



Tuthill Pump Group  
12500 South Pulaski Road  
Alsip, IL 60803  
USA  
o 708.389.2500  
f 708.388.0869

**Service Instruction No. 40**

# **Installation and Service Instructions**

## **4000 Series Pumps**

## Table of Contents

Page 3:	Introduction
Page 3-4:	General Description
Page 4:	Pumping Principle
Page 5:	4000 Model General Flow and Pressure Information
Page 5:	4100 Model Materials of Construction
Page 6:	4200/4300 Model Materials of Construction
Page 7:	4000 Model Temperature Limits
Page 8-9:	Location & Installation
Page 9-10:	Method of Drive
Page 10-11:	Relief Valve Protection
Page 11:	Strainer Protection
Page 12:	Startup
Page 14-15:	4101-4108 & 4121-4128 Seal Replacement
Page 15:	4101-4108 & 4121-4128 Pump Disassembly
Page 15-16:	4101-4108 & 4121-4128 Inspection
Page 16:	4101-4108 & 4121-4128 Pump Assembly & Changing Rotation
Page 17:	4212-4216 & 4232-4236 Lubrication
Page 17-18:	4212-4216 & 4232-4236 Repacking
Page 18:	4212-4216 & 4232-4236 Pump Disassembly & Inspection & Pump Assembly
Page 19:	4312-4316 Seal Replacement
Page 20-21:	4332-4336 Seal Replacement and Resetting of Clearances
Page 21:	4312-4316 & 4332-4336 Pump Disassembly & Inspection & Pump Assembly
Page 22-23:	Changing Rotation
Page 25:	Troubleshooting
Page 26:	Warranty & Tuthill Contact Information

## Introduction

The 4000 Series pumps, **except 4212-4216 & 4222-4226 models**, have been certified to the requirements of the ATEX Directive 94/9/EC for use in Category II, Group 2 G applications. Read this manual before operating or working on the 4000 Series pumps. If additional information is required to facilitate operation or maintenance, contact the authorized Tuthill distributor shown at the back of this service manual.

4100 & 4300 Series pumps are compact, highly efficient, cast iron, positive displacement rotary pumps with mechanical seals and have been designed and manufactured to provide years of service under normal operating conditions.

Illustrations used in this manual are for reference purposes only. Consult the factory or an authorized Tuthill distributor for proper part identification.

When ordering replacement parts, provide as much detail as possible to ensure correct parts are provided. Details should include the full model number, name of part, and part number (if known).

## General Description

### Models 4101-4108 & 4121-4128:

Tuthill's 4100 and 4120 pumps are available in six sizes each, with nominal capacities ranging from 0.5 to 12.9 GPM (1.9 to 49 LPM). These pumps can handle inlet pressure to 250 PSI (17 bar) and differential pressure to 500 PSI (34 bar) and have a maximum discharge pressure of 500 PSI (17 bar). Differential and maximum pressure is limited to 300 PSI (20 bar) in models 4108/4128. These pumps are self-priming and particularly suited to handle liquids of 35 to 1000 SSU (2 to 200 centipoise.) Higher viscosities can be handled at reduced speeds.

A mounting foot is available as an option, as is an internal relief valve. These pumps are bi-rotational (unless outfitted with the optional relief valve) and designed for direct drive at standard motor speeds, with modifications available for indirect drive.

Model 4100 pumps include a mechanical seal and carbon graphite idler and housing bushings.

Model 4120 pumps include an abrasion resistant mechanical seal, carbon graphite idler bushing, ceramic housing bushing, Tutrided cover and induction hardened rotor.

### Models 4312-4316 & 4332-4336:

Models 4300 and 4320 are flange mount pumps with mechanical seal. They are available in five sizes each with capacities from 6 to 84 GPM (23 to 318 LPM.) These pumps can handle inlet pressure to 250 PSI (17 bar), maximum discharge pressure to 300 PSI (20 bar), and differential pressure to 150 PSI (10 bar.) A mounting foot is optional.

Model 4300 pumps include a mechanical seal, carbon graphite idler and bracket bushings.

Model 4320 pumps include an abrasion resistant mechanical seal, carbon graphite idler bushing, ceramic bracket bushing, Tutrided cover, induction hardened rotor and adjustable thrust bearing feature.

### Models 4212-4216 & 4222-4226:

Models 4200 and 4220 are available in five sizes each, ranging in nominal capacity from 6 to 84 GPM (23 to 318 LPM). Maximum inlet pressure capability is 25 PSI (2 bar) and maximum differential pressure capability is 100 PSI (7 bar). Maximum pump discharge pressure is 125 PSI (8.6 bar).

These pumps have an integrally-cast mounting foot, are suitable for driving at direct motor speeds and will pump equally well in either direction of rotation (unless supplied with the optional relief valve.) They are equipped with Teflon packing and an adjustable packing gland.

Model 4200 pumps include carbon graphite idler and bracket bushings.

Model 4220 pumps include a carbon graphite idler bushing, ceramic bracket bushing, Tuttrid cover and induction hardened rotor.

### The Pumping Principle

Tuthill 4000 Series cast iron pumps employ the internal gear pumping principle. There are only two moving parts. Pumping action is based on a rotor, idler gear, and crescent-shaped partition cast integral with the cover.

Power applied to the rotor is transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the crescent.

As the pump starts, the teeth come out of mesh, increasing the volume. This creates a partial vacuum, drawing the liquid into the pump through the suction port.

The liquid fills the spaces between the teeth of the idler and the rotor and is carried past the crescent partition through the pressure side of the pump.

When the teeth mesh on the pressure side, the liquid is forced from the spaces and out through the discharge port.



## 4000 Model Pumps:

Size	Max Speed	Capacity		Max. Pressure		Weight	
		GPM	LPM	PSI	Bar	LBS	KG
4101/4121	1800	.3	1.1	500	34.3	4	1.8
4102/4122	1800	.8	3.0	500	34.3	5	2.3
4103/4123	1800	1.6	6.0	500	34.3	5	2.3
4104/4124	1800	2.7	10.2	500	34.3	6	2.7
4105/4125	1800	4.9	18.5	500	34.3	9	4.1
4108/4128	1800	12.9	48.9	300	20.6	17	7.7

4312/4332	1800	8	30	300	20.6	12	5.4
4313/4333	1800	17	64	300	20.6	20	9.1
4314/4334	1800	36	136	300	20.6	25	11.3
4315/4335	1800	61	231	300	20.6	45	20.4
4316/4336	1800	84	318	300	20.6	50	22.7

\* Capacity based on pumping fluid of 200 SSU (40 cps) viscosity at 100 PSI (7 Bar) at 1750 RPM.

## 4100 Pump Materials of Construction:

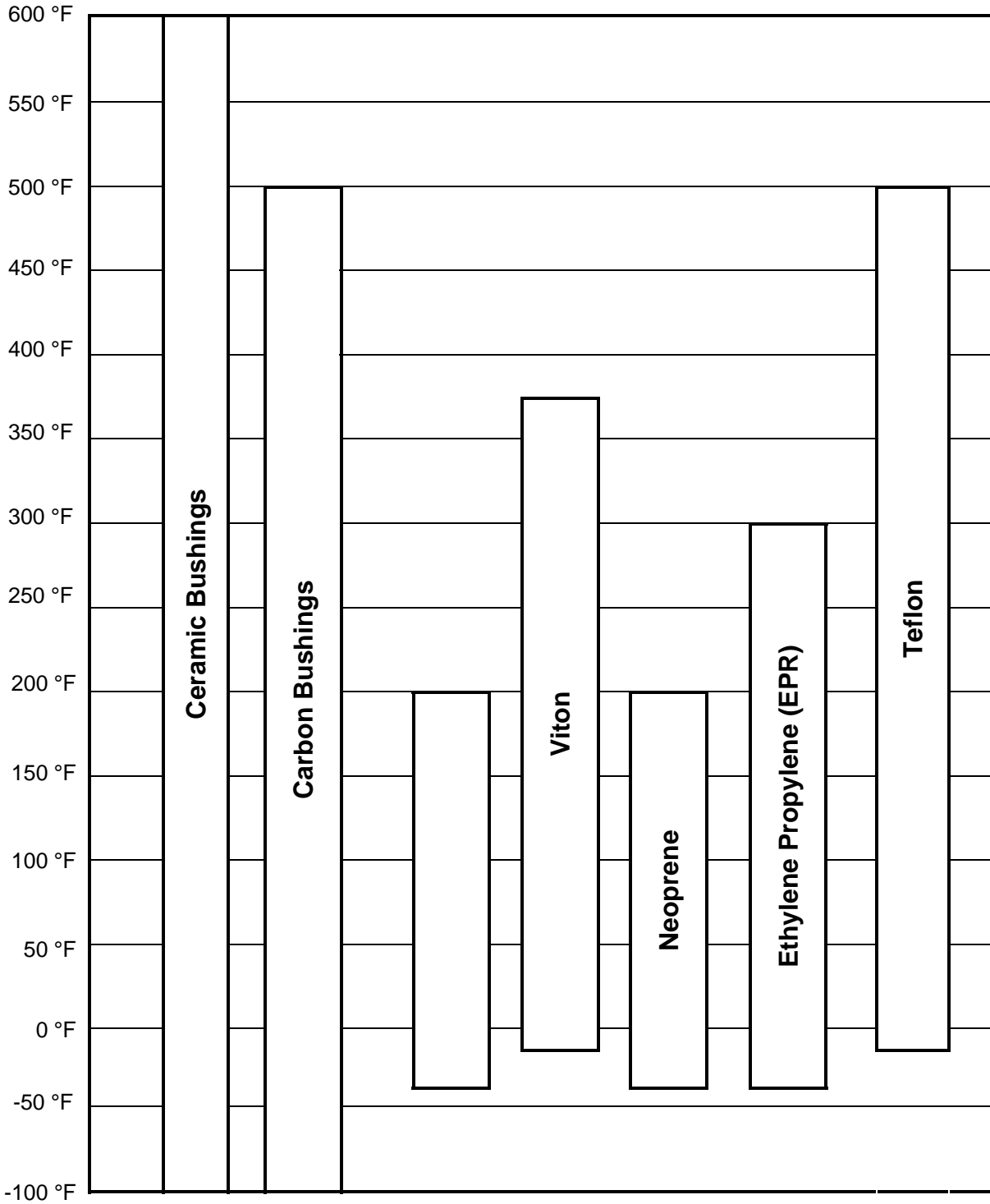
<b>Part Name</b>	<b>Material</b>	<b>Standard</b>	<b>Comments</b>	<b>Availability</b>
Housing	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
Housing Bushing	Carbon	Carbon Graphite Resin		Std.
	Ceramic	Alumina Ceramic, Diamonite	Standard on 4120 Models	Opt.
Cover	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
	Cast Iron	ASTM A48 – 96a	Heat Treated (Standard on 4120 Models)	Opt.
Rotor	Steel	ASTM A311	Stressproof	Std.
	Steel	ASTM A311	Stressproof and Heat Treated (Standard on 4120 Models)	Opt.
Idler	Steel	C1118 or C1117		Std.
Idler Pin	Steel	C1117	Heat Treated	Std.
Idler Bushing	Carbon	Carbon Graphite Resin		Std.
Housing Plug	Steel	AISI 12L14	DU Bushing is assembled in housing plug	Std.
Gaskets	Standard	Oriented Polyester		Std.
	Standard	Buna Coated Aluminum	Available on 2L size only	Std.
O-Rings				
	Viton			Std.
	Neoprene			Opt.
	EPR			Opt.
	Teflon			Opt.

## 4200/4300 Pump Materials of Construction:

<b>Part Name</b>	<b>Material</b>	<b>Standard</b>	<b>Comments</b>	<b>Availability</b>
Housing	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
Bracket	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
Bracket Bushing	Carbon	Carbon Graphite Resin		Std.
	Ceramic	Alumina Ceramic, Diamonite	Std. on 4230 & 4330 Models	Opt.
Cover	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
	Cast Iron	ASTM A48 – 96a	Heat Treated (Std. on 4230 & 4330 Models)	Opt.
Rotor	Steel	C1137 or C1141	Steel Forging	Std.
	Steel	C1137 or C1141	Heat Treated (Std. on 4230 & 4330 Models)	Opt.
Idler	Steel	C1117		Std.
Idler Pin	Steel	C1117	Heat Treated	Std.
Idler Bushing	Carbon	Carbon Graphite Resin		Std.
Seal Gland	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
	DU Bushing		Only on 4310 models	
Adjustable Thrust Sleeve	Steel	AISI 1018	Only on 4330 Models	Std.
Packing Gland	Cast Iron	ASTM A48 – 96a	Only on 4210 & 4230 models	Std.
	Bronze	SAE 660		
O-Rings				
	Viton			Std.
	Neoprene			Opt.
	EPR			Opt.
	Teflon			Opt.

\* Bronze idler bushing standard on 3-6 size pumps (2 size available with steel idler gear).

### 4000 Model Temperature Limits:



#### Notes:

1. A pump's performance is dependent on more than just the temperature ranges of the component materials. Buna seal Obsolete.

**WARNING**



**WARNING**

Failure to follow these instructions could result in serious bodily injury or death.

These pumps should not be used for handling plain water, corrosive or abrasive liquids or liquids not possessing adequate lubricity.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pumps contain residual 200 SSU lube oil from the factory production test.

Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

If the pump is to be operated at elevated temperatures, the pump should be brought up to operating temperatures gradually. Rapid or sudden introduction of liquids at elevated temperatures into the cold liquid chamber of the pump could cause damage to pump externals, seals or other internal parts.

Do not run the pump dry. Failure to comply with this could cause severe damage to the internal seal, bushings and/or metal parts.

Pump needs to be Earthed separately to avoid build up of Electro-Static Charge.

Most Tuthill 4000 Series pumps are required to develop 25" mercury vacuum at 0 psi on factory test. While these pumps will develop as high as 27" of vacuum, it is a sound engineering practice to avoid extreme vacuum whenever possible. Select a pipe size to reduce line friction loss to a minimum.

The pump should be located as close to the source of supply as conditions permit and if possible, below the level of the liquid in the reservoir. When necessary to locate the pump in a pit, provisions should be made to safeguard against flooding. Care must be taken to properly support the suction and discharge piping so that no strain is put on the pump due to either weight or expansion. Piping strain can result in misalignment, hot bearings, worn couplings, and vibration. It is important that the piping used be clean and free of chips and scales.



## Proper Installation

Unsatisfactory pump installations are usually characterized by poor suction conditions for the specific liquid being handled. Suction conditions should be minimized to prevent vaporization of the liquid. If vacuum conditions force the liquid to vaporize, cavitation will occur, resulting in loss of capacity, premature wear and noisy operation.

When handling high viscosity liquids, the speed of the pump must be reduced and the size of the lines increased to prevent cavitation.

Note: Pipeline friction increases at a rapid rate with an increase in viscosity. For a given pump and motor, larger pipelines are necessary to maintain the same pump pressure when changing from a thin fluid to a thick one.

Most Tuthill 4000 Series pumps are supplied with both ports on the same plane. Pumps with this type of porting arrangement should always be installed with the ports facing upward to insure proper priming. If it is necessary to install the pump with the ports pointing to either side, it is recommended that the top port be the suction port. This will prevent gravity-induced drainage of fluid through the suction port. When pipes are installed, an inverted "U" bend should be incorporated into the suction line close to the pump for priming purposes.

The multiple port arrangement in the 4108/4128 pumps offers flexibility but is limited to some common sense restrictions. There is an inlet and an outlet side to the pump. There must always be at least one pipe on each side. Units ordered with the side port option (modification S) are shipped with port plugs in the top ports. To adapt to a 90° porting arrangement, the plugs must be relocated.

Because of its size, the 4108/4128 pump will not mount onto a NEMA 48 frame motor unless the motor is shimmed approximately ¼".

Viewing the pump from the shaft end, the inlet port is on the right for clockwise rotation and on the left for counter-clockwise rotation. On pumps with built in relief valves, the adjusting screw of the valve must always be located on the suction side of the pump.

Pumps should be filled with oil at installation and should never be allowed to run dry.

Every pump installation should have a good foundation. Its structure should be sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered. The installation should be leveled, checked for proper piping alignment, and then fastened securely.

## Method of Drive

Direct drive through a traditional flexible coupling is recommended. However, do not expect the flexible coupling to compensate for misalignment. Contact the coupling manufacturer to determine the maximum amount of misalignment to which the coupling can be subjected.

4100 Series pumps can be driven in either direction of rotation, unless outfitted with an internal relief valve. The seal chamber communicates with the neutral zone and therefore the seal is subjected to approximately one half of the discharge pressure.

All 4200 & 4300 Series pumps are directional. Rotation must be specified at the time of order. The seal chamber communicates with the suction side and therefore the seal/packing is subjected to approximately one half of the discharge pressure.

All pump and motor units must be properly aligned during assembly and periodically checked since misalignment may occur later due to abuse or other conditions. Pipe strain can force the pump and motor shafts out of alignment. Therefore, all piping to the pump must be properly supported. Do not allow the pump to act as a pipe support.

Provide for proper expansion of pipes when handling hot liquids. Allow pump to reach operating temperature slowly. Rapid temperature change can result in damage to the cast iron components.

Never align a pump and motor supplied with a pin type coupling without first removing the pins.

Never depend upon sight or feel. Use proper gauges when aligning the pump.

Never operate the pump without all guards in place.

### **Relief Valve Protection**

All 4000 Series models are positive displacement pumps. As the pump rotates, liquid is positively delivered to the discharge side of the pump. If the discharge line is closed off, pressure will increase until the drive stalls and/or fails, the pump breaks or ruptures, or the piping bursts. To prevent this from happening, the use of a pressure relief valve is required. A relief valve that directs the flow back to the supply tank is recommended.

The internal relief valve available on 4000 Series pumps is designed for overpressure protection only. It is not intended as a flow control device or for any similar use. Continuous operation of the relief valve will result in excessive heat buildup within the pump cavity that could cause serious internal damage. Make certain the adjusting screw of the relief valve is located on the suction side of the pump.

Tuthill specifies relief valve settings based on full-bypass pressure, where 100% of the pump flow is recirculating through the valve. It is important to know that the valve will be partially open at pressures below the full-bypass pressure. The difference between the partially open pressure and the full-bypass pressure is dependent on pump speed and fluid viscosity.

If an internal relief valve has not been supplied with the pump some other means of protection must be utilized. These include in-line safety relief valves, pressure shutdown switches or other similar devices.

### **4100 Series:**

Unless otherwise specified at the time of order, all 4100/4120 pumps are supplied with the standard spring, with a range of 55-120 PSI (4 to 8 bar), set to relieve at 55 PSI (4 bar) full-bypass on 200 SSU oil. The standard spring range in the 4108/4128 is 40-70 PSI (3 to 5 bar) and is set to relieve at 55 PSI. The relief valve setting should be reset in the actual operating condition.

To adjust the relief setting within the range of a given spring's capability:

- Remove the acorn nut. (Not supplied with models 4108/4128.)
- Insert a screwdriver into the slot of the adjusting screw and hold it steady.
- Loosen the locking nut with a wrench by turning counterclockwise.
- Throttle the outlet line until the differential pressure at the pump port reaches the desired level.

- If the pressure fails to reach this level with the throttling valve closed, turn the adjusting screw inward (clockwise) until the desired pressure is reached. (Adjusting clockwise raises the pressure setting.)
- If the pressure reaches the desired level before the throttling valve is completely closed, turn the adjusting screw outward (counterclockwise) until the desired pressure is reached. (Adjusting counterclockwise lowers the pressure setting.)
- Retighten the nut to lock the setting in place and replace the acorn nut, if supplied.
- Recheck the pressure gauge reading.

#### **4210 & 4310 Series:**

Unless otherwise specified at the time of order, all 4120 & 4310 Series pumps with an internal relief valve are supplied with the standard spring, with a range of 30-225 psi (10 - 200 psi in size 2 pumps), set to provide full bypass relief at 90 psi.

To adjust the relief setting within the range of a given spring's capability:

- With a small wrench, hold the adjusting screw steady.
- With a second wrench, loosen the locking nut by rotating counterclockwise.
- Throttle the outlet line until the differential pressure at the pump port reaches the desired level.
- If the pressure fails to reach this level with the throttling valve closed, turn the adjusting screw inward (clockwise) until the desired pressure is reached. (Adjusting clockwise raises the pressure setting.)
- If the pressure reaches the desired level before the throttling valve is completely closed, turn the adjusting screw outward (counterclockwise) until the desired pressure is reached. (Adjusting counterclockwise lowers the pressure setting.)
- Retighten the nut to lock the setting in place.
- Recheck the pressure gauge reading.

#### **Strainer Protection**

Strainers are used to remove contaminated particles from the fluid system and extend pump life. Every pump should be protected from these particles by a strainer in the suction line.

Strainer size and mesh of screen are determined by the rate of flow and viscosity of the fluid. Consult the strainer manufacturer for recommendations.

Never use a strainer with a built-in automatic by-pass on the suction line set to open under 30" Hg. vacuum.

Install the strainer according to the designated direction of flow, locating it so that it is accessible for servicing. Use a duplex type strainer when shutdown during service is not possible.

Provide a vacuum gauge in the suction line for determining when the strainer requires cleaning. Make certain strainer baskets are properly reinforced so as not to collapse under 30" Hg. vacuum.

**WARNING**



**WARNING**

All Tuthill pumps contain residual 200 SSU lube oil from the factory test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

If the pump is to operate at elevated temperatures, it should be brought up to operating temperature gradually. Rapid or sudden introduction of liquid at an elevated temperature into the cold liquid chamber of the pump could cause damage to the seal or other internal parts.

**DO NOT RUN THE PUMP DRY.** This could cause severe damage to the seal, bushing and/or metal parts.

### **Startup**

Prior to starting the pump double check the following:

- Pressure and vacuum gauges should be installed as close as possible to the pump.
- Rotate pump shaft to ensure it turns freely without binding.
- Recheck alignment and ensure all guards are in place.
- Make sure piping is independently supported and no strain is being transmitted to the pump.
- Make sure the safety relief valve is installed correctly.
- Check pump rotation.
- Open suction and discharge gate valves.

Check for any leaks once gate valves are open. After completing these checks the pump can be started.

**WARNING**



**WARNING**

**THE PUMP SHOULD NOT BE RUN DRY.** If after approximately 60 seconds there is no discharge of liquid, stop the pump and investigate the possible cause.

Failure to comply with this could cause severe damage to internal seals, bushings and/or metal parts.

**WARNING**



**WARNING**

Failure to follow these instructions could result in serious bodily injury or death.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

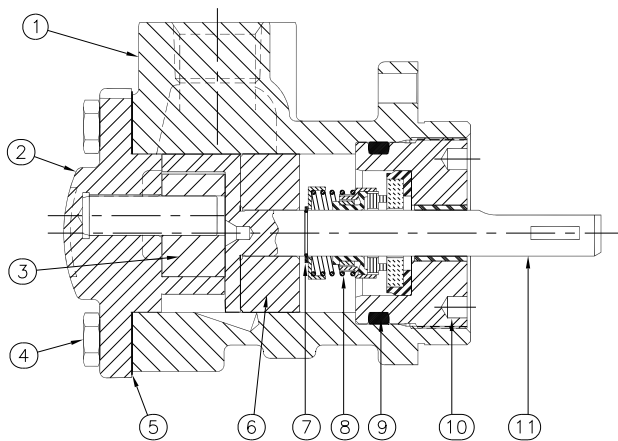
Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

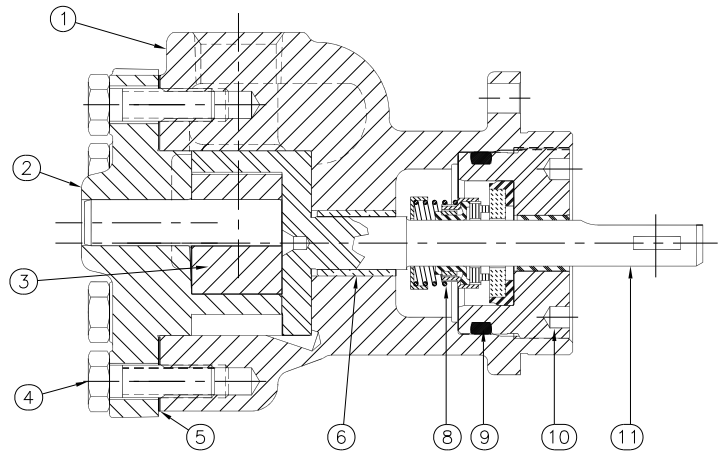
All Tuthill pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

## Service – Specific Models

### Model 4101-4108 & 4121-4128



**MODELS 4101-4104**



**MODELS 4105-4108**

<u>Item</u>	<u>Description</u>
1	Housing
2	Cover Assembly
3	Idler Gear
4	Cover Screws
5	Cover Gasket
6	Housing Bushing

<u>Item</u>	<u>Description</u>
7	Retaining Ring*
8	Mechanical Seal
9	O-Ring
10	Housing Plug
11	Rotor

\* Models 4101/4121, 4102/4122, 4103/4123 & 4104/4124 only.

### Seal Replacement:

The seal assembly in 4100/4120 pumps can be changed without disassembly of the rest of the pump.

1. Place the pump in a vise with the shaft facing up so that one jaw grips across the two ports. Do not tighten excessively as the pump housing may become distorted.
2. Inspect the shaft at the keyway, flat or tang. Any burrs will interfere with removal of the housing plug and bearing assembly.
3. Remove the housing plug with a face-type spanner wrench, available from Tuthill as part number 0L506.
4. Remove the seal from the shaft. The rubber boot will be bonded to the shaft, so it is necessary to push down on the seal to break this bond. Grasp the metal outer shell with any suitable device and pull the seal assembly upward. Remove the spring and washer.
5. Models 4101/4121, 4102/4122, 4103/4123, and 4104/4124 have a retaining ring on the shaft to back up the seal assembly. Do not remove this retaining ring unless you are completely disassembling the pump. Models 4105/4125 and 4108/4128 do not have a retaining ring. A step on the shaft is used as the seal backup.
6. Remove the stationary seal face from the housing plug by pressing out from the opposite side.
7. If damaged, remove the o-ring from the OD of the housing plug.
8. Clean all parts thoroughly using great care to eliminate all dirt.
9. Oil the shaft with suitable lubricating oil. (If the pump has an EPR seal, apply a silicon-based lubricant instead.)
10. Apply the appropriate lubricant to the inside of the new seal assembly.

11. Install the seal head:

11a. For standard full-length shafts with flat and/or keyway:

- a. Place seal assembly on the pump shaft.
- b. Push seal down with your fingers to a position approximately half way down the shaft.

11b. For modification "A" tang shafts:

- a. Use a tapered plastic sleeve. This is available from Tuthill as part number 1LPF531-7010.
- b. Lubricate the sleeve.
- c. Place seal assembly on the sleeve. The tapered end of the sleeve fits into the spring end of the seal assembly.
- d. Place the slotted end of the sleeve on a bench. Press down on the carbon face of the seal with your fingers and slide the seal to about the midpoint on the sleeve.
- e. Place the slotted end of the sleeve over the tang on the pump shaft. Line up the outside diameters of the sleeve and shaft by eye.
- f. Push seal down with your fingers so that it passes from the sleeve to a position approximately halfway down the shaft.

