

**Industrial Maintenance**

# **Flexible Impeller Pump**

**Courseware Sample**

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By the staff of Festo Didactic

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



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








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# Safety and Common Symbols

The following safety and common symbols may be used in this manual and on the equipment:

Symbol	Description
	<b>DANGER</b> indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	<b>WARNING</b> indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	<b>CAUTION</b> indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	<b>CAUTION</b> used without the <i>Caution, risk of danger</i> sign  , indicates a hazard with a potentially hazardous situation which, if not avoided, may result in property damage.
	Caution, risk of electric shock
	Caution, hot surface
	Caution, risk of danger
	Caution, lifting hazard
	Caution, hand entanglement hazard
	Notice, non-ionizing radiation
	Direct current
	Alternating current
	Both direct and alternating current
	Three-phase alternating current

# Safety and Common Symbols

Symbol	Description
	Earth (ground) terminal
	Protective conductor terminal
	Frame or chassis terminal
	Equipotentiality
	On (supply)
	Off (supply)
	Equipment protected throughout by double insulation or reinforced insulation
	In position of a bi-stable push control
	Out position of a bi-stable push control

We invite readers of this manual to send us their tips, feedback, and suggestions for improving the book.

Please send these to [did@de.festo.com](mailto:did@de.festo.com).

The authors and Festo Didactic look forward to your comments.



# To the Instructor

## **NCCER Accreditation**

Contact the National Center for Construction Education and Research (NCCER), at [www.nccer.org](http://www.nccer.org), to obtain the requirements relative to the NCCER accreditation of this course.

## **Care and Maintenance of the Pumps Training System**

### **Every week**

- Check the general condition of the Pumps Training System.
- Check the condition of the snap-grip clamps on the hoses.
- Make sure the expanding work surface is solidly fixed on the bench. Check the condition of the four (4) push-lock fasteners.

### **Once a month**

- Check the operation of the ground fault circuit interrupter (GFCI).
- Make sure that an O-ring is present and in good condition in each hose coupling.

### **Every 6 months**

- Replace the water in the reservoir.
- Add the following solutions to the water in the reservoir:
  - 2 fl oz (60 ml) of Antibacterial solution, Lab-Volt p/n 38097
  - 8 fl oz (240 ml) of Rust inhibitor, Lab-Volt p/n 38096



Sample Work Order  
Extracted from  
Flexible Impeller Pump





## Flexible Impeller Pump S Teel

### Description

The Flexible Impeller Pump of your training system is shown in Figure 1-1. It consists of a flexible-bladed impeller which is placed eccentrically in a cam ring. As shown in Table C-1 in Appendix C, a flexible impeller pump is a positive displacement rotary pump.

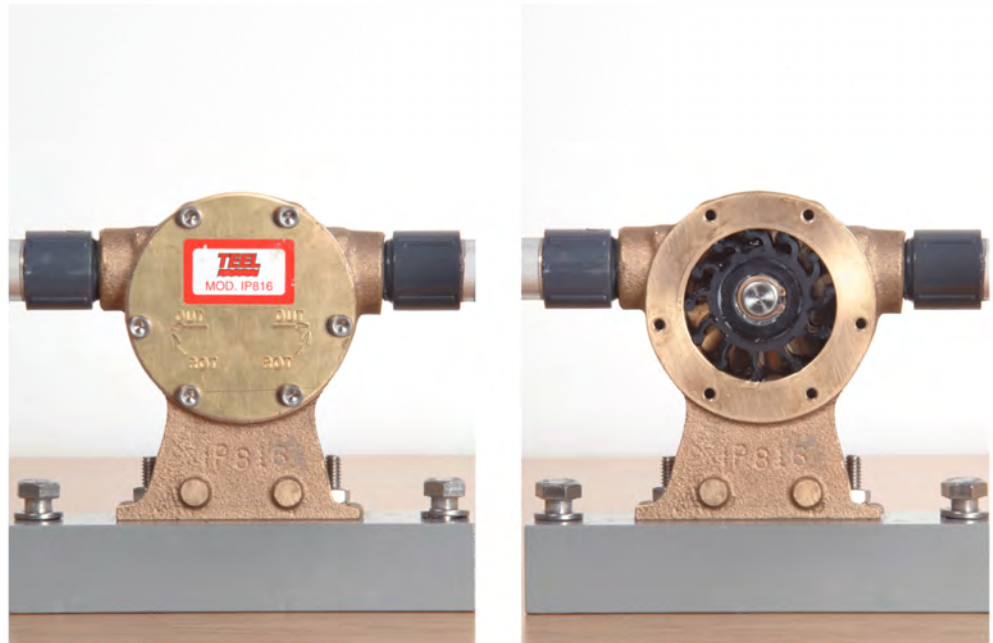
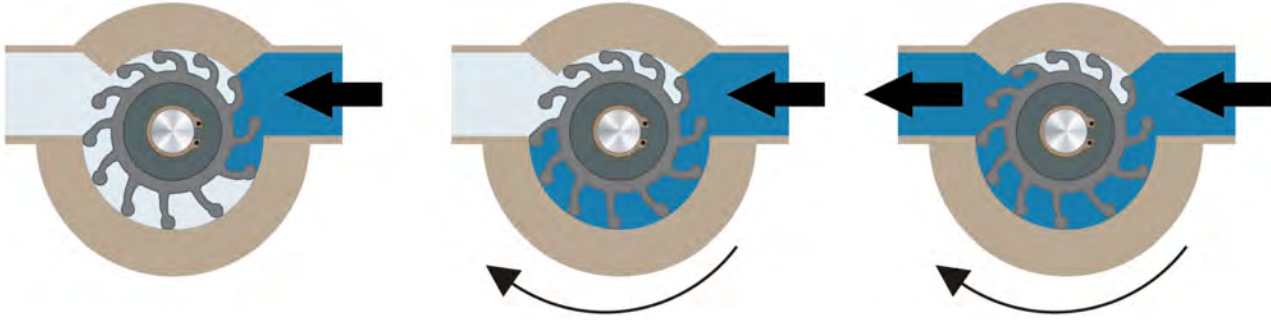


