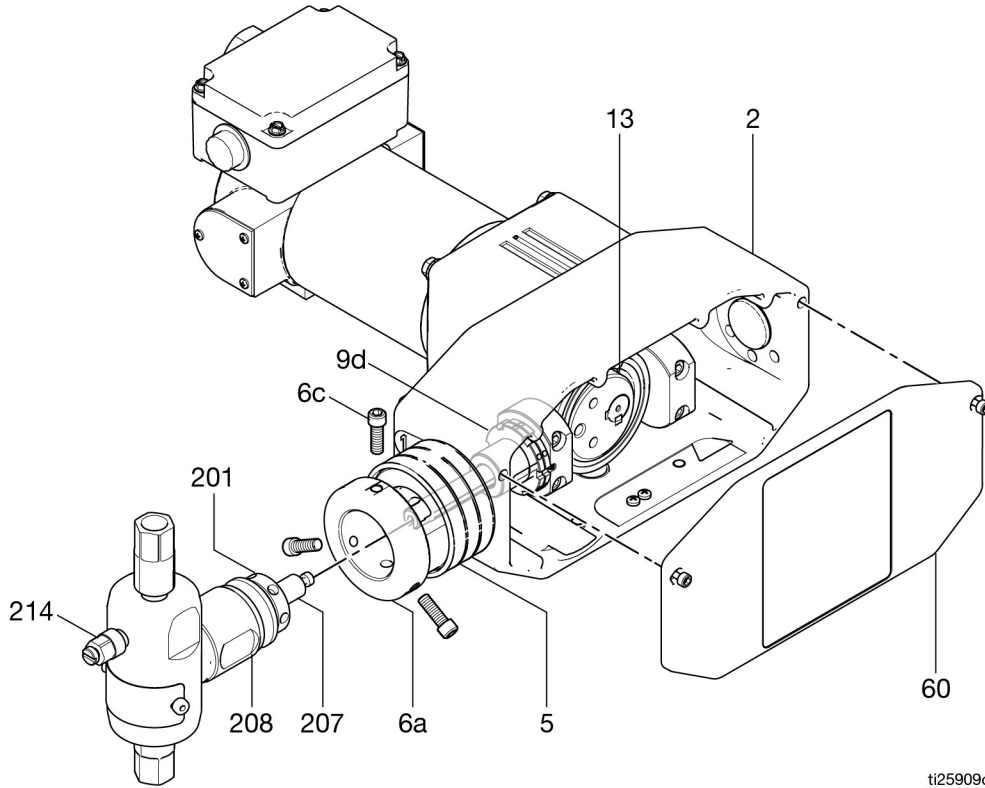


**FIG. 14: Remove dust cover**



**FIG. 15**

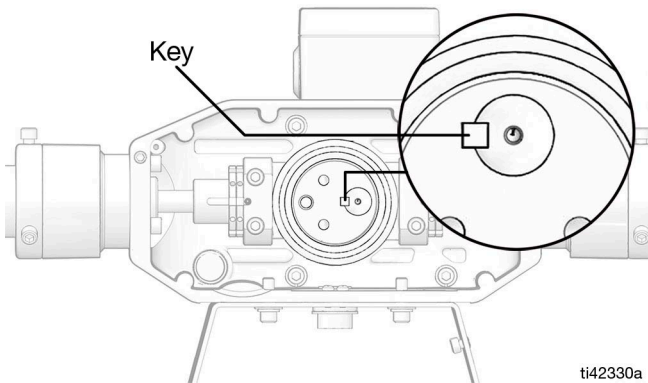
4. Loosen the three set screws (6c) from the drive cylinder (6a) to release and remove the fluid cylinder (208) (FIG. 16). On No Drip fluid models, the fluid cylinder is referenced by 308.



**FIG. 16: Disconnect Wolverine Advanced and Hazardous Location Drive Module**

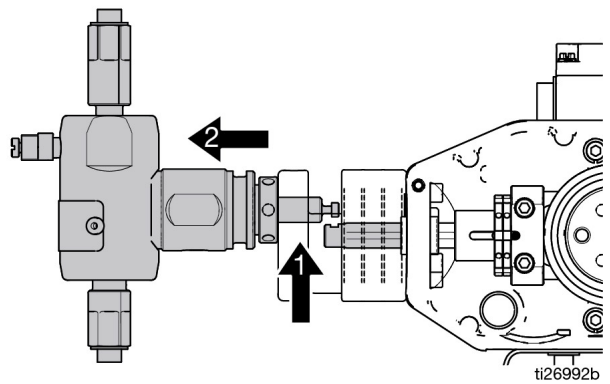
- Place two 7/32 in. (or smaller) hex keys (or similar tools) in the holes on the cam (13). Use them to rotate the cam (13) until the key is towards the fluid module being repaired (FIG. 17).

**NOTE:** On No Drip fluid models, the plunger is referenced by 307.



**FIG. 17**

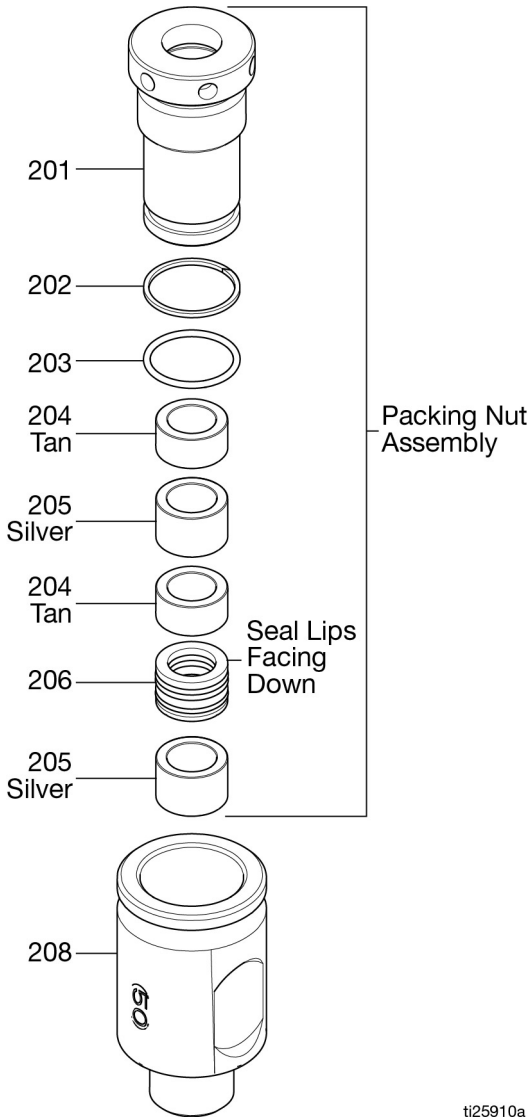
- Carefully remove the plunger (207) from the drive shaft (9c) (see FIG. 16).



**FIG. 18: Disconnect plunger from drive shaft**

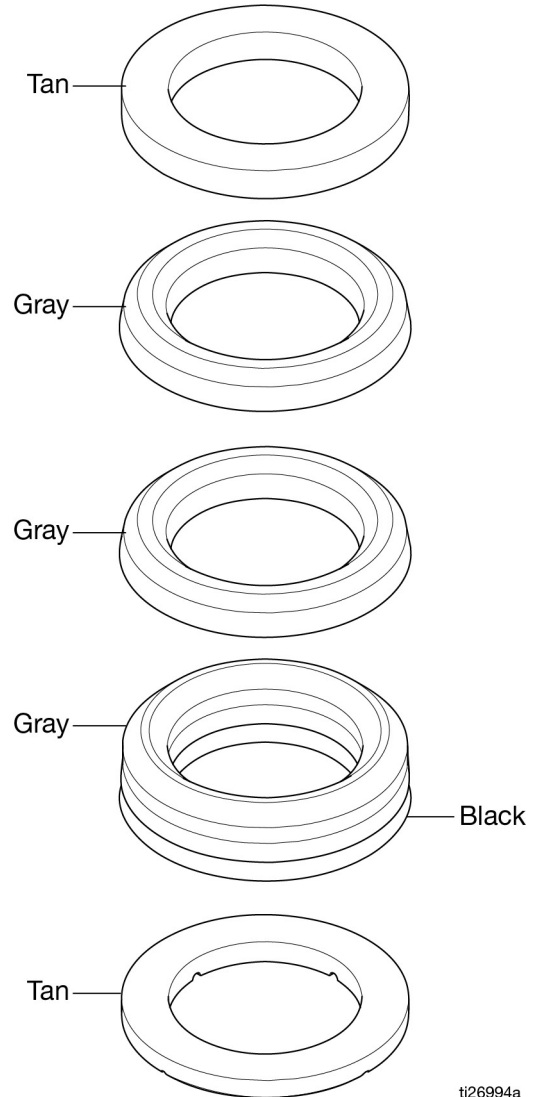
# Fluid Module Repair

1. Remove packing nut assembly from fluid cylinder (208) (FIG. 19).



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4. Replace the o-ring (202) and back-up ring (203) on the outside of the packing nut (201). Lubricate prior to reassembly (see FIG. 19).



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**FIG. 19: Wolverine Fluid Module Repair**

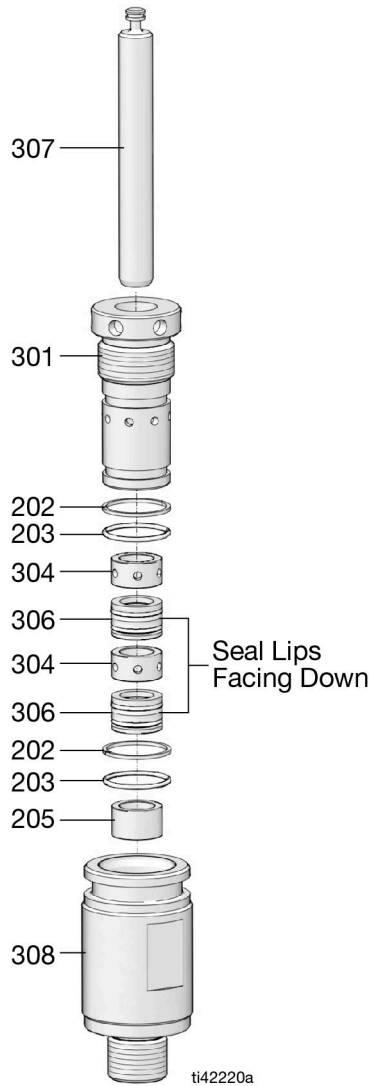
2. Use a socket or flat punch to press out the packing assembly.
3. Replace packing (206) and bearings (204). Inspect spacers and replace, if necessary. Lubricate prior to reassembly (FIG. 19 and FIG. 20).

**FIG. 20: Packing (206) detailed view**

5. Replace packing nut assembly into fluid cylinder. Tighten hand tight and back off 1/2 of a turn to prevent damage to packing during reassembly.

## No Drip Fluid Module Repair

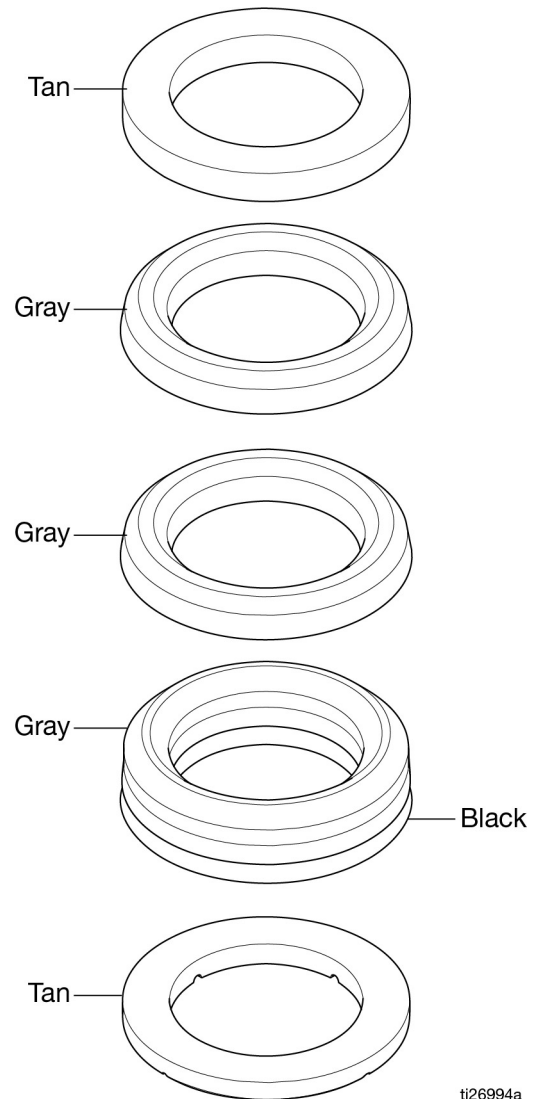
1. Remove packing nut assembly from fluid cylinder (308) (FIG. 21).



**FIG. 21: Wolverine No Drip Fluid Module Repair**

2. Use a socket or flat punch to press out the packing assembly.
3. Replace packing (306) and bearings (304). Inspect spacers and replace, if necessary. Lubricate prior to reassembly. Replace both packings as a pair (FIG. 21 and FIG. 22).

4. Replace the o-ring (202) and back-up ring (203) on the outside of the packing nut (201). Lubricate prior to reassembly. Replace both sets as a pair (see FIG. 21).



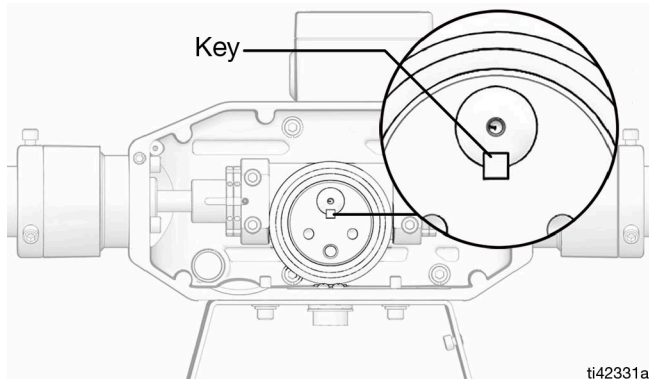
**FIG. 22: Packing (306) detailed view**

5. Replace packing nut assembly into fluid cylinder. Tighten hand tight and back off 1/2 of a turn to prevent damage to packing during reassembly.



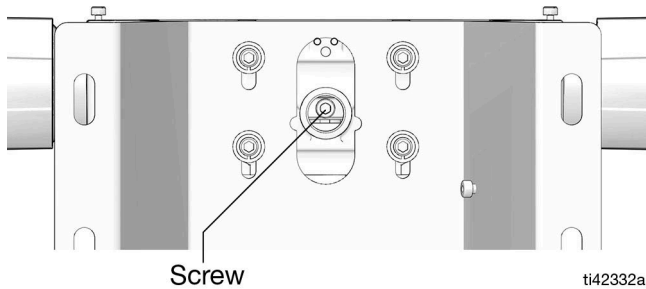
# Drive Module Repair

1. **Disconnect Fluid Module**, page 29.
2. Place two 7/32 in. (or smaller) hex keys (or similar tools) in the holes on the cam assembly (13), and use them to rotate the cam assembly until the key (12) is in the downward position.