12. Press the stationary face completely into the housing plug. The lapped surface must be up. Protect this lapped surface by covering it with a piece of paper when pressing down on the face. Use your fingers for this operation.
13. Place a new o-ring on the OD of the housing plug, if required, and lubricate.
14. Lubricate the carbon face liberally.
15. Re-assemble the housing plug into position over the pump shaft. Do not nick the seal face by hitting the pump shaft. Tighten the housing plug with the spanner wrench. The seal will automatically be positioned by this operation.
16. If the pump is equipped with a ball bearing (modification K), press the bearing onto the shaft. Press on the bearing inner race with a suitable sleeve. Do not hammer into position or press on the bearing outer race.
17. Check pump for free rotation by turning the shaft with a suitable wrench. There will be a definite resistance to turning because of the seal load. The pump must turn freely without binding.

**Pump Disassembly:**

1. Follow steps 1-5 from "Seal Replacement" above to remove the seal assembly.
2. On models 4101/4121, 4102/4122, 4103/4123, and 4104/4145, remove the retaining ring from the shaft.
3. Mark the cover and housing of the pump for proper re-assembly.
4. Remove the cover screws, cover, idler and rotor from the housing.

**Inspection:**

1. Check the housing, rotor, idler gear, idler pin and cover for wear and chipped or broken teeth. There must not be any deep scratches or grooves on any of the following:
  - The ID surface of the housing.
  - The OD of the rotor.
  - The end face of the rotor.
  - The OD of the idler.
  - Both faces of the idler.
  - The inside surfaces of the cover, including the crescent.

2. Replace worn parts as needed.
3. The rotor should be positioned in the housing and checked for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing, bracket, rotor, or all three parts.

#### **Pump Assembly:**

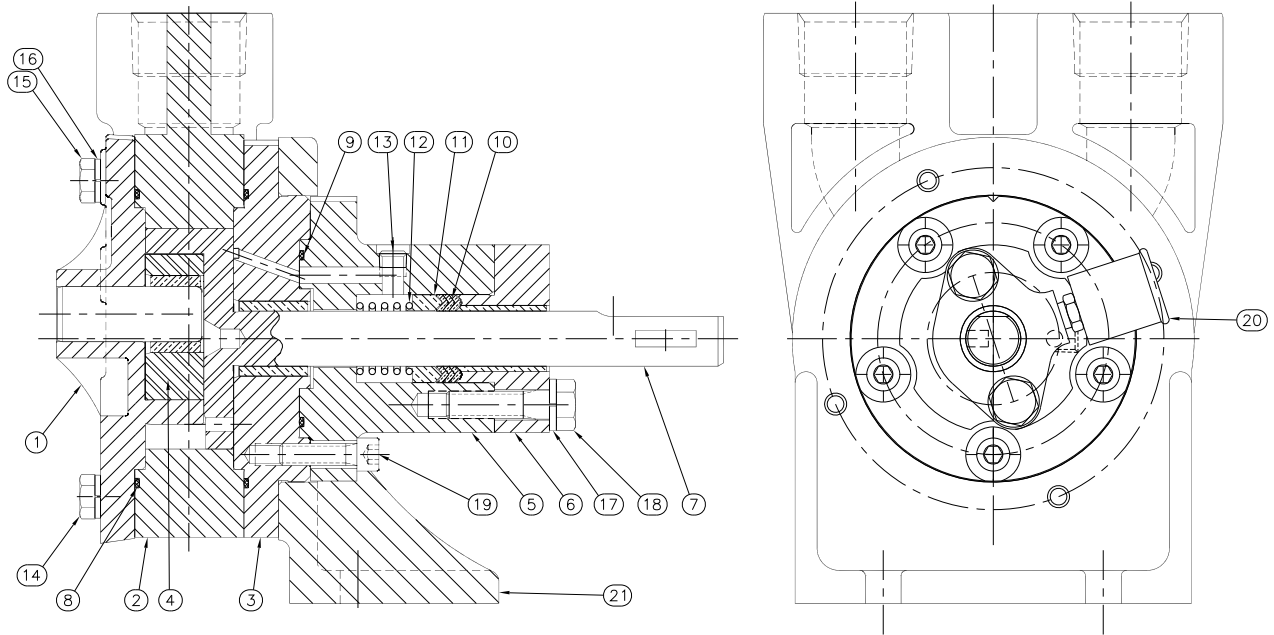
1. Clean all parts thoroughly using great care to eliminate all dirt.
2. Install the rotor in the pump housing.
3. Apply the gasket to the cover. Use a new gasket if the old one is damaged. (Models 4101/4121 and 4108/4128 are also supplied with an o-ring between the cover and housing. Replace if damaged.)
4. Place the idler gear on the pin in the cover assembly.
5. Place the cover assembly with gear on the pump, aligning the matching marks for proper location.
6. Install the cover screws. Tighten gradually, alternating from a screw on one side to a screw on the opposite side.
7. Install the retaining ring on models 4101/4121, 4102/4122, 4103/4123, and 4104/4124.
8. Follow steps 8-17 from "Seal Replacement" above to install the seal assembly.

#### **Changing Rotation:**

Model 4100/4120 pumps are bi-directional and will work equally well in either direction with no modification. However, if outfitted with an internal relief valve (V option), these pumps become rotational. Rotation cannot be changed in the field unless the housing is replaced.



## Model 4212-4216 & 4232-4236



### MODEL 4212-4216 & 4232-4236

<u>Item</u>	<u>Description</u>	<u>Item</u>	<u>Description</u>
1	Cover	12	Spring
2	Housing	13	Plug
3	Bracket	14	Cover Screws
4	Idler Gear	15	Cover Screws
5	Packing Adapter	16	Lockwasher
6	Packing Gland	17	Lockwasher
7	Rotor	18	Gland Screws
8	O-Ring	19	Adapter Screws
9	O-Ring	20	Grease Cup
10	Packing	21	Foot
11	Packing Retainer		

### Lubrication:

Model 4200 pumps are provided with a grease cup or grease gun fitting at the outer bearing which also lubricates the packing. A good grade of medium cup grease, such as Fiske Bros. Lubriplate #907, should be used. Apply until visible at the outer end of the packing gland. If the pump is overheating, it may be due to lack of lubricant. Add lubricant as needed or at least every 60 days or 500 hours of operation.

### Repacking:

1. Grip the pump firmly across the ports and secure the housing in a vise with the shaft end up.
2. Inspect the shaft at the flat and keyway area. Any burrs will interfere with removal of the packing gland. Use a small, fine file if necessary.
3. Remove the two packing gland screws at the shaft end and slide the packing gland assembly off the shaft.
4. Remove the old packing, packing retainer and spring.
5. Inspect the shaft. If badly scored, the rotor must be replaced.
6. Clean the packing chamber thoroughly. Carefully remove any sharp ridges from the shaft end. This will eliminate possible damage to the lips of the packing and ease installation.

7. Replace the spring and packing retainer. Be certain that the spring is properly located on the packing retainer and that the beveled surface of the packing retainer is facing the shaft end of the pump.
8. Install the V type packing rings. Rings should be installed separately and not in sets. Three rings are required per pump. Exercise care when sliding the rings into place so that the lips of the packing rings are stacked in line and positioned on the beveled surface of the packing retainer ring.
9. Replace the packing gland assembly and fasten it securely to the bracket assembly with the packing gland screws. The tension of the spring is such that normal wear on the packing is taken up automatically.

### **Pump Disassembly:**

The seal or packing must be removed before the pump can be disassembled.

1. Mark the cover, housing and bracket for proper re-assembly.
2. Remove the cover screws, cover, housing, idler and rotor from the bracket.

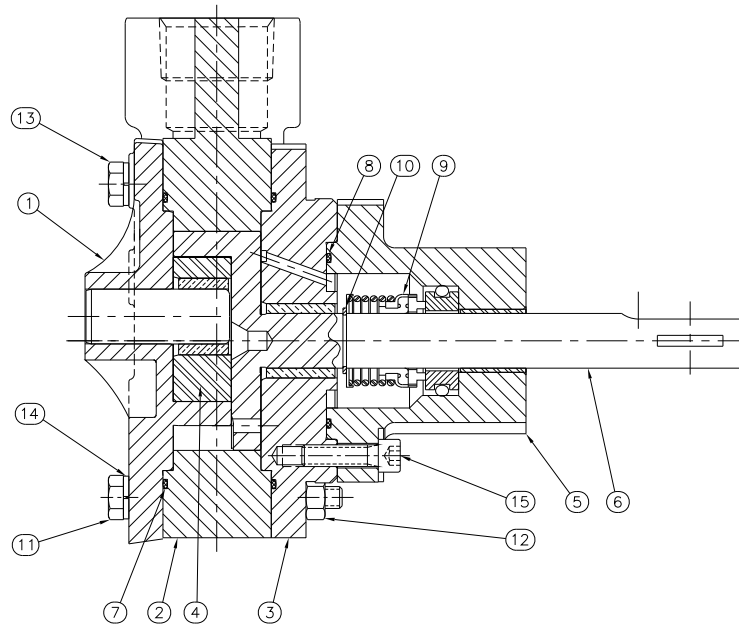
### **Inspection:**

1. Check the housing, rotor, idler gear, idler pin, and cover for wear and chipped or broken teeth. There must not be any deep scratches or grooves on any of the following:
  - The ID surface of the housing.
  - The OD of the rotor.
  - The end face of the rotor.
  - The OD of the idler.
  - Both faces of the idler.
  - The inside surfaces of the cover, including the crescent.
2. Replace worn parts as needed.
3. The rotor should be positioned in the housing and checked for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing, bracket, rotor, or all three parts.

### **Pump Assembly:**

1. Clean all parts thoroughly using great care to eliminate all dirt.
2. Install the rotor in the pump bracket.
3. Install O-Ring in bracket O-ring groove
4. Install the housing over the rotor head positioned on the bracket register.
5. Install O-Ring in bracket O-ring groove
6. Place the idler gear on the pin in the cover assembly and position in the housing register.
7. Align the matching marks for proper location.
8. Install the cover screws. Tighten gradually, alternating from a screw on one side to a screw on the opposite side.
9. Align and install gland adapter to bracket side and tighten bolts.
10. Install the spring, packing retainer, packing, and packing gland. Tighten gland screws.
11. Install grease cup in packing gland.
12. Check pump rotation by turning shaft by hand. Shaft should rotate freely without binding.

## Model 4312-4316 & 4332-4336

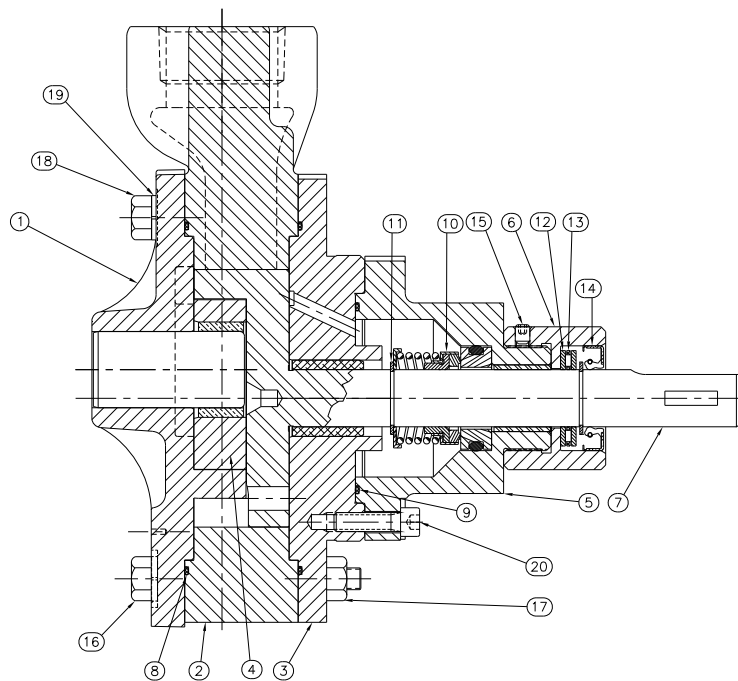


**MODEL 4312-4316**

<u>Item</u>	<u>Description</u>	<u>Item</u>	<u>Description</u>
1	Cover	9	Mechanical Seal
2	Housing	10	Retaining Ring
3	Bracket	11	Cover Screws
4	Idler Gear	12	Nut
5	Seal Gland	13	Cover Screws
6	Rotor	14	Lockwasher
7	O-Ring	15	Gland Screws
8	O-Ring		

### Seal Replacement:

1. Grip the pump firmly across the ports and secure the housing in a vise with the shaft end up.
2. Remove any burrs or nicks on the shaft. Use a small, fine file if needed.
3. Remove the seal gland cap screws.
4. Slide the seal gland cap off the shaft.
5. Remove the stationary seat of the seal from the seal gland.
6. Slide the seal cartridge off the shaft.
7. Polish the pump shaft with crocus cloth or very fine sandpaper and clean the seal chamber thoroughly with a clean cloth. This will prevent damage to the new seal and ease installation.
8. Place the new seal cartridge on the shaft and slide into place.
9. Install the new stationary seat into the seal gland.
10. Place the bearing cap on the shaft and slide into place.
11. Align the mounting holes and reinstall the seal gland cap screws.



**MODEL 4332-4336**

<u>Item</u>	<u>Description</u>	<u>Item</u>	<u>Description</u>
1	Cover	11	Retaining Ring
2	Housing	12	Thrust Washer
3	Bracket	13	Thrust Bearing
4	Idler Gear	14	Lip Seal
5	Seal Gland	15	Set Screw
6	Adjusting Sleeve	16	Cover Screws
7	Rotor	17	Nut
8	O-Ring	18	Cover Screws
9	O-Ring	19	Lockwasher
10	Mechanical Seal	20	Gland Screws

### **Seal Replacement and Resetting of Clearances:**

1. Grip the pump firmly across the ports and opposite side of the housing in a vise with the shaft end up.
2. Remove any burrs or nicks on the shaft. Use a small, fine file if needed.
3. Remove the lip seal from the adjustment sleeve.
4. Loosen the setscrew in the adjustment sleeve.
5. Rotate the adjustment sleeve clockwise until it makes contact with the housing plug.
6. Remove the retaining ring from the shaft.
7. Remove the cap screws at the shaft end.
8. Slide the housing plug and thrust bearing off the shaft.
9. Remove the stationary seat of the seal from the housing plug.
10. Slide the seal head off the shaft.
11. Polish the pump shaft with crocus cloth or very fine sandpaper and clean the seal chamber thoroughly with a clean cloth. This will prevent damage to the new seal and ease installation.
12. Oil the shaft with appropriate lubricating oil.
13. Place the new seal head on the pump shaft and push down with your fingers to a position approximately half way down the shaft.

14. Press the new stationary seat into the housing plug. Make sure the lapped surface is facing up. Protect the lapped surface by covering it with a piece of paper when pressing down on the face. Use your fingers for this operation. The stationary seat must be seated squarely in the housing plug.
15. Place a new o-ring on the OD of the housing, if required, and lubricate with oil.
16. Place the housing plug on the shaft and slide into place. Use care when placing into position over the pump shaft. Do not nick the seal face by hitting the pump shaft.
17. Align the mounting holes and reinstall the cap screws.
18. Place the thrust bearing into the adjustment sleeve.
19. Replace the retaining ring on the shaft.
20. Fill the bearing/adjustment sleeve with light grease for lubrication of the bearing.
21. Press the lip seal into the adjustment sleeve.
22. Rotate the adjustment sleeve counterclockwise until the rotor makes contact with the bracket assembly. At this time the rotor shaft will not turn freely.
23. Rotate the adjustment sleeve clockwise until the rotor does turn freely.
24. Tighten the setscrew in the adjustment sleeve.

### **Pump Disassembly:**

The seal must be removed before the pump can be disassembled.

1. Mark the cover, housing and bracket for proper re-assembly.
2. Remove the cover screws, cover, housing, idler and rotor from the bracket.

### **Inspection:**

1. Check the pump housing, rotor, idler gear, idler pin and cover for wear and chipped or broken teeth. There must not be any deep scratches or grooves on any of the following:
  - The ID surface of the housing.
  - The OD of the rotor.
  - The end face of the rotor.
  - The OD of the idler.
  - Both faces of the idler.
  - The inside surfaces of the cover, including the crescent.
2. Replace worn parts as needed.
3. The rotor should be positioned in the housing or bracket and checked for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing, bracket, rotor, or all three parts.

### **Pump Assembly:**

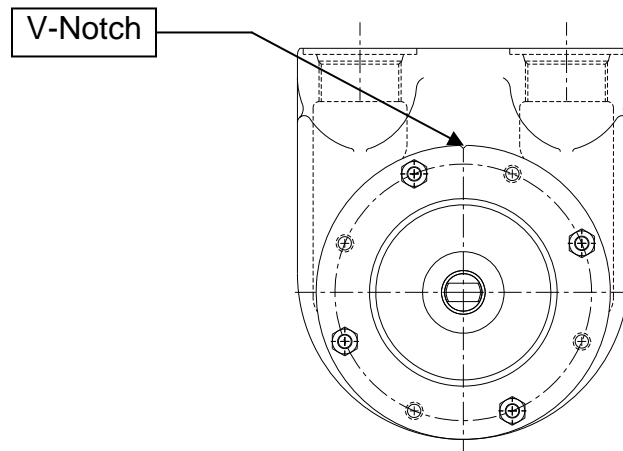
1. Clean all parts thoroughly using great care to eliminate all dirt.
2. Install the rotor in the pump bracket.
3. Install the housing over the rotor head positioned on the bracket register.
4. Place the idler gear on the pin in the cover assembly and position in the housing register.
5. Align the matching marks for proper location.
6. Install the cover screws. Tighten gradually, alternating from a screw on one side to a screw on the opposite side.
7. Install the seal, following the instructions for the specific model in question.
8. Check the end clearance.

## Changing suction ports while maintaining shaft rotation

### Models 4212-4216, 4232-4236, 4312-4316, 4332-4336:

To maintain the same shaft rotation (clockwise or counterclockwise) and yet switch suction and discharge ports please do the following.

- Looking at the pump from the shaft end with the ports up, note the location of the V notch in the bracket. If at the top (12 o'clock), rotation is clockwise; if at the bottom (6 o'clock), counterclockwise.
- Remove the cover screws so that the bracket and cover move freely.
- Rotate the bracket and cover 180°.
- Align the mounting holes and reinstall the cover screws making sure the seal gland is vented to the suction side of the pump.

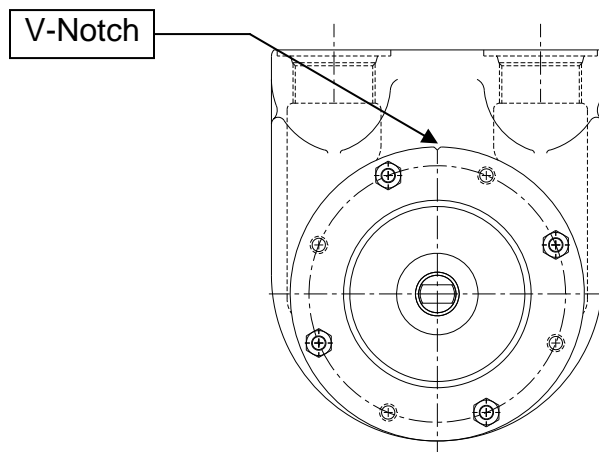


## Changing shaft rotation while maintaining suction ports

### Models 4212-4216, 4232-4236, 4312-4316, 4332-4336:

To maintain the same suction port and yet change shaft rotation from clockwise to counter-clockwise or vice versa please do the following.

- Looking at the pump from the shaft end with the ports up, note the location of the V notch in the bracket. If at the top (12 o'clock), rotation is clockwise; if at the bottom (6 o'clock), counterclockwise.
- Remove the cover screws so that the cover moves freely.
- Rotate the cover 180°.
- Align the mounting holes and reinstall the cover screws making sure the seal gland is vented to the suction side of the pump.

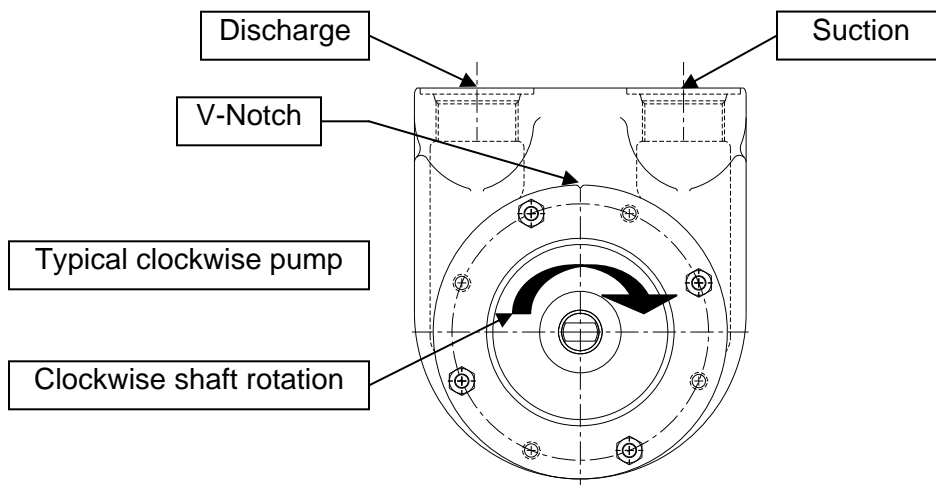


### Changing suction ports while changing shaft rotation

#### Models 4212-4216, 4232-4236, 4312-4316, 4332-4336:

To change suction ports and change shaft rotation (clockwise or counterclockwise) please do the following.

- Looking at the pump from the shaft end with the ports up, note the location of the V notch in the bracket. If at the top (12 o'clock), rotation is clockwise; if at the bottom (6 o'clock), counterclockwise.



- Remove the cover screws so that the bracket moves freely.
- Rotate the bracket 180°.
- Align the mounting holes and reinstall the cover screws making sure the seal gland is vented to the suction side of the pump.
- If outfitted with an internal relief valve the rotation cannot be changed in the field unless the cover/valve assembly is also replaced.

**WARNING**



**WARNING**

Failure to follow these instructions could result in serious bodily injury or death.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pump contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.



## **Troubleshooting**

### **No fluid is delivered:**

- Power is not on.
- Net positive suction head available (NPSHA) is lower than required for the inlet conditions and the vapor pressure of the liquid pumped. Calculate NPSHA and redesign piping if necessary.
- Leaks in suction line or port passages. These can be detected by submerging the pressure line from the discharge side of the pump into a pail of liquid where the air will be seen in the form of bubbles.
- Direction of shaft rotation is incorrect.
- Pump shaft is not rotating. The coupling is defective or the tongue and groove are not engaged.
- The relief valve setting is too low. Liquid is discharging through the by-pass port.

### **Capacity is too low:**

- There are leaks in the suction line.
- Suction losses are too high. The suction lift is too great or the suction line too small or too long. This can be detected by installing a vacuum gauge directly at the pump suction. The maximum vacuum at the pump suction should never exceed 15" of mercury. Vaporization caused by higher vacuums will generally result in capacity drop-off. Suction conditions must be redesigned.
- Pump speed is too slow.
- The strainer is too small or obstructed.
- The suction port or pipe is not immersed deeply enough in the liquid.
- Piping is improperly installed, permitting an air pocket to form in the pump.

### **Pump works spasmodically:**

- Leaky suction line.
- Varying suction conditions.
- Air or vapor in the fluid.

### **Excessive power draw:**

- Pressure too high.
- Liquid is more viscous than originally expected.
- Suction or discharge lines obstructed.
- Insufficient horsepower.
- Drive shaft and pump misaligned.
- Pump binding due to insufficient end clearance.
- Pump shaft is bent.
- Misalignment within the pump due to bad piping or poor installation, causing strain or distortion.

### **Pump is noisy:**

- Pump is cavitating due to inadequate suction conditions.
- Misalignment of coupling.
- Coupling is set too close to pump.

- Vibration of pump due to worn or bent shaft.
- Air leaks on suction side of pump or air entrainment in the fluid.

#### **Pump leaks:**

- Cover bolts need tightening or o-rings are defective.
- Worn or defective seal.

### **Material Returns**

If it becomes necessary to return a pump to the factory, a Return Goods Authorization (RGA) must be obtained from either your local Authorized Distributor or our Chicago plant. No RGA can be issued until a completed Material Safety Data Sheet (MSDS) has been forwarded to our Chicago plant and return of the pump approved.

- Tuthill pumps are precision built and must be handled with care.
- Pumps must be drained of all fluid and the ports plugged to prevent foreign material from getting into the pump.
- Pumps must be packaged securely to prevent damage while in transit.

### **WARRANTY**

Tuthill Pump Group warrants its products against defective material and workmanship for 90 days from the date of startup or one year from date of shipment from Tuthill's plant, whichever comes first. This warranty does not include products damaged by tampering, improper installation, abuse, or wear. Nor does it cover consequential damages, or other losses due to pump failure.

Because of the unpredictable nature of fluids encountered, pumps are not warranted for any specific life.

### **Contact Information**

If additional information is required to facilitate operation or maintenance, contact the authorized Tuthill distributor shown below. Information on Tuthill contacts can also be obtained at [www.tuthillpump.com](http://www.tuthillpump.com).

#### **European Contact Info:**

Tuthill Pump Group  
Manners Industrial Estate  
Ilkeston, Derbyshire DE7 8YA  
England  
[tuthilluk@tuthill.com](mailto:tuthilluk@tuthill.com)

#### **North America Contact Info:**

Tuthill Pump Group  
12500 South Pulaski Road  
Alsip, Illinois 60803  
U.S.A.  
[www.tuthillpump.com](http://www.tuthillpump.com).