Figure 1-1. Flexible Impeller Pump with and without cover.

### How it works

As the impeller blades leave the cam, the cavities between them increase in size and create a vacuum which draws in the liquid. See Figure 1-2.



**Figure 1-2. Fluid flow in a flexible impeller pump.**

Once the blades clear the inlet port, the liquid is captured in the cavity between the blades and the housing. As the blades contact the cam and bend, the cavity between them is reduced in size and the liquid is forced out the discharge.

Flexible impeller pumps do not require a pressure relief because they can operate against a closed discharge for a short time without damage and the contact between the impeller and casing prevents backwards flow.

### **Advantages and disadvantages**

Advantages: most flexible impeller pumps are self priming, create low pressure pulsations, are reversible, can handle gaseous fluids and fluids with some solids in suspension, and are easily cleaned.

Disadvantages: they cannot run dry, are only suitable for low pressure applications, and not suitable for abrasive services.

### **Applications**

Flexible impeller pumps are designed for fluid transfer, chemical injection, garden work, and spraying.

### **Maintenance**

The maintenance required by flexible impeller pumps consists in:

- Checking the pump to motor shaft alignment at regular intervals.
- Inspecting and cleaning the components inside the Flexible Impeller Pump.
- For continuous duty, grease the pump daily. Grease less frequently for intermittent duty.

**Characteristics of the Flexible Impeller Pump of the training system**

Maximum speed: 1750 r/min

Maximum discharge pressure: 25 psi (175 kPa)

Direction of rotation: bidirectional

Sealing element: lip seal



## Flexible Impeller Pump S Teel

**Task:** To inspect, lubricate, install, operate, and troubleshoot a flexible impeller pump.

### PROCEDURE



#### CAUTION!

Before proceeding with this procedure, complete the safety checklist in Appendix B.

- 1. Refer to Figure 1-3 to locate and identify the various components of the Flexible Impeller Pump.