**FIG. 23**

3. Use a 3/16 in. hex key to remove the two (2) screws (17) attaching the stroke adjuster (9a) to the return carriage (11) (FIG. 25).
4. Remove the red plug from the bottom of the housing (2) and use a 3/16 in. hex key to remove the set screw on the bottom rear of the cam assembly (FIG. 25).

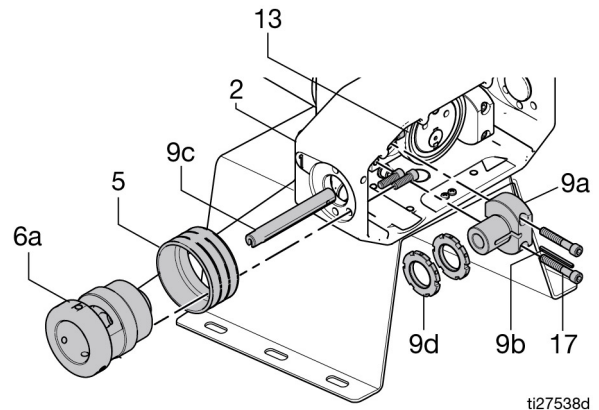


**FIG. 24**

**NOTE:** Earlier series models may require different-sized hex wrenches.

5. Remove the cam assembly (13) from the motor shaft (FIG. 25).

6. Slide the stroke adjuster assembly (9a) towards the motor shaft and out of the housing (FIG. 25).
7. Bring the stroke adjuster assembly (9a) into the housing (2), and slide the shaft through the drive cylinder (6a) (FIG. 25).
8. Place the cam assembly (13) onto the shaft, with the bearing in the front and the step-down in the rear, and slide on until the motor shaft is flush with the front face of the cam assembly (13) (FIG. 25).
9. Apply lubricant to the cam assembly (13) outside diameter bearing surface (FIG. 25).
10. Insert the cam set screw (16), with pre-applied thread lock, and torque to 70-75 in-lb (7.9-8.5 N•m) (FIG. 25).
11. Orient the stroke adjuster assembly (9a) so that the end of the shaft (where the fluid head connects) has the opening of the U-shape at the top; otherwise, the fluid head will not be able to be attached during reassembly (FIG. 25).
12. Use the two (2) screws (17) to attach the stroke adjuster (9a) to the plunger return carriage (11) behind the cam assembly (13). Torque the screws to 70-75 in-lb (7.9-8.5 N•m) (FIG. 25).
13. Install the red plug into the bottom of the housing (2) (FIG. 25).

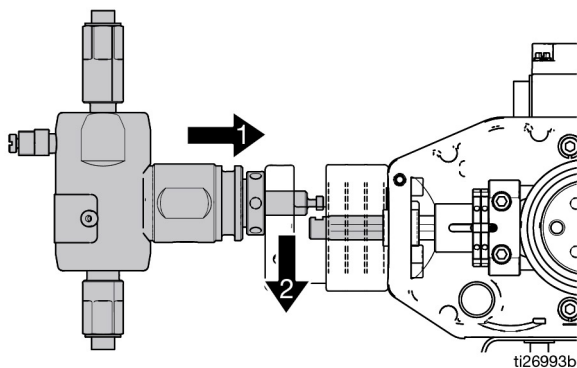


**FIG. 25: Drive Module repair**

## Reconnect Fluid Module

1. Reconnect the fluid module plunger (207) to the drive shaft (9c).

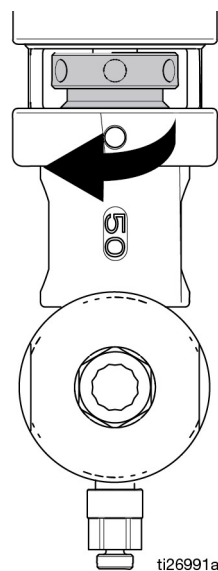
**NOTE:** On No Drip fluid models, the plunger is referenced by 307.



**FIG. 26: Reconnect plunger to drive shaft**

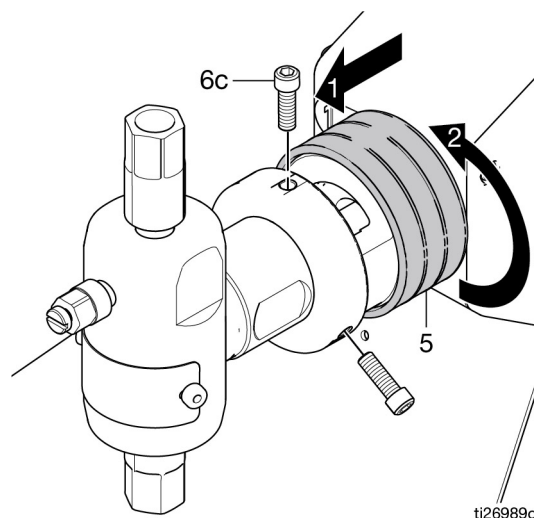
2. While guiding the plunger (207/No Drip models 307) back into the fluid cylinder (208/No Drip models 308), guide the fluid cylinder into the drive cylinder (6a).
3. Apply thread lock to the three set screws (6c) and tighten them to restrain the fluid cylinder (208/No Drip Models 308) to the drive cylinder (6a). Torque the set screws to 15-20 in-lb (1.7-2.3 N•m).
4. Verify the set screws (6c) are in the groove of the drive cylinder (6a).

5. Tighten packing nut assembly hand tight plus a 1/16th turn.



**FIG. 27: Tighten packing nut**

6. Cover the packing nut (201) by threading the dust cover (5) onto the drive cylinder (6a). On No Drip fluid models, the packing nut is referenced by 301.



**FIG. 28: Replace dust cover**

7. Reconnect inlet and outlet fluid lines to the fluid module.
8. Reconnect power to the motor.
9. **Prime the Pump**, page 20.
10. If necessary, **Calibrate Chemical Dosage**, page 21.
11. Tighten packing nut as necessary to seal fluid module plunger.

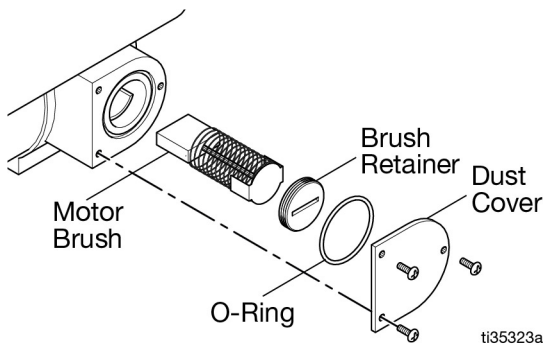
## DC Motor Brush Repair (not Hazardous Location (C1 D1) or ATEX)



**NOTE:** Running the pump above the rated pressure decreases the motor life and results in additional brush wear and dust buildup.

Use FIG. 29 for the reference to this section.

1. Disconnect pump from power source.
2. Remove dust cover screws, dust cover, and o-ring
3. Remove the brush retainer using a flathead screwdriver.
4. Remove and replace the motor brush.
5. Reinstall the brush retainer.
6. Ensure that the o-ring is in place and reinstall the dust cover and dust cover screws.
7. Repeat steps 2 through 6 for the other side of the motor.

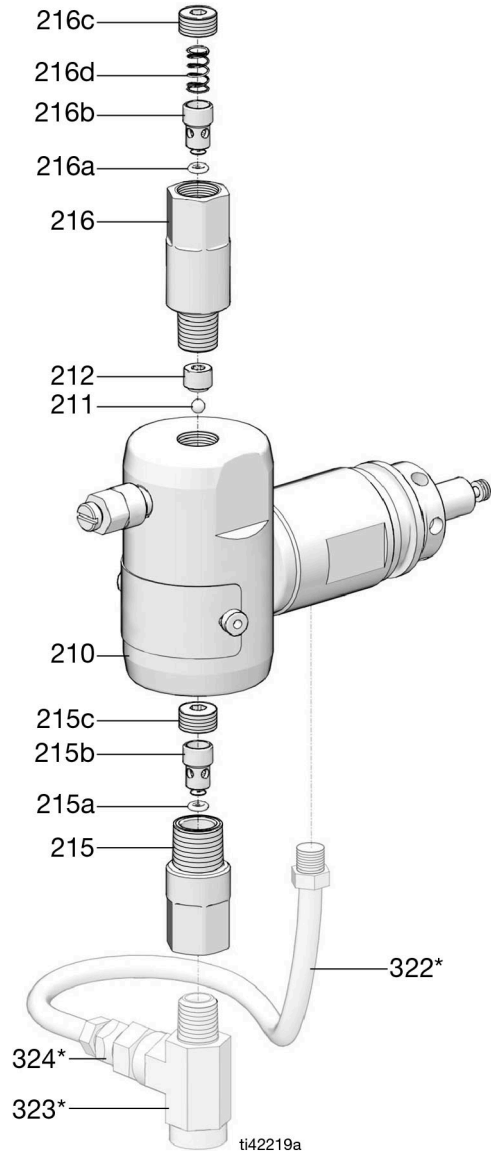


**FIG. 29: Motor Brush Repair**

## Check Valve Repair



The following procedures apply to the check valves on Wolverine Advanced and Wolverine Hazardous Location pumps. FIG. 30 shows the placement of the check valves on a Wolverine Advanced fluid module.



\*Only applies to No Drip Fluid Modules

**FIG. 30: Check Valve Repair**

## Inlet Check Valve

1. Follow the **Pressure Relief Procedure**, page 20.
2. Remove the inlet check valve assembly (215). For No Drip fluid models, begin disassembly with removing the hose (322) from the swivel (324). Remove the inlet check valve assembly (215), the tee fitting (323), and the swivel (324) as a complete assembly.
3. Remove the retaining nut (215c) and piston (215b).
4. Remove the piston o-ring (215a) from the piston (215b).
5. Inspect parts for wear, and replace as needed.
6. Install the piston o-ring (215a).
7. Reassemble the piston (215b) and retaining nut (215c). Torque the retaining nut to 30-35 in-lb (3.4.0 N•m).
8. Reconnect the inlet check valve assembly (215). Apply sealant to the exterior threads of the valve assembly.
9. Reconnect and tighten fluid lines.
10. **Prime the Pump**, page 20.
11. If necessary, **Calibrate Chemical Dosage**, page 21.

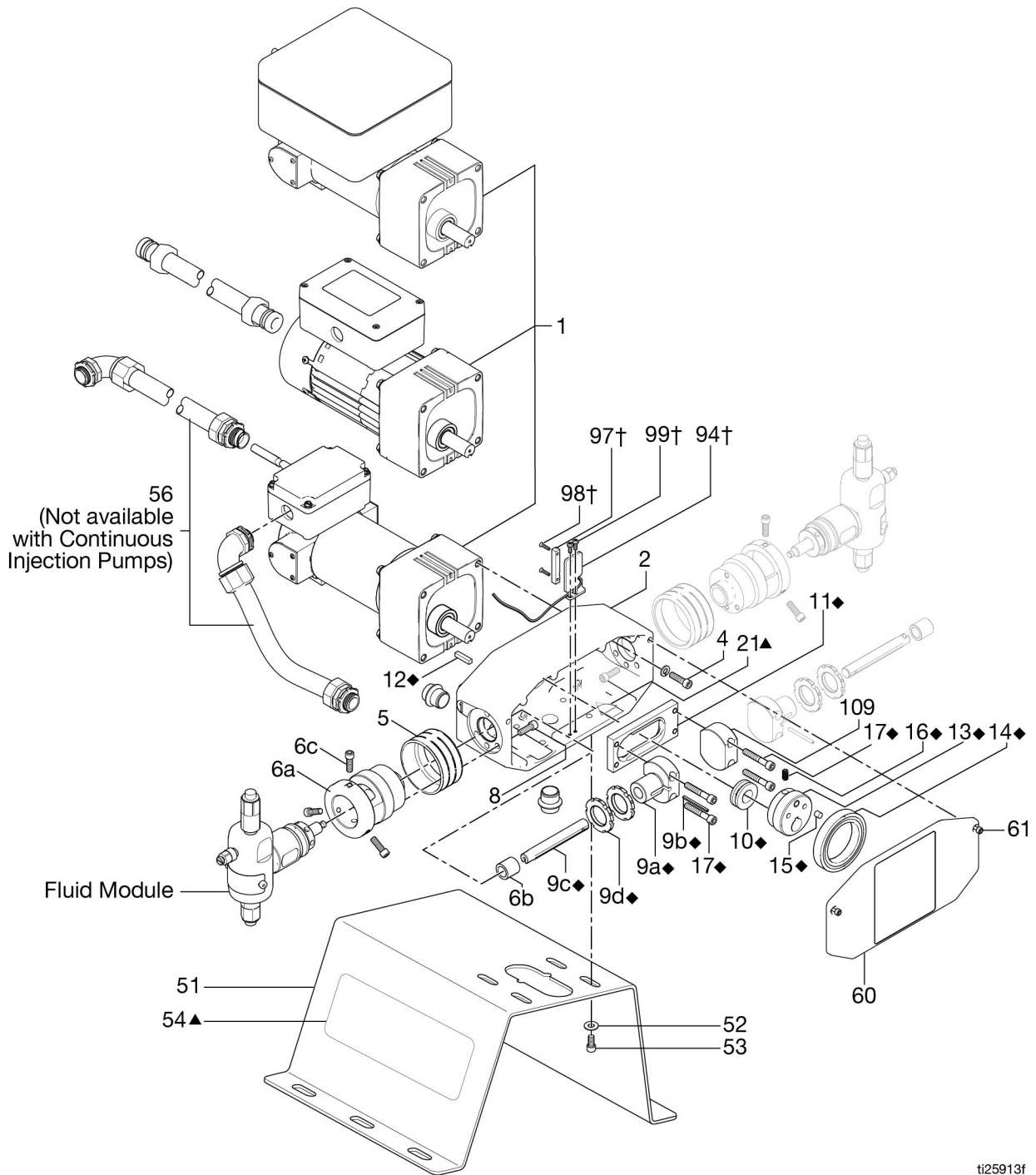
## Outlet Check Valve

1. Follow the **Pressure Relief Procedure**, page 20.
2. Remove the outlet check valve assembly (216).
3. Remove the retaining nut (216c), spring (216d), and piston (216b).
4. Remove the piston o-ring (216a) from the piston (216b).
5. Inspect parts for wear, and replace as needed.
6. Install the piston o-ring (216a).
7. Reassemble the piston (216b), spring (216d), and retaining nut (216c). Torque the retaining nut to 30-35 in-lb (3.4.0 N•m).
8. Reconnect the outlet check valve assembly (216). Apply sealant to the exterior threads of the valve assembly.
9. Reconnect and tighten fluid lines.
10. **Prime the Pump**, page 20.
11. If necessary, **Calibrate Chemical Dosage**, page 21.



