

OPERATION MANUAL

YAMADA AIR-OPERATED DIAPHRAGM PUMPS

DP-FE. FX
DP-FE/D
DP-FsE/D/H

DECLARATION OF CONFORMITY

Name of company : YAMADA CORPORATION

Address : No.1-3,1-Chome,Minami-Magome,Ohta-ku,Tokyo,143-8504 Japan

declares, in sole responsibility, that the following product

Equipment : Diaphragm Pumps

Type : NDP- and DP- series

Referred to in this declaration conforms with the following standard(s) or directive(s)

- European Standard EN 809 / October 1998
- Directive 98/37/EC

YAMADA CORPORATION will keep on file for review the following technical documentation

- operating instructions as required
- plans
- description of measures designed to ensure conformity
- other technical documentation

Importer / Distributor in EU

Name of company : YAMADA EUROPE B.V.

Address : Aquamarijnstraat 50, 7554 NS Hengelo (O), The Netherlands

This product is certificated in TÜV Rheinland about safety.
Certificate Number is R9850515

Place and date issued : Sagamihara Factory / Apr.16.2003

Name and signature as well as position of undersigned :

Hiromasa Kumagai (Quality assurance Dept. Director)

CE



·Introduction

Thank you for purchasing a Yamada Diaphragm Pump. This product is a positive-displacement pump that transfers fluids by movement of diaphragms driven by compressed air through the electromagnet valve switching mechanism. The casing that comes in contact with the fluid is made of fluorine resin Yamada.


·For safe operation


This document contains information vital for safe and efficient operation of this product. Before using the pump, be sure to read this document carefully, particularly the "warnings and cautions," and be fully familiar with the operating procedures. Be sure to keep this document handy for future reference.

Warnings and Cautions

For safe use of this product, be sure to note the following: In this document, warnings and cautions are indicated by symbols. These symbols are for those who will operate this product and for those who will be nearby, for safe operation and for prevention of personal injury and property damage.

The following warning and caution symbols have the meanings described below. Be sure to remember their meanings.

 **WARNING:** If you ignore the warning described and operate the product in an improper manner, there is danger of serious bodily injury or death.

 **CAUTION:** If you ignore the caution described and operate the product in an improper manner, there is danger of personal injury or property damage.

Furthermore, to indicate the type of danger and damage, the following symbols are also used along with those mentioned above:



This symbol indicates a DON'T, and will be accompanied by an explanation on something you must not do.



This symbol indicates a DO, and will be accompanied by instructions on something you must do in a certain situation.

Operating caution

Before using this product

WARNING



• When using compressed gas (hereinafter called "compressed air") to drive this pump, be sure it is one of the following:

- * Compressed air supplied from an air compressor
- * Nitrogen (N₂) gas

Use of compressed air other than the above may cause air pollution, damage to the pump, or even an explosion.



• The maximum permissible pressure for the compressed air, and the fluid pumped by one of these pumps, depending upon the casing material of the model you are using, is as follows:

- * Casing of the fluorine resin : 0.5 MPa (5kgf/cm²)
- However, DP-25FE and DP-38FE are 0.7 MPa (7kgf/cm²).

If the pressure of the compressed air and fluid exceeds the above applicable maximum permissible pressure specified above, there may be leakage of fluid, damage to the casing, or even a severe, possibly even fatal, accident.



• When moving this product, make sure that the internal pressure is released.

If the pump is moved while under pressure, any shock imparted by dropping, etc. may damage the pump any shock imparted by drop page or even cause an explosion.



• Hazardous fluids (with strong acid or alkali, flammable or toxic) or gas bubbles generated by such fluids may cause serious injury or even death if accidentally inhaled or consumed or if they come into contact with the eyes or adhere to skin. Therefore, the following precautions are strongly advised.

- * Be fully familiar with the properties of the fluid to be pumped and work in strict accordance with the operating instructions provided by the suppliers of such fluids (such as wearing goggles, gloves, mask or work clothes).
- * When storing a hazardous fluid, strictly comply with the regulatory procedures (such as using proper containers, storage conditions, etc.).
- * Always install the piping and exhaust port of this pump away from human and animal traffic.

When a diaphragm is damaged, fluid will gush out together with air through the exhaust port. Provide protective measures in consideration of possible leakage of fluid (see Notes: Arranging outside exhaust on p.11). When you use the hose and pit etc., be sure you are using a model with appropriate corrosion resistance for the fluid to be pumped.

WARNING



- Improper grounding, poor ventilation, or unshielded fire or spark can create a danger of fire or explosion. Therefore, the following precautions are strongly advised.
 - *All peripheral equipment and piping connected to this product should be properly grounded.
 - *To pump flammable liquids, use a model with an aluminum or stainless-steel casing.
 - *Whenever you notice any spark while operating this product, immediately stop its operation, and do NOT start using it again unless you are sure of the cause and corrective actions have been taken.
 - *Depending upon the type of fluid being pumped, bubbles of flammable gas may be generated. Make sure that ventilation is satisfactory.
 - *This product itself, its piping and exhaust ports should be kept away from unshielded fire, spark and other causes of ignition. If a diaphragm is damaged, fluid will gush out together with air from the exhaust port.
 - *Do NOT leave gasoline or solvent etc. that contains waste at the work site.
 - *Machinery and other equipment near the place of installation of this product should be properly insulated to prevent conduction with each other.
 - *Do NOT operate heating devices that create flames or have heating filaments anywhere near the pump or its piping.
 - *If there are flammable gases in the air while the pump is operating, do NOT switch electric appliance on and off.
 - *Do NOT operate a gasoline engine at the work site.
 - *Restrict smoking at the work site.



- DP-FE and DP-FX series pump uses electricity for signals as well as driving air. Therefore, do not use the pump in any flammable atmosphere. Should the diaphragm be damaged, electric leak shall occur. Never use the pump for transporting flammable fluid.



- The amplifier controller that is to be connected to a DP-FE/D or FsE/D/H series product uses electricity for signals. Do not operate the amplifier controller in any flammable atmosphere.



- After you shut down the pump and disconnect the piping, some fluid may remain inside the pump. Also, if the pump is left unused for a prolonged period, some fluid may remain inside the pump and connected piping. Therefore, be sure to purge the system of fluid and clean the pump before prolonged disuse. If the product is left unused for a prolonged period with fluid remaining in the connected piping as well as the pump itself, the fluid may expand, depending on the ambient temperature (because of freezing or heat), which may cause damage to the pump and/or piping and possible leakage of fluid.



- Always use genuine Yamada parts when replacing component parts of this product. Do NOT attempt to modify the components parts or replace them with other than genuine Yamada parts.



- Torque of all tightening parts must be inspected before operation. Designated torque are mentioned in maintenance manual.

⚠ WARNING



• When pumping a hazardous fluid (hot, flammable, strong acid, etc.) with this product, provide protective measures (install a pit, a protection box, sensors, etc.) in consideration of possible leakage of fluid, and post warning signs at necessary places. Make the warning symbols on p.50, and attach them to the casing and piping, etc. Leakage of fluid may cause fire, air pollution or a serious accident. When pumping a hot fluid, the casing and piping will become hot, which may burn the skin when touched.

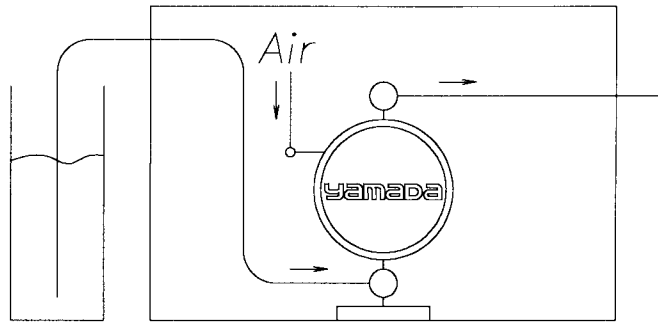


Fig.0-1



• Before using this product, be sure you are familiar with the precautions regarding the fluid to be pumped, and verify the corrosion resistance of the parts that will come into contact with the fluid. NEVER use the product with any fluid against which it does not have sufficient corrosion resistance or with a fluid that poses a risk of explosion. If you are unsure of the corrosion resistance, contact your dealer or our regional office. If you use this product with any fluid against which the parts that will come in contact with the fluid do not have sufficient corrosion resistance, it may result in damaging the product or leakage of fluid.



• When working in the vicinity of pumping of fluid with this product, be sure to wear protective gear (goggles, mask, etc.).



• When using this product, observe the relevant regulatory rules concerning fire prevention, labor safety standards, etc.



• If you have any questions on the operation of this product (method of connection or installation), contact your dealer or our regional office.

⚠ CAUTION



• When operating this product, it may generate loud operating noise, depending upon the condition of use (fluid pumped, supply air pressure and discharge pressure). If regulatory rules apply, provide appropriate acoustic measures where necessary. (For the noise value of this product, see 10.1 Main specifications after p.25.)



• To drive this product, use supply air with minimum moisture content.



• If a diaphragm of this product is damaged, supply air may mix with the fluid or the fluid may flow into the main body (air-switching portion). If air supply is inadequate or contaminated, do NOT operate the pump.



• While operating this product, do NOT cover the intake port by hand.



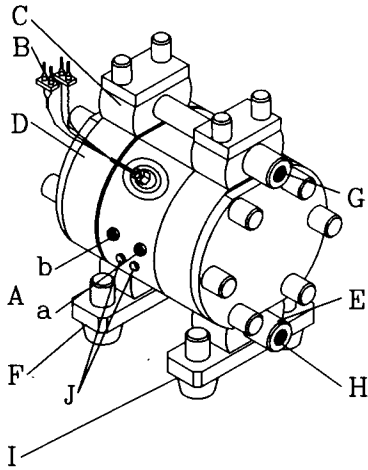
• If more than two years have elapsed since this product was shipped from the factory, notify your dealer or our regional office, and do NOT operate it without assurance from the dealer or our regional office that the pump may be operated safely.

Table of contents

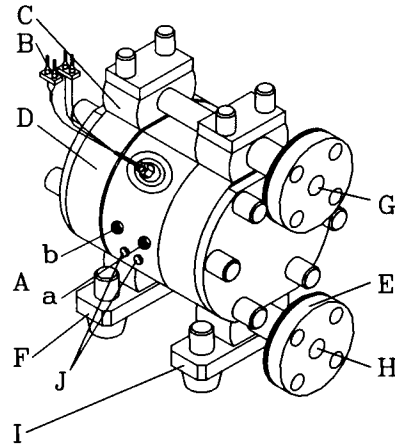
·Introduction	1
·For safe operation	1
·Warnings and Cautions	2
·Operating caution	2
·Table of contents	5
1. Names of parts and materials	
1.1 DP-FE and DP-FE series	6
1.2 DP-FE/D series	7
1.3 DP-FsE/D/H series	8
2. Assembly	
2.1 Installation of accessories	9
3. Installation	
3.1 Method of transport	10
3.2 Installing the pump	10
3.3 Assembling the cooling nozzle	11
4. Connection	
4.1 Connecting fluid piping	12
4.2 Connecting air piping	13
4.3 Connecting the cooling nozzle	14
4.4 Connecting the controller	15
4.4.1 DP-FE and DP-FX series	15
4.4.2 DP-FE/D and DP-FsE/D/H series	15
4.5 Setting the amplifier	17
4.6 Example of the operation performed via a sequencer	18
5. Operation	
5.1 Method of operation	19
5.2 Flow adjustment	19
5.3 Shutdown	20
5.4 Releasing the pressure	20
6. Method of cleaning	21
7. Daily check	22
8. Troubleshooting	
8.1 Pump does not run	22
8.2 Pump runs, but fluid does not come out	22
8.3 Flow (discharge quantity) decreased	22
8.4 Fluid leaks from exhaust port (silencer)	23
8.5 High air consumption during in operation	23
8.6 Irregular noise	23
8.7 Irregular vibration	23
9. Returning the product for servicing	
9.1 How to use the FAX sheet	23
9.2 Before returning the product	23
10. Main body specifications	
10.1 Main specifications	24
10.2 Appearance and dimensions	26
10.2.1 DP-FE, DP-FX series	26
10.2.2 DP-FE/D series	29
10.2.3 DP-FsE/D/H series	31
10.3 Performance curve	32
10.3.1 DP-FE, DP-FX series	32
10.3.2 DP-FE/D series	34
10.3.3 DP-FsE/D/H series	36
11. Trouble-Reporting FAX Sheet	38
12. Limited warranty	39
13. Warning symbols	40

1.2 DP-FE/D Series

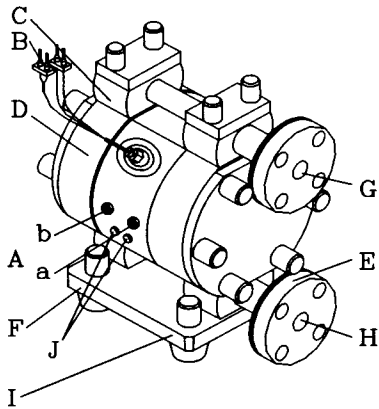
A : Air supply port (a, b) F : Pump base
 B : Sensor cable G : Discharge Port
 C : Out manifold H : Intake Port
 D : Out chamber I : Lift point
 E : In manifold J : Port for cooling



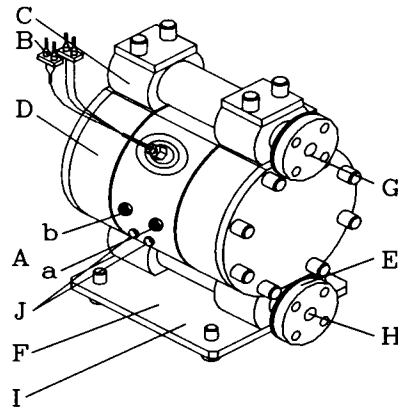
DP-10FE/D (Screw type)
 DP-20FE/D (Screw type)



DP-10FE/D (Flange type)
 DP-20FE/D (Flange type)



DP-25FE/D



DP-38FE/D

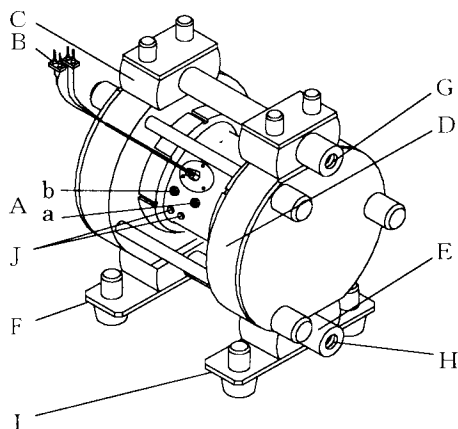
Type	10FE/D	20FE/D	25FE/D	38FE/D
Switching Portion	PP		HDPE, PP	
Fluid contact Portion	PTFE			
Diaphragm	PTFE			
Ball / O Ring	PTFE			
Valve seat	PTFE			

■ List of accessories

- Operation Manual 1
- Maintenance Manual 1
- Union (Air supply port) 2
- Reinforcement plate 8 (only flange type.)
- Fiber Attachment 2
- Fiber Cutter 2

1.3 DP-FsE/D/H series

- A : Air supply port (a, b)
- B : Sensor cable
- C : Out manifold
- D : Out chamber
- E : In manifold
- F : Pump base
- G : Discharge Port
- H : Intake Port
- I : Lift point
- J : Port for cooling



DP-10FsE/D/H (Screw type)
 DP-20FsE/D/H (Screw type)

Type	DP-10FsE/D/H	DP-20FsE/D/H
Switching Portion	PP, PVC	
Fluid contact Portion	PTFE	
Diaphragm	PTFE	
Ball / O Ring	PTFE/PTFE, Perfro	
Valve seat	PTFE	

■ List of accessories

- Operation Manual 1
- Maintenance Manual 1
- Maintenance Manual (Addition version) 1
- Union (Air supply port) 2
- Fiber Attachment 2
- Fiber Cutter 2

2. Assembly

2.1 Installation of accessories

First, open the product package and make sure that all the accessories are in order (see 1. Names of parts and materials , List of accessories p.6).