## SERVICE & OPERATING MANUAL



# Model G1F Metallic Design Level 1

**Certified to CSA Requirement 2.01 U.S. for natural gas operated diaphragm pumps.**

## Table of Contents

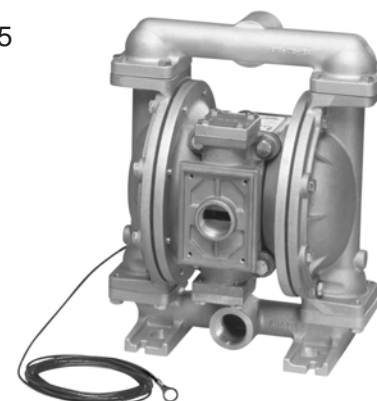
Engineering Data and Temperature Limitations .....	1
Explanation of Pump Nomenclature .....	2
Performance Curve .....	3
Dimensions .....	4
Metric Dimensions .....	5
Principle of Pump Operation .....	6
Installation and Start-Up .....	6
Natural Gas Supply .....	6
Natural Gas Valve Lubrication .....	6
Natural Gas Line Moisture .....	6
Natural Gas Inlet and Priming .....	6
Between Uses .....	6
Installation Guide .....	7
Troubleshooting .....	8
Warranty .....	8
Recycling .....	9
Important Safety Information .....	9
Material Codes .....	10



II 2GD b T5



U.S. Patent #  
5,996,627; 6,241,487  
Other U.S. Patents  
Applied for



Composite Repair Parts Drawing .....	12
Available Service and Conversion Kits .....	12
Composite Repair Parts List .....	13
Natural Gas Distribution Valve Assembly Drawing and Parts List .....	14
Natural Gas Distribution Valve Servicing .....	15
Diaphragm Service Drawing, with Overlay .....	16
Diaphragm Service Drawing, Non-Overlay .....	16
Diaphragm Servicing .....	17
Overlay Diaphragm Servicing .....	17
Actuator Plunger Servicing .....	18
Check Valve Servicing .....	19
Check Valve Drawing .....	19
Provision for Piping Gas Exhaust .....	20
Pumping Hazardous Liquids .....	20
Piping Exhaust Natural Gas .....	20
Exhaust Illustration .....	20
Grounding The Pump .....	21



**WARREN  
RUPP®**

Quality System  
ISO9001 Certified

Environmental  
Management System  
ISO14001 Certified

**IDEX**  
IDEX CORPORATION



II 2GD b T5



U.S. Patent #  
5,996,627; 6,241,487  
Other U.S. Patents  
Applied for



**SANDPIPER®**  
A WARREN RUPP PUMP BRAND

**G1F Metallic**  
**Certified to CSA**  
**Requirement 2.01 U.S.**  
**for natural gas operated**  
**diaphragm pumps.**

ENGINEERING, PERFORMANCE  
& CONSTRUCTION DATA

INTAKE/DISCHARGE PIPE SIZE	CAPACITY	GAS VALVE	SOLIDS-HANDLING	HEADS UP TO	DISPLACEMENT/STROKE
1" NPT(internal) 1" BSPT Tapered (internal)	0 to 45 gallons per minute (0 to 170 liters per minute)	No-lube, no-stall design	Up to .25 in. (6mm)	125 psi or 289 ft. of water (8.6 Kg/cm <sup>2</sup> or 86 meters)	.11 Gallon / .42 liter
<b>⚠ CAUTION! Operating temperature limitations are as follows:</b>					
<b>Materials</b>				Operating Temperatures	
				Maximum	Minimum
<b>Buna N</b> General purpose, oil-resistant. Shows good solvent, oil, water and hydraulic fluid resistance. Should not be used with highly polar solvents like acetone and MEK, ozone, chlorinated hydrocarbons and nitro hydrocarbons.				190°F 88°C	-10°F -23°C
<b>Virgin PTFE</b> Chemically inert, virtually impervious. Very few chemicals are known to react chemically with PTFE: molten alkali metals, turbulent liquid or gaseous fluorine and a few fluoro-chemicals such as chlorine trifluoride or oxygen difluoride which readily liberate free fluorine at elevated temperatures.				220°F 104°C	-35°F -37°C

For specific applications, always consult "Chemical Resistance Chart" Technical Bulletin

These G1F SANDPIPER® models are designed to be powered only by natural gas.

# Explanation of Pump Nomenclature

## G1F Metallic · Design Level 1· Ball Valve

MODEL	Pump Brand	Pump Size	Check Valve Type	Design Level	Wetted Material	Diaphragm/ Check Valve Materials	Check Valve Seat	Non-Wetted Material Options	Porting Options	Pump Style	Pump Options	Kit Options	Shipping Weight lbs. (kg)
G1FB1ABTXNSX00.	G	1F	B	1	A	B	T	X	N	S	X	00.	28 (13)
G1FB1ATTXNSX00.	G	1F	B	1	A	T	T	X	N	S	X	00.	28 (13)
G1FB1SBTXNSX00.	G	1F	B	1	S	B	T	X	N	S	X	00.	43 (20)
G1FB1STTXNSX00.	G	1F	B	1	S	T	T	X	N	S	X	00.	43 (20)
G1FB1ABTXBSX00.	G	1F	B	1	A	B	T	X	B	S	X	00.	28 (13)
G1FB1ATTXBSX00.	G	1F	B	1	A	T	T	X	B	S	X	00.	28 (13)
G1FB1SBTXBSX00.	G	1F	B	1	S	B	T	X	B	S	X	00.	43 (20)
G1FB1STTXBSX00.	G	1F	B	1	S	T	T	X	B	S	X	00.	43 (20)

### Pump Brand

G= Sweet Gas Operated

### Pump Size

1F=1"

### Check Valve Type

B= Ball

### Design Level

1= Design Level

### Wetted Material

S= Stainless Steel

A= Aluminum

### Diaphragm Check Ball Materials

B= Buna/Buna

T=PTFE -Buna/PTFE

### Check Valve Seat

T= Virgin PTFE

A= Aluminum

S= Stainless Steel

### Non-Wetted Material Options

X= Unpainted Aluminum

### Porting Options

N=NPT Threads

B= BSPT (Tapered) Threads

### Pump Style

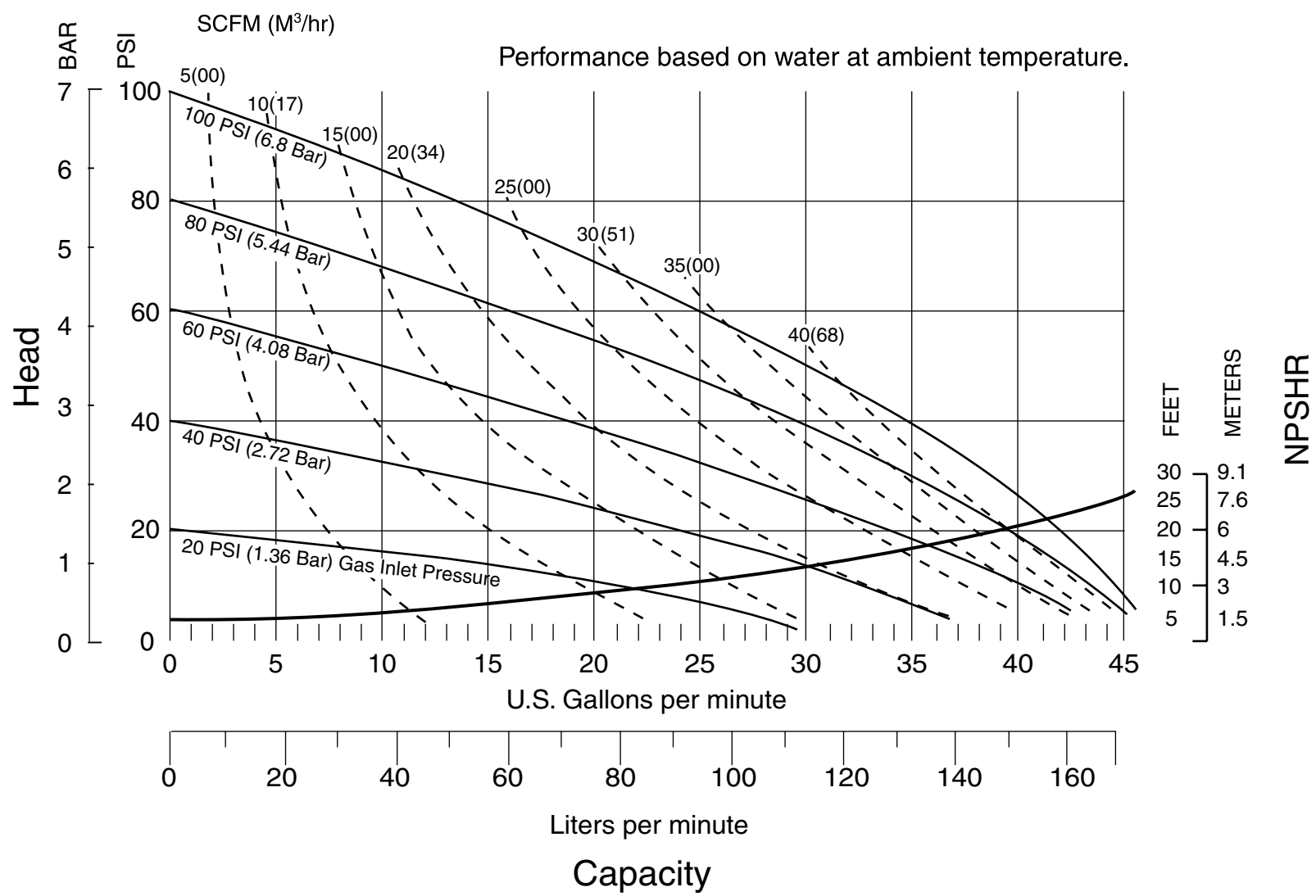
S= Standard

### Pump Options

X= No Muffler

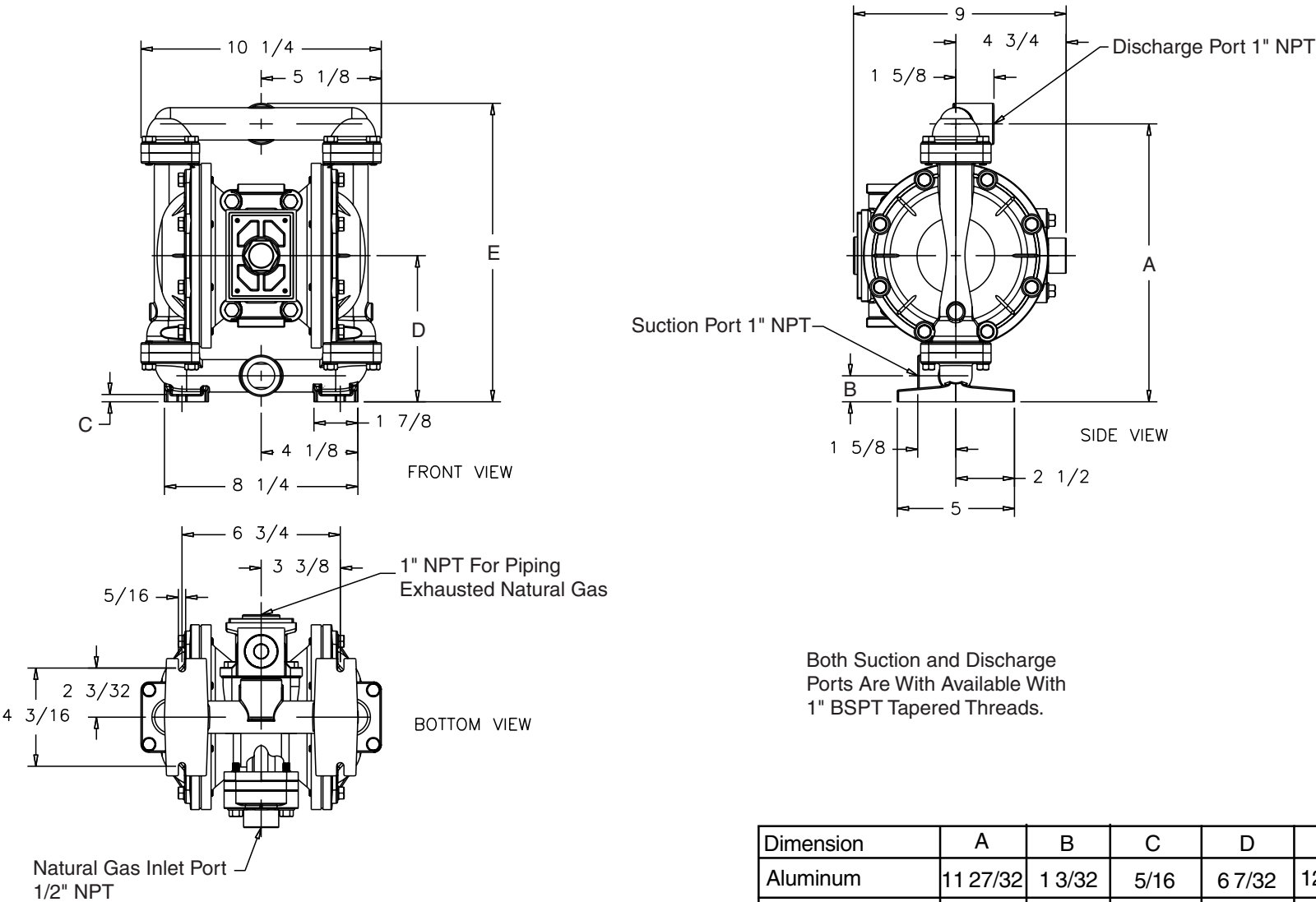
These pump models are designed to pump the following fluids:  
Crude Oil, Salt Water, Drilling Mud, Condensate, Lubrication Oils,  
Glycol, Caustic liquids, and Acids.

# Performance Curve, G1F Model Metallic Design Level 1



# Dimensions: G1F Model Metallic

Dimensions in Inches  
Dimensional Tolerance:  $\pm 1/8$ "

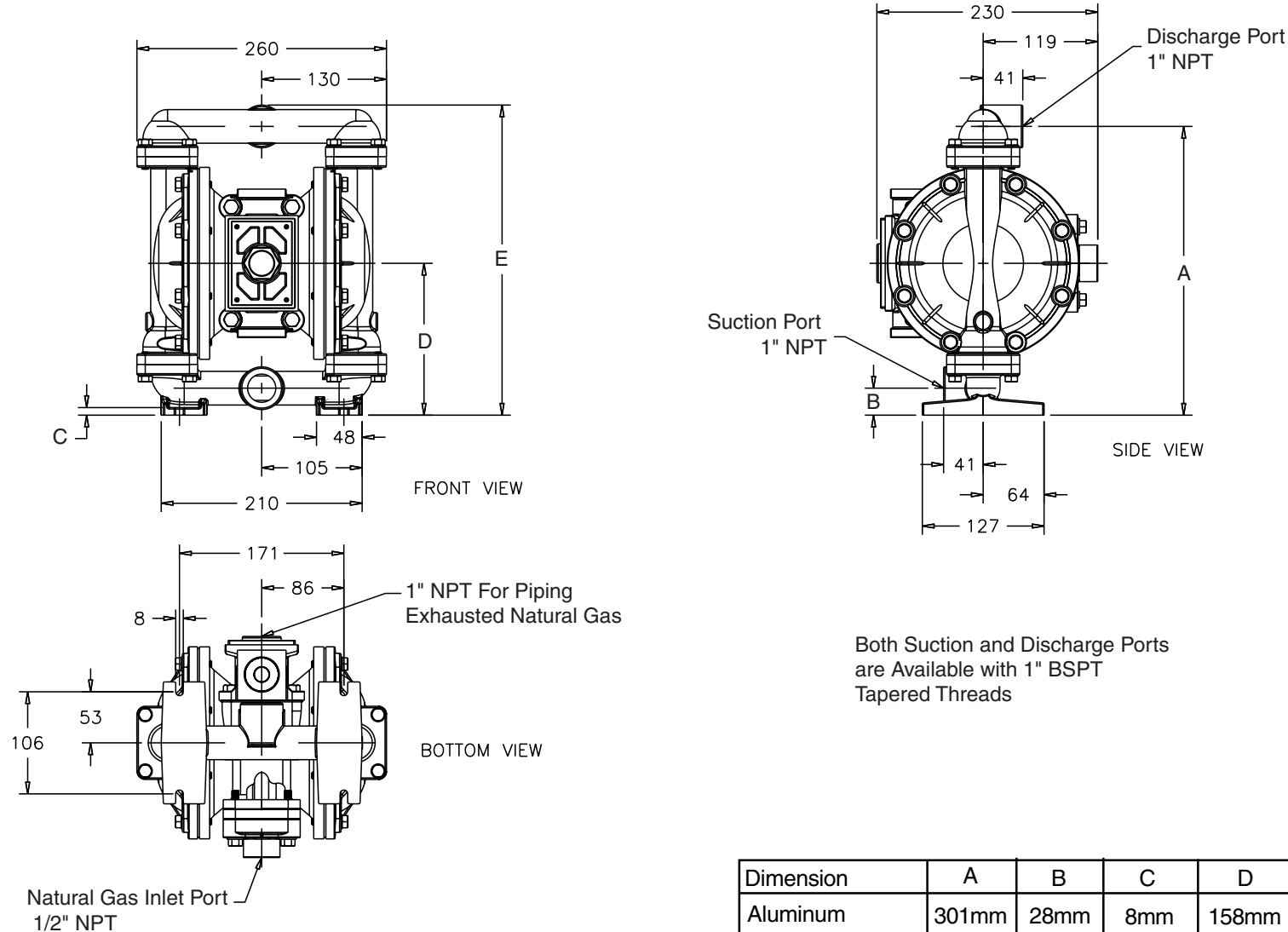


Dimension	A	B	C	D	E
Aluminum	$11 \frac{27}{32}$	$1 \frac{3}{32}$	$5/16$	$6 \frac{7}{32}$	$12 \frac{23}{32}$
Stainless Steel	$11 \frac{31}{32}$	$1 \frac{7}{32}$	$7/16$	$6 \frac{11}{32}$	$12 \frac{27}{32}$



# Metric Dimensions: G1F Model Metallic

Dimensions in Millimeters  
Dimensional Tolerance:± 3mm



Dimension	A	B	C	D	E
Aluminum	301mm	28mm	8mm	158mm	323mm
Stainless Steel	304mm	31mm	11mm	161mm	326mm

## PRINCIPLE OF PUMP OPERATION

This ball type check valve pump is powered by sweet natural gas and is a 1:1 ratio design. The inner side of one diaphragm chamber is alternately pressurized while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod secured by plates to the centers of the diaphragms, to move in a reciprocating action. (As one diaphragm performs the discharge stroke the other diaphragm is pulled to perform the suction stroke in the opposite chamber.) Gas pressure is applied over the entire inner surface of the diaphragm while liquid is discharged from the opposite side of the diaphragm. The diaphragm operates in a balanced condition during the discharge stroke which allows the pump to be operated at discharge heads over 200 feet (61 meters) of water.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Positive suction head in excess of 10 feet of liquid (3.048 meters) may require a back pressure regulating device to maximize diaphragm life.

Alternate pressurizing and exhausting of the diaphragm chamber is performed by an externally mounted, pilot operated, four way spool type gas distribution valve. When the spool shifts to one end of the valve body, inlet pressure is applied to one diaphragm chamber and the other diaphragm chamber exhausts. When the spool shifts to the opposite end of the valve

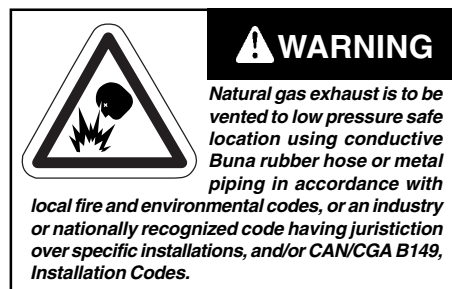
body, the pressure to the chambers is reversed. The gas distribution valve spool is moved by a internal pilot valve which alternately pressurizes one end of the valve while exhausting the other end. The pilot valve is shifted at each end of the diaphragm stroke when a actuator plunger is contacted by the diaphragm plate. This actuator plunger then pushes the end of the pilot valve spool into position to activate the gas distribution valve.

The chambers are connected with manifolds with a suction and discharge check valve for each chamber, maintaining flow in one direction through the pump.

## INSTALLATION AND START-UP

Locate the pump as close to the product being pumped as possible. Keep the suction line length and number of fittings to a minimum. Do not reduce the suction line diameter.

For installations of rigid piping, short sections of flexible conductive hose should be installed between the pump and the piping. The flexible conductive hose reduces vibration and strain to the pumping system. A surge suppressor is recommended to further reduce pulsation in flow.



## NATURAL GAS SUPPLY

Natural gas inlet pressure must be regulated to 100 (7 bar) psi with a pressure regulator. Connect the pump gas inlet to an gas supply of sufficient capacity and pressure required for desired performance. When the gas supply line is solid piping, use a short length of flexible conductive hose not less than 3/4" (19mm) in diameter between the pump and the piping to reduce strain to the piping. The weight of the gas supply line, regulators and filters must be supported by some means other than the gas inlet cap. Failure to provide support for the piping may result in damage to the pump. A pressure regulating valve should be installed to insure gas supply pressure does not exceed recommended limits.

## VALVE LUBRICATION

The natural gas distribution valve and the pilot valve are designed to operate WITHOUT lubrication. This is the preferred mode of operation. There may be instances of personal preference or poor quality gas supplies when lubrication of the supply is required. The pump system will operate with properly lubricated supply. Proper lubrication requires the use of an gas line lubricator (available from Warren Rupp) set to deliver one drop of SAE 10 non-detergent oil for every 20 SCFM (9.4 liters/sec.) of gas the pump consumes at the point of operation. Consult the pump's published Performance Curve to determine this.

## GAS INLET AND PRIMING

To start the pump, open the gas valve approximately 1/2" to 3/4" turn. After the pump primes, the valve can be opened to increase gas flow as desired. If opening the valve increases cycling rate, but does not increase the rate of flow, cavitation has occurred. The valve should be closed slightly to obtain the most efficient gas flow to pump flow ratio.

## BETWEEN USES

When the pump is used for materials that tend to settle out or solidify when not in motion, the pump should be flushed after each use to prevent damage. (Product remaining in the pump between uses could dry out or settle out. This could cause problems with the diaphragms and check valves at restart.) In freezing temperatures the pump must be completely drained between uses in all cases.



## INSTALLATION GUIDE

### Top Discharge Ball Valve Pump



#### CAUTION

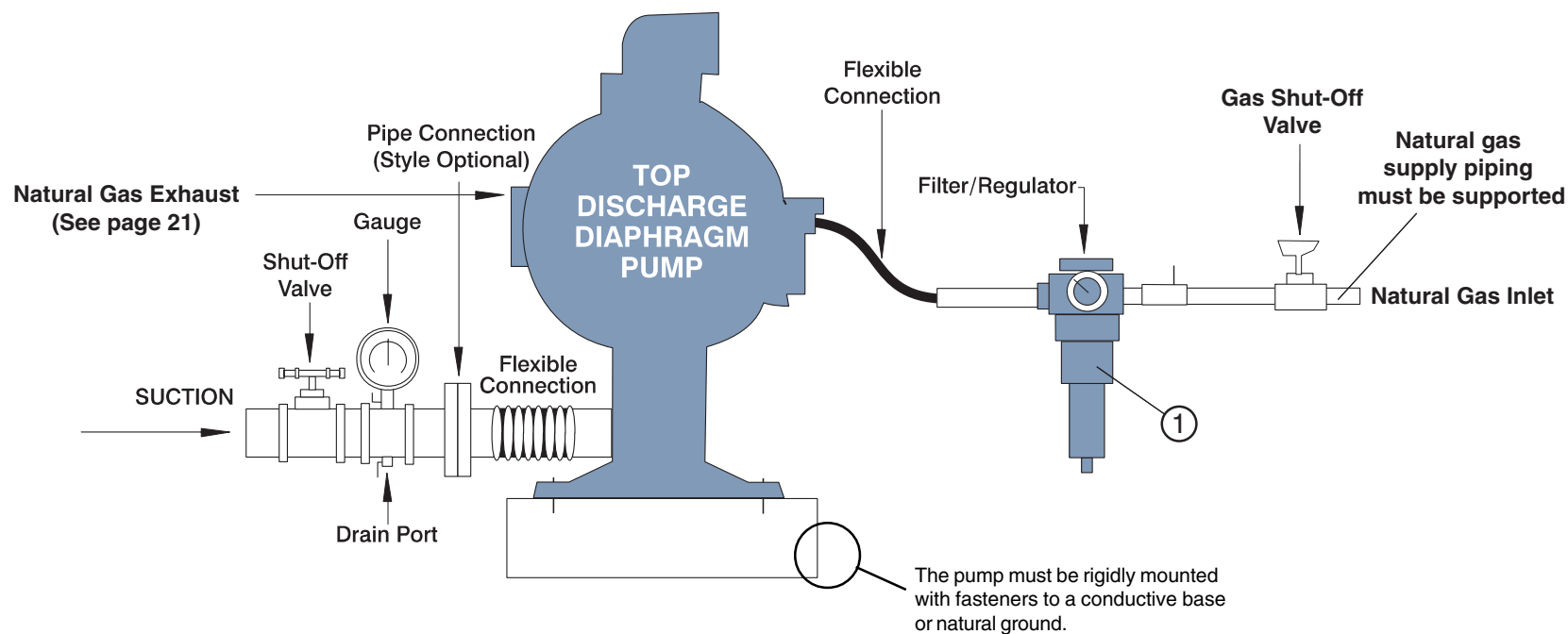
The natural gas exhaust must be piped to an area for safe disposition of the product being pumped, in the event of a diaphragm failure. (See page 21)



#### WARNING

To maintain conductivity, do not paint the pump, or if painted, use a conductive paint or coating.

#### ① Filter/Regulator



## TROUBLESHOOTING

### Possible Symptoms:

- Pump will not cycle.
- Pump cycles, but produces no flow.
- Pump cycles, but flow rate is unsatisfactory.
- Pump cycle seems unbalanced.
- Pump cycle seems to produce excessive vibration.

**What to Check:** Excessive suction lift in system.

**Corrective Action:** For lifts exceeding 20 feet (6 meters), filling the pumping chambers with liquid will prime the pump in most cases.

**What to Check:** Excessive flooded suction in system.

**Corrective Action:** For flooded conditions exceeding 10 feet (3 meters) of liquid, install a back pressure device.

**What to Check:** System head exceeds natural gas supply pressure.

**Corrective Action:** Increase the inlet gas pressure to the pump. Most diaphragm pumps are designed for 1:1 pressure ratio at zero flow.

**What to Check:** Natural gas supply pressure or volume exceeds system head.

**Corrective Action:** Decrease inlet gas pressure and volume to the pump as calculated on the published PERFORMANCE CURVE. Pump is cavitating the fluid by fast cycling.

**What to Check:** Undersized suction line.

**Corrective Action:** Meet or exceed pump connection recommendations shown on the DIMENSIONAL DRAWING.

**What to Check:** Restricted or undersized gas line.

**Corrective Action:** Install a larger gas line and connection. Refer to gas inlet recommendations shown in your pump's SERVICE MANUAL.

**What to Check:** Check the externally serviceable gas distribution system of the pump.

**Corrective Action:** Disassemble and inspect the natural gas distribution valve, pilot valve and pilot valve actuators. Refer to the parts drawing and valve section of the SERVICE MANUAL. Check for clogged discharge or closed valve before reassembly.

**What to Check:** Pumped fluid in gas exhaust line.

**Corrective Action:** Disassemble pump chambers. Inspect for diaphragm rupture or loose diaphragm plate assembly. Refer to the Diaphragm Replacement section of your pump SERVICE MANUAL.

**What to Check:** Fluid suction side air leakage or air in product.

**Corrective Action:** Visually inspect all suction side gaskets and pipe connections.

**What to Check:** Obstructed check valve.

**Corrective Action:** Disassemble the wet end of the pump and manually dislodge obstruction in the check valve pocket. Refer to the Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

**What to Check:** Worn or misaligned check valve or check valve seat.

**Corrective Action:** Inspect check valves and seats for wear and proper seating. Replace if necessary. Refer to Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

**What to Check:** Blocked suction line.

**Corrective Action:** Remove or flush obstruction. Check and clear all suction screens and strainers.

**What to Check:** Blocked discharge line.

**Corrective Action:** Check for obstruction or closed discharge line valves.

**What to Check:** Blocked pumping chamber.

**Corrective Action:** Disassemble and inspect the wetted chambers of the pump. Remove or flush any obstructions. Refer to the pump SERVICE MANUAL for disassembly instructions.