# Parts

## Wolverine Drive Module for AC, DC, and Continuous Injection Pumps (C1 D2)



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## Wolverine Drive Module Parts List for AC, DC, and Continuous Injection Pumps (C1 D2)

Ref.	Part	Description	Qty
1	B33038	Motor: small, 12 VDC	1
	B32109	Motor: large, 12 VDC	1
	B32761	Motor: medium, 115 VAC	1
	B32146	Motor: large, 115 VAC	1
	B32147	Motor: large, 230 VAC	1
	B32151	Motor: large, 230/460 VAC 3 Phase	1
	B32032	Motor: continuous injection variable speed, brushless, 12 VDC, C1 D2	1
	B32236	Motor: continuous injection variable speed, brushless, 24 VDC, C1 D2	1
2	24Z033	Drive housing, small	1
	24Z034	Drive housing, large	1
4		Button head cap screw, included with motor (ref. 2)	4
5	B32427	Dust cover	1
6a	B32880	Drive cylinder for plunger sizes 1/4 in., 3/8 in., 1/2 in.	1
	B32879	Drive cylinder for plunger sizes 3/16 in., 5/8 in., 3/4 in.	1
6b		Sleeve bearing; included with drive cylinder (ref. 6a)	1
6c	B33048	Socket head cap screw; included with drive cylinder (ref. 6a)	3
8		Socket head cap screw, included with drive cylinder (ref. 6a)	3
9a◆	B32712	Stroke adjuster	1
9b◆		Coiled pin (17F380)	1
9c◆		Drive shaft	1
9d◆		Stroke adjuster nut	2
10◆	B32708	Carriage bearing, small	1
	B32709	Carriage bearing, large	1
11◆		Plunger return carriage, small	1
		Plunger return carriage, large	1
12◆		Square key, included with motor (ref. 2) & cam (ref. 13) & plunger return carriage (ref. 11) & carriage bearing (ref. 10)	1

Ref.	Part	Description	Qty
13◆	B32084	Cam, small motors	1
	B32411	Cam, large motors	1
14◆		Deep groove ball bearing; included with cam (ref. 13)	1
15◆		Magnet; included with cam (ref. 13)	1
16◆		Set screw, included with motor (ref. 2) & cam (ref. 13) & plunger return carriage (ref. 11) & carriage bearing (ref. 10)	1
17◆		Socket head cap screw, included with plunger return carriage (ref. 11) & plunger return block (ref. 109)	4
21▲	15H108	Pinch hazard warning label	1
40		Tapered cap plug (not shown)	1
51		Pump base	1
52		Flat washer	4
53		Socket head cap screw	4
54▲	17G318	Multiple warning safety label	1
56		Liquid-tight flex metal conduit assembly	2
60	B32401	Drive guard	1
61		Captive fastener, included with drive guard (ref. 60)	2
94†		Reed switch bracket	1
97†		Reed switch, with connector	1
98†		Flat Head Phillips Screw, 4-40 x .500	1
99†		Pan Head Phillips Screw, 6-32UNC x .375	3
109	B32711	Plunger return block (not used with duplex models)	1

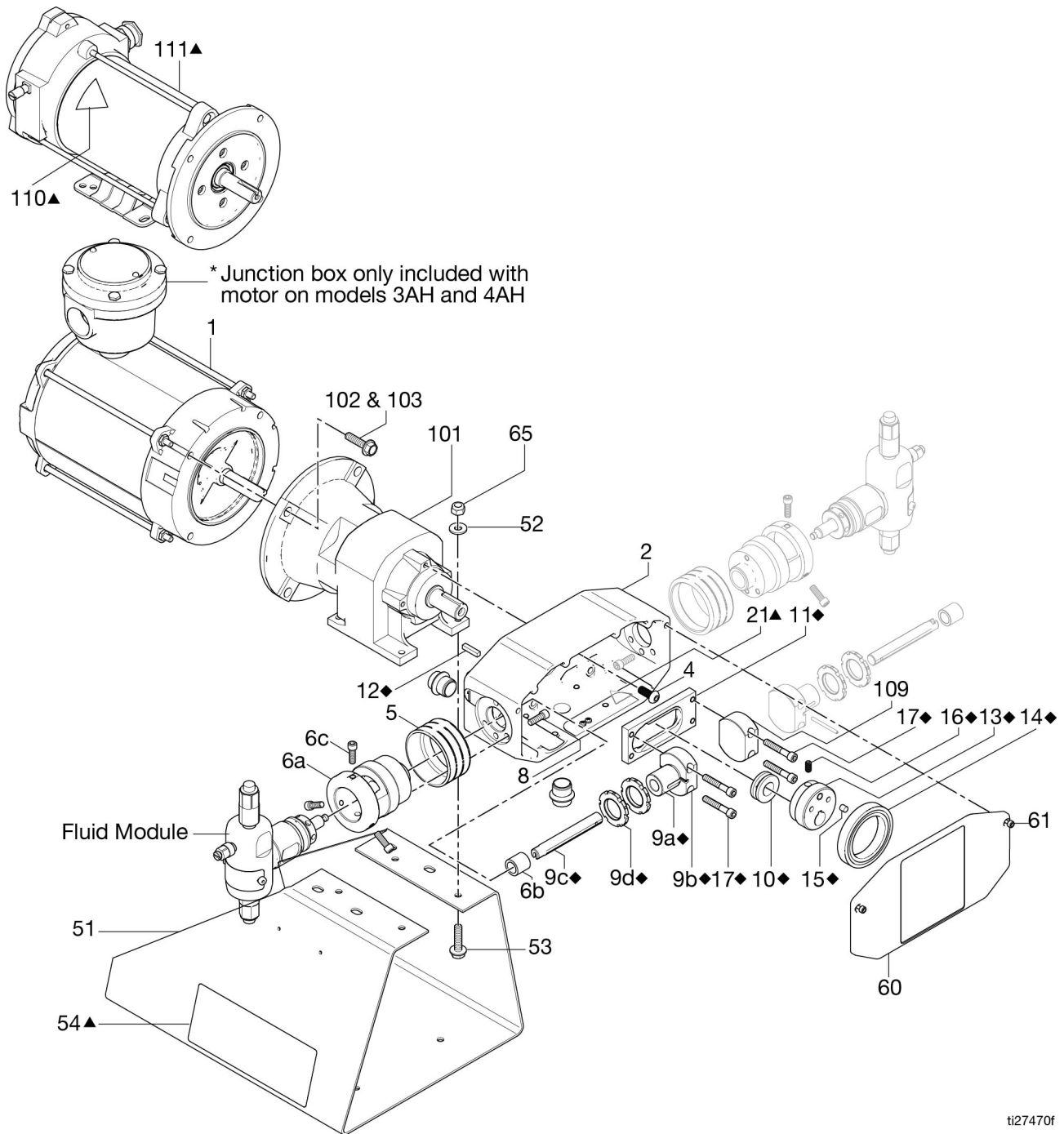
▲ Replacement safety labels, tags, and cards are available at no cost.

† Included in Cycle Count kit, see **Kits and Accessories**, page 49.

★ See Duplex Add-On Kits in **Kits and Accessories**, page 49.

◆ Included in Drive Train Repair kit, see **Kits and Accessories**, page 49.

# Wolverine Drive Module for Hazardous Location (C1 D1) and ATEX Pumps





## Wolverine Drive Module Parts List for Hazardous Location (C1 D1) and ATEX Pump

Ref.	Part	Description	Qty
1	B32149	Motor: Hazardous Location, 12 VDC, 1/5 HP, C1 D1	1
	B32209	Motor: Hazardous Location, 115/230 VAC, 1/4 HP, C1 D1	1
	B32210	Motor: Hazardous Location, 230/460 VAC, 1/4 HP, C1 D1	1
	B32211	Motor: Hazardous Location, 24 VDC, 1/5 HP, C1 D1	1
	B33001	Motor: ATEX, 24 VDC, Zone 1	1
	B33002	Motor: ATEX, 230 VAC, Zone 1	1
	B33003	Motor: ATEX, 230/400 VAC, Zone1	1
2	24Z147	Drive housing	1
4		Socket head cap screw, included with gear reducer (ref. 101)	4
5	B32427	Dust cover	1
6a	B32880	Drive cylinder for plunger sizes 1/4 in., 3/8 in., 1/2 in.	1
	B32879	Drive cylinder for plunger sizes 3/16 in., 5/8 in., 3/4 in.	1
6b		Sleeve bearing; included with drive cylinder (ref. 6a)	1
6c	B33048	Socket head cap screw; included with drive cylinder (ref. 6a)	3
8		Socket head cap screw, included with drive cylinder (ref. 6a)	3
9a◆	B32712	Stroke adjuster	1
9b◆		Coiled pin (17F380)	1
9c◆		Drive shaft	1
9d◆		Stroke adjuster nut	2
10◆	B32710	Carriage bearing, included with plunger return carriage (ref. 11)	1
11◆		Plunger return carriage	1
12◆		Square key, included with motor (ref. 2) & cam (ref. 13) & plunger return carriage (ref. 11) & carriage bearing (ref. 10)	1
13◆	B32212	Cam	1

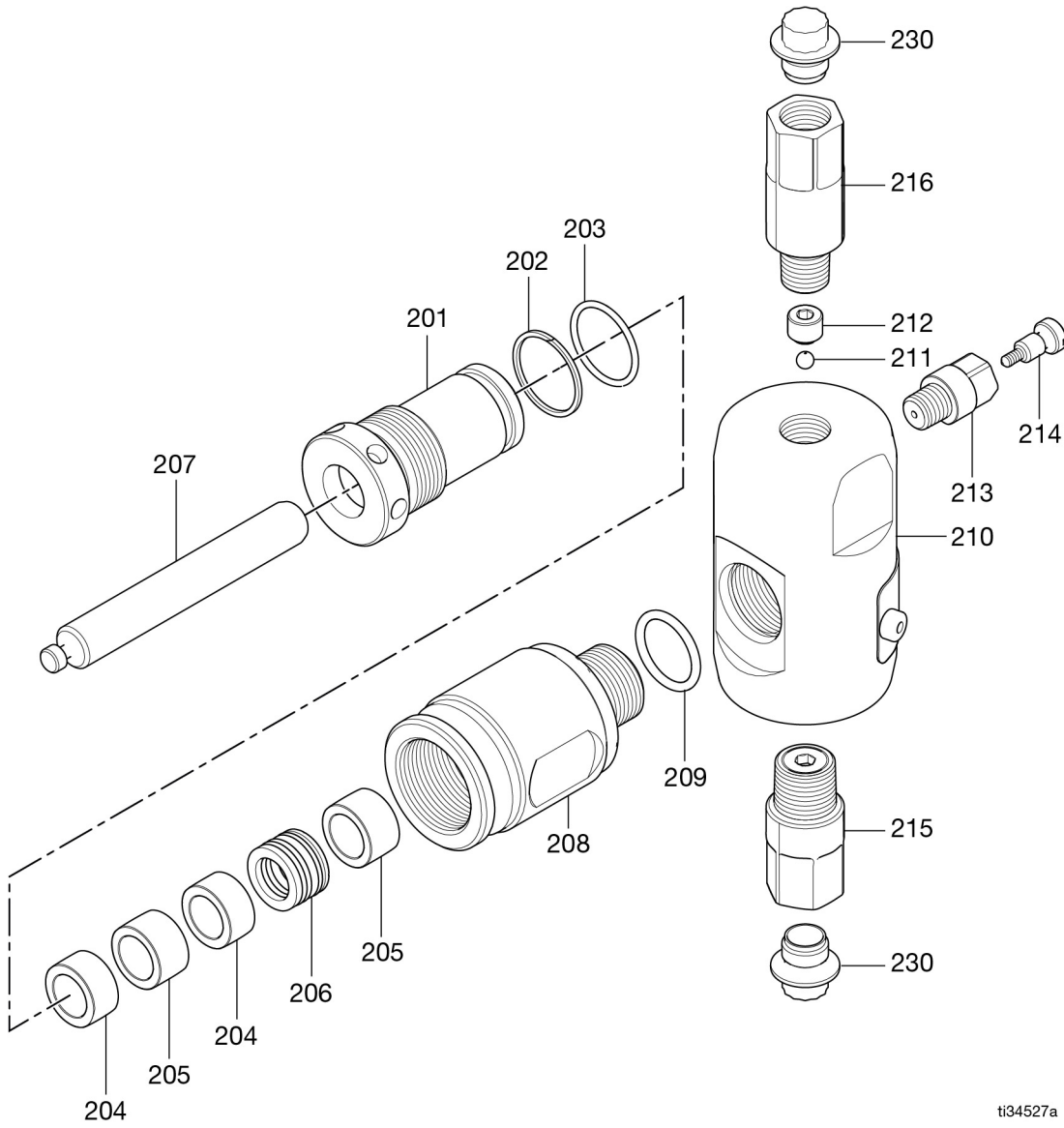
Ref.	Part	Description	Qty
14◆		Deep groove ball bearing; included with cam (ref. 13)	1
15◆		Magnet; included with cam (ref. 13)	1
16◆		Set screw, included with motor (ref. 2) & cam (ref. 13) & plunger return carriage (ref. 11) & carriage bearing (ref. 10)	1
17◆		Socket head cap screw, included with plunger return carriage (ref. 11) & plunger return block (ref. 109)	4
21▲	15H108	Pinch hazard warning label	1
40		Tapered cap plug (not shown)	1
51		Pump base	1
52		Flat washer, included with gear reducer (ref. 101)	4
53		Socket head cap screw, included with gear reducer (ref. 101)	4
54▲	17G318	Multiple warning safety label	1
56		Liquid-tight flex metal conduit	1
60	B32401	Drive guard	1
61		Captive fastener, included with drive guard (ref. 60)	2
65		Hex nut, included with gear reducer (ref. 101)	4
101	B32876	Gear Reducer: Hazardous Location	1
	B32877	Gear Reducer: ATEX	
102		Hex head screw	4
103		Lock washer	4
109	B32711	Plunger return block (not used with duplex models)	1
110▲	15G303	Electric Shock Warning Label	1
111▲	125363	Burn Hazard Warning Label	1

▲ Replacement safety labels, tags, and cards are available at no cost.

★ See Duplex Add-On Kits in **Kits and Accessories**, page 49.

◆ Included in Drive Train Repair kit, see **Kits and Accessories**, page 49.