CAUTION



• All of the connection parts are capped or taped for shipment. Remove the caps and tapes.



• When installing accessories, make sure that no foreign matter falls into the product, as it could cause malfunction of the switching portion.



• Cover each screw with sealing tape to prevent leakage.



• See 10.1 Main specifications after p.24. Remember that the pump is heavy, so extreme care must be taken when lifting it.

3. Installation

3.1 Method of transport

When lifting the pump using a chain hoist or crane before transporting it, be sure to lift it by the specified lift point (see 1. Names of parts and materials after p.6).

⚠ WARNING	
!	• Be careful that nobody will pass under the pump when you lift it. It would be very dangerous if the pump should fall.

⚠ CAUTION	
!	• See 10.1 Main specifications after p.24. Remember that the pump is heavy, so extreme care must be taken when lifting it.
!	• When moving the pump with a forklift or truck, make sure that the pump will not fall. If it does, it may be damaged and/or cause bodily injury.
⊘	• NEVER try to move the pump by pulling the hose connected to the pump. The hose or the pump may be damaged.

3.2 Installing the pump

1) Decide where the pump should be installed and secure a suitable space (see Fig. 3.1 A to D).

< NOTES >

- Try to keep the suction lift as short as possible. Protect diaphragm from abnormal breakage, inlet pressure must be kept below the following values:
 - *PTFE diaphragm: 0.02 MPa (height 2 m) During operation
 - : 0.05 MPa (height 5 m) Not in operation
 - *Other diaphragms: 0.1 MPa (height 10 m)
 - (Condition with fresh water under ambient temperature)
- Remember to provide sufficient space around the pump for maintenance.
- The direction of the fluid intake port and the discharge port can be switched opposite from each other. (For switching, see the maintenance manual.)
- In the event diaphragm failure the exhaust from pump may contain some sludge. When operating the pump where it would have an impact on the environment, the exhaust should be directed to a place where there will be no environmental impact.

2) Remove the pump from the package and install it in the designated location.

3) When fixing the pump in place, use the cushions on the pump base, and secure the pump by tightening the tied-down bolts a little at a time.

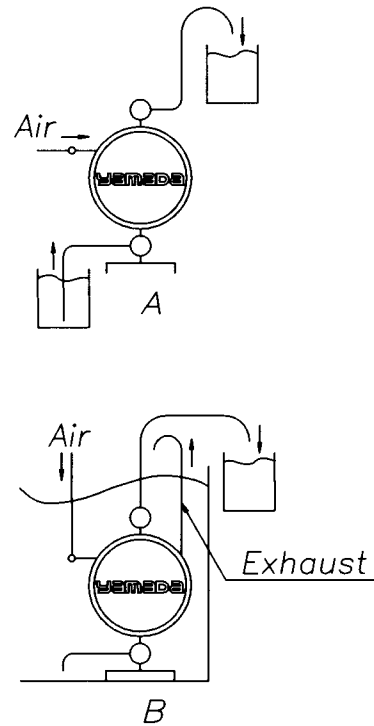
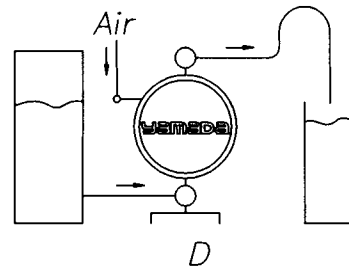
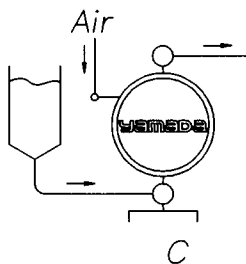


Fig. 3-1

⚠ CAUTION



- Even if you do not use the cushions to secure the pump in place, mount it in such a way that vibration generated by pump operation will be absorbed.



- If the pump will be submerged during operation, follow the steps below:
 - *Verify the corrosion resistance of each component of the pump, and do NOT expose the pump to any fluid for which it does not have proper corrosion resistance.
 - *Exhaust should be directed outside, not into the fluid in which the pump is submerged. For information on how to arrange the exhaust, see Note: Arranging outside exhaust and Fig. 3.2 below.
 - *Make sure that you can reach all of the valves without submerging your hand.



- When operating the pump, operation noise may be generated, depending upon conditions of use (kind of fluid being pumped, supply air pressure and discharge pressure). If any regulatory rules apply, provide appropriate acoustic measures. (For the noise level of this product, see 10.1 Main specifications on p.24.)



- When pumping a hazardous fluid (hot, flammable, strong acid, etc.), provide protective measures (installation of a pit or sensors, etc.) in consideration of possible leakage of fluid, and post warning signs at necessary places. For details, see the applicable operating caution on p.2 and p.4.

<NOTES> Arranging outside exhaust

- Remove the silencer of the electromagnet valve.
- Connect a hose with a ground wire to the electromagnet valve exhaust port, and attach the silencer to the tip of the hose. Use a hose of the same diameter as the exhaust port. (If the hose is longer than 5 meters, consult your dealer or our regional office.)
- Have a pit, a protection box, etc. at the end of the hose.

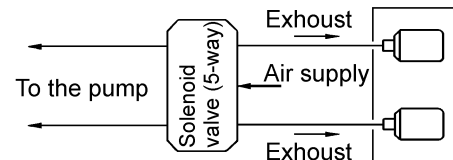


Fig.3-2

⚠ WARNING



- Be sure to have a pit, a protection box, etc. at the end of the hose in preparation for the flow of fluid in case of damage to a diaphragm. For details, see the applicable operating caution on p.2.



- Pump exhaust should be directed to a safe place, away from people, animals and food.

3.3 Assembling the cooling nozzle

When environmental or fluid temperature is 60°C or higher when using DP-FE, FX, DP-FE/D or DP-FsE/D/H series products a cooling system is required, see section 4.3 of the maintenance manual (connecting the cooling nozzle).

In this case, provide a tube whose outer diameter is 6 mm and inner diameter is 4 mm.

The air bleed inlet (for air supply) is located on the left side of the product, and the outlet (exhaust port) is located on the right side when viewed from your side toward the product.

Connect clean air for cooling the product to the air bleed inlet: the required air flow is approximately 40 L per minute (ANR). If the length of the entire tube for cooling is less than 2.5 m, the nozzle that is built into the pump is adjusted so that the pump can obtain the required air flow described above by supplying 0.3 MPa air pressure as air supply.

If the length of this tube is 2.5 m or longer but shorter than 5 m, raise the supply air pressure to 0.4 MPa. The length of the tube for air supply should be almost the same as that of the tube for exhausting air.

4. Connection

4.1 Connecting fluid piping

- 1) Connect a flow valve and a drain valve to the fluid discharge port of the pump.
- 2) Connect a valve for maintenance to the fluid suction intake port of the pump.
- 3) Connect a hose to the valve on the suction-port side and the valve of the discharge-port side of the pump.
- 4) Connect a hose on the suction-side intake and the discharge-port side to the respective vessels.

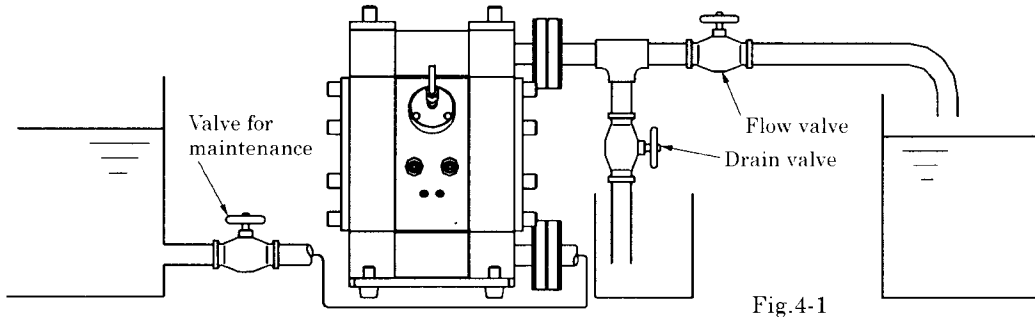


Fig.4-1

⚠ CAUTION



• Use a flexible hose to absorb pump vibration, and ground the hose.



• Make sure that there will be no external force on any connection part of the pump. Be especially careful not to have the pump support part of the weight of the hose and the Piping.



• Use a sturdy hose that will not collapse under the strong suction of the pump. Also, make sure the hose is of more than sufficient pressure rating.



• Use a hose of a diameter the same as or larger than the pump's ports. If you use a hose of smaller diameter, the pump's performance will be adversely affected, and it may even malfunction.



• When pumping a fluid that contains slurry, verify that the particle size is below the slurry limitation (after p.24, 10.1 Main specifications). If it exceeds the limitation of slurries indicated in the main specifications, attach a strainer to the pump to stop larger particles. Otherwise, such particles may cause a malfunction.



• If, depending upon the place of pump installation, the volume of the pumped fluid changes drastically, install a relief valve on the discharge side, and bring the pressure down below the maximum permissible value. If, owing to a change in the volume of fluid, the pressure inside the pump exceeds the maximum permissible pressure, it may cause damage.

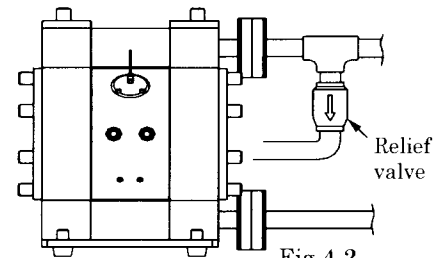


Fig.4-2



• Keep a vessel below the relief valve to catch any drain off.



• When testing piping for leakage, do NOT apply pressure to the pump's inlet and outlet sides with compressed air from outside. It may cause abnormal breakage to the diaphragm or the switching portion. When testing the piping, either install a valve between the pump's suction inlet and the discharge outlet and piping, or disconnect the pump from the piping and install plugs so that there will be no pressure from outside.



• In our product inspection, clean water is used. To prevent mixture of dirty water into the fluid to be pumped, clean the inside of the pump before finishing installation work.



• When installing a standby pump or two pumps in parallel from, be sure to provide a valve on each of the IN and OUT sides and perform pump switching by using the liquid material valve. If the valve of the stop-side pump is open, the diaphragm will be inverted by the discharge Pressure of the operating-side pump, resulting in damage in an early stage.

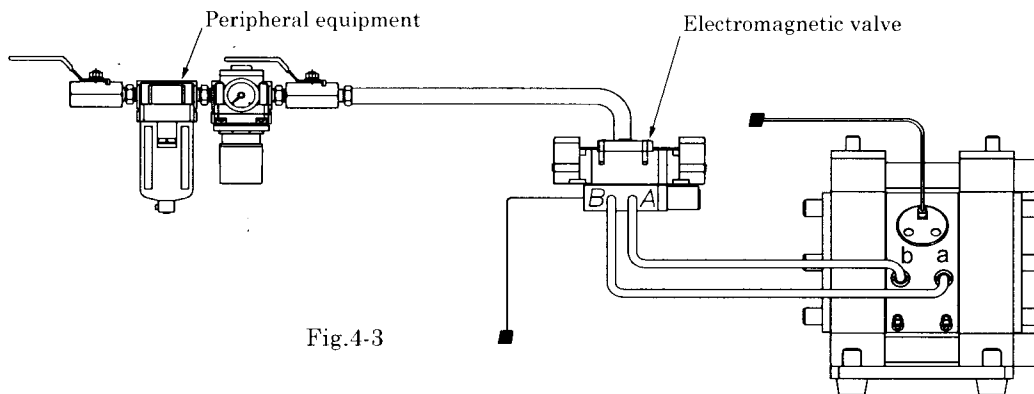
4.2 Connecting air piping

⚠ WARNING



• Before starting work, make sure that the air compressor is shut off.

- 1) Connect an air valve, air filter, regulator and if necessary lubricator (hereinafter called the "peripheral equipment") to hose which connected to compressor. Refer (NOTE) for detail information.
- 2) Install these peripheral items supported by brackets, etc., near the pump.
- 3) Connect the hose from the peripheral equipment to the air valve of the pump's supply port.
- 4) See Section 1. "Name of parts and materials" (page 6 and the following pages) to connect the air hose from the electromagnetic valve to the air valves a and b of the pump. (For the dedicated electromagnetic valve, connect the electromagnetic valve A port to the air valve b port of the pump, and connect the electromagnetic valve B port to the air valve a port of the pump.)



⚠ CAUTION



• Use a flexible hose to absorb pump vibration, and ground the hose.



• Make sure that there will be no external force on any connection part of the pump. Be especially careful not to have the pump support part of the weight of the hose and the piping.



• The piping and the peripheral equipment may become clogged with sludge. Clean the inside of the piping for 10 to 20 seconds before connecting it to the pump.



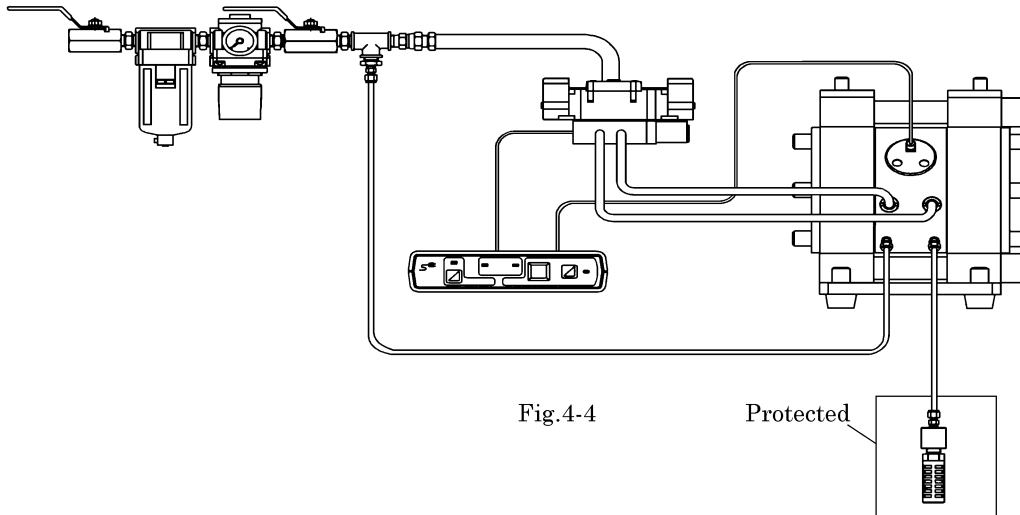
• Be sure to sufficiently ground the piping and peripheral equipment.

<NOTES>

- So that sufficient air can be supplied to meet the needs of the pump, the diameter of the piping should be the thing over the diameter of the supply port of the pump. Also choose peripheral equipment with sufficient airflow to meet the requirement of air consumption of the pump. Also must be considered usage and stability of air pressure. Also must be installed it nearest position of pump unit. And select the center exhaust type thing that has 5 ports in 3 positions, in the case that the electromagnet valve of the except for exclusive use is used.
- Use of a coupler for the connection part of each hose will make operation and maintenance easier.

4.3 Connecting the cooling nozzle

- When environmental or fluid temperature is 60°C or higher when using DP-FE, FX, DP-FE/D or DP-FsE/D/H series products, be sure to purchase the cooling nozzle to blow air so that the sensor parts can be cooled down.
- 1) Connect the cooling nozzle to the pump. See “Names of parts and materials” on page 6 and the Figure 4.5 for where to connect the cooling nozzle.
 - 2) Connect the air supply tube (outer diameter 6 mm × inner diameter 4 mm) to the cooling nozzle IN port.
 - 3) Connect the air exhaust tube whose length is the same as that of the air supply tube (outer diameter 6 mm × inner diameter 4 mm) to the cooling nozzle OUT port. See page 11 “Notes: Arranging outside exhaust” to protect the end of the air exhaust tube.

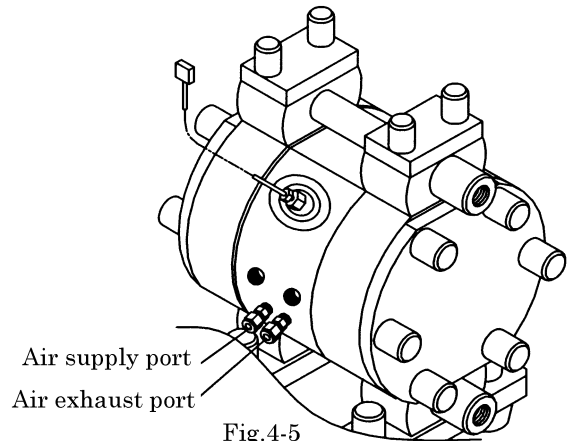


<NOTE>

- The air supply port is located on the left side and the air exhaust port is on the right side of all models of the DP-FE, FX, DE/D, and DP-FsE/D/H series products.

<NOTES>

- Connect the air supply tube to the air supply pipe that is connected to the electromagnetic valve. (The required air flow is approximately 40 NL/minute.)
- The cooling nozzle is adjusted so that the air flow described above can be obtained if the supply air pressure is 0.3 MPa when the length of the cooling tube is less than 2.5 m. When the cooling tube is 2.5 m or longer but shorter than 5 m, supply 0.4 MPa air pressure to the pump.



⚠ CAUTION



• When the environmental or fluid temperature is 60 °C or higher, (Incase of use DP-10~38FE series temperature rating change to 55°C) be sure to use the air cooling system . Otherwise, it may damage the sensor unit.



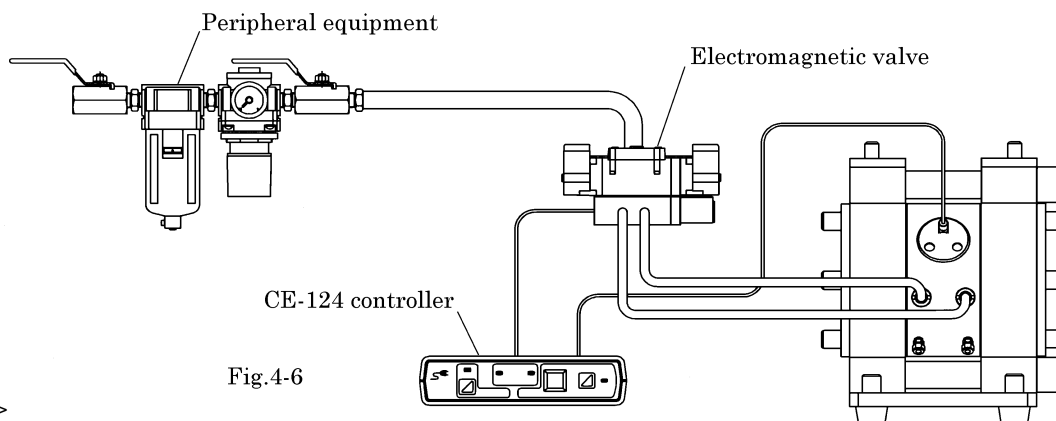
• To blow air, do not supply any compressed air to both the IN and OUT ports of the cooling nozzles. It may damage the nozzle.

4.4 Connecting the controller

- This section describes how to operate the pump by using the electromagnetic valve exclusively designed for an optional CE-124 pump controller.
- If you do not use the CE-124 controller and the dedicated electromagnetic valve, see Section 4.6 “Example of the operation performed via a sequencer” on page 18.
(See Section 4.4.2 also for a DP-FE/D or DP-FsE/D/H series product.)

4.4.1 DP-FE and DP-FX series

- 1) Connect the cable of the electromagnetic valve to the “VALVE” slot of the CE-124 controller.
- 2) Connect the cable of the pump to the “SENSOR” slot of the CE-124 controller.
- 3) Connect the CE-124 controller to the 24 V DC or 100 V AC power supply.



<NOTE>

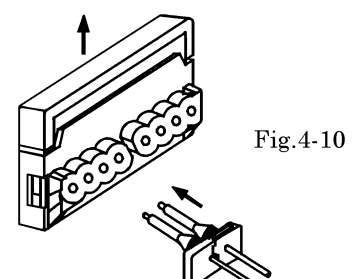
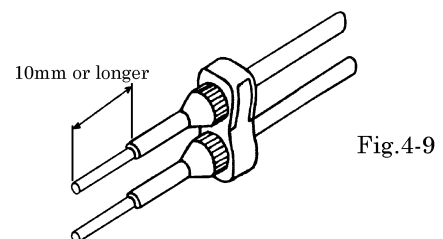
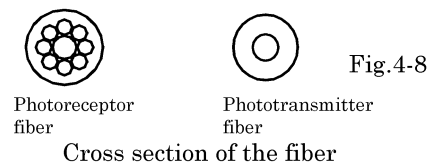
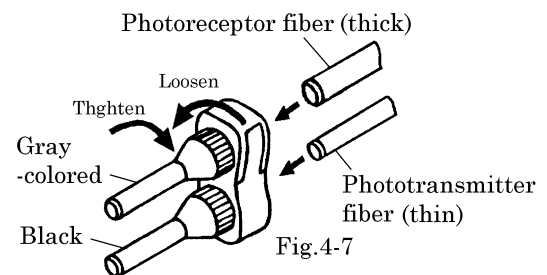
- When bending a cord type distribution line, please ensure the bends radius is no less than R25mm.

4.4.2 DP-FE/D and DP-FsE/D/H series

- 1) Assemble the fiber attachment (supplied) onto the optical fiber.
 - Insert the phototransmitter fiber (thin) to the black tip of the fiber attachment, and photoreceptor fiber (thick) to the gray-colored tip respectively. [See Fig. 4.7.]
The cross section of the optical fiber is shown in Fig. 4.8.
 - Pull out the optical fiber from the tip section of the fiber attachment by 10 mm or longer, and fix the tip section of the fiber attachment. [See Fig. 4.9.]
 - Follow the instructions above to perform the same operation for the side A (the phototransmitter fiber and photoreceptor fiber equipped with a mark tube) and the side B (the phototransmitter fiber and photoreceptor fiber without a mark tube) respectively.

<NOTE>

- Be careful not confuse the optical fiber on the side A (with the mark tube) with that on the side B (without a mark tube).
- 2) Cut the tip of the optical fiber with the supplied fiber cutter.
 - Raise the blade of the supplied fiber cutter, and insert the base section of the fiber attachment to the cutter from its protruded section. [See Fig. 4.10.]
 - Cut the tip of the fiber.



<NOTE>

- After cutting the tip of the fiber, approximately 1 mm of the optical fiber is adjusted to protrude from the tip of the fiber attachment.
- Do not displace the fiber attachment after cutting the tip of the fiber.

- 3) Connect the optical fiber to the amplifier assembly.
 - Connect the optical fiber on the side A to the amplifier on which the seal "A" is pasted, and that on the side B to the amplifier on which the seal "B" is pasted respectively.
 - Connect the gray fiber attachment (photoreceptor side) to the upper side and the black one (phototransmitter side) to the lower side.

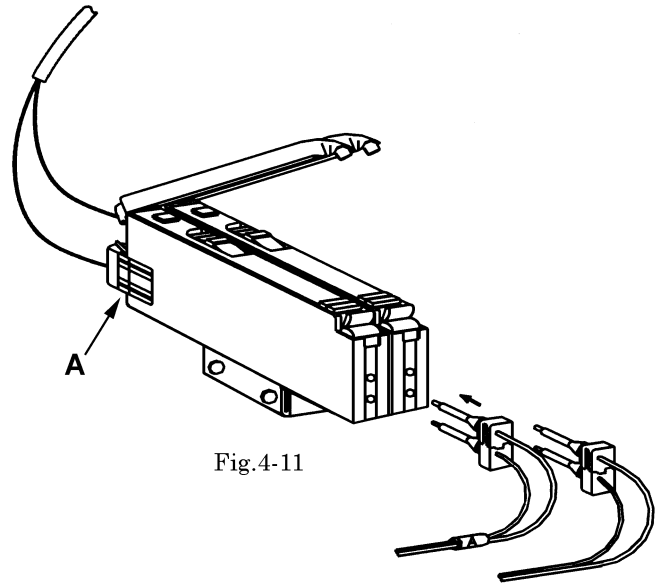


Fig.4-11

<NOTE>

- When bending an optical fibre type distribution line, please ensure the bends radius is no less than R25mm.
- Refer to the Operation Manual supplied with the amplifier for how to connect the optical fiber and the amplifier.

(Use an "FX-AT6" as the fiber attachment.)

- 4) Connect the cable of the amplifier assembly to the "SENSOR" slot of the CE-124 controller.
- 5) Connect the cable of the electromagnetic valve to the "VALVE" slot of the CE-124 controller.
- 6) Connect the CE-124 controller to the 24 V DC or 100 V AC power supply.
- 7) See Section 4.5 "Setting the amplifier" on page 17 to set the amplifier.

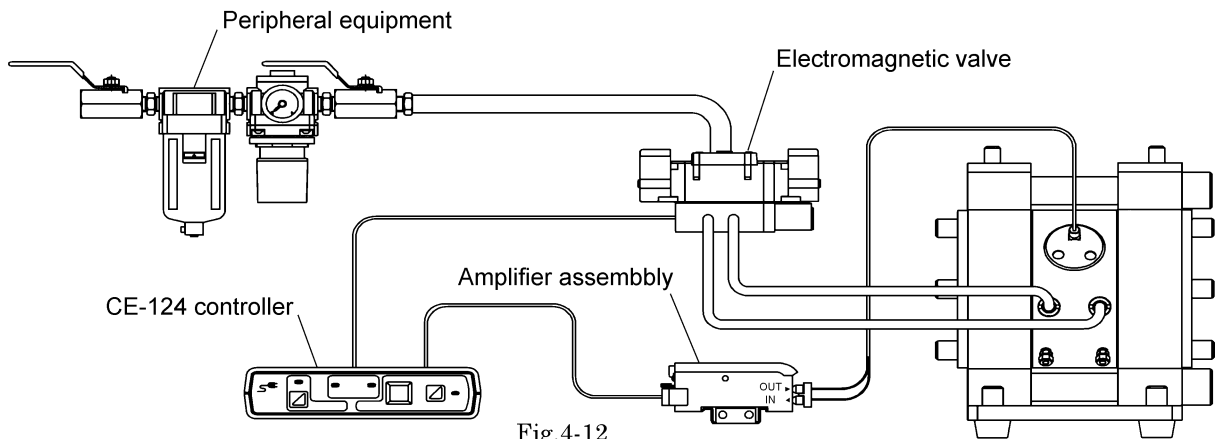
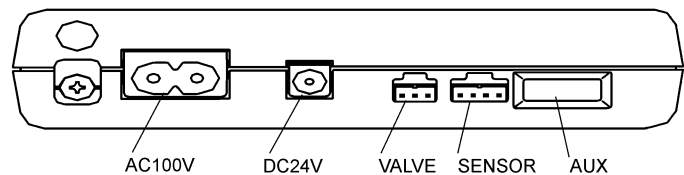


Fig.4-12

<NOTE>

- When bending a cord type distribution line, please ensure the bends radius is no less than R25mm.
- Refer to the Operation Manual supplied with the CE-124 controller for the detailed information on how to connect the pump to the CE-124 controller.



Rear view of the CE-124 controller

Fig.4-13

4.5 Setting the amplifier

For any of the DP-FE/D or DP-FsE/D/H series products, refer to its Operation Manual to make the following settings.

Be sure to perform the settings of both the side A and B of the amplifier.

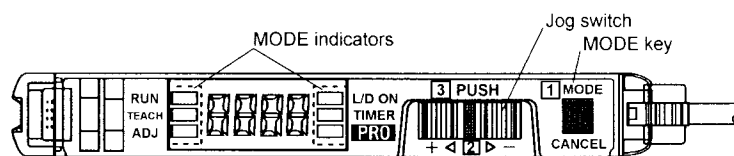
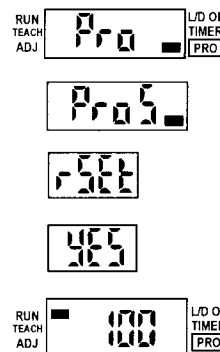


Fig.4-14

- Resetting the amplifier settings

- 1) Press the MODE key (five times) to select the "Pro" MODE indicator.
- 2) Turn the jog switch to the + side (five times) to display "PRO5" and press the jog switch.
- 3) Turn the jog switch to the + side (five times) to display "SEE" and press the jog switch.
- 4) Turn the jog switch to the + side (once) to display "YES" and press the jog switch.
- 5) Press the MODE key (three times) or hold it depressed for two seconds or longer to select the "RUN" MODE indicator.

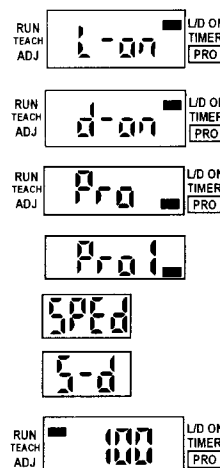


<NOTE>

When you reset the amplifier settings, they are reset to the factory settings (response time: standard, output operation: ON at light reception, threshold value: 40).

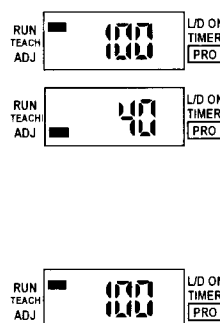
- Setting the output operation and response time

- 1) Press the MODE key (four times) to select the "L/DON" MODE indicator.
- 2) Turn the jog switch to the + side (once) to display "D-ON" and press the jog switch.
- 3) Press the MODE key twice to select the "PRO" MODE indicator.
- 4) Turn the jog switch to the + side (once) to display "PRO1" and press the jog switch.
- 5) Press the jog switch while "SPED" is displayed
- 6) Turn the jog switch to the + side (three times) to display "S-D" and press the jog switch.
- 7) Press the MODE key three times or hold it depressed for two seconds or longer to display the "RUN" MODE indicator.



- Adjusting the threshold value

- 1) Check the value displayed on the digital display while the "RUN" MODE indicator is selected.
- 2) Press the MODE key twice to select the "ADJ" MODE indicator.
- 3) Turn the jog switch to display a value twice the value you checked at Step (1), and press the jog switch.
(To increase the displayed value, turn the jog switch to the + side, and to decrease it, turn the jog switch to the - side.)
- 4) Press the MODE key four times or hold it depressed for two seconds or longer to select the "RUN" MODE indicator.



4.6 Example of the operation performed via a sequencer

The DP-FE, FX, DP-FE/D and DP-FsE/D/H series products use the sensor, which always outputs signals, called “B contact” to output signals with taking consideration into its several advantages and safety. Combination of this sensor and a sequencer can function as part of the control system.

Since the 5-port and 3-position electromagnetic valve operates the pump, the flip-flop (F/F) control method makes the pump operate stably. There are many types of F/F methods, but we recommend the control method shown in the figure below.

“S” and “R” of the logical circuit shown in Fig. 4. 15 represent the Set signals respectively. In case of the F/F method, either of these signals can be connected to S and R. The F/F method becomes the control output and only one of the two signals is always output. The F/F method is the mechanism that holds either one of signals input via two lines until another one is input. The set function prioritized type of F/F method shown in the right figure outputs only one of the

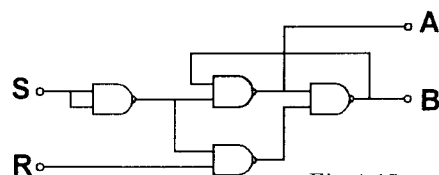


Fig.4-15

input signals even though both input signals are set to ON or OFF, so it operates stably. Therefore, if both signals are disabled due to wrong connection of the electromagnetic valve or any other reason, this method prevents a risky accident such as a burnout of the electromagnetic coil from occurring. This mechanism can be established with a sequence controller also, but you have to note the followings:

Sequencer output	Transistor method	Triac method
Rated operating power-supply	12-24 V/DC	100-200 V/AC
Allowable power voltage range	0-30 V/DC	50-200 V/AC
Maximum load power	0.5-1 A	0.5-1 A
Output delay	< 0.2 msec	< 1-10 msec

About the signal input level of the sequencer

Since the output of the DP-FE, FX, DP-FE/D and DP-FsE/D/H series products is the contact B of the NPN open collector, the signal voltage becomes approximation to the voltage of the power supply applied to the sensor. Since the rated voltage of the sensor is 12 V DC to 24 V DC, you can use the power supply unit of an ordinary sequencer as it is. There are three possible output section configurations, and the most commonly used one is a relay. However, the life cycle of the contact of the relay is approximately one million times with assuming that the life of the pump is greater than 6 million strokes, and this is too short. So, we recommend that you use output via a transistor for a solenoid valve whose voltage is up to 24 V DC, or output via a triac for a solenoid valve whose voltage is 100 V AC.

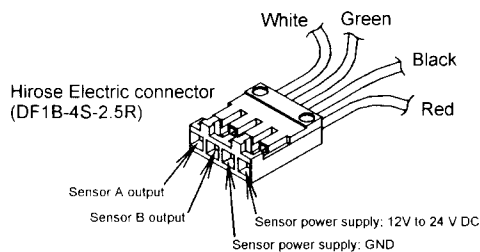


Fig.4-16

[Example of the prioritized RS type flip-flop]

A flip-flop instruction is already in a command of some sequencers. As your reference, we provide one example to establish a new method as shown in the right figure.

We recommend that you use the auxiliary relay located inside the sequencer as outputs A, B, C and D in Fig. 4. 17.

“S” and “R” are input from the pump sensor.

(Input to “S” and “R” is normally “ON” or “HI-LEVEL.”)

The Out A and Out B are the final output. Connect them to the electromagnetic coil sections located on both edges of the electromagnetic valve via the power-supply circuit.

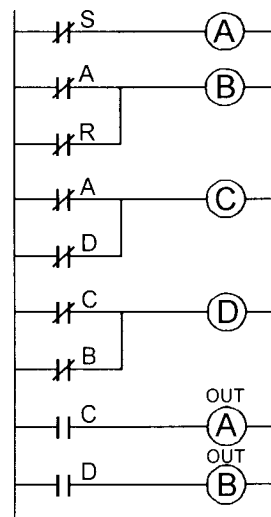


Fig.4-17

5. Operation

5.1 Method of operation

CAUTION



• Before starting the pump, make sure that all piping is properly connected.



• Also, before starting the pump, make sure that all the bolts are securely tightened. (Refer to the maintenance manual for the bolts that a regulation torque are explained.)



• Make sure that the air valve, regulator and the drain valve on the discharge side are closed. Also, make sure that the valve on the suction side is opened.

- 1) Start the air compressor.
- 2) Open the air valve in front of peripheral equipment, and adjust the supply air pressure with the regulator to a value within the regulated range (see Section 10.1 "Specifications" on page 24 or the following pages).
- 3) Open the flow valve on the discharge side.
- 4) Press the START/STOP button of the CE-124 controller to operate the pump (the RUN indicator lights), and open the air valve located in front of the electromagnetic valve little by little.
- 5) Check that fluid is supplied to the discharge side via pipes, and then fully open the air valve.

CAUTION



• Do NOT open the air valve suddenly.



• In case of use lubricator, must be used turbine oil none addition class 1 turbine oil (equivalent ISO VG32 grade) for lubricants. Do not apply lubricants more than required and also do not use any other lubricants, which designated on this instruction manual. This may cause of pump problem and there is danger of serious bodily damage.

5.2 Flow adjustment

- Adjust the flow valve on the discharge side. For the relationship among the flow, supply air pressure and discharge pressure, see 10.3 Performance curve after p.32.

CAUTION



• As you start closing the flow valve, the supply air pressure may rise. Make sure that the pressure is kept within the normal operating range (see 10.1 Main specifications after p.25).



• Depending upon the viscosity and specific gravity of the fluid, the suction stroke and other conditions, the permissible suction flow speed of fluid into the pump will vary; however, if the pump speed (flow speed of fluid) increases greatly, cavitation will occur, and this not only will reduce pump performance, but it may cause a malfunction. Adjust the supply air pressure as well as the flow in order to prevent cavitation.



• If fluid is not discharged after you start the pump, or if you hear an abnormal noise or notice any irregularity, shut down the pump immediately (see 8. Troubleshooting after p.22).

5.3 Shutdown

- Press the START/STOP button of the CE-124 controller to stop the pump (the RUN indicator goes off), and then close the air valve to shut off the supply air. (If you use a device such as a sequencer, stop the pump.)

CAUTION



• There is no problem in shutting down the pump with the flow valve closed while air is being supplied; however, if this condition continues for many hours while there is nobody watching the pump, it may continue running when there is a leak from the pump or piping, and fluid may continue flowing out of the position of leakage. Upon finishing your work, release the internal pressure from the pump and close the air valve (see 5.4 Releasing the pressure).



• When the pump is shut down while pumping slurry, particulate matter contained in the slurry will be deposited and get stuck inside the out chamber. If the pump is started again as-is, the diaphragm may be damaged or the center disk may be overloaded, and this may cause damage such as bending of the center rod. After finishing your work, purge the remaining fluid from the pump (see 6. Cleaning on p.21).

5.4 Releasing the pressure

- 1) Press the START/STOP button of the CE-124 controller to operate the pump (the RUN indicator lights).
- 2) Stop the air compressor or close the valve located in front of the peripheral equipment.
- 3) Close the flow valve on the discharge side, and start slowly opening the drain valve to discharge the pressurized fluid.
- 4) After making sure that the pump stops completely and the pressure is released, fully open the regulator and close the drain valve.

CAUTION



• Keep a vessel below the relief valve to catch any drain off.



• Fluid under pressure will gush out as soon as you open the valve, so be careful.



• If the pump will be unused for a prolonged period, purge and clean the pump (see the Operating caution on p.3).

6. Method of cleaning

WARNING



• Before starting operation, make sure that compressed air is not supplied to the pump.



• Before starting operation, make sure that the pump is not pressurized.

- 1) Remove the hose from the suction side of the pump.
- 2) Close the flow valve on the discharge side, open the drain valve, and then operate a pump by starting air pressure for a while to discharge any fluid remaining inside the pump as much as possible.
- 3) Remove the hose from the discharge side, and attach different hoses to the suction side and the discharge side for cleaning.
- 4) Be ready with a vessel with cleaning solution, select cleaning solution appropriate for the type of fluid pumped, and then connect the suction-side and the discharge-side hoses of the pump.
- 5) Operate a pump by starting air pressure slowly, and let the cleaning solution circulate for sufficient cleaning.
- 6) Finally, flush with clean water.
- 7) Remove the hose from the suction side of the pump, run the pump for a while and purge the pump of remaining fluid as much as possible.

CAUTION



• Be careful when removing piping. Fluid will gush out.



• After cleaning with clean water, turn the pump upside-down to drain out the water.

7. Daily check

- Before starting pump operation, be sure to conduct the following check every day. If any irregularity is found, do NOT start running the pump until the cause of the irregularity has been found and corrective measures have been taken.
 - a) Verify the drain flow through the air filter.
 - b) In case using a lubricator, verify the quantity of lubricating oil.
 - c) Make sure that there is no leakage of fluid from any connection part or the pump.
 - d) Make sure that there are no cracks in the pump casing or piping.
 - e) Check the tightness of every bolt of the pump.
(Refer to “maintenance manual” about the retighten of “Tie rod”)
 - f) Make sure that the connection parts of the piping and peripheral equipment are not loose.
 - g) Make sure that the time has not elapsed for replacing any parts of the pump that are to be replaced at regular intervals. For details, see the maintenance manual.

8. Troubleshooting

8.1 Pump does not run

Cause	Action to be taken
The air tube is connected in the opposite direction between the electromagnetic valve and the pump.	Change the air hose direction and connect it in the proper direction.
Air is not supplied.	Start the compressor, and open the air valve and air regulator.
The supply air pressure is low.	Check the compressor and the configuration of air piping.
Air leaks from connection parts.	Check the connection parts and tightness of bolts.
Air piping or peripheral equipment is clogged with sludge.	Check and clean the air piping.
The flow valve on the discharge side is not open.	Open the flow valve on the discharge side.
The fluid piping is clogged with sludge.	Check and clean the fluid piping.
The pump is clogged with sludge.	Disassemble the casing, check and clean.
Sludge is stuck to the tip of the optical fiber.	Check and clean the sensor assembly
The optical fiber is damaged.	Replace the optical fiber with a new one.

8.2 Pump runs, but fluid does not come out

Cause	Action to be taken
The suction lift or discharge head is long.	Confirm the piping configuration and shorten the length.
The discharge-side fluid piping (including the strainer) is clogged with sludge.	Check and clean the fluid piping.
The valve on the suction side is not open.	Open the valve on the suction side.
The pump is clogged with sludge.	Disassemble the casing, check and clean.
The ball and valve seat are worn out or damaged.	Disassemble the manifold, check and replace parts.

8.3 Flow (discharge volume) decreased

Cause	Action to be taken
The supply air pressure is low.	Check the compressor and configuration of air piping.
Air piping or peripheral equipment is clogged with sludge.	Check and clean the air piping.
The discharge-side flow valve opens differently.	Adjust the discharge-side flow valve.
Air is taken in together with fluid.	Replenish fluid and check the configuration of the suction-side piping.
Cavitation occurs.	Adjust the supply air pressure and discharge pressure, and shorten the suction lift.
Chattering occurs.	Adjust the supply air pressure and discharge pressure. Reduce inlet flow valve to adjusting liquid pressure and volume.
Icing on air-switching portion.	Eliminate ice from air-switching valve and check and clean the air filter. Use external exhaust hose to control exhaust air speed. (Refer Fig.3.2)

The fluid piping (including the strainer) is clogged with sludge.	Check and clean the fluid piping and strainer.
The exhaust port (silencer) of the pump is clogged with sludge.	Check and clean the exhaust port and silencer.
The pump is clogged with sludge.	Disassemble the casing, check and clean.

8.4 Liquid leakage from exhaust port (silencer)

Cause	Action to be taken
The diaphragm is damaged.	Disassemble and check the pump and replace the diaphragm.
The fastening nuts for the center disk are loose.	Disassemble and check the pump. Tighten the nuts.

8.5 High air consumption during operation

Cause	Action to be taken
The electromagnetic valve, packing of the center rod section and O-ring are worn out.	Check and replace the electromagnetic valve, packing of the center rod section and O-ring.

8.6 Irregular noise

Cause	Action to be taken
The supply air pressure too high.	Adjust the supply air pressure.
The spool oscillates, and occur ball chattering.	Adjust the supply air pressure and discharge pressure. Reduce inlet flow valve to adjusting liquid pressure and volume.
The pump is clogged with sludge with particles of larger than the permissible diameter.	Disassemble the casing, check and clean.

8.7 Irregular vibration

Cause	Action to be taken
The supply air pressure is too high.	Adjust the supply air pressure.
The spool oscillates, and occur ball chattering.	Adjust the supply air pressure and exhaust pressure.
Connection parts and pump mounting are loose.	Check each connection part and tighten the bolts.

- If disassembly is required, refer to the maintenance manual and follow with the instructions.
- If any of the above mentioned causes does not apply to your problem, contact your dealer or our regional office.

9. Returning the product for servicing

9.1 How to use the FAX Sheet

- Copy the FAX Sheet on p.38 "11. Trouble-Reporting FAX Sheet", fill out the necessary details regarding your problem and conditions of operation, and fax it to your dealer or our regional office.

9.2 Before returning the product

- 1) Purge the pump of fluid and clean (see 6. Cleaning method on p.21).
- 2) Return the product in the same package as when it was first shipped from the factory.

WARNING



- It will be the end-user responsibility to thoroughly wash and clean the pumps to prevent accidents caused by liquid leaks.

CAUTION



- Be sure to prevent liquid leak from pump for safe transport.

10. Main Body Specification

10.1 Main Specification

■ DP-FE, FX series

Type		DP-5FE	DP-5FX	DP-10FE
Nominal Diameter		1/4" (6 mm)		3/8" (10 mm)
Fluid Connection	Suction Port	Rc1/4	Ø12x L100	Rc3/8 Or equivalent to JIS flange 10K10A
	Discharge Port			
Air Connection	Supply Port	Rc1/4		
	Exhaust Port			
Nominal Air Pressure		0.2~0.5 MPa		
Maximum Discharge Pressure		0.5 MPa		
Discharge Volume/cycle		18 mL		60 mL
Maximum Discharge Volume		12 L/min		20 L/min
Maximum Air Consumption L/min(ANR)		300 L/min(ANR)		350 L/min(ANR)
Slurry Limitation *1		—		1 mm or less
Limitation of Viscosity		0.5 Pa·s or below		1 Pa·s or below
Operating Ambient Temperature Range	Temp.	0~70°C *2		
	Fluid Temp.	0~80°C *2	0~150°C *2	0~80°C *2
Temperature rating whose require cooling system.		60 °C or higher		55 °C or higher
Maximum Operating Noise		71 dB(A) *3		82 dB(A) *3
Weight		3.4 kg	2.3 kg	7.2 kg

■ DP-FE, FX series

		DP-20FE	DP-25FE	DP-38FE
Nominal Diameter		3/4" (20 mm)		1" (25 mm)
Fluid Connection	Suction Port	Rc 3/4 Or equivalent to JIS flange 10K20A	Equivalent to JIS flange 10K25A	Equivalent to JIS flange 10K25A
	Discharge Port			
Air Connection	Supply Port	Rc1/4	Rc1/2	
	Exhaust Port			
Nominal Air Pressure		0.2~0.5 MPa	0.2~0.7 MPa	
Maximum Discharge Pressure		0.5 MPa	0.7 MPa	
Discharge Volume/cycle		200 mL	300 mL	560 mL
Maximum Discharge Volume		52 L/min	65 L/min	85 L/min
Maximum Air Consumption L/min(ANR)		400 L/min(ANR)	1400 L/min(ANR)	1000 L/min(ANR)
Slurry Limitation *1		2 mm or less	3 mm or less	
Limitation of Viscosity		2 Pa·s or below	2.5 Pa·s or below	
Operating Ambient Temperature Range	Temp.	0~70°C *2		
	Fluid Temp.	0~80°C *2		
Temperature rating whose require cooling system.		55 °C or higher		
Maximum Operating Noise		85 dB(A) *3	85 dB(A) *3	85 dB(A) *3
Weight		15.5 kg	28.4 kg	51 kg

CAUTION

*1 : Do not use the flat valve type pump for the liquids with slurry.

*2 : When the environmental or fluid temperature is 55 °C or higher, (Incase of use DP-5FE,5FX series, temperature rating change to 60°C) be sure to use the air cooling system .

*3 : See 37 pages of "Method of measurement of operating noise".

■ DP-FE/D series

Nominal Diameter		DP-10FE/D	DP-20FE/D	DP-25FE/D	DP-38FE/D
Nominal Diameter		3/8" (10 mm)	3/4" (20 mm)	1" (25 mm)	1" (25 mm)
Fluid Connection	Suction Port	Rc 3/8 Or equivalent to JIS flange 10K10A	Rc 3/4 Or equivalent to JIS flange 10K20A	Equivalent to JIS flange 10K25A	Equivalent to JIS flange 10K25A
	Discharge Port				
Air Connection	Supply Port	Rc1/4		Rc1/2	
	Exhaust Port				
Nominal Air Pressure		0.2~0.5 MPa			
Maximum Discharge Pressure		0.5 MPa			
Discharge Volume/cycle		60 mL	200 mL	300 mL	560 mL
Maximum Discharge Volume		20 L/min	50 L/min	60 L/min	70 L/min
Maximum Air Consumption L/min(ANR)		350 L/min(ANR)	400 L/min(ANR)	940 L/min(ANR)	1000 L/min(ANR)
Slurry Limitation *1		1 mm or less	2 mm or less	3 mm or less	
Limitation of Viscosity		1 Pa·s or below	2 Pa·s or below	2.5 Pa·s or below	
Operating Ambient Temperature Range	Temp.	0~70°C *2			
	Fluid Temp.	0~80°C *2			
Temperature rating whose require cooling system.		60 °C or higher			
Maximum Operating Noise		82 dB(A) *3	85 dB(A) *3	85 dB(A) *3	85 dB(A) *3
Weight		7.2 kg	15.5 kg	28.4 kg	51 kg

■ DP-FsE series

Nominal Diameter		DP-10FsE/D/H	DP-20FsE/D/H
Nominal Diameter		3/8" (10 mm)	3/4" (20 mm)
Fluid Connection	Suction Port	Rc3/8	Rc3/4
	Discharge Port		
Air Connection	Supply Port	Rc 1/4	
	Exhaust Port		
Nominal Air Pressure		0.2~0.5 MPa	
Maximum Discharge Pressure		0.5 MPa	
Discharge Volume/cycle		85mL	160 mL
Maximum Discharge Volume		20 L/min	40L/min
Maximum Air Consumption L/min(ANR)		300 L/min(ANR)	400L/min(ANR)
Slurry Limitation *1		1mm or less	2 mm or less
Limitation of Viscosity		1 Pa·s or below	2 Pa·s or below
Operating Ambient Temperature Range	Temp.	0~70°C *2	
	Fluid Temp.	0~80°C *2	
Temperature rating whose require cooling system.		60 °C or higher	
Maximum Operating Noise		80 dB(A) *3	82dB(A) *3
Weight		10.6 kg	17.7 kg



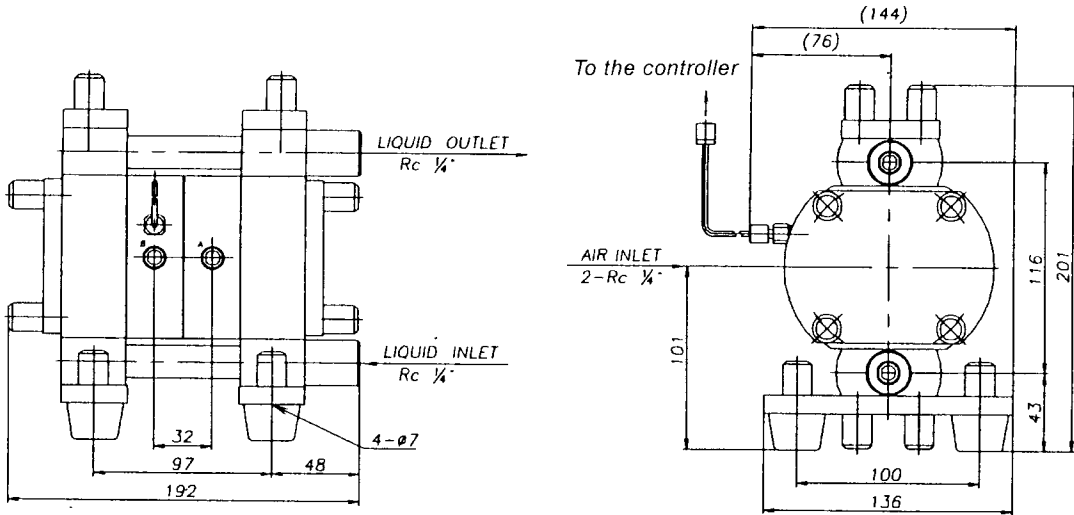
CAUTION

- *1 : Do not use the flat valve type pump for the liquids with slurry.
 *2 : Use cooling air blow, in the case that it uses it exceeding 60°C
 *3 : See 37 pages of "Method of measurement of operating noise".

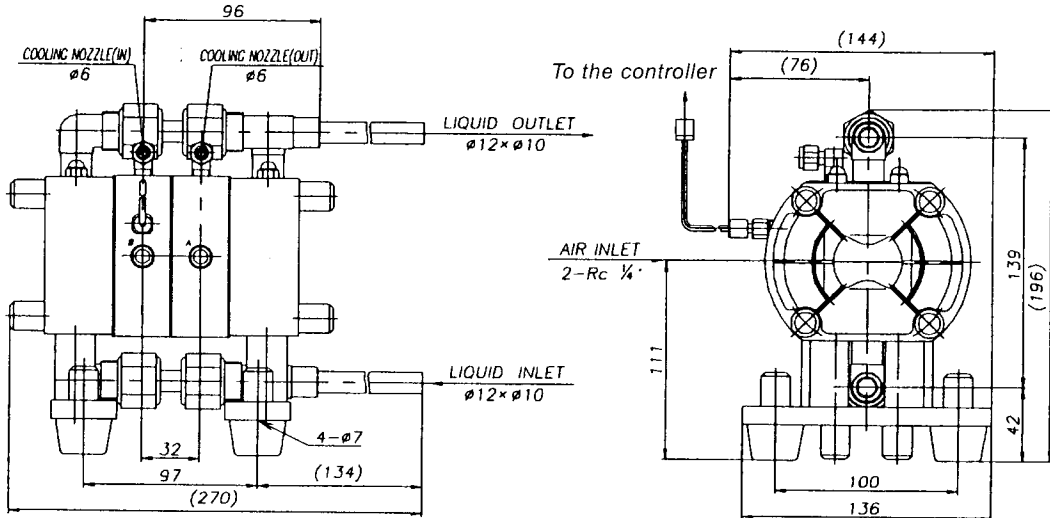
10.2 Appearance and Dimensions

10.2.1 DP-FE, DP-FX series

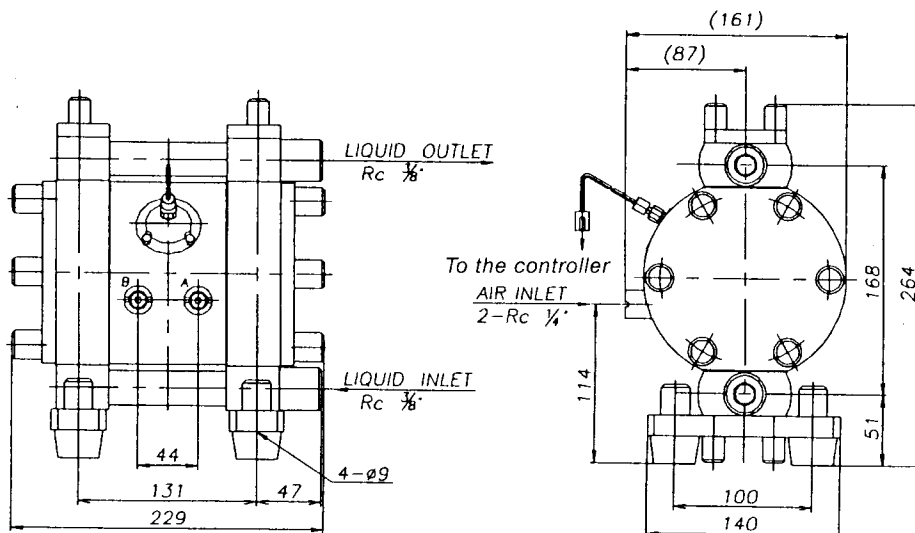
■ DP-5FE



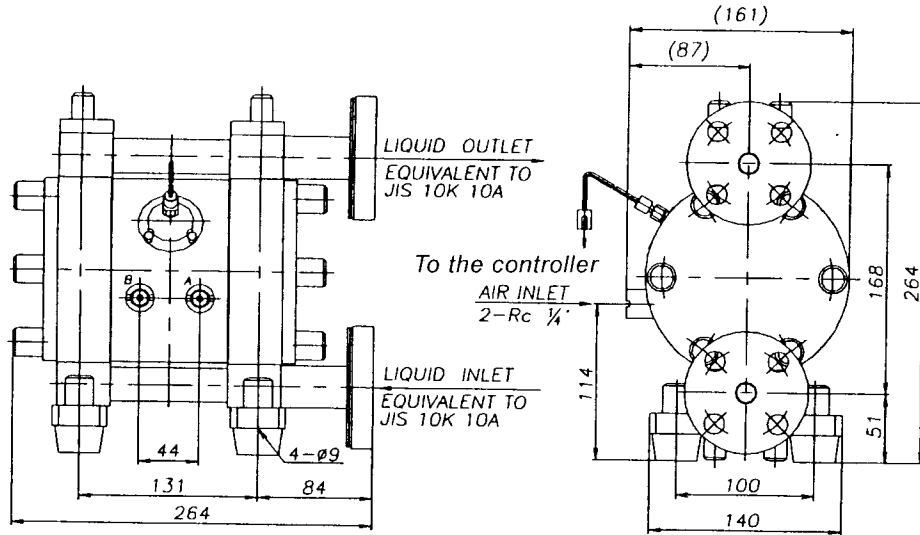
■ DP-5FX



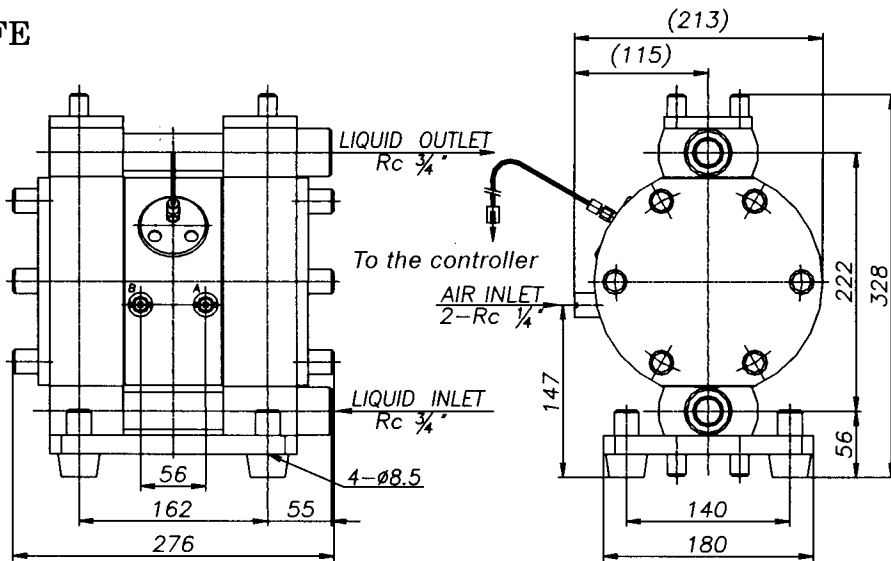
■ DP-10FE



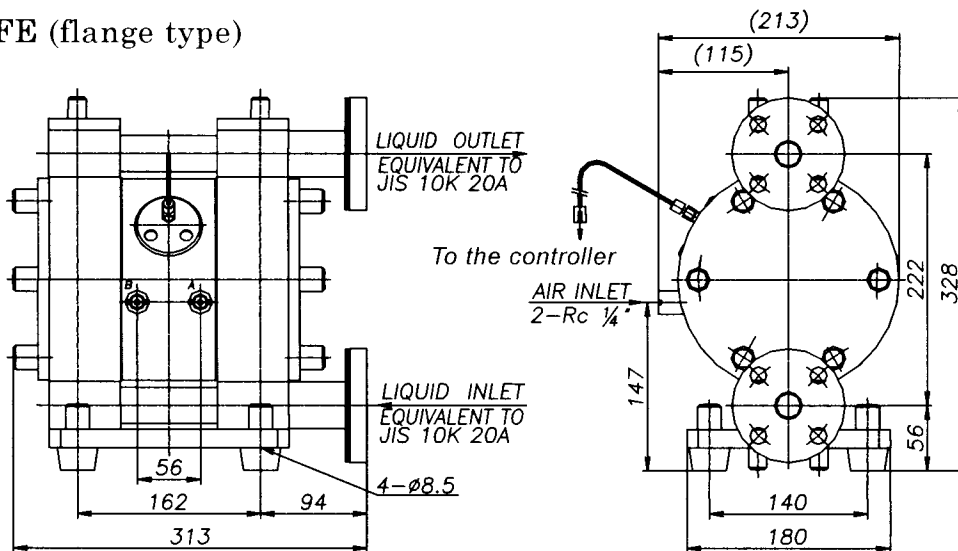
■ DP-10FE (flange type)



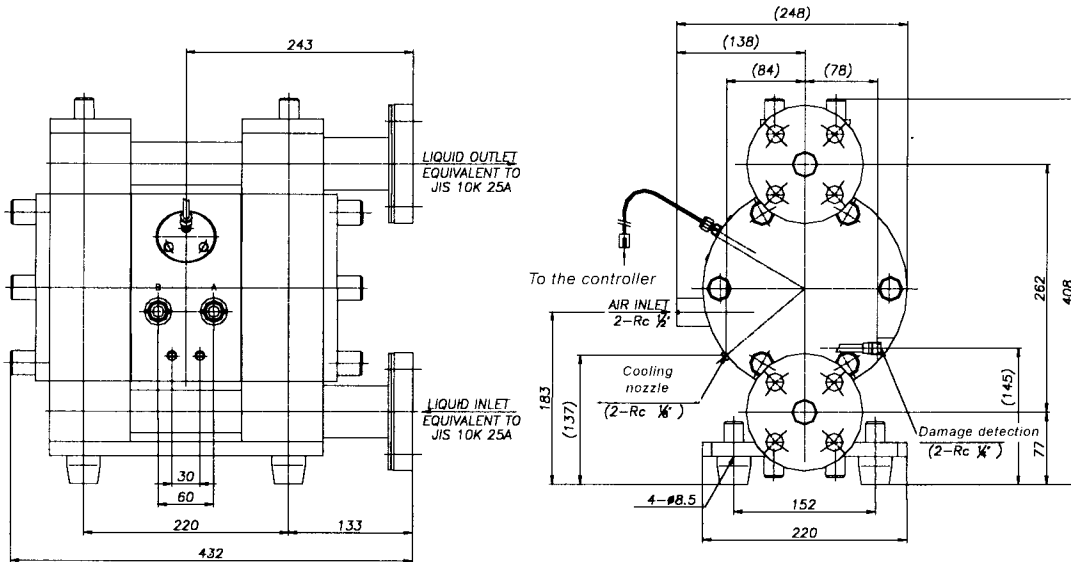
■ DP-20FE



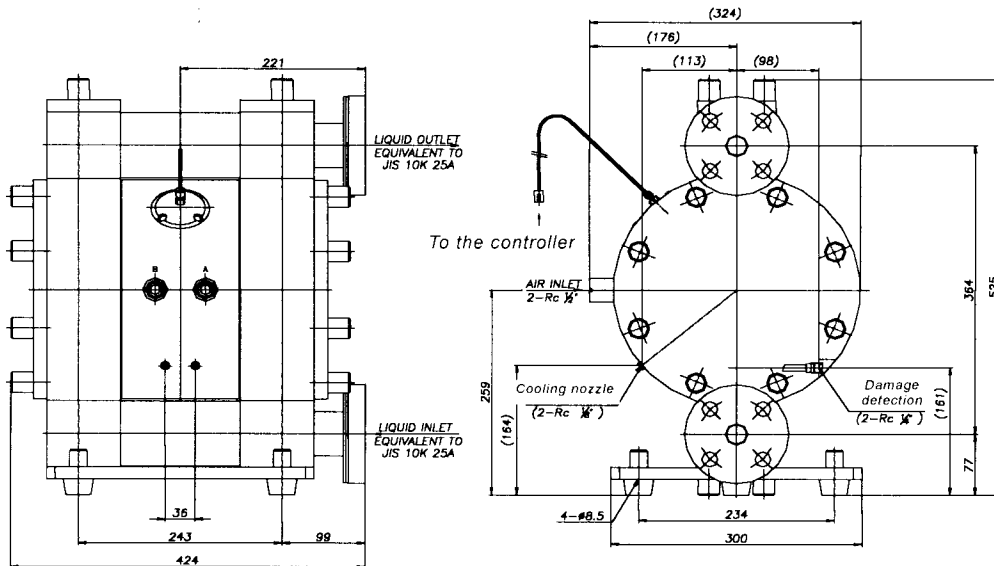
■ DP-20FE (flange type)



■ DP-25FE (flange type)



■ DP-38FE (flange type)

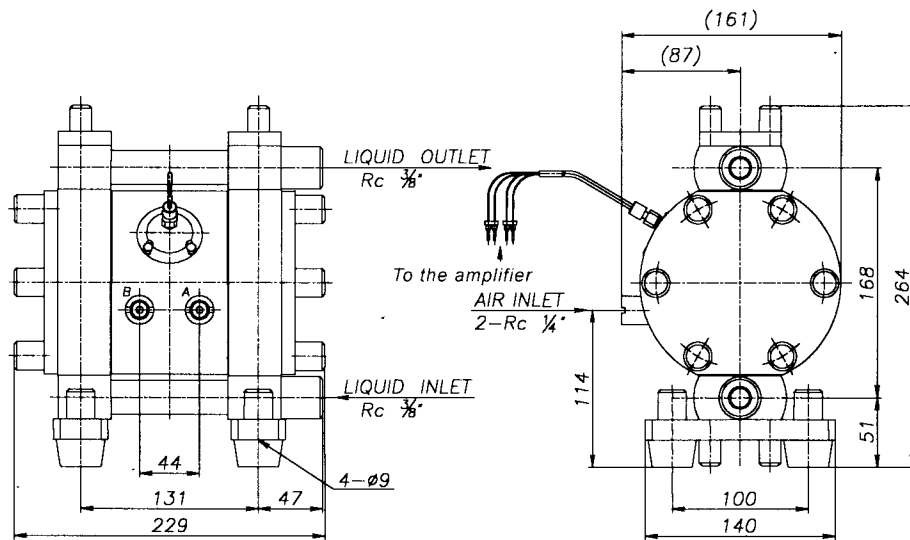


⚠ CAUTION

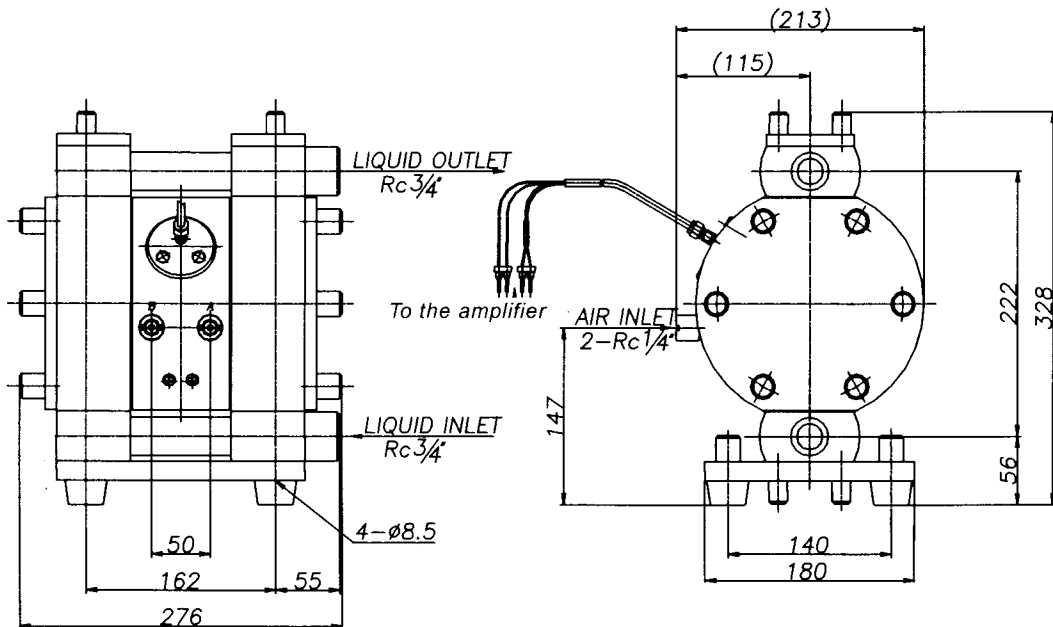
- Due to improvement or modification of products, dimensions may change without notice. Please contact your distributor our regional office for detailed information.

10.2.2 DP-FE/D series

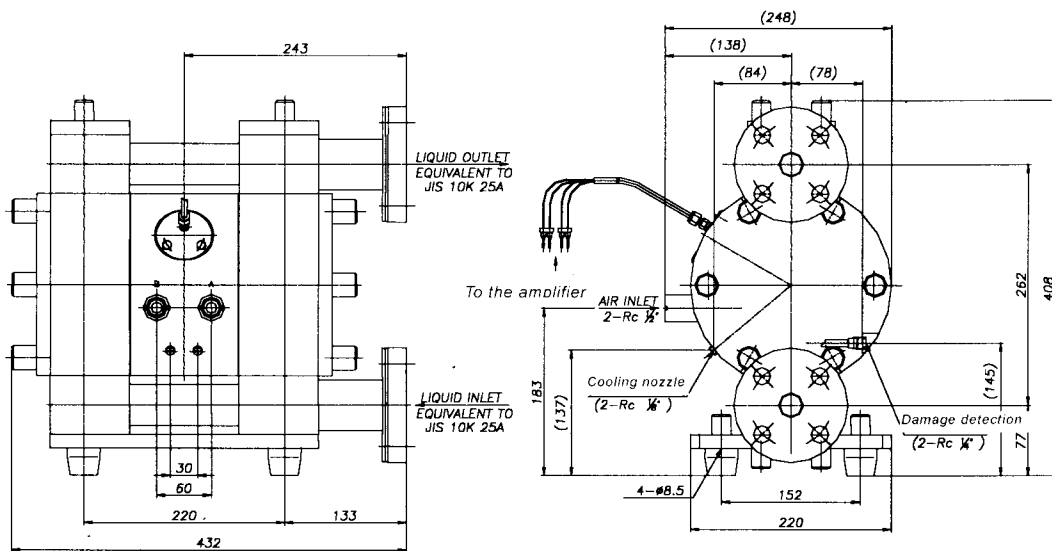
■ DP-10FE/D



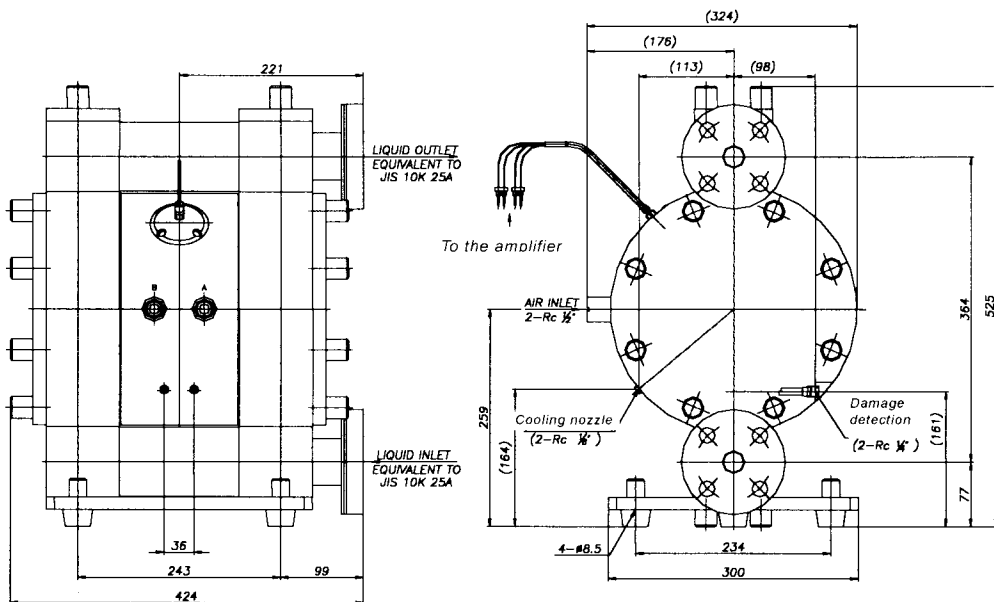
■ DP-20FE/D



■ DP-25FE/D (flange type)



■ DP-38FE/D (flange type)

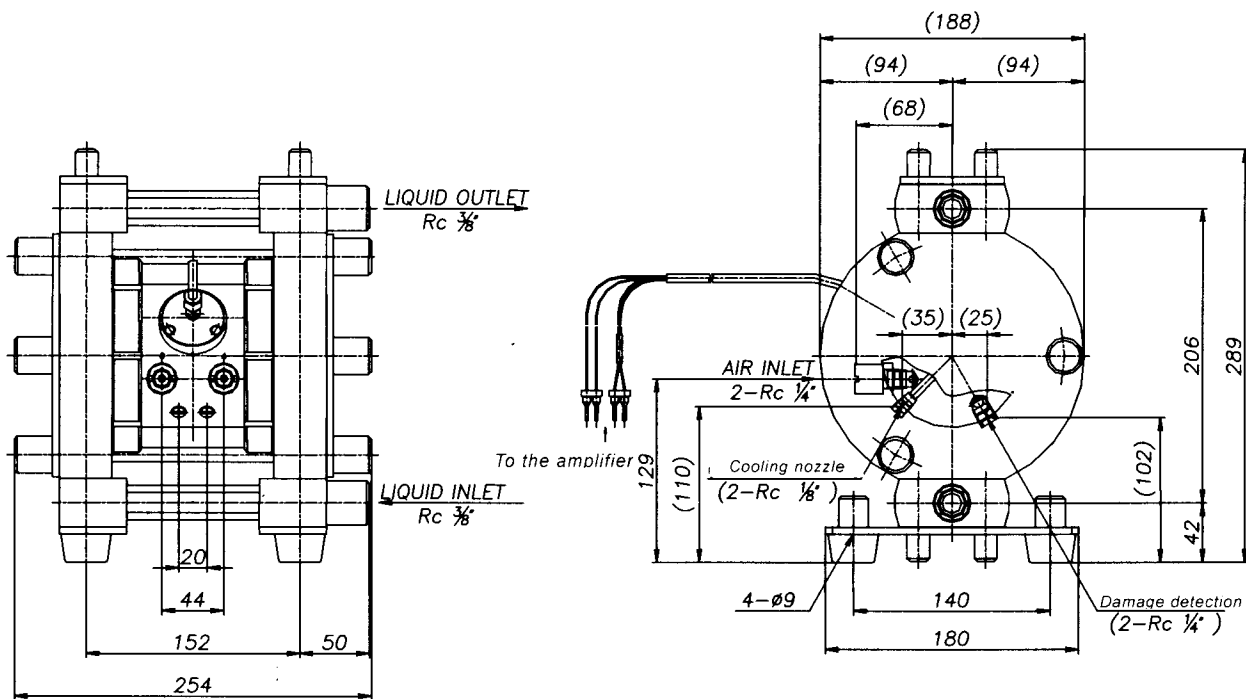


⚠ CAUTION

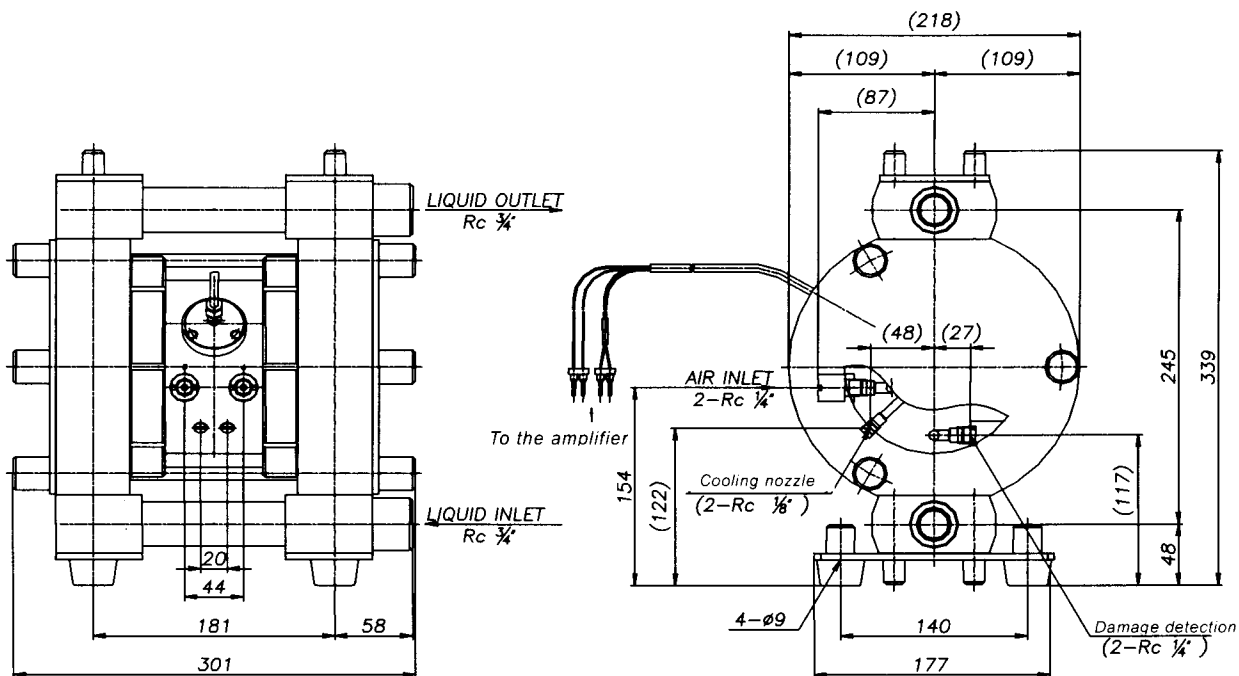
- Due to improvement or modification of products, dimensions may change without notice. Please contact your distributor our regional office for detailed information.

10.2.3 DP-FsE/D/H series

■ DP-FsE/D/H



■ DP-20FsE/D/H



⚠ CAUTION

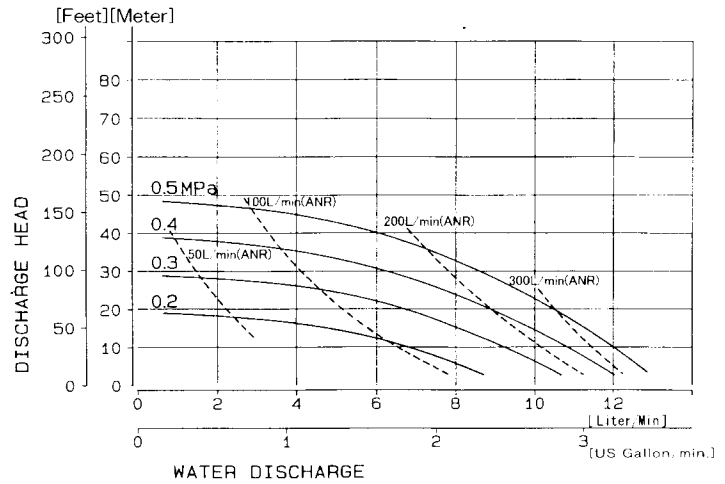
- Due to improvement or modification of products, dimensions may change without notice. Please contact your distributor or our regional office for detailed information.

10.3 Performance curve

10.3.1 DP-FE, DP-FX series

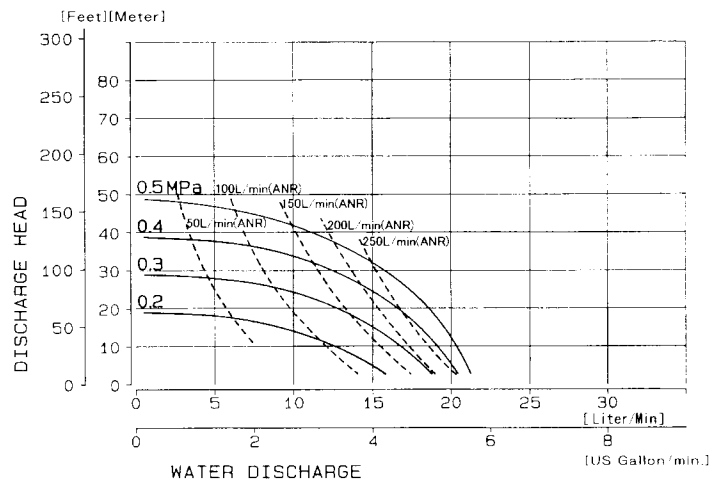
■ DP-5FE, DP-5FX

The following data was sampled when the inner diameter of the air tube is 6 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 34.2 m² or equivalent is used.



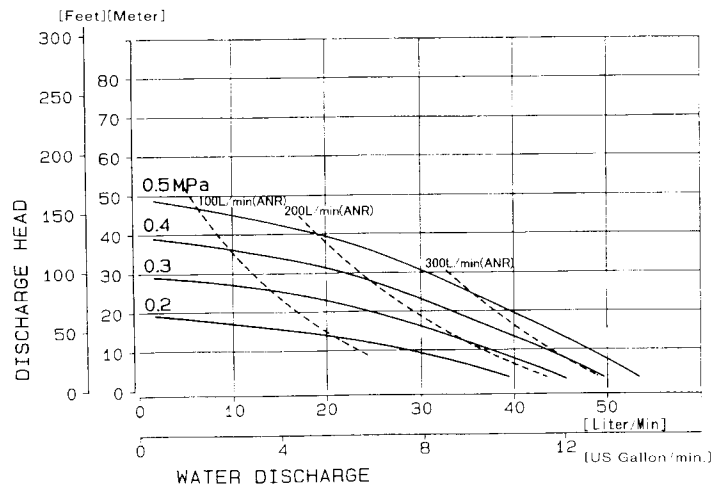
■ DP-10FE

The following data was sampled when the inner diameter of the air tube is 6 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 34.2 m² or equivalent is used.



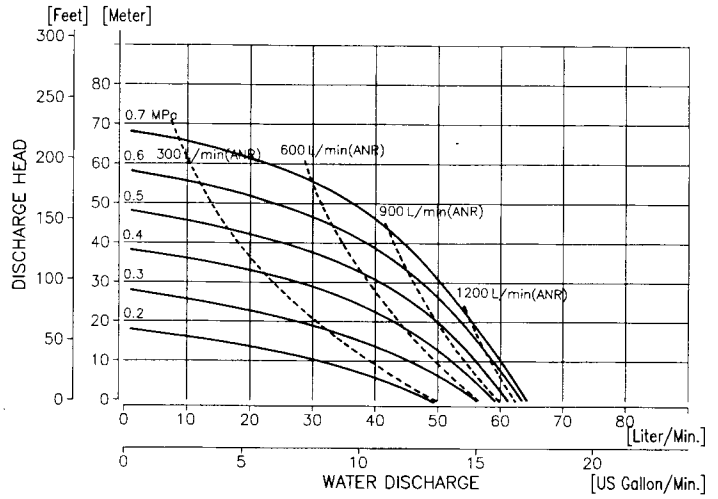
■ DP-20FE

The following data was sampled when the inner diameter of the air tube is 8 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 34.2 m² or equivalent is used.



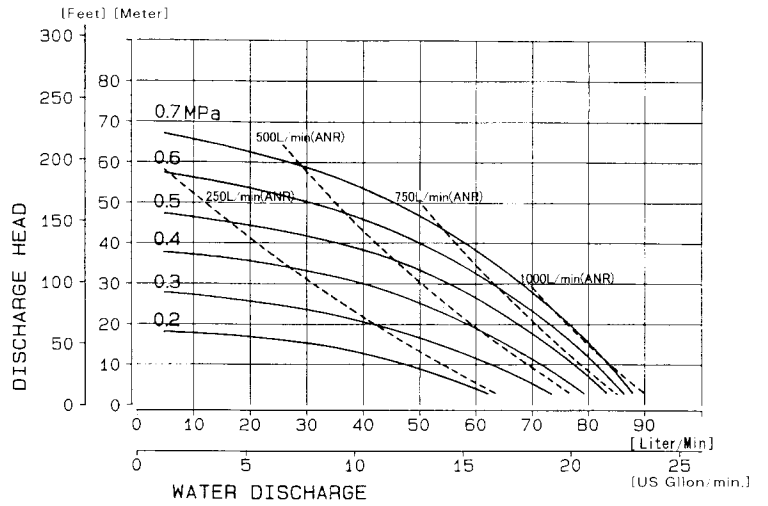
■ DP-25FE

The following data was sampled when the inner diameter of the air tube is 10 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 81.0 m² or equivalent is used.



■ DP-38FE

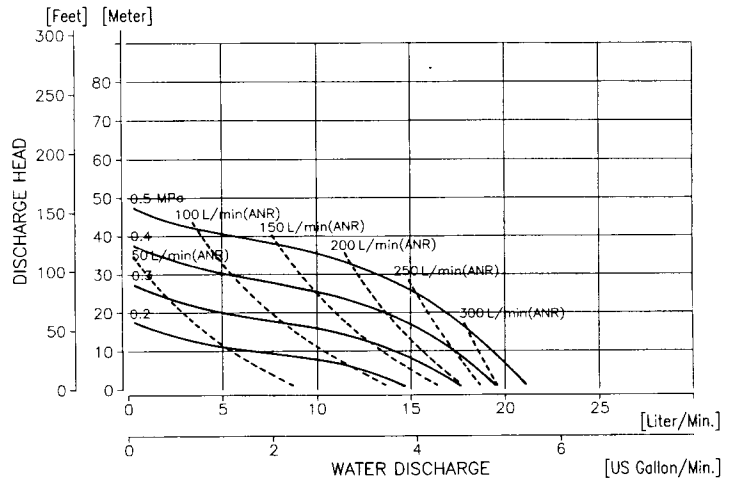
The following data was sampled when the inner diameter of the air tube is 10 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 81.0 m² or equivalent is used.



10.3.2 DP-FE/D series

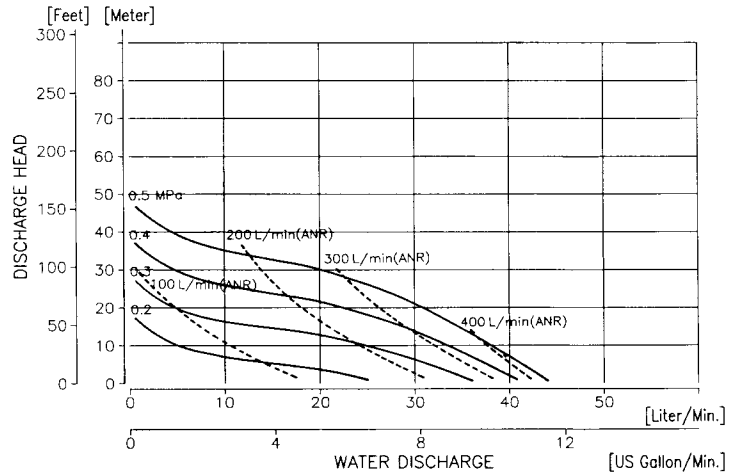
■ DP-10FE/D

The following data was sampled when the inner diameter of the air tube is 6 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 34.2 m² or equivalent is used.



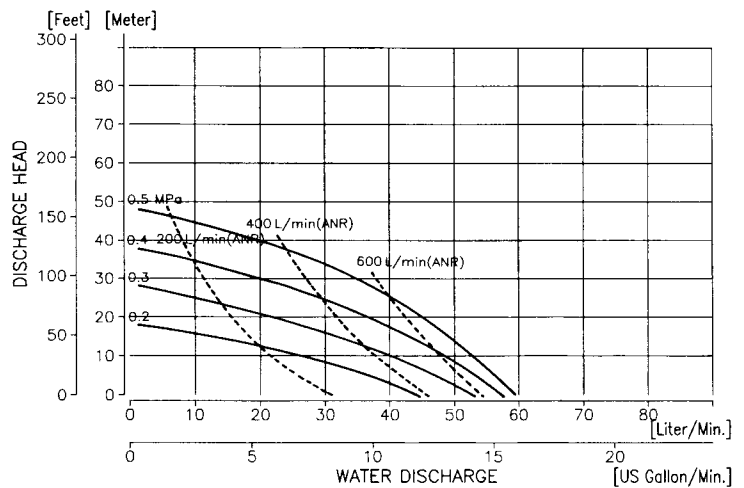
■ DP-20FE/D

The following data was sampled when the inner diameter of the air tube is 8 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 34.2 m² or equivalent is used.



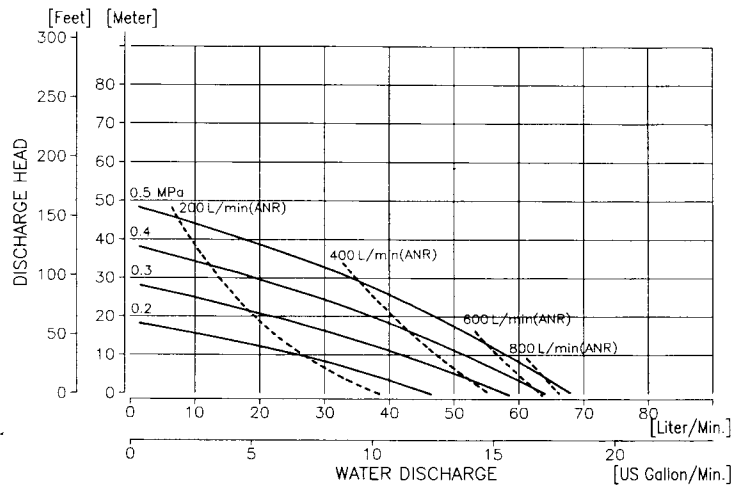
■ DP-25FE/D

The following data was sampled when the inner diameter of the air tube is 10 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 81.0 m² or equivalent is used.



■ DP-38FE/D

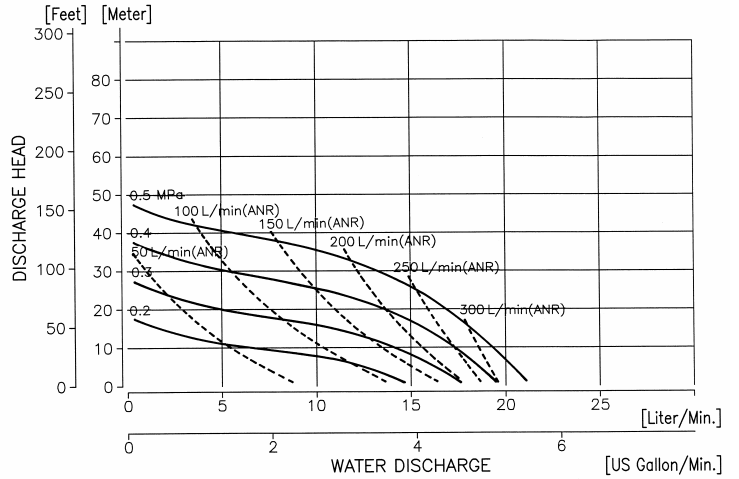
The following data was sampled when the inner diameter of the air tube is 10 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 81.0 m² or equivalent is used.



10.3.3 DP-FsE/D/H series

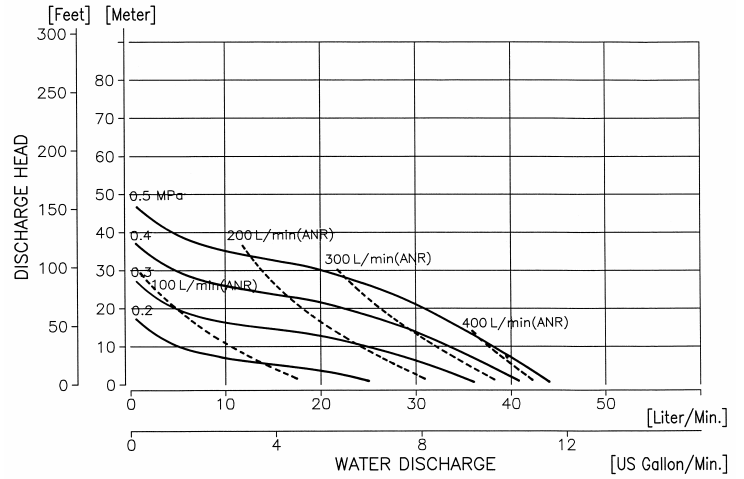
■ DP-10FsE/D/H

The following data was sampled when the inner diameter of the air tube is 6 mm and the length is 1.5 m.
The electromagnetic valve whose effective cross section area is 34.2 m² or equivalent is used.



■ DP-20FsE/D/H

The following data was sampled when the inner diameter of the air tube is 6 mm and the length is 1.5 m. The electromagnetic valve whose effective cross section area is 34.2 m² or equivalent is used.



11. Trouble-Reporting FAX Sheet

Your information will be most helpful in our efforts to improve our service as well as checking into causes of troubles and irregularities. Therefore, please, fill out the following FAX sheet and fax it to your distributor or our regional office. Thank you.

Trouble-Reporting FAX Sheet	
Name of your firm _____	Name of person in charge _____
Address _____ _____	Department _____
	Telephone () _____ - _____ Fax () _____ - _____
MODEL/No. (Product name/Product No.)	Date of product
Period of use From _____ to _____ _____/____/____	SERIAL No. (Lot No.)
Operating conditions <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor Frequency of operation <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent _____ Hours / day / week / month	Date of purchase _____ Name of dealer _____
Operating air pressure _____ MPa Discharge pressure _____ MPa Discharge volume _____ L/min. Stroke Suction side _____ m Discharge side _____ m Oil lubrication <input type="checkbox"/> YES <input type="checkbox"/> NO	Type of fluid pumped _____ Specific gravity _____ Viscosity _____ Pa·s Fluid temperature _____ °C / °F Slurry <input type="checkbox"/> YES Density _____ wt% Particulate diameter _____ mm <input type="checkbox"/> NO
Condition of pump (nature of problem)	
Draw a summary drawing of application (size, length of piping, and component parts)	

12. Limited warranty

- This product is shipped to customers only after meeting strict inspection standards. If an abnormality occurs during normal operation in accordance with the operating instructions and other operating cautions within the warranty period (12 months after date of purchase) that can be attributed to a manufacturing defect, the defective parts of this product will be serviced or the product will be replaced free of charge. However, this warranty will not cover compensation for incidental damage or any malfunction listed below.

1. Warranty period

This warranty will be valid for a period of 12 months after the date of purchase.

2. Warranty

If, during the warranty period, any of the material of the genuine parts of this product or the workmanship of this product is found defective, and is so verified by our company, the servicing cost will be fully born by our company.

3. Exclusion

Even during the warranty period, this warranty does not cover the following:


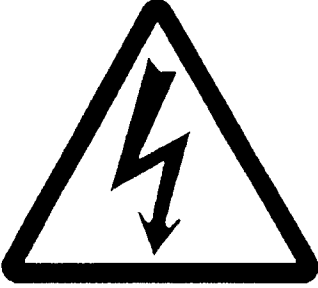



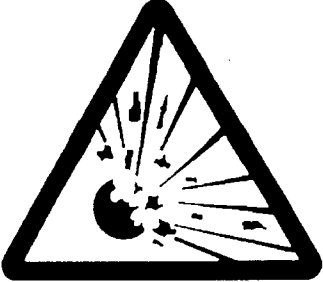


- (1) Malfunction arising from use of parts other than manufacturer-specified genuine parts
- (2) Malfunction arising from misuse or operating errors, or lack of storage or maintenance care
- (3) Malfunction arising from use with a fluid that may cause corrosion, inflation or dissolution of the component parts of the product
- (4) Irregularity arising from repair made by other than by our firm, our regional office, dealer or authorized service personnel
- (5) Malfunction arising from modification of the product by other than authorized service personnel
- (6) Wear and tear of parts that must be regularly replaced in the course of normal operation, such as diaphragms, valve seats, balls, air switch sleeve valves and O-rings
- (7) Malfunction and/or damage due to transportation, moving or droppage of the product after purchase
- (8) Malfunction and/or damage due to fire, earthquake, flood or other force majeure
- (9) Malfunction arising from use of compressed air that contains impurities or excessive moisture, or use of gases or fluids other than the specified compressed air
- (10) Malfunction arising from use with a fluid that causes excessive abrasion or use of lubricating oil other than that specified for this product

Furthermore, this warranty does not cover the rubber parts, or other parts that are subject to wear in normal operation, used in this product and its accessories.

4. Parts

Parts for this product will be kept available for 5 years after discontinuation of production. Once 5 years have elapsed after close of production, availability of parts for this product cannot be guaranteed.

13. Warning symbols

<p>BEWARE: HIGH TEMPERATURE</p> 	<p>ELECTRIC SHOCK</p> 	<p>POISON</p> 
<p>FLAMMABLE</p> 	<p>CORROSION</p> 	<p>EXPLOSION</p> 
<p>General warnings, cautions and danger notifications</p> 	<p>FIRE STRICTLY PROHIBITED</p> 	

Manufactured by

YAMADA CORPORATION

INTERNATIONAL DEPARTMENT

No.1-3, 1-Chome, Minami-Magome, Ohta-Ku, Tokyo, 143-8504, Japan

PHONE : +81-(0)3-3777-0241

FAX : +81-(0)3-3777-0584

YAMADA EUROPE B.V.

Aquamarijnstraat 50,7554 NS Hengelo (O),The Netherlands

PHONE : +31-(0)74-242-2032

FAX : +31-(0)74-242-1055