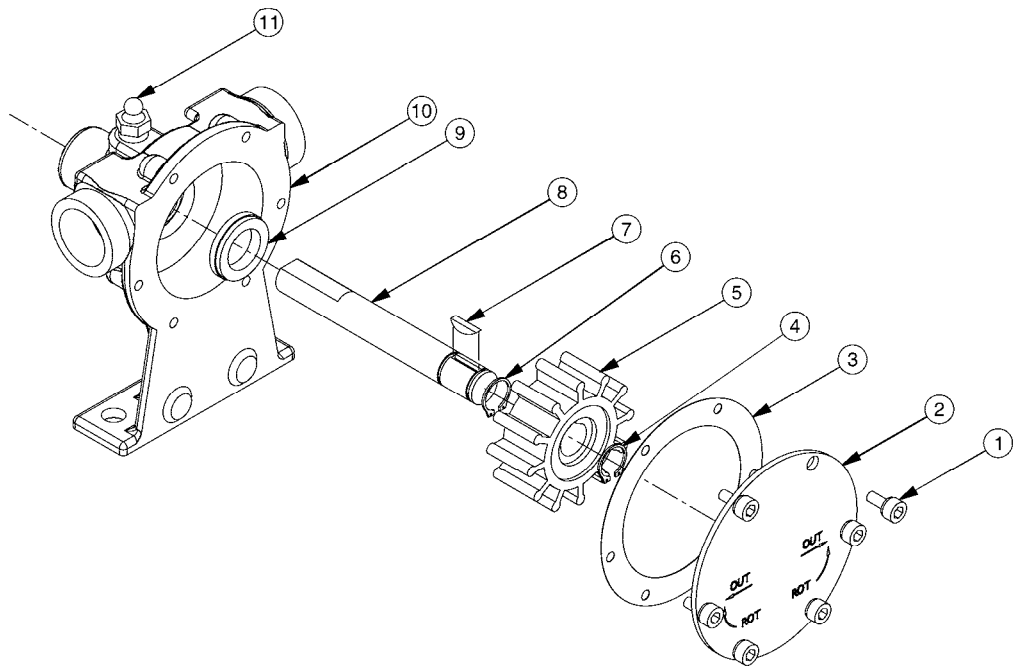


Figure 1-3. Exploded view of the Flexible Impeller Pump.

1	Screw	7	Woodruff key
2	Cover	8	Shaft
3	Gasket	9	Lip seal
4	Retaining ring	10	Housing
5	Impeller	11	Grease fitting
6	Retaining ring		

### Disassembly of the Flexible Impeller Pump

2. Disassemble the pump as follows:

- Remove the screws and cover.

**Note:** *Be careful not to damage the gasket when removing the cover.*

- Remove the retaining ring visible in the impeller bore.
- Remove the impeller-shaft assembly.
- Remove the impeller.

**Note:** *Do not remove the Woodruff key from the shaft.*

#### CAUTION!

**Do not remove the lip seal from the pump housing.**



### Inspection

3. Clean all components, remove all hardened residues.

4. Check the components as follows:

- Inspect the pump housing for excessive wear.
- Inspect the shaft for wear.
- Inspect the impeller for wear or damage.
- Visually inspect the lip seal for wear or damage.

**Note:** *Notify your instructor if any parts seem damaged.*

### Reassembly of the pump

5. Reassemble the pump as follows:

- Install the impeller on the shaft.

**Note:** *Make sure the Woodruff key is installed.*

- Install the retaining ring. Make sure that both retaining rings are fully seated in the impeller groove.

- Carefully push the impeller-shaft assembly through the lip seal in the housing. Rotate the assembly during the insertion to prevent damage to the lip seal. Rotate the assembly several turns in the direction of rotation to position the impeller vanes.
- Install the cover.

**Note:** *Make sure the gasket is correctly oriented to fit the hole position. It may be necessary to wet the gasket to facilitate the installation.*

- Install the screws, and tighten in an opposing sequence.

**Note:** *As the cover is tightened, the shaft should be rotated to prevent binding.*

### Lubrication

- 6. Lubricate the pump as follows:

- Make sure that the grease fitting is tightened firmly.
- Wipe off the grease fitting and the grease coupler of the grease gun.
- Press the grease coupler on the grease fitting until it snaps into place.

**Note:** *Make sure to use the grease supplied with the Lab-Volt Lubrication Kit, Model 46792.*

- Pump the grease. Do not over lubricate.
- Disengage the grease coupler from the grease fitting.
- Wipe off the grease from the fittings and grease coupler.



### Circuit setup

- 7. Install the Flexible Impeller Pump on the Pump Universal Base as shown in Figure 1-4.



**Figure 1-4. Installation of the Flexible Impeller Pump on the Pump Universal Base.**

- 8. Install the coupling and align the shafts.

**Note:** Position the 1/2-in. coupling hub on the pump shaft so the setscrew faces the flat surface of the shaft.

- 9. Install the coupling guard.

- 10. Set up the pumping circuit shown in Figure 1-5.

**Note:** Since grease may circulate in the piping, install the strainer at the pump outlet to prevent water contamination.

Since the flow rate produced by the Flexible Impeller Pump is below 5 gal US/min (19 l/min), you should use the optional Paddle Wheel Flowmeter (low range), Model 46731.

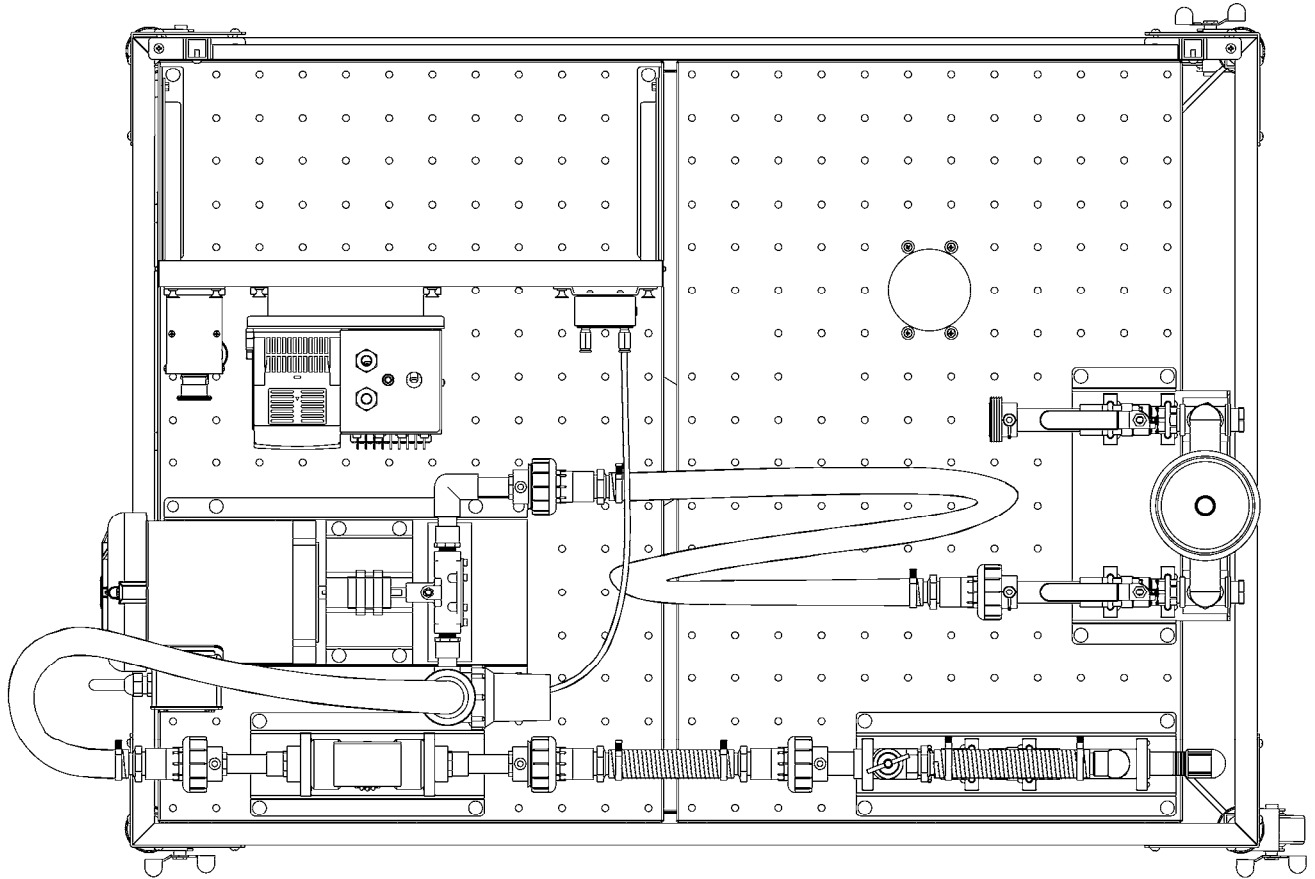


Figure 1-5. Pumping circuit using the Flexible Impeller Pump.

- 11. Connect the Variable Speed Drive and Motor.

**CAUTION!**



**Never run the Flexible Impeller Pump dry.**

- 12. Perform the following settings on the Variable Speed Drive:
  - Set the maximum output frequency to 30 Hz.
  - Set the direction of rotation to forward.

**CAUTION!**



**Make sure that the direction of rotation is correctly set. If the pump output is returned to the suction line, damage may occur.**

- 13. Set the relief valve to limit the pressure in the circuit to 25 psi (175 kPa) when the output frequency is 30 Hz.

**Note:** *The Flexible Impeller Pump may start to rotate with difficulty if it is new, or if the lubrication or assembly is inadequate.*

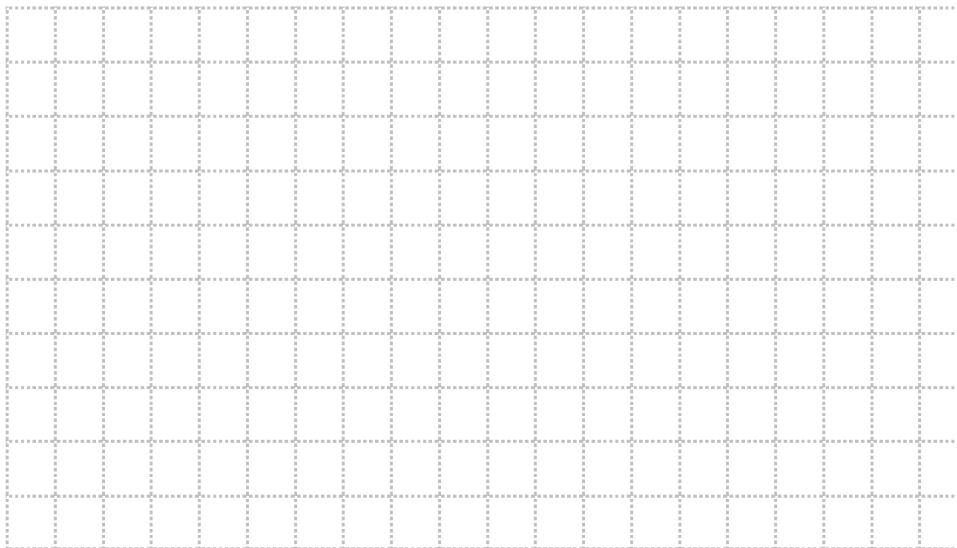
**Flow rate versus speed**

- 14. Determine the flow rate versus speed characteristics as follows:
  - Open valve HV-4.
  - On the Variable Speed Drive, increase the output frequency from 0 to 30 Hz by increments of 5 Hz. For each setting, measure the flow rate and enter your results in Table 1-1.

OUTPUT FREQUENCY (Hz)	0	5	10	15	20	25	30
FLOW RATE							

**Table 1-1. Flow rate versus output frequency.**

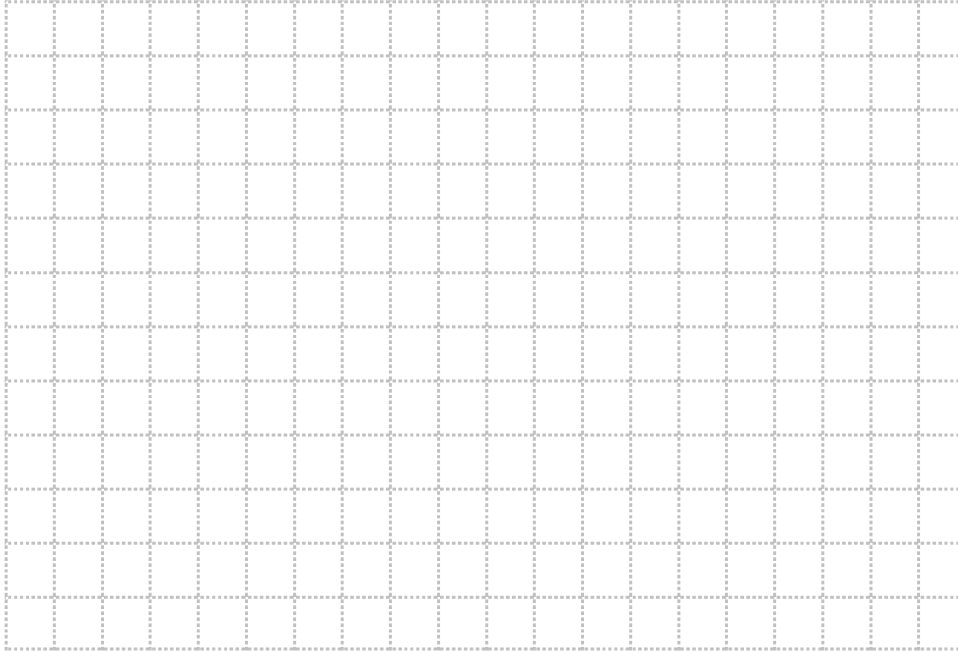
- 15. Plot the flow rate versus speed (30 Hz  $\approx$  1725 r/min) curve in Figure 1-6.



**Figure 1-6. Flow rate versus speed curve.**



- 18. Stop the pump.
  
- 19. Plot the head versus flow rate curves in Figure 1-7.



**Figure 1-7. Head versus flow rate.**

**Troubleshooting**

- 20. By referring to the Troubleshooting Chart in Appendix E, identify two symptoms that a clogged strainer may cause.

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- 21. By referring to the Troubleshooting Chart in Appendix E, name five possible causes for a pump that does not prime or retain prime after operation.

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- 22. Ask your instructor to check your work.
  
- 23. Disconnect your setup, clean the strainer, and return the equipment to the storage location.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Instructor's approval: \_\_\_\_\_