# Wolverine Fluid Module

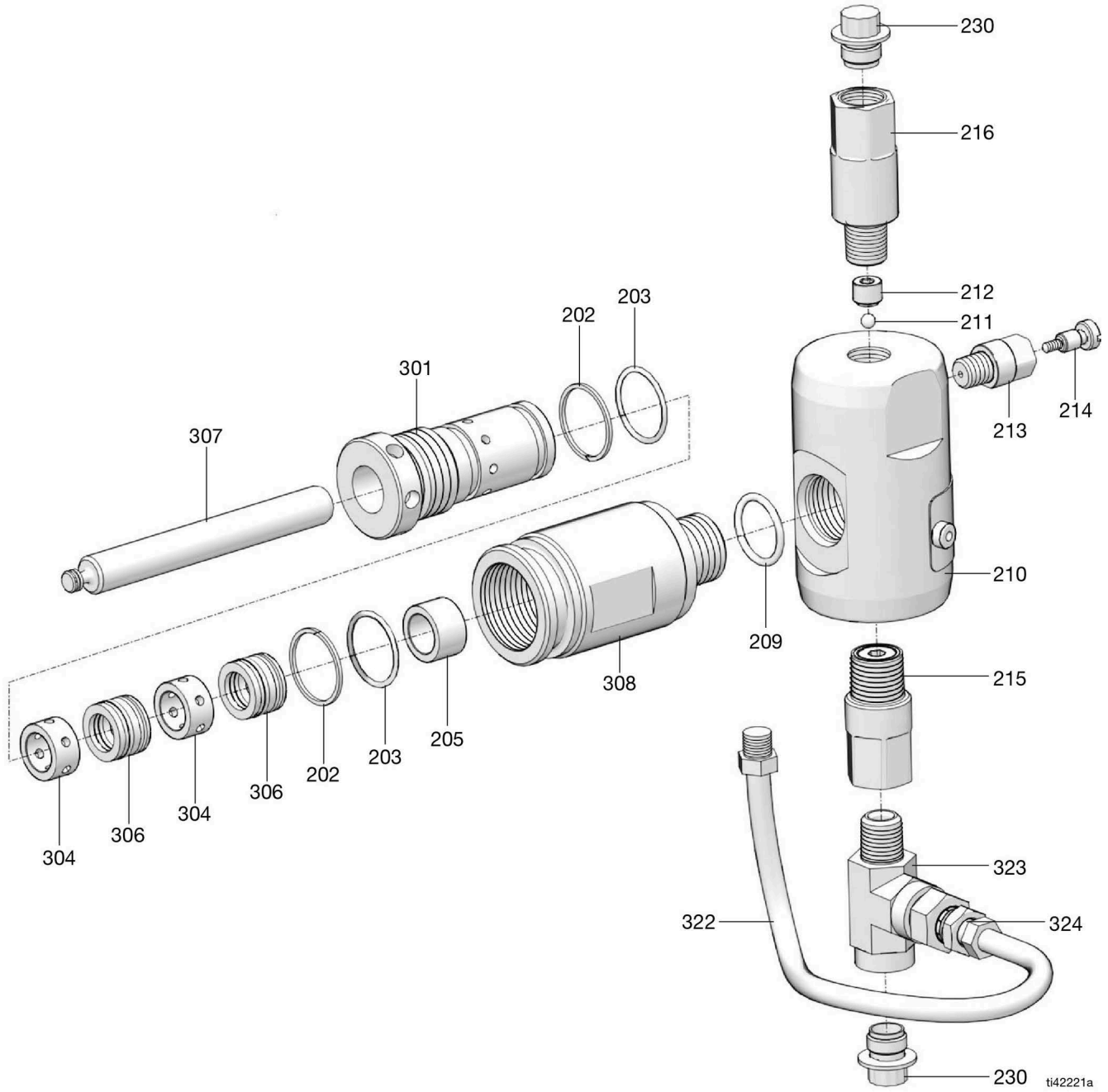


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## Wolverine Fluid Module Parts List

Ref.	Part	Description	Qty
201	See Table 6	Packing nut	1
202	See Table 6 and Table 7	O-Ring, included with packing nut (ref. 201) & packing stack (ref. 206)	1
203	See Table 6 and Table 7	Backup o-ring, included with packing nut (ref. 201) & packing stack (ref. 206)	1
204		Plunger bearing, included with packing (ref. 206)	2
205	See Table 12	Spacer	2
206	See Table 7	Packing	1
207	See Table 9	Plunger	1
208	See Table 8	Fluid cylinder	1
209	See Table 5 and Table 8	O-Ring, included with check/bleed housing (ref. 210) & fluid cylinder (ref. 208)	1
210	See Table 5	Check/bleed housing	1
211		Ball, included with check/bleed housing (ref. 210)	1
212		Ball retainer, included with check/bleed housing (ref. 210)	1
213	B32191	Bleed housing	1
214	17F572	Bleed valve, included with bleed housing (ref. 213)	1
215	See Table 10	Inlet check valve	1
216	See Table 11	Outlet check valve	1
230		Plug cap	2

# No Drip Wolverine Fluid Module



## No Drip Wolverine Fluid Module Parts List

Ref.	Part	Description	Qty
301		Packing nut	1
202		O-Ring, included with packing nut (ref. 201) & packing stack (ref. 206)	2
203		Backup o-ring, included with packing nut (ref. 201) & packing stack (ref. 206)	2
204		Plunger bearing, included with packing (ref. 206)	2
205	See Table 12	Spacer	1
306	See Table 14	Packing	2
307		Plunger	1
308		Fluid cylinder	1
209		O-Ring, included with check/bleed housing (ref. 210) & fluid cylinder (ref. 208)	1
210	See Table 5	Check/bleed housing	1
211		Ball, included with check/bleed housing (ref. 210)	1
212		Ball retainer, included with check/bleed housing (ref. 210)	1
213	B32191	Bleed housing	1
214	17F572	Bleed valve, included with bleed housing (ref. 213)	1
215	See Table 10	Inlet check valve	1
216	See Table 11	Outlet check valve	1
230		Plug cap	2
322		Hose	1
323		Tee	1
324		Swivel	1

**Table 5: Check/Bleed Housing**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
FKM							
210	B32539	B32477	B32477	B32477	B32478	B32478	1
FKMETP							
210	B32540	B32509	B32509	B32509	B32512	B32512	1
HNBR							
210	B32541	B32510	B32510	B32510	B32513	B32513	1
FFKM							
210	B32542	B32511	B32511	B32511	B32514	B32514	1

**Table 6: Packing Nut**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
FKM							
201	B32420	B32421	B32422	B32423	B32424	B32425	1
FKMETP							
201	B32489	B32490	B32491	B32492	B32493	B32494	1
HNBR							
201	B32496	B32497	B32498	B32499	B32500	B32501	1
FFKM							
201	B32503	B32504	B32505	B32506	B32507	B32508	1

**Table 7: Packing, including Plunger Bearing, qty 2 (ref. 204)**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
FKM							
206	B32429	B32430	B32431	B32432	B32433	B32434	1
FKMETP							
206	B32436	B32437	B32438	B32439	B32440	B32441	1
HNBR							
206	B32443	B32444	B32445	B32446	B32447	B32448	1
FFKM							
206	B32450	B32451	B32452	B32453	B32454	B32455	1
TFE/P							
206	B32882	B32883	B32884	B32885	B32886	B32887	1

**Table 8: Fluid Cylinder**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
FKM							
208	B32482	B32483	B32484	B32485	B32486	B32487	1
FKMETP							
208	B32516	B32517	B32518	B32519	B32520	B32521	1
HNBR							
208	B32523	B32524	B32525	B32526	B32527	B32528	1
FFKM							
208	B32530	B32531	B32532	B32533	B32534	B32535	1

**Table 9: Fluid Plunger**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
Ceramic-Coated							
207	B32543	B32544	B32545	B32546	B32547	B32548	1
Chromex-Coated 17-4 Stainless Steel							
207	B32060	B32061	B32062	B32063	B32064	B32065	1
Solid Ceramic							
207	---	---	B33029	B33030	B33031	B33032	1
Non-Coated 316 Stainless Steel							
207	---	B33075	B33076	B33077	---	---	1

**Table 10: Inlet Check Valve**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
FKM							
215	B32216	B32024	B32024	B32024	B32024	B32024	1
FKMETP							
215	B32218	B32026	B32026	B32026	B32026	B32026	1
HNBR							
215	B32220	B32113	B32113	B32113	B32113	B32113	1
FFKM							
215	B32222	B32028	B32028	B32028	B32028	B32028	1
TFE/P							
215	B32092	B32610	B32610	B32610	B32610	B32610	1

Parts

**Table 11: Outlet Check Valve**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
FKM							
216	B32217	B32025	B32025	B32025	B32025	B32025	1
FKMETP							
216	B32219	B32027	B32027	B32027	B32027	B32027	1
HNBR							
216	B32221	B32114	B32114	B32114	B32114	B32114	1
FFKM							
216	B32223	B32029	B32029	B32029	B32029	B32029	1
TFE/P							
216	B32087	B32608	B32608	B32608	B32608	B32608	1

**Table 12: Stainless Steel Packing Spacer Kits**

Ref	Part Numbers by Fluid Plunger Size Diameter						Qty
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	
205	B32859	B32860	B32861	B32862	B32863	B32864	1

**Table 13: Poppet Kits**

Ref	Part Numbers by Fluid Plunger Size Diameter					Qty
	FKM	FKM-ETP	HNBR	FFKM	TFE/P	
Small Poppet (Fluid Module Sizes: 3/16 in.)						
215/216	B33095	B33094	B33092	B33092	B33096	1*
Large Poppet (Fluid Module Sizes: 1/4 in., 3/8 in., 1/2 in., 5/8 in., and 3/4 in.)						
215/216	B33097	B33098	B33158	B33099	B33159	1*

\*Each kit contains five (5) of reference 215 and five (5) of reference 216.

**Table 14: No Drip Wolverine Packing Kits**

Ref	Part Numbers by Fluid Plunger Size Diameter			Qty
	1/4 in.	3/8 in.	1/2 in.	
FKMETP				
306/304	B33201	B33204	B33207	1
HNBR				
306/304	B33202	B33205	B33208	1
FFKM				
306/304	B33203	B33206	B33209	1

\*Each kit contains two of reference 306 and two of reference 304.



# Kits and Accessories

## Wolverine (All)

Part No.	Description
B32038	FKM Inlet and Outlet Check Valve Repair Kit for 1/4 in., 3/8 in. 1/2 in., 5/8 in., and 3/4 in. (includes ref. 215a, 216a, 216d)
B32224	FKM Inlet and Outlet Check Valve Repair Kit for 3/16 in. (includes ref. 215a, 216a, 216d)
B32039	FKM ETP Inlet and Outlet Check Valve Repair Kit for 1/4 in., 3/8 in. 1/2 in., 5/8 in., and 3/4 in. (includes ref. 215a, 216a, 216d)
B32225	FKM ETP Inlet and Outlet Check Valve Repair Kit for 3/16 in. (includes ref. 215a, 216a, 216d)
B32040	FFKM Inlet and Outlet Check Valve Repair Kit for 1/4 in., 3/8 in. 1/2 in., 5/8 in., and 3/4 in. (includes ref. 215a, 216a, 216d)
B32235	FFKM Inlet and Outlet Check Valve Repair Kit for 3/16 in. (includes ref. 215a, 216a, 216d)
B32111	HNBR Inlet and Outlet Check Valve Repair Kit for 1/4 in., 3/8 in. 1/2 in., 5/8 in., and 3/4 in. (includes ref. 215a, 216a, 216d)
B32234	HNBR Inlet and Outlet Check Valve Repair Kit for 3/16 in. (includes ref. 215a, 216a, 216d)
B32870	TFE/P Inlet and Outlet Check Valve Repair Kit for 1/4 in., 3/8 in., 1/2 in., 5/8 in., and 3/4 in. (includes ref. 215a, 216a, 216d)
B32871	TFE/P Inlet and Outlet Check Valve Repair Kit for 3/16 in. (includes ref. 215a, 216a, 216d)
B32157	316 SST Ball Valve Kit, 3/4 NPT(F)
B32075	Motor Brush Repair, 12 VDC (CI-12L-xxx-xxx-x) Round gearbox, terminal box on top of motor
B33047	Motor Brush Repair, 115 VAC (CI-1AD-xxx-xxx-x)
B33046	Motor Brush Repair, 12 VDC (CI-12S-xxx-xxx-x) Square gearbox, terminal box on back of motor
B33078***	115VAC Variable speed motor repair kit (for B32705)
B32045	225-750 PSI Pressure Relief Valve Kit
B32046	750-1500 PSI Pressure Relief Valve Kit
B32047	1500-2250 PSI Pressure Relief Valve Kit
B32048	2250-3000 PSI Pressure Relief Valve Kit
B32049	3000-4000 PSI Pressure Relief Valve Kit
B32050	4000-5000 PSI Pressure Relief Valve Kit
B32051	5000-6000 PSI Pressure Relief Valve Kit
B32737	Small Motor Duplex Conversion Kit (CI-12S-x0-x)
B32738	Large Motor Duplex Conversion Kit (all simplex models except CI-12S-x0-x)

B33039	Variable Speed Control Board, 115 VAC (CI-1AD-xxx-xxx-x)
B33040	Variable Speed Control Board, 24 VDC (CI-24B-xxx-xxx-x)
B33041	Variable Speed Control Board, 12 VDC (CI-12B-xxx-xxx-x)
B32881	AC Potentiometer Repair Kit
B32990	DC Potentiometer Repair Kit
B32479*	Cycle Count Accessory (ordinary location only)
B32004**	Simplex Small Motor Drive Train Repair Kit (for configuration CI-12S-x0-x)
B32005**	Duplex Small Motor Drive Train Repair Kit (for configuration CI-12S-xx-x)
B32006**	Simplex Large Motor Drive Train Repair Kit (for configurations CI-12L-x0-x, CI-12B-x0-x, CI-24B-x0-x, CI-1AL-x0-x, CI-1AD-x0-x, CI-2Ax-x0-x, and CI-4AL-x0-x)
B32008**	Duplex Large Motor Drive Train Repair Kit (for configurations CI-12L-xx-x, CI-12B-xx-x, CI-24B-xx-x, CI-1AL-xx-x, CI-1AD-xx-x, CI-2Ax-xx-x, and CI-4AL-xx-x)
B32030**	Simplex Hazardous Location (C1 D1) and ATEX (Zone 1) Drive Train Repair Kit (for configurations CI-12H-x0-x, CI-24H-x0-x, CI-3AH-x0-x, CI-4AH-x0-x, CI-24X-x0-x, CI-2AX-x0-x, and CI-5AX-x0-x)
B32031**	Duplex Hazardous Location (C1 D1) and ATEX (Zone 1) Drive Train Repair Kit (for configurations CI-12H-xx-x, CI-24H-xx-x, CI-3AH-xx-x, CI-4AH-xx-x, CI-24X-xx-x, CI-2AX-xx-x, and CI-5AX-xx-x)
B32869	Simplex Plug Kit
B33009	ATEX Motor Dust Shield
B33074	Conduit Adapter Kit; 3/4 in. to 1/2 in.
B33079	Prime ball repair kit (Includes qty. 25 of ref. 211, page 42.
B33080	Pump mount screw repair kit (includes qty 25 of ref. 6c, page 30
B33200	Legacy pump adapter kit

\* Includes ref. 91, 92, 93, 94, 95, 96, 97, and 98.

\*\* Includes ref. 7, 9a, 9b, 9c, 9d, 10, 11, 13, 14, 15, 16, 17, and 109.