**What to Check:** Entrained air or vapor lock in one or both fluid pumping chambers.

**Corrective Action:** Purge chambers through tapped chamber vent plugs. PURGING THE CHAMBERS OF AIR CAN BE DANGEROUS! Contact the Warren Rupp Technical Services Group before performing this procedure. Any model with top-ported discharge will reduce or eliminate problems with entrained air.

If your pump continues to perform below your expectations, contact your local Warren Rupp Distributor or factory Technical Services Group for a service evaluation.

## WARRANTY

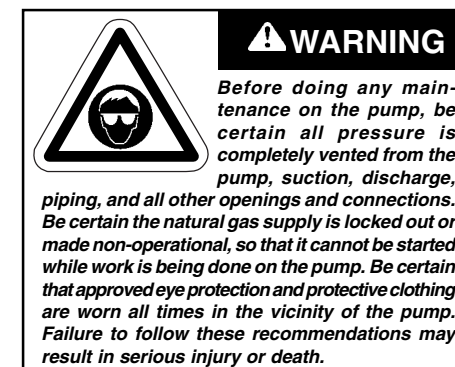
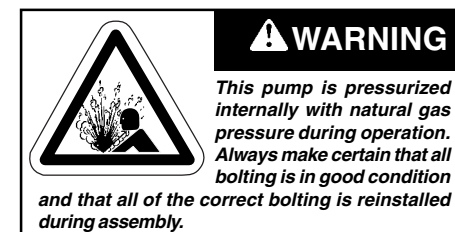
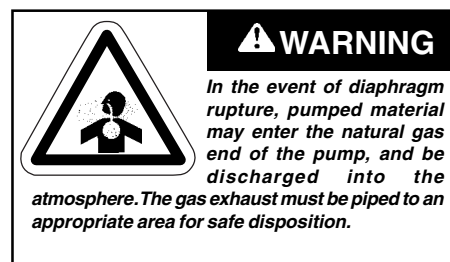
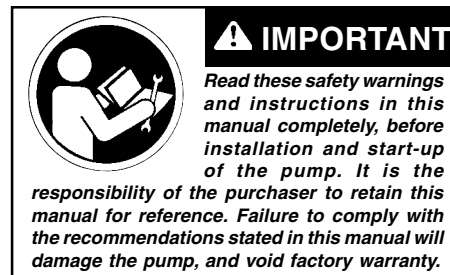
Refer to the enclosed Warren Rupp Warranty Certificate.

## RECYCLING

Many components of Natural Gas Operated SANDPIPER® Metallic pumps are made of recyclable materials (see chart on page 10 for material specifications). We encourage pump users to recycle worn out parts and pumps whenever possible, after any hazardous pumped fluids are thoroughly flushed.



## IMPORTANT SAFETY INFORMATION



Pump complies with EN809 Pumping Directive, Directive 98/37/EC Safety of Machinery, and Directive 94/9/EC Equipment for use in Potentially Explosive Environments. For reference to the directive certificates visit:



II 2GD b T5



[www.warrenrupp.com](http://www.warrenrupp.com)

# MATERIAL CODES

## The Last 3 Digits of Part Number

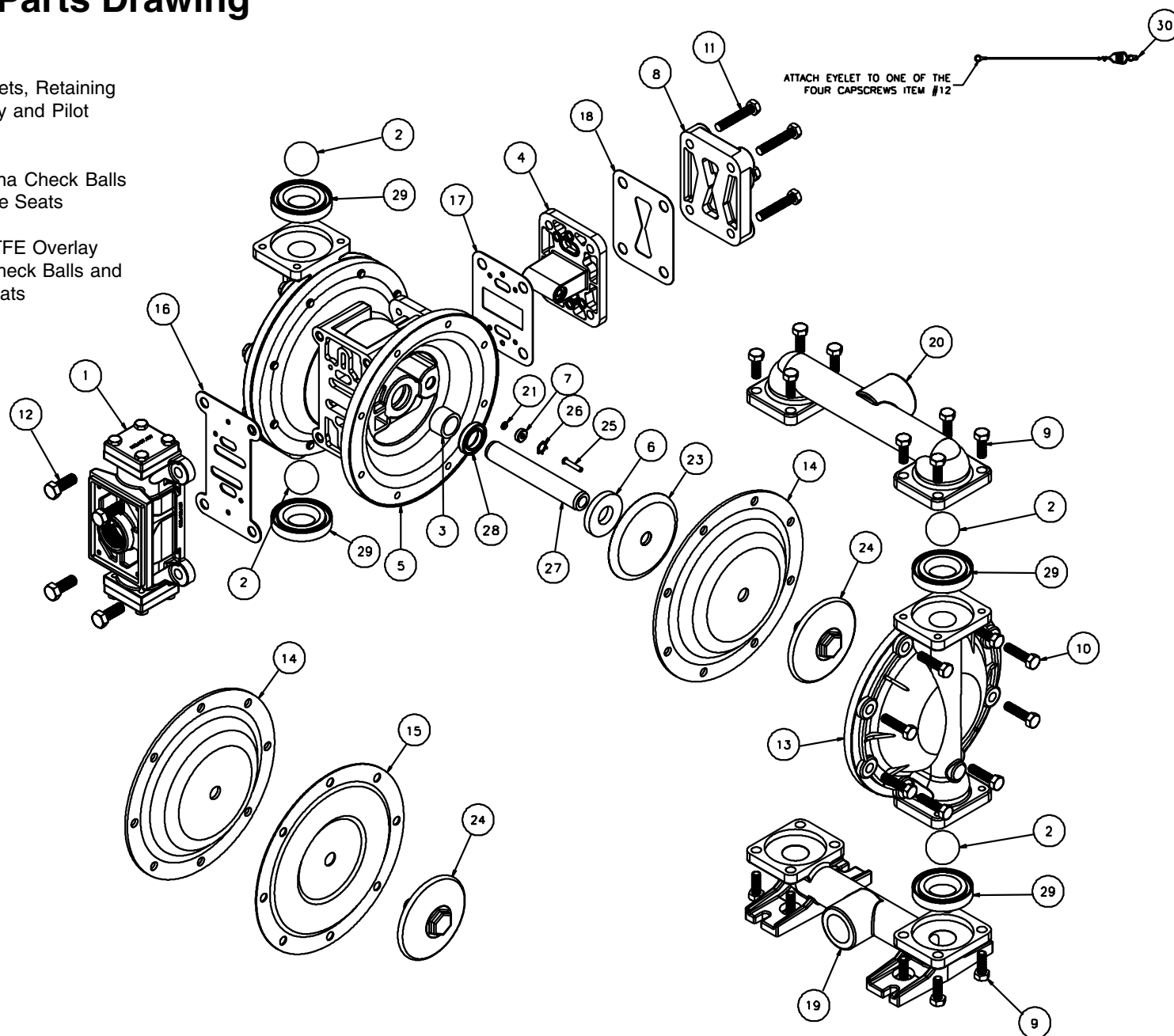
000 ..... Assembly, sub-assembly; and some purchased items	175 ..... Die Cast Zinc	374 ..... Carboxylated Nitrile	603 ..... Blue Gylon
010 ..... Cast Iron	180 ..... Copper Alloy	375 ..... Fluorinated Nitrile	604 ..... PTFE
012 ..... Powered Metal	305 ..... Carbon Steel, Black Epoxy Coated	377 ..... Conductive HNBR	607 ..... Envelon
015 ..... Ductile Iron	306 ..... Carbon Steel, Black PTFE Coated	378 ..... High Density Polypropylene	606 ..... PTFE
020 ..... Ferritic Malleable Iron	307 ..... Aluminum, Black Epoxy Coated	379 ..... Conductive Nitrile	608 ..... Conductive PTFE
025 ..... Music Wire	308 ..... Stainless Steel, Black PTFE Coated	405 ..... Cellulose Fibre	610 ..... PTFE Encapsulated Silicon
080 ..... Carbon Steel, AISI B-1112	309 ..... Aluminum, Black PTFE Coated	408 ..... Cork and Neoprene	611 ..... PTFE Encapsulated Viton
100 ..... Alloy 20	310 ..... Kynar Coated	425 ..... Compressed Fibre	632 ..... Neoprene/Hytrel
110 ..... Alloy Type 316 Stainless Steel	330 ..... Zinc Plated Steel	426 ..... Blue Gard	633 ..... Viton/PTFE
111 ..... Alloy Type 316 Stainless Steel (Electro Polished)	331 ..... Chrome Plated Steel	440 ..... Vegetable Fibre	634 ..... EPDM/PTFE
112 ..... Alloy "C" (Hastelloy equivalent)	332 ..... Aluminum, Electroless Nickel Plated	465 ..... Fibre	635 ..... Neoprene/PTFE
113 ..... Alloy Type 316 Stainless Steel (Hand Polished)	333 ..... Carbon Steel, Electroless Nickel Plated	500 ..... Delrin 500	637 ..... PTFE , Viton/PTFE
114 ..... 303 Stainless Steel	334 ..... Cast Iron, Electroless Nickel Plated	501 ..... Delrin 570	638 ..... PTFE , Hytrel/PTFE
115 ..... 302/304 Stainless Steel	335 ..... Galvanized Steel	502 ..... Conductive Acetal, ESD-800	639 ..... Buna-N/TFE
117 ..... 440-C Stainless Steel (Martensitic)	336 ..... Zinc Plated Yellow Brass	503 ..... Conductive Acetal, Glass-Filled	643 ..... Santoprene®/EPDM
120 ..... 416 Stainless Steel (Wrought Martensitic)	337 ..... Silver Plated Steel	505 ..... Acrylic Resin Plastic	644 ..... Santoprene®/PTFE
123 ..... 410 Stainless Steel (Wrought Martensitic)	340 ..... Nickel Plated	506 ..... Delrin 150	649 ..... PTFE Buna-N/PTFE
148 ..... Hardcoat Anodized Aluminum	342 ..... Filled Nylon	520 ..... Injection Molded PVDF Natural color	656 ..... Santoprene Diaphragm and Check Balls/EPDM Seats
149 ..... 2024-T4 Aluminum	353 ..... Geolast; Color: Black	540 ..... Nylon	
150 ..... 6061-T6 Aluminum	354 ..... Injection Molded #203-40 Santoprene- Duro 40D +/-5; Color: RED	541 ..... Nylon	
151 ..... 6063-T6 Aluminum	355 ..... Thermal Plastic	542 ..... Nylon	
152 ..... 2024-T4 Aluminum (2023-T351)	356 ..... Hytrel	544 ..... Nylon Injection Molded	Delrin, Viton and Hytrel are registered tradenames of E.I. DuPont.
154 ..... Almag 35 Aluminum	357 ..... Injection Molded Polyurethane	550 ..... Polyethylene	Gylon is a registered tradename of Garlock, Inc.
155 ..... 356-T6 Aluminum	358 ..... Urethane Rubber (Some Applications) (Compression Mold)	551 ..... Glass Filled Polypropylene	Nylatron is a registered tradename of Polymer Corp.
156 ..... 356-T6 Aluminum	359 ..... Urethane Rubber	552 ..... Unfilled Polypropylene	Santoprene is a registered tradename of Monsanto Corp.
157 ..... Die Cast Aluminum Alloy #380	360 ..... Buna-N Rubber. Color coded: RED	553 ..... Unfilled Polypropylene	Rulon II is a registered tradename of Dixon Industries Corp.
158 ..... Aluminum Alloy SR-319	361 ..... Buna-N	555 ..... Polyvinyl Chloride	Hastelloy-C is a registered tradename of Cabot Corp.
159 ..... Anodized Aluminum	363 ..... Viton (Fluorel). Color coded: YELLOW	556 ..... Black Vinyl	Ryton is a registered tradename of Phillips Chemical Co.
162 ..... Brass, Yellow, Screw Machine Stock	364 ..... E.P.D.M. Rubber. Color coded: BLUE	558 ..... CONductive HDPE	Valox is a registered tradename of General Electric Co.
165 ..... Cast Bronze, 85-5-5-5	365 ..... Neoprene Rubber. Color coded: GREEN	570 ..... Rulon II	Warren Rupp, SANDPIPER, Portapump, Tranquilizer and SludgeMaster are registered tradenames of Warren Rupp, Inc.
166 ..... Bronze, SAE 660	366 ..... Food Grade Nitrile	590 ..... Valox	
170 ..... Bronze, Bearing Type, Oil Impregnated	368 ..... Food Grade EPDM	591 ..... Nylatron G-S	
	370 ..... Butyl Rubber. Color coded: BROWN	592 ..... Nylatron NSB	
	371 ..... Philthane (Tuftane)	600 ..... PTFE (virgin material) Tetrafluorocarbon (TFE)	
		601 ..... PTFE (Bronze and moly filled)	
		602 ..... Filled PTFE	



# Composite Repair Parts Drawing

## Available Service Kits:

- 476-230-000 Gas End Kit**  
Seals, O-Rings, Gaskets, Retaining Rings, Valve Assembly and Pilot Valve Assembly
- 476-204-360 Wetted End Kit**  
Buna Diaphragms, Buna Check Balls and PTFE Check Valve Seats
- 476-204-649 Wetted End Kit**  
Buna Diaphragms, PTFE Overlay Diaphragms, PTFE Check Balls and PTFE Check Valve Seats

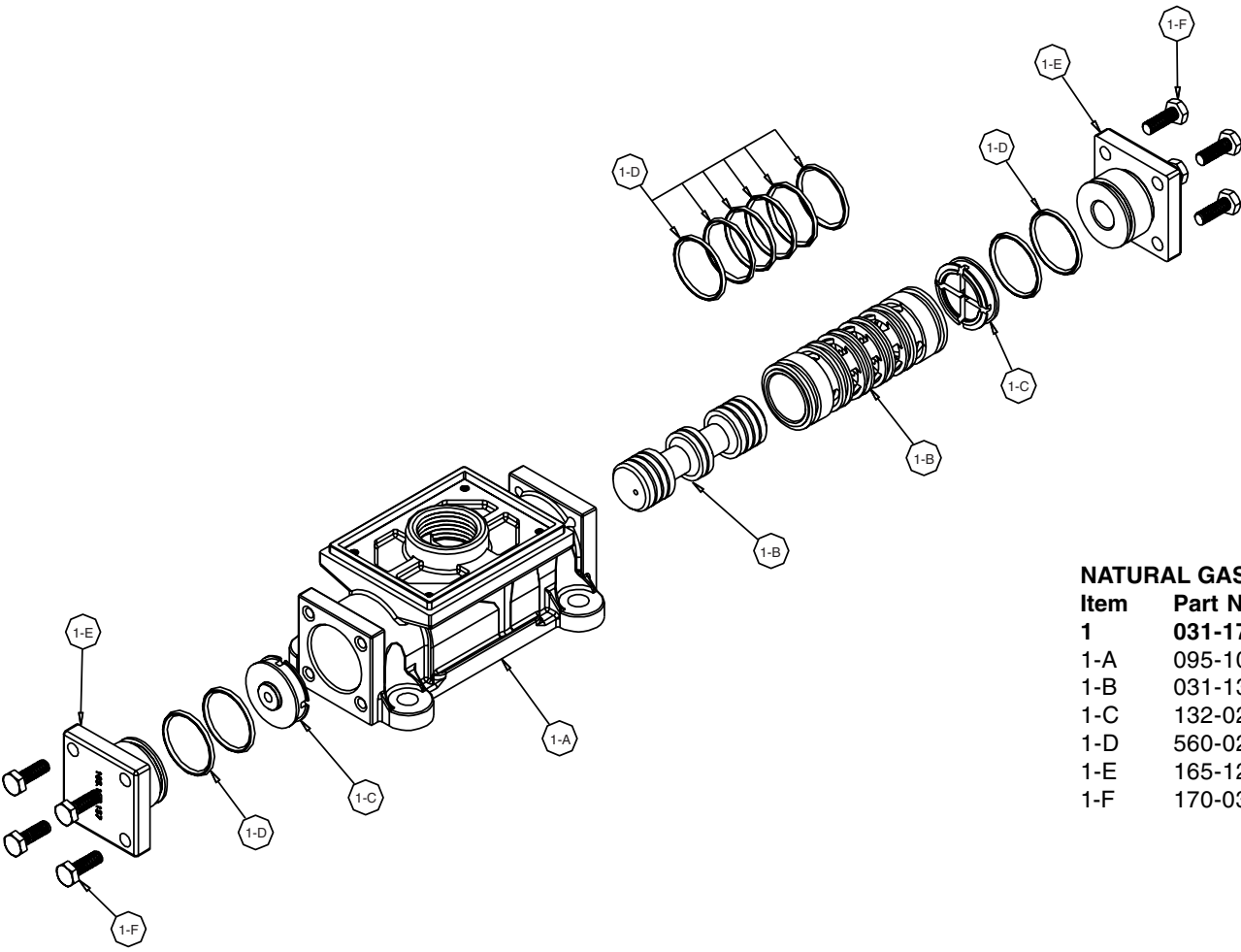




# Composite Repair Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
1	031-178-000	Gas Valve Assembly	1	19	518-175-156	Manifold, Suction	1
2	050-028-360	Ball, Check	4		518-175-156E	Manifold, Suction 1-1/2" BSPT (Tapered)	1
	050-028-600	Ball, Check	4		518-175-110	Manifold, Suction	1
3	070-012-170	Bushing	2		518-175-110E	Manifold, Suction 1-1/2" BSPT (Tapered)	1
4	095-110-000	Pilot Valve Assembly	1	20	518-176-156	Manifold, Discharge	1
5	114-025-157	Intermediate Bracket	1		518-176-156E	Manifold, Discharge 1-1/2" BSPT (Tapered)	1
6	132-019-360	Bumper, Diaphragm	2		518-176-110	Manifold, Discharge	1
7	135-036-506	Bushing, Plunger	2		518-176-110E	Manifold, Discharge 1-1/2" BSPT	1
8	165-120-000	Cap, Gas Inlet Assembly	1	21	560-001-379	O-Ring	2
9	170-005-330	Capscrew, Hex Hd 5/16-18 X .88	16	23	612-022-330	Plate, Inner Diaphragm	2
10	170-045-330	Capscrew, Hex Hd 5/16-18 X 1.25	16	24	612-108-157	Plate, Outer Diaphragm Assembly	2
11	170-069-330	Capscrew, Hex Hd 5/16-18 X 1.75	4		612-101-110	Plate, Outer Diaphragm Assembly	2
12	170-006-330	Capscrew, Hex 3/8-16 X 1.00	4	25	620-022-115	Pin, Actuator	2
13	196-173-157	Chamber, Outer	2	26	675-042-115	Ring, Retaining	2
	196-173-110	Chamber, Outer	2	27	685-060-120	Rod, Diaphragm	1
14	286-008-360	Diaphragm	2	28	720-010-375	Seal, U-Cup	2
15	286-015-604	Diaphragm, Overlay	2	29	722-098-600	Seat, Check Valve	4
16	360-093-360	Gasket, Natural Gas Valve	1		722-098-150	Seat, Check Valve	4
17	360-103-360	Gasket, Pilot Valve	1		722-098-150	Seat, Check Valve	4
18	360-104-379	Gasket, Gas Inlet	1	30	920-025-000	Ground Strap	1
				31	560-091-360	O-ring (metallic seats only)	8
					560-091-611	O-ring (metallic seats only)	8

# Natural Gas Valve Assembly Drawing, Parts List



## NATURAL GAS ASSEMBLY PARTS LIST

Item	Part Number	Description	Qty
1	031-178-000	Gas Valve Assembly	1
1-A	095-109-157	Valve Body	1
1-B	031-139-000	Sleeve and Spool Set	1
1-C	132-029-357	Bumper	2
1-D	560-020-379	O-Ring	10
1-E	165-127-157	Cap, End	2
1-F	170-032-330	Capscrew	8

## NATURAL GAS DISTRIBUTION VALVE SERVICING

To service the natural gas valve first shut off the compressed air, bleed pressure from the pump, and disconnect the gas supply line from the pump.

### Step #1: See COMPOSITE REPAIR PARTS DRAWING.

Using a 9/16" wrench or socket, remove the four hex capscrews (items 12). Remove the air valve assembly from the pump.

Remove and inspect gasket (item 16) for cracks or damage. Replace gasket if needed.

### Step #2: Disassembly of the natural gas valve.

Using a 7/16" wrench or socket, remove the eight hex capscrews (items 1-F) that fasten the end caps to the valve body. Next remove the two end caps (items 1-E). Inspect the two o-rings (items 1-D) on each end cap for damage or wear. Replace the o-rings as needed.

Remove the bumpers (items 1-C). Inspect the bumpers for damage or wear. Replace the bumpers as needed.

Remove the spool (part of item 1-B) from the sleeve. Be careful not to scratch or damage the outer diameter of the spool. Wipe spool with a soft cloth and

inspect for scratches or wear.

Inspect the inner diameter of the sleeve (part of item 1-B) for dirt, scratches, or other contaminants. Remove the sleeve if needed and replace with a new sleeve and spool set (item 1-A).

### Step #3: Reassembly of the natural gas valve.

Install one bumper (item 1-C) and one end cap (item 1-E), with two o-rings (items 1-D), and fasten with four hex capscrews (items 1-F) to the valve body (item 1-A).

Remove the new sleeve and spool set (item 1-B) from the plastic bag. Carefully remove the spool from the sleeve. Install the six o-rings (item 1-D) into the six grooves on the sleeve. Apply a light coating of grease to the o-rings before installing the sleeve into the valve body (item 1-A), align the slots in the sleeve with the slots in the valve body. Insert the spool into the sleeve. Be careful not to scratch or damage the spool during installation. Install the remaining bumper and end cap (with o-rings), and fasten with the remaining hex capscrews.

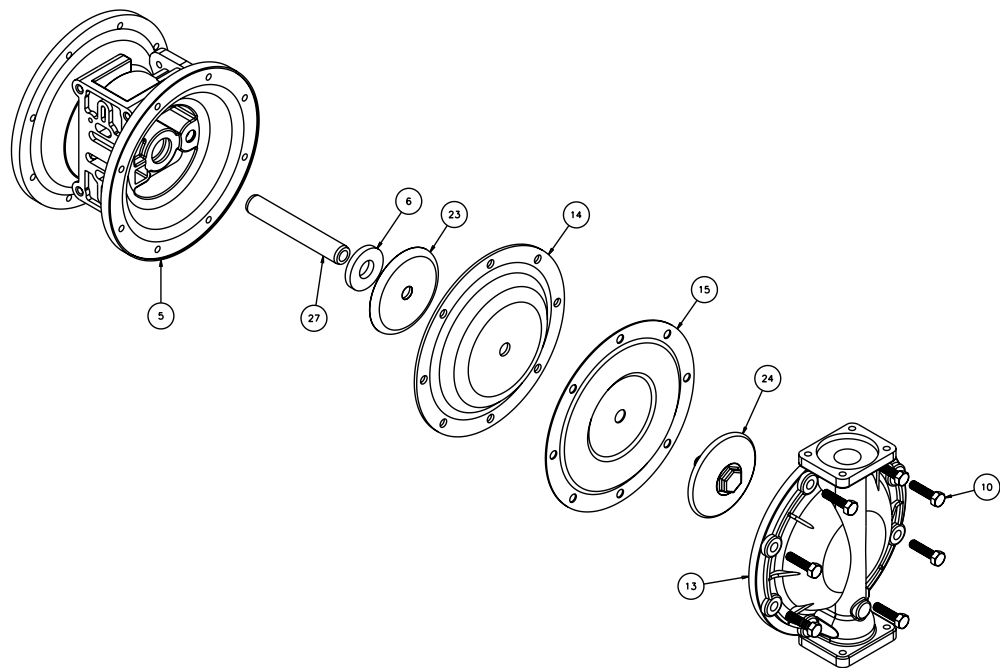
Fasten the natural gas valve assembly (item 1) and gasket to the pump. Connect the compressed gas line to the pump. The pump is now ready for operation.



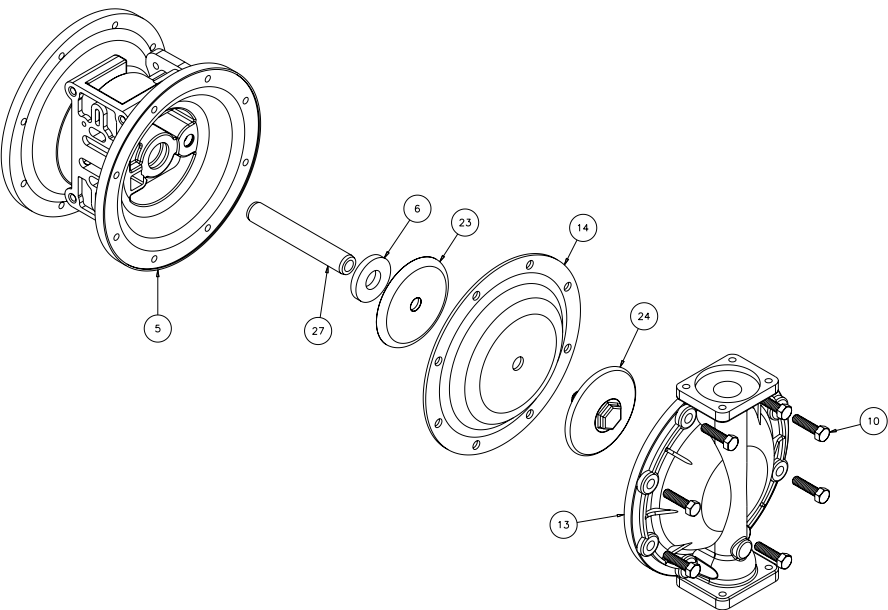
## ! IMPORTANT

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

# Diaphragm Service Drawing, with Overlay



# Diaphragm Service Drawing, Non-Overlay



## DIAPHRAGM SERVICING

To service the diaphragms first shut off the suction, then shut off the discharge lines to the pump. Shut off the natural gas supply, bleed the pressure from the pump and disconnect the natural gas supply line from the pump. Drain any remaining liquid from the pump.

**Step #1:** See the pump assembly drawing and the diaphragm servicing illustration.

Using a 1/2" wrench or socket, remove the 16 capscrews (item 9) that fasten the manifolds (items 19 & 20) to the outer chambers (item 13).

**Step #2:** Removing outer chambers.

Using a 1/2" wrench or socket, remove the 16 capscrews (item 10), that fasten the outer chambers (item 13), diaphragms (item 14) and intermediate (item 5) together.

**Step #3:** Removing the diaphragms and diaphragm plates.

Use a 7/8" wrench or six point socket to remove the outer diaphragm plate assemblies (item 24), diaphragms (item 14) and inner diaphragm plates (item 23) from the diaphragm rod (item 27) by turning counterclockwise. Inspect the diaphragm for cuts, punctures, abrasive wear or chemical attack. Replace the diaphragms if necessary. **DO NOT USE A WRENCH ON THE DIAPHRAGM ROD. FLAWS ON THE SURFACE MAY DAMAGE BEARINGS AND SEALS.**

**Step #4:** Assembling the diaphragm and diaphragm plates to the diaphragm rod.

Push the threaded stud of one outer diaphragm plate assembly through the center of one diaphragm and through one inner diaphragm plate. Install the diaphragm with the natural bulge facing away from the diaphragm rod and make sure the radius on the inner diaphragm plate is towards the diaphragm, as indicated on the diaphragm servicing illustration. Thread the assembly onto the diaphragm rod, leaving loose.

**Step #5:** Installing the diaphragm and rod assembly to the pump.

Make sure the bumper (item 6) is installed over the diaphragm rod. Insert rod into pump.

On the opposite side of the pump, pull the diaphragm rod out as far as possible. Make sure the second bumper is installed over the diaphragm rod.

Push the threaded stud of the other outer diaphragm plate assembly through the center of the other diaphragm and through the other inner diaphragm plate. Make sure the radius on the inner diaphragm plate is towards the diaphragm. Thread the assembly onto the diaphragm rod. Use a 7/8" wrench or socket to hold one outer diaphragm plate. Then, use a torque wrench to tighten the other outer diaphragm plate to the diaphragm rod to 500 in. lbs. (56.5 Newton meters).

Align one diaphragm with the intermediate and install the outer chamber to the pump using the 8

capscrews. Tighten the opposite diaphragm plate until the holes in the diaphragm align with the holes in the intermediate. Then, install the other outer chamber using the 8 capscrews.

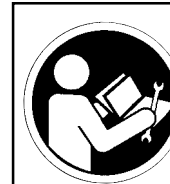
**Step #6:** Reinstall the manifolds to the pump using the 16 capscrews.

The pump is now ready to be reinstalled, connected and returned to operation.

## OVERLAY DIAPHRAGM SERVICING

The overlay diaphragm (item 15) is designed to fit over the exterior of the standard diaphragm (item 14).

Follow the same procedures described for the standard diaphragm for removal and installation, except tighten the outer diaphragm plate assembly, diaphragms and inner diaphragm plate to the diaphragm rod to 500 in. lbs. (56.5 Newton meters).



## ! IMPORTANT

*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

### ACTUATOR PLUNGER SERVICING

To service the actuator plunger first shut off the compressed natural gas supply, bleed the pressure from the pump, and disconnect the natural gas supply line from the pump.

**Step #1:** See PUMP ASSEMBLY DRAWING.

Using a 1/2" wrench or socket, remove the four capscrews (items 11). Remove the gas inlet cap (item 8) and gas inlet gasket (item 18). The pilot valve assembly (item 4) can now be removed.

**Step #2:** Inspect the actuator plungers.

See ILLUSTRATION AT RIGHT.

The actuator plungers (items 25) can be reached through the pilot valve cavity in the intermediate assembly (item 5).

Remove the plungers (item 25) from the bushings (item 7) in each end of the cavity. Inspect the installed o-ring (items 21) for cuts and/or wear. Replace the o-rings if necessary. Apply a light coating of grease to each o-ring and re-install the plungers in to the bushings. Push the plungers in as far as they will go.

To remove the bushings (item 7), first remove the retaining rings (item 26) by using a flat screwdriver.

**NOTE:** It is recommended that new retaining rings be installed.

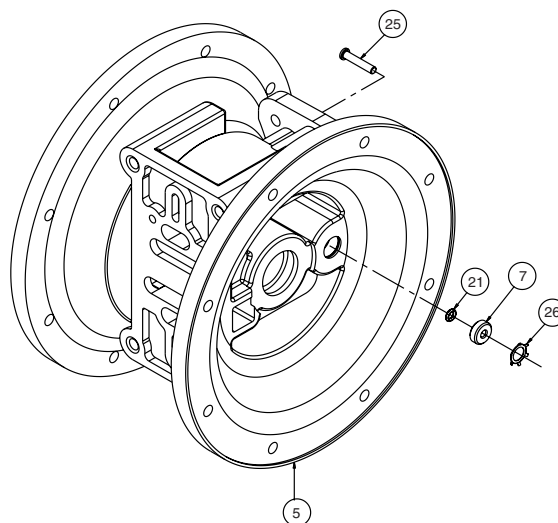
**Step #3:** Re-install the pilot valve assembly into the intermediate assembly.


Be careful to align the ends of the stem between the plungers when inserting the stem of the pilot valve into the cavity of the intermediate.

Re-install the gasket (item 18), natural gas inlet cap (item 8) and capscrews (item 11).

Connect the natural gas supply to the pump. The pump is now ready for operation.

### ACTUATOR PLUNGER SERVICING





**! IMPORTANT**  
*Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*

## CHECK VALVE SERVICING

Before servicing the check valve components, first shut off the suction line and then the discharge line to the pump. Next, shut off the compressed natural gas supply, bleed natural gas pressure from the pump, and disconnect the natural gas supply line from the pump. Drain any remaining fluid from the pump. The pump can now be removed for service.

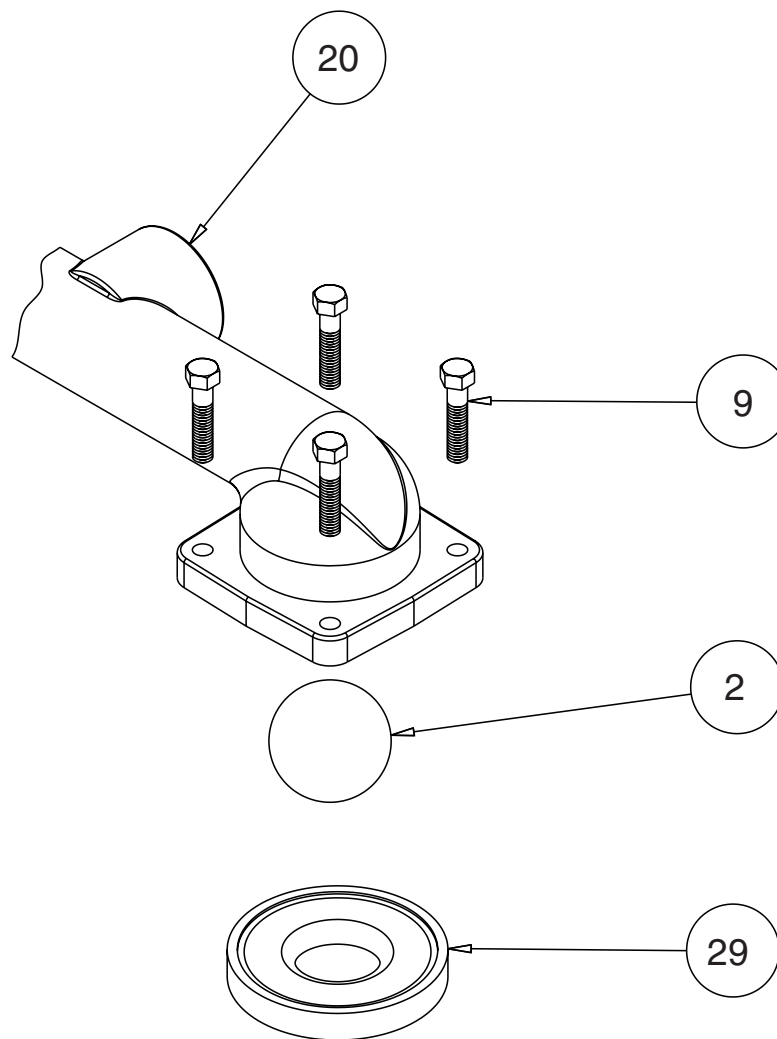
To access the check valve components, remove the manifolds (item 19 not shown). Use a 9/16" wrench or socket to remove the fasteners. Once the manifold is removed, the check valve components can be seen.

Inspect the check balls (items 2) for wear, abrasion, or cuts on the spherical surface. The check valve seats (item 29) should be inspected for cuts, abrasive wear, or embedded material on the surfaces of both the external and internal chambers. The spherical surface of the check balls must seat flush to the surface of the check valve seats for the pump to operate to peak efficiency. Replace any worn or damaged parts as necessary.

Re-assemble the check valve components. The seat should fit into the counter bore of the outer chamber.

The pump can now be reassembled, reconnected and returned to operation.

## Check Valve Drawing



## PUMPING HAZARDOUS LIQUIDS

When a diaphragm fails, the pumped liquid or fumes enter the natural gas end of the pump. Fumes are exhausted into the surrounding environment. When pumping hazardous or toxic materials, the exhaust gas must be piped to an appropriate area for safe disposal. See illustration #1 at right.

This pump can be submerged if the pump materials of construction are compatible with the liquid being pumped. The natural gas exhaust must be piped above the liquid level. See illustration #2 at right. Piping used for the gas exhaust must not be smaller than 1" (2.54 cm) diameter. Reducing the pipe size will restrict natural gas flow and reduce pump performance. When the pumped product source is at a higher level than the pump (flooded suction condition), pipe the exhaust gas higher than the product source to prevent siphoning spills. See illustration #3 at right.

## PIPING THE NATURAL GAS EXHAUST

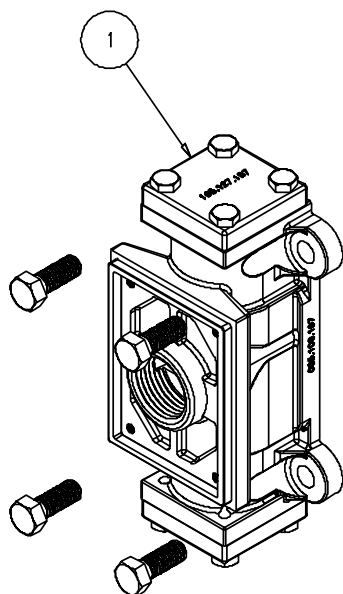
The following steps are necessary to pipe the exhaust gas away from the pump.


The gas distribution valve assembly (item 1) has 1" NPT threads for piped exhaust.

in damage to the natural gas distribution valve body.

Any piping or hose connected to the pump's natural gas exhaust port must be conductive and physically supported. Failure to support these connections could also result in damage to the valve body.

If a high pressure gas spike is possible through the exhaust line, a pressure regulator is required in the exhaust piping.

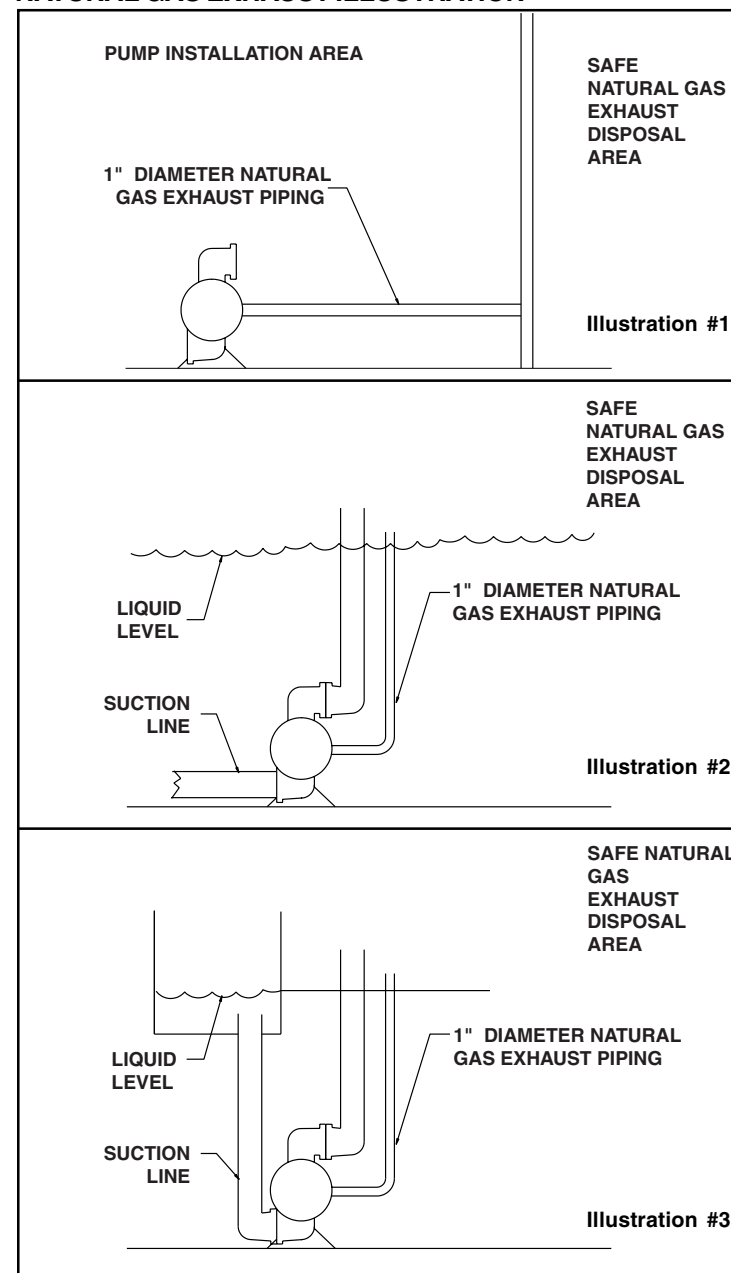




**WARNING**

*Natural gas exhaust is to be vented to low pressure safe location using conductive Buna rubber hose or metal piping in accordance with local fire and environmental codes, or an industry or nationally recognized code having jurisdiction over specific installations, and/or CAN/CGA B149, Installation Codes.*

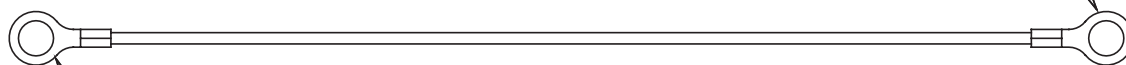
## NATURAL GAS EXHAUST ILLUSTRATION





# Grounding The Pump

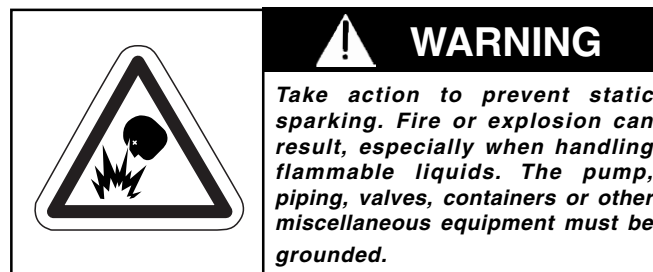
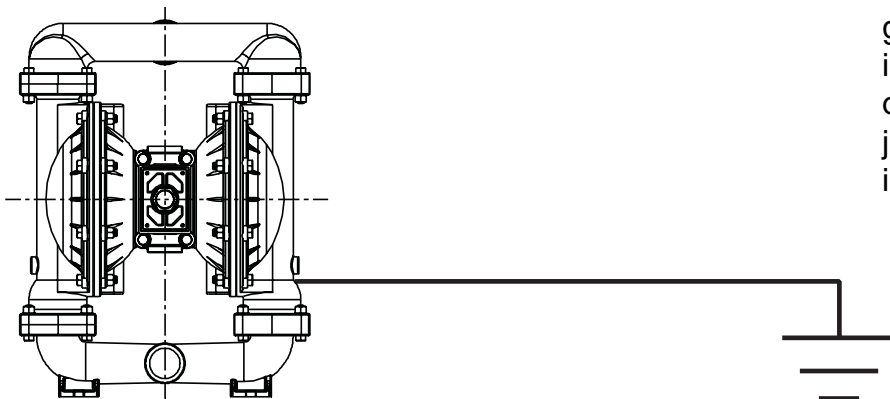
One eyelet is installed to a true earth ground. (Requires a maximum 5/16 or 8mm maximum diameter blot)



One eyelet is fastened to the pump hardware.

This 8 foot long (244 centimeters) Ground Strap (Item 30) is shipped with the eyelet end fastened to the pump hardware.

To reduce the risk of static electrical sparking, this pump must be grounded. Check the local electrical code for detailed grounding instruction and the type of equipment required, or in the absence of local codes, an industry or nationally recognized code having jurisdiction over specific installations, and/or CAN/CGA B149, installation codes.



# Product Specification Guide

HIGH PERFORMANCE AIR-POWERED DOUBLE DIAPHRAGM PUMPS

The **Proof's** in the Pump

[yamadapump.com](http://yamadapump.com)

# Yamada



# About Yamada...



**Yamada America, Inc.**  
955 E. Algonquin Road  
Arlington Heights, IL 60005

800 990-7867 Toll-Free  
847 631-9200 Phone  
847 631-9273 Fax

E-mail: [sales@yamadapump.com](mailto:sales@yamadapump.com)  
Web: [www.yamadapump.com](http://www.yamadapump.com)

**Yamada**





**The Yamada Corporation** has been a leading producer of industrial equipment since 1905, and of fluid handling products for over 60 years. As a pioneer of pumping technology, Yamada is known in many industries worldwide for its innovative products, superior quality, and unmatched reliability. Other companies may claim to be innovators, but an impressive history of delivering new products and solving customer problems confirms Yamada's position as the industry leader.

Yamada's reputation for manufacturing top quality products, allied with perennial efforts in research and development have created a strong foundation for market leadership. As an ISO 9001 certified corporation, stringent quality procedures are followed throughout the manufacturing process, including liquid testing of every pump prior to shipping.

The Yamada Corporation is headquartered in Tokyo, with primary manufacturing based in Sagami-hara City, Japan. Assembly facilities are located in The Netherlands and West Chicago, Illinois, USA.

Yamada America, Inc., a wholly owned subsidiary of Yamada Corporation, was established in 1986 to provide service and support for the North, Central, and South American markets, through a highly trained network of distributors. Yamada America maintains an impressive inventory minimum of 3,000 built and tested pumps in a 40,000 square foot state-of-the-art facility. A professional staff provides:

- Customer Service
- Product Training
- Research & Development
- Parts and Service for All Yamada Pumps
- Application Engineering
- Industry Knowledge

With over 150 distributors worldwide, Yamada is in position to service the global market needs. Contact Yamada America for the closest local stocking distributor location.

Our slogan, "The Proof's in the Pump<sup>SM</sup>" underscores our solid reputation for innovation and reliability. This reputation is truly built into every Yamada pump.

For additional information, AutoCAD® drawings, product literature, and promotions, please visit [yamadapump.com](http://yamadapump.com) or contact our Sales Staff toll-free at 800 990-7867.

## CONTENTS

### Features & Benefits

Inside a Yamada Pump .....	2
Air Valve Technology .....	3
Non-Metallic Components .....	4
Ten Intelligent Reasons to Specify Yamada .....	4
NDP-5 Series .....	5
DP-10/15 Series .....	6
NDP-15 Series .....	8
NDP-20 Series .....	10
NDP-25 Series .....	12
NDP-40 Series .....	14
NDP-50 Series .....	16
NDP-80 Series .....	18
Slurry Servant Series .....	20
Phantom Series .....	20
EP Series .....	21
F-Series .....	21
Drum Pumps .....	22
U.L. Listed Pumps .....	23
FDA Compliant Pumps .....	23
High Pressure (2:1) Pumps .....	24
Split Manifold Pumps .....	24
Pump Controllers .....	25
Powder Pumps .....	25
Pulsation Dampeners .....	26
Pump Diaphragms .....	27
Optional Coatings .....	27
Additional Options .....	28
Installation Diagram ....	Inside cover
Understanding Performance Curves .....	Inside cover



# Yamada Pumps – *Engineered for Performance. Designed for Life.*

The **Proof's**  
in the **Pump**

## **Leak-Free Mating Surfaces**

All Yamada pumps incorporate bolted construction, which eliminates leaks and simplifies reassembly after maintenance. Many competitors utilize clamp band construction, which frequently requires frustrating and unnecessary rebuilds due to leakage from misalignment during reassembly.

## **Outside Accessible Air Valve**

Inspection or maintenance of every Yamada air valve may be performed without removing the pump from service.

## **Unified Air Valve Concept**

Common-size air valve assemblies reduce parts confusion.

## **Pilot Valve**

Unique to the Yamada design is an individual modular pilot valve that actuates the air valve. It is depressed slightly by the inner center disk creating a pressure drop at one end of the air valve, allowing shifting to occur. It is maintenance free with no cumbersome snap rings or lubricated dynamic o-rings to replace or repair.

## **Diaphragm Dynamics**

Extensive research has led to the development of an optimal stroke length that maximizes diaphragm life and performance while minimizing downtime and maintenance costs.



# Air Valve Technology



Air valve technology is the heart of the air-powered double diaphragm pump and determines reliability. Yamada holds three patents on its field proven valve and enjoys a superior reputation throughout the industry.

## Unified Air Valve Concept

To simplify, Yamada offers two common size air valve assemblies within five sizes of pumps (3/4" & 1" pumps and 1-1/2", 2" & 3" pumps) further reducing reassembly confusion and parts inventory. Other air-powered double diaphragm pump manufacturers offer multiple air valve designs and revisions in an effort to address pump reliability problems. Multiple designs and revisions typically create maintenance rebuild issues, parts confusion, and obsolete inventory. Whether your pumps are functioning continuously or intermittently; at high or low pressure; using dirty or clean air; Yamada offers **one field proven design**.

## Truly Non-Lubricated Air Valve

The patented air valve on all NDP series pumps never requires lubrication or pre-packing. The advanced design eliminates the need for external lubrication which can lead to pumpage contamination and maintenance headaches. **Yamada is proud to be the originator of non-lubricated air valve technology for air-powered double diaphragm pumps.** Many of our competitors claim to offer a non-lubricated air valve – does your experience agree? Dependent upon the competitor design, the air valve will probably require lubrication for continuous operation, or lubricator installation if moisture is present in the air system. These valves are pre-packed with grease and are not truly non-lubricated.

## Component Replaceable

All Yamada air valves can be restored with individual components, without requiring complete valve and housing replacement. Many competitor air valves incorporate a complicated design which requires complete replacement of the valve assembly and housing, further increasing the cost of ownership.

*Common-size air valve assemblies reduce parts confusion.*



NDP-20 & -25 Series  
Air Valve

NDP-40, -50, & -80  
Series Air Valve

## Non-Stalling

A patented non-centering, spring-assisted shifter is incorporated into every NDP Series pump, ensuring a positive shift every time. The 304 stainless steel C-springs provide exceptional durability and longevity and are tested to last over **300 million cycles!** The spring assist also aides in long dead head applications for reliable startup.

*Continued on next page* ➤

For additional information on Yamada products and services, visit [yamadapump.com](http://yamadapump.com)



# Non-Metallic Components

*Features & Benefits—continued from preceding page.*

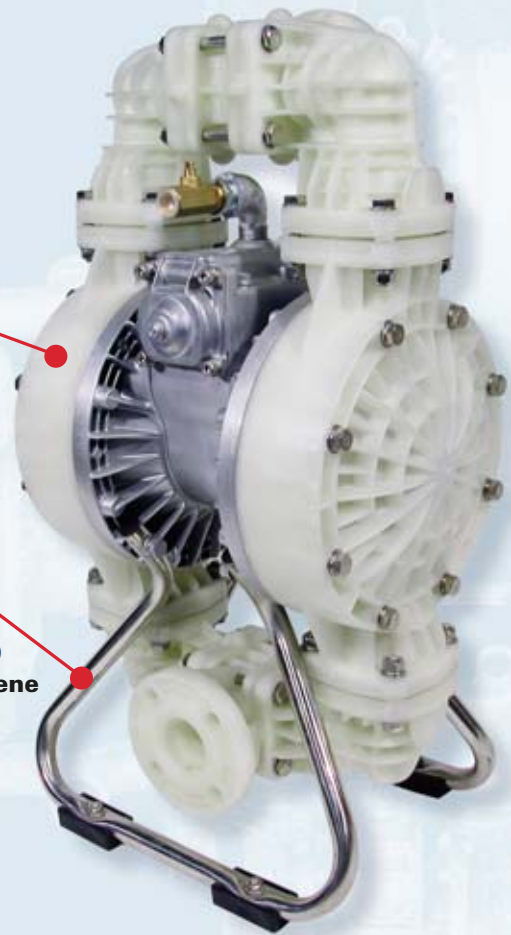
## Non-Metallic Components

Yamada Engineers utilize state-of-the-art solid modeling and finite element analysis techniques, including rib and shell methods of injection molding to design non-metallic parts structure. This “patented” technique greatly increases the component strength and reduces material usage.

## NDP-40, 50, & 80 Series Non-Metallic Pump Base

The tubular 304 Stainless Steel base was designed to simplify rebuilding procedures and to absorb weight distribution. Maintenance operations are streamlined by mounting the base directly to the air motor so that the pump can sit upright on a workbench for most of the service. The radially bent tubular steel base is rated to 85,000 PSI giving it exceptional strength vs. welded angle designs.

**NDP-40  
Polypropylene**



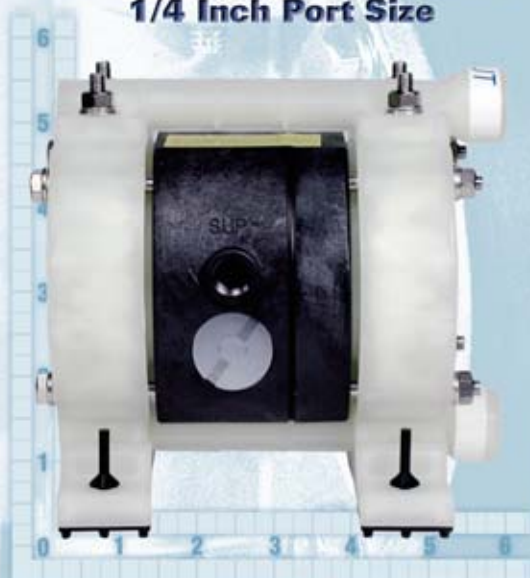
# Ten Intelligent Reasons...

**To Specify Yamada Air-Powered Double Diaphragm Pumps:**

- 1. Handles a wide variety of fluids with high solids content:** No close fitting or rotating parts so liquid with high solids content and/or size can be easily pumped.
  - 2. Self Priming:** The Yamada pump design (incorporating internal check valves) allows for high suction lift even at dry start-up and with heavier fluids.
  - 3. Ability to run dry:** No close fittings or sliding parts are at risk—the pump can run dry without damage.
  - 4. Variable flow rate and discharge pressure:** Yamada pumps will run at any setting within their operating range simply by adjusting the air inlet pressure and system conditions. One pump can fit a broad spectrum of applications.
  - 5. Portable/Simple Installation:** Yamada pumps transport easily to the application site. Simply connect your air supply line and liquid lines; the pump is ready to perform. There are no complex controls to install and operate.
  - 6. Dead Head:** Because the discharge pressure can never exceed air inlet pressure, the discharge line can be closed with no damage or wear. The pump will simply slow down and stop.
  - 7. Shear sensitive:** The gentle nature and minimal parts contact with the liquid makes Yamada pumps an excellent choice for shear sensitive fluids.
  - 8. Explosion Proof:** Yamada pumps are operated by compressed air, therefore, they are intrinsically safe.
  - 9. Submersible:** If external components are compatible—Yamada pumps can be submerged in the liquid by simply running the exhaust line above the liquid level.
  - 10. Pumping efficiency remains constant:** There are no rotors, gears, or pistons, which wear over time and lead to the gradual decline in performance/flow rate.
- For additional information on Yamada products & services, visit [yamadapump.com](http://yamadapump.com).

# NDP-5 Series

**3.4 GPM Maximum Capacity**  
**1/4 Inch Port Size**



## ▲ Polypropylene

**Dimensions:** 6.14" W x 5.79" H  
**Net Wt.:** 3.0 lbs. (1.36 kg)  
**Shipping Wt.:** 4 lbs.

## Kynar® (PVDF)

**Dimensions:** 6.14" W x 5.79" H  
**Net Wt.:** 3.7 lbs. (1.67 kg)  
**Shipping Wt.:** 4.7 lbs.

## Groundable Acetal

**Dimensions:** 6.14" W x 5.79" H  
**Net Wt.:** 3.7 lbs. (1.67 kg)  
**Shipping Wt.:** 4.7 lbs.

## Stainless Steel

**Dimensions:** 6.1" W x 5.87" H  
**Net Wt.:** 5.9 lbs. (2.68 kg)  
**Shipping Wt.:** 6.9 lbs.

## Aluminum

**Dimensions:** 6.1" W x 5.87" H  
**Net Wt.:** 3.3 lbs. (1.5 kg)  
**Shipping Wt.:** 4.3 lbs.



# Specifications

## Port Dimensions

Intake & discharge	1/4" Female NPT
Air inlet (incl. ball valve):	1/4" Female NPT
Air exhaust (internal silencer):	3/8" Female NPT

## Maximum Liquid Temperature

Fitted with Teflon® (PTFE) diaphragm

Pump Material	Temperature
Polypropylene (PPG)	180°F (82°C)
Kynar® (PVDF)	212°F (100°C)
Groundable Acetal	180°F (82°C)
Aluminum (ADC-12)	212°F (100°C)
Stainless Steel (316)	212°F (100°C)

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kfg/cm)

## Discharge Volume Per Cycle

0.0085 gallons (35 cc)

**Maximum Cycles Per Minute:** 400

**Maximum Dry Suction Lift:** 5-feet

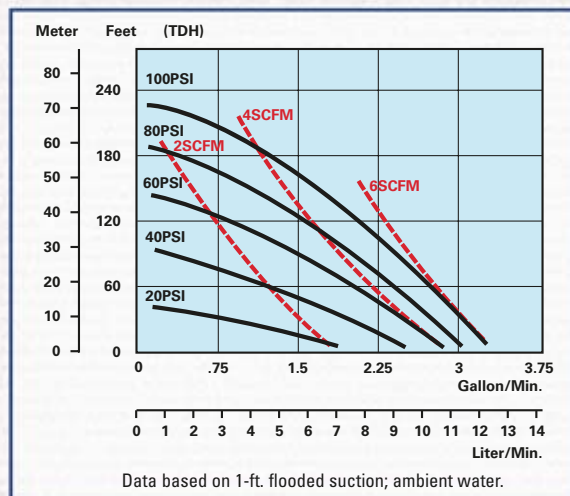
## Pump Air Motor

Ryton® air motor standard

## Model Number Nomenclature

Polypropylene (PPG)	NDP-5FPT
Kynar® (PVDF)	NDP-5FVT
Groundable Acetal	NDP-5FDT
Aluminum (ADC-12)	NDP-5FAT
Stainless Steel (316)	NDP-5FST

## Performance Curve



AutoCAD® drawings are available on CD ROM  
or at [yamadapump.com](http://yamadapump.com)



# DP-10 Series / DP-15 Series

**6 GPM Maximum Capacity  
3/8 Inch Port Size**

**8 GPM Maximum Capacity  
1/2 Inch Port Size**



**DP-10 Aluminum**

**Dimensions:** 7.32" W x 9.49" H  
**Net Wt.:** 7.9 lbs. (3.6 kg)  
**Shipping Wt.:** 9.9 lbs.

**DP-10 Stainless Steel**

**Dimensions:** 7.32" W x 9.49" H  
**Net Wt.:** 11.7 lbs. (5.3 kg)  
**Shipping Wt.:** 13.7 lbs.



**DP-10**

**Polypropylene**

**Dimensions:**  
7.72" W x 7.72" H  
**Net Wt.:** 6.8 lbs. (3.1 kg)  
**Shipping Wt.:** 8.8 lbs.



**DP-15**

**Groundable Acetal**

**Dimensions:**  
9.68" W x 11.69" H  
**Net Wt.:** 9 lbs. (4 kg)  
**Shipping Wt.:** 12 lbs.



**DP-15**

**Polypropylene**

**Dimensions:**  
9.68" W x 11.69" H  
**Net Wt.:** 9 lbs. (4 kg)  
**Shipping Wt.:** 12 lbs.

AutoCAD® drawings are available on  
CD ROM or at [yamadapump.com](http://yamadapump.com)

# DP Series Specifications

## DP-10 Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG)	3/8" Female NPT
Aluminum (ADC-12)	3/8" Female NPT
Stainless Steel (316)	3/8" Female NPT

## DP-15 Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG)	1/2" Female NPT
Groundable Acetal	1/2" Female NPT

## Air Inlet/Exhaust

Air inlet (incl. ball valve):	1/4" Female NPT
Air exhaust (incl. silencer):	3/8" Female NPT

## Maximum Liquid Temperature\*

Diaphragm Material	Temperature
Neoprene	180°F (82°C)
Buna N	180°F (82°C)
Hytrel®	248°F (120°C)
Santoprene®	225°F (107°C)
Viton®	248°F (120°C)
Teflon (PTFE)	212°F (100°C)

\*Polypropylene and Groundable Acetal pumps have a maximum liquid temperature of 180°F (82°C) regardless of diaphragm material.

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kfg/cm)

## Discharge Volume Per Cycle

DP-10: 0.020 gallons (74 cc)

DP-15: 0.027 gallons (102 cc)

## Maximum Cycles Per Minute

All diaphragms: 300

## Maximum Size Solid

1/32" (1 mm)

## Maximum Dry Suction Lift

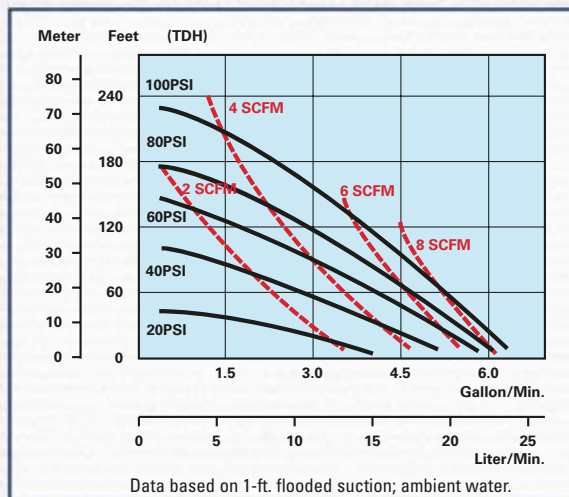
All diaphragms: 10-feet

## Aluminum Air Motor–Standard

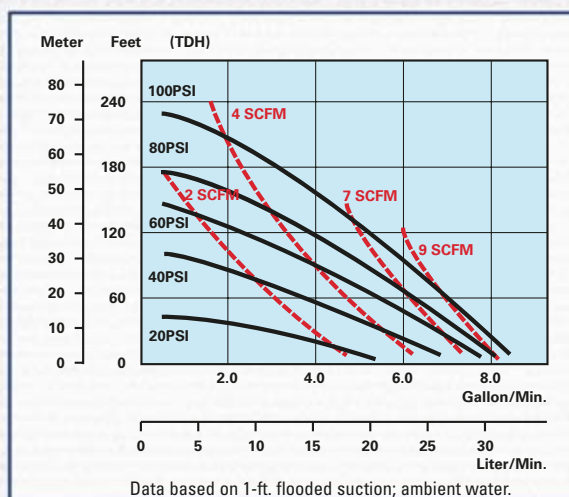
Optional: Epoxy-coated, Teflon-coated, or Electroless Nickel Plate

Notes: Hytrel-fitted pumps include Buna N check balls & wetted o-rings. Santoprene-fitted pumps include EPDM check balls & wetted o-rings.

## DP-10 Series Performance Curve



## DP-15 Series Performance Curve



## Model Number Nomenclature

<b>Series:</b>	DP-1x	x	x	x
<b>Valve Type:</b>				
B = Ball				
F = Flat*				
<b>Body Material:</b>				
P = Polypropylene				
D = Groundable Acetal				
A = Aluminum				
S = Stainless Steel				
<b>Diaphragm Material:</b>				
C = Neoprene (CR)				
N = Buna N (NBR)				
S = Santoprene (TPO)				
T = Teflon (PTFE)				
V = Viton (FPM)				
H = Hytrel (TPE)				

\* Flat valves available for DP-15 pumps only.  
NOTE: Additional options listed on page 28.



# NDP-15 Series

**15 GPM Maximum Capacity  
1/2 Inch Port Size**



## **Kynar (PVDF)**

**Dimensions:** 8.66" W x 11.73" H  
**Net Wt.:** 9.4 lbs. (4.2 kg)  
**Shipping Wt.:** 11 lbs.

## **Polypropylene**

**Dimensions:**  
8.66" W x 11.73" H  
**Net Wt.:** 7.7 lbs. (3.5 kg)  
**Shipping Wt.:** 9.5 lbs.



## **Groundable Acetal**

**Dimensions:**  
8.66" W x 11.73" H  
**Net Wt.:** 9 lbs. (4 kg)  
**Shipping Wt.:** 11 lbs.



## **Aluminum**

**Dimensions:**  
8.66" W x 10.71" H  
**Net Wt.:** 9 lbs. (4 kg)  
**Shipping Wt.:** 11 lbs.



## **Stainless Steel**

**Dimensions:**  
8.31" W x 9.7" H  
**Net Wt.:** 13.6 lbs. (6.16 kg)  
**Shipping Wt.:** 15.5 lbs.

AutoCAD® drawings are available on  
CD ROM or at [yamadapump.com](http://yamadapump.com)

# NDP-15 Series Specifications

## Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG) ■	1/2" Female NPT
Kynar (PVDF) ◆	1/2" Female NPT
Groundable Acetal ◆	1/2" Female NPT
Aluminum (ADC-12) ▲	1/2" Female NPT
Stainless Steel (316) ▲	1/2" Female NPT
Air inlet (includes ball valve):	1/4" Female NPT
Air exhaust (internal silencer):	3/8" Female NPT

- Polypropylene pumps may be fitted with ball or flat check valves. Ball-type check valves are recommended for flooded suction applications. Flat-type check valves are recommended for suction lift applications.
- ◆ Kynar and Groundable Acetal pumps are fitted with flat check valves only.
- ▲ Aluminum and Stainless Steel pumps are fitted with ball check valves only.

## Maximum Liquid Temperature\*

Diaphragm Material	Temperature
Neoprene	180°F (82°C)
Buna N	180°F (82°C)
Hytrel	248°F (120°C)
Santoprene	225°F (107°C)
Viton	248°F (120°C)
Teflon (PTFE)	212°F (100°C)

\*Polypropylene and Groundable Acetal pumps have a maximum liquid temperature of 180°F (82°C) regardless of diaphragm material. Kynar pumps have a maximum temperature of 248°F (120°C) when fitted with Hytrel or Viton diaphragms.

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kgf/cm)

## Discharge Volume Per Cycle

Flat-type check valve: 0.0375 gallons (138 cc)

Ball-type check valve: 0.031 gallons (119 cc)

## Maximum Cycles Per Minute

All diaphragms: 400

## Maximum Size Solid: 1/32" (1 mm)

## Maximum Dry Suction Lift

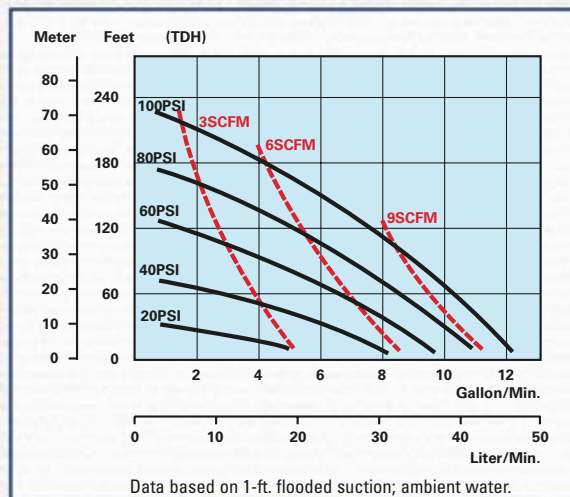
Flat-type check valve: 8-feet

Ball-type check valve: 5-feet

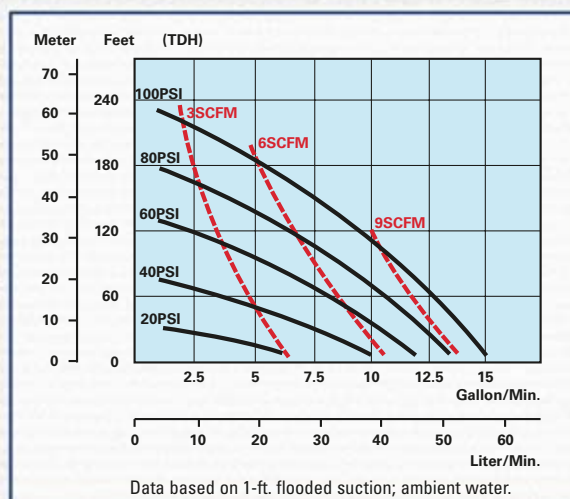
## Pump Air Motor: Ryton air motor standard

Notes: Hytrel-fitted pumps include Buna N check balls & wetted o-rings. Santoprene-fitted pumps include EPDM check balls & wetted o-rings.

## All Diaphragm Materials–Ball Valve



## All Diaphragm Materials–Flat Valve



## Model Number Nomenclature

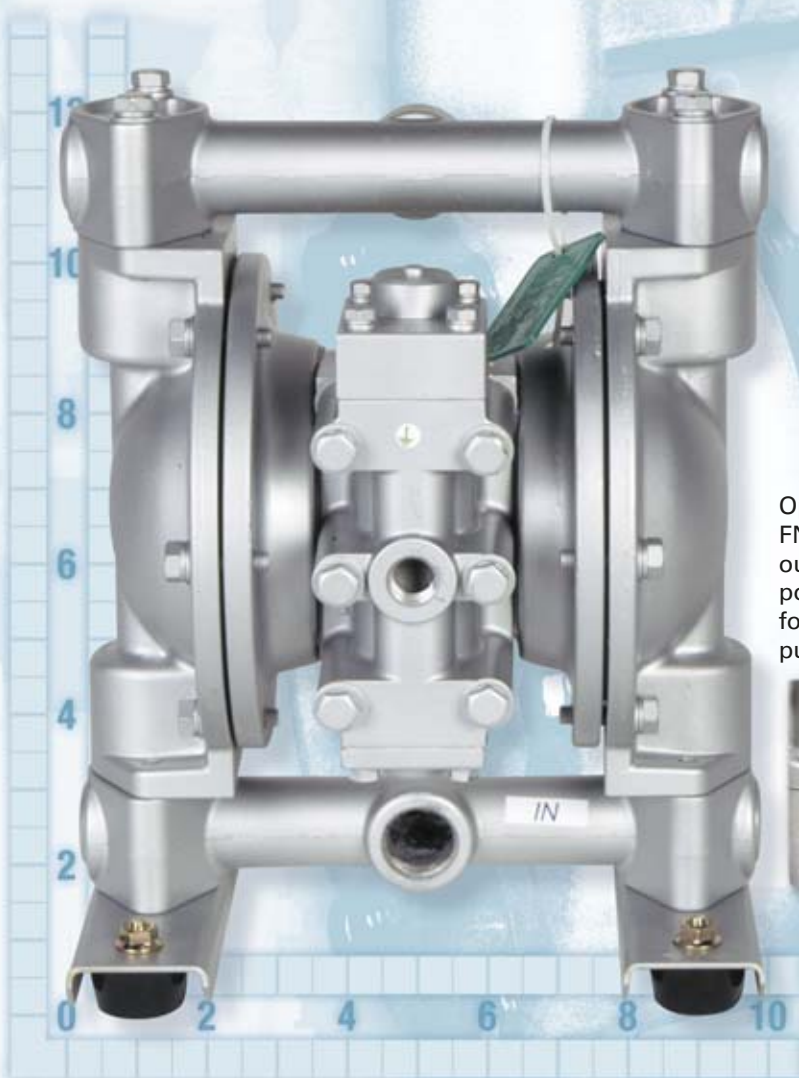
Series:	NDP-15	x	x	x
NDP-15 Pump				
Valve Type:				
B = Ball				
F = Flat*				
Body Material:				
P = Polypropylene				
V = Kynar (PVDF)				
D = Groundable Acetal				
A = Aluminum				
S = Stainless Steel				
Diaphragm Material:				
C = Neoprene (CR)				
N = Buna N (NBR)				
S = Santoprene (TPO)				
T = Teflon (PTFE)				
V = Viton (FPM)				
H = Hytrel (TPE)				

\* Flat valves are available for plastic pumps only.  
NOTE: Additional options listed on page 28.



# NDP-20 Series

**28 GPM Maximum Capacity  
3/4 Inch Port Size**



## **Aluminum**

### **Dimensions:**

9.80" W x 12.60" H

**Net Wt.:** 19.8 lbs. (9.0 kg)

**Shipping Wt.:** 23 lbs.

## **Stainless Steel**

### **Dimensions:**

9.80" W x 12.60" H

**Net Wt.:** 30.8 lbs. (13.9 kg)

**Shipping Wt.:** 32 lbs.

Optional: 1"  
FNPT inlet &  
outlet side  
ports. Available  
for aluminum  
pumps only.



## **Polypropylene-NPT**

**Dimensions:** 12.44" W x 14.50" H

**Net Wt.:** 17.6 lbs. (8.2 kg)

**Shipping Wt.:** 22.6 lbs.



## **Polypropylene-Flange**

**Dimensions:** 12.44" W x 14.75" H

**Net Wt.:** 17.6 lbs. (8.2 kg)

**Shipping Wt.:** 22.6 lbs.

AutoCAD® drawings are available on  
CDROM or at [yamadapump.com](http://yamadapump.com)

# NDP-20 Series Specifications

## Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG)	3/4" Female NPT
Aluminum (ADC-12)	3/4" Female NPT
Stainless Steel (316)	3/4" Female NPT
Air inlet (incl. ball valve):	1/4" Female NPT
Air exhaust (incl. silencer):	3/4" Female NPT

**ANSI Flange** also available — consult Yamada.

## Maximum Liquid Temperature\*

Diaphragm Material	Temperature
Neoprene	180°F (82°C)
Buna N	180°F (82°C)
EPDM	212°F (100°C)
Hytrel	248°F (120°C)
Santoprene	225°F (107°C)
Viton	248°F (120°C)
Teflon (PTFE)	212°F (100°C)

\*Polypropylene pumps have a maximum liquid temperature of 180°F (82°C) regardless of diaphragm material.

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kfg/cm)

## Discharge Volume Per Cycle

Rubber diaphragm: 0.14 gallons (490 cc)

PTFE diaphragm: 0.10 gallons (290 cc)

## Maximum Cycles Per Minute

Rubber diaphragm: 195

PTFE diaphragm: 195

## Maximum Size Solid

1/16" (2.0 mm)

## Maximum Dry Suction Lift

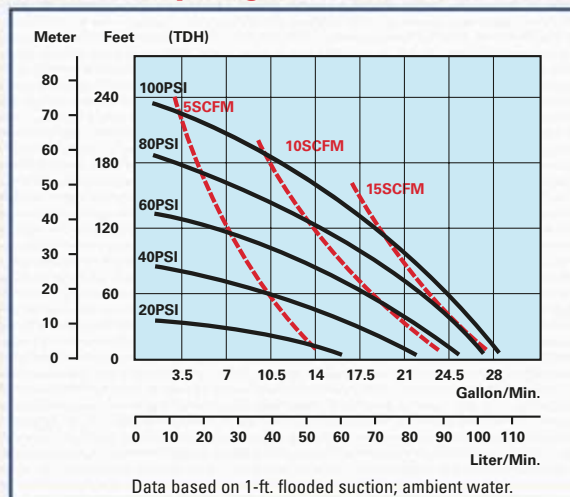
Rubber-fitted pump capability: 18-feet

## Aluminum Air Motor—Standard

Optional: Epoxy-coated, Teflon-coated, or Electroless Nickel Plate

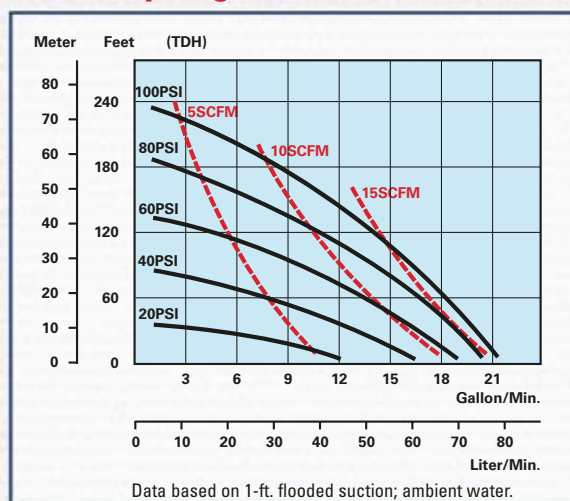
Notes: Hytrel-fitted pumps include Buna N check balls & wetted o-rings. Santoprene-fitted pumps include EPDM check balls & wetted o-rings.

## Rubber Diaphragm Performance Curve



To calculate performance for Santoprene and Hytrel-fitted pumps, use Rubber Diaphragm Curve.

## PTFE Diaphragm Performance Curve



## Model Number Nomenclature

Series:	NDP-20	B	x	x
NDP-20 Pump				
Valve Type:				
B = Ball				
Body Material:				
P = Polypropylene				
A = Aluminum				
S = Stainless Steel				
Diaphragm Material:				
C = Neoprene (CR)				
N = Buna N (NBR)				
E = Nordel® (EPDM)				
S = Santoprene (TPO)				
T = Teflon (PTFE)				
V = Viton (FPM)				
H = Hytrel (TPE)				

Additional options listed on page 28.



# NDP-25 Series

**49 GPM Maximum Capacity  
1 Inch Port Size**

## **Polypropylene-NPT**

**Dimensions:** 14.40" W x 16.90" H

**Net Wt.:** 29 lbs. (10.9 kg)

**Shipping Wt.:** 30 lbs.



## **Kynar (PVDF)-NPT**

**Dimensions:**

14.40" W x 16.90" H

**Net Wt.:** 29.7 lbs. (13.4 kg)

**Shipping Wt.:** 33 lbs.



## **Kynar (PVDF)-Flange**

**Dimensions:**

14.40" W x 17.40" H

**Net Wt.:** 29.7 lbs. (13.4 kg)

**Shipping Wt.:** 33 lbs.

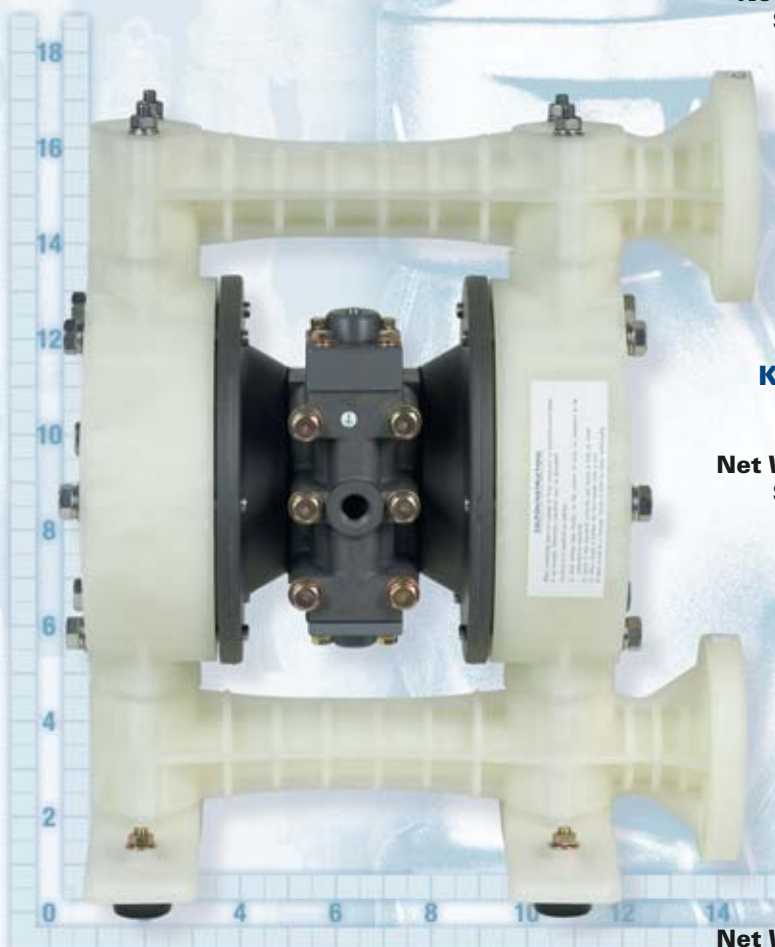


## **Polypropylene-Flange**

**Dimensions:** 14.40" W x 17.40" H

**Net Wt.:** 29 lbs. (10.9 kg)

**Shipping Wt.:** 30 lbs.



## **Aluminum**

**Dimensions:** 11.30" W x 15.08" H

**Net Wt.:** 27 lbs. (13.0 kg)

**Shipping Wt.:** 31 lbs.

## **Stainless Steel**

**Dimensions:** 11.30" W x 15.08" H

**Net Wt.:** 42 lbs. (19.9 kg)

**Shipping Wt.:** 46 lbs.

## **Cast Iron**

**Dimensions:** 11.30" W x 15.08" H

**Net Wt.:** 43 lbs. (19.9 kg)

**Shipping Wt.:** 46 lbs.



AutoCAD® drawings are available on  
CDROM or at yamadapump.com



# NDP-25 Series Specifications

## Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG)	1" Female NPT
Kynar® (PVDF)	1" Female NPT
Aluminum (ADC-12)	1" Female NPT
Stainless Steel (316)	1" Female NPT
Cast Iron	1" Female NPT
Air inlet (incl. ball valve):	3/8" Female NPT
Air exhaust (incl. silencer):	3/4" Female NPT

**ANSI Flange** also available — consult Yamada.

## Maximum Liquid Temperature\*

Diaphragm Material	Temperature
Neoprene	180°F (82°C)
Buna N	180°F (82°C)
EPDM	212°F (100°C)
Hytrel	248°F (120°C)
Santoprene	225°F (107°C)
Viton	248°F (120°C)
Teflon (PTFE)	212°F (100°C)

\*Polypropylene pumps have a maximum liquid temperature of 180°F (82°C) regardless of diaphragm material. Kynar pumps have a maximum temperature of 248°F (120°C) when fitted with Hytrel or Viton diaphragms.

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kfg/cm)

## Discharge Volume Per Cycle

Rubber diaphragm: 0.23 gallons (862 cc)

PTFE diaphragm: 0.17 gallons (654 cc)

## Maximum Cycles Per Minute

Rubber diaphragm: 210

PTFE diaphragm: 210

## Maximum Size Solid

3/16" (4.8 mm)

## Maximum Dry Suction Lift

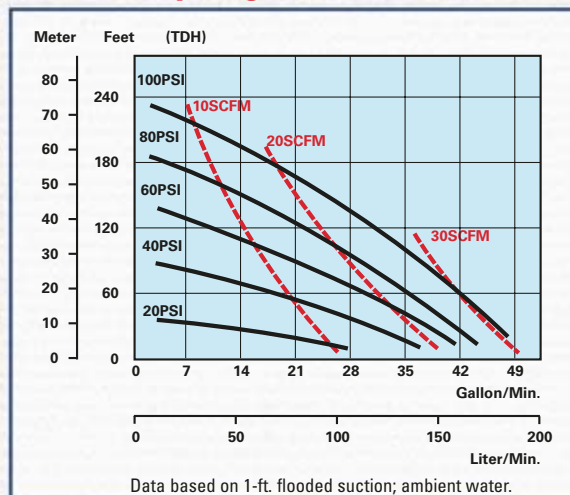
Rubber-fitted pump capability: 18-feet

## Aluminum Air Motor – Standard

Optional: Epoxy-coated, Teflon-coated, or Electroless Nickel Plate

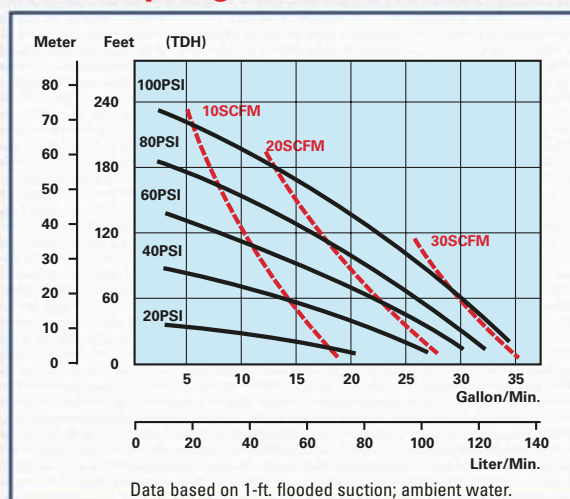
All Polypropylene, Aluminum, Cast Iron, and SS Hytrel fitted pumps include Buna N check balls & o-rings and Santoprene fitted pumps include EPDM check balls & wetted o-rings. Kynar (PVDF) pumps fitted with Santoprene, Hytrel, or Teflon include Teflon check balls & o-rings. Kynar/EPDM fitted pumps include EPDM check balls & o-rings and Viton fitted include Viton balls & o-rings.

## Rubber Diaphragm Performance Curve



To calculate performance for Santoprene and Hytrel-fitted pumps, use Rubber Diaphragm Curve.

## PTFE Diaphragm Performance Curve



## Model Number Nomenclature

<b>Series:</b> NDP-25 Pump	<b>NDP-25</b>	<b>B</b>	<b>x</b>	<b>x</b>
<b>Valve Type:</b> B = Ball				
<b>Body Material:</b> P = Polypropylene A = Aluminum S = Stainless Steel F = Cast Iron V = Kynar				
<b>Diaphragm Material:</b> C = Neoprene (CR) N = Buna N (NBR) E = Nordel (EPDM) S = Santoprene (TPO) T = Teflon (PTFE) V = Viton (FPM) H = Hytrel (TPE)				

Additional options listed on page 28.



# NDP-40 Series

**116 GPM Maximum Capacity  
1-1/2 Inch Port Size**



## **Kynar (PVDF)**

**Dimensions:** 15.75" W x 29.61" H  
**Net Wt.:** 70 lbs. (29.9 kg)  
**Shipping Wt.:** 78 lbs.

## **Polypropylene**

**Dimensions:**  
15.75" W x 29.61" H  
**Net Wt.:** 70 lbs. (29.9 kg)  
**Shipping Wt.:** 78 lbs.



## **Aluminum**

**Dimensions:**  
16.18" W x 27.91" H  
**Net Wt.:** 68 lbs. (28.9 kg)  
**Shipping Wt.:** 75 lbs.



## **Stainless Steel or Hastelloy C-NPT**

**Dimensions:**  
16.18" W x 27.75" H  
**Net Wt.:** 98 lbs. (39.9 kg)  
**Shipping Wt.:** 106 lbs.

## **Cast Iron-NPT**

**Dimensions:**  
16.18" W x 27.75" H  
**Net Wt.:** 112 lbs. (59.8 kg)  
**Shipping Wt.:** 120 lbs.



AutoCAD® drawings are available on  
CDROM or at [yamadapump.com](http://yamadapump.com)

ANSI #150 Flange avail-  
able on Stainless Steel &  
Hastelloy C pumps.





# NDP-40 Series Specifications

## Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG)	1-1/2" ANSI B16.5 #150
Kynar (PVDF)	1-1/2" ANSI B16.5 #150
Aluminum (ADC-12)	1-1/2" ANSI B16.5 #150 (with tapped 1-1/2" Female NPT)
Stainless Steel (316) or Hastelloy C	1-1/2" ANSI B16.5 #150 or 1-1/2" Female NPT
Cast Iron	1-1/2" Female NPT
Air inlet (incl. ball valve):	1/2" Female NPT
Air exhaust (incl. silencer):	1" Female NPT

## Maximum Liquid Temperature\*

Diaphragm Material	Temperature
Neoprene	180°F (82°C)
Buna N	180°F (82°C)
EPDM	212°F (100°C)
Hytrel	248°F (120°C)
Santoprene	212°F (100°C)
Viton	248°F (120°C)
Teflon (PTFE)	212°F (100°C)

\*Polypropylene pumps have a maximum liquid temperature of 180°F (82°C) regardless of diaphragm material. Kynar pumps have a maximum temperature of 248°F (120°C) when fitted with Hytrel or Viton diaphragms.

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kfg/cm)

## Discharge Volume Per Cycle

Rubber diaphragm: 0.79 gallons (3.0 liters)

PTFE diaphragm: 0.37 gallons (1.4 liters)

## Maximum Cycles Per Minute

Rubber diaphragm: 148

PTFE diaphragm: 270

## Maximum Size Solid

9/32" (7 mm)

## Maximum Dry Suction Lift

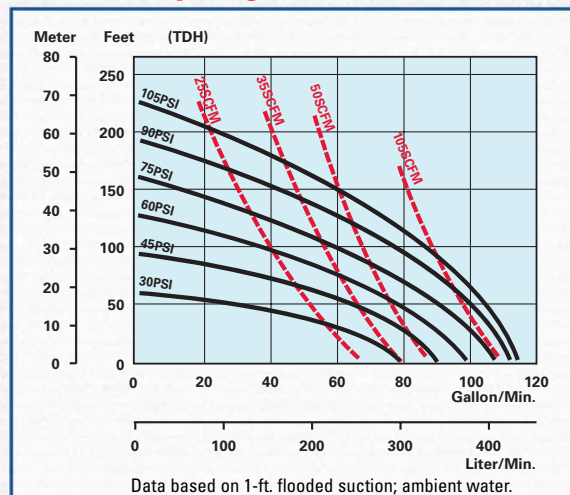
Rubber-fitted pump capability: 18-feet

## Aluminum Air Motor – Standard

Optional: Epoxy-coated, Teflon-coated, or Electroless Nickel Plate

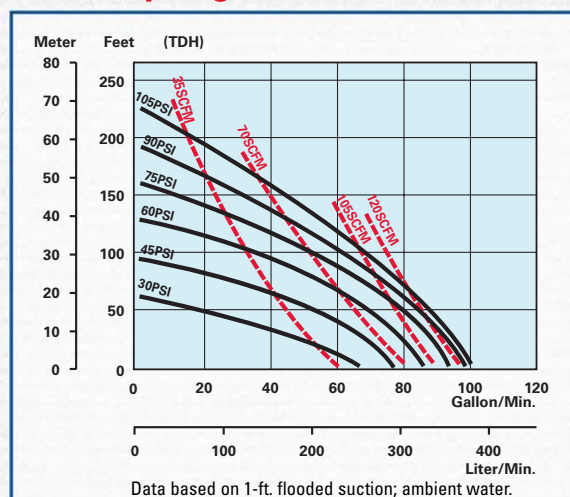
All Polypropylene, Aluminum, Cast Iron, Hastelloy C, and SS Hytrel fitted pumps include Buna N check balls & o-rings and Santoprene fitted pumps include EPDM check balls & wetted o-rings. Kynar (PVDF) pumps fitted with Santoprene, Hytrel, or Teflon include Teflon check balls & o-rings. Kynar/EPDM fitted pumps include EPDM check balls & o-rings and Viton fitted include Viton balls & o-rings.

## Rubber Diaphragm Performance Curve



To calculate performance for Santoprene and Hytrel-fitted pumps, use Rubber Diaphragm Curve.

## PTFE Diaphragm Performance Curve



## Model Number Nomenclature

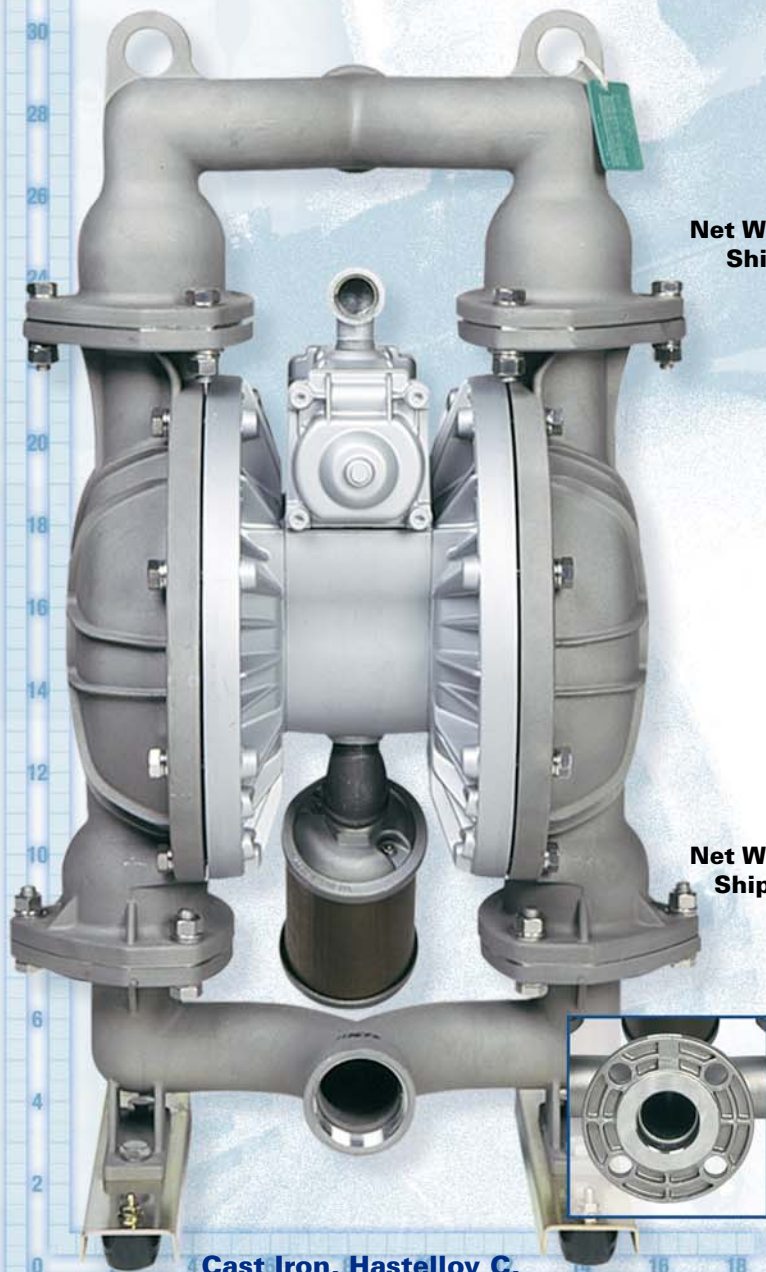
Series:	NDP-40	B	x	x
NDP-40 Pump				
Valve Type:				
B = Ball				
Body Material:				
P = Polypropylene				
V = Kynar				
A = Aluminum				
S = Stainless Steel				
F = Cast Iron				
H = Hastelloy C				
Diaphragm Material:				
C = Neoprene (CR)				
N = Buna N (NBR)				
E = Nordel (EPDM)				
S = Santoprene (TPO)				
T = Teflon (PTFE)				
V = Viton (FPM)				
H = Hytrel (TPE)				

Note: For NPT-fitted SS or Hastelloy C, add "NPT" at end of model number nomenclature. Additional options listed on page 28.



# NDP-50 Series

**166 GPM Maximum Capacity  
2-Inch Port Size**



**Cast Iron, Hastelloy C,  
or Stainless Steel**

**Dimensions:** 17.72" W x 30.55" H  
**Net Wt.:** Cast Iron-159 lbs. (72.1 kg)  
 SS and Hastelloy C-162 lbs. (73.5 kg)  
**Shipping Wt.:** Cast Iron-168 lbs.  
 SS and Hastelloy C-173 lbs.

AutoCAD® drawings are available on  
 CD ROM or at [yamadapump.com](http://yamadapump.com)

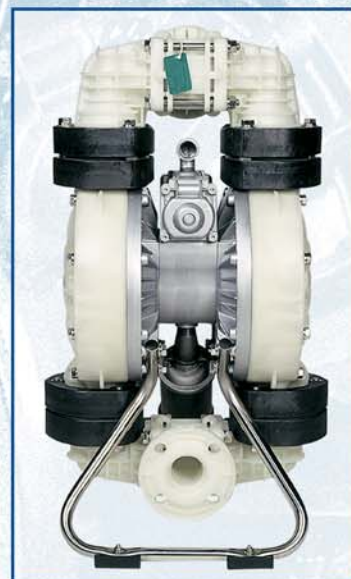
**Aluminum  
Dimensions:**

17.68" W x 30.67" H  
**Net Wt.:** 88 lbs. (39.9 kg)  
**Shipping Wt.:** 99 lbs.



**Polypropylene  
Dimensions:**

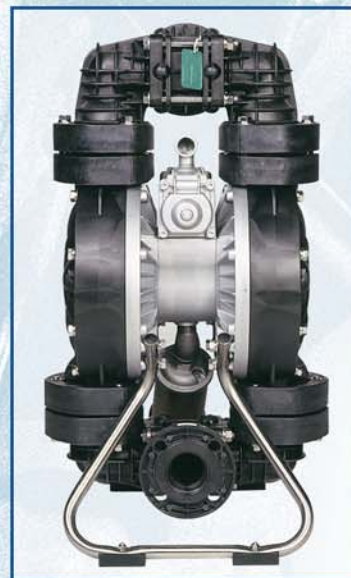
18.63" W x 32.32" H  
**Net Wt.:** 84 lbs. (38.1 kg)  
**Shipping Wt.:** 108 lbs.



Optional ANSI  
 Flange for  
 Stainless Steel  
 and Hastelloy C  
 models.

**Kynar (PVDF)  
Dimensions:**

18.63" W x 32.32" H  
**Net Wt.:** 103 lbs. (46.7 kg)  
**Shipping Wt.:** 121 lbs.





# NDP-50 Series Specifications

## Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG)	2" ANSI B16.5 #150
Kynar (PVDF)	2" ANSI B16.5 #150
Aluminum (ADC-12)	2" ANSI B16.5 #150 (with tapped 2" Female NPT)
Stainless Steel (316) or Hastelloy C	2" ANSI B16.5 #150 or 2" Female NPT
Cast Iron	2" Female NPT
Air inlet (incl. ball valve):	3/4" Female NPT
Air exhaust (incl. silencer):	1" Female NPT

## Maximum Liquid Temperature\*

Diaphragm Material	Temperature
Neoprene	180°F (82°C)
Buna N	180°F (82°C)
EPDM	212°F (100°C)
Hytrel	248°F (120°C)
Santoprene	212°F (100°C)
Viton	248°F (120°C)
Teflon (PTFE)	212°F (100°C)

\*Polypropylene pumps have a maximum liquid temperature of 180°F (82°C) regardless of diaphragm material. Kynar pumps have a maximum temperature of 248°F (120°C) when fitted with Hytrel or Viton diaphragms.

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kgf/cm)

## Discharge Volume Per Cycle

Rubber diaphragm: 1.14 gallons (4.3 liters)

PTFE diaphragm: 0.55 gallons (2.1 liters)

## Maximum Cycles Per Minute

Rubber diaphragm: 146

PTFE diaphragm: 220

## Maximum Size Solid

5/16" (8 mm)

## Maximum Dry Suction Lift

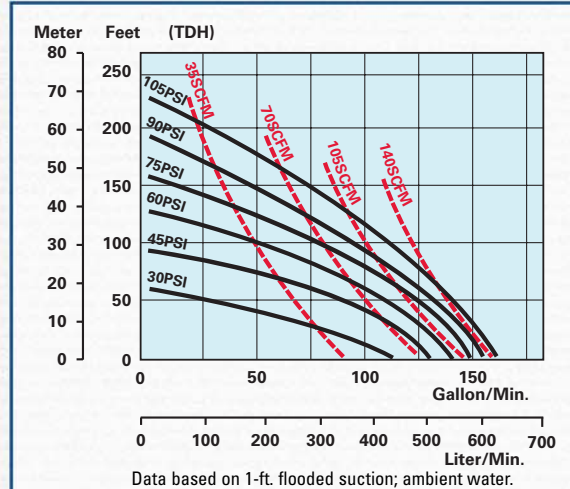
Rubber-fitted pump capability: 19-feet

## Aluminum Air Motor–Standard

Optional: Epoxy-coated, Teflon-coated, or Electroless Nickel Plate

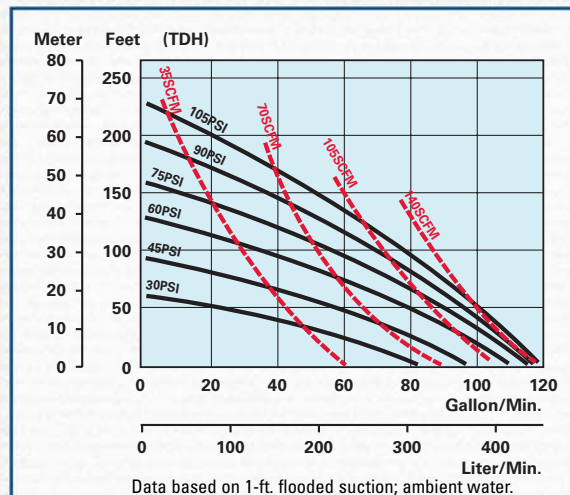
All Polypropylene, Aluminum, Cast Iron, Hastelloy C, and SS Hytrel fitted pumps include Buna N check balls & o-rings and Santoprene fitted pumps include EPDM check balls & wetted o-rings. Kynar (PVDF) pumps fitted with Santoprene, Hytrel, or Teflon include Teflon check balls & o-rings. Kynar/EPDM fitted pumps include EPDM check balls & o-rings and Viton fitted include Viton balls & o-rings.

## Rubber Diaphragm Performance Curve



To calculate performance for Santoprene and Hytrel-fitted pumps, use Rubber Diaphragm Curve.

## PTFE Diaphragm Performance Curve



## Model Number Nomenclature

Series: NDP-50 B x x  
NDP-50 Pump

Valve Type:  
B = Ball

Body Material:  
P = Polypropylene  
V = Kynar (PVDF)  
A = Aluminum  
S = Stainless Steel  
F = Cast Iron  
H = Hastelloy C

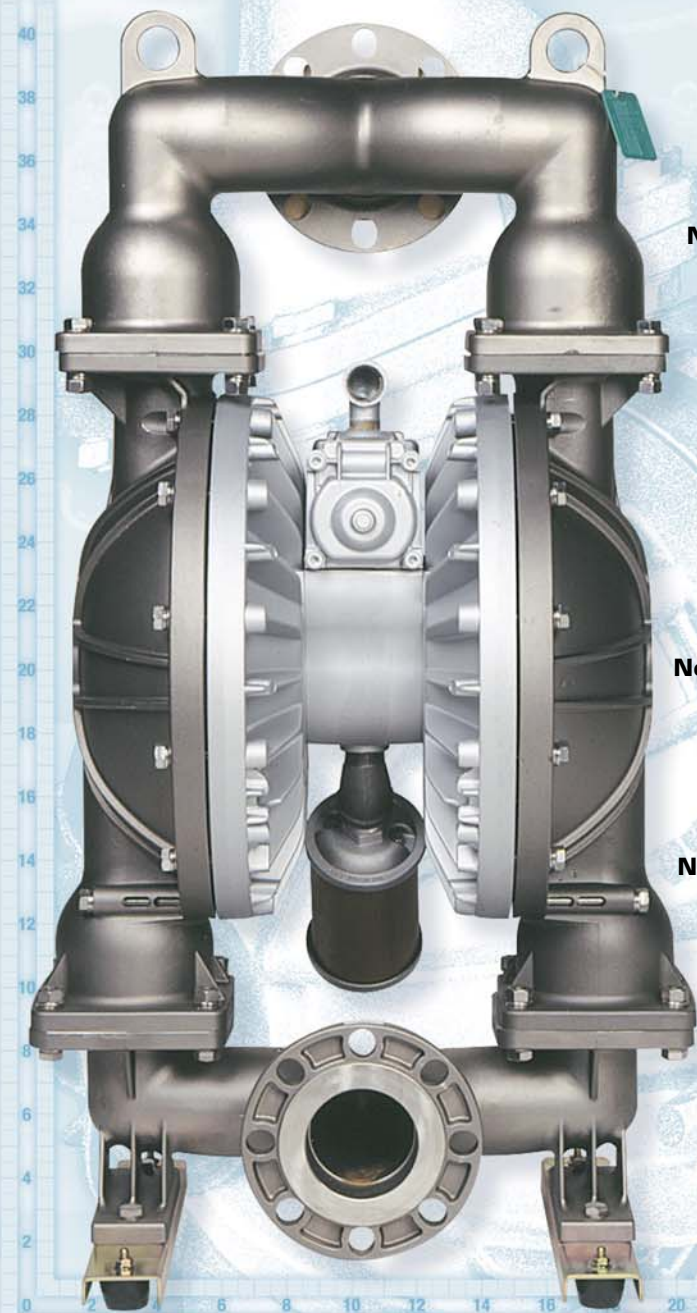
Diaphragm Material:  
C = Neoprene (CR)  
N = Buna N (NBR)  
E = Nordel (EPDM)  
S = Santoprene (TPO)  
T = Teflon (PTFE)  
V = Viton (FPM)  
H = Hytrel (TPE)

Note: For NPT-fitted SS or Hastelloy C, add "NPT" at end of model number nomenclature. Additional options listed on page 28.



# NDP-80 Series

**214 GPM Maximum Capacity  
3 Inch Port Size**



## **Stainless Steel or Hastelloy C-Flange**

**Dimensions:** 20.43" W x 38.74" H  
**Net Wt.:** 252 lbs. (114.3 kg)  
**Shipping Wt.:** 271 lbs.

## **Aluminum**

**Dimensions:**  
20.43" W x 40.75" H  
**Net Wt.:** 151 lbs. (68.5 kg)  
**Shipping Wt.:** 165 lbs.

## **Cast Iron-NPT**

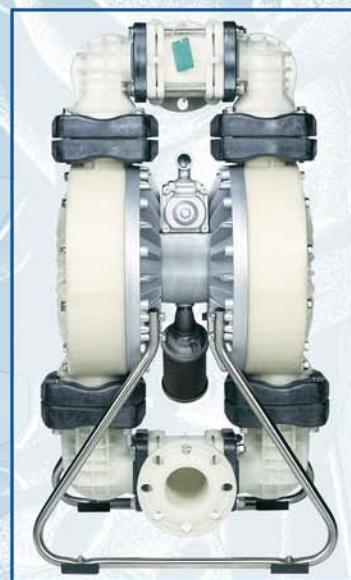
**Dimensions:**  
20.54" W x 38.74" H  
**Net Wt.:** 271 lbs. (122.9 kg)  
**Shipping Wt.:** 277 lbs.

## **Stainless Steel or Hastelloy C-NPT**

**Dimensions:**  
20.54" W x 38.74" H  
**Net Wt.:** 244 lbs. (110.7 kg)  
**Shipping Wt.:** 263 lbs.

## **Polypropylene**

**Dimensions:**  
22.83" W x 41.10" H  
**Net Wt.:** 162 lbs. (73.5 kg)  
**Shipping Wt.:** 177 lbs.





# NDP-80 Series Specifications

## Port Dimensions

*Intake & discharge connection:*

Polypropylene (PPG)	3" ANSI B16.5 #150
Aluminum (ADC-12)	3" ANSI B16.5 #150 (with tapped 3" Female NPT)
Stainless Steel (316) or Hastelloy C	3" ANSI B16.5 #150 or 3" Female NPT
Cast Iron	3" Female NPT
Air inlet (incl. ball valve):	3/4" Female NPT
Air exhaust (incl. silencer):	1" Female NPT

## Maximum Liquid Temperature\*

Diaphragm Material	Temperature
Neoprene	180°F (82°C)
Buna N	180°F (82°C)
EPDM	212°F (100°C)
Hytrel	248°F (120°C)
Santoprene	212°F (100°C)
Viton	248°F (120°C)
Teflon (PTFE)	212°F (100°C)

\*Polypropylene pumps have a maximum liquid temperature of 180°F (82°C) regardless of diaphragm material.

## Air Supply Pressure (All Models)

20–100 PSI (1.4–7 kgf/cm)

## Discharge Volume Per Cycle

Rubber diaphragm: 2.25 gallons (8.5 liters)

PTFE diaphragm: 1.0 gallons (3.8 liters)

## Maximum Cycles Per Minute

Rubber diaphragm: 95

PTFE diaphragm: 160

## Maximum Size Solid

13/32" (10 mm)

## Maximum Dry Suction Lift

Rubber-fitted pump capability: 19-feet

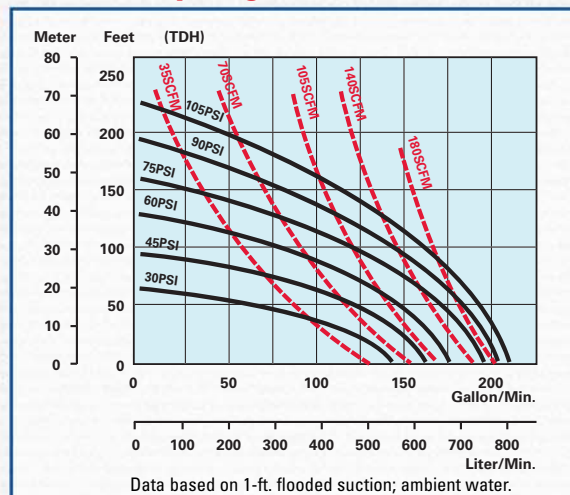
## Aluminum Air Motor – Standard

Optional: Epoxy-coated, Teflon-coated, or Electroless Nickel Plate

Notes: Hytrel-fitted pumps include Buna N check balls & wetted o-rings. Santoprene-fitted pumps include EPDM check balls & wetted o-rings.

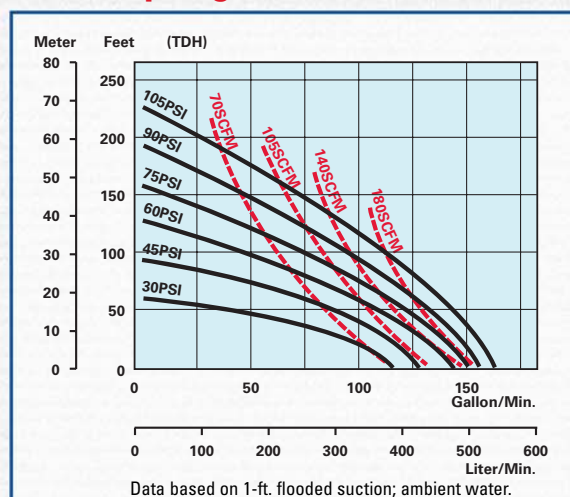
AutoCAD® drawings are available on CDROM or at [yamadapump.com](http://yamadapump.com)

## Rubber Diaphragm Performance Curve



To calculate performance for Santoprene and Hytrel-fitted pumps, use Rubber Diaphragm Curve.

## PTFE Diaphragm Performance Curve



## Model Number Nomenclature

Series:	NDP-80	B	x	x
NDP-80 Pump				
Valve Type:	B = Ball			
Diaphragm Material:				
Body Material:				

**Diaphragm Material:**  
 C = Neoprene (CR)  
 N = Buna N (NBR)  
 E = Nordel (EPDM)  
 S = Santoprene (TPO)  
 T = Teflon (PTFE)  
 V = Viton (FPM)  
 H = Hytrel (TPE)

**Body Material:**  
 P = Polypropylene  
 A = Aluminum  
 S = Stainless Steel  
 F = Cast Iron  
 H = Hastelloy C

Note: For NPT-fitted SS or Hastelloy C, add "NPT" at end of model number nomenclature. Additional options listed on page 28.



# Phantom Series

## Ultra-High Purity PTFE Pumps

Yamada Phantom Series pumps are designed for the transfer and recirculation of ultra-high purity process fluids and utilize absolutely NO internal or external metallic components. Its revolutionary pumping process sets a new standard for purity levels and low particle generation.

Ultra-high purity PTFE/PFA wetted components

Clean room assembled and tested

No re-torque required

Simple, compact design — small footprint

Fluid port sizes 3/8", 1/2", 3/4", & 1"

Fluid connections Flaretek® or FNPT

Flow rates 1 to 16 GPM

Air control Internal ceramic shuttle valve or external timer based control

Air pressure range 30 to 75 PSI

Temperatures up to 176° F (80° C)

**Phantom Series**  
Ultra-High Purity Pumps



**All Phantom Pumps have guaranteed life and performance... regardless of cycles!**

# Slurry Servant Series

Slurry Series Pumps are designed to transfer and recirculate abrasive process slurries when purity levels and component life is of the utmost concern. The SDP Series utilizes NO internal metallic components and ultra-high purity PTFE wetted components.

Designed to "flex" at liquid sealing areas, eliminating potential leaks

Hard-seal diaphragm design eliminates the need to re-torque

Single piece differential thickness diaphragm design

Clean room assembled and tested

Fluid port sizes 3/8", 1/2", 3/4" & 1"

Fluid connections Flaretek, ANSI Flange, or FNPT

Flow rates 1 to 16 GPM

Air control Internal ceramic shuttle valve; external timer; or external fiber-optic based control

Air pressure range 30 to 75 PSI

Temperatures up to 176° F (80° C)

**Slurry Servant Series**  
Ultra-High Purity Pumps





**F-Series**  
**Ultra-High Purity Pumps**



**Yamada has the largest installed base  
of high-purity pumps in the world!**

**EP Series**  
**Electro-Polished Pumps**



# F-Series

Extensively field proven Yamada F-Series clean room manufactured pumps are specifically designed for the safe and efficient transfer of Ultra High-Purity Process Chemistries. They provide maximum corrosion resistance, ultra high-purity levels and low particle generation.

Pumps include 100% machined virgin PTFE diaphragms, liquid chambers and manifolds.

F-Series pumps are available in six sizes

Fluid connections	Flaretek, ANSI Flange, or FNPT
-------------------	-----------------------------------

Flow rate	1 to 35 GPM
-----------	-------------

Air control	internal shuttle valve or external timer-based control
-------------	---

Air pressure range	20 to 100 PSI
--------------------	---------------

Temperatures up to 212°F (100°C)	
----------------------------------	--

For additional information, please request the Yamada *High-Purity PTFE Pumps* catalog or visit [yamadapump.com](http://yamadapump.com).

# EP Series

Yamada EP Series pumps are specifically designed for transferring ultra high-purity solvents and other non-corrosive liquids compatible with 316 Stainless Steel.

Pumps include 20Ra Electro Polished 316 Stainless Steel wetted components, PTFE elastomers and FNPT liquid ports.

Available in 1/2", 3/4", and 1" FNPT port sizes

❖ Optional Swagelok®, VCR®, Sanitary Clamp, Tube or ANSI Flange Connections

Optional clean room flush & bagging available

Maximum flow rate	35 GPM
-------------------	--------

Operating range	20 to 100 PSI
-----------------	---------------

For additional information, please visit [yamadapump.com](http://yamadapump.com) or refer to the Yamada *EP Series* flyer.



# Drum Pumps

Yamada Air-Powered Double Diaphragm Pumps have distinct design advantages that make them very versatile and cost effective drum pumps.

Models are available in Polypropylene, PVDF (Kynar®), Aluminum, and Stainless Steel which includes a 2" bung adapter and 33" suction tube.

Available in 3/8", 1/2", and 3/4" port sizes (3/8" metal only & 1/2" plastic only)

Flow rates up to 28 GPM

Note: Yamada plastic drum pumps incorporate side liquid ports and utilize a 90° elbow on the top of the drum.

Refer to DP-10, NDP-15 & NDP-20 technical information for additional performance data.

Other sizes and materials are also available, consult Yamada.

## Port Dimensions

*Intake & discharge connection:*

Aluminum (ADC-12) 3/8" Female NPT  
or 3/4" Female NPT

*Includes Aluminum  
Male NPT Bung adapter  
and suction pipe*

Stainless Steel (316) 3/8" Female NPT  
or 3/4" Female NPT

*Includes Stainless Steel  
Male NPT Bung adapter  
and suction pipe*

Polypropylene (PPG) 1/2" Female NPT  
or 3/4" Female NPT

*Includes PVC suction  
pipe, elbow, & Bung adapter (PPG also avail.)  
Note: Yamada recommends utilizing flat type check  
valves for the NDP-15 series polypropylene pumps.*

Kynar (PVDF) 1/2" Female NPT

*Includes PVDF suction pipe,  
elbow, and Bung adapter*

Drum inlet connection 2" Bung

For additional information, please visit  
[yamadapump.com](http://yamadapump.com).

## Drum Pumps 3/8", 1/2", & 3/4" Port Sizes



## Drum Pump Model Nomenclature

<b>Drum Pump Series:</b>	xxx-xx	x	x	x	-D
DP-10 (3/8" NPT)					D
NDP-15 (1/2" NPT)					R
NDP-20 (3/4" NPT)					U
					M
<b>Valve Type:</b>					
B = Ball					
F = Flat					
<b>Body Material:</b>					
P = Polypropylene					
A = Aluminum					
S = Stainless Steel					
V = Kynar					
<b>Diaphragm Material:</b>					
C = Neoprene (CR)					
N = Buna N (NBR)					
E = Nardel (EPDM)					
S = Santoprene (TPO)					
T = Teflon (PTFE)					
V = Viton (FPM)					
H = Hytel (TPE)					



**FDA Compliant  
316 Stainless Steel**



**U.L. Listed  
Aluminum Pumps**

# FDA Compliant Pumps

Yamada FDA compliant pumps are specifically designed for Food, Pharmaceutical & Cosmetic industries where 3A or USDA standards are not required.

Pumps include 316 Stainless Steel wetted components with Passivated Satin Finish, Epoxy-Coated Air Motor, Sanitary Clamp Fittings, and FDA compliant elastomers: Hytrel®, EPDM and PTFE.

Eight sizes from 3/4" to 4" ports

Flow ranges from 1–215 gallons per minute

Air pressures ranging from 20 to 100 PSI.

## Additional Options

Air motor	Teflon-coated or Electroless Nickel Plate
Finish	Interior mechanical polish available on most models. Consult Yamada

Note: FDA Series pumps utilize oversized sanitary ports—reference [yamadapump.com](http://yamadapump.com) or FDA Series flyer for specifics.

# U.L. Listed Pumps

Yamada U.L. listed pumps are manufactured for the petrochemical, chemical and petroleum industries to meet safety requirements established by Underwriters Laboratory Code 79.

Pumps include Aluminum wetted components with durable Buna N elastomers, approved by U.L. to transfer volatile fluids.

Available in 3/4" and 1" port sizes

Flow ranges from 1–44 gallons per minute

U.L. Code 79 limits pump discharge pressures to no more than 50 PSI and pumping temperatures must adhere to the range of –20° F to 125° F.



Listed  
Air-Powered Double  
Diaphragm Pump For  
Petroleum Products 19GL

For additional information, please visit [yamadapump.com](http://yamadapump.com) or refer to the U.L. flyer.

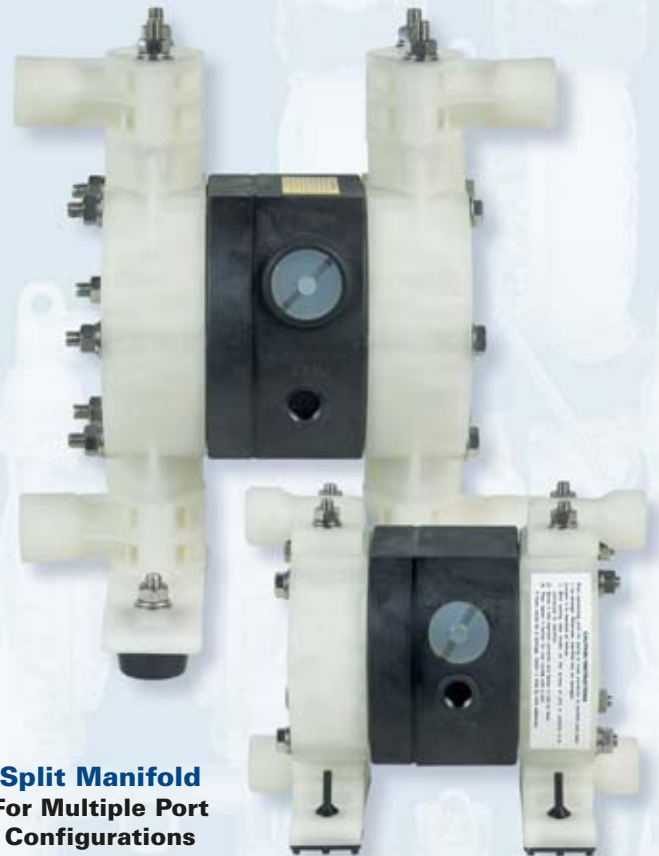


# Split Manifold Pumps

By utilizing one pump, Yamada offers a design in which the inlet and outlet ports can be configured to multiple combinations; ideal for pumping or combining two similar specific gravity fluids.

Port sizes	1/4", 3/8", 1/2", 3/4", and 1"
Construction	Polypropylene, Aluminum, or Stainless Steel
Diaphragm	Choice of seven elastomers (most models)
Modes of operation	Dual suction—Dual discharge Dual suction—Single discharge Single suction—Dual discharge

*NDP-5FPT-Z & NDP-15FPT-Z models shown*



**Split Manifold  
For Multiple Port  
Configurations**

# High Pressure Pumps

## 2:1 Ratio High Pressure Pumps

Designed for applications where 100 PSI maximum pump operating pressure is insufficient to overcome system requirements. The flow rate is roughly half of the equivalent size pump output, though a maximum discharge pressure of 200 PSI can be achieved with only 100 PSI air inlet pressure supplied.

Port sizes	3/4" through 3"
Construction	Stainless Steel, Cast Iron, or Aluminum wetted materials
Diaphragm	Choice of seven elastomers
Capacity	1 to 100 GPM
Controls	No elaborate bypass, relief valves, or complicated controls required. Great pressure retention

Also refer to the 2:1 flyer



**High Pressure  
Pump  
2 to 1 Ratio**





**Powder Pump**



**YSC-2EX Pump Speed Controller**

# Powder Pumps

Yamada Powder Pumps are designed to move bulk powders more effectively throughout your process vs. other unsafe and labor intensive means. These heavy duty pumps will consistently transfer fine-grained, low-bulk density dry powders in a dust-free operation.

Port sizes	1-1/2", 2", or 3"
Construction	Aluminum, Cast Iron, or Stainless Steel
Availability	Three pump series are offered, dependent upon requirements

*Model NDP-80BA-BH-3 shown*

Also refer to the *Powder Pump* flyer and *Pumpable Powders* data sheet.

# Pump Controller

## YSC-2EX Pump Speed Controller

Provides a reliable cost-effective solution for accurate speed / flow control of externally controlled pumps. There is no extensive programming required for setup and works with a direct or remote mount solenoid when the standard air valve is removed. Through the large lighted front panel display, information for both rate (cycle speed), fluid displacement per minute, and totalization (number of cycles) is easily attained.

- Allows for flow rate adjustment at any given delivery pressure
- Micro-processor controlled
- Flow meter or fiber optic interface
- Simplifies preventative maintenance schedules

Not applicable to NDP-5 & NDP-15 Series Pumps. Also refer to the YSC-2EX flyer.



# Pulsation Dampeners

## AD Series Pulsation Dampeners

### Metering/Injection/Dosing

Equalizes discharge pressure spikes, increasing accuracy.

### Filter Press/Inline Filters

Increases filter efficiency and life by providing a smooth flow.

**Spraying:** Smooth, consistent spray pattern.

### Filling

Eliminates inconsistent filling and splashing.

### Transfer

Eliminates harmful water hammer, preventing pipe and valve damage.

Yamada Pulsation Dampeners incorporate a flow-through design which keeps solids in suspension, maintaining dampener effectiveness.

A completely automatic air motor self-relieves if reduction of discharge head condition occurs.

**Port Sizes:** 3/8", 1", 1-1/2", and 2"

Dampener Model...	Fits Pump Models
AD-10 (3/8" port)	NDP-5, DP10/15, & NDP-15
AD-25 (1" port)	NDP-20 & NDP-25
AD-40 (1-1/2" port)	NDP-40
AD-50 (2" port)	NDP-50 & NDP-80

### Material

Aluminum (ADC-12)	All models
Stainless Steel (316)	All models
Cast Iron	AD-25, AD-40, & AD-50
Polypropylene (PPG)	All models
Kynar®	AD-25 & AD-50

### Diaphragm

Choice of seven elastomers.

### Air Side Coating Options

Epoxy, Teflon, or E-Nickel plate air-side.

For additional information see the Yamada *AD Dampeners* flyer. Refer to inside back cover for installation diagram.

Model AD-25



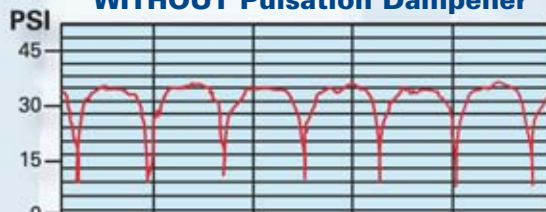
Model AD-10

Model AD-40

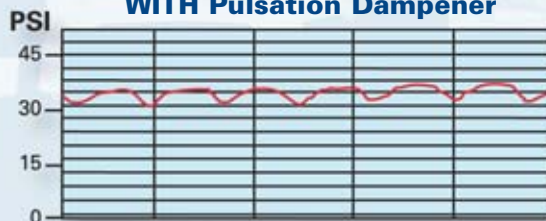


Model AD-50

**WITHOUT Pulsation Dampener**



**WITH Pulsation Dampener**





# Pump Diaphragms



## Rubber Compounds

### Neoprene (CR)

Excellent for non-corrosive abrasive applications.

Identification: Dull Black with No Dot

Temperature Range: 0°F to 180°F

### Buna-N (NBR)

Excellent for petroleum based fluids.

Identification: Black with a Red or Pink Dot

Temperature Range: 10°F to 180°F

### Nordel (EPDM)

Excellent for low temperatures, caustics and some acids.

FDA Compliant Material (must be specified).

Identification: Black with Green Dot

Temperature Range: -40°F to 212°F

### Viton (FPM)

Excellent for aggressive fluids and high temperature applications.

Identification: Black with Silver or Blue Dot

Temperature Range: -20°F to 248°F

## What to Consider When Selecting the Proper Diaphragm Material

- Chemical resistance
- Cost
- Estimated flex life
- Temperature limitations
- Abrasion resistance

## Thermoplastic Compounds

### Hytrek (TPE)

Excellent general-purpose diaphragm for non-corrosive abrasive applications and high-flex life. FDA compliant material.

Identification: Tan/Cream material with No Dot

Temperature Range: 0°F to 248°F

### Santoprene (TPO)

Excellent for acids or caustics and incorporates a high flex life. Also utilized as a back-up diaphragm material for PTFE when requested.

Identification: Black Thermoplastic

Temperature Range: -10°F to 225°F

### Teflon (PTFE)

Excellent choice for pumping highly aggressive fluids.

Identification: White diaphragm with No Dot

Temperature Range: 40°F to 212°F

■ Please note that excessive inlet pressure or excessive suction lift can shorten diaphragm life. Please consult Yamada for further information.

# Optional Coatings\*

Air motor Epoxy and Teflon coating and E-Nickel plating is available for Yamada pumps for two primary reasons:

**Environment:** Pump installation in a chemically aggressive location where material or fumes not compatible with Aluminum may contact the air motor; or

**Diaphragm Failure:** If properly selected, the coating or plating will defend the major Aluminum air valve components from the fluid being pumped.

For internal and external protection, the four major air motor components are independently coated or plated then assembled.

\* Not available for NDP-5 & 15 Series Pumps.



Epoxy  
Coating

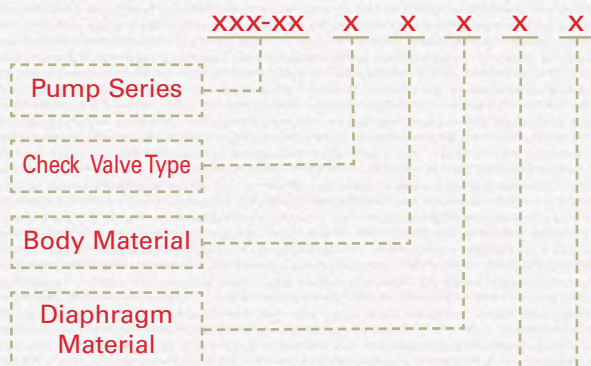
Teflon Coating

E-Nickel Plating



# Additional Options

## Model Number Nomenclature



### Optional Ball Valve/Seat Materials

- C: Neoprene (CR)
- N: Buna N (NBR)
- E: Nordel® (EPDM)
- T: Teflon® (PTFE)
- V: Viton® (FPM)
- SS: 316 Stainless Steel (Ball & Seat Only)
- S1: 316 SS Ball Only
- S2: 316 SS Seat Only

Nordel®, Viton®, Teflon®, & Hytrel® are registered trademarks of DuPont Dow Elastomers.

Santoprene® is a registered trademark of Monsanto Co. Swagelok® & VCR® are trademarks of the Swagelok Companies.

Flaretek® is a registered trademark of Entegris®.

Kynar® is a registered trademark of ATOFINA®.

Ryton is a registered trademark of Chevron Phillips Chemical Company.

AutoCAD® is a registered trademark of Autodesk, Inc.

Due to Yamada's continued commitment to product improvement, specifications may change without notice.

## To properly specify a Yamada Pump, the following information is required:

- ✓ Material to be pumped (viscosity and specific gravity)
- ✓ Pumping Temperature (°F or °C)
- ✓ Capacity and Operating Condition
- ✓ Discharge Pressure (PSI or TDH)
- ✓ Corrosive and/or abrasive?
- ✓ Suction Line Details
- ✓ Available Air Supply

A complete specification form is available at [yamadapump.com](http://yamadapump.com)

### Additional Options

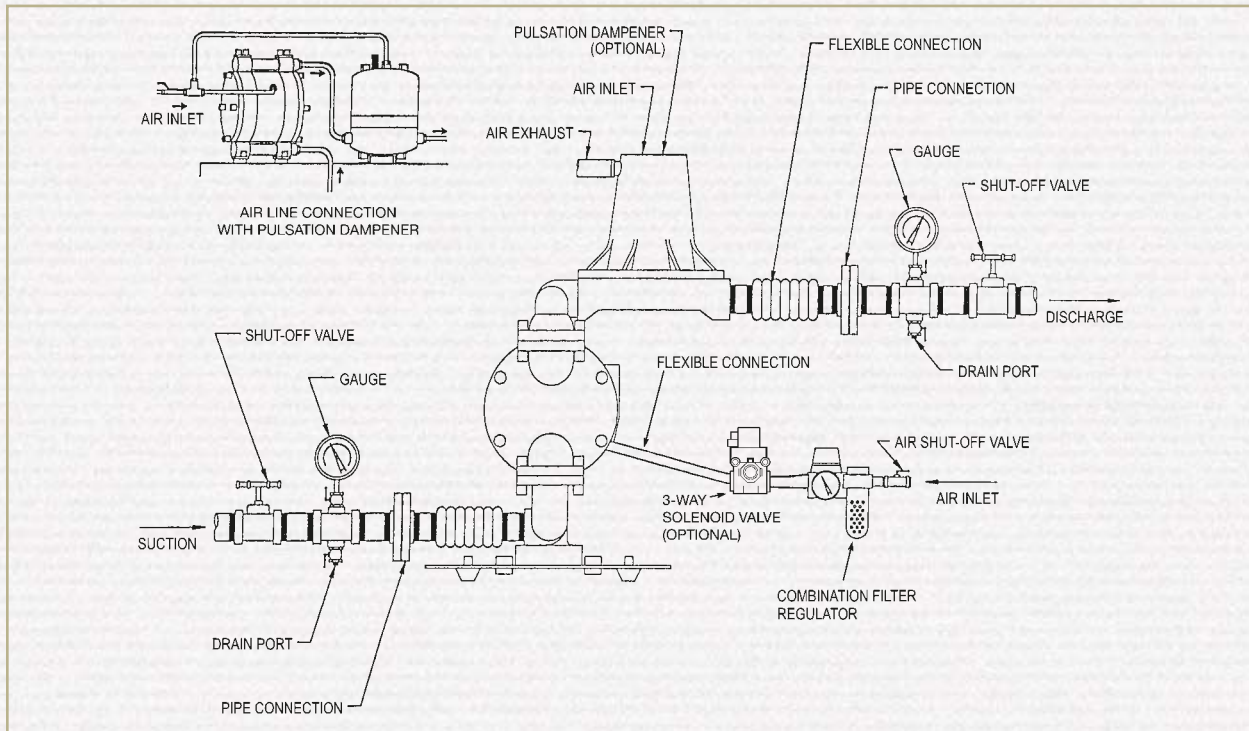
- BU: Santoprene Backup Diaphragm (*NDP-20 through NDP-80 Series only*)
- AP: Abrasion Pads
- I: Split Suction Manifold
- Z: Both Manifolds Split
- O: Split Discharge Manifold
- X: Epoxy Coated Air Motor
- X2: E-Nickel Plated Air Motor
- XS: Teflon Coated Air Motor
- D: Drum Pump (*10/15/20/25 Series only*)
- U: High Performance Muffler
- J: Speed Control Muffler
- FLG: Flanged Manifold (*15/20/25 Series and 40/50/80 Cast Iron only*)
- Y: NPT Companion Flange (*40/50/80 Poly Series*)
- L: Destroke (*NDP-20 thru NDP-80*)
- K: 316SS Pilot Valve Seats (*20/25 Series only*)
- P1: Proximity Sensor 10-30 VDC
- P2: Proximity Sensor 24-240 VAC
- Q: Diaphragm Monitor
- FDA: FDA Compliant
- UL: UL Listed
- BH-1: Powder Pump Series 1
- BH-2: Powder Pump Series 2
- BH-3: Powder Pump Series 3
- HP: 2:1 High Pressure Pump
- DM: Direct Mount Solenoid Valve
- EX: Remote Mount Solenoid Valve
- AC: Accordion Balls, Neoprene
- AN: Accordion Balls, Buna N
- AE: Accordion Balls, EPDM
- Accordion Balls available for NDP- 25/40/50/80*
- EP-20 RA: 20RA Electro-polished Finish (*only 5/10/15/20/25 SS*)

The **Proof's**<sup>SM</sup>  
in the **Pump**



# Installation Diagram

## Ideal Air-Powered Double Diaphragm Pump Installation



# Understanding Performance Curves

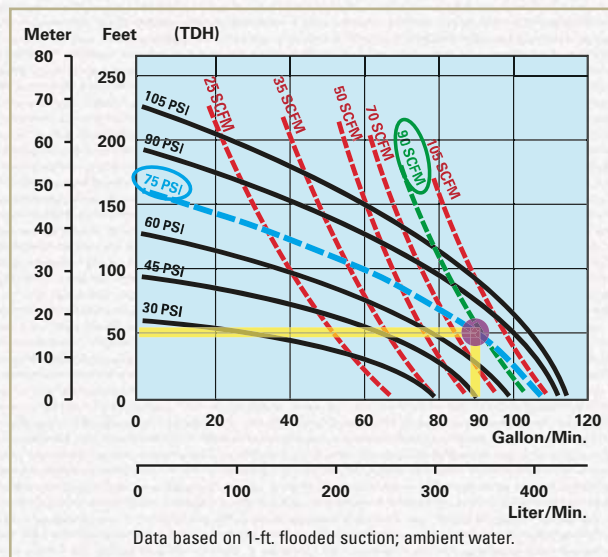
To determine compressed air requirements and proper size for a Yamada Air-Powered Double Diaphragm Pump, two elements of information are required:

1. Required Flow Rate (GPM)
2. Total Dynamic Head (TDH)

As an example, consider an NDP-40 Series Pump performance curve with **rubber diaphragms**, pumping at 90 GPM (|) at 50' TDH (—).

Point "●" on the performance curve is where the desired **Flow Rate** (GPM) and **Total Dynamic Head** points intersect. This point determines compressed air requirements for the particular pump.

At performance point "●", the pump will require approximately 75 PSI air inlet pressure. To arrive at this figure, follow the solid curve (—) to the left to read the air pressure rating in PSI.



By looking at the nearest dashed line (---), it is determined the pump will require approximately 90 SCFM of air volume.





**Yamada America, Inc.**

955 E. Algonquin Road  
Arlington Heights, IL 60005

800 990-7867 Toll-Free

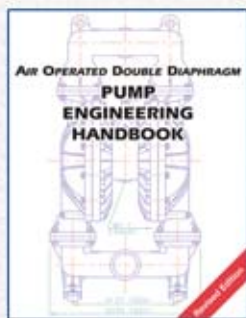
847 631-9200 Phone

847 631-9273 Fax

E-mail: [sales@yamadapump.com](mailto:sales@yamadapump.com)

Web: [yamadapump.com](http://yamadapump.com)

# The Proof's<sup>SM</sup> in the Pump



**Yamada's Engineering Handbook for  
Air-Powered Double Diaphragm Pumps**

150 pages — filled with *everything you need to know* about air-powered double diaphragm pumps. Includes in-depth information on principles of pump operation, correct installation, formulas & conversions, air and hydraulic data, and a complete corrosion resistance guide. Available on CD ROM! — order your copy today!

YOUR LOCAL DISTRIBUTOR:

