

Plunger (Glutton) Pumps

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Introduction

Module Purpose

The purpose of this module is to help you understand the design and operational characteristics of *Glutton Pumps*.

Primary Audience

The primary audience for this module is for anyone who would like a better understanding of Glutton pumps.

Benefits to You

The benefits to you of successfully completing this module include:

- Gaining knowledge of Glutton pump design and operation.
- Being able to understand and satisfy the customer's pumping application requirements.

Objectives

After completing this module, you should be able to:

- Explain the theory of operation of Graco Glutton Pumps.
- Know the advantages of the Graco Glutton Pumps.

How Do I Use This Module?

Use this module at your own pace and at the time you most need it in your job. You can also use the module as a reference after completing it.

What Materials Do I Need?

In addition to this booklet, you will also need these items to complete this module:

- Fluid Basics Module - 321-038
- Moving Fluids Module - 321-037

You may want to obtain copies of the following resources to gain a better understanding of this topic:

- Videotape titled *Glutton Pump Training* (Tape number G07-V88)

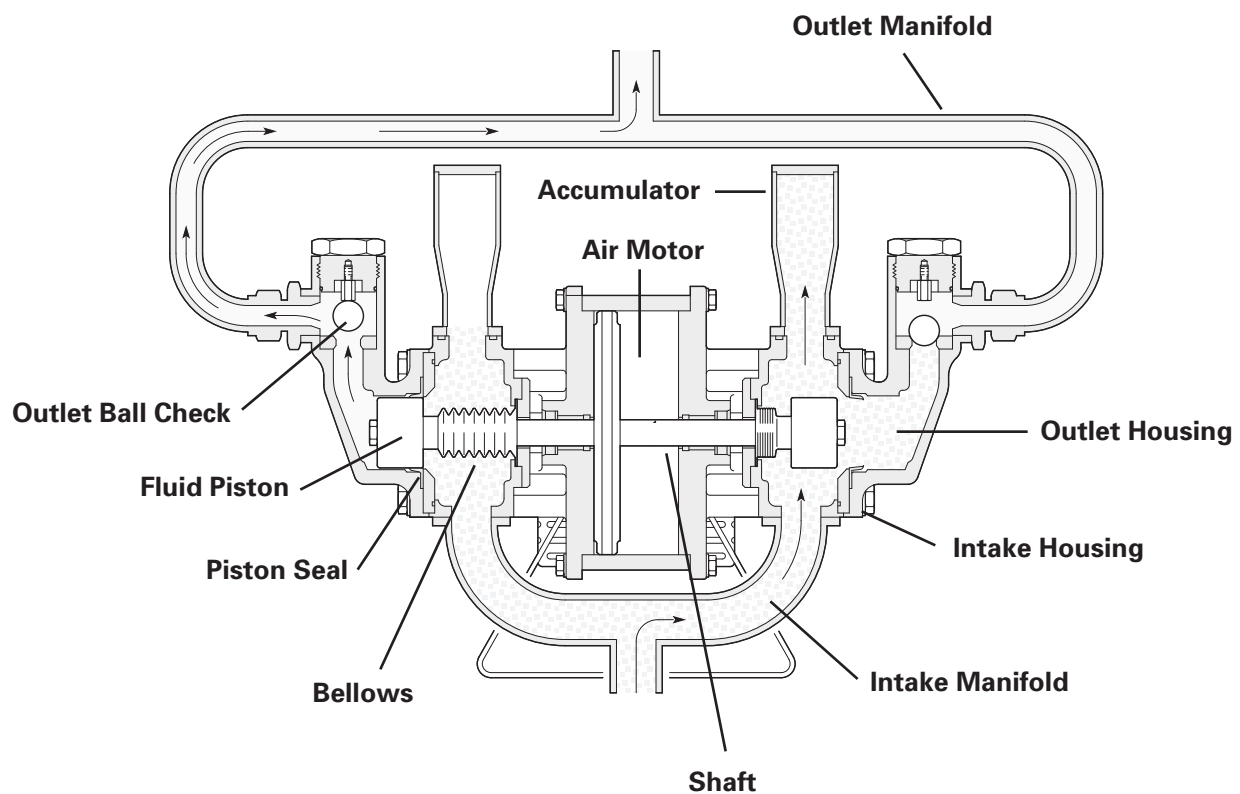


Glutton Pump

The generic name of the pump described in this module is a plunger pump and the trade name is Glutton™. At Graco you will hear the plunger pump commonly referred to by its trade name, so for the purposes of this module we will use the trade name Glutton when referring to the plunger pump.

The Glutton pump operates with a compressed air motor that provides reciprocating motion that loads and dispenses fluid.

Component Identification and Function



05100

Figure 1 Fluid Section Component ID and Function.

Fluid section

Fluid piston

The Fluid Piston loads or discharges fluid from the outlet housing.

Fluid piston seal

The Fluid piston seal creates a seal around fluid piston allowing a pressure or vacuum to be formed in the outlet housing.

Outlet Housing

The fluid loads into and discharges from the Outlet Housing by the reciprocating motion of the fluid piston.

Bellows

The Bellows seals each fluid section preventing it from leaking externally during the operation of the pump making the pump leak free for the life of the bellows.

Accumulator

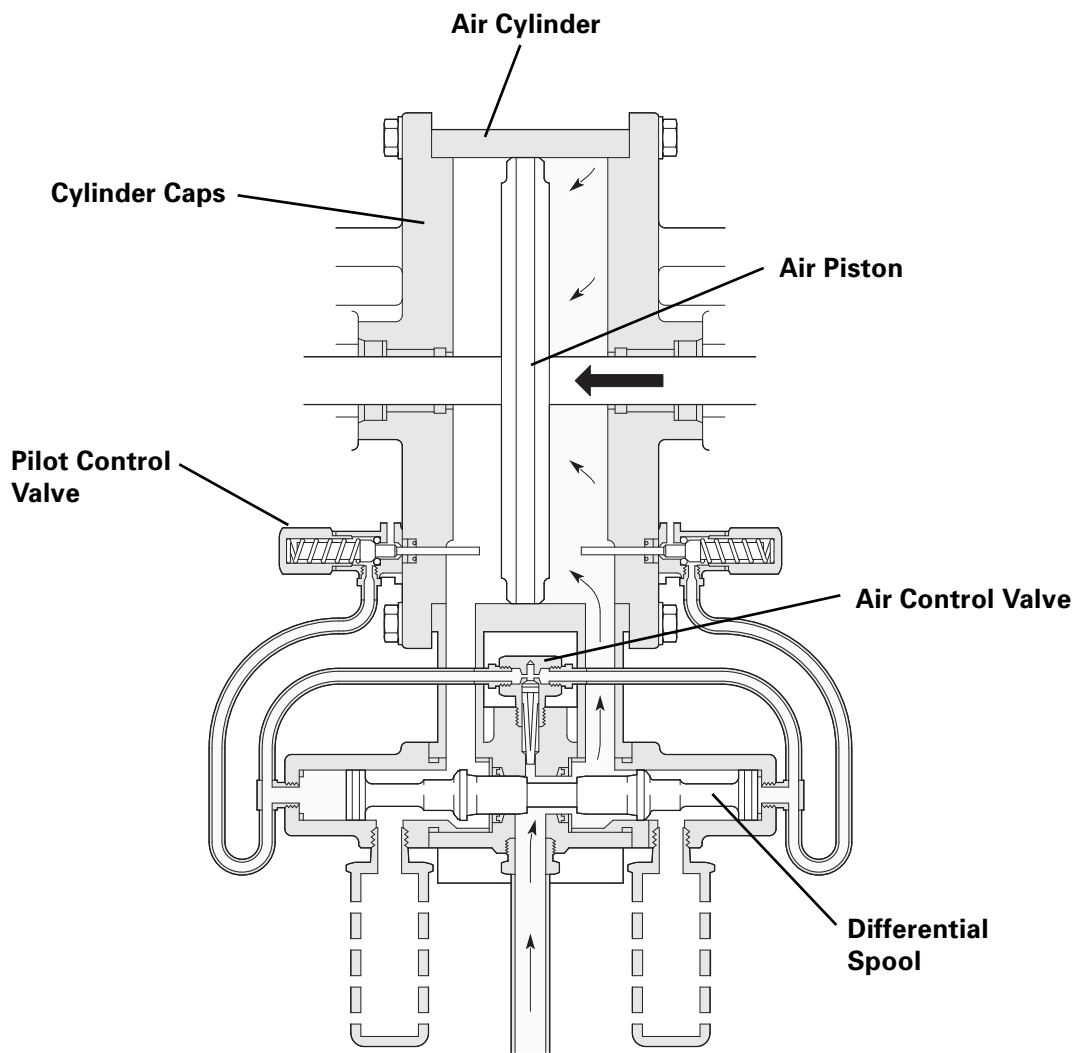
The Accumulator acts as a material reservoir allowing the pump to fully prime without cavitation.