\*\*\* Includes rear bearing (1x), input shaft seal (1x), Gearbox bearing (1x), motor body O-rings (2x), and brush cap o-rings

## Wolverine Advanced, Hazardous Location (C1 D1), ATEX, and Continuous Injection (C1 D2) Fluid Module Kits

Seal Material	Fluid Module Kits by Plunger Size*					
	3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.
Chromex-Coated Plunger						
FKM	A30300	A30400	A30500	A30600	A30700	A30800
FKM ETP	A30301	A30401	A30501	A30601	A30701	A30801
HNBR	A30302	A30402	A30502	A30602	A30702	A30802
FFKM	A30303	A30403	A30503	A30603	A30703	A30803
TFE/P	A30304	A30404	A30504	A30604	A30704	A30804
Ceramic-Coated Plunger						
FKM	A30310	A30410	A30510	A30610	A30710	A30810
FKM ETP	A30311	A30411	A30511	A30611	A30711	A30811
HNBR	A30312	A30412	A30512	A30612	A30712	A30812
FFKM	A30313	A30413	A30513	A30613	A30713	A30813
TFE/P	A30314	A30414	A30514	A30614	A30714	A30814
Solid Ceramic Plunger and Ceramic-Coated Wetted Section						
FKM	N/A	N/A	N/A	N/A	N/A	N/A
FKM ETP	N/A	N/A	N/A	N/A	N/A	N/A
HNBR	N/A	N/A	N/A	N/A	N/A	N/A
FFKM	N/A	N/A	A30513T12	A30613T12	A30713T12	A30813T12
TFE/P	N/A	N/A	N/A	N/A	N/A	N/A

\* Includes ref. 201-216.

Fluid Module Seal Conversion Kits by Plunger Size**					
3/16 in.	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.
FKM					
B32549	B32550	B32551	B32552	B32553	B32554
FKMETP					
B32555	B32556	B32557	B32558	B32559	B32560
HNBR					
B32561	B32562	B32563	B32564	B32565	B32566
FFKM					
B32567	B32568	B32569	B32570	B32571	B32572

\*\* Includes ref. 202, 203, 204, 206, and 209.

**NOTE:** A 1 cc grease packet and a new O-ring for the outlet check valve are also included in conversion kits.

Check Valve Poppet Kits by Seal Material***				
FKM	FKM-ETP	FFKM	HNBR	TFE/P
Small Poppet				
B33095	B33094	B33093	B33092	B33096
Large Poppet				
B33097	B33098	B33099	B33158	B33159

\*\*\* Includes five each of Ref. 216a and 216b

## Wolverine Advanced, Hazardous Location (C1 D1), ATEX, and Continuous Injection (C1 D2) Drive Module Kits

### Small Motor (Advanced)

Simplex (25:38:50)	Simplex (19:63:75)	Duplex Side 1 - 25:38:50 Side 2 - 25:38:50	Duplex Side 1 - 19:63:75 Side 2 - 19:63:75	Duplex Side 1 - 19:63:75 Side 2 - 25:38:50	Duplex Side 1 - 25:38:50 Side 2 - 19:63:75
<b>12 VDC</b>					
A30000	A30003	A30001	A30005	A30004	A30002

### Medium Motor (Advanced)

Simplex (25:38:50)	Simplex (19:63:75)	Duplex Side 1 - 25:38:50 Side 2 - 25:38:50	Duplex Side 1 - 19:63:75 Side 2 - 19:63:75	Duplex Side 1 - 19:63:75 Side 2 - 25:38:50	Duplex Side 1 - 25:38:50 Side 2 - 19:63:75
<b>115 VAC</b>					
A30095	A30097	A30096	A30098	---	---

### Large Motor (Advanced)

Simplex (25:38:50)	Simplex (19:63:75)	Duplex Side 1 - 25:38:50 Side 2 - 25:38:50	Duplex Side 1 - 19:63:75 Side 2 - 19:63:75	Duplex Side 1 - 19:63:75 Side 2 - 25:38:50	Duplex Side 1 - 25:38:50 Side 2 - 19:63:75
<b>12 VDC</b>					
A30020	A30023	A30021	A30025	A30024	A30022
<b>115 VAC</b>					
A30040	A30043	A30041	A30045	A30044	A30042
<b>115 VAC Harrier AC</b>					
A30170	A30173	A30171	A30175	A30174	A30172
<b>115 VAC Variable Speed</b>					
A30260	A30263	A30261	A30265	A30264	A30262
<b>230 VAC</b>					
A30060	A30063	A30061	A30065	A30064	A30062
<b>230 VAC Harrier AC</b>					
A30188	A30191	A30189	A30193	A30192	A30190
<b>230/480 VAC 3 Phase</b>					
A30080	A30083	A30081	A30085	A30084	A30082

**Hazardous Location (C1 D1)**

Simplex (25:38:50)	Simplex (19:63:75)	Duplex Side 1 - 25:38:50 Side 2 - 25:38:50	Duplex Side 1 - 19:63:75 Side 2 - 19:63:75	Duplex Side 1 - 19:63:75 Side 2 - 25:38:50	Duplex Side 1 - 25:38:50 Side 2 - 19:63:75
<b>12 VDC</b>					
A30100	A30103	A30101	A30105	A30104	A30102
<b>24 VDC</b>					
A30120	A30123	A30121	A30125	A30124	A30122
<b>115/230 VAC Hazardous Location</b>					
A30140	A30143	A30141	A30145	A30144	A30142
<b>230/480 VAC 3 Phase</b>					
A30160	A30163	A30161	A30165	A30164	A30162

**Continuous Injection (C1 D2)**

Simplex (25:38:50)	Simplex (19:63:75)	Duplex Side 1 - 25:38:50 Side 2 - 25:38:50	Duplex Side 1 - 19:63:75 Side 2 - 19:63:75	Duplex Side 1 - 19:63:75 Side 2 - 25:38:50	Duplex Side 1 - 25:38:50 Side 2 - 19:63:75
<b>12 VDC</b>					
A30200	A30203	A30201	A30205	A30204	A30202
<b>24 VDC</b>					
A30210	A30213	A30211	A30215	A30214	A30212

**ATEX**

Simplex (25:38:50)	Simplex (19:63:75)	Duplex Side 1 - 25:38:50 Side 2 - 25:38:50	Duplex Side 1 - 19:63:75 Side 2 - 19:63:75	Duplex Side 1 - 19:63:75 Side 2 - 25:38:50	Duplex Side 1 - 25:38:50 Side 2 - 19:63:75
<b>24 VDC</b>					
A30126	A30128	A30127	A30129	---	---
<b>230 VAC ATEX</b>					
A30072	A30074	A30073	A30075	---	---
<b>230/400 VAC ATEX 3 PHASE</b>					
A30166	A30168	A30167	A30169	---	---

# Performance Charts

## Wolverine Advanced Pumps

### 3/16 in. Plunger

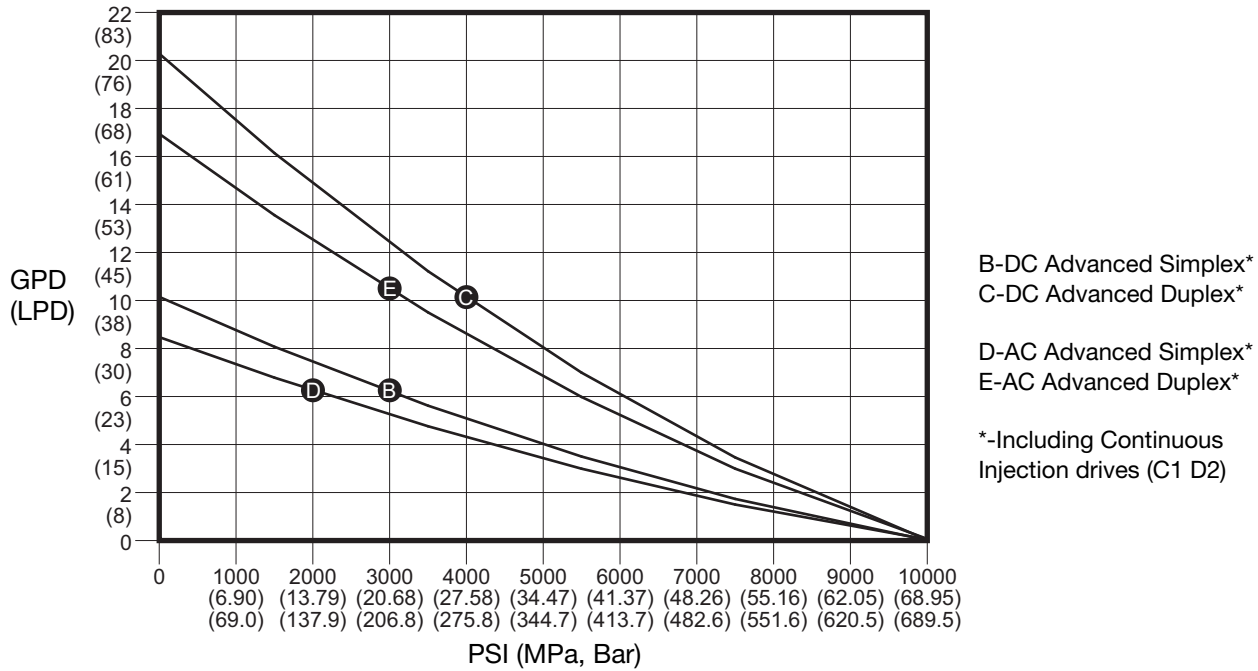


FIG. 31

### 1/4 in. Plunger

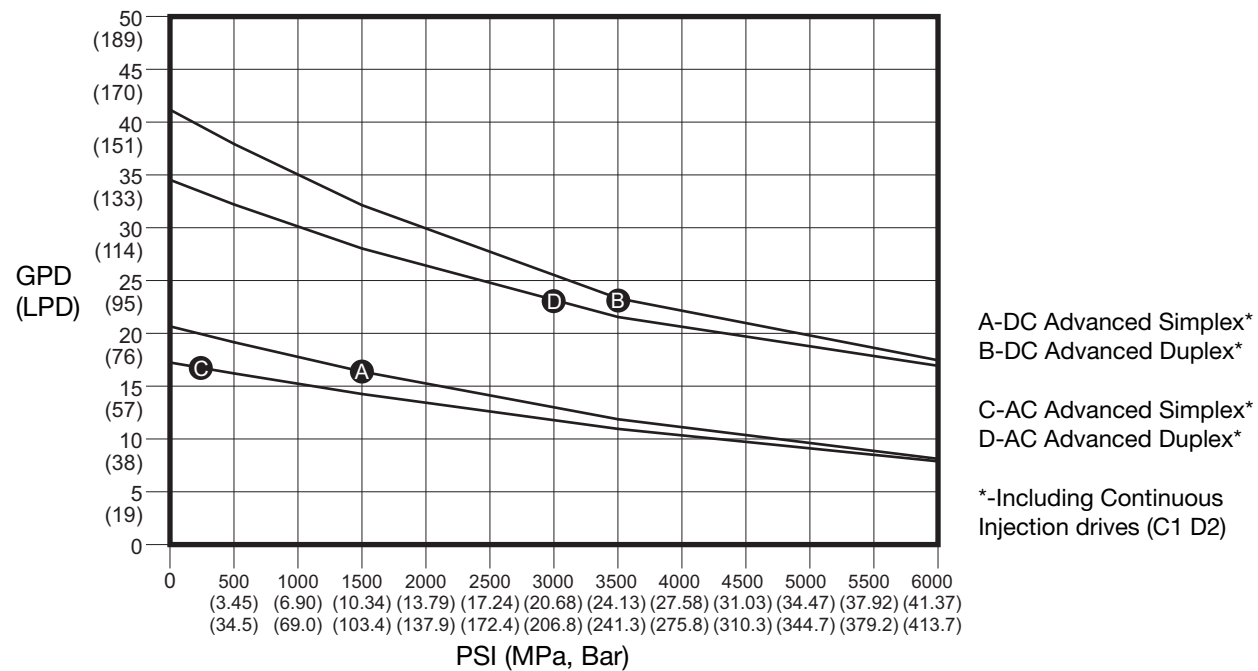
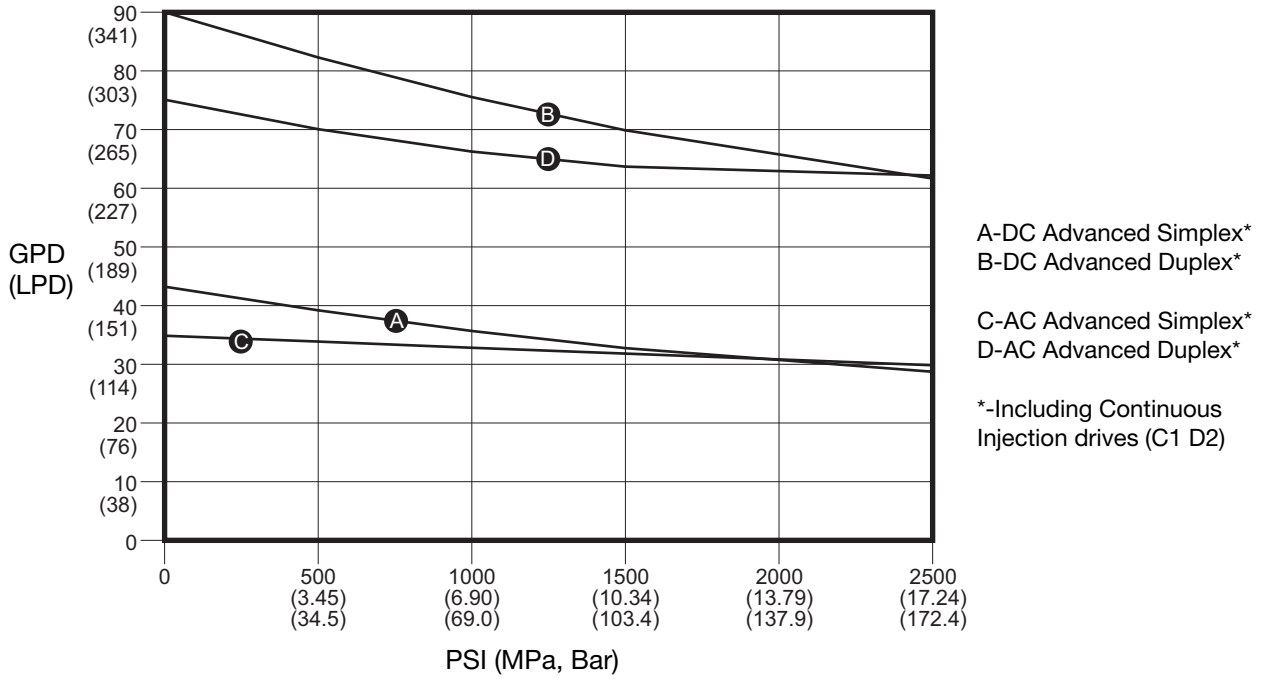


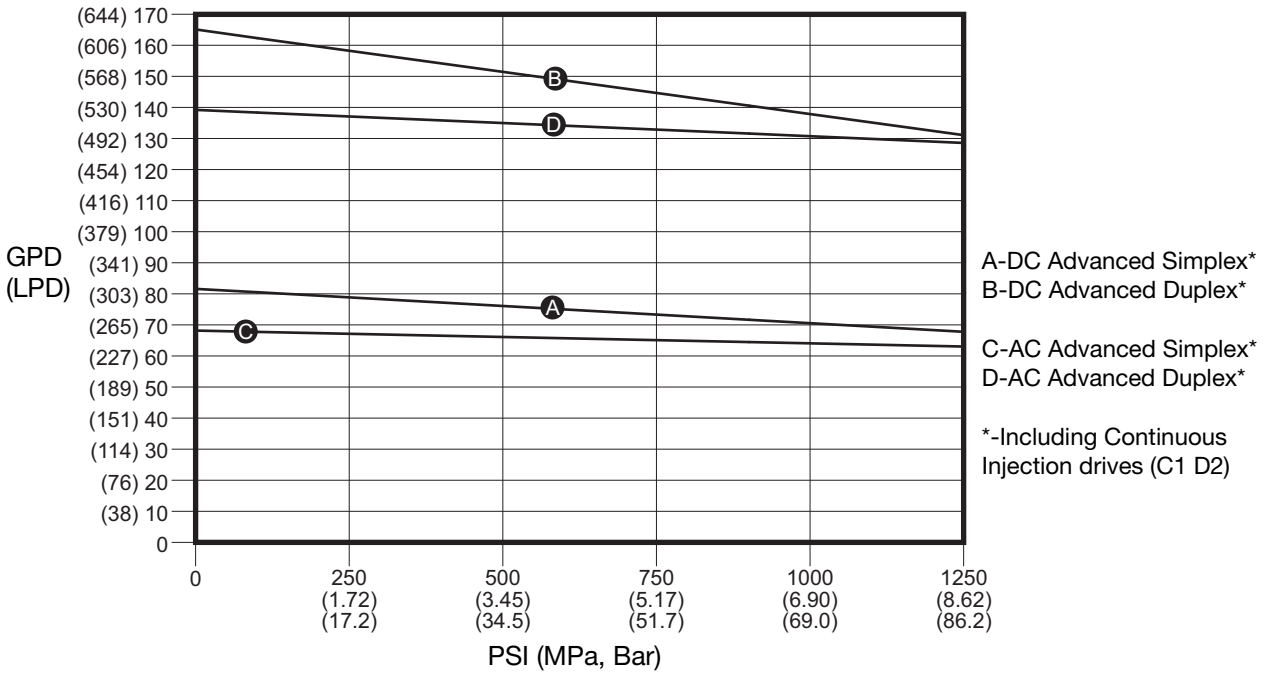
FIG. 32

**3/8 in. Plunger**



**FIG. 33**

**1/2 in. Plunger**



**FIG. 34**

5/8 in. Plunger

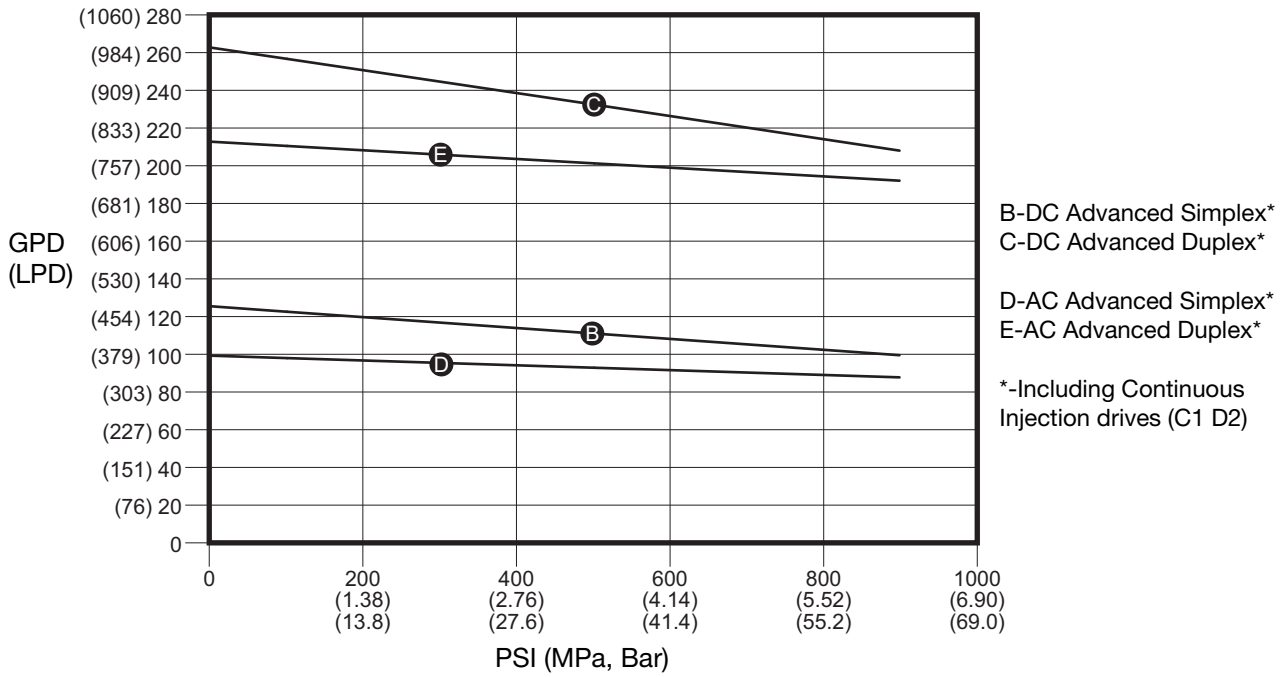


FIG. 35

3/4 in. Plunger

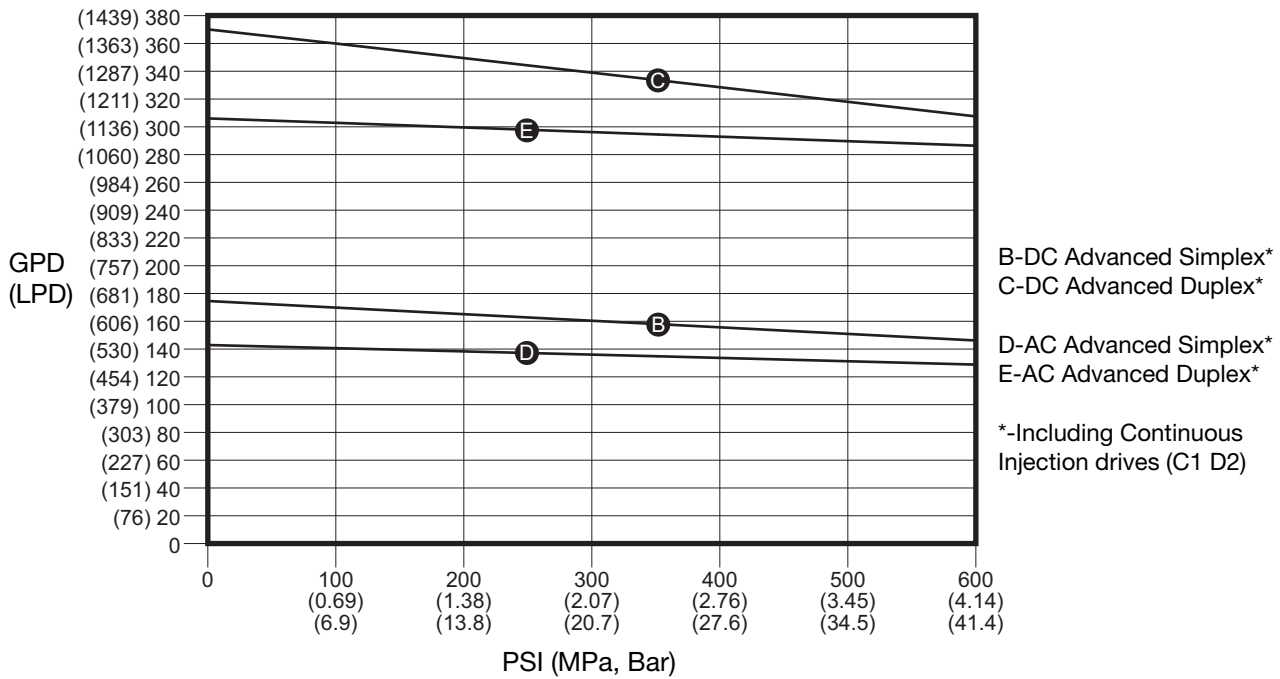


FIG. 36



## Wolverine Hazardous Location Pumps (C1 D1) and ATEX

### 3/16 in. Plunger

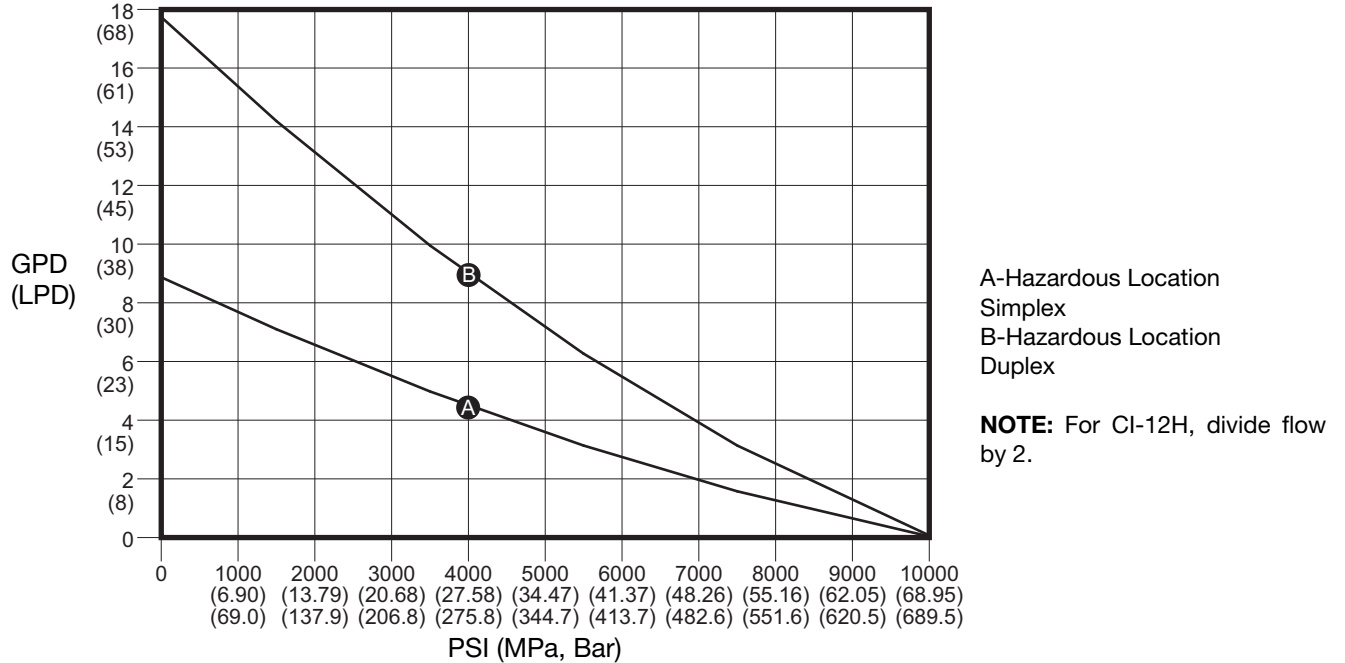


FIG. 37

### 1/4 in. Plunger

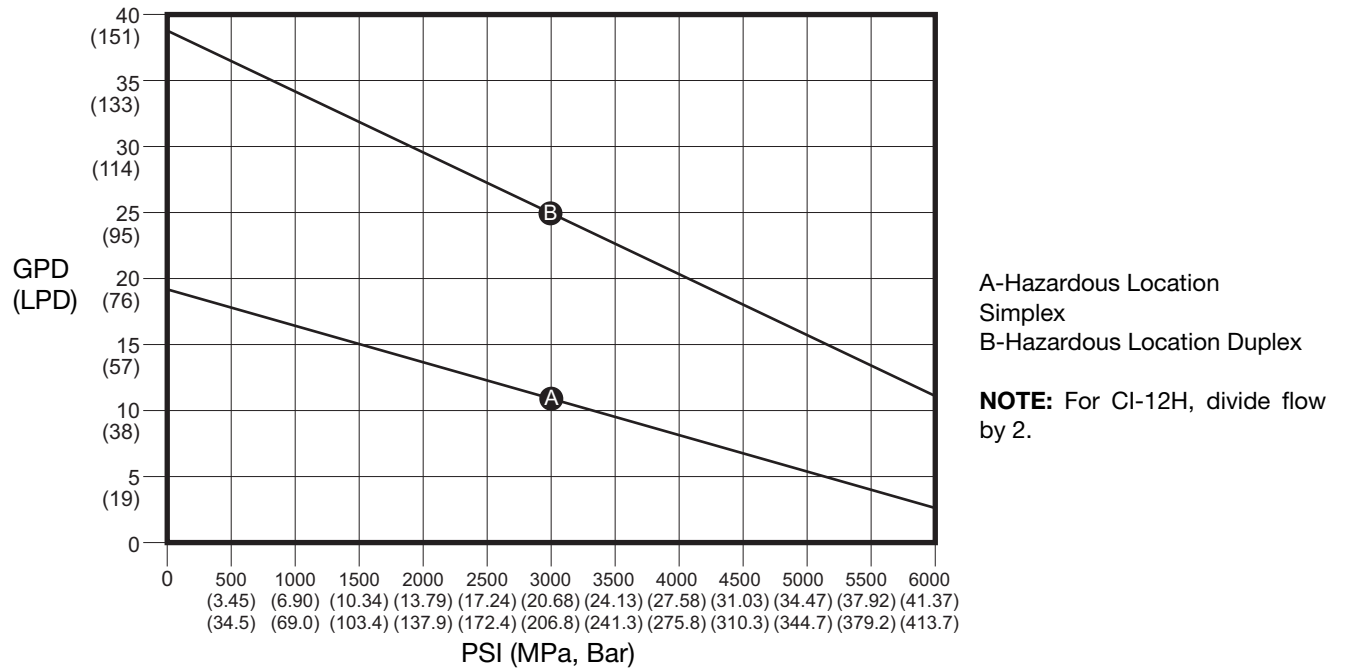
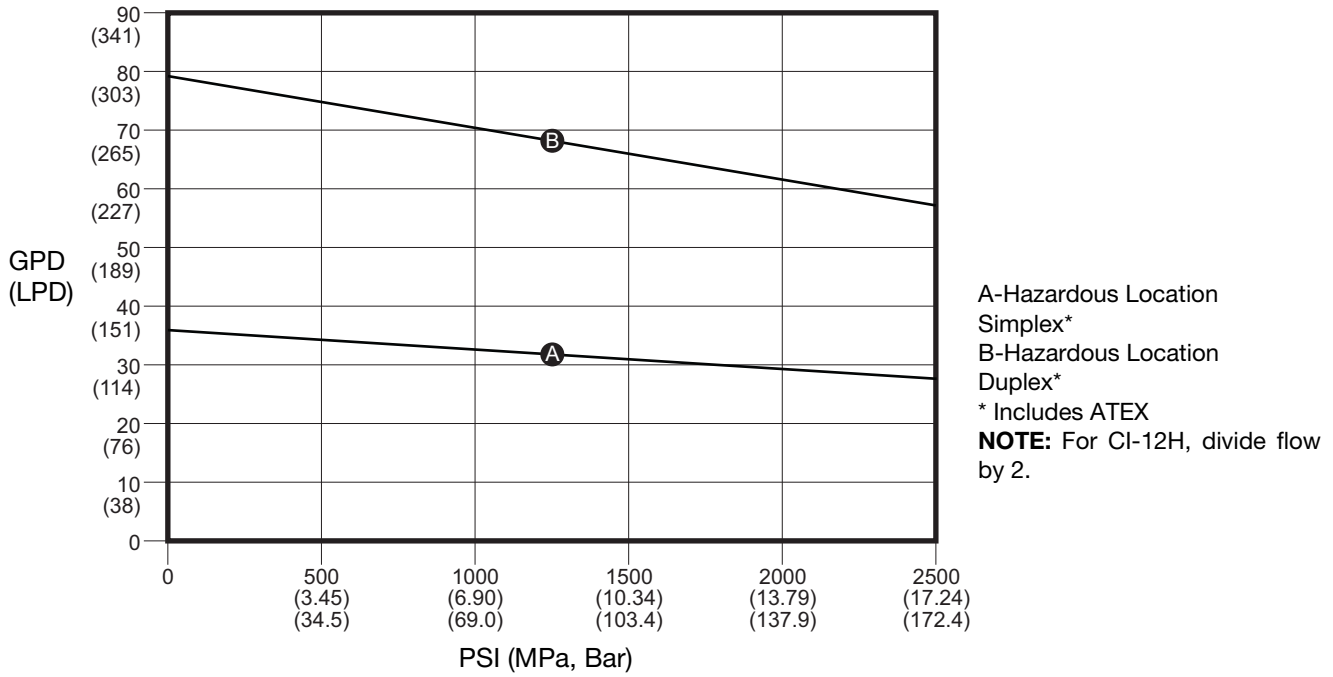