Intake housing

The fluid flows through the Intake Housing on its way to the outlet housing.

Shaft

The pump shaft connects the fluid pistons to the air piston.



05101

Figure 2 Air Section Component ID and Function.

Air section

Air motor

The air motor which is the driving mechanism of the pump, is composed of the cylinder caps, air motor cylinder, air piston, pilot valves, and air valve. The air piston travels back and forth in the air motor cylinder between the two caps.

Air control valve

The air control valve alternates the direction of air flow to either side of the air piston.

Pilot valve assembly

The pilot valve assembly acts as triggering mechanism to activate the air control valve.

Muffler

The mufflers reduce the noise of the exhausting air.

Progress Check

Directions: After answering the following questions, compare your answers with those provided in the answer key following this progress check. If you respond to any items incorrectly, return to the text and review the appropriate topics.

1. Glutton pumps can be driven by air, hydraulic, or electric motors.
 - a. True
 - b. False
2. The Glutton pump is virtually leak free because of the bellows design.
 - a. True
 - b. False
3. The pilot valve assembly is in contact with the pumped fluid during normal pump operation.
 - a. True
 - b. False

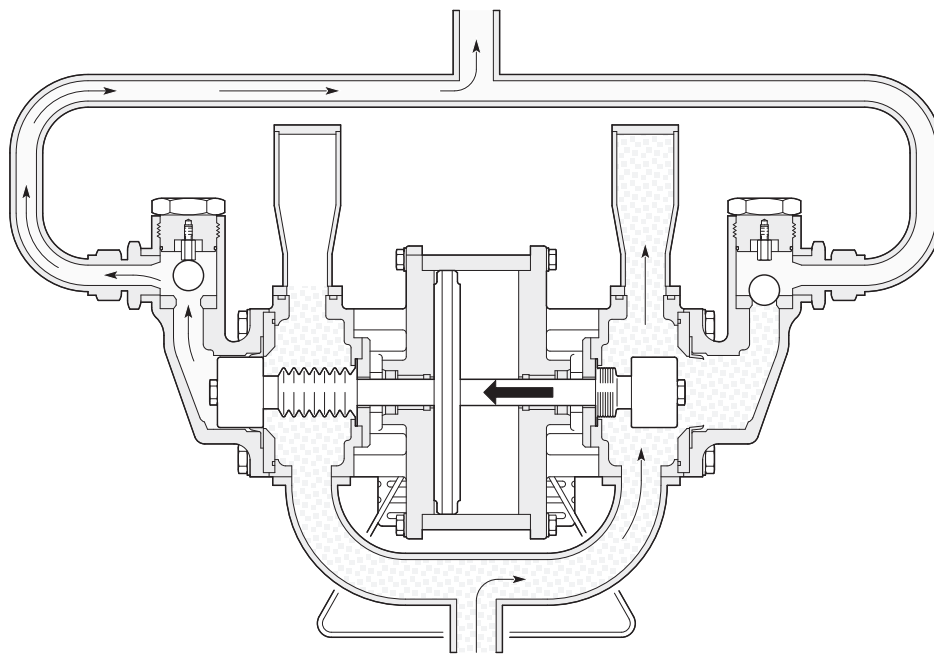
Answers to Progress Check

1. False
2. True
3. False

Operation of the Glutton Pump

Fluid system

As the pump shaft moves to the left it forces the right fluid piston to retract from the piston seal. See Figure 3. This creates a vacuum which draws fluid through the intake manifold and intake housing. On the left side, the fluid piston is forced through the piston seal and into the outlet housing which creates pressure, forcing the check ball to unseat. Fluid flows out the outlet manifold. On the right side the check ball is forced onto the seat. When the pump reaches the end of its stroke, the air valve causes the pump shaft to change directions.

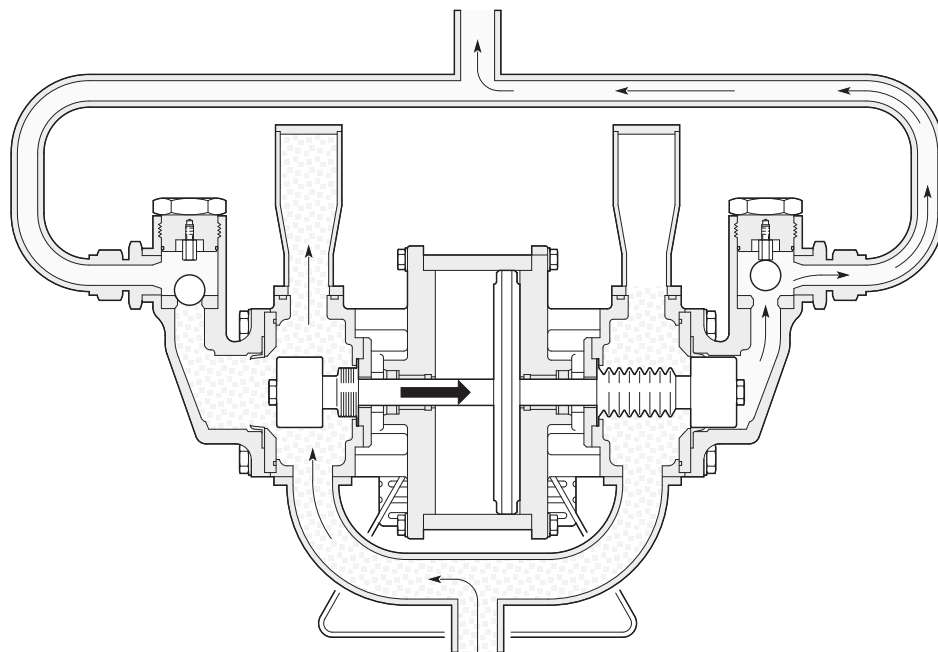


05100

Figure 3 Fluid Section Operation - Shaft moving left.

As the pump shaft moves right, it forces the left fluid piston to retract from the piston seal. This creates a vacuum which draws fluid through the in intake manifold and housing. On the right side the fluid piston is forced into the outlet housing which creates pressure, forcing the check ball to unseat. Fluid flows out the outlet manifold. On the left side the check ball is forced onto the seat. At the end of the stroke, the air motor piston changes direction and the operating cycle repeats itself.

The Glutton air motor drives two single acting fluid sections. As one section is pumping fluid the other is loading fluid.

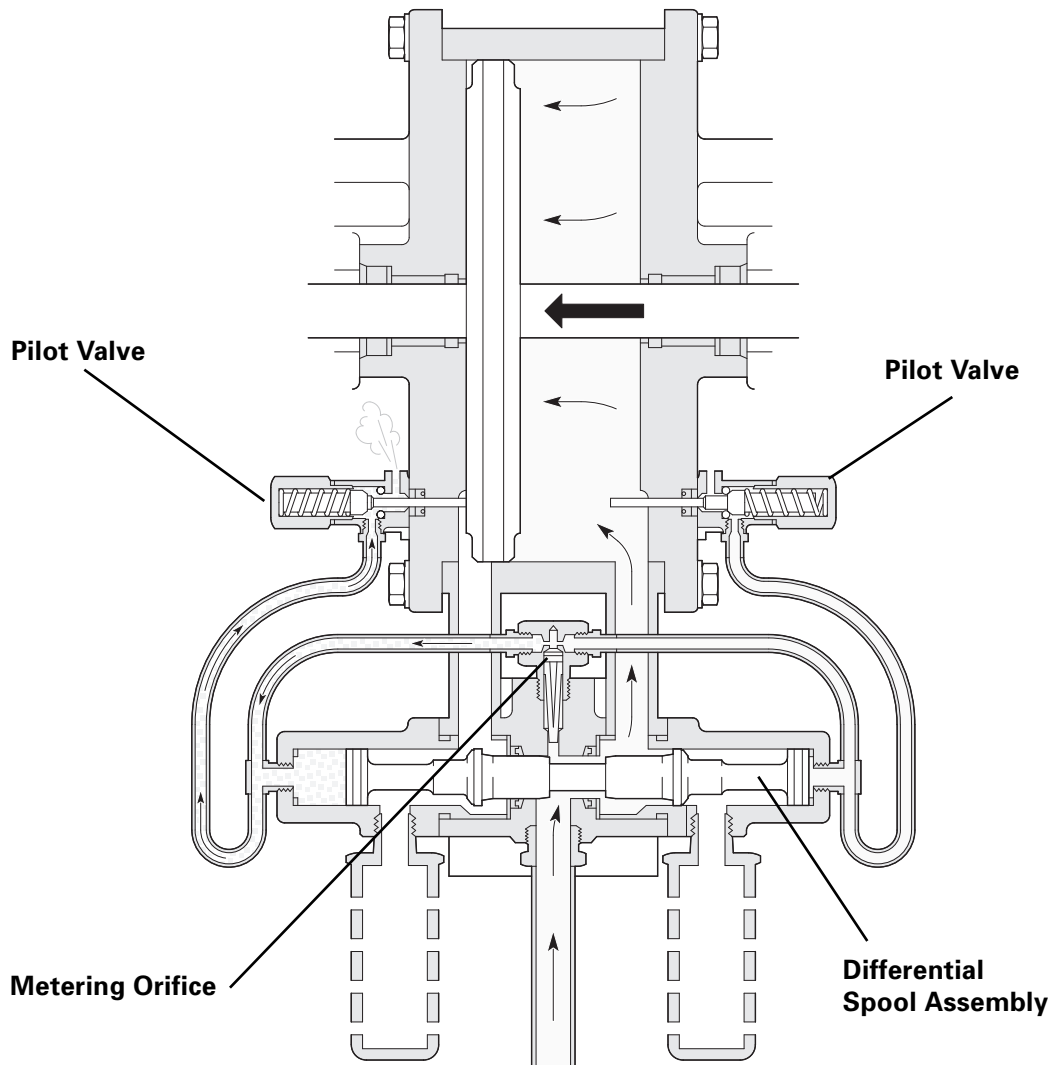


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Figure 4 Fluid Section Operation - Shaft moving right.

Air System

The Glutton is an air operated pump. Compressed air drives the air piston to the right or left based on the position of the spool. The illustration shows the air flowing into the right air chamber driving the air piston to the left.

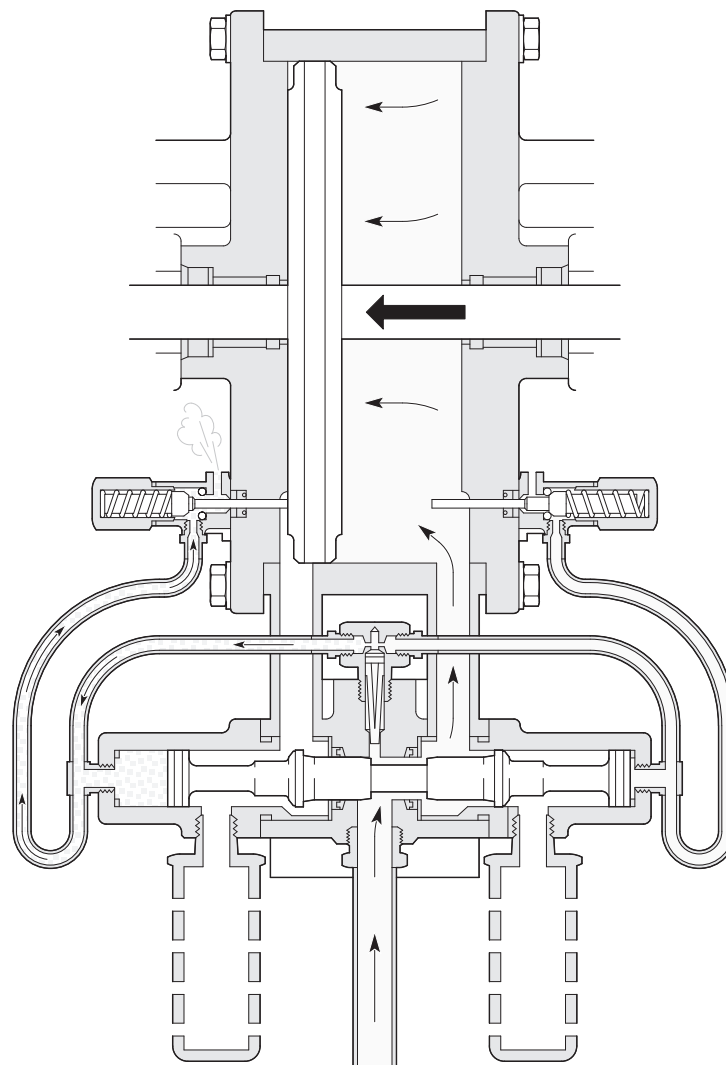


05102

Figure 5 Air system.

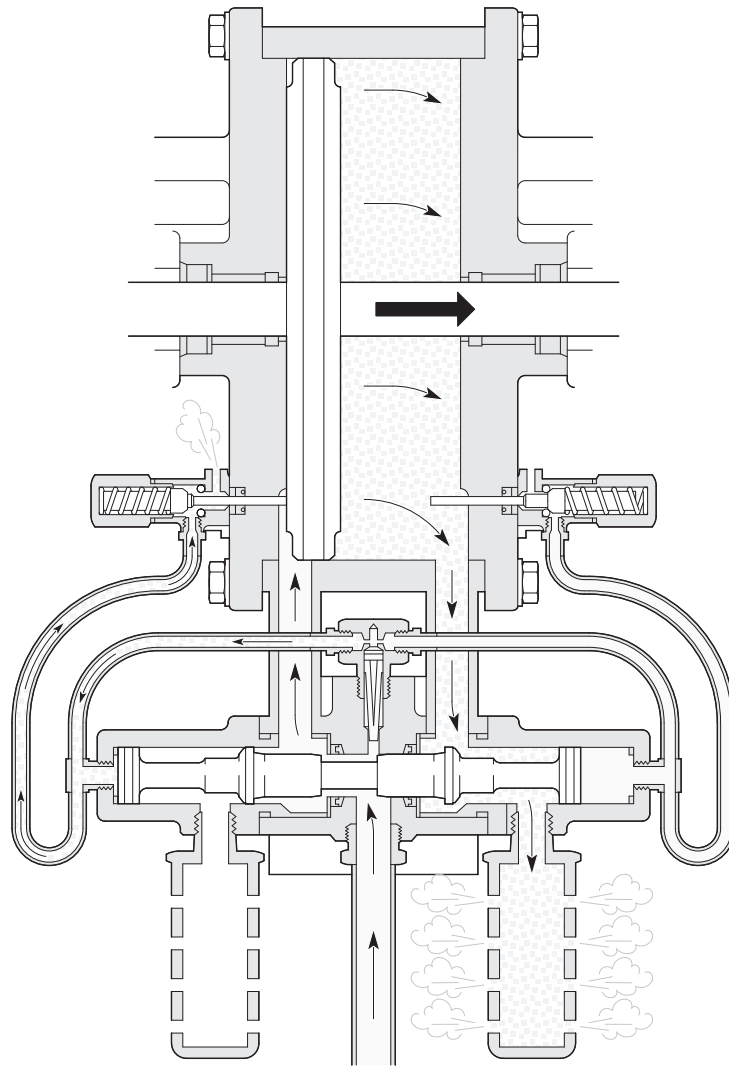
The direction of air piston movement depends on the position of the spool in the air control valve. The pilot valves control the air pressure at the ends of the differential spool assembly.

As the air piston depresses the left pilot valve stem as in Figure 6, the pilot valve stem must overcome an internal spring compression force. When the mechanical force of the piston exceeds the spring force, the valve opens, exhausting the pilot air line to atmosphere. A metering orifice controls the air flow to the pilot lines. The metered air flows through a hole in the pilot valve causing a lower pressure at the left side of the spool. The air pressure on the right side of the spool is now greater, causing the spool to shift left.



05102

Figure 6 Pilot valve operation.



05103

Figure 7 Pilot valve operation with exhaust.

The air on the right of the piston exhausts through the muffler. The mufflers reduce the noise of the exhausting air. Compressed air is directed to the left side of the air piston and the piston and shaft move to the right.

The air control valve spool directs the regulated inbound air to either side of the air motor piston. The pilot valves signal the spool to shift for proper air motor operation.

Summary

The Glutton pump uses a compressed air motor as its driving medium to provide the reciprocating motion to load and dispense fluid. The direction of motion changes by the pilot valve signaling the air control valve to change position. This directs the inlet air to flow into the opposite side of the air motor.

Progress Check

Directions: After answering the following questions, compare your answers with those provided in the answer key following this progress check. If you respond to any items incorrectly, return to the text and review the appropriate topics.

1. Fluid flow is directed by:
 - a. A fluid piston and four ball checks.
 - b. Two fluid pistons and two ball checks.
 - c. Flexible diaphragms.
 - d. Two pilot valves and differential spool.

2. The Glutton pump is comprised of two single acting fluid sections.
 - a. True
 - b. False

3. Air flow is directed by:
 - a. A fluid piston and four ball checks.
 - b. Two fluid pistons and two ball checks.
 - c. Flexible diaphragms.
 - d. Two pilot valves and differential spool.

Answers to Progress Check

1. b.
2. True
3. d.

Materials of Construction

The following is a list of materials used in the Graco Glutton Pump. The list tells you the components and material options, with advantages or disadvantages of each. See product literature for availability of materials by model number.

Urethane — piston seals

- available as an option for all models
- waterbased abrasive materials like ceramic frit or slurries

Carbide — ball and seat

- severely abrasive fluids
- available as an accessory kit for all models

Ultra high molecular weight polyethylene — piston seal

- standard all models
- designed to wear with the fluid piston
- three times more wear life than nylon in some applications

Nylon — piston seal option

- solvent/paint applications
- available on all models

Polypropylene — bellows

- provides long service life without repair

Carbon steel — wetted parts

- all models
- high strength
- non corrosive fluids

Stainless steel — wetted parts

- all models
- corrosive fluids

Teflon — most wetted seals (not piston seal)

- chemical compatibility with a wide range of materials

Pump Application

When fluid characteristics tend to be abrasive or when the advantage of a leak proof design is important, the Glutton would be an excellent pumping option for a customer.

The fluid pressure of the Glutton is equal to the air pressure applied to the air motor multiplied by the pump ratio. To calculate the pump ratio divide the area of the air motor piston by the area of the fluid piston.

- The Glutton 400 with a pump ratio of 4:1 has a maximum working pressure of 400 psi (28 bar) and will deliver about 6 gpm (22.7 lpm) at 60 cycle/min.
- The Glutton 1200 with a pump ratio of 12:1 has a maximum working pressure of 1200 psi (83 bar) and will deliver about 2 GPM (7.6 lpm) at 60 cycles/min.
- The Glutton 2500 with a pump ratio of 25:1 has the highest maximum working pressure of 2500 psi (173 bar) and will deliver nearly 1 gpm (3.8 lpm) at 60 cycles/min.

Advantages

- The Glutton pump is available in three models that provide a wide pressure and volume range to meet a variety of customer application requirements.
- All models have a “divorced” design, meaning the air motor is separate from the fluid sections. This prevents the risk of air motor contamination from the fluid should a bellows seal leak.
- The visible piston rods in a divorced design make troubleshooting the Glutton easier.
- The patented center air valve design provides a long service life with little risk of stalling. The long bleed time of the pilots provides a very positive shift of the air valve spool for reliable pump operation.
- The Glutton pumps have a vertical ball check design. Gravity and fluid pressure provides a positive seal between the ball and seat. This design allows the balls to tumble freely with the ball guides for more uniform wear, proving a long service life.
- The stainless steel ball seats are reversible, providing a long service life without replacement; lowering customer’s maintenance costs.
- Customers that pump severely abrasive materials can use the carbide seat accessory kit for longer service life.
- The Glutton Pump design uses static seals made of Teflon to accommodate the chemical compatibility of a wide range of fluids.
- The co-polymer polypropylene construction of the bellows provides long service life without repair.
- The bellows seal makes the Glutton extremely leak-proof for the life of the bellows. The bellows prevents environmental contamination, reducing the customer’s maintenance costs with the added advantage of handling moisture sensitive materials.
- Graco engineers designed the standard ultra high molecular weight polyethylene piston seal to wear with the fluid piston. The flexible sealing surface of the piston seal allows it to maintain a positive seal as the fluid piston wears. This is unlike traditional piston pumps and can provide up to three times more wear life in some applications.
- This unique piston seal design makes the Glutton especially useful for abrasive materials such as: high solids in excess of 50%, gel coats for fiberglass, acid catalyzed varnish and lacquer, waterbased

epoxy for can coating, and many other materials

- Glutton pumps come in an option of electropolished stainless steel for water based coatings.
- The optional urethane piston seal kit accessory allows the customer to pump abrasive materials like ceramic frit or slurries.
- The outlet manifold can face forward or reverse to simplify the customers plumbing installation requirements.
- The Glutton mounting bracket fits all current Graco covers and brackets. The Glutton pump can be wall, drum, bulk tank, cart, stand, or floor mounted.
- The air filter, regulator and lubricator accessories provide the customer fast installation and immediate on-line operation with clean, regulated and lubricated air.
- The air operated Glutton is explosion proof for use in hazardous areas.
- The external air valving allows quick access for servicing, reducing a customer's downtime concerns.
- The Glutton is a positive displacement pump that will stall against pressure and respond on demand for material. Since the Glutton pump does not run continuously, like some other pump technologies, the pump achieves a longer service life.

Limitations

- Graco does not recommend that the Glutton pump be used with more than 15 psi (1.0 bar) of inlet pressure. If the inlet pressure is too high, it may damage the bellows.
- Glutton pumps cause fluid surges at changeover. Surge control devices are needed for some

applications.

Self Check

Instructions: Answer each of the following questions. The answers to this self check are at the end. Cover the answers while completing the self check. If you get less than 80% correct, you may want to review the module for reinforcement.

1. The Glutton 2500 has a pump ratio of:
 - a. 4:1.
 - b. 1:1.
 - c. 25:1.
 - d. None of the above.

2. The Glutton pump can handle _____ of inlet pressure.
 - a. 0 psi (0.0 bar).
 - b. 15 psi (1.0 bar).
 - c. 100 psi (7.0 bar).
 - d. None of the above.

3. The Glutton pump has a high output pressure with low input pressure.
 - a. True
 - b. False

4. The Glutton pump is a good choice for fluids that are abrasive in nature.
 - a. True
 - b. False

5. A Glutton pump will load both fluid chambers at the same time?
 - a. True

- b. False
6. The accumulator allows the pump to prime without cavitation.
- a. True
 - b. False
7. The generic name for the Glutton pump is:
- a. Plunger pump.
 - b. Double diaphragm pump.
 - c. Two check piston pump.
 - d. None of the above.
8. The _____ acts as a triggering mechanism to change pump direction.
9. The air flow in the pilot lines is controlled by:
- a. Metering orifice.
 - b. Pilot valve.
 - c. Differential spool.
 - d. None of the above.
10. Check valves will prevent pump fluid from flowing back into source container.
- a. True

b. False

Answers to Self Check

1. c

2. b

3. True

4. True

5. False

6. True

7. a

8. Pilot valve assembly

9. a

10. True

Module Evaluation

The purpose of this Module Evaluation is to help the Graco Technical Communications department determine the usefulness and effectiveness of the module.

*Instructions: Please complete the evaluation, tear it on the perforation, and return to:
Graco Technical Communications Department, P.O. Box 1441, Minneapolis, MN 55440-1441, USA.*

1. *Based on the objectives, this module:*

- Significantly exceeded my expectations
- Exceeded my expectations
- Met my expectations
- Was below my expectations
- Was significantly below my expectations

2. *Why did you select the above rating?*

3. *How do you plan to use the module information in your job?*

4. *How do you think the module could be improved?*

I verify that I have successfully completed Module No. 321-047, Plunger (Glutton) Pumps

Signature _____

Date _____



Graco

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This module was developed by the Graco Technical Communications Department with assistance from the following individuals:

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The Graco Concept and Theory Training program consists of the following topics:

Fluid Basics
Atomization
Electrostatic Spray Finishing
Safety
Airspray Technology
Fluid Types: Paints and Other Coatings
Fluid Types: Lubricants
Fluid Types: Sealants and Adhesives
Airless Atomization
Spraying Techniques
Transfer Efficiency
Fluid Movement
Fluid Controls
Pumps
Motors and Power Sources
Plural Component Paint Handling
Plural Component Sealant and Adhesive Handling
Paint Circulating Systems
Automatic Finishing
Lube Reels and Dispense Valves
Lube Metering Systems
Electronic Fluid Management Systems