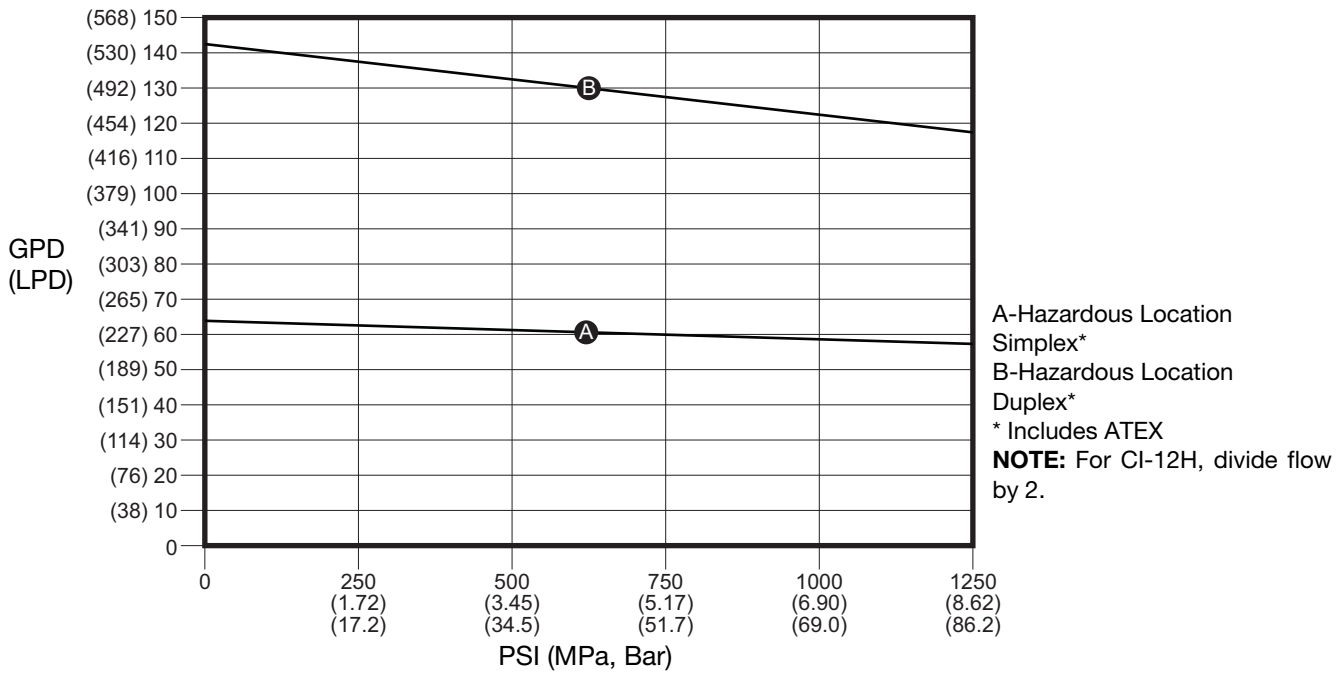
FIG. 38

**3/8 in. Plunger**



**FIG. 39**

**1/2 in. Plunger**



**FIG. 40**

5/8 in. Plunger

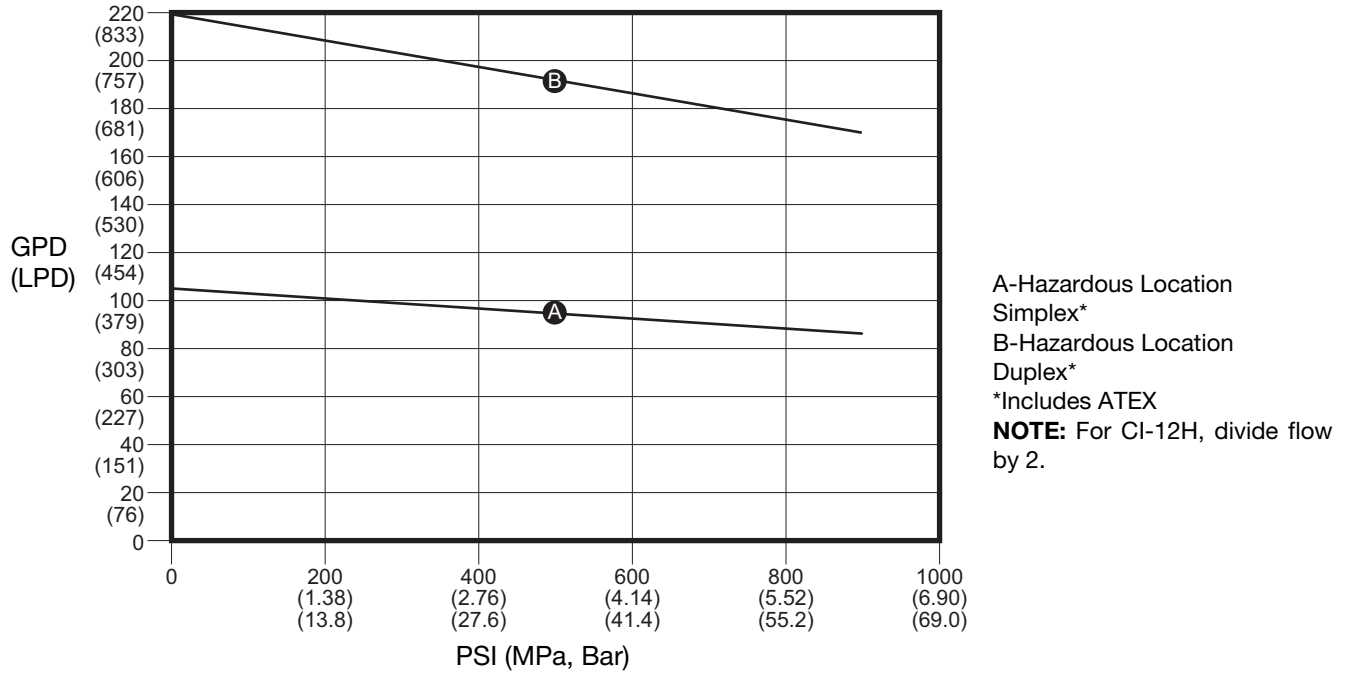


FIG. 41

3/4 in. Plunger

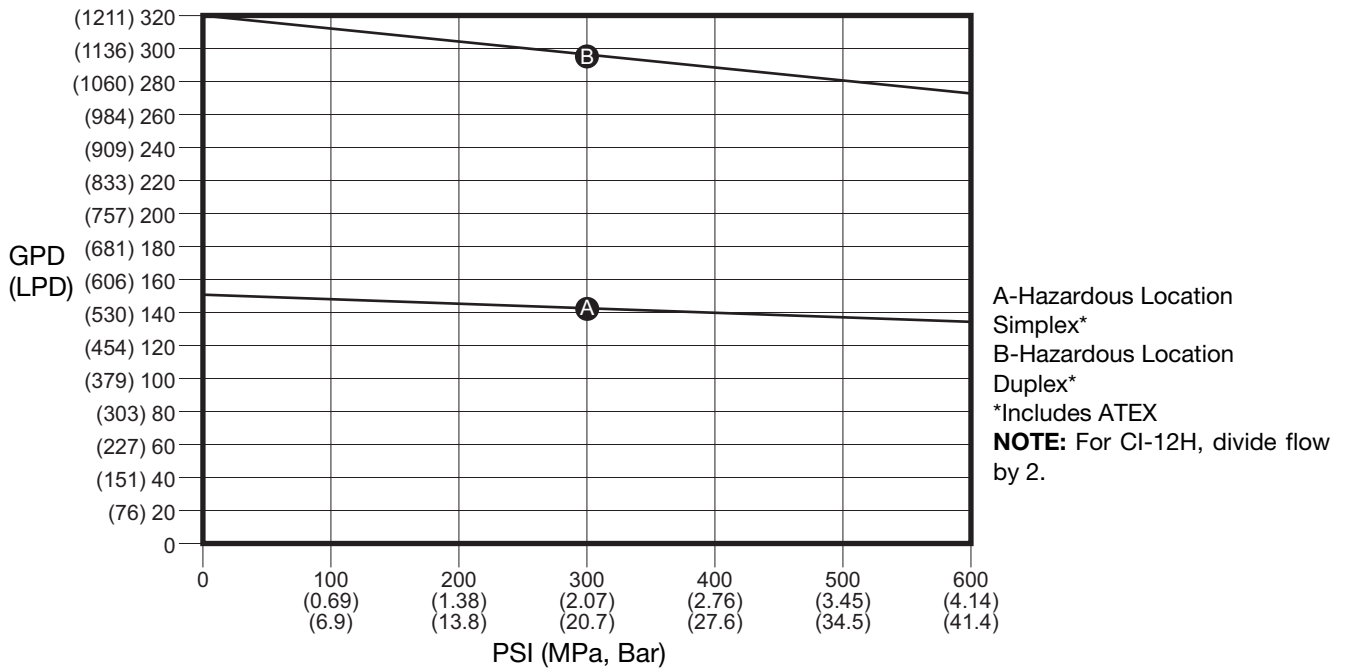
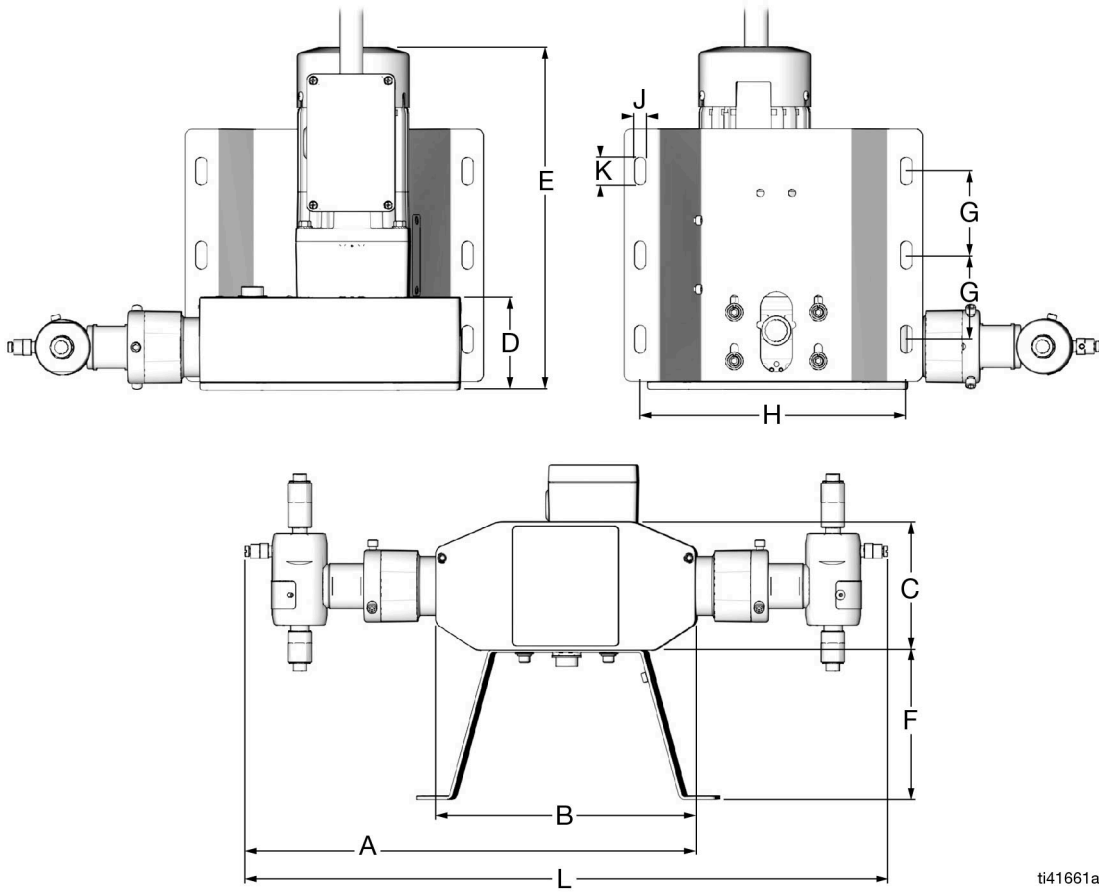


FIG. 42

# Dimensions

## Wolverine Advanced Pump Dimensions

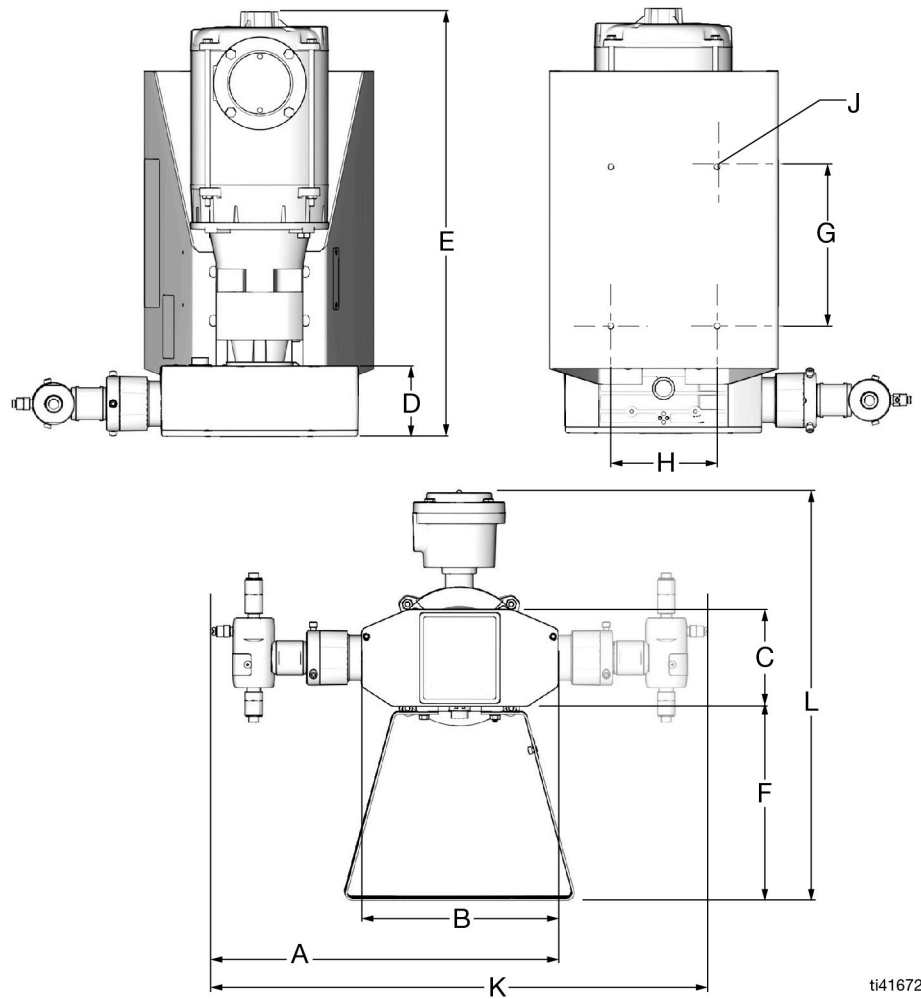


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**FIG. 43 Wolverine Advanced Pump Dimensions**

A	B	C	D	E	F	G	H	J	K	L
16.3 in. (41.4 cm)	8.9 in. (22.6 cm)	4.5 in. (11.4 cm)	2.85 in. (7.2 cm)	11.9 in. (30.2 cm)	5.34 in. (13.56 cm)	3.0 in. (7.62 cm)	9.48 in. (24.08 cm)	0.41 in. (1.04 cm)	1.00 in. (2.54 cm)	23.7 in. (60.2 cm)

## Wolverine Hazardous Location (C1 D1) Pump Dimensions

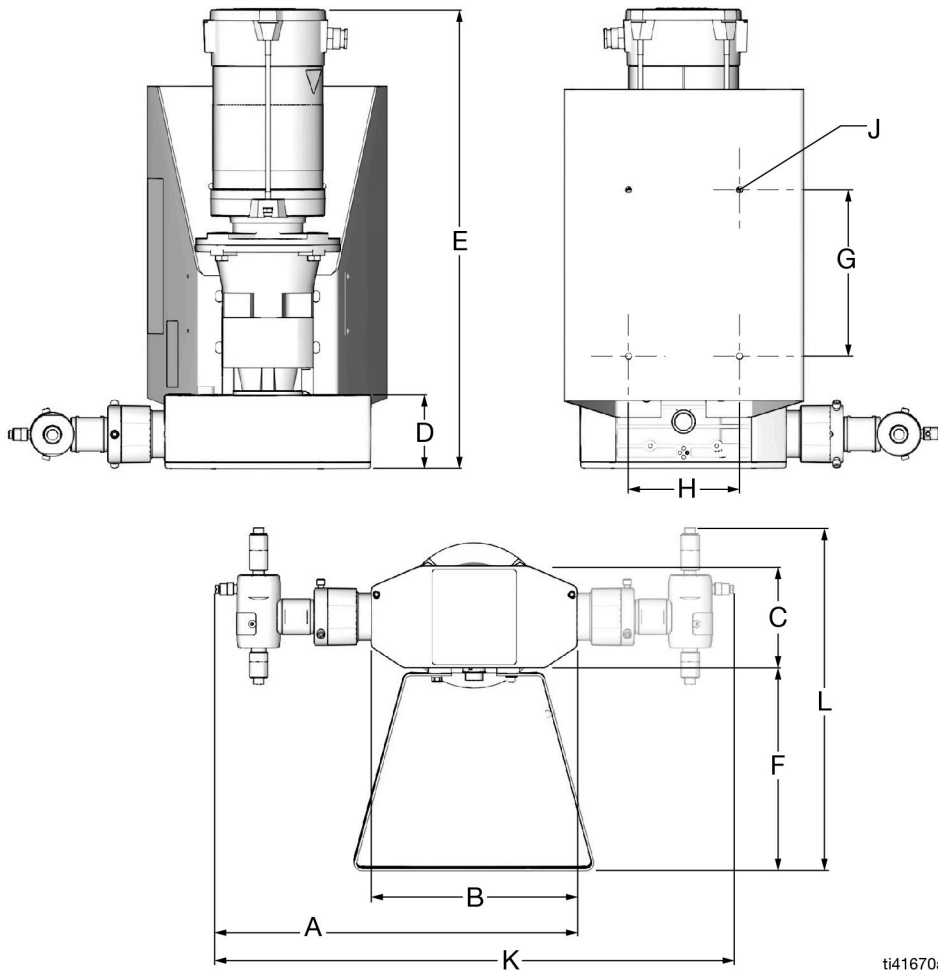


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**FIG. 44 Wolverine Hazardous Location Pump Dimensions**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>J</b>	<b>K</b>	<b>L</b>
<b>AC Pump</b>	16.3 in. (41.4 cm)	8.9 in. (22.6 cm)	4.5 in. (11.4 cm)	2.85 in. (7.2 cm)	19.6 in. (49.8 cm)	9.6 in. (25.1 cm)	7.5 in. (19.8 cm)	5.0 in. (12.7 cm)	0.281 in. dia (0.714 cm)	23.7 in. (60.2 cm)	19.6 in. (49.8 cm)
<b>DC Pump</b>	16.3 in. (41.4 cm)	8.9 in. (22.6 cm)	4.5 in. (11.4 cm)	2.85 in. (7.2 cm)	17.6 in. (44.7 cm)	9.6 in. (25.1 cm)	7.5 in. (19.8 cm)	5.0 in. (12.7 cm)	0.281 in. dia (0.714 cm)	23.7 in. (60.2 cm)	--

## Wolverine ATEX Pump Dimensions

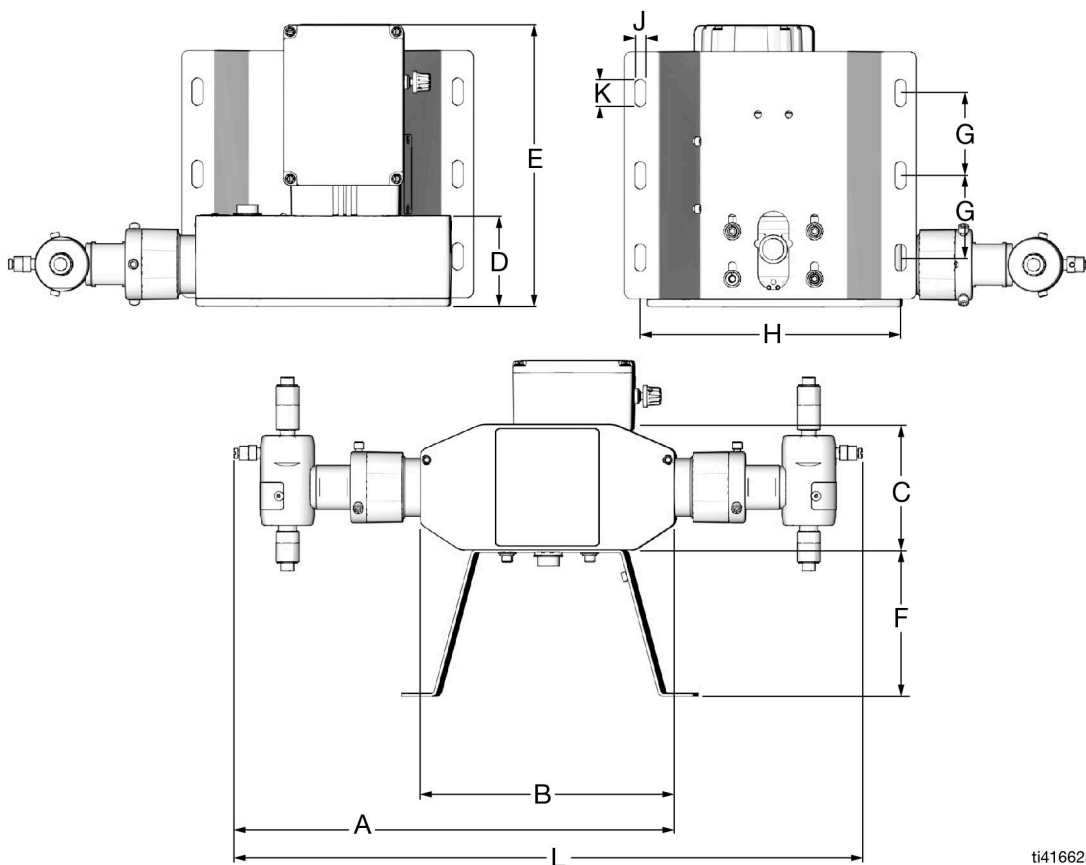


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**Fig. 45 Wolverine Hazardous Location Pump Dimensions**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>J</b>	<b>K</b>	<b>L</b>
<b>AC Pump</b>	16.3 in. (41.4 cm)	8.9 in. (22.6 cm)	4.5 in. (11.4 cm)	2.85 in. (7.2 cm)	20.63 in. (52.4 cm)	9.6 in. (25.1 cm)	7.5 in. (19.8 cm)	5.0 in. (12.7 cm)	0.281 in. dia (0.714 cm)	23.7 in. (60.2 cm)	14.19 in. (36.0 cm)
<b>DC Pump</b>	16.3 in. (41.4 cm)	8.9 in. (22.6 cm)	4.5 in. (11.4 cm)	2.85 in. (7.2 cm)	20.52 in. (52.1 cm)	9.6 in. (25.1 cm)	7.5 in. (19.8 cm)	5.0 in. (12.7 cm)	0.281 in. dia (0.714 cm)	23.7 in. (60.2 cm)	14.85 in. (37.7 cm)

# Wolverine Continuous Injection (C1 D2) Pump Dimensions



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**FIG. 46 Wolverine Continuous Injection Pump Dimensions**

A	B	C	D	E	F	G	H	J	K	L
16.3 in. (41.4 cm)	8.9 in. (22.6 cm)	4.5 in. (11.4 cm)	2.85 in. (7.2 cm)	10.8 in. (27.3 cm)	5.34 in. (13.56 cm)	3.0 in. (7.62 cm)	9.48 in. (24.08 cm)	0.41 in. (1.04 cm)	1.00 in. (2.54 cm)	23.7 in. (60.2 cm)

# Technical Specifications

<b>Wolverine Chemical Injection Pump</b>		
	<b>US</b>	<b>Metric</b>
Maximum fluid working pressure	Varies by model, see <b>Models and Approvals</b> , page 3	
Input Voltage (by <b>Drive Modules</b> , page 3)		
CI-12x-xx-x	12 VDC	
CI-24x-xx-x	24 VDC	
CI-1Ax-xx-x	115 VAC	
CI-2Ax-xx-x	230 VAC	
CI-3Ax-xx-x	115 VAC or 230 VAC 3 Single Phase	
CI-4Ax-xx-x	230 VAC or 460 VAC 3 Phase	
Maximum Input Current (by <b>Drive Modules</b> , page 3)		
CI-12S-xx-x	11 A @ 12 VDC	
CI-12L-xx-x	16 A @ 12 VDC	
CI-12B-xx-x	16 A @ 12 VDC	
CI-12H-xx-x	23 A @ 12 VDC (Intermittent duty cycle, see page 22)	
CI-24H-xx-x	12 A @ 24 VDC	
CI-24B-xx-x	11 A @ 24 VDC	
CI-1AL-xx-x	2.0 A @ 110 VAC Single Phase	
CI-1AD-xx-x	3.0 A @ 110 VAC Single Phase	
CI-1AJ-xx-x	2.0 A @ 110 VAC Single Phase	
CI-2Ax-xx-x	1.2 A @ 230 VAC Single Phase	
CI-3AH-xx-x	4.8 A @ 110 VAC Single Phase	
CI-3AH-xx-x	2.4 A @ 230 VAC Single Phase	
CI-4AL-xx-x	0.59 A @ 230 VAC 3 Phase	
CI-4AL-xx-x	0.30 A @ 460 VAC 3 Phase	
CI-4AH-xx-x	1.1 A @ 230 VAC 3 Phase (Not VFD rated)	
CI-4AH-xx-x	0.55 A @ 460 VAC 3 Phase (Not VFD rated)	
CI-24X-xx-x	11.5 A @ 24 VDC	
CI-2AX-xx-x	1.5 A @ 230 VAC Single Phase	
CI-5AX-xx-x	2.0 A @ 230 VAC 3 Phase	
CI-5AX-xx-x	1.0 A @ 400 VAC 3 Phase	
Power Connection	See <b>Motor Electrical Connections</b> , page 16	
<b>Environmental Temperature Range</b>		
CI-xxS-xx-x, CI-xxL-xx-x	-40° - 176°F	-40° - 80°C
CI-1AJ-xx-x	-40° - 131°F	-40° - 55°C
CI-xxH-xx-x, CI-xxD-xx-x	-13° - 104°F	-25° - 40°C
CI-xxB-xx-x	-4° - 104°F	-20° - 40°C
CI-xxX-xx-x	-4° - 140°F	-20° - 60°C
<b>Noise (dBa)</b>		
Maximum sound pressure	< 70 dBa	
<b>Inlet/Outlet Sizes</b>		
Fluid inlet size	1/4 NPT(F)	
Fluid outlet size	1/4 NPT(F)	



<b>Wolverine Chemical Injection Pump</b>		
	<b>US</b>	<b>Metric</b>
<b>Materials of Construction</b>		
Pump/Check Valve Seal Material	See <b>Configuration Chart</b> on page 7 for seal material. All other packing materials are PEEK and PTFE unless otherwise noted.	
Wetted Parts	See <b>Configuration Chart</b> on page 7 for plunger material. All other materials are 316 stainless steel unless otherwise noted.	
<b>Weight</b>		
Wolverine Advanced/Continuous Injection, 1 pump (Simplex)	35 lb.	16 kg
Wolverine Advanced/Continuous Injection, 2 pumps (Duplex)	39 lb.	18 kg
Wolverine Hazardous Location, 1 pump (Simplex)	72 lb.	33 kg
Wolverine Hazardous Location, 2 pumps (Duplex)	76 lb.	34 kg

## California Proposition 65

### CALIFORNIA RESIDENTS

 **WARNING:** Cancer and reproductive harm – [www.P65warnings.ca.gov](http://www.P65warnings.ca.gov).

# Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

**THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

**GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO.** These items sold, but not manufactured by Graco (such as electric motors, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

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# Graco Information

For the latest information about Graco products, visit [www.graco.com](http://www.graco.com).

For patent information, see [www.graco.com/patents](http://www.graco.com/patents).

**TO PLACE AN ORDER**, contact your Graco distributor or call to identify the nearest distributor.

**Phone:** 612-623-6928 **or Toll Free:** 1-800-533-9655, **Fax:** 612-378-3590

*All written and visual data contained in this document reflects the latest product information available at the time of publication. Graco reserves the right to make changes at any time without notice.*